

**DISTRICT STRUCTURE PLAN  
DEVELOPMENT AREA 19  
CITY OF COCKBURN  
WESTERN AUSTRALIA**

**GEOTECHNICAL  
AND  
ACID SULPHATE SOIL ASSESSMENT**

**MAY 2007  
Ref: 06036.01**

**FOR  
KOLTASZ SMITH**



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3. Findings and conclusions produced in the report are based on the investigation of the sub-surface through isolated locations. Conditions between investigated sites are based on extrapolation, interpretation and professional estimates. Unexpected variations in ground conditions often occur which cannot always be anticipated. The conclusions and recommendations in the report were considered accurate at the time of issue and based on certain assumptions at the time. Conditions and assumptions change with time and may affect the accuracy of the report.
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6. The recommendations of this report should be considered a starting point. Recommendations should be continuously reviewed during the earthworks stage as sub-surface information and results from monitoring become available. It is strongly recommended that the Company be retained to provide consultancy and/or inspections during the earthwork stages.

## TABLE OF CONTENTS

<b>1</b>	<b>Introduction.....</b>	<b>1</b>
<b>2</b>	<b>Site Location.....</b>	<b>1</b>
<b>3</b>	<b>Site Details and Background.....</b>	<b>1</b>
<b>4</b>	<b>Geology and Environmental Studies.....</b>	<b>1</b>
<b>5</b>	<b>Objectives .....</b>	<b>2</b>
<b>6</b>	<b>Methodology and Scope of Works.....</b>	<b>2</b>
<b>7</b>	<b>Fieldwork and Laboratory Testing .....</b>	<b>3</b>
7.1	Investigation Fieldwork .....	3
7.2	ASS Field Testing .....	3
7.3	Laboratory Testing.....	3
<b>8</b>	<b>Results.....</b>	<b>3</b>
8.1	Subsurface Conditions .....	3
8.1.1	Fill.....	3
8.1.2	Topsoil.....	4
8.1.3	Sand.....	4
8.1.4	Coffee Rock.....	4
8.1.5	Groundwater.....	4
8.2	Test Results.....	4
8.2.1	Geotechnical Laboratory Test Results.....	5
8.2.2	Acid Sulphate Soil Test Results .....	6
<b>9</b>	<b>Analysis and Discussion.....</b>	<b>8</b>
9.1	Subsurface Conditions .....	8
9.2	Site Classification .....	8
9.3	Earthwork Requirements.....	8
9.4	Borrow Materials .....	8
9.5	Groundwater.....	9
9.6	Soil Permeability and Drainage .....	9
9.7	Public Open Spaces.....	9
9.8	CBR for Road Pavement Design.....	9
9.9	Acid Sulphate Soils.....	10
	<b>REFERENCES.....</b>	<b>11</b>

## **LIST OF FIGURES**

- Figure 1**      **Site Location Plan**  
**Figure 2**      **Site Layout and Test Location Plan**  
**Figure 3**      **Potential Acid Sulphate Soils Zones**

## **LIST OF APPENDICES**

- Appendix A**    **Test Pit Logs**  
**Appendix B**    **Perth Sand Penetrometer Plots**  
**Appendix C**    **Geotechnical Laboratory Test Certificates**  
**Appendix D**    **Acid Sulphate Soil Field Test Results**  
                    **Acid Sulphate Soil laboratory Test Certificates**  
**Appendix E**    **Acid Sulphate Soil Assessment Criteria**

## **1 Introduction**

A District Structure Plan (DSP) is currently being prepared for the City of Cockburn's Development Area 19, Jandakot. As part of the DSP a geotechnical and acid sulphate soil assessment is required. Brown Geotechnical & Environmental was commissioned by Koltasz Smith (Project Engineers) on behalf of associated land owners to undertake the assessment. This report presents the results of the assessment.

The terms of reference for the assessment were outlined in Brown Geotechnical and Environmental's proposal dated 4 August 2006. Instructions to proceed with the investigation were received from the Koltasz Smith on 4 October 2006.

Details and plans for the development area, survey plans and contact details for individual Lot owners were supplied through Koltasz Smith.

## **2 Site Location**

Development Area 19 lies at the northwest corner of the intersection of North Lake Road and the Kwinana Freeway. The land is approximately 16km south of the Perth central business district and approximately 10km southeast of Fremantle, within the City of Cockburn. The land adjoins the predominantly developed suburb of South Lake to the west along Semple Court, abuts the Kwinana Freeway to the east, and is bounded by Verna Court to the north and North Lake Road to the south.

## **3 Site Details and Background**

The area has previously been used for a mixture of rural lifestyle, horse agistment and similar related activities. Some light industrial and commercial activities have also been present in the area. Immediately to the west there is history of market gardens.

The area is characterized by low density housing surrounded by grassed paddocks and occasional trees. An area of very dense trees is present towards the south eastern corner and past aerial photographs show groundwater in a small lake bed within this area. During the investigation this area was dry; however a depression with old reeds was evident, though inaccessible to the excavator.

The site area is generally level at approximately 24m AHD with high points to approximately 27m AHD in the central south and northeast.

## **4 Geology and Environmental Studies**

The Environmental Geology sheet for the area [2] indicates the site to be underlain by Thin Bassendean Sands over the Guildford Formation (consisting of silts and clays) in the north and south, with Bassendean Sands running west to east through the centre. A pocket of Swamp deposits consisting of silty sand is present towards the south eastern corner.

The Perth Groundwater Atlas [3] shows the maximum historical groundwater level to be approximately 23m AHD.

The City of Cockburn, Arterial Drainage Scheme Review Nov 2005 [4] show design regional groundwater levels to range from 23.5m AHD in the east of the development area to 20m AHD in the west. The hydraulic gradient is therefore to the west.

The WAPC Bulletin No.64 May 2007 – *Acid Sulphate Soils, Central Perth Metro Area* [5] shows the potential for Acid Sulphate Soils (ASS) over the majority of the site to be medium to low. The exception to this is towards the south eastern corner where high risk soils are indicated and are likely to be associated with the swamp deposits show on the geological map.

## **5 Objectives**

It was essential that the geotechnical and acid sulphate soil assessment methodology for the development area was consistent with the requirements for a Structure Plan as detailed in the Town Planning Scheme and WAPC Guidelines for the Preparation of Local Structural Plans in Urban Release Areas (June 1992).

The following issues will therefore be addressed in this report:

- Subsurface conditions.
- Present site classifications in accordance with AS 2870-1996 [1].
- Earthwork required to obtain site classifications suitable for the development of the area.
- The suitability of soils within the area to be used as borrow material for residential or industrial land fill.
- Groundwater levels.
- Drainage and soil permeability issues.
- Public Open Spaces.
- Design CBR's for road pavement design.
- Potential acid sulphate soil issues.

## **6 Methodology and Scope of Works**

To enable an assessment of the geotechnical issues highlighted in Section 5, it was proposed to carry out a limited test pitting exercise across the whole development area. Perth sand penetrometer testing would also be carried out to determine the relative density of sands and current groundwater levels would be recorded in test pits. Selected soil samples would be collected for field descriptions and laboratory testing.

It was also proposed to use the test pitting exercise to assess the extent of the high risk ASS in the south eastern corner of the site. An increased density of test pits would be required in this area. ASS field testing would be carried out on samples from test pits in this area at selected depths.

The fieldwork would be followed by laboratory testing to determine relevant geotechnical properties of the soils and potential ASS risk.

## **7 Fieldwork and Laboratory Testing**

### **7.1 Investigation Fieldwork**

The fieldwork was undertaken during the period from 15 March 2007 to 23 March 2007. Thirty-four test pits were excavated across the site using a 5 tonne excavator. The test pits were extended to a maximum depth of 2.7m. Occasionally test pits were terminated early due to the test pit walls collapsing or where refusal in very dense material was encountered. Perth sand penetrometer (PSP) tests were carried out to determine relative density of the soils at thirty locations. Soil samples were obtained from the test pits for field descriptions, ASS field testing, geotechnical and ASS laboratory testing. Groundwater levels were recorded where encountered.

The original grid system envisaged proved impossible to implement due to site access problems with the high number Lots owners involved. Test pits were located on accessible Lots and an acceptable coverage of the development area was attained. Access into the dense area of trees in the southern corner of the site proved impossible due to the dense vegetation and owner access issues.

Test pit and PSP locations are shown in Figure 1, with test pit logs enclosed in Appendix A and PSP plots in Appendix B.

### **7.2 ASS Field Testing**

Thirty-six soil samples were selected for preliminary ASS testing. Field tests were carried out on all the samples and included the initial pH of the soil ( $\text{pH}_F$ ) and pH after oxidation by hydrogen peroxide ( $\text{pH}_{FOX}$ ), in accordance with the DoE's 'Identification and Investigation of Acid Sulphate Soils and Groundwater' [6] and 'Guidelines for Sampling and Analysis of Lowland Acid Sulphate Soils in Queensland' [7]. ASS field test results are presented in Appendix D.

### **7.3 Laboratory Testing**

Soil samples were delivered to Western Geotechnics Group laboratories for particle size distributions determinations, percent fines determinations and organic contents. Soil samples were also delivered to ALS Environmental for ASS laboratory testing. The geotechnical laboratory test certificates are presented in Appendix C and ASS laboratory test certificates in Appendix D.

## **8 Results**

### **8.1 Subsurface Conditions**

Subsurface conditions encountered in the test pits and inferred from laboratory testing and penetrometer test results are described as follows:

#### **8.1.1 Fill**

Fill was encountered in TP1, 2, 17, 22, 23, 25, 29, 30 and 31. The majority of the fill material encountered consisted of reworked or imported sand often containing gravel or limestone associated with old road base. The depth of fill extended to approximately 0.5m. In TP29 fill

was encountered to 1m depth and consisted of household rubbish and building materials in a sandy matrix.

### 8.1.2 Topsoil

Topsoil was encountered in seventeen of the test pits and generally consisted of dark grey, fine and medium grained sand with rootlets and occasional roots. The thickness of the topsoil varied from 0.2m to 0.5m.

### 8.1.3 Sand

Medium grained, grey sand with a trace of silt was encountered below the topsoil or fill in all test pits. The sand extended beyond the base of all test pits. The sand from TP25 and 28 contained traces of organic material, with laboratory results indicating low values of up to 0.85%.

The relative density of the sand was generally medium dense, becoming dense below approximately 1.5m depth. In TP19, 20, 24, 27 and 32 the sand was dense throughout. In TP23, 26 and 33 sands were loose to 1m depth.

The test pits walls were generally stable, only occasionally collapsing in looser sands above approximately 1.5m depth as the excavations deepened.

### 8.1.4 Coffee Rock

Very dense (weakly cemented), brown sand, colloquially named coffee rock, was encountered in TP14 and TP15 below 1.6m and 2.0m depth respectively. The 5 tonne excavator refused in the material at approximately 2.2m depth.

### 8.1.5 Groundwater

Groundwater was encountered in a number of the test pits. Groundwater depths and reduced levels are shown in Table 1. Ground levels have been taken from survey plans provided.

**Table 1 - Groundwater Depth**

Location	Groundwater Depth (m BGL)	Ground Level (m AHD)	Groundwater Level (m AHD)
TP17	2.4	25.0	22.6
TP20	2.2	23.6	21.4
TP27	2.4	24.8	22.4
TP28	2.5	24.0	21.5
TP29	2.1	23.8	21.7
TP30	2.3	24.0	21.7
TP31	2.1	24.5	22.4
TP32	2.3	24.8	22.5
TP33	2.0	23.8	21.8
TP34	2.1	22.8	20.7

The maximum groundwater level encountered was 22.6m AHD (2.4m bgl) in the north east corner of the site (TP17). The minimum depth to groundwater encountered was 2.0m (21.8m AHD) in the west of the site (TP33).

## 8.2 Test Results

### 8.2.1 Geotechnical Laboratory Test Results

Laboratory test results are summarised in Table 2.

**Table 2 – Geotechnical Laboratory Test Results**

Test Pit No.	Depth (m)	Organic Content (%)	Particle Size Distribution					USC
			Fines (%)	Sand (%)			Gravel (%)	
				fine	medium	coarse		
TP5	0.5 – 1.5	-	2	6	75	17	0	SP
TP7	1.3 – 2.5	-	2	10	75	13	0	SP
TP11	0.5 – 1.5	-	1	-	-	-	-	SP
TP13	0.5 – 1.5	-	1	-	-	-	-	SP
TP15	0.5 – 1.5	-	2	16	76	6	0	SP
TP17	0.9 – 2.0	-	0	9	78	13	0	SP
TP20	0.5 – 1.5	-	2	12	80	6	0	SP
TP22	1.5 – 2.5	-	1	5	78	16	0	SP
TP28	0.5 – 1.5	0.8	3	11	75	11	0	SP

Sands tested were poorly graded with low fines content. Organic contents were low.

### 8.2.2 Acid Sulphate Soil Test Results

ASS field test results are summarised in Table 3.

**Table 3 – Acid Sulphate Soil Field Test Results**

Test Pit No	Depth (m)	pH <sub>F</sub> (field)	pH <sub>Fox</sub> (post oxidation)	Reaction Strength
TP1	0.5	6.9	5.1	Moderate
TP1	1.5	7.2	5.5	Slight
TP1	2.5	6.9	5.0	Slight*
TP2	0.5	6.8	4.9	Slight
TP2	1.5	7.2	5.2	Slight
TP2	2.5	7.1	5.0	Slight
TP3	0.5	6.7	4.2	Slight
TP3	1.5	6.6	4.5	Slight*
TP3	2.5	7.1	5.2	Slight
TP4	0.5	7.0	3.8	Slight
TP4	1.5	5.8	3.8	Slight*
TP4	2.5	6.2	4.8	Slight
TP5	0.5	6.3	4.7	Slight
TP5	1.5	6.2	4.7	Slight
TP5	2.5	6.5	4.9	Slight
TP9	0.5	6.8	4.9	Slight
TP9	1.5	6.9	4.7	Slight
TP9	2.5	6.8	4.9	Slight
TP26	0.5	6.2	4.6	Slight
TP26	1.5	6.2	4.5	Slight*
TP26	2.5	6.3	4.6	Slight
TP27	0.5	6.0	4.8	Slight
TP27	1.5	6.3	4.8	Slight*
TP27	2.5	6.0	5.9	Slight
TP28	0.5	6.1	5.0	Slight
TP28	1.5	6.2	4.8	Slight
TP28	2.5	6.3	4.9	Slight
TP29	0.5	7.9	4.9	Slight
TP29	1.5	7.7	5.2	Slight
TP29	2.5	7.3	4.6	Strong*
TP30	0.5	7.3	4.3	Moderate*
TP30	1.5	6.8	4.7	Slight
TP30	2.5	6.8	4.6	Slight
TP31	0.5	7.0	4.5	Moderate*
TP31	1.5	7.0	5.0	Slight
TP31	2.5	7.0	5.1	Slight*
TP32	0.5	6.1	2.9	Moderate*
TP32	1.5	6.3	4.1	Slight*
TP32	2.5	5.9	4.2	Slight

\* Selected for laboratory testing.

The field results show the actual  $pH_F$  of the soil to be non-acidic i.e. generally  $pH_F > 6$ . The  $pH_{FOX}$  results however indicated that some soils in the vicinity of the high risk area may become acidic if oxidised, with  $pH_{FOX}$  of 2.9 in TP32 and 3.8 in TP4. These samples and samples showing volatile reactions were sent for confirmatory laboratory analysis to confirm sulphitic content.

ASS laboratory test results are summarised in Table 4.

**Table 4 – Acid Sulphate Soil Laboratory Test Results**

	Sample		TP1	TP3	TP4	TP4	TP26	TP27	TP29	TP30	TP31	TP31	TP32	TP32
	Depth		0.25	1.5	1.5	2.5	1.5	1.5	2.5	0.5	0.5	2.5	0.5	1.5
<b>Analyte grouping / Analyte</b>	<b>Units</b>	<b>LOR</b>												
EA033-A: Actual Acidity														
pH KCl (23A)	pH Unit	0.1	6.5	6.2	5.4	6.6	6.4	6.2	6.6	6.7	6.9	6.2	4.9	5.8
Titrateable Actual Acidity (23F)	mole H+ / t	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
sulfidic - Titrateable Actual Acidity	% pyrite S	.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02
Potential Acidity														
Chromium Reducible Sulfur (22B)	% S	0.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02
acidity - Chromium Reducible Sulfur	mole H+ / t	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
EA033-E: Acid Base Accounting														
ANC Fineness Factor	---	0.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	% S	0.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02
Net Acidity (acidity units)	mole H+ / t	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10

All results are below critical threshold limits (see Appendix E).

## **9 Analysis and Discussion**

### **9.1 Subsurface Conditions**

Evidence from the limited test pitting exercise has shown the whole of Development Area 19 to be underlain by medium grained, grey sand to a depth of at least 2m. This formation is consistent with the Bassendean Sands shown on the geological map for the area [2].

The laboratory test results show the sand to have a low fines content (approximately 2%) and a zero gravel content. In-situ penetrometer testing has shown the density of the sand to be generally medium dense, becoming dense below approximately 1.5m depth. Some tests indicated loose sand to approximately 1m depth; however these areas appear to be sporadic across the site. The sand was usually overlain by a thin layer of sandy topsoil.

The geology map for the area indicates the Guildford Formation, consisting of silt and clay deposits, to be present in the northern and southern areas of the site. No evidence of these deposits was uncovered during the investigation.

Pockets of fill were identified during the test pitting exercise and appear to occur randomly across the site. It should be noted that the majority of test pits were located in areas easily accessible to the excavator, such as paddocks or in areas where disruption to occupiers or land owners would be minimised. The test pit positions would therefore not necessarily be located in areas where fill would be expected.

The fill encountered should be suitable for foundation support, however screening to remove deleterious material may be required in some areas. The detailed geotechnical investigations for future individual developments will be able to identify suspect fill areas.

### **9.2 Site Classification**

Future Site Classifications for the area, in accordance with AS 2870 – 1996 [1], are likely to be Site Class 'A'. This assumes the underlying sand identified during this investigation is consistent across the whole site. Detailed geotechnical investigations for future individual developments within the area will be required to confirm site classifications.

### **9.3 Earthwork Requirements**

The majority of the earthworks envisaged as part of any future development will be associated with removal of topsoil, trees, old buildings and associated fill materials. Proof compacting of surface sand will be required, and any filling with imported sands to bring future site developments up to formation levels (see Section 9.6) will require compaction to relevant residential or industrial standards.

### **9.4 Borrow Materials**

The grain size, low fines content and free draining nature of in-situ sands underlying the development area make them suitable for use as imported fill material for residential and industrial building developments.

## **9.5 Groundwater**

The maximum groundwater level encountered during the investigation was 22.6m AHD in the north eastern corner of the site. This was at a depth of 2.4m below existing ground level. The minimum depth to groundwater encountered was 2.0m (21.8m AHD) towards the western boundary of the site.

The City of Cockburn, Arterial Drainage Scheme Review Nov 2005 [4] show design regional groundwater levels to vary from 23.5m AHD in the east of the development area to 20m AHD in the west. The hydraulic gradient therefore being to the west.

It appears from the above study, that the design regional groundwater levels will be closest to the existing ground level in the south eastern corner of the site at approximately 23.5m AHD (1.5m below existing ground level).

## **9.6 Soil Permeability and Drainage**

The grain size, low fines content and free draining nature of in-situ sands underlying the development area make them suitable for the use of soakwells in future developments. It is estimated, based on particle size distribution analysis from laboratory test results, that a permeability value approximating to  $1 \times 10^{-4}$  m/sec would be appropriate for soakwell design. However, as with all geotechnical assumptions within this report, a full geotechnical investigation will be required for each future development to confirm these values.

It is not envisaged that existing ground levels would require raising for site drainage using soakwells. The approximate depth to the design regional groundwater levels is 1.5m.

## **9.7 Public Open Spaces**

The Structure Plan for development areas requires the provision of Public Open Spaces (POS). POS areas often contain lakes both ornamental and for drainage related issues. The free draining nature of the in-situ soils may require the provision of an impermeable lining for the lakes to prevent drying out in times of low groundwater levels.

## **9.8 CBR for Road Pavement Design**

The in-situ sand appears to be consistent across the site. With surface sands compacted to a minimum of 98% SMDD at optimum moisture content, a design CBR of approximately 12% should be appropriate for future road pavement designs [8]. Further geotechnical investigations will be required to confirm this value.

## 9.9 Acid Sulphate Soils

The WAPC Bulletin No.64 May 2007 – *Acid Sulphate Soils, Central Perth Metro Area* [5] indicates the potential for acid sulphate generating soils within the development area to be mostly moderate to low. The exception is a pocket of potentially high risk soil towards the south eastern corner.

Moderate to low risk ASS zones require a full ASS investigation if soils are to be disturbed below a depth of 3m or below the groundwater level. High risk ASS zones require detailed ASS investigations if soils are to be disturbed below the existing ground level.

Test pitting was carried out in the vicinity of the south western corner of the development area in order to determine the extent of the high risk soils. Samples taken were field tested for actual pH ( $pH_F$ ) and pH after oxidation with hydrogen peroxide ( $pH_{FOX}$ ) which gives an indication of potential acidity should the soils be excavated and exposed to air. Further confirmatory testing was carried out in the laboratory. Samples could not be obtained from the very centre of the high risk hotspot, a small dried up lake area within dense vegetation.

Laboratory results revealed that some sands within the high risk ASS area contained existing acidity, however no potential acidity was identified. Sands containing existing acidity may require remediation during earthworks. This would consist of blending the sands with lime to neutralise the acidity. The extent of any remediation would be confirmed during detailed ASS investigation as part of future developments.

Based on the preliminary acid sulphate assessments, it can be concluded that the sand surrounding the dense vegetated areas denoted as high risk may contain some existing acidity but no potential acidity (refer Figure 3). It should be assumed that high risk soils exist in the centre of the area where the old lake existed.

Detailed ASS investigations will be required for all future developments in the area denoted as high risk by the WAPC Bulletin No.64. It is likely however that these investigations will show little or no potential acidity within the soils, except in the vicinity of the old lake.

If potential ASS soils are identified as part of these detailed investigations, ASS Management Plans will be required to treat acid generating soils. Dewatering Management Plans will also be required if excavations are to extend below groundwater level.

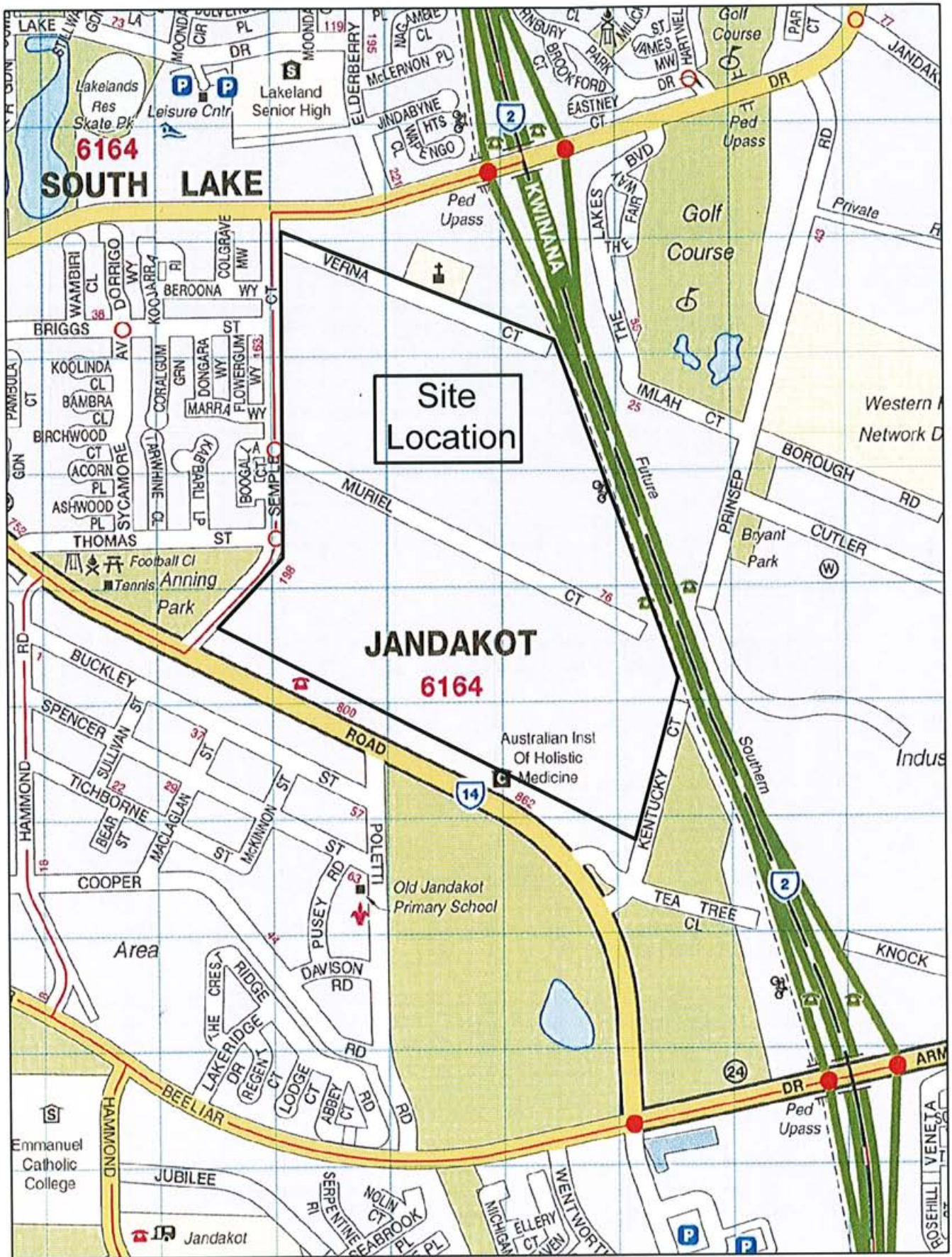
## **BROWN GEOTECHNICAL & ENVIRONMENTAL**

**Ken Brown**

**REFERENCES**

- [1] Standards Australia AS 2870 (1996). Residential Slabs and Footings – Construction.
- [2] Geological Survey of Western Australia. 1:50,000 Environmental Geology Series, Perth.
- [3] Department of Water: [www.environment.wa.gov.au](http://www.environment.wa.gov.au)
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- [5] DoE and WAPC (Up-dated May 2007). Planning Bulletin No.64. Central Metropolitan Region Scheme Acid Sulphate Soils.
- [6] DoE (2004). Identification and Investigation of Acid Sulphate Soils (August).
- [7] CR Ahern et al (1998). Guidelines for Sampling and Analysis of Lowland Acid Sulphate Soils in Queensland 1998 (October).
- [8] Main Roads Western Australia (April 2004); Engineering Road Note No 9. Procedure for Thickness Design of Flexible Pavements.

