GEOTECHNIQUE
PTY LTD
ABN 64 002 841 063

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JOHNSON PROPERTY GROUP

PROPOSED RESIDENTIAL AND RECREATIONAL DEVELOPMENT HALL STREET, PITT TOWN

GEOTECHNICAL INVESTIGATION

REPORT NO 11124/1-AA 26 JUNE 2006

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Job No: 11124/1
Our Ref: 11124/1-AA
26 June 2006

Johnson Property Group Pty Ltd
268 Old Northern Road
CASTLE HILL NSW 2154

Attention: Mr P Hedge

Dear Sir

re: **Proposed Residential and Recreational Development**
Hall Street, Pitt Town
Geotechnical Investigation

Please find our geotechnical investigation report in relation to the above project. Results of the contamination assessment will be submitted in a separate report.

This report includes details of surface and sub-surface conditions across the site and provides assessments on acid sulphate and saline soils.

Should you have any questions relating to this report, please do not hesitate to contact the undersigned.

Yours faithfully
GEOTECHNIQUE PTY LTD

INDRA JWORCHAN
Associate

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1.0 INTRODUCTION

This report details the results of a geotechnical investigation carried out at Hall Street, Pitt Town, for a proposed residential and recreational development. The investigation was commissioned by Mr P Hedge of Johnson Property Group Pty Ltd in an email dated 6 June 2006 and was carried out in general, accordance with Geotechnique Pty Ltd proposal PG.pb/Q3193 dated 1 June 2006.

It is understood that the site is proposed to be rezoned for residential and recreation developments and information on acid sulphate soils and saline soils are required to supplement already available information to accompany a rezoning application. A salinity and acid sulphate soil plan showing different areas (shaded in colours) within the site was provided for preparation of this report. A geotechnical investigation was specifically required to assess sub-surface conditions across the site for the followings.

1. An acid sulphate soil assessment in two areas of the site, highlighted in blue and green on the provided plan.
2. A salinity assessment in two areas of the site, highlighted in blue and green on the provided plan.
3. A preliminary contamination assessment in one area of the site, highlighted in green on the plan.

Results of contamination assessment will be submitted in a separate report.

It is also understood that the results of this study will accompany a rezoning application at this stage and therefore are preliminary in nature.

2.0 EXISTING INFORMATION

Based on the Geological Map of Penrith (1:100,000), bedrock at the site is anticipated to be Ashfield Shale, belonging to the Wianamatta Group of rocks and comprising dark grey to black shale and laminite. The map also indicates that the bedrock is likely to be overlain by fluvial deposits, comprising gravel, sand, silt and clay, in most portion of the site.

The thickness of alluvial soils and depth to bedrock is not known at this stage.

Reference to the Soil Landscape Map (1:100,000) of Penrith indicates that the landscapes at the site belong to the Agnes Bank and Freemans Reach Groups.

Agnes Bank Group is characterised by low parallel sand dunes deposited on the flat tertiary terraces, with local relief to 7.0m and ground surface slopes generally less than 5%. The soils in the group are sandy, strongly leached overlying sandy clay, with high permeability and susceptible to high water and wind erosion hazards. This group has high seasonal water table and is subject to seasonal logging. Freemans Reach Group, which is a present active floodplain of Nepean River, is characterised by level ground with minor (less than 10m) relief, levees and back swamp. This landform is susceptible to high stream bank erosion and frequent flooding. Soils in this landscape are deep (more than 2.0m) and comprise sands and loams.

Acid Sulphate Soil Risk Map (Edition 2, 1:25,000) of Wilberforce prepared by Department of Land and Water Conservation indicates that there is low probability of occurrence of acid sulphate soil materials within the soil profiles at the site at depths shallower than 3.0m. However, acid sulphate soils may be encountered at depths exceeding 3.0m from existing ground surface.

3.0 SCOPE OF WORK

Available information about the site were reviewed to assess the following:

- Geology of site, including types of rocks and soils likely to be encountered across the site
- Landforms and geomorphology of the site, including ground elevations and slopes, hills and valleys
- Hydrogeology of site, including drainage systems, surface water bodies, creeks/streams, groundwater wells, if any
- Acid sulphate soils potential.

At the completion of the information review, the following field work was carried out:

- Walk over survey of the site to assess geological and geomorphological conditions as well as types of soil encountered across the site.
- Excavation of fifteen test pits (TP1 to TP15) using a backhoe. Test pits were uniformly distributed across the site ensuring at least one test pit is located in all types of soils and landforms. Test pits were terminated at backhoe refusal or depth of about 2.0m, whichever occurs first. Approximate test pit locations are indicated on Drawing No 11124/1-1 presented in Appendix A. Excavation logs are also presented in Appendix A.
- Collect representative soil samples for visual assessment and laboratory tests
- Measuring depth to groundwater level or seepage in test pits, where encountered.

The field work was carried out on 12 June 2006 under supervision of a Geotechnical Engineer from this company, who nominated the test pits locations, carried out sampling and prepared the excavation logs.

Representative soil samples were tested in NATA accredited laboratory to assess if soils encountered in test pits are saline soils and/or acid sulphate soils. Soil samples colleted from different landforms (valley, slope and ridge of hill) and varying depths were tested to ensure all soil types likely to be encountered across the site are represented.

4.0 SITE DESCRIPTION

The proposed development site is of irregular shape and measures approximately 1.5km by 0.6m in plan area. The following observations were made during field work.

- The site is bound by the Hawkesbury River to the north west and east, an existing Caravan Park to the north, Punt Road to the west and existing rural residential properties to the south. Hall Street passes through the site.
- The ground surface in the site is sloping down towards the central portion of the site from both the northern and the southern portions. The central portion of the site forms valley/depression oriented in an almost east west direction. Ground surface slope varies from about 5 degrees to more than 25 degrees.
- There are some ponds (water bodies) in the eastern portion of the site.
- The site is densely grassed with scattered mature trees and currently used for cattle grazing.

Subsurface profiles encountered in test pits are detailed in excavation logs and summarised below in Table 1.

TABLE 1

Test Pit No	Test Pit Termination Depths* (m)	Topsoil (m)	Sandy Soils* (m)	Clayey and Silty Soils* (m)
TP1	2.8	0.0-0.2	Not Encountered	0.2->2.8
TP2	2.8	0.0-0.2	Not Encountered	0.2->2.8
TP3	2.7	0.0-0.2	Not Encountered	0.2->2.7
TP4	2.9	0.2-0.2	Not Encountered	0.2->2.9
TP5	2.9	0.0-0.2	Not Encountered	0.2->2.9
TP6	2.7	0.0-0.1	Not Encountered	0.1->2.7
TP7	2.8	0.0-0.2	Not Encountered	0.2->2.8
TP8	2.8	0.0-0.2	Not Encountered	0.2->2.8
TP9	2.7	0.0-0.2	Not Encountered	0.2->2.7
TP10	2.6	0.0-0.4	0.4->2.6	Not Encountered
TP11	2.9	Not Encountered	0.0->2.9	Not Encountered
TP12	2.9	Not Encountered	0.0->2.9	Not Encountered
TP13	2.8	0.0-0.2	0.2-0.8	0.8->2.8
TP14	2.5	Not Encountered	0.0-1.3	1.3->2.5
TP15	2.0	0.0-0.1	0.1-1.4	1.4->2.0

*Approximate only from existing ground surface

Table 1 indicates that the subsurface profiles across the site are of two types. In the eastern portion of the site (TP1 to TP9), the subsurface profile comprises a sequence of topsoil underlain by clayey or silty soils. In the western portion of the site the subsurface profile comprises a sequence of topsoil and sandy soil underlain by clayey and/or silty soils. It is our assessment that the clayey, silty and sandy soils encountered up to test pit termination depths are alluvial deposits. Topsoil is predominantly clayey silt.

Groundwater levels or seepage were not encountered up to test pit termination depths of about 2.0m to 2.9m, from existing ground surface. It should be noted that fluctuations in the level of groundwater might occur due to variations in rainfall and/or other factors.

5.0 LABORATORY TEST RESULTS

Representative soil samples collected from the test pits were tested in a NATA accredited laboratory, to determine following soil properties:

- Indicative salinity of soils in terms of Electrical Conductivity (EC),
- Indicative aggressivity of soils in terms of EC, pH, Chloride, Sulphate and Resistivity
- Acid sulphate soils and/or potentially acid sulphate soils in accordance with the Suspended Peroxide Oxidation Combined Acidity and Sulphate (SPOCAS) Method, recommended by Queensland Acid Sulphate Soil Investigation Team (Reference 1), which includes determination of **pH_{KCl}, pH_{ox}, TPA** (Total Potential Acidity), **TAA** (Total Actual Acidity) and **TSA** (Total Sulfidic Acidity).

