Metro Corridor Impact Statement

Iglu 80-88 Regent Street, Redfern

Prepared for Iglu Pty Ltd / 23 January 2019

181172

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Structural
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Traffic
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Contents

1.0 Introduction

This report addresses the impacts that may be required to be considered for the proposed development at 80-88 Regent Street, Redfern, in relation to the Sydney Metro City and Southwest Tunnel corridors which are planned to pass beneath the site. The site is bound by Regent Street to the east, Marian Street to the south, William Lane to the west and the 60-78 Regent Street development to the north.

The development at 80-88 Regent Street, Redfern, comprises of a new 20 storey tower with no basement structure. The development will include retail at ground and mezzanine levels, with student accommodation and associated facilities above this. The proposed structural concept design has been included within Appendix A for reference.

This report highlights the infrastructure which will be considered as part of the development and outlines the key issues which will be addressed as part of the design. The approximate alignment of the tunnels and corridors have been shown in Figure 1 below.

At this stage of the design, no site-specific geotechnical study has been undertaken for the proposed development. However, geotechnical reports available from adjacent sites at 60-78 Regent Street, and 157 Redfern Street both with similar sized developments are available and have been used as references for this report, and can be found in Appendix B and Appendix D. Further to this, TTW were the structural engineers engaged on 60-78 Regent Street and have knowledge of the foundation solution that was used for this development which was of similar size to that proposed for this site. The pile logs for this site have been included in Appendix D.

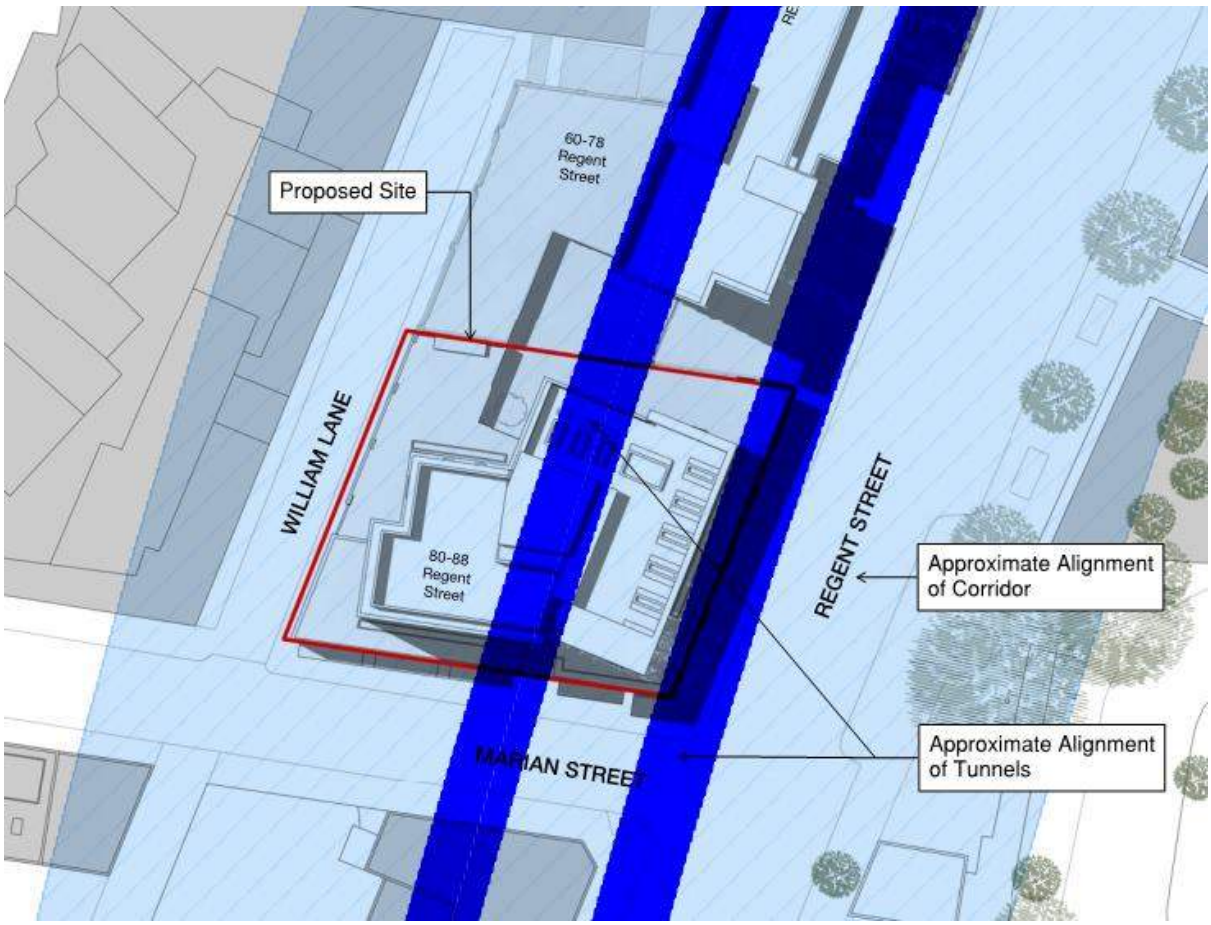

Figure 1: Proposed Development Site Bounded by the Red Box

2.0 Infrastructure Coordination

2.1 Tunnel Alignment and Depth

The proposed Metro corridor and tunnels in Figure 2 below, shows the approximate alignment with respect to the site. The tunnels and corridor run beneath the entirety of the site in an east-west direction and are anticipated to be approximately 40 m below existing ground level at the development location.

Figure 2: Excerpt from Chatswood to Sydenham Environmental Impact Statement Summary May-June 2016 Showing Site Location Adjacent to Tunnel Corridor

2.2 Protection Reserves and Construction Restrictions

Transport for NSW have produced the *Sydney Metro Underground Corridor Protection Technical Guidelines* which outlines protection reserves and construction restrictions that are applicable to developments adjacent to existing and planned metro infrastructure.

The first reserve is the ground immediately adjacent to the metro infrastructure and is a zone that must not be infringed by any planned development. For the proposed development, this zone represents a 5 m distance from the top of the Metro tunnel.

The second reserve is the ground surrounding the first reserve and represents and area where development works have potential to unfavourably effect the performance of the support elements of planned or constructed metro infrastructure. For the proposed development, this represents a 25 m distance from the top of the first reserve.

For this development there are no basement works planned, and it is anticipated that the structure will be supported on piled foundations. Piled foundations are not allowed within the first reserve zone, but are allowed in the second reserve zone, and are subject to load restrictions with further assessment being required as the design progresses.

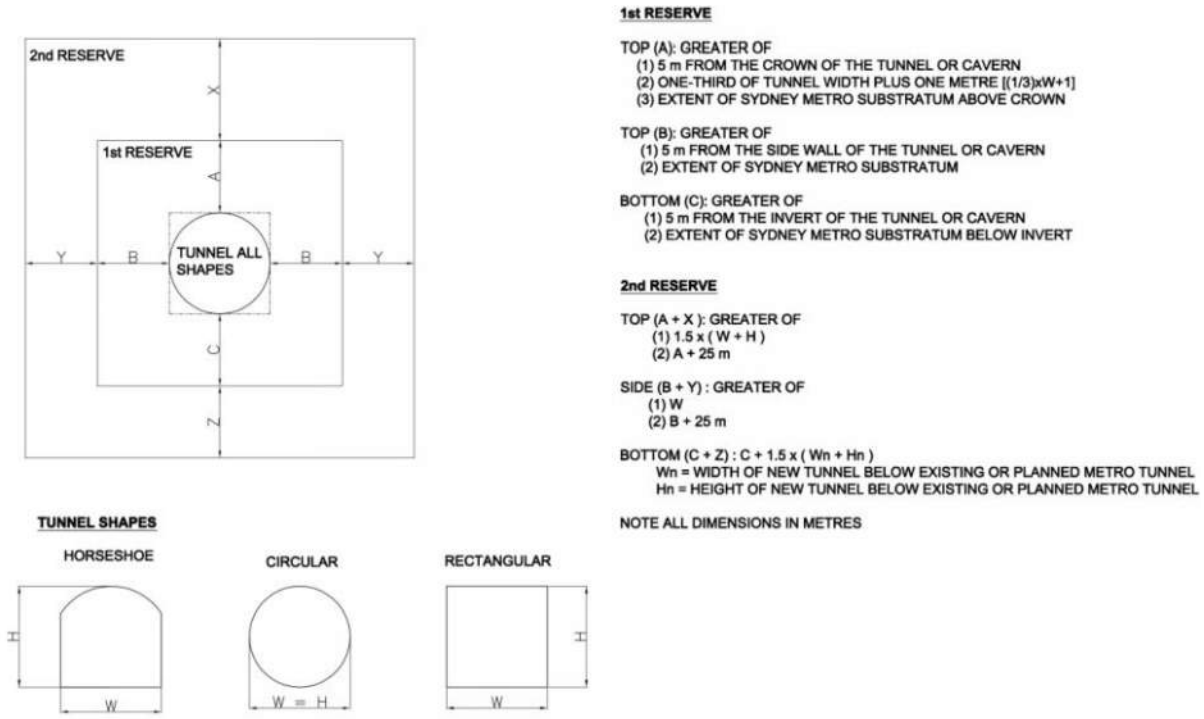

Figure 3: Excerpt Sydney Metro Underground Corridor Protection Technical Guidelines Showing First and Second Reserve Zones

2.3 Design Considerations

As the site is located above the proposed tunnel corridor, there are a number of design considerations that are to be addressed. How they relate to the proposed development are broadly outlined below.

2.3.1 Foundation Forces

It is anticipated that the proposed foundation scheme for the new development will be to utilise a series of large diameter piles to support the loading from the structure above. It is anticipated that similar geological ground conditions to the neighbouring developments will be encountered on this site, and that large diameter piles will socket into the underlying shale bedrock at a depth of approximately 10-12 m below existing ground level. It is expected that the piles will sit wholly outside the first reserve zone, with the potential to slightly encroach on the second reserve zone. As the design develops, if required, rock modelling will be able to be used to demonstrate the impact that the building will have on the future Metro.

2.3.2 Construction Vibrations

Due to the depth of the tunnel relative to the proposed development, it is not anticipated that vibrations during construction of the tunnel will adversely affect the proposed development, or vice versa.

2.3.3 Vibrations from The Rail Corridor

There are no uses proposed within the new structure which will make it susceptible to ground borne vibration from the operational rail tunnel. Detailed analysis will be carried out during design to confirm the impacts of the operational tunnel. The building is not proposed to be isolated as part of the overall design.

2.3.4 Electrolysis and Stray Currents

The use of DC can have an impact on buried structures and may lead to an increased risk of corrosion. The provisions for this will be required to be considered during the design process.

2.3.5 Noise

Due to the depth of the tunnel, noise is unlikely to be an issue for the new structure. Low frequency sound will be required to be considered as part of the design in a similar means to the vibration assessment.

2.3.6 Maintenance and Access

Although the depth of the tunnel would largely prohibit the use of any access or maintenance from ground level, the first reserve zone is kept clear as part of the design.

3.0 Conclusions

The proposed development located at 80-88 Regent Street, Redfern, is situated above the proposed Sydney Metro City and Southwest Tunnel corridors.

Further consultation will be required, but at the time of writing, the alignment of the tunnels has been provided with the proposed depths of approximately 40 metres below our site as outlined in the *Chatswood to Sydenham Environmental Impact Statement Summary May-June 2016*.

As the design progresses, further detailed design is required to demonstrate that the design addresses the issues related to:

- Foundation forces;
- Construction vibrations;
- Vibrations from the rail corridor;
- Electrolysis and stray currents;
- Noise; and
- Maintenance and access.

Our preliminary investigation based on the current level of design, our understanding of the ground conditions, and likely foundation solution suggest that the construction of the building is unlikely to have a negative impact on the future transport infrastructure and the design of the proposed structure will be able to proceed.

Prepared by

TAYLOR THOMSON WHITTING (NSW) PTY LTD

ALEX ZECEVIC
Senior Structural Engineer

Authorised By

TAYLOR THOMSON WHITTING (NSWPTY LTD

KEVIN BERRY
Director

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Appendix A

Structural Concept Design Sketches

GROUND FLOOR PLAN

BLUE HATCH - ELEMENT BELOW SLAB

RED HATCH - ELEMENT ABOVE SLAB

Iglu Regent St

Ground Floor Plan

Check all dimensions and site conditions prior to commencement of any work, the purchase or ordering of any materials, fittings, plant, services or equipment and the preparation of shop drawings and or the fabrication of any components.

Do not scale drawings - refer to figured dimensions only. Any discrepancies shall immediately be referred to the architect for clarification.

