APPENDIX E

Civil, Structural and Geotechnical Reports

E1. Response to DGRs **E2.** Stormwater Concept Plan **E3.** Erosion and Sediment Control Plan **E4.** Geotechnical Report 1 (October 2009) **E5.** Geotechnical Report 2 (June 2010) **E6.** Civil and Structural Engineering Report **E7.** Site Audit Interim Advice

E1: Response to DGRs

Prepared by SCP Consulting Pty Ltd

STRUCTURAL & CIVIL ENGINEERING WORKS

EXECUTIVE SUMMARY

In summary, the structural and civil engineering works required for the proposed development will generally comprise the following:

1. Sediment and Erosion Control:
   - To protect local drainage systems from pollutants generated during construction activity.
2. Bulk Earthworks and Soil Contamination:

   _ To provide a basement level and suitable foundation for the proposed structure.

   Site contamination investigation was undertaken by Argus in October 2009. The soil samples analysed were generally lower than the relevant regulatory guideline criteria. The report stated that the risk to human health and the environment associated with soil contamination on the site are low in context of the proposed use of the site.

3. Stormwater Drainage and Stormwater Quality:
   - To provide a stormwater collection and conveyance system incorporating on-site stormwater detention to ensure that stormwater runoff from the site does not have a detrimental effect on the proposed development, neighbouring properties and downstream drainage systems.
   - To provide stormwater quality improvement devices as part of the stormwater drainage system to ensure that stormwater pollutants are removed from stormwater runoff prior to discharging from the site to ensure there is no detrimental effect on the downstream drainage system and receiving waterway.
   - To provide a drainage connection to Council's existing stormwater system in Susan Street to provide a lawful point of discharge from the development site.
   - All rainwater re-use to be designed and detailed by the services consultant.
4. Roads and Carparking:
   - To provide entry and exit points to the site.
   - To provide all weather access to the proposed development.
5. Pedestrian Walkways, Footways and General Site Regrading:
   - To provide accessible roads, car parks, pedestrian links and landscaped areas throughout the site.
   - The proposed civil engineering works will be designed and constructed in accordance with Council and the relevant Service Authorities standards and requirements, Building Code of Australia and the relevant Australian Standards.

1. DESIGN STANDARDS AND CODES

The structural and civil engineering works will be designed in accordance with the latest issue of all relevant design standards, codes and other statutory and authority requirements. As a minimum requirement, the design will be based on but not limited to:

- AS 1170.0 – 2002 SAA Loading Code Part 0 General Principles
- AS 1170.1 – 2002 SAA Loading Code Part 1 Dead and Live Loads
- AS 1170.2 – 2002 SAA Loading Code Part 2 Wind Loads
- AS 1170.4 – 2007 SAA Loading Code Part 4 Earthquake Loads
- AS 4100 – 1998 Steel Structures
- AS 3600 – 2009 Concrete Structures
- AS 3700 – 2001 Masonry Structures
- AS 2159 – 1995 Piling Code
- AS 4678 – 2002 Retaining Structures Code
- Council's Civil Works Specification
- Council's Water Management Development Control Plan
- Managing Urban Stormwater: Soils and Construction Manual
- Australian Rainfall & Runoff
- Australian Water Quality Runoff
- AS 3500.3 Stormwater Drainage
- AS 2890.1 Off Street Car Parking
- AS 2890.2 Commercial Parking Facilities
- AS 1742 Manual of Uniform Traffic Control Devices
- New South Wales Roads & Traffic Authority (RTA) Traffic Control at Worksites manual
- Austroads – Pavement Design, A Guide to the Structural Design of Road Pavements

2. BUILT FORM

SCP Consulting has provided structural input into the architectural planning by reviewing the following building elements:

- Column Sizes:- Preliminary column sizes (minimum dimensions) are being assesses so as to comply with both strength and fire resistance.
- Building Stability:- Earthquake & Wind resisting lift and stair cores are to be strategically located such that the building does not twist or deflect excessively.
- Floor Framing:- The structural framing and orientation of the floor beams within the floor slab system will take into account the direction of mechanical a/c ducts, building cantilevers and the required fire resistance.

3. GROUND WATER

Refer to the Geotechnical Investigation Report prepared by Aargus Pty Ltd on 15 June 2010.

4. SEDIMENT AND EROSION CONTROL

Temporary sediment and erosion control measures will be designed to be incorporated into the construction works and sequencing of the project to ensure that the proposed construction activities on site do not pollute local drainage systems nor have a detrimental effect on downstream waterways.

A concept Sediment and Erosion Control Plan has been provided in Appendix E3.

6. BULK EARTHWORKS and SOIL CONTAMINATION

The excavation will extend to RL 23.90 which is approximately 12m below street level. The bulk of the excavation will occur in Class IV/V shales. All vertical excavation faces will be completely shored to support all external ground. Temporary anchors for the shoring will be required and approval will be obtained from the local authorities.

The site was investigated by Aargus Pty Ltd to conduct an Environmental Site Assessment (ESD) in October 2009.

Based on the results of this investigation it is considered that the risks to human health and the environment associated with the soil contamination at the site are low.

The site is therefore considered suitable for ongoing use and the proposed development.

The criteria to assess soil contamination by the Argus report was the National Environmental Protection Council (1999) *National Environmental Protection (Assessment of site contamination) Measure* (NEPM). Also with respect human health, the analytical results were assessed against risk based health investigation (HIL) guidelines appropriate for industrial and commercial development (HIL 'F').

The NEPM 1999 does not include investigation levels for TPH and BTEX. These were assessed using the NSW EPA (1994) "Guidelines for Assessing Service Station sites"

All soil acidity and salinity is addressed in the Geotechnical Investigation Report prepared by Aargus Pty Ltd on 15 June 2010.

6. STORMWATER DRAINAGE

Stormwater drainage for the site will be designed to collect and convey stormwater drainage via a conventional piped stormwater drainage system for storm events up to and including a 1 in 20 year Average Recurrence Interval (ARI) storm event.

On-site stormwater detention (OSD) will be provided in accordance with Sydney Water's requirements as outlined in their advice dated 10 March 2010 (see Attachment A). In summary, a minimum storage of 81m3 and a maximum site discharge of 152l/s will be provided.

The site is located at a high point within the local drainage catchment and is therefore not affected by flooding or external overland flow paths. Provision will

be made for the safe conveyance of storm flows via overland flow paths within the development site for storm events up to the 1 in 100 year ARI storm event. Adequate freeboard will be provided within defined overland flow paths within the development site to allow some protection from overland flows generated from storm events larger than a 1 in 100 year ARI event.

Stormwater pollution control devices will be incorporated into the site stormwater drainage system to assist with the removal of sediment, oils and hydrocarbons from stormwater runoff from the road and carpark areas.

A concept Stormwater Drainage Plan showing the OSD and discharge/connection point has been provided in Appendix E2.

All rainwater collection for re-use will be design and detailed by the services consultant (SKM).

7. ROADS AND CARPARKS

Design and document the new roads and footpaths so that the geometry complies with the relevant standards.

Swept turning paths of suitable design vehicles will be reviewed and considered in the design.

Design and document traffic control staging plans in accordance with the RTA's Traffic Control at Worksites manual. This will allow staging of the construction works while maintaining vehicular access to hospital facilities during construction of the civil works.

8. PEDESTRIAN WALKWAYS / FOOTWAYS AND GENERAL SITE GRADING

Design and document the proposed pedestrian walkways and footways within the hospital site. Locations and treatments shall be provided by the architect and landscape architect.

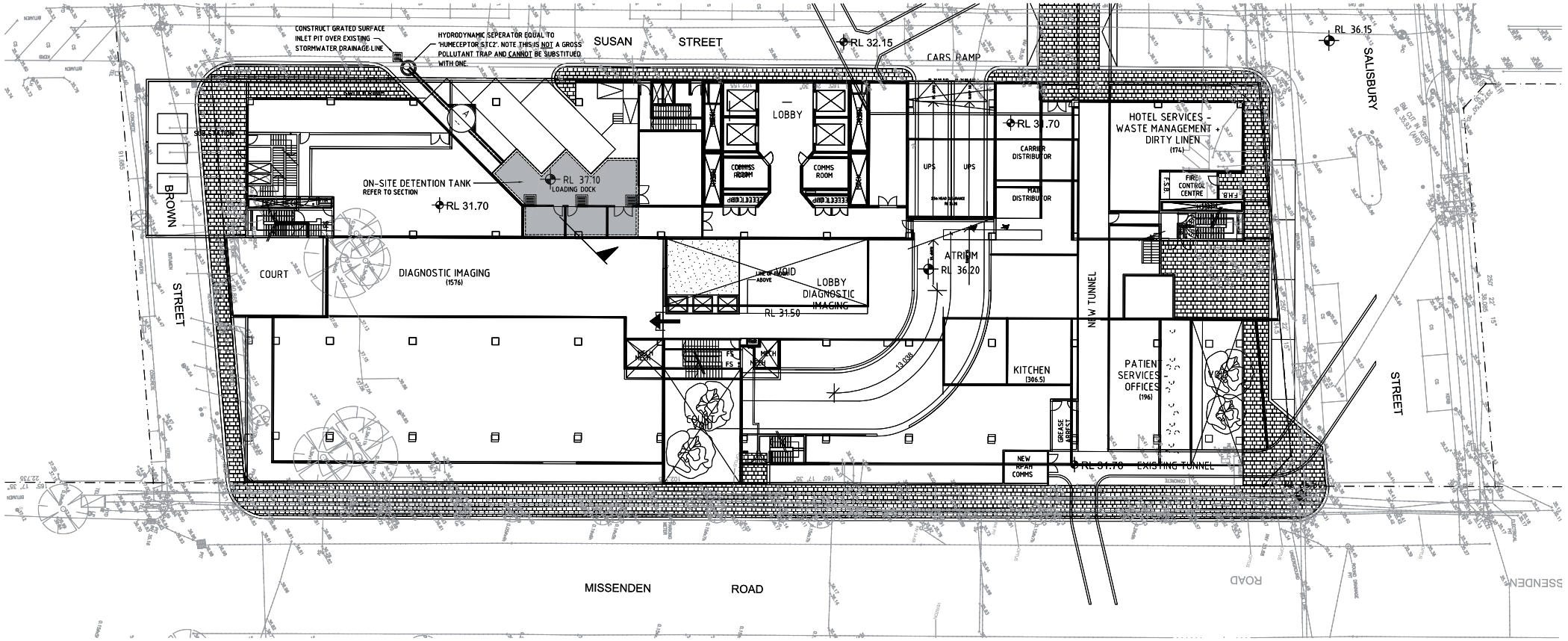
Design and document the grading of site areas between the buildings and roads to ensure that the areas are adequately drained.

Design and document pedestrian control staging plans in accordance with the RTA's Traffic Control at Worksites manual. This will allow staging of the construction works while maintaining pedestrian access to hospital facilities during construction of the civil works.

E2: Stormwater Concept Plan

Prepared by SCP Consulting Pty Ltd

A1



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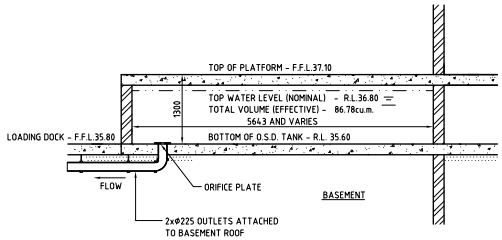

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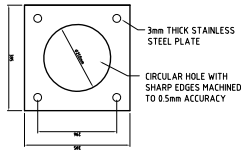

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P2	TT	20/05/10	E.S.	20/05/10	ADJUSTED ON-SITE DETENTION TANK LOCATION - ISSUE FOR PART 3A..
P1	TT	04/05/10	E.S.	04/05/10	PRELIMINARY ISSUE FOR COMMENT

CONSULTING ENGINEERS
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PHONE: (02) 8209 3846
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ABN 21 118 134 240

DESIGNED	T.TOMIC	DATE	04/05/10
VERIFIED	E. SHIN	DATE	04/05/10
DRAWN	T. TOMIC	SCALE @ A1	AS NOTED

LIFEHOUSE PROJECT, R.P.A.

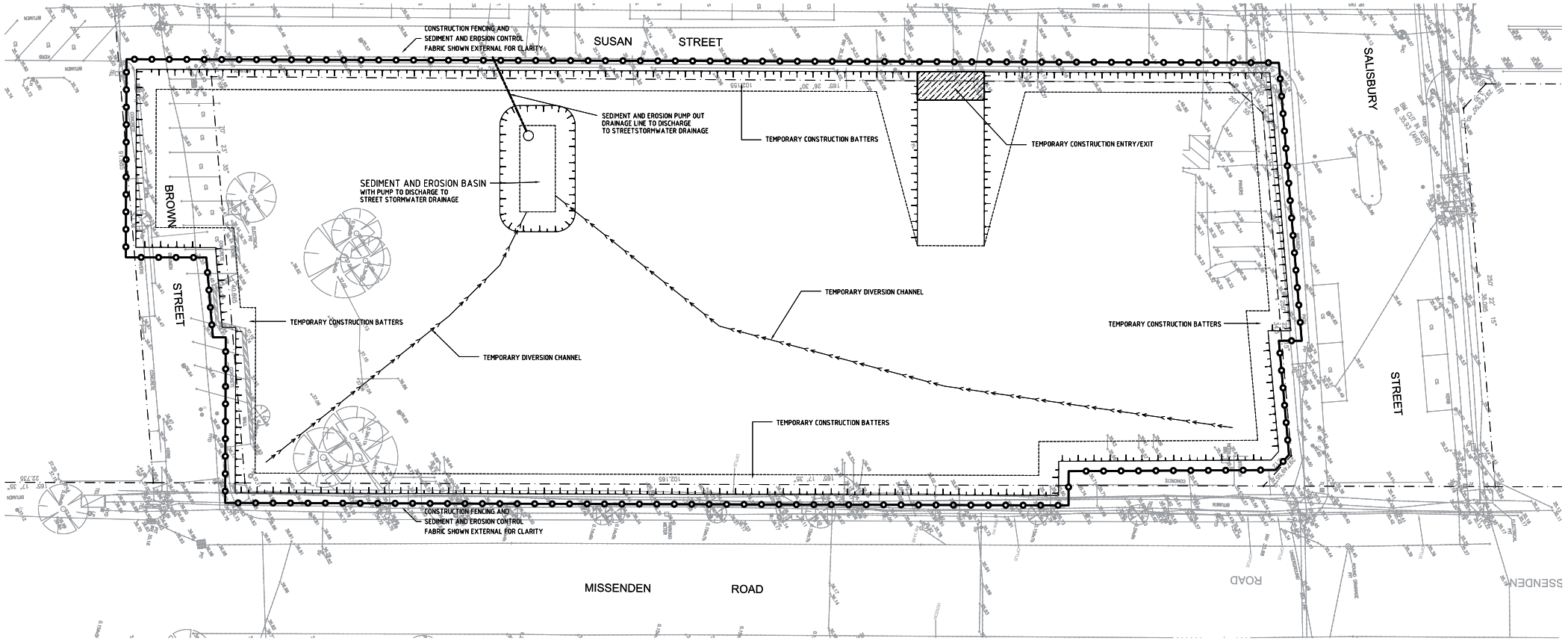
CONCEPT
STORMWATER DRAINAGE

STATUS	DRAWING No.	REVISION
CONCEPT/PRELIMINARY	00502_C001	P2

E3: Erosion and Sediment Control Plan

Prepared by SCP Consulting Pty Ltd

A1



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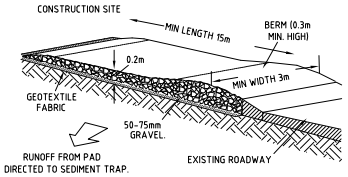

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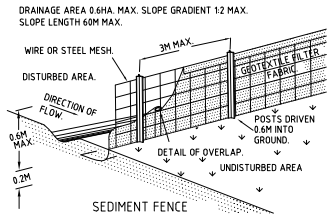

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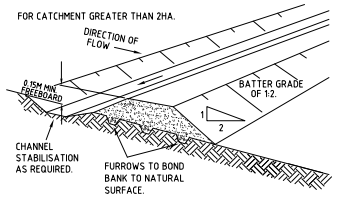

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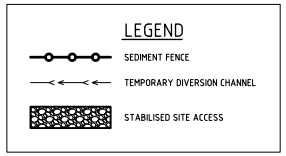

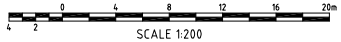

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REV.	DES.	DATE	VER.	DATE	DESCRIPTION
P1	TT	20/05/10	E.S.	20/05/10	ISSUE FOR PART 3A APPROVAL

CONSULTING ENGINEERS
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ABN 21 118 134 240

DESIGNED	T.TOMIC	DATE	04/05/10
VERIFIED	E. SHIN	DATE	04/05/10
DRAWN	T. TOMIC	SCALE @ A1	AS NOTED

LIFEHOUSE PROJECT, R.P.A.

CONCEPT
SEDIMENT AND EROSION CONTROL PLAN

STATUS	DRAWING No.	REVISION
CONCEPT/PRELIMINARY	00502_C002	P1

E4: Geotechnical Investigation Report 1

Prepared by Aargus Pty Ltd (October 2009)

Aargus
AUSTRALIA

ACN 063 579 313
Environmental Services - Remediation - Geotechnical Engineering - Drilling

LIFEHOUSE AT RPA LIMITED

CAPITAL INSIGHT PTY LTD

PAGE CHEST PAVILLION AND BROWN STREET OUTPATIENT BUILDING

MISSENDEN ROAD, CAMPERDOWN

GEOTECHNICAL INVESTIGATION

Report No.:	GS2948/1
Prepared By:	AC:MC
Date:	19th October 2009
Client:	Lifehouse at RPA Ltd
	c/o Capital Insight Pty Ltd
	77 Berry St, North Sydney NSW, 2060

TABLE OF CONTENTS

1.0 INTRODUCTION

This report details the results of a Geotechnical Investigation carried out at the Page Chest Pavillion and Brown Street Outpatient Buildings in Missenden Road, Camperdown.

The investigation was commissioned by Mr Tim Dugan, CEO of Lifehouse at RPA.

The purpose of the geotechnical assessment was to determine the details of the sites surface and subsurface conditions in order to provide advice and recommendations from a geotechnical viewpoint for the design and construction of the proposed Lifehouse Building.

2.0 PROPOSED DEVELOPMENT

At the time of preparation of this report, the following documentation was provided to us:

- A Geotechnical brief titled "Brief for Provision of Services for Geotechnical Engineer", Referenced 18102-70409-6.3-PC-pc-Geotech-V4, prepared by Capital Insights Pty Ltd.
- Document titled "Conditions of Engagement – Geotechnical Engineer", Referenced 18104-70409-6.3-PC-pc-Engage Geotech, prepared by Capital Insights Pty Ltd.

With reference to the above listed documents, the following is understood:

- The proposed development involves the demolition of existing site features and the construction of the Lifehouse Building, which will have up to eleven-storeys above ground and will contain two levels of below-ground basement.
- The proposed building will be linked by below ground tunnels to the adjacent oncology building to the west, King George V Building to the north and the main RPA campus to the east.
- The site is bounded by Salisbury Road to the north, Susan Street to the west, Brown Street to the south and Missenden Road to the east.
- Two existing brick buildings are present within the site. A multi-storey building "Page Chest Building" is located in the northern portion of the site, whilst a single-storey building "Brown Street Outpatients Building" is located in the southern portion of the site, we understand that these buildings will be demolished as part of the development.

3.0 METHOD OF INVESTIGATION

In order to gain an understanding of the sites geotechnical conditions and to provide the necessary information for the geotechnical assessment, the following fieldwork was carried out over the period covering the 6th October 2009 to 12th October 2009 under the supervision of a Senior Engineering Geologist, Senior Geotechnical Engineer and a Geotechnical Engineer from our office:

- A detailed walk-over inspection of the site by a Geotechnical Engineer/ Engineering Geologist.
- On-site subsurface services locating by a specialist sub-contractor using electromagnetic detection equipment.
- Concrete coring at the intended borehole locations
- Drilling of five (5) boreholes, at locations as near as possible to client nominated locations. The boreholes were drilled using a truck-mounted drill rig fully equipped for geotechnical investigations, in order to identify the subsurface soil and/or rock profile. The boreholes were drilled initially using a V-bit attached to solid flight augers to refusal in bedrock, and further continued using a T-C bit in the weathered shale bedrock. The boreholes were then advanced into the Shale bedrock using NMLC diamond rock coring techniques.
- Recovered rock cores were carefully boxed on site and returned to our laboratory for testing.
- Reinstatement of the boreholes with the displaced soils and a concrete cap.

Borehole locations are shown on Figure 1 attached to this report.

4.0 SURFACE AND SUBSURFACE CONDITIONS

4.1. Location

The site is located within the south western extents of Camperdown bordered by Missenden Road, Susan St, Salisbury road and Brown Street.

4.2. Topography

The site generally slopes down towards the North West at grades of between about 1^{o} & 2^{o}, with the surrounding topography gently undulating with overall ground slopes dipping from West to East.

4.3. Site Description

The site is near rectangular in shape, covering an area of approximately 4160m^2, and measures approximately 104m along the Eastern (Missenden Rd) and Western Boundaries (Susan Street), and approximately 40m along the Northern (Salisbury Road) and Southern (Brown Street) boundaries. The northern half of the footprint of the proposed development is currently occupied by the multi storey "Page Chest Pavilion" and the southern half of the site by a single storey brick building with basement level.

Existing subsurface pedestrian tunnels extend from the "Page Chest Building" to buildings to the north, east and west. Based on the presence of these tunnels, we anticipate that at least one basement level may be present below this building.

The existing buildings cover the entire site area with the exception of a small grassed area located within the south-eastern corner of the site.

4.4. Regional Geology

Reference to the Sydney 1:100,000 Geological Series Sheet 9130 Edition 1, 1983 indicates that the site is underlain by Ashfield Shale (Rwa) of the Wianamatta Group, which comprises black to dark grey shale and laminite.

