AITKEN ROWE TESTING LABORATORIES PTY LTDLTD
CONSULTANTS IN ENVIRONMENTAL AND GEOTECHNICAL ENGINEERING AND TESTING
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24th March 2010 Reg. No.: GS10-15

Miestudio - Griffith
Shop 6, 130-140 Banna Avenue
Griffith, NSW, 2680

Attention: Mr. Troy Patten

Dear Troy,

GEOTECHNICAL INVESTIGATION – PROPOSED PRIVATE HOSPITAL, ANIMOO AVENUE, GRIFFITH, NSW

Further to your request in response to our quotation, Q10-03a dated 4th February 2010, we drilled eight boreholes (BH1 to BH8) to the depths ranging from 0.3m to 2.7m at the specified locations across the location of the proposed structures as shown in the attached plan, using our trailer mounted drill rig on 16th February 2010. It should however be noted that BH1 and BH2 were hand augured inside the existing building as shown in the attached plan after holes were cored through the existing concrete slab. Eight Dynamic Cone Penetrometer tests (DCP) were also carried out at each borehole to assess the strength of the underlying material. Disturbed samples were recovered for relevant laboratory testing at our NATA accredited testing laboratory in Griffith.

The site for the proposed development is located at the corner of Animoo Avenue and Warrambool Street approximately 1km north of the Griffith City Centre. The site has varying slopes and is situated at or near the crest of a hill. The site is noted to be occupied by existing buildings and covered with vegetation at the time of the investigation. It should be noted no cracking or obvious defects were found in the existing buildings at the time of the investigation.

1. Subsurface Condition

The boreholes (BH1 to BH8) drilled at the location of the proposed hospital site revealed that the site is underlain by fill comprising topsoil to 0.1m (in BH3 and BH4 only) and fine to medium grained sandy gravel, medium plasticity silty sandy clay and silty clay to 0.3 to 0.9m in BH1 to BH5 and natural topsoil to 0.1 in BH6 to BH8 which in turn is underlain by natural alluvium deposit material comprising fine to medium grained clayey sand, fine to coarse grained silty sand, low to medium plasticity silty clay and sandy silty clay and extremely to highly weathered, very weak to weak, siltstone and sandstone bedrock, extending to the borehole refusal depths ranging from 0.3m to 2.7m (refer to borehole logs). The borehole refusal appeared to have occurred on the underlying sandstone bedrock, except in BH1 and BH2 which was due to refusal in hand augering.

The fill material encountered on site appeared to have been placed "uncontrolled" and moderately compacted. The moisture condition of the underlying material was generally greater than plastic limit and dry to moist throughout the profile in all boreholes except in BH7 where the moisture condition was noted to be moist to wet throughout the profile at the time of the investigation. As per the DCP test results and visual observation of the resistance by auger TC bit, the underlying natural soil and fill material is assessed to be stiff to very stiff consistency and moderately dense to dense throughout the profile. However the upper profile in BH4 and BH7 were assessed to be firm to stiff consistency and very loose respectively.

No groundwater or seepage was encountered during the drilling in the boreholes drilled, however it should be noted that variations to the water table level could fluctuate with changes to the season, temperature and rainfall.

2. Laboratory Testing

The laboratory tests including particle size distribution, Atterberg Limit and linear shrinkage tests were carried out on the recovered underlying material from the boreholes. The laboratory tests were undertaken at our NATA accredited testing laboratory in Griffith. Laboratory tests including pH, Electrical Conductivity, sulphate and Chloride content test were also carried out on the recovered samples from the boreholes and they were undertaken at Sydney Environmental and Soil Laboratory Pty Ltd in Sydney and the test reports as received are herewith attached. The laboratory test reports for particle size distribution and Atteberg Limit tests are also herewith attached. The test results for linear shrinkage test are incorporated in the respective borehole logs.

3. Discussion & Comment

3.1 Site Preparation and Earthworks

The fill material encountered across the site appeared to have been placed "uncontrolled" and therefore considered "not suitable" to use as foundation of any structure in its current state. We therefore recommend excavation of this material and re-compact in such a way that it achieves a minimum of 98% of Standard Maximum Dry Density (SMDD) if it is to be used as subgrade for the proposed construction. It may also require removal of old footing system once the existing buildings are demolished and removed at the site for the new development.

In general, the following site preparation is recommended once the topsoil & unsuitable material, if any, and old buildings and its footing system are removed and cuts if required are undertaken.

- The fill material encountered should be excavated where it exceeds greater than 0.3m and stockpiled for later use. It should be noted 0.6m of excavation may be required in locations where the fill extends to approximately 0.9m in BH3. It is assumed that fill material beneath the existing buildings, which are to be removed, would extend to approximately 0.9m only in the south west corner of the site. The exposed fill material should then be scarified to a depth of about 0.2m; moisture conditioned to within -2 to 0% of Standard Optimum Moisture Content (SOMC) and compacted to 100% of SMDD.
- Proof roll the exposed subgrade using a minimum of 10 passes of 12 tonne dead weight roller to detect any soft, loose or heaving areas.

- Any soft or heave areas, if detected during the process, should be excavated down and backfilled with appropriate approved materials compacted in 150mm thick layers to the minimum equivalent density of 100% of SMDD.
- Any area of exposed subgrade, which exhibits shrinkage cracking and does not require recompaction, should be watered and rolled until the shrinkage cracks do not reappear. During this undertaking, care should be exercised to ensure the surface does not become soft.

Subsequent to the above subgrade preparation, clean approved fill preferably granular materials can be placed as required and compacted to the compaction requirements as given above. The degree of compaction of any fill placement should be verified by a NATA accredited testing authority to ensure that it achieves specified density. As the fill is to be laid on the clay formation, the compaction shall be carried out with minimum amount of water required to achieve the required density. The boundaries of the fill areas should be sloped to a maximum batter of 1.0 Vertical (V) to 2.0 Horizontal (H).

The structural fill supporting any structural element of the structures shall be prepared in such a way that it achieves a minimum of 100% of Standard Maximum Dry Density in every 150mm thick compacted layers and certified by a relevant NATA accredited testing laboratory for which a safe allowable bearing pressure of 100kPa may be adopted, provided proper drainage measures are incorporated in the design, during and after the construction.

