GEOTECHNICAL INVESTIGATION AND ACID SULFATE SOIL ASSESSMENT

FOR

NANEVSKI DEVELOPMENTS PTY LTD

73 Vista Street, Sans Souci, New South Wales

Report No: 15/2181A

Project No: 20537/5961C

September 2015

14/1 Cowpasture Place, Wetherill Park, NSW 2164, Australia
(PO Box 6989, Wetherill Park, NSW 2164, Australia)
T +61 2 9756 2166 | **F** +61 2 9756 1137
www.stsgeo.com.au | enquiries@stsgeo.com.au
ABN 61 162 976 543 | **ACN** 162 976 543

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1. INTRODUCTION

This report presents the results of a combined Geotechnical Investigation and Acid Sulfate Soil (ASS) assessment carried out by STS GeoEnvironmental Pty Limited (STS) for a proposed new residential development to be constructed at 73 Vista Street, Sans Souci. We have been informed the proposed development includes two basement levels that will require excavating about 6 metres below the existing ground surface. We understand that the site is located within a Class 2 Acid Sulfate Soils area and therefore Council requires an assessment to be undertaken.

The purpose of the investigation was to:

- assess the subsurface conditions over the site,
- site classification to AS2870,
- provide recommendations regarding the appropriate foundation system for the site including design parameters,
- provide parameters for the temporary and permanent support of the excavation,
- comment on soil aggressiveness to buried steel and concrete,
- undertake an ASS assessment, and
- determine if an ASS Management Plan is required.

The investigation was undertaken at the request of Tom Nanevski of Nanevski Developments Pty Ltd.

Our scope of work did not include a contamination assessment.

2. NATURE OF THE INVESTIGATION

2.1. Fieldwork

The fieldwork consisted of drilling four (4) boreholes numbered BH1 to BH4 inclusive, at the locations shown on Drawing No. 15/2181. They were drilled using an Edson RP70 drilling rig owned and operated by STS. Soils were drilled using rotary solid flight augers. Soils strengths were determined by undertaking Dynamic Cone Penetrometer (DCP) tests at each borehole location.

Drilling operations were undertaken by one of STS's senior geologists who also logged the subsurface conditions encountered.

The subsurface conditions observed are recorded on the borehole logs given in Appendix A. An explanation of the terms used on the logs is also given in Appendix A. Notes relating to geotechnical reports are also attached.

2.2. Laboratory Testing

In order to the soils for their aggressiveness selected representative soil samples were tested to determine the following:

- pH
- sulphate content

Based on field observations, four soil samples were also selected for laboratory analysis for the Acid Sulfate Soils assessment. The samples were dispatched to Australian Laboratory Services (ALS) for analysis using the Suspension Peroxide Oxidation Combined Acidity and Sulphate (SPOCAS) method. The method allows both a measure of the existing and potential acidity.

Detailed test reports are given in Appendix B.

3. GEOLOGY AND SITE CONDITIONS

The Sydney geological series sheet at a scale of 1:100,000 shows Triassic Age Hawkesbury Sandstone underlies the site. Rocks within this formation comprise mainly medium to coarse grained quartz sandstone. Consistent with the geological setting, weathered sandstone was observed in Kogarah Bay adjacent to the site

At the time of the fieldwork, the site was occupied by a residential building asphalt driveway and separate garage. Site vegetation comprised grass, trees and shrubs. The surrounding properties are residential in nature.

The ground surface falls approximately 5 to 6 metres to the west.

4. SUBSURFACE CONDITIONS

When making an assessment of the subsurface conditions across a site from a limited number of boreholes there is the possibility that variations may occur between test locations. The data derived from the site investigation programme are extrapolated across the site to form a geological model and an engineering opinion is rendered about overall subsurface conditions and their likely behaviour with regard to the proposed development. The actual conditions at the site may differ from those inferred, since no subsurface exploration programme, no matter how comprehensive, can reveal all subsurface details and anomalies.

The subsurface conditions generally consist of fill overlying clayey sands, sandy clays and weathered sandstone. Fill was present in all boreholes to depths of 0.5 to 0.8 metres. Where present, natural clayey sands and sandy clays, were encountered, to depths of 1.5 to 2.1 metres. The consistency of these materials varies between soft and very stiff. Weathered sandstone underlies the site to the depth of auger refusal, 1.6 to 3.0 metres.

Groundwater was observed in three of the boreholes at depths of 1.2 to 1.3 metres.

5. GEOTECHNICAL DISCUSSION

5.1. Site Classification to AS2870

The classification has been prepared in accordance with the guidelines set out in the "Residential Slabs and Footings" Code, AS2870 – 2011.

Because there are buildings and trees present, abnormal moisture conditions (AMC) prevail at the site (Refer to Section 1.3.3 of AS2870).

Because of the AMC and fill present, the site is classified *a problem site (P).*

5.2. Excavation Conditions and Support

Based on subsurface conditions observed in the boreholes, it is expected that the proposed basement excavations will encounter fill clayey sands, sandy clays and weathered sandstone. Excavators without assistance should be able to remove the fill and soils.

Excavators alone without assistance will not be able to remove any significant amount of rock below the depth of auger refusal as shown on the borehole logs. Hydraulic breakers mounted on an excavator or jack hammers will be required to break up the majority of the rock below these depths before it can be removed using an excavator.

Particular care will be required to ensure that buildings or other developments on adjacent properties are not damaged when excavating the rock. The adjacent buildings may be founded directly on the underlying bedrock. Buildings founded directly on rock can often be very susceptible to damage from vibrations.

Excavations methods should be adopted which limit ground vibrations at the adjoining developments to not more than 10 mm/sec. Vibration monitoring will be required to verify that this is achieved. However, if the contractor adopts methods and/or equipment in accordance with the recommendations in Table 5.1 for a ground vibration limit of 5 mm/sec, vibration monitoring may not be required.