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Scale: 1 : 200 @ A3

Drawn: JC

Checked: MH

Project no.: s12174

Status: Development Application

Plot Date: 10/08/2018 12:49:57 PM

Drawing no.: A03.101

Revision: A

Job Name : IGLU REDFERN STAGE 2

Sketch Title: STRUCTURAL CONCEPT DESIGN PRELIMINARY SKETCH SET

Date: 17/08/2018

By: CG

Taylor Thomson Whitting

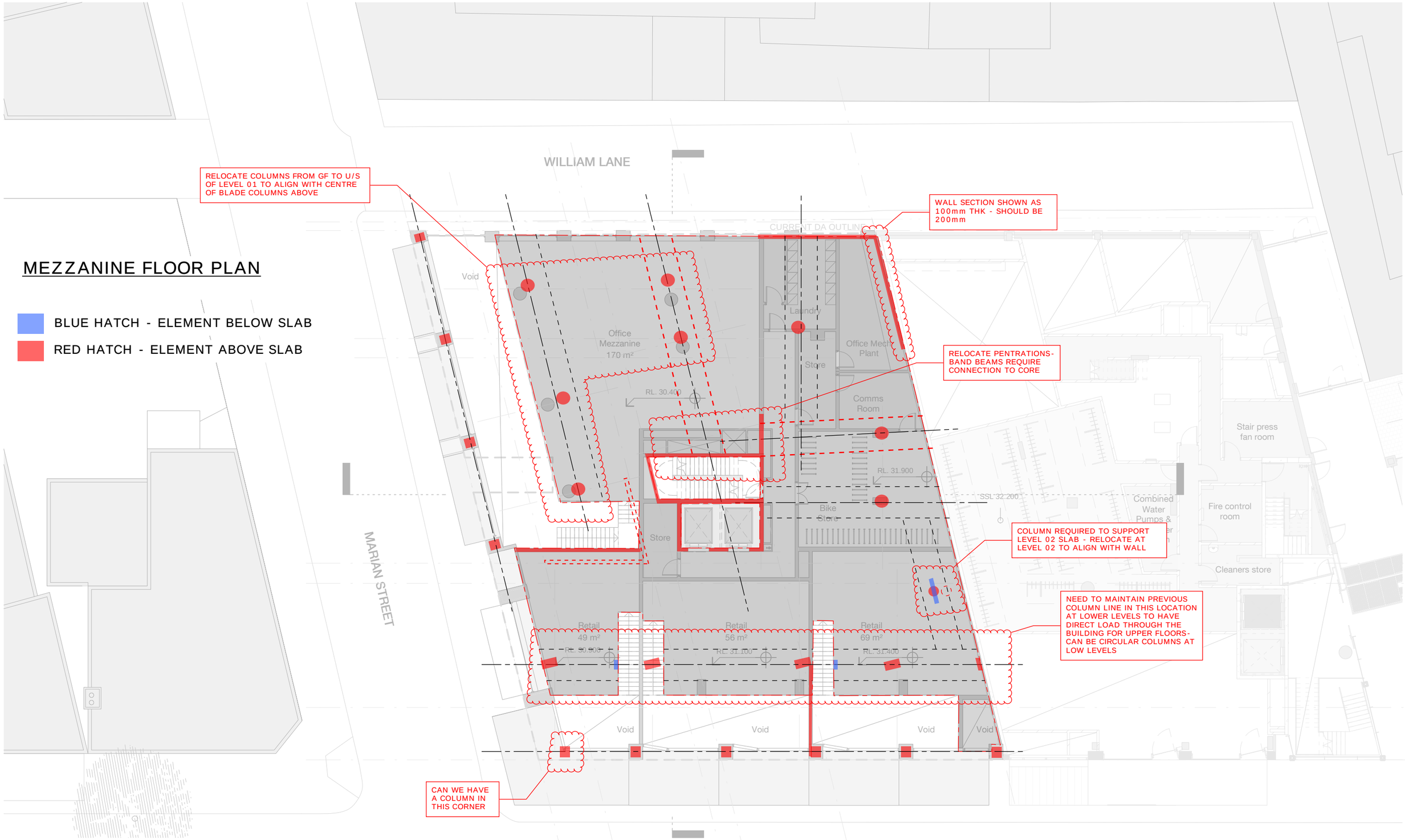
Job Number: 181126

Sketch No. : SK004

MEZZANINE FLOOR PLAN

BLUE HATCH - ELEMENT BELOW SLAB

RED HATCH - ELEMENT ABOVE SLAB



Iglu Regent St

Level 00 Mezzanine

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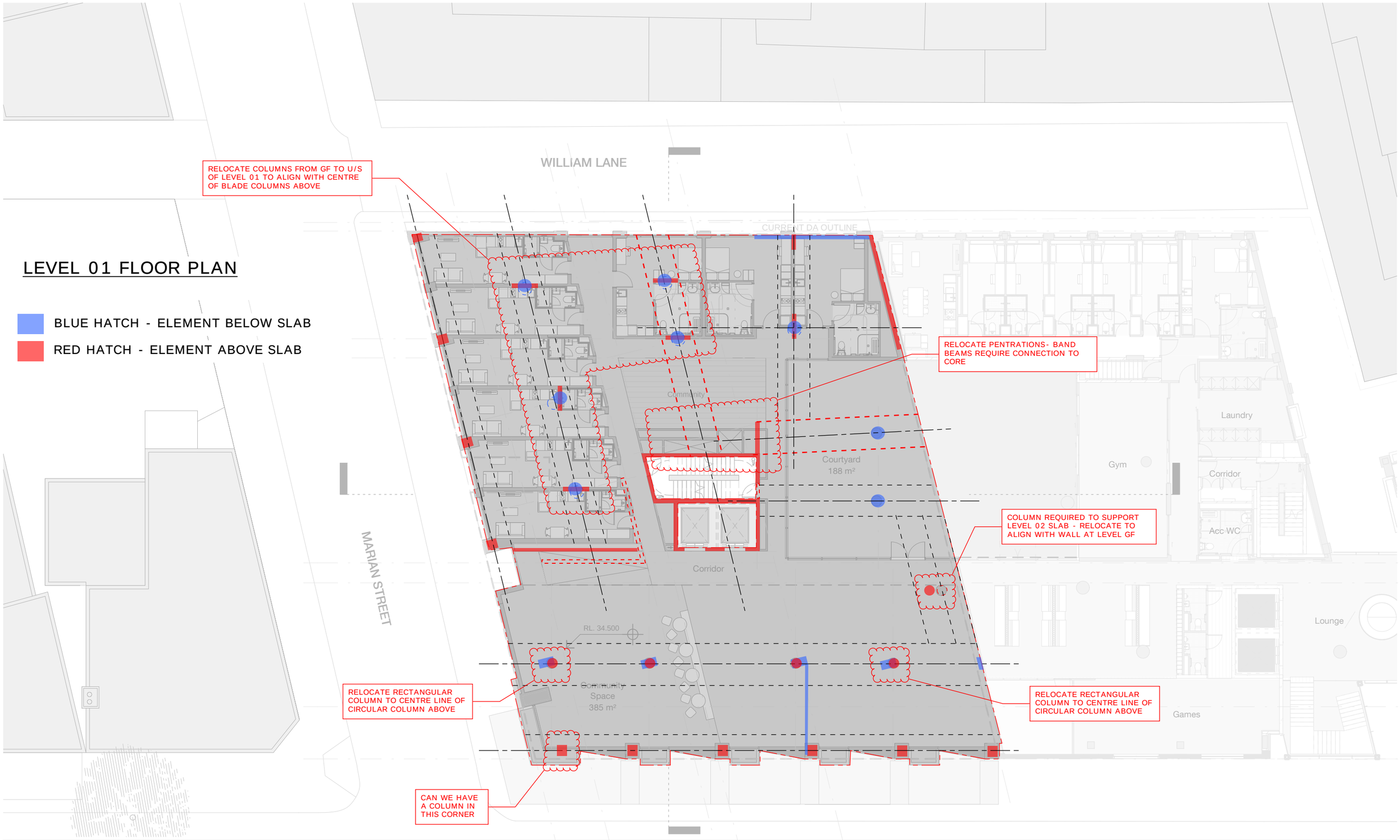
LEVEL 01 FLOOR PLAN

BLUE HATCH - ELEMENT BELOW SLAB

RED HATCH - ELEMENT ABOVE SLAB



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Level 01

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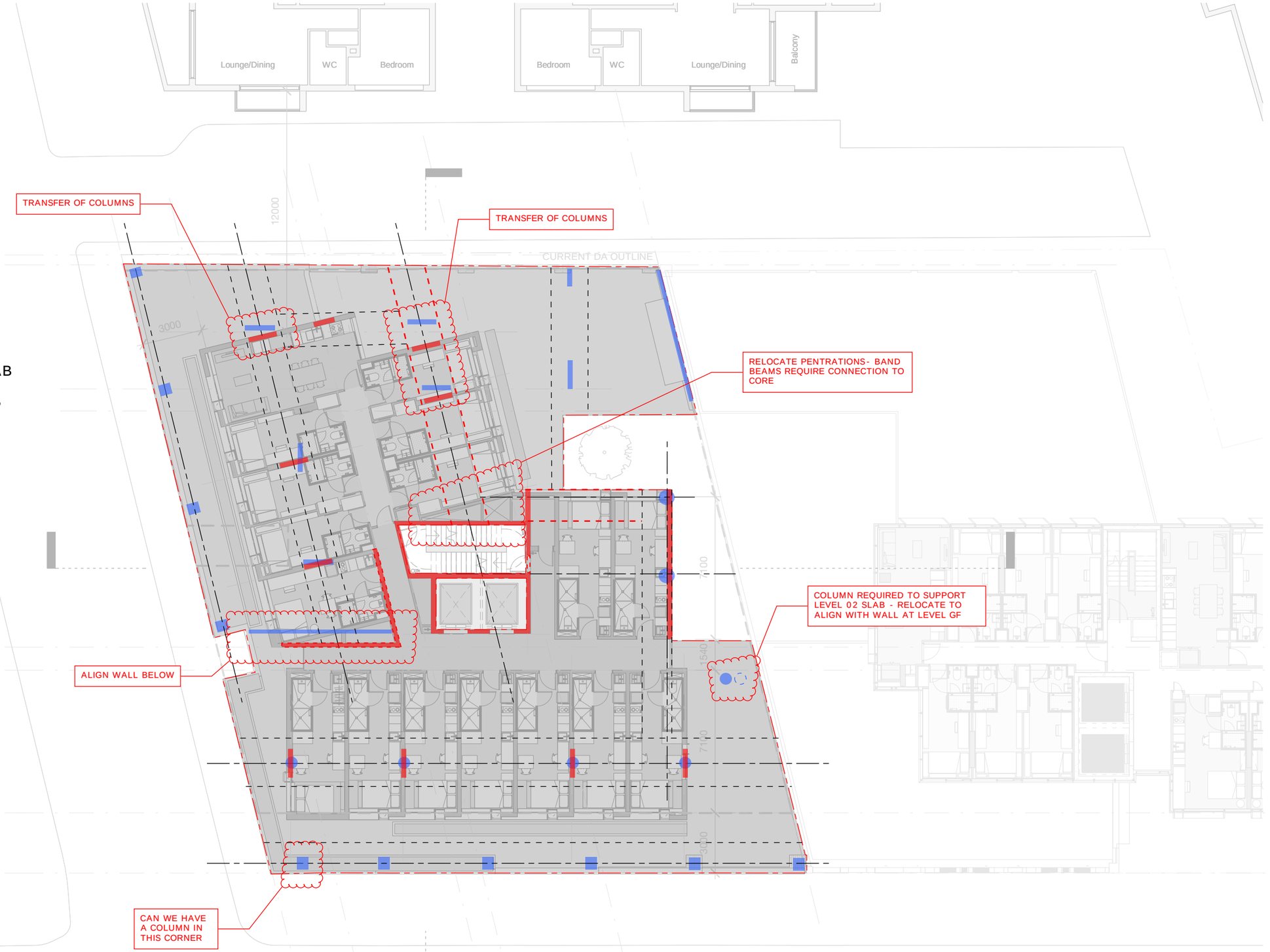
LEVEL 02 FLOOR PLAN

BLUE HATCH - ELEMENT BELOW SLAB

RED HATCH - ELEMENT ABOVE SLAB



Iglu Regent St

Level 02

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Drawing no. A03.104 Revision A

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LEVEL 03, 07, 12, 13 FLOOR PLAN

BLUE HATCH - ELEMENT BELOW SLAB

RED HATCH - ELEMENT ABOVE SLAB

Iglu Regent St

Floorplate Level 03, 07, 12, 13

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LEVEL 04, 08, 14 FLOOR PLAN

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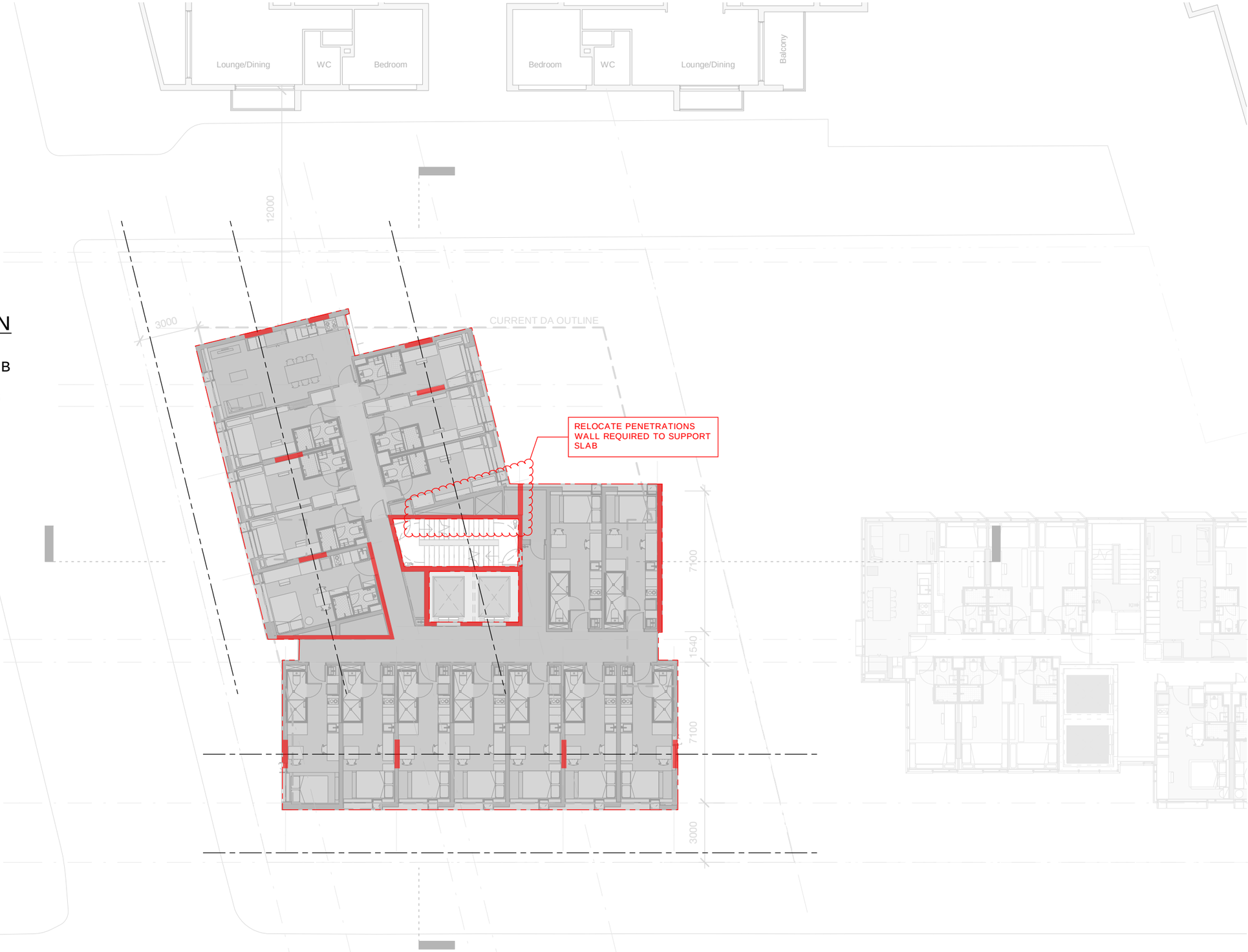
RED HATCH - ELEMENT ABOVE SLAB



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Floorplate Level 4, 8 ,14

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LEVEL 05, 09, 10, 15, 16, 17 FLOOR PLAN

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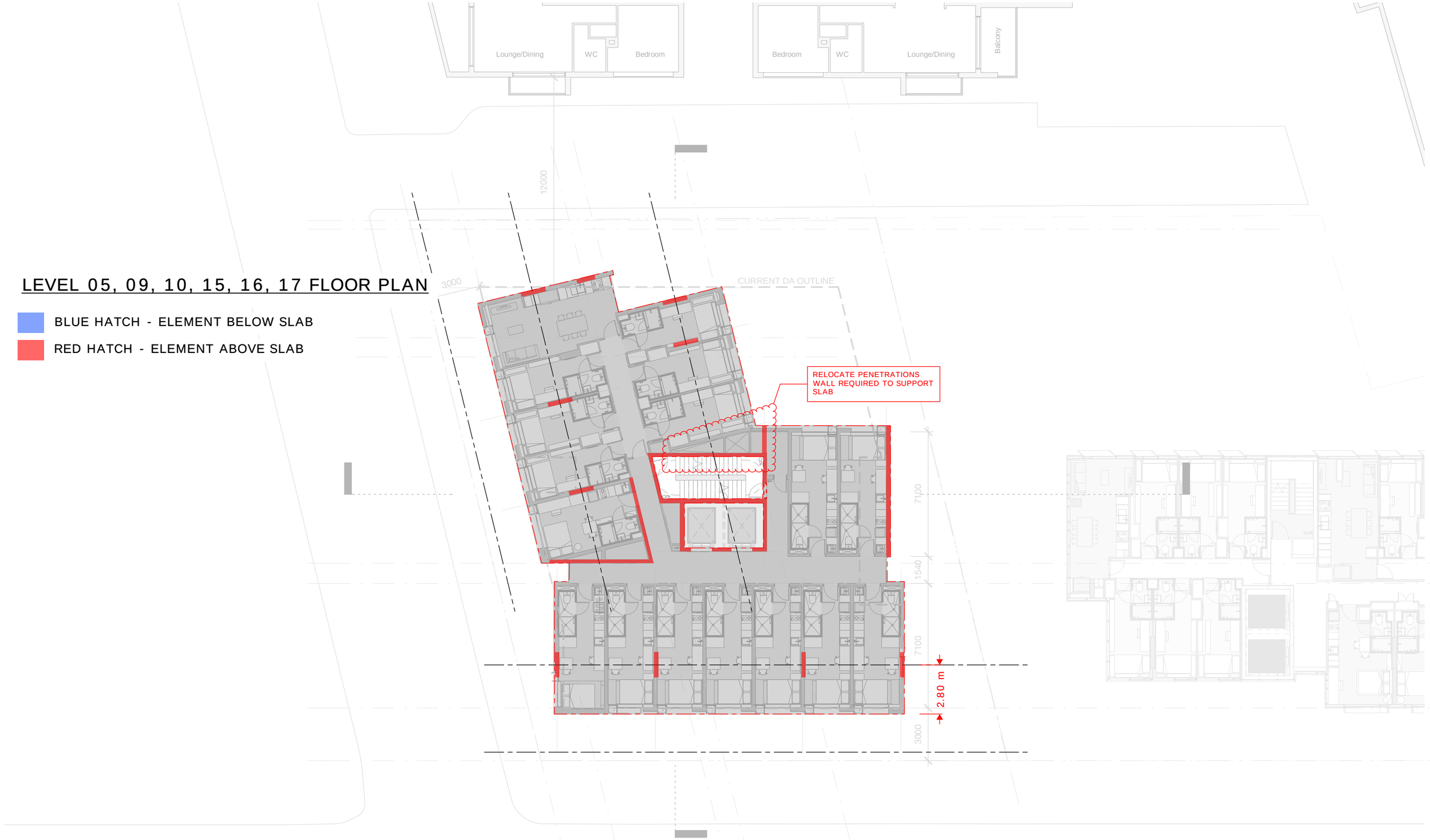
RED HATCH - ELEMENT ABOVE SLAB



