28th November 2010

Ref: E734/5

Ian Edwards

Mortlake Consolidated Investments Pty Ltd

PO Box 48, Pymble NSW 2073
By email: ian@austequity.com.au

Dear Ian

Re: Salinity Assessment

Hilly, Bennett and Northcoate Streets Mortlake NSW

This assessment presents the results of an investigation of soil salinity on the property located at Hilly, Bennett and Morthcoate Street Mortlake NSW (hereafter known as the "site"). Aargus Pty Ltd was commissioned by Mortlake Consolidated Investments Pty Ltd in Movember 2010.

The objective of this assessment was to identify any salinity issues within the site and subsequently provide recommendations for salinity management during future construction.

The salinity assessment was carried out with reference to the following Department of Land & Water Conservation (DLWC), now the Department Natural Resources (DNR) and Australian Standard publications:

- "*Site Investigations for Urban Salinity*" – 2002

- "*Building in a Saline Environment*" – 2003
- "*Map of Salinity Potential*" – 2002
- *''NSW Soil and Land Information System"*
- *"Dryland Salinity Occurrences and indicators " 1999*
- *"Salinity Hazard" 1999*
- *"Soil Profiles" 2005*
- *"Piling and Design" 2009*

SCOPE OF WORK

In order to achieve the objective of this assessment, the following scope of work was conducted:

- Review of the DNR publications mentioned above.
- A thorough site inspection to identify any visible indicators of soil and/or water salinity.
- Sampling of soils within the site in accordance with the abovementioned DNR guidelines.
- Analysis of salinity indicators by a NATA accredited laboratory.
- Assessment of the laboratory test data against applicable reference materials, including impacts on future building and infrastructure within the site.
- Preparation of this letter report.

SITE DESCRIPTION

The site is located at Hilly Street, Bennett Street and Northcoate Street in the suburb of Mortlake NSW. The site is known as Majors Bay Development and contains 5 Precincts and has an area of approximately 35,000m^2.

At the time of conducting field sampling (13th November 2010), the site is currently occupied by a variety of commercial/industrial buildings with some low density residential which are to be demolished as part of the redevelopment of the site for residential purposes.

The site is bound to the west by Majors Bay and to the north, east and south by mixed use commercial and residential dwellings.

The field scientist also carried out an inspection to observe and record any visually obvious signs of salinity within the site and surrounding region, including salt tolerant plant species, areas of erosion, or salt deposits, or evidence of salt attack on existing buildings. No such indicators were noted within the site.

TOPOGRAPHY AND GEOLOGY

In general, the site slopes in a westerly direction. Low lying areas on the site are not evident and will not be evident as part of the proposed development. Surfaces are to be either concrete sealed, bitumen hardstand areas or landscaped areas as per the prepared site drawings.

The nearest surface water bodies is Majors Bay which is located adjoining the western boundary. Stormwater from the local and surrounding areas would be expected to flow into the guttering of the surrounding streets and into the local stormwater drains.

Research was conducted on the geology of the area by reviewing the Sydney 1:100 000 Geological Sheet 9130. It was found that geological formations in this area belong to the Mesozoic Era of the Triassic Period. The site itself is located on geological formations of Hawkesbury Sandstone that include medium-to coarse-grained quartz sandstone, very minor shale and laminate lenses.

The site covers only one soil landscape area and is confirmed by the similar soil profile in each of the boreholes that were augered at different locations within the site.

Reference should be made to the attached Borehole Logs for a detailed description of the soil profile encountered beneath the site during the fieldwork for this assessment.

In general, the following sub-surface soil profile was encountered across the site:

Topsoil	Silty Sandy Clay, low plasticity, medium grained, brown loamy soil encountered over the majority of the site to depths of about 0.3m below the existing ground level.
Natural Soil	Silty Clay, medium plasticity, encountered beneath the topsoil, extending to depths of up 2.0m below existing natural ground level (maximum depth of drilling).
Bedrock	Sandstone, weathered, light grey, weak from 2.0m to 3.0m (maximum depth of augering). It should be noted that much of the area has a shallow rock profile around 0.5m.

All the boreholes were dry to the maximum depth of auguring (3.0m) below the existing natural ground level. It should be noted that fluctuations in the level of the regional groundwater might occur due to variations in rainfall, and/or other factors.

It should be noted that dry boreholes do not necessarily indicate that the water table was not encountered. It may take an extended period of time (days) for sufficient seepage to become observable and considerably longer time for the true groundwater level to stabilise, however, the boreholes were dry for the entire period they remained open (full day) and it is unlikely that groundwater will be encountered as the basement excavation proposed at the building 2b area does not affect the known water table levels. Therefore, groundwater should not affect the proposed development. Only one area within a rock formation comes near the basement level but should be able to be managed as seepage.

Reference to the Salinity Potential in Western Sydney Map and Guidelines, prepared by the Department of Infrastructure, planning and Natural Resources (DIPNR), indicate that the majority of the site lies within areas of low salinity potential. The map did not indicate areas of known salinity.

SOIL SALINITY ASSESSMENT CRITERIA

Salinity is the accumulation of mineral salts in the soil, groundwater and surface waters. It is primarily a groundwater problem that produces effects at the soil surface, which can lead to serious land degradation problems. High salinity can also cause dehydration of plant cells, reducing plant growth potential and sometimes causing death of a species. Saline soils in an urban environment can cause damage to bitumen, concrete structures, bricks and steel structures (including pipes).