The laboratory test certificates are presented in Appendix B are summarised in the following Table 2.

TABLE 2

Test Pit	Depth (m)	EC	Cl	SO_4	R	pH_{KCl}	pH_{ox}	TPA (pH 5.5)	TAA (pH 5.5)	TSA (pH 5.5)
TP1	0.3-0.6	0.36	NT	NT	NT	5.20	5.90	<2.0	6.0	<2.0
TP1	2.4-2.8	0.09	NT	NT	NT	6.82	5.20	<2.0	<2.0	<2.0
TP2	0.3-0.8	0.04	NT	NT	NT	NT	NT	NT	NT	NT
TP2	2.0-2.3	0.04	NT	NT	NT	NT	NT	NT	NT	NT
TP3	0.3-0.7	0.08	50	200	111.5	5.18	5.88	<2.0	8.0	<2.0
TP3	1.4-1.8	0.19	100	<5	35.9	4.51	4.43	30.0	28.0	2.0
TP4	0.4-0.8	2.49	NT	NT	NT	NT	NT	NT	NT	NT
TP4	2.0-2.4	1.94	NT	NT	NT	NT	NT	NT	NT	NT
TP5	0.9-1.3	0.10	NT	NT	NT	NT	NT	NT	NT	NT
TP5	2.0-2.4	0.40	NT	NT	NT	NT	NT	NT	NT	NT
TP7	1.7-2.1	0.13	NT	NT	NT	NT	NT	NT	NT	NT
TP9	0.3-0.7	0.06	NT	NT	NT	NT	NT	NT	NT	NT
TP9	2.1-2.5	0.52	NT	NT	NT	NT	NT	NT	NT	NT
TP11	0.8-1.2	0.07	30	70	108.5	5.85	5.89	<2.0	<2.0	<2.0
TP11	1.9-2.3	0.07	20	60	144.7	5.80	5.63	<2.0	<2.0	<2.0
TP13	0.3-0.7	0.10	NT	NT	NT	5.83	5.73	<2.0	2.0	<2.0
TP13	1.5-2.0	0.18	NT	NT	NT	4.71	5.19	<2.0	14.0	<2.0
TP14	0.6-1.0	0.11	NT	NT	NT	5.78	5.61	<2.0	<2.0	<2.0
TP14	1.5-1.9	0.23	NT	NT	NT	4.15	4.04	36.0	30.0	6.0
TP15	0.2-0.5	0.05	NT	NT	NT	NT	NT	NT	NT	NT
TP15	1.5-1.8	0.10	NT	NT	NT	NT	NT	NT	NT	NT

EC = Electrical Conductivity (ms/cm)
Cl = Chloride (ppm)
SO_4 = Sulphate (ppm)
R = Resistivity (ohm-m)
pH_{KCl} = pH of filtered 1:20, 1M K_{Cl} extract, overnight shake
pH_{ox} = pH of filtered 1:20, 1M K_{Cl} after peroxide digestion
TPA = Total Potential Acidity (mol H^+/tonne)
TAA = Total Actual Acidity (mol H^+/tonne)
TSA = Total Sulfidic Acidity (mol H^+/tonne)
NT = Not Tested

6.0 DISCUSSION and RECOMMENDATIONS

6.1 Proposed Development

It is understood that the site is proposed to be re-zoned for residential and recreational development. Details on possible developments are not known at this stage. However, we anticipate that the development works will include construction of houses, roads, car parks, sports fields, ponds/lakes and landscaping of open areas. We also anticipate site preparation for construction of abovementioned structures will involve some cut (less than 2.0m) and fill (less than 2.0m) operations.

Acid sulphate soil assessment is required if proposed development works involves excavations to evaluate the following:

- If the soils within the footprint of the proposed excavations are actually acid sulphate soils or potential acid sulphate soils.
- If an Acid Sulphate Soil Management Plan is required during proposed excavation.

Soil salinity assessment is required to determine if soils within the site are saline and assess the following:

- Is the salt concentration in soils high enough to adversely effect lawn and plant growth, that may be required as part of landscaping.
- Will the salt in soils adversely effect construction materials, such as cement, brick, steel etc, and provide recommendations on appropriate construction materials for the assessed soil salinity and aggressivity

6.2 Acid Sulphate Soil Assessment

The Acid Sulphate Management Advisory Committee, New South Wales (Reference 2), recommends that the assessment of acid sulphate soils, or potentially acid sulphate soils at a site, is carried out in stages, as follows:

Step 1 – Check the Acid Sulphate Soils map.

Step 2 – Check if the area meets the geomorphic or site criteria.

Step 3 – Analyse soil and water indicators.

Step 4 – Chemical analysis to confirm Acid Sulphate Soil and action level.

As noted earlier, the Acid Sulphate Soils Map of Wilberforce (1:25,000), indicates that there is low probability of occurrence of acid sulphate soil materials within the soil profiles at the site at depths shallower than 3.0m. However, acid sulphate soils may be encountered at depths exceeding 3.0m from existing ground surface.

The laboratory test results presented in Table 2 may be summarised as follows:

- The pH_{kcl} (field pH) value is in range of 4.1 to 6.8, indicating that the soils at the proposed development site are slightly alkaline in nature. This indicates that soils at the site are unlikely to be acid sulphate soils, though potentially acid sulphate soils may be present.
- The pH_{ox} values (pH after oxidation) of most soil samples are higher than the pH_{kcl} values, indicating that oxidation of soils at the site is unlikely to produce any significant acid. Therefore, it is unlikely that unoxidised sulphides of significance, which may oxidise to produce acid if disturbed, are present at the site. Samples collected from depths exceeding about 1.5m in three test pits TP1, TP3 and TP14 have pH_{ox} values slightly lower than the pH_{kcl} values, indicating that oxidation of soils at the site may to produce some acid. However, pH_{ox} values are more than 3 and drop in pH after oxidation is less than 0.6 units indicating it is unlikely that unoxidised sulphides will produce any significance acid.

The New South Wales Acid Sulphate Soils Management Advisory Committee (Reference 2) recommends “Action Criteria” (Table 3) based on results of acid sulphate soils analysis for three broad texture categories. Works in soils that exceed these “Action Criteria” must prepare an acid sulphate soils management plan and obtain development consent.

TABLE 3

Type of Material		**Action Criteria 1-1000 tonnes of soil is disturbed**		**Action Criteria More than 1000 tonnes of soil is disturbed**	
Texture Range	**Approx Clay Content** (%<0.002mm)	**Sulphur Trail** %S oxidisable (oven dry basis) eg S_{TOS} or S_{POS}	**Acid Trail** mol H^+/tonne (oven dry basis) eg TPA or TSA	**Sulphur Trail** % S oxidisable (oven dry basis) eg S_{TOS} or S_{POS}	**Acid Trail** mol H^+/tonne (oven dry basis) eg TPA or TSA
Coarse Texture Sands to loamy sands	≤5	0.03	18	0.03	18
Medium Texture Sandy loams to light clays	5-40	0.06	36	0.03	18
Fine Texture Medium to heavy clays and silty clays	≥40	0.10	62	0.03	18

The excavation logs indicate that the subsurface soils across the site comprise clay, silt and fine grained sand, which belong to fine to medium texture. Therefore, based on test results presented in Table 2 and Action Criteria presented in Table 3, it is our assessment that:

- Soils to depth of about 1.5m are unlikely to be acid sulphate soils across the site. Therefore, an Acid Sulphate Soils Management Plan will not be required if proposed development works involves excavation to depths shallower than 1.5m from existing ground surface.
- Soils at depths exceeding depth of 1.5m are potentially acid sulphate soils in some portions of the site, especially in vicinity of test pits TP3 and TP14. Therefore, an Acid Sulphate Soils Management Plan may be required if proposed development works involves excavations to depths exceeding 1.5m in vicinity of test pits TP3 and TP14. Therefore, we suggest for additional sampling and testing of samples to delineate areas with potentially acid sulphate soils, if any, and provide recommendations on treatment of acid sulphate soils, if depth of excavation exceed 1.5m in vicinity of test pits TP3 and TP14

6.3 Saline Soil Assessment

Salinity refers to the presence of excess salt in the environment, either in soil or water. Soil salinity relates to the salt content of the soils. These salts usually involve sodium chloride, but other salts occur in some soils. The three main sources of salts are as follows:

- Salts transported from the ocean and deposited by rainfall.
- Salts released during the process of soil and rock weathering.
- Salts naturally present in the soil profile, resulting from marine sediments deposited in earlier geological times.