Table 5.1 – Recommendations for Rock Breaking Equipment

Distance from adjoining structure (m)	**Maximum Peak Particle Velocity 5 mm/sec**		**Maximum Peak Particle Velocity 10 mm/sec**	
	Equipment	Operating Limit (% of Maximum Capacity)	Equipment	Operating Limit (% of Maximum Capacity)
1.5 to 2.5	Hand operated jackhammer only	100	300 kg rock hammer	50
2.5 to 5.0	300 kg rock hammer	50	300 kg rock hammer or 600 kg rock hammer	100 50
5.0 to 10.0	300 kg rock hammer or 600 kg rock hammer	100 50	600 kg rock hammer or 900 kg rock hammer	100 50

*Vibration monitoring is recommended for 10 mm/sec vibration limit.

The limits of 5 mm/sec and 10 mm/sec are expected to be achievable if rock breaker equipment or other excavation methods are restricted as indicated in Table 5.1.

At all times, the excavation equipment must be operated by experienced personnel, according to the manufacturer's instructions and in a manner consistent with minimising vibration effects.

Use of other techniques (eg. grinding, rock sawing), although less productive, would reduce or possibly eliminate risks of damage to property through vibration effects transmitted via the ground. Such techniques may be considered if an alternative to rock breaking is required.

If rock sawing is carried out around excavation boundaries in not less than 1 metre deep lifts, a 900 kg rock hammer could be used at up to 100% maximum operating capacity with an assessed peak particle velocity not exceeding 5 mm/sec, subject to observation and confirmation by a geotechnical engineer at the commencement of excavation.

It should be noted that vibrations that are below threshold levels for building damage may be experienced at adjoining developments.

Saw cutting should be carried out before any rock breaking is commenced on the site. It would be appropriate before commencing excavation to undertake a dilapidation survey of any adjacent structures that may potentially be damaged. This will provide a reasonable basis for assessing any future claims of damage.

It is of course important that the onsite excavations are adequately supported at all times and do not endanger the adjacent properties.

Temporary slopes in the soils may be constructed at a maximum angle of 1.5 (H) to 1 (V). Where this is not possible it will be necessary to provide temporary support.

When considering the design of the supports, it will be necessary to allow for the loading from structures in adjoining properties, any groundsurface slope and the water table present. Where the structures in adjoining properties are within the zone of influence of the excavation, it will be necessary to adopt K_o conditions when designing the temporary support. Anchors or props can be used to provide the required support. If anchors extend into adjoining property, it will be necessary to obtain the permission of the property owners. Anchors should be installed into the weathered rock. When props or anchors are used for support, a rectangular earth pressure distribution should be adopted on the active side of the support. K_o should also be used to design the permanent support.

The following parameters are suggested for the design of the retaining wall system where there is a level ground surface:

Soil and Weathered Sandstone to the depth of auger refusal:

Active Earth Pressure Coefficient (K_a)	=	0.4
At Rest Pressure Coefficient (K_o)	=	0.55
Total (Bulk) Density	=	20 kN/m^3

Weathered Sandstone/Shale below the depth of auger refusal:

Earth Pressure Coefficient	=	0.1 or 10 kPa (whichever is lesser)
Passive Earth Pressure Coefficient (K_p)	=	4.5 (sandstone only)
Total (Bulk) Density	=	22 kN/m^3

Based on the groundwater observations in the boreholes, the proposed basement excavation extends below the groundwater table. This has implications for both the construction and long term phases of the project.

The support system selected must be impermeable, otherwise lowering the water table beyond site boundaries will likely cause ground settlement and possible damage to the roadways and buildings on adjacent properties. Dewatering beyond site boundaries may also impact on any adjacent Acid Sulfate Soils that may be present.

Provided that an impermeable system is installed, we have calculated that the total volume of water to be extracted during the construction of the basement would be in the order of 0.3 megalitres.

Contiguous pile walls are often used for support, however, experience indicates they are difficult to make watertight if there is considerable water flow. A version of this system is secant piles, where adjoining piles drill into one another. This system would usually be more watertight and has been successfully used in similar ground conditions. Hawkesbury Sandstone is typically relatively impermeable. Because no information is available regarding the fracturing of the rock and therefore its permeability, the secant piles should be taken to the base of the proposed excavation

Steel sheet pile walls are often used to support excavations. Because of their nature, they are very difficult to make watertight, however, when used together with shotcrete they may be successfully employed. In order to be successful, the sheet piles would need to penetrate into the underlying sandstone. This is not considered possible.

Regardless of which system is adopted, a specialist piling contractor should be used to construct the works.

5.3. Foundation Design

After the basement excavation has been completed the exposed material will likely comprise weathered sandstone. An allowable bearing pressure of 1000 kPa may be used to proportion pad and/or strip footings founded in this material. Higher capacities are possible; however this will necessitate coring the rock to determine the presence of joints and other discontinuities.

In order to ensure the bearing values given can be achieved, care should be taken to ensure that the base of excavations are free of all loose material prior to concreting. It is recommended that all footing excavations be protected with a layer of blinding concrete as soon as possible, preferably immediately after excavating, cleaning, inspection and approval. The possible presence of groundwater needs to be considered when pouring concrete.

5.4. Soil Aggressiveness

The aggressiveness or erosion potential of an environment in building materials, particularly concrete and steel is dependent on the levels of soil pH and the types of salts present, generally sulphates and chlorides. In order to determine the degree of aggressiveness, the test values obtained are compared to Tables 6.4.2 (C) and 6.5.2 (C) in AS2159 – 2009 Piling – Design and Installation. The test results are summarised in Table 5.2 below.

Table 5.2 – Soil Aggressiveness Summary Table

Sample No.	Location	Depth (m)	pH	Sulfate (mg/kg)	Chloride (mg/kg)
S1	BH1	0.5	7.7	210	320
S2	BH2	1.5	7.6	220	1290

The report results range between:

- pH - 7.6 and 7.7
- soluble SO_4 - 210 and 220 mg/kg (ppm)
- Chloride Cl - 320 and 1290 mg/kg (ppm)

The soils on the site consist of low permeability silty clays. Therefore, the soil conditions B are considered appropriate.

