Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Report on
Geotechnical and Salinity Investigation

Calibre Industrial Estate
60 Wallgrove Road
Eastern Creek

Prepared for
Mirvac Projects Pty Ltd

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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.

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Table of Contents

Report on Geotechnical and Salinity Investigation
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1. Introduction

This report presents the results of a geotechnical and salinity investigation undertaken by Douglas Partners Pty Ltd (DP) at the Quarantine Station, 60 Wallgrove Road, Eastern Creek. The work was commissioned by Mirvac Projects Pty Ltd and was undertaken in accordance with DP's fee proposal SYD150178 dated 27 February 2015.

It is understood that the proposed development is a new industrial development comprising five large warehouses. The aim of the investigation is to assess the current subsurface conditions and provide geotechnical advice for the proposed development for DA and design purposes.

The investigation included the drilling of ten boreholes and nineteen test pits. Details of the investigation and comments relating to design and construction practice are provided herein.

2. Site Description and Geology

The Eastern Creek Quarantine Station site has a total area of approximately 15.3 hectares and is approximately rectangular in shape with maximum plan dimensions of 430 m (east-west) at the northern boundary and 380 m (north-south) about one-third the way into the site from the eastern boundary. The topography of the site comprises gently undulating terrain which is governed by:

- A localised ridge line that extends from the south-western corner to the centre and then turns north to north-east and continues beyond the northern boundary;
- An east-facing slope on the eastern side of the ridge line that falls to the boundary adjoining Wallgrove Road;
- A west to north-west facing slope on the western side of the ridge line that falls to beyond the western boundary, originally to meet a meandering gully/creek within the adjoining cemetery but now interrupted by embankments on the cemetery land;
- Tributaries of Eastern Creek that bypass the site to its north and west and delineate the toe of the natural west-facing slopes, together with modified ground surfaces (cut and filled ground) within the adjoining cemetery; and
- The alignment of Eastern Creek, which lies approximately 600 m east of the site and delineates the toe of the east-facing natural slopes, together with modified ground surfaces (embankments) along the M7 Motorway alignment.

Site grades are gentle with most areas exhibiting slopes of less than 10% (≈ 6 degrees). Localised slopes about the dam within the south-western corner of the site are slightly steeper and reach approximately 10 degrees.

Existing developments at site have caused only minor disturbance of the land surface by way of localised cutting and filling for the construction of building pads, pavements and associated site services. Whilst there are many buildings (office buildings, stables, kennels, catteries, greenhouses, maintenance buildings, residences, etc) on-site, most have required excavations and/or filling depths of about 1 m or less. More significant excavation and filling has occurred within the central western, south-western and southern portions of the site where developments have included the construction of dams/ponds, dressage areas, service trenching, various pits and buried tanks. Excavation and filling within these areas is estimated to affect up to 3 m or so of the current/previous land surface.

The *Penrith 1:100 000 Geological Series Sheet* indicates that the site is located over Bringelly Shale which typically comprises shale, claystone, laminite and sandstone.

3. Field Work Methods

It was proposed to drill ten bores, two bores for each of the five proposed warehouses and excavate twenty test pits across the site for salinity investigation. As the site is a working quarantine station at the time of the field work, access was not available at certain locations for quarantine purposes and other locations had to be moved to suit operational activities. In addition, prolong wet weather softened the existing ground during the drilling and the drilling rig became bogged at a couple of locations. Thus drilling was temporarily interrupted after six bores were drilled due to poor ground conditions and continued a few weeks later. One of the pits was also abandoned due to its restricted location and the presence of several underground services.

The field investigation comprised ten boreholes (Bores 1 to 10) drilled with a DT100 or Scout truck mounted auger/rotary drilling rig. The bores were drilled to depths ranging from 2.6 m to 8.3 m. Five of the bores were terminated at the rock surface and five of the bores were continued into rock by coring approximately 3 m of core using NMLC equipment. Standard penetration tests (SPT) were carried out in 1.5 m depth intervals in the soil.

The nineteen test pits were excavated using a small tracked mounted excavator to a nominal depth between 2.0 m to 2.5 m depth. Three pits were terminated at shallower depths due to refusal on rock.

The locations and levels of the boreholes and pits were determined by high precision, digital GPS equipment whose accuracy is nominally ±100 mm. The datum for the levels is the Australian height datum (AHD).

Drawing 1 in Appendix B shows the approximate locations of the tests.

In addition to samples taken at depth intervals of 0.5 m in the pits for salinity purposes, four bulk samples of soil were also collected from the near surface for laboratory testing for California bearing ratio (CBR) and aggressivity testing.

4. Field Work Results

The borehole logs are provided in Appendix C, together with notes defining classification methods and terms used to describe the soil and rock.

Based on the results of the investigation, the subsurface profile (excluding surface pavements) can be summarised as follows:

- TOPSOIL – grey-brown sandy clay/clayey sand filling with roadbase gravel to depths of 0.1 - 0.3 m; overlying;
- CLAY/SILTY CLAY – firm to stiff, grey and brown clay or silty clay to depths of 1.0 – 2.3 m; overlying;
- SHALY CLAY – very stiff to hard shaly clay, to depths of 1.2 – 2.1 m; overlying; and
- SHALE – extremely low to low strength, moderately weathered, fractured, grey shale to the base the termination depths of 7.3 m and 7.4 m.

The exception to the above was some surface filling up to approximately 0.8 m depth in Bore 7 and Pits 105, 114, 115 and 117 which is associated with the dam's embankment in the south-western corner.

Free groundwater was observed in Pits 101 and 103 at 1.7 m and 1.5 m depths, respectively but not in the other pits. Groundwater was not observed in the bores while augering and the use of water as a drilling fluid during rotary and core drilling operations precluded the measurement of groundwater levels below the depth of auger drilling in the bores.

Four cross-sections (Drawings 2 to 5) with nearby tests profiles are provided in Appendix B.

5. Results of Laboratory Testing

Laboratory testing was performed on selected samples from the borehole and test pits locations, and comprised the following:

- California bearing ratio (CBR) tests on bulk samples. The samples were compacted to approximately 100% Standard dry density ratio at the estimated optimum moisture content (OMC) for Standard compaction and soaked for four days under a surcharge loading of 4.5 kg prior to penetration;
- pH and electrical conductivity (EC (1:5)) tests for soil aggressivity and salinity assessment;
- five chloride and sulphate ion concentration tests for soil aggressivity assessment; and
- five Exchangeable Sodium Percentage & Cation Exchange Capacity (CEC) tests for soil sodicity assessment.

The details and results of the laboratory testing are provided on the test certificates in Appendix D. The laboratory test results are briefly summarised in Tables 1 and 2.

Table 1: Results of CBR Testing

Sample	Depth (m)	W_F (%)	SMDD (t/m3)	OMC (%)	Swell (%)	CBR (%)	Material
104	0.0 – 0.5 m	16.5	1.76	17.0	0.6	8	Clay/Silty clay
109	0.5 m	20.6	1.62	22.1	0.8	5	Clay/Silty clay
116	0 – 0.5 m	15.0	1.77	16.4	1.7	6	Clay/Silty clay
120	0 – 0.5 m	14.7	1.69	18.3	0.9	7	Clay/Silty clay

Notes: W_F – field moisture content; SMDD – Standard maximum dry density
OMC – optimum moisture content for Standard compaction
CBR – California bearing ratio at 100% SMDD after four day soak

Table 2: Summary of Laboratory Aggressivity and Salinity Test Results

Test Location	Depth (m)	pH	SO_4 (mg/kg)	Cl (mg/kg)	CEC (meq/100g)	EC (µS/cm)	Multiplication Factor	EC_e (dS/m)	ESP (%)
101	0.2	5.8				370	9	3.3	
	0.5	5.8	120	1100		790	9	7.1	
	1.0	8.6				1300	8.5	11.1	
	1.5	8.3				1200	8.5	10.2	
	2.0	8.0				1400	8	11.2	
102	0.2	6.2				42	9	0.4	
	0.5	5.3			9.5	430	7	3.0	17
	1.0	4.9				820	7	5.7	
	1.5	5.0				720	8.5	6.1	
	2.0	5.1				710	8.5	6.0	
103	0.2	5.9				78	9	0.7	
	0.5	5.6				510	8.5	4.3	
	1.0	5.6				710	8.5	6.0	
	1.5	7.1				1100	9	9.9	
	2.0	6.9			8.4	1100	9	9.9	33
104	0.2	5.9	200	1,300	13	450	9	4.1	9
	0.5	5.2				930	8.5	7.9	
	1.0	6.2				1500	8.5	12.8	
	1.5	6.7				1200	8.5	10.2	
	2.0	6.7				1400	8.5	11.9	
105	0.2	7.0				86	8	0.7	
	0.5	4.9				520	6	3.1	
	1.0	5.1				450	8.5	3.8	

Test Location	Depth (m)	pH	SO_4 (mg/kg)	Cl (mg/kg)	CEC (meq/100g)	EC (µS/cm)	Multiplication Factor	EC_e (dS/m)	ESP (%)
	1.5	5.2				390	8.5	3.3	
	2.0	5.1				410	8	3.3	
106	0.5	5.0				640	7	4.5	
	1.0	5.0	300	780		680	8	5.4	
	1.5	4.9				600	8	4.8	
107	0.2	5.9				73	9	0.7	
	0.5	5.1				520	7	3.6	
	1.0	5.2				580	7	4.1	
	1.5	5.1			13	610	8.5	5.2	30
	2.0	5.1				810	8	6.5	
108	0.2	5.5				480	9	4.3	
	0.5	4.7				970	8.5	8.2	
	1.0	5.0				810	8.5	6.9	
	1.5	5.5	190	1400		910	9	8.2	
	2.0	6.8				940	8.5	8.0	
109	0.2	5.3				260	8	2.1	
	0.5	5.0	320	430		490	7	3.4	
	1.0	5.0				630	7	4.4	
	1.5	5.0				620	8.5	5.3	
110	0.2	6.1				44	9	0.4	
	0.5	5.7				180	7	1.3	
	1.0	5.3			10	500	7	3.5	22
	1.5	5.2				780	8.5	6.6	
	2.0	5.4				660	8.5	5.6	
111	0.2	6.4				48	9	0.4	
	0.5	5.6				270	6	1.6	
	1.0	5.3				630	7	4.4	
	1.5	5.2				830	8	6.6	
	2.0	5.2				540	8	4.3	
113	0.2	6.4			12	59	8	0.5	4
	0.5	5.3				360	8	2.9	
	1.0	5.0				1000	7	7.0	
	1.5	5.2				960	8.5	8.2	
	2.0	5.5				750	8.5	6.4	

Test Location	Depth (m)	pH	SO_4 (mg/kg)	Cl (mg/kg)	CEC (meq/100g)	EC (µS/cm)	Multiplication Factor	EC_e (dS/m)	ESP (%)
114	0.2	5.4				91	10	0.9	
	0.5	5.7				130	8.5	1.1	
	1.0	8.3				110	7	0.8	
	1.5	6.4				230	7	1.6	
	2.0	5.4	570	450		540	7	3.8	
115	0.2	6.4				57	8.5	0.5	
	0.5	5.5				220	7	1.5	
	1.0	5.2				470	7	3.3	
	1.5	5.4				370	8.5	3.1	
116	0.2	5.6				170	8.5	1.4	
	0.5	5.4	430	280	15	720	8	5.8	21
	1.0	5.4				730	8	5.8	
	1.5	5.8				640	8.5	5.4	
117	0.2	7.0				35	17	0.6	
	0.5	5.7				170	8	1.4	
	1.0	5.5				270	7	1.9	
	1.5	5.2				370	7	2.6	
	2.0	5.3				440	8.5	3.7	
118	0.2	5.7				37	17	0.6	
	0.5	5.7				66	8.5	0.6	
	1.0	5.6				160	8.5	1.4	
	1.5	5.5				200	6	1.2	
	2.0	5.8				170	8.5	1.4	
119	0.2	6.0			10	68	9	0.6	1
	0.5	5.2				350	7	2.5	
	1.0	4.8				760	7	5.3	
	1.5	4.9				830	8	6.6	
	2.0	5.1				610	8	4.9	
120	0.2	6.1	42	54		110	9	1.0	
	0.5	4.8	160	280		550	7	3.9	
	1.0	4.5				1200	8	9.6	
	1.5	4.5				1100	8	8.8	
	2.0	4.7				1000	8	8.0	

6. Proposed Development

It is understood that the proposed industrial development will involve the construction of a five large warehouse platforms with surrounding pavements and access roads.

Preliminary earthworks designs have five building platforms for the site with levels varying from RL 52.2 m to RL 53.2 m. The proposed platform levels are shown on the cross-sections in Appendix B. This will entail filling up to heights of 4 m to 5 m in the north-western sector and the eastern side of the site. Excavation up to approximately 5 m to 6 m depth is proposed diagonally across the site with the deepest excavation near the south-western corner tapering to zero near the north-eastern corner.

7. Comments

7.1 Soil Aggressivity

Figure 1 in Appendix E presents variations of aggressivity with depth, based on pH profiles at borehole locations, together with the aggressivity class ranges indicated in Tables 6.4.2 (C) and 6.5.2 (C) in Australian Standard AS 2159 – 2009. The absence of free groundwater from most boreholes and the impermeability of the sampled clay-rich material indicates that soils at all test pits are in Condition "B" as defined by AS 2159.

The Summary Table in Appendix E indicates that 47% of all individual samples tested were non-aggressive, 41% mildly aggressive, and 12% moderately aggressive to concrete and non-aggressive to steel.

Based on the results of the three tests for sulphate and chloride ions and with reference to Table 6.4.2(C) of AS 2159 – 2009, the natural silty clays may be classified as 'non-aggressive' to 'mild' exposure classification with respect to buried, reinforced concrete, structural elements.

7.2 Soil Salinity

Figure 2 in Appendix E presents the variations of salinity with depth, based on salinity (ECe) profiles at borehole locations, together with the salinity classifications of Richards (1954).

The Summary Table in Appendix E indicates that 30% of all individual soil samples tested were non-saline, 20% were slightly saline, 34% were moderately saline and 16% very saline. Individual salinities, assigned to specific locations and depths, are subject to various statistical and measurement errors and are not considered satisfactory for the classification of soils at those specific locations. Lateral and vertical variability of soils (particularly filling materials), together with finite precision in determination of the textural classes used as $EC_{1:5}$ multipliers, may lead to unrealistic salinity classifications of soils based on a single test, particularly if the derived ECe value lies close to a class boundary. Classifications based on bulk salinities are therefore considered more appropriate.

As 50% of the results indicate moderately or very saline result, it is reasonable to assume that there is a saline issue on the site.

7.3 Salinity Management

There are major earthworks proposed for the site which will alter the status of salinity on site. As a generalisation, the higher measurements of salinity are located in the lower lying areas which are to be filled and the lower salinity measurements are generally located in the top 0.5 m over the site.

There is a potential issue of salinity for the site and earthworks should be carried out to in order to manage the salinity on site. The following management strategies are confined to the management of those factors with a potential to impact on the development:

- Management should focus on capping of the upper surface of the saline 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;
- When possible placement of excavated soils in fill areas with similar salinity characteristics (i.e. to place material on to in-situ soils with a similar or higher aggressivity or salinity classification). With respect to imported filling, testing should be undertaken prior to importation, to determine the salinity characteristics of the material;
- Avoiding 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;
- -Minimisation of exposure of saline and sodic soils in temporary faces or stockpiles during site preparation works;
- The collection and controlled discharge of seepage from cut faces and stormwater from hard surfaces of the proposed development such that the potential for localised ponding or waterlogging is minimised;
- The provision of lining of temporary or permanent ponds to minimise groundwater recharge;
- The application of gypsum to areas of exposed soils or unpaved landscaping areas;
- Protection of in-ground structures from potential salt attack;
- 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;
- 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;
- Salt tolerant grasses and trees should be considered for landscaping, to reduce soil erosion and to maintain the existing evapo-transpiration and groundwater levels. Reference should be made to an experienced landscape planner or agronomist; and
- With regard to surface slopes, a minimum of 1V:100H is suggested.

The following additional strategies are recommended for completion of service installation and for building 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:

- Where soils are classified as non-aggressive to concrete, concrete piles should nevertheless have a minimum strength of 32 MPa and a minimum cover to reinforcement of 45 mm (as per AS2159);
- Where soils are classified as mildly aggressive to concrete, concrete 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 soils (in accordance with AS2159);
- With regard to concrete foundation structures, for non-saline and slightly saline soils (with salinities less than 4 dS/m);
    - Where soils are classified as non aggressive to concrete (AS3600 – A1) slabs and foundations should have a minimum strength of 20 MPa, and should be allowed to cure for a minimum of three days (as per AS3600) to limit the corrosive effects of the surrounding soils
- Any future installation of concrete pipes up to a maximum diameter of 750 mm, in the defined areas of moderately to very saline or mildly to moderately aggressive soil at services depths, should employ fibre reinforced cement. Alternatively, concrete pipes in these areas should be encased in outer PVC conduit;
- Concrete pipes with a larger diameter than 750 mm should utilise sulphate resistant cement;
- Results indicate soils that are non-aggressive to steel. The following corrosion allowance (as per AS 2159 – 2009) should be taken into account by the designer:
    - Non-aggressive soil: uniform corrosion allowance < 0.01 mm/year
- Higher than normal strength concrete or sulphate resistant cement may need to be considered in potentially very saline to highly saline or aggressive areas in order to reduce the risk of reinforcement corrosion in concrete slabs. A minimum of 50-55 mm of concrete cover on slab reinforcement, proper compaction and curing concrete are also suggested to produce a dense low permeability concrete; and
- Use of a heavy duty plastic to separated concrete slabs from the underlying soil.

It is assumed that the earthworks on the site will be a balance of cut to fill with cut material comprising soil and rock. Therefore, the general principal for the earthworks for the proposed development should be:

- After stripping the cut area of topsoil and unsuitable material; excavate and stockpile the top 0.5 m of soil from the cut areas;
- In the transition zone between cut and fill, it is also suggest that any existing in-situ soil is removed to a depth of 1 m below bulk design level and used as filling in the deeper fill areas. (Stockpiled material and excavated rock of lower salinity can be used to backfill the area.);
- Continue to excavate the soil from the cut areas and place as layers in the deeper fill areas, filling progressively across the site;
- Excavate the rock from the cut areas and stockpile for re-use as a surface capping;
- After all the cut soil (except for the stockpile) has been placed and compacted; continue to fill using the stockpiled material; and
- Replace the rock from the stockpile / cut areas as a capping layer over the fill areas.

7.4 Excavation Conditions and Vibrations

Excavation to level the site will necessitate cuts varying between 0 m near the north-eastern corner to about 5 to 6 m near the south western corner in a zone approximately diagonally across the site. Within these depths of excavation, it is expected that filling, silty clay, extremely low to very low strength shale and medium strength shale will be encountered. There may even be some high strength shale in the deeper cut areas. Excavation in the filling, silty clay and extremely low to very low strength shale could be readily carried out using conventional earthmoving equipment, such as dozers or hydraulic excavators with bucket attachments. Medium to heavy ripping of the medium or higher strength shale will be required to complete the bulk excavation.

Medium to heavy ripping or using a rock hammer will generally cause some vibrations but they are not expected to be an issue on this site as the adjacent properties to the area to be cut are a motorway and a cemetery and they are some distance away from the major works.

Significant groundwater inflows into site excavations are not anticipated and any seepage, if present, is likely to be minor. It is recommended that drainage be provided to limit ponding of both seepage and stormwater runoff, with the collected water being passed through sedimentation basins and monitored to ensure compliance with water quality requirements prior to discharge or reuse for moisture conditioning of filling within the site.

