STS GeoEnvironmental Pty Ltd
Geotechnical and Environmental Solutions

GEOTECHNICAL INVESTIGATION

FOR

DESIGNER HOME CONSTRUCTION

2 – 6 Bold Street and 80 – 82 Cowper Street, Granville, New South Wales

Report No: 15/2254A

Project No: 19305/5926C

November 2016

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1. INTRODUCTION

This report presents the results of a geotechnical investigation carried out by STS GeoEnvironmental Pty Limited (STS) for a proposed new mixed use development to be constructed at 2 – 6 Bold Street & 80 – 82 Cowper Street, Granville. We have been informed the development comprises construction of sixteen above ground levels with a double level basement. Construction of the basement will require excavating up to 6 metres below the ground surface.

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,
- provide recommendations regarding vibration control during rock excavation, and
- comment on soil aggressiveness to buried steel and concrete.

The work was undertaken at the request of IDraft Pty Limited on behalf of Designer Home Construction Pty Limited.

STS has previously undertaken a Preliminary Site Investigation (PSI) contamination assessment in July 2014. The results of the PSI are presented separately under Report No. 14/1646.

2. NATURE OF THE INVESTIGATION

2.1. Fieldwork

September 2013

The fieldwork consisted of drilling four boreholes numbered BH1 to BH4, inclusive, at the locations shown on Drawing No. 15/2254. Restricted site access dictated some of the borehole locations. All boreholes were drilled using an Edson RP70 drilling rig owned and operated by STS. Boreholes were drilled using rotary solid flight augers. Soil strengths were

determined by undertaking Dynamic Cone Penetrometer (DCP) tests at each borehole location. Due to the shallow nature of the shale bedrock, piezometers were not installed.

August 2015

The fieldwork consisted of drilling three (3) boreholes numbered BH101 to BH103, inclusive, at the locations shown on Drawing No. 15/2254. The borehole locations were nominated by the client's representative. All boreholes were drilled using a Comacchio Geo 205 track mounted drilling rig owned and operated by Terratest. Soils and extremely low strength weathered rock were drilled using rotary solid flight augers. All boreholes were extended into the underlying rock using NMLC sized diamond coring equipment. Due to the shallow nature of the shale bedrock, Standard Penetration Testing (SPT) in soils was not undertaken.

In order to measure the groundwater levels, PVC standpipe piezometers were installed in BH1 and BH2. The recovered rock cores were boxed, photographed and logged. The strength of the recovered rock core was assessed by undertaking Point Load Strength index tests at regular intervals along the rock core.

Drilling operations during both phases of investigation 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 and chloride content

The 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 Ashfield Shale of the Wianamatta Group underlies the site. Rocks within this formation comprise shale, claystone and laminite. Sandstone lenses are known to exist.

The site is located on the southern western corner of the intersection of Bold Street and Cowper Street, Granville. At the time of the fieldwork there was an existing warehouse, gravel car parks and concrete hard stand area present on the site.

To the south of the site is a rail corridor. The rail corridor is elevated slightly above the subject site.

The existing ground surface falls approximately 0.5 metres towards the north.

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 consist of concrete and fill overlying silty clays and weathered shale. Concrete was encountered in BH2 and BH3 with thicknesses of 90mm and 150mm. Fill was encountered across the site to depths of 0.3 to 0.7 meters. Firm to stiff becoming very stiff silty clays are present to depths of 1.2 to 2.0 metres. Weathered shale underlies the site. Table 4.1 below outlines the depth to each rock class as encountered in the boreholes.

Table 4.1 – Rock Class Summary

BH ID	Depth of Class V (m)	Depth of Class IV (m)	Depth of Class III (m)
BH1	1.7 – 2.2	2.2	-
BH2	2.0 – 2.2	2.2	-
BH3	1.3 – 3.0	3.0	-
BH4	1.5 – 2.5	2.5	-
BH101	1.5 – 2.5	2.5 – 7.0	7.0 – 10.7
BH102	1.2 – 4.4	4.4 – 7.6	7.6 – 10.7
BH103	1.6 – 4.4	4.4 – 6.7	6.7 – 10.7

Groundwater seepage was not observed during drilling of the boreholes. The piezometers were bailed of drilling water on completion of drilling. The water levels in BH101 and BH102 were re-measured after a period of 9 days and were recorded as 6.0 and 3.8 metres respectively.

5. 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 is a concrete slab and warehouse 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)*. Provided the recommendations given below are adopted and foundations bear in natural materials, the site may be reclassified *highly reactive (H1)*.

5.2. Excavation Conditions and Support

Based on subsurface conditions observed in the boreholes, it is expected that the proposed basement excavation will encounter concrete, fill, silty clays and weathered shale. Excavators without assistance should be able to remove the soils and some of the weathered shale.

Excavators alone without assistance will not be able to remove any significant amount of the Class IV/III rock as shown in Table 4.1. 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 structures on the adjacent properties may be founded directly on the shale. 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 and weathered rock may be constructed at a maximum angle of 1 to 1. Where this is not possible it will be necessary to provide temporary support. Support will probably need to be drilled and fixed into the rock below the base of the excavation. The depth of penetration should be a minimum of 1.0 metre.

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 Shale (Class V):

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

Weathered Shale (Class IV/III):

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

Based on the observations during drilling and in the piezometers, the basement excavation is not expected to encounter the groundwater table. However, some minor perched water seepage may flow into the excavation from the soil rock interface. The inflow rates are likely to be minor and therefore a sump and a pump should be sufficient to control the anticipated seepage.

5.3. Foundation Design

Footings that bear in the firm to stiff natural clayey soils at a high level may be proportioned using an allowable bearing pressure of 100 kPa. This value may be increased to 150 kPa and 300 kPa when founding in the stiff and very stiff materials, respectively.

After the basement excavation has been completed, the exposed material will likely comprise Class IV weathered shale. The bearing pressures given below in Table 5.2 have been determined using the procedures given by Pells et al, in their paper titled "Design Loadings for Foundations on Shale and Sandstone in the Sydney Region," published in the Australian Geomechanics Journal, 1998.

Table 5.2 – Bearing Pressures for Shale

Rock Classification	Allowable End Bearing (kPa)	Ultimate End Bearing (kPa)	Allowable Adhesion / Bond Stress (kPa)	Ultimate Adhesion / Bond Stress (kPa)
Shale Class V	700	3,000	70	100
Shale Class IV	1,000	4,500	100	150
Shale Class III	3,500	6,000	350	600

When piers are founded in rock the adhesion in the overlying soils must be ignored. 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 drilling piers and 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 the table below.

Table 5.2 – Soil Aggressiveness Summary Table

Sample No.	Location	Depth (m)	pH	Chloride (mg/kg)	Sulfate (mg/kg)
S1	BH1	0.05	7.2	30	200
S2	BH1	0.4	5.5	50	250
S5	BH2	1.1	5.1	10	180
S11	BH4	0.5	5.0	30	280

The report results range between:

- pH - 5.0 to 7.2
- soluble SO_4 - 180 to 280 mg/kg (ppm)
- soluble chloride - 10 to 50 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 5.0
- SO_4 : maximum value of 280 mg/kg (ppm) < 5000 ppm
- Cl : maximum value of 50 mg/kg (ppm) < 5000 ppm

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

5.5. Impact on Adjacent Rail Corridor

The boundary of the rail corridor is approximately 8 metres from the southern extent of the proposed excavation. Excavations on the site (other than some deeper piles) are not proposed to extend beyond 6.0 metres, and therefore will be outside the zone of influence of the rail corridor. Based on our experience, it is our expectation that the movements at the rail corridor boundary will be of a very minor nature.

Basement excavation on the site will most likely require rock excavation using hydraulic hammers. Provided the vibration limits noted in Section 5.2 are adopted, vibrations generated during rock excavation will not have a negative impact on the adjacent rail corridor.

Further, we understand that a finite element numerical analysis of the basement support system and staged excavation is being undertaken by SMEC Australia.

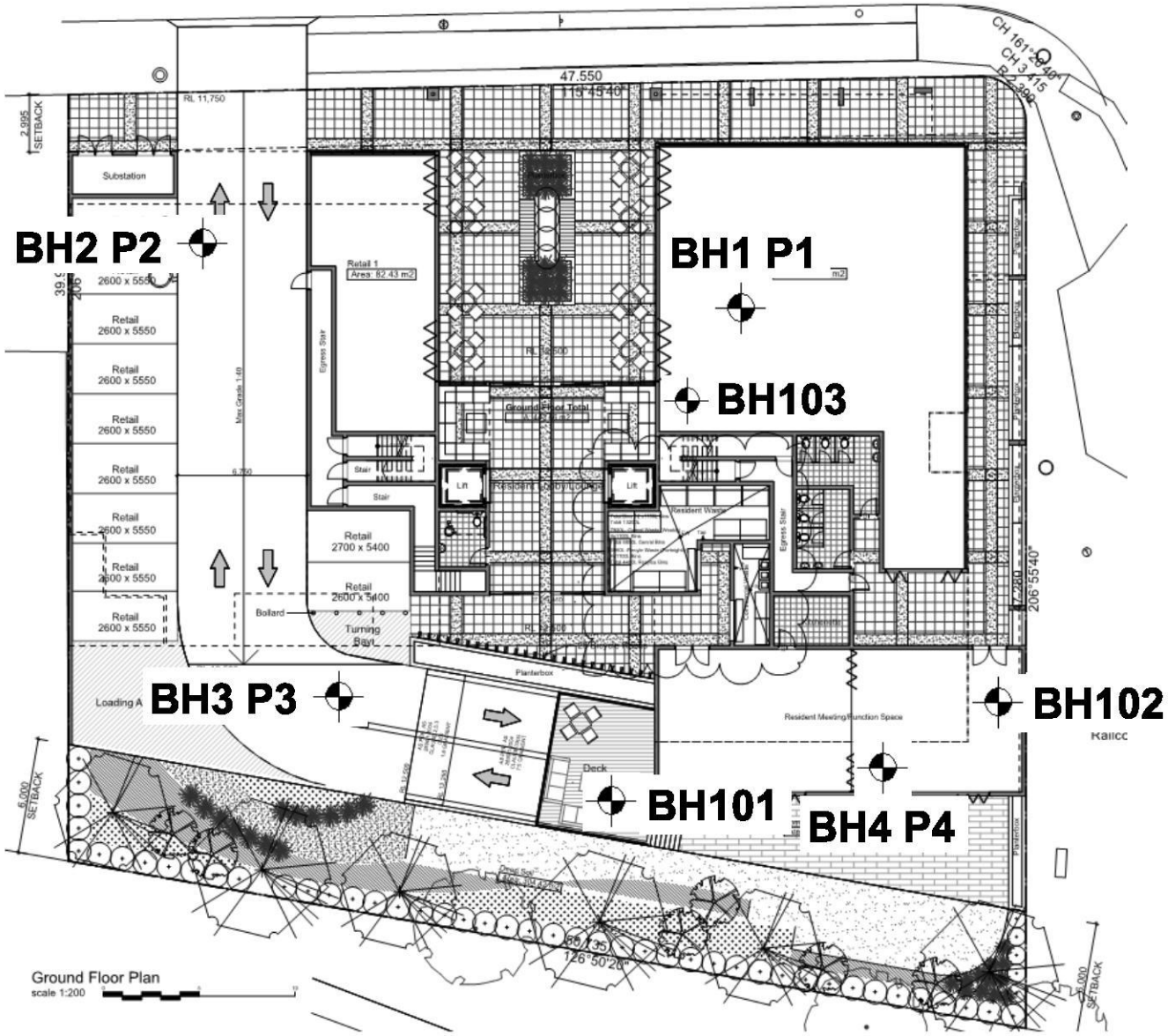
6. FINAL COMMENTS

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.