A review of the durability aspects indicates that:

- pH : minimum value of 7.6
- SO_4 : maximum value of 210 mg/kg (ppm) < 5000 ppm
- Cl : maximum value of 1290 mg/kg (ppm) <5000 ppm

The exposure classification for the onsite soils is non-aggressive for steel and concrete.

6. ACID SULFATE SOIL ASSESSMENT

6.1. Introduction

ASS are the common name given to sediments and soils containing iron sulfides which, when exposed to oxygen generate sulfuric acid. Natural processes formed the majority of acid sulfate sediments when certain conditions existed in the Holocene geological period (the last 10,000 years). Formation conditions require the presence of iron-rich sediments, sulfate (usually from seawater), removal of reaction products such as bicarbonate, the presence of sulfate reducing bacteria and a plentiful supply of organic matter. It should be noted that these conditions exist in mangroves, salt marsh vegetation or tidal areas, and at the bottom of coastal rivers and lakes.

The relatively specific conditions under which acid sulfate soils are formed usually limit their occurrence to low lying parts of coastal floodplains, rivers and creeks. This includes areas with saline or brackish water such as deltas, coastal flats, backswamps and seasonal or permanent freshwater swamps that were formerly brackish. Due to flooding and stormwater erosion, these sulfidic sediments may continue to be re-distributed through the sands and sediments of the estuarine floodplain region. Sulfidic sediment may be found at any depth in suitable coastal sediments – usually beneath the water table.

Any lowering in the water table that covers and protects potential ASS will result in their aeration and the exposure of iron sulfide sediments to oxygen. The lowering in the water table can occur naturally due to seasonal fluctuations and drought or any human intervention, when carrying out any excavations during site development. Potential ASS can also be the exposed to air during physical disturbance with the material at the disturbance face, as well as the extracted material, both potentially being oxidised. The oxidation of iron sulfide sediments in potential ASS results in ASS soils.

Successful management of areas with ASS is possible but must take into account the specific nature of the site and the environmental consequences of development. While it is preferable that sites exhibiting acid sulfate characteristics not be disturbed, management techniques have been devised to minimise and manage impacts in certain circumstances.

When works involving the disturbance of soil or the change of groundwater levels are proposed in coastal areas, a preliminary assessment should be undertaken to determine whether acid sulfate soils are present and if the proposed works are likely to disturb these soils.

6.2. Presence of ASS

Reference to the Port Hacking ASS Risk Map indicates the property is within an area designated as AP4. This indicates a low probability of ASS being present with a surface elevation of greater than X2. This suggests the area is distributed (filled) terrain, and if any ASS is present, it would be encountered at depths greater than 2 metres. It should be noted that maps are a guide only.

The following geomorphic or site criteria are normally used to determine if acid sulfate soils are likely to be present:

- sediments of recent geological age (Holocene)
- soil horizons less than 5 in AHD
- marine or estuarine sediments and tidal lakes
- in coastal wetlands or back swamp areas

6.3. Assessment

Some of the site and geomorphic criteria noted above apply to the site.

In order to assess the significance of the ASS potential, the laboratory results carried out were compared to action criteria contained in ASSM (1998) summarised in Table 6.1. The action criteria trigger the need to prepare an ASSMP and are based on the percentage of oxidisable sulphur (or equivalent TPA and TSA) for broad categories of soil types. Works in soils that exceed these action criteria must prepare a management plan and obtain development consent.

As the soils encountered on the site primarily consisted of clayey sands and sandy clays, the fine texture grade criteria are the most appropriate and have been adopted for this assessment.

Table 6.1 – ASS Action Criteria

Type of material		Action Criteria if 1-1000 tonnes ASS disturbed		Action Criteria if more than 1000 tonnes ASS disturbed	
Texture Range (McDonald et al 1990)	Approx. clay content (%<0.02mm)	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_S	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_S
Coarse Texture (CT) Sands to loamy sands	>5	0.03	18	0.03	18
Medium Texture (MT) Sandy loams to light clays	5-50	0.06	36	0.03	18
Fine Texture (FT) Medium to heavy clays and silty clays	>40	0.1	62	0.03	18

The laboratory test results are summarised in relation to the action criteria in Table 6.2.

Table 6.2 – SPOCAS TEST RESULTS SUMMARY

Analysis	Unit	LOR	ASS1 BH2 @ 1.0 m	ASS2 BH3 @ 0.5 m	ASS3 BH3 @ 1.5 m	ASS4 BH4 @ 0.4 m	Action Criteria[1] <1000 tonnes disturbed
pH before Oxidation	NA	0.1	9.4	8.5	8.9	7.6	-
pH after Oxidation	NA	0.1	8.0	7.8	6.7	6.9	<3 (high risk)
S (POS)	%	0.02	0.095	<0.02	<0.02	<0.02	0.03
TPA	mole/tonne	2	<2	<2	<2	<2	18
TSA	Mole/tonne	2	<2	<2	<2	<2	18

1 = ASSMAC (1998)

Action Criteria Exceeded

The results of the soil sample analyses are compared to the above criteria in Table 6.2, and the analytical laboratory reports for the testing performed are provided in Appendix B.

The results show that the peroxide oxidisable sulfur (POS) percentages are less than the action criteria values except for ASS1. The titratable peroxide acidity (TPA) concentrations measured in the samples are below the 'Acid Trail' criterion of 18 mol H+/tonne. All the pH values are either in the neutral or alkaline range, which indicates non acidic conditions. Therefore, the POS value for ASS1 is considered to be due to something else other than then presence of ASS.

Based on the above an ASS Management Plan will not be required provided onsite dewatering does not lower the groundwater level outside the site.

