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ABN 64 002 841 063

Job No: 12382/1
Our Ref: 12382/1-AA
15 December 2010

Capital Corporation
Suite 705
12 Century Drive
BAULKHAM HILLS NSW 2153

Attention: Mr A Wheat

Dear Sir

re: **Proposed Development**
2 Australia Avenue, Sydney Olympic Park
Geotechnical Investigation

This report provides the results of a geotechnical investigation at the above location. The investigation was commissioned by Mr Adam Wheat of Capital Corporation in an email dated 16 October 2010 and was carried out in general accordance with Geotechnique Pty Ltd proposal, ER.pb/Q5149R dated 13 October 2010.

Proposed Development
It is understood that the proposed development includes demolition of existing structures and creation of two new roads. The development also includes creation of three basement levels. Expected column loads are in the order of 9000kN.

A geotechnical investigation was required to assess sub-surface conditions in the footprint of the proposed development in order to provide geotechnical recommendations for design and construction.

Field Work
Field work for the investigation was carried out between 24 and 26 November 2010 and consisted of the following:

- A walk over survey to assess existing site conditions.
- Scanning borehole locations for underground services. A specialist services locater was engaged for this purpose. DBYD drawings were also obtained prior to commencing field work.
- Drilling eight boreholes (BH1 to BH8) using a truck mounted drilling rig fully equipped for geotechnical investigation. The boreholes were drilled to depths ranging from 5.4m to 12m. The boreholes were initially drilled using V and TC bits to refusal on bedrock and then cored to obtain rock cores (BH1 to BH5 and BH8). Approximate borehole locations are indicated on the attached Drawing No 12382/1-AA1. Engineering borehole logs and cores photographs are also attached.
- Conducting Standard Penetration Tests (SPT) at regular depth intervals to assess strength and compressibility characteristics of sub-surface soils.
- Recovering soil and rock samples for visual assessment and laboratory testing (CBR, aggressivity and point load strength index).

Field work was supervised by a Geotechnical Engineer from this company, responsible for nominating the borehole locations, sampling and preparation of field logs.

Site Conditions
General site features observed during the investigation are described below:

- The site is located at the corner of Australia Avenue and Herb Elliot Avenue, Sydney Olympic Park.
- The topography of the site is generally flat.
- The site is occupied by an industrial building and car parking in the east and south-east portions.
- The north and north-western portion of the site is an open area and covered with grass, pedestrian walkways and trees.
- The site is bound to the south and west by car parking areas.

Regional Geology
Based on the Geological Map of Sydney (1:100,000), bedrock at the site is anticipated to be Ashfield Shale, belonging to the Wianamatta Group of rocks and comprising dark grey to black shale and laminite.

Reference to the Soil Landscape Map (1:100,000) of Sydney indicates that the landscape at the site belongs to the Blacktown Group, which is characterised by gently undulating rises on Wianamatta Group shale, with local relief to 30m, ground slope less than 5%, broad rounded crests and gently inclined slopes. The sub-surface soil in this landscape is likely to be up to 3m thick, moderately reactive, highly plastic and with poor drainage.

Sub-surface Conditions
Sub-surface conditions encountered at the site are detailed in the attached borehole logs and summarised below in Table 1.

TABLE 1

BH	Top RL (m AHD)+	Termination Depth (m)	AC (m)	Roadbase (m)	Fill (m)	Residual (m)	Bedrock (m)
1	17.4	12.0	NE	NE	0.0 – 4.0	NE	4.0 –> 12.0
2	17.1	11.0	NE	NE	0.0 – 2.6	2.6 – 3.2	3.2 –> 11.0
3	17.18	12.0	NE	NE	0.0 – 1.6	NE	1.6 –> 12.0
4	17.6	6.0	0.0 – 0.04	0.04 – 0.2	NE	NE	0.2 –> 6.0
5	17.85	7.7	0.0 – 0.04	0.04 – 0.2	NE	0.2 – 1.6	1.6 –> 7.7
6	17.6	5.4	0.0 – 0.04	0.04 – 0.22	NE	NE	0.22 –> 5.4
7	17.4	7.6	NE	NE	0.0 – 1.6	NE	1.6 –> 7.6
8	16.5	12.0	0.0 – 0.19*	NE	0.19 – 0.25	0.25 – 1.2	1.2 –> 12.0

** Concrete Slab; RL : Reduced Level*
+ Approximate and estimated from drawings provided

Fill	Gravelly Clayey Sand, fine to coarse grained, yellow-brown, with crushed sandstone gravels
	Gravelly Clayey Sand, fine to coarse grained, dark brown, with rubbish such as timber, plastic bags and coal and brick fragments
	Gravelly Silty Sand, fine to coarse grained, pale yellow, with crushed sandstone gravels, roots and root fibres
Residual Soils	Gravelly Silty Clay, low to medium plasticity, yellow-brown, with ironstone bands
	Clay, high plasticity, orange-yellow, light grey, with trace of ironstone gravel

Bedrock	Shale, grey, yellow-brown, light grey, extremely weathered grading to slightly weathered to fresh with depth, extremely low strength grading to medium to high strength with depth, with fine grained sandstone laminae at deeper depths
	Shale/Siltstone interbedded, yellow-grey-brown, distinctly weathered, very low strength with trace of ironstone bands
	Siltstone/Ironstone/Shale interbedded, yellow-grey-brown, extremely to distinctly weathered, extremely low to very low strength, with clay seams
	Siltstone/Ironstone/Clay interbedded, yellow-grey-brown, extremely weathered and extremely low strength

Groundwater Conditions

With the exception of some seepage in BH1 at about 2.6m, groundwater and/or seepage were not encountered up to auger refusal depths. The use of water for coring in bedrock precluded further measurement of groundwater. However, it should be noted that levels of rock seepage might vary due to rainfall, temperature and other factors not evident during drilling.

Laboratory Testing

California Bearing Ratio Tests

Two (2) recovered bulk samples from BH4 and BH5 were tested in the NATA accredited laboratory of Geotech Testing Pty Ltd. The detailed results are attached and summarised below in Table 2.

TABLE 2

Borehole	Depth (m)	Summary Description	MDD (t/m^3)	CBR (%)	FMC/OMC (%)	Variation from OMC(%)
4	0.2 – 1.0	(CI) Gravelly Clay, medium plasticity, grey brown (extremely weathered siltstone/ironstone)	1.87	6	10.5/12.5	2 Dry
5	0.4 – 1.0	(CI) Silty Clay, medium plasticity, grey-red-brown	1.74	4	20.1/19.0	1.1 Wet

MDD: Maximum Dry Density; CBR: California Bearing ratio; FMC: Field Moisture Content; OMC: Optimum Moisture Content

Chemical Tests

Seven samples were tested for pH, sulphate and chloride in the NATA accredited laboratory of SGS Environmental Services. Tests results are attached and summarised below in Table 3.

TABLE 3

Borehole	Depth (m)	pH	Chloride, Cl (mg/kg)	Sulphate, SO_4 (mg/kg)	Sulphate, SO_3* (mg/kg)
1	0.5 – 0.95	7.3	8.1	15	12
1	3.0 – 3.45	7.9	25	200	160
2	1.5 – 1.95	8.5	35	91	73
3	1.0 – 1.5	4.7	220	240	192
4	0.5 – 0.95	5.0	100	160	128
5	1.0 – 1.5	4.8	44	100	80
8	0.5 – 0.95	4.9	98	170	136

*SO_3=0.8xSO_4

Point Load Strength Index Tests

Rock cores recovered from BH1 to BH5 and BH8 were photographed and tested for determination of point load strength index (I_{s50}). The point load strength indices for the rock cores and the assessed rock strength classes for axially loaded samples, in accordance with Australian Standards (Reference 1), are summarised in the following Table 4.