4.5. Subsurface Conditions

Subsurface conditions encountered within the boreholes are detailed on the engineering logs presented in Appendix A of this report and have been summarised as follows:

PAVEMENT	ASPHALTIC CONCRETE, to depths of between about 0.055m (BH4) and 0.11m (BH1), underlain by
	CONCRETE, to depths of between about 0.175m (BH5) and 0.31m (BH1), underlain by,
	ROADBASE, CLAY & ASH, to depths of between about 0.3m (BH4) and 0.4m (BH1), underlain by,
RESIDUAL	CLAY & Silty CLAY: medium to high plasticity, pale orange , orange, red and pale grey, to depths of between about 1.2m (BH5) and 1.9m (BH4), underlain by,
	CLAY & Silty CLAY: medium plasticity, pale grey and red brown, interbedded with ironstone and shale gravel layers, to depths of between about 3.2m (BH1) and 5.5m (BH3 & BH4), underlain by,

BEDROCK SHALE, extremely weathered, very low strength, brown and dark grey, to depths of between about 4.0m (BH1) and 7.6m (BH4), overlying,

SHALE, distinctly weathered, low to medium strength, dark grey, to borehole termination depths of between about 7.55m (BH1) and depths 10.85m (BH5).

The following should also be noted:

- BH5 did not encounter Asphaltic Concrete.
- BH5 did not have a roadbase layer below the concrete pavement.
- BH5 encountered uncontrolled, poorly compacted fill comprising silty sands and silty clay to a depth of about 1.2m below existing ground surface levels.

Table 1: Summary of Soil and Rock Properties

Depth (m)	**BH 1**	**BH 2**	**BH 3**	**BH 4**	**BH 5**
Approx. Surface RL	33.8m	38.0m	38.5m	38.8m	38.8m
Asphaltic Concrete	0 – 0.11	0 - 0.10	0 – 0.06	0 - 0.055	NE
Concrete	0.11 – 0.31	0.10 – 0.30	0.06 – 0.24	0.055 – 0.245	0 – 0.175
Roadbase	0.31 – 0.40	0.30 – 0.40	0.24 – 0.39	0.245 – 0.30	NE
Fill	NE	NE	NE	NE	0.175 – 1.2
Residual Clay	0.40 – 1.30	0.40 – 1.3	0.39 – 1.9	0.30 – 1.6	NE
Interbedded Clay & shale/ironstone	1.3-3.2	1.3 – 3.3	1.9 – 5.5	1.6 – 5.5	1.2 – 5.4
VL St Shale	3.2-4.0	3.3 – 4.5	5.5 – 7.0	5.5 – 7.65	5.4 -6.8
L-M St Shale	4.0-7.55+	4.5 – 10.3+	7.0 – 10.45+	7.65 – 9.95+	6.8 - 10.85+
V Bit Refusal	1.3	1.3	1.9	1.6	1.2
Borehole Termination Depth	7.55	10.3	10.45	9.95	10.85

Notes : **Units are in metres (m)**
Reduced Levels (RL) estimated from survey plan
Not Encountered (NE)
Very Low Strength (VL)
Low to Medium Strength (L-M)

4.6. Groundwater Conditions

Groundwater was encountered in BH 4 at a depth of approximately 6.7m. Water used for rock coring techniques prevented the measuring of groundwater during the process of rock coring. It should be noted however, that fluctuations in the level of groundwater might occur due to variations in rainfall and/or other factors.

5.0 LABORATORY TESTING

Recovered rock cores from all boreholes were returned to our NATA accredited laboratory for testing. The testing carried out on the rock samples was the Point Load Strength Index Test. The Point Load Strength Indices for the rock cores and the assessed rock strengths, in accordance with Australian Standards (Reference 1), are summarised in the following table, Table 2.

Table 2: Point Load Strength Test Results

Borehole	Depth (m)	Diametral $I_{s(50)}$ (MPa)	Axial $I_{s(50)}$ (MPa)	Assessed Strength
1	5.75	NT	0.50	M
1	6.31	NT	0.25	L
1	6.69	NT	0.72	M
1	7.22	NT	0.54	M
2	7.32	0.16	0.38	M
2	7.76	0.21	0.60	M
2	8.25	0.36	0.46	M
2	8.67	0.38	0.56	M
2	9.25	0.48	0.72	M
2	9.93	0.06	0.56	M
3	7.85	0.17	0.44	M
3	8.29	0.10	0.33	M
3	8.75	0.33	0.36	M
3	9.14	0.15	0.40	M
3	9.84	0.25	0.89	M
3	10.14	0.13	0.59	M
4	7.58	0.10	0.03	VL
4	8.47	0.45	0.28	M
4	9.38	0.27	0.13	L
5	7.85	0.35	0.61	M

5	8.32	0.64	0.63	M
5	8.73	0.31	0.30	M
5	9.20	0.35	0.38	M
5	9.87	0.38	0.48	M
5	10.43	0.23	0.55	M

Notes: **Units are in metres (m)**
Not Tested (NT)
VL – Very Low Strength
L – Low Strength
M – Medium Strength

Based on the rock core strengths (Table 2) and the rock discontinuities (shown in the core logs), the bedrock from the proposed development site is classified for foundation design purposes in accordance with Pells et al (Reference 2) as detailed in Table 3

Table 3: Rock Classification

Borehole	Depth (m)	Rock Classification (Reference 2)
1	4.00 – 7.55	Class IV
2	4.50 – 10.30	Class IV
3	7.00 – 10.43	Class IV
4	7.65 – 8.38	Class V
	8.38 – 9.42	Class IV
	9.42 – 9.65	Class V
	9.65 – 9.95	Class IV
5	7.72 – 9.26	Class IV
	9.26 – 9.37	Class V
	9.37 – 10.84	Class IV

6.0 COMMENTS AND RECOMMENDATIONS

6.1. Existing Fill Materials

Fill material was encountered at each borehole location comprising asphaltic concrete, concrete and road base pavement materials within BH1, BH2, BH3 & BH4. Fill within BH5 was poorly compacted and comprised sand, clay and gravels. We note that the existing roads do not form part of the development and as such, for design purposes, the pavement materials may be neglected for the purposes of this report.

6.2. Excavation Conditions

Based on the limited drawings provided, excavation is proposed for two basement levels with a possibility of a third basement level being excavated. As such, it is expected that excavations will extend to depths of between about 6.0m and 9.0m below existing ground surface levels.

Excavations will encounter limited fill materials and natural clays, extremely weathered shale and clayey shale and low to medium strength shale bedrock.

Excavations of these materials may be achieved using conventional earthmoving equipment such as excavators or dozers.

Trafficability problems may arise locally during wet weather, or if water is allowed to pond on these materials. However as seepage was encountered during augering of the overburden soils and weathered bedrock in BH4 at a depth of 6.7m, we do anticipate some groundwater seepage into the proposed excavations. It should be noted however, that groundwater conditions of a site might change with climatic and other factors. It is our assessment that groundwater inflow during excavation, if any, may be adequately handled by a conventional sump and pump system without impacting on regional groundwater levels.

6.3. Retaining Structures and Batter Slopes

Materials likely to be encountered during excavation are likely to comprise minor fill, natural clays, possibly with some interbedding of ironstone and shale. Very steep or vertical faces could not be maintained in these materials. Excavations in these materials would need to be appropriately battered or retained by engineered retaining structures prior to excavation.

For unsupported cuts in these materials, up to a height of about 2.0m, the recommended batter slopes are presented in the following Table 4.

Table 4: Recommended Batter Slopes For Unsupported Cuts (not exceeding 2m in height)

Material	Temporary (Horizontal : Vertical)		Permanent (Horizontal : Vertical)	
	Exposed	Protected	Exposed	Protected
Fill & clays	1.5:1.0	1.0:1.0	2.5:1.0	2.0:1.0

Surface protection of the cut slope can be provided by shotcrete. If required, the shotcrete may be reinforced. Adequate surface and sub-surface drainage must be provided to prevent the build-up of hydrostatic pressures behind the installed shotcrete.

Temporary surface protection may also be provided by means of covering with plastic sheeting. It should be noted however, that the plastic sheeting should extend at least 2m behind the crest of the cut face, augmented with a v-drain near the crest of the cut face to divert all surface runoff from the cut face.

As excavation progresses, the cut faces should be inspected by a Geotechnical Engineer or Engineering Geologist, to assess localised shotcreting requirements, batter slope stability and to assess the suitability of recommended parameters for the design of retaining structures.

However, we note that it is anticipated that the majority of site excavations will extend to site boundaries and as such, insufficient area will be available to batter the majority of proposed excavation faces. Batter slopes, steeper than those recommended above would need to be retained by engineered retaining structures prior to excavation. Appropriate retaining structures would comprise either contiguous pile or discrete soldier pile walls, installed prior to excavation and in-filled with concrete panels to form the wall during excavation. Retaining walls may be socketed into and founded in medium strength or better shale bedrock, as a cantilever wall, below the bulk excavation level.

The pressure distribution on such retaining structures may be assumed to be triangular and estimated as follows:

$$p_h = \gamma kH + qk$$

Where,

p_h = Horizontal pressure (kN/m^2)
γ = Wet density (kN/m^3)
k = Coefficient of earth pressure (k_a or k_o)
H = Retained height (m)
q = Surcharge pressure behind retaining wall (kN/m^2)

For the design of flexible retaining structures, where some lateral movement is acceptable, an active earth pressure coefficient is recommended. Should it be critical to limit the horizontal deformation of a retaining structure, use of an earth pressure

coefficient at rest should be considered. Recommended parameters for the design of retaining structures are presented in the following Table 5.

TABLE 5: Design Parameters For Retaining Structures

Founding Material	Unit Weight (kN/m^3)	Active Earth Pressure Coefficient	Passive earth pressure	At rest earth pressure Coefficent
Fill	18	0.50	Ignore	0.60
Natural Overburden Soils – Stiff Consistency	18	0.40	Ignore	0.55
Natural Overburden Soils – Hard Consistency	20	0.25	Ignore	0.40
Shale Bedrock, weathered, low and medium strength	20	0.20	200kPa	0.30

The foregoing coefficients assume that the ground level behind the retaining structures is horizontal and the retained material is effectively drained.

The design of any retaining structure should be checked for bearing capacity, overturning, sliding and overall stability of the slope.

Should the retaining structures be anchored or strutted, the earth pressure may be assumed to be rectangular and estimated as 5.5H kPa for the residual soil profile and 4H for the Class V shale bedrock, where H is the retained height.

Should retained soil be subject to groundwater pressure, additional earth pressure resulting from groundwater should be allowed for in the design.

A qualified Structural Engineer should check the design of any retaining structures for bearing capacity, overturning, sliding and overall stability of the slope.

Surcharge loading from neighbouring structures (if present) should also be taken into account in the design of retaining structures should it be within the zone of influence of the excavation. The zone of influence is defined as a plane projected from the toe of the excavation into the excavation face upwards towards the ground surface at 45 degrees from horizontal.

Where permanent retaining structures have not been provided to retain the excavation, the building wall at the lower ground floor level should be designed to provide permanent support to the excavation faces.

6.4. Floor Slabs

"Uncontrolled" fill was encountered in BH5 only, there is a potential that these materials may be encountered at other locations at existing ground surface levels. However, we anticipate that the majority of the site will be excavated to depths of between about 6.0m and 9.0m below existing ground surface levels, exposing extremely weathered shale bedrock or better. Concrete infill slabs may be utilised at these depths.

If isolated ground bearing slabs are required at existing ground surface levels, existing uncontrolled fill materials must be excavated and replaced in a "controlled" manner to form a platform for support of the ground bearing slabs. The existing fill material is considered suitable for reuse as "Controlled" fill provided all over size, deleterious and other demolition refuse is sieved and removed prior to reuse and subject to appropriate moisture conditioning.

If ground floor slabs are bearing on varying materials of distinct types (controlled fill and bedrock or residual clays and bedrock) differential settlement of the slabs is likely to occur unless a very rigid slab is used. Therefore, we recommend that where varying subgrade materials are exposed across the footprint of ground bearing slabs, these materials should be over-ripped to a depth of 0.3m, mixed to homogenise and recompacted to a minimum dry density ratio of 100% standard within 2% of optimum moisture content (OMC).

Ground bearing slabs founded on constructed fill platforms (by replacement of suitable portions of the existing "uncontrolled" fill) may be designed for a Modulus of Subgrade Reaction value of 15kPa/mm

6.5. Footings

Based on the limited documentation provided, we anticipate that footings for the proposed building will need to bear on shale bedrock. We anticipate that shale bedrock will be exposed at or near bulk excavation level. As such, shallow or deep footings below bulk excavations are considered suitable for the proposed development.

Shallow or deep footings founded and socketed a minimum of 0.3m into the respective classes of shale bedrock may be designed for the serviceability end bearing capacities detailed in Table 6.

TABLE 6: Serviceability End Bearing Capacity of Footings.

Founding Material	Serviceability End Bearing Capacity
Shale (Class V)	600kPa
Shale (Class IV)	1000kPa

Likewise, bored shoring piers, comprising discrete soldier piers or contiguous piles founded and socketed into at least Class IV shale bedrock or better, may be design for a vertical loading of 1000kPa end bearing.

We recommend that bored piers are socketed at least 0.3m into the respective rock class, in order to confirm that the recommended serviceability end bearing capacity has been achieved.

It should be noted that a zone of influence of 1.5 times the pile diameter or minimum footing dimension is to be considered for foundation design. Therefore, should the zone of influence of footings extend between rock classes, the lower of the rock class should be adopted.

The total settlement of piers and shoring piers founded in shale bedrock under the recommended serviceability end bearing capacity is estimated to not exceed about 1% of the minimum footing dimension or pier diameter and the differential settlements are estimated to be about half of the estimated total settlements.

It is recommended that all footings are founded below and outside the zone of influence of excavations.

It must be noted however, that foundations pertaining to the same structure are to be founded on similar materials to minimise the potential for differential movement.

7.0 LIMITATIONS & GENERAL COMMENTS

The assessment of the sub-surface profile at the proposed development site and the recommendations presented in this report are based on information from five boreholes drilled at client nominated locations. Significant differences in geotechnical conditions occur across the site and as such, there is a possibility that the actual geotechnical conditions across the site could differ from the inferred geotechnical model (on which our recommendations are based) presented in this report. Groundwater seepage was only encountered in one of the boreholes during augering in the overburden soils and weathered bedrock. There is however, a possibility that groundwater levels or minor seepage could be encountered during excavation.

We recommend that this office is contacted immediately for further advice if the sub-surface and groundwater conditions encountered during construction vary from those presented in this report.

Please do not hesitate to contact the undersigned if you have any queries.

For and on behalf of
Aargus Engineering

Adrian Collins
Geotechnical Engineer

Reviewed by

Matthew Cupitt BSc (App Geol)
Senior Engineering Geologist

APPENDICES

Appendix A
- Figure 1 Site Plan
- Engineering Logs
- Core Logs of Boreholes
- Core Box Photographs

APPENDIX A

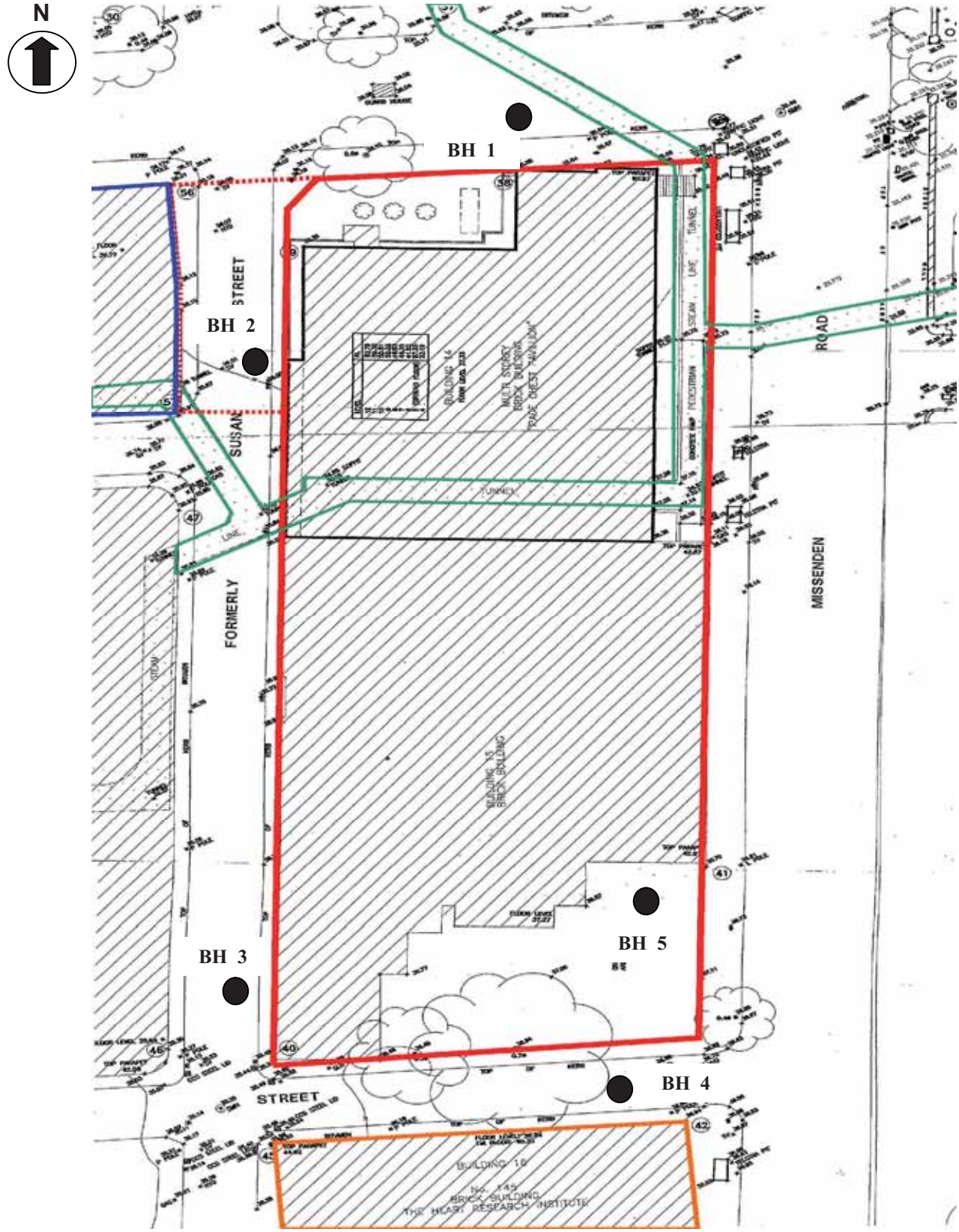
Figure 1 – Site Plan

Borehole Logs

Cored Logs of Boreholes

Core Photographs

Site Plan



Aargus Environmental- Remediation- Engineering- Drilling - Laboratories

Drawn:	AC	*Lifehouse at RPA Limited* *c/ Capital Insight Pty Ltd*	Aargus AUSTRALIA	Figure 1
Approved:	ML	*Page Chest Pavillion & Brown St Outpatient Building*		
Date:	22/10/09	*Missenden Road, Camperdown*		
Scale:	N/A	*Borehole Location Plan*		Job No: GS 2948

Job No:	GS2948
Hole No:	BH 1
Sheet	1 of 3

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AUSTRALIA

ENGINEERING LOG OF DRILLED BOREHOLE

Client:	Capital Insight Limited	Test Location: Refer to Fig 1	
Project:	Lifehouse at RPA	Test Method: Truck Mounted Drill Rig	
Project Location:	Missenden Road, Camperdown	Coordinates: -	Logged by: MC
		Surface Level:Existing	Date:6/10/09

Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Rel. Density	Additional Comments	Depth (m)
				-	AC: 110 mm CONCRETE: 200mm	-	-	Pavement	
	DS				FILL: Roadbase, Ash and Clay				
		0.5		CI-CH	CLAY: medium - high plasticity, pale orange grading to pale grey	M > Wp	St - VSt	Residual	0.5
		1.0							1.0
					Interbedded SHALE / IRONSTONE & CLAY: very low - low strength, pale grey and red brown			V-bit refusal at 1.3m	
		1.5							1.5
		2.0							2.0
		2.5							2.5
		3.0							3.0
					SHALE: very low - low strength, dark grey, DW			Bedrock	
		3.5							3.5

Explanatory Notes:

Consistency		Density Index		Samples		Moisture	
VS	Very Soft	**VL**	Very Loose	**B**	Bulk Sample	**D**	Dry
S	Soft	**L**	Loose	**D**	Disturbed Sample	**M**	Moist
F	Firm	**MD**	Medium Dense	**U50**	Undisturbed Sample (50mm diam.)	**W**	Wet
St	Stiff	**D**	Dense			**Wp**	Plastic Limit
VSt	Very Stiff	**VD**	Very Dense	**N**	S.P.T. Value	**Wl**	Liquid Limit
H	Hard						

Job No:	GS2948
Hole No:	BH 1
Sheet	2 of 3

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ENGINEERING LOG OF DRILLED BOREHOLE

Client:	Capital Insight Limited	Test Location: Refer to Fig 1	
Project:	Lifehouse at RPA	Test Method: Truck Mounted Drill Rig	
Project Location:	Missenden Road, Camperdown	Coordinates: -	Logged by: MC
		Surface Level:Existing	Date:6/10/09

Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Rel. Density	Additional Comments	Depth (m)
		4.0			SHALE: low - medium strength, dark grey, DW			Moderate to high TC bit Resistance from 4.0m	4.0
		4.5							4.5
		5.0							5.0
		5.5						TC Bit refusal at 5.7m	5.5
Dry		6.0			Refer to Cored BH Log				6.0
		6.5							6.5
		7.0							7.0

Explanatory Notes:

Consistency		Density Index		Samples		Moisture	
VS	Very Soft	**VL**	Very Loose	**B**	Bulk Sample	**D**	Dry
S	Soft	**L**	Loose	**D**	Disturbed Sample	**M**	Moist
F	Firm	**MD**	Medium Dense	**U50**	Undisturbed Sample	**W**	Wet
St	Stiff	**D**	Dense		(50mm diam.)	**Wp**	Plastic Limit
VSt	Very Stiff	**VD**	Very Dense	**N**	S.P.T. Value	**Wl**	Liquid Limit
H	Hard						