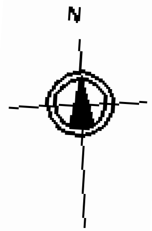
7. VENM CLASSIFICATION

Based on the findings of our site inspection, the natural clayey silty sands, clayey sands, sandy clays and weathered sandstone that is proposed to be excavated from the site is not likely to be contaminated and may be classified as virgin excavated natural material (VENM). That is, it would be suitable for beneficial reuse as clean fill. However, any building waste, topsoil or imported fill materials are not included in this classification; these materials should be screened and excluded from the VENM materials. Care should be taken not to mix any of these materials with the natural VENM.

8. FINAL COMMENTS

During construction, should the subsurface conditions vary from those inferred above, we would be contacted to determine if any changes should be made to our recommendations.

Laurie Ihnativ, BE, MEngSc, MBA, FIE Aust.
Manager, STS GeoEnvironmental Pty Limited



SMEC TESTING SERVICES Pty. Ltd.	Scale: Unknown	Date: August 2015
Client: NANEVSKI DEVELOPMENTS PTY LIMITED		
GEOTECHNICAL INVESTIGATION **73 VISTA STREET, SANS SOUCI** **BOREHOLE AND PENETROMETER LOCATIONS**	Project No. 20537/5961C Drawing No: 15/2181	

NOTES RELATING TO GEOTECHNICAL REPORTS

Introduction

These notes have been provided to outline the methodology and limitations inherent in geotechnical reporting. The issues discussed are not relevant to all reports and further advice should be sought if there are any queries regarding any advice or report.

When copies of reports are made, they should be reproduced in full.

Geotechnical Reports

Geotechnical reports are prepared by qualified personnel on the information supplied or obtained and are based on current engineering standards of interpretation and analysis.

Information may be gained from limited subsurface testing, surface observations, previous work and is supplemented by knowledge of the local geology and experience of the range of properties that may be exhibited by the materials present. For this reason, geotechnical reports should be regarded as interpretative rather than factual documents, limited to some extent by the scope of information on which they rely.

Where the report has been prepared for a specific purpose (eg. design of a three-storey building), the information and interpretation may not be appropriate if the design is changed (eg. a twenty storey building). In such cases, the report and the sufficiency of the existing work should be reviewed by SMEC Testing Services Pty Limited in the light of the new proposal.

Every care is taken with the report content, however, it is not always possible to anticipate or assume responsibility for the following conditions:

- Unexpected variations in ground conditions. The potential for this depends on the amount of investigative work undertaken.
- Changes in policy or interpretation by statutory authorities.
- The actions of contractors responding to commercial pressures.

If these occur, SMEC Testing Services Pty Limited would be pleased to resolve the matter through further investigation, analysis or advice.

Unforeseen Conditions

Should conditions encountered on site differ markedly from those anticipated from the information contained in the report, SMEC Testing Services Pty Limited should be notified immediately. Early identification of site anomalies generally results in any problems being more readily resolved and allows re-interpretation and assessment of the implications for future work.

Subsurface Information

Logs of a borehole, recovered core, test pit, excavated face or cone penetration test are an engineering and/or geological interpretation of the subsurface conditions. The reliability of the logged information depends on the drilling/testing method, sampling and/or observation spacings and the ground conditions. It is not always possible or economic to obtain continuous high quality data. It should also be recognised that the volume or material observed or tested is only a fraction of the total subsurface profile.

Interpretation of subsurface information and application to design and construction must take into consideration the spacing of the test locations, the frequency of observations and testing, and the possibility that geological boundaries may vary between observation points.

Groundwater observations and measurements outside of specially designed and constructed piezometers should be treated with care for the following reasons:

- In low permeability soils groundwater may not seep into an excavation or bore in the short time it is left open.
- A localised perched water table may not represent the true water table.
- Groundwater levels vary according to rainfall events or season.
- Some drilling and testing procedures mask or prevent groundwater inflow.

The installation of piezometers and long term monitoring of groundwater levels may be required to adequately identify groundwater conditions.

Supply of Geotechnical Information or Tendering Purposes

It is recommended tenderers are provided with as much geological and geotechnical information that is available and that where there are uncertainties regarding the ground conditions, prospective tenders should be provided with comments discussing the range of likely conditions in addition to the investigation data.

APPENDIX A – BOREHOLE LOGS AND EXPLANATION SHEETS

SMEC Testing Services Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: Nanevski Developments Pty Limited Project: 73 Vista Street, Sans Souci Location: Refer to Drawing No. 15/2181	Project No. 20537/5961C Date : August 10, 2015 Logged: JK	**BOREHOLE NO.: BH 1** Sheet 1 of 1

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
			CLAYEY SILTY SAND: dark brown, fine grained FILL	CL	SOFT	M
WT		1.0	GRAVELLY SANDY CLAY: orange brown with light grey, fine to medium grained sand, low plasticity, some sandstone gravel FILL	CL	SOFT BECOMING FIRM VERY STIFF	M-D
		2.0	WEATHERED SANDSTONE: orange brown with light grey, fine to medium grained		EXTREMELY LOW STRENGTH	M-D
		3.0 4.0 5.0	AUGER REFUSAL AT 2.1 M ON WEATHERED SANDSTONE			

NOTES: D - disturbed sample; U - undisturbed tube sample; B - bulk sample WT - level of water table or free water; N - Standard Penetration Test (SPT)	Contractor: STS Equipment: Edson RP70
See explanation sheets for meaning of all descriptive terms and symbols	Hole Diameter (mm): 100 Angle from Vertical (°) 0

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: Nanevski Developments Pty Limited Project: 73 Vista Street, Sans Souci Location: Refer to Drawing No. 15/2181	Project No. 20537/5961C Date : August 10, 2015 Logged: JK	**BOREHOLE NO.: BH 2** Sheet 1 of 1

