Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Report on
Salinity Investigation and Management Plan

Proposed Residential Subdivision
51 St Andrews Road, Leppington

Prepared for
Cornish Group Pty Ltd

Project 76571.02
July 2014

Douglas Partners
Geotechnics / Environment / Groundwater

Document History

Document details

Project No.	76571.02	Document No.	1
Document title	Salinity Investigation and Management Plan		
Site address	51 St Andrews Road, Leppington		
Report prepared for	Cornish Group Pty Ltd		
File name	P:\76571.02 LEPPINGTON, Salinity Inv & Management Plan, BAH\Report\ 76571.02 LEPPINGTON SMP 020714.doc		

Document status and review

Revision	Prepared by	Reviewed by	Date issued
0	Bradley Harris	John Lean	2 July 2014

Distribution of copies

Revision	Electronic	Paper	Issued to
0	1	3	Cornish Group Pty Ltd, c/ SMEC Urban Pty Ltd

The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

	Signature	Date
Author		2 July 2014
Reviewer	for JL	2 July 2014

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Table of Contents

Page

Report on Salinity Investigation and Management Plan
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1. Introduction

This report presents the results of a salinity investigation and provides a salinity management plan for the proposed residential subdivision at 51 St Andrews Road, Leppington. The work was commissioned by Mr Paul Parfenow of SMEC Urban Pty Ltd on behalf of Cornish Group Pty Ltd.

Saline soils affect much of the Western Sydney Region. Buildings and infrastructure located on shales of the Wianamatta Group are particularly at risk. Salinity can affect urban structures in a number of ways including corrosion of concrete, break down of bricks and mortar, corrosion of steel (including reinforcement), break up of roads, attack on buried infrastructure, reduced ability to grow vegetation and increased erosion potential.

It is understood that a residential subdivision is proposed and that an assessment of soil salinity is required for submission to Camden Council with the subdivision application and to assist in conceptual planning of the development.

The investigation comprised excavation of test pits, followed by laboratory testing of selected samples, engineering analysis and reporting. Details of the work undertaken and the results obtained are given within this report, together with comments relating to design and construction practice.

This assessment was undertaken concurrently with a geotechnical investigation for the site (Project 76571.03) which is reported separately.

2. Scope of Works

The current report includes two parts:

1. Salinity assessment of the site based upon:

- Collection of samples at regular depth intervals from 39 test pits (14 deep test pits to 3 m (or prior refusal) and 25 shallow test pits to 0.5 m);
- Inspection of the site for signs of salinity;
- Analysis of electrical conductivity (EC1:5), pH and soil texture test results for 116 soil and weathered rock samples determined at a NATA accredited analytical laboratory, for classification of salinity and aggressivity;
- Laboratory analysis of additional salinity, aggressivity and erodibility indicators, including chloride and sulphate concentrations (56 samples), sodicities (26 samples) and dispersibility testing (five samples) at a NATA accredited analytical laboratory; and

- Assessment of the results with respect to potential for salinity impacts on the development.

2. Preparation of a Salinity Management Plan (SMP) for the site providing guidance on development strategies to reduce the impact of saline materials (if and where found). The Plan was based upon:

- Review of the salinity investigation results;
- Review of the following documents detailing Council requirements:
  - 'Building in Salinity Prone Environments', Camden Council, 2004;
  - 'Map of Salinity Potential in Western Sydney', DNR (2002);
  - 'Guidelines to Accompany Map of Salinity Potential in Western Sydney', DNR (2002);
  - 'Western Sydney Salinity Code of Practice' (amended January 2004), Rebecca Nicholson for WSROC, DNR and Natural Heritage Trust;
  - 'Guide to Residential Slabs and Footings in a Saline Environment', Cement, Concrete and Aggregates, Australia (2005);
  - 'Introduction to Urban Salinity', DNR (2003);
  - 'Building in a Saline Environment' DNR (2003);
  - 'Roads and Salinity', DNR (2003);
  - 'Indicators of Urban Salinity', DNR (2002);
  - 'Site Investigations for Urban Salinity', DNR (2002);
  - 'Urban Salinity Processes', DNR (2004);
  - 'Waterwise Parks and Gardens', DNR (2004); and
  - 'Broad Scale Resources for Urban Salinity Assessment' DNR (2002).

3. Site Description

The site is located at 51 St Andrews Road, Leppington (Lot 72 in Deposited Plan 706546) and was previously used for the production of fireworks. The site has an irregular shape and covers an area of approximately 13 ha. The site location and boundaries are shown on Drawing 1, Appendix A.

At the time of undertaking this assessment the site was in the process of being decommissioned with all buildings vacated and no pyrotechnic production occurring. The northern portion of the site consisted of brick and corrugated iron buildings associated with the former production of pyrotechnics. Various shipping containers were located within the site, as well as other storage sheds. Access tracks (some asphalt and some dirt) were located within the site. The southern portion of the site was grass-covered in the west and tree covered in the south-east and a large shed formerly located along the southern boundary had been removed. Two dams were located within the site, one within the former fireworks manufacturing area and the second down-gradient within the southern portion of the site.

Fill mounds consisting of reworked natural material were observed in the northern portion of the site and anecdotal evidence indicates that the material was sourced from the construction of St Andrews Road.

4. Geology and Hydrogeology

Reference to the Penrith 1:100 000 Geological Series Sheet indicates that the site is underlain by Bringelly Shale (mapping unit Rwb) of the Wianamatta Group of Triassic age. This formation typically comprises shale, carbonaceous claystone, laminite and some minor coaly bands which weather to form clays of high plasticity. The results of the investigation were consistent with the geological mapping, with siltstone encountered in the pits that intersected rock.

The Penrith 1:100,000 Soils Landscape Sheet indicates that the majority of the site is within the Blacktown soil landscape group (mapping unit bt), which is associated with residual soils with moderately reactive, highly plastic subsoil, low soil fertility and poor soil drainage.

Additional reference to the Map of Salinity Potential in Western Sydney, indicates that the site is located in an area of *"Moderate salinity potential"* where *"saline areas may occur .... which have not yet been identified or may occur if risk factors change adversely"*. The classification is based on the landform and geology and it is noted that due to the resolution at the scale of the mapping, it is not possible to delineate the zone boundaries with precision.

The McNally, G. 2005, Investigation of Urban Salinity – Case Studies from Western Sydney, Urban Salt 2005 Conference Paper, Parramatta (McNally 2005) describes some general features of the hydrogeology of Western Sydney which are relevant to this site. The shale terrain of much of Western Sydney is known for saline groundwater, resulting either from the release of connate salt in shales of marine origin or from the accumulation of windblown sea salt. Seasonal groundwater level changes of 1 – 2 m can occur in a shallow regolith aquifer or a deeper shale aquifer due to natural influences.

Groundwater investigations undertaken by DP in the Camden area and previous studies of areas underlain by the Wianamatta Group and Quaternary river alluvium indicate that:

- the shales have a very low intrinsic permeability, hence groundwater flow is likely to be dominated by fracture flow with resultant low yields (typically < 1 L/s) in bores; and
- the groundwater in the Wianamatta Group is typically brackish to saline with total dissolved solids (TDS) in the range 4000 – 5000 mg/L (but with cases of TDS up to 31750 mg/L being reported). The dominant ions are typically sodium and chloride and the water being generally unsuitable for livestock or irrigation.

5. Field Work Methods

The current field work for this salinity investigation comprised the excavation of 39 test pits (TP) with a JCB 4CX backhoe fitted with a 450 mm bucket. These included TP103 and TP105 to depths of up to 5 m or prior refusal, TP101, TP107, TP110, TP117, TP122, TP124, TP126, TP128, TP129, TP133, TP136 and TP138 to depths of up to 3 m or prior refusal (deep test pits) and TP102, TP104, TP106,

TP108, TP109, TP111 to TP116, TP118 to TP121, TP123, TP125, TP127, TP130 to TP132, TP134, TP135, TP137 and TP139 to depths of 0.5 m (shallow test pits). The pits were logged on site by a geo-environmental engineer, who collected representative disturbed samples to assist in strata identification and for laboratory testing. After carefully backfilling each test pit, the surface was reinstated to its previous level.

The test pit locations were nominated by DP and were pegged on site prior to the investigation by SMEC Urban Pty Ltd, project surveyors. The location of the test pits are indicated on Drawing 2 (Appendix A). The surface levels (to Australian Height Datum, AHD) and co-ordinates (to the MGA94 Zone 56 system) were also provided by SMEC Urban Pty Ltd. The surface levels and co-ordinates are given on the test pit logs (Appendix B) and in the Summary Table (Appendix C).

6. Results

A review of the pits excavated for both contamination and salinity indicated that the majority of the site was covered by topsoil to depths of between 0.2 – 0.4 m which was underlain by silty clay with ironstone gravels noted in some locations to depths of between 0.8 – 3.8 m or test pit termination. These soils were underlain in turn by shale bedrock.

Filling was encountered in seven test pits (TP101, TP113, TP118, TP124, TP125, TP128 and TP129) and comprised silt with traces of some clay and gravel and silty clay with traces of ironstone gravel. TP128 comprised silty clay with some gravel and trace anthropogenic materials consisting of hose section, tile fragments and wooden paling.

No free groundwater was observed in excavated test pits. It is noted that the test pits were immediately backfilled on completion which precluded long term monitoring of groundwater levels.

The test pit logs are provided in Appendix B, together with notes defining classification methods and descriptive terms.

No signs of efflorescence were noted during the inspection.

A Summary Table (Appendix C), presents the results of laboratory tests, assessments of aggressivity to concrete and steel, sodicity class, textural classification, calculated salinity ECe and salinity class inferred from ECe values using the method of Richards (1954). The Summary Table (Appendix C) also includes results of Emerson Crumb tests and derived Dispersion Potentials. The detailed laboratory test reports and chain of custody information are provided in Appendix D.

Drawing 3 (Appendix A) shows the areas of the site which are proposed to be cut and filled (based on the draft bulk earthworks plan supplied by SMEC Urban Pty Ltd (SMEC Urban Drawing No. 77831.00.DA501 Rev A – Cut and Fill Plan)). The Summary Table (Appendix C) presents approximate, interpolated cut and fill depths. The maximum proposed cut is up to 4 m in the vicinity of test pits TP103 and TP105 and the maximum proposed fill is up to 3 m in the vicinity of TP115 and TP116.

A “worst case” scenario was used to classify the extent of salinity and aggressivity within the site. This was achieved by utilising a maxima/minima analysis within three area types defined by the cut-fill diagram provided for this assessment.

For foundation depths of up to 1.0 m below the proposed surface:

- Cut areas – relevant maximum or minimum values from the sample closest to the proposed surface level (after cutting) and from 0.5 m and 1.0 m below that sample (where available) were determined at individual locations and interpolated between locations to assess future foundation zone conditions in these sub-areas of the finished site; and
- Fill areas – the most saline and most aggressive classifications of all the material to be excavated from above the proposed surface within the cut areas, were first used to classify the material to be used as filling. These classifications were then compared with those from shallow samples (up to 1.0 m bgl) at individual test locations within areas that are proposed to receive shallow fill (less than 1.0 m). The worst case results from the filling material as a whole and from the shallow samples at individual locations were used to classify the future foundation soils at the individual locations. These maxima or minima were interpolated between locations to assess future foundation zone conditions in these sub-areas into which filling materials are to be placed;

For deep foundations (i.e. piers):

- Finished surface area – This comprised the entire site area, where minimum pH and resistivity values at individual locations (from all investigated depths below the proposed surface level), were interpolated across the site to assess soil aggressivity to future concrete and steel piles.

These maximum or minimum values were used for spatial mapping of salinities and aggressivities throughout the investigation area.

Table 1 (following page) summaries total test sample numbers and the range of test results obtained.

Table 1: Summary of Test Results

Parameter		Units	Samples	Minimum	Maximum
pH		pH units	116	4.4	7
Chlorides		(mg/kg)	56	78	1000
Sulphates		(mg/kg)	56	21	480
Aggressivity	to Concrete	[AS2159]		non-aggressive	moderate
	to Steel	[AS2159]		non-aggressive	mild
Exchangeable Sodium (Na)		(meq/100g)	26	1.3	4.8
CEC (cation exchange capacity)		(meq/100g)	26	4.9	18
Sodicity [Na/CEC]		(ESP%)	26	15.5	34.8
Sodicity Class		[after DLWC]	-	highly sodic	highly sodic
EC1:5 [Lab.]		(mS/cm)	116	84	890
Resistivity		Ω.cm	116	1123.6	11904
ECe [M x EC1:5] [1]		(dS/m)	-	0.7	8.6
Salinity Class		[after Richards 1954]	-	non-saline	very saline

1 M is soil textural factor

6.1 Aggressivity

Figure 1 (following page) presents variations of aggressivity with depth, based on pH profiles at deep test pit locations, together with the aggressivity class ranges indicated in Australian Standard AS2159 (2009). The absence of free groundwater from all test pits and the impermeability of the sampled clay-rich soils indicate that soils at all test pits are in Condition “B” as defined by AS2159.

The pH profiles of Figure 1 indicate that the materials throughout the site, at all investigated depths, are non-aggressive to steel. The chloride concentration guidelines of AS2159 support this non-aggressive classification. However, based on resistivity criteria (Appendix C), samples were classified as non-aggressive to mildly aggressive to steel.

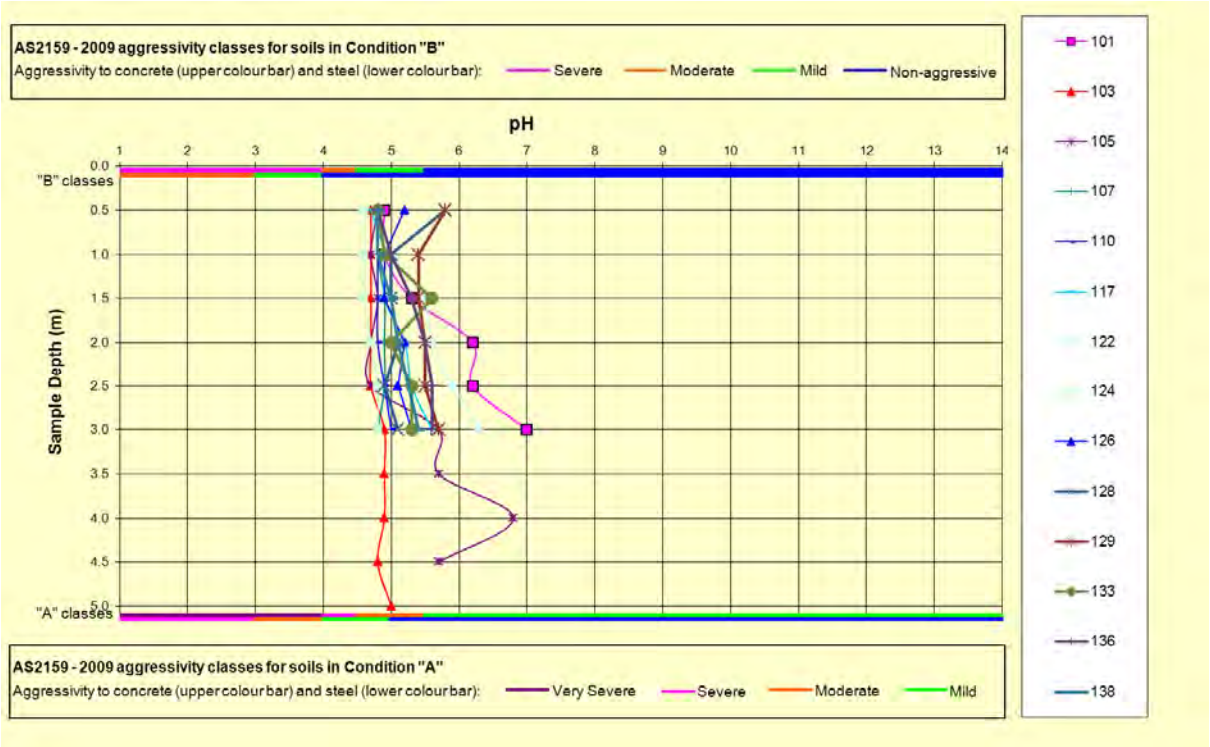

Figure 1: Vertical pH Profiles and Aggressivity Classes

The Summary Table also indicates that 83.6% of all samples were non-aggressive to concrete, 15.5% were mildly aggressive and 0.9% were moderately aggressive. The worst case analysis indicated that the majority of the site was underlain by soils with mild aggressivity to concrete foundations and concrete piles. However, one sample (TP108/0.5 m) is classified as moderately aggressive to concrete, with a pH result of 4.4. This result is on the threshold of being mildly aggressive to concrete (pH of 4.5 – 5). On this basis and based on the cut and fill that is proposed, the entire site has been classified as mildly aggressive to concrete.

Calculated soil resistivities indicated higher aggressivities to steel than were indicated by pH measurements. The worst case analysis indicated that the majority of the site was underlain by soils with mild aggressivity to steel piles and on this basis and based on the cut and fill that is proposed, the entire site has been classified as mildly aggressive to steel.

6.2 Salinity

Figure 2 (below) presents the variations of salinity with depth, based on salinity (ECe) profiles at deep test pit locations, together with the salinity classifications of Richards (1954).