3.2 Excavation & Support and Retaining Wall

It is noted that some excavations and cuts may be involved for the construction of the new development. Based upon the subsurface conditions encountered in the boreholes, it is expected that any materials to be excavated will comprise layers of topsoil and natural clayey sand, silty sand, sandy/silty clay, silt clay, and extremely to highly weathered siltstone and sandstone rock materials depending on the extent of the proposed cut. It is therefore anticipated that all the required earthworks within soil and extremely weathered, extremely weak sandstone/siltstone rock should be capable of being performed by conventional earthmoving plant such as scrapers, dozers, rollers and backhoes or excavator. However, the excavation within highly weathered rock, if required, is likely to be undertaken by a large tracked hydraulic excavator or medium weight tracked dozer, both fitted with a ripping tyne. It should be noted that assessment on the requirement of type of machinery for excavation below current borehole investigation depth could only be undertaken with coring into the rock.

It would be essential to maintain drainage of the site area during any earthworks to prevent rainfall from adversely affecting the materials such that they become unsuitable for direct re-use. It should be noted that trafficability in the clay materials for wheeled vehicles can be expected to be slightly difficult during and following rainfall if it is exposed.

The temporary batter slopes of 1(V): 1(H) and 1.5(V): 1(H) are recommended for unsupported cuts of up to 3.0m depth within natural soils and extremely weathered rock respectively.

The followings are recommended for permanent batter slopes for unsupported cuts of up to 3.0m depth in the various materials:

- Alluvium/Residual soils 1(V): 2(H)
- Extremely weathered Sandstone and Siltstone 1(V): 1(H)
- Highly weathered Sandstone and Siltstone 1.5(V): 1(H)

The permanent batter slope of the unsupported structural fill of up to 3.0m height should not exceed 1(V): 2(H).

If vertical cut with equivalent retaining wall design option is to be adopted, the following characteristic earth pressure coefficients and subsoil parameters given in Table 1 may be adopted for the design of the wall.

Table 1 Design Parameters – Retaining Wall

Design Parameters	**Controlled Fill, Natural Soil & Extremely weathered Rock**
Bulk Unit Weight	19 kN/m^3
Active Earth Pressure Coefficient, K_a	0.3
At rest Earth Pressure Coefficient, K_o	0.5
Passive Earth Pressure Coefficient, K_p	4.0
Effective cohesion, c'	0.0
Effective Friction Angle, φ'	30$^\bullet$

Appropriate factor of safety should be applied in the design of the walls. The walls should be designed to withstand full hydrostatic pressure unless special measures are taken to introduce complete and permanent drainage of the ground behind the wall. It should be noted that similar design parameters may be used for the fill embankment provided similar quality material is used for the fill and the fill placement is placed under Level 1 supervision as specified above.

It should be noted that surcharge loadings should not be placed within a distance equivalent to the excavation depth form the crest of a batter cut or fill.

Care would be required to ensure excavation bases are cleaned of loosened and remoulded debris if the clay or weathered rock material is exposed. The exposed clay subgrade base, if exposed, should be proof rolled to detect any soft or heaving areas. Any soft or heave areas should be removed. The excavation base, particularly clay base, should not be left exposed for prolonged periods as deterioration of bases may occur when subjected to wetting and drying processes. Care should be exercised during construction to ensure water ponding does not occur in the excavations since this may lead to subsequent softening of the founding materials.

Although no groundwater seepage was observed within the investigated depth in the boreholes during the site investigation, it would be prudent to expect some seepage, even at shallower depth, particularly if excavation is carried out after periods of extreme rainfall. Any such seepage should be readily controllable by conventional sump and pump dewatering systems installed at the base of the excavation.

The excavated residual soil and weathered rock can be used as structural fill provided particles larger than 75mm in the weathered rock are broken down or excluded.

It should be noted that, no matter what method of excavation support is used, some ground displacement will occur within and immediately surrounding the excavation. We recommend that the risk of structural damage to nearby buildings and buried services as a result of such excavation-induced movements, be carefully evaluated. We believe it is unlikely that excavation induced movements will significantly affect structures situated back from the excavation perimeter a distance greater than the excavation depth.

3.3 Footing Design and Foundation

Based on the field and laboratory investigation, the site for the new buildings shall be generally classified as **"M– Moderately reactive"** in accordance with the Australian Standard AS 2870, provided trees are removed and the subgrade is prepared as specified in Section 3. The footings may be designed similar to those recommended for "Class M" in AS2870 and may be founded below topsoil into natural ground. It should however be noted that the fill material in BH3 area extends to approximately 0.9m below existing level and therefore **"Class P – Problem site"** should be adopted unless the fill is removed and the subgrade is prepared as specified in Section 3.1. The footings shall be designed similar to those recommended for "**Class M-D**" or **"Class P"** in AS2870 and shall be founded **below topsoil and fill, if not controlled** into natural ground.

It is noted that a number of trees exist on site. It is highly recommended to site the buildings away from these trees at a distance equivalent to at least 75% the mature height of the trees. If the trees are to be removed it is highly recommended to remove the entire tree including root system and allow the ground to achieve equilibrium moisture condition prior to construction. If the trees are to be retained and the buildings are to be built within the distance equivalent to 75% the mature height of the trees, then the footing system shall be designed similar to those recommended for "**Class P – Problem site**" classification in AS2870.

It should also be noted that if fill other than sand and gravel is to be used for filling, then the site classification shall be reviewed.

The fill material encountered at the site is considered "not suitable" for any structural element of the footing system in its current state. The footing shall therefore be founded on the underlying natural **clayey sand / silty sand / sandy silty clay at or below 0.2 to 0.4m** from the existing surface (refer borehole logs) except in BH2 and BH3 where the footing system may be founded on the **prepared as specified in Section 3.** The footing may be designed for an allowable bearing capacity of 100kPa founded on the prepared subgrade as specified in Section 3 and 250kPa on the natural material at the depths as specified above, provided proper drainage measures are incorporated in the design, during and after the construction. The slab panel, internal beams and load support thickening may be founded on the underlying natural subgrade or prepared fill subgrade as specified in Section 3.

The bored and cast-in-place pile footing system, if adopted, should be taken into the underlying siltstone/sandstone bedrock for which an allowable bearing pressure of 500kPa may be adopted. **Caution should be exercised to ensure that the footings are taken to the underlying bedrock, not on the floaters as the area is known to have floaters.** The allowable skin friction of 20kPa and 50kPa may be adopted within residual soil and extremely to highly weathered rock respectively. The skin friction within the top 1.0m depth of natural soil and within structural fill shall be ignored. The piles shall be embedded at least 1m or 3D (D-Pile diameter) whichever is

greater into the rock. It should be noted that the rock depth is varied across the site being varied from 0.4 to 2.5m below existing ground level.

