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Our Ref: PSM1473.R1 Rev2
Date: 16 August 2010

LOGOS Property
Suite 3, Level 15
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ATTENTION: MR JOHN MARSH

Dear John,

RE: PRELIMINARY ENVIRONMENTAL SITE ASSESSMENT (PESA) AND SALINITY ASSESSMENT, CORNER OF BAKERS LANE AND MAMRE ROAD, ERSKINE PARK

We are please to submit our revised final report addressing the above.

For and on behalf of
PELLS SULLIVAN MEYNINK

GARRY MOSTYN

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LOGOS Property

PRELIMINARY ENVIRONMENTAL SITE ASSESSMENT (PESA) AND SALINITY ASSESSMENT, CORNER OF BAKERS LANE AND MAMRE ROAD, ERSKINE PARK

Report PSM1473.R1 Rev2 **August 2010**

EXECUTIVE SUMMARY

Pells Sullivan Meynink Pty Ltd (PSM) has undertaken a preliminary environmental site assessment (PESA) and salinity assessment at Bakers Lane and Mamre Road, Erskine Park (the Site). The work was commissioned by John Marsh of LOGOS Property Pty Ltd, as per our standard acceptance letter (PSM1473.L1), dated 31 May 2010, and was performed in accordance with our proposal PSM letter A1183.L1, dated 21 May 2010.

The site has an area of 50 hectares and measures approximately 1000m by 500m. It is bounded by Mamre Road, Bakers Lane and private properties to the east and south.

We have performed a Phase 1 environmental and salinity assessment which included the following:

- A desk top review of historical aerial photographs, and a walkover survey.
- Fieldwork comprising of the excavation of test pits, boreholes and installation of piezometers.
- A sampling and chemical testing program to target potential salinity concerns.
- A detailed report providing results to all the above works and advice on the management of site salinity
- The results of this study can be summarised as follows:
    - The site is underlain by residual clay of very stiff to hard consistency, underlain by shale of extremely low to medium strength.
    - The soils on site can be classified as non-saline with slightly saline soils at depth. No special consideration with regards to salinity issues is required for the proposed development.
    - The soils on site above groundwater can be classified as non-aggressive. Requirements for minimum concrete strength and reinforcement cover apply for concrete foundation piles and footings.
    - The soils on site below groundwater can be classified as non-aggressive to mild. Requirements for minimum concrete strength and reinforcement cover apply for concrete foundation piles and footings.
    - The groundwater on site can be classified as saline. This is typical of a shale environment.

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A Urban Environmental Report “Preliminary Environmental Site Assessment Lot 1 Lot 1 DP104958 Bakers Lane, Erskine Park, NSW (Ref: UES033.R01)”
B Test Pit Logs, Borehole Logs and Piezometer Construction Records
C Bulk Earthworks Plan (Buckton Lysenko Drawing 249910 BEW1 Rev1)
D Soil Laboratory Test Results
E Groundwater Laboratory Test Results

1. INTRODUCTION

Pells Sullivan Meynink Pty Ltd (PSM) has undertaken a preliminary environmental site assessment (PESA) and salinity assessment at Bakers Lane and Mamre Road, Erskine Park (the Site). The work was commissioned by John Marsh of LOGOS Property Pty Ltd, as per our standard acceptance letter (PSM1473.L1), dated 31 May 2010, and was performed in accordance with our proposal PSM letter A1183.L1, dated 21 May 2010.

2. PROPOSED DEVELOPMENT

From the documentation provided we understand that it is proposed to subdivide the approximately 50 hectare site into industrial subdivisions of varying dimensions. Each subdivision will be levelled and developed using a combination of buildings, hardstand areas and associated access roads and car parking facilities.

The bulk earthworks plan provided is included as Appendix C of this report. It indicates that final levels vary between approximately RL 53.0 m and RL 63.0 m. Achieving the final landform will require approximately 1.5 million m^3 of earthworks. The maximum cut depth is shown as approximately 22 m and the maximum fill depth shown as approximately 15 m.

3. SCOPE OF WORK

3.1. General

Two (2) separate assessments have been undertaken on site, namely, the **PESA** and the **salinity assessment**. The following points describe the scope of work completed for each assessment.

3.2. Preliminary Environmental Site Assessment (PESA).

PSM commissioned Urban Environmental to undertake a PESA for the site. As part of this work Urban Environmental completed the following tasks:

- Site inspection;
- Review of background geological and hydrogeological information;
- Review of historical title deeds associated with the property;
- Review of historical aerial photography;
- Review of readily available reports and records;
- Reporting detailing the findings of the assessment.

3.3. Salinity Assessment and Preliminary Field Work

PSM commissioned Urban Environmental to undertake a preliminary salinity appraisal of the site comprising of a desktop study of historical aerial photography.

PSM has completed a Salinity Assessment (SA) and preliminary field work for the site. As part of this work PSM completed the following tasks:

1. Site walkover survey. Details are provided in Section 3.4 of this report.
2. Test pit, borehole and piezometer installation. Details are provided in Section 3.5 of this report.
3. Soil sampling and laboratory testing program to assess the salinity status of the site. Details of the soil sampling and testing programme are provided in Section 3.6 of this report.
4. Groundwater sampling and laboratory testing program to assess the salinity status of the site. Details of the groundwater sampling are provided in Section 3.7 of this report.

Section 4 presents and discusses the results of the above tasks.

The salinity assessment based on the results discussed in Section 4 is presented in Section 5 of this report. This section also provides advice addressing the management of site salinity.

3.4. Site walkover

On 8 June 2010, prior to commencement of the test pit and borehole excavations a PSM geotechnical engineer completed a site walkover during which the following tasks were completed:

- Inspected the site for signs/evidence of salinity,
- Selected test locations,
- Completed service location.

3.5. Test pit, borehole and piezometer installation

3.5.1. Aim

The primary aim of the test pit, borehole and piezometer installation undertaken on site was to define the subsurface profile and collect soil and groundwater samples for testing as part of the salinity assessment for the site.

The conditions encountered in the test pits and boreholes were also logged geotechnically in order to provide the basis for the preliminary geotechnical advice included in this report.

A PSM geotechnical engineer was present on site fulltime during the field work. The PSM geotechnical engineer completed the following tasks:

- Located the test pits and boreholes;
- Prepared engineering logs of the test pit and boreholes;
- Conducted field tests;

- Collected soil samples;
- Recorded water inflows and levels where possible;
- Purged and collected groundwater samples.

3.5.2. Test Pits

Twenty (20) test pits were excavated on 8 and 9 June 2010 at the locations shown in Figure 1. These were numbered TP1 to TP20. Test pit locations were measured with a hand-held GPS unit with a horizontal accuracy of about ±5 m; their reduced levels were estimated from the survey plan prepared by Warren F Cole Registered Surveyor (Ref. 847). Engineering test pit logs together with the terms and symbols used in their preparation are presented in Appendix B.

The test pits were excavated using a JCB 3CX Backhoe fitted with 450 mm bucket, and were excavated through the soils to virtual refusal or to a maximum depth of approximately 3.0 m. Test pit depths ranged from 1.2 m to 3.8 m. The test pits were loosely backfilled upon completion, and extra spoil mounded on the surface.

Samples were recovered in the test pits at discrete intervals, and field tests were conducted to estimate the soil strength. Twenty samples were sent to the laboratory for salinity and corrosivity testing.

The samples were collected in a manner to result in a representative selection of the observed subsurface profile.

3.5.3. Boreholes

The borehole drilling was carried out on 9 to 11 June 2010. Three boreholes (BH1 to BH3) were drilled at the locations shown in Figure 1. These locations were measured with a hand-held GPS unit with a horizontal accuracy of about ±5 m; their reduced levels were estimated from the survey plan prepared by Warren F Cole Registered Surveyor (Ref. 847). Engineering borehole logs together with the terms and symbols used in their preparation are presented in Appendix B.

The boreholes were drilled using a truck mounted JK500 rig. BH1 and BH3 were excavated using auger drilling methods to the target depths. Standard Penetration Tests (SPTs) were undertaken at 1.5 m intervals. BH 1 was terminated at 9.0m depth and BH3 was terminated at 8.1m depth.

BH2 was augered down to 12 m depth and then cored using HQ diamond coring techniques to a final depth of 21.5 m.

3.5.4. Piezometers

At each borehole a standpipe piezometer was installed. The piezometers were developed at completion. Piezometer completion details are shown on the piezometer construction records presented in Appendix B.

The groundwater level encountered during drilling was recorded.

3.6. Soil sampling and laboratory testing programme

3.6.1. Sampling methodology

The sampling was carried out in accordance with standard environmental protocol. This included collection of environmental samples in new sterilised glass jars, preservation of samples in ice chests and transport of samples to the contract laboratory under chain of custody documentation.

3.6.2. Laboratory testing

Twenty samples were recovered from the test pits from the site and taken to a NATA registered laboratory for the following assessment:

- Cation Exchange Capacity (CEC) of sodium, calcium, magnesium and potassium
- Exchangeable sodium percentage
- Soil pH
- Sulphates
- Chlorides
- Salinity (EC 1:5, one part soil to five parts water)

3.7. Groundwater sampling and laboratory testing programme

3.7.1. Sampling methodology

The sampling was carried out in accordance with standard environmental protocol. This included collection of groundwater samples in new sterilised plastic bottles, preservation of samples in ice chests and transport of samples to the contract laboratory under chain of custody documentation.

3.7.2. Laboratory testing

Three groundwater samples, together with two QA samples were recovered from the piezometers and were subjected to the following tests:

- Electrical conductivity,
- pH,
- Sodium, calcium, magnesium and potassium,
- Sulphates,
- Carbonates,
- Chlorides.

4. SUMMARY OF SITE CONDITIONS

4.1. Regional Geology

The 1:100,000 geology map for the Sydney region indicates that the site is underlain by residual clay over shale. It is located within a gently undulating regional topography consistent with typical Bringelly Shale landscapes. We also note that there are volcanic intrusions in the area.

Several dams exist on the site; a drainage line / creek run from the eastern boundary through a dam northwards.

A rough ridge line runs along the centre and southeast of the site with RL of up to 86m. It slopes down towards the northeast and southwest with the lowest RL of 42m on the southwest boundary.

Regionally the site is located along a ridge between Ropes Creek to the east and Kemps creek to the west. Thus it is likely that the site is located on the catchment boundary.

4.2. Site history

A review of the site's history is provided in Urban Environmental Report titled "Preliminary Environmental Sites Assessment Lot 1 DP104958 Bakers Lane Erskine Park, NSW" (Ref UES033.R1), dated 24 June, 2010 in Appendix A.

The following summarises the abovementioned report:

- The site comprises rural land in a predominantly rural area of Erskine Park;
- Review of the historical title information indicates that the site has had a history of farming and pastoral use;
- Review of historical aerial photography indicates that the site has had a history of pastoral land use. No market garden or orchards were evident. From 1947 to the present the land showed no indication of salinity indicators;
- A search of the NSW EPA website register indicated that there are no notices pertaining to environmental issues under the Contaminated Land Management Act (1997) for the site.

4.3. Surface conditions

4.3.1. General

The site is approximately rectangular in shape and measures approximately 1000m along Bakers Lane and 500m along Mamre Road. The site is bounded by private properties to the east and south.

The survey plan provided shows existing ground levels to be approximately RL 42 m to RL 86 m. At the time of the field work a vacant residential dwelling structure occupied the northwest corner of the site. Ground cover and scattered mature trees were present.

4.3.2. Evidence of salinity indicators

During the site walkover survey, the following observations were made:

- No visible distress to groundcover on site;
- No visible distress to trees and shrubs on site;
- The dams on the site appear to be full.

