Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Report on Geotechnical Investigation and Preliminary Contamination Assessment

Proposed Additions to Port Macquarie Base Hospital
Wrights Road, Port Macquarie

Prepared for
Health Infrastructure
on behalf of
Aurecon Pty Ltd

Project 49728
November 2011

Douglas Partners
Geotechnics / Environment / Groundwater

Document History

Document details

Project No.	49728	Document No.	1
Document title	Proposed Additions to Port Macquarie Base Hospital		
Site address	Wrights Road, Port Macquarie		
Report prepared for	Health Infrastructure C/- Aurecon Pty Ltd		
File name	P:\49728.01\Docs\49728 Rev 3.doc		

Document status and review

Revision	Prepared by	Reviewed by	Date issued
Draft	Joel Cowan	Will Wright	11 April 2011
1	Joel Cowan Patrick Heads	Will Wright Stephen Jones	10 June 2011
2	Joel Cowan Patrick Heads	Will Wright Stephen Jones	9 November 2011
3	Joel Cowan Patrick Heads	Will Wright Stephen Jones	18 November 2011

Distribution of copies

Revision	Electronic	Paper	Issued to
Draft	1	0	Health Infrastructure
Draft	1	0	Aurecon Pty Ltd
1	1	0	Health Infrastructure
1	1	3	Aurecon Pty Ltd
2	1	1	Aurecon Pty Ltd
3	1	1	Aurecon Pty Ltd

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

	Signature	Date
Author		18 November 2011
Reviewer		18 November 2011

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Report on Geotechnical Investigation and Preliminary Contamination Assessment
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1. Introduction

This report presents the results of a geotechnical investigation undertaken for proposed additions to the Port Macquarie Base Hospital at Wrights Road, Port Macquarie. The investigation was commissioned in an email dated 10 February 2011 by Mr Michael Brooks of Health Infrastructure and was undertaken in accordance with Douglas Partners proposal dated 9 December 2010.

It is understood that the proposed development includes the following:

- Five storey extensions to the north/west of the existing buildings;
- Possible new two storey building to north east of existing buildings;
- Possible new two storey building to north of existing buildings;
- New buildings will be of reinforced concrete construction with column working loads of up to about 6000 kN for the five storey extensions and about 2000 kN for the two storey building;
- There will also be new areas of at grade car parking to the east of the existing buildings, which will not extend past the existing lot boundaries. These will include areas of existing carpark as well as existing grassed areas;
- Possible access road through the lot to the north.

The aim of the investigation was to undertake a desktop assessment and assess the subsurface soil conditions across the site in order to provide comments on the following:

- Existing and likely variability of groundwater levels and potential for groundwater recharge;
- Aggressivity of soil and groundwater with regard to durability of buried structural elements;
- Shrink-swell behaviour of soils;
- Comments on suitable footing types, founding depths and geotechnical design parameters and construction methodology;
- Earthquake sub-soil classification;
- Comments on temporary support of excavations/batter slopes as well as suitable retaining structure types and geotechnical design parameters;
- Slope Stability Risk Assessment;
- Expected subgrade conditions, recommended site preparation measures, design CBR for areas of slabs and pavements and pavement thickness design;
- Suggested site preparation for detention basin construction;
- Potential contamination sources within the site;

- Concentrations of a range of potential organic and inorganic contaminants in soil within the proposed building areas;
- Presence of soil salinity or sodic or permeable soils.

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

2. Site Identification

The hospital site is identified as Lot 23, DP 1099567 and Lot 1, DP 1050937. The site is bounded to the south by Wrights Road, to the west by bushland and the Oxley Highway, to the north by residential development and to the east by commercial development.

The site has a southern frontage to Wrights Road of approximately 320 m, and comprises a total site area of approximately 9.7 ha. The site layout is shown on Drawing 1, Appendix D.

3. Geology, Hydrogeology and Regional Maps

Reference to the geological map of the Port Macquarie Block by the NSW Department of Primary Industries indicates that the site is underlain by two to three geological units. The western part of the site is underlain by undifferentiated Karkeree Metadolerite and Sea Acres Dolerite, a variably altered dolerite which typically comprises massive cleaved dolerite and some acid and ultra basic rocks.

The eastern part of the site is underlain by the Devonian aged Touchwood Formation which typically comprises siltstone, sandstone, paraconglomerate, breccia and andesite. The Watonga Formation of undifferentiated rocks lies further to the east (possibly outside the site) which typically consists of slate, chert, mudstone, sandstone, conglomerate and minor basalt and stratabound metalliferous rocks.

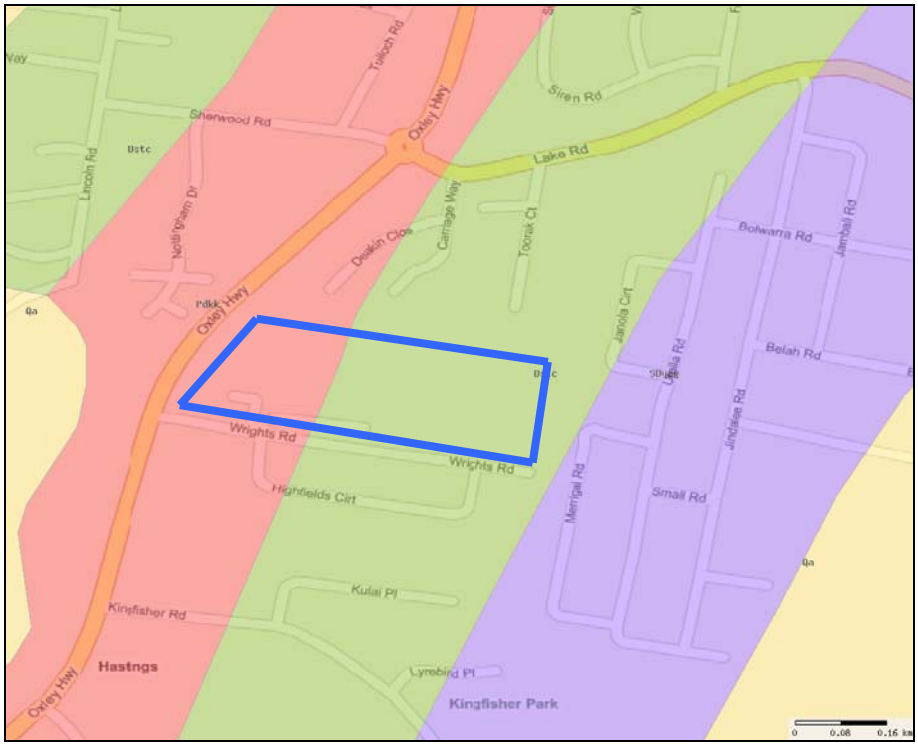

Figure 1 - Site Geology **- Red area (Karikeree Metadolerite and Sea Acres Dolerite)**
- Green area (Devonian aged Touchwood Formation)
- Purple area (Undifferentiated rocks of the Watonga formation)

Groundwater is likely to be present at variable depths due to the presence of filling and changing geology. There is a potential for perched water to be present within fill materials at the site.

The groundwater flow direction is likely to be to the north to a localised drainage channel immediately north of the site, which flows into Lake Innes Nature reserve approximately 500 m east of the site. The nature reserve feeds into Kooloonbung Creek to the north-east of the site.

Groundwater levels are affected by factors such as climatic conditions and soil permeability and will therefore vary with time.

An on-line groundwater search of the area was undertaken by DP. Two registered groundwater wells (GW304464 and GW303730) are located approximately 250 m east and 150 m south of the site respectively, and are registered for domestic use. Standing water levels in the groundwater wells was approximately 10 m below ground level, with water bearing zones between 23 m and 34 m below ground level.

Reference to the Wauchope-Port Macquarie Acid Sulphate Soil Risk Map prepared by the former Department of Land & Water Conservation indicates that the site is within an area of no known occurrence of acid sulphate soil materials. An area of disturbed terrain (ie possible filling/reclamation) is located immediately north of the site.

Reference to the NSW Natural resources atlas (www.nratlas.nsw.gov.au) indicates that absence of mapped dryland salinity occurrences and salinity hazard at the site.

4. Site History

4.1 Extent of Site History Review

The review of site history comprised the following:

- Brief discussions with current hospital staff;
- Port-Macquarie - Hastings Council (PMHC) records search;
- Review of Section 149 Planning Certificate for Lot 1 DP 1050937 and Lot 23 DP 1099567;
- Historical title deeds search;
- Review of historical aerial photos;
- Searches with NSW DECCW;
- A Dangerous Goods Register search undertaken through NSW Work Cover.

Details are presented in the following sections.

4.2 Discussions with Current Hospital Staff

Discussions held with current hospital staff during the site inspection on 3 March 2011 indicated the following:

- The site was formerly grazing land, with some areas of market gardens. Two macadamia trees in the western portion of the site remain from the market garden operations. Some vines were possibly located in the southern portion of the site also;
- Construction of the hospital began in 1990, with the facility opening in 1994;
- Earthworks for the site generally comprised cut in the south and south-western portions of the site, with fill placement in the central and eastern portions of the site;
- Waste generated from the site is collected and taken off-site for disposal;
- An underground fuel storage tank (UST) is located within the service area in the western portion of the site. The tank capacity is approximately 5000 L and is used for diesel storage for the emergency generator;
- The generator is tested for two hours each fortnight and is also used during loss of power at the site. Diesel is pumped from the UST into 'day tanks' when required;
- The UST is of metal construction and uses a cathodic protection system to minimise corrosion of the tank;
- Monitoring and recording of the fuel level in the tank is undertaken regularly (ie dipstick measurements).

4.3 Council Records Search

Correspondence with PMHC indicated that a number of Development Applications (DA) have been submitted for the site, based on the Council records as follows:

- 2007/41 – New office space and refurbishment of mental health unit, plus 12 bed ward and PA system;
- 1992/522 – refurbishment of base hospital.

4.4 Section 149 Certificate

Review of the Section 149(2) and 149(5) Planning Certificate for the site indicated the following:

- Lot 1 DP 1050937 is zoned R1 General Residential;
- Lot 23 DP 1099567 is zoned SP2 Infrastructure;
- Lots 1 and 23 have no matters arising under the Contaminated Land Management Act;
- Lots 1 and 23 are not within a proclaimed Mine Subsidence District.

The Section 149 Certificate also indicates that Lot 1 DP 1050937 is affected by a policy regarding contaminated land. Council has categorised Lot 1 as Contaminated Land Class A and B. Discussions with Port Macquarie Hastings Council defines Contaminated Land Class A and B as land that is known to be contaminated and where previous land use has the potential for contamination of land. Council indicated that previous land use on the site was identified as agricultural use, including a farm storage shed and on-site effluent disposal.

4.5 Historical Title Deed Search

A historic title deeds search was carried out by Service First Registration Pty Ltd, the results of which are provided in Appendix B and summarised in Table 1 and Table 2 below.

Table1: Historical Title Deed Search – Lot 23 DP1099567 (Main Site)

Date of Acquisition and term held	Registered Proprietor(s) & Occupations where available
02.01.1912 (1912 to 1922)	Charles Edwin Dick (Oyster Culturist)
14.08.1922 (1922 to 1924)	Thomas Dick (Oyster Culturist)
14.02.1924 (1924 to 1930)	James Wrigley (Orchardist)
31.03.1930 (1930 to 1932)	Frank Gough (Labourer)
10.03.1932 (1932 to 1939)	Richard Gough (Gardener)
03.11.1939 (1939 to 1941)	Robert Bernard Byrnes (Hotel Manager)
07.02.1941 (1941 to 1943)	Alfred William Miller (Farmer) Mary Jean Miller (Married Woman)
08.02.1943 (1943 to 1946)	Leonard Laurie Steel (Farmer)
01.07.1946 (1946 to 1959)	William Hugh Kennewell (Farmer)
24.08.1959 (1959 to 1963)	John McAdam (Aust) Pty Limited
04.09.1963 (1963 to 1964)	Rupert James Somerville (Executive Officer)
12.11.1964 (1964 to 1985)	Arthur John Lowe (Café Proprietor) Rose Lee Lowe (Married Woman)
05.12.1985 (1985 to 1988)	The Council of the Municipality of Hastings
10.11.1988 (1988 to 1993)	Health Administration Corporation
20.09.1993 (1993 to 2007)	Port Macquarie Base Hospital Pty Limited
15.02.2007 (2007 to date)	# Health Administration Corporation

Table 2: Historical Title Deed Search – Lot 1 DP1050937

Date of Acquisition and term held	Registered Proprietor(s) & Occupations where available
27.02.1909 (1900 to 1919)	Mary Ann Stiles (Married Woman)
16.10.1919 (1919 to 1937)	Joseph Henry Stiles (Labourer)
11.12.1937 (1937 to 1940)	Harry Baslin Tozer (Farmer)
07.11.1940 (1940 to 1942)	William George Burgess (Apiarist)
24.10.1942 (1942 to 1962)	William Valentine Thornton (Train Driver)
22.03.1962 (1962 to 1965)	Gerda Rosalie de Graaf (Married Woman)
21.06.1965 (1965 to 1966)	Walter Alfred Goldstein (Marine Mechanic)
24.11.1966? (1966 to 1966)	David Kingston Adams Button (Law Clerk)
01.11.1966 (1966 to 1977)	Lewis Goodley Clifton (Grazier) Gwendoline Rosina Clifton (Married Woman)
18.07.1977 (1977 to 1980)	Dennis Matthew O'Brien (Railway Employee) Peter James O'Brien (Butcher) Patrick (or Patric) William O'Brien (Butcher)
04.07.1980 (1980 to 2000)	Peter James O'Brien (Butcher) Patrick (or Patric) William O'Brien (Butcher)
05.10.2000 (2000 to 2003)	Robert James Laing Karen Sarah Laing
05.05.2003 (2003 to 2007)	Goldenboot Pty Limited
15.01.2007 (2007 to date)	# HCOA Operations (Australia) Pty Limited

4.6 Review of Historical Aerial Photos

The historical aerial photo review for the assessment is summarised in Table 3 below.

Table 3: Aerial Photo Review

Year	Scale / (Colour)	Main Observations
1956	1:40,000 (B&W)	Areas to the south of the site are cleared grazing land, with the majority of the remaining surrounds being bushland. The majority of the subject site has been cleared, with some areas of trees. Some areas of crops/trees in rows in the western portion of the site, and also to the north-west and east of the site. Possible structures are visible, possibly just to the south of Wrights Road, north-west of the site and to the east of the site (associated with the areas of crops). Possible unpaved road/track in the western and southern portions.
1965	1:40,000 (B&W)	Unpaved road/track in the southern portion of the site. Remainder of site is similar to 1956 photo.
1979	1:25,000 (B&W)	Some possible structures observed just north of the site (possibly associated with farm activities). The subject site has been cleared of the majority of trees. A low lying area is present to the north-west of the site.
1989	1:25000 (B&W)	Site is vacant. Acreage residential lots are located to the south and north-east of the site. The north-western portion of the site is cleared, with some trees in the southern portion as previous. Commercial/industrial development is located to the east of the site
2006	Not to scale (SIX viewer, colour)	Site is developed as current.

4.7 NSW DECCW

A review of the NSW DECCW public register indicated the site has no statutory notices issued under the provision of the Contaminated Land Management Act.

4.8 NSW WorkCover

A search of the Stored Chemical Information Database (SCID) records through WorkCover New South Wales indicated licences for five aboveground LPG tanks at the site. Four tanks are located in the south-western portion of the site, with one tank located in the north-eastern portion of the site. The search of WorkCover records did not reference the underground diesel tank in the western portion of the site.

5. Site Description

The site is located at the Port Macquarie Base Hospital which is situated at the intersection of Oxley Highway and Wrights Road, Port Macquarie.

Photo 1: Aerial View of the Site, (red outlines proposed building envelopes, yellow outline proposed new car parking and access road)

At the time of the investigation the proposed west building envelope consisted of a sealed carpark, grassed areas, small to large sized trees, shipping container, rubbish bins and gas storage facilities (LPG and medical liquid oxygen). An underground fuel storage tank was observed to the east of the proposed west building envelope (Photo 4). Mature trees, likely to be remnants of the former market garden, were observed within the proposed western building envelope (Photo 5).

Photo 2: Looking south at proposed west building envelope

Photo 3: Looking north to north east from Bore 2 towards proposed west building envelope

Photo 4 – Underground fuel storage tank to the east of the proposed western building envelope

Photo 5 – Possible former market garden trees within the proposed western building envelope

Photo 6: Looking south at proposed north building envelope

The proposed eastern building envelope consisted of grassed areas, small trees, medium to large trees and shrubs, and a grassed detention basin with associated stormwater pits. The detention basin was well grassed at the time of the investigation and there was no ponded water present.

Photo 7: Looking south to south west at proposed east building envelope

Photo 8: Looking north at proposed east building envelope

Photo 9: Looking west at fill embankment

Photo 10: Looking north at detention basin and Bore 9

To the east of the proposed building envelopes is an existing car park and grassed areas with a helipad and access road. This area is proposed to have an expanded carpark. An emergency generator (with self-contained fuel tanks) was observed within the proposed car park area (Photo 13). Sprayed/killed weeds were observed adjacent to the northern boundary of the proposed car park area (Photo16).

Photo 11: Looking east at existing helipad and access road

Photo 12: Looking east at existing carpark

Photo 13 – Emergency generator in the proposed eastern car park area


Photos 14 and 15: looking north and north east at existing grassed area east of existing carpark

Photo 16 – Possible sprayed weeds in the northern portion of the proposed eastern car park

Overall site levels fall from about RL 23 m AHD along Wright's Road to the east of the site, to about RL 10 to 12 m AHD to the north of the main building and in the existing carparking area to the east. Levels continue to fall towards the north east, with levels of about RL 6 in the north-east corner of the site.

The site seems to have been subject to cut and fill as part of construction of the existing development, resulting in a level of about RL 17 around the main building. The areas of cut and fill are generally battered, however there is a concrete crib retaining wall supporting cut around the southern and western side of the car park to the south-west of the existing main building. The crib wall is about 2.5 m to 3.0 m high and no obvious distress to the wall was observed (Photo 17). There is a batter, about 3.5 m high and sloping at about 15°, located to the south of the main building which is presumably located in cut.

Fill batters are present to the north and east of the main building (Photos 18 and 19). The batters range in vertical height from about 4 m to 5 m with slopes in the range 15° to 17° and locally up to 21° and the crest of the batters are set back from the main building by a level grassed area about 10 m wide (Photo 20). The batter slopes are generally vegetated with low bushes and there were no obvious signs of erosion or slumping.

Photo 17 – Crib Wall in South West Site

Photo 18 – Batter Slope to West of Car Park

Photo 19 – Batter North of Main Building

Photo 20, Level Area Between the Main Building and Batter Slope to North

6. Potential Contaminants

Based on the available site history information and observations made during the site inspection, the principal sources of potential contamination within the site are considered to be:

- Former market garden activities in the western portion of the site, which may be a source of pesticides, petroleum hydrocarbons and heavy metals;
- Former farming activities, which may have included chemical use and storage, fuel use and storage and equipment use and storage. Use, spills and leaks of chemicals/fuels etc may be a source of petroleum hydrocarbons, PAH, BTEX, pesticides and heavy metals;
- Possible on-site effluent disposal during former site use, which may be a source of petroleum hydrocarbons, nutrients, microbiological contamination and heavy metals;
- Underground fuel storage to the east of the proposed western building envelope. Spills/leaks from the tank may be a source of petroleum hydrocarbons, PAH, BTEX and heavy metals;
- Aboveground fuel storage within the emergency generator in the eastern portion of the site (ie within the proposed car park envelope), which may be a source of petroleum hydrocarbons, PAH, BTEX and heavy metals;
- Possible filling (source unknown) used to fill/level the site during initial construction of the hospital, which may contain a range of potential contaminants;
- Possible use of pesticides/weed killer on the north-eastern site boundary, which may be a source of pesticides, hydrocarbons and heavy metals.

7. Field Work Methods

The field work was undertaken during the periods 7 March 2011 to 11 March 2011 and 14 March 2011 to 16 March 2011 and comprised the following:

- Drilling of nine bores (Bores 1 to 9) within the proposed building envelopes. Bores 1, 2, 3, 4 and 5 were located in the proposed western building envelope. Bore 6 was located in the proposed northern building envelope and Bores 7, 8 and 9 were located in the proposed eastern building envelope. The bores were drilled using a truck mounted drill rig, to depths of between 11.95 m to 28.00 m;
- Excavation of seven Test Pits (Pits 10 to 16) within the proposed new car parking and access road areas. The pits were excavated using a Fermac 760 Backhoe with 300 mm wide bucket with rock teeth. The test pits were excavated to depths of 1.5 m;
- Supplementary Dynamic Penetrometer Tests (DPT) were performed in the subgrade materials in Bores 12 to 16, DPT was not performed in Bores 10 and 11 due to depth of fill material encountered;
- The bores and pits were set out by a geotechnical engineer from Douglas Partners Pty Ltd (DP) who also logged the subsurface profile in each bore and took samples for laboratory testing and identification purposes;
- Piezometers were installed to 18m depth in Bores 1, 3 and 7 to monitor ground water levels and to enable the sampling of groundwater for the assessment of agressivity.

The approximate location of all bores and test pits is indicated on the attached Drawing 1, Appendix D.

The bores were surveyed by DP using an adopted benchmark on the north-west corner of the existing building. The RL for this benchmark was estimated to be 17.28m AHD, based on the survey plan supplied by the client.

Samples for environmental purposes were generally collected from the near surface, and at regular depth intervals or changes in strata within each borehole, generally to beyond the depth of observed filling. Soil samples were collected directly from the solid flight augers or sample tubes using disposable gloves. Augers were screwed into the ground at discrete depths and retracted without rotation to minimise sample disturbance. Care was taken to remove any extraneous material deposited on the outer auger flights as the auger was withdrawn from the borehole.

All sampling data was recorded on DP chain of custody sheets, and the general sampling procedure comprised:

- The use of new disposable gloves for each sampling event;
- Transfer of samples into laboratory-prepared glass jars, and capping immediately;
- Collection of 10% replicate samples for QA/QC purposes;
- Collection of replicate soil samples in zip-lock plastic bags at each depth for PID screening;
- Labelling of sample containers with individual and unique identification, including project number, sample location and sample depth;
- Placement of the sample jars and replicate sample bags into a cooled, insulated and sealed container for transport to the laboratory;
- Use of chain of custody (C-O-C) documentation ensuring that sample tracking and custody could be cross-checked at any point in the transfer of samples from the field to the laboratory.

The process of obtaining samples and their transportation, storage and delivery to laboratories for analysis was documented on a DP standard chain-of-custody form. Copies of completed forms are attached.

Replicate samples for each sample were screened for the presence of volatile organic compounds (VOCs), using a MiniRAE 2000 photo-ionisation detector (PID) with a 10.6 eV lamp, calibrated to 100 ppm Isobutylene.

Information on quality assurance and quality control, including analysis of replicate samples, is provided in Appendix C.

8. Field Work Results

8.1 Soil

The subsurface conditions encountered at the test locations are presented in detail in the attached Test Pit Logs and Borehole Logs. These should be read in conjunction with the notes "About this Report", which explain the descriptive terms and classification methods used in the logs.

The subsurface conditions encountered in the bores can generally be summarised as follows:

Table 4: Summary of Subsurface Conditions Bores 1 to 9 (Deep bores fro proposed structures)

Strata	Depth (m)		Description
	From	To	
TOPSOIL	0.0	0.1	Typically comprising brown clayey silt, with some grass and organic matter, with trace fine to medium sized gravel and fine to medium grained sand
FILLING	0.0	0.4/4.4	Typically comprising red brown, brown and grey clay with some fine to medium sized gravel and coal chitter (charcoal)
CLAY	0.1 / 4.4	1.0/6.7	Typically very stiff, red brown, with some fine to coarse sized gravel
SERPENTENITE	1.0 / 6.7	>11.5/>28.0	Variable strength, typically extremely low strength however including bands of weathered material with strength equivalent to very stiff to hard clay, grey, green, iron stained, red brown, black and orange
DOLERITE (Bore 3 only)	18.5	>22.2	High to very high strength

Bore 4 encountered filling associated with road pavement, Bores 5, 6 and 7 encountered filling associated with the fill embankment for the existing hospital structures. Bore 9 encountered filling associated with the construction of in ground services. Bore 5 encountered a very low strength claystone layer at 5.1 m to 9.3 m depth and some high to very high strength dolerite inclusions between 22.3 m to 24.0 m depth underlain by extremely low strength material to the depth of investigation (24.0 m).

Table 5: Summary of Subsurface Conditions Pits 10 and 11 (existing pavement)

Strata	Depth (m)		Description
	From	To	
ASPHALT	0.0	0.05 / 0.06	Typically 50 mm to 60 mm thick Asphaltic Concrete
FILLING	0.05 / 0.06	0.3 / 0.4	Typically red brown sandy gravel filling associated with pavement construction
FILLING	0.4	1.2	Typically grey brown sand, clay, gravel, cobbles and some boulders
CLAY	0.3 / 1.2	>1.5	Typically very stiff, red brown, yellow brown.

Table 6: Summary of Subsurface Conditions Pits 12 to 16 (proposed pavement)

Strata	Depth (m)		Description
	From	To	
FILLING / TOPSOIL	0.0	0.02 / 0.15	Typically comprising brown clayey silt, with some grass and organic matter.
FILLING	0.1 / 0.15	0.3 / 0.7	Typically brown, sand, gravel, clay, silt and coal chitter (charcoal)
CLAY	0.3 / 0.7	>1.5	Typically stiff to hard, red brown, yellow brown, orange brown.

Pit 12 encountered red brown sandy gravel filling from 0.02 m to 0.28 m depth overlying clayey silt (0.28 m - 0.3 m depth). Pit 14 encountered clayey silt from 0.1 m to 0.4 m depth.

The results of PID screening on soil samples are shown on the borehole logs in Appendix A, and generally suggest the absence of gross volatile hydrocarbon impact (ie <1ppm).

There was no visual or olfactory evidence (ie staining or odours) to suggest the presence of gross contamination within the soils investigated.

8.2 Groundwater

Free groundwater was generally obscured due to drilling fluids. Free groundwater was encountered in Bore 8 at 9.9 m depth. Bores 1, 3 and 7 had piezometers installed to monitor ground water levels. Groundwater was measured on the 16 March 2011 and was measured at 8.9 m and 6.3 m depth in Bores 3 and 7. Bore 1 was not measured due to excess drilling fluids. It should be noted that groundwater levels are dependent on climatic conditions and soil permeability and therefore will vary with time.

9. Laboratory Testing

9.1 Geotechnical Testing

Geotechnical laboratory testing included three 4 day soaked CBR/standard compaction tests on subgrade materials and three shrink-swell tests performed on shallow clay samples.

Detailed laboratory test result sheets are attached and are summarised in Table 7 below.

Table 7: Results of Geotechnical Laboratory Testing

Bore	Depth (m)	Description	FMC (%)	SOMC (%)	SMDD (t/m^3)	CBR (%)	Iss (% per ΔpF)
1	0.5 - 0.84	Clay: Orange Brown	32.2	-	-	-	2.7
5	1.0 - 1.4	Clay: Red Brown	38.8	-	-	-	3.7
8	1.0 - 1.4	Clay: Red Brown	32.8	-	-	-	3.5
14	0.5 - 1.0	Clay: Red Brown	17.0	25.6	1.56	14/11	-
12	0.5 - 1.0	Clay: Red Brown	32.9	34.2	1.34	5/6	-
16	1.0 - 1.5	Clay: Yellow Brown	18.5	17.6	1.83	4/3.5	-

Notes to Table 7:
FMC – Field Moisture Content
SOMC – Standard Optimum Moisture Content
SMDD – Standard Maximum Dry Density
CBR – California Bearing Ratio (4 day soak), with 4.5 kg surcharge
Iss – Shrink/Swell Index

9.2 Soil Aggressivity and Sodicity Testing

Laboratory testing was undertaken by Envirolab Service Pty Ltd, a National Association of Testing Authorities, Australia (NATA) registered laboratory. Five samples were submitted for analysis to assess the aggressiveness of the ground toward buried steel/concrete structures. The laboratory testing comprised soluble sulphate, soluble chloride, electrical conductivity and pH on both soil and water samples. Six samples were submitted for analysis to assess the Exchangeable Sodium Percentage (ESP) and Cation Exchange Capacity of site soils. ESP is an indicator test for soil sodicity.