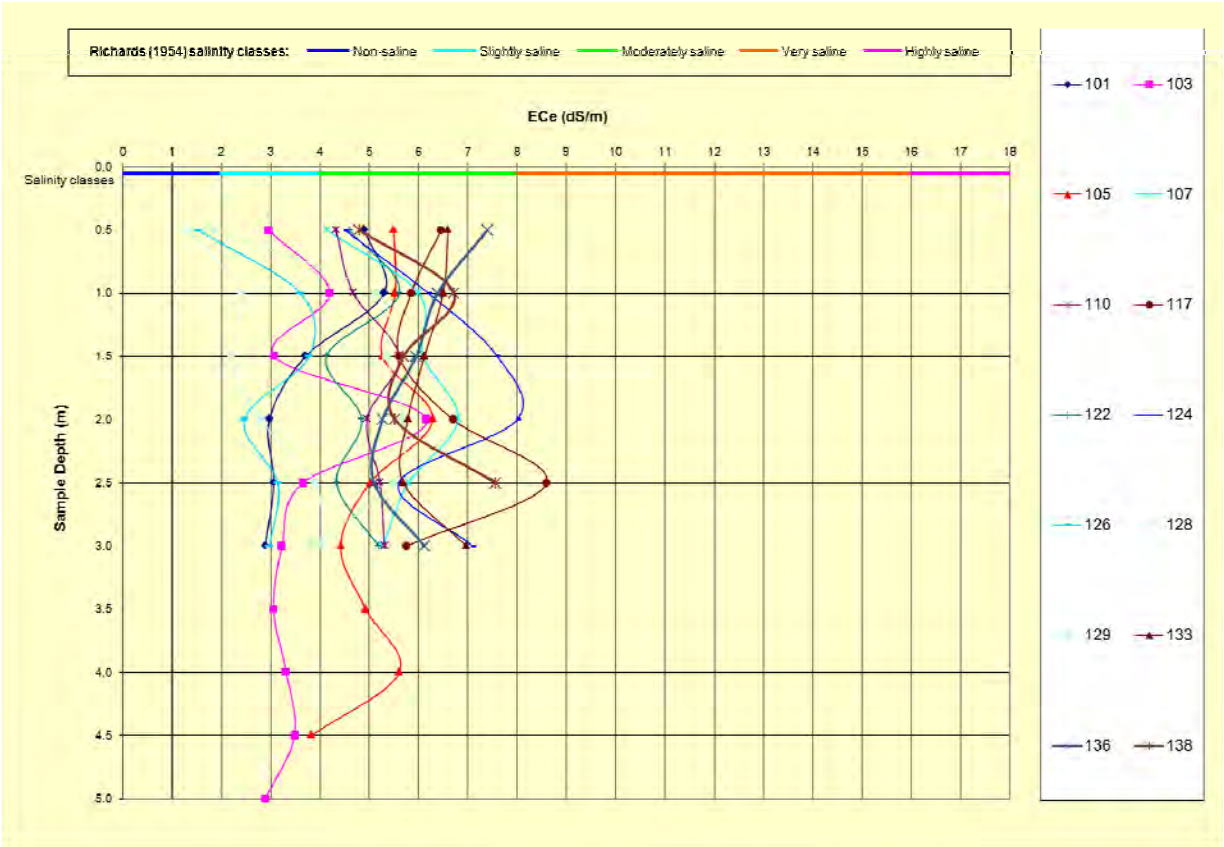

Figure 2: Vertical Salinity Profiles and Salinity Classes

The Summary Table (Appendix C) indicates that 7% of all soil samples were non-saline, 28% were slightly saline, 65% were moderately saline and 1% were very saline (1 sample).

As for soil aggressivity, the worst case analysis was used to define areas of moderately saline (ECe 4 – 8 dS/m) and very saline (ECe 8 – 16 dS/m) soil (see Drawing 4, Appendix A).

6.3 Sodicity and Dispersibility

The sodicity test reported in the Summary Table shows highly sodic soils, indicating some potential for erodability of soils left exposed.

Dispersion potential, tested at depths of 0.5 m – 2.0 m bgl by the Emerson Crumb Test (refer Summary Table, Appendix C), were determined to be class 5 and class 6 (no dispersion).

7. Impact of the Site Materials on the Proposed Development

The mild aggressivity to concrete and steel, the presence of moderately saline and very saline materials and the highly sodic soils are naturally occurring features of the local landscape and are not considered significant impediments to the proposed development, provided appropriate remediation or management techniques are employed.

7.1 Aggressivity

As indicated above in Section 6.1, the site materials have been classified as mildly aggressive to concrete, using the criteria within Australian Standard AS2159 (2009).

Concrete classifications under AS2159 allow for a 40 – 60 year lifetime, provided a minimum concrete strength of 32 MPa is applied in mildly aggressive conditions. Where concrete of lower than recommended strength is employed then a shorter lifetime may be expected, however no estimates are given in the Standard of this reduced lifetime.

In areas where materials are mildly aggressive to steel, corrosion allowance should be taken into account by the designer as discussed in the Salinity Management Plan (Section 8).

7.2 Salinity

Moderately saline and very saline conditions were found within the investigated depth zones, flagging the potential for salt-induced damage to susceptible services, slabs and shallow footings and demonstrating the need for appropriate salinity management.

7.3 Sodicity

Results (refer Summary Table, Appendix C) indicate that soils within depths of 0.5 – 4.0 m below the ground surface are highly sodic and it is considered that there is potential for sodic soils (either in situ, transported or imported as filling) to occur at the proposed ground surface. Sodic soils have low permeability due to infilling of interstices with fine clay particles during the weathering process, restricting infiltration of surface water and potentially creating perched water tables, seepage in cut faces or ponding of water in flat open areas. In addition, sodic soils tend to erode when exposed. Management of sodic soils is therefore required to prevent these adverse affects. As detailed in Section 8 below, management of sodic soils, following completion of bulk earthworks, is focussed on prevention of exposure.

8. Salinity Management Plan

The current salinity investigation indicates that materials within the site are moderately to very saline. Testing of other parameters associated with salinity indicates that the materials are mildly aggressive to steel (by the resistivity and chloride criteria of AS2159) and mildly aggressive to concrete within the site (by the pH and sulphate criteria of AS2159). In addition, shallow soils were highly sodic.

The following management strategies are confined to the management of those factors with a potential to impact on the development.

A. Management should focus on capping of the upper surface of the sodic soils, both exposed by excavation and placed as filling, with a more permeable material to prevent ponding, to reduce capillary rise, to act as a drainage layer and to reduce the potential for erosion.

B. When possible, place excavated materials in fill areas with similar salinity characteristics (ie: place material onto in-situ soils with a similar or higher aggressivity or salinity classification). With respect to imported fill material, testing should be undertaken prior to importation, to determine the salinity characteristics of the material, which should be non-aggressive and non-saline to slightly saline where possible but in any case not more aggressive or more saline than the material on which it is to be placed.

C. Sodic soils can also be managed by maintaining vegetation where possible and planting new salt tolerant species. The addition of organic matter, gypsum and lime can also be considered where appropriate. After gypsum addition, reduction of sodicity levels may require some time for sufficient infiltration and leaching of sodium into the subsoils, however capping of exposed sodic material should remain the primary management method. Topsoil added at the completion of bulk earthworks is, in effect, also adding organic matter which may help infiltration and leaching of sodium.

D. Avoid water collecting in low lying areas, in depressions, or behind fill. This can lead to water logging of the soils, evaporative concentration of salts, and eventual breakdown in soil structure resulting in accelerated erosion.

E. Any pavements should be designed to be well drained of surface water. There should not be excessive concentrations of runoff or ponding that would lead to waterlogging of the pavement or additional recharge to the groundwater through any more permeable zones in the underlying filling material.

F. Surface drains should generally be provided along the top of batter slopes to reduce the potential for concentrated flows of water down slopes possibly causing scour.

G. Salt tolerant grasses and trees should be considered for landscaping, to reduce soil erosion as in Strategy A above and to maintain the existing evapo-transpiration and groundwater levels. Reference should be made to an experienced landscape planner or agronomist.

The following additional strategies are recommended for completion of service installation and for house construction. These strategies should be complementary to standard good building practices recommended within the Building Code of Australia, including cover to reinforcement within concrete and correct installation of a brick damp course, so that it cannot be bridged to allow moisture to move into brick work and up the wall.

H. As the entire site is classified as mildly aggressive to concrete piles, piles should have a minimum strength of 32 MPa and a minimum cover to reinforcement of 60 mm (as per AS2159) to limit the corrosive effects of the surrounding materials (in accordance with AS2159).

I. With regard to concrete structures, for moderately saline soils that are mildly aggressive to concrete (refer Drawing 4, Appendix A), slabs and foundations should have a minimum strength of 25 MPa, a minimum cover to reinforcement of 45 mm from unprotected ground and should be allowed to cure for a minimum of three days (as per AS3600) to limit the corrosive effects of the surrounding soils.

J. With regard to concrete structures, for very saline soils that are mildly aggressive to concrete (refer Drawing 4, Appendix A), slabs and foundations should have a minimum strength of 32 MPa, a minimum cover to reinforcement of 50 mm from unprotected ground and should be allowed to cure for a minimum of seven days (as per AS3600) to limit the corrosive effects of the surrounding soils.

K. Any future installation of concrete pipes up to a maximum diameter of 750 mm, within the site, should employ fibre reinforced cement. Alternatively, concrete pipes in these areas should be encased in outer PVC conduits or should have a minimum equivalent strength as defined in I and J above.

L. Concrete pipes with a larger diameter than 750 mm should utilise sulphate resistant cement.

M. Resistivity results indicate soils that are mildly aggressive to steel. For soils that are mildly aggressive to steel, the following corrosion allowances (as per AS 2159 – 2009) should be taken into account by the designer:

   o Mild: uniform corrosion allowance 0.01 – 0.02 mm/year; and

   In instances where a coating is applied to the pile, if the design life of the pile is greater than the design life for the coating, consideration must be given to corrosion of the pile in accordance with the above list.

9. Additional Considerations

This SMP is based on the bulk earthworks plan supplied by SMEC Urban Pty Ltd (SMEC Urban Drawing No. 77831.00.DA501 Rev A – Cut and Fill Plan). Subsequent revisions to this plan must be reviewed by DP to assess the applicability of the SMP to the revised design. Such a review must be in writing and must be attached to copies of this report. Substantial changes to the proposed cut and fill on the site are likely to require additional testing or alterations of the drawings.

10. References:

- Chhabra, R. 1966, *Soil Salinity and Water Quality*, A. Bakema/Rotterdam/Brookfield, New York, 284 pp.
- Department of Mines 1985, *Geology of Wollongong – Port Hacking 1:100 000 Geological Series* Sheet No 9029 – 9129.
- Camden Council 2004, *Building in Salinity Prone Environments*.
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- Hazelton, P. A. and Murphy B. W. 2007, *Interpreting Soil Test Results* Department of Natural Resources.
- McNally, G. 2005, *Investigation of Urban Salinity – Case Studies from Western Sydney, Urban Salt 2005 Conference Paper*, Parramatta.
- Richards, L. A. (ed.) 1954, *Diagnosis and Improvement of Saline and Alkaline Soils* USDA Handbook No. 60, Washington D.C.
- Soil Conservation Service of New South Wales 1990, *Soil Landscapes of Wollongong and Port Hacking 1:100 000 Sheet*.
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- Standards Australia 1995, AS 2159 – 2009 *Piling Design and Installation*.
- Standards Australia 1996, AS 2870 – 1996 *Residential Slabs and Footings*.

11. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for this project at 51 St Andrews Road, Leppington. This report is provided for the exclusive use of Cornish Group Pty Ltd for this project only and for the purpose(s) as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the subsurface conditions on the site only at the specific sampling locations, and then only to the depths investigated and at the time the work was carried out. Subsurface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be limited by undetected variations in ground conditions across the site between and beyond the sampling locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

This report must be read in conjunction with all of the attached notes and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as a part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

Douglas Partners Pty Ltd

Appendix A

About this Report
Drawings 1 – 4

About this Report

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Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

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

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- 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 with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- 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 first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps 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.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

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

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report 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. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

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

Sampling Methods

Douglas Partners

Sampling

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

Disturbed samples taken during drilling provide information on colour, type, 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 into the soil and withdrawing it to obtain 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.

Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter into the pit. The depth of excavation is limited to about 3 m for a backhoe and up to 6 m for a large excavator. A potential disadvantage of this investigation method is the larger area of disturbance to the site.

Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 300 mm or larger in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5 m) 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 samples.

Continuous Spiral Flight Augers

The borehole is advanced using 90-115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively low reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud being pumped down the drill rods 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 rate of penetration. Where drilling mud is used this can mask the cuttings and reliable identification is only possible from separate sampling such as SPTs.

Continuous Core Drilling

A continuous core sample can be obtained using a diamond tipped core barrel, usually with a 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in weak rocks and granular soils), this technique provides a very reliable method of investigation.

Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, Methods of Testing Soils for Engineering Purposes - Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

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

  4,6,7
  N=13

- In the case where the test is discontinued before the full penetration depth, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm as:

  15, 30/40 mm

The results of the SPT tests can be related empirically to the engineering properties of the soils.

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

Dynamic penetrometer tests (DCP or PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil the number of blows required to penetrate each successive 150 mm depth are recorded. Normally there is a depth limitation of 1.2 m, but this may be extended in certain conditions by the use of extension rods. Two types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.
- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities.

Symbols & Abbreviations

Douglas Partners

Introduction

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

Drilling or Excavation Methods

C	Core Drilling
R	Rotary drilling
SFA	Spiral flight augers
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

Water

▷	Water seep
▽	Water level

Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
E	Environmental sample
U_{50}	Undisturbed tube sample (50mm)
W	Water sample
pp	pocket penetrometer (kPa)
PID	Photo ionisation detector
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

Description of Defects in Rock

The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

Defect Type

B	Bedding plane
Cs	Clay seam
Cv	Cleavage
Cz	Crushed zone
Ds	Decomposed seam
F	Fault
J	Joint
Lam	lamination
Pt	Parting
Sz	Sheared Zone
V	Vein

Orientation

The inclination of defects is always measured from the perpendicular to the core axis.

h	horizontal
v	vertical
sh	sub-horizontal
sv	sub-vertical

Coating or Infilling Term

cln	clean
co	coating
he	healed
inf	infilled
stn	stained
ti	tight
vn	veneer

Coating Descriptor

ca	calcite
cbs	carbonaceous
cly	clay
fe	iron oxide
mn	manganese
slt	silty

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

Symbols & Abbreviations

Graphic Symbols for Soil and Rock

General


Asphalt


Road base


Concrete


Filling

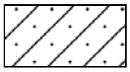
Soils


Topsoil

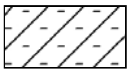

Peat


Clay

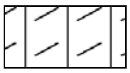

Silty clay

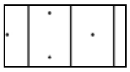

Sandy clay

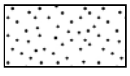

Gravelly clay

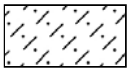

Shaly clay

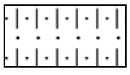

Silt


Clayey silt


Sandy silt

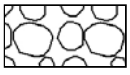

Sand

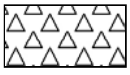

Clayey sand


Silty sand


Gravel


Sandy gravel


Cobbles, boulders

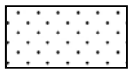

Talus

Sedimentary Rocks

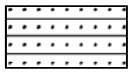

Boulder conglomerate

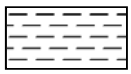

Conglomerate


Conglomeratic sandstone

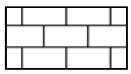

Sandstone


Siltstone


Laminite

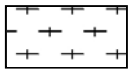

Mudstone, claystone, shale

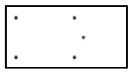

Coal


Limestone

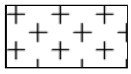
Metamorphic Rocks

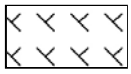

Slate, phyllite, schist

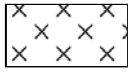

Gneiss

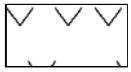

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

Soil Descriptions

Douglas Partners

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard AS 1726, Geotechnical Site Investigations Code. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

Soil Types

Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

Type	Particle size (mm)
Boulder	>200
Cobble	63 - 200
Gravel	2.36 - 63
Sand	0.075 - 2.36
Silt	0.002 - 0.075
Clay	<0.002

The sand and gravel sizes can be further subdivided as follows:

Type	Particle size (mm)
Coarse gravel	20 - 63
Medium gravel	6 - 20
Fine gravel	2.36 - 6
Coarse sand	0.6 - 2.36
Medium sand	0.2 - 0.6
Fine sand	0.075 - 0.2

The proportions of secondary constituents of soils are described as:

Term	Proportion	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	20 - 35%	Sandy Clay
Slightly	12 - 20%	Slightly Sandy Clay
With some	5 - 12%	Clay with some sand
With a trace of	0 - 5%	Clay with a trace of sand

Definitions of grading terms used are:

- Well graded - a good representation of all particle sizes
- Poorly graded - an excess or deficiency of particular sizes within the specified range
- Uniformly graded - an excess of a particular particle size
- Gap graded - a deficiency of a particular particle size with the range

Cohesive Soils

Cohesive soils, such as clays, are classified on the basis of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defined as follows:

Description	Abbreviation	Undrained shear strength (kPa)
Very soft	vs	<12
Soft	s	12 - 25
Firm	f	25 - 50
Stiff	st	50 - 100
Very stiff	vst	100 - 200
Hard	h	>200

Cohesionless Soils

Cohesionless soils, such as clean sands, are classified on the basis of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT) or dynamic penetrometers (PSP). The relative density terms are given below:

Relative Density	Abbreviation	SPT N value	CPT qc value (MPa)
Very loose	vl	<4	<2
Loose	l	4 - 10	2 -5
Medium dense	md	10 - 30	5 - 15
Dense	d	30 - 50	15 - 25
Very dense	vd	>50	>25

Soil Descriptions

Soil Origin

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

- Residual soil - derived from in-situ weathering of the underlying rock;
- Transported soils - formed somewhere else and transported by nature to the site; or
- Filling - moved by man.

Transported soils may be further subdivided into:

- Alluvium - river deposits
- Lacustrine - lake deposits
- Aeolian - wind deposits
- Littoral - beach deposits
- Estuarine - tidal river deposits
- Talus - scree or coarse colluvium
- Slopewash or Colluvium - transported downslope by gravity assisted by water. Often includes angular rock fragments and boulders.

Rock Strength

Rock strength is defined by the Point Load Strength Index ($Is_{(50)}$) and refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects. The test procedure is described by Australian Standard 4133.4.1 - 1993. The terms used to describe rock strength are as follows:

Term	Abbreviation	Point Load Index $Is_{(50)}$ MPa	Approx Unconfined Compressive Strength MPa*
Extremely low	EL	<0.03	<0.6
Very low	VL	0.03 - 0.1	0.6 - 2
Low	L	0.1 - 0.3	2 - 6
Medium	M	0.3 - 1.0	6 - 20
High	H	1 - 3	20 - 60
Very high	VH	3 - 10	60 - 200
Extremely high	EH	>10	>200

* Assumes a ratio of 20:1 for UCS to $Is_{(50)}$

Degree of Weathering

The degree of weathering of rock is classified as follows:

Term	Abbreviation	Description
Extremely weathered	EW	Rock substance has soil properties, i.e. it can be remoulded and classified as a soil but the texture of the original rock is still evident.
Highly weathered	HW	Limonite staining or bleaching affects whole of rock substance and other signs of decomposition are evident. Porosity and strength may be altered as a result of iron leaching or deposition. Colour and strength of original fresh rock is not recognisable
Moderately weathered	MW	Staining and discolouration of rock substance has taken place
Slightly weathered	SW	Rock substance is slightly discoloured but shows little or no change of strength from fresh rock
Fresh stained	Fs	Rock substance unaffected by weathering but staining visible along defects
Fresh	Fr	No signs of decomposition or staining

Degree of Fracturing

The following classification applies to the spacing of natural fractures in diamond drill cores. It includes bedding plane partings, joints and other defects, but excludes drilling breaks.