The bases of the pile shafts and footings must be clean and free of soft and loose material and the sides of bored pile holes where side adhesion is adopted must be free of smear prior to concreting. To achieve this, bases of bored pile holes should be cleaned using a cleaning bucket and the sides of the pile holes should be roughed to remove the smear zone associated with drilling, or the side adhesion values given above should be reduced by 50%.

The footing excavations should not be left exposed for prolonged periods as deterioration of footing bases may occur when subjected to wetting and drying processes. Care should be exercised during construction to ensure water ponding does not occur since this may lead to subsequent softening of the founding materials. Groundwater seepage may be encountered if the footing excavation is carried out after prolonged periods of extreme rainfall. Any such seepage should be readily controllable by conventional sump and pump dewatering systems installed at the base of the excavation. The footing excavations shall be cleared off the debris and ponding water prior to the placement of the concrete in order to adopt the above recommended bearing pressures. If water ponds in the base of footings or the base founding material are affected by moisture ingress, then this material should be excavated to expose the subgrade, which has not been exposed to moisture, and pour the concrete immediately. If a delay in pouring concrete is anticipated, then a blinding layer should be placed over the base of the footing to prevent softening of the footing base.

The settlement should be minimal provided the design is made within the allowable design parameters recommended and the maintenance of the structures and proper drainage measures are adopted around the structures.

3.4 Soil Aggression

The pH tests indicated pH values generally 8.3 and above and therefore the underlying soil is considered “not acidic but alkaline”. EC values ranging from 0.05 to 0.12mS/cm were recorded on the samples tested, which are assessed to be “very low saline”. The sulphate content value 30 mg/kg and chloride content ranges from 60 to 90 mg/kg were recorded on the samples tested and they are considered generally “low”. Therefore it should not affect the long-term durability of concrete and steel in contact with these soils in the subject site location. However, the resistivity values of 28.6 to 43.3Ω.m were recorded on the same sample tested, which is assessed to be “moderate resistivity”. The “moderate resistivity” is considered to provide a mild to non-aggressive environment towards unprotected steel. Therefore, the designer is referred to the Cement and Concrete Association of Australia Technical Note 57 for any special precautionary measures required for buried concrete and steel elements into these material.

4. General Comment

Occasionally, the subsurface soil conditions within the site may be found different (or may be interpreted to be different) from those expected. This can also occur with groundwater conditions, especially after climatic changes. If such differences appear to exist, we recommend that you immediately contact us.

Should you have any queries, please do contact us.

Yours truly,

Tin Maung
Senior Geotechnical Engineer

Attachments:

- Addendum
- Plan showing Borehole Locations
- Borehole logs with Explanatory Note
- Dynamic Cone Penetrometer test report
- Laboratory test reports by Aitken Rowe Testing Laboratories Pty Ltd
- Laboratory test report by Sydney Environmental & Soil Laboratory

ADDENDUM

LIMITS OF INVESTIGATION

The recommendations made in this report are based on the assumption that the test results are representative of the overall subsurface conditions. However, it should be noted that even under optimum circumstances, actual conditions in some parts of the building site may differ from those said to exist, because no geotechnical engineer, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal all that is hidden by earth, rock and time.

The client should also be aware that our recommendations refer only to our test site locations and the ground level at the time of testing.

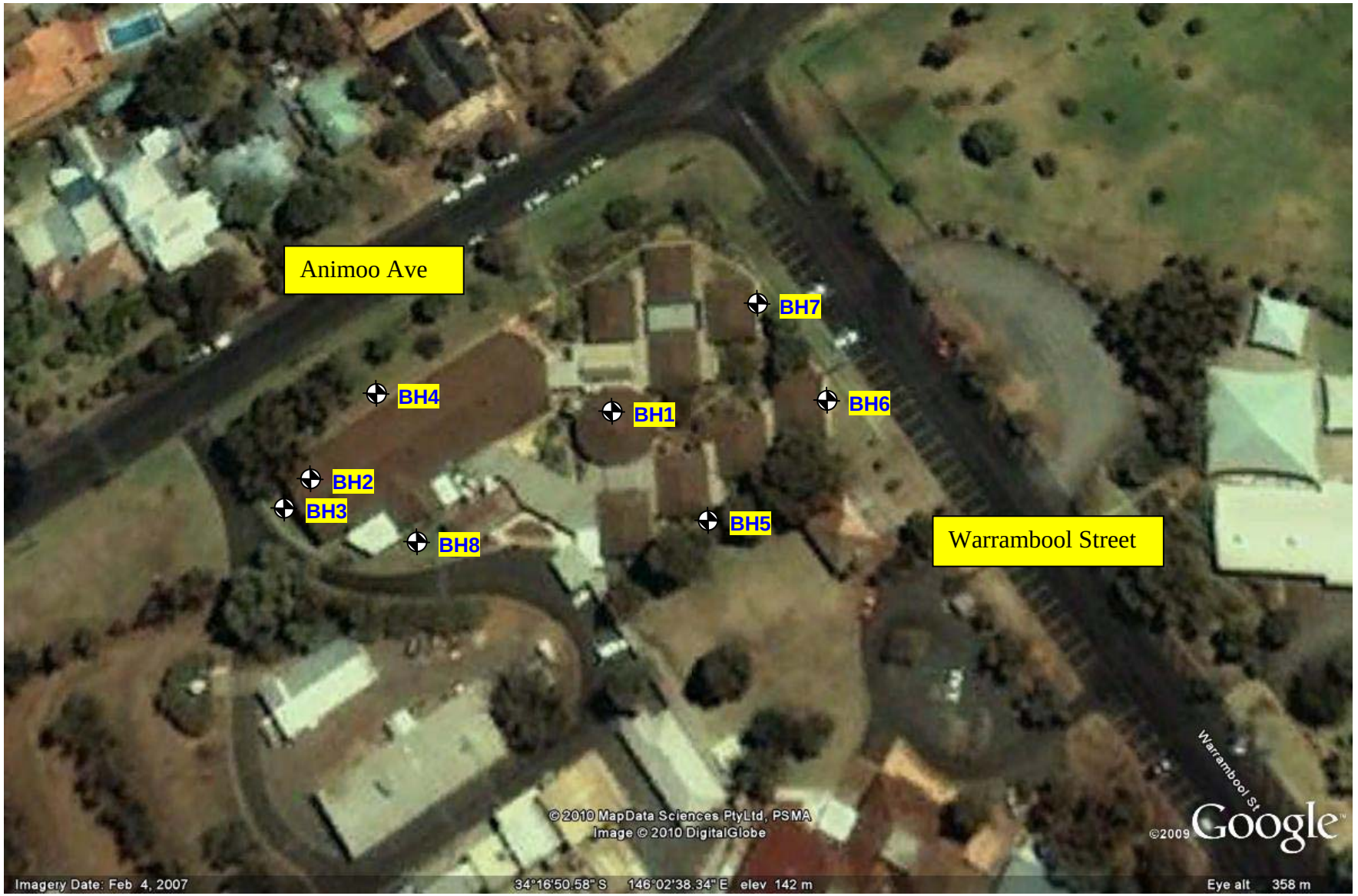
The recommendations in this report are based on the following: -