Indications of salinity, such as visible salt crystal remnants, bare soil patches, indicator vegetation species, die back of trees, gully erosion or staining and marking of brickwork around the existing house were not observed. The natural soils appeared to be in good condition.

No visible signs of land degradation such as erosion, salt pans, dead trees were observed.

4.4. Subsurface conditions

The findings of the field work were generally consistent with the geological map, except at high points of the site where there appears to be a sandstone capping overlying the residual clay and shale layers (encountered in BH2 and TP20). The inferred geotechnical model may be summarised as follows:

- **UNIT 1** - Topsoil comprising CLAY, Sandy CLAY or Clayey SAND, moist, brown and dark brown in colour, with some rootlets. Present at all test locations, overlying
- **UNIT 2** - Sandy CLAY / Clayey SAND, (only present in BH2 and TP20) moist, low to intermediate plasticity, yellow brown, sand is fine to medium grained, overlying
- **UNIT 3** - SANDSTONE, (only present in BH1, BH2 and TP20) highly to moderately weathered, fine to medium grained, yellow brown, iron stained, overlying
- **UNIT 4** - CLAY, present in most locations generally moist, of low to intermediate plasticity, yellow brown or orange brown or brown in colour, stiff to very stiff consistency with some shale fragments, overlying
- **UNIT 5** - CLAY, inferred to be residual in origin, present at most locations, of intermediate to high plasticity, very stiff to hard in consistency, grey mottled orange brown / red brown overlying
- **UNIT 6** - SHALE, extremely weathered to highly weathered, extremely low to low strength, dark grey to grey, iron staining generally present in the test pits overlying.
- **UNIT 7** - SHALE, slightly weathered to fresh, low to medium strength, dark grey, only encountered in BH1, BH2 and BH3

Table 1 summarises the subsurface conditions encountered at each test location. Surface levels at each test location were estimated from the survey drawing.

TABLE 1
SUMMARY OF GEOTECHNICAL UNITS ENCOUNTERED IN TEST LOCATIONS

BOREHOLE / TEST PIT	APPROXIMATE SURFACE LEVEL RL (m)	DEPTH TO TOP OF UNIT (m)							
		Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	End of Hole
TP1	46	0.0	-	-	-	0.3	0.7	-	1.2[1]
TP2	71	0.0	-	-	0.1	0.9	1.2	-	2.0[1]
TP3	65	0.0	-	-	0.2	0.7	1.4	-	3.0
TP4	56	0.0	-	-	0.3	0.8	1.6	-	3.1
TP5	61	0.0	-	-	0.3	0.9	1.9	-	3.0
TP6	47	0.0	-	-	0.2	-	1.3	-	2.1[1]
TP7	64	0.0	-	-	0.2	-	1.5	-	1.6[1]
TP8	68	0.0	-	-	0.4	-	1.0	-	2.0[1]
TP9	64	0.0	-	-	0.3	0.5	1.6	-	2.9
TP10	62	0.0	-	-	-	0.3	1.6	-	2.6[1]
TP11	65	0.0	-	-	0.3	0.7	1.7	-	3.0
TP12	45	0.0	-	-	-	0.3	1.2	-	2.9
TP13	55	0.0	-	-	0.3	2.1	2.8	-	3.0[1]
TP14	70	0.0	-	-	0.3	0.6	1.0	-	1.4[1]
TP15	70	0.0	-	-	0.3	1.0	2.0	-	2.6[1]
TP16	43	0.0	-	-	0.3	0.6	2.4	-	3.0[1]
TP17	47	0.0	-	-	0.3	2.1	-	-	3.8
TP18	59	0.0	-	-	0.4	0.6	1.0	-	3.0
TP19	81	0.0	-	-	0.3	-	1.0	-	2.7[1]
TP20	86	0.0	0.4	0.6	-	-	-	-	1.5[1]
BH1	48	0.0	-	0.6	-	-	2.1	7.2	9.0[2]
BH2	83	0.0	0.3	-	-	3.6	6.8	17.5	21.5
BH3	60	0.0	-	-	0.3	3.6	4.2	7.8	8.1[2]

Notes: 1. Effective refusal of excavator.
2. Effective refusal of auger

4.5. Soil chemistry

The complete set of soil laboratory results are attached in Appendix D.

The laboratory tests results indicated pH in the soil samples analysed to be in the range of 5.8 to 9.3, with an average of 7.5.

The laboratory tests results indicated concentrations of soluble sulphates in the samples analysed to be in the range of 3.2 mg/kg up to 580 mg/kg.

The laboratory tests results indicated concentrations of soluble chlorides in the samples analysed to be in the range of 3.3 mg/kg up to 1020 mg/kg.

The laboratory tests results indicated Cation Exchange Capacity (CEC) in the samples analysed to be in the range of 5 meq/100g to 22 meq/100g, with an average of 15 meq/100g.

The 1:5 soil to water extraction and subsequent electrical conductivity measurement were converted to equivalent saturated paste (EC_e) measurements, which is a measurement for salinity. The laboratory tests results indicated electric conductivity, in terms of microSiemens/centimetre to be in the range from 13 μS/cm to 737 μS/cm.

Table 2 summarises the results of the soil laboratory testing.

TABLE 2
SUMMARY OF SOIL LABORATORY TESTING

SAMPLE ID	pH	ELECTRICAL CONDUCTIVITY	EXCHANGEABLE SODIUM PERCENTAGE	SOLUBLE CHLORIDES	SOLUBLE SULPHATES
		µs/cm	%	mg/kg	mg/kg
TP04 Topsoil	8	17	6.7	3.8	5.4
TP04 0.3m	8	80	12.9	42.9	11.3
TP04 2.5-2.6m	7.3	737	39.3	1020	246
TP07 Topsoil	6.6	95	2.2	90.4	17
TP07 0.35-0.4m	8.7	41	4.9	21.4	14.2
TP07 0.6m	7.1	32	6.7	15	6.1
TP09 Topsoil	7.4	20	3.2	3.6	4.5
TP09 0.5-0.6m	7.5	240	16	250	77.7
TP09 0.7-0.8m	6.1	542	28.2	729	293
TP10 Topsoil	9.3	27	6.3	5.5	3.4
TP10 0.3-0.4m	6.3	209	24.6	192	106
TP10 0.6-0.7m	6.8	465	39.2	508	452
TP10 0.9-1.0m	7.8	621	13	700	580
TP12 Topsoil	8.4	13	9.4	3.3	5.8
TP12 0.6-0.65m	7.8	50	16.6	70.4	29.2
TP12 1.2-1.3m	5.8	630	47.9	930	233
TP12 2.2-2.3m	8.1	599	40.8	752	170
TP20 Topsoil	6.7	23	1.8	3.8	3.2
TP20 0.4-0.5m	8.9	26	1.6	5.2	6.2
TP20 1.0-1.1m	7.5	631	4.6	23.6	44.2

4.6. Groundwater level

Groundwater was encountered in BH3 during drilling at 6.8m depth; no groundwater was encountered in the other two boreholes. No groundwater inflows were observed during test pit excavation.

Groundwater levels in the piezometers were measured on 23 June 2010 and 1 July 2010. The depth to groundwater at the piezometer locations is summarised in Table 3.

TABLE 3
SUMMARY OF GROUNDWATER LEVELS

PIEZOMETER	DATE	MEASURED DEPTH (m)	APPROXIMATE REDUCED LEVEL (RL m AHD)
BH1	23/06/2010	3.6	44.4
	01/07/2010	5.1	42.9
BH2	23/06/2010	14.5	68.5
	01/07/2010	18.2	64.8
BH3	23/06/2010	2.9	58.1
	01/07/2010	2.8	58.2

4.7. Groundwater chemistry

The complete sets of groundwater laboratory results are attached in Appendix E.

The laboratory test results indicated Electrical conductivity in the groundwater samples analysed to be in the range of 1960 μS/cm to 19400 μS/cm.

The laboratory tests results indicated pH in the groundwater samples analysed to be in the range of 7.2 to 7.7, with an average of 7.4.

The laboratory tests results indicated concentrations of soluble sulphates in the groundwater samples analysed to be in the range of 45.4 mg/L up to 398 mg/L.

The laboratory tests results indicated concentrations of soluble chlorides in the groundwater samples analysed to be in the range of 451 mg/L up to 7330 mg/kg.

5. ASSESSMENT

5.1. Salinity, Corrossivity and Sodicity Classification

5.1.1. Electrical Conductivity

Site Investigations for Urban Salinity (DLWC, 2002) classify soil salinity based on electrical conductivity (EC_e). Values less than 2 dS/m are considered to be non-saline, indicating that salinity effects and mostly negligible. Values between 2 and 4 are

considered slightly saline; between 4 and 8 are moderately saline; between 8 to 16 are very saline and above 16 to be highly saline.

Twenty soil samples were tested for electric conductivity, of which 13 samples were non-saline and 7 samples was slightly saline.

Calculation of EC_e values and salinity class for samples tested are presented in Table 4.

TABLE 4
SALINITY CLASSIFICATION

SAMPLE	CONDUCTIVITY EC (1:5) (µS/cm)	SOIL TYPE	CONVERSION FACTORS	CONDUCTIVITY EC_e (dS/m)	SALINITY CLASS
TP04 Topsoil	17	Sandy CLAY	9	0.2	Non-saline
TP04 0.3m	80	CLAY	8	0.6	Non-saline
TP04 2.5-2.6m	737	CLAY	6	4.4	Slightly saline
TP07 Topsoil	95	CLAY	9	0.9	Non-saline
TP07 0.35-0.4m	41	CLAY	8	0.3	Non-saline
TP07 0.6m	32	CLAY	7	0.2	Non-saline
TP09 Topsoil	20	Sandy CLAY	9	0.2	Non-saline
TP09 0.5-0.6m	240	CLAY	8	1.9	Non-saline
TP09 0.7-0.8m	542	CLAY	7	3.8	Slightly saline
TP10 Topsoil	27	Sandy CLAY	9	0.2	Non-saline
TP10 0.3-0.4m	209	CLAY	8	1.7	Non-saline
TP10 0.6-0.7m	465	CLAY	7	3.3	Slightly saline
TP10 0.9-1.0m	621	CLAY	6	3.7	Slightly saline
TP12 Topsoil	13	Clayey SAND	14	0.2	Non-saline
TP12 0.6-0.65m	50	CLAY	7	0.4	Non-saline
TP12 1.2-1.3m	630	CLAY	6	3.8	Slightly saline
TP12 2.2-2.3m	599	CLAY	6	3.6	Slightly saline
TP20 Topsoil	23	Sandy CLAY	9	0.2	Non-saline
TP20 0.4-0.5m	26	Clayey SAND	14	0.4	Non-saline
TP20 1.0-1.1m	631	CLAY	6	3.8	Slightly Saline

One way to measure how much dissolved salt in water is to look at the concentration of salt in the water. Concentration is the amount (by weight) of salt in water and can be expressed in parts per million (mg/L). Concentrations less than 1000 mg/L can be classified as fresh water, concentrations between 1000 mg/L and 3000 mg/L can be classified as slightly saline water, concentrations between 3000 mg/L and 10000 can be classified as moderately saline water and concentrations above 10000 mg/L can be classified as highly saline water. Comparison of the electrical conductivity of the groundwater results with the criteria indicates that the groundwater samples are moderately to highly saline.

5.1.2. pH

Soil and water pH are important indicators for corrosivity. Acids combine with calcium hydroxide in cement to form soluble calcium compound. These are leached from the concrete, increasing its porosity and decreasing its strength. pH gives an indication of the corrosivity of the soil. Australian Standard AS2159:2009, *Piling – Design and Installation*, provides recommended pH limits for corrosivity.