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with some fragments
Fractured	Core lengths of 40-200 mm with some shorter and longer sections
Slightly Fractured	Core lengths of 200-1000 mm with some shorter and loner sections
Unbroken	Core lengths mostly > 1000 mm

Rock Descriptions

Rock Quality Designation

The quality of the cored rock can be measured using the Rock Quality Designation (RQD) index, defined as:

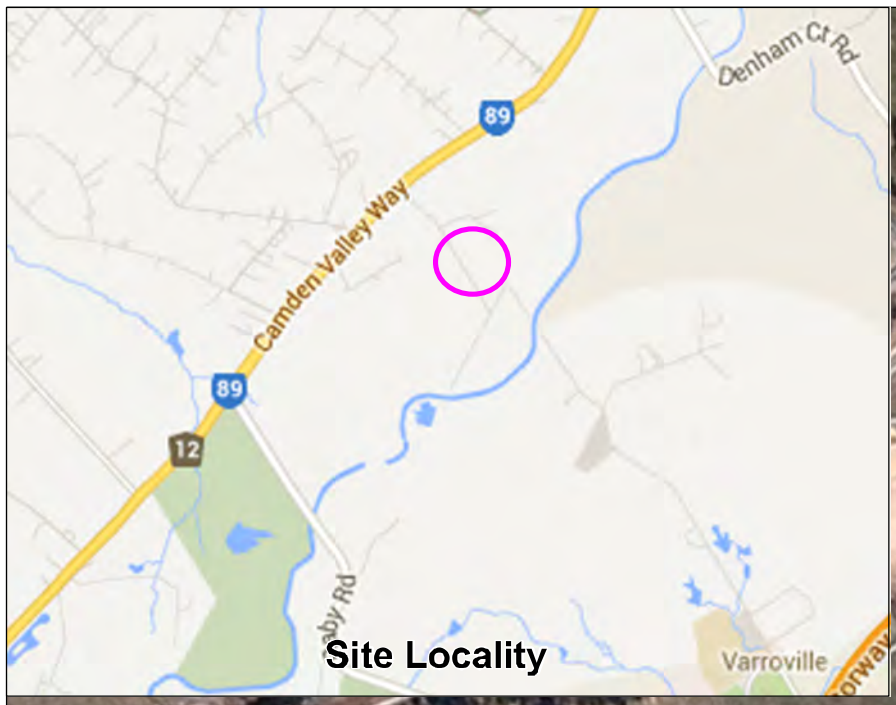
$$\text{RQD \%} = \frac{\text{cumulative length of 'sound' core sections} \geq \text{100 mm long}}{\text{total drilled length of section being assessed}}$$

where 'sound' rock is assessed to be rock of low strength or better. The RQD applies only to natural fractures. If the core is broken by drilling or handling (i.e. drilling breaks) then the broken pieces are fitted back together and are not included in the calculation of RQD.

Stratification Spacing

For sedimentary rocks the following terms may be used to describe the spacing of bedding partings:

Term	Separation of Stratification Planes
Thinly laminated	< 6 mm
Laminated	6 mm to 20 mm
Very thinly bedded	20 mm to 60 mm
Thinly bedded	60 mm to 0.2 m
Medium bedded	0.2 m to 0.6 m
Thickly bedded	0.6 m to 2 m
Very thickly bedded	> 2 m



296800
297000
297200
297400
297600
6237600
6237400
6237200
6237000

Legend

Site Boundary

Grid: GDA94/MGA94 Zone 56

0 200.0

Metres

Douglas Partners
Geotechnics / Environment / Groundwater

TITLE: Site Boundary and Locality
Salinity Investigation and Management Plan
51 St Andrews Road, Leppington

N
MGA

OFFICE: Macarthur
DRAWN BY: BAH
DATE: 18.06.2014

CLIENT: Cornish Group Pty Ltd | PROJECT No: 76571.02 | DRAWING No: 1 | REVISION: A | SCALE: As shown

297000

297200

297400

6237600

6237400

6237200

6237000

101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139

Legend

- Site Boundary
- Test Pit Location
- Proposed Lot layout
- Grid: GDA94/MGA94 Zone 56

0 100.0

Metres

Douglas Partners
Geotechnics / Environment / Groundwater

TITLE: **Test Pit Locations**
Salinity Investigation and Management Plan
51 St Andrews Road, Leppington

N
MGA

OFFICE: Macarthur
DRAWN BY: BAH
DATE: 18.06.2014

CLIENT: Cornish Group Pty Ltd | PROJECT No: 76571.02 | DRAWING No: 2 | REVISION: A | SCALE: As shown

297000
297200
297400
6237600
6237400
6237200
6237000
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
Legend
Site Boundary
Test Pit Location
Area of Cut
Area of Fill
0
200.0
Metres
N
MGA
Douglas Partners
Geotechnics / Environment / Groundwater
TITLE: Proposed Cut and Fill
Salinity Investigation and Management Plan
51 St Andrews Road, Leppington
OFFICE: Macarthur
DRAWN BY: BAH
DATE: 18.06.2014
CLIENT: Cornish Group Pty Ltd
PROJECT No: 76571.02
DRAWING No: 3
REVISION: A
SCALE: As shown

297000

297200

297400

6237600

6237400

6237200

101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139

Legend

- Site Boundary
- Moderately Saline
- Very Saline

0 100.0

Metres

N

MGA

Douglas Partners
Geotechnics / Environment / Groundwater

TITLE: Salinity Within Foundation Depths Below Proposed Surface

Salinity Investigation and Management Plan
51 St Andrews Road, Leppington

CLIENT: Cornish Group Pty Ltd	PROJECT No: 76571.02	DRAWING No: 4	REVISION: A	SCALE: As shown

OFFICE: Macarthur
DRAWN BY: BAH
DATE: 18.06.2014

Appendix B

Test Pit Logs

TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 113.3 mAHD
EASTING: 296951
NORTHING: 6237411

PIT No: 101
PROJECT No: 76571.02
DATE: 28/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
113	0.8	FILLING - brown and grey silt with trace clay and (sandstone and shale) gravel		D	0.5				
112	1.8	SILTY CLAY - hard, red mottled brown silty clay with trace (ironstone) gravel and rootlets, mc<pl		D/B	1.0				
		- becoming red and grey with shale banding below 1.5m		D	1.5				
111	3.2	SHALE - low strength, grey and brown shale with some silty clay banding		D	2.0				
		- becoming low to medium strength below 2.5m		D	2.5				
				D	3.0				
110		Pit discontinued at 3.2m - limit of investigation							
109									
108									
107									
106									

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Test pit moved due to earthworks site boundary

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 114.9 mAHD
EASTING: 297065
NORTHING: 6237441

PIT No: 102
PROJECT No: 76571.02
DATE: 28/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
	0.0	TOPSOIL - brown and grey silty clay with some (ironstone) gravel (possible filling)							
	0.3	SILTY CLAY - hard, orange and red mottled brown silty clay with trace (ironstone) gravel, mc<pl		D	0.5				
114	0.8	SHALE - low strength, grey and orange shale with trace silty clay banding		D	1.0				
		- becoming low to medium strength below 1.5m		D	1.5				
113	1.8	SHALE - very low to low strength, extremely weathered, grey and orange shale with silty clay banding		D	2.0				
				D/B	2.5				
112		- becoming low to medium strength below 3.0m		D	3.0				
				D	3.5				
111	3.6	Pit discontinued at 3.6m - limit of investigation							
110									
109									
108									
107									

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20; 1, 2, 3, 4, 5, 6, 7; >>

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 115.0 mAHD
EASTING: 297171
NORTHING: 6237491

PIT No: 103
PROJECT No: 76571.02
DATE: 28/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
115	0.4	TOPSOIL - brown silt with some clay and rootlets							
		SILTY CLAY - very stiff to hard, red mottled grey silty clay with trace fine grained (ironstone) gravel, mc<pl		D	0.5				
114	1	- becoming grey mottled red and orange below 1.0m		D	1.0				
				D	1.5				
113	2	- with some extremely low to very low strength red shale banding below 2.0m		D	2.0				
	2.3	SHALE - extremely low to very low strength, extremely weathered, red and grey shale with silty clay banding		D	2.5				
112	3	- becoming very low to low strength below 3.0m		D	3.0				
				D/B	3.5				
111	4	- becoming light brown with trace silty clay banding below 4.0m		D	4.0				
				D	4.5				
110	5			D	5.0				
	5.2	Pit discontinued at 5.2m - limit of investigation							
109	6								
108	7								

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 113.9 mAHD
EASTING: 297251
NORTHING: 6237529

PIT No: 104
PROJECT No: 76571.02
DATE: 28/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
113	0.4	TOPSOIL - brown and grey silt with some clay							
		SILTY CLAY - very stiff, red and orange silty clay with trace (ironstone) gravel, mc<pl		D	0.5				
	1	- becoming hard, light brown and orange mottled grey with some very low strength shale bands below 1.0m		D	1.0				
	1.3	SHALE - very low to low strength, grey and brown shale with some silty clay banding		D	1.5				
112	2	- becoming low to medium strength below 1.5m		D/B	2.0				
	2.1	Pit discontinued at 2.1m - refusal in low to medium strength shale							
111	3								
110	4								
109	5								
108	6								
107	7								
106									

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 108.7 mAHD
EASTING: 297343
NORTHING: 6237570

PIT No: 105
PROJECT No: 76571.02
DATE: 28/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
108	0.4	TOPSOIL - brown and grey silt and clay with rootlets							
		SILTY CLAY - very stiff, orange and red mottled brown silty clay with trace (ironstone) gravel, mc<pl		D	0.5				
	1	- becoming hard, grey with shale banding below 1.0m		D	1.0				
107				D	1.5				
	1.8	SHALE - extremely low to very low strength, red and grey shale and with some silty clay banding		D	2.0				
	2			D	2.5				
106				D	3.0				
	3	- becoming low to medium strength, light brown below 3.0m		D/B	3.3				
		- reduced silty clay banding below 3.5m		D	3.5				
105									
	4			D	4.0				
				D	4.5				
	4.6	Pit discontinued at 4.6m - refusal in low to medium strength shale							
104	5								
103	6								
102	7								
101									

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 113.4 mAHD
EASTING: 297010
NORTHING: 6237330

PIT No: 106
PROJECT No: 76571.02
DATE: 28/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
113	0.4	TOPSOIL - brown silt with some clay and rootlets							
		SILTY CLAY - hard, red mottled grey silty clay with trace fine grained (ironstone) gravel, mc<pl		D/B	0.4				
				D	0.5				
	1	- becoming grey below 1.0m		D	1.0				>>
112	1.3	SHALE - very low to low strength, grey shale with trace silty clay banding		D	1.5				
	1.6	Pit discontinued at 1.6m - limit of investigation							
111	2								
110	3								
109	4								
108	5								
107	6								
106	7								

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 111.6 mAHD
EASTING: 297068
NORTHING: 6237375

PIT No: 107
PROJECT No: 76571.02
DATE: 26/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
111	0.4	TOPSOIL - brown and orange silt with some clay and rootlets							
		SILTY CLAY - stiff to very stiff, orange and red mottled brown silty clay with some fine grained (ironstone) gravel, mc~pl		D	0.5				
	1			D/B	1.0				
110		- becoming very stiff to hard, grey below 1.5m		D	1.5				
	2	- with some very low strength shale bands below 2.0m		D	2.0				
109				D	2.5				
	2.8	SHALE - extremely low strength, extremely weathered, grey and orange shale with grey silty clay banding		D	3.0				
	3								
	3.2	Pit discontinued at 3.2m - limit of investigation							
108	4								
107	5								
106	6								
105	7								
104									

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 111.8 mAHD
EASTING: 297170
NORTHING: 6237424

PIT No: 108
PROJECT No: 76571.02
DATE: 27/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
111	0.3	TOPSOIL - dark brown silt and clay							
		SILTY CLAY - very stiff to hard, red mottled grey silty clay with trace (ironstone) gravel and roots, mc<pl		D	0.5				
	1	- with some shale bands below 1.0m		D/B	1.0				
	1.5	SHALE - low strength, grey and orange shale with some silty clay banding		D	1.5				
110	2	- becoming low to medium strength below 2.0m		D	2.0				
	2.2	Pit discontinued at 2.2m - limit of investigation							
109	3								
108	4								
107	5								
106	6								
105	7								
104									

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 108.6 mAHD
EASTING: 297274
NORTHING: 6237468

PIT No: 109
PROJECT No: 76571.02
DATE: 27/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
108	0.3	TOPSOIL - dark brown silt with some clay, rootlets and trace (ironstone) gravel							
		SILTY CLAY - stiff, orange and red silty clay, mc~pl		D	0.5				
		- becoming mottled grey below 0.5m		D	1.0				
107				D	1.5				
				D	2.0				
				D/B	2.2				
106		- with some extremely low strength, red shale bands below 2.5m		D	2.5				
				D	3.0				
105	3.8	SHALE - low to medium strength, red and grey shale with trace silty clay banding							
104	4.0	Pit discontinued at 4.0m - limit of investigation							

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 106.1 mAHD
EASTING: 297359
NORTHING: 6237505

PIT No: 110
PROJECT No: 76571.02
DATE: 26/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
106	0.4	TOPSOIL - brown silt with some clay							
		SILTY CLAY - stiff, grey and orange silty clay, mc~pl		D	0.5				
105	1			D	1.0				
		- with some very low strength shale bands below 1.5m		D	1.5				
104	2			D	2.0				
				D/Bx2	2.2				
				D	2.5				
103	3			D	3.0				
	3.2	SHALE - very low strength, highly weathered, grey and red shale and grey silty clay banding		D	3.5				
	3.6	Pit discontinued at 3.6m - limit of investigation							
102	4								
101	5								
100	6								
99	7								

Dynamic Penetrometer Test (blows per 150mm) scale: 5, 10, 15, 20

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 108.0 mAHD
EASTING: 297101
NORTHING: 6237307

PIT No: 111
PROJECT No: 76571.02
DATE: 26/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
108	0.3	TOPSOIL - dark brown silt and clay with rootlets and trace (ironstone) gravel							
		SILTY CLAY - stiff to very stiff, orange mottled grey silty clay, mc~pl - becoming grey below 0.5m		B D	0.3 0.4 0.5				
107	1			D	1.0				
	1.2	Pit discontinued at 1.2m - limit of investigation							
106	2								
105	3								
104	4								
103	5								
102	6								
101	7								

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	⧗	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 108.4 mAHD
EASTING: 297194
NORTHING: 6237351

PIT No: 112
PROJECT No: 76571.02
DATE: 27/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
108	0.4	TOPSOIL - dark brown silt and clay with some gravel and rootlets							
		SILTY CLAY - very stiff, orange and red mottled grey silty clay with trace fine grained (ironstone) gravel, mc<pl		D/B	0.4				
				D	0.5				
		- becoming hard, grey mottled red below 0.8m		D	1.0				
107	1.3	SHALE - extremely low to very low strength, extremely weathered, grey and red shale with grey silty clay banding		D	1.5				
	1.8	Pit discontinued at 1.8m							
		- limit of investigation							

Dynamic Penetrometer Test (blows per 150mm) scale: 5, 10, 15, 20

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 105.7 mAHD
EASTING: 297275
NORTHING: 6237387

PIT No: 113
PROJECT No: 76571.02
DATE: 27/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
105	0.2	FILLING - black bitumen (road surface)							
	0.6	FILLING - brown silty clay with some (shale and bitumen) gravel and trace sand		D	0.5				
	1	SILTY CLAY - very stiff, red mottled grey silty clay with trace (ironstone) gravel, mc<pl		D/B	1.0				
104	2	- with some red shale banding below 1.5m		D	1.5				
	2.2			D	2.0				
103	3	Pit discontinued at 2.2m - limit of investigation							
102	4								
101	5								
100	6								
99	7								
98									

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Disused water poly pipe intercepted at 0.5m

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 104.1 mAHD
EASTING: 297336
NORTHING: 6237400

PIT No: 114
PROJECT No: 76571.02
DATE: 26/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
104	0.4	TOPSOIL - dark brown and orange silty clay with trace (ironstone) gravel							
		SILTY CLAY - very stiff to hard, grey and brown mottled orange silty clay, mc<pl		D/B	0.4				
				D	0.5				
103	1			D	1.0				
	1.2	Pit discontinued at 1.2m - limit of investigation							
102	2								
101	3								
100	4								
99	5								
98	6								
97	7								

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

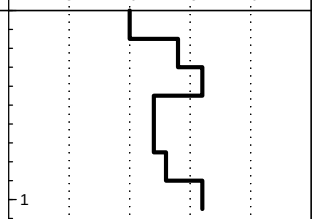
TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 106.5 mAHD
EASTING: 297065
NORTHING: 6237243

PIT No: 115
PROJECT No: 76571.02
DATE: 28/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
106	0.4	TOPSOIL - brown silt with some clay							
		SILTY CLAY - hard, red mottled brown silty clay with trace fine grained (ironstone) gravel, mc<pl		D	0.5				
	1	- becoming orange and grey with some (shale) gravel below 0.8m		D	1.0				
	1.2	Pit discontinued at 1.2m - limit of investigation							



RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 104.9 mAHD
EASTING: 297145
NORTHING: 6237247

PIT No: 116
PROJECT No: 76571.02
DATE: 27/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
104	0.4	TOPSOIL - brown silt with some clay, roots and trace fine grained (ironstone) gravel							
		SILTY CLAY - hard, red mottled brown silty clay with trace (ironstone) gravel, mc<pl		D	0.5				
	1			D	1.0				
	1.2	Pit discontinued at 1.2m - limit of investigation							

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 105.9 mAHD
EASTING: 297229
NORTHING: 6237284

PIT No: 117
PROJECT No: 76571.02
DATE: 27/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
105	0.3	TOPSOIL - brown silt with some clay, roots and trace fine grained (ironstone) gravel							
		SILTY CLAY - hard, red mottled grey and brown silty clay with trace fine grained (ironstone) gravel, mc<pl		D	0.5				
	1	- becoming very stiff, grey and orange below 1.0m - with some extremely low strength, red shale banding below 1.0m		D	1.0				
				D	1.5				
104	2			D/B	2.0				
	2.3	SILTY CLAY - very stiff to hard, grey mottled red silty clay, mc<pl		D	2.5				
103	3			D	3.0				
	3.2	Pit discontinued at 3.2m - limit of investigation							
102	4								
101	5								
100	6								
99	7								
98									

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 103.7 mAHD
EASTING: 297295
NORTHING: 6237297

PIT No: 118
PROJECT No: 76571.02
DATE: 26/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
103	0.5	FILLING - brown and orange silty clay with some (ironstone) gravel (reworked natural)		D	0.5				
	1	SILTY CLAY - very stiff, red mottled grey silty clay with some (ironstone) gravel, mc<pl		D/B	0.8				
				D	1.0				
102		- with some very low strength, extremely weathered shale bands below 1.5m		D	1.5				
	2			D	2.0				
	2.2	Pit discontinued at 2.2m - limit of investigation							
101	3								
100	4								
99	5								
98	6								
97	7								
96									

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Test pit on boundary of shed pad

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 108.0 mAHD
EASTING: 297122
NORTHING: 6237168

