GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown, NSW 2148, Australia
PO Box 1543, Macquarie Centre. North Ryde, NSW 2113
ABN 62 084 294 762
Tel : (02) 9679 8733
Fax : (02) 9679 8744

Report

Preliminary Geotechnical Investigation and Dam Embankment Investigation Airds and Bradbury Redevelopment Project St Johns Road, Greengate Road and Georges River Road, Airds, NSW

Prepared for
JBS Environmental Pty Ltd
Suite 128 O'Riordan Street
MASCOT NSW 2020

Ref: JG09245A
April 2009

GeoEnviro Consultancy Pty Ltd
Unit 5/39-41 Fourth Avenue, Blacktown, NSW 2148, Australia
PO Box 1543, Macquarie Centre. North Ryde, NSW 2113
ABN 62 084 294 762
Tel : (02) 9679 8733
Fax : (02) 9679 8744

3rd April 2009

Our Ref: JG09245A-r1

JBS Environmental Pty Ltd
128 O'Riordan Street
MASCOT NSW 2020

Attention: Ms Cathy Roberts

Dear Madam

Re: Preliminary Geotechnical Investigation and Dam Embankment Investigation Airds and Bradbury Redevelopment

Please find attached our geotechnical investigation report for the project referred to as the Airds and Bradbury Redevelopment.

If there are any queries regarding this report, please contact the undersigned.

Yours faithfully,
GeoEnviro Consultancy Pty Ltd

Solern Liew CPEng
Director

C:\\09JOB\245\A\JG09245A-r1.DOC

Executive Summary

This report presents the results of a preliminary geotechnical and salinity investigation for the Airds and Bradbury Redevelopment Project. The investigation was commissioned by Ms Cathy Roberts of JBS Environmental Pty Ltd (JBS).

The Airds and Bradbury Redevelopment project is situated about 2.5km south west of Campbelltown and will include staged demolition of existing structures including roads and reconstruction of new houses and a town centre with open spaces. Details of type of building structures are not provided however we expect the structures will consist of low to medium rise up to three storey high with possible single level basement in the town centre. The project also includes road construction along the western side of the dam which is situated to the south west of the Community and Indoor Sports Centre. The road construction is expected to involve excavation within 10m from the toe of the dam embankment and the stability of the dam is considered critical

The aim of this investigation was to obtain information on subsurface ground conditions and based on the information obtained, to provide preliminary comments and recommendations on geotechnical and salinity issues considered relevant to the proposed redevelopment of the site.

The scope of this investigation included excavation of a total of 67 test pits across the site using a rubber tyred backhoe. Soil samples were taken from the site for laboratory analysis to assess geotechnical and salinity parameters.

The investigation revealed the site to be generally underlain by thin topsoil/fill and fill overlying residual clays overlying bedrock. The upper bedrock unit comprises of Ashfield Shale and the lower bedrock unit comprises of Hawkesbury Sandstone. The laboratory test results indicate the natural clay to be plastic and generally moderately reactive and non to slightly saline with localised moderately saline soil at lower depths. The topsoil was generally assessed to be non to slightly saline.

Soil salinity is not considered significant within the site and Section 6.1 provides recommendations on good soil and water management strategies to be adopted for the proposed redevelopment of the site. Acid sulphate soil was not encountered in the investigation and is not considered to impact on the proposed redevelopment of the site

The investigation identified no major geotechnical constraints on the site and Section 6.3 for general geotechnical comments and recommendations considered relevant. The dam embankment of interest was considered inadequate and total reconstruction of the embankment was recommended in Section 6.3.6.

TABLE OF CONTENTS

Section Page

LIST OF DRAWINGS

LIST OF APPENDICES

1. INTRODUCTION

This report presents the results of a preliminary geotechnical investigation and dam embankment investigation for the Airds and Bradbury Redevelopment project. The investigation was commissioned by Ms Cathy Roberts of JBS Environmental Pty Ltd (JBS), following our fee proposals referenced PG08920A dated 8th December 2008.

The Airds and Bradbury Redevelopment project is situated about 2.5km south west of Campbelltown and will include staged demolition of existing structures including roads and reconstruction of new houses and a town centre with open spaces. Details of the type of building structures are not available however we expect the structures will be low to medium rise up to three storeys high with possible single level basement in the town centre.

The project also includes road construction along the western side of the dam which is situated to the south west of the Community and Indoor Sports Centre. The road construction is expected to involve excavation within 10m from the toe of the dam embankment and the stability of the dam is considered critical.

The objective of the investigations was to obtain information on subsurface conditions across the site including the existing dam embankment and based on the information obtained, to provide the following;

- Assessment on insitu fill, natural soil and bedrock type and comments on reusability of the insitu material for future development.
- Comments and recommendations on site preparation and excavations including potential vibration impacts on existing properties.
- Recommendations on fill construction procedure and specifications.
- Comments and recommendations on retaining walls and temporary/permanent batter slopes
- Advice on indicative site classification (AS 2870) including foundation types.

- Stability assessment of the existing dam embankment at the Community/Sports Centre
- Advice on preliminary pavement designs.
- Assessment on potential hazards associated with soil salinity and acid sulphate soil.

2. SITE INFORMATION

2.1 Site Locality

The project (Principle Site) is situated about 2.5km south west of Campbelltown and the site is bound by Greengate Road and Dalkeith Place to the south, St Johns Road to the west and Georges River Road to the north.

The dam of interest (Dam Site) is located within the Principle Site, approximately in the middle western portion. Refer to the attached Drawing No 1 for site locality.

Geographical location of the Principle Site is between about 299000 and 301000 Easting and 6225000 and 6227000 Northing.

Georges Parkway Reserve abuts to the eastern perimeter of the site.

2.2 Site Description

Principle Site

The site is located within an existing residential area with Riverside Drive, being the collector road looping around the middle and northern portions of the site and Greengate Road running off Riverside Drive to the southern portion of the site.

Creigan Road provides access to the western portion of the site. This portion of the site is separated from the remaining major portion by a road reserve.

Briar Road is the main collector road leading into the site from the south west. The Airds Community Centre, Shopping Village and Airds High School occupy the area between Briar Road and Riverside Drive. Reiby Juvenile Justice Centre and the Briar Road Primary school are situated on the southern side of Briar Road.

Dam Site

The dam of interest is situated to the south west of the Community and Indoor Sports Centre. Refer to Drawing No 4 for dam features.

This dam has an approximate 110m long earthfill embankment with a maximum height of about 3.5m at mid-section and the height of embankment reduces to nothing at both ends. The crest of the embankment averages about 3m wide and the width increases to 4 to 5m at both ends.

At the time of our site investigation, the dam water level was at about 1.5m below crest level. Shrink cracking and some subsidence of the crest were noted on the southern section of the embankment.

The downstream embankment has an average batter slope of 1 Vertical to 2.5 Horizontal and the batter slope increases to about 1 Vertical to 2 Horizontal at the northern section. The downstream embankment on the southern end has relatively gentle batters of less than 1 Vertical to 5 Horizontal.

The upstream embankment which has a steep batter slope of about 1 Vertical to 1 Horizontal, has substantially eroded with uneven surface and some near vertical batters near the waterline possibly from previous slumping.

The spillway is situated on the southern side of the embankment and consists of an open channel diverting flows into a 375mm diameter pipe through the embankment.

2.3 Soil Landscape and Topography

The site is on gently undulating terrain. Ground surface over the major portion of the site is on elevated ground at Reduced Levels (RL) typically between 135m and 143m Australian Height Datum, with the south western portion (ie schools and community areas) at lower elevation, between RL 125m and 135m.

Ground surface along the eastern perimeter of the site generally slopes down to the east. Typical ground surface slopes within the site range from about 2 to 5 degrees.

Based on the Soil Landscape Series Sheet 9030, 1:100,000 sheet, prepared by Soil Conservation Service of NSW, the site is underlain by three main soil landscape grouping as follows (refer to Drawing No 2);

- Unit I - Blacktown Soil Landscape group (Bt) of residual origin and this soil unit is wide spread across the entire site on the upper slopes. Typically this soil consists of low permeability, highly plastic and moderately reactive soil

- Unit II - Hawkesbury Soil Landscape group (Ha) of colluvial origin at the lower slopes along the eastern perimeter of the site and the proposed road reserve to the north west of the school and community areas. Typical soil consists of earthy sand, yellow earths and some yellow podzolic soil on the inside of sandstone benches and along joints and fractures.

- Unit III - There is a third soil landscape unit which occurs between the upper and lower slopes along the eastern fringes of the site and this unit is less prominent consisting of residual soil belonging to the Lucas Heights Landscape group (Ih). Typical soil is moderately deep and consists of low permeability yellow Podzolic Soils and Yellow Soloths on the ridges and Yellow Earths on the shoulders of ridges and Earthy Sand on the valley flats.

2.4 Regional Geology and Hydrogeology

The 1:100,000 geological map of Port Hacking – Wollongong (Reference 2) indicates soil landscape Unit I (Blacktown residual soil) to be underlain by Ashfield shale of the Wianamatta Group consisting of Dark-Grey to black claystone-Siltstone and fine sandstone and siltstone laminate.

Soil landscape Unit II (Hawkesbury colluvial soil) and Units III (Lucas Heights residual soil) are underlain by Hawkesbury Sandstone consisting of medium to coarse grained quartz sandstone with minor shale and laminite lenses.

The site is situated on elevated ground and permanent groundwater table is not expected to be at shallow depths (ie less than 3m).

The site is situated within the upper catchment area of the Georges River system. Regional surface runoff and near perched groundwater in the area tends to flow in a general direction to the north west into Smith Creek which flows into Bow Bowing Creek and ultimately into Georges River.

Deep groundwater tends to flow to the east into Georges River which is situated about 400m to the east of the site.

3. INVESTIGATION METHODOLOGY

3.1 Field Investigation

Fieldwork for the preliminary geotechnical investigation consisted of excavation of sixty seven test pits (TP 1 to 67) across the site over five days using a rubber tyred backhoe between 10th and 24th February 2009. The works which were carried out in conjunction with the contamination investigation by JBS, were supervised on a full-time basis by a geotechnical engineer from this company. The test pit locations as shown on the attached Drawing No 3 were nominated and located by JBS.

In general, the test pits were excavated through topsoil, fill, natural clay and into shale/sandstone to depths varying from 0.7m to 3.25m below existing ground surface. In a number of locations within Council's park, a pendulum drill rig attached to the backhoe was used to minimise ground disturbance. To assess the strength of the subsurface soil profiles, hand penetrometer tests were carried out on the test pit walls. The test pits were observed for groundwater, during and upon completion of the site investigation. Upon completion of the test pit investigation, the test pits were backfilled with excavation spoil and the backfill compacted using the backhoe bucket.

The dam embankment investigation included borehole drilling at three locations (ie BH 1 to 3) along the crest of the embankment and another 3 locations (BH 4 to 6) along the toe of the embankment on 12th February 2009. The borehole investigation was carried out using a truck mounted PD5 drill rig equipped for site investigation purposes and the investigation was supervised on a full time basis by a geotechnical engineer from GeoEnviro Consultancy Pty Ltd. Refer to Drawing No 4 for borehole locations.

The boreholes along the crest were drilled through the embankment and underlying natural clay and into shale to depths varying from 3.6m to 6.0m below crest level. The boreholes along the toe of the embankment were drilled through topsoil and natural clay and into shale to depths varying from 1.1m to 3.5m below existing ground surface.

Standard Penetration Testing (SPT) was carried out in the boreholes to assess the compaction of the fill embankment and strength of the residual soil. Hand penetrometer tests were carried out on the recovered SPT split-tube clayey samples to augment the SPT results.

The boreholes were observed for groundwater seepage, during and upon completion of the site investigation. A PVC standpipe was installed in BH 1 and 2 in order to enable future groundwater monitoring. The remaining boreholes were backfilled with drilling spoil after completion of the site investigation.

Details of subsurface profiles encountered in the test pits are summarised on Table A. The field test results, together with details of the subsurface profiles encountered from the dam investigation are presented on Borehole Reports attached in Appendix B. Explanatory notes and Graphic Symbols for Soil and Rock are attached in Appendix H.

3.2 Laboratory Testing

Salinity Testing

To assess the likely impact of soil salinity on the proposed development, the following laboratory tests were carried out by Envirolab Services Pty Ltd, a NATA accredited laboratory;

- pH
- Electrical Conductivity (Ec)
- Chloride (Cl)
- Sulphate ($S0_4$)

In addition to the above, the following tests were carried out in our NATA accredited laboratory to further assess soil salinity properties;

- Particle Size Distribution
- Emerson Dispersion Test

The laboratory test results are summarised on Laboratory Test Reports in Appendix C.

Geotechnical Testing

To assess geotechnical soil properties, disturbed and undisturbed "U_{50}" soil samples were taken from the site to our laboratory for analysis.

Shrink-Swell Index tests were carried out to assess the reactivity of soil and to enable classification to AS2870. Atterberg Limits Tests and Particle Size Distribution tests were carried out to aid classification of soil in accordance with the Unified Soil Classification System. To assess the pavement subgrade characteristics, four-days soaked California Bearing Ratio (CBR) tests were undertaken.

Laboratory test schedule for the dam investigation included following;

- Saturated Consolidated Undrained Triaxial testing with pore pressure measurement to obtain effective shear strength parameters of embankment material.
- Atterberg Limits and Particle Size Distribution to aid assessment of the material properties and classification.
- Emerson Dispersion and Pin Hole Dispersion to assess soil stability in the presence of water.

The Trixial tests were carried out by GHD Geotechnics Pty Ltd and the remaining tests were carried out in our NATA accredited laboratory.

The laboratory test results are summarised on Laboratory Test Reports in Appendix D and Appendix E.

4. SUBSURFACE CONDITIONS

4.1 Principle Site

Reference should be made to Table A Summary of Test Pit Profiles in Appendix A for details of subsurface profiles encountered in the test pits and Drawing No 3 for test pit locations. In general, the site may be divided into 6 zones (Zones A to F) as shown on Drawing No 5.

The following is a generalised description of subsurface profiles encountered for each zone;

Zone A	**Exploratory Holes – TP 30 to 40, 42 to 46, 48 to 51, 59 to 64, 67**	
Material Type	**Depths**	**Material Description**
Fill/Topsoil	Up to 0.6m (Generally)	• Generally consisting of Clayey Silt topsoil and thin Gravelly Silty Clay fill. • Natural topsoil and silt (with topsoil properties) encountered beneath fill in a number of test pits with thickness typically between 100mm to 200mm. • Some building rubble and foreign inclusion (eg glass, timber, and tree roots) encountered in TP 42, 49 and 94.
	Up to 1.2 - 2.0m (TP 35, 42 and 63)	• Wet fill consisting mainly of Gravelly Silty Clay and Sandy in TP 35. • Topsoil/fill consisting of Clayey Silt and Silty Clay in TP 41 and 63
Natural Soil	0.2m to 1.5m (Generally)	• Generally consisting of high plasticity Silty Clay becoming medium plasticity. Generally very stiff consistency with moisture content less than or equal to the plastic limit • Natural clay not encountered in TP 36
	Up to 2.6m in TP 35, 37, 42, 46, 51, 62 and 63	• Generally consisting of high plasticity Silty Clay becoming medium plasticity and more gravelly at lower depths. Very stiff to hard consistency. • Thickness of natural clay generally less than 1.5m with thick topsoil/fill on top
Bedrock	Less than 1.5m (Generally)	• Mainly shale and siltstone. • Sandstone encountered in TP 36 and 38
	Up to 2.6m (TP 35, 37, 42, 46, 51, 62 and 63	• Mainly shale and siltstone. • Sandstone encountered in TP 51. • Bedrock not encountered in TP 63 but Shaley Clay with shale bands encountered between 1.8m to 3.9m depth.

Zone B	**Exploratory Holes – TP 6, 7, 19, 20, 47, 55 to 58**	
Material Type	**Depths**	**Material Description**
Fill/Topsoil	0.0-0.4 (General)	• Generally consisting of Clayey Silt topsoil • Fill encountered in TP 47 consists of Silty Clay overlying topsoil.
	Up to 1.05m (TP 55, 56 and 58)	• Fill encountered consisting of medium to high plasticity Silty Clay and Gravelly Silty Clay. • A lot of building rubble inclusion (eg bricks concrete, tiles and glass) encountered in TP 56 and 58 • Topsoil encountered beneath fill in TP 58
Natural Soil	Up to 1.45- to 2.9m (Generally)	• Generally consists of high plasticity Silty Clay at the upper stratum and medium to high plasticity Gravelly Silty Clay/Shaley Clay at lower depths. • Shale bands encountered at the lower clayey profile.
Bedrock	Greater than 1.5m and up to 2.9m (Generally)	• Shale encountered. • Bedrock not encountered in TP 58 which was terminated at 3.1m depth

Zone C	**Exploratory Holes – TP 9 to 17, 21 to 24**	
Material Type	**Depths**	**Material Description**
Fill/Topsoil	0.0-0.4 (General)	• Generally consisting of Clayey Silt topsoil and topsoil/fill
	0.4 to 0.6m (TP 12, 13, 14 and 22)	• Fill encountered with a mixture of topsoil. • One steel and plastic pipe encountered in the fill in TP 12 • Topsoil encountered beneath fill in TP 11, 12, 14 and 21.
	Up to 2.6m (TP 24)	• Fill encountered consisting of medium to high plasticity Gravelly Silty Clay and Shaley Clay.
Natural Soil	Up to 1.5m to 3.2m (Generally)	• Generally consists of high plasticity Silty Clay at the upper stratum and medium to high plasticity Gravelly Silty Clay/Shaley Clay at lower depths. • Shale bands encountered at the lower clayey profile.
	Less than 1.5 (TP 9, 22 and 23)	• Consists mainly of high plasticity Silty Clay. • Natural clay not encountered in TP 24.
Bedrock	Greater than 1.5m and up to 2.1m (Generally)	• Shale encountered. • Sandstone encountered in TP 24 • Bedrock not encountered in TP 21 which was terminated at 2.9m depth
	Less than 1.5m (TP 9, 22 and 23)	• Shale encountered.

Zone D	**Exploratory Holes – TP 25, 26, 52 to 54 , 65 and 66**	
Material Type	**Depths**	**Material Description**
Fill/Topsoil	0.0-0.7 (General)	• Generally consisting of Clayey Silt topsoil • Fill consisting of Sandstone , Silty Clay, and Gravelly Silty Clay encountered in TP 25, 26, 52, 54 and 66 • Topsoil encountered beneath fill in TP 53 and 66 with thickness of 250mm and 150mm respectively
Natural Soil	Less than 1.8m (Generally)	• Generally consists of high plasticity Silty Clay at the upper stratum and medium plasticity Sandy Clay and Gravelly Silty Clay at lower depths. • Natural Clay not encountered in TP 54
Bedrock	Generally at between 1.1 and 1.6m	• Generally consisting of Sandstone . • Sandstone in TP 52 and 66 encountered at 1.9 and 1.8m respectively.

Zone E	**Exploratory Holes – TP 8, 27 to 29**	
Material Type	**Depths**	**Material Description**
Fill/Topsoil	0.0-0.35 (General)	• Generally consisting of Clayey Silt topsoil and Clayey Sand and sandstone fill • Fill overlying topsoil to 0.55m encountered in TP 28
Natural Soil	Up to 1.95m to 2.9m (Generally)	• Consisting of high plasticity Silty Clay ovelying medium plasticity Shaley Clay and Gravelly Sitly Clay at lower depths. Generally very stiff to hard.
Bedrock	Between 1.95m and 2.9m	• Consisting of shale

Zone F	**Exploratory Holes – TP 1, 2, 3, 4, 5, 18, 41**	
Material Type	**Depths**	**Material Description**
Fill/Topsoil	0.0-0.25 (General)	• Consisting mainly of Clayey Silt topsoil of low liquid limit • A layer of silt (Possibly alluvial creek material) encountered beneath the topsoil in TP 1, 2, 4, 5, 18 and 41 with thickness up to about 300mm • Thick fill up to 1.9m deep encountered in TP 3 with some sandstone boulders
Natural Soil	Up to 2.1m (Generally)	• Generally consisting of Silty Clay, Sandy Silty Clay and Gravelly Silty Clay of very stiff consistency.
Bedrock	Between 1.1m and 2.1	• Generally Sandstone. • Shallow Shale/siltstone at 0.55m encountered in TP 4

4.2 Dam Site

Reference should be made to the Borehole Reports in Appendix B for details of the subsurface profiles encountered in our dam investigation. A summary of the interpreted subsurface profiles is as follows:

Embankment

The dam embankment consists predominantly of Silty Clay of medium to high plasticity with some gravel. The embankment material in the southern section appeared more gravelly as revealed by BH 3. A layer of crushed rock about 300mm thick was below the earthfill in BH 1 at depths between 2.2m and 2.5m below crest level.

Based on the SPT results, the earthfill embankment material was assessed to have marginal compaction

The earthfill embankment material was found to be dry to moist.

Foundation

The underlying foundation material beneath the embankment consists predominantly of high plasticity Silty Clay. The plasticity of the natural clay generally reduces at lower depths. Thickness of this clayey foundation material varies from 0.9m to 2.0m. The SPT and hand penetrometer results indicate the natural clay to be very stiff to hard. Moisture content of the natural clay was assessed to be approximately equal to less than the plastic limit.

Beneath the natural clay, shale/siltstone bedrock was encountered.

Toe of Embankment

BH 4 to BH 6 indicate the toe of the embankment to consist of 100mm to 200mm thick topsoil overlying natural clayey profile over shale/siltstone bedrock at depths varying from 0.6m to 1.6m below existing ground surface.

The natural clay was found to be very stiff to hard and dry with moisture content approximately equal to less than the plastic limit.

Groundwater

All boreholes were found to be dry except for BH 3 where groundwater was encountered within the shale stratum at a depth of 5.4m below crest level.

5. RESULTS OF THE INVESTIGATION

5.1 Salinity

5.1.1 Guidelines

Salinity refers to the presence of excess salt in the environment and occurs when salts which are naturally found in soil or groundwater mobilise, allowing capillary rise and evaporation to concentrate the salt at the upper subsurface soil profile. Such movements are caused by changes in the natural water cycle. In urban areas, the processes which cause salinity are intensified by the increased volumes of water added to the natural system from irrigation of gardens, lawn and parks and from leaking infrastructures (eg pipes, sewer, stormwater, etc) and pool.

Saline soil may have adverse impact on development such as;

- Damage to buildings and houses caused by deterioration of bricks, mortar and concrete when salt drawn up into capillaries of bricks and mortar expands resulting in spalling.
- Deterioration of concrete kerbs and gutters as a result of chemical reaction between concrete and sulphates.
- High chloride content in the soil may result in corrosion of steel reinforcement and buried metal structures.
- Damage to underground pipes and infrastructures.
- Water logging of ground surface due to sealing effect of sodic and dispersive soil.
- Loss of vegetation cover and plants due to high salt content resulting in retardation of plants.

In recognition of the potential adverse impact of salinity to development, the Western Sydney Regional Organisation of Councils Ltd has a Salinity Code of Practice (Reference 4) to address the issue of salinity. It was acknowledge in the Code that salinity problems can change substantially over time and it is difficult to predict exactly where salinity will occur and how it will respond to the changing environment conditions.

The fundamental criterion for assessing soil salinity is based on Electrical Conductivity (Reference 3).

Class	**EC_e (ds/m)**	**Comments**
Non-Saline	<2	Salinity effects mostly negligible
Slightly Saline	2-4	Yields of very sensitive crops may be affected
Moderately Saline	4-8	Yield of many crops affected
Very Saline	8-16	Only tolerant crops yield satisfactorily
Highly Saline	>16	Only a few

In addition to the above, the presence of Sulphate and Chloride in the soil has the potential to cause high soil aggressivity to concrete, in particular if the structures are in direct contact with the soil. The following is a measure of soil aggressivity based on the Australian Standard (Reference 6).

Sulphate expressed as SO_3		**pH**	**Chloride in water (ppm)**	**Soil conditions A***	**Soil conditions B#**
In Soil (%)	**In Groundwater (ppm)**				
<0.2	<300	>6.5	<2000	Non-aggressive	Non-aggressive
0.2-0.5	300-1000	5-6	2000-6000	Mild	Non-aggressive
0.5-1.0	1000-2500	4.5-5	6000-12000	Moderate	Mild
1.0-2.0	2500-5000	4-4.5	12000-30000	Severe	Moderate
>2.0	>5000	<4	>30000	Very Severe	Severe

Approximate 100ppm of SO_4=80ppm of SO_3
* Soil condition A = High permeability soils (eg sands and gravels) which is below groundwater
# Soil conditions B = Low permeability soils (eg silts and clays) and all soils above groundwater

5.1.2 Laboratory Test Results

For details of the laboratory test results, refer to the Laboratory Test Reports in Appendix C.

The following is a summary of the laboratory test results;

Sample	Depth (m)	PH	EC	EC_e	CL	SO4
TP1	0.0-0.1	6.2	0.17	1.7	<100	<25
	0.6-0.7	4.3	0.38	3.2	520	73
	1.1-1.2	4.8	0.57	4	610	220
TP8	0.0-0.1	5.6	0.075	0.8	<100	34
	0.55-0.65	5.5	0.11	0.9	<100	38
	1.5-1.6	5.5	0.39	2.7	<100	73
TP14	0.0-0.1	6.8	0.08	0.8	530	<25
	0.5-0.6	5.2	0.23	2	<100	180
	1.5-1.6	4.2	0.58	4.1	200	480
TP16	0.0-0.1	5.5	0.058	0.6	550	<25
	0.3-0.4	4.9	0.054	0.5	<100	<25
	1.0-1.1	4.8	0.11	0.8	<100	57
TP18	0.0-0.1	6	0.061	0.6	<100	<25
	0.45-0.55	5.9	0.069	0.6	<100	<25
	0.95-1.05	4.9	0.049	0.3	<100	33
TP25	0.0-0.2	5.2	0.044	0.4	<100	<25
	0.2-0.3	5.5	0.04	0.3	<100	<25
	1.2-1.3	4.4	0.12	0.8	<100	<25

Note: EC – Electrical Conductivity (ds/m)
EC_e-Electrical Conducivity (ds/m)
CEC – Cation Exchange Capacity ($cmol^+/kg$)
ESP – Exchangeable Sodium Percentage (%)
SAR – Sodium Absorption Ratio
CL – Chloride (mg/kg)
SO4- Sulphate (mg.kg)

Sample	Depth (m)	PH	EC	ECe	CL	SO4
TP26	0.0-0.1	8.5	0.041	0.4	<100	<25
	0.25-0.35	4.7	0.12	1	130	<25
	0.9-1.1	4.7	0.065	0.5	<100	47
TP28	0.0-0.05	7.2	0.12	1.2	<100	88
	0.25-0.35	7.2	0.066	0.6	<100	52
	1.4-1.5	4.5	0.48	3.4	520	270
TP29	0.0-0.1	5.4	0.23	2.3	280	57
	0.35-0.45	4.1	0.85	7.2	1300	65
	1.0-1.1	4.2	0.99	6.9	1500	140
TP31	0.0-0.1	5.3	0.041	0.4	<100	39
	0.2-0.3	5.4	0.061	0.5	<100	<25
	1.0-1.1	4.9	0.055	0.4	<100	38
TP34	0.0-0.1	5.3	0.095	1	<100	<25
	0.35-0.45	4.2	0.23	2	310	34
	1.0-1.1	4.3	0.43	3	630	25
TP37	0.0-0.1	5.8	0.04	0.4	<100	29
	0.5-0.7	5.5	0.17	1.4	<100	130
	1.5-1.6	6	0.24	1.8	240	45

Note: EC – Electrical Conductivity (ds/m)
EC_e-Electrical Conducivity (ds/m)
CEC – Cation Exchange Capacity ($cmol^+/kg$)
ESP – Exchangeable Sodium Percentage (%)
SAR – Sodium Absorption Ratio
CL – Chloride (mg/kg)
SO4- Sulphate (mg.kg)

Sample	Depth (m)	PH	EC	ECe	CL	SO4
TP40	0.0-0.1	7	0.1	1	<100	<25
	0.3-0.4	5.4	0.035	0.3	<100	43
	1.0-1.1	4.7	0.082	0.6	110	<25
TP43	0.0-0.1	5.5	0.065	0.7	<100	<25
	0.3-0.4	4.9	0.055	0.5	<100	<25
	1.1-1.3	5.4	0.025	0.2	<100	25
TP45	0.0-0.1	5.2	0.06	0.6	<100	29
	0.3-0.4	4.7	0.1	0.9	<100	80
	1.3-1.4	4.8	0.22	1.5	220	94
TP50	0.0-0.1	4.9	0.15	1.5	<100	140
	0.3-0.4	4.4	0.09	0.8	<100	67
	1.8-1.9	4.6	0.22	1.5	220	120
TP56	0.0-0.1	7.4	1.4	14	<100	3000
	0.65-0.75	5.3	0.13	1.1	<100	240
	2.0-2.2	5.6	0.19	1.3	160	94
TP66	0.0-0.1	7.4	0.28	2.8	<100	140
	0.35-0.45	4.6	0.11	0.9	130	<25
	1.4-1.6	4.8	0.036	0.3	<100	32

Note: EC – Electrical Conductivity (ds/m)
EC_e-Electrical Conducivity (ds/m)
CEC – Cation Exchange Capacity ($cmol^+/kg$)
ESP – Exchangeable Sodium Percentage (%)
SAR – Sodium Absorption Ratio
CL – Chloride (mg/kg)
SO4- Sulphate (mg.kg)

5.2 Geotechnical

5.2.1 Principles of Site Classification

Most natural clay soils have sufficient bearing capacities to support typical residential loads. Most distress to residential structures occurs due to reactive soil movements rather than settlement movements.

AS2870 establishes a classification system whereby reactive sites are classified based on the reactive soil movements anticipated. Other foundation conditions such as the presence of fill material, may affect the site classification. Appendix F of this report provides a comprehensive explanation of site classification.

The purpose of the classification is to allow the design of an economical footing system that will limit cracking of footings, floor slabs and masonry walls to an extent normally considered acceptable. The performance expectations associated with the design guidelines are presented in AS 2870. It is fundamental when applying the following site classifications to residential footing design that these performance expectations are acceptable to the house owners.

5.2.2 Laboratory Test Results – Principle Site

For details of the laboratory test results, refer to the Laboratory Test Reports in Appendix D of this report.

The following is a summary of the Shrink-Swell Index test results for samples taken from the test pits;

Test Pit	Depth (m)	Swell (%)	Shrinkage (%)	Shrink-Swell Index (%/pF)
TP1	0.5-0.8	2.06	1.28	1.3
TP6	0.8-1.1	3.58	1.91	2.1
TP8	0.55-0.85	5.39	2.24	2.7
TP11	0.7-1.0	6.24	1.18	2.4
TP14	0.7-0.9	5.53	2.03	2.7
TP16	0.3-0.6	3.9	0.75	1.5

Test Pit	Depth (m)	Swell (%)	Shrinkage (%)	Shrink-Swell Index (%/pF)
TP18	0.45-0.75	6.2	2.25	3.0
TP23	0.1-0.3	4.76	3.11	2.2
TP28	0.55-0.85	3.47	3.21	2.7
TP29	0.35-0.65	4.42	1.89	2.3
TP31	0.2-0.5	1.66	1.38	1.2
TP34	0.35-0.55	2.85	1.64	1.7
TP37	0.5-0.8	1.85	2.21	1.7
TP38	0.35-0.55	0.7	0.74	0.6
TP45	0.3-0.6	1.15	0.89	0.8
TP52	0.6-0.85	0.65	1.95	1.3
TP55	1.1-1.4	1.39	1.89	1.4
TP56	0.65-0.9	2.8	0.62	1.1
TP60	0.25-0.55	1.39	1.3	1.1
TP61	0.4-0.7	0.49	1.4	0.9
TP65	0.25-0.55	1.24	1.0	0.8
TP66	0.35-0.65	0.82	0.56	0.6

A Shrink-swell Index for the clayey sample of between 1.2%/pF and 3.0%/pF indicates moderately reactive soil to moisture variation and a Shrink-swell Index of less than 1.2%/pF indicates the clayey soil to have a low reactivity to moisture variation.

The following is a summary of the Atterberg Limits test.

Test Pit	Depth (m)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)
TP1	0.5-0.7	70	22	48	16.5
TP6	0.8-1.0	73	21	52	13
TP8	0.58-0.75	61	25	36	11.5
TP11	0.7-0.85	59	26	33	13.5
TP14	0.7-0.9	59	24	35	13.5
TP16	0.3-0.6	54	23	31	13.5
TP18	0.45-0.7	25	34	41	18.0
TP20	0.25-0.55	60	24	36	12.0
TP25	1.2-1.35	47	18	29	10.5
TP26	0.25-0.45	56	25	31	13.5
TP28	0.55-0.7	65	26	39	15.5
TP29	0.35-0.55	67	28	38	12.5
TP31	0.2-0.45	70	33	38	17.5
TP32	0.5-0.7	79	27	52	16.5
TP34	0.35-0.5	68	28	40	17.5
TP38	0.38-0.55	50	22	28	7.8
TP40	0.6-0.85	47	22	25	11.5
TP43	0.3-0.5	77	34	44	14.5
TP45	0.3-0.5	68	26	41	16.0
TP50	0.3-0.6	53	28	26	13.0

Note: LL - Liquid Limit
PL – Plastic Limit
PI - Plasticity Index
LS – Linear Shrinkage

Test Pit	Depth (m)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)
TP56	0.65-0.85	63	28	35	13.5
TP60	0.25-0.5	68	28	40	15.0
TP61	0.4-0.6	64	26	38	13.5
TP65	0.25-0.5	52	23	29	13.0
TP66	0.35-0.6	52	22	30	14.5

Note: LL - Liquid Limit
PL – Plastic Limit
PI - Plasticity Index
LS – Linear Shrinkage

The laboratory test results confirmed the insitu natural soil to be generally highly plastic (ie LL > 50%). The Linear Shrinkage correlates to soil with moderate reactivity based on empirical data.

Particle Size Distribution

Sample	Silt and Clay (%)	Sand (%)	Gravel (%)
TP8 (1.0-1.1m)	88	12	0
TP 14 (0.7-0.9m)	92	6	2
TP 18 (0.95-1.15m)	46	46	8
TP 25 (1.2-1.3m)	50	39	11
TP 26 (0.9-1.1m)	63	13	24
TP 28 (1.7-1.8m)	75	5	20
TP 34 (1.0-1.3m)	30	10	60
TP 40 (0.6-0.7m)	19	26	55
TP 43 (1.1-1.3m)	21	19	60
TP 66 (0.35-0.45m)	40	35	25

The particle size distribution confirms our visual soil classification. All near surface samples analysed indicate high clay content with higher gravel content at lower depths.

The following is a summary of CBR test results obtained;

Test Pit	**Depth (m)**	**CBR (%)**
TP1	0.9-1.0	3.5
TP8	0.55-0.70	4.0
TP14	0.7-0.9	4.0
TP16	0.3-0.5	8.0
TP18	0.45-0.65	10.0
TP22	0.4-0.6	9.0
TP25	1.2-1.35	6.0
TP26	0.25-0.35	11.0
TP28	0.55-0.75	4.5
TP29	0.35-0.55	4.0
TP31	0.2-0.35	10.0
TP34	0.35-0.5	9.0
TP37	0.5-0.7	9.0
TP40	0.6-0.7	13.0
TP43	0.3-0.5	8.0
TP50	0.3-0.5	7.0
TP53	0.55-0.75	8.0
TP56	0.65-0.8	8.0
TP61	0.4-0.55	10.0
TP64	0.3-0.6	6.0
TP66	0.35-0.45	8.0

5.2.3 Laboratory Test Results – Dam Embankment

The laboratory test results for the dam embankment are summarised as follows;

Atterberg Limits

Test Pit	Depth (m)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)
BH 1	1.0-1.5	46	19	27	13
BH 2	0.5-1.0	39	16	23	5.5
BH 2	1.5-2.0	40	16	24	8.0
BH 2	3.0-3.5	66	24	42	15
BH 3	1.5-2.0	66	24	42	14.5
BH 6	0.2-0.6	67	28	39	16.5

Note: LL - Liquid Limit
PL – Plastic Limit
PI - Plasticity Index
LS – Linear Shrinkage

The laboratory test results confirmed the embankment material to be medium to high plastic (ie LL 39 to 50%) and the underlying natural clay to be high plastic (ie LL > 50%).

Particle Size Distribution

Sample	Silt and Clay (%)	Sand (%)	Gravel (%)
BH 2 (0.3-0.6m)	60	20	20
BH 3 (0.2-0.6m)	72	15	13
BH 6 (0.2-0.6m)	88	7	5

The particle size distribution confirms our visual soil classification.

Emerson Dispersion

Sample	Material Description	Class	Description
BH 1 (0.5-1.0m)	Fill: Silty Clay, medium to to high plasticity, brown with some gravel	3	Slight Dispersion
BH 1 (1.5-2.0m)	Fill: Silty Clay, medium plasticity, brown	2	High Dispersion
BH 2 (0.3-0.6m)	Fill : Silty Clay, medium plasticity, grey brown with ironstone gravel	2	High Dispersion
BH 2 (0.6-1.0m)	Fill: Gravelly Silty Clay: medium plasticity, grey	2	High Dispersion
BH 2 (1.5-2.0m)	Fill: Silty Clay, medium to high plasticity, grey and brown	2	High Dispersion
BH 2 (3.0-3.5m)	Silty Clay, high plasticity, red brown	3	Slight Dispersion
BH 3 (0.2-0.6m)	Fill: Silty Clay: medium to high plasticity, Red brown and grey	5	Slight Dispersion
BH 3 (1.5-2.0m)	Fill: Silty Clay, medium plasticity, grey mottled yellow brown	5	Slight Dispersion
BH 4 (0.5-0.95m)	Silty Clay, medium to high plasticity, orange brown	5	Slight Dispersion
BH 5 (0.2-0.4m)	Silty Clay, medium to high plasticity, orange brown	2	High Dispersion
BH 6 (0.2-0.6m)	Silty Clay, medium to high plasticity, red brown	5	Slight Dispersion

Pin Hole Dispersion

Sample	Material Description	Class	Description
BH 1 (0.5-1.0m)	Fill: Silty Clay, medium to to high plasticity, brown with some gravel	ND1	Non Erodible
BH 2 (0.3-0.6m)	Fill : Silty Clay, medium plasticity, grey brown with ironstone gravel	PD2	Partially Erodible
BH 4 (0.2-0.5m)	Silty Clay, medium to high plasticity, orange brown	5	Non Erodible

Triaxial Test

Sample	Cohesion (C') (KPa)	Friction Angle (Ø') (degrees)
BH 1 (1.0-1.2m)	1 kPa	24^0
BH 2 (1.5-1.8m)	3 kPa	24^0

For details of the laboratory test results, refer to the Laboratory Test Reports in Appendix E of this report.

6. ASSESSMENTS AND RECOMMENDATIONS

6.1 Salinity Issues

The laboratory test results indicate the upper 1.0m of the subsurface soil within the site to be generally non to slightly saline with Ec values ranging from 0.2 to 3.2 ds/m. In TP 1 and 14, the natural clay at below 1.0m was assessed to be moderately saline with Ec values ranging from 4.0 to 4.1ds/m. Moderately saline soil was also encountered in TP 29 at near surface with an Ec value of 7.2ds/m. The topsoil soil sample from TP 56 was found to be very saline with an Ec value of 14ds/m.

It was noted that the relatively high saline soils encountered at near surface in TP 29 and TP 56 were likely to be derived from landscaping activities (eg fertilizers) and these soils are likely to be present in localised areas. Moderately to highly saline soil may affect yields of some plants. Future landscaping of the proposed development should incorporate planting of salt-tolerant plants.

The laboratory test results confirmed that the site is underlain by a clayey soil with low permeability in the order of 0.012m/day. In view of the low permeability of the residual soil associated with the Blacktown and Lucas Heights soil landscape groups, the site was assessed to have low to moderate erodibility.

Based on the results of the investigation, we are of the opinion that soil salinity is not considered significant within the site. Not withstanding the foregoing, we recommend good soil and water management strategy be adopted for future redevelopment to minimise impact of soil degradation caused by stormwater runoff and infiltration. Future redevelopment of the site should include the following salinity management strategies;

- Avoid exposure and disturbance of dispersive soil found at lower depths. In general excavation should be kept less than 1.0m if possible. Deeper excavations in excess of 1.0m should be covered and retained by retaining walls.

- Appropriate batter slopes for excavations should be adopted to prevent erosion and scouring.

Under good drainage conditions, the following batter slopes may be adopted;

Material	Recommended Minimum Batter Slopes
Insitu Fill (Poorly compacted)	3 Horizontal : 1 Vertical
Compacted Fill	2 Horizontal : 1 Vertical
Very stiff residual clay	2 Horizontal : 1 Vertical
Weathered Shale/Sandstone	0.5 Horizontal : 1 Vertical

- All cut and fill batters should be stabilised by planting with appropriate plant species as soon as practicable after construction. Sprayed-on mulch may be applied to protect bare ground surface.

- The subsurface natural soil was generally found to have low Sulphate and Chloride, however in an environment with a lowest pH value of 4.1, the soil was assessed to be moderately aggressive to buried concrete structure. Reference should be made to the AS 2159 guidelines (Reference 6) for recommendations on protection of buried concrete structures.

6.2 Acid Sulphate Issue

Acid sulfate soils are the common name given to sediments and soils containing iron sulfides which when exposed to oxygen generate sulfuric acid. Formation conditions which normally exist in mangroves, salt marsh vegetation or tidal areas and at the bottom of coastal rivers and lakes, require a number of elements such as;

- the presence of iron-rich sediments,
- the presence of sulfate,
- removal of reaction products (ie bicarbonate),
- the presence of sulfate reducing bacterial and
- a plentiful supply of organic matter.

The relatively specific conditions under which acid sulfate soils are formed usually limit their occurrence to low lying areas with soil horizon less than 5m AHD (Reference 9).

The site is situated on gently undulating terrain with ground surface Reduced Levels (RL) ranging from 125m to 143m Australian Height Datum (AHD).

From the geological and soil landscape maps and as confirmed by our exploratory pits, typical soil within the site consist of medium to high plasticity red brown and grey Silty Clay of residual soil origin. The site is well drained and permanent groundwater table was not encountered at shallow depths within the soil profiles.

Based on the results of our investigation and review of available information, the site is situated in an area with no known occurrence of acid sulphate soil and therefore the proposed development is not likely to be impacted by acid sulphate soil.

6.3 Geotechnical Issues

We understand that the Airds and Bradbury Redevelopment project will include staged demolition of existing structures including roads and reconstruction of new houses and a town centre with open spaces. Details of the type of building structures are not available however we expect the structures will be low to medium rise up to three storey high with possible single level basement in the town centre.

6.3.1 Site Preparation and Earthworks

The extent of site preparation and earthworks will depend on the future use of the land and the foundation system to be adopted for future buildings. It is common for land development to include some earthworks by cut and fill however as the site is an established residential area, the extent of earthworks to regrade the site for future redevelopment is not expected to be significant.

For shallow footing construction, typical site preparation and earthworks should include;

- Stripping of topsoil and topsoil/fill from the surface.
- Excavation of all "Uncontrolled" fill and buried topsoil to expose the natural clay. Our test pits indicate buried topsoil to exist beneath the fill in TP 11, 12, 14, 21, 28, 30, 32, 33, 47, 51, 53, 55, 58, 66 and 67.
- Proof rolling of the exposed natural clay to delineate soft and heaving areas.
- Any soft and heaving areas delineated by the proof rolling should be further excavated and replaced with a select granular fill having a maximum particle size of 75mm.

- All fill required to elevate the site to proposed design platform level should be placed in layers not exceeding 250mm loose thickness and compacted to a minimum 95% Standard Maximum Dry Density (SMDD) at within 2% of Optimum Moisture Content (OMC) for residential development and 98% for commercial development.