As discussed above, it is important the excavation is inspected regularly as it progresses. Also the exposed bearing surfaces for footings should be inspected by a geotechnical engineer to ensure the allowable pressure given has been achieved.

Matt Green BSC Hons
Senior Engineering Geologist

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



STS GEOENVIRONMENTAL Pty. Ltd.	**Scale: Unknown**	**Date: August 2015**
Client: DESIGNER HOME CONSTRUCTION		
GEOTECHNICAL INVESTIGATION **2-6 BOLD STREET & 80-82 COWPER STREET, GRANVILLE** **BOREHOLE AND PENETROMETER LOCATIONS**		Project No. 19305/5926C Drawing No: 15/2254

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, CORE PHOTOS AND EXPLANATION SHEETS

SMEC Testing Services Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: Designer Home Constructions Pty Limited
Project: 2-6 Bold and 80-82 Cowper Street, Granville
Location: Refer to Drawing No. 15/2254

Project No.: 19305/3376C
Date : August 28, 2013
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
	S1 @ 0.05 m		SANDY GRAVEL: light grey with dark grey and red brown FILL	GW		D
			SILTY CLAY: dark grey/brown, medium plasticity, trace of gravel	CL		D-M
			FILL			
	S2 @ 0.4 m		SILTY CLAY: orange brown with light grey, medium to high plasticity	CL/CH	FIRM TO STIFF	M
		0.5			STIFF	
		1.0				
			SILTY CLAY: light grey with orange brown, medium plasticity, occasional shale gravel	CL	VERY STIFF	M
		1.5				
			WEATHERED SHALE: dark grey with orange brown, occasional clay seams		EXTREMELY LOW STRENGTH	D
		2.0				
			AUGER REFUSAL AT 2.2 M ON WEATHERED SHALE			
		2.5				

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

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: Designer Home Constructions Pty Limited
Project: 2-6 Bold and 80-82 Cowper Street, Granville
Location: Refer to Drawing No. 15/2254

Project No.: 19305/3376C
Date : August 28, 2013
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
	S3 @ 0.1 m		CONCRETE: (90 mm thick)			
			SILTY SANDY CLAY: dark grey with occasional light grey, fine grained sand, low plasticity, trace of gravel	CL	FIRM	M
			FILL			
	S4 @ 0.5 m	0.5	SILTY CLAY: orange brown with dark grey, medium plasticity, trace of fine grained sand, trace of gravel	CL	FIRM TO STIFF	M
	S5 @ 1.1 m	1.0	FILL			
			SILTY CLAY: orange brown with light grey, medium to high plasticity	CL/CH	STIFF	M
		1.5	SILTY CLAY: light grey with orange brown, medium to high plasticity, occasional shale gravel	CL/CH	VERY STIFF	M
		2.0	WEATHERED SHALE: dark grey with orange brown, clay seams		EXTREMELY LOW STRENGTH	D
			AUGER REFUSAL AT 2.2 M ON WEATHERED SHALE			
		2.5				

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

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: Designer Home Constructions Pty Limited
Project: 2-6 Bold and 80-82 Cowper Street, Granville
Location: Refer to Drawing No. 15/2254

Project No.: 19305/3376C
Date : August 28, 2013
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
			CONCRETE: (150 mm thick)			
	S6/S7/S8 @ 0.2 m		SILTY CLAY: dark brown with dark grey and orange brown and light grey, medium to high plasticity, trace of fine grained sand, trace of gravel	CL	FIRM TO STIFF	M
			FILL			
	S9 @ 0.5 m	0.5	SILTY C LAY: orange brown with light grey, medium to high plasticity	CL/CH	FIRM TO STIFF	M
					STIFF	
		1.0	SILTY CLAY: light grey with orange brown, medium plasticity	CL	STIFF	M
					VERY STIFF	
			WEATHERED SHALE: dark grey with light grey and orange brown, clay seams		EXTREMELY LOW STRENGTH	D
		1.5				
		2.0				
		2.5				
			AUGER REFUSAL AT 3.0 M ON WEATHERED SHALE			

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

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: Designer Home Constructions Pty Limited
Project: 2-6 Bold and 80-82 Cowper Street, Granville
Location: Refer to Drawing No. 15/2254

Project No.: 19305/3376C
Date : August 28, 2013
Logged: JK

BOREHOLE NO.: BH 4

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
	S10		ASPHALT/SANDY GRAVEL: dark grey FILL	GW		D
	@ 0.1 m		SILTY CLAY: orange brown with dark grey and light grey, medium to high plasticity, trace of gravel	CL/CH	FIRM TO VERY STIFF	M
			FILL			
	S11		SILTY CLAY: orange brown with light grey, medium to high plasticity	CL/CH	FIRM TO STIFF	M
	@ 0.5 m	0.5				
					STIFF	
		1.0	SILTY CLAY: light grey with orange brown, medium to high plasticity	CL/CH	VERY STIFF	M
		1.5	WEATHERED SHALE: dark grey with light grey, clay seams		EXTREMELY LOW STRENGTH	D
		2.0				
		2.5	AUGER REFUSAL AT 2.5 M ON WEATHERED SHALE			

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

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client:	Designer Home Constructions	Project: 19305/5926C	**BOREHOLE NO.: BH 101**
Project:	2-6 Bold St & 80-82 Cowper St, Granville	Date : August 19, 2015	Sheet 1 of 3
Location:	Refer to Drawing No. 15/2254	Logged: JK	

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
			SANDY GRAVEL: dark grey, fine to medium gravel, dark grey gravel and asphalt	GP		D
			FILL			
			SILTY CLAY: orange brown with dark brown, medium plasticity, traces of gravel	CL		M
			FILL			
			SILTY CLAY: orange brown with light grey, medium to high plasticity	CL/CH		M
		1.0				
			SILTY CLAY: light grey with orange brown, medium plasticity, traces of gravel	CL		M
			WEATHERED SHALE: light grey with dark grey and orange brown, clay seams		EXTREMELY LOW STRENGTH	D
		2.0				
			BOREHOLE DISCONTINUED AT 2.5M ON WEATHERED SHALE			
		3.0				
			For core log details, refer to core log sheets			
		4.0				
		5.0				
28/8/15 WT		6.0				

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: Terratest
Equipment: Commachio
Hole Diameter (mm): 100
Angle from Vertical (°) 0

SMEC Testing Services Pty Ltd — **GEOTECHNICAL LOG - CORED BOREHOLE**

Client: Designer Home Construction | Project / STS No.: 19305/5926C | **BOREHOLE NO.: BH101**

Project: 2-6 Bold St & 80-82 Cowper St, Granville | Date : August 19, 2015

Location:Refer to Drawing 15/2254 | Logged: JK | Checked By: | Sheet 2 of 3

DRILLING				MATERIAL STRENGTH										DISCONTINUITIES		
						Estimated Rock Strength							Joint Spacing (mm)			
Method	Water	Recovery	Depth (m)	Rock Type (Color, Grain Size, Structure & Minor Components)	Weathering	Extremely Low	Very Low	Low	Medium	High	Very High	Extremely High	20 40 100 300 1000	Visual	Additional Data (Joints, partings, seams, zones etc. Description, orientation, infilling, or coating, shape, roughness, thickness, other)
			1.0	For non core log, refer to non core log sheets											
			2.0	For non core details, refer to non core log sheets											
				START CORING AT 2.50M											
				NO CORE 2.50 - 2.58 M											
N M L C C O R I N G			3.0	WEATHERED SHALE: light grey with orange brown/ red brown and occassional dark grey	HW										2.74m, Pt, 5 deg, Ir, Ro 2.83-2.92m, Jt, Ir, Ro, Cy 3.09m, Pt 0 deg, Ir, Ro 3.23m, Pt, 0 deg, Ro, Cy 3.53m, Pt, 0 deg Pl, Ro, (fe) 3.69m, Pt, 0 deg, Pl, Ro
			4.0												3.83m, Pt, 0 deg, Pl, Ro
				WEATHERED SHALE: dark grey with orange brown and occassional light grey	MW										4.12m, Pt, 5 deg, Pl, Ro, (fe) 4.27m, Pt, 0 deg, Pl, Sm 4.34m, Jt, Ir, Ro, Cy 4.52m, Pt, 0 deg, Pl, Sm 4.56-4.65m, Cz, Cy 4.89m, Pt, Ir, Ro, Cy
			5.0												5.10-5.26m, Jt, 85 deg, Ir, Ro, Cy 5.30m, Cz, Cy 5.46m, Pt, 0 deg, Pl, Ro 5.54m, Jt, 45 deg, Pl, Ro 5.63m, Pt, 0 deg, Pl, Ro
			6.0												5.81m, Pt, 0 deg, Pl, Ro

Notes:

Contractor: Terratest

Equipment: Commachio

Hole Diameter (mm):

Angle from Vertical (°):

See explanation sheets for meaning of all descriptive terms and symbols

SMEC Testing Services Pty Ltd — **GEOTECHNICAL LOG - CORED BOREHOLE**

Client: Designer Home Construction | Project / STS No.: 19305/5926C | **BOREHOLE NO.: BH101**

Project: 2-6 Bold St & 80-82 Cowper St, Granville | Date : August 19, 2015

Location: Refer to Drawing 15/2254 | Logged: JK | Checked By: | Sheet 3 of 3

DRILLING				MATERIAL STRENGTH											DISCONTINUITIES	
						Estimated Rock Strength							Joint Spacing (mm)			
Method	Water	Recovery	Depth (m)	Rock Type (Color, Grain Size, Structure & Minor Components)	Weathering	Extremely Low	Very Low	Low	Medium	High	Very High	Extremely High	20 40 100 300 1000	Visual	Additional Data (Joints, partings, seams, zones etc. Description, orientation, infilling, or coating, shape, roughness, thickness, other)
N M L C C O R I N G			7.0	WEATHERED SHALE: dark grey with orange brown and occasional light grey											6.00-6.03m, Cz, Cy 6.11-6.18m, Jt, 85 deg, Ir, Ro 6.25m, Pt, 0 deg, Pl, Ro 6.43m, Jt, 0 deg, Pl, Ro, Cy 6.58m, Jt, 0 deg, Pl, Ro, Cy, tight 6.71m, Pt, 0 deg, Pl, Ro 6.81m, Pt, 0 deg, Pl, Ro
				WEATHERED SHALE: dark grey with light grey	Fr/ St										6.89m, Jt, Ir, Ro, Cy 7.09m, Jt, 0 deg, Pl., Ro, Cy 7.17m, Sm, Cy 7.23m, Jt, 30 deg, Pl, Ro, Fe, veneer 7.30m, Pt, 0 deg, Pl, Ro, Cy 7.37m, Sm, Cy 7.49m, Pt, 0 deg, Pl, Sm 7.56m, Pt, 2 deg, Pl, Ro 7.69m, Jt, 0 deg, Pl, Ro 7.77m, Jt, 5 deg, Pl, Ro 7.80m, Pt, 0 deg, Pl, Ro
			8.0		Fr										7.92m, Pt, 0 deg, Pl, Sm 7.96m, Pt, 0 deg, Pl, Ro 8.04m, Pt, 0 deg, Pl, Sm 8.10m, Jt, 0 deg, Pl, Ro, Cy 8.18m, Jt, 0 deg, Pl, Ro, Cy, Infill 8.45m, Cz, Cy 8.61m, Pt, 0 deg, Pl, Ro 8.72m, Jt, 0 deg, Pl, Ro, Cy 8.79m, Jt, 0 deg, Pl, Ro, Cy 8.89m, Pt, 0 deg, Pl, Sm
			9.0												8.96m, Jt, Ir, Ro 9.15-9.62m, Jt, 90 deg, Ir, Ro, Cy
			10.0												9.70m, Jt, 0 deg, Pl, Ro, Cy, veneer 9.85-10.0m, Jt, 0-85 deg, Ir, rough 10.06m, Pt, 0 deg, Pl, Sm 10.19m, Jt, 0 deg, Pl, Ro, Cy. Veneer 10.33-10.51m, Jt, Ir, Ro, minor Cy 10.54m, Pt, 0 deg, Pl, Ro 10.60m, Pt, 0 deg, Pl, Ro
			11.0	BOREHOLE DISCONTINUED AT 10.67M STANDPIPE PIEZOMETER INSTALLED											
			12.0												

Notes:

Contractor: Terratest
Equipment: Commachio
Hole Diameter (mm):
Angle from Vertical (°):

See explanation sheets for meaning of all descriptive terms and symbols


Project: 2-6 BOLD & 80-82 COWPER STS, GRANVILLE
Project No. 19305/5926C
Client: Designer Home Constructions
Date Cored: 19/8/2015
Borehole No. BH101
Depth (m): 2.50-10.67 End
Boxes 1 & 2 of 2
BH101 19/8/15
19305 Granville
Start
2.50
No Core
2.50
3
4
5
6
7
8
9
10
10.67
End.