The three main sources of salts are as follows:

- Salts transported from the ocean and deposited by rainfall.
- Salts released during the process of soil and rock weathering.
- Salts naturally present in the soil profile, resulting from marine sediments deposited in earlier geological times.

Soil salinity in Western Sydney is thought to be primarily the result of early marine sediment deposits and the extent is largely related to the underlying Wianamatta Group shales. Soil salinity in western Sydney can also be related to the process of soil and rock weathering and therefore it is not unusual for higher salt content to be present at or close to the soil / bedrock interface in a residual soil profile.

Surface water and groundwater can dissolve salts present in soils and mobilise these salts to other areas. Over time, a balance is reached between water and the movement of salt and ecosystems will develop that are adapted to the salt in soil and water.

Land development can change the movement of surface and groundwater and as a consequence, carry the salts to other areas potentially outside the balanced environment. This movement can have adverse impacts on ecosystems; particularly plant growth and can also result in damage to building materials where salts accumulate.

Measuring Electrical Conductivity (EC) generally assesses soil salinity. A soil sample for salinity testing is generally made up of 1:5 soil water suspension, which is one part in air dried soil to five parts distilled water. The determined Electrical Conductivity (EC) is multiplied by a factor (varying from 6 to 17) based on the texture of the soil sample, to obtain Corrected Electrical Conductivity designated as EC_e.

The *Environmental Planning and Assessment Regulation 1994* defines saline soils as soil profiles or layers (within the upper 2m of soil) with an Electrical Conductivity (EC_e) of Saturated Extracts greater than 4dS/m. The Department of Conservation and Land Management publication "*Dryland Salinity – Introductory Extension Notes - 1991*" defines various classes of saline soils, as shown in the following table:

Classification	**EC_e (dS/m)**
Non saline	<2
Slightly saline	2 – 4
Moderately saline	4 – 8
Very saline	8 – 16
Highly saline	>16

The impact of saline or potentially saline soils is also associated with other factors, including pH and the relative amounts of cations, such as sodium, calcium, magnesium and potassium. The impact of salts on building materials is related to the amount of salt and water present, the types of salts, chemical and physical reactions with the building materials and the amount of wetting and drying occurring.

The DNR 2002 publication "*Site Investigations for Urban Salinity*" provides guidance for assessing and managing the impacts of salinity on development sites. In carrying out a comprehensive assessment, the publication recommends determination of a number of soil and/or water chemical and physical properties, such as the following:

- Permeability
- Cation Exchange Capacity

- Sodicity
- Corrosivity (pH, sulphate, chloride)
- Salinity (electrical conductivity)

Once the chemical and physical parameters of the soil and/or water are obtained, the DNR publication suggests reference to the following:

- Australian Standard AS3600-2001: Concrete Structures
- Australian Standard AS3700-2001: Masonry Structures
- Australian Standard AS2159-2009: Piling – Design and Installation
- Australian Standard AS2870-1996: Residential Slabs and Footings - Construction

Aqueous solutions of chlorides cause 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 AS2159-2009, are as follows.

Chloride		**pH**	**Resistivity (ohm)**	**Soil Condition A***	**Soil Condition B#**
In Soil (ppm)	**In Water (ppm)**				
<5000	<1000	>5.0	>5000	Non-aggressive	Non-aggressive
5000-20000	1000-10000	4.0-5.0	2000-5000	Mild	Non-aggressive
20000-50000	10000-20000	3.0-4.0	1000-2000	Moderate	Mild
>50000	>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 AS2159-2009, are given below.

Sulphate expressed as SO_4		pH	Chloride in Water (ppm)	Soil Condition A*	Soil Condition B#
In Soil (ppm)	In Groundwater (ppm)				
<5000	300-1000	>5.5	6000	Mild	Non-aggressive
5000-10000	1000-2500	4.5-5.5	6000-12000	Moderate	Mild
10000-20000	2500-500	4.0-4.5	12000-30000	Severe	Moderate
>2000	>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

The appropriate site condition for predominant soils at the site is assessed to be "Condition B".

FIELD WORK AND LABORATORY ANALYSIS

An Environmental Scientist, who was responsible for positioning the sampling locations, carried out soil sampling on 13th November 2010, sample recovery, preparation of samples for delivery to a NATA accredited laboratory and logging the sub-surface profile encountered at each sampling location.

Two (2) boreholes (BH1 to BH2) were augured across the site as part of this assessment.

Representative soil samples were recovered from near surface and at depth, as recommended in the *Environmental Planning and Assessment Regulation 1994* and the DNR 2002 publication "*Site Investigations for Urban Salinity*". The sampling strategy adopted was aimed at assessing the salinity of the soil through the profile within the site.

The soil samples were forwarded to the NATA accredited laboratory of SGS and a selection were analysed for the following:

- Electrical Conductivity (EC)
- pH
- Chloride
- Sulphate

LABORATORY RESULTS AND ASSESSMENT

The laboratory test results certificates are attached with this report. The attached Tables A & B present the results, together with the assessment criteria adopted, soil descriptions and appropriate multiplication factors.