- All earthworks should be monitored and tested by a NATA accredited laboratory.

Our general comments on suitable bearing material and reusability of onsite soil with respect to shallow foundation construction are as follows;

- The topsoil and topsoil/fill encountered on the surface in the majority of the test pits are not considered suitable to support permanent structures such as pavements, slabs and buildings and therefore should be excavated and removed. The topsoil and topsoil/fill may be reused in future landscaping areas (eg earth mounds).

- The Gravelly Silt (with topsoil properties) which is present beneath the topsoil in some test pits (eg TP 1, 2, 5, 18, 34, 40, 41, 43, 47 and 65) is not considered suitable for reuse as structural fill because silt is sensitive to moisture and is difficult to rework and compact. It is often possible to improve the silty soil by mixing with better quality clay.

- The insitu fill as encountered in some test pits would be classified as "Uncontrolled" fill in accordance with the definition outlined in AS 3798 (Reference 8) and is therefore not suitable to support permanent structures such as pavements, slabs and buildings with shallow footings.

- Some foreign inclusion such as bricks and concrete were encountered in the fill in some test pit (eg TP 49, 56, 58 and 61) and this fill is not considered suitable for reuse and is recommended to be disposed off site to a landfill. If this fill is to be reuse in future development, the fill should be screened of all oversized material including building rubble (eg concrete, bricks etc) greater than 75mm particle size and deleterious material (eg topsoil, timber and organic). The options of treatment of fill for reuse versus landfill disposal should be considered with care taking into consideration the potential difficulty in separating "good" from "bad" fill.

- The underlying natural clay, shale and sandstone are considered suitable for reuse as structural fill provided the fill is well graded with maximum particle size of not greater than 75mm.

Minimal site preparation and earthworks will be required if deep foundation system is adopted for future buildings.

6.3.2 Excavation and Vibration Issues

The test pit investigation indicates the major portion of the site to be underlain by Ashfield shale at varying depths generally less than 3.0m below existing ground surface. We note that Hawkesbury sandstone which was encountered at the lower slopes continues below the Ashfield shale, hence forming the lower bedrock unit.

Excavation of the fill and natural clayey soil may be carried out using conventional earthmoving equipment such as tracked loaders or hydraulic excavators. As the upper shale bedrock was generally assessed to be very low strength, excavation of the upper 1.0m shale may be carried out using the same equipment but equipped with rock-teeth buckets.

Deeper excavation greater than 1.0m if necessary is expected to encounter better quality shale or sandstone bedrock requiring the use of an impact hammer attached to an excavator or a dozer equipped with rippers. Information on the strength and quality of bedrock is limited from this investigation and additional investigation by drilling to obtain bedrock core samples may be carried out to obtain more accurate information of bedrock condition.

If a dozer is use, the rippability of rock will be governed by the strength, number of defects and defects orientation of the bedrock unit. We recommend trial runs be undertaken at different directions to obtain maximum production rates.

A hydraulic rock breaker may be required to penetrate through harder bedrock expected to present at lower depths. There is an inherent risk of damage to adjacent buildings caused by excessive vibration from excavation using impact hammers. If impact hammers are to be used in rock excavation and the excavation is situated within close proximity to nearby building (say within 15m), we recommend the following measures be adopted to mitigate such risks;

- Use of a small size hammer.

- Prior to excavation works, ground vibration criteria should be established on site by specialist vibration engineers/scientists. To monitor vibration during excavation works, geophones should be installed at strategic locations determined by the specialist and the vibration monitoring unit should be set-up the alert the excavation contractor if the vibration exceeds the recommend level. Vibration monitoring should be carried out by a suitable qualified person with data loggers. Daily records of vibration (measured in Peak Particle Velocity) should be reviewed and appropriate construction measures be adopted to control vibration.

- Excavation works should be carried out by an experienced operator who is aware of factors affecting vibration and transmission of vibration such as orientation of hammer, duration of hamming, size of excavation bite and speed of vibration of the hammer.

Dilapidation reports of nearby structures are recommended prior to excavation works.

6.3.3 Retaining Wall and Batter Slopes

Cut and fill in excess of 0.9m should be adequately retained by a structural wall. If retaining walls are adopted, rigid or 'propped' walls (eg supported by floor slab) should be designed using an "at-rest" lateral earth pressure coefficient (K_o) and based on a rectangular stress block. Gravity or 'cantilever' walls should be designed using an "Active" lateral earth pressure coefficient (K_a) based on a triangular stress block.

The following lateral earth pressure coefficients may be adopted;

Material	**K_o**	**K_a**	**Bulk Density (kN/m^3)**
Loose Fill	0.55	0.36	18.5
Very stiff natural clay/Compacted Fill	0.5	0.33	19.0
Weathered Shale/Sandstone	0.25	0.1	22.0

Permanent subsurface drains should be provided at the back of the retaining wall, or half hydrostatic ground water pressures should be taken into account in the design. Surcharge due to adjacent structures, construction loads and sloping backfill should be taken into account in the design.

Retaining walls may not be required if the excavation and filling is battered to the following;

Material	**Temporary Batter**	**Permanent Batter**
Loose Fill	1 Vertical : 1.5 Horizontal	1 Vertical : 3 Horizontal
Very stiff natural clay/Compacted Fill	1 Vertical : 1 Horizontal	1 Vertical : 2 Horizontal
Weathered Shale/Sandstone	Near Vertical	0.5 Vertical : 1 Horizontal

6.3.4 Foundation Design and Indicative Lot Classification

Shallow footings consisting of stiffened raft slabs, waffle slabs or strip and pad footings may be adopted for future residential building buildings or light weight structures subject to site preparation and earthworks as described in the above Section 6.3.1.

Deep footings such as bored piles, grout injected piles or steel piles should be adopted if the site contains "Uncontrolled" fill or other incompetent foundation material (eg topsoil, weak soil, etc) and minimal earthworks are undertaken to improve the foundation.

For preliminary footing design, the following allowable bearing capacities may be adopted;

Foundation Material	Allowable Bearing Capacities
Controlled Fill (95% Standard)	100kPa
Controlled Fill (98% Standard)	150kPa
Natural Very Stiff Clay or better	150kPa
Weathered Shale/Sandstone	600kPa

There is limited site information to classify the site to AS 2870 "Residential Slabs and Footings". Preliminary site classification assessment may be based on the following criteria;

Site Classification	Site Conditions
'S' (Slight)	➢ Topsoil or uncontrolled fill less than 400mm thick ➢ Stable 'Controlled' fill compacted to a minimum 95% Standard ➢ Natural clay to be of very stiff or better consistency ➢ Bedrock profiles less than 0.6m deep ➢ Surface movements from reactive clay less than 20mm
'M' (Moderate)	➢ Topsoil or uncontrolled fill less than 400mm thick ➢ Stable 'Controlled" fill compacted to a minimum 95% Standard ➢ Natural clay to be of very stiff or better consistency ➢ Bedrock profiles less than 2.5m deep ➢ Surface movements from reactive clay between 20mm to 40mm

Site Classification	**Site Conditions**
'H' (High)	➢ Topsoil or uncontrolled fill less than 400mm thick ➢ Stable 'Controlled' fill compacted to a minimum 95% Standard ➢ Natural clay to be of very stiff or better consistency ➢ Bedrock profiles greater than 2.5m deep ➢ Surface movements from reactive clay between 40mm to 70mm
'P' (Problem)	➢ Topsoil or 'Uncontrolled' fill greater than 400mm thick Soft and wet natural clay

The following are our preliminary assessments of site classification based on available information obtained from the investigation. The site may be broadly categorised into six zone (Zone A to F) based on locality, topography, soil landscape and geology. Refer to Drawing no 5 for the various zones;

Zone	**Indicative Site Classification**
A	M
B	H
C	H
D	M
E	H
F	P

Note that upgrading of lot classification may be possible through earthworks as follows;

- Class 'P' sites with "Uncontrolled" fill (As defined in AS 3798) may be upgraded to either Class 'M' or 'H' by excavation and removal of all uncontrolled fill. Sites with "Controlled" fill (AS 3798) may be classified as Class 'M' or 'H'.

- Class 'H' sites may be upgraded to Class 'M' by replacement of the highly reactive clays at the upper 1.0m with stable and "Controlled" fill such as ripped sandstone.

6.3.5 Subgrade Preparation and Pavement Design

Pavement subgrade preparation as described in above Section 6.3.1 is also applicable for the proposed pavements. The upper 150mm of the fill material forming the subgrade of the pavement should be compacted to a minimum 100% SMDD and within 2% OMC.

The California Bearing Ratio (CBR) tests carried out on samples taken from the site ranges from 3.5% to 13%.

For preliminary pavement design, a design CBR value of 5% may be adopted for flexible pavement design. Rigid pavement design may be based on a Modulus of Subgrade Reaction of 38kPa/mm.

6.3.6 Dam Embankment

The project also includes road construction along the western side of the dam which is situated to the south west of the Community and Indoor Sports Centre. The road construction is expected to involve excavation within 10m from the toe of the dam embankment and the stability of the dam is considered critical.

Analysis of Slopes

A stability analysis was carried out on typical cross sections of the embankment at critical locations, using the XSTAB (Version 5.202) computer program. The program was based on the Simplified Bishop and/or Janbu Method of Slip Circles.

Analysis of existing downstream batter slope was carried out based on existing configuration and subsurface soil and fill conditions encountered in the boreholes. The analysis included an assumed piezometric surface extending from the proposed permanent water level (assumed to be 0.5m below the embankment crest) to the toe of the downstream embankment.

The stability of the upstream slope was analysed for a rapid drawdown situation.

The following parameters were used in the analysis;

Location	Stratum	Dry Density (t/m^3)	Wet Density (t/m^3)	Cohesion C (kPa)	Friction Angle ϕ (degrees)
BH 1	Embankment	1.7	2.0	0.0	24.0
	Foundation	1.7	2.0	1.0	33.0
BH 2	Embankment	1.95	2.3	0.0	24.0
	Foundation	1.7	2.0	3.0	33.0

Analysis Results and Assessment

For details of the slope stability computation, refer to Appendix G. A minimum factor of safety (FOS) of unity implies that slopes should remain intact and a drop of FOS to below unity suggests unstable slopes. The recommended minimum FOS for an embankment with steady state seepage is 1.5 and the minimum FOS against rapid draw down condition is 1.2

The following is a summary of the analysis based on information obtained for the existing embankment;

Test Location	Batter Slopes	Height	Slope Angle	Computed FOS	Recommended FOS
BH 1	Downstream	2.0m	1 Vertical :2 Horizontal	1.23	1.5
BH 2	Downstream	3.5m	1 Vertical : 2.5 Horizontal	1.29	1.5
BH 2	Upstream	3.5m	1 Vertical : 1 Horizontal	0.43	1.2

The following are our comments based on the results of the investigation and stability analysis;

- The low FOS of 0.43 calculated for the upstream embankment at BH 2 location is due to the steep nature of the embankment (ie 1 Vetrical : 1 Horizontal) and the relatively low friction angle of the earthfill material (due to poor compaction). The upstream embankment has already failed, evidenced from the slumped and near vertical batters on the lower section near the waterline.

- Relatively higher FOS of 1.23 and 1.29 were calculated for the downstream embankment at BH 1 and BH 2 locations respectively however, these FOS values are below the recommended 1.5.

- The fill embankment material was assessed to be poorly compacted with SPT values generally less than 10 blows per 300mm penetration.

- The water holding capacity of the dam embankment could not be fully assessed in this investigation as the dam water level was low (possibly below the embankment level) at the time of our investigation. Though there were no obvious signs of leakage on the downstream side of the embankment, the water holding capacity of the dam is questionable on the basis that the earthfill was considered poorly compacted and the presence of a relatively pervious crushed rock layer at the interface between the earthfill and natural clay in BH 1 location.

Recommendations

As the existing embankment stability fails to meet the minimum recommended factor of safety with poorly compacted earthfill and possible relatively porous gravel layers through the embankment, we recommend the dam embankment be reconstructed.

Our recommendations for reconstruction of the embankment are as follows;

- The new embankment should have upstream and downstream slope batters of not steeper than 1 Vertical to 3 Horizontal

- Good quality fill should be used and this may include Silty Clay or Sandy Silty Clay of low to medium plasticity having a Liquid Limit of less than 45%. The fill should be non dispersive (ie Emerson Class numbers other than 1 to 3) and non erodible.

- The insitu earthfill material was generally found to be highly dispersive and some parts of the embankment (eg BH 3) were found to be too gravelly. If the insitu material is to be used for the new embankment, we recommend the Silty Clay material to be placed in the middle of the dam to form a minimum 2m wide core. The Gravelly Silty Clay may be used for the construction of the outer embankment.

- The upper 0.5m of the fill forming the embankment should be stabilised with 5% by weight of lime. Otherwise, the embankment should be covered by a stable capping layer not less than 0.5m thick consisting of a well graded ripped sandstone having a maximum particle size of 75mm.

- All fill material forming the embankment should be compacted to a minimum 98% to 102% SMDD at–1% to +3% Optimum Moisture Content.

- Prior to placement of the earthfill, the surface should be proof rolled using a minimum 10 tonne vibrating drum roller. Any soft or heaving areas delineated by the proof rolling should be boxed out and replaced with good quality fill. In addition, the surface should be cleared of all loose material and moistened.

- A cut-off trench should be constructed below the core of the earth embankment. This cut-off trench should be keyed a minimum of 0.5m into shale. To ensure adequate compaction, the cut-off trench wall should be battered too not steeper than 1 Vertical to 1 Horizontal and the base width should be not less than 3m.

- The construction of the new embankment should be controlled by a NATA accredited laboratory..

7. LIMITATIONS

The interpretation and recommendations submitted in this report are based in part upon data obtained from a limited number of test pits and boreholes. There is no investigation which is thorough enough to determine all site conditions and anomalies, no matter how comprehensive the investigation program is as site data is derived from extrapolation of limited test locations. The nature and extent of variations between test locations may not become evident until construction.

Groundwater conditions were only briefly examined in this investigation. The groundwater conditions may vary seasonally or as a consequence of construction activities on or adjacent to the site.

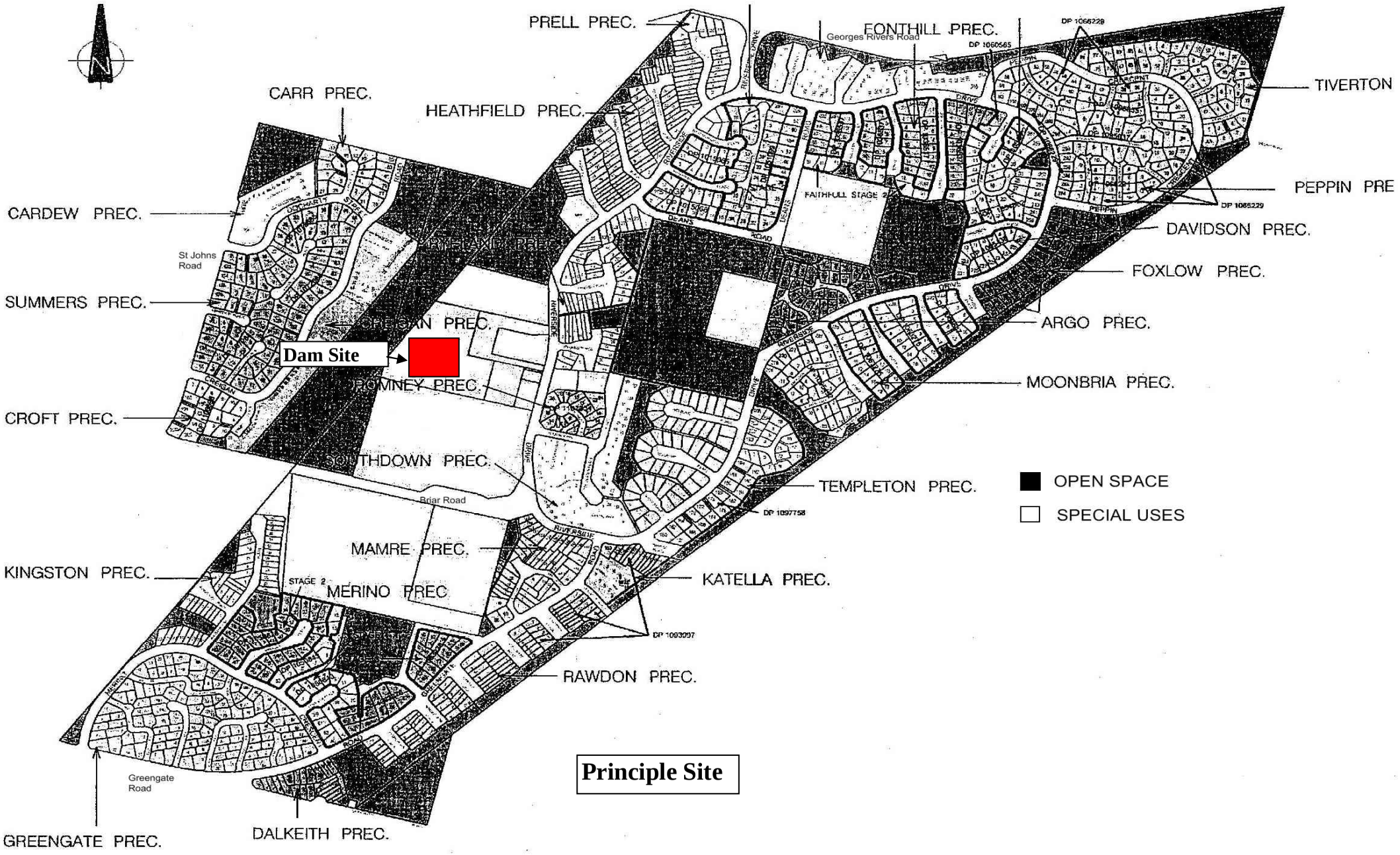
The statements presented in this document are intended to advise you of what should be your realistic expectations of this report and to present you with recommendations on how to minimise the risk associated with groundworks for this project. The document is not intended to reduce the level of responsibility accepted by GeoEnviro Consultancy Pty Ltd, but rather to ensure that all parties who may rely on this report are aware of their responsibilities.

Your attention is drawn to the attached "Explanatory Notes" in Appendix H and this document should be read in conjunction with our report

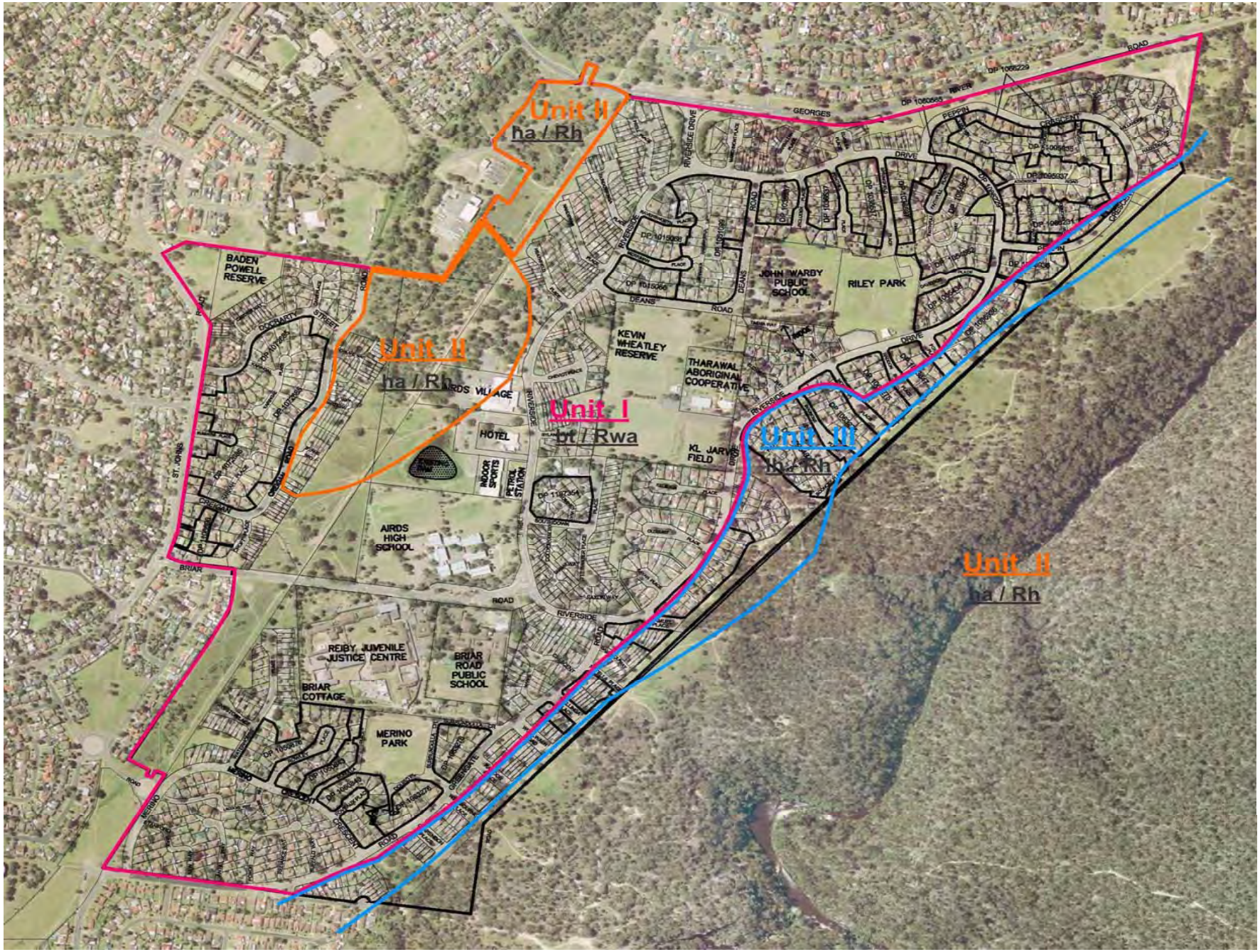
REFERENCES

1. *1:100,000 Soil Landscape Map of Port Hacking Wollongong– Soil Conservation Service of NSW ; Sheet 9029-9129*
2. *1:100,000 Geological Map of Port Hacking Wollongong– Geological Series Sheet 9029-9129 (Edition 1) 1985*
3. *Department of Land and Water Conservation – "Site Investigation for Urban Salinity".2002*
4. *Salinity Code of Practice – Western Sydney Regional Organisation of Councils Ltd – 2004*
5. *What do all the numbers mean? A guide for the interpretation of soil test results. – Department of Conservation and Land Management, 1992*
6. *Australian Standard, AS 2159-1995 "Piling – Design and Installation"*
7. *Australian Standard, AS 2870 -2000 "Residential Slabs and Footings".*
8. *Australian Standard, AS 3798 - 1996"Bulk Earthworks for Commercial and Residential Site"*
9. *Acid Sulfate Soil Manual – NSW Acid Sulfate Soil Management Advisory Committee August 1998*

C:\\09JOB\245\A\JG09245A-r1
18/3/09 2:14 PM



GeoEnviro Consultancy	Drawn By: JC	Date : 20/03/09		JBS Environmental Pty Ltd	
	Checked By: SL	Date : 20/03/09		Airds/Bradbury Redevelopment	
	Revision By:	Date:		Site Locality Sketch	
	Scale: Proportional	A3	Project No: JG09245A	Drawing No: 1	

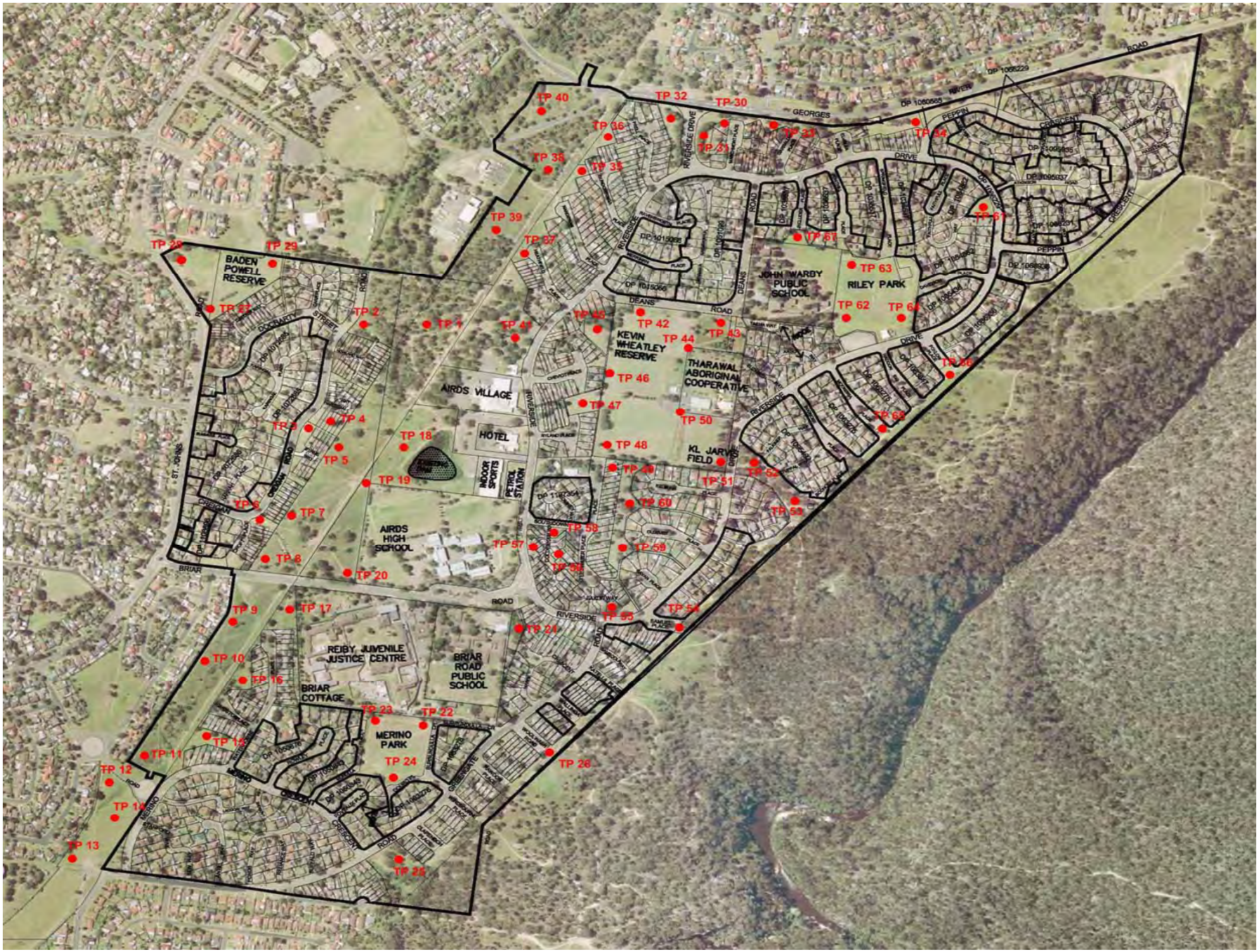


Legend

- Unit 1 - bt/Rwa
- Unit 2 - ha/Rh
- Unit 3 - Ih/Rh

GeoEnviro Consultancy

Drawn By:	JC	Date : 20/03/09	JBS Environmantal Pty Ltd	
Checked By:	SL	Date : 20/03/09	Airds/Bradbury Redevelopment	
Revision By:		Date:	Soil Landscape and Geological Units	
Scale:	Proportional	A3	Project No: JG09245A	Drawing No: 2

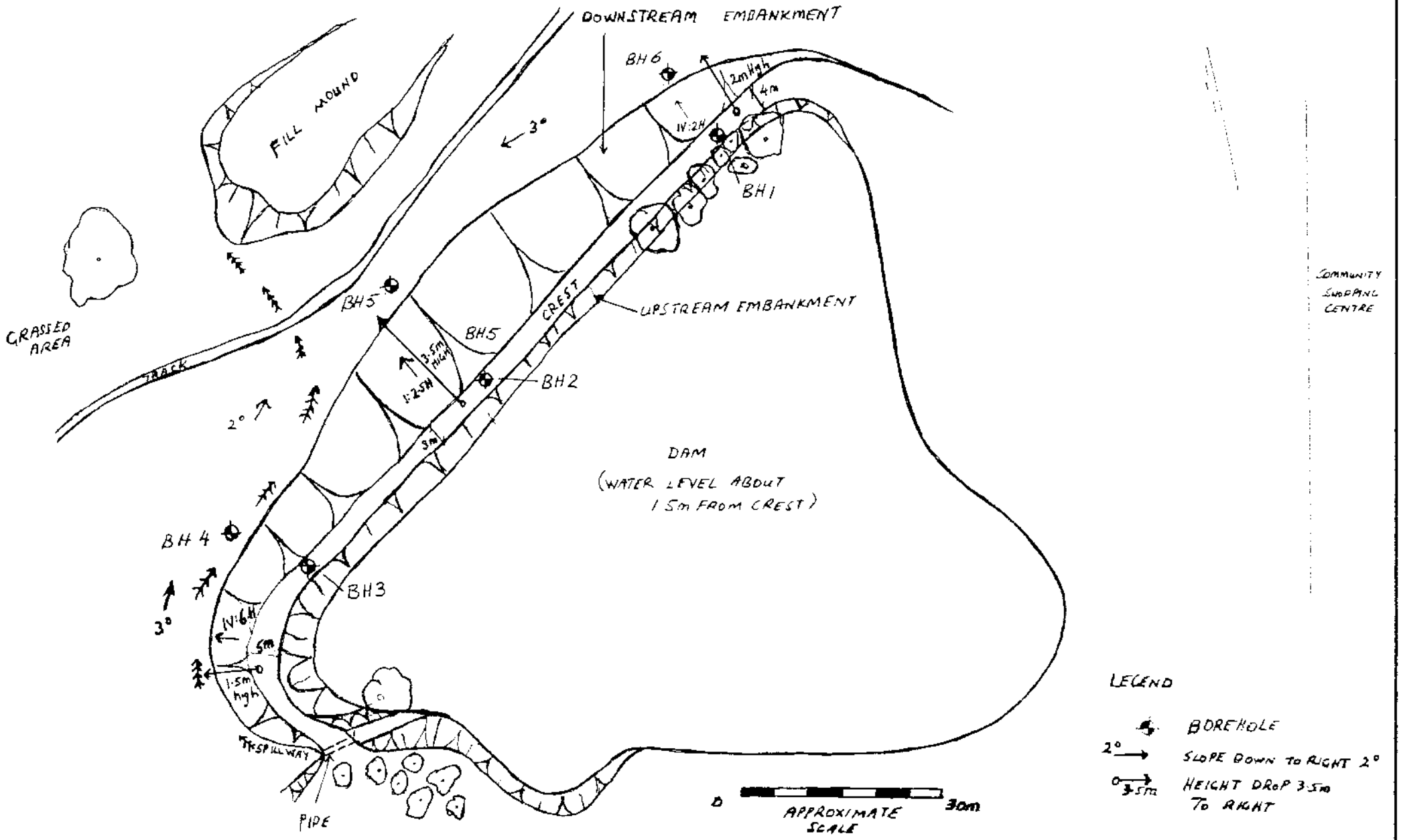


Legend

Test Pit

GeoEnviro Consultancy

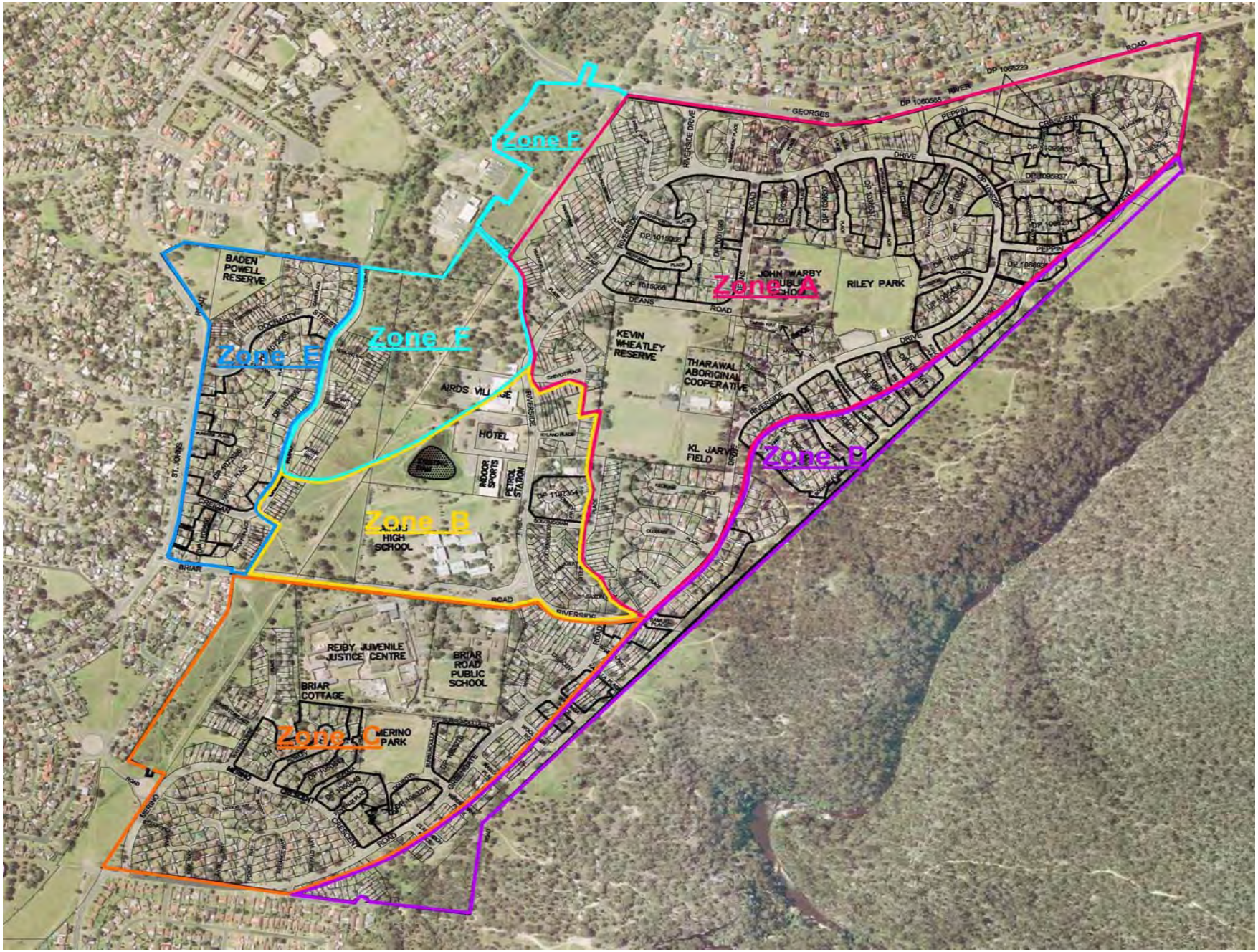
Drawn By:	JC	Date : 20/03/09		JBS Environmental Pty Ltd	
Checked By:	SL	Date : 20/03/09		Airds/Bradbury Redevelopment	
Revision By:		Date:		Test Pit Location Plan	
Scale:	Proportional	A3	Project No: JG09245A		Drawing No: 3



AIRDS HIGH SCHOOL

GeoEnviro Consultancy

Drawn By: JS	Date: 25/3/09	JBS Environmental Pty Ltd	
Checked By: NL	Date: 25/3/09	Airds Bradbury Redevelopment	
Reviewed By:	Date:	Dam Embankment and Borehole Location Plan	
Scale: Proportional	A3	Project No: JG09245A	Drawing No: 4



GeoEnviro Consultancy	Drawn By: JC	Date : 20/03/09		JBS Environmantal Pty Ltd	
	Checked By: SL	Date : 20/03/09		Airds/Bradbury Redevelopment	
	Revision By:	Date:		Site Zoning Plan	
	Scale: Proportional	A3	Project No: JG09245A	Drawing No: 5	

Appendix A

Table A : Summary of Test Pit Profile

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Table A : Summary of Test Pit Profile

CLIENT: JBS Environmental Pty Ltd — Job Number: JG09245A
PROJECT: Airds/Bradbury Redevelopment — Logged By: AF
LOCATION: Airds/Bradbury — Date: 03/03/2009

Test Pit Number	Lot Number	Depth (m) From	Depth (m) To	Material Description
1		0.0	0.15	Topsoil: Clayey Silt: Low liquid limit, grey brown, dry
		0.15	0.30	Gravely Silt: Low liquid limit, white grey, dry
		0.30	1.00	(CH) Silty Clay: High plasticity, red and brown, MC<=PL, PP = >600kPa, hard
		1.00	1.60	(CI) Gravely Silty Clay: Medium plasticity, grey and brown, extremely to distinclty weathered gravel, MC<=PL
		1.60	-	Sandstone: Fine grained, brown, medium strength, refusal at 1.6m
2		0.0	0.15	Topsoil: Clayey Silt: Low liquid limit, grey brown, dry
		0.15	0.30	Gravely Silt: Low liquid limit, white grey, dry
		0.30	0.60	(CH) Silty Clay: High plasticity, brown, MC<PL
		0.60	0.90	(CI) Sandy Silty Clay: Medium plasticity, brown and red and grey
		0.90	1.15	(CI) Gravely Silty Clay: Medium plasticity, grey, extremely to distinclty weathered gravel, MC<=PL
		1.15	-	Sandstone: Fine grained, brown, medium strength, refusal at 1.15m
3		0.0	0.25	Topsoil/Fill: Clayey Silt: Low liquid limit, grey brown, dry
		0.25	1.90	Fill: Gravely Silty Clay: Low to medium plasticity, brown, some sandstone cobbles, 1 boulder (0.6m Diameter), some Clayey Silt, MC<=PL, moderately compacted
		1.90	2.00	Gravely Silty Clay: Red an dgrey, 1 boulder, MC<=PL
		2.00	-	Sandstone: Fine grained, brown, medium strength, refusal at 2.0m
4		0.0	0.15	Topsoil: Clayey Silt: Low liquid limit, grey brown, dry
		0.15	0.40	Gravely Silt: Low liquid limit, grey, dry
		0.40	0.55	(CH) Silty Clay: High plasticity. Red and brown, MC<=PL
		0.55	0.60	Shale/Siltstone: Distinctley weathered, grey brown, medium strength refusal at 0.6m
5		0.0	0.02	Topsoil: Clayey Silt: Low liquid limit, grey brown, dry
		0.20	0.40	Gravely Silt: Low liquid limit, grey brown, dry
		0.40	1.00	(CH) Silty Clay: High plasticity, brown and red, MC<PL, PP = >600kPa
		1.00	1.10	(CI) Shaley Clay: Medium plasticity, grey, extremely to distinctley weathered shale, low strength, MC<=PL
		1.10	-	Sandstone: Distinctley weathered, grey, medium to high strength, refusal at 1.1m
6		0.0	0.15	Topsoil/Fill: Clayey Silt: Low liquid limit, grey brown, dry
		0.15	0.40	Fill: Gravely Silty Clay: Medium plasticity, brown, moderate compaction, MC<PL
		0.40	1.00	(CI-CH) Silty Clay: Medium to high plasticity, red brown and grey, MC<PL
		1.00	1.40	(CI) Gravely Silty Clay: Medium plasticity, red brown and grey, MC<PL
		1.40	2.50	(CI) Shaley Clay: Medium plasticity, grey brown, extremely weathered, MC<PL
		2.50	-	Shale: Distinctley weathered, brown grey, medium strength, refusal at 2.5m
				Notes:
				MC = Moisture Content.
				PL = Plastic Limit.
				PP = Pocket Penetrometer.

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Table A : Summary of Test Pit Profile

CLIENT: JBS Environmental Pty Ltd
PROJECT: Airds/Bradbury Redevelopment
LOCATION: Airds/Bradbury

Job Number: JG09245A
Logged By: AF
Date: 03/03/2009

Test Pit Number	Lot Number	Depth (m) From	Depth (m) To	Material Description
7		0.0	0.37	Topsoil: Clayey Silt: Low liquid limit, grey brown, dry
		0.37	0.55	(CH) Silty Clay: High plasticity, red brown, MC<PL
		0.55	0.80	(CH) Silty Clay: High plasticity, grey red MC<PL
		0.80	1.45	(CI) Gravely Silty Clay: Medium plasticity, grey brown and red, MC<PL
		1.45	1.50	Shale: Distinctly weathered, grey, medium strength, refusal at 1.45m
8		0.0	0.37	Topsoil: Clayey Silt: low liquid limit, grey brown, dry
		0.37	1.00	(CH) Silty Clay: High plasticity, red brown, MC<PL
		1.00	1.40	As above, but grey brown with some gravel
		1.40	1.95	(CI) Shaley Clay: medium plasticity, grey brown with some shale bands, MC<=PL
		1.95	1.95	Shale: Distinctly weathered, grey, medium strength, refusal at 1.95m
9		0.0	0.22	Topsoil: Clayey Silt: low liquid limit, grey brown, dry
		0.22	0.80	(CH) Silty Clay: High plasticity, red brown, MC<PL
		0.80	0.95	(CI) Shaley Clay: medium plasticity, grey brown, MC<=PL
		0.95	1.50	Shale: Distinctly weathered, grey, medium strength, refusal at 1.50m
10		0.0	0.40	Topsoil: Clayey Silt: low liquid limit, grey brown, dry
		0.40	0.90	(CH) Silty Clay: High plasticity, red brown, MC<PL
		0.90	1.40	As above, but grey brown, MC<PL
		1.40	1.80	(CI) Shaley Clay: medium plasticity, grey brown with some shale bands, MC<=PL (Backhoe refusal on hard shale band on 1.80m)
11		0.0	0.10	Topsoil/Fill: Clayey Silt: low liquid limit, grey brown, dry
		0.10	0.20	Fill: Silty Clay: brown, dry, appears loosely comapcted
		0.20	0.40	Topsoil: Clayey Silt: low liquid limit, grey brown, dry
		0.40	0.80	(CH) Silty Clay: High plasticity, red brown, MC<PL
		0.80	1.30	(CI-CH) Gravelly Silty Clay: medium to high plasticity, grey brown
		1.30	2.80	(CI) Shaley Clay: medium plasticity, grey with shale bands
		2.80	2.90	Shale: Distinctly weathered, grey, medium strength, refusal at 2.90m
12		0.0	0.10	Topsoil/Fill: Clayey Silt: low liquid limit, grey brown, dry
		0.10	0.25	Fill: Shale/Silty Clay/topsoil mixture: with one steel and plastic pipe
		0.25	0.60	Topsoil: Clayey Silt: low liquid limit, grey brown, dry
		0.60	1.00	(CH) Silty Clay: high plasticity, red brown with some gravel
		1.00	1.55	(CI-CH) Gravelly Silty Clay: medium to high plasticity, grey brown red
		1.55	3.20	(CI) Shaley Clay: medium plasticity, grey brown with shale bands
		3.20	3.25	Shale: Distinctly weathered, grey, medium strength, refusal at 3.25m
				Notes:
				MC = Moisture Content.
				PL = Plastic Limit.
				PP = Pocket Penetrometer.