# FIGURES



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Date	Description	Drawn	Checked	Approved
01.05.07	Location Plan	TW	KIB	

LOCATION PLAN  
 DEVELOPMENT AREA 19  
 JANDAKOT

CLIENT  
 KOLTASZ SMITH

Drawing No. 06036.01  
 Scale: NTS  
 Sheet Size: A4  
 Job No. 06036.01  
 FIGURE 1



# **APPENDIX A**

CLIENT City of Cockburn PROJECT NAME District Structural Plan - Development Area 19

PROJECT NUMBER J06036.01 PROJECT LOCATION Jandakot

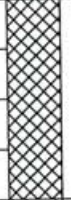
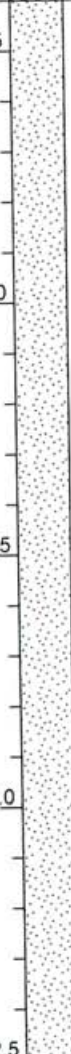
DATE STARTED 15/3/07 COMPLETED 15/3/07 R.L. SURFACE 25.6 DATUM m AHD

EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---

EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.854064E 32.119052S MGA

TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB



NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
		25.5			FILL	FILL: Light brown, coarse sandy gravel and limestone road base		
			0.5		SP	SAND: Medium dense, medium, dark grey, trace silt, moist, roots to 1.2m	pH <sub>f</sub> =6.9% pH <sub>fox</sub> =5.1%	
		25.0						
	Not Encountered	24.5						
			1.0					
		24.0						
			1.5			dense below 1.5m	pH <sub>f</sub> =7.2% pH <sub>fox</sub> =5.5%	
		23.5						
			2.0					
		23.0						
			2.5			Borehole TP1 terminated at 2.5m	pH <sub>f</sub> =6.9% pH <sub>fox</sub> =5.0%	
			3.0					

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

CLIENT City of Cockburn PROJECT NAME District Structural Plan - Development Area 19  
 PROJECT NUMBER J06036.01 PROJECT LOCATION Jandakot  
 DATE STARTED 15/3/07 COMPLETED 15/3/07 R.L. SURFACE 24.8 DATUM m AHD  
 EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---  
 EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.853531E 32.120831S MGA  
 TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					FILL	FILL: Sandy gravel, coarse, light brown, road base, trace limestone		
		24.5	0.5		SP	SAND: Medium dense, medium, light grey, trace silt, moist	pH <sub>F</sub> =6.8% pH <sub>FOX</sub> =4.9%	
	Not Encountered	24.0	1.0					
		23.5	1.5			dense below 1.2m collapse below 1.3m	pH <sub>F</sub> =7.2% pH <sub>FOX</sub> =5.2%	
		23.0	2.0					
		22.5	2.5				pH <sub>F</sub> =7.1% pH <sub>FOX</sub> =5.0%	
						Borehole TP2 terminated at 2.5m		
		22.0						
			3.0					

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

CLIENT City of Cockburn PROJECT NAME District Structural Plan - Development Area 19

PROJECT NUMBER J06036.01 PROJECT LOCATION Jandakot

DATE STARTED 15/3/07 COMPLETED 15/3/07 R.L. SURFACE 25.3 DATUM m AHD

EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---

EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.853048E 32.118670S MGA

TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB

NOTES \_\_\_\_\_

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
						TOPSOIL: Medium dense, medium, dark grey, with many rootlets to 1.1m		
		25.0	0.5			SAND: Medium dense, medium, grey, moist	pH <sub>F</sub> =6.7% pH <sub>Fox</sub> =4.2%	
		24.5	1.0					
	Not Encountered	24.0	1.5			dense below 1.5m	pH <sub>F</sub> =6.6% pH <sub>Fox</sub> =4.5%	
		23.5	2.0					
		23.0	2.5				pH <sub>F</sub> =7.1% pH <sub>Fox</sub> =5.2%	
		22.5	3.0			Borehole TP3 terminated at 2.5m		

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

CLIENT City of Cockburn PROJECT NAME District Structural Plan - Development Area 19

PROJECT NUMBER J06036.01 PROJECT LOCATION Jandakot

DATE STARTED 15/3/07 COMPLETED 15/3/07 R.L. SURFACE 24 DATUM m AHD

EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---

EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.852489E 32.120323S MGA

TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
						TOPSOIL: Medium dense, fine to medium, black, trace rootlets		
		23.5	0.5		SP	SAND: Medium dense, medium, dark grey, trace silt, moist, roots to 1.7m	pH <sub>F</sub> =7.0% pH <sub>Fox</sub> =3.8%	
		23.0	1.0			dense below 0.9m		
	Not Encountered	22.5	1.5				pH <sub>F</sub> =5.8% pH <sub>Fox</sub> =3.8%	
		22.0	2.0					
		21.5	2.5				pH <sub>F</sub> =6.2% pH <sub>Fox</sub> =4.8%	
						Borehole TP4 terminated at 2.5m		
		21.0	3.0					

BOREHOLE / TEST PIT LOGS GPJ GINT AUSTRALIA GDT 23/1/08

CLIENT City of Cockburn PROJECT NAME District Structural Plan - Development Area 19

PROJECT NUMBER J06036.01 PROJECT LOCATION Jandakot

DATE STARTED 15/3/07 COMPLETED 15/3/07 R.L. SURFACE 24.7 DATUM m AHD

EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---

EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.851294E 32.119890S MGA

TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
		24.5				TOPSOIL: Medium dense, medium, dark grey, rootlets, dry		
			0.5		SP	SAND: Medium dense, medium, light grey, moist	pH <sub>F</sub> =6.3% pH <sub>Fox</sub> =4.7%	
		24.0						
			1.0			dense below 0.9m	Fines=2% Sand=98% Gravel=0%	
	Not Encountered	23.5						
			1.5				pH <sub>F</sub> =6.2% pH <sub>Fox</sub> =4.7%	
		23.0						
			2.0					
		22.5						
			2.5			Borehole TP5 terminated at 2.5m	pH <sub>F</sub> =6.5% pH <sub>Fox</sub> =4.9%	
		22.0						
			3.0					

CLIENT City of Cockburn PROJECT NAME District Structural Plan - Development Area 19

PROJECT NUMBER J06036.01 PROJECT LOCATION Jandakot

DATE STARTED 15/3/07 COMPLETED 15/3/07 R.L. SURFACE 25.4 DATUM m AHD

EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---

EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 116.853454E 32.117476S MGA

TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
						TOPSOIL: Medium dense, medium, dark grey, rootlets, dry		
		25.0	0.5		SP	SAND: Medium dense, medium, grey, trace silt, moist		
	Not Encountered	24.5	1.0			dense below 1.2m		
		24.0	1.5					
		23.5	2.0					
		23.0	2.5					
						Borehole TP6 terminated at 2.5m		
		22.5						
			3.0					

CLIENT City of Cockburn PROJECT NAME District Structural Plan - Development Area 19

PROJECT NUMBER J06036.01 PROJECT LOCATION Jandakot

DATE STARTED 15/3/07 COMPLETED 15/3/07 R.L. SURFACE 25.5 DATUM m AHD

EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---

EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.852336E 32.116866S MGA

TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
						TOPSOIL: Medium dense, fine to medium, dark grey, rootlets, dry		
		25.0	0.5			SAND: Medium dense, medium, light grey, trace silt, moist		
	Not Encountered	24.5	1.0			dense below 1.2m		
		24.0	1.5					
		23.5	2.0					
		23.0	2.5			Borehole TP7 terminated at 2.5m		
		22.5	3.0					

Fines=2%  
Sand=98%  
Gravel=0%

BOREHOLE / TEST PIT LOGS GPJ\_GINT AUSTRALIA\_GDT\_23/1/08

CLIENT City of Cockburn PROJECT NAME District Structural Plan - Development Area 19  
 PROJECT NUMBER J06036.01 PROJECT LOCATION Jandakot  
 DATE STARTED 15/3/07 COMPLETED 15/3/07 R.L. SURFACE 25 DATUM m AHD  
 EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---  
 EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.850684E 32.118188S MGA  
 TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
						TOPSOIL: Medium dense, medium, grey, trace rootlets, dry		
		24.5	0.5		SP	SAND: Medium dense, medium, light grey, trace silt, moist		
	Not Encountered	24.0	1.0					
		23.5	1.5					
		23.0	2.0			Collapse below 1.8m		
		22.5	2.5			dense below 2.4m		
		22.0	3.0			Borehole TP8 terminated at 2.5m		

BOREHOLE / TEST PIT LOGS GP J GINT AUSTRALIA GDT 23/1/08



CLIENT City of Cockburn PROJECT NAME District Structural Plan - Development Area 19

PROJECT NUMBER J06036.01 PROJECT LOCATION Jandakot

DATE STARTED 15/3/07 COMPLETED 15/3/07 R.L. SURFACE 25.6 DATUM m AHD

EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---

EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.851142E 32.116866S MGA

TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
		25.5				TOPSOIL: Medium dense, medium, grey, trace rootlets, dry		
					SP	SAND: Medium dense, medium, light grey, trace silt, moist		
		25.0	0.5					
Not Encountered		24.5	1.0					
		24.0	1.5					
		23.5	2.0			dense below 2.1m		
		23.0	2.5			Borehole TP10 terminated at 2.3m		
			3.0					

BOREHOLE / TEST PIT LOGS GPJ\_GINT AUSTRALIA GDT 23/1/08

CLIENT City of Cockburn PROJECT NAME District Structural Plan - Development Area 19  
 PROJECT NUMBER J06036.01 PROJECT LOCATION Jandakot  
 DATE STARTED 15/3/07 COMPLETED 15/3/07 R.L. SURFACE 25.1 DATUM m AHD  
 EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---  
 EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.851447E 32.115748S MGA  
 TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
		25.0				TOPSOIL: Medium dense, medium, dark grey, rootlets, dry		
		24.5	0.5			SAND: Medium dense, medium, light grey, trace silt, moist		
	Not Encountered	24.0	1.0			dense below 1.2m	Fines=1%	
		23.5	1.5					
		23.0	2.0					
		22.5	2.5			Borehole TP11 terminated at 2.5m		
			3.0					

BOREHOLE / TEST PIT LOGS GPJ GINT AUSTRALIA GDT 23/1/08

CLIENT City of Cockburn PROJECT NAME District Structural Plan - Development Area 19  
 PROJECT NUMBER J06036.01 PROJECT LOCATION Jandakot  
 DATE STARTED 15/3/07 COMPLETED 15/3/07 R.L. SURFACE 24.8 DATUM m AHD  
 EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---  
 EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.849439E 32.117146S MGA  
 TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB

NOTES


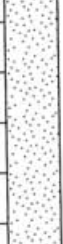




Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
						TOPSOIL: Medium dense, medium, dark grey, rootlets, dry		
		24.5			SP	SAND: Medium dense, medium, grey, trace silt, moist		
			0.5					
		24.0						
			1.0					
		23.5						
			1.5			wet below 1.5m		
						collapse below 1.5m		
						brown below 1.6m		
		23.0						
			2.0					
		22.5						
			2.5					
						Borehole TP12 terminated at 2.5m		
		22.0						
			3.0					

BOREHOLE / TEST PIT LOGS GPJ GINT AUSTRALIA GDT 23/1/08

Not Encountered

CLIENT City of Cockburn PROJECT NAME District Structural Plan - Development Area 19  
 PROJECT NUMBER J06036.01 PROJECT LOCATION Jandakot  
 DATE STARTED 15/3/07 COMPLETED 15/3/07 R.L. SURFACE 24.5 DATUM m AHD  
 EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---  
 EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.848906E 32.118569S MGA  
 TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
		24.0	0.5		SP	SAND: Medium dense, medium, grey, trace silt, roots to 0.5m, dry		
	Not Encountered	23.5	1.0			dense and moist below 0.6m	Fines=1%	
		23.0	1.5					
		22.5	2.0					
		22.0	2.5					
						Borehole TP13 terminated at 2.5m		
		21.5	3.0					

BOREHOLE / TEST PIT LOGS GPJ GINT AUSTRALIA GDT 23/1/08

CLIENT City of Cockburn PROJECT NAME District Structural Plan - Development Area 19  
 PROJECT NUMBER J06036.01 PROJECT LOCATION Jandakot  
 DATE STARTED 15/3/07 COMPLETED 15/3/07 R.L. SURFACE 25 DATUM m AHD  
 EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---  
 EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.850024E 32.116053S MGA  
 TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
						TOPSOIL: Medium dense, fine, grey, trace rootlets, dry		
					SP	SAND: Medium dense, medium, light grey, trace silt, moist		
	Not Encountered	24.5	0.5					
		24.0	1.0			dense below 1.2m		
		23.5	1.5					
		23.0	2.0			COFFEE ROCK: Very dense, medium, brown sand, moist (weakly cemented)		
		22.5	2.5			Refusal Borehole TP14 terminated at 2.3m		
		22.0	3.0					

BOREHOLE / TEST PIT LOGS GPJ GINT AUSTRALIA GDT 23/1/08

CLIENT City of Cockburn PROJECT NAME District Structural Plan - Development Area 19  
 PROJECT NUMBER J06036.01 PROJECT LOCATION Jandakot  
 DATE STARTED 15/3/07 COMPLETED 15/3/07 R.L. SURFACE 24 DATUM m AHD  
 EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---  
 EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.848346E 32.116714S MGA  
 TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
						TOPSOIL: Medium dense, medium, dark grey, rootlets, dry		
		23.5	0.5		SP	SAND: Medium dense, medium, grey, trace silt, moist		
	Not Encountered	23.0	1.0			dense below 1.2m	Fines=2% Sand=98% Gravel=0%	
		22.5	1.5					
		22.0	2.0			COFFEE ROCK: Very dense, medium, brown sand, moist (weakly cemented)		
		21.5	2.5			Refusal Borehole TP15 terminated at 2.2m		
		21.0	3.0					

BOREHOLE / TEST PIT LOGS GPJ GINT AUSTRALIA GDT 23/1/08

CLIENT City of Cockburn PROJECT NAME District Structural Plan - Development Area 19  
 PROJECT NUMBER J06036.01 PROJECT LOCATION Jandakot  
 DATE STARTED 15/3/07 COMPLETED 15/3/07 R.L. SURFACE 24.7 DATUM m AHD  
 EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---  
 EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.848372E 32.114503S MGA  
 TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations	
		24.5			SP	SAND: Medium dense, medium, light grey, rootlets to 0.8m, dry			
			0.5						
		24.0							
			1.0						
		23.5							
			1.5						
		23.0							
			2.0						
		22.5							
			2.5						
						Borehole TP16 terminated at 2.5m			
		22.0							
			3.0						

BOREHOLE / TEST PIT LOGS GPJ GINT AUSTRALIA GDT 23/1/08

CLIENT City of Cockburn PROJECT NAME District Structural Plan - Development Area 19  
 PROJECT NUMBER J06036.01 PROJECT LOCATION Jandakot

DATE STARTED 16/3/07 COMPLETED 16/3/07 R.L. SURFACE 25 DATUM m AHD  
 EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---  
 EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.852108E 32.113766S MGA  
 TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
						FILL: Medium dense, fine to medium, light brown, sand, dry		
		24.5	0.5		SP	SAND: Medium dense, medium, dark grey, trace silt, moist		
		24.0	1.0			trace roots at 0.9m		
		23.5	1.5			dense below 1.2m		
		23.0	2.0					
		22.5	2.5			Borehole TP17 terminated at 2.4m		
		22.0	3.0					

Fines=0%  
 Sand=100%  
 Gravel=0%

BOREHOLE / TEST PIT LOGS GPJ\_GINT AUSTRALIA\_GDT 231/08

CLIENT City of Cockburn PROJECT NAME District Structural Plan - Development Area 19

PROJECT NUMBER J06036.01 PROJECT LOCATION Jandakot

DATE STARTED 16/3/07 COMPLETED 16/3/07 R.L. SURFACE 24.3 DATUM m AHD

EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---

EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.849871E 32.113740S MGA

TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB

**NOTES**

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
		24.0	0.5			SAND: Medium dense, medium, grey, trace silt, dry		
		23.5	1.0			dense below 0.9m		
		23.0	1.5			moist below 1.2m		
		22.5	2.0					
		22.0	2.5					
						Borehole TP18 terminated at 2.5m		
		21.5						
			3.0					

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA GDT 23/1/08

Not Encountered

CLIENT City of Cockburn PROJECT NAME District Structural Plan - Development Area 19

PROJECT NUMBER J06036.01 PROJECT LOCATION Jandakot

DATE STARTED 16/3/07 COMPLETED 16/3/07 R.L. SURFACE 24 DATUM m AHD

EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---

EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.484999E 32.112800S MGA

TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
				SP		SAND: Dense, fine to medium, grey, trace silt, dry, with rootlets		
		23.5	0.5			medium grained below 0.5m		
						moist below 0.8m		
		23.0	1.0			light grey, moist below 1.2m		
		22.5	1.5					
		22.0	2.0					
		21.5	2.5					
						Borehole TP19 terminated at 2.7m		
		21.0	3.0					

BOREHOLE / TEST PIT LOGS GPJ GINT AUSTRALIA GDT 23/1/08

CLIENT City of Cockburn PROJECT NAME District Structural Plan - Development Area 19

PROJECT NUMBER J06036.01 PROJECT LOCATION Jandakot

DATE STARTED 16/3/07 COMPLETED 16/3/07 R.L. SURFACE 23.6 DATUM m AHD

EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---

EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.846517E 32.111606S MGA

TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations	
		23.5				<p>SAND: Dense, medium, grey, trace silt, rootlets to 0.5m, moist</p>			
			0.5						
		23.0							
			1.0						
		22.5							
			1.5						
		22.0							
			2.0						
		21.5							
			2.5						
		21.0							
			3.0						
						Borehole TP20 terminated at 2.7m			



BOREHOLE / TEST PIT LOGS GPJ\_GINT AUSTRALIA.GDT 23/1/08

CLIENT City of Cockburn PROJECT NAME District Structural Plan - Development Area 19  
 PROJECT NUMBER J06036.01 PROJECT LOCATION Jandakot  
 DATE STARTED 16/3/07 COMPLETED 16/3/07 R.L. SURFACE 24 DATUM m AHD  
 EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---  
 EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.847305E 32.116205S MGA  
 TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
						TOPSOIL: Medium dense, medium, grey, dry with rootlets		
		23.5	0.5		SP	SAND: Medium dense, medium, grey, trace silt, moist		
	Not Encountered	23.0	1.0					
		22.5	1.5			Collapse above 1.4m dense below 1.5m		
		22.0	2.0					
		21.5	2.5			Borehole TP21 terminated at 2.2m		
		21.0	3.0					

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

CLIENT City of Cockburn PROJECT NAME District Structural Plan - Development Area 19

PROJECT NUMBER J06036.01 PROJECT LOCATION Jandakot


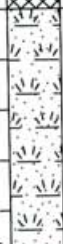

DATE STARTED 16/3/07 COMPLETED 16/3/07 R.L. SURFACE 22 DATUM m AHD

EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---

EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.845246E 32.119026S MGA

TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
Not Encountered		21.5	0.5			FILL: Medium dense, fine to medium, grey, sand, trace limestone		
		21.0	1.0			TOPSOIL: Medium dense, medium, dark grey, rootlets, moist		
		20.5	1.5		SP	SAND: Dense, medium, grey, trace silt, moist		Fines=1% Sand=99% Gravel=0%
		19.5	2.5			Borehole TP22 terminated at 2.5m		
		19.0	3.0					

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA GDT 23/1/08

CLIENT City of Cockburn PROJECT NAME District Structural Plan - Development Area 19

PROJECT NUMBER J06036.01 PROJECT LOCATION Jandakot



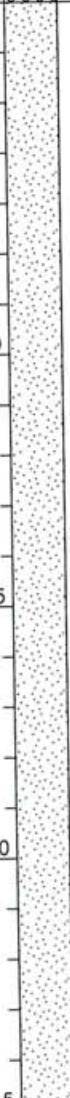
DATE STARTED 16/3/07 COMPLETED 16/3/07 R.L. SURFACE 24.7 DATUM m AHD

EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---

EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.846695E 32.114223S MGA

TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
		24.5				FILL: Medium dense, fine to medium, red sand, rootlets to 0.2m, dry		
						FILL: Medium dense, fine to medium, light brown, trace limestone, dry		
					SP	SAND: Loose, medium, grey, trace silt, dry		
			0.5					
		24.0						
						medium dense and moist below 0.9m		
		23.5						
			1.0					
		23.0						
						dense below 1.8m		
		22.5						
			2.5			Borehole TP23 terminated at 2.5m		
		22.0						
			3.0					

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

Not Encountered

CLIENT City of Cockburn PROJECT NAME District Structural Plan - Development Area 19

PROJECT NUMBER J06036.01 PROJECT LOCATION Jandakot


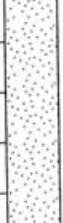



DATE STARTED 16/3/07 COMPLETED 16/3/07 R.L. SURFACE 24 DATUM m AHD

EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---

EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.847254E 32.120170S MGA

TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
		23.5	0.5		SP	SAND: Dense, medium, grey, dry, roots to 1m		
		23.0	1.0			moist below 1.0m		
	Not Encountered	22.5	1.5					
		22.0	2.0					
		21.5	2.5					
		21.0	3.0			Borehole TP24 terminated at 2.7m		

BOREHOLE / TEST PIT LOGS GPJ GINT AUSTRALIA GDT 23/1/08

CLIENT City of Cockburn PROJECT NAME District Structural Plan - Development Area 19

PROJECT NUMBER J06036.01 PROJECT LOCATION Jandakot

DATE STARTED 23/3/07 COMPLETED 23/3/07 R.L. SURFACE 24.4 DATUM m AHD

EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---

EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.850024E 32.121263S MGA

TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
						FILL: Medium dense, medium, brown, sand, rootlets		
		24.0	0.5		SP	SAND: Medium dense, medium, dark grey, moist		
	Not Encountered	23.5	1.0			peaty between 1.1m and 1.3m		
		23.0	1.5			dense below 1.5m		
		22.5	2.0					
		22.0	2.5			Borehole TP25 terminated at 2.2m		
		21.5	3.0					

CLIENT City of Cockburn PROJECT NAME District Structural Plan - Development Area 19  
 PROJECT NUMBER J06036.01 PROJECT LOCATION Jandakot  
 DATE STARTED 23/3/07 COMPLETED 23/3/07 R.L. SURFACE 25.2 DATUM m AHD  
 EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---  
 EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.854573E 32.121212S MGA  
 TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations	
		25.0			SP	SAND: Loose, coarse, dark grey, moist, roots to 1m			
			0.5					pH <sub>f</sub> =6.2% pH <sub>fox</sub> =4.6%	
		24.5					medium dense and medium grained below 1.0m		
	Not Encountered	24.0						pH <sub>f</sub> =6.2% pH <sub>fox</sub> =4.5%	
		23.5					dense below 1.8m		
		23.0						pH <sub>f</sub> =6.3% pH <sub>fox</sub> =4.6%	
		22.5				Collapse Borehole TP26 terminated at 2.5m			
			3.0						



CLIENT City of Cockburn PROJECT NAME District Structural Plan - Development Area 19  
 PROJECT NUMBER J06036.01 PROJECT LOCATION Jandakot  
 DATE STARTED 23/3/07 COMPLETED 23/3/07 R.L. SURFACE 24 DATUM m AHD  
 EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---  
 EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.852641E 32.121085S MGA  
 TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB


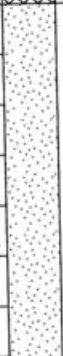



NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
				SP		SAND: Medium dense, medium, grey, locally brown, trace silt, trace organics, moist		
		23.5	0.5				pH <sub>f</sub> =6.1% pH <sub>fox</sub> =5.0%	
		23.0	1.0			dense below 1.0m	Organic Content=0.84%	
		22.5	1.5				pH <sub>f</sub> =6.2% pH <sub>fox</sub> =4.8%	
		22.0	2.0			brown and wet below 1.6m		
		21.5	2.5				pH <sub>f</sub> =6.3% pH <sub>fox</sub> =4.9%	
		21.0	3.0			Borehole TP28 terminated at 2.5m		

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

CLIENT City of Cockburn PROJECT NAME District Structural Plan - Development Area 19  
 PROJECT NUMBER J06036.01 PROJECT LOCATION Jandakot  
 DATE STARTED 23/3/07 COMPLETED 23/3/07 R.L. SURFACE 23.8 DATUM m AHD  
 EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---  
 EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.851879E 32.120780S MGA  
 TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
		23.5	0.5			FILL: Fine to medium, grey, rocks, rubbish, pipe, in a sandy matrix	pH <sub>F</sub> =7.9% pH <sub>FOX</sub> =4.9%	
		23.0	1.0		SP	SAND: Medium dense, medium, grey, trace silt, moist  yellow below 0.7m		
		22.5	1.5				pH <sub>F</sub> =7.7% pH <sub>FOX</sub> =5.2%	
		22.0	2.0					
		21.5	2.5			Borehole TP29 terminated at 2.5m	pH <sub>F</sub> =7.3% pH <sub>FOX</sub> =4.6%	
		21.0	3.0					

BOREHOLE / TEST PIT LOGS GPJ GINT AUSTRALIA GDT 23/1/08

CLIENT City of Cockburn PROJECT NAME District Structural Plan - Development Area 19

PROJECT NUMBER J06036.01 PROJECT LOCATION Jandakot



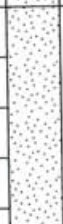


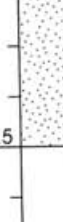


DATE STARTED 23/3/07 COMPLETED 23/3/07 R.L. SURFACE 24 DATUM m AHD

EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---

EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.850811E 32.121440S MGA

TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					FILL	FILL: Medium dense, medium, yellow and grey sand, trace rootlets		
		23.5	0.5				pH <sub>f</sub> =7.3% pH <sub>fox</sub> =4.3%	
					TOPSOIL	TOPSOIL: Fine to medium, dark grey, sand, with rootlets		
		23.0	1.0					
					SP	SAND: Dense, medium, grey, trace silt, moist		
		22.5	1.5				pH <sub>f</sub> =6.8% pH <sub>fox</sub> =4.7%	
								
		22.0	2.0					
		21.5	2.5				pH <sub>f</sub> =6.8% pH <sub>fox</sub> =4.6%	
		21.0	3.0					
						Borehole TP30 terminated at 2.5m		

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

2.3m

CLIENT City of Cockburn PROJECT NAME District Structural Plan - Development Area 19

PROJECT NUMBER J06036.01 PROJECT LOCATION Jandakot



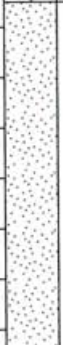
DATE STARTED 23/3/07 COMPLETED 23/3/07 R.L. SURFACE 24.5 DATUM m AHD

EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---

EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.851472E 32.122355S MGA

TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
						FILL: Fine to medium, yellow, sand, trace rootlets		
		24.0	0.5			TOPSOIL: Fine to medium, dark grey, sand, trace rootlets	pH <sub>F</sub> =7.0% pH <sub>Fox</sub> =4.5%	
		23.5	1.0		SP	SAND: Medium dense, medium, grey, moist		
		23.0	1.5			brown and wet below 1.35m	pH <sub>F</sub> =7.0% pH <sub>Fox</sub> =5.0%	
		22.5	2.0					
		22.0	2.5			Borehole TP31 terminated at 2.5m	pH <sub>F</sub> =7.0% pH <sub>Fox</sub> =5.1%	
		21.5	3.0					

BOREHOLE / TEST PIT LOGS GP J\_GINT AUSTRALIA GDT\_23/1/08

2.1m

CLIENT City of Cockburn PROJECT NAME District Structural Plan - Development Area 19

PROJECT NUMBER J06036.01 PROJECT LOCATION Jandakot

DATE STARTED 23/3/07 COMPLETED 23/3/07 R.L. SURFACE 24.8 DATUM m AHD

EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---

EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.852235E 32.122203S MGA

TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB






NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
		24.5	0.5			TOPSOIL: Fine to medium, dark grey sand, trace rootlets	pH <sub>f</sub> =6.1% pH <sub>fox</sub> =2.9%	
		24.0	1.0		SP	SAND: Dense, medium, light grey, trace silt, moist		
		23.5	1.5			collapse above 1.2m brown and wet below 1.3m	pH <sub>f</sub> =6.3% pH <sub>fox</sub> =4.1%	
		23.0	2.0					
		22.5	2.5				pH <sub>f</sub> =5.9% pH <sub>fox</sub> =4.2%	
		22.0	3.0			Borehole TP32 terminated at 2.5m		

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

CLIENT City of Cockburn PROJECT NAME District Structural Plan - Development Area 19  
 PROJECT NUMBER J06036.01 PROJECT LOCATION Jandakot  
 DATE STARTED 23/3/07 COMPLETED 23/3/07 R.L. SURFACE 23.8 DATUM m AHD  
 EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---  
 EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.846949E 32.117527S MGA  
 TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
		23.5	0.5		SP	SAND: Loose, coarse, dark grey, moist	pH <sub>F</sub> =7.9% pH <sub>FOX</sub> =4.9%	
		23.0	1.0			medium dense and medium grained below 1.0m		
		22.5	1.5				pH <sub>F</sub> =7.7% pH <sub>FOX</sub> =5.2%	
		22.0	2.0					
		21.5	2.5			Collapse above 2.2m	pH <sub>F</sub> =7.3% pH <sub>FOX</sub> =4.6%	
		21.0	3.0			Borehole TP33 terminated at 2.5m		

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

CLIENT City of Cockburn PROJECT NAME District Structural Plan - Development Area 19  
 PROJECT NUMBER J06036.01 PROJECT LOCATION Jandakot  
 DATE STARTED 23/3/07 COMPLETED 23/3/07 R.L. SURFACE 22.8 DATUM m AHD  
 EXCAVATION CONTRACTOR Burke Contracting SLOPE --- BEARING ---  
 EQUIPMENT 5 Tonne Mini Excavator TEST PIT LOCATION 115.846440E 32.118975S MGA  
 TEST PIT SIZE 0.5m x 1m LOGGED BY TW CHECKED BY KB

NOTES

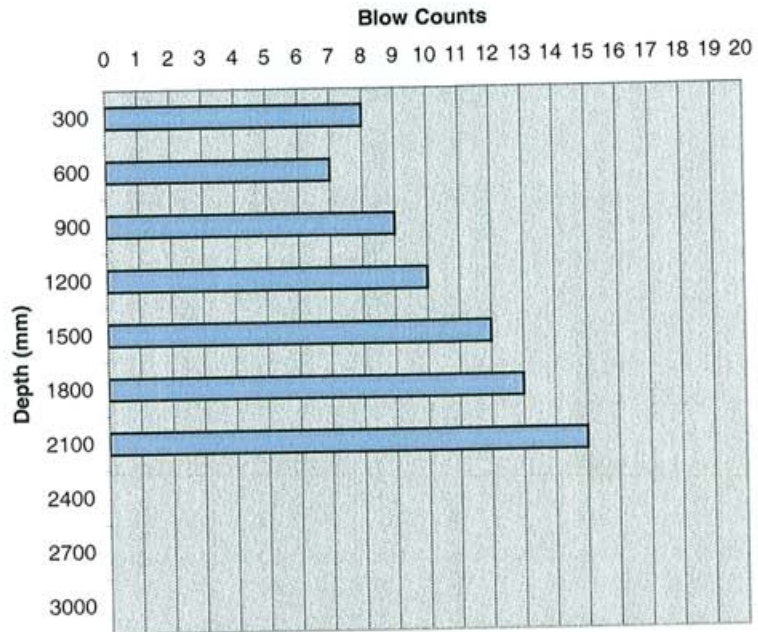
Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
		22.5				TOPSOIL: Medium dense, medium, dark grey, dry		
			0.5		SP	SAND: Medium dense, medium, grey, trace silt, moist	pH <sub>F</sub> =7.9% pH <sub>FOX</sub> =4.9%	
		22.0						
			1.0					
		21.5					pH <sub>F</sub> =7.7% pH <sub>FOX</sub> =5.2%	
			1.5					
		21.0						
			2.0					
		20.5					pH <sub>F</sub> =7.3% pH <sub>FOX</sub> =4.6%	
			2.5			Borehole TP34 terminated at 2.5m		
		20.0						
			3.0					

BOREHOLE / TEST PIT LOGS.GPJ GINT AUSTRALIA.GDT 23/1/08

2.1m

Depth (mm)	Blow Counts
300	8
600	7
900	9
1200	10
1500	12
1800	13
2100	15
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 13



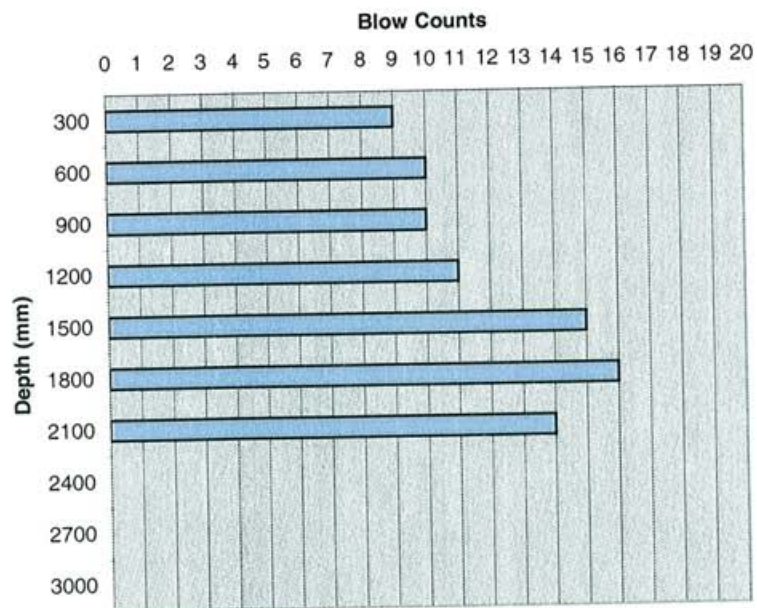
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth	Blow Counts
300	9
600	10
900	10
1200	11
1500	15
1800	16
2100	14
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 14