The presence of high plasticity clay and weathered shale at bulk excavation levels is likely to result in poor trafficability conditions during and after rainfall. Hence, the provision of adequate site drainage and a surface capping layer (e.g. ripped sandstone, recycled concrete) during construction will be required to reduce the inconvenience caused by poor trafficability. Ripped shale from site is expected to break down under wet weather and traffic and therefore the capping layer material may have to be imported.

7.5 Re-Use of Excavated Materials

The filling and natural soils and rock at the site would generally be suitable for re-use as general filling after moisture conditioning has been carried out, although the soils are mostly of medium plasticity, therefore their re-use should be strictly controlled under structures and pavements. The excavated rock should be crushed to a maximum size of 150 mm. The re-use is subject to assessment of salinity control.

NSW EPA guidelines require that all material to be disposed off site, such as may be required during excavation of existing filling volumes if unsuitable materials are identified, should be the subject of a Waste Classification Assessment. To minimise the risk of unexpected delays and disposal costs it may be preferable to conduct sampling and testing on any excess excavated soils prior to commencement of excavation, if such soils can be identified.

7.6 Existing Water Course

It is assumed that some earthworks may be required for the existing watercourse through the site, although no details have been made available. The works may involve constructing an underground

culvert or something similar. If any works are proposed, water effected soils around the watercourse should be removed prior to any new works.

7.7 Filling Conditions

The preparation of surfaces to receive new filling and the placement of the filling should be carried out under Level 1 engineering control in general accordance with AS 3798-2007 Guidelines on Earthworks for Commercial and Residential Developments.

Before any filling is placed, the area should be prepared by stripping any topsoil and unsuitable material and proof rolling in the presence of a geotechnical testing authority. Any soft spots would require some repairs.

Due to the expected medium to high plasticity of the clays, care should be taken not to over-compact the clay, due to the risk of subsequent swelling. It is also important to maintain the moisture content close to optimum moisture content. It is suggested that general filling is placed in layers whose thickness is appropriate to the machinery being used, but no thicker than 300 mm, and compacted to a density ratio of between 98% and 102% relative to Standard compaction with the moisture content within 2% of optimum moisture content. The testing carried out on samples taken from site indicated that the soils were generally dry of optimum moisture content with 75% of samples tested for moisture within 2% of optimum moisture content. This situation may change with time and weather conditions.

The moisture content should also be maintained after compaction by spray coating or placement of a granular surfacing. This will minimise the erosion potential of the prepared surface until the areas are covered with buildings and/or pavements.

Any imported filling should preferably include granular materials, such as ripped or crushed rock, or low plasticity clays of non-saline or low salinity classification that is free of deleterious substances.

A consequence of substantial amount of filling is the long term consolidation (also known as creep) as the clayey filling settles under its own weight. A typical value of creep for compacted clay is 0.5% of filling height per log cycle in years. Therefore, for 5 m of compacted filling, creep could be of the order of 25 mm over the first 10 years, with another 25 mm over the next 90 years. As filling depths vary under the warehouses, the amount of creep will also vary under the warehouses. For a large warehouse, these values of creep may not be significant, but should be considered in the design.

Reference should be made to Section 7.2 Soil Salinity concerning the placement of filling.

7.8 Batter and Erosion

Cut faces should be battered back to reduce the risk of slope failures during the construction of retaining walls, or alternatively, where retaining walls are not required, they should be graded at appropriate temporary or permanent batter slopes. A short-term batter slope of 1:1 (H:V) is suggested for batter heights of up to 4 m in clay and extremely weathered rock. For long-term conditions, a minimum batter slope of 2:1 (H:V) is suggested, with 3:1 (H:V) being preferred to permit surface protection (e.g. by grassing) to reduce the potential for erosion of soil batters. For very low strength or

better rock a batter slope of 0.75:1 (H:V) is suggested for short term and 1:1 (H:V) for long term. The above batters are provided on the basis that there is no surcharge from stockpiled materials and building or vehicular loads to a setback distance of at least the excavation depth behind the crest of excavations.

Erosion of permanent batter slopes in clays is likely unless the faces of the slopes are protected. This is also applicable to the faces of shale which tend to fret readily when subjected to alternate wetting and drying. For all cuts, provision should be made for drainage at the top and at the base of the slopes to control any run-off and potential face erosion.

7.9 Acid Sulphate Soils

The site generally lies at an elevation some 50 m or more above the formation environment of estuarine acid sulphate soils. As such, it is considered that there is no risk of estuarine acid sulphate soil conditions.

7.10 Groundwater

It is considered that bulk excavation works will generally not intersect and will have no direct impact upon the regional groundwater table. There may be some water perched or trapped within the higher areas of the site, but it is not considered to be part of the regional groundwater table.

7.11 Foundations

After earthworks, it is expected that the exposed surface will vary across the site and will include filling, and rock, assuming the natural clays have been removed or buried for salinity purposes. In some cases, the filling depth will be substantial.

After earthworks are completed, each building should be further investigated for detailed design purposes. For preliminary design purposes, shallow footings within the filling and stiff clays could be adopted for relatively light loads using an allowable bearing pressure of 150 kPa. Where rock is exposed, e.g. in Warehouse 5, shallow footings would also be suitable using an allowable bearing pressure in the order of 700 kPa to 1000 kPa, or possibly higher if medium or high strength shale is exposed.

For more heavily loaded footings on soil and filling, bored piles taken to rock are suggested. For preliminary purpose only, an allowable end bearing pressure of 1000 kPa could be adopted. With further testing, higher end bearing pressures are possible.

The selection of the footing type should also take into account the settlement of the footing, generally expected to be of the order of 1% of the footing width and also the long term consolidation of any underlying filling.

7.12 Retaining Structures

Retaining walls, for temporary and permanent support of existing soils or newly filled areas, may be designed on the basis of an average bulk unit weight of 20 kN/m^3 and a triangular earth pressure distribution based on a lateral active earth pressure coefficient (K_a) of 0.35 where some wall movement is acceptable. An "at rest" earth pressure coefficient (K_o) of 0.5 should be used where wall movement is to be limited. All surcharge loads including any nearby footings should be included in the design.

Drainage of the ground behind impermeable walls and discharge of the collected water to the existing stormwater system should be provided otherwise the walls should be designed for full hydrostatic pressures.

7.13 Pavement Design and Construction

It is assumed that the proposed industrial park road will be on some minor filling near the entrance to the development and moving onto the excavated building platforms.

Appropriate methods to address the potential salinity issues on site include:

- provision of drains along the perimeter of the pavements with a longitudinal fall to discharge points to minimise the risk of ponding;
- measures to limit ingress of salt and moisture into the substrate. This can be addressed by consideration of the type and amount of materials and water used during construction. Methods of achieving this may include minimising permeability through compaction, stabilisation and seal characteristics and ensuring the seal is applied as soon as possible after the pavement has been compacted; and
- the location of sedimentation and detention basins away from salinity and waterlogging susceptible areas (if applicable).

The results of laboratory testing on samples of natural clay at the site returned soaked CBRs of 5%, 6%, 7% and 8%. A design CBR of 6% is suggested for pavements constructed on the natural silty clay and clay. This value should be reviewed after earthworks as the final subgrade material is expected to be different to the existing near surface clays.

8. Further Investigations

Due to the large earthworks proposed for the site and the salinity issue, further geotechnical and salinity investigations will be required after earthworks are completed for the detailed design of the warehouses.

9. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for the proposed development at 60 Wallgrove Road, Eastern Creek in accordance with DP's proposal SYD150178 dated 27 February 2015. The

work was carried out under Mirvac's previously agreed Consultancy Agreement. The report is provided for the use of Mirvac for this project only and for the purpose 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. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. 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 sub-surface 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. Sub-surface 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 affected 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 a statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as 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.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the geotechnical components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

Douglas Partners Pty Ltd

References

1. Australian Standard AS 2870 – 2011: *"Residential Slabs and Footings"*, Standards Association of Australia.

2. Australian Standard AS 3798 – 2007: *"Guidelines on Earthworks for Commercial and Residential Developments"*, Standards Association of Australia.

3. Australian Standard AS 2159 – 2009: *"Piling – Design and Construction"*, Standards Association of Australia.

Appendix A

About this Report

About this Report

Douglas Partners

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.

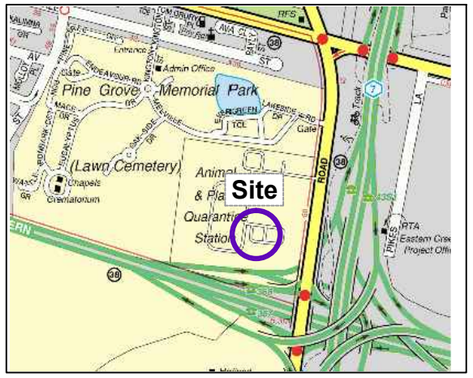
Site Inspection

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.

Appendix B

Drawings

NOTE: 1. Base drawing from Mirvac Pty Ltd
2. Test locations are approximate only and are shown with reference to existing site fetaures.



Locality Plan

WAREHOUSE 4 RL 53.20
WAREHOUSE 1 RL 52.15
WAREHOUSE 5 RL 53.20
WAREHOUSE 2 RL 53.20
WAREHOUSE 3 RL 53.20
OFFICE
ROAD 1
WALLGROVE ROAD
M4 MOTORWAY
DP1091805

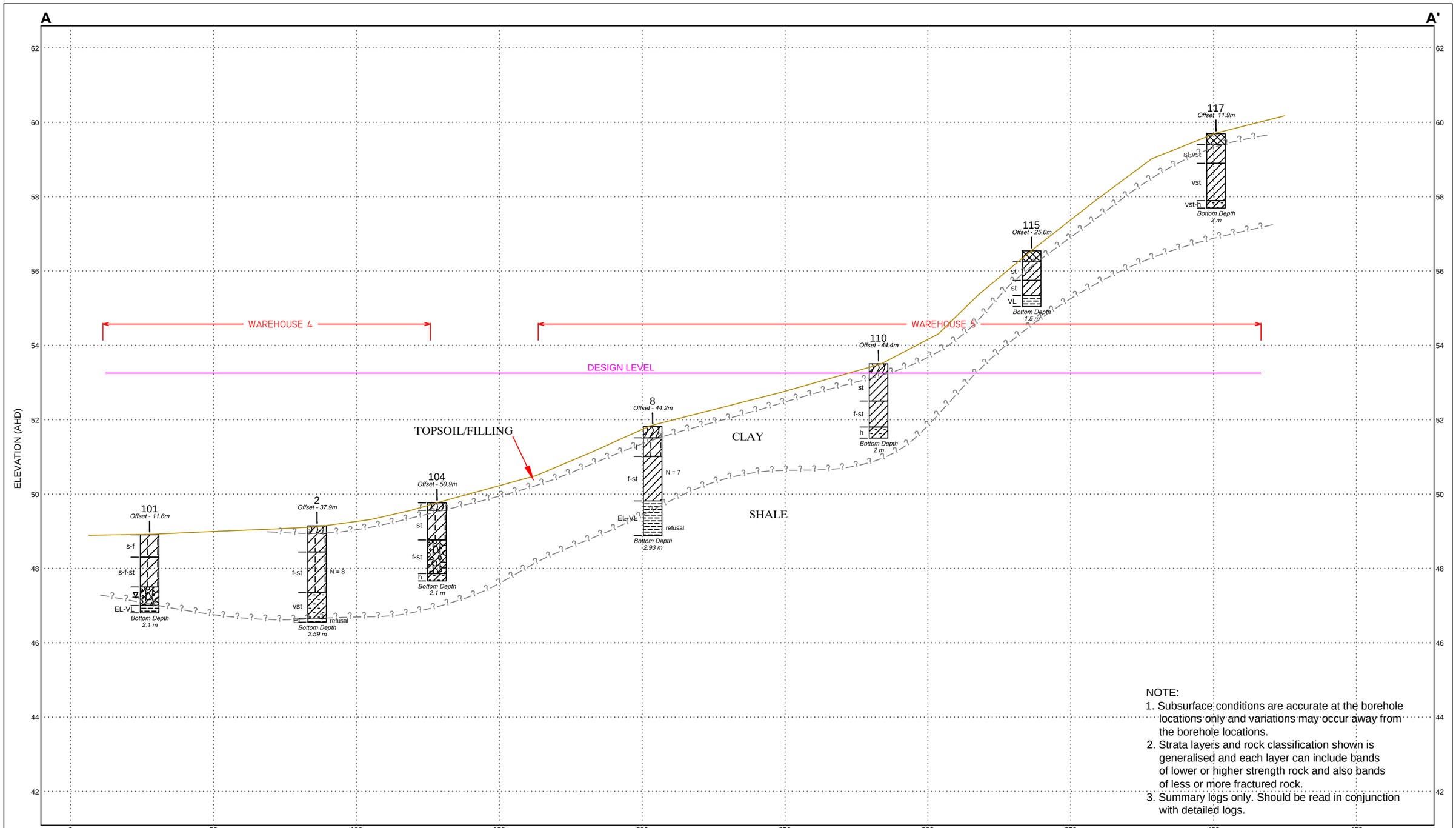
0 10 20 30 40 60 80 100 150 200m
1:2000 @ A3

LEGEND
- Test Pit Location
- Borehole Location
- Exclusion Zone
- Geotechnical Cross Section A-A'

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Mirvac		TITLE: **Location of Tests** **Proposed Industrial Development** **60 Wallgrove Road, EASTERN CREEK**
OFFICE: Sydney	DRAWN BY: PSCH	
SCALE: 1:2000 @ A3	DATE: 300.4..2015	

PROJECT No: 84798
DRAWING No: 1
REVISION: 0



NOTE:
1. Subsurface conditions are accurate at the borehole locations only and variations may occur away from the borehole locations.
2. Strata layers and rock classification shown is generalised and each layer can include bands of lower or higher strength rock and also bands of less or more fractured rock.
3. Summary logs only. Should be read in conjunction with detailed logs.

DISTANCE ALONG PROFILE (m)

LEGEND

- Topsoil
- Silty Clay
- Shaly Clay
- Shale
- Clay
- Gravelly Silty Clay
- Filling

ROCK STRENGTH
EL - Extremely Low
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High

SOIL CONSISTENCY
vs - very soft
s - soft
f - firm
st - stiff
vst - very stiff
h - hard
vl - very loose
l - loose
md - medium dense
d - dense
vd - very dense

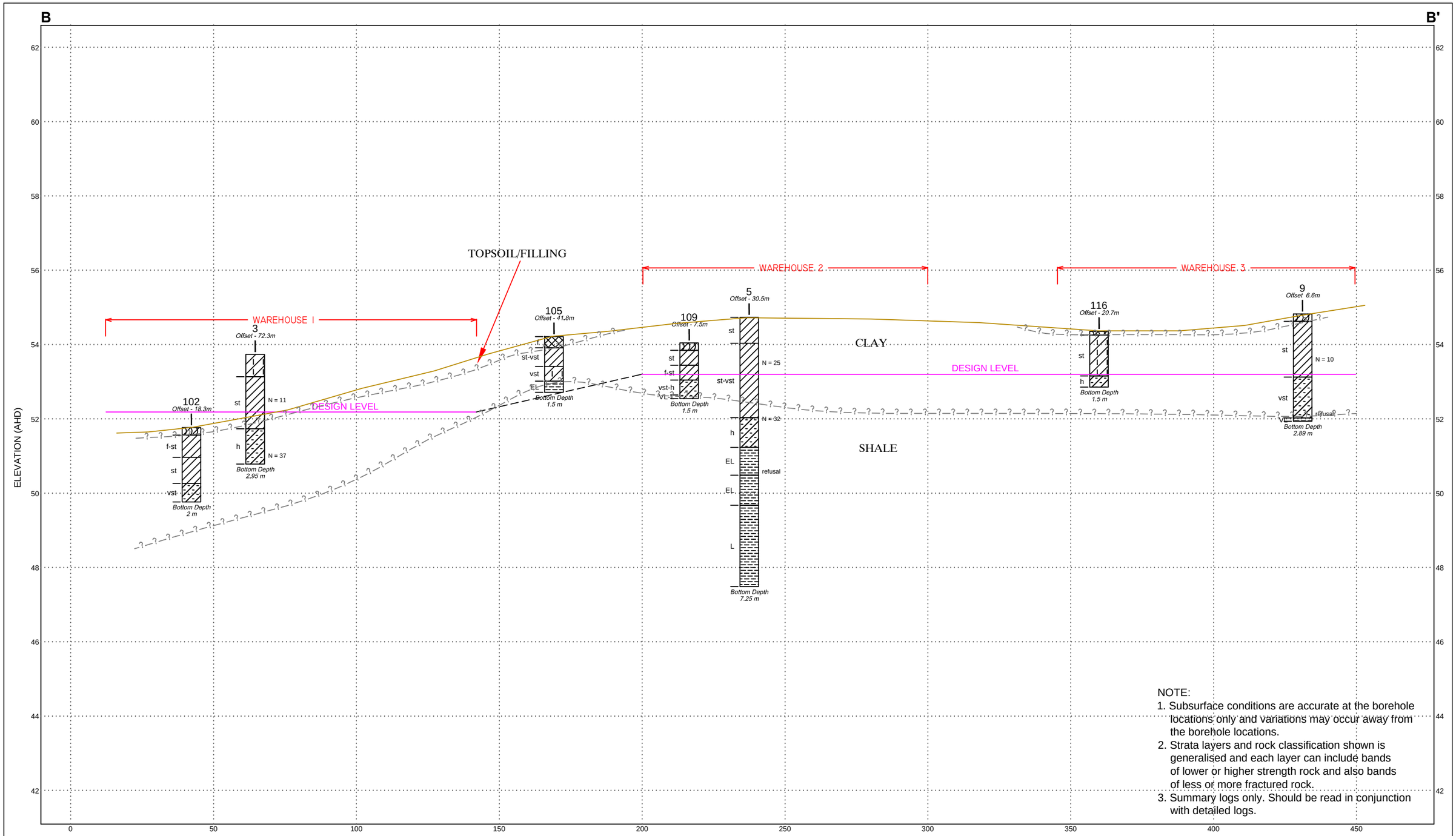
TESTS / OTHER
N - Standard penetration test value
- Water level

0 26
Horizontal Scale (metres)

Vertical Exaggeration = 13.0

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: MIRVAC		TITLE: **Geotechnical Cross-section A-A'**	PROJECT No: 84798
OFFICE: Sydney	DRAWN BY: GSY/LD	**Geotechnical Investigation & Salinity Assessment**	DRAWING No: 2
SCALE: 1:1300 (H) 1:100 (V) @ A3	DATE: 30.04.2015	**60 Wallgrove Road, Eastern Creek**	REVISION: 0



Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: MIRVAC		TITLE: **Geotechnical Cross-section B-B'**	PROJECT No: 84798
OFFICE: Sydney	DRAWN BY: GSY/LD	**Geotechnical Investigation & Salinity Assessment**	DRAWING No: 3
SCALE: 1:1300 (H) 1:100 (V) @ A3	DATE: 30.04.2015	**60 Wallgrove Road, Eastern Creek**	REVISION: 0

C

C'

ELEVATION (AHD)

62
60
58
56
54
52
50
48
46
44
42

WAREHOUSE 4

DESIGN LEVEL

TOPSOIL/FILLING

ROAD

CLAY

SHALE

1
Offset 89.0m
f-st
N = 6
vst
N = 17
EL
L
L-M,L
Bottom Depth 6.48 m

2
Offset - 5.1m
f-st
N = 8
vst
EL
refusal
Bottom Depth 2.59 m

111
Offset 4.2m
f-st
st
vst
EL-VL
Bottom Depth 2 m

105
Offset - 11.5m
st-vst
vst
EL
Bottom Depth 1.5 m

106
Offset 12.3m
f-st
st
vst
EL-VL
Bottom Depth 2 m

4
Offset 177.8m
st
h
N = 36
EL-VL
L-M,M
Bottom Depth 4.6 m

107
Offset 1.8m
f-st
st
vst-h
Bottom Depth 2 m

-50
0
50
100
150
200
250
300
350
400

DISTANCE ALONG PROFILE (m)

NOTE:
1. Subsurface conditions are accurate at the borehole locations only and variations may occur away from the borehole locations.
2. Strata layers and rock classification shown is generalised and each layer can include bands of lower or higher strength rock and also bands of less or more fractured rock.
3. Summary logs only. Should be read in conjunction with detailed logs.