TABLE A
ELECTRICAL CONDUCTIVITY TEST RESULTS

Sample location	Depth(m)	Electrical Conductivity (dS/m) EC	Multiplication Factor [a]	Electrical Conductivity of Saturated Extract (dS/m) EC_e	Soil Type
Surface soils					
BH1	0.2	0.099	14	1.39	sandy loam, fine grained
BH2	0.1	0.097	14	1.36	sandy loam, fine grained
Soil Horizon 0.3 -2.0m BGL					
BH1	1.2	0.1	8	0.80	silty clay, medium plasticity
BH2	1	0.11	8	0.88	silty clay, medium plasticity
Soil Horizon 2.0 - 3.0m BGL					
BH1	3.0	0.093	7	0.65	shale, light grey, weathered
BH2	3.0	0.1	7	0.70	shale, light grey, weathered
Environmental Planning & Assessment Regulation 1994				Saline at >4 dS/m	
Dryland Salinity (1993)				Non-saline <2 dS/m Slightly saline 2-4 dS/m Moderately saline 4-8 dS/m Very saline 8-16 dS/m Highly saline >16 dS/m	

As indicated in Table A, the EC_e values determined through applying appropriate multiplication factors to the EC results, are grouped into various depths. The results show no discernible trend in conductivity values with borehole position in the site (i.e. relative elevation) or with soil composition at similar depths. As such, it was considered that taking the maximum value over a number of depth intervals would provide an overall indication of the salinity characteristics of the soil profile beneath the site.

The EC_e ranges and maximum values were determined for each depth interval, as follows:

Depths at 0.0 - 0.3m:	EC_e range	1.36 to 1.39 dS/m
	EC_e max	1.39dS/m
Depths at 0.2 - 2.0m:	EC_e range	0.80 to 0.88 dS/m
	EC_e max	0.88dS/m

Depths at 2.0 – 3.0m:	EC_e range	0.65 to 0.7 dS/m
	EC_e max	0.7dS/m

The results tend to indicate a marginal decrease in soil salinity with depth, which suggests a salt source resulting from deposition from rainfall. In general, based on the test results, the soils within the site to depths at 3.0m of the soil profile may be considered as generally non-saline across the site.

As mentioned earlier, there does not appear to be any significant variation in salinity levels with changes in topography or soil composition.

TABLE B
pH, CHLORIDE, SULPHATE, RESISTIVITY TEST RESULTS

Sample location	Depth(m)	pH	Chloride in Soil (mg/kg)	Sulphate in Soil (mg/kg)
Surface soils				
BH1	0.2	6.2	38	27
BH2	0.1	6.2	37	29
Soil Horizon 0.3 -2.0m BGL				
BH1	1.2	6.1	46	32
BH2	1	6.5	45	29
Soil Horizon 2.0 - 3.0m BGL				
BH1	3.0	6.2	32	30
BH2	3.0	6.3	43	28
AS2159-2009				
Piling - Design and Installation				
Reinforced Concrete Piles				
High Permeability Soils				
non-aggressive		>5.5		<5000
mild		4.5 - 5.5		5000 - 10000
moderately aggressive		4 - 4.5		10000 - 20000
severely aggressive		<4		>20000
Low Permeability Soils				
non-aggressive		>5		<5000
mild		4.5 - 5		5000 - 10000
moderately aggressive		4 - 4.5		10000 - 20000
severely aggressive		<4		>20000
Steel Piles				
High Permeability Soils				
non-aggressive		>5	<20000	
mild		4.0 - 5.0	20000 - 50000	
moderately aggressive		3.0 - 4.0	20000 - 50000	
severe		<3	>50000	
Low Permeability Soils				
non-aggressive		>5	<20000	
non-aggressive		4.0 - 5.0	20000 - 50000	
mild		3.0 - 4.0	20000-50000	
moderately aggressive		<3	>50000	

Note: *High Permeability soils (e.g,, sands and gravels) that are in groundwater
*Low Permeability soils (e.g,, silts and clay) or all soils that are above groundwater

The soil pH, chloride, and sulphate test results are presented in Table B. With reference to AS2159-2009 “Piling-Design and Installation”, the soils are considered to be generally non-aggressive in pH to concrete and steel.

SALINITY MANAGEMENT MEASURES

The ways forward in salinity management are many and varied depending on objectives and the local biophysical environment. A combination of approaches that considers both individual sites and whole catchment factors is likely to be the best option.

The fundamental steps in managing salinity should be to address the cause of the problem by:

- **Reduce the recharge** - Local groundwater systems might be addressed at the individual scale or at least at the catchment scale. Regional systems, however, will be far more difficult to manage, because landholders with the recharge problem will rarely experience the discharge symptom and also because the time lag between intervention and meaningful response might span generations.
- **Enhancement of remnant vegetation -** The conservation of remnant vegetation brings added benefits such as biodiversity enhancement and carbon sequestration.
- **Revegetation –** using local native plants. The amount of revegetation required to arrest recharge will vary from catchment to catchment depending on the hydrogeology, soils and climate

Engineering options will sometimes be required to complement recharge reduction and plant based management of discharge Some further salinity management measures requiring engineering options include:

- **Surface water drains -** whilst often dealing with fresh water, can be a very effective means of reducing inundation of low lying areas which might otherwise cause plant death due to waterlogging. Drainage may therefore assist in both reducing recharge and enhancing safe discharge. There is evidence to suggest that surface drainage on saline sites, normally subject to seasonal inundation, may deny the normal flushing process that prevents salt accumulation in the root zone.

If the surface water is saline, as will generally be the case on discharge sites, much greater care must be taken with drainage. Soils might be sodic and therefore highly erodible and in some instances acid sulfate soils might be disturbed with serious off-site consequences.

- **Groundwater drains** - may be deep open drains or subterranean drains with the specific aim of lowering the local watertable. The effectiveness of these systems is very dependent on the soil properties, an inverse relationship often existing between soil permeability and stability.

- **Groundwater pumping** - is usually so costly that it is applicable only where it offers protection to high value assets. The cost of pumping can sometimes be offset if the water is harvested (e.g., for aquaculture or for salt extraction).

