Douglas Partners
Geotechnics | Environment | Groundwater

Integrated Practical Solutions

Report on
Supplementary Geotechnical Investigation

Proposed Redevelopment
Wagga Wagga Base Hospital
Edward Street, Wagga Wagga

Prepared for
Health Infrastructure

Project 72320.03
October 2011

## Document History

Document details

| | | | |
|---|---|---|---|
| Project No. | 72320.03 | Document No. | 1 |
| Document title | Supplementary Geotechnical Investigation<br>Proposed Wagga Wagga Base Hospital Redevelopment | | |
| Site address | Edward Street, Wagga Wagga | | |
| Report prepared for | Mr Mark Baker – Health Infrastructure | | |
| File name | P:\72320.03 WAGGA WAGGA, Base Hospital Supplementary Geotechnical Investigation PGH\Docs\72320.03 Report.doc | | |

Document status and review

| Revision | Prepared by | Reviewed by | Date issued |
|---|---|---|---|
| DRAFT | Peter Hartcliff | Dr Terry Wiesner | 31 October 2011 |
| | | | |
| | | | |
| | | | |

Distribution of copies

| Revision | Electronic | Paper | Issued to |
|---|---|---|---|
| DRAFT | 1 | 0 | Health Infrastructure, Capital Insight 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 | | |
| Reviewer | | |

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666
Fax (02) 9809 4095

Douglas Partners
Geotechnics | Environment | Groundwater

# Table of Contents

**Page**

## List of Appendices

# Report on Supplementary Geotechnical Investigation
# Proposed Wagga Wagga Base Hospital Redevelopment
# Edward Street, Wagga Wagga

## 1. Introduction

This report presents the results of geotechnical investigations carried out by Douglas Partners Pty Ltd (DP) for a proposed redevelopment of the Wagga Wagga Base Hospital at Edward Street (Sturt Highway), Wagga Wagga. The most recent investigation work was commissioned by Capital Insight Pty Ltd in an email dated 6 September 2011.

It is understood that the current redevelopment plans include the demolition of a number of existing buildings and the construction of a new main building, with sections of the building varying in height from one to eight storeys. The present supplementary investigation was carried out to provide additional information on subsurface conditions for the planning and design of excavations, pavements and foundations.

Architectural Drawing No. DA11 by Rice Daubney, showing indicative building heights together with a site survey plan (untitled) were supplied by Capital Insight Pty Ltd for use in the investigation. Survey and Service Location Plans (Sheets 1 to 14 by Rivland Surveyors, dated 24/06/11) were also supplied by Capital Insight.

The field work for the previous investigation (Stage 1) conducted in March 2011 included the drilling of nine (9) deep geotechnical boreholes with in-situ testing and sampling of the subsurface strata, and the installation of two (2) standpipes for groundwater sampling and monitoring purposes. Laboratory testing of selected soil and groundwater samples was undertaken, followed by engineering analysis and reporting.

DP also carried out a preliminary contamination assessment in conjunction with the Stage 1 geotechnical investigation. The preliminary contamination assessment was reported separately for Project 72320.01 dated May 2011.

The supplementary investigation (Stage 2) conducted in September 2011 was carried out to provide additional information for the design of carpark areas, a new access road, the proposed Phase 1 and Phase 2 buildings, and the CEP zone. The Stage 2 field work included the drilling of eleven (11) shallow geotechnical boreholes with dynamic cone penetrometer (DCP) tests, and five (5) cone penetration tests (CPTs). Laboratory testing of selected soil samples from the shallow boreholes was also undertaken for geotechnical and waste classification purposes.

A settlement analysis was also conducted by DP in August 2011 for the purpose of providing preliminary design charts for the designer. These results have been included within this present report.

All relevant geotechnical information from the previous and present investigations have been included in this present report which consequently supersedes the previous geotechnical report and other communications.

## 2. Site Description and Geology

The site for the proposed redevelopment is located within the existing hospital complex at Edward Street (Sturt Highway), Wagga Wagga. The site is approximately rectangular in shape with an area totalling approximately 55 000 $m^2$. It has an approximate 220 m northern frontage to Edward Street and a length of approximately 270 m along Docker Street on the western boundary. The eastern boundary is irregular and typically fronts neighbouring residential boundaries and hospital support buildings. Rawson Avenue runs along the southern site boundary. The ground surface falls gently to the north of the site with a cross fall of approximately 2 m over a total distance of 270 m.

The site is currently occupied by a number of separate buildings, some of which date back to the early 1800s. The main hospital building (refer to Figure 1) located within the central part of the site is eight storeys in height and is understood to have been constructed around the 1960's. The original three storey hospital building located adjacent to the main building (adjacent to the lawn area that fronts Edward Street) is still operational. A number of smaller brick buildings ranging in height from between one and three storeys are located throughout the site and are currently used as university buildings (Harvey House circa 1825), hospital nursing quarters, engineering/ maintenance buildings and hospital specialist buildings. A more recently constructed theatre building (CSB building) is located to the south-west of the main building and is between two and three storeys in height. Open asphalt and gravel car parks are located along the eastern side of the site.


**Figure 1: Main Hospital Building and the Original Hospital Building (looking south-east)**

Reference to the Wagga Wagga 1:250 000 Geological Series Sheet (SI 55-15) indicates that the northern half of the site is underlain by unconsolidated sand, silt, clay and gravel (floodplain sediments) and includes high-level Tertiary aged terrace sediments of the Murray Valley comprising gravel, sand, silt and clay. The southern half of the site is shown to be underlain by the Wagga Marginal Base Formation comprising shale, slate, quartzite, sandstone and subgreywacke.

The Stage 1 and Stage 2 field work confirmed the presence of predominantly alluvial clays (extending to over 32.5 m depth) with zones of sands and gravelly sand.

## 3. Field Work Methods

### 3.1 Stage 1 – March 2011

The field work for the Stage 1 investigation comprised ten boreholes (BH101 to BH107, BH107A, BH108 and BH109). The locations of these boreholes are shown on Drawing 1 in Appendix B.

The boreholes were drilled to depths of 2.4 m to 26.95 m with a truck-mounted Scout drilling rig using spiral auger and rotary washboring techniques within the soil. Bore BH107 was discontinued and relocated (BH107A) approximately 1 m to the west following premature refusal at a depth of 2.4 m.

Standard penetration tests (SPTs) were carried out below depths of 1.0 m to sample the soil and assess the in-situ strength of the materials. Disturbed soil samples were taken from the cuttings returned by the auger blade and used for identification and classification purposes. Soil samples were logged on site by a senior engineering geologist.

Slotted PVC standpipes were installed in bores BH101 and BH106 to allow for sampling of the groundwater and measurements of the groundwater levels during the investigation period.

The bores were set out relative to existing surface features (e.g. buildings and boundaries) by tape measurement and the reduced surface levels (RLs) at each test location to, Australian Height Datum (AHD), were interpolated from the site survey plan (untitled) provided by the client.

### 3.2 Stage 2 – September 2011

The field work for the Stage 2 investigation included eleven (11) shallow boreholes (BH201 to BH211) drilled to depths of between 2.9 m and 3.0 m with a 5-tonne excavator fitted with a 200 mm diameter auger attachment. Undisturbed (UD50) and disturbed soil samples were taken for the purpose of identification and classification purposes as well as geotechnical and waste classification laboratory testing. Due to the hardness of the clay within the top 3 m, only one undisturbed (UD50) sample was successfully collected from eight (8) attempts.

Dynamic cone penetrometer tests (DCP201 to DCP211) were carried out adjacent to the shallow boreholes to depths of between 1.95 m and 2.4 m to assess the relative strength of the soil. In a DCP, a cone-tipped steel rod is driven into the ground using a 9 kg hammer dropping a standard height of

510 mm. The number of blows required to drive the rod into the ground each successive 150 mm depth interval is recorded and these values are used to assess the density/consistency of the soils.

Sampling and testing for waste classification purposes was undertaken in general accordance with Waste Classification Guidelines – Part 1: Classifying Waste (Department of Environment and Climate Change NSW, 2008). The Waste Classification samples were stored in glass jars and were transported to a NATA accredited analytical laboratory for analysis. Soil samples were logged on site by a senior engineering geologist.

Five (5) cone penetration tests (CPT1 to CPT5) were also conducted to depths of between 15.0 m and 32.5 m. In a CPT, a 35 mm diameter cone and 130 mm long friction sleeve is attached to rods of the same diameter and pushed continuously into the soil using hydraulic thrust from a ballasted truck mounted test rig. Strain gauges in the cone and sleeve measure resistance to penetration, and the results are displayed on a digital monitor and stored on a computer for later plotting and interpretation. Further details of the method and the interpretation of CPTs are given in the notes included in Appendix A.

The boreholes were drilled to gain additional information on the shallow subsoil profile at key areas of the site where new car parks, access roads and buildings will be located. The CPTs were located within close proximity to the most heavily loaded areas of the proposed new building in the Phase 1, Phase 2 and CEP zones.

The locations of the Stage 2 boreholes and CPTs are also shown on Drawing 1 in Appendix B. These were set out relative to existing surface features (e.g. buildings and boundaries) by tape measurement and the reduced surface levels (RLs) at each test location (to AHD) were interpolated from the site survey plans (Rivland Surveyors, Sheets 1 – 14, dated 24/06/11) provided by the client.

## 4. Results

Details of the conditions encountered during the investigations are provided in Appendix C, together with notes defining classification methods and descriptive terms.

The boreholes and CPTs generally encountered filling over alluvial clay and sand. The subsurface conditions may be generally summarised as follows:

- **PAVEMENTS:** encountered in boreholes BH102 (roadbase only), BH103, BH104, BH107, BH107A, BH204, BH205, BH206 (roadbase only), BH207 and BH208 (roadbase only) and comprised asphaltic concrete (AC), apart from where mentioned above, over roadbase with a combined pavement thickness of between 0.1 m and 0.2 m;
- **TOPSOIL:** encountered in bores BH101, BH105, BH106, BH108, BH109, BH201 to BH203, and BH209 and BH210 to depths of between 0.1 m and 0.7 m. The topsoil generally comprised sandy silt and silty clay;
- **FILLING:** encountered to depths of 0.2 m to 2.4 m in numerous locations and generally comprised poorly compacted silty clay filling with some building rubble (tiles and concrete fragments), silt and sand;

- **SILTY CLAY AND GRAVELLY SILTY CLAY:** silty clay encountered in all test locations to depths of 7.0 m to 32.5 m, gravelly silty clay encountered in bore BH101 from between 7.0 m and 8.0 m and between 16.0 m and 19.0 m, and sandy clay encountered in borehole BH104 between 13.0 m and 13.2 m. The silty clay was of a typically very stiff to hard consistency in all bores however some stiff zones were logged in BH106 to BH109 generally between depths of 2 m and 4 m. Gravelly silty clay was logged in bore BH101 between 7 m and 8 m depth and 16.0 m and 19.0 m depth, and was typically of hard consistency. The CPTs indicated some minor gravel bands of less than 0.4 m thickness extending to the maximum test depth of 32.5 m (RL 150 m), with minor interbeds of clayey sand and clayey sandy gravel interpreted in CPT4 only at depths of 8.5 m (RL 174.1 m) and 10.6 m (RL 172.0 m) with thicknesses of approximately 1.5 m;
- **SAND AND CLAYEY SAND:** encountered towards the northern end of the site in boreholes BH104, BH105 and BH106 to depths of 10.0 m to 15.5 m. The sand was typically medium dense to dense, medium to coarse grained and appeared to be well graded.

Free groundwater was observed during augering (or after leaving the boreholes open for a 12-hour period) in boreholes BH104 at a depth of 14.95 m, BH106 at a depth of 13.10 m and BH107A at a depth of 13.10 m. The use of water during washbore drilling prevented the measurement of groundwater below depths of 8.50 m in bores BH101, BH102 and BH103 and also below a depth of 14.5 m in the remaining bores (BH104 to BH109). The groundwater level was measured in CPT4 at a depth of 8.5 m (RL 174.1 m) at the end of the test using a hand-held tape measure.

Water levels within the standpipes in boreholes BH101 and BH106 were recorded after completion of the drilling and "bailing out" the standpipes to lower the water level during the Stage 1 investigation on the 29 March 2011and 5 April 2011, respectively. The water level measurements are given in Table 1.

**Table 1: Standing Water Levels in Standpipes**

| Borehole | Surface RL | Water Level Measurements | | |
|---|---|---|---|---|
| | (m AHD) | Date | Depth (m) | RL (m AHD) |
| BH101 | 183.0 | 31.3.11 | 6.6 | 176.4 |
| | | 7.4.11 | 6.7 | 176.3 |
| | | 20.9.11 | 7.3 | 175.7 |
| BH106 | 182.6 | 6.4.11 | 6.3 | 176.3 |
| | | 20.9.11 | 5.8 | 176.8 |

# 5. Laboratory Testing

## 5.1 Geotechnical Testing

Selected samples of soils were tested for Emerson class, Atterberg limits, linear shrinkage, Standard maximum dry density, Californian bearing ratio (CBR), shrink-swell index, electrical conductivity, pH, chloride ion and sulphate ion content. The results of the laboratory testing of the soils are included in Appendix D and summarised in Tables 2 and 3.

**Table 2: Summary of Physical Geotechnical Test Results**

| Bore/ Depth (m) | Material | Emer. (class) | $W_L$ (%) | $W_P$ (%) | PI (%) | LS (%) | MDD ($t/m^3$) | OMC (%) | CBR (%) | Swell (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 101/0.3 | Silty clay | - | - | - | - | - | 1.80 | 13.5 | 7 | 0.8 |
| 101/4-4.45 | Silty clay | - | 35 | 18 | 17 | 11.0 | - | - | - | - |
| 102/1-1.45 | Silty clay | 3 | - | - | - | - | - | - | - | - |
| 103/0.5 | Clay | - | - | - | - | - | 1.89 | 13.5 | 10 | 0.3 |
| 106/0.3 | Silty clay | - | - | - | - | - | 1.82 | 14.0 | 8 | 0.6 |
| 106/2.5-2.95 | Silty clay | - | 33 | 18 | 15 | 10.0 | - | - | - | - |
| 106/4-4.45 | Silty clay | 3 | - | - | - | - | - | - | - | - |
| 108/1.4-1.85 | Silty clay | - | 28 | 15 | 13 | 8.5 | - | - | - | - |
| 109/0.4 | Clay | - | - | - | - | - | 1.71 | 15.0 | 11 | 1.3 |
| 109/4-4.45 | Silty clay | - | 34 | 17 | 17 | 10.5 | - | - | - | - |
| 201/0.8-1.2 | Silty clay | - | - | - | - | - | 1.76 | 18.0 | 6 | 0.3 |
| 202/0.8-1.2 | Clay | - | - | - | - | - | 1.81 | 16.0 | 4 | 0.4 |
| 202/1.9-2.0 | Silty clay | - | 32 | 16 | 16 | 10.0 | - | - | - | - |
| 203/0.3-0.6 | Silty clay | - | - | - | - | - | 1.80 | 16.0 | 6 | 0.3 |
| 204/0.5-0.8 | Silty clay | - | - | - | - | - | 1.80 | 17.5 | 7 | 0 |
| 205/0.7-1.0 | Silty clay | - | - | - | - | - | 1.81 | 16.5 | 7 | 0.3 |
| 205/1.5-1.6 | Silty clay | - | 28 | 18 | 10 | 9.5 | - | - | - | - |
| 206/0.5-1.0 | Silty clay | - | - | - | - | - | 1.89 | 14.0 | 6 | 0.2 |
| 207/0.4-0.5 | Silty clay | - | 35 | 17 | 18 | 12.0 | - | - | - | - |
| 208/0.4-0.5 | Silty clay | - | 34 | 16 | 18 | 12.5 | - | - | - | - |
| 208/0.7-0.73 | Silty clay | - | 31 | 17 | 14 | 12.5 | - | - | - | - |
| 209/0.7-0.8 | Silty clay | - | 34 | 17 | 17 | 10.0 | - | - | - | - |
| 210/0.5-0.6 | Silty clay | - | 34 | 18 | 16 | 11.0 | - | - | - | - |
| 211/1.3-1.4 | Silty clay | - | 28 | 16 | 12 | 8.0 | - | - | - | - |

Emer = Emerson
$W_L$ = Liquid Limit
$W_P$ = Plastic Limit
PI = Plasticity Index
LS = Linear Shrinkage
OMC =Optimum Moisture Content
MDD = Maximum Dry Density
CBR = Californian Bearing Ratio
- = not tested

In addition to these test results, the shrink-swell index of the sample obtained from 0.8 m depth in borehole BH209 was 2.2%.

**Table 3: Summary of Chemical Geotechnical Test Results**

| Bore/ Depth (m) | Material | Electrical Cond. (µS/cm) | pH | Chloride (mg/kg) | Sulphate (mg/kg) |
|---|---|---|---|---|---|
| 101/5.5-5.95 | Silty clay | 150 | 8.5 | 24 | <20 |
| 106/4-4.45 | Silty clay | 140 | 8.1 | 21 | <20 |
| 107A/11.5-11.95 | Silty clay | 100 | 7.8 | <20 | 64 |
| 108/2.5-2.95 | Silty clay | 100 | 8.0 | 31 | <20 |

## 5.2 Waste Classification Testing

Selected samples collected during the Stage 2 investigation were tested for a range of potential contaminants. A summary of the results is shown in Table 4. The detailed laboratory results are provided in Appendix D.

**Table 4: Range of Waste Classification Test Results**

| Analyte | Specific Contaminant Concentration (mg/kg) | Leachable Concentration (mg/L) |
|---|---|---|
| Benzene | All <0.2 | - |
| Toluene | All <0.5 | - |
| Ethylbenzene | All <1 | - |
| Xylene | All <2 | - |
| $TRH_{C6-C9}$ | All <25 | - |
| $TRH_{C10-C36}$ | All <100 | - |
| Total PAHs | <0.2 to 35.1 | <0.002 to 0.054 |
| Benzo(a)pyrene | <0.05 to 2.4 | All <0.001 |
| OCPs | All <0.1 | - |
| PCBs | All <0.1 | - |
| Phenol | All <5 | - |
| Arsenic | <4 to 10 | - |
| Cadmium | All <0.5 | - |
| Chromium | 11 to 28 | - |
| Lead | 10 to 150 | All <0.03 |
| Mercury | <0.1 to 0.6 | - |
| Nickel | 6 to 19 | - |

Notes: TRH = total recoverable hydrocarbons; PAHs = polycyclic aromatic hydrocarbons; OCPs = organochlorine pesticides PCBs = polychlorinated biphenyls; - = not tested

In addition to the chemical analysis outlined above, selected soil samples were also analysed for asbestos. Asbestos was not identified in the soil samples tested and respirable fibres were not detected in the trace analysis.

## 6. Geotechnical Model

A geotechnical model of the site is presented in the form of two interpreted geotechnical cross-sections in Drawing 2 (Section A-A') and in Drawing 3 (Section B-B') in Appendix B. The sections show the depth of filling and soil overburden logged in the borehole locations and interpreted CPTs.

The natural sub-surface profile at the site comprises alluvial clays and sands. The sediments consist of interbedded layers of silty clay, gravelly silty clay, sandy clay and sand. Due to their origin these soil materials are expected to be variable across the site, varying in depth, thickness and extent, depending on the alignment and size of ancient river channels. The laboratory test results suggest that the clayey soils are of moderate plasticity.

Groundwater was encountered below depths of 6 m, at about RL 176.3 m.

## 7. Proposed Development

It is understood that the proposed redevelopment of the site includes three stages of construction activities including the demolition of all buildings except the CSB building (the newly constructed theatre building), Harvey House (UNSW medical building) and the Hydrotherapy Pool building. The proposed new main building will vary between two and eight storeys in height and will spread out across the site (refer to Drawing 1, in Appendix B).

The preliminary conceptual design also includes the following:

- A CEP building located to the south of the site;
- A service tunnel under the new building constructed to a depth equivalent to approximately one basement level;
- Permanent car parking located on ground level to the north of the site where the open lawn area is located, as well as the north-eastern and south-western corners of the site where existing car parking exists;
- An on-site detention (OSD) tank located below the proposed car park to the east of the site; and
- A new access road running north-south along the eastern side of the site.

Based on the brief provided for the Stage 1 investigation, estimated maximum working column loads for the larger building were understood to be around 8,000 kN (internal) and 4,000 kN (external).

# 8. Comments

## 8.1 Site Classification

For Wagga Wagga, an Hs of 3 m and Δu of either 1.2 (AS2870 value) or 1.5 pF (maximum value from Barnett and Kingsford, 1999) are considered applicable. The shrink-swell index (Iss) of a sample of clay obtained from borehole BH209 (0.8 m depth) was measured at 2.2 % per pF.

Based on the shrink-sell results and the Atterberg limit results from other testing, the site could be classified as M-D in accordance with Australian Standard AS 2870 – 2011, providing that 'normal' moisture conditions prevail for the site soils. Where 'abnormal' moisture conditions occur (as defined in AS 2870) due to factors such as nearby trees or on-site detention tanks that release water into the surrounding soil profile, the range of soil moisture and suction variation can exceed that implicit in the design. In these circumstances, a more severe site classification (e.g. H-D or P) may apply.

## 8.2 Site Preparation and Earthworks

### 8.2.1 Excavation Conditions

The proposed redevelopment will involve excavation depths of approximately 3 m for the proposed service tunnel, lift-wells and on-site detention (OSD) tanks. The majority of the excavated material is expected to comprise very stiff to hard silty clay with some filling material.

It is considered that excavation in the filling and silty clay should be readily achievable using conventional earthmoving equipment (e.g. bulldozers and hydraulic excavators).

It is suggested that a working platform comprising a layer of crushed rock or concrete be placed over areas of the site where machinery and personnel traffic is expected, due to the risk of poor trafficability over the clays when wet.

### 8.2.2 Waste Classification of Excavated Material

Waste classification in NSW is usually undertaken in accordance with *Waste Classification Guidelines* (DECC NSW, 2008). These guidelines include the following six-step process for waste classification:

- Establish if the waste is 'special waste'.
- Establish if the waste is 'liquid waste'.
- Establish if the waste is 'pre-classified' by the EPA.
- Establish if the waste possesses hazardous characteristics.
- Determine the contaminant concentrations of the waste.
- Establish if the waste is putrescible.

Visual inspection and the laboratory analysis indicated that asbestos was not present in the soil samples tested. The soil samples did not contain clinical waste or tyres and therefore the soils on the site cannot be classified as special waste.

The samples analysed were not in liquid form and therefore could not be described as liquid waste.

The Department has pre-classified glass, plastic, rubber, bricks, concrete, building and demolition waste, and asphalt waste as General Solid Waste (non-putrescible). The materials tested were typically in a soil matrix and therefore the waste cannot be pre-classified.

The samples analysed did not possess any obvious hazardous characteristics and could not be described as hazardous waste prior to chemical analysis. All samples analysed were assessed on a visual and tactile basis as being incapable of significant biological transformation and are therefore considered to be non-putrescible.

The total and leachable concentrations of various contaminants in the samples tested were compared to the threshold criteria provided in the guidelines. The thirteen samples tested from the Stage 2 boreholes can therefore be classified as General Solid Waste (non-putrescible) based on the total and leachable contaminant concentrations.

It may be necessary to undertake additional testing during construction for materials required to be taken off site. The type and extent of testing undertaken will depend on the final use or destination of the spoil, and requirements of the receiving site.

The natural soils may be able to be described as virgin excavated natural material (VENM) pending confirmation that cross-contamination has not occurred during site works.

### 8.2.3 Vibrations from Excavation

It is anticipated that most of the excavation work within filling and natural soils will result in relatively minor vibrations. Some vibrations may however occur from the operation of heavy machinery and compaction plant (i.e. rollers).

Available information indicates that the types of structures adjacent to the site could probably withstand vibration levels higher than those required to maintain the comfort of their occupants. It is suggested that a provisional maximum peak particle velocity of 5 mm/sec (in any component direction) be adopted at the foundation level of adjacent structures for both structural and human comfort considerations. However, this limit should be reviewed prior to the commencement of site work with regards to the effects noise and vibration may have on a working hospital. It is anticipated that a working hospital will have specific requirements/limits with regard to noise and vibration.

As the magnitude of vibration transmission is site specific, if the equipment to be used on site is likely to cause concern then it is recommended that vibration trials be undertaken at the commencement of any work that may result in unacceptable vibrations of the surrounding ground and structures. The trial may indicate that smaller or different types of equipment should be used for earthworks at the site.

Dilapidation surveys should be carried out on neighbouring buildings prior to commencement of construction activities so as to allow an appropriate and informed response to any claims for damages arising from construction activities.

### 8.2.4 Groundwater Seepage

Groundwater levels were measured during the fieldwork at about RL 176.3 m, or 6.3 m to 6.7 m below the ground surface. The groundwater levels are expected to vary over time due to seasonal, climatic and other factors.

Due to the relatively low permeability of the clayey soils above a depth of approximately 6 m, it is anticipated that inflow rates would be relatively low and consequently, should be readily controlled by pumping from suitably located sumps within the floor of the excavation. As part of a permanent drainage system, it may be prudent to provide under-floor drainage to protect the subgrade (and footing bases) from softening. This layer could comprise a 100 mm thick durable, open-graded crushed rock with subsurface drains and sumps.

## 8.3 Excavation Batters

The excavated faces may stand vertically where the excavation depth is less than 1.5 m. Some minor slumping may occur and site personnel should be made aware of the risks. Faces should either be battered or shored where the excavation depth exceeds 1.5 m. The suggested batter angles for temporary and permanent excavations are given in Table 5.

**Table 5: Suggested Excavation Batter Angles**

| Material | Slope Height | Batter Slope (H:V) | |
|---|---|---|---|
| | | Short term<br>Temporary | Long term<br>Permanent |
| Existing filling and stiff clay | <2 m<br>2 m to 3 m | 1:1<br>1.5:1 | 1.5:1<br>2:1 |
| Very stiff/hard clay | <2 m<br>2 m to 4 m | 0.75:1<br>1:1 | 1.5:1<br>2:1 |

All batters should be subject to geotechnical inspection for every 1.5 m of vertical excavation to confirm the adequacy of the slopes indicated above and to assess whether a flatter slope or localised dowelling is required to control any local instability within the face.

The silty clay will be susceptible to significant slaking and erosion from exposure to air and water flows from run-off. Any permanent or semi-permanent batter slopes will need to be covered with either shotcrete pinned to the face, or preferably battered to 3H:1V or flatter, to allow the establishment of topsoil and vegetation (e.g. grass).

## 8.4 Excavation Support

Where battering cannot be incorporated due to space limitations and/or softening of the subsoils is likely, the provision of temporary and permanent retaining measures will be required. It is suggested that the design of the retaining system is based on an average bulk unit weight of 20 kN/m$^3$ for soil, with a triangular earth pressure distribution calculated as follows:

$h_z = K z \gamma$

where $h_z$ = horizontal pressure at depth z
$\gamma$ = unit weight of soil or rock
K = earth pressure coefficient

The earth pressure coefficient to be adopted for design will vary depending upon the nature and strength of the retained material. Suggested active lateral earth pressure coefficients (horizontal backfill conditions) are given in Table 6 as a guide for design purposes.

**Table 6: Suggested Active Lateral Earth Pressure Coefficients**

| Retained Material | Earth Pressure Coefficient | | |
|---|---|---|---|
| | Active (short-term) | Active (long-term) | Passive |
| Clays - stiff / very stiff | 0.3 | 0.35 | 2.5 |

Additional lateral pressures should be included where surcharging occurs either from footings, adjacent construction activities, traffic or other loads. Unless positive drainage measures can be incorporated to prevent water pressure build up behind the walls, full hydrostatic head should be allowed for in the design while, at the same time, allowing for the soil unit weight on the passive side to reduce due to the buoyant condition.

## 8.5 Foundations

### 8.5.1 General

Given the magnitude of the column loads and taking into consideration that the depth to rock on the site is in excess of approximately 30 m, it is unlikely to be economically feasible to construct piles founded on rock. Alternative foundation systems include the use of friction piles (bored and cast-in place pile footing systems) or the construction of a stiffened raft slab with or without a pile foundation system.

### 8.5.2 Modulus of Elasticity for Soils

The soil modulus can be estimated from published correlations of CPT data. In general, a soil modulus value for over-consolidated material of stiff to hard consistency can be determined by multiplying the $q_c$ value by between 5 and 7.

Based on the above, a soil modulus value of between approximately 20 and 30 MPa for the very stiff clays and between 50 and 70 MPa for the hard clays could be adopted based on the CPT results.

### 8.5.3 Shallow Foundations

Based on the results of the boreholes and CPTs, the clay below the site within approximately 10 m depth from the surface is generally very stiff to hard consistency.

Therefore, consideration may be given to the use of a raft slab foundation. Based on an assumed floor (Working) load of 10 kPa per floor it is anticipated that a distributed slab load in the order of 20 kPa to 80 kPa may be applicable for a building varying in height between two and eight storeys. As a guide, for raft slab foundations, preliminary settlement analyses has been carried out assuming a uniform distributed slab pressure of 20 kPa to 80 kPa over a loaded area of 20 m by 20 m. Based on the results of the analyses, the preliminary design of raft slabs to support column and floor loadings may be based on a modulus of subgrade reaction in the order of 2 to 8 kPa/mm for the broad loaded area (i.e. 20 m by 20 m). Settlements in the order of 5 mm to 30 mm could therefore be expected under the assumed loads. The modulus of subgrade reaction value will vary with the load and the size of the loaded higher area and for detailed design of a raft foundation, modelling the soil profile as an elastic solid is preferred.

The design of raft slabs should consider potential differential settlements between different building heights due to the varying loadings on the raft slab and separate raft slabs may be required. A piled raft foundation may be considered to minimise differential settlements, particularly for the eight-storey section of the building, if required. Further geotechnical advice will be required in relation to the design of both raft slabs and possibly piled raft slabs once the column layout and loadings are confirmed.

### 8.5.4 Piled Foundations

The alternative to shallow foundations is to support the structural loads on piles founded within at least very stiff clay typically observed between 2 m and 10 m depth (RL 183 m and RL 171 m). Relatively large diameter piles or pile groups may be required to accommodate the heavier column loads of up to 8,000 kN.

It is expected that noise and vibration constraints at this site will preclude the use of driven pile types. The adoption of uncased bored piles is possible within the clay but is not recommended below depths of about 10 m due to the presence of sand (in the northern part of the site) and the potential for soil collapse and major groundwater inflows. Even so, groundwater seepage may occur below 5 m depth but should be able to be handled by pumping to remove the water immediately prior to concrete placement. It may be necessary to drill the piles and pour each one directly after cleaning and installing steel reinforcement. Steel screw piles are unlikely to be feasible for the high column loads and may have difficulty penetrating through the hard clays.

Suitable pile types would include bored piers and continuous flight auger (CFA) piles. These types of piles are all associated with relatively low levels of noise and vibration.

It is recommended that the bored piles be subject to regular geotechnical inspections of the founding condition in order to assess whether ground conditions are consistent with the bearing capacity requirements of the piles. In contrast, CFA piling is a 'blind' piling technique, and the piling contractor would need to be responsible for assessment or whether suitable materials were encountered and whether available bearing capacities meet the design requirements. Further investigation may be required.

It is recommended that piles founded within the very stiff to hard clay, be designed on the basis of the following Ultimate parameters:

- Ultimate End Bearing Pressure (compression) 600 kPa
- Ultimate Shaft Adhesion (compression) 50 kPa (ignoring the upper 3 m of shaft)

Table 7 provides a comparison of the possible Working loads capable of being supported on different pile types (bored and CFA) and pile diameters (900 mm and 1500 mm). It is noted that Table 7 assumes the piles are installed in very stiff and hard clay.

**Table 7: Pile Type Working Loads**

| Pile Diameter (mm) | CFA and Bored Piles | | |
|---|---|---|---|
| | Shaft Load (1) (kN) | End Bearing Load (kN) | Total Load (kN) |
| 900 | 490 | 189 | 679 |
| 1500 | 826 | 531 | 1357 |

1. Assuming a pile depth of 10 m below surface level, but only taking into account the lower 7 m in hard clay

Based on the total working loads for the different pile types and sizes shown in Table 7, an approximate pile quantity required for different design loads can be estimated. For example, a working column load of 8,000 kN will require a group of twelve (12) 900 mm diameter bored piles taken to a depth of 10 m to support the column load. Alternatively the same working column load of 8000 kN will require a group of six (6) 1500 mm diameter bored piles taken to a depth of 10 m to support the column load.

A Geotechnical Strength Reduction Factor ($\phi_g$) that is appropriate for the level of pile testing and site investigation should be applied to $R_{ug}$, in accordance with AS 2159-2009. Settlements for pile groups, if adopted, will be larger than settlements for individual piles due to the increased zone of influence below the base of the pile group.

### 8.5.5 Settlements

Estimated settlements for piles are provided in the preliminary design chart shown in Figure 2.

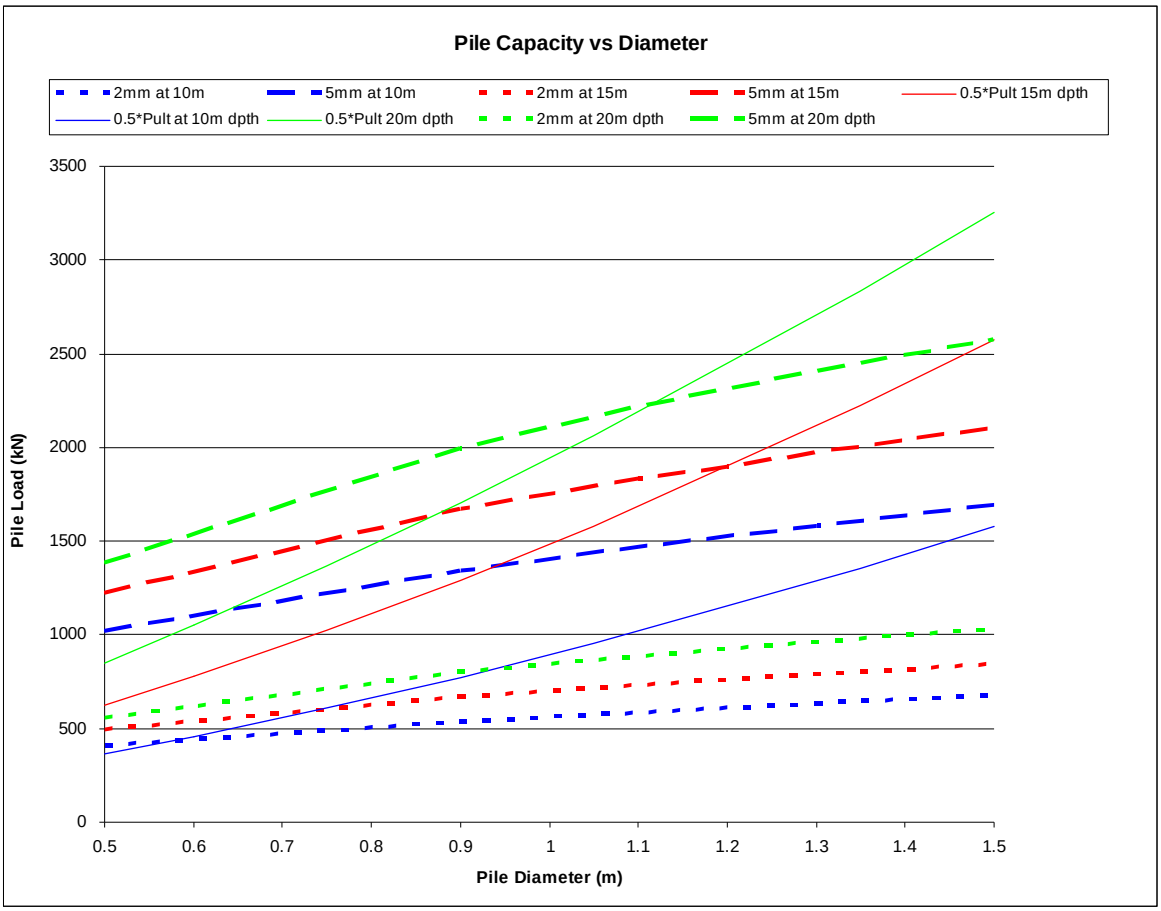



**Figure 2: Pile Settlement Design Chart**

By way of example, consider a 1 m diameter pile founded in very stiff to hard clays at a depth of 10 m. In order to limit settlements to about 2 mm, a maximum load of 550 kN could be applied. In order to limit settlements to about 5 mm, a maximum load of 1,400 kN could be applied.

Estimated settlements for pad footings are provided in the preliminary design chart shown in Figure 3.


**Figure 3: Pad Settlement Design Chart**

By way of example, consider a 3 m square pad footing founded in very stiff to hard clays. In order to limit settlements to about 10 mm, a maximum load of 1,000 kN could be applied. In order to limit settlements to 30 mm, a maximum load of 2,800 kN could be applied.

### 8.5.6 Floor Slabs

Proof rolling of the exposed subgrade should be carried out under the supervision of a geotechnical engineer to detect any soft or heaving areas. Any soft spots detected during proof rolling would need to be stripped to a stiff base and replaced with engineered filling. Engineered filling should be placed in maximum 200 mm thick loose layers and compacted to a minimum dry density ratio (DDR) of 98% relative to Standard compaction, with moisture contents within 2% of the Standard optimum moisture content (SOMC). The compaction should be increased to a DDR of 100% relative to Standard compaction within 0.3 m of the subgrade surface.

The existing filling and topsoil is not considered suitable for use as subgrade and therefore needs to be removed. The underlying natural clay should generally be suitable for reuse as engineered filling provided it has a maximum particle size of 70 mm and moisture content within 2% of OMC (where possible, preference should be given to the use of granular material).

The design of floor slabs for wheel loadings may be based on a modulus of subgrade reaction in the range 20 to 30 kPa/mm. A lower value will be applicable for design of slabs to support column and floor slab loadings, probably of the order of 5 to 8 kPa/mm, but dependent on the area of the floor slab subject to loading.

It is recommended that a layer of crushed rock or concrete be placed over the exposed subgrade surface within 12 hours of exposure. This layer could be incorporated into the final floor slab or pavement design thereby reducing the thickness of the slab (or base course) required and providing a means of sub-floor drainage, which would involve contouring of the subgrade to achieve adequate cross-falls.

### 8.5.7 Soil Aggressivity

The pH values on the clay were recorded above 7.8 and the Electrical Conductivity (EC) ranging from 100 to 150 µS/cm. The sulphate content ranged from <20 to 64 ppm and the chloride from between <20 and 31 ppm.

Based on the results from the chemical laboratory testing of soil samples collected on site and with reference to Table 6.4.2(C) in AS 2159 – 209, the Exposure Classification for concrete piles (and other concrete elements such as pad footings) for the site soils is likely to non-aggressive.

### 8.5.8 Seismic

In accordance with the Earthquake Loading Standard, AS1170.4-2007, the site has a hazard factor (z) of 0.09 and a site sub-soil class $D_e$ based on the testing undertaken to date.

## 8.6 Pavements

The previous and current boreholes drilled in the proposed pavement areas indicate similar subgrade conditions; filling materials over very stiff to hard clayey soils. The laboratory testing on the clay samples from boreholes tested in the Stage 1 investigation (BH101, BH103, BH106, and BH109) indicated a four-day soaked CBR value of between 6% and 10% and for the Stage 2 investigation (BH201 to BH206) of between 4% and 7%. These CBR test results are higher than would generally be expected for medium to high plasticity clays. Subject to the subgrade preparation outlined below, it is recommended that the design of pavements on clayey subgrade be based on a CBR value of 3%.

Site preparation for pavement areas should be undertaken in accordance with Section 8.5.6 of this report. Appropriate cross-fall and subsurface drainage should be installed to reduce the risk of the clayey subgrade becoming saturated during periods of wet weather.

It is noted that the filling logged in boreholes BH105, BH106, BH201, BH202 and BH203 located in the lawn area at the north of the existing hospital, where a new carpark is proposed, was generally clean (i.e. predominantly silty clay with some sand). In this instance, it may be possible to use the existing filling as a subgrade for the new pavement provided it satisfies the requirements detailed above.

## 9. Limitations

Douglas Partners (DP) has prepared this report for a project at Wagga Wagga Base Hospital, NSW in accordance with DPs proposals dated 16 February 2011 and 1 September 2011, and acceptances received from Mr Frank Tong of Capital Insight on 2 March 2011 and 6 September 2011. The report is provided for the purpose(s) 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.

**Douglas Partners Pty Ltd**

# Appendix A

About this Report

# About this Report

Douglas Partners

## Introduction

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

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

## Copyright



## Borehole and Test Pit Logs

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

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

## Groundwater

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

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

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

## Reports

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

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

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

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

# *About this Report*

## Site Anomalies

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

## Information for Contractual Purposes

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

## Site Inspection

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

# Sampling Methods

Douglas Partners

## Sampling

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

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

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

## Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter 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.

## 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

Douglas Partners

## Introduction

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

## Drilling or Excavation Methods

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

## Water

| | |
|---|---|
| ▷ | Water seep |
| ▽ | Water level |

## Sampling and Testing

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

## Description of Defects in Rock

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

### Defect Type

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

### Orientation

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

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

### Coating or Infilling Term

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

### Coating Descriptor

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

### Shape

| | |
|---|---|
| cu | curved |
| ir | irregular |
| pl | planar |
| st | stepped |
| un | undulating |

### Roughness

| | |
|---|---|
| po | polished |
| ro | rough |
| sl | slickensided |
| sm | smooth |
| vr | very rough |

### Other

| | |
|---|---|
| fg | fragmented |
| bnd | band |
| qtz | quartz |

# Symbols & Abbreviations

## Graphic Symbols for Soil and Rock

### General


Asphalt


Road base


Concrete


Filling

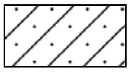
### Soils


Topsoil

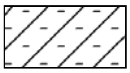

Peat


Clay

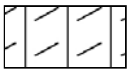

Silty clay

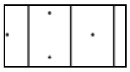

Sandy clay

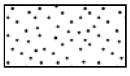

Gravelly clay

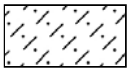

Shaly clay

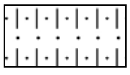

Silt


Clayey silt


Sandy silt

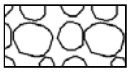

Sand

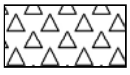

Clayey sand


Silty sand


Gravel


Sandy gravel


Cobbles, boulders

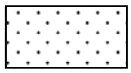

Talus

### Sedimentary Rocks

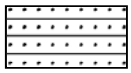

Boulder conglomerate

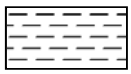

Conglomerate


Conglomeratic sandstone

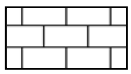

Sandstone


Siltstone


Laminite

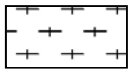

Mudstone, claystone, shale

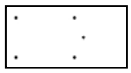

Coal


Limestone

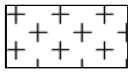
### Metamorphic Rocks

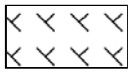

Slate, phyllite, schist

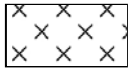

Gneiss

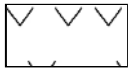

Quartzite

### Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

# Cone Penetration Tests

Douglas Partners

## Introduction

The Cone Penetration Test (CPT) is a sophisticated soil profiling test carried out in-situ. A special cone shaped probe is used which is connected to a digital data acquisition system. The cone and adjoining sleeve section contain a series of strain gauges and other transducers which continuously monitor and record various soil parameters as the cone penetrates the soils.