Detailed laboratory report sheets are attached in Appendix C and the results are summarised in Table 8, below:

Table 8: Results of Laboratory Soil and Water Aggressivity Testing and Soil Sodicity Testing

Bore	Depth (m)	Sample Description	pH	EC (dS/m)	EC_e (dS/m)	Cl (mg/kg)	SO_4 (mg/kg)	CEC meq/100g	ESP %
BH1	0.05	Topsoil – Brown clayey silt	-	-	-	-	-	8.2	1.9
BH1	0.5	Clayey Silt – Brown	-	-		-	-	2.8	3.5
BH3	0.5	Clay – Red brown	-	-		-	-	3.2	1.1
BH4	0.5	Clay – Red brown	-	-	-	-	-	3.8	<1
BH5	0.5	Clay – Red brown	6.8	0.12	0.84	16	120		
BH6	1.0	Filling – Red brown clay	4.6	0.077	0.54	71	12	1.7	12.2
BH9	0.05	Filling – Red brown clay	-	-	-	-	-	6.4	<1
BH9	1.5	Filling – red brown and orange clay	5.8	0.021	0.15	14	16	-	-
3	-	Water Sample	7.2	550	-	24	3	-	-
7	-	Water Sample	6.8	274	-	23	3	-	-

Notes to Table 8:
dS – deci Siemens
Cl – Chloride Content
SO_4 – Sulphate Content
CEC – Cation Exchange Capacity
ESP – Exchangeable Sodium Percentage
ECe – Extract Electrical Conductivity, based on soil type (Ref 1)
Non saline soils - <2 ECe dS/m (Ref 1)
Slightly saline soils - 2-4 ECe dS/m (Ref 1)
Moderately Saline – 4-8 ECe dS/m (Ref 1)
Very Saline – 8-16 ECe dS/m (Ref 1)
Highly Saline - >16 ECe dS/m (Ref 1)
Non-Sodic - <5% ESP (Ref 1)
Sodic – 5-15% ESP (Ref 1)
Highly Sodic - >15% ESP (Ref 1)

9.3 Contamination Testing

Laboratory testing was undertaken by Envirolab Services Pty Ltd (Envirolab), a National Association of Testing Authorities, Australia (NATA) registered laboratory. Analytical Methods used are shown on the attached laboratory.

A total of 14 soil samples (including two QA/QC samples) were selected to provide a preliminary assessment of soil/fill conditions. The samples were selected to target the identified potential sources of contamination (See Section 6).

The samples were analysed for total concentrations of some or all of the following potential contaminants:

- Total Recoverable Hydrocarbons (TRH);
- Polycyclic Aromatic Hydrocarbons (PAH);
- Organochlorine Pesticides (OCP);
- Organophosphorus Pesticides (OPP);
- Polychlorinated Biphenyls (PCB);
- Benzene, Toluene, Ethyl Benzene, Xylene (BTEX);
- Metals: Arsenic (As), Cadmium (Cd), Chromium (Cr), Copper (Cu), Lead (Pb), Mercury (Hg), Nickel (Ni), Zinc (Zn);
- Hexavalent Chromium (Cr^{6+})
- Asbestos.

Following receipt of total contaminant concentrations, selected soil samples were also analysed for leachable (TCLP) concentrations for selected heavy metals to assist in assessing re-use disposal options.

Quality Assurance/Quality Control (QA/QC) comprised testing of two soil replicate (samples D4 and D9).

The results of chemical analysis of soil samples are presented in the laboratory report sheets in Appendix C, and are summarised in Tables 9, 10, 11 and 12 below.

Table 9: Laboratory Results for Metals in Soil

Bore	Depth (m)	PID (ppm)	Metal										
			As	Cd	Cr total	Cr TCLP	Cr 6+	Cu	Pb	Hg	Ni	Ni TCLP	Zn
Bore 1	1.5	<1	<4	<0.5	150	<0.01	NT	2	2	<0.1	4	NT	2
Bore 2	0.05	<1	<4	<0.5	440	<0.01	NT	23	3	<0.1	25	NT	5
Bore 3	2.5-2.95	<1	<4	<0.5	99	NT	NT	24	<1	<0.1	8	NT	3
Bore 3	4-4.45	<1	<4	<0.5	110	<0.01	NT	27	2	0.1	8	NT	11
Bore 4	0.5	<1	<4	<0.5	770	<0.01	3	16	5	0.2	44	<0.02	5
R9		<1	<4	<0.5	850	NT	NT	16	6	0.1	42	NT	5
Bore 5	0.05	<1	<4	<0.5	500	<0.01	<1	12	5	<0.1	37	NT	10
Bore 6	0.5	<1	<4	<0.5	140	<0.01	NT	11	10	<0.1	12	NT	7
Bore 6	2	<1	<4	<0.5	430	<0.01	NT	9	3	0.1	27	NT	7
Bore 7	0.5	<1	<4	<0.5	290	<0.01	NT	10	4	<0.1	19	NT	6
R4		<1	<4	<0.5	360	NT	NT	9	5	<0.1	21	NT	6
Bore 8	0.05	<1	<4	<0.5	530	<0.01	<1	13	6	<0.1	38	NT	10
Bore 8	2	<1	<4	<0.5	1100	<0.01	9	5	2	0.4	7	NT	2
Bore 9	0.5	<1	<4	<0.5	420	<0.01	NT	5	4	<0.1	17	NT	6
Laboratory PQL			4	0.5	1	0.01	1	1	1	0.1	1	0.02	1
NSW EPA - NEHF F [1] (Ref 2)			500	100	60%	NC	500	5000	1500	75	3000	NC	35000
NSW EPA - General Solid Waste Guidelines (Ref 3)			100	20	NC	5	100/1900[2]	NC	100	4	40/1050[2]	2	NC
NSW EPA - Restricted Solid Waste Guidelines - CT2 (Ref 3)			400	80	NC	20	400/7600[2]	NC	400	16	160/4200[2]	8	NC

Notes to Table 9:
All results in mg/kg on a dry weight basis
NC - No Criteria
NT - Not Tested
PID - Photoionisation Detector
PQL - Practical Quantitation Limits
1 - Health Based Criteria for Commercial/Industrial Land Use
2 - Total concentrations for waste classification when used with TCLP results

Table 10: Laboratory Results for TRH and BTEX in Soil

Bore	Depth (m)	PID (ppm)	Analyte							
			TRH				BTEX			
			C_6 - C_9	C_{10} - C_{14}	C_{15} - C_{28}	C_{29} - C_{36}	Benzene	Toluene	Ethyl Benzene	Xylene
Bore 1	1.5	<1	<25	<50	<100	<100	<0.5	<0.5	<1	<3
Bore 2	0.05	<1	<25	<50	<100	<100	<0.5	<0.5	<1	<3
Bore 3	2.5-2.95	<1	NT	NT	NT	NT	NT	NT	NT	NT
Bore 3	4-4.45	<1	NT	NT	NT	NT	NT	NT	NT	NT
Bore 4	0.5	<1	<25	<50	<100	<100	<0.5	<0.5	<1	<3
R9		<1	<25	<50	<100	<100	<0.5	<0.5	<1	<3
Bore 5	0.05	<1	<25	<50	<100	<100	<0.5	<0.5	<1	<3
Bore 6	0.5	<1	<25	<50	<100	<100	<0.5	<0.5	<1	<3
Bore 6	2	<1	<25	<50	<100	<100	<0.5	<0.5	<1	<3
Bore 7	0.5	<1	<25	<50	<100	<100	<0.5	<0.5	<1	<3
R4		<1	<25	<50	<100	<100	<0.5	<0.5	<1	<3
Bore 8	0.05	<1	<25	<50	<100	<100	<0.5	<0.5	<1	<3
Bore 8	2	<1	<25	<50	<100	<100	<0.5	<0.5	<1	<3
Bore 9	0.5	<1	<25	<50	<100	<100	<0.5	<0.5	<1	<3
Laboratory PQL			25	50	100	100	0.5	0.5	1	3
NSW EPA Criteria for Service Station Sites [1] (Ref 4)			65	1000 total			1	1.4/130[2]	3.1/50[2]	14/25[2]
NSW EPA - General Solid Waste Guidelines (Ref 3)			650 SCC1	10000 total SCC1			10	288	600	1000
NSW EPA - Restricted Solid Waste Guidelines - CT2 (Ref 3)			2600 SCC2	40000 total SCC2			40	1152	2400	4000

Notes to Table 10:

All results in mg/kg on a dry weight basis

NT - Not Tested

PID - Photoionisation Detector

PQL - Practical Quantitation Limits

SCC - Specific Contaminant Concentration

1 - Threshold Concentration for Sensitive Land Use

2 - Human Health Based Protection Level.

Table 11: Laboratory Results for Total PAH, PCB, OPP and OCP in Soil

Bore	Depth (m)	PID (ppm)	Total PAH	Benzo(a) Pyrene	PCB	Total OPP	Total OCP	Aldrin + Dieldrin	Chlordane	DDT	Heptachlor
Bore 1	1.5	<1	<1.55	<0.05	<0.7	<0.8	<2	<0.2	<0.2	<0.1	<0.1
Bore 2	0.05	<1	<1.55	<0.05	<0.7	<0.8	<2	<0.2	<0.2	<0.1	<0.1
Bore 3	2.5-2.95	<1	NT	NT	NT	NT	NT	NT	NT	NT	NT
Bore 3	4-4.45	<1	NT	NT	NT	NT	NT	NT	NT	NT	NT
Bore 4	0.5	<1	<1.55	<0.05	<0.7	<0.8	<2	<0.2	<0.2	<0.1	<0.1
R9		<1	<1.55	<0.05	<0.7	<0.8	<2	<0.2	<0.2	<0.1	<0.1
Bore 5	0.05	<1	<1.55	<0.05	<0.7	<0.8	<2	<0.2	<0.2	<0.1	<0.1
Bore 6	0.5	<1	<1.55	<0.05	<0.7	<0.8	<2	<0.2	<0.2	<0.1	<0.1
Bore 6	2	<1	<1.55	<0.05	<0.7	<0.8	<2	<0.2	<0.2	<0.1	<0.1
Bore 7	0.5	<1	<1.55	<0.05	<0.7	<0.8	<2	<0.2	<0.2	<0.1	<0.1
R4		<1	<1.55	<0.05	<0.7	<0.8	<2	<0.2	<0.2	<0.1	<0.1
Bore 8	0.05	<1	<1.55	<0.05	<0.7	<0.8	<2	<0.2	<0.2	<0.1	<0.1
Bore 8	2	<1	<1.55	<0.05	<0.7	<0.8	<2	<0.2	<0.2	<0.1	<0.1
Bore 9	0.5	<1	<1.55	<0.05	<0.7	<0.8	<2	<0.2	<0.2	<0.1	<0.1
Laboratory PQL			1.55	0.05	0.7	0.8	2	0.2	0.2	0.1	0.1
NSW EPA - NEHF F [1] (Ref 2)			100	5	50	NC	NC	50	250	1000	50
NSW EPA - General Solid Waste Guidelines - CT1 (Ref 3)			200 SCC1	0.8	50 SCC1	NC	NC	NC	NC	NC	NC
NSW EPA - Restricted Solid Waste Guidelines - CT2 (Ref 3)			800 SCC2	3.2	50 SCC2	NC	NC	NC	NC	NC	NC

Notes to Table 11:

All results in mg/kg on a dry weight basis

CT - Concentration Threshold

NC - No Criteria

NT - Not Tested

PID - Photoionisation Detector

PQL - Practical Quantitation Limits

SCC - Specific Contaminant Concentration

Total PAH - Sum of positive and PQL values

1 - Health Based Criteria for Commercial/Industrial Land Use

Table 12: Laboratory Results for Asbestos in Soil

Bore/Depth (m)	Asbestos Result
Bore 1/1.5	No asbestos found at reporting limit of 0.1 g/kg, respirable fibres not detected
Bore 2/0.05	No asbestos found at reporting limit of 0.1 g/kg, respirable fibres not detected
Bore 3/2.5-2.95	No asbestos found at reporting limit of 0.1 g/kg, respirable fibres not detected
Bore 3/4.0-4.45	No asbestos found at reporting limit of 0.1 g/kg, respirable fibres not detected
Bore 4/0.5	No asbestos found at reporting limit of 0.1 g/kg, respirable fibres not detected
Bore 5/0.05	No asbestos found at reporting limit of 0.1 g/kg, respirable fibres not detected
Bore 6/0.5	No asbestos found at reporting limit of 0.1 g/kg, respirable fibres not detected
Bore 6/2.0	No asbestos found at reporting limit of 0.1 g/kg, respirable fibres not detected
Bore 7/0.5	No asbestos found at reporting limit of 0.1 g/kg, respirable fibres not detected
Bore 8/0.05	No asbestos found at reporting limit of 0.1 g/kg, respirable fibres not detected
Bore 8/2.0	No asbestos found at reporting limit of 0.1 g/kg, respirable fibres not detected
Bore 9/0.5	No asbestos found at reporting limit of 0.1 g/kg, respirable fibres not detected

10. Proposed Development

It is understood that the proposed development includes the following:

- Five storey extensions to the north/west of the existing buildings;
- Possible new two storey building to north east of existing buildings;
- Possible new two storey building to north of existing buildings;
- New buildings will be of reinforced concrete construction with column working loads of up to about 6000 kN for the five storey extensions and about 2000 kN for the two storey building;
- There will also be new areas of at grade car parking to the east of the existing buildings, which will not extend past the existing lot boundaries. These will include areas of existing carpark as well as existing grassed areas;
- Possible access road through Lot 1, DP1050937 to the north, off Toorak Court;
- Cuts and fills are not known at this stage for the proposed eastern and northern building envelopes, but for the proposed west building envelope are expected to be up to 3 m in the southern portion of the building envelope and possibly up to 0.5 m of fill in the northern extents. With a basement excavation in the north eastern corner cut is expected up to 3 m depth.
- It is understood that a detention basin is proposed for the north east corner of the site

11. Assessment of Contamination

11.1 Assessment Criteria

The results of the chemical analysis were compared to the following NSW DECCW recommended guidelines:

- NSW DEC. Contaminated Sites - Guidelines for the Site Auditor Scheme 2nd Edition, April 2006 (Ref 2);
- NSW EPA (1994). Contaminated Sites - Guidelines for Assessing Service Station Sites, December 1994 (Ref 4);
- NSW DECCW (2009). Waste Classification Guidelines – Part 1: Classifying Waste, December 2009, (Ref 3).

The NSW DEC Guidelines for the NSW Site Auditor Scheme (Ref 2) contain National Environmental Health Forum (NEHF) levels for various beneficial use scenarios including: low density residential (A), high density residential (D), recreational (E) and commercial/industrial (F). These criteria are applicable where aesthetic and ecological concerns are not an issue. Health based criteria for commercial/industrial landuse (NEHF F), are considered to be appropriate for the current and proposed development.

The NSW EPA Guidelines for Assessing Service Station Sites (Ref 4) were used to assess total TRH and BTEX contamination across the site. The criteria used are threshold concentrations for sensitive land use.

The NSW DECCW Guidelines for Waste Classification (Ref 3) were used to assess soil conditions for possible off-site disposal to a licensed landfill.

11.2 Assessment of Contamination

Soil chemical analysis results were within the health based criteria for commercial/industrial landuse (ie NEHF F) and NSW EPA sensitive landuse criteria for TRH and BTEX,

The results of the assessment indicated that the materials tested are classified ‘General Solid Waste’, considering total and leachable contaminant concentrations.

12. Comments

12.1 Site Classification

Site classification of foundation soil reactivity provides an indication of the propensity of the ground surface to move with seasonal variation in moisture. The site classification is based on procedures presented in AS 2870-2011 (Ref 5), the typical soil profiles revealed in the boreholes and the results of laboratory testing.

Filling was encountered in the proposed northern and eastern building envelopes to depths greater than 0.4 m, therefore each building envelope is classified Class P. A Class P classification requires all footings to be designed in accordance with engineering principles for the conditions encountered at the individual footing locations. Further advice on footing options and design parameters are presented in Section 12.2.

The characteristic surface movement, y_s, due to reactive clay filling in Class P areas is estimated to be in the order of 50 mm – 65 mm and the design of structures and footings (including if piled footings are adopted) would need would need to take into account the potential for such reactive soil movements.

The classification of the proposed western building envelope and in the main the eastern building envelope is Class M (Moderately Reactive). The characteristic surface movement, ys, for these building envelopes is estimated to be in the order of 25 mm – 40 mm.

Based on the methods presented in AS2870-2011 (Ref 5), surface movements (y_t) of up to 30 mm greater than normal seasonal effects could be expected due to the removal of trees. These surface movements should be added to the differential mound movement (y_m) as defined in AS2870-2011 (Ref 5). This should be considered for the design of the footings at the site.

Site classification, as above, has been based on information obtained from the boreholes and on the results of laboratory testing. In the event that conditions encountered during construction are different to those presented in this report, it is recommended that advice be obtained from this office.

It should be noted that this classification is dependant on proper site maintenance, which should be carried out in accordance with the attached CSIRO BTF 18, “Foundation Maintenance and Footing Performance: A Homeowner’s Guide” and with AS 2870-2011 (Ref 5) for a Class M site.

Masonry walls should be articulated in accordance with TN61 (Ref 6), to reduce the effects of differential movement.

The above classification should be revised if any significant cutting or filling is proposed, as required by AS 2870-2011 (Ref 5).

12.2 Footings

Shallow Footings

Footings should not be founded in existing or proposed filling unless it has been placed and compacted under Level 1 earthworks inspection and testing in accordance with AS 3798-2007 (Ref 7).

Shallow footings are not expected to be suitable due to the anticipated large loads (2000 kN and 6000 kN) proposed for the columns. Where strip, pad or thickened edge beams are supported on natural soil, the footing with width of 1 m could be proportioned for a maximum allowable bearing pressure of 150 kPa.

For the eastern building envelope, if this is to have a similar ground floor level to the adjacent structure then placement of an extended filled building platform will be required. The use of shallow footings, founded in the filling, would only be suitable if the existing filling and any new filling is rework/placed as controlled filling. Otherwise structural loads should be supported on piles, founded in the underlying natural ground, as discussed in the following section. If the footings are founded within Level 1 filling then the footings could be proportioned for a maximum allowable bearing pressure of 150 kPa.

Deep Footings

Piled footings are considered the most appropriate foundation type for the site conditions and the anticipated structural loads. It is understood that the existing structures are founded on bored piles. Review of a previous letter by DP (Ref 12) indicates that the recommended design parameters for bored piers founded in the extremely weathered rock were an allowable end bearing pressure of 600 kPa and allowable shaft adhesion of 50 kPa for the existing building. The report indicated that the weathered rock strength was less to the north and east of the existing building and for these locations, where a building was previously proposed, the allowable end bearing pressure was reduced to 400 kPa.

Various pile types have been considered, including driven piles (precast concrete, timber), bored cased piles, continuous flight auger (CFA, or grout-injected), and screw cast concrete (eg Atlas, Omega). Driven piles are unlikely to be suitable for major loads due to the proximity of existing structures and the vibration associated with installation. Consequently, bored CFA and screw cast concrete piles are considered suitable.

It is considered that the extremely low and very low materials are appropriate founding stratum for such piles. Based on the expected loads, this is likely to required groups of several piles at some column locations.

Although high to very high strength material was encountered in some of the bores, the depth was highly variable (over 28 m in some locations) and the material was also found to banded (Bore 5) which could result in piles refusing on very high strength material but still be underlain by the extremely low strength material. This means this material cannot be relied on for provision of additional capacity and if possible should be avoided to reduce the risk of differential settlements with piles founded on varying stiffness materials.

The estimated design geotechnical strengths ($R_{d,g}$) and allowable pressures for a range of pile diameters are shown in Table 13 and Table 14.

Table 13: Design Parameters for Bored Piles – 5 Storey Building Envelope

Stratum	Depth to Suitable Bearing Stratum for Bored Piles (m)					Limit State/Design Geotechnical Strength ($R_{d,g}$)[3]:	
	Bore 1	Bore 2	Bore 3	Bore 4	Bore 5	End Bearing[4] (kPa)	Shaft Adhesion (kPa)[5]
Very stiff	0.5	0.5	0.5	0.5	0.5	400	20
Extremely low strength/very stiff to hard	2.5	2.5	2.5	3.3	5.1	675	40
Very low strength rock	17.5	23.5	16.0[1]	17.5	17.5[2]	950	70

Notes to Table 13:

(1) High to very high strength meta dolerite encountered at 18.5 m depth

(2) Intermittent layers of high strength meta dolerite encountered below this depth

(3) Design geotechnical strength based on ϕ_g = 0.45

(4) Provided depth of pile > 4 x pile diameter

(5) AS 2159 – 2009 (Ref 8) requires that the contribution of the shaft from ground surface for 1.5 times pile diameter or 1 m (which ever is greater) shall be ignored

Table 14: Design Parameters for Bored Piles – 2 Storey Building Envelopes

Stratum	Depth to Suitable Bearing Stratum for Bored Piles (m)				Limit State/Design Geotechnical Strength ($R_{d,g}$) [1]:	
	Bore 6	Bore 7	Bore 8	Bore 9	End Bearing[2] (kPa)	Shaft Adhesion [3] (kPa)
Very stiff	1.8	4.4	0.5	1.7	400	20
Extremely low strength / very stiff to hard	6.7	5.6	1.6	3.8	450	40
Very low strength rock	-	19.0	-	-	950	70

Notes to Table 14:

(1) Design geotechnical strength based on ϕ_g = 0.45

(2) Provided depth of pile > 4 x pile diameter

(3) AS 2159 – 2009 (Ref 8) requires that the contribution of the shaft from ground surface for 1.5 times pile diameter or 1 m (which ever is greater) shall be ignored

Settlements of single piles at working loads equivalent to about 75% of the limit state design action would be approximately 1% of pile diameter, however greater settlements could occur for groups of piles. It is recommended that settlement of specific proposed pile groups be assessed as part of detailed design.

Care should be taken to ensure the base of the bored piles are cleaned and free of all loose debris and water at the time of placing concrete. Shaft adhesion values presented in Tables 13 and 14 also require all clay smear to be removed.

Numerous geological factors control the depth of weathering and hence the rock surface level is expected to vary considerably. Based on the results of Bores 1 to 9, the very low to low strength or better rock levels at the site vary considerably, from approximately 16 m to 23.5 m depth in the bores. Furthermore previous investigations at the site, of which there are limited details, indicated deteriorating strengths to the north and the east of the current building. Some evidence of reduced strengths were observed in the weathered rock profile in Bores 6 to 9 (two-storey building footprints), however not to any significant extent in Bores 1 to 5 for the five storey building. It is noted however that the Bores 3 and 5 were located as far north in the proposed five storey building as practical due to site access and it is possible that reduced strengths may be present at the northern end of this building, more commensurate with the parameters provided in Table 14. Accordingly, geotechnical monitoring and inspection of cuttings should be undertaken during pile installation to confirm pile capacities and that the piles have been socketed into suitable material.

If CFA piles are proposed, which do not allow the founding conditions to be assessed during installation, it is recommended that additional bores or possibly cone penetration testing (CPT) be undertaken to confirm founding conditions for piles.

Higher capacities than those presented in Tables 13 and 14 may be achievable if load testing is undertaken during construction in accordance with AS 2159-2009 (Ref 8).

The geo-chemical soil and water tests listed in Table 8 (Section 9.2) indicate a non-aggressive to moderate classification when compared to the requirements for steel/concrete piles presented in AS 2159-2009 (Ref 8).

In view of the results, it would be advisable, however, to provide sufficient concrete cover and appropriate strength to accommodate for the environment in which Port Macquarie is situated.

12.3 Earthquake Sub-soil Classification

Based on AS 1770.4-2007 and the subsurface conditions encountered on site, the earthquake sub-soil classification for the site is Class C_e – Shallow Soil Site.

12.4 Batters and Retaining Walls

It is understood that permanent batter slopes and retaining walls may be required for modification to the existing carparking areas.

In general long term batter slopes in the compacted clay fill and very stiff clay should be limited to no steeper than 2H:1V for batter heights up to 3 m vertical height, and no steeper than 3H:1V for batters up to 5 m height, however flatter batters may be required to allow maintenance if the slope is to be grassed. This should include appropriate erosion protection. Filled batters should be compacted in accordance with Section 13.8.

Unsupported excavations should not be undertaken close to the existing structures or services, as it could affect existing shallow footings. Any such proposed excavations should be subject to prior geotechnical review.

Retaining walls such as for landscaping which are not required to prevent movement of the adjacent ground, may be designed based upon “active” (Ka) earth pressure coefficients. This would comprise any non-propped or laterally unrestrained walls (eg cantilever type walls).

Where support for the ground on adjoining sites is to be maintained, the retaining wall would require anchoring or propping by some method in order to minimise lateral displacement upon excavation. If there are permanent basement walls which are expected to be laterally restrained by the completed structure, the earth pressure distribution in these situations should be based on “at-rest” (Ko) earth pressure coefficients.

The suggested design soil parameters are shown in Table 15 below. The earth pressure coefficients are for level ground at the crest and toe and are unfactored. Any additional surcharge loads, during or after construction, should be accounted for in design.

Table 15: Unfactored Retaining Wall Design Parameters

Parameter	Symbol	Clay Fill and Stiff Clay
Unit weight (above water table)	γb	18 kN/m3
Submerged (buoyant) unit weight (below water table)	γsub	8 kN/m3
Angle of Friction	ϕ	20°
Active earth pressure coefficient	Ka	0.50
At-rest earth pressure coefficient	Ko	0.7
Passive earth pressure coefficient	Kp	2.0

For cantilever or single-propped walls, the horizontal earth pressure distribution should be taken as triangular:-

$ph = K \cdot \gamma b \cdot z$, where z = depth below ground level.

Below the water table, γsub should be used instead of γb, and the contribution of hydrostatic water pressure should be added ($\gamma w.zw$, where zw is the depth below the water table, γw = 9.81 kN/m3).

The walls should be backfilled using free draining gravel encapsulated in a filter fabric and should include subsoil drainage routed to the site stormwater system.

12.5 Slope Stability

No evidence of deep seated or overall slope instability was observed on the site or immediate surrounds.

The south western carpark is in an area of cut supported by concrete crib walls up to about 3 m vertical height, which seemed in good condition.

Fill batters up to 5 m vertical height with slopes typically about 15^{o} to 17^{o} and locally up to 21^{o} were located to the north and west of the main building and the footprint of the proposed northern building will extend across this batter. The results of investigation indicate that the batters are likely to comprise clay filling (ranging in thickness at Bores 5 to 7 from 0.4 m to 4.4 m thick) overlying very stiff clay. Groundwater was measured in Bore 7 about 2 m below the base of the batter.

Based on site observations, regional topography and geology and results of subsurface investigation on site a qualitative assessment of slope instability has been undertaken using the methods outlined in Appendix G of Ref 13. A copy of that appendix is attached.

The following hazards are identified:

- Deep seated overall sliding. In the absence of known sliding in the area, with relatively gentle overall slopes and the presence of competent weathered bedrock at shallow depth this would be considered a rare event;
- Instability of existing retaining walls to south western of carpark. The walls appear to be in good condition and failure is considered unlikely;
- Failure of the fill batter slopes encroaching below the main structure which is set 10 m back from the batter crest and at batter slopes about 20^{o} or less. Such a failure would be considered rare and as the structure is supported on piles below the toe of the batter such a batter failure may have limited effect on the structure. Shallow slumping of the batters is considered possible in adverse wet conditions; however such slumping would only be expected to affect the landscaping;
- Failure of proposed new retaining wall and batters would be considered rare provided that they are designed in accordance with sound engineering principles and recommendations in Section 13.4 are taking into account.

The consequences of the events are summarised in Table 16, together with the qualitative risk assessment as per Appendix G of Ref 7.