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
			CLAYEY SILTY SAND: dark brown, fine to medium grained FILL	SC	FIRM	M
			CLAYEY SILTY SAND: dark grey with orange brown, fine to medium grained, trace of sandstone gravel FILL	SC	SOFT AND FIRM	M
WT	ASS1 @ 1.0 m	1.0	CLAYEY SILTY SAND: dark grey, fine to medium grained	SC	FIRM AND SOFT	M-VM
		2.0	WEATHERED SANDSTONE: light grey with orange brown, fine to medium grained, clay seams		EXTREMELY LOW STRENGTH	M-D
		3.0	AUGER REFUSAL AT 3.0 M ON WEATHERED SANDSTONE			
		4.0				
		5.0				

NOTES: D - disturbed sample; U - undisturbed tube sample; B - bulk sample WT - level of water table or free water; N - Standard Penetration Test (SPT)	Contractor: STS Equipment: Edson RP70
See explanation sheets for meaning of all descriptive terms and symbols	Hole Diameter (mm): 100 Angle from Vertical (°) 0

SMEC Testing Services Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: Nanevski Developments Pty Limited Project: 73 Vista Street, Sans Souci Location: Refer to Drawing No. 15/2181	Project No. 20537/5961C Date : August 10, 2015 Logged: JK	**BOREHOLE NO.: BH 3** Sheet 1 of 1

WATER TABLE	**SAMPLES**	**DEPTH** (m)	**DESCRIPTION OF DRILLED PRODUCT** (Soil type, colour, grain size, plasticity, minor components, observations)	**SYMBOL**	**CONSISTENCY** (cohesive soils) or **RELATIVE DENSITY** (sands and gravels)	**MOISTURE**
			CLAYEY SILTY SAND: dark grey/brown, fine to medium grained FILL	SC	SOFT	M
	ASS2 @ 0.5 m		GRAVELLY CLAYEY SAND: orange brown with light grey, fine to medium grained sandstone gravel FILL	SC	SOFT AND FIRM	M
		1.0				
WT	ASS3 @ 1.5 m		CLAYEY SAND: orange brown, fine to medium grained	SC	FIRM	M-VM
	S2 @ 2.0 m	2.0				
			WEATHERED SANDSTONE: orange brown, fine tom medium grained		EXTREMELY LOW STRENGTH	M-D
			AUGER REFUSAL AT 2.6 M ON WEATHERED SANDSTONE			
		3.0				
		4.0				
		5.0				

NOTES: D - disturbed sample; U - undisturbed tube sample; B - bulk sample WT - level of water table or free water; N - Standard Penetration Test (SPT)	Contractor: STS Equipment: Edson RP70
See explanation sheets for meaning of all descriptive terms and symbols	Hole Diameter (mm): 100 Angle from Vertical (°) 0

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: Nanevski Developments Pty Limited	Project No. 20537/5961C	**BOREHOLE NO.: BH 4**
Project: 73 Vista Street, Sans Souci	Date : August 10, 2015	
Location: Refer to Drawing No. 15/2181	Logged: JK	Sheet 1 of 1

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
	ASS4 @ 0.4 m		CLAYEY SILTY SAND: dark grey/brown, fine to medium grained TOPSOIL/FILL	SC	FIRM	M
			CLAYEY SAND: orange brown, fine to medium grained	SC	FIRM TO STIFF	M
		1.0	SANDY CLAY: orange brown, fine tom medium grained, low plasticity	CL	FIRM TO STIFF	M
			WEATHERED SANDSTONE:: orange brown, fine tom medium grained		EXTREMELY LOW STRENGTH	M-D
			AUGER REFUSAL AT 1.6 M ON WEATHERED SANDSTONE			
		2.0				
		3.0				
		4.0				
		5.0				

NOTES: D - disturbed sample U - undisturbed tube sample B - bulk sample
WT - level of water table or free water N - Standard Penetration Test (SPT)

See explanation sheets for meaning of all descriptive terms and symbols

Contractor: STS
Equipment: Edson RP70
Hole Diameter (mm): 100
Angle from Vertical (°) 0

SMEC Testing Services Pty Ltd
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: enquiries@smectesting.com.au

Dynamic Cone Penetrometer Test Report

Project: 73 VISTA STREET, SANS SOUCI — Project No.: 20537/5961C
Client: NANEVSKI DEVELOPMENTS PTY LIMITED — Report No.: 15/2181
Address: 34 Plimsoll Street Sans Souci — Report Date: 19/08/2015
Test Method: AS 1289.6.3.2 —

Site No.	P1	P2	P3	P4		
Location	Refer to Drawing No. 15/2181	Refer to Drawing No. 15/2181	Refer to Drawing No. 15/2181	Refer to Drawing No. 15/2181		
Starting Level	Surface Level	Surface Level	Surface Level	Surface Level		
Depth (m)	Penetration Resistance (blows / 150mm)					
0.00 - 0.15	1	2	1	1		
0.15 - 0.30	2	1	2	2		
0.30 - 0.45	1	3	2	2		
0.45 - 0.60	1	4	3	2		
0.60 - 0.75	2	2	1	3		
0.75 - 0.90	3	2	2	3		
0.90 - 1.05	22	2	2	4		
1.05 - 1.20	Refusal	2	2	3		
1.20 - 1.35		1	2	4		
1.35 - 1.50		1	3	22		
1.50 - 1.65		2	2	Refusal		
1.65 - 1.80		22	2			
1.80 - 1.95		Refusal	3			
1.95 - 2.10			22			
2.10 - 2.25			Refusal			
2.25 - 2.40						
2.40 - 2.55						
2.55 - 2.70						
2.70 - 2.85						
2.85 - 3.00						
3.00 - 3.15						
3.15 - 3.30						
3.30 - 3.45						
3.45 - 3.60						
3.60 - 3.75						

Remarks: * Pre drilled prior to testing

Approved Signatory..
Technician: JK — Laurie Ihnativ - Manager

E1. CLASSIFICATION OF SOILS

E1.1 Soil Classification and the Unified System

An assessment of the site conditions usually includes an appraisal of the data available by combining values of engineering properties obtained by the site investigation with descriptions, from visual observation of the materials present on site.