The soil parameters measured depend on the type of cone being used, however they always include the following basic measurements

- Cone tip resistance $q_c$
- Sleeve friction $f_s$
- Inclination (from vertical) i
- Depth below ground z

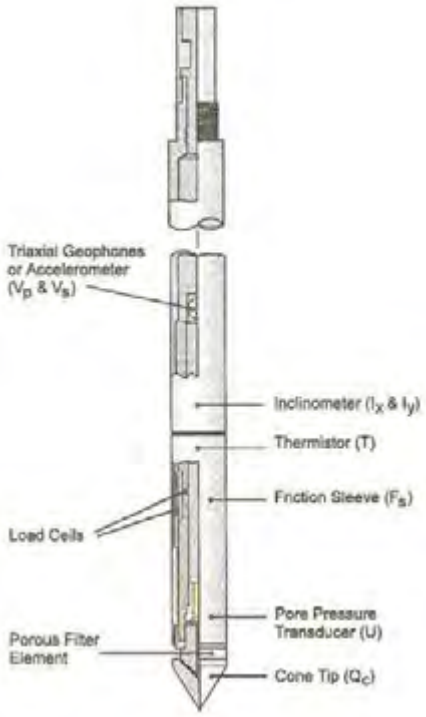



Figure 1: Cone Diagram

The inclinometer in the cone enables the verticality of the test to be confirmed and, if required, the vertical depth can be corrected.

The cone is thrust into the ground at a steady rate of about 20 mm/sec, usually using the hydraulic rams of a purpose built CPT rig, or a drilling rig. The testing is carried out in accordance with the Australian Standard AS1289 Test 6.5.1.

Figure 2: Purpose built CPT rig

The CPT can penetrate most soil types and is particularly suited to alluvial soils, being able to detect fine layering and strength variations. With sufficient thrust the cone can often penetrate a short distance into weathered rock. The cone will usually reach refusal in coarse filling, medium to coarse gravel and on very low strength or better rock. Tests have been successfully completed to more than 60 m.

## Types of CPTs

Douglas Partners (and its subsidiary GroundTest) owns and operates the following types of CPT cones:

| Type | Measures |
|---|---|
| Standard | Basic parameters ($q_c$, $f_s$, i & z) |
| Piezocone | Dynamic pore pressure (u) plus basic parameters. Dissipation tests estimate consolidation parameters |
| Conductivity | Bulk soil electrical conductivity ($\sigma$) plus basic parameters |
| Seismic | Shear wave velocity ($V_s$), compression wave velocity ($V_p$), plus basic parameters |

## Strata Interpretation

The CPT parameters can be used to infer the Soil Behaviour Type (SBT), based on normalised values of cone resistance (Qt) and friction ratio (Fr). These are used in conjunction with soil classification charts, such as the one below (after Robertson 1990)

# Cone Penetration Tests

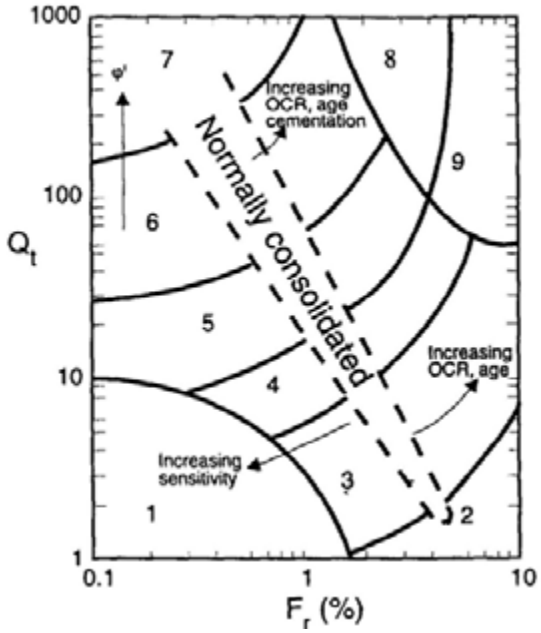



Figure 3: Soil Classification Chart

DP's in-house CPT software provides computer aided interpretation of soil strata, generating soil descriptions and strengths for each layer. The software can also produce plots of estimated soil parameters, including modulus, friction angle, relative density, shear strength and over consolidation ratio.

DP's CPT software helps our engineers quickly evaluate the critical soil layers and then focus on developing practical solutions for the client's project.

## Engineering Applications

There are many uses for CPT data. The main applications are briefly introduced below:

**Settlement**

CPT provides a continuous profile of soil type and strength, providing an excellent basis for settlement analysis. Soil compressibility can be estimated from cone derived moduli, or known consolidation parameters for the critical layers (eg. from laboratory testing). Further, if pore pressure dissipation tests are undertaken using a piezocone, in-situ consolidation coefficients can be estimated to aid analysis.

**Pile Capacity**

The cone is, in effect, a small scale pile and, therefore, ideal for direct estimation of pile capacity. DP's in-house program ConePile can analyse most pile types and produces pile capacity versus depth plots. The analysis methods are based on proven static theory and empirical studies, taking account of scale effects, pile materials and method of installation. The results are expressed in limit state format, consistent with the Piling Code AS2159.

**Dynamic or Earthquake Analysis**

CPT and, in particular, Seismic CPT are suitable for dynamic foundation studies and earthquake response analyses, by profiling the low strain shear modulus $G_0$. Techniques have also been developed relating CPT results to the risk of soil liquefaction.

**Other Applications**

Other applications of CPT include ground improvement monitoring (testing before and after works), salinity and contaminant plume mapping (conductivity cone), preloading studies and verification of strength gain.

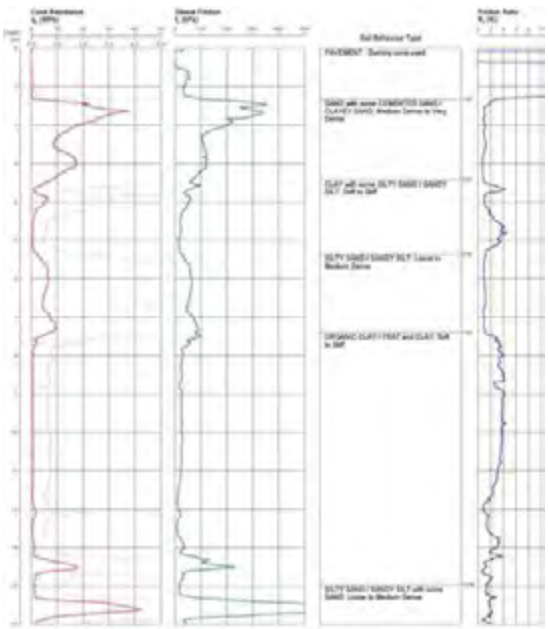
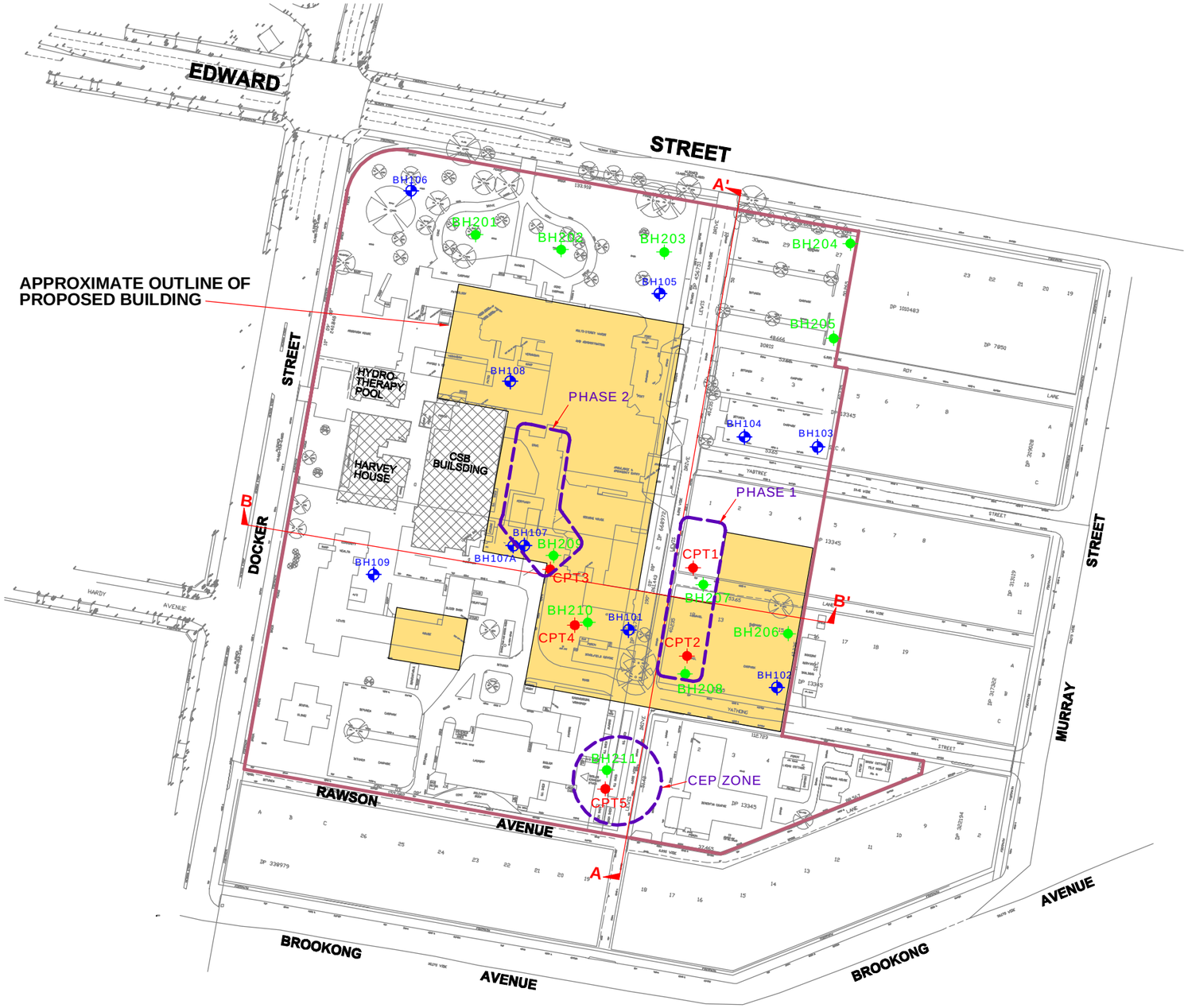


Figure 4: Sample Cone Plot

# Appendix B

Drawings


**Locality Plan**




## LEGEND

- Previous Borehole Location (April 2011)
- Current CPT Location
- Current Borehole Location
- Approximate Site Boundary
- Existing Building to Remain

| | | | |
|---|---|---|---|
| Douglas Partners Geotechnics / Environment / Groundwater | CLIENT: Health Infrastructure | TITLE: **Test Location Plan** | PROJECT No: 72320.03 |
| | OFFICE: Sydney / DRAWN BY: PSCH | **Proposed Wagga Wagga Base Hospital Redevelopment** | DRAWING No: 1 |
| | SCALE: As shown / DATE: 25.9.2011 | **Edward Street, Wagga Wagga** | REVISION: B |

MGA

P:\72320.03 WAGGA WAGGA, Base Hospital Supplementary Geotechnical Investigation PGHDrawings\72320.03-1.dwg, 28/10/2011 11:03:42 AM

A

A'

RAWSON AVENUE

SOUTHERN SITE BOUNDARY

NORTHERN SITE BOUNDARY

EDWARD STREET

ELEVATION (AHD)

190 185 180 175 170 165 160 155 150

CPT 5
Offset 12m W
Qc 0 5 50
Bottom Depth 15 m

CPT 2
Offset 10m E
Qc 0 5 50
Bottom Depth 15 m

101
Offset 10m W
st–vst N = 42
vst–h N = 30
vst refusal
refusal
h refusal
N = 33
N = 22
vst refusal
N = 44
h N = 22
vst N = 38
h refusal
N = 24
vst N = 24
vst N = 28
N = 32
Bottom Depth 26.95 m

CPT 1
Offset 6m E
Qc 0 5 50
Bottom Depth 20 m

104
Offset 20m E
h N = 37
N = 32
N = 23
vst N = 18
N = 20
vst N = 16
st–vst N = 18
vst N = 32
d N = 27
md N = 21
Bottom Depth 14.95 m

105
Offset 25m W
vst N = 29
N = 40
h N = 32
vst–h N = 21
N = 20
vst N = 24
md N = 20
Bottom Depth 10.45 m

SILTY CLAY & CLAY

GRAVELLY SILTY CLAY

SILTY CLAY & CLAY

GRAVELLY SILTY CLAY

SILTY CLAY & CLAY

SILTY CLAY

SAND

CROSS-SECTION A-A'

NOTE: Summary logs only. Should be read in conjunction with detailed logs.

DISTANCE ALONG PROFILE (m)

LEGEND

- Filling
- Silty Clay
- Gravelly Silty Clay
- Roadbase
- Sand
- Sandy Clay

0 1 2 3 4 6 8 10 15 20m
1:200 @ A3 (V)

0 10 20 30 40 50 75 100m
1:1000 @ A3 (H)

ROCK STRENGTH
EL – Extremely Low
VL – Very Low
L – Low
M – Medium
H – High
VH – Very High

SOIL CONSISTENCY
vs – very soft
s – soft
f – firm
st – stiff
vst – very stiff
h – hard
vl – very loose
l – loose
md – medium dense
d – dense
vd – very dense

TESTS / OTHER
N – Standard penetration test value
– Water level

Douglas Partners
Geotechnics / Environment / Groundwater

| | | | |
|---|---|---|---|
| CLIENT: Health Infrastructure | | TITLE: **Cross-Section A-A'** | PROJECT No: 72320.03 |
| OFFICE: Sydney | DRAWN BY: PSCH | **Proposed Wagga Wagga Base Hospital Redevelopment** | DRAWING No: 2 |
| SCALE: As shown | DATE: 17.10.2011 | **Edward Street, Wagga Wagga** | REVISION: B |

P:\72320.03 WAGGA WAGGA, Base Hospital Supplementary Geotechnical Investigation PGH\Drawings\72320.03-2.dwg, 28/10/2011 11:04:41 AM

B

B′

WESTERN SITE BOUNDARY

EASTERN SITE BOUNDARY

DOCKER STREET

GRAVELLY SITLY CLAY & SANDY GRAVEL

SILTY CLAY & CLAY

SILTY CLAY & CLAY

GRAVELLY SITLY CLAY

109 Offset 10m S
st N = 13
st N = 12
N = 25
vst N = 22
st N = 15
N = 33
h refusal
Bottom Depth 10.15 m

107A Offset 10m N
vst N = 27
vst N = 14
st N = 22
h N = 23
vst N = 17
N = 16
st-vst N = 44
h N = 13
st N = 34
Bottom Depth 13.45 m

CPT 3 Offset 2m N
Qc

CPT 4 Offset 18m S
Qc

101 Offset 16m S
vst N = 42
vst N = 30
refusal
refusal
refusal
N = 33
N = 22
refusal
N = 44
N = 22
vst N = 38
refusal
N = 24
vst N = 24
vst N = 28
N = 32
Bottom Depth 26.95 m

CPT 1 Offset 14m N
Qc
Bottom Depth 20 m

102 Offset 30m S
vst N = 26
N = 40
h refusal
N = 42
N = 29
h N = 35
N = 48
vst N = 20
N = 42
h N = 48
N = 41
Bottom Depth 16.45 m

Bottom Depth 31.8 m

Bottom Depth 32.5 m

ELEVATION (AHD)

190 185 180 175 170 165 160 155 150

CROSS-SECTION B-B'

NOTE: Summary logs only. Should be read in conjunction with detailed logs.

DISTANCE ALONG PROFILE (m)

LEGEND

- Filling
- Silty Clay
- Gravelly Silty Clay
- Roadbase
- Sand
- Sandy Clay

0 1 2 3 4 6 8 10 15 20m
1:200 @ A3 (V)

0 10 20 30 40 50 75 100m
1:1000 @ A3 (H)

ROCK STRENGTH
EL – Extremely Low
VL – Very Low
L – Low
M – Medium
H – High
VH – Very High

SOIL CONSISTENCY
vs – very soft
s – soft
f – firm
st – stiff
vst – very stiff
h – hard
vl – very loose
l – loose
md – medium dense
d – dense
vd – very dense

TESTS / OTHER
N – Standard penetration test value
⊻ – Water level

Douglas Partners
Geotechnics / Environment / Groundwater

| | | | |
|---|---|---|---|
| CLIENT: Health Infrastructure | | TITLE: **Cross-Section B-B'** | PROJECT No: 72320.03 |
| OFFICE: Sydney | DRAWN BY: PSCH | **Proposed Wagga Wagga Base Hospital Redevelopment** | DRAWING No: 3 |
| SCALE: As shown | DATE: 17.10.2011 | **Edward Street, Wagga Wagga** | REVISION: B |

P:\72320.03 WAGGA WAGGA, Base Hospital Supplementary Geotechnical Investigation PGH\Drawings\72320.03-3.dwg, 28/10/2011 11:05:16 AM

# Appendix C

Results of Field Work

# BOREHOLE LOG

**CLIENT:** Health Infrastructure
**PROJECT:** Wagga Wagga Base Hospital Redevelopment
**LOCATION:** Edward Street, Wagga Wagga

**SURFACE LEVEL:** 183.0 AHD
**EASTING:**
**NORTHING:**
**DIP/AZIMUTH:** 90°/--

**BORE No:** 101
**PROJECT No:** 72320.00
**DATE:** 28/3/2011
**SHEET** 1 OF 3

| RL | Depth (m) | Description of Strata | Graphic Log | Sampling & In Situ Testing: Type | Depth | Sample | Results & Comments | Water | Well Construction Details |
|---|---|---|---|---|---|---|---|---|---|
| 183 | 0.2 | FILLING (TOPSOIL) - dark brown, sandy silt filling with rootlets, dry | | E | 0.1 | | | | Gatic cover |
| | | | | | 0.2 | | | | Quick-set concrete |
| | 0.5 | SILTY CLAY - stiff to very stiff, brown silty clay with a trace of sand | | D | 0.3 | | | | |
| | | | | E | 0.5 | | | | Bentonite |
| | | SILTY CLAY - hard, red brown silty clay, dry | | | 0.6 | | | | |
| 182 | 1 | | | | 1.0 | | | | 1 |
| | | | | S | | | 20,22,20 N = 42 | | |
| | | | | | 1.45 | | | | |
| 181 | 2 | 2.0 | | | 2.0 | | | | 2 |
| | | SILTY CLAY - very stiff, orange brown silty clay, dry | | E | 2.2 | | | | |
| | | | | | 2.5 | | | | |
| | | | | S | | | 10,13,17 N = 30 | | |
| 180 | 3 | | | | 2.95 | | | | 3 |
| 179 | 4 | 4.0 | | | 4.0 | | | | 4 |
| | | SILTY CLAY - hard, orange brown silty clay with some sub-rounded ironstone gravel, dry | | S | | | 16,22,20/100mm refusal | | |
| | | | | | 4.4 | | | | |
| | | 4.5-4.7m: rounded quartz gravel | | | | | | | |
| 178 | 5 | | | | 5.5 | | | | 5 |
| | | | | S | | | 13,24,20/100mm refusal | | |
| 177 | 6 | | | | 5.9 | | | | 6 |
| | | | | | | | | 31-03-11 | |
| 176 | 7 | 7.0 | | | 7.0 | | | | 7 |
| | | GRAVELLY SILTY CLAY - hard, orange brown, gravelly (sub-rounded ironstone and quartz gravel) silty clay, dry | | S | | | 26,28,20/100mm refusal | | |
| | | | | | 7.4 | | | | |
| 175 | 8 | 8.0 | | | | | | | 8 |
| | | SILTY CLAY - hard, orange brown, silty clay with a trace of ironstone gravel, moist | | | 8.5 | | | | |
| | | | | S | | | 10,16,17 N = 33 | | |
| 174 | 9 | | | | 8.95 | | | | 9 |
| | 10.0 | | | | 10.0 | | | | |

**RIG:** Scout **DRILLER:** JS **LOGGED:** PGH **CASING:** HQ to 8.8m

**TYPE OF BORING:** Solid flight auger (TC-bit) to 8.50m; Rotary (water) to 26.95m

**WATER OBSERVATIONS:** No free groundwater observed.Standpipe pumped dry on 30/3/11&4/4/11.Water level at 6.6m on 31/3/11& 6.7m on 5&7/4/11

**REMARKS:** Standpipe piezometer installed: Solid 0.0-6.0m; Slotted 6.0-26.95m; Bentonite plug 0.3-1.0m; Quick-set concrete 0.0-0.3m with Gatic cover

**SAMPLING & IN SITU TESTING LEGEND**

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

Douglas Partners
Geotechnics / Environment / Groundwater

# BOREHOLE LOG

**CLIENT:** Health Infrastructure
**PROJECT:** Wagga Wagga Base Hospital Redevelopment
**LOCATION:** Edward Street, Wagga Wagga

**SURFACE LEVEL:** 183.0 AHD
**EASTING:**
**NORTHING:**
**DIP/AZIMUTH:** 90°/--

**BORE No:** 101
**PROJECT No:** 72320.00
**DATE:** 28/3/2011
**SHEET** 2 OF 3

| RL | Depth (m) | Description of Strata | Graphic Log | Sampling & In Situ Testing: Type | Depth | Sample | Results & Comments | Water | Well Construction Details |
|---|---|---|---|---|---|---|---|---|---|
| 173 | | | | | | | | | |
| 172 | 11 | SILTY CLAY - very stiff, orange brown, silty clay with some schist gravel, moist | | S | 10.45 | | 10,10,12 N = 22 | | 11 |
| | | | | S | 11.5 | | 12,24 refusal (bouncing) | | |
| 171 | 12 | 11.7m: ironstone gravel band (~100mm thick) | | | 11.8 | | | | 12 |
| 170 | 13 13.0 | SILTY CLAY - hard, grey silty clay, moist | | S | 13.0 | | 13,21,23 N = 44 | | 13 |
| | | | | | 13.45 | | | | |
| 169 | 14 | | | | | | | | 14 Backfilled with gravel |
| | 14.54 | SILTY CLAY - very stiff, red brown, silty clay with some ironstone gravel, moist | | S | 14.5 | | 7,9,13 N = 22 | | |
| 168 | 15 | | | | 14.95 | | | | 15 |
| 167 | 16 16.0 | GRAVELLY SILTY CLAY - hard, red brown, gravelly (rounded quartz, schist and ironstone gravels) silty clay, moist | | S | 16.0 | | 9,15,23 N = 38 | | 16 |
| | | | | | 16.45 | | | | Machine slotted PVC screen |
| 166 | 17 | | | S | 17.5 | | 17,25/130mm refusal | | 17 |
| 165 | 18 | | | | 17.95 | | | | 18 |
| 164 | 19 19.0 | SILTY CLAY - very stiff, red brown silty clay, moist | | S | 19.0 | | 7,10,14 N = 24 | | 19 |
| | | | | | 19.45 | | | | |

**RIG:** Scout **DRILLER:** JS **LOGGED:** PGH **CASING:** HQ to 8.8m

**TYPE OF BORING:** Solid flight auger (TC-bit) to 8.50m; Rotary (water) to 26.95m

**WATER OBSERVATIONS:** No free groundwater observed.Standpipe pumped dry on 30/3/11&4/4/11.Water level at 6.6m on 31/3/11& 6.7m on 5&7/4/11

**REMARKS:** Standpipe piezometer installed: Solid 0.0-6.0m; Slotted 6.0-26.95m; Bentonite plug 0.3-1.0m; Quick-set concrete 0.0-0.3m with Gatic cover

**SAMPLING & IN SITU TESTING LEGEND**

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

Douglas Partners
Geotechnics / Environment / Groundwater

# BOREHOLE LOG

**CLIENT:** Health Infrastructure
**PROJECT:** Wagga Wagga Base Hospital Redevelopment
**LOCATION:** Edward Street, Wagga Wagga

**SURFACE LEVEL:** 183.0 AHD
**EASTING:**
**NORTHING:**
**DIP/AZIMUTH:** 90°/--

**BORE No:** 101
**PROJECT No:** 72320.00
**DATE:** 28/3/2011
**SHEET** 3 OF 3

| RL | Depth (m) | Description of Strata | Graphic Log | Sampling & In Situ Testing: Type | Depth | Sample | Results & Comments | Water | Well Construction Details |
|---|---|---|---|---|---|---|---|---|---|
| 163 | | SILTY CLAY - very stiff, red brown silty clay, moist *(continued)* | | | | | | | |
| | 20.3 | SILTY CLAY - very stiff, red brown silty clay with some ironstone gravel, moist | | | 20.5 | | | | |
| 162 | 21 | | | S | | | 7,10,14 N = 24 | | |
| | | | | | 20.95 | | | | |
| 161 | 22 | | | | | | | | |
| 160 | 23 | | | | | | | | |
| | | | | | 23.5 | | | | |
| 159 | 24 | | | S | | | 7,10,18 N = 28 | | |
| | | | | | 23.95 | | | | |
| 158 | 25 | | | | | | | | |
| 157 | 26 | | | | | | | | |
| | | | | | 26.5 | | | | |
| | 26.95 | | | S | | | 10,12,20 N = 32 | | |
| 156 | 27 | Bore discontinued at 26.95m - target depth achieved | | | 26.95 | | | | End cap |
| 155 | 28 | | | | | | | | |
| 154 | 29 | | | | | | | | |

**RIG:** Scout **DRILLER:** JS **LOGGED:** PGH **CASING:** HQ to 8.8m

**TYPE OF BORING:** Solid flight auger (TC-bit) to 8.50m; Rotary (water) to 26.95m

**WATER OBSERVATIONS:** No free groundwater observed.Standpipe pumped dry on 30/3/11&4/4/11.Water level at 6.6m on 31/3/11& 6.7m on 5&7/4/11

**REMARKS:** Standpipe piezometer installed: Solid 0.0-6.0m; Slotted 6.0-26.95m; Bentonite plug 0.3-1.0m; Quick-set concrete 0.0-0.3m with Gatic cover

**SAMPLING & IN SITU TESTING LEGEND**

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

Douglas Partners
Geotechnics / Environment / Groundwater

# BOREHOLE LOG

**CLIENT:** Health Infrastructure
**PROJECT:** Wagga Wagga Base Hospital Redevelopment
**LOCATION:** Edward Street, Wagga Wagga

**SURFACE LEVEL:** 183.8 AHD
**EASTING:**
**NORTHING:**
**DIP/AZIMUTH:** 90°/--

**BORE No:** 102
**PROJECT No:** 72320.00
**DATE:** 29 - 30/3/2011
**SHEET** 1 OF 2

| RL | Depth (m) | Description of Strata | Graphic Log | Sampling & In Situ Testing: Type | Depth | Sample | Results & Comments | Water | Well Construction Details |
|---|---|---|---|---|---|---|---|---|---|
| 183 | 0.1 | FILLING (ROADBASE) - grey, sandy gravel (blue metal), dry | | A | 0.1 | | | | |
| | | SILTY CLAY - very stiff, orange brown, silty clay with some ironstone gravel and a trace of sand, dry | | E* | 0.4<br>0.5 | | | | |
| | 1 | | | S | 1.0<br>1.45 | | 5,8,18<br>N = 26 | | |
| 182 | 2 | | | E | 2.0<br>2.2 | | | | |
| | 2.5 | SILTY CLAY - hard, orange brown silty clay, dry | | S | 2.5<br>2.95 | | 10,15,25<br>N = 40 | | |
| 181 | 3 | | | | | | | | |
| 180 | 4 | | | S | 4.0<br>4.45 | | 15,25/130mm<br>refusal | | |
| 179 | 5 | | | | | | | | |
| | | | | S | 5.5<br>5.95 | | 18,22,20<br>N = 42 | | |
| 178 | 6 | | | A | 6.0<br>6.2 | | | | |
| 177 | 7 | 7.0 SILTY CLAY - hard, orange brown, silty clay with some sub-rounded schist gravel and a trace of ironstone gravel, dry | | S | 7.0<br>7.45 | | 9,13,16<br>N = 29 | | |
| 176 | 8 | | | | | | | | |
| | 8.5 | SILTY CLAY - hard, orange brown, silty clay with a trace of ironstone gravel, dry | | S | 8.5<br>8.95 | | 9,19,16<br>N = 35 | | |
| 175 | 9 | | | | | | | | |
| 174 | | | | | 10.0 | | | | |

**RIG:** Scout **DRILLER:** JS **LOGGED:** PGH **CASING:** HQ to 3.0m

**TYPE OF BORING:** Solid flight auger (TC-bit) to 8.50m; Rotary (water) to 16.0m

**WATER OBSERVATIONS:** No free groundwater observed

**REMARKS:** Dry on completion of auger drilling. *Denotes field replicate sample BD1/29.3.11 collected

**SAMPLING & IN SITU TESTING LEGEND**

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

Douglas Partners
Geotechnics / Environment / Groundwater

# BOREHOLE LOG

**CLIENT:** Health Infrastructure
**PROJECT:** Wagga Wagga Base Hospital Redevelopment
**LOCATION:** Edward Street, Wagga Wagga

**SURFACE LEVEL:** 183.8 AHD
**EASTING:**
**NORTHING:**
**DIP/AZIMUTH:** 90°/--

**BORE No:** 102
**PROJECT No:** 72320.00
**DATE:** 29 - 30/3/2011
**SHEET** 2 OF 2

| RL | Depth (m) | Description of Strata | Graphic Log | Sampling & In Situ Testing: Type | Depth | Sample | Results & Comments | Water | Well Construction Details |
|---|---|---|---|---|---|---|---|---|---|
| 173 | 11 | SILTY CLAY - hard, orange brown, silty clay with a trace of ironstone gravel, dry *(continued)* | | S | 10.45 | | 8,23,25<br>N = 48 | | 11 |
| 172 | 11.5<br>12 | SILTY CLAY - very stiff, red brown, silty clay with a trace of quartz and ironstone gravel, moist | | S | 11.5<br>11.95 | | 6,8,12<br>N = 20 | | 11.5<br>12 |
| 171 | 13 13.0 | SILTY CLAY - hard, red and grey, silty clay with some ironstone gravel, moist | | S | 13.0<br>13.45 | | 8,16,26<br>N = 42 | | 13 |
| 170 | 14 | | | | | | | | 14 |
| 169 | 15 | | | S | 14.5<br>14.95 | | 10,20,28<br>N = 48 | | 15 |
| 168 | 16 | | | S | 16.0 | | 9,18,23<br>N = 41 | | 16 |
| | 16.45 | Bore discontinued at 16.45m<br>- target depth achieved | | | 16.45 | | | | |
| 167 | 17 | | | | | | | | 17 |
| 166 | 18 | | | | | | | | 18 |
| 165 | 19 | | | | | | | | 19 |
| 164 | | | | | | | | | |

**RIG:** Scout **DRILLER:** JS **LOGGED:** PGH **CASING:** HQ to 3.0m

**TYPE OF BORING:** Solid flight auger (TC-bit) to 8.50m; Rotary (water) to 16.0m

**WATER OBSERVATIONS:** No free groundwater observed

**REMARKS:** Dry on completion of auger drilling. *Denotes field replicate sample BD1/29.3.11 collected

**SAMPLING & IN SITU TESTING LEGEND**

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

Douglas Partners
Geotechnics / Environment / Groundwater

# BOREHOLE LOG

**CLIENT:** Health Infrastructure
**PROJECT:** Wagga Wagga Base Hospital Redevelopment
**LOCATION:** Edward Street, Wagga Wagga

**SURFACE LEVEL:** 182.5 AHD
**EASTING:**
**NORTHING:**
**DIP/AZIMUTH:** 90°/--

**BORE No:** 103
**PROJECT No:** 72320.00
**DATE:** 30/3/2011
**SHEET** 1 OF 1

| RL | Depth (m) | Description of Strata | Graphic Log | Sampling & In Situ Testing: Type | Depth | Sample | Results & Comments | Water | Well Construction Details |
|---|---|---|---|---|---|---|---|---|---|
| 182 | 0.04 | ASPHALT - 40mm thick | | A | 0.1 | | | | |
| | 0.2 | ROADBASE - grey, angular blue metal gravel, 160mm thick | | | 0.2 | | | | |
| | | SILTY CLAY - hard, orange brown, silty clay with a trace of ironstone gravel, dry | | B | 0.5 | | | | |
| | | | | E | 0.6 | | | | |
| | 1 | | | S | 1.0 | | 8,17,33 N = 50 | | 1 |
| 181 | | | | | 1.45 | | | | |
| | 2 | | | E | 2.0 | | | | 2 |
| | | 2.25m: grading to very stiff and moist | | | 2.2 | | | | |
| | 2.3 | SILTY CLAY - very stiff, orange brown silty clay with some ironstone gravel, moist | | S | 2.5 | | 5,8,14 N = 22 | | |
| 180 | 3 | 2.85-3.0m: sub-rounded quartz gravel (to 10mm) | | A | 2.9 | | | | 3 |
| | | | | | 2.95 | | | | |
| | | | | | 3.0 | | | | |
| 179 | 3.5 | SILTY CLAY - very stiff, orange brown, silty clay with a trace of ironstone gravel, moist | | | | | | | |
| | 4 | | | S | 4.0 | | 5,8,10 N = 18 | | 4 |
| 178 | | | | | 4.45 | | | | |
| | 5 | | | | | | | | 5 |
| 177 | | | | S | 5.5 | | 7,11,16 N = 27 | | |
| | 6 | | | | 5.95 | | | | 6 |
| 176 | | | | | | | | | |
| | 7 | | | | 7.0 | | | | 7 |
| | 7.0 | SILTY CLAY - very stiff, orange brown, silty clay with a trace of sand, moist | | S | | | 5,10,10 N = 20 | | |
| 175 | | | | | 7.45 | | | | |
| | 8 | | | | | | | | 8 |
| 174 | 8.5 | SILTY CLAY - stiff to very stiff, orange brown, silty clay with a trace of sand, moist | | S | 8.5 | | 5,6,10 N = 16 | | |
| | 8.95 | Bore discontinued at 8.95m - target depth achieved | | | 8.95 | | | | 9 |
| 173 | | | | | | | | | |

**RIG:** Scout **DRILLER:** JS **LOGGED:** PGH **CASING:** Uncased

**TYPE OF BORING:** Solid flight auger (TC-bit) to 8.50m

**WATER OBSERVATIONS:** No free groundwater observed

**REMARKS:** Hole backfilled on 31/3/11. Dry on completion and the following day

**SAMPLING & IN SITU TESTING LEGEND**

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

Douglas Partners
Geotechnics / Environment / Groundwater

# BOREHOLE LOG

**CLIENT:** Health Infrastructure
**PROJECT:** Wagga Wagga Base Hospital Redevelopment
**LOCATION:** Edward Street, Wagga Wagga

**SURFACE LEVEL:** 182.2 AHD
**EASTING:**
**NORTHING:**
**DIP/AZIMUTH:** 90°/--

**BORE No:** 104
**PROJECT No:** 72320.00
**DATE:** 31/3/2011
**SHEET** 1 OF 2

| RL | Depth (m) | Description of Strata | Graphic Log | Sampling & In Situ Testing: Type | Depth | Sample | Results & Comments | Water | Well Construction Details |
|---|---|---|---|---|---|---|---|---|---|
| 182 | 0.04 | ASPHALT - 40mm thick | | | | | | | |
| | 0.2 | ROADBASE - blue grey, angular basalt gravel, dry | | E | 0.3–0.4 | | | | |
| | | SILTY CLAY - hard, orange brown, silty clay with a trace of ironstone gravel, dry | | S | 1.0–1.45 | | 9,17,20 N = 37 | | |
| | | | | E | 1.6–1.7 | | | | |
| | | 2.0m: grading to very stiff | | S | 2.5–2.95 | | 10,10,22 N = 32 | | |
| 178 | 4.0 | SILTY CLAY - very stiff, orange brown silty clay, dry | | S | 4.0–4.45 | | 6,8,15 N = 23 | | |
| | | 4.5m: becoming brown | | S | 5.5–5.95 | | 6,6,12 N = 18 | | |
| 175 | 7.0 | SILTY CLAY - very stiff, orange brown, silty clay with a trace of ironstone gravel, dry | | S | 7.0–7.45 | | 7,9,11 N = 20 | | |
| 173 | 8.5 | SILTY CLAY - stiff to very stiff, orange brown silty clay, moist | | S | 8.5–8.95 | | 5,7,9 N = 16 | | |
| | 10.0 | | | | 10.0 | | | | |

**RIG:** Scout **DRILLER:** JS **LOGGED:** PGH **CASING:** Uncased

**TYPE OF BORING:** Solid flight auger (TC-bit) to 14.50m

**WATER OBSERVATIONS:** Free groundwater observed on hole completion at 14.95m on 31/3/11 and at 12.75m on 1/4/11

**REMARKS:** Hole backfilled on 1/4/11

**SAMPLING & IN SITU TESTING LEGEND**

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

Douglas Partners
Geotechnics / Environment / Groundwater

# BOREHOLE LOG

**CLIENT:** Health Infrastructure
**PROJECT:** Wagga Wagga Base Hospital Redevelopment
**LOCATION:** Edward Street, Wagga Wagga

**SURFACE LEVEL:** 182.2 AHD
**EASTING:**
**NORTHING:**
**DIP/AZIMUTH:** 90°/--

**BORE No:** 104
**PROJECT No:** 72320.00
**DATE:** 31/3/2011
**SHEET** 2 OF 2

| RL | Depth (m) | Description of Strata | Graphic Log | Sampling & In Situ Testing: Type | Depth | Sample | Results & Comments | Water | Well Construction Details |
|---|---|---|---|---|---|---|---|---|---|
| 172 | | SILTY CLAY - very stiff, mottled grey and orange brown, silty clay with some sand, moist | | S | 10.45 | | 3,8,10<br>N = 18 | | |
| 171 | 11 | | | | 11.5 | | | | 11 |
| | 11.65 | SAND - dense, orange brown, medium to coarse grained sand, moist | | S | 11.95 | | 6,15,17<br>N = 32 | | |
| 170 | 12 | | | | | | | | 12 |
| | 13 13.0 | | | | 13.0 | | | | 13 |
| 169 | 13.2 | SANDY CLAY - very stiff, brown, sandy (medium grained) sand, moist | | S | 13.45 | | 11,13,14<br>N = 27 | | |
| | | SAND - medium dense, orange brown, medium to coarse grained sand with a trace of clay, moist | | | | | | | |
| 168 | 14 | | | | 14.5 | | | | 14 |
| | | | | S | | | 4,8,13<br>N = 21 | | |
| | 15 14.95 | Bore discontinued at 14.95m | | | 14.95 | | | 31-03-11 | 15 |
| 167 | | | | | | | | | |
| | 16 | | | | | | | | 16 |
| 166 | | | | | | | | | |
| | 17 | | | | | | | | 17 |
| 165 | | | | | | | | | |
| | 18 | | | | | | | | 18 |
| 164 | | | | | | | | | |
| | 19 | | | | | | | | 19 |
| 163 | | | | | | | | | |

**RIG:** Scout **DRILLER:** JS **LOGGED:** PGH **CASING:** Uncased

**TYPE OF BORING:** Solid flight auger (TC-bit) to 14.50m

**WATER OBSERVATIONS:** Free groundwater observed on hole completion at 14.95m on 31/3/11 and at 12.75m on 1/4/11

**REMARKS:** Hole backfilled on 1/4/11

**SAMPLING & IN SITU TESTING LEGEND**

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

Douglas Partners
Geotechnics / Environment / Groundwater

# BOREHOLE LOG

**CLIENT:** Health Infrastructure
**PROJECT:** Wagga Wagga Base Hospital Redevelopment
**LOCATION:** Edward Street, Wagga Wagga

**SURFACE LEVEL:** 181.5 AHD
**EASTING:**
**NORTHING:**
**DIP/AZIMUTH:** 90°/--

**BORE No:** 105
**PROJECT No:** 72320.00
**DATE:** 31/3/2011
**SHEET** 1 OF 2

| RL | Depth (m) | Description of Strata | Graphic Log | Sampling & In Situ Testing: Type | Depth | Sample | Results & Comments | Water | Well Construction Details |
|---|---|---|---|---|---|---|---|---|---|
| 181 | 0.15 | FILLING (TOPSOIL) - poorly compacted, brown, sandy silt filling with some grass rootlets, dry | | E | 0.2 | | | | |
| | | FILLING - poorly compacted, orange brown, silty clay filling with some building rubble (concrete, tile) and quartz gravel, dry | | | 0.3 | | | | |
| | | | | E | 0.8 | | | | |
| | 1 | | | | 0.9 | | | | 1 |
| | 1.2 | SILTY CLAY - very stiff, orange brown, silty clay with a trace of ironstone gravel, dry | | S | 1.2 | | 2,11,18 N = 29 | | |
| 180 | | | | | 1.65 | | | | |
| | 2 | | | E | 2.0 | | | | 2 |
| | | | | | 2.2 | | | | |
| 179 | 2.5 | SILTY CLAY - hard, orange brown silty clay, dry | | S | 2.5 | | 13,18,22 N = 40 | | |
| | 3 | | | | 2.95 | | | | 3 |
| 178 | | | | | | | | | |
| | 4 | | | | | | | | 4 |
| | 4.0 | SILTY CLAY - very stiff to hard, orange brown silty clay | | S | 4.0 | | 9,12,20 N = 32 | | |
| 177 | | | | | 4.45 | | | | |
| | 5 | | | | | | | | 5 |
| 176 | 5.5 | SILTY CLAY - very stiff, brown silty clay, dry | | S | 5.5 | | 7,9,12 N = 21 | | |
| | 6 | 6.0m: becoming moist | | | 5.95 | | | | 6 |
| 175 | | | | | | | | | |
| | 7 | | | S | 7.0 | | 6,8,12 N = 20 | | 7 |
| 174 | | | | | 7.45 | | | | |
| | 8 | | | | | | | | 8 |
| 173 | | | | S | 8.5 | | 7,10,14 N = 24 | | |
| | 9 | | | | 8.95 | | | | 9 |
| 172 | | | | | | | | | |
| | 10.0 | | | | 10.0 | | | | |

**RIG:** Scout **DRILLER:** JS **LOGGED:** PGH **CASING:** Uncased

**TYPE OF BORING:** Solid flight auger (TC-bit) to 10.0m

**WATER OBSERVATIONS:** No free groundwater observed

**REMARKS:**

**SAMPLING & IN SITU TESTING LEGEND**

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

Douglas Partners
Geotechnics / Environment / Groundwater

# BOREHOLE LOG

**CLIENT:** Health Infrastructure
**PROJECT:** Wagga Wagga Base Hospital Redevelopment
**LOCATION:** Edward Street, Wagga Wagga