LEGEND

- Topsoil
- Silty Clay
- Shaly Clay
- Shale
- Filling
- Clay

ROCK STRENGTH
EL - Extremely Low
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High

SOIL CONSISTENCY
vs - very soft
s - soft
f - firm
st - stiff
vst - very stiff
h - hard
vl - very loose
l - loose
md - medium dense
d - dense
vd - very dense

TESTS / OTHER
N - Standard penetration test value
- Water level

0 26
Horizontal Scale (metres)

Vertical Exaggeration = 13.0

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: MIRVAC		TITLE: **Geotechnical Cross-section C-C'**	PROJECT No: 84798
OFFICE: Sydney	DRAWN BY: GSY/LD	**Geotechnical Investigation & Salinity Assessment**	DRAWING No: 4
SCALE: 1:1300 (H) 1:100 (V) @ A3	DATE: 30.04.2015	**60 Wallgrove Road, Eastern Creek**	REVISION: 0

D

D'

WAREHOUSE 5

WAREHOUSE 3

TOPSOIL/FILLING

CLAY

SHALE

DESIGN LEVEL

7
Offset - 273.8m
f-st
st
vst
st
st-vst
vst
EL-VL
L-M
N = 11
N = 22
refusal
Bottom Depth 8.3 m

114
Offset - 2.2m
vst
st
vst-h
h
st-vst
vst
Bottom Depth 2.5 m

115
Offset 2.9m
st
st
st
VL
Bottom Depth 1.5 m

116
Offset 24.9m
st
h
Bottom Depth 1.5 m

6
Offset 7.2m
st
st
vst
vst
Bottom Depth 1.42 m

113
Offset 54.6m
st
st
vst
refusal
Bottom Depth 2.1 m

10
Offset - 17.9m
st
vst
EL-VL
VL
VL-L/L-M
N = 10
refusal
Bottom Depth 7.37 m

120
Offset 11.9m
st
st
vst
N = 10
Bottom Depth 2.1 m

ELEVATION (AHD)

62 60 58 56 54 52 50 48 46 44 42

0 50 100 150 200 250 300 350 400 450

DISTANCE ALONG PROFILE (m)

NOTE:
1. Subsurface conditions are accurate at the borehole locations only and variations may occur away from the borehole locations.
2. Strata layers and rock classification shown is generalised and each layer can include bands of lower or higher strength rock and also bands of less or more fractured rock.
3. Summary logs only. Should be read in conjunction with detailed logs.

LEGEND

- Topsoil
- Silty Clay
- Clay
- Shaly Clay
- Shale
- Filling

ROCK STRENGTH
EL - Extremely Low
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High

SOIL CONSISTENCY
vs - very soft
s - soft
f - firm
st - stiff
vst - very stiff
h - hard
vl - very loose
l - loose
md - medium dense
d - dense
vd - very dense

TESTS / OTHER
N - Standard penetration test value
▼ - Water level

0 26
Horizontal Scale (metres)

Vertical Exaggeration = 13.0

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: MIRVAC		TITLE: **Geotechnical Cross-section D-D'**	PROJECT No: 84798
OFFICE: Sydney	DRAWN BY: GSY/LD	**Geotechnical Investigation & Salinity Assessment**	DRAWING No: 5
SCALE: 1:1300 (H) 1:100 (V) @ A3	DATE: 30.04.2015	**60 Wallgrove Road, Eastern Creek**	REVISION: 0

Appendix C

Results of Field Work

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.

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

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

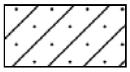
Soils


Topsoil

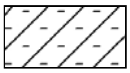

Peat


Clay

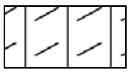

Silty clay

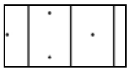

Sandy clay

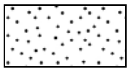

Gravelly clay

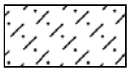

Shaly clay

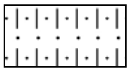

Silt


Clayey silt


Sandy silt

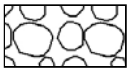

Sand

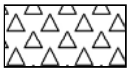

Clayey sand


Silty sand


Gravel


Sandy gravel


Cobbles, boulders

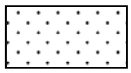

Talus

Sedimentary Rocks

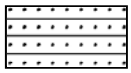

Boulder conglomerate

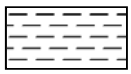

Conglomerate


Conglomeratic sandstone

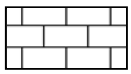

Sandstone


Siltstone


Laminite

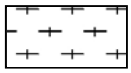

Mudstone, claystone, shale

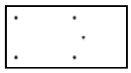

Coal


Limestone

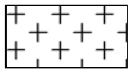
Metamorphic Rocks

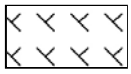

Slate, phyllite, schist

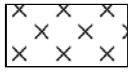

Gneiss

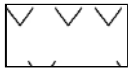

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

DOUGLAS PARTNERS PTY LTD

GEOTECHNICAL INVESTIGATION – EASTERN CREEK

BORE 1 PROJECT 84798 MAY 2015

3.4 – 6.4m

BOREHOLE LOG

CLIENT: MIRVAC
PROJECT: Geotechnical Investigation & Salinity Assessment
LOCATION: 60 Wallgrove Road, Eastern Creek

SURFACE LEVEL: 49.17 AHD
EASTING: 300872.5
NORTHING: 6258804.08
DIP/AZIMUTH: 90°/--

BORE No: 1
PROJECT No: 84798
DATE: 12/5/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
49	0.05	TOPSOIL - grey, silty clay topsoil with grass rootlets, moist							A			
		SILTY CLAY - apparently firm to stiff, light brown, silty clay, moist							A			
48	1								A			
									S			2,3,3 N = 6
47	2											
	2.1	SILTY CLAY - very stiff, mottled red-brown, silty clay with some ironstone gravel, moist to wet				▼		Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0°- 10°				
									S			2,7,10 N = 17
46	3											
	3.1	SHALE - extremely low strength, light grey-brown shale										
	3.4	SHALE - low strength, highly to moderately weathered, fractured, grey-brown, shale with some extremely low to very low strength bands						3.45m: J75°, pl, sm, cln 3.5-3.55m: Cs 3.6-3.8m: B's 0°, cly co, 1-5mm 3.85m: J50°, pl, sm, cln 3.94-3.97m: Cs 4.16m: B0°, fe, cly, 5mm 4.4-4.43m: Cs 4.49m: B0°, fe, cly, 10mm 4.63m: B0°, cly, 20mm	C	100	0	PL(A) = 0.2
45	4											
	4.7	SHALE - low to medium then low strength, slightly weathered, slightly fractured, light grey-brown shale						5m: J45°, pl, sm, cln 5.22m: J30°- 45°, cu, sm, cly, 20mm 5.47 & 5.67m: J35° & 45°, pl, sm, fe				PL(A) = 0.3
44	5								C	100	98	PL(A) = 0.3
43	6											PL(A) = 0.2
	6.48	Bore discontinued at 6.48m										
42	7											
41	8											
40	9											

RIG: Scout **DRILLER:** SS **LOGGED:** SI **CASING:** HW to 3.4m

TYPE OF BORING: Solid flight auger to 3.4m; NMLC-Coring to 6.48m

WATER OBSERVATIONS: Free groundwater observed at 2.2m whlst augering

REMARKS:

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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BOREHOLE LOG

CLIENT: MIRVAC
PROJECT: Geotechnical Investigation & Salinity Assessment
LOCATION: 60 Wallgrove Road, Eastern Creek

SURFACE LEVEL: 49.15 AHD
EASTING: 300946.87
NORTHING: 6258732.44
DIP/AZIMUTH: 90°/--

BORE No: 2
PROJECT No: 84798
DATE: 20/4/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
49	0.2	TOPSOIL - grey, silty clay topsoil with grass roots, moist		A	0.1				
		SILTY CLAY - grey-brown, silty clay, moist		A	0.5				
	0.7	SILTY CLAY - firm to stiff, light grey and yellow-brown, silty clay with a trace of fine sand, moist		A	1.0				
48	1			S	1.45		2,3,5 N = 8		1
	1.8	SHALY CLAY - apparently very stiff, light grey-brown, shaly clay with ironstone bands, moist							
47	2								2
	2.5			S	2.5		25/90mm refusal		
	2.59	SHALE - extremely low strength, light grey to grey shale			2.59				
		Bore discontinued at 2.59m							
46	3								3
45	4								4
44	5								5
43	6								6
42	7								7
41	8								8
40	9								9

RIG: DT 100 **DRILLER:** SM **LOGGED:** SI **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 2.5m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

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

BOREHOLE LOG

CLIENT: MIRVAC
PROJECT: Geotechnical Investigation & Salinity Assessment
LOCATION: 60 Wallgrove Road, Eastern Creek

SURFACE LEVEL: 53.74 AHD
EASTING: 301108.04
NORTHING: 6258777.03
DIP/AZIMUTH: 90°/--

BORE No: 3
PROJECT No: 84798
DATE: 20/4/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
53	0.0	SILTY CLAY - brown, silty clay with some grass roots, moist		A	0.1				
				A	0.5				
	0.6	CLAY - stiff, brown clay, slightly silty with a trace of ironstone gravel, damp to moist		A	1.0				
52	1			S	1.45		4,5,6 N = 11		
	2.0	SHALY CLAY - hard, light grey and red-brown, shaly clay with ironstone bands, damp		S	2.5		7,13,24 N = 37		
51	2.95	Bore discontinued at 2.95m			2.95				
50	3								
49	4								
48	5								
47	6								
46	7								
45	8								
44	9								

RIG: DT 100 **DRILLER:** SM **LOGGED:** SI **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 2.5m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

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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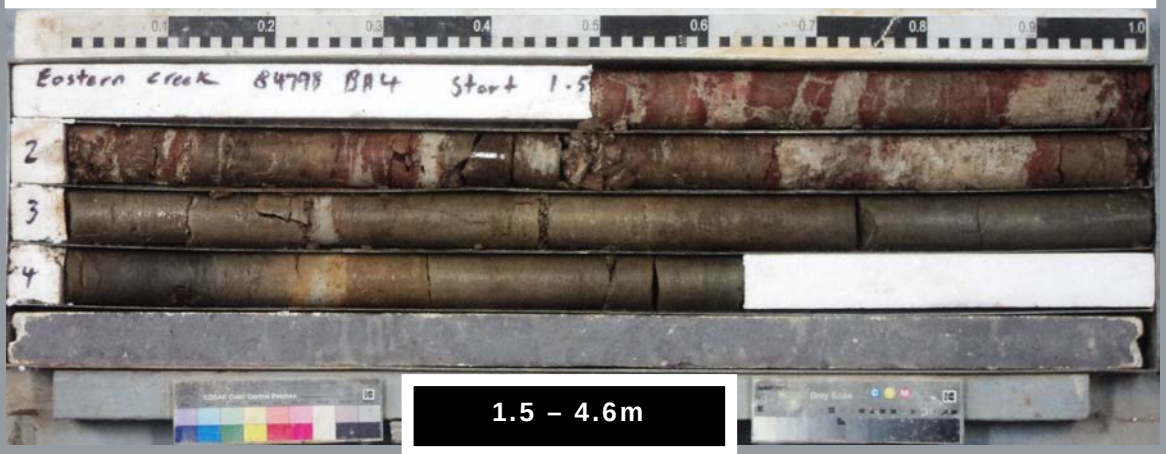
GEOTECHNICAL INVESTIGATION – EASTERN CREEK

BORE 4 PROJECT 84798 MAY 2015



1.5 – 4.6m

BOREHOLE LOG

CLIENT: MIRVAC
PROJECT: Geotechnical Investigation & Salinity Assessment
LOCATION: 60 Wallgrove Road, Eastern Creek

SURFACE LEVEL: 50.81 AHD
EASTING: 301270.11
NORTHING: 6258750.83
DIP/AZIMUTH: 90°/--

BORE No: 4
PROJECT No: 84798
DATE: 13/5/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
			EW HW MW SW FS FR		Ex Low / Very Low / Low / Medium / High / Very High / Ex High		0.01 / 0.05 / 0.10 / 0.50 / 1.00	B - Bedding J - Joint S - Shear F - Fault				
50	0.3	TOPSOIL - grey-brown, silty clay topsoil with some grass roots, moist							A			
		CLAY - apparently stiff, red-brown clay, moist						Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0°- 10°	A			
1	1.0	SHALY CLAY - hard, mottled red, light brown, shaly clay, damp							A S			5,14,22 N = 36
	1.5	SHALE - extremely low and very low strength, extremely and highly weathered, fractured and slightly fractured, light brown to red-brown, shale with medium and high strength ironstone bands							C	100	0	PL(A) = 2.1
49								2.1-2.32m: fg, cly 2.32-2.34m: Cs 2.37m: J35°, pl, ro, cly 2.45m: B0°, cly co 2.55m: J45°, pl, ro, cly 2.65-2.9m: Cs				
2												
48	2.9	SHALE - low to medium and medium strength, moderately weathered, slightly fractured, grey-brown shale						3.05m: J45°- 55°, cu, ro, fe 3.16m: J80°, un, ro, cln 3.23m: B0°, cly, 10mm 3.3-3.45m: J60° & 75°, st, ro, fe 3.86-4.05m: J75°, pl, ro, fe 4.2-4.25m: Cs	C	100	80	PL(A) = 0.4 PL(A) = 0.3
3												
47												
4	4.6	Bore discontinued at 4.6m										
46												
5												
45												
6												
44												
7												
43												
8												
42												
9												
41												

RIG: Scout 1 **DRILLER:** SS **LOGGED:** SI **CASING:** HW to 1.0m

TYPE OF BORING: Solid flight auger to 1.0m; Rotary to 1.5m; NMLC-Coring to 4.6m

WATER OBSERVATIONS:

REMARKS:

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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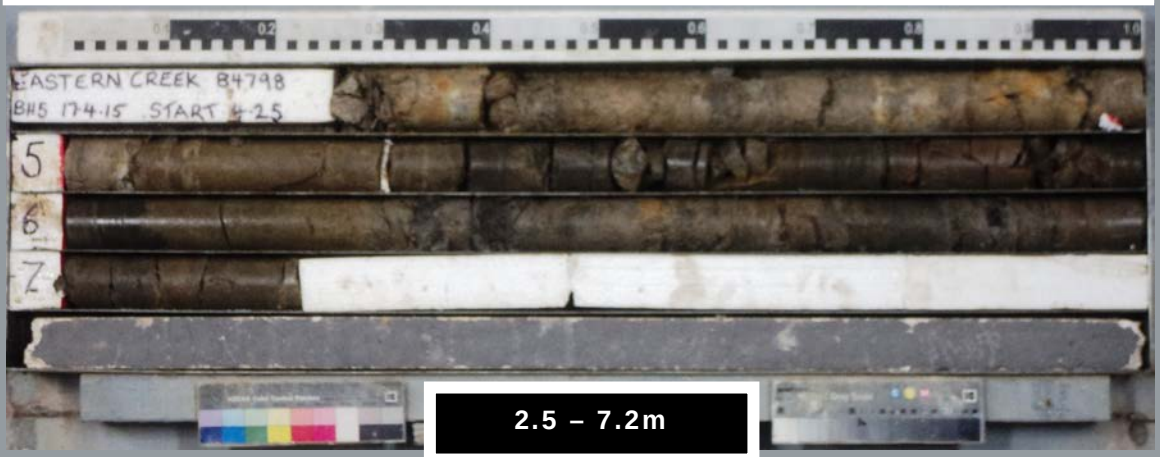
GEOTECHNICAL INVESTIGATION – EASTERN CREEK

BORE 5 PROJECT 84798 MAY 2015



2.5 – 7.2m

BOREHOLE LOG

CLIENT: MIRVAC
PROJECT: Geotechnical Investigation & Salinity Assessment
LOCATION: 60 Wallgrove Road, Eastern Creek

SURFACE LEVEL: 54.74 AHD
EASTING: 301089.19
NORTHING: 6258600.16
DIP/AZIMUTH: 90°/--

BORE No: 5
PROJECT No: 84798
DATE: 21/4/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
54	0.7	CLAY - apparently stiff, red-brown clay, slightly silty, with a trace of fine ironstone gravel, moist							A			
									A			
		CLAY - stiff then very stiff, light grey and mottled red-brown clay, moist							A			
53	1	1.0m: becoming very stiff							S			4,7,18 N = 25
	2											
52	2.7	SHALY CLAY - hard, light grey and mottled brown, shaly clay with ironstone bands							S			7,11,21 N = 32
	3											
51	3.5	SHALE - extremely low strength, grey shale						Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0°- 15°	S			25/150mm refusal
	4											
50	4.25	SHALE - extremely low strength, extremely weathered, grey and orange shale with some medium strength ironstone bands						4.43m: J90°, cu, ro	C	100	17	PL(A) = 0.2
	5							5.12m: J90°, pl, ro				PL(A) = 0.2
	5.06	SHALE - low strength, highly and moderately weathered, fractured and slightly fractured, grey shale with some medium strength ironstone bands						5.53m: J70°, pl, ro 5.6m: J90°, cu, ro 5.76m: J30°, st, ro 5.8m: J80°, pl, ro				
49	6							6.15m: J20°, pl, ro 6.3m: J30°, un, ro	C	100	46	PL(A) = 0.3
48	7							6.67m: J80°, un, ro				PL(A) = 0.2
	7.25	Bore discontinued at 7.25m						7.13m: J20°, pl, ro				
47	8											
46	9											
45												

RIG: DT 100 **DRILLER:** SM **LOGGED:** IW/SI **CASING:** HW to 4.0m

TYPE OF BORING: Solid flight auger to 4.0m; Rotary to 4.25m; NMLC-Coring to 7.25m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

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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BOREHOLE LOG

CLIENT: MIRVAC
PROJECT: Geotechnical Investigation & Salinity Assessment
LOCATION: 60 Wallgrove Road, Eastern Creek

SURFACE LEVEL: 49.53 AHD
EASTING: 301243.51
NORTHING: 6258578.65
DIP/AZIMUTH: 90°/--

BORE No: 6
PROJECT No: 84798
DATE: 13/5/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
49	0	CLAY - apparently stiff, red-brown clay, moist		A	0.1				
				A	0.5				
	1			A	1.0				1
	1.1	SHALY CLAY - very stiff, mottled brown light grey, shaly clay, moist		S			3,11,25/120mm refusal		
	1.4								
48	1.42	SHALE - extremely low strength, light grey-brown shale			1.42				
		Bore discontinued at 1.42m							
	2								2
47									
	3								3
46									
	4								4
45									
	5								5
44									
	6								6
43									
	7								7
42									
	8								8
41									
	9								9
40									

RIG: Scout 1 **DRILLER:** SS **LOGGED:** SI **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 1.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