The criterion for concrete piles exposure classification indicates that soil pH values greater than 5 in low permeability soils (i.e. clays/silts) and all soils above groundwater are considered to be non-aggressive. Values between 5 and 6.5 in high permeability soils (i.e. sands/gravels) below groundwater are considered to be mildly corrosive and values above 6.5 are considered to be non-aggressive. Criteria for steel piles exposure classification indicate that values greater than 5 in all soils are considered to be non-aggressive. Comparison of the soil pH results with these criteria indicates that the soil samples tested are non-aggressive.

Criteria for concrete piles exposure classification indicate that groundwater pH values between 5 and 6.5 are considered to be mildly corrosive and values above 6.5 are considered to be non-aggressive. Criteria for steel piles exposure classification indicate that values greater than 5 in are considered to be non-aggressive. Comparison of the groundwater pH results with these criteria indicates that the groundwater samples tested are non-aggressive.

5.1.3. Soluble Sulphates

Soluble sulphates are tested for concrete durability issues as it reacts with hydrated calcium aluminate in concrete to create spalling. Australian Standard AS2159:2009, *Piling – Design and Installation*, provides recommended sulphate limits for corrosivity of concrete piles. Values less than 0.5% (i.e. 5000 mg/kg) are considered to be non-aggressive. Comparison with this criterion indicates that the soil samples tested are non-aggressive.

Criteria for concrete piles exposure classification indicates that values less than 1000mg/L in groundwater are considered to be non-aggressive. Comparison with this criterion indicates that the groundwater samples tested are non-aggressive.

5.1.4. Soluble Chlorides

Chlorides are tested for concrete durability as they react with steel reinforcement, causing it to corrode and expand. Australian Standard AS2159:2009, *Piling - Design and installation,* contains limits for chlorides for corrosivity of steel piles.

Criteria for steel piles exposure classification indicate that values less than 0.6% (i.e.6000 mg/kg) are non-aggressive. Comparison with this criterion indicates that the soil samples tested are non-aggressive.

Criterion for concrete piles exposure classification indicate that values less than 6000 mg/L in groundwater are non-aggressive, values between 6000 mg/L and 12000 mg/L in groundwater are classified as mild. Comparison with this criterion indicates that the groundwater samples tested are non-aggressive to mild.

Criteria for steel piles exposure classification indicate that values less than 1000 mg/L are non-aggressive, values between 1000mg/L and 10000mg/L are also classified as non-aggressive for low permeability soils. Comparison with this criterion indicates that the groundwater samples tested are non-aggressive.

5.1.5. Exchangeable Sodium Percentages

Exchangeable sodium percentages are tested for soil sodicity, according to DLWC 2002 sodic soils lose their structure and disperse into very small particles when wet, and these small particles fill the pore spaces in the soil, creating an impermeable layer. This blocking of natural drainage can result in tunnelling soil erosion. Gullying or tunnelling can also occur if the sodic soils are exposed to rainfall. This impacts on landscaping as it may restrict root growth and cause shallow rooting depths for plants.

The Exchangeable Sodium Percentages (ESP) calculated from these laboratory results, ranging from 1.6% to 48%, indicates that the soils on site are highly sodic when compared to criteria listed in *Site Investigations for Urban Salinity*, DLWC 2002.

5.2. Discussions and Recommendations

5.2.1. Effect of Proposed Development on Groundwater

It is our opinion that the proposed earthworks are likely to result in changes to the existing groundwater levels on site. These changes will be associated with decreased infiltration, changes in final ground level and the presence of a deep cut. The changes to the groundwater levels are likely to be limited to the site and the immediate surrounds.

It is our opinion that groundwater seepage is likely to be limited to near the toe of the deep cut in the south-east corner of the site, during and after periods of wet weather. The volume of such inflows is likely to be low, based on the measured groundwater levels on the site, the position of the site near the top of the local catchment, and our experience in similar areas. It is considered that such inflows can be dealt with within the normal site surface drainage system without significantly affecting the capacity or salt loading of the system. A separate groundwater drainage system is thus unlikely to be required.

Based on the low anticipated seepage rates, the changes to groundwater are not expected to have a significant effect on any surrounding groundwater users, or the environment. We note that the proposed excavation may have an effect on the yield of the adjacent dams (where these are located above the BEL). However, we do not expect this effect to be significant.

5.2.2. Salinity, Corrosivity and Sodicity

There are requirements on concentrations of certain chemical analytes governing the limits on salinity and corrosivity. Salinity and corrosivity affects both landscaping and engineering issues.

5.2.2.1. Salinity

The soils at the site can be classified as non-saline for most of the site with slightly saline soils present at depth.

The groundwater results indicate that most of the groundwater on site can be classified as saline which is typical of a shale environment.

The use of salt tolerant native vegetation for landscaping will minimise the impact of salinity on the environment. The landscape designer should take account of the factual information in this report in its design.

Site drainage is an important management tool to minimise the impact of salinity on site, and to improve the overall salinity status of the site and its surrounding area. In landscaped areas methods such as controlled irrigation to match plant requirements, sub-soil drainage, and impervious pavement areas will aid in reducing surface water infiltration.

The amount of water infiltration on site will be reduced by the development by the sealing of a large portion of the land, the planting of deep rooted native trees and shrubs, and the installation of a surface drainage system to drain surface water to minimise infiltration.

Site observations do not indicate manifestation of salinity issues on site.

The chemical testing indicates that the site soils are not saline, do not exhibit salinity problems on site, and are not likely to be the cause of salinity problems on this site.

Hence it is concluded that no special consideration of salinity issues are required for the proposed development.

5.2.2.2. Corrosivity

The soils at the site above groundwater are classified as non-aggressive against exposure to concrete piles. Minimum concrete strength of 32 MPa and reinforcement cover of 45 mm cover are the requirements in accordance with AS2159:2009, *Piling – Design and Construction*, for concrete cast-in-place piles and footings in non-aggressive soils and 50 year design life.

The soils at the site below groundwater are classified as non-aggressive to mild against exposure to concrete piles. Minimum concrete strength of 32 MPa and reinforcement cover of 60 mm cover are the requirements in accordance with AS2159:2009, *Piling – Design and Construction*, for concrete cast-in-place piles and footings in non-aggressive soils and 50 year design life.

The soils at the site are classified as non-corrosive against exposure to steel piles. Australian Standard AS2159:2009, *Piling – Design and Construction* states that the corrosion allowance for steel piles in non-aggressive soils to be <0.01 mm/year.

5.2.2.3. Sodicity

The soils at the site can be classified as sodic.

For sodic soils present on site, a minimal impact has been observed for the past 63 years:

- Dams have been present on site since at least 1947. These dams have performed successfully.
- Trees and shrubs present on site since 1947 appear to be in good health.

We observed no visual erosion of the surface soils during the field investigation. The past history and performance of water courses and vegetation on site also suggest that the impact of sodicity is minimal on site.

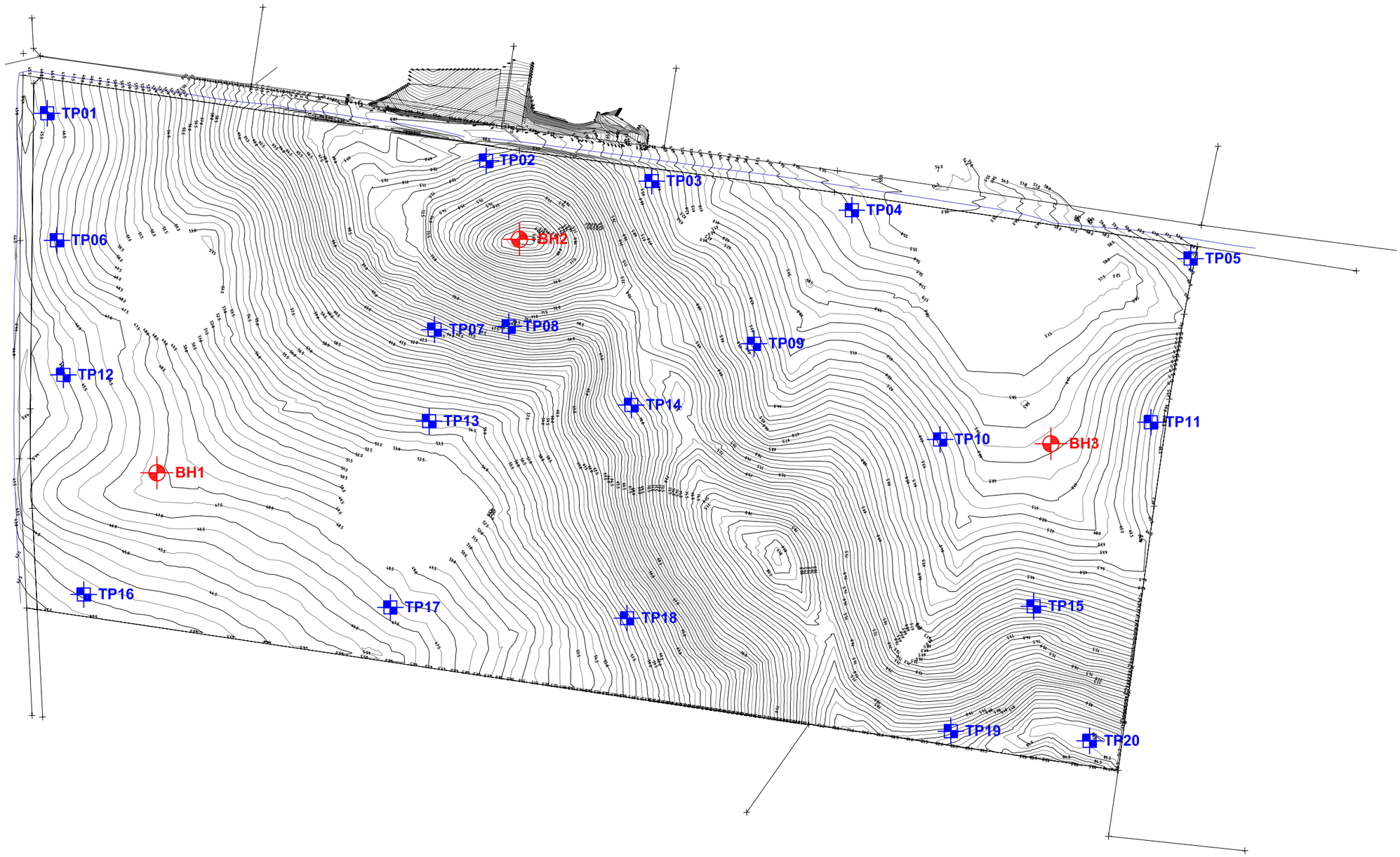
We assess that the impact of sodic soils on landscaping on site will be minimal. No special requirements for landscaping are necessary.

REFERENCES

1. AS2159:2009, *Piling – Design and Installation*, Standards Australia,
2. AS3798:2007, *Guidelines on earthworks for commercial and residential developments*, Standards Australia,
3. Department of Land and Water Conservation, Site Investigations for Urban Salinity, 2002.