**SURFACE LEVEL:** 181.5 AHD
**EASTING:**
**NORTHING:**
**DIP/AZIMUTH:** 90°/--

**BORE No:** 105
**PROJECT No:** 72320.00
**DATE:** 31/3/2011
**SHEET** 2 OF 2

| RL | Depth (m) | Description of Strata | Graphic Log | Sampling & In Situ Testing: Type | Depth | Sample | Results & Comments | Water | Well Construction Details |
|---|---|---|---|---|---|---|---|---|---|
| 171 | 10.45 | SAND - medium dense, orange brown, medium to coarse grained sand with a trace of clay, moist | | S | 10.45 | | 8,9,11<br>N = 20<br>(no sample recovered) | | |
| | | Bore discontinued at 10.45m<br>- target depth achieved | | | | | | | |
| 170 | 11 | | | | | | | | |
| 169 | 12 | | | | | | | | |
| 168 | 13 | | | | | | | | |
| 167 | 14 | | | | | | | | |
| 166 | 15 | | | | | | | | |
| 165 | 16 | | | | | | | | |
| 164 | 17 | | | | | | | | |
| 163 | 18 | | | | | | | | |
| 162 | 19 | | | | | | | | |

**RIG:** Scout **DRILLER:** JS **LOGGED:** PGH **CASING:** Uncased
**TYPE OF BORING:** Solid flight auger (TC-bit) to 10.0m
**WATER OBSERVATIONS:** No free groundwater observed
**REMARKS:**

**SAMPLING & IN SITU TESTING LEGEND**

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

Douglas Partners
Geotechnics / Environment / Groundwater

# BOREHOLE LOG

**CLIENT:** Health Infrastructure
**PROJECT:** Wagga Wagga Base Hospital Redevelopment
**LOCATION:** Edward Street, Wagga Wagga

**SURFACE LEVEL:** 182.6 AHD
**EASTING:**
**NORTHING:**
**DIP/AZIMUTH:** 90°/--

**BORE No:** 106
**PROJECT No:** 72320.00
**DATE:** 5/4/2011
**SHEET** 1 OF 2

| RL | Depth (m) | Description of Strata | Graphic Log | Sampling & In Situ Testing: Type | Depth | Sample | Results & Comments | Water | Well Construction Details |
|---|---|---|---|---|---|---|---|---|---|
| 182 | 0.2 | FILLING (TOPSOIL) - poorly compacted, brown, silty clay filling with some sand | | E* | 0.1 | | | | Gatic cover |
| | 0.4 | SILTY CLAY - hard, orange brown silty clay, dry | | B | 0.2<br>0.3 | | | | Concrete |
| | | SILTY CLAY - hard, orange brown, silty clay with a trace of ironstone gravel, dry | | | | | | | Bentonite |
| 181 | 1 | | | S | 1.3 | | 7,22,20<br>N = 42 | | 1 |
| | | | | E | 1.75 | | | | |
| 180 | 2 | 2.0m: very stiff | | | 2.0 | | | | 2 |
| | | | | S | 2.5 | | 16,29,25<br>N = 54 | | |
| 179 | 3 | | | | 2.95 | | | | 3 |
| | 4.0 | SILTY CLAY - stiff, mottled orange brown and grey, silty clay with a trace of ironstone gravel and sand, moist | | S | 4.0 | | 4,4,5<br>N = 9 | | 4 |
| 178 | 5 | | | | 4.45 | | | | 5 |
| | 5.5 | SILTY CLAY - very stiff, brown silty clay, moist | | S | 5.5 | | 5,8,12<br>N = 20 | | |
| 177 | 6 | | | | 5.95 | | | | 6 |
| | 7.0 | SILTY CLAY - hard, brown, silty clay with a trace of sand, dry | | S | 7.0 | | 10,13,21<br>N = 34 | | 7 |
| 176 | 7 | | | | 7.45 | | | | |
| 175 | 8 | | | | | | | | 8 |
| 174 | | | | S | 8.5 | | 8,16,19<br>N = 35 | | Backfilled with gravel |
| | 9 | | | | 8.95 | | | | 9 |
| 173 | | | | | 10.0 | | | | |

**RIG:** Scout **DRILLER:** JS **LOGGED:** PGH **CASING:** HQ to 15.0m

**TYPE OF BORING:** Pot holing to 1.2m; Solid flight auger to 14.50m; Rotary (water) to 15.50m

**WATER OBSERVATIONS:** Free groundwater observed at 13.10m

**REMARKS:** *Denotes field replicate sample BD2/5.4.11 collected. Standpipe piezometer installed: solid 0.0-6.0m; Slotted 6.0-15.5m; Bentonite plug 0.3-1.0m; Quick-set concrete 0.0-0.3m with gatic cover

**SAMPLING & IN SITU TESTING LEGEND**

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

Douglas Partners
Geotechnics I Environment I Groundwater

# BOREHOLE LOG

**CLIENT:** Health Infrastructure
**PROJECT:** Wagga Wagga Base Hospital Redevelopment
**LOCATION:** Edward Street, Wagga Wagga

**SURFACE LEVEL:** 182.6 AHD
**EASTING:**
**NORTHING:**
**DIP/AZIMUTH:** 90°/--

**BORE No:** 106
**PROJECT No:** 72320.00
**DATE:** 5/4/2011
**SHEET** 2 OF 2

| RL | Depth (m) | Description of Strata | Graphic Log | Sampling & In Situ Testing: Type | Depth | Sample | Results & Comments | Water | Well Construction Details |
|---|---|---|---|---|---|---|---|---|---|
| 172 | 10.35 | SILTY CLAY - hard, brown, silty clay with a trace of sand, dry *(continued)* | | S | 10.45 | | 14,23,25<br>N = 48 | | |
| | | SAND - dense, medium to coarse grained sand, dry | | | | | | | Machine slotted PVC screen |
| 11 | | 10.95m: rounded quartz gravel | | | | | | | 11 |
| 171 | | | | S | 11.5<br>11.95 | | 16,25,25<br>N = 50 | | |
| 12 | | | | | | | | | 12 |
| 170 | | | | A | 12.5 | | | | |
| 13 | 13.1 | | | | 13.0 | | | ▼ | 13 |
| | | SAND - dense, medium to coarse grained, brown sand with some clay and rounded quartz gravel (to 50mm diameter), saturated | | S | 13.45 | | 12,12,19<br>N = 31 | | |
| 169 | | | | | | | | | |
| 14 | | | | | | | | | 14 |
| | 14.4 | | | A | 14.4 | | | | |
| 168 | | CLAYEY SAND - dense, medium to coarse grained, clayey sand with some rounded quartz gravel, wet | | S | 14.5<br>14.95 | | 10,15,25<br>N = 40<br>(no sample recovered) | | |
| 15 | | | | | | | | | 15 |
| | 15.5 | Bore discontinued at 15.5m<br>- target depth achieved | | | | | | | End cap |
| 167 | | | | | | | | | |
| 16 | | | | | | | | | 16 |
| 166 | | | | | | | | | |
| 17 | | | | | | | | | 17 |
| 165 | | | | | | | | | |
| 18 | | | | | | | | | 18 |
| 164 | | | | | | | | | |
| 19 | | | | | | | | | 19 |
| 163 | | | | | | | | | |

**RIG:** Scout **DRILLER:** JS **LOGGED:** PGH **CASING:** HQ to 15.0m

**TYPE OF BORING:** Pot holing to 1.2m; Solid flight auger to 14.50m; Rotary (water) to 15.50m

**WATER OBSERVATIONS:** Free groundwater observed at 13.10m

**REMARKS:** *Denotes field replicate sample BD2/5.4.11 collected. Standpipe piezometer installed: solid 0.0-6.0m; Slotted 6.0-15.5m; Bentonite plug 0.3-1.0m; Quick-set concrete 0.0-0.3m with gatic cover

**SAMPLING & IN SITU TESTING LEGEND**

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

Douglas Partners
Geotechnics / Environment / Groundwater

# BOREHOLE LOG

**CLIENT:** Health Infrastructure
**PROJECT:** Wagga Wagga Base Hospital Redevelopment
**LOCATION:** Edward Street, Wagga Wagga

**SURFACE LEVEL:** 182.3 AHD
**EASTING:**
**NORTHING:**
**DIP/AZIMUTH:** 90°/--

**BORE No:** 107
**PROJECT No:** 72320.00
**DATE:** 6 - 7/4/2011
**SHEET** 1 OF 1

| RL | Depth (m) | Description of Strata | Graphic Log | Sampling & In Situ Testing: Type | Depth | Sample | Results & Comments | Water | Well Construction Details |
|---|---|---|---|---|---|---|---|---|---|
| 182 | 0.07 | ASPHALT - 70mm thick | | | | | | | |
| | 0.4 | FILLING (ROADBASE) - angular blue metal gravel and sand | | | | | | | |
| | | FILLING - poorly compacted, red brown, silty clay filling with granite gravel, slag and some sand, moist | | S | 1.35 | | 3,3,2<br>N = 5 | | |
| 181 | 1 | | | | | | | | 1 |
| | | | | E | 1.8<br>1.9 | | | | |
| | 2 | | | | 2.0 | | | | 2 |
| | 2.2 | | | A | 2.2 | | | | |
| 180 | 2.4 | FILLING - poorly compacted, medium grained sand filling with some clay, moist | | E | 2.4 | | | | |
| | | Bore discontinued at 2.4m<br>- hole abandoned due to obstruction | | | | | | | |
| | 3 | | | | | | | | 3 |
| 179 | | | | | | | | | |
| | 4 | | | | | | | | 4 |
| 178 | | | | | | | | | |
| | 5 | | | | | | | | 5 |
| 177 | | | | | | | | | |
| | 6 | | | | | | | | 6 |
| 176 | | | | | | | | | |
| | 7 | | | | | | | | 7 |
| 175 | | | | | | | | | |
| | 8 | | | | | | | | 8 |
| 174 | | | | | | | | | |
| | 9 | | | | | | | | 9 |
| 173 | | | | | | | | | |

**RIG:** Scout **DRILLER:** JS **LOGGED:** PGH **CASING:** Uncased

**TYPE OF BORING:** Pot holing to 1.30m; Solid flight auger to 2.40m

**WATER OBSERVATIONS:** No free groundwater observed whilst auger drilling

**REMARKS:**

**SAMPLING & IN SITU TESTING LEGEND**

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

Douglas Partners
Geotechnics / Environment / Groundwater

# BOREHOLE LOG

**CLIENT:** Health Infrastructure
**PROJECT:** Wagga Wagga Base Hospital Redevelopment
**LOCATION:** Edward Street, Wagga Wagga

**SURFACE LEVEL:** 182.3 AHD
**EASTING:**
**NORTHING:**
**DIP/AZIMUTH:** 90°/--

**BORE No:** 107A
**PROJECT No:** 72320.00
**DATE:** 7/4/2011
**SHEET** 1 OF 2

| RL | Depth (m) | Description of Strata | Graphic Log | Sampling & In Situ Testing: Type | Depth | Sample | Results & Comments | Water | Well Construction Details |
|---|---|---|---|---|---|---|---|---|---|
| 182 | 0.07 | ASPHALT - 70mm thick | | | | | | | |
| | 0.4 | FILLING (ROADBASE) - brown, angular blue metal gravel filling with sand, dry | | E | 0.4<br>0.5 | | | | |
| | | SILTY CLAY - apparently very stiff, red brown silty clay, dry | | | | | | | |
| 181 | 1 | | | | | | | | 1 |
| | 1.5 | SILTY CLAY - very stiff, red brown, silty clay with some ironstone gravel, dry | | | 1.5 | | | | |
| | | | | S<br>E | 1.6<br>1.95 | | 7,9,18<br>N = 27 | | |
| 180 | 2 | | | | | | | | 2 |
| | 2.5 | SILTY CLAY - stiff, red brown, silty clay with a trace of ironstone gravel, dry | | | 2.5 | | | | |
| | | | | S | 2.95 | | 6,6,8<br>N = 14 | | |
| 179 | 3 | | | | | | | | 3 |
| | 4.0 | SILTY CLAY - very stiff, red brown, silty clay with a trace of ironstone gravel, dry | | | 4.0 | | | | |
| 178 | 4 | | | S | 4.45 | | 5,8,14<br>N = 22 | | 4 |
| | 5 | | | | | | | | 5 |
| 177 | | | | | 5.5 | | | | |
| | | | | S | 5.95 | | 6,9,14<br>N = 23 | | |
| | 6 | | | | | | | | 6 |
| 176 | 7 | | | | 7.0 | | | | 7 |
| | | | | S | 7.45 | | 4,6,11<br>N = 17 | | |
| 175 | 8 | | | | | | | | 8 |
| | 8.5 | SILTY CLAY - stiff to very stiff, red brown and grey, silty clay, moist | | | 8.5 | | | | |
| 174 | | | | S | 8.95 | | 6,7,9<br>N = 16 | | |
| | 9 | | | | | | | | 9 |
| 173 | 10.0 | | | | 10.0 | | | | |

**RIG:** Scout **DRILLER:** JS **LOGGED:** PGH **CASING:** Uncased

**TYPE OF BORING:** Pot holing to 1.2m; Solid flight auger (TC-bit) to 13.0m

**WATER OBSERVATIONS:** Free groundwater observed at 13.10m on SPT sampler

**REMARKS:**

**SAMPLING & IN SITU TESTING LEGEND**

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

Douglas Partners
Geotechnics / Environment / Groundwater

# BOREHOLE LOG

**CLIENT:** Health Infrastructure
**PROJECT:** Wagga Wagga Base Hospital Redevelopment
**LOCATION:** Edward Street, Wagga Wagga

**SURFACE LEVEL:** 182.3 AHD
**EASTING:**
**NORTHING:**
**DIP/AZIMUTH:** 90°/--

**BORE No:** 107A
**PROJECT No:** 72320.00
**DATE:** 7/4/2011
**SHEET** 2 OF 2

| RL | Depth (m) | Description of Strata | Graphic Log | Sampling & In Situ Testing: Type | Depth | Sample | Results & Comments | Water | Well Construction Details |
|---|---|---|---|---|---|---|---|---|---|
| 172 | | SILTY CLAY - hard, red brown silty clay, moist | | S | 10.45 | | 9,14,30<br>N = 44 | | |
| 171 | 11 | | | | | | | | 11 |
| | 11.5 | SILTY CLAY - stiff, mottled orange brown and grey, silty clay, moist | | S | 11.5<br>11.95 | | 5,6,7<br>N = 13 | | |
| 170 | 12 | 12.0m: gravel | | | | | | | 12 |
| | 13 13.0 | SILTY CLAY - hard, orange brown silty clay, moist | | S | 13.0 | | 8,15,19<br>N = 34 | ▼ | 13 |
| 169 | 13.45 | Bore discontinued at 13.45m | | | 13.45 | | | | |
| | 14 | | | | | | | | 14 |
| 168 | | | | | | | | | |
| | 15 | | | | | | | | 15 |
| 167 | | | | | | | | | |
| | 16 | | | | | | | | 16 |
| 166 | | | | | | | | | |
| | 17 | | | | | | | | 17 |
| 165 | | | | | | | | | |
| | 18 | | | | | | | | 18 |
| 164 | | | | | | | | | |
| | 19 | | | | | | | | 19 |
| 163 | | | | | | | | | |

**RIG:** Scout **DRILLER:** JS **LOGGED:** PGH **CASING:** Uncased

**TYPE OF BORING:** Pot holing to 1.2m; Solid flight auger (TC-bit) to 13.0m

**WATER OBSERVATIONS:** Free groundwater observed at 13.10m on SPT sampler

**REMARKS:**

**SAMPLING & IN SITU TESTING LEGEND**

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

Douglas Partners
Geotechnics / Environment / Groundwater

# BOREHOLE LOG

**CLIENT:** Health Infrastructure
**PROJECT:** Wagga Wagga Base Hospital Redevelopment
**LOCATION:** Edward Street, Wagga Wagga

**SURFACE LEVEL:** 181.8 AHD
**EASTING:**
**NORTHING:**
**DIP/AZIMUTH:** 90°/--

**BORE No:** 108
**PROJECT No:** 72320.00
**DATE:** 6/4/2011
**SHEET** 1 OF 2

| RL | Depth (m) | Description of Strata | Graphic Log | Sampling & In Situ Testing: Type | Depth | Sample | Results & Comments | Water | Well Construction Details |
|---|---|---|---|---|---|---|---|---|---|
| 181 | 0.0 | FILLING - poorly compacted, medium grained clayey sand filling, moist | | A | 0.1 | | | | |
| | | | | | 0.2 | | | | |
| | 0.4 | SILTY CLAY - apparently hard, red brown silty clay, dry | | | | | | | |
| | 1 | | | | | | | | 1 |
| | 1.4 | SILTY CLAY - hard, red brown silty clay, dry | | | 1.4 | | | | |
| 180 | | | | S | | | 5,17,22 N = 39 | | |
| | | | | | 1.85 | | | | |
| | 2 | | | | 2.0 | | | | 2 |
| | | | | A | 2.2 | | | | |
| | | 2.5m: with a trace of ironstone gravel | | | 2.5 | | | | |
| 179 | | | | S | | | 10,13,25 N = 38 | | |
| | 3 | | | | 2.95 | | | | 3 |
| 178 | | | | | | | | | |
| | 4 | | | | | | | | 4 |
| | 4.0 | SILTY CLAY - very stiff, brown silty clay, moist | | | 4.0 | | | | |
| | | | | S | | | 5,9,13 N = 22 | | |
| | | | | | 4.45 | | | | |
| 177 | 5 | | | | | | | | 5 |
| | | | | | 5.5 | | | | |
| | | | | S | | | 5,7,13 N = 20 | | |
| 176 | 6 | | | | 5.95 | | | | 6 |
| | | | | | | | | | |
| 175 | | | | | | | | | |
| | 7 | | | | 7.0 | | | | 7 |
| | | 7.0m: becoming grey brown | | S | | | 4,8,12 N = 20 | | |
| | | | | | 7.45 | | | | |
| 174 | 8 | | | | | | | | 8 |
| | 8.5 | SILTY CLAY - stiff, brown silty clay, moist | | | 8.5 | | | | |
| 173 | | | | S | | | 5,6,8 N = 14 | | |
| | 9 | | | | 8.95 | | | | 9 |
| | | | | | | | | | |
| 172 | 10.0 | | | | 10.0 | | | | |

**RIG:** Scout **DRILLER:** JS **LOGGED:** PGH **CASING:** Uncased

**TYPE OF BORING:** Pot holing to 1.2m; Solid flight auger (TC-bit) to 10.0m

**WATER OBSERVATIONS:** No free groundwater observed whilst auger drilling

**REMARKS:**

**SAMPLING & IN SITU TESTING LEGEND**

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

Douglas Partners
Geotechnics / Environment / Groundwater

# BOREHOLE LOG

**CLIENT:** Health Infrastructure
**PROJECT:** Wagga Wagga Base Hospital Redevelopment
**LOCATION:** Edward Street, Wagga Wagga

**SURFACE LEVEL:** 181.8 AHD
**EASTING:**
**NORTHING:**
**DIP/AZIMUTH:** 90°/--

**BORE No:** 108
**PROJECT No:** 72320.00
**DATE:** 6/4/2011
**SHEET** 2 OF 2

| RL | Depth (m) | Description of Strata | Graphic Log | Sampling & In Situ Testing: Type | Depth | Sample | Results & Comments | Water | Well Construction Details |
|---|---|---|---|---|---|---|---|---|---|
| | | SILTY CLAY - stiff, brown silty clay, mois*(continued)* | | S | | | 3,5,6<br>N = 11 | | |
| | 10.45 | Bore discontinued at 10.45m<br>- target depth achieved | | | 10.45 | | | | |

**RIG:** Scout **DRILLER:** JS **LOGGED:** PGH **CASING:** Uncased

**TYPE OF BORING:** Pot holing to 1.2m; Solid flight auger (TC-bit) to 10.0m

**WATER OBSERVATIONS:** No free groundwater observed whilst auger drilling

**REMARKS:**

**SAMPLING & IN SITU TESTING LEGEND**

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

Douglas Partners
Geotechnics / Environment / Groundwater

# BOREHOLE LOG

**CLIENT:** Health Infrastructure
**PROJECT:** Wagga Wagga Base Hospital Redevelopment
**LOCATION:** Edward Street, Wagga Wagga

**SURFACE LEVEL:** 182.4 AHD
**EASTING:**
**NORTHING:**
**DIP/AZIMUTH:** 90°/--

**BORE No:** 109
**PROJECT No:** 72320.00
**DATE:** 1 - 5/4/2011
**SHEET** 1 OF 2

| RL | Depth (m) | Description of Strata | Graphic Log | Sampling & In Situ Testing: Type | Depth | Sample | Results & Comments | Water | Well Construction Details |
|---|---|---|---|---|---|---|---|---|---|
| 182 | 0.4 | FILLING (TOPSOIL) - poorly compacted, dark brown, silty clay filling (topsoil) with some sand, moist | | E | 0.1<br>0.2 | | | | |
| | | SILTY CLAY - apparently stiff, orange brown silty clay, dry | | B<br>A | 0.4<br>0.5<br>0.6 | | | | |
| 181 | 1.0 | SILTY CLAY - stiff, orange brown silty clay, dry | | S | 1.0<br>1.45 | | 4,4,9<br>N = 13 | | |
| 180 | 2.5 | | | S | 2.5<br>2.95 | | 4,5,7<br>N = 12 | | |
| 179 | 4.0 | SILTY CLAY - very stiff, orange brown silty clay, dry | | S | 4.0<br>4.45 | | 7,11,14<br>N = 25 | | |
| 178 | | 5.0m: trace of ironstone gravel | | | | | | | |
| 177 | 5.5 | | | S | 5.5<br>5.95 | | 7,10,12<br>N = 22 | | |
| 176 | 7.0 | SILTY CLAY - stiff, orange brown, silty clay with a trace of ironstone gravel, dry | | S | 7.0<br>7.45 | | 4,7,8<br>N = 15 | | |
| 175 | 8.5 | SILTY CLAY - hard, red brown, silty clay with a trace of ironstone gravel, dry | | S | 8.5<br>8.95 | | 10,12,21<br>N = 33 | | |
| 174 | | | | | 10.0 | | | | |
| 173 | | | | | | | | | |

**RIG:** Scout **DRILLER:** JS **LOGGED:** PGH **CASING:** Uncased
**TYPE OF BORING:** Solid flight auger (TC-bit) to 10.0m
**WATER OBSERVATIONS:** No free groundwater observed
**REMARKS:**

**SAMPLING & IN SITU TESTING LEGEND**

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

Douglas Partners
Geotechnics / Environment / Groundwater

# BOREHOLE LOG

**CLIENT:** Health Infrastructure
**PROJECT:** Wagga Wagga Base Hospital Redevelopment
**LOCATION:** Edward Street, Wagga Wagga

**SURFACE LEVEL:** 182.4 AHD
**EASTING:**
**NORTHING:**
**DIP/AZIMUTH:** 90°/--

**BORE No:** 109
**PROJECT No:** 72320.00
**DATE:** 1 - 5/4/2011
**SHEET** 2 OF 2

| RL | Depth (m) | Description of Strata | Graphic Log | Sampling & In Situ Testing: Type | Depth | Sample | Results & Comments | Water | Well Construction Details |
|---|---|---|---|---|---|---|---|---|---|
| | 10.15 | 10.10m: rounded quartz gravel | | S | 10.15 | | 20 refusal | | |
| | | Bore discontinued at 10.15m - target depth achieved | | | | | | | |

**RIG:** Scout **DRILLER:** JS **LOGGED:** PGH **CASING:** Uncased

**TYPE OF BORING:** Solid flight auger (TC-bit) to 10.0m

**WATER OBSERVATIONS:** No free groundwater observed

**REMARKS:**

**SAMPLING & IN SITU TESTING LEGEND**

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

Douglas Partners
Geotechnics / Environment / Groundwater

# BOREHOLE LOG

**CLIENT:** Health Infrastructure
**PROJECT:** Wagga Wagga Base Hospital Redevelopment
**LOCATION:** Edward Street, Wagga Wagga

**SURFACE LEVEL:** 181.4 AHD
**EASTING:**
**NORTHING:**
**DIP/AZIMUTH:** 90°/--

**BORE No:** 201
**PROJECT No:** 72320.03
**DATE:** 21/9/2011
**SHEET** 1 OF 1

| RL | Depth (m) | Description of Strata | Graphic Log | Sampling & In Situ Testing: Type | Depth | Sample | Results & Comments | Water |
|---|---|---|---|---|---|---|---|---|
| 181 | 0.0 | FILLING (TOPSOIL) - poorly compacted, brown, sandy silt filling with some rootlets, dry | | E | 0.1–0.2 | | PID<1 | |
| | 0.3 | FILLING - poorly compacted, brown, silty clay filling with some sand, moist | | E | 0.3–0.4 | | PID<1 | |
| | 0.8 | SILTY CLAY - very stiff, orange brown silty clay, dry | | A | 0.8–0.9 | | 0.8-1.1m: Bulk sample | |
| 180 | 1 | - hard from 1.2m | | | | | | |
| | | | | A | 1.5–1.6 | | | |
| 179 | 2 | | | | | | | |
| | | | | A | 2.9 | | | |
| | 3.0 | Bore discontinued at 3.0m - target depth achieved | | | 3.0 | | | |
| 178 | 3 | | | | | | | |
| | 4 | | | | | | | |
| 177 | | | | | | | | |

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

**RIG:** 5 tonne Excavator **DRILLER:** John Rapley **LOGGED:** PGH **CASING:** Uncased

**TYPE OF BORING:** 200mm diameter auger

**WATER OBSERVATIONS:** No free groundwater observed

**REMARKS:**

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

**SAMPLING & IN SITU TESTING LEGEND**

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

Douglas Partners
Geotechnics | Environment | Groundwater

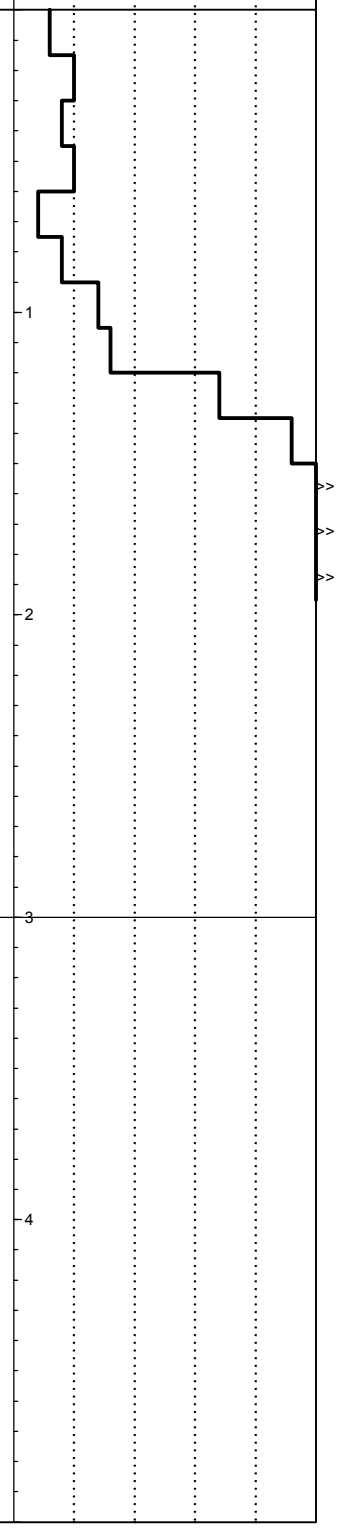
# BOREHOLE LOG

**CLIENT:** Health Infrastructure
**PROJECT:** Wagga Wagga Base Hospital Redevelopment
**LOCATION:** Edward Street, Wagga Wagga

**SURFACE LEVEL:** 181.5 AHD
**EASTING:**
**NORTHING:**
**DIP/AZIMUTH:** 90°/--

**BORE No:** 202
**PROJECT No:** 72320.03
**DATE:** 21/9/2011
**SHEET** 1 OF 1

| RL | Depth (m) | Description of Strata | Graphic Log | Sampling & In Situ Testing: Type | Depth | Sample | Results & Comments | Water |
|---|---|---|---|---|---|---|---|---|
| 181 | 0.0 | FILLING (TOPSOIL) - poorly compacted, brown, sandy silt filling with rootlets, dry | | E* | 0.1<br>0.2 | | PID<1 | |
| | 0.3 | FILLING - poorly compacted, brown clay filling with some silt, moist | | E<br>D | 0.3<br>0.4 | | PID<1 | |
| | 0.6 | FILLING - poorly compacted, red brown, silty clay filling with some silt and sand, moist | | D<br>E | 0.6<br>0.7 | | PID<1 | |
| 180 | 0.8 | SILTY CLAY - very stiff then hard, orange brown, silty clay, moist | | B | 0.8<br>1.1 | | | |
| 179 | | | | D | 1.9<br>2.0 | | | |
| 178 | 3.0 | Bore discontinued at 3.0m<br>- target depth achieved | | | | | | |
| 177 | | | | | | | | |




**RIG:** 5 tonne Excavator **DRILLER:** John Rapley **LOGGED:** PGH **CASING:** Uncased

**TYPE OF BORING:** 200mm diameter auger

**WATER OBSERVATIONS:** No free groundwater observed

**REMARKS:** *Denotes field replicate sample BD1/21911 collected

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

**SAMPLING & IN SITU TESTING LEGEND**

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

Douglas Partners
Geotechnics | Environment | Groundwater

# BOREHOLE LOG

**CLIENT:** Health Infrastructure
**PROJECT:** Wagga Wagga Base Hospital Redevelopment
**LOCATION:** Edward Street, Wagga Wagga

**SURFACE LEVEL:** 181.5 AHD
**EASTING:**
**NORTHING:**
**DIP/AZIMUTH:** 90°/--

**BORE No:** 203
**PROJECT No:** 72320.03
**DATE:** 21/9/2011
**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) |
|---|---|---|---|---|---|---|---|---|---|
| 181 | 0.25 | FILLING (TOPSOIL) - poorly compacted, brown, sandy silt filling with some rootlets, dry | | E | 0.1<br>0.2 | | PID<1 | | |
| | | SILTY CLAY - very stiff, orange brown silty clay, dry | | A | 0.3<br>0.4 | | 0.3-0.4m: Bulk sample | | |
| | | - hard from 0.6m | | | | | | | |
| 180 | 1 | | | A | 1.0<br>1.1 | | | | |
| | | | | A | 1.8<br>1.9 | | | | |
| 179 | 2 | 2.5-2.6m: ironstone gravel | | A | 2.6<br>2.7 | | | | |
| | 3 | 3.0 Bore discontinued at 3.0m<br>- target depth achieved | | | | | | | |
| 178 | 4 | | | | | | | | |
| 177 | | | | | | | | | |

**RIG:** 5 tonne Excavator **DRILLER:** John Rapley **LOGGED:** PGH **CASING:** Uncased

**TYPE OF BORING:** 200mm diameter auger

**WATER OBSERVATIONS:** No free groundwater observed

**REMARKS:**

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

**SAMPLING & IN SITU TESTING LEGEND**

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

Douglas Partners
Geotechnics | Environment | Groundwater

# BOREHOLE LOG

**CLIENT:** Health Infrastructure
**PROJECT:** Wagga Wagga Base Hospital Redevelopment
**LOCATION:** Edward Street, Wagga Wagga

**SURFACE LEVEL:** 181.4 AHD
**EASTING:**
**NORTHING:**
**DIP/AZIMUTH:** 90°/--

**BORE No:** 204
**PROJECT No:** 72320.03
**DATE:** 20/9/2011
**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) |
|---|---|---|---|---|---|---|---|---|---|
| 181 | 0.02 | ASPHALT | | | | | | | |
| | 0.2 | ROADBASE - orange grey, sandy gravel roadbase, dry | | | | | | | |
| | | FILLING - poorly compacted, brown, silty clay filling with some sand and gravel, dry | | E | 0.2 | | PID<1 | | |
| | | | | A | 0.3 | | | | |
| | | | | | 0.4 | | | | |
| | 0.5 | SILTY CLAY - very stiff then hard, red brown silty clay, moist | | | 0.5 | | | | |
| | | | | B | | | | | |
| | | | | | 0.8 | | | | |
| 180 | 1 | | | | | | | | 1 |
| | | | | | 1.9 | | | | |
| | 2 | | | A | 2.0 | | | | 2 |
| 179 | | | | | | | | | |
| | | | | | 2.6 | | | | |
| | | | | A | 2.7 | | | | |
| | 3 | 3.0 Bore discontinued at 3.0m - target depth achieved | | | | | | | 3 |
| 178 | 4 | | | | | | | | 4 |
| 177 | | | | | | | | | |

**RIG:** 5 tonne Excavator **DRILLER:** John Rapley **LOGGED:** PGH **CASING:** Uncased

**TYPE OF BORING:** 200mm diameter auger

**WATER OBSERVATIONS:** No free groundwater observed

**REMARKS:**

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

**SAMPLING & IN SITU TESTING LEGEND**

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

Douglas Partners
Geotechnics | Environment | Groundwater

# BOREHOLE LOG

**CLIENT:** Health Infrastructure
**PROJECT:** Wagga Wagga Base Hospital Redevelopment
**LOCATION:** Edward Street, Wagga Wagga

**SURFACE LEVEL:** 181.4 AHD
**EASTING:**
**NORTHING:**
**DIP/AZIMUTH:** 90°/--

**BORE No:** 205
**PROJECT No:** 72320.03
**DATE:** 20/9/2011
**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) |
|---|---|---|---|---|---|---|---|---|---|
| 181 | 0.03 | ASPHALT | | | | | | | |
| | 0.15 | ROADBASE - orange grey, sandy gravel roadbase, dry | | E | 0.1 | | PID<1 | | |
| | | FILLING - poorly compacted, red and brown, silty clay filling with some blue metal gravel and glass, moist | | | 0.2 | | | | |
| | | | | A/E* | 0.3 | | PID<1 | | |
| | | | | | 0.4 | | | | |
| | 0.7 | SILTY CLAY - very stiff, orange brown silty clay, moist | | B | 0.7 | | | | |
| 180 | 1 | | | | 1.0 | | | | 1 |
| | 1.2 | SILTY CLAY - hard, orange brown silty clay, moist | | | | | | | |
| | | - dry from 1.6m | | A | 1.5 | | | | |
| | | | | | 1.6 | | | | |
| 179 | 2 | | | | | | | | 2 |
| | | | | | | | | | |
| | | | | A | 2.7 | | | | |
| | 3 | | | | 2.8 | | | | 3 |
| | 3.0 | Bore discontinued at 3.0m - target depth achieved | | | | | | | |
| 178 | 4 | | | | | | | | 4 |
| 177 | | | | | | | | | |

**RIG:** 5 tonne Excavator **DRILLER:** John Rapley **LOGGED:** PGH **CASING:** Uncased

**TYPE OF BORING:** 200mm diameter auger

**WATER OBSERVATIONS:** No free groundwater observed

**REMARKS:**

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

**SAMPLING & IN SITU TESTING LEGEND**

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

Douglas Partners
Geotechnics | Environment | Groundwater

# BOREHOLE LOG

**CLIENT:** Health Infrastructure
**PROJECT:** Wagga Wagga Base Hospital Redevelopment
**LOCATION:** Edward Street, Wagga Wagga

**SURFACE LEVEL:** 182.5 AHD
**EASTING:**
**NORTHING:**
**DIP/AZIMUTH:** 90°/--

**BORE No:** 206
**PROJECT No:** 72320.03
**DATE:** 20/9/2011
**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) |
|---|---|---|---|---|---|---|---|---|---|
| 182 | 0.1 | ROADBASE - orange grey, sandy gravel roadbase, dry | | | | | | | |
| | | SILTY CLAY - very stiff, orange brown, silty clay with some ironstone gravel | | E | 0.15<br>0.25 | | PID<1 | | |
| | | | | A | 0.5<br>0.6 | | 0.5-1.0m: Bulk sample | | |
| 181 | 1.8 | SILTY CLAY - hard, orange brown silty clay, moist | | A | 1.5<br>1.6 | | | | |
| 180 | 2.9 | Bore discontinued at 2.9m<br>- target depth achieved | | | | | | | |
| 179 | | | | | | | | | |
| 178 | | | | | | | | | |

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20; 1, 2, 3, 4

**RIG:** 5 tonne Excavator **DRILLER:** John Rapley **LOGGED:** PGH **CASING:** Uncased

**TYPE OF BORING:** 200mm diameter auger

**WATER OBSERVATIONS:** No free groundwater observed

**REMARKS:**

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

**SAMPLING & IN SITU TESTING LEGEND**

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

Douglas Partners
Geotechnics | Environment | Groundwater

# BOREHOLE LOG

**CLIENT:** Health Infrastructure
**PROJECT:** Wagga Wagga Base Hospital Redevelopment
**LOCATION:** Edward Street, Wagga Wagga

**SURFACE LEVEL:** 182.6 AHD
**EASTING:**
**NORTHING:**
**DIP/AZIMUTH:** 90°/--

**BORE No:** 207
**PROJECT No:** 72320.03
**DATE:** 20/9/2011
**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) |
|---|---|---|---|---|---|---|---|---|---|
| 182 | 0.03 | ASPHALT | | E | 0.05 | | PID<1 | | |
| | 0.1 | ROADBASE - orange grey, sandy gravel roadbase, dry | | | 0.1 | | | | |
| | | SILTY CLAY - hard, orange brown silty clay, dry | | A | 0.4 | | | | |
| | | | | | 0.5 | | | | |
| 181 | 1 | | | | | | | | 1 |
| | | | | | | | | | |
| 180 | 2 | | | A | 2.0 | | | | 2 |
| | | | | | 2.1 | | | | |
| | | | | A | 2.8 | | | | |
| | 2.9 | Bore discontinued at 2.9m - target depth achieved | | | 2.9 | | | | |
| 179 | 3 | | | | | | | | 3 |
| | 4 | | | | | | | | 4 |
| 178 | | | | | | | | | |

**RIG:** 5 tonne Excavator **DRILLER:** John Rapley **LOGGED:** PGH **CASING:** Uncased

**TYPE OF BORING:** 200mm diameter auger

**WATER OBSERVATIONS:** No free groundwater observed

**REMARKS:**

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

**SAMPLING & IN SITU TESTING LEGEND**

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

Douglas Partners
Geotechnics | Environment | Groundwater

# BOREHOLE LOG

**CLIENT:** Health Infrastructure
**PROJECT:** Wagga Wagga Base Hospital Redevelopment
**LOCATION:** Edward Street, Wagga Wagga

**SURFACE LEVEL:** 182.9 AHD
**EASTING:**
**NORTHING:**
**DIP/AZIMUTH:** 90°/--

**BORE No:** 208
**PROJECT No:** 72320.03
**DATE:** 20/9/2011
**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) |
|---|---|---|---|---|---|---|---|---|---|
| 182 | 0.1 | ROADBASE - orange grey, sandy gravel roadbase, dry | | | 0.1 | | | | |
| | | SILTY CLAY - very stiff, orange brown silty clay | | E | 0.2 | | PID<1 | | |
| | | | | A | 0.4 | | | | |
| | | | | | 0.5 | | | | |
| | | | | $U_{50}$ | 0.7 | | | | |
| | | | | | 0.73 | | | | |
| | 1 | | | | | | | | 1 |
| 181 | 1.1 | SILTY CLAY - hard, orange brown, silty clay with a trace of ironstone gravel | | | | | | | |
| | 2 | | | | | | | | 2 |
| | | | | A | 2.6 | | | | |
| | | | | | 2.7 | | | | |
| 180 | 2.9 | Bore discontinued at 2.9m - target depth achieved | | | | | | | |
| | 3 | | | | | | | | 3 |
| 179 | 4 | | | | | | | | 4 |
| 178 | | | | | | | | | |

**RIG:** 5 tonne Excavator **DRILLER:** John Rapley **LOGGED:** PGH **CASING:** Uncased

**TYPE OF BORING:** 200mm diameter auger

**WATER OBSERVATIONS:** No free groundwater observed

**REMARKS:**

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

**SAMPLING & IN SITU TESTING LEGEND**

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

Douglas Partners
Geotechnics | Environment | Groundwater

# BOREHOLE LOG

**CLIENT:** Health Infrastructure
**PROJECT:** Wagga Wagga Base Hospital Redevelopment
**LOCATION:** Edward Street, Wagga Wagga

**SURFACE LEVEL:** 181.8 AHD
**EASTING:**
**NORTHING:**
**DIP/AZIMUTH:** 90°/--

**BORE No:** 209
**PROJECT No:** 72320.03
**DATE:** 21/9/2011
**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) |
|---|---|---|---|---|---|---|---|---|---|
| 181 | 0.0 | FILLING - poorly compacted, brown, silty sand filling with some building rubble (bricks, quartz cobbles and glass) | | D/E | 0.1<br>0.2 | | PID<1 | | |
| | 0.4 | SILTY CLAY - hard, orange brown silty clay, moist | | A | 0.7<br>0.8 | | | | |
| | 1 | | | $U_{50}$ | 1.1 | | pp>400 | | |
| 180 | 2 | - rounded ironstone gravel from 1.5m to 1.9m | | A | 1.5<br>1.6 | | | | |
| 179 | 3 | | | A | 2.5<br>2.6 | | | | |
| | 3.0 | Bore discontinued at 3.0m<br>- target depth achieved | | | | | | | |
| 178 | 4 | | | | | | | | |
| 177 | | | | | | | | | |

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

**RIG:** 5 tonne Excavator **DRILLER:** John Rapley **LOGGED:** PGH **CASING:** Uncased

**TYPE OF BORING:** 200mm diameter auger

**WATER OBSERVATIONS:** No free groundwater observed

**REMARKS:**

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

**SAMPLING & IN SITU TESTING LEGEND**

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

Douglas Partners
Geotechnics | Environment | Groundwater

# BOREHOLE LOG

**CLIENT:** Health Infrastructure
**PROJECT:** Wagga Wagga Base Hospital Redevelopment
**LOCATION:** Edward Street, Wagga Wagga

**SURFACE LEVEL:** 182.6 AHD
**EASTING:**
**NORTHING:**
**DIP/AZIMUTH:** 90°/--

**BORE No:** 210
**PROJECT No:** 72320.03
**DATE:** 21/9/2011
**SHEET** 1 OF 1

| RL | Depth (m) | Description of Strata | Graphic Log | Sampling & In Situ Testing: Type | Depth | Sample | Results & Comments | Water |
|---|---|---|---|---|---|---|---|---|
| | 0.0 | FILLING (TOPSOIL) - brown sandy silt filling, dry | | E | 0.1 | | PID<1 | |
| | 0.2 | SILTY CLAY - very stiff, orange brown silty clay, dry | | | 0.2 | | | |
| | | | | A | 0.5 | | | |
| 182 | 0.6 | SILTY CLAY - hard, orange brown silty clay, dry | | | 0.6 | | | |
| | 1 | | | E | 1.2 | | PID<1 | |
| | | | | | 1.3 | | | |
| 181 | 2 | | | | | | | |
| | | | | A | 2.2 | | | |
| | | | | | 2.3 | | | |
| 180 | | | | | | | | |
| | | | | A | 2.9 | | | |
| | 3 3.0 | Bore discontinued at 3.0m - target depth achieved | | | 3.0 | | | |
| 179 | 4 | | | | | | | |
| 178 | | | | | | | | |