The proposed development of the site dictates that the most appropriate option should be effective surface water drainage on and around the site.

It should also be noted that there is also the **potential for shrink-swell soil movement** at the site. Soils with this shrink/swell potential create difficult performance problems for buildings constructed on these soils. As the soil water content increases, the soil swells and heaves upward. As the soil water content decreases, the soil shrinks and the ground surface recedes and pulls away from the foundation. These problems are of particular concern in homes / buildings with shallow foundations. To assess the potential for shrink-swell soil movement at the site a geotechnical engineer should be used to ascertain the expansiveness of the soil.

SOIL MANAGEMENT PLAN

This assessment has revealed in general, that soil salinity and aggressiveness are not likely to be significant issues within the soil profile to 3.0m BGL. The proposed development plans of the site were provided at the time of preparing this report and the cut and fill depths were expected to be either in rock or above the water table in the deepest part of the excavation.

Soils located at depths greater than about 3.0m should be considered as potentially saline. As such, any works involving ground penetration to these depths should take this into account and adherence to this soil management plan should be required.

As no groundwater was encountered within the depth of investigation, it is considered unlikely that the groundwater would be intercepted by construction techniques to be used.

Given the problems associated with soil salinity in Western Sydney, even at low salt concentrations, we recommend as a matter of course, that some general soil and water management principals be implemented as preventative measures in dealing with soil salinity.

We recommend implementation of the following as part of a soil management plan for the site:

Site Preparation and Environmental Management

- Develop the best use of the existing topography in order to minimise cut and fill operations. Excavation depths proposed within the site drawings indicate that minimal concerns arise from basement excavations.

- Erosion and Sediment Control Plans must be developed and implemented by the appointed earthworks contractor, in accordance with the NSW Department of Housing document "Managing Urban Stormwater: Soils and Construction (1998").
- All sediment and erosion controls proposed by the Erosion and Sediment Control Plan are to be installed prior to commencement of any excavation or construction works.

Building Recommendations

- For slab on ground construction, a layer of bedding sand of at least 30mm thickness under the slab should be provided. This will permit free drainage of water beneath the slab, minimising the possibility of pooling or trapping water that might potentially be carrying salts.
- A high impact waterproof membrane, not just a vapour proof membrane, should be laid under the ground bearing slab (refer to NSW Building Code of Australia).
- The waterproof membrane must be extended to the outside face of the external edge beam up to the finished ground level, as detailed in the Building Code of Australia (BCA).
- For masonry building construction, the damp proof course must consist of polyethylene or polyethylene coated metal and is correctly placed in accordance with BCA Clause 3.3.4.4.
- Once installed, any later construction works must not breach the damp proof course and/or waterproof membrane.
- Slabs must be vibrated and cured for a minimum of three days. Care must be taken not to over-vibrate the concrete during placement, as segregation of the concrete aggregates will occur.

- Ground levels immediately adjacent to masonry walls should be kept below the damp-proof course.
- Water should not be permitted to pond against the walls of any new structures. Surrounding paths and ground levels should be sloped so as to drain water away from any external walls.
- Adequate drainage of down pipes must be provided to divert water away from structures.
- Landscaping and garden designs should not be placed against walls and be designed to minimise the use of water on site
- Utilise native and deep-rooted plants in order to minimise soil erosion. Western Sydney soils are generally prone to dispersion and erosion; therefore, where vegetation cover is not adequate to control erosion, improve soil resistance to erosion by stabilising dispersive soils with hydrated lime and gypsum.

Infrastructure Recommendations

For the purpose of this report, infrastructure refers to features such as footpaths, water, stormwater and sewerage systems, power lines, gas lines and telephone lines. The following recommendations are for installation and construction of infrastructure. These recommendations could be superseded by industry requirements or Council construction practices.

- Minimise the extent of cut into the existing ground.
- Minimise the potential for accumulation / ponding of surface water by the following practices:
    - Provide adequate fall of the site surfaces to promote collection of surface water run-off in stormwater drains.
    - Provide a good quality bituminous / concrete seal.

- Utilise copper or non-metallic pipes as opposed to galvanised iron.
- Ensure all underground services are provided with adequate corrosion protection, including sheaths to power and telecommunication cables.
- Monitor water pipes for leaks and repair any damaged pipes as soon as possible after detection.
- Promote the use of native and salt tolerant plant species so that future water application is minimised, thereby limiting water infiltration and the potential for mobilisation of salts, which might impact on surface water features.
- Provide adequate surface cover, such as turf, plants and hardstand areas, to minimise the potential for soil erosion, which might impact on nearby surface water features.
- Do not construct unlined water retention or detention systems. If required, use a stormwater management system that minimises the amount of groundwater recharge.

Reference should be made to the following DIPNR publications prior to and during planning of earthworks and construction within the site:

  - Building in a Saline Environment (2003)
  - Roads and Salinity (2003)

CONCLUSION

Based on assessment of the sub-surface profile encountered at the borehole locations and the results of laboratory testing, it is our assessment that the soils likely to be disturbed by the proposed development are generally non-saline.

It is our assessment, that from a salinity consideration, the site is **suitable** for the proposed development, however it is recommended that the soil management recommendations presented in this report be followed in order to minimise any potential impact on the development, or impact on the soils resulting from the development proposed.

Should you have any questions regarding this report, please do not hesitate to contact the undersigned.