For and on behalf of
PELLS SULLIVAN MEYNINK

GARRY MOSTYN



0 50 100 150 200 250m

Scale: 1:4000 @ A3

Pells Sullivan Meynink

Wilson Constructions
Preliminary Environmental Site Assessment And Salinity Assessment, Bakers Lane, Erskine Park

LOCATIONS OF TEST PITS AND BOREHOLES

PSM1473.R1	FIGURE 1

APPENDIX A

URBAN ENVIRONMENTAL REPORT "PRELIMINARY ENVIRONMENTAL SITE ASSESSMENT LOT 1 LOT 1 DP104958 BAKERS LANE, ERSKINE PARK, NSW (REF: UES033.R01)"

URBAN ENVIRONMENTAL

PRELIMINARY
ENVIRONMENTAL SITE ASSESSMENT
LOT 1 DP104958 BAKERS LANE
ERSKINE PARK, NSW

Prepared for:

Pells Sullivan Meynink Pty Ltd
G3, 56 Delhi Road
North Ryde, NSW, 2113

24 June, 2010

Project Ref: UES033.R01

URBAN ENVIRONMENTAL SERVICES PTY LTD
E&J LYCETT BUILDING SUITE 1, 18 MOORE STREET, ROZELLE
PO BOX 1070, ROZELLE, 2039 NSW
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DISTRIBUTION LIST

No. of Copies	Reference	Status	Date Issued	Prepared for:	Initials
1	UES033.R01	Final	24/6/10	Pells Sullivan Meynink Pty Ltd	
1	UES033.R01	Final	24/6/10	Urban Environmental	

PREPARED BY

Franco Fuccenecco BSc (Hons) MAppSc
Principal Consultant

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EXECUTIVE SUMMARY

Urban Environmental Services Pty Ltd was commissioned by Pells Sullivan Meynink Pty Ltd to undertake a preliminary environmental site assessment of the property located at Lot 1 DP104958 Bakers Lane, Erskine Park.

A preliminary environmental site assessment as per the *NSW EPA (1997) Guidelines for Consultants Reports* – Stage 1 assessment was undertaken to determine potential contamination issues associated with the future rezoning and redevelopment of the site and undertake appraisal of potential for salinity via desk top review and site inspection.

The site currently comprises rural land. The surrounding landuse is predominantly rural with a college located directly to the north of the site s.

Review of the geological and hydrological setting indicates the site occurs near a boundary between the Blacktown Residual Soil Landscape and Luddenham Erosional Soil Landscape. These soils are developed on Wianamatta Shale and Minchinbury Sandstone.

The nearest surface water features are farm dams located on the property. Ropes Creek is located 1.5km to the east of the site.

Review of historical title information indicates that the site has had a history of farming and pastoral use.

Review of historical aerial photography indicates that the site has had a history of pastoral landuse. No market garden or orchards were evident. From the period 1947 to the present the land showed no indication of salinity indicators – bare soil patches, dieback of trees or gully erosion.

Review of the Natural Resources Atlas – Dryland Salinity and the NSW Soil and Land Information System (SALIS) indicated no salinity hazards or occurrences in the area.

Site inspection showed the site to comprise crest and slope landforms with minimal degradation. No salinity indicators were evident such as bare soil patches, salt crystals on the surface, indicator vegetation species, die back of trees, gully erosion or staining and marking of brickwork around the existing house.

A search of the NSW EPA website register indicated that there are no notices pertaining to environmental issues under the Contaminated Land Management Act (1997) for the sites.

Urban Environmental Services Pty Ltd concludes based on the historical evaluation of site usage that the subject site has not had a history of potential contaminating activities and does not show signs of salinity indicators. Based on the past history and geological setting no further contamination investigation is warranted.

1 INTRODUCTION

1.1 Background

Urban Environmental Services Pty Ltd was commissioned by Pells Sullivan Meynink Pty Ltd to undertake a preliminary environmental site assessment of the property located at Lot 1 DP104958 Bakers Lane, Erskine Park. A cadastral plan is contained in Appendix A.

1.2 Objectives

The objective of the assessment was to determine the likelihood of site contamination by undertaking a Stage 1 Site Assessment as per the *NSW EPA (1997) Guidelines for Consultants Reports* and appraisal of potential for salinity via desk top review and site inspection.

1.3 Scope of Works

To achieve the objective, the following work scope was undertaken:

- Site inspection and discussions with the client;
- Review of background geological and hydrogeological information;
- Review of historical title deeds associated with the property;
- Review of historical aerial photography;
- Review of readily available reports and records;
- Preparation of a report detailing the findings of the assessment.

2 BACKGROUND INFORMATION

2.1 Site Identification

The site is located on Bakers Lane, Erskine Park and comprises Lot 1 DP104958.

2.2 Regional Geology

Review of the Department of Land and Water Conservation Sydney Soil Landscape Series Sheet 9130 (2004) indicates the site is near a boundary between the Blacktown Residual Soil Landscape and the Luddenham Erosional Soil Landscape.

The Blacktown Residual Soil Landscape comprising gently undulating rises on Wianamatta Group Shales. The soils in this landscape are described as shallow to moderately deep (<100cm) red and brown podzolic soils on crests, upper slopes and well drained areas and deep (150 – 300cm) yellow podzolic soils and soloths on lower slopes and in areas of poor drainage. These soils are moderately reactive, highly plastic subsoil, low soil fertility with poor drainage soil.

The Luddenham Erosional Soil Landscape comprising undulating to rolling low hills on Wianamatta Group Shales often associated with Minchinbury Sandstone. The soils in this landscape are described as shallow to moderately deep (70 - 150cm) red podzolic soils on upper slopes and yellow podzolic soils on upper slopes (>200cm). These soils have a high soil erosion hazard, localised impermeable highly plastic subsoil and are moderately reactive.

2.3 Regional Hydrology and Hydrogeology

The nearest surface water features are farm dams located on the property. Ropes Creek is located 1.5km to the east of the site.

2.4 Site Condition and Surrounding Environment

The site comprises rural land. The surrounding landuse is predominantly rural with a college located directly to the north of the site.

2.5 Salinity Appraisal

A salinity appraisal comprising desktop review and site inspection was undertaken:

Review of the Natural Resources Atlas – Dryland Salinity and the NSW Soil and Land Information System (SALIS) indicated no salinity hazards or occurrences in the area.

Site inspection showed the site to comprise crest and slope landforms with minimal degradation. No salinity indicators were evident such as bare soil patches, salt crystals on the surface, indicator vegetation species, die back of trees, gully erosion or staining and marking of brickwork around the existing house.

3 SITE HISTORY

3.1 Site Title Deeds

The site title deeds indicated the properties have evolved as follows:

Year	Proprietor (Lot 1 DP 104958)
2002 – to date	Sam Camilleri Elizabeth Camilleri Adcom Holdings Pty Ltd Michael Camilleri Rosemary Cassar Joseph Cassar
1988 – 2002	Werona Pastoral Co Pty Limited
	(Lot 1 DP 104958 – CTVol 10340 Fol 135)
1972 – 1988	Werona Pastoral Co Pty Limited
1966 – 1972	Olive May Hoyer, widow
	(Part Portion 52 Parish Melville – Area 128 acres 3 Roods – CTVol 7241 Fol's 51 & 52)
1957 – 1966	Henry Charles Hoyer, farmer Olive May Hoyer
1957 – 1957	Doris Muriel Clark Olive May Hoyer, married woman
	(Part Portion 52 Parish Melville – Area 128 Acres 3 Roods – CTVol 2375 Fol 233)
1913 – 1957	Samuel Charles Baker, farmer

Review of historical title information indicates that the site has had a history of farming and pastoral use.

Detailed title information is contained in Appendix B.

3.2 Aerial Photography

Review of historical aerial photographs held by the Department of Land & Water Conservation indicates the site has undergone the following changes since 1947. A summary of photographs reviewed is outlined below:

- *Penrith* *1:25,000* *2005* *Run 9* *Photo 222 -245*

The site appears in its current state comprising rural paddocks and farm dams. The original residence is evident just off Bakers Lane. The land shows no indication of salinity indicators – bare soil patches, dieback of trees or gully erosion. The surrounding landuses included college facilities to the north and market gardens/rural land to the south, east and west

- *Penrith* *1:25,000* *1994* *Run 9* *Photo 200 -220*

The site appears as above.

- *Sydney ISG* *1:16,000* *1986* *Run 21* *Photo 68 -114*

The site appears as above with less surrounding development present. (No college)

- *Cumberland* *1:16,000* *1978* *Run 14* *Photo 2707-198*

The site appears as above with no large farm dams evident.

- *Cumberland* *No Scale* *1961* *Run 32w* *Photo 1048 - 5138*

The site appears as above.

- *Liverpool* *12" 12,200* *1947* *Run 30* *Photo 63-83*

The site appears as above. An extensive garden is evident at the rear of the house fronting Bakers Lane

Review of historical aerial photography indicates that the site has had a history of pastoral landuse. No market garden or orchards were evident. From the period 1947 to the present the land showed no indication of salinity indicators – bare soil patches, dieback of trees or gully erosion.

A copy of select aerial photography is contained in Appendix C.

3.3 Notices, Permits and Licences

A search of the NSW EPA website register indicated that there are no notices pertaining to environmental issues under the Contaminated Land Management Act (1997) for the site.

4 CONCLUSIONS

Based on the results of the preliminary environmental site assessment, Urban Environmental Services Pty Ltd concludes the following:

- The site comprises rural land in a predominantly rural area of Erskine Park.

- Review of geological maps indicates the site is underlain by soils developed on Wianamatta Shales.

- Review of historical title deeds indicates the site has had a history of farming and pastoral use.

- Review of historical aerial photography indicates that the site has had a history of pastoral landuse. No market garden or orchards were evident. From the period 1947 to the present the land showed no indication of salinity indicators – bare soil patches, dieback of trees or gully erosion.

- A search of the NSW EPA website register indicated that there are no notices pertaining to environmental issues under the Contaminated Land Management Act (1997) for the site.

- Urban Environmental concludes that based on the historical evaluation of site usage, the subject site has a history of pastoral use.

- The site does not have a history of potential contaminating activities and does not show signs of salinity indicators. Based on the past history and geological setting no further contamination investigation is warranted.

5 REFERENCES

NSW Department of Mineral Resources (1983). Sydney Geological Series Sheet 9130 (Edition 1) 1:100,000 scale.

Department of Land and Water Conservation (2004). Sydney Soil Landscape Series Sheet 9130

NSW EPA (1997). Guidelines for Consultants Reporting on Contaminated Sites.

NEPC (1999). The National Environment Protection – Assessment of Site Contamination Measure (NEPM), National Environment Protection Council, December 1999.

DLWC (2002). Site Investigations for Urban Salinity

DISCLAIMER

Urban Environmental Services Pty Ltd have conducted work concerning the environmental status of the property which is the subject of this report, and has prepared this report on the basis of that assessment.

The work was conducted, and the report has been prepared, in response to specific instructions from the client to whom this report is addressed, within the time and budgetary requirements of the client, and in reliance on certain data and information made available to Urban Environmental Services Pty Ltd. The analyses, evaluations, opinions and conclusions presented in this report are based on that information, and they could change if the information is in fact inaccurate or incomplete.

Urban Environmental Services Pty Ltd will not update the report and has not taken into account events occurring after the time its assessment was conducted.

This report is intended for the sole use of the client and only for the purpose for which it was prepared. Any representation contained in the report is made only to the client. Any third party who relies on the report or on any representation contained in it does so at their own risk.