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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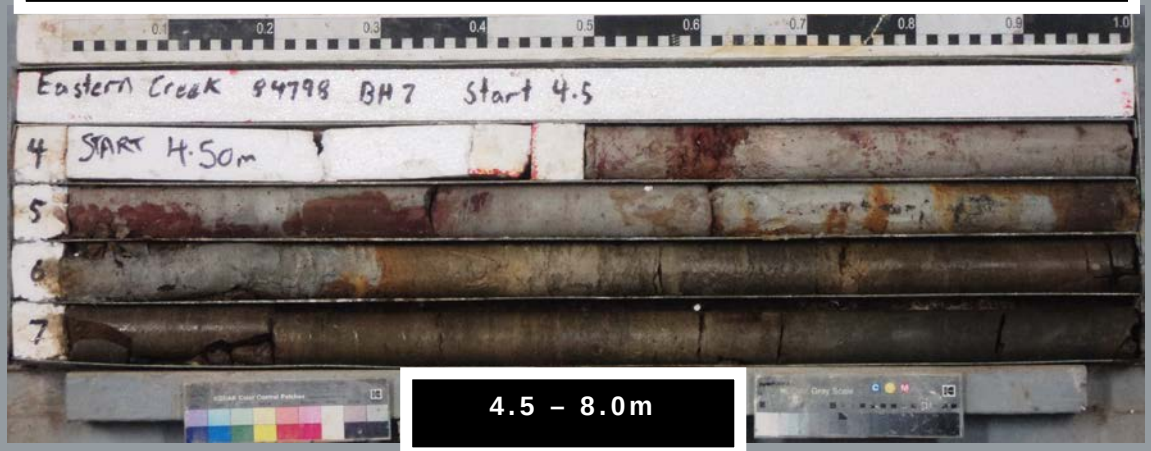
GEOTECHNICAL INVESTIGATION – EASTERN CREEK

BORE 7 PROJECT 84798 MAY 2015

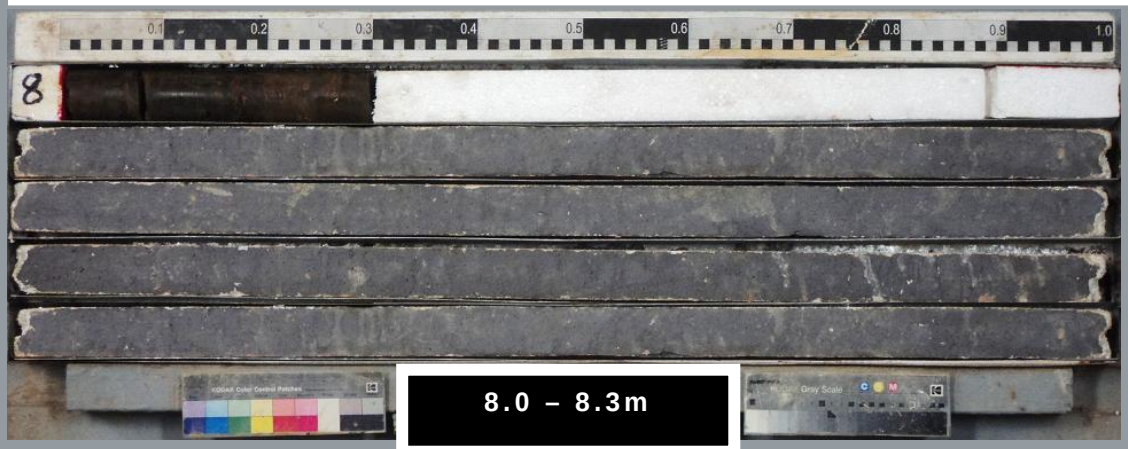


4.5 – 8.0m

DOUGLAS PARTNERS PTY LTD

GEOTECHNICAL INVESTIGATION – EASTERN CREEK

BORE 7 PROJECT 84798 MAY 2015



8.0 – 8.3m

BOREHOLE LOG

CLIENT: MIRVAC
PROJECT: Geotechnical Investigation & Salinity Assessment
LOCATION: 60 Wallgrove Road, Eastern Creek

SURFACE LEVEL: 58.58 AHD
EASTING: 300815.09
NORTHING: 6258438.4
DIP/AZIMUTH: 90°/--

BORE No: 7
PROJECT No: 84798
DATE: 12/5/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
58	0.0	CLAY - apparently firm to stiff, light brown and red-brown clay, moist							A			
	0.6	CLAY - stiff, red-brown clay, moist							A			
57	1								A			
									S			3,5,6 N = 11
56	2	2.5m: becoming very stiff							S			8,11,11 N = 22
55	3											
	3.3	SILTY CLAY - very stiff to hard, light brown, silty clay with ironstone gravel, moist						Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0°- 10°				
	4.1	SHALY CLAY - hard, light grey and red-brown, shaly clay, damp (possible extremely low strength shale)							S			5,20,25/110mm refusal
54	4.5	CLAY - very stiff, light grey-brown, clay with some ironstone bands						4.5-6.3m: EW/HW	C	100	0	pp = 420 pp = 400
53	5											
	5.9	SHALE - extremely low then very low strength, extremely to highly weathered, light grey and brown shale										pp = 500
52	6.5	SHALE - low then medium strength, moderately then slightly weathered, slightly fractured, grey-brown shale						6.63m: J40°, pl, sm, fe 6.73m: B0°, fe, cly, 10mm 6.9-7.1m: J80°- 90°, cu, ro, fe 7.12m: J80°, un, ro, fe 7.27m: J45°- 70°, cu, sm, fe 7.6m: J75 , un, ro, fe 7.75m: J30°- 50°, cu, sm, cln	C	100	65	PL(A) = 0.2 PL(A) = 0.6 PL(A) = 0.5 PL(A) = 0.4
51	7											
	8											
	8.3	Bore discontinued at 8.3m										
50	9											
49												

RIG: Scout 1 **DRILLER:** SS **LOGGED:** SI **CASING:** HW to 4.0m

TYPE OF BORING: Solid flight auger to 4.0m; Rotary to 4.5m; NMLC-Coring to 8.3m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

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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BOREHOLE LOG

CLIENT: MIRVAC
PROJECT: Geotechnical Investigation & Salinity Assessment
LOCATION: 60 Wallgrove Road, Eastern Creek

SURFACE LEVEL: 51.82 AHD
EASTING: 300908.18
NORTHING: 6258621.35
DIP/AZIMUTH: 90°/--

BORE No: 8
PROJECT No: 84798
DATE: 17/4/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
51	0.3	TOPSOIL - grey, sandy silty clay topsoil with some grass roots, moist		A	0.1				
		SILTY CLAY - apparently firm, brown, silty clay with a trace of plant roots, moist		A	0.5				
	0.8	CLAY - firm to stiff, light grey-brown, clay with a trace of ironstone gravel, moist		A	1.0				
				S	1.45		1,3,4 N = 7		
50	2.0	SHALE - extremely low to very low strength, grey-brown shale with ironstone bands							
				S	2.5		9,20,25/130mm refusal		
49	2.93	Bore discontinued at 2.93m			2.93				
48									
47									
46									
45									
44									
43									
42									

RIG: DT 100 **DRILLER:** SM **LOGGED:** SI **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 2.5m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

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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BOREHOLE LOG

CLIENT: MIRVAC
PROJECT: Geotechnical Investigation & Salinity Assessment
LOCATION: 60 Wallgrove Road, Eastern Creek

SURFACE LEVEL: 54.83 AHD
EASTING: 301058.9
NORTHING: 6258405.3
DIP/AZIMUTH: 90°/--

BORE No: 9
PROJECT No: 84798
DATE: 16/4/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
54	0.2	TOPSOIL - grey-brown, silty clay topsoil with a trace of fine sand and grass roots, moist		A	0.1				
		CLAY - stiff, orange-brown clay, slightly silty with a trace of ironstone gravel, moist		A	0.5				
	1			A	1.0				
				S			3,4,6 N = 10		
					1.45				
53	1.7	SHALY CLAY - very stiff, light grey and red-brown, shaly clay with ironstone bands							
	2								
					2.5				
				S			7,16,25/90mm refusal		
52	2.8								
	2.89	SHALE - very low strength, light grey and red-brown shale			2.89				
	3	Bore discontinued at 2.89m							
51	4								
50	5								
49	6								
48	7								
47	8								
46	9								
45									

RIG: DT 100 **DRILLER:** SM **LOGGED:** SI **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 2.5m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

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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GEOTECHNICAL INVESTIGATION – EASTERN CREEK

BORE 10 PROJECT 84798 MAY 2015

4.25 – 7.37m

BOREHOLE LOG

CLIENT: MIRVAC
PROJECT: Geotechnical Investigation & Salinity Assessment
LOCATION: 60 Wallgrove Road, Eastern Creek

SURFACE LEVEL: 51.18 AHD
EASTING: 301218.15
NORTHING: 6258409.85
DIP/AZIMUTH: 90°/--

BORE No: 10
PROJECT No: 84798
DATE: 16/4/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
			EW HW MW SW FS FR		Ex Low / Very Low / Low / Medium / High / Very High / Ex High		0.01 / 0.05 / 0.10 / 0.50 / 1.00	B - Bedding J - Joint S - Shear F - Fault				
51	0.2	TOPSOIL - grey-brown, silty clay topsoil with some grass rootlets, moist							A			
	0.5	SILTY CLAY - grey-brown, silty clay with a trace of sand and fine ironstone gravel, moist							A			
50	1	CLAY - stiff, red-brown then mottled brown light grey clay with a trace of ironstone gravel, moist							A S			3,4,6 N = 10
49	2											
	2.0	SHALY CLAY - very stiff, light grey and brown, shaly clay with ironstone bands, damp							S			8,9,12 N = 21
	2.8	SHALE - extremely low to very low strength, grey-brown shale						Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0°- 10°				
48	3											
47	4								S			11,25/60mm refusal
	4.25	SHALE - very low strength, highly weathered, slightly fractured, grey-brown shale						4.48m: B0°, fe, cly, 10mm 4.8m: J80°, pl, ro, cln	C	100	27	PL(A) = 0.1
	5.0	SHALE - very low to low and low to medium strength, slightly weathered, slightly fractured, light grey to grey-brown shale						5.06m: J45°, un, ro, fe 5.2m: B0°, cly 5.38-5.42m: cly 5.61m: B10°, fe, cly co 5.75m: J65°, un, ro, cly				PL(A) = 0.3
46	5											
45	6							6.2m: B10°, cly co 6.55m: J60°, pl, ro, cln 6.65m: J65°- 70°, cu, ro, cln	C	100	30	PL(A) = 0.15
44	7							7.1 & 7.26m: B0°, cly co, 2-5mm	C	100	54	
	7.37	Bore discontinued at 7.37m										PL(A) = 0.3
43	8											
42	9											

RIG: DT 100 **DRILLER:** SM **LOGGED:** SI **CASING:** HW to 4.25m

TYPE OF BORING: Solid flight auger to 4.0m; Rotary to 4.25m; NMLC-Coring to 7.37m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

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: MIRVAC
PROJECT: Geotechnical Investigation & Salinity Assessment
LOCATION: 60 Wallgrove Road, Eastern Creek

SURFACE LEVEL: 48.91 AHD
EASTING: 300988.41
NORTHING: 6258781.45

PIT No: 101
PROJECT No: 84798
DATE: 16/4/2015
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)
48	0.6	SILTY CLAY - soft to firm, grey, silty clay with a trace of gravel and grass root at top, moist		A	0.2				
				A	0.5				
	1	SILTY CLAY - soft to firm to stiff, light brown, silty clay with a trace of fine sand, moist		A	1.0				1
	1.4	GRAVELLY SILTY CLAY - grey-brown, gravelly (ironstone) silty clay, moist to wet		A	1.5			▼	
47	1.9	- wet at 1.7m							
	2	SHALE - extremely low to very low strength shale with medium strength bands		A	2.0				2
	2.1	Pit discontinued at 2.1m							
46	3								3
45	4								4
44									

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

RIG: Backhoe
LOGGED: SI
SURVEY DATUM: MGA94

WATER OBSERVATIONS: Free groundwater observed at 1.7m

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: MIRVAC
PROJECT: Geotechnical Investigation & Salinity Assessment
LOCATION: 60 Wallgrove Road, Eastern Creek

SURFACE LEVEL: 51.77 AHD
EASTING: 301166.38
NORTHING: 6258779.86

PIT No: 102
PROJECT No: 84798
DATE: 16/4/2015
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)
51	0.2	TOPSOIL - light grey to grey, silty clay topsoil with some grass/grass roots, moist							
		CLAY - apparently firm to stiff, red-brown then mottled brown-light grey, clay with a trace of ironstone gravel, moist		A	0.2				
				A	0.5				
	0.8	CLAY - apparently stiff, light grey and mottled orange-brown, clay with some ironstone gravel, moist							
	1			A	1.0				1
	1.5	SHALY CLAY - apparently very stiff, light grey and red-brown, shaly clay with some ironcemented shale bands, damp		A	1.5				
50	2								2
	2.0	Pit discontinued at 2.0m		A	2.0				
49	3								3
48	4								4
47									

RIG: Backhoe

LOGGED: SI

SURVEY DATUM: MGA94

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: MIRVAC
PROJECT: Geotechnical Investigation & Salinity Assessment
LOCATION: 60 Wallgrove Road, Eastern Creek

SURFACE LEVEL: 51.12 AHD
EASTING: 300836.09
NORTHING: 6258689.9

PIT No: 103
PROJECT No: 84798
DATE: 16/4/2015
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)
51	0.2	TOPSOIL - firm, light grey, silty clay topsoil with some grass rootlets, moist							
		SILTY CLAY - firm to stiff, light grey-brown, silty clay with a trace of ironstone gravel, moist		A	0.2				
				A	0.5				
50	1.0	SILTY SANDY CLAY - stiff, light grey mottled brown, silty clay with some fine sand and ironstone gravel, moist to wet		A	1.0				
				A	1.5				
	2.0	Pit discontinued at 2.0m		A	2.0				
49									
48									
47									

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

RIG: Backhoe
LOGGED: SI
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed (1.5m wet sample)

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: MIRVAC
PROJECT: Geotechnical Investigation & Salinity Assessment
LOCATION: 60 Wallgrove Road, Eastern Creek

SURFACE LEVEL: 49.77 AHD
EASTING: 300922.7
NORTHING: 6258695.73

PIT No: 104
PROJECT No: 84798
DATE: 16/4/2015
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)
49	0.2	TOPSOIL - firm, grey, silty clay topsoil with some grass and grass rootlets, moist		A	0.2				
		SILTY CLAY - stiff, light grey-brown, silty clay with a trace of fine sand, moist		B					
				A	0.5				
	1.0			A	1.0				
48		GRAVELLY SILTY CLAY - firm to stiff, light brown to red-brown, gravelly (ironstone) silty clay with some fine sand, moist to wet		A	1.5				
	1.9								
		SHALY CLAY - apparently hard, grey-brown, shaly clay with ironcemented bands, moist		A	2.0				
	2.1	Pit discontinued at 2.1m							
47									
46									
45									

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

RIG: Backhoe

LOGGED: SI

SURVEY DATUM: MGA94

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: MIRVAC
PROJECT: Geotechnical Investigation & Salinity Assessment
LOCATION: 60 Wallgrove Road, Eastern Creek

SURFACE LEVEL: 54.22 AHD
EASTING: 301101.57
NORTHING: 6258668.28

PIT No: 105
PROJECT No: 84798
DATE: 16/4/2015
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)
54	0.3	FILLING - firm, light grey-brown, silty clay filling with some ironstone gravel, moist		A	0.2				
		CLAY - stiff to very stiff, red-brown clay, moist		A	0.5		pp = 300		
	0.8	SILTY CLAY - very stiff, yellow-brown, silty clay with some ironstone gravel, moist		A	1.0				
53	1.2	SHALE - extremely low strength, light grey, shale with low to medium strength ironcemented bands							
	1.5	Pit discontinued at 1.5m		A	1.5				
52	2								
51	3								
50	4								

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

RIG: Backhoe
LOGGED: SI
SURVEY DATUM: MGA94

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: MIRVAC
PROJECT: Geotechnical Investigation & Salinity Assessment
LOCATION: 60 Wallgrove Road, Eastern Creek

SURFACE LEVEL: 52.15 AHD
EASTING: 301185.77
NORTHING: 6258662.49

PIT No: 106
PROJECT No: 84798
DATE: 16/4/2015
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)
52	0.1	TOPSOIL - firm, grey-brown, silty clay topsoil with some grass/grass rootlets							
		CLAY - firm to stiff, red-brown clay, slightly silty, with some fine ironstone gravel, moist		A	0.2				
				A	0.5				
	0.6	CLAY - stiff, light grey and mottled brown, clay with a trace of ironstone gravel, moist							
51	1 1.0	SHALY CLAY - very stiff, light grey, shaly clay with ironstone bands, damp		A	1.0				1
				A	1.5				
	1.8	SHALE - extremely low to very low strength, light grey-brown, shale with ironcemented bands							
50	2 2.0	Pit discontinued at 2.0m							2
49	3								3
48	4								4

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

RIG: Backhoe
LOGGED: SI
SURVEY DATUM: MGA94

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: MIRVAC
PROJECT: Geotechnical Investigation & Salinity Assessment
LOCATION: 60 Wallgrove Road, Eastern Creek

SURFACE LEVEL: 49.11 AHD
EASTING: 301275.9
NORTHING: 6258617.84

PIT No: 107
PROJECT No: 84798
DATE: 16/4/2015
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)
49	0.3	FILLING - light grey-brown, silty clay filling with some grass/grass rootlets, damp		A	0.2				
		CLAY - firm to stiff, red-brown clay with some dry grass rootlets, moist		A	0.5				
	0.8	CLAY - stiff, light grey and mottled brown clay with some ironstone gravel, moist		A	1.0				
48	1								1
	1.5	SHALY CLAY - apparently very stiff to hard, light grey, shaly clay with some brown low and low to medium strength ironcemented bands		A	1.5				
		2.0m: becoming shale							
	2 2.0	Pit discontinued at 2.0m		A	2.0				2
47									
	3								3
46									
	4								4
45									

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

RIG: Backhoe
LOGGED: SI
SURVEY DATUM: MGA94

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: MIRVAC
PROJECT: Geotechnical Investigation & Salinity Assessment
LOCATION: 60 Wallgrove Road, Eastern Creek

SURFACE LEVEL: 51.97 AHD
EASTING: 300822.01
NORTHING: 6258612.22

PIT No: 108
PROJECT No: 84798
DATE: 16/4/2015
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)
51	0.2	TOPSOIL - firm, grey-brown, silty clay topsoil with some grass rootlets, moist							
		SILTY CLAY - firm to stiff, red-brown, silty clay with fine ironstone gravel, moist		A	0.2				
				A	0.5				
	1.0			A	1.0				
		SILTY CLAY - stiff, light grey and mottled brown, silty clay with some fine sand and a trace of ironstone gravel, moist to wet		A	1.5				
	1.8								
50	2.0	SANDY CLAY - apparently stiff, light grey and brown, fine sandy clay with some ironstone gravel and decomposed organic matter, wet		A	2.0				
		Pit discontinued at 2.0m							
49									
48									

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

RIG: Backhoe

LOGGED: SI

SURVEY DATUM: MGA94

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: MIRVAC
PROJECT: Geotechnical Investigation & Salinity Assessment
LOCATION: 60 Wallgrove Road, Eastern Creek

SURFACE LEVEL: 54.05 AHD
EASTING: 301117.89
NORTHING: 6258612.19

PIT No: 109
PROJECT No: 84798
DATE: 16/4/2015
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)
54	0.2	TOPSOIL - light brown to red-brown, silty clay topsoil with grass/grass roots, moist		A	0.2				
		CLAY - stiff, light grey mottled brown clay, slightly silty with some ironstone gravel, damp (possible filling)		B					
	0.6			A	0.5				
		CLAY - firm to stiff, red-brown clay with a trace of ironstone gravel, moist							
53	1.0	SHALY CLAY - very stiff to hard, light grey, shaly clay with ironcemented bands, damp		A	1.0				
		1.4m: becoming very low to low strength shale							
	1.5	Pit discontinued at 1.5m		A	1.5				
52	2								
51	3								
50	4								

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

RIG: Backhoe
LOGGED: SI
SURVEY DATUM: MGA94

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: MIRVAC
PROJECT: Geotechnical Investigation & Salinity Assessment
LOCATION: 60 Wallgrove Road, Eastern Creek