For and on behalf of

Aargus Pty Ltd **Reviewed By**

Ben Buckley

Ben Buckley
Environmental Forensic Scientist

Nick Kariotoglou
Principal Environmental Scientist

Attachments

Borehole Logs

Laboratory Results

References

1. Australian Government Website (http://www.anra.gov.au/topics/salinity/managment/index.html) Australian Natural Resources Atlas, 2009
2. Department of Land & Water Conservation – Site Investigations for Urban Salinity, 2002
3. Department of Land & Water Conservation – Indicators of Urban Salinity, 2002
4. Department of Infrastructure Planning and Natural Resources – Building in a Saline Environment, 2003
5. Department of Infrastructure Planning and Natural Resources – Roads and Salinity, 2003
6. Department of Infrastructure Planning and Natural Resources – Introduction to Urban Salinity, 2003
7. Department of Infrastructure Planning and Natural Resources – Land use Planning and Urban Salinity, 2003

8. Department of Natural Resources - *NSW Soil and Land Information System*

9. Department of Natural Resources - *Dryland Salinity Occurrences and indicators 1999*

10. Department of Natural Resources - *Salinity Hazard Map 1999*

11. Department of Natural Resources - *Soil Profiles 2005*

12. Taylor S - Dryland Salinity, Introductory Extension Noted, Salt Action, Second Edition, Department of Conservation and Land Management, 1993.
13. Quirk, J. P. – Sodic Soils, Website (http://www.science.org.au/nova/035/quirk.htm) of the Australian Academy of Science, 1999.
14. Walker, M – Causes, Effects, Remediation and Measurement of Land and River Salinity in Australia, Runoff and Solute Processes in High Water table Areas: Measurement, Modelling and Management, Cooperative Research Centre for Catchment Hydrology, 1994.
15. Sodic Soils (Sodicity), Website (http://hort.usu.edu/classes/Plsci3800/sec9/sld043.htm, 1999
16. Fell, R., MacGregor, P and Stapleton, D. - Geotechnical Engineering of Embankment Dams, 1992.
17. NSW Department of Housing – Managing Urban Stormwater, Soils and Construction, 1998
18. Fetter, C. W. – Applied Hydrogeology, Third Edition, Prentice Hall, 1994.
19. Hazelton, P. A. & Murphy, B. W (ed) – What Do All the Number Mean? A Guide for the Interpretation of Soil Test Results, Department of Conservation and Land Management, 1992.
20. Standards Australia - AS2159-2009 “Piling – Design and Installation”, 2009.

BOREHOLE LOG

CLIENT	Austequity	**BOREHOLE NO.**	**BH1**
PROJECT	Salinity Assessment	**DATE.**	**13/11/2010**
LOCATION	Mortlake	**JOB NO.**	**E734/5**
METHOD	Hand Auguer	**SURFACE ELEV.**	**N/A**
LOGGED BY	BB	**CHECKED BY**	**MK**

Depth (m)	Sample	Graphic Symbol	Ground Water	Classification Symbol	Soil Description (Colour, particle characteristics, strength, placticity, moisture, etc)	Observations
				T	Topsoil - Silty sand, fine to medium grained, brown, dry	
0.5				CI	Silty CLAY, medium plasticity, brown/orange and moist	
1						
1.5						
2				CI	Shale, weathered, weak and dry	
2.5						
3					BH1 terminated @ 3.0m BGL in Shale	
3.5						
4						
4.5						
5						
5.5						

Log Symbols

Standing groundwater level in borehole

Water seepage in borehole (wet)

Samples

BH1.0.5 - Soil sample taken at indicated depth

S - Surface water sample

GW/W - Groundwater sample/water sample

Moisture Condition

D Dry - Runs freely through fingers

M Moist - Does not run freely but no free water visible on soil surface

W Wet - Free water visible on soil surface

Soil Classification

Clay - Particle size less than 0.002mm

Silt - Particle size between 0.002 and 0.06mm

Sand - Particle size between 0.06 and 2.0mm

Gravel - Particle size between 2.0 and 60mm

Strength

VS Very Soft - Unconfined compressive strength less than 25kPa

S Soft - Unconfined compressive strength 25-50kPa

F Firm - Unconfined compressive strength 50-100kPa

St Stiff - Unconfined compressive strength 100-200kPa

VSt Very Stiff - Unconfined compressive strength 200-400kPa

H Hard - Unconfined compressive strength greater than 400kPa

BOREHOLE LOG

CLIENT	Austequity	**BOREHOLE NO.**	**BH2**
PROJECT	Salinity Assessment	**DATE.**	**13/11/2010**
LOCATION	Mortlake	**JOB NO.**	**E734/5**
METHOD	Hand Auguer	**SURFACE ELEV.**	**N/A**
LOGGED BY	BB	**CHECKED BY**	**MK**

Aargus AUSTRALIA

Depth (m)	Sample	Graphic Symbol	Ground Water	Classification Symbol	Soil Description (Colour, particle characteristics, strength, placticity, moisture, etc)	Observations
0–0.3				T	Topsoil - Silty sand, fine to medium grained, brown, dry	
0.3–2.0				CI	Silty CLAY, medium plasticity, brown/orange and moist	
2.0–3.0				CI	Shale, weathered, weak and dry	
3.0					BH2 terminated @ 3.0m BGL in Shale	

Depth scale: 0.5, 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5, 5.5

Log Symbols

Standing groundwater level in borehole
Water seepage in borehole (wet)

Samples

BH1.0.5 - Soil sample taken at indicated depth
S - Surface water sample
GW/W - Groundwater sample/water sample

Moisture Condition

D Dry - Runs freely through fingers
M Moist - Does not run freely but no free water visible on soil surface
W Wet - Free water visible on soil surface