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Table A : Summary of Test Pit Profile

CLIENT: JBS Environmental Pty Ltd
PROJECT: Airds/Bradbury Redevelopment
LOCATION: Airds/Bradbury

Job Number: JG09245A
Logged By: AF
Date: 03/03/2009

Test Pit Number	Lot Number	Depth (m) From	Depth (m) To	Material Description
13		0.0	0.55	Topsoil: Clayey Silt: low liquid limit, grey brown with one concrete slab diameter up to 200mm on surface, dry
		0.55	1.05	(CH) Silty Clay: high plasticity, red brown, MC<PL
		1.05	2.10	(CI) Gravelly Silty Clay: medium plasticity, grey brown with shale bands
		2.10	2.50	(CI) Shaley Clay: medium plasticity, grey brown with shale bands
		2.50	2.80	Shale: distinctly weathered, grey, medium strength, refusal at 2.80m
14		0.0	0.40	Fill: Gravelly Silty Clay: medium plasticity, appears loosely comapcted, dry
		0.40	0.65	Topsoil: Clayey Silt: low liquid limit, grey brown, dry
		0.65	1.00	(CH) Silty Clay: high plasticity, red brown with some gravel, MC<PL
		1.00	1.30	As above, but grey brown red
		1.30	2.10	(CI-CH) Gravelly Silty Clay: medium to high plasticity, grey brown
		2.10	2.50	(CI) Shaley Clay: medium plasticity, grey brown with shale bands
		2.50	-	Shale: distinctly weathered, grey, medium strength, refusal at 2.50m
15		0.0	0.25	Topsoil: Clayey Silt: low liquid limit, grey brown, dry
		0.25	0.45	(CH) Silty Clay: high plasticity, red brown, MC<PL
		0.45	0.90	As above, but red brown grey
		0.90	1.20	(CI-CH) Gravelly Silty Clay: medium to high plasticity, grey brown
		1.20	1.50	(CI) Shaley Clay: medium plasticity, grey brown with shale bands
		1.50	1.70	Shale: distinctly weathered, grey, medium strength, refusal at 1.70m
16		0.0	0.25	Topsoil: Clayey Silt: low liquid limit, grey brown, dry
		0.25	0.60	(CH) Silty Clay: high plasticity, red brown, MC<PL
		0.60	2.10	(CI) Shaley Clay: medium plasticity, grey brown with shale bands
		2.10	-	Shale: distinctly weathered, grey, medium strength, refusal at 2.10m
17		0.0	0.30	Topsoil: Clayey Silt: low liquid limit, grey brown, dry
		0.30	0.55	(CI-CH) Gravelly Silty Clay: medium to high plasticity, grey
		0.55	1.70	(CH) Silty Clay: high plasticity, red brown grey, MC<PL
		1.70	1.85	(CI-CH) Gravelly Silty Clay: medium to high plasticity, grey brown
		1.85	2.10	(CI) Shaley Clay: medium plasticity, grey brown with shale bands
		2.10	-	Shale: distinctly weathered, dark grey, medium strength, refusal at 2.10m
18		0.0	0.16	Topsoil: Clayey Silt: low liquid limit, grey brown, dry
		0.16	0.45	Gravelly Silt: low liquid limit, grey
		0.45	0.95	(CH) Silty Clay: high plasticity, red brown, MC<PL
		0.95	1.20	(CL) Sandy Clay: low plasticity, red grey with some sandstone gravel, MC<PL
		1.20	-	Sandstone: distinctly weathered, medium strength, refusal at 1.20m
				Notes:
				MC = Moisture Content.
				PL = Plastic Limit.
				PP = Pocket Penetrometer.

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Table A : Summary of Test Pit Profile

CLIENT: JBS Environmental Pty Ltd
PROJECT: Airds/Bradbury Redevelopment
LOCATION: Airds/Bradbury

Job Number: JG09245A
Logged By: AF
Date: 03/03/2009

Test Pit Number	Lot Number	Depth (m) From	Depth (m) To	Material Description
19		0.0	0.30	Topsoil: Clayey Silt: low liquid limit, grey brown, dry
		0.30	0.90	(CH) Silty Clay: high plasticity, red brown, MC<PL
		0.90	1.50	(CI) Gravelly Silty Clay: medium plasticity, red brown grey, MC<PL
		1.50	2.10	(CI) Shalley Clay: medium plasticity, grey with shale bands
20		0.0	0.20	Topsoil: Clayey Silt: low liquid limit, grey brown, dry
		0.20	0.70	(CH) Silty Clay: high plasticity, red brown, MC<PL
		0.70	0.90	As above, but grey brown
		0.90	1.10	As above, but with some gravel
		1.10	2.10	(CI-CH) Gravelly Silty Clay: medium to high plasticity, grey brown
		2.10	2.80	(CI) Shaley Clay: medium plasticity, grey brown with shale bands
		2.80	2.95	Shale: distinctly weathered, dark grey, low to medium strength
21		0.0	0.05	Topsoil/Fill: Clayey Silt: low liquid limit, grey brown, dry
		0.05	0.15	Fill: Gravelly Silty Clay: medium plasticity, brown (appears loosely compacted)
		0.15	0.30	Topsoil: Clayey Silt: low liquid limit, grey brown, dry
		0.30	0.80	(CH) Silty Clay: high plasticity, red brown, MC<PL
		0.80	2.70	(CI-CH) Gravelly Silty Clay: meidum to high plasticity, grey brown, MC<PL
		2.70	2.90	(CI) Shaley Clay: medium plasticity, grey brown with shale bands
22		0.0	0.40	Fill: Gravelly Silty Clay: medium plasticity, brown, moist (appears loosely compacted)
		0.40	1.00	(CI) Shaley Clay: medium plasticity, grey brown with shale bands
		1.00	1.15	Shale: distinctly weathered, dark grey, medium strength, refusal at 1.15m
23		0.0	0.05	Fill: Gravelly Silty Clay: medium plasticity, brown, moist
		0.05	0.20	(CH) Silty Clay: high plasticity, red brown, MC<PL
		0.20	1.00	(CI) Shaley Clay: medium plasticity, grey brown with shale bands
		1.00	-	Shale: distinctly weathered, dark grey, medium strength, refusal at 1.00m
24		0.0	0.30	Topsoil/Fill: Clayey Silt: low liquid limit, brown with some roots and gravel
		0.30	1.10	Fill: Gravelly Silty Clay: medium to high plasticity, dry to moist (appears loosely to moderately comapcted)
		1.10	1.30	Fill: Shaley Clay: medium plasticity, grey brown with shale fragments
		1.30	2.60	Fill: Gravelly Silty Clay: medium plasticity, brown/black grey (appears moderately compacted), moist
		2.60	-	Sandstone: distinctly weathered, medium strength, refusal at 2.6m
				Notes:
				MC = Moisture Content.
				PL = Plastic Limit.
				PP = Pocket Penetrometer.

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Table A : Summary of Test Pit Profile

CLIENT: JBS Environmental Pty Ltd
PROJECT: Airds/Bradbury Redevelopment
LOCATION: Airds/Bradbury

Job Number: JG09245A
Logged By: AF
Date: 03/03/2009

Test Pit Number	Lot Number	Depth (m) From	Depth (m) To	Material Description
25		0.0	0.002	Topsoil/Fill: Clayey Silt: low liquid limit, dry
		0.002	0.70	Fill: Ripped Sandstone with cobbles and boulders
		0.70	1.20	(SC) Clayey Sand: fine to medium grained, brown with some roots
		1.20	1.35	(CL) Sandy Clay: low plasticity, brown grey with some gravel
		1.35	-	Sandstone: distinctly weathered, medium strength, refusal at 1.35m
26		0.0	0.25	Fill: Crushed Sandstone
		0.25	0.65	(CH) Silty Clay: high plasticity, brown red
		0.65	1.10	(CH) Silty Clay: high plasticity, grey brown with some gravel, MC<PL
		1.10	-	Sandstone: distinctly weathered, medium strength, refusal at 1.10m
27		0.0	0.30	Topsoil: Clayey Silt: low liquid limit, grey brown, moist
		0.30	0.90	(CH) Silty Clay: high plasticity, red brown, MC<PL
		0.90	1.30	(CI) Shaley Clay: medium plasticity, grey brown with shale bands, MC<PL
		1.30	1.90	(CI) Gravelly Silty Clay: medium plasticity, grey brown
		1.90	2.70	(CI) Shaley Clay: medium plasticity, grey brown with shale bands, MC<PL
		2.70	2.80	Shale: distinctly weathered, grey brown, low to medium strength, refusal at 2.80m
28		0.0	0.05	Topsoil/Fill: Clayey Silt: low liquid limit, grey brown, moist
		0.05	0.25	Fill: Gravelly Silty Clay: medium plasticity, brown grey, dry, appears loosely comapcted
		0.25	0.35	Fill: Sandstone, appears loosely comapcted
		0.35	0.40	Fill: Gravel
		0.40	0.55	Topsoil: Clayey Silt: low liquid limit, grey brown, dry to moist
		0.55	1.10	(CH) Silty Clay: high plasticity, red brown, MC<=PL
		1.10	1.40	As above, but grey brown red
		1.40	1.70	As above, but with some gravel
		1.70	2.90	(CI-CH) Silty Clay: medium to high plasticity, grey brown with gravel
		2.90	2.95	Shale: distinctly weathered, grey, medium strength, refusal at 2.9m
29		0.0	0.35	Topsoil: Clayey Silt: low liquid limit, grey brown, moist
		0.35	0.55	(CH) Silty Clay: high plasticity, red brown, MC<=PL
		0.55	1.00	As above, but grey red brown, MC<PL
		1.00	2.00	(CI-CH) Gravelly Silty Clay: medium to high plasticity, grey brown, MC=PL
		2.00	2.45	(CI) Shaley Clay: medium plasticity, dark grey brown with shale bands
		2.45	3.00	Shale: distinctly weathered, dark grey, medium strength, refusal at 3.0m
				Notes:
				MC = Moisture Content.
				PL = Plastic Limit.
				PP = Pocket Penetrometer.

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Table A : Summary of Test Pit Profile

CLIENT: JBS Environmental Pty Ltd
PROJECT: Airds/Bradbury Redevelopment
LOCATION: Airds/Bradbury

Job Number: JG09245A
Logged By: AF
Date: 03/03/2009

Test Pit Number	Lot Number	Depth (m) From	Depth (m) To	Material Description
30		0.0	0.30	Fill: Gravelly Silty Clay: medium plasticity, brown with fine to coarse grained gravel, dry, appears loosely compacted
		0.30	0.40	Topsoil: Clayey Silt: low liquid limit, grey brown, dry to moist
		0.40	0.60	Gravelly Sandy Silt
		0.60	0.70	(CH) Silty Clay: high plasticity, brown with some gravel
		0.70	-	Shale/Siltstone: distinctly weathered, dark grey brown, refusal at 0.7m
31		0.0	0.20	Gravelly Sandy Silt: low liquid limit, grey
		0.20	0.50	(CH) Silty Clay: high plasticity, brown, MC<PL
		0.50	0.80	As above, but with some gravel
		0.80	1.30	(CI-CH) Gravelly Silty Clay: medium to high plasticity, grey brown red
		1.30	1.40	Shale: extremely to distinctly weathered, grey, low to meidum strength, refusal at 1.40m
32		0.0	0.10	Topsoil/Fill: Clayey Silt: low liquid limit, grey brown, moist
		0.10	0.25	Fill: Silty Clay: medium to high plasticity, brown with some gravel, appear loosely comapcted
		0.25	0.60	Topsoil: Clayey Silt: low liquid limit, grey brown
		0.60	1.40	(CH) Silty Clay: high plasticity, brown, MC<PL
		1.40	1.80	Shale/Siltstone: Distinctly weathered, medium strength, refusal at 1.80m
33		0.0	0.10	Topsoil/Fill: Clayey Silt: low liquid limit, grey brown
		0.10	0.30	Fill: Gravelly Silty Clay: medium plasticity, brown, dry, appears loosely compacted
		0.30	0.45	Topsoil: Clayey Silt: low liquid limit, grey brown
		0.45	0.65	(CI) Gravelly Silty Clay: medium plasticity, grey
		0.65	0.80	(CH) Silty Clay: high plasticity, brown with some gravel
		0.80	-	Shale: distinctly weathered, dark grey brown, medium strength, refusal at 0.80m
34		0.0	0.15	Topsoil: Clayey Silt: low liquid limit, grey brown
		0.15	0.35	Gravelly Sandy Silt
		0.35	0.60	(CH) Silty Clay: high plasticity, red brown, MC<PL
		0.60	1.00	As above, but grey red brown, MC<PL
		1.00	1.30	(GC) Clayey Gravel: grey , dry
		1.30	-	Shale: distinctly weathered, dark grey brown, medium strength, refusal at 1.30m
				Notes: MC = Moisture Content. PL = Plastic Limit. PP = Pocket Penetrometer.

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Table A : Summary of Test Pit Profile

CLIENT: JBS Environmental Pty Ltd
PROJECT: Airds/Bradbury Redevelopment
LOCATION: Airds/Bradbury

Job Number: JG09245A
Logged By: AF
Date: 03/03/2009

Test Pit Number	Lot Number	Depth (m) From	Depth (m) To	Material Description
35		0.0	0.05	Topsoil: Clayey Silt: low liquid limit, grey brown, moist
		0.05	1.20	Fill: Sandstone/Gravelly Silty Clay mixture, dry, appears loosely to moderately comapcted
		1.20	2.0	Fill: Gravelly Silty Clay: medium plasticity, grey with some sandstone bounders, very wet
		2.0	2.10	(CI) Shaley Clay: medium plasticity, grey brown with shale bands
		2.10	-	Shale: distinctly weathered, dark grey brown, medium strength, refusal at 2.10m
36		0.0	0.05	Topsoil: Clayey Silt: low liquid limit, grey brown, moist
		0.05	0.25	Fill: Gravelly Silty Clay: medium plasticity, brown mixture with some cobbles
		0.25	0.45	(ML) Gravelly Sandy Silt: low liquid limit, grey, dry
		0.45	-	Sandstone: distinctly weathered, fine grained, medium strength, refusal at 0.45m
37		0.0	0.05	Topsoil: Clayey Silt: low liquid limit, grey brown, moist
		0.05	0.25	Fill: Gravelly Silty Clay: medium plasticity, brown, dry, appears loosely comapcted
		0.25	0.45	(ML) Gravelly Sandy Silt: low liquid limit, grey, dry
		0.45	0.90	(CH) Silty Clay: high plasticity, brown, MC<PL
		0.90	1.50	As above, but red brown grey
		1.50	1.70	(CI) Shaley Clay: medium plasticity, brown
		1.70	1.90	As above, but grey
		1.90	-	Shale: distinctly weathered, dark grey brown, medium strength, refusal at 1.90m
38		0.0	0.30	Topsoil: Clayey Silt: low liquid limit, grey brown, moist
		0.30	0.65	(CL) Sandy Clay: low plasticity, brown
		0.65	0.95	(CL) Gravelly Sandy Clay: low plasticity, grey with fine to coarse grained gravel
		0.95	-	Sandstone: distinctly weathered, fine grained, medium strength, refusal at 0.95m
39		0.0	0.45	Topsoil: Clayey Silt: low liquid limit, grey brown, moist
		0.45	0.60	(CH) Silty Clay: high plasticity, brown, MC<PL
		0.60	1.00	(CI-CH) Gravelly Silty Clay: medium to high plasticity, red brown, MC<PL
		1.00	-	Sandstone: distinctly weathered, fine grained, medium strength, refusal at 1.00m
				Notes:
				MC = Moisture Content.
				PL = Plastic Limit.
				PP = Pocket Penetrometer.

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Table A : Summary of Test Pit Profile

CLIENT: JBS Environmental Pty Ltd
PROJECT: Airds/Bradbury Redevelopment
LOCATION: Airds/Bradbury

Job Number: JG09245A
Logged By: AF
Date: 03/03/2009

Test Pit Number	Lot Number	Depth (m) From	Depth (m) To	Material Description
40		0.0	0.30	Topsoil: Clayey Silt: low liquid limit, grey brown, moist
		0.30	0.45	(ML) Gravelly Sandy Silt: low liquid limit, brown, very dry
		0.45	0.75	(GC) Clayey Sandy Gravel: fine to medium grained gravel, brown red, dry
		0.75	1.10	(CL-CI) Gravelly Silty Clay: low to medium plasticity, brown with some cobbles
41		0.0	0.20	Topsoil: Clayey Silt: low liquid limit, grey brown, moist
		0.20	0.40	(ML) Gravelly Sandy Silt: low liquid limit
		0.40	1.00	(CH) Silty Clay: high plasticity, red brown with a trace of coarse gravel, MC<PL
		1.00	1.70	As above, but grey brown red, MC<PL
		1.70	2.10	(CI-CH) Gravelly Silty Clay: medium to high plasticity, grey brown red
		2.10	-	Sandstone: distinctly weathered, medium strength, refusal at 2.1m
42		0.0	0.10	Topsoil/Fill: Silty Sand: fine to medium grained, dark brown with some fine to medium grained gravel and roots, dry
		0.10	1.30	Topsoil/Fill: Clayey Silt: low liquid limit, brown with two tree roots fragments and two broken clay pipe
		1.30	1.75	(CH) Silty Clay: high plasticity, red brown, MC<PL
		1.75	2.20	As above, but red brown grey
		2.20	2.30	(CI) Gravelly Silty Clay: medium plasticity, grey brown
		2.30	-	Shale: distinctly weathered, dark grey brown, medium strength, refusal at 2.3m
43		0.0	0.10	Topsoil: Clayey Silt: low liquid limit, grey brown, moist
		0.10	0.30	(ML) Gravelly Sandy Silt: low liquid limit, grey brown
		0.30	0.85	(CH) Silty Clay: high plasticity, red brown, MC<PL
		0.85	1.10	As above, but grey brown red with some gravel
		1.10	1.40	(GC) Clayey Sandy Gravel: fine to medium grained, brown
		1.40	-	Shale: distinctly weathered, grey, medium to high strength, refusal at 1.40m
44		0.0	0.40	Fill: Silty Clay: medium plasticity, brown with some gravel, dry, appears loosely compacted
		0.40	0.65	(CI) Shaley Clay: medium plasticity, brown with shale bands
		0.65	-	Shale: distinctly weathered, grey, medium to high strength, refusal at 0.65m
45		0.0	0.30	Topsoil/Fill: Clayey Silt: low liquid limit, brown with a treace of sandstone gravel
		0.30	0.70	(CH) Silty Clay: high plasticity, red brown, MC<PL
		0.70	1.20	As above, but grey brown red
		1.20	1.35	(CL-CI) Gravelly Silty Clay: low to medium plasticity, grey brown red
		1.35	-	Shale: distinctly weathered, grey, medium strength, refusal at 2.30m

Notes:
MC = Moisture Content.
PL = Plastic Limit.
PP = Pocket Penetrometer.

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Table A : Summary of Test Pit Profile

CLIENT: JBS Environmental Pty Ltd
PROJECT: Airds/Bradbury Redevelopment
LOCATION: Airds/Bradbury

Job Number: JG09245A
Logged By: AF
Date: 03/03/2009

Test Pit Number	Lot Number	Depth (m) From	Depth (m) To	Material Description
46		0.0	0.40	Topsoil: Clayey Silt: low liquid limit, grey brown, moist
		0.40	0.70	(CH)Silty Clay: high plasticity, red brown, MC<PL
		0.70	1.20	As above, but grey brown red, MC<PL
		1.20	2.60	As above, but with some gravel
		2.60	-	Shale: distinctly weathered, grey brown, medium strengthm refusal at 2.60m
47		0.0	0.15	Fill: Silty Clay: medium to high plasticity, red brown, dry, appears loosely comapcted
		0.15	0.40	Topsoil: Clayey Silt: low liquid limit, grey brown, dry
		0.40	0.70	(CH)Silty Clay: high plasticity, red brown, MC<PL
		0.70	0.90	As above, but grey brown red
		0.90	2.30	(CI) Shaley Clay: medium plasticity, grey brown
		2.30	-	Shale: distinctly weathered, grey brown, medium strengthm refusal at 2.30m
48		0.0	0.35	Topsoil: Clayey Silt: low liquid limit, grey brown, moist
		0.35	0.55	(CH)Silty Clay: high plasticity, red brown, MC<PL
		0.55	0.70	(CI) Shaley Clay: medium plasticity, grey brown
		0.70	-	Shale: distinctly weathered, grey brown, medium strengthm refusal at 0.7m
49		0.0	0.40	Fill: Gravelly Silty Clay: medium plasticity, brown with some cobble and small concrete fragments and broken brick
		0.40	0.55	(CH)Silty Clay: high plasticity, red brown, MC<PL
		0.55	1.20	(CI) Shaley Clay: medium plasticity, grey brown with shale bands
		1.20	1.60	Shale: distinctly weathered, grey, medium strength, refusal at 1.60m
50		0.0	0.30	Topsoil: Clayey Silt: low liquid limit, grey brown, moist
		0.30	0.50	(CH)Silty Clay: high plasticity, red brown with a trace of gravel, MC<PL
		0.50	2.80	(CI) Shaley Clay: meidum plasticity, grey brown with shale bands
51		0.0	0.25	Topsoil/Fill: Clayey Silt: low liquid limit, grey brown, moist
		0.25	0.35	Fill: Silty Clay: high plasticity, red brown, dry
		0.35	0.55	Topsoil: Clayey Silt: low liquid limit, grey brown
		0.55	0.85	(CH)Silty Clay: high plasticity, red brown, MC<PL
		0.85	1.40	As above, but grey brown red, MC<PL
		1.40	2.20	(CI-CH) Silty Clay: medium to high plasticity, grey brown red with some gravel, MC<PL
		2.20	-	Sandstone: distinctly weathered, brown grey, medium strength, refusal at 2.20m
				Notes: MC = Moisture Content. PL = Plastic Limit. PP = Pocket Penetrometer.

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Table A : Summary of Test Pit Profile

CLIENT: JBS Environmental Pty Ltd
PROJECT: Airds/Bradbury Redevelopment
LOCATION: Airds/Bradbury

Job Number: JG09245A
Logged By: AF
Date: 03/03/2009

Test Pit Number	Lot Number	Depth (m) From	Depth (m) To	Material Description
52		0.0	0.05	Topsoil/Fill: Clayey Silt: low liquid limit, dark brown, dry
		0.05	0.25	Fill: Silty Clay: medium plasticity, brown
		0.25	0.60	Fill: Clayey Silt: low liquid limit, dark grey
		0.60	0.90	(CH) Silty Clay: high plasticity, red brown, MC<PL
		0.90	1.30	As above, medium to high plasticity, brown red with some gravel
		1.30	1.90	(CI) Silty Clay: medium plasticity, grey brown red with some gravel, MC<=PL
		1.90	-	Sandstone: distinctly weathered, grey, medium, refusal at 1.90m
53		0.0	0.20	Fill: Silty Clay: medium to high plasticity, red brown with some gravel and roots, dry, appears loosely comapcted
		0.20	0.55	Topsoil: Silty Sand: fine to medium grained, black brown with two sandstone boulders
		0.55	0.80	(CH) Silty Clay: high plasticity, brown, MC=PL
		0.80	-	Sandstone: distinctly weathered, grey, medium, refusal at 0.80m
54		0.0	0.10	Topsoil/Fill: Clayey Silt: low liquid limit, moist
		0.10	1.00	Fill: Gravelly Silty Clay: medium to high plasticity, brown some sandstone cobbles, dry to moist, appears moderately compacted
		1.00	-	Sandstone: distinctly weathered, grey, medium, refusal at 0.80m
55		0.0	0.20	Topsoil: Clayey Silt: low liquid limit, moist
		0.20	0.35	Fill: Silty Clay: high plasticity, brown red, dry, appears loosely comapcted
		0.35	0.55	Fill: Silty Clay: medium to high plasticity, brown red with some gravel, appears loosely comapcted
		0.55	0.95	Topsoil: Clayey Silt: low liquid limit
		0.95	1.10	(ML) Gravelly Sandy Silt: low liquid limit
		1.10	1.50	(CH) Silty Clay: high plasticity, brown, MC<PL
		1.50	1.80	As above, but grey brown with some gravel
		1.80	2.00	(CI) Shaley Clay: medium plasticity, grey brown with some shale bands
		2.00	2.30	Shale: distinctly weathered, grey brown, low to medium strength, refusal at 2.30m
56		0.0	0.65	Fill: Silty Clay: brown mixture with a lot of building rubbles, such as bricks, concrete, tiles and glass.
		0.65	1.25	(CH) Silty Clay: high plasticity, red brown, MC<PL
		1.25	2.50	As above, but grey brown red, MC=PL
		2.50	2.90	(CI) Shaley Clay: medium plasticity, dark grey with some shale bands
		2.90	-	Shale: distinctly weathered, dark grey brown, medium strength, refusal at 2.90m

Notes:
MC = Moisture Content.
PL = Plastic Limit.
PP = Pocket Penetrometer.

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Table A : Summary of Test Pit Profile

CLIENT: JBS Environmental Pty Ltd
PROJECT: Airds/Bradbury Redevelopment
LOCATION: Airds/Bradbury

Job Number: JG09245A
Logged By: AF
Date: 03/03/2009

Test Pit Number	Lot Number	Depth (m) From	Depth (m) To	Material Description
57		0.0	0.05	Topsoil: Clayey Silt: low liquid limit, grey, moist
		0.05	0.50	(CI-CH) Silty Clay: medium to high plasticity, red brown with some gravel
		0.50	1.90	(CI) Shaley Clay: medium plasticity, grey brown with shale bands, MC<=PL
		1.90	2.50	Shale: extremely to distinctly weathered, grey with clay bands, low strength, refusal at 2.50m
58		0.0	0.65	Fill: Gravelly Silty Clay: low to medium plasticity, brown mixture with a lot of building rubbles, such as broken bricks, small concrete fragments, broken glass, tile, plastic and timber, appears loosely comapcted
		0.65	1.05	Topsoil: Clayey Silt: low liquid limit, grey brown
		1.05	1.50	(CI-CH) Silty Clay: medium to high plasticity, brown, MC<PL
		1.50	2.40	As above, but high plasticity, grey brown red with some gravel, MC<PL
		2.40	3.10	(CI-CH) Gravelly Silty Clay: medium to high plasticity, grey brown, refsual on gravel at 3.10m
59		0.0	0.30	Topsoil: Clayey Silt: low liquid limit, grey brown, dry to moist
		0.30	0.70	(CH) Silty Clay: high plasticity, red brown, MC<PL
		0.70	1.00	As above, but grey brown with some gravel
		1.00	1.10	(CI) Gravelly Silty Clay: medium plasticity, grey brown, MC<PL
		1.10	1.20	Shale: distinctly weathered, grey, medium strength, refusal at 1.20m
60		0.0	0.25	Topsoil: Clayey Silt: low liquid limit, grey brown, dry to moist
		0.25	0.45	(CH) Silty Clay: high plasticity, red brown, MC<PL
		0.45	1.00	As above, but red brown grey, MC<PL
		1.00	1.15	Shale: extremely to distinctly weathered, grey, low to medium strength, refusal at 1.15m
61		0.0	0.15	Fill: Gravelly Silty Clay/Gravelly Clayey Silt: low liquid limit, brown with some building rubble
		0.15	0.40	(ML) Gravelly Sandy Silt
		0.40	0.90	(CH) Silty Clay: high plasticity, red brown, MC<PL
		0.90	1.10	(CH) Gravelly Silty Clay: high plasticity, grey brown red, MC<PL
		1.10	-	Shale: distinctly weathered, grey, medium strength, refusal at 1.10m
62		0.0	0.10	Topsoil/Fill: Clayey Silt: low liquid limit, dry to moist
		0.10	0.25	Fill: Gravelly Silty Clay: low to medium plasticity, brown
		0.25	0.50	Fill: Clayey Silt: low liquid limit, dark brown
		0.50	0.70	Fill: Silty Clay: high plasticity, red brown
		0.70	1.40	As above, but grey brown mixture with some topsoil and gravel
		1.40	1.55	(CH) Silty Clay: high plasticity, red brown
		1.55	2.00	(CI-CH) Silty Clay: medium to high plasticity, brown grey red with some gravel
		2.00	2.30	(CI) Shaley Clay: medium strength, grey brown with shale bands
		2.30	-	Backhoe- Auger refusal (shale ?)
				Notes:
				MC = Moisture Content.
				PL = Plastic Limit.
				PP = Pocket Penetrometer.

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Table A : Summary of Test Pit Profile

CLIENT: JBS Environmental Pty Ltd
PROJECT: Airds/Bradbury Redevelopment
LOCATION: Airds/Bradbury

Job Number: JG09245A
Logged By: AF
Date: 03/03/2009

Test Pit Number	Lot Number	Depth (m) From	Depth (m) To	Material Description
63		0.0	1.20	Fill: Topsoil: Clayey Silt/Silty Clay: grey brown mixture with some fine roots
		1.20	1.80	(CH) Silty Clay: high plasticity, red grey, MC<PL
		1.80	3.90	(CI) Shaley Clay: medium plasticity, grey brown with shale bands, MC<PL
				(Backhoe-Auger terminated at 3.9m)
64		0.0	0.20	Topsoil: Silty Sand: fine to medium grained, brown with roots, dry
		0.20	0.70	(CH) Silty Clay: high plasticity, red brown, MC<PL
		0.70	0.90	As above, grey brown
		0.90	1.30	(CI) Gravelly Silty Clay: medium plasticity, grey
		1.30	-	Shale: distinctly weathered, grey brown, medium strength
				Backhoe-Auger refusal on shale at 1.30m
65		0.0	0.05	Topsoil: Clayey Silt: low liquid limit, grey brown, dry to moist
		0.05	0.25	(ML) Gravelly Sandy Silt
		0.25	0.60	(CH) Silty Clay: high plasticity, brown, MC<PL
		0.60	0.90	(CI) Gravelly Silty Clay: medium plasticity, brown grey
		0.90	1.40	As above, but low to medium plasticity, grey brown
		1.40	1.60	Sandstone: extremely to distinctly weathered, grey, very low strength
		1.60	-	As above, but medium to high strength, refusal at 1.60m
66		0.0	0.05	Topsoil/Fill: Clayey Silt: low liquid limit, grey brown, dry to moist
		0.05	0.15	Fill: Gravelly Silty Clay: low to medium plasticity, dry, appears loosely compacted
		0.15	0.30	Topsoil: Clayey Silt: low liquid limit, grey brown
		0.30	0.70	(CL-CI) Gravelly Sandy Clay: low to medium plasticity, brown red
		0.70	1.40	As above, but grey brown red
		1.40	1.80	(CI) Shaley Clay: medium plasticity, grey brown with shale bands
		1.80	-	Sandstone: distinctly weathered, grey, low to medium strength, refusal at 1.80m
67		0.0	0.05	Topsoil/Fill: Clayey Silt: low liquid limit, grey brown
		0.05	0.20	Fill: Silty Clay: medium to high plasticity, brown, MC<PL, appears loosely comapcted
		0.20	0.35	Topsoil: Clayey Silt: low liquid limit, grey brown
		0.35	0.80	(CH) Silty Clay: high plasticity, red brown, MC<PL
		0.80	1.10	(CI-CH) Gravelly Silty Clay: medium to high plasticity, grey brown red
		1.10	1.50	(CI) Shaley Clay: medium plasticity, grey brown with shale bands
		1.50	1.70	Shale: distinctly weathered, grey, low to medium strength, refusal at 1.70m

Notes:
MC = Moisture Content.
PL = Plastic Limit.
PP = Pocket Penetrometer.

Appendix B

Borehole Reports - Dam Investigation

GeoEnviro Consultancy Pty Ltd

Borehole Report

Borehole no: 1

Client:	JBS Environmental	Job no:	JG09245B
Project:	Airds Bradbury Redevelopment - Dam Embankment	Date:	24/03/2009
Location:	Community Centre/Sports Centre, Airds	Logged by:	SG
		Checked By:	SL

Drill Model and Mounting: PD 5 | Slope: 90 degrees | R.L. Surface: -

Hole Diameter: 100 mm | Bearing: - | Datum: -

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer (kPa)	Structure and Additional Observations
V - B I T	N I L	NO GROUNDWATER ENCOUNTERED		0.0			Fill: Silty Clay: meidum to high plasticity, grey red brown	D	Vst-H		
				1.0			As above, but brown	D			
			N=17 2,6,11	2.0			As above, but with some fine to coarse grained gravel				V-bit refusal at 2.2m
T C - B I T			N>=10 10/150 mm				Fill: Crushed rock: low to medium strength				SPT bouncing
				3.0		CI	Silty Clay: medium plasticity, grey brown with some ironstone gravel and shale bands	MC <= PL	St-Vst		
			N>3 3/5mm				Siltstone: distinctly weathered, brown, medium strength				
				4.0			End of BH 1 at 3.6m				
				5.0							
				6.0							
				7.0							
				8.0							

GeoEnviro Consultancy Pty Ltd

Borehole Report

Borehole no: 2

Client:	JBS Environmental	Job no:	JG09245B
Project:	Airds Bradbury Redevelopment - Dam Embankment	Date:	24/03/2009
Location:	Community Centre/Sports Centre, Airds	Logged by:	SG
		Checked By:	SL

Drill Model and Mounting: PD 5 | Slope: 90 degrees | R.L. Surface: -

Hole Diameter: 100 mm | Bearing: - | Datum: -

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description (Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component)	Moisture Content	Consistency/Density Index	Hand Penetrometer (kPa)	Structure and Additional Observations
V - B I T				0.0			Fill: Silty Clay: medium plasticity, grey red	D	Vst		
			N=7 4,3,4	1.0			As above, but brown grey with some ironstone gravel				
							As above, but medium to high plasticity, brown	D-M			
			N=8 2,4,4	2.0			As above, but red brown mottled grey			500	
			N=16 4,8,8	3.0		CH	Silty Clay: high plasticity, red brown		Vst-H		
				4.0			As above, but medium plasticity, yellow brown				
			N>10 3,5,5			CI-CH	Silty Clay: medium to high plasticity, grey brown with some siltstone/shale bands		St	250	V-bit refusal at 4.9m SPT bouncing at 4.9m
T C				5.0			Siltstone/Shale: distinctly weathered, grey brown, medium strength				TC-bit refusal at 4.9m
							End of BH 2 at 4.9m				
				6.0							
				7.0							
				8.0							

GeoEnviro Consultancy Pty Ltd

Borehole Report

Borehole no: 3

Client:	JBS Environmental	Job no:	JG09245B
Project:	Airds Bradbury Redevelopment - Dam Embankment	Date:	24/03/2009
Location:	Community Centre/Sports Centre, Airds	Logged by:	SG
		Checked By:	SL

Drill Model and Mounting: PD 5 | Slope: 90 degrees | R.L. Surface: -

Hole Diameter: 100 mm | Bearing: - | Datum: -

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description (Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component)	Moisture Content	Consistency/Density Index	Hand Penetrometer (kPa)	Structure and Additional Observations
V - B I T	N I L			0.0			Topsoil/Fill: Clayey Silt: brown	D			
							Fill: Silty Clay: medium to high plasticity, brown grey	D-M			
			N=7 2,4,3	1.0			Fill: Gravelly Silty Clay: medium to high plasticity, brown red with irosntone gravel		Vst	350	
			N=7 1,2,5	2.0		CH	Silty Clay: high plasticity, red brown		St		Natural (?)
							As above, but with siltstone bands: thickness=100mm				
			N=12 4,8,4	3.0		CI	Silty Clay: medium plasticity, brown red	MC= PL	St		
T C - B I T				4.0			Siltstone: extremely to distinctly weathered, brown with clay bands, low strength				
			N>10 10/50 mm	5.0			Shale: distinctly weathered, grey with ironstone bands, low stength				SPT bouncing
		▼					As above, but low to medium strength				Water seepage encounetred at 5.5m (1 hour after borehole drilling)
				6.0			End of BH 3 at 6.0m				TC-bit refusal at 6.0m
				7.0							
				8.0							

GeoEnviro Consultancy Pty Ltd

Borehole Report

Borehole no: 4

Client:	JBS Environmental	Job no:	JG09245B
Project:	Airds Bradbury Redevelopment - Dam Embankment	Date:	24/03/2009
Location:	Community Centre/Sports Centre, Airds	Logged by:	SG
		Checked By:	SL

Drill Model and Mounting: PD 5 | Slope: 90 degrees | R.L. Surface: -

Hole Diameter: 100 mm | Bearing: - | Datum: -

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer (kPa)	Structure and Additional Observations
V				0.0			Topsoil: Clayey Silt: low liquid limit, grey	D			
TC - BIT						CH	Silty Clay: high plasticity, red brown	MC <PL	H		
			N=14 2,6,8	1.0		CI-CH	Silty Clay: medium to high plasticity, grey red with some siltstone bands	MC< PL	H		
							As above, but medium plasticity, grey orange with a trace of gravel	MC= PL			SPT bouncing
			N>10 10/ 20mm	2.0			Siltstone/Shale: distinctly weathered, grey brown, medium strength				
				3.0							
							End of BH 4 at 3.5m				TC-Bit refusal at 3.5m
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

GeoEnviro Consultancy Pty Ltd

Borehole Report

Borehole no: 5

Client:	JBS Environmental	Job no:	JG09245B
Project:	Airds Bradbury Redevelopment - Dam Embankment	Date:	24/03/2009
Location:	Community Centre/Sports Centre, Airds	Logged by:	SG
		Checked By:	SL

Drill Model and Mounting: PD 5 | Slope: 90 degrees | R.L. Surface: -

Hole Diameter: 100 mm | Bearing: - | Datum: -

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer (kPa)	Structure and Additional Observations
V				0.0			Topsoil: Clayey Silt: low liquid limit, grey	D			
TC-BIT						CI	Silty Clay: medium plasticity, brown with some fine gravel	MC <PL	Vst-H		
				1.0			Siltstone: distinctly weathered, grey, medium strength				
							End of BH 5 at 1.1m				TC-bit refusal at 1.1m
				2.0							
				3.0							
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

GeoEnviro Consultancy Pty Ltd

Borehole Report

Borehole no: 6

Client:	JBS Environmental	Job no:	JG09245B
Project:	Airds Bradbury Redevelopment - Dam Embankment	Date:	24/03/2009
Location:	Community Centre/Sports Centre, Airds	Logged by:	SG
		Checked By:	SL

Drill Model and Mounting: PD 5 | Slope: 90 degrees | R.L. Surface: -

Hole Diameter: 100 mm | Bearing: - | Datum: -

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer (kPa)	Structure and Additional Observations
V-BIT	NIL	DRY		0.0		CH -	Topsoil: Clayey Silt: low liquid limit, brown Silty Clay: high plasticity, red brown	D MC= PL			
TC-BIT				1.0			Siltstone: distinctly weathered, grey brown with clay bands, low strength As above, but low to medium strength				
				2.0			Siltstone/Shale: distinctly weathered, grey medium strength End of BH 6 at 1.8m				
				3.0							
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

Appendix C

Salinity Laboratory Test Certificates

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

CERTIFICATE OF ANALYSIS 26640

Client:
Geoenviro Consultancy Pty Ltd
PO Box 1543, Macquarie Centre
North Ryde
NSW 2113

Attention: Solern Liew

Sample log in details:

Your Reference:	**JG09245A, Airds**
No. of samples:	54 Soils
Date samples received:	16/02/09
Date completed instructions received:	16/02/09@6pm

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

Report Details:

Date results requested by:	24/02/09
Date of Preliminary Report:	Not Issued
Issue Date:	24/02/09

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

Results Approved By:

Jacinta Hurst
Operations Manager

Miscellaneous Inorg - soil						
Our Reference:	UNITS	26640-1	26640-2	26640-3	26640-4	26640-5
Your Reference	----------	TP1	TP1	TP1	TP8	TP8
Depth	----------	0.0-0.1	0.6-0.7	1.1-1.2	0.0-0.1	0.55-0.65
Date Sampled		10/02/09-13/02/09	10/02/09-13/02/09	10/02/09-13/02/09	10/02/09-13/02/09	10/02/09-13/02/09
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	19/02/2009	19/02/2009	19/02/2009	19/02/2009	19/02/2009
Date analysed	-	23/02/2009	23/02/2009	23/02/2009	23/02/2009	23/02/2009
pH 1:5 soil:water	pH Units	6.2	4.3	4.8	5.6	5.5
Electrical Conductivity 1:5 soil:water	µS/cm	170	380	570	75	110
Sulphate, SO4 1:5 soil:water	mg/kg	<25	73	220	34	38
Chloride 1:5 soil:water	mg/kg	<100	520	610	<100	<100

Miscellaneous Inorg - soil						
Our Reference:	UNITS	26640-6	26640-7	26640-8	26640-9	26640-10
Your Reference	----------	TP8	TP14	TP14	TP14	TP16
Depth	----------	1.5-1.6	0.0-0.1	0.5-0.6	1.5-1.6	0.0-0.1
Date Sampled		10/02/09-13/02/09	10/02/09-13/02/09	10/02/09-13/02/09	10/02/09-13/02/09	10/02/09-13/02/09
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	19/02/2009	19/02/2009	19/02/2009	19/02/2009	19/02/2009
Date analysed	-	23/02/2009	23/02/2009	23/02/2009	23/02/2009	23/02/2009
pH 1:5 soil:water	pH Units	5.5	6.8	5.2	4.2	5.5
Electrical Conductivity 1:5 soil:water	µS/cm	390	80	230	580	58
Sulphate, SO4 1:5 soil:water	mg/kg	73	<25	180	480	<25
Chloride 1:5 soil:water	mg/kg	530	<100	200	550	<100

Miscellaneous Inorg - soil						
Our Reference:	UNITS	26640-11	26640-12	26640-13	26640-14	26640-15
Your Reference	----------	TP16	TP16	TP18	TP18	TP18
Depth	----------	0.3-0.4	1.0-1.1	0.0-0.1	0.45-0.55	0.95-1.05
Date Sampled		10/02/09-13/02/09	10/02/09-13/02/09	10/02/09-13/02/09	10/02/09-13/02/09	10/02/09-13/02/09
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	19/02/2009	19/02/2009	19/02/2009	19/02/2009	19/02/2009
Date analysed	-	23/02/2009	23/02/2009	23/02/2009	23/02/2009	23/02/2009
pH 1:5 soil:water	pH Units	4.9	4.8	6.0	5.9	4.9
Electrical Conductivity 1:5 soil:water	µS/cm	54	110	61	69	49
Sulphate, SO4 1:5 soil:water	mg/kg	<25	57	<25	<25	33
Chloride 1:5 soil:water	mg/kg	<100	<100	<100	<100	<100

Miscellaneous Inorg - soil **Our Reference:** **Your Reference** **Depth** **Date Sampled** **Type of sample**	**UNITS** ---------- ----------	**26640-16** **TP25** **0.0-0.2** **10/02/09-13/02/09** **Soil**	**26640-17** **TP25** **0.2-0.3** **10/02/09-13/02/09** **Soil**	**26640-18** **TP25** **1.2-1.3** **10/02/09-13/02/09** **Soil**	**26640-19** **TP26** **0.0-1.0** **10/02/09-13/02/09** **Soil**	**26640-20** **TP26** **0.25-0.35** **10/02/09-13/02/09** **Soil**
Date prepared	-	19/02/2009	19/02/2009	19/02/2009	19/02/2009	19/02/2009
Date analysed	-	23/02/2009	23/02/2009	23/02/2009	23/02/2009	23/02/2009
pH 1:5 soil:water	pH Units	5.2	5.5	4.4	8.5	4.7
Electrical Conductivity 1:5 soil:water	µS/cm	44	40	120	41	120
Sulphate, SO4 1:5 soil:water	mg/kg	<25	<25	<25	<25	<25
Chloride 1:5 soil:water	mg/kg	<100	<100	<100	<100	130

Miscellaneous Inorg - soil Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ---------- ----------	26640-21 TP26 0.9-1.1 10/02/09-13/02/09 Soil	26640-22 TP28 0.0-0.05 10/02/09-13/02/09 Soil	26640-23 TP28 0.25-0.35 10/02/09-13/02/09 Soil	26640-24 TP28 1.4-1.5 10/02/09-13/02/09 Soil	26640-25 TP29 0.0-0.1 10/02/09-13/02/09 Soil
Date prepared	-	19/02/2009	19/02/2009	19/02/2009	19/02/2009	19/02/2009
Date analysed	-	23/02/2009	23/02/2009	23/02/2009	23/02/2009	23/02/2009
pH 1:5 soil:water	pH Units	4.7	7.2	7.2	4.5	5.4
Electrical Conductivity 1:5 soil:water	µS/cm	65	120	66	480	230
Sulphate, SO4 1:5 soil:water	mg/kg	47	88	52	270	57
Chloride 1:5 soil:water	mg/kg	<100	<100	<100	520	280