12382/1-AA
2 Australia Avenue, Sydney Olympic Park

TABLE 4

Borehole No	Depth (m)	Diametral Point Load Strength Index (MPa)	Axial Point Load Strength Index (MPa)	Estimated UCS* (MPa)	Estimated Axial Strength (MPa)
BH1	6.3		0.13	1.6	Low
	7.3	0.25	0.38	4.5	Medium
	8.3	0.30	0.85	10.2	Medium
	9.4	0.28	1.25	15.1	High
	10.6	0.62	0.75	9.0	Medium
	11.5	0.89	1.24	14.9	High
BH2	4.56		0.09	1.0	Very Low
	5.27	0.27	0.12	1.4	Low
	6.5	0.31	0.22	2.7	Low
	7.54	0.58	0.95	11.3	Medium
	8.3	0.17	1.04	12.4	High
	8.74	0.16	0.78	9.4	Medium
	9.5	0.25	0.49	5.9	Medium
	10.34	0.25	1.55	18.6	High
BH3	3.94	0.24	0.86	10.3	Medium
	4.7		0.60	7.2	Medium
	5.75	0.35	0.63	7.6	Medium
	6.4	0.15	0.87	10.5	Medium
	7.7	0.27	1.36	16.4	High
	8.3	0.62	1.75	21.0	High
	9.6	0.31	1.43	17.2	High
	10.7	0.27	1.15	13.8	High
	11.2	0.29	2.24	26.9	High
BH4	3.9	0.33	1.33	15.9	High
	4.7	0.27	0.69	8.3	Medium
	5.9	0.41	0.94	11.2	Medium
BH5	3.81	0.22	0.39	4.6	Medium
	4.63	0.32	0.41	4.9	Medium
	5.3	0.42	0.59	7.0	Medium
	5.84	0.18	0.55	6.6	Medium
	6.36	0.14	0.69	8.3	Medium
	7.35	0.31	0.79	9.5	Medium
BH8	4.7	0.12	0.36	4.4	Medium
	5.42	0.19	0.24	2.9	Low
	6.32	0.53	0.71	8.6	Medium
	7.66	0.37	0.68	8.1	Medium
	8.44	0.98	2.09	25.1	High
	9.2	1.28	1.42	17.0	High
	10.32	1.24	1.50	18.0	High

* Approximate from existing ground surface
+ Estimated using correlation : UCS = 12 x $I_{s(50)}$ (axial)

Bedrock Classification
Based on rock strengths (Table 4) and rock discontinuities shown in the borehole logs, bedrock at the site is classified for foundation design in accordance with Pells et al (Reference 2) and shown in Table 5 below.

TABLE 5

BH	Estimated Top depth (RL) to Class V (m)*	Estimated Top depth (RL) to Class IV(m)*	Estimated Top depth (RL) to Class III (m)*	Estimated Top depth (RL) to Class II (m)*
1	4 (13.4)	NE	6.2 (11.2)	10.2 (7.2)
2	3.2 (13.9)	4.5 (12.6)	6.5 (10.6)	9.6 (7.5)
3	1.6 (15.5)	NE	3.8 (13.3)	6.2 (10.9)
4	0.2 (17.4)	NE	3.8 (13.8)	4.4 (13.2)
5	1.6 (16.2)	NE	4.0 (13.8)	7.2 (10.6)
6	0.3 (17.3)	4.0 –> 5.4 (12.2)	NE	NE
7	1.6 (15.8)	6.0 (11.4)	=>7.6 (9.8)	NE
8	1.2 (15.3)	4.6 (11.9)	NE	6.0 (10.5)

**Approximate from existing ground surface; RL : Reduced Level;*
+Estimated from drawings provided

Discussion and Recommendations
Nature of Fill
Fill was encountered at borehole locations BH1, 2, 3, 7 and 8. The fill was generally variably compacted and soft/loose. The fill at BH1 also contained rubbish material. Based on inspection the fill is generally considered uncontrolled (unless further testing proves otherwise) and not suitable for supporting load bearing structures.

The fill is not expected to be exposed at the footing levels of the proposed structure. However it could be exposed at subgrade levels for the proposed pavements. The fill, if exposed at the pavement subgrade levels should be over-excavated to about 0.8m or to natural soils/rock and recompacted to at least 100% Standard Maximum Dry Density (SMDD) after moisture conditioning (OMC ± 2%) and removal of deleterious materials, if present.

Excavation Conditions
We anticipate that excavations for basement construction will reach to depths of 9m to 10m below existing grade. Sub-surface materials to the anticipated excavation depths are likely to comprise fill, residual clays and extremely low to high strength shale/siltstone bedrock. We consider that fill, residual clays and extremely low to low strength and extremely to distinctly weathered shale/siltstone bedrock could be easily removed using conventional earthmoving equipment, such as excavators and dozers. However, excavation into medium to high strength and slightly weathered to fresh shale/siltstone could be more difficult and require larger equipment (such as a Caterpillar D9, rock saw, rock hammer etc).

We suggest that selection of rock cutting equipment is based on site access, desired smoothness of the excavated rock surface and acceptable ground vibration during rock excavation.

Selection of excavation equipment should be based on site access, strength of sub-surface materials and the likely impact of vibration to structures (building, houses, roads, etc.) in the vicinity of the proposed excavation. Acceptable vibration is based on the nature and condition of neighbouring structures, which will have to be established by a dilapidation survey. As a general guide, the acceptable maximum peak particle velocity in a residential area would range from about 5mm/s to 10mm/s.

With the exception of some seepage in BH1 at about 2.6m, rock seepage was not encountered to auger refusal depths in the boreholes. The use of water for rock coring precluded further measurement. It should be noted that rock seepage could vary due to changes in rainfall, temperature and other factors not evident during drilling. If minor water is encountered in excavations we consider that it could be removed using a conventional pump and sump system. Trafficability problems might arise locally during wet weather or if water is allowed to pond at the site.

Subgrade Preparation & Placement of Controlled Fill
The following is recommended for subgrade preparation:

- Excavate to design subgrade level. Fill, if encountered, should be over-excavated and recompacted as recommended in the previous section “Nature of Fill”. Also if bedrock is encountered, over-excavate to about 300mm and recompact to 100%SMDD to provide uniform subgrade.
- Undertake proof rolling (using a 6 to 8 tonnes roller) of the exposed controlled fill or residual soils to detect potentially weak spots (ground heave). Excavate areas of localised heaving to a depth of about 300mm and replace with granular fill, compacted as described below:
    - Undertake proof rolling of soft spots backfilled with granular fill, as described above. If the backfilled area shows movement during proof rolling, this office should be contacted for further recommendations.
    - The fill should be placed in horizontal layers of 200mm to 250mm maximum loose thickness and compacted to a Minimum Dry Density Ratio (MDDR) of 98% Standard, at moisture content within 2% of Optimum Moisture Content (OMC). The upper 300mm of fill forming subgrade for the pavement should be compacted to a Minimum Dry Density Ratio (MDDR) of 100% Standard, at moisture content within 2% of Optimum Moisture Content (OMC).
- Controlled fill should preferably comprise non-reactive fill (e.g. crushed sandstone), with a maximum particle size not exceeding 75mm, or low plasticity clay. The fill material and residual soils obtained from excavations within the site may be selectively used in controlled fill, after moisture conditioning and removal of unsuitable materials, if any.
- Fill placement should be supervised to ensure that material quality, layer thickness, testing frequency and compaction criteria conform to the specifications. We recommend "Level 2" or better supervision, in accordance with AS3796 – "Guidelines on Earthworks for Commercial and Residential Developments".

Retaining Structures
Cut and fill during and after site preparation should be battered for stability or retained by engineered retaining structures. Where battered slopes are possible we recommended the following:

TABLE 6

Material	Temporary (Horizontal : Vertical)	Permanent (Horizontal : Vertical)
Fill/Natural Soils	1.0:1.0	2.0:1.0
Shale/Siltstone – Class V/IV	0.75:1.0	1.5:1.0
Shale/Siltstone – Class III or better	Sub-vertical	Sub-vertical

Surface protection of the cut slope can be provided by shotcreting, reinforced where necessary. It is also recommended that adequate surface and sub-surface drainage is provided.

Vertical excavation in Class III or better shale/siltstone bedrock is assessed to have a low risk of instability. However, rock bolting (local or patterned) and/or shotcreting might be required, depending on the relative orientations of the rock discontinuities (bedding partings and joint systems) and cut faces. As the boreholes encountered some rock discontinuities (such as high angle joints in BH1, BH2, BH3 and BH5), excavation faces should be inspected by a Geotechnical Engineer or an Engineering Geologist, as excavation progresses, at about 1.5m depth intervals, to assess requirements for rock bolting and/or shotcreting.

If batter slopes steeper than those recommended in Table 6 are required in fill and Class V/IV shale/siltstone bedrock, the materials would need to be retained by engineered retaining structures. Also considering that high angle joints were encountered in bedrock at a number of borehole locations, it would be prudent to retain excavation faces. Appropriate retaining structures for the proposed development works would be contiguous pile walls, cantilever walls or soldier pile walls.

Earth pressure distribution for non-anchored retaining walls is assumed to be triangular and estimated as follows:

$$p_h = \gamma kH$$

Where,

- p_h = Horizontal active pressure (kN/m^2)
- γ = Total density of materials to be retained (kN/m^3)
- k = Coefficient of earth pressure (k_a or k_o)
- H = Retained height (m)

For anchored retaining walls, earth pressure can be assumed trapezoidal and estimated as 0.8k□H kPa (k, □, H defined above). The pressure distribution should be nil at the surface, increasing to 0.8k□H at depth of 0.25H and remaining constant to 0.75H, then decreasing to nil at the base of the excavation.

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

TABLE 7

Founding Material	Bulk Unit Weight (kN/m^3)	Active Earth Pressure Coefficient	Passive Earth Pressure Coefficient	Earth Pressure Coefficient at Rest
Fill	17	0.40	-	0.60
Residual Clays	19	0.35	2.7	0.55
Class V/IV (Shale/Siltstone)	22	0.25	350 kPa	0.40
Class III / II (Shale/Siltstone)	22	-	1500 kPa	-

The above coefficients are based on the assumption that ground level behind the retaining structure is horizontal and the retained material is effectively drained. If retained materials are subjected to groundwater pressure or other surcharge loads (structures and traffic in the vicinity of the site), additional loads should also be allowed for in design of retaining structures. Also appropriate safety factors should be applied to passive earth pressure coefficients for bedrock classes shown above.