Soil salinity is assessed by measuring Electrical Conductivity (EC). A soil sample for salinity testing is generally made up of 1:5 soil water suspension, which is one part in air dried soil to five parts distilled water. Thus determined EC is multiplied by a factor, varying from 6 to 17 based on the texture of the soil sample, to obtain Corrected Electrical Conductivity designated as EC_e (Reference 3). Criteria for assessment of salinity classes are shown in the following Table 4 (Reference 3):

TABLE 4

Classification	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	Yields of many crops affected
Very saline	8 – 16	Only tolerant crops yield satisfactorily
Highly saline	>16	Only a few tolerant crops yield satisfactorily

Soils are classified as saline if Electrical Conductivity (EC_e) of the saturated extract exceeds 4.0dS/m or 4.0ms/cm (Reference 3).

Results of electrical conductivity tests on soil samples, presented in Table 2, indicate that the soils from the site have EC values of less than 4.0 dS/m and hence non-saline in nature. Therefore, it is our assessment that the salinity of alluvial soils across the site is unlikely to affect plant growth.

Chemical tests also indicate that the clayey and silty soils across the site are non-aggressive to mildly aggressive. Therefore, we recommend that construction materials, such as concrete, steel, brick etc used for the proposed development should be appropriate for a mildly aggressive site.

7.0 GENERAL

The assessment and recommendations provided in this report are based on information from a limited number of test pits and laboratory testing on representative soil samples. Although all test pits were extended to anticipated depths of excavations during proposed development works, the test pit locations were governed by site accessibility. As the sub-surface profile presented in this report is based on limited test pit information and site observation, the actual sub-surface soil conditions across the site and between test pits could differ from those expected (interpreted). If such differences appear to exist, or are encountered during construction, we recommend that this office is contacted for further advice.

Likewise, representative soil samples recovered from all possible type of soils encountered in test pits were tested. However, due to large spacing between test pits, some type of soils might have been missed out. Therefore, if different types of soils appear to exist or are encountered during development works, we recommend that this office is contacted for further advice.

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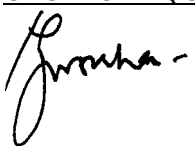


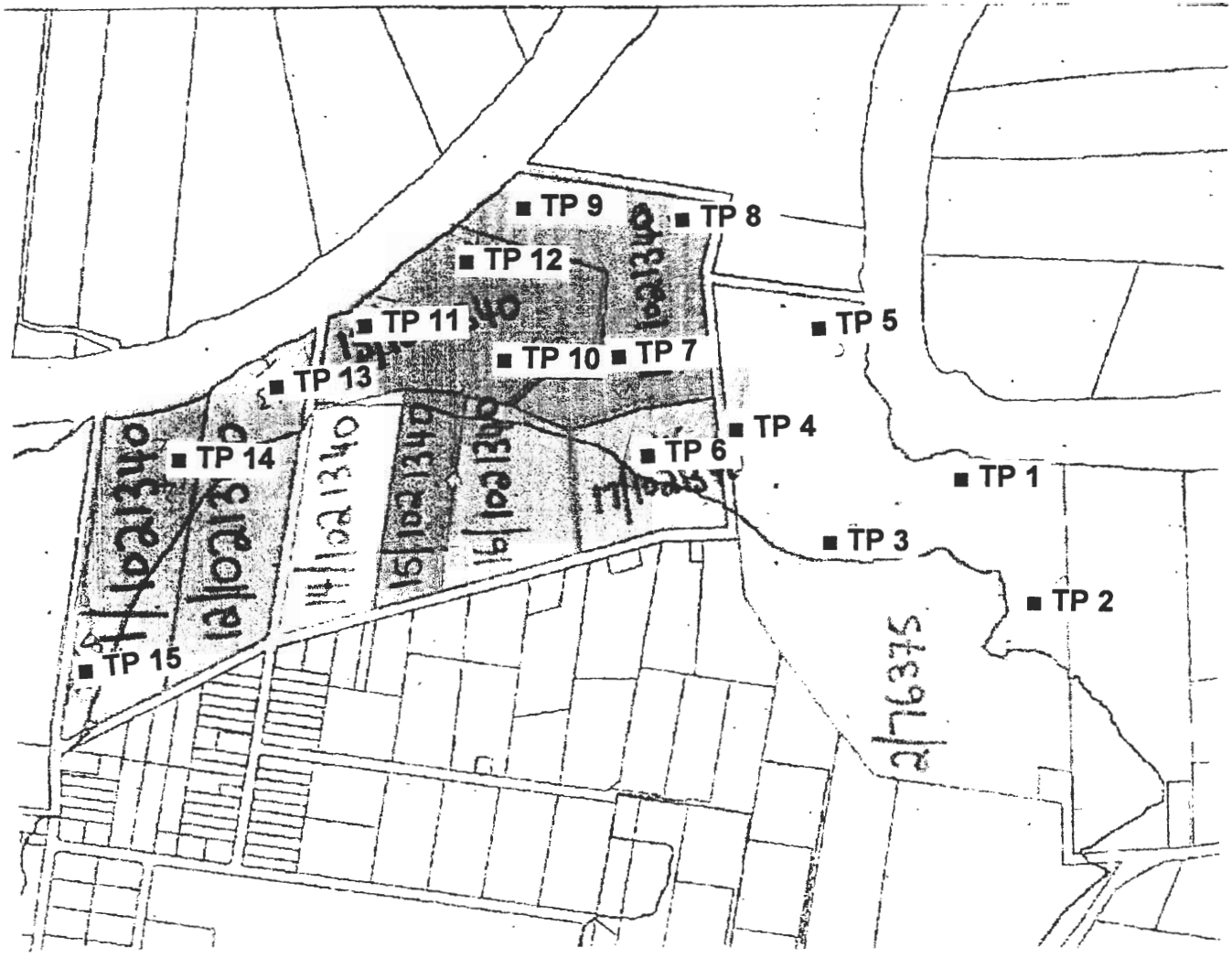
References

1. Queensland Acid Sulphate Soil Investigation Team – Acid Sulphate Soils Laboratory Methods Guidelines, Version 2.1, June 2004
2. The New South Wales Acid Sulphate Soils Management Advisory Committee – Acid Sulphate Soils Assessment Guidelines, August 1998.
3. Taylor S - Dryland Salinity, Introductory Extension Noted, Salt Action, Second Edition, Department of Conservation and Land Management, 1993.

APPENDIX A

TEST PIT LOCATION PLAN
(Drawing No 11124/1-1)

EXCAVATION LOGS



Legend
■ **Test Pit**

NOTE
This Drawing has been produced using a base plan provided by others to which additional information e.g., Test Pits, Borehole Locations or Notes have been added. Some or all of the information shown on the plan may not be relevant at the time of producing this drawing.

GEOTECHNIQUE PTY LTD — CONSULTING ENGINEERS

Drawn:	SD	Johnson Property Group Pty Ltd Proposed Residential and Recreational Development Hall St, Pitt Town Plan showing approximate location of Test Pits	Drawing No:	11124/1-1
Approved:	IJ		Job No:	11124/1
Date:	14/6/2006		Our Ref:	11124/1-AA
Scale:	1:14,000		File No:	

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engineering log - excavation

Client : Johnson Group Pty Ltd
Project : Proposed Residential & Recreational Development
Location : Hall Street, Pitt Town

Job No : 11124/1&2
Pit No : 1
Date : 14.06.2006
Logged/Typed/Checked by: SD/lm/

Equipment type and model : Backhoe
R.L. surface :

Excavation dimensions : 2.0 **m long** 0.45 **m wide** **datum :**

1 2 3 penetration	groundwater	samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks
				0			TOPSOIL: Clayey Silt, low plasticity, brown, with roots & root fibres				
		DS		0.5		ML	SILT, low plasticity, brown	M<PL			
				1							
				1.5		ML	SILT, low plasticity, orange-brown				
				2							
	Dry	DS		2.5		CL	Silty CLAY, low plasticity, pale grey mottled orange	M<PL			
				3			TP1 terminated at 2.8m				
				3.5							
				4							
				4.5							

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engineering log - excavation

Client : Johnson Group Pty Ltd
Project : Proposed Residential & Recreational Development
Location : Hall Street, Pitt Town