Miscellaneous Inorg - soil Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ---------- ----------	26640-26 TP29 0.35-0.45 10/02/09-13/02/09 Soil	26640-27 TP29 1.0-1.1 10/02/09-13/02/09 Soil	26640-28 TP31 0.0-0.1 10/02/09-13/02/09 Soil	26640-29 TP31 0.2-0.3 10/02/09-13/02/09 Soil	26640-30 TP31 1.0-1.1 10/02/09-13/02/09 Soil
Date prepared	-	19/02/2009	19/02/2009	19/02/2009	19/02/2009	19/02/2009
Date analysed	-	23/02/2009	23/02/2009	23/02/2009	23/02/2009	23/02/2009
pH 1:5 soil:water	pH Units	4.1	4.2	5.3	5.4	4.9
Electrical Conductivity 1:5 soil:water	µS/cm	850	990	41	61	55
Sulphate, SO4 1:5 soil:water	mg/kg	65	140	39	<25	38
Chloride 1:5 soil:water	mg/kg	1,300	1,500	<100	<100	<100

Miscellaneous Inorg - soil **Our Reference:** **Your Reference** **Depth** **Date Sampled** **Type of sample**	**UNITS** ---------- ----------	**26640-31** **TP34** **0.0-0.1** **10/02/09-13/02/09** **Soil**	**26640-32** **TP34** **0.35-0.45** **10/02/09-13/02/09** **Soil**	**26640-33** **TP34** **1.0-1.1** **10/02/09-13/02/09** **Soil**	**26640-34** **TP37** **0.0-0.1** **10/02/09-13/02/09** **Soil**	**26640-35** **TP37** **0.5-0.7** **10/02/09-13/02/09** **Soil**
Date prepared	-	19/02/2009	19/02/2009	19/02/2009	19/02/2009	19/02/2009
Date analysed	-	23/02/2009	23/02/2009	23/02/2009	23/02/2009	23/02/2009
pH 1:5 soil:water	pH Units	5.3	4.2	4.3	5.8	5.5
Electrical Conductivity 1:5 soil:water	µS/cm	95	230	430	44	170
Sulphate, SO4 1:5 soil:water	mg/kg	<25	34	25	29	130
Chloride 1:5 soil:water	mg/kg	<100	310	630	<100	<100

Miscellaneous Inorg - soil Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ---------- ----------	26640-36 TP37 1.5-1.6 10/02/09-13/02/09 Soil	26640-37 TP40 0.0-0.1 10/02/09-13/02/09 Soil	26640-38 TP40 0.3-0.4 10/02/09-13/02/09 Soil	26640-39 TP40 1.0-1.1 10/02/09-13/02/09 Soil	26640-40 TP43 0.0-0.1 10/02/09-13/02/09 Soil
Date prepared	-	19/02/2009	19/02/2009	19/02/2009	19/02/2009	19/02/2009
Date analysed	-	23/02/2009	23/02/2009	23/02/2009	23/02/2009	23/02/2009
pH 1:5 soil:water	pH Units	6.0	7.0	5.4	4.7	5.5
Electrical Conductivity 1:5 soil:water	µS/cm	240	100	35	82	65
Sulphate, SO4 1:5 soil:water	mg/kg	45	<25	43	<25	<25
Chloride 1:5 soil:water	mg/kg	240	<100	<100	110	<100

Miscellaneous Inorg - soil Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ---------- ----------	26640-41 TP43 0.3-0.4 10/02/09-13/02/09 Soil	26640-42 TP43 1.1-1.3 10/02/09-13/02/09 Soil	26640-43 TP45 0.0-0.1 10/02/09-13/02/09 Soil	26640-44 TP45 0.3-0.4 10/02/09-13/02/09 Soil	26640-45 TP45 1.3-1.4 10/02/09-13/02/09 Soil
Date prepared	-	19/02/2009	19/02/2009	19/02/2009	19/02/2009	19/02/2009
Date analysed	-	23/02/2009	23/02/2009	23/02/2009	23/02/2009	23/02/2009
pH 1:5 soil:water	pH Units	4.9	5.4	5.2	4.7	4.8
Electrical Conductivity 1:5 soil:water	µS/cm	55	25	60	100	220
Sulphate, SO4 1:5 soil:water	mg/kg	<25	25	29	80	94
Chloride 1:5 soil:water	mg/kg	<100	<100	<100	<100	220

Miscellaneous Inorg - soil **Our Reference:** **Your Reference** **Depth** **Date Sampled** **Type of sample**	**UNITS** ---------- ----------	**26640-46** **TP50** **0.0-0.1** **10/02/09-13/02/09** **Soil**	**26640-47** **TP50** **0.3-0.4** **10/02/09-13/02/09** **Soil**	**26640-48** **TP50** **1.8-1.9** **10/02/09-13/02/09** **Soil**	**26640-49** **TP56** **0.0-0.1** **10/02/09-13/02/09** **Soil**	**26640-50** **TP56** **0.65-0.75** **10/02/09-13/02/09** **Soil**
Date prepared	-	19/02/2009	19/02/2009	19/02/2009	19/02/2009	19/02/2009
Date analysed	-	23/02/2009	23/02/2009	23/02/2009	23/02/2009	23/02/2009
pH 1:5 soil:water	pH Units	4.9	4.4	4.6	7.4	5.3
Electrical Conductivity 1:5 soil:water	µS/cm	150	90	220	1,400	130
Sulphate, SO4 1:5 soil:water	mg/kg	140	67	120	3,000	240
Chloride 1:5 soil:water	mg/kg	<100	<100	220	<100	<100

Miscellaneous Inorg - soil Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ---------- ----------	26640-51 TP56 2.0-2.2 10/02/09-13/02/09 Soil	26640-52 TP66 0.0-0.1 10/02/09-13/02/09 Soil	26640-53 TP66 0.35-0.45 10/02/09-13/02/09 Soil	26640-54 TP66 1.4-1.6 10/02/09-13/02/09 Soil
Date prepared	-	19/02/2009	19/02/2009	19/02/2009	19/02/2009
Date analysed	-	23/02/2009	23/02/2009	23/02/2009	23/02/2009
pH 1:5 soil:water	pH Units	5.6	7.4	4.6	4.8
Electrical Conductivity 1:5 soil:water	µS/cm	190	280	110	36
Sulphate, SO4 1:5 soil:water	mg/kg	94	140	<25	32
Chloride 1:5 soil:water	mg/kg	160	<100	130	<100

Method ID	Methodology Summary
LAB.1	pH - Measured using pH meter and electrode in accordance with APHA 20th ED, 4500-H+.
LAB.2	Conductivity and Salinity - measured using a conductivity cell and dedicated meter, in accordance with APHA2510 20th ED and Rayment & Higginson.
LAB.9	Sulphate determined turbidimetrically.
LAB.11	Chloride determined by argentometric titration.

QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			19/2/09	26640-1	19/02/2009 || 19/02/2009	LCS-1	19/2/09%
Date analysed	-			23/2/09	26640-1	23/02/2009 || 23/02/2009	LCS-1	23/2/09%
pH 1:5 soil:water	pH Units		LAB.1	[NT]	26640-1	6.2 || 6.1 || RPD: 2	LCS-1	100%
Electrical Conductivity 1:5 soil:water	µS/cm	1	LAB.2	<1.0	26640-1	170 || 170 || RPD: 0	LCS-1	104%
Sulphate, SO4 1:5 soil:water	mg/kg	25	LAB.9	<25	26640-1	<25 || <25	LCS-1	100%
Chloride 1:5 soil:water	mg/kg	100	LAB.11	<100	26640-1	<100 || <100	LCS-1	104%

QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	26640-11	19/02/2009 || 19/02/2009	LCS-2	19/2/09%
Date analysed	-	26640-11	23/02/2009 || 23/02/2009	LCS-2	23/2/09%
pH 1:5 soil:water	pH Units	26640-11	4.9 || 4.9 || RPD: 0	LCS-2	100%
Electrical Conductivity 1:5 soil:water	µS/cm	26640-11	54 || 52 || RPD: 4	LCS-2	104%
Sulphate, SO4 1:5 soil:water	mg/kg	26640-11	<25 || <25	LCS-2	100%
Chloride 1:5 soil:water	mg/kg	26640-11	<100 || <100	LCS-2	96%

QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	26640-21	19/02/2009 || 19/02/2009	LCS-3	19/2/09%
Date analysed	-	26640-21	23/02/2009 || 23/02/2009	LCS-3	23/2/09%
pH 1:5 soil:water	pH Units	26640-21	4.7 || 4.7 || RPD: 0	LCS-3	100%
Electrical Conductivity 1:5 soil:water	µS/cm	26640-21	65 || 64 || RPD: 2	LCS-3	104%
Sulphate, SO4 1:5 soil:water	mg/kg	26640-21	47 || 42 || RPD: 11	LCS-3	96%
Chloride 1:5 soil:water	mg/kg	26640-21	<100 || <100	LCS-3	102%

QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	26640-31	19/02/2009 || 19/02/2009	26640-2	19/2/09%
Date analysed	-	26640-31	23/02/2009 || 23/02/2009	26640-2	23/2/09%
pH 1:5 soil:water	pH Units	26640-31	5.3 || 5.3 || RPD: 0	[NR]	[NR]
Electrical Conductivity 1:5 soil:water	µS/cm	26640-31	95 || 100 || RPD: 5	[NR]	[NR]
Sulphate, SO4 1:5 soil:water	mg/kg	26640-31	<25 || <25	26640-2	108%
Chloride 1:5 soil:water	mg/kg	26640-31	<100 || <100	[NR]	[NR]

QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	26640-41	19/02/2009 || 19/02/2009	26640-22	19/2/09%
Date analysed	-	26640-41	23/02/2009 || 23/02/2009	26640-22	23/2/09%
pH 1:5 soil:water	pH Units	26640-41	4.9 || 4.9 || RPD: 0	[NR]	[NR]
Electrical Conductivity 1:5 soil:water	µS/cm	26640-41	55 || 57 || RPD: 4	[NR]	[NR]
Sulphate, SO4 1:5 soil:water	mg/kg	26640-41	<25 || <25	26640-22	100%
Chloride 1:5 soil:water	mg/kg	26640-41	<100 || <100	[NR]	[NR]
QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	26640-51	19/02/2009 || 19/02/2009	26640-42	19/2/09%
Date analysed	-	26640-51	23/02/2009 || 23/02/2009	26640-42	23/2/09%
pH 1:5 soil:water	pH Units	26640-51	5.6 || 5.4 || RPD: 4	[NR]	[NR]
Electrical Conductivity 1:5 soil:water	µS/cm	26640-51	190 || 200 || RPD: 5	[NR]	[NR]
Sulphate, SO4 1:5 soil:water	mg/kg	26640-51	94 || 94 || RPD: 0	26640-42	92%
Chloride 1:5 soil:water	mg/kg	26640-51	160 || 150 || RPD: 6	[NR]	[NR]

Report Comments:

Asbestos was analysed by Approved Identifier: Not applicable for this job
INS: Insufficient sample for this test NT: Not tested PQL: Practical Quantitation Limit <: Less than >: Greater than
RPD: Relative Percent Difference NA: Test not required LCS: Laboratory Control Sample NR: Not requested

Quality Control Definitions

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

Laboratory Acceptance Criteria:

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

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

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

SAMPLE RECEIPT ADVICE

Client:

Geoenviro Consultancy Pty Ltd
PO Box 1543, Macquarie Centre
North Ryde NSW 2113

ph: 9679 8733
Fax: 9679 8744

Attention: Solern Liew

Sample log in details:

Your reference:	**JG09245A, Airds**
Envirolab Reference:	**26640**
Date received:	16/02/09
Date results expected to be reported:	**24/02/09**

Samples received in appropriate condition for analysis:	YES
No. of samples provided	54 Soils
Turnaround time requested:	Standard
Temperature on receipt	Not applicable
Cooling Method:	None

Comments:

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

Contact details:

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

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

12 Ashley St
Chatswood NSW 2067
Ph: 9910 6200

Job No: 26640
Date received: 16/2/09
Time received:
Received by: SS
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Laboratory Test Request/Chain of Custody Record

Job Details:
Job Number: JG09245A
Client:
Project: Airds/Bradbury Redevelopment
Location: Airds

Sample Date: 10/02/2009 - 13/02/2009
Sampled By: AF
Project Manager: SL
Store Location:

External Laboratory Details:
Laboratory name: EnviroLab Services Pty Ltd
Address: 12 Ashley Street
Chatswood, NSW, 2067
Contact Tania Notaris

Sampling Details			Sample Type		Test Required (\)																								
Location	Depth (m)		Soil	Water																									
	From	To			pH	EC	So_4 / CL-																						Keep Sample
1 TP1	0.00	0.10	DG		/	/	/																						
2 TP1	0.60	0.70	DG		/	/	/																						
3 TP1	1.10	1.20	DG		/	/	/																						
4 TP8	0.00	0.10	DG		/	/	/																						
5 TP8	0.55	0.65	DG		/	/	/																						
6 TP8	1.50	1.60	DG		/	/	/																						
7 TP14	0.00	0.10	DG		/	/	/																						
8 TP14	0.50	0.60	DG		/	/	/																						
9 TP14	1.50	1.60	DG		/	/	/																						
10 TP16	0.00	0.10	DG		/	/	/																						
11 TP16	0.30	0.40	DG		/	/	/																						
12 TP16	1.00	1.10	DG		/	/	/																						
13 TP18	0.00	0.10	DG		/	/	/																						
14 TP18	0.45	0.55	DG		/	/	/																						
15 TP18	0.95	1.05	DG		/	/	/																						
16																													

Relinguished by				Received By			
Laboratory	Name	Signature	Date	Laboratory	Name	Signature	Date
GeoEnviro	Steven Goss		14/02/2009	ELS	Simon Song		16/2/09

Legend
DB Disturbed Sample (Bulk, Plastic bag)
DS Disturbed Sample (Small, Plastic bag)
DG Disturbed Sample (Glass Jar)
STP Standard Penetration Test Sample
U50 Undisturbed sample, 50mm tube
U75 Undisturbed sample, 75mm tube
WG Water sample, Amber glass jar
WP Water sample, Plastic bottle
Y keep Sample
N discard sample

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Laboratory Test Request/Chain of Custody Record

Job Details:
Job Number: JG09245A
Client:
Project: Airds/Bradbury Redevelopment
Location: Airds

Sample Date: 10/02/2009 - 13/02/2009
Sampled By: AF
Project Manager: SL
Store Location:

External Laboratory Details:
Laboratory name: EnviroLab Services Pty Ltd
Address: 12 Ashley Street
Chatswood, NSW, 2067
Contact Tania Notaris

Sampling Details			Sample Type		Test Required (\)			Test Performed(X)																						
Location	Depth (m)		Soil	Water																										
	From	To			pH	EC	So_4 / CL-																							Keep Sample
16 TP25	0.00	0.20	DG		/	/	/																							
17 TP25	0.20	0.30	DG		/	/	/																							
18 TP25	1.20	1.30	DG		/	/	/																							
19 TP26	0.00	0.10	DG		/	/	/																							
20 TP26	0.25	0.35	DG		/	/	/																							
21 TP26	0.90	1.10	DG		/	/	/																							
22 TP28	0.00	0.05	DG		/	/	/																							
23 TP28	0.25	0.35	DG		/	/	/																							
24 TP28	1.40	1.50	DG		/	/	/																							
25 TP29	0.00	0.10	DG		/	/	/																							
26 TP29	0.35	0.45	DG		/	/	/																							
27 TP29	1.00	1.10	DG		/	/	/																							
28 TP31	0.00	0.10	DG		/	/	/																							
29 TP31	0.20	0.30	DG		/	/	/																							
30 TP31	1.00	1.10	DG		/	/	/																							
7																														

Relinquished by				Received By			
Laboratory	Name	Signature	Date	Laboratory	Name	Signature	Date
GeoEnviro	Steven Goss	S.Goss	14/02/2009	ELS	SS		16/2/09

Legend
DB Disturbed Sample (Bulk, Plastic bag)
DS Disturbed Sample (Small, Plastic bag)
DG Disturbed Sample (Glass Jar)
STP Standard Penetration Test Sample
U50 Undisturbed sample, 50mm tube
U75 Undisturbed sample, 75mm tube
WG Water sample, Amber glass jar
WP Water sample, Plastic bottle
Y keep Sample
N discard sample

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Laboratory Test Request/Chain of Custody Record

Job Details:
Job Number: JG09245A
Client:
Project: Airds/Bradbury Redevelopment
Location: Airds

Sample Date: 10/02/2009 - 13/02/2009
Sampled By: AF
Project Manager: SL
Store Location:

External Laboratory Details:
Laboratory name: EnviroLab Services Pty Ltd
Address: 12 Ashley Street
Chatswood, NSW, 2067
Contact Tania Notaris

Sampling Details			Sample Type		Test Required (\)																											Test Performed(X)
Location	Depth (m)		Soil	Water																												
	From	To			pH	EC	So_4 / CL-																									Keep Sample
31 TP34	0.00	0.10	DG		/	/	/																									
32 TP34	0.35	0.45	DG		/	/	/																									
33 TP34	1.00	1.10	DG		/	/	/																									
34 TP37	0.00	0.10	DG		/	/	/																									
35 TP37	0.50	0.70	DG		/	/	/																									
36 TP37	1.50	1.60	DG		/	/	/																									
37 TP 40	0.00	0.10	DG		/	/	/																									
38 TP 40	0.30	0.40	DG		/	/	/																									
39 TP 40	1.00	1.10	DG		/	/	/																									
40 TP43	0.00	0.10	DG		/	/	/																									
41 TP43	0.30	0.40	DG		/	/	/																									
42 TP43	1.10	1.30	DG		/	/	/																									
43 TP45	0.00	0.10	DG		/	/	/																									
44 TP45	0.30	0.40	DG		/	/	/																									
45 TP45	1.30	1.40	DG		/	/	/																									

Relinguished by				Received By			
Laboratory	Name	Signature	Date	Laboratory	Name	Signature	Date
GeoEnviro	Steven Goss		14/02/2009	ELS	SS		16/2/09

Legend
DB Disturbed Sample (Bulk, Plastic bag)
DS Disturbed Sample (Small, Plastic bag)
DG Disturbed Sample (Glass Jar)
STP Standard Penetration Test Sample
U50 Undisturbed sample, 50mm tube
U75 Undisturbed sample, 75mm tube
WG Water sample, Amber glass jar
WP Water sample, Plastic bottle
Y keep Sample
N discard sample

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Laboratory Test Request/Chain of Custody Record

Job Details:
Job Number: JG09245A
Client:
Project: Airds/Bradbury Redevelopment
Location: Airds

Sample Date: 10/02/2009 - 13/02/2009
Sampled By: AF
Project Manager: SL
Store Location:

External Laboratory Details:
Laboratory name: EnviroLab Services Pty Ltd
Address: 12 Ashley Street
Chatswood, NSW, 2067
Contact Tania Notaris

Sampling Details			Sample Type		Test Required (\)			Test Performed(X)																				
Location	Depth (m)		Soil	Water																								
	From	To			pH	EC	So_4/ CL-																					Keep Sample
46 TP50	0.00	0.10	DG		/	/	/																					
47 TP50	0.30	0.40	DG		/	/	/																					
48 TP50	1.80	1.90	DG		/	/	/																					
49 TP56	0.00	0.10	DG		/	/	/																					
50 TP56	0.65	0.75	DG		/	/	/																					
51 TP56	2.00	2.20	DG		/	/	/																					
52 TP66	0.00	0.10	DG		/	/	/																					
53 TP66	0.35	0.45	DG		/	/	/																					
54 TP66	1.40	1.60	DG		/	/	/																					

Relinguished by				Received By			
Laboratory	Name	Signature	Date	Laboratory	Name	Signature	Date
GeoEnviro	Steven Goss		14/02/2009		SS		16/2/9

Legend
DB Disturbed Sample (Bulk, Plastic bag)
DS Disturbed Sample (Small, Plastic bag)
DG Disturbed Sample (Glass Jar)
STP Standard Penetration Test Sample
U50 Undisturbed sample, 50mm tube
U75 Undisturbed sample, 75mm tube
WG Water sample, Amber glass jar
WP Water sample, Plastic bottle
Y keep Sample
N discard sample

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

CERTIFICATE OF ANALYSIS 26864

Client:
Geoenviro Consultancy Pty Ltd
PO Box 1543, Macquarie Centre
North Ryde
NSW 2113

Attention: Solern Liew

Sample log in details:

Your Reference:	**JG09245A, Airds**
No. of samples:	9 Soils
Date samples received:	25/02/09
Date completed instructions received:	25/02/09

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

Report Details:

Date results requested by:	4/03/09
Date of Preliminary Report:	Not Issued
Issue Date:	2/03/09

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

Results Approved By:

Jacinta Hurst
Operations Manager

Miscellaneous Inorg - soil						
Our Reference:	UNITS	26864-1	26864-2	26864-3	26864-4	26864-5
Your Reference	----------	TP23	TP23	TP23	TP53	TP53
Depth	----------	0-0.1	0.1-0.2	0.8-1.0	0-0.1	0.2-0.3
Date Sampled		23/02/2009	23/02/2009	23/02/2009	23/02/2009	23/02/2009
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	27/02/2009	27/02/2009	27/02/2009	27/02/2009	27/02/2009
Date analysed	-	27/02/2009	27/02/2009	27/02/2009	27/02/2009	27/02/2009
pH 1:5 soil:water	pH Units	6.3	5.1	5.0	7.6	6.6
Electrical Conductivity 1:5 soil:water	µS/cm	65	66	46	180	34
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	[NA]	31	[NA]	[NA]
Chloride 1:5 soil:water	mg/kg	[NA]	[NA]	<100	[NA]	[NA]

Miscellaneous Inorg - soil					
Our Reference:	UNITS	26864-6	26864-7	26864-8	26864-9
Your Reference	----------	TP53	TP63	TP63	TP63
Depth	----------	0.5-0.65	0-0.1	1.3-1.4	2.6-2.7
Date Sampled		23/02/2009	23/02/2009	23/02/2009	23/02/2009
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	27/02/2009	27/02/2009	27/02/2009	27/02/2009
Date analysed	-	27/02/2009	27/02/2009	27/02/2009	27/02/2009
pH 1:5 soil:water	pH Units	5.1	6.6	4.5	5.3
Electrical Conductivity 1:5 soil:water	µS/cm	120	54	200	50
Sulphate, SO4 1:5 soil:water	mg/kg	<25	[NA]	180	33
Chloride 1:5 soil:water	mg/kg	<100	[NA]	<100	<100

Method ID	Methodology Summary
LAB.1	pH - Measured using pH meter and electrode in accordance with APHA 20th ED, 4500-H+.
LAB.2	Conductivity and Salinity - measured using a conductivity cell and dedicated meter, in accordance with APHA2510 20th ED and Rayment & Higginson.
LAB.9	Sulphate determined turbidimetrically.
LAB.11	Chloride determined by argentometric titration.

QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			27/02/2009	26864-3	27/02/2009 || 27/02/2009	LCS-1	27/02/2009
Date analysed	-			27/02/2009	26864-3	27/02/2009 || 27/02/2009	LCS-1	27/02/2009
pH 1:5 soil:water	pH Units		LAB.1	[NT]	26864-3	5.0 || 4.9 || RPD: 2	LCS-1	100%
Electrical Conductivity 1:5 soil:water	µS/cm	1	LAB.2	<1.0	26864-3	46 || 54 || RPD: 16	LCS-1	104%
Sulphate, SO4 1:5 soil:water	mg/kg	25	LAB.9	<25	26864-3	31 || <25	LCS-1	94%
Chloride 1:5 soil:water	mg/kg	100	LAB.11	<100	26864-3	<100 || <100	LCS-1	104%

Report Comments:

Asbestos was analysed by Approved Identifier: Not applicable for this job
INS: Insufficient sample for this test NT: Not tested PQL: Practical Quantitation Limit <: Less than >: Greater than
RPD: Relative Percent Difference NA: Test not required LCS: Laboratory Control Sample NR: Not requested

Quality Control Definitions

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

Laboratory Acceptance Criteria:

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

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

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

SAMPLE RECEIPT ADVICE

Client:

Geoenviro Consultancy Pty Ltd
PO Box 1543, Macquarie Centre
North Ryde NSW 2113

ph: 9679 8733
Fax: 9679 8744

Attention: Solern Liew

Sample log in details:

Your reference:	**JG09245A, Airds**
Envirolab Reference:	**26864**
Date received:	25/02/09
Date results expected to be reported:	**4/03/09**

Samples received in appropriate condition for analysis:	YES
No. of samples provided	9 Soils
Turnaround time requested:	Standard
Temperature on receipt	Cool
Cooling Method:	Ice

Comments:

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

Contact details:

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

GEOENVIRO CONSULTANCY Pty Ltd

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: 9910 6200

Job No: 26864
Date received: 25/2/09
Time received: 10
Received by: S S
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Laboratory Test Request/Chain of Custody Record

Job Details:
Job Number: JG0924SA
Client:
Project: Ardo/Bradbury Re development
Location Ardo

Sample Date: 23/2/09
Sampled By: SG
Project Manager: SL
Store Location:

External Laboratory Details:
Laboratory name: Envirolab
Address:
Contact Tania N

Sampling Details				Sample Type		Test Required (\) / Test Performed(X)																											
Location		Depth (m)		Soil	Water	GCMS Scan (TPH, PAH, Phenols)	Metals (As Cd Cr Cu Pb Zn Ni Hg)	Metals Sb Be Co Mn Se Sn	pH	TPH	BTEX	PAH	OCP	PCB	Halogenated Volatile Organics	Cyanide		pH	EC	SO_4/Cl^-													Keep Sample
		From	To																														
TP23	1	0	0.1															/	/														
TP25	2	0.1	0.2															/	/														
TP23	3	0.8	1.0															/	/														
TP53	4	0	0.1															/	/	/													
TP53	5	0.2	0.3															/	/														
TP53	6	0.5	0.65															/	/														
TP63	7	0	0.1															/	/	/													
TP63	8	1.3	1.4															/	/														
TP63	9	2.6	2.7															/	/	/													

Relinguished by				Received By			
Laboratory	Name	Signature	Date	Laboratory	Name	Signature	Date
GeoEnviro	Steven Gu		24/2/09	EVS	Simon Song		25/2/09

Legend
DB Disturbed Sample (Bulk, Plastic bag)
DS Disturbed Sample (Small, Plastic bag)
DG Disturbed Sample (Glass Jar)
STP Standard Penetration Test Sample

U50 Undisturbed sample, 50mm tube
U75 Undisturbed sample, 75mm tube
WG Water sample, Amber glass jar
WP Water sample, Plastic bottle

Y keep Sample
N discard sample

c:\\Lab\worksheet\w019-1

Form No. W019-1/Ver02/06/99

Appendix D

Geotechnical Laboratory Test Certificates –
Principle Site

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fouth Avenue, Blacktown
Tel: (02) 96798733 Fax: (02) 96798744

California Bearing Ratio Test Report

Client / Address:	JBS Environmental (Mascot)	Job No.	JG09245A
Project:	Airds / Bradbury Redevelopment	Date:	13-03-09
Location:	Airds / Bradbury	Report No.	R01A

SAMPLE INFORMATION Test Methods – 1289.1

Lab Reference No.			SR5205	SR5207	SR5209	SR5210
Date Sampled			14 to 23-02-09	14 to 23-02-09	14 to 23-02-09	14 to 23-02-09
Date Tested			20-02-09	20-02-09	20-02-09	20-02-09
Sample Identification			TP 1 (0.9-1.0m)	TP 8 (0.55-0.70m)	TP 14 (0.7-0.9m)	TP 16 (0.3-0.5m)
Laboratory Specimen Description			(CH) Silty Clay: high Plasticity, red brown	(CH) Silty Clay: high plasticity, red brown	(CH) Silty Clay: high plasticity, red brown	(CH) Silty Clay: high plasticity, red brown

TEST RESULTS

Laboratory Compaction & Moisture Content - Test Methods AS1289 5.1.1 Mould A and AS1289 2.1.1

Maximum Dry Density	t/m^3		1.66	1.63	1.53	1.60
Optimum Moisture Content	%		22.0	22.0	24.0	22.5
Field Moisture Content	%		17.0	18.5	18.5	15.0
% Of Oversize	19mm		Nil	Nil	Nil	Nil
Replacement of Oversize(See remarks B)			Nil	Nil	Nil	Nil

California Bearing Ratio - Test Method AS1289 6.1.1

CBR TEST	Dry Density t/m^3	Before Soaking	1.65	1.61	1.54	1.60
		After Soaking	1.62	1.58	1.51	1.58
	Density Ratio %	Before Soaking	99.5	99.0	101.0	100.0
		After Soaking	97.5	97.5	99.0	99.0
	Moisture Content %	Before Soaking	21.0	22.0	25.0	22.0
		After Soaking	23.5	25.0	29.0	25.0
	Number of Days Soaked		4	4	4	4
	Surcharge kg		9.0	9.0	9.0	9.0
	Moisture Content After Test %	Top 30mm	26.0	29.5	31.0	27.0
		Whole Sample	23.0	25.0	28.5	25.0
	Swell After Soaking %		2.0	2.0	2.0	1.0
	Penetration mm		2.5	2.5	2.5	2.5
	CBR Value %		3.5	4.0	4.0	8.0

Remarks: (A) Test specimen was compacted to a target dry density of 100 percent standard (AS 1289 5.1.1)
(B) If specified the percentage of oversize retained on the 19mm may be replaced by an equal portion of –19mm to +4.75mm

This document is issued in accordance with NATA's accreditation requirements
Accredited for compliance with ISO/IEC 17025
NATA Accredited Laboratory Number: 14208.

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

Approved Signatory: _____ Solern Liew Date: 13/03/09

Pricinpal

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fouth Avenue, Blacktown
Tel: (02) 96798733 Fax: (02) 96798744

California Bearing Ratio Test Report

Client / Address:	JBS Environmental (Mascot)	Job No.	JG09245A
Project:	Airds / Bradbury Redevelopment	Date:	13-03-09
Location:	Airds / Bradbury	Report No.	R02A

SAMPLE INFORMATION Test Methods – 1289.1

Lab Reference No.			SR5211	SR5260	SR5213	SR5214
Date Sampled			14 to 23-02-09	14 to 23-02-09	14 to 23-02-09	14 to 23-02-09
Date Tested			20-02-09	26-02-09	20-02-09	16-02-09
Sample Identification			TP 18 (0.45-0.65m)	TP 22 (0.4-0.6m)	TP 25 (1.2-1.35m)	TP 26 (0.25-0.35m)
Laboratory Specimen Description			(CH) Silty Clay: high plasticity, red brown	(CI) Silty Clay: medium plasticity, grey brown	(CH) Silty Clay: high plasticity, brown grey	(CH) Silty Clay: high plasticity, brown red

TEST RESULTS

Laboratory Compaction & Moisture Content - Test Methods AS1289 5.1.1 Mould A and AS1289 2.1.1

Maximum Dry Density	t/m^3		1.42	1.77	1.78	1.63
Optimum Moisture Content	%		32.0	16.5	16.5	22.0
Field Moisture Content	%		24.0	13.0	11.5	16.5
% Of Oversize	19mm		Nil	Nil	Nil	Nil
Replacement of Oversize(See remarks B)			Nil	Nil	Nil	Nil

California Bearing Ratio - Test Method AS1289 6.1.1

CBR TEST	Dry Density t/m^3	Before Soaking	1.43	1.76	1.78	1.62
		After Soaking	1.42	1.75	1.75	1.62
	Density Ratio %	Before Soaking	100.5	99.0	100.0	100.0
		After Soaking	100.5	98.5	98.5	99.5
	Moisture Content %	Before Soaking	32.5	16.5	16.5	22.5
		After Soaking	34.0	19.0	18.5	24.0
	Number of Days Soaked		4	4	4	4
	Surcharge	kg	9.0	9.0	6.75	9.0
	Moisture Content After Test %	Top 30mm	37.0	22.0	20.5	25.0
		Whole Sample	34.0	19.0	18.5	24.0
	Swell After Soaking	%	0.5	0.5	1.5	0.5
	Penetration	mm	2.5	2.5	5.0	2.5
	CBR Value	%	10.0	9.0	6.0	11.0

Remarks: (A) Test specimen was compacted to a target dry density of 100 percent standard (AS 1289 5.1.1)
(B) If specified the percentage of oversize retained on the 19mm may be replaced by an equal portion of –19mm to +4.75mm

This document is issued in accordance with NATA's accreditation requirements
Accredited for compliance with ISO/IEC 17025
NATA Accredited Laboratory Number: 14208.

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

Approved Signatory: _____ Solern Liew Date: 13/03/09

Pricinpal

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fouth Avenue, Blacktown
Tel: (02) 96798733 Fax: (02) 96798744

California Bearing Ratio Test Report

Client / Address: JBS Environmental (Mascot)		Job No.	JG09245A
Project:	Airds / Bradbury Redevelopment	Date:	13-03-09
Location:	Airds / Bradbury	Report No.	R03A

SAMPLE INFORMATION Test Methods – 1289.1

Lab Reference No.		SR5214	SR5215	SR5216	SR5217
Date Sampled		14 to 23-02-09	14 to 23-02-09	14 to 23-02-09	14 to 23-02-09
Date Tested		16-02-09	19-02-09	20-02-09	16-02-09
Sample Identification		TP 26 (0.25-0.35m)	TP 28 (0.55-0.75m)	TP 29 (0.35-0.55m)	TP 31 (0.2-0.35m)
Laboratory Specimen Description		(CH) Silty Clay: high plasticity, brown red	(CH) Silty Clay: high plasticity, red brown	(CH) Silty Clay: high plasticity, red brown	(CH) Silty Clay: high plasticity, brown

TEST RESULTS

Laboratory Compaction & Moisture Content - Test Methods AS1289 5.1.1 Mould A and AS1289 2.1.1

Maximum Dry Density	t/m^3	1.63	1.53	1.61	1.38
Optimum Moisture Content	%	22.0	26.0	22.0	33.0
Field Moisture Content	%	16.5	21.0	17.0	25.5
% Of Oversize	19mm	Nil	Nil	Nil	Nil
Replacement of Oversize(See remarks B)		Nil	Nil	Nil	Nil

California Bearing Ratio - Test Method AS1289 6.1.1

CBR TEST	Dry Density t/m^3	Before Soaking	1.63	1.54	1.63	1.39
		After Soaking	1.62	1.52	1.59	1.38
	Density Ratio %	Before Soaking	100.0	101.0	101.0	101.0
		After Soaking	99.5	99.5	99.0	100.5
	Moisture Content %	Before Soaking	22.5	25.5	22.5	32.5
		After Soaking	24.0	28.0	25.0	34.5
	Number of Days Soaked		4	4	4	4
	Surcharge	kg	9.0	9.0	9.0	9.0
	Moisture Content After Test %	Top 30mm	25.0	31.0	27.0	36.5
		Whole Sample	24.0	28.0	25.0	34.5
	Swell After Soaking	%	0.5	1.50	2.0	0.5
	Penetration	mm	2.5	5.0	2.5	2.5
	CBR Value	%	11.0	4.5	4.0	10.0

Remarks: (A) Test specimen was compacted to a target dry density of 100 percent standard (AS 1289 5.1.1)
(B) If specified the percentage of oversize retained on the 19mm may be replaced by an equal portion of –19mm to +4.75mm

This document is issued in accordance with NATA's accreditation requirements
Accredited for compliance with ISO/IEC 17025
NATA Accredited Laboratory Number: 14208.

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

Approved Signatory: _____ Solern Liew Date: 13/03/09

Pricinpal

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fouth Avenue, Blacktown
Tel: (02) 96798733 Fax: (02) 96798744

California Bearing Ratio Test Report

Client / Address:	JBS Environmental (Mascot)	Job No.	JG09245A
Project:	Airds / Bradbury Redevelopment	Date:	13-03-09
Location:	Airds / Bradbury	Report No.	R04A

SAMPLE INFORMATION Test Methods – 1289.1

Lab Reference No.			SR5218	SR5219	SR5221	SR5222
Date Sampled			14 to 23-02-09	14 to 23-02-09	14 to 23-02-09	14 to 23-02-09
Date Tested			14-02-09	19-02-09	19-02-09	20-02-09
Sample Identification			TP 34 (0.35-0.50m)	TP 37 (0.5-0.7m)	TP 40 (0.6-0.7m)	TP 43 (0.3-0.5m)
Laboratory Specimen Description			(CH) Silty Clay: high plasticity, red brown	(CH) Silty Clay: high plasticity, brown	(CI-CH) Silty Clay: medium to high plasticity, brown red with gravel	(CH) Silty Clay: high plasticity, red brown

TEST RESULTS

Laboratory Compaction & Moisture Content - Test Methods AS1289 5.1.1 Mould A and AS1289 2.1.1

Maximum Dry Density	t/m^3		1.46	1.35	1.77	1.44
Optimum Moisture Content	%		29.0	34.0	17.5	30.0
Field Moisture Content	%		21.5	27.0	12.0	21.5
% Of Oversize	19mm		Nil	Nil	Nil	Nil
Replacement of Oversize(See remarks B)			Nil	Nil	Nil	Nil

California Bearing Ratio - Test Method AS1289 6.1.1

CBR TEST	Dry Density t/m^3	Before Soaking	1.45	1.37	1.78	1.45
		After Soaking	1.44	1.36	1.78	1.43
	Density Ratio %	Before Soaking	99.5	101.0	101.0	101.0
		After Soaking	98.5	105.0	100.5	100.0
	Moisture Content %	Before Soaking	28.5	33.0	17.5	28.5
		After Soaking	31.5	35.5	18.0	31.5
	Number of Days Soaked		4	4	4	4
	Surcharge	kg	9.0	9.0	6.75	9.0
	Moisture Content After Test %	Top 30mm	34.0	38.0	19.0	33.0
		Whole Sample	31.5	35.5	18.5	31.5
	Swell After Soaking	%	0.5	1.0	0	1.0
	Penetration	mm	2.5	2.5	2.5	2.5
	CBR Value	%	9.0	9.0	13.0	8.0

Remarks: (A) Test specimen was compacted to a target dry density of 100 percent standard (AS 1289 5.1.1)
(B) If specified the percentage of oversize retained on the 19mm may be replaced by an equal portion of –19mm to +4.75mm

This document is issued in accordance with NATA's accreditation requirements
Accredited for compliance with ISO/IEC 17025
NATA Accredited Laboratory Number: 14208.

NATA ACCREDITED FOR TECHNICAL COMPETENCE

Approved Signatory: _____ Solern Liew Date: 13/03/09

Pricinpal

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fouth Avenue, Blacktown
Tel: (02) 96798733 Fax: (02) 96798744

California Bearing Ratio Test Report

Client / Address: JBS Environmental (Mascot)		Job No.	JG09245A
Project:	Airds / Bradbury Redevelopment	Date:	13-03-09
Location:	Airds / Bradbury	Report No.	R05A

SAMPLE INFORMATION Test Methods – 1289.1

Lab Reference No.		SR5224	SR5263	SR5225	SR5227
Date Sampled		14 to 23-02-09	14 to 23-02-09	14 to 23-02-09	14 to 23-02-09
Date Tested		20-02-09	26-02-09	19-02-09	16-02-09
Sample Identification		TP 50 (0.3-0.5m)	TP 53 (0.55-0.75m)	TP 56 (0.65-0.8m)	TP 61 (0.4-0.55m)
Laboratory Specimen Description		(CH) Silty Clay: high plasticity, red brown with gravel	(CH) Silty Clay: high plasticity, brown	(CH) Silty Clay: high plasticity, red brown	(CH) Silty Clay: high plasticity, red brown

TEST RESULTS

Laboratory Compaction & Moisture Content - Test Methods AS1289 5.1.1 Mould A and AS1289 2.1.1

Maximum Dry Density	t/m^3	1.55	1.72	1.54	1.39
Optimum Moisture Content	%	25.5	18.5	26.5	33.0
Field Moisture Content	%	16.5	19.5	20.5	24.0
% Of Oversize	19mm	Nil	Nil	Nil	Nil
Replacement of Oversize(See remarks B)		Nil	Nil	Nil	Nil

California Bearing Ratio - Test Method AS1289 6.1.1

CBR TEST	Dry Density t/m^3	Before Soaking	1.56	1.72	1.55	1.38
		After Soaking	1.58	1.72	1.55	1.37
	Density Ratio %	Before Soaking	100.0	100.5	100.5	99.5
		After Soaking	100.0	100.0	100.0	99.0
	Moisture Content %	Before Soaking	24.0	19.0	27.0	33.0
		After Soaking	26.0	20.0	28.0	35.5
	Number of Days Soaked		4	4	4	4
	Surcharge kg		9.0	9.0	9.0	9.0
	Moisture Content After Test %	Top 30mm	28.0	22.0	30.0	37.5
		Whole Sample	25.5	20.0	28.0	35.0
	Swell After Soaking %		0.5	0.5	0	0.5
	Penetration mm		2.5	2.5	2.5	2.5
	CBR Value %		7.0	8.0	8.0	10.0

Remarks: (A) Test specimen was compacted to a target dry density of 100 percent standard (AS 1289 5.1.1)
(B) If specified the percentage of oversize retained on the 19mm may be replaced by an equal portion of –19mm to +4.75mm

This document is issued in accordance with NATA's accreditation requirements
Accredited for compliance with ISO/IEC 17025
NATA Accredited Laboratory Number: 14208.

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

Approved Signatory: _____ Solern Liew Date: 13/03/09

Pricinpal

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fouth Avenue, Blacktown
Tel: (02) 96798733 Fax: (02) 96798744

California Bearing Ratio Test Report

Client / Address: JBS Environmental (Mascot)		Job No.	JG09245A
Project: Airds / Bradbury Redevelopment		Date:	13-03-09
Location: Airds / Bradbury		Report No.	R06A

SAMPLE INFORMATION Test Methods – 1289.1

Lab Reference No.	SR5264	SR5229		
Date Sampled	14 to 23-02-09	14 to 23-02-09		
Date Tested	26-02-09	16-02-09		
Sample Identification	TP 64 (0.3-0.6m)	TP 66 (0.35-0.45m)		
Laboratory Specimen Description	(CH) Silty Clay: high plasticity, red brown	(CI-CH) Gravelly Silty Clay: medium to high plasticity, brown red		

TEST RESULTS

Laboratory Compaction & Moisture Content - Test Methods AS1289 5.1.1 Mould A and AS1289 2.1.1

Maximum Dry Density t/m^3	1.51	1.65		
Optimum Moisture Content %	27.0	22.0		
Field Moisture Content %	24.0	14.5		
% Of Oversize 19mm	Nil	Nil		
Replacement of Oversize(See remarks B)	Nil	Nil		

California Bearing Ratio - Test Method AS1289 6.1.1

CBR TEST	Dry Density t/m^3	Before Soaking	1.52	1.63		
		After Soaking	1.51	1.63		
	Density Ratio %	Before Soaking	101.0	99.0		
		After Soaking	100.0	99.0		
	Moisture Content %	Before Soaking	27.5	22.5		
		After Soaking	29.0	23.5		
	Number of Days Soaked		4	4		
	Surcharge kg		9.0	9.0		
	Moisture Content After Test %	Top 30mm	32.0	27.0		
		Whole Sample	29.0	23.5		
	Swell After Soaking %		1.0	0		
	Penetration mm		2.5	2.5		
	CBR Value %		6.0	8.0		

Remarks: (A) Test specimen was compacted to a target dry density of 100 percent standard (AS 1289 5.1.1)
(B) If specified the percentage of oversize retained on the 19mm may be replaced by an equal portion of –19mm to +4.75mm

This document is issued in accordance with NATA's accreditation requirements
Accredited for compliance with ISO/IEC 17025
NATA Accredited Laboratory Number: 14208.