Iglu Regent St

Floorplate Level 05, 09, 10, 15, 16, 17

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LEVEL 06, 11 FLOOR PLAN

BLUE HATCH - ELEMENT BELOW SLAB

RED HATCH - ELEMENT ABOVE SLAB

Iglu Regent St

Floorplate Level 06, 11

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ROOF TERRACE FLOOR PLAN

BLUE HATCH - ELEMENT BELOW SLAB

RED HATCH - ELEMENT ABOVE SLAB

Iglu Regent St

Roof Terrace level

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Appendix B

Geotechnical Report for 60-78 Regent Street, Redfern

STS GeoEnvironmental Pty Ltd
Geotechnical and Environmental Solutions

GEOTECHNICAL INVESTIGATION

FOR

RICHARD CROOKES CONSTRUCTIONS PTY LTD

60 – 78 Regent Street, Redfern, New South Wales

Report No: 16/1247

Project No: 19962/6761C

May 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 student accommodation development to be constructed at 60 – 78 Regent Street, Redfern. We have been informed the development comprises construction of eighteen (18) above ground levels. We understand that no basement excavation is proposed, however a plant room is to be constructed. Construction of the plant room will require excavating to a depth of approximately three (3) metres below the existing ground surface.

The purpose of the investigation was to:

- assess the subsurface conditions over the site,
- provide a 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 investigation was undertaken at the request of Richard Crookes Constructions Pty Limited.

Our scope of works did not include a contamination assessment of the site.

2. NATURE OF THE INVESTIGATION

2.1. Fieldwork

The fieldwork consisted of drilling two (2) boreholes numbered BH1 and BH2, at the locations shown on Drawing No. 16/1247. Restricted site access dictated the borehole locations and were determined in consultation with the clients. Both boreholes were drilled using a Comacchio Geo 205 track mounted drilling rig owned and operated by Numac Drilling. Soils and weathered rock were drilled using rotary solid flight augers. Soils strengths were determined by undertaking Standard Penetration Tests (SPT') at regular intervals in the boreholes.

The boreholes were then extended into the underlying bedrock using NMLC sized diamond coring equipment. The recovered rock core was logged, boxed and photographed. To assist in assessing rock strength, the recovered rock core was point load tested at a nominal spacing of 1 metre.

Drilling operations were directed by one of STS's 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 together with photographs of the recovered rock core and results of the point load testing.

2.2. Laboratory Testing

In order to assess 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 that the site is underlain by Quaternary Age alluvial soils comprising fine to medium grained quartz sands with podols. The site is located close to a geological boundary with Triassic Age Ashfield Shale of the Wianamatta Group. Rocks within this formation comprise shale, claystone and laminite.

The site is located on the western side of Regent Site. The site is irregular in shape with a combined area of approximately 1,412m^2. At the time of the fieldwork, the site was occupied by a series of double level brick terrace buildings that were being demolished. We understand that the front facade of the buildings is to be retained.

The ground surface falls approximately 3 metres to the south.

To the north and south of the site are further mixed use terraces. To the west of the site are two multi-level mixed used buildings with between 5 and 6 basement car park levels extending between 15 and 18 metres below the existing ground surface.

4. SUBSURFACE CONDITIONS

When making an assessment of the subsurface conditions across a site from a limited number of boreholes there is the possibility that variations may occur between test

locations. The data derived from the site investigation programme are extrapolated across the site to form a geological model and an engineering opinion is rendered about overall subsurface conditions and their likely behaviour with regard to the proposed development. The actual conditions at the site may differ from those inferred, since no subsurface exploration programme, no matter how comprehensive, can reveal all subsurface details and anomalies.

The subsurface conditions generally consist of fill overlying silty clays and weathered shale. Fill was encountered across the site in both boreholes to a depth of 1.1 to 1.2 metres. Concrete was cored in BH2 with a thickness of 200mm. Natural silty clays were encountered below the fill to depths of 5.0 to 5.4 metres. The consistency of the clays varies between stiff and very stiff. Weathered shale underlies the site. Table 4.1 below outlines the depth to each rock class as encountered in BH1 and BH2.

Table 4.1 – Rock Class Summary

BH ID	Depth of Class V (m)	Depth of Class IV (m)	Depth of Class III (m)	Depth of Class II (m)
BH1	5.4 – 7.7	7.7 – 10.0	10.0 – 14.4	14.4 – 20.0
BH2	5.0 – 7.4	7.4 – 9.0	9.0 – 13.25	13.25 – 20.0

Groundwater seepage was not observed during drilling of the boreholes.

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

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

5.2. Excavation Conditions and Support

Based on the subsurface conditions observed in the boreholes, the excavation for the proposed plant room is likely to encounter concrete, fill and silty clays. Excavators without assistance should be able to remove the soils to the proposed depth of excavation, 3.0 metres. The use of hydraulic hammers or breakers is not anticipated.

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

Temporary slopes in the soils may be constructed at a maximum angle of 1 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 materials below the base of the excavation.

When considering the design of the supports, it will be necessary to allow for the loading from structures in adjoining properties, any ground surface 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.

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
Passive Earth Pressure Coefficient (K_p)	=	2.5
Total (Bulk) Density	=	20 kN/m^3

Weathered Shale (Class IV or better):

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

Based on the observations during drilling and on the piezometers, the plant room excavation is not expected to encounter the groundwater table. However, some minor perched water seepage may flow into the excavation. 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 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, respectively, when founding in the stiff and very stiff materials.

We understand that the proposed building will be founded on piles extending down to the underlying shale bedrock. Table 5.1 below provides bearing pressures for the various rock classes encountered.

Table 5.1 – Allowable Bearing Pressures for Shale

Rock Classification	Allowable End Bearing (kPa)	Allowable Adhesion (kPa)
Shale Class V	700	70
Shale Class IV	1500	150
Shale Class III	3500	350
Shale Class II	6000*	600*

* Should you wish to adopt the higher bearing pressures for Class II bedrock we recommend that at least 50% of the piles be inspected by a geotechnical engineer or engineering geologist during construction to confirm that the higher bearing pressures have been achieved.

When piles 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 Table 5.2.

Table 5.2 – Soil Aggressiveness Summary Table

Sample No.	Location	Depth (m)	pH	Chloride (mg/kg)	Sulfate (mg/kg)
S1	BH1	1.0	8.9	110	250
S2	BH1	3.0	5.8	30	60
S3	BH2	2.0	5.5	10	140

The report results range between:

- pH - 5.5 to 8.9
- soluble SO_4 - 60 to 250 mg/kg (ppm)
- soluble chloride - 10 to 110 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:

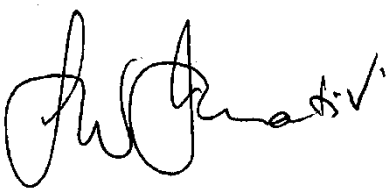
- pH : minimum value of 5.5
- SO_4 : maximum value of 250 mg/kg (ppm) < 5000 ppm
- Cl : maximum value of 110 mg/kg (ppm) < 5000 ppm

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

6. FINAL COMMENTS

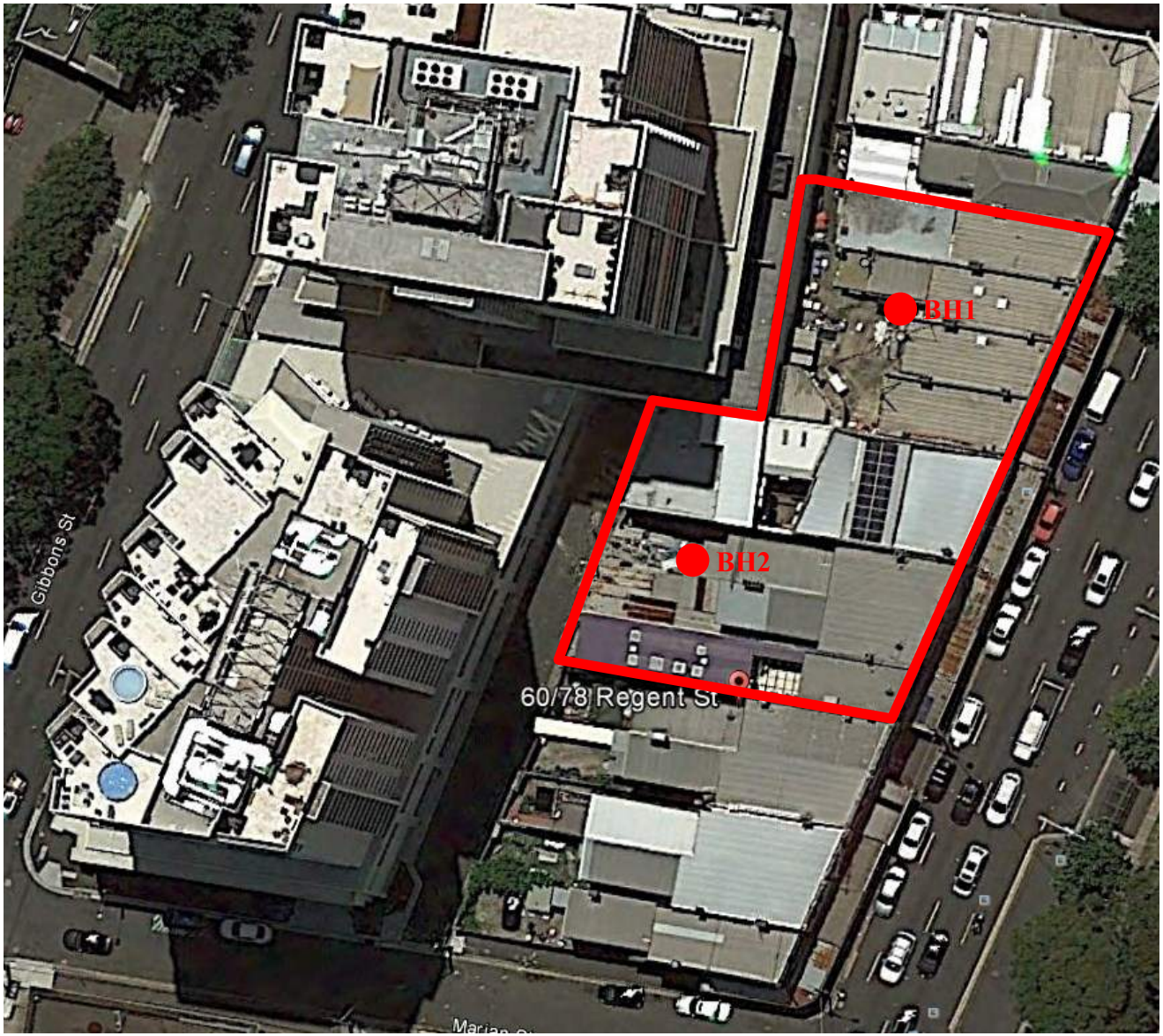
During construction, should the subsurface conditions vary from those inferred above, we would be contacted to determine if any changes should be made to our recommendations.

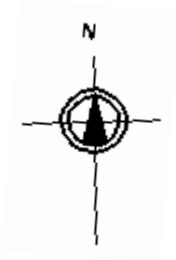
The exposed bearing surfaces for footings should be inspected by a geotechnical engineer to ensure the allowable pressure given has been achieved.



Matt Green
Senior Engineering Geologist

Laurie Ihnativ
Principal Geotechnical Engineer





STS GeoEnvironmental Pty. Ltd.	Scale: Unknown	Date: May 2016
Client: RICHARD CROOKES CONSTRUCTIONS PTY LIMITED		
GEOTECHNICAL INVESTIGATION **60-78 REGENT STREET, REDFERN** **BOREHOLE LOCATIONS**		Project No. 19962/6761C Drawing No: 16/1247

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, POINT LOAD TEST RESULTS AND EXPLANATION SHEETS

STS GeoEnvironmental Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: Richard Crookes Constructions Pty Limited
Project: 60-78 Regent Street, Redfern
Location: Refer to Drawing No. 16/1247

Project: 19962/6761C
Date : May 16, 2016
Logged: DG

BOREHOLE NO.: BH 1

Sheet 1 of 5

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: (200 mm thick)			
			SILTY CLAY: light brown, high plasticity, fine grained sand, gravel	CH	SOFT TO FIRM	D-M
	S1 @ 1.0 m	1.0	FILL?			
	SPT 1.5-1.95 m 4, 5, 10 N = 15		SILTY CLAY: light brown, medium to high plasticity, fine grained sand		STIFF	
		2.0				
			SILTY CLAY: light grey/light brown, low to medium plasticity, fine grained sad	CL	STIFF TO VERY STIFF	D
	S2 @ 3.0 m	3.0			VERY STIFF	
		4.0				
		5.0				
			WEATHERED SHALE: light grey and light brown, fine grained		EXTREMELY LOW STRENGTH	D

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: Numac Drilling
Equipment: Comacchio Geo 205
Hole Diameter (mm): 100
Angle from Vertical (°) 0

STS GeoEnvironmental Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: Richard Crookes Constructions Pty Limited
Project: 60-78 Regent Street, Redfern
Location: Refer to Drawing No. 16/1247

Project: 19962/6761C
Date : May 16, 2016
Logged: DG

BOREHOLE NO.: BH 1

Sheet 2 of 5

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
	SPT 6.0-6.45 m 7, 22, 26 N = 48		WEATHERED SHALE: light grey/light brown, fine grained		EXTREMELY LOW STRENGTH	D
		7.0				
	SPT 7.5 -7.77 m >30 N > 30		AUGER DISCONTINUED AT 7.7 M ON WEATHERED SHALE			
		8.0	For core details, refer to core log sheets			
		9.0				
		10.0				
		11.0				

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: Numac Drilling
Equipment: Comacchio Geo 205
Hole Diameter (mm): 100
Angle from Vertical (°) 0

STS GeoEnvironmental Pty Ltd — **GEOTECHNICAL LOG - CORED BOREHOLE**

Client: Richard Crookes Constructions Pty Limited
Project: 60-78 Regent Street, Redfern
Location: Refer to Drawing No. 16/1247
Project / STS No.: 19962/6761C
Date : May 16, 2016
Logged: DG
Checked By: MG

BOREHOLE NO.: BH 1
Sheet 3 of 5

DRILLING				MATERIAL STRENGTH										DISCONTINUITIES		
						Estimated Rock Strength							Joint Spacing (mm)			
Method	Water	Recovery	Depth (m)	Rock Type (Colour, 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)
			7.0	For non core details, refer to non core log sheets START CORING AT 7.7 M											
N M L C CORING		100%	8.0	SHALE: light grey/brown, fine grained, minor laminations, occasional clay seams	MW										7.7-9.0m, numerous Jt, Pt, Pl
			9.0												9.15m, Ir, Pt, Ro 9.27m, 5 deg. Ir, Jt, Ro 9.51m, Ir, 3 deg. Pt 9.66m, 25 deg. Jt 9.72-10.0m, numerous Ir, clay infill
			10.0		SW/ Fr										10.23m, Jt, 2 deg.
		100%	11.0												10.48m, Pt, Ir, Jt, 70 deg. 10.61m, Jt, 65 deg. Ro, Ir 10.71mJt, 3 deg. 10.84m, Jt, 65 deg. 11.13m, Jt, 45 deg. IR, Pt, clay infill 11.66m, Ir, Jt, 45 deg. Ro 11.7m, Ir, Pl, Pt, Ro 11.91m, Ir, Pt, Ro, 30 deg.