SURFACE LEVEL: 53.51 AHD
EASTING: 300886.01
NORTHING: 6258545.48

PIT No: 110
PROJECT No: 84798
DATE: 16/4/2015
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)
53	0.25	TOPSOIL - grey, silty clay topsoil with grass and grass roots, moist		A	0.2				
		CLAY - stiff, red-brown clay with some ironstone gravel, moist		A	0.5				
52	1.0	CLAY - firm to stiff, light grey and mottled red-brown clay, slightly silty, moist		A	1.0		pp = 150		
				A	1.5		pp = 120		
	1.7	SHALY CLAY - apparently hard, light grey and red-brown, shaly clay with medium strength ironcemented bands		A	1.8				
51	2.0	1.9m: becoming shale Pit discontinued at 2.0m			2.0				
50									
49									

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

RIG: Backhoe
LOGGED: SI
SURVEY DATUM: MGA94

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: MIRVAC
PROJECT: Geotechnical Investigation & Salinity Assessment
LOCATION: 60 Wallgrove Road, Eastern Creek

SURFACE LEVEL: 51.69 AHD
EASTING: 301027.33
NORTHING: 6258712.5

PIT No: 111
PROJECT No: 84798
DATE: 16/4/2015
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)
51	0.2	TOPSOIL - grey, silty clay topsoil with some grass and grass rootlets, moist							
		CLAY - firm to stiff, red-brown clay, moist		A	0.2				
				A	0.5				
	1.0	CLAY - stiff, light grey and mottled red-brown clay, slightly silty with some ironstone gravel, moist		A	1.0				
50	1.5	SHALY CLAY - apparently very stiff, light grey and red-brown, shaly clay with some ironcemented bands, damp		A	1.5				
	1.9	SHALE - extremely low to very low strength, grey-brown shale with some ironcemented bands		A	2.0				
	2.0	Pit discontinued at 2.0m							
49									
48									
47									

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

RIG: Backhoe

LOGGED: SI

SURVEY DATUM: MGA94

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: MIRVAC
PROJECT: Geotechnical Investigation & Salinity Assessment
LOCATION: 60 Wallgrove Road, Eastern Creek

SURFACE LEVEL: 50.01 AHD
EASTING: 301193.3
NORTHING: 6258487.89

PIT No: 113
PROJECT No: 84798
DATE: 16/4/2015
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)
50	0.1	TOPSOIL - grey-brown, silty clay topsoil with grass/grass rootlets, damp							
		CLAY - stiff, light grey and red-brown clay with some ironstone gravel and a trace of organic matter, damp		A	0.2				
				A	0.5				
	0.8	CLAY - stiff, red-brown clay with a trace of ironstone gravel, moist							
49	1			A	1.0				1
	1.4	SILTY CLAY - apparently stiff, light grey and mottled brown, silty clay, moist		A	1.5				
	1.9	SHALY CLAY - apparently very stiff, light grey and red-brown, shaly clay with low to medium strength ironcemented bands, damp		A	2.0				
48	2								2
	2.1	Pit discontinued at 2.1m							
47	3								3
46	4								4

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

RIG: Backhoe

LOGGED: SI

SURVEY DATUM: MGA94

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: MIRVAC
PROJECT: Geotechnical Investigation & Salinity Assessment
LOCATION: 60 Wallgrove Road, Eastern Creek

SURFACE LEVEL: 56.14 AHD
EASTING: 300821.84
NORTHING: 6258495.36

PIT No: 114
PROJECT No: 84798
DATE: 16/4/2015
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)
56	0.0	FILLING - apparently moderately compacted, light grey-brown, silty clay filling with some roadbase gravel, plastic pipe fragments, wet		A	0.2				
				A	0.5				
	0.8	CLAY - stiff, light grey and mottled brown, clay with some dry grass rootlets, damp		A	1.0				
55	1								1
				A	1.5				
	1.7	CLAY - apparently stiff to very stiff, red-brown clay, moist							
54	2			A	2.0				2
	2.3	SHALY CLAY - apparently very stiff, light grey and brown, shaly clay with a trace of ironstone gravel, moist							
	2.5	Pit discontinued at 2.5m		A	2.5				
53	3								3
52	4								4

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

RIG: Backhoe

LOGGED: SI

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Reworked clay at the slope of damp

☐ 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: MIRVAC
PROJECT: Geotechnical Investigation & Salinity Assessment
LOCATION: 60 Wallgrove Road, Eastern Creek

SURFACE LEVEL: 56.55 AHD
EASTING: 300889.84
NORTHING: 6258488.6

PIT No: 115
PROJECT No: 84798
DATE: 16/4/2015
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)
56	0.3	FILLING - light grey to grey-brown, silty clay filling with a trace of shale fragments		A	0.2				
	0.8	CLAY - stiff, red-brown clay with a trace of ironstone gravel and dry grass roots, humid to damp (possible filling)		A	0.5				
	1	CLAY - stiff, light brown clay, slightly silty with ironstone gravel, damp		A	1.0				
	1.2	SHALE - very low strength, light grey-brown, shale with some low and medium strength bands							
55	1.5	Pit discontinued at 1.5m		A	1.5				
54	2								
53	3								
52	4								

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

RIG: Backhoe
LOGGED: SI
SURVEY DATUM: MGA94

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: MIRVAC
PROJECT: Geotechnical Investigation & Salinity Assessment
LOCATION: 60 Wallgrove Road, Eastern Creek

SURFACE LEVEL: 54.36 AHD
EASTING: 301057.15
NORTHING: 6258481.58

PIT No: 116
PROJECT No: 84798
DATE: 16/4/2015
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)
54	0.1	TOPSOIL - brown, silty clay topsoil with grass roots, damp							
		SILTY CLAY - stiff, mottled brown, light grey, silty clay with some ironstone gravel, moist		A	0.2				
				B					
				A	0.5				
	1								1
				A	1.0				
53	1.2	SHALY CLAY - hard, light grey and red-brown, shaly clay with ironcemented bands, damp							
	1.5	Pit discontinued at 1.5m		A	1.5				
	2								2
52									
	3								3
51									
	4								4
50									

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

RIG: Backhoe

LOGGED: SI

SURVEY DATUM: MGA94

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: MIRVAC
PROJECT: Geotechnical Investigation & Salinity Assessment
LOCATION: 60 Wallgrove Road, Eastern Creek

SURFACE LEVEL: 59.70 AHD
EASTING: 300907.33
NORTHING: 6258416.39

PIT No: 117
PROJECT No: 84798
DATE: 16/4/2015
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)
59.70	0.0	FILLING - brown, coarse sand filling with some roadbase gravel and geofabric		A	0.2				
	0.3	CLAY - stiff to very stiff, light grey and mottled brown clay, moist		A	0.5		pp = 310		
59	0.8	CLAY - very stiff, red-brown clay with a trace of ironstone gravel, moist		A	1.0		pp = 420		
	1			A	1.5		pp = 450		
58	1.8	SHALY CLAY - apparently very stiff to hard, light grey and brown, shaly clay with low to medium strength ironstone bands		A	2.0				
	2	Pit discontinued at 2.0m							
57	3								
56	4								
55									

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

RIG: Backhoe
LOGGED: SI
SURVEY DATUM: MGA94

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: MIRVAC
PROJECT: Geotechnical Investigation & Salinity Assessment
LOCATION: 60 Wallgrove Road, Eastern Creek

SURFACE LEVEL: 58.70 AHD
EASTING: 300970.68
NORTHING: 6258407.23

PIT No: 118
PROJECT No: 84798
DATE: 17/4/2015
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	FILLING - light grey-brown, sand filling with grass and grass roots, humid							
	0.2	FILLING - apparently moderately compacted, light grey clay, shale fragmented and ironstone bands filling, damp		A	0.2				
				A	0.5				
58	1			A	1.0				1
	1.2	CLAY - very stiff, red-brown clay, moist			1.2		pp = 300		
				A	1.5				
57	1.7	SILTY CLAY - very stiff, yellow-brown, silty clay, moist		A	1.7		pp = 420		
	1.9	SHALY CLAY - hard, grey-brown, shaly clay with ironstone bands		A	2.0				
	2								2
	2.1	2.0m: becoming shale Pit discontinued at 2.1m							
56	3								3
55	4								4
54									

RIG: Backhoe

LOGGED: SI

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Elevated ground (mound)

☐ 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: MIRVAC
PROJECT: Geotechnical Investigation & Salinity Assessment
LOCATION: 60 Wallgrove Road, Eastern Creek

SURFACE LEVEL: 53.37 AHD
EASTING: 301122.21
NORTHING: 6258396.78

PIT No: 119
PROJECT No: 84798
DATE: 16/4/2015
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)
53	0.2	TOPSOIL - grey, silty clay topsoil with grass/grass roots, moist							
		CLAY - firm to stiff, red-brown clay, slightly silty and a trace of fine ironstone gravel, moist		A	0.2				
				A	0.5		pp = 130		
	0.8	CLAY - stiff, light grey, mottled brown clay with some organic matter (decomposed plant roots), moist							
	1			A	1.0				1
52		1.4m: becoming very stiff			1.4		pp = 300		
				A	1.5				
	1.6	SHALY CLAY - hard, light grey and red-brown, shaly clay with medium strength ironcemented bands, moist							
	1.8	Pit discontinued at 1.8m		A	1.8				
	2								2
51									
	3								3
50									
	4								4
49									

RIG: Backhoe
LOGGED: SI
SURVEY DATUM: MGA94

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: MIRVAC
PROJECT: Geotechnical Investigation & Salinity Assessment
LOCATION: 60 Wallgrove Road, Eastern Creek

SURFACE LEVEL: 50.23 AHD
EASTING: 301239.46
NORTHING: 6258436.44

PIT No: 120
PROJECT No: 84798
DATE: 16/4/2015
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)
50	0.2	TOPSOIL - light grey, silty clay topsoil with grass and grass rootlets, moist							
		CLAY - stiff, brown clay, slightly silty, moist		A	0.2				
				B					
				A	0.5				
	0.8	CLAY - stiff, mottled brown, light grey clay with some plant roots (decomposed)							
49	1			A	1.0				1
		1.5m: becoming very stiff with some ironstone gravel		A	1.5		pp = 220		
	1.9	SHALY CLAY - apparently very stiff, light grey, shaly clay, moist		A	2.0				
	2								2
	2.1	Pit discontinued at 2.1m							
48									
	3								3
47									
	4								4
46									

RIG: Backhoe
LOGGED: SI
SURVEY DATUM: MGA94

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
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Results of Dynamic Penetrometer Tests

Client MIRVAC
Project Geotechnical Investigation & Salinity Assessment
Location 60 Wallgrove Road, Eastern Creek

Project No. 84798
Date 16/04/15
Page No. 1 of 1

Test Locations	101	103	104	105	106	107	108	109	110	111
RL of Test (AHD)	48.91	51.77	49.77	54.22	52.15	49.11	51.97	54.05	53.51	51.69
Depth (m)	**Penetration Resistance** Blows/150 mm									
0.00 – 0.15	2	2	2	3	3	4	2	2	2	2
0.15 – 0.30	1	2	3	5	3	5	3	3	3	3
0.30 – 0.45	1	3	4	5	4	5	2	4	4	3
0.45 – 0.60	2	4	2	6	2	4	3	4	5	4
0.60 – 0.75	1	4	2	6	3	3	4	2	6	4
0.75 – 0.90	1	3	3	6	4	2	5	2	3	5
0.90 – 1.05	1	4	3	5	4	3	4	3	2	4
1.05 – 1.20	2	5	4	17	6	4	5	14	3	4
1.20 – 1.35										
1.35 – 1.50										
1.50 – 1.65										
1.65 – 1.80										
1.80 – 1.95										
1.95 – 2.10										
2.10 – 2.25										
2.25 – 2.40										
2.40 – 2.55										
2.55 – 2.70										
2.70 – 2.85										
2.85 – 3.00										

Test Method AS 1289.6.3.2, Cone Penetrometer ☑
AS 1289.6.3.3, Sand Penetrometer ☐

Tested By SI
Checked By GSY

Remarks

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Results of Dynamic Penetrometer Tests

Client MIRVAC
Project Geotechnical Investigation & Salinity Assessment
Location 60 Wallgrove Road, Eastern Creek

Project No. 84798
Date 16/04/15
Page No. 1 of 1

Test Locations	113	114	115	116	117	118	119	120		
RL of Test (AHD)	50.1	56.14	56.55	54.36	59.70	58.70	53.37	50.23		
Depth (m)	**Penetration Resistance** Blows/150 mm									
0.00 – 0.15	2	4	2	4	2	2	2	3		
0.15 – 0.30	4	5	4	5	4	5	2	4		
0.30 – 0.45	5	5	5	5	6	16	3	4		
0.45 – 0.60	5	4	5	6	6	18	3	5		
0.60 – 0.75	3	6	4	5	9	12	3	4		
0.75 – 0.90	3	6	5	6	8	10	4	4		
0.90 – 1.05	4	4	4	6	8	15	5	3		
1.05 – 1.20	3	3	12	12	7		4	3		
1.20 – 1.35										
1.35 – 1.50										
1.50 – 1.65										
1.65 – 1.80										
1.80 – 1.95										
1.95 – 2.10										
2.10 – 2.25										
2.25 – 2.40										
2.40 – 2.55										
2.55 – 2.70										
2.70 – 2.85										
2.85 – 3.00										

Test Method AS 1289.6.3.2, Cone Penetrometer ☑
AS 1289.6.3.3, Sand Penetrometer ☐

Tested By SI
Checked By GSY

Remarks

Appendix D

Results of Laboratory Testing

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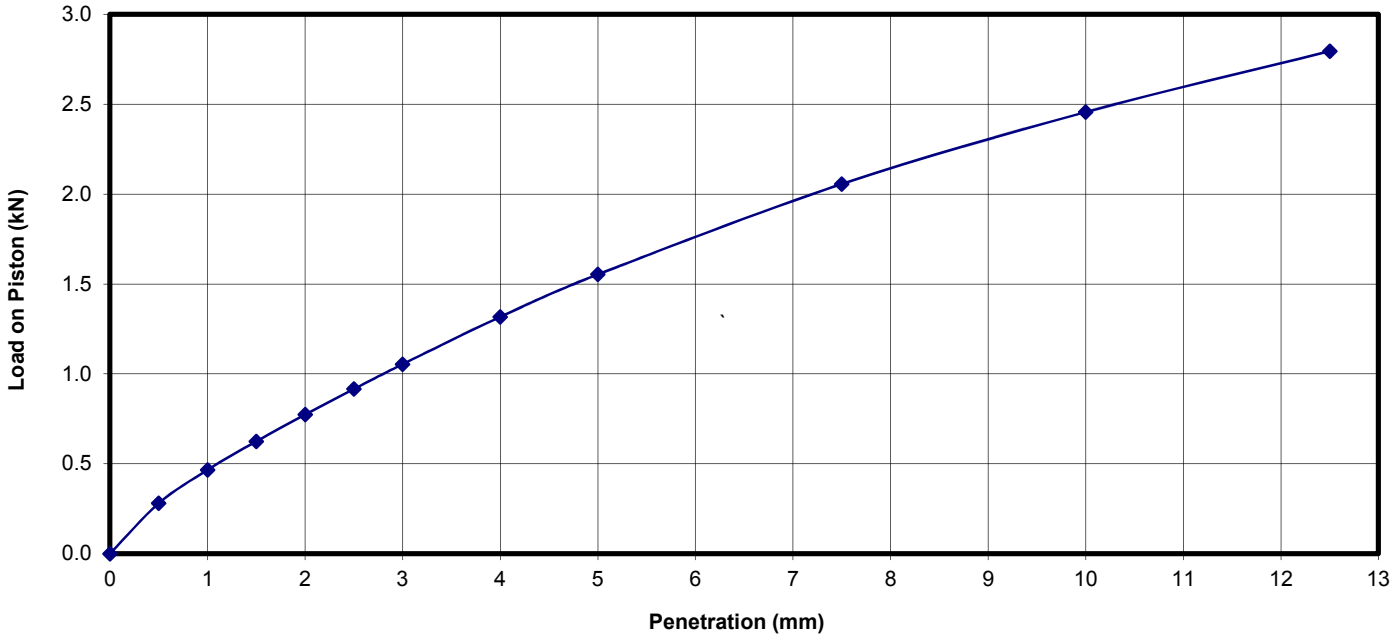
Results of California Bearing Ratio Test

Client :	Mirvac Pty Ltd	**Project No. :**	84798.00
		Report No. :	1
Project :	60 Wallgrove Road	**Report Date :**	12/05/2015
		Date Sampled :	16/04/2015
Location :	60 Wallgrove Road, Eastern Creek	**Date of Test:**	7/05/2015
Test Location :	T104		
Depth / Layer :	0.0 - 0.5m	**Page:**	1 of 1



Description: Clay/Silty Clay

Test Method(s): AS1289 6.1.1, AS1289 5.1.1, AS1289 2.1.1

Sampling Method(s): Sampled by Engineering Department **Percentage > 19mm:** 0%

LEVEL OF COMPACTION: 100% of STD MDD **SURCHARGE:** 4.5 kg **SWELL:** 0.6%
MOISTURE RATIO: 100% of STD OMC **SOAKING PERIOD:** 4 days

CONDITION		MOISTURE CONTENT %	DRY DENSITY t/m^3
At compaction		16.9	1.76
After soaking		19.1	1.76
After test	Top 30mm of sample	18.8	-
	Remainder of sample	17.9	-
Field values		16.5	-
Standard Compaction	(OMC/MDD)	17.0	1.76

RESULTS		
TYPE	**PENETRATION**	**CBR (%)**
TOP	**5.0 mm**	**8**

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Mark Matthews
Laboratory Manager

Douglas Partners
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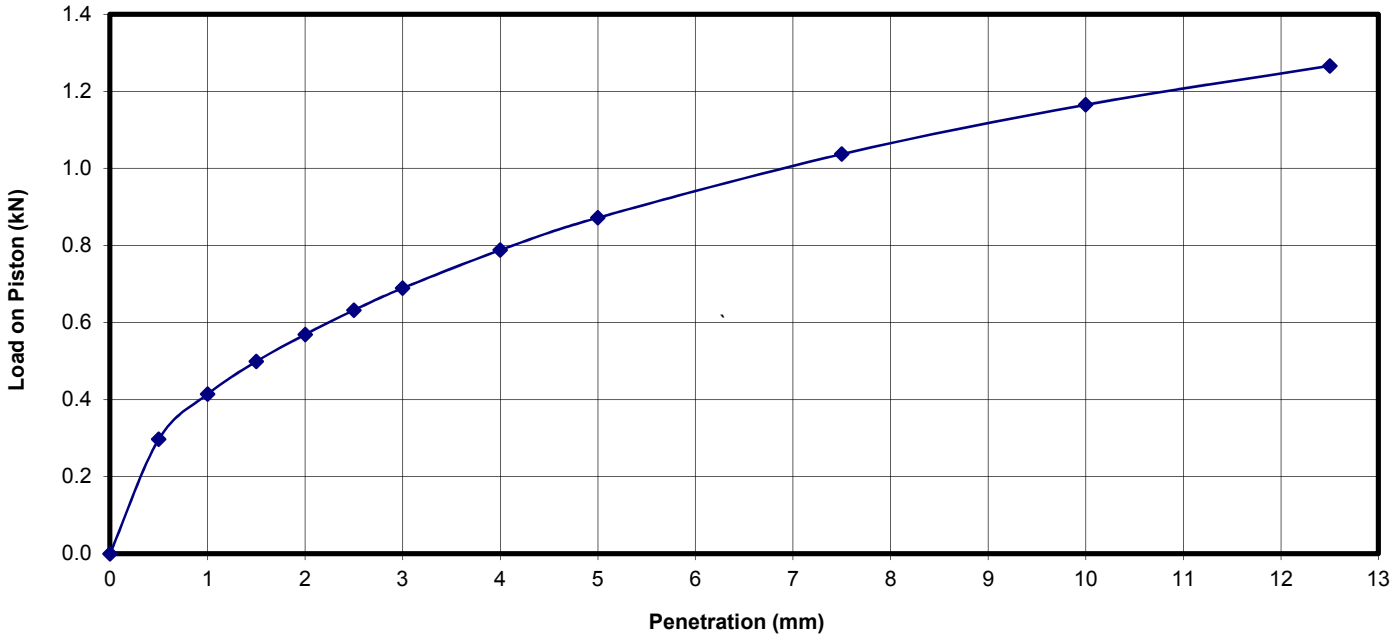
Results of California Bearing Ratio Test