Table 16: Slope Stability Risk Assessment

Hazard Description		Likelihood	Consequences of Hazard		Risk Evaluation Property
			Elements at Risk	Consequences for Property	
1	Deep seated overall sliding	Not Credible	Extensive damage to buildings, services and roads	Catastrophic	Very Low
2	Instability of existing retaining walls (south western boundary)	Unlikely	Gas tank and car parking	Minor	Very Low to Low
3	Failure of fill batters, north-east area encroaching to main structures	Rare	Main Structure	Major	Low to Medium
4	Shallow slumping of fill batters	Unlikely	Landscaping	Minor	Very low to low
5	New Retaining Walls and Batters designed in accordance with sound engineering principles	Rare	Various structures	Minor-Major	Lot to Medium

Very low, low and low to medium risk would normally be considered acceptable by owners and authorities.

By reference to Table 16, it will be seen that:

- The risk associated with deep seated instability is Very Low;
- The risk associated with the existing retaining walls in the south western of the site is Very Low to Low;
- The risk associated with failure of the northern and eastern fill batters is Low to Medium. This would normally be considered acceptable
- The risk associated with new retaining wall and batters is considered no greater than Low to Medium, provided that they are designed in accordance with sound engineering principles and recommendations in Section 13.4 are taking into account.

12.6 Detention Basin

It is understood that a detention basin is now proposed in the north east corner of the site. The basin will be formed from battered soil walls and the base level of the basin is proposed to be slightly below existing ground levels. It is understood that a low permeability base and walls are required in the pond to assist with retaining water.

No specific investigation was undertaken for this basin; however it is understood to be located in the proximity of Pit 14. Pit 14 encountered clayey silt topsoil to 0.1 m, over clayey silt to 0.4 m over very stiff to hard clay to at least 1.5 m depth.

No specific permeability testing has been undertaken, however experience indicates that the clayey silt soils can have a relatively high permeability compared to the underlying clay soils. Such material can also be very sensitive to moisture, becoming difficult to work in wet conditions,

Therefore, it is considered that any clayey silt material should be stripped from the footprint of the proposed basin to the level of stiff clay. The clay foundation would require compaction to a suggested depth of at least 0.3 m. Raising of the base of the basin, if required, as well as construction of the basin walls could then be undertaken using appropriately compacted clay.

Provided that the clay soils are compacted to a minimum dry density ratio of 100% Standard (AS1289.5.1.1) within a moisture content of ± 2% of standard optimum moisture content the estimated permeability would be in the order of 10^{-7} m/s and possibly lower.

It is noted that clay soils can be susceptible to dispersion, which can lead to erosion and/or piping failure of detention basin walls, however no testing has been undertaken to see if the site clays are dispersive. The risk of dispersion can be reduced by limiting batter slopes (preferably to 3H:1V or less) and undertaking appropriate compaction, however for highly dispersive clay there may be a need to add gypsum at 1% to 2% to control the risk. It is recommended that Emerson class dispersion testing be undertaken to assess the dispersiveness of the clay and determine if gypsum dosing is required.

12.7 Pavement Design

12.7.1 Pavement Design Parameters

As recommended by the Port Macquarie Hastings Council Pavement Design Specification (Ref 9), the following pavement thickness designs are in accordance with Austroads – Guide to Pavement Technology (Ref 10).

Design Traffic

With reference to Austroads – Guide to Pavement Technology (Ref 10) and a design life of 20 years for flexible pavement, a traffic loading of $4x10^4$ Equivalent Standard Axles (ESA) has been adopted for the main access road. This is equivalent to a local access road without a regular bus service, or about eight heavy vehicle movements per day.

For access roads subject to car traffic and with the occasional heavy vehicle movement, a traffic loading of $4x10^3$ ESA has been adopted. This approximately equivalent to one heavy vehicle per day over a 20 year design life.

A pavement thickness has also been provided for areas subject to only cars and light commercial vehicles less than 3 tonnes gross weight. This pavement should not be subject to heavy vehicle traffic.

If the traffic loading is to be significantly different from these assumed values, the pavement thickness design should be reviewed.

Subgrade CBR

The results of laboratory testing on the clay subgrade indicated a soaked CBR of 3.5%, 5% and 14%. Based on experience with similar materials in this area, a design subgrade CBR of 3% is considered appropriate for pavement thickness design. It is noted that the results of compaction testing indicated field moisture contents ranged from 8% dry to 1% wet of optimum moisture content (OMC) and therefore moisture conditioning may be required during construction.

12.7.2 Flexible Pavement Thickness Design

The flexible pavement thickness design for the proposed carpark is presented in Table 17, below. The thickness design has been undertaken in accordance with Austroads (Ref 10).

Table 17: Flexible Unbound Pavement Thickness

Pavement Layer	Thickness (mm)		
	Car Parking (4x10^3 DESA)	Light Access Road (4x10^3 DESA)	Main Access Road (4x10^4 DESA)
Wearing Course	Two Coat Spray Seal or 30 mm AC[1]	Two Coat Spray Seal or 40 mm AC[1]	Two Coat Spray Seal or 40 mm AC[1]
Basecourse	200	100	100
Subbase	-	200	255
Select Subgrade	-[2]	-[2]	-[2]
Total	**200**	**300**	**355**

Notes to Table 17:

[1] Where an asphalt (AC) wearing course is used the thickness of the subbase course may be reduced by the thickness of asphalt to maintain the same total pavement thickness as for two coat spray seal.

[1]Where asphalt is to be used as a wearing course, a 7 mm or 10 mm prime seal should be placed over the basecourse.

[2] Select subgrade could be required if subgrade moisture conditions at the time of construction are higher than those encountered during this investigation. The thickness of the select material will depend on the moisture content at the time, however could range from 300 to 500 mm.

The pavement thicknesses presented above is dependant on the provision and maintenance of adequate surface and subsurface drainage.

The recommended material quality and compaction requirements for flexible pavement are presented in Table 18, below.

Table 18: Material Quality and Compaction Requirements – Flexible Pavement

Pavement Layer	Material Quality	Compaction Requirements
Basecourse	CBR >80%, PI <6%, Grading in accordance with RTA Form 3051 (Ref 11)	Compact to at least 98% dry density ratio Modified (AS 1289.5.2.1)
Subbase	CBR >30%, PI <12%. Grading in accordance with RTA Form 3051 (Ref 11)	Compact to at least 95% dry density ratio Modified (AS 1289.5.2.1)
Select Subgrade	CBR ≥ 15%	Compact to at least 100% dry density ratio Standard (AS 1289.5.1.1)
Subgrade	CBR ≥ 3%	Refer Section 12.3.3 below

Notes to Table 18:
CBR – California bearing ratio
PI – Plasticity Index

The pavement layers should be placed at a maximum loose thickness of 300 mm prior to compaction.

The site of the access road, near Bores 15 and 16, contains variable filling. Construction of a pavement over the existing filling would involve acceptance of a risk of differential movement and reduced or possible resultant loss of serviceability of the pavement.

This risk could be reduced, but not necessarily eliminated, by re-compaction of the upper zone of filling. It is suggested that excavation to about 0.5 m depth below the proposed subgrade level, followed by compaction of the exposed surface with a heavy vibratory roller of at least 8 tonne static mass would improve the subgrade conditions. Alternatively, the settlements could be minimised by removing the full depth of the existing filling and recompacting under Level 1 requirements presented in AS 3798 – 2007 (Ref 7).

12.8 Subgrade Preparation and Site Earthworks

The following general subgrade preparation and treatment procedure is suggested for below proposed pavements and slabs, and for general site filling:

- Excavate to design subgrade level;
- Remove any additional topsoil, loose filling, deleterious materials including organic materials. Over-excavate in areas of variable filling, as discussed above;
- Test roll the surface in order to determine any soft zones and assess moisture condition;
- Clay subgrade moisture contents should be in the range -3% (dry) to standard optimum moisture content (OMC);
- If required, place select subgrade in areas of wet subgrade and/or areas, exhibiting excessive movement. The thickness of select subgrade will depend on the conditions during construction but could be expected to range up to 300 mm, possibly more;

- For raising of subgrade levels and/or placing select subgrade, the material should be placed in layers not exceeding 300 mm loose thickness and compact to a minimum dry density ratio of 100% Standard (AS1289.5.1.1);
- Filling should be placed beyond the line of any proposed batters and then subsequently trimmed to form the required batter slope.

Geotechnical inspections and testing should be undertaken during construction in accordance with AS 3798-2007 (Ref 7).

12.9 Contamination

Limited contamination testing has been undertaken within the areas of proposed development. The results of this limited contamination testing from the boreholes within the site suggested the general absence of contamination at the locations tested. Access to some parts of the site was limited at the time on investigation. Additional work may be required in the event of a review by regulatory authorities or Auditor.

Historical site information suggested the potential for contamination from former landuses, including possible market gardens, a farm shed, on-site effluent disposal and possible filling. Current potential contaminant sources include underground and above ground fuel storage associated with the emergency generator systems. Investigation has not been undertaken on the fuel storage areas, and the potential for site contamination associated with underground fuel storage cannot be discounted. It is noted, however, that the fuel storage areas are not associated with the proposed development.

Therefore the site is considered suitable for the proposed development with respect to contamination, provided that additional inspections be undertaken during construction to verify conditions with respect to contamination.

If soils other than those observed during the investigation are encountered during development, or staining or odours are observed within excavated soils during development, additional investigation and advice should be sought. If additional contamination is identified then appropriate excavation and removal/disposal/capping of contaminated soil, followed by validation sampling and analysis to the requirements of SEPP 55 and NSW OEH may be required.

Laboratory testing indicated the soil samples tested would be classified as ‘General Solid Waste’ for disposal to an appropriately licensed landfill, based on total and leachable (TCLP) contaminant concentrations.

Soils have not been assessed for transport and re-use on another site. Additional assessment, including inspections and possibly laboratory testing, will be required if soils are proposed to be re-used as filling at another site.

12.10 Salinity and Sodicity

The results of the assessment indicated the following with respect to potential soil salinity at the site:

- Published mapping suggests the absence of dryland salinity indicators in the vicinity of the site;
- Subsurface conditions typically comprise clayey soils underlain by bedrock across the site;
- EC testing of groundwater at the site suggested fresh conditions;
- EC testing of selected soils indicated non-saline soils.

Based on the above results, it is considered that the site poses a low salinity risk

The exchangeable sodium percentage (ESP) testing undertaken on selected soils/fill within the site is a measure of sodicity (ie exchangeable sodium) of the soil, which relates to likely dispersion and shrink/swell of soils upon wetting (Ref 1). The results of laboratory testing indicated generally non-sodic conditions in the soils tested, with the exception of the clay filling sample from Bore 6/1.0 m. Sodicity can lead to poor drainage, hard setting soils and erosion (Ref 1).

At this stage, no specific soil improvement is recommended with respect to soil sodicity, due to the general absence of sodic soils. Maintenance of a vegetation cover and minimising exposure of potentially sodic soils to rainfall and surface water runoff will assist in reducing the affects of sodicity.

In the event that soil sodicity is affects site soils (eg possible hard setting soils, erosion or poor vegetation growth), then an application of gypsum may be required to the affected soils.

12.11 Groundwater Depth, Recharge and Permeability

Subsurface investigation undertaken at the site indicated the predominance of clay filling and clay soil overlying bedrock at the site. A detailed assessment of soil permeability has not been undertaken at the site, however, based on the published geology and observed soil conditions, the soils at the site are considered to have low permeability.

Groundwater was encountered at depths ranging between 6.3 m and 8.9 m in weathered rock and can be expected to vary with time according to climatic conditions. Shallow groundwater is generally not expected, apart from possible seeps/perched water in the filling which could occur, especially following rainfall, however would not be associated with the regional groundwater.

The presence of low permeability fill and clay indicate that minimal groundwater recharge to the regional groundwater would be expected to occur on the site

13. References

1. Department of Land and Water Conservation, “Site Investigations for Urban Salinity”, 2002
2. NSW DEC Contaminated Sites. “Guidelines for NSW Site Auditor Scheme, 2nd Edition”, April 2006.
3. NSW DECCW, “Waste Classification Guidelines, Part 1: Classifying Waste”, December 2009.
4. NSW EPA Contaminated Sites, “Guidelines for Assessing Service Station Sites”, December 1994.
5. Australian Standard AS 2870-2011 “Residential Slabs and Footings – Construction”, January 2011, Standards Australia.
6. Cement Concrete and Aggregates Australia, TN61, “Articulated Walling”, August 2008
7. Australian Standard AS 3798-2007 “Guidelines on Earthworks for Commercial and Residential Developments”, Standards Australia.
8. Australian Standard AS 2159-2009 “Piling – Design and Installation”, Standards Australia.
9. “Development Design Specification – D2 – Pavement Design”, Port Macquarie Hastings Council, February 2004.
10. AGPT02/10 “Guide to Pavement Technology, Part 2: Pavement Structural Design”, AUSTROADS 2010.
11. RTA 3051 “Unbound and Modified Base and Subbase Materials for Surfaced Road Pavements”, Roads and Traffic Authority NSW, October 2010.
12. D J Douglas and Partners, “Port Macquarie Base Hospital, Geotechnical Investigation” Letter DJD/9160/1, 22 May 1990.
13. Landslide Risk Management Concepts and Guidelines, Australian Geomechanics Society - .37(2), May 2002

14. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for a project at Port Macquarie Base Hospital in accordance with DP's proposal dated 9 December 2010 and acceptance received from Paul Nickson of Aurecon. The report is provided for the exclusive use of Health Infrastructure and Aurecon for this project only and for the purpose described in the report. It should not be used for other projects or by a third party. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions only at the specific sampling or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of anthropogenic influences. Such changes may occur after DP's field testing has been completed.

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

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

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Appendix A

About this Report
Sampling Methods
Soil Descriptions
Symbols and Abbreviations
Rock Descriptions
Landslide Risk Management – Appendix G

About this Report

Douglas Partners

Introduction

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

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

Copyright

Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

Reports

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

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

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

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

About this Report

Site Anomalies

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

Information for Contractual Purposes

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

Site Inspection

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

Sampling

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

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

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

Test Pits

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

Large Diameter Augers

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

Continuous Spiral Flight Augers

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

Non-core Rotary Drilling

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

Continuous Core Drilling

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

Standard Penetration Tests

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

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

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of, say, 4, 6 and 7 as:

  4,6,7
  N=13

- In the case where the test is discontinued before the full penetration depth, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm as:

  15, 30/40 mm

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

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

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

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

Soil Descriptions

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Description and Classification Methods

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

Soil Types

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

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

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

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

The proportions of secondary constituents of soils are described as:

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

Definitions of grading terms used are:

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

Cohesive Soils

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

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

Cohesionless Soils

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

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

Soil Descriptions

Soil Origin

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

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

Transported soils may be further subdivided into:

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

Symbols & Abbreviations

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Introduction

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

Drilling or Excavation Methods

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

Water

▷	Water seep
▽	Water level

Sampling and Testing

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

Description of Defects in Rock

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

Defect Type

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

Orientation

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

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

Coating or Infilling Term

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

Coating Descriptor

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

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

Symbols & Abbreviations

Graphic Symbols for Soil and Rock

General


Asphalt


Road base


Concrete


Filling

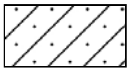
Soils


Topsoil

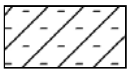

Peat


Clay

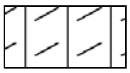

Silty clay

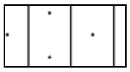

Sandy clay

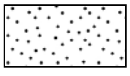

Gravelly clay

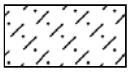

Shaly clay

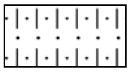

Silt


Clayey silt


Sandy silt

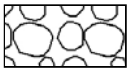

Sand

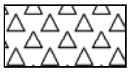

Clayey sand


Silty sand


Gravel


Sandy gravel


Cobbles, boulders

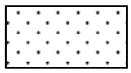

Talus

Sedimentary Rocks

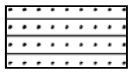

Boulder conglomerate

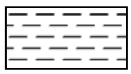

Conglomerate


Conglomeratic sandstone

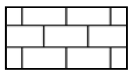

Sandstone


Siltstone


Laminite

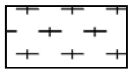

Mudstone, claystone, shale

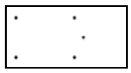

Coal


Limestone

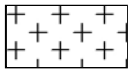
Metamorphic Rocks

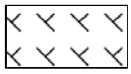

Slate, phyllite, schist

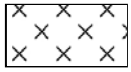

Gneiss

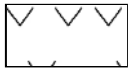

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

Rock Strength

Rock strength is defined by the Point Load Strength Index ($Is_{(50)}$) and refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects. The test procedure is described by Australian Standard 4133.4.1 - 1993. The terms used to describe rock strength are as follows:

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

* Assumes a ratio of 20:1 for UCS to $Is_{(50)}$

Degree of Weathering

The degree of weathering of rock is classified as follows:

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

Degree of Fracturing

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

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

Rock Descriptions

Rock Quality Designation

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

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

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

Stratification Spacing

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

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

APPENDIX G

LANDSLIDE RISK ASSESSMENT – EXAMPLE OF QUALITATIVE TERMINOLOGY FOR USE IN ASSESSING RISK TO PROPERTY

Qualitative Measures of Likelihood

Level	Descriptor	Description	Indicative Annual Probability
A	ALMOST CERTAIN	The event is expected to occur	$>\approx 10^{-1}$
B	LIKELY	The event will probably occur under adverse conditions	$\approx 10^{-2}$
C	POSSIBLE	The event could occur under adverse conditions	$\approx 10^{-3}$
D	UNLIKELY	The event might occur under very adverse circumstances	$\approx 10^{-4}$
E	RARE	The event is conceivable but only under exceptional circumstances.	$\approx 10^{-5}$
F	NOT CREDIBLE	The event is inconceivable or fanciful	$<10^{-6}$

Note: "≈" means that the indicative value may vary by say ±• order of magnitude, or more.

Qualitative Measures of Consequences to Property

Level	Descriptor	Description
1	CATASTROPHIC	Structure completely destroyed or large scale damage requiring major engineering works for stabilisation.
2	MAJOR	Extensive damage to most of structure, or extending beyond site boundaries requiring significant stabilisation works.
3	MEDIUM	Moderate damage to some of structure, or significant part of site requiring large stabilisation works.
4	MINOR	Limited damage to part of structure, or part of site requiring some reinstatement/stabilisation works.
5	INSIGNIFICANT	Little damage.

Note: The "Description" may be edited to suit a particular case.

Qualitative Risk Analysis Matrix – Level of Risk to Property

LIKELIHOOD	CONSEQUENCES to PROPERTY				
	1: CATASTROPHIC	2: MAJOR	3: MEDIUM	4: MINOR	5: INSIGNIFICANT
A – ALMOST CERTAIN	VH	VH	H	H	M
B – LIKELY	VH	H	H	M	L-M
C – POSSIBLE	H	H	M	L-M	VL-L
D – UNLIKELY	M-H	M	L-M	VL-L	VL
E – RARE	M-L	L-M	VL-L	VL	VL
F – NOT CREDIBLE	VL	VL	VL	VL	VL

Risk Level Implications

Risk Level		Example Implications(1)
VH	VERY HIGH RISK	Extensive detailed investigation and research, planning and implementation of treatment options essential to reduce risk to acceptable levels; may be too expensive and not practical
H	HIGH RISK	Detailed investigation, planning and implementation of treatment options required to reduce risk to acceptable levels
M	MODERATE RISK	Tolerable provided treatment plan is implemented to maintain or reduce risks. May be accepted. May require investigation and planning of treatment options.
L	LOW RISK	Usually accepted. Treatment requirements and responsibility to be defined to maintain or reduce risk.
VL	VERY LOW RISK	Acceptable. Manage by normal slope maintenance procedures.

Note: (1) The implications for a particular situation are to be determined by all parties to the risk assessment; these are only given as a general guide.

(2) Judicious use of dual descriptors for Likelihood, Consequence and Risk to reflect the uncertainty of the estimate may be appropriate in some cases.

Appendix B

Borehole Logs (Bores 1 to 9)
Test Pit Logs (Pits 10 to 16)
Dynamic Penetrometer Testing

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Additions to Hospital
LOCATION: Port Macquarie Base Hospital

SURFACE LEVEL: 19.4 * AHD **BORE No:** 1
EASTING: **PROJECT No:** 49728
NORTHING: **DATE:** 15 - 16/3/2011
DIP/AZIMUTH: 90°/-- **SHEET** 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
19	0.1	TOPSOIL: Brown, clayey silt topsoil, generally comprising, abundant rootlets, leaf litter							A, PID			<1 ppm
	0.6	CLAYEY SILT: Brown clayey silt, M~Wp							A, PID			<1 ppm
									U_{50}			300 - 400 kPa
18	1.0	CLAY: Very stiff to hard, orange-brown, clay, M<Wp							pp			
		SERPENTINITE: Extremely low strength, extremely weathered, grey, iron stained, orange serpentinite							A, PID			<1 ppm
									S			4,9,10 N = 19
17	2								A, PID			<1 ppm
									S			4,12,15 N = 27
16	3											
15	4								S			7,12,19 N = 31
	5											
14									S			6, 14, 30/100mm
13	6											
12	7								S			5,12,30 N = 42
11	8											
									S			5,6,14 N = 20
10	9											

RIG: Scout **DRILLER:** Cooper G **LOGGED:** Cowan **SURVEY DATUM:** MGA94

TYPE OF BORING: Solid flight auger to 2.95m, rotary drilling from 2.95m to 20.75m **CASING:** HW to 2.5m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS: * DP levelled using assumed RL, based on ground floor slab of western building - Piezometer installed to 18m depth, screened 12m to 18m, gravel backfill to 11m, bentonite seal to 10.5m

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Additions to Hospital
LOCATION: Port Macquarie Base Hospital

SURFACE LEVEL: 19.4 * AHD **BORE No:** 1
EASTING: **PROJECT No:** 49728
NORTHING: **DATE:** 15 - 16/3/2011
DIP/AZIMUTH: 90°/-- **SHEET** 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		SERPENTINITE: Extremely low strength, extremely weathered, grey, iron stained, orange serpentinite *(continued)*							S			12, 26, 20/90mm
	11											
									S			6,20,30 N = 50
	12											
	13								S			7,11,16 N = 27
	14											
									S			11, 30, -
	15											
	16								S			5,12,19 N = 31
	17											
									S			11, 30, -
	18											
	19								S			8, 18, 30/110mm

RIG: Scout **DRILLER:** Cooper G **LOGGED:** Cowan **SURVEY DATUM:** MGA94

TYPE OF BORING: Solid flight auger to 2.95m, rotary drilling from 2.95m to 20.75m **CASING:** HW to 2.5m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS: * DP levelled using assumed RL, based on ground floor slab of western building - Piezometer installed to 18m depth, screened 12m to 18m, gravel backfill to 11m, bentonite seal to 10.5m

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Additions to Hospital
LOCATION: Port Macquarie Base Hospital

SURFACE LEVEL: 19.4 * AHD **BORE No:** 1
EASTING: **PROJECT No:** 49728
NORTHING: **DATE:** 15 - 16/3/2011
DIP/AZIMUTH: 90°/-- **SHEET** 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-1		SERPENTINITE: Extremely low strength, extremely weathered, grey, iron stained, orange serpentinite *(continued)*										
									S			14, 30/100mm, -
	20.75	Bore discontinued at 20.75m, limit of investigation										
	21											
-2												
	22											
-3												
	23											
-4												
	24											
-5												
	25											
-6												
	26											
-7												
	27											
-8												
	28											
-9												
	29											
-10												

RIG: Scout **DRILLER:** Cooper G **LOGGED:** Cowan **SURVEY DATUM:** MGA94

TYPE OF BORING: Solid flight auger to 2.95m, rotary drilling from 2.95m to 20.75m **CASING:** HW to 2.5m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS: * DP levelled using assumed RL, based on ground floor slab of western building - Piezometer installed to 18m depth, screened 12m to 18m, gravel backfill to 11m, bentonite seal to 10.5m

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Additions to Hospital
LOCATION: Port Macquarie Base Hospital

SURFACE LEVEL: 19.2 * AHD **BORE No:** 2
EASTING: **PROJECT No:** 49728
NORTHING: **DATE:** 10/3/2011
DIP/AZIMUTH: 90°/-- **SHEET** 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
19	0.1	TOPSOIL: Dark grey clayey silt topsoil generally comprising trace to some fine sized subangular gravel, abundant rootlets							A, PID			<1 ppm
									A, PID			<1 ppm
18	1	CLAY: Very stiff to hard, red brown clay with some fine to medium sized subangular to angular gravel, M~Wp							A, PID			<1 ppm
									S, pp			3,6,8 N = 14 >400 kPa
17	2											
	2.5	SERPENTINITE: Extremely low strength, extremely weathered, grey-green, iron stained seperntinite							S, pp			8,11,18 N = 29 >400 kPa
16	3											
15	4								S, pp			6,9,15 N = 24 350 - >400kPa
14	5											
									S, pp			5,10,18 N = 28 >400 kPa
13	6											
12	7								S, pp			6,10,16 N = 26 >400 kPa
11	8											
									S, pp			7,13,17 N = 30 >400 kPa
10	9											

RIG: Scout **DRILLER:** Cooper L **LOGGED:** Cowan **SURVEY DATUM:** MGA94

TYPE OF BORING: Solid flight auger vbit to 2.95m, rotary drilling from 2.95m to 28.0m **CASING:** HW to 2.5m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS: * DP levelled using assumed RL, based on ground floor slab of western building

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Additions to Hospital
LOCATION: Port Macquarie Base Hospital

SURFACE LEVEL: 19.2 * AHD **BORE No:** 2
EASTING: **PROJECT No:** 49728
NORTHING: **DATE:** 10/3/2011
DIP/AZIMUTH: 90°/-- **SHEET** 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
9		SERPENTINITE: Extremely low strength, extremely weathered, grey-green, iron stained seperntinite *(continued)*							S, pp			7,12,16 N = 28 >400 kPa
8	11											
7									S, pp			6,13,17 N = 30 >400 kPa
	12											
6	13								S, pp			5,12,16 N = 28 300 - >400 kPa
5	14											
		From 14.5m to 14.7m, sv, joints, healed							S, pp			7,15,24 N = 39
4	15											
3	16								S, pp			9,14,22 N = 36 300 - >400 kPa
2	17											
									S, pp			6,14,17 N = 31 300 - >400 kPa
1	18											
0	19								S, pp			6,9,16 N = 25 >400 kPa

RIG: Scout **DRILLER:** Cooper L **LOGGED:** Cowan **SURVEY DATUM:** MGA94

TYPE OF BORING: Solid flight auger vbit to 2.95m, rotary drilling from 2.95m to 28.0m **CASING:** HW to 2.5m

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Additions to Hospital
LOCATION: Port Macquarie Base Hospital

SURFACE LEVEL: 19.2 * AHD **BORE No:** 2
EASTING: **PROJECT No:** 49728
NORTHING: **DATE:** 10/3/2011
DIP/AZIMUTH: 90°/-- **SHEET** 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-1	21	SERPENTINITE: Extremely low strength, extremely weathered, grey-green, iron stained seperntinite *(continued)*							S, pp			4,8,11 N = 19 300 - >400 kPa
-2												
-3	22	From 22.0m, slightly silty/fine grained sand							S			5,14,32 N = 46
-4	23											
-5	24								S			18,46,- refusal
-6	25	From 24.5m, very low to low strength										
-7	26											
-8	27											
-9	28 28.0	Bore discontinued at 28.0m, limit of investigation										
-10	29											

RIG: Scout **DRILLER:** Cooper L **LOGGED:** Cowan **SURVEY DATUM:** MGA94

TYPE OF BORING: Solid flight auger vbit to 2.95m, rotary drilling from 2.95m to 28.0m **CASING:** HW to 2.5m

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B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Additions to Hospital
LOCATION: Port Macquarie Base Hospital