The system used by SMEC in the identification of soil is the Unified Soil Classification system (USC) which was developed by the US Army Corps of Engineers during World War II and has since gained international acceptance and has been adopted in its metricated form by the Standards Association of Australia.

The Australian Site Investigation Code (AS1726-1981, Appendix D) recommends that the description of a soil includes the USC group symbols which are an integral component of the system.

The soil description should contain the following information in order:

Soil composition

- SOIL NAME and USC classification symbol (IN BLOCK LETTERS)
- plasticity or particle characteristics
- colour
- secondary and minor constituents (name estimated proportion, plasticity or particle characteristics, colour

Soil condition

- moisture condition
- consistency or density index

Soil structure

- structure (zoning, defects, cementing)

Soil origin

interpretation based on observation eg FILL, TOPSOIL, RESIDUAL, ALLUVIUM.

E1.2 Soil Composition

(a) Soil Name and Classification Symbol

The USC system is summarized in Figure E1.2.1. The primary division separates soil types on the basis of particle size into:

- Coarse grained soils - more than 50% of the material less than 60 mm is larger than 0.06 mm (60 µm).
- Fine grained soils - more than 50% of the material less than 60 mm is smaller than 0.06 mm (60 µm).

Initial classification is by particle size as shown in Table E1.2.1. Further classification of fine grained soils is based on plasticity.

TABLE E1.2.1 - CLASSIFICATION BY PARTICLE SIZE

NAME	SUB-DIVISION	SIZE
Clay (1)		< 2 µm
Silt (2)		2 µm to 60 µm
Sand	Fine Medium Coarse	60 µm to 200 µm 200 µm to 600 µm 600 µm to 2 mm
Gravel (3)	Fine Medium Coarse	2 mm to 6 mm 6 mm to 20 mm 20 mm to 60 mm
Cobbles (3)		60 mm to 200 mm
Boulders (3)		> 200 mm

Where a soil contains an appropriate amount of secondary material, the name includes each of the secondary components (greater than 12%) in increasing order of significance, eg sandy silty clay.

Minor components of a soil are included in the description by means of the terms “some” and “trace” as defined in Table E1.2.2.

TABLE E1.2.2 - MINOR SOIL COMPONENTS

TERM	DESCRIPTION	APPROXIMATE PROPORTION (%)
Trace	presence just detectable, little or no influence on soil properties	0-5
Some	presence easily detectable, little influence on soil properties	5-12

The USC group symbols should be included with each soil description as shown in Table E1.2.3

TABLE E1.2.3 - SOIL GROUP SYMBOLS

SOIL TYPE	PREFIX
Gravel	G
Sand	S
Silt	M
Clay	C
Organic	O
Peat	Pt

The group symbols are combined with qualifiers which indicate grading, plasticity or secondary components as shown on Table E1.2.4

TABLE E1.2.4 - SOIL GROUP QUALIFIERS

SUBGROUP	SUFFIX
Well graded	W
Poorly Graded	P
Silty	M
Clayey	C
Liquid Limit <50% - low to medium plasticity	L
Liquid Limit >50% - low to medium plasticity	H

(b) Grading

"Well graded"	Good representation of all particle sizes from the largest to the smallest.
"Poorly graded"	One or more intermediate sizes poorly represented
"Gap graded"	One or more intermediate sizes absent
"Uniformly graded"	Essentially single size material.

(c) Particle shape and texture

The shape and surface texture of the coarse grained particles should be described.

Angularity may be expressed as "rounded", "sub-rounded", "sub-angular" or "angular".

Particle **form** can be "equidimensional", "flat" or elongate".

Surface texture can be "glassy", "smooth", "rough", pitted" or striated".

(d) Colour

The colour of the soil should be described in the moist condition using simple terms such as:

Black	White	Grey	Red
Brown	Orange	Yellow	Green
Blue			

These may be modified as necessary by "light" or "dark". Borderline colours may be described as a combination of two colours, eg. red-brown.

For soils that contain more than one colour terms such as:

- Speckled Very small (<10 mm dia) patches
- Mottled Irregular
- Blotched Large irregular (>75 mm dia)
- Streaked Randomly oriented streaks

(e) Minor Components

Secondary and minor components should be individually described in a similar manner to the dominant component.

E1.3 Soil Condition

(a) Moisture

Soil moisture condition is described as "dry", "moist" or "wet".

The moisture categories are defined as:
Dry (D) - Little or no moisture evident. Soils are running.
Moist (M) - Darkened in colour with cool feel. Granular soil particles tend to adhere. No free water evident upon remoulding of cohesive soils.

In addition the moisture content of cohesive soils can be estimated in relation to their liquid or plastic limit.

(b) Consistency

Estimates of the consistency of a clay or silt soil may be made from manual examination, hand penetrometer test, SPT results or from laboratory tests to determine undrained shear or unconfined compressive strengths. The classification of consistency is defined in Table E1.3.1.

TABLE E1.3.1 - CONSISTENCY OF FINE-GRAINED SOILS

TERM	UNCONFINED STRENGTH (kPa)	FIELD IDENTIFICATION
Very Soft	<25	Easily penetrated by fist. Sample exudes between fingers when squeezed in the fist.
Soft	25 – 50	Easily moulded in fingers. Easily penetrated 50 mm by thumb.
Firm	50 – 100	Can be moulded by strong pressure in the fingers. Penetrated only with great effort.
Stiff	100 – 200	Cannot be moulded in fingers. Indented by thumb but penetrated only with great effort.
Very Stiff	200 – 400	Very tough. Difficult to cut with knife. Readily indented with thumb nail.
Hard	>400	Brittle, can just be scratched with thumb nail. Tends to break into fragments.