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

Rock anchors might be required to resist lateral pressures. In the design of rock anchors an allowable bond stress between the grout and the bedrock can be taken as 10% of serviceability end bearing pressure value given in Table 8 of this report.

Considering that high angle joints were encountered in the boreholes it is important that excavation faces are inspected by an experienced geotechnical engineer/engineering geologist to assess if additional rock bolting (for unstable wedges) or changes in the anchoring system will be required.

Footings

Based on the boreholes drilled at the site, Class III and Class II (Reference 2) shale/siltstone bedrock are likely to be encountered below about 4m to 7.5m. The proposed structure can either be supported on shallow footings (pad or strip) or on deep footings (bored piers) founded on the above bedrock and proportioned for the allowable bearing pressure values given in Table 8.

TABLE 8

Founding Material	Ultimate End Bearing Pressure (kPa)	Serviceability End Bearing Pressure (kPa)	Ultimate Shaft Adhesion (kPa)*	Allowable Shaft Adhesion (kPa)*	Elastic Modulus (MPa)
Class V/IV Shale/Siltstone	2000	700	100	50	100
Class IV Shale/Siltstone	3000	1000	150	75	200
Class III Shale/Siltstone	9000	3000	900	300	500
Class II Shale/Siltstone	15000	5000	1200	400	1000

** Clean Socket of roughness category R2 or better as per Pells et al (Reference 2)*

In calculating the geotechnical strength of footings (end bearing and side shear), a reduction factor of 0.65 (Reference 2) can be used. If only side shear of bored piers is considered, a reduction factor of 0.5 shall be used. A modulus reduction factor of 0.5 should be applied for the calculation of settlements (long-term serviceability).

Total settlements of footings bearing in the bedrock, under the recommended allowable bearing pressures (serviceability end bearing pressure and allowable shaft adhesion), are estimated to be about 1% of the minimum dimension of footings or pier diameter. Differential settlements are estimated to be about half the estimated total settlements.

It is important that all footings (pad, strip, piers etc) are inspected and tested (spoon testing or coring for bedrock with bearing capacity more than 3000kPa) as deemed necessary by an experienced geotechnical or engineering geologist, to ensure that the design bearing pressure values are obtained.

Floor slabs can either be ground-bearing supported on shale bedrock, or suspended on footings or bored piers. Floor slabs constructed as ground-bearing could be designed for a modulus of subgrade reaction of 35kPa/mm. If any loose/soft rocks or clay bands are encountered in the floor slab areas we recommend removal to competent rock and replacement with mass concrete.

Soil Aggressivity

Aqueous solution of chlorides causes corrosion of iron and steel, including steel reinforcements in concrete. Corrosion damage by chlorides is only relevant to the iron and steel. The aggressivity classifications of soil and groundwater applicable to iron and steel, in accordance with Australian Standard AS2159-1995 *(Piling – Design and Installation)*, are given below in Table 9.

TABLE 9 - Soil Aggressivity to Steel/Iron

Chloride		pH	Resistivity (ohm cm)	Soil Condition A*	Soil Condition B#
In Soil (%)	In Water (ppm)				
<0.5	<1000	>5.0	>5000	Non-aggressive	Non-aggressive
0.5-2.0	1000-10000	4.0-5.0	2000-5000	Mild	Non-aggressive
2.0-5.0	10000-20000	3.0-4.0	1000-2000	Moderate	Mild
>5.0	>20000	<3.0	<1000	Severe	Moderate

*Soil Condition A = high permeability soils (e.g. sands and gravels) which are below groundwater
#Soil Condition B = low permeability soils (e.g. silts and clays) and all soils above groundwater

The aggressivity classifications of soil and groundwater applicable to concrete, in accordance with Australian Standard AS2159-1995 *(Piling – Design and Installation)*, are given below in Table 10.

TABLE 10 - Soil Aggressivity to Concrete

Sulphate expressed as SO_3		**pH**	**Chloride in Water (ppm)**	**Soil Condition A***	**Soil Condition B#**
In Soil (%)	**In Water (ppm)**				
<0.2	<300	>6.5	<2000	Non-aggressive	Non-aggressive
0.2-0.5	300-1000	5.0-6.0	2000-6000	Mild	Non-aggressive
0.5-1.0	1000-2500	4.5-5.0	6000-12000	Moderate	Mild
1.0-2.0	2500-500	4.0-4.5	12000-30000	Severe	Moderate
>2.0	>5000	<4.0	>30000	Very Severe	Severe

Approximately 100ppm of SO_4 = 80ppm of SO_3
*Soil Condition A = high permeability soils (e.g. sands and gravels) which are below groundwater
#Soil Condition B = low permeability soils (e.g. silts and clays) and all soils above groundwater

Based on chloride tests results, the soils at the site were generally found to be non-aggressive to steel/iron and concrete. pH (BH3, 5 and 8) and sulphate results indicate the soils at the site to be mild to non-aggressive to concrete.

Pavement Design

Two CBR tests were conducted on samples recovered from BH4 and BH5. Extremely weathered siltstone (classified as Gravelly Clay in CBR certificate) in BH4 indicated a CBR value of 6% and residual clay obtained from BH5 indicated a CBR value of 4%.

Considering possible variation of sub-surface conditions across the site, a design CBR value of 4% is recommended.

Design traffic loading for the proposed roads was not available at the time of preparing this report. For the purpose of pavement design we have assumed a design traffic load of 2×10^5 ESA (5×10^5 HVAG) for a design period of 20 years.

Based on the above design CBR value, assumed traffic loads and Reference 3, the following pavement profiles are recommended:

Flexible Pavement

Design Traffic (ESA)	Asphaltic Concrete (mm)	Basecourse (mm)	Sub-base (mm)	Total Thickness (mm)
$2x10^5$	50	150	230	430

The pavement depth is only valid if the subgrade and pavement materials are compacted to the following Minimum Dry Density Ratios:

Basecourse	98% Modified
Sub-basecourse	95% Modified
Subgrade	100% Standard

Rigid Pavement(CRCP/JRCP)

Design Traffic (HVAG)	Concrete Base (mm)
$5x10^5$	190

Rigid pavement design is based on the following assumptions:

- Flexural strength of concrete = 4.24MPa
- Minimum thickness of bound sub-base = 125mm
- Load safety factor = 1.2

Earthquake Parameters
Based on the sub-surface materials encountered at the site and in accordance with Australian Standard AS1170.4-1993 "Minimum design loads on structures – Part 4: Earthquake loads", an Acceleration Coefficient (a) of 0.08 for Sydney region and a Site Factor (S) of 0.67 for footings placed in shale/siltstone bedrock are recommended.

Impact of Construction of Railway Line
Based on the drawings provided, the northern and eastern basement excavation faces are about 100m away from the railway lines. Considering that ground settlement will be negligible at a distance of about 10m to 15m from the face of excavation, we do not anticipate any impact of construction of the basements on the railway line.

General
As the recommendations presented in this report are based on information from eight (8) boreholes and site observation, actual sub-surface conditions across the site might differ from those expected (interpreted). If such differences are encountered during construction, we recommend that this office is contacted for further advice. This can also occur with groundwater conditions, especially after climatic changes.

If you have any questions, please do not hesitate to contact the undersigned.

Yours faithfully
GEOTECHNIQUE PTY LTD

Reviewed by

ZIAUDDIN AHMED
Senior Geotechnical Engineer

EMGED RIZKALLA
Director

Attached Drawing No 12382/1-AA1 - Borehole Location Plan
Borehole Logs
Core Photographs
Explanatory Notes
Laboratory Tests Results

References
1. *Australian Standard – Geotechnical Site Investigation, AS1726-1993.*
2. *Pells, P J N, Mostyn, E and Walker, B F – Foundations on Sandstone and Shale in the Sydney Region, Australian Geomechanics Journal, Dec 1998.*
3. *AUSTROADS PAVEMENT TECHNOLOGY SERIES "Pavement Design : A Guide to the Structural Design of Road Pavements" Sydney (2004)*

Aerial photograph obtained from nearmap.com

LEGEND

● Borehole

0 15 30 45 60 75m

Scale 1:1500

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NOTES

1. Site features are indicative and are not to scale.
2. This drawing has been produced using a base plan provided by others to which additional information e.g test pits, borehole locations or notes have been added. Some or all of the plan may not be relevant at the time of producing this drawing

Capital Corporation
Proposed Development
2 Australia Avenue
Sydney Olympic Park

Borehole Location Plan

Drawing No: 12382/1-AA1
Job No: 12382/1
Drawn By: MH
Date: 7 December 2010
Checked By: ZA

File No: Drawing 12382-1
Layers: 0, AA1

GEOTECHNIQUE PTY LTD

engineering log - borehole

Client : Capital Corporation
Project : Proposed Development
Location : 2 Australia Avenue, Sydney Olympic Park