Job No: GS 2948	
Hole No: BH 1	
Sheet: 3 of 3	

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CORELOG OF TEST HOLE

Client:	Capital Insight Limited		Hole Commenced: 6/10/2009
Project:	Lifehouse at RPA Limited		Hole Completed: 6/10/2009
Project Location:	Missenden Road, Camperdown		Supervised by: MC
			Checked by: MC
Drill Model:		Slope: 90°	R.L. Surface: Existing
Barrel Type / Length:	NMLC	Bearing: -	Datum: -

Drilling Information					Rock Substance						Rock Mass Defects			
Method	Case - Lift	Groundwater	Samples / Field Tests	Depth (m)	Graphic Log	Substance Description	Weathering	Estimated Strength EL VL L M H VH EH	Is(50) MPa	Defect Spacing 30 100 300 1000 3000	Defect Description	Depth (m)
				5.5		Started Coring at 5.7 m						5.5
N M L C				6.0		SHALE: Grey	Fr		0.50		5.93 - Subvertical Fracture	6.0
				6.5					0.25		6.27 - Fracture 45° 6.4 - Subvertical Fracture	6.5
				7.0					0.72			7.0
				7.5					0.54		7.3 - Fracture 45°	7.5
				8.0		End Of Borehole at 7.55m						8.0
				8.5								8.5

Key - Method		Case - lift		Weathering		Strength	Is (50) MPa
AS	Auger Screwing	Casing used		Fr	Fresh	EL Extremely Low	< 0.03
AD	Auger Drilling	Barrel withdrawn	water level	SW	Slightly weathered	VL Very Low	0.03 - 0.1
R	Roller / Tricone		date shown	DW	Distinctly Weathered	L Low	0.1 - 0.3
W	Washbore	Water inflow		XW	Extremely weathered	M Medium	0.3 - 1.0
NMLC	NMLC Core Drill	Partial drilling water loss				H High	1.0 - 3.0
NQ,HQ	Wireline Core Drill	Complete drilling water loss				VH Very High	3.0 - 10.0
						EH Extremely High	>10.0

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Job No:	GS 2948
Hole No:	BH 2
Sheet	1 of 3

ENGINEERING LOG OF DRILLED BOREHOLE

Client:	Capital Insight Limited	Test Location: Refer to Fig 1	
Project:	Lifehouse at RPA	Test Method: Truck Mounted Drill Rig	
Project Location:	Missenden Road, Camperdown	Coordinates: -	Logged by: ML
		Surface Level:Existing	Date:7/10/09

Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Rel. Density	Additional Comments	Depth (m)
				-	AC: 100mm thick	-	-	Pavement	
					Concrete: 200mm thick			Basecourse	
	DS				Roadbase: Gravels			Subbase	
				Cl	CLAY: medium plasticity, orange brown	M ≥ Wp	St	Residual	
	DS	0.5							0.5
				Cl	CLAY: medium plasticity, pale grey mottled yellow	M = Wp	St - VSt		
		1.0							1.0
				Cl	CLAY: medium plasticity, pale grey mottled yellow and brown with some weathered shale gravels	M< Wp	H		
		1.5							1.5
		2.0							2.0
		2.5							2.5
		3.0						V Bit Refusal at 3.3m	3.0
					SHALE: brown and dark grey, very low strength, XW			Bedrock	
		3.5							3.5

Explanatory Notes:

Consistency		Density Index		Samples		Moisture	
VS	Very Soft	**VL**	Very Loose	**B**	Bulk Sample	**D**	Dry
S	Soft	**L**	Loose	**D**	Disturbed Sample	**M**	Moist
F	Firm	**MD**	Medium Dense	**U50**	Undisturbed Sample (50mm diam.)	**W**	Wet
St	Stiff	**D**	Dense			**Wp**	Plastic Limit
VSt	Very Stiff	**VD**	Very Dense	**N**	S.P.T. Value	**Wl**	Liquid Limit
H	Hard						

Job No:	GS 2948
Hole No:	BH 2
Sheet	2 of 3

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ENGINEERING LOG OF DRILLED BOREHOLE

Client:	Capital Insight Limited	Test Location: Refer to Fig 1	
Project:	Lifehouse at RPA	Test Method: Truck Mounted Drill Rig	
Project Location:	Missenden Road, Camperdown	Coordinates: -	Logged by: ML
		Surface Level:Existing	Date:7/10/09

Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Rel. Density	Additional Comments	Depth (m)
		4.0							4.0
		4.5			SHALE: dark grey black, DW, low to medium strength				4.5
		5.0							5.0
		5.5							5.5
		6.0							6.0
		6.5							6.5
		7.0							7.0
Dry					Refer to Cored BH Log				

Explanatory Notes:

Consistency		Density Index		Samples		Moisture	
VS	Very Soft	**VL**	Very Loose	**B**	Bulk Sample	**D**	Dry
S	Soft	**L**	Loose	**D**	Disturbed Sample	**M**	Moist
F	Firm	**MD**	Medium Dense	**U50**	Undisturbed Sample	**W**	Wet
St	Stiff	**D**	Dense		(50mm diam.)	**Wp**	Plastic Limit
VSt	Very Stiff	**VD**	Very Dense	**N**	S.P.T. Value	**Wl**	Liquid Limit
H	Hard						

Job No: GS 2948	
Hole No: BH 2	
Sheet: 3 of 3	

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CORELOG OF TEST HOLE

Client:	Capital Insight Limited		Hole Commenced: 7/10/2009
Project:	Lifehouse at RPA		Hole Completed: 7/10/2009
Project Location:	Missenden Road, Camperdown		Supervised by: ML
			Checked by: ML
Drill Model:		Slope: 90°	R.L. Surface: Existing
Barrel Type / Length:	NMLC	Bearing: -	Datum: -

Drilling Information					Rock Substance							Rock Mass Defects				
Method	Case - Lift	Groundwater	Samples / Field Tests	Depth (m)	Graphic Log	Substance Description	Weathering	Estimated Strength EL VL L M H VH EH	Is(50) MPa	Defect Spacing 30 100 300 1000 3000	Defect Description	Depth (m)
				7.0		Start Coring at 7.0m						7.0
N M L C				7.5		SHALE: dark grey	Fr		0.38		7.6 - Fracture 60°	7.5
				8.0					0.60			8.0
				8.5					0.46		8.38 - Crushed Seam 2mm thick	8.5
				9.0					0.56			9.0
				9.5					0.72		9.44 - Joint 60°	9.5
				10.0					0.56		9.67 - Fracture 45° 9.68 - XW Seam 5 mm thick 9.71 - Joint, Curved, Slicken sides 9.79 - Joint, Curved, Slicken sides	10.0
				10.5		End of Borehole at 10.3m						10.5

Key - Method		Case - lift		Weathering		Strength	Is (50) MPa
AS	Auger Screwing	Casing used		Fr	Fresh	EL Extremely Low	< 0.03
AD	Auger Drilling	Barrel withdrawn	water level	SW	Slightly weathered	VL Very Low	0.03 - 0.1
R	Roller / Tricone		date shown	DW	Distinctly Weathered	L Low	0.1 - 0.3
W	Washbore	Water inflow		XW	Extremely weathered	M Medium	0.3 - 1.0
NMLC	NMLC Core Drill	Partial drilling water loss				H High	1.0 - 3.0
NQ,HQ	Wireline Core Drill	Complete drilling water loss				VH Very High	3.0 - 10.0
						EH Extremely High	>10.0

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Job No:	GS 2948
Hole No:	BH 3
Sheet	1 of 4

ENGINEERING LOG OF DRILLED BOREHOLE

Client:	Capital Insight Limited	Test Location: Refer to Fig 1	
Project:	Lifehouse at RPA	Test Method: Truck Mounted Drill Rig	
Project Location:	Missenden Road, Camperdown	Coordinates: -	Logged by: AC
		Surface Level:Existing	Date:9/10/09

Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Rel. Density	Additional Comments	Depth (m)
				-	AC: 60mm thick CONCRETE: 180MM thick	-	-	Pavement	
	DS				ROADBASE: Gravels				
		0.5		CI-CH	SILTY CLAY: medium to high plasticity, orange red	M ≥ Wp	St		0.5
	ES/DS								
	DS			CI-CH	AS ABOVE but pale grey and red				
		1.0							1.0
	DS			CI	SILTY CLAY: medium plasticity pale grey and orange	M ≥ Wp	VSt - St		
		1.5							1.5
		2.0						V Bit Refusal at 2.0m	2.0
	DS				INTERBEDDED SHALE / IRONSTONE AND CLAY: red brown and pale grey				
		2.5							2.5
		3.0							3.0
		3.5							3.5

Explanatory Notes:

Consistency		Density Index		Samples		Moisture	
VS	Very Soft	**VL**	Very Loose	**B**	Bulk Sample	**D**	Dry
S	Soft	**L**	Loose	**D**	Disturbed Sample	**M**	Moist
F	Firm	**MD**	Medium Dense	**U50**	Undisturbed Sample (50mm diam.)	**W**	Wet
St	Stiff	**D**	Dense			**Wp**	Plastic Limit
VSt	Very Stiff	**VD**	Very Dense	**N**	S.P.T. Value	**Wl**	Liquid Limit
H	Hard						

Job No:	GS 2948
Hole No:	BH 3
Sheet	2 of 4

ENGINEERING LOG OF DRILLED BOREHOLE

Client:	Capital Insight Limited	Test Location: Refer to Fig 1	
Project:	Lifehouse at RPA	Test Method: Truck Mounted Drill Rig	
Project Location:	Missenden Road, Camperdown	Coordinates: -	Logged by: AC
		Surface Level:Existing	Date:9/10/09

Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Rel. Density	Additional Comments	Depth (m)
		4.0							4.0
		4.5							4.5
		5.0							5.0
		5.5							5.5
	DS				SHALE: brown and grey, low strength, XW			Bedrock	
		6.0							6.0
		6.5							6.5
		7.0			AS ABOVE but dark grey and brown, medium strength, DW-XW			Medium TC bit resistance	7.0

Explanatory Notes:

Consistency		Density Index		Samples		Moisture	
VS	Very Soft	**VL**	Very Loose	**B**	Bulk Sample	**D**	Dry
S	Soft	**L**	Loose	**D**	Disturbed Sample	**M**	Moist
F	Firm	**MD**	Medium Dense	**U50**	Undisturbed Sample	**W**	Wet
St	Stiff	**D**	Dense		(50mm diam.)	**Wp**	Plastic Limit
VSt	Very Stiff	**VD**	Very Dense	**N**	S.P.T. Value	**Wl**	Liquid Limit
H	Hard						

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Job No:	GS 2948
Hole No:	BH 3
Sheet	3 of 4

ENGINEERING LOG OF DRILLED BOREHOLE

Client:	Capital Insight Limited	Test Location: Refer to Fig 1	
Project:	Lifehouse at RPA	Test Method: Truck Mounted Drill Rig	
Project Location:	Missenden Road, Camperdown	Coordinates: -	Logged by: AC
		Surface Level:Existing	Date:9/10/09

Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Rel. Density	Additional Comments	Depth (m)
					As ABOVE			Medium TC bit resistance	
		7.5							7.5
Dry					Refer to Cored Borehole Log				
		8.0							8.0
		8.5							8.5
		9.0							9.0
		9.5							9.5
		###							10.0
		###							10.5

Explanatory Notes:

Consistency		Density Index		Samples		Moisture	
VS	Very Soft	**VL**	Very Loose	**B**	Bulk Sample	**D**	Dry
S	Soft	**L**	Loose	**D**	Disturbed Sample	**M**	Moist
F	Firm	**MD**	Medium Dense	**U50**	Undisturbed Sample (50mm diam.)	**W**	Wet
St	Stiff	**D**	Dense			**Wp**	Plastic Limit
VSt	Very Stiff	**VD**	Very Dense	**N**	S.P.T. Value	**Wl**	Liquid Limit
H	Hard						

Job No: GS 2948
Hole No: BH 3
Sheet 4 of 4

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CORELOG OF TEST HOLE

Client:	Capital Insight Limited		Hole Commenced: 9/10/2009
Project:	Lifehouse at RPA		Hole Completed: 9/10/2009
Project Location:	Missenden Road, Camperdown		Supervised by: AC
			Checked by:

Drill Model: Slope: 90° R.L. Surface: Existing

Barrel Type / Length: NMLC Bearing: - Datum: -

Drilling Information					Rock Substance									Rock Mass Defects		
Method	Case - Lift	Groundwater	Samples / Field Tests	Depth (m)	Graphic Log	Substance Description	Weathering	Estimated Strength EL VL L M H VH EH	Is(50) MPa	Defect 30 100	Spacing 300 1000 3000	Defect Description	Depth (m)
				7.5		Start Coring at 7.50m							7.5
				7.67		CORE LOSS 0.17m							
				7.71		SHALE:dark grey with light grey laminae and iron indurated bands	Fr					7.76 - Joint 45°	
				8.0		SHALE: dark grey with light grey laminae			0.44				8.0
N M L C				8.5					0.33				8.5
	9.0			9.0					0.36				9.0
				9.5					0.40				9.5
				10.0					0.89				10.0
				10.5					0.59				10.5
						End of Borehole at 10.43m							

Key - Method		Case - lift		Weathering		Strength	Is (50) MPa
AS	Auger Screwing	Casing used		Fr	Fresh	EL Extremely Low	< 0.03
AD	Auger Drilling	Barrel withdrawn	water level	SW	Slightly weathered	VL Very Low	0.03 - 0.1
R	Roller / Tricone		date shown	DW	Distinctly Weathered	L Low	0.1 - 0.3
W	Washbore	Water inflow		XW	Extremely weathered	M Medium	0.3 - 1.0
NMLC	NMLC Core Drill	Partial drilling water loss				H High	1.0 - 3.0
NQ,HQ	Wireline Core Drill	Complete drilling water loss				VH Very High	3.0 - 10.0
						EH Extremely High	>10.0

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Job No:	GS 2948
Hole No:	BH 4
Sheet	1 of 4

ENGINEERING LOG OF DRILLED BOREHOLE

Client:	Capital Insight Limited	Test Location: Refer to Fig 1	
Project:	Lifehouse at RPA	Test Method: Truck Mounted Drill Rig	
Project Location:	Missenden Road, Camperdown	Coordinates: -	Logged by: MC
		Surface Level:Existing	Date:8/10/09

Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Rel. Density	Additional Comments	Depth (m)
				-	AC: 55mm thick	-	-	Pavement	
					CONCRETE: 190mm thick				
	DS				ROADBASE/ASH				
				CI-CH	CLAY: medium to high plasticity, orange red	M> Wp	St	Residual	
		0.5							0.5
	DS								
	DS			CI	CLAY: medium plasticity, pale grey and white	M> Wp	VSt - St		
		1.0							1.0
		1.5							1.5
								V bit refusal at 1.6m	
					INTERBEDDED SHALE AND CLAY: very low strength, pale grey and red brown with ironstone layers				
		2.0							2.0
		2.5							2.5
		3.0							3.0
		3.5							3.5

Explanatory Notes:

Consistency		Density Index		Samples		Moisture	
VS	Very Soft	**VL**	Very Loose	**B**	Bulk Sample	**D**	Dry
S	Soft	**L**	Loose	**D**	Disturbed Sample	**M**	Moist
F	Firm	**MD**	Medium Dense	**U50**	Undisturbed Sample (50mm diam.)	**W**	Wet
St	Stiff	**D**	Dense			**Wp**	Plastic Limit
VSt	Very Stiff	**VD**	Very Dense	**N**	S.P.T. Value	**Wl**	Liquid Limit
H	Hard						

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AUSTRALIA

Job No:	GS 2948
Hole No:	BH 4
Sheet	2 of 4

ENGINEERING LOG OF DRILLED BOREHOLE

Client:	Capital Insight Limited	Test Location: Refer to Fig 1	
Project:	Lifehouse at RPA	Test Method: Truck Mounted Drill Rig	
Project Location:	Missenden Road, Camperdown	Coordinates: -	Logged by: MC
		Surface Level:Existing	Date:8/10/09

Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Rel. Density	Additional Comments	Depth (m)
					AS ABOVE				
		4.0							4.0
		4.5							4.5
		5.0							5.0
		5.5							5.5
					SHALE: low strength, dark grey, DW with very low strength bands			Bedrock	
		6.0							6.0
		6.5							6.5
▼								Groundwater seepage encountered at 6.7m	
		7.0							7.0

Explanatory Notes:

Consistency		Density Index		Samples		Moisture	
VS	Very Soft	**VL**	Very Loose	**B**	Bulk Sample	**D**	Dry
S	Soft	**L**	Loose	**D**	Disturbed Sample	**M**	Moist
F	Firm	**MD**	Medium Dense	**U50**	Undisturbed Sample	**W**	Wet
St	Stiff	**D**	Dense		(50mm diam.)	**Wp**	Plastic Limit
VSt	Very Stiff	**VD**	Very Dense	**N**	S.P.T. Value	**Wl**	Liquid Limit
H	Hard						

Aargus
AUSTRALIA

Job No:	GS 2948
Hole No:	BH 4
Sheet	3 of 4

ENGINEERING LOG OF DRILLED BOREHOLE

Client:	Capital Insight Limited	Test Location: Refer to Fig 1	
Project:	Lifehouse at RPA	Test Method: Truck Mounted Drill Rig	
Project Location:	Missenden Road, Camperdown	Coordinates: -	Logged by: MC
		Surface Level:Existing	Date:8/10/09

Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Rel. Density	Additional Comments	Depth (m)
					AB ABOVE				
					Refer to Cored BH Log				
		7.5							7.5
		8.0							8.0
		8.5							8.5
		9.0							9.0
		9.5							9.5
		###							10.0
		###							10.5

Explanatory Notes:

Consistency		Density Index		Samples		Moisture	
VS	Very Soft	**VL**	Very Loose	**B**	Bulk Sample	**D**	Dry
S	Soft	**L**	Loose	**D**	Disturbed Sample	**M**	Moist
F	Firm	**MD**	Medium Dense	**U50**	Undisturbed Sample	**W**	Wet
St	Stiff	**D**	Dense		(50mm diam.)	**Wp**	Plastic Limit
VSt	Very Stiff	**VD**	Very Dense	**N**	S.P.T. Value	**Wl**	Liquid Limit
H	Hard						

Job No: GS 2948
Hole No: BH 4
Sheet: 4 of 4

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AUSTRALIA

CORELOG OF TEST HOLE

Client:	Capital Insight Limited	Hole Commenced: 8/10/2009	
Project:	Lifehouse at RPA	Hole Completed: 8/10/2009	
Project Location:	Missenden Road, Camperdown	Supervised by: AC	
		Checked by:	

Drill Model: Slope: 90° R.L. Surface: Existing

Barrel Type / Length: NMLC Bearing: - Datum: -

Drilling Information					Rock Substance							Rock Mass Defects			
Method	Case - Lift	Groundwater	Samples / Field Tests	Depth (m)	Graphic Log	Substance Description	Weathering	Estimated Strength (EL VL L M H VH EH)	Is(50) MPa	Defect Spacing (30 100 300 1000 3000)		Defect Description	Depth (m)
				7.0		Start Coring at 7.10m							7.0
N M L C				7.5		SHALE: light and dark grey	EW		0.03				7.5
				8.0			SW-Fr					7.6-XWS, 40mm thick 7.75-Joint, 45° 7.81-Joint, 45° 7.85-Joint 45° 8.05-Joint, 45° 8.12-Joint, 45° 8.20-CS, 5mm thick 8.28-Joint 45° & CS	8.0
				8.5					0.28			5mm thick 8.38-Joint, 20° 8.6-Joint, 45°	8.5
				9.0		SHALE: dark grey with light grey laminae and iron indurated bands						8.72-Joint,45°	9.0
				9.5		SHALE: dark grey with light grey laminae			0.13			9.08-Joint, 50° 9.42-Joint, 45° 9.48-Joint, 45° 9.51-Joint, 45°	9.5
				10.0			MW-SW FR					9.6-Joint, 45° 9.65-Joint, 45°	10.0
						End of Borehole At 9.95m							

Key - Method		Case - lift		Weathering		Strength	Is (50) MPa
AS	Auger Screwing	Casing used		Fr	Fresh	EL Extremely Low	< 0.03
AD	Auger Drilling	Barrel withdrawn	water level	SW	Slightly weathered	VL Very Low	0.03 - 0.1
R	Roller / Tricone		date shown	DW	Distinctly Weathered	L Low	0.1 - 0.3
W	Washbore	Water inflow		XW	Extremely weathered	M Medium	0.3 - 1.0
NMLC	NMLC Core Drill	Partial drilling water loss				H High	1.0 - 3.0
NQ,HQ	Wireline Core Drill	Complete drilling water loss				VH Very High	3.0 - 10.0
						EH Extremely High	>10.0

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Job No:	GS 2948
Hole No:	BH 5
Sheet	1 of 5

ENGINEERING LOG OF DRILLED BOREHOLE

Client:	Capital Insight Limited	Test Location: Refer to Fig 1	
Project:	Lifehouse at RPA	Test Method: Truck Mounted Drill Rig	
Project Location:	Missenden Road, Camperdown	Coordinates: -	Logged by: AC
		Surface Level:Existing	Date:12/10/09

Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Rel. Density	Additional Comments	Depth (m)
				-	CONCRETE: 175mm thick	-	-	Pavement	
	ES	0.5			FILL: Silty Sand: brown and light brown with ironstone and shale gravels	M			0.5
		1.0			FILL: Silty Clay: dark brown with sandstone and ironstone gravels, medium to high plasticity	M ≥ Wp			1.0
	DS	1.5		CH-CI	SILTY CLAY: medium to high plasticity grey and orange brown with ironstone gravels, medium to high plasticity	M = Wp	St - VSt	Residual	1.5
		2.0							2.0
		2.5							2.5
		3.0							3.0
		3.5							3.5

Explanatory Notes:

Consistency		Density Index		Samples		Moisture	
VS	Very Soft	**VL**	Very Loose	**B**	Bulk Sample	**D**	Dry
S	Soft	**L**	Loose	**D**	Disturbed Sample	**M**	Moist
F	Firm	**MD**	Medium Dense	**U50**	Undisturbed Sample (50mm diam.)	**W**	Wet
St	Stiff	**D**	Dense			**Wp**	Plastic Limit
VSt	Very Stiff	**VD**	Very Dense	**N**	S.P.T. Value	**Wl**	Liquid Limit
H	Hard						