Notes:

Contractor: Numac Drilling
Equipment: Comacchio Geo 205
Hole Diameter (mm):
Angle from Vertical (°):

See explanation sheets for meaning of all descriptive terms and symbols

STS GeoEnvironmental Pty Ltd — **GEOTECHNICAL LOG - CORED BOREHOLE**

Client: Richard Crookes Constructions Pty Limited
Project: 60-78 Regent Street, Redfern
Location: Refer to Drawing No. 16/1247

Project / STS No.: 19962/6761C
Date : May 16, 2016
Logged: DG
Checked By: MG

BOREHOLE NO.: BH 1
Sheet 4 of 5

DRILLING				MATERIAL STRENGTH										DISCONTINUITIES		
						Estimated Rock Strength							Joint Spacing (mm)			
Method	Water	Recovery	Depth (m)	Rock Type (Colour, 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			13.0	SHALE: light grey/light brown, fine grained,											12.29m, Jt, 3 deg. 12.65m, Pl, Jt, 45 deg. 12.79-12.91m, Jt, Pl 13.11-13.25m, Pl, Jt, Pt 13.30-13.43m, Ir, Jt, 30 deg, clay infill
			14.0												14.18-14.24m, Ir, Jt, Pl 14.31m, Jt, 45 deg. Pl,
		100%	15.0												
			16.0												16.55m, Ir, Jt, 45 deg. Ro 16.74-16.90m, Jt, 5 deg.
			17.0												
		100%													17.83-19.07m, Jt. 90 deg.

Notes:

Contractor: Numac Drilling
Equipment: Comacchio Geo 205
Hole Diameter (mm):
Angle from Vertical (°):

See explanation sheets for meaning of all descriptive terms and symbols

STS GeoEnvironmental Pty Ltd — **GEOTECHNICAL LOG - CORED BOREHOLE**

Client: Richard Crookes Constructions Pty Limited
Project: 60-78 Regent Street, Redfern
Location: Refer to Drawing No. 16/1247
Project / STS No.: 19962/6761C
Date : May 16, 2016
Logged: DG
Checked By: MG

BOREHOLE NO.: BH 1
Sheet 5 of 5

DRILLING				MATERIAL STRENGTH										DISCONTINUITIES						
						Estimated Rock Strength							Joint Spacing (mm)							
Method	Water	Recovery	Depth (m)	Rock Type (Colour, 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			19.0	SHALE: light grey/light brown, fine grained clay infill	Fr														
			20.0	BOREHOLE DISCONTINUED AT 20.0 M															
			21.0																
			22.0																
			23.0																

Notes:

Contractor: Numac Drilling
Equipment: Comacchio Geo 205
Hole Diameter (mm):
Angle from Vertical (°):

See explanation sheets for meaning of all descriptive terms and symbols


PROJECT: 60 – 78 Regent Street, Redfern
Project No: 19962/6731C
Client: Richard Crookes Construction Pty Ltd
Borehole No: BH1
Depth (m) Start 7.7m – 17.0m
Box 1 & 2 of 3
STS
GeoEnvironmental
Geotechnical and Environmental Solutions
19962 START CORING BH1 @ 7.7m
8
9
10
11
12
13
14
15
16


PROJECT: 60 – 78 Regent Street, Redfern
Project No: 19962/6731C
Client: Richard Crookes Construction Pty Ltd
Borehole No: BH1
Depth (m) 17.0m – 20.0m End
Box 3 of 3
STS
GeoEnvironmental
Pty Ltd
Geotechnical and Environmental Solutions
17
18
19
19962 END OF HOLE BH1 @ 20.0m

STS GeoEnvironmental Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: Richard Crookes Constructions Pty Limited	Project: 19962/6761C	**BOREHOLE NO.: BH 2**
Project: 60-78 Regent Street, Redfern	Date : May 16, 2016	Sheet 1 of 5
Location: Refer to Drawing No. 16/1247	Logged: DG	

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: (200 mm thick)			
			SANDY SILTY CLAY: light brown/light grey, fine grained sand, high plasticity, gravel	CH	SOFT TO FIRM	D-M
		1.0	FILL?			
			SILTY CLAY: light brown, medium to high plasticity, fine grained sand	CL/CH	STIFF	D
	SPT 1.5-1.95 m 4, 7, 10 N = 17	2.0				
			SILTY CLAY: light grey/light brown, medium to high plasticity, fine grained sand	CL/CH	STIFF TO VERY STIFF	D
		3.0				
		4.0				
	SPT 4/5-4.95 m 12, 20, 27 N = 47					
		5.0				
			WEATHERED SHALE: light grey/light brown, fine grained, minor clay seams		EXTREMELY LOW STRENGTH	D

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: Numac Drilling
Equipment: Comacchio Geo 205
Hole Diameter (mm): 100
Angle from Vertical (°) 0

STS GeoEnvironmental Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: Richard Crookes Constructions Pty Limited	Project: 19962/6761C	**BOREHOLE NO.: BH 2**
Project: 60-78 Regent Street, Redfern	Date : May 16, 2016	
Location: Refer to Drawing No. 16/1247	Logged: DG	Sheet 2 of 5

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
			WEATHERED SHALE: light grey/light brown, fine grained, occasional clay seams		EXTREMELY LOW STRENGTH	D
		7.0				
			AUGER DISCONTINUED AT 7.4 M ON WEATHERED SHALE			
			For core details, refer to core log sheets			
		8.0				
		9.0				
		10.0				
		11.0				

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: Numac Drilling
Equipment: Comacchio Geo 205
Hole Diameter (mm): 100
Angle from Vertical (°) 0

STS GeoEnvironmental Pty Ltd — **GEOTECHNICAL LOG - CORED BOREHOLE**

Client: Richard Crookes Constructions Pty Limited
Project: 60-78 Regent Street, Redfern
Location: Refer to Drawing No. 16/1247
Project / STS No.: 19962/6761C
Date : May 16, 2016
Logged: DG
Checked By: MG

BOREHOLE NO.: BH 2
Sheet 3 of 5

DRILLING				MATERIAL STRENGTH										DISCONTINUITIES			
						Estimated Rock Strength							Joint Spacing (mm)						
Method	Water	Recovery	Depth (m)	Rock Type (Colour, 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)
			7.0	For non core details, refer to non core log sheets START CORING AT 7.4 M															
N M L C CORING		100%	8.0	SHALE: light grey and brown, fine grained, minor lamination, gravel	HW/ MW														7.4-7.9m, numerous Jt, Pt
					MW														
			9.0		MW/ SW														numerous Pl, Jt, 0-3 deg.
			10.0		SW														
		100%	11.0																10.4-10.42m, numerous Pl, Jt
					Fr/ SW														

Notes:

Contractor: Numac Drilling
Equipment: Comacchio Geo 205
Hole Diameter (mm):
Angle from Vertical (°):

See explanation sheets for meaning of all descriptive terms and symbols

STS GeoEnvironmental Pty Ltd — **GEOTECHNICAL LOG - CORED BOREHOLE**

Client: Richard Crookes Constructions Pty Limited
Project: 60-78 Regent Street, Redfern
Location: Refer to Drawing No. 16/1247
Project / STS No.: 19962/6761C
Date : May 16, 2016
Logged: DG
Checked By: MG

BOREHOLE NO.: BH 2
Sheet 4 of 5

DRILLING				MATERIAL STRENGTH		Estimated Rock Strength							DISCONTINUITIES							
													Joint Spacing (mm)							
Method	Water	Recovery	Depth (m)	Rock Type (Colour, 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		100%	13.0	SHALE: light grey/brown, fine grained, minor laminations	Fr/ SW															
			14.0		Fr															
			15.0																	
			16.0																	
			17.0																	

Notes:

Contractor: Numac Drilling
Equipment: Comacchio Geo 205
Hole Diameter (mm):
Angle from Vertical (°):

See explanation sheets for meaning of all descriptive terms and symbols

STS GeoEnvironmental Pty Ltd — **GEOTECHNICAL LOG - CORED BOREHOLE**

Client: Richard Crookes Constructions Pty Limited
Project: 60-78 Regent Street, Redfern
Location: Refer to Drawing No. 16/1247
Project / STS No.: 19962/6761C
Date : May 16, 2016
Logged: DG
Checked By: MG

BOREHOLE NO.: BH 2
Sheet 5 of 5

DRILLING				MATERIAL STRENGTH											DISCONTINUITIES		
						Estimated Rock Strength							Joint Spacing (mm)						
Method	Water	Recovery	Depth (m)	Rock Type (Colour, 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			19.0	SHALE: light grey/brown, fine grained	Fr														
			20.0	BOREHOLE DISCONTINUED AT 20.0 M															
			21.0																
			22.0																
			23.0																

Notes:

Contractor: Numac Drilling
Equipment: Comacchio Geo 205
Hole Diameter (mm):
Angle from Vertical (°):

See explanation sheets for meaning of all descriptive terms and symbols


PROJECT: 60 – 78 Regent Street, Redfern
Project No: 19962/6731C
Client: Richard Crookes Construction Pty Ltd
Borehole No: BH2
Depth (m) Start 7.4m – 16.0m
Box 1 & 2 of 3
STS
GeoEnvironmental
Pty Ltd
Geotechnical and Environmental Solutions
19962 START CORING BH2 @ 7.4m
8
9
10
11
12
13
14
15


PROJECT: 60 – 78 Regent Street, Redfern
Project No: 19962/6731C
Client: Richard Crookes Construction Pty Ltd
Borehole No: BH2
Depth (m) 16.0m – 20.0m End
Box 3 of 3
STS
GeoEnvironmental
Pty Ltd
Geotechnical and Environmental Solutions
16
17
18
19
19962 END OF HOLE BH2 @ 20.0m

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: 60-78 REGENT STREET, REDFERN — Project No.: 19962/6761C
Client: RICHARD CROOKES CONSTRUCTIONS PTY LIMITED — Report No.: 16/1344
Address: 214 Willoughby Road, Naremburn — Report Date: May 30, 2016
Test Method: AS4133.4.1 —

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: 16/5/2016

Borehole No. BH1

Depth	Test Type	Is(50) (Mpa)	Rock Type	Rock Structure	Moisture
7.82	D	**0.16**	SH	LA	W
7.9	A	**0.19**	SH	LA	W
8.22	D	**0.06**	SH	LA	W
	A	**0.21**	SH	LA	W
9	D	**0.26**	SH	LA	W
	A	**0.28**	SH	LA	W
10.24	D	**0.15**	SH	LA	W
	A	**0.59**	SH	LA	W
11.7	D	**0.09**	SH	LA	W
	A	**0.42**	SH	LA	W
12.21	D	**0.33**	SH	LA	W
12.29	A	**0.93**	SH	LA	W
13.43	D	**0.95**	SH	LA	W
	A	**1.98**	SH	LA	W

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: 16/5/2016

Borehole No. BH1 (Cont.)

Depth	Test Type	Is(50) (Mpa)	Rock Type	Rock Structure	Moisture
14.25	D	**1.41**	SH	LA	W
	A	**2.11**	SH	LA	W
15	D	**1.3**	SH	LA	W
	A	**4.33**	SH	LA	W
16	D	**0.53**	SH	LA	W
	A	**2.49**	SH	LA	W
17.06	D	**1.74**	SH	LA	W
	A	**2.26**	SH	LA	W
19.43	D	**0.67**	SH	LA	W
	A	**1.77**	SH	LA	W

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

Approved Signatory.....

Technician: FV

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: 60-78 REGENT STREET, REDFERN — Project No.: 19962/6761C
Client: RICHARD CROOKES CONSTRUCTIONS PTY LIMITED — Report No.: 16/1344
Address: 214 Willoughby Road, Naremburn — Report Date: May 30, 2016
Test Method: AS4133.4.1 —

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: 25/5/2016

Borehole No. BH2

Depth	Test Type	Is(50) (Mpa)	Rock Type	Rock Structure	Moisture
7.5	D	**0.27**	SH	LA	M
7.9	A	**0.28**	SH	LA	M
8.36	D	**0.29**	SH	LA	M
	A	**0.26**	SH	LA	M
9.24	D	**0.59**	SH	LA	M
	A	**0.9**	SH	LA	M
10.7	D	**0.98**	SH	LA	M
	A	**1.22**	SH	LA	M
11.82	D	**0.73**	SH	LA	M
	A	**2.93**	SH	LA	M
12.26	D	**0.42**	SH	LA	M
	A	**1.65**	SH	LA	M
13	D	**1.15**	SH	LA	M
	A	**3.34**	SH	LA	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: 25/5/2016

Borehole No. BH2 (Cont.)

Depth	Test Type	Is(50) (Mpa)	Rock Type	Rock Structure	Moisture
14.24	D	**0.99**	SH	LA	M
	A	**2.86**	SH	LA	M
15.31	D	**0.43**	SH	LA	M
	A	**2.73**	SH	LA	M
16.57	D	**0.48**	SH	LA	W
	A	**2.52**	SH	LA	W
17.12	D	**1.17**	SH	LA	W
	A	**2.37**	SH	LA	W
18.66	D	**0.42**	SH	LA	W
	A	**2.61**	SH	LA	W
19.77	D	**0.34**	SH	LA	W
	A	**1.09**	SH	LA	W

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

Approved Signatory.....

Technician: FV

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 ***S****oil 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 Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1610789**	Page	: 1 of 4
Client	: **SMEC TESTING SERVICES PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: SMEC TESTING ALL RESULTS	Contact	:
Address	: P O BOX 6989 WETHERILL PARK NSW, AUSTRALIA 2164	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: 19962/19710/19161	Date Samples Received	: 19-May-2016 10:00
Order number	: 12744	Date Analysis Commenced	: 20-May-2016
C-O-C number	: ----	Issue Date	: 24-May-2016 17:22
Sampler	: J K		
Site	: ----		
Quote number	: ----		
No. of samples received	: 9		
No. of samples analysed	: 9		

NATA Accredited Laboratory 825
Accredited for compliance with
ISO/IEC 17025.