Job No : 11124/1&2
Pit No : 2
Date : 14.06.2006
Logged/Typed/Checked by: SD/lm/

Equipment type and model : Backhoe
R.L. surface :
Excavation dimensions : 2.0 **m long** 0.45 **m wide** **datum :**

1 2 3 penetration	groundwater	samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks
				0			TOPSOIL: Clayey Silt, low plasticity, brown, with roots & root fibres				
						ML	SILT, low plasticity, yellow-brown	M<PL			
		DS		0.5							
				1							
				1.5							
						CL	Silty CLAY, low plasticity, pale grey mottled orange	M<PL			
		DS		2							
	Dry			2.5		CL	Silty CLAY, orange with slight mottling of grey	M≤PL			
							TP2 terminated at 2.8m				
				3							
				3.5							
				4							
				4.5							

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engineering log - excavation

Client : Johnson Group Pty Ltd
Project : Proposed Residential & Recreational Development
Location : Hall Street, Pitt Town

Job No : 11124/1&2
Pit No : 3
Date : 14.06.2006
Logged/Typed/Checked by: SD/lm/

Equipment type and model : Backhoe
R.L. surface :
Excavation dimensions : 2.0 **m long** 0.45 **m wide** **datum :**

penetration 1 2 3	groundwater	samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks
				0			TOPSOIL: Clayey Silt, low plasticity, brown, with roots & root fibres				
		DS		0.5		ML	SILT, low plasticity, grey	M<PL			
		DS		1		CL	Silty CLAY, low plasticity, orange mottled grey	M<PL			
	Dry			1.5							
				2							
				2.5							
				3			TP3 terminated at 2.7m				
				3.5							
				4							
				4.5							

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engineering log - excavation

Client : Johnson Group Pty Ltd
Project : Proposed Residential & Recreational Development
Location : Hall Street, Pitt Town

Job No : 11124/1&2
Pit No : 4
Date : 14.06.2006
Logged/Typed/Checked by: SD/lm/

Equipment type and model : Backhoe
R.L. surface :

Excavation dimensions : 2.0 **m long** 0.45 **m wide** **datum :**

1 2 3 penetration	groundwater	samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks
				0			TOPSOIL: Clayey Silt, low plasticity, brown, with roots & root fibres				
						ML	SILT, low plasticity, orange-brown	M<PL			
		DS		0.5							
				1							
				1.5							
						CL	Silty CLAY, low plasticity, yellow-brown	M≤PL			
		DS		2							
	Dry			2.5							
				3			TP4 terminated at 2.9m				
				3.5							
				4							
				4.5							

GEOTECHNIQUE
PTY LTD

engineering log - excavation

Client : Johnson Group Pty Ltd
Project : Proposed Residential & Recreational Development
Location : Hall Street, Pitt Town

Job No : 11124/1&2
Pit No : 5
Date : 14.06.2006
Logged/Typed/Checked by: SD/lm/

Equipment type and model : Backhoe
R.L. surface :

Excavation dimensions : 2.0 **m long** 0.45 **m wide** **datum :**

penetration 1 2 3	groundwater	samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks
				0			TOPSOIL: Clayey Silt, low plasticity, brown, with roots & root fibres				
						ML	SILT, low plasticity, dark brown	M<PL			
				0.5							
		DS		1							
				1.5							
						CL	Silty CLAY, low plasticity, grey/brown	M<PL			
		DS		2							
	Dry			2.5							
							TP5 terminated at 2.9m				
				3							
				3.5							
				4							
				4.5							

GEOTECHNIQUE
PTY LTD

engineering log - excavation

Client : Johnson Group Pty Ltd
Project : Proposed Residential & Recreational Development
Location : Hall Street, Pitt Town

Job No : 11124/1&2
Pit No : 6
Date : 14.06.2006
Logged/Typed/Checked by: SD/lm/

Equipment type and model : Backhoe
R.L. surface :

Excavation dimensions : 2.0 **m long** 0.45 **m wide** **datum :**

penetration 1 2 3	groundwater	samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks
				0			TOPSOIL: Clayey Silt, low plasticity, dark brown, with roots & root fibres				
						CL	Silty CLAY, low plasticity, orange-brown	M<PL			
		DS		0.5							
				1		CL	Silty CLAY, low plasticity, pale grey mottled orange				
		DS		1.5							
	Dry			2							
				2.5							
							TP6 terminated at 2.7m				
				3							
				3.5							
				4							
				4.5							

GEOTECHNIQUE
PTY LTD

engineering log - excavation

Client : Johnson Group Pty Ltd
Project : Proposed Residential & Recreational Development
Location : Hall Street, Pitt Town

Job No : 11124/1&2
Pit No : 7
Date : 14.06.2006
Logged/Typed/Checked by: SD/lm/

Equipment type and model : Backhoe
R.L. surface :
Excavation dimensions : 2.0 **m long** 0.45 **m wide** **datum :**

penetration 1 2 3	groundwater	samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks
				0			TOPSOIL: Clayey Silt, low plasticity, brown				
		DS		0.5		ML	SILT, low plasticity, orange-brown	M<PL			
				1							
				1.5		CL	Silty CLAY, low plasticity, black/grey	M≤PL			
		DS		2							
	Dry			2.5							
				3			TP7 terminated at 2.8m				
				3.5							
				4							
				4.5							

GEOTECHNIQUE
PTY LTD

engineering log - excavation

Client : Johnson Group Pty Ltd
Project : Proposed Residential & Recreational Development
Location : Hall Street, Pitt Town

Job No : 11124/1&2
Pit No : 8
Date : 14.06.2006
Logged/Typed/Checked by: SD/lm/

Equipment type and model : Backhoe
R.L. surface :

Excavation dimensions : 2.0 **m long** 0.45 **m wide** **datum :**

penetration 1 2 3	groundwater	samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks
				0			TOPSOIL: Clayey Silt, low plasticity, dark brown, with roots & root fibres				
						CL	Silty CLAY, low plasticity, orange-brown	M<PL			
		DS		0.5							
				1							
				1.5		CL	Silty CLAY, low plasticity, grey with slight mottlling of orange	M<PL			
		DS		2							
	Dry			2.5							
							TP8 terminated at 2.8m				
				3							
				3.5							
				4							
				4.5							

GEOTECHNIQUE
PTY LTD

engineering log - excavation

Client : Johnson Group Pty Ltd
Project : Proposed Residential & Recreational Development
Location : Hall Street, Pitt Town

Job No : 11124/1&2
Pit No : 9
Date : 14.06.2006
Logged/Typed/Checked by: SD/lm/

Equipment type and model : Backhoe
R.L. surface :
Excavation dimensions : 2.0 **m long** 0.45 **m wide** **datum :**

penetration 1 2 3	groundwater	samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks
				0			TOPSOIL: Silty Clay, low plasticity, dark brown, with roots & root fibres				
		DS		0.5		ML	Clayey SILT, low plasticity, pale grey	M<PL			
				1							
				1.5							
				2		CL	Silty CLAY, low plasticity, grey with slight mottling of orange	M<PL			
		DS		2.5							
	Dry										
				3			TP9 terminated at 2.7m				
				3.5							
				4							
				4.5							

GEOTECHNIQUE
PTY LTD

engineering log - excavation

Client : Johnson Group Pty Ltd
Project : Proposed Residential & Recreational Development
Location : Hall Street, Pitt Town

Job No : 11124/1&2
Pit No : 10
Date : 14.06.2006
Logged/Typed/Checked by: SD/lm/

Equipment type and model : Backhoe
R.L. surface :

Excavation dimensions : 2.0 **m long** 0.45 **m wide** **datum :**

penetration 1 2 3	groundwater	samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks
				0			TOPSOIL: Silty Sand, fine grained, orange-brown	M			
				0.5		SM	Silty SAND, fine grained, brown	M			
		DS		1							
				1.5							
				2							
	Dry			2.5							
							TP10 terminated at 2.6m				
				3							
				3.5							
				4							
				4.5							

GEOTECHNIQUE
PTY LTD

engineering log - excavation

Client : Johnson Group Pty Ltd
Project : Proposed Residential & Recreational Development
Location : Hall Street, Pitt Town

Job No : 11124/1&2
Pit No : 11
Date : 14.06.2006
Logged/Typed/Checked by: SD/lm/

Equipment type and model : Backhoe
R.L. surface :
Excavation dimensions : 2.0 **m long** 0.45 **m wide** **datum :**

penetration 1 2 3	groundwater	samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks
				0		SM	Silty SAND, fine grained, dark brown	M			
						SP	SAND, fine grained, pale brown	D			
				0.5							
		DS		1							
				1.5							
						SP	SAND, fine to medium grained, pale yellow				
		DS		2							
	Dry			2.5							
				3			TP11 terminated at 2.9m				
				3.5							
				4							
				4.5							