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

Approved Signatory: _____ Solern Liew Date: 13/03/09

Pricinpal

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Test Results - Shrink/Swell Index

Client/Address: JBS Environmental (Mascot)		Job No:	JG09245A
Project:	Airds / Bradbury Redevelopment	Date:	13/03/2009
Location:	Airds / Bradbury	Report No:	R07A

Test Procedure: AS 1289 1.1, 2.1.1, 7.1.1

Sample Identification	TP 1 (0.5-0.8m)	TP 6 (0.8-1.1m)	TP 8 (0.55-0.85m)	TP 11 (0.7-1.0m)
Sample Register No	SR5205	SR5206	SR5207	SR5208
Sample Date	14 to 23-02-09	14 to 23-02-09	14 to 23-02-09	14 to 23-02-09
Test Date	16-02-09	12-02-09	12-02-09	17-02-09
Test Results				
Moisture Content				
Initial %	16.5	19.5	14.5	13.5
Final %	22.0	27.5	19.0	20.5
Estimated UCS				
Before Test kPa	>600	>600	>600	>600
After Test kPa	310	580	510	>600
Swell %	2.06	3.58	5.39	6.24
Shrinkage %	1.28	1.91	2.24	1.18
Shrink/Swell Index %/pF	1.3	2.1	2.7	2.4
Material Description	(CH) Silty Clay: high plasticity, red brown	(CI-CH) Silty Clay: medium to high plasticity, red brown grey	(CH) Silty Clay: high plasticity, red brown	(CH) Silty Clay: high plasticity, red brown

Approved Signatory _____ Solern Liew 13/03/09
Principal

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Test Results - Shrink/Swell Index

Client/Address: JBS Environmental (Mascot)		Job No:	JG09245A
Project:	Airds / Bradbury Redevelopment	Date:	13/03/2009
Location:	Airds / Bradbury	Report No:	R08A

Test Procedure: AS 1289 1.1, 2.1.1, 7.1.1

Sample Identification	TP 14 (0.7-0.9m)	TP 16 (0.3-0.6m)	TP 18 (0.45-0.75m)	TP 23 (0.1-0.3m)
Sample Register No	SR5209	SR5210	SR5211	SR5261
Sample Date	14 to 23-02-09	14 to 23-02-09	14 to 23-02-09	14 to 23-02-09
Test Date	12-02-09	12-02-09	12-02-09	24-02-09
Test Results				
Moisture Content				
Initial %	16.5	13.5	26.0	19.5
Final %	23.0	21.0	33.0	30.5
Estimated UCS				
Before Test kPa	>600	>600	>600	>600
After Test kPa	>600	>600	590	310
Swell %	5.53	3.90	6.20	1.76
Shrinkage %	2.03	0.75	2.25	3.11
Shrink/Swell Index %/pF	2.7	1.5	3.0	2.2
Material Description	(CH) Silty Clay: high plasticity, red brown	(CH) Silty Clay: high plasticity, red brown	(CH) Silty Clay: high plasticity, red brown	(CH) Silty Clay: high plasticity, red brown

Approved Signatory _____ Solern Liew 13/03/09
Principal

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Test Results - Shrink/Swell Index

Client/Address: JBS Environmental (Mascot)		Job No:	JG09245A
Project: Airds / Bradbury Redevelopment		Date:	13/03/2009
Location: Airds / Bradbury		Report No:	R09A

Test Procedure: AS 1289 1.1, 2.1.1, 7.1.1

Sample Identification	TP 28 (0.55-0.85m)	TP 29 (0.35-0.65m)	TP 31 (0.2-0.5m)	TP 34 (0.35-0.55m)
Sample Register No	SR5215	SR5216	SR5217	SR5218
Sample Date	14 to 23-02-09	14 to 23-02-09	14 to 23-02-09	14 to 23-02-09
Test Date	12-02-09	13-02-09	13-02-09	13-02-09
Test Results				
Moisture Content				
Initial %	21.0	16.5	24.0	21.5
Final %	26.0	24.0	33.5	29.0
Estimated UCS				
Before Test kPa	>600	>600	>600	>600
After Test kPa	550	410	390	340
Swell %	3.47	4.42	1.66	2.85
Shrinkage %	3.21	1.89	1.38	1.64
Shrink/Swell Index %/pF	2.7	2.3	1.2	1.7
Material Description	(CH) Silty Clay: high plasticity, red brown	(CH) Silty Clay: high plasticity, red brown	(CH) Silty Clay: high plasticity, brown	(CH) Silty Clay: high plasticity, red brown

Approved Signatory  Solern Liew 13/03/09

Principal

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Test Results - Shrink/Swell Index

Client/Address: JBS Environmental (Mascot)		Job No:	JG09245A
Project:	Airds / Bradbury Redevelopment	Date:	13/03/2009
Location:	Airds / Bradbury	Report No:	R10A

Test Procedure: AS 1289 1.1, 2.1.1, 7.1.1

Sample Identification	TP 37 (0.5-0.8m)	TP 38 (0.35-0.55m)	TP 45 (0.3-0.6m)	TP 52 (0.6-0.85m)
Sample Register No	SR5219	SR5220	SR5223	SR5262
Sample Date	14 to 23-02-09	14 to 23-02-09	14 to 23-02-09	14 to 23-02-09
Test Date	17-02-09	17-02-09	16-02-09	24-02-09
Test Results				
Moisture Content				
Initial %	18.0	10.5	16.5	25.0
Final %	25.0	19.0	26.5	32.5
Estimated UCS				
Before Test kPa	>600	>600	>600	290
After Test kPa	320	450	250	-
Swell %	1.85	0.70	1.15	0.65
Shrinkage %	2.21	0.74	0.89	1.95
Shrink/Swell Index %/pF	1.7	0.6	0.8	1.3
Material Description	(CH) Silty Clay: high plasticity, brown	(CL) Sandy Clay: low plasticity, brown	(CH) Silty Clay: high plasticity, red brown	(CH) Silty Clay: high plasticity, red brown

Approved Signatory _____ Solern Liew 13/03/09
Principal

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Test Results - Shrink/Swell Index

Client/Address: JBS Environmental (Mascot)		Job No:	JG09245A
Project: Airds / Bradbury Redevelopment		Date:	13/03/2009
Location: Airds / Bradbury		Report No:	R11A

Test Procedure: AS 1289 1.1, 2.1.1, 7.1.1

Sample Identification	TP 55 (1.1-1.4m)	TP 56 (0.65-0.9m)	TP 60 (0.25-0.55m)	TP 61 (0.4-0.7m)
Sample Register No	-	SR5225	SR5226	SR5227
Sample Date	14 to 23-02-09	14 to 23-02-09	14 to 23-02-09	14 to 23-02-09
Test Date	13-02-09	17-02-09	17-02-09	13-02-09
Test Results				
Moisture Content				
Initial %	13.5	20.0	23.5	22.5
Final %	22.0	24.5	31.5	35.5
Estimated UCS				
Before Test kPa	>600	>600	>600	>600
After Test kPa	440	240	300	390
Swell %	1.39	2.80	1.39	0.49
Shrinkage %	1.89	0.62	1.30	1.40
Shrink/Swell Index %/pF	1.4	1.1	1.1	0.9
Material Description	(CH) Silty Clay: high plasticity, red brown	(CH) Silty Clay: high plasticity, red brown	(CH) Silty Clay: high plasticity, red brown	(CH) Silty Clay: high plasticity, red brown

Approved Signatory  Solern Liew 13/03/09

Principal

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Test Results - Shrink/Swell Index

Client/Address: JBS Environmental (Mascot)		Job No:	JG09245A
Project: Airds / Bradbury Redevelopment		Date:	13/03/2009
Location: Airds / Bradbury		Report No:	R12A

Test Procedure: AS 1289 1.1, 2.1.1, 7.1.1

Sample Identification	TP 65 (0.25-0.55m)	Tp 66 (0.35-0.65m)		
Sample Register No	SR5228	SR5229		
Sample Date	14 to 23-02-09	14 to 23-02-09		
Test Date	13-02-09	18-02-09		
Test Results				
Moisture Content Initial % Final %	 16.5 26.0	 14.5 17.0		
Estimated UCS Before Test kPa After Test kPa	 >600 400	 >600 >600		
Swell % Shrinkage %	1.24 0.8/2	1.00 0.56		
Shrink/Swell Index %/pF	0.8	0.6		
Material Description	(CH) Silty Clay: high plasticity, brown	(CI-CH) Gravelly Silty Clay: medium to high plasticity, brown red		

Approved Signatory  Solern Liew 13/03/09

Principal

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Test Results - Atterberg Limits

Client / Address: JBS Environmental (Mascot) | Job No: JG09245A
Project: Airds / Bradbury Redevelopment | Date: 13-03-09
Location: Airds / Bradbury | Report No: R13A

Test Procedure: AS 1289 2.1.1, 3.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1

Sample Identification	TP 1 (0.5-0.7m)	TP 6 (0.8-1.0m)	TP 8 (0.55-0.75m)	TP 11 (0.7-0.85m)
Sample Register No	SR5205	SR5206	SR5207	SR5208
Sample Date	14 to 23-02-09	14 to 03-02-09	14 to 23-02-09	14 to 23-02-09
Test Date	18-02-09	18-02-09	18-02-09	18-02-09
Test Results				
Liquid Limit (%)	70	73	61	59
Plasitc Limit (%)	22	21	25	26
Plasticity Index (%)	48	52	36	33
Linear Shrinkage (%)	16.5	13.0	11.5	13.5
Natural Moisture Content %	-	-	-	-
Material Description	(CH) Silty Clay: high plasticity, red brown	(CI-CH) Silty Clay: meidum to high plasticity, red brown grey	(CH) Silty Clay: high plasticity, red brown	(CH) Silty Clay: high plasticity, red brown

Approved Signatory

Principal

Solern Liew Date 13 / 03 / 09

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Test Results - Atterberg Limits

Client / Address: JBS Environmental (Mascot)	Job No: JG09245A
Project: Airds / Bradbury Redevelopment	Date: 13-03-09
Location: Airds / Bradbury	Report No: R14A

Test Procedure: AS 1289 2.1.1, 3.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1

Sample Identification	TP 14 (0.7-0.9m)	TP 16 (0.3-0.6m)	TP 18 (0.45-0.7m)	TP 20 (0.25-0.55m)
Sample Register No	SR5209	SR5210	SR5211	SR5212
Sample Date	14 to 23-02-09	14 to 03-02-09	14 to 23-02-09	14 to 23-02-09
Test Date	25-02-09	24-02-09	18-02-09	26-02-09
Test Results				
Liquid Limit (%)	59	54	25	60
Plasitc Limit (%)	24	23	34	24
Plasticity Index (%)	35	31	41	36
Linear Shrinkage (%)	13.5	13.5	18.0	12.0
Natural Moisture Content %	-	-	-	-
Material Description	(CH) Silty Clay: high plasticity, red brown	(CH) Silty Clay: high plasticity, red brown	(CH) Silty Clay: high plasticity, red brown	(CH) Silty Clay: high plasticity, red brown

Approved Signatory

Principal

Solern Liew Date 13 / 03 / 09

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Test Results - Atterberg Limits

Client / Address: JBS Environmental (Mascot)	Job No: JG09245A
Project: Airds / Bradbury Redevelopment	Date: 13-03-09
Location: Airds / Bradbury	Report No: R15A

Test Procedure: AS 1289 2.1.1, 3.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1

Sample Identification	TP 25 (1.2-1.35m)	TP 26 (0.25-0.45m)	TP 28 (0.55-0.7m)	TP 29 (0.35-0.55m)
Sample Register No	SR5213	SR5214	SR5215	SR5216
Sample Date	14 to 23-02-09	14 to 03-02-09	14 to 23-02-09	14 to 23-02-09
Test Date	24-02-09	25-02-09	26-02-09	18-02-09
Test Results				
Liquid Limit (%)	47	56	65	67
Plasitc Limit (%)	18	25	26	28
Plasticity Index (%)	29	31	39	38
Linear Shrinkage (%)	10.5	13.5	15.5	12.5
Natural Moisture Content %	-	-	-	-
Material Description	(CH) Silty Clay: high plasticity, brown grey with some gravel	(CH) Silty Clay: high plasticity, brown red	(CH) Silty Clay: high plasticity, red brown	(CH) Silty Clay: high plasticity, red brown

Approved Signatory

Principal

Solern Liew Date 13 / 03 / 09

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Test Results - Atterberg Limits

Client / Address: JBS Environmental (Mascot)	Job No: JG09245A
Project: Airds / Bradbury Redevelopment	Date: 13-03-09
Location: Airds / Bradbury	Report No: R16A

Test Procedure: AS 1289 2.1.1, 3.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1

Sample Identification	TP 31 (0.2-0.45m)	TP 32 (0.5-0.7m)	TP 34 (0.35-0.5m)	TP 38 (0.35-0.55m)
Sample Register No	SR5217	SR5219	SR5218	SR5220
Sample Date	14 to 23-02-09	14 to 03-02-09	14 to 23-02-09	14 to 23-02-09
Test Date	24-02-09	27-02-09	24-02-09	26-02-09
Test Results				
Liquid Limit (%)	70	79	68	50
Plasitc Limit (%)	33	27	28	22
Plasticity Index (%)	38	52	40	28
Linear Shrinkage (%)	17.5	16.5	17.5	7.8
Natural Moisture Content %	-	-	-	-
Material Description	(CH) Silty Clay: high plasticity, brown	(CH) Silty Clay: high plasticity, red brown	(CH) Silty Clay: high plasticity, red brown	(CL) Sandy Clay: low plasticity, brown

Approved Signatory

Principal

Solern Liew Date 13 / 03 / 09

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Test Results - Atterberg Limits

Client / Address: JBS Environmental (Mascot) | Job No: JG09245A
Project: Airds / Bradbury Redevelopment | Date: 13-03-09
Location: Airds / Bradbury | Report No: R17A

Test Procedure: AS 1289 2.1.1, 3.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1

Sample Identification	TP 40 (0.6-0.85m)	TP 43 (0.3-0.5m)	TP 45 (0.3-0.5m)	TP 50 (0.3-0.6m)
Sample Register No	SR5221	SR5222	SR5223	SR5224
Sample Date	14 to 23-02-09	14 to 03-02-09	14 to 23-02-09	14 to 23-02-09
Test Date	25-02-09	18-02-09	18-02-09	26-02-09
Test Results				
Liquid Limit (%)	47	77	68	53
Plasitc Limit (%)	22	34	26	28
Plasticity Index (%)	25	44	41	26
Linear Shrinkage (%)	11.5	14.5	16.0	13.0
Natural Moisture Content %	-	-	-	-
Material Description	(CI-CH) Silty Clay: high plasticity, brown red with some gravel	(CH) Silty Clay: high plasticity, red brown	(CH) Silty Clay: high plasticity, red brown	(CH) Silty Clay: high plasticity, red brown with a trace of gravel

Approved Signatory

Principal

Solern Liew Date 13 / 03 / 09

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Test Results - Atterberg Limits

Client / Address: JBS Environmental (Mascot)	Job No: JG09245A
Project: Airds / Bradbury Redevelopment	Date: 13-03-09
Location: Airds / Bradbury	Report No: R18A

Test Procedure: AS 1289 2.1.1, 3.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1

Sample Identification	TP 56 (0.65-0.85m)	TP 60 (0.25-0.5m)	TP 61 (0.4-0.6m)	TP 65 (0.25-0.5m)
Sample Register No	SR5225	SR5226	SR5227	SR5228
Sample Date	14 to 23-02-09	14 to 03-02-09	14 to 23-02-09	14 to 23-02-09
Test Date	18-02-09	24-02-09	24-02-09	26-02-09
Test Results				
Liquid Limit (%)	63	68	64	52
Plasitc Limit (%)	28	28	26	23
Plasticity Index (%)	35	40	38	29
Linear Shrinkage (%)	13.5	15.0	13.5	13.0
Natural Moisture Content %	-	-	-	-
Material Description	(CH) Silty Clay: high plasticity, red brown	(CH) Silty Clay: high plasticity, red brown	(CH) Silty Clay: high plasticity, red brown	(CH) Silty Clay: high plasticity, brown

Approved Signatory

Principal

Solern Liew Date 13 / 03 / 09

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Test Results - Atterberg Limits

Client / Address: JBS Environmental (Mascot)	Job No: JG09245A
Project: Airds / Bradbury Redevelopment	Date: 13-03-09
Location: Airds / Bradbury	Report No: R19A

Test Procedure: AS 1289 2.1.1, 3.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1

Sample Identification	TP 66 (0.35-0.6m)			
Sample Register No	SR5229			
Sample Date	14 to 23-02-09			
Test Date	18-02-09			
Test Results				
Liquid Limit (%)	52			
Plasitc Limit (%)	22			
Plasticity Index (%)	30			
Linear Shrinkage (%)	14.5			
Natural Moisture Content %	-			
Material Description	(CI-CH) Gravelly Silty Clay: medium to high plasticity brown red			

Approved Signatory

Principal

Solern Liew Date 13 / 03 / 09

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown, NSW 2148, Australia

Particle Size Distribution & Atterberg Limits Test Report

Client/Address:	JBS Environmental (Mascot)	Job No.	JG09245A
Project:	Airds / Bradbury Redevelopment	Date:	13-03-09
Location:	Airds / Bradbury	Report No.	R20A

Lab Reference No. SR5207	Sample Identification: TP 8 (1.0-1.1m)	Sample / Test Date: 14-02-09/14-02-09

Laboratory Specimen Description: (CH) Silty Clay: high plasticity, grey brown with some gravel

Particle Size Distribution AS1289 1.1, 1.2.1-Clause 6.5, 3.6.1

Sieve Size	% Passing	Specification
150 mm	-	-
75 mm	-	-
63mm	-	-
53mm	-	-
37.5 mm	-	-
26.5 mm	-	-
19.0 mm	-	-
16.0 mm	-	-
13.2 mm	-	-
9.5 mm	-	-
6.7 mm	100	-
4.75 mm	100	-
2.36 mm	100	-
1.18 mm	100	-
600 um	100	-
425 um	100	-
300 um	99	-
150 um	97	-
75 um	88	-

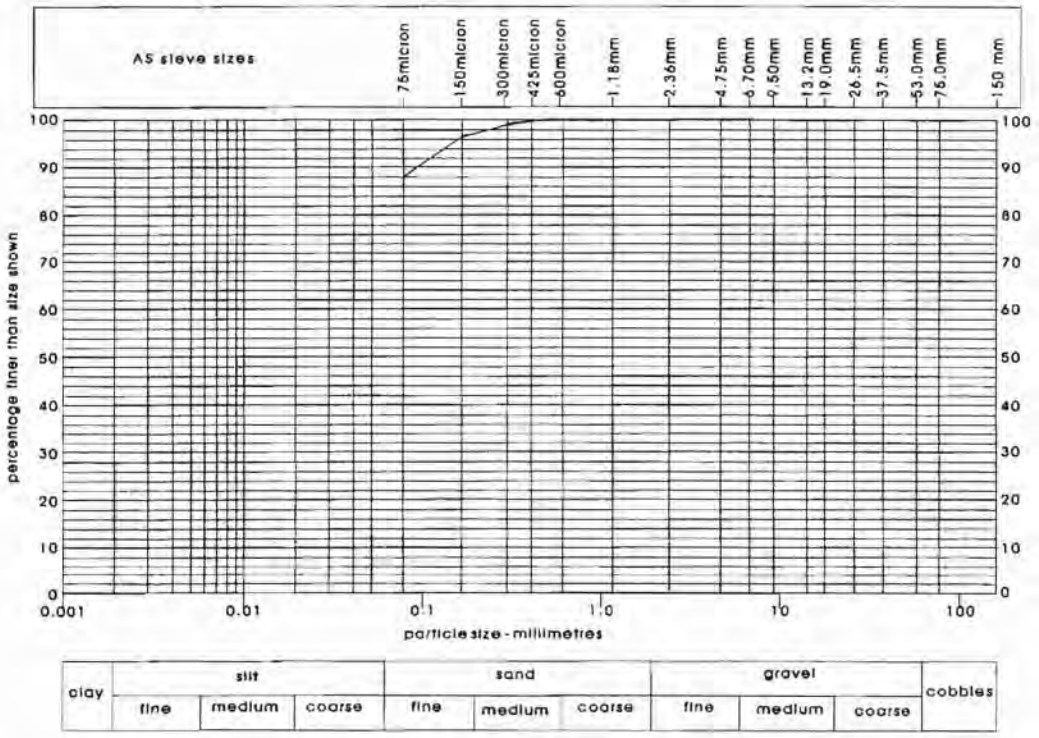
Atterberg Limits and Moisture Content AS 1289 2.1.1, 3.1.1, 3.2.1, 3.3.1, 3.4.1

Test		Method	Result	Spec.
Liquid Limit	%	As 1289 3.1.2		
Plastic Limit	%	AS1289 3.2.1		
Plasticity Index	%	AS1289 3.3.1		
Linear Shrinkage	%	AS1289 3.4.1		
Moisture Content	%	AS1289 2.1.1		

Sample History:
Preparation Method.
Crumbling / Curling of linear shrinkage.
Linear shrinkage mould length. 250mm
ND = not determined NO = not obtainable NP = non plastic

Moisture / Dry Density Relationship: AS 1289 5.2.1
Maximum Dry Density. t/m3
Optimum Moisture Content. %

Notes:



Approved Signatory

Solern Liew 13/03/09
Principal

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown, NSW 2148, Australia

Particle Size Distribution & Atterberg Limits Test Report

Client/Address:	JBS Environmental (Mascot)	Job No.	JG09245A
Project:	Airds / Bradbury Redevelopment	Date:	13-03-09
Location:	Airds / Bradbury	Report No.	R21A

Lab Reference No. SR5209	Sample Identification: TP 14 (0.7-0.9m)	Sample / Test Date: 14-02-09/14-02-09

Laboratory Specimen Description: (CH) Silty Clay: high plasticity, red brown with some gravel

Particle Size Distribution AS1289 1.1, 1.2.1-Clause 6.5, 3.6.1

Sieve Size	% Passing	Specification
150 mm	-	-
75 mm	-	-
63mm	-	-
53mm	-	-
37.5 mm	-	-
26.5 mm	-	-
19.0 mm	100	-
16.0 mm	99	-
13.2 mm	99	-
9.5 mm	99	-
6.7 mm	99	-
4.75 mm	99	-
2.36 mm	98	-
1.18 mm	96	-
600 um	96	-
425 um	95	-
300 um	95	-
150 um	94	-
75 um	94	-

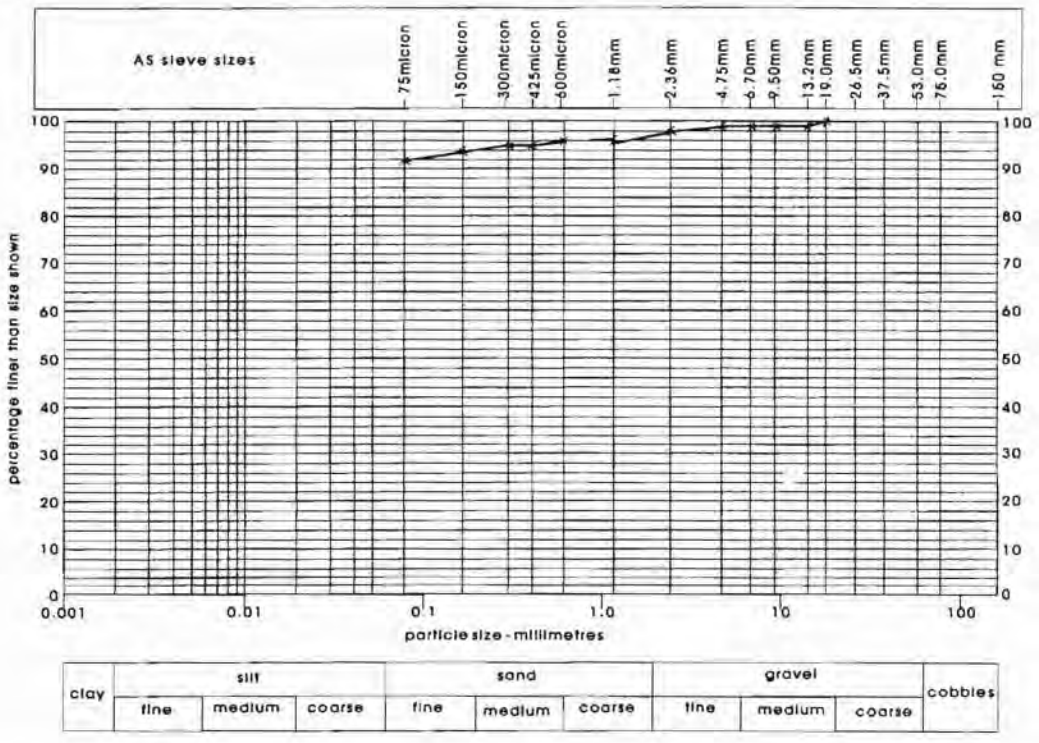
Atterberg Limits and Moisture Content AS 1289 2.1.1, 3.1.1, 3.2.1, 3.3.1, 3.4.1.

Test		Method	Result	Spec.
Liquid Limit	%	As 1289 3.1.2		
Plastic Limit	%	AS1289 3.2.1		
Plasticity Index	%	AS1289 3.3.1		
Linear Shrinkage	%	AS1289 3.4.1		
Moisture Content	%	AS1289 2.1.1		

Sample History:
Preparation Method.
Crumbling / Curling of linear shrinkage.
Linear shrinkage mould length. 250mm
ND = not determined NO = not obtainable NP = non plastic

Moisture / Dry Density Relationship: AS 1289 5.2.1
Maximum Dry Density. t/m3
Optimum Moisture Content. %

Notes:



This document is issued in accordance with NATA's accreditation requirements
Accredited for compliance with ISO/IEC 17025
NATA Accredited Laboratory Number: 14208

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

Approved Signatory

Principal

Solern Liew 13/03/09

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown, NSW 2148, Australia

Particle Size Distribution & Atterberg Limits Test Report

Client/Address:	JBS Environmental (Mascot)	Job No.	JG09245A
Project:	Airds / Bradbury Redevelopment	Date:	13-03-09
Location:	Airds / Bradbury	Report No.	R22A

Lab Reference No. SR5211	Sample Identification: TP 18 (0.95-1.15m)	Sample / Test Date: 14-02-09/14-02-09

Laboratory Specimen Description: (CL): Sandy Clay: low plasticity, red grey with some sandstone gravel

Particle Size Distribution AS1289 1.1, 1.2.1-Clause 6.5, 3.6.1

Sieve Size	% Passing	Specification
150 mm	-	-
75 mm	-	-
63mm	-	-
53mm	100	-
37.5 mm	97	-
26.5 mm	96	-
19.0 mm	96	-
16.0 mm	95	-
13.2 mm	95	-
9.5 mm	95	-
6.7 mm	94	-
4.75 mm	93	-
2.36 mm	92	-
1.18 mm	91	-
600 um	91	-
425 um	90	-
300 um	88	-
150 um	59	-
75 um	46	-

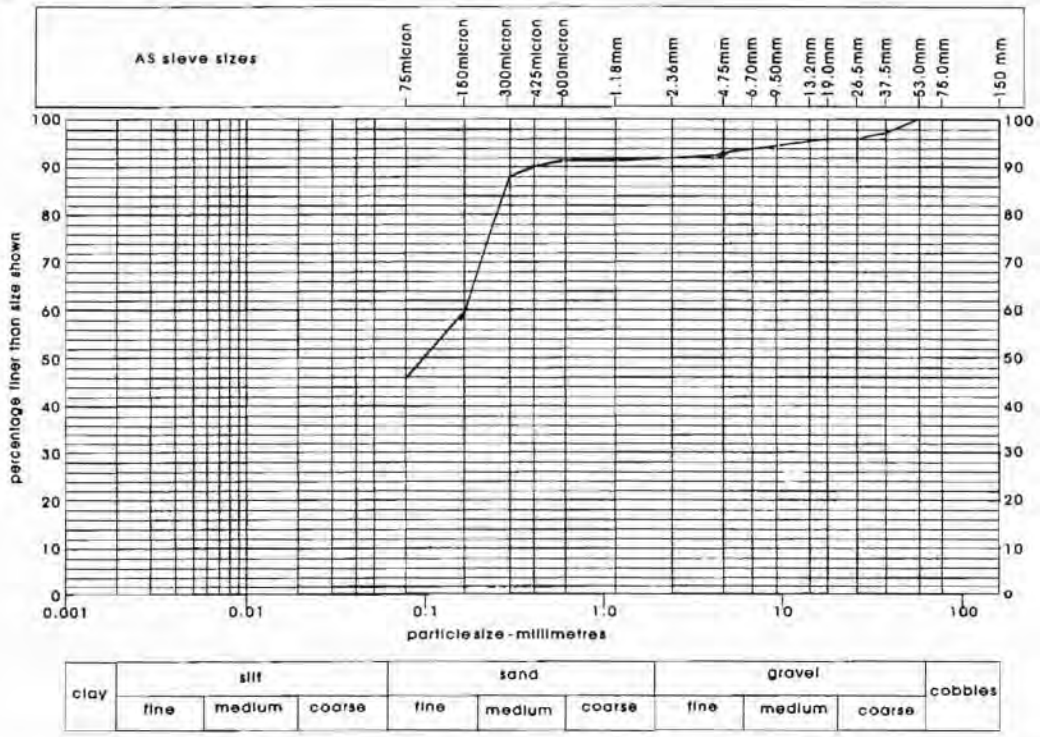
Atterberg Limits and Moisture Content AS 1289 2.1.1, 3.1.1, 3.2.1, 3.3.1, 3.4.1.

Test		Method	Result	Spec.
Liquid Limit	%	As 1289 3.1.2		
Plastic Limit	%	AS1289 3.2.1		
Plasticity Index	%	AS1289 3.3.1		
Linear Shrinkage	%	AS1289 3.4.1		
Moisture Content	%	AS1289 2.1.1		

Sample History:
Preparation Method.
Crumbling / Curling of linear shrinkage.
Linear shrinkage mould length. 250mm
ND = not determined NO = not obtainable NP = non plastic

Moisture / Dry Density Relationship: AS 1289 5.2.1
Maximum Dry Density. t/m3
Optimum Moisture Content. %

Notes:



This document is issued in accordance with NATA's accreditation requirements
Accredited for compliance with ISO/IEC 17025
NATA Accredited Laboratory Number: 14208.

ACCREDITED FOR TECHNICAL COMPETENCE

Approved Signatory

Principal

Solern Liew 13/03/09

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown, NSW 2148, Australia

Particle Size Distribution & Atterberg Limits Test Report

Client/Address:	JBS Environmental (Mascot)	Job No.	JG09245A
Project:	Airds / Bradbury Redevelopment	Date:	13-03-09
Location:	Airds / Bradbury	Report No.	R23A

Lab Reference No. SR5213	Sample Identification: TP 25 (1.2-1.3m)	Sample / Test Date: 14-02-09/14-02-09

Laboratory Specimen Description: (CL): Sandy Clay: low plasticity, brown with some gravel

Particle Size Distribution AS1289 1.1, 1.2.1-Clause 6.5, 3.6.1

Sieve Size	% Passing	Specification
150 mm	-	-
75 mm	-	-
63mm	100	-
53mm	94	-
37.5 mm	94	-
26.5 mm	92	-
19.0 mm	91	-
16.0 mm	91	-
13.2 mm	91	-
9.5 mm	91	-
6.7 mm	90	-
4.75 mm	89	-
2.36 mm	89	-
1.18 mm	88	-
600 um	87	-
425 um	85	-
300 um	81	-
150 um	61	-
75 um	51	-

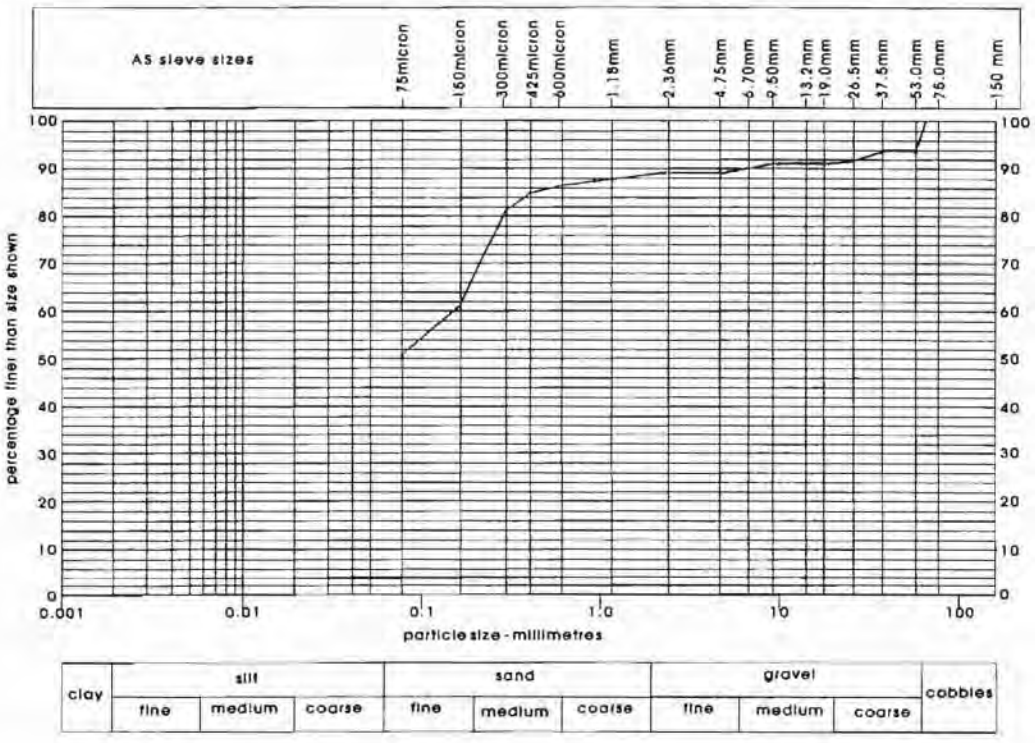
Atterberg Limits and Moisture Content AS 1289 2.1.1, 3.1.1, 3.2.1, 3.3.1, 3.4.1

Test		Method	Result	Spec.
Liquid Limit	%	As 1289 3.1.2		
Plastic Limit	%	AS1289 3.2.1		
Plasticity Index	%	AS1289 3.3.1		
Linear Shrinkage	%	AS1289 3.4.1		
Moisture Content	%	AS1289 2.1.1		

Sample History:
Preparation Method.
Crumbling / Curling of linear shrinkage.
Linear shrinkage mould length. 250mm
ND = not determined NO = not obtainable NP = non plastic

Moisture / Dry Density Relationship: AS 1289 5.2.1
Maximum Dry Density. t/m3
Optimum Moisture Content. %

Notes:



Approved Signatory

Solern Liew 13/03/09
Principal

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown, NSW 2148, Australia

Particle Size Distribution & Atterberg Limits Test Report

Client/Address:	JBS Environmental (Mascot)	Job No.	JG09245A
Project:	Airds / Bradbury Redevelopment	Date:	13-03-09
Location:	Airds / Bradbury	Report No.	R24A

Lab Reference No. SR5214	Sample Identification: TP 26 (0.9-1.1m)	Sample / Test Date: 14-02-09/14-02-09

Laboratory Specimen Description: (CH) Silty Clay: high plasticity, grey brown with some gravel

Particle Size Distribution AS1289 1.1, 1.2.1-Clause 6.5, 3.6.1

Sieve Size	% Passing	Specification
150 mm	-	-
75 mm	-	-
63mm	-	-
53mm	100	-
37.5 mm	87	-
26.5 mm	84	-
19.0 mm	84	-
16.0 mm	83	-
13.2 mm	82	-
9.5 mm	81	-
6.7 mm	80	-
4.75 mm	79	-
2.36 mm	78	-
1.18 mm	77	-
600 um	76	-
425 um	75	-
300 um	73	-
150 um	69	-
75 um	63	-

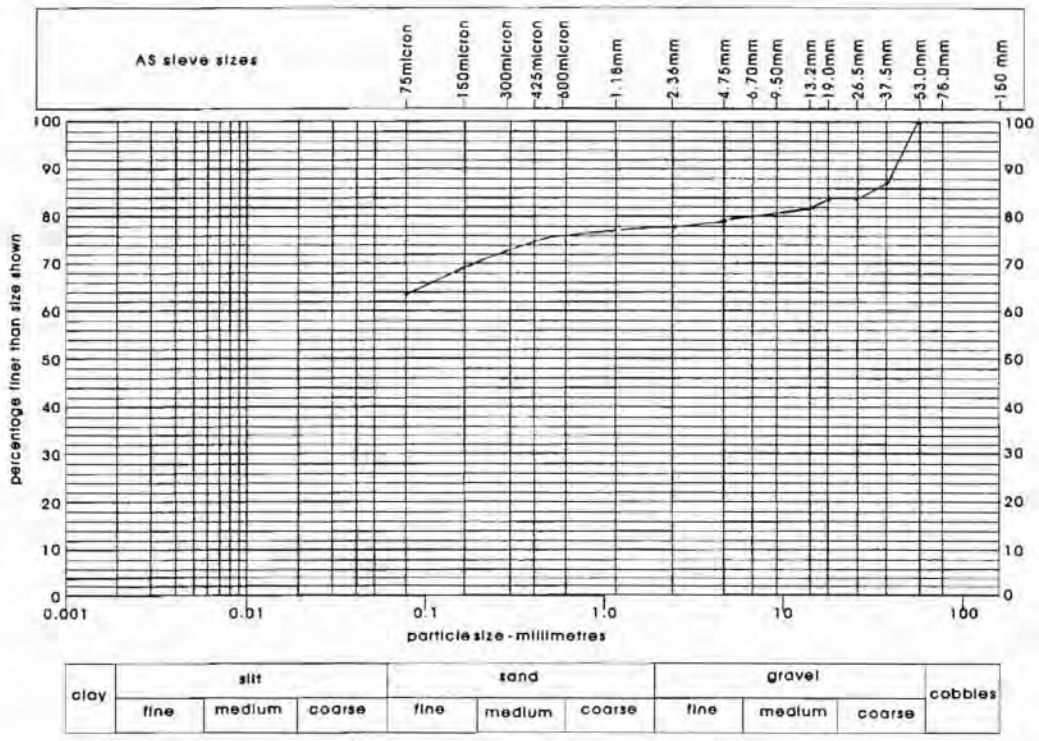
Atterberg Limits and Moisture Content AS 1289 2.1.1, 3.1.1, 3.2.1, 3.3.1, 3.4.1.

Test		Method	Result	Spec.
Liquid Limit	%	As 1289 3.1.2		
Plastic Limit	%	AS1289 3.2.1		
Plasticity Index	%	AS1289 3.3.1		
Linear Shrinkage	%	AS1289 3.4.1		
Moisture Content	%	AS1289 2.1.1		

Sample History:
Preparation Method.
Crumbling / Curling of linear shrinkage.
Linear shrinkage mould length. 250mm
ND = not determined NO = not obtainable NP = non plastic

Moisture / Dry Density Relationship: AS 1289 5.2.1
Maximum Dry Density. t/m3
Optimum Moisture Content. %

Notes:



This document is issued in accordance with NATA's accreditation requirements
Accredited for compliance with ISO/IEC 17025
NATA Accredited Laboratory Number: 14208

ACCREDITED FOR TECHNICAL COMPETENCE

Approved Signatory

Principal

Solern Liew 13/03/09

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown, NSW 2148, Australia

Particle Size Distribution & Atterberg Limits Test Report

Client/Address:	JBS Environmental (Mascot)	Job No.	JG09245A
Project:	Airds / Bradbury Redevelopment	Date:	13-03-09
Location:	Airds / Bradbury	Report No.	R26A

Lab Reference No. SR5215	Sample Identification: TP 28 (1.7-1.8m)	Sample / Test Date: 14-02-09/14-02-09

Laboratory Specimen Description: (CI-CH) Silty Clay: medium to high plasticity, grey brown with gravel

Particle Size Distribution AS1289 1.1, 1.2.1-Clause 6.5, 3.6.1

Sieve Size	% Passing	Specification
150 mm	-	-
75 mm	-	-
63mm	-	-
53mm	-	-
37.5 mm	100	-
26.5 mm	98	-
19.0 mm	95	-
16.0 mm	91	-
13.2 mm	89	-
9.5 mm	85	-
6.7 mm	83	-
4.75 mm	81	-
2.36 mm	80	-
1.18 mm	78	-
600 um	77	-
425 um	77	-
300 um	76	-
150 um	75	-
75 um	75	-

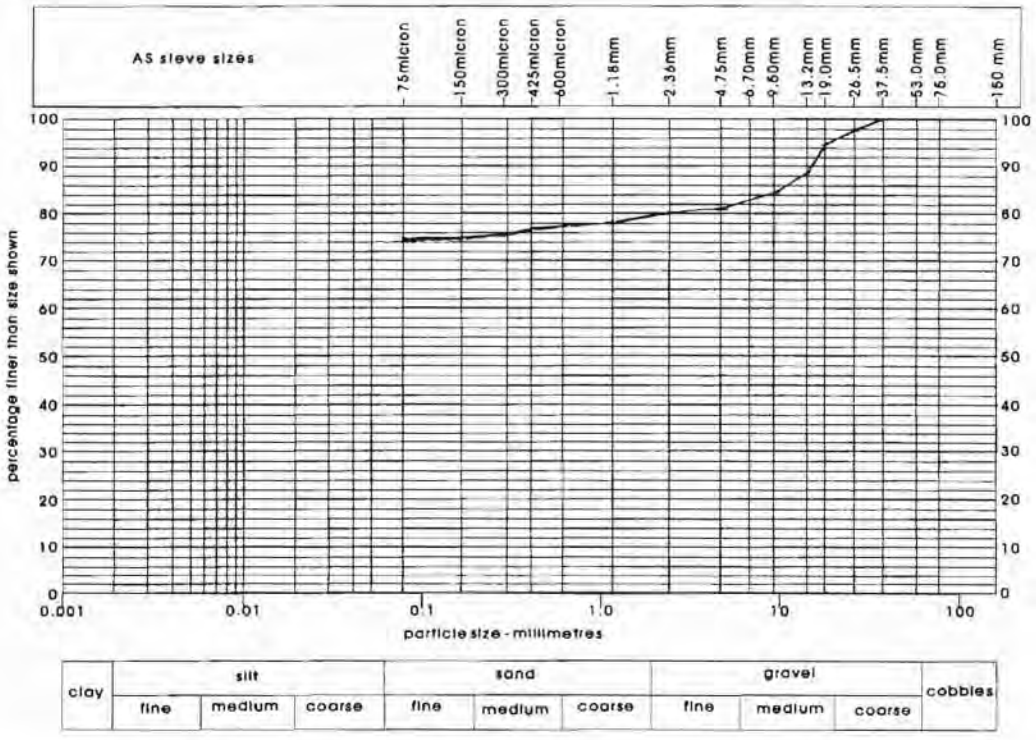
Atterberg Limits and Moisture Content AS 1289 2.1.1, 3.1.1, 3.2.1, 3.3.1, 3.4.1

Test		Method	Result	Spec
Liquid Limit	%	As 1289 3.1.2		
Plastic Limit	%	AS1289 3.2.1		
Plasticity Index	%	AS1289 3.3.1		
Linear Shrinkage	%	AS1289 3.4.1		
Moisture Content	%	AS1289 2.1.1		

Sample History:
Preparation Method.
Crumbling / Curling of linear shrinkage.
Linear shrinkage mould length. 250mm
ND = not determined NO = not obtainable NP = non plastic

Moisture / Dry Density Relationship: AS 1289 5.2.1
Maximum Dry Density t/m3
Optimum Moisture Content. %

Notes:



This document is issued in accordance with NATA's accreditation requirements
Accredited for compliance with ISO/IEC 17025
NATA Accredited Laboratory Number: 14208.