Client :	Mirvac Pty Ltd	**Project No. :**	84798.00
		Report No. :	2
Project :	60 Wallgrove Road	**Report Date :**	12/05/2015
		Date Sampled :	16/04/2015
Location :	60 Wallgrove Road, Eastern Creek	**Date of Test:**	7/05/2015
Test Location :	TP109		
Depth / Layer :	0.5 - 0.5m	**Page:**	1 of 1



Description: Clay/Silty Clay

Test Method(s): AS1289 6.1.1, AS1289 5.1.1, AS1289 2.1.1

Sampling Method(s): Sampled by Engineering Department

Percentage > 19mm: 0%

LEVEL OF COMPACTION: 100% of STD MDD
MOISTURE RATIO: 101% of STD OMC
SURCHARGE: 4.5 kg
SOAKING PERIOD: 4 days
SWELL: 0.8%

CONDITION		MOISTURE CONTENT %	DRY DENSITY t/m^3
At compaction		22.4	1.62
After soaking		24.1	1.62
After test	Top 30mm of sample	25.7	-
	Remainder of sample	23.0	-
Field values		20.6	-
Standard Compaction	(OMC/MDD)	22.1	1.62

RESULTS		
TYPE	**PENETRATION**	**CBR (%)**
TOP	**2.5 mm**	**5**

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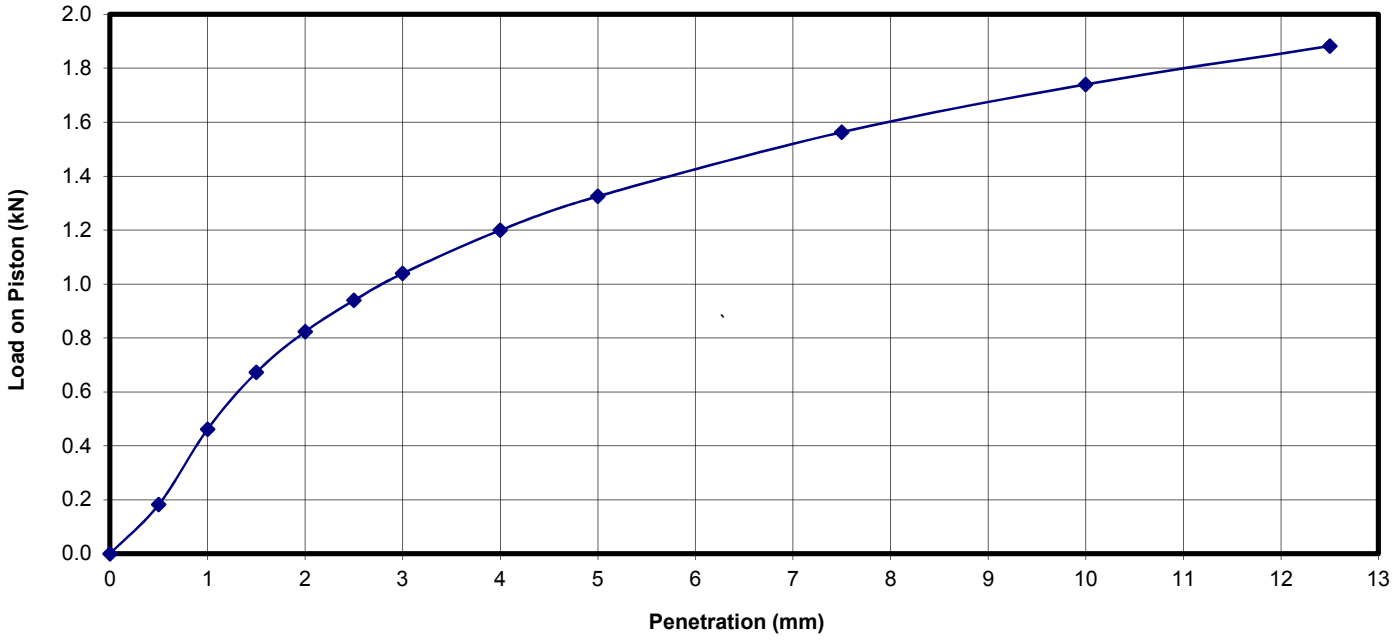
Results of California Bearing Ratio Test

Client :	Mirvac Pty Ltd	**Project No. :**	84798.00
		Report No. :	3
Project :	60 Wallgrove Road	**Report Date :**	12/05/2015
		Date Sampled :	16/04/2015
Location :	60 Wallgrove Road, Eastern Creek	**Date of Test:**	7/05/2015
Test Location :	TP120		
Depth / Layer :	0.0 - 0.5m	**Page:**	1 of 1



Description: Clay/Silty Clay

Test Method(s): AS1289 6.1.1, AS1289 5.1.1, AS1289 2.1.1

Sampling Method(s): Sampled by Engineering Department **Percentage > 19mm:** 0%

LEVEL OF COMPACTION: 100% of STD MDD **SURCHARGE:** 4.5 kg **SWELL:** 0.9%
MOISTURE RATIO: 102% of STD OMC **SOAKING PERIOD:** 4 days

CONDITION		MOISTURE CONTENT %	DRY DENSITY t/m^3
At compaction		18.7	1.68
After soaking		21.1	1.68
After test	Top 30mm of sample	21.9	-
	Remainder of sample	20.6	-
Field values		14.7	-
Standard Compaction	(OMC/MDD)	18.3	1.69

RESULTS		
TYPE	**PENETRATION**	**CBR (%)**
TOP	**5.0 mm**	**7**

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Mark Matthews
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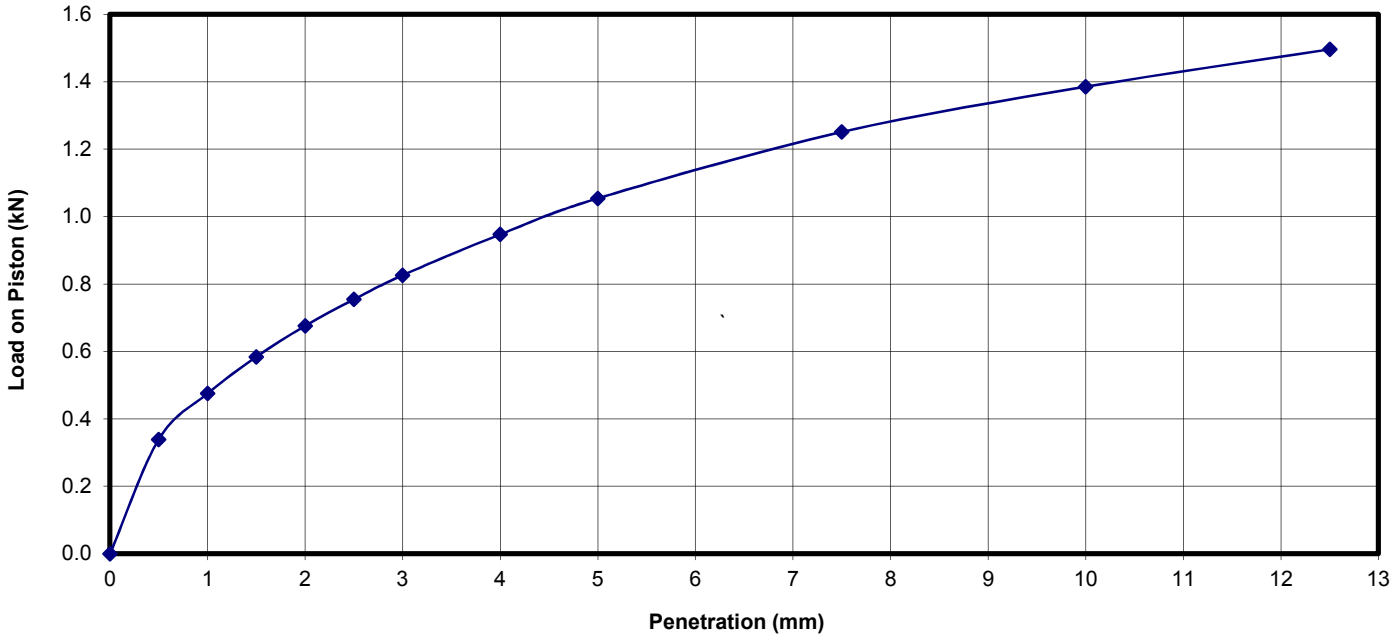
Results of California Bearing Ratio Test

Client :	Mirvac Pty Ltd	**Project No. :**	84798.00
		Report No. :	4
Project :	60 Wallgrove Road	**Report Date :**	14/05/2015
		Date Sampled :	16/04/2015
Location :	60 Wallgrove Road, Eastern Creek	**Date of Test:**	12/05/2015
Test Location :	TP116		
Depth / Layer :	0.0 - 0.5m	**Page:**	1 of 1



Description: Clay/Silty Clay

Test Method(s): AS1289 6.1.1, AS1289 5.1.1, AS1289 2.1.1

Sampling Method(s): Sampled by Engineering Department

Percentage > 19mm: 0%

LEVEL OF COMPACTION: 100% of STD MDD
MOISTURE RATIO: 100% of STD OMC
SURCHARGE: 4.5 kg
SOAKING PERIOD: 4 days
SWELL: 1.7%

CONDITION		MOISTURE CONTENT %	DRY DENSITY t/m^3
At compaction		16.4	1.76
After soaking		19.6	1.76
After test	Top 30mm of sample	21.2	-
	Remainder of sample	19.2	-
Field values		15.0	-
Standard Compaction	(OMC/MDD)	16.4	1.77

RESULTS		
TYPE	**PENETRATION**	**CBR (%)**
TOP	**2.5 mm**	**6**

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Mark Matthews
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CERTIFICATE OF ANALYSIS 127365

Client:
Douglas Partners Pty Ltd
96 Hermitage Rd
West Ryde
NSW 2114

Attention: Lujia Wu

Sample log in details:

Your Reference:	**84798, Eastern Creek**
No. of samples:	4 Soils
Date samples received / completed instructions received	04/05/2015 / 04/05/2015

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:	11/05/15 / 7/05/15
Date of Preliminary Report:	Not Issued

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Results Approved By:

Jacinta Hurst
Laboratory Manager

Misc Inorg - Soil					
Our Reference:	UNITS	127365-1	127365-2	127365-3	127365-4
Your Reference	----------	TP104	TP109	TP116	TP120
Depth	----------	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5
Date Sampled		16/04/2015	16/04/2015	16/04/2015	16/04/2015
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	06/05/2015	06/05/2015	06/05/2015	06/05/2015
Date analysed	-	06/05/2015	06/05/2015	06/05/2015	06/05/2015
pH 1:5 soil:water	pH Units	5.3	4.9	5.9	5.2
Chloride, Cl 1:5 soil:water	mg/kg	1,300	430	280	280
Sulphate, SO4 1:5 soil:water	mg/kg	200	320	430	160

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B.

Client Reference: 84798, Eastern Creek

QUALITY CONTROL Misc Inorg - Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			06/05/2015	127365-1	06/05/2015 || 06/05/2015	LCS-1	06/05/2015
Date analysed	-			06/05/2015	127365-1	06/05/2015 || 06/05/2015	LCS-1	06/05/2015
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	127365-1	5.3 || 5.3 || RPD: 0	LCS-1	101%
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	127365-1	1300 || 1400 || RPD: 7	LCS-1	91%
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	127365-1	200 || 190 || RPD: 5	LCS-1	103%

QUALITY CONTROL Misc Inorg - Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	[NT]	[NT]	127365-2	06/05/2015
Date analysed	-	[NT]	[NT]	127365-2	06/05/2015
pH 1:5 soil:water	pH Units	[NT]	[NT]	[NR]	[NR]
Chloride, Cl 1:5 soil:water	mg/kg	[NT]	[NT]	127365-2	#
Sulphate, SO4 1:5 soil:water	mg/kg	[NT]	[NT]	127365-2	#

Report Comments:

MISC_INORG_S:# 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.

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 (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics 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.

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CERTIFICATE OF ANALYSIS 127172

Client:
Douglas Partners Pty Ltd
96 Hermitage Rd
West Ryde
NSW 2114

Attention: Geoff Young

Sample log in details:

Your Reference:	**84798, Geotechnical Investigation & Salinity**
No. of samples:	90 soils
Date samples received / completed instructions received	29/04/15 / 29/04/15

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:	6/05/15 / 6/05/15
Date of Preliminary Report:	Not Issued

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Results Approved By:

Jacinta Hurst
Laboratory Manager

Misc Inorg - Soil						
Our Reference:	UNITS	127172-1	127172-2	127172-3	127172-4	127172-5
Your Reference	----------	TP101	TP101	TP101	TP101	TP101
Depth	----------	0.2	0.5	1.0	1.5	2.0
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	30/04/2015	30/04/2015	30/04/2015	30/04/2015	30/04/2015
Date analysed	-	05/05/2015	05/05/2015	05/05/2015	05/05/2015	05/05/2015
pH 1:5 soil:water	pH Units	5.8	5.8	8.6	8.3	8.0
Electrical Conductivity 1:5 soil:water	µS/cm	370	790	1,300	1,200	1,400
Chloride, Cl 1:5 soil:water	mg/kg	[NA]	1,100	[NA]	[NA]	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	120	[NA]	[NA]	[NA]

Misc Inorg - Soil						
Our Reference:	UNITS	127172-6	127172-7	127172-8	127172-9	127172-10
Your Reference	----------	TP102	TP102	TP102	TP102	TP102
Depth	----------	0.2	0.5	1.0	1.5	2.0
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	30/04/2015	30/04/2015	30/04/2015	30/04/2015	30/04/2015
Date analysed	-	05/05/2015	05/05/2015	05/05/2015	05/05/2015	05/05/2015
pH 1:5 soil:water	pH Units	6.2	5.3	4.9	5.0	5.1
Electrical Conductivity 1:5 soil:water	µS/cm	42	430	820	720	710

Misc Inorg - Soil						
Our Reference:	UNITS	127172-11	127172-12	127172-13	127172-14	127172-15
Your Reference	----------	TP103	TP103	TP103	TP103	TP103
Depth	----------	0.2	0.5	1.0	1.5	2.0
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	30/04/2015	30/04/2015	30/04/2015	30/04/2015	30/04/2015
Date analysed	-	05/05/2015	05/05/2015	05/05/2015	05/05/2015	05/05/2015
pH 1:5 soil:water	pH Units	5.9	5.6	5.6	7.1	6.9
Electrical Conductivity 1:5 soil:water	µS/cm	78	510	710	1,100	1,100

Misc Inorg - Soil						
Our Reference:	UNITS	127172-16	127172-17	127172-18	127172-19	127172-20
Your Reference	----------	TP104	TP104	TP104	TP104	TP104
Depth	----------	0.2	0.5	1.0	1.5	2.0
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	30/04/2015	30/04/2015	30/04/2015	30/04/2015	30/04/2015
Date analysed	-	05/05/2015	05/05/2015	05/05/2015	05/05/2015	05/05/2015
pH 1:5 soil:water	pH Units	5.9	5.2	6.2	6.7	6.7
Electrical Conductivity 1:5 soil:water	µS/cm	450	930	1,500	1,200	1,400

Misc Inorg - Soil						
Our Reference:	UNITS	127172-21	127172-22	127172-23	127172-24	127172-25
Your Reference	----------	TP105	TP105	TP105	TP105	TP106
Depth	----------	0.2	0.5	1.0	1.5	0.2
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	30/04/2015	30/04/2015	30/04/2015	30/04/2015	30/04/2015
Date analysed	-	05/05/2015	05/05/2015	05/05/2015	05/05/2015	05/05/2015
pH 1:5 soil:water	pH Units	7.0	4.9	5.1	5.2	5.1
Electrical Conductivity 1:5 soil:water	µS/cm	86	520	450	390	410

Misc Inorg - Soil						
Our Reference:	UNITS	127172-26	127172-27	127172-28	127172-29	127172-30
Your Reference	----------	TP106	TP106	TP106	TP107	TP107
Depth	----------	0.5	1.0	1.5	0.2	0.5
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	30/04/2015	30/04/2015	30/04/2015	30/04/2015	30/04/2015
Date analysed	-	05/05/2015	05/05/2015	05/05/2015	05/05/2015	05/05/2015
pH 1:5 soil:water	pH Units	5.0	5.0	4.9	5.9	5.1
Electrical Conductivity 1:5 soil:water	µS/cm	640	680	600	73	520
Chloride, Cl 1:5 soil:water	mg/kg	[NA]	780	[NA]	[NA]	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	300	[NA]	[NA]	[NA]

Misc Inorg - Soil						
Our Reference:	UNITS	127172-31	127172-32	127172-33	127172-34	127172-35
Your Reference	----------	TP107	TP107	TP107	TP108	TP108
Depth	----------	1.0	1.5	2.0	0.2	0.5
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	30/04/2015	30/04/2015	30/04/2015	30/04/2015	30/04/2015
Date analysed	-	05/05/2015	05/05/2015	05/05/2015	05/05/2015	05/05/2015
pH 1:5 soil:water	pH Units	5.2	5.1	5.1	5.5	4.7
Electrical Conductivity 1:5 soil:water	µS/cm	580	610	810	480	970

Misc Inorg - Soil						
Our Reference:	UNITS	127172-36	127172-37	127172-38	127172-39	127172-40
Your Reference	----------	TP108	TP108	TP108	TP109	TP109
Depth	----------	1.0	1.5	2.0	0.2	0.5
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	30/04/2015	30/04/2015	30/04/2015	30/04/2015	30/04/2015
Date analysed	-	05/05/2015	05/05/2015	05/05/2015	05/05/2015	05/05/2015
pH 1:5 soil:water	pH Units	5.0	5.5	6.8	5.3	5.0
Electrical Conductivity 1:5 soil:water	µS/cm	810	910	940	260	490
Chloride, Cl 1:5 soil:water	mg/kg	[NA]	1,400	[NA]	[NA]	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	190	[NA]	[NA]	[NA]

Misc Inorg - Soil						
Our Reference:	UNITS	127172-41	127172-42	127172-43	127172-44	127172-45
Your Reference	----------	TP109	TP109	TP110	TP110	TP110
Depth	----------	1.0	1.5	0.2	0.5	1.0
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	30/04/2015	30/04/2015	30/04/2015	30/04/2015	30/04/2015
Date analysed	-	05/05/2015	05/05/2015	05/05/2015	05/05/2015	05/05/2015
pH 1:5 soil:water	pH Units	5.0	5.0	6.1	5.7	5.3
Electrical Conductivity 1:5 soil:water	µS/cm	630	620	44	180	500

Misc Inorg - Soil						
Our Reference:	UNITS	127172-46	127172-47	127172-48	127172-49	127172-50
Your Reference	----------	TP110	TP110	TP111	TP111	TP111
Depth	----------	1.5	2.0	0.2	0.5	1.0
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	30/04/2015	30/04/2015	30/04/2015	30/04/2015	30/04/2015
Date analysed	-	05/05/2015	05/05/2015	05/05/2015	05/05/2015	05/05/2015
pH 1:5 soil:water	pH Units	5.2	5.4	6.4	5.6	5.3
Electrical Conductivity 1:5 soil:water	µS/cm	780	660	48	270	630