Job No. : 12382/1
Borehole No. : 1
Date : 24/11/2010
Logged/Checked by: ZM/ZA

drill model and mounting : Edson 3000 **slope :** 90° **deg.** **R.L. surface :** ≅12.4
hole diameter : 125 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
				0			FILL; Gravelly Clayey Sand, fine to coarse grained, yellow-brown, with crushed sandstone gravels	M			
		DS	N=4 2,2,2				FILL; Gravelly Clayey Sand, fine to coarse grained, dark brown, with mixture of general rubbish waste such as timber, plastic bags, coal and bricks	M-W			Fill appears variably compacted
				1							
		DS	N=18 5,6,12								
				2							
	▶										Seepage encountered at 2.6m
				3							
		DS	N=14 2,11,3								
				4			SHALE, grey, yellow-brown, extremely low strength, extremely weathered				Bedrock
							Borehole No 1 started coring at 4.7m				
				5							
				6							
				7							
				8							
				9							

GEOTECHNIQUE PTY LTD

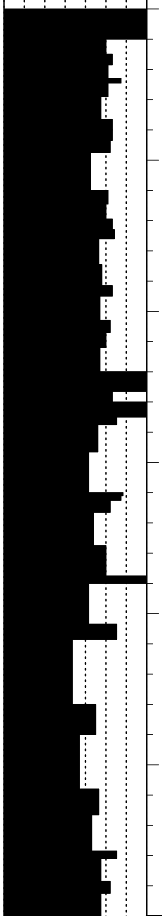
engineering log
cored borehole

Client : Capital Corporation
Project : Proposed Development
Location : 1 Australia Avenue, Sydney Olympic Park

Job No. : 12382/1
Borehole No. : 1
Date : 24/11/2010
Logged/Checked by : ZM/ZA

drill model and mounting : **slope :** 90° **deg.** **R.L. surface :** ≅17.4
core size: NMLC **bearing :** **deg.** **datum :** AHD

barrel lift	water loss/level	depth of R.L. in meters	graphic log	CORE DESCRIPTION rock type, grain characteristics, colour, structure, minor components.	weathering	strength	point load index strength $I_S(50)$ (EL VL L M H VH)	defect spacing (mm) (2000 1000 500 300 100 50)	DEFECT DETAILS DESCRIPTION type, inclination, thickness, planarity, roughness, coating. Specific	General
				Borehole No 1 started coring at 4.7m						
		5		CORE LOSS; 4.7-6.0m						
		6		SHALE, yellow-grey-brown	DW	VL-M	×			
		7					×		J 55°	
				SHALE, grey, light grey, with very fine grained sandstone laminae	SW-FR	M-H			J 50°	
		8					×		J 60°	
									J 65°	
		9					×		J 70°	
									J 50°	
		10					×		J 70°	
		11					×		J 75°	
									J 55°	
									J 55°	
									J 65°	
		12		Borehole No 1 terminated at 12.0m						
		13								
		14								



GEOTECHNIQUE
PTY LTD

Job No 12382/1 BH1 Started Coring at 4.7m	Core Loss 4.7m to 6m

5m
6m
7m
8m
9m
10m
11m

BH1 terminated at 12.0m

engineering log - borehole

Client : Capital Corporation
Project : Proposed Development
Location : 2 Australia Avenue, Sydney Olympic Park

Job No. : 12382/1
Borehole No. : 2
Date : 24/11/2010
Logged/Checked by: ZM/ZA

drill model and mounting : Edson 3000 **slope :** 90° **deg.** **R.L. surface :** ≅17.1
hole diameter : 125 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
		DS		0			FILL; Gravelly Silty Sand, fine to coarse grained, pale yellow, with traces of crushed sandstone gravels, roots and root fibres	M			
				1			FILL; Gravelly Clayey Sand, fine to medium grained, brown, with crushed shale gravels	M			
		DS		2			FILL; Gravelly Silty Sand, fine to coarse grained, grey, with crushed sandstone gravels	M			
		DS		3		CL-CI	Gravelly Silty CLAY, low to medium plasticity, yellow-brown, with ironstone bands	M≤PL	St-VSt		Residual
	Dry						SHALE/SILTSTONE, interbedded, yellow-grey-brown, with traces of ironstone bands, very low strength, distinctly weathered				Bedrock
				4			Borehole No 2 started coring at 3.7m				
				5							
				6							
				7							
				8							
				9							

GEOTECHNIQUE PTY LTD

engineering log
cored borehole

Client :	Capital Corporation	**Job No. :**	12382/1
Project :	Proposed Development	**Borehole No. :**	2
Location :	1 Australia Avenue, Sydney Olympic Park	**Date :**	24/11/2010
		Logged/Checked by :	ZM/ZA

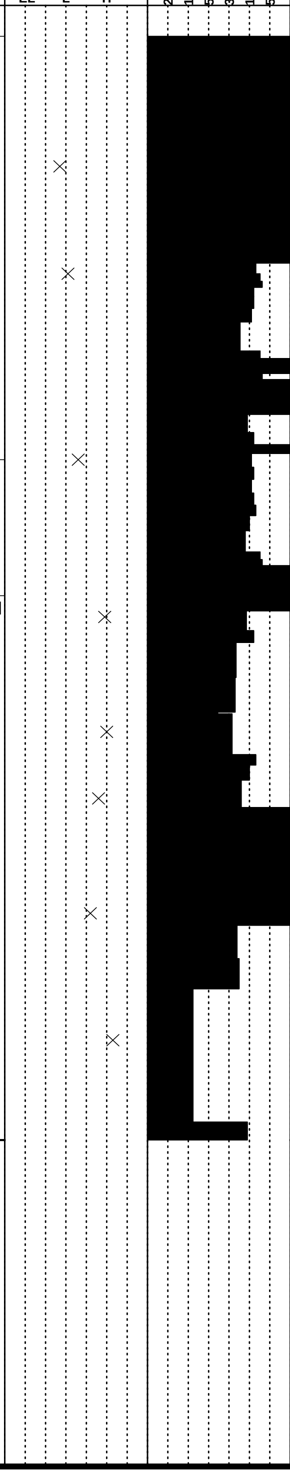
drill model and mounting :		**slope :** 90° **deg.**	**R.L. surface :** ≅17.16
core size:	NMLC	**bearing :** **deg.**	**datum :** AHD

barrel lift	water loss/level	depth of R.L. in meters	graphic log	CORE DESCRIPTION: rock type, grain characteristics, colour, structure, minor components.	weathering	strength	DEFECT DETAILS – DESCRIPTION (type, inclination, thickness, planarity, roughness, coating.) Specific	General
		3.7		Borehole No 2 started coring at 3.7m				
		3.7–6.5		SILTSTONE, Ironstone & minor Shale interbedded, yellow-grey-brown, with clay seams	DW-EW	EL-L	J 50°; J 50°; J 50°; J 80°; J 60°	
		6.5–7.4		SHALE, yellow-brown, grey-brown	DW	L	J 60°; J 70°	
		7.4–11.0		SHALE, grey-light grey, with very fine-grained sandstone laminae	FR	M-H	J 90°; J 60°; J 80°	
		11.0		Borehole No 2 terminated at 11.0m				

Depth scale: 4, 5, 6, 7, 8, 9, 10, 11, 12, 13

point load index strength $I_{S(50)}$: EL, VL, L, M, H, VH

defect spacing (mm): 2000, 1000, 500, 300, 100, 50



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Job No 12382/1 BH2 Started Coring at 3.7m

4m
5m
6m
7m
8m
9m
10m

BH2 terminated at 11.0m

GEOTECHNIQUE PTY LTD

engineering log - borehole

Client : Capital Corporation
Project : Proposed Development
Location : 2 Australia Avenue, Sydney Olympic Park

Job No. : 12382/1
Borehole No. : 3
Date : 25/11/2010
Logged/Checked by: ZM/ZA

drill model and mounting : Edson 3000 **slope :** 90° **deg.** **R.L. surface :** ≅17.18
hole diameter : 125 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
V-bit	Dry			0			FILL; Gravelly Silty Sand, fine to coarse grained, yellow-brown, traces of crushed sandstone gravels, roots and root fibres	M			
		DS	N=5 2,2,3	1			FILL; Gravelly Silty Clay, low to medium plasticity, yellow-grey-brown, with shale and ironstone gravels	M≤PL			
		DS									
TC-bit				2			SILTSTONE, Ironstone and Clay interbedded, yellow-grey-brown, extremely low strength, extremely weathered				Bedrock
				3							
				4			Borehole No 3 started coring at 3.6m				
				5							
				6							
				7							
				8							
				9							