Dynamic Penetrometer Test (blows per 150mm)
5 10 15 20
1 2 3 4

**RIG:** 5 tonne Excavator **DRILLER:** John Rapley **LOGGED:** PGH **CASING:** Uncased

**TYPE OF BORING:** 200mm diameter auger

**WATER OBSERVATIONS:** No free groundwater observed

**REMARKS:**

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

**SAMPLING & IN SITU TESTING LEGEND**

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

Douglas Partners
Geotechnics | Environment | Groundwater

# BOREHOLE LOG

**CLIENT:** Health Infrastructure
**PROJECT:** Wagga Wagga Base Hospital Redevelopment
**LOCATION:** Edward Street, Wagga Wagga

**SURFACE LEVEL:** 184.2 AHD
**EASTING:**
**NORTHING:**
**DIP/AZIMUTH:** 90°/--

**BORE No:** 211
**PROJECT No:** 72320.03
**DATE:** 21/9/2011
**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) |
|---|---|---|---|---|---|---|---|---|---|
| 184 | 0.0 | | | | | | | | |
| | 0.1 | FILLING - poorly compacted, gravelly clay filling, dry | | A/E | 0.1 | | | | |
| | | FILLING - poorly compacted, medium to coarse grained sand filling with some clay, dry | | E* | 0.3<br>0.4 | | PID<1 | | |
| | 0.6 | FILLING - poorly compacted, silty clay filling with some sand, moist | | A/E* | 0.6<br>0.7 | | PID<1 | | |
| 183 | 1.1 | SILTY CLAY - very stiff then hard, orange brown silty clay, dry | | A | 1.3<br>1.4 | | | | |
| 182 | | | | A | 2.8<br>2.9 | | | | |
| 181 | 3.0 | Bore discontinued at 3.0m<br>- target depth achieved | | | | | | | |
| 180 | | | | | | | | | |

5 10 15 20

1 2 3 4

**RIG:** 5 tonne Excavator **DRILLER:** John Rapley **LOGGED:** PGH **CASING:** Uncased

**TYPE OF BORING:** 200mm diameter auger

**WATER OBSERVATIONS:** No free groundwater observed

**REMARKS:**

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

**SAMPLING & IN SITU TESTING LEGEND**

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

Douglas Partners
Geotechnics | Environment | Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666
Fax (02) 9809 4095

# Results of Dynamic Penetrometer Tests

**Client** Health Infrastructure
**Project** Wagga Wagga Base Hospital Redevelopment
**Location** Edward Street, Wagga Wagga

**Project No.** 72320.03
**Date** 20/9/11
**Page No.** 1 of 1

| Test Locations | 201 | 202 | 203 | 204 | 205 | 206 | 207 | 208 | 209 | 210 | 211 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RL of Test (AHD) | 181.4 | 181.5 | 181.5 | 181.4 | 181.4 | 182.5 | 182.6 | 182.9 | 181.8 | 182.6 | 184.2 |
| Depth (m) | **Penetration Resistance** Blows/150 mm | | | | | | | | | | |
| 0.00 – 0.15 | 3 | 3 | 5 | 10 | 7 | 15 | 12 | 12 | 15 | 10 | 12 |
| 0.15 – 0.30 | 3 | 5 | 7 | 10 | 4 | 11 | 15 | 9 | 12 | 16 | 5 |
| 0.30 – 0.45 | 3 | 4 | 8 | 4 | 9 | 7 | 14 | 11 | 12 | 6 | 3 |
| 0.45 – 0.60 | 5 | 5 | 9 | 9 | 9 | 7 | 14 | 11 | 17 | 6 | 4 |
| 0.60 – 0.75 | 6 | 2 | 12 | 13 | 8 | 8 | 14 | 11 | 15 | 7 | 5 |
| 0.75 – 0.90 | 12 | 4 | 15 | 13 | 9 | 7 | 15 | 11 | 17 | 6 | 7 |
| 0.90 – 1.05 | 10 | 7 | 19 | 12 | 9 | 7 | 20 | 11 | 19 | 6 | 7 |
| 1.05 – 1.20 | 10 | 8 | 19 | 12 | 8 | 8 | 22 | 12 | 25 | 12 | 8 |
| 1.20 – 1.35 | 15 | 17 | 23 | 12 | 20 | 9 | 25 | 14 | 29 | 15 | 12 |
| 1.35 – 1.50 | 25 | 23 | 29 | 15 | 25 | 10 | 25 | 17 | 31 | 25 | 16 |
| 1.50 – 1.65 | 33 | 29 | 30 | 25 | 27 | 10 | 29 | 20 | 34 | 30 | 24 |
| 1.65 – 1.80 | 35 | 30 | 32 | 25 | 30 | 11 | 30 | 22 | 34 | 30 | 30 |
| 1.80 – 1.95 | 35 | 30 | 35 | 30 | 32 | 12 | 32 | 25 | 40 | 35 | 35 |
| 1.95 – 2.10 | | | | 32 | | 14 | | 27 | | | |
| 2.10 – 2.25 | | | | | | 14 | | 30 | | | |
| 2.25 – 2.40 | | | | | | 16 | | 30 | | | |
| 2.40 – 2.55 | | | | | | | | | | | |
| 2.55 – 2.70 | | | | | | | | | | | |
| 2.70 – 2.85 | | | | | | | | | | | |
| 2.85 – 3.00 | | | | | | | | | | | |

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

**Tested By** PGH
**Checked By** PMO

**Remarks**

# CONE PENETRATION TEST

**CLIENT:** HEALTH INFRASTRUCTURE

**PROJECT:** WAGGA WAGGA BASE HOSPITAL REDEVELOPMENT

**LOCATION:** EDWARD STREET, WAGGA WAGGA

**REDUCED LEVEL:** 182.6 m AHD

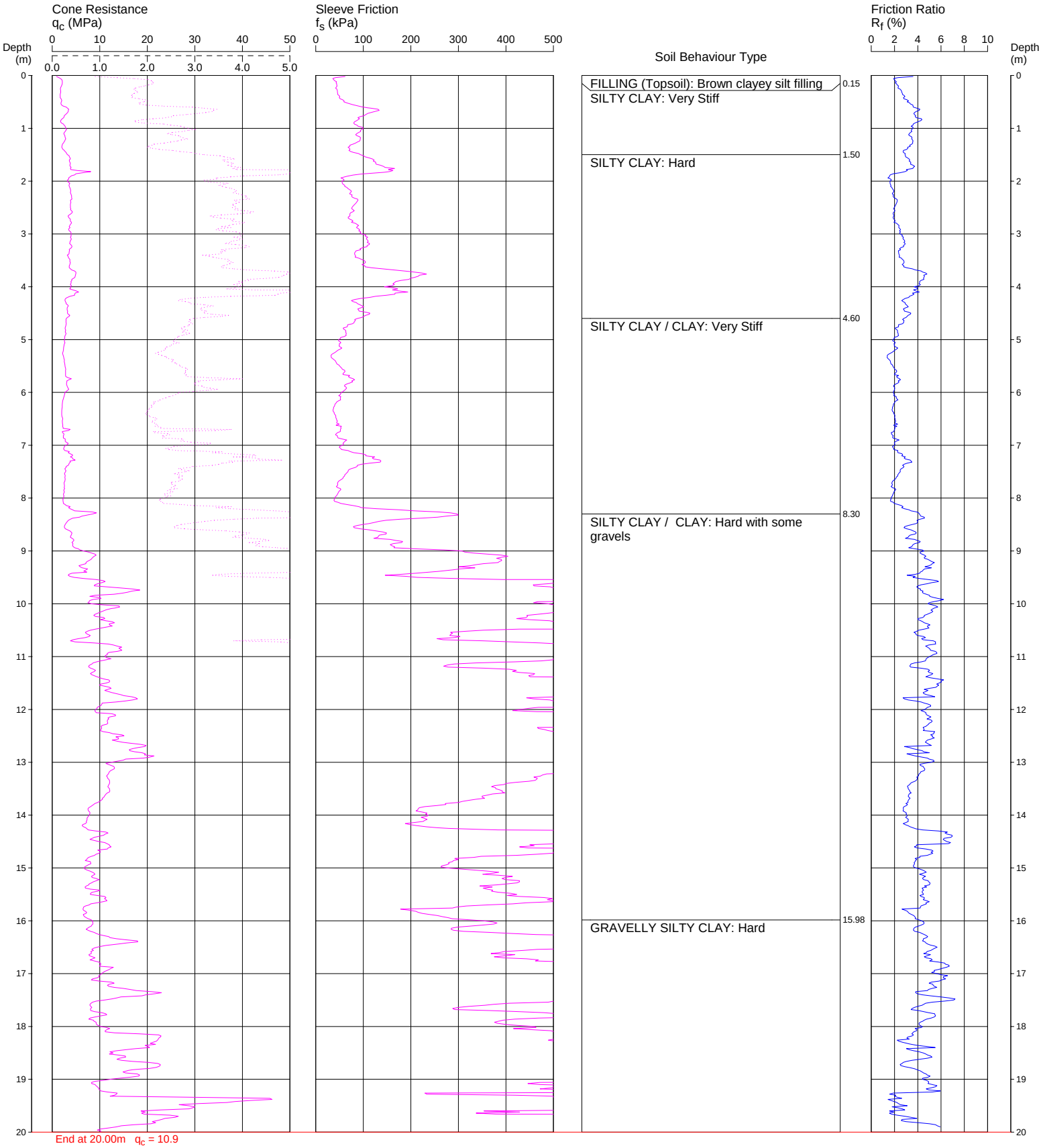
**COORDINATES:**

**CPT 1**

**Page 1 of 1**

**DATE** 20/9/2011

**PROJECT No:** 72320.03




**REMARKS:**

**File:** P:\72320.03 WAGGA WAGGA, Base Hospital Supplementary Geotechnical Investigation PGH\Field\72320.03-01.CP5
**Cone ID:** CONE-402 **Type:** 2 Standard

ConePlot Version 5.9.1


Douglas Partners
Geotechnics | Environment | Groundwater

# CONE PENETRATION TEST

**CLIENT:** HEALTH INFRASTRUCTURE

**PROJECT:** WAGGA WAGGA BASE HOSPITAL REDEVELOPMENT

**LOCATION:** EDWARD STREET, WAGGA WAGGA

**REDUCED LEVEL:** 182.9 m AHD

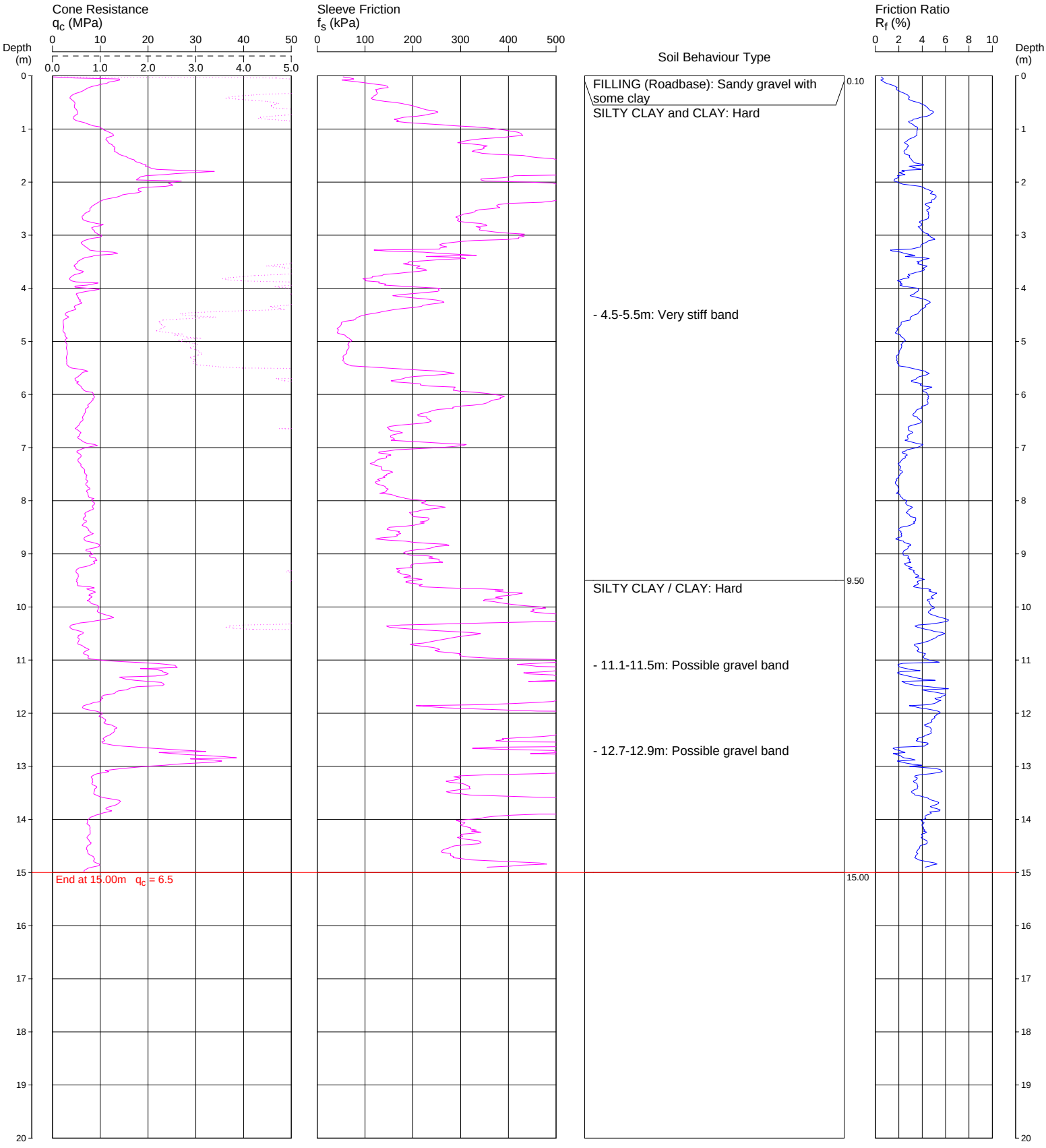
**COORDINATES:**

## CPT 2

**Page 1 of 1**

**DATE** 20/9/2011

**PROJECT No:** 72320.03




**REMARKS:**

**File:** P:\72320.03 WAGGA WAGGA, Base Hospital Supplementary Geotechnical Investigation PGH\Field\72320.03-02.CP5
**Cone ID:** CONE-402 **Type:** 2 Standard

ConePlot Version 5.9.1


Douglas Partners
Geotechnics | Environment | Groundwater

# CONE PENETRATION TEST

**CLIENT:** HEALTH INFRASTRUCTURE

**PROJECT:** WAGGA WAGGA BASE HOSPITAL REDEVELOPMENT

**LOCATION:** EDWARD STREET, WAGGA WAGGA

**REDUCED LEVEL:** 181.8 m AHD

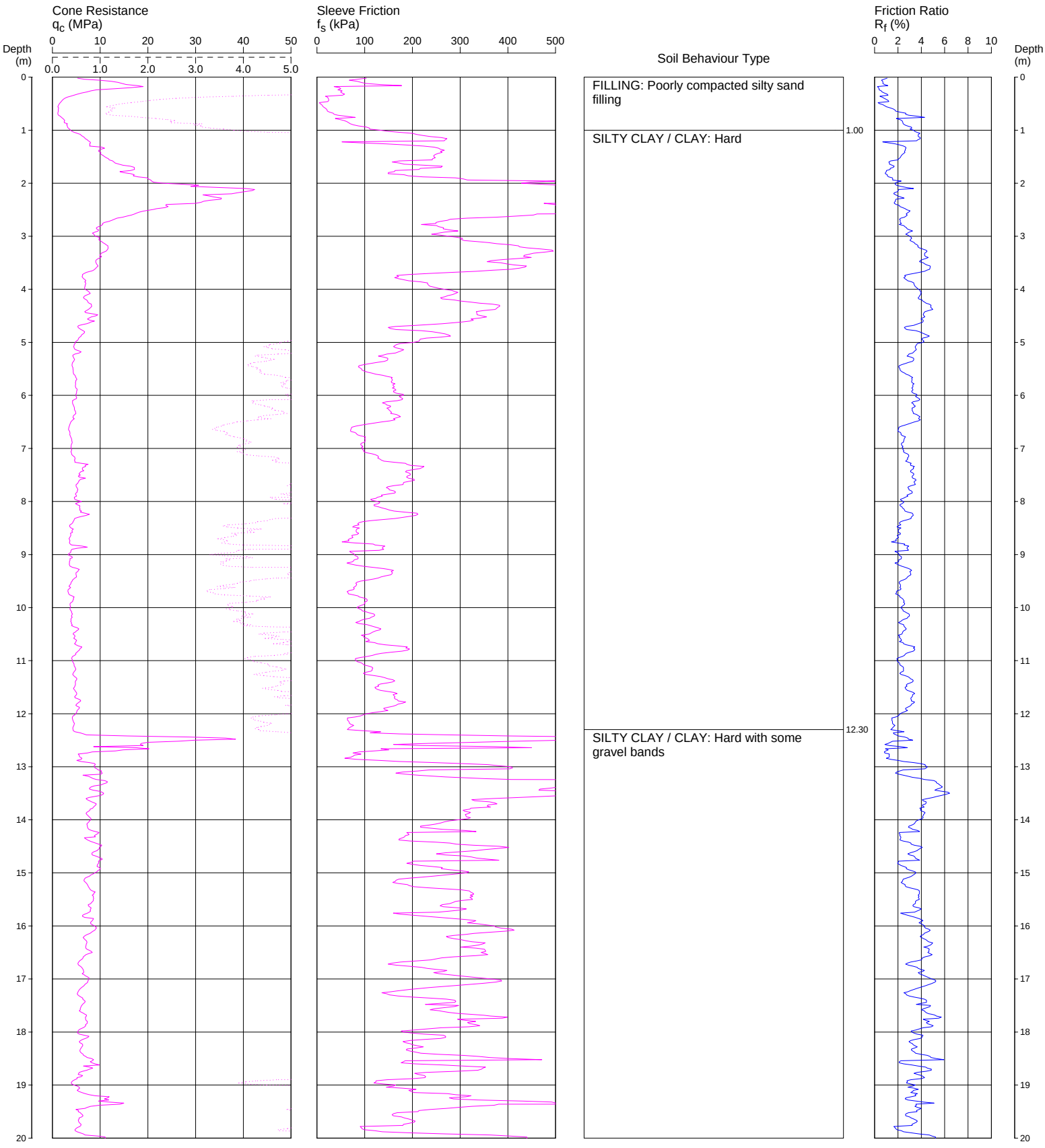
**COORDINATES:**

## CPT 3



**DATE** 20/9/2011

**PROJECT No:** 72320.03




**REMARKS:** TEST DISCONTINUED DUE TO LIMIT OF RIG HYDRAULIC THRUST

**File:** P:\72320.03 WAGGA WAGGA, Base Hospital Supplementary Geotechnical Investigation PGH\Field\72320.03-03.CP5
**Cone ID:** CONE-402 **Type:** 2 Standard

ConePlot Version 5.9.1

# CONE PENETRATION TEST

**CLIENT:** HEALTH INFRASTRUCTURE

**PROJECT:** WAGGA WAGGA BASE HOSPITAL REDEVELOPMENT

**LOCATION:** EDWARD STREET, WAGGA WAGGA

**REDUCED LEVEL:** 181.8 m AHD

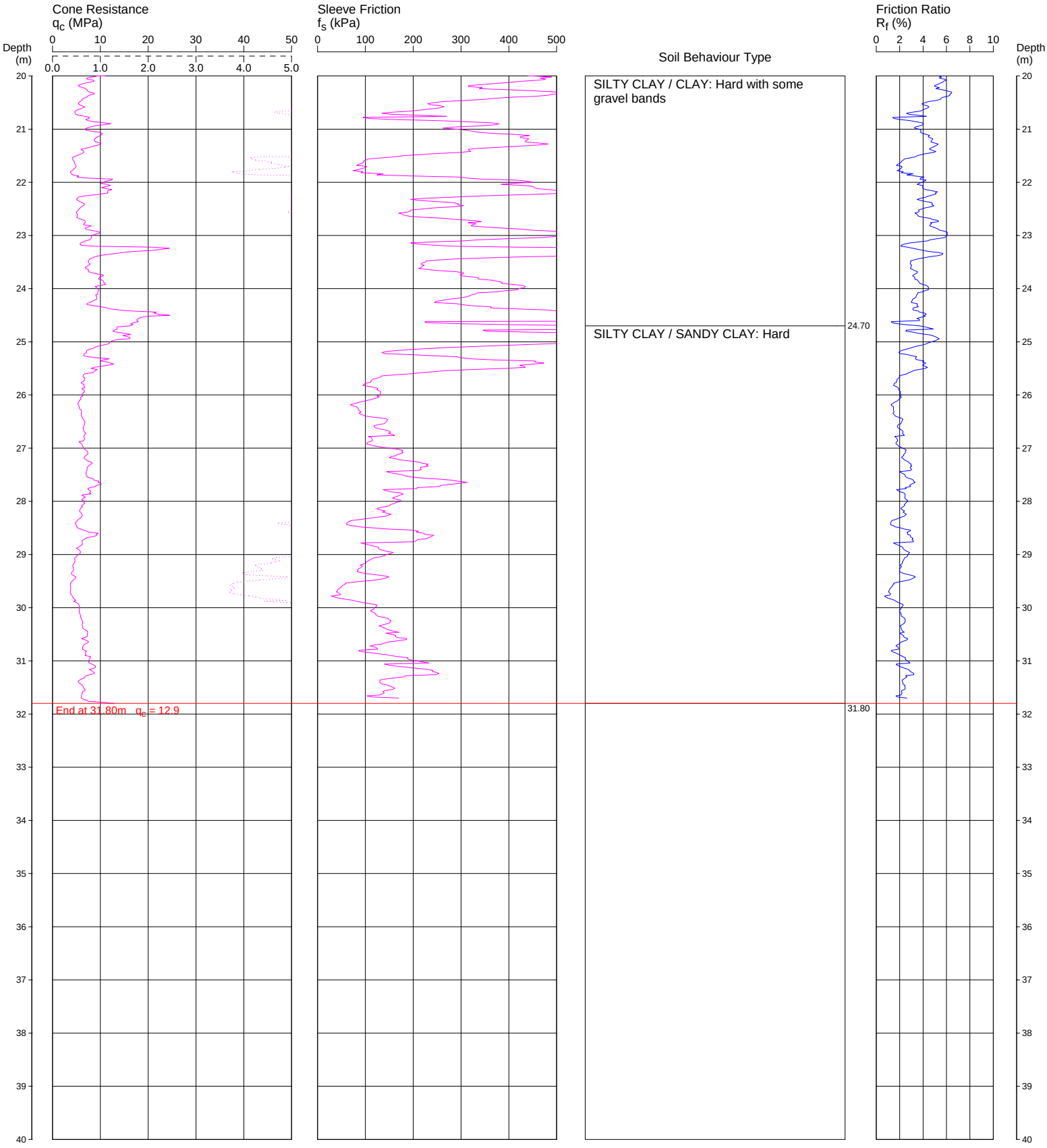
**COORDINATES:**

**CPT 3**

**Page 2 of 2**

**DATE** 20/9/2011

**PROJECT No:** 72320.03




**REMARKS:** TEST DISCONTINUED DUE TO LIMIT OF RIG HYDRAULIC THRUST

**File:** P:\72320.03 WAGGA WAGGA, Base Hospital Supplementary Geotechnical Investigation PGH\Field\72320.03-03.CP5
**Cone ID:** CONE-402 **Type:** 2 Standard

ConePlot Version 5.9.1


Douglas Partners
Geotechnics | Environment | Groundwater

# CONE PENETRATION TEST

**CLIENT:** HEALTH INFRASTRUCTURE

**PROJECT:** WAGGA WAGGA BASE HOSPITAL REDEVELOPMENT

**LOCATION:** EDWARD STREET, WAGGA WAGGA

**REDUCED LEVEL:** 182.6 m AHD

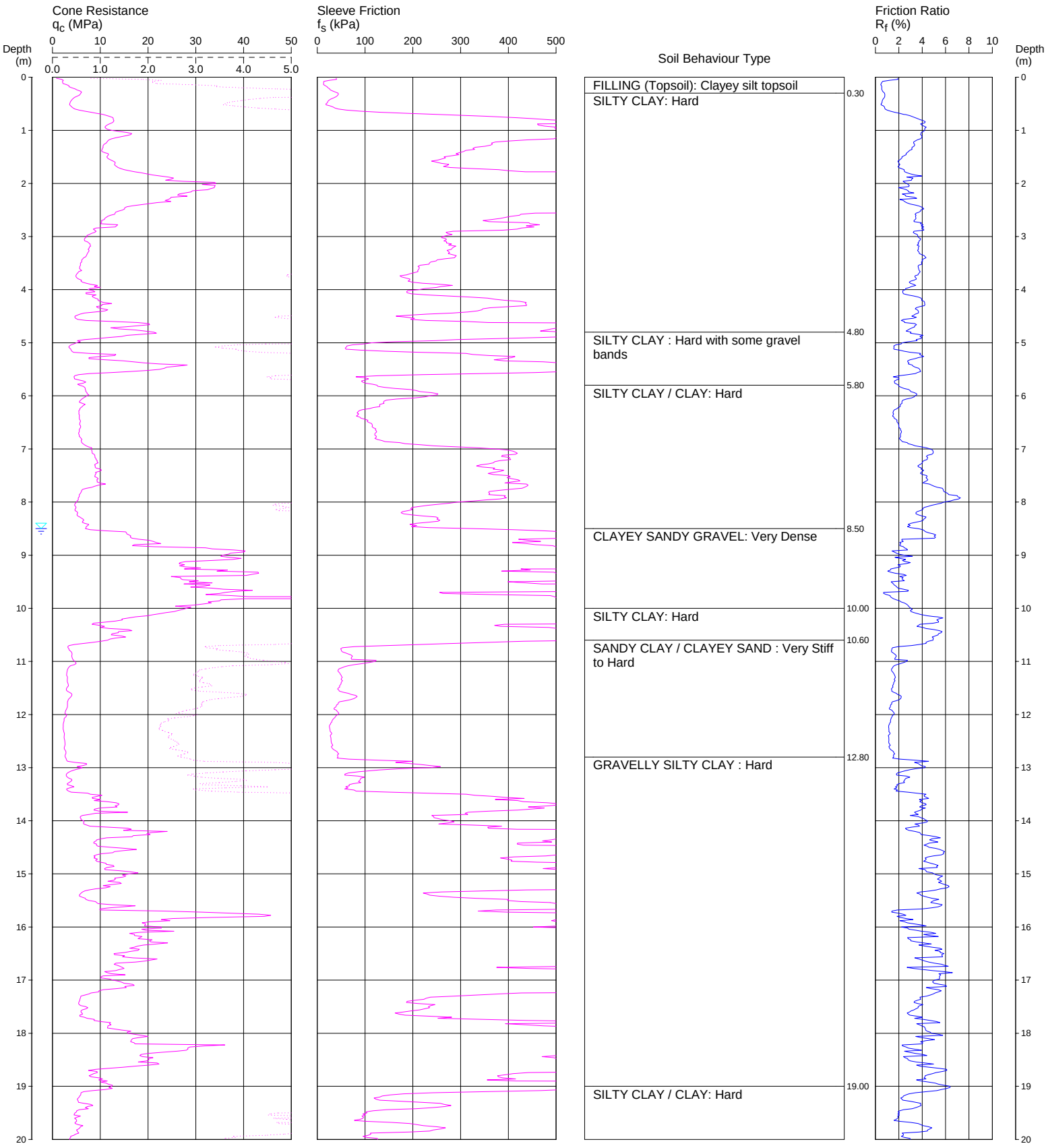
**COORDINATES:**

## CPT 4



**DATE** 19/9/2011

**PROJECT No:** 72320.03




**REMARKS:** TEST DISCONTINUED DUE TO LIMIT OF RIG HYDRAULIC THRUST
WATER LEVEL MEASURED AT 8.5 m DEPTH AFTER REMOVAL OF RODS

**File:** P:\72320.03 WAGGA WAGGA, Base Hospital Supplementary Geotechnical Investigation PGH\Field\72320.03-04.CP5
**Cone ID:** CONE-402 **Type:** 2 Standard

ConePlot Version 5.9.1


Douglas Partners
Geotechnics | Environment | Groundwater

# CONE PENETRATION TEST

**CLIENT:** HEALTH INFRASTRUCTURE

**PROJECT:** WAGGA WAGGA BASE HOSPITAL REDEVELOPMENT

**LOCATION:** EDWARD STREET, WAGGA WAGGA

**REDUCED LEVEL:** 182.6 m AHD

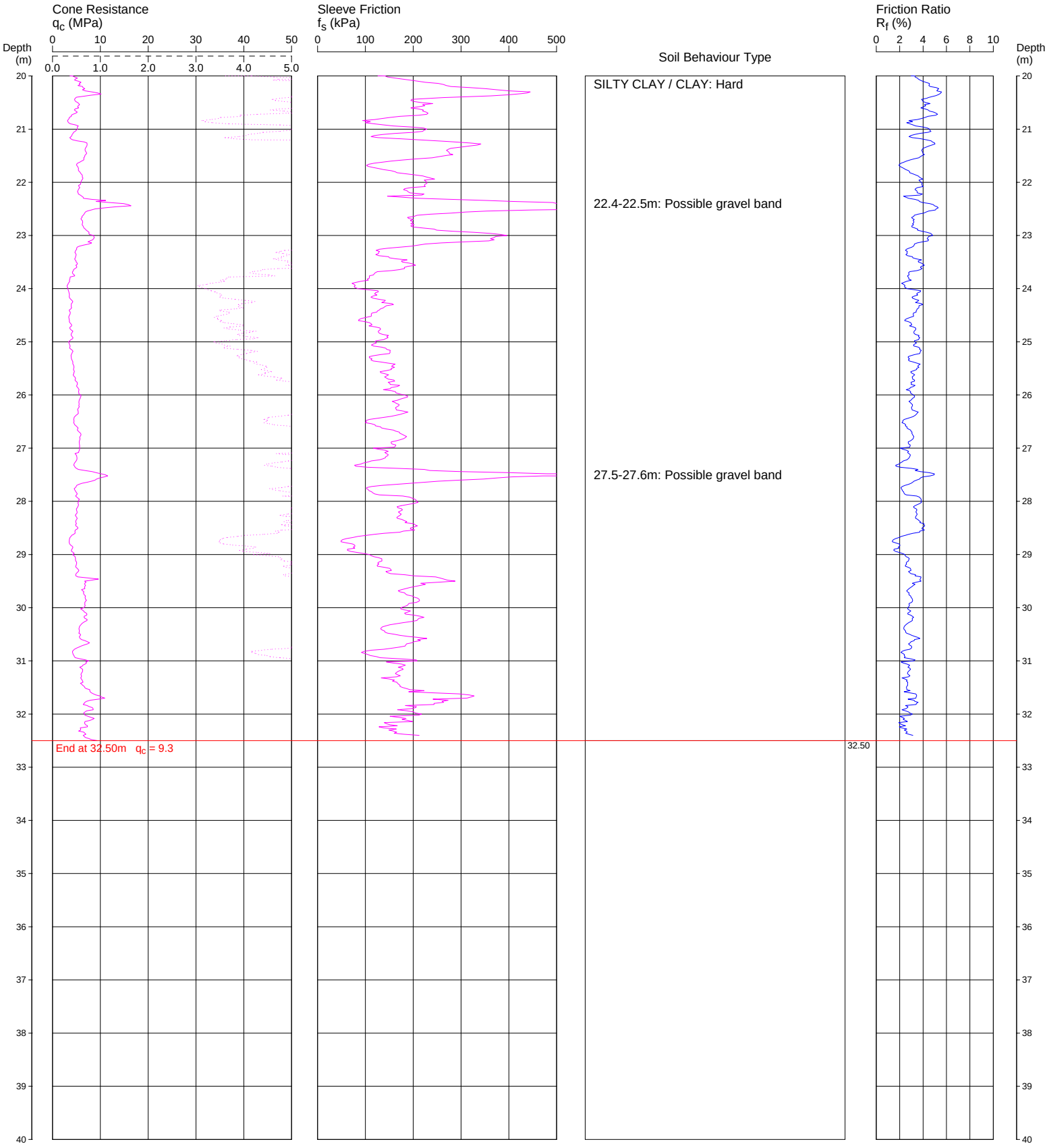
**COORDINATES:**

## CPT 4

**Page 2 of 2**

**DATE** 19/9/2011

**PROJECT No:** 72320.03




**REMARKS:** TEST DISCONTINUED DUE TO LIMIT OF RIG HYDRAULIC THRUST
WATER LEVEL MEASURED AT 8.5 m DEPTH AFTER REMOVAL OF RODS

**File:** P:\72320.03 WAGGA WAGGA, Base Hospital Supplementary Geotechnical Investigation PGH\Field\72320.03-04.CP5
**Cone ID:** CONE-402 **Type:** 2 Standard

ConePlot Version 5.9.1


Douglas Partners
Geotechnics | Environment | Groundwater

# CONE PENETRATION TEST

**CLIENT:** HEALTH INFRASTRUCTURE

**PROJECT:** WAGGA WAGGA BASE HOSPITAL REDEVELOPMENT

**LOCATION:** EDWARD STREET, WAGGA WAGGA

**REDUCED LEVEL:** 184.2 m AHD

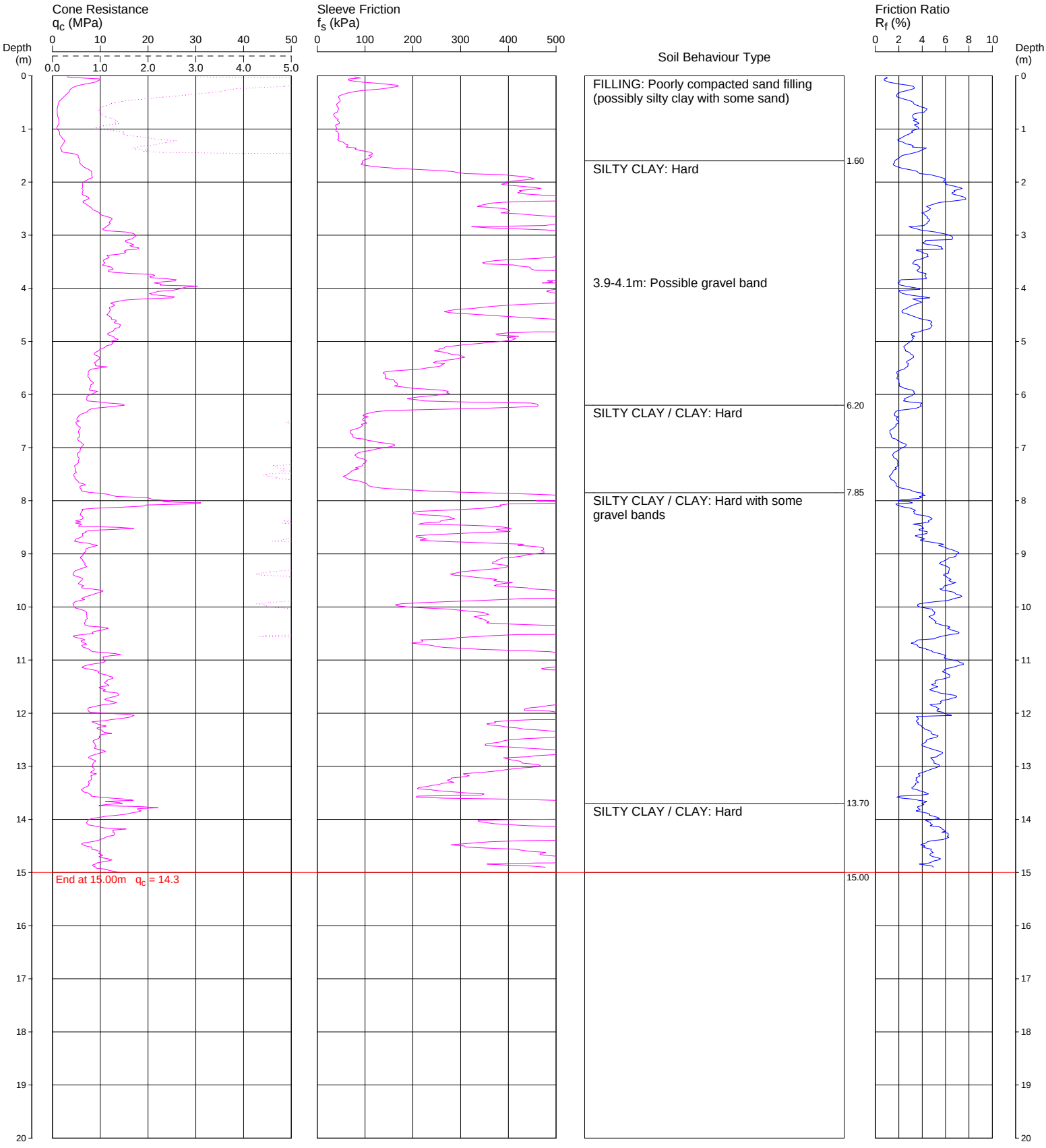
**COORDINATES:**

**CPT 5**

**Page 1 of 1**

**DATE** 20/9/2011

**PROJECT No:** 72320.03




**REMARKS:**

**File:** P:\72320.03 WAGGA WAGGA, Base Hospital Supplementary Geotechnical Investigation PGH\Field\72320.03-05.CP5
**Cone ID:** CONE-402 **Type:** 2 Standard

ConePlot Version 5.9.1


Douglas Partners
Geotechnics | Environment | Groundwater

# Appendix D

Laboratory Results

Douglas Partners
Geotechnics | Environment | Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666
Fax (02) 9809 4095

# Results of Moisture Content, Plasticity and Linear Shrinkage Tests

| | | | |
|---|---|---|---|
| **Client:** | HEALTH INFRASTRUCTURE | **Project No:** | 72320 |
| | | **Report No:** | S11-075 B |
| **Project:** | WAGGA WAGGA BASE HOSPITAL | **Report Date:** | 27-04-11 |
| | | **Date Sampled:** | 04-04-11 |
| **Location:** | WAGGA WAGGA | **Date of Test:** | 19-04-11 |
| | | **Page:** | 1 of 1 |

| Test Location | Depth (m) | Description | Code | $W_F$ % | $W_L$ % | $W_P$ % | PI % | *LS % |
|---|---|---|---|---|---|---|---|---|
| BH 101 | 4.00 – 4.45 | SILTY CLAY – Orange brown silty clay with some ironstone gravel | 2,5 | - | 35 | 18 | 17 | 11.0 |
| BH 106 | 2.50 – 2.95 | SILTY CLAY – Orange brown silty clay with traces of ironstone gravel | 2,5 | - | 33 | 18 | 15 | 10.0 |
| BH 108 | 1.40 – 1.85 | SILTY CLAY – Red brown silty clay | 2,5 | - | 28 | 15 | 13 | 8.5 |
| BH 109 | 4.00 – 4.45 | SILTY CLAY – Orange brown silty clay | 2,5 | - | 34 | 17 | 17 | 10.5 |

**Legend:**

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

**Test Methods:**

Moisture Content: AS 1289 2.1.1
Liquid Limit: AS 1289.3.1.2
Plastic Limit: AS 1289 3.2.1
Plasticity Index: AS 1289 3.3.1
Linear Shrinkage: AS 1289 3.4.1

**Code:**

**Sample history for plasticity tests**

1. Air dried
2. Low temperature (<50°C) oven dried
3. Oven (105°C) dried
4. Unknown

**Method of preparation for plasticity tests**

5. Dry sieved
6. Wet sieved
7. Natural

*Specify if sample crumbled CR or curled CU

**Sampling Methods:** Sampled by Engineering Department

**Remarks:**

NATA Accredited Laboratory Number: 828

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

Tested: MO
Checked: NW

Norman Weimann
Laboratory Manager

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666
Fax (02) 9809 4095

# Determination of Emerson Class Number of Soil

| | | | |
|---|---|---|---|
| **Client:** | **HEALTH INFRASTRUCTURE** | **Project No:** | 72320 |
| | | **Report No:** | S11-075 A |
| **Project:** | WAGGA WAGGA BASE HOSPITAL | **Report Date:** | 27-04-11 |
| | | **Date Sampled:** | 04-04-11 |
| **Location:** | WAGGA WAGGA | **Date of Test:** | 27-04-11 |
| | | **Page:** | 1 of 1 |

| Sample No. | Depth (m) | Description | Water Type | Water Temp | Class No. |
|---|---|---|---|---|---|
| BH 102 | 1.00 – 1.45 | SILTY CLAY – Orange brown silty clay with some ironstone gravel and traces of sand | Distilled | 20°C | 3 |
| BH 106 | 4.00 – 4.45 | SILTY CLAY – Mottled orange brown and grey silty clay with traces of ironstone gravel and sand | Distilled | 20°C | 3 |

**Test Methods:** AS 1289 3.8.1

**Sampling Methods:** AS 1289.1.2.1, AS 1289.1.1

**Remarks:**

NATA Accredited Laboratory Number: 828

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

Tested: MO
Checked: NW

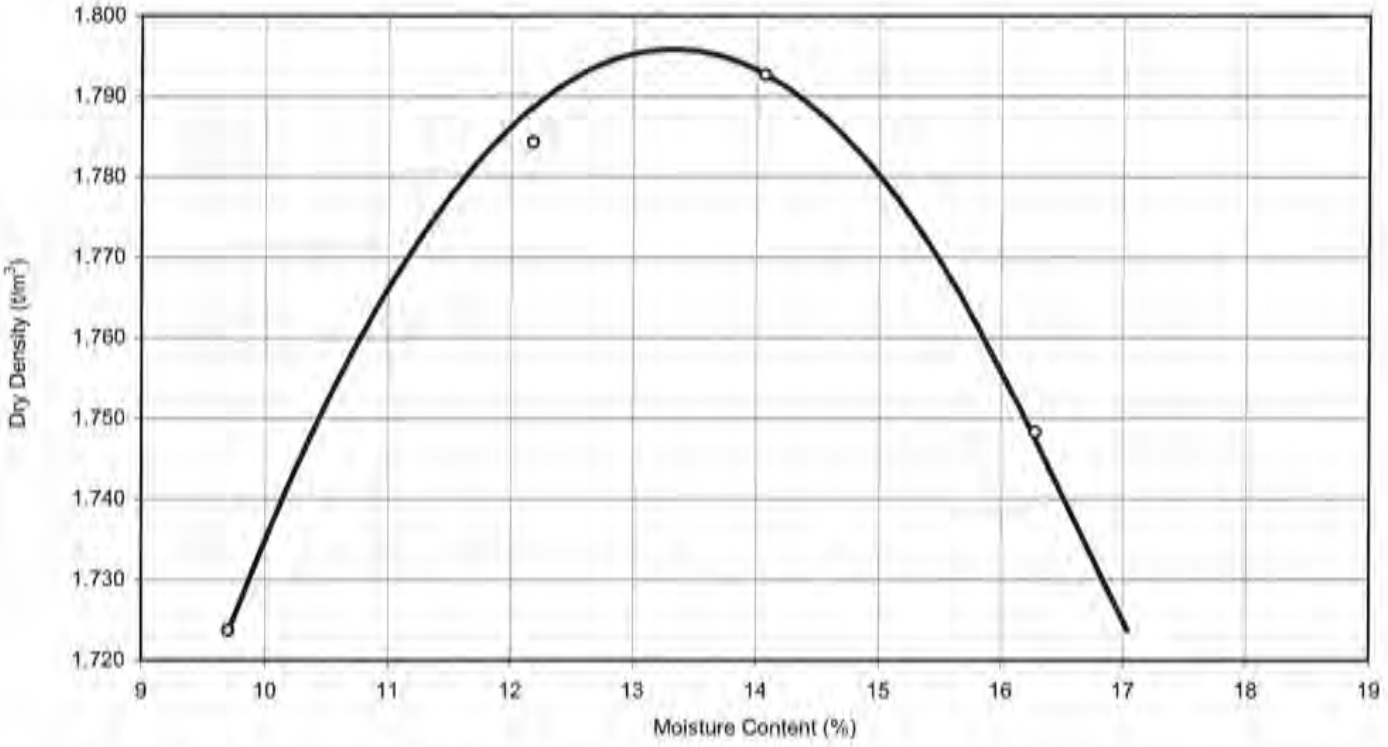
Norman Weimann
Laboratory Manager

Douglas Partners
Geotechnics | Environment | Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666
Fax (02) 9809 4095