Misc Inorg - Soil						
Our Reference:	UNITS	127172-51	127172-52	127172-53	127172-54	127172-55
Your Reference	----------	TP111	TP111	TP113	TP113	TP113
Depth	----------	1.5	2.0	0.2	0.5	1.0
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	30/04/2015	30/04/2015	30/04/2015	30/04/2015	30/04/2015
Date analysed	-	05/05/2015	05/05/2015	05/05/2015	05/05/2015	05/05/2015
pH 1:5 soil:water	pH Units	5.2	5.2	6.4	5.3	5.0
Electrical Conductivity 1:5 soil:water	µS/cm	830	540	59	360	1,000

Misc Inorg - Soil						
Our Reference:	UNITS	127172-56	127172-57	127172-58	127172-59	127172-60
Your Reference	----------	TP113	TP113	TP114	TP114	TP114
Depth	----------	1.5	2.0	0.2	0.5	1.0
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	30/04/2015	30/04/2015	30/04/2015	30/04/2015	30/04/2015
Date analysed	-	05/05/2015	05/05/2015	05/05/2015	05/05/2015	05/05/2015
pH 1:5 soil:water	pH Units	5.2	5.5	5.4	5.7	8.3
Electrical Conductivity 1:5 soil:water	µS/cm	960	750	91	130	110

Misc Inorg - Soil						
Our Reference:	UNITS	127172-61	127172-62	127172-63	127172-64	127172-65
Your Reference	----------	TP114	TP114	TP115	TP115	TP115
Depth	----------	1.5	2.0	0.2	0.5	1.0
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	30/04/2015	30/04/2015	30/04/2015	30/04/2015	30/04/2015
Date analysed	-	05/05/2015	05/05/2015	05/05/2015	05/05/2015	05/05/2015
pH 1:5 soil:water	pH Units	6.4	5.4	6.4	5.5	5.2
Electrical Conductivity 1:5 soil:water	µS/cm	230	540	57	220	470
Chloride, Cl 1:5 soil:water	mg/kg	[NA]	450	[NA]	[NA]	[NA]

Misc Inorg - Soil						
Our Reference:	UNITS	127172-61	127172-62	127172-63	127172-64	127172-65
Your Reference	----------	TP114	TP114	TP115	TP115	TP115
Depth	----------	1.5	2.0	0.2	0.5	1.0
Type of sample		Soil	Soil	Soil	Soil	Soil
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	570	[NA]	[NA]	[NA]

Misc Inorg - Soil						
Our Reference:	UNITS	127172-66	127172-67	127172-68	127172-69	127172-70
Your Reference	----------	TP115	TP116	TP116	TP116	TP116
Depth	----------	1.5	0.2	0.5	1.0	1.5
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	30/04/2015	30/04/2015	30/04/2015	30/04/2015	30/04/2015
Date analysed	-	05/05/2015	05/05/2015	05/05/2015	05/05/2015	05/05/2015
pH 1:5 soil:water	pH Units	5.4	5.6	5.4	5.4	5.8
Electrical Conductivity 1:5 soil:water	µS/cm	370	170	720	730	640

Misc Inorg - Soil						
Our Reference:	UNITS	127172-71	127172-72	127172-73	127172-74	127172-75
Your Reference	----------	TP117	TP117	TP117	TP117	TP117
Depth	----------	0.2	0.5	1.0	1.5	2.0
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	30/04/2015	30/04/2015	30/04/2015	30/04/2015	30/04/2015
Date analysed	-	05/05/2015	05/05/2015	05/05/2015	05/05/2015	05/05/2015
pH 1:5 soil:water	pH Units	7.0	5.7	5.5	5.2	5.3
Electrical Conductivity 1:5 soil:water	µS/cm	35	170	270	370	440

Misc Inorg - Soil						
Our Reference:	UNITS	127172-76	127172-77	127172-78	127172-79	127172-80
Your Reference	----------	TP118	TP118	TP118	TP118	TP118
Depth	----------	0.2	0.5	1.0	1.5	2.0
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	30/04/2015	30/04/2015	30/04/2015	30/04/2015	30/04/2015
Date analysed	-	05/05/2015	05/05/2015	05/05/2015	05/05/2015	05/05/2015
pH 1:5 soil:water	pH Units	5.7	5.7	5.6	5.5	5.8
Electrical Conductivity 1:5 soil:water	µS/cm	37	66	160	200	170

Misc Inorg - Soil						
Our Reference:	UNITS	127172-81	127172-82	127172-83	127172-84	127172-85
Your Reference	----------	TP119	TP119	TP119	TP119	TP119
Depth	----------	0.2	0.5	1.0	1.5	2.0
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	30/04/2015	30/04/2015	30/04/2015	30/04/2015	30/04/2015
Date analysed	-	05/05/2015	05/05/2015	05/05/2015	05/05/2015	05/05/2015
pH 1:5 soil:water	pH Units	6.0	5.2	4.8	4.9	5.1
Electrical Conductivity 1:5 soil:water	µS/cm	68	350	760	830	610

Misc Inorg - Soil						
Our Reference:	UNITS	127172-86	127172-87	127172-88	127172-89	127172-90
Your Reference	----------	TP120	TP120	TP120	TP120	TP120
Depth	----------	0.2	0.5	1.0	1.5	2.0
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	30/04/2015	30/04/2015	30/04/2015	30/04/2015	30/04/2015
Date analysed	-	05/05/2015	05/05/2015	05/05/2015	05/05/2015	05/05/2015
pH 1:5 soil:water	pH Units	6.1	4.8	4.5	4.5	4.7
Electrical Conductivity 1:5 soil:water	µS/cm	110	550	1,200	1,100	1,000
Chloride, Cl 1:5 soil:water	mg/kg	54	[NA]	[NA]	[NA]	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	42	[NA]	[NA]	[NA]	[NA]

ESP/CEC Our Reference: Your Reference Depth Type of sample	UNITS ---------- ----------	127172-7 TP102 0.5 Soil	127172-15 TP103 2.0 Soil	127172-16 TP104 0.2 Soil	127172-32 TP107 1.5 Soil	127172-45 TP110 1.0 Soil
Date extracted	-	01/05/2015	01/05/2015	01/05/2015	01/05/2015	1/05/2015
Date analysed	-	01/05/2015	01/05/2015	01/05/2015	01/05/2015	01/05/2015
Exchangeable Ca	meq/100g	0.4	<0.1	3.0	<0.1	<0.1
Exchangeable K	meq/100g	0.2	<0.1	0.4	0.2	0.2
Exchangeable Mg	meq/100g	7.4	5.5	8.4	8.6	7.7
Exchangeable Na	meq/100g	1.6	2.8	1.1	3.9	2.3
Cation Exchange Capacity	meq/100g	9.5	8.4	13	13	10
ESP	%	17	33	9	30	22

ESP/CEC Our Reference: Your Reference Depth Type of sample	UNITS ---------- ----------	127172-53 TP113 0.2 Soil	127172-68 TP116 0.5 Soil	127172-81 TP119 0.2 Soil
Date extracted	-	1/05/2015	01/05/2015	01/05/2015
Date analysed	-	01/05/2015	01/05/2015	01/05/2015
Exchangeable Ca	meq/100g	3.0	1.3	4.3
Exchangeable K	meq/100g	0.4	0.2	0.4
Exchangeable Mg	meq/100g	7.8	10	5.1
Exchangeable Na	meq/100g	0.42	3.1	0.14
Cation Exchange Capacity	meq/100g	12	15	10
ESP	%	4	21	1

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 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 latest edition 2510 and Rayment & Lyons.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B.
Metals-009	Determination of exchangeable cations and cation exchange capacity in soil based on Rayment and Lyons 2011.

QUALITY CONTROL Misc Inorg - Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			30/04/2015	127172-1	30/04/2015 || 30/04/2015	LCS-1	30/04/2015
Date analysed	-			05/05/2015	127172-1	05/05/2015 || 05/05/2015	LCS-1	30/04/2015
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	127172-1	5.8 || 5.8 || RPD: 0	LCS-1	102%
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	127172-1	370 || 360 || RPD: 3	LCS-1	103%
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	LCS-1	96%
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	LCS-1	98%

QUALITY CONTROL ESP/CEC	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			01/05/2015	127172-81	01/05/2015 || 01/05/2015	LCS-1	01/05/2015
Date analysed	-			01/05/2015	127172-81	01/05/2015 || 01/05/2015	LCS-1	01/05/2015
Exchangeable Ca	meq/100g	0.1	Metals-009	<0.1	127172-81	4.3 || 4.5 || RPD: 5	LCS-1	107%
Exchangeable K	meq/100g	0.1	Metals-009	<0.1	127172-81	0.4 || 0.4 || RPD: 0	LCS-1	99%
Exchangeable Mg	meq/100g	0.1	Metals-009	<0.1	127172-81	5.1 || 5.4 || RPD: 6	LCS-1	105%
Exchangeable Na	meq/100g	0.1	Metals-009	<0.1	127172-81	0.14 || 0.14 || RPD: 0	LCS-1	108%
Cation Exchange Capacity	meq/100g	1	Metals-009	<1.0	127172-81	10 || 10 || RPD: 0	[NR]	[NR]
ESP	%	1	Metals-009	<1	127172-81	1 || 1 || RPD: 0	[NR]	[NR]

QUALITY CONTROL Misc Inorg - Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	127172-11	30/04/2015 || 30/04/2015	LCS-2	30/04/2015
Date analysed	-	127172-11	05/05/2015 || 05/05/2015	LCS-2	05/05/2015
pH 1:5 soil:water	pH Units	127172-11	5.9 || 5.9 || RPD: 0	LCS-2	101%
Electrical Conductivity 1:5 soil:water	µS/cm	127172-11	78 || 79 || RPD: 1	LCS-2	101%
Chloride, Cl 1:5 soil:water	mg/kg	[NT]	[NT]	[NR]	[NR]
Sulphate, SO4 1:5 soil:water	mg/kg	[NT]	[NT]	[NR]	[NR]

QUALITY CONTROL Misc Inorg - Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	127172-21	30/04/2015 || 30/04/2015	LCS-3	30/04/2015
Date analysed	-	127172-21	05/05/2015 || 05/05/2015	LCS-3	05/05/2015
pH 1:5 soil:water	pH Units	127172-21	7.0 || 7.1 || RPD: 1	LCS-3	102%
Electrical Conductivity 1:5 soil:water	µS/cm	127172-21	86 || 86 || RPD: 0	LCS-3	100%
Chloride, Cl 1:5 soil:water	mg/kg	[NT]	[NT]	[NR]	[NR]
Sulphate, SO4 1:5 soil:water	mg/kg	[NT]	[NT]	[NR]	[NR]

QUALITY CONTROL Misc Inorg - Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	127172-31	30/04/2015 || 30/04/2015	LCS-4	30/04/2015
Date analysed	-	127172-31	05/05/2015 || 05/05/2015	LCS-4	30/04/2015
pH 1:5 soil:water	pH Units	127172-31	5.2 || 5.2 || RPD: 0	LCS-4	101%
Electrical Conductivity 1:5 soil:water	µS/cm	127172-31	580 || 550 || RPD: 5	LCS-4	101%
Chloride, Cl 1:5 soil:water	mg/kg	[NT]	[NT]	[NR]	[NR]
Sulphate, SO4 1:5 soil:water	mg/kg	[NT]	[NT]	[NR]	[NR]

QUALITY CONTROL Misc Inorg - Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Date prepared	-	127172-41	30/04/2015 || 30/04/2015
Date analysed	-	127172-41	05/05/2015 || 05/05/2015
pH 1:5 soil:water	pH Units	127172-41	5.0 || 4.9 || RPD: 2
Electrical Conductivity 1:5 soil:water	µS/cm	127172-41	630 || 680 || RPD: 8
Chloride, Cl 1:5 soil:water	mg/kg	[NT]	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	[NT]	[NT]

QUALITY CONTROL Misc Inorg - Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Date prepared	-	127172-51	30/04/2015 || 30/04/2015
Date analysed	-	127172-51	05/05/2015 || 05/05/2015
pH 1:5 soil:water	pH Units	127172-51	5.2 || 5.2 || RPD: 0
Electrical Conductivity 1:5 soil:water	µS/cm	127172-51	830 || 780 || RPD: 6
Chloride, Cl 1:5 soil:water	mg/kg	[NT]	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	[NT]	[NT]

QUALITY CONTROL Misc Inorg - Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Date prepared	-	127172-61	30/04/2015 || 30/04/2015
Date analysed	-	127172-61	05/05/2015 || 05/05/2015
pH 1:5 soil:water	pH Units	127172-61	6.4 || 6.5 || RPD: 2
Electrical Conductivity 1:5 soil:water	µS/cm	127172-61	230 || 220 || RPD: 4
Chloride, Cl 1:5 soil:water	mg/kg	[NT]	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	[NT]	[NT]

QUALITY CONTROL Misc Inorg - Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Date prepared	-	127172-71	30/04/2015 || 30/04/2015
Date analysed	-	127172-71	05/05/2015 || 05/05/2015
pH 1:5 soil:water	pH Units	127172-71	7.0 || 7.2 || RPD: 3
Electrical Conductivity 1:5 soil:water	µS/cm	127172-71	35 || 36 || RPD: 3
Chloride, Cl 1:5 soil:water	mg/kg	[NT]	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	[NT]	[NT]

QUALITY CONTROL Misc Inorg - Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Date prepared	-	127172-81	30/04/2015 || 30/04/2015
Date analysed	-	127172-81	05/05/2015 || 05/05/2015
pH 1:5 soil:water	pH Units	127172-81	6.0 || 6.0 || RPD: 0
Electrical Conductivity 1:5 soil:water	µS/cm	127172-81	68 || 64 || RPD: 6
Chloride, Cl 1:5 soil:water	mg/kg	[NT]	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	[NT]	[NT]

Report Comments:

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 (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics 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.