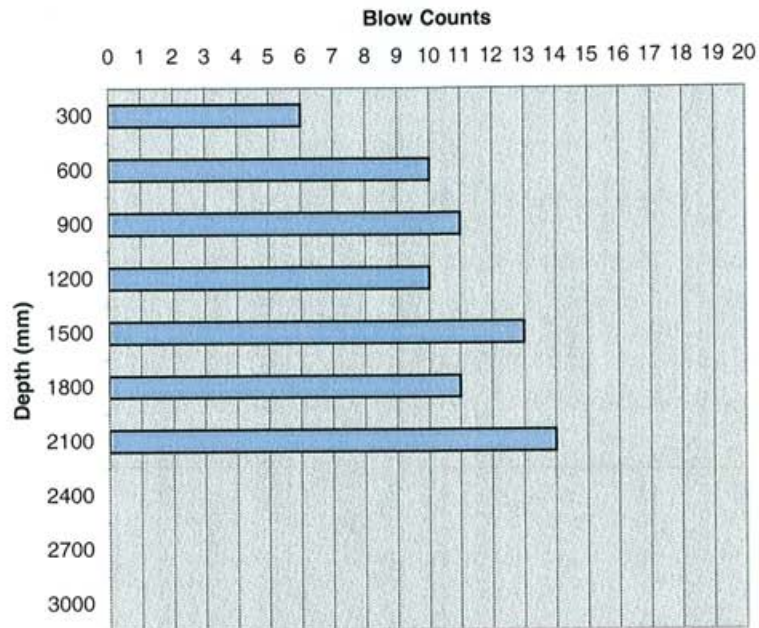
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth (mm)	Blow Counts
300	6
600	10
900	11
1200	10
1500	13
1800	11
2100	14
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 15



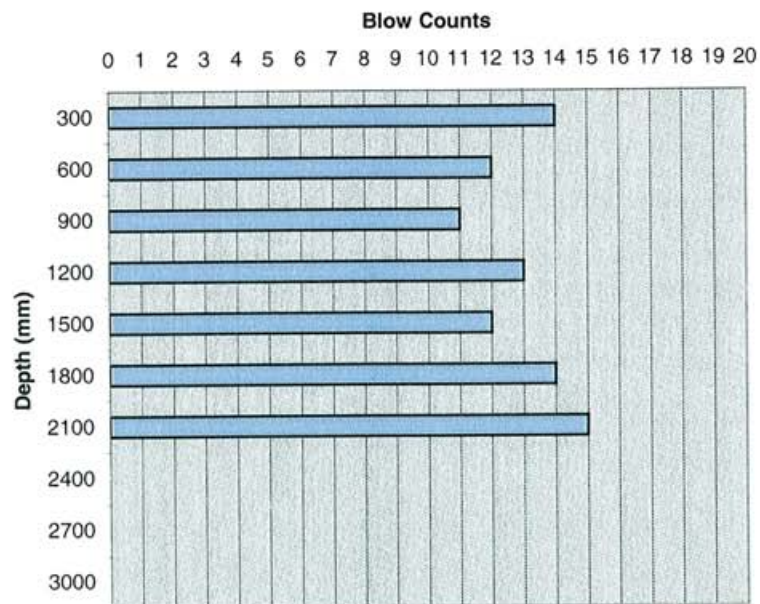
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth	Blow Counts
300	14
600	12
900	11
1200	13
1500	12
1800	14
2100	15
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 16



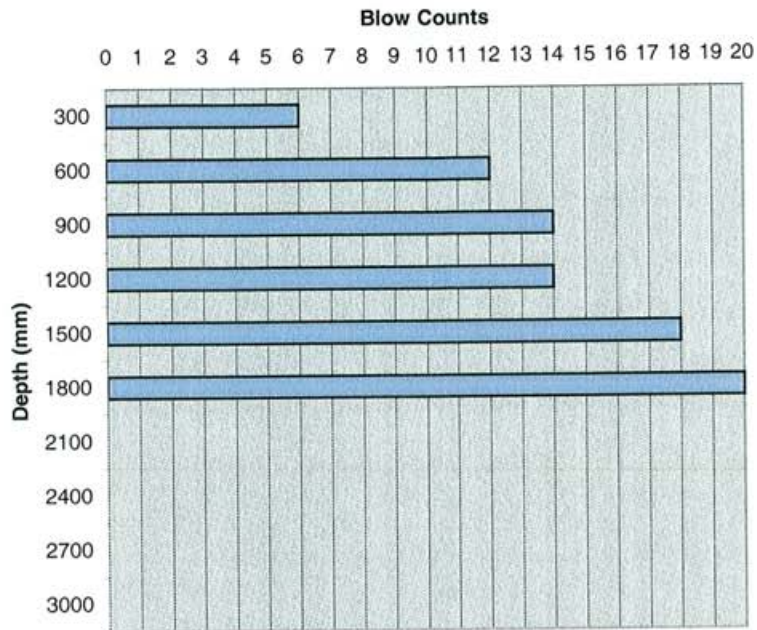
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth (mm)	Blow Counts
300	6
600	12
900	14
1200	14
1500	18
1800	20
2100	
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 17



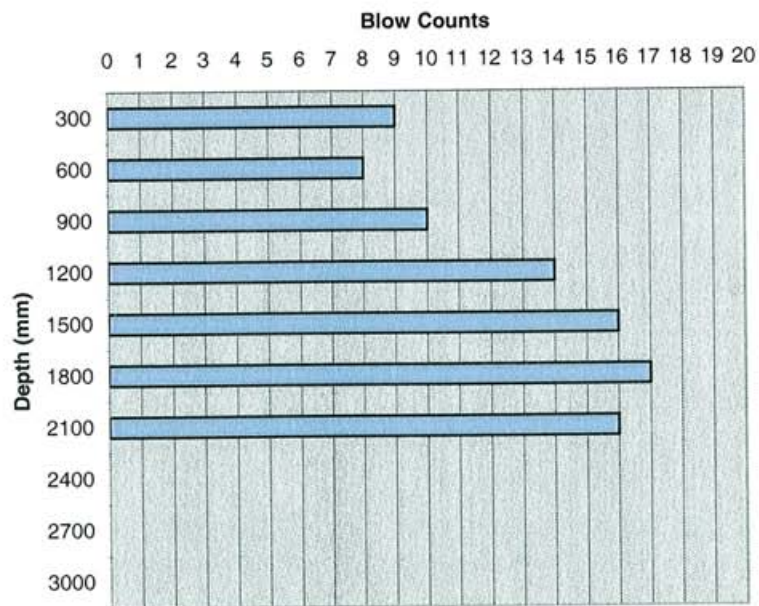
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth	Blow Counts
300	9
600	8
900	10
1200	14
1500	16
1800	17
2100	16
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 18



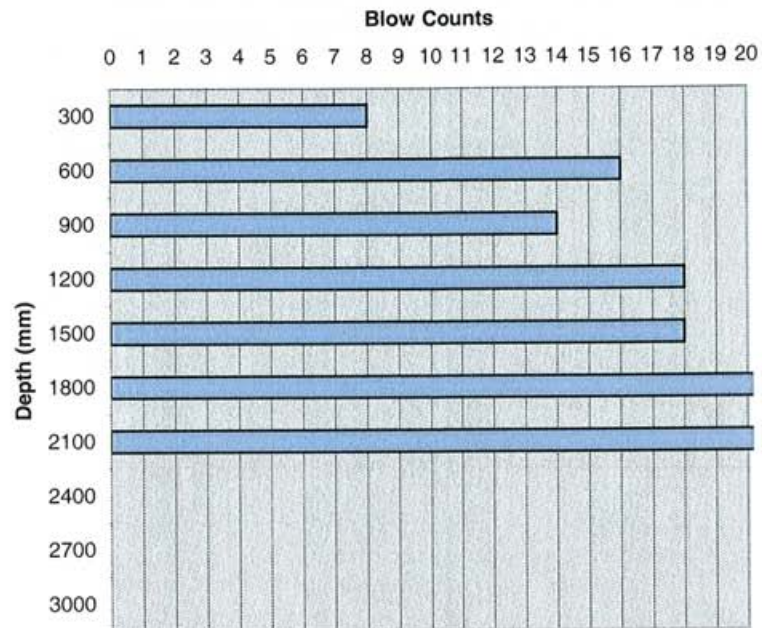
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth (mm)	Blow Counts
300	8
600	16
900	14
1200	18
1500	18
1800	22
2100	24
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 19



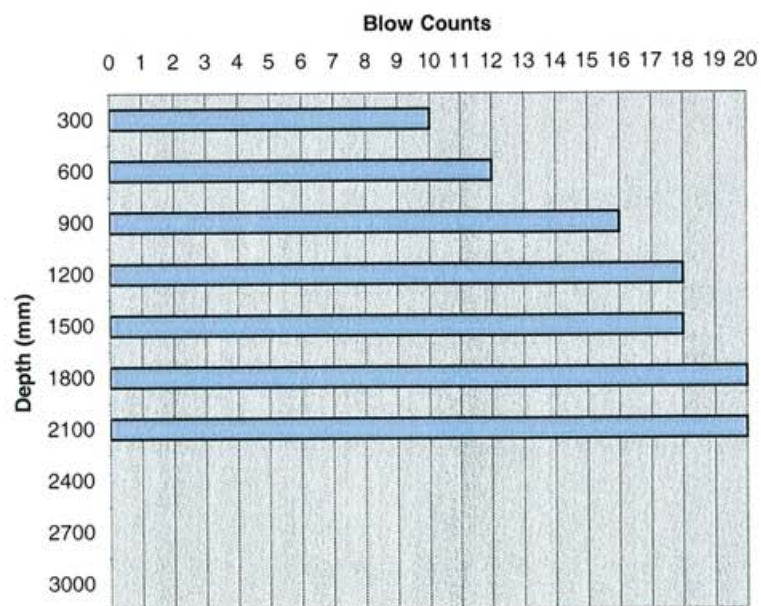
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth	Blow Counts
300	10
600	12
900	16
1200	18
1500	18
1800	20
2100	20
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 20



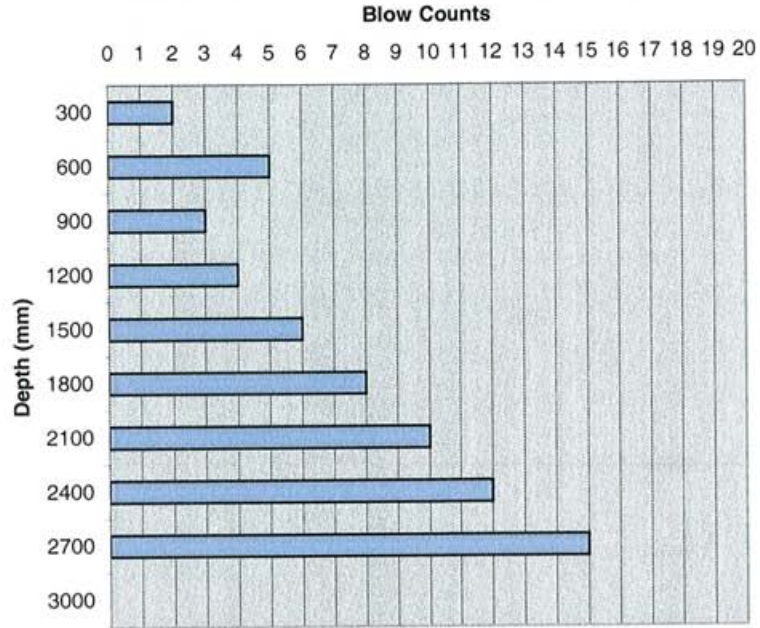
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth (mm)	Blow Counts
300	2
600	5
900	3
1200	4
1500	6
1800	8
2100	10
2400	12
2700	15
3000	

### Perth Sand Penetrometer Results - Test 21

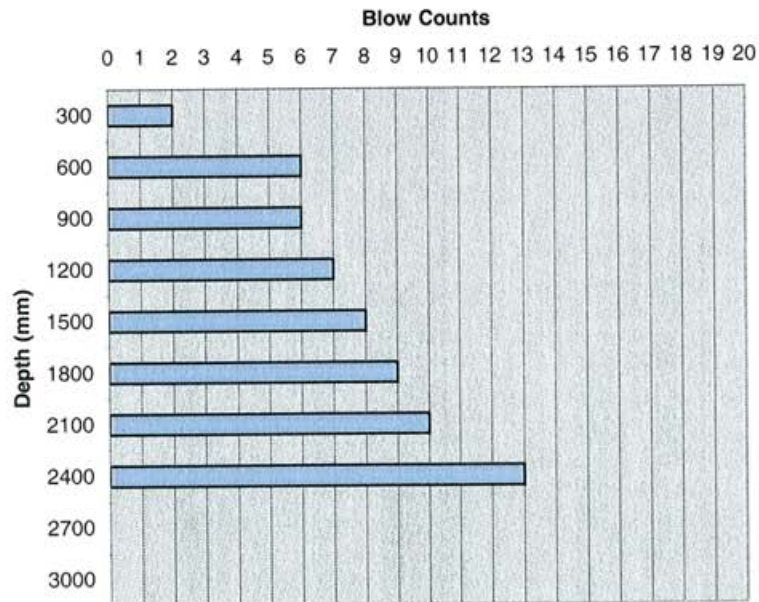


**Job Name:** Area 19 Northlake Road, Jandakot  
**Date:** 15/03/2007

**Job No:** J06036.01

Depth	Blow Counts
300	2
600	6
900	6
1200	7
1500	8
1800	9
2100	10
2400	13
2700	
3000	

### Perth Sand Penetrometer Results - Test 22

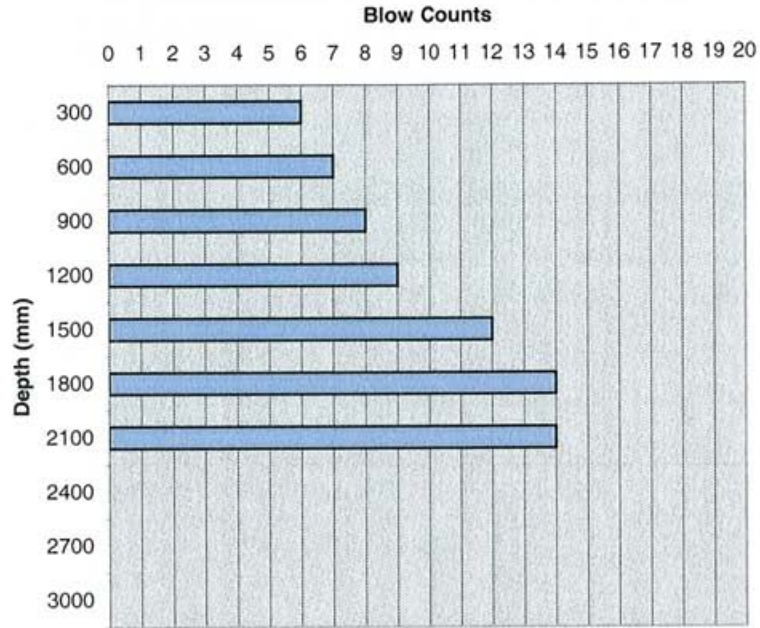


**Job Name:** Area 19 Northlake Road, Jandakot  
**Date:** 15/03/2007

**Job No:** J06036.01

Depth (mm)	Blow Counts
300	6
600	7
900	8
1200	9
1500	12
1800	14
2100	14
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 23



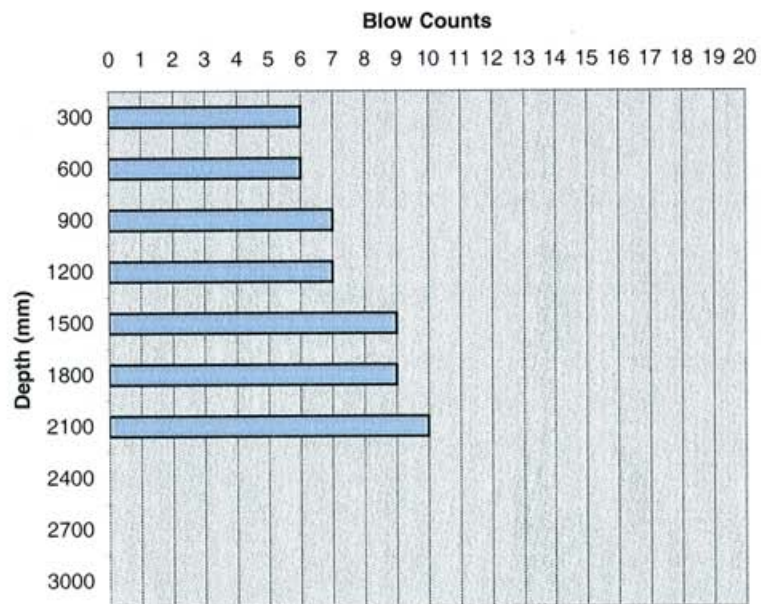
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth	Blow Counts
300	6
600	6
900	7
1200	7
1500	9
1800	9
2100	10
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 24



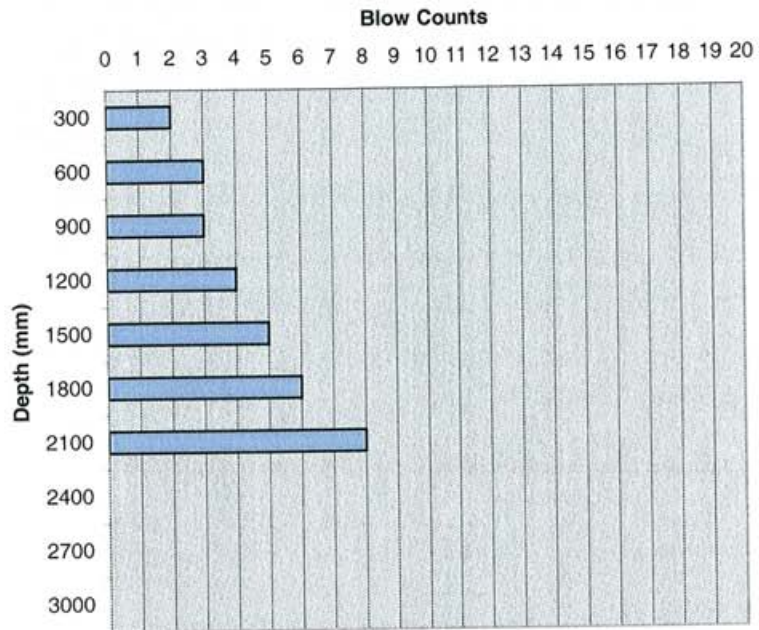
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth (mm)	Blow Counts
300	2
600	3
900	3
1200	4
1500	5
1800	6
2100	8
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 25



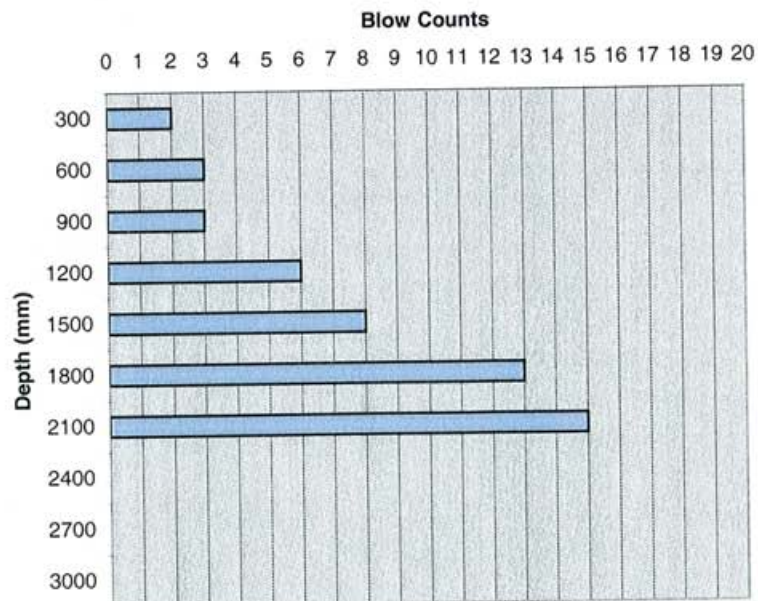
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth	Blow Counts
300	2
600	3
900	3
1200	6
1500	8
1800	13
2100	15
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 26



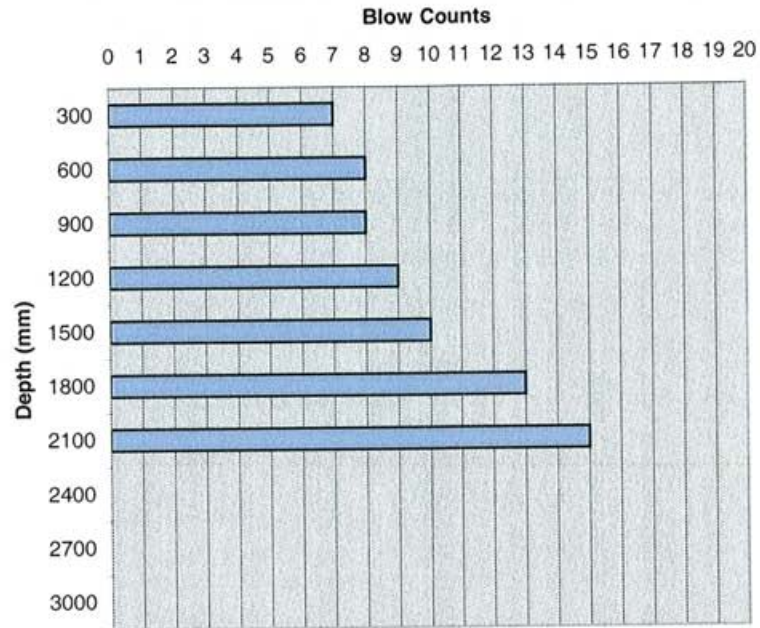
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth (mm)	Blow Counts
300	7
600	8
900	8
1200	9
1500	10
1800	13
2100	15
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 27



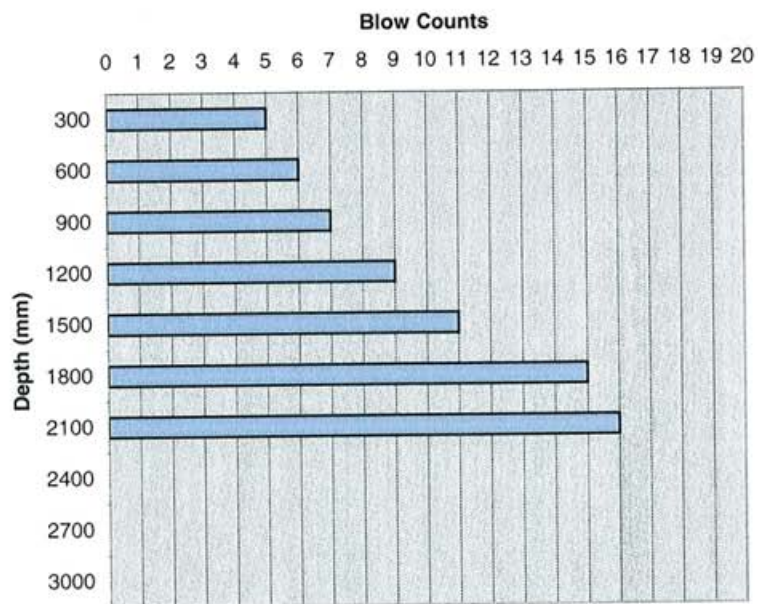
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth	Blow Counts
300	5
600	6
900	7
1200	9
1500	11
1800	15
2100	16
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 28



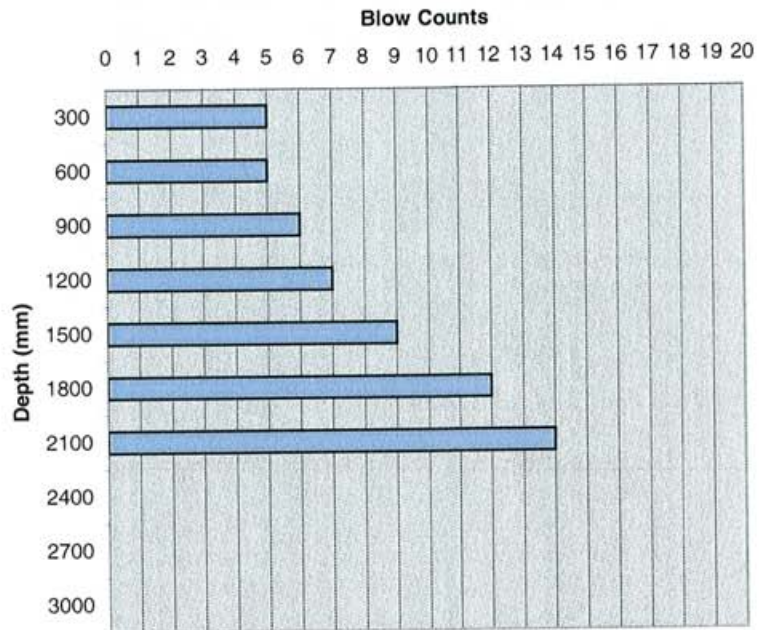
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth (mm)	Blow Counts
300	5
600	5
900	6
1200	7
1500	9
1800	12
2100	14
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 29



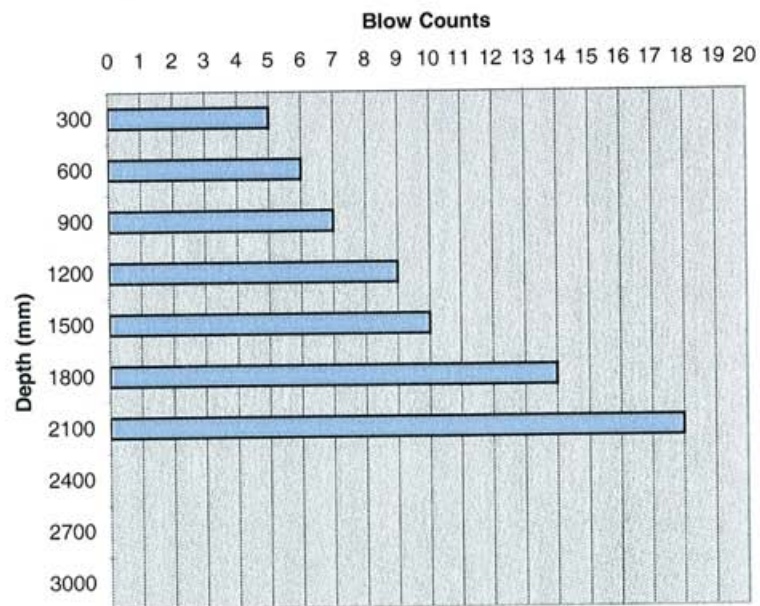
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth	Blow Counts
300	5
600	6
900	7
1200	9
1500	10
1800	14
2100	18
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 30



**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

# **APPENDIX C**

Western Geotechnics Group  
 PO Box 219 Bentley WA 6982  
 36 Railway Parade  
 Welshpool WA 6106



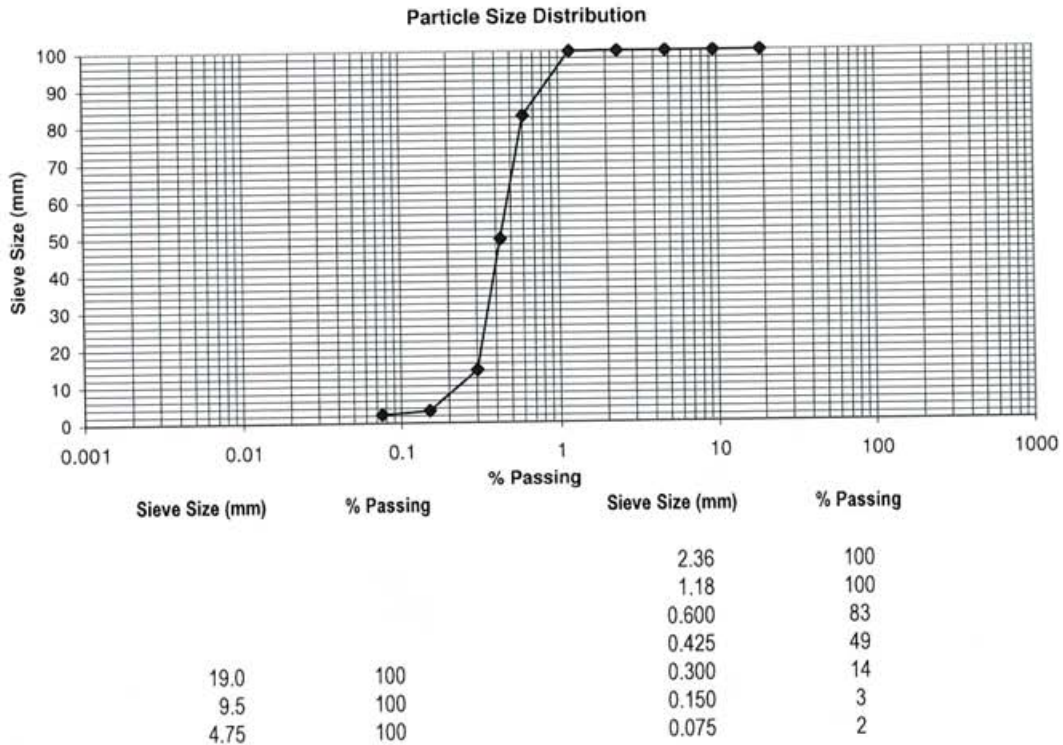
perth@westerngeo.com.au  
 ABN 91105324436  
 ph: 1300 781 744  
 fx: (08) 9458 3700

### TEST CERTIFICATE

Client: Brown Geotechnical & Environmental Pty Ltd  
 Project: Muriel Court (Area 19)  
 Location: Jandakot  
 Sample No.:  
 Sample ID.: TP5

Client Job No.: J06036/1  
 Test Date: 28/03/07  
 WG Job No.: 07-01-175  
 Lab No.: 07-WG-710  
 Depth: 0.5 - 1.5m