a) The information gained from our investigation.
b) The present "state of the art" in testing and design.
c) The building type and site treatment conveyed to us by the client.
d) Historical Information

Should the client or his agent have omitted to supply us with the correct relevant information, or make significant changes to the building type and/or building envelope, our report may not take responsibility for any consequences and we reserve the right to make an additional charge if more testing is necessary.

Not withstanding the recommendations made in this report, we also recommend that whenever footings are close to any excavations or easements, that consideration should be given to deepening the footings.

Unless otherwise stated in our commission, any dimensions or slope direction and magnitude should not be used for any building costing calculations and/or positioning. Any sketch supplied should be considered as only an approximate pictorial evidence of our work.



AITKEN ROWE TESTING LABORATORIES PTY LTD
REGISTRATION NUMBER: GS10-15

MIESTUDIO - GRIFFITH
GEOTECHNICAL INVESTIGATION
PROPOSED PRIVATE HOSPITAL, ANIMOO AVE - GRIFFITH
BOREHOLE LOCATION PLAN

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **1**

Sheet No.: 1 of 1

Ground Level: Existing

Date: 16/02/10

Method: Hand augering with hand auger

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test L.S %	Remarks & Field Records
	CONCRETE SLAB 150mm							Concrete Slab inside existing building
GW	FILL: Sandy GRAVEL; fine to medium grained, blue gray, fine to coarse sand		D	MD				FILL: Appears to be moderately compacted "Uncontrolled"
SC	Clayey SAND; fine to medium grained, red brown	**0.5**	M	D	D	1A		NATURAL
	End of Borehole (BH1) @ 0.5m	**1.0** **1.5** **2.0** **2.5** **3.0** **3.5**						Refusal on sandstone bedrock

Logged By: M.S.

Scale: As shown

Dry on Completion

Registration No.: GS10-15
Location: Proposed Private Hospital, Animoo Avenue, Griffith, NSW
Client: Miestudio - Griffith, NSW

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **2**

Sheet No.: 1 of 1

Ground Level: Existing

Date: 16/02/10

Method: Hand augering with hand auger

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test L.S %	Remarks & Field Records
	CONCRETE SLAB 150mm							Concrete Slab inside existing building
CI	FILL: Silty Sandy CLAY; medium plasticity, red orange brown		MC<PL	VSt.	D	2A	5.5	FILL: Appears to be moderately compacted
	End of Borehole (BH2) @ 0.3m	**0.5**						Refusal on coarse gravel
		1.0						
		1.5						
		2.0						
		2.5						
		3.0						
		3.5						

Logged By: M.S.

Scale: As shown

Dry on Completion

Registration No.: GS10-15
Location: Proposed Private Hospital, Animoo Avenue, Griffith, NSW
Client: Miestudio - Griffith, NSW

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **3**

Sheet No.: 1 of 1

Ground Level: Existing

Date: 16/02/10

Method: Auger drilling with TC Bit

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test L.S %	Remarks & Field Records
SC	TOPSOIL/FILL: Clayey SAND; fine to medium, red brown		M	VL				FILL: Appears to be moderately compacted
SC	FILL: Clayey SAND; fine to medium grained, red brown							"Uncontrolled"
CI	FILL: Silty Sandy CLAY; medium plasticity, red orange brown, fine to medium sand, trace gravel	**0.5**	MC>PL	St.	D	3A	6.5	@ omc 2-3 % < omc
CI	FILL: Silty Sandy CLAY; medium plasticity, orange brown, fine to medium sand, trace gravel				D	3B	6.5	
CI	FILL: Silty CLAY; medium plasticity, mottled grey red brown, trace sand			St.-VSt.				
SC	Clayey SAND; fine to medium grained, dark brown fines of low plasticity	**1.0**	D	MD-D	D	3C	3.0	NATURAL
CL-CI	Silty CLAY; low to medium plasticity, mottled red orang brown, with fine sand	**1.5**	MC>PL	VSt.	D	3D	8.0	
CI	Silty CLAY; medium plasticity, mottled grey orange brown, trace fine sand and gravel	**2.0**			D	3E	9.5	
CI	Silty CLAY; medium plasticity, mottled grey orange brov trace sand and gravel	**2.5**			D	3F	10.0	
	SANDSTONE: highly weathered, weak, grey brown, with clay bands		D					
	End of Borehole (BH3) @ 2.7m	**3.0** **3.5**						Refusal on sandstone bedrock

Logged By: M.S.

Scale: As shown

Dry on Completion

Registration No.: GS10-15
Location: Proposed Private Hospital, Animoo Avenue, Griffith, NSW
Client: Miestudio - Griffith, NSW

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **4**

Sheet No.: 1 of 1

Ground Level: Existing

Date: 16/02/10

Method: Auger drilling with TC Bit

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test L.S %	Remarks & Field Records
CL	TOPSOIL/FILL: Clayey SAND; fine to medium, red brown		M	L				FILL: Appears to be moderately compacted "Uncontrolled"
CI	FILL: Silty Sandy CLAY; medium plasticity, red orange brown, fine to medium sand		MC>PL	F-St.	D	4A	4.5	
SC	Clayey SAND; low plasticity, dark brown, fine sand fines of low plasticity	**0.5**	D	D				NATURAL
					D	4B	4.0	
CL-CI	Sandy Silty CLAY; low to medium plasticity, brown, fine to medium sand	**1.0**	MC>PL	VSt.	D	4C	7.5	
CI	Sandy Silty CLAY; medium plasticity, orange brown, fine sand, trace gravel							
					D	4D	8.5	
		1.5						
CI	Sandy Silty CLAY; medium plasticity, light orange brown, fine to medium sand and gravel				D	4E	8.5	
	SILTSTONE: extremely weathered to highly weathered, very weak to weak, cream		D					
		2.0						
	SILTSTONE: highly weathered, weak, cream							
	End of Borehole (BH4) @ 2.2m	**2.5**						Refusal on sandstone bedrock
		3.0						
		3.5						

Logged By: M.S.