SMEC Testing Services Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client:	Designer Home Constructions	Project: 19305/5926C	**BOREHOLE NO.: BH102**
Project:	2-6 Bold St & 80-82 Cowper St, Granville	Date : August 19, 2015	Sheet 1 of 3
Location:	Refer to Drawing No. 15/2254	Logged: JK	

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
			SANDY GRAVEL: dark grey, fine to medium grained sand, dark grey gravel/ asphalt FILL	GW		D
			SILTY CLAY: orange brown with occassional light grey, medium to high plasticity	CL/CH		M
		1.0	SILTY CLAY: light grey with orange brown, medium to high plasticity, trace of gravel	CL		M
			WEATHERED SHALE: dark brown/ orange brown with light grey, clay seams		EXTREMELY LOW STRENGTH	D
		2.0				D-M
		3.0				
WT 28/8/15		4.0				D
			BOREHOLE DISCONTINUED T 4.45M ON WEATHERED SHALE			
		5.0	For core log details, refer to core log sheets			
		6.0				

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: Terratest
Equipment: Chang 205
Hole Diameter (mm): 100
Angle from Vertical (°) 0

SMEC Testing Services Pty Ltd — **GEOTECHNICAL LOG - CORED BOREHOLE**

Client: Designer Home Construction | Project / STS No.: 19305/5926C | **BOREHOLE NO.: BH102**

Project: 2-6 Bold St & 80-82 Cowper St, Granville | Date : August 19, 2015

Location: Refer to Drawing 15/2254 | Logged: JK | Checked By: | Sheet 2 of 3

DRILLING				MATERIAL STRENGTH										DISCONTINUITIES		
						Estimated Rock Strength							Joint Spacing (mm)			
Method	Water	Recovery	Depth (m)	Rock Type (Color, Grain Size, Structure & Minor Components)	Weathering	Extremely Low	Very Low	Low	Medium	High	Very High	Extremely High	20 40 100 300 1000	Visual	Additional Data (Joints, partings, seams, zones etc. Description, orientation, infilling, or coating, shape, roughness, thickness, other)
			1.0												
			2.0												
			3.0												
			4.0	For non core details, refer to non core log sheets											
				START CORING AT 4.45M											
N M L C O R I N G			5.0	WEATHERED SHALE: dark grey with light grey and orange brown	MW										4.66m, Pt, 0 deg, Pl, Ro 4.74m, Pt, - deg, Pl, Ro 4.86m, Jt, 0 deg, Ir, Ro 5.15m, Jt, 0 deg, Ir, Ro, Cy, Infill 5.18m, Pt, - deg, Pl, Ro 5.26m, Pt, 0 deg, Pl, Ro 5.45m, Jt, 0 deg, Pl, Ro, Cy, Infill 5.48m, Jt, 0 deg, Pl, Ro, Cy, Infill 5.58m, Pt, 0 deg, Pl, Ro 5.69m, Jt, 0 deg, Pl, Ro, Cy, veneer 5.80m, Pt, 0 deg, Pl, Ro 5.84m, Pt, 0 deg, Pl, RO 5.88m, Jt, 0 deg, Pl, Ro, Cy, Infill
			6.0												5.95m, Pt, 0 deg, Pl, Ro

Notes:

Contractor: Terratest

Equipment: Commachio

Hole Diameter (mm):

Angle from Vertical (°):

See explanation sheets for meaning of all descriptive terms and symbols

SMEC Testing Services Pty Ltd — **GEOTECHNICAL LOG - CORED BOREHOLE**

Client: Designer Home Construction
Project: 2-6 Bold St & 80-82 Cowper St, Granville
Location: Refer to Drawing 15/2254
Project / STS No.: 19305/5926C
Date : August 19, 2015
Logged: JK
Checked By:

BOREHOLE NO.: BH102
Sheet 3 of 3

DRILLING				MATERIAL STRENGTH										DISCONTINUITIES		
						Estimated Rock Strength							Joint Spacing (mm)			
Method	Water	Recovery	Depth (m)	Rock Type (Color, Grain Size, Structure & Minor Components)	Weathering	Extremely Low	Very Low	Low	Medium	High	Very High	Extremely High	20 40 100 300 1000	Visual	Additional Data (Joints, partings, seams, zones etc. Description, orientation, infilling, or coating, shape, roughness, thickness, other)
N M L C CORING			7.0	WEATHERED SHALE: dark grey with light grey and orange brown	SW										6.03m, Jt, 0 deg, Pl, Ro, Cy, Infill
															6.18m, Pt, 0 deg, Pl, Sm
															6.27-6.29m, Cy, Sm
															6.40m, Pt, 0 deg, Pl, Sm
															6.63m, Pt, 0 deg, Pl, Sm
															6.76m, Pt, 0 deg, Pl, Sm
															6.87m, Pt, 0 deg, Pl, Sm
															6.89m, Pt, 0 deg, Pl, Sm
															7.11m, Pt, 0 deg, Pl, Sm
					FR/ST										7.23-7.24m, Cy, Sm
															7.27m, Jt, 2 deg, Pl, Ro, Cy, Infill
															7.35m, Jt, 0 deg, Pl, Ro, Cy, Infill
															7.41m, Pt, 0 deg, Pl, Ro
															7.50m, Jt, 0 deg, Ir, Ro
															7.52m, Jt, 0 deg, Ir, Ro
															7.54m, Jt, 0 deg, Ir, Ro
															7.62m, Pt, 0 deg, Pl, Sm
															7.72-7.79m, Jt, Ir, Ro, Cy, Infill
															7.83m, Pt, 0 deg, Pl, Sm
			8.0												7.90m, Pt, 0 deg, Pl, Sm
					FR										7.93m, Jt, 2 deg, Pl, Ro, Cy, veneer
															8.15m, Jt, 0 deg, Pl, Ro, Cy, veneer
															8.25m, Jt, 0 deg, Pl, Ro, Cy, veneer
															8.31m, Jt, 0 deg, Ir, Ro
															8.52-8.57m, Jt, 45 deg, Ir, Ro, Cy, veneer
															8.66m, Pt, 0 deg, Pl, Ro
															8.75m, Pt, 0 deg, Pl, Ro
															8.84m, Pt, 0 deg, Pl, Sm
															8.94-8.97m, Cy, Sm
			9.0												
															9.16m, Jt, 0 deg, Pl, Sm, Cy, Infill
															9.17-9.19m, Cy, Sm
															9.23m, Jt, 0 deg, Pl, Ro, Cy, Infill
															9.27m, Jt, 0 deg, Pl, Ro, Cy, Infill
															9.50m, Pt, 0 deg, Pl, Sm
															9.57m, Jt, 0 deg, Pl, Ro, Cy, Infill
															9.65m, Pt, 0 deg, Pl, Ro, Cy, Infill
															9.69m, Jt, 0 deg, Pl, Ro, Cy, Infill
															9.77m, Pt 0deg, Pl, Ro
			10.0												10.10m, Jt, 0 deg, Pl, Ro, Cy, Infill
															10.18m, Jt, 0 deg, Pl, Ro, Cy, Infill
															10.39m, Jt, 0 deg, Ir, Ro
															10.44, Pt, 0 deg, Pl, Ro
				BOREHOLE DISCONTINUED AT 10.65M											
			11.0												
				STANDARD PIEZOMETER INSTALLED											
			12.0												

Notes:

Contractor: Terratest
Equipment: Commachio
Hole Diameter (mm):
Angle from Vertical (°):

See explanation sheets for meaning of all descriptive terms and symbols


Project: 2-6 BOLD & 80-82 COWPER STS, GRANVILLE
Project No. 19305/5926C
Client: Designer Home Constructions
Date Cored: 19/8/2015
Borehole No. BH102
Depth (m): 4.45-10.65 End
Boxes 1 & 2 of 2
BH 102 19/8/15
Granville 19305
Start.
4.45
5
6
7
8
9
10
10.65
End

SMEC Testing Services Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client:	Designer Home Constructions	Project: 19305/5926C	**BOREHOLE NO.: BH103**
Project:	2-6 Bold St & 80-82 Cowper St, Granville	Date : August 19, 2015	Sheet 1 of 3
Location:	Refer to Drawing No. 15/2254	Logged: JK	

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
			SANDY GRAVEL: light grey with dark grey, fine to medium grained sand FILL	GW		D
			SILTY CLAY: dark brown/ grey, medium plasticity	CL		M
			OLD TOPSOIL			
			SILTY CLAY: orange brown with light grey, medium to high plasticity	CL/CH		M
		1.0				
			SILTY CLAY: light grey with orange brown, medium to high plasticity, occassional gravel	CL/CH		M
			WEATHERED SHALE: light grey with orange brown and occassional dark grey, clay seams		EXTREMELY LOW STRENGTH	D
		2.0				
		3.0				
		4.0				
			BOREHOLE DISCONTINUED AT 4.39M ON WEATHERED SHALE			
		5.0	For core log details, refer to core log sheets			
		6.0				

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: Terratest
Equipment: Commachio
Hole Diameter (mm): 100
Angle from Vertical (°) 0

SMEC Testing Services Pty Ltd — **GEOTECHNICAL LOG - CORED BOREHOLE**

Client: Designer Home Construction | Project / STS No.: 19305/5926C | **BOREHOLE NO.: BH103**

Project: 2-6 Bold St & 80-82 Cowper St, Granville | Date : August 19, 2015

Location: Refer to Drawing 15/2254 | Logged: JK | Checked By: | Sheet 2 of 3

DRILLING				MATERIAL STRENGTH									DISCONTINUITIES							
						Estimated Rock Strength							Joint Spacing (mm)							
Method	Water	Recovery	Depth (m)	Rock Type (Color, Grain Size, Structure & Minor Components)	Weathering	Extremely Low	Very Low	Low	Medium	High	Very High	Extremely High	20	40	100	300	1000	Visual	Additional Data (Joints, partings, seams, zones etc. Description, orientation, infilling, or coating, shape, roughness, thickness, other)
			1.0																
			2.0																
			3.0																
			4.0	For non core log details , refer to non core log sheets															
				START CORING AT 4.39M															
N M L C C O R I N G			5.0	WEATHERED SHALE: dark grey with orange brown and light grey	MW														4.61-4.68m, Jt, Ir, Und, Fe, veneer 4.75m, Jt, 20 deg, Ir, Ro, fee, veneer 4.84m, Pt, 0 deg, Pl, Sm 4.90-5.03m, Cy, Sm 5.07m, Jt, 0 deg, Pl, Ro, Cy, Infill 5.14-5.17m, Jt, 90 deg, Ir, Ro 5.40m, Jt, Cz, Cy 5.42-5.51m, Cy, Sm 5.62m, Pt, 0 deg, Pl, Sm 5.77m, Pt, 0 deg, Pl, Sm 5.79m, Pt, 0 deg, Pl, Ro 5.96m, Pt, 0 deg, Pl, Ro
			6.0																