# Results of Compaction Test

| | | | |
|---|---|---|---|
| **Client :** | HEALTH INFRASTRUCTURE | **Project No. :** | 72320 |
| | | **Report No. :** | S11 - 063 A |
| **Project :** | WAGGA WAGGA BASE HOSPITAL REDEVELOP | **Report Date :** | 19/04/2011 |
| **Location :** | EDWARD STREET - WAGGA WAGGA | **Date of Test:** | 11/04/2011 |
| | | **Page:** | 1 of 1 |




**Sample Details:** **Location:** BH 101
**Depth:** 0.3m

**Particles > 19mm:** 0%

**Description:** SILTY CLAY - Red orange silty clay

| | |
|---|---|
| **Maximum Dry Density:** | **1.80 t/m³** |
| **Optimum Moisture Content:** | **13.5 %** |

**Remarks:**

**Test Methods:** AS1289.5.1.1, AS1289.2.1.1

**Sampling Methods:** By Engineering Dept

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

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

| | |
|---|---|
| Tested: | RA |
| Checked: | NW |

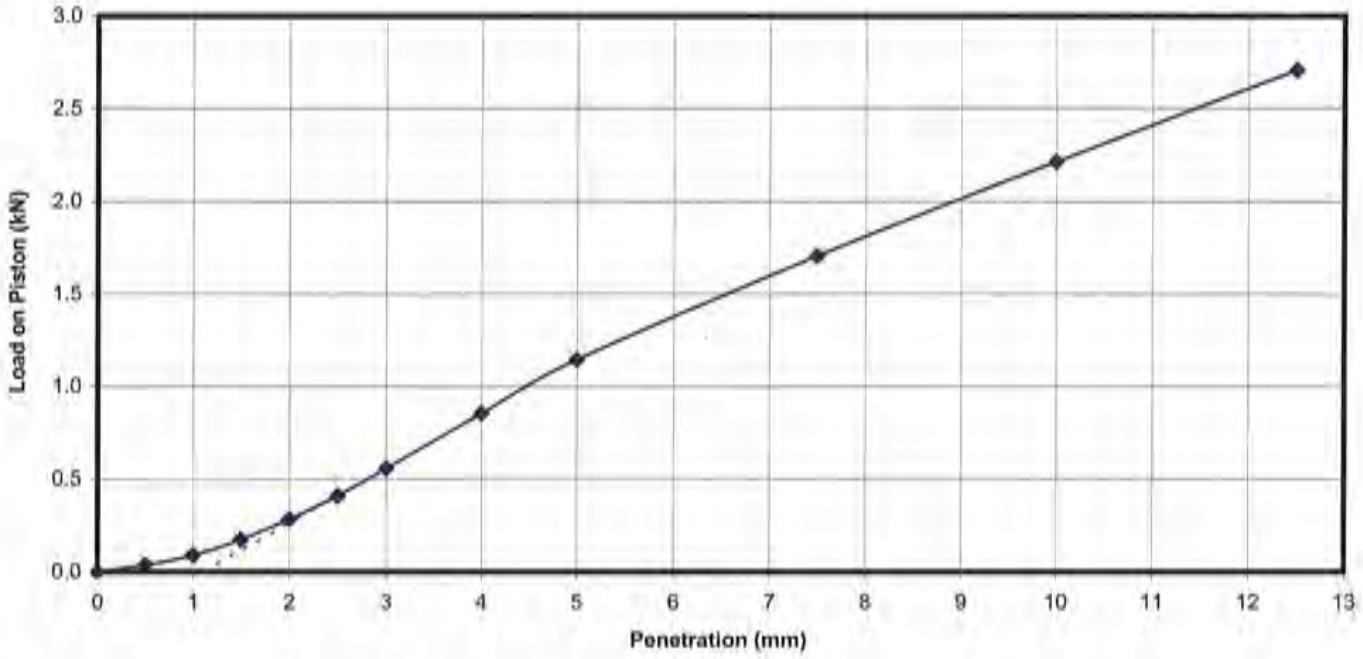
Norman Weimann
Laboratory Manager

Douglas Partners
Geotechnics / Environment / Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666
Fax (02) 9809 4095

# Result of California Bearing Ratio Test

| | | | |
|---|---|---|---|
| **Client :** | HEALTH INFRASTRUCTURE | **Project No. :** | 72320 |
| | | **Report No. :** | S11 - 063 B |
| **Project :** | WAGGA WAGGA BASE HOSPITAL | **Report Date :** | 19/04/2011 |
| | | **Date Sampled :** | 1-7/04/2011 |
| **Location :** | EDWARD STREET - WAGGA WAGGA | **Date of Test:** | 14/04/2011 |
| **Test Location :** | BH101 | | |
| **Depth / Layer :** | 0.3 | **Page:** | 1 of 1 |




**Description:** SILTY CLAY - Red orange silty clay

**Test Method(s):** AS 1289.6.1.1, AS 1289.2.1.1

**Sampling Method(s):** Sampled by Engineering Dept

**Percentage > 19mm:** 0.0%

**LEVEL OF COMPACTION:** 100% of STD MDD
**MOISTURE RATIO:** 102% of STD OMC
**SURCHARGE:** 4.5 kg
**SOAKING PERIOD:** 4 days
**SWELL:** 0.8%

| CONDITION | | MOISTURE CONTENT % | DRY DENSITY t/m$^3$ |
|---|---|---|---|
| At compaction | | 13.6 | 1.79 |
| After soaking | | 17.1 | 1.78 |
| After test | Top 30mm of sample | 16.6 | - |
| | Remainder of sample | 15.2 | - |
| Field values | | 9.7 | - |
| Standard Compaction | | 13.3 | 1.80 |

| RESULTS | | |
|---|---|---|
| TYPE | PENETRATION | CBR (%) |
| BOTTOM | 2.5 mm | 6 |
| | 5.0 mm | 7 |

NATA ACCREDITED FOR TECHNICAL COMPETENCE

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

Tested: RA
Checked: NW

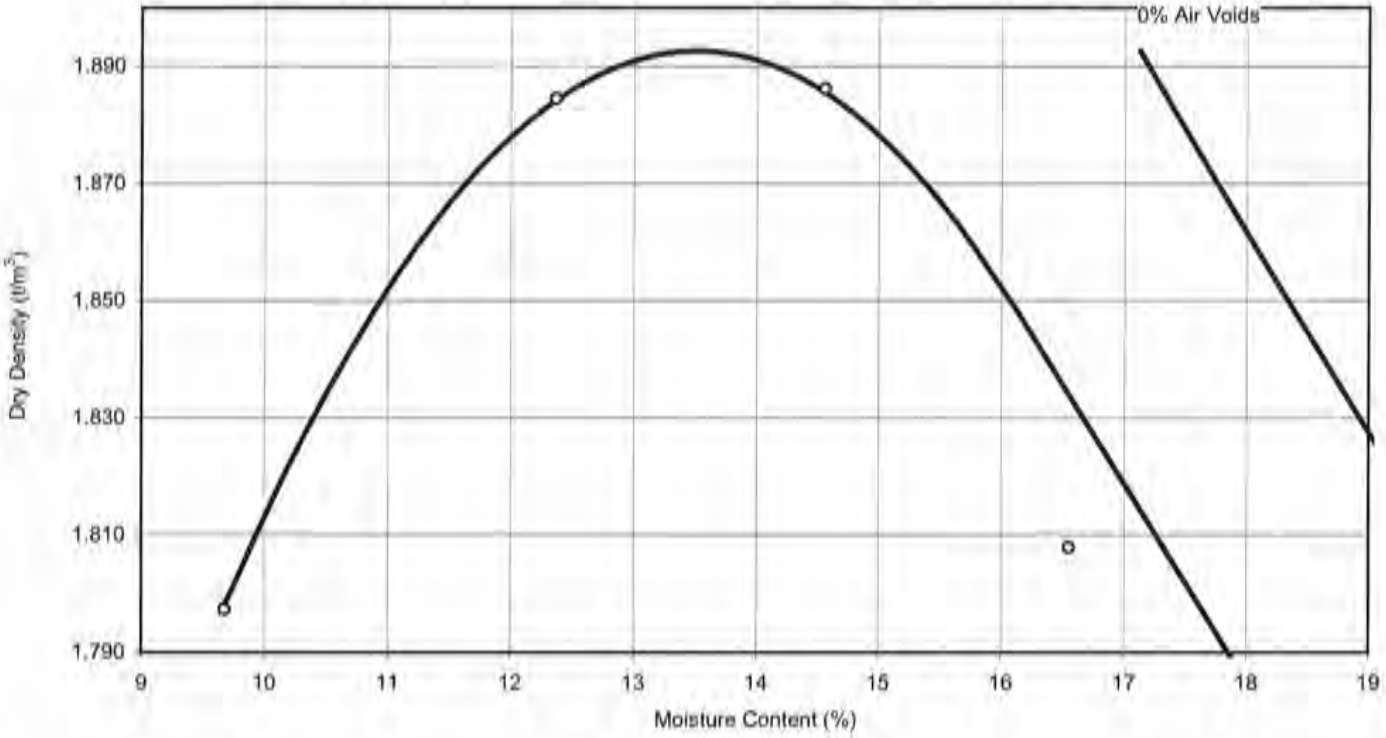
Norman Weimann
Laboratory Manager

Douglas Partners
Geotechnics | Environment | Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666
Fax (02) 9809 4095

# Results of Compaction Test

| | | | |
|---|---|---|---|
| **Client :** | HEALTH INFRASTRUCTURE | **Project No. :** | 72320 |
| | | **Report No. :** | S11 - 063 C |
| **Project :** | WAGGA WAGGA BASE HOSPITAL REDEVELOP | **Report Date :** | 19/04/2011 |
| **Location :** | EDWARD STREET - WAGGA WAGGA | **Date of Test:** | 11/04/2011 |
| | | **Page:** | 1 of 1 |




**Sample Details:** **Location:** BH 103
**Depth:** 0.5m

**Particles > 19mm:** 0%

**Description:** CLAY - Red orange clay with some gravel

| | |
|---|---|
| **Maximum Dry Density:** | **1.89 t/m³** |
| **Optimum Moisture Content:** | **13.5 %** |

**Remarks:**

**Test Methods:** AS1289.5.1.1, AS1289.2.1.1

**Sampling Methods:** By Engineering Dept

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

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

| | |
|---|---|
| Tested: | RA |
| Checked: | NW |

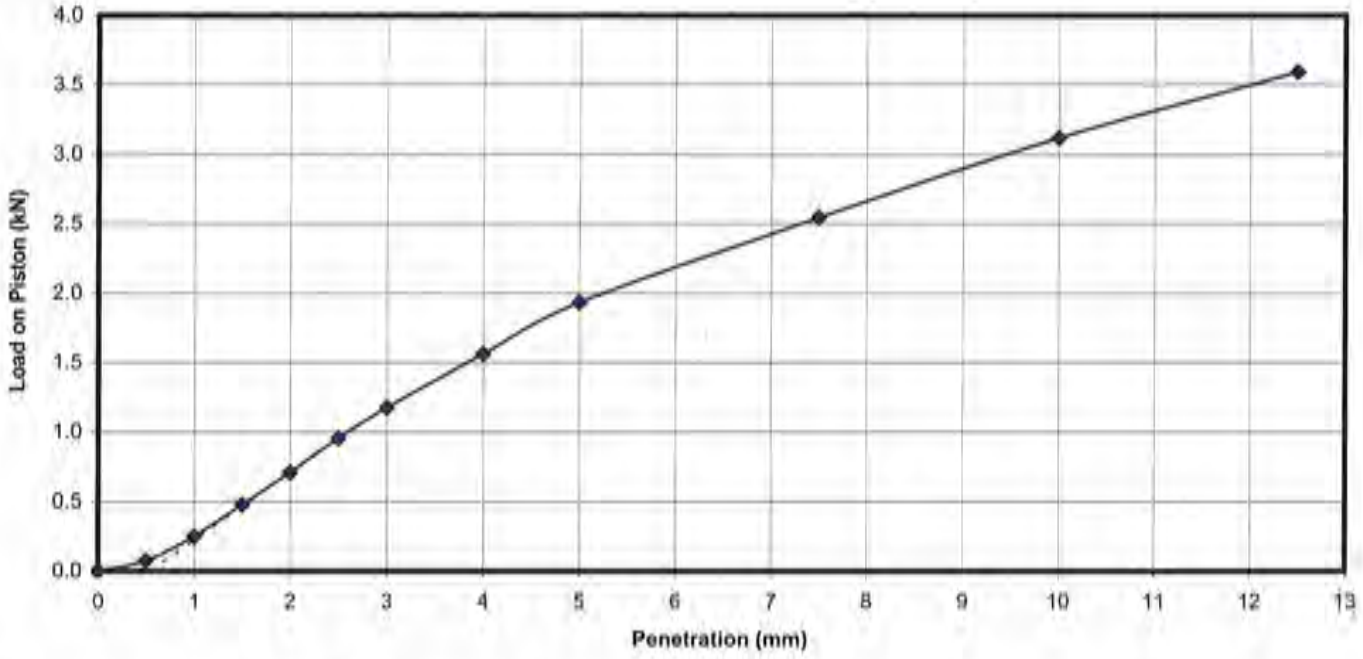
Norman Weimann
Laboratory Manager

Douglas Partners
Geotechnics / Environment / Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666
Fax (02) 9809 4095

# Result of California Bearing Ratio Test

| | | | |
|---|---|---|---|
| **Client :** | HEALTH INFRASTRUCTURE | **Project No. :** | 72320 |
| | | **Report No. :** | S11 - 063 D |
| **Project :** | WAGGA WAGGA BASE HOSPITAL | **Report Date :** | 19/04/2011 |
| | | **Date Sampled :** | 1-7/04/2011 |
| **Location :** | EDWARD STREET - WAGGA WAGGA | **Date of Test:** | 14/04/2011 |
| **Test Location :** | BH103 | | |
| **Depth / Layer :** | 0.5 | **Page:** | 1 of 1 |




**Description:** CLAY - Red orange clay with some gravel

**Test Method(s):** AS 1289.6.1.1, AS 1289.2.1.1

**Sampling Method(s):** Sampled by Engineering Dept

**Percentage > 19mm:** 0.0%

**LEVEL OF COMPACTION:** 100% of STD MDD
**MOISTURE RATIO:** 98% of STD OMC
**SURCHARGE:** 4.5 kg
**SOAKING PERIOD:** 4 days
**SWELL:** 0.3%

| CONDITION | | MOISTURE CONTENT % | DRY DENSITY t/m³ |
|---|---|---|---|
| At compaction | | 13.2 | 1.90 |
| After soaking | | 14.8 | 1.89 |
| After test | Top 30mm of sample | 14.3 | - |
| | Remainder of sample | 13.7 | - |
| Field values | | 12.4 | - |
| Standard Compaction | | 13.5 | 1.89 |

| RESULTS | | |
|---|---|---|
| TYPE | PENETRATION | CBR (%) |
| BOTTOM | 2.5 mm | 9 |
| | 5.0 mm | 10 |

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

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

Tested: RA
Checked: NW

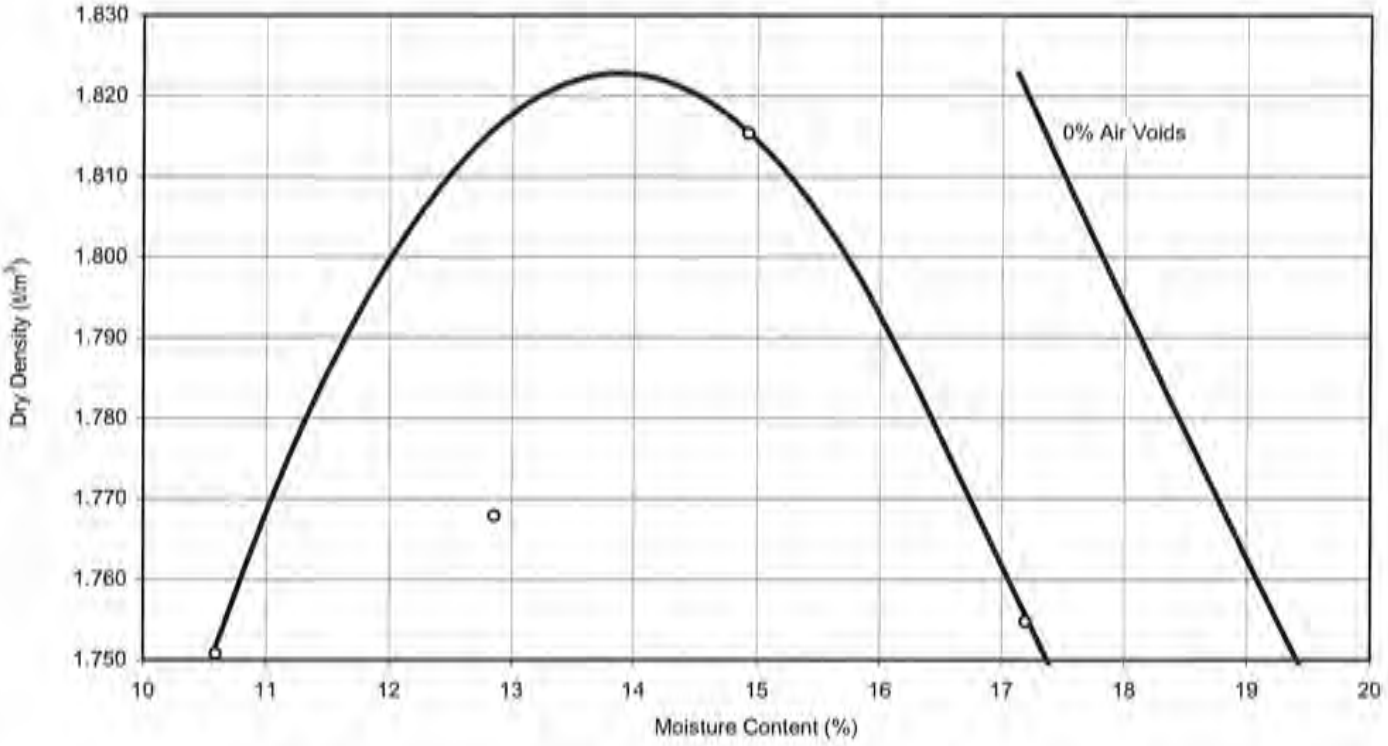
Norman Weimann
Laboratory Manager

Douglas Partners
Geotechnics / Environment / Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666
Fax (02) 9809 4095

# Results of Compaction Test

| | | | |
|---|---|---|---|
| **Client :** | HEALTH INFRASTRUCTURE | **Project No. :** | 72320 |
| | | **Report No. :** | S11 - 063 E |
| **Project :** | WAGGA WAGGA BASE HOSPITAL REDEVELOP | **Report Date :** | 19/04/2011 |
| **Location :** | EDWARD STREET - WAGGA WAGGA | **Date of Test:** | 11/04/2011 |
| | | **Page:** | 1 of 1 |




**Sample Details:** **Location:** BH 106
**Depth:** 0.3m

**Particles > 19mm:** 0%

**Description:** SILTY CLAY - Brown silty clay

| | |
|---|---|
| **Maximum Dry Density:** | **1.82 t/m³** |
| **Optimum Moisture Content:** | **14.0 %** |

**Remarks:**

**Test Methods:** AS1289.5.1.1, AS1289.2.1.1

**Sampling Methods:** By Engineering Dept

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

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

| | |
|---|---|
| Tested: | RA |
| Checked: | NW |

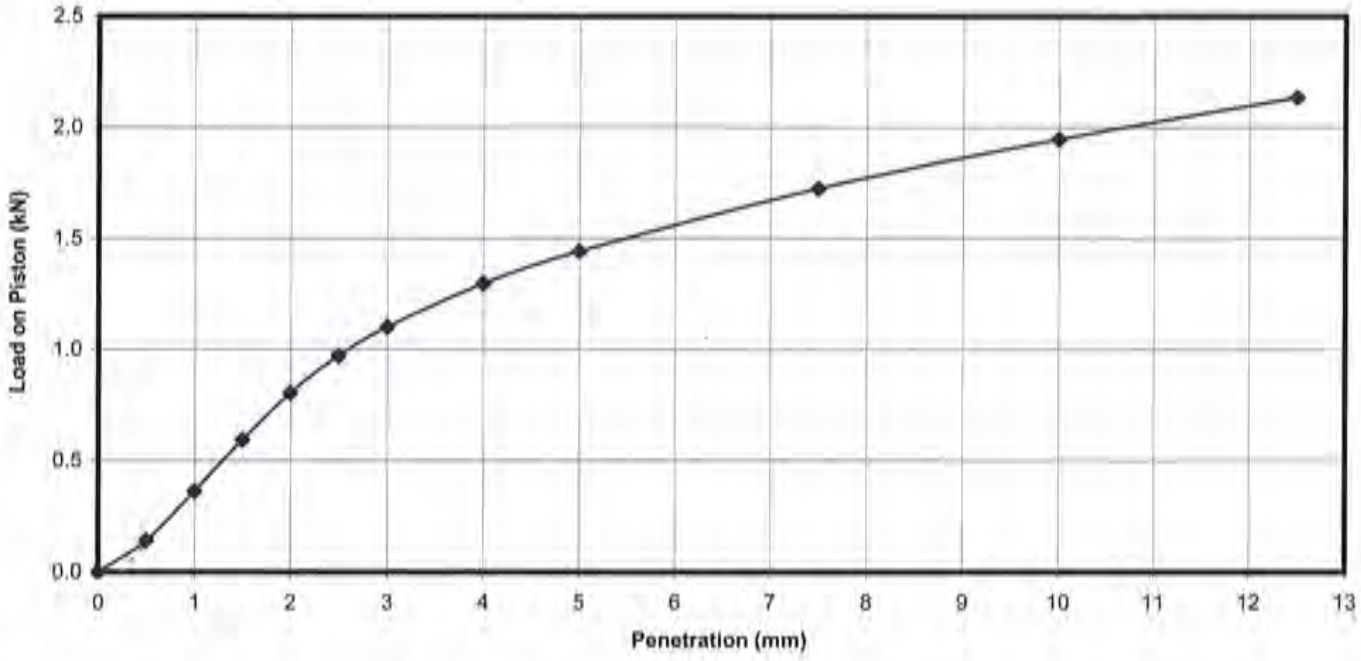
Norman Weimann
Laboratory Manager

Douglas Partners
Geotechnics / Environment / Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666
Fax (02) 9809 4095

# Result of California Bearing Ratio Test

| | | | |
|---|---|---|---|
| **Client :** | HEALTH INFRASTRUCTURE | **Project No. :** | 72320 |
| | | **Report No. :** | S11 - 063 F |
| **Project :** | WAGGA WAGGA BASE HOSPITAL | **Report Date :** | 19/04/2011 |
| | | **Date Sampled :** | 1-7/04/2011 |
| **Location :** | EDWARD STREET - WAGGA WAGGA | **Date of Test:** | 14/04/2011 |
| **Test Location :** | BH106 | | |
| **Depth / Layer :** | 0.3 | **Page:** | 1 of 1 |




**Description:** SILTY CLAY - Brown silty clay

**Test Method(s):** AS 1289.6.1.1, AS 1289.2.1.1

**Sampling Method(s):** Sampled by Engineering Dept

**Percentage > 19mm:** 0.0%

**LEVEL OF COMPACTION:** 100% of STD MDD
**MOISTURE RATIO:** 98% of STD OMC
**SURCHARGE:** 4.5 kg
**SOAKING PERIOD:** 4 days
**SWELL:** 0.6%

| CONDITION | | MOISTURE CONTENT % | DRY DENSITY t/m³ |
|---|---|---|---|
| At compaction | | 13.7 | 1.83 |
| After soaking | | 17.4 | 1.82 |
| After test | Top 30mm of sample | 17.7 | - |
| | Remainder of sample | 16.2 | - |
| Field values | | 12.9 | - |
| Standard Compaction | | 13.9 | 1.82 |

| RESULTS | | |
|---|---|---|
| TYPE | PENETRATION | CBR (%) |
| BOTTOM | 2.5 mm | 8 |
| | 5.0 mm | 7 |

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

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

Tested: RA
Checked: NW

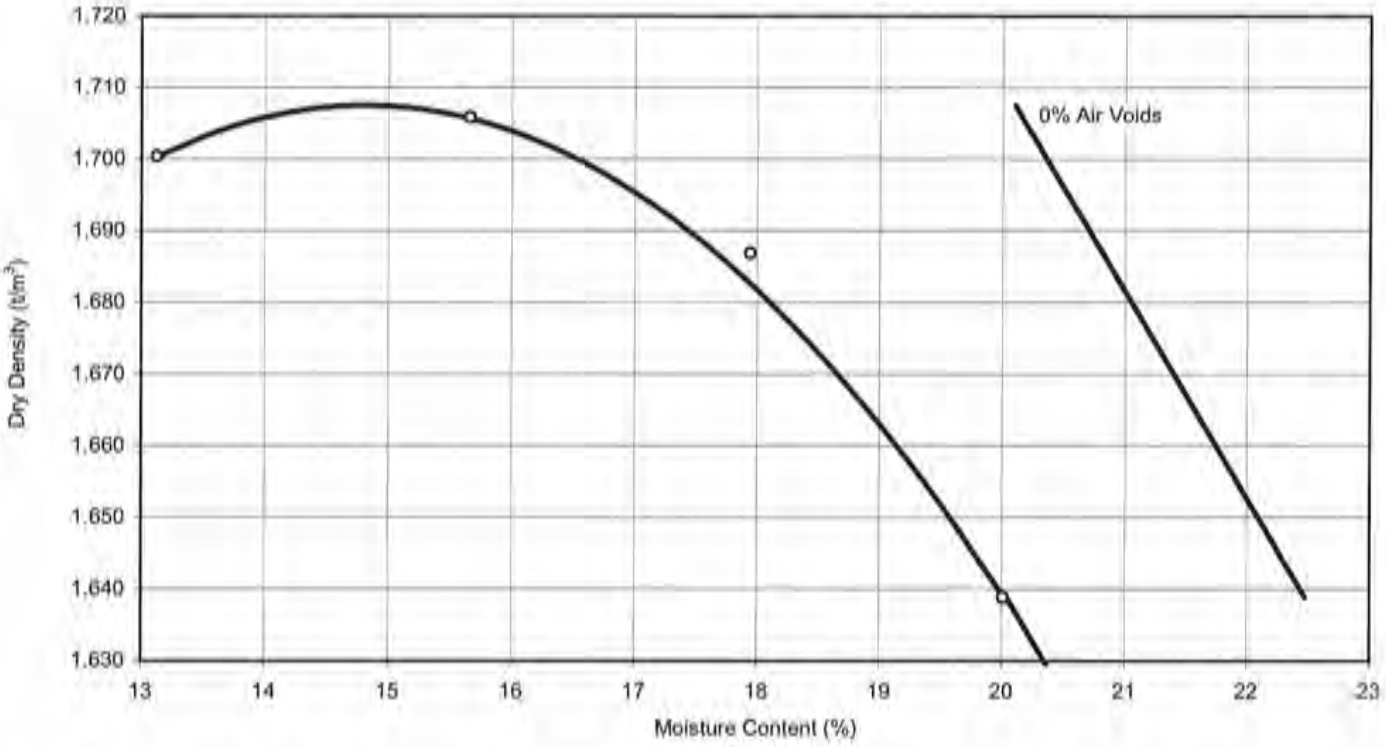
Norman Weimann
Laboratory Manager

Douglas Partners
Geotechnics | Environment | Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666
Fax (02) 9809 4095

# Results of Compaction Test

| | | | |
|---|---|---|---|
| **Client :** | HEALTH INFRASTRUCTURE | **Project No. :** | 72320 |
| | | **Report No. :** | S11 - 063 G |
| **Project :** | WAGGA WAGGA BASE HOSPITAL REDEVELOP | **Report Date :** | 19/04/2011 |
| **Location :** | EDWARD STREET - WAGGA WAGGA | **Date of Test:** | 11/04/2011 |
| | | **Page:** | 1 of 1 |




**Sample Details:** **Location:** BH 109
**Depth:** 0.4m

**Particles > 19mm:** 0%

**Description:** CLAY - Brown clay

| | |
|---|---|
| **Maximum Dry Density:** | **1.71 t/m³** |
| **Optimum Moisture Content:** | **15.0 %** |

**Remarks:**

**Test Methods:** AS1289.5.1.1, AS1289.2.1.1

**Sampling Methods:** By Engineering Dept

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

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

| | |
|---|---|
| Tested: | RA |
| Checked: | NW |

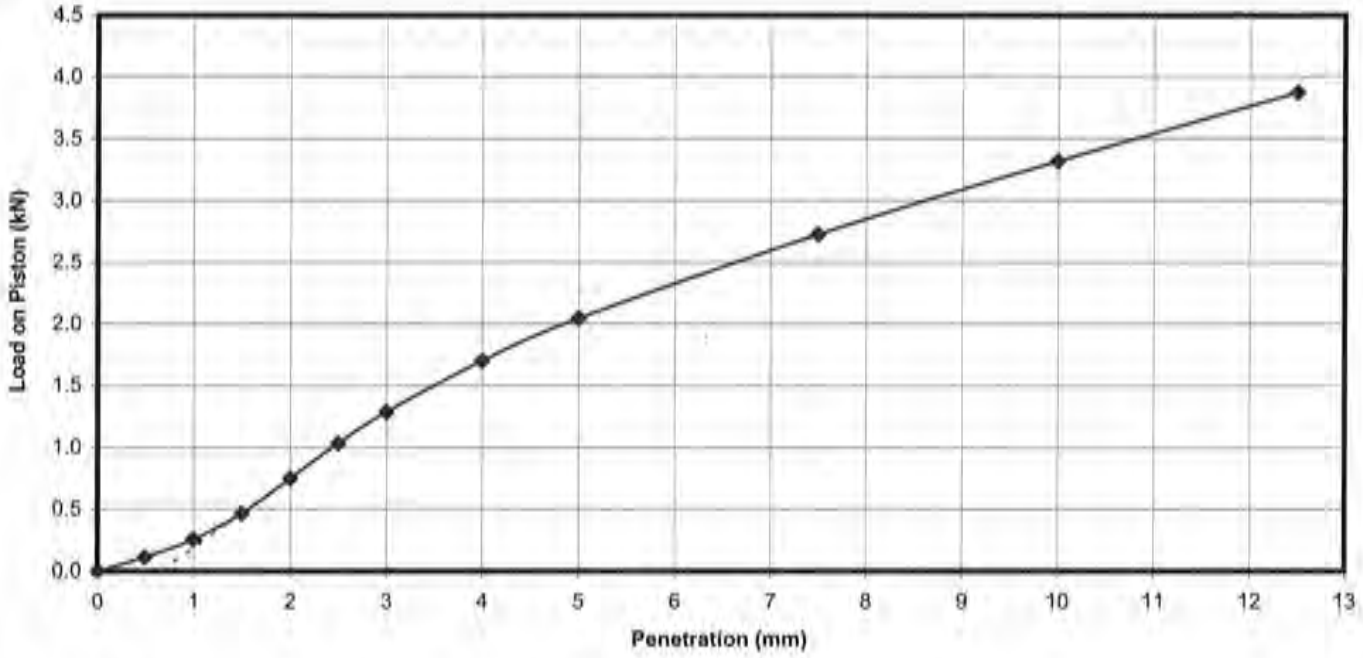
Norman Weimann
Laboratory Manager

**Douglas Partners**
*Geotechnics / Environment / Groundwater*

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666
Fax (02) 9809 4095

# Result of California Bearing Ratio Test

| | | | |
|---|---|---|---|
| **Client :** | HEALTH INFRASTRUCTURE | **Project No. :** | 72320 |
| | | **Report No. :** | S11 - 063 H |
| **Project :** | WAGGA WAGGA BASE HOSPITAL | **Report Date :** | 19/04/2011 |
| | | **Date Sampled :** | 1-7/04/2011 |
| **Location :** | EDWARD STREET - WAGGA WAGGA | **Date of Test:** | 14/04/2011 |
| **Test Location :** | BH109 | | |
| **Depth / Layer :** | 0.4 | **Page:** | 1 of 1 |




**Description:** CLAY - Brown clay

**Test Method(s):** AS 1289.6.1.1, AS 1289.2.1.1

**Sampling Method(s):** Sampled by Engineering Dept

**Percentage > 19mm:** 0.0%

**LEVEL OF COMPACTION:** 101% of STD MDD
**MOISTURE RATIO:** 92% of STD OMC
**SURCHARGE:** 4.5 kg
**SOAKING PERIOD:** 4 days
**SWELL:** 1.3%

| CONDITION | | MOISTURE CONTENT % | DRY DENSITY t/m$^3$ |
|---|---|---|---|
| At compaction | | 13.6 | 1.72 |
| After soaking | | 18.7 | 1.70 |
| After test | Top 30mm of sample | 20.5 | - |
| | Remainder of sample | 18.4 | - |
| Field values | | 15.7 | - |
| Standard Compaction | | 14.8 | 1.71 |

| RESULTS | | |
|---|---|---|
| TYPE | PENETRATION | CBR (%) |
| BOTTOM | 2.5 mm | 10 |
| | 5.0 mm | 11 |

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

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

Tested: RA
Checked: NW

Norman Weimann
Laboratory Manager

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

# CERTIFICATE OF ANALYSIS 54174

**Client:**
**Douglas Partners**
96 Hermitage Rd
West Ryde
NSW 2114

**Attention:** Peter Hartcliff

**Sample log in details:**

| | |
|---|---|
| Your Reference: | **72320, Wagga Wagga Base Hospital** |
| No. of samples: | 4 Soils |
| Date samples received / completed instructions received | 12/04/11 / 12/04/11 |

**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: | 19/04/11 / 19/04/11 |
| Date of Preliminary Report: | Not issued |

NATA accreditation number 2901. This document shall not be reproduced except in full.
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:**

Nick Sarlamis
Inorganics Supervisor

| Miscellaneous Inorg - soil | | | | | |
|---|---|---|---|---|---|
| Our Reference: | UNITS | 54174-1 | 54174-2 | 54174-3 | 54174-4 |
| Your Reference | ---------- | BH101/5.5-5.95 | BH106/4.0-4.45 | BH108/2.5-2.95 | BH107A/11.5-11.95 |
| Type of sample | ---------- | Soil | Soil | Soil | Soil |
| Date prepared | - | 15/4/2011 | 15/4/2011 | 15/4/2011 | 15/4/2011 |
| Date analysed | - | 19/4/2011 | 19/4/2011 | 19/4/2011 | 19/4/2011 |
| pH 1:5 soil:water | pH Units | 8.5 | 8.1 | 7.8 | 8.0 |
| Chloride, Cl 1:5 soil:water | mg/kg | 24 | 21 | <20 | 31 |
| Sulphate, SO4 1:5 soil:water | mg/kg | <20 | <20 | 64 | <20 |
| Resistivity in soil* | ohmm | 150 | 140 | 100 | 100 |

| Method ID | Methodology Summary |
|---|---|
| Inorg-001 | pH - Measured using pH meter and electrode in accordance with APHA 21st ED, 4500-H+. |
| Inorg-081 | Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA 21st ED, 4110-B. |
| Inorg-002 | Conductivity and Salinity - measured using a conductivity cell and dedicated meter, in accordance with APHA 21st ED 2510 and Rayment & Higginson. |

**Client Reference: 72320, Wagga Wagga Base Hospital**

| QUALITY CONTROL<br>Miscellaneous Inorg - soil | UNITS | PQL | METHOD | Blank | Duplicate Sm# | Duplicate results<br>Base II Duplicate II %RPD | Spike Sm# | Spike % Recovery |
|---|---|---|---|---|---|---|---|---|
| Date prepared | - | | | 15/4/2011 | [NT] | [NT] | LCS-1 | 15/4/2011 |
| Date analysed | - | | | 19/4/2011 | [NT] | [NT] | LCS-1 | 19/4/2011 |
| pH 1:5 soil:water | pH Units | | Inorg-001 | [NT] | [NT] | [NT] | LCS-1 | 102% |
| Chloride, Cl 1:5 soil:water | mg/kg | 2 | Inorg-081 | <2 | [NT] | [NT] | LCS-1 | 96% |
| Sulphate, SO4 1:5 soil:water | mg/kg | 2 | Inorg-081 | <2 | [NT] | [NT] | LCS-1 | 100% |
| Resistivity in soil* | ohmm | 1 | Inorg-002 | <1.0 | [NT] | [NT] | LCS-1 | 108% |

**Report Comments:**

Chlride\Sulphate:PQL raised due to sample matrix.