Job No:	GS 2948
Hole No:	BH 5
Sheet	2 of 5

ENGINEERING LOG OF DRILLED BOREHOLE

Client:	Capital Insight Limited	Test Location: Refer to Fig 1	
Project:	Lifehouse at RPA	Test Method: Truck Mounted Drill Rig	
Project Location:	Missenden Road, Camperdown	Coordinates: -	Logged by: AC
		Surface Level:Existing	Date:12/10/09

Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Rel. Density	Additional Comments	Depth (m)
					AS ABOVE				
	DS	4.0			SILTY CLAY: medium plasticity, brown mottled grey and orange with shale and ironstone gravels	M = Wp	St - VSt		4.0
		4.5							4.5
		5.0						V Bit Refusal at 5.4m	5.0
	DS	5.5			SHALE: grey brown, low strength, XW to DW			Bedrock	5.5
		6.0							6.0
		6.5							6.5
	DS	7.0			SHALE: dark grey, low to medium strength, SW				7.0

Explanatory Notes:

Consistency		Density Index		Samples		Moisture	
VS	Very Soft	**VL**	Very Loose	**B**	Bulk Sample	**D**	Dry
S	Soft	**L**	Loose	**D**	Disturbed Sample	**M**	Moist
F	Firm	**MD**	Medium Dense	**U50**	Undisturbed Sample (50mm diam.)	**W**	Wet
St	Stiff	**D**	Dense			**Wp**	Plastic Limit
VSt	Very Stiff	**VD**	Very Dense	**N**	S.P.T. Value	**Wl**	Liquid Limit
H	Hard						

Job No:	GS 2948
Hole No:	BH 5
Sheet	3 of 5

ENGINEERING LOG OF DRILLED BOREHOLE

Client:	Capital Insight Limited	Test Location: Refer to Fig 1	
Project:	Lifehouse at RPA	Test Method: Truck Mounted Drill Rig	
Project Location:	Missenden Road, Camperdown	Coordinates: -	Logged by: AC
		Surface Level:Existing	Date:12/10/09

Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Rel. Density	Additional Comments	Depth (m)
					AS ABOVE				
		7.5							7.5
Dry					Refer to Cored BH Log				
		8.0							8.0
		8.5							8.5
		9.0							9.0
		9.5							9.5
		###							10.0
		###							10.5

Explanatory Notes:

Consistency		Density Index		Samples		Moisture	
VS	Very Soft	**VL**	Very Loose	**B**	Bulk Sample	**D**	Dry
S	Soft	**L**	Loose	**D**	Disturbed Sample	**M**	Moist
F	Firm	**MD**	Medium Dense	**U50**	Undisturbed Sample	**W**	Wet
St	Stiff	**D**	Dense		(50mm diam.)	**Wp**	Plastic Limit
VSt	Very Stiff	**VD**	Very Dense	**N**	S.P.T. Value	**Wl**	Liquid Limit
H	Hard						

Job No: GS 2948
Hole No: BH 5
Sheet: 4 of 5

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CORELOG OF TEST HOLE

Client:	Capital Insight Limited		Hole Commenced: 12/10/2009
Project:	Lifehouse at RPA		Hole Completed: 12/10/2009
Project Location:	Missenden Road, Camperdown		Supervised by:AC
			Checked by:

Drill Model: Slope: 90° R.L. Surface: Existing

Barrel Type / Length: NMLC Bearing: - Datum: -

Drilling Information					Rock Substance						Rock Mass Defects					
Method	Case - Lift	Groundwater	Samples / Field Tests	Depth (m)	Graphic Log	Substance Description	Weathering	Estimated Strength EL VL L M H VH EH	Is(50) MPa		Defect Spacing 30 100 300 1000 3000	Defect Description	Depth (m)			
				7.5		Start Coring at 7.72m							7.5			
N M L C				8.0		SHALE: dark grey with light grey laminae and iron indurated bands	Fr		0.61				8.0			
				8.5		SHALE: dark grey with light grey laminae			0.63	0.30			8.5			
				9.0									9.0			
				9.5					0.38			9.26-Joint 45°, Slicken Sides 9.31-Joint 45° 9.37-Joint 45°, Slicken Sides	9.5			
				10.0					0.48				10.0			
				10.5					0.55				10.5			

Key - Method		Case - lift		Weathering		Strength	Is (50) MPa
AS	Auger Screwing	Casing used		Fr	Fresh	EL Extremely Low	< 0.03
AD	Auger Drilling	Barrel withdrawn	water level	SW	Slightly weathered	VL Very Low	0.03 - 0.1
R	Roller / Tricone		date shown	DW	Distinctly Weathered	L Low	0.1 - 0.3
W	Washbore	Water inflow		XW	Extremely weathered	M Medium	0.3 - 1.0
NMLC	NMLC Core Drill	Partial drilling water loss				H High	1.0 - 3.0
NQ,HQ	Wireline Core Drill	Complete drilling water loss				VH Very High	3.0 - 10.0
						EH Extremely High	>10.0

Job No: GS 2948
Hole No: BH 5
Sheet: 5 of 5

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CORELOG OF TEST HOLE

Client:	Capital Insight Limited		Hole Commenced: 12/10/2009
Project:	Lifehouse at RPA		Hole Completed: 12/10/2009
Project Location:	Missenden Road, Camperdown		Supervised by:AC
			Checked by:

Drill Model: Slope: 90° R.L. Surface: Existing

Barrel Type / Length: NMLC Bearing: - Datum: -

Drilling Information					Rock Substance							Rock Mass Defects			
Method	Case - Lift	Groundwater	Samples / Field Tests	Depth (m)	Graphic Log	Substance Description	Weathering	Estimated Strength EL VL L M H VH EH	Is(50) MPa	Defect Spacing 30 100 300 1000 3000	Defect Description	Depth (m)
						End of Borehole at 10.84m						
				11.0								11.0
				11.5								11.5
				12.0								12.0
N M L C				12.5								12.5
				13.0								13.0
				13.5								13.5
				14.0								14.0

Key - Method		Case - lift		Weathering		Strength	Is (50) MPa
AS	Auger Screwing	Casing used		Fr	Fresh	EL Extremely Low	< 0.03
AD	Auger Drilling	Barrel withdrawn	water level	SW	Slightly weathered	VL Very Low	0.03 - 0.1
R	Roller / Tricone		date shown	DW	Distinctly Weathered	L Low	0.1 - 0.3
W	Washbore	Water inflow		XW	Extremely weathered	M Medium	0.3 - 1.0
NMLC	NMLC Core Drill	Partial drilling water loss				H High	1.0 - 3.0
NQ,HQ	Wireline Core Drill	Complete drilling water loss				VH Very High	3.0 - 10.0
						EH Extremely High	>10.0

GS 2948 – BH 1 (5.70m – 7.55m)

GS 2948 – BH2 (7.00m – 10.24m)

GS 2948 – BH 3 (7.50m – 10.43m)

GS 2948 – BH 4 (7.10m – 9.95m)

GS 2948 – BH 5 (7.72m – 10.84m)

E5: Geotechnical Investigation Report 2

Prepared by Aargus Pty Ltd (June 2010)

Aargus
AUSTRALIA

Environmental - Remediation - Engineering - Laboratories - Drilling

GEOTECHNICAL INVESTIGATION REPORT

LIFEHOUSE AT RPA

MISSENDEN ROAD CAMPERDOWN

Prepared for

Lifehouse at RPA
C/- Capital Insight Pty Ltd

Report No. GS2948/1-B
15th June 2010

HEAD OFFICE: PO Box 398 Drummoyne NSW 1470
Telephone: 1300 137 038 Facsimile: 1300 136 038 Email: admin@aargus.net Website: www.aargus.net
Aargus Pty Ltd ACN 063 579 313 Aargus Engineering Pty Ltd ACN 050 212 710 Aargus Laboratories Pty Ltd ACN 086 993 937

15th June 2010

GS2948/1-B AC:MC

Lifehouse at RPA
C/- Capital Insight Pty Ltd
Level 6, 77 Berry Street
NORTH SYDNEY NSW 2060
Email: phill.castle@capitalinsight.com.au, elisabeth.wallace@capitalinsight.com.au

ATTENTION: Mr. Phill Castle and Ms Elizabeth Wallace

Dear Sir and Madam,

RE: Proposed Lifehouse at RPA Facility
Missenden Road, Camperdown
Further Geotechnical Investigation

This report presents and interprets the findings of the geotechnical investigation carried out at the subject site, known as the Page Chest Pavillion and Brown Street Outpatient Buildings in Missenden Road, Camperdown. The investigation was carried out between 10th May 2010 and 26th May 2010. The geotechnical site investigation was commissioned by Miss Elisabeth Wallace from Capital Insight Pty Ltd, and was carried out in general accordance with the Aargus Engineering fee proposal dated 12th April 2010.

The purpose of the geotechnical investigation is to assess the existing site conditions in order to provide recommendations from a geotechnical viewpoint for the design and construction of the proposed Lifehouse facility.

It is understood that the proposed development involves the demolition of the existing structures within the site and construction of a new multi level facility with nine levels above ground and three basement levels. Formation of the basement levels is expected to entail excavations of up to 14m deep.

Based on the results of this investigation, it is considered that the subject site is **suitable** for the proposed development, in accordance with the recommendations provided in this report.

EXECUTIVE SUMMARY

The purpose of the geotechnical investigation undertaken by Aargus Engineering was to assess the existing site conditions in order to provide recommendations from a geotechnical viewpoint for the design and construction of the proposed development.

Materials expected to be encountered to the base of the proposed excavations for the development are likely to comprise residual silty clays with some ironstone and shale layers overlying shale at a depth of between about 3.3m and 6.2m below existing ground surface levels.

Excavation of materials overlying the bedrock profile may be achieved using conventional earthmoving equipment such as bulldozers and excavators. A 30 tonne excavator may readily excavate into the shale bedrock to depths of between about 6m and 8m below existing ground surfaces levels. Considerable difficultly excavating with such a machine alone may be encountered below these depths, however, excavation in conjunction with heavy ripping from a bulldozer will readily achieve excavation to bulk excavation levels of up to 14m below existing ground surface levels.

Excavation of isolated sections of high strength bedrock may require the use of excavator mounted vibratory rock breaking equipment. Test hammering combined with vibration monitoring in the presence of a Geotechnical Engineer/Engineering Geologist should be carried out at the time of commencement of hammering and periodically throughout excavation to confirm that induced vibrations in surrounding structures do not exceed acceptable vibration limits detailed in this report.

For excavations in topsoil, natural residual clayey sands, distinctly weathered bedrock, batter slopes (if appropriate subject to set-back distances from site boundaries) should conform to that presented in Table 6 of this report. Recommended parameters for the design of retaining structures are presented in Table 7.

We anticipate that bedrock will be exposed at bulk excavation level within the proposed development. As such, to minimise the potential for differential settlement, all footings must be taken to found on bedrock of similar bearing characteristics as that exposed. Footings socketed a nominal 0.3m into Class III shale bedrock may be designed for an allowable bearing pressure of 2000kPa.

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DOCUMENT HISTORY

Revision No.	Issue Date	Description
0	15/06/2010	Initial Issue

Issued By:

Adrian Collins BE (Civil & Enviro) DipEngPrac
Geotechnical Engineer
Date: 15/06/2010

Matthew Cupitt BSc (App Geol)
Senior Engineering Geologist

TABLE OF CONTENTS

LIST OF APPENDICES

1.0 INTRODUCTION

This geotechnical site investigation was commissioned by Miss Elizabeth Wallace of Capital Insight Pty Ltd, on behalf of Lifehouse at RPA, owner of the site, and was carried out in general accordance with the Aargus Engineering fee proposal dated 12th April 2010. This investigation was carried out in addition to our previous geotechnical assessment of the site referenced GS2948-A and dated 19th October 2009.

2.0 OBJECTIVES

The purpose of this further geotechnical investigation is to determine details of the site's surface and subsurface conditions in order to provide supplementary advice and recommendations from a geotechnical viewpoint for the design and construction of the proposed Lifehouse Building to complement the information obtained from the initial geotechnical investigation conducted in October 2009, addressing the requirements of the geotechnical brief prepared by SCP Consulting Pty Ltd. This investigation includes the following:

- Method of investigation.
- Surface and sub-surface conditions.
- Results of Laboratory testing, including CBR value, pH, chlorides and sulfates.
- Groundwater conditions, groundwater level and management, if encountered.
- Excavation conditions.
- Temporary and Permanent batter slopes for excavations in rock if appropriate.
- Provision of earth pressure parameters for design of retaining structures.
- Appropriate footings including footing types, founding depths, serviceability bearing pressures and anticipated settlements.
- Recommendations on earthworks and subgrade preparation.
- Vibration control, management, and monitoring accompanied by appropriate excavation techniques.
- Site specific "Subsoil Class" for Earthquake Design in accordance with AS1170.4.
- Any other relevant geotechnical recommendations and design parameters.
- Recommendations on supplementary geotechnical investigation following demolition of Building 14 occupying the northern portion of the site.

3.0 SCOPE OF WORKS

Fieldwork for this geotechnical investigation was carried out between 10th May 2010 and 26th May 2010 by our drilling crew and supervised by a Geotechnical Engineer from Aargus Engineering, and comprised the following:

- A detailed walk-over inspection of the site by a Geotechnical Engineer/ Engineering Geologist.
- Drilling of four (4) boreholes, at locations as near as possible to client nominated locations. The boreholes were drilled using a truck-mounted drill rig fully equipped for geotechnical investigations, in order to identify the subsurface soil and rock profile. The boreholes were drilled initially using a V-bit attached to solid flight augers to refusal in bedrock, and further continued using a T-C bit in the weathered shale bedrock. The boreholes were then advanced into the Shale bedrock using NMLC diamond rock coring techniques to depths of about 20m.
- Standard Penetration Tests (SPT) at regular depth intervals during drilling within each borehole in the overburden soils to assess the in-situ soil strength.
- Recovered rock cores were carefully boxed on site and returned to our laboratory for testing.
- Concrete coring at the location of BH9.
- Collection of two (2) representative soil samples from approximate subgrade level of external paved areas for laboratory Californian Bearing Ratio (CBR) testing.
- Testing of recovered soil samples in the overburden soil profile to assess its aggressivity to steel and concrete structures, and hence exposure classification for piles
- Installation of one (1) standpipe in BH 8.
- Reinstatement of the boreholes with the displaced soils.

The encountered subsurface materials and their relative strengths have been recorded and logged as Engineering Borehole Logs and are attached in Appendix C of this report. The approximate borehole locations are shown on the attached site plan referenced Figure 1 in Appendix B. The locality map of the subject site is attached and referenced Figure 2, also in Appendix B.

4.0 AVAILABLE INFORMATION

4.1. Document Review

At the time of preparation of this report, the following documentation was made available to us:

- A Geotechnical brief, referenced 2010-076-PS, dated 1st April 2010, prepared by SCP Consulting Pty Ltd.
- An architectural drawing titled 'Ground Floor Plan', referenced Project No. 08500, Drawing No. SK 107 revision B, prepared by Rice Daubney, dated 4th May 2010
- A detailed survey prepared by Whelans Insites Pty Ltd, titled 'Plan Showing Detail and Levels Royal Prince Alfred Hospital Camperdown', referenced Job Ref G163SC Sheet 1 of 2 and Sheet 2 of 2, dated 28th October 2009.

4.2. Proposed Development

Upon review of the above listed documents, we now understand the following:

- The proposed development involves the construction of the Lifehouse Building, which will have up to nine-storeys above ground and will contain three levels of below-ground basement.
- The proposed building will be linked by sub-ground tunnels to the adjacent oncology building to the west, King George V Building to the north and the main RPA campus to the east.
- The site is bounded by Salisbury Road to the north, Susan Street to the west, Brown Street to the south and Missenden Road to the east.
- A multi-storey building "Page Chest Building" (Building 14) occupies the northern portion of the site.
- The "Brown Street Outpatients Building" located in the southern portion of the site had been demolished since our geotechnical investigation fieldwork in October 2009.
- The lowest excavation level is at RL23.60m
- The bulk excavation level for Level 3 is RL28.20m at the northern end of the site.

- Proposed foundations comprising piles are to be founded and socketed into Class II and Class III rock.

4.3. Location

The site is located centrally within Camperdown. More specifically, it is located on the western side of Missenden Road, about 75m north of the intersection between Carillon Avenue and Missenden Road. The locality map of the subject site is attached in Appendix B and referenced Figure 2.

4.4. Regional Geology

Reference to the Sydney 1:100,000 Geological Series Sheet 9130 Edition 1, 1983 indicates that the site is underlain by Ashfield Shale (Rwa) of the Wianamatta Group, which comprises black to dark grey shale and laminite.

The Soil Landscape Map of Sydney, Series Sheet 9130, Second Edition, indicates that the site is underlain by Blacktown Group Soils pertaining to a Residual Landscape. Blacktown Group Landscape is described as gently undulating rises on Wianamatta Group shales and Hawkesbury sandstones. Local relief to 30m, slopes are usually <5%. Broad rounded crests and ridges with gently inclined slopes. Cleared eucalypt woodland and tall open forest. The soils are described as shallow to moderately deep (<100cm) Red and Brown Podzolic soils on crests, upper slopes and well drained areas, deep (150-300cm) Yellow Podzolic soils and Soloths on lower slopes and in areas of poor drainage.

5.0 FINDINGS OF INVESTIGATION

The findings of this geotechnical investigation are summarised in the following sections.

5.1. Site Description

The site is near rectangular in shape, covering an area of approximately 4160m^2, and measures approximately 104m along the Eastern (Missenden Rd) and Western Boundaries (Susan Street), and approximately 40m along the Northern (Salisbury Road) and Southern (Brown Street) boundaries. The northern half of the footprint of the proposed development is currently occupied by the multi storey “Page Chest Pavilion”, which is currently

undergoing demolition works and the southern half of the site is vacant as the previous single storey brick building had been demolished.

5.2. Sub-Surface Conditions

Subsurface conditions encountered within the boreholes are detailed on the attached Engineering Logs, presented in Appendix C of this report. The subsurface conditions encountered have been summarised as follows:

PAVEMENT (BH9 only)	ASPHALTIC CONCRETE, to depths of about 0.07m (BH9), underlain by
	CONCRETE, to depths of about 0.27m (BH9), underlain by,
	ROADBASE, to depths of about 0.37m (BH9), underlain by,
RESIDUAL	Silty CLAY: medium to high plasticity, pale orange , orange and pale grey, to depths of between about 0.37m (BH9) and 2.5m (BH7), underlain by,
	Silty CLAY: medium plasticity, pale grey and orange brown, interbedded with ironstone and shale gravel layers, to depths of between about 3.3m (BH6) and 6.2m (BH7), underlain by,
BEDROCK	SHALE, extremely weathered, very low strength, brown and pale grey, to depths of between about 4.5m (BH6) and 6.6m (BH7), overlying,
	SHALE, distinctly weathered to slightly weathered, low to medium strength, dark grey, to borehole termination depths of between about 19.9m (BH9) and depths 20.2m (BH6).

The following should also be noted:

- BH 7 encountered uncontrolled, poorly compacted fill comprising silty sandy clay to a depth of about 0.5m below existing ground surface levels.

Table 1: Summary of Soil and Rock Properties

Depth (m)	BH 6	BH 7	BH 8	BH 9
Approx. Surface RL	~ 35.92m	~ 36.85m	~ 36.10m	~ 35.40m
Asphaltic Concrete	NE	NE	NE	0 - 0.07
Concrete	NE	NE	NE	0.07 – 0..27
Roadbase	NE	NE	NE	0.27 – 0..37
Fill	NE	0 – 0.50m	NE	NE
Residual Clay	0.00 – 1.00	0.50 – 2.50	0.00 – 1.30	0.37 – 1.00
Interbedded Clay & Shale/Ironstone	1.00 - 3.30	2.50 – 6.20	1.30 – 4.30	1.00 - 5.60
VL St Shale	3.30 – 4.50	6.20 – 6.60	4.30 – 4.70	5.60 – 5.90
L-M St Shale	4.50 – 20.2+	6.60 – 20.1+	4.70 – 20.18+	5.90 – 19.86
V Bit Refusal	3.30	6.20	4.30	5.60
TC Bit Refusal	7.00	7.00	6.65	6.30
Borehole Termination Depth	20.2	20.1	20.18	19.86

Notes : Units are in metres (m)
Reduced Levels (RL) estimated from survey plan
Not Encountered (NE)
Very Low Strength (VL)
Low to Medium Strength (L-M)

5.3. Groundwater Conditions

A standpipe piezometer was installed upon completion of drilling in BH8 to a depth of 20.18m. Groundwater levels were measured in BH 8 at depths detailed in Table 2 below:

Table 2: Groundwater Levels

Borehole	Date	Depth (m)	Approximate RL. (m)
8	26/05/10	13.98	~RL 23.02
8	17/06/10	2.8	~RL 34.20

It should be noted however, that fluctuations in the level of groundwater might occur due to variations in rainfall and/or other factors.

6.0 LABORATORY TESTING

6.1. Point Load Strength Test Results

Recovered rock cores from all boreholes were returned to our NATA accredited laboratory for testing. The testing carried out on the rock samples was the Point Load Strength Index Test. The Point Load Strength Indices for the rock cores and the assessed rock strengths, in accordance with Australian Standards (Reference 1), are summarised in the following table, Table 3.