NATA
WORLD RECOGNISED ACCREDITATION

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
RICHARD TEA	Lab technician	Sydney Inorganics, Smithfield, NSW

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.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

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

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	19962/S1	19962/S2	19962/S3	S1/0265	S1/0274
				Client sampling date / time	[16-May-2016]	[16-May-2016]	[16-May-2016]	[17-May-2016]	[17-May-2016]
Compound	CAS Number	LOR	Unit		ES1610789-001	ES1610789-002	ES1610789-003	ES1610789-004	ES1610789-005
					Result	Result	Result	Result	Result
EA002 : pH (Soils)									
pH Value	----	0.1	pH Unit		**8.9**	**5.8**	**5.5**	**5.6**	**5.4**
EA010: Conductivity									
Electrical Conductivity @ 25°C	----	1	µS/cm		**----**	**----**	**----**	**130**	**97**
EA055: Moisture Content									
Moisture Content (dried @ 103°C)	----	1	%		**20.1**	**14.7**	**17.7**	**11.7**	**15.1**
ED040S : Soluble Sulfate by ICPAES									
Sulfate as SO4 2-	14808-79-8	10	mg/kg		**250**	**60**	**140**	**120**	**100**
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	10	mg/kg		**110**	**30**	**10**	**----**	**----**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	S1/2217	S1/2229	S1/2230	S1/2231	----
				Client sampling date / time	[17-May-2016]	[17-May-2016]	[17-May-2016]	[17-May-2016]	----
Compound	CAS Number	LOR	Unit		ES1610789-006	ES1610789-007	ES1610789-008	ES1610789-009	--------
					Result	Result	Result	Result	----
EA002 : pH (Soils)									
pH Value	----	0.1	pH Unit		**5.4**	**6.5**	**6.8**	**7.2**	**----**
EA010: Conductivity									
Electrical Conductivity @ 25°C	----	1	µS/cm		**674**	**120**	**236**	**248**	**----**
EA055: Moisture Content									
Moisture Content (dried @ 103°C)	----	1	%		**11.0**	**11.8**	**7.1**	**9.0**	**----**
ED040S : Soluble Sulfate by ICPAES									
Sulfate as SO4 2-	14808-79-8	10	mg/kg		**260**	**160**	**90**	**100**	**----**
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	10	mg/kg		**----**	**----**	**----**	**----**	**----**

Appendix C

Geotechnical Report for 157 Redfern Street, Redfern

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GEOTECHNICAL INVESTIGATION
157 REDFERN STREET, REDFERN

FOR

DEICORP PTY LIMITED

PROJECT NO. 17055/5911B **MARCH 2009**
REPORT NO. 09/0180

TABLE OF CONTENTS **PAGE NO.**

1. INTRODUCTION

This report presents the results of a geotechnical investigation for a proposed residential/commercial/retail development at 157 Redfern Street, Redfern. We understand the development is to consist of sixteen above ground storeys structure with basement car parking. The latter will involve excavating to a maximum depth of about 15 metres below the existing groundsurface.

The purpose of the investigation was to:

- determine the subsurface conditions at the site,
- provide comments on the foundation conditions,
- recommend foundation design parameters,
- comment on the temporary and permanent support of the proposed excavation,
- comment on the rock excavation, and
- comment on the affect of the proposed excavation on the proposed future rail line that will pass under the site.

The work was undertaken at the request of Mr. G. Colbran of DeiCorp Pty Limited.

Our scope of work did not include a contamination assessment.

2. SITE CONDITIONS

The site is some 1500 m^2 in area and is located on the southeastern corner of the intersection of Gibbons and Redfern Streets. At the time of the fieldwork the site was occupied by the existing Redfern RSL Club. The surrounding buildings are commercial buildings.

There was no site vegetation, the non building areas were covered by pavement.

The existing groundsurface falls towards the southwest, relief being about 2 metres.

3. GEOLOGY

The Sydney geological series sheet, at a scale of 1:100,000 shows the site is underlain by Triassic Age Ashfield Shale of the Wianamatta Group near to the contact with Quaternary Age alluvial deposits. These are underlain by Triassic Age Hawkesbury Sandstone. Rocks within the Ashfield Shale formation typically comprise dark grey and black shale and laminite. The alluvial deposits comprise marine sands that were deposited as transgressive dunes. Hawkesbury Sandstone comprises medium to coarse grained quartz sandstone.

No rock outcrops were observed on the site.

4. FIELDWORK

Three boreholes were drilled to depths of between 20.0 and 39.48 metres at the locations shown on Drawing No. 09/0180. The location of the boreholes was agreed with the client. The boreholes were advanced using either an Edson 3000 or Explorer 2000 drilling rig owned and operated by Terratest Pty Limited. The fieldwork was directed by one of our experienced geologists who chose the borehole locations and logged the subsurface conditions encountered. In order to determine soil strengths Standard Penetration Tests (SPTs) were periodically carried out in each of the boreholes. When the rock was of sufficient strength, it was cored with a diamond encrusted cutting shoe.

The subsurface conditions encountered are recorded on the borehole logs given in Appendix A. Photographs of the rock core retrieved are given in Appendix A together with a description of the terms used on the logs. Notes relating to geotechnical reports are also attached.

5. SUBSURFACE CONDITIONS

We have assumed the subsurface conditions encountered in the borehole are representative of the site.

In 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 from a geological model and an engineering opinion is rendered about overall subsurface conditions and their likely behaviour with regard to the proposed development. No matter how comprehensive the investigation may be, it is not always possible to detect all subsurface anomalies and variations that may be present.

The subsurface conditions consist of pavement, minor filling and silty clays overlying weathered shale and sandstone. Details are given below:

PAVEMENT AND FILL: The pavement comprises both concrete and asphaltic concrete. Together with fill these are present to depths of 0.6 to 0.8 metres.

SILTY CLAYS: These are present to depths of 2.7 to 5.5 metres. The strength of these materials range between firm to stiff and very stiff.

SHALE: Weathered shale was observed in all boreholes. In BH2 and BH3, the shale was observed to the depth of drilling, 20.74 and 20.0 metres. In BH1, the shale was present to a depth of 28.8 metres. The shale is of extremely low strength when first encountered and becomes high strength with depth.

SANDSTONE: Weathered sandstone was encountered in BH1 below a depth of 28.8 metres to the depth of drilling, 39.48 metres. The rock is medium and high strength and generally massive.

When water is used in the drilling process it can mask the real water level present. The groundwater depths were measured on various occasions. The depths recorded are given below:

Date	Depth (m)		
	BH1	BH2	BH3
26/2/2009	5.0	4.5	-
10/3/2009	5.0	4.5	5.0
18/3/2009	5.0	4.2	5.0

6. EXCAVATION CONDITIONS AND SUPPORT

The construction of the basement will involve excavating near to the property boundaries. It is of course important that the excavation is adequately supported at all times and that it does not endanger the adjacent properties.

Conventional earth moving equipment, such as excavators, should be capable of removing the soils and some of the jointed rock to a depth of 7 to 8 metres. Below these depths, rock excavation will more than likely require some form of assistance. Care should be taken when using this equipment not to damage adjacent buildings. Based on the subsurface conditions observed in the boreholes and general experience in this geological environment, it is expected that excavation on this site will encounter medium and high strength shales. It is important that the excavation contractor has equipment capable of removing this rock.

Excavators alone without assistance from a breaker will probably not be able to remove any significant amount of the rock below the jointed rock. Hydraulic breakers mounted on an excavator or jack hammers will be required to break up the majority of the rock before it can be removed using an excavator. Other forms of excavation that may be required include ripping, sawing and grinding.

Particular care will be required to ensure that buildings or other developments on adjacent properties are not damaged when excavating the rock. At their closest point some buildings will be adjacent to the excavation. The structures on the adjacent properties are likely founded directly on the shale. Buildings founded directly on rock can often be very susceptible to damage from vibrations transmitted directly through competent rock.

It is extremely difficult to definitively predict the affect of the above type of excavation on adjacent buildings. There are various relations available that have been used to carry out such predictions, but these do not easily take account of the natural variability of rock. There have been many cases in Sydney where predictions based on experience of the above relationships have been proved inaccurate and adjacent structures have been damaged. For these reasons the following comments should only be taken as a guide. Particular care must be exercised when removing the rock and onsite guidance by a vibration specialist will likely be necessary during the early part of the excavation.

When excavating rock adjacent to buildings in adjoining properties a specialist should be employed to monitor onsite vibrations and advise the permissible size of excavation equipment that can be used. If a specialist is not engaged, rock should not be excavated closer than 20 metres to adjoining buildings.

Saw cutting should be carried out before any rock breaking is commenced. 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.

Because of the proximity of the excavation to some of the property boundaries, temporary support will be required for the soils and rock. Reinforced concrete piles with shotcrete infill are probably the most cost-effective option for providing this support. The piles may be drilled and fixed into the material below the base of the excavation. This will provide one fixing point. Where the pile toe is fixed in the rock a passive pressure of 600 kPa may be adopted for the design with a minimum embedment of 1 metre. Additional support may be provided using rows of anchors. These anchors may be installed into the jointed

shale and proportioned using an allowable bond of 500 kPa. All bond lengths should be located outside the active wedge and should not be less than 3 metres.

It is vital that an experienced engineering geologist or geotechnical engineer observes that excavation as it progresses. At that time he will be able to recommend any support that is required for either temporary or permanent conditions.

When considering the design of the supports, it will be necessary to allow for the groundsurface slope, loading from adjacent structures and water pressure. Where the structures 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 properties, it will be necessary to obtain the permission of the property owners. When props or anchors are sued for support, a rectangular earth pressure distribution should be adopted on the active side of the support. The permanent basement support should be designed assuming K_o conditions.

The following parameters are suggested for the design of the temporary and permanent retaining wall system:

Soil & Weathered Shale (to a depth of 8 metres)

Active Earth Pressure Coefficient (K_a)	=	0.4
At Rest Pressure Coefficient (K_o)	=	0.5
Total (Bulk) Density	=	20 kN/m^3

Shale (below a depth of 8 metres)

Earth Pressure Coefficient	=	0.1 or horizontal pressure of 10 kPa (whichever is smaller)
Total (Bulk) Density	=	23 kN/m^3

7. FOUNDATIONS

The allowable bearing pressures given below 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.

At the proposed depth of founding (15 metres) the medium to high strength rock is assessed to be at least Class III shale. An allowable bearing pressure of 3.5 MPa may be used to proportion the footings at this level.

In order to ensure the bearing values given can be achieved, care should be taken to ensure the base of the 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 presence of groundwater needs to be considered when pouring concrete.

Some groundwater flow can be expected into the excavation. The amount of water is unknown, however, a sump with a pump should be adequate to remove most of the water.

8. PROPOSED RAILCORP TUNNEL

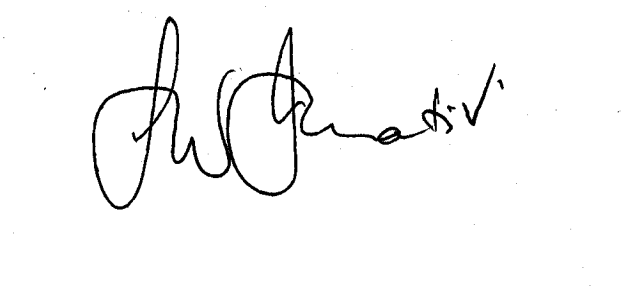
As noted above, we have been informed that RailCorp have plans for a tunnel below the site. We have been informed this tunnel is some 35 metres below the proposed base of the excavation and that provided there is at least 10 metres of sound sandstone above the tunnel, there will be no impact on the rail infrastructure.

Fresh generally high strength sandstone was encountered in BH1 below a depth of 28.8 metres. This means there is about 21 metres of sound sandstone over the proposed tunnel. Therefore, the minimum requirements of RailCorp have been more than satisfied and the proposed construction will not impact on the proposed tunnel.

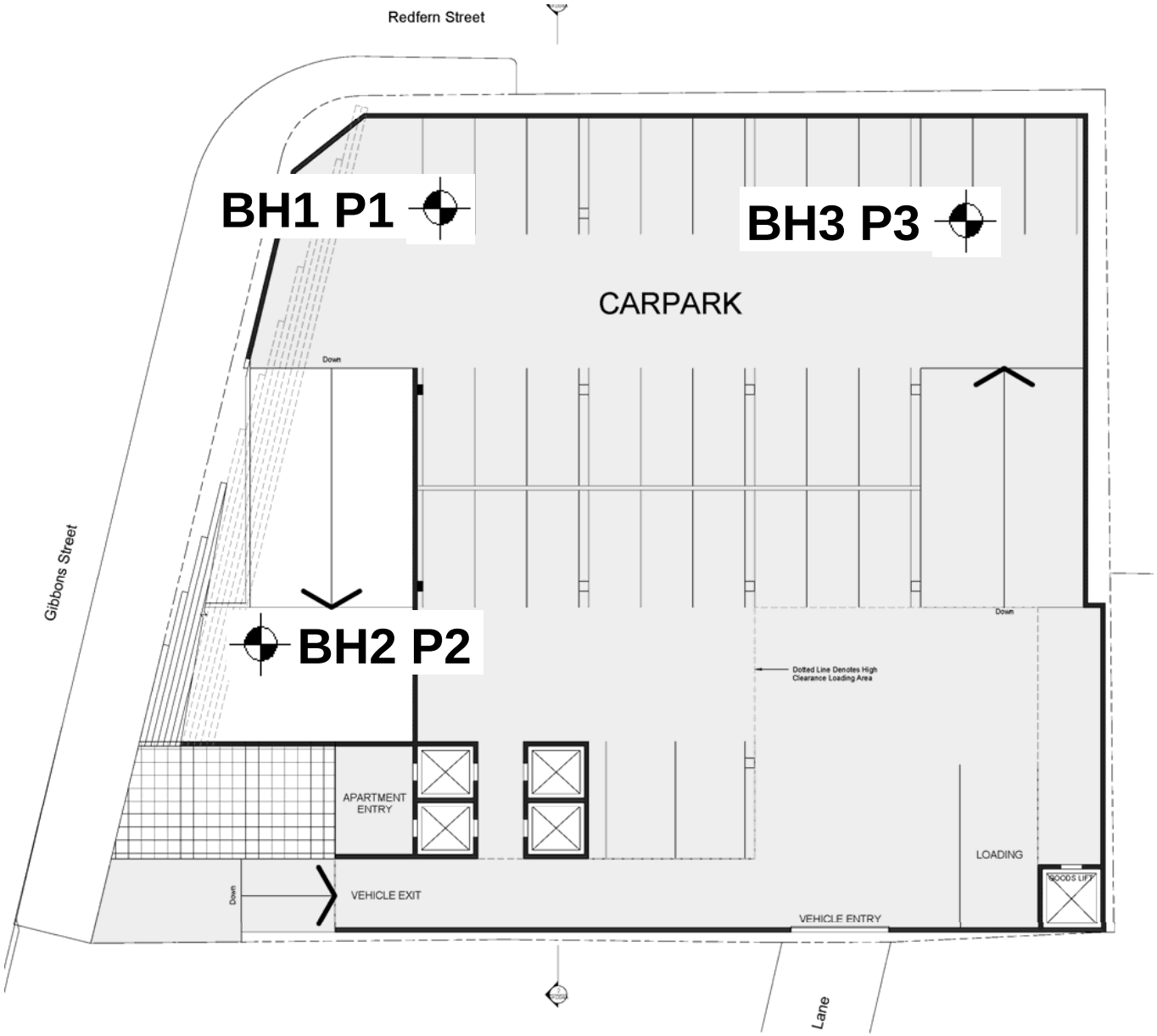
9. FINAL COMMENTS

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

The exposed bearing surfaces should be inspected by a geotechnical engineer to ensure the bearing value given have been achieved.