Soil Classification

Clay - Particle size less than 0.002mm
Silt - Particle size between 0.002 and 0.06mm
Sand - Particle size between 0.06 and 2.0mm
Gravel - Particle size between 2.0 and 60mm

Strength

VS Very Soft - Unconfined compressive strength less than 25kPa
S Soft - Unconfined compressive strength 25-50kPa
F Firm - Unconfined compressive strength 50-100kPa
St Stiff - Unconfined compressive strength 100-200kPa
VSt Very Stiff - Unconfined compressive strength 200-400kPa
H Hard - Unconfined compressive strength greater than 400kPa

LABORATORY REPORT COVERSHEET

Date: 21 November 2010

To: AARGUS Pty Ltd
PO Box 398
DRUMMOYNE NSW 1470

Attention: Ben Buckley

Your Reference: SE81416 - E734/5 Mortlake
Laboratory Report No: CE68915

Samples Received: 17/11/2010
Samples / Quantity: 6 Soils

The above samples were received intact and analysed according to your written instructions. Unless otherwise stated, solid samples are reported on a dry weight basis and liquid samples as received.

Jon Dicker
Manager
CAIRNS

Shey Goddard
Administration Manager
CAIRNS

SGS Australia Pty Ltd ABN 44 000 964 278 | Environmental Services Unit 2, 58 Comport Street, Portsmith 4870 QLD Australia t +61 (0)7 4035 5111 f +61 (0)7 4035 5122

CLIENT: AARGUS Pty Ltd
PROJECT: SE81416 - E734/5 Mortlake **Laboratory Report No:** CE68915

LABORATORY REPORT

Cation Exchange Capacity Suite Our Reference Your Reference Type of Sample Date Sampled	Units	CE68915-1 BH1 0.2 Soil 13/09/2010	CE68915-2 BH1 1.2 Soil 13/09/2010	CE68915-3 BH1 3.0 Soil 13/09/2010
Date Extracted		17/11/2010	17/11/2010	17/11/2010
Date Analysed		20/11/2010	20/11/2010	20/11/2010
Sodium, Na	mg/kg	120	110	110
Sodium (meq%)	meq%	0.52	0.48	0.48
Exchangeable Sodium	%	3	4	4
Potassium, K	mg/kg	310	270	320
Potassium (meq%)	meq%	0.79	0.69	0.82
Exchangeable Potassium	%	4	6	6
Calcium, Ca	mg/kg	2,600	1,000	1,100
Calcium (meq%)	meq%	13	5.0	5.5
Exchangeable Calcium	%	65	41	42
Magnesium, Mg	mg/kg	690	740	770
Magnesium (meq%)	meq%	5.7	6.1	6.3
Exchangeable Magnesium	%	28	50	48
CEC	meq%	20	12	13

CLIENT: AARGUS Pty Ltd
PROJECT: SE81416 - E734/5 Mortlake **Laboratory Report No:** CE68915

LABORATORY REPORT

Cation Exchange Capacity Suite Our Reference Your Reference Type of Sample Date Sampled	Units	CE68915-4 BH2 0.1 Soil 13/11/2010	CE68915-5 BH2 1.0 Soil 13/09/2010	CE68915-6 BH2 3.0 Soil 13/09/2010
Date Extracted		17/11/2010	17/11/2010	17/11/2010
Date Analysed		20/11/2010	20/11/2010	20/11/2010
Sodium, Na	mg/kg	160	170	120
Sodium (meq%)	meq%	0.70	0.74	0.52
Exchangeable Sodium	%	4	5	4
Potassium, K	mg/kg	290	260	350
Potassium (meq%)	meq%	0.74	0.66	0.90
Exchangeable Potassium	%	4	5	6
Calcium, Ca	mg/kg	1,800	1,200	1,300
Calcium (meq%)	meq%	9.0	6.0	6.5
Exchangeable Calcium	%	54	44	45
Magnesium, Mg	mg/kg	750	770	780
Magnesium (meq%)	meq%	6.1	6.3	6.4
Exchangeable Magnesium	%	37	46	45
CEC	meq%	17	14	14

CLIENT: AARGUS Pty Ltd
PROJECT: SE81416 - E734/5 Mortlake **Laboratory Report No:** CE68915

LABORATORY REPORT

TEST PARAMETERS	UNITS	LOR	METHOD
Date Extracted			
Date Analysed			
Sodium, Na	mg/kg	2	AN122 CEI-014
Sodium (meq%)	meq%	0.01	Calculation
Exchangeable Sodium	%	1	Calculation
Potassium, K	mg/kg	2	AN122 CEI-014
Potassium (meq%)	meq%	0.01	Calculation
Exchangeable Potassium	%	1	Calculation
Calcium, Ca	mg/kg	2	AN122 CEI-014
Calcium (meq%)	meq%	0.01	Calculation
Exchangeable Calcium	%	1	Calculation
Magnesium, Mg	mg/kg	2	AN122 CEI-014
Magnesium (meq%)	meq%	0.01	Calculation
Exchangeable Magnesium	%	1	Calculation
CEC	meq%	0.01	R & H ##

CLIENT: AARGUS Pty Ltd
PROJECT: SE81416 - E734/5 Mortlake **Laboratory Report No:** CE68915