Scale: As shown

Dry on Completion

Registration No.: GS10-15
Location: Proposed Private Hospital, Animoo Avenue, Griffith, NSW
Client: Miestudio - Griffith, NSW

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **5**

Sheet No.: 1 of 1

Ground Level: Existing

Date: 16/02/10

Method: Auger drilling with TC Bit

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test L.S %	Remarks & Field Records
	AGGREGATE; 10mm, pink		D					
SM	FILL: Silty SAND; medium to coarse grained, grey			MD				FILL: Appears to be moderately compacted "Uncontrolled"
SM	Silty SAND; fine to medium grained, red brown, fines of low plasticity	**0.5**		MD-D	D	5A	2.0	NATURAL
	SANDSTONE: highly weathered, weak, brown							
	End of Borehole (BH5) @ 0.6m	**1.0** **1.5** **2.0** **2.5** **3.0**						Refusal on sandstone bedrock
		3.5						

Logged By: M.S.

Scale: As shown

Dry on Completion

Registration No.: GS10-15
Location: Proposed Private Hospital, Animoo Avenue, Griffith, NSW
Client: Miestudio - Griffith, NSW

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **6**

Sheet No.: 1 of 1

Ground Level: Existing

Date: 16/02/10

Method: Auger drilling with TC Bit

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test L.S %	Remarks & Field Records
SC	TOPSOIL: Clayey SAND; fine to medium, red brown		M	L-MD				NATURAL
SM	Silty SAND; fine to medium grained, red brown trace clay				D	6A	1.0	
	SANDSTONE: extremely weathered to highly weathered very weak to weak, orange brown	**0.5**	D-M					
	SANDSTONE: highly weathered, weak, pink brown	**1.0**	D					
	End of Borehole (BH6) @ 1.1m	**1.5** **2.0** **2.5** **3.0** **3.5**						Refusal on sandstone bedrock

Logged By: M.S.

Scale: As shown

Dry on Completion

Registration No.: GS10-15
Location: Proposed Private Hospital, Animoo Avenue, Griffith, NSW
Client: Miestudio - Griffith, NSW

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **7**

Sheet No.: 1 of 1

Ground Level: Existing

Date: 16/02/10

Method: Auger drilling with TC Bit

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test L.S %	Remarks & Field Records
SC	TOPSOIL: Clayey SAND; fine to medium, red brown		M-W	VL				NATURAL
SM	Silty SAND; fine to medium grained, red brown				D	7A	1.5	
		0.5						
	SANDSTONE: highly weathered, very weak to weak, orange brown		M					
	End of Borehole (BH7) @ 0.8m	**1.0**						Refusal on sandstone bedrock
		1.5						
		2.0						
		2.5						
		3.0						
		3.5						

Logged By: M.S.

Scale: As shown

Dry on Completion

Registration No.: GS10-15
Location: Proposed Private Hospital, Animoo Avenue, Griffith, NSW
Client: Miestudio - Griffith, NSW

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **8**

Sheet No.: 1 of 1

Ground Level: Existing

Date: 16/02/10

Method: Auger drilling with TC Bit

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test L.S %	Remarks & Field Records
	TOPSOIL: Clayey SAND; fine to medium, red brown		M	L				NATURAL
CL	Silty Sandy CLAY; low plasticity, red brown, fine to medium sand	**0.5**	MC>PL	VSt.	D	8A	4.5	
CL	Silty Sandy CLAY; low plasticity, brown, fine to medium sand				D	8B	4.0	
CI	Sandy Silty CLAY; medium plasticity, mottled grey red brown, fine to medium sand	**1.0**			D	8C	8.5	
	End of Borehole (BH8) @ 1.3m	**1.5** **2.0** **2.5** **3.0** **3.5**						Refusal on sandstone bedrock

Logged By: M.S.

Scale: As shown

Dry on Completion

Registration No.: GS10-15
Location: Proposed Private Hospital, Animoo Avenue, Griffith, NSW
Client: Miestudio - Griffith, NSW

Aitken Rowe Testing Laboratories Pty Ltd

60 Benerembah Street Griffith N.S.W 2680

DYNAMIC CONE PENETROMETER REPORT

CLIENT: MIESTUDIO - GRIFFITH

PROJECT: GEOTECHNICAL INVESTIGATION

LOCATION: PROPOSED PRIVATE HOSPITAL, ANIMOO AVENUE, NSW

DEPTH OF GROUND WATER TABLE IF INTERSECTED: NIL

PAGE: 1 OF: 4

REGISTRATION NO: **GS10-15**

DATE OF TEST: 16/02/10

DEPTH BELOW SURFACE (mm): 200

TEST METHOD: AS 1289.6.3.2

BOREHOLE No. 1

NUMBER OF BLOWS PER 100 mm PENETRATION

Depth(m)	Blow	Depth(m)	Blow	Depth(m)	Blow
0.0 - 0.1	8	2.0 - 2.1	*	4.0 - 4.1	*
0.1 - 0.2	12	2.1 - 2.2	*	4.1 - 4.2	*
0.2 - 0.3	8	2.2 - 2.3	*	4.2 - 4.3	*
0.3 - 0.4	17	2.3 - 2.4	*	4.3 - 4.4	*
0.4 - 0.5	20+	2.4 - 2.5	*	4.4 - 4.5	*
0.5 - 0.6	END	2.5 - 2.6	*	4.5 - 4.6	*
0.6 - 0.7	*	2.6 - 2.7	*	4.6 - 4.7	*
0.7 - 0.8	*	2.7 - 2.8	*	4.7 - 4.8	*
0.8 - 0.9	*	2.8 - 2.9	*	4.8 - 4.9	*
0.9 - 1.0	*	2.9 - 3.0	*	4.9 - 5.0	*
1.0 - 1.1	*	3.0 - 3.1	*		
1.1 - 1.2	*	3.1 - 3.2	*		
1.2 - 1.3	*	3.2 - 3.3	*		
1.3 - 1.4	*	3.3 - 3.4	*		
1.4 - 1.5	*	3.4 - 3.5	*		
1.5 - 1.6	*	3.5 - 3.6	*		
1.6 - 1.7	*	3.6 - 3.7	*		
1.7 - 1.8	*	3.7 - 3.8	*		
1.8 - 1.9	*	3.8 - 3.9	*		
1.9 - 2.0	*	3.9 - 4.0	*		