Table 3: Point Load Strength Test Results

Borehole	Depth (m)	Diametral $I_{s(50)}$ (MPa)	Axial $I_{s(50)}$ (MPa)	Assessed Strength
6	7.90	0.15	1.84	H
	8.73	0.35	1.70	H
	9.60	0.13	0.98	M
	10.50	0.30	0.60	M
	11.51	0.70	0.90	M
	12.58	0.06	0.57	M
	13.84	0.02	0.63	M
	14.76	0.04	0.58	M
	15.72	0.06	0.27	L
	16.55	0.06	0.47	M
	17.87	0.11	0.72	M
	18.54	0.12	0.78	M
	19.78	0.38	1.32	H
7	6.80	0.19	1.13	H
	7.72	0.11	0.86	M
	8.82	0.11	0.42	M
	9.72	0.02	0.48	M
	10.80	0.17	0.54	M
	11.77	0.23	0.91	M
	12.68	0.05	0.91	M
	13.61	0.09	0.45	M
	14.83	0.11	0.43	M

	15.87	0.320	0.20	L
	16.27	0.26	0.29	L
	17.50	0.20	0.43	M
	18.32	0.32	0.39	M
	19.63	0.21	0.31	M
8	7.48	0.09	0.77	M
	8.87	0.21	0.62	M
	9.77	0.25	0.64	M
	10.80	0.13	0.44	M
	11.72	0.19	0.58	M
	12.72	0.13	0.19	L
	13.83	0.32	0.29	L
	14.76	0.17	0.33	M
	15.80	0.03	0.32	M
	16.52	3.41	3.55	VH
	17.83	0.17	0.31	M
	18.62	0.01	0.18	L
	19.76	0.26	0.48	M
9	6.84	0.32	0.24	L
	7.53	0.24	0.36	M
	8.90	0.21	0.40	M
	9.85	0.46	0.66	M
	10.52	0.43	0.84	M
	11.65	0.15	0.46	M
	12.70	0.28	0.18	L
	13.60	0.21	0.02	L
	14.65	0.07	0.14	L
	15.62	0.15	0.40	M
	16.87	0.05	0.29	L
	17.73	0.02	0.31	M
	18.82	0.17	0.47	M
	19.45	0.11	0.30	M

Notes: **L – Low Strength**

M – Medium Strength

H – High Strength

VH – Very High Strength

Based on the rock core strengths (Table 2) and the rock discontinuities (shown in the core logs), the bedrock from the proposed development site is classified for foundation design purposes in accordance with Pells et al (Reference 2) as detailed in Table 4

Table 4: Rock Classification

Borehole	Depth (m)	Rock Classification (Reference 2)
6	7.00 – 9.50	Class IV
	9.50 – 20.20	Class III
7	6.18 – 20.10	Class III
8	6.65 – 20.18	Class III
9	6.30 – 8.20	Class IV
	8.20 – 19.86	Class III

6.2. CBR Results

Recovered soil samples from two boreholes were returned to our NATA accredited laboratory for testing. The testing carried out on the soil samples was a California Bearing Ratio. The results are summarised in the following table, Table 4

Table 4 – Laboratory Test Results

Borehole	Depth (m)	CBR Value (%) 2.5 / 5.0mm Penetration
7	0.5 – 1.0	3 / 3
8	0.2 – 0.5	9 / 12

6.3. Exposure Classification

Recovered soil samples from two boreholes were sent to SGS Australia. a NATA accredited laboratory for testing. The testing carried out on the soil samples was Chlorides, Sulphates and pH. The results are summarised in the following table, Table 5

Table 5: Laboratory Test Results

Borehole	Depth (m)	Chloride (mg/kg)	Sulphate (mg/kg)	pH (pH Units)
8	0.1 - 0.6	13	46	5
	1.0 – 1.2	9.1	82	5.3
	1.4 – 1.7	3	22	5.7
	2.5 – 2.82	2.3	28	6.1
9	0.4 – 0.6	2.9	47	4.9
	1.0 – 1.45	3.7	33	4.8
	2.5 – 2.95	3.4	58	5.6
	4.0 – 4.23	4.1	130	5.5

7.0 DISCUSSION & RECOMMENDATIONS

7.1. General

Based on the results of this investigation, we consider that subsurface conditions comprise residual silty clays and silty clays with interbedded ironstone and shale bands overlying shale bedrock. Depth to bedrock within the footprint of the proposed development is in the order of 3.30m to 6.20m below existing ground surface levels.

The proposed development involves the construction of the Lifehouse Building, which will have up to nine-storeys above ground and will contain three levels of below-ground basement. The proposed building will be linked by sub-ground tunnels to the adjacent oncology building to the west, King George V Building to the north and the main RPA campus to the east.

A multi-storey building "Page Chest Building" (Building 14) occupies the northern portion of the site. The "Brown Street Outpatients Building" located in the southern portion of the site has been demolished since our geotechnical investigation fieldwork in October 2009.

The lowest excavation level is at RL23.60m. The bulk excavation level for Level 3 is RL28.20m at the northern end of the site.

7.2. Excavation Conditions and Vibration Control

Based on the limited drawings provided, excavation is proposed for three basement levels. It is expected that excavations will extend to depths of up to 14.0m below existing ground surface levels to RL of 23.60.

Materials expected to be encountered to the base of the proposed excavations for the development are likely to comprise residual silty clays with some ironstone and shale layers overlying shale at a depth of between about 3.3m and 6.2m below existing ground surface levels.

Excavation of materials overlying the bedrock profile may be achieved using conventional earthmoving equipment such as bulldozers and excavators. A 30 tonne excavator may readily excavate into the shale bedrock to depths of between about 6m and 8m below existing ground surfaces levels. Considerable difficultly excavating with such a machine alone may be encountered below these depths, however, excavation in conjunction with heavy ripping from a bulldozer will readily achieve excavation to bulk excavation levels of up to 14m below existing ground surface levels.

Excavation of isolated sections of high strength bedrock may require the use of excavator mounted vibratory rock breaking equipment. Test hammering combined with vibration monitoring in the presence of a Geotechnical Engineer/Engineering Geologist should be carried out at the time of commencement of hammering and periodically throughout excavation to confirm that induced vibrations in surrounding structures do not exceed acceptable vibration limits detailed following.

Induced vibrations in structures adjacent to the excavation should not exceed a Peak Particle Velocity (PPV) of 5mm/sec for structures in good condition, or 2mm/sec for structures in poor condition or heritage structures. If vibrations in adjacent structures exceed these PPV's or if vibrations appear excessive, this office should be contacted immediately for further advice.

Trafficability problems may arise locally during wet weather, or if water is allowed to pond on materials expected to be encountered during excavation. A groundwater level of

approximately ~ RL 23.02m was measured in BH8 after drilling and ~RL34.2m On 17th June 2010. As such, we do anticipate minor groundwater seepage into the proposed excavations and if left to pond on the excavation surfaces, trafficability problems may arise.

It should be noted however, that groundwater conditions of a site might change with climatic and other factors.

7.3. Dewatering Conditions

The groundwater level in BH8 was measured upon completion of drilling at 13.98m (~RL 23.02) below existing ground surface levels . Groundwater had risen to 2.8m (~RL34.2) when measured on 17th June 2010. The proposed basement excavation is expected to be in the order of 14.0m deep. Therefore, groundwater will be encountered during excavation. However, due to the very slow recharge rate of the monitoring well, we anticipate that groundwater infiltration will be minor only and that dewatering of the excavation will be adequately handled by appropriately located sumps within the base of the proposed excavation. The sumps should be intermittently pumped to remove collected groundwater.

It should be noted that lowering of groundwater levels outside the site perimeters could adversely impact existing foundation conditions of adjacent structures, underground services and roads, due to settlement. To ensure that lowering of the groundwater table will not result in settlement of neighbouring structures, the following needs to be considered if inflow rates encountered are significant:

- Assessment of the rates of ground water inflow.. This information will be required by a specialist contractor to determine model parameters for assessment of the ground water draw down, ground water recharge rates and settlements of the subsurface soils within adjacent properties.
- Installation of a cut-off wall, such as a contiguous reinforced concrete retaining wall within the site boundaries or around the basement excavation, socketed into the underlying shale bedrock. Although this wall is considered a non-watertight retaining wall, under moderate ground water inflows, it can be made watertight by shotcrete placement between the piles. As some water seepage

through the wall of contiguous piles is unavoidable during the initial stage of construction, this system is not recommended where some water leakage (and some settlement) from the adjacent property is not acceptable in situations where high groundwater inflows are encountered.

- Lowering of the groundwater level by pumping prior to excavation. If required, a specialised contractor should design an appropriate pumping system using the information obtained by the standpipe piezometers and subsequent groundwater modelling.
- Alternatively, install a watertight permanent retaining wall, such as a secant grout injected pile wall or bentonite diaphragm wall, taken to found and socket into the underlying shale bedrock.

Consideration should be given to ground water movements subsequent to the installation of the cut off wall and long term affects of the changes to the ground water flows on adjacent properties around and down slope of the site.

7.4. Batter Slopes and Retaining Structures

Materials to be encountered during excavation are likely to comprise minor fill, natural clays, possibly with some interbedding of ironstone and shale. Very steep or vertical faces could not be maintained in these materials. Excavations in these materials would need to be appropriately battered or retained by engineered retaining structures prior to excavation.

For unsupported cuts in these materials, up to a height of about 3.0m, the recommended batter slopes are presented in the following Table 6.

Table 6: Recommended Batter Slopes For Unsupported Cuts
(not exceeding 3m in height)

Material	Temporary (Horizontal : Vertical)		Permanent (Horizontal : Vertical)	
	Exposed	Protected	Exposed	Protected
Fill & clays	1.5:1.0	1.0:1.0	2.5:1.0	2.0:1.0
Low strength Shale	1.0:1.0	0.5:1.0	1.0:1.5	1.0:1.0

Temporary subvertical excavations in Class III shale may be considered appropriate upon inspection by a Geotechnical Consultant.

Surface protection of the cut slope can be provided by shotcrete. If required, the shotcrete may be reinforced. Adequate surface and sub-surface drainage must be provided to prevent the build-up of hydrostatic pressures behind the installed shotcrete.

Temporary surface protection may also be provided by means of covering with plastic sheeting. It should be noted however, that the plastic sheeting should extend at least 2m behind the crest of the cut face, augmented with a v-drain near the crest of the cut face to divert all surface runoff from the cut face.

As excavation progresses, the cut faces should be inspected by a Geotechnical Engineer or Engineering Geologist, to assess localised shotcreting requirements, batter slope stability and to assess the suitability of recommended parameters for the design of retaining structures.

The pressure distribution on such retaining structures may be assumed to be triangular and estimated as follows:

$$p_h = \gamma k H + qk$$

Where,

p_h = Horizontal pressure (kN/m^2)
γ = Wet density (kN/m^3)
k = Coefficient of earth pressure (k_a or k_o)
H = Retained height (m)
q = Surcharge pressure behind retaining wall (kN/m^2)

For the design of flexible retaining structures, where some lateral movement is acceptable, an active earth pressure coefficient is recommended. Should it be critical to limit the horizontal deformation of a retaining structure, use of an earth pressure coefficient at rest should be considered. Recommended parameters for the design of retaining structures are presented in the following Table 7.

Table 7: Design Parameters For Retaining Structures

Founding Material	Unit Weight (kN/m^3)	Active Earth Pressure Coefficient	Passive earth pressure	At rest earth pressure Coefficent
Fill	18	0.50	Ignore	0.60
Natural Overburden Soils – Stiff Consistency	18	0.40	Ignore	0.55
Natural Overburden Soils – Hard Consistency	19	0.25	Ignore	0.40
Shale Bedrock, weathered, low and medium strength	20	0.20	200kPa	0.30

The foregoing coefficients assume that the ground level behind the retaining structures is horizontal and the retained material is effectively drained.

The design of any retaining structure should be checked for bearing capacity, overturning, sliding and overall stability of the slope.

Should the retaining structures be anchored or strutted, the earth pressure may be assumed to be rectangular and estimated as 5.5H kPa for the residual soil profile and 4H for the Class IV and III shale bedrock, where H is the retained height.

Should retained soil be subject to groundwater pressure, additional earth pressures resulting from groundwater should be allowed for in the design.

A qualified Structural Engineer should check the design of any retaining structures for bearing capacity, overturning, sliding and overall stability of the slope.

Surcharge loading from neighbouring structures (if present) should also be taken into account in the design of retaining structures should the structure be within the zone of influence of the excavation. The zone of influence is defined as a plane projected from the toe of the excavation into the excavation face upwards towards the ground surface at 45 degrees from horizontal.

Where permanent retaining structures have not been provided to retain the excavation, the building walls below ground should be designed to provide permanent support to the excavation faces.

Where temporary batters as detailed above cannot be utilised during excavation, or it is undesirable to utilise such batter slopes, excavation faces must be retained prior to excavation. Suitable pre excavation retaining structures may comprise contiguously bored piled concrete retaining walls, secant bored pile retaining walls, diaphragm retaining walls or concrete soldier piled retaining walls with concrete infill panels. Soldier piles should not exceed a spacing of 3D.

Due to high angle jointing encountered within the boreholes during this investigation, we consider that all piles installed prior to excavation for pre-excavation retaining structures must extend below the base of bulk excavations to prevent founding on these adversely orientated jointed bedrock above the excavation base.

7.5. Floor Slabs

"Uncontrolled" fill was encountered in BH2 only, there is a potential that these materials may be encountered at other locations at existing ground surface levels. However, we anticipate that the majority of the site will be excavated to depths of up to 14m below existing ground surface levels, exposing extremely weathered shale bedrock or better. Concrete infill slabs may be utilised at these depths.

If isolated ground bearing slabs are required at existing ground surface levels, existing uncontrolled fill materials must be excavated and replaced in a "controlled" manner to form a platform for support of the ground bearing slabs. The existing fill material is considered suitable for reuse as "Controlled" fill provided all over-size, deleterious and other demolition refuse is sieved and removed prior to reuse and subject to appropriate moisture conditioning.

If ground floor slabs are bearing on varying materials of distinct types (controlled fill and bedrock or residual clays and bedrock) differential settlement of the slabs is likely to occur unless a very rigid slab is used. Therefore, we recommend that where varying subgrade

materials are exposed across the footprint of ground bearing slabs, these materials should be over-ripped to a depth of 0.3m, mixed to homogenise and recompacted to a minimum dry density ratio of 100% standard within 2% of optimum moisture content (OMC).

Ground bearing slabs founded on constructed fill platforms (by replacement of suitable portions of the existing "uncontrolled" fill) may be designed for a Modulus of Subgrade Reaction value of 15kPa/mm.

7.6. Footings

Based on the limited documentation provided, we anticipate that footings for the proposed building will need to bear on shale bedrock. We anticipate that shale bedrock will be exposed at or near bulk excavation level. As such, shallow or deep footings below bulk excavations are considered suitable for the proposed development.

Shallow or deep footings founded and socketed a minimum of 0.3m into the respective classes of shale bedrock may be designed for the serviceability end bearing capacities detailed in Table 8.

TABLE 8: Serviceability End Bearing Capacity of Footings.

Founding Material	Serviceability End Bearing Capacity
Shale (Class V)	600kPa
Shale (Class IV)	1000kPa
Shale (Class III)	2000kPa

Likewise, bored shoring piers, comprising discrete soldier piers or contiguous piles founded and socketed into at least Class III shale bedrock or better, may be designed for a vertical loading of 2000kPa end bearing with an ultimate shaft adhesion of 350kPa.

We recommend that bored piers are socketed at least 0.3m into the respective rock class, in order to confirm that the recommended serviceability end bearing capacity has been achieved.

It should be noted that a zone of influence of 1.5 times the pile diameter or minimum footing dimension is to be considered for foundation design. Therefore, should the zone of influence of footings extend between rock classes, the lower of the rock class should be adopted.

The total settlement of piers and shoring piers founded in shale bedrock under the recommended serviceability end bearing capacity is estimated to not exceed about 1% of the minimum footing dimension or pier diameter and the differential settlements are estimated to be about half of the estimated total settlements.

It is recommended that all footings are founded below and outside the zone of influence of excavations.

It must be noted however, that foundations pertaining to the same structure are to be founded on similar materials to minimise the potential for differential movement.

7.7. Pile Exposure Classification

Based on the results of laboratory testing, under AS2159-1995 the exposure classification for piles are found to be **Non Aggressive**.

7.8. Subsoil Class for Earthquake Design

Under AS1170.4- 1993, site specific subsoil class parameters are as follows:

- An acceleration co efficient (a) of <0.09
- A site factor (S) for general structures of 0.67 where founded on shale bedrock.

7.9. Pavement Design

Based on the results of the laboratory testing, a subgrade CBR of 3% has been adopted for pavement thickness determination. We note that based on a CBR of 3% it is likely that subgrade replacement will be required to facilitate a suitable pavement for the proposed development

8.0 CONCLUSION

This report presents and interprets the findings of the geotechnical investigation carried out at the subject site, known as the proposed Lifehouse building at RPA, Missenden Road in Camperdown between 10th May 2010 and 26th May 2010.

The recommendations presented in this report are based on the following:

- Findings of the geotechnical investigation at the site comprising the drilling of four boreholes only.
- The geotechnical model developed based on the results of the geotechnical investigation and previous geotechnical investigation.
- Groundwater seepage may be encountered during the proposed excavations.
- The information presented in the architectural drawings.

Based on the results of findings, it is considered that the subject site is **suitable** for the proposed development, in accordance with the recommendations provided in this report.

For and on behalf of
Aargus Engineering

Adrian Collins BE (Civil & Enviro) DipEngPrac
Geotechnical Engineer

Reviewed By

Matthew Cupitt BSc (App Geol)
Senior Engineering Geologist

LIMITATIONS

The assessment of the sub-surface profile within the proposed development area and the recommendations presented in this report are based on limited information from the excavation of four boreholes located within the proposed development footprint.

The recommendations and advice presented in this report on rock condition is considered to be indicative only. Site inspection by a consulting Geotechnical Engineer or Engineering Geologist are to be undertake at the time of excavation and upon encountering rock to confirm the rock conditions on which this geotechnical investigation report have been based.

The comments and recommendations provided in this report are provided on the basis that permanent groundwater seepage and/or groundwater table is present within the anticipated depth of excavation.

There is a possibility that the actual geotechnical conditions across the site could differ from the inferred geotechnical model (on which our recommendations are based) presented in this report. We recommend that this office is contacted immediately for further advice or if sub-surface and groundwater conditions encountered during excavation and construction vary from those presented in this report.

APPENDIX A

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL REPORT

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT

More construction problems are caused by site subsurface conditions than any other factor. As troublesome as subsurface problems can be, their frequency and extent have been lessened considerably in recent years, due in large measure to programs and publications of ASFE/ The Association of Engineering Firms Practicing in the Geosciences.

The following suggestions and observations are offered to help you reduce the geotechnical-related delays, cost-overruns and other costly headaches that can occur during a construction project.

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

A geotechnical engineering report is based on a subsurface exploration plan designed to incorporate a unique set of project-specific factors. These typically include the general nature of the structure involved, its size and configuration, the location of the structure on the site and its orientation, physical concomitants such as access roads, parking lots, and underground utilities, and the level of additional risk which the client assumed by virtue of limitations imposed upon the exploratory program.

To help avoid costly problems, consult the geotechnical engineer to determine how any factors which change subsequent to the date of the report may affect its recommendations.

Unless your consulting geotechnical engineer indicates otherwise, *your geotechnical engineering report should NOT be used:*

- when the nature of the proposed structure is changed: for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an un-refrigerated one,
- when the size or configuration of the proposed structure is altered,
- when the location or orientation of the proposed structure is modified,
- when there is a change of ownership, or

for application to an adjacent site.

Geotechnical engineers cannot accept responsibility for problems which may develop if they are not consulted after factors considered in their report's development have changed.

Geotechnical reports present the results of investigations carried out for a specific project and usually for a specific phase of the project. The report may not be relevant for other phases of the project, or where project details change.

The advice herein relates only to this project and the scope of works provided by the Client.

Soil and Rock Descriptions are based on AS1726-1993, using visual and tactile assessment except at discrete locations where field and/or laboratory tests have been carried out. Refer to the attached terms and symbols sheets for definitions.

MOST GEOTECHNICAL "FINDINGS" ARE PROFESSIONAL ESTIMATES

Site exploration identifies actual subsurface conditions only at those points where samples are taken, when they are taken. Data derived through sampling and subsequent laboratory testing are extrapolated by geotechnical engineers who then render an opinion about overall subsurface conditions, their likely reaction to proposed construction activity, and appropriate foundation design. Even under optimal circumstances actual conditions may differ from those inferred to exist, because no geotechnical engineer, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than a report indicates. Actual conditions in areas not sampled may differ from predictions. *Nothing can be done to prevent the unanticipated, but steps can be taken to help minimize their impact. For this reason, most experienced owners retain their geotechnical consultants through the construction stage,* to identify variances, conduct additional tests which may be needed, and to

recommend solutions to problems encountered on site.

SUBSURFACE CONDITIONS CAN CHANGE

Subsurface conditions may be modified by constantly changing natural forces. Because a geotechnical engineering report is based on conditions which existed at the time of subsurface exploration, *construction decisions should not be based on a geotechnical engineering report whose adequacy may have been affected by time.* Speak with the geotechnical consultant to learn if additional tests are advisable before construction starts.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes or groundwater fluctuations may also affect subsurface conditions, and thus, the continuing adequacy of a geotechnical report. The geotechnical engineer should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

Subsurface conditions can change with time and can vary between test locations. Construction activities at or adjacent to the site and natural events such as flood, earthquake or groundwater fluctuations can also affect the subsurface conditions.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND PERSONS

Geotechnical engineers' reports are prepared to meet the specific needs of specific individuals. A report prepared for a consulting civil engineer may not be adequate for a construction contractor, or even some other consulting civil engineer. Unless indicated otherwise, this report was prepared expressly for the client involved and expressly for purposes indicated by the client. Use by any other persons for any purpose, or by the client for a different purpose, may result in problems.
No individual other than the client should apply this report for its intended purpose without first conferring with the geotechnical engineer. No person should apply this report for any purpose other than that originally contemplated without first conferring with the geotechnical engineer.

A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Costly problems can occur when other design professional develop their plans based on misinterpretations of a geotechnical engineering report. To help avoid these problems, the geotechnical engineer should be retained to work with other appropriate design professionals to explain relevant geotechnical findings and to review the adequacy of their plans and specifications relative to geotechnical issues.

The interpretation of the discussion and recommendations contained in this report are based on extrapolation/interpretation from data obtained at discrete locations. Actual conditions in areas not sampled or investigated may differ from those predicted

BORING LOGS SHOULD NOT BE SEPARATED FROM THE ENGINEERING REPORT

Final boring logs are developed by geotechnical engineers based upon their interpretation of field logs (assembled by site personnel) and laboratory evaluation of field samples. Only final boring logs customarily are included in geotechnical engineering reports. These logs should not under any circumstances be redrawn for inclusion in architectural or other design drawings because drafters may commit errors or omissions in the transfer process. Although photographic reproduction eliminates this problem, it does nothing to minimize the possibility of contractors misinterpreting the logs during bid preparation. When this occurs, delays, disputes and unanticipated costs are the all-too-frequent result.