PIT No: 119
PROJECT No: 76571.02
DATE: 28/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
108	0.3	TOPSOIL - dark brown silt with some clay							
		SILTY CLAY - very stiff, red mottled brown and grey silty clay with trace (ironstone) gravel, mc<pl		B	0.3–0.4				
				D	0.5				
107	1	- becoming grey below 0.8m		D	1.0				
	1.2	Pit discontinued at 1.2m - limit of investigation							
106	2								
105	3								
104	4								
103	5								
102	6								
101	7								

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 102.1 mAHD
EASTING: 297255
NORTHING: 6237215

PIT No: 120
PROJECT No: 76571.02
DATE: 26/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
102	0.0	TOPSOIL - brown silt and clay with some rootlets and gravel		B	0.3				
	0.4	SILTY CLAY - hard, orange and brown silty clay with some rootlets and trace (ironstone) gravel, mc<pl		D	0.5				
101	1	- becoming grey below 1.0m		D	1.0				
	1.6	Pit discontinued at 1.6m - limit of investigation		D	1.5				
100	2								
99	3								
98	4								
97	5								
96	6								
95	7								

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 104.1 mAHD
EASTING: 297226
NORTHING: 6237127

PIT No: 121
PROJECT No: 76571.02
DATE: 26/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
104	0.3	TOPSOIL - dark brown silty clay with roots and trace (ironstone) gravel							
		SILTY CLAY - very stiff to hard, orange and red silty clay with trace (ironstone) gravel, mc<pl		B	0.4				
				D	0.5				
103	1			D	1.0				
	1.2	Pit discontinued at 1.2m - limit of investigation							
102	2								
101	3								
100	4								
99	5								
98	6								
97	7								

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 104.4 mAHD
EASTING: 297172
NORTHING: 6237073

PIT No: 122
PROJECT No: 76571.02
DATE: 28/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
104	0.3	TOPSOIL - light brown and grey silt and clay with some roots and rootlets							
		SILTY CLAY - red and orange mottled brown silty clay with trace fine grained (ironstone) gravel, mc<pl		D	0.5				
103	1	- becoming grey mottled red with trace shale banding below 1.0m		D/B	1.0				
				D	1.5				
102	1.8	SHALE - low strength, brown, grey and orange shale with some silty clay banding		D	2.0				
		- becoming low to medium strength, highly weathered below 2.5m		D	2.5				
101	3			D	3.0				
	3.2	Pit discontinued at 3.2m - limit of investigation							
100	4								
99	5								
98	6								
97	7								

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 112.8 mAHD
EASTING: 297007
NORTHING: 6237389

PIT No: 123
PROJECT No: 76571.02
DATE: 26/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
112.8	0.0	TOPSOIL - dark brown silt with some clay							
112.5	0.3	SILTY CLAY - hard, red and orange mottled brown silty clay, mc<pl		D	0.5				
112.2	0.6	Pit discontinued at 0.6m - limit of investigation							

Dynamic Penetrometer Test (blows per 150mm): 5 10 15 20

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 114.3 mAHD
EASTING: 297130
NORTHING: 6237447

PIT No: 124
PROJECT No: 76571.02
DATE: 27/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
114	0.4	FILLING - brown silty clay with some (ironstone and shale) gravel							
		SILTY CLAY - very stiff, red mottled grey silty clay with some fine grained (ironstone) gravel, mc<pl		D	0.5				
	1			D	1.0				
113		- becoming very stiff to hard below 1.5m		D	1.5				
	2	- becoming grey mottled red below 2.0m		D	2.0				
112		- with some extremely low strength shale bands below 2.5m		D	2.5				
	3			D	3.0				
111	3.2	Pit discontinued at 3.2m - limit of investigation							
	4								
110									
	5								
109									
	6								
108									
	7								
107									

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 111.9 mAHD
EASTING: 297229
NORTHING: 6237491

PIT No: 125
PROJECT No: 76571.02
DATE: 27/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
111	0.0	FILLING - brown silty clay with rootlets and (ironstone) gravel		D	0.5				
	0.6	SILTY CLAY - stiff to very stiff, red mottled grey silty clay, mc<pl							
	0.8	Pit discontinued at 0.8m - limit of investigation							

5 10 15 20

1 2 3 4 5 6 7

110 109 108 107 106 105 104

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Disused water poly pipe intercepted at 0.4m

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 108.9 mAHD
EASTING: 297323
NORTHING: 6237531

PIT No: 126
PROJECT No: 76571.02
DATE: 26/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
		TOPSOIL - brown silt with some clay							
	0.4	SILTY CLAY - stiff to very stiff, red mottled grey silty clay with trace (ironstone) gravel, mc~pl		D	0.5				
108	1	- becoming grey mottled orange below 1.0m		D	1.0				
		- with very low strength shale banding below 1.5m		D	1.5				
	1.8	SHALE - extremely low to low strength, extremely weathered, grey and orange shale with some silty clay banding							
107	2	- becoming low to medium strength, highly weathered, grey with trace silty clay banding below 2.0m		D	2.0				
				D	2.5				
106	3			D	3.0				
	3.2	Pit discontinued at 3.2m - limit of investigation							
105	4								
104	5								
103	6								
102	7								
101									

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 107.4 mAHD
EASTING: 297061
NORTHING: 6237304

PIT No: 127
PROJECT No: 76571.02
DATE: 26/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
107	0.3	TOPSOIL - dark brown silt and clay with some rootlets							
	0.6	SILTY CLAY - very stiff, red and orange silty clay with trace (ironstone) gravel, mc<pl		D	0.5				
		Pit discontinued at 0.6m - limit of investigation							

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 110.7 mAHD
EASTING: 297145
NORTHING: 6237370

PIT No: 128
PROJECT No: 76571.02
DATE: 26/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
110	0.8	FILLING - brown silty clay with some gravel and trace anthropogenics comprising hose section, tile fragments and wooden paling		D	0.5				
	1	SILTY CLAY - hard, red mottled grey silty clay with trace fine grained (ironstone) gravel, mc<pl		D	1.0				
109		- becoming grey mottled orange with some shale bands below 1.5m		D	1.5				
	2			D	2.0				
108				D	2.5				
	2.8	SHALE - extremely low strength, extremely weathered, grey shale and grey silty clay banding		D	3.0				
	3								
	3.2	Pit discontinued at 3.2m - limit of investigation							
107	4								
106	5								
105	6								
104	7								
103									

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20; 1, 2, 3, 4, 5, 6, 7; >>

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Test pit moved 5m north due to inaccessibility; Disused water poly pipe intercepted at 0.3m

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	⧗	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 107.1 mAHD
EASTING: 297274
NORTHING: 6237428

PIT No: 129
PROJECT No: 76571.02
DATE: 27/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
107	0.4	FILLING - brown and orange silt with some clay and rootlets							
		SILTY CLAY - grey and red mottled orange silty clay with some (ironstone) gravel, mc~pl		D	0.5				
106	1			D	1.0				
		- becoming very stiff, mc<pl below 1.5m		D	1.5				
105	2			D	2.0				
		- with some extremely low to very low strength red shale bands below 2.5m		D	2.5				
	2.8	SHALE - extremely low to very low strength, extremely weathered, grey and red shale and grey mottled red silty clay banding		D	3.0				
104	3								
	3.2	Pit discontinued at 3.2m - limit of investigation							
103	4								
102	5								
101	6								
100	7								

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Disused water poly pipe intercepted at 0.4m

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

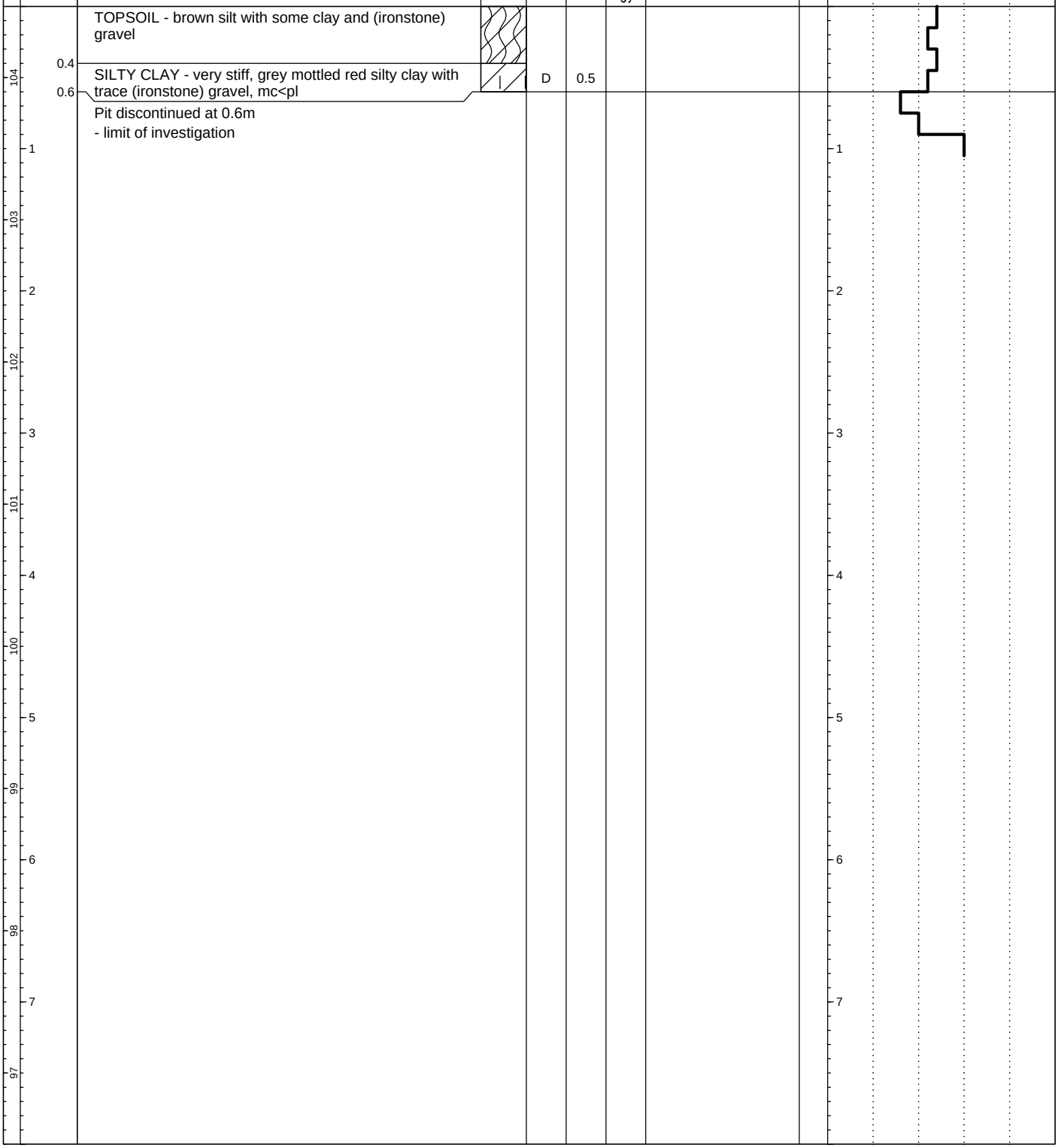
TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 104.5 mAHD
EASTING: 297360
NORTHING: 6237454

PIT No: 130
PROJECT No: 76571.02
DATE: 26/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
104	0.4	TOPSOIL - brown silt with some clay and (ironstone) gravel							
	0.6	SILTY CLAY - very stiff, grey mottled red silty clay with trace (ironstone) gravel, mc<pl		D	0.5				
		Pit discontinued at 0.6m - limit of investigation							



RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 104.7 mAHD
EASTING: 297098
NORTHING: 6237242

PIT No: 131
PROJECT No: 76571.02
DATE: 26/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
104	0.4	TOPSOIL - dark brown and black (alluvial) sediment and clay							
	0.6	SILTY CLAY - stiff to very stiff, orange mottled grey silty clay with some gravel, mc~pl		D	0.5				
		Pit discontinued at 0.6m - limit of investigation							

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RL: 104, 103, 102, 101, 100, 99, 98, 97
Depth (m): 1, 2, 3, 4, 5, 6, 7

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Test pit located at edge of dam

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 107.6 mAHD
EASTING: 297172
NORTHING: 6237299

PIT No: 132
PROJECT No: 76571.02
DATE: 27/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
107	0.3	TOPSOIL - brown silty clay with roots							
	0.6	SILTY CLAY - hard, red and orange mottled brown silty clay with roots, mc<pl		D	0.5				
		Pit discontinued at 0.6m - limit of investigation							

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 104.7 mAHD
EASTING: 297285
NORTHING: 6237331

PIT No: 133
PROJECT No: 76571.02
DATE: 26/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
104	0.2	TOPSOIL - brown and grey silt and clay							
		SILTY CLAY - very stiff to hard, orange mottled brown and grey silty clay with trace fine grained (ironstone) gravel, mc<pl		D	0.5				
	1	- becoming grey below 1.0m		D	1.0				
103	1.3	SHALE - extremely low to very low strength, extremely weathered, grey and orange shale with some silty clay banding		D	1.5				
	2	- becoming low to very low strength, highly weathered below 2.0m		D	2.0				
102		- becoming red below 2.5m		D	2.5				
	3			D	3.0				
	3.2	Pit discontinued at 3.2m - limit of investigation							
101	4								
100	5								
99	6								
98	7								
97									

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	⧗	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 102.7 mAHD
EASTING: 297349
NORTHING: 6237363

PIT No: 134
PROJECT No: 76571.02
DATE: 26/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
102	0.0	TOPSOIL - grey and dark brown silt with trace clay and some (ironstone) gravel (possible filling)							
	0.4	SILTY CLAY - very stiff, orange brown silty clay with trace (ironstone) gravel, mc~pl		D	0.5				
	0.6	Pit discontinued at 0.6m - limit of investigation							

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 105.7 mAHD
EASTING: 297196
NORTHING: 6237204

PIT No: 135
PROJECT No: 76571.02
DATE: 27/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
105	0.0	TOPSOIL - dark brown silt with some clay and roots							
	0.4	SILTY CLAY - stiff to very stiff, brown and orange silty clay with trace (ironstone) gravel and roots, mc<pl		D	0.5				
	0.6	Pit discontinued at 0.6m - limit of investigation							
104	1								
103	2								
102	3								
101	4								
100	5								
99	6								
98	7								

Dynamic Penetrometer Test (blows per mm): 5, 10, 15, 20

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Test pit moved ~3m east due to dam

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 107.8 mAHD
EASTING: 297170
NORTHING: 6237131

PIT No: 136
PROJECT No: 76571.02
DATE: 26/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
107	0.3	TOPSOIL - brown silty clay with roots, rootlets and trace (ironstone) gravel							
		SILTY CLAY - very stiff, red and orange mottled brown silty clay with trace (ironstone) gravel, mc<pl		D	0.5				
	1			D	1.0				
		- with some extremely low strength, extremely weathered shale banding below 1.0m							
	1.3	SHALE - very low to low strength, extremely weathered, red and grey shale with some silty clay banding		D	1.5				
106	2			D	2.0				
		- becoming low to medium strength, highly weathered below 2.5m		D	2.5				
105	3			D	3.0				
	3.2	Pit discontinued at 3.2m - limit of investigation							
104	4								
103	5								
102	6								
101	7								
100									

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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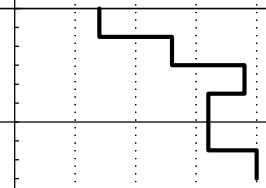
TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 102.2 mAHD
EASTING: 297246
NORTHING: 6237176

PIT No: 137
PROJECT No: 76571.02
DATE: 26/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
102	0.4	TOPSOIL - dark brown silty clay with some rootlets							
	0.6	SILTY CLAY - hard, orange and brown mottled silty clay with roots		D	0.5				
		Pit discontinued at 0.6m - limit of investigation							



RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 104.4 mAHD
EASTING: 297233
NORTHING: 6237068

PIT No: 138
PROJECT No: 76571.02
DATE: 26/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
104	0.3	TOPSOIL - dark brown silt and clay with some gravel							
		SILTY CLAY - hard, orange and red mottled grey silty clay with some (ironstone) gravel and roots, mc<pl		D	0.5				
	1	- becoming grey mottled orange below 1.0m		D	1.0				
103	1.3	SHALE - very low strength, highly weathered, red and grey shale with some silty clay banding		D	1.5				
	2	- becoming low to medium strength below 2.0m		D	2.0				
102				D	2.5				
	3			D	3.0				
	3.2	Pit discontinued at 3.2m - limit of investigation							
101	4								
100	5								
99	6								
98	7								
97									

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Cornish Group Pty Ltd
PROJECT: Salinity Investigation and SMP
LOCATION: 51 St Andrews Road, Leppington

SURFACE LEVEL: 104.4 mAHD
EASTING: 297208
NORTHING: 6237020

PIT No: 139
PROJECT No: 76571.02
DATE: 28/5/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
104	0.3	TOPSOIL - dark brown silty clay with rootlets							
	0.6	SILTY CLAY - very stiff, orange and red silty clay with trace (ironstone) gravel, mc<pl		D	0.5				
		Pit discontinued at 0.6m - limit of investigation							