Notes:

Contractor: Terratest

Equipment: Com 205

Hole Diameter (mm):

Angle from Vertical (°):

See explanation sheets for meaning of all descriptive terms and symbols

SMEC Testing Services Pty Ltd — **GEOTECHNICAL LOG - CORED BOREHOLE**

Client: Designer Home Construction | Project / STS No.: 19305/5926C | **BOREHOLE NO.: BH103**

Project: 2-6 Bold St & 80-82 Cowper St, Granville | Date : August 19, 2015

Location: Refer to Drawing 15/2254 | Logged: JK | Checked By: | Sheet 3 of 3

DRILLING				MATERIAL STRENGTH										DISCONTINUITIES	
						Estimated Rock Strength							Joint Spacing (mm)		
Method	Water	Recovery	Depth (m)	Rock Type (Color, Grain Size, Structure & Minor Components)	Weathering	Extremely Low	Very Low	Low	Medium	High	Very High	Extremely High	20 40 100 300 1000	Visual	Additional Data (Joints, partings, seams, zones etc. Description, orientation, infilling, or coating, shape, roughness, thickness, other)
				WEATHERED SHALE: dark grey with orange brown and light grey	MW										6.01m, Pt, 0 deg, Pl, Ro
				WEATHERED SHALE: dark grey with light grey	FR										6.21-6.24m, Jt, Ir, Ro, Cy
															6.34m, PT, 0 deg, Pl, Ro
															6.45m, Pt, 0 deg, Ir, Ro, Cy
															6.46-6.48m, Cy, Sm
N															6.77m, Jt, 0 deg, Pl, Ro, Cy, Infill
M															
L			7.0												6.91m, Jt, 0 deg, Pl, Ro, Cy, veneer
C															7.16m, Pt, 0 deg, Pl, Sm
C															
O															
R															7.55m, Pt, 0 deg, Pl, Sm
I															7.58m, Pt, 0 deg, Pl, Ro
N															7.61-9.38m, Numerous Jt/Pt, 0 deg, Pl, Sm/ Ro, Cy, Infill and Seams
G			8.0												
			9.0												
															9.74-9.75m, Cy, Sm
															10.02m, Jt, 0 deg, Pl, Ro, Cy infill
															10.07m, Pt, 0 deg, Pl, Ro
			10.0												10.16m, Jt, 0 deg, PL, Ro, Cy, veneer
															10.19m, Jt, 0 deg, Pl, Ro, Cy, veneer
															10.24m, Jt, 0 deg, Pl, Ro, Cy, Infill
															10.32m, Pt, 0 deg, Pl, Ro
															10.44m, Pt, 0 deg, Pl, Sm
															10.51m, Pt, 0 deg, Pl, Sm
															10.54m, Jt, 0 deg, Pl, Ro, Cy, Infill
															10.64m, Pt, 0 deg, Pl, Ro
				BOREHOLE DISCONTINUED AT 10.69M											
			11.0												
			12.0												

Notes:

Contractor: Terratest

Equipment: Commachio

Hole Diameter (mm):

Angle from Vertical (°):

See explanation sheets for meaning of all descriptive terms and symbols


Project: 2-6 BOLD & 80-82 COWPER STS, GRANVILLE
Project No. 19305/5926C
Client: Designer Home Constructions
Date Cored: 20/8/2015
Borehole No. BH103
Depth (m): 4.39-10.69 End
Boxes 1 & 2 of 2
BH 103 20/8/15
19305
Granville
Start
4.39m
5
6
7
8
9
10
10.69m
End

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: 2-6 BOLD & 80-82 COWPER STREET, GRANVILLE — Project No.: 19305/3376C
Client: DESIGNER HOME CONSTRUCTIONS PTY LIMITED — Report No.: 13/1616
Address: 82 Cowper Street, Granville — Report Date: August 28, 2013
Test Method: AS 1289.6.3.2 — Page: 1 of 1

Site No.	P1	P2	P3	P4		
Location	Refer to Drawing No. 15/2254	Refer to Drawing No. 15/2254	Refer to Drawing No. 15/2254	Refer to Drawing No. 15/2254		
Starting Level	Surface Level	Surface Level	Surface Level	Surface Level		
Depth (m)	Penetration Resistance (blows / 150mm)					
0.00 - 0.15	*	*	*	12		
0.15 - 0.30	*	*	*	22		
0.30 - 0.45	2	2	2	4		
0.45 - 0.60	3	2	3	3		
0.60 - 0.75	3	3	3	3		
0.75 - 0.90	4	2	4	4		
0.90 - 1.05	4	3	5	6		
1.05 - 1.20	4	4	8	10		
1.20 - 1.35	5	5	22	22		
1.35 - 1.50	22	8	Refusal	Refusal		
1.50 - 1.65	Refusal	12				
1.65 - 1.80		22				
1.80 - 1.95		Refusal				
1.95 - 2.10						
2.10 - 2.25						
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						
3.75 - 3.90						

Remarks: * Pre drilled prior to testing

Approved Signatory.. ...

Technician: JK — Laurie Ihnativ - Manager

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

Point Load Strength Index Report

Project: 2-6 BOLD ST & 80-82 COWPER ST
Client: DESIGNER HOME CONSTRUCTION
Address: 82 Cowper St, Granville
Test Method: AS 4133.4.1

Project No.: 19305/5926C
Report No.: 15/2254
Report Date: 24/08/2015

Sampling Procedure: AS 1289.1.2.1 Clause 6.5.3 - Power Auger Drilling (Not covered under NATA Scope of Accreditation)

Date Samples Drilled / Taken: 19/8/15

Borehole No. BH101

Depth	Test Type	Is(50) (Mpa)	Rock Type	Rock Structure	Moisture
6.87	D	0.54	SH	LH	D-M
	A	0.96	SH	LH	D-M
7.87	D	O	SH	LH	D-M
	A	0.39	SH	LH	D-M
8.58	D	0.19	SH	LH	D-M
	A	1.39	SH	LH	D-M
10.04	D	0.16	SH	LH	D-M
	A	1.09	SH	LH	D-M

Sampling Procedure: AS 1289.1.2.1 Clause 6.5.3 - Power Auger Drilling (Not covered under NATA Scope of Accreditation)

Date Samples Drilled / Taken: 19/8/15

Borehole No. BH102

Depth	Test Type	Is(50) (Mpa)	Rock Type	Rock Structure	Moisture
5.15	D	0.03	SH	LH	D-M
	A	0.15	SH	LH	D-M
6.23	D	0.03	SH	LH	D-M
	A	0.34	SH	LH	D-M
7.08	D	0.05	SH	LH	D-M
	A	0.13	SH	LH	D-M
8.04	D	0.57	SH	LH	D-M
	A	0.99	SH	LH	D-M
9.05	D	0.5	SH	LH	D-M
	A	1.13	SH	LH	D-M

STRUCTURE	TEST TYPE	MOISTURE CONDITION	ROCK TYPE
MA= MASSIVE	A= AXIAL	W= WET	SS= SANDSTONE
BE= BEDDED	D= DIMETRAL	M= MOIST	ST= SILTSTONE
LA= LAMINATED	I= IRREGULAR	D= DRY	SH= SHALE
CR= CRYSTALLINE	C= CUBE		YS= CLAYSTONE
			IG= IGNEOUS

Remarks:

Technician: JK

Approved Signatory.....
Laurie Ihnativ - Manager

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

Point Load Strength Index Report

Project: 2-6 BOLD ST & 80-82 COWPER ST
Client: DESIGNER HOME CONSTRUCTION
Address: 82 Cowper St, Granville
Test Method: AS 4133.4.1

Project No.: 19305/5926C
Report No.: 15/2254
Report Date: 24/08/2015

Sampling Procedure: AS 1289.1.2.1 Clause 6.5.3 - Power Auger Drilling (Not covered under NATA Scope of Accreditation)

Date Samples Drilled / Taken: 19/8/15

Borehole No. BH103

Depth	Test Type	Is(50) (Mpa)	Rock Type	Rock Structure	Moisture
5.87	D	0.08	SH	LH	D-M
	A	0.29	SH	LH	D-M
6.95	D	0.09	SH	LH	D-M
	A	0.54	SH	LH	D-M
7.79	D	0.21	SH	LH	D-M
	A	0.52	SH	LH	D-M
8.96	D	O	SH	LH	D-M
	A	1.04	SH	LH	D-M
9.65	D	0.32	SH	LH	D-M
	A	0.63	SH	LH	D-M

Sampling Procedure: AS 1289.1.2.1 Clause 6.5.3 - Power Auger Drilling (Not covered under NATA Scope of Accreditation)

Date Samples Drilled / Taken:

Borehole No.

Depth	Test Type	Is(50) (Mpa)	Rock Type	Rock Structure	Moisture

STRUCTURE	TEST TYPE	MOISTURE CONDITION	ROCK TYPE
MA= MASSIVE	A= AXIAL	W= WET	SS= SANDSTONE
BE= BEDDED	D= DIMETRAL	M= MOIST	ST= SILTSTONE
LA= LAMINATED	I= IRREGULAR	D= DRY	SH= SHALE
CR= CRYSTALLINE	C= CUBE		YS= CLAYSTONE
			IG= IGNEOUS

Remarks:

NATA Accredited Laboratory Number 2750
Accredited for compliance with ISO/IEC 17025
The results of tests, calibrations and / or measurements included in this document are traceable to Australian / national standards

Technician: JK

Approved Signatory.....
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.

E2 CLASSIFICATION OF ROCKS

E2.1 Uniform Rock Description

The aim of a rock description for engineering purposes is to give an indication of the expected engineering properties of the material.

In a similar manner to soil materials, the assessment of site conditions where rock is encountered has to be based on the use of a descriptive method which is uniform and repeatable. Description has to:

- provide a clear identification of the rock substance and its engineering properties, and
- include details of the features which affect the engineering properties of the rock mass.

There is no internationally accepted system for rock description but SMEC Testing Services Pty Ltd has adopted a method which incorporates terminology defined by common usage in the engineering geological profession. Most feature definitions are as recommended by the International Society of Rock Mechanics and by the Standards Association of Australia.

For uniform presentation the different features are described in order:

Rock Substance

- NAME (in block letters)
- Mineralogy
- Grain Size
- Colour
- Fabric
- Strength
- Weathering/Alteration

Rock Mass

- Defect type
- Defect orientation
- Defect features
- Defect spacing

E2.2 Rock Substance

(a) Rock name

Each rock type has a specific name which is based on:

- mineralogy
- grain size
- fabric
- origin

The only method of determining the precise rock name is by thin section petrography.

Field identification of rocks for engineering purposes should be based on the use of common, easily understood, simple, geological names. In many cases knowledge of the precise name is of little consequence in the assessment of site conditions. If required the "field name" can be qualified by reference to a petrographic report. Reference to local geological reports often provides information on the rock types which may be expected.

(b) Mineralogy

The rock description should include the identification of the prominent minerals. This identification is usually restricted to the more common minerals in medium and coarse grained rocks.