To minimise the likelihood of boring log misinterpretation, give contractors ready access in the complete geotechnical engineering report prepared or authorized for their use. Those who do not provide such access may proceed under mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes which aggravate them to disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY

Because geotechnical engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against geotechnical consultants. To help prevent this problem, geotechnical engineers have developed model clauses for use in written transmittals. These are not exculpatory clauses designed to foist geotechnical engineers' liabilities onto someone else. Rather, they are definitive clauses which identify where geotechnical engineers' responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your geotechnical engineering report, and you are encouraged to read them closely. Your geotechnical engineer will be pleased to give full and frank answers to your questions.

OTHER STEPS YOU CAN TAKE TO REDUCE RISK

Your consulting geotechnical engineer will be pleased to discuss other techniques which can be employed to mitigate risk. In addition, ASFE has developed a variety of materials which may be beneficial. Contact ASFE for a complimentary copy of its publications directory.

FURTHER GENERAL NOTES

Groundwater levels indicated on the logs are taken at the time of measurement and may not reflect the actual groundwater levels at those specific locations. It should be noted that groundwater levels can fluctuate due to seasonal and tidal activities.

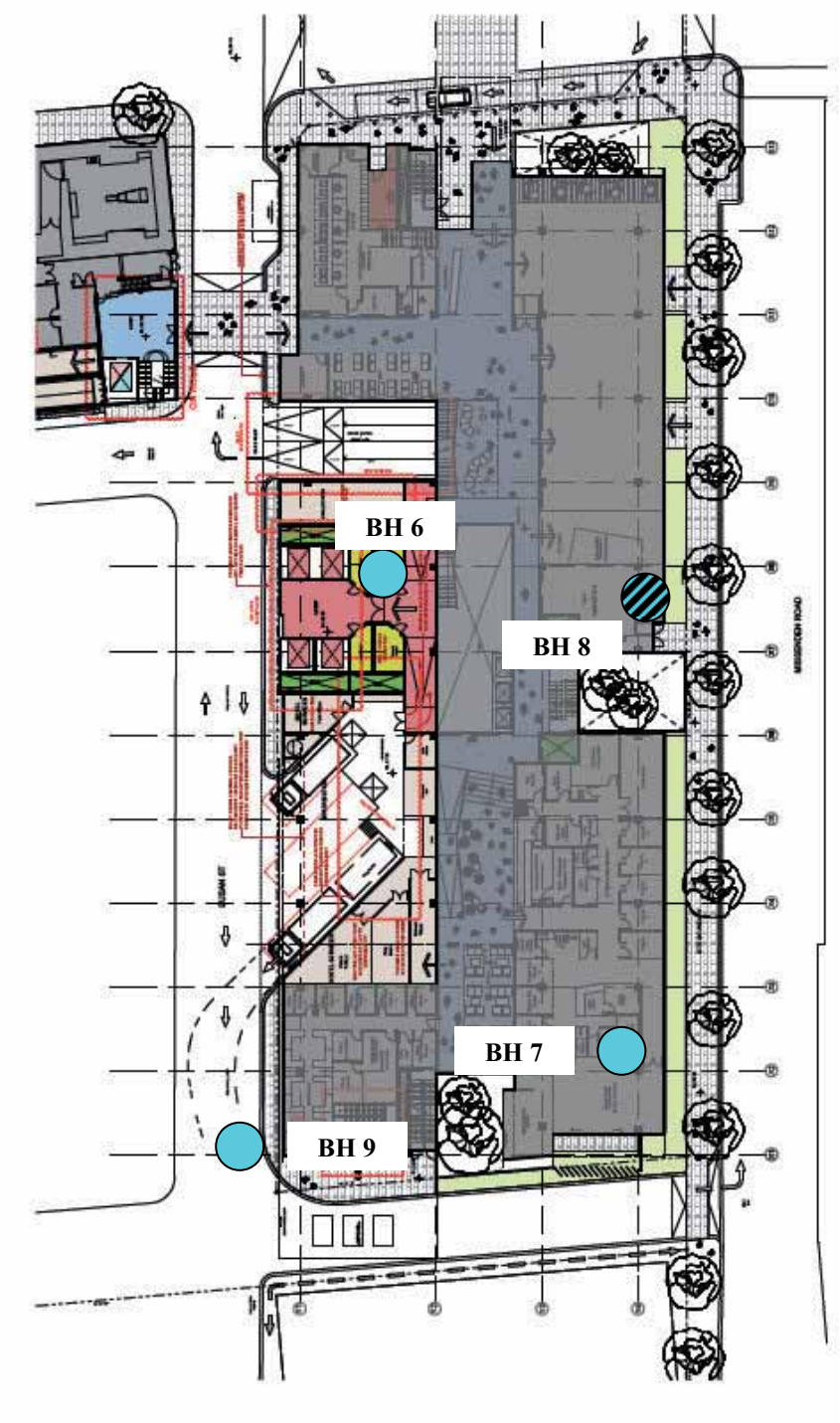
APPENDIX B

BOREHOLE & IN-SITU TEST LOCATION PLAN (FIGURE 1)

SITE LOCALITY MAP (FIGURE 2)

Site Plan

N



Borehole Location

Borehole Location with Installed Standpipe

Aargus Environmental- Remediation- Engineering- Drilling - Laboratories

Drawn:	AC	*Lifehouse at RPA* *C/- Capital Insight Pty Ltd* *RPA Lifehouse* *Missenden Road, Camperdown* Borehole Location Plan	Aargus AUSTRALIA	Figure 1
Approved:	ML			
Date:	2/6/10			
Scale:	NTS			Job No: GS2948-B

Site Locality

Reference: whereis.com.au (2010)

Aargus Environmental- Remediation- Engineering- Drilling - Laboratories

Drawn:	AC	*Lifehouse at RPA* *C/- Capital Insight Pty Ltd* *RPA Lifehouse* *Missenden Road, Camperdown* Site Locality Map	Aargus AUSTRALIA	Figure 2
Approved:	ML			
Date:	2/6/10			
Scale:	NTS			Job No: GS2948-B

APPENDIX C

ENGINEERING BOREHOLE LOGS &

PENETRATION RESISTANCE OF SOIL TEST REPORT – GRAPHIC

Job No:	GS2948-B
Hole No:	BH 6
Sheet	1 of 6

Aargus
AUSTRALIA

ENGINEERING LOG OF DRILLED BOREHOLE

Client:	Lifehouse at RPA	Test Location: Refer to Fig 1	
Project:	RPA Lifehouse	Test Method: Drill Rig	
Project Location:	Missenden Road, Camperdown	Coordinates: -	Logged by: AC
		Surface Level:Existing	Date: 10/5/10

Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Rel. Density	Additional Comments	Depth (m)
				CI - CH	Silty CLAY: medium to high plasticity, grey and orange brown	M ≥ Wp	St - F	RESIDUAL	
		0.5							0.5
		1.0							1.0
					Interbedded Shale and CLAY: very low strength orange brown and pale grey		St	Moderate V-bit resistance	
		1.5							1.5
	1, 1, 12 N = 13								
		2.0		CI - CH	Silty CLAY: medium to high plasticity, grey and orange brown with ironstone gravels		VSt	Moderate - High V-bit resistance	2.0
		2.5							2.5
		3.0							3.0
	1,9,4/10mm Refusal N > 13							V-bit refusal	
					SHALE: pale grey and brown, XW, VL-L strength			BEDROCK	
		3.5						Bands of High TC bit resistance	3.5
					Continued on sheet 2 of 6				

Explanatory Notes:

Consistency		Density Index		Samples		Moisture	
VS	Very Soft	**VL**	Very Loose	**B**	Bulk Sample	**D**	Dry
S	Soft	**L**	Loose	**D**	Disturbed Sample	**M**	Moist
F	Firm	**MD**	Medium Dense	**U50**	Undisturbed Sample (50mm diam.)	**W**	Wet
St	Stiff	**D**	Dense			**Wp**	Plastic Limit
VSt	Very Stiff	**VD**	Very Dense	**N**	S.P.T. Value	**Wl**	Liquid Limit
H	Hard						

Job No:	GS2948-B
Hole No:	BH 6
Sheet	2 of 6

Aargus
AUSTRALIA

ENGINEERING LOG OF DRILLED BOREHOLE

Client:	Lifehouse at RPA	Test Location: Refer to Fig 1	
Project:	RPA Lifehouse	Test Method: Drill Rig	
Project Location:	Missenden Road, Camperdown	Coordinates: -	Logged by: AC
		Surface Level:Existing	Date: 10/5/10

Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Rel. Density	Additional Comments	Depth (m)
					Continued from sheet 1 of 6			BEDROCK	
					SHALE: pale grey and brown, XW, VL-L strength				
		4.0							4.0
		4.5			grading to dark grey, DW, L strength			Low - Moderate TC-bit resistance	4.5
		5.0							5.0
		5.5							5.5
		6.0			grading to dark grey, SW-F, L-M strength			High - Very High TC bit resistance	6.0
		6.5							6.5
		7.0			Refer to Cored Borehole Log			TC bit refusal	7.0
					Continued on sheet 3 of 6				

Explanatory Notes:

Consistency		Density Index		Samples		Moisture	
VS	Very Soft	**VL**	Very Loose	**B**	Bulk Sample	**D**	Dry
S	Soft	**L**	Loose	**D**	Disturbed Sample	**M**	Moist
F	Firm	**MD**	Medium Dense	**U50**	Undisturbed Sample	**W**	Wet
St	Stiff	**D**	Dense		(50mm diam.)	**Wp**	Plastic Limit
VSt	Very Stiff	**VD**	Very Dense	**N**	S.P.T. Value	**Wl**	Liquid Limit
H	Hard						

Job No: GS2948-B
Hole No: BH 6
Sheet: 3 of 6

Aargus
AUSTRALIA

CORELOG OF TEST HOLE

Client:	Lifehouse at RPA	Hole Commenced:	10/5/10
Project:	RPA Lifehouse	Hole Completed:	13/5/10
Project Location:	Missenden Road, Camperdown	Supervised by:	AC
		Checked by:	

Drill Model: Slope: 90° R.L. Surface: Existing

Barrel Type / Length: NMLC Bearing: - Datum: -

Drilling Information					Rock Substance										Rock Mass Defects		
Method	Case - Lift	Groundwater	Samples / Field Tests	Depth (m)	Graphic Log	Substance Description	Weathering	Estimated Strength EL	VL	L	M	H	VH	EH	Is(50) MPa	Defect Spacing 30	100	300	1000	3000	Defect Description	Depth (m)
						Continued from sheet 2 of 6																
				7.0		Start Coring at 7.0m																7.0
NMLC						SHALE: dark grey brown	XW														7.25m J, Sub Vert	
				7.5		CORE LOSS 0.40m																7.5
				8.0		SHALE: dark grey with light grey laminae	FR								1.84							8.0
				8.5											1.7							8.5
				9.0																		9.0
						CORE LOSS 0.20m																
				9.5		CORE LOSS 0.10m																9.5
				10.0											0.98						9.86m J, 45° Slicken Sides	10.0
						Continued on sheet 4 of 6																

Key - Method		Case - lift		Weathering		Strength	Is (50) MPa
AS	Auger Screwing	Casing used		Fr	Fresh	EL Extremely Low	< 0.03
AD	Auger Drilling	Barrel withdrawn	water level	SW	Slightly weathered	VL Very Low	0.03 - 0.1
R	Roller / Tricone		date shown	DW	Distinctly weathered	L Low	0.1 - 0.3
W	Washbore	Water inflow		HW	Highly weathered	M Medium	0.3 - 1.0
NMLC	NMLC Core Drill	Partial drilling water loss		EW	Extremely weathered	H High	1.0 - 3.0
NQ,HQ	Wireline Core Drill	Complete drilling water loss				VH Very High	3.0 - 10.0
						EH Extremely High	>10.0

Job No: GS2948-B
Hole No: BH 6
Sheet: 4 of 6

Aargus
AUSTRALIA

CORELOG OF TEST HOLE

Client:	Lifehouse at RPA	Hole Commenced:10/5/10	
Project:	RPA Lifehouse	Hole Completed:13/5/10	
Project Location:	Missenden Road, Camperdown	Supervised by: AC	
		Checked by:	
Drill Model:		Slope: 90°	R.L. Surface: Existing
Barrel Type / Length:	NMLC	Bearing: -	Datum: -

Drilling Information					Rock Substance								Rock Mass Defects		
Method	Case - Lift	Groundwater	Samples / Field Tests	Depth (m)	Graphic Log	Substance Description	Weathering	Estimated Strength (EL VL L M H VH EH)	Is(50) MPa	Defect Spacing (30 100 300 1000 3000)	Defect Description	Depth (m)
						Continued from sheet 3 of 6						
						SHALE: dark grey with light grey laminae	FR					
				10.5					0.60			10.5
											10.7m J, 45°	
				11.0								11.0
N M L C				11.5					0.90			11.5
											11.8m J, 80° Slicken Sides	
				12.0							11.95 J, 45°	12.0
											12.05m J, Sub Vert Slicken Sides	
				12.5					0.57			12.5
				13.0							13.06m,XWS,30mmt	13.0
						CORE LOSS 0.06m						
						CORE LOSS 0.40m						
				13.5		**Continued on sheet 5 of 6**						13.5

Key - Method		Case - lift		Weathering		Strength	Is (50) MPa
AS	Auger Screwing	Casing used		Fr	Fresh	EL Extremely Low	< 0.03
AD	Auger Drilling	Barrel withdrawn	water level	SW	Slightly weathered	VL Very Low	0.03 - 0.1
R	Roller / Tricone		date shown	DW	Distinctly weathered	L Low	0.1 - 0.3
W	Washbore	Water inflow		HW	Highly weathered	M Medium	0.3 - 1.0
NMLC	NMLC Core Drill	Partial drilling water loss		EW	Extremely weathered	H High	1.0 - 3.0
NQ,HQ	Wireline Core Drill	Complete drilling water loss				VH Very High	3.0 - 10.0
						EH Extremely High	>10.0

Job No: GS2948-B
Hole No: BH 6
Sheet: 5 of 6

Aargus
AUSTRALIA

CORELOG OF TEST HOLE

Client:	Lifehouse at RPA	Hole Commenced:10/5/10	
Project:	RPA Lifehouse	Hole Completed:13/5/10	
Project Location:	Missenden Road, Camperdown	Supervised by: AC	
		Checked by:	
Drill Model:		Slope: 90°	R.L. Surface: Existing
Barrel Type / Length:	NMLC	Bearing: -	Datum: -

Drilling Information					Rock Substance										Rock Mass Defects		
Method	Case - Lift	Groundwater	Samples / Field Tests	Depth (m)	Graphic Log	Substance Description	Weathering	Estimated Strength EL	VL	L	M	H	VH	EH	Is(50) MPa	Defect Spacing 30 100 300 1000 3000	Defect Description	Depth (m)
						Continued from page 4 of 6												
				14.0		SHALE: dark grey with light grey laminae	FR								0.63		13.75m J, Sub Vert	14.0
				14.5											0.58			14.5
N M L C				15.0													14.9m J, Sub Vert	15.0
				15.5											0.27			15.5
				16.0														16.0
				16.5											0.47		16.66 XWS, 20mmt	16.5
																	16.8m J, Sub Vert	
						CORE LOSS 0.07m												
				17.0		**Continued on page 6 of 6**												17.0

Key - Method		Case - lift		Weathering		Strength	Is (50) MPa
AS	Auger Screwing	Casing used		Fr	Fresh	EL Extremely Low	< 0.03
AD	Auger Drilling	Barrel withdrawn	water level	SW	Slightly weathered	VL Very Low	0.03 - 0.1
R	Roller / Tricone		date shown	DW	Distinctly weathered	L Low	0.1 - 0.3
W	Washbore	Water inflow		HW	Highly weathered	M Medium	0.3 - 1.0
NMLC	NMLC Core Drill	Partial drilling water loss		EW	Extremely weathered	H High	1.0 - 3.0
NQ,HQ	Wireline Core Drill	Complete drilling water loss				VH Very High	3.0 - 10.0
						EH Extremely High	>10.0

Job No: GS2948-B
Hole No: BH 6
Sheet: 6 of 6

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AUSTRALIA

CORELOG OF TEST HOLE

Client:	Lifehouse at RPA	Hole Commenced:	10/5/10
Project:	RPA Lifehouse	Hole Completed:	13/5/10
Project Location:	Missenden Road, Camperdown	Supervised by:	AC
		Checked by:	

Drill Model: Slope: 90° R.L. Surface: Existing

Barrel Type / Length: NMLC Bearing: - Datum: -

Drilling Information					Rock Substance								Rock Mass Defects		
Method	Case - Lift	Groundwater	Samples / Field Tests	Depth (m)	Graphic Log	Substance Description	Weathering	Estimated Strength EL VL L M H VH EH	Is(50) MPa	Defect Spacing 30 100 300 1000 3000	Defect Description	Depth (m)
NMLC				17.5		**Continued from page 5 of 6** SHALE: dark grey with light grey laminae	FR				17.2m J, 50°	17.5
				18.0					0.72		18.16m J, 50° 18.3m J, Un	18.0
				18.5					0.78			18.5
				19.0							19.3m J, Un	19.0
				19.5					1.32			19.5
				20.0							20m J, Sub Vert	20.0
				20.5		Borehole Terminated at 20.20m						20.5

Key - Method		Case - lift		Weathering		Strength	Is (50) MPa
AS	Auger Screwing	Casing used		Fr	Fresh	EL Extremely Low	< 0.03
AD	Auger Drilling	Barrel withdrawn	water level	SW	Slightly weathered	VL Very Low	0.03 - 0.1
R	Roller / Tricone		date shown	DW	Distinctly weathered	L Low	0.1 - 0.3
W	Washbore	Water inflow		HW	Highly weathered	M Medium	0.3 - 1.0
NMLC	NMLC Core Drill	Partial drilling water loss		EW	Extremely weathered	H High	1.0 - 3.0
NQ,HQ	Wireline Core Drill	Complete drilling water loss				VH Very High	3.0 - 10.0
						EH Extremely High	>10.0

Job No:	GS2948-B
Hole No:	BH 7
Sheet	1 of 6

Aargus
AUSTRALIA

ENGINEERING LOG OF DRILLED BOREHOLE

Client:	Lifehouse at RPA	Test Location: Refer to Fig 1	
Project:	RPA Lifehouse	Test Method: Drill Rig	
Project Location:	Missenden Road, Camperdown	Coordinates: -	Logged by: AC
		Surface Level:Existing	Date: 13/5/10

Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Rel. Density	Additional Comments	Depth (m)
		0.5		-	Silty Sandy CLAY: low to medium plasticity, dark brown and orange with concrete, bricks and woodchips	M ≥ Wp	-	FILL Appears Poorly Compacted	0.5
	BS	1.0		CI - CH	Silty CLAY: medium to high plasticity, grey red and orange brown	M ≥ Wp	VSt	RESIDUAL	1.0
	3, 5, 8 N = 13	1.5							1.5
		2.0							2.0
		2.5							2.5
	3, 5, 17 N = 22	3.0			Interbedded Shale and CLAY: low strength orange brown and pale grey		H	High V bit resistance	3.0
		3.5		CI - CH	Silty CLAY: medium to high plasticity, grey mottled orange with ironstone gravels				3.5

Continued over on page 2 of 6

Explanatory Notes:

Consistency		Density Index		Samples		Moisture	
VS	Very Soft	**VL**	Very Loose	**B**	Bulk Sample	**D**	Dry
S	Soft	**L**	Loose	**D**	Disturbed Sample	**M**	Moist
F	Firm	**MD**	Medium Dense	**U50**	Undisturbed Sample (50mm diam.)	**W**	Wet
St	Stiff	**D**	Dense			**Wp**	Plastic Limit
VSt	Very Stiff	**VD**	Very Dense	**N**	S.P.T. Value	**Wl**	Liquid Limit
H	Hard						

Job No:	GS2948-B
Hole No:	BH 7
Sheet	2 of 6

Aargus
AUSTRALIA

ENGINEERING LOG OF DRILLED BOREHOLE

Client:	Lifehouse at RPA	Test Location: Refer to Fig 1	
Project:	RPA Lifehouse	Test Method: Drill Rig	
Project Location:	Missenden Road, Camperdown	Coordinates: -	Logged by: AC
		Surface Level:Existing	Date: 13/5/10

Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Rel. Density	Additional Comments	Depth (m)
					Continued from page 1 of 6			RESIDUAL	
					Silty CLAY: medium to high plasticity, grey mottled orange with ironstone gravels			High - Very high V bit resistance	
		4.0							4.0
	2, 4, 5 N = 9				Interbedded Shale and CLAY: low strength, orange brown and pale grey		St		
		4.5							4.5
		5.0							5.0
		5.5					VSt		5.5
	7, 8, 7 N = 15								
		6.0						Very High V bit resistance V bit refusal	6.0
					SHALE: pale and dark grey, XW, VL - L strength			BEDROCK High - Very High TC bit resistance	
		6.5							6.5
					grading to dark grey, DW - SW, L - M strength			Very High TC bit resistance	
		7.0			Refer to Cored Borehole Log			TC bit refusal	7.0
					Contiuned on page 3 of 6				

Explanatory Notes:

Consistency		Density Index		Samples		Moisture	
VS	Very Soft	**VL**	Very Loose	**B**	Bulk Sample	**D**	Dry
S	Soft	**L**	Loose	**D**	Disturbed Sample	**M**	Moist
F	Firm	**MD**	Medium Dense	**U50**	Undisturbed Sample	**W**	Wet
St	Stiff	**D**	Dense		(50mm diam.)	**Wp**	Plastic Limit
VSt	Very Stiff	**VD**	Very Dense	**N**	S.P.T. Value	**Wl**	Liquid Limit
H	Hard						

Job No: GS2948-B
Hole No: BH 7
Sheet: 3 of 6

Aargus
AUSTRALIA

CORELOG OF TEST HOLE

Client:	Lifehouse at RPA	Hole Commenced:	13/5/10
Project:	RPA Lifehouse	Hole Completed:	18/5/10
Project Location:	Missenden Road, Camperdown	Supervised by:	AC
		Checked by:	