RIG: JCB 4WD backhoe - 450mm bucket

LOGGED: MJC

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

Appendix C

Laboratory Summary Table

Test Bore or Pit	Test Location				Sample ID	Sample Depth	pH	Chloride Concentration	Sulphate Concentration	Resistivity	Soil Condition	Sample Aggressivity Class				
	East (m MGA56)	North (m MGA56)	RL (m AHD)	Proposed Cut (-) and Fill (+) (m)		(m bgl)	(pH units)	(mg/kg)	(mg/kg)	By inversion of EC1:5 Ω.cm	[AS2159-2009]	Aggr. to Concrete - from sample pH	Aggr. to Concrete - from Sulphate conc.	Aggr. to Steel - from sample pH [AS2159-2009]	Aggr. to Steel - from Chloride conc.	Aggr. to Steel - from sample Resistivity
101	296950.9	6237410.5	113.3	-1	101/0.5	0.5	4.9	410	21	2857	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive
					101/1.0	1.0	4.9	640	53	1887	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
					101/1.5	1.5	5.3	690	63	1754	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
					101/2.0	2.0	6.2			2857	B	Non-Aggressive		Non-Aggressive		Non-Aggressive
					101/2.5	2.5	6.2			2778	B	Non-Aggressive		Non-Aggressive		Non-Aggressive
.	.	.	.		101/3.0	3.0	7			2941	B	Non-Aggressive		Non-Aggressive		Non-Aggressive
102	297065.0	6237441.0	114.9	-2	102/0.5	0.5	5.1	300	61	3125	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive
103	297171.0	6237491.0	115.0	-3	103/0.5	0.5	4.7			2703	B	Mild		Non-Aggressive		Non-Aggressive
					103/1.0	1.0	4.7			2381	B	Mild		Non-Aggressive		Non-Aggressive
					103/1.5	1.5	4.7	340	170	2439	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive
					103/2.0	2.0	4.7			2273	B	Mild		Non-Aggressive		Non-Aggressive
					103/2.5	2.5	4.7	340	210	2326	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive
					103/3.0	3.0	4.9	310	210	2632	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive
					103/3.5	3.5	4.9	280	180	2778	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive
					103/4.0	4.0	4.9			2564	B	Mild		Non-Aggressive		Non-Aggressive
					103/4.5	4.5	4.8			2439	B	Mild		Non-Aggressive		Non-Aggressive
.	.	.	.		103/5.0	5.0	5			2941	B	Mild		Non-Aggressive		Non-Aggressive
104	297251.0	6237529.0	113.9	-2	104/0.5	0.5	5.5			8333	B	Mild		Non-Aggressive		Non-Aggressive
105	297343.0	6237570.0	108.7	-2	105/0.5	0.5	4.8			1818	B	Mild		Non-Aggressive		Mild
					105/1.0	1.0	4.7			1538	B	Mild		Non-Aggressive		Mild
					105/1.5	1.5	4.8			1613	B	Mild		Non-Aggressive		Mild
					105/2.0	2.0	4.7			1351	B	Mild		Non-Aggressive		Mild
					105/2.5	2.5	4.7	660	190	1695	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
					105/3.0	3.0	5.7			1923	B	Non-Aggressive		Non-Aggressive		Mild
					105/3.5	3.5	5.7			1724	B	Non-Aggressive		Non-Aggressive		Mild
					105/4.0	4.0	6.8	740	180	1515	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
.	.	.	.		105/4.5	4.5	5.7	460	150	2222	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive
106	297010.0	6237330.0	108.3	-0.5	106/0.5	0.5	4.7	570	230	1852	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
107	297068.2	6237375.2	111.6	-0.5	107/0.5	0.5	4.8	360	300	2174	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive
					107/1.0	1.0	4.8			1667	B	Mild		Non-Aggressive		Mild
					107/1.5	1.5	4.9			1639	B	Mild		Non-Aggressive		Mild
					107/2.0	2.0	4.9			1471	B	Mild		Non-Aggressive		Mild
					107/2.5	2.5	4.9			1724	B	Mild		Non-Aggressive		Mild
.	.	.	.		107/3.0	3.0	4.8			1613	B	Mild		Non-Aggressive		Mild
108	297170.0	6237424.5	111.8	-1	108/0.5	0.5	4.4	940	170	1282	B	Moderate	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
109	297274.2	6237468.4	108.6	-1.5	109/0.5	0.5	4.9	280	280	2632	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive
110	297359.1	6237505.2	106.1	-2	110/0.5	0.5	4.8			2083	B	Mild		Non-Aggressive		Non-Aggressive
					110/1.0	1.0	4.8	500	270	1818	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
					110/1.5	1.5	4.8			1786	B	Mild		Non-Aggressive		Mild
					110/2.0	2.0	4.8	570	260	1818	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
					110/2.5	2.5	4.9	570	280	1724	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
.	.	.	.		110/3.0	3.0	5			1695	B	Mild		Non-Aggressive		Mild
111	297100.8	6237306.8	108.0	1	111/0.5	0.5	5.1	200	130	3846	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive
112	297193.5	6237350.6	108.4	0.5	112/0.5	0.5	5.2	100	91	5882	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive
113	297275.3	6237387.0	105.7	-0.5	113/0.5	0.5	4.8	790	320	1351	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
114	297336.5	6237399.7	104.1	1	114/0.5	0.5	5.4	470	150	2273	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive
115	297065.0	6237243.0	106.5	2	115/0.5	0.5	5	180	120	4167	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive
116	297145.3	6237247.2	104.9	1.5	116/0.5	0.5	4.7	400	170	2439	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive
117	297229.0	6237283.8	105.9	-1.5	117/0.5	0.5	4.7			1316	B	Mild		Non-Aggressive		Mild
					117/1.0	1.0	4.9			1538	B	Mild		Non-Aggressive		Mild
					117/1.5	1.5	4.9	730	180	1515	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
					117/2.0	2.0	5.2			1493	B	Mild		Non-Aggressive		Mild
					117/2.5	2.5	5.3			1163	B	Mild		Non-Aggressive		Mild
.	.	.	.		117/3.0	3.0	5.6			1563	B	Non-Aggressive		Non-Aggressive		Mild
118	297294.6	6237297.4	103.7	-1	118/0.5	0.5	4.7	780	200	1515	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
119	297122.0	6237168.0	108.0	0.5	119/0.5	0.5	4.6	590	300	1613	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
120	297255.3	6237215.1	102.1	1	120/0.5	0.5	4.8	330	40	3448	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive
121	297225.8	6237127.1	104.1	1	121/0.5	0.5	4.7	600	370	1587	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
122	297172.0	6237073.0	104.4	-1	122/0.5	0.5	4.8			2174	B	Mild		Non-Aggressive		Non-Aggressive
					122/1.0	1.0	5	740	210	1515	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
					122/1.5	1.5	5.5			1695	B	Mild		Non-Aggressive		Mild
					122/2.0	2.0	5.6	600	190	1754	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
					122/2.5	2.5	5.9			1961	B	Non-Aggressive		Non-Aggressive		Mild
.	.	.	.		122/3.0	3.0	6.3			1639	B	Non-Aggressive		Non-Aggressive		Mild
123	297007.5	6237388.5	112.8	-1	123/0.5	0.5	5			3846	B	Mild		Non-Aggressive		Non-Aggressive
124	297129.5	6237446.9	114.3	-2	124/0.5	0.5	4.6			2000	B	Mild		Non-Aggressive		Non-Aggressive
					124/1.0	1.0	4.6			1613	B	Mild		Non-Aggressive		Mild
					124/1.5	1.5	4.6			1316	B	Mild		Non-Aggressive		Mild
					124/2.0	2.0	4.7	1000	260	1250	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
					124/2.5	2.5	4.8	640	180	1786	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
.	.	.	.		124/3.0	3.0	4.8			1408	B	Mild		Non-Aggressive		Mild
125	297228.5	6237491.1	111.9	-2	125/0.5	0.5	5.5			3226	B	Mild		Non-Aggressive		Non-Aggressive
126	297322.9	6237531.2	108.9	-3	126/0.5	0.5	5.2			5882	B	Mild		Non-Aggressive		Non-Aggressive
					126/1.0	1.0	4.9			2500	B	Mild		Non-Aggressive		Non-Aggressive
					126/1.5	1.5	4.9			2381	B	Mild		Non-Aggressive		Non-Aggressive
					126/2.0	2.0	5.2	220	110	3448	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive
					126/2.5	2.5	5.1	340	150	2703	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive
.	.	.	.		126/3.0	3.0	5.3			2857	B	Mild		Non-Aggressive		Non-Aggressive
127	297060.9	6237303.7	107.4	1	127/0.5	0.5	4.8			1818	B	Mild		Non-Aggressive		Mild
128	297144.8	6237370.2	110.7	-1	128/0.5	0.5	5.8			7692	B	Non-Aggressive		Non-Aggressive		Non-Aggressive
					128/1.0	1.0	5	110	220	4167	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive
					128/1.5	1.5	5			4545	B	Mild		Non-Aggressive		Non-Aggressive
					128/2.0	2.0	5.1	200	180	3571	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive
					128/2.5	2.5	4.9			2564	B	Mild		Non-Aggressive		Non-Aggressive
.	.	.	.		128/3.0	3.0	5.1			2222	B	Mild		Non-Aggressive		Non-Aggressive
129	297273.8	6237427.7	107.1	-1	129/0.5	0.5	5.8			4545	B	Non-Aggressive		Non-Aggressive		Non-Aggressive
					129/1.0	1.0	5.4	500	390	1754	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
					129/1.5	1.5	5.4	520	480	1587	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
					129/2.0	2.0	5.5	390	370	1754	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
					129/2.5	2.5	5.5			1818	B	Mild		Non-Aggressive		Mild
.	.	.	.		129/3.0	3.0	5.7			2222	B	Non-Aggressive		Non-Aggressive		Non-Aggressive
130	297360.5	6237454.4	104.5	0.5	130/0.5	0.5	4.9	690	200	1471	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
131	297098.5	6237241.9	104.7	2.5	131/0.5	0.5	5.5	78	110	11905	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive
132	297172.4	6237299.0	107.6	-1	132/0.5	0.5	4.8	480	190	2128	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive
133	297285.3	6237331.2	104.7	-1	133/0.5	0.5	4.8			1515	B	Mild		Non-Aggressive		Mild
					133/1.0	1.0	4.9	730	190	1538	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
					133/1.5	1.5	5.6	820	250	1389	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
					133/2.0	2.0	5			1471	B	Mild		Non-Aggressive		Mild
					133/2.5	2.5	5.3			1493	B	Mild		Non-Aggressive		Mild
.	.	.	.		133/3.0	3.0	5.3	980	260	1220	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
134	297348.6	6237362.6	102.7	1	134/0.5	0.5	5.2	130	170	4545	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive
135	297196.3	6237203.8	105.7	2.5	135/0.5	0.5	6.8	740	170	1493	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
136	297169.5	6237131.0	107.8	-0.5	136/0.5	0.5	4.8	760	360	1351	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
					136/1.0	1.0	5			1408	B	Mild		Non-Aggressive		Mild
					136/1.5	1.5	5.3	780	320	1429	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
					136/2.0	2.0	5.5			1613	B	Mild		Non-Aggressive		Mild
					136/2.5	2.5	5.6			1667	B	Non-Aggressive		Non-Aggressive		Mild
.	.	.	.		136/3.0	3.0	5.6			1389	B	Non-Aggressive		Non-Aggressive		Mild
137	297245.7	6237175.7	102.2	1.5	137/0.5	0.5	5.2	670	59	1852	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
138	297233.3	6237068.4	104.4	-0.5	138/0.5	0.5	4.8			1667	B	Mild		Non-Aggressive		Mild
					138/1.0	1.0	4.8	880	450	1266	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
					138/1.5	1.5	5	680	400	1493	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
					138/2.0	2.0	5.1			1538	B	Mild		Non-Aggressive		Mild
					138/2.5	2.5	5.1	680	400	1124	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
.	.	.	.		138/3.0	3.0	5.4	650	340	1493	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild
139	297208.0	6237020.0	104.4	-0.5	139/0.5	0.5	5.4	120	76	6667	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive

Test Bore or Pit	Test Location				Sample ID	Sample Depth	Exchangeable Sodium (Na) Concentration	Cation Exchange Capacity	Sodicity	Sodicity Class	Emerson Crumb Class Number	Dispersion?	Soil Texture Group	Textural Factor (M)	$EC_{1:5}$	EC_e	Sample Salinity Class
	East	North	RL	Proposed Cut (-) and Fill (+)					[Na/CEC]			(from Emerson Class)	(for detailed soil logs see Report Appendix)		[Lab.]	[M x $EC_{1:5}$]	(Based on sample ECe)
	(m MGA56)	(m MGA56)	(m AHD)	(m)		(m bgl)	(meq/100g)	(meq/100g)	(%)	[after DLWC]		[AS1289.3.8.1]	[after DLWC]	[after DLWC]	(microS/cm)	(deciS/m)	[Richards 1954]
101	296950.9	6237410.5	113.3	-1	101/0.5	0.5							Sandy loam	14	350	4.9	Moderately Saline
					101/1.0	1.0	1.3	8.4	15	Highly Sodic			Loam	10	530	5.3	Moderately Saline
					101/1.5	1.5	3.3	18	18	Highly Sodic			Heavy clay	6.5	570	3.7	Slightly Saline
					101/2.0	2.0							Light clay	8.5	350	3.0	Slightly Saline
					101/2.5	2.5							Light clay	8.5	360	3.1	Slightly Saline
					101/3.0	3.0							Light clay	8.5	340	2.9	Slightly Saline
102	297065.0	6237441.0	114.9	-2	102/0.5	0.5							Loam	10	320	3.2	Slightly Saline
103	297171.0	6237491.0	115.0	-3	103/0.5	0.5							Light medium clay	8	370	3.0	Slightly Saline
					103/1.0	1.0							Loam	10	420	4.2	Moderately Saline
					103/1.5	1.5							Medium clay	7.5	410	3.1	Slightly Saline
					103/2.0	2.0							Sandy loam	14	440	6.2	Moderately Saline
					103/2.5	2.5							Light clay	8.5	430	3.7	Slightly Saline
					103/3.0	3.0	2.7	12	23	Highly Sodic			Light clay	8.5	380	3.2	Slightly Saline
					103/3.5	3.5	2.4	11	22	Highly Sodic			Light clay	8.5	360	3.1	Slightly Saline
					103/4.0	4.0							Light clay	8.5	390	3.3	Slightly Saline
					103/4.5	4.5							Light clay	8.5	410	3.5	Slightly Saline
					103/5.0	5.0							Light clay	8.5	340	2.9	Slightly Saline
104	297251.0	6237529.0	113.9	-2	104/0.5	0.5							Light clay	8.5	120	1.0	Non-Saline
105	297343.0	6237570.0	108.7	-2	105/0.5	0.5							Loam	10	550	5.5	Moderately Saline
					105/1.0	1.0							Light clay	8.5	650	5.5	Moderately Saline
					105/1.5	1.5							Light clay	8.5	620	5.3	Moderately Saline
					105/2.0	2.0							Light clay	8.5	740	6.3	Moderately Saline
					105/2.5	2.5	1.5	5	30	Highly Sodic			Light clay	8.5	590	5.0	Moderately Saline
					105/3.0	3.0							Light clay	8.5	520	4.4	Moderately Saline
					105/3.5	3.5							Light clay	8.5	580	4.9	Moderately Saline
					105/4.0	4.0	3.9	16	24	Highly Sodic			Light clay	8.5	660	5.6	Moderately Saline
					105/4.5	4.5							Light clay	8.5	450	3.8	Slightly Saline
106	297010.0	6237330.0	108.3	-0.5	106/0.5	0.5							Loam	10	540	5.4	Moderately Saline
107	297068.2	6237375.2	111.6	-0.5	107/0.5	0.5	1.6	7.5	21	Highly Sodic			Clay loam	9	460	4.1	Moderately Saline
					107/1.0	1.0	2	8.4	24	Highly Sodic			Loam	10	600	6.0	Moderately Saline
					107/1.5	1.5							Loam	10	610	6.1	Moderately Saline
					107/2.0	2.0							Loam	10	680	6.8	Moderately Saline
					107/2.5	2.5							Loam	10	580	5.8	Moderately Saline
					107/3.0	3.0							Light clay	8.5	620	5.3	Moderately Saline
108	297170.0	6237424.5	111.8	-1	108/0.5	0.5	1.7	8	21	Highly Sodic			Light clay	8.5	780	6.6	Moderately Saline
109	297274.2	6237468.4	108.6	-1.5	109/0.5	0.5	1.5	9	17	Highly Sodic			Clay loam	9	380	3.4	Slightly Saline
110	297359.1	6237505.2	106.1	-2	110/0.5	0.5							Clay loam	9	480	4.3	Moderately Saline
					110/1.0	1.0							Light clay	8.5	550	4.7	Moderately Saline
					110/1.5	1.5							Loam	10	560	5.6	Moderately Saline
					110/2.0	2.0	3.5	13	27	Highly Sodic			Clay loam	9	550	5.0	Moderately Saline
					110/2.5	2.5							Clay loam	9	580	5.2	Moderately Saline
					110/3.0	3.0							Clay loam	9	590	5.3	Moderately Saline
111	297100.8	6237306.8	108.0	1	111/0.5	0.5							Light medium clay	8	260	2.1	Slightly Saline
112	297193.5	6237350.6	108.4	0.5	112/0.5	0.5							Light clay	8.5	170	1.4	Non-Saline
113	297275.3	6237387.0	105.7	-0.5	113/0.5	0.5							Clay loam	9	740	6.7	Moderately Saline
114	297336.5	6237399.7	104.1	1	114/0.5	0.5							Clay loam	9	440	4.0	Slightly Saline
115	297065.0	6237243.0	106.5	2	115/0.5	0.5							Light clay	8.5	240	2.0	Slightly Saline
116	297145.3	6237247.2	104.9	1.5	116/0.5	0.5							Light clay	8.5	410	3.5	Slightly Saline
117	297229.0	6237283.8	105.9	-1.5	117/0.5	0.5							Light clay	8.5	760	6.5	Moderately Saline
					117/1.0	1.0							Clay loam	9	650	5.9	Moderately Saline
					117/1.5	1.5	3	12	25	Highly Sodic			Light clay	8.5	660	5.6	Moderately Saline
					117/2.0	2.0							Loam	10	670	6.7	Moderately Saline
					117/2.5	2.5							Loam	10	860	8.6	Very Saline
					117/3.0	3.0							Clay loam	9	640	5.8	Moderately Saline
118	297294.6	6237297.4	103.7	-1	118/0.5	0.5							Clay loam	9	660	5.9	Moderately Saline
119	297122.0	6237168.0	108.0	0.5	119/0.5	0.5							Loam	10	620	6.2	Moderately Saline
120	297255.3	6237215.1	102.1	1	120/0.5	0.5							Clay loam	9	290	2.6	Slightly Saline
121	297225.8	6237127.1	104.1	1	121/0.5	0.5							Loam	10	630	6.3	Moderately Saline
122	297172.0	6237073.0	104.4	-1	122/0.5	0.5							Loam	10	460	4.6	Moderately Saline
					122/1.0	1.0	3.9	14	28	Highly Sodic			Light clay	8.5	660	5.6	Moderately Saline
					122/1.5	1.5							Medium clay	7	590	4.1	Moderately Saline
					122/2.0	2.0	4.8	15	32	Highly Sodic			Light clay	8.5	570	4.8	Moderately Saline
					122/2.5	2.5							Light clay	8.5	510	4.3	Moderately Saline
					122/3.0	3.0							Light clay	8.5	610	5.2	Moderately Saline
123	297007.5	6237388.5	112.8	-1	123/0.5	0.5							Clay loam	9	260	2.3	Slightly Saline
124	297129.5	6237446.9	114.3	-2	124/0.5	0.5							Clay loam	9	500	4.5	Moderately Saline
					124/1.0	1.0							Loam	10	620	6.2	Moderately Saline
					124/1.5	1.5							Loam	10	760	7.6	Moderately Saline
					124/2.0	2.0	3.2	10	32	Highly Sodic			Loam	10	800	8.0	Moderately Saline
					124/2.5	2.5	2.6	8.3	31	Highly Sodic			Loam	10	560	5.6	Moderately Saline
					124/3.0	3.0							Loam	10	710	7.1	Moderately Saline
125	297228.5	6237491.1	111.9	-2	125/0.5	0.5							Loam	10	310	3.1	Slightly Saline
126	297322.9	6237531.2	108.9	-3	126/0.5	0.5							Clay loam	9	170	1.5	Non-Saline
					126/1.0	1.0							Clay loam	9	400	3.6	Slightly Saline
					126/1.5	1.5							Clay loam	9	420	3.8	Slightly Saline
					126/2.0	2.0	3.1	8.9	35	Highly Sodic			Light clay	8.5	290	2.5	Slightly Saline
					126/2.5	2.5	3.2	9.7	33	Highly Sodic			Light clay	8.5	370	3.1	Slightly Saline
					126/3.0	3.0							Light clay	8.5	350	3.0	Slightly Saline
127	297060.9	6237303.7	107.4	1	127/0.5	0.5							Loam	10	550	5.5	Moderately Saline
128	297144.8	6237370.2	110.7	-1	128/0.5	0.5							Loam	10	130	1.3	Non-Saline
					128/1.0	1.0	1.3	7.3	18	Highly Sodic			Loam	10	240	2.4	Slightly Saline
					128/1.5	1.5							Loam	10	220	2.2	Slightly Saline
					128/2.0	2.0							Loam	10	280	2.8	Slightly Saline
					128/2.5	2.5							Loam	10	390	3.9	Slightly Saline
					128/3.0	3.0							Clay loam	9	450	4.1	Moderately Saline
129	297273.8	6237427.7	107.1	-1	129/0.5	0.5							Light clay	8.5	220	1.9	Non-Saline
					129/1.0	1.0	1.8	6.9	26	Highly Sodic			Clay loam	9	570	5.1	Moderately Saline
					129/1.5	1.5	2	7.4	27	Highly Sodic			Light clay	8.5	630	5.4	Moderately Saline
					129/2.0	2.0							Loam	10	570	5.7	Moderately Saline
					129/2.5	2.5							Loam	10	550	5.5	Moderately Saline
					129/3.0	3.0							Light clay	8.5	450	3.8	Slightly Saline
130	297360.5	6237454.4	104.5	0.5	130/0.5	0.5							Loam	10	680	6.8	Moderately Saline
131	297098.5	6237241.9	104.7	2.5	131/0.5	0.5							Light clay	8.5	84	0.7	Non-Saline
132	297172.4	6237299.0	107.6	-1	132/0.5	0.5							Loam	10	470	4.7	Moderately Saline
133	297285.3	6237331.2	104.7	-1	133/0.5	0.5							Loam	10	660	6.6	Moderately Saline
					133/1.0	1.0	2.5	10	25	Highly Sodic			Loam	10	650	6.5	Moderately Saline
					133/1.5	1.5	2.7	11	25	Highly Sodic			Light clay	8.5	720	6.1	Moderately Saline
					133/2.0	2.0							Light clay	8.5	680	5.8	Moderately Saline
					133/2.5	2.5							Light clay	8.5	670	5.7	Moderately Saline
					133/3.0	3.0							Light clay	8.5	820	7.0	Moderately Saline
134	297348.6	6237362.6	102.7	1	134/0.5	0.5							Light clay	8.5	220	1.9	Non-Saline
135	297196.3	6237203.8	105.7	2.5	135/0.5	0.5							Clay loam	9	670	6.0	Moderately Saline
136	297169.5	6237131.0	107.8	-0.5	136/0.5	0.5							Loam	10	740	7.4	Moderately Saline
					136/1.0	1.0							Clay loam	9	710	6.4	Moderately Saline
					136/1.5	1.5	1.3	4.9	27	Highly Sodic			Light clay	8.5	700	6.0	Moderately Saline
					136/2.0	2.0							Light clay	8.5	620	5.3	Moderately Saline
					136/2.5	2.5							Light clay	8.5	600	5.1	Moderately Saline
					136/3.0	3.0							Light clay	8.5	720	6.1	Moderately Saline
137	297245.7	6237175.7	102.2	1.5	137/0.5	0.5							Clay loam	9	540	4.9	Moderately Saline
138	297233.3	6237068.4	104.4	-0.5	138/0.5	0.5							Light medium clay	8	600	4.8	Moderately Saline
					138/1.0	1.0	2.1	8.9	24	Highly Sodic			Light clay	8.5	790	6.7	Moderately Saline
					138/1.5	1.5	3.4	14	24	Highly Sodic			Light clay	8.5	670	5.7	Moderately Saline
					138/2.0	2.0							Light clay	8.5	650	5.5	Moderately Saline
					138/2.5	2.5							Light clay	8.5	890	7.6	Moderately Saline
					138/3.0	3.0							Light clay	8.5	670	5.7	Moderately Saline
139	297208.0	6237020.0	104.4	-0.5	139/0.5	0.5							Light clay	8.5	150	1.3	Non-Saline