### METHOD FOR DETERMINATION OF PARTICLE SIZE DISTRIBUTION -acc to AS 1289.3.6.1



Notes:  
 Sample supplied by client

Certificate No.:07-WG-710 / S301

Approved Signatory: *Mark Matthews* ( Mark Matthews ) Date: 12/04/2007



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 Welshpool WA 6106



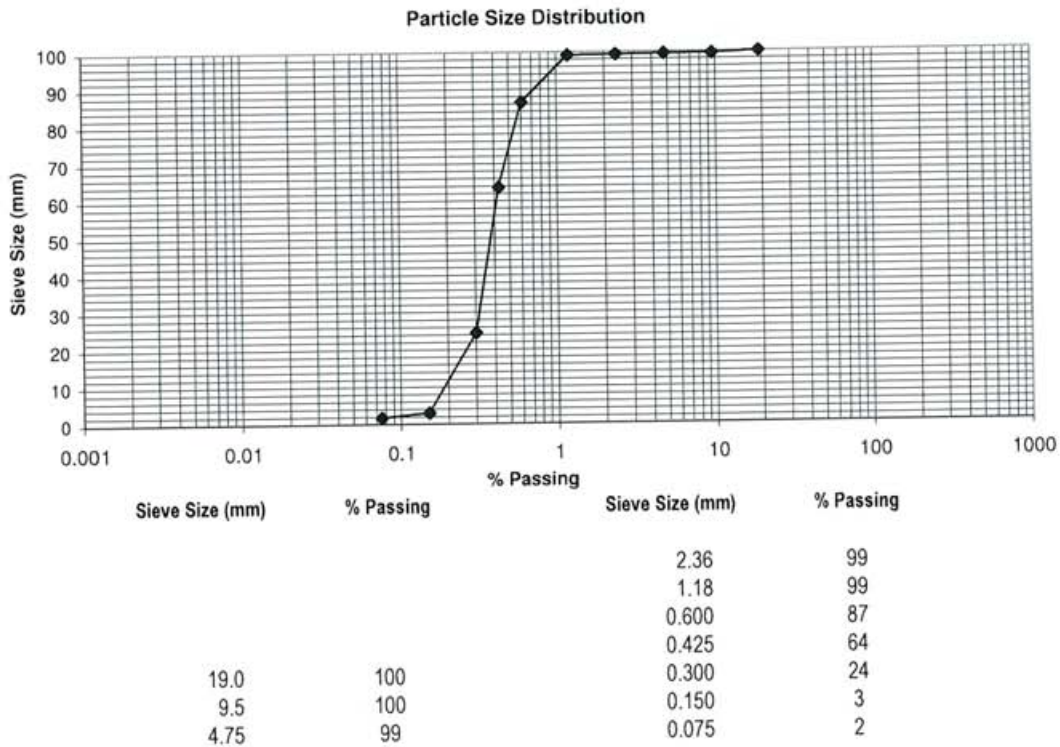
perth@westerngeo.com.au  
 ABN 91105324436  
 ph: 1300 781 744  
 fx: (08) 9458 3700

### TEST CERTIFICATE

Client: Brown Geotechnical & Environmental Pty Ltd  
 Project: Muriel Court (Area 19)  
 Location: Jandakot  
 Sample No.:  
 Sample ID.: TP7

Client Job No.: J06036/1  
 Test Date: 29/03/07  
 WG Job No.: 07-01-175  
 Lab No.: 07-WG-718  
 Depth: 1.3 - 2.5m

### METHOD FOR DETERMINATION OF PARTICLE SIZE DISTRIBUTION -acc to AS 1289.3.6.1



Notes:  
 Sample supplied by client

Certificate No.:07-WG-718 / S301

Approved Signatory:  (Mark Matthews) Date: 12/04/2007



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PO Box 219 Bentley WA 6982  
36 Railway Parade  
Welshpool WA 6982

## TEST CERTIFICATE



perth@westerngeo.com.au  
ABN: 91105324436  
ph: 1300 781 744  
fx: (08) 9458 3700

Client:	Brown Geotechnical & Environmental Pty Ltd	Client Job No:	J06036/1
Project:	Muriel Court (Area 19)	Order No:	
Location:	Jandakot	Tested Date:	12/04/2007
Sample No:	07-WG-711	WG Job Number:	07-01-175
Sample ID:	TP11 0.5 - 1.5m	Lab:	Welshpool

### PSD: PERCENT FINES <0.075MM


AS1289.3.6.1 (% Fines)

#### Part Method

Material Finer than 75µm (%) 1

#### Notes:

Note: Sample supplied by client

Approved Signatory:  (M. Matthews)

Date: 12/04/2007



Accreditation No.: 2418

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Site No.: 2411  
Cert No.: 07-WG-711-S306  
Page: 1

Western Geotechnics Group  
PO Box 219 Bentley WA 6982  
36 Railway Parade  
Welshpool WA 6982

## TEST CERTIFICATE



perth@westerngeo.com.au  
ABN: 91105324436  
ph: 1300 781 744  
fx: (08) 9458 3700

Client:	Brown Geotechnical & Environmental Pty Ltd	Client Job No:	J06036/1
Project:	Muriel Court (Area 19)	Order No:	
Location:	Jandakot	Tested Date:	12/04/2007
Sample No:	07-WG-712	WG Job Number:	07-01-175
Sample ID:	TP13 0.5 - 1.5m	Lab:	Welshpool

### PSD: PERCENT FINES <0.075MM

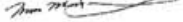
AS1289.3.6.1 (% Fines)

#### Part Method

Material Finer than 75µm (%) 1

#### Notes:

Note: Sample supplied by client

Approved Signatory:  (M. Matthews)

Date: 12/04/2007



Accreditation No.: 2418

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Site No.: 2411  
Cert No.: 07-WG-712-S306  
Page: 1

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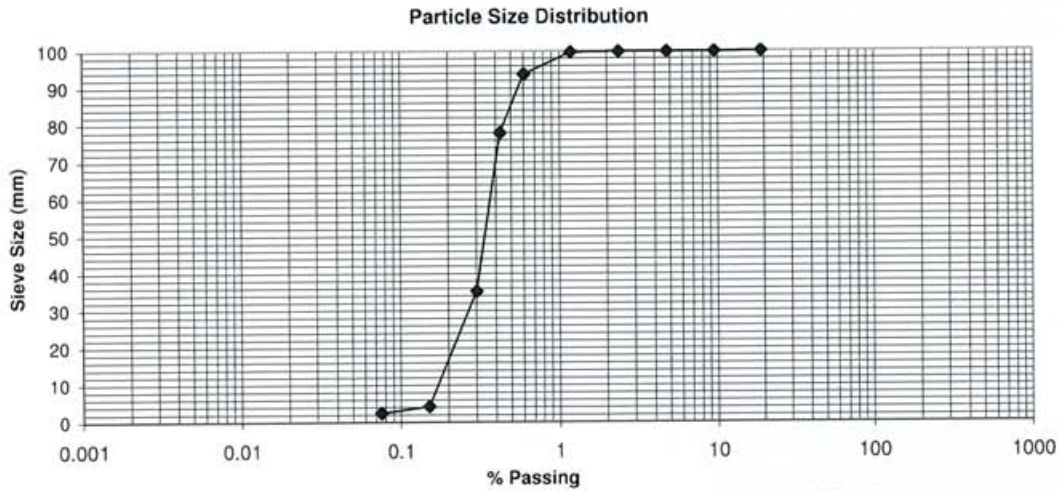
perth@westerngeo.com.au  
 ABN 91105324436  
 ph: 1300 781 744  
 fx: (08) 9458 3700

## TEST CERTIFICATE

Client: Brown Geotechnical & Environmental Pty Ltd  
 Project: Muriel Court (Area 19)  
 Location: Jandakot  
 Sample No.:  
 Sample ID.: TP15

Client Job No.: J06036/1  
 Test Date: 29/03/07  
 WG Job No.: 07-01-175  
 Lab No.: 07-WG-713  
 Depth: 0.5 - 1.5m

### METHOD FOR DETERMINATION OF PARTICLE SIZE DISTRIBUTION -acc to AS 1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
		2.36	100
		1.18	100
		0.600	94
		0.425	78
19.0	100	0.300	35
9.5	100	0.150	4
4.75	100	0.075	2

Notes:  
 Sample supplied by client

Certificate No.:07-WG-713 / S301

Approved Signatory:  ( Mark Matthews ) Date: 12/04/2007



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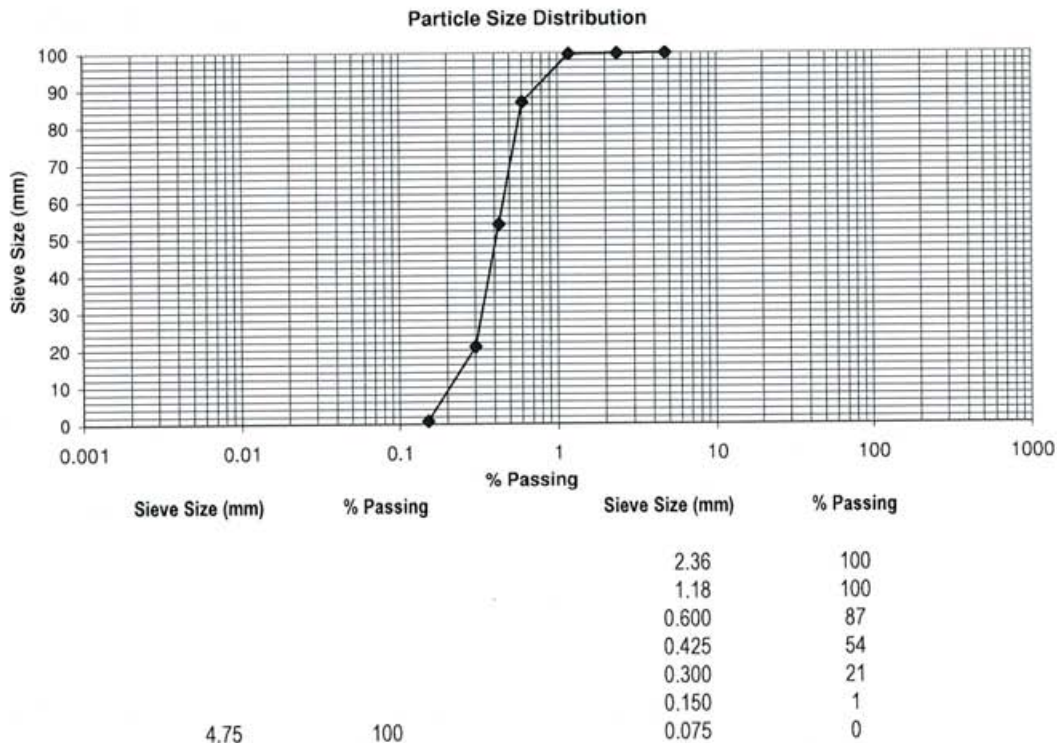
perth@westerngeo.com.au  
 ABN 91105324436  
 ph: 1300 781 744  
 fx: (08) 9458 3700

### TEST CERTIFICATE

Client: Brown Geotechnical & Environmental Pty Ltd  
 Project: Muriel Court (Area 19)  
 Location: Jandakot  
 Sample No.:  
 Sample ID.: TP17

Client Job No.: J06036/1  
 Test Date: 29/03/07  
 WG Job No.: 07-01-175  
 Lab No.: 07-WG-714  
 Depth: 0.9 - 2.0

### METHOD FOR DETERMINATION OF PARTICLE SIZE DISTRIBUTION -acc to AS 1289.3.6.1



Notes:  
 Sample supplied by client

Certificate No.:07-WG-714 / S301

Approved Signatory:  ( Mark Matthews ) Date: 12/04/2007



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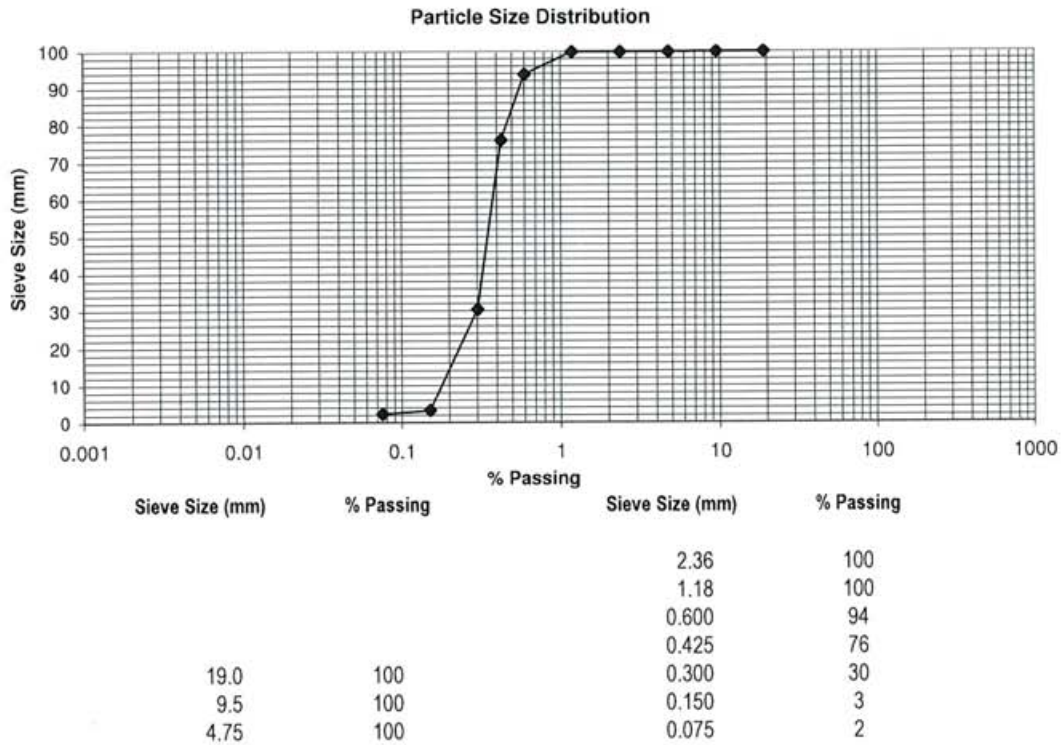
## TEST CERTIFICATE

Client: Brown Geotechnical & Environmental Pty Ltd  
 Project: Muriel Court (Area 19)  
 Location: Jandakot  
 Sample No.:  
 Sample ID.: TP20

Client Job No.: J06036/1  
 Test Date: 29/03/07  
 WG Job No.: 07-01-175  
 Lab No.: 07-WG-715  
 Depth: 0.5 - 1.5m

### METHOD FOR DETERMINATION OF PARTICLE SIZE DISTRIBUTION

-acc to AS 1289.3.6.1



Notes:  
 Sample supplied by client

Certificate No.: 07-WG-715 / S301

Approved Signatory: \_\_\_\_\_

( Mark Matthews )

Date: 12/04/2007



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 PO Box 219 Bentley WA 6982  
 36 Railway Parade  
 Welshpool WA 6106



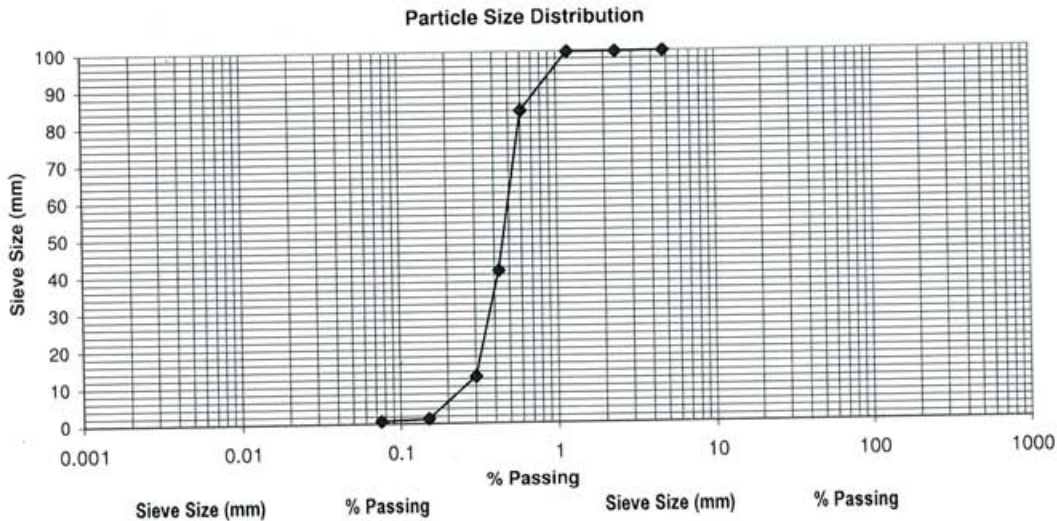
perth@westerngeo.com.au  
 ABN 91105324436  
 ph: 1300 781 744  
 fx: (08) 9458 3700

### TEST CERTIFICATE

Client: Brown Geotechnical & Environmental Pty Ltd  
 Project: Muriel Court (Area 19)  
 Location: Jandakot  
 Sample No.:  
 Sample ID.: TP22

Client Job No.: J06036/1  
 Test Date: 30/03/07  
 WG Job No.: 07-01-175  
 Lab No.: 07-WG-716  
 Depth: 1.5 - 2.5m

### METHOD FOR DETERMINATION OF PARTICLE SIZE DISTRIBUTION -acc to AS 1289.3.6.1



Notes:  
 Sample supplied by client

Certificate No.:07-WG-716 / S301

Approved Signatory: *Mark Matthews* (Mark Matthews) Date: 12/04/2007



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 PO Box 219 Bentley WA 6982  
 36 Railway Parade  
 Welshpool WA 6106



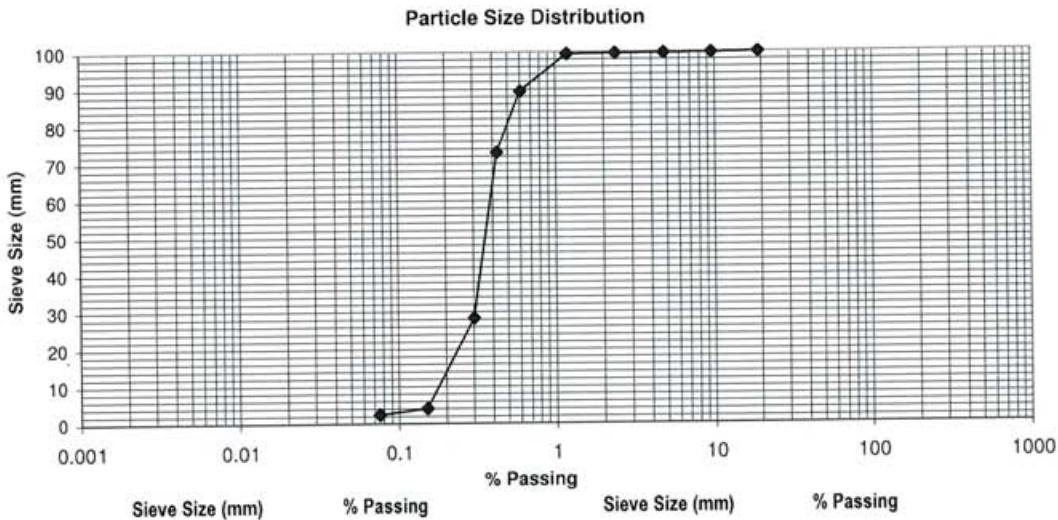
perth@westerngeo.com.au  
 ABN 91105324436  
 ph: 1300 781 744  
 fx: (08) 9458 3700

### TEST CERTIFICATE

Client: Brown Geotechnical & Environmental Pty Ltd  
 Project: Muriel Court (Area 19)  
 Location: Jandakot  
 Sample No.:  
 Sample ID.: TP28

Client Job No.: J06036/1  
 Test Date: 28/03/07  
 WG Job No.: 07-01-175  
 Lab No.: 07-WG-717  
 Depth: 0.5 - 1.5m

#### METHOD FOR DETERMINATION OF PARTICLE SIZE DISTRIBUTION -acc to AS 1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
		2.36	100
		1.18	99
		0.600	89
		0.425	73
19.0	100	0.300	28
9.5	100	0.150	4
4.75	100	0.075	3

Notes:  
 Sample supplied by client

Certificate No.:07-WG-717 / S301

Approved Signatory:  (Mark Matthews) Date: 12/04/2007



Accreditation No. 2418

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SN 2411

# TEST CERTIFICATE

Page 1 of 1

CLIENT: Brown Geotechnical & Environmental Pty Ltd  
PROJECT: Muriel Court (Area 19)  
LOCATION: Jandakot

JOB NO.: 07-01-175  
CLIENT JOB NO.: J06036/1  
DATE TESTED: 30/03/2007

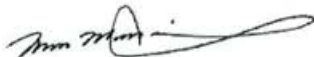
Lab Ref No.: 07-WG-717  
Sample Id:  
Sample No.: TP28 - 0.5 - 1.5m  
Description:

**ORGANIC MATTER CONTENT - FURNACE METHOD**  
- according to ASTM D 2974, Part 9, Method C

Organic Content (%): 0.84

Note:

Approved Signatory :\_



(M. Matthews)

Certificate No.: WG717

Date : 12/04/2007

QMS.Forms.Soils.WG086.01.C

# APPENDIX D

### Acid Sulphate Soil Field Test Results

Test Pit No	Depth (m)	pH <sub>F</sub> (field)	pH <sub>FOX</sub> (post oxidation)	Reaction Strength
TP1	0.5	6.9	5.1	Moderate
TP1	1.5	7.2	5.5	Slight
TP1	2.5	6.9	5.0	Slight*
TP2	0.5	6.8	4.9	Slight
TP2	1.5	7.2	5.2	Slight
TP2	2.5	7.1	5.0	Slight
TP3	0.5	6.7	4.2	Slight
TP3	1.5	6.6	4.5	Slight*
TP3	2.5	7.1	5.2	Slight
TP4	0.5	7.0	3.8	Slight
TP4	1.5	5.8	3.8	Slight*
TP4	2.5	6.2	4.8	Slight
TP5	0.5	6.3	4.7	Slight
TP5	1.5	6.2	4.7	Slight
TP5	2.5	6.5	4.9	Slight
TP9	0.5	6.8	4.9	Slight
TP9	1.5	6.9	4.7	Slight
TP9	2.5	6.8	4.9	Slight
TP26	0.5	6.2	4.6	Slight
TP26	1.5	6.2	4.5	Slight*
TP26	2.5	6.3	4.6	Slight
TP27	0.5	6.0	4.8	Slight
TP27	1.5	6.3	4.8	Slight*
TP27	2.5	6.0	5.9	Slight
TP28	0.5	6.1	5.0	Slight
TP28	1.5	6.2	4.8	Slight
TP28	2.5	6.3	4.9	Slight
TP29	0.5	7.9	4.9	Slight
TP29	1.5	7.7	5.2	Slight
TP29	2.5	7.3	4.6	Strong*
TP30	0.5	7.3	4.3	Moderate*
TP30	1.5	6.8	4.7	Slight
TP30	2.5	6.8	4.6	Slight
TP31	0.5	7.0	4.5	Moderate*
TP31	1.5	7.0	5.0	Slight
TP31	2.5	7.0	5.1	Slight*
TP32	0.5	6.1	2.9	Moderate*
TP32	1.5	6.3	4.1	Slight*
TP32	2.5	5.9	4.2	Slight

\* Selected for laboratory testing.

# ALS Environmental



11/F, Chung Shun Knitting Centre  
 1-3 Wing Yip St, Kwai Chung  
 Tel : (852) 2610 1044  
 Fax : (852) 2610 2021  
 Email: alshk@hknet.com

## SAMPLE SUBMISSION FORM

*Please Note : The following information is required to expedite sample analysis. Please complete all the necessary details and return this form with your samples.*

### CLIENT DETAILS:

Company Name: Brown Geotechnical & Environmental

Client Contact Name: Ken Brown Date: 05/04/07

Postal Address: POBox 4000, Victotia Park WA6979  
 Email: bge@acidss.com.au

Phone: 9368 2615 Fax: 9367 7409

CLIENT ORDER No : J06036.01/2 ALS QUOTATION NUMBER : PEN/063/06

PROJECT NAME: Area 19, Muriel Court, Jandakot

### SECONDARY CONTACT

Name :

Environmental Division  
Perth

Address: \_\_\_\_\_

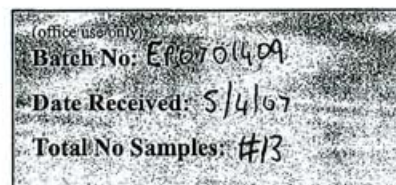
Work Order

**EP0701409**

Phone : \_\_\_\_\_



Telephone : 61-8-9209 7655



*Lula Jones* ←  
5/4/07 16:30

### SAMPLE ANALYTIC

Lab ID (office use only)	Sample ID.	Matrix	Sampling Date/Time	Analysis Required
①	TP1 - 2.5m EP07012007003	Soil	15/03/07	ASS Chromium Suite
②	TP3 - 1.5m EP07012007008	Soil	15/03/07	ASS Chromium Suite
③	TP4 - 1.5m EP07012007011	Soil	15/03/07	ASS Chromium Suite
④	TP4 - 2.5m EP07012007012	Soil	15/03/07	ASS Chromium Suite
⑤	TP26 - 1.5m EP07012007020	Soil	15/03/07	ASS Chromium Suite
⑥	TP27 - 1.5m EP07012007023	Soil	15/03/07	ASS Chromium Suite
⑦	TP29 - 2.5m EP07012007027	Soil	15/03/07	ASS Chromium Suite
⑧	TP30 - 0.5m EP07012007028	Soil	15/03/07	ASS Chromium Suite
⑨	TP31 - 0.5m EP07012007031	Soil	15/03/07	ASS Chromium Suite





# ALS Environmental

## CERTIFICATE OF ANALYSIS

Client	: BROWN GEOTECHNICAL AND ENVIRONMENTAL	Laboratory	: Environmental Division Perth	Page	: 1 of 6
Contact	: MR KEN BROWN	Contact	: Michael Sharp	Work Order	: EP0701409
Address	: SUITE 4 / 47 MONASH AVENUE COMO WA AUSTRALIA 6152	Address	: 10 Hod Way Malaga WA Australia 6090		
E-mail	: kenbrown@acidss.com.au	E-mail	: Michael.Sharp@alsenviro.com		
Telephone	: 93682615	Telephone	: 61-8-9209 7655	Date received	: 5 Apr 2007
Facsimile	: - Not provided -	Facsimile	: 61-8-9209 7600	Date issued	: 17 Apr 2007
Project	: J06036.01 2 Ex EP0701207	Quote number	: PEN-063-06	No. of samples	: 13
Order number	: - Not provided -			Received	: 13
C-O-C number	: - Not provided -			Analysed	: 13
Site	: Area 19, Muriel Court, Janakot				

### ALSE - Excellence in Analytical Testing

This document has been electronically signed by those names that appear on this report and are the authorised signatories. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatory	Position	Department
Stacey Hawkins	Instrument Chemist	Perth Inorganics - NATA 825 (15847 - Perth)

NATA Accredited Laboratory  
825

This document is issued in accordance with NATA's accreditation requirements.

Accredited for compliance with  
ISO/IEC 17025.



WORLD RECOGNISED  
ACCREDITATION

Page Number : 2 of 6  
Client : BROWN GEOTECHNICAL AND ENVIRONMENTAL  
Work Order : EP0701409

### Comments

This report for the ALSE reference EP0701409 supersedes any previous reports with this reference. Results apply to the samples as submitted. All pages of this report have been checked and approved for release.

This report contains the following information:

- Analytical Results for Samples Submitted
- Surrogate Recovery Data

The analytical procedures used by ALS Environmental have been developed from established internationally-recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported herein. Reference methods from which ALSE methods are based are provided in parenthesis.

When moisture determination has been performed, results are reported on a dry weight basis. When a reported 'less than' result is higher than the LOR, this may be due to primary sample extracts/digestion dilution and/or insufficient sample amount for analysis. Surrogate Recovery Limits are static and based on USEPA SW846 or ALS-QWI/EN38 (in the absence of specified USEPA limits). Where LOR of reported result differ from standard LOR, this may be due to high moisture, reduced sample amount or matrix interference. When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for process purposes. Abbreviations: CAS number = Chemical Abstract Services number, LOR = Limit of Reporting. \* Indicates failed Surrogate Recoveries.