GEOTECHNIQUE
PTY LTD

engineering log - excavation

Client : Johnson Group Pty Ltd
Project : Proposed Residential & Recreational Development
Location : Hall Street, Pitt Town

Job No : 11124/1&2
Pit No : 12
Date : 14.06.2006
Logged/Typed/Checked by: SD/lm/

Equipment type and model : Backhoe
R.L. surface :
Excavation dimensions : 2.0 **m long** 0.45 **m wide** **datum :**

penetration 1 2 3	groundwater	samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks
				0		SM	Silty SAND, fine grained, dark brown	M			
				0.5		SP	SAND, fine grained, pale brown	D			
		DS		1							
				1.5							
				2		SP	SAND, fine to medium grained, yellow-brown				
		DS		2.5							
	Dry										
				3			TP12 terminated at 2.9m				
				3.5							
				4							
				4.5							

GEOTECHNIQUE
PTY LTD

engineering log - excavation

Client : Johnson Group Pty Ltd
Project : Proposed Residential & Recreational Development
Location : Hall Street, Pitt Town

Job No : 11124/1&2
Pit No : 13
Date : 14.06.2006
Logged/Typed/Checked by: SD/lm/

Equipment type and model : Backhoe
R.L. surface :
Excavation dimensions : 2.0 **m long** 0.45 **m wide** **datum :**

1 2 3 penetration	groundwater	samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks
				0			TOPSOIL: Clayey Silt, low plasticity, dark brown				
		DS		0.5		SP	SAND, fine to medium grained, pale yellow	M			
	Dry	DS		1 1.5 2 2.5		CI	Silty CLAY, medium plasticity, dark grey with slight mottling of brown	M=PL			
				3 3.5 4 4.5			TP13 terminated at 2.8m				

GEOTECHNIQUE
PTY LTD

engineering log - excavation

Client : Johnson Group Pty Ltd
Project : Proposed Residential & Recreational Development
Location : Hall Street, Pitt Town

Job No : 11124/1&2
Pit No : 14
Date : 14.06.2006
Logged/Typed/Checked by: SD/lm/

Equipment type and model : Backhoe
R.L. surface :

Excavation dimensions : 2.0 **m long** 0.45 **m wide** **datum :**

1 2 3 penetration	groundwater	samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks
				0		SM	Silty SAND, fine to medium grained, dark brown	M			
				0.5		SP	SAND, fine to medium grained, pale yellow mottled orange	M			
		DS		1							
				1.5		CI	CLAY, medium plasticity, pale grey mottled orange	M≤PL			
		DS		2							
	Dry			2.5			TP14 terminated at 2.5m				
				3							
				3.5							
				4							
				4.5							

GEOTECHNIQUE
PTY LTD

engineering log - excavation

Client : Johnson Group Pty Ltd
Project : Proposed Residential & Recreational Development
Location : Hall Street, Pitt Town

Job No : 11124/1&2
Pit No : 15
Date : 14.06.2006
Logged/Typed/Checked by: SD/lm/

Equipment type and model : Backhoe
R.L. surface :

Excavation dimensions : 2.0 **m long** 0.45 **m wide** **datum :**

penetration 1 2 3	groundwater	samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks
				0			TOPSOIL: Silty Sand, fine grained, brown, with roots & root fibres				
						SP	SAND, fine to medium grained, white	D			
		DS		0.5							
						SC	Clayey SAND, fine to medium grained, indurated	D			
		DS		1							
						ML	SILT, low plasticity, orange, indurated	M<PL			
	Dry	DS		1.5							
				2			TP15 terminated at 2.0m				
				2.5							
				3							
				3.5							
				4							
				4.5							

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Topsoil
	Description not given for: "Z"
	Description not given for: ".O"
	Description not given for: "RZ"
	Silty Sand
	Sand
	Description not given for: ".CO"
	Low to high plasticity clays
	Clayey Sand

Notes:

1. Exploratory borings were drilled on 14.06.2006 using a 4-inch diameter continuous flight power auger.

2. No free water was encountered at the time of drilling or when re-checked the following day.

3. Boring locations were taped from existing features and elevations extrapolated from the final design schematic plan.

4. These logs are subject to the limitations, conclusions, and recommendations in this report.

5. Results of tests conducted on samples recovered are reported on the logs.

EXPLANATORY NOTES

Introduction
These notes have been provided to simplify the geotechnical report with regard to investigation procedures, classification methods and certain matters relating to the Discussion and Comments section. 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 of description and classification of soils and rocks used in this report are based on AS1726 - 1993 "Geotechnical Site Investigations". 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 (e.g. sandy clay) on the following basis:

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
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 tests (CPT), as below:

Relative Density	SPT 'N' Value (blows/300mm)	CPT Cone Value (q_c-MPQ)
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 provide information on plasticity, grain 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 known 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 to accommodate the poorly compacted backfill.

Large Diameter Auger (e.g. 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 0.5m) 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 auger 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 lower reliability due to remoulding, mixing or softening of samples by groundwater, resulting in uncertainties of the original sample depth.

The spiral augers are usually advanced by using a V-bit through the soil profile to refusal, followed by Tungsten Carbide (TC) bit, to penetrate into bedrock. The quality and continuity of the bedrock may be assessed by examination of 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 drill cuttings. Only major changes in stratification can be determined from 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 (e.g. 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 low strength rocks 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 AS1289 6.3.1.

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 rock, 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 blow counts for each 150mm of, say 4, 6 and 7 blows as;

  N = 13
  4,6,7

- 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 method is used to obtain samples in 50mm diameter thin walled sample tubes in clays. In these circumstances, the test results are shown on the bore logs in brackets.

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 AS1289 6.5.1.

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. Transducers 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 given 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

The ratios of the sleeve resistance to cone resistance will vary with the type of soil encountered, with higher relative friction 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.

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 (DCP)
Portable Dynamic Cone Penetrometer tests are carried out by driving a rod into the ground with a falling weight hammer and measuring the blows per successive 100mm increment of penetration.

There are two similar tests, Cone Penetrometer (commonly known as Scala Penetrometer) AS1289 6.3.2 and the Perth Sand Penetrometer AS1289 6.3.3. 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 (AS1289 Test P3.2).

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.

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

- in low permeability soils groundwater, although present, may enter the hole slowly or perhaps not at all during the investigation period
- a localised perched water table may lead to an erroneous indication of the true water table
- water table levels will vary from time to time 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 groundwater inflow. Water has to be blown out of the hole and drilling mud must be washed out of the hole if water observations are to be made

More reliable measurements can be achieved by installing standpipes that are read at intervals over several days, or weeks for low permeability soils. Piezometers sealed in a particular stratum may be advisable in low permeability soils, or where there may be interference from a perched water table 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, perhaps a three-storey building, the information and interpretation may not be relevant if the 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 that were expected from the information contained in the report, the Company requests immediate notification. Most problems are much more easily resolved when conditions are exposed rather 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 in Tender Documents", published by the Institute of Engineers Australia. Where information obtained from this Investigation is provided for tendering purposes; it is recommended that all information, including the written report and discussion, be made available.

In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. The Company would be pleased to assist in this regard and/or make additional copies of the report available for contract purposes, at a nominal charge.

Site Inspection
The Company will always be pleased to provide engineering inspection services for geotechnical aspects 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.

APPENDIX B

LABORATORY TEST RESULTS

SPOCAS Profile

CLIENT: **Geotechnique Pty. Limited.**
PO Box 880
PENRITH NSW 2750
Attn: Indra Jworchan

PROJECT: Name: **Residential & Recreational Development**
Location: **Hall Street Pitt Town**
Client Job N°: **11124/1** Order N°:
Date Received: **16/06/2006**

SAMPLE: Batch N°: **1493** Sample N°: **1**
Name: **TP1 0.3-0.6**
Test Type: **sPOCAS EC**

Quality System
Quality Endorsed Company
AS/NZS ISO 9001: 2000 QEC 21650

Sydney Environmental and Soil Laboratory
Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Tests are performed under a quality system certified as complying with ISO 9001: 2000. Results and conclusions assume that sampling is representative. This document shall not be reproduced except in full.