Unconfined compressive strength as derived by a hand penetrometer can be taken as approximately double the undrained shear strength ($q_u = 2\ c_u$).

(c) Density Index

The insitu density index of granular soils can be assessed from the results of SPT or cone penetrometer tests. Density index should not be estimated visually.

TABLE E1.3.2 - DENSITY OF GRANULAR SOILS

TERM	SPT N VALUE	STATIC CONE VALUE q_c (MPa)	DENSITY INDEX (%)
Very Loose	0 – 3	0 - 2	0 - 15
Loose	3 – 8	2 - 5	15 - 35
Medium Dense	8 – 25	5 - 15	35 - 65
Dense	25 – 42	15 - 20	65 - 85
Very Dense	>42	>20	>85

E1.4 Soil Structure

(a) Zoning

A sample may consist of several zones differing in colour, grain size or other properties. Terms to classify these zones are:

Layer - continuous across exposure or sample
Lens - discontinuous with lenticular shape
Pocket - irregular inclusion
Each zone should be described, their distinguishing features, and the nature of the interzone boundaries.

(b) Defects

Defects which are present in the sample can include:

- fissures
- roots (containing organic matter)
- tubes (hollow)
- casts (infilled)

Defects should be described giving details of dimensions and frequency. Fissure orientation, planarity, surface condition and infilling should be noted. If there is a tendency to break into blocks, block dimensions should be recorded

E1.5 Soil Origin

Information which may be interpretative but which may contribute to the usefulness of the material description should be included. The most common interpreted feature is the origin of the soil. The assessment of the probable origin is based on the soil material description, soil structure and its relationship to other soil and rock materials.

Common terms used are:

"Residual Soil" - Material which appears to have been derived by weathering from the underlying rock. There is no evidence of transport.

"Colluvium" - Material which appears to have been transported from its original location. The method of movement is usually the combination of gravity and erosion.

"Landslide Debris" - An extreme form of colluvium where the soil has been transported by mass movement. The material is obviously distributed and contains distinct defects related to the slope failure.

"Alluvium" - Material which has been transported essentially by water. Usually associated with former stream activity.

"Fill" - Material which has been transported and placed by man. This can range from natural soils which have been placed in a controlled manner in engineering construction to dumped waste material. A description of the constituents should include an assessment of the method of placement.

E1.6 Fine Grained Soils

The physical properties of fine grained soils are dominated by silts and clays.

The definition of clay and silt soils is governed by their Atterberg Limits. Clay soils are characterised by the properties of cohesion and plasticity with cohesion defines as the ability to deform without rupture. Silts exhibit cohesion but have low plasticity or are non-plastic.

The field characteristics of clay soils include:

- dry lumps have appreciable dry strength and cannot be powdered
- volume changes occur with moisture content variation
- feels smooth when moist with a greasy appearance when cut.

The field characteristics of silt soils include:

- dry lumps have negligible dry strength and can be powdered easily
- dilatancy - an increase in volume due to shearing - is indicted by the presence of a shiny film of water after a hand sample is shaken. The water disappears upon remoulding. Very fine grained sands may also exhibit dilatancy.
- low plasticity index
- feels gritty to the teeth

E1.7 Organic Soils

Organic soils are distinguished from other soils by their appreciable content of vegetable matter, usually derived from plant remains.

The soil usually has a distinctive smell and low bulk density.

The USC system uses the symbol Pt for partly decomposed organic material. The O symbol is combined with suffixes "O" or "H" depending on plasticity.

Where roots or root fibres are present their frequency and the depth to which they are encountered should be recorded. The presence of roots or root fibres does not necessarily mean the material is an "organic material" by classification.

Coal and lignite should be described as such and not simply as organic matter.

APPENDIX B – LABORATORY TEST RESULTS

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1528106**	Page	: 1 of 6
Client	: **SMEC TESTING SERVICES PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: ALL REPORTS (ENQUIRIES)	Contact	:
Address	: P O BOX 6989 WETHERILL PARK NSW, AUSTRALIA 2164	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: enquiries@smectesting.com.au	E-mail	:
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: 20537/5961C	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: 12292	Date Samples Received	: 11-Aug-2015 16:20
C-O-C number	:	Date Analysis Commenced	: 13-Aug-2015
Sampler	: ----	Issue Date	: 17-Aug-2015 14:20
Site	: ----		
		No. of samples received	: 6
Quote number	: ----	No. of samples analysed	: 6

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA
WORLD RECOGNISED ACCREDITATION

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
Satishkumar Trivedi	Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.