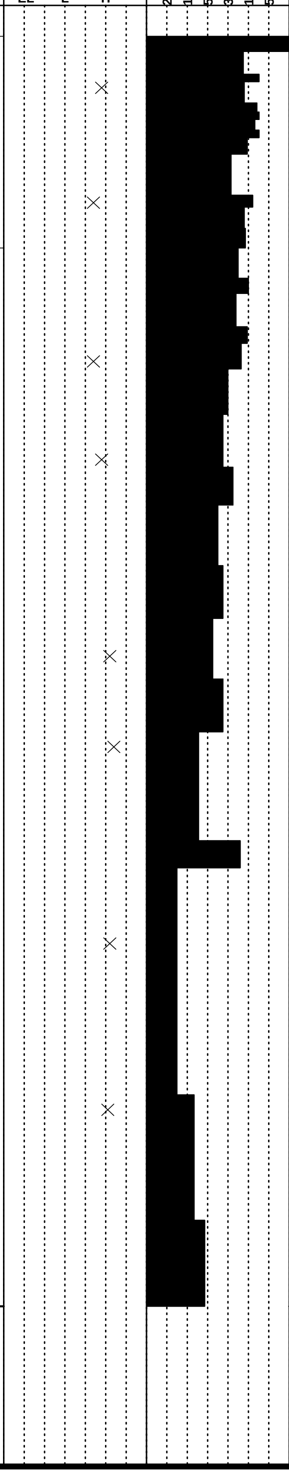
GEOTECHNIQUE PTY LTD

engineering log
cored borehole

Client :	Capital Corporation	**Job No. :**	12382/1
Project :	Proposed Development	**Borehole No. :**	3
Location :	1 Australia Avenue, Sydney Olympic Park	**Date :**	25/11/2010
		Logged/Checked by :	ZM/ZA

drill model and mounting :		**slope :** 90°	**deg.**	**R.L. surface :**	≅17.18
core size:	NMLC	**bearing :**	**deg.**	**datum :**	AHD

barrel lift	water loss/level	depth of R.L. in meters	graphic log	CORE DESCRIPTION rock type, grain characteristics, colour, structure, minor components.	weathering	strength	point load index strength $I_S(50)$ EL VL L M H VH	defect spacing (mm) 2000 1000 500 300 100 50	DEFECT DETAILS – DESCRIPTION type, inclination, thickness, planarity, roughness, coating. Specific	General
				Borehole No 3 starting coring at 3.6m						
		4		SHALE, yellow-brown, grey-brown	DW	VL-M				
									J 70°	
		5		SHALE, grey, light grey, with very fine grained, sandstone laminae	FR	M-H				
									J 70°	
		6								
		7							J 75°	
		8							J 80°	
		9								
		10								
		11								
		12		Borehole No 3 terminated at 12.0m						
		13								



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GEOTECHNIQUE
PTY LTD

Job No 12382/1 BH3 Started Coring at 3.7m

4m
5m
6m
7m
8m
9m
10m
11m

BH3 terminated at 12.0m

engineering log - borehole

Client : Capital Corporation
Project : Proposed Development
Location : 2 Australia Avenue, Sydney Olympic Park

Job No. : 12382/1
Borehole No. : 4
Date : 25/11/2010
Logged/Checked by: ZM/ZA

drill model and mounting : Edson 3000 **slope :** 90° **deg.** **R.L. surface :** ≅17.6
hole diameter : 125 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
				0			ASPHALTIC CONCRETE; 40mm thick				
							BASE; Sandy Gravel, fine to medium grained				Bedrock
		DB					SILTSTONE & Ironstone interbedded, with traces of clay layers, extremely low strength, extremely weathered				
				1							
				2							
	Dry			3							
							Borehole No 4 started coring at 3.6m				
				4							
				5							
				6							
				7							
				8							
				9							

GEOTECHNIQUE PTY LTD

engineering log
cored borehole

Client : Capital Corporation
Project : Proposed Development
Location : 1 Australia Avenue, Sydney Olympic Park

Job No. : 12382/1
Borehole No. : 4
Date : 25/11/2010
Logged/Checked by : ZM/ZA

drill model and mounting :
slope : 90° **deg.**
R.L. surface : ≅17.6
core size: NMLC
bearing : **deg.**
datum : AHD

barrel lift	water loss/level	depth of R.L. in meters	graphic log	CORE DESCRIPTION rock type, grain characteristics, colour, structure, minor components.	weathering	strength	point load index strength $I_{S}(50)$ EL VL L M H VH	defect spacing (mm) 2000 1000 500 300 100 50	DEFECT DETAILS DESCRIPTION type, inclination, thickness, planarity, roughness, coating. Specific	General
				Borehole No 4 started coring at 3.6m						
		4		SHALE, SILTSTONE & Ironstone interbedded, grey-red-brown, with minor clay seams	DW-SW		×			
		5		SHALE, grey-light grey, with very fine grained sandstone laminae	SW-FR	M-H	× ×			
		6		Borehole No 6 terminated at 6.0m						
		7								
		8								
		9								
		10								
		11								
		12								
		13								

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GEOTECHNIQUE
PTY LTD

Job No 12382/1 BH4 Started Coring at 3.6m

4m

5m

BH4 terminated at 6.0m

GEOTECHNIQUE
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engineering log - borehole

Client : Capital Corporation
Project : Proposed Development
Location : 2 Australia Avenue, Sydney Olympic Park

Job No. : 12382/1
Borehole No. : 5
Date : 25/11/2010
Logged/Checked by: ZM/ZA

drill model and mounting : Edson 3000 **slope :** 90° **deg.** **R.L. surface :** ≅17.85
hole diameter : 125 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
				0			ASPHALTIC CONCRETE; 40mm thick				
						CH	BASE; Sandy Gravel, fine to medium grained	M<PL	VSt		Residual
							CLAY, high plasticity, orange-yellow, light grey-orange				
		DS	N=15 5,7,8								
		DS		1							
							SILTSTONE & Ironstone interbedded, yellow-grey-brown, with minor shale, extremely weathered, very low strength				Bedrock
				2							
	Dry			3							
							Borehole No 5 started coring at 3.7m				
				4							
				5							
				6							
				7							
				8							
				9							

engineering log
cored borehole

Client : Capital Corporation
Project : Proposed Development
Location : 1 Australia Avenue, Sydney Olympic Park
Job No. : 12382/1
Borehole No. : 5
Date : 26/11/2010
Logged/Checked by : ZM/ZA

drill model and mounting :
slope : 90° **deg.**
R.L. surface : ≅17.85
core size: NMLC
bearing : **deg.**
datum : AHD

barrel lift	water loss/level	depth of R.L. in meters	graphic log	CORE DESCRIPTION: rock type, grain characteristics, colour, structure, minor components.	weathering	strength	point load index strength $I_S(50)$ (EL VL L M H VH)	defect spacing (mm) (2000 1000 500 300 100 50)	DEFECT DETAILS – DESCRIPTION: type, inclination, thickness, planarity, roughness, coating. Specific	General
				Borehole No 5 started coring at 3.7m						
		4, 5		SHALE, grey, yellow-brown	DW	VL-M				
		6		SHALE, grey, minor yellow-brown	SW	M			J 75°	
		7		SHALE, grey-light grey, with very fine grained sandstone laminae	FR	M-H			J 85°	
		8, 9, 10, 11, 12, 13		Borehole No 5 terminated at 7.7m						

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Job No 12382/1 BH5 Started Coring at 3.7m

4m
5m
6m
7m

BH5 terminated at 7.7m

GEOTECHNIQUE PTY LTD

engineering log - borehole

Client : Capital Corporation
Project : Proposed Development
Location : 2 Australia Avenue, Sydney Olympic Park

Job No. : 12382/1
Borehole No. : 6
Date : 25/11/2010
Logged/Checked by: ZM/ZA

drill model and mounting : Edson 3000 **slope :** 90° **deg.** **R.L. surface :** ≅17.6
hole diameter : 125 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
TC-bit				0			ASPHALTIC CONCRETE; 40mm thick				
							BASE; Sandy Gravel, 180mm thick				
							SILTSTONE; Ironstone & minor Shale interbedded, yellow-grey-brown, with traces of clay seams				Bedrock
				1							
				2							
				3							
				4			SHALE, grey, medium strength, slightly weathered to fresh				
	Dry			5							
							Borehole No 6 terminated at 5.4m due to next TC-bit refusal				
				6							
				7							
				8							
				9							

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engineering log - borehole

Client : Capital Corporation
Project : Proposed Development
Location : 2 Australia Avenue, Sydney Olympic Park

Job No. : 12382/1
Borehole No. : 7
Date : 26/11/2010
Logged/Checked by: ZM/ZA

drill model and mounting : Edson 3000 **slope :** 90° **deg.** **R.L. surface :** ≅17.7
hole diameter : 125 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
TC-bit				0			FILL; Gravelly Silty Sand, fine to coarse grained, yellow-brown	M			
							FILL; Gravelly Silty Clay, low plasticity, brown, with shale gravels	M≤PL			
				1			FILL; Gravelly Sand, fine to coarse grained, grey, with crushed sandstone gravels	M			
				2			SILTSTONE; Ironstone and Shale interbedded, yellow-grey-brown, red-brown, extremely low to very low strength, extremely to distinctly weathered				Bedrock
				3							
				4							
				5							
				6			SHALE, grey-brown, very low to low strength, distinctly weathered				very high TC-bit resistance from 6.0m
	Dry			7			SHALE, grey, slightly weathered				
				8			Borehole No 7 terminated at 7.6m due to near TC_bit refusal				
				9							