Specific comments for Work Order **EP0701409**

Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.  
Retained Acidity not required because pH KCl greater than or equal to 4.5



ALS Environmental

Page Number : 3 of 6  
 Client : BROWN GEOTECHNICAL AND ENVIRONMENTAL  
 Work Order : EP0701409

**Analytical Results**

Analyte	CAS number	Client Sample ID :			
		TP1	TP3	TP4	TP26
Sample Matrix Type / Description :		TP1	TP3	TP4	TP26
Sample Date / Time :		2.5	1.5	2.5	1.5
Laboratory Sample ID :		SOIL	SOIL	SOIL	SOIL
LOR		15 Mar 2007	15 Mar 2007	15 Mar 2007	15 Mar 2007
Units		15:00	15:00	15:00	15:00
LOR		EP0701409-001	EP0701409-003	EP0701409-004	EP0701409-005
<b>EA033-A: Actual Acidity</b>					
pH KCl (23A)	0.1 pH Unit	6.5	6.2	6.6	6.4
Titratable Actual Acidity (23F)	2 mole H+ / t	<2	2	<2	2
sulfidic - Titratable Actual Acidity (s-23F)	0.02 % pyrite S	<0.02	<0.02	<0.02	<0.02
<b>EA033-B: Potential Acidity</b>					
Chromium Reducible Sulfur (22B)	0.02 % S	<0.02	<0.02	<0.02	<0.02
acidity - Chromium Reducible Sulfur (a-22B)	10 mole H+ / t	<10	<10	<10	<10
<b>EA033-C: Acid Neutralising Capacity</b>					
Acid Neutralising Capacity (19A1)	0.01 % CaCO3	---	---	<0.01	---
acidity - Acid Neutralising Capacity (a-19A1)	10 mole H+ / t	---	---	<10	---
sulfidic - Acid Neutralising Capacity (s-19A1)	0.01 % pyrite S	---	---	<0.01	---
<b>EA033-E: Acid Base Accounting</b>					
ANC Fineness Factor	0.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	0.02 % S	<0.02	<0.02	<0.02	<0.02
Net Acidity (acidity units)	10 mole H+ / t	<10	11	<10	<10
Liming Rate	1 kg CaCO3/t	<1	<1	<1	<1
Net Acidity excluding ANC (sulfur units)	0.02 % S	<0.02	<0.02	<0.02	<0.02
Net Acidity excluding ANC (acidity units)	10 mole H+ / t	<10	11	<10	<10
Liming Rate excluding ANC	1 kg CaCO3/t	<1	<1	<1	<1



Page Number : 4 of 6  
 Client : BROWN GEOTECHNICAL AND ENVIRONMENTAL  
 Work Order : EP0701409

**Analytical Results**

Analyte	CAS number	Client Sample ID :		Sample Matrix Type / Description : Sample Date / Time :	Laboratory Sample ID :
		LOR	Units		
<b>EA033-A: Actual Acidity</b>					
pH KCl (23A)		0.1	pH Unit	TP27 1.5 SOIL 15 Mar 2007 15:00	EP0701409-006
Titratable Actual Acidity (23F)		2	mole H+ / t	TP29 2.5 SOIL 15 Mar 2007 15:00	EP0701409-007
sulfidic - Titratable Actual Acidity (s-23F)		0.02	% pyrite S	TP30 0.5 SOIL 15 Mar 2007 15:00	EP0701409-008
<b>EA033-B: Potential Acidity</b>					
Chromium Reducible Sulfur (a-22B)		0.02	% S	TP31 0.5 SOIL 15 Mar 2007 15:00	EP0701409-009
acidity - Chromium Reducible Sulfur (a-22B)		10	mole H+ / t	TP31 2.5 SOIL 15 Mar 2007 15:00	EP0701409-010
<b>EA033-C: Acid Neutralising Capacity</b>					
Acid Neutralising Capacity (19A1)		0.01	% CaCO3		
acidity - Acid Neutralising Capacity (a-19A1)		10	mole H+ / t		
sulfidic - Acid Neutralising Capacity (s-19A1)		0.01	% pyrite S		
<b>EA033-E: Acid Base Accounting</b>					
ANC Fineness Factor		0.5			
Net Acidity (sulfur units)		0.02	% S		
Net Acidity (acidity units)		10	mole H+ / t		
Liming Rate		1	kg CaCO3/t		
Net Acidity excluding ANC (sulfur units)		0.02	% S		
Net Acidity excluding ANC (acidity units)		10	mole H+ / t		
Liming Rate excluding ANC		1	kg CaCO3/t		



**Analytical Results**

Analyte	CAS number	Client Sample ID :		
		TP32 0.5	TP32 1.5	QA1
Sample Matrix Type / Description :		SOIL		
Sample Date / Time :		15 Mar 2007 15:00		
Laboratory Sample ID :		EP0701409-011		
LOR		TP32 0.5	TP32 1.5	QA1
<b>EA033-A: Actual Acidity</b>				
pH KCl (23A)	0.1 pH Unit	4.9	5.8	5.9
Titratable Actual Acidity (23F)	2 mole H+ / t	5	2	2
sulfidic - Titratable Actual Acidity (s-23F)	0.02 % pyrite S	<0.02	<0.02	<0.02
<b>EA033-B: Potential Acidity</b>				
Chromium Reducible Sulfur (22B)	0.02 % S	<0.02	<0.02	<0.02
acidity - Chromium Reducible Sulfur (a-22B)	10 mole H+ / t	<10	<10	<10
<b>EA033-E: Acid Base Accounting</b>				
ANC Fineness Factor	0.5	1.5	1.5	1.5
Net Acidity (sulfur units)	0.02 % S	<0.02	<0.02	<0.02
Net Acidity (acidity units)	10 mole H+ / t	<10	<10	<10
Liming Rate	1 kg CaCO3/t	<1	<1	<1
Net Acidity excluding ANC (sulfur units)	0.02 % S	<0.02	<0.02	<0.02
Net Acidity excluding ANC (acidity units)	10 mole H+ / t	<10	<10	<10
Liming Rate excluding ANC	1 kg CaCO3/t	<1	<1	<1



### Surrogate Control Limits

- No surrogates present on this report.



**QUALITY CONTROL REPORT**

<b>Client</b> :	<b>BROWN GEOTECHNICAL AND ENVIRO</b>	<b>Laboratory</b> :	Environmental Division Perth	<b>Page</b> :	1 of 5
<b>Contact</b> :	MR KEN BROWN	<b>Contact</b> :	Michael Sharp	<b>Work order</b> :	EP0701409
<b>Address</b> :	SUITE 4 / 47 MONASH AVENUE COMO WA AUSTRALIA 6152	<b>Address</b> :	10 Hod Way Malaga WA Australia 6090	<b>Amendment No.</b> :	
<b>Project</b> :	J06036.01 2 Ex EP0701207	<b>Quote number</b> :	PEN-063-06	<b>Date received</b> :	5 Apr 2007
<b>Order number</b> :	- Not provided -			<b>Date issued</b> :	17 Apr 2007
<b>C-O-C number</b> :	- Not provided -				
<b>Site</b> :	Area 19, Muriel Court, Janakot				
<b>E-mail</b> :	kenbrown@acidss.com.au	<b>E-mail</b> :	Michael.Sharp@alsenviro.com	<b>No. of samples</b>	
<b>Telephone</b> :	93682615	<b>Telephone</b> :	61-8-9209 7655	<b>Received</b>	13
<b>Facsimile</b> :	- Not provided -	<b>Facsimile</b> :	61-8-9209 7600	<b>Analysed</b>	13

This final report for the ALSE work order reference EP0701409 supersedes any previous reports with this reference. Results apply to the samples as submitted. All pages of this report have been checked and approved for release.

This report contains the following information:

- Laboratory Duplicates (DUP); Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Samples (LCS); Recovery and Acceptance Limits
- Matrix Spikes (MS); Recovery and Acceptance Limits

**Work order specific comments**

Limiting Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5. Retained Acidity not required because pH KCl greater than or equal to 4.5

**ALSE - Excellence in Analytical Testing**



NATA Accredited Laboratory - 825

This document is issued in accordance with NATA's accreditation requirements.

Accredited for compliance with ISO/IEC 17025

This document has been electronically signed by those names that appear on this report and are the authorised signatories. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

**Signatory**

Stacey Hawkins

**Department**

Perth Inorganics - NATA 825 (15847 - Perth)



**Quality Control Report - Laboratory Duplicates (DUP)**

The quality control term **Laboratory Duplicate** refers to an intralaboratory split sample randomly selected from the sample batch. Laboratory duplicates provide information on method precision and sample heterogeneity.  
 - Anonymous - Client Sample IDs refer to samples which are not specifically part of this work order but formed part of the QC process lot. Abbreviations: **LOR = Limit of Reporting**, **RPD = Relative Percent Difference**.  
 • Indicates failed QC. The permitted ranges for the RPD of Laboratory Duplicates (relative percent deviation) are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: - Result < 10 times LOR, no limit - Result between 10 and 20 times LOR, 0% - 50% - Result > 20 times LOR, 0% - 20%

**Laboratory Duplicates (DUP) Report**

Matrix Type: SOIL		Analyte name	LOR	Original Result		Duplicate Result		RPD
Laboratory Sample ID	Client Sample ID			pH Unit	pH Unit	pH Unit	%	
<b>EA033-A: Actual Acidity</b>								
<b>EA033-A: Actual Acidity - (QC Lot: 389856)</b>								
EP0701409-001	TP1 - 2.5	pH KCl (23A)	0.1 pH Unit	6.5	6.5	6.5	0.0	0.0
		Titratable Actual Acidity (23F)	2 mole H+ / t	<2	<2	<2	0.0	0.0
		sulfidic - Titratable Actual Acidity (s-23F)	0.02 % pyrite S	<0.02	<0.02	<0.02	0.0	0.0
EP0701409-011	TP32 - 0.5	pH KCl (23A)	0.1 pH Unit	4.9	5.5	5.5	11.1	11.1
		Titratable Actual Acidity (23F)	2 mole H+ / t	5	4	4	28.4	28.4
		sulfidic - Titratable Actual Acidity (s-23F)	0.02 % pyrite S	<0.02	<0.02	<0.02	0.0	0.0
<b>EA033-B: Potential Acidity</b>								
<b>EA033-B: Potential Acidity - (QC Lot: 389856)</b>								
EP0701409-001	TP1 - 2.5	Chromium Reducible Sulfur (22B)	0.02 % S	<0.02	<0.02	<0.02	0.0	0.0
		Acidity - Chromium Reducible Sulfur (a-22B)	10 mole H+ / t	<10	<10	<10	0.0	0.0
EP0701409-011	TP32 - 0.5	Chromium Reducible Sulfur (22B)	0.02 % S	<0.02	<0.02	<0.02	0.0	0.0
		Acidity - Chromium Reducible Sulfur (a-22B)	10 mole H+ / t	<10	<10	<10	0.0	0.0
<b>EA033-E: Acid Base Accounting</b>								
<b>EA033-E: Acid Base Accounting - (QC Lot: 389856)</b>								
EP0701409-001	TP1 - 2.5	ANC Fineness Factor		1.5	1.5	1.5	0.0	0.0
		Net Acidity (sulfur units)	0.02 % S	<0.02	<0.02	<0.02	0.0	0.0
		Net Acidity (acidity units)	10 mole H+ / t	<10	<10	<10	0.0	0.0
		Liming Rate	1 kg CaCO3/t	<1	<1	<1	0.0	0.0
		Net Acidity excluding ANC (sulfur units)	0.02 % S	<0.02	<0.02	<0.02	0.0	0.0
		Net Acidity excluding ANC (acidity units)	10 mole H+ / t	<10	<10	<10	0.0	0.0
		Liming Rate excluding ANC	1 kg CaCO3/t	<1	<1	<1	0.0	0.0
EP0701409-011	TP32 - 0.5	ANC Fineness Factor		1.5	1.5	1.5	0.0	0.0
		Net Acidity (sulfur units)	0.02 % S	<0.02	<0.02	<0.02	0.0	0.0
		Net Acidity (acidity units)	10 mole H+ / t	<10	<10	<10	0.0	0.0
		Liming Rate	1 kg CaCO3/t	<1	<1	<1	0.0	0.0





**Quality Control Report - Method Blank (MB) and Laboratory Control Samples (LCS)**

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC type is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a known, interference free matrix spiked with target analytes or certified reference material. The purpose of this QC type is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of actual laboratory data. Flagged outliers on control limits for inorganics tests may be within the NEMP specified data quality objective of recoveries in the range of 70 to 130%. Where this occurs, no corrective action is taken. Abbreviations: LOR = Limit of reporting.

Matrix Type: SOIL

Analyte name	LOR	Method blank result	Actual Results		Recovery Limits	
			Spike concentration	Spike Recovery	Dynamic Recovery	High
<b>EA033-A: Actual Acidity</b>						
EA033-A: Actual Acidity - ( QC Lot: 389856 )		pH Unit	pH Unit	%	%	%
pH KCl (23A)	0.1 pH Unit	<0.1	-----	-----	-----	-----
sulfidic - Titratable Actual Acidity (s-23F)	0.02 % pyrite S	<0.02	-----	-----	-----	-----
Titratable Actual Acidity (23F)	2 mole H+ / t	<2	-----	-----	-----	-----
<b>EA033-B: Potential Acidity</b>						
EA033-B: Potential Acidity - ( QC Lot: 389856 )		mole H+ / t	mole H+ / t	%	%	%
Acidity - Chromium Reducible Sulfur (a-22B)	10 mole H+ / t	<10	-----	-----	-----	-----
Chromium Reducible Sulfur (22B)	0.02 % S	<0.02	-----	-----	-----	-----
<b>EA033-E: Acid Base Accounting</b>						
EA033-E: Acid Base Accounting - ( QC Lot: 389856 )				%	%	%
ANC Fineness Factor		<0.5	-----	-----	-----	-----
Liming Rate	1 kg CaCO3/t	<1	-----	-----	-----	-----
Net Acidity (acidity units)	10 mole H+ / t	<10	-----	-----	-----	-----
Net Acidity (sulfur units)	0.02 % S	<0.02	-----	-----	-----	-----



**Quality Control Report - Matrix Spikes (MS)**

The quality control term **Matrix Spike (MS)** refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC type is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQO's). 'Ideal' recovery ranges stated may be waived in the event of sample matrix interferences. - Anonymous - Client Sample IDs refer to samples which are not specifically part of this work order but formed part of the QC process lot. Abbreviations: **LOR** = Limit of Reporting, **RPD** = Relative Percent Difference.

\* Indicates failed QC

Analyte name	Laboratory Sample ID	Client Sample ID	LOR	Spike Concentration	Actual Results		Recovery Limits	
					Sample Result	Spike Recovery MS	Static Limits	High
-( QC Lot: )						%		%

● No Matrix Spike (MS) carried out on this Work Order.



# ALS Environmental

## INTERPRETIVE QUALITY CONTROL REPORT

<b>Client</b> :	<b>BROWN GEOTECHNICAL AND ENVIRONMENTAL</b>	<b>Laboratory</b> :	Environmental Division Perth	<b>Page</b> :	1 of 5
<b>Contact</b> :	MR KEN BROWN	<b>Contact</b> :	Michael Sharp	<b>Work order</b> :	EP0701409
<b>Address</b> :	SUITE 4 / 47 MONASH AVENUE COMO WA AUSTRALIA 6152	<b>Address</b> :	10 Hod Way Malaga WA Australia 6090	<b>Amendment No.</b> :	
<b>Project</b> :	J06036.01 2 Ex EP0701207	<b>Quote number</b> :	PEN-063-06	<b>Date received</b> :	5 Apr 2007
<b>Order number</b> :	- Not provided -			<b>Date issued</b> :	17 Apr 2007
<b>C-O-C number</b> :	- Not provided -				
<b>Site</b> :	Area 19, Muriel Court, Janakot				
<b>E-mail</b> :	kenbrown@acidss.com.au	<b>E-mail</b> :	Michael.Sharp@alsenviro.com	<b>No. of samples</b>	
<b>Telephone</b> :	93682615	<b>Telephone</b> :	61-8-9209 7655	<b>Received</b>	13
<b>Facsimile</b> :	- Not provided -	<b>Facsimile</b> :	61-8-9209 7600	<b>Analysed</b>	13

This Interpretive Quality Control Report was issued on 17 Apr 2007 for the ALS work order reference EP0701409 and supersedes any previous reports with this reference. This report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Type Frequency Compliance
- Summary of all Quality Control Outliers
- Brief Method Summaries





### Interpretive Quality Control Report - Frequency of Quality Control Samples

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which this work order was processed. Actual rate should be greater than or equal to the expected rate.

Quality Control Sample Type Method	QC	Regular	Rate (%)		Quality Control Specification
			Actual	Expected	
<b>Matrix Type: SOIL</b>					
<b>Laboratory Duplicates (DUP)</b>					
EA033: Chromium Suite for Acid Sulphate Soils	2	13	15.4	10.0	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
<b>Laboratory Control Samples (LCS)</b>					
EA033: Chromium Suite for Acid Sulphate Soils	1	13	7.7	5.0	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
<b>Method Blanks (MB)</b>					
EA033: Chromium Suite for Acid Sulphate Soils	1	13	7.7	5.0	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement



## **Interpretive Quality Control Report - Summary of Outliers**

### **Outliers : Quality Control Samples**

The following report highlights outliers flagged on the 'Quality Control Report'. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QW/EN/38 (in the absence of specific USEPA limits). Flagged outliers on control limits for inorganics tests may be within the NEPM specified data quality objective of recoveries in the range of 70 to 130%. Where this occurs, no corrective action is taken. - Anonymous - Client Sample IDs refer to samples which are not specifically part of this work order but formed part of the QC process lot.

### **Non-surrogates**

- For all matrices, no RPD recovery outliers occur for the duplicate analysis.
- For all matrices, no method blank result outliers occur.
- For all matrices, no laboratory spike recoveries breaches occur.
- For all matrices, no matrix spike recoveries breaches occur.

### **Surrogates**

- For all matrices, no surrogate recovery outliers occur.

### **Outliers : Analysis Holding Time**

The following report highlights outliers within this 'Interpretive Quality Control Report - Analysis Holding Time'.

- No holding time outliers occur.

### **Outliers : Frequency of Quality Control Samples**

The following report highlights outliers within this 'Interpretive Quality Control Report - Frequency of Quality Control Samples'.

- No frequency outliers occur.



## Method Reference Summary

The analytical procedures used by ALS Environmental are based on established internationally-recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house procedure are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported herein. Reference methods from which ALSE methods are based are provided in parenthesis.

Matrix Type: SOIL

### Preparation Methods

EN020PR : Drying at 85 degrees, bagging and labelling (ASS) - In house

### Analytical Methods

EA033 : Chromium Suite for Acid Sulphate Soils - Aherm et al 2004. This method covers the determination of Chromium Reducible Sulfur (SCR); pH(KCl); titratable actual acidity (TAA); acid neutralising capacity by back titration (ANC); and net acid soluble sulfur (SNAS) which incorporates peroxide sulfur. It applies to soils and sediments (including sands) derived from coastal regions. Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.

Method Reference Summary

# **APPENDIX E**

## APPENDIX E

### Soil Assessment Criteria

Western Australia's Draft Acid Sulphate Soil Guidelines (2006) have established action criteria for the assessment of the environmental risk of acid sulphate soils. The action criteria are based on the sum of existing plus, potential acidity, calculated as equivalent sulphur (e.g. s-TAA + S<sub>CR</sub> in %S units) or equivalent acidity (e.g. TAA + TPA in mol H<sup>+</sup>/tonne). The highest laboratory result was used to assess against the action criteria.

As clay content tends to influence the soils natural pH buffering capacity, the action criteria are grouped by three broad texture categories – coarse, medium and fine. The criteria are used to define when acid sulphate soils disturbed at a site will need to be treated and managed. The Table below summarises the action criteria.

**Texture based acid sulphate soils action criteria**

Type of Material		Action Criteria if <1,000 tonnes of material is disturbed		Action Criteria if >1,000 tonnes of material is disturbed	
Texture Range	Approx. Clay Content	Equivalent Sulphur (%)	Equivalent Acidity (mol H <sup>+</sup> /tonne)	Equivalent Sulphur	Equivalent Acidity (mol H <sup>+</sup> /tonne)
Coarse – sands to loamy sands	≤ 5%	0.03	18.7	0.03	18.7
Medium – sandy loams to light clays	5 – 40%	0.06	37.4	0.03	18.7
Fine – medium to heavy clays and silty clays	≥ 40%	0.1	64.8	0.03	18.7

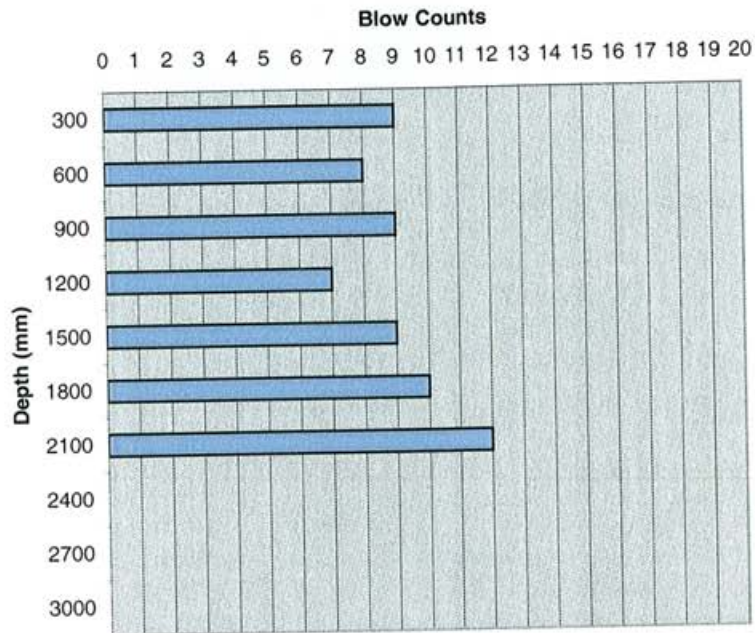
In addition to the action criteria, the guidelines define indicator pH values for field pH (pH<sub>F</sub>) and field peroxide pH (pH<sub>FOX</sub>) to assist with identifying likely acid generating soils. The pH indicator values are defined as:

- pH<sub>F</sub> ≤ 4 (when pH >4 but <5 may indicate some existing acidity); and
- pH<sub>FOX</sub> <3 or a much lower pH<sub>FOX</sub> than pH<sub>F</sub> (greater than 1 pH unit change).

# **APPENDIX B**

Depth (mm)	Blow Counts
300	9
600	8
900	9
1200	7
1500	9
1800	10
2100	12
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 1



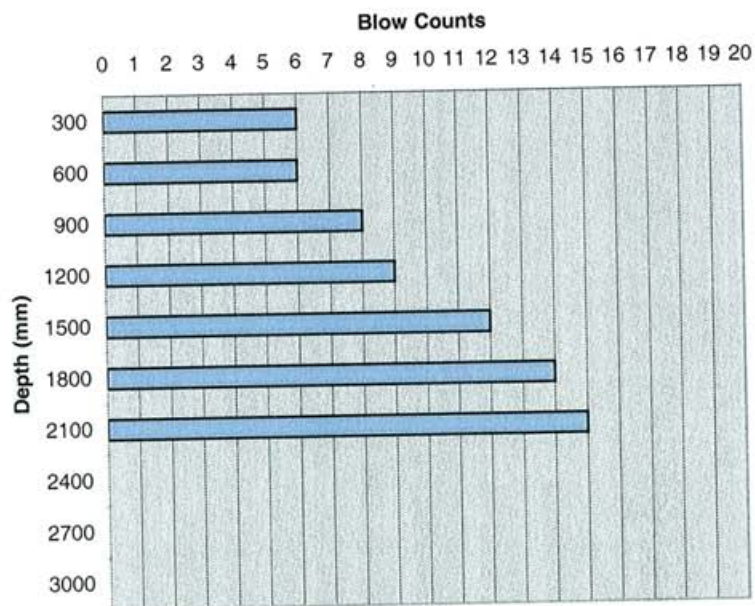
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth	Blow Counts
300	6
600	6
900	8
1200	9
1500	12
1800	14
2100	15
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 2



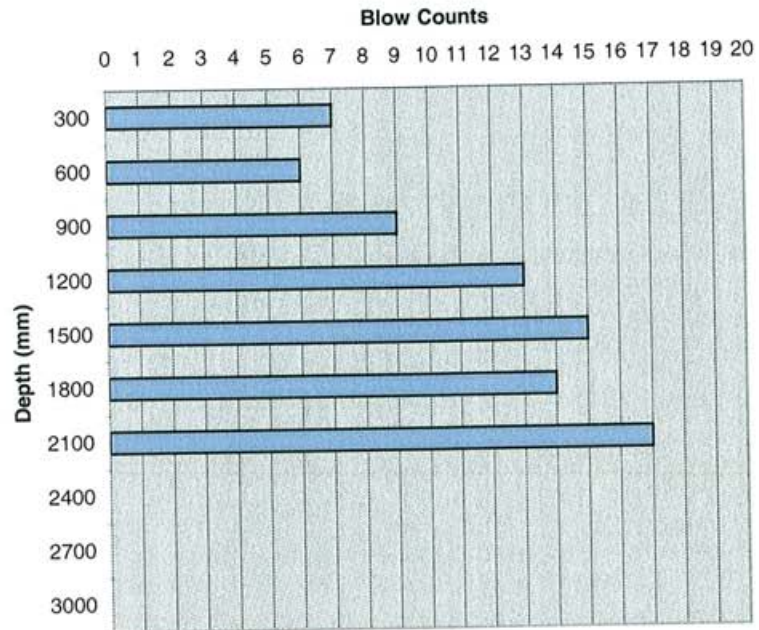
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth (mm)	Blow Counts
300	7
600	6
900	9
1200	13
1500	15
1800	14
2100	17
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 3



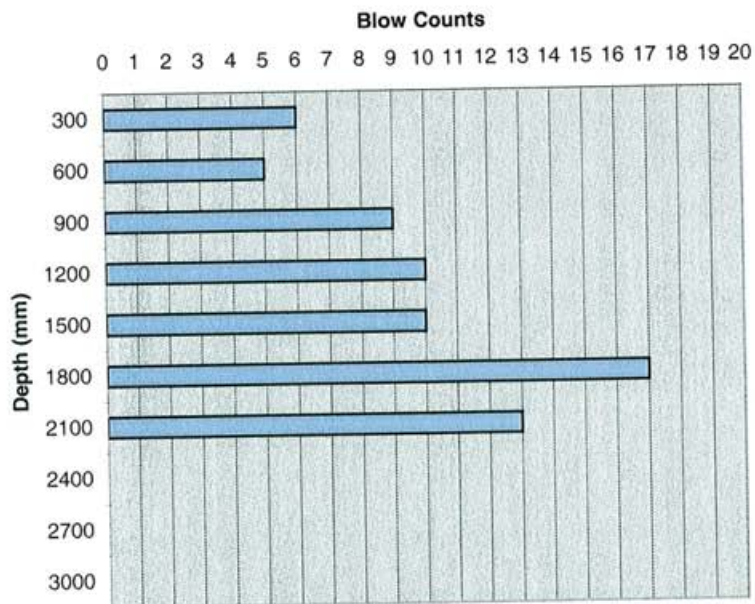
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth	Blow Counts
300	6
600	5
900	9
1200	10
1500	10
1800	17
2100	13
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 4



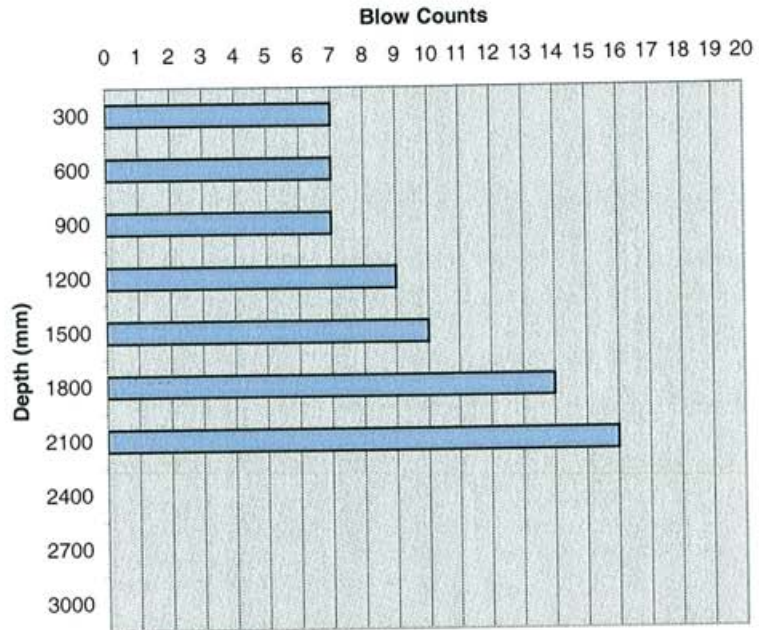
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth (mm)	Blow Counts
300	7
600	7
900	7
1200	9
1500	10
1800	14
2100	16
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 5



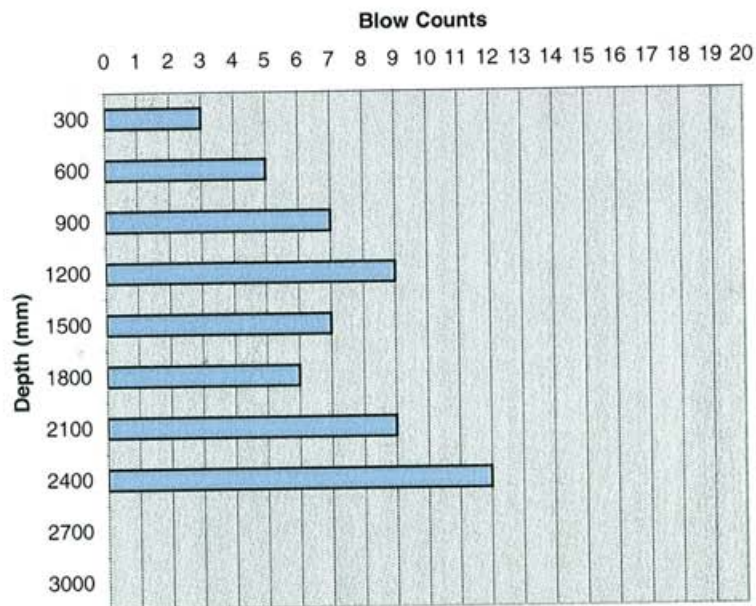
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth	Blow Counts
300	3
600	5
900	7
1200	9
1500	7
1800	6
2100	9
2400	12
2700	
3000	

### Perth Sand Penetrometer Results - Test 6



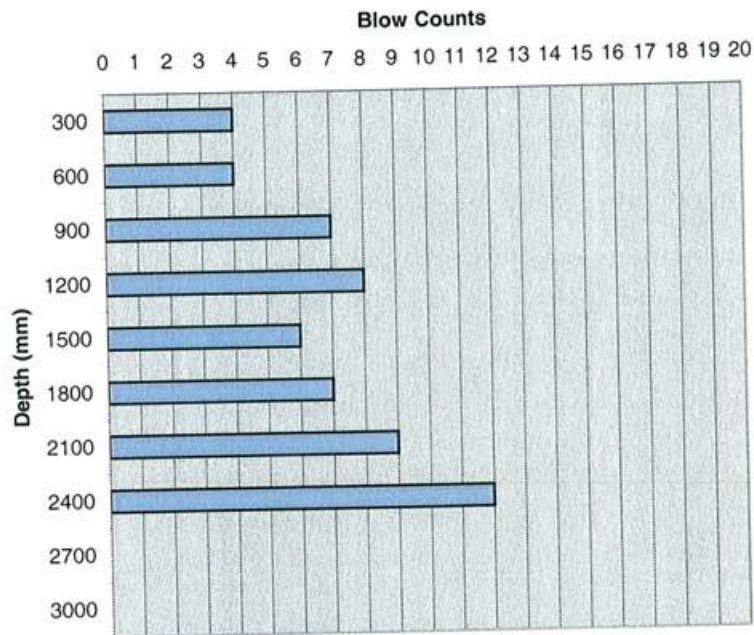
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth (mm)	Blow Counts
300	4
600	4
900	7
1200	8
1500	6
1800	7
2100	9
2400	12
2700	
3000	