(c) Grain Size

Rock material descriptions should include general grouping of the size of the predominant mineral grains as defined in Table E2.2.1. The maximum size, or size range, of the larger mineral grains or rock fragments should be recorded.

TABLE E2.2.1. - GRAIN SIZE GROUPS

TERM	GRAIN SIZE (mm)
Very Coarse	>60
Coarse	2 – 60
Medium	0.06 – 2
Fine	0.002 - 0.06
Very Fine	<0.002
Glassy	

(d) Colour

The colour of the rock 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 by a combination of two colours, eg: grey-blue.

(e) Fabric

The fabric of a rock includes all the features of texture and structure, though the term refers specifically to the arrangement of the constituent grains or crystals in a rock. The fabric can provide an indication of the mode of formation of the rock:

- in sedimentary rocks bedding indicates depositional conditions,
- in igneous rocks the texture indicates the rate of cooling, and
- in metamorphic rocks the foliation indicates the stress conditions

Descriptions of fabric should include structure orientation, either with reference to North and horizontal, or to a plane normal to the core axis.

Tables E2.2.2, E2.2.3 and E2.2.4 list common textural features of sedimentary, igneous and metamorphic rocks with the subdivision of stratification spacing in Table E2.2.5.

TABLE E2.2.2 - COMMON STRUCTURES IN IGNEOUS ROCKS

STRATIFICATION (Planar)	STRATIFICATION (Irregular)
Bedding	Washout
Cross Bedding	Slump Structure
Graded Bedding	Shale Breccia
Lamination	

TABLE E2.2.3 - COMMON STRUCTURES IN IGNEOUS ROCKS

	FINE GRAINED ROCKS	COARSE GRAINED ROCKS
Uniform Grain Size	Massive	Massive
	Flow Banded	Granitic
	Vesicular	Pegmatitic
Different Grain Size	Porphyritic	Porphyritic

TABLE E.2.2.4 - COMMON STRUCTURES IN METAMORPHIC ROCKS

FINE GRAINED ROCKS	COARSE GRAINED ROCKS
Slatey Cleavage	Granoblastic
Spotted	Porphyroblastic
Hornsfelsic	Lincated
Foliated	Gneissic
Mylonitic	Mylonitic

TABLE E2.2.5 - STRATIFICATION SPACING

TERM	SEPARATION (mm)
Very Thickly Bedded	>2000
Thickly Bedded	600 - 2000
Medium Bedded	200 - 600
Thinly Bedded	60 - 200
Very Thinly Bedded	20 - 60
Laminated	6 - 20
Thinly Laminated	<6

(f) Strength

Substance strength is one of the most important engineering features of a rock and every description should include at least an estimate of the rock strength class of the material. This estimate can be calibrated by test results, either by Point Loan Strength Index or by Unconfined Compressive Strength.

The rock strength class in As 1726-1981 is defined by Point Loan Strength Index $I_{s}(50)$. The relationship between Point Loan and Unconfined Strength is commonly assumed to be about 20, but can range from 4 (in some carbonate rocks) to 40 (in some igneous rocks). It is necessary to confirm the relationship for each rock type and project. classification should be based on material at field moisture content, as some rocks give a significantly higher strength when tested dry.

Table E2.2.6 defines the rock strength classes, with indicative field tests listed in Table E2.2.7 which assist in classification when testing equipment is not available.

TABLE E2.2.6 - CLASSIFICATION OF ROCK STRENGTH

SYMBOL	TERM	POINT LOAD STRENGTH (MPa)	APPROX Qu (MPa)
EL	Extremely low	<0.03	<1
VL	very low	0.03 - 0.1	1 - 3
L	Low	0.1 - 0.3	3 - 10
M	Medium	0.3 - 1	10 - 30
H	High	1 - 3	30 - 70
VH	very high	3 - 10	70 - 200
EH	Extremely high	>10	>200

TABLE E2.2.7 - FIELD TESTS FOR ROCK STRENGTH CLASSIFICATION

STRENGTH CLASS	FIELD TEST
Extremely Low	Indented by thumb nail with difficulty
Very Low	Scratched by thumb nail
Low	Easily broken by hand or pared with a knife
Medium	Broken by hand or scraped with a knife
High	Broken in hand by firm hammer blows
Very High	Broken against solid object with several hammer blow
Extremely High	Difficult to break against solid object with several hammer blows

(g) Weathering/Alteration

In addition to the description of rock substance as examined, an assessment is required of the extent to which the original rock material has been affected by subsequent events. The usual processes are:

- Weathering - Decomposition due to the effect of surface or near surface activities
- Alteration - Chemical modification by the action of materials originating from within the mantle below.

The classification of weathering/alteration presented in Table E2.2.8 is based on the extent/degree to which the original rock substance has been affected. This classification has little engineering significance, as the properties of the rock as examined may bear no relationship to the properties of the fresh rock.

TABLE E2.2.8 - CLASSIFICATION OR ROCK WEATHERING/ALTERATION

TERMS	DEFINITION
Fresh (Fr)	Rock substance unaffected.
Fresh Stained (FR St)	Rock substance unaffected. Staining of defect surfaces.
Slightly (SW)	Partial staining or discolouration of rock substance.
Moderately (MW)	Staining or discolouration extends throughout the whole rock substance.
Highly (HW)	Rock substance partly decomposed.
Completely (CW)	Rock substance entirely decomposed.

E2.3 Rock Mass

The engineering properties of rock mass reflect the effect which the presence of defects has on the properties of the rock substance. Description of the rock mass properties consists of supplementing the description covered by Section E2.2 with data on the defects which are present.

(a) Defect type

The different defect types are described in Table E2.3.1.

(b) Defect orientation

Descriptions of defects should include orientation, either of individual fractures or of groups of fractures. Orientation should be with reference to North and horizontal, or to a plane normal to the core axis.

TABLE E2.3.1 - ROCK DEFECT TYPES

TYPE	SYMBOL	DESCRIPTION
Parting	Pt	A defect parallel or subparallel to a layered arrangement of mineral grains or micro-fractures which has caused planar anistrophy in the rock substance.
Joint	Jt	A defect across which the rock substance has little tensile strength and is not related to textural or structural features with the rock substance.
Sheared Zone	SZ	A zone with roughly parallel planar boundaries or rock substance containing closely spaced, often slickensided, joints.
Crushed Zone	CZ	A zone with roughly parallel planar boundaries of rock substance composed of disoriented, usually angular, fragments of rock.
Seam	Sm	A zone with roughly parallel boundaries infilled by soil or decomposed rock.

(c) Defect features

The character of a defect is described by its continuity, planarity, surface roughness, width, and infilling.

Continuity In outcrop the extent of a joint, bedding plane or similar defect both along and across the strike can be measured. In core, continuity measurement is restricted to defects nearly parallel to the core axis.

Planarity Described as "Planar", "Irregular", "Curved" or "Undulose".

Roughness Described as "Rough", "Smooth", "Polished" or "Slickensided".

Width Measured in millimetres normal to the plane of the defect

Infilling Described as "Clean", "Stained", "Veneer" (<1 mm) or "Infill" (>1 mm). The coating or infilling material should be identified.

(d) Defect spacing

The spacing of defects, particularly where they occur in parallel groups or sets, provides an indication of the rock block sizes which:

- have to be supported in the face or roof of an excavation
- will be produced by the excavation operation.

It is preferable to provide measured data but discontinuity spacing is grouped as shown in Table E2.3.2.

TABLE E2.3.2 - DISCONTINUITY SPACING

DESCRIPTION	SPACING (mm)
Extremely Widely Spaced	>6000
Very Widely Spaced	2000 - 6000
Widely Spaced	600 - 2000
Medium Spaced	200 - 600
Closely Spaced	60 - 200
Very Closely Spaced	20 - 60
Extremely Closely Spaced	<20

E3. DESCRIPTION OF WELL CONSTRUCTION, PID AND GROUNDWATER SYMBOLS

TABLE E3.1 – BORE CONSTRUCTION DETAILS

SHADING / SYMBOL	DESCRIPTION
	Cement-Based Grout
	Bentonite Seal
	Sand Filter
	Borehole Cuttings
	Class 18 PVC casing
	Class 18 PVC Slotted Screen
	End Caps
	Vapour Probe Tip
	Teflon Tubing

TABLE E3.2 – PID SYMBOLS

SYMBOL	MEANING
I	Insitu
A	Above Soil
H	Headspace

TABLE E3.3 – WATERTABLE SYMBOLS

SYMBOL	DESCRIPTION
	Standing Water Level
	Inflow
	Outflow

APPENDIX B – LABORATORY TEST RESULTS

ALS Group

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **ES1319417**	Page	: 1 of 17
Client	: **SMEC TESTING SERVICES PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: DAVID YONGE	Contact	: Client Services
Address	: P O BOX 6989 WETHERILL PARK NSW, AUSTRALIA 2164	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
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Project	: 19305 3376C	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: 10371		
C-O-C number	: P19305-COC1	Date Samples Received	: 03-SEP-2013
Sampler	: ---	Issue Date	: 10-SEP-2013
Site	: ---		
		No. of samples received	: 10
Quote number	: EN/025/13	No. of samples analysed	: 10

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

- **EK026SF: Spike failed for Total Cyanide due to matrix interferences (confirmed by re-analysis).**
- **EP068: Pozitive results on sample S3 confirmed by re-extracrion and re-analysis.**

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
Alex Rossi	Organic Chemist	Sydney Organics
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Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	S1	S2	S3	S4	S5
			Client sampling date / time	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00
Compound	CAS Number	LOR	Unit	ES1319417-001	ES1319417-002	ES1319417-003	ES1319417-004	ES1319417-005
EA002 : pH (Soils)								
pH Value	---	0.1	pH Unit	7.2	5.5	---	---	5.1
EA010: Conductivity								
Electrical Conductivity @ 25°C	---	1	µS/cm	175	111	---	---	71
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	---	1.0	%	12.6	25.8	19.2	23.0	20.1
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	200	250	---	---	180
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	10	mg/kg	30	50	---	---	10
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	11	11	14	14	---
Barium	7440-39-3	10	mg/kg	290	30	---	70	---
Beryllium	7440-41-7	1	mg/kg	<1	<1	---	<1	---
Boron	7440-42-8	50	mg/kg	<50	<50	---	<50	---
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	---
Chromium	7440-47-3	2	mg/kg	25	35	29	37	---
Cobalt	7440-48-4	2	mg/kg	3	<2	---	<2	---
Copper	7440-50-8	5	mg/kg	39	7	55	11	---
Lead	7439-92-1	5	mg/kg	541	16	335	39	---
Manganese	7439-96-5	5	mg/kg	230	6	---	36	---
Nickel	7440-02-0	2	mg/kg	8	<2	6	4	---
Selenium	7782-49-2	5	mg/kg	<5	<5	---	<5	---
Vanadium	7440-62-2	5	mg/kg	60	101	---	107	---
Zinc	7440-66-6	5	mg/kg	598	12	349	216	---
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	0.1	<0.1	0.1	<0.1	---
EK026SF: Total CN by Segmented Flow Analyser								
Total Cyanide	57-12-5	1	mg/kg	<1	---	---	---	---
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	---	0.1	mg/kg	---	---	<0.1	---	---
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	---	<0.05	<0.05	---	---
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	---	<0.05	<0.05	---	---