Drill Model: Slope: 90° R.L. Surface: Existing

Barrel Type / Length: NMLC Bearing: - Datum: -

Drilling Information					Rock Substance									Rock Mass Defects		
Method	Case - Lift	Groundwater	Samples / Field Tests	Depth (m)	Graphic Log	Substance Description	Weathering	Estimated Strength EL VL L M H VH EH	Is(50) MPa	Defect Spacing 30 100 300 1000 3000	Defect Description	Depth (m)
						Continued from page 2 of 6						
						Start Coring at 6.18m						
						SHALE: dark grey with light grey laminae	FR				6.28m XWS, 20mmt	
				6.5								6.5
									1.13			
				7.0							7.06m J, 45° Slicken Sides	7.0
				7.5							7.40m J, 45° Slicken Sides	7.5
									0.86			
				8.0							8.15m J, Sub Vert	8.0
						CORE LOSS 0.50m Due to drilling equipment						
				8.5								8.5
									0.42			
				9.0								9.0
				9.5							9.5m J, 45°	9.5
						Continued on page 4 of 6						

Key - Method		Case - lift		Weathering		Strength	Is (50) MPa
AS	Auger Screwing	Casing used		Fr	Fresh	EL Extremely Low	< 0.03
AD	Auger Drilling	Barrel withdrawn	water level	SW	Slightly weathered	VL Very Low	0.03 - 0.1
R	Roller / Tricone		date shown	DW	Distinctly weathered	L Low	0.1 - 0.3
W	Washbore	Water inflow		HW	Highly weathered	M Medium	0.3 - 1.0
NMLC	NMLC Core Drill	Partial drilling water loss		EW	Extremely weathered	H High	1.0 - 3.0
NQ,HQ	Wireline Core Drill	Complete drilling water loss				VH Very High	3.0 - 10.0
						EH Extremely High	>10.0

Job No: GS2948-B
Hole No: BH 7
Sheet: 4 of 6

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AUSTRALIA

CORELOG OF TEST HOLE

Client:	Lifehouse at RPA	Hole Commenced:13/5/10	
Project:	RPA Lifehouse	Hole Completed:18/5/10	
Project Location:	Missenden Road, Camperdown	Supervised by: AC	
		Checked by:	
Drill Model:		Slope: 90°	R.L. Surface: Existing
Barrel Type / Length:	NMLC	Bearing: -	Datum: -

Drilling Information					Rock Substance								Rock Mass Defects		
Method	Case - Lift	Groundwater	Samples / Field Tests	Depth (m)	Graphic Log	Substance Description	Weathering	Estimated Strength EL VL L M H VH EH	Is(50) MPa	Defect Spacing 30 100 300 1000 3000	Defect Description	Depth (m)
						Continued from page 3 of 6						
						SHALE: dark grey with light grey laminae	FR		0.48			
				10.0								10.0
				10.5					0.54			10.5
				11.0							11.08m J, 50° Slicken Sides	11.0
				11.5					0.91		11.45m J, Un	11.5
				12.0								12.0
				12.5					0.91			12.5
				13.0								13.0
						Continued on page 5 of 6						

Key - Method		Case - lift		Weathering		Strength	Is (50) MPa
AS	Auger Screwing	Casing used		Fr	Fresh	EL Extremely Low	< 0.03
AD	Auger Drilling	Barrel withdrawn	water level	SW	Slightly weathered	VL Very Low	0.03 - 0.1
R	Roller / Tricone		date shown	DW	Distinctly weathered	L Low	0.1 - 0.3
W	Washbore	Water inflow		HW	Highly weathered	M Medium	0.3 - 1.0
NMLC	NMLC Core Drill	Partial drilling water loss		EW	Extremely weathered	H High	1.0 - 3.0
NQ,HQ	Wireline Core Drill	Complete drilling water loss				VH Very High	3.0 - 10.0
						EH Extremely High	>10.0

Job No: GS2948-B
Hole No: BH 7
Sheet: 5 of 6

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AUSTRALIA

CORELOG OF TEST HOLE

Client:	Lifehouse at RPA	Hole Commenced:13/5/10	
Project:	RPA Lifehouse	Hole Completed:18/5/10	
Project Location:	Missenden Road, Camperdown	Supervised by: AC	
		Checked by:	
Drill Model:		Slope: 90°	R.L. Surface: Existing
Barrel Type / Length:	NMLC	Bearing: -	Datum: -

Drilling Information					Rock Substance							Rock Mass Defects			
Method	Case - Lift	Groundwater	Samples / Field Tests	Depth (m)	Graphic Log	Substance Description	Weathering	Estimated Strength EL VL L M H VH EH	Is(50) MPa	Defect Spacing 30 100 300 1000 3000	Defect Description	Depth (m)
						Continued from page 4 of 6						
						SHALE: dark grey with light grey laminae	FR					
				13.5								13.5
									0.45			
				14.0								14.0
				14.5							14.54m J, 45°	14.5
									0.43		14.84m CS, 20mmt	
				15.0								15.0
											15.35m J, Sub Vert Slicken Sides	
				15.5		CORE LOSS 0.10m						15.5
									0.20			
				16.0								16.0
									0.29			
				16.5								16.5
						Continued on page 6 of 6					16.51m J, 45°	

Key - Method		Case - lift		Weathering		Strength	Is (50) MPa
AS	Auger Screwing	Casing used		Fr	Fresh	EL Extremely Low	< 0.03
AD	Auger Drilling	Barrel withdrawn	water level	SW	Slightly weathered	VL Very Low	0.03 - 0.1
R	Roller / Tricone		date shown	DW	Distinctly weathered	L Low	0.1 - 0.3
W	Washbore	Water inflow		HW	Highly weathered	M Medium	0.3 - 1.0
NMLC	NMLC Core Drill	Partial drilling water loss		EW	Extremely weathered	H High	1.0 - 3.0
NQ,HQ	Wireline Core Drill	Complete drilling water loss				VH Very High	3.0 - 10.0
						EH Extremely High	>10.0

Job No: GS2948-B
Hole No: BH 7
Sheet: 6 of 6

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AUSTRALIA

CORELOG OF TEST HOLE

Client:	Lifehouse at RPA	Hole Commenced:13/5/10	
Project:	RPA Lifehouse	Hole Completed:18/5/10	
Project Location:	Missenden Road, Camperdown	Supervised by: AC	
		Checked by:	
Drill Model:		Slope: 90°	R.L. Surface: Existing
Barrel Type / Length:	NMLC	Bearing: -	Datum: -

Drilling Information					Rock Substance								Rock Mass Defects		
Method	Case - Lift	Groundwater	Samples / Field Tests	Depth (m)	Graphic Log	Substance Description	Weathering	Estimated Strength EL VL L M H VH EH	Is(50) MPa	Defect Spacing 30 100 300 1000 3000	Defect Description	Depth (m)
						Continued from page 5 of 6						
						SHALE: dark grey with light grey laminae	FR					
				17.0								17.0
											17.25m J, 45°	
				17.5					0.43			17.5
				18.0								18.0
									0.39			
				18.5								18.5
											18.82m J, Sub Vert	
				19.0								19.0
											19.14m J, Sub Vert	
											19.38m J, 45°	
				19.5							19.42m J, 45°	19.5
									0.31			
				20.0								20.0
						Borehole Terminated at 20.10m						

Key - Method		Case - lift		Weathering		Strength	Is (50) MPa
AS	Auger Screwing	Casing used		Fr	Fresh	EL Extremely Low	< 0.03
AD	Auger Drilling	Barrel withdrawn	water level	SW	Slightly weathered	VL Very Low	0.03 - 0.1
R	Roller / Tricone		date shown	DW	Distinctly weathered	L Low	0.1 - 0.3
W	Washbore	Water inflow		HW	Highly weathered	M Medium	0.3 - 1.0
NMLC	NMLC Core Drill	Partial drilling water loss		EW	Extremely weathered	H High	1.0 - 3.0
NQ,HQ	Wireline Core Drill	Complete drilling water loss				VH Very High	3.0 - 10.0
						EH Extremely High	>10.0

Job No:	GS2948-B
Hole No:	BH 8
Sheet	1 of 7

Aargus
AUSTRALIA

ENGINEERING LOG OF DRILLED BOREHOLE

Client:	Lifehouse at RPA	Test Location: Refer to Fig 1	
Project:	RPA Lifehouse	Test Method: Drill Rig	
Project Location:	Missenden Road, Camperdown	Coordinates: -	Logged by: AC
		Surface Level:Existing	Date: 19/5/10

Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Rel. Density	Additional Comments	Depth (m)
				CI - CH	Silty CLAY: medium to high plasticity, grey red and orange brown with ironstone gravels	M ≥ Wp	St	Standpipe Installed to a Depth of 20.18m. 18.0m Slotted, 2.18m Unslotted Filter Sock to 20.18m Graded Sand to 19.9m Bentonite Plug 0.28m RESIDUAL	
	BS	0.5							0.5
		1.0							1.0
	2,10/50mm N>10								
		1.5			Interbedded Shale and CLAY: very low strength grey brown				1.5
		2.0							2.0
		2.5							2.5
	14,17,20/50 mm Refusal N > 37	3.0			grading to grey brown with ironstone gravels				3.0
		3.5			grading to grey brown				3.5

Continued on page 2 of 7

Explanatory Notes:

Consistency		Density Index		Samples		Moisture	
VS	Very Soft	**VL**	Very Loose	**B**	Bulk Sample	**D**	Dry
S	Soft	**L**	Loose	**D**	Disturbed Sample	**M**	Moist
F	Firm	**MD**	Medium Dense	**U50**	Undisturbed Sample	**W**	Wet
St	Stiff	**D**	Dense		(50mm diam.)	**Wp**	Plastic Limit
VSt	Very Stiff	**VD**	Very Dense	**N**	S.P.T. Value	**Wl**	Liquid Limit
H	Hard						

Job No:	GS2948-B
Hole No:	BH 8
Sheet	2 of 7

Aargus
AUSTRALIA

ENGINEERING LOG OF DRILLED BOREHOLE

Client:	Lifehouse at RPA	Test Location: Refer to Fig 1	
Project:	RPA Lifehouse	Test Method: Drill Rig	
Project Location:	Missenden Road, Camperdown	Coordinates: -	Logged by: AC
		Surface Level:Existing	Date: 19/5/10

Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Rel. Density	Additional Comments	Depth (m)
					Continued from page 1 of 7			RESIDUAL	
					Interbedded Shale and CLAY: very low strength grey brown	M ≥ Wp	St		
		4.0							4.0
	3, 22/140 Refusal N > 22							V bit refusal	
					SHALE: dark grey, XW-DW, VL strength			BEDROCK	
		4.5							4.5
					grading to DW-SW, L strength			High TC bit resistance	
		5.0							5.0
		5.5							5.5
					grading to SW-FR, L-M strength			Very High TC bit resistance	
▼		6.0							6.0
		6.5			Refer to Cored Borehole Log			TC bit refusal	6.5
		7.0			**Continued on page 3 of 7**				7.0

Explanatory Notes:

Consistency		Density Index		Samples		Moisture	
VS	Very Soft	**VL**	Very Loose	**B**	Bulk Sample	**D**	Dry
S	Soft	**L**	Loose	**D**	Disturbed Sample	**M**	Moist
F	Firm	**MD**	Medium Dense	**U50**	Undisturbed Sample	**W**	Wet
St	Stiff	**D**	Dense		(50mm diam.)	**Wp**	Plastic Limit
VSt	Very Stiff	**VD**	Very Dense	**N**	S.P.T. Value	**Wl**	Liquid Limit
H	Hard						

Job No: GS2948-B
Hole No: BH 8
Sheet: 3 of 7

Aargus
AUSTRALIA

CORELOG OF TEST HOLE

Client:	Lifehouse at RPA	Hole Commenced:	19/5/10
Project:	RPA Lifehouse	Hole Completed:	21/5/10
Project Location:	Missenden Road, Camperdown	Supervised by:	AC
		Checked by:	

Drill Model: Slope: 90° R.L. Surface: Existing

Barrel Type / Length: NMLC Bearing: - Datum: -

Drilling Information					Rock Substance								Rock Mass Defects		
Method	Case - Lift	Groundwater	Samples / Field Tests	Depth (m)	Graphic Log	Substance Description	Weathering	Estimated Strength EL VL L M H VH EH	Is(50) MPa	Defect Spacing 30 100 300 1000 3000	Defect Description	Depth (m)
						Continued from page 2 of 7						
				6.5		Start coring at 6.65m						6.5
						SHALE: dark grey with light grey laminae	FR					
				7.0							6.95m J, Sub Vert	7.0
				7.5					0.77			7.5
				8.0							7.97m CS, 15mmt	8.0
				8.5								8.5
				9.0					0.62			9.0
				9.5		**Continued on page 4 of 7**						9.5

Key - Method		Case - lift		Weathering		Strength	Is (50) MPa
AS	Auger Screwing	Casing used		Fr	Fresh	EL Extremely Low	< 0.03
AD	Auger Drilling	Barrel withdrawn	water level	SW	Slightly weathered	VL Very Low	0.03 - 0.1
R	Roller / Tricone		date shown	DW	Distinctly weathered	L Low	0.1 - 0.3
W	Washbore	Water inflow		HW	Highly weathered	M Medium	0.3 - 1.0
NMLC	NMLC Core Drill	Partial drilling water loss		EW	Extremely weathered	H High	1.0 - 3.0
NQ,HQ	Wireline Core Drill	Complete drilling water loss				VH Very High	3.0 - 10.0
						EH Extremely High	>10.0

Job No: GS2948-B
Hole No: BH 8
Sheet: 4 of 7

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AUSTRALIA

CORELOG OF TEST HOLE

Client:	Lifehouse at RPA	Hole Commenced:19/5/10	
Project:	RPA Lifehouse	Hole Completed:21/5/10	
Project Location:	Missenden Road, Camperdown	Supervised by: AC	
		Checked by:	
Drill Model:		Slope: 90°	R.L. Surface: Existing
Barrel Type / Length:	NMLC	Bearing: -	Datum: -

Drilling Information					Rock Substance							Rock Mass Defects		
Method	Case - Lift	Groundwater	Samples / Field Tests	Depth (m)	Graphic Log	Substance Description	Weathering	Estimated Strength EL VL L M H VH EH	Is(50) MPa	Defect Spacing 30 100 300 1000 3000	Defect Description	Depth (m)
						Continued from page 3 of 7						
						SHALE: dark grey with light grey laminae	FR		0.64			
				10.0								10.0
				10.5					0.44			10.5
				11.0								11.0
											11.21m XWS,20mmt	
				11.5							11.48m J, Sub Vert	11.5
									0.58			
				12.0								12.0
											12.37m J, 45°	
				12.5								12.5
											12.52m J, 45°	
									0.19			
				13.0								13.0
						Continued on page 5 of 7						

Key - Method		Case - lift		Weathering		Strength	Is (50) MPa
AS	Auger Screwing	Casing used		Fr	Fresh	EL Extremely Low	< 0.03
AD	Auger Drilling	Barrel withdrawn	water level	SW	Slightly weathered	VL Very Low	0.03 - 0.1
R	Roller / Tricone		date shown	DW	Distinctly weathered	L Low	0.1 - 0.3
W	Washbore	Water inflow		HW	Highly weathered	M Medium	0.3 - 1.0
NMLC	NMLC Core Drill	Partial drilling water loss		EW	Extremely weathered	H High	1.0 - 3.0
NQ,HQ	Wireline Core Drill	Complete drilling water loss				VH Very High	3.0 - 10.0
						EH Extremely High	>10.0

Job No: GS2948-B
Hole No: BH 8
Sheet: 5 of 7

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AUSTRALIA

CORELOG OF TEST HOLE

Client:	Lifehouse at RPA	Hole Commenced:	19/5/10
Project:	RPA Lifehouse	Hole Completed:	21/5/10
Project Location:	Missenden Road, Camperdown	Supervised by:	AC
		Checked by:	

Drill Model: Slope: 90° R.L. Surface: Existing

Barrel Type / Length: NMLC Bearing: - Datum: -

Drilling Information					Rock Substance									Rock Mass Defects		
Method	Case - Lift	Groundwater	Samples / Field Tests	Depth (m)	Graphic Log	Substance Description	Weathering	Estimated Strength EL VL L M H VH EH	Is(50) MPa	Defect Spacing 30 100 300 1000 3000	Defect Description	Depth (m)
						Continued from page 4 of 7						
						SHALE: dark grey with light grey laminae	FR					
				13.5								13.5
									0.29			
				14.0								14.0
				14.5								14.5
									0.33			
				15.0								15.0
				15.5								15.5
									0.32			
				16.0								16.0
				16.5					3.55			16.5
						Continued on page 6 of 7						

Key - Method		Case - lift		Weathering		Strength	Is (50) MPa
AS	Auger Screwing	Casing used		Fr	Fresh	EL Extremely Low	< 0.03
AD	Auger Drilling	Barrel withdrawn	water level	SW	Slightly weathered	VL Very Low	0.03 - 0.1
R	Roller / Tricone		date shown	DW	Distinctly weathered	L Low	0.1 - 0.3
W	Washbore	Water inflow		HW	Highly weathered	M Medium	0.3 - 1.0
NMLC	NMLC Core Drill	Partial drilling water loss		EW	Extremely weathered	H High	1.0 - 3.0
NQ,HQ	Wireline Core Drill	Complete drilling water loss				VH Very High	3.0 - 10.0
						EH Extremely High	>10.0

Job No: GS2948-B
Hole No: BH 8
Sheet: 6 of 7

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AUSTRALIA

CORELOG OF TEST HOLE

Client:	Lifehouse at RPA	Hole Commenced:	19/5/10
Project:	RPA Lifehouse	Hole Completed:	21/5/10
Project Location:	Missenden Road, Camperdown	Supervised by:	AC
		Checked by:	

Drill Model: Slope: 90° R.L. Surface: Existing

Barrel Type / Length: NMLC Bearing: - Datum: -

Drilling Information					Rock Substance										Rock Mass Defects		
Method	Case - Lift	Groundwater	Samples / Field Tests	Depth (m)	Graphic Log	Substance Description	Weathering	Estimated Strength EL	VL	L	M	H	VH	EH	Is(50) MPa	Defect Spacing 30	100	300	1000	3000	Defect Description	Depth (m)
						Continued from page 5 of 7																
						SHALE: dark grey with light grey laminae	FR															
																					16.78m, J, Sub Vert	
						CORE LOSS 0.20m																
				17.0		Due to drilling equipment																17.0
																					17.0m CS, 10mmt	
																					17.23m J, 45°	
																					17.34m J, 45°	
																					17.48m J, 45°	
				17.5																	Slicken Sides	17.5
																					17.57m J, 45°	
																					Slicken Sides	
															0.31							
				18.0																		18.0
																					18.33m J, 45°	
				18.5											0.18							18.5
				19.0																	18.97m J, 45	19.0
				19.5																		19.5
															0.48							
				20.0		**Continued on page 7 of 7**																20.0

Key - Method		Case - lift		Weathering		Strength	Is (50) MPa
AS	Auger Screwing	Casing used		Fr	Fresh	EL Extremely Low	< 0.03
AD	Auger Drilling	Barrel withdrawn	water level	SW	Slightly weathered	VL Very Low	0.03 - 0.1
R	Roller / Tricone		date shown	DW	Distinctly weathered	L Low	0.1 - 0.3
W	Washbore	Water inflow		HW	Highly weathered	M Medium	0.3 - 1.0
NMLC	NMLC Core Drill	Partial drilling water loss		EW	Extremely weathered	H High	1.0 - 3.0
NQ,HQ	Wireline Core Drill	Complete drilling water loss				VH Very High	3.0 - 10.0
						EH Extremely High	>10.0

Job No: GS2948-B
Hole No: BH 8
Sheet: 7 of 7

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AUSTRALIA

CORELOG OF TEST HOLE

Client:	Lifehouse at RPA	Hole Commenced:19/5/10	
Project:	RPA Lifehouse	Hole Completed:21/5/10	
Project Location:	Missenden Road, Camperdown	Supervised by: AC	
		Checked by:	
Drill Model:		Slope: 90°	R.L. Surface: Existing
Barrel Type / Length:	NMLC	Bearing: -	Datum: -

Drilling Information					Rock Substance										Rock Mass Defects					
Method	Case - Lift	Groundwater	Samples / Field Tests	Depth (m)	Graphic Log	Substance Description	Weathering	Estimated Strength EL	VL	L	M	H	VH	EH	Is(50) MPa	Defect Spacing 30	100	300	1000	3000	Defect Description	Depth (m)
						Continued over from page 6 of 7																
						Borehole Terminated at 20.18m																
				20.5																		20.5
				21.0																		21.0
				21.5																		21.5
				22.0																		22.0
				22.5																		22.5
				23.0																		23.0
				23.5																		23.5

Key - Method		Case - lift		Weathering		Strength	Is (50) MPa
AS	Auger Screwing	Casing used		Fr	Fresh	EL Extremely Low	< 0.03
AD	Auger Drilling	Barrel withdrawn	water level	SW	Slightly weathered	VL Very Low	0.03 - 0.1
R	Roller / Tricone		date shown	DW	Distinctly weathered	L Low	0.1 - 0.3
W	Washbore	Water inflow		HW	Highly weathered	M Medium	0.3 - 1.0
NMLC	NMLC Core Drill	Partial drilling water loss		EW	Extremely weathered	H High	1.0 - 3.0
NQ,HQ	Wireline Core Drill	Complete drilling water loss				VH Very High	3.0 - 10.0
						EH Extremely High	>10.0

Job No:	GS2948-B
Hole No:	BH 9
Sheet	1 of 6

Aargus
AUSTRALIA

ENGINEERING LOG OF DRILLED BOREHOLE

Client:	Lifehouse at RPA	Test Location: Refer to Fig 1	
Project:	RPA Lifehouse	Test Method: Drill Rig	
Project Location:	Missenden Road, Camperdown	Coordinates: -	Logged by: AC
		Surface Level:Existing	Date: 24/5/10

Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Rel. Density	Additional Comments	Depth (m)
					AC 70mm thick			PAVEMENT	
					CONCRETE 200mm thick			BASECOURSE	
					ROADBASE: Gravels 100mm thick			SUBBASE	
		0.5		CI - CH	Silty CLAY: medium to high plasticity, grey red and orange brown	M ≥ Wp	St-VSt	RESIDUAL	0.5
		1.0							1.0
	4, 7, 12 N = 19				grading to grey red and orange brown with ironstone gravels		VSt		
		1.5							1.5
		2.0			grading to grey red and orange brown				2.0
		2.5					H		2.5
	4, 11, 10 N = 21				grading to grey red and orange brown with ironstone gravels				
		3.0							3.0
		3.5							3.5

Continued on page 2 of 6

Explanatory Notes:

Consistency		Density Index		Samples		Moisture	
VS	Very Soft	**VL**	Very Loose	**B**	Bulk Sample	**D**	Dry
S	Soft	**L**	Loose	**D**	Disturbed Sample	**M**	Moist
F	Firm	**MD**	Medium Dense	**U50**	Undisturbed Sample (50mm diam.)	**W**	Wet
St	Stiff	**D**	Dense			**Wp**	Plastic Limit
VSt	Very Stiff	**VD**	Very Dense	**N**	S.P.T. Value	**Wl**	Liquid Limit
H	Hard						

Job No:	GS2948-B
Hole No:	BH 9
Sheet	2 of 6

Aargus
AUSTRALIA

ENGINEERING LOG OF DRILLED BOREHOLE

Client:	Lifehouse at RPA	Test Location: Refer to Fig 1	
Project:	RPA Lifehouse	Test Method: Drill Rig	
Project Location:	Missenden Road, Camperdown	Coordinates: -	Logged by: AC
		Surface Level:Existing	Date: 24/5/10

Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Rel. Density	Additional Comments	Depth (m)
					Continued from page 1 of 6				
					Silty CLAY: medium to high plasticity, grey red and orange brown with ironstone gravels	M ≥ Wp	H		
		4.0							4.0
	9,14/80mm Refusal N>14								
					Interbedded Shale and CLAY: very low strength grey brown			Moderate - High V bit resistance	
		4.5							4.5
		5.0							5.0
								Very High V bit resistance	
		5.5						V bit refusal	5.5
					SHALE: grey brown, XW, VL strength			BEDROCK	
		6.0			grading to grey, DW, L strength			Very High TC bit resistance	6.0
					Refer to Cored Borehole Log			TC bit refusal	
		6.5							6.5
		7.0							7.0
					Continued on page 3 of 6				

Explanatory Notes:

Consistency		Density Index		Samples		Moisture	
VS	Very Soft	**VL**	Very Loose	**B**	Bulk Sample	**D**	Dry
S	Soft	**L**	Loose	**D**	Disturbed Sample	**M**	Moist
F	Firm	**MD**	Medium Dense	**U50**	Undisturbed Sample	**W**	Wet
St	Stiff	**D**	Dense		(50mm diam.)	**Wp**	Plastic Limit
VSt	Very Stiff	**VD**	Very Dense	**N**	S.P.T. Value	**Wl**	Liquid Limit
H	Hard						

Job No: GS2948-B
Hole No: BH 9
Sheet: 3 of 6

Aargus
AUSTRALIA

CORELOG OF TEST HOLE

Client:	Lifehouse at RPA	Hole Commenced:	24/5/10
Project:	RPA Lifehouse	Hole Completed:	26/5/10
Project Location:	Missenden Road, Camperdown	Supervised by:	AC
		Checked by:	

Drill Model: Slope: 90° R.L. Surface: Existing

Barrel Type / Length: NMLC Bearing: - Datum: -

Drilling Information					Rock Substance								Rock Mass Defects			
Method	Case - Lift	Groundwater	Samples / Field Tests	Depth (m)	Graphic Log	Substance Description	Weathering	Estimated Strength EL VL L M H VH EH	Is(50) MPa	Defect Spacing 30 100 300 1000 3000	Defect Description	Depth (m)
						Continued from page 2 of 6						
						Start Coring at 6.30m						
						SHALE: dark grey with light grey laminae	FR					
				6.5							6.44m J, 45°	6.5
						CORE LOSS 0.15m						
									0.24		6.75m J, 45°	
				7.0								7.0
											7.22m CS, 30mmt	
				7.5					0.36			7.5
											7.63 J, Sub Vert	
						CORE LOSS 0.38m						
				8.0								8.0
							XW					
							FR					
				8.5								8.5
											8.71, XWS, 10mmt	
				9.0					0.40			9.0
				9.5								9.5
						Continued on page 4 of 6						

Key - Method

AS	Auger Screwing
AD	Auger Drilling
R	Roller / Tricone
W	Washbore
NMLC	NMLC Core Drill
NQ,HQ	Wireline Core Drill

Case - lift

Casing used
Barrel withdrawn — water level date shown
Water inflow
Partial drilling water loss
Complete drilling water loss

Weathering

Fr	Fresh
SW	Slightly weathered
DW	Distinctly weathered
HW	Highly weathered
EW	Extremely weathered

Strength — Is (50) MPa

EL	Extremely Low	< 0.03
VL	Very Low	0.03 - 0.1
L	Low	0.1 - 0.3
M	Medium	0.3 - 1.0
H	High	1.0 - 3.0
VH	Very High	3.0 - 10.0
EH	Extremely High	>10.0

Job No: GS2948-B
Hole No: BH 9
Sheet: 4 of 6

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AUSTRALIA

CORELOG OF TEST HOLE

Client:	Lifehouse at RPA	Hole Commenced:	24/5/10
Project:	RPA Lifehouse	Hole Completed:	26/5/10
Project Location:	Missenden Road, Camperdown	Supervised by:	AC
		Checked by:	

Drill Model: Slope: 90° R.L. Surface: Existing

Barrel Type / Length: NMLC Bearing: - Datum: -

Drilling Information					Rock Substance							Rock Mass Defects			
Method	Case - Lift	Groundwater	Samples / Field Tests	Depth (m)	Graphic Log	Substance Description	Weathering	Estimated Strength EL VL L M H VH EH	Is(50) MPa	Defect Spacing 30 100 300 1000 3000	Defect Description	Depth (m)
						Continued from page 3 of 6						
						SHALE: dark grey with light grey laminae	FR					
				10.0					0.66		9.75m J, 45° Slicken Sides 9.84m J, 45° Slicken Sides	10.0
				10.5					0.84			10.5
				11.0								11.0
				11.5					0.46			11.5
				12.0								12.0
				12.5								12.5
				13.0					0.18		12.83m J, Sub Vert 12.88m CS, 20mmt	13.0
						Continued on page 5 of 6						

Key - Method		Case - lift		Weathering		Strength	Is (50) MPa
AS	Auger Screwing	Casing used		Fr	Fresh	EL Extremely Low	< 0.03
AD	Auger Drilling	Barrel withdrawn	water level	SW	Slightly weathered	VL Very Low	0.03 - 0.1
R	Roller / Tricone		date shown	DW	Distinctly weathered	L Low	0.1 - 0.3
W	Washbore	Water inflow		HW	Highly weathered	M Medium	0.3 - 1.0
NMLC	NMLC Core Drill	Partial drilling water loss		EW	Extremely weathered	H High	1.0 - 3.0
NQ,HQ	Wireline Core Drill	Complete drilling water loss				VH Very High	3.0 - 10.0
						EH Extremely High	>10.0

Job No: GS2948-B
Hole No: BH 9
Sheet: 5 of 6

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AUSTRALIA

CORELOG OF TEST HOLE

Client:	Lifehouse at RPA	Hole Commenced:	24/5/10
Project:	RPA Lifehouse	Hole Completed:	26/5/10
Project Location:	Missenden Road, Camperdown	Supervised by:	AC
		Checked by:	

Drill Model: Slope: 90° R.L. Surface: Existing

Barrel Type / Length: NMLC Bearing: - Datum: -

Drilling Information					Rock Substance									Rock Mass Defects		
Method	Case - Lift	Groundwater	Samples / Field Tests	Depth (m)	Graphic Log	Substance Description	Weathering	Estimated Strength EL VL L M H VH EH	Is(50) MPa	Defect Spacing 30 100 300 1000 3000	Defect Description	Depth (m)
						Continued from page 4 of 6						
						SHALE: dark grey with light grey laminae	FR				13.31m J, Sub Vert	
				13.5					0.02			13.5
											13.84m J, Sub Vert	
				14.0								14.0
											14.17m J, Sub Vert	
				14.5					0.14			14.5
											14.74m J, Sub Vert	
				15.0								15.0
				15.5					0.40			15.5
				16.0								16.0
				16.5		**Continued on page 6 of 6**						16.5

Key - Method

AS	Auger Screwing
AD	Auger Drilling
R	Roller / Tricone
W	Washbore
NMLC	NMLC Core Drill
NQ,HQ	Wireline Core Drill

Case - lift

	Casing used
	Barrel withdrawn
	Water inflow
	Partial drilling water loss
	Complete drilling water loss

water level date shown

Weathering

Fr	Fresh
SW	Slightly weathered
DW	Distinctly weathered
HW	Highly weathered
EW	Extremely weathered

Strength	Is (50) MPa
EL Extremely Low	< 0.03
VL Very Low	0.03 - 0.1
L Low	0.1 - 0.3
M Medium	0.3 - 1.0
H High	1.0 - 3.0
VH Very High	3.0 - 10.0
EH Extremely High	>10.0

Job No: GS2948-B
Hole No: BH 9
Sheet: 6 of 6

Aargus
AUSTRALIA

CORELOG OF TEST HOLE

Client:	Lifehouse at RPA	Hole Commenced: 24/5/10	
Project:	RPA Lifehouse	Hole Completed: 26/5/10	
Project Location:	Missenden Road, Camperdown	Supervised by: AC	
		Checked by:	
Drill Model:		Slope: 90°	R.L. Surface: Existing
Barrel Type / Length:	NMLC	Bearing: -	Datum: -

Drilling Information					Rock Substance										Rock Mass Defects		
Method	Case - Lift	Groundwater	Samples / Field Tests	Depth (m)	Graphic Log	Substance Description	Weathering	Estimated Strength: EL	VL	L	M	H	VH	EH	Is(50) MPa	Defect Spacing: 30	100	300	1000	3000	Defect Description	Depth (m)
						Continued from page 5 of 6																
						SHALE: dark grey with light grey laminae	FR								0.29							
				17.0																		17.0
				17.5																	17.6m J, 20°	17.5
															0.31							
				18.0																	18.2m J, Sub Vert	18.0
				18.5																		18.5
															0.47						18.8m J, 45°	
				19.0																	19.0m J, 45° Slicken Sides	19.0
				19.5											0.30							19.5
																					19.8m J, Sub Vert	
				20.0		Borehole Terminated at 19.86m																20.0

Key - Method		Case - lift		Weathering		Strength	Is (50) MPa
AS	Auger Screwing	Casing used		Fr	Fresh	EL Extremely Low	< 0.03
AD	Auger Drilling	Barrel withdrawn	water level	SW	Slightly weathered	VL Very Low	0.03 - 0.1
R	Roller / Tricone		date shown	DW	Distinctly weathered	L Low	0.1 - 0.3
W	Washbore	Water inflow		HW	Highly weathered	M Medium	0.3 - 1.0
NMLC	NMLC Core Drill	Partial drilling water loss		EW	Extremely weathered	H High	1.0 - 3.0
NQ,HQ	Wireline Core Drill	Complete drilling water loss				VH Very High	3.0 - 10.0
						EH Extremely High	>10.0

APPENDIX D

CORE PHOTOGRAPHS

BH 6 (7.00m – 20.20m)

BH 7 (6.18m – 20.10m)

BH 8 (6.65m - 20.18m)

BH 9 (6.30m - 19.86m)

APPENDIX E

LABORATORY TEST RESULTS

Aargus Laboratories Pty Ltd ACN: 086 993 937
Environmental - Remediation - Engineering - Laboratories - Drilling
446 Parramatta Road, Petersham NSW 2049
Ph: 1300 137 038 Fax: 1300 136 038

CALIFORNIA BEARING RATIO TEST REPORT

Client	Capital Insight	Job Number	LS2948-1
Project	RPA Lifehouse	Date	11/06/2010
Location	Missenden Rd Camperdown	Page	1 of 1

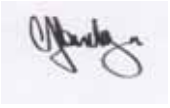
SAMPLE DETAILS					
Test Number		MT 1	MT 2		
Date Sampled		24/05/2010	24/05/2010		
Test Location		BH2	BH 3		
Sample Depth		0.5 - 1.0m	0.2 - 0.5m		
LABORATORY COMPACTION		**AS1289 5.1.1 (Standard)** ☐		**AS1289 5.2.1 (Modified)** ☐	
Maximum Dry Density	t/m^3	1.52	1.82		
Optimum Moisture Content	%	25.5	16.3		
TEST RESULTS		**AS1289.6.1.1**			
Dry Density Before Soak	t/m^3	1.52	1.80		
Moisture Content Before Soak	%	26.7	17.3		
Density Ratio Before Soak	%	100.0	99.0		
Moisture Ratio Before Soak	%	105.0	106.0		
Dry Density After Soak	t/m^3	1.48	1.80		
Moisture Content After Soak	%	30.7	18.1		
Moisture Cont. After Test (Whole)	%	28.2	17.0		
Moisture Cont. After Test (Top30mm)	%	30.6	17.6		
Material Retained 19.0mm	%	3.6	8.1		
+19.0mm Crushed/Included (Y/N)		N	N		
Mass of Surcharge	Kg	4.5	4.5		
Compactive Effort		STD	STD		
Period of Soaking	days	4	4		
Swell After Soaking	%	3.1	0.1		
CBR value @ 2.5/5.0mm penetration	%	3 / 3	9 / 12		

Specification: N/A

Material Description:
MT1 Silty Clay Traces Of Gravel Grey Brown
MT2 Silty Shaley Clay Light Brown

Notes: 1. Unless otherwise stated the CBR test is not repeated if the 5.0mm value exceeds the 2.5mm value

Approved Signatory
O.Mendoza



Date:11/6/2010

ANALYTICAL REPORT

28 May 2010

Aargus Pty Ltd
446 Parramatta Road
PETERSHAM
NSW 2049

Attention: **Adrian Collins**

Your Reference: GS2948-B - RPA Lifehouse - Camperdown

Our Reference: SE78608 Samples: 8 Soils
Received: 27/05/2010

Preliminary Report Sent: Not Issued

These samples were analysed in accordance with your written instructions.

For and on Behalf of:
SGS ENVIRONMENTAL SERVICES

Sample Receipt:	Angela Mamalicos	AU.SampleReceipt.Sydney@sgs.com
Production Manager:	Huong Crawford	Huong.Crawford@sgs.com

Results Approved and/or Authorised by:

Dong Liang
Quality Manager

Huong Crawford
Metals Signatory

SGS Australia Pty Ltd
ABN 44 000 964 278
Environmental Services Unit 16/33 Maddox Street Alexandria NSW 2015 Australia
t +61 (0)2 8594 0400 f + 61 (0)2 8594 0499 www.au.sgs.com

Anions in soil Our Reference: Your Reference Depth Sample Matrix	UNITS ---------- ----------	SE78608-1 BH3 0.1-0.6 Soil	SE78608-2 BH3 1.0-1.2 Soil	SE78608-3 BH3 1.4-1.7 Soil	SE78608-4 BH3 2.5-2.82 Soil	SE78608-5 BH4 0.4-0.6 Soil
Date Extracted		28/05/2010	28/05/2010	28/05/2010	28/05/2010	28/05/2010
Date Analysed		28/05/2010	28/05/2010	28/05/2010	28/05/2010	28/05/2010
Chloride, Cl 1:5 soil:water	mg/kg	13	9.1	3.0	2.3	2.9
Sulphate, SO4 1:5 soil:water	mg/kg	46	82	22	28	47

Anions in soil Our Reference: Your Reference Depth Sample Matrix	UNITS ---------- ----------	SE78608-6 BH4 1.0-1.45 Soil	SE78608-7 BH4 2.5-2.95 Soil	SE78608-8 BH4 4.0-4.23 Soil
Date Extracted		28/05/2010	28/05/2010	28/05/2010
Date Analysed		28/05/2010	28/05/2010	28/05/2010
Chloride, Cl 1:5 soil:water	mg/kg	3.7	3.4	4.1
Sulphate, SO4 1:5 soil:water	mg/kg	33	58	130

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Inorganics Our Reference: Your Reference Depth Sample Matrix	UNITS ---------- ----------	SE78608-1 BH3 0.1-0.6 Soil	SE78608-2 BH3 1.0-1.2 Soil	SE78608-3 BH3 1.4-1.7 Soil	SE78608-4 BH3 2.5-2.82 Soil	SE78608-5 BH4 0.4-0.6 Soil
Date Extracted- (pH 1:5 soil: Water)		28/05/2010	28/05/2010	28/05/2010	28/05/2010	28/05/2010
Date Analysed (pH 1:5 Soil: Water)		28/05/2010	28/05/2010	28/05/2010	28/05/2010	28/05/2010
pH 1:5 soil:water	pH Units	5.0	5.3	5.7	6.1	4.9

Inorganics Our Reference: Your Reference Depth Sample Matrix	UNITS ---------- ----------	SE78608-6 BH4 1.0-1.45 Soil	SE78608-7 BH4 2.5-2.95 Soil	SE78608-8 BH4 4.0-4.23 Soil
Date Extracted- (pH 1:5 soil: Water)		28/05/2010	28/05/2010	28/05/2010
Date Analysed (pH 1:5 Soil: Water)		28/05/2010	28/05/2010	28/05/2010
pH 1:5 soil:water	pH Units	4.8	5.6	5.5

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Moisture Our Reference: Your Reference Depth Sample Matrix	UNITS ---------- ----------	SE78608-1 BH3 0.1-0.6 Soil	SE78608-2 BH3 1.0-1.2 Soil	SE78608-3 BH3 1.4-1.7 Soil	SE78608-4 BH3 2.5-2.82 Soil	SE78608-5 BH4 0.4-0.6 Soil
Date Analysed (moisture)		28/05/2010	28/05/2010	28/05/2010	28/05/2010	28/05/2010
Moisture	%	14	12	12	11	21

Moisture Our Reference: Your Reference Depth Sample Matrix	UNITS ---------- ----------	SE78608-6 BH4 1.0-1.45 Soil	SE78608-7 BH4 2.5-2.95 Soil	SE78608-8 BH4 4.0-4.23 Soil
Date Analysed (moisture)		28/05/2010	28/05/2010	28/05/2010
Moisture	%	18	15	13

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Method ID	Methodology Summary
SEI-038	Water Soluble Chloride Water Soluble Chloride After carrying out a 1:5 soil:water extraction, an aliquot of the extract is reacted with mercuric thiocyanate forming a mercuric chloride complex. In the presence of ferric iron, highly coloured ferric thiocyanate is formed which is proportional to the chloride concentration. Reference NEPM, Schedule B(3), 401 and APHA 4500Cl- Water Soluble Sulphate After carrying out a 1:5 soil:water extraction ,sulphate in the extract is precipitated in an acidic medium with barium chloride. The resulting turbidity is measured photometrically at 405nm and compared with standard calibration solutions to determine the sulphate concentration in the sample. Reference NEPM, Schedule B(3), 401 and APHA 4500-SO42-.
AN101	pH - Measured using pH meter and electrode based on APHA 21st Edition, 4500-H+. For water analyses the results reported are indicative only as the sample holding time requirement specified in APHA was not met (APHA requires that the pH of the samples are to be measured within 15 minutes after sampling).
AN002	Preparation of soils, sediments and sludges undergo analysis by either air drying, compositing, subsampling and 1:5 soil water extraction where required. Moisture content is determined by drying the sample at 105 ± 5°C.

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QUALITY CONTROL Anions in soil	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Date Extracted				28/05/10	[NT]	[NT]	LCS	28/05/10
Date Analysed				28/05/10	[NT]	[NT]	LCS	28/05/10
Chloride, Cl 1:5 soil:water	mg/kg	0.25	SEI-038	<0.2	[NT]	[NT]	LCS	97%
Sulphate, SO4 1:5 soil:water	mg/kg	0.5	SEI-038	<0.5	[NT]	[NT]	LCS	95%

QUALITY CONTROL Inorganics	UNITS	LOR	METHOD	Blank
Date Extracted- (pH 1:5 soil: Water)				[NT]
Date Analysed (pH 1:5 Soil: Water)				[NT]
pH 1:5 soil:water	pH Units	0	AN101	0.0

QUALITY CONTROL Moisture	UNITS	LOR	METHOD	Blank
Date Analysed (moisture)				[NT]
Moisture	%	1	AN002	<1

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Result Codes

[INS] : Insufficient Sample for this test
[NR] : Not Requested
[NT] : Not tested
[LOR] : Limit of reporting
[RPD] : Relative Percentage Difference
* : Not part of NATA Accreditation
[N/A] : Not Applicable

Report Comments

Samples analysed as received. Solid samples expressed on a dry weight basis.
Date Organics extraction commenced:
NATA Corporate Accreditation No. 2562, Site No 4354
Note: Test results are not corrected for recovery (excluding Air-toxics and Dioxins/Furans*)
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Quality Control Protocol

Method Blank: An analyte free matrix to which all reagents are added in the same volume or proportions as used in sample processing. The method blank should be carried through the complete sample preparation and analytical procedure. A method blank is prepared every 20 samples.
Duplicate: A separate portion of a sample being analysed that is treated the same as the other samples in the batch. One duplicate is processed at least every 10 samples.
Surrogate Spike: An organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples. Surrogates are added to samples before extraction to monitor extraction efficiency and percent recovery in each sample.
Internal Standard: Added to all samples requiring analysis for organics (where relevant) or metals by ICP after the extraction/digestion process; the compounds/elements serve to give a standard of retention time and/or response, which is invariant from run-to-run with the instruments.
Laboratory Control Sample: A known matrix spiked with compound(s) representative of the target analytes. It is used to document laboratory performance. When the results of the matrix spike analysis indicates a potential problem due to the sample matrix itself, the LCS results are used to verify that the laboratory can perform the analysis in a clean matrix.
Matrix Spike: An aliquot of sample spiked with a known concentration of target analyte(s). The spiking occurs prior to sample preparation and analysis. A matrix spike is used to document the bias of a method in a given sample matrix.

Quality Acceptance Criteria

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: http://www.au.sgs.com/sgs-mp-au-env-qu-022-qa-qc-plan-en-09.pdf

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