Aggressivity Flags
- Very Severe
- Severe
- Moderate
- Mild
- Non-Aggressive

Sodicity Flags
- Highly Sodic
- Sodic
- Non-Sodic

Dispersion Flags
- Complete
- Some
- Dispersive
- No

Salinity Flags
- Highly Saline
- Very Saline
- Moderately Saline
- Slightly Saline
- Non-Saline

Appendix D

NATA Report and Chain Of Custody

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
Unit 5, 50 Topham Road
Smeaton Grange NSW 2567
Phone (02) 4647 0075
Fax (02) 4646 1886

Determination of Emerson Class Number of Soil

Client:	**CORNISH GROUP PTY LTD**	**Project No:**	76571.02
		Report No:	MAC14-279
Project:	Salinity Investigation and Management Plan	**Report Date:**	16/06/2014
Location:	51 St Andrews Road Leppington	**Date of Test:**	16/06/2014
		Page:	1 of 1

Sample No.	Depth (m)	Description	Water Type	Water Temp	Class No.
103	1.5	SILTY CLAT – Grey mottled red and orange silty clay	Distilled	21	6
110	2.0	SILTY CLAY – Grey and orange silty clay	Distilled	21	6
117	1.0	SILTY CLAY – Grey and orange silty clay	Distilled	21	6
128	1.0	SILTY CLAY – Red mottled grey silty clay	Distilled	21	6
138	0.5	SILTY CLAY – Orange and red mottled grey silty clay	Distilled	21	5

Test Methods: AS 1289 3.8.1

Sampling Methods: Sampled By DP Engineering

Remarks:

NATA Accredited Laboratory Number: 828

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Accredited for compliance with ISO/IEC 17025

Tested: AS
Checked: AJS

A J Sweetland
Laboratory Manager

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
enquiries@envirolabservices.com.au
www.envirolabservices.com.au

CERTIFICATE OF ANALYSIS 110762

Client:

Douglas Partners Pty Ltd Smeaton Grange
Unit 5/50 Topham Rd
Smeaton Grange
NSW 2567

Attention: Brad Harris

Sample log in details:

Your Reference:	**76571.02, 51 St Andrews Rd, Leppington**		
No. of samples:	116 soils		
Date samples received / completed instructions received	30/05/14	/	30/05/14

Analysis Details:

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	6/06/14	/	6/06/14
Date of Preliminary Report:	Not issued		

NATA accreditation number 2901. This document shall not be reproduced except in full.
Accredited for compliance with ISO/IEC 17025. **Tests not covered by NATA are denoted with *.**

Results Approved By:

Jacinta Hurst
Laboratory Manager

Miscellaneous Inorg - soil						
Our Reference:	UNITS	110762-1	110762-2	110762-3	110762-4	110762-5
Your Reference	----------	101	101	101	101	101
Depth	----------	0.5	1.0	1.5	2.0	2.5
Date Sampled		28/05/2014	28/05/2014	28/05/2014	28/05/2014	28/05/2014
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	03/06/2014	03/06/2014	03/06/2014	03/06/2014	03/06/2014
Date analysed	-	04/06/2014	04/06/2014	04/06/2014	04/06/2014	04/06/2014
pH 1:5 soil:water	pH Units	4.9	4.9	5.3	6.2	6.2
Electrical Conductivity 1:5 soil:water	µS/cm	350	530	570	350	360
Chloride, Cl 1:5 soil:water	mg/kg	410	640	690	[NA]	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	21	53	63	[NA]	[NA]

Miscellaneous Inorg - soil						
Our Reference:	UNITS	110762-6	110762-7	110762-8	110762-9	110762-10
Your Reference	----------	101	102	103	103	103
Depth	----------	3.0	0.5	0.5	1.0	1.5
Date Sampled		28/05/2014	28/05/2014	28/05/2014	28/05/2014	28/05/2014
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	03/06/2014	03/06/2014	03/06/2014	03/06/2014	03/06/2014
Date analysed	-	04/06/2014	04/06/2014	04/06/2014	04/06/2014	04/06/2014
pH 1:5 soil:water	pH Units	7.0	5.1	4.7	4.7	4.7
Electrical Conductivity 1:5 soil:water	µS/cm	340	320	370	420	410
Chloride, Cl 1:5 soil:water	mg/kg	[NA]	300	[NA]	[NA]	340
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	61	[NA]	[NA]	170

Miscellaneous Inorg - soil						
Our Reference:	UNITS	110762-11	110762-12	110762-13	110762-14	110762-15
Your Reference	----------	103	103	103	103	103
Depth	----------	2.0	2.5	3.0	3.5	4.0
Date Sampled		28/05/2014	28/05/2014	28/05/2014	28/05/2014	28/05/2014
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	03/06/2014	03/06/2014	03/06/2014	03/06/2014	03/06/2014
Date analysed	-	04/06/2014	04/06/2014	04/06/2014	04/06/2014	04/06/2014
pH 1:5 soil:water	pH Units	4.7	4.7	4.9	4.9	4.9
Electrical Conductivity 1:5 soil:water	µS/cm	440	430	380	360	390
Chloride, Cl 1:5 soil:water	mg/kg	[NA]	340	310	280	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	210	210	180	[NA]

Miscellaneous Inorg - soil						
Our Reference:	UNITS	110762-16	110762-17	110762-18	110762-19	110762-20
Your Reference	----------	103	103	104	105	105
Depth	----------	4.5	5.0	0.5	0.5	1.0
Date Sampled		28/05/2014	28/05/2014	28/05/2014	28/05/2014	28/05/2014
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	03/06/2014	03/06/2014	03/06/2014	03/06/2014	03/06/2014
Date analysed	-	04/06/2014	04/06/2014	04/06/2014	04/06/2014	04/06/2014
pH 1:5 soil:water	pH Units	4.8	5.0	5.5	4.8	4.7
Electrical Conductivity 1:5 soil:water	µS/cm	410	340	120	550	650

Miscellaneous Inorg - soil						
Our Reference:	UNITS	110762-21	110762-22	110762-23	110762-24	110762-25
Your Reference	----------	105	105	105	105	105
Depth	----------	1.5	2.0	2.5	3.0	3.5
Date Sampled		28/05/2014	28/05/2014	28/05/2014	28/05/2014	28/05/2014
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	03/06/2014	03/06/2014	03/06/2014	03/06/2014	03/06/2014
Date analysed	-	04/06/2014	04/06/2014	04/06/2014	04/06/2014	04/06/2014
pH 1:5 soil:water	pH Units	4.8	4.7	4.7	5.7	5.7
Electrical Conductivity 1:5 soil:water	µS/cm	620	740	590	520	580
Chloride, Cl 1:5 soil:water	mg/kg	[NA]	[NA]	660	[NA]	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	[NA]	190	[NA]	[NA]

Miscellaneous Inorg - soil						
Our Reference:	UNITS	110762-26	110762-27	110762-28	110762-29	110762-30
Your Reference	----------	105	105	106	107	107
Depth	----------	4.0	4.5	0.5	0.5	1.0
Date Sampled		28/05/2014	28/05/2014	28/05/2014	28/05/2014	28/05/2014
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	03/06/2014	03/06/2014	03/06/2014	03/06/2014	03/06/2014
Date analysed	-	04/06/2014	04/06/2014	04/06/2014	04/06/2014	04/06/2014
pH 1:5 soil:water	pH Units	6.8	5.7	4.7	4.8	4.8
Electrical Conductivity 1:5 soil:water	µS/cm	660	450	540	460	600
Chloride, Cl 1:5 soil:water	mg/kg	740	460	570	360	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	180	150	230	300	[NA]

Miscellaneous Inorg - soil						
Our Reference:	UNITS	110762-31	110762-32	110762-33	110762-34	110762-35
Your Reference	----------	107	107	107	107	108
Depth	----------	1.5	2.0	2.5	3.0	0.5
Date Sampled		28/05/2014	28/05/2014	28/05/2014	28/05/2014	27/05/2014
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	03/06/2014	03/06/2014	03/06/2014	03/06/2014	03/06/2014
Date analysed	-	04/06/2014	04/06/2014	04/06/2014	04/06/2014	04/06/2014
pH 1:5 soil:water	pH Units	4.9	4.9	4.9	4.8	4.4
Electrical Conductivity 1:5 soil:water	µS/cm	610	680	580	620	780
Chloride, Cl 1:5 soil:water	mg/kg	[NA]	[NA]	[NA]	[NA]	940
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	[NA]	[NA]	[NA]	170

Miscellaneous Inorg - soil						
Our Reference:	UNITS	110762-36	110762-37	110762-38	110762-39	110762-40
Your Reference	----------	109	110	110	110	110
Depth	----------	0.5	0.5	1.0	1.5	2.0
Date Sampled		27/05/2014	26/05/2014	26/05/2014	26/05/2014	26/05/2014
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	03/06/2014	03/06/2014	03/06/2014	03/06/2014	03/06/2014
Date analysed	-	04/06/2014	04/06/2014	04/06/2014	04/06/2014	04/06/2014
pH 1:5 soil:water	pH Units	4.9	4.8	4.8	4.8	4.8
Electrical Conductivity 1:5 soil:water	µS/cm	380	480	550	560	550
Chloride, Cl 1:5 soil:water	mg/kg	280	[NA]	500	[NA]	570
Sulphate, SO4 1:5 soil:water	mg/kg	280	[NA]	270	[NA]	260

Miscellaneous Inorg - soil						
Our Reference:	UNITS	110762-41	110762-42	110762-43	110762-44	110762-45
Your Reference	----------	110	110	111	112	113
Depth	----------	2.5	3.0	0.5	0.5	0.5
Date Sampled		26/05/2014	26/05/2014	26/05/2014	27/05/2014	27/05/2014
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	03/06/2014	03/06/2014	03/06/2014	03/06/2014	03/06/2014
Date analysed	-	04/06/2014	04/06/2014	04/06/2014	04/06/2014	04/06/2014
pH 1:5 soil:water	pH Units	4.9	5.0	5.1	5.2	4.8
Electrical Conductivity 1:5 soil:water	µS/cm	580	590	260	170	740
Chloride, Cl 1:5 soil:water	mg/kg	570	[NA]	200	100	790
Sulphate, SO4 1:5 soil:water	mg/kg	280	[NA]	130	91	320

Miscellaneous Inorg - soil						
Our Reference:	UNITS	110762-46	110762-47	110762-48	110762-49	110762-50
Your Reference	----------	114	115	116	117	117
Depth	----------	0.5	0.5	0.5	0.5	1.0
Date Sampled		26/05/2014	28/05/2014	27/05/2014	27/05/2014	27/05/2014
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	03/06/2014	03/06/2014	03/06/2014	03/06/2014	03/06/2014
Date analysed	-	04/06/2014	04/06/2014	04/06/2014	04/06/2014	04/06/2014
pH 1:5 soil:water	pH Units	5.4	5.0	4.7	4.7	4.9
Electrical Conductivity 1:5 soil:water	µS/cm	440	240	410	760	650
Chloride, Cl 1:5 soil:water	mg/kg	470	180	400	[NA]	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	150	120	170	[NA]	[NA]

Miscellaneous Inorg - soil						
Our Reference:	UNITS	110762-51	110762-52	110762-53	110762-54	110762-55
Your Reference	----------	117	117	117	117	118
Depth	----------	1.5	2.0	2.5	3.0	0.5
Date Sampled		27/05/2014	27/05/2014	27/05/2014	27/05/2014	26/05/2014
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	03/06/2014	03/06/2014	03/06/2014	03/06/2014	03/06/2014
Date analysed	-	04/06/2014	04/06/2014	04/06/2014	04/06/2014	04/06/2014
pH 1:5 soil:water	pH Units	4.9	5.2	5.3	5.6	4.7
Electrical Conductivity 1:5 soil:water	µS/cm	660	670	860	640	660
Chloride, Cl 1:5 soil:water	mg/kg	730	[NA]	[NA]	[NA]	780
Sulphate, SO4 1:5 soil:water	mg/kg	180	[NA]	[NA]	[NA]	200

Miscellaneous Inorg - soil						
Our Reference:	UNITS	110762-56	110762-57	110762-58	110762-59	110762-60
Your Reference	----------	119	120	121	122	122
Depth	----------	0.5	0.5	0.5	0.5	1.0
Date Sampled		28/05/2014	26/05/2014	26/05/2014	28/05/2014	28/05/2014
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	03/06/2014	03/06/2014	03/06/2014	03/06/2014	03/06/2014
Date analysed	-	04/06/2014	04/06/2014	04/06/2014	04/06/2014	04/06/2014
pH 1:5 soil:water	pH Units	4.6	4.8	4.7	4.8	5.0
Electrical Conductivity 1:5 soil:water	µS/cm	620	290	630	460	660
Chloride, Cl 1:5 soil:water	mg/kg	590	330	600	[NA]	740
Sulphate, SO4 1:5 soil:water	mg/kg	300	40	370	[NA]	210

Miscellaneous Inorg - soil						
Our Reference:	UNITS	110762-61	110762-62	110762-63	110762-64	110762-65
Your Reference	----------	122	122	122	122	123
Depth	----------	1.5	2.0	2.5	3.0	0.5
Date Sampled		28/05/2014	28/05/2014	28/05/2014	28/05/2014	26/05/2014
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	03/06/2014	03/06/2014	03/06/2014	03/06/2014	03/06/2014
Date analysed	-	04/06/2014	04/06/2014	04/06/2014	04/06/2014	04/06/2014
pH 1:5 soil:water	pH Units	5.5	5.6	5.9	6.3	5.0
Electrical Conductivity 1:5 soil:water	µS/cm	590	570	510	610	260
Chloride, Cl 1:5 soil:water	mg/kg	[NA]	600	[NA]	[NA]	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	190	[NA]	[NA]	[NA]

Miscellaneous Inorg - soil						
Our Reference:	UNITS	110762-66	110762-67	110762-68	110762-69	110762-70
Your Reference	----------	124	124	124	124	124
Depth	----------	0.5	1.0	1.5	2.0	2.5
Date Sampled		27/05/2014	27/05/2014	27/05/2014	27/05/2014	27/05/2014
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	03/06/2014	03/06/2014	03/06/2014	03/06/2014	03/06/2014
Date analysed	-	04/06/2014	04/06/2014	04/06/2014	04/06/2014	04/06/2014
pH 1:5 soil:water	pH Units	4.6	4.6	4.6	4.7	4.8
Electrical Conductivity 1:5 soil:water	µS/cm	500	620	760	800	560
Chloride, Cl 1:5 soil:water	mg/kg	[NA]	[NA]	[NA]	1,000	640
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	[NA]	[NA]	260	180