### Perth Sand Penetrometer Results - Test 7



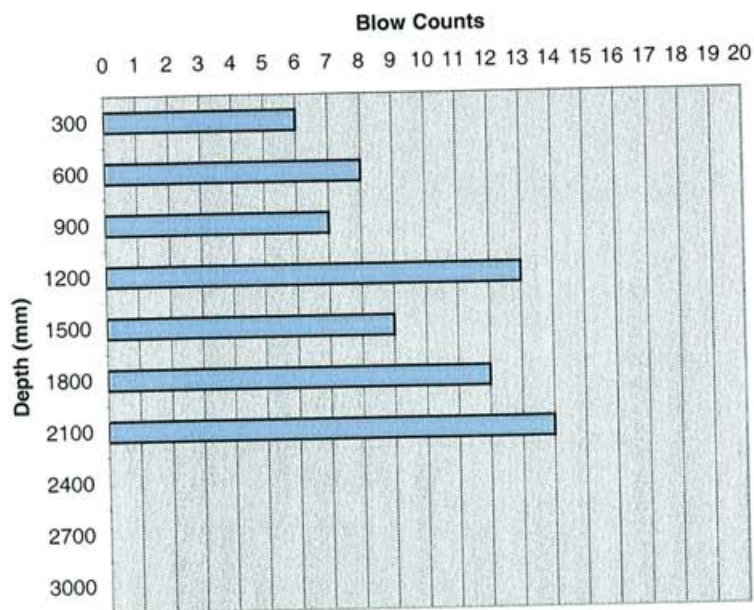
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth	Blow Counts
300	6
600	8
900	7
1200	13
1500	9
1800	12
2100	14
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 8



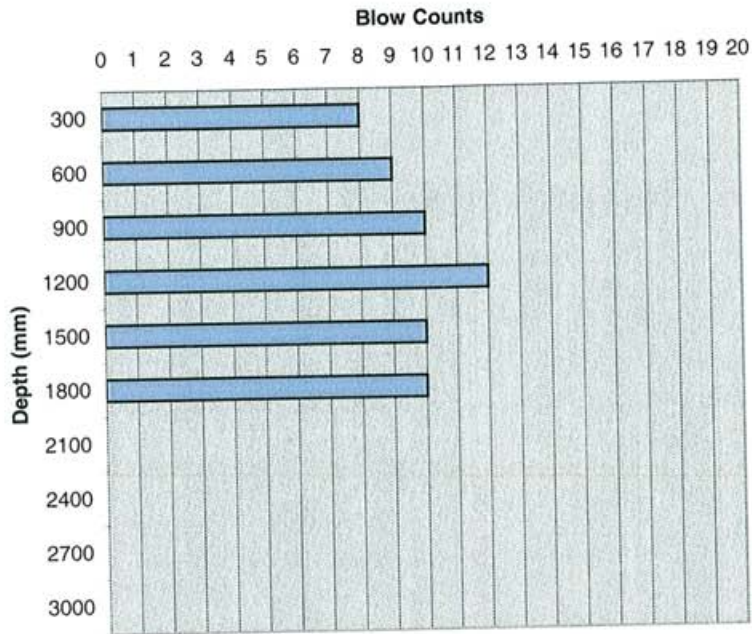
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth (mm)	Blow Counts
300	8
600	9
900	10
1200	12
1500	10
1800	10
2100	
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 9



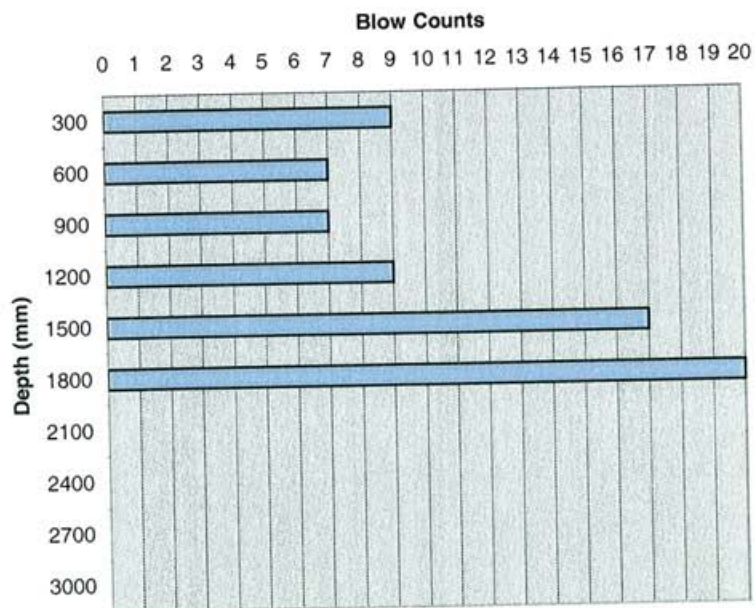
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth	Blow Counts
300	9
600	7
900	7
1200	9
1500	17
1800	20
2100	
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 10



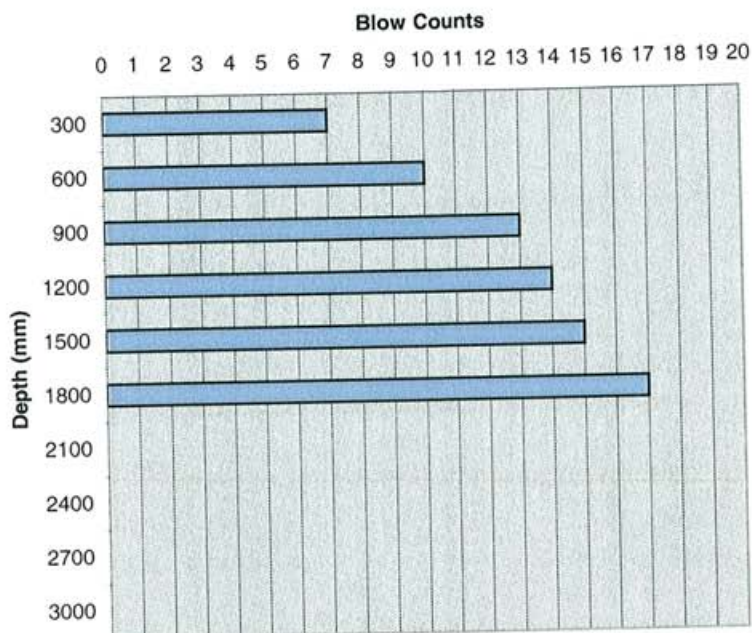
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth (mm)	Blow Counts
300	7
600	10
900	13
1200	14
1500	15
1800	17
2100	
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 11



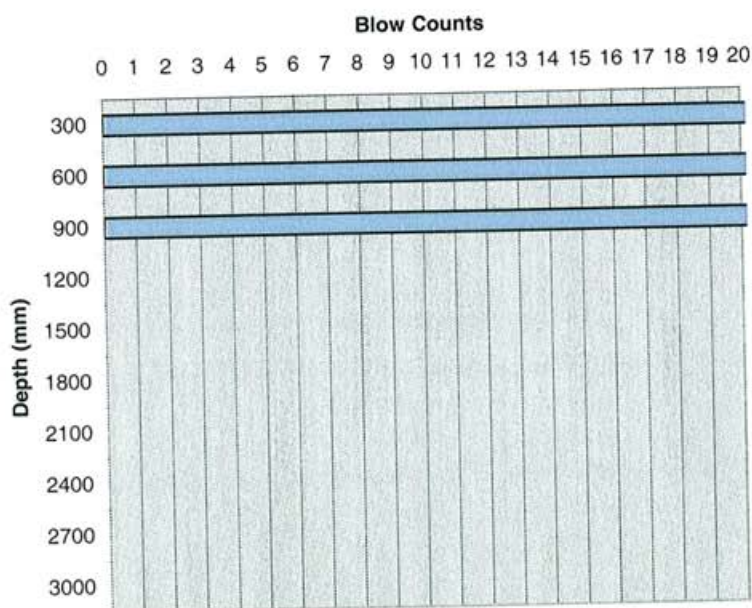
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth	Blow Counts
300	22
600	24
900	24
1200	
1500	
1800	
2100	
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 12



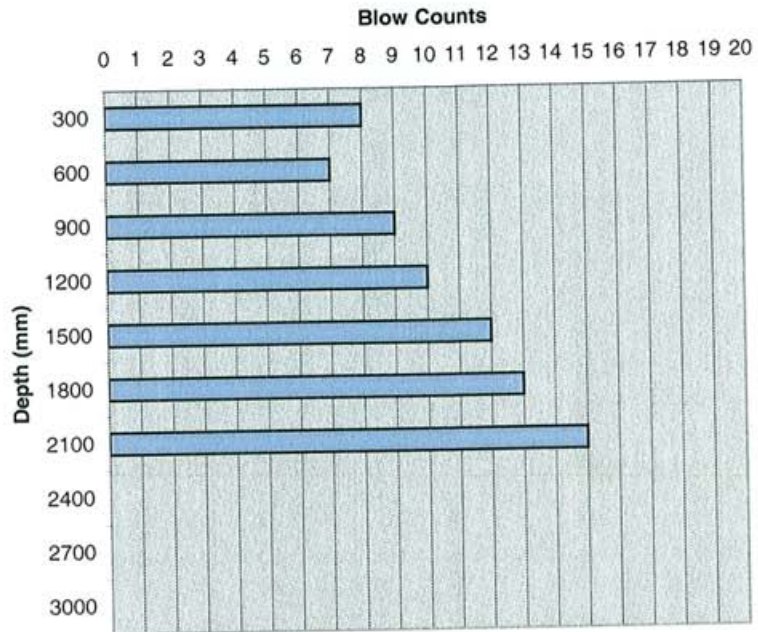
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth (mm)	Blow Counts
300	8
600	7
900	9
1200	10
1500	12
1800	13
2100	15
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 13



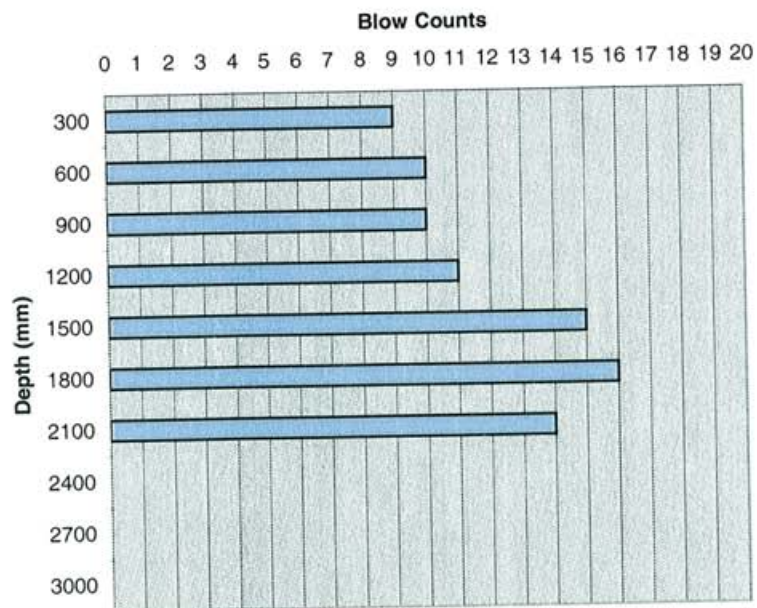
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth	Blow Counts
300	9
600	10
900	10
1200	11
1500	15
1800	16
2100	14
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 14



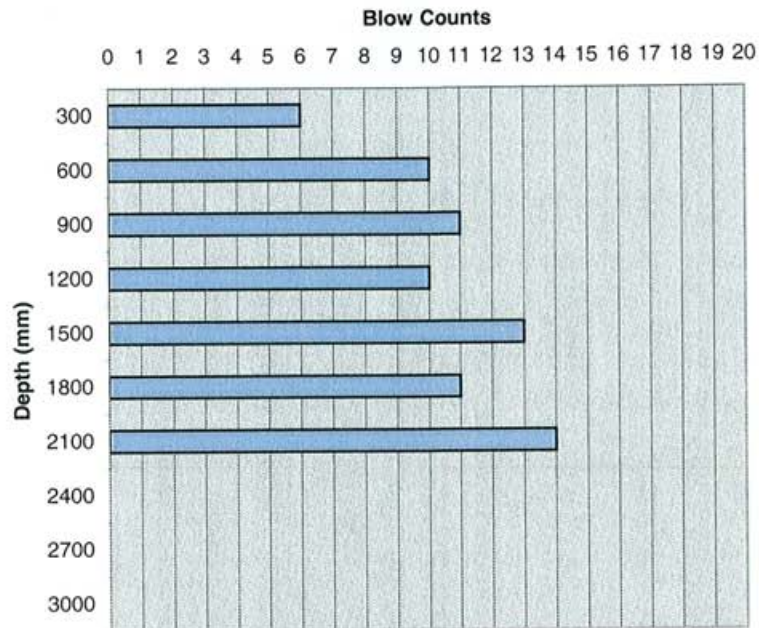
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth (mm)	Blow Counts
300	6
600	10
900	11
1200	10
1500	13
1800	11
2100	14
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 15



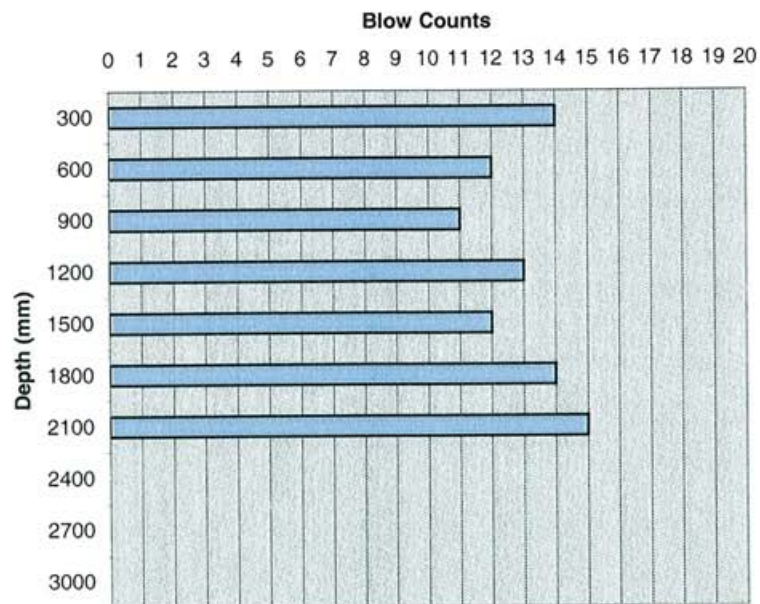
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth	Blow Counts
300	14
600	12
900	11
1200	13
1500	12
1800	14
2100	15
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 16



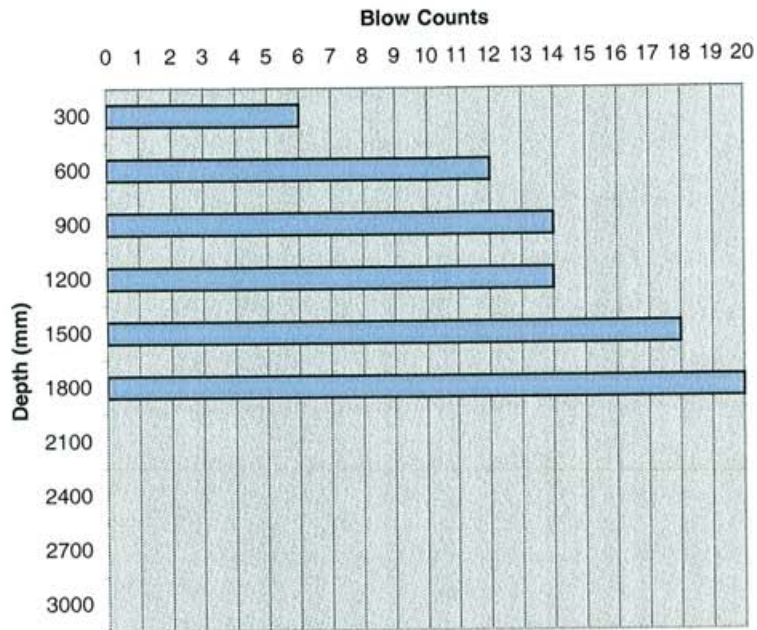
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth (mm)	Blow Counts
300	6
600	12
900	14
1200	14
1500	18
1800	20
2100	
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 17



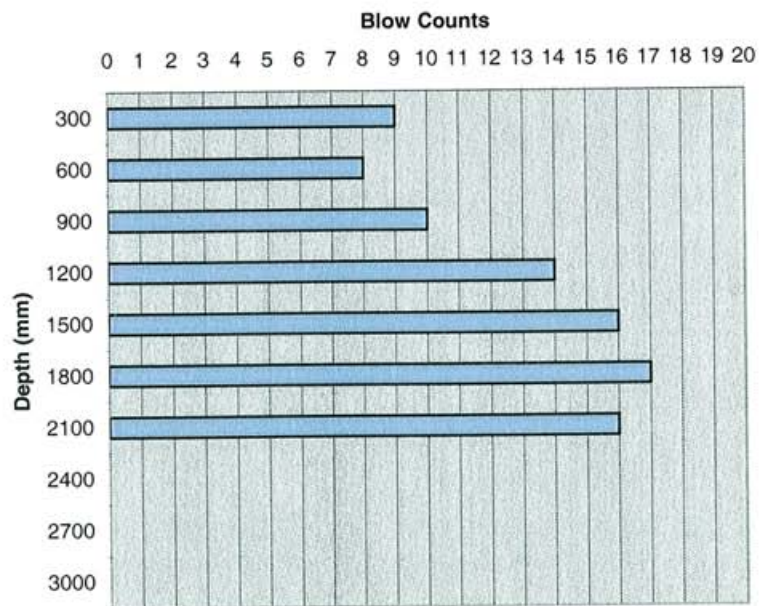
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth	Blow Counts
300	9
600	8
900	10
1200	14
1500	16
1800	17
2100	16
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 18



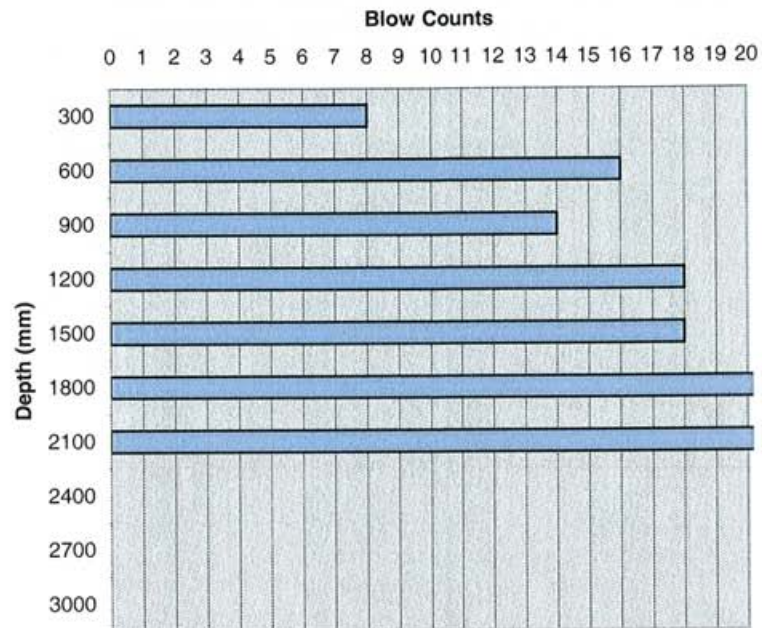
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth (mm)	Blow Counts
300	8
600	16
900	14
1200	18
1500	18
1800	22
2100	24
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 19



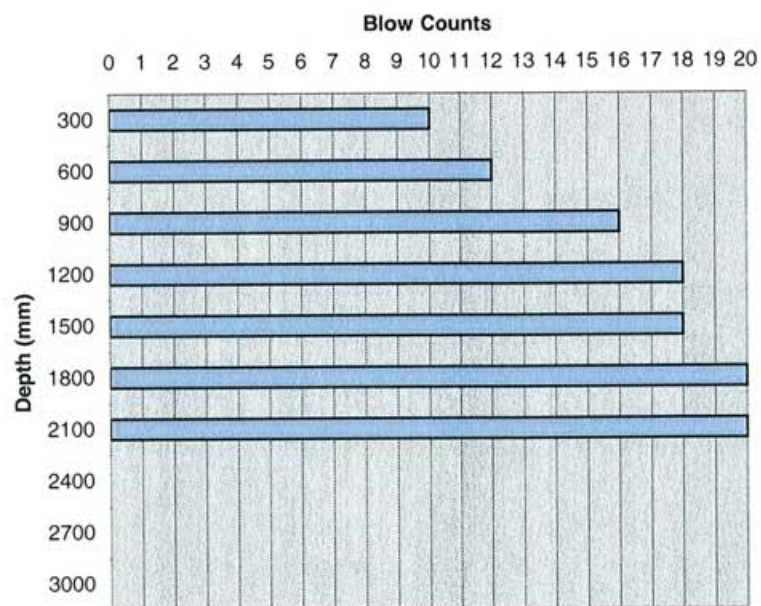
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth	Blow Counts
300	10
600	12
900	16
1200	18
1500	18
1800	20
2100	20
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 20



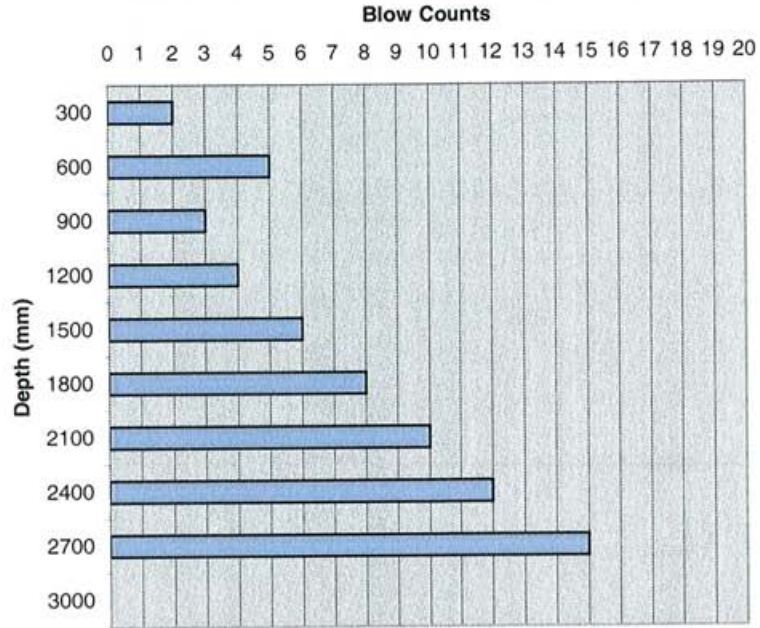
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth (mm)	Blow Counts
300	2
600	5
900	3
1200	4
1500	6
1800	8
2100	10
2400	12
2700	15
3000	

### Perth Sand Penetrometer Results - Test 21



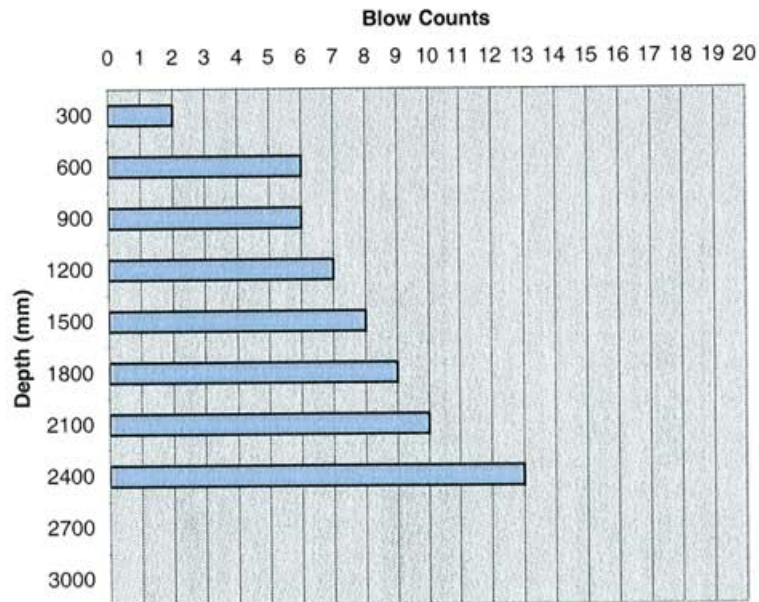
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth	Blow Counts
300	2
600	6
900	6
1200	7
1500	8
1800	9
2100	10
2400	13
2700	
3000	

### Perth Sand Penetrometer Results - Test 22



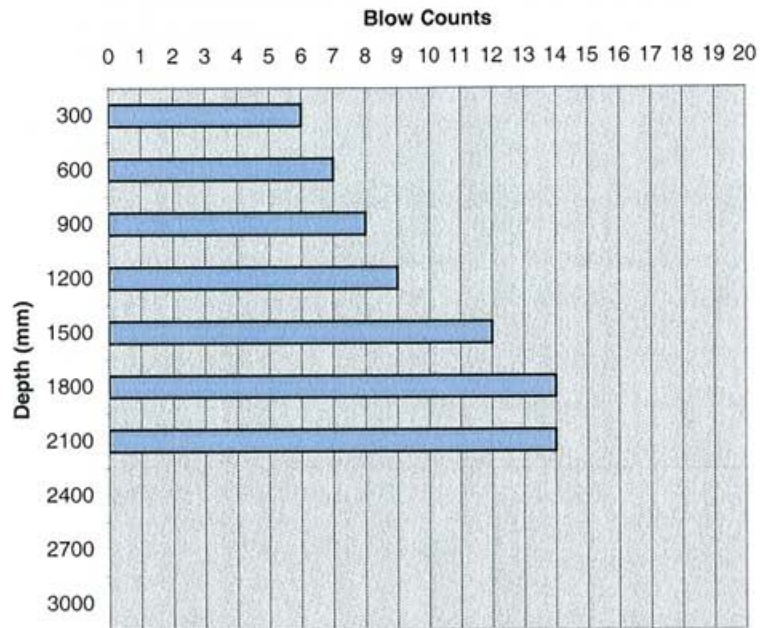
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth (mm)	Blow Counts
300	6
600	7
900	8
1200	9
1500	12
1800	14
2100	14
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 23



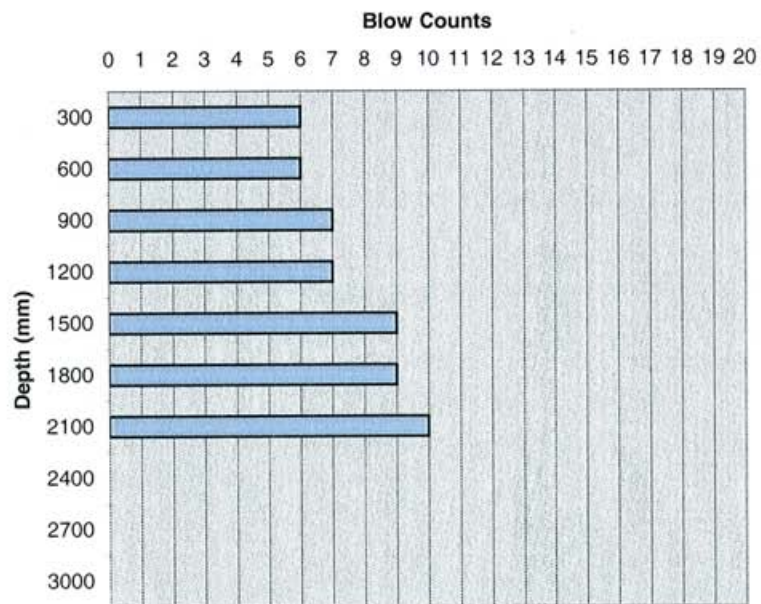
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth	Blow Counts
300	6
600	6
900	7
1200	7
1500	9
1800	9
2100	10
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 24



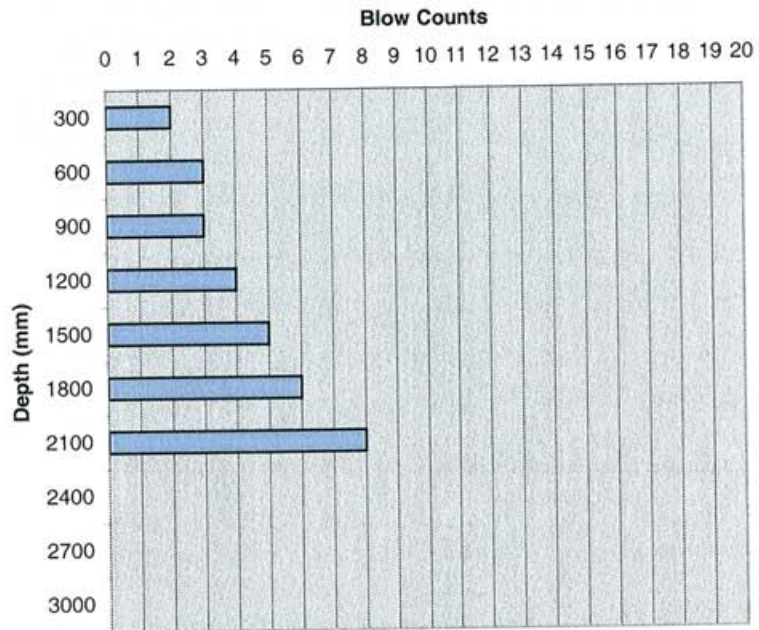
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth (mm)	Blow Counts
300	2
600	3
900	3
1200	4
1500	5
1800	6
2100	8
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 25



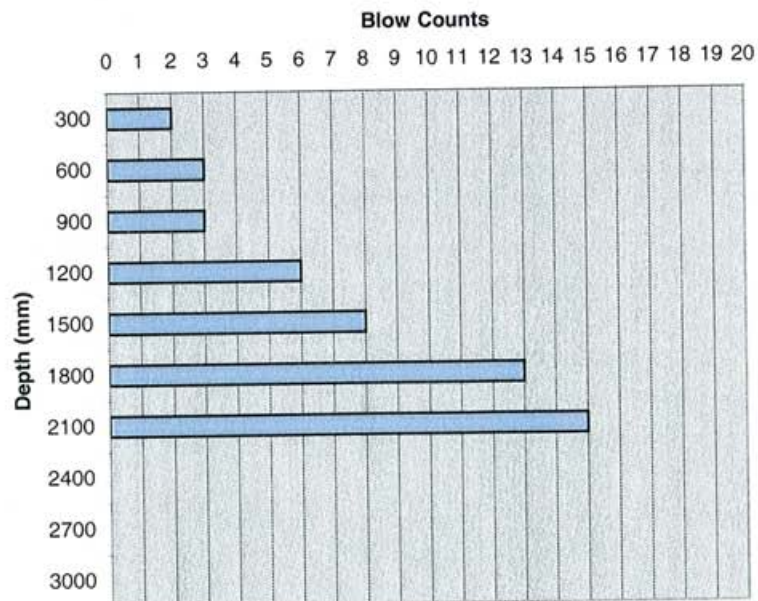
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth	Blow Counts
300	2
600	3
900	3
1200	6
1500	8
1800	13
2100	15
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 26