APPENDIX A
BACKGROUND RECORDS

Department of Lands
Reliable from the ground up

Cadastral Records Enquiry Report

Ref : BOX 97 - ERSKINE PARK

Requested Parcel : Lot 1 DP 104958

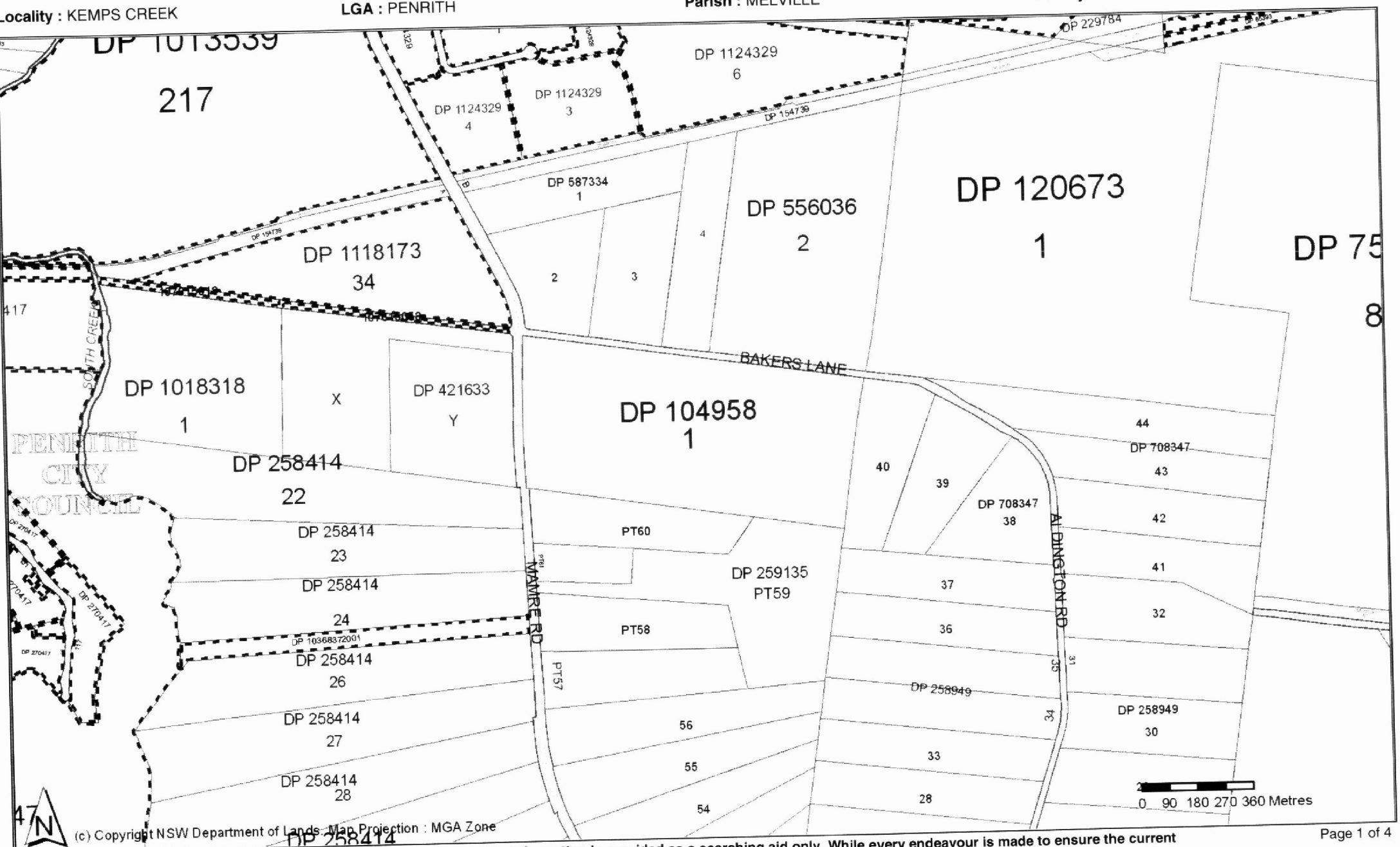
Identified Parcel : Lot 1 DP 104958

Locality : KEMPS CREEK

LGA : PENRITH

Parish : MELVILLE

County : CUMBERLAND



Report Generated 12:36:15 PM, 3 June, 2010

APPENDIX B
TITLE RECORDS

ADVANCE LEGAL SEARCH PTY LIMITED

(ACN 077 067 068)
ABN 49 077 067 068

PO Box 149
Yagoona NSW 2199

Telephone: +612 9754 1590
Mobile: 0412 169 809
Facsimile: +612 9754 1364
Email: alsearch@optusnet.com.au

07th June 2010

URBAN ENVIRONMENTAL SERVICES PTY LTD
PO Box 1070,
ROZELLE NSW 2039

Attention: Franco Fuccenecco

RE: **Bakers Lane ,**
Erskine Park

Current Search

Folio Identifier 1/104958 (title attached)
DP 104958 (plan attached)
Dated 04th June 2010
Registered Proprietor:
SAM CAMILLERI
ELIZABETH CAMILLERI
ADCOM HOLDINGS PTY LTD
MICHAEL CAMILLERI
ROSEMARY CASSAR
JOSEPH CASSAR

Title Tree
Lot 1 DP 104958

Folio Identifier 1/104958

Certificate of Title Volume 10340 Folio 135

Certificate of Title Volume 7241 Folio's 51 & 52

Certificate of Title Volume 2375 Folio 233

PA 17335

****

Summary of Proprietors
Lot 1 DP 104958

Year	Proprietor
	(Lot 1 DP 104958)
2002 – todate	Sam Camilleri Elizabeth Camilleri Adcom Holdings Pty Ltd Michael Camilleri Rosemary Cassar Joseph Cassar
1988 – 2002	Werona Pastoral Co Pty Limited
	(Lot 1 DP 104958 – CTVol 10340 Fol 135)
1972 – 1988	Werona Pastoral Co Pty Limited
1966 – 1972	Olive May Hoyer, widow
	(Part Portion 52 Parish Melville – Area 128 acres 3 Roods – CTVol 7241 Fol's 51 & 52)
1957 – 1966	Henry Charles Hoyer, farmer Olive May Hoyer
1957 – 1957	Doris Muriel Clark Olive May Hoyer, married woman
	(Part Portion 52 Parish Melville – Area 128 Acres 3 Roods – CTVol 2375 Fol 233)
1913 – 1957	Samuel Charles Baker, farmer

****

APPENDIX C
AERIAL PHOTOGRAPHY

PENRITH
1:25000 Approx. Scale

RUN 9
10-12-05

152.76 mm

PENRITH
1:25000 Approx. Scale
NSW4244 (Colour)

RUN 9
4-10-94
200-220

4054M ASL
152.76mm

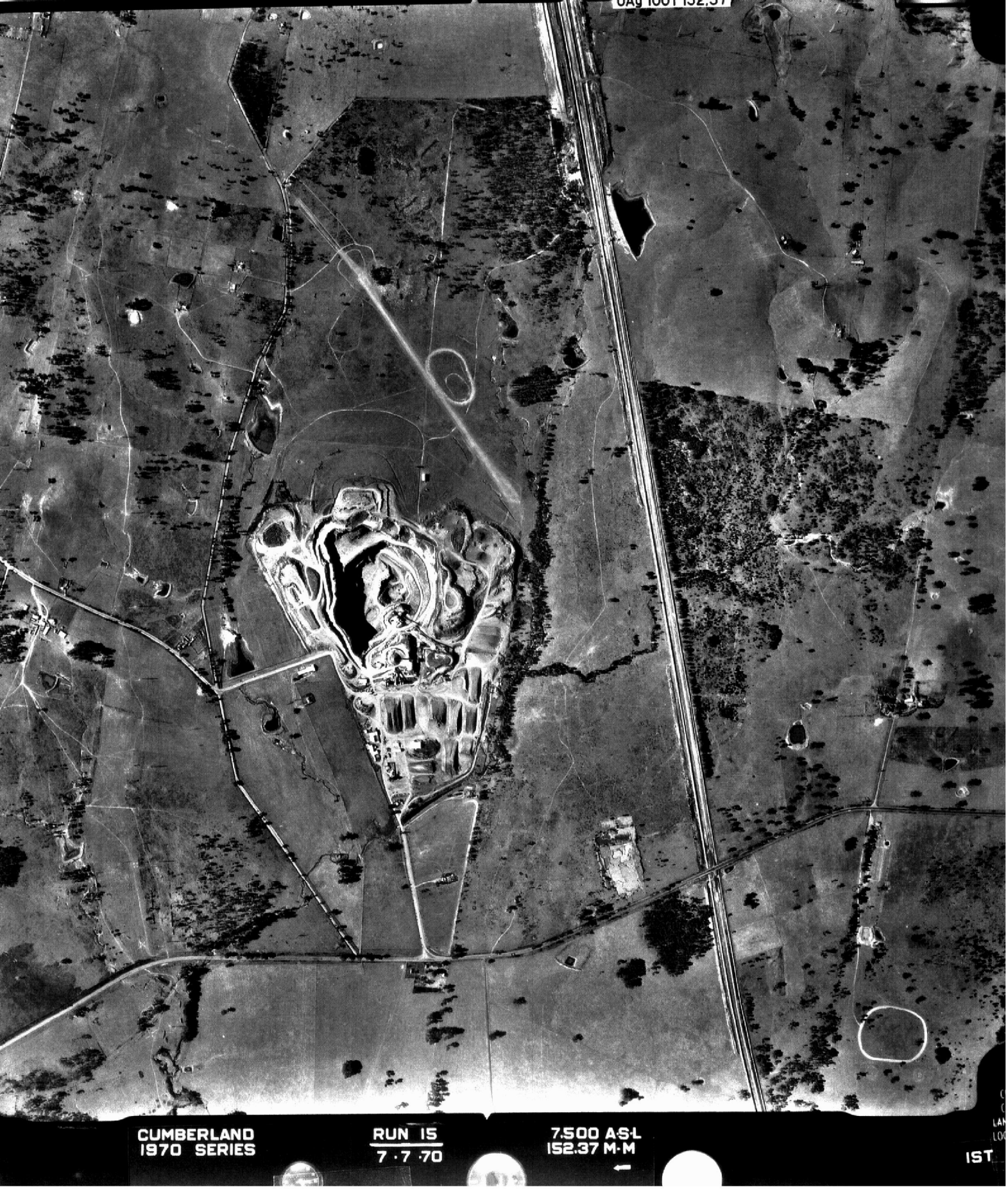

NSW
3528
100
SYDNEY ISG
1:16000 Approx. Scale
NSW3528 (M1743)
RUN 21
03-08-86
68-114
153.10 mm
Land and Property Infor
All Rights Re