BOREHOLE No. 2

NUMBER OF BLOWS PER 100 mm PENETRATION

Depth(m)	Blow	Depth(m)	Blow	Depth(m)	Blow
0.0 - 0.1	16	2.0 - 2.1	END	4.0 - 4.1	*
0.1 - 0.2	16	2.1 - 2.2	*	4.1 - 4.2	*
0.2 - 0.3	14	2.2 - 2.3	*	4.2 - 4.3	*
0.3 - 0.4	12	2.3 - 2.4	*	4.3 - 4.4	*
0.4 - 0.5	8	2.4 - 2.5	*	4.4 - 4.5	*
0.5 - 0.6	7	2.5 - 2.6	*	4.5 - 4.6	*
0.6 - 0.7	4	2.6 - 2.7	*	4.6 - 4.7	*
0.7 - 0.8	8	2.7 - 2.8	*	4.7 - 4.8	*
0.8 - 0.9	7	2.8 - 2.9	*	4.8 - 4.9	*
0.9 - 1.0	6	2.9 - 3.0	*	4.9 - 5.0	*
1.0 - 1.1	10	3.0 - 3.1	*		
1.1 - 1.2	14	3.1 - 3.2	*		
1.2 - 1.3	10	3.2 - 3.3	*		
1.3 - 1.4	8	3.3 - 3.4	*		
1.4 - 1.5	7	3.4 - 3.5	*		
1.5 - 1.6	5	3.5 - 3.6	*		
1.6 - 1.7	5	3.6 - 3.7	*		
1.7 - 1.8	7	3.7 - 3.8	*		
1.8 - 1.9	15	3.8 - 3.9	*		
1.9 - 2.0	20+	3.9 - 4.0	*		

REMARKS *

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Number: 13039

APPROVED SIGNATORY: ……

J.GORNALL

DATE: 23/02/2010

Aitken Rowe Testing Laboratories Pty Ltd

60 Benerembah Street Griffith N.S.W 2680

DYNAMIC CONE PENETROMETER REPORT

CLIENT: MIESTUDIO - GRIFFITH

PROJECT: GEOTECHNICAL INVESTIGATION

LOCATION: PROPOSED PRIVATE HOSPITAL, ANIMOO AVENUE, NSW

DEPTH OF GROUND WATER TABLE IF INTERSECTED: NIL

PAGE: 2 OF: 4

REGISTRATION NO: **GS10-15**

DATE OF TEST: 16/02/10

DEPTH BELOW SURFACE (mm): NIL

TEST METHOD: AS 1289.6.3.2

BOREHOLE No. 3

NUMBER OF BLOWS PER 100 mm PENETRATION

Depth(m)	Blow	Depth(m)	Blow	Depth(m)	Blow
0.0 - 0.1	1	2.0 - 2.1	*	4.0 - 4.1	*
0.1 - 0.2	1	2.1 - 2.2	*	4.1 - 4.2	*
0.2 - 0.3	4	2.2 - 2.3	*	4.2 - 4.3	*
0.3 - 0.4	6	2.3 - 2.4	*	4.3 - 4.4	*
0.4 - 0.5	5	2.4 - 2.5	*	4.4 - 4.5	*
0.5 - 0.6	6	2.5 - 2.6	*	4.5 - 4.6	*
0.6 - 0.7	7	2.6 - 2.7	*	4.6 - 4.7	*
0.7 - 0.8	8	2.7 - 2.8	*	4.7 - 4.8	*
0.8 - 0.9	12	2.8 - 2.9	*	4.8 - 4.9	*
0.9 - 1.0	20+	2.9 - 3.0	*	4.9 - 5.0	*
1.0 - 1.1	END	3.0 - 3.1	*		
1.1 - 1.2	*	3.1 - 3.2	*		
1.2 - 1.3	*	3.2 - 3.3	*		
1.3 - 1.4	*	3.3 - 3.4	*		
1.4 - 1.5	*	3.4 - 3.5	*		
1.5 - 1.6	*	3.5 - 3.6	*		
1.6 - 1.7	*	3.6 - 3.7	*		
1.7 - 1.8	*	3.7 - 3.8	*		
1.8 - 1.9	*	3.8 - 3.9	*		
1.9 - 2.0	*	3.9 - 4.0	*		

BOREHOLE No. 4

NUMBER OF BLOWS PER 100 mm PENETRATION

Depth(m)	Blow	Depth(m)	Blow	Depth(m)	Blow
0.0 - 0.1	1	2.0 - 2.1	*	4.0 - 4.1	*
0.1 - 0.2	2	2.1 - 2.2	*	4.1 - 4.2	*
0.2 - 0.3	4	2.2 - 2.3	*	4.2 - 4.3	*
0.3 - 0.4	3	2.3 - 2.4	*	4.3 - 4.4	*
0.4 - 0.5	15	2.4 - 2.5	*	4.4 - 4.5	*
0.5 - 0.6	16	2.5 - 2.6	*	4.5 - 4.6	*
0.6 - 0.7	11	2.6 - 2.7	*	4.6 - 4.7	*
0.7 - 0.8	8	2.7 - 2.8	*	4.7 - 4.8	*
0.8 - 0.9	11	2.8 - 2.9	*	4.8 - 4.9	*
0.9 - 1.0	20+	2.9 - 3.0	*	4.9 - 5.0	*
1.0 - 1.1	END	3.0 - 3.1	*		
1.1 - 1.2	*	3.1 - 3.2	*		
1.2 - 1.3	*	3.2 - 3.3	*		
1.3 - 1.4	*	3.3 - 3.4	*		
1.4 - 1.5	*	3.4 - 3.5	*		
1.5 - 1.6	*	3.5 - 3.6	*		
1.6 - 1.7	*	3.6 - 3.7	*		
1.7 - 1.8	*	3.7 - 3.8	*		
1.8 - 1.9	*	3.8 - 3.9	*		
1.9 - 2.0	*	3.9 - 4.0	*		