Sydney Environmental & Soil Laboratory Pty Ltd
ABN 70 106 810 708
16 Chilvers Road
Thornleigh NSW 2120
Australia
Address mail to:
PO Box 357
Pennant Hills NSW 1715
Tel: 02 9980 6554
Fax: 02 9484 2427
Em: info@sesl.com.au
Web: www.sesl.com.au

TEST	RESULT	COMMENTS
pH in KCl	5.20	strong acidity
pH in H_2O_2	5.9	medium acidity
Δ pH unit	-0.70	very slight pH increase
Acidity Trail		
TPA mol H+/t	< 2	
TAA mol H+/t	6	some actual acidity
TSA mol H+/t	< 2	little to no potential acidity
Sulphur Trail		
% S_P	< 0.01	
% S_{KCl}	< 0.01	little to no actual sulfur activity
% S_{POS}	< 0.01	little to no potential sulfur activity
Derived Values		
% S_{TPA} *	< 0.01	
Lime Requirement (kg/tonne) **	0.00	no lime requirements

* TPA equivalent S%, where 1% sulphide produces 623.7 mole H^+ / tonne soil.
** Includes a safety factor of 1.5.

Recommendations

EC (mS/cm): 0.36 - low salt content, non saline.

This soil has strong acidity, though is not an acid sulfate soil.

There is **nil actual or potential acid sulfate soil risk**.

Explanation of the Methods:
Ahern CR, Blunden B and Stone Y (eds.) (1998). *Acid Sulphate Soils Laboratory Methods* Guidelines Published by the Acid Sulphate Soil Management Advisory committe, Wollongbar, NSW, Australia

Checked by ..... Murray Fraser

Consultant..... Stacy Crook

Date of Report 22/06/2006

SPOCAS Profile

CLIENT: **Geotechnique Pty. Limited.**
PO Box 880
PENRITH NSW 2750
Attn: Indra Jworchan

PROJECT: Name: **Residential & Recreational Development**
Location: **Hall Street Pitt Town**
Client Job N°: **11124/1** Order N°:
Date Received: **16/06/2006**

SAMPLE: Batch N°: **1493** Sample N°: **2**
Name: **TP1 2.4-2.8**
Test Type: **sPOCAS EC**

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Web: www.sesl.com.au

TEST	RESULT	COMMENTS
pH in KCl	6.82	very slight acidity
pH in H_2O_2	5.2	strong acidity
Δ pH unit	1.62	significant pH decline
Acidity Trail		
TPA mol H+/t	< 2	
TAA mol H+/t	< 2	little to no actual acidity
TSA mol H+/t	< 2	little to no potential acidity
Sulphur Trail		
% S_P	< 0.01	
% S_{KCl}	< 0.01	little to no actual sulfur activity
% S_{POS}	< 0.01	little to no potential sulfur activity
Derived Values		
% S_{TPA} *	< 0.01	
Lime Requirement (kg/tonne) **	-0.50	no lime requirement

* TPA equivalent S%, where 1% sulphide produces 623.7 mole H^+ / tonne soil.

** Includes a safety factor of 1.5.

Recommendations

EC (mS/cm): 0.09 - low salt content, non saline.

This soil has very slight acidity, though is not an acid sulfate soil.

There is **nil actual or potential acid sulfate soil risk**.

Explanation of the Methods:
Ahern CR, Blunden B and Stone Y (eds.) (1998). *Acid Sulphate Soils Laboratory Methods* Guidelines Published by the Acid Sulphate Soil Management Advisory committe, Wollongbar, NSW, Australia

Checked by .....
Murray Fraser

Consultant.....
Stacy Crook

Date of Report
22/06/2006

SPOCAS Profile

CLIENT: **Geotechnique Pty. Limited.**
PO Box 880
PENRITH NSW 2750
Attn: Indra Jworchan

PROJECT: Name: **Residential & Recreational Development**
Location: **Hall Street Pitt Town**
Client Job N°: **11124/1** Order N°:
Date Received: **16/06/2006**

SAMPLE: Batch N°: **1493** Sample N°: **3**
Name: **TP3 0.3-0.7**
Test Type: **sPOCASpH EC Cl SO4 text Resistivity**

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TEST	RESULT	COMMENTS
pH in KCl	5.18	strong acidity
pH in H_2O_2	5.88	medium acidity
Δ pH unit	-0.70	very slight pH increase
Acidity Trail		
TPA mol H+/t	< 2	
TAA mol H+/t	8	some actual acidity
TSA mol H+/t	< 2	little to no potential acidity
Sulphur Trail		
% S_P	< 0.01	
% S_{KCl}	< 0.01	little to no actual sulfur activity
% S_{POS}	< 0.01	little to no potential sulfur activity
Derived Values		
% S_{TPA} *	< 0.01	
Lime Requirement (kg/tonne) **	-0.20	no lime requirement

* TPA equivalent S%, where 1% sulphide produces 623.7 mole H^+ / tonne soil.
** Includes a safety factor of 1.5.

Recommendations

This soil has strong acidity, though is not an acid sulfate soil.

There is **nil actual or potential acid sulfate soil risk.**

Explanation of the Methods:
Ahern CR, Blunden B and Stone Y (eds.) (1998). *Acid Sulphate Soils Laboratory Methods* Guidelines Published by the Acid Sulphate Soil Management Advisory committe, Wollongbar, NSW, Australia

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SPOCAS Profile

CLIENT: **Geotechnique Pty. Limited.**
PO Box 880
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Attn: Indra Jworchan

PROJECT: Name: **Residential & Recreational Development**
Location: **Hall Street Pitt Town**
Client Job N°: **11124/1** Order N°:
Date Received: **16/06/2006**

SAMPLE: Batch N°: **1493** Sample N°: **4**
Name: **TP3 1.4-1.8**
Test Type: **sPOCASpH EC Cl SO4 text Resistivity**

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TEST	RESULT	COMMENTS
pH in KCl	4.51	extreme acidity
pH in H_2O_2	4.43	extreme acidity
Δ pH unit	0.08	very slight pH increase
Acidity Trail		
TPA mol H+/t	30	
TAA mol H+/t	28	significant actual acidity
TSA mol H+/t	2	very slight potential acidity
Sulphur Trail		
% S_P	.05	
% S_{KCl}	< 0.01	little to no actual sulfur activity
% S_{POS}	.05	slight potential sulfur activity
Derived Values		
% S_{TPA} *	.05	acidity present due to sulfur activity
Lime Requirement (kg/tonne) **	2.30	some lime requirement

* TPA equivalent S%, where 1% sulphide produces 623.7 mole H^+ / tonne soil.
** Includes a safety factor of 1.5.

Recommendations

This soil has extreme acidity. There is slight potential sulfur activity and potential acidity when the soil is oxidised.

There is **no actual acid sulfate risk**, though a **slight potential acid sulfate risk**. Amelioration with 2.30 kg/tonne of Agricultural Lime will neutralize the risk.

Explanation of the Methods:
Ahern CR, Blunden B and Stone Y (eds.) (1998). *Acid Sulphate Soils Laboratory Methods* Guidelines Published by the Acid Sulphate Soil Management Advisory committe, Wollongbar, NSW, Australia

Checked by ..... Murray Fraser

Consultant..... Stacy Crook

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SPOCAS Profile

CLIENT: **Geotechnique Pty. Limited.**
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Attn: Indra Jworchan

PROJECT: Name: **Residential & Recreational Development**
Location: **Hall Street Pitt Town**
Client Job N°: **11124/1** Order N°:
Date Received: **16/06/2006**

SAMPLE: Batch N°: **1493** Sample N°: **5**
Name: **TP11 0.8-1.2**
Test Type: **sPOCASpH EC Cl SO4 text Resistivity**

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TEST	RESULT	COMMENTS
pH in KCl	5.85	medium acidity
pH in H_2O_2	5.89	medium acidity
Δ pH unit	-0.04	insignificant pH change
Acidity Trail		
TPA mol H+/t	< 2	
TAA mol H+/t	< 2	little to no actual acidity
TSA mol H+/t	< 2	little to no potential acidity
Sulphur Trail		
% S_P	.01	
% S_{KCl}	< 0.01	little to no actual sulfur activity
% S_{POS}	.01	very slight potential sulfur activity
Derived Values		
% S_{TPA} *	< 0.01	some buffering capacity
Lime Requirement (kg/tonne) **	-0.90	no lime requirements

* TPA equivalent S%, where 1% sulphide produces 623.7 mole H^+ / tonne soil.