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

BORE No: 3
PROJECT No: 49728
DATE: 9/3/2100 - 9/3/2011
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
17	0.1	TOPSOIL: Dark grey clayey silt topsoil generally comprising trace to some fine sized subangular gravel, abundant rootlets							A, PID			<1 ppm
									A, PID			<1 ppm
16	1	CLAY: Very stiff to hard, red brown clay with some fine to medium sized subangular to angular gravel, M~Wp							A, PID			<1 ppm
									S, pp			3,4,8 N = 12 350 - 400 kPa
									A, PID			<1 ppm
15	2											
	2.5	SERPENTINITE: Extremely low strength, extremely weathered, grey green and iron stained serpentinite							S, pp			5,11,14 N = 25 >400 kPa
14	3											
13	4								S, pp			5,12,18 N = 30 >400 kPa
12	5											
									S, pp			7,17,25 N = 42 >400 kPa
11	6											
10	7								S, pp			6,10,14 N = 24 >400 kPa
9	8											
									S			5,9,13 N = 22
8	9											

RIG: Scout **DRILLER:** Cooper L **LOGGED:** Cowan **SURVEY DATUM:** MGA94

TYPE OF BORING: Solid flight auger to 2.95m, rotary drilling from 2.95m to 22.2m **CASING:** HW to 2.5m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS: * DP levelled using assumed RL, based on ground floor slab of western building - Piezometer installed to 18m depth, screened 12m to 18m, gravel backfill to 11m, bentonite seal to 10.5m

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Additions to Hospital
LOCATION: Port Macquarie Base Hospital

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

BORE No: 3
PROJECT No: 49728
DATE: 9/3/2100 - 9/3/2011
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
6	11	SERPENTINITE: Extremely low strength, extremely weathered, grey green and iron stained serpentinite *(continued)*							S, pp			4,7,10 N = 17 >400 kPa
5	12								S			5,7,10 N = 17
4	13	From 13.0m to 13.45m, some sh, 45° to 60°, joints healed							S, pp			3,7,9 N = 16 >400 kPa
3	14											
2	15								S, pp			4,10,18 N = 28 >400 kPa
1	16	From 16.0m, slightly silty/fine grained sand							S			23, 55, -
0	17											
-1	18								S			14,25,45 N = 70
	18.5	META DOLERITE: High to very high strength, slightly to moderately weathered, grey meta dolerite						18.68m: P, sh, pl, ro				PL(D) = 0.91 PL(D) = >14.93
-2	19	From 18.5m to 18.61m, quarts vein 2.5mm thick From 18.77m to 18.97m, quartz vein 2mm to 10mm thick From 19.04m to 19.09m, quartz vein 5mm to 15mm thick						19m: P, sh, pl, ro 19.15m: P, sh, pl, ro 19.36m: P, sh, sv, lr, ro 19.68m: P, 60°, pl, ro	C	100	100	PL(D) = 6.21 PL(A) = 4.39 PL(D) = 3.47

RIG: Scout **DRILLER:** Cooper L **LOGGED:** Cowan **SURVEY DATUM:** MGA94

TYPE OF BORING: Solid flight auger to 2.95m, rotary drilling from 2.95m to 22.2m **CASING:** HW to 2.5m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS: * DP levelled using assumed RL, based on ground floor slab of western building - Piezometer installed to 18m depth, screened 12m to 18m, gravel backfill to 11m, bentonite seal to 10.5m

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Additions to Hospital
LOCATION: Port Macquarie Base Hospital

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

BORE No: 3
PROJECT No: 49728
DATE: 9/3/2100 - 9/3/2011
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
-3		META DOLERITE: High to very high strength, slightly to moderately weathered, grey meta dolerite *(continued)*							C	100	100	PL(A) = 2.17 PL(D) = 4.4
												PL(D) = 2.84
-4	21							20.67m: P, sh, pl, sm				
								21.26m: P, 30°, pl, ro	C	100	100	PL(D) = 3.94
-5	22							21.54m: J, 45°, pl, sm 21.55m: J, 45°, pl, sm (opposing direction) 21.76m: Hm 50°, pl, ro 21.84m: J, 70°, closed From 21.84m to 22.0m, multiple J's, 45°, he 21.94m: J, 70°, pl, ro (opposing direction) 22.08m: J, 70°, pl, ro 22.17m: J, 50°, pl, ro				
	22.2	Bore discontinued at 22.2m, limit of investigation										
-6	23											
-7	24											
-8	25											
-9	26											
-10	27											
-11	28											
-12	29											

RIG: Scout **DRILLER:** Cooper L **LOGGED:** Cowan **SURVEY DATUM:** MGA94

TYPE OF BORING: Solid flight auger to 2.95m, rotary drilling from 2.95m to 22.2m **CASING:** HW to 2.5m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS: * DP levelled using assumed RL, based on ground floor slab of western building - Piezometer installed to 18m depth, screened 12m to 18m, gravel backfill to 11m, bentonite seal to 10.5m

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Additions to Hospital
LOCATION: Port Macquarie Base Hospital

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

BORE No: 4
PROJECT No: 49728
DATE: 15/3/2011
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
17	0.015	SPRAY SEAL: 5mm thick							A			
	0.1	FILLING: Brown sandy gravel filling, generally comprising fine to medium grained sand, fine to medium sized subangular, subrounded gravel, humid							A, PID			<1 ppm
									U_{50}			
16	1	CLAY: Very stiff to hard, red-brown clay, M~Wp							pp			>400 kPa
									A, PID			<1 ppm
									S, pp			2,5,5 N = 10 300 - >400 kPa
									A, PID			<1 ppm
15	2								A, PID			<1 ppm
									S			5,11,14 N = 25
14	3											
	3.3	SERPERTENITE: Extremely low strength, extremely weathered, red-brown, grey, iron stained serpentinite										
13	4								S			29/120mm, -, -
12	5											
									S			11, 20, 29/120mm
11	6											
10	7								S			9,18,25 N = 43
9	8											
									S			9,15,22 N = 37
8	9											

RIG: Scout **DRILLER:** Cooper G **LOGGED:** Cowan **SURVEY DATUM:** MGA94

TYPE OF BORING: Solid flight auger to 2.95m, rotary drilling from 2.95m to 20.55m **CASING:** HW to 2.5m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS: * DP levelled using assumed RL, based on ground floor slab of western building

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Additions to Hospital
LOCATION: Port Macquarie Base Hospital

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

BORE No: 4
PROJECT No: 49728
DATE: 15/3/2011
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
6	11	SERPERTENITE: Extremely low strength, extremely weathered, red-brown, grey, iron stained serpentinite *(continued)*							S			9,18,26 N = 44
5	12								S			5,9,13 N = 22
4	13								S			3,7,10 N = 17
3	14											
2	15								S, pp			4,6,10 N = 16 200 - 300 kPa
1	16								S			4,5,7 N = 12
0	17											
-1	18								S			30/50mm, -, -
-2	19								S			33/50mm, -, -

RIG: Scout **DRILLER:** Cooper G **LOGGED:** Cowan **SURVEY DATUM:** MGA94

TYPE OF BORING: Solid flight auger to 2.95m, rotary drilling from 2.95m to 20.55m **CASING:** HW to 2.5m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS: * DP levelled using assumed RL, based on ground floor slab of western building

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Additions to Hospital
LOCATION: Port Macquarie Base Hospital

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

BORE No: 4
PROJECT No: 49728
DATE: 15/3/2011
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	20.55	Bore discontinued at 20.55m, limit of investigation							S			31/50mm, - , -

RIG: Scout **DRILLER:** Cooper G **LOGGED:** Cowan **SURVEY DATUM:** MGA94

TYPE OF BORING: Solid flight auger to 2.95m, rotary drilling from 2.95m to 20.55m **CASING:** HW to 2.5m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS: * DP levelled using assumed RL, based on ground floor slab of western building

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Additions to Hospital
LOCATION: Port Macquarie Base Hospital

SURFACE LEVEL: 16.2 * AHD **BORE No:** 5
EASTING: **PROJECT No:** 49728
NORTHING: **DATE:** 11 - 13/3/2011
DIP/AZIMUTH: 90°/-- **SHEET** 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
16	0.1	FILLING: Brown, clayey silt filling, generally comprising abundant rootlets							A, PID			<1 ppm
	0.4	FILLING: Brown, clay filling, generally comprising some fine to medium sized subangular, subrounded gravel, trace coal chitter							A, PID			<1 ppm
15	1	CLAY: Very stiff to hard, red-brown clay, with some fine sized subangular, subrounded gravel							A, PID U_{50}			<1 ppm 350 - >400 kPa
									pp A, PID			<1 ppm
14	2											
									S, pp			3,4,8 N = 12 350 - >400 kPa
13	3											
12	4								S, pp			6,11,14 N = 25 >400 kPa
11	5											
	5.1	CLAYSTONE: Very low strength, highly weathered, red-brown with some grey and orange claystone, with some fine to medium grained sandstone pieces, with some intermixed gravel layers							S			17,37,59 N = 96
10	6											
9	7								S			18,27,29 N = 56
8	8											
									S			31, 56, -
7	9											
	9.3	SERPENTINITE: Extremely low strength, extremely weathered, grey-green iron stained serpentinite										

RIG: Scout **DRILLER:** Cooper L **LOGGED:** Cowan **SURVEY DATUM:** MGA94

TYPE OF BORING: Solid flight auger vbit to 2.95m, rotary 2.95m to 21.40m, NMLC 21.4m to 24.0m **CASING:** HW to 2.5m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS: * DP levelled using assumed RL, based on ground floor slab of western building

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Additions to Hospital
LOCATION: Port Macquarie Base Hospital

SURFACE LEVEL: 16.2 * AHD **BORE No:** 5
EASTING: **PROJECT No:** 49728
NORTHING: **DATE:** 11 - 13/3/2011
DIP/AZIMUTH: 90°/-- **SHEET** 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
6		SERPENTINITE: Extremely low strength, extremely weathered, grey-green iron stained serpentinite *(continued)*							S			8,12,15 N = 27
5	11											
4	12								S			8,17,22 N = 39
3	13								S, pp			3,6,10 N = 16 100 - 200 kPa
2	14											
1	15								S			5,6,17 N = 23
0	16								S			4,9,18 N = 27
-1	17											
-2	18								S			8, 23, 28/90mm
-3	19								S			17, 48, 21/20mm

RIG: Scout **DRILLER:** Cooper L **LOGGED:** Cowan **SURVEY DATUM:** MGA94

TYPE OF BORING: Solid flight auger vbit to 2.95m, rotary 2.95m to 21.40m, NMLC 21.4m to 24.0m **CASING:** HW to 2.5m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS: * DP levelled using assumed RL, based on ground floor slab of western building

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Additions to Hospital
LOCATION: Port Macquarie Base Hospital

SURFACE LEVEL: 16.2 * AHD **BORE No:** 5
EASTING: **PROJECT No:** 49728
NORTHING: **DATE:** 11 - 13/3/2011
DIP/AZIMUTH: 90°/-- **SHEET** 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-4		SERPENTINITE: Extremely low strength, extremely weathered, grey-green iron stained serpentinite *(continued)*										
-5	21								C	100	0	
-6	22								C	100	0	
	22.3	SERPENTINITE: Extremely low to very low strength, extremely to highly weathered, dark grey and green serpentinite										
-7	23	From 22.70m to 22.94m, meta dolerite, high to vey high strength, moderately to slightly weathered, dark grey and green meta dolerite							C	100	0	PL(A) = 2.29 PL(D) = 3.6
		From 23.22m to 23.44m, meta dolerite, high strength, moderately to slightly weathered, dark grey and green, meta dolerite						From 23.44m to 24.00m, fragmented				PL(A) = 2.29 PL(D) = 2.23
-8	24 24.0	From 23.44m, extremely low strength, extremely weathered										
		Bore discontinued at 24.0m, limit of investigation										
-9	25											
-10	26											
-11	27											
-12	28											
-13	29											

RIG: Scout **DRILLER:** Cooper L **LOGGED:** Cowan **SURVEY DATUM:** MGA94

TYPE OF BORING: Solid flight auger vbit to 2.95m, rotary 2.95m to 21.40m, NMLC 21.4m to 24.0m **CASING:** HW to 2.5m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS: * DP levelled using assumed RL, based on ground floor slab of western building

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Additions to Hospital
LOCATION: Port Macquarie Base Hospital

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

BORE No: 6
PROJECT No: 49728
DATE: 14/3/2011
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
17	0.1	FILLING: Brown, clayey silt filling, generally comprising abundant rootlets							A, PID			<1 ppm
		FILLING: Red brown and grey clay filling, generally comprising trace fine sized subangular gravel, M~Wp							A, PID			<1 ppm
16	1								A, PID / S, pp			<1 ppm 5,5,4 N = 9 >400 kPa
	1.8	CLAY: Very stiff, red-brown, clay, M~Wp							A, PID			<1 ppm
15	2								A, PID			<1 ppm
									A, PID / S, pp			<1 ppm 5,7,8 N = 15 350 - >400 kPa
14	3											
13	4								S			2,5,6 N = 11
12	5											
									S			5,9,12 N = 21
11	6											
	6.7	SERPENTINITE: Extremely low strength, extremely weathered, red-brown, grey, iron stained serpentinite							S			8,15,28 N = 43
10	7											
9	8											
									S			18, 30/100mm, -
8	9											

RIG: Scout **DRILLER:** Cooper G **LOGGED:** Cowan **SURVEY DATUM:** MGA94

TYPE OF BORING: Solid flight auger to 2.95m, rotary drilling from 2.95m to 14.95m **CASING:** HW to 2.5m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS: * DP levelled using assumed RL, based on ground floor slab of western building

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Additions to Hospital
LOCATION: Port Macquarie Base Hospital

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

BORE No: 6
PROJECT No: 49728
DATE: 14/3/2011
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		SERPENTINITE: Extremely low strength, extremely weathered, red-brown, grey, iron stained serpentinite *(continued)*							S			24, 29/130mm, -
	11											
	12								S			13, 5, 29/110mm
	13								S, pp			4,6,5 N = 11 200 - 300 kPa
	14											
	15 14.95								S			3,19,19 N = 38
		Bore discontinued at 14.95m, limit of investigation										
	16											
	17											
	18											
	19											

RIG: Scout **DRILLER:** Cooper G **LOGGED:** Cowan **SURVEY DATUM:** MGA94

TYPE OF BORING: Solid flight auger to 2.95m, rotary drilling from 2.95m to 14.95m **CASING:** HW to 2.5m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS: * DP levelled using assumed RL, based on ground floor slab of western building

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Additions to Hospital
LOCATION: Port Macquarie Base Hospital

SURFACE LEVEL: 16.8 * AHD **BORE No:** 7
EASTING: **PROJECT No:** 49728
NORTHING: **DATE:** 8 - 9/3/2011
DIP/AZIMUTH: 90°/-- **SHEET** 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
16	0.1	FILLING: Brown clayey silt filling, generally comprising abundant rootlets, M~Wp							A,PID			<1ppm
		FILLING: Red brown clay filling, generally comprising trace to some fine to medium sized, subangular gravel, M>Wp							A,PID			<1ppm
15	1								A,PID			<1ppm
									S			2,5,7 N = 12
									pp			200 - >400kPa
									A,PID			<1ppm
14	2								A,PID			<1ppm
									A,PID			<1ppm
		From 2.8m, grey brown							S, pp			4,6,9 N = 15
13	3								A,PID			150 - 300kPa <1ppm
									A,PID			<1ppm
12	4								A,PID			<1ppm
	4.4	CLAYEY SILT: Brown clayey silt with trace fine grained sand, M~Wp							S, pp			4,2,3 N = 5
	4.7	CLAY: Very stiff to hard, red brown clay with some fine to medium sized subangular subrounded gravel, M<Wp										150 - 200kPa
11	5											
	5.6	SERPENTINITEE: Extremely low strength, extremely weathered, grey green with iron stained pockets, serpentinite							S, pp			3,8,10 N = 18
10	6											300 - >400kPa
	7								S, pp			6,6,16 N = 22
9												>400kPa
	8											
8									S, pp			7,12,16 N = 28
	9											>400kPa
7												

RIG: Scout **DRILLER:** Cooper L **LOGGED:** Cowan **SURVEY DATUM:** MGA94

TYPE OF BORING: Solid flight auger to 5.95m, rotary drilling from 5.95m to 19.45m **CASING:** HW to 5.5m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS: * DP levelled using assumed RL, based on ground floor slab of western building - Piezometer installed to 18m depth, screened 12m to 18m, gravel backfill to 11m, bentonite seal to 10.5m

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Additions to Hospital
LOCATION: Port Macquarie Base Hospital

SURFACE LEVEL: 16.8 * AHD **BORE No:** 7
EASTING: **PROJECT No:** 49728
NORTHING: **DATE:** 8 - 9/3/2011
DIP/AZIMUTH: 90°/-- **SHEET** 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		SERPENTINITEE: Extremely low strength, extremely weathered, grey green with iron stained pockets, serpentinite *(continued)*							S, pp			6,12,14 N = 26 >400kPa
	11											
		From 11.5m, ironstained with some pockets of grey white							S, pp			4,5,9 N = 14 150 - 250kPa
	12											
	13								S, pp			4,11,18 N = 29 250 - 300kPa
	14											
	15								S, pp			4,8,13 N = 21 200 - 300kPa
	16								S			8,16,17 N = 33
	17											
		From 17.5m, with some green							S			10,11,27 N = 38
	18											
	19	From 19.0m, multiple J, SH, 45°-55°, closed							S			6,19,43 N = 62
	19.45	Bore discontinued at 19.45m, limit of investigation										

RIG: Scout **DRILLER:** Cooper L **LOGGED:** Cowan **SURVEY DATUM:** MGA94

TYPE OF BORING: Solid flight auger to 5.95m, rotary drilling from 5.95m to 19.45m **CASING:** HW to 5.5m

WATER OBSERVATIONS: Free groundwater obscured by drilling fluids

REMARKS: * DP levelled using assumed RL, based on ground floor slab of western building - Piezometer installed to 18m depth, screened 12m to 18m, gravel backfill to 11m, bentonite seal to 10.5m

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Additions to Hospital
LOCATION: Port Macquarie Base Hospital

SURFACE LEVEL: 11.3 * AHD **BORE No:** 8
EASTING: **PROJECT No:** 49728
NORTHING: **DATE:** 8/3/2011
DIP/AZIMUTH: 90°/-- **SHEET** 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
11	0.1	TOPSOIL: Brown clayey silt topsoil, generally comprising trace fine grained sand, abundant rootlets, M~Wp							A,PID			<1 ppm
	0.3	CLAYEY SILT: Brown clayey silt, with trace fine grained sand, M~Wp							A,PID			<1 ppm
10	1	CLAY: Very stiff to hard, red brown clay, M<Wp, with some fine to medium sized subangular, subrounded gravel							A, PID, U_{50}			>400 kPa
	1.6	SERPENTINITE: Extremely low strength, extremely weathered, grey green with some iron pockets, serpentinite							pp, A,PID			<1 ppm
9	2								A,PID			<1 ppm
									A,PID			<1 ppm
	3								S, pp			8,15,17 N = 32 >400 kPa
8	4	From 4.0 to 5.7m, heavily iron stained							S, pp			8,17,23 N = 40 >400 kPa
7	5											
6									S, pp			7,7,9 N = 16 300 - 350 kPa
5	6											
4	7								S, pp			4,7,9 N = 16 200 -250 kPa
3	8											
									S, pp			5,8,10 N = 18 250 - 300 kPa
2	9											

RIG: Scout **DRILLER:** Cooper L **LOGGED:** Cowan **SURVEY DATUM:** MGA94

TYPE OF BORING: Solid flight auger to 11.95m **CASING:** Nil

WATER OBSERVATIONS: Free groundwater observed at 9.9m

REMARKS: * DP levelled using assumed RL, based on ground floor slab of western building

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Additions to Hospital
LOCATION: Port Macquarie Base Hospital

SURFACE LEVEL: 11.3 * AHD **BORE No:** 8
EASTING: **PROJECT No:** 49728
NORTHING: **DATE:** 8/3/2011
DIP/AZIMUTH: 90°/-- **SHEET** 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
1		SERPENTINITE: Extremely low strength, extremely weathered, grey green with some iron pockets, serpentinite *(continued)*							S, pp			24,23,27 N = 50 >400 kPa
0	11	From 10.0m, with some black pockets										
	11.95								S			5,11,15 N = 26 <1 ppm
-1	12	Bore discontinued at 11.95m, limit of investigation										
	13											
-2												
	14											
-3												
	15											
-4												
	16											
-5												
	17											
-6												
	18											
-7												
	19											
-8												

RIG: Scout **DRILLER:** Cooper L **LOGGED:** Cowan **SURVEY DATUM:** MGA94

TYPE OF BORING: Solid flight auger to 11.95m **CASING:** Nil

WATER OBSERVATIONS: Free groundwater observed at 9.9m

REMARKS: * DP levelled using assumed RL, based on ground floor slab of western building

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Additions to Hospital
LOCATION: Port Macquarie Base Hospital

SURFACE LEVEL: 9.3 * AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 9
PROJECT No: 49728
DATE: 7 - 8/3/2011
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
9.3	0	FILLING: Red brown clay filling generally comprising some fine to medium sized subrounded gravel, M~Wp							A,PID			<1 ppm
									A,PID			<1 ppm
	1	From 0.8m, orange red brown and brown							S			4,5,9 N = 14
									pp			150 - 200k Pa
	1.7	CLAY: Very stiff to hard, red brown with some grey clay, some fine to medium sized subangular gravel, M<Wp							A,PID			<1 ppm
	2								A,PID			<1 ppm
									S, pp			13,12,12 N = 24 350 - >400 kPa
	3								A,PID			<1 ppm
									A,PID			<1 ppm
5.5	3.8	SERPENTINITE: Extremely low strength, extremely weathered, green grey with some ironstained pockets, serpentinite							S			11,16,28 N = 44
	4											
	5											
									S, pp			4,7,11 N = 18 350 - >400 kPa
	6											
	7								S, pp			6,7,9 N = 16 200 kPa
									pp			>400 kPa
	8											
		From 8.5m, green grey mottled orange, red brown and ironstaining							S, pp			6,12,16 N = 28 200 - 350 kPa
	9											

RIG: Scout **DRILLER:** Cooper L **LOGGED:** Cowan **SURVEY DATUM:** MGA94

TYPE OF BORING: Solid flight auger to 11.95m **CASING:** Nil

WATER OBSERVATIONS: No free groundwater observed

REMARKS: * DP levelled using assumed RL, based on ground floor slab of western building

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Additions to Hospital
LOCATION: Port Macquarie Base Hospital

SURFACE LEVEL: 9.3 * AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 9
PROJECT No: 49728
DATE: 7 - 8/3/2011
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-1		SERPENTINITE: Extremely low strength, extremely weathered, green grey with some ironstained pockets, serpentinite *(continued)*							S, pp			6,8,11 N = 19 250 - 300 kPa
-2	11	From 1.5m, with some black veins							S			5,8,10 N = 18
-3	12 11.95	Bore discontinued at 11.95m, limit of investigation										
-4	13											
-5	14											
-6	15											
-7	16											
-8	17											
-9	18											
-10	19											

RIG: Scout **DRILLER:** Cooper L **LOGGED:** Cowan **SURVEY DATUM:** MGA94

TYPE OF BORING: Solid flight auger to 11.95m **CASING:** Nil

WATER OBSERVATIONS: No free groundwater observed

REMARKS: * DP levelled using assumed RL, based on ground floor slab of western building

SAMPLING & IN SITU TESTING LEGEND

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

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TEST PIT LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Additions to Hospital
LOCATION: Port Macquarie Base Hospital

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 10
PROJECT No: 49728
DATE: 16/3/2011
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		ASPHALT - 60mm thick							
	0.06	FILLING - Red-brown, sandy gravel filling, generally comprising fine to medium grained sand, fine to medium sized subangular, subrounded gravel, humid							
		From 0.25m, brown							
	0.3	CLAY - Very stiff, red-brown, clay, M~Wp		pp	0.4		250-350 kPa		
	0.5	CLAY - Very stiff, yellow-brown, clay, M<Wp		B	0.5				
	1			pp	1.0		300-350 kPa		1
	1.5	Pit discontinued at 1.5m, limit of investigation							

RIG: Fermac 760 Backhoe
LOGGED: Cowan
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

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TEST PIT LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Additions to Hospital
LOCATION: Port Macquarie Base Hospital

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 11
PROJECT No: 49728
DATE: 16/3/2011
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
	0.05	ASPHALT - 50 mm thick							
		FILLING - Red-brown, sandy gravel filling, generally comprising fine to medium grained sand, fine to medium sized subangular, subrounded gravel, humid		D	0.2				
	0.4	FILLING - Grey-brown filling, generally comprising fine to medium grained sand, fine to coarse sized, subangular, subrounded gravel, cobbles and boulders up to 450mm, some clay, M>Wp		D	0.6				
	1								1
	1.2	CLAY - Very stiff to hard, red-brown clay, M~Wp		pp	1.3		300->400 kPa		
				D	1.4				
	1.5	Pit discontinued at 1.5m, limit of investigation							

RIG: Fermac 760 Backhoe
LOGGED: Cowan
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

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TEST PIT LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Additions to Hospital
LOCATION: Port Macquarie Base Hospital

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 12
PROJECT No: 49728
DATE: 16/3/2011
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
	0.02	FILLING - Brown, clayey silt filling, abundant rootlets							
		FILLING - Red-brown, sandy gravel filling, generally comprising fine to medium grained sand, fine to medium sized subangular, subrounded gravel, humid							
	0.28								
	0.3	CLAYEY SILT - Brown clayey silt, M~Wp							
		CLAY - Stiff to very stiff, red-brown, clay, M<Wp							
					0.5				
				B					
	1				1.0				1
	1.5	Pit discontinued at 1.5m, limit of investigation							

5 10 15 20

RIG: Fermac 760 Backhoe
LOGGED: Cowan
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

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Geotechnics I Environment I Groundwater

TEST PIT LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Additions to Hospital
LOCATION: Port Macquarie Base Hospital

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 13
PROJECT No: 49728
DATE: 16/3/2011
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
	0.1	FILLING - Brown clayey silt filling, abundant rootlets, damp							
		FILLING - Brown filling, generally comprising fine to medium grained sand, fine to medium sized subangular, subrounded gravel, with some clay and silt		D	0.2				
	0.4	CLAY - Very stiff to hard, red-brown, clay, M>Wp							
	0.6	CLAY - Very stiff to hard, yellow-brown, clay, M~Wp		D	0.8				
	1.5	Pit discontinued at 1.5m, limit of investigation							

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: Fermac 760 Backhoe
LOGGED: Cowan
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

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TEST PIT LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Additions to Hospital
LOCATION: Port Macquarie Base Hospital

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 14
PROJECT No: 49728
DATE: 16/3/2011
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
	0.0	TOPSOIL - Brown, clayey silt topsoil, abundant rootlets							
	0.1	CLAYEY SILT - Brown, clayey silt, M~Wp							
	0.4	CLAY - Very stiff to hard, red-brown, clay, M<Wp		B	0.5				
	1				1.0				1
	1.5	Pit discontinued at 1.5m, limit of investigation							

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: Fermac 760 Backhoe
LOGGED: Cowan
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

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TEST PIT LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Additions to Hospital
LOCATION: Port Macquarie Base Hospital

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 15
PROJECT No: 49728
DATE: 16/3/2011
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
	0.1	FILLING - Brown, clayey silt filling, abundant rootlets							
		FILLING - Brown, clayey silt filling, with some coal chitter		D	0.2				
	0.3	CLAY - Stiff, red-brown to orange-brown, clay							
		From 0.75m, very stiff		D	0.8				
	1.5	Pit discontinued at 1.5m, limit of investigation							

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20; 1

RIG: Fermac 760 Backhoe
LOGGED: Cowan
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

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TEST PIT LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Additions to Hospital
LOCATION: Port Macquarie Base Hospital

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 16
PROJECT No: 49728
DATE: 16/3/2011
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
		FILLING - Brown, clayey silt filling, abundant rootlets, damp							
	0.15	FILLING - Brown filling, generally comprising fine to medium grained sand, fine to coarse sized subangular, subrounded gravel, some silt and clay, damp		D	0.3				
	0.7	CLAY - Stiff to very stiff, yellow-brown, clay, M>Wp		pp	1.0		150-200 kPa		
	1			B					
	1.5	Pit discontinued at 1.5m, limit of investigation			1.5				