LABORATORY REPORT

QUALITY CONTROL	UNITS	Blank	Duplicate Sm#	Duplicate Sample||Duplicate	Spike Sm#	Spike Recovery
Date Extracted		17/11/2010	CE68915-1	17/11/2010 || 17/11/2010	Batch Spike	17/11/2010
Date Analysed		20/11/2010	CE68915-1	20/11/2010 || 20/11/2010	Batch Spike	20/11/2010
Sodium, Na	mg/kg	<2	CE68915-1	120 || 130 || RPD: 8	Batch Spike	93%
Sodium (meq%)	meq%	-	CE68915-1	0.52 || 0.57 || RPD: 9	Batch Spike	-
Exchangeable Sodium	%	-	CE68915-1	3 || 3 || RPD: 0	Batch Spike	-
Potassium, K	mg/kg	<2	CE68915-1	310 || 310 || RPD: 0	Batch Spike	105%
Potassium (meq%)	meq%	-	CE68915-1	0.79 || 0.79 || RPD: 0	Batch Spike	-
Exchangeable Potassium	%	-	CE68915-1	4 || 4 || RPD: 0	Batch Spike	-
Calcium, Ca	mg/kg	<2	CE68915-1	2600 || 2600 || RPD: 0	Batch Spike	93%
Calcium (meq%)	meq%	-	CE68915-1	13 || 13 || RPD: 0	Batch Spike	-
Exchangeable Calcium	%	-	CE68915-1	65 || 65 || RPD: 0	Batch Spike	-
Magnesium, Mg	mg/kg	<2	CE68915-1	690 || 690 || RPD: 0	Batch Spike	102%
Magnesium (meq%)	meq%	-	CE68915-1	5.7 || 5.7 || RPD: 0	Batch Spike	-
Exchangeable Magnesium	%	-	CE68915-1	28 || 28 || RPD: 0	Batch Spike	-
CEC	meq%	-	CE68915-1	20 || 20 || RPD: 0	Batch Spike	-

CLIENT: AARGUS Pty Ltd
PROJECT: SE81416 - E734/5 Mortlake **Laboratory Report No:** CE68915

LABORATORY REPORT

NOTES:
LOR - Limit of Reporting.
##Method from Rayment & Higginson - "Australian Laboratory Handbook of Soil and Water Chemical Methods".

Analysis Date: **Between** 17/11/10 **and** 21/11/10

SGS Terms and Conditions are available at www.au.sgs.com

ANALYTICAL REPORT

21 November 2010

Aargus Pty Ltd
446 Parramatta Road
PETERSHAM
NSW 2049

Attention: **Ben Buckley**

Your Reference: E734/5 Mortlake

Our Reference: SE81416

Samples: 6 Soils
Received: 15/11/10

Preliminary Report Sent: Not Issued

These samples were analysed in accordance with your written instructions.

For and on Behalf of:
SGS ENVIRONMENTAL SERVICES

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

Results Approved and/or Authorised by:

Dong Liang
Quality Manager

Huong Crawford
Metals Signatory

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

Inorganics Our Reference: Your Reference Sample Matrix Depth Date Sampled	UNITS ------------- ------------	SE81416-1 BH1 Soil 0.2 13/11/2010	SE81416-2 BH1 Soil 1.2 13/11/2010	SE81416-3 BH1 Soil 3.0 13/11/2010	SE81416-4 BH2 Soil 0.1 13/11/2010	SE81416-5 BH2 Soil 1.0 13/11/2010
Date Extracted- (pH 1:5 soil: Water)		17/11/2010	17/11/2010	17/11/2010	17/11/2010	17/11/2010
Date Analysed (pH 1:5 Soil: Water)		17/11/2010	17/11/2010	17/11/2010	17/11/2010	17/11/2010
pH 1:5 soil:water	pH Units	6.2	6.1	6.2	6.2	6.5
Date Extracted (Conductivity)		17/11/2010	17/11/2010	17/11/2010	17/11/2010	17/11/2010
Date Analysed (Conductivity)		17/11/2010	17/11/2010	17/11/2010	17/11/2010	17/11/2010
Electrical Conductivity 1:5 soil:water	µS/cm	99	100	93	97	110

Inorganics Our Reference: Your Reference Sample Matrix Depth Date Sampled	UNITS ------------- ------------	SE81416-6 BH2 Soil 3.0 13/11/2010
Date Extracted- (pH 1:5 soil: Water)		17/11/2010
Date Analysed (pH 1:5 Soil: Water)		17/11/2010
pH 1:5 soil:water	pH Units	6.3
Date Extracted (Conductivity)		17/11/2010
Date Analysed (Conductivity)		17/11/2010
Electrical Conductivity 1:5 soil:water	µS/cm	100

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

Anions in soil Our Reference: Your Reference Sample Matrix Depth Date Sampled	UNITS ------------- ------------	SE81416-1 BH1 Soil 0.2 13/11/2010	SE81416-2 BH1 Soil 1.2 13/11/2010	SE81416-3 BH1 Soil 3.0 13/11/2010	SE81416-4 BH2 Soil 0.1 13/11/2010	SE81416-5 BH2 Soil 1.0 13/11/2010
Date Extracted		17/11/2010	17/11/2010	17/11/2010	17/11/2010	17/11/2010
Date Analysed		17/11/2010	17/11/2010	17/11/2010	17/11/2010	17/11/2010
Sulphate, SO4 1:5 soil:water	mg/kg	38	46	32	37	45
Chloride, Cl 1:5 soil:water	mg/kg	27	32	30	29	29

Anions in soil Our Reference: Your Reference Sample Matrix Depth Date Sampled	UNITS ------------- ------------	SE81416-6 BH2 Soil 3.0 13/11/2010
Date Extracted		17/11/2010
Date Analysed		17/11/2010
Sulphate, SO4 1:5 soil:water	mg/kg	43
Chloride, Cl 1:5 soil:water	mg/kg	28