Appendix E

Salinity and Aggressivity Analysis

Boreholes		Location			Sample Depth	pH	Moisture	Chloride Concentration	Sulphate Concentration	Resistivity	Soil Condition	Sample Aggressivity Class					Bulk pH	Zone Aggressivity Class		Soil Texture Group	Textural Factor (M)	$EC_{1:5}$	EC_e	Sample Salinity Class	Bulk ECe	Zone Salinity Class
		East	North	RL						By inversion of EC1:5		Aggr. to Concrete - from sample pH	Aggr. to Concrete - from Sulphate conc.	Aggr. to Steel - from sample pH	Aggr. to Steel - from Chloride conc.	Aggr. to Steel - from sample Resistivity	In Depth Zones (m) 0-1/1-2	Aggr. to Concrete - from Bulk pH in Zones: 0-1/1-2	Aggr. to Steel - from Bulk pH in Zones: 0-1/1-2	(for detailed soil logs see Report Appendix)		[Lab.]	[M x $EC_{1:5}$]	(Based on sample ECe)	In Zones (m) 0-1/1-2	From Bulk ECe in Zones (m): 0-1/1-2
		(m MGA56)	(m MGA56)	(m AHD)	(m bgl)	(pH units)	(%)	(mg/kg)	(mg/kg)	Ω.cm	[AS2159-2009]	[AS2159-2009]					(pH units)			[after DLWC]	[after DLWC]	(microS/cm)	(deciS/m)	[Richards 1954]	(dS/m)	[Richards 1954]
101	1	300988.4	6258781.4	48.9	0.2	5.8				2703	B	Non-Aggressive		Non-Aggressive		Non-Aggressive				Clay loam	9	370	3.3	Slightly Saline		
	1				0.5	5.8				1266	B	Non-Aggressive		Non-Aggressive		Mild				Clay loam	9	790	7.1	Moderately Saline		
	1				1.0	8.6		60	120	769	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Moderate	6.9	Non-Aggressive	Non-Aggressive	Light clay	8.5	1300	11.1	Very Saline	7.6	Moderately Saline
	1				1.5	8.3				833	B	Non-Aggressive		Non-Aggressive		Moderate				Light clay	8.5	1200	10.2	Very Saline		
.	1	.	.	.	2.0	8				714	B	Non-Aggressive		Non-Aggressive		Moderate	8.2	Non-Aggressive	Non-Aggressive	Light medium clay	8	1400	11.2	Very Saline	10.5	Very Saline
102	2	301166.4	6258779.9	51.8	0.2	6.2				23810	B	Non-Aggressive		Non-Aggressive		Non-Aggressive				Clay loam	9	42	0.4	Non-Saline		
	2				0.5	5.3				2326	B	Mild		Non-Aggressive		Non-Aggressive				Medium clay	7	430	3.0	Slightly Saline		
	2				1.0	4.9	11.0			1220	B	Mild		Non-Aggressive		Mild	5.4	Mild	Non-Aggressive	Medium clay	7	820	5.7	Moderately Saline	3.4	Slightly Saline
	2				1.5	5		20	20	1389	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild				Light clay	8.5	720	6.1	Moderately Saline		
.	2	.	.	.	2.0	5.1				1408	B	Mild		Non-Aggressive		Mild	5.0	Mild	Non-Aggressive	Light clay	8.5	710	6.0	Moderately Saline	6.1	Moderately Saline
103	3	300836.1	6258689.9	51.1	0.2	5.9		20	65	12821	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive				Clay loam	9	78	0.7	Non-Saline		
	3				0.5	5.6				1961	B	Non-Aggressive		Non-Aggressive		Mild				Light clay	8.5	510	4.3	Moderately Saline		
	3				1.0	5.6				1408	B	Non-Aggressive		Non-Aggressive		Mild	5.7	Non-Aggressive	Non-Aggressive	Light clay	8.5	710	6.0	Moderately Saline	4.0	Slightly Saline
	3				1.5	7.1				909	B	Non-Aggressive		Non-Aggressive		Moderate				Clay loam	9	1100	9.9	Very Saline		
	3				2.0	6.9	17.4			909	B	Non-Aggressive		Non-Aggressive		Moderate	7.0	Non-Aggressive	Non-Aggressive	Clay loam	9	1100	9.9	Very Saline	9.9	Very Saline
104	4	300922.7	6258695.7	49.8	0.2	5.9				2222	B	Non-Aggressive		Non-Aggressive		Non-Aggressive				Clay loam	9	450	4.1	Moderately Saline		
	4				0.5	5.2				1075	B	Mild		Non-Aggressive		Mild				Light clay	8.5	930	7.9	Moderately Saline		
	4				1.0	6.2		290	450	667	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Moderate	5.8	Non-Aggressive	Non-Aggressive	Light clay	8.5	1500	12.8	Very Saline	8.8	Very Saline
	4				1.5	6.7				833	B	Non-Aggressive		Non-Aggressive		Moderate				Light clay	8.5	1200	10.2	Very Saline		
.	4	.	.	.	2.0	6.7				714	B	Non-Aggressive		Non-Aggressive		Moderate	6.7	Non-Aggressive	Non-Aggressive	Light clay	8.5	1400	11.9	Very Saline	10.8	Very Saline
105	5	301101.6	6258668.3	54.2	0.2	7		24	100	11628	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive				Light medium clay	8	86	0.7	Non-Saline		
	5				0.5	4.9				1923	B	Mild		Non-Aggressive		Mild				Heavy clay	6	520	3.1	Slightly Saline		
	5				1.0	5.1				2222	B	Mild		Non-Aggressive		Non-Aggressive	5.6	Non-Aggressive	Non-Aggressive	Light clay	8.5	450	3.8	Slightly Saline	2.7	Slightly Saline
	5				1.5	5.2				2564	B	Mild		Non-Aggressive		Non-Aggressive				Light clay	8.5	390	3.3	Slightly Saline		
.	5	.	.	.	2.0	5.1	20.5			2439	B	Mild		Non-Aggressive		Non-Aggressive	5.2	Mild	Non-Aggressive			410			
106	6	301185.8	6258662.5	52.1	0.5	5				1563	B	Mild		Non-Aggressive		Mild				Medium clay	7	640	4.5	Moderately Saline		
	6				1.0	5				1471	B	Mild		Non-Aggressive		Mild	5.0	Mild	Non-Aggressive	Light medium clay	8	680	5.4	Moderately Saline	4.9	Moderately Saline
.	6	.	.	.	1.5	4.9	24.9			1667	B	Mild		Non-Aggressive		Mild	4.9	Mild	Non-Aggressive	Light medium clay	8	600	4.8	Moderately Saline	4.8	Moderately Saline
107	7	301275.9	6258617.8	49.1	0.2	5.9				13699	B	Non-Aggressive		Non-Aggressive		Non-Aggressive				Clay loam	9	73	0.7	Non-Saline		
	7				0.5	5.1				1923	B	Mild		Non-Aggressive		Mild				Medium clay	7	520	3.6	Slightly Saline		
	7				1.0	5.2				1724	B	Mild		Non-Aggressive		Mild	5.4	Mild	Non-Aggressive	Medium clay	7	580	4.1	Moderately Saline	3.0	Slightly Saline
	7				1.5	5.1				1639	B	Mild		Non-Aggressive		Mild				Light clay	8.5	610	5.2	Moderately Saline		
.	7	.	.	.	2.0	5.1				1235	B	Mild		Non-Aggressive		Mild	5.1	Mild	Non-Aggressive			810			
108	8	300822.0	6258612.2	52.0	0.2	5.5				2083	B	Mild		Non-Aggressive		Non-Aggressive				Clay loam	9	480	4.3	Moderately Saline		
	8				0.5	4.7				1031	B	Mild		Non-Aggressive		Mild				Light clay	8.5	970	8.2	Very Saline		
	8				1.0	5				1235	B	Mild		Non-Aggressive		Mild	5.0	Mild	Non-Aggressive	Light clay	8.5	810	6.9	Moderately Saline	6.6	Moderately Saline
	8				1.5	5.5				1099	B	Mild		Non-Aggressive		Mild				Light clay	9	910	8.2	Very Saline		
.	8	.	.	.	2.0	6.8				1064	B	Non-Aggressive		Non-Aggressive		Mild	5.9	Non-Aggressive	Non-Aggressive	Light clay	8.5	940	8.0	Moderately Saline	8.1	Very Saline
109	9	301117.9	6258612.2	54.1	0.2	5.3				3846	B	Mild		Non-Aggressive		Non-Aggressive				Light medium clay	8	260	2.1	Slightly Saline		
	9				0.5	5				2041	B	Mild		Non-Aggressive		Non-Aggressive				Medium clay	7	490	3.4	Slightly Saline		
	9				1.0	5				1587	B	Mild		Non-Aggressive		Mild	5.1	Mild	Non-Aggressive	Medium clay	7	630	4.4	Moderately Saline	3.4	Slightly Saline
.	9	.	.	.	1.5	5				1613	B	Mild		Non-Aggressive		Mild	5.0	Mild	Non-Aggressive	Light clay	8.5	620	5.3	Moderately Saline	5.3	Moderately Saline
110	10	300886.0	6258545.5	53.5	0.2	6.1				22727	B	Non-Aggressive		Non-Aggressive		Non-Aggressive				Clay loam	9	44	0.4	Non-Saline		
	10				0.5	5.7				5556	B	Non-Aggressive		Non-Aggressive		Non-Aggressive				Medium clay	7	180	1.3	Non-Saline		
	10				1.0	5.3				2000	B	Mild		Non-Aggressive		Non-Aggressive	5.7	Non-Aggressive	Non-Aggressive	Medium clay	7	500	3.5	Slightly Saline	1.9	Non-Saline
	10				1.5	5.2				1282	B	Mild		Non-Aggressive		Mild				Light clay	8.5	780	6.6	Moderately Saline		
.	10	.	.	.	2.0	5.4				1515	B	Mild		Non-Aggressive		Mild	5.3	Mild	Non-Aggressive	Light clay	8.5	660	5.6	Moderately Saline	6.3	Moderately Saline
111	11	301027.3	6258712.5	51.7	0.2	6.4				20833	B	Non-Aggressive		Non-Aggressive		Non-Aggressive				Clay loam	9	48	0.4	Non-Saline		
	11				0.5	5.6				3704	B	Non-Aggressive		Non-Aggressive		Non-Aggressive				Heavy clay	6	270	1.6	Non-Saline		
	11				1.0	5.3				1587	B	Mild		Non-Aggressive		Mild	5.7	Non-Aggressive	Non-Aggressive	Medium clay	7	630	4.4	Moderately Saline	2.4	Slightly Saline
	11				1.5	5.2				1205	B	Mild		Non-Aggressive		Mild				Light medium clay	8	830	6.6	Moderately Saline		
.	11	.	.	.	2.0	5.2				1852	B	Mild		Non-Aggressive		Mild	5.2	Mild	Non-Aggressive			540			
113	12	301193.3	6258487.9	50.0	0.2	6.4				16949	B	Non-Aggressive		Non-Aggressive		Non-Aggressive				Light medium clay	8	59	0.5	Non-Saline		
	12				0.5	5.3				2778	B	Mild		Non-Aggressive		Non-Aggressive				Light medium clay	8	360	2.9	Slightly Saline		
	12				1.0	5				1000	B	Mild		Non-Aggressive		Mild	5.5	Mild	Non-Aggressive	Medium clay	7	1000	7.0	Moderately Saline	3.9	Slightly Saline
	12				1.5	5.2				1042	B	Mild		Non-Aggressive		Mild				Light clay	8.5	960	8.2	Very Saline		
.	12	.	.	.	2.0	5.5				1333	B	Mild		Non-Aggressive		Mild	5.3	Mild	Non-Aggressive	Light clay	8.5	750	6.4	Moderately Saline	7.6	Moderately Saline
114	13	300821.8	6258495.4	56.1	0.2	5.4				10989	B	Mild		Non-Aggressive		Non-Aggressive				Loam	10	91	0.9	Non-Saline		
	13				0.5	5.7				7692	B	Non-Aggressive		Non-Aggressive		Non-Aggressive				Light clay	8.5	130	1.1	Non-Saline		
	13				1.0	8.3				9091	B	Non-Aggressive		Non-Aggressive		Non-Aggressive	6.7	Non-Aggressive	Non-Aggressive	Medium clay	7	110	0.8	Non-Saline	0.9	Non-Saline
	13				1.5	6.4				4348	B	Non-Aggressive		Non-Aggressive		Non-Aggressive				Medium clay	7	230	1.6	Non-Saline		
.	13	.	.	.	2.0	5.4				1852	B	Mild		Non-Aggressive		Mild	6.1	Non-Aggressive	Non-Aggressive	Medium clay	7	540	3.8	Slightly Saline	2.3	Slightly Saline
115	14	300889.8	6258488.6	56.5	0.2	6.4				17544	B	Non-Aggressive		Non-Aggressive		Non-Aggressive				Light clay	8.5	57	0.5	Non-Saline		
	14				0.5	5.5				4545	B	Mild		Non-Aggressive		Non-Aggressive				Medium clay	7	220	1.5	Non-Saline		
	14				1.0	5.2				2128	B	Mild		Non-Aggressive		Non-Aggressive	5.6	Non-Aggressive	Non-Aggressive	Medium clay	7	470	3.3	Slightly Saline	1.9	Non-Saline
.	14	.	.	.	1.5	5.4				2703	B	Mild		Non-Aggressive		Non-Aggressive	5.4	Mild	Non-Aggressive	Light clay	8.5	370	3.1	Slightly Saline	3.1	Slightly Saline
116	15	301057.1	6258481.6	54.4	0.2	5.6				5882	B	Non-Aggressive		Non-Aggressive		Non-Aggressive				Light clay	8.5	170	1.4	Non-Saline		
	15				0.5	5.4				1389	B	Mild		Non-Aggressive		Mild				Light medium clay	8	720	5.8	Moderately Saline		
	15				1.0	5.4				1370	B	Mild		Non-Aggressive		Mild	5.5	Mild	Non-Aggressive	Light medium clay	8	730	5.8	Moderately Saline	4.6	Moderately Saline
	15				1.5	5.8				1563	B	Non-Aggressive		Non-Aggressive		Mild	5.8	Non-Aggressive	Non-Aggressive	Light clay	8.5	640	5.4	Moderately Saline	5.4	Moderately Saline
117	16	300907.3	6258416.4	59.7	0.2	7				28571	B	Non-Aggressive		Non-Aggressive		Non-Aggressive				Sand	17	35	0.6	Non-Saline		
	16				0.5	5.7				5882	B	Non-Aggressive		Non-Aggressive		Non-Aggressive				Light medium clay	8	170	1.4	Non-Saline		
	16				1.0	5.5				3704	B	Mild		Non-Aggressive		Non-Aggressive	6.0	Non-Aggressive	Non-Aggressive	Medium clay	7	270	1.9	Non-Saline	1.4	Non-Saline
	16				1.5	5.2				2703	B	Mild		Non-Aggressive		Non-Aggressive				Medium clay	7	370	2.6	Slightly Saline		
.	16	.	.	.	2.0	5.3				2273	B	Mild		Non-Aggressive		Non-Aggressive	5.2	Mild	Non-Aggressive	Light clay	8.5	440	3.7	Slightly Saline	3.0	Slightly Saline
118	17	300970.7	6258407.2	58.7	0.2	5.7				27027	B	Non-Aggressive		Non-Aggressive		Non-Aggressive				Sand	17	37	0.6	Non-Saline		
	17				0.5	5.7				15152	B	Non-Aggressive		Non-Aggressive		Non-Aggressive				Light clay	8.5	66	0.6	Non-Saline		
	17				1.0	5.6				6250	B	Non-Aggressive		Non-Aggressive		Non-Aggressive	5.7	Non-Aggressive	Non-Aggressive	Light clay	8.5	160	1.4	Non-Saline	0.9	Non-Saline
	17				1.5	5.5				5000	B	Mild		Non-Aggressive		Non-Aggressive				Heavy clay	6	200	1.2	Non-Saline		
.	17	.	.	.	2.0	5.8				5882	B	Non-Aggressive		Non-Aggressive		Non-Aggressive	5.6	Non-Aggressive	Non-Aggressive	Light clay	8.5	170	1.4	Non-Saline	1.3	Non-Saline
119	18	301122.2	6258396.8	53.4	0.2	6				14706	B	Non-Aggressive		Non-Aggressive		Non-Aggressive				Clay loam	9	68	0.6	Non-Saline		
	18				0.5	5.2				2857	B	Mild		Non-Aggressive		Non-Aggressive				Medium clay	7	350	2.5	Slightly Saline		
	18				1.0	4.8				1316	B	Mild		Non-Aggressive		Mild	5.3	Mild	Non-Aggressive	Medium clay	7	760	5.3	Moderately Saline	3.1	Slightly Saline
	18				1.5	4.9				1205	B	Mild		Non-Aggressive		Mild				Light medium clay	8	830	6.6	Moderately Saline		
.	18	.	.	.	2.0	5.1				1639	B	Mild		Non-Aggressive		Mild	5.0	Mild	Non-Aggressive	Light medium clay	8	610	4.9	Moderately Saline	6.1	Moderately Saline
120	19	301239.5	6258436.4	50.2	0.2	6.1				9091	B	Non-Aggressive		Non-Aggressive		Non-Aggressive				Clay loam	9	110	1.0	Non-Saline		
	19				0.5	4.8				1818	B	Mild		Non-Aggressive		Mild				Medium clay	7	550	3.9	Slightly Saline		
	19				1.0	4.5				833	B	Moderate		Non-Aggressive		Moderate	5.0	Mild	Non-Aggressive	Light medium clay	8	1200	9.6	Very Saline	5.3	Moderately Saline
	19				1.5	4.5				909	B	Moderate		Non-Aggressive		Moderate				Light medium clay	8	1100	8.8	Very Saline		
.	19	.	.	.	1.5	4.5				909	B	Moderate		Non-Aggressive		Moderate	4.5	Moderate	Non-Aggressive	Light medium clay	8	1100	8.8	Very Saline	8.8	Very 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

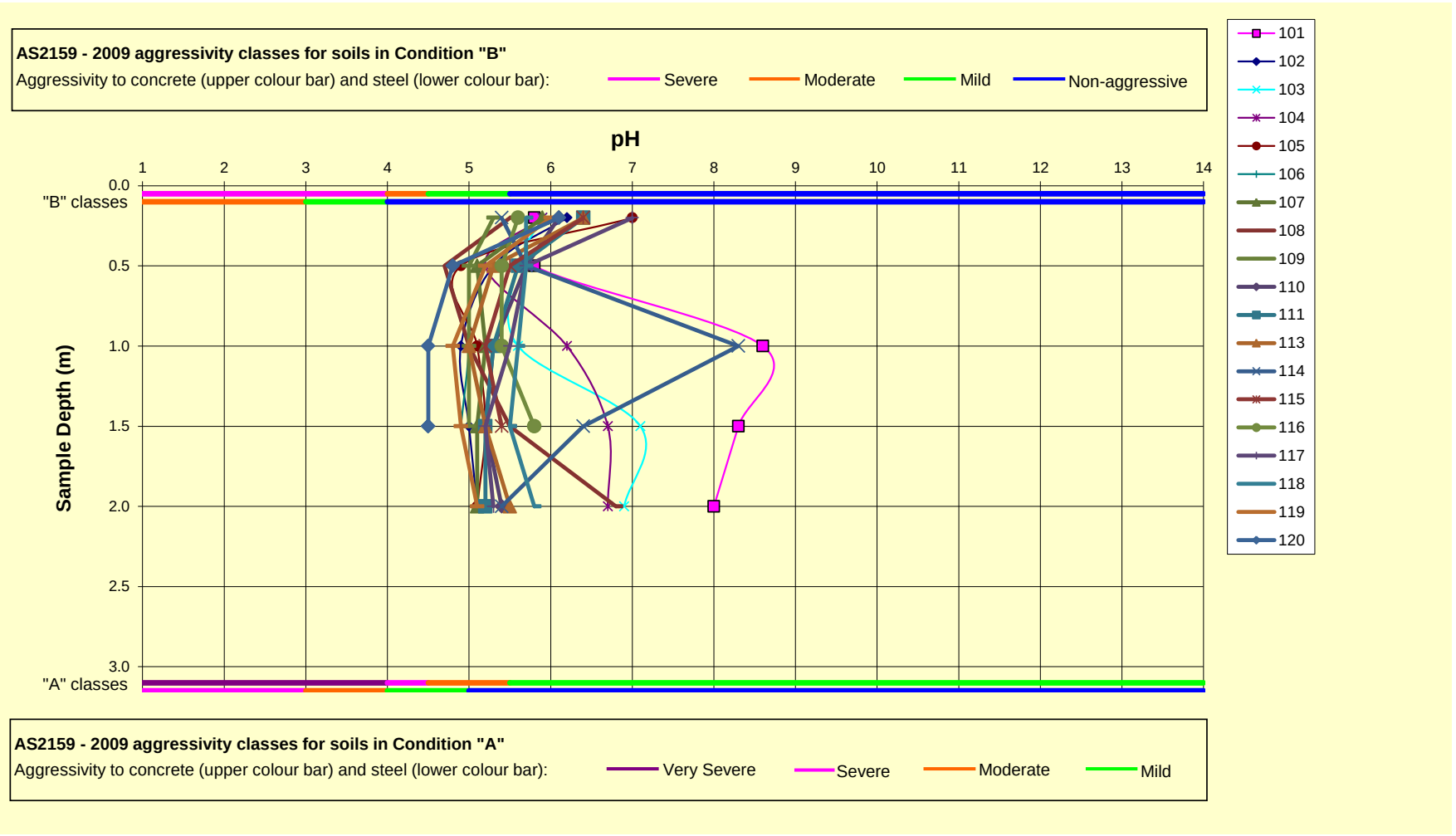

Figure 1: Vertical Soil pH Profiles and Aggressivity Classes

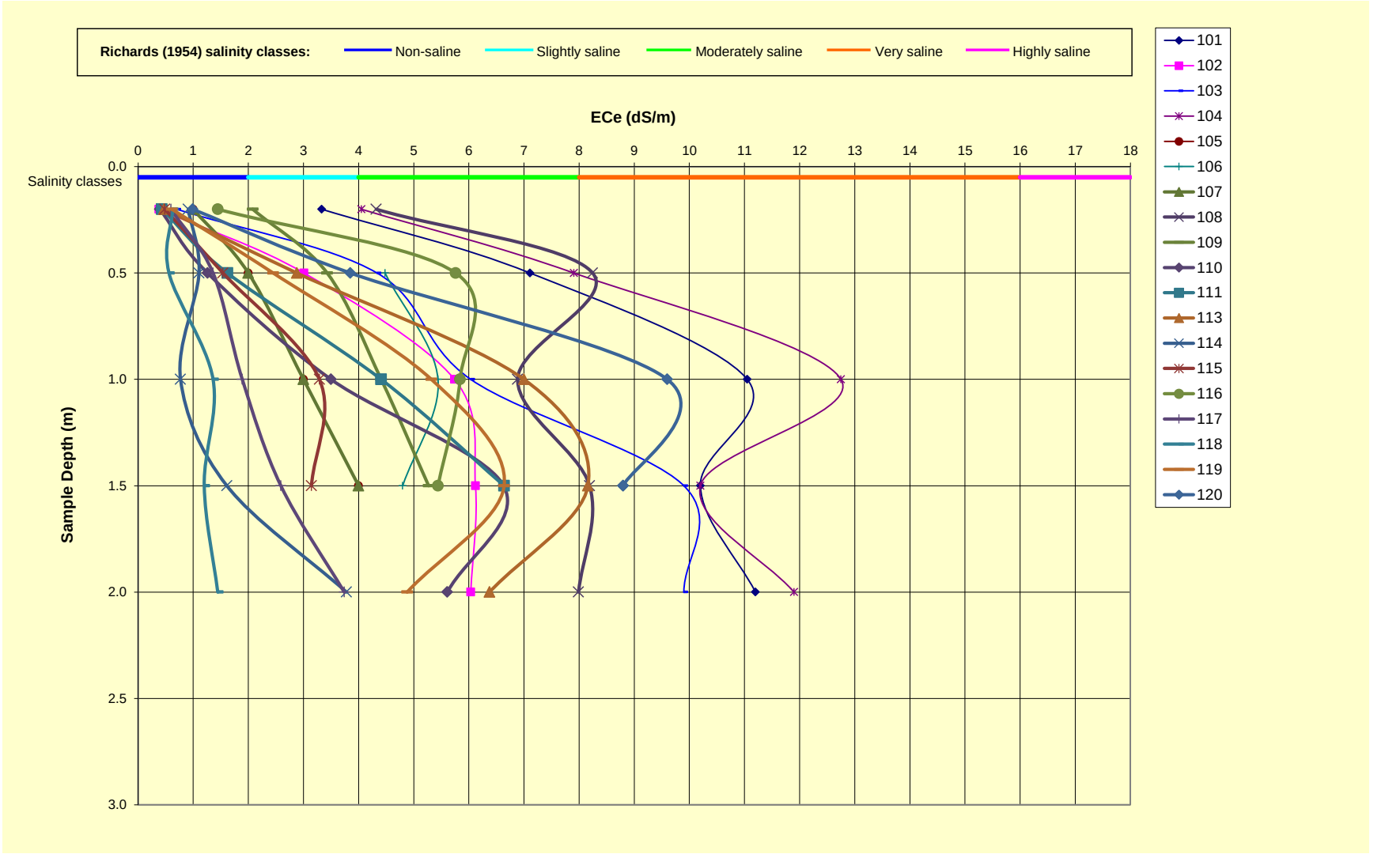

Figure 2: Vertical Soil Salinity Profiles and Salinity Classes