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

Approved Signatory

Solern Liew 13/03/09
Principal

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown, NSW 2148, Australia

Particle Size Distribution & Atterberg Limits Test Report

Client/Address:	JBS Environmental (Mascot)	Job No.	JG09245A
Project:	Airds / Bradbury Redevelopment	Date:	13-03-09
Location:	Airds / Bradbury	Report No.	R27A

Lab Reference No. SR5218	Sample Identification: TP 34 (1.0-1.3m)	Sample / Test Date: 14-02-09/14-02-09

Laboratory Specimen Description: (GC) Clayey Gravel: grey

Particle Size Distribution AS1289 1.1, 1.2.1-Clause 6.5, 3.6.1

Sieve Size	% Passing	Specification
150 mm	-	-
75 mm	-	-
63mm	-	-
53mm	-	-
37.5 mm	100	-
26.5 mm	94	-
19.0 mm	86	-
16.0 mm	83	-
13.2 mm	78	-
9.5 mm	68	-
6.7 mm	59	-
4.75 mm	52	-
2.36 mm	43	-
1.18 mm	37	-
600 um	35	-
425 um	34	-
300 um	33	-
150 um	32	-
75 um	29	-

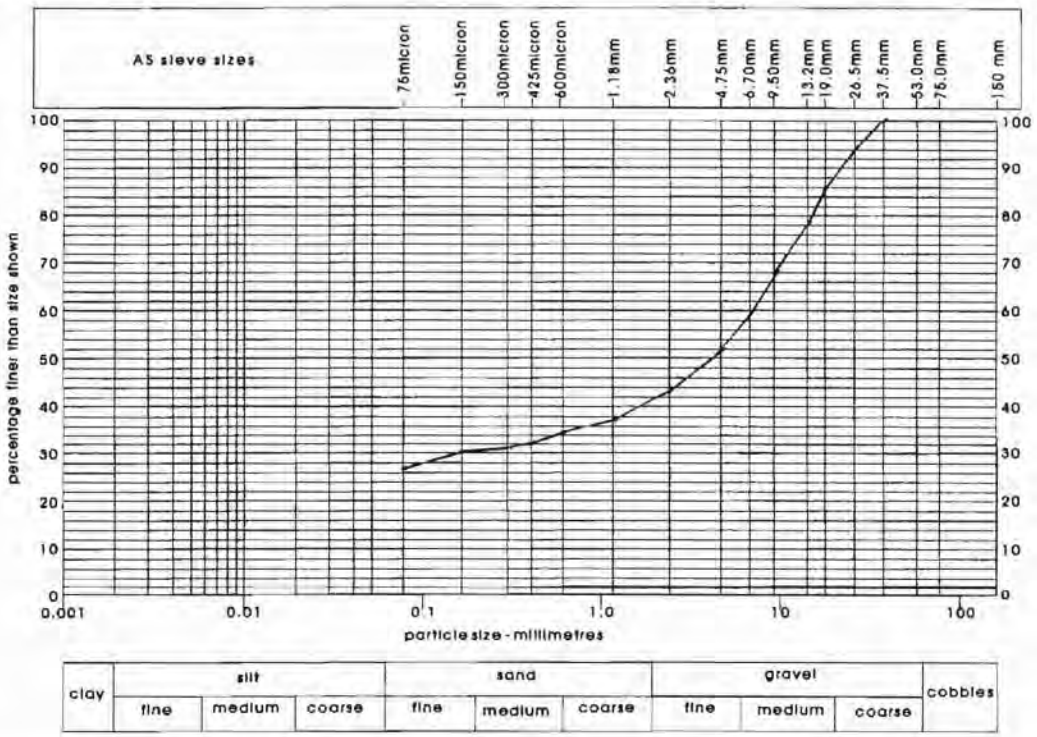
Atterberg Limits and Moisture Content AS 1289 2.1.1, 3.1.1, 3.2.1, 3.3.1, 3.4.1

Test		Method	Result	Spec.
Liquid Limit	%	As 1289 3.1.2		
Plastic Limit	%	AS1289 3.2.1		
Plasticity Index	%	AS1289 3.3.1		
Linear Shrinkage	%	AS1289 3.4.1		
Moisture Content	%	AS1289 2.1.1		

Sample History:
Preparation Method.
Crumbling / Curling of linear shrinkage.
Linear shrinkage mould length. 250mm
ND = not determined NO = not obtainable NP = non plastic

Moisture / Dry Density Relationship: AS 1289 5.2.1
Maximum Dry Density. t/m3
Optimum Moisture Content. %

Notes:



This document is issued in accordance with NATA's accreditation requirements
Accredited for compliance with ISO/IEC 17025
NATA Accredited Laboratory Number: 14208.

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

Approved Signatory

Principal

Solern Liew 13/03/09

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown, NSW 2148, Australia

Particle Size Distribution & Atterberg Limits Test Report

Client/Address:	JBS Environmental (Mascot)	Job No.	JG09245A
Project:	Airds / Bradbury Redevelopment	Date:	13-03-09
Location:	Airds / Bradbury	Report No.	R28A

Lab Reference No. SR5221	Sample Identification: TP 40 (0.6-0.7m)	Sample / Test Date: 14-02-09/14-02-09

Laboratory Specimen Description: (GC) Clayey Sandy Gravel: fine to medium grained gravel, brown red, dry

Particle Size Distribution AS1289 1.1, 1.2.1-Clause 6.5, 3.6.1

Sieve Size	% Passing	Specification
150 mm	-	-
75 mm	-	-
63mm	100	-
53mm	94	-
37.5 mm	86	-
26.5 mm	78	-
19.0 mm	74	-
16.0 mm	72	-
13.2 mm	69	-
9.5 mm	63	-
6.7 mm	57	-
4.75 mm	52	-
2.36 mm	47	-
1.18 mm	43	-
600 um	40	-
425 um	35	-
300 um	29	-
150 um	22	-
75 um	19	-

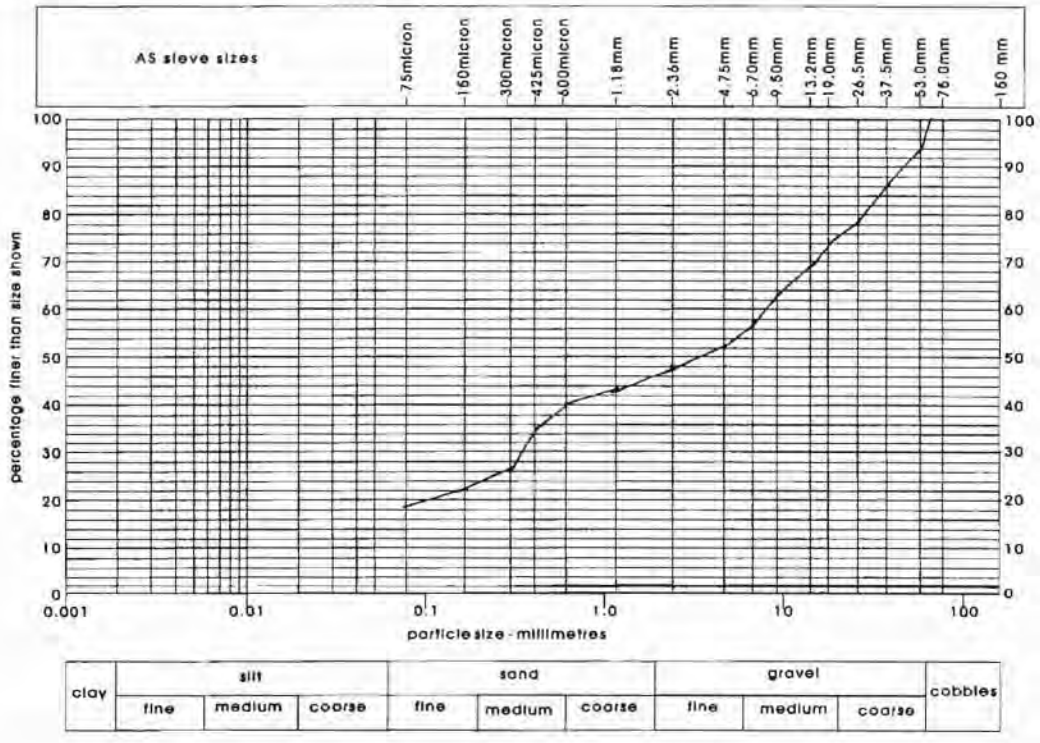
Atterberg Limits and Moisture Content AS 1289 2.1.1, 3.1.1, 3.2.1, 3.3.1, 3.4.1.

Test		Method	Result	Spec.
Liquid Limit	%	As 1289 3.1.2		
Plastic Limit	%	AS1289 3.2.1		
Plasticity Index	%	AS1289 3.3.1		
Linear Shrinkage	%	AS1289 3.4.1		
Moisture Content	%	AS1289 2.1.1		

Sample History:
Preparation Method.
Crumbling / Curling of linear shrinkage.
Linear shrinkage mould length. 250mm
ND = not determined NO = not obtainable NP = non plastic

Moisture / Dry Density Relationship: AS 1289 5.2.1
Maximum Dry Density. t/m3
Optimum Moisture Content. %

Notes:



c:\\Lab\report\R002

Form No. R002/Ver03/11/04

This document is issued in accordance with NATA's accreditation requirements
Accredited for compliance with ISO/IEC 17025
NATA Accredited Laboratory Number: 14208.

ACCREDITED FOR TECHNICAL COMPETENCE

Approved Signatory

Solern Liew 13/03/09

Principal

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown, NSW 2148, Australia

Particle Size Distribution & Atterberg Limits Test Report

Client/Address:	JBS Environmental (Mascot)	Job No.	JG09245A
Project:	Airds / Bradbury Redevelopment	Date:	13-03-09
Location:	Airds / Bradbury	Report No.	R29A

Lab Reference No. SR5222	Sample Identification: TP 43 (1.1-1.3m)	Sample / Test Date: 14-02-09/14-02-09

Laboratory Specimen Description: (GC) Clayey Sandy Gravel: fien to medium grained, brown

Particle Size Distribution AS1289 1.1, 1.2.1-Clause 6.5, 3.6.1

Sieve Size	% Passing	Specification
150 mm	-	-
75 mm	-	-
63mm	100	-
53mm	95	-
37.5 mm	92	-
26.5 mm	89	-
19.0 mm	87	-
16.0 mm	84	-
13.2 mm	81	-
9.5 mm	75	-
6.7 mm	67	-
4.75 mm	59	-
2.36 mm	47	-
1.18 mm	39	-
600 um	34	-
425 um	32	-
300 um	31	-
150 um	28	-
75 um	25	-

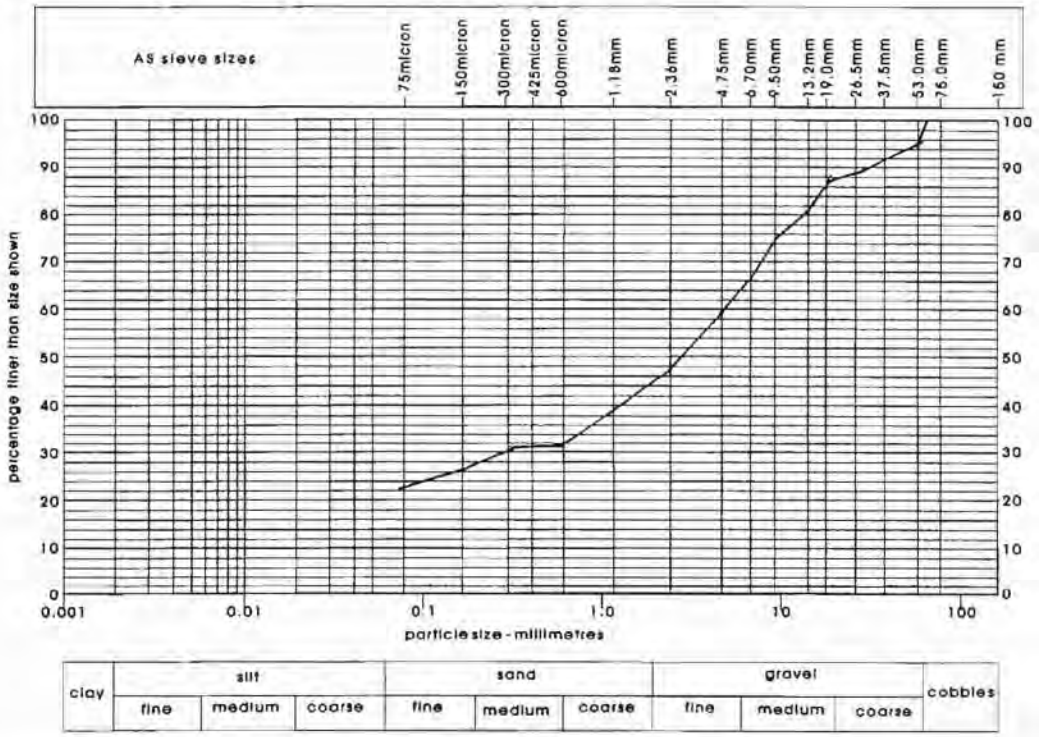
Atterberg Limits and Moisture Content AS 1289 2.1.1, 3.1.1, 3.2.1, 3.3.1, 3.4.1

Test		Method	Result	Spec.
Liquid Limit	%	As 1289 3.1.2		
Plastic Limit	%	AS1289 3.2.1		
Plasticity Index	%	AS1289 3.3.1		
Linear Shrinkage	%	AS1289 3.4.1		
Moisture Content	%	AS1289 2.1.1		

Sample History:
Preparation Method.
Crumbling / Curling of linear shrinkage.
Linear shrinkage mould length. 250mm
ND = not determined NO = not obtainable NP = non plastic

Moisture / Dry Density Relationship: AS 1289 5.2.1
Maximum Dry Density. t/m3
Optimum Moisture Content. %

Notes:



c:\\LabVeport\R002

Form No R002/Ver03/11/04

This document is issued in accordance with NATA's accreditation requirements
Accredited for compliance with ISO/IEC 17025
NATA Accredited Laboratory Number: 14208.

ACCREDITED FOR TECHNICAL COMPETENCE

Approved Signatory

Principal

Solern Liew 13/03/09

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown, NSW 2148, Australia

Particle Size Distribution & Atterberg Limits Test Report

Client/Address:	JBS Environmental (Mascot)	Job No.	JG09245A
Project:	Airds / Bradbury Redevelopment	Date:	13-03-09
Location:	Airds / Bradbury	Report No.	R30A

Lab Reference No. SR5229	Sample Identification: TP 66 (0.35-0.45m)	Sample / Test Date: 14-02-09/14-02-09

Laboratory Specimen Description: (CL-CI) Gravelly Sandy Clay: low to medium plasticity, brown red

Particle Size Distribution AS1289 1.1, 1.2.1-Clause 6.5, 3.6.1

Sieve Size	% Passing	Specification
150 mm	-	-
75 mm	-	-
63mm	-	-
53mm	-	-
37.5 mm	100	-
26.5 mm	99	-
19.0 mm	98	-
16.0 mm	97	-
13.2 mm	95	-
9.5 mm	93	-
6.7 mm	89	-
4.75 mm	84	-
2.36 mm	76	-
1.18 mm	71	-
600 um	69	-
425 um	68	-
300 um	65	-
150 um	49	-
75 um	40	-

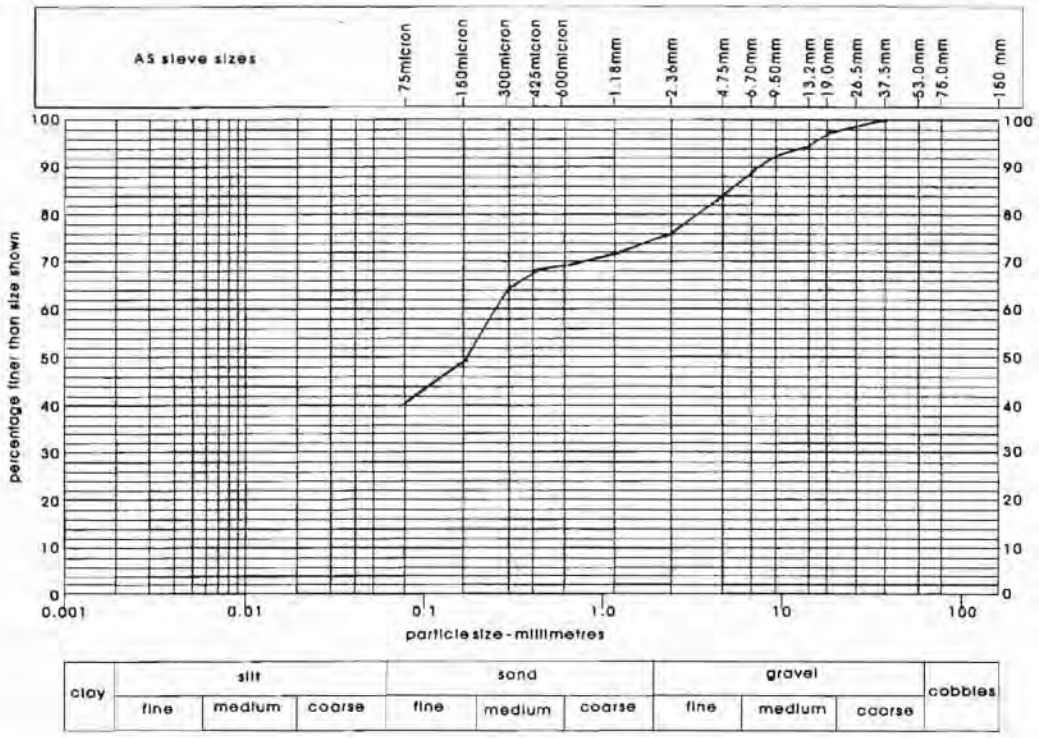
Atterberg Limits and Moisture Content AS 1289 2.1.1, 3.1.1, 3.2.1, 3.3.1, 3.4.1

Test		Method	Result	Spec.
Liquid Limit	%	As 1289 3.1.2		
Plastic Limit	%	AS1289 3.2.1		
Plasticity Index	%	AS1289 3.3.1		
Linear Shrinkage	%	AS1289 3.4.1		
Moisture Content	%	AS1289 2.1.1		

Sample History:
Preparation Method:
Crumbling / Curling of linear shrinkage:
Linear shrinkage mould length: 250mm
ND = not determined NO = not obtainable NP = non plastic

Moisture / Dry Density Relationship: AS 1289 5.2.1
Maximum Dry Density: t/m3
Optimum Moisture Content: %

Notes:



Approved Signatory

Solern Liew 13/03/09
Principal

Appendix E

Geotechnical Laboratory Test Certificates
Dam Embankment

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Test Results - Atterberg Limits & Emerson Class

Client / Address: JBS Environmental (Mascot)	Job No: JG09245B
Project: Airds / Bradbury Redevelopment - Dam Embankment	Date: 13-03-09
Location: Community Centre/Sports Centre, Airds	Report No: R01B
Test Procedure: AS 1289 1.1, 1.2.1, 2.1.1, 3.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1, 3.8.1	

Sample Identification	BH 1 (1.0-1.5m)	BH 2 (0.5-1.0m)	BH 2 (1.5-2.0m)	BH 2 (3.0-3.5
Sample Register No	SR 5243	SR 5246	SR 5247	SR 5248
Sample Date	12-Feb-09	12-Feb-09	12-Feb-09	12-Feb-09
Test Date	27-Feb-09	27-Feb-09	27-Feb-09	27-Feb-09
Test Results				
Liquid Limit (%)	46.0	39.0	40.0	66.0
Plasitc Limit (%)	19.0	16.0	16.0	24.0
Plasticity Index (%)	27.0	23.0	24.0	42.0
Linear Shrinkage (%)	13.0	5.5	8.0	15.0
Natural Moisture Content %	-	-	-	-
Material Description	Fill: Silty Clay: Medium to high plasticity, brown	Fill: Silty Clay: Medium plasticity, grey brown	Fill: Silty Clay: Medium to high plasticity, brown	CH: Silty Clay: High plasticity, red brown

Approved Signatory

Allan Fong Date 30/03/2009
Laboratory Manager

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Test Results - Atterberg Limits & Emerson Class

Client / Address: JBS Environmental (Mascot)	Job No: JG09245B
Project: Airds / Bradbury Redevelopment	Date: 13-03-09
Location: Community Centre/Sports Centre, Airds	Report No: R02B
Test Procedure: AS 1289 1.1, 1.2.1, 2.1.1, 3.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1, 3.8.1	

Sample Identification	BH 3 (1.5-2.0m)	BH 6 (0.2-0.6m)		
Sample Register No	SR 5250	SR 5254		
Sample Date	12-Feb-09	12-Feb-09		
Test Date	27-Feb-09	27-Feb-09		
Test Results				
Liquid Limit (%)	66.0	64.0		
Plasitc Limit (%)	24.0	28.0		
Plasticity Index (%)	42.0	39.0		
Linear Shrinkage (%)	14.5	16.5		
Natural Moisture Content %	-	-		
Material Description	CH: Silty Clay: High plasticity, red brown	CH: Silty Clay: High plasticity, red brown		

Approved Signatory _____ Allan Fong Date 30/03/2009
Laboratory Manager

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Emerson Class Number of a Soil

Client / Address: JBS Environmental (Mascot)	Job No: JG09245B
Project: Airds Bradbury Redevelopment - Dam Embankment	Date: 30/03/2009
Location: Community Centre/Sports Centre, Airds	Report No: R03B
Test Procedure: AS 1289 1.1, 1.2.1, 3.8.1	Lab Reference No. SR 4242
Sample Identification: BH 1 (0.5-1.0m)	Sample Description: Fill: Silty Clay: Medium to high plasticity, brown
Sample Date: 12/02/2009	Test Date: 26/02/2009

Details of Test

AIR DRIED CRUMBS

Time in water:
9:31
Time dispersion starts:
-

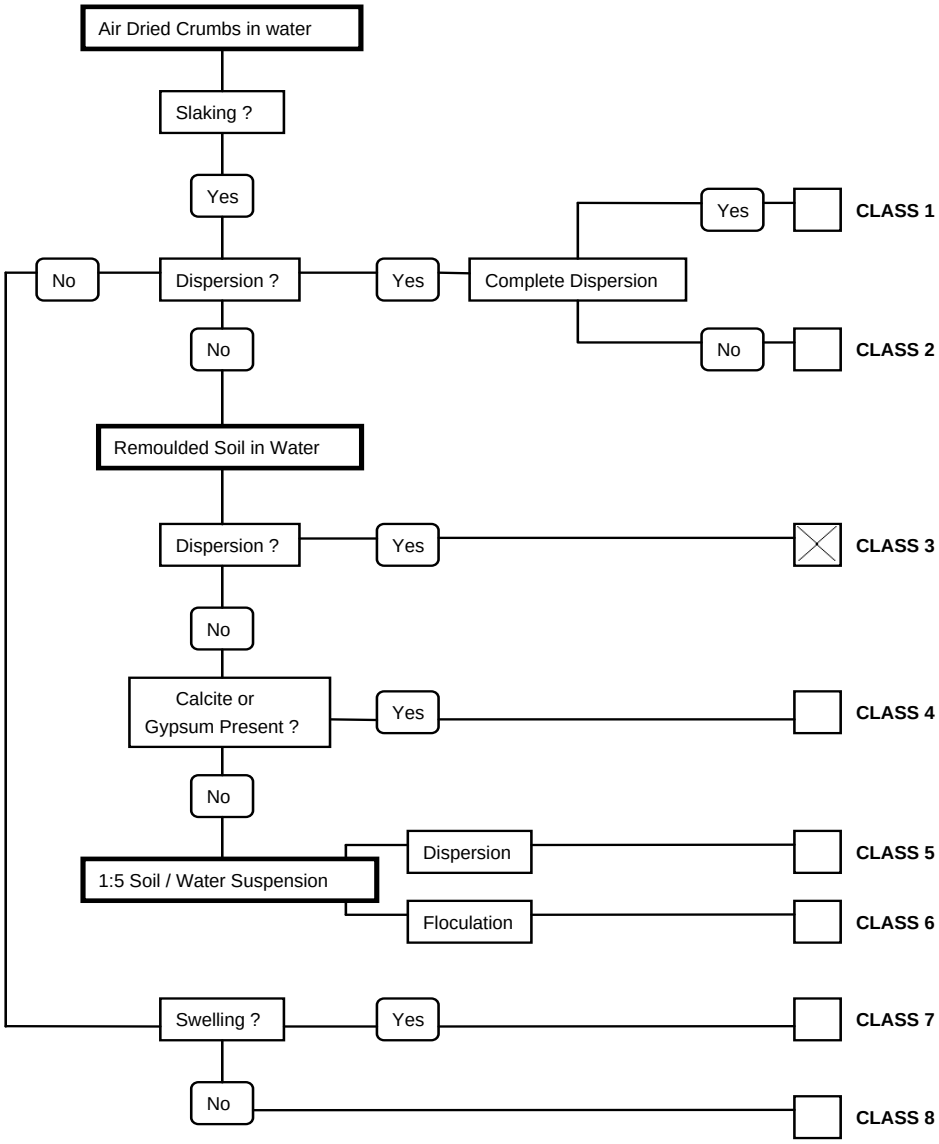
REMOULDED SOIL

Time in water:
9:49
Time dispersion starts:
9:54

TYPE OF WATER
Distilled
Temp. of water
24°C

OTHER OBSERVATIONS:

Dispersion Flow Chart



Approved Signatory

Allan Fong Date 30/03/2009

Laboratory Manager

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Emerson Class Number of a Soil

Client / Address: JBS Environmental (Mascot)	Job No: JG09245B
Project: Airds Bradbury Redevelopment - Dam Embankment	Date: 30/03/2009
Location: Community Centre/Sports Centre, Airds	Report No: R04B
Test Procedure: AS 1289 1.1, 1.2.1, 3.8.1	Lab Reference No. SR 4244
Sample Identification: BH 1 (1.5-2.0m)	Sample Description: Fill: Silty Clay: Medium to high plasticity, brown
Sample Date: 12/02/2009	Test Date: 26/02/2009

Details of Test

AIR DRIED CRUMBS

Time in water:
10:07
Time dispersion starts:
10:25

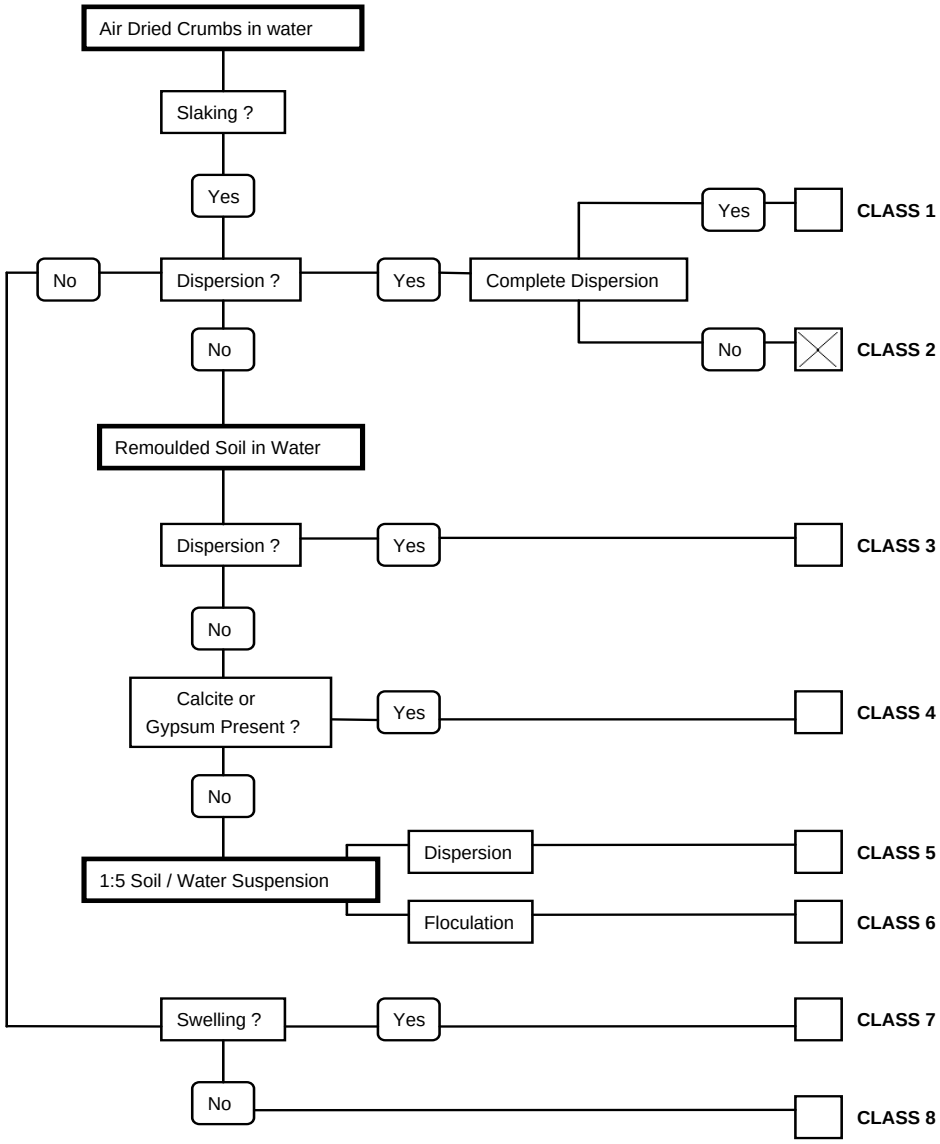
REMOULDED SOIL

Time in water:
-
Time dispersion starts:
-

TYPE OF WATER
Distilled
Temp. of water
24°C

OTHER OBSERVATIONS:

Dispersion Flow Chart



c:/lab/reports/R019

Form No. R019/Ver 03/06/07

NATA ACCREDITED FOR TECHNICAL COMPETENCE

This document is issued in accordance with NATA's accreditation requirements
Accredited for compliance with ISO/IEC 17025
NATA Accredited Laboratory Number: 14208.

Approved Signatory

Laboratory Manager

Allan Fong Date 30/03/2009

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Emerson Class Number of a Soil

Client / Address: JBS Environmental (Mascot)	Job No: JG09245B
Project: Airds Bradbury Redevelopment - Dam Embankment	Date: 30/03/2009
Location: Community Centre/Sports Centre, Airds	Report No: R05B
Test Procedure: AS 1289 1.1, 1.2.1, 3.8.1	Lab Reference No. SR 5245
Sample Identification: BH 2 (0.3-0.6m)	Sample Description: Fill: Silty Clay: Medium plasticity, brown grey
Sample Date: 12/02/2009	Test Date: 26/02/2009

Details of Test

AIR DRIED CRUMBS

Time in water:
9:43
Time dispersion starts:
9:44

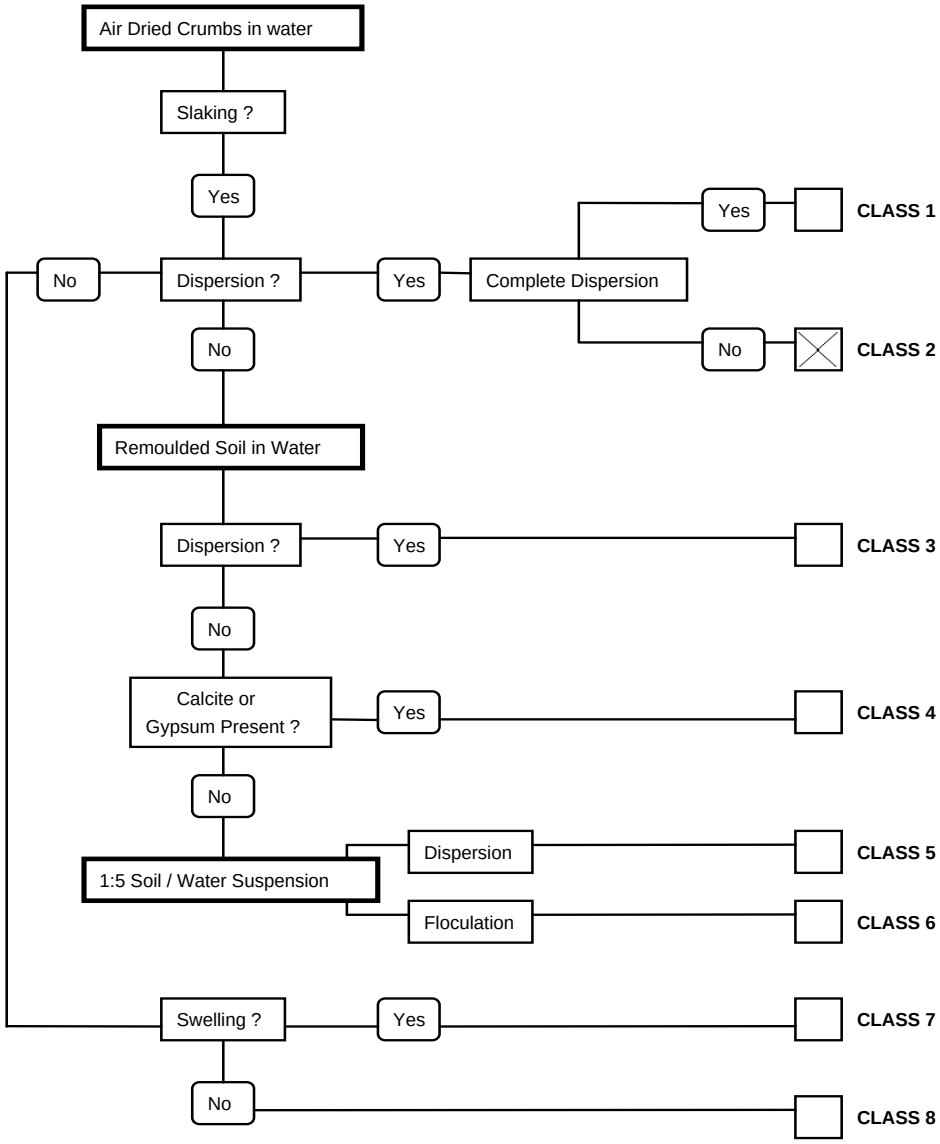
REMOULDED SOIL

Time in water:
-
Time dispersion starts:
-

TYPE OF WATER
Distilled
Temp. of water
24°C

OTHER OBSERVATIONS:

Dispersion Flow Chart



Approved Signatory

Allan Fong Date 30/03/2009

Laboratory Manager

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Emerson Class Number of a Soil

Client / Address: JBS Environmental (Mascot)	Job No: JG09245B
Project: Airds Bradbury Redevelopment - Dam Embankment	Date: 30/03/2009
Location: Community Centre/Sports Centre, Airds	Report No: R06B
Test Procedure: AS 1289 1.1, 1.2.1, 3.8.1	Lab Reference No. SR 5246
Sample Identification: BH 2 (0.6-1.0m)	Sample Description: Fill: Silty Clay: Medium plasticity, brown grey
Sample Date: 12/02/2009	Test Date: 26/02/2009

Details of Test

AIR DRIED CRUMBS

Time in water:
9:31
Time dispersion starts:
9:32

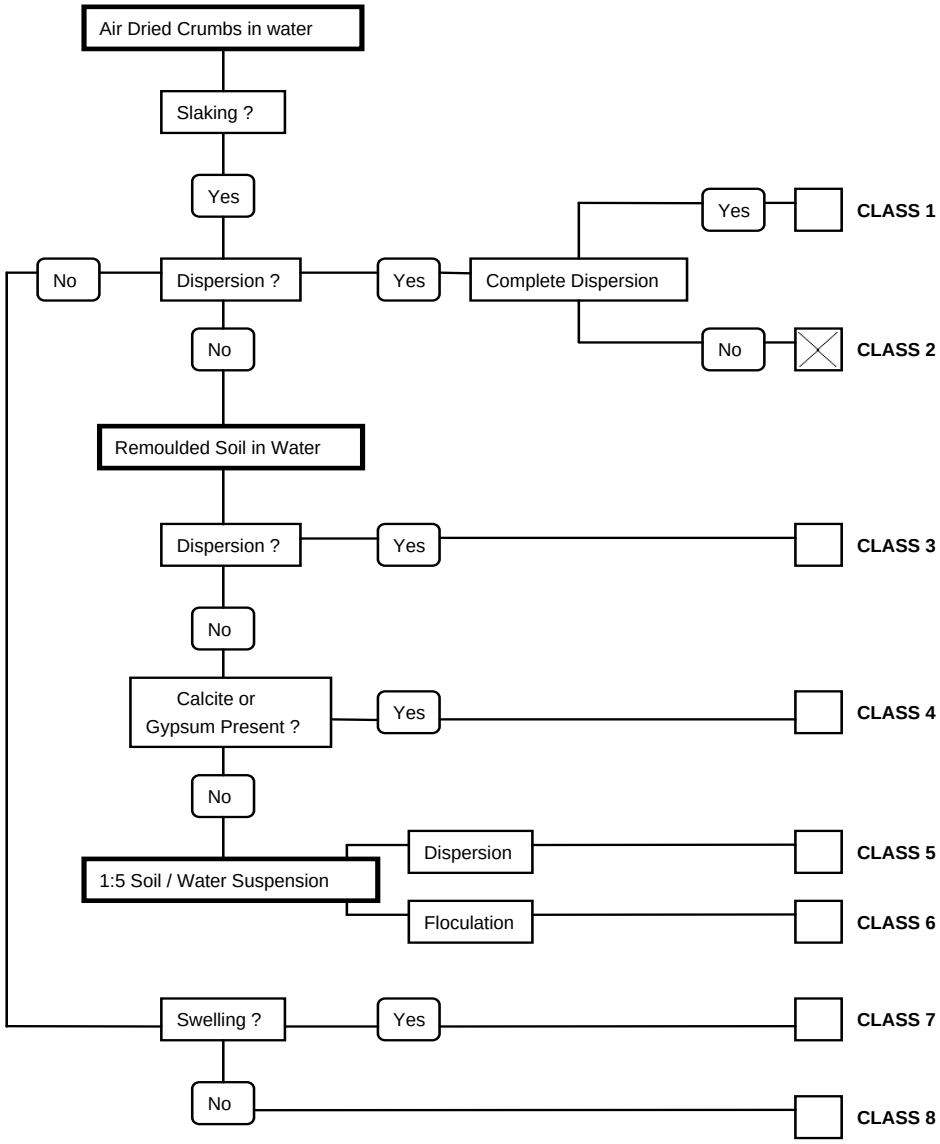
REMOULDED SOIL

Time in water:
-
Time dispersion starts:
-

TYPE OF WATER
Distilled
Temp. of water
24°C

OTHER OBSERVATIONS:

Dispersion Flow Chart



Approved Signatory

Allan Fong Date 30/03/2009

Laboratory Manager

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Emerson Class Number of a Soil

Client / Address: JBS Environmental (Mascot)	Job No: JG09245B
Project: Airds Bradbury Redevelopment - Dam Embankment	Date: 30/03/2009
Location: Community Centre/Sports Centre, Airds	Report No: R07B
Test Procedure: AS 1289 1.1, 1.2.1, 3.8.1	Lab Reference No. SR 5247
Sample Identification: BH 2 (1.5-2.0m)	Sample Description: Fill: Silty Clay: Medium to high plasticity, brown grey
Sample Date: 12/02/2009	Test Date: 26/02/2009

Details of Test

AIR DRIED CRUMBS

Time in water:
9:31
Time dispersion starts:
9:35

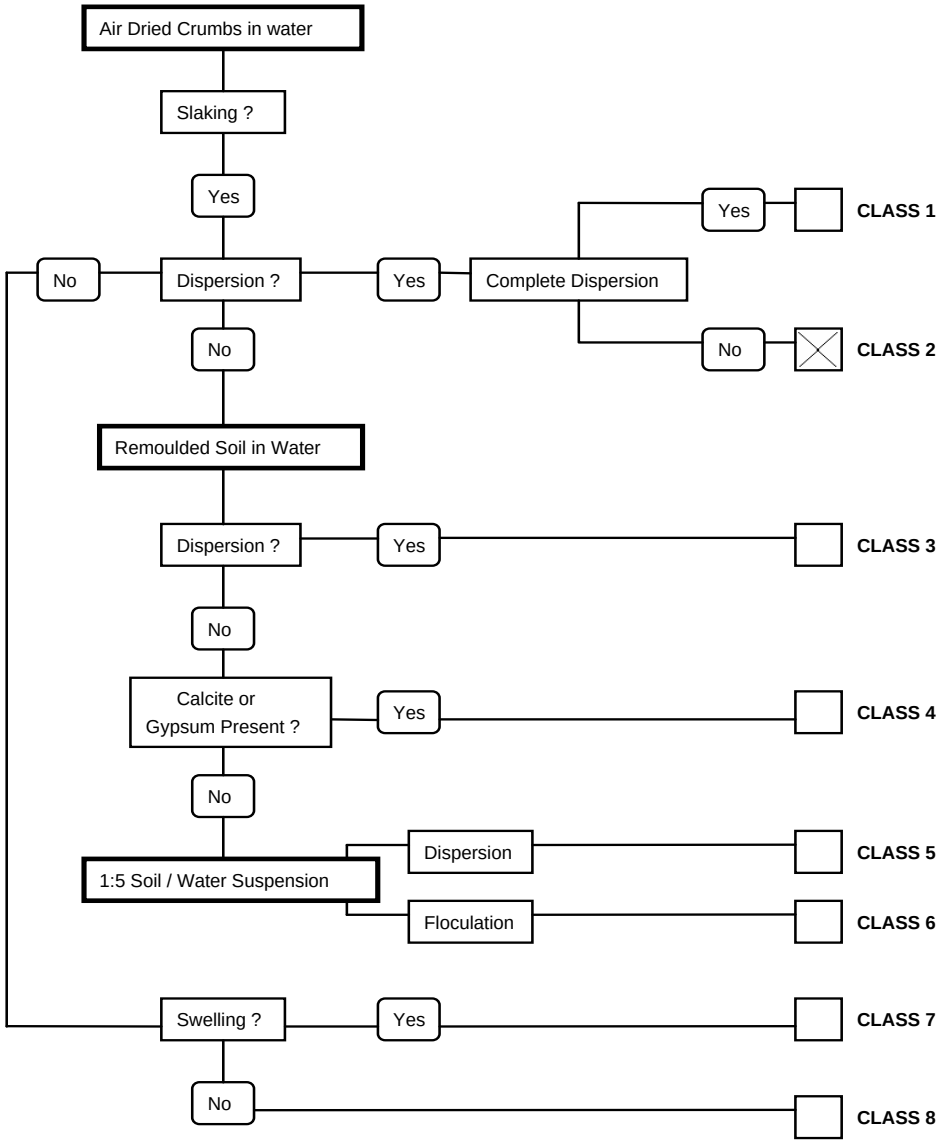
REMOULDED SOIL

Time in water:
-
Time dispersion starts:
-

TYPE OF WATER
Distilled
Temp. of water
24°C

OTHER OBSERVATIONS:

Dispersion Flow Chart



Approved Signatory

Allan Fong Date 30/03/2009

Laboratory Manager

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Emerson Class Number of a Soil

Client / Address: JBS Environmental (Mascot)	Job No: JG09245B
Project: Airds Bradbury Redevelopment - Dam Embankment	Date: 30/03/2009
Location: Community Centre/Sports Centre, Airds	Report No: R08B
Test Procedure: AS 1289 1.1, 1.2.1, 3.8.1	Lab Reference No. SR 5248
Sample Identification: BH 2 (3.0-3.5m)	Sample Description: CH: Silty Clay: High plasticity, red brown
Sample Date: 12/02/2009	Test Date: 26/02/2009