GEOTECHNIQUE PTY LTD

engineering log - borehole

Client : Capital Corporation
Project : Proposed Development
Location : 2 Australia Avenue, Sydney Olympic Park

Job No. : 12382/1
Borehole No. : 8
Date : 26/11/2010
Logged/Checked by: ZM/ZA

drill model and mounting : Edson 3000 **slope :** 90° **deg.** **R.L. surface :** ≅16.5
hole diameter : 125 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
TC-bit	Dry			0			CONCRETE; Slab, 190mm				
							FILL; Gravelly Sand, fine to coarse grained				
						CH	CLAY, high plasticity, orange-grey, with traces of ironstone gravels	M≤PL	St-VSt		Residual
		DS	N=15 5,8,7	1							
							SILTSTONE, Ironstone & minor Shale interbedded, with traces of clay seams, yellow-grey-brown, extremely low strength, extremely weathered				Bedrock
				2							
				3							
				4			Borehole No 8 started coring at 4.0m				
				5							
				6							
				7							
				8							
				9							

GEOTECHNIQUE PTY LTD

engineering log
cored borehole

Client : Capital Corporation
Project : Proposed Development
Location : 1 Australia Avenue, Sydney Olympic Park

Job No. : 12382/1
Borehole No. : 8
Date : 26/11/2010
Logged/Checked by : ZM/ZA

drill model and mounting :
slope : 90° **deg.**
R.L. surface : ≅16.5
core size: NMLC
bearing : **deg.**
datum : AHD

barrel lift	water loss/level	depth of R.L. in meters	graphic log	CORE DESCRIPTION: rock type, grain characteristics, colour, structure, minor components.	weathering	strength	point load index strength $I_S(50)$	defect spacing (mm)	DEFECT DETAILS – DESCRIPTION (type, inclination, thickness, planarity, roughness, coating.) Specific	General
				Borehole No 8 started coring at 4.0m						
		4		SILTSTONE, Ironstone & Clay interbedded, red-grey-brown	EW-RS	EL			Clay seam 4.3-4.55m	
				SHALE, yellow-grey-brown	DW	VL-M				
		5								
				SHALE, grey	EW	EL			Fragmented recovery from 5.5-6.0m	
		6		SHALE, grey, minor light grey, with very fine grained sandstone laminae	FR	M-H				
		7								
		8								
		9								
		10								
		11								
		12		Borehole No 8 terminated at 12.0m						
		13								

Point load index strength scale: EL VL L M H VH

Defect spacing scale: 2000 1000 500 300 100 50

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Job No 12382/1 BH8 Started Coring at 4.0m

4m
5m
6m
7m
8m
9m
10m
11m

BH8 terminated at 12.0m

EXPLANATORY NOTES

Introduction
These notes have been provided to simplify the geotechnical report with regard to investigation procedures, classification methods and certain matters relating to the Discussion and Comments section. Not all notes are necessarily relevant to all reports.

Geotechnical reports are based on information gained from finite sub-surface probing, excavation, boring, sampling or other means of investigation, supplemented by experience and knowledge of local geology. For this reason they must be regarded as interpretative rather than factual documents, limited to some extent by the scope of information on which they rely.

Description and Classification Methods
The methods of description and classification of soils and rocks used in this report are based on AS1726 - 1993 "Geotechnical Site Investigations". In general, descriptions cover the following properties; strength or density, colour, structure, soil or rock type, and inclusions. Identification and classification of soil and rock involves, to a large extent, judgement within the acceptable level commonly adopted by current geotechnical practices.

Soil types are described according to the predominating particle size, qualified by the grading or other particles present (e.g. sandy clay) on the following basis:

Soil Classification	Particle Size
Clay	Less than 0.002mm
Silt	0.002 to 0.06mm
Sand	0.06 to 2.00mm
Gravel	2.00mm to 60.00mm

Cohesive soils are classified on the basis of strength, either by laboratory testing or engineering examination. The strength terms are defined as follows:

Classification	Undrained Shear Strength kPa
Very Soft	Less than 12
Soft	12 – 25
Firm	25 – 50
Stiff	50 – 100
Very Stiff	100 – 200
Hard	Greater than 200

Non-cohesive soils are classified on the basis of relative density, generally from the results of standard penetration tests (SPT) or Dutch cone penetrometer tests (CPT), as below:

Relative Density	SPT 'N' Value (blows/300mm)	CPT Cone Value (q_c-MPQ)
Very Loose	Less than 5	Less than 2
Loose	5 – 10	2 – 5
Medium Dense	10 – 30	5 – 15
Dense	30 – 50	15 – 25
Very Dense	>50	>25

Rock types are classified by their geological names, together with descriptive terms on degrees of weathering, strength, defects and other minor components. Where relevant, further information regarding rock classification is given on the following sheet.

Sampling
Sampling is carried out during drilling to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on plasticity, grain size, colour, type, moisture content, inclusions and depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin walled sample tube (normally known as U_{50}) into the soil and withdrawing a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils. Details of the type and method of sampling are given in the report.

Field Investigation Methods
The following is a brief summary of investigation methods currently carried out by this Company and comments on their use and application.

Hand Auger Drilling
The borehole is advanced by manually operated equipment. The diameter of the borehole ranges from 50mm to 100mm. Penetration depth of hand augered boreholes may be limited by premature refusal on a variety of materials, such as hard clay, gravels or ironstone.

Test Pits
These are excavated with a tractor-mounted backhoe or a tracked excavator, allowing close examination of the insitu soils if it is safe to descend into the pit. The depth of penetration is limited to about 3.0m for a backhoe and up to 6.0m for an excavator. A potential disadvantage is the disturbance caused by the excavation.

Care must be taken if construction is to be carried out near, or within the test pit locations, to either adequately recompact the backfill during construction, or to design the structure to accommodate the poorly compacted backfill.

Large Diameter Auger (e.g. Pengo)
The hole is advanced by a rotating plate or short spiral auger, generally 300mm or larger in diameter. The cuttings are returned to the surface at intervals (generally of not more than 0.5m) and are disturbed, but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers and is usually supplemented by occasional undisturbed tube sampling.

Continuous Spiral Flight Augers
The hole is advanced by using 90mm-115mm diameter continuous spiral flight augers, which are withdrawn at intervals to allow sampling or insitu testing. This is a relatively economical means of drilling in clays and in sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are very disturbed and may be highly mixed with soil of other stratum.

Information from the drilling (as distinct from specific sampling by SPT or undisturbed samples) is of relatively lower reliability due to remoulding, mixing or softening of samples by groundwater, resulting in uncertainties of the original sample depth.

The spiral augers are usually advanced by using a V-bit through the soil profile to refusal, followed by Tungsten Carbide (TC) bit, to penetrate into bedrock. The quality and continuity of the bedrock may be assessed by examination of recovered rock fragments and through observation of the drilling penetration resistance.

Non-core Rotary Drilling (Wash Boring)
The hole is advanced by a rotary bit, with water being pumped down the drill rod and returned up the annulus carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from the feel and rate of penetration.

Rotary Mud Stabilised Drilling
This is similar to rotary drilling, but uses drilling mud as a circulating fluid, which may consist of a range of products from bentonite to polymers such as Revert or Biogel. The mud tends to mask the cuttings and reliable identification is again only possible from separate intact sampling (e.g. SPT and U_{50}) samples).

Continuous Core Drilling
A continuous core sample is obtained using a diamond tipped core barrel. Providing full core recovery is achieved (which is not always possible in very low strength rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation. In rocks, an NMLC triple tube core barrel, which gives a core of about 50mm diameter, is usually used with water flush.

Portable Proline Drilling
This is manually operated equipment and is only used in sites which require bedrock core sampling and there is restricted site access to truck mounted drill rigs. The boreholes are usually advanced initially using a tricone roller bit and water circulation to penetrate the upper soil profile. In some instances, a hand auger may be used to penetrate the soil profile. Subsequent drilling into bedrock involves the use of NMLC triple tube equipment, using water as a lubricant.

Standard Penetration Tests
Standard penetration tests are used mainly in non-cohesive soils, but occasionally also in cohesive soils, as a means of determining density or strength and of obtaining a relatively undisturbed sample. The test procedure is described in AS1289 6.3.1.

The test is carried out in a borehole by driving a 50mm diameter split sample tube under the impact of a 63kg hammer with a free fall of 769mm. It is normal for the tube to be driven in three successive 150mm increments and the 'N' value is taken as the number of blows for the last 300mm. In dense sands, very hard clays or weak rock, the full 450mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form:

- In a case where full penetration is obtained with successive blow counts for each 150mm of, say 4, 6 and 7 blows as;

N = 13
4,6,7

- In a case where the test is discontinued short of full penetration, say after 15 blows for the first 150mm and 30 blows for the next 40mm as;

15, 30/40mm

The results of the tests can be related empirically to the engineering properties of the soil. Occasionally the test method is used to obtain samples in 50mm diameter thin walled sample tubes in clays. In these circumstances, the test results are shown on the bore logs in brackets.