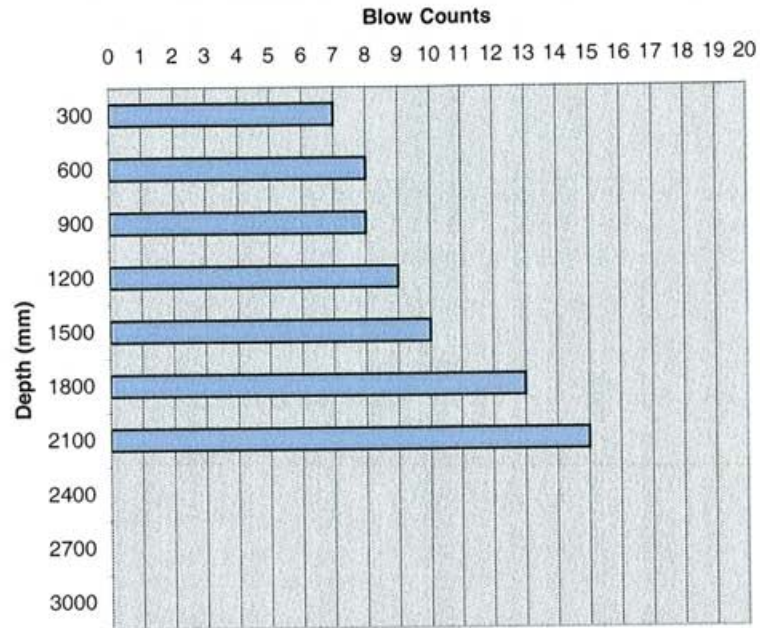
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth (mm)	Blow Counts
300	7
600	8
900	8
1200	9
1500	10
1800	13
2100	15
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 27



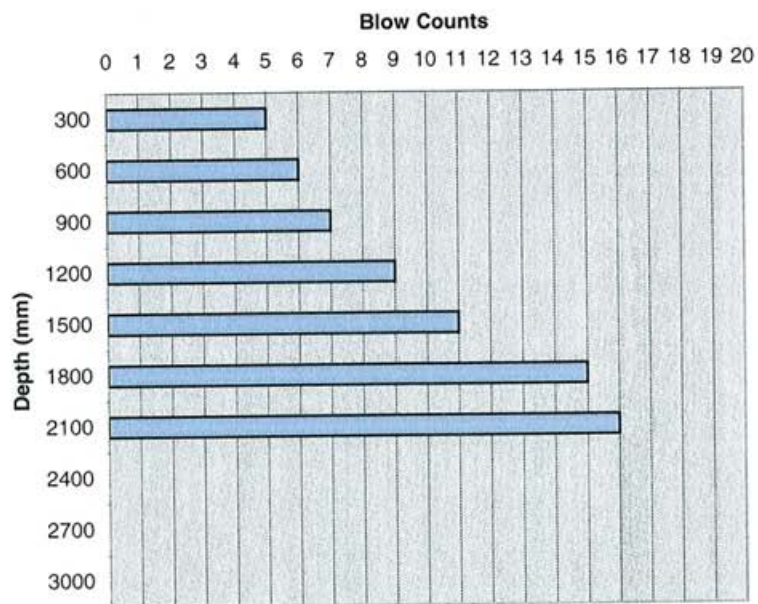
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth	Blow Counts
300	5
600	6
900	7
1200	9
1500	11
1800	15
2100	16
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 28



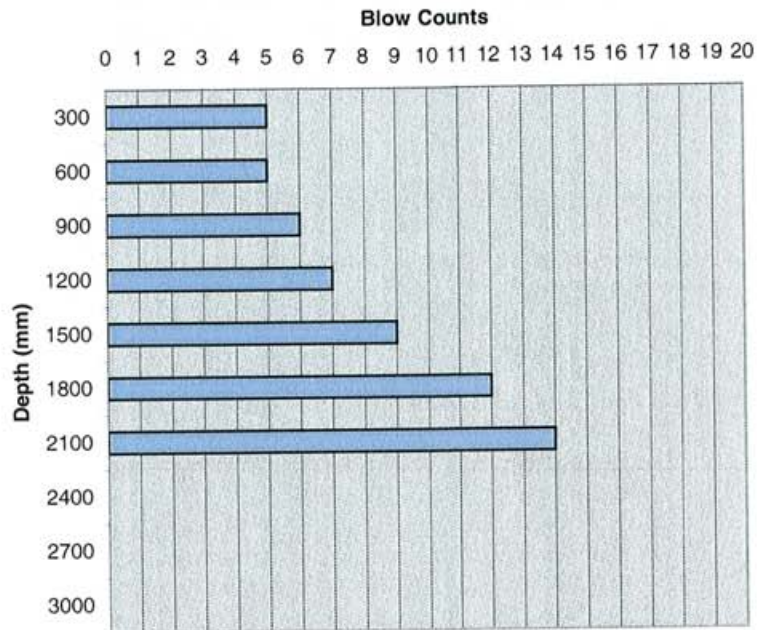
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth (mm)	Blow Counts
300	5
600	5
900	6
1200	7
1500	9
1800	12
2100	14
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 29



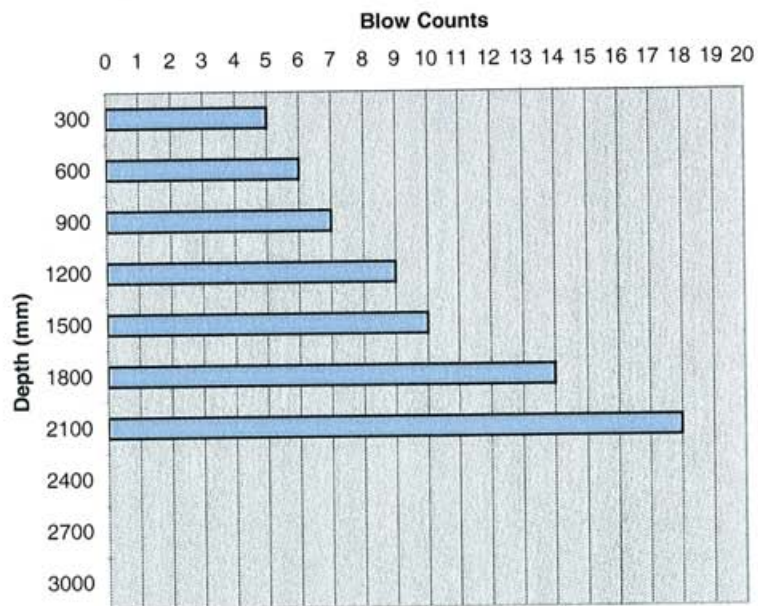
**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

Depth	Blow Counts
300	5
600	6
900	7
1200	9
1500	10
1800	14
2100	18
2400	
2700	
3000	

### Perth Sand Penetrometer Results - Test 30



**Job Name:** Area 19 Northlake Road, Jandakot

**Job No:** J06036.01

**Date:** 15/03/2007

# **APPENDIX C**

Western Geotechnics Group  
 PO Box 219 Bentley WA 6982  
 36 Railway Parade  
 Welshpool WA 6106



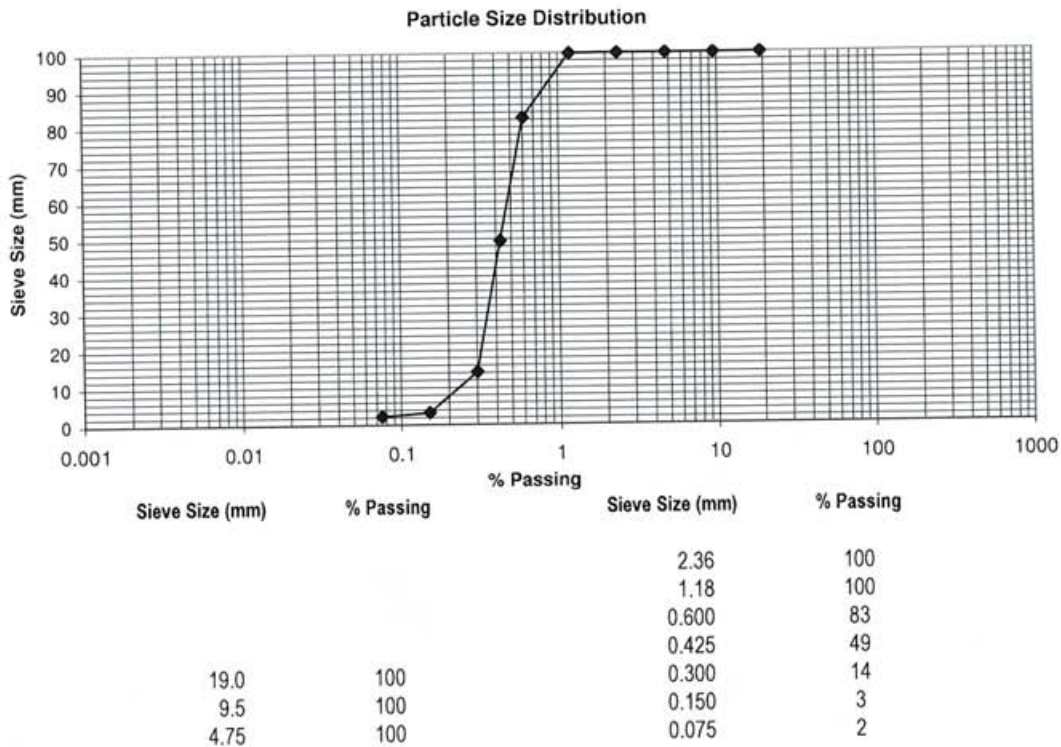
perth@westerngeo.com.au  
 ABN 91105324436  
 ph: 1300 781 744  
 fx: (08) 9458 3700

### TEST CERTIFICATE

Client: Brown Geotechnical & Environmental Pty Ltd  
 Project: Muriel Court (Area 19)  
 Location: Jandakot  
 Sample No.:  
 Sample ID.: TP5

Client Job No.: J06036/1  
 Test Date: 28/03/07  
 WG Job No.: 07-01-175  
 Lab No.: 07-WG-710  
 Depth: 0.5 - 1.5m

### METHOD FOR DETERMINATION OF PARTICLE SIZE DISTRIBUTION -acc to AS 1289.3.6.1



Notes:  
 Sample supplied by client

Certificate No.:07-WG-710 / S301

Approved Signatory: *Mark Matthews* ( Mark Matthews ) Date: 12/04/2007



Accreditation No. 2418

This document is issued in accordance with NATA's accreditation requirements

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Western Geotechnics Group  
 PO Box 219 Bentley WA 6982  
 36 Railway Parade  
 Welshpool WA 6106



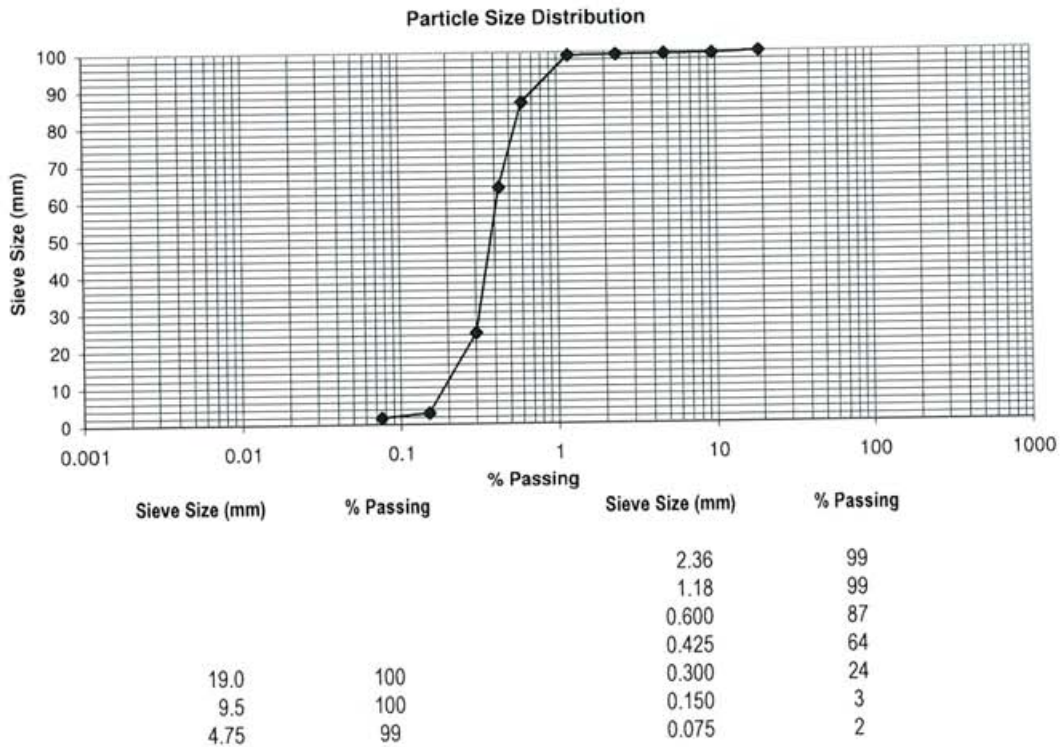
perth@westerngeo.com.au  
 ABN 91105324436  
 ph: 1300 781 744  
 fx: (08) 9458 3700

### TEST CERTIFICATE

Client: Brown Geotechnical & Environmental Pty Ltd  
 Project: Muriel Court (Area 19)  
 Location: Jandakot  
 Sample No.:  
 Sample ID.: TP7

Client Job No.: J06036/1  
 Test Date: 29/03/07  
 WG Job No.: 07-01-175  
 Lab No.: 07-WG-718  
 Depth: 1.3 - 2.5m

### METHOD FOR DETERMINATION OF PARTICLE SIZE DISTRIBUTION -acc to AS 1289.3.6.1



Notes:  
 Sample supplied by client

Certificate No.:07-WG-718 / S301

Approved Signatory:  (Mark Matthews) Date: 12/04/2007



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Western Geotechnics Group  
PO Box 219 Bentley WA 6982  
36 Railway Parade  
Welshpool WA 6982

## TEST CERTIFICATE



perth@westerngeo.com.au  
ABN: 91105324436  
ph: 1300 781 744  
fx: (08) 9458 3700

Client:	Brown Geotechnical & Environmental Pty Ltd	Client Job No:	J06036/1
Project:	Muriel Court (Area 19)	Order No:	
Location:	Jandakot	Tested Date:	12/04/2007
Sample No:	07-WG-711	WG Job Number:	07-01-175
Sample ID:	TP11 0.5 - 1.5m	Lab:	Welshpool

### PSD: PERCENT FINES <0.075MM


AS1289.3.6.1 (% Fines)

#### Part Method

Material Finer than 75µm (%) 1

#### Notes:

Note: Sample supplied by client

Approved Signatory:  (M. Matthews)

Date: 12/04/2007



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Site No.: 2411  
Cert No.: 07-WG-711-S306  
Page: 1

Western Geotechnics Group  
PO Box 219 Bentley WA 6982  
36 Railway Parade  
Welshpool WA 6982

## TEST CERTIFICATE



perth@westerngeo.com.au  
ABN: 91105324436  
ph: 1300 781 744  
fx: (08) 9458 3700

Client:	Brown Geotechnical & Environmental Pty Ltd	Client Job No:	J06036/1
Project:	Muriel Court (Area 19)	Order No:	
Location:	Jandakot	Tested Date:	12/04/2007
Sample No:	07-WG-712	WG Job Number:	07-01-175
Sample ID:	TP13 0.5 - 1.5m	Lab:	Welshpool

### PSD: PERCENT FINES <0.075MM

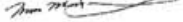
AS1289.3.6.1 (% Fines)

#### Part Method

Material Finer than 75µm (%)	1
------------------------------	---

#### Notes:

Note: Sample supplied by client

Approved Signatory:  (M. Matthews)

Date: 12/04/2007



Accreditation No.: 2418

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Site No.: 2411  
Cert No.: 07-WG-712-S306  
Page: 1

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 36 Railway Parade  
 Welshpool WA 6106



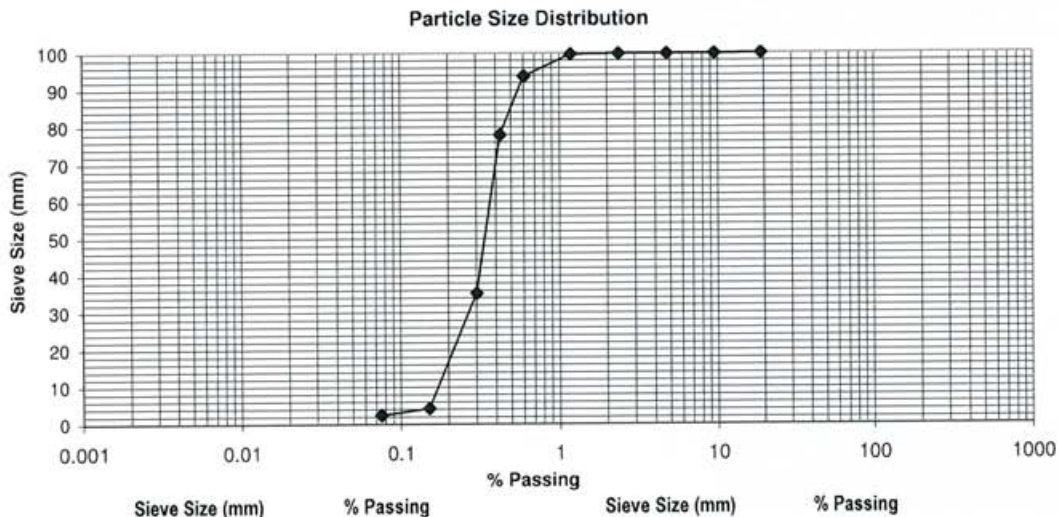
perth@westerngeo.com.au  
 ABN 91105324436  
 ph: 1300 781 744  
 fx: (08) 9458 3700

### TEST CERTIFICATE

Client: Brown Geotechnical & Environmental Pty Ltd  
 Project: Muriel Court (Area 19)  
 Location: Jandakot  
 Sample No.:  
 Sample ID.: TP15

Client Job No.: J06036/1  
 Test Date: 29/03/07  
 WG Job No.: 07-01-175  
 Lab No.: 07-WG-713  
 Depth: 0.5 - 1.5m

### METHOD FOR DETERMINATION OF PARTICLE SIZE DISTRIBUTION -acc to AS 1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
		2.36	100
		1.18	100
		0.600	94
		0.425	78
19.0	100	0.300	35
9.5	100	0.150	4
4.75	100	0.075	2

Notes:  
 Sample supplied by client

Certificate No.:07-WG-713 / S301

Approved Signatory: *Mark Matthews* ( Mark Matthews ) Date: 12/04/2007



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 36 Railway Parade  
 Welshpool WA 6106



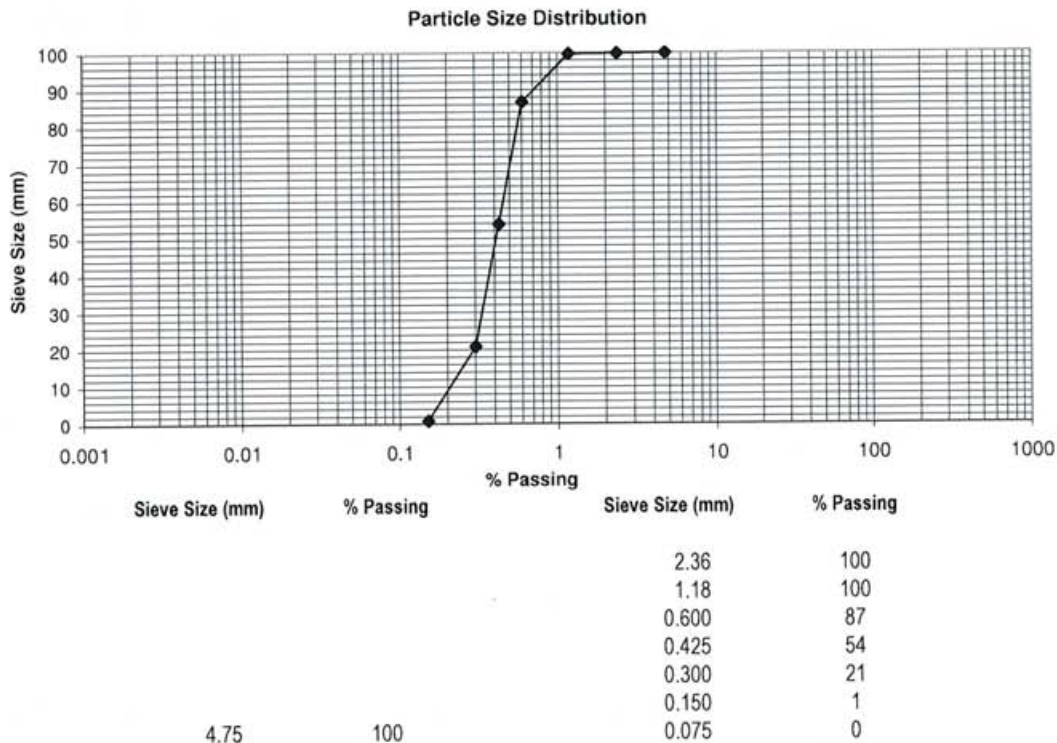
perth@westerngeo.com.au  
 ABN 91105324436  
 ph: 1300 781 744  
 fx: (08) 9458 3700

### TEST CERTIFICATE

Client: Brown Geotechnical & Environmental Pty Ltd  
 Project: Muriel Court (Area 19)  
 Location: Jandakot  
 Sample No.:  
 Sample ID.: TP17

Client Job No.: J06036/1  
 Test Date: 29/03/07  
 WG Job No.: 07-01-175  
 Lab No.: 07-WG-714  
 Depth: 0.9 - 2.0

### METHOD FOR DETERMINATION OF PARTICLE SIZE DISTRIBUTION -acc to AS 1289.3.6.1



Notes:  
 Sample supplied by client

Certificate No.:07-WG-714 / S301

Approved Signatory:  ( Mark Matthews ) Date: 12/04/2007



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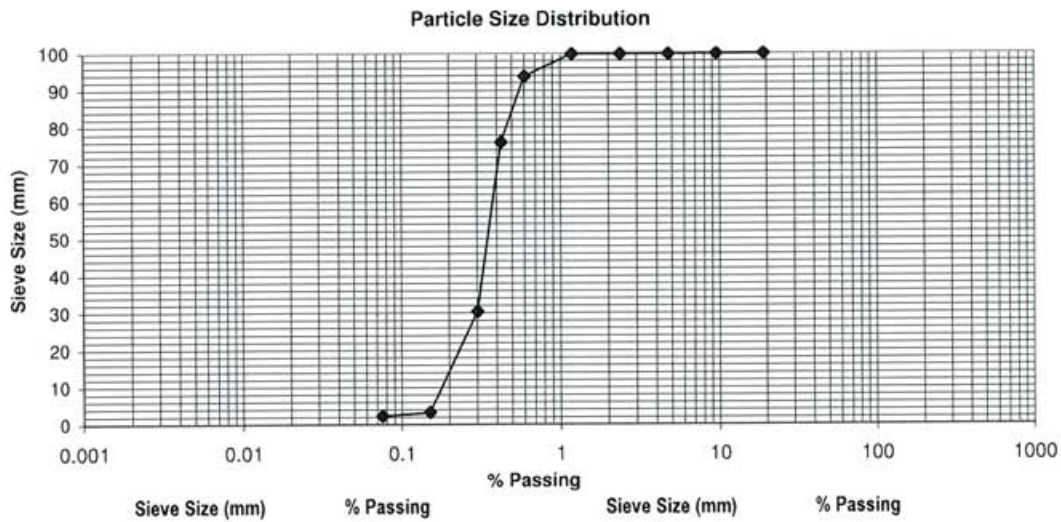
## TEST CERTIFICATE

Client: Brown Geotechnical & Environmental Pty Ltd  
 Project: Muriel Court (Area 19)  
 Location: Jandakot  
 Sample No.:  
 Sample ID.: TP20

Client Job No.: J06036/1  
 Test Date: 29/03/07  
 WG Job No.: 07-01-175  
 Lab No.: 07-WG-715  
 Depth: 0.5 - 1.5m

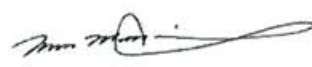
### METHOD FOR DETERMINATION OF PARTICLE SIZE DISTRIBUTION

-acc to AS 1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
		2.36	100
		1.18	100
		0.600	94
		0.425	76
19.0	100	0.300	30
9.5	100	0.150	3
4.75	100	0.075	2

Notes:  
 Sample supplied by client



Approved Signatory: \_\_\_\_\_ ( Mark Matthews )

Date: 12/04/2007

Certificate No.:07-WG-715 / S301



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 Welshpool WA 6106



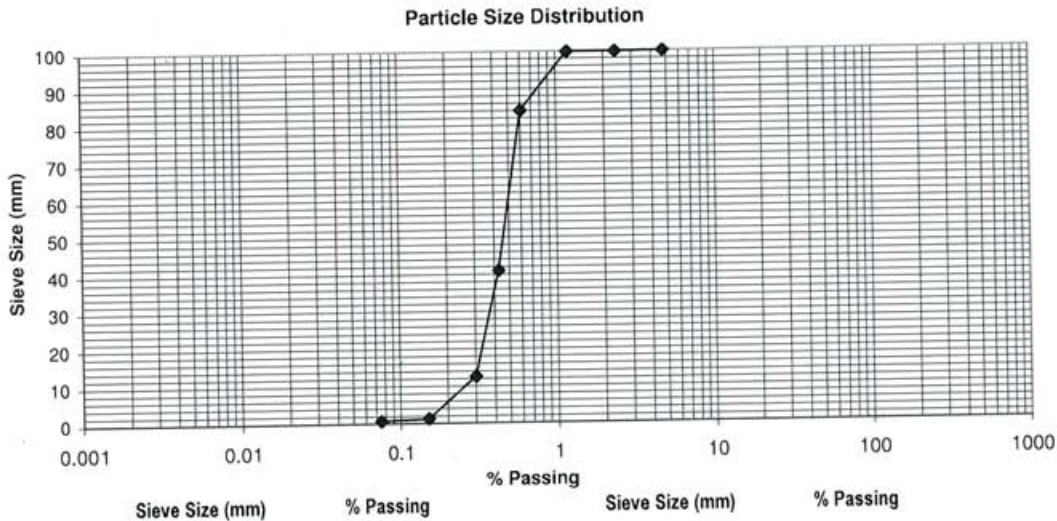
perth@westerngeo.com.au  
 ABN 91105324436  
 ph: 1300 781 744  
 fx: (08) 9458 3700

### TEST CERTIFICATE

Client: Brown Geotechnical & Environmental Pty Ltd  
 Project: Muriel Court (Area 19)  
 Location: Jandakot  
 Sample No.:  
 Sample ID.: TP22

Client Job No.: J06036/1  
 Test Date: 30/03/07  
 WG Job No.: 07-01-175  
 Lab No.: 07-WG-716  
 Depth: 1.5 - 2.5m

### METHOD FOR DETERMINATION OF PARTICLE SIZE DISTRIBUTION -acc to AS 1289.3.6.1



Notes:  
 Sample supplied by client

Certificate No.:07-WG-716 / S301

Approved Signatory: *Mark Matthews* (Mark Matthews) Date: 12/04/2007



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 36 Railway Parade  
 Welshpool WA 6106



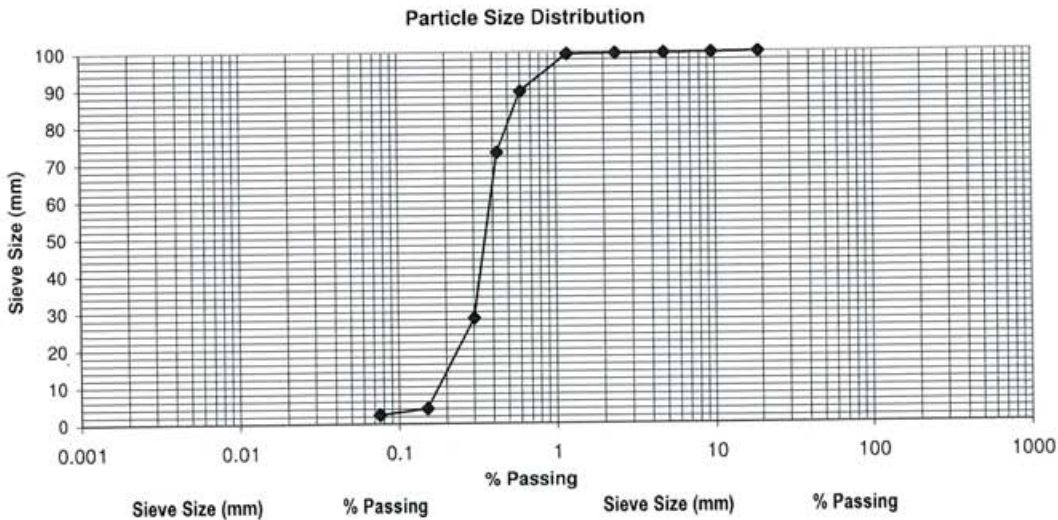
perth@westerngeo.com.au  
 ABN 91105324436  
 ph: 1300 781 744  
 fx: (08) 9458 3700

### TEST CERTIFICATE

Client: Brown Geotechnical & Environmental Pty Ltd  
 Project: Muriel Court (Area 19)  
 Location: Jandakot  
 Sample No.:  
 Sample ID.: TP28

Client Job No.: J06036/1  
 Test Date: 28/03/07  
 WG Job No.: 07-01-175  
 Lab No.: 07-WG-717  
 Depth: 0.5 - 1.5m

#### METHOD FOR DETERMINATION OF PARTICLE SIZE DISTRIBUTION -acc to AS 1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
		2.36	100
		1.18	99
		0.600	89
		0.425	73
19.0	100	0.300	28
9.5	100	0.150	4
4.75	100	0.075	3

Notes:  
 Sample supplied by client

Certificate No.:07-WG-717 / S301

Approved Signatory:  (Mark Matthews) Date: 12/04/2007



Accreditation No. 2418

This document is issued in accordance with NATA's accreditation requirements

SN 2411

# TEST CERTIFICATE

Page 1 of 1

CLIENT: Brown Geotechnical & Environmental Pty Ltd  
PROJECT: Muriel Court (Area 19)  
LOCATION: Jandakot

JOB NO.: 07-01-175  
CLIENT JOB NO.: J06036/1  
DATE TESTED: 30/03/2007

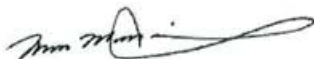
Lab Ref No.: 07-WG-717  
Sample Id:  
Sample No.: TP28 - 0.5 - 1.5m  
Description:

**ORGANIC MATTER CONTENT - FURNACE METHOD**  
- according to ASTM D 2974, Part 9, Method C

Organic Content (%): 0.84

Note:

Approved Signatory :\_



(M. Matthews)

Certificate No.: WG717

Date : 12/04/2007

QMS.Forms.Soils.WG086.01.C

# APPENDIX D

### Acid Sulphate Soil Field Test Results

Test Pit No	Depth (m)	pH <sub>F</sub> (field)	pH <sub>FOX</sub> (post oxidation)	Reaction Strength
TP1	0.5	6.9	5.1	Moderate
TP1	1.5	7.2	5.5	Slight
TP1	2.5	6.9	5.0	Slight*
TP2	0.5	6.8	4.9	Slight
TP2	1.5	7.2	5.2	Slight
TP2	2.5	7.1	5.0	Slight
TP3	0.5	6.7	4.2	Slight
TP3	1.5	6.6	4.5	Slight*
TP3	2.5	7.1	5.2	Slight
TP4	0.5	7.0	3.8	Slight
TP4	1.5	5.8	3.8	Slight*
TP4	2.5	6.2	4.8	Slight
TP5	0.5	6.3	4.7	Slight
TP5	1.5	6.2	4.7	Slight
TP5	2.5	6.5	4.9	Slight
TP9	0.5	6.8	4.9	Slight
TP9	1.5	6.9	4.7	Slight
TP9	2.5	6.8	4.9	Slight
TP26	0.5	6.2	4.6	Slight
TP26	1.5	6.2	4.5	Slight*
TP26	2.5	6.3	4.6	Slight
TP27	0.5	6.0	4.8	Slight
TP27	1.5	6.3	4.8	Slight*
TP27	2.5	6.0	5.9	Slight
TP28	0.5	6.1	5.0	Slight
TP28	1.5	6.2	4.8	Slight
TP28	2.5	6.3	4.9	Slight
TP29	0.5	7.9	4.9	Slight
TP29	1.5	7.7	5.2	Slight
TP29	2.5	7.3	4.6	Strong*
TP30	0.5	7.3	4.3	Moderate*
TP30	1.5	6.8	4.7	Slight
TP30	2.5	6.8	4.6	Slight
TP31	0.5	7.0	4.5	Moderate*
TP31	1.5	7.0	5.0	Slight
TP31	2.5	7.0	5.1	Slight*
TP32	0.5	6.1	2.9	Moderate*
TP32	1.5	6.3	4.1	Slight*
TP32	2.5	5.9	4.2	Slight

\* Selected for laboratory testing.