Laurie Ihnativ, BE, MEngSc, MBA
Manager, SMEC Testing Services Pty Limited



SMEC TESTING SERVICES Pty. Ltd.	Scale: Unknown	Date: February 2009
Client: DEICORP PTY LIMITED		
GEOTECHNICAL INVESTIGATION **157 REDFERN STREET, REDFERN** **BOREHOLE LOCATIONS**	Project No. 17055/5911B	
	Drawing No: 09/0180	

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 & EXPLANATION SHEETS

SMEC Testing Services Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: DeiCorp Pty Limited	Project No.: 17055/5911B	**BOREHOLE NO.: BH 1**
Project: 157 Redfern Street, Redfern	Date : February 18, 2009	Sheet 1 of 8
Location: Refer to Drawing No. 09/0180	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
			CONCRETE (200 mm thick)			
			CLAYEY GRAVELLY SAND: light grey/brown, fine to medium grained, gravel FILL	SC	MEDIUM DENSE	M
		1.0	SILTY CLAY: orange brown with light grey, medium plasticity	CL	FIRM TO STIFF	M
	SPT 1.5-1.95 m 3, 4, 6 N = 10	2.0	SILTY CLAY: light grey with red brown and orange brown, medium plasticity, trace of ironstone gravel	CL	STIFF	M
		3.0	SHALE: light grey/brown with orange brown, fine grained sand, clay seams		EXTREMELY LOW STRENGTH	D
		4.0	WASHBORE DRILLING DISCONTINUED AT 4.0 M For core details, refer to core log sheets			
		5.0				

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

See explanation sheets for meaning of all descriptive terms and symbols

Contractor: Terratest
Equipment: Edson 3000
Hole Diameter (mm): 100
Angle from Vertical (°) 0

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

Client: DeiCorp Pty Limited
Project: 157 Redfern Street, Redfern
Location: Refer to Drawing No. 09/0180

Project / STS No.: 17055/5911B
Date : February 18, 2009
Logged: JK — Checked By: JH

BOREHOLE NO.: BH 1
Sheet 2 of 8

DRILLING				MATERIAL STRENGTH										DISCONTINUITIES		
						Estimated Rock Strength							Joint Spacing (mm)			
Method	Water	Recovery	Depth (m)	Rock Type (Colour, 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												
				For non core details, refer to non core log sheets											
			4.0	START CORING AT 4.0 M											
N Q CORING		11%	5.0	NO CORE 4.0 TO 5.78 M											
			6.0	SHALE: orange brown with light grey and occasional cark grey, fine grained	MW/ HW										5.78-6.0 m, Jt, 0-15 deg. Ir, Ro Cy, fe

Notes:

Contractor: Terratest
Equipment: Edson 3000
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: DeiCorp Pty Limited | Project / STS No.: 17055/5911B | **BOREHOLE NO.: BH 1**

Project: 157 Redfern Street, Redfern | Date : February 18, 2009

Location: Refer to Drawing No. 09/0180 | Logged: JK | Checked By: JH | Sheet 3 of 8

DRILLING				MATERIAL STRENGTH											DISCONTINUITIES	
						Estimated Rock Strength							Joint Spacing (mm)			
Method	Water	Recovery	Depth (m)	Rock Type (Colour, 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)
NQ CORING		79%	7.0	SHALE: orange brown/light grey and occasional dark grey, fine grained	MW/HW		■						■		6.0-6.2 m, Jt 0-15 deg, Ir. Ro, Cy, fe
				NO CORE 6.2 TO 6.73 M											
				SHALE: dark brown/grey, fine grained, clay seams	MW		■						■		6.73-7.1 m, Jt, Ir, Ro, Cy
													■		7.22 m, Jt, 0 deg. Pl, Ro
															7.32 m, Jt, 0 deg. Pl, Sm
															7.44 m, Jt, 0 deg. Pl, Ro, Cy
															opening upon drying
															7.61 m, Jt. 0 deg. Pl, Sm
			8.0												7.85-7.95 m, CZ, Cy
					MW/SW			■							8.1-8.16 m, Sm, Cy
															8.3 m, Jt, 0 deg. Pl, Ro, Cy
															8.38 m, Jt, 0 deg. Pl, Ro
															8.42-8.5 m, Sm, Cy
			9.0	NO CORE 8.5 TO 9.2 M											
		61%		SHALE: dark grey with light grey, fine grained	Fr			■	■				■		9.28-9.34 m, Jt, 90 deg. Ir, Ro
															9.39 m, Jt, 0 deg. Pl, Sm
															9.46 m, Jt, 0 deg. Pl, Sm
															9.54 m, Jt, 0 deg. Pl, Sm
															9.74 m, Jt, 0 deg. Pl, Sm
															9.79 m, Jt, 0 deg. Pl, Sm
			10.0												9.89-9.92 m, Jt, 90 deg. Ir, Ro
															9.93-10.32 m, numerous Jt, 0-90 deg. Ir, Pl, Cy
				NO CORE 10.2 TO 10.85 M											
	↓ water loss	66%	11.0	SHALE: dark grey with light grey, fine grained	Fr			■	■				■		10.85-11.69 m, Numerous Jt, 0 deg. Pl, Ro
															11.7-11.9 m, Sm, Cy
			12.0												

Notes:

Contractor: Terratest

Equipment: Edson 3000

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: DeiCorp Pty Limited
Project: 157 Redfern Street, Redfern
Location: Refer to Drawing No. 09/0180

Project / STS No.: 17055/5911B
Date : February 18, 2009
Logged: JK — Checked By: JH

BOREHOLE NO.: BH 1
Sheet 4 of 8

DRILLING				MATERIAL STRENGTH											DISCONTINUITIES	
						Estimated Rock Strength							Joint Spacing (mm)			
													20 40 100 300 1000			
Method	Water	Recovery	Depth (m)	Rock Type (Colour, Grain Size, Structure & Minor Components)	Weathering	Extremely Low	Very Low	Low	Medium	High	Very High	Extremely High			Visual	Additional Data (Joints, partings, seams, zones etc. Description, orientation, infilling, or coating, shape, roughness, thickness, other)
		66%		SHALE: dark grey with light grey, fine grained	Fr											
																12.26 M, Jt, 0 deg.. Pl, Sm
																12.42 m, Jt, 0 deg. Pl, Sm
																12.68 m, Jt, 0 deg. Pl, Sm
																12.73 m, Jt, 0 deg. Pl, Sm
N																12.86 m, Jt, 0 deg. Pl, Sm
Q			13.0													12.88-12.92 m, numerous Jt, 0 deg. Pl, tight-open
C																13.05 m, Jt, 0 deg. Pl, Ro, cy veneer
O																13.1 m, Jt, 0 deg. Pl, Ro
R																13.12-13.15 m, Jt, 0 deg. Pl, Ro, cy, veneer
I		100%														13.22 m, Jt, 0 deg. Pl, Sm
N																13.31 m, Jt, 0 deg. Pl, Sm
G																13.54-13.84 m, Jt, Ir, Ro, 0-90 deg.
			14.0													
																14.03 m, Jt, 0 deg. Pl, Ro
																14.15 m, Jt, 0 deg. Pl, Ro
																14.23 m, Jt, Ir, Ro, cy
																14.45 m, t, 0 deg. Pl, Ro
																14.59 m, Jt, 0 deg. PL, Ro
																14.69 m, Jt, 0 deg. PL, Ro
																14.87 m, Jt, 2 deg. Pl, Ro
			15.0													
																15.13 m, Jt, 0 deg. Pl, Ro
		100%	16.0													
																16.58 m, Pt, Pl, Ro
																16.8 m, Pt, Pl, Ro
			17.0													
																17.14 m, Jt, 0 deg. PL, Sm
																17.3 m, Jt, 0 deg. Pl, Sm
																17.71 m, Jt, 0 deg. PL, Sm
			18.0													

Notes:

Contractor: Terratest
Equipment: Edson 3000
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: DeiCorp Pty Limited | Project / STS No.: 17055/5911B | **BOREHOLE NO.: BH 1**

Project: 157 Redfern Street, Redfern | Date : February 18, 2009

Location: Refer to Drawing No. 09/0180 | Logged: JK | Checked By: JH | Sheet 5 of 8

DRILLING				MATERIAL STRENGTH											DISCONTINUITIES	
						Estimated Rock Strength							Joint Spacing (mm)			
													20 40 100 300 1000			
Method	Water	Recovery	Depth (m)	Rock Type (Colour, Grain Size, Structure & Minor Components)	Weathering	Extremely Low	Very Low	Low	Medium	High	Very High	Extremely High			Visual	Additional Data (Joints, partings, seams, zones etc. Description, orientation, infilling, or coating, shape, roughness, thickness, other)
NQ CORING		100%		SHALE: dark grey with light grey, fine grained	Fr											
																18.56 m, Jt, 0 deg. Pl, Sm
			19.0													18.93 m, Pt, 0 deg. Pl, Sm 19.02-19.04 m, Jt, -45 deg. Ir, Ro 19.07-19.11 m, Jt, 45 deg, Pl, Sm 19.24-19.26 m, Jt, 20 deg. Pl, Sm
		100%														19.68 m, Jt, 2 deg. Pl, Sm 19.8 m, Jt, 0 deg. PL, Ro
			20.0													20.08 m, Jt, 0 deg. PL, Sm 20.2 m, Jt, 0 deg. Pl, Sm 20.33 m, Jt, 0 deg. PL, Sm
																20.73 m, Jt, 0 deg.. Pl, Sm 20.91 m, Pt. 0 deg. PL, Sm
			21.0													21.26 m, Jt, 0 deg. PL, Sm 21.5 m, Pt, 0 deg. Pl, Ro 21.74 m, Jt, 0 deg. PL, Sm 21.88 m, Jt. 2 deg. Pl, Sm
		100%	22.0													22.03 m, Pt, 0 deg. Pl, Sm 22.17 m, Jt, 0 deg. PL, Ro 22.38 m, Pt, 0 deg. Pl, Sm 22.59 m, Pt, 0 deg. Pl, Sm
			23.0													23.17 m, Pl, 0 deg. Ro, cy veneer 23.2 m, Jt, 0 deg. PL, Sm 22.55 m, Pt, 0 deg. Pl, Ro 23.63-23.7 m, Jt, Und. Tight 23.73-23.76 m, Jt, 5-30 deg. Ir, Ro
			24.0													

Notes:

Contractor: Terratest

Equipment: Edson 3000

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: DeiCorp Pty Limited
Project: 157 Redfern Street, Redfern
Location: Refer to Drawing No. 09/0180

Project / STS No.: 17055/5911B
Date : February 19, 2009
Logged: JK Checked By: JH

BOREHOLE NO.: BH 1
Sheet 6 of 8

DRILLING				MATERIAL STRENGTH													DISCONTINUITIES	
						Estimated Rock Strength							Joint Spacing (mm)					
													20 40 100 300 1000					
Method	Water	Recovery	Depth (m)	Rock Type (Colour, Grain Size, Structure & Minor Components)	Weathering	Extremely Low	Very Low	Low	Medium	High	Very High	Extremely High					Visual	Additional Data (Joints, partings, seams, zones etc. Description, orientation, infilling, or coating, shape, roughness, thickness, other)
NQ CORING		100%	25.0	SHALE: dark grey with light grey, fine grained	Fr													24.03 m, Pt, 0 deg. Pl, Sm 24.25 m, Jt, 0 deg. PL., Ro 24.32 m, Pt, 0 deg.. Pl, Sm 24.83 m, Pt, 0 deg. PL, Sm 25.46 m, Pt, 0 deg. Pl, Sm 25.59-25.7 m, Jt, -80 deg. Ir, Sm, open-tight
			26.0															25.93 m, Pt, 0 deg. Pl, Sm 26.11 m, Jt, 45 deg. PL, Sm, cy veneer 26.36-26.39 m, Jt, 40 deg. Ir, Ro 26.44-26.51 m, Jt, 30-45 deg. Ir, Ro
			27.0															26.9 m, Pt, 0 deg. Pl Sm 27.01-27.23m, numerous Jt, 0 deg Pl, Ro, minor cy 27.37 m, Jt, 0 deg. PL, Sm
		100%	28.0	SHALE: light grey with dark grey, fine grained, occasional sandy interbeds	Fr													27.83 m, Pt, 0 deg. Sm 28.12 m, Pt, 0 deg. Pl, Ro 28.33 m, Jt, 0 deg. Pl, Ro
			29.0	SANDSTONE: light grey with dark grey bands fine to medium grained	Fr													28.76 m, Jt, 0 deg. PL, Ro 28.8m, Jt, 2 deg. PL, Ro 29.6 m, Pt, 0 deg. Pl, Sm 29.82 m, Jt, 0 deg. Pl, Ro
			30.0															

Notes:

Contractor: Terratest
Equipment: Edson 3000
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: DeiCorp Pty Limited
Project: 157 Redfern Street, Redfern
Location: Refer to Drawing No. 09/0180

Project / STS No.: 17055/5911B
Date : February 19, 2009
Logged: JK — Checked By: JH

BOREHOLE NO.: BH 1
Sheet 7 of 8

DRILLING				MATERIAL STRENGTH											DISCONTINUITIES		
						Estimated Rock Strength							Joint Spacing (mm)				
													20 40 100 300 1000				
Method	Water	Recovery	Depth (m)	Rock Type (Colour, Grain Size, Structure & Minor Components)	Weathering	Extremely Low	Very Low	Low	Medium	High	Very High	Extremely High					Visual	Additional Data (Joints, partings, seams, zones etc. Description, orientation, infilling, or coating, shape, roughness, thickness, other)
NQ CORING		100%	31.0	SANDSTONE: light grey with dark grey bands, fine to medium grained	Fr													30.18 M, Pt, 0 deg. Pl, Ro 30.26 m, Pt, 0 deg Pl, Ro 30.7 m, Jt, 0 deg. Pl, Sm cy infill 30.76 m, Jt, 0 deg. Pl, Ro
		100%	32.0															
			33.0															32.9 m, Jt, 0 deg. Pl, Sm 33.19 m, Jt, 0 deg. Pl, Sm, Cy
		100%	34.0															34.13 m, Pl, 0 deg. Pl, Ro
			35.0															34.74 m, Jt, 20 deg. Pl, Ro, cy infill
			36.0															

Notes:

Contractor: Terratest
Equipment: Edson 3000
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: DeiCorp Pty Limited
Project: 157 Redfern Street, Redfern
Location: Refer to Drawing No. 09/0180

Project / STS No.: 17055/5911B
Date : February 19, 2009
Logged: JK — Checked By: JH

BOREHOLE NO.: BH 1
Sheet 8 of 8

DRILLING				MATERIAL STRENGTH		Estimated Rock Strength							DISCONTINUITIES							
													Joint Spacing (mm)							
													20	40	100	300	1000			
Method	Water	Recovery	Depth (m)	Rock Type (Colour, Grain Size, Structure & Minor Components)	Weathering	Extremely Low	Very Low	Low	Medium	High	Very High	Extremely High							Visual	Additional Data (Joints, partings, seams, zones etc. Description, orientation, infilling, or coating, shape, roughness, thickness, other)
NQ CORING		100%		SANDSTONE: light grey with dark grey bands, fine to medium grained	Fr															36.17 m, Pt, 20 deg. Pl, Sm
		100%	37.0																	37.43 m, Pt, 20 deg. Pl, Sm
			38.0																	
			39.0																	
			40.0	BOREHOLE DISCONTINUED AT 39.48 M																
			41.0																	
			42.0																	

Notes:

Contractor: Terratest
Equipment: Edson 3000
Hole Diameter (mm):
Angle from Vertical (°):