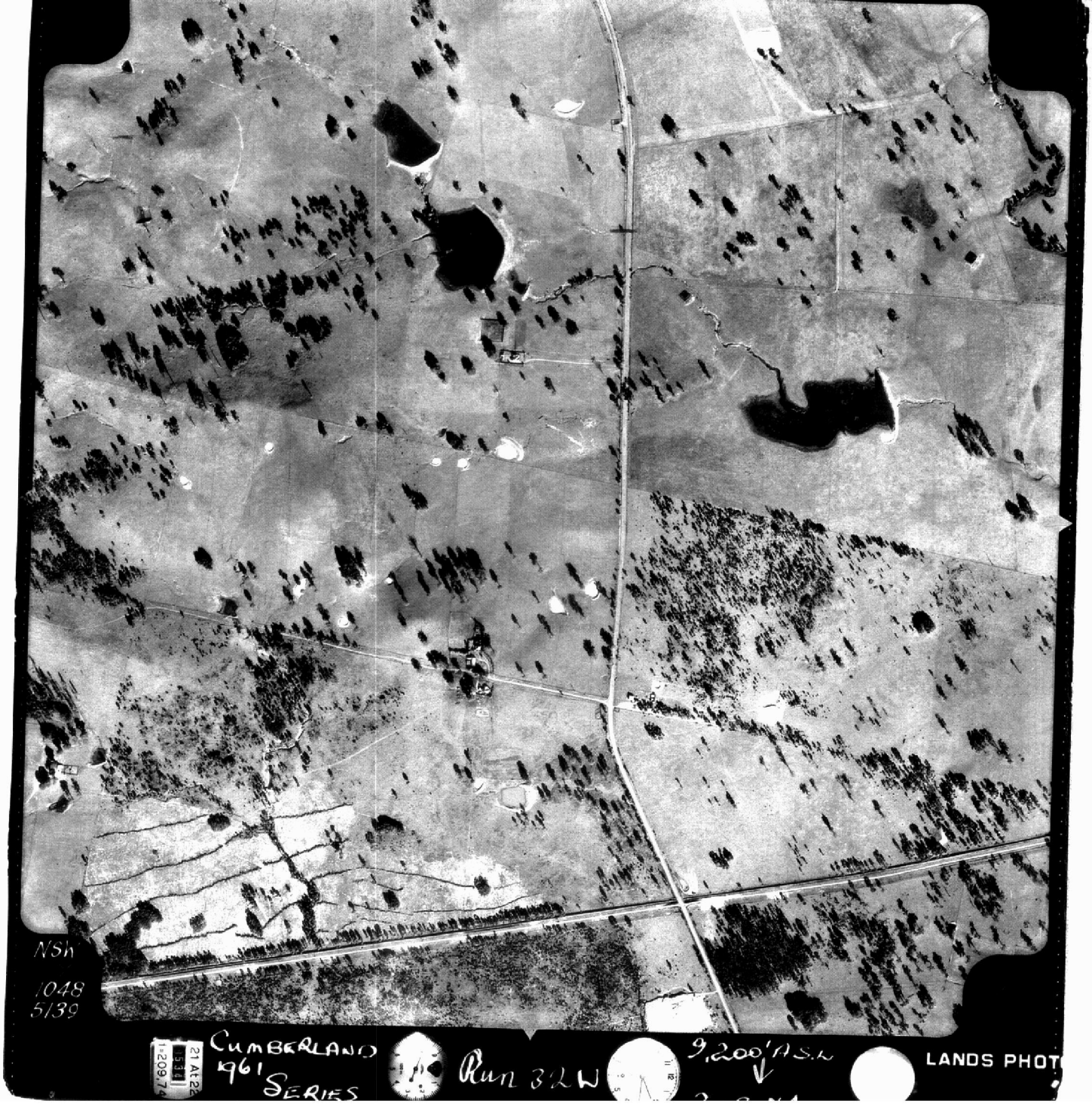
NSW
2707
198

COUNTY OF CUMBERLAND
1:16 000 (I.S.G.) 1978
(MISC. 1029) NSW 2707

RUN 14
11.4.78

2590m ASL
151.45mm


CUMBERLAND
1970 SERIES
RUN 15
7·7·70
7,500 A·S·L
152.37 M·M
IST


NSh
1048
5139
CUMBERLAND
1961 SERIES
Run 32W
9,200' A.S.L.
LANDS PHOT

63-83

LIVERPOOL (CO.C'LAND) RUN 30 ↓ JAN 47 12" 12200

APPENDIX B

TEST PIT LOGS, BOREHOLE LOGS AND PIEZOMETER CONSTRUCTION RECORDS

Pells Sullivan Meynink

Engineering Consultants
Rock-Soil-Water

Excavation Log

Excavation No: **TP01**

Sheet: 1 of 1

Job No: PSM1473

Client:	Wilson Constructions	**Date commenced:**	08/06/2010
Principal:		**Date completed:**	08/06/2010
Project:	Bakers Lane Industrial Estate - Geotechnical & Salinity Investigation	**Logged by:**	RT
Site location:	Erskine Park	**Checked by:**	

Equipment type:	JCB 3CX	**R.L. surface:**	46 m	**Vertical datum:**	
Excavation dimensions:	450 mm bucket	**Easting:**		**Horizontal datum:**	
		Northing:			

Method	Penetration (1 2 3)	Water	Samples	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material	Moisture Condition	Estimated Strength	Pocket Penetrometer (kPa)	Structure and Additional Observations
Back Hoe				46.0			CL	TOPSOIL - CLAY; low to medium plasticity, dark brown, with some fine sand	M	ST		Rootlets down to 0.4 m
							CH	CLAY; medium to high plasticity, red brown, with traces of fine sand and traces shale fragments up to 5 mm		VST		
				45.0	1.0			Clayey SHALE; extremely to highly weathered, grey, iron stained	D	R1		
								Becoming stronger with depth				
								EOH @ 1.2 m, refusal on low to medium strength shale				
				44.0	2.0							
				43.0	3.0							
				42.0								

Sketch:

Pells Sullivan Meynink

Engineering Consultants
Rock-Soil-Water

Excavation Log

Excavation No: **TP02**

Sheet: 1 of 1

Job No: PSM1473

Client:	Wilson Constructions	**Date commenced:**	08/06/2010
Principal:		**Date completed:**	08/06/2010
Project:	Bakers Lane Industrial Estate - Geotechnical & Salinity Investigation	**Logged by:**	RT
Site location:	Erskine Park	**Checked by:**	

Equipment type:	JCB 3CX	**R.L. surface:**	71 m	**Vertical datum:**	
Excavation dimensions:	450 mm bucket	**Easting:**		**Horizontal datum:**	
		Northing:			

Method	Penetration (1 2 3)	Water	Samples	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material	Moisture Condition	Estimated Strength	Pocket Penetrometer (kPa)	Structure and Additional Observations
Back Hoe				71.0				TOPSOIL - CLAY; low to medium plasticity, brown, with traces of silt	D	ST		Rootlets down to 0.4 m
							CL	CLAY; low to medium plasticity, mottled orange brown	M	VST		
								Becoming more grey, with some shale gravels up to 5 mm, angular to subangular				
				70.0	1.0		CH	CLAY; medium to high plasticity, grey with specks of red				
								Becoming dry				
								Clayey SHALE; extremely to highly weathered, grey with red brown specks, clay is medium to high plasticity, hard	D	R0		
								SHALE; highly weathered, grey yellow brown, low strength		R2		
				69.0	2.0			EOH @ 2.0 m, refusal on low strength shale bedrock				
				68.0	3.0							
				67.0								

Sketch:

Pells Sullivan Meynink

Engineering Consultants
Rock-Soil-Water

Excavation Log

Excavation No: **TP03**

Sheet: 1 of 1

Job No: PSM1473

Client:	Wilson Constructions	**Date commenced:**	08/06/2010
Principal:		**Date completed:**	08/06/2010
Project:	Bakers Lane Industrial Estate - Geotechnical & Salinity Investigation	**Logged by:**	VHL
Site location:	Erskine Park	**Checked by:**	

Equipment type:	JCB 3CX	**R.L. surface:**	65 m	**Vertical datum:**	
Excavation dimensions:	450 mm bucket	**Easting:**		**Horizontal datum:**	
		Northing:			

Method	Penetration 1 2 3	Water	Samples	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material	Moisture Condition	Estimated Strength	Pocket Penetrometer (kPa) 100 200 300 400	Structure and Additional Observations
Back Hoe				65.0			CL	TOPSOIL - Sandy CLAY; low to medium plasticity, dark brown, fine grained sand				Rootlets down to 0.3 m
								CLAY; low to medium plasticity, orange brown, traces of shale fragments up to 5 mm, angular to subangular	M	VST		
							CH	CLAY; high plasticity, red brown with specks of grey				
				64.0	1.0			Becoming drier, becoming predominantly grey		H		
								Clayey SHALE; extremely to highly weathered, grey, iron stained				
								Becoming yellow brown	D	R1		
				63.0	2.0							
				62.0	3.0			EOH @ 3.0 m, target depth				
				61.0								

Sketch:

File Name: PSM1473 TEST PIT LOGS.GPJ Print date: 25/6/10

Pells Sullivan Meynink

Engineering Consultants
Rock-Soil-Water

Excavation Log

Excavation No: **TP04**

Sheet: 1 of 1

Job No: PSM1473

Client:	Wilson Constructions	**Date commenced:**	08/06/2010
Principal:		**Date completed:**	08/06/2010
Project:	Bakers Lane Industrial Estate - Geotechnical & Salinity Investigation	**Logged by:**	RT
Site location:	Erskine Park	**Checked by:**	

Equipment type:	JCB 3CX	**R.L. surface:**	56 m	**Vertical datum:**	
Excavation dimensions:	450 mm bucket	**Easting:**		**Horizontal datum:**	
		Northing:			

Method	Penetration 1 2 3	Water	Samples	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material: SOIL TYPE; plasticity or particle characteristics, colour, secondary and minor components / ROCK TYPE; weathering, colour, secondary and minor components	Moisture Condition	Estimated Strength	Pocket Penetrometer (kPa) 100 200 300 400	Structure and Additional Observations
Back Hoe			D	56.0				TOPSOIL - Sandy CLAY; low plasticity, dark brown, fine grained sand		F		Rootlets down to 0.35 m
			D				CL	CLAY; medium plasticity, orange brown, traces of shale fragments up to 5 mm	M	VST		
				55.0	1.0		CH	CLAY; medium to high plasticity, red brown, shale fragments up to 30 mm (Residual shale?)	D	H		
								SHALE; EW, dark grey, iron stained with calcite, extremely low to very low strength		R1		
				54.0	2.0		CH	CLAY; high plasticity, mottled grey and red brown, with traces of shale gravels up to 20 mm, grey	M	H		
			D									
				53.0	3.0			EOH @ 3.1 m, target depth				
				52.0								

Sketch:

File Name: PSM1473 TEST PIT LOGS.GPJ Print date: 25/6/10

Pells Sullivan Meynink

Engineering Consultants
Rock-Soil-Water

Excavation Log

Excavation No: **TP05**

Sheet: 1 of 1

Job No: PSM1473

Client:	Wilson Constructions	**Date commenced:**	09/06/2010
Principal:		**Date completed:**	09/06/2010
Project:	Bakers Lane Industrial Estate - Geotechnical & Salinity Investigation	**Logged by:**	VHL
Site location:	Erskine Park	**Checked by:**	

Equipment type:	JCB 3CX	**R.L. surface:**	61 m	**Vertical datum:**	
Excavation dimensions:	450 mm bucket	**Easting:**		**Horizontal datum:**	
		Northing:			

Method	Penetration (1 2 3)	Water	Samples	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material	Moisture Condition	Estimated Strength	Pocket Penetrometer (kPa)	Structure and Additional Observations
Back Hoe				61.0			CL	TOPSOIL - Sandy CLAY; low to medium plasticity, dark brown, fined gained sand	M	F		Rootlets down to 0.3 m
								CLAY; low to medium plasticity, brown with specks of black, grey and red		ST		
				60.0	1.0		CH	CLAY; medium to high plasticity, brown and becoming more grey, with some shale fragments up to 20 mm, red iron staining on fragments		VST		
								CLAY; medium to high plasticity, brown, with grey shale fragments up to 20 mm, red iron staining	D	H		
				59.0	2.0			SHALE; extremely to highly weathered, grey with red iron staining		R1		
								SHALE; highly weathered, becoming grey, strength increasing with depth		R2		
				58.0	3.0			EOH @ 3.0 m, target depth				
				57.0								

Pocket Penetrometer (kPa): 100, 200, 300, 400

Sketch:

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Excavation Log

Excavation No: **TP06**

Sheet: 1 of 1

Job No: PSM1473

Client:	Wilson Constructions	**Date commenced:**	08/06/2010
Principal:		**Date completed:**	08/06/2010
Project:	Bakers Lane Industrial Estate - Geotechnical & Salinity Investigation	**Logged by:**	RT
Site location:	Erskine Park	**Checked by:**	

Equipment type:	JCB 3CX	**R.L. surface:**	47 m	**Vertical datum:**	
Excavation dimensions:	450 mm bucket	**Easting:**		**Horizontal datum:**	
		Northing:			

Method	Penetration 1 2 3	Water	Samples	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material	Moisture Condition	Estimated Strength	Pocket Penetrometer (kPa) 100 200 300 400	Structure and Additional Observations
Back Hoe			D	47.0			SC	TOPSOIL - Clayey SAND, fine grained, brown, with traces of silt	M	ST		Rootlets down to 0.3 m
			D					CLAY; low to medium plasticity, yellow brown, with some fine sand and traces of shale fragments up to 5 mm		VST		
			D				CL					
				46.0	1.0			Presence of angular to subangular iron stained shale fragments up to 30 mm		H		
								Clayey SHALE; extremely to highly weathered, grey, clay is medium to high plasticity and hard, trace of silt	D	R0		
				45.0	2.0							
								EOH @ 2.1 m, refusal on low strength shale				
				44.0	3.0							
				43.0								