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

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

**Quality Control Definitions**

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

**Laboratory Acceptance Criteria**

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

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

Douglas Partners
Geotechnics / Environment / Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666
Fax (02) 9809 4095

# Results of Moisture Content, Plasticity and Linear Shrinkage Tests

| | | | |
|---|---|---|---|
| **Client:** | **HEALTH INFRASTRUCTURE** | **Project No:** | 72320.03 |
| | | **Report No:** | S11-216G |
| **Project:** | BASE HOSPITAL REDEVELOPMENT | **Report Date:** | 20/10/2011 |
| | | **Date Sampled:** | 21/09/2011 |
| **Location:** | EDWARD STREET, WAGGA WAGGA. | **Date of Test:** | 4/10/2011 |
| | | **Page:** | 1 of 1 |

| Test Location | Depth (m) | Description | Code | $W_F$ % | $W_L$ % | $W_P$ % | PI % | *LS % |
|---|---|---|---|---|---|---|---|---|
| BH205 | 1.5 - 1.6 | SILTY CLAY - Orange / brown silty clay | 2,5 | - | 28 | 18 | 10 | 9.5 |
| BH207 | 0.4 - 0.5 | SILTY CLAY - Orange / brown silty clay | 2,5 | - | 35 | 17 | 18 | 12.0 |
| BH208 | 0.4 - 0.5 | SILTY CLAY - Orange / brown silty clay | 2,5 | - | 34 | 16 | 18 | 12.5 |
| BH209 | 0.7 - 0.8 | SILTY CLAY - Orange / brown silty clay | 2,5 | - | 34 | 17 | 17 | 10.0 |
| BH210 | 0.5 - 0.6 | SILTY CLAY - Orange / brown silty clay | 2,5 | - | 34 | 18 | 16 | 11.0 |
| BH211 | 1.3 - 1.4 | SILTY CLAY - Orange / brown silty clay | 2,5 | - | 28 | 16 | 12 | 8.0 |
| BH202 | 1.9 - 2.0 | SILTY CLAY - Orange / brown silty clay | 2,5 | - | 32 | 16 | 16 | 10.0 |

**Legend:**

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

**Test Methods:**

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

**Code:**

**Sample history for plasticity tests**

1. Air dried
2. Low temperature (<50°C) oven dried
3. Oven (105°C) dried
4. Unknown

**Method of preparation for plasticity tests**

5. Dry sieved
6. Wet sieved
7. Natural

*Specify if sample crumbled CR or curled CU

**Sampling Methods:** By Engineering Department

**Remarks:**

NATA Accredited Laboratory Number: 828

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

ACCREDITED FOR TECHNICAL COMPETENCE

Tested: RR
Checked: NW

Norman Weinmann
Laboratory Manager

Douglas Partners
Geotechnics / Environment / Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666
Fax (02) 9809 4095

# Results of Moisture Content, Plasticity and Linear Shrinkage Tests

| | | | |
|---|---|---|---|
| **Client:** | **HEALTH INFRASTRUCTURE** | **Project No:** | 72320.03 |
| | | **Report No:** | S11-216H |
| **Project:** | BASE HOSPITAL REDEVELOPMENT | **Report Date:** | 20/10/2011 |
| | | **Date Sampled:** | 21/09/2011 |
| **Location:** | EDWARD STREET, WAGGA WAGGA. | **Date of Test:** | 4/10/2011 |
| | | **Page:** | 1 of 1 |

| Test Location | Depth (m) | Description | Code | $W_F$ % | $W_L$ % | $W_P$ % | PI % | *LS % |
|---|---|---|---|---|---|---|---|---|
| BH208 | 0.7 - 0.725 | SILTY CLAY - Orange / brown silty clay. | 2,5 | - | 31 | 17 | 14 | 12.5 |

**Legend:**

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

**Test Methods:**

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

**Code:**

**Sample history for plasticity tests**

1. Air dried
2. Low temperature (<50ºC) oven dried
3. Oven (105ºC) dried
4. Unknown

**Method of preparation for plasticity tests**

5. Dry sieved
6. Wet sieved
7. Natural

*Specify if sample crumbled CR or curled CU

**Sampling Methods:** By Engineering Department

**Remarks:**

NATA Accredited Laboratory Number: 828

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

ACCREDITED FOR TECHNICAL COMPETENCE

Tested: RR
Checked: NW

Norman Weinmann
Laboratory Manager

Douglas Partners
Geotechnics / Environment / Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666
Fax (02) 9809 4095

# Result of Shrink-Swell Index Determination

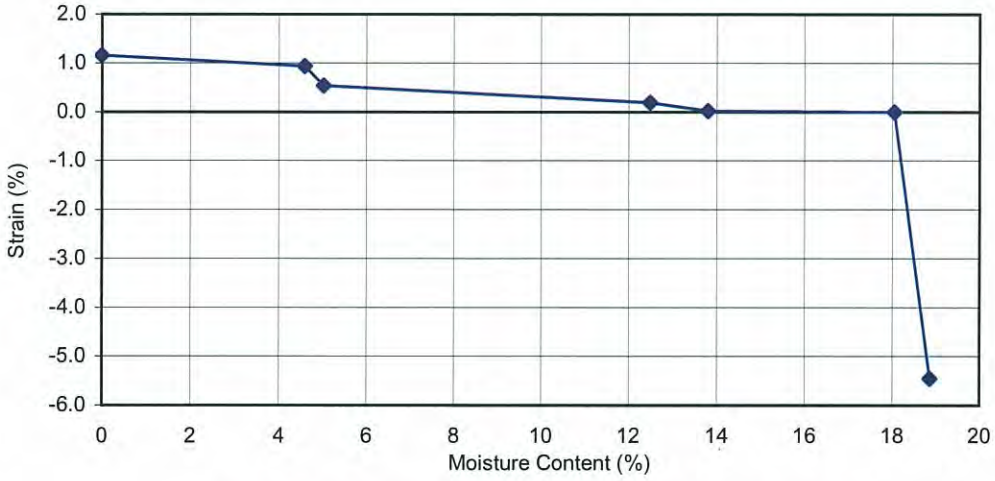
| | | | |
|---|---|---|---|
| **Client :** | HEALTH INFRASTRUCTURE | **Project No. :** | 72320.03 |
| | | **Report No. :** | S11-216I |
| **Project :** | BASE HOSPITAL REDEVELOPMENTS | **Report Date :** | 20/10/2011 |
| | | **Date Sampled :** | 21/09/2011 |
| **Location :** | EDWARD STREET, WAGGA WAGGA. | **Date of Test:** | 29/09/2011 |
| **Test Location :** | BH209 | | |
| **Depth / Layer :** | 0.8 - 1.1 | **Page:** | 1 of 1 |

## CORE SHRINKAGE TEST

| | |
|---|---|
| Shrinkage - air dried | 0.9 % |
| Shrinkage - oven dried | 1.2 % |
| Significant inert inclusions | 0.0 % |
| Extent of cracking | FR |
| Extent of soil crumbling | 3.1 % |
| Moisture content of core | 18.1 % |

## SWELL TEST

| | |
|---|---|
| Pocket penetrometer reading at initial moisture content | >400 kPa |
| Pocket penetrometer reading at final moisture content | 380 kPa |
| Initial Moisture Content | 16.0 % |
| Final Moisture Content | 18.9 % |
| Swell under 25kPa | 5.5 % |




**SHRINK-SWELL INDEX Iss 2.2% 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 Sydney Engineering Department

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

**Remarks:** 0

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

NATA ACCREDITED FOR TECHNICAL

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

Tested: RR
Checked: NW

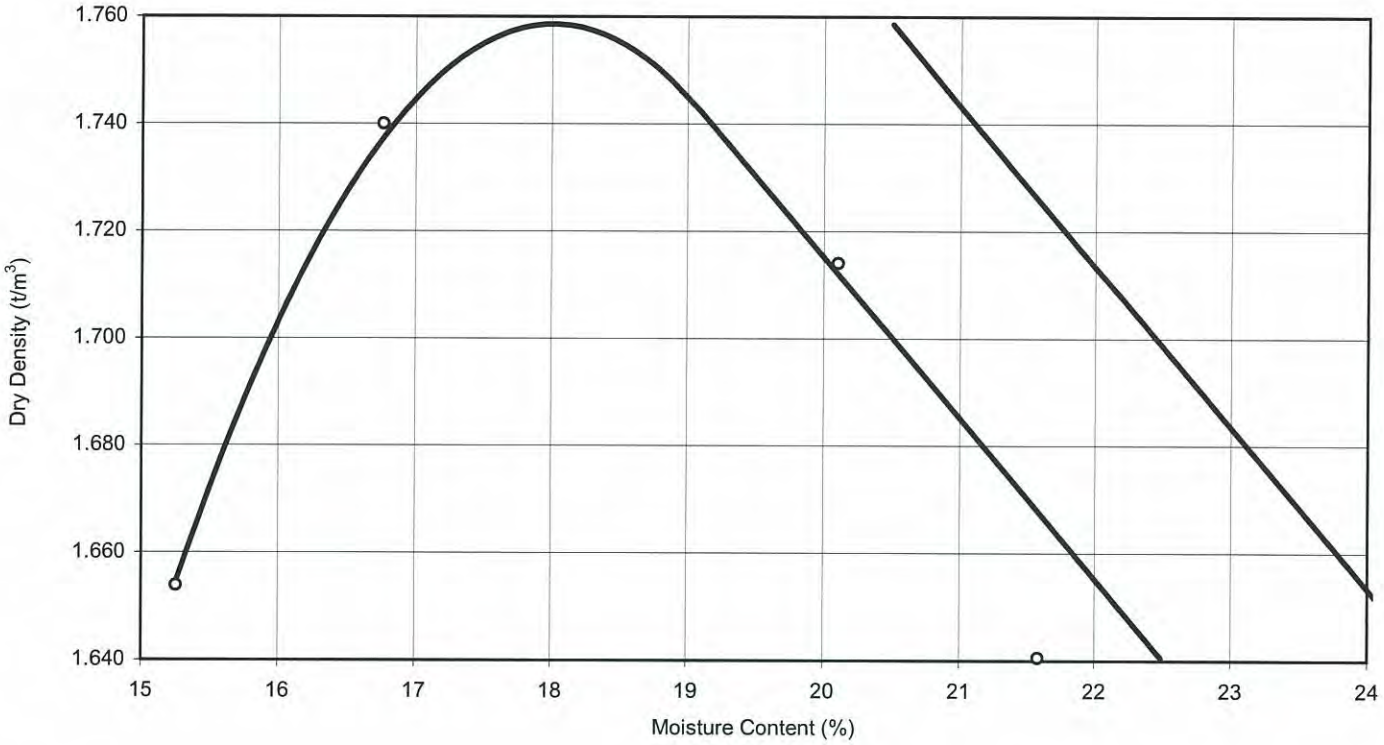
Norman Weimann
Laboratory Manager

Douglas Partners
Geotechnics / Environment / Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666
Fax (02) 9809 4095

# Results of Compaction Test

| | | | |
|---|---|---|---|
| **Client :** | HEALTH INFRASTRUCTURE | **Project No. :** | 72320.03 |
| | | **Report No. :** | S11-216A1 |
| **Project :** | HOSPITAL REDEVELOPMENT | **Report Date :** | 10/10/2011 |
| **Location :** | EDWARD STREET, WAGGA WAGGA | **Date of Test:** | 7/10/2011 |
| | | **Page:** | 1 of 1 |




**Sample Details:** **Location:** 201
**Depth:** 0.8-1.2M

**Particles > 19mm:** 0%

**Description:** SILTY CLAY - Orange / brown silty clay.

| | |
|---|---|
| **Maximum Dry Density:** | **1.76 t/m$^3$** |
| **Optimum Moisture Content:** | **18.0 %** |

**Remarks:**

**Test Methods:** AS1289.5.1.1

**Sampling Methods:** By Engineering Dept

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

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

| | |
|---|---|
| Tested: | AM |
| Checked: | NW |

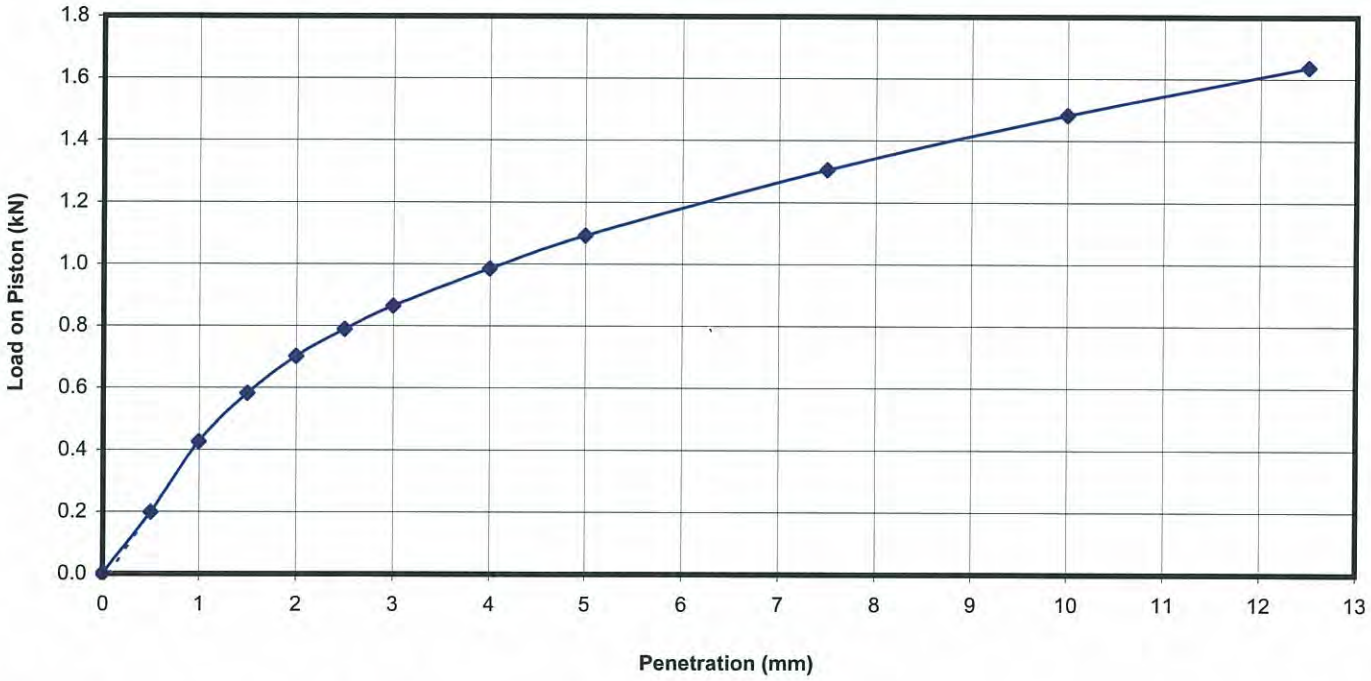
Norman Weimann
Laboratory Manager

Douglas Partners
Geotechnics / Environment / Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666
Fax (02) 9809 4095

# Results of California Bearing Ratio Test

| | | | |
|---|---|---|---|
| **Client :** | HEALTH INFRASTRUCTURE | **Project No. :** | 72320.03 |
| | | **Report No. :** | S11-216A |
| **Project :** | BASE HOSPITAL REDEVELOPMENT | **Report Date :** | 20/10/2011 |
| | | **Date Sampled :** | 21/09/2011 |
| **Location :** | EDWARD STREET, WAGGA WAGGA. | **Date of Test:** | 7/10/2011 |
| **Test Location :** | BH201 | | |
| **Depth / Layer :** | 0.8 - 1.2 | **Page:** | 1 of 1 |




**Description:** SILTY CLAY - Orange brown silty clay.

**Test Method(s):** AS 1289.6.1.1, AS 1289.2.1.1

**Sampling Method(s):** By Engineering Department

**Percentage > 19mm:** 0.0%

**LEVEL OF COMPACTION:** 100% of STD MDD
**MOISTURE RATIO:** 94% of STD OMC
**SURCHARGE:** 4.5 kg
**SOAKING PERIOD:** 4 days
**SWELL:** 0.3%

| CONDITION | | MOISTURE CONTENT % | DRY DENSITY t/m$^3$ |
|---|---|---|---|
| At compaction | | 16.9 | 1.77 |
| After soaking | | 19.1 | 1.76 |
| After test | Top 30mm of sample | 20.4 | - |
| | Remainder of sample | 18.6 | - |
| Field values | | 15.3 | - |
| Standard Compaction | | 18.0 | 1.76 |

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

NATA Accredited Laboratory No 828
This Document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025

Tested: AM
Checked: NW

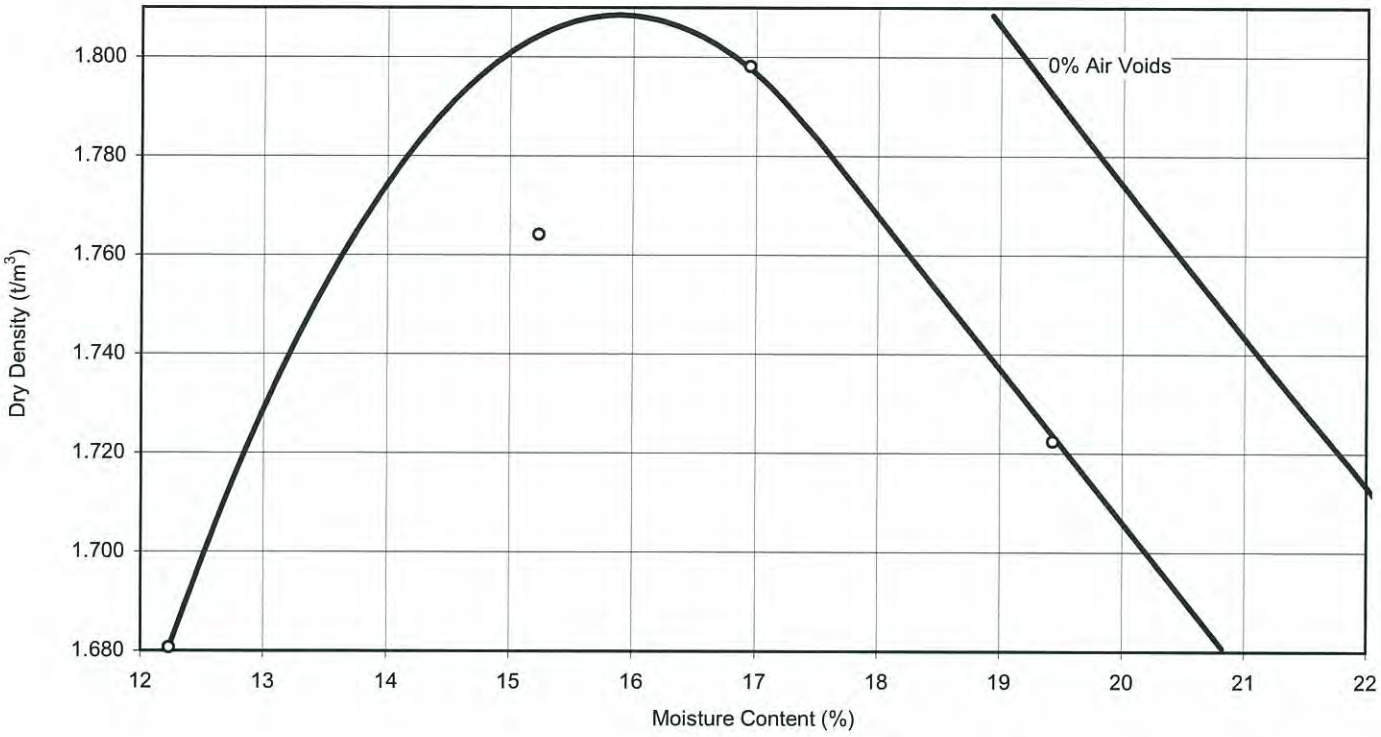
Norman Weimann
Laboratory Manager

Douglas Partners
Geotechnics / Environment / Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666
Fax (02) 9809 4095

# Results of Compaction Test

| | | | |
|---|---|---|---|
| **Client :** | HEALTH INFRASTRUCTURE | **Project No. :** | 72320.03 |
| | | **Report No. :** | S11-216B1 |
| **Project :** | HOSPITAL REDEVELOPMENT | **Report Date :** | 10/10/2011 |
| **Location :** | EDWARD STREET, WAGGA WAGGA | **Date of Test:** | 7/10/2011 |
| | | **Page:** | 1 of 1 |




**Sample Details:** **Location:** 202
**Depth:** 0.8-1.2

**Particles > 19mm:** 0%

**Description:** SILTY CLAY - Orange / brown silty clay.

| | |
|---|---|
| **Maximum Dry Density:** | **1.81 t/m$^3$** |
| **Optimum Moisture Content:** | **16.0 %** |

**Remarks:**

**Test Methods:** AS1289.5.1.1

**Sampling Methods:** By Engineering Dept

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

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

| | |
|---|---|
| Tested: | AM |
| Checked: | NW |

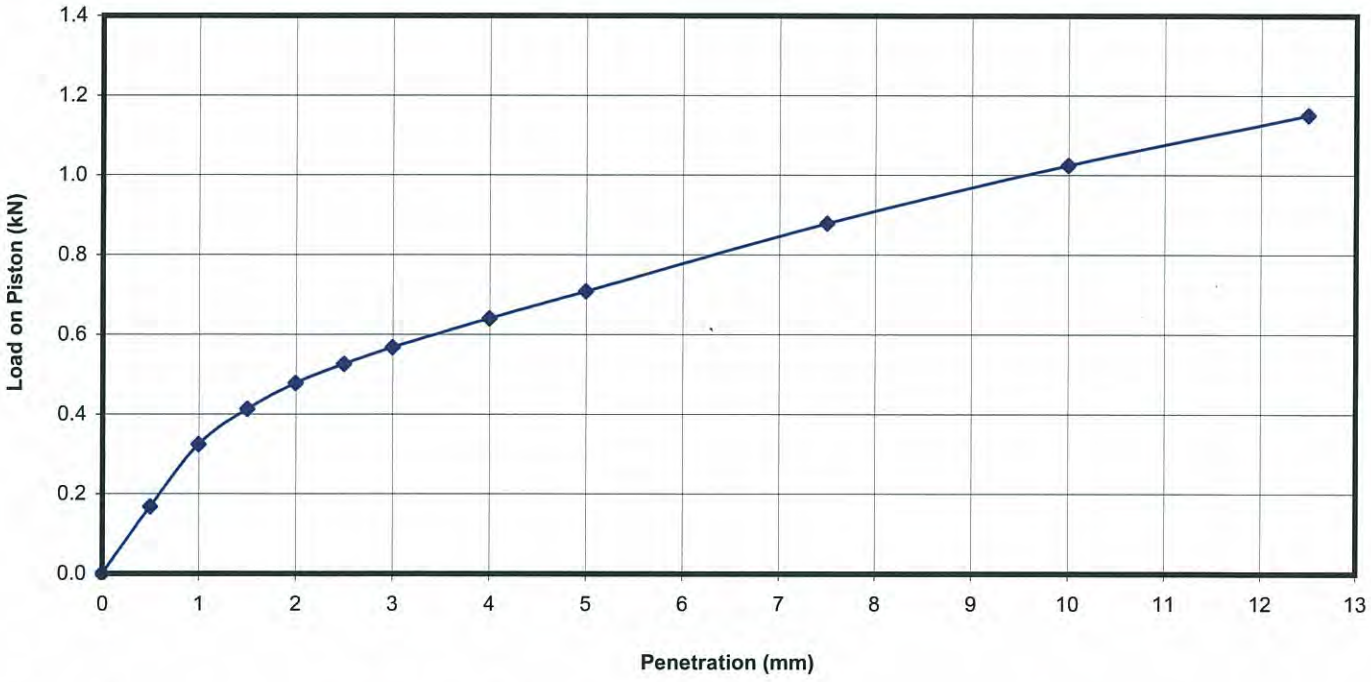
Norman Weimann
Laboratory Manager

Douglas Partners
Geotechnics / Environment / Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666
Fax (02) 9809 4095

# Results of California Bearing Ratio Test

| | | | |
|---|---|---|---|
| **Client :** | HEALTH INFRASTRUCTURE | **Project No. :** | 72320.03 |
| | | **Report No. :** | S11-216B |
| **Project :** | BASE HOSPITAL REDEVELOPMENT | **Report Date :** | 20/10/2011 |
| | | **Date Sampled :** | 21/09/2011 |
| **Location :** | EDWARD STREET, WAGGA WAGGA. | **Date of Test:** | 7/10/2011 |
| **Test Location :** | BH202 | | |
| **Depth / Layer :** | 0.8 - 1.2 | **Page:** | 1 of 1 |




**Description:** SILTY CLAY - Orange / brown silty clay.

**Test Method(s):** AS 1289.6.1.1, AS 1289.2.1.1

**Sampling Method(s):** By Engineering Department

**Percentage > 19mm:** 0.0%

**LEVEL OF COMPACTION:** 100% of STD MDD
**MOISTURE RATIO:** 97% of STD OMC
**SURCHARGE:** 4.5 kg
**SOAKING PERIOD:** 4 days
**SWELL:** 0.4%

| CONDITION | | MOISTURE CONTENT % | DRY DENSITY t/m$^3$ |
|---|---|---|---|
| At compaction | | 15.4 | 1.81 |
| After soaking | | 17.2 | 1.80 |
| After test | Top 30mm of sample | 19.3 | - |
| | Remainder of sample | 16.5 | - |
| Field values | | 15.2 | - |
| Standard Compaction | | 15.9 | 1.81 |

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

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

NATA Accredited Laboratory No 828
This Document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025

Tested: AM
Checked: NW

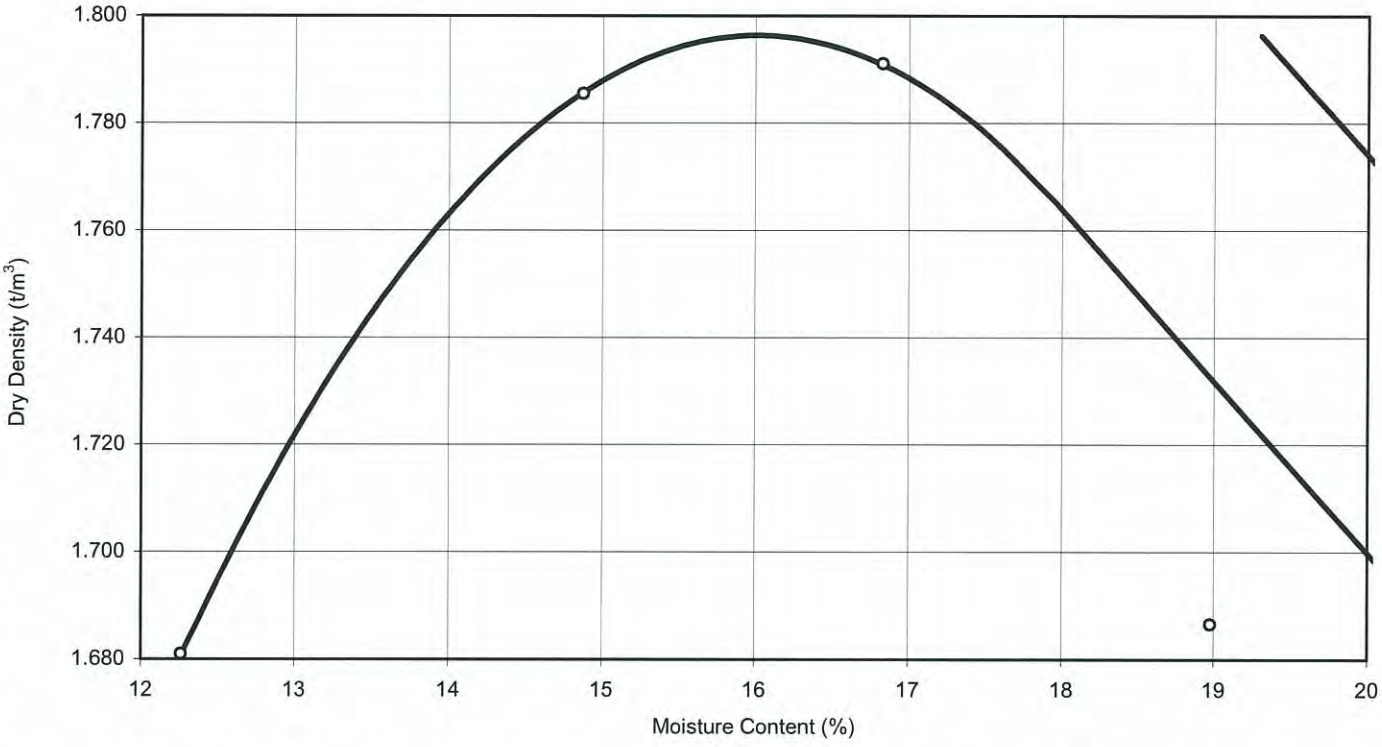
Norman Weimann
Laboratory Manager

Douglas Partners
Geotechnics / Environment / Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666
Fax (02) 9809 4095

# Results of Compaction Test

| | | | |
|---|---|---|---|
| **Client :** | HEALTH INFRASTRUCTURE | **Project No. :** | 72320.03 |
| | | **Report No. :** | S11-216C1 |
| **Project :** | HOSPITAL REDEVELOPMENT | **Report Date :** | 10/10/2011 |
| **Location :** | EDWARD STREET, WAGGA WAGGA | **Date of Test:** | 7/10/2011 |
| | | **Page:** | 1 of 1 |




**Sample Details:** **Location:** 203
**Depth:** 0.3-0.6m

**Particles > 19mm:** 0%

**Description:** SILTY CLAY - Orange / brown silty clay.

| | |
|---|---|
| **Maximum Dry Density:** | **1.80 t/m$^3$** |
| **Optimum Moisture Content:** | **16.0 %** |

**Remarks:**

**Test Methods:** AS1289.5.1.1

**Sampling Methods:** By Engineering Dept

NATA ACCREDITED FOR TECHNICAL COMPETENCE

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

| | |
|---|---|
| Tested: | AM |
| Checked: | NW |

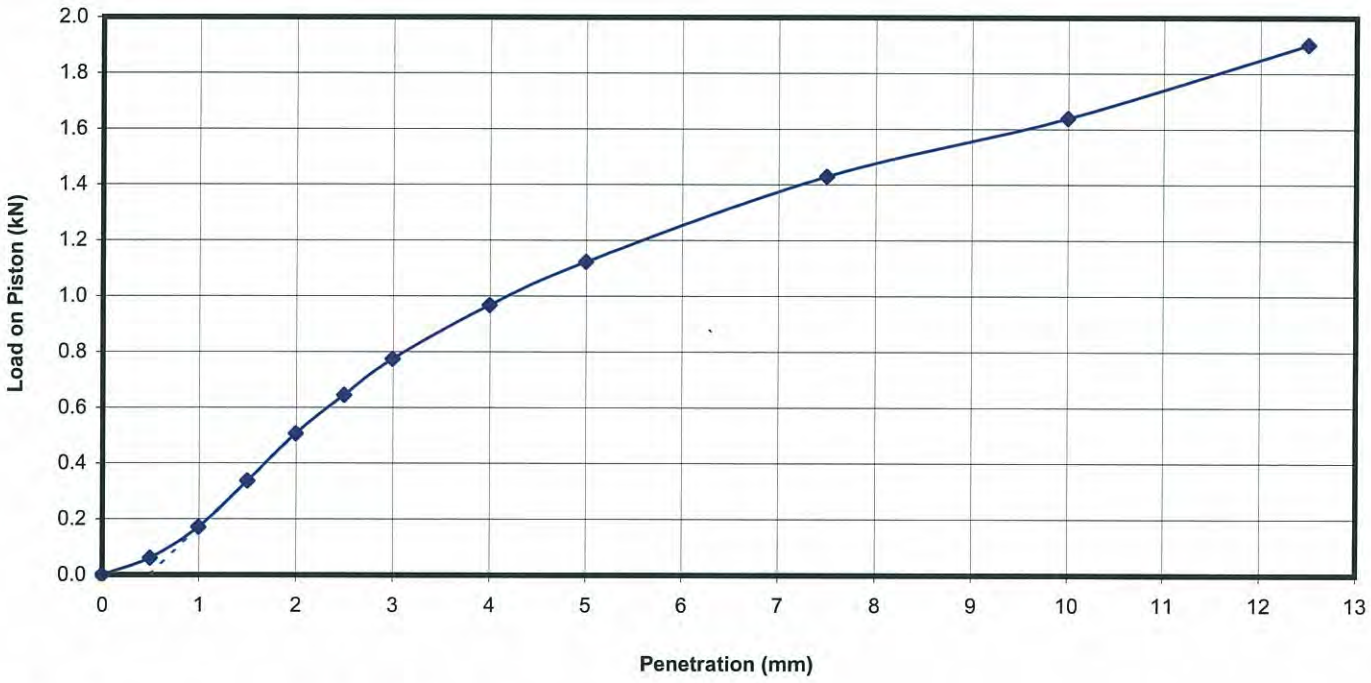
Norman Weimann
Laboratory Manager

Douglas Partners
Geotechnics / Environment / Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666
Fax (02) 9809 4095

# Results of California Bearing Ratio Test

| | | | |
|---|---|---|---|
| **Client :** | HEALTH INFRASTRUCTURE | **Project No. :** | 72320.03 |
| | | **Report No. :** | S11-216C |
| **Project :** | BASE HOSPITAL REDEVELOPMENT | **Report Date :** | 20/10/2011 |
| | | **Date Sampled :** | 21/09/2011 |
| **Location :** | EDWARD STREET, WAGGA WAGGA. | **Date of Test:** | 7/10/2011 |
| **Test Location :** | BH203 | | |
| **Depth / Layer :** | 0.3 - 0.6 | **Page:** | 1 of 1 |




**Description:** SILTY CLAY - Orange / brown silty clay.

**Test Method(s):** AS 1289.6.1.1, AS 1289.2.1.1

**Sampling Method(s):** By Engineering Department

**Percentage > 19mm:** 0.0%

**LEVEL OF COMPACTION:** 100% of STD MDD
**MOISTURE RATIO:** 98% of STD OMC
**SURCHARGE:** 4.5 kg
**SOAKING PERIOD:** 4 days
**SWELL:** 0.3%

| CONDITION | | MOISTURE CONTENT % | DRY DENSITY t/m$^3$ |
|---|---|---|---|
| At compaction | | 15.7 | 1.79 |
| After soaking | | 18.1 | 1.79 |
| After test | Top 30mm of sample | 19.1 | - |
| | Remainder of sample | 17.4 | - |
| Field values | | 12.3 | - |
| Standard Compaction | | 16.0 | 1.80 |

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

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

NATA Accredited Laboratory No 828
This Document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025

Tested: NW
Checked: NW

Norman Weimann
Laboratory Manager

Douglas Partners
Geotechnics / Environment / Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666
Fax (02) 9809 4095

# Results of Compaction Test

| | | | |
|---|---|---|---|
| **Client :** | HEALTH INFRASTRUCTURE | **Project No. :** | 72320.03 |
| | | **Report No. :** | S11-216D1 |
| **Project :** | HOSPITAL REDEVELOPMENT | **Report Date :** | 10/10/2011 |
| **Location :** | EDWARD STREET, WAGGA WAGGA | **Date of Test:** | 7/10/2011 |
| | | **Page:** | 1 of 1 |


**Sample Details:** **Location:** 204
**Depth:** 0.5-0.8m

**Particles > 19mm:** 0%

**Description:** SILTY CLAY - Red / brown silty clay.

| | |
|---|---|
| **Maximum Dry Density:** | **1.80 t/m$^3$** |
| **Optimum Moisture Content:** | **17.5 %** |

**Remarks:**

**Test Methods:** AS1289.5.1.1

**Sampling Methods:** By Engineering Dept

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

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

| | |
|---|---|
| Tested: | AM |
| Checked: | NW |

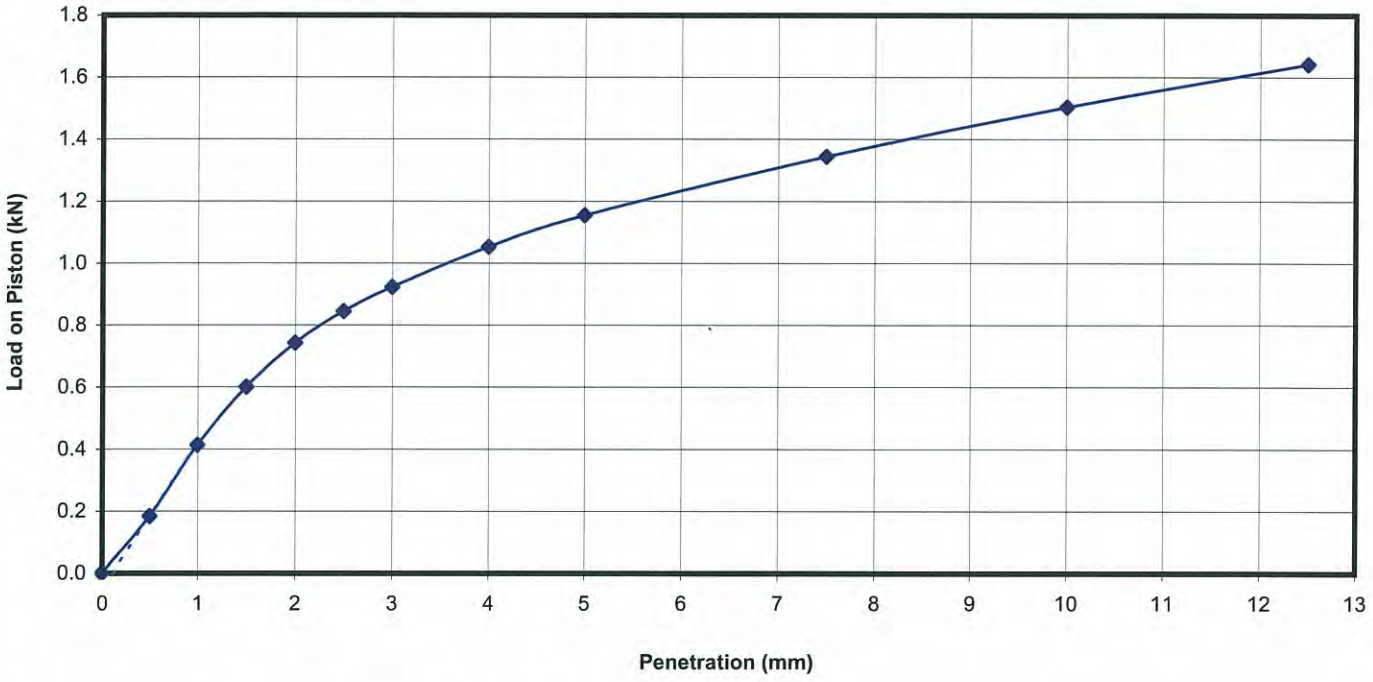
Norman Weimann
Laboratory Manager

Douglas Partners
Geotechnics / Environment / Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666
Fax (02) 9809 4095

# Results of California Bearing Ratio Test

| | | | |
|---|---|---|---|
| **Client :** | HEALTH INFRASTRUCTURE | **Project No. :** | 72320.03 |
| | | **Report No. :** | S11-216D |
| **Project :** | BASE HOSPITAL REDEVELOPMENT | **Report Date :** | 20/10/2011 |
| | | **Date Sampled :** | 21/09/2011 |
| **Location :** | EDWARD STREET, WAGGA WAGGA. | **Date of Test:** | 7/10/2011 |
| **Test Location :** | BH 204 | | |
| **Depth / Layer :** | 0.5 - 0.8 | **Page:** | 1 of 1 |




**Description:** SILTY CLAY - Red / brown silty clay.

**Test Method(s):** AS 1289.6.1.1, AS 1289.2.1.1

**Sampling Method(s):** By Engineering Department

**Percentage > 19mm:** 0.0%

**LEVEL OF COMPACTION:** 101% of STD MDD
**MOISTURE RATIO:** 95% of STD OMC
**SURCHARGE:** 4.5 kg
**SOAKING PERIOD:** 4 days
**SWELL:** -0.1%

| CONDITION | | MOISTURE CONTENT % | DRY DENSITY t/m$^3$ |
|---|---|---|---|
| At compaction | | 16.7 | 1.81 |
| After soaking | | 18.2 | 1.81 |
| After test | Top 30mm of sample | 19.5 | - |
| | Remainder of sample | 17.1 | - |
| Field values | | 16.0 | - |
| Standard Compaction | | 17.5 | 1.80 |

| RESULTS | | |
|---|---|---|
| **TYPE** | **PENETRATION** | **CBR (%)** |
| **TOP** | **2.5 mm** | **7** |
| | **5.0 mm** | **6** |





NATA
ACCREDITED FOR TECHNICAL COMPETENCE

NATA Accredited Laboratory No 828
This Document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025

Tested: AM
Checked: NW

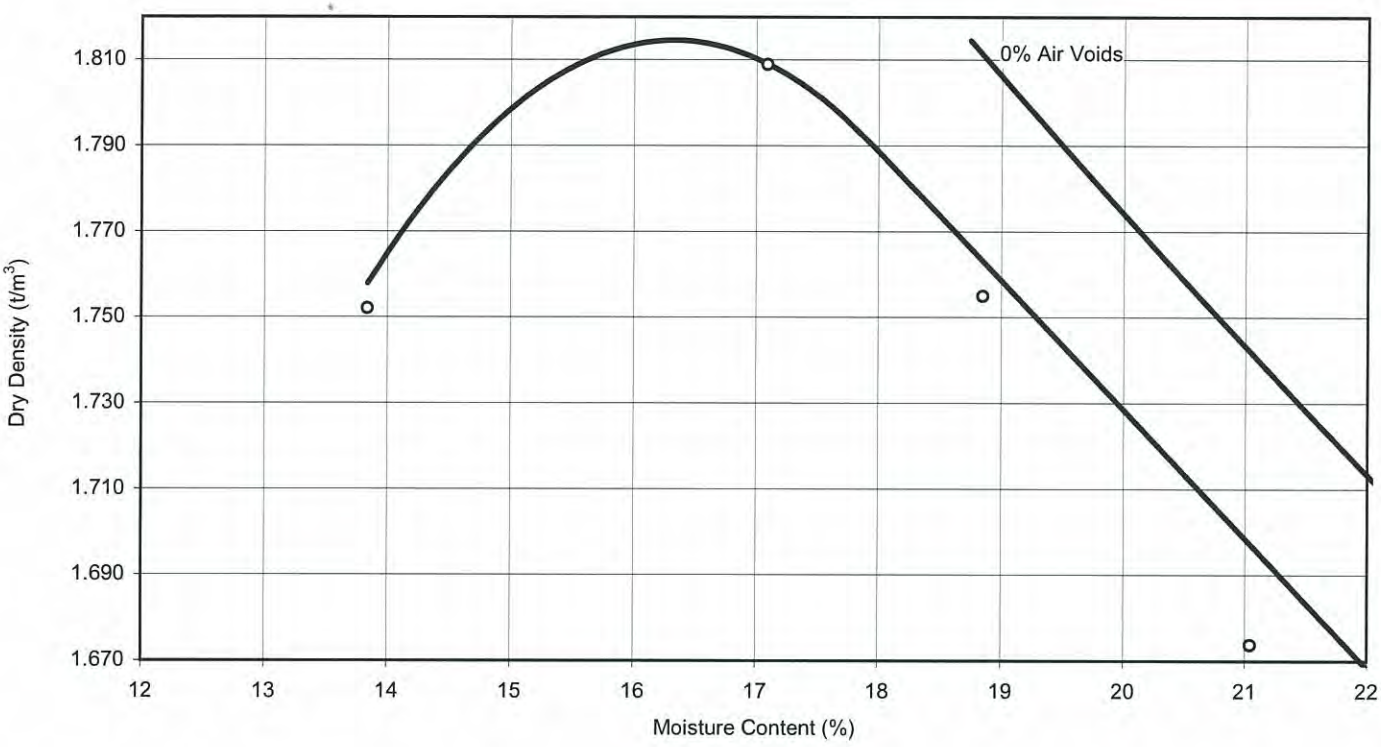
Norman Weimann
Laboratory Manager

Douglas Partners
Geotechnics / Environment / Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666
Fax (02) 9809 4095

# Results of Compaction Test

| | | | |
|---|---|---|---|
| **Client :** | HEALTH INFRASTRUCTURE | **Project No. :** | 72320.03 |
| | | **Report No. :** | S11-216E1 |
| **Project :** | HOSPITAL REDEVELOPMENT | **Report Date :** | 10/10/2011 |
| **Location :** | EDWARD STREET, WAGGA WAGGA | **Date of Test:** | 7/10/2011 |
| | | **Page:** | 1 of 1 |




**Sample Details:** **Location:** 205
**Depth:** 0.7-1.0m

**Particles > 19mm:** 0%

**Description:** SILTY CLAY - Orange / brown silty clay.

| | |
|---|---|
| **Maximum Dry Density:** | **1.81 t/m$^3$** |
| **Optimum Moisture Content:** | **16.5 %** |

**Remarks:**

**Test Methods:** AS1289.5.1.1

**Sampling Methods:** By Engineering Dept

NATA ACCREDITED FOR TECHNICAL COMPETENCE

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

| | |
|---|---|
| Tested: | AM |
| Checked: | NW |

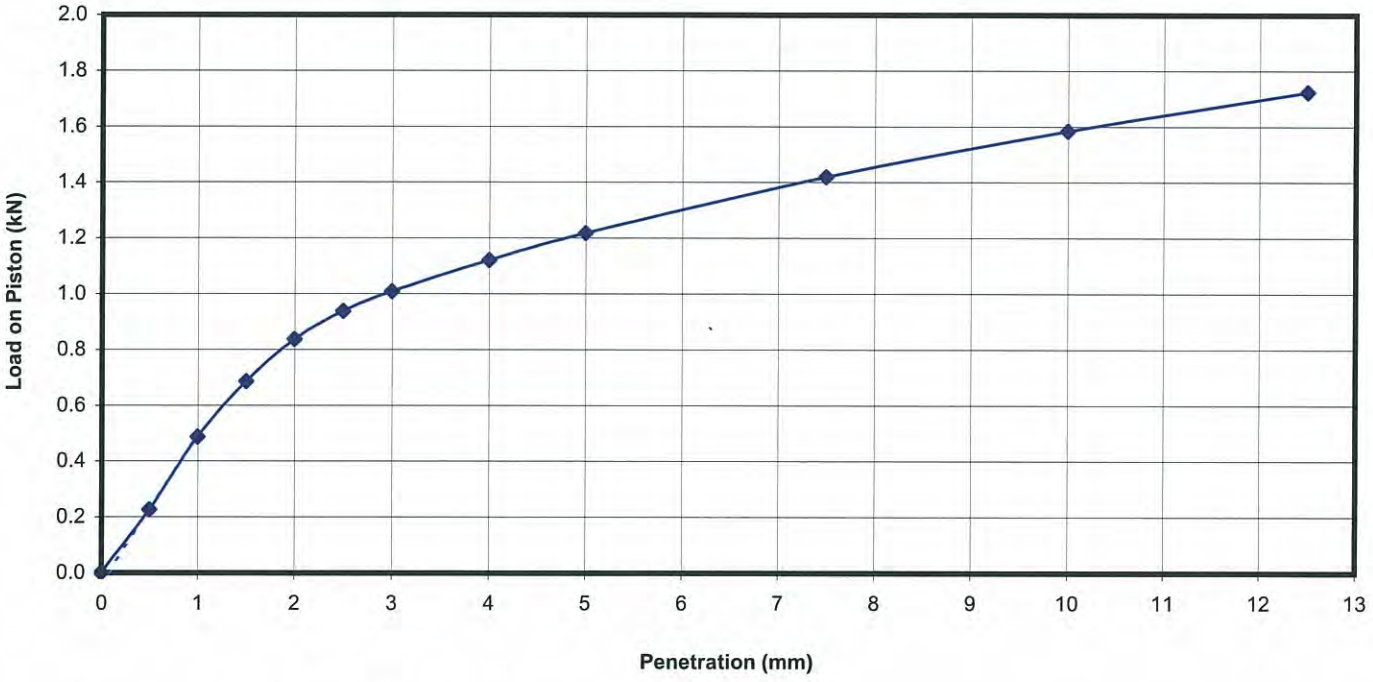
Norman Weimann
Laboratory Manager

Douglas Partners
Geotechnics / Environment / Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666
Fax (02) 9809 4095