See explanation sheets for meaning of all descriptive terms and symbols

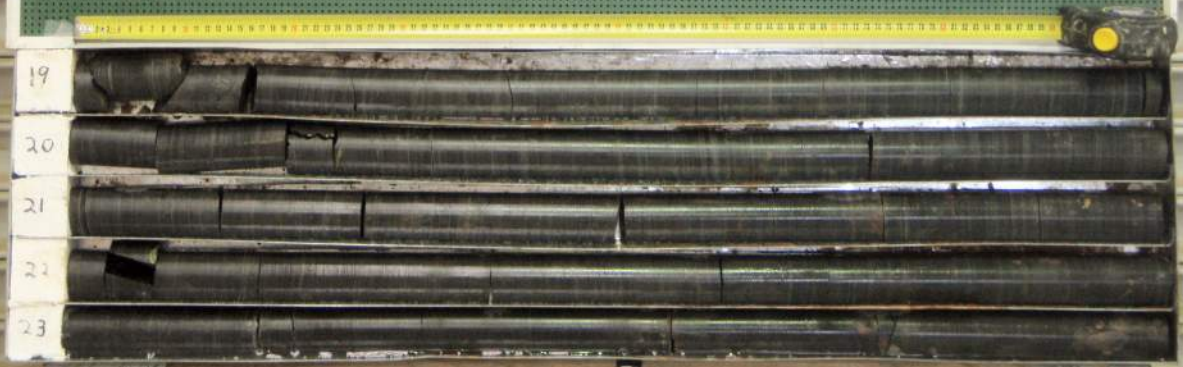

Project: 157 Redfern St., Redfern
Project No: 17055/5911B
Client: DeiCorp Pty Limited
Date Cored: 18/02/09
Borehole No: 1
Depth (m): Start 4.00 - 9.00
Box 1 of 8
SMEC Testing Services
4
START
NO CORE
5
NO CORE
6
NO CORE
5.29
7
8
8.50
NO CORE


Project: 157 Redfern St., Redfern
Project No: 17055/5911B
Client: DeiCorp Pty Limited
Date Cored:18/02/09
Borehole No: 1
Depth (m): 9.00 - 14.00
Box 2 of 8
SMEC Testing Services
9
NO CORE
10
NO CORE
11
12
13


Project: 157 Redfern St., Redfern
Project No: 17055/5911B
Client: DeiCorp Pty Limited
Date Cored:18/02/09
Borehole No: 1
Depth (m): 14.00 - 19.00
Box 3 of 8
SMEC
Testing
Services
14
15
16
17
18

Project: 157 Redfern St., Redfern
Project No: 17055/5911B
Client: DeCorp Pty Limited
Date Cored:18/02/09
Borehole No: 1
Depth (m): 19.00 - 24.00
Box 4 of 8

SMEC Testing Services



Project: 157 Redfern St., Redfern
Project No: 17055/5911B
Client: DeiCorp Pty Limited
Date Cored:18/02/09
Borehole No: 1
Depth (m): 24.00 - 29.00
Box 5 of 8

SMEC Testing Services


Project: 157 Redfern St., Redfern
Project No: 17055/5911B
Client: DeiCorp Pty Limited
Date Cored:18/02/09
Borehole No: 1
Depth (m): 29.00 - 34.00
Box 6 of 8
SMEC Testing Services
29
30
31
32
33

Project: 157 Redfern St., Redfern
Project No: 17055/5911B
Client: DeiCorp Pty Limited
Date Cored:18/02/09
Borehole No: 1
Depth (m): 34.00 - 39.00
Box 7 of 8

SMEC Testing Services


Project: 157 Redfern St., Redfern
Project No: 17055/5911B
Client: DeiCorp Pty Limited
Date Cored:18/02/09
Borehole No: 1
Depth (m): 39.00 - 39.48 End
Box 8 of 8
SMEC Testing Services
39
39.48
END

SMEC Testing Services Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: DeiCorp Pty Limited	Project No.: 17055/5911B	**BOREHOLE NO.: BH 2**
Project: 157 Redfern Street, Redfern	Date : February 19, 2009	
Location: Refer to Drawing No. 09/0180	Logged: JK	Sheet 1 of 5

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
			ASPHALT/SANDY GRAVEL: (230 mm thick)	GW	DENSE	D
			SILTY SANDY CLAY: dark brown, fine grained sand, low plasticity, trace of gravel FILL	CL	VERY STIFF	M
			SILTY CLAY: orange brown with light grey, medium plasticity	CL	STIFF	M
		1.0				
	SPT 1.5-1.95 m 3, 6, 10 N = 16		SILTY CLAY: light grey with red brown and occasional orange brown, medium plasticity, trace of ironstone gravel	CL	STIFF TO VERY STIFF	M
		2.0				
	SPT 3.0-3.45 m 5, 11, 16 N = 27	3.0				
		4.0				
			SILTY CLAY: light grey with occasional red brown, low to medium plasticity, (CW shale)	CL	VERY STIFF	M-D
	SPT 4.5-4.95 m 3, 8, 12 N = 20	5.0				
			SHALE: dark brown/grey with occasional orange brown, fine grained		EXTREMELY LOW STRENGTH	D

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: Explorer 2000
Hole Diameter (mm): 100
Angle from Vertical (°) 0

SMEC Testing Services Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: DeiCorp Pty Limited	Project No.: 17055/5911B	**BOREHOLE NO.: BH 2**
Project: 157 Redfern Street, Redfern	Date : February 19, 2009	Sheet 2 of 5
Location: Refer to Drawing No. 09/0180	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
			SHALE: dark brown/grey with occasional orange brown, fine grained		EXTREMELY LOW STRENGTH	D
			WASHBORE DRILLING DISCONTINUED AT 6.1 M			
			For core details, refer to core log sheets			
		7.0				
		8.0				
		9.0				
		10.0				
		11.0				

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: Explorer 2000
Hole Diameter (mm): 100
Angle from Vertical (°) 0

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

Client: DeiCorp Pty Limited
Project: 157 Redfern Street, Redfern
Location: Refer to Drawing No. 09/0180
Project / STS No.: 17055/5911B
Date : February 19, 2009
Logged: JK
Checked By: JH

BOREHOLE NO.: BH 2
Sheet 3 of 5

DRILLING				MATERIAL STRENGTH														DISCONTINUITIES	
						Estimated Rock Strength							Joint Spacing (mm)						
Method	Water	Recovery	Depth (m)	Rock Type (Colour, 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)
				START CORING AT 6.1 M (For non core details refer to non core log sheets)															
				NO CORE 6.1 TO 6.2 M															
		75%		SHALE: dark brown/grey with occasional orange brown, fine grained	HW														6.2-8.05 m, numerous Jt, fractured, cy, Ir, Ro
		100%	7.0																
				SHALE: dark grey with occasional orange brown, fin grained, clay seams	MW/ SW														
		60%	8.0	SHALE: dark grey with light grey bands, fine grained	SW														8.05 m, Jt, 0 deg. Pl, Sm 8.14-822 m, Sm, Cy
N Q C O R I N G																			8.41 m, Jt, 0 deg. Pl, Sm 8.56 m, Jt, 0 deg. Pl, Sm 8.67 m, Jt, 0 deg. Pl, Sm 8.7-8.92 m, Jt, - deg. Pl, Ro, minor cy, open-tight
					Fr														
			9.0																9.16-9.2 m, Sm, Cy
				NO CORE 9.2 TO 9.76 M															
		100%		SHALE: dark grey with light grey bands, fine grained	Fr														9.83 m, Jt, 0 deg. PL, Sm
			10.0																10.07 m, Pt, 0 deg. Pl, Ro 10.2 m, Jt, 0 deg. Pl, Sm 10.32 m, Pt, 0 deg. Pl, Ro 10.37 m, Pt, 0 deg. Pl, Ro 10.48 m, Jt, 0 deg. PL, Sm 10.62 m, Pt, 0 deg. Pl, Sm 10.72 m, Jt, 0 deg. PL, Sm, cy veneer 10.8-11.26 m, numerous Jt, 0 deg. Pl, Ro tight-open
			11.0																11.32 m, Jt, 0 deg. PL, Ro 11.4 m, Jt, 0 deg. PL, Ro 11.5 m, Jt, 0 deg. Pl, Ro 11.63 m, Jt, 2 deg. Pl, Ro 11.68 m, Jt, 5 deg. Pl, Sm 11.77 m, Jt, 0 deg. PL, Sm 11.96 m, Jt, 0 deg. Pl, Sm
			12.0																

Notes:

Contractor: Terratest
Equipment: Explorer 2000
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: DeiCorp Pty Limited
Project: 157 Redfern Street, Redfern
Location: Refer to Drawing No. 09/0180

Project / STS No.: 17055/5911B
Date : February 19, 2009
Logged: JK — Checked By: JH

BOREHOLE NO.: BH 2
Sheet 4 of 5

DRILLING				MATERIAL STRENGTH													DISCONTINUITIES	
						Estimated Rock Strength							Joint Spacing (mm)					
Method	Water	Recovery	Depth (m)	Rock Type (Colour, 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)
NQ CORING		100%		SHALE: dark grey with light grey bands, fine grained	Fr														12.03 m, Pt, 0 deg. Pl, Sm
																			12.06 m, Pt, 0 deg. Pl, Sm
																			12.13 m, Jt, 0 deg. PL, Sm
																			12.21 m, Jt, 0 deg. PL, Sm
																			12.31-12.4 m, numerous Jt/Pt, Pl, Ro
																			12.54 m, Jt, 0 deg. Pl, Sm
																			12.65-12.7 m, cz, Cy
																			12.76-12.79 m, Jt, Ir, Ro
			13.0																
																			13.05-13.93 m, Jt, 10-90 deg. Ir, Ro, occ. Cy
		100%																	
			14.0																
																			14.05 m, Jt, 0 deg. Pl, Sm
																			14.28-14.3 m, Jt, 30 deg. Pl, Sm
																			14.31 m, Jt, 20 deg. Pl, tight
																			14.34 m, Jt, 20 deg. Pl, tight
																			14.54-14.58 m, Jt, 40 deg. Pl, Ro
																			14.71 m, Jt, 0 deg. Pl, Ro
																			14.77-14.9 m, Jt, 85 deg. Pl, Ro
			15.0																
																			15.22 m, Jt, 0 deg. PL, Ro
																			15.27-15.32 m, Jt, 35 deg. Pl, Sm
																			15.43 m, Jt, 0 deg. Pl, Sm
																			15.59 m, Jt, 0 deg. Pl, Sm
			16.0																
																			15.83 M, Jt, 0 deg. Pl, Sm
																			15.87 m, Jt, 0 deg. Pl, Sm
																			16.1 m, Pt, 0 deg. Pl, Sm
																			16.27 m, Jt, 5 deg. Pl, Ro
																			16.37 m, Pt, 5 deg. Pl Ro
																			16.51 m, Jt, 0 deg. Pl, Sm
		100%																	
																			16.8 m, Jt, 0 deg. Pl, Ro
			17.0																
																			17.17 m, Pt, 0 deg. Pl, Ro
																			17.3 m, Jt, 0 deg. Pl, Ro
		100%																	
																			17.78 m, Jt, 0 deg. Pl, Sm
			18.0																

Notes:

Contractor: Terratest
Equipment: Explorer 2000
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: DeiCorp Pty Limited
Project: 157 Redfern Street, Redfern
Location: Refer to Drawing No. 09/0180
Project / STS No.: 17055/5911B
Date : February 19, 2009
Logged: JK Checked By: JH

BOREHOLE NO.: BH 2
Sheet 5 of 5

DRILLING				MATERIAL STRENGTH											DISCONTINUITIES	
						Estimated Rock Strength							Joint Spacing (mm)			
Method	Water	Recovery	Depth (m)	Rock Type (Colour, 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)
NQ CORING		100%		SHALE: dark grey with light grey bands, fine grained	Fr										18.17 m, Pt, 0 deg. Pl, Ro
															18.43 m, Jt, 0 deg. Pl, Sm
															18.48 m, Jt, 0 deg. Pl, Sm
															18.56-18.64 m, Jt, Pl, Ro, cy infill
			19.0												18.8 m, Jt, 0 deg. Pl, Ro
															19.11 m, Pt, 0 deg. Pl Sm
															19.23 m, Pt, 0 deg. Pl, Sm
		100%													19.44 m, Jt, 0 deg. Pl, Sm
			20.0												19.95 m, Pt, 0 deg. Pl, Sm
															20.07 m, Jt, 0 deg. PL., Sm
															20.23 m, Pt, 0 deg. Pl, Sm
															20.44 m, Jt, 0 deg. Pl, Ro
															20.47 m, Jt, 0 deg. Pl, Ro
				BOREHOLE DISCONTINUED AT 20.74 M											
			21.0												
			22.0												
			23.0												
			24.0												

Notes:

Contractor: Terratest
Equipment: Explorer 2000
Hole Diameter (mm):
Angle from Vertical (°):

See explanation sheets for meaning of all descriptive terms and symbols

Project: 157 Redfern St., Redfern
Project No: 17055/5911B
Client: DeiCorp Pty Limited
Date Cored:18/02/09
Borehole No: 2
Depth (m): Start 6.10 - 11.00
Box 1 of 3

SMEC Testing Services


Project: 157 Redfern St., Redfern
Project No: 17055/5911B
Client: DeiCorp Pty Limited
Date Cored:18/02/09
Borehole No: 2
Depth (m): 11.00 - 16.00
Box 2 of 3
SMEC
Testing
Services
11
12
13
14
15


Project: 157 Redfern St., Redfern
Project No: 17055/5911B
Client: DeiCorp Pty Limited
Date Cored:18/02/09
Borehole No: 2
Depth (m): 16.00 - 20.74 End
Box 3 of 3
SMEC
Testing
Services
16
17
18
19
20
20.74 End

SMEC Testing Services Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: DeiCorp Pty Limited	Project No.: 17055/5911B	**BOREHOLE NO.: BH 3**
Project: 157 Redfern Street, Redfern	Date : February 20, 2009	
Location: Refer to Drawing No. 09/0180	Logged: JK	Sheet 1 of 5

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
			ASPHALT/SANDY GRAVEL: dark grey, fine to medium grained	GW	DENSE	D
			CLAYEY SAND: dark brown with orange brown, fine to medium grained, trace of gravel	SC	STIFF	M
			FILL			
		1.0	SILTY CLAY: orange brown with red brown and light grey, medium plasticity. occasional ironstone gravel	CL	STIFF	M
	SPT 1.5-1.95 m 4, 4, 7 N = 11	2.0	SILTY CLAY: light grey with red brown, medium plasticity, trace of ironstone gravel occasional bands of shale and ironstone	CL	STIFF WITH BANDS OF VERY STIFF	M
	SPT 2.5-2.95 m 7, 12, 14 N = 26	3.0				
	SPT 4.0-4.45 m 12, 16, 19 N = 35	4.0				
			SHALE: orange brown with red brown and dark grey, fine grained, clay seams		EXTREMELY LOW STRENGTH	D
		5.0				

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

See explanation sheets for meaning of all descriptive terms and symbols

Contractor: Terratest
Equipment: Edson 3000
Hole Diameter (mm): 100
Angle from Vertical (°) 0

SMEC Testing Services Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: DeiCorp Pty Limited	Project No.: 17055/5911B	**BOREHOLE NO.: BH 3**
Project: 157 Redfern Street, Redfern	Date : February 20, 2009	
Location: Refer to Drawing No. 09/0180	Logged: JK	Sheet 2 of 5

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
			SHALE: orange brown with red brown and dark grey, fine grained, clay seams		EXTREMELY LOW STRENGTH	D
		7.0				
		8.0				
			WASHBORE DRILLING DISCONTINUED AT 8.5 M For core details, refer to core log sheets			
		9.0				
		10.0				
		11.0				

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: Edson 3000
Hole Diameter (mm): 100
Angle from Vertical (°) 0