# ALS Environmental



11/F, Chung Shun Knitting Centre  
 1-3 Wing Yip St, Kwai Chung  
 Tel : (852) 2610 1044  
 Fax : (852) 2610 2021  
 Email: alshk@hknet.com

## SAMPLE SUBMISSION FORM

*Please Note : The following information is required to expedite sample analysis. Please complete all the necessary details and return this form with your samples.*

### CLIENT DETAILS:

Company Name: Brown Geotechnical & Environmental

Client Contact Name: Ken Brown Date: 05/04/07

Postal Address: POBox 4000, Victotia Park WA6979  
 Email: bge@acidss.com.au

Phone: 9368 2615 Fax: 9367 7409

CLIENT ORDER No : J06036.01/2 ALS QUOTATION NUMBER : PEN/063/06

PROJECT NAME: Area 19, Muriel Court, Jandakot

### SECONDARY CONTACT

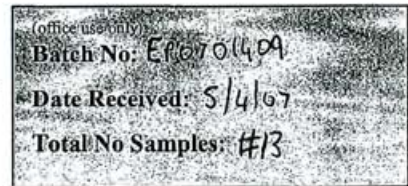
Name : \_\_\_\_\_ Environmental Division  
 Perth

Address: \_\_\_\_\_ Work Order  
**EP0701409**

Phone : \_\_\_\_\_



Telephone : 61-8-9209 7655



*Lula Jones* ←  
 5/4/07 16:30

### SAMPLE ANALYTIC

Lab ID (office use only)	Sample ID.	Matrix	Sampling Date/Time	Analysis Required
①	TP1 - 2.5m EP07012007003	Soil	15/03/07	ASS Chromium Suite
②	TP3 - 1.5m EP07012007008	Soil	15/03/07	ASS Chromium Suite
③	TP4 - 1.5m EP07012007011	Soil	15/03/07	ASS Chromium Suite
④	TP4 - 2.5m EP07012007012	Soil	15/03/07	ASS Chromium Suite
⑤	TP26 - 1.5m EP07012007020	Soil	15/03/07	ASS Chromium Suite
⑥	TP27 - 1.5m EP07012007023	Soil	15/03/07	ASS Chromium Suite
⑦	TP29 - 2.5m EP07012007027	Soil	15/03/07	ASS Chromium Suite
⑧	TP30 - 0.5m EP07012007028	Soil	15/03/07	ASS Chromium Suite
⑨	TP31 - 0.5m EP07012007031	Soil	15/03/07	ASS Chromium Suite





# ALS Environmental

## CERTIFICATE OF ANALYSIS

Client	: BROWN GEOTECHNICAL AND ENVIRONMENTAL	Laboratory	: Environmental Division Perth	Page	: 1 of 6
Contact	: MR KEN BROWN	Contact	: Michael Sharp	Work Order	: EP0701409
Address	: SUITE 4 / 47 MONASH AVENUE COMO WA AUSTRALIA 6152	Address	: 10 Hod Way Malaga WA Australia 6090		
E-mail	: kenbrown@acidss.com.au	E-mail	: Michael.Sharp@alsenviro.com		
Telephone	: 93682615	Telephone	: 61-8-9209 7655	Date received	: 5 Apr 2007
Facsimile	: - Not provided -	Facsimile	: 61-8-9209 7600	Date issued	: 17 Apr 2007
Project	: J06036.01 2 Ex EP0701207	Quote number	: PEN-063-06	No. of samples	: 13
Order number	: - Not provided -			Received	: 13
C-O-C number	: - Not provided -			Analyse	: 13
Site	: Area 19, Muriel Court, Janakot				

### ALSE - Excellence in Analytical Testing

This document has been electronically signed by those names that appear on this report and are the authorised signatories. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatory	Position	Department
Stacey Hawkins	Instrument Chemist	Perth Inorganics - NATA 825 (15847 - Perth)

NATA Accredited Laboratory  
825

This document is issued in accordance with NATA's accreditation requirements.

Accredited for compliance with  
ISO/IEC 17025.



WORLD RECOGNISED  
ACCREDITATION

Page Number : 2 of 6  
Client : BROWN GEOTECHNICAL AND ENVIRONMENTAL  
Work Order : EP0701409

### Comments

This report for the ALSE reference EP0701409 supersedes any previous reports with this reference. Results apply to the samples as submitted. All pages of this report have been checked and approved for release.

This report contains the following information:

- Analytical Results for Samples Submitted
- Surrogate Recovery Data

The analytical procedures used by ALS Environmental have been developed from established internationally-recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported herein. Reference methods from which ALSE methods are based are provided in parenthesis.

When moisture determination has been performed, results are reported on a dry weight basis. When a reported 'less than' result is higher than the LOR, this may be due to primary sample extracts/digestion dilution and/or insufficient sample amount for analysis. Surrogate Recovery Limits are static and based on USEPA SW846 or ALS-QWI/EN38 (in the absence of specified USEPA limits). Where LOR of reported result differ from standard LOR, this may be due to high moisture, reduced sample amount or matrix interference. When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for process purposes. Abbreviations: CAS number = Chemical Abstract Services number, LOR = Limit of Reporting. \* Indicates failed Surrogate Recoveries.

Specific comments for Work Order **EP0701409**

Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.  
Retained Acidity not required because pH KCl greater than or equal to 4.5



ALS Environmental

Page Number : 3 of 6  
 Client : BROWN GEOTECHNICAL AND ENVIRONMENTAL  
 Work Order : EP0701409

**Analytical Results**

Analyte	CAS number	Client Sample ID :			
		TP1	TP3	TP4	TP4
Sample Matrix Type / Description :		SOIL			
Sample Date / Time :		15 Mar 2007 15:00			
Laboratory Sample ID :		EP0701409-001			
LOR	Units	TP1	TP3	TP4	TP4
<b>EA033-A: Actual Acidity</b>					
pH KCl (23A)	0.1 pH Unit	6.5	6.2	5.4	6.4
Titratable Actual Acidity (23F)	2 mole H+ / t	<2	2	10	2
sulfidic - Titratable Actual Acidity (s-23F)	0.02 % pyrite S	<0.02	<0.02	<0.02	<0.02
<b>EA033-B: Potential Acidity</b>					
Chromium Reducible Sulfur (22B)	0.02 % S	<0.02	<0.02	<0.02	<0.02
acidity - Chromium Reducible Sulfur (a-22B)	10 mole H+ / t	<10	<10	<10	<10
<b>EA033-C: Acid Neutralising Capacity</b>					
Acid Neutralising Capacity (19A1)	0.01 % CaCO3	---	---	---	---
acidity - Acid Neutralising Capacity (a-19A1)	10 mole H+ / t	---	---	---	---
sulfidic - Acid Neutralising Capacity (s-19A1)	0.01 % pyrite S	---	---	---	---
<b>EA033-E: Acid Base Accounting</b>					
ANC Fineness Factor	0.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	0.02 % S	<0.02	<0.02	<0.02	<0.02
Net Acidity (acidity units)	10 mole H+ / t	<10	<10	<10	<10
Liming Rate	1 kg CaCO3/t	<1	<1	<1	<1
Net Acidity excluding ANC (sulfur units)	0.02 % S	<0.02	<0.02	<0.02	<0.02
Net Acidity excluding ANC (acidity units)	10 mole H+ / t	<10	<10	<10	<10
Liming Rate excluding ANC	1 kg CaCO3/t	<1	<1	<1	<1



Page Number : 4 of 6  
 Client : BROWN GEOTECHNICAL AND ENVIRONMENTAL  
 Work Order : EP0701409

**Analytical Results**

Analyte	CAS number	Client Sample ID :				
		TP27	TP29	TP30	TP31	TP31
Sample Matrix Type / Description :	Units	1.5	2.5	0.5	0.5	2.5
Sample Date / Time :		SOIL	SOIL	SOIL	SOIL	SOIL
Laboratory Sample ID :	LOR	15 Mar 2007	15 Mar 2007	15 Mar 2007	15 Mar 2007	15 Mar 2007
		15:00	15:00	15:00	15:00	15:00
		EP0701409-006	EP0701409-007	EP0701409-008	EP0701409-009	EP0701409-010
<b>EA033-A: Actual Acidity</b>						
pH KCl (23A)	0.1 pH Unit	6.2	6.6	6.7	6.9	6.2
Titratable Actual Acidity (23F)	2 mole H+ / t	2	<2	<2	<2	2
sulfidic - Titratable Actual Acidity (s-23F)	0.02 % pyrite S	<0.02	<0.02	<0.02	<0.02	<0.02
<b>EA033-B: Potential Acidity</b>						
Chromium Reducible Sulfur (a-22B)	0.02 % S	<0.02	<0.02	<0.02	<0.02	<0.02
acidity - Chromium Reducible Sulfur (a-22B)	10 mole H+ / t	<10	<10	<10	<10	<10
<b>EA033-C: Acid Neutralising Capacity</b>						
Acid Neutralising Capacity (19A1)	0.01 % CaCO3	---	0.06	0.24	0.30	---
acidity - Acid Neutralising Capacity (a-19A1)	10 mole H+ / t	---	11	48	61	---
sulfidic - Acid Neutralising Capacity (s-19A1)	0.01 % pyrite S	---	0.02	0.08	0.10	---
<b>EA033-E: Acid Base Accounting</b>						
ANC Fineness Factor	0.5	1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	0.02 % S	<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity (acidity units)	10 mole H+ / t	<10	<10	<10	<10	<10
Liming Rate	1 kg CaCO3/t	<1	<1	<1	<1	<1
Net Acidity excluding ANC (sulfur units)	0.02 % S	<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity excluding ANC (acidity units)	10 mole H+ / t	<10	<10	<10	<10	<10
Liming Rate excluding ANC	1 kg CaCO3/t	<1	<1	<1	<1	<1



**Analytical Results**

Analyte	CAS number	Client Sample ID :		
		TP32 0.5	TP32 1.5	QA1
	Units	Sample Matrix Type / Description :		
	Units	Sample Date / Time :		
	Units	Laboratory Sample ID :		
	Units	TP32 0.5	TP32 1.5	QA1
<b>EA033-A: Actual Acidity</b>				
pH KCl (23A)	0.1 pH Unit	4.9	5.8	5.9
Titratable Actual Acidity (23F)	2 mole H+ / t	5	2	2
sulfidic - Titratable Actual Acidity (s-23F)	0.02 % pyrite S	<0.02	<0.02	<0.02
<b>EA033-B: Potential Acidity</b>				
Chromium Reducible Sulfur (22B)	0.02 % S	<0.02	<0.02	<0.02
acidity - Chromium Reducible Sulfur (a-22B)	10 mole H+ / t	<10	<10	<10
<b>EA033-E: Acid Base Accounting</b>				
ANC Fineness Factor	0.5	1.5	1.5	1.5
Net Acidity (sulfur units)	0.02 % S	<0.02	<0.02	<0.02
Net Acidity (acidity units)	10 mole H+ / t	<10	<10	<10
Liming Rate	1 kg CaCO3/t	<1	<1	<1
Net Acidity excluding ANC (sulfur units)	0.02 % S	<0.02	<0.02	<0.02
Net Acidity excluding ANC (acidity units)	10 mole H+ / t	<10	<10	<10
Liming Rate excluding ANC	1 kg CaCO3/t	<1	<1	<1



### Surrogate Control Limits

- No surrogates present on this report.



**QUALITY CONTROL REPORT**

<b>Client</b> :	<b>BROWN GEOTECHNICAL AND ENVIRO</b>	<b>Laboratory</b> :	Environmental Division Perth	<b>Page</b> :	1 of 5
<b>Contact</b> :	MR KEN BROWN	<b>Contact</b> :	Michael Sharp	<b>Work order</b> :	EP0701409
<b>Address</b> :	SUITE 4 / 47 MONASH AVENUE COMO WA AUSTRALIA 6152	<b>Address</b> :	10 Hod Way Malaga WA Australia 6090	<b>Amendment No.</b> :	
<b>Project</b> :	J06036.01 2 Ex EP0701207	<b>Quote number</b> :	PEN-063-06	<b>Date received</b> :	5 Apr 2007
<b>Order number</b> :	- Not provided -			<b>Date issued</b> :	17 Apr 2007
<b>C-O-C number</b> :	- Not provided -				
<b>Site</b> :	Area 19, Muriel Court, Janakot				
<b>E-mail</b> :	kenbrown@acidss.com.au	<b>E-mail</b> :	Michael.Sharp@alsenviro.com	<b>No. of samples</b>	
<b>Telephone</b> :	93682615	<b>Telephone</b> :	61-8-9209 7655	<b>Received</b>	13
<b>Facsimile</b> :	- Not provided -	<b>Facsimile</b> :	61-8-9209 7600	<b>Analysed</b>	13

This final report for the ALSE work order reference EP0701409 supersedes any previous reports with this reference. Results apply to the samples as submitted. All pages of this report have been checked and approved for release.

This report contains the following information:

- Laboratory Duplicates (DUP); Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Samples (LCS); Recovery and Acceptance Limits
- Matrix Spikes (MS); Recovery and Acceptance Limits

**Work order specific comments**

Limiting Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5. Retained Acidity not required because pH KCl greater than or equal to 4.5

**ALSE - Excellence in Analytical Testing**



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This document is issued in accordance with NATA's accreditation requirements.

Accredited for compliance with ISO/IEC 17025

This document has been electronically signed by those names that appear on this report and are the authorised signatories. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

**Signatory**

Stacey Hawkins

**Department**

Perth Inorganics - NATA 825 (15847 - Perth)



**Quality Control Report - Laboratory Duplicates (DUP)**

The quality control term **Laboratory Duplicate** refers to an intralaboratory split sample randomly selected from the sample batch. Laboratory duplicates provide information on method precision and sample heterogeneity.  
 - Anonymous - Client Sample IDs refer to samples which are not specifically part of this work order but formed part of the QC process lot. Abbreviations: **LOR = Limit of Reporting, RPD = Relative Percent Difference.**  
 • Indicates failed QC. The permitted ranges for the RPD of Laboratory Duplicates (relative percent deviation) are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: - Result < 10 times LOR, no limit - Result between 10 and 20 times LOR, 0% - 50% - Result > 20 times LOR, 0% - 20%

Matrix Type: SOIL		Laboratory Duplicates (DUP) Report				
Laboratory Sample ID	Client Sample ID	Analyte name	LOR	Original Result	Duplicate Result	RPD
<b>EA033-A: Actual Acidity</b>						
<b>EA033-A: Actual Acidity - (QC Lot: 389856)</b>						
EP0701409-001	TP1 - 2.5	pH KCl (23A)	0.1 pH Unit	6.5	6.5	0.0
		Titratable Actual Acidity (23F)	2 mole H+ / t	<2	<2	0.0
		sulfidic - Titratable Actual Acidity (s-23F)	0.02 % pyrite S	<0.02	<0.02	0.0
EP0701409-011	TP32 - 0.5	pH KCl (23A)	0.1 pH Unit	4.9	5.5	11.1
		Titratable Actual Acidity (23F)	2 mole H+ / t	5	4	28.4
		sulfidic - Titratable Actual Acidity (s-23F)	0.02 % pyrite S	<0.02	<0.02	0.0
<b>EA033-B: Potential Acidity</b>						
<b>EA033-B: Potential Acidity - (QC Lot: 389856)</b>						
EP0701409-001	TP1 - 2.5	Chromium Reducible Sulfur (22B)	0.02 % S	<0.02	<0.02	0.0
		Acidity - Chromium Reducible Sulfur (a-22B)	10 mole H+ / t	<10	<10	0.0
EP0701409-011	TP32 - 0.5	Chromium Reducible Sulfur (22B)	0.02 % S	<0.02	<0.02	0.0
		Acidity - Chromium Reducible Sulfur (a-22B)	10 mole H+ / t	<10	<10	0.0
<b>EA033-E: Acid Base Accounting</b>						
<b>EA033-E: Acid Base Accounting - (QC Lot: 389856)</b>						
EP0701409-001	TP1 - 2.5	ANC Fineness Factor		1.5	1.5	0.0
		Net Acidity (sulfur units)	0.02 % S	<0.02	<0.02	0.0
		Net Acidity (acidity units)	10 mole H+ / t	<10	<10	0.0
		Liming Rate	1 kg CaCO3/t	<1	<1	0.0
		Net Acidity excluding ANC (sulfur units)	0.02 % S	<0.02	<0.02	0.0
		Net Acidity excluding ANC (acidity units)	10 mole H+ / t	<10	<10	0.0
		Liming Rate excluding ANC	1 kg CaCO3/t	<1	<1	0.0
EP0701409-011	TP32 - 0.5	ANC Fineness Factor		1.5	1.5	0.0
		Net Acidity (sulfur units)	0.02 % S	<0.02	<0.02	0.0
		Net Acidity (acidity units)	10 mole H+ / t	<10	<10	0.0
		Liming Rate	1 kg CaCO3/t	<1	<1	0.0



Matrix Type: SOIL		LOR		Original Result		Duplicate Result		RPD
Laboratory Sample ID	Client Sample ID	Analyte name		% S	% S	% S	% S	%
<b>EA033-E: Acid Base Accounting - continued</b>								
EA033-E: Acid Base Accounting - ( QC Lot: 389856 ) - continued		Net Acidity excluding ANC (sulfur units)	0.02 % S	<0.02	<0.02	<0.02	<0.02	0.0
EP0701409-011	TP32 - 0.5	Net Acidity excluding ANC (acidity units)	10 mole H+ / t	<10	<10	<10	<10	0.0
		Liming Rate excluding ANC	1 kg CaCO3/t	<1	<1	<1	<1	0.0



**Quality Control Report - Method Blank (MB) and Laboratory Control Samples (LCS)**

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC type is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a known, interference free matrix spiked with target analytes or certified reference material. The purpose of this QC type is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of actual laboratory data. Flagged outliers on control limits for inorganics tests may be within the NEMP specified data quality objective of recoveries in the range of 70 to 130%. Where this occurs, no corrective action is taken. Abbreviations: LOR = Limit of reporting.

Matrix Type: SOIL

Analyte name	LOR	Method blank result	Actual Results		Recovery Limits	
			Spike concentration	Spike Recovery	Dynamic	High
<b>EA033-A: Actual Acidity</b>						
EA033-A: Actual Acidity - ( QC Lot: 389856 )		pH Unit	pH Unit	%	%	%
pH KCl (23A)	0.1 pH Unit	<0.1	-----	-----	-----	-----
sulfidic - Titratable Actual Acidity (s-23F)	0.02 % pyrite S	<0.02	-----	-----	-----	-----
Titratable Actual Acidity (23F)	2 mole H+ / t	<2	-----	-----	-----	-----
<b>EA033-B: Potential Acidity</b>						
EA033-B: Potential Acidity - ( QC Lot: 389856 )		mole H+ / t	mole H+ / t	%	%	%
Acidity - Chromium Reducible Sulfur (a-22B)	10 mole H+ / t	<10	-----	-----	-----	-----
Chromium Reducible Sulfur (22B)	0.02 % S	<0.02	-----	-----	-----	-----
<b>EA033-E: Acid Base Accounting</b>						
EA033-E: Acid Base Accounting - ( QC Lot: 389856 )				%	%	%
ANC Fineness Factor		<0.5	-----	-----	-----	-----
Liming Rate	1 kg CaCO3/t	<1	-----	-----	-----	-----
Net Acidity (acidity units)	10 mole H+ / t	<10	-----	-----	-----	-----
Net Acidity (sulfur units)	0.02 % S	<0.02	-----	-----	-----	-----



**Quality Control Report - Matrix Spikes (MS)**

The quality control term **Matrix Spike (MS)** refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC type is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQO's). 'Ideal' recovery ranges stated may be waived in the event of sample matrix interferences. - Anonymous - Client Sample IDs refer to samples which are not specifically part of this work order but formed part of the QC process lot. Abbreviations: **LOR** = Limit of Reporting, **RPD** = Relative Percent Difference.

\* Indicates failed QC

Analyte name	Laboratory Sample ID	Client Sample ID	LOR	Spike Concentration	Actual Results		Recovery Limits	
					Sample Result	Spike Recovery MS	Static Limits	High
-( QC Lot: )						%		%

● No Matrix Spike (MS) carried out on this Work Order.



# ALS Environmental

## INTERPRETIVE QUALITY CONTROL REPORT

<b>Client</b>	: BROWN GEOTECHNICAL AND ENVIRONMENTAL	<b>Laboratory</b>	: Environmental Division Perth	<b>Page</b>	: 1 of 5
<b>Contact</b>	: MR KEN BROWN	<b>Contact</b>	: Michael Sharp	<b>Work order</b>	: EP0701409
<b>Address</b>	: SUITE 4 / 47 MONASH AVENUE COMO WA AUSTRALIA 6152	<b>Address</b>	: 10 Hod Way Malaga WA Australia 6090	<b>Amendment No.</b>	:
<b>Project</b>	: J06036.01 2 Ex EP0701207	<b>Quote number</b>	: PEN-063-06	<b>Date received</b>	: 5 Apr 2007
<b>Order number</b>	: - Not provided -			<b>Date issued</b>	: 17 Apr 2007
<b>C-O-C number</b>	: - Not provided -				
<b>Site</b>	: Area 19, Muriel Court, Janakot				
<b>E-mail</b>	: kenbrown@acidss.com.au	<b>E-mail</b>	: Michael.Sharp@alsenviro.com	<b>No. of samples Received</b>	: 13
<b>Telephone</b>	: 93682615	<b>Telephone</b>	: 61-8-9209 7655	<b>Analysed</b>	: 13
<b>Facsimile</b>	: - Not provided -	<b>Facsimile</b>	: 61-8-9209 7600		

This Interpretive Quality Control Report was issued on 17 Apr 2007 for the ALS work order reference EP0701409 and supersedes any previous reports with this reference. This report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Type Frequency Compliance
- Summary of all Quality Control Outliers
- Brief Method Summaries



### Interpretive Quality Control Report - Analysis Holding Time

The following report summarises extraction / preparation and analysis times and compares with recommended holding times. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. Information is also provided re the sample container (preservative) from which the sample aliquot was taken. Elapsed time to analysis represents time from sampling where no extraction / digestion is involved or time from extraction / digestion where this is present. For composite samples, sampling date/time is taken as that of the oldest sample contributing to that composite. Sample date/time for laboratory produced leaches are taken from the completion date/time of the leaching process. Outliers for holding time are based on USEPA SW846, APHA, AS and NEPM (1999). Failed outliers, refer to the 'Summary of Outliers'.

Method Container / Client Sample ID(s)	Date Sampled	Extraction / Preparation		Analysis	
		Date extracted	Due for extraction	Date analysed	Due for analysis
EA033: Chromium Suite for Acid Sulphate Soils					
80° dried soil	15 Mar 2007	13 Apr 2007	14 Mar 2008	16 Apr 2007	12 Jul 2007
TP1 - 2.5,				Pass	
TP4 - 1.5,					
TP26 - 1.5,					
TP29 - 2.5,					
TP31 - 0.5,					
TP32 - 0.5,					
QA1					



### Interpretive Quality Control Report - Frequency of Quality Control Samples

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which this work order was processed. Actual rate should be greater than or equal to the expected rate.

Quality Control Sample Type Method	QC	Regular	Rate (%)		Quality Control Specification
			Actual	Expected	
<b>Matrix Type: SOIL</b>					
Laboratory Duplicates (DUP)					
EA033: Chromium Suite for Acid Sulphate Soils	2	13	15.4	10.0	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
<b>Laboratory Control Samples (LCS)</b>					
EA033: Chromium Suite for Acid Sulphate Soils	1	13	7.7	5.0	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
<b>Method Blanks (MB)</b>					
EA033: Chromium Suite for Acid Sulphate Soils	1	13	7.7	5.0	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement

Frequency of Quality Control Samples



## **Interpretive Quality Control Report - Summary of Outliers**

### **Outliers : Quality Control Samples**

The following report highlights outliers flagged on the 'Quality Control Report'. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QW/EN/38 (in the absence of specific USEPA limits). Flagged outliers on control limits for inorganics tests may be within the NEPM specified data quality objective of recoveries in the range of 70 to 130%. Where this occurs, no corrective action is taken. - Anonymous - Client Sample IDs refer to samples which are not specifically part of this work order but formed part of the QC process lot.

### **Non-surrogates**

- For all matrices, no RPD recovery outliers occur for the duplicate analysis.
- For all matrices, no method blank result outliers occur.
- For all matrices, no laboratory spike recoveries breaches occur.
- For all matrices, no matrix spike recoveries breaches occur.

### **Surrogates**

- For all matrices, no surrogate recovery outliers occur.

### **Outliers : Analysis Holding Time**

The following report highlights outliers within this 'Interpretive Quality Control Report - Analysis Holding Time'.

- No holding time outliers occur.

### **Outliers : Frequency of Quality Control Samples**

The following report highlights outliers within this 'Interpretive Quality Control Report - Frequency of Quality Control Samples'.

- No frequency outliers occur.



## Method Reference Summary

The analytical procedures used by ALS Environmental are based on established internationally-recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house procedure are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported herein. Reference methods from which ALSE methods are based are provided in parenthesis.

Matrix Type: SOIL

### Preparation Methods

EN020PR : Drying at 85 degrees, bagging and labelling (ASS) - In house

### Analytical Methods

EA033 : Chromium Suite for Acid Sulphate Soils - Aherm et al 2004. This method covers the determination of Chromium Reducible Sulfur (SCR); pH(KCl); titratable actual acidity (TAA); acid neutralising capacity by back titration (ANC); and net acid soluble sulfur (SNAS) which incorporates peroxide sulfur. It applies to soils and sediments (including sands) derived from coastal regions. Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.

Method Reference Summary

# **APPENDIX E**

## APPENDIX E

### Soil Assessment Criteria

Western Australia's Draft Acid Sulphate Soil Guidelines (2006) have established action criteria for the assessment of the environmental risk of acid sulphate soils. The action criteria are based on the sum of existing plus, potential acidity, calculated as equivalent sulphur (e.g. s-TAA + S<sub>CR</sub> in %S units) or equivalent acidity (e.g. TAA + TPA in mol H<sup>+</sup>/tonne). The highest laboratory result was used to assess against the action criteria.

As clay content tends to influence the soils natural pH buffering capacity, the action criteria are grouped by three broad texture categories – coarse, medium and fine. The criteria are used to define when acid sulphate soils disturbed at a site will need to be treated and managed. The Table below summarises the action criteria.

**Texture based acid sulphate soils action criteria**

Type of Material		Action Criteria if <1,000 tonnes of material is disturbed		Action Criteria if >1,000 tonnes of material is disturbed	
Texture Range	Approx. Clay Content	Equivalent Sulphur (%)	Equivalent Acidity (mol H <sup>+</sup> /tonne)	Equivalent Sulphur	Equivalent Acidity (mol H <sup>+</sup> /tonne)
Coarse – sands to loamy sands	≤ 5%	0.03	18.7	0.03	18.7
Medium – sandy loams to light clays	5 – 40%	0.06	37.4	0.03	18.7
Fine – medium to heavy clays and silty clays	≥ 40%	0.1	64.8	0.03	18.7

In addition to the action criteria, the guidelines define indicator pH values for field pH (pH<sub>F</sub>) and field peroxide pH (pH<sub>FOX</sub>) to assist with identifying likely acid generating soils. The pH indicator values are defined as:

- pH<sub>F</sub> ≤ 4 (when pH >4 but <5 may indicate some existing acidity); and
- pH<sub>FOX</sub> <3 or a much lower pH<sub>FOX</sub> than pH<sub>F</sub> (greater than 1 pH unit change).