Cone Penetrometer Testing and Interpretation
Cone penetrometer testing (sometimes referred to as Dutch Cone-CPT) described in this report, has been carried out using an electrical friction cone penetrometer and the test is described in AS1289 6.5.1.

In the test, a 35mm diameter rod with cone tipped end is pushed continuously into the soil, the reaction being provided by a specially designed truck or rig, which is fitted with a hydraulic ram system. Measurements are made of the end bearing resistance on the cone and the friction resistance on a separate 130mm long sleeve, immediately behind the cone. Transducers in the tip of the assembly are connected by electrical wires passing through the centre of the push rods to an amplifier and recorder unit mounted on the control truck.

As penetration occurs (at a rate of approximately 20mm per second) the information is output on continuous chart recorders. The plotted results given in this report have been traced from the original records. The information provided on the charts comprises:

- Cone resistance - the actual end bearing force divided by the cross sectional area of the cone, expressed in MPa *
- Sleeve friction - the frictional force on the sleeve divided by the surface area, expressed in kPa

The ratios of the sleeve resistance to cone resistance will vary with the type of soil encountered, with higher relative friction in clays than in sands. Friction ratios of 1% to 2% are commonly encountered in sands and very soft clays, rising to 4% to 10% in stiff clays.

In sands, the relationship between cone resistance and SPT value is commonly in the range:

$$q_c \text{ (MPa)} = (0.4 \text{ to } 0.6) \text{ N (blows per 300mm)}$$

In clays, the relationship between undrained shear strength and cone resistance is commonly in the range:

$$q_c = (12 \text{ to } 18) C_u$$

Interpretation of CPT values can also be made to allow estimate of modulus or compressibility values, to allow calculation of foundation settlements. Inferred stratification, as shown on the attached report, is assessed from the cone and friction traces, from experience and information from nearby boreholes etc.

This information is presented for general guidance, but must be regarded as being to some extent interpretive. The test method provides a continuous profile of engineering properties and where precise information or soil classification is required, direct drilling and sampling may be preferable.

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

There are two similar tests, Cone Penetrometer (commonly known as Scala Penetrometer) AS1289 6.3.2 and the Perth Sand Penetrometer AS1289 6.3.3. Scala Penetrometer is commonly adopted by this company and consists of a 16mm rod with a 20mm diameter cone end, driven with a 9kg hammer, dropping 510mm (AS1289 Test P3.2).

Laboratory Testing
Laboratory testing is carried out in accordance with Australian Standard 1289 "Methods of Testing Soil for Engineering Purposes". Details of the test procedures are given on the individual report forms.

Engineering Logs
The engineering logs presented herein are an engineering and/or geological interpretation of the sub-surface conditions and their reliability will depend to some extent on frequency of sampling and the method of drilling. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, however, this is not always practicable or possible to justify economically. As it is, the boreholes represent only a small sample of the total sub-surface profile. Interpretation of the information and its application to design and construction should take into account the spacing of boreholes, frequency of sampling and the possibility of other than 'straight line' variations between the boreholes.

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

- in low permeability soils groundwater, although present, may enter the hole slowly or perhaps not at all during the investigation period
- a localised perched water table may lead to an erroneous indication of the true water table
- water table levels will vary from time to time due to the seasons or recent weather changes. They may not be the same at the time of construction as indicated in the report
- the use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must be washed out of the hole if water observations are to be made

More reliable measurements can be achieved by installing standpipes that are read at intervals over several days, or weeks for low permeability soils. Piezometers sealed in a particular stratum may be advisable in low permeability soils, or where there may be interference from a perched water table or surface water.

Engineering Reports
Engineering reports are prepared by qualified personnel and are based on the information obtained and on current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, perhaps a three-storey building, the information and interpretation may not be relevant if the design proposal is changed, say to a twenty-storey building. If this occurs, the Company will be pleased to review the report and sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of sub-surface conditions, discussions of geotechnical aspects and recommendations or suggestions for design and construction. However, the Company cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on bore spacing and sampling frequency.

- Changes in policy or interpretation of policy by statutory authorities.

- The actions of contractors responding to commercial pressures.

If these occur, the Company will be pleased to assist with investigation or advice to resolve the matter.

Site Anomalies
In the event that conditions encountered on-site during construction appear to vary from those that were expected from the information contained in the report, the Company requests immediate notification. Most problems are much more easily resolved when conditions are exposed rather than at some later stage, well after the event.

Reproduction of Information for Contractual Purposes
Attention is drawn to the document "Guidelines for the Provision of Geotechnical Information in Tender Documents", published by the Institute of Engineers Australia. Where information obtained from this Investigation is provided for tendering purposes; it is recommended that all information, including the written report and discussion, be made available.

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

Site Inspection
The Company will always be pleased to provide engineering inspection services for geotechnical aspects of work to which this report is related. This could range from a site visit to confirm that the conditions exposed are as expected, to full time engineering presence on site.

Review of Design
Where major civil or structural developments are proposed, or where only a limited investigation has been completed, or where the geotechnical conditions are complex, it is prudent to have the design reviewed by a Senior Geotechnical Engineer.

GEOTECH TESTING PTY LTD

ABN 71 076 676 321

Certified System Quality ISO 9001 SAI GLOBAL

CAPITAL CORPORATION
SUITE 705, 12 CENTURY DRIVE
BAULKHAM HILLS NSW 2153

GEOTECHNICAL INVESTIGATION
PROPOSED DEVELOPMENT - 2 AUSTRALIA AVENUE, SYDNEY OLYMPIC PARK

CALIFORNIA BEARING RATIO TEST REPORT

CBR Test Procedure	Laboratory Compaction Method	Sampling Method	Date of Test
AS1289 6.1.1	AS1289 5.1.1	AS1289 1.2.1 Clause 6.5.3	10/12/2010
Job No: 12382/1	Tested By: MM & AK	Checked By: AK	Lab Penrith

Laboratory Number		12382/1-1	12382/1-2		
		Borehole 4	Borehole 5		
Drawing No		12382/1-1	12382/1-1		
Depth (m)		0.2 - 1.0	0.4 - 1.0		
Sample No		4	5		
Date Sampled		26/11/2010	26/11/2010		
Sample Description		(CI) Gravelly CLAY, medium plasticity, grey-brown	(CI) Silty CLAY, medium plasticity, grey-red-brown		
Maximum Dry Density	t/m3	1.87	1.74		
Optimum Moisture Content	%	12.5	19.0		
Field Moisture Content	%	10.5	20.1		
% Retained 19mm		<5	0		
Excluded (Yes/No/Not Applicable)		Yes	Not Applicable		

CBR TEST RESULTS

Dry Density t/m^3	Before soaking	1.89	1.75		
	After soaking	1.87	1.74		
Density Ratio %	Before soaking	101	100.5		
Moisture Content %	Before soaking	12.0	18.6		
	After soaking	15.6	23.6		
Moisture Ratio %	Before soaking	96	98		
Number of Days Soaked		4	4		
Surcharge	kg	4.5	4.5		
Moisture Content after test %	Top 30mm	18.5	24.8		
	Whole Sample	15.5	23.5		
Swell after soaking	%	1.0	0.5		
Penetration	mm	5.0	5.0		
CBR VALUE	%	**6**	**4**		

Form No R003 Version 10/10 - issued by ER

A Kench 13/12/2010

Approved Signatory

NATA ACCREDITED FOR TECHNICAL COMPETENCE
Nata Accreditation Number 2734
Corporate Site Number 2727

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email: info@geotech.com.au www.geotech.com.au

ANALYTICAL REPORT

10 December 2010

Geotechnique
P.O. Box 880
PENRITH
NSW 2751

Attention: **Ziauddin Ahmed**

Your Reference: 12382-1 - Proposed Development-Sydney Olympic Park

Our Reference: SE83776

Samples: 7 Soils
Received: 6/12/2010

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:

Snezana Kostoka
Chemist

Anions in soil Our Reference: Your Reference Depth Sample Matrix Location	UNITS ------------- ------------	SE83776-1 BH1 0.5-0.95 Soil 2 Australia Avenue, Sydney Olympic Park	SE83776-2 BH1 3.0-3.45 Soil 2 Australia Avenue, Sydney Olympic Park	SE83776-3 BH2 1.5-1.95 Soil 2 Australia Avenue, Sydney Olympic Park	SE83776-4 BH3 1.0-1.5 Soil 2 Australia Avenue, Sydney Olympic Park	SE83776-5 BH4 0.5-0.95 Soil 2 Australia Avenue, Sydney Olympic Park
Date Extracted		10/12/2010	10/12/2010	10/12/2010	10/12/2010	10/12/2010
Date Analysed		10/12/2010	10/12/2010	10/12/2010	10/12/2010	10/12/2010
Chloride, Cl 1:5 soil:water	mg/kg	8.1	25	35	220	100
Sulphate, SO4 1:5 soil:water	mg/kg	15	200	91	240	160