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: Fermac 760 Backhoe
LOGGED: Cowan
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

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Results of Dynamic Penetrometer Tests

Client Health Infrastructure
Project Proposed Additions to Hospital
Location Port Macquarie Base Hospital

Project No. 49728
Date 16/3/2011
Page No. 1 of 1

Test Locations	12	13	14	15	16					
RL of Test (AHD)										
Depth (m)	**Penetration Resistance** Blows/150 mm									
0.00 – 0.15	2	4	2	4	4					
0.15 – 0.30	9	7	4	9	5					
0.30 – 0.45	7	7	5	3	3					
0.45 – 0.60	5	12	9	5	25					
0.60 – 0.75	4	15	10	4	20					
0.75 – 0.90	10	15	13	8	19					
0.90 – 1.05	13	15	15	8						
1.05 – 1.20	5	4	15	8						
1.20 – 1.35										
1.35 – 1.50										
1.50 – 1.65										
1.65 – 1.80										
1.80 – 1.95										
1.95 – 2.10										
2.10 – 2.25										
2.25 – 2.40										
2.40 – 2.55										
2.55 – 2.70										
2.70 – 2.85										
2.85 – 3.00										
3.00 – 3.15										
3.15 – 3.30										
3.30 – 3.45										
3.45 – 3.60										

Test Method AS 1289.6.3.2, Cone Penetrometer ☑
AS 1289.6.3.3, Sand Penetrometer ☐

Tested By JRC
Checked By PWW

Remarks Ref = Refusal, 25/110 indicates 25 blows for 110 mm penetration

Appendix C

Geotechnical Laboratory Test Results
Point Load Test Report
Soil Aggressivity Laboratory Test Results
Soil Sodicity Laboratory Test Results
Chemical Laboratory Test Results
Chain of Custody (Field and Despatch)
Sample Receipt
QA/QC Report

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Result of Shrink-Swell Index Determination

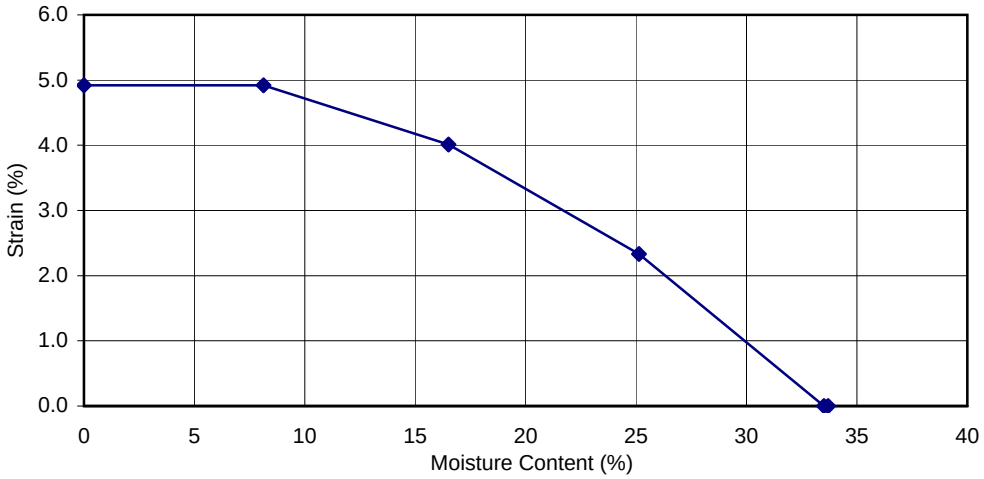
Client :	Health Infrastructure	**Project No. :**	49728.00
		Report No. :	N11-127
Project :	Proposed Additions to Hospital	**Report Date :**	18.4.2011
		Date Sampled :	7-16.3.2011
Location :	Port Macquarie	**Date of Test:**	28.3.2011
Test Location :	Bore 1		
Depth / Layer :	0.5m - 0.84m	**Page:**	1 of 1

CORE SHRINKAGE TEST

Shrinkage - air dried	4.9 %
Shrinkage - oven dried	4.9 %
Significant inert inclusions	0.0 %
Extent of cracking	SC
Extent of soil crumbling	0.0 %
Moisture content of core	33.5 %

SWELL TEST

Pocket penetrometer reading at initial moisture content	410 kPa
Pocket penetrometer reading at final moisture content	370 kPa
Initial Moisture Content	32.2 %
Final Moisture Content	33.7 %
Swell under 25kPa	0.0 %



SHRINK-SWELL INDEX Iss 2.7% per Δ pF

Description: SILTY CLAY - Orange brown silty clay

Test Method(s): AS 1289.7.1.1, AS 1289.2.1.1

Sampling Method(s): Sampled by Newcastle Engineering Department

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

Remarks: –

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

NATA Accredited Laboratory Number: 828
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Tested:	MG
Checked:	DR

Dave Millard
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Result of Shrink-Swell Index Determination

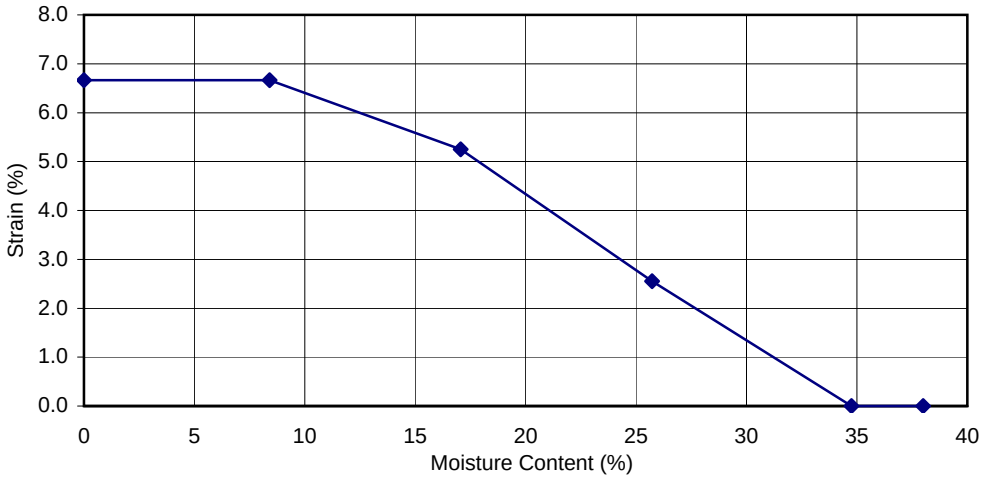
Client :	Health Infrastructure	**Project No. :**	49728.00
		Report No. :	N11-127a
Project :	Proposed Additions to Hospital	**Report Date :**	18.4.2011
		Date Sampled :	7-16.3.2011
Location :	Port Macquarie	**Date of Test:**	28.3.2011
Test Location :	Bore 5		
Depth / Layer :	1.0m - 1.4m	**Page:**	1 of 1

CORE SHRINKAGE TEST

Shrinkage - air dried	6.7 %
Shrinkage - oven dried	6.7 %
Significant inert inclusions	0.0 %
Extent of cracking	SC
Extent of soil crumbling	0.0 %
Moisture content of core	34.7 %

SWELL TEST

Pocket penetrometer reading at initial moisture content	220 kPa
Pocket penetrometer reading at final moisture content	200 kPa
Initial Moisture Content	35.2 %
Final Moisture Content	38.0 %
Swell under 25kPa	0.0 %



SHRINK-SWELL INDEX Iss 3.7% per Δ pF

Description: SILTY CLAY - Red brown silty clay

Test Method(s): AS 1289.7.1.1, AS 1289.2.1.1

Sampling Method(s): Sampled by Newcastle Engineering Department

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

Remarks: –

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

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Tested:	MG
Checked:	DR

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Result of Shrink-Swell Index Determination

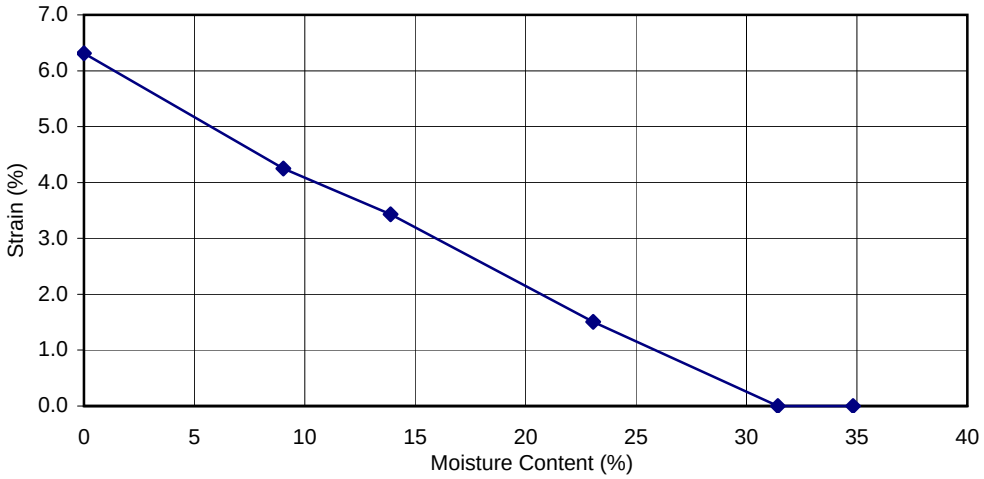
Client :	Health Infrastructure	**Project No. :**	49728.00
		Report No. :	N11-127b
Project :	Proposed Additions to Hospital	**Report Date :**	18.4.2011
		Date Sampled :	7-16.3.2011
Location :	Port Macquarie	**Date of Test:**	28.3.2011
Test Location :	Bore 8		
Depth / Layer :	1.0m - 1.4m	**Page:**	1 of 1

CORE SHRINKAGE TEST

Shrinkage - air dried	4.3 %
Shrinkage - oven dried	6.3 %
Significant inert inclusions	0.0 %
Extent of cracking	SC
Extent of soil crumbling	0.0 %
Moisture content of core	31.4 %

SWELL TEST

Pocket penetrometer reading at initial moisture content	>600 kPa
Pocket penetrometer reading at final moisture content	>600 kPa
Initial Moisture Content	32.8 %
Final Moisture Content	34.8 %
Swell under 25kPa	0.0 %



SHRINK-SWELL INDEX Iss 3.5% per Δ pF

Description: SILTY CLAY - Red brown silty clay

Test Method(s): AS 1289.7.1.1, AS 1289.2.1.1

Sampling Method(s): Sampled by Newcastle Engineering Department

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

Remarks: –

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

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Tested:	MG
Checked:	DR

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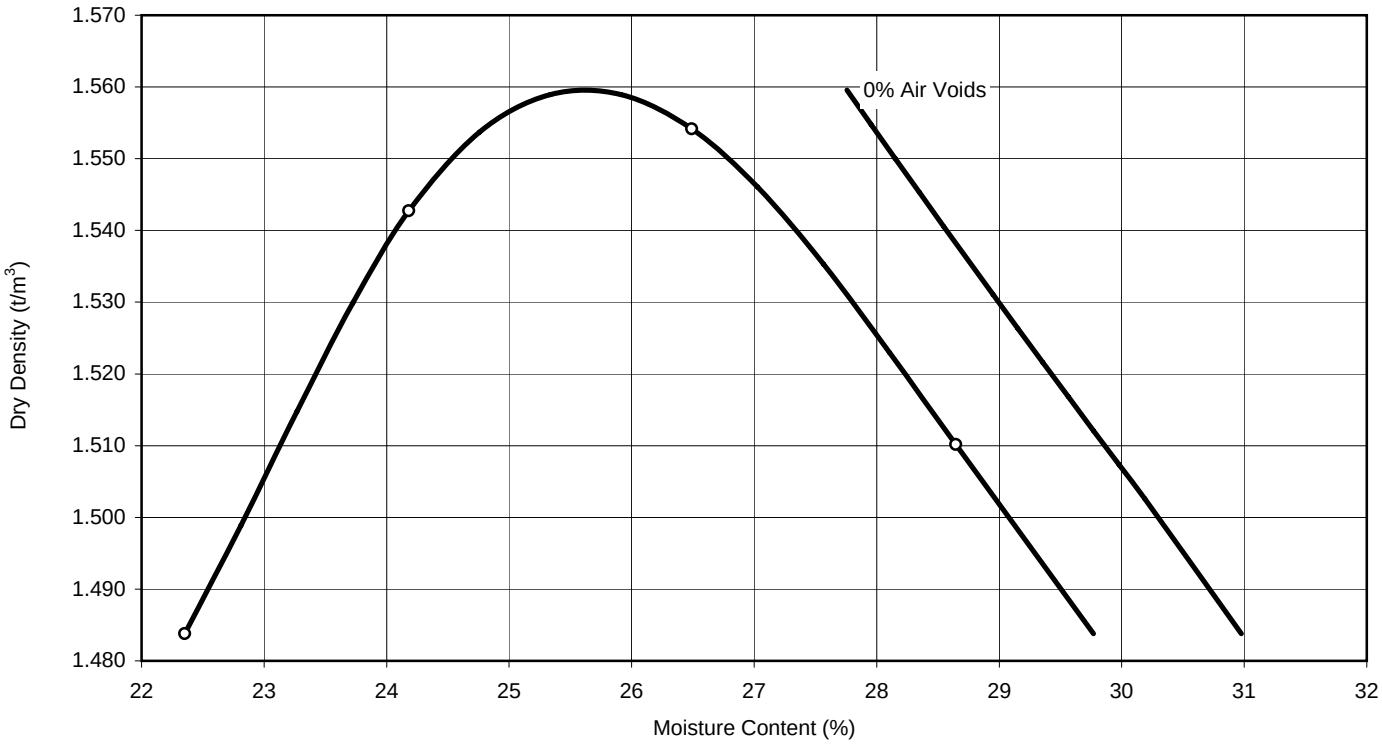
Results of Compaction Test

Client :	Health Infrastructure	**Project No. :**	49728
		Report No. :	N11-127c
Project :	Proposed Additions to Hospital	**Report Date :**	18.4.2011
Location :	Port Macquarie	**Date of Test:**	26.3.2011
		Page:	1 of 1



Sample Details: **Location:** Pit 14
Depth: 0.5m - 1.0m

Particles > 19mm: 0%

Description: CLAY - Red brown clay

Maximum Dry Density:	**1.56 t/m^3**
Optimum Moisture Content:	**25.5 %**

Remarks:

Test Methods: AS 1289.2.1.1, AS 1289. 5.1.1

Sampling Methods: Sampled by Douglas Partners' Engineers

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Tested: BB
Checked: DR

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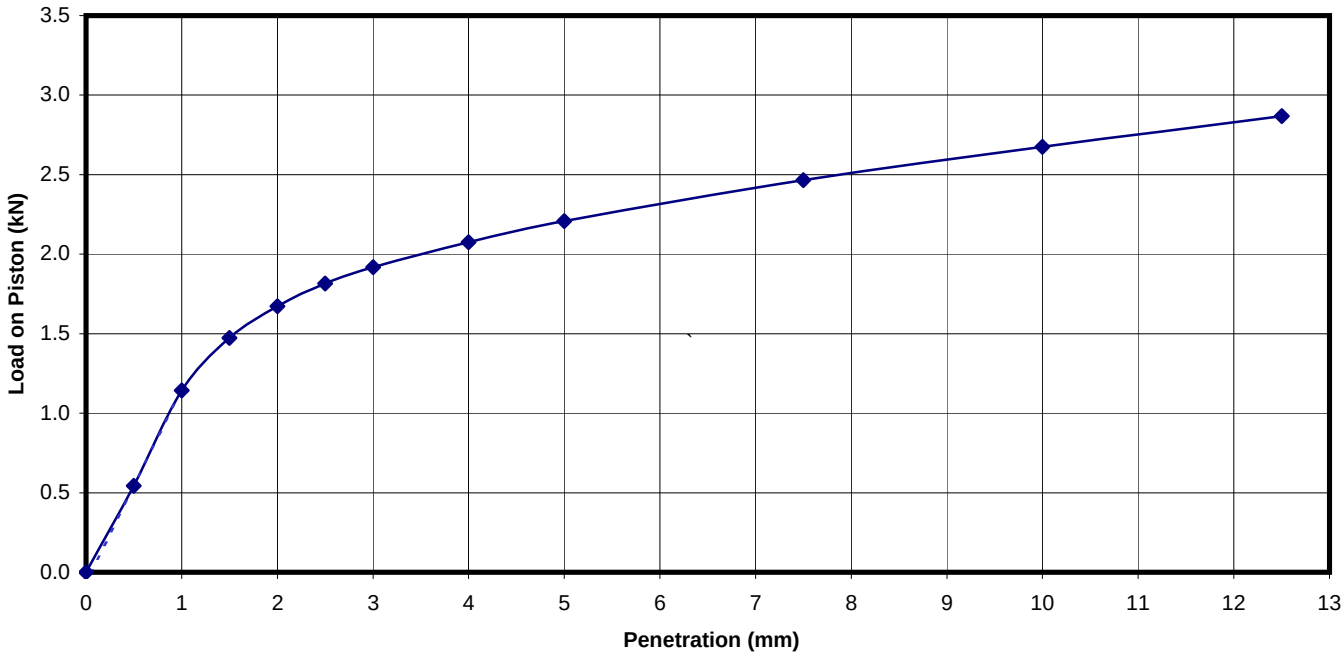
Result of California Bearing Ratio Test

Client :	Health Infrastructure	**Project No. :**	49728
		Report No. :	N11-127d
Project :	Proposed Additions to Hospital	**Report Date :**	18.4.2011
		Date Sampled :	7-16.3.2011
Location :	Port Macquarie	**Date of Test:**	1.4.2011
Test Location :	Pit 14		
Depth / Layer :	0.5m - 1.0m	**Page:**	1 of 1



Description: CLAY - Red brown clay

Test Method(s): AS 1289.6.1.1, AS 1289.2.1.1

Sampling Method(s): Sampled by Douglas Partners' Engineers **Percentage > 19mm:** 0.0%

LEVEL OF COMPACTION: 99% of STD MDD **SURCHARGE:** 4.5 kg **SWELL:** 0.2%
MOISTURE RATIO: 98% of STD OMC **SOAKING PERIOD:** 4 days

CONDITION		MOISTURE CONTENT %	DRY DENSITY t/m^3
At compaction		25.1	1.55
After soaking		27.7	1.55
After test	Top 30mm of sample	28.9	-
	Remainder of sample	26.9	-
Field values		18.4	-
Standard Compaction		25.6	1.56

RESULTS		
TYPE	**PENETRATION**	**CBR (%)**
TOP	**2.5 mm**	**14**
	5.0 mm	**11**

NATA Accredited Laboratory Number: 828
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Tested:	NH
Checked:	BB

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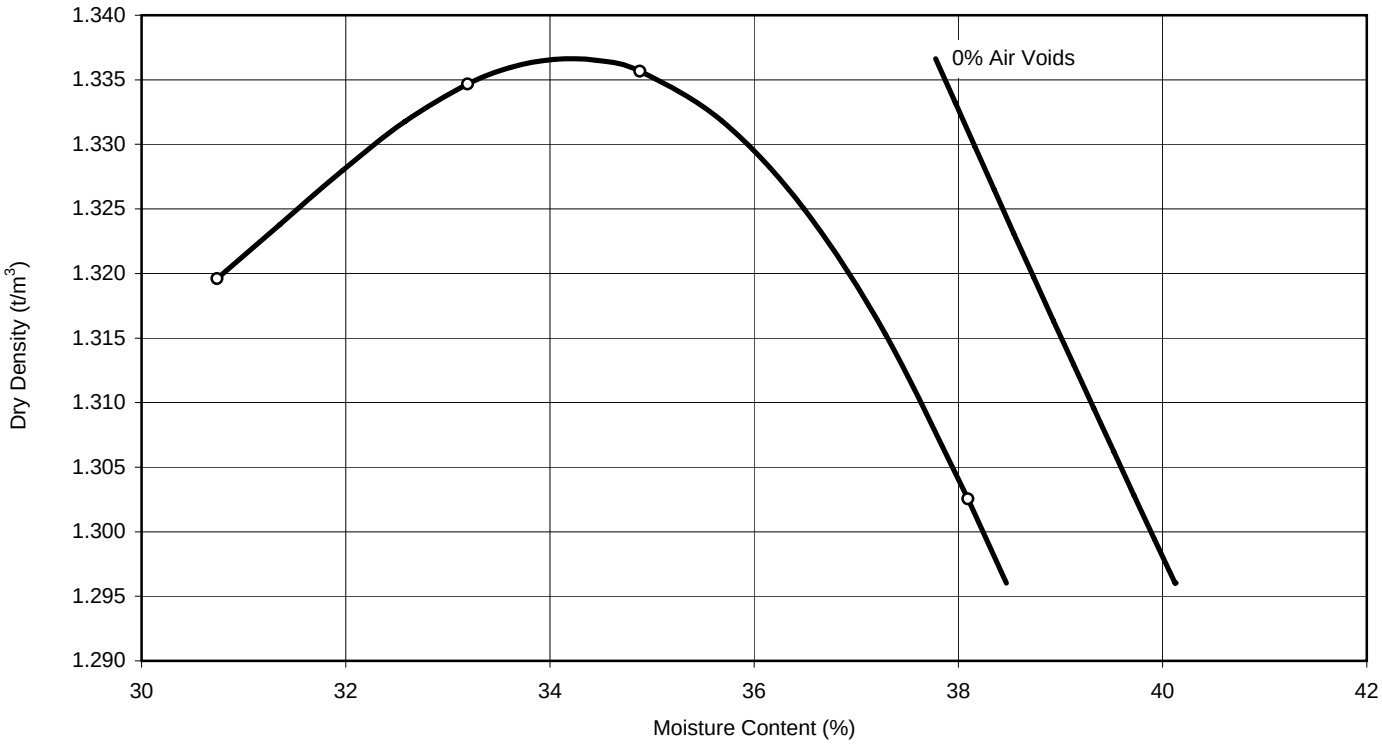
Results of Compaction Test

Client :	Health Infrastructure	**Project No. :**	49728
		Report No. :	N11-127e
Project :	Proposed Additions to Hospital	**Report Date :**	18.4.2011
Location :	Port Macquarie	**Date of Test:**	29.3.2011
		Page:	1 of 1



Sample Details: **Location:** Pit 12
Depth: 0.5m - 1.0m

Particles > 19mm: 0%

Description: CLAY - Red brown clay

Maximum Dry Density:	**1.34 t/m^3**
Optimum Moisture Content:	**34.0 %**

Remarks:

Test Methods: AS 1289.2.1.1, AS 1289. 5.1.1

Sampling Methods: Sampled by Douglas Partners' Engineers

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Tested: HG
Checked: DR

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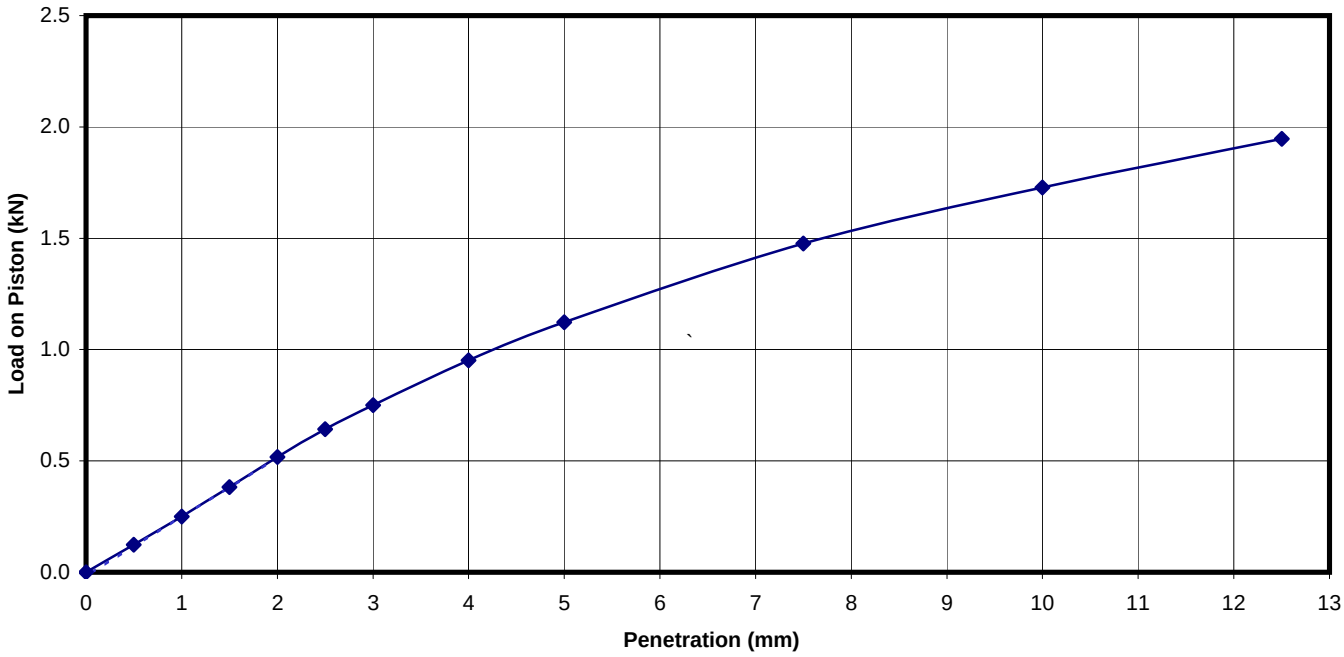
Result of California Bearing Ratio Test

Client :	Health Infrastructure	**Project No. :**	49728
		Report No. :	N11-127f
Project :	Proposed Additions to Hospital	**Report Date :**	18.4.2011
		Date Sampled :	7-16.3.2011
Location :	Port Macquarie	**Date of Test:**	1.4.2011
Test Location :	Pit 12		
Depth / Layer :	0.5m - 1.0m	**Page:**	1 of 1



Description: CLAY - Red brown clay

Test Method(s): AS 1289.6.1.1, AS 1289.2.1.1

Sampling Method(s): Sampled by Douglas Partners' Engineers **Percentage > 19mm:** 0.0%

LEVEL OF COMPACTION: 102% of STD MDD **SURCHARGE:** 4.5 kg **SWELL:** 1.2%
MOISTURE RATIO: 101% of STD OMC **SOAKING PERIOD:** 4 days

CONDITION		MOISTURE CONTENT %	DRY DENSITY t/m^3
At compaction		34.6	1.37
After soaking		36.9	1.35
After test	Top 30mm of sample	39.3	-
	Remainder of sample	36.5	-
Field values		33.2	-
Standard Compaction		34.2	1.34

RESULTS		
TYPE	**PENETRATION**	**CBR (%)**
TOP	**2.5 mm**	**5.0**
	5.0 mm	**6**

NATA Accredited Laboratory Number: 828
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Tested:	NH
Checked:	BB