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	S1	S2	S3	S4	S5
				Client sampling date / time	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00
Compound	CAS Number	LOR	Unit		ES1319417-001	ES1319417-002	ES1319417-003	ES1319417-004	ES1319417-005
EP068A: Organochlorine Pesticides (OC) - Continued									
beta-BHC	319-85-7	0.05	mg/kg		---	<0.05	<0.05	---	---
gamma-BHC	58-89-9	0.05	mg/kg		---	<0.05	<0.05	---	---
delta-BHC	319-86-8	0.05	mg/kg		---	<0.05	<0.05	---	---
Heptachlor	76-44-8	0.05	mg/kg		---	<0.05	<0.05	---	---
Aldrin	309-00-2	0.05	mg/kg		---	<0.05	<0.05	---	---
Heptachlor epoxide	1024-57-3	0.05	mg/kg		---	<0.05	<0.05	---	---
^ Total Chlordane (sum)	---	0.05	mg/kg		---	<0.05	<0.05	---	---
trans-Chlordane	5103-74-2	0.05	mg/kg		---	<0.05	<0.05	---	---
alpha-Endosulfan	959-98-8	0.05	mg/kg		---	<0.05	<0.05	---	---
cis-Chlordane	5103-71-9	0.05	mg/kg		---	<0.05	<0.05	---	---
Dieldrin	60-57-1	0.05	mg/kg		---	<0.05	0.14	---	---
4.4`-DDE	72-55-9	0.05	mg/kg		---	<0.05	0.25	---	---
Endrin	72-20-8	0.05	mg/kg		---	<0.05	<0.05	---	---
beta-Endosulfan	33213-65-9	0.05	mg/kg		---	<0.05	<0.05	---	---
^ Endosulfan (sum)	115-29-7	0.05	mg/kg		---	<0.05	<0.05	---	---
4.4`-DDD	72-54-8	0.05	mg/kg		---	<0.05	<0.05	---	---
Endrin aldehyde	7421-93-4	0.05	mg/kg		---	<0.05	<0.05	---	---
Endosulfan sulfate	1031-07-8	0.05	mg/kg		---	<0.05	<0.05	---	---
4.4`-DDT	50-29-3	0.2	mg/kg		---	<0.2	<0.2	---	---
Endrin ketone	53494-70-5	0.05	mg/kg		---	<0.05	<0.05	---	---
Methoxychlor	72-43-5	0.2	mg/kg		---	<0.2	<0.2	---	---
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg		---	<0.05	0.14	---	---
^ Sum of DDD + DDE + DDT	---	0.05	mg/kg		---	<0.05	0.25	---	---
EP068B: Organophosphorus Pesticides (OP)									
Dichlorvos	62-73-7	0.05	mg/kg		---	<0.05	<0.05	---	---
Demeton-S-methyl	919-86-8	0.05	mg/kg		---	<0.05	<0.05	---	---
Monocrotophos	6923-22-4	0.2	mg/kg		---	<0.2	<0.2	---	---
Dimethoate	60-51-5	0.05	mg/kg		---	<0.05	<0.05	---	---
Diazinon	333-41-5	0.05	mg/kg		---	<0.05	<0.05	---	---
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg		---	<0.05	<0.05	---	---
Parathion-methyl	298-00-0	0.2	mg/kg		---	<0.2	<0.2	---	---
Malathion	121-75-5	0.05	mg/kg		---	<0.05	<0.05	---	---
Fenthion	55-38-9	0.05	mg/kg		---	<0.05	<0.05	---	---
Chlorpyrifos	2921-88-2	0.05	mg/kg		---	<0.05	<0.05	---	---

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	S1	S2	S3	S4	S5
				Client sampling date / time	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00
Compound	CAS Number	LOR	Unit		ES1319417-001	ES1319417-002	ES1319417-003	ES1319417-004	ES1319417-005
EP068B: Organophosphorus Pesticides (OP) - Continued									
Parathion	56-38-2	0.2	mg/kg		---	<0.2	<0.2	---	---
Pirimphos-ethyl	23505-41-1	0.05	mg/kg		---	<0.05	<0.05	---	---
Chlorfenvinphos	470-90-6	0.05	mg/kg		---	<0.05	<0.05	---	---
Bromophos-ethyl	4824-78-6	0.05	mg/kg		---	<0.05	<0.05	---	---
Fenamiphos	22224-92-6	0.05	mg/kg		---	<0.05	<0.05	---	---
Prothiofos	34643-46-4	0.05	mg/kg		---	<0.05	<0.05	---	---
Ethion	563-12-2	0.05	mg/kg		---	<0.05	<0.05	---	---
Carbophenothion	786-19-6	0.05	mg/kg		---	<0.05	<0.05	---	---
Azinphos Methyl	86-50-0	0.05	mg/kg		---	<0.05	<0.05	---	---
EP074D: Fumigants									
2.2-Dichloropropane	594-20-7	0.5	mg/kg		<0.5	---	---	---	---
1.2-Dichloropropane	78-87-5	0.5	mg/kg		<0.5	---	---	---	---
cis-1.3-Dichloropropylene	10061-01-5	0.5	mg/kg		<0.5	---	---	---	---
trans-1.3-Dichloropropylene	10061-02-6	0.5	mg/kg		<0.5	---	---	---	---
1.2-Dibromoethane (EDB)	106-93-4	0.5	mg/kg		<0.5	---	---	---	---
EP074E: Halogenated Aliphatic Compounds									
Dichlorodifluoromethane	75-71-8	5	mg/kg		<5	---	---	---	---
Chloromethane	74-87-3	5	mg/kg		<5	---	---	---	---
Vinyl chloride	75-01-4	5	mg/kg		<5	---	---	---	---
Bromomethane	74-83-9	5	mg/kg		<5	---	---	---	---
Chloroethane	75-00-3	5	mg/kg		<5	---	---	---	---
Trichlorofluoromethane	75-69-4	5	mg/kg		<5	---	---	---	---
1.1-Dichloroethene	75-35-4	0.5	mg/kg		<0.5	---	---	---	---
Iodomethane	74-88-4	0.5	mg/kg		<0.5	---	---	---	---
trans-1.2-Dichloroethene	156-60-5	0.5	mg/kg		<0.5	---	---	---	---
1.1-Dichloroethane	75-34-3	0.5	mg/kg		<0.5	---	---	---	---
cis-1.2-Dichloroethene	156-59-2	0.5	mg/kg		<0.5	---	---	---	---
1.1.1-Trichloroethane	71-55-6	0.5	mg/kg		<0.5	---	---	---	---
1.1-Dichloropropylene	563-58-6	0.5	mg/kg		<0.5	---	---	---	---
Carbon Tetrachloride	56-23-5	0.5	mg/kg		<0.5	---	---	---	---
1.2-Dichloroethane	107-06-2	0.5	mg/kg		<0.5	---	---	---	---
Trichloroethene	79-01-6	0.5	mg/kg		<0.5	---	---	---	---
Dibromomethane	74-95-3	0.5	mg/kg		<0.5	---	---	---	---

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	S1	S2	S3	S4	S5
				Client sampling date / time	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00
Compound	CAS Number	LOR	Unit		ES1319417-001	ES1319417-002	ES1319417-003	ES1319417-004	ES1319417-005
EP074E: Halogenated Aliphatic Compounds - Continued									
1.1.2-Trichloroethane	79-00-5	0.5	mg/kg		<0.5	---	---	---	---
1.3-Dichloropropane	142-28-9	0.5	mg/kg		<0.5	---	---	---	---
Tetrachloroethene	127-18-4	0.5	mg/kg		<0.5	---	---	---	---
1.1.1.2-Tetrachloroethane	630-20-6	0.5	mg/kg		<0.5	---	---	---	---
trans-1.4-Dichloro-2-butene	110-57-6	0.5	mg/kg		<0.5	---	---	---	---
cis-1.4-Dichloro-2-butene	1476-11-5	0.5	mg/kg		<0.5	---	---	---	---
1.1.2.2-Tetrachloroethane	79-34-5	0.5	mg/kg		<0.5	---	---	---	---
1.2.3-Trichloropropane	96-18-4	0.5	mg/kg		<0.5	---	---	---	---
Pentachloroethane	76-01-7	0.5	mg/kg		<0.5	---	---	---	---
1.2-Dibromo-3-chloropropane	96-12-8	0.5	mg/kg		<0.5	---	---	---	---
Hexachlorobutadiene	87-68-3	0.5	mg/kg		<0.5	---	---	---	---
EP074F: Halogenated Aromatic Compounds									
Chlorobenzene	108-90-7	0.5	mg/kg		<0.5	---	---	---	---
Bromobenzene	108-86-1	0.5	mg/kg		<0.5	---	---	---	---
2-Chlorotoluene	95-49-8	0.5	mg/kg		<0.5	---	---	---	---
4-Chlorotoluene	106-43-4	0.5	mg/kg		<0.5	---	---	---	---
1.3-Dichlorobenzene	541-73-1	0.5	mg/kg		<0.5	---	---	---	---
1.4-Dichlorobenzene	106-46-7	0.5	mg/kg		<0.5	---	---	---	---
1.2-Dichlorobenzene	95-50-1	0.5	mg/kg		<0.5	---	---	---	---
1.2.4-Trichlorobenzene	120-82-1	0.5	mg/kg		<0.5	---	---	---	---
1.2.3-Trichlorobenzene	87-61-6	0.5	mg/kg		<0.5	---	---	---	---
EP074G: Trihalomethanes									
Chloroform	67-66-3	0.5	mg/kg		<0.5	---	---	---	---
Bromodichloromethane	75-27-4	0.5	mg/kg		<0.5	---	---	---	---
Dibromochloromethane	124-48-1	0.5	mg/kg		<0.5	---	---	---	---
Bromoform	75-25-2	0.5	mg/kg		<0.5	---	---	---	---
EP075(SIM)A: Phenolic Compounds									
Phenol	108-95-2	0.5	mg/kg		---	---	<0.5	---	---
2-Chlorophenol	95-57-8	0.5	mg/kg		---	---	<0.5	---	---
2-Methylphenol	95-48-7	0.5	mg/kg		---	---	<0.5	---	---
3- & 4-Methylphenol	1319-77-3	1	mg/kg		---	---	<1	---	---
2-Nitrophenol	88-75-5	0.5	mg/kg		---	---	<0.5	---	---
2.4-Dimethylphenol	105-67-9	0.5	mg/kg		---	---	<0.5	---	---