Sketch:

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Excavation Log

Excavation No: **TP07**

Sheet: 1 of 1

Job No: PSM1473

Client:	Wilson Constructions	**Date commenced:**	08/06/2010
Principal:		**Date completed:**	08/06/2010
Project:	Bakers Lane Industrial Estate - Geotechnical & Salinity Investigation	**Logged by:**	RT
Site location:	Erskine Park	**Checked by:**	

Equipment type:	JCB 3CX	**R.L. surface:**	64 m	**Vertical datum:**	
Excavation dimensions:	450 mm bucket	**Easting:**		**Horizontal datum:**	
		Northing:			

Method	Penetration (1 2 3)	Water	Samples	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material	Moisture Condition	Estimated Strength	Pocket Penetrometer (kPa)	Structure and Additional Observations
Back Hoe			D	64.0			CL	TOPSOIL - CLAY; low to medium plasticity, brown, with traces of fine grained sand	M	ST	100 200 300 400	Rootlets down to 0.3 m
			D					CLAY; low to medium plasticity, mottled orange brown, with traces of shale fragments up to 5 mm				
			D					Becoming yellow brown, shale fragments more prominent with depth		VST		
				63.0	1.0				D			
								SHALE; moderately weathered, grey		R2		
								EOH @ 1.6 m, refusal on low to medium strength shale bedrock				
				62.0	2.0							
				61.0	3.0							
				60.0								

Sketch:

Pells Sullivan Meynink

Engineering Consultants
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Excavation Log

Excavation No: **TP08**

Sheet: 1 of 1

Job No: PSM1473

Client:	Wilson Constructions	**Date commenced:**	08/06/2010
Principal:		**Date completed:**	08/06/2010
Project:	Bakers Lane Industrial Estate - Geotechnical & Salinity Investigation	**Logged by:**	VHL/RT
Site location:	Erskine Park	**Checked by:**	

Equipment type:	JCB 3CX	**R.L. surface:**	68 m	**Vertical datum:**	
Excavation dimensions:	450 mm bucket	**Easting:**		**Horizontal datum:**	
		Northing:			

Method	Penetration (1 2 3)	Water	Samples	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material: SOIL TYPE; plasticity or particle characteristics, colour, secondary and minor components. ROCK TYPE; weathering, colour, secondary and minor components	Moisture Condition	Estimated Strength	Pocket Penetrometer (kPa)	Structure and Additional Observations
Back Hoe				68.0			CL	TOPSOIL - Sandy CLAY, low plasticity, dark brown, sand is fine to medium grained	M	VST		Rootlets down to 0.3 m
								CLAY; low to medium plasticity, orange brown, with traces of shale fragments up to 5 mm				
							CH	CLAY; low to medium plasticity, yellow brown, with traces of shale fragments up to 5 mm		H		
				67.0	1.0			SHALE; extremely to highly weathered, dark grey with iron staining, extremely low to low strength	D	R1		
								Becoming stronger with depth				
				66.0	2.0			EOH @ 2.0 m, refusal on low strength shale bedrock				
				65.0	3.0							
				64.0								

Sketch:

File Name: PSM1473 TEST PIT LOGS.GPJ Print date: 25/6/10

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Engineering Consultants
Rock-Soil-Water

Excavation Log

Excavation No: **TP09**

Sheet: 1 of 1

Job No: PSM1473

Client:	Wilson Constructions	**Date commenced:**	08/06/2010
Principal:		**Date completed:**	08/06/2010
Project:	Bakers Lane Industrial Estate - Geotechnical & Salinity Investigation	**Logged by:**	RT
Site location:	Erskine Park	**Checked by:**	

Equipment type:	JCB 3CX	**R.L. surface:**	64 m	**Vertical datum:**	
Excavation dimensions:	450 mm bucket	**Easting:**		**Horizontal datum:**	
		Northing:			

Method	Penetration (1 2 3)	Water	Samples	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material: SOIL TYPE; plasticity or particle characteristics, colour, secondary and minor components / ROCK TYPE; weathering, colour, secondary and minor components	Moisture Condition	Estimated Strength	Pocket Penetrometer (kPa)	Structure and Additional Observations
Back Hoe			D	64.0			CL	TOPSOIL - Sandy CLAY; low plasticity, dark brown, fine grained sand	M	F	100 200 300 400	Rootlets down to 0.3 m
			D					CLAY; medium plasticity, red brown and dark grey, traces of sand		VST		
			D					CLAY; medium to high plasticity, yellow brown, trace of shale fragments up to 5 mm				
				63.0	1.0		CH	CLAY; medium to high plasticity, grey mottled red brown. Becoming drier with depth		H		
								Shale fragments appearing, grey, iron stained, up to 40 mm				
								SHALE; extremely to highly weathered, grey with iron staining		R1		
				62.0	2.0			Becoming less iron stained	D	H		
								SHALE; extremely to highly weathered, grey with iron staining		R2		
				61.0	3.0			EOH @ 2.9 m, target depth				
				60.0								

Sketch:

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Excavation Log

Excavation No: **TP10**

Sheet: 1 of 1

Job No: PSM1473

Client:	Wilson Constructions	**Date commenced:**	09/06/2010
Principal:		**Date completed:**	09/06/2010
Project:	Bakers Lane Industrial Estate - Geotechnical & Salinity Investigation	**Logged by:**	VHL
Site location:	Erskine Park	**Checked by:**	

Equipment type:	JCB 3CX	**R.L. surface:**	62 m	**Vertical datum:**	
Excavation dimensions:	450 mm bucket	**Easting:**		**Horizontal datum:**	
		Northing:			

Method	Penetration 1 2 3	Water	Samples	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material: SOIL TYPE; plasticity or particle characteristics, colour, secondary and minor components / ROCK TYPE; weathering, colour, secondary and minor components	Moisture Condition	Estimated Strength	Pocket Penetrometer (kPa) 100 200 300 400	Structure and Additional Observations
Back Hoe			D	62.0			CL	TOPSOIL - Sandy CLAY; low to medium plasticity, dark brown, fine grained sand	M	ST		Rootlets down to 0.3 m
			D					CLAY; medium to high plasticity, brown with red specks		VST		
			D					CLAY; high plasticity, red with grey specks				
			D	61.0	1.0		CH	CLAY; high plasticity, grey mottled red, shale fragments up to 10mm, shale is extremely weathered, extremely low strength		H		
								SHALE; extremely weathered, grey with red specks, iron stained	D	R0		
				60.0	2.0					R1		
								Strength increasing with depth		R2		
				59.0	3.0			EOH @ 2.6 m, refusal on low strength shale				
				58.0								

Sketch:

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Excavation Log

Excavation No: **TP11**

Sheet: 1 of 1

Job No: PSM1473

Client:	Wilson Constructions	**Date commenced:**	09/06/2010
Principal:		**Date completed:**	09/06/2010
Project:	Bakers Lane Industrial Estate - Geotechnical & Salinity Investigation	**Logged by:**	VHL
Site location:	Erskine Park	**Checked by:**	

Equipment type:	JCB 3CX	**R.L. surface:**	65 m	**Vertical datum:**	
Excavation dimensions:	450 mm bucket	**Easting:**		**Horizontal datum:**	
		Northing:			

Method	Penetration 1 2 3	Water	Samples	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material: SOIL TYPE; plasticity or particle characteristics, colour, secondary and minor components / ROCK TYPE; weathering, colour, secondary and minor components	Moisture Condition	Estimated Strength	Pocket Penetrometer (kPa) 100 200 300 400	Structure and Additional Observations
Back Hoe				65.0				TOPSOIL - Sandy CLAY; low to medium plasticity, dark brown, fine grained sand		ST		Rootlets down to 0.3 m
							CL	CLAY; low to medium plasticity, brown mottled red and black	M			
				64.0	1.0		CH	CLAY; medium to high plasticity, pale brown, with grey shale fragments up to 10 mm, extremely to highly weathered, angular, iron stained, extremely low to very low strength		VST		
								Shale fragments up to 50 mm				
				63.0	2.0			SHALE; extremely to highly weathered, grey with red iron staining	D	R0		
								Becoming very low to low strength		R1		
				62.0	3.0			EOH @ 3.0 m, target depth				
				61.0								

Sketch:

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Excavation Log

Excavation No: **TP12**

Sheet: 1 of 1

Job No: PSM1473

Client:	Wilson Constructions	**Date commenced:**	08/06/2010
Principal:		**Date completed:**	08/06/2010
Project:	Bakers Lane Industrial Estate - Geotechnical & Salinity Investigation	**Logged by:**	RT
Site location:	Erskine Park	**Checked by:**	

Equipment type:	JCB 3CX	**R.L. surface:**	45 m	**Vertical datum:**	
Excavation dimensions:	450 mm bucket	**Easting:**		**Horizontal datum:**	
		Northing:			

Method	Penetration 1 2 3	Water	Samples	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material: SOIL TYPE; plasticity or particle characteristics, colour, secondary and minor components / ROCK TYPE; weathering, colour, secondary and minor components	Moisture Condition	Estimated Strength	Pocket Penetrometer (kPa) 100 200 300 400	Structure and Additional Observations
Back Hoe			D	45.0			SC	TOPSOIL - Clayey SAND, fine to medium grained sand, dark brown	W	F		Rootlets down to 0.6 m
			D				CH	CLAY; medium to high plasticity, red brown, trace of sand	M	VST		
				44.0	1.0			Shale fragments appearing up to 10 mm				
			D					Clayey SHALE; extremely to highly weathered, dark grey with red brown specks	D	R0		
				43.0	2.0							
			D				CH	CLAY; medium to high plasticity, grey with red specks	M	VST		
								Iron staining (i.e. red specks) becoming less prominent		H		
				42.0	3.0			EOH @ 2.9 m, target depth				
				41.0								

Sketch:

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Excavation Log

Excavation No: **TP13**

Sheet: 1 of 1

Job No: PSM1473

Client:	Wilson Constructions	**Date commenced:**	08/06/2010
Principal:		**Date completed:**	08/06/2010
Project:	Bakers Lane Industrial Estate - Geotechnical & Salinity Investigation	**Logged by:**	RT
Site location:	Erskine Park	**Checked by:**	

Equipment type:	JCB 3CX	**R.L. surface:**	55 m	**Vertical datum:**	
Excavation dimensions:	450 mm bucket	**Easting:**		**Horizontal datum:**	
		Northing:			

Method	Penetration (1 2 3)	Water	Samples	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material	Moisture Condition	Estimated Strength	Pocket Penetrometer (kPa)	Structure and Additional Observations
Back Hoe			D	55.0				TOPSOIL - Sandy CLAY, low to medium plasticity, dark brown, fine grained sand				Rootlets down to 0.2 m
			D					CLAY; low to medium plasticity, mottled orange brown, trace of shale fragments up to 5 mm	M	ST		
				54.0	1.0		CL	Becoming drier				
								Becoming mottled grey and orange brown		VST		
				53.0	2.0				D			
							CH	CLAY; medium to high plasticity, grey with specks of orange brown		H		
								SHALE; extremely to highly weathered, light grey, iron stained, extremely low to low strength		R1		
				52.0	3.0			EOH @ 3.0 m, target depth and refusal on shale bedrock				
				51.0								

Sketch:

Pells Sullivan Meynink

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Rock-Soil-Water

Excavation Log

Excavation No: **TP14**

Sheet: 1 of 1

Job No: PSM1473

Client:	Wilson Constructions	**Date commenced:**	09/06/2010
Principal:		**Date completed:**	09/06/2010
Project:	Bakers Lane Industrial Estate - Geotechnical & Salinity Investigation	**Logged by:**	VHL
Site location:	Erskine Park	**Checked by:**	