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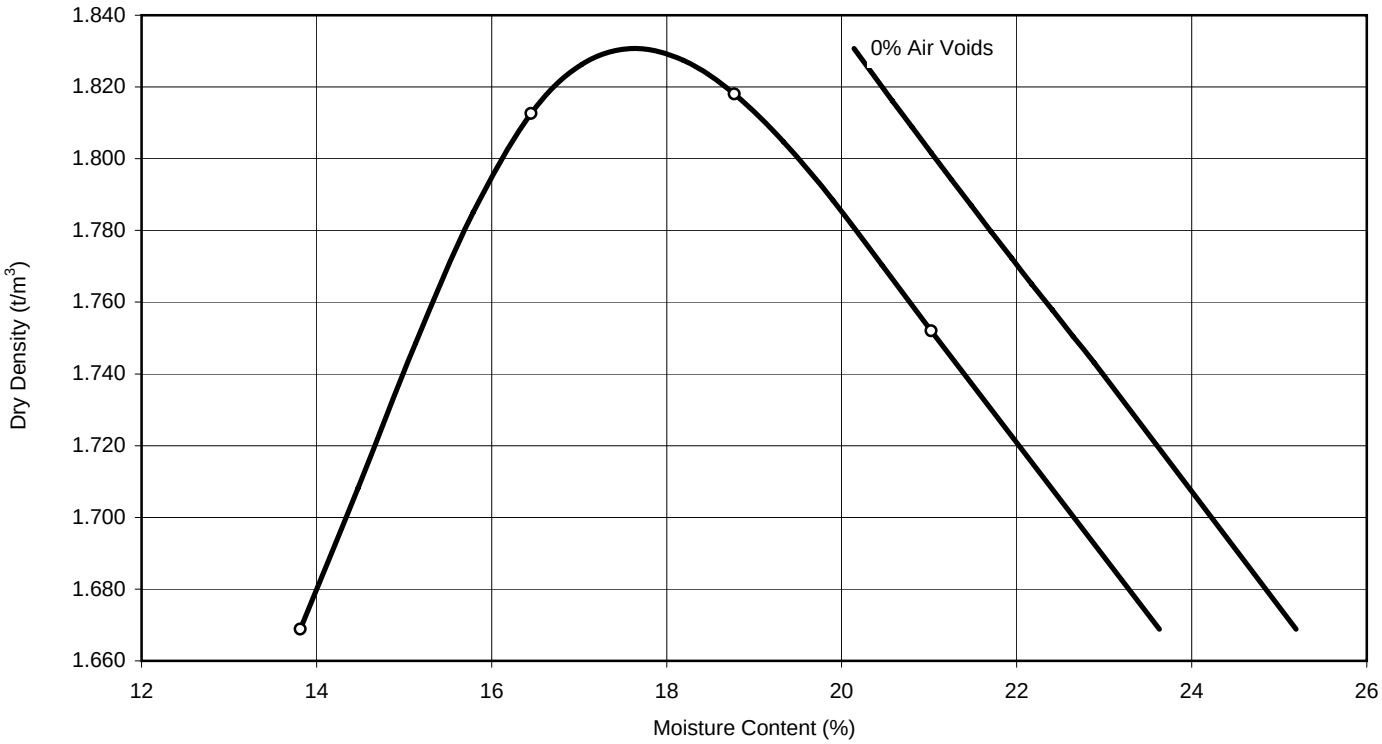
Results of Compaction Test

Client :	Health Infrastructure	**Project No. :**	49728
		Report No. :	N11-127g
Project :	Proposed Additions to Hospital	**Report Date :**	18.4.2011
Location :	Port Macquarie	**Date of Test:**	30.3.2011
		Page:	1 of 1



Sample Details: **Location:** Pit 16
Depth: 1.0m - 1.5m

Particles > 19mm: 0%

Description: CLAY - Yellow brown clay

Maximum Dry Density:	**1.83 t/m^3**
Optimum Moisture Content:	**17.5 %**

Remarks:

Test Methods: AS 1289.2.1.1, AS 1289. 5.1.1

Sampling Methods: Sampled by Douglas Partners' Engineers

NATA Accredited Laboratory Number: 828
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Tested: DR
Checked: DR

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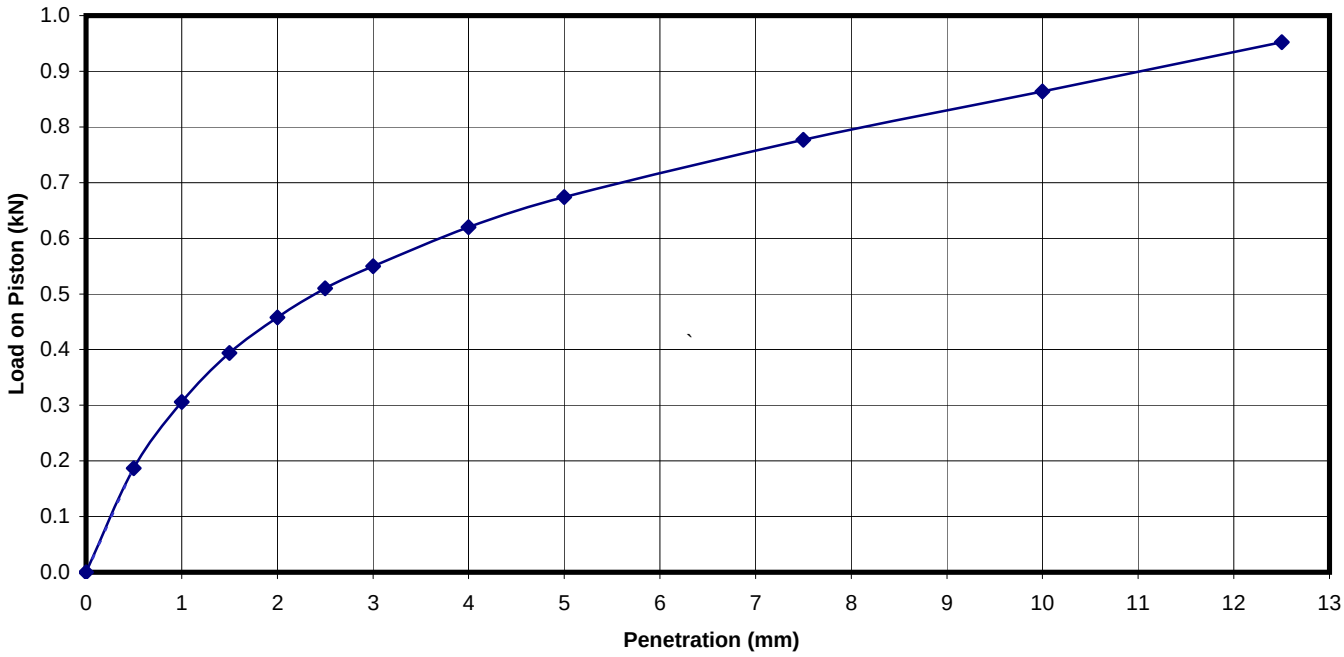
Result of California Bearing Ratio Test

Client :	Health Infrastructure	**Project No. :**	49728
		Report No. :	N11-127h
Project :	Proposed Additions to Hospital	**Report Date :**	18.4.2011
		Date Sampled :	7-16.3.2011
Location :	Port Macquarie	**Date of Test:**	1.4.2011
Test Location :	Pit 16		
Depth / Layer :	1.0m - 1.5m	**Page:**	1 of 1



Description: CLAY - Yellow brown clay

Test Method(s): AS 1289.6.1.1, AS 1289.2.1.1

Sampling Method(s): Sampled by Douglas Partners' Engineers **Percentage > 19mm:** 0.0%

LEVEL OF COMPACTION: 100% of STD MDD **SURCHARGE:** 4.5 kg **SWELL:** 0.5%
MOISTURE RATIO: 101% of STD OMC **SOAKING PERIOD:** 4 days

CONDITION		MOISTURE CONTENT %	DRY DENSITY t/m^3
At compaction		17.8	1.83
After soaking		19.0	1.82
After test	Top 30mm of sample	20.0	-
	Remainder of sample	18.4	-
Field values		13.8	-
Standard Compaction		17.6	1.83

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

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Accredited for compliance with ISO/IEC 17025

Tested:	NH
Checked:	BB

Dave Millard
Laboratory Manager

POINT LOAD TEST REPORT

CLIENT : Health Infrastructure
PROJECT : Proposed Additions to Hospital
LOCATION : Port Macquarie Base Hospital
TEST METHOD: AS 4133.4.1

DATE: 15-16/3/11
PROJECT NO : 49728
TESTED BY : JRC

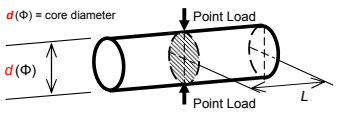
BORE: G

SHEET: 1 OF 1

DEPTH (m)	ROCK DESCRIPTION	TEST TYPE Axial (A), Diametral (D) Irregular (I)	DIMENSIONS Min. Width (*W*) (mm)	DIMENSIONS Depth (*d*) (mm)	FAILURE READING (KN)	POINT LOAD INDEX, $Is_{(50)}$ Axial (A) or Irregular (I)	POINT LOAD INDEX $I_{s(50)}$ Diametral (D)	INTERPRETED ROCK STRENGTH
18.55	Meta Dolerite	D	51.5	51.5	2.38	-	0.91	MEDIUM
18.75	Meta Dolerite	D	51.5	51.5	>12.91	-	>14.93	> V HIGH
19.20	Meta Dolerite	D	51.5	51.5	16.25	-	6.21	V HIGH
19.88	Meta Dolerite	D	51.5	51.5	9.08	-	3.47	V HIGH
19.88	Meta Dolerite	A	51.5	30	9.12	4.39	-	V HIGH
20.30	Meta Dolerite	D	51.5	51.5	11.51	-	4.40	V HIGH
20.30	Meta Dolerite	A	51.5	50	6.69	2.17	-	HIGH
20.66	Meta Dolerite	D	51.5	51.5	7.43	-	2.84	HIGH
21.37	Meta Dolerite	D	51.5	51.5	10.31	-	3.94	V HIGH

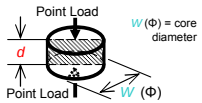
Diametral Test:
CHECK $L > 0.5 \cdot d$
L = distance from load point to nearest free end
d = distance between load points

Equivalent core diameter: $d_e = d$



Axial Test:
CHECK $0.3 \cdot W < d < W$

Equivalent core diameter: $d_e = \sqrt{4 \cdot \frac{d}{\pi} \cdot W}$



CHECKED
Initials
Date

Douglas Partners
Geotechnics · Environment · Groundwater

POINT LOAD TEST REPORT

CLIENT : Health Infrastructure
PROJECT : Proposed Additions to Hospital
LOCATION : Port Macquarie Base Hospital
TEST METHOD: AS 4133.4.1

DATE: 15-16/3/11
PROJECT NO : 49728
TESTED BY : JRC

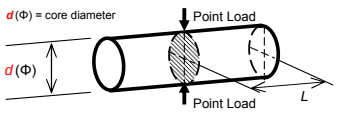
BORE: I

SHEET: 1 OF 1

DEPTH (m)	ROCK DESCRIPTION	TEST TYPE Axial (A), Diametral (D) Irregular (I)	DIMENSIONS Min. Width (*W*) (mm)	DIMENSIONS Depth (*d*) (mm)	FAILURE READING (KN)	POINT LOAD INDEX, $Is_{(50)}$ Axial (A) or Irregular (I)	POINT LOAD INDEX $I_{s(50)}$ Diametral (D)	INTERPRETED ROCK STRENGTH
22.70	Meta Dolerite	D	51.5	51.5	9.41	-	3.60	V HIGH
22.70	Meta Dolerite	A	51.5	35	5.36	2.29	-	HIGH
23.33	Meta Dolerite	D	51.5	51.5	5.83	-	2.23	HIGH
23.33	Meta Dolerite	A	51.5	45	6.51	2.29	-	HIGH

Diametral Test:
CHECK $L > 0.5 \cdot d$
L = distance from load point to nearest free end
d = distance between load points

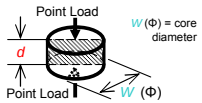
Equivalent core diameter: $d_e = d$



Axial Test:
CHECK $0.3 \cdot W < d < W$

Equivalent core diameter:

$$d_e = \sqrt{4 \cdot \frac{d}{\pi} \cdot W}$$



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CERTIFICATE OF ANALYSIS 53239

Client:
Douglas Partners Newcastle
Box 324 Hunter Region Mail Centre
Newcastle
NSW 2310

Attention: Will Wright

Sample log in details:

Your Reference:	**49728, Port Macquarie**
No. of samples:	16 soils, 2 waters
Date samples received / completed instructions received	22/03/2011 / 22/03/2011

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

Report Details:

Date results requested by: / Issue Date:	29/03/11 / 29/03/11
Date of Preliminary Report:	Not issued

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Results Approved By:

Nancy Zhang
Chemist

Rhian Morgan
Reporting Supervisor

Nick Sarlamis
Inorganics Supervisor

Matt Mansfield
Approved Signatory

Jeremy Faircloth
Chemist

vTRH & BTEX in Soil						
Our Reference:	UNITS	53239-1	53239-2	53239-5	53239-6	53239-7
Your Reference	----------	C/1.5	F/0.05	H/0.5	I/0.05	L/0.5
Date Sampled	----------	15/03/2011	10/03/2011	15/03/2011	11/03/2011	14/03/2011
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	23/03/2011	23/03/2011	23/03/2011	23/03/2011	23/03/2011
Date analysed	-	23/03/2011	23/03/2011	23/03/2011	23/03/2011	23/03/2011
vTRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	88	92	90	97	92

vTRH & BTEX in Soil						
Our Reference:	UNITS	53239-8	53239-9	53239-10	53239-11	53239-12
Your Reference	----------	L/2.0	M/0.5	O/0.05	O/2.0	P/0.5
Date Sampled	----------	14/03/2011	08/03/2011	08/03/2011	08/03/2011	07/03/2011
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	23/03/2011	23/03/2011	23/03/2011	23/03/2011	23/03/2011
Date analysed	-	23/03/2011	23/03/2011	23/03/2011	23/03/2011	23/03/2011
vTRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	104	98	92	89	97

vTRH & BTEX in Soil			
Our Reference:	UNITS	53239-13	53239-14
Your Reference	----------	R4	R9
Date Sampled	----------	08/03/2011	15/03/2011
Type of sample		Soil	Soil
Date extracted	-	23/03/2011	23/03/2011
Date analysed	-	23/03/2011	23/03/2011
vTRH C_6 - C_9	mg/kg	<25	<25
Benzene	mg/kg	<0.5	<0.5
Toluene	mg/kg	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1
m+p-xylene	mg/kg	<2	<2
o-Xylene	mg/kg	<1	<1
Surrogate aaa-Trifluorotoluene	%	93	91

sTRH in Soil (C10-C36)						
Our Reference:	UNITS	53239-1	53239-2	53239-5	53239-6	53239-7
Your Reference	----------	C/1.5	F/0.05	H/0.5	I/0.05	L/0.5
Date Sampled	----------	15/03/2011	10/03/2011	15/03/2011	11/03/2011	14/03/2011
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	23/03/2011	23/03/2011	23/03/2011	23/03/2011	23/03/2011
Date analysed	-	24/03/2011	24/03/2011	24/03/2011	24/03/2011	24/03/2011
TRHC$_{10}$ - C$_{14}$	mg/kg	<50	<50	<50	<50	<50
TRHC$_{15}$ - C$_{28}$	mg/kg	<100	<100	<100	<100	<100
TRHC$_{29}$ - C$_{36}$	mg/kg	<100	<100	<100	<100	<100
Surrogate o-Terphenyl	%	110	110	106	105	108

sTRH in Soil (C10-C36)						
Our Reference:	UNITS	53239-8	53239-9	53239-10	53239-11	53239-12
Your Reference	----------	L/2.0	M/0.5	O/0.05	O/2.0	P/0.5
Date Sampled	----------	14/03/2011	08/03/2011	08/03/2011	08/03/2011	07/03/2011
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	23/03/2011	23/03/2011	23/03/2011	23/03/2011	23/03/2011
Date analysed	-	24/03/2011	24/03/2011	24/03/2011	24/03/2011	24/03/2011
TRHC$_{10}$ - C$_{14}$	mg/kg	<50	<50	<50	<50	<50
TRHC$_{15}$ - C$_{28}$	mg/kg	<100	<100	<100	<100	<100
TRHC$_{29}$ - C$_{36}$	mg/kg	<100	<100	<100	<100	<100
Surrogate o-Terphenyl	%	102	108	108	106	108

sTRH in Soil (C10-C36)			
Our Reference:	UNITS	53239-13	53239-14
Your Reference	----------	R4	R9
Date Sampled	----------	08/03/2011	15/03/2011
Type of sample		Soil	Soil
Date extracted	-	23/03/2011	23/03/2011
Date analysed	-	24/03/2011	24/03/2011
TRHC$_{10}$ - C$_{14}$	mg/kg	<50	<50
TRHC$_{15}$ - C$_{28}$	mg/kg	<100	<100
TRHC$_{29}$ - C$_{36}$	mg/kg	<100	<100
Surrogate o-Terphenyl	%	106	105

PAHs in Soil Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	53239-1 C/1.5 15/03/2011 Soil	53239-2 F/0.05 10/03/2011 Soil	53239-5 H/0.5 15/03/2011 Soil	53239-6 I/0.05 11/03/2011 Soil	53239-7 L/0.5 14/03/2011 Soil
Date extracted	-	23/03/2011	23/03/2011	23/03/2011	23/03/2011	23/03/2011
Date analysed	-	23/03/2011	23/03/2011	23/03/2011	23/03/2011	23/03/2011
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate p-Terphenyl-d_{14}	%	96	96	93	89	93

PAHs in Soil Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	53239-8 L/2.0 14/03/2011 Soil	53239-9 M/0.5 08/03/2011 Soil	53239-10 O/0.05 08/03/2011 Soil	53239-11 O/2.0 08/03/2011 Soil	53239-12 P/0.5 07/03/2011 Soil
Date extracted	-	23/03/2011	23/03/2011	23/03/2011	23/03/2011	23/03/2011
Date analysed	-	23/03/2011	23/03/2011	23/03/2011	23/03/2011	23/03/2011
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1

PAHs in Soil						
Our Reference:	UNITS	53239-8	53239-9	53239-10	53239-11	53239-12
Your Reference	----------	L/2.0	M/0.5	O/0.05	O/2.0	P/0.5
Date Sampled	----------	14/03/2011	08/03/2011	08/03/2011	08/03/2011	07/03/2011
Type of sample		Soil	Soil	Soil	Soil	Soil
Surrogate p-Terphenyl-d_{14}	%	98	95	85	91	96

PAHs in Soil			
Our Reference:	UNITS	53239-13	53239-14
Your Reference	----------	R4	R9
Date Sampled	----------	08/03/2011	15/03/2011
Type of sample		Soil	Soil
Date extracted	-	23/03/2011	23/03/2011
Date analysed	-	23/03/2011	23/03/2011
Naphthalene	mg/kg	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1
Benzo(b+k)fluoranthene	mg/kg	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1
Surrogate p-Terphenyl-d_{14}	%	91	96

Organochlorine Pesticides in soil						
Our Reference:	UNITS	53239-1	53239-2	53239-5	53239-6	53239-7
Your Reference	----------	C/1.5	F/0.05	H/0.5	I/0.05	L/0.5
Date Sampled	----------	15/03/2011	10/03/2011	15/03/2011	11/03/2011	14/03/2011
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	23/03/2011	23/03/2011	23/03/2011	23/03/2011	23/03/2011
Date analysed	-	24/03/2011	24/03/2011	24/03/2011	24/03/2011	24/03/2011
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCLMX	%	97	95	97	93	96

Organochlorine Pesticides in soil						
Our Reference:	UNITS	53239-8	53239-9	53239-10	53239-11	53239-12
Your Reference	----------	L/2.0	M/0.5	O/0.05	O/2.0	P/0.5
Date Sampled	----------	14/03/2011	08/03/2011	08/03/2011	08/03/2011	07/03/2011
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	23/03/2011	23/03/2011	23/03/2011	23/03/2011	23/03/2011
Date analysed	-	24/03/2011	24/03/2011	24/03/2011	24/03/2011	24/03/2011
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCLMX	%	88	93	102	95	96

Organochlorine Pesticides in soil			
Our Reference:	UNITS	53239-13	53239-14
Your Reference	----------	R4	R9
Date Sampled	----------	08/03/2011	15/03/2011
Type of sample		Soil	Soil
Date extracted	-	23/03/2011	23/03/2011
Date analysed	-	24/03/2011	24/03/2011
HCB	mg/kg	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1
Surrogate TCLMX	%	105	85

Organophosphorus Pesticides						
Our Reference:	UNITS	53239-1	53239-2	53239-5	53239-6	53239-7
Your Reference	----------	C/1.5	F/0.05	H/0.5	I/0.05	L/0.5
Date Sampled	----------	15/03/2011	10/03/2011	15/03/2011	11/03/2011	14/03/2011
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	23/03/2011	23/03/2011	23/03/2011	23/03/2011	23/03/2011
Date analysed	-	24/03/2011	24/03/2011	24/03/2011	24/03/2011	24/03/2011
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCLMX	%	97	95	97	93	96

Organophosphorus Pesticides						
Our Reference:	UNITS	53239-8	53239-9	53239-10	53239-11	53239-12
Your Reference	----------	L/2.0	M/0.5	O/0.05	O/2.0	P/0.5
Date Sampled	----------	14/03/2011	08/03/2011	08/03/2011	08/03/2011	07/03/2011
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	23/03/2011	23/03/2011	23/03/2011	23/03/2011	23/03/2011
Date analysed	-	24/03/2011	24/03/2011	24/03/2011	24/03/2011	24/03/2011
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCLMX	%	88	93	102	95	96

Organophosphorus Pesticides			
Our Reference:	UNITS	53239-13	53239-14
Your Reference	----------	R4	R9
Date Sampled	----------	08/03/2011	15/03/2011
Type of sample		Soil	Soil
Date extracted	-	23/03/2011	23/03/2011
Date analysed	-	24/03/2011	24/03/2011
Diazinon	mg/kg	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1
Surrogate TCLMX	%	105	85

PCBs in Soil						
Our Reference:	UNITS	53239-1	53239-2	53239-5	53239-6	53239-7
Your Reference	----------	C/1.5	F/0.05	H/0.5	I/0.05	L/0.5
Date Sampled	----------	15/03/2011	10/03/2011	15/03/2011	11/03/2011	14/03/2011
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	23/03/2011	23/03/2011	23/03/2011	23/03/2011	23/03/2011
Date analysed	-	24/03/2011	24/03/2011	24/03/2011	24/03/2011	24/03/2011
Arochlor 1016	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1221*	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1232	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1242	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1248	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1254	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1260	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCLMX	%	97	95	97	93	96

PCBs in Soil						
Our Reference:	UNITS	53239-8	53239-9	53239-10	53239-11	53239-12
Your Reference	----------	L/2.0	M/0.5	O/0.05	O/2.0	P/0.5
Date Sampled	----------	14/03/2011	08/03/2011	08/03/2011	08/03/2011	07/03/2011
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	23/03/2011	23/03/2011	23/03/2011	23/03/2011	23/03/2011
Date analysed	-	24/03/2011	24/03/2011	24/03/2011	24/03/2011	24/03/2011
Arochlor 1016	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1221*	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1232	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1242	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1248	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1254	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1260	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCLMX	%	88	93	102	95	96

PCBs in Soil			
Our Reference:	UNITS	53239-13	53239-14
Your Reference	----------	R4	R9
Date Sampled	----------	08/03/2011	15/03/2011
Type of sample		Soil	Soil
Date extracted	-	23/03/2011	23/03/2011
Date analysed	-	24/03/2011	24/03/2011
Arochlor 1016	mg/kg	<0.1	<0.1
Arochlor 1221*	mg/kg	<0.1	<0.1
Arochlor 1232	mg/kg	<0.1	<0.1
Arochlor 1242	mg/kg	<0.1	<0.1
Arochlor 1248	mg/kg	<0.1	<0.1
Arochlor 1254	mg/kg	<0.1	<0.1
Arochlor 1260	mg/kg	<0.1	<0.1
Surrogate TCLMX	%	105	85

Acid Extractable metals in soil						
Our Reference:	UNITS	53239-1	53239-2	53239-3	53239-4	53239-5
Your Reference	----------	C/1.5	F/0.05	G/2.5-2.95	G/4-4.45	H/0.5
Date Sampled	----------	15/03/2011	10/03/2011	09/03/2011	09/03/2011	15/03/2011
Type of sample		Soil	Soil	Soil	Soil	Soil
Date digested	-	23/03/2011	23/03/2011	23/03/2011	23/03/2011	23/03/2011
Date analysed	-	23/03/2011	23/03/2011	23/03/2011	23/03/2011	23/03/2011
Arsenic	mg/kg	<4	<4	<4	<4	<4
Cadmium	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	mg/kg	150	440	99	110	770
Copper	mg/kg	2	23	24	27	16
Lead	mg/kg	2	3	<1	2	5
Mercury	mg/kg	<0.1	<0.1	<0.1	0.1	0.2
Nickel	mg/kg	4	25	8	8	44
Zinc	mg/kg	2	5	3	11	5

Acid Extractable metals in soil						
Our Reference:	UNITS	53239-6	53239-7	53239-8	53239-9	53239-10
Your Reference	----------	I/0.05	L/0.5	L/2.0	M/0.5	O/0.05
Date Sampled	----------	11/03/2011	14/03/2011	14/03/2011	08/03/2011	08/03/2011
Type of sample		Soil	Soil	Soil	Soil	Soil
Date digested	-	23/03/2011	23/03/2011	23/03/2011	23/03/2011	23/03/2011
Date analysed	-	23/03/2011	23/03/2011	23/03/2011	23/03/2011	23/03/2011
Arsenic	mg/kg	<4	<4	<4	<4	<4
Cadmium	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	mg/kg	500	140	430	290	530
Copper	mg/kg	12	11	9	10	13
Lead	mg/kg	5	10	3	4	6
Mercury	mg/kg	<0.1	<0.1	0.1	<0.1	<0.1
Nickel	mg/kg	37	12	27	19	38
Zinc	mg/kg	10	7	7	6	10

Acid Extractable metals in soil					
Our Reference:	UNITS	53239-11	53239-12	53239-13	53239-14
Your Reference	----------	O/2.0	P/0.5	R4	R9
Date Sampled	----------	08/03/2011	07/03/2011	08/03/2011	15/03/2011
Type of sample		Soil	Soil	Soil	Soil
Date digested	-	23/03/2011	23/03/2011	23/03/2011	23/03/2011
Date analysed	-	23/03/2011	23/03/2011	23/03/2011	23/03/2011
Arsenic	mg/kg	<4	<4	<4	<4
Cadmium	mg/kg	<0.5	<0.5	<0.5	<0.5
Chromium	mg/kg	1,100	420	360	850
Copper	mg/kg	5	5	9	16
Lead	mg/kg	2	4	5	6
Mercury	mg/kg	0.4	<0.1	<0.1	0.1
Nickel	mg/kg	7	17	21	42
Zinc	mg/kg	2	6	6	5

Miscellaneous Inorg - soil				
Our Reference:	UNITS	53239-15	53239-16	53239-19
Your Reference	----------	I/0.5	L/1.0	P/1.5
Date Sampled	----------	11/03/2011	14/03/2011	07/03/2011
Type of sample		Soil	Soil	Soil
Date prepared	-	25/3/2011	25/3/2011	25/3/2011
Date analysed	-	25/3/2011	25/3/2011	25/3/2011
pH 1:5 soil:water	pH Units	6.8	4.6	5.8
Electrical Conductivity 1:5 soil:water	µS/cm	120	77	21
Chloride, Cl 1:5 soil:water	mg/kg	16	71	14
Sulphate, SO4 1:5 soil:water	mg/kg	120	12	16
Resistivity in soil*	ohm m	83	130	480

Moisture						
Our Reference:	UNITS	53239-1	53239-2	53239-3	53239-4	53239-5
Your Reference	----------	C/1.5	F/0.05	G/2.5-2.95	G/4-4.45	H/0.5
Date Sampled	----------	15/03/2011	10/03/2011	09/03/2011	09/03/2011	15/03/2011
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	23/03/2011	23/03/2011	23/03/2011	23/03/2011	23/03/2011
Date analysed	-	24/03/2011	24/03/2011	24/03/2011	24/03/2011	24/03/2011
Moisture	%	23	27	21	26	35

Moisture						
Our Reference:	UNITS	53239-6	53239-7	53239-8	53239-9	53239-10
Your Reference	----------	I/0.05	L/0.5	L/2.0	M/0.5	O/0.05
Date Sampled	----------	11/03/2011	14/03/2011	14/03/2011	08/03/2011	08/03/2011
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	23/03/2011	23/03/2011	23/03/2011	23/03/2011	23/03/2011
Date analysed	-	24/03/2011	24/03/2011	24/03/2011	24/03/2011	24/03/2011
Moisture	%	25	23	29	25	28

Moisture					
Our Reference:	UNITS	53239-11	53239-12	53239-13	53239-14
Your Reference	----------	O/2.0	P/0.5	R4	R9
Date Sampled	----------	08/03/2011	07/03/2011	08/03/2011	15/03/2011
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	23/03/2011	23/03/2011	23/03/2011	23/03/2011
Date analysed	-	24/03/2011	24/03/2011	24/03/2011	24/03/2011
Moisture	%	27	15	25	35

Asbestos ID - soils						
Our Reference:	UNITS	53239-1	53239-2	53239-3	53239-4	53239-5
Your Reference	----------	C/1.5	F/0.05	G/2.5-2.95	G/4-4.45	H/0.5
Date Sampled	----------	15/03/2011	10/03/2011	09/03/2011	09/03/2011	15/03/2011
Type of sample		Soil	Soil	Soil	Soil	Soil
Date analysed	-	24/03/2011	24/03/2011	24/03/2011	24/03/2011	24/03/2011
Sample mass tested	g	Approx 30g	Approx 35g	Approx 40g	Approx 40g	Approx 30g
Sample Description	-	Clay Soil	Soil	Clay	Clay Soil	Soil
Asbestos ID in soil	-	No asbestos found at reporting limit of 0.1g/kg	No asbestos found at reporting limit of 0.1g/kg	No asbestos found at reporting limit of 0.1g/kg	No asbestos found at reporting limit of 0.1g/kg	No asbestos found at reporting limit of 0.1g/kg
Trace Analysis	-	Respirable fibres not detected	Respirable fibres not detected	Respirable fibres not detected	Respirable fibres not detected	Respirable fibres not detected

Asbestos ID - soils						
Our Reference:	UNITS	53239-6	53239-7	53239-8	53239-9	53239-10
Your Reference	----------	I/0.05	L/0.5	L/2.0	M/0.5	O/0.05
Date Sampled	----------	11/03/2011	14/03/2011	14/03/2011	08/03/2011	08/03/2011
Type of sample		Soil	Soil	Soil	Soil	Soil
Date analysed	-	24/03/2011	24/03/2011	24/03/2011	24/03/2011	24/03/2011
Sample mass tested	g	Approx 35g	Approx 35g	Approx 35g	Approx 35g	Approx 35g
Sample Description	-	Soil	Clay Soil	Clay Soil	Clay Soil	Soil
Asbestos ID in soil	-	No asbestos found at reporting limit of 0.1g/kg	No asbestos found at reporting limit of 0.1g/kg	No asbestos found at reporting limit of 0.1g/kg	No asbestos found at reporting limit of 0.1g/kg	No asbestos found at reporting limit of 0.1g/kg
Trace Analysis	-	Respirable fibres not detected	Respirable fibres not detected	Respirable fibres not detected	Respirable fibres not detected	Respirable fibres not detected

Asbestos ID - soils			
Our Reference:	UNITS	53239-11	53239-12
Your Reference	----------	O/2.0	P/0.5
Date Sampled	----------	08/03/2011	07/03/2011
Type of sample		Soil	Soil
Date analysed	-	24/03/2011	24/03/2011
Sample mass tested	g	Approx 35g	Approx 35g
Sample Description	-	Soil	Soil
Asbestos ID in soil	-	No asbestos found at reporting limit of 0.1g/kg	No asbestos found at reporting limit of 0.1g/kg
Trace Analysis	-	Respirable fibres not detected	Respirable fibres not detected

Miscellaneous Inorganics			
Our Reference:	UNITS	53239-17	53239-18
Your Reference	----------	Bore G	Bore M
Date Sampled	----------	16/03/2011	16/03/2011
Type of sample		Water	Water
Date prepared	-	25/03/2011	25/03/2011
Date analysed	-	25/03/2011	25/03/2011
Chloride, Cl	mg/L	24	23
Sulphate, SO4	mg/L	3	4

Method ID	Methodology Summary
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID.
Org-012 subset	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS.
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-008	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.
Metals-021 CV-AAS	Determination of Mercury by Cold Vapour AAS.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA 21st ED, 4500-H+.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell and dedicated meter, in accordance with APHA 21st ED 2510 and Rayment & Higginson.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA 21st ED, 4110-B.
Inorg-008	Moisture content determined by heating at 105 deg C for a minimum of 4 hours.
AS4964-2004	Asbestos ID - Qualitative identification of asbestos type fibres in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques.