# Results of California Bearing Ratio Test

| | | | |
|---|---|---|---|
| **Client :** | HEALTH INFRASTRUCTURE | **Project No. :** | 72320.03 |
| | | **Report No. :** | S11-216E |
| **Project :** | BASE HOSPITAL REDEVELOPMENT | **Report Date :** | 20/10/2011 |
| | | **Date Sampled :** | 21/09/2011 |
| **Location :** | EDWARD STREET, WAGGA WAGGA. | **Date of Test:** | 7/10/2011 |
| **Test Location :** | BH205 | | |
| **Depth / Layer :** | 0.7 - 1.0 | **Page:** | 1 of 1 |




**Description:** SILTY CLAY - Red / brown silty clay.

**Test Method(s):** AS 1289.6.1.1, AS 1289.2.1.1

**Sampling Method(s):** AS 1289.1.2.1, AS 1289.1.1

**Percentage > 19mm:** 0.0%

**LEVEL OF COMPACTION:** 100% of STD MDD
**MOISTURE RATIO:** 99% of STD OMC
**SURCHARGE:** 4.5 kg
**SOAKING PERIOD:** 4 days
**SWELL:** 0.3%

| CONDITION | | MOISTURE CONTENT % | DRY DENSITY t/m$^3$ |
|---|---|---|---|
| At compaction | | 16.2 | 1.81 |
| After soaking | | 18.0 | 1.81 |
| After test | Top 30mm of sample | 19.2 | - |
| | Remainder of sample | 17.2 | - |
| Field values | | 17.1 | - |
| Standard Compaction | | 16.3 | 1.82 |

| RESULTS | | |
|---|---|---|
| **TYPE** | **PENETRATION** | **CBR (%)** |
| **TOP** | **2.5 mm** | **7** |
| | **5.0 mm** | **6** |

NATA Accredited Laboratory No 828
This Document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025

Tested: AM
Checked: NW

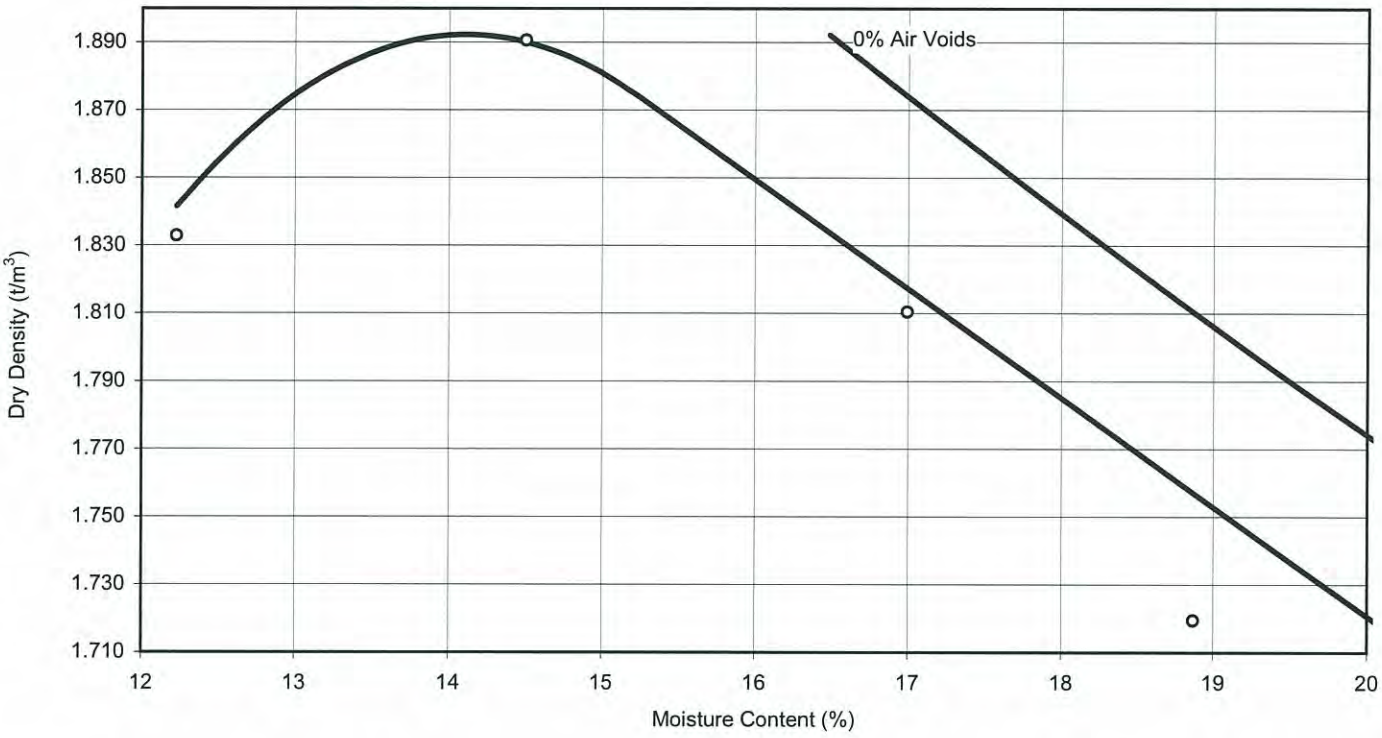
Norman Weimann
Laboratory Manager

Douglas Partners
Geotechnics / Environment / Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666
Fax (02) 9809 4095

# Results of Compaction Test

| | | | |
|---|---|---|---|
| **Client :** | HEALTH INFRASTRUCTURE | **Project No. :** | 72320.03 |
| | | **Report No. :** | S11-216F1 |
| **Project :** | HOSPITAL REDEVELOPMENT | **Report Date :** | 10/10/2011 |
| **Location :** | EDWARD STREET, WAGGA WAGGA | **Date of Test:** | 7/10/2011 |
| | | **Page:** | 1 of 1 |




**Sample Details:** **Location:** 206
**Depth:** 0.5-1.0m

**Particles > 19mm:** 0%

**Description:** SILTY CLAY - Orange / brown silty clay.

| | |
|---|---|
| **Maximum Dry Density:** | **1.89 t/m$^3$** |
| **Optimum Moisture Content:** | **14.0 %** |

**Remarks:**

**Test Methods:** AS1289.5.1.1

**Sampling Methods:** By Engineering Dept

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

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

| | |
|---|---|
| Tested: | AM |
| Checked: | NW |

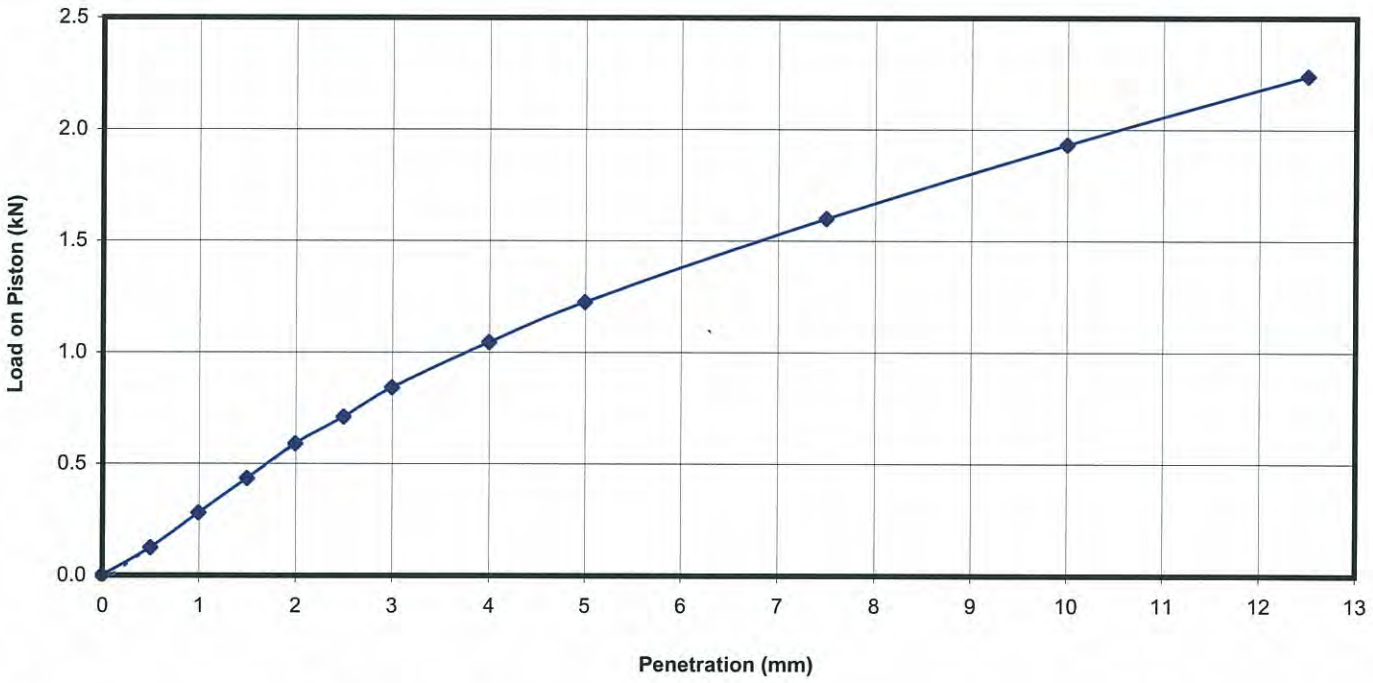
Norman Weimann
Laboratory Manager

Douglas Partners
Geotechnics / Environment / Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666
Fax (02) 9809 4095

# Results of California Bearing Ratio Test

| | | | |
|---|---|---|---|
| **Client :** | HEALTH INFRASTRUCTURE | **Project No. :** | 72320.03 |
| | | **Report No. :** | S11-216F |
| **Project :** | BASE HOSPITAL REDEVELOPMENT | **Report Date :** | 20/10/2011 |
| | | **Date Sampled :** | 21/09/2011 |
| **Location :** | EDWARD STREET, WAGGA WAGGA. | **Date of Test:** | 7/10/2011 |
| **Test Location :** | BH206 | | |
| **Depth / Layer :** | 0.5 - 1.0 | **Page:** | 1 of 1 |




**Description:** SILTY CLAY - Orange / brown silty clay.

**Test Method(s):** AS 1289.6.1.1, AS 1289.2.1.1

**Sampling Method(s):** AS 1289.1.2.1, AS 1289.1.1

**Percentage > 19mm:** 0.0%

**LEVEL OF COMPACTION:** 100% of STD MDD
**MOISTURE RATIO:** 102% of STD OMC
**SURCHARGE:** 4.5 kg
**SOAKING PERIOD:** 4 days
**SWELL:** 0.2%

| CONDITION | | MOISTURE CONTENT % | DRY DENSITY t/m$^3$ |
|---|---|---|---|
| At compaction | | 14.5 | 1.88 |
| After soaking | | 16.1 | 1.88 |
| After test | Top 30mm of sample | 16.9 | - |
| | Remainder of sample | 14.9 | - |
| Field values | | 14.9 | - |
| Standard Compaction | | 14.1 | 1.89 |

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

NATA Accredited Laboratory No 828
This Document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025

Tested: AM
Checked: NW

Norman Weimann
Laboratory Manager

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

# CERTIFICATE OF ANALYSIS 62247

**Client:**
**Douglas Partners**
96 Hermitage Rd
West Ryde
NSW 2114

**Attention:** Peter Hartcliff

**Sample log in details:**

| | |
|---|---|
| Your Reference: | **72320.03, Wagga Wagga Base Hospital** |
| No. of samples: | 13 Soils |
| Date samples received / completed instructions received | 22/09/11 / 22/09/11 |

**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: | 29/09/11 / 29/09/11 |
| Date of Preliminary Report: | Not issued |

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

**Results Approved By:**

Nancy Zhang
Chemist

Rhian Morgan
Reporting Supervisor

Tania Notaras
Manager

Paul Ching
Approved Signatory

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

| vTRH & BTEX in Soil | | | | | | |
|---|---|---|---|---|---|---|
| Our Reference: | UNITS | 62247-1 | 62247-2 | 62247-3 | 62247-4 | 62247-5 |
| Your Reference | ---------- | BH201/0.3-0.4 | BH202/0.1-0.2 | BH203/0.1-0.2 | BH204/0.2-0.3 | BH205/0.3-0.4 |
| Date Sampled | ---------- | 21/09/2011 | 21/09/2011 | 21/09/2011 | 21/09/2011 | 20/09/2011 |
| Type of sample | | Soil | Soil | Soil | Soil | Soil |
| Date extracted | - | 23/9/11 | 23/9/11 | 23/9/11 | 23/9/11 | 23/9/11 |
| Date analysed | - | 25/9/11 | 25/9/11 | 25/9/11 | 25/9/11 | 25/9/11 |
| vTRH $C_6$ - $C_9$ | mg/kg | <25 | <25 | <25 | <25 | <25 |
| Benzene | mg/kg | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 |
| 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 | % | 120 | 115 | 124 | 122 | 111 |

| vTRH & BTEX in Soil | | | | | | |
|---|---|---|---|---|---|---|
| Our Reference: | UNITS | 62247-6 | 62247-7 | 62247-8 | 62247-9 | 62247-10 |
| Your Reference | ---------- | BH206/0.15-0.25 | BH207/0.05-0.1 | BH208/0.1-0.2 | BH209/0.1-0.2 | BH210/0.1-0.2 |
| Date Sampled | ---------- | 20/09/2011 | 20/09/2011 | 20/09/2011 | 21/09/2011 | 21/09/2011 |
| Type of sample | | Soil | Soil | Soil | Soil | Soil |
| Date extracted | - | 23/9/11 | 23/9/11 | 23/9/11 | 23/9/11 | 23/9/11 |
| Date analysed | - | 25/9/11 | 25/9/11 | 25/9/11 | 25/9/11 | 25/9/11 |
| vTRH $C_6$ - $C_9$ | mg/kg | <25 | <25 | <25 | <25 | <25 |
| Benzene | mg/kg | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 |
| 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 | % | 117 | 118 | 118 | 117 | 122 |

| vTRH & BTEX in Soil | | | | |
|---|---|---|---|---|
| Our Reference: | UNITS | 62247-11 | 62247-12 | 62247-13 |
| Your Reference | ---------- | BH211/0.3-0.4 | BD1/21.9.11 | BH211/0.6-0.7 |
| Date Sampled | ---------- | 21/09/2011 | 21/09/2011 | 21/09/2011 |
| Type of sample | | Soil | Soil | Soil |
| Date extracted | - | 23/9/11 | 23/9/11 | 23/9/11 |
| Date analysed | - | 25/9/11 | 25/9/11 | 25/9/11 |
| vTRH $C_6$ - $C_9$ | mg/kg | <25 | <25 | <25 |
| Benzene | mg/kg | <0.2 | <0.2 | <0.2 |
| Toluene | mg/kg | <0.5 | <0.5 | <0.5 |
| Ethylbenzene | mg/kg | <1 | <1 | <1 |
| m+p-xylene | mg/kg | <2 | <2 | <2 |
| o-Xylene | mg/kg | <1 | <1 | <1 |
| *Surrogate* aaa-Trifluorotoluene | % | 124 | 133 | 130 |

| sTRH in Soil (C10-C36) | | | | | | |
|---|---|---|---|---|---|---|
| Our Reference: | UNITS | 62247-1 | 62247-2 | 62247-3 | 62247-4 | 62247-5 |
| Your Reference | ---------- | BH201/0.3-0.4 | BH202/0.1-0.2 | BH203/0.1-0.2 | BH204/0.2-0.3 | BH205/0.3-0.4 |
| Date Sampled | ---------- | 21/09/2011 | 21/09/2011 | 21/09/2011 | 21/09/2011 | 20/09/2011 |
| Type of sample | | Soil | Soil | Soil | Soil | Soil |
| Date extracted | - | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 |
| Date analysed | - | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 |
| 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 | % | 92 | 93 | 91 | 92 | 92 |

| sTRH in Soil (C10-C36) | | | | | | |
|---|---|---|---|---|---|---|
| Our Reference: | UNITS | 62247-6 | 62247-7 | 62247-8 | 62247-9 | 62247-10 |
| Your Reference | ---------- | BH206/0.15-0.25 | BH207/0.05-0.1 | BH208/0.1-0.2 | BH209/0.1-0.2 | BH210/0.1-0.2 |
| Date Sampled | ---------- | 20/09/2011 | 20/09/2011 | 20/09/2011 | 21/09/2011 | 21/09/2011 |
| Type of sample | | Soil | Soil | Soil | Soil | Soil |
| Date extracted | - | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 |
| Date analysed | - | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 |
| 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 | % | 93 | 94 | 96 | 93 | 93 |

| sTRH in Soil (C10-C36) | | | | |
|---|---|---|---|---|
| Our Reference: | UNITS | 62247-11 | 62247-12 | 62247-13 |
| Your Reference | ---------- | BH211/0.3-0.4 | BD1/21.9.11 | BH211/0.6-0.7 |
| Date Sampled | ---------- | 21/09/2011 | 21/09/2011 | 21/09/2011 |
| Type of sample | | Soil | Soil | Soil |
| Date extracted | - | 23/09/2011 | 23/09/2011 | 23/09/2011 |
| Date analysed | - | 23/09/2011 | 23/09/2011 | 23/09/2011 |
| TRHC$_{10}$ - C$_{14}$ | mg/kg | <50 | <50 | <50 |
| TRHC$_{15}$ - C$_{28}$ | mg/kg | <100 | <100 | <100 |
| TRHC$_{29}$ - C$_{36}$ | mg/kg | <100 | <100 | <100 |
| *Surrogate* o-Terphenyl | % | 93 | 92 | 83 |

| PAHs in Soil<br>Our Reference:<br>Your Reference<br><br>Date Sampled<br>Type of sample | UNITS<br>----------<br><br>---------- | 62247-1<br>BH201/0.3-0.4<br>21/09/2011<br>Soil | 62247-2<br>BH202/0.1-0.2<br>21/09/2011<br>Soil | 62247-3<br>BH203/0.1-0.2<br>21/09/2011<br>Soil | 62247-4<br>BH204/0.2-0.3<br>21/09/2011<br>Soil | 62247-5<br>BH205/0.3-0.4<br>20/09/2011<br>Soil |
|---|---|---|---|---|---|---|
| Date extracted | - | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 |
| Date analysed | - | 26/09/2011 | 26/09/2011 | 26/09/2011 | 26/09/2011 | 26/09/2011 |
| 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 | 0.2 | 0.2 | <0.1 | <0.1 |
| Anthracene | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Fluoranthene | mg/kg | <0.1 | 0.4 | 0.3 | 0.1 | 0.1 |
| Pyrene | mg/kg | <0.1 | 0.4 | 0.4 | 0.1 | 0.2 |
| Benzo(a)anthracene | mg/kg | <0.1 | 0.2 | 0.2 | <0.1 | <0.1 |
| Chrysene | mg/kg | <0.1 | 0.2 | 0.2 | <0.1 | 0.1 |
| Benzo(b+k)fluoranthene | mg/kg | <0.2 | 0.3 | 0.3 | <0.2 | <0.2 |
| Benzo(a)pyrene | mg/kg | <0.05 | 0.19 | 0.17 | 0.05 | 0.08 |
| 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-$d_{14}$ | % | 97 | 97 | 97 | 96 | 95 |

| PAHs in Soil<br>Our Reference:<br>Your Reference<br><br>Date Sampled<br>Type of sample | UNITS<br>----------<br><br>---------- | 62247-6<br>BH206/0.15-0.25<br>20/09/2011<br>Soil | 62247-7<br>BH207/0.05-0.1<br>20/09/2011<br>Soil | 62247-8<br>BH208/0.1-0.2<br>20/09/2011<br>Soil | 62247-9<br>BH209/0.1-0.2<br>21/09/2011<br>Soil | 62247-10<br>BH210/0.1-0.2<br>21/09/2011<br>Soil |
|---|---|---|---|---|---|---|
| Date extracted | - | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 |
| Date analysed | - | 26/09/2011 | 26/09/2011 | 26/09/2011 | 26/09/2011 | 26/09/2011 |
| 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 | 0.4 | <0.1 | <0.1 | <0.1 |
| Fluorene | mg/kg | <0.1 | 0.3 | <0.1 | <0.1 | <0.1 |
| Phenanthrene | mg/kg | <0.1 | 4.6 | <0.1 | 1.3 | 0.1 |
| Anthracene | mg/kg | <0.1 | 0.7 | <0.1 | 0.3 | <0.1 |
| Fluoranthene | mg/kg | <0.1 | 6.9 | <0.1 | 1.7 | 0.2 |
| Pyrene | mg/kg | <0.1 | 6.0 | <0.1 | 1.8 | 0.2 |
| Benzo(a)anthracene | mg/kg | <0.1 | 2.3 | <0.1 | 0.9 | <0.1 |
| Chrysene | mg/kg | <0.1 | 2.6 | <0.1 | 0.9 | 0.1 |
| Benzo(b+k)fluoranthene | mg/kg | <0.2 | 4.5 | <0.2 | 1.2 | <0.2 |
| Benzo(a)pyrene | mg/kg | <0.05 | 2.4 | <0.05 | 0.75 | 0.1 |
| Indeno(1,2,3-c,d)pyrene | mg/kg | <0.1 | 2.1 | <0.1 | 0.3 | <0.1 |
| Dibenzo(a,h)anthracene | mg/kg | <0.1 | 0.4 | <0.1 | <0.1 | <0.1 |
| Benzo(g,h,i)perylene | mg/kg | <0.1 | 1.9 | <0.1 | 0.3 | <0.1 |
| *Surrogate p*-Terphenyl-$d_{14}$ | % | 100 | 92 | 103 | 95 | 96 |

| PAHs in Soil | | | | |
|---|---|---|---|---|
| Our Reference: | UNITS | 62247-11 | 62247-12 | 62247-13 |
| Your Reference | ---------- | BH211/0.3-0.4 | BD1/21.9.11 | BH211/0.6-0.7 |
| Date Sampled | ---------- | 21/09/2011 | 21/09/2011 | 21/09/2011 |
| Type of sample | | Soil | Soil | Soil |
| Date extracted | - | 23/09/2011 | 23/09/2011 | 23/09/2011 |
| Date analysed | - | 26/09/2011 | 26/09/2011 | 26/09/2011 |
| Naphthalene | mg/kg | <0.1 | <0.1 | <0.1 |
| Acenaphthylene | mg/kg | <0.1 | <0.1 | <0.1 |
| Acenaphthene | mg/kg | <0.1 | <0.1 | <0.1 |
| Fluorene | mg/kg | <0.1 | <0.1 | <0.1 |
| Phenanthrene | mg/kg | <0.1 | 0.2 | <0.1 |
| Anthracene | mg/kg | <0.1 | <0.1 | <0.1 |
| Fluoranthene | mg/kg | <0.1 | 0.3 | <0.1 |
| Pyrene | mg/kg | <0.1 | 0.4 | <0.1 |
| Benzo(a)anthracene | mg/kg | <0.1 | 0.2 | <0.1 |
| Chrysene | mg/kg | <0.1 | 0.2 | <0.1 |
| Benzo(b+k)fluoranthene | mg/kg | <0.2 | 0.3 | <0.2 |
| Benzo(a)pyrene | mg/kg | <0.05 | 0.17 | <0.05 |
| Indeno(1,2,3-c,d)pyrene | mg/kg | <0.1 | 0.1 | <0.1 |
| Dibenzo(a,h)anthracene | mg/kg | <0.1 | <0.1 | <0.1 |
| Benzo(g,h,i)perylene | mg/kg | <0.1 | 0.1 | <0.1 |
| *Surrogate p*-Terphenyl-$d_{14}$ | % | 100 | 97 | 98 |

| Organochlorine Pesticides in soil | | | | | | |
|---|---|---|---|---|---|---|
| Our Reference: | UNITS | 62247-1 | 62247-2 | 62247-3 | 62247-4 | 62247-5 |
| Your Reference | ---------- | BH201/0.3-0.4 | BH202/0.1-0.2 | BH203/0.1-0.2 | BH204/0.2-0.3 | BH205/0.3-0.4 |
| Date Sampled | ---------- | 21/09/2011 | 21/09/2011 | 21/09/2011 | 21/09/2011 | 20/09/2011 |
| Type of sample | | Soil | Soil | Soil | Soil | Soil |
| Date extracted | - | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 |
| Date analysed | - | 26/09/2011 | 26/09/2011 | 26/09/2011 | 26/09/2011 | 26/09/2011 |
| 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 | % | 93 | 89 | 90 | 89 | 86 |

| Organochlorine Pesticides in soil<br>Our Reference:<br>Your Reference<br><br>Date Sampled<br>Type of sample | UNITS<br>----------<br><br>---------- | 62247-6<br>BH206/0.15-0.25<br>20/09/2011<br>Soil | 62247-7<br>BH207/0.05-0.1<br>20/09/2011<br>Soil | 62247-8<br>BH208/0.1-0.2<br>20/09/2011<br>Soil | 62247-9<br>BH209/0.1-0.2<br>21/09/2011<br>Soil | 62247-10<br>BH210/0.1-0.2<br>21/09/2011<br>Soil |
|---|---|---|---|---|---|---|
| Date extracted | - | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 |
| Date analysed | - | 26/09/2011 | 26/09/2011 | 26/09/2011 | 26/09/2011 | 26/09/2011 |
| 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 | % | 91 | 91 | 97 | 89 | 92 |

| Organochlorine Pesticides in soil | | | | |
|---|---|---|---|---|
| Our Reference: | UNITS | 62247-11 | 62247-12 | 62247-13 |
| Your Reference | ---------- | BH211/0.3-0.4 | BD1/21.9.11 | BH211/0.6-0.7 |
| Date Sampled | ---------- | 21/09/2011 | 21/09/2011 | 21/09/2011 |
| Type of sample | | Soil | Soil | Soil |
| Date extracted | - | 23/09/2011 | 23/09/2011 | 23/09/2011 |
| Date analysed | - | 26/09/2011 | 26/09/2011 | 26/09/2011 |
| HCB | mg/kg | <0.1 | <0.1 | <0.1 |
| alpha-BHC | mg/kg | <0.1 | <0.1 | <0.1 |
| gamma-BHC | mg/kg | <0.1 | <0.1 | <0.1 |
| beta-BHC | mg/kg | <0.1 | <0.1 | <0.1 |
| Heptachlor | mg/kg | <0.1 | <0.1 | <0.1 |
| delta-BHC | mg/kg | <0.1 | <0.1 | <0.1 |
| Aldrin | mg/kg | <0.1 | <0.1 | <0.1 |
| Heptachlor Epoxide | mg/kg | <0.1 | <0.1 | <0.1 |
| gamma-Chlordane | mg/kg | <0.1 | <0.1 | <0.1 |
| alpha-chlordane | mg/kg | <0.1 | <0.1 | <0.1 |
| Endosulfan I | mg/kg | <0.1 | <0.1 | <0.1 |
| pp-DDE | mg/kg | <0.1 | <0.1 | <0.1 |
| Dieldrin | mg/kg | <0.1 | <0.1 | <0.1 |
| Endrin | mg/kg | <0.1 | <0.1 | <0.1 |
| pp-DDD | mg/kg | <0.1 | <0.1 | <0.1 |
| Endosulfan II | mg/kg | <0.1 | <0.1 | <0.1 |
| pp-DDT | mg/kg | <0.1 | <0.1 | <0.1 |
| Endrin Aldehyde | mg/kg | <0.1 | <0.1 | <0.1 |
| Endosulfan Sulphate | mg/kg | <0.1 | <0.1 | <0.1 |
| Methoxychlor | mg/kg | <0.1 | <0.1 | <0.1 |
| *Surrogate* TCLMX | % | 94 | 91 | 91 |

| Organophosphorus Pesticides | | | | | | |
|---|---|---|---|---|---|---|
| Our Reference: | UNITS | 62247-1 | 62247-2 | 62247-3 | 62247-4 | 62247-5 |
| Your Reference | ---------- | BH201/0.3-0.4 | BH202/0.1-0.2 | BH203/0.1-0.2 | BH204/0.2-0.3 | BH205/0.3-0.4 |
| Date Sampled | ---------- | 21/09/2011 | 21/09/2011 | 21/09/2011 | 21/09/2011 | 20/09/2011 |
| Type of sample | | Soil | Soil | Soil | Soil | Soil |
| Date extracted | - | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 |
| Date analysed | - | 26/09/2011 | 26/09/2011 | 26/09/2011 | 26/09/2011 | 26/09/2011 |
| 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 | % | 93 | 89 | 90 | 89 | 86 |

| Organophosphorus Pesticides | | | | | | |
|---|---|---|---|---|---|---|
| Our Reference: | UNITS | 62247-6 | 62247-7 | 62247-8 | 62247-9 | 62247-10 |
| Your Reference | ---------- | BH206/0.15-0.25 | BH207/0.05-0.1 | BH208/0.1-0.2 | BH209/0.1-0.2 | BH210/0.1-0.2 |
| Date Sampled | ---------- | 20/09/2011 | 20/09/2011 | 20/09/2011 | 21/09/2011 | 21/09/2011 |
| Type of sample | | Soil | Soil | Soil | Soil | Soil |
| Date extracted | - | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 |
| Date analysed | - | 26/09/2011 | 26/09/2011 | 26/09/2011 | 26/09/2011 | 26/09/2011 |
| 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 | % | 91 | 91 | 97 | 89 | 92 |

| Organophosphorus Pesticides | | | | |
|---|---|---|---|---|
| Our Reference: | UNITS | 62247-11 | 62247-12 | 62247-13 |
| Your Reference | ---------- | BH211/0.3-0.4 | BD1/21.9.11 | BH211/0.6-0.7 |
| Date Sampled | ---------- | 21/09/2011 | 21/09/2011 | 21/09/2011 |
| Type of sample | | Soil | Soil | Soil |
| Date extracted | - | 23/09/2011 | 23/09/2011 | 23/09/2011 |
| Date analysed | - | 26/09/2011 | 26/09/2011 | 26/09/2011 |
| Diazinon | mg/kg | <0.1 | <0.1 | <0.1 |
| Dimethoate | mg/kg | <0.1 | <0.1 | <0.1 |
| Chlorpyriphos-methyl | mg/kg | <0.1 | <0.1 | <0.1 |
| Ronnel | mg/kg | <0.1 | <0.1 | <0.1 |
| Chlorpyriphos | mg/kg | <0.1 | <0.1 | <0.1 |
| Fenitrothion | mg/kg | <0.1 | <0.1 | <0.1 |
| Bromophos-ethyl | mg/kg | <0.1 | <0.1 | <0.1 |
| Ethion | mg/kg | <0.1 | <0.1 | <0.1 |
| *Surrogate* TCLMX | % | 94 | 91 | 91 |

| PCBs in Soil | | | | | | |
|---|---|---|---|---|---|---|
| Our Reference: | UNITS | 62247-1 | 62247-2 | 62247-3 | 62247-4 | 62247-5 |
| Your Reference | ---------- | BH201/0.3-0.4 | BH202/0.1-0.2 | BH203/0.1-0.2 | BH204/0.2-0.3 | BH205/0.3-0.4 |
| Date Sampled | ---------- | 21/09/2011 | 21/09/2011 | 21/09/2011 | 21/09/2011 | 20/09/2011 |
| Type of sample | | Soil | Soil | Soil | Soil | Soil |
| Date extracted | - | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 |
| Date analysed | - | 26/09/2011 | 26/09/2011 | 26/09/2011 | 26/09/2011 | 26/09/2011 |
| 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 | % | 93 | 89 | 90 | 89 | 86 |

| PCBs in Soil | | | | | | |
|---|---|---|---|---|---|---|
| Our Reference: | UNITS | 62247-6 | 62247-7 | 62247-8 | 62247-9 | 62247-10 |
| Your Reference | ---------- | BH206/0.15-0.25 | BH207/0.05-0.1 | BH208/0.1-0.2 | BH209/0.1-0.2 | BH210/0.1-0.2 |
| Date Sampled | ---------- | 20/09/2011 | 20/09/2011 | 20/09/2011 | 21/09/2011 | 21/09/2011 |
| Type of sample | | Soil | Soil | Soil | Soil | Soil |
| Date extracted | - | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 |
| Date analysed | - | 26/09/2011 | 26/09/2011 | 26/09/2011 | 26/09/2011 | 26/09/2011 |
| 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 | % | 91 | 91 | 97 | 89 | 92 |

| PCBs in Soil | | | | |
|---|---|---|---|---|
| Our Reference: | UNITS | 62247-11 | 62247-12 | 62247-13 |
| Your Reference | ---------- | BH211/0.3-0.4 | BD1/21.9.11 | BH211/0.6-0.7 |
| Date Sampled | ---------- | 21/09/2011 | 21/09/2011 | 21/09/2011 |
| Type of sample | | Soil | Soil | Soil |
| Date extracted | - | 23/09/2011 | 23/09/2011 | 23/09/2011 |
| Date analysed | - | 26/09/2011 | 26/09/2011 | 26/09/2011 |
| Arochlor 1016 | mg/kg | <0.1 | <0.1 | <0.1 |
| Arochlor 1221* | mg/kg | <0.1 | <0.1 | <0.1 |
| Arochlor 1232 | mg/kg | <0.1 | <0.1 | <0.1 |
| Arochlor 1242 | mg/kg | <0.1 | <0.1 | <0.1 |
| Arochlor 1248 | mg/kg | <0.1 | <0.1 | <0.1 |
| Arochlor 1254 | mg/kg | <0.1 | <0.1 | <0.1 |
| Arochlor 1260 | mg/kg | <0.1 | <0.1 | <0.1 |
| *Surrogate* TCLMX | % | 94 | 91 | 91 |

| Total Phenolics in Soil | | | | | | |
|---|---|---|---|---|---|---|
| Our Reference: | UNITS | 62247-1 | 62247-2 | 62247-3 | 62247-4 | 62247-5 |
| Your Reference | ---------- | BH201/0.3-0.4 | BH202/0.1-0.2 | BH203/0.1-0.2 | BH204/0.2-0.3 | BH205/0.3-0.4 |
| Date Sampled | ---------- | 21/09/2011 | 21/09/2011 | 21/09/2011 | 21/09/2011 | 20/09/2011 |
| Type of sample | | Soil | Soil | Soil | Soil | Soil |
| Date extracted | - | 27/09/2011 | 27/09/2011 | 27/09/2011 | 27/09/2011 | 27/09/2011 |
| Date analysed | - | 27/09/2011 | 27/09/2011 | 27/09/2011 | 27/09/2011 | 27/09/2011 |
| Total Phenolics (as Phenol) | mg/kg | <5 | <5 | <5 | <5 | <5 |

| Total Phenolics in Soil | | | | | | |
|---|---|---|---|---|---|---|
| Our Reference: | UNITS | 62247-6 | 62247-7 | 62247-8 | 62247-9 | 62247-10 |
| Your Reference | ---------- | BH206/0.15-0.25 | BH207/0.05-0.1 | BH208/0.1-0.2 | BH209/0.1-0.2 | BH210/0.1-0.2 |
| Date Sampled | ---------- | 20/09/2011 | 20/09/2011 | 20/09/2011 | 21/09/2011 | 21/09/2011 |
| Type of sample | | Soil | Soil | Soil | Soil | Soil |
| Date extracted | - | 27/09/2011 | 27/09/2011 | 27/09/2011 | 27/09/2011 | 27/09/2011 |
| Date analysed | - | 27/09/2011 | 27/09/2011 | 27/09/2011 | 27/09/2011 | 27/09/2011 |
| Total Phenolics (as Phenol) | mg/kg | <5 | <5 | <5 | <5 | <5 |

| Total Phenolics in Soil | | | | |
|---|---|---|---|---|
| Our Reference: | UNITS | 62247-11 | 62247-12 | 62247-13 |
| Your Reference | ---------- | BH211/0.3-0.4 | BD1/21.9.11 | BH211/0.6-0.7 |
| Date Sampled | ---------- | 21/09/2011 | 21/09/2011 | 21/09/2011 |
| Type of sample | | Soil | Soil | Soil |
| Date extracted | - | 27/09/2011 | 27/09/2011 | 27/09/2011 |
| Date analysed | - | 27/09/2011 | 27/09/2011 | 27/09/2011 |
| Total Phenolics (as Phenol) | mg/kg | <5 | <5 | <5 |

| Acid Extractable metals in soil | | | | | | |
|---|---|---|---|---|---|---|
| Our Reference: | UNITS | 62247-1 | 62247-2 | 62247-3 | 62247-4 | 62247-5 |
| Your Reference | ---------- | BH201/0.3-0.4 | BH202/0.1-0.2 | BH203/0.1-0.2 | BH204/0.2-0.3 | BH205/0.3-0.4 |
| Date Sampled | ---------- | 21/09/2011 | 21/09/2011 | 21/09/2011 | 21/09/2011 | 20/09/2011 |
| Type of sample | | Soil | Soil | Soil | Soil | Soil |
| Date digested | - | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 |
| Date analysed | - | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 |
| Arsenic | mg/kg | 6 | 6 | 5 | 9 | 8 |
| Cadmium | mg/kg | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Chromium | mg/kg | 18 | 25 | 25 | 28 | 27 |
| Lead | mg/kg | 10 | 46 | 37 | 37 | 89 |
| Mercury | mg/kg | <0.1 | 0.4 | 0.1 | <0.1 | 0.6 |
| Nickel | mg/kg | 11 | 13 | 13 | 15 | 14 |

| Acid Extractable metals in soil | | | | | | |
|---|---|---|---|---|---|---|
| Our Reference: | UNITS | 62247-6 | 62247-7 | 62247-8 | 62247-9 | 62247-10 |
| Your Reference | ---------- | BH206/0.15-0.25 | BH207/0.05-0.1 | BH208/0.1-0.2 | BH209/0.1-0.2 | BH210/0.1-0.2 |
| Date Sampled | ---------- | 20/09/2011 | 20/09/2011 | 20/09/2011 | 21/09/2011 | 21/09/2011 |
| Type of sample | | Soil | Soil | Soil | Soil | Soil |
| Date digested | - | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 |
| Date analysed | - | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 |
| Arsenic | mg/kg | 4 | 5 | 6 | 10 | 5 |
| Cadmium | mg/kg | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Chromium | mg/kg | 22 | 21 | 27 | 13 | 18 |
| Lead | mg/kg | 13 | 12 | 16 | 81 | 64 |
| Mercury | mg/kg | <0.1 | <0.1 | <0.1 | <0.1 | 0.1 |
| Nickel | mg/kg | 13 | 7 | 11 | 19 | 15 |

| Acid Extractable metals in soil | | | | |
|---|---|---|---|---|
| Our Reference: | UNITS | 62247-11 | 62247-12 | 62247-13 |
| Your Reference | ---------- | BH211/0.3-0.4 | BD1/21.9.11 | BH211/0.6-0.7 |
| Date Sampled | ---------- | 21/09/2011 | 21/09/2011 | 21/09/2011 |
| Type of sample | | Soil | Soil | Soil |
| Date digested | - | 23/09/2011 | 23/09/2011 | 23/09/2011 |
| Date analysed | - | 23/09/2011 | 23/09/2011 | 23/09/2011 |
| Arsenic | mg/kg | <4 | 5 | 6 |
| Cadmium | mg/kg | <0.5 | <0.5 | <0.5 |
| Chromium | mg/kg | 11 | 22 | 23 |
| Lead | mg/kg | 12 | 150 | 30 |
| Mercury | mg/kg | <0.1 | 0.3 | 0.1 |
| Nickel | mg/kg | 6 | 11 | 12 |

| Moisture | | | | | | |
|---|---|---|---|---|---|---|
| Our Reference: | UNITS | 62247-1 | 62247-2 | 62247-3 | 62247-4 | 62247-5 |
| Your Reference | ---------- | BH201/0.3-0.4 | BH202/0.1-0.2 | BH203/0.1-0.2 | BH204/0.2-0.3 | BH205/0.3-0.4 |
| Date Sampled | ---------- | 21/09/2011 | 21/09/2011 | 21/09/2011 | 21/09/2011 | 20/09/2011 |
| Type of sample | | Soil | Soil | Soil | Soil | Soil |
| Date prepared | - | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 |
| Date analysed | - | 24/09/2011 | 24/09/2011 | 24/09/2011 | 24/09/2011 | 24/09/2011 |
| Moisture | % | 17 | 11 | 9.3 | 11 | 16 |

| Moisture | | | | | | |
|---|---|---|---|---|---|---|
| Our Reference: | UNITS | 62247-6 | 62247-7 | 62247-8 | 62247-9 | 62247-10 |
| Your Reference | ---------- | BH206/0.15-0.25 | BH207/0.05-0.1 | BH208/0.1-0.2 | BH209/0.1-0.2 | BH210/0.1-0.2 |
| Date Sampled | ---------- | 20/09/2011 | 20/09/2011 | 20/09/2011 | 21/09/2011 | 21/09/2011 |
| Type of sample | | Soil | Soil | Soil | Soil | Soil |
| Date prepared | - | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 | 23/09/2011 |
| Date analysed | - | 24/09/2011 | 24/09/2011 | 24/09/2011 | 24/09/2011 | 24/09/2011 |
| Moisture | % | 11 | 6.9 | 10 | 5.0 | 10 |

| Moisture | | | | |
|---|---|---|---|---|
| Our Reference: | UNITS | 62247-11 | 62247-12 | 62247-13 |
| Your Reference | ---------- | BH211/0.3-0.4 | BD1/21.9.11 | BH211/0.6-0.7 |
| Date Sampled | ---------- | 21/09/2011 | 21/09/2011 | 21/09/2011 |
| Type of sample | | Soil | Soil | Soil |
| Date prepared | - | 23/09/2011 | 23/09/2011 | 23/09/2011 |
| Date analysed | - | 24/09/2011 | 24/09/2011 | 24/09/2011 |
| Moisture | % | 10 | 12 | 14 |

| Asbestos ID - soils | | | | | | |
|---|---|---|---|---|---|---|
| Our Reference: | UNITS | 62247-1 | 62247-2 | 62247-3 | 62247-4 | 62247-5 |
| Your Reference | ---------- | BH201/0.3-0.4 | BH202/0.1-0.2 | BH203/0.1-0.2 | BH204/0.2-0.3 | BH205/0.3-0.4 |
| Date Sampled | ---------- | 21/09/2011 | 21/09/2011 | 21/09/2011 | 21/09/2011 | 20/09/2011 |
| Type of sample | | Soil | Soil | Soil | Soil | Soil |
| Date analysed | - | 27/09/2011 | 27/09/2011 | 27/09/2011 | 27/09/2011 | 27/09/2011 |
| Sample mass tested | g | Approx 40g | Approx 40g | Approx 40g | Approx 40g | Approx 40g |
| Sample Description | - | Brown fine-grained soil | Brown fine-grained soil | Brown fine-grained soil | Brown fine-grained soil | Brown fine-grained 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 | - | No respirable fibres detected | No respirable fibres detected | No respirable fibres detected | No respirable fibres detected | No respirable fibres detected |