Miscellaneous Inorg - soil						
Our Reference:	UNITS	110762-71	110762-72	110762-73	110762-74	110762-75
Your Reference	----------	124	125	126	126	126
Depth	----------	3.0	0.5	0.5	1.0	1.5
Date Sampled		27/05/2014	27/05/2014	26/05/2014	26/05/2014	26/05/2014
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	03/06/2014	03/06/2014	03/06/2014	03/06/2014	03/06/2014
Date analysed	-	04/06/2014	04/06/2014	04/06/2014	04/06/2014	04/06/2014
pH 1:5 soil:water	pH Units	4.8	5.5	5.2	4.9	4.9
Electrical Conductivity 1:5 soil:water	µS/cm	710	310	170	400	420

Miscellaneous Inorg - soil						
Our Reference:	UNITS	110762-76	110762-77	110762-78	110762-79	110762-80
Your Reference	----------	126	126	126	127	128
Depth	----------	2.0	2.5	3.0	0.5	0.5
Date Sampled		26/05/2014	26/05/2014	26/05/2014	26/05/2014	26/05/2014
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	03/06/2014	03/06/2014	03/06/2014	03/06/2014	03/06/2014
Date analysed	-	04/06/2014	04/06/2014	04/06/2014	04/06/2014	04/06/2014
pH 1:5 soil:water	pH Units	5.2	5.1	5.3	4.8	5.8
Electrical Conductivity 1:5 soil:water	µS/cm	290	370	350	550	130
Chloride, Cl 1:5 soil:water	mg/kg	220	340	[NA]	[NA]	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	110	150	[NA]	[NA]	[NA]

Miscellaneous Inorg - soil						
Our Reference:	UNITS	110762-81	110762-82	110762-83	110762-84	110762-85
Your Reference	----------	128	128	128	128	128
Depth	----------	1.0	1.5	2.0	2.5	3.0
Date Sampled		26/05/2014	26/05/2014	26/05/2014	26/05/2014	26/05/2014
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	03/06/2014	03/06/2014	03/06/2014	03/06/2014	03/06/2014
Date analysed	-	04/06/2014	04/06/2014	04/06/2014	04/06/2014	04/06/2014
pH 1:5 soil:water	pH Units	5.0	5.0	5.1	4.9	5.1
Electrical Conductivity 1:5 soil:water	µS/cm	240	220	280	390	450
Chloride, Cl 1:5 soil:water	mg/kg	110	[NA]	200	[NA]	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	220	[NA]	180	[NA]	[NA]

Miscellaneous Inorg - soil						
Our Reference:	UNITS	110762-86	110762-87	110762-88	110762-89	110762-90
Your Reference	----------	129	129	129	129	129
Depth	----------	0.5	1.0	1.5	2.0	2.5
Date Sampled		27/05/2014	27/05/2014	27/05/2014	27/05/2014	27/05/2014
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	03/06/2014	03/06/2014	03/06/2014	03/06/2014	03/06/2014
Date analysed	-	04/06/2014	04/06/2014	04/06/2014	04/06/2014	04/06/2014
pH 1:5 soil:water	pH Units	5.8	5.4	5.4	5.5	5.5
Electrical Conductivity 1:5 soil:water	µS/cm	220	570	630	570	550
Chloride, Cl 1:5 soil:water	mg/kg	[NA]	500	520	390	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	390	480	370	[NA]

Miscellaneous Inorg - soil						
Our Reference:	UNITS	110762-91	110762-92	110762-93	110762-94	110762-95
Your Reference	----------	129	130	131	132	133
Depth	----------	3.0	0.5	0.5	0.5	0.5
Date Sampled		27/05/2014	26/05/2014	26/05/2014	27/05/2014	26/05/2014
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	03/06/2014	03/06/2014	03/06/2014	03/06/2014	03/06/2014
Date analysed	-	04/06/2014	04/06/2014	04/06/2014	04/06/2014	04/06/2014
pH 1:5 soil:water	pH Units	5.7	4.9	5.5	4.8	4.8
Electrical Conductivity 1:5 soil:water	µS/cm	450	680	84	470	660
Chloride, Cl 1:5 soil:water	mg/kg	[NA]	690	78	480	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	200	110	190	[NA]

Miscellaneous Inorg - soil						
Our Reference:	UNITS	110762-96	110762-97	110762-98	110762-99	110762-100
Your Reference	----------	133	133	133	133	133
Depth	----------	1.0	1.5	2.0	2.5	3.0
Date Sampled		26/05/2014	26/05/2014	26/05/2014	26/05/2014	26/05/2014
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	03/06/2014	03/06/2014	03/06/2014	03/06/2014	03/06/2014
Date analysed	-	04/06/2014	04/06/2014	04/06/2014	04/06/2014	04/06/2014
pH 1:5 soil:water	pH Units	4.9	5.6	5.0	5.3	5.3
Electrical Conductivity 1:5 soil:water	µS/cm	650	720	680	670	820
Chloride, Cl 1:5 soil:water	mg/kg	730	820	[NA]	[NA]	980
Sulphate, SO4 1:5 soil:water	mg/kg	190	250	[NA]	[NA]	260

Miscellaneous Inorg - soil						
Our Reference:	UNITS	110762-101	110762-102	110762-103	110762-104	110762-105
Your Reference	----------	134	135	136	136	136
Depth	----------	0.5	0.5	0.5	1.0	1.5
Date Sampled		26/05/2014	27/05/2014	26/05/2014	26/05/2014	26/05/2014
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	03/06/2014	03/06/2014	03/06/2014	03/06/2014	03/06/2014
Date analysed	-	04/06/2014	04/06/2014	04/06/2014	04/06/2014	04/06/2014
pH 1:5 soil:water	pH Units	5.2	6.8	4.8	5.0	5.3
Electrical Conductivity 1:5 soil:water	µS/cm	220	670	740	710	700
Chloride, Cl 1:5 soil:water	mg/kg	130	740	760	[NA]	780
Sulphate, SO4 1:5 soil:water	mg/kg	170	170	360	[NA]	320

Miscellaneous Inorg - soil						
Our Reference:	UNITS	110762-106	110762-107	110762-108	110762-109	110762-110
Your Reference	----------	136	136	136	137	138
Depth	----------	2.0	2.5	3.0	0.5	0.5
Date Sampled		26/05/2014	26/05/2014	26/05/2014	26/05/2014	26/05/2014
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	03/06/2014	03/06/2014	03/06/2014	03/06/2014	03/06/2014
Date analysed	-	04/06/2014	04/06/2014	04/06/2014	04/06/2014	04/06/2014
pH 1:5 soil:water	pH Units	5.5	5.6	5.6	5.2	4.8
Electrical Conductivity 1:5 soil:water	µS/cm	620	600	720	540	600
Chloride, Cl 1:5 soil:water	mg/kg	[NA]	[NA]	[NA]	670	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	[NA]	[NA]	59	[NA]

Miscellaneous Inorg - soil						
Our Reference:	UNITS	110762-111	110762-112	110762-113	110762-114	110762-115
Your Reference	----------	138	138	138	138	139
Depth	----------	1.0	1.5	2.0	3.0	0.5
Date Sampled		26/05/2014	26/05/2014	26/05/2014	26/05/2014	28/05/2014
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	03/06/2014	03/06/2014	03/06/2014	03/06/2014	03/06/2014
Date analysed	-	04/06/2014	04/06/2014	04/06/2014	04/06/2014	04/06/2014
pH 1:5 soil:water	pH Units	4.8	5.0	5.1	5.4	5.4
Electrical Conductivity 1:5 soil:water	µS/cm	790	670	650	670	150
Chloride, Cl 1:5 soil:water	mg/kg	880	680	[NA]	650	120
Sulphate, SO4 1:5 soil:water	mg/kg	450	400	[NA]	340	76

Miscellaneous Inorg - soil		
Our Reference:	UNITS	110762-116
Your Reference	----------	138
Depth	----------	2.5
Date Sampled		26/05/2014
Type of sample		soil
Date prepared	-	03/06/2014
Date analysed	-	04/06/2014
pH 1:5 soil:water	pH Units	5.1
Electrical Conductivity 1:5 soil:water	µS/cm	890

ESP/CEC						
Our Reference:	UNITS	110762-2	110762-3	110762-13	110762-14	110762-23
Your Reference	----------	101	101	103	103	105
Depth	----------	1.0	1.5	3.0	3.5	2.5
Date Sampled		28/05/2014	28/05/2014	28/05/2014	28/05/2014	28/05/2014
Type of sample		soil	soil	soil	soil	soil
Exchangeable Ca	meq/100g	0.1	<0.1	0.5	0.4	<0.1
Exchangeable K	meq/100g	0.2	0.3	0.4	0.4	0.2
Exchangeable Mg	meq/100g	6.8	14	8.7	8.1	3.3
Exchangeable Na	meq/100g	1.3	3.3	2.7	2.4	1.5
Cation Exchange Capacity	meq/100g	8.4	18	12	11	5.0
ESP	%	16	19	22	21	30

ESP/CEC						
Our Reference:	UNITS	110762-26	110762-29	110762-30	110762-35	110762-36
Your Reference	----------	105	107	107	108	109
Depth	----------	4.0	0.5	1.0	0.5	0.5
Date Sampled		28/05/2014	28/05/2014	28/05/2014	27/05/2014	27/05/2014
Type of sample		soil	soil	soil	soil	soil
Exchangeable Ca	meq/100g	1	0.2	<0.1	0.8	0.5
Exchangeable K	meq/100g	0.3	0.2	0.2	0.1	0.2
Exchangeable Mg	meq/100g	11	5.6	6.1	5.4	6.8
Exchangeable Na	meq/100g	3.9	1.6	2.0	1.7	1.5
Cation Exchange Capacity	meq/100g	16	7.5	8.4	8.0	9.0
ESP	%	24	21	24	21	17

ESP/CEC						
Our Reference:	UNITS	110762-40	110762-51	110762-60	110762-62	110762-69
Your Reference	----------	110	117	122	122	124
Depth	----------	2.0	1.5	1.0	2.0	2.0
Date Sampled		26/05/2014	27/05/2014	28/05/2014	28/05/2014	27/05/2014
Type of sample		soil	soil	soil	soil	soil
Exchangeable Ca	meq/100g	<0.1	<0.1	0.1	<0.1	<0.1
Exchangeable K	meq/100g	0.4	0.2	0.4	0.3	0.3
Exchangeable Mg	meq/100g	9.0	8.7	10	10	6.6
Exchangeable Na	meq/100g	3.5	3.0	3.9	4.8	3.2
Cation Exchange Capacity	meq/100g	13	12	14	15	10
ESP	%	27	25	27	31	31

ESP/CEC						
Our Reference:	UNITS	110762-70	110762-76	110762-77	110762-81	110762-87
Your Reference	----------	124	126	126	128	129
Depth	----------	2.5	2.0	2.5	1.0	1.0
Date Sampled		27/05/2014	26/05/2014	26/05/2014	26/05/2014	27/05/2014
Type of sample		soil	soil	soil	soil	soil
Exchangeable Ca	meq/100g	<0.1	0.2	0.3	0.3	<0.1
Exchangeable K	meq/100g	0.2	0.2	0.3	0.2	<0.1
Exchangeable Mg	meq/100g	5.4	5.5	5.9	5.6	4.9
Exchangeable Na	meq/100g	2.6	3.1	3.2	1.3	1.8
Cation Exchange Capacity	meq/100g	8.3	8.9	9.7	7.3	6.9
ESP	%	31	34	33	18	26

ESP/CEC						
Our Reference:	UNITS	110762-88	110762-96	110762-97	110762-105	110762-111
Your Reference	----------	129	133	133	136	138
Depth	----------	1.5	1.0	1.5	1.5	1.0
Date Sampled		27/05/2014	26/05/2014	26/05/2014	26/05/2014	26/05/2014
Type of sample		soil	soil	soil	soil	soil
Exchangeable Ca	meq/100g	<0.1	<0.1	0.2	<0.1	<0.1
Exchangeable K	meq/100g	0.1	0.2	0.2	0.1	0.3
Exchangeable Mg	meq/100g	5.2	7.4	7.5	3.5	6.5
Exchangeable Na	meq/100g	2.0	2.5	2.7	1.3	2.1
Cation Exchange Capacity	meq/100g	7.4	10	11	4.9	8.9
ESP	%	28	24	25	27	24

ESP/CEC		
Our Reference:	UNITS	110762-112
Your Reference	----------	138
Depth	----------	1.5
Date Sampled		26/05/2014
Type of sample		soil
Exchangeable Ca	meq/100g	<0.1
Exchangeable K	meq/100g	0.4
Exchangeable Mg	meq/100g	9.9
Exchangeable Na	meq/100g	3.4
Cation Exchange Capacity	meq/100g	14
ESP	%	24

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA 22nd ED, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25oC in accordance with APHA 22nd ED 2510 and Rayment & Lyons.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA 22nd ED, 4110 -B.
Metals-009	Determination of exchangeable cations and cation exchange capacity in soil based on Rayment and Lyons 2011.

QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			03/06/2014	110762-1	03/06/2014 || 03/06/2014	LCS-1	03/06/2014
Date analysed	-			04/06/2014	110762-1	04/06/2014 || 04/06/2014	LCS-1	04/06/2014
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	110762-1	4.9 || 4.9 || RPD: 0	LCS-1	101%
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	110762-1	350 || 350 || RPD: 0	LCS-1	104%
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	110762-1	410 || 400 || RPD: 2	LCS-1	95%
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	110762-1	21 || 23 || RPD: 9	LCS-1	99%

QUALITY CONTROL ESP/CEC	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Exchangeable Ca	meq/100g	0.1	Metals-009	<0.1	110762-3	<0.1 || 0.1	LCS-1	104%
Exchangeable K	meq/100g	0.1	Metals-009	<0.1	110762-3	0.3 || 0.3 || RPD: 0	LCS-1	113%
Exchangeable Mg	meq/100g	0.1	Metals-009	<0.1	110762-3	14 || 15 || RPD: 7	LCS-1	101%
Exchangeable Na	meq/100g	0.1	Metals-009	<0.1	110762-3	3.3 || 3.5 || RPD: 6	LCS-1	100%
Cation Exchange Capacity	meq/100g	1	Metals-009	<1.0	110762-3	18 || 19 || RPD: 5	[NR]	[NR]
ESP	%	1	Metals-009	<1	110762-3	19 || 19 || RPD: 0	[NR]	[NR]

QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	110762-11	03/06/2014 || 03/06/2014	LCS-2	03/06/2014
Date analysed	-	110762-11	04/06/2014 || 04/06/2014	LCS-2	04/06/2014
pH 1:5 soil:water	pH Units	110762-11	4.7 || 4.7 || RPD: 0	LCS-2	101%
Electrical Conductivity 1:5 soil:water	µS/cm	110762-11	440 || 430 || RPD: 2	LCS-2	103%
Chloride, Cl 1:5 soil:water	mg/kg	[NT]	[NT]	LCS-2	98%
Sulphate, SO4 1:5 soil:water	mg/kg	[NT]	[NT]	LCS-2	109%

QUALITY CONTROL ESP/CEC	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Exchangeable Ca	meq/100g	110762-36	0.5 || 0.5 || RPD: 0	LCS-2	102%
Exchangeable K	meq/100g	110762-36	0.2 || 0.2 || RPD: 0	LCS-2	112%
Exchangeable Mg	meq/100g	110762-36	6.8 || 7.5 || RPD: 10	LCS-2	98%
Exchangeable Na	meq/100g	110762-36	1.5 || 1.6 || RPD: 6	LCS-2	98%
Cation Exchange Capacity	meq/100g	110762-36	9.0 || 9.9 || RPD: 10	[NR]	[NR]
ESP	%	110762-36	17 || 17 || RPD: 0	[NR]	[NR]

QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	110762-21	03/06/2014 || 03/06/2014	LCS-3	03/06/2014
Date analysed	-	110762-21	04/06/2014 || 04/06/2014	LCS-3	04/06/2014
pH 1:5 soil:water	pH Units	110762-21	4.8 || 4.7 || RPD: 2	LCS-3	101%
Electrical Conductivity 1:5 soil:water	µS/cm	110762-21	620 || 650 || RPD: 5	LCS-3	105%
Chloride, Cl 1:5 soil:water	mg/kg	[NT]	[NT]	LCS-3	98%
Sulphate, SO4 1:5 soil:water	mg/kg	[NT]	[NT]	LCS-3	106%

QUALITY CONTROL ESP/CEC	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Exchangeable Ca	meq/100 g	110762-96	<0.1 || <0.1
Exchangeable K	meq/100 g	110762-96	0.2 || 0.2 || RPD: 0
Exchangeable Mg	meq/100 g	110762-96	7.4 || 8.4 || RPD: 13
Exchangeable Na	meq/100 g	110762-96	2.5 || 2.7 || RPD: 8
Cation Exchange Capacity	meq/100 g	110762-96	10 || 11 || RPD: 10
ESP	%	110762-96	24 || 24 || RPD: 0

QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	110762-31	03/06/2014 || 03/06/2014	LCS-4	03/06/2014
Date analysed	-	110762-31	04/06/2014 || 04/06/2014	LCS-4	04/06/2014
pH 1:5 soil:water	pH Units	110762-31	4.9 || 4.8 || RPD: 2	LCS-4	101%
Electrical Conductivity 1:5 soil:water	µS/cm	110762-31	610 || 620 || RPD: 2	LCS-4	105%
Chloride, Cl 1:5 soil:water	mg/kg	[NT]	[NT]	LCS-4	93%
Sulphate, SO4 1:5 soil:water	mg/kg	[NT]	[NT]	LCS-4	101%

QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	110762-41	03/06/2014 || 03/06/2014	LCS-5	03/06/2014
Date analysed	-	110762-41	04/06/2014 || 04/06/2014	LCS-5	04/06/2014
pH 1:5 soil:water	pH Units	110762-41	4.9 || 4.9 || RPD: 0	LCS-5	101%
Electrical Conductivity 1:5 soil:water	µS/cm	110762-41	580 || 630 || RPD: 8	LCS-5	103%
Chloride, Cl 1:5 soil:water	mg/kg	110762-41	570 || 660 || RPD: 15	LCS-5	94%
Sulphate, SO4 1:5 soil:water	mg/kg	110762-41	280 || 310 || RPD: 10	LCS-5	101%

QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	110762-51	03/06/2014 || 03/06/2014	LCS-6	03/06/2014
Date analysed	-	110762-51	04/06/2014 || 04/06/2014	LCS-6	04/06/2014
pH 1:5 soil:water	pH Units	110762-51	4.9 || 4.9 || RPD: 0	LCS-6	101%
Electrical Conductivity 1:5 soil:water	µS/cm	110762-51	660 || 720 || RPD: 9	LCS-6	102%
Chloride, Cl 1:5 soil:water	mg/kg	110762-51	730 || 800 || RPD: 9	[NR]	[NR]
Sulphate, SO4 1:5 soil:water	mg/kg	110762-51	180 || 190 || RPD: 5	[NR]	[NR]
QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	110762-61	03/06/2014 || 03/06/2014	110762-2	04/06/2014
Date analysed	-	110762-61	04/06/2014 || 04/06/2014	110762-2	04/06/2014
pH 1:5 soil:water	pH Units	110762-61	5.5 || 5.5 || RPD: 0	[NR]	[NR]
Electrical Conductivity 1:5 soil:water	µS/cm	110762-61	590 || 560 || RPD: 5	[NR]	[NR]
Chloride, Cl 1:5 soil:water	mg/kg	[NT]	[NT]	110762-2	102%
Sulphate, SO4 1:5 soil:water	mg/kg	[NT]	[NT]	110762-2	113%
QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	110762-71	03/06/2014 || 03/06/2014	110762-46	04/06/2014
Date analysed	-	110762-71	04/06/2014 || 04/06/2014	110762-46	04/06/2014
pH 1:5 soil:water	pH Units	110762-71	4.8 || 4.9 || RPD: 2	[NR]	[NR]
Electrical Conductivity 1:5 soil:water	µS/cm	110762-71	710 || 660 || RPD: 7	[NR]	[NR]
Chloride, Cl 1:5 soil:water	mg/kg	[NT]	[NT]	110762-46	#
Sulphate, SO4 1:5 soil:water	mg/kg	[NT]	[NT]	110762-46	130%
QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	110762-81	03/06/2014 || 03/06/2014	110762-94	04/06/2014
Date analysed	-	110762-81	04/06/2014 || 04/06/2014	110762-94	04/06/2014
pH 1:5 soil:water	pH Units	110762-81	5.0 || 5.1 || RPD: 2	[NR]	[NR]
Electrical Conductivity 1:5 soil:water	µS/cm	110762-81	240 || 230 || RPD: 4	[NR]	[NR]
Chloride, Cl 1:5 soil:water	mg/kg	110762-81	110 || 96 || RPD: 14	110762-94	90%
Sulphate, SO4 1:5 soil:water	mg/kg	110762-81	220 || 190 || RPD: 15	110762-94	#

QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Date prepared	-	110762-91	03/06/2014 || 03/06/2014
Date analysed	-	110762-91	04/06/2014 || 04/06/2014
pH 1:5 soil:water	pH Units	110762-91	5.7 || 5.6 || RPD: 2
Electrical Conductivity 1:5 soil:water	µS/cm	110762-91	450 || 480 || RPD: 6
Chloride, Cl 1:5 soil:water	mg/kg	[NT]	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	[NT]	[NT]

QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Date prepared	-	110762-101	03/06/2014 || 03/06/2014
Date analysed	-	110762-101	04/06/2014 || 04/06/2014
pH 1:5 soil:water	pH Units	110762-101	5.2 || 5.2 || RPD: 0
Electrical Conductivity 1:5 soil:water	µS/cm	110762-101	220 || 210 || RPD: 5
Chloride, Cl 1:5 soil:water	mg/kg	110762-101	130 || 120 || RPD: 8
Sulphate, SO4 1:5 soil:water	mg/kg	110762-101	170 || 160 || RPD: 6

QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Date prepared	-	110762-111	03/06/2014 || 03/06/2014
Date analysed	-	110762-111	04/06/2014 || 04/06/2014
pH 1:5 soil:water	pH Units	110762-111	4.8 || 4.7 || RPD: 2
Electrical Conductivity 1:5 soil:water	µS/cm	110762-111	790 || 830 || RPD: 5
Chloride, Cl 1:5 soil:water	mg/kg	110762-111	880 || 920 || RPD: 4
Sulphate, SO4 1:5 soil:water	mg/kg	110762-111	450 || 460 || RPD: 2

Report Comments:

Cl# Percent recovery is not possible to report due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

SO4# Percent recovery not available due to matrix interference, however an acceptable recovery was achieved for the LCS.

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NA: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.
Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.
Spikes for Physical and Aggregate Tests are not applicable.
For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Douglas Partners
Geotechnics / Environment / Groundwater

CHAIN OF CUSTODY

Project Name:	51 St Andrews Road, Leppington - SMP			**To:**	Envirolab Services
Project No:	76571.02	**Sampler:**	BAH		12 Ashley Street, Chatswood NSW 2067
Project Mgr:	CCK	**Mob. Phone:**	0412 754 162	**Attn:**	Tania Notaras
Email:	Bradley.Harris@douglaspartners.com.au			**Phone:**	(02) 9910 6200 **Fax:** (02) 9910 6201
Date Required:	Standard			**Email:**	tnotaras@envirolabservices.com.au

Sample ID	Lab ID	Sampling Date	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes									Notes/preservation
					EC	pH	Chlorides Sulphates	Sodicity						
101/0.5	1	28.05.14	S	G	x	x	x							
101/1.0	2	28.05.14	S	G	x	x	x	x						
101/1.5	3	28.05.14	S	G	x	x	x	x						
101/2.0	4	28.05.14	S	G	x	x								
101/2.5	5	28.05.14	S	G	x	x								
101/3.0	6	28.05.14	S	G	x	x								
102/0.5	7	28.05.14	S	G	x	x	x							
103/0.5	8	28.05.14	S	G	x	x								
103/1.0	9	28.05.14	S	G	x	x								
103/1.5	10	28.05.14	S	G	x	x	x							
103/2.0	11	28.05.14	S	G	x	x								
103/2.5	12	28.05.14	S	G	x	x	x							
103/3.0	13	28.05.14	S	G	x	x	x	x						

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 110762

Date Received: 30.5.14
Time Received: 14:45
Received by: PT
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Lab Report No:			
Send Results to:	Douglas Partners Pty Ltd	**Address** Unit 5, 50 Topham Road, Smeaton Grange 2567	**Phone:** (02) 4647 0075 **Fax:** (02) 4646 1886
Relinquished by:	BAH	**Transported to laboratory by:**	
Signed:	**Date & Time:** 10:00am 30-May-14	**Received by:** PT 30.5.14 14:45	

Form COC

Douglas Partners
Geotechnics / Environment / Groundwater

CHAIN OF CUSTODY

Project Name:	51 St Andrews Road, Leppington - SMP			**To:**	Envirolab Services
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Project Mgr:	CCK	**Mob. Phone:**	0412 754 162	**Attn:**	Tania Notaras
Email:	Bradley.Harris@douglaspartners.com.au			**Phone:**	(02) 9910 6200 **Fax:** (02) 9910 6201
Date Required:	Standard			**Email:**	tnotaras@envirolabservices.com.au

Sample ID	Lab ID	Sampling Date	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes									Notes/preservation
					EC	pH	Chlorides Sulphates	Sodicity						
103/3.5	14	28.05.14	S	G	x	x	x	x						
103/4.0	15	28.05.14	S	G	x	x								
103./4.5	16	28.05.14	S	G	x	x								
103/5.0	17	28.05.14	S	G	x	x								
104/0.5	18	28.05.14	S	G	x	x								
105/0.5	19	28.05.14	S	G	x	x								
105/1.0	20	28.05.14	S	G	x	x								
105/1.5	21	28.05.14	S	G	x	x								
105/2.0	22	28.05.14	S	G	x	x								
105/2.5	23	28.05.14	S	G	x	x	x	x						
105/3.0	24	28.05.14	S	G	x	x								
105/3.5	25	28.05.14	S	G	x	x								
105/4.0	26	28.05.14	S	G	x	x	x	x						

Lab Report No:					
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Relinquished by:	BAH		**Transported to laboratory by:**		
Signed:		**Date & Time:** 10:00 am 30-May-14	**Received by:**	PT 30.5.14 14:45	

Form COC

Douglas Partners
Geotechnics / Environment / Groundwater

CHAIN OF CUSTODY

Project Name:	51 St Andrews Road, Leppington - SMP			**To:**	Envirolab Services
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Project Mgr:	CCK	**Mob. Phone:**	0412 754 162	**Attn:**	Tania Notaras
Email:	Bradley.Harris@douglaspartners.com.au			**Phone:**	(02) 9910 6200 **Fax:** (02) 9910 6201
Date Required:	Standard			**Email:**	tnotaras@envirolabservices.com.au

Sample ID	Lab ID	Sampling Date	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes									Notes/preservation
					EC	pH	Chlorides Sulphates	Sodicity						
105/4.5	27	28.05.14	S	G	x	x	x							
106/0.5	28	28.05.14	S	G	x	x	x							
107/0.5	29	26.05.14	S	G	x	x	x	x						
107/1.0	30	26.05.14	S	G	x	x		x						
107/1.5	31	26.05.14	S	G	x	x								
107/2.0	32	26.05.14	S	G	x	x								
107/2.5	33	26.05.14	S	G	x	x								
107/3.0	34	26.05.14	S	G	x	x								
108/0.5	35	27.05.14	S	G	x	x	x	x						
109/0.5	36	27.05.14	S	G	x	x	x	x						
110/0.5	37	26.05.14	S	G	x	x								
110/1.0	38	26.05.14	S	G	x	x	x							
110/1.5	39	26.05.14	S	G	x	x								

Lab Report No:					
Send Results to:	Douglas Partners Pty Ltd	**Address** Unit 5, 50 Topham Road, Smeaton Grange 2567		**Phone:** (02) 4647 0075	**Fax:** (02) 4646 1886
Relinquished by:	BAH		**Transported to laboratory by:**		
Signed:		**Date & Time:** 10:00 am 30-May-14	**Received by:** PT 30.5.14 14:45		

Form COC

Douglas Partners
Geotechnics / Environment / Groundwater

CHAIN OF CUSTODY

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Date Required:	Standard			**Email:**	tnotaras@envirolabservices.com.au

Sample ID	Lab ID	Sampling Date	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes									Notes/preservation
					EC	pH	Chlorides Sulphates	Sodicity						
110/2.0	40	26.05.14	S	G	x	x	x	x						
110/2.5	41	26.05.14	S	G	x	x	x							
110/3.0	42	26.05.14	S	G	x	x								
111/0.5	43	26.05.14	S	G	x	x	x							
112/0.5	44	27.05.14	S	G	x	x	x							
113/0.5	45	27.05.14	S	G	x	x	x							
114/0.5	46	26.05.14	S	G	x	x	x							
115/0.5	47	28.05.14	S	G	x	x	x							
116/0.5	48	27.05.14	S	G	x	x	x							
117/0.5	49	27.05.14	S	G	x	x								
117/1.0	50	27.05.14	S	G	x	x								
117/1.5	51	27.05.14	S	G	x	x	x	x						
117/2.0	52	27.05.14	S	G	x	x								

Lab Report No:					
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Relinquished by:	BAH		**Transported to laboratory by:**		
Signed:		**Date & Time:** 10:00am 30-May-14	**Received by:** PT 30.5.14 14:45		

Form COC

Douglas Partners
Geotechnics / Environment / Groundwater

CHAIN OF CUSTODY

Project Name:	51 St Andrews Road, Leppington - SMP			**To:**	Envirolab Services
Project No:	76571.02	**Sampler:**	BAH		12 Ashley Street, Chatswood NSW 2067
Project Mgr:	CCK	**Mob. Phone:**	0412 754 162	**Attn:**	Tania Notaras
Email:	Bradley.Harris@douglaspartners.com.au			**Phone:**	(02) 9910 6200 **Fax:** (02) 9910 6201
Date Required:	Standard			**Email:**	tnotaras@envirolabservices.com.au

Sample ID	Lab ID	Sampling Date	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes									Notes/preservation
					EC	pH	Chlorides Sulphates	Sodicity						
117/2.5	53	27.05.14	S	G	x	x								
117/3.0	54	27.05.14	S	G	x	x								
118/0.5	55	26.05.14	S	G	x	x	x							
119/0.5	56	28.05.14	S	G	x	x	x							
120/0.5	57	26.05.14	S	G	x	x	x							
121/0.5	58	26.05.14	S	G	x	x	x							
122/0.5	59	28.05.14	S	G	x	x								
122/1.0	60	28.05.14	S	G	x	x	x	x						
122/1.5	61	28.05.14	S	G	x	x								
122/2.0	62	28.05.14	S	G	x	x	x	x						
122/2.5	63	28.05.14	S	G	x	x								
122/3.0	64	28.05.14	S	G	x	x								
123/0.5	65	26.05.14	S	G	x	x								

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Send Results to:	Douglas Partners Pty Ltd	**Address** Unit 5, 50 Topham Road, Smeaton Grange 2567		**Phone:** (02) 4647 0075	**Fax:** (02) 4646 1886
Relinquished by:	BAH		**Transported to laboratory by:**		
Signed:		**Date & Time:** 10:00am 30-May-14	**Received by:**	PT 30.5.14 14:45	

Douglas Partners
Geotechnics / Environment / Groundwater

CHAIN OF CUSTODY

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Date Required:	Standard			**Email:**	tnotaras@envirolabservices.com.au

Sample ID	Lab ID	Sampling Date	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes									Notes/preservation
					EC	pH	Chlorides Sulphates	Sodicity						
124/0.5	66	27.05.14	S	G	x	x								
124/1.0	67	27.05.14	S	G	x	x								
124/1.5	68	27.05.14	S	G	x	x								
124/2.0	69	27.05.14	S	G	x	x	x	x						
124/2.5	70	27.05.14	S	G	x	x	x	x						
124/3.0	71	27.05.14	S	G	x	x								
125/0.5	72	27.05.14	S	G	x	x								
126/0.5	73	26.05.14	S	G	x	x								
126/1.0	74	26.05.14	S	G	x	x								
126/1.5	75	26.05.14	S	G	x	x								
126/2.0	76	26.05.14	S	G	x	x	x	x						
126/2.5	77	26.05.14	S	G	x	x	x	x						
126/3.0	78	26.05.14	S	G	x	x								

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Relinquished by:	BAH		**Transported to laboratory by:**		
Signed:		**Date & Time:** 10:00 on 30-May-14	**Received by:** PT 30.5.14 14:45		

Douglas Partners
Geotechnics / Environment / Groundwater

CHAIN OF CUSTODY

Project Name:	51 St Andrews Road, Leppington - SMP			**To:**	Envirolab Services
Project No:	76571.02	**Sampler:**	BAH		12 Ashley Street, Chatswood NSW 2067
Project Mgr:	CCK	**Mob. Phone:**	0412 754 162	**Attn:**	Tania Notaras
Email:	Bradley.Harris@douglaspartners.com.au			**Phone:**	(02) 9910 6200 **Fax:** (02) 9910 6201
Date Required:	Standard			**Email:**	tnotaras@envirolabservices.com.au

Sample ID	Lab ID	Sampling Date	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes									Notes/preservation
					EC	pH	Chlorides Sulphates	Sodicity						
127/0.5	79	26.05.14	S	G	x	x								
128/0.5	80	26.05.14	S	G	x	x								
128/1.0	81	26.05.14	S	G	x	x	x	x						
128/1.5	82	26.05.14	S	G	x	x								
128/2.0	83	26.05.14	S	G	x	x	x							
128/2.5	84	26.05.14	S	G	x	x								
128/3.0	85	26.05.14	S	G	x	x								
129/0.5	86	27.05.14	S	G	x	x								
129/1.0	87	27.05.14	S	G	x	x	x	x						
129/1.5	88	27.05.14	S	G	x	x	x	x						
129/2.0	89	27.05.14	S	G	x	x	x							
129/2.5	90	27.05.14	S	G	x	x								
129/3.0	91	27.05.14	S	G	x	x								

Lab Report No:			
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Relinquished by:	BAH	**Transported to laboratory by:**	
Signed:	**Date & Time:** 10:00 am 30-May-14	**Received by:** PT 30.5.14 14:45	

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Geotechnics / Environment / Groundwater

CHAIN OF CUSTODY

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Date Required:	Standard			**Email:**	tnotaras@envirolabservices.com.au

Sample ID	Lab ID	Sampling Date	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes									Notes/preservation
					EC	pH	Chlorides Sulphates	Sodicity						
130/0.5	92	26.05.14	S	G	x	x	x							
131/0.5	93	26.05.14	S	G	x	x	x							
132/0.5	94	27.05.14	S	G	x	x	x							
133/0.5	95	26.05.14	S	G	x	x								
133/1.0	96	26.05.14	S	G	x	x	x	x						
133/1.5	97	26.05.14	S	G	x	x	x	x						
133/2.0	98	26.05.14	S	G	x	x								
133/2.5	99	26.05.14	S	G	x	x								
133/3.0	100	26.05.14	S	G	x	x	x							
134/0.5	101	26.05.14	S	G	x	x	x							
135/0.5	102	27.05.14	S	G	x	x	x							
136/0.5	103	26.05.14	S	G	x	x	x							
136/1.0	104	26.05.14	S	G	x	x								

Lab Report No:					
Send Results to:	Douglas Partners Pty Ltd	**Address** Unit 5, 50 Topham Road, Smeaton Grange 2567		**Phone:** (02) 4647 0075	**Fax:** (02) 4646 1886
Relinquished by:	BAH		**Transported to laboratory by:**		
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Date Required:	Standard			**Email:**	tnotaras@envirolabservices.com.au

Sample ID	Lab ID	Sampling Date	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes									Notes/preservation
					EC	pH	Chlorides Sulphates	Sodicity						
136/1.5	105	26.05.14	S	G	x	x	x	x						
136/2.0	106	26.05.14	S	G	x	x								
136/2.5	107	26.05.14	S	G	x	x								
136/3.0	108	26.05.14	S	G	x	x								
137/0.5	109	26.05.14	S	G	x	x	x							
138/0.5	110	26.05.14	S	G	x	x								
138/1.0	111	26.05.14	S	G	x	x	x	x						
138/1.5	112	26.05.14	S	G	x	x	x	x						
138/2.0	113	26.05.14	S	G	x	x								
138/3.0	114	26.05.14	S	G	x	x	x							
139/0.5	115	28.05.14	S	G	x	x	x							
138/2.5	116	26.05.14	S	G	x	x								

Lab Report No:					
Send Results to:	Douglas Partners Pty Ltd	**Address** Unit 5, 50 Topham Road, Smeaton Grange 2567		**Phone:** (02) 4647 0075	**Fax:** (02) 4646 1886
Relinquished by:	BAH		**Transported to laboratory by:**		
Signed:		**Date & Time:** 10:00 am 30-May-14	**Received by:** PT 30.5.14 14:45		

Form COC