Details of Test

AIR DRIED CRUMBS

Time in water:
9:31
Time dispersion starts:
-

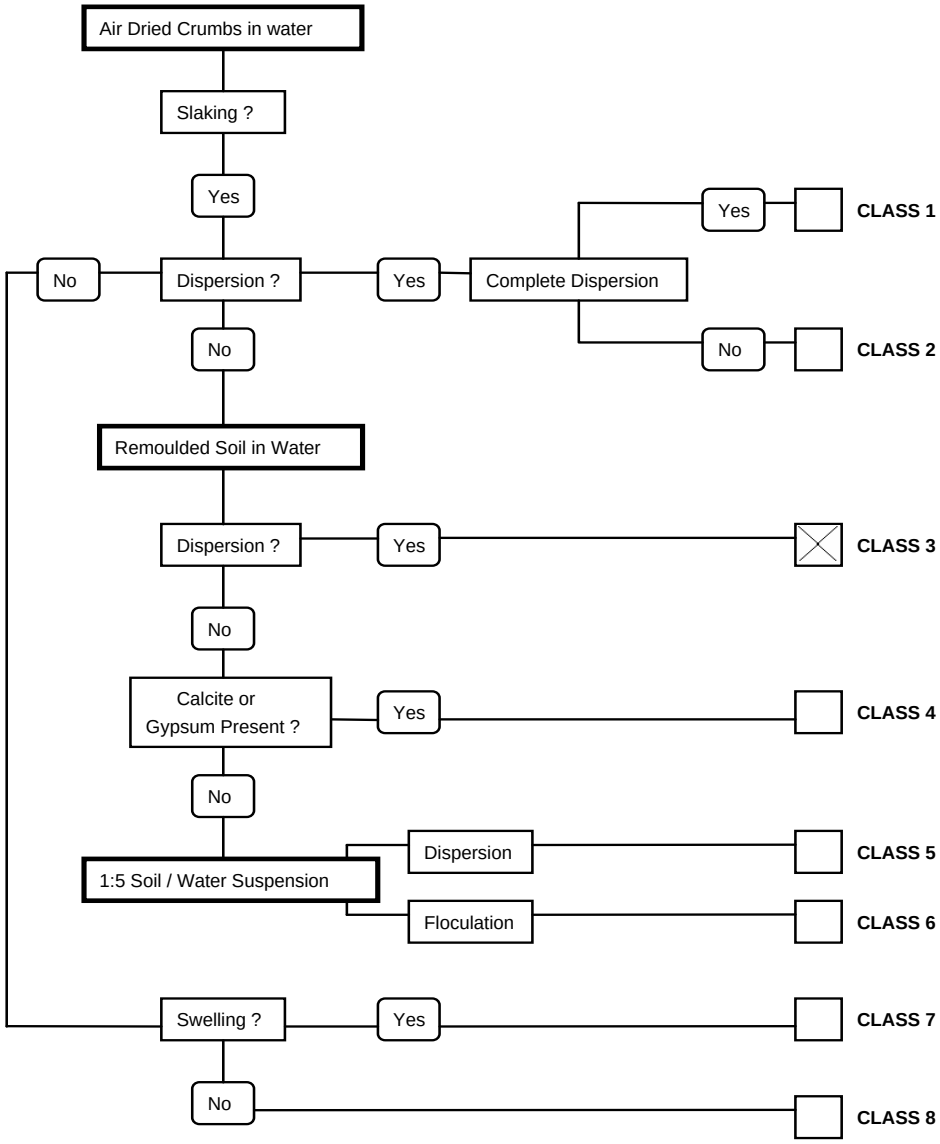
REMOULDED SOIL

Time in water:
9:45
Time dispersion starts:
9:48

TYPE OF WATER
Distilled
Temp. of water
24°C

OTHER OBSERVATIONS:

Dispersion Flow Chart



Approved Signatory

Allan Fong Date 30/03/2009

Laboratory Manager

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Emerson Class Number of a Soil

Client / Address: JBS Environmental (Mascot)	Job No: JG09245B
Project: Airds Bradbury Redevelopment - Dam Embankment	Date: 30/03/2009
Location: Community Centre/Sports Centre, Airds	Report No: R09B
Test Procedure: AS 1289 1.1, 1.2.1, 3.8.1	Lab Reference No. SR 5249
Sample Identification: BH 3 (0.2-0.6m)	Sample Description: Fill: Silty Clay: medium to high plasticity, brown grey
Sample Date: 12/02/2009	Test Date: 26/02/2009

Details of Test

AIR DRIED CRUMBS

Time in water:
10:06
Time dispersion starts:
-

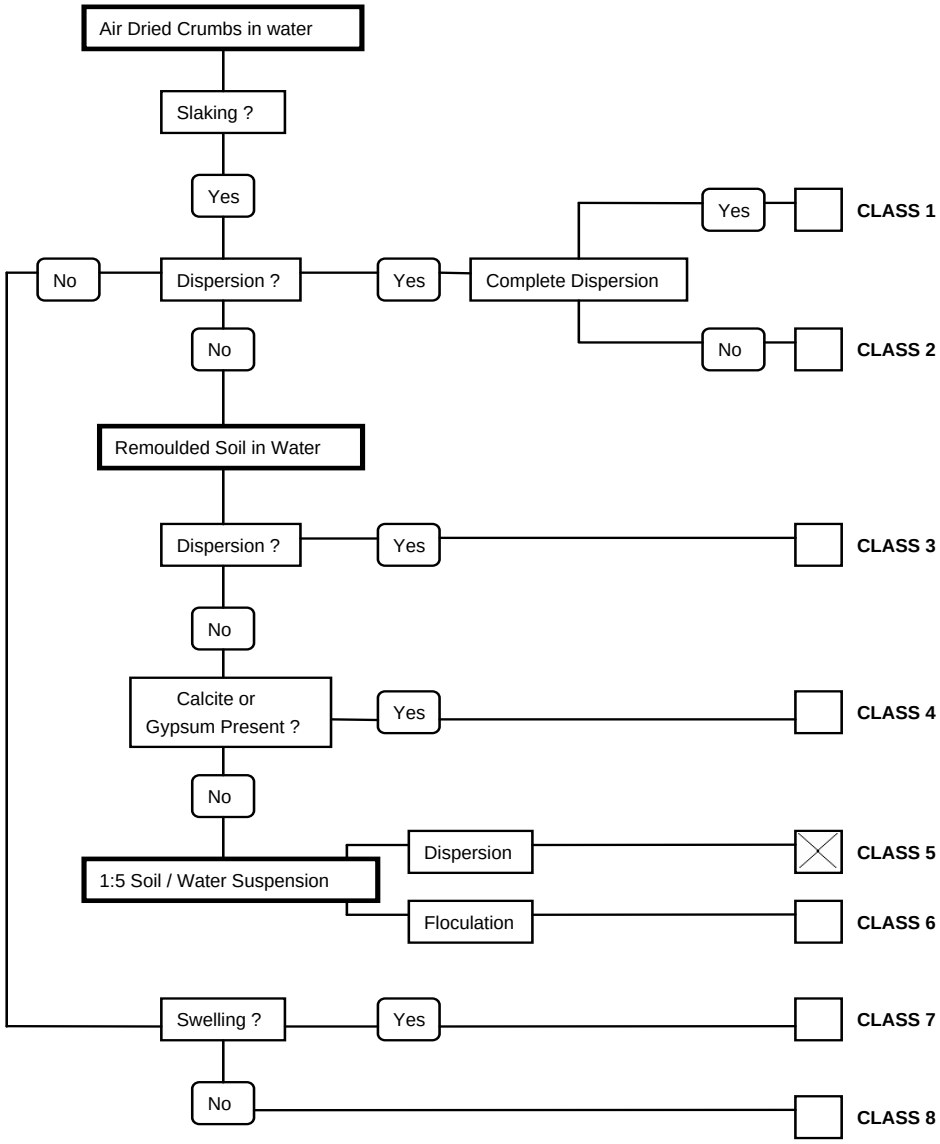
REMOULDED SOIL

Time in water:
10:17
Time dispersion starts:
-

TYPE OF WATER
Distilled
Temp. of water
24°C

OTHER OBSERVATIONS:

Dispersion Flow Chart



Approved Signatory

Allan Fong Date 30/03/2009

Laboratory Manager

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Emerson Class Number of a Soil

Client / Address: JBS Environmental (Mascot)	Job No: JG09245B
Project: Airds Bradbury Redevelopment - Dam Embankment	Date: 30/03/2009
Location: Community Centre/Sports Centre, Airds	Report No: R10B
Test Procedure: AS 1289 1.1, 1.2.1, 3.8.1	Lab Reference No. SR 5250
Sample Identification: BH 3 (1.5-2.0m)	Sample Description: CH: Silty Clay: High plasticity, red brown
Sample Date: 12/02/2009	Test Date: 26/02/2009

Details of Test

AIR DRIED CRUMBS

Time in water:
11:04
Time dispersion starts:
-

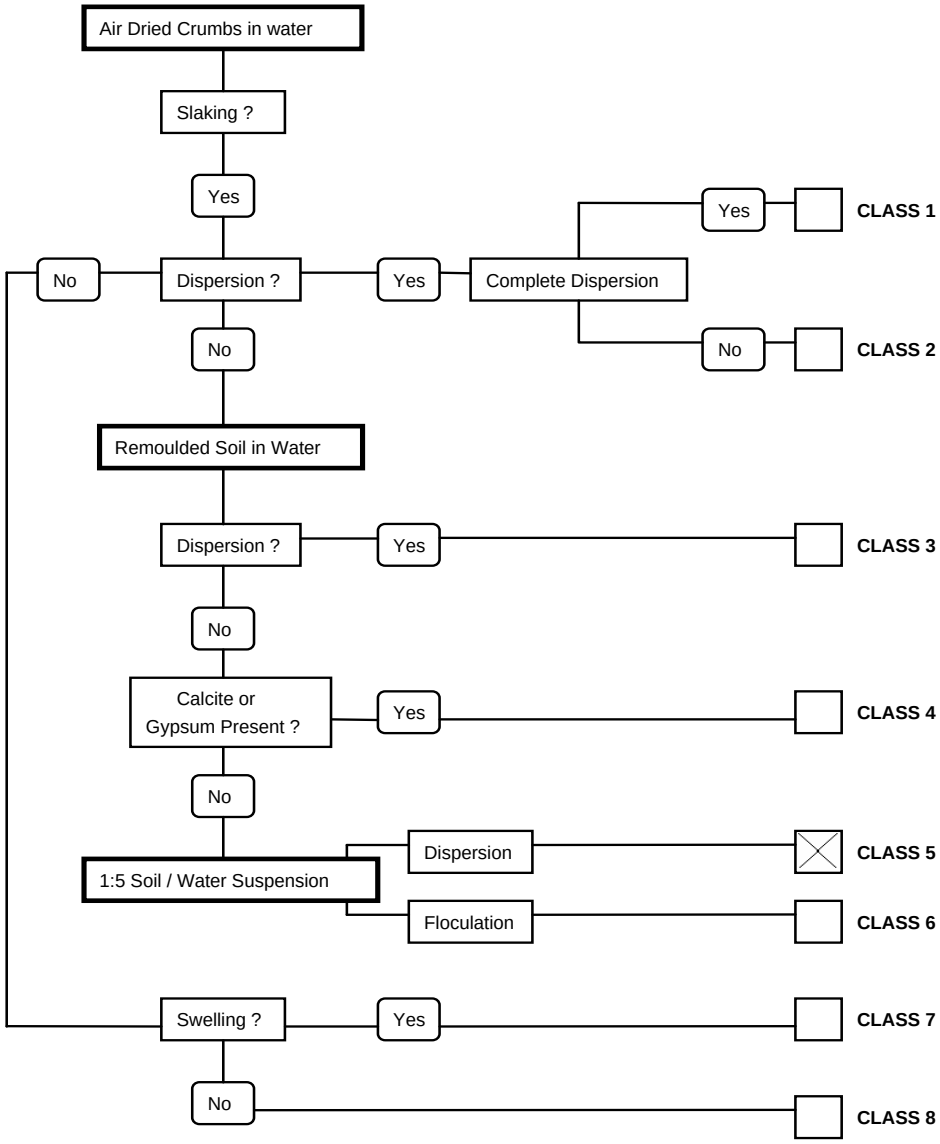
REMOULDED SOIL

Time in water:
11:15
Time dispersion starts:
-

TYPE OF WATER
Distilled
Temp. of water
24°C

OTHER OBSERVATIONS:

Dispersion Flow Chart



Approved Signatory

Allan Fong Date 30/03/2009

Laboratory Manager

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Emerson Class Number of a Soil

Client / Address: JBS Environmental (Mascot)	Job No: JG09245B
Project: Airds Bradbury Redevelopment - Dam Embankment	Date: 30/03/2009
Location: Community Centre/Sports Centre, Airds	Report No: R11B
Test Procedure: AS 1289 1.1, 1.2.1, 3.8.1	Lab Reference No. SR 5252
Sample Identification: BH 4 (0.5-0.95m)	Sample Description: CI-CH: Silty Clay: Medium to high plasticity, grey red
Sample Date: 12/02/2009	Test Date: 26/02/2009

Details of Test

AIR DRIED CRUMBS

Time in water:
9:31
Time dispersion starts:
-

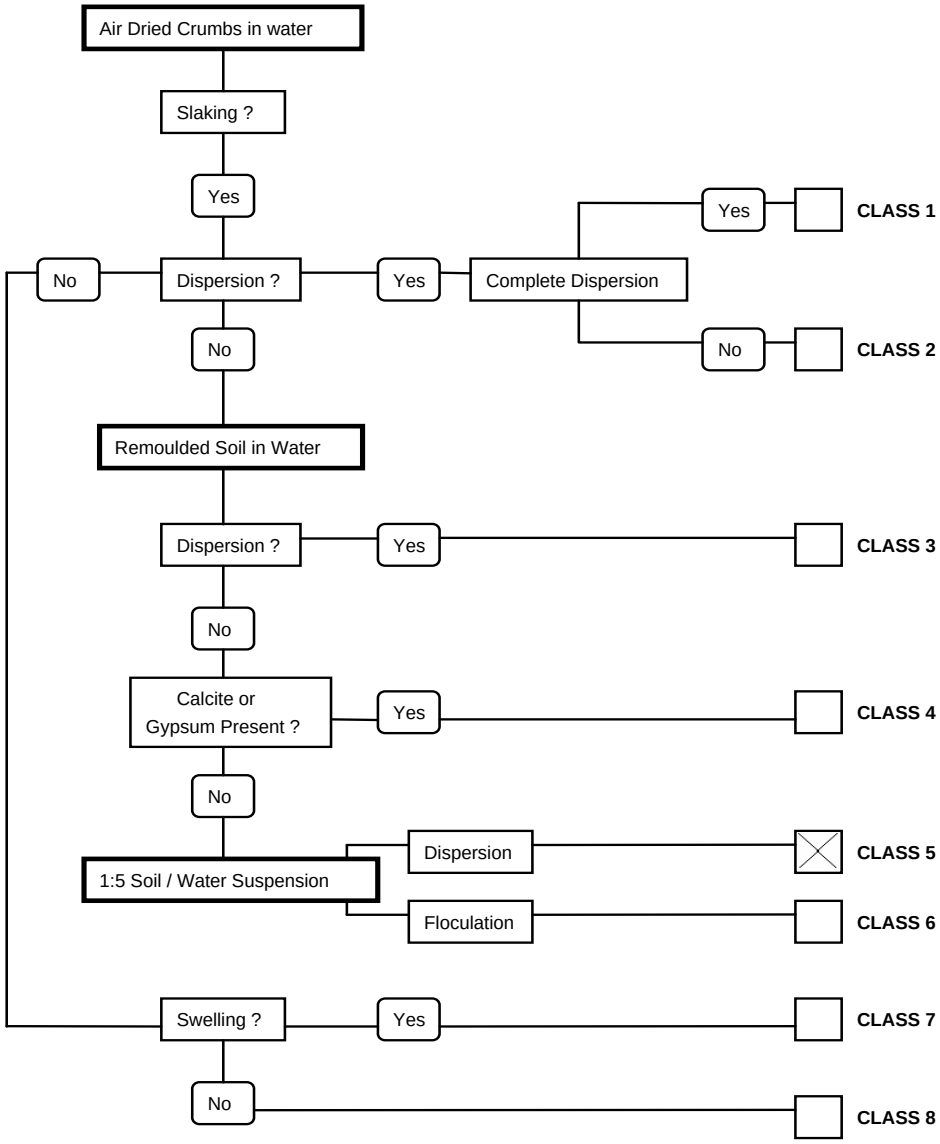
REMOULDED SOIL

Time in water:
9:45
Time dispersion starts:
-

TYPE OF WATER
Distilled
Temp. of water
24°C

OTHER OBSERVATIONS:

Dispersion Flow Chart



Approved Signatory

Allan Fong Date 30/03/2009

Laboratory Manager

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Emerson Class Number of a Soil

Client / Address: JBS Environmental (Mascot)	Job No: JG09245B
Project: Airds Bradbury Redevelopment - Dam Embankment	Date: 30/03/2009
Location: Community Centre/Sports Centre, Airds	Report No: R12B
Test Procedure: AS 1289 1.1, 1.2.1, 3.8.1	Lab Reference No. SR 52532
Sample Identification: BH 5 (0.2-0.4m)	Sample Description: CI: Sitly Clay: Medium plasticity, brown
Sample Date: 12/02/2009	Test Date: 26/02/2009

Details of Test

AIR DRIED CRUMBS

Time in water:
10:09
Time dispersion starts:
10:24

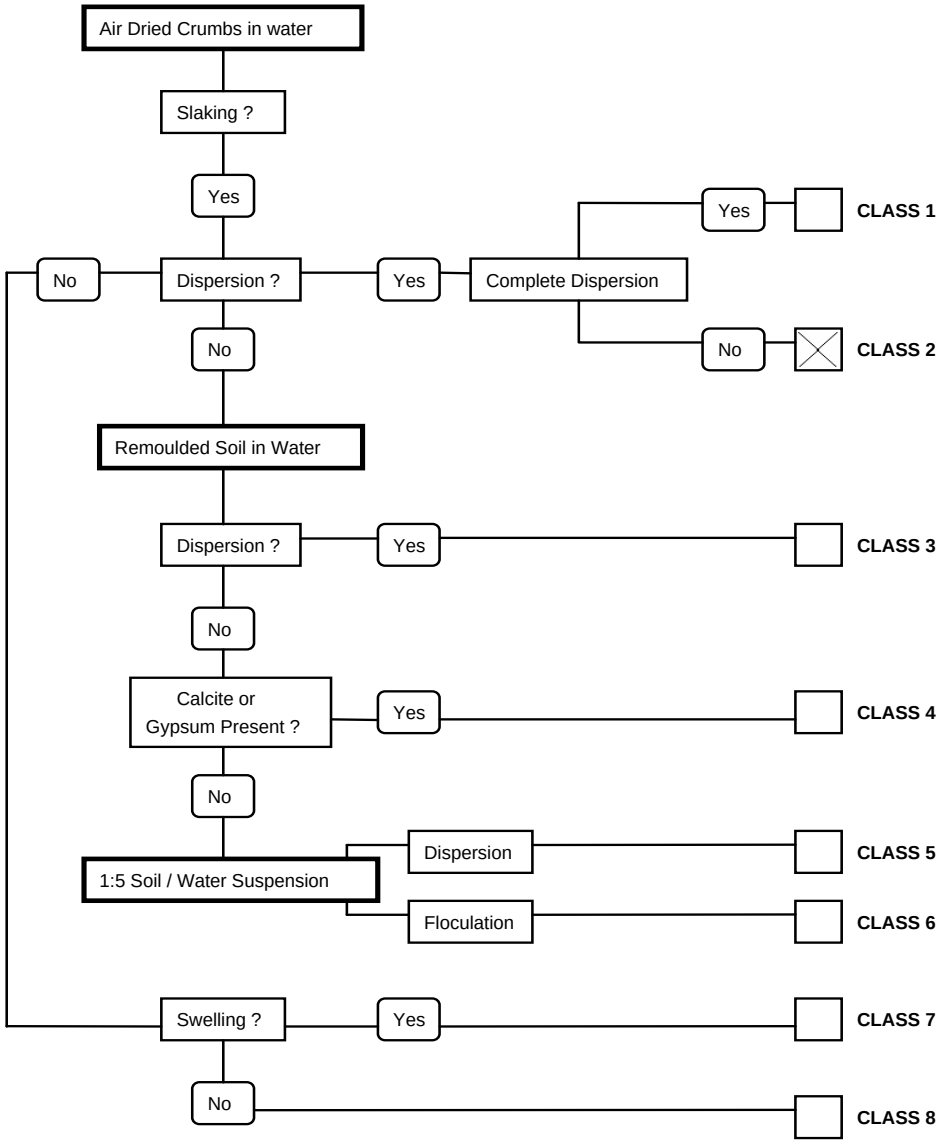
REMOULDED SOIL

Time in water:
-
Time dispersion starts:
-

TYPE OF WATER
Distilled
Temp. of water
24°C

OTHER OBSERVATIONS:

Dispersion Flow Chart



Approved Signatory

Allan Fong Date 30/03/2009

Laboratory Manager

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Emerson Class Number of a Soil

Client / Address: JBS Environmental (Mascot)	Job No: JG09245B
Project: Airds Bradbury Redevelopment - Dam Embankment	Date: 30/03/2009
Location: Community Centre/Sports Centre, Airds	Report No: R13B
Test Procedure: AS 1289 1.1, 1.2.1, 3.8.1	Lab Reference No. SR 5254
Sample Identification: BH 6 (0.2-0.6m)	Sample Description: CH: Sitly Clay: High plasticity, red brown
Sample Date: 12/02/2009	Test Date: 26/02/2009

Details of Test

AIR DRIED CRUMBS

Time in water:
10:05
Time dispersion starts:
-

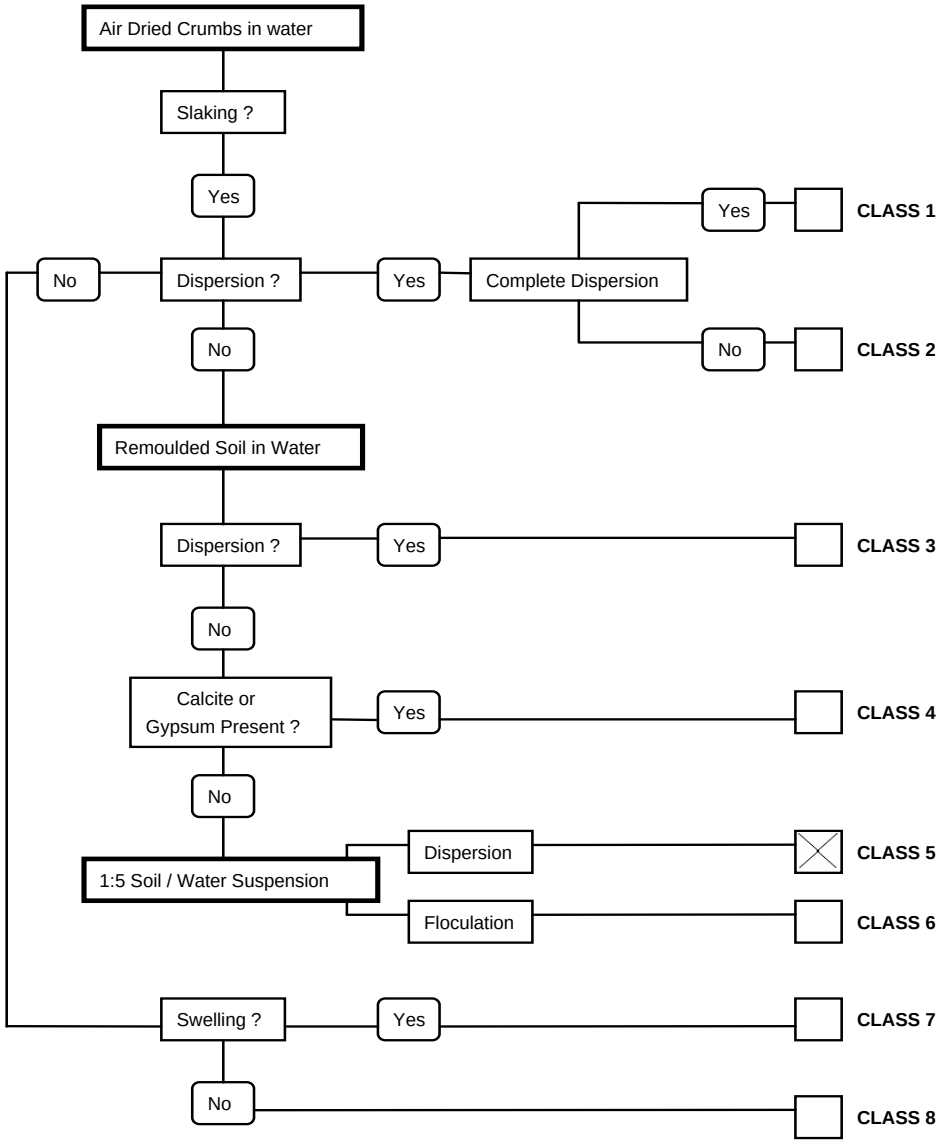
REMOULDED SOIL

Time in water:
10:15
Time dispersion starts:
-

TYPE OF WATER
Distilled
Temp. of water
24°C

OTHER OBSERVATIONS:

Dispersion Flow Chart



Approved Signatory

Allan Fong Date 30/03/2009

Laboratory Manager

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Particle Size Distribution & Atterberg Limits Test Report

Client / Address: JBS Environmental (Mascot)	Job No. JG09245B
Project: Airds Bradbury Redevelopment - Dam Embankment	Date: 30/03/2009
Location: Community Centre/Sports Centre, Airds	Report No. R14B

Lab Reference No. SR 5245	Sample Identification: BH 2 (0.3-0.6m)	Sample / Test Date: 17/02/2009

Laboratory Specimen Description: Fill: Silty Clay: Medium plasticity, brown grey with some ironstone gravel

Particle Size Distribution AS1289 1.1, 1.2.1, 3.6.1

Sieve Size	% Passing	Specification
150 mm		
75 mm		
63mm		
53mm	100	
37.5 mm	100	
26.5 mm	95	
19.0 mm	91	
16.0 mm	89	
13.2 mm	89	
9.5 mm	87	
6.7 mm	86	
4.75 mm	84	
2.36 mm	82	
1.18 mm	81	
600 um	79	
425 um	79	
300 um	78	
150 um	69	
75 um	59	

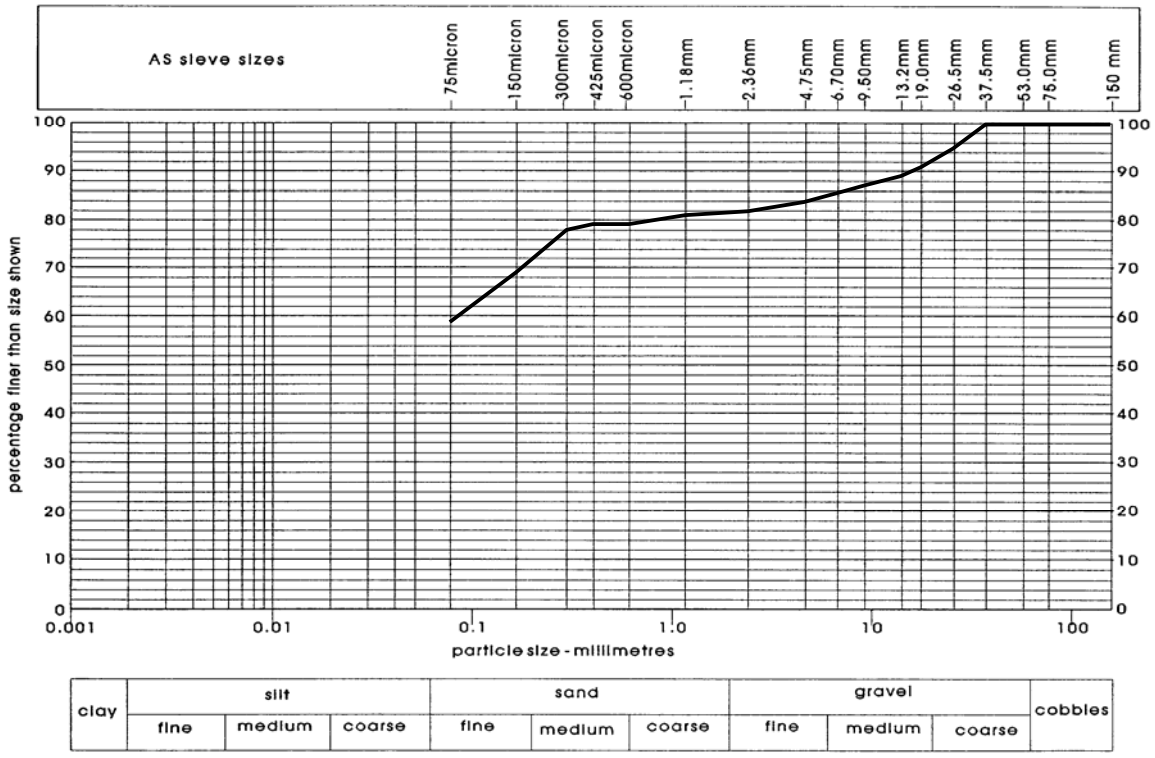
Atterberg Limits and Moisture Content AS 1289 2.1.1, 3.1.1, 3.2.1, 3.3.1, 3.4.1.

Test		Method	Result	Spec.
Liquid Limit	%	As 1289 3.1.2	ND	
Plastic Limit	%	AS1289 3.2.1	ND	
Plasticity Index	%	AS1289 3.3.1	ND	
Linear Shrinkage	%	AS1289 3.4.1	ND	
Moisture Content	%	AS1289 2.1.1	ND	

Sample History:
Preparation Method.
Crumbling / Curling of linear shrinkage.
Linear shrinkage mould length. 250mm
ND = not determined NO = not obtainable NP = non plastic

Moisture / Dry Density Relationship: AS 1289 5.2.1
Maximum Dry Density. t/m3
Optimum Moisture Content. %

Notes:



Approved Signatory _____ Allan Fong Date 30/03/2009
Laboratory Manager

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Particle Size Distribution & Atterberg Limits Test Report

Client / Address: JBS Environmental (Mascot)	Job No. JG09245B
Project: Airds Bradbury Redevelopment - Dam Embankment	Date: 30/03/2009
Location: Community Centre/Sports Centre, Airds	Report No. R15B

Lab Reference No. SR 5249	Sample Identification: BH 3 (0.2-0.6m)	Sample / Test Date: 17/02/2009

Laboratory Specimen Description: Fill: Silty Clay: Medium to high plasticity, brown grey

Particle Size Distribution AS1289 1.1, 1.2.1, 3.6.1

Sieve Size	% Passing	Specification
150 mm		
75 mm		
63mm		
53mm		
37.5 mm		
26.5 mm	100	
19.0 mm	99	
16.0 mm	99	
13.2 mm	97	
9.5 mm	96	
6.7 mm	94	
4.75 mm	92	
2.36 mm	89	
1.18 mm	87	
600 um	85	
425 um	85	
300 um	83	
150 um	78	
75 um	72	

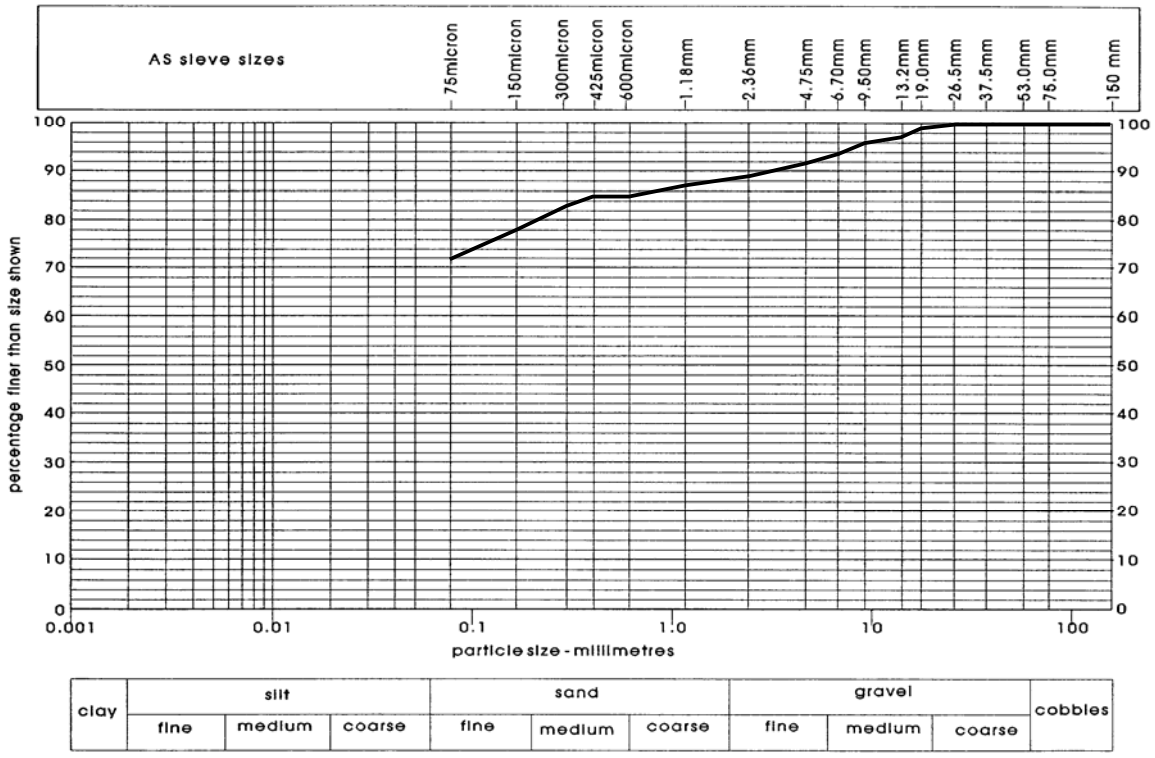
Atterberg Limits and Moisture Content AS 1289 2.1.1, 3.1.1, 3.2.1, 3.3.1, 3.4.1.

Test		Method	Result	Spec.
Liquid Limit	%	As 1289 3.1.2	ND	
Plastic Limit	%	AS1289 3.2.1	ND	
Plasticity Index	%	AS1289 3.3.1	ND	
Linear Shrinkage	%	AS1289 3.4.1	ND	
Moisture Content	%	AS1289 2.1.1	ND	

Sample History:
Preparation Method.
Crumbling / Curling of linear shrinkage.
Linear shrinkage mould length. 250mm
ND = not determined NO = not obtainable NP = non plastic

Moisture / Dry Density Relationship: AS 1289 5.2.1
Maximum Dry Density. t/m3
Optimum Moisture Content. %

Notes:



Approved Signatory _____ Allan Fong Date 30/03/2009
Laboratory Manager

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Particle Size Distribution & Atterberg Limits Test Report

Client / Address: JBS Environmental (Mascot)		Job No. JG09245B
Project: Airds Bradbury Redevelopment - Dam Embankment		Date: 30/03/2009
Location: Community Centre/Sports Centre, Airds		Report No. R16B
Lab Reference No. SR 5254	Sample Identification: BH 6 (0.2-0.6m)	Sample / Test Date: 17/02/2009
Laboratory Specimen Description: CH: Silty Clay: High plasticity, red brown		

Particle Size Distribution AS1289 1.1, 1.2.1, 3.6.1

Sieve Size	% Passing	Specification
150 mm		
75 mm		
63mm		
53mm		
37.5 mm		
26.5 mm		
19.0 mm		
16.0 mm		
13.2 mm	100	
9.5 mm	98	
6.7 mm	97	
4.75 mm	97	
2.36 mm	96	
1.18 mm	95	
600 um	94	
425 um	94	
300 um	94	
150 um	93	
75 um	88	

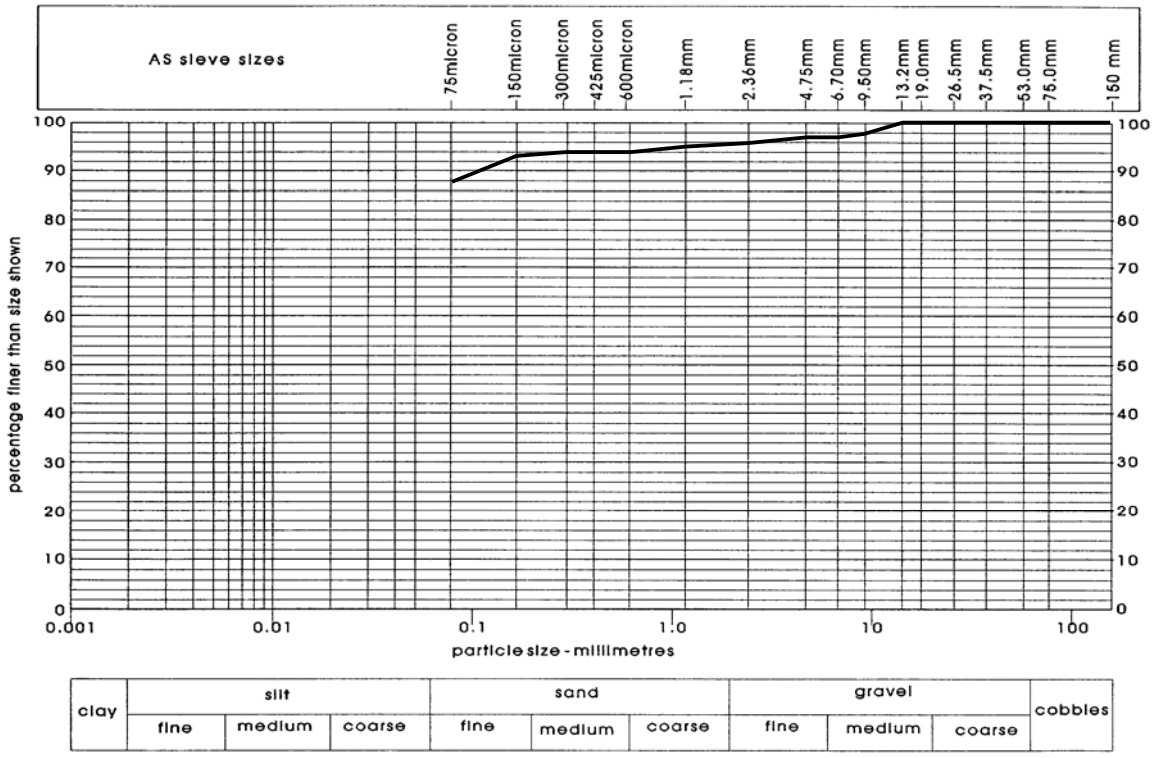
Atterberg Limits and Moisture Content AS 1289 2.1.1, 3.1.1, 3.2.1, 3.3.1, 3.4.1.