** Includes a safety factor of 1.5.

Recommendations

This soil has medium acidity and very slight potential sulfur activity, however there is some buffering capacity which prevents the soil from becoming further acidic, i.e. there is no net acid generation. The pH does not drop below 5.89 after oxidation, to be an acid sulfate soil a 4.5 pH or lower is required. The potential sulfur activity may be due to natural sulfate in the soil. No lime requirements are necessary.

There is **nil actual or potential acid sulfate soil risk**.

Explanation of the Methods:
Ahern CR, Blunden B and Stone Y (eds.) (1998). *Acid Sulphate Soils Laboratory Methods* Guidelines Published by the Acid Sulphate Soil Management Advisory committe, Wollongbar, NSW, Australia

Checked by ..... Murray Fraser

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SPOCAS Profile

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Attn: Indra Jworchan

PROJECT: Name: **Residential & Recreational Development**
Location: **Hall Street Pitt Town**
Client Job N°: **11124/1** Order N°:
Date Received: **16/06/2006**

SAMPLE: Batch N°: **1493** Sample N°: **6**
Name: **TP11 1.9-2.3**
Test Type: **sPOCASpH EC Cl SO4 text Resistivity**

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TEST	RESULT	COMMENTS
pH in KCl	5.80	medium acidity
pH in H_2O_2	5.63	medium acidity
Δ pH unit	0.17	very slight pH decline
Acidity Trail		
TPA mol H+/t	< 2	
TAA mol H+/t	< 2	little to no actual acidity
TSA mol H+/t	< 2	little to no potential acidity
Sulphur Trail		
% S_P	.02	
% S_{KCl}	< 0.01	little to no actual sulfur activity
% S_{POS}	.02	very slight potential sulfur activity
Derived Values		
% S_{TPA} *	< 0.01	some buffering capacity
Lime Requirement (kg/tonne) **	-0.90	no lime requirements

* TPA equivalent S%, where 1% sulphide produces 623.7 mole H^+ / tonne soil.

** Includes a safety factor of 1.5.

Recommendations

This soil has medium acidity and very slight potential sulfur activity, however there is some buffering capacity which prevents the soil from becoming further acidic, i.e. there is no net acid generation. The pH does not drop below 5.63 after oxidation, to be an acid sulfate soil a 4.5 pH or lower is required. The potential sulfur activity may be due to natural sulfate in the soil. No lime requirements are necessary.

There is **nil actual or potential acid sulfate soil risk**.

Explanation of the Methods:
Ahern CR, Blunden B and Stone Y (eds.) (1998). *Acid Sulphate Soils Laboratory Methods* Guidelines Published by the Acid Sulphate Soil Management Advisory committe, Wollongbar, NSW, Australia

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SPOCAS Profile

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PROJECT: Name: **Residential & Recreational Development**
Location: **Hall Street Pitt Town**
Client Job N°: **11124/1** Order N°:
Date Received: **16/06/2006**

SAMPLE: Batch N°: **1493** Sample N°: **7**
Name: **TP13 0.3-0.7**
Test Type: **sPOCAS EC**

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TEST	RESULT	COMMENTS
pH in KCl	5.83	medium acidity
pH in H_2O_2	5.73	medium acidity
Δ pH unit	0.10	very slight pH decline
Acidity Trail		
TPA mol H+/t	< 2	
TAA mol H+/t	2	some actual acidity
TSA mol H+/t	< 2	little to no potential acidity
Sulphur Trail		
% S_P	.01	
% S_{KCl}	< 0.01	little to no actual sulfur activity
% S_{POS}	.01	very slight potential sulfur activity
Derived Values		
% S_{TPA} *	< 0.01	some buffering capacity
Lime Requirement (kg/tonne) **	-0.90	no lime requirements

* TPA equivalent S%, where 1% sulphide produces 623.7 mole H^+ / tonne soil.

** Includes a safety factor of 1.5.

Recommendations

EC (mS/cm): 0.10 - low salt content, non saline.

This soil has medium acidity and very slight potential sulfur activity, however there is some buffering capacity which prevents the soil from becoming further acidic, i.e. there is no net acid generation. The pH does not drop below 5.73 after oxidation, to be an acid sulfate soil a 4.5 pH or lower is required. The potential sulfur activity may be due to natural sulfate in the soil. No lime requirements are necessary.

There is **nil actual or potential acid sulfate soil risk**.

Explanation of the Methods:
Ahern CR, Blunden B and Stone Y (eds.) (1998). *Acid Sulphate Soils Laboratory Methods* Guidelines Published by the Acid Sulphate Soil Management Advisory committe, Wollongbar, NSW, Australia

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SPOCAS Profile

CLIENT: **Geotechnique Pty. Limited.**
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PROJECT: Name: **Residential & Recreational Development**
Location: **Hall Street Pitt Town**
Client Job N°: **11124/1** Order N°:
Date Received: **16/06/2006**

SAMPLE: Batch N°: **1493** Sample N°: **8**
Name: **TP13 1.5-2.0**
Test Type: **sPOCAS EC**

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TEST	RESULT	COMMENTS
pH in KCl	4.71	very strong acidity
pH in H_2O_2	5.19	strong acidity
Δ pH unit	-0.48	pH increase
Acidity Trail		
TPA mol H+/t	< 2	
TAA mol H+/t	14	significant actual acidity
TSA mol H+/t	< 2	little to no potential acidity
Sulphur Trail		
% S_P	.01	
% S_{KCl}	< 0.01	little to no actual sulfur activity
% S_{POS}	.01	very slight potential sulfur activity
Derived Values		
% S_{TPA} *	< 0.01	some buffering capacity
Lime Requirement (kg/tonne) **	-0.50	no lime requirements

* TPA equivalent S%, where 1% sulphide produces 623.7 mole H^+ / tonne soil.

** Includes a safety factor of 1.5.

Recommendations

EC (mS/cm): 0.18 - low salt content, non saline.

This soil has very strong acidity and very slight potential sulfur activity, however there is some buffering capacity which prevents the soil from becoming further acidic, i.e. there is no net acid generation. The pH does not drop below 5.19 after oxidation, to be an acid sulfate soil a 4.5 pH or lower is required. The potential sulfur activity may be due to natural sulfate in the soil. No lime requirements are necessary.

There is **nil actual or potential acid sulfate soil risk.**

Explanation of the Methods:
Ahern CR, Blunden B and Stone Y (eds.) (1998). *Acid Sulphate Soils Laboratory Methods* Guidelines Published by the Acid Sulphate Soil Management Advisory committe, Wollongbar, NSW, Australia

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SPOCAS Profile

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Attn: Indra Jworchan

PROJECT: Name: **Residential & Recreational Development**
Location: **Hall Street Pitt Town**
Client Job N°: **11124/1** Order N°:
Date Received: **16/06/2006**

SAMPLE: Batch N°: **1493** Sample N°: **9**
Name: **TP140.6-1.0**
Test Type: **sPOCAS EC**

Quality System
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TEST	RESULT	COMMENTS
pH in KCl	5.78	medium acidity
pH in H_2O_2	5.61	medium acidity
Δ pH unit	0.17	very slight pH decline
Acidity Trail		
TPA mol H+/t	< 2	
TAA mol H+/t	< 2	little to no actual acidity
TSA mol H+/t	< 2	little to no potential acidity
Sulphur Trail		
% S_P	< 0.01	
% S_{KCl}	< 0.01	little to no actual sulfur activity
% S_{POS}	< 0.01	little to no potential sulfur activity
Derived Values		
% S_{TPA} *	< 0.01	
Lime Requirement (kg/tonne) **	0.00	no lime requirements

* TPA equivalent S%, where 1% sulphide produces 623.7 mole H^+ / tonne soil.
** Includes a safety factor of 1.5.

Recommendations

EC (mS/cm): 0.11 - low salt content, non saline.

This soil has medium acidity, though is not an acid sulfate soil.

There is **nil actual or potential acid sulfate soil risk**.