REMARKS *

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J.GORNALL

DATE: 23/02/2010

Aitken Rowe Testing Laboratories Pty Ltd

60 Benerembah Street Griffith N.S.W 2680

DYNAMIC CONE PENETROMETER REPORT

CLIENT: MIESTUDIO - GRIFFITH

PROJECT: GEOTECHNICAL INVESTIGATION

LOCATION: PROPOSED PRIVATE HOSPITAL, ANIMOO AVENUE, NSW

DEPTH OF GROUND WATER TABLE IF INTERSECTED: NIL

PAGE: 3 OF: 4

REGISTRATION NO: **GS10-15**

DATE OF TEST: 16/02/10

DEPTH BELOW SURFACE (mm): 100 / NIL

TEST METHOD: AS 1289.6.3.2

BOREHOLE No. 5

NUMBER OF BLOWS PER 100 mm PENETRATION

Depth(m)	Blow	Depth(m)	Blow	Depth(m)	Blow
0.0 - 0.1	7	2.0 - 2.1	*	4.0 - 4.1	*
0.1 - 0.2	10	2.1 - 2.2	*	4.1 - 4.2	*
0.2 - 0.3	10	2.2 - 2.3	*	4.2 - 4.3	*
0.3 - 0.4	10	2.3 - 2.4	*	4.3 - 4.4	*
0.4 - 0.5	20+	2.4 - 2.5	*	4.4 - 4.5	*
0.5 - 0.6	END	2.5 - 2.6	*	4.5 - 4.6	*
0.6 - 0.7	*	2.6 - 2.7	*	4.6 - 4.7	*
0.7 - 0.8	*	2.7 - 2.8	*	4.7 - 4.8	*
0.8 - 0.9	*	2.8 - 2.9	*	4.8 - 4.9	*
0.9 - 1.0	*	2.9 - 3.0	*	4.9 - 5.0	*
1.0 - 1.1	*	3.0 - 3.1	*		
1.1 - 1.2	*	3.1 - 3.2	*		
1.2 - 1.3	*	3.2 - 3.3	*		
1.3 - 1.4	*	3.3 - 3.4	*		
1.4 - 1.5	*	3.4 - 3.5	*		
1.5 - 1.6	*	3.5 - 3.6	*		
1.6 - 1.7	*	3.6 - 3.7	*		
1.7 - 1.8	*	3.7 - 3.8	*		
1.8 - 1.9	*	3.8 - 3.9	*		
1.9 - 2.0	*	3.9 - 4.0	*		

BOREHOLE No. 6

NUMBER OF BLOWS PER 100 mm PENETRATION

Depth(m)	Blow	Depth(m)	Blow	Depth(m)	Blow
0.0 - 0.1	3	2.0 - 2.1	*	4.0 - 4.1	*
0.1 - 0.2	5	2.1 - 2.2	*	4.1 - 4.2	*
0.2 - 0.3	6	2.2 - 2.3	*	4.2 - 4.3	*
0.3 - 0.4	3	2.3 - 2.4	*	4.3 - 4.4	*
0.4 - 0.5	19	2.4 - 2.5	*	4.4 - 4.5	*
0.5 - 0.6	15	2.5 - 2.6	*	4.5 - 4.6	*
0.6 - 0.7	20+	2.6 - 2.7	*	4.6 - 4.7	*
0.7 - 0.8	END	2.7 - 2.8	*	4.7 - 4.8	*
0.8 - 0.9	*	2.8 - 2.9	*	4.8 - 4.9	*
0.9 - 1.0	*	2.9 - 3.0	*	4.9 - 5.0	*
1.0 - 1.1	*	3.0 - 3.1	*		
1.1 - 1.2	*	3.1 - 3.2	*		
1.2 - 1.3	*	3.2 - 3.3	*		
1.3 - 1.4	*	3.3 - 3.4	*		
1.4 - 1.5	*	3.4 - 3.5	*		
1.5 - 1.6	*	3.5 - 3.6	*		
1.6 - 1.7	*	3.6 - 3.7	*		
1.7 - 1.8	*	3.7 - 3.8	*		
1.8 - 1.9	*	3.8 - 3.9	*		
1.9 - 2.0	*	3.9 - 4.0	*		

REMARKS *

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DATE: 23/02/2010

Aitken Rowe Testing Laboratories Pty Ltd

60 Benerembah Street Griffith N.S.W 2680

DYNAMIC CONE PENETROMETER REPORT

CLIENT: MIESTUDIO - GRIFFITH

PROJECT: GEOTECHNICAL INVESTIGATION

LOCATION: PROPOSED PRIVATE HOSPITAL, ANIMOO AVENUE, NSW

DEPTH OF GROUND WATER TABLE IF INTERSECTED: NIL

PAGE: 4 OF: 4

REGISTRATION NO: **GS10-15**

DATE OF TEST: 16/02/10

DEPTH BELOW SURFACE (mm): NIL

TEST METHOD: AS 1289.6.3.2

BOREHOLE No. 7

NUMBER OF BLOWS PER 100 mm PENETRATION

Depth(m)	Blow	Depth(m)	Blow	Depth(m)	Blow
0.0 - 0.1	1	2.0 - 2.1	*	4.0 - 4.1	*
0.1 - 0.2	1	2.1 - 2.2	*	4.1 - 4.2	*
0.2 - 0.3	1	2.2 - 2.3	*	4.2 - 4.3	*
0.3 - 0.4	1	2.3 - 2.4	*	4.3 - 4.4	*
0.4 - 0.5	1	2.4 - 2.5	*	4.4 - 4.5	*
0.5 - 0.6	18	2.5 - 2.6	*	4.5 - 4.6	*
0.6 - 0.7	20+	2.6 - 2.7	*	4.6 - 4.7	*
0.7 - 0.8	END	2.7 - 2.8	*	4.7 - 4.8	*
0.8 - 0.9	*	2.8 - 2.9	*	4.8 - 4.9	*
0.9 - 1.0	*	2.9 - 3.0	*	4.9 - 5.0	*
1.0 - 1.1	*	3.0 - 3.1	*		
1.1 - 1.2	*	3.1 - 3.2	*		
1.2 - 1.3	*	3.2 - 3.3	*		
1.3 - 1.4	*	3.3 - 3.4	*		
1.4 - 1.5	*	3.4 - 3.5	*		
1.5 - 1.6	*	3.5 - 3.6	*		
1.6 - 1.7	*	3.6 - 3.7	*		
1.7 - 1.8	*	3.7 - 3.8	*		
1.8 - 1.9	*	3.8 - 3.9	*		
1.9 - 2.0	*	3.9 - 4.0	*		