- ASS: EA029 (SPOCAS): Retained Acidity not required because pH KCl greater than or equal to 4.5
- ASS: EA029 (SPOCAS): Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from kg/t dry weight to kg/m3 in-situ soil, multiply reported results x wet bulk density of soil in t/m3.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	ASS1	ASS2	ASS3	ASS4	S1
			Client sampling date / time	[11-Aug-2015]	[11-Aug-2015]	[11-Aug-2015]	[11-Aug-2015]	[11-Aug-2015]
Compound	CAS Number	LOR	Unit	ES1528106-001	ES1528106-002	ES1528106-003	ES1528106-004	ES1528106-005
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	----	----	----	----	7.7
EA029-A: pH Measurements								
pH KCl (23A)	----	0.1	pH Unit	9.4	8.5	8.9	7.6	----
pH OX (23B)	----	0.1	pH Unit	8.0	7.8	6.7	6.9	----
EA029-B: Acidity Trail								
Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	<2	<2	----
Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	<2	<2	<2	<2	----
Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	<2	<2	<2	<2	----
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.020	<0.020	<0.020	<0.020	----
sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.02	% pyrite S	<0.020	<0.020	<0.020	<0.020	----
sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.02	% pyrite S	<0.020	<0.020	<0.020	<0.020	----
EA029-C: Sulfur Trail								
KCl Extractable Sulfur (23Ce)	----	0.02	% S	0.124	<0.020	0.021	<0.020	----
Peroxide Sulfur (23De)	----	0.02	% S	0.219	<0.020	0.033	0.021	----
Peroxide Oxidisable Sulfur (23E)	----	0.02	% S	0.095	<0.020	<0.020	0.021	----
acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	59	<10	<10	13	----
EA029-D: Calcium Values								
KCl Extractable Calcium (23Vh)	----	0.02	% Ca	0.263	0.341	0.087	0.213	----
Peroxide Calcium (23Wh)	----	0.02	% Ca	0.706	0.738	0.096	0.253	----
Acid Reacted Calcium (23X)	----	0.02	% Ca	0.442	0.396	<0.020	0.040	----
acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	221	198	<10	20	----
sulfidic - Acid Reacted Calcium (s-23X)	----	0.02	% S	0.354	0.317	<0.020	0.032	----
EA029-E: Magnesium Values								
KCl Extractable Magnesium (23Sm)	----	0.02	% Mg	0.024	<0.020	<0.020	<0.020	----
Peroxide Magnesium (23Tm)	----	0.02	% Mg	0.063	0.045	0.021	0.022	----
Acid Reacted Magnesium (23U)	----	0.02	% Mg	0.039	0.045	0.021	0.022	----
Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	32	37	17	18	----
sulfidic - Acid Reacted Magnesium (s-23U)	----	0.02	% S	0.052	0.059	0.028	0.029	----
EA029-F: Excess Acid Neutralising Capacity								
Excess Acid Neutralising Capacity (23Q)	----	0.02	% CaCO3	1.76	1.06	0.270	0.344	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	ASS1	ASS2	ASS3	ASS4	S1
			Client sampling date / time	[11-Aug-2015]	[11-Aug-2015]	[11-Aug-2015]	[11-Aug-2015]	[11-Aug-2015]
Compound	CAS Number	LOR	Unit	ES1528106-001	ES1528106-002	ES1528106-003	ES1528106-004	ES1528106-005
				Result	Result	Result	Result	Result
EA029-F: Excess Acid Neutralising Capacity - Continued								
acidity - Excess Acid Neutralising Capacity (a-23Q)	----	10	mole H+ / t	**353**	**213**	**54**	**69**	----
sulfidic - Excess Acid Neutralising Capacity (s-23Q)	----	0.02	% S	**0.565**	**0.341**	**0.086**	**0.110**	----
EA029-H: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	**1.5**	**1.5**	**1.5**	**1.5**	----
Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	----
Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	<10	<10	----
Liming Rate	----	1	kg CaCO3/t	<1	<1	<1	<1	----
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1	%	----	----	----	----	**16.9**
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	----	----	----	----	**210**
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	----	----	----	----	**320**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	S2	----	----	----	----
			Client sampling date / time	[11-Aug-2015]	----	----	----	----
Compound	CAS Number	LOR	Unit	ES1528106-006	--------	--------	--------	--------
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**7.6**	----	----	----	----
EA029-A: pH Measurements								
pH KCl (23A)	----	0.1	pH Unit	----	----	----	----	----
pH OX (23B)	----	0.1	pH Unit	----	----	----	----	----
EA029-B: Acidity Trail								
Titratable Actual Acidity (23F)	----	2	mole H+ / t	----	----	----	----	----
Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	----	----	----	----	----
Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	----	----	----	----	----
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	----	----	----	----	----
sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.02	% pyrite S	----	----	----	----	----
sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.02	% pyrite S	----	----	----	----	----
EA029-C: Sulfur Trail								
KCl Extractable Sulfur (23Ce)	----	0.02	% S	----	----	----	----	----
Peroxide Sulfur (23De)	----	0.02	% S	----	----	----	----	----
Peroxide Oxidisable Sulfur (23E)	----	0.02	% S	----	----	----	----	----
acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	----	----	----	----	----
EA029-D: Calcium Values								
KCl Extractable Calcium (23Vh)	----	0.02	% Ca	----	----	----	----	----
Peroxide Calcium (23Wh)	----	0.02	% Ca	----	----	----	----	----
Acid Reacted Calcium (23X)	----	0.02	% Ca	----	----	----	----	----
acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	----	----	----	----	----
sulfidic - Acid Reacted Calcium (s-23X)	----	0.02	% S	----	----	----	----	----
EA029-E: Magnesium Values								
KCl Extractable Magnesium (23Sm)	----	0.02	% Mg	----	----	----	----	----
Peroxide Magnesium (23Tm)	----	0.02	% Mg	----	----	----	----	----
Acid Reacted Magnesium (23U)	----	0.02	% Mg	----	----	----	----	----
Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	----	----	----	----	----
sulfidic - Acid Reacted Magnesium (s-23U)	----	0.02	% S	----	----	----	----	----
EA029-F: Excess Acid Neutralising Capacity								
Excess Acid Neutralising Capacity (23Q)	----	0.02	% CaCO3	----	----	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	S2	----	----	----	----
			Client sampling date / time	[11-Aug-2015]	----	----	----	----
Compound	CAS Number	LOR	Unit	ES1528106-006	--------	--------	--------	--------
				Result	Result	Result	Result	Result
EA029-F: Excess Acid Neutralising Capacity - Continued								
acidity - Excess Acid Neutralising Capacity (a-23Q)	----	10	mole H+ / t	----	----	----	----	----
sulfidic - Excess Acid Neutralising Capacity (s-23Q)	----	0.02	% S	----	----	----	----	----
EA029-H: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	----	----	----	----	----
Net Acidity (sulfur units)	----	0.02	% S	----	----	----	----	----
Net Acidity (acidity units)	----	10	mole H+ / t	----	----	----	----	----
Liming Rate	----	1	kg CaCO3/t	----	----	----	----	----
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1	%	20.5	----	----	----	----
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	220	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	1290	----	----	----	----