Test		Method	Result	Spec.
Liquid Limit	%	As 1289 3.1.2	ND	
Plastic Limit	%	AS1289 3.2.1	ND	
Plasticity Index	%	AS1289 3.3.1	ND	
Linear Shrinkage	%	AS1289 3.4.1	ND	
Moisture Content	%	AS1289 2.1.1	ND	

Sample History:
Preparation Method.
Crumbling / Curling of linear shrinkage.
Linear shrinkage mould length. 250mm
ND = not determined NO = not obtainable NP = non plastic

Moisture / Dry Density Relationship: AS 1289 5.2.1
Maximum Dry Density. t/m3
Optimum Moisture Content. %

Notes:



Approved Signatory _____ Allan Fong Date 30/03/2009
Laboratory Manager

Triaxial - Report

Report No. : SYD092156

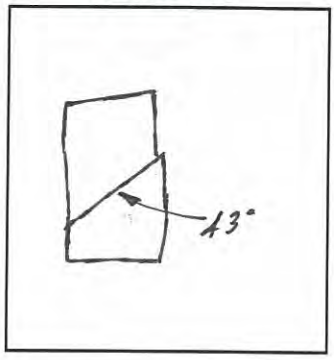
Client:	GeoEnviro Consultancy Pty Ltd
Project:	Airds / Bradbury Redevelopment
Location:	Community Centre, Airds

Job No.:	2116066
Sample No.:	SYD09-3507
Test Hole No.:	BH 1
Depth (m) :	1.00 to 1.20
Client Sample ID :	n/av

TEST METHOD ☐ AS1289.6.4.1 ☑ AS1289.6.4.2

Sample History : Supplied by client

Failure Mode



SAMPLE INFORMATION					
Specimen No :		1	2	3	4
Moisture Content Before (%)		15.2			
Dry Density Before (t/m³)		1.71			
Moisture Content After	Top (%)	28.9			
	Centre (%)	28.5			
	Bottom (%)	27.4			
Sample Size (mm)		50 x 100			

TEST TYPE

☑ Consolidated ☐ Drained ☑ With pore pressure measurement
☐ Unconsolidated ☑ Undrained ☐ Without pore pressure measurement
☑ Sample stage tested ☐ Separate sample for each stage

SATURATION

☑ Yes Checked by ☑ Pore water pressure respose ($\overline{B}$) 98
☐ No ☐

FILTERS

Side Drains ☑ Filter paper ☐ Not used

SAMPLE DESCRIPTION / TEST COMMENTS

red brown CLAY, trace of gravel

TEST DATA

Stage No.		1	2	3	4
Back Pressure	(kPa)	500	500	500	-
Effective Consolidation Stress	(kPa)	10	20	50	-
Rate of Strain	(mm/min)	0.0061	0.0061	0.0061	-
Deviator stress at failure	(kPa)	12.3	19.3	46.3	-
Pore water pressure at failure	(kPa)	1.5	10.5	26.1	-
Volume Change	(ml)	nt	2.48	12.9	-
☐ ☐		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-

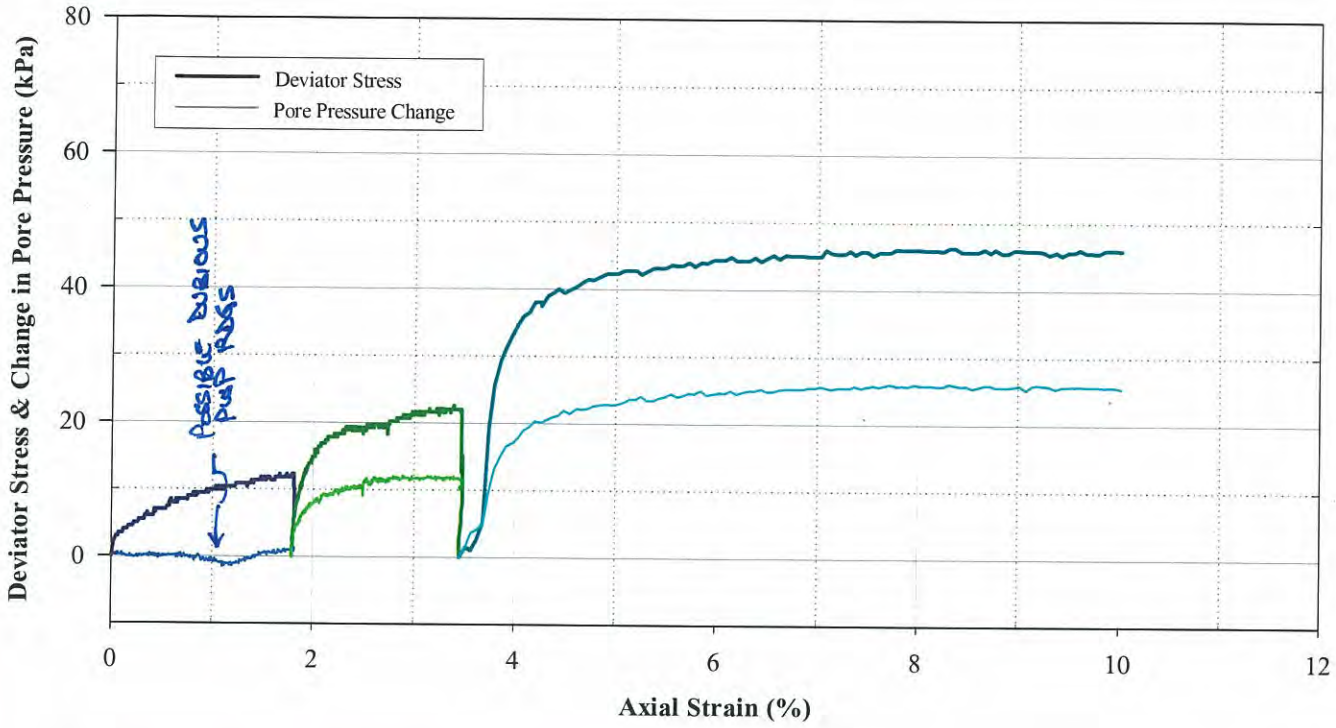
Tested by:	SI
Date tested:	18.02.09
Checked by:	
Approved Signatory :	
Date:	30 March 09

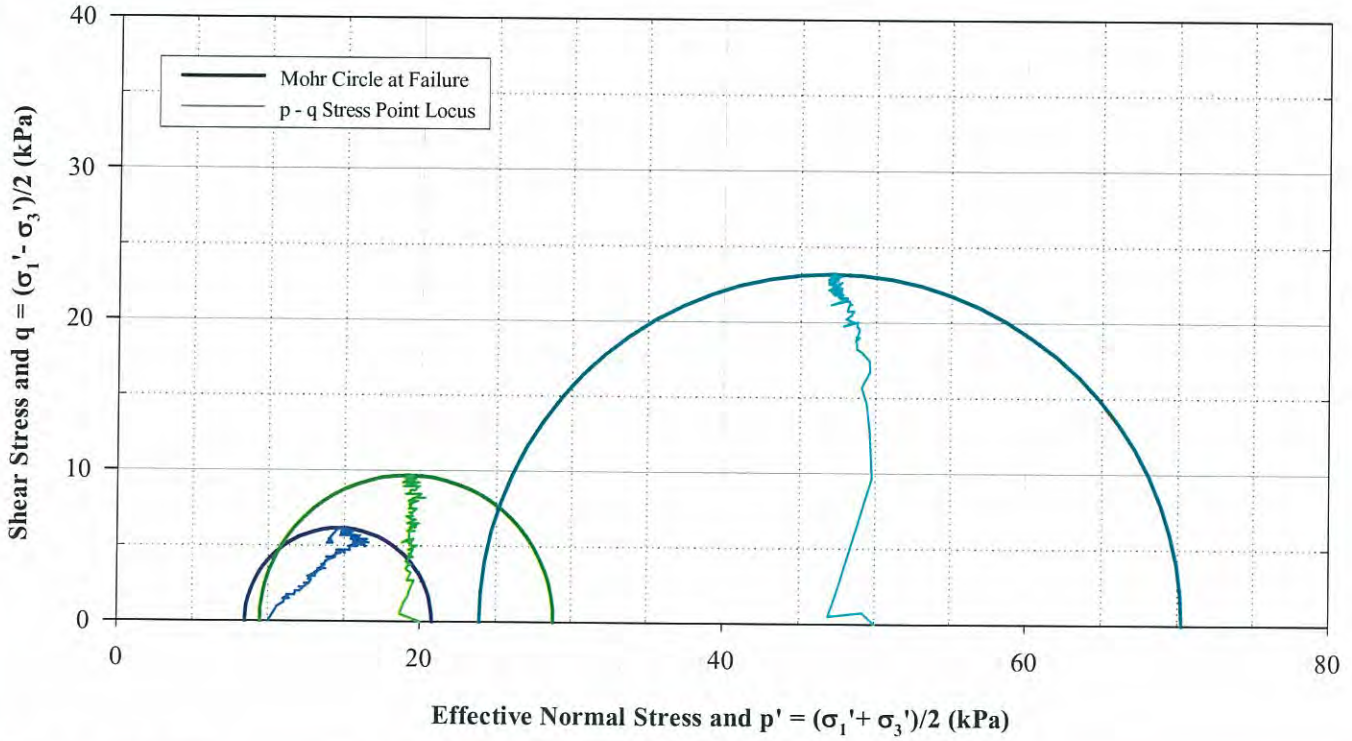
GHD GEOTECHNICS
57 Herbert St, Artarmon NSW, 2064
Tel: (02) 9462 4860 Fax: (02) 94624710
Geotechnical Testing Services

This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025.
Laboratory Accreditation Number 679

Client:	GeoEnviro Consultancy Pty Ltd
Project:	Airds / Bradbury Redevelopment
Location:	Community Centre, Airds
Test Method:	AS 1289.6.4.2

Job Number:	2166066
Borehole No:	BH 1
Depth (m):	1.00 to 1.20
LM Sample No:	SYD09-3507
Client Sample ID:	n/av





Tested by:	SI
Date Tested:	18.02.2009
Checked by:	
Approved Signatory:	
Date:	23 March

GHD GEOTECHNICS
57 Herbert Street Artarmon NSW 2064
Tel: (02) 9462 4700 Fax: (02) 9462 4710
Geotechnical Testing Services

This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025
Laboratory Accreditation No. 679

Triaxial - Report

Report No. : SYD092157

Client:	GeoEnviro Consultancy Pty Ltd
Project:	Airds / Bradbury Redevelopment
Location:	Community Centre, Airds

Job No.:	2116066
Sample No.:	SYD09-3508
Test Hole No.:	BH 2
Depth (m) :	1.50 to 1.80
Client Sample ID :	n/av

TEST METHOD ☐ AS1289.6.4.1 ☑ AS1289.6.4.2

Sample History : Supplied by client

Failure Mode

SAMPLE INFORMATION

Specimen No :		1	2	3	4
Moisture Content Before (%)		10.3			
Dry Density Before (t/m³)		1.95			
Moisture Content After	Top (%)	19.7			
	Centre (%)	21.9			
	Bottom (%)	21.5			
Sample Size (mm)		50 x 99			

TEST TYPE

☑ Consolidated ☐ Drained ☑ With pore pressure measurement
☐ Unconsolidated ☑ Undrained ☐ Without pore pressure measurement
☑ Sample stage tested ☐ Separate sample for each stage

SATURATION

☑ Yes Checked by ☑ Pore water pressure respose ($\overline{B}$) 97.6
☐ No ☐

FILTERS

Side Drains ☑ Filter paper ☐ Not used

SAMPLE DESCRIPTION / TEST COMMENTS

brown mottled grey CLAY, trace of gravel

TEST DATA

Stage No.		1	2	3	4
Back Pressure	(kPa)	500	500	500	-
Effective Consolidation Stress	(kPa)	10	20	50	-
Rate of Strain	(mm/min)	0.0061	0.0089	0.00406	-
Deviator stress at failure	(kPa)	20.7	34.9	56.8	-
Pore water pressure at failure	(kPa)	1.8	4.9	17.3	-
Volume Change	(ml)	nt	0.03	5.57	-
☐ ☐		-	-	-	-
		-	-	-	-
		-	-	-	-
		-	-	-	-

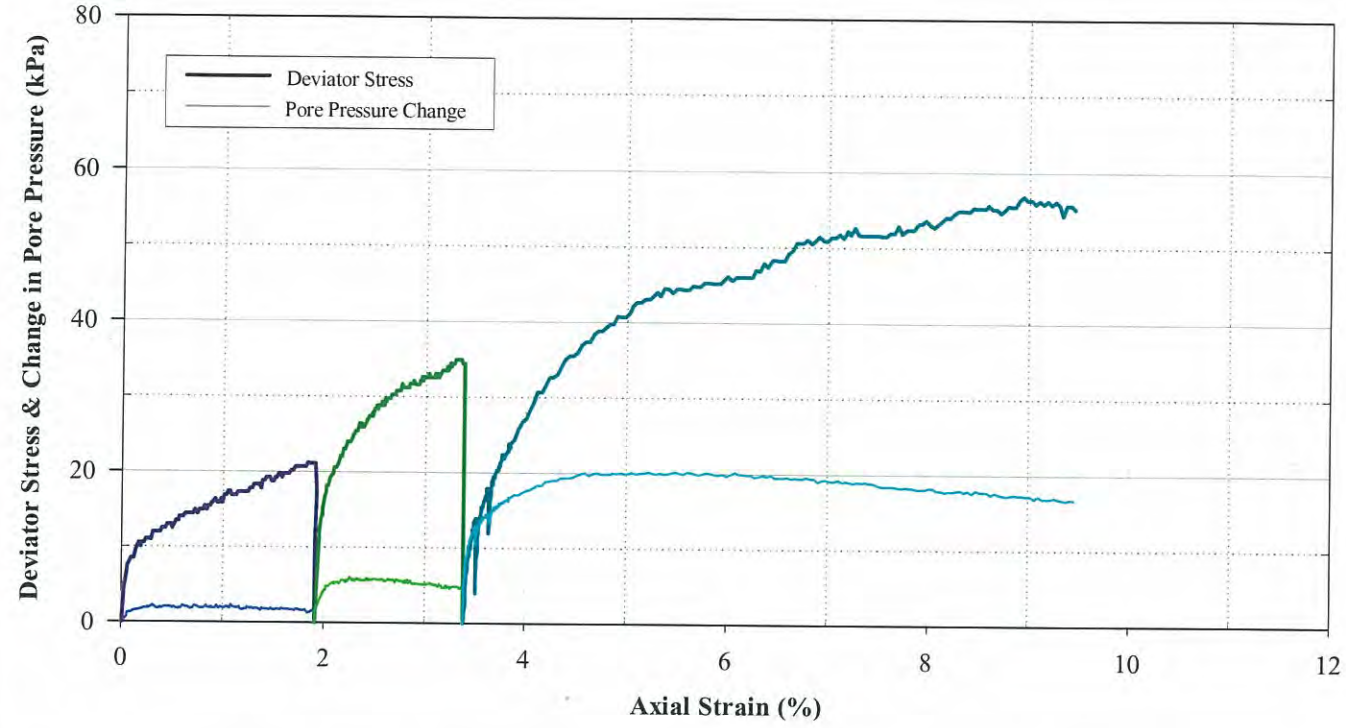
Tested by:	SI
Date tested:	18.02.09
Checked by:	
Approved Signatory :	
Date:	20 Mar 09

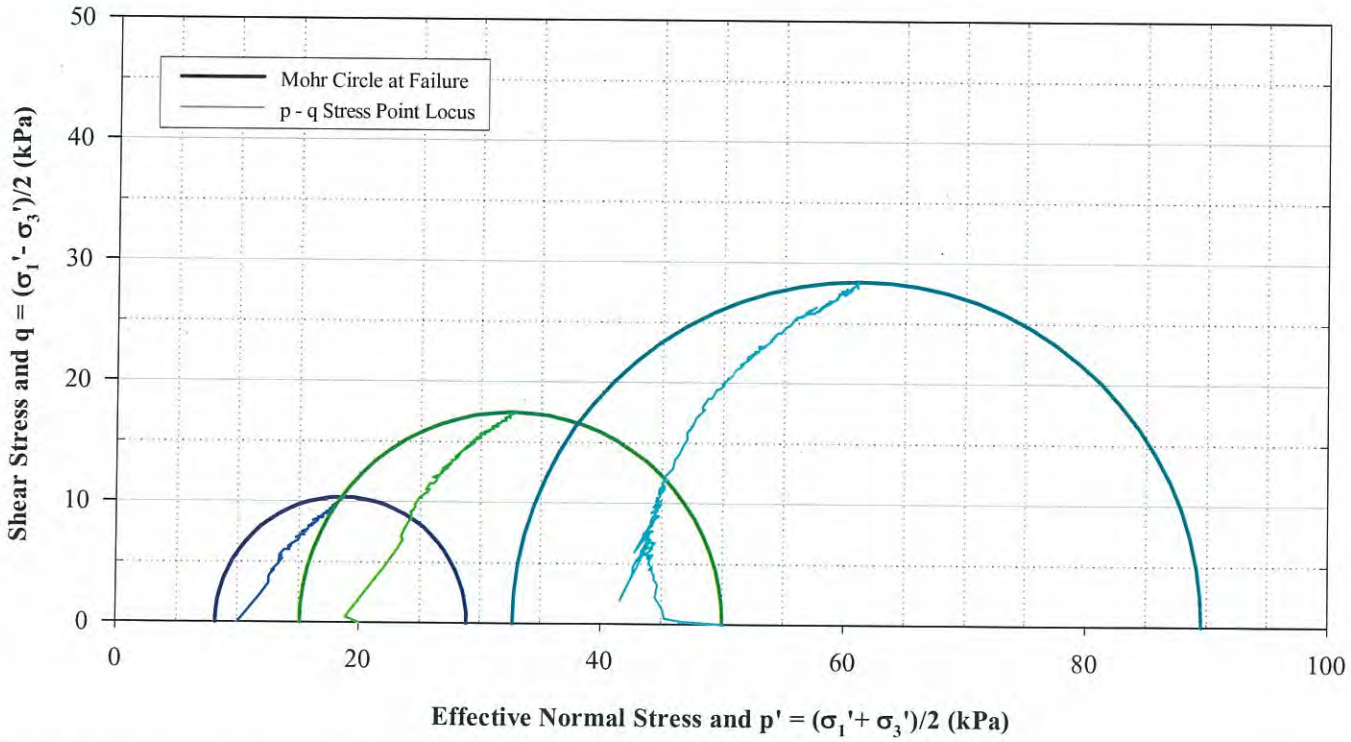
GHD GEOTECHNICS
57 Herbert St, Artarmon NSW, 2064
Tel: (02) 9462 4860 Fax: (02) 94624710
Geotechnical Testing Services

This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025.
Laboratory Accreditation Number 679

Client:	GeoEnviro Consultancy Pty Ltd
Project:	Airds / Bradbury Redevelopment
Location:	Community Centre, Airds
Test Method:	AS 1289.6.4.2

Job Number:	2116066
Borehole No:	BH 2
Depth (m):	1.50 to 1.80
LM Sample No:	SYD09-3508
Client Sample ID:	n/av





Tested by:	SI
Date Tested:	18.02.2009
Checked by:	
Approved Signatory:	
Date:	30Mar09

GHD GEOTECHNICS
57 Herbert Street Artarmon NSW 2064
Tel: (02) 9462 4700 Fax: (02) 9462 4710
Geotechnical Testing Services

This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025
Laboratory Accreditation No. 679

Appendix F

Brief Explanation on Site Classification

A BRIEF EXPLANATION OF SITE CLASSIFICATION

1. Introduction

The intention of the Australian Standard 2870-1996, "Residential Slabs and Footings" is to provide guidance on footing design for residential buildings with a particular emphasis on reactive clay sites. Footing design and construction involves the following steps:

- site classification
- selection of an appropriate footing system
- structural design
- construction in accordance with the required design details and construction methods
- proper site maintenance after construction

The classification assessed in this report is the first step in providing an economical footing system for a residence which will limit cracking of footings, floor slabs and masonry walls to an extent normally considered acceptable. (Performance expectations are explained in AS 2870- 1996). It is necessary that each subsequent step be diligently observed to achieve acceptable performance.

It is imperative when applying the site classifications presented in this report to residential footing design, that these performance expectations are acceptable to the home owner.

2. What is a Reactive Soil?

A reactive soil undergoes appreciable volume change when its moisture content changes. This causes ground surface movements which can result in fooling movements. The extent of ground movement that can occur depends on the clay mineralogy, the depth of clay in the soil profile, the depth of potential moisture variation in the soil and the change in soil suction that occurs from dry to wet soil conditions. AS2870 provides a classification system to quantify the range of ground surface movements anticipated (defined as having less than 5% chance of being exceeded in the design life of the structure).

3. How are Sites Classified in the Sydney Region

Experiment and observation within the Sydney Region indicates a high variability in the potential for reactive movements, which is not clearly related to soil association, terrain location or visual appearance and may not be accurately predicted by simple soil tests. Intense, complex and expensive testing is required at a site to accurately predict its potential for reactive behaviour. To avoid this, a simplified classification procedure for the Sydney region has been devised which is based on the depth of clay in the soil profile. This procedure is detailed in AS2870 – 1996.

4. What is a Class P Site?

Footing design may need to consider other factors beside reactive soils. Such factors include the presence of filling, the presence of compressible or collapsible soils, or the need to consider slope stability aspects. When these or other factors need to be considered the site may be classified P. The footing "solution" for Class P sites requires special engineering consideration. On many sites the "solution may the straight forward and may not necessarily incur major cost increases.

5. Filled Sites

The most common "problem" associated with residential lots is the presence of fill, compacted or otherwise, overlying the natural soils. If the fill is uncompacted, or if there are no records of adequate compaction, a piered footing system is usually adopted which penetrates the fill and found on natural ground.

AS2870 - 1996 indicates that a compacted fill site may be given a less severe classification than P if assessed in accordance with engineering principles. Subdivision developments often include areas of compacted filling which will usually have been required to have been compacted to the relevant Council Specifications. Adequately compacted filling will usually provide sufficient bearing capacity for residential footing loads, but the clay in the fill will also experience reactive soil movements. Depending on the moisture content at which the fill is placed and the compaction which has been achieved, reactive soil movements may exceed those experienced by the natural soil from which the fill has been derived. As a result, classification of compacted fill sites sometimes needs to be conservative.

6. Site Classifications should be Project Specific

Many Councils require that all lots within a new subdivision be classified prior to subdivision approval. This practice precludes a consideration of the impact of site preparation works on the classification. Sites which are not level are often cut and filled to provide a level platform for floor slab construction. AS2870 specifies that the classification shall be reconsidered if:

(a) the depth of cut exceeds 500mm, or
(b) the depth of compacted fill exceeds 400mm for clay (or 800mm for sand).

Where the classification provided in this report is carried out prior to the site development details being known it is a condition of this report that plans for future development of the block be reviewed by a geotechnical engineer to assess the impact of proposed site works and also the impact of work which may have occurred on adjacent sites since the date of this classification. Altering the site classification may be required in some cases.

7. Site Maintenance

The classifications presented in this report have been assessed for moisture variations caused by climatic and "normal" garden conditions. More severe moisture variation can be caused by other common factors, such as removing or planting trees, leaking plumbing, irrigation systems etc. Guidelines to appropriate site maintenance are provided in CSIRO 10-91 "A Guide to Home Owners on Foundation Maintenance and Footing Performance". Most Damage to residences on reactive sites is due to poor site maintenance. Footings designed to AS2870 may not perform satisfactorily if sites are not properly maintained.

Appendix G

XStabl Slope Stability Computer Printout

XSTABL File: BH1DS 4-02-** 20:09

```
*****************************************
*          X S T A B L                  *
*                                       *
*       Slope Stability Analysis        *
*            using the                  *
*          Method of Slices             *
*                                       *
*       Copyright (C) 1992 Ä 97         *
*  Interactive Software Designs, Inc.   *
*       Moscow, ID 83843, U.S.A.        *
*                                       *
*         All Rights Reserved           *
*                                       *
* Ver. 5.202              96 Ä 1324     *
*****************************************
```

Problem Description : Airds BH 1 Downstream Embank

SEGMENT BOUNDARY COORDINATES

---

3 SURFACE boundary segments

Segment No.	x-left (m)	y-left (m)	x-right (m)	y-right (m)	Soil Unit Below Segment
1	10.0	10.0	15.0	10.0	2
2	15.0	10.0	19.0	12.0	1
3	19.0	12.0	23.0	12.0	1

2 SUBSURFACE boundary segments

Segment No.	x-left (m)	y-left (m)	x-right (m)	y-right (m)	Soil Unit Below Segment

1	10.0	10.0	15.0	10.0	2
2	15.0	10.0	23.0	10.0	2

ISOTROPIC Soil Parameters

---

2 Soil unit(s) specified

Soil No.	Unit Weight (kN/m3)	Water Unit Weight (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Parameter Ru	Pore Pressure Constant (kPa)	Water Surface No.
1	17.0	20.0	.0	24.00	.000	.0	1
2	17.0	20.0	1.0	33.00	.000	.0	1

1 Water surface(s) have been specified

Unit weight of water = 9.81 (kN/m3)

Water Surface No. 1 specified by 3 coordinate points

****

PHREATIC SURFACE,

****

Point No.	x-water (m)	y-water (m)
1	10.00	10.00
2	15.00	10.00
3	23.00	11.50

BOUNDARIES THAT LIMIT SURFACE GENERATION HAVE BEEN SPECIFIED

LOWER limiting boundary of 1 segments:

Segment No.	x-left (m)	y-left (m)	x-right (m)	y-right (m)
1	10.0	9.0	23.0	9.0

A critical failure surface searching method, using a random technique for generating CIRCULAR surfaces has been specified.

100 trial surfaces will be generated and analyzed.

10 Surfaces initiate from each of 10 points equally spaced along the ground surface between x = 12.0 m
and x = 15.0 m

Each surface terminates between x = 19.0 m
and x = 23.0 m

Unless further limitations were imposed, the minimum elevation at which a surface extends is y = .0 m

* * * * * DEFAULT SEGMENT LENGTH SELECTED BY XSTABL * * * *
*

1.0 m line segments define each trial failure surface.

ANGULAR RESTRICTIONS

The first segment of each failure surface will be inclined within the angular range defined by :

Lower angular limit := -45.0 degrees
Upper angular limit := (slope angle - 5.0) degrees

Factors of safety have been calculated by the :

***** SIMPLIFIED BISHOP METHOD *****

The most critical circular failure surface is specified by 8 coordinate points

Point No.	x-surf (m)	y-surf (m)
1	14.33	10.00
2	15.33	9.89
3	16.32	9.96
4	17.29	10.22
5	18.19	10.66
6	19.00	11.25
7	19.68	11.98
8	19.69	12.00

**** Simplified BISHOP FOS = 1.227 ****

The following is a summary of the TEN most critical surfaces

Problem Description : Airds BH 1 Downstream Embank

BH1DS

	FOS (BISHOP)	Circle Center x-coord (m)	Circle Center y-coord (m)	Radius (m)	Initial x-coord (m)	Terminal x-coord (m)	Resisting Moment (kN-m)
1.	1.227	15.42	15.26	5.37	14.33	19.69	1.350E+02
2.	1.276	15.34	15.79	5.95	14.00	19.89	1.714E+02
3.	1.287	15.10	15.42	5.61	13.67	19.52	1.436E+02
4.	1.292	15.90	13.31	3.43	15.00	19.07	7.586E+01
5.	1.297	15.31	16.63	6.76	14.00	20.21	2.077E+02
6.	1.318	15.12	16.83	6.98	13.67	20.15	2.131E+02
7.	1.329	14.48	16.50	6.67	13.00	19.40	1.373E+02
8.	1.341	16.05	14.43	4.56	15.00	19.87	1.448E+02
9.	1.391	15.44	14.47	4.80	13.67	19.54	1.644E+02
10.	1.396	15.72	14.51	4.82	14.00	19.81	1.817E+02

* * * END OF FILE * * *

```
*****************************************
*          X S T A B L                  *
*                                       *
*      Slope Stability Analysis         *
*           using the                   *
*        Method of Slices               *
*                                       *
*      Copyright (C) 1992 Ä 97          *
*  Interactive Software Designs, Inc.   *
*      Moscow, ID 83843, U.S.A.         *
*                                       *
*       All Rights Reserved             *
*                                       *
* Ver. 5.202              96 Ä 1324     *
*****************************************
```

Problem Description : Airds BH 2 Downstream Embank

SEGMENT BOUNDARY COORDINATES

---

3 SURFACE boundary segments

Segment No.	x-left (m)	y-left (m)	x-right (m)	y-right (m)	Soil Unit Below Segment
1	10.0	10.0	15.0	10.0	2
2	15.0	10.0	23.8	13.5	1
3	23.8	13.5	26.8	13.5	1

2 SUBSURFACE boundary segments

Segment No.	x-left (m)	y-left (m)	x-right (m)	y-right (m)	Soil Unit Below Segment

1	10.0	10.0	15.0	10.0	2
2	15.0	10.0	26.8	10.0	2

ISOTROPIC Soil Parameters
---

2 Soil unit(s) specified

Soil No.	Unit Weight (kN/m3)	Water Unit Moist (kN/m3)	Cohesion Sat. Intercept (kPa)	Friction Angle (deg)	Pore Pressure Parameter Ru	Water Constant (kPa)	Surface No.
1	19.5	23.0	.0	24.00	.000	.0	1
2	17.0	20.0	3.0	33.00	.000	.0	1

1 Water surface(s) have been specified

Unit weight of water = 9.81 (kN/m3)

Water Surface No. 1 specified by 3 coordinate points

****
PHREATIC SURFACE,
****

Point No.	x-water (m)	y-water (m)
1	10.00	10.00
2	15.00	10.00
3	26.80	13.00

BOUNDARIES THAT LIMIT SURFACE GENERATION HAVE BEEN SPECIFIED

LOWER limiting boundary of 1 segments:

Segment No.	x-left (m)	y-left (m)	x-right (m)	y-right (m)
1	10.0	9.0	26.8	9.0

A critical failure surface searching method, using a random technique for generating CIRCULAR surfaces has been specified.

100 trial surfaces will be generated and analyzed.

10 Surfaces initiate from each of 10 points equally spaced along the ground surface between x = 12.0 m
and x = 15.0 m

Each surface terminates between x = 23.8 m
and x = 26.0 m

Unless further limitations were imposed, the minimum elevation at which a surface extends is y = .0 m

* * * * * DEFAULT SEGMENT LENGTH SELECTED BY XSTABL * * * *
*

1.0 m line segments define each trial failure surface.

ANGULAR RESTRICTIONS

The first segment of each failure surface will be inclined within the angular range defined by :

Lower angular limit := -45.0 degrees
Upper angular limit := (slope angle - 5.0) degrees

Factors of safety have been calculated by the :

* * * * * SIMPLIFIED BISHOP METHOD * * * * *

The most critical circular failure surface is specified by 12 coordinate points

Point No.	x-surf (m)	y-surf (m)
1	14.67	10.00
2	15.66	9.89
3	16.66	9.87
4	17.66	9.95
5	18.64	10.12
6	19.61	10.39
7	20.54	10.74
8	21.44	11.18
9	22.29	11.70
10	23.09	12.30
11	23.83	12.98
12	24.31	13.50

**** Simplified BISHOP FOS = 1.294 ****

The following is a summary of the TEN most critical surfaces

Problem Description : Airds BH 2 Downstream Embank

	FOS (BISHOP)	Circle Center x-coord (m)	y-coord (m)	Radius (m)	Initial x-coord (m)	Terminal x-coord (m)	Resisting Moment (kN-m)
1.	1.294	16.33	20.47	10.60	14.67	24.31	8.982E+02
2.	1.298	15.29	21.88	11.99	13.67	23.86	7.685E+02
3.	1.299	15.96	20.28	10.40	14.33	23.84	7.475E+02
4.	1.313	16.22	21.14	11.29	14.33	24.53	1.025E+03
5.	1.332	15.76	22.16	12.34	13.67	24.54	1.100E+03
6.	1.334	15.46	23.39	13.56	13.33	24.72	1.203E+03
7.	1.350	15.60	22.75	12.95	13.33	24.66	1.197E+03
8.	1.353	15.27	23.91	14.09	13.00	24.76	1.263E+03
9.	1.353	15.61	22.34	12.55	13.33	24.51	1.135E+03
10.	1.371	15.42	24.23	14.44	13.00	25.08	1.440E+03

* * * END OF FILE * * *

XSTABL File: BH2UP2 4-02-** 20:04

```
*****************************************
*          X S T A B L                  *
*                                       *
*      Slope Stability Analysis         *
*           using the                   *
*        Method of Slices               *
*                                       *
*      Copyright (C) 1992 Ä 97          *
*  Interactive Software Designs, Inc.   *
*      Moscow, ID 83843, U.S.A.         *
*                                       *
*       All Rights Reserved             *
*                                       *
* Ver. 5.202              96 Ä 1324     *
*****************************************
```

Problem Description :

SEGMENT BOUNDARY COORDINATES

---

3 SURFACE boundary segments

Segment No.	x-left (m)	y-left (m)	x-right (m)	y-right (m)	Soil Unit Below Segment
1	10.0	10.0	13.5	10.0	2
2	13.5	10.0	17.0	13.5	1
3	17.0	13.5	19.5	13.5	1

2 SUBSURFACE boundary segments

Segment No.	x-left (m)	y-left (m)	x-right (m)	y-right (m)	Soil Unit Below Segment

1	10.0	10.0	13.5	10.0	2
2	13.5	10.0	19.5	10.0	2

ISOTROPIC Soil Parameters

---

2 Soil unit(s) specified

Soil No.	Unit Weight Moist (kN/m3)	Unit Weight Sat. (kN/m3)	Cohesion Intercept (kPa)	Friction Angle (deg)	Pore Pressure Parameter Ru	Water Constant (kPa)	Surface No.
1	19.5	23.0	.0	24.00	.000	.0	1
2	17.0	20.0	3.0	33.00	.000	.0	1

1 Water surface(s) have been specified

Unit weight of water = 9.81 (kN/m3)

Water Surface No. 1 specified by 4 coordinate points

****

PHREATIC SURFACE,

****

Point No.	x-water (m)	y-water (m)
1	10.00	10.00
2	13.50	10.00
3	16.50	13.00
4	19.50	13.00

BOUNDARIES THAT LIMIT SURFACE GENERATION HAVE BEEN

SPECIFIED

LOWER limiting boundary of 1 segments:

Segment No.	x-left (m)	y-left (m)	x-right (m)	y-right (m)
1	10.0	9.0	19.5	9.0

A critical failure surface searching method, using a random technique for generating CIRCULAR surfaces has been specified.

100 trial surfaces will be generated and analyzed.

10 Surfaces initiate from each of 10 points equally spaced along the ground surface between x = 12.0 m
and x = 13.5 m

Each surface terminates between x = 18.0 m
and x = 19.0 m

Unless further limitations were imposed, the minimum elevation at which a surface extends is y = .0 m

* * * * * DEFAULT SEGMENT LENGTH SELECTED BY XSTABL * * * *
*

1.0 m line segments define each trial failure surface.

ANGULAR RESTRICTIONS

The first segment of each failure surface will be inclined within the angular range defined by :

Lower angular limit := -45.0 degrees
Upper angular limit := (slope angle - 5.0) degrees

Factors of safety have been calculated by the :

* * * * * SIMPLIFIED BISHOP METHOD * * * * *

The most critical circular failure surface is specified by 8 coordinate points

Point No.	x-surf (m)	y-surf (m)
1	13.50	10.00
2	14.48	10.21
3	15.40	10.59
4	16.24	11.13
5	16.98	11.81
6	17.59	12.60
7	18.05	13.49
8	18.05	13.50

**** Simplified BISHOP FOS = .429 ****

The following is a summary of the TEN most critical surfaces

BH2UP2

Problem Description :

	FOS (BISHOP)	Circle Center x-coord (m)	Circle Center y-coord (m)	Radius (m)	Initial x-coord (m)	Terminal x-coord (m)	Resisting Moment (kN-m)
1.	.429	12.78	15.65	5.69	13.50	18.05	1.494E+02
2.	.435	-102.62	182.78	208.17	13.50	18.54	3.196E+03
3.	.474	13.41	14.95	4.95	13.50	18.12	1.608E+02
4.	.492	12.92	16.55	6.57	13.50	18.72	2.407E+02
5.	.529	13.84	14.66	4.67	13.50	18.34	1.895E+02
6.	.544	13.86	14.95	4.96	13.50	18.58	2.177E+02
7.	.645	13.30	15.05	5.17	12.17	18.22	2.498E+02
8.	.653	13.53	14.68	4.79	12.50	18.15	2.358E+02
9.	.662	13.57	14.44	4.57	12.50	18.01	2.230E+02
10.	.668	13.39	14.74	4.90	12.17	18.11	2.458E+02

*** END OF FILE ***

Appendix H

Explanatory Notes.

EXPLANATORY NOTES

Introduction

These notes have been provided to amplify the geotechnical report with regard to investigation procedures, classification methods and certain matters relating to the Discussion and Comments sections. Not all notes are necessarily relevant to all reports.

Geotechnical reports are based on information gained from finite sub-surface probing, excavation, boring, sampling or other means of investigation, supplemented by experience and knowledge of local geology. For this reason they must be regarded as interpretative rather than factual documents, limited to some extent by the scope of information on which they rely.

Description and Classification Methods
The methods the description and classification of soils and rocks used in this report are based on Australian standard 1726, the SSA Site investigation Code, in general descriptions cover the following properties - strength or density, colour, structure, soil or rock type and inclusions. Identification and classification of soil and rock involves to a large extent, judgement within the acceptable level commonly adopted by current geotechnical practices.

Soil types are described according to the predominating particle size, qualified by the grading or other particles present (eg sandy clay) on the following bases:

Soil Classification	Particle Size
Clay	Less than 0.002mm
Silt	0.002 to 0.6mm
Sand	0.6 to 2.00mm
Gravel	2.00m to 60.00mm

Soil Classification	Particle size
Clay	less than 0.002mm
Silt	0.002 to 0.06mm
Sand	0.06 to 2.00mm
Gravel	2.00mm to 60.00mm

Cohesive soils are classified on the basis of strength, either by laboratory testing or engineering examination. The strength terms are defined as follows:

Classification	Undrained Shear Strength kPa
Very Soft	Less than 12
Soft	12 - 25
Firm	25 - 50
Stiff	50 - 100
Very Stiff	100 - 200
Hard	Greater than 200

Non-cohesive soils are classified on the basis of relative density, generally from the results of standard penetration tests (SPT) or Dutch cone penetrometer test (CPT), as below:

Relative Dense	SPT 'N' Value (blows/300mm)	CPT Cone Value (q_c-Mpa)
Very Loose	Less than 5	Less than 2
Loose	5 - 10	2 - 5
Medium Dense	10 - 30	5 - 15
Dense	30 - 50	15 - 25
Very Dense	> 50	> 25

Rock types are classified by their geological names, together with descriptive terms on degrees of weathering strength, defects and other minor components. Where relevant, further information regarding rock classification, is given on the following sheet.

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

Disturbed samples taken during drilling provided information on plasticity, grained size, colour, type, moisture content, inclusions and depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin walled sample tube (normally know as U_{50}) into the soil and withdrawing a sample of the soil in a relatively undisturbed state. Such Samples yield information on structure and strength and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils. Details of the type and method of sampling are given in the report.

Field Investigation Methods
The following is a brief summary of investigation methods currently carried out by this company and comments on their use and application.

Hand Auger Drilling
The borehole is advanced by manually operated equipment. The diameter of the borehole ranges from 50mm to 100mm. Penetration depth of hand augered boreholes may be limited by premature refusal on a variety of materials, such as hard clay, gravels or ironstone.

Test Pits
These are excavated with a tractor-mounted backhoe or a tracked excavator, allowing close examination of the insitu soils if it is safe to descend into the pit. The depth of penetration is limited to about 3.0m for a backhoe and up to 6.0m for an excavator. A potential disadvantage is the disturbance caused by the excavation.

Care must be taken if construction is to be carried out near, or within the test pit locations, to either adequately recompact the backfill during construction, or to design the structure or accommodate the poorly compacted backfill.

Large Diameter Auger (eg Pengo)
The hole is advanced by a rotating plate or short spiral auger generally 300mm or larger in diameter. The cuttings are returned to the surface at intervals (generally of not more than 05m) and are disturbed, but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers and is usually supplemented by occasional undisturbed tube sampling.

Continuous Spiral Flight Augers
The hole is advanced by using 90mm - 115mm diameter continuous spiral flight augers, which are withdrawn at intervals to allow sampling or insitu testing. This is a relatively economical means of drilling in clays and in sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the augers flights, but they are very disturbed and may be highly mixed with soil of other stratum.

Information from the drilling (as distinct from specific sampling by SPT or undisturbed samples) is of relatively low reliability due to remoulding, mixing or softening of samples by ground water, resulting in uncertainties of the original sample depth.

Continuous Spiral Flight Augers (continued)
The spiral augers are usually advanced by using a V - bit through the soil profile refusal, followed by Tungsten Carbide (TC) bit, to penetrate into bedrock. The quality and continuity of the bedrock may be assessed by examination of the recovered rock fragments and through observation of the drilling penetration resistance.

Non - core Rotary Drilling (Wash Boring)
The hole is advanced by a rotary bit, with water being pumped down the drill rod and returned up the annulus, carrying the cuttings, together with some information from the "feel" and rate of penetration.

Rotary Mud Stabilised Drilling
This is similar to rotary drilling, but uses drilling mud as a circulating fluid, which may consist of a range of products, from bentonite to polymers such as Revert or Biogel. The mud tends to mask the cuttings and reliable identification is again only possible from separate intact sampling (eg SPT and U_{50} samples).

Continuous Core Drilling
A continuous core sample is obtained using a diamond tipped core barrel. Providing full core recovery is achieved (which is not always possible in very weak rock and granular soils) this technique provides a very reliable (but relatively expensive) method of investigation. In rocks an NMLC triple tube core barrel which gives a core of about 50mm diameter, is usually used with water flush.

Portable Proline Drilling
This is manually operated equipment and is only used in sites which require bedrock core sampling and there is restricted site access to truck mounted drill rigs. The boreholes are usually advanced initially using a tricone roller bit and water circulation to penetrate the upper soil profile. In some instances a hand auger may be used to penetrate the soil profile. Subsequent drilling into bedrock involves the use of NMLC triple tube equipment, using water as a lubricant.

Standard Penetration Tests
Standard penetration tests are used mainly in non-cohesive soils, but occasionally also in cohesive soils, as a means of determining density or strength and of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289 "Methods of testing Soils for Engineering Purpose"- Test F31.

The test is carried out in a borehole by driving a 50mm diameter split sample tube under the impact of a 63Kg hammer with a free fall of 769mm. It is normal for the tube to be driven in three successive 150mm increments and the "N" value is taken as the number of blows for the last 300mm. In dense sands, very hard clays or weak rocks, the full 450mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form:

- In a case where full penetration is obtained with successive blows counts for each 150mm of, say 4, 6, and 7 blows.

  as 4, 6, 7
  N = 13

- In a case where the test is discontinued short of full penetration, say after 15 blows for the first 150mm and 30 blows for the next 40mm.

  as 15,30/40mm

The results of the tests can be related empirically to the engineering properties of the soil. Occasionally the test methods is used to obtain samples in 50mm diameter thin walled samples tubes in clays. In these circumstances, the best results are shown on the bore logs in brackets.

Dynamic Cone Penetration Test
A modification to the SPT test is where the same driving system is used with a solid 60^0 tipped steel cone of the same diameter as the SPT hollow sampler. The cone can be continuously driven into the borehole and is normally used in areas with thick layers of soft clays or loose sand. The results of this test are shown as 'N_c' on the bore logs, together with the number of blows per 150mm penetration.

Cone Penetrometer Testing and Interpretation
Cone penetrometer testing (sometimes referred to as Dutch Cone-CPT) described in this report, has been carried out using an electrical friction cone penetrometer and the test is described in Australian Standard 1289 test F5.1.

In the test, a 35mm diameter rod with cone tipped end is pushed continuously into the soil, the reaction being provided by a specially designed truck or rig, which is fitted with a hydraulic ram system. Measurements are made of the end bearing resistance on the cone and the friction resistance on a separate 130mm long sleeve, immediately behind the cone. Transducer in the tip of the assembly are connected by electrical wires passing through the centre of the push rods to an amplifier and recorder unit mounted on the control truck.

As penetration occurs (at a rate of approximately 20mm per second) the information is output on continuous chart recorders. The plotted results in this report have been traced from the original records. The information provided on the charts comprises:

- Cone resistance - the actual end bearing force divided by the cross sectional area of the cone, expressed in Mpa.
- Sleeve friction - the frictional force on the sleeve divided by the surface area, expressed in kPa.
- Friction ratio - the ratio of sleeve friction to cone resistance, expressed in percentage.

There are two scales available for measurement of cone resistance. The lower "A" scale (0-5Mpa) is used in very soft soils where increased sensitivity is required and is shown in the graphs as a dotted line. The main "B" scale (0-50Mpa) is less sensitive and is shown as a full line.

The ratios of the sleeve resistance to cone resistance will vary with the type of soil encountered, with higher relative frictions in clays than in sands. Friction ratios of 1% to 2% are commonly encountered in sands and very soft clays, rising to 4% to 10% in stiff clays.

In sands, the relationship between cone resistance and SPT value is commonly in the range:

$$q_c \text{ (Mpa)} = (0.4 \text{ to } 0.6)\ N \text{ (blows per 300mm)}$$

In clays the relationship between undrained shear strength and cone resistance is commonly in the range:

$$q_c = (12 \text{ to} 18)\ C_u$$

Interpretation of CPT values can also be made to allow estimate of modulus or compressibility values to allow calculation of foundation settlements. Inferred stratification, as shown on the attached report, is assessed from the cone and friction traces, from experience and information from nearby boreholes etc.

Cone Penetrometer Testing and Interpretation continued
This information is presented for general guidance, but must be regarded as being to some extent interpretive. The test method provides a continuous profile of engineering properties and where precise information or soil classification is required, direct drilling and sampling may be preferable.

Portable Dynamic Cone Penetrometer (AS1289)
Portable dynamic cone penetrometer tests are carried out by driving a rod in to the ground with a falling weight hammer and measuring the blows per successive 100mm increments of penetration.

There are two similar tests, Cone Penetrometer (commonly known as Scala Penetrometer) and the Perth Sand Penetrometer. Scala Penetrometer is commonly adopted by this company and consists of a 16mm rod with a 20mm diameter cone end, driven with a 9kg hammer, dropping 510mm (AS 1289 Test F3.2).

Laboratory Testing
Laboratory testing is carried out in accordance with Australian Standard 1289 "Methods of Testing Soil for Engineering Purposes". Details of the test procedures are given on the individual report forms.

Engineering Logs
The engineering logs presented herein are an engineering and/or geological interpretation of the sub-surface conditions and their reliability will depend to some extent on frequency of sampling and the method of drilling. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, however, this is not always practicable or possible to justify economically. As it is, the boreholes represent only a small sample of the total sub-surface profile. Interpretation of the information and its application to design and construction should take into account the spacing of boreholes, frequency of sampling and the possibility of other than "straight line" variations between the boreholes.

Ground water
Where ground water levels are measured in boreholes, there are several potential problems:
- In low permeability soils, ground water although present, may enter the hole slowly, or perhaps not at all, during the investigation period.
- A localised perched water table may lead to a erroneous indication of the true water table.
- Water table levels will vary from time to time, due to the seasons or recent weather changes. They may not be the same at the time of construction as indicated in the report.
- The use of water or mud as a drilling fluid will mask any ground water inflow. Water has to be blown out of the hole and drilling mud must be washed out of the hole if any water observations are to be made.

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

Engineering Reports
Engineering reports are prepared by qualified personnel and are based on the information obtained and on current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal is changed, say to a twenty storey building. If this occurs, the company will be pleased to review the report and sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of sub-surface conditions, discussions of geotechnical aspects and recommendations or suggestions for design and construction. However, the company cannot always anticipate or assume responsibility for:
- Unexpected variations in ground conditions. The potential for this will depend partly on bore spacing and sampling frequency.
- Changes in policy or interpretation of policy by statutory authorities.
- The actions of contractors responding to commercial pressures.

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

Site Anomalies
In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, the company request immediate notification. Most problems are much more readily resolved when conditions are exposed than at some later stage, well after the event.

Reproduction of Information for Contractual Purposes
Attention is drawn to the document “Guidelines for the Provision of Geotechnical Information trader Documents”, published by the Institute of Engineers Australia. Where information obtained for this investigation is provided for tender purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. The Company would be pleased to assist in this regard and/or make additional copies of the report available for contract purpose, at a nominal charge.

Site Inspection

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

Review of Design
Where major civil or structural developments are proposed, or where only a limited investigation has been completed, or where the geotechnical conditions are complex, it is prudent to have the design reviewed by a Senior Geotechnical Engineer.