| Asbestos ID - soils | | | | | | |
|---|---|---|---|---|---|---|
| Our Reference: | UNITS | 62247-6 | 62247-7 | 62247-8 | 62247-9 | 62247-10 |
| Your Reference | ---------- | BH206/0.15-0.25 | BH207/0.05-0.1 | BH208/0.1-0.2 | BH209/0.1-0.2 | BH210/0.1-0.2 |
| Date Sampled | ---------- | 20/09/2011 | 20/09/2011 | 20/09/2011 | 21/09/2011 | 21/09/2011 |
| Type of sample | | Soil | Soil | Soil | Soil | Soil |
| Date analysed | - | 27/09/2011 | 27/09/2011 | 27/09/2011 | 27/09/2011 | 27/09/2011 |
| Sample mass tested | g | Approx 40g | Approx 40g | Approx 40g | Approx 40g | Approx 40g |
| Sample Description | - | Brown fine-grained soil | Brown fine-grained soil | Brown fine-grained soil | Brown fine-grained soil | Brown fine-grained 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 | - | No respirable fibres detected | No respirable fibres detected | No respirable fibres detected | No respirable fibres detected | No respirable fibres detected |

| Asbestos ID - soils | | | | |
|---|---|---|---|---|
| Our Reference: | UNITS | 62247-11 | 62247-12 | 62247-13 |
| Your Reference | ---------- | BH211/0.3-0.4 | BD1/21.9.11 | BH211/0.6-0.7 |
| Date Sampled | ---------- | 21/09/2011 | 21/09/2011 | 21/09/2011 |
| Type of sample | | Soil | Soil | Soil |
| Date analysed | - | 27/09/2011 | 27/09/2011 | 27/09/2011 |
| Sample mass tested | g | Approx 40g | Approx 40g | Approx 40g |
| Sample Description | - | Brown fine-grained soil | Brown fine-grained soil | Brown fine-grained 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 |
| Trace Analysis | - | No respirable fibres detected | No respirable fibres detected | No respirable fibres detected |

| Metals in TCLP USEPA1311 | | | | | | |
|---|---|---|---|---|---|---|
| Our Reference: | UNITS | 62247-1 | 62247-2 | 62247-3 | 62247-4 | 62247-5 |
| Your Reference | ---------- | BH201/0.3-0.4 | BH202/0.1-0.2 | BH203/0.1-0.2 | BH204/0.2-0.3 | BH205/0.3-0.4 |
| Date Sampled | ---------- | 21/09/2011 | 21/09/2011 | 21/09/2011 | 21/09/2011 | 20/09/2011 |
| Type of sample | | Soil | Soil | Soil | Soil | Soil |
| Date extracted | - | 28/09/2011 | 28/09/2011 | 28/09/2011 | 28/09/2011 | 28/09/2011 |
| Date analysed | - | 29/09/2011 | 29/09/2011 | 29/09/2011 | 29/09/2011 | 29/09/2011 |
| pH of soil for fluid# determ. | pH units | 6.6 | 6.3 | 6.8 | 6.5 | 8.0 |
| pH of soil for fluid # determ. (acid) | pH units | 1.7 | 1.8 | 1.7 | 1.7 | 1.7 |
| Extraction fluid used | - | 1 | 1 | 1 | 1 | 1 |
| pH of final Leachate | pH units | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| Lead in TCLP | mg/L | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 |

| Metals in TCLP USEPA1311 | | | | | | |
|---|---|---|---|---|---|---|
| Our Reference: | UNITS | 62247-6 | 62247-7 | 62247-8 | 62247-9 | 62247-10 |
| Your Reference | ---------- | BH206/0.15-0.25 | BH207/0.05-0.1 | BH208/0.1-0.2 | BH209/0.1-0.2 | BH210/0.1-0.2 |
| Date Sampled | ---------- | 20/09/2011 | 20/09/2011 | 20/09/2011 | 21/09/2011 | 21/09/2011 |
| Type of sample | | Soil | Soil | Soil | Soil | Soil |
| Date extracted | - | 28/09/2011 | 28/09/2011 | 28/09/2011 | 28/09/2011 | 28/09/2011 |
| Date analysed | - | 29/09/2011 | 29/09/2011 | 29/09/2011 | 29/09/2011 | 29/09/2011 |
| pH of soil for fluid# determ. | pH units | 7.7 | 7.1 | 7.3 | 7.4 | 8.2 |
| pH of soil for fluid # determ. (acid) | pH units | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 |
| Extraction fluid used | - | 1 | 1 | 1 | 1 | 1 |
| pH of final Leachate | pH units | 4.9 | 4.9 | 5.0 | 5.0 | 5.0 |
| Lead in TCLP | mg/L | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 |

| Metals in TCLP USEPA1311 | | | | |
|---|---|---|---|---|
| Our Reference: | UNITS | 62247-11 | 62247-12 | 62247-13 |
| Your Reference | ---------- | BH211/0.3-0.4 | BD1/21.9.11 | BH211/0.6-0.7 |
| Date Sampled | ---------- | 21/09/2011 | 21/09/2011 | 21/09/2011 |
| Type of sample | | Soil | Soil | Soil |
| Date extracted | - | 28/09/2011 | 28/09/2011 | 28/09/2011 |
| Date analysed | - | 29/09/2011 | 29/09/2011 | 29/09/2011 |
| pH of soil for fluid# determ. | pH units | 8.2 | 6.9 | 8.2 |
| pH of soil for fluid # determ. (acid) | pH units | 1.7 | 1.6 | 1.7 |
| Extraction fluid used | - | 1 | 1 | 1 |
| pH of final Leachate | pH units | 5.0 | 4.9 | 5.0 |
| Lead in TCLP | mg/L | <0.03 | <0.03 | <0.03 |

| PAHs in TCLP (USEPA 1311) | | | | | | |
|---|---|---|---|---|---|---|
| Our Reference: | UNITS | 62247-1 | 62247-2 | 62247-3 | 62247-4 | 62247-5 |
| Your Reference | ---------- | BH201/0.3-0.4 | BH202/0.1-0.2 | BH203/0.1-0.2 | BH204/0.2-0.3 | BH205/0.3-0.4 |
| Date Sampled | ---------- | 21/09/2011 | 21/09/2011 | 21/09/2011 | 21/09/2011 | 20/09/2011 |
| Type of sample | | Soil | Soil | Soil | Soil | Soil |
| Date extracted | - | 28/09/2011 | 28/09/2011 | 28/09/2011 | 28/09/2011 | 28/09/2011 |
| Date analysed | - | 28/09/2011 | 28/09/2011 | 28/09/2011 | 28/09/2011 | 28/09/2011 |
| Naphthalene in TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Acenaphthylene in TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Acenaphthene in TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Fluorene in TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Phenanthrene in TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Anthracene in TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Fluoranthene in TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Pyrene in TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Benzo(a)anthracene in TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Chrysene in TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Benzo(b+k)fluoranthene in TCLP | mg/L | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 |
| Benzo(a)pyrene in TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Indeno(1,2,3-c,d)pyrene - TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Dibenzo(a,h)anthracene in TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Benzo(g,h,i)perylene in TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| *Surrogate p*-Terphenyl-$d_{14}$ | % | 107 | 89 | 102 | 108 | 111 |

| PAHs in TCLP (USEPA 1311) | | | | | | |
|---|---|---|---|---|---|---|
| Our Reference: | UNITS | 62247-6 | 62247-7 | 62247-8 | 62247-9 | 62247-10 |
| Your Reference | ---------- | BH206/0.15-0.25 | BH207/0.05-0.1 | BH208/0.1-0.2 | BH209/0.1-0.2 | BH210/0.1-0.2 |
| Date Sampled | ---------- | 20/09/2011 | 20/09/2011 | 20/09/2011 | 21/09/2011 | 21/09/2011 |
| Type of sample | | Soil | Soil | Soil | Soil | Soil |
| Date extracted | - | 28/09/2011 | 28/09/2011 | 28/09/2011 | 28/09/2011 | 28/09/2011 |
| Date analysed | - | 28/09/2011 | 28/09/2011 | 28/09/2011 | 28/09/2011 | 28/09/2011 |
| Naphthalene in TCLP | mg/L | <0.001 | <0.001 | 0.006 | <0.001 | <0.001 |
| Acenaphthylene in TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Acenaphthene in TCLP | mg/L | <0.001 | 0.006 | 0.003 | <0.001 | <0.001 |
| Fluorene in TCLP | mg/L | <0.001 | 0.004 | 0.006 | <0.001 | <0.001 |
| Phenanthrene in TCLP | mg/L | <0.001 | 0.027 | 0.005 | <0.001 | <0.001 |
| Anthracene in TCLP | mg/L | <0.001 | 0.002 | <0.001 | <0.001 | <0.001 |
| Fluoranthene in TCLP | mg/L | <0.001 | 0.009 | <0.001 | <0.001 | <0.001 |
| Pyrene in TCLP | mg/L | <0.001 | 0.006 | 0.002 | <0.001 | <0.001 |
| Benzo(a)anthracene in TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Chrysene in TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Benzo(b+k)fluoranthene in TCLP | mg/L | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 |
| Benzo(a)pyrene in TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Indeno(1,2,3-c,d)pyrene - TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Dibenzo(a,h)anthracene in TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Benzo(g,h,i)perylene in TCLP | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| *Surrogate p*-Terphenyl-$d_{14}$ | % | 110 | 101 | 112 | 111 | 99 |

| PAHs in TCLP (USEPA 1311) | | | | |
|---|---|---|---|---|
| Our Reference: | UNITS | 62247-11 | 62247-12 | 62247-13 |
| Your Reference | ---------- | BH211/0.3-0.4 | BD1/21.9.11 | BH211/0.6-0.7 |
| Date Sampled | ---------- | 21/09/2011 | 21/09/2011 | 21/09/2011 |
| Type of sample | | Soil | Soil | Soil |
| Date extracted | - | 28/09/2011 | 28/09/2011 | 28/09/2011 |
| Date analysed | - | 28/09/2011 | 28/09/2011 | 28/09/2011 |
| Naphthalene in TCLP | mg/L | <0.001 | <0.001 | <0.001 |
| Acenaphthylene in TCLP | mg/L | <0.001 | <0.001 | <0.001 |
| Acenaphthene in TCLP | mg/L | <0.001 | <0.001 | <0.001 |
| Fluorene in TCLP | mg/L | <0.001 | <0.001 | <0.001 |
| Phenanthrene in TCLP | mg/L | <0.001 | <0.001 | <0.001 |
| Anthracene in TCLP | mg/L | <0.001 | <0.001 | <0.001 |
| Fluoranthene in TCLP | mg/L | <0.001 | <0.001 | <0.001 |
| Pyrene in TCLP | mg/L | <0.001 | <0.001 | <0.001 |
| Benzo(a)anthracene in TCLP | mg/L | <0.001 | <0.001 | <0.001 |
| Chrysene in TCLP | mg/L | <0.001 | <0.001 | <0.001 |
| Benzo(b+k)fluoranthene in TCLP | mg/L | <0.002 | <0.002 | <0.002 |
| Benzo(a)pyrene in TCLP | mg/L | <0.001 | <0.001 | <0.001 |
| Indeno(1,2,3-c,d)pyrene - TCLP | mg/L | <0.001 | <0.001 | <0.001 |
| Dibenzo(a,h)anthracene in TCLP | mg/L | <0.001 | <0.001 | <0.001 |
| Benzo(g,h,i)perylene in TCLP | mg/L | <0.001 | <0.001 | <0.001 |
| *Surrogate p*-Terphenyl-$d_{14}$ | % | 113 | 85 | 114 |

| 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. |
| Inorg-030 | Total Phenolics - determined colorimetrically following disitillation, based upon APHA 21st ED 5530 D. |
| Metals-020 ICP-AES | Determination of various metals by ICP-AES. |
| Metals-021 CV-AAS | Determination of Mercury by Cold Vapour AAS. |
| Inorg-008 | Moisture content determined by heating at 105 deg C for a minimum of 4 hours. |
| ASB-001 | Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004. |
| 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. |
| Org-012 subset | Leachates are extracted with Dichloromethane and analysed by GC-MS. |
| Org-012 | Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. |

| QUALITY CONTROL<br>vTRH & BTEX in Soil | UNITS | PQL | METHOD | Blank | Duplicate Sm# | Duplicate results<br>Base \|\| Duplicate \|\| %RPD | Spike Sm# | Spike % Recovery |
|---|---|---|---|---|---|---|---|---|
| Date extracted | - | | | 23/9/11 | 62247-1 | 23/9/11 \|\| 23/9/11 | LCS-1 | 23/9/11 |
| Date analysed | - | | | 25/9/11 | 62247-1 | 25/9/11 \|\| 25/9/11 | LCS-1 | 25/6/11 |
| vTRH $C_6$ - $C_9$ | mg/kg | 25 | Org-016 | <25 | 62247-1 | <25 \|\| <25 | LCS-1 | 109% |
| Benzene | mg/kg | 0.2 | Org-016 | <0.2 | 62247-1 | <0.2 \|\| <0.2 | LCS-1 | 99% |
| Toluene | mg/kg | 0.5 | Org-016 | <0.5 | 62247-1 | <0.5 \|\| <0.5 | LCS-1 | 111% |
| Ethylbenzene | mg/kg | 1 | Org-016 | <1 | 62247-1 | <1 \|\| <1 | LCS-1 | 112% |
| m+p-xylene | mg/kg | 2 | Org-016 | <2 | 62247-1 | <2 \|\| <2 | LCS-1 | 111% |
| o-Xylene | mg/kg | 1 | Org-016 | <1 | 62247-1 | <1 \|\| <1 | LCS-1 | 117% |
| *Surrogate* aaa-Trifluorotoluene | % | | Org-016 | 119 | 62247-1 | 120 \|\| 119 \|\| RPD: 1 | LCS-1 | 119% |

| QUALITY CONTROL<br>sTRH in Soil (C10-C36) | UNITS | PQL | METHOD | Blank | Duplicate Sm# | Duplicate results<br>Base \|\| Duplicate \|\| %RPD | Spike Sm# | Spike % Recovery |
|---|---|---|---|---|---|---|---|---|
| Date extracted | - | | | 23/09/2011 | 62247-1 | 23/09/2011 \|\| 23/09/2011 | LCS-12 | 23/09/2011 |
| Date analysed | - | | | 23/09/2011 | 62247-1 | 23/09/2011 \|\| 23/09/2011 | LCS-12 | 23/09/2011 |
| TRH $C_{10}$ - $C_{14}$ | mg/kg | 50 | Org-003 | <50 | 62247-1 | <50 \|\| <50 | LCS-12 | 106% |
| TRH $C_{15}$ - $C_{28}$ | mg/kg | 100 | Org-003 | <100 | 62247-1 | <100 \|\| <100 | LCS-12 | 101% |
| TRH $C_{29}$ - $C_{36}$ | mg/kg | 100 | Org-003 | <100 | 62247-1 | <100 \|\| <100 | LCS-12 | 95% |
| *Surrogate* o-Terphenyl | % | | Org-003 | 94 | 62247-1 | 92 \|\| 96 \|\| RPD: 4 | LCS-12 | 98% |

| QUALITY CONTROL<br>PAHs in Soil | UNITS | PQL | METHOD | Blank | Duplicate Sm# | Duplicate results<br>Base \|\| Duplicate \|\| %RPD | Spike Sm# | Spike % Recovery |
|---|---|---|---|---|---|---|---|---|
| Date extracted | - | | | 23/09/2011 | 62247-1 | 23/09/2011 \|\| 23/09/2011 | LCS-12 | 23/09/2011 |
| Date analysed | - | | | 26/09/2011 | 62247-1 | 26/09/2011 \|\| 26/09/2011 | LCS-12 | 26/09/2011 |
| Naphthalene | mg/kg | 0.1 | Org-012 subset | <0.1 | 62247-1 | <0.1 \|\| <0.1 | LCS-12 | 100% |
| Acenaphthylene | mg/kg | 0.1 | Org-012 subset | <0.1 | 62247-1 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Acenaphthene | mg/kg | 0.1 | Org-012 subset | <0.1 | 62247-1 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Fluorene | mg/kg | 0.1 | Org-012 subset | <0.1 | 62247-1 | <0.1 \|\| <0.1 | LCS-12 | 107% |
| Phenanthrene | mg/kg | 0.1 | Org-012 subset | <0.1 | 62247-1 | <0.1 \|\| <0.1 | LCS-12 | 110% |
| Anthracene | mg/kg | 0.1 | Org-012 subset | <0.1 | 62247-1 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Fluoranthene | mg/kg | 0.1 | Org-012 subset | <0.1 | 62247-1 | <0.1 \|\| <0.1 | LCS-12 | 106% |
| Pyrene | mg/kg | 0.1 | Org-012 subset | <0.1 | 62247-1 | <0.1 \|\| <0.1 | LCS-12 | 112% |
| Benzo(a)anthracene | mg/kg | 0.1 | Org-012 subset | <0.1 | 62247-1 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Chrysene | mg/kg | 0.1 | Org-012 subset | <0.1 | 62247-1 | <0.1 \|\| <0.1 | LCS-12 | 114% |
| Benzo(b+k)fluoranthene | mg/kg | 0.2 | Org-012 subset | <0.2 | 62247-1 | <0.2 \|\| <0.2 | [NR] | [NR] |

| QUALITY CONTROL<br><br>PAHs in Soil | UNITS | PQL | METHOD | Blank | Duplicate Sm# | Duplicate results<br><br>Base ll Duplicate ll %RPD | Spike Sm# | Spike % Recovery |
|---|---|---|---|---|---|---|---|---|
| Benzo(a)pyrene | mg/kg | 0.05 | Org-012 subset | <0.05 | 62247-1 | <0.05 \|\| <0.05 | LCS-12 | 109% |
| Indeno(1,2,3-c,d)pyrene | mg/kg | 0.1 | Org-012 subset | <0.1 | 62247-1 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Dibenzo(a,h)anthracene | mg/kg | 0.1 | Org-012 subset | <0.1 | 62247-1 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Benzo(g,h,i)perylene | mg/kg | 0.1 | Org-012 subset | <0.1 | 62247-1 | <0.1 \|\| <0.1 | [NR] | [NR] |
| *Surrogate p*-Terphenyl-$d_{14}$ | % | | Org-012 subset | 100 | 62247-1 | 97 \|\| 103 \|\| RPD: 6 | LCS-12 | 99% |

| QUALITY CONTROL<br><br>Organochlorine Pesticides in soil | UNITS | PQL | METHOD | Blank | Duplicate Sm# | Duplicate results<br><br>Base ll Duplicate ll %RPD | Spike Sm# | Spike % Recovery |
|---|---|---|---|---|---|---|---|---|
| Date extracted | - | | | 23/09/2011 | 62247-1 | 23/09/2011 \|\| 23/09/2011 | LCS-12 | 23/09/2011 |
| Date analysed | - | | | 26/09/2011 | 62247-1 | 26/09/2011 \|\| 26/09/2011 | LCS-12 | 26/09/2011 |
| HCB | mg/kg | 0.1 | Org-005 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | [NR] | [NR] |
| alpha-BHC | mg/kg | 0.1 | Org-005 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | LCS-12 | 94% |
| gamma-BHC | mg/kg | 0.1 | Org-005 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | [NR] | [NR] |
| beta-BHC | mg/kg | 0.1 | Org-005 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | LCS-12 | 94% |
| Heptachlor | mg/kg | 0.1 | Org-005 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | LCS-12 | 92% |
| delta-BHC | mg/kg | 0.1 | Org-005 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Aldrin | mg/kg | 0.1 | Org-005 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | LCS-12 | 88% |
| Heptachlor Epoxide | mg/kg | 0.1 | Org-005 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | LCS-12 | 94% |
| gamma-Chlordane | mg/kg | 0.1 | Org-005 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | [NR] | [NR] |
| alpha-chlordane | mg/kg | 0.1 | Org-005 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Endosulfan I | mg/kg | 0.1 | Org-005 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | [NR] | [NR] |
| pp-DDE | mg/kg | 0.1 | Org-005 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | LCS-12 | 89% |
| Dieldrin | mg/kg | 0.1 | Org-005 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | LCS-12 | 93% |
| Endrin | mg/kg | 0.1 | Org-005 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | LCS-12 | 92% |
| pp-DDD | mg/kg | 0.1 | Org-005 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | LCS-12 | 109% |
| Endosulfan II | mg/kg | 0.1 | Org-005 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | [NR] | [NR] |
| pp-DDT | mg/kg | 0.1 | Org-005 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Endrin Aldehyde | mg/kg | 0.1 | Org-005 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Endosulfan Sulphate | mg/kg | 0.1 | Org-005 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | LCS-12 | 92% |
| Methoxychlor | mg/kg | 0.1 | Org-005 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | [NR] | [NR] |
| *Surrogate* TCLMX | % | | Org-005 | 89 | 62247-1 | 93 \|\| 89 \|\| RPD: 4 | LCS-12 | 92% |

| QUALITY CONTROL<br><br>Organophosphorus Pesticides | UNITS | PQL | METHOD | Blank | Duplicate Sm# | Duplicate results<br><br>Base II Duplicate II %RPD | Spike Sm# | Spike % Recovery |
|---|---|---|---|---|---|---|---|---|
| Date extracted | - | | | 23/09/2011 | 62247-1 | 23/09/2011 \|\| 23/09/2011 | LCS-2 | 23/09/2011 |
| Date analysed | - | | | 26/09/2011 | 62247-1 | 26/09/2011 \|\| 26/09/2011 | LCS-2 | 26/09/2011 |
| Diazinon | mg/kg | 0.1 | Org-008 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Dimethoate | mg/kg | 0.1 | Org-008 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Chlorpyriphos-methyl | mg/kg | 0.1 | Org-008 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Ronnel | mg/kg | 0.1 | Org-008 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Chlorpyriphos | mg/kg | 0.1 | Org-008 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | LCS-2 | 105% |
| Fenitrothion | mg/kg | 0.1 | Org-008 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | LCS-2 | 104% |
| Bromophos-ethyl | mg/kg | 0.1 | Org-008 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Ethion | mg/kg | 0.1 | Org-008 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | LCS-2 | 102% |
| *Surrogate* TCLMX | % | | Org-008 | 89 | 62247-1 | 93 \|\| 89 \|\| RPD: 4 | LCS-2 | 90% |
| QUALITY CONTROL<br><br>PCBs in Soil | UNITS | PQL | METHOD | Blank | Duplicate Sm# | Duplicate results<br><br>Base II Duplicate II %RPD | Spike Sm# | Spike % Recovery |
| Date extracted | - | | | 23/09/2011 | 62247-1 | 23/09/2011 \|\| 23/09/2011 | LCS-2 | 23/09/2011 |
| Date analysed | - | | | 26/09/2011 | 62247-1 | 26/09/2011 \|\| 26/09/2011 | LCS-2 | 26/09/2011 |
| Arochlor 1016 | mg/kg | 0.1 | Org-006 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Arochlor 1221* | mg/kg | 0.1 | Org-006 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Arochlor 1232 | mg/kg | 0.1 | Org-006 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Arochlor 1242 | mg/kg | 0.1 | Org-006 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Arochlor 1248 | mg/kg | 0.1 | Org-006 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Arochlor 1254 | mg/kg | 0.1 | Org-006 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | LCS-2 | 138% |
| Arochlor 1260 | mg/kg | 0.1 | Org-006 | <0.1 | 62247-1 | <0.1 \|\| <0.1 | [NR] | [NR] |
| *Surrogate* TCLMX | % | | Org-006 | 89 | 62247-1 | 93 \|\| 89 \|\| RPD: 4 | LCS-2 | 100% |
| QUALITY CONTROL<br><br>Total Phenolics in Soil | UNITS | PQL | METHOD | Blank | Duplicate Sm# | Duplicate results<br><br>Base II Duplicate II %RPD | Spike Sm# | Spike % Recovery |
| Date extracted | - | | | 27/09/2011 | 62247-2 | 27/09/2011 \|\| 27/09/2011 | LCS-1 | 27/09/2011 |
| Date analysed | - | | | 27/09/2011 | 62247-2 | 27/09/2011 \|\| 27/09/2011 | LCS-1 | 27/09/201 |
| Total Phenolics (as Phenol) | mg/kg | 5 | Inorg-030 | <5 | 62247-2 | <5 \|\| <5 | LCS-1 | 113% |
| QUALITY CONTROL<br><br>Acid Extractable metals in soil | UNITS | PQL | METHOD | Blank | Duplicate Sm# | Duplicate results<br><br>Base II Duplicate II %RPD | Spike Sm# | Spike % Recovery |
| Date digested | - | | | 23/09/2011 | 62247-1 | 23/09/2011 \|\| 23/09/2011 | LCS-1 | 23/09/2011 |
| Date analysed | - | | | 23/09/2011 | 62247-1 | 23/09/2011 \|\| 23/09/2011 | LCS-1 | 23/09/2011 |
| Arsenic | mg/kg | 4 | Metals-020 ICP-AES | <4 | 62247-1 | 6 \|\| 6 \|\| RPD: 0 | LCS-1 | 103% |
| Cadmium | mg/kg | 0.5 | Metals-020 ICP-AES | <0.5 | 62247-1 | <0.5 \|\| <0.5 | LCS-1 | 105% |

| QUALITY CONTROL<br>Acid Extractable metals in soil | UNITS | PQL | METHOD | Blank | Duplicate Sm# | Duplicate results<br>Base ll Duplicate ll %RPD | Spike Sm# | Spike % Recovery |
|---|---|---|---|---|---|---|---|---|
| Chromium | mg/kg | 1 | Metals-020 ICP-AES | <1 | 62247-1 | 18 \|\| 19 \|\| RPD: 5 | LCS-1 | 106% |
| Lead | mg/kg | 1 | Metals-020 ICP-AES | <1 | 62247-1 | 10 \|\| 13 \|\| RPD: 26 | LCS-1 | 103% |
| Mercury | mg/kg | 0.1 | Metals-021 CV-AAS | <0.1 | 62247-1 | <0.1 \|\| <0.1 | LCS-1 | 107% |
| Nickel | mg/kg | 1 | Metals-020 ICP-AES | <1 | 62247-1 | 11 \|\| 11 \|\| RPD: 0 | LCS-1 | 106% |

| QUALITY CONTROL<br>Moisture | UNITS | PQL | METHOD | Blank |
|---|---|---|---|---|
| Date prepared | - | | | 23/09/2011 |
| Date analysed | - | | | 24/09/2011 |
| Moisture | % | 0.1 | Inorg-008 | [NT] |

| QUALITY CONTROL<br>Asbestos ID - soils | UNITS | PQL | METHOD | Blank |
|---|---|---|---|---|
| Date analysed | - | | | [NT] |

| QUALITY CONTROL<br>Metals in TCLP USEPA1311 | UNITS | PQL | METHOD | Blank | Duplicate Sm# | Duplicate results<br>Base ll Duplicate ll %RPD |
|---|---|---|---|---|---|---|
| Date extracted | - | | | 29/09/2011 | 62247-7 | 28/09/2011 \|\| 28/09/2011 |
| Date analysed | - | | | 29/09/2011 | 62247-7 | 29/09/2011 \|\| 29/09/2011 |
| Lead in TCLP | mg/L | 0.03 | Metals-020 ICP-AES | <0.03 | 62247-7 | <0.03 \|\| <0.03 |

| QUALITY CONTROL<br>PAHs in TCLP (USEPA 1311) | UNITS | PQL | METHOD | Blank | Duplicate Sm# | Duplicate results<br>Base ll Duplicate ll %RPD | Spike Sm# | Spike % Recovery |
|---|---|---|---|---|---|---|---|---|
| Date extracted | - | | | 28/09/2011 | [NT] | [NT] | LCS-W3 | 28/09/2011 |
| Date analysed | - | | | 28/09/2011 | [NT] | [NT] | LCS-W3 | 28/09/2011 |
| Naphthalene in TCLP | mg/L | 0.001 | Org-012 subset | <0.001 | [NT] | [NT] | LCS-W3 | 83% |
| Acenaphthylene in TCLP | mg/L | 0.001 | Org-012 subset | <0.001 | [NT] | [NT] | [NR] | [NR] |
| Acenaphthene in TCLP | mg/L | 0.001 | Org-012 subset | <0.001 | [NT] | [NT] | [NR] | [NR] |
| Fluorene in TCLP | mg/L | 0.001 | Org-012 subset | <0.001 | [NT] | [NT] | LCS-W3 | 92% |
| Phenanthrene in TCLP | mg/L | 0.001 | Org-012 subset | <0.001 | [NT] | [NT] | LCS-W3 | 87% |
| Anthracene in TCLP | mg/L | 0.001 | Org-012 subset | <0.001 | [NT] | [NT] | [NR] | [NR] |
| Fluoranthene in TCLP | mg/L | 0.001 | Org-012 subset | <0.001 | [NT] | [NT] | LCS-W3 | 85% |

| QUALITY CONTROL<br>PAHs in TCLP (USEPA 1311) | UNITS | PQL | METHOD | Blank | Duplicate Sm# | Duplicate results<br>Base II Duplicate II %RPD | Spike Sm# | Spike % Recovery |
|---|---|---|---|---|---|---|---|---|
| Pyrene in TCLP | mg/L | 0.001 | Org-012 subset | <0.001 | [NT] | [NT] | LCS-W3 | 90% |
| Benzo(a)anthracene in TCLP | mg/L | 0.001 | Org-012 subset | <0.001 | [NT] | [NT] | [NR] | [NR] |
| Chrysene in TCLP | mg/L | 0.001 | Org-012 subset | <0.001 | [NT] | [NT] | LCS-W3 | 90% |
| Benzo(b+k)fluoranthene in TCLP | mg/L | 0.002 | Org-012 subset | <0.002 | [NT] | [NT] | [NR] | [NR] |
| Benzo(a)pyrene in TCLP | mg/L | 0.001 | Org-012 subset | <0.001 | [NT] | [NT] | LCS-W3 | 97% |
| Indeno(1,2,3-c,d)pyrene - TCLP | mg/L | 0.001 | Org-012 subset | <0.001 | [NT] | [NT] | [NR] | [NR] |
| Dibenzo(a,h)anthracene in TCLP | mg/L | 0.001 | Org-012 subset | <0.001 | [NT] | [NT] | [NR] | [NR] |
| Benzo(g,h,i)perylene in TCLP | mg/L | 0.001 | Org-012 subset | <0.001 | [NT] | [NT] | [NR] | [NR] |
| *Surrogate p*-Terphenyl-$d_{14}$ | % | | Org-012 | 99 | [NT] | [NT] | LCS-W3 | 100% |

| QUALITY CONTROL<br>vTRH & BTEX in Soil | UNITS | Dup. Sm# | Duplicate<br>Base + Duplicate + %RPD | Spike Sm# | Spike % Recovery |
|---|---|---|---|---|---|
| Date extracted | - | 62247-11 | 23/9/11 \|\| 23/9/11 | 62247-2 | 23/9/11 |
| Date analysed | - | 62247-11 | 25/9/11 \|\| 25/9/11 | 62247-2 | 25/9/11 |
| vTRH $C_6$ - $C_9$ | mg/kg | 62247-11 | <25 \|\| <25 | 62247-2 | 107% |
| Benzene | mg/kg | 62247-11 | <0.2 \|\| <0.2 | 62247-2 | 95% |
| Toluene | mg/kg | 62247-11 | <0.5 \|\| <0.5 | 62247-2 | 108% |
| Ethylbenzene | mg/kg | 62247-11 | <1 \|\| <1 | 62247-2 | 110% |
| m+p-xylene | mg/kg | 62247-11 | <2 \|\| <2 | 62247-2 | 110% |
| o-Xylene | mg/kg | 62247-11 | <1 \|\| <1 | 62247-2 | 114% |
| *Surrogate* aaa-Trifluorotoluene | % | 62247-11 | 124 \|\| 119 \|\| RPD: 4 | 62247-2 | 114% |

| QUALITY CONTROL<br>sTRH in Soil (C10-C36) | UNITS | Dup. Sm# | Duplicate<br>Base + Duplicate + %RPD | Spike Sm# | Spike % Recovery |
|---|---|---|---|---|---|
| Date extracted | - | 62247-11 | 23/09/2011 \|\| 23/09/2011 | 62247-2 | 23/09/2011 |
| Date analysed | - | 62247-11 | 23/09/2011 \|\| 23/09/2011 | 62247-2 | 23/09/2011 |
| TRH $C_{10}$ - $C_{14}$ | mg/kg | 62247-11 | <50 \|\| <50 | 62247-2 | 91% |
| TRH $C_{15}$ - $C_{28}$ | mg/kg | 62247-11 | <100 \|\| <100 | 62247-2 | 87% |
| TRH $C_{29}$ - $C_{36}$ | mg/kg | 62247-11 | <100 \|\| <100 | 62247-2 | 81% |
| *Surrogate* o-Terphenyl | % | 62247-11 | 93 \|\| 94 \|\| RPD: 1 | 62247-2 | 84% |

| QUALITY CONTROL PAHs in Soil | UNITS | Dup. Sm# | Duplicate Base + Duplicate + %RPD | Spike Sm# | Spike % Recovery |
|---|---|---|---|---|---|
| Date extracted | - | 62247-11 | 23/09/2011 \|\| 23/09/2011 | 62247-2 | 23/09/2011 |
| Date analysed | - | 62247-11 | 26/09/2011 \|\| 26/09/2011 | 62247-2 | 26/09/2011 |
| Naphthalene | mg/kg | 62247-11 | <0.1 \|\| <0.1 | 62247-2 | 90% |
| Acenaphthylene | mg/kg | 62247-11 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Acenaphthene | mg/kg | 62247-11 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Fluorene | mg/kg | 62247-11 | <0.1 \|\| <0.1 | 62247-2 | 94% |
| Phenanthrene | mg/kg | 62247-11 | <0.1 \|\| <0.1 | 62247-2 | 94% |
| Anthracene | mg/kg | 62247-11 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Fluoranthene | mg/kg | 62247-11 | <0.1 \|\| <0.1 | 62247-2 | 94% |
| Pyrene | mg/kg | 62247-11 | <0.1 \|\| <0.1 | 62247-2 | 99% |
| Benzo(a)anthracene | mg/kg | 62247-11 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Chrysene | mg/kg | 62247-11 | <0.1 \|\| <0.1 | 62247-2 | 96% |
| Benzo(b+k)fluoranthene | mg/kg | 62247-11 | <0.2 \|\| <0.2 | [NR] | [NR] |
| Benzo(a)pyrene | mg/kg | 62247-11 | <0.05 \|\| <0.05 | 62247-2 | 98% |
| Indeno(1,2,3-c,d)pyrene | mg/kg | 62247-11 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Dibenzo(a,h)anthracene | mg/kg | 62247-11 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Benzo(g,h,i)perylene | mg/kg | 62247-11 | <0.1 \|\| <0.1 | [NR] | [NR] |
| *Surrogate p*-Terphenyl-$d_{14}$ | % | 62247-11 | 100 \|\| 99 \|\| RPD: 1 | 62247-2 | 86% |

| QUALITY CONTROL Organochlorine Pesticides in soil | UNITS | Dup. Sm# | Duplicate Base + Duplicate + %RPD | Spike Sm# | Spike % Recovery |
|---|---|---|---|---|---|
| Date extracted | - | 62247-11 | 23/09/2011 \|\| 23/09/2011 | 62247-2 | 23/09/2011 |
| Date analysed | - | 62247-11 | 26/09/2011 \|\| 26/09/2011 | 62247-2 | 26/09/2011 |
| HCB | mg/kg | 62247-11 | <0.1 \|\| <0.1 | [NR] | [NR] |
| alpha-BHC | mg/kg | 62247-11 | <0.1 \|\| <0.1 | 62247-2 | 85% |
| gamma-BHC | mg/kg | 62247-11 | <0.1 \|\| <0.1 | [NR] | [NR] |
| beta-BHC | mg/kg | 62247-11 | <0.1 \|\| <0.1 | 62247-2 | 85% |
| Heptachlor | mg/kg | 62247-11 | <0.1 \|\| <0.1 | 62247-2 | 82% |
| delta-BHC | mg/kg | 62247-11 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Aldrin | mg/kg | 62247-11 | <0.1 \|\| <0.1 | 62247-2 | 79% |
| Heptachlor Epoxide | mg/kg | 62247-11 | <0.1 \|\| <0.1 | 62247-2 | 84% |
| gamma-Chlordane | mg/kg | 62247-11 | <0.1 \|\| <0.1 | [NR] | [NR] |
| alpha-chlordane | mg/kg | 62247-11 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Endosulfan I | mg/kg | 62247-11 | <0.1 \|\| <0.1 | [NR] | [NR] |
| pp-DDE | mg/kg | 62247-11 | <0.1 \|\| <0.1 | 62247-2 | 79% |
| Dieldrin | mg/kg | 62247-11 | <0.1 \|\| <0.1 | 62247-2 | 83% |
| Endrin | mg/kg | 62247-11 | <0.1 \|\| <0.1 | 62247-2 | 83% |
| pp-DDD | mg/kg | 62247-11 | <0.1 \|\| <0.1 | 62247-2 | 97% |
| Endosulfan II | mg/kg | 62247-11 | <0.1 \|\| <0.1 | [NR] | [NR] |
| pp-DDT | mg/kg | 62247-11 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Endrin Aldehyde | mg/kg | 62247-11 | <0.1 \|\| <0.1 | [NR] | [NR] |

| QUALITY CONTROL Organochlorine Pesticides in soil | UNITS | Dup. Sm# | Duplicate Base + Duplicate + %RPD | Spike Sm# | Spike % Recovery |
|---|---|---|---|---|---|
| Endosulfan Sulphate | mg/kg | 62247-11 | <0.1 \|\| <0.1 | 62247-2 | 82% |
| Methoxychlor | mg/kg | 62247-11 | <0.1 \|\| <0.1 | [NR] | [NR] |
| *Surrogate* TCLMX | % | 62247-11 | 94 \|\| 90 \|\| RPD: 4 | 62247-2 | 82% |
| QUALITY CONTROL Organophosphorus Pesticides | UNITS | Dup. Sm# | Duplicate Base + Duplicate + %RPD | Spike Sm# | Spike % Recovery |
| Date extracted | - | 62247-11 | 23/09/2011 \|\| 23/09/2011 | 62247-2 | 23/09/2011 |
| Date analysed | - | 62247-11 | 26/09/2011 \|\| 26/09/2011 | 62247-2 | 26/09/2011 |
| Diazinon | mg/kg | 62247-11 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Dimethoate | mg/kg | 62247-11 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Chlorpyriphos-methyl | mg/kg | 62247-11 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Ronnel | mg/kg | 62247-11 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Chlorpyriphos | mg/kg | 62247-11 | <0.1 \|\| <0.1 | 62247-2 | 114% |
| Fenitrothion | mg/kg | 62247-11 | <0.1 \|\| <0.1 | 62247-2 | 110% |
| Bromophos-ethyl | mg/kg | 62247-11 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Ethion | mg/kg | 62247-11 | <0.1 \|\| <0.1 | 62247-2 | 117% |
| *Surrogate* TCLMX | % | 62247-11 | 94 \|\| 90 \|\| RPD: 4 | 62247-2 | 98% |
| QUALITY CONTROL PCBs in Soil | UNITS | Dup. Sm# | Duplicate Base + Duplicate + %RPD | Spike Sm# | Spike % Recovery |
| Date extracted | - | 62247-11 | 23/09/2011 \|\| 23/09/2011 | 62247-2 | 23/09/2011 |
| Date analysed | - | 62247-11 | 26/09/2011 \|\| 26/09/2011 | 62247-2 | 26/09/2011 |
| Arochlor 1016 | mg/kg | 62247-11 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Arochlor 1221* | mg/kg | 62247-11 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Arochlor 1232 | mg/kg | 62247-11 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Arochlor 1242 | mg/kg | 62247-11 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Arochlor 1248 | mg/kg | 62247-11 | <0.1 \|\| <0.1 | [NR] | [NR] |
| Arochlor 1254 | mg/kg | 62247-11 | <0.1 \|\| <0.1 | 62247-2 | 134% |
| Arochlor 1260 | mg/kg | 62247-11 | <0.1 \|\| <0.1 | [NR] | [NR] |
| *Surrogate* TCLMX | % | 62247-11 | 94 \|\| 90 \|\| RPD: 4 | 62247-2 | 111% |
| QUALITY CONTROL Total Phenolics in Soil | UNITS | Dup. Sm# | Duplicate Base + Duplicate + %RPD | Spike Sm# | Spike % Recovery |
| Date extracted | - | 62247-12 | 27/09/2011 \|\| 27/09/2011 | 62247-3 | 27/09/2011 |
| Date analysed | - | 62247-12 | 27/09/2011 \|\| 27/09/2011 | 62247-3 | 27/09/2011 |
| Total Phenolics (as Phenol) | mg/kg | 62247-12 | <5 \|\| <5 | 62247-3 | 98% |
| QUALITY CONTROL Acid Extractable metals in soil | UNITS | Dup. Sm# | Duplicate Base + Duplicate + %RPD | Spike Sm# | Spike % Recovery |
| Date digested | - | 62247-11 | 23/09/2011 \|\| 23/09/2011 | 62247-2 | 23/09/2011 |
| Date analysed | - | 62247-11 | 23/09/2011 \|\| 23/09/2011 | 62247-2 | 23/09/2011 |
| Arsenic | mg/kg | 62247-11 | <4 \|\| 4 | 62247-2 | 104% |
| Cadmium | mg/kg | 62247-11 | <0.5 \|\| <0.5 | 62247-2 | 100% |

| QUALITY CONTROL<br>Acid Extractable metals in soil | UNITS | Dup. Sm# | Duplicate<br>Base + Duplicate + %RPD | Spike Sm# | Spike % Recovery |
|---|---|---|---|---|---|
| Chromium | mg/kg | 62247-11 | 11 \|\| 13 \|\| RPD: 17 | 62247-2 | 105% |
| Lead | mg/kg | 62247-11 | 12 \|\| 13 \|\| RPD: 8 | 62247-2 | 91% |
| Mercury | mg/kg | 62247-11 | <0.1 \|\| <0.1 | 62247-2 | 107% |
| Nickel | mg/kg | 62247-11 | 6 \|\| 7 \|\| RPD: 15 | 62247-2 | 102% |

**Report Comments:**

Asbestos: Sample 62247-12; A portion of the supplied sample was sub-sampled for asbestos according to Envirolab procedures. We cannot guarantee that this sub-sample is indicative of the entire sample. Envirolab recommends supplying 30-40g of sample in its own container.

| | |
|---|---|
| Asbestos ID was analysed by Approved Identifier: | Paul Ching |
| Asbestos ID was authorised by Approved Signatory: | Paul Ching |

| | | |
|---|---|---|
| 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.