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

Exchangeable Sodium Percent						
Our Reference:	UNITS	SE81416-1	SE81416-2	SE81416-3	SE81416-4	SE81416-5
Your Reference	-------------	BH1	BH1	BH1	BH2	BH2
Sample Matrix	------------	Soil	Soil	Soil	Soil	Soil
Depth		0.2	1.2	3.0	0.1	1.0
Date Sampled		13/11/2010	13/11/2010	13/11/2010	13/11/2010	13/11/2010
Exchangeable Sodium Percent		#	#	#	#	#

Exchangeable Sodium Percent		
Our Reference:	UNITS	SE81416-6
Your Reference	-------------	BH2
Sample Matrix	------------	Soil
Depth		3.0
Date Sampled		13/11/2010
Exchangeable Sodium Percent		#

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

Moisture Our Reference: Your Reference Sample Matrix Depth Date Sampled	UNITS ------------- ------------	SE81416-1 BH1 Soil 0.2 13/11/2010	SE81416-2 BH1 Soil 1.2 13/11/2010	SE81416-3 BH1 Soil 3.0 13/11/2010	SE81416-4 BH2 Soil 0.1 13/11/2010	SE81416-5 BH2 Soil 1.0 13/11/2010
Date Analysed (moisture)		17/11/2010	17/11/2010	17/11/2010	17/11/2010	17/11/2010
Moisture	%	16	16	14	16	16

Moisture Our Reference: Your Reference Sample Matrix Depth Date Sampled	UNITS ------------- ------------	SE81416-6 BH2 Soil 3.0 13/11/2010
Date Analysed (moisture)		17/11/2010
Moisture	%	16

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

Method ID	Methodology Summary
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).
SEI-037	Ammonia - Determined by salicylate colourimetric method using Discrete Analyser.
AN106	Conductivity and TDS by Calculation (cTDS) - Conductivity is measured using a conductivity cell and dedicated meter, in accordance with APHA 21st Edition, 2510. TDS is calculated by TDS(mg/L)=0.6 x Conductivity(µS/cm).
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-.
Ext-002	Analysis subcontracted to SGS Environmental Services Cairns, NATA Accreditation No. 2562, Site No. 3146.
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.

QUALITY CONTROL Inorganics	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD
Date Extracted- (pH 1:5 soil: Water)				[NT]	SE81416-1	17/11/2010 || 17/11/2010
Date Analysed (pH 1:5 Soil: Water)				[NT]	SE81416-1	17/11/2010 || 17/11/2010
pH 1:5 soil:water	pH Units	0	AN101	[NT]	SE81416-1	6.2 || 6.2 || RPD: 0
Electrical Conductivity 1:5 soil:water	µS/cm	1	AN106	[NT]	SE81416-1	99 || 95 || RPD: 4

QUALITY CONTROL Anions in soil	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Date Extracted				17/11/10	[NT]	[NT]	LCS	17/11/10
Date Analysed				17/11/10	[NT]	[NT]	LCS	17/11/10
Sulphate, SO4 1:5 soil:water	mg/kg	0.5	SEI-038	<0.5	[NT]	[NT]	LCS	99%
Chloride, Cl 1:5 soil:water	mg/kg	0.25	SEI-038	<0.2	[NT]	[NT]	LCS	99%

QUALITY CONTROL Exchangeable Sodium Percent	UNITS	LOR	METHOD	Blank
Exchangeable Sodium Percent			Ext-002	<0.01

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

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

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

ESP analysed by SGS-Cairns, report No. CE68915, report attched.
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*)

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.pc

SAMPLE RECEIPT ADVICE (SRA)

16 November 2010

Client Details			**Laboratory Details**		
Requested By	:	**Ben Buckley**			
Client	:	Aargus Pty Ltd	Laboratory	:	SGS Environmental Services
Contact	:	Ben Buckley	Manager	:	Edward Ibrahim
Address	:	446 Parramatta Road PETERSHAM NSW 2049	Address	:	Unit 16, 33 Maddox Street Alexandria NSW 2015
Email	:	admin@aargus.net	Email	:	au.samplereceipt.sydney@sgs.com
Telephone	:	1300 137 038	Telephone	:	61 2 8594 0400
Facsimile	:	1300 136 038	Facsimile	:	61 2 8594 0499
Project	:	E734/5 Mortlake	Report No	:	**SE81416**
Order Number	:		No. of Samples	:	6
Samples	:	6 Soils	Due Date	:	21/11/2010

Date Instructions Received	:	15/11/2010
Sample Receipt Date	:	15/11/2010

Samples received in good order	:	YES	Samples received in correct containers	:	YES
Samples received without headspace	:	YES	Sufficient quantity supplied	:	YES
Upon receipt sample temperature	:	Cool	Cooling Method	:	Ice Pack
Sample containers provided by	:	SGS	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

ESP subcontracted to SGS Cairns

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

SAMPLE RECEIPT ADVICE (SRA) - continued

Client : Aargus Pty Ltd
Project : E734/5 Mortlake

Report No : SE81416

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	Inorganics	Anions in soil	Exchangeable Sodium Percent	Moisture
1	BH1	X	X	X	X	X
2	BH1	X	X	X	X	X
3	BH1	X	X	X	X	X
4	BH2	X	X	X	X	X
5	BH2	X	X	X	X	X
6	BH2	X	X	X	X	X

Sample No.	Description
1	BH1
2	BH1
3	BH1
4	BH2
5	BH2
6	BH2