Explanation of the Methods:
Ahern CR, Blunden B and Stone Y (eds.) (1998). *Acid Sulphate Soils Laboratory Methods* Guidelines Published by the Acid Sulphate Soil Management Advisory committe, Wollongbar, NSW, Australia

Checked by ..... Murray Fraser

Consultant..... Stacy Crook

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SPOCAS Profile

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PROJECT: Name: **Residential & Recreational Development**
Location: **Hall Street Pitt Town**
Client Job N°: **11124/1** Order N°:
Date Received: **16/06/2006**

SAMPLE: Batch N°: **1493** Sample N°: **10**
Name: **TP14 1.5-1.9**
Test Type: **sPOCAS EC**

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TEST	RESULT	COMMENTS
pH in KCl	4.15	extreme acidity
pH in H_2O_2	4.04	extreme acidity
Δ pH unit	0.11	slight pH decline
Acidity Trail		
TPA mol H+/t	36	
TAA mol H+/t	30	significant actual acidity
TSA mol H+/t	6	some potential acidity
Sulphur Trail		
% S_P	.07	
% S_{KCl}	< 0.01	little to no actual sulfur activity
% S_{POS}	.07	some potential sulfur activity
Derived Values		
% S_{TPA} *	.06	slight buffering capacity
Lime Requirement (kg/tonne) **	2.70	some lime requirements

* TPA equivalent S%, where 1% sulphide produces 623.7 mole H^+ / tonne soil.

** Includes a safety factor of 1.5.

Recommendations

EC (mS/cm): 0.23 - low salt content, non saline.

This soil has extreme acidity. There is some potential sulfur activity and potential acidity when the soil is oxidised. There is slight buffering capacity though lime requirements are necessary.

There is **no actual acid sulfate risk**, though a **slight potential acid sulfate risk**. Amelioration with 2.70 kg/tonne of Agricultural Lime will neutralize the risk.

Explanation of the Methods:
Ahern CR, Blunden B and Stone Y (eds.) (1998). *Acid Sulphate Soils Laboratory Methods* Guidelines Published by the Acid Sulphate Soil Management Advisory committe, Wollongbar, NSW, Australia

Checked by ..... Murray Fraser

Consultant..... Stacy Crook

Date of Report 22/06/2006

Corrosion & Scaling Assessment:
Soil Reporting Profile

CLIENT: **Geotechnique Pty. Limited.**
PO Box 880
PENRITH NSW 2750
Attn: Indra Jworchan

PROJECT: Name: **Residential & Recreational Development**
Location: **Hall Street Pitt Town**
Client Job N°: **11124/1** Order N°:
Date Received: **16/06/2006**

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Web: www.sesl.com.au

SAMPLE: Batch N°: **1493** Sample N°: **3**
Name: **TP3 0.3-0.7**
Test Type: **sPOCASpH EC Cl SO4 text Resistivity**

TEST	RESULT	COMMENTS
pH in water (1:2)	6.1	slight acidity, non-aggressive towards concrete and steel
EC mS/cm (1:2)	.08	very low salt content
Texture Class	Light Clay	
Soil Permeability Class	Low	
SOLUBLE ANION ANALYSIS		
Sulphate (1:2) $mgSO_4$ / kg	200	low non-aggressive towards concrete
Chloride (1:2) mgCl / kg	50	low, non-corrosive towards steel
* Resistivity Ω.m	111.5	high, non-corrosive towards steel

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/L = 1%)

Recommendations

This soil is non-aggressive towards both concrete and steel with regards to the parameters tested.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:1995; **Resistivity,** AS1289.4.4.1:1997,

Checked by .....
Murray Fraser

Consultant.....
Stacy Crook

Date of Report
22/06/2006

Corrosion & Scaling Assessment: Soil Reporting Profile

CLIENT: **Geotechnique Pty. Limited.**
PO Box 880
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Attn: Indra Jworchan

PROJECT: Name: **Residential & Recreational Development**
Location: **Hall Street Pitt Town**
Client Job N°: **11124/1** Order N°:
Date Received: **16/06/2006**

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SAMPLE: Batch N°: **1493** Sample N°: **4**
Name: **TP3 1.4-1.8**
Test Type: **sPOCASpH EC Cl SO4 text Resistivity**

TEST	RESULT	COMMENTS
pH in water (1:2)	5.1	strong acidity, non-aggressive towards concrete and steel
EC mS/cm (1:2)	.19	low salt content
Texture Class	Clay Loam	
Soil Permeability Class	Low	
SOLUBLE ANION ANALYSIS		
Sulphate (1:2) $mgSO_4$ / kg	<5.0	low non-aggressive towards concrete
Chloride (1:2) mgCl / kg	100	low, non-corrosive towards steel
* Resistivity Ω.m	35.9	non-corrosive towards steel

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/L = 1%)

Recommendations

This soil is non-aggressive towards both concrete and steel with regards to the parameters tested.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:1995; **Resistivity,** AS1289.4.4.1:1997,

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Consultant.....
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22/06/2006

Corrosion & Scaling Assessment: Soil Reporting Profile

CLIENT: **Geotechnique Pty. Limited.**
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Attn: Indra Jworchan

PROJECT: Name: **Residential & Recreational Development**
Location: **Hall Street Pitt Town**
Client Job N°: **11124/1** Order N°:
Date Received: **16/06/2006**

Quality System
Quality Endorsed Company
AS/NZS ISO 9001: 2000 QEC 21650

Sydney Environmental and Soil Laboratory
Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Sydney Environmental & Soil Laboratory Pty Ltd
ABN 70 106 810 708
16 Chilvers Road
Thornleigh NSW 2120
Australia
Address mail to:
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Pennant Hills NSW 1715
Tel: 02 9980 6554
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Em: info@sesl.com.au
Web: www.sesl.com.au

SAMPLE: Batch N°: **1493** Sample N°: **5**
Name: **TP11 0.8-1.2**
Test Type: **sPOCASpH EC Cl SO4 text Resistivity**

TEST	RESULT	COMMENTS
pH in water (1:2)	6.2	slight acidity, non-aggressive towards concrete and steel
EC mS/cm (1:2)	.07	very low salt content
Texture Class	Loamy Sand	
Soil Permeability Class	High	
SOLUBLE ANION ANALYSIS		
Sulphate (1:2) mgSO_4 / kg	70	low non-aggressive towards concrete
Chloride (1:2) mgCl / kg	30	low, non-corrosive towards steel
* Resistivity Ω.m	108.5	high, non-corrosive towards steel

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/L = 1%)

Recommendations

This soil is non-aggressive towards both concrete and steel with regards to the parameters tested.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:1995; **Resistivity,** AS1289.4.4.1:1997,

Checked by .....
Murray Fraser

Consultant.....
Stacy Crook

Date of Report
22/06/2006

Corrosion & Scaling Assessment: Soil Reporting Profile

CLIENT: **Geotechnique Pty. Limited.**
PO Box 880
PENRITH NSW 2750
Attn: Indra Jworchan

PROJECT: Name: **Residential & Recreational Development**
Location: **Hall Street Pitt Town**
Client Job N°: **11124/1** Order N°:
Date Received: **16/06/2006**

SAMPLE: Batch N°: **1493** Sample N°: **6**
Name: **TP11 1.9-2.3**
Test Type: **sPOCASpH EC Cl SO4 text Resistivity**

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TEST	RESULT	COMMENTS
pH in water (1:2)	6.2	slight acidity, non-aggressive towards concrete and steel
EC mS/cm (1:2)	.07	very low salt content
Texture Class	Loamy Sand	
Soil Permeability Class	High	
SOLUBLE ANION ANALYSIS		
Sulphate (1:2) $mgSO_4$ / kg	60	low non-aggressive towards concrete
Chloride (1:2) mgCl / kg	20	low, non-corrosive towards steel
* Resistivity Ω.m	144.7	high, non-corrosive towards steel

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/L = 1%)

Recommendations

This soil is non-aggressive towards both concrete and steel with regards to the parameters tested.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:1995; **Resistivity,** AS1289.4.4.1:1997,

Checked by .....
Murray Fraser

Consultant.....
Stacy Crook

Date of Report
22/06/2006

Multiple Analysis Profile

CLIENT: **Geotechnique Pty. Limited.**
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PENRITH NSW 2750
Attn: Indra Jworchan

PROJECT: Name: **Residential & Recreational Development**
Location: **Hall Street Pitt Town**
Client Job N°: **11124/1** Order N°:
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Quality System
Quality Endorsed Company
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SAMPLE: Batch N°: **1493** Sample N°: **11**
Name: **TP2**
Test Type: **EC**

Sample #	Result - EC (1:2) mS/cm	Comment
11	0.04	very low salt content, non saline
12	0.04	very low salt content, non saline
13	2.49	elevated salt content, saline
14	1.94	elevated salt content, saline
15	0.10	low salt content, non saline
16	0.40	low salt content, non saline
17	0.06	very low salt content, non saline
18	0.52	low salt content, non saline
19	--	--
20	0.13	low salt content, non saline
21	0.10	low salt content, non saline
22	0.05	very low salt content, non saline

Consultant: .....
Stacy Crook

Authorised Signatory: .....
Murray Fraser

Date of Report: **22/06/2006**