QUALITY CONTROL vTRH & BTEX in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base || Duplicate || %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			23/03/2011	53239-1	23/03/2011 || 23/03/2011	LCS-3	23/03/2011
Date analysed	-			23/03/2011	53239-1	23/03/2011 || 23/03/2011	LCS-3	23/03/2011
vTRH C_6 - C_9	mg/kg	25	Org-016	<25	53239-1	<25 || <25	LCS-3	95%
Benzene	mg/kg	0.5	Org-016	<0.5	53239-1	<0.5 || <0.5	LCS-3	87%
Toluene	mg/kg	0.5	Org-016	<0.5	53239-1	<0.5 || <0.5	LCS-3	92%
Ethylbenzene	mg/kg	1	Org-016	<1	53239-1	<1 || <1	LCS-3	96%
m+p-xylene	mg/kg	2	Org-016	<2	53239-1	<2 || <2	LCS-3	101%
o-Xylene	mg/kg	1	Org-016	<1	53239-1	<1 || <1	LCS-3	102%
Surrogate aaa-Trifluorotoluene	%		Org-016	104	53239-1	88 || 94 || RPD: 7	LCS-3	105%

QUALITY CONTROL sTRH in Soil (C10-C36)	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base || Duplicate || %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			23/03/2011	53239-1	23/03/2011 || 23/03/2011	LCS-3	23/03/2011
Date analysed	-			24/03/2011	53239-1	24/03/2011 || 24/03/2011	LCS-3	24/03/2011
TRH C_{10} - C_{14}	mg/kg	50	Org-003	<50	53239-1	<50 || <50	LCS-3	105%
TRH C_{15} - C_{28}	mg/kg	100	Org-003	<100	53239-1	<100 || <100	LCS-3	107%
TRH C_{29} - C_{36}	mg/kg	100	Org-003	<100	53239-1	<100 || <100	LCS-3	102%
Surrogate o-Terphenyl	%		Org-003	106	53239-1	110 || 110 || RPD: 0	LCS-3	105%

QUALITY CONTROL PAHs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base || Duplicate || %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			23/03/2011	53239-1	23/03/2011 || 23/03/2011	LCS-3	23/03/2011
Date analysed	-			23/03/2011	53239-1	23/03/2011 || 23/03/2011	LCS-3	23/03/2011
Naphthalene	mg/kg	0.1	Org-012 subset	<0.1	53239-1	<0.1 || <0.1	LCS-3	93%
Acenaphthylene	mg/kg	0.1	Org-012 subset	<0.1	53239-1	<0.1 || <0.1	[NR]	[NR]
Acenaphthene	mg/kg	0.1	Org-012 subset	<0.1	53239-1	<0.1 || <0.1	[NR]	[NR]
Fluorene	mg/kg	0.1	Org-012 subset	<0.1	53239-1	<0.1 || <0.1	LCS-3	103%
Phenanthrene	mg/kg	0.1	Org-012 subset	<0.1	53239-1	<0.1 || <0.1	LCS-3	114%
Anthracene	mg/kg	0.1	Org-012 subset	<0.1	53239-1	<0.1 || <0.1	[NR]	[NR]
Fluoranthene	mg/kg	0.1	Org-012 subset	<0.1	53239-1	<0.1 || <0.1	LCS-3	113%
Pyrene	mg/kg	0.1	Org-012 subset	<0.1	53239-1	<0.1 || <0.1	LCS-3	107%
Benzo(a)anthracene	mg/kg	0.1	Org-012 subset	<0.1	53239-1	<0.1 || <0.1	[NR]	[NR]

QUALITY CONTROL PAHs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Chrysene	mg/kg	0.1	Org-012 subset	<0.1	53239-1	<0.1 || <0.1	LCS-3	102%
Benzo(b+k)fluoranthene	mg/kg	0.2	Org-012 subset	<0.2	53239-1	<0.2 || <0.2	[NR]	[NR]
Benzo(a)pyrene	mg/kg	0.05	Org-012 subset	<0.05	53239-1	<0.05 || <0.05	LCS-3	100%
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012 subset	<0.1	53239-1	<0.1 || <0.1	[NR]	[NR]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012 subset	<0.1	53239-1	<0.1 || <0.1	[NR]	[NR]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012 subset	<0.1	53239-1	<0.1 || <0.1	[NR]	[NR]
Surrogate p-Terphenyl-d14	%		Org-012 subset	89	53239-1	96 || 91 || RPD: 5	LCS-3	87%

QUALITY CONTROL Organochlorine Pesticides in soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			23/03/2011	53239-1	23/03/2011 || 23/03/2011	LCS-3	23/03/2011
Date analysed	-			24/03/2011	53239-1	24/03/2011 || 24/03/2011	LCS-3	24/03/2011
HCB	mg/kg	0.1	Org-005	<0.1	53239-1	<0.1 || <0.1	[NR]	[NR]
alpha-BHC	mg/kg	0.1	Org-005	<0.1	53239-1	<0.1 || <0.1	LCS-3	84%
gamma-BHC	mg/kg	0.1	Org-005	<0.1	53239-1	<0.1 || <0.1	[NR]	[NR]
beta-BHC	mg/kg	0.1	Org-005	<0.1	53239-1	<0.1 || <0.1	LCS-3	95%
Heptachlor	mg/kg	0.1	Org-005	<0.1	53239-1	<0.1 || <0.1	LCS-3	85%
delta-BHC	mg/kg	0.1	Org-005	<0.1	53239-1	<0.1 || <0.1	[NR]	[NR]
Aldrin	mg/kg	0.1	Org-005	<0.1	53239-1	<0.1 || <0.1	LCS-3	81%
Heptachlor Epoxide	mg/kg	0.1	Org-005	<0.1	53239-1	<0.1 || <0.1	LCS-3	89%
gamma-Chlordane	mg/kg	0.1	Org-005	<0.1	53239-1	<0.1 || <0.1	[NR]	[NR]
alpha-chlordane	mg/kg	0.1	Org-005	<0.1	53239-1	<0.1 || <0.1	[NR]	[NR]
Endosulfan I	mg/kg	0.1	Org-005	<0.1	53239-1	<0.1 || <0.1	[NR]	[NR]
pp-DDE	mg/kg	0.1	Org-005	<0.1	53239-1	<0.1 || <0.1	LCS-3	94%
Dieldrin	mg/kg	0.1	Org-005	<0.1	53239-1	<0.1 || <0.1	LCS-3	88%
Endrin	mg/kg	0.1	Org-005	<0.1	53239-1	<0.1 || <0.1	LCS-3	85%
pp-DDD	mg/kg	0.1	Org-005	<0.1	53239-1	<0.1 || <0.1	LCS-3	91%
Endosulfan II	mg/kg	0.1	Org-005	<0.1	53239-1	<0.1 || <0.1	[NR]	[NR]
pp-DDT	mg/kg	0.1	Org-005	<0.1	53239-1	<0.1 || <0.1	[NR]	[NR]
Endrin Aldehyde	mg/kg	0.1	Org-005	<0.1	53239-1	<0.1 || <0.1	[NR]	[NR]
Endosulfan Sulphate	mg/kg	0.1	Org-005	<0.1	53239-1	<0.1 || <0.1	LCS-3	89%
Methoxychlor	mg/kg	0.1	Org-005	<0.1	53239-1	<0.1 || <0.1	[NR]	[NR]
Surrogate TCLMX	%		Org-005	88	53239-1	97 || 99 || RPD: 2	LCS-3	88%

QUALITY CONTROL Organophosphorus Pesticides	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			23/03/2011	53239-1	23/03/2011 || 23/03/2011	LCS-3	23/03/2011
Date analysed	-			24/03/2011	53239-1	24/03/2011 || 24/03/2011	LCS-3	24/03/2011
Diazinon	mg/kg	0.1	Org-008	<0.1	53239-1	<0.1 || <0.1	[NR]	[NR]
Dimethoate	mg/kg	0.1	Org-008	<0.1	53239-1	<0.1 || <0.1	[NR]	[NR]
Chlorpyriphos-methyl	mg/kg	0.1	Org-008	<0.1	53239-1	<0.1 || <0.1	[NR]	[NR]
Ronnel	mg/kg	0.1	Org-008	<0.1	53239-1	<0.1 || <0.1	[NR]	[NR]
Chlorpyriphos	mg/kg	0.1	Org-008	<0.1	53239-1	<0.1 || <0.1	LCS-3	84%
Fenitrothion	mg/kg	0.1	Org-008	<0.1	53239-1	<0.1 || <0.1	LCS-3	77%
Bromophos-ethyl	mg/kg	0.1	Org-008	<0.1	53239-1	<0.1 || <0.1	[NR]	[NR]
Ethion	mg/kg	0.1	Org-008	<0.1	53239-1	<0.1 || <0.1	LCS-3	74%
Surrogate TCLMX	%		Org-008	88	53239-1	97 || 99 || RPD: 2	LCS-3	85%

QUALITY CONTROL PCBs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			23/03/2011	53239-1	23/03/2011 || 23/03/2011	LCS-3	23/03/2011
Date analysed	-			24/03/2011	53239-1	24/03/2011 || 24/03/2011	LCS-3	24/03/2011
Arochlor 1016	mg/kg	0.1	Org-006	<0.1	53239-1	<0.1 || <0.1	[NR]	[NR]
Arochlor 1221*	mg/kg	0.1	Org-006	<0.1	53239-1	<0.1 || <0.1	[NR]	[NR]
Arochlor 1232	mg/kg	0.1	Org-006	<0.1	53239-1	<0.1 || <0.1	[NR]	[NR]
Arochlor 1242	mg/kg	0.1	Org-006	<0.1	53239-1	<0.1 || <0.1	[NR]	[NR]
Arochlor 1248	mg/kg	0.1	Org-006	<0.1	53239-1	<0.1 || <0.1	[NR]	[NR]
Arochlor 1254	mg/kg	0.1	Org-006	<0.1	53239-1	<0.1 || <0.1	LCS-3	128%
Arochlor 1260	mg/kg	0.1	Org-006	<0.1	53239-1	<0.1 || <0.1	[NR]	[NR]
Surrogate TCLMX	%		Org-006	88	53239-1	97 || 99 || RPD: 2	LCS-3	89%

QUALITY CONTROL Acid Extractable metals in soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date digested	-			23/03/2011	53239-1	23/03/2011 || 23/03/2011	LCS-1	23/03/2011
Date analysed	-			23/03/2011	53239-1	23/03/2011 || 23/03/2011	LCS-1	23/03/2011
Arsenic	mg/kg	4	Metals-020 ICP-AES	<4	53239-1	<4 || <4	LCS-1	105%
Cadmium	mg/kg	0.5	Metals-020 ICP-AES	<0.5	53239-1	<0.5 || <0.5	LCS-1	106%
Chromium	mg/kg	1	Metals-020 ICP-AES	<1	53239-1	150 || 180 || RPD: 18	LCS-1	106%
Copper	mg/kg	1	Metals-020 ICP-AES	<1	53239-1	2 || 2 || RPD: 0	LCS-1	107%
Lead	mg/kg	1	Metals-020 ICP-AES	<1	53239-1	2 || 3 || RPD: 40	LCS-1	112%

QUALITY CONTROL Acid Extractable metals in soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Mercury	mg/kg	0.1	Metals-021 CV-AAS	<0.1	53239-1	<0.1 || <0.1	LCS-1	113%
Nickel	mg/kg	1	Metals-020 ICP-AES	<1	53239-1	4 || 5 || RPD: 22	LCS-1	106%
Zinc	mg/kg	1	Metals-020 ICP-AES	<1	53239-1	2 || 2 || RPD: 0	LCS-1	105%

QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			25/3/2011	[NT]	[NT]	LCS-1	25/3/2011
Date analysed	-			25/3/2011	[NT]	[NT]	LCS-1	25/3/2011
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	[NT]	[NT]	LCS-1	101%
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1.0	[NT]	[NT]	LCS-1	108%
Chloride, Cl 1:5 soil:water	mg/kg	2	Inorg-081	<2	[NT]	[NT]	LCS-1	94%
Sulphate, SO4 1:5 soil:water	mg/kg	2	Inorg-081	<2	[NT]	[NT]	LCS-1	102%
Resistivity in soil*	ohm m	1	Inorg-002	<1.0	[NT]	[NT]	LCS-1	108%

QUALITY CONTROL Moisture	UNITS	PQL	METHOD	Blank
Date prepared	-			24/03/2011
Date analysed	-			25/03/2011
Moisture	%	0.1	Inorg-008	<0.10

QUALITY CONTROL Asbestos ID - soils	UNITS	PQL	METHOD	Blank
Date analysed	-			[NT]

QUALITY CONTROL Miscellaneous Inorganics	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			25/03/2011	[NT]	[NT]	LCS-W1	25/03/2011
Date analysed	-			25/03/2011	[NT]	[NT]	LCS-W1	25/03/2011
Chloride, Cl	mg/L	1	Inorg-081	<1	[NT]	[NT]	LCS-W1	92%
Sulphate, SO4	mg/L	1	Inorg-081	<1	[NT]	[NT]	LCS-W1	92%

QUALITY CONTROL vTRH & BTEX in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	53239-13	23/03/2011 || 23/03/2011	53239-2	23/03/2011
Date analysed	-	53239-13	23/03/2011 || 23/03/2011	53239-2	23/03/2011
vTRH C_6 - C_9	mg/kg	53239-13	<25 || <25	53239-2	76%
Benzene	mg/kg	53239-13	<0.5 || <0.5	53239-2	68%
Toluene	mg/kg	53239-13	<0.5 || <0.5	53239-2	73%
Ethylbenzene	mg/kg	53239-13	<1 || <1	53239-2	78%
m+p-xylene	mg/kg	53239-13	<2 || <2	53239-2	80%
o-Xylene	mg/kg	53239-13	<1 || <1	53239-2	82%
Surrogate aaa-Trifluorotoluene	%	53239-13	93 || 101 || RPD: 8	53239-2	90%
QUALITY CONTROL sTRH in Soil (C10-C36)	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	53239-13	23/03/2011 || 23/03/2011	53239-2	23/03/2011
Date analysed	-	53239-13	24/03/2011 || 24/03/2011	53239-2	24/03/2011
TRH C_{10} - C_{14}	mg/kg	53239-13	<50 || <50	53239-2	94%
TRH C_{15} - C_{28}	mg/kg	53239-13	<100 || <100	53239-2	109%
TRH C_{29} - C_{36}	mg/kg	53239-13	<100 || <100	53239-2	106%
Surrogate o-Terphenyl	%	53239-13	106 || 110 || RPD: 4	53239-2	110%
QUALITY CONTROL PAHs in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	53239-13	23/03/2011 || 23/03/2011	53239-2	23/03/2011
Date analysed	-	53239-13	23/03/2011 || 23/03/2011	53239-2	23/03/2011
Naphthalene	mg/kg	53239-13	<0.1 || <0.1	53239-2	81%
Acenaphthylene	mg/kg	53239-13	<0.1 || <0.1	[NR]	[NR]
Acenaphthene	mg/kg	53239-13	<0.1 || <0.1	[NR]	[NR]
Fluorene	mg/kg	53239-13	<0.1 || <0.1	53239-2	97%
Phenanthrene	mg/kg	53239-13	<0.1 || <0.1	53239-2	106%
Anthracene	mg/kg	53239-13	<0.1 || <0.1	[NR]	[NR]
Fluoranthene	mg/kg	53239-13	<0.1 || <0.1	53239-2	106%
Pyrene	mg/kg	53239-13	<0.1 || <0.1	53239-2	100%
Benzo(a)anthracene	mg/kg	53239-13	<0.1 || <0.1	[NR]	[NR]
Chrysene	mg/kg	53239-13	<0.1 || <0.1	53239-2	93%
Benzo(b+k)fluoranthene	mg/kg	53239-13	<0.2 || <0.2	[NR]	[NR]
Benzo(a)pyrene	mg/kg	53239-13	<0.05 || <0.05	53239-2	96%
Indeno(1,2,3-c,d)pyrene	mg/kg	53239-13	<0.1 || <0.1	[NR]	[NR]
Dibenzo(a,h)anthracene	mg/kg	53239-13	<0.1 || <0.1	[NR]	[NR]
Benzo(g,h,i)perylene	mg/kg	53239-13	<0.1 || <0.1	[NR]	[NR]
Surrogate p-Terphenyl-d_{14}	%	53239-13	91 || 94 || RPD: 3	53239-2	86%

QUALITY CONTROL Organochlorine Pesticides in soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	53239-13	23/03/2011 || 23/03/2011	53239-2	23/03/2011
Date analysed	-	53239-13	24/03/2011 || 24/03/2011	53239-2	24/03/2011
HCB	mg/kg	53239-13	<0.1 || <0.1	[NR]	[NR]
alpha-BHC	mg/kg	53239-13	<0.1 || <0.1	53239-2	81%
gamma-BHC	mg/kg	53239-13	<0.1 || <0.1	[NR]	[NR]
beta-BHC	mg/kg	53239-13	<0.1 || <0.1	53239-2	93%
Heptachlor	mg/kg	53239-13	<0.1 || <0.1	53239-2	77%
delta-BHC	mg/kg	53239-13	<0.1 || <0.1	[NR]	[NR]
Aldrin	mg/kg	53239-13	<0.1 || <0.1	53239-2	79%
Heptachlor Epoxide	mg/kg	53239-13	<0.1 || <0.1	53239-2	86%
gamma-Chlordane	mg/kg	53239-13	<0.1 || <0.1	[NR]	[NR]
alpha-chlordane	mg/kg	53239-13	<0.1 || <0.1	[NR]	[NR]
Endosulfan I	mg/kg	53239-13	<0.1 || <0.1	[NR]	[NR]
pp-DDE	mg/kg	53239-13	<0.1 || <0.1	53239-2	92%
Dieldrin	mg/kg	53239-13	<0.1 || <0.1	53239-2	85%
Endrin	mg/kg	53239-13	<0.1 || <0.1	53239-2	81%
pp-DDD	mg/kg	53239-13	<0.1 || <0.1	53239-2	87%
Endosulfan II	mg/kg	53239-13	<0.1 || <0.1	[NR]	[NR]
pp-DDT	mg/kg	53239-13	<0.1 || <0.1	[NR]	[NR]
Endrin Aldehyde	mg/kg	53239-13	<0.1 || <0.1	[NR]	[NR]
Endosulfan Sulphate	mg/kg	53239-13	<0.1 || <0.1	53239-2	85%
Methoxychlor	mg/kg	53239-13	<0.1 || <0.1	[NR]	[NR]
Surrogate TCLMX	%	53239-13	105 || 93 || RPD: 12	53239-2	96%

QUALITY CONTROL Organophosphorus Pesticides	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	53239-13	23/03/2011 || 23/03/2011	53239-2	23/03/2011
Date analysed	-	53239-13	24/03/2011 || 24/03/2011	53239-2	24/03/2011
Diazinon	mg/kg	53239-13	<0.1 || <0.1	[NR]	[NR]
Dimethoate	mg/kg	53239-13	<0.1 || <0.1	[NR]	[NR]
Chlorpyriphos-methyl	mg/kg	53239-13	<0.1 || <0.1	[NR]	[NR]
Ronnel	mg/kg	53239-13	<0.1 || <0.1	[NR]	[NR]
Chlorpyriphos	mg/kg	53239-13	<0.1 || <0.1	53239-2	92%
Fenitrothion	mg/kg	53239-13	<0.1 || <0.1	53239-2	81%
Bromophos-ethyl	mg/kg	53239-13	<0.1 || <0.1	[NR]	[NR]
Ethion	mg/kg	53239-13	<0.1 || <0.1	53239-2	82%
Surrogate TCLMX	%	53239-13	105 || 93 || RPD: 12	53239-2	89%
QUALITY CONTROL PCBs in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	53239-13	23/03/2011 || 23/03/2011	53239-2	23/03/2011
Date analysed	-	53239-13	24/03/2011 || 24/03/2011	53239-2	24/03/2011
Arochlor 1016	mg/kg	53239-13	<0.1 || <0.1	[NR]	[NR]
Arochlor 1221*	mg/kg	53239-13	<0.1 || <0.1	[NR]	[NR]
Arochlor 1232	mg/kg	53239-13	<0.1 || <0.1	[NR]	[NR]
Arochlor 1242	mg/kg	53239-13	<0.1 || <0.1	[NR]	[NR]
Arochlor 1248	mg/kg	53239-13	<0.1 || <0.1	[NR]	[NR]
Arochlor 1254	mg/kg	53239-13	<0.1 || <0.1	53239-2	122%
Arochlor 1260	mg/kg	53239-13	<0.1 || <0.1	[NR]	[NR]
Surrogate TCLMX	%	53239-13	105 || 93 || RPD: 12	53239-2	89%
QUALITY CONTROL Acid Extractable metals in soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date digested	-	53239-13	23/03/2011 || 23/03/2011	53239-2	23/03/2011
Date analysed	-	53239-13	23/03/2011 || 23/03/2011	53239-2	23/03/2011
Arsenic	mg/kg	53239-13	<4 || <4	53239-2	82%
Cadmium	mg/kg	53239-13	<0.5 || <0.5	53239-2	98%
Chromium	mg/kg	53239-13	360 || 440 || RPD: 20	53239-2	71%
Copper	mg/kg	53239-13	9 || 7 || RPD: 25	53239-2	104%
Lead	mg/kg	53239-13	5 || 4 || RPD: 22	53239-2	103%
Mercury	mg/kg	53239-13	<0.1 || 0.1	53239-2	114%
Nickel	mg/kg	53239-13	21 || 21 || RPD: 0	53239-2	99%
Zinc	mg/kg	53239-13	6 || 3 || RPD: 67	53239-2	98%

Report Comments:

Acid Extractable Metals in Soil:The RPD for duplicate results is accepted due to the inhomogeneous nature of the sample/s.

Asbestos ID was analysed by Approved Identifier: Paul Ching
Asbestos ID was authorised by Approved Signatory: Matt Mansfield

INS: Insufficient sample for this test
NA: Test not required
<: Less than

PQL: Practical Quantitation Limit
RPD: Relative Percent Difference
>: Greater than

NT: Not tested
NA: Test not required
LCS: Laboratory Control Sample

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

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

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

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CERTIFICATE OF ANALYSIS 65011

Client:
Douglas Partners Newcastle
Box 324 Hunter Region Mail Centre
Newcastle
NSW 2310

Attention: Patrick Heads

Sample log in details:

Your Reference:	**49728.01, Port Macquarie**		
No. of samples:	6 Soils		
Date samples received / completed instructions received	16/11/11	/	16/11/11

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

Report Details:

Date results requested by: / Issue Date:	17/11/11	/	17/11/11
Date of Preliminary Report:	Not issued		

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Accredited for compliance with ISO/IEC 17025. **Tests not covered by NATA are denoted with *.**

Results Approved By:

Rhian Morgan
Reporting Supervisor

ESP/CEC Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	65011-1 Bore 1/0.005 15/03/2011 Soil	65011-2 Bore 1/0.5 15/03/2011 Soil	65011-3 Bore 3/0.5 9/03/2011 Soil	65011-4 Bore 4/0.5 15/03/2011 Soil	65011-5 Bore 6/1.0 14/03/2011 Soil
Exchangeable Ca	meq/100g	3.7	0.53	1.6	2.6	0.18
Exchangeable K	meq/100g	0.31	0.13	0.039	0.087	0.086
Exchangeable Mg	meq/100g	4.0	2.0	1.6	1.0	1.2
Exchangeable Na	meq/100g	0.16	0.097	0.034	0.036	0.21
Cation Exchange Capacity	meq/100g	8.2	2.8	3.2	3.8	1.7
ESP	%	1.9	3.5	1.1	<1.0	12.2

ESP/CEC Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	65011-6 Bore 9/0.05 7/03/2011 Soil
Exchangeable Ca	meq/100g	5.2
Exchangeable K	meq/100g	0.088
Exchangeable Mg	meq/100g	1.0
Exchangeable Na	meq/100g	0.048
Cation Exchange Capacity	meq/100g	6.4
ESP	%	<1.0

Method ID	Methodology Summary
Metals-009	Determination of exchangeable cations and cation exchange capacity in soil based on Rayment and Lyons 2011.