Anions in soil Our Reference: Your Reference Depth Sample Matrix Location	UNITS ------------- ------------	SE83776-6 BH5 1.0-1.5 Soil 2 Australia Avenue, Sydney Olympic Park	SE83776-7 BH8 0.5-0.95 Soil 2 Australia Avenue, Sydney Olympic Park
Date Extracted		10/12/2010	10/12/2010
Date Analysed		10/12/2010	10/12/2010
Chloride, Cl 1:5 soil:water	mg/kg	44	98
Sulphate, SO4 1:5 soil:water	mg/kg	100	170

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t +61 (0)2 8594 0400 f + 61 (0)2 8594 0499 www.au.sgs.com

Inorganics Our Reference: Your Reference Depth Sample Matrix Location	UNITS ------------- ------------	SE83776-1 BH1 0.5-0.95 Soil 2 Australia Avenue, Sydney Olympic Park	SE83776-2 BH1 3.0-3.45 Soil 2 Australia Avenue, Sydney Olympic Park	SE83776-3 BH2 1.5-1.95 Soil 2 Australia Avenue, Sydney Olympic Park	SE83776-4 BH3 1.0-1.5 Soil 2 Australia Avenue, Sydney Olympic Park	SE83776-5 BH4 0.5-0.95 Soil 2 Australia Avenue, Sydney Olympic Park
Date Extracted- (pH 1:5 soil: Water)		10/12/2010	10/12/2010	10/12/2010	10/12/2010	10/12/2010
Date Analysed (pH 1:5 Soil: Water)		10/12/2010	10/12/2010	10/12/2010	10/12/2010	10/12/2010
pH 1:5 soil:water	pH Units	7.3	7.9	8.5	4.7	5.0

Inorganics Our Reference: Your Reference Depth Sample Matrix Location	UNITS ------------- ------------	SE83776-6 BH5 1.0-1.5 Soil 2 Australia Avenue, Sydney Olympic Park	SE83776-7 BH8 0.5-0.95 Soil 2 Australia Avenue, Sydney Olympic Park
Date Extracted- (pH 1:5 soil: Water)		10/12/2010	10/12/2010
Date Analysed (pH 1:5 Soil: Water)		10/12/2010	10/12/2010
pH 1:5 soil:water	pH Units	4.8	4.9

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Moisture Our Reference: Your Reference Depth Sample Matrix Location	UNITS ------------- ------------	SE83776-1 BH1 0.5-0.95 Soil 2 Australia Avenue, Sydney Olympic Park	SE83776-2 BH1 3.0-3.45 Soil 2 Australia Avenue, Sydney Olympic Park	SE83776-3 BH2 1.5-1.95 Soil 2 Australia Avenue, Sydney Olympic Park	SE83776-4 BH3 1.0-1.5 Soil 2 Australia Avenue, Sydney Olympic Park	SE83776-5 BH4 0.5-0.95 Soil 2 Australia Avenue, Sydney Olympic Park
Date Analysed (moisture)		8/12/2010	8/12/2010	8/12/2010	8/12/2010	8/12/2010
Moisture	%	11	12	7	11	16

Moisture Our Reference: Your Reference Depth Sample Matrix Location	UNITS ------------- ------------	SE83776-6 BH5 1.0-1.5 Soil 2 Australia Avenue, Sydney Olympic Park	SE83776-7 BH8 0.5-0.95 Soil 2 Australia Avenue, Sydney Olympic Park
Date Analysed (moisture)		8/12/2010	8/12/2010
Moisture	%	15	17

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Method ID	Methodology Summary
SEI-038	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				10/12/10	[NT]	[NT]	LCS	10/12/10
Date Analysed				10/12/10	[NT]	[NT]	LCS	10/12/10
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	98%

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

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*)
This document is issued by the Company subject to its General Conditions of Service (www.sgs.com/terms_and_conditions.htm). Attention is drawn to the limitations of liability, indemnification and jurisdictional issues established therein.

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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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SAMPLE RECEIPT ADVICE (SRA)

7 December 2010

Client Details			**Laboratory Details**		
Requested By	:	**Ziauddin Ahmed**			
Client	:	Geotechnique	Laboratory	:	SGS Environmental Services
Contact	:	Frances Kuipers	Manager	:	Edward Ibrahim
Address	:	P.O. Box 880 PENRITH NSW 2751	Address	:	Unit 16, 33 Maddox Street Alexandria NSW 2015
Email	:	frances.kuipers@geotech.com.au	Email	:	au.samplereceipt.sydney@sgs.com
Telephone	:	02 4722 2700	Telephone	:	61 2 8594 0400
Facsimile	:	02 4722 6161	Facsimile	:	61 2 8594 0499
Project	:	12382-1 - Proposed Development-Sydney Olympic Pa	Report No	:	**SE83776**
Order Number	:		No. of Samples	:	7
Samples	:	7 Soils	Due Date	:	10/12/2010

Date Instructions Received : 3/12/2010
Sample Receipt Date : 6/12/2010

Samples received in good order	:	YES	Samples received in correct containers	:	YES
Samples received without headspace	:	N/A	Sufficient quantity supplied	:	YES
Upon receipt sample temperature	:	Ambient	Cooling Method	:	None
Sample containers provided by	:	Customer	Samples clearly Labelled	:	YES
Turnaround time requested	:	Standard	Completed documentation received	:	YES

Samples will be held for 1 month for water samples and 3 months for soil samples from date of receipt of samples, unless otherwise instructed.

Comments

To the extent not inconsistent with the other provisions of this document and unless specifically agreed otherwise in writing by SGS, all SGS services are rendered in accordance with the applicable SGS General Conditions of Service accessible at http://www.sgs.com/terms_and_conditions.htm as at the date of this document. Attention is drawn to the limitations of liablility and to the clauses of indemnification.

The signed chain of custody will be returned to you with the original report.

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Member of the SGS Group (SGS SA)

SAMPLE RECEIPT ADVICE (SRA) - continued

Client	:	Geotechnique	Report No	:	SE83776
Project	:	12382-1 - Proposed Development-Sydney Olympic Park			

Summary of Samples and Requested Analysis

The table below represents SGS Environmental Service's understanding and interpretation of the customer supplied sample request.
Please indicate ASAP if your request differs from these details.
Testing shall commence immediately as per this table, unless the customer intervenes with a correction prior to testing.
Note that a small X in the table below indicates some testing has not been requested in the package.

Sample No.	Description	No Prep Required	Anions in soil	Inorganics	Moisture
1	BH1	X	X	X	X
2	BH1	X	X	X	X
3	BH2	X	X	X	X
4	BH3	X	X	X	X
5	BH4	X	X	X	X
6	BH5	X	X	X	X
7	BH8	X	X	X	X

Sample No.	Description
1	BH1
2	BH1
3	BH2
4	BH3
5	BH4
6	BH5
7	BH8

COC received 3/12/10 @ 12:30pm.

GEOTECHNIQUE PTY LTD

Laboratory Test Request / Chain of Custody Record

Lemko Place
PENRITH NSW 2750
P O Box 880
PENRITH NSW 2751
Tel: (02) 4722 2700
Fax: (02) 4722 6161
email: info@geotech.com.au

TO: SGS ENVIRONMENTAL SERVICES
UNIT 16
33 MADDOX STREET
ALEXANDRIA NSW 2015

PH: 02 8594 0400 **FAX:** 02 8594 0499
ATTN: MS ANGELA MAMALICOS

Sampling Date: 24 to 26 Nov 2010 **Job No:** 12382/1
Sampled By: Zo Mung **Project:** Proposed Development
Project Manager: ZA/ER **Location:** 2 Australia Avenue, Sydney Olympic Park

Results required by: ASAP

Sampling details		Sample type											
Location	Depth (m)	Soil	Water		pH	Sulphate	Chloride						KEEP SAMPLE
1 BH1	0.5 - 0.95				✓	✓	✓						YES
2 BH1	3.0 - 3.45				✓	✓	✓						YES
3 BH2	1.5 - 1.95				✓	✓	✓						YES
4 BH3	1.0 - 1.5				✓	✓	✓						YES
5 BH4	0.5 - 0.95				✓	✓	✓						YES
6 BH5	1.0 - 1.5				✓	✓	✓						YES
7 BH8	0.5 - 0.95				✓	✓	✓						YES

SGS
Received 6/12/10
By CC
Time 245
Samples intact
Ice/Cooler Pack yes
Temperature on Receipt 20
Storage Location 5619
SGS REF No. SE83776

Relinquished by			Received by		
Name	Signature	Date	Name	Signature	Date
Ziauddin Ahmed	Ziauddin Ahmed	3/12/2010	CC	[signature]	6/12/10 245pm

Legend:

WG Water sample, glass bottle
WP Water sample, plastic bottle
USG Undisturbed soil sample (glass jar)
DSG Disturbed soil sample (glass jar)
DSP Disturbed soil sample (small plastic bag)
✓ Test required
* Purge & Trap
# Geotechnique Screen
@ mole H^+/tonne