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

Client: DeiCorp Pty Limited
Project: 157 Redfern Street, Redfern
Location: Refer to Drawing No. 09/0180
Project / STS No.: 17055/5911B
Date : February 20, 2009
Logged: JK Checked By: JH

BOREHOLE NO.: BH 3
Sheet 3 of 5

DRILLING				MATERIAL STRENGTH														DISCONTINUITIES	
						Estimated Rock Strength							Joint Spacing (mm)						
													20	40	100	300	1000		
Method	Water	Recovery	Depth (m)	Rock Type (Colour, Grain Size, Structure & Minor Components)	Weathering	Extremely Low	Very Low	Low	Medium	High	Very High	Extremely High						Visual	Additional Data (Joints, partings, seams, zones etc. Description, orientation, infilling, or coating, shape, roughness, thickness, other)
			7.0																
			8.0	For non core details, refer to non core log sheets															
				START CORING AT 8.5 M															
N M L C CORING			9.0	SHALE: dark grey with orange brown, fine grained, clay seams	MW														8.5-10.21 m, numerous Jt, Ir, Ro, Cy tight Jt opening upon drying
		100%		SHALE: dark grey with light grey bands, fine grained	Fr/St														
					Fr														
		100%	10.0																10.22 m, Jt, 0 deg. Pl Ro 10.35 m, Jt, 0 deg. Pl, Ro 10.38 m, Jt, 0 deg. PL, Ro 10.47 m, Jt, 0 deg. Pl, Ro 10.53-10.56 m, Jt, 30 deg. Ir, Ro
		100%	11.0																10.7 m, Jt, 0 deg. Pl, R 10.76 m, Jt, 0 deg. PL, Ro 10.86 m, Jt, 0 deg. Pl, Ro 10.94 m, Jt,0 deg. Pl, Ro 11.1 m, Jt, 0 deg. Pl Ro 11.24 m, JT, 0 deg. PL, Ro 11.34 m, Jt, 0 deg. PL, Ro 11.41 m, Jt, 0 deg. PL, Ro 11.48 m, Jt, 0 deg. Pl, Ro
		100%	12.0																11.7-12.35 m, numerous Jt, 0 deg. Pl, Ro/Sm

Notes:

Contractor: Terratest
Equipment: Edson 3000
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: DeiCorp Pty Limited
Project: 157 Redfern Street, Redfern
Location: Refer to Drawing No. 09/0180
Project / STS No.: 17055/5911B
Date : February 20, 2009
Logged: JK
Checked By: JH

BOREHOLE NO.: BH 3
Sheet 4 of 5

DRILLING				MATERIAL STRENGTH												DISCONTINUITIES	
						Estimated Rock Strength							Joint Spacing (mm)				
Method	Water	Recovery	Depth (m)	Rock Type (Colour, 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)
				SHALE: dark grey with light grey bands, fine grained	Fr												
		100%															12.65 m, Jt
			13.0														
																	13.22-13.33 m, Jt, 45 deg. Pl, Ro
																	13.48 m, Jt, 0 deg. Pl, Sm
																	13.63 m, Jt, 0 deg. PL, Sm
																	13.84 m, Pt, 0 deg. Pl, Sm
			14.0														13.91 m, Jt, 0 deg. Pl, Sm
																	14.05 m, Pt, 0 deg. Pl, Sm
																	14.14 m, Jt, 0 deg. Pl, Sm
																	14.29 m, Jt, 0 deg. Pl, Sm
N																	
M																	14.4 m, Jt, 0 deg. Pl, Ro
L																	
C		100%															14.65 m, JT, 0 deg. Pl, Ro
C																	14.89 m, Jt, 0 deg. Pl, Ro
O			15.0														
R																	15.03 m, Pt, 0 deg. PL, Ro
I																	
N																	15.29 m, Jt, 0 deg. Pl, Sm
G																	15.38 m, Jt, 0 deg. Pl, Ro
																	15.62 m, Jt, 0 deg. Pl, Ro
			16.0														15.94 m, Pt, 0 deg. Pl, Sm
																	16.02 m, Pt, 0 deg. Pl, Ro
																	16.42 m, Pt, 0 deg. Pl, Sm
																	16.73 m, Pt, 0 deg. Pl, Sm
			17.0														
																	17.2 m, Pt, 0 deg. Pl, Sm
		100%															17.44 m, Pt, 0 deg. Pl, Sm
																	17.6 m, Jt, 0 deg. Pl, Sm
																	17.74 m, Pt, 0 deg. Pl, Ro
																	17.87 m, Pt, 0 deg. Pl, Sm
			18.0														

Notes:

Contractor: Terratest
Equipment: Edson 3000
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: DeiCorp Pty Limited
Project: 157 Redfern Street, Redfern
Location: Refer to Drawing No. 09/0180

Project / STS No.: 17055/5911B
Date : February 20, 2009
Logged: JK — Checked By: JH

BOREHOLE NO.: BH 3
Sheet 5 of 5

DRILLING				MATERIAL STRENGTH														DISCONTINUITIES	
						Estimated Rock Strength							Joint Spacing (mm)						
Method	Water	Recovery	Depth (m)	Rock Type (Colour, 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)
NMLC CORING		100%	19.0	SHALE: dark grey with light grey bands, fine grained	Fr														18.43-19.08 m, Jt, 90 deg. Ir, Ro, fractured 19.24 m, Jt, 0 deg. Pl, Sm 19.4 m, Jt, 0 deg. Pl, Sm 19.66 m, Jt, 0 deg. PL, Ro 19.95 m, Pt, 0 deg. Pl, Sm
			20.0																
			21.0	BOREHOLE DISCONTINUED AT 20.0 M															
			22.0																
			23.0																
			24.0																

Notes:

Contractor: Terratest
Equipment: Edson 3000
Hole Diameter (mm):
Angle from Vertical (°):

See explanation sheets for meaning of all descriptive terms and symbols


Project: 157 Redfern St, Redfern
Project No: 17055/5911B
Client: DeiCorp Pty Limited
Date Cored:18/02/09
Borehole No: 3
Depth (m): Start 8.50 - 13.00
Box 1 of 3
SMEC Testing Services
BH3 17055
Start
No Core
9
10
11
12

Project: 157 Redfern St., Redfern
Project No: 17055.5911B
Client: DeiCorp Pty Limited
Date Cored:18/02/09
Borehole No: 3
Depth (m): 13.00 - 18.00
Box 2 of 3

SMEC Testing Services


Project: 157 Redfern St., Redfern
Project No: 17055/5911B
Client: DeiCorp Pty Limited
Date Cored:18/02/09
Borehole No: 3
Depth (m): 18.00 - 20.00 End
Box 3 of 3
SMEC
Testing
Services
18
19

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 ***S****oil 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	
Cross 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 nthe 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

APPENDIX B

POINT LOAD TEST RESULTS

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

Point Load Strength Index Report

Project: 157 Redfern Street, Redfern
Client: DiCorp Pty Limited
Address: 5/140 - 152 New Canterbury Rd, Petersham
Test Method: AS 4133.4.1

Project No.: 17055 / 5911B
Report No.: 09/0174
Report Date: 24/02/2009

Samples Supplied By: Terratest
Date Samples Drilled / Taken: 18/2/09
Borehole No. BH1

Depth	Test Type	Is(50) (Mpa)	Rock Type	Rock Structure	Moisture
9.68	D	0.22	SH	LA	M/D
9.68	A	0.03	SH	LA	M/D
12.78	D	0.14	SH	LA	M/D
12.78	A	0.36	SH	LA	M/D
13.96	D	1.08	SH	LA	M/D
13.96	A	1.15	SH	LA	M/D
15.40	D	1.33	SH	LA	M/D
15.40	A	2.70	SH	LA	M/D
17.07	D	1.21	SH	LA	M/D
17.07	A	1.68	SH	LA	M/D
20.24	D	0.03	SH	LA	M/D
20.24	A	1.48	SH	LA	M/D
22.08	D	0.30	SH	LA	M/D
22.08	A	0.45	SH	LA	M/D

Samples Supplied By: Terratest
Date Samples Drilled / Taken: 18/2/09
Borehole No. BH1

Depth	Test Type	Is(50) (Mpa)	Rock Type	Rock Structure	Moisture
25.88	D	0.46	SH	LA	M/D
25.88	A	0.43	SH	LA	M/D
27.93	D	0.94	SH	LA	M/D
27.93	A	1.72	SH	LA	M/D
29.96	D	1.39	SS	MA	M/D
29.96	A	1.22	SS	MA	M/D
32.94	D	1.19	SS	MA	M/D
32.94	A	1.24	SS	MA	M/D
34.04	D	1.89	SS	MA	M/D
34.04	A	1.44	SS	MA	M/D
36.36	D	1.67	SS	MA	M/D
36.36	A	1.38	SS	MA	M/D
39.43	D	1.80	SS	MA	M/D
39.43	A	1.34	SS	MA	M/D

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:

Approved Signatory.....

Technician: JK

James Hughes - QA Manager

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

Point Load Strength Index Report

Project: 157 Redfern Street, Redfern
Client: DiCorp Pty Limited
Address: 5/140 - 152 New Canterbury Rd, Petersham
Test Method: AS 4133.4.1

Project No.: 17055 / 5911B
Report No.: 09/0174
Report Date: 24/02/2009

Samples Supplied By: Terratest
Date Samples Drilled / Taken: 18/2/09
Borehole No. BH2

Depth	Test Type	Is(50) (Mpa)	Rock Type	Rock Structure	Moisture
8.28	D	0.40	SH	LA	M/D
8.28	A	0.57	SH	LA	M/D
10.41	D	0.40	SH	LA	M/D
10.41	A	0.43	SH	LA	M/D
12.10	D	0.76	SH	LA	M/D
12.10	A	2.51	SH	LA	M/D
15.04	D	2.46	SH	LA	M/D
15.04	A	6.04	SH	LA	M/D
17.21	D	1.98	SH	LA	M/D
17.21	A	2.41	SH	LA	M/D
20.04	D	0.70	SH	LA	M/D
20.04	A	6.13	SH	LA	M/D

Samples Supplied By: Terratest
Date Samples Drilled / Taken: 18/2/09
Borehole No. BH3

Depth	Test Type	Is(50) (Mpa)	Rock Type	Rock Structure	Moisture
10.42	D	0.14	SH	LA	M/D
10.42	A	0.70	SH	LA	M/D
12.6	D	0.34	SH	LA	M/D
12.6	A	3.51	SH	LA	M/D
14.09	D	0.20	SH	LA	M/D
14.09	A	4.95	SH	LA	M/D
16.5	D	1.43	SH	LA	M/D
16.5	A	3.03	SH	LA	M/D
18.06	D	1.44	SH	LA	M/D
18.06	A	3.47	SH	LA	M/D
20.6	D	2.36	SH	LA	M/D
20.6	A	2.77	SH	LA	M/D

STRUCTURE
MA= MASSIVE
BE= BEDDED
LA= LAMINATED
CR= CRYSTALLINE

TEST TYPE
A= AXIAL
D= DIMETRAL
I= IRREGULAR
C= CUBE

MOISTURE CONDITION
W= WET
M= MOIST
D= DRY

ROCK TYPE
SS= SANDSTONE
ST= SILTSTONE
SH= SHALE
YS= CLAYSTONE
IG= IGNEOUS

Remarks:

Approved Signatory.....

Technician: JK

James Hughes - QA Manager

Appendix D

Pile Logs 60-78 Regent Street, Redfern

IGLU Redfern, 60-78 Regent Street Redfern - Pile Log

RICHARD CROOKES CONSTRUCTIONS

Pile number	Pile type	Depth of drilling (m)	Top of concrete RL	Bottom of Pile RL	Required concrete (mPa)
1	P10	9.3	30.18	20.88	32
2	P10	9.2	30.18	20.98	32
3	P10	8.9	29.78	20.88	32
4	P10	9.4	29.18	19.78	32
5	P10	9.7	29.26	19.56	32
6	P10	9.7	28.862	19.16	32
7	P11	9.8	30.18	20.38	32
8	P6	10	30.08	20.08	40
9	P6	9.5	29.68	20.18	40
10	P9	9.7	29.08	19.38	40
11	P4	11.35	29.16	17.81	50
12	P6	9.3	28.862	19.56	40
13	P3	9.5	29.68	20.18	50
14	P11	9.6	30.23	20.63	32
15	P8	9.5	29.68	20.18	40
16	P7	10.1	29.14	19.04	40
17	P7	9.3	29.14	19.84	40
18	P10	9.8	28.64	18.84	32
19	P8	9.5	29.68	20.18	40
20	P1	9.7	29.14	19.44	40
21	P1	9.6	29.14	19.54	40
22	P5	10.3	29.14	18.84	50
23	P5	10.6	28.8	18.20	50
24	P11	9.6	30.23	20.63	32
25	P11	9.6	30.23	20.63	32
26	P1	9.7	29.14	19.44	40
27	P1	9.6	29.14	19.54	40
28	P10	9.6	30.23	20.63	32
29	P10	10.1	29.58	19.48	32
30	P10	9.4	29.58	20.18	32
31	P10	9.8	29.05	19.25	32
32	P10	10.7	28.64	17.94	32
33	P10	10.3	28.85	18.55	32
34	P12	10.3	29.75	19.45	32
35	P12	10.4	26.6	16.20	32
36	P10	9.55	28.3	18.75	32
37	P10	9.4	28.105	18.71	32
38	P10	9.8	27.75	17.95	32
39	P11	9.3	27.75	18.45	32
40	P11	10	28.3	18.30	32
41	P11	10	28.105	18.11	32
42	P11	9.8	27.75	17.95	32
43	P12	10.3	29.75	19.45	32
44	P5	11.5	28.97	17.47	50
45	P15	10.6	27.5	16.90	40
46	P15	10.65	27.5	16.85	40
47	P6	9.9	28.3	18.40	40
48	P13	10	28.15	18.15	32
49	P13	10	28.15	18.15	32
50	P2	10.4	27.5	17.10	40
51	P2	10.8	27.5	16.70	40
52	P2	10.8	27.5	16.70	40
53	P2	10.6	27.5	16.90	40
54	P6	10.3	27.67	17.37	40
55	P2	10.9	27.88	16.98	40
56	P2	10.7	27.88	17.18	40
57	P11	9.8	28.43	18.63	32
58	P11	9.7	28.43	18.73	32
59	P2	10.8	27.88	17.08	40
60	P2	10.7	27.88	17.18	40
61	P5	10.4	27.67	17.27	50
62	P6	10.3	27.67	17.37	40
63	P1	10.4	27.88	17.48	40
64	P1	10.1	27.88	17.78	40
65	P10	9.5	27.4	17.90	32
66	P10	9.1	27.4	18.30	32
67	P10	9	27.4	18.40	32
68	P10	9.2	27.9	18.70	32
69	P11	9.4	26.9	17.50	32
70	P11	9.3	26.9	17.60	32
71	P10	9.5	27.9	18.40	32
72	P10	9.3	27.4	18.10	32
73	P10	9.1	27.4	18.30	32
74	P10	9	27.4	18.40	32
75	P11	10.1	27.9	17.80	32
76	P10	9.6	28.15	18.55	32
77	P10	9.6	27.4	17.80	32
78	P11	10.5	27.4	16.90	32
79	P10	9.3	27.4	18.10	32
80	P11	10.5	26.6	16.10	32
81	P11	9.9	26.4	16.50	32
82	P11	9.6	26.4	16.80	32
83	P10	9.5	27.5	18.00	32
84	P10	9.4	27.5	18.10	32
85	P10	8.5	27.18	18.68	32
86	P10	9.4	26.4	17.00	32
87	P11	9	29.65	20.65	32
88	P14	10.3	26.95	16.65	40
89	P14	10.2	26.95	16.75	40
90	P14	10.1	26.95	16.85	40