QUALITY CONTROL ESP/CEC	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Exchangeable Ca	meq/100 g	0.01	Metals-009	<0.01	65011-1	3.7 || 3.7 || RPD: 0	LCS-1	96%
Exchangeable K	meq/100 g	0.01	Metals-009	<0.01	65011-1	0.31 || 0.30 || RPD: 3	LCS-1	96%
Exchangeable Mg	meq/100 g	0.01	Metals-009	<0.01	65011-1	4.0 || 4.0 || RPD: 0	LCS-1	95%
Exchangeable Na	meq/100 g	0.01	Metals-009	<0.01	65011-1	0.16 || 0.16 || RPD: 0	LCS-1	100%
Cation Exchange Capacity	meq/100 g	1	Metals-009	<1.0	65011-1	8.2 || 8.2 || RPD: 0	[NR]	[NR]
ESP	%	1	Metals-009	<1.0	65011-1	1.9 || 1.9 || RPD: 0	[NR]	[NR]

Report Comments:

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

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

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

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

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

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

CERTIFICATE OF ANALYSIS 53239-A

Client:
Douglas Partners Newcastle
Box 324 Hunter Region Mail Centre
Newcastle
NSW 2310

Attention: Patrick Heads

Sample log in details:

Your Reference:	**49728, Port Macquarie**
No. of samples:	Additional Testing on 11 Soils
Date samples received / completed instructions received	22/03/2011 / 07/04/2011

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

Report Details:

Date results requested by: / Issue Date:	14/04/11 / 14/04/11
Date of Preliminary Report:	Not issued

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This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. **Tests not covered by NATA are denoted with *.**

Results Approved By:

Rhian Morgan
Reporting Supervisor

Nick Sarlamis
Inorganics Supervisor

Miscellaneous Inorg - soil					
Our Reference:	UNITS	53239-A-5	53239-A-6	53239-A-10	53239-A-11
Your Reference	----------	H/0.5	I/0.05	O/0.05	O/2.0
Date Sampled	----------	15/03/2011	11/03/2011	08/03/2011	08/03/2011
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	13/4/2011	13/4/2011	13/4/2011	13/4/2011
Date analysed	-	13/4/2011	13/4/2011	13/4/2011	13/4/2011
Hexavalent Chromium, Cr^{6+}	mg/kg	3	<1	<1	9

Metals in TCLP USEPA1311						
Our Reference:	UNITS	53239-A-1	53239-A-2	53239-A-4	53239-A-5	53239-A-6
Your Reference	----------	C/1.5	F/0.05	G/4-4.45	H/0.5	I/0.05
Date Sampled	----------	15/03/2011	10/03/2011	09/03/2011	15/03/2011	11/03/2011
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	12/04/2011	12/04/2011	12/04/2011	12/04/2011	12/04/2011
Date analysed	-	12/04/2011	12/04/2011	12/04/2011	12/04/2011	12/04/2011
pH of soil for fluid# determ.	pH units	6.3	6.6	5.7	5.0	6.1
pH of soil for fluid # determ. (acid)	pH units	1.4	1.4	1.4	1.4	1.5
Extraction fluid used	-	1	1	1	1	1
pH of final Leachate	pH units	4.9	4.9	4.9	4.9	4.9
Chromium in TCLP	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel in TCLP	mg/L	[NA]	[NA]	[NA]	<0.02	[NA]

Metals in TCLP USEPA1311						
Our Reference:	UNITS	53239-A-7	53239-A-8	53239-A-9	53239-A-10	53239-A-11
Your Reference	----------	L/0.5	L/2.0	M/0.5	O/0.05	O/2.0
Date Sampled	----------	14/03/2011	14/03/2011	08/03/2011	08/03/2011	08/03/2011
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	12/04/2011	12/04/2011	12/04/2011	12/04/2011	12/04/2011
Date analysed	-	12/04/2011	12/04/2011	12/04/2011	12/04/2011	12/04/2011
pH of soil for fluid# determ.	pH units	6.0	5.6	5.4	6.2	5.6
pH of soil for fluid # determ. (acid)	pH units	1.5	1.4	1.4	1.4	1.5
Extraction fluid used	-	1	1	1	1	1
pH of final Leachate	pH units	4.9	4.9	4.9	4.9	4.9
Chromium in TCLP	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01

Metals in TCLP USEPA1311		
Our Reference:	UNITS	53239-A-12
Your Reference	----------	P/0.5
Date Sampled	----------	07/03/2011
Type of sample		Soil
Date extracted	-	12/04/2011
Date analysed	-	12/04/2011
pH of soil for fluid# determ.	pH units	6.9
pH of soil for fluid # determ. (acid)	pH units	1.4
Extraction fluid used	-	1
pH of final Leachate	pH units	4.9
Chromium in TCLP	mg/L	<0.01

Method ID	Methodology Summary
Inorg-024	Hexavalent Chromium (Cr6+) - determined colourimetrically based upon APHA 21st ED, 3500-Cr-B.
Inorg-004	Toxicity Characteristic Leaching Procedure (TCLP) using AS 4439 and USEPA 1311.
EXTRACT.7	Toxicity Characteristic Leaching Procedure (TCLP).
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA 21st ED, 4500-H+.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.

QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			13/4/2011	53239-A-5	13/4/2011 || 13/4/2011	LCS-1	13/4/2011
Date analysed	-			13/4/2011	53239-A-5	13/4/2011 || 13/4/2011	LCS-1	13/4/2011
Hexavalent Chromium, Cr^{6+}	mg/kg	1	Inorg-024	<1	53239-A-5	3 || 3 || RPD: 0	LCS-1	103%
QUALITY CONTROL Metals in TCLP USEPA1311	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			12/04/2011	53239-A-5	12/04/2011 || 12/04/2011	LCS-1	12/04/2011
Date analysed	-			12/04/2011	53239-A-5	12/04/2011 || 12/04/2011	LCS-1	12/04/2011
Chromium in TCLP	mg/L	0.01	Metals-020 ICP-AES	<0.01	53239-A-5	<0.01 || <0.01	LCS-1	106%
Nickel in TCLP	mg/L	0.02	Metals-020 ICP-AES	<0.02	53239-A-5	<0.02 || <0.02	LCS-1	106%

Report Comments:

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

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

Quality Control Definitions

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Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

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

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

Douglas Partners
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CHAIN OF CUSTODY FIELD SHEET

Client: Health Infrastructure.....
Project: Proposed Additions to Hospital..... Project No: 49728.....
Location: Port Macquarie Base Hospital, Wrights Road, Port Macquarie.....

Field								DP Office	Despatch	Notes
Sample ID	Depth (m)	Duplicate/ Replicate Sample	Sample Type S-soil W-water	Container Type G-glass P-plastic	Sampling By	Sampling Date	Sampling Time	Received by: SRC Date: 11/3/11 Storage Location*	☑ enviolab Date: 21/3/11	
Bore P	0.05		S	G/P	SRC	7/3/11	1605	*		
	0.5		↓	↓	↓	↓	1607	↓	✓	
	1.5	R1					1610		[redacted]	
	2.0						1615			
	3.0						1620			
	3.5		↓	↓	↓	↓	1625	↓		
Bore O	0.05		S	G/P	SRC	8/3/11	1032	*	✓	
	0.5	R2	↓	↓	↓	↓	1033	↓		
	1.0						1035			
	1.5						1040			
	2.0	R3					1045		✓	
	2.5		↓	↓	↓	↓	1050	↓		
Bore M	0.05		S	G/P	SRC	8/3/11	1510	*		
	0.5	R4	↓	↓	↓	↓	1512	↓	✓ ✓	
	1.0						1513			
	1.5						1518			
	2.0	R5					1520			
	2.5		↓	↓	↓	↓	1523	↓		

Default containers for soil: glass = clear 125/250 mL with teflon liner, plastic =press seal bag
*Default storage: Glass containers in fridge, plastic containers shelved, all water samples in fridge

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CHAIN OF CUSTODY FIELD SHEET

Client: Health Infrastructure.....
Project: Proposed Additions to Hospital..... Project No: 49728.....
Location: Port Macquarie Base Hospital, Wrights Road, Port Macquarie.....

Field								DP Office	Despatch	Notes
Sample ID	Depth (m)	Duplicate/ Replicate Sample	Sample Type S-soil W-water	Container Type G-glass P-plastic	Sampling By	Sampling Date	Sampling Time	Received by: JRC Date: 11/3/11 Storage Location*	☑ Envirolabs Date: 21/3/11	
Bore M	3.0		S	G/P	JRC	8/3/11	1526	*		
	3.5		↓	↓	↓	↓	1530	↓		
	4.0		↓	↓	↓	↓	1535	↓		
Bore G	0.05		S	G/P	JRC	9/3/11	1312	*		
	0.5	R6	S	↓	↓	↓	1314	↓		
	1.0		↓	↓	↓	↓	1315	↓		
	1.5		↓	↓	↓	↓	1320	↓		
	2.5-2.95		↓	P	↓	↓	1330	↓	✓	
Bore F	0.05		S	G/P	JRC	10/3/11	1205	*	✓	
	0.5	R7	↓	↓	↓	↓	1206	↓		
	1.0		↓	↓	↓	↓	1208	↓		
Bore I	0.05		S	G/P	JRC	11/3/11	805	*	✓	
	0.5	R8	↓	↓	↓	↓	806	↓		
	1.0		↓	↓	↓	↓	808	↓		
	1.5		↓	↓	↓	↓	813	↓		
Bore G	4-4.95		S	P	JRC	9/3/11	1350	*	✓	

Default containers for soil: glass = clear 125/250 mL with teflon liner, plastic =press seal bag
*Default storage: Glass containers in fridge, plastic containers shelved, all water samples in fridge

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CHAIN OF CUSTODY FIELD SHEET

Client: Health Infrastructure

Project: Proposed Additions to Hospital Project No: 49728

Location: Port Macquarie Base Hospital, Wrights Road, Port Macquarie

Field								DP Office	Despatch	Notes
Sample ID	Depth (m)	Duplicate/ Replicate Sample	Sample Type S-soil W-water	Container Type G-glass P-plastic	Sampling By	Sampling Date	Sampling Time	Received by: JRC Date: 16/3/11 Storage Location*	☑ envirolab Date: 24/3/11	
Bore L	0.05		S	G/P	JRC	14/3/11	1230	*		
	0.5	R9	↓	↓	↓	↓	1231	↓	✓✓	
	1.0						1233			
	1.5						1238			
	2.0						1240		✓	
	2.5		↓	↓	↓	↓	1243	↓		
Bore H	0.05		S	G/P	JRC	15/3/11	718	*		
	0.5	R10	↓	↓	↓	↓	719	↓	✓	
	1.0						721			
	1.5						726			
	2.0						728			
	2.5		↓	↓	↓	↓	730	↓		
Bore C	0.05		S	G/P	JRC	15/3/11	1632	*		
	0.5	R11	↓	↓	↓	↓	1633	↓		
	1.0						1635			
	1.5		↓	↓	↓	↓	1640	↓	✓	

Default containers for soil: glass = clear 125/250 mL with teflon liner, plastic =press seal bag
*Default storage: Glass containers in fridge, plastic containers shelved, all water samples in fridge

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CHAIN OF CUSTODY DESPATCH SHEET

Project Name: PORT MACQUARIE
Project No: 49728 DP Order No: T3763
DP Contact Person: WILL WRIGHT / PATRICK HEADS
Prior Storage: esky / fridge / shelved (circle)

To: Envirolab Services Pty Ltd
12 Ashley Street
CHATSWOOD NSW 2067
Ph: (02) 9910 6200
Attn: Jacinta Hurst

	Sample ID	Date Sampled	Sample Type S-soil W-water	Lab ID	Analytes: TRH	BTEX	PAH	PCB	OCP	OPP	Metals #	Asbestos							TCLP	Notes
1	C 1.5	15/3/11	S		✓	✓	✓	✓	✓	✓	✓	✓								Combo 6A
2	F 0.05	10/3/11			✓	✓	✓	✓	✓	✓	✓	✓								"
3	G 2.5-2.95	9/3/11									✓	✓								
4	G 4.4-4.45	9/3/11									✓	✓								
5	H 0.5	15/3/11			✓	✓	✓	✓	✓	✓	✓	✓								"
6	I 0.05	11/3/11			✓	✓	✓	✓	✓	✓	✓	✓								"
7	L 0.5	14/3/11			✓	✓	✓	✓	✓	✓	✓	✓								"
8	L 2.0	14/3/11			✓	✓	✓	✓	✓	✓	✓	✓								"
9	M 0.5	8/3/11			✓	✓	✓	✓	✓	✓	✓	✓								"
10	O 0.05	8/3/11			✓	✓	✓	✓	✓	✓	✓	✓								"
11	O 2.0	8/3/11			✓	✓	✓	✓	✓	✓	✓	✓								"
12	P 0.5	7/3/11	↓		✓	✓	✓	✓	✓	✓	✓	✓								"
	PQL (S)		mg/kg																	
	PQL (W)		mg/L																	

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: 9910 6200
Job No: 53239
Date received: 22/3 1000
Time received:
Received by:
Temp: Cool / Ambient
Cooling: Ice/Icepack
Security: Intact / Broken / None

PQL = practical quantitation limit *As per Laboratory Method (Detection Limit)
# - Metals to Analyse (Please circle): As Cd Cr Cu Pb Zn Hg Ni Other
Date relinquished: 21/3/11
Total number of samples in container: 14
Results required by: 28/3/11
TAT (Circle): Standard 72 hr 48hr 24hr

SAMPLES RECEIVED
Please sign and date to acknowledge receipt of samples and return by fax
Signature:
Date: 22/3 Lab Ref:

Send results to:
Douglas Partners Pty Ltd
Address:
BOX 324 Hunter Region Mail Centre
NSW 2310
Fax: (02) 4960 9601

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CHAIN OF CUSTODY DESPATCH SHEET

Project Name: PORT MACQUARIE
Project No: 49728 DP Order No: 93760
DP Contact Person: WILL WRIGHT / PATRICK HEADS
Prior Storage: esky / fridge / shelved (circle)

To: Envirolab Services Pty Ltd
12 Ashley Street
CHATSWOOD NSW 2067
Ph: (02) 9910 6200
Attn: Jacinta Hurst

	Sample ID	Date Sampled	Sample Type S-soil W-water	Lab ID	Analytes: TRH	BTEX	PAH	PCB	OCP	OPP	Metals #	Asbestos	pH	EC	Sulphate	Chloride	Resistivity		TCLP	Notes
13	RA	8/3/11	S		✓	✓	✓	✓	✓	✓	✓									Combo 6
14	RA	15/3/11	↓		✓	✓	✓	✓	✓	✓	✓									↓
15	I/0.5	11/3/11	S										✓	✓	✓	✓	✓			
16	L/1.0	14/3/11	S										✓	✓	✓	✓	✓			
17 NR	P/1.5	7/3/11	S										✓	✓	✓	✓	✓			
17	Bore G	16/3/11	W												✓	✓				
18	Bore M	16/3/11	W												✓	✓				
	PQL (S)		mg/kg																	
	PQL (W)		mg/L																	

PQL = practical quantitation limit *As per Laboratory Method (Detection Limit)
# - Metals to Analyse (Please circle): As Cd Cr Cu Pb Zn Hg Ni Other
Date relinquished: 21/3/11
Total number of samples in container: 14
Results required by: 28/3/11
TAT (Circle): Standard 72 hr 48hr 24hr

SAMPLES RECEIVED
Please sign and date to acknowledge receipt of samples and return by fax
Signature: 22/3
Date: Lab Ref:

Send results to:
Douglas Partners Pty Ltd
Address:
BOX 324 Hunter Region Mail Centre
NSW 2310
Fax: (02) 4960 9601

(N.R. = Not received)

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CHAIN OF CUSTODY DESPATCH SHEET

Project Name: PORT MACQUARIE
Project No: 44728 DP Order No:
DP Contact Person: PATRICIA HEADS
Prior Storage: esky / fridge / shelved (circle) at Lab (53239)

To: Envirolab Services Pty Ltd
12 Ashley Street
CHATSWOOD NSW 2067
Ph: (02) 9910 6200
Attn: Jacinta Hurst

Sample ID	Date Sampled	Sample Type S-soil W-water	Lab ID	Analytes: Cr 6+ Hexavalent	TCLP Cr	TCLP Ni												TCLP	Notes
C/1.5	15/3/11		1		✓														
F/0.05	10/3/11		2		✓														
G/4.0	9/3/11		4		✓														
H/0.5	15/3/11		5	✓	✓	✓													
I/0.05	11/3/11		6	✓	✓														
L/0.5	14/3/11		7		✓														
L/2.0	14/3/11		8		✓														
M/0.5	8/3/11		9		✓														
O/0.05	8/3/11		10	✓	✓														
O/2.0	8/3/11		11	✓	✓														
P/0.5	7/3/11		12		✓														
PQL (S)		mg/kg																	
PQL (W)		mg/L																	

PQL = practical quantitation limit *As per Laboratory Method (Detection Limit)
# - Metals to Analyse (Please circle): As Cd Cr Cu Pb Zn Hg Ni Other
Date relinquished:
Total number of samples in container: —
Results required by:
TAT (Circle): (Standard) 72 hr 48hr 24hr

SAMPLES RECEIVED
Please sign and date to acknowledge receipt of samples and return by fax
Signature:
Date: 7/4/11 Lab Ref: 53239A

Send results to:
Douglas Partners Pty Ltd
Address:
BOX 324 Hunter Region Mail Centre
NSW 2310
Fax: (02) 4960 9601

DUE: 14/4/11
std T/A.

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CHAIN OF CUSTODY DESPATCH SHEET

Project Name: PORT MACQUARIE
Project No: 49728.01 DP Order No: 97534
DP Contact Person: PATRICK HEADS
Prior Storage: esky / fridge / freezer / shelved (circle)

To: Envirolab Services Pty Ltd
12 Ashley Street
CHATSWOOD NSW 2067
Ph: (02) 9910 6200
Attn: Jacinta Hurst

	Sample ID	Date Sampled	Sample Type S-soil W-water	Lab ID	Analytes: CEC	ESP													TCLP	Notes
1	BORE1/0.05	15/3/11	S		✓	✓														
2	BORE1/0.5	15/3/11			✓	✓														
3	BORE3/0.5	9/3/11			✓	✓														
4	BORE4/0.5	15/3/11			✓	✓														
5	BORE6/1.0	14/3/11			✓	✓														
6	BORE9/0.05	7/3/11	↓		✓	✓														
	PQL (S)		mg/kg																	
	PQL (W)		mg/L																	

ENVIROLAB
Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No: 65011
Date Received: 16/11/11
Time Received: 8.30am
Received by:
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

PQL = practical quantitation limit *As per Laboratory Method (Detection Limit)
# - Metals to Analyse (Please circle): As Cd Cr Cu Pb Zn Hg Ni Other
Date relinquished: 15/11/11
Total number of samples in container: 6
Results required by: 17/11/11
TAT (Circle): Standard 72 hr 48hr 24hr

SAMPLES RECEIVED
Please sign and date to acknowledge receipt of samples and return by fax
Signature:
Date: 16/11/11 Lab Ref:

Send results to:
Douglas Partners Pty Ltd
Address:
BOX 324 Hunter Region Mail Centre
NSW 2310
Fax: (02) 4960 9601

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

SAMPLE RECEIPT ADVICE

Client:

Douglas Partners Newcastle
Box 324 Hunter Region Mail Centre
Newcastle NSW 2310

ph: 4960 9600
Fax: 4960 9601

Attention: Will Wright

Sample log in details:

Your reference:	**49728, Port Macquarie**
Envirolab Reference:	**53239**
Date received:	22/03/2011
Date results expected to be reported:	**29/03/11**

Samples received in appropriate condition for analysis:	YES
No. of samples provided	16 soils, 2 waters
Turnaround time requested:	Standard
Temperature on receipt	Cool
Cooling Method:	Ice

Comments:

Samples will be held for 1 month for water samples and 2 months for soil samples from date of receipt of samples.

Contact details:

Please direct any queries to Aileen Hie or Jacinta Hurst
ph: 02 9910 6200 fax: 02 9910 6201
email: ahie@envirolabservices.com.au or jhurst@envirolabservices.com.au

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

SAMPLE RECEIPT ADVICE

Client:

Douglas Partners Newcastle
Box 324 Hunter Region Mail Centre
Newcastle NSW 2310

ph: 4960 9600
Fax: 4960 9601

Attention: Patrick Heads

Sample log in details:

Your reference:	**49728, Port Macquarie**
Envirolab Reference:	**53239-A**
Date received:	22/03/2011
Date results expected to be reported:	**14/04/11**

Samples received in appropriate condition for analysis:	YES
No. of samples provided	Additional Testing on 11 Soils
Turnaround time requested:	Standard
Temperature on receipt	Cool
Cooling Method:	Ice

Comments:

Samples will be held for 1 month for water samples and 2 months for soil samples from date of receipt of samples.

Contact details:

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email: ahie@envirolabservices.com.au or jhurst@envirolabservices.com.au

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SAMPLE RECEIPT ADVICE

Client:

Douglas Partners Newcastle
Box 324 Hunter Region Mail Centre
Newcastle NSW 2310

ph: 4960 9600
Fax: 4960 9601

Attention: Patrick Heads

Sample log in details:

Your reference:	**49728.01, Port Macquarie**
Envirolab Reference:	**65011**
Date received:	16/11/11
Date results expected to be reported:	**17/11/11**

Samples received in appropriate condition for analysis:	YES
No. of samples provided	6 Soils
Turnaround time requested:	24hr
Temperature on receipt	Cool
Cooling Method:	None

Comments:

Samples will be held for 1 month for water samples and 2 months for soil samples from date of receipt of samples.

Contact details:

Please direct any queries to Aileen Hie or Jacinta Hurst
ph: 02 9910 6200 fax: 02 9910 6201
email: ahie@envirolabservices.com.au or jhurst@envirolabservices.com.au

Quality Assurance/Quality Control Report
Geotechnical Assessment, Proposed Additions to Hospital
Wrights Road, Port Macquarie

Quality Assurance (QA) was maintained by:

- Compliance with a Project Quality Plan written for the objectives of the study;
- Using qualified engineers/scientists to undertake the field supervision and sampling;
- Following the Douglas Partners Pty Ltd (DP) operating procedures for sampling, field testing and decontamination as presented in Table C1;
- Using NATA registered laboratories for sample testing that generally utilise standard laboratory methods of the US EPA, the APHA and NSW EPA.

Table C1: Field Procedures

Abbreviation	Procedure Name
FPM LOG	Logging
FPM DECONT	Decontamination of Personnel and Equipment
FPM ENVID	Sample Identification, Handling, Transport and Storage of Contamination Samples
FPM PIDETC	Operation of Field Analysers
FPM ENVSAMP	Sampling of Contaminated Soils

Notes: From DP Field Procedures Manual

Quality Control (QC) of the laboratory programme was achieved by the following means:

- Check replicate - a specific sample was split in the field, placed in separate containers and labelled with different sample numbers, and sent to the laboratory for analysis;
- Method blanks - the laboratory ran reagent blanks to confirm the equipment and standards used were uncontaminated;
- Laboratory replicates - the laboratory split samples internally and conducted tests on separate extracts;
- Laboratory spikes - samples were spiked by the laboratory with a known concentration of contaminants and subsequently tested for percent recovery;

Discussion

A. Check Replicate

The Relative Percent Difference (RPD) between replicate results is used as a measure of laboratory reproducibility and is given by the following:

$$RPD = \frac{ABS(\text{Replicate result } 1 - \text{Replicate result } 2)}{(\text{Replicate result } 1 + \text{Replicate result } 2)/2} \times 100$$

The RPD can have a value between 0% and 200%. An RPD data quality objective of up to 50% is generally considered to be acceptable for organic analysis, and 35% for inorganics (i.e. Metals).

A summary of the results of the soil replicate QA/QC testing is provided in Table C2.

Table C2: Results of Quality Control Analysis

Analyte		Bore 4/0.5	R9	RPD (%)	Bore 7/0.5	R4	RPD (%)
Metals	As	<4	<4	N/A	<4	<4	N/A
	Cd	<0.5	<0.5	N/A	<0.5	<0.5	N/A
	Cr	770	850	10	290	360	22
	Cu	16	16	0	10	9	11
	Pb	5	6	18	4	5	22
	Hg	0.2	0.1	67	<0.1	<0.1	N/A
	Ni	44	42	5	19	21	10
	Zn	5	5	0	6	6	0
TRH	C_6 - C_9	<25	<25	N/A	<25	<25	N/A
	C_{10} - C_{14}	<50	<50	N/A	<50	<50	N/A
	C_{15} - C_{28}	<100	<100	N/A	<100	<100	N/A
	C_{29} - C_{36}	<100	<100	N/A	<100	<100	N/A
BTEX	Benzene	<0.5	<0.5	N/A	<0.5	<0.5	N/A
	Toluene	<0.5	<0.5	N/A	<0.5	<0.5	N/A
	Ethyl Benzene	<1	<1	N/A	<1	<1	N/A
	Xylene	<3	<3	N/A	<3	<3	N/A
PAH	Total	<1.55	<1.55	N/A	<1.55	<1.55	N/A
	Benzo(a)pyrene	<0.05	<0.05	N/A	<0.05	<0.05	N/A
OCPs	Total	<2	<2	N/A	<2	<2	N/A
	Aldrin + Dieldrin	<0.2	<0.2	N/A	<0.2	<0.2	N/A
	Chlordane	<0.2	<0.2	N/A	<0.2	<0.2	N/A
	DDT	<0.1	<0.1	N/A	<0.1	<0.1	N/A
	Heptachlor	<0.1	<0.1	N/A	<0.1	<0.1	N/A
OPPs		<0.7	<0.7	N/A	<0.7	<0.7	N/A
PCBs		<0.8	<0.8	N/A	<0.8	<0.8	N/A

Notes:

Results expressed in mg/kg on dry weight basis
N/A - Not Applicable

RPDs were generally found to be within the within the quality control objectives.

An elevated RPD was found for Bore 4/0.5 and R9 for mercury. The elevated RPD may be attributed to relatively low concentrations of mercury (ie small changes in concentration), which results in high RPDs:

B. Method Blanks

All method blanks returned results lower than the laboratory detection limit, therefore are acceptable.

C. Laboratory Duplicates

The average RPD for individual contaminants ranges from 0% to 67%. An elevated RPD was found for Zinc. The concentrations were, however, very low, resulting in a high RPD for a small difference in concentration.

D. Laboratory Spikes

Recoveries in the order of 70% to 130% are generally considered to be acceptable for inorganic material and 60% to 140% for organic material. The average percent recovery for individual organic contaminants ranged from 68% to 128%, which is generally within the quality control objectives. The results should however be qualified and may slightly under-estimate or over-estimate contaminant concentrations in certain samples (ie biased low or high respectively).

Conclusions

In summary, while some elevated RPD results were found, they can be attributed to the relatively low concentration of contaminants.

The accuracy and precision of the soil testing procedures, as inferred by the laboratory QA/QC data is considered to be of sufficient standard to allow the data reported to be used in interpret site contamination conditions.

Appendix D

Drawing 1 – Test Location Plan

Locality Plan

0 10 20 30 40 60 80 100 150 200m

1:2000 @ A3

NOTE: Base drawing from plan by Hassell,Ref A011 dated 24/01/2011, and Nearmap image dated 19/02/2011

LEGEND

- Approximate Test Pit Location
- Approximate Test Bore Location
- 1 Approximate Photo Location & Orientation
- Approximate Lot Boundaries

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Health Infrastructure		
OFFICE: Newcastle	DRAWN BY: PLH	
SCALE: 1:2000@A3 Sheet	DATE: 14.06.2011	

TITLE: **Test Location Plan**
Proposed Additions to Port Macquarie Base Hospital
Wrights Road, Port Macquarie

N

PROJECT No:	49728
DRAWING No:	1
REVISION:	0