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	S1	S2	S3	S4	S5
				Client sampling date / time	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00
Compound	CAS Number	LOR	Unit		ES1319417-001	ES1319417-002	ES1319417-003	ES1319417-004	ES1319417-005
EP075(SIM)A: Phenolic Compounds - Continued									
2.4-Dichlorophenol	120-83-2	0.5	mg/kg		---	---	<0.5	---	---
2.6-Dichlorophenol	87-65-0	0.5	mg/kg		---	---	<0.5	---	---
4-Chloro-3-Methylphenol	59-50-7	0.5	mg/kg		---	---	<0.5	---	---
2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg		---	---	<0.5	---	---
2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg		---	---	<0.5	---	---
Pentachlorophenol	87-86-5	2	mg/kg		---	---	<2	---	---
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		<0.5	---	<0.5	<0.5	---
Acenaphthylene	208-96-8	0.5	mg/kg		<0.5	---	<0.5	<0.5	---
Acenaphthene	83-32-9	0.5	mg/kg		<0.5	---	<0.5	<0.5	---
Fluorene	86-73-7	0.5	mg/kg		<0.5	---	<0.5	<0.5	---
Phenanthrene	85-01-8	0.5	mg/kg		<0.5	---	<0.5	<0.5	---
Anthracene	120-12-7	0.5	mg/kg		<0.5	---	<0.5	<0.5	---
Fluoranthene	206-44-0	0.5	mg/kg		<0.5	---	<0.5	<0.5	---
Pyrene	129-00-0	0.5	mg/kg		<0.5	---	<0.5	<0.5	---
Benz(a)anthracene	56-55-3	0.5	mg/kg		<0.5	---	<0.5	<0.5	---
Chrysene	218-01-9	0.5	mg/kg		<0.5	---	<0.5	<0.5	---
Benzo(b)fluoranthene	205-99-2	0.5	mg/kg		<0.5	---	<0.5	<0.5	---
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		<0.5	---	<0.5	<0.5	---
Benzo(a)pyrene	50-32-8	0.5	mg/kg		<0.5	---	<0.5	<0.5	---
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5	---	<0.5	<0.5	---
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		<0.5	---	<0.5	<0.5	---
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	---	<0.5	<0.5	---
^ Sum of polycyclic aromatic hydrocarbons	---	0.5	mg/kg		<0.5	---	<0.5	<0.5	---
^ Benzo(a)pyrene TEQ (zero)	---	0.5	mg/kg		<0.5	---	<0.5	<0.5	---
^ Benzo(a)pyrene TEQ (half LOR)	---	0.5	mg/kg		0.6	---	0.6	0.6	---
^ Benzo(a)pyrene TEQ (LOR)	---	0.5	mg/kg		1.2	---	1.2	1.2	---
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	---	10	mg/kg		<10	---	<10	<10	---
C10 - C14 Fraction	---	50	mg/kg		<50	---	<50	<50	---
C15 - C28 Fraction	---	100	mg/kg		<100	---	<100	<100	---
C29 - C36 Fraction	---	100	mg/kg		<100	---	<100	<100	---
^ C10 - C36 Fraction (sum)	---	50	mg/kg		<50	---	<50	<50	---

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	S1	S2	S3	S4	S5
				Client sampling date / time	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00
Compound	CAS Number	LOR	Unit		ES1319417-001	ES1319417-002	ES1319417-003	ES1319417-004	ES1319417-005
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	---	<10	<10	---
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10	---	<10	<10	---
>C10 - C16 Fraction	>C10_C16	50	mg/kg		<50	---	<50	<50	---
>C16 - C34 Fraction	---	100	mg/kg		<100	---	<100	<100	---
>C34 - C40 Fraction	---	100	mg/kg		<100	---	<100	<100	---
^ >C10 - C40 Fraction (sum)	---	50	mg/kg		<50	---	<50	<50	---
^ >C10 - C16 Fraction minus Naphthalene (F2)	---	50	mg/kg		<50	---	<50	<50	---
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	---	<0.2	<0.2	---
Toluene	108-88-3	0.5	mg/kg		<0.5	---	<0.5	<0.5	---
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	---	<0.5	<0.5	---
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	---	<0.5	<0.5	---
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	---	<0.5	<0.5	---
^ Total Xylenes	1330-20-7	0.5	mg/kg		<0.5	---	<0.5	<0.5	---
^ Sum of BTEX	---	0.2	mg/kg		<0.2	---	<0.2	<0.2	---
Naphthalene	91-20-3	1	mg/kg		<1	---	<1	<1	---
EP066S: PCB Surrogate									
Decachlorobiphenyl	2051-24-3	0.1	%		---	---	83.3	---	---
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.1	%		---	92.0	116	---	---
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.1	%		---	112	123	---	---
EP074S: VOC Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		103	---	---	---	---
Toluene-D8	2037-26-5	0.1	%		116	---	---	---	---
4-Bromofluorobenzene	460-00-4	0.1	%		105	---	---	---	---
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.1	%		92.7	---	95.4	90.7	---
2-Chlorophenol-D4	93951-73-6	0.1	%		88.8	---	88.0	88.6	---
2.4.6-Tribromophenol	118-79-6	0.1	%		89.4	---	83.3	91.0	---
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		90.7	---	90.4	89.3	---

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	S1	S2	S3	S4	S5
				Client sampling date / time	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00
Compound	CAS Number	LOR	Unit		ES1319417-001	ES1319417-002	ES1319417-003	ES1319417-004	ES1319417-005
EP075(SIM)T: PAH Surrogates - Continued									
Anthracene-d10	1719-06-8	0.1	%		90.3	---	91.4	90.0	---
4-Terphenyl-d14	1718-51-0	0.1	%		95.3	---	95.2	96.5	---
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		101	---	121	111	---
Toluene-D8	2037-26-5	0.1	%		108	---	98.5	90.4	---
4-Bromofluorobenzene	460-00-4	0.1	%		102	---	101	96.1	---

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	S6	S7	S9	S10	S11
			Client sampling date / time	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00
Compound	CAS Number	LOR	Unit	ES1319417-006	ES1319417-007	ES1319417-008	ES1319417-009	ES1319417-010
EA002 : pH (Soils)								
pH Value	---	0.1	pH Unit	---	---	---	---	5.0
EA010: Conductivity								
Electrical Conductivity @ 25°C	---	1	µS/cm	---	---	---	---	104
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	---	1.0	%	22.8	20.7	26.0	22.4	24.0
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	---	---	---	---	280
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	10	mg/kg	---	---	---	---	30
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	10	8	8	8	---
Barium	7440-39-3	10	mg/kg	---	---	40	---	---
Beryllium	7440-41-7	1	mg/kg	---	---	<1	---	---
Boron	7440-42-8	50	mg/kg	---	---	<50	---	---
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	---
Chromium	7440-47-3	2	mg/kg	25	18	22	12	---
Cobalt	7440-48-4	2	mg/kg	---	---	12	---	---
Copper	7440-50-8	5	mg/kg	22	22	16	32	---
Lead	7439-92-1	5	mg/kg	68	38	21	126	---
Manganese	7439-96-5	5	mg/kg	---	---	23	---	---
Nickel	7440-02-0	2	mg/kg	3	2	<2	9	---
Selenium	7782-49-2	5	mg/kg	---	---	<5	---	---
Vanadium	7440-62-2	5	mg/kg	---	---	62	---	---
Zinc	7440-66-6	5	mg/kg	70	62	16	67	---
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	0.2	0.1	<0.1	<0.1	---
EK026SF: Total CN by Segmented Flow Analyser								
Total Cyanide	57-12-5	1	mg/kg	<1	---	---	---	---
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	---	0.1	mg/kg	---	---	---	<0.1	---
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	---	---	<0.05	<0.05	---
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	---	---	<0.05	<0.05	---

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Compound	CAS Number	LOR	Unit	Client sample ID	S6	S7	S9	S10	S11
				Client sampling date / time	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00
					ES1319417-006	ES1319417-007	ES1319417-008	ES1319417-009	ES1319417-010
EP068A: Organochlorine Pesticides (OC) - Continued									
beta-BHC	319-85-7	0.05	mg/kg		---	---	<0.05	<0.05	---
gamma-BHC	58-89-9	0.05	mg/kg		---	---	<0.05	<0.05	---
delta-BHC	319-86-8	0.05	mg/kg		---	---	<0.05	<0.05	---
Heptachlor	76-44-8	0.05	mg/kg		---	---	<0.05	<0.05	---
Aldrin	309-00-2	0.05	mg/kg		---	---	<0.05	<0.05	---
Heptachlor epoxide	1024-57-3	0.05	mg/kg		---	---	<0.05	<0.05	---
^ Total Chlordane (sum)	---	0.05	mg/kg		---	---	<0.05	<0.05	---
trans-Chlordane	5103-74-2	0.05	mg/kg		---	---	<0.05	<0.05	---
alpha-Endosulfan	959-98-8	0.05	mg/kg		---	---	<0.05	<0.05	---
cis-Chlordane	5103-71-9	0.05	mg/kg		---	---	<0.05	<0.05	---
Dieldrin	60-57-1	0.05	mg/kg		---	---	<0.05	<0.05	---
4.4`-DDE	72-55-9	0.05	mg/kg		---	---	<0.05	<0.05	---
Endrin	72-20-8	0.05	mg/kg		---	---	<0.05	<0.05	---
beta-Endosulfan	33213-65-9	0.05	mg/kg		---	---	<0.05	<0.05	---
^ Endosulfan (sum)	115-29-7	0.05	mg/kg		---	---	<0.05	<0.05	---
4.4`-DDD	72-54-8	0.05	mg/kg		---	---	<0.05	<0.05	---
Endrin aldehyde	7421-93-4	0.05	mg/kg		---	---	<0.05	<0.05	---
Endosulfan sulfate	1031-07-8	0.05	mg/kg		---	---	<0.05	<0.05	---
4.4`-DDT	50-29-3	0.2	mg/kg		---	---	<0.2	<0.2	---
Endrin ketone	53494-70-5	0.05	mg/kg		---	---	<0.05	<0.05	---
Methoxychlor	72-43-5	0.2	mg/kg		---	---	<0.2	<0.2	---
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg		---	---	<0.05	<0.05	---
^ Sum of DDD + DDE + DDT	---	0.05	mg/kg		---	---	<0.05	<0.05	---
EP068B: Organophosphorus Pesticides (OP)									
Dichlorvos	62-73-7	0.05	mg/kg		---	---	<0.05	<0.05	---
Demeton-S-methyl	919-86-8	0.05	mg/kg		---	---	<0.05	<0.05	---
Monocrotophos	6923-22-4	0.2	mg/kg		---	---	<0.2	<0.2	---
Dimethoate	60-51-5	0.05	mg/kg		---	---	<0.05	<0.05	---
Diazinon	333-41-5	0.05	mg/kg		---	---	<0.05	<0.05	---
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg		---	---	<0.05	<0.05	---
Parathion-methyl	298-00-0	0.2	mg/kg		---	---	<0.2	<0.2	---
Malathion	121-75-5	0.05	mg/kg		---	---	<0.05	<0.05	---
Fenthion	55-38-9	0.05	mg/kg		---	---	<0.05	<0.05	---
Chlorpyrifos	2921-88-2	0.05	mg/kg		---	---	<0.05	<0.05	---

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	S6	S7	S9	S10	S11
				Client sampling date / time	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00
Compound	CAS Number	LOR	Unit		ES1319417-006	ES1319417-007	ES1319417-008	ES1319417-009	ES1319417-010
EP068B: Organophosphorus Pesticides (OP) - Continued									
Parathion	56-38-2	0.2	mg/kg		---	---	<0.2	<0.2	---
Pirimphos-ethyl	23505-41-1	0.05	mg/kg		---	---	<0.05	<0.05	---
Chlorfenvinphos	470-90-6	0.05	mg/kg		---	---	<0.05	<0.05	---
Bromophos-ethyl	4824-78-6	0.05	mg/kg		---	---	<0.05	<0.05	---
Fenamiphos	22224-92-6	0.05	mg/kg		---	---	<0.05	<0.05	---
Prothiofos	34643-46-4	0.05	mg/kg		---	---	<0.05	<0.05	---
Ethion	563-12-2	0.05	mg/kg		---	---	<0.05	<0.05	---
Carbophenothion	786-19-6	0.05	mg/kg		---	---	<0.05	<0.05	---
Azinphos Methyl	86-50-0	0.05	mg/kg		---	---	<0.05	<0.05	---
EP074D: Fumigants									
2.2-Dichloropropane	594-20-7	0.5	mg/kg		---	---	---	<0.5	---
1.2-Dichloropropane	78-87-5	0.5	mg/kg		---	---	---	<0.5	---
cis-1.3-Dichloropropylene	10061-01-5	0.5	mg/kg		---	---	---	<0.5	---
trans-1.3-Dichloropropylene	10061-02-6	0.5	mg/kg		---	---	---	<0.5	---
1.2-Dibromoethane (EDB)	106-93-4	0.5	mg/kg		---	---	---	<0.5	---
EP074E: Halogenated Aliphatic Compounds									
Dichlorodifluoromethane	75-71-8	5	mg/kg		---	---	---	<5	---
Chloromethane	74-87-3	5	mg/kg		---	---	---	<5	---
Vinyl chloride	75-01-4	5	mg/kg		---	---	---	<5	---
Bromomethane	74-83-9	5	mg/kg		---	---	---	<5	---
Chloroethane	75-00-3	5	mg/kg		---	---	---	<5	---
Trichlorofluoromethane	75-69-4	5	mg/kg		---	---	---	<5	---
1.1-Dichloroethene	75-35-4	0.5	mg/kg		---	---	---	<0.5	---
Iodomethane	74-88-4	0.5	mg/kg		---	---	---	<0.5	---
trans-1.2-Dichloroethene	156-60-5	0.5	mg/kg		---	---	---	<0.5	---
1.1-Dichloroethane	75-34-3	0.5	mg/kg		---	---	---	<0.5	---
cis-1.2-Dichloroethene	156-59-2	0.5	mg/kg		---	---	---	<0.5	---
1.1.1-Trichloroethane	71-55-6	0.5	mg/kg		---	---	---	<0.5	---
1.1-Dichloropropylene	563-58-6	0.5	mg/kg		---	---	---	<0.5	---
Carbon Tetrachloride	56-23-5	0.5	mg/kg		---	---	---	<0.5	---
1.2-Dichloroethane	107-06-2	0.5	mg/kg		---	---	---	<0.5	---
Trichloroethene	79-01-6	0.5	mg/kg		---	---	---	<0.5	---
Dibromomethane	74-95-3	0.5	mg/kg		---	---	---	<0.5	---