Equipment type:	JCB 3CX	**R.L. surface:**	70 m	**Vertical datum:**	
Excavation dimensions:	450 mm bucket	**Easting:**		**Horizontal datum:**	
		Northing:			

Method	Penetration 1 2 3	Water	Samples	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material: SOIL TYPE; plasticity or particle characteristics, colour, secondary and minor components. ROCK TYPE; weathering, colour, secondary and minor components	Moisture Condition	Estimated Strength	Pocket Penetrometer (kPa) 100 200 300 400	Structure and Additional Observations
Back Hoe				70.0				TOPSOIL - Sandy CLAY; low plasticity, dark brown, fine grained sand		F		Rootlets down to 0.3 m
							CL	CLAY; low to medium plasticity, mottled brown and dark brown	M	ST		
							CH	CLAY; medium to high plasticity, brown with specks of grey, becoming drier		F		
				69.0	1.0			CLAY; medium to high plasticity, brown with specks of grey, shale fragments up to 20 mm, extremely to highly weathered, extremely low to very low strength		VST		
								SHALE; extremely to highly weathered, yellow brown, iron staining	D	R1		
								Strength increasing with depth		R2		
								EOH @ 1.4 m, refusal on low strength shale				
				68.0	2.0							
				67.0	3.0							
				66.0								

Sketch:

Pells Sullivan Meynink

Engineering Consultants
Rock-Soil-Water

Excavation Log

Excavation No: **TP15**

Sheet: 1 of 1

Job No: PSM1473

Client:	Wilson Constructions	**Date commenced:**	09/06/2010
Principal:		**Date completed:**	09/06/2010
Project:	Bakers Lane Industrial Estate - Geotechnical & Salinity Investigation	**Logged by:**	VHL
Site location:	Erskine Park	**Checked by:**	

Equipment type:	JCB 3CX	**R.L. surface:**	70 m	**Vertical datum:**	
Excavation dimensions:	450 mm bucket	**Easting:**		**Horizontal datum:**	
		Northing:			

Method	Penetration (1 2 3)	Water	Samples	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material	Moisture Condition	Estimated Strength	Pocket Penetrometer (kPa)	Structure and Additional Observations
Back Hoe				70.0			CL	TOPSOIL - Sandy CLAY; low plasticity, dark brown, fine grained sand		ST		Rootlets down to 0.3 m
								CLAY; low to medium plasticity, brown with mottled red and black	M			
								CLAY; low to medium plasticity, yellow brown		VST		
				69.0	1.0			Becoming dry				
							CH	CLAY; medium to high plasticity, brown with grey shale fragments. Shale is extremely weathered, red iron stained, up to 20 mm, extremely low strength	D	H		
				68.0	2.0			SHALE; extremely weathered, grey and red iron staining		R0		
								Becoming stronger with depth		R2		
				67.0	3.0			EOH @ 2.6 m, refusal on low strength shale				
				66.0								

Sketch:

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Engineering Consultants
Rock-Soil-Water

Excavation Log

Excavation No: **TP16**

Sheet: 1 of 1

Job No: PSM1473

Client:	Wilson Constructions	**Date commenced:**	08/06/2010
Principal:		**Date completed:**	08/06/2010
Project:	Bakers Lane Industrial Estate - Geotechnical & Salinity Investigation	**Logged by:**	RT
Site location:	Erskine Park	**Checked by:**	

Equipment type:	JCB 3CX	**R.L. surface:**	43 m	**Vertical datum:**	
Excavation dimensions:	450 mm bucket	**Easting:**		**Horizontal datum:**	
		Northing:			

Method	Penetration (1 2 3)	Water	Samples	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material	Moisture Condition	Estimated Strength	Pocket Penetrometer (kPa)	Structure and Additional Observations
Back Hoe				43.0			SC	TOPSOIL - Clayey SAND, fine grained, brown, with traces of silt	W	ST		Rootlets down to 0.35 m
								CLAY; low to medium plasticity, orange brown, with trace of sand and some shale fragments up to 10 mm				
							CL	Becoming mottled grey and orange brown	M	VST		
				42.0	1.0							
							CH	CLAY; medium to high plasticity, grey with specks of red brown				
								Becoming drier, shale fragments up to 30 mm appearing, extremely weathered, iron staining, angular to subangular, extremely low strength		H		
				41.0	2.0							
								Clayey SHALE; extremely to highly weathered, grey with red brown specks	D	R0		
								Strength decreasing with depth, iron staining more prominent		R2		
				40.0	3.0			EOH @ 3.0 m, refusal on shale				
				39.0								

Sketch:

Pells Sullivan Meynink

Engineering Consultants
Rock-Soil-Water

Excavation Log

Excavation No: **TP17**

Sheet: 1 of 1

Job No: PSM1473

Client:	Wilson Constructions	**Date commenced:**	08/06/2010
Principal:		**Date completed:**	08/06/2010
Project:	Bakers Lane Industrial Estate - Geotechnical & Salinity Investigation	**Logged by:**	RT
Site location:	Erskine Park	**Checked by:**	

Equipment type:	JCB 3CX	**R.L. surface:**	47 m	**Vertical datum:**	
Excavation dimensions:	450 mm bucket	**Easting:**		**Horizontal datum:**	
		Northing:			

Method	Penetration 1 2 3	Water	Samples	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material: SOIL TYPE; plasticity or particle characteristics, colour, secondary and minor components / ROCK TYPE; weathering, colour, secondary and minor components	Moisture Condition	Estimated Strength	Pocket Penetrometer (kPa) 100 200 300 400	Structure and Additional Observations
Back Hoe			D	47.0			SC	TOPSOIL - Clayey SAND, fine grained, brown, with traces of silt	W	ST		Rootlets down to 0.2 m
			D					CLAY; low to medium plasticity, orange brown, with some sand and trace of shale gravels up to 5 mm				
				46.0	1.0			Shale fragments becoming more prominent, extremely to highly weathered, extremely low to very low strength				
							CL	Gravelly CLAY; medium plasticity, red brown, hard clay. Gravel is shale, dark grey to black, extremely to highly weathered, fragments up to 30 mm, extremely low to very low strength; trace of sand				
				45.0	2.0			Becoming more mottled grey and red brown, black shale fragments becoming less prominent	M	VST		
							CH	CLAY; medium to high plasticity, grey with specks of red				
				44.0	3.0							
								EOH @ 3.8 m, target depth				
				43.0								

Sketch:

Pells Sullivan Meynink

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Rock-Soil-Water

Excavation Log

Excavation No: **TP18**

Sheet: 1 of 1

Job No: PSM1473

Client:	Wilson Constructions	**Date commenced:**	09/06/2010
Principal:		**Date completed:**	09/06/2010
Project:	Bakers Lane Industrial Estate - Geotechnical & Salinity Investigation	**Logged by:**	VHL
Site location:	Erskine Park	**Checked by:**	

Equipment type:	JCB 3CX	**R.L. surface:**	59 m	**Vertical datum:**	
Excavation dimensions:	450 mm bucket	**Easting:**		**Horizontal datum:**	
		Northing:			

Method	Penetration (1 2 3)	Water	Samples	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material (SOIL TYPE; plasticity or particle characteristics, colour, secondary and minor components / ROCK TYPE; weathering, colour, secondary and minor components)	Moisture Condition	Estimated Strength	Pocket Penetrometer (kPa)	Structure and Additional Observations
Back Hoe				59.0			CL	TOPSOIL - Sandy CLAY; low plasticity, dark brown, fine grained sand		F		Rootlets down to 0.4 m
								CLAY; low to medium plasticity, mottled orange brown	M	ST		
							CH	CLAY; medium to high plasticity, brown with black and grey specks		H		
				58.0	1.0			SHALE; extremely to highly weathered, grey with red iron staining		R0		
								SHALE; extremely to highly weathered, grey				
				57.0	2.0			Becoming stronger with depth	D	R1		
				56.0	3.0			EOH @ 3.0 m, target depth				
				55.0								

Sketch:

Pells Sullivan Meynink

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Rock-Soil-Water

Excavation Log

Excavation No: **TP19**

Sheet: 1 of 1

Job No: PSM1473

Client:	Wilson Constructions	**Date commenced:**	09/06/2010
Principal:		**Date completed:**	09/06/2010
Project:	Bakers Lane Industrial Estate - Geotechnical & Salinity Investigation	**Logged by:**	VHL
Site location:	Erskine Park	**Checked by:**	

Equipment type:	JCB 3CX	**R.L. surface:**	81 m	**Vertical datum:**	
Excavation dimensions:	450 mm bucket	**Easting:**		**Horizontal datum:**	
		Northing:			

Method	Penetration (1 2 3)	Water	Samples	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material: SOIL TYPE; plasticity or particle characteristics, colour, secondary and minor components / ROCK TYPE; weathering, colour, secondary and minor components	Moisture Condition	Estimated Strength	Pocket Penetrometer (kPa)	Structure and Additional Observations
Back Hoe				81.0				TOPSOIL - Sandy CLAY; low plasticity, dark brown, fine grained sand	M	F		Rootlets down to 0.3 m
							CL	CLAY; low to medium plasticity, brown with specks of red and black		ST		
								CLAY; low to medium plasticity, pale brown with trace of grey shale fragments, EW, iron stained, fragments up to 40 mm, extremely low strength		VST		
				80.0	1.0			SHALE; extremely to highly weathered, grey with red iron staining		R0		
								SHALE; highly weathered, grey with red iron staining		R1		
								Strength increasing with depth	D			
				79.0	2.0					R2		
				78.0	3.0			EOH @ 2.7 m, refusal on low strength shale				
				77.0								

Sketch:

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Rock-Soil-Water

Excavation Log

Excavation No: **TP20**

Sheet: 1 of 1

Job No: PSM1473

Client:	Wilson Constructions	**Date commenced:**	09/06/2010
Principal:		**Date completed:**	09/06/2010
Project:	Bakers Lane Industrial Estate - Geotechnical & Salinity Investigation	**Logged by:**	VHL
Site location:	Erskine Park	**Checked by:**	

Equipment type:	JCB 3CX	**R.L. surface:**	86 m	**Vertical datum:**	
Excavation dimensions:	450 mm bucket	**Easting:**		**Horizontal datum:**	
		Northing:			

Method	Penetration 1 2 3	Water	Samples	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material: SOIL TYPE; plasticity or particle characteristics, colour, secondary and minor components / ROCK TYPE; weathering, colour, secondary and minor components	Moisture Condition	Estimated Strength	Pocket Penetrometer (kPa) 100 200 300 400	Structure and Additional Observations
Back Hoe			D	86.0			CL	TOPSOIL - Sandy CLAY; low plasticity, dark brown, fine grained sand	D	ST		Rootlets down to 0.4 m
			D				SC	Clayey SAND; fine to medium grained, brown, clay is low plasticity, with some boulders up to 500 mm in size		MD		
								CLAY; low to medium plasticity, orange brown with grey shale fragments up to 50 mm, extremely to highly weathered, extremely low to very low strength		VST		
			D	85.0	1.0			SANDSTONE; highly weathered, yellow brown, iron stained, fine to medium grained		R2		
								EOH @ 1.5m, refusal on sandstone				
				84.0	2.0							
				83.0	3.0							
				82.0								

Sketch:

Pells Sullivan Meynink

Engineering Consultants
Rock-Soil-Water

Borehole Log

Borehole No: **BH1**
Sheet: 1 of 1
Job No: PSM1473

Client:	Wilson Constructions	**Date commenced:**	11/06/2010
Principal:		**Date completed:**	11/06/2010
Project:	Bakers Lane Industrial Estate - Geotechnical and Salinity Investigation	**Logged by:**	RT
Site location:	Erskine Park	**Checked by:**	