BOREHOLE No. 8

NUMBER OF BLOWS PER 100 mm PENETRATION

Depth(m)	Blow	Depth(m)	Blow	Depth(m)	Blow
0.0 - 0.1	1	2.0 - 2.1	*	4.0 - 4.1	*
0.1 - 0.2	7	2.1 - 2.2	*	4.1 - 4.2	*
0.2 - 0.3	14	2.2 - 2.3	*	4.2 - 4.3	*
0.3 - 0.4	13	2.3 - 2.4	*	4.3 - 4.4	*
0.4 - 0.5	9	2.4 - 2.5	*	4.4 - 4.5	*
0.5 - 0.6	11	2.5 - 2.6	*	4.5 - 4.6	*
0.6 - 0.7	13	2.6 - 2.7	*	4.6 - 4.7	*
0.7 - 0.8	13	2.7 - 2.8	*	4.7 - 4.8	*
0.8 - 0.9	16	2.8 - 2.9	*	4.8 - 4.9	*
0.9 - 1.0	END	2.9 - 3.0	*	4.9 - 5.0	*
1.0 - 1.1	*	3.0 - 3.1	*		
1.1 - 1.2	*	3.1 - 3.2	*		
1.2 - 1.3	*	3.2 - 3.3	*		
1.3 - 1.4	*	3.3 - 3.4	*		
1.4 - 1.5	*	3.4 - 3.5	*		
1.5 - 1.6	*	3.5 - 3.6	*		
1.6 - 1.7	*	3.6 - 3.7	*		
1.7 - 1.8	*	3.7 - 3.8	*		
1.8 - 1.9	*	3.8 - 3.9	*		
1.9 - 2.0	*	3.9 - 4.0	*		

REMARKS *

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Number: 13039

APPROVED SIGNATORY: ……

J.GORNALL

DATE: 23/02/2010

Corrosion & Scaling Assessment: Soil Reporting Profile

CLIENT: **Aitken Rowe Testing Laboratories (ARTL) Pty Limited**
PO Box 5158
WAGGA WAGGA NSW 2650
Attn: Jarrod Gornall

PROJECT: Name: **GS10-15**
Location:
SESL Quote N°: Client Job N°:
Order N°: Date Received: **22/02/2010**

SAMPLE: Batch N°: **13287** Sample N°: **1**
Name: **4B**
Test Type: **pH, EC, Cl, SO4, Resistivity**

Certified System
Quality
ISO 9001

Sydney Environmental and Soil Laboratory
Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Sydney Environmental & Soil Laboratory Pty Ltd
ABN 70 106 810 708
16 Chilvers Road
Thornleigh NSW 2120
Australia
Address mail to:
PO Box 357
Pennant Hills NSW 1715
Tel: 02 9980 6554
Fax: 02 9484 2427
Em: info@sesl.com.au
Web: www.sesl.com.au

TEST	RESULT	COMMENTS
pH in water (1:5)	8.9	Strong Alkalinity
EC mS/cm (1:5)	0.12	Low Salinity
Texture Class		
Soil Permeability Class		
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) $mgSO_4$ / kg	30	Low Sulphate
Chloride (1:5) mgCl / kg	90	Low Chloride
* Resistivity Ω.m	28.6	Moderate Resistivity

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/L = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows strong alkalinity, low salinity, low sulphate and low chloride levels.

According to AS2159:1995, the strong alkalinity is considered non-aggressive towards concrete and non-corrosive towards steel. The low sulphate and low chloride levels are considered non-aggressive towards concrete and non-corrosive towards steel. The resistivity is considered to provide a mild to non-aggressive environment towards unprotected steel.

If you would like to discuss further please contact the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:1995; **Resistivity,** AS1289.4.4.1:1997,

Consultant Ryan Jacka

Authorised Signatory Daniel Saunders

Date of Report 26/02/2010

Corrosion & Scaling Assessment: Soil Reporting Profile

CLIENT: **Aitken Rowe Testing Laboratories (ARTL) Pty Limited**
PO Box 5158
WAGGA WAGGA NSW 2650
Attn: Jarrod Gornall

PROJECT: Name: **GS10-15**
Location:
SESL Quote N°: Client Job N°:
Order N°: Date Received: **22/02/2010**

SAMPLE: Batch N°: **13287** Sample N°: **2**
Name: **7A**
Test Type: **pH, EC, Cl, SO4, Resistivity**

Certified System
Quality
ISO 9001

Sydney Environmental and Soil Laboratory
Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Sydney Environmental & Soil Laboratory Pty Ltd
ABN 70 106 810 708
16 Chilvers Road
Thornleigh NSW 2120
Australia
Address mail to:
PO Box 357
Pennant Hills NSW 1715
Tel: 02 9980 6554
Fax: 02 9484 2427
Em: info@sesl.com.au
Web: www.sesl.com.au

TEST	RESULT	COMMENTS
pH in water (1:5)	8.3	Moderate Alkalinity
EC mS/cm (1:5)	0.05	Very Low Salinity
Texture Class		
Soil Permeability Class		
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) $mgSO_4$ / kg	30	Low Sulphate
Chloride (1:5) mgCl / kg	60	Low Chloride
* Resistivity Ω.m	43.3	Moderate Resistivity

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/L = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows moderate alkalinity, very low salinity, low sulphate and low chloride levels.

According to AS2159:1995, the moderate alkalinity is considered non-aggressive towards concrete and non-corrosive towards steel. The low sulphate and low chloride levels are considered non-aggressive towards concrete and non-corrosive towards steel. The resistivity is considered to provide a mild to non-aggressive environment towards unprotected steel.

If you would like to discuss further please contact the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:1995; **Resistivity,** AS1289.4.4.1:1997,

Consultant
Ryan Jacka

Authorised Signatory
Daniel Saunders

Date of Report
26/02/2010