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	S6	S7	S9	S10	S11
				Client sampling date / time	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00
Compound	CAS Number	LOR	Unit		ES1319417-006	ES1319417-007	ES1319417-008	ES1319417-009	ES1319417-010
EP074E: Halogenated Aliphatic Compounds - Continued									
1.1.2-Trichloroethane	79-00-5	0.5	mg/kg		---	---	---	<0.5	---
1.3-Dichloropropane	142-28-9	0.5	mg/kg		---	---	---	<0.5	---
Tetrachloroethene	127-18-4	0.5	mg/kg		---	---	---	<0.5	---
1.1.1.2-Tetrachloroethane	630-20-6	0.5	mg/kg		---	---	---	<0.5	---
trans-1.4-Dichloro-2-butene	110-57-6	0.5	mg/kg		---	---	---	<0.5	---
cis-1.4-Dichloro-2-butene	1476-11-5	0.5	mg/kg		---	---	---	<0.5	---
1.1.2.2-Tetrachloroethane	79-34-5	0.5	mg/kg		---	---	---	<0.5	---
1.2.3-Trichloropropane	96-18-4	0.5	mg/kg		---	---	---	<0.5	---
Pentachloroethane	76-01-7	0.5	mg/kg		---	---	---	<0.5	---
1.2-Dibromo-3-chloropropane	96-12-8	0.5	mg/kg		---	---	---	<0.5	---
Hexachlorobutadiene	87-68-3	0.5	mg/kg		---	---	---	<0.5	---
EP074F: Halogenated Aromatic Compounds									
Chlorobenzene	108-90-7	0.5	mg/kg		---	---	---	<0.5	---
Bromobenzene	108-86-1	0.5	mg/kg		---	---	---	<0.5	---
2-Chlorotoluene	95-49-8	0.5	mg/kg		---	---	---	<0.5	---
4-Chlorotoluene	106-43-4	0.5	mg/kg		---	---	---	<0.5	---
1.3-Dichlorobenzene	541-73-1	0.5	mg/kg		---	---	---	<0.5	---
1.4-Dichlorobenzene	106-46-7	0.5	mg/kg		---	---	---	<0.5	---
1.2-Dichlorobenzene	95-50-1	0.5	mg/kg		---	---	---	<0.5	---
1.2.4-Trichlorobenzene	120-82-1	0.5	mg/kg		---	---	---	<0.5	---
1.2.3-Trichlorobenzene	87-61-6	0.5	mg/kg		---	---	---	<0.5	---
EP074G: Trihalomethanes									
Chloroform	67-66-3	0.5	mg/kg		---	---	---	<0.5	---
Bromodichloromethane	75-27-4	0.5	mg/kg		---	---	---	<0.5	---
Dibromochloromethane	124-48-1	0.5	mg/kg		---	---	---	<0.5	---
Bromoform	75-25-2	0.5	mg/kg		---	---	---	<0.5	---
EP075(SIM)A: Phenolic Compounds									
Phenol	108-95-2	0.5	mg/kg		---	---	---	<0.5	---
2-Chlorophenol	95-57-8	0.5	mg/kg		---	---	---	<0.5	---
2-Methylphenol	95-48-7	0.5	mg/kg		---	---	---	<0.5	---
3- & 4-Methylphenol	1319-77-3	1	mg/kg		---	---	---	<1	---
2-Nitrophenol	88-75-5	0.5	mg/kg		---	---	---	<0.5	---
2.4-Dimethylphenol	105-67-9	0.5	mg/kg		---	---	---	<0.5	---

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	S6	S7	S9	S10	S11
				Client sampling date / time	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00
Compound	CAS Number	LOR	Unit		ES1319417-006	ES1319417-007	ES1319417-008	ES1319417-009	ES1319417-010
EP075(SIM)A: Phenolic Compounds - Continued									
2.4-Dichlorophenol	120-83-2	0.5	mg/kg		---	---	---	<0.5	---
2.6-Dichlorophenol	87-65-0	0.5	mg/kg		---	---	---	<0.5	---
4-Chloro-3-Methylphenol	59-50-7	0.5	mg/kg		---	---	---	<0.5	---
2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg		---	---	---	<0.5	---
2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg		---	---	---	<0.5	---
Pentachlorophenol	87-86-5	2	mg/kg		---	---	---	<2	---
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		<0.5	<0.5	---	<0.5	---
Acenaphthylene	208-96-8	0.5	mg/kg		<0.5	<0.5	---	<0.5	---
Acenaphthene	83-32-9	0.5	mg/kg		<0.5	<0.5	---	<0.5	---
Fluorene	86-73-7	0.5	mg/kg		<0.5	<0.5	---	<0.5	---
Phenanthrene	85-01-8	0.5	mg/kg		<0.5	<0.5	---	<0.5	---
Anthracene	120-12-7	0.5	mg/kg		<0.5	<0.5	---	<0.5	---
Fluoranthene	206-44-0	0.5	mg/kg		<0.5	<0.5	---	<0.5	---
Pyrene	129-00-0	0.5	mg/kg		<0.5	<0.5	---	<0.5	---
Benz(a)anthracene	56-55-3	0.5	mg/kg		<0.5	<0.5	---	<0.5	---
Chrysene	218-01-9	0.5	mg/kg		<0.5	<0.5	---	<0.5	---
Benzo(b)fluoranthene	205-99-2	0.5	mg/kg		<0.5	<0.5	---	<0.5	---
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		<0.5	<0.5	---	<0.5	---
Benzo(a)pyrene	50-32-8	0.5	mg/kg		<0.5	<0.5	---	<0.5	---
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5	<0.5	---	<0.5	---
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		<0.5	<0.5	---	<0.5	---
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	<0.5	---	<0.5	---
^ Sum of polycyclic aromatic hydrocarbons	---	0.5	mg/kg		<0.5	<0.5	---	<0.5	---
^ Benzo(a)pyrene TEQ (zero)	---	0.5	mg/kg		<0.5	<0.5	---	<0.5	---
^ Benzo(a)pyrene TEQ (half LOR)	---	0.5	mg/kg		0.6	0.6	---	0.6	---
^ Benzo(a)pyrene TEQ (LOR)	---	0.5	mg/kg		1.2	1.2	---	1.2	---
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	---	10	mg/kg		<10	<10	---	<10	---
C10 - C14 Fraction	---	50	mg/kg		<50	<50	---	<50	---
C15 - C28 Fraction	---	100	mg/kg		<100	<100	---	<100	---
C29 - C36 Fraction	---	100	mg/kg		<100	<100	---	<100	---
^ C10 - C36 Fraction (sum)	---	50	mg/kg		<50	<50	---	<50	---

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	S6	S7	S9	S10	S11
				Client sampling date / time	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00
Compound	CAS Number	LOR	Unit		ES1319417-006	ES1319417-007	ES1319417-008	ES1319417-009	ES1319417-010
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	<10	---	<10	---
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10	<10	---	<10	---
>C10 - C16 Fraction	>C10_C16	50	mg/kg		<50	<50	---	<50	---
>C16 - C34 Fraction	---	100	mg/kg		<100	<100	---	<100	---
>C34 - C40 Fraction	---	100	mg/kg		<100	<100	---	<100	---
^ >C10 - C40 Fraction (sum)	---	50	mg/kg		<50	<50	---	<50	---
^ >C10 - C16 Fraction minus Naphthalene (F2)	---	50	mg/kg		<50	<50	---	<50	---
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	---	<0.2	---
Toluene	108-88-3	0.5	mg/kg		<0.5	<0.5	---	<0.5	---
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	<0.5	---	<0.5	---
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	<0.5	---	<0.5	---
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	<0.5	---	<0.5	---
^ Total Xylenes	1330-20-7	0.5	mg/kg		<0.5	<0.5	---	<0.5	---
^ Sum of BTEX	---	0.2	mg/kg		<0.2	<0.2	---	<0.2	---
Naphthalene	91-20-3	1	mg/kg		<1	<1	---	<1	---
EP066S: PCB Surrogate									
Decachlorobiphenyl	2051-24-3	0.1	%		---	---	---	83.4	---
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.1	%		---	---	88.7	88.8	---
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.1	%		---	---	106	88.3	---
EP074S: VOC Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		---	---	---	106	---
Toluene-D8	2037-26-5	0.1	%		---	---	---	118	---
4-Bromofluorobenzene	460-00-4	0.1	%		---	---	---	106	---
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.1	%		98.2	90.0	---	98.6	---
2-Chlorophenol-D4	93951-73-6	0.1	%		92.4	90.2	---	93.8	---
2.4.6-Tribromophenol	118-79-6	0.1	%		83.9	88.7	---	97.3	---
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		93.0	90.4	---	95.5	---

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	S6	S7	S9	S10	S11
			Client sampling date / time	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00	28-AUG-2013 15:00
Compound	CAS Number	LOR	Unit	ES1319417-006	ES1319417-007	ES1319417-008	ES1319417-009	ES1319417-010
EP075(SIM)T: PAH Surrogates - Continued								
Anthracene-d10	1719-06-8	0.1	%	80.9	80.0	---	84.2	---
4-Terphenyl-d14	1718-51-0	0.1	%	101	99.3	---	99.3	---
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.1	%	122	128	---	104	---
Toluene-D8	2037-26-5	0.1	%	102	104	---	109	---
4-Bromofluorobenzene	460-00-4	0.1	%	106	99.9	---	102	---

Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP066S: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	39	149
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	49	147
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	35	143
EP074S: VOC Surrogates			
1.2-Dichloroethane-D4	17060-07-0	64	130
Toluene-D8	2037-26-5	66	136
4-Bromofluorobenzene	460-00-4	60	122
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	63	123
2-Chlorophenol-D4	93951-73-6	66	122
2.4.6-Tribromophenol	118-79-6	40	138
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	70	122
Anthracene-d10	1719-06-8	66	128
4-Terphenyl-d14	1718-51-0	65	129
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	72.8	133.2
Toluene-D8	2037-26-5	73.9	132.1
4-Bromofluorobenzene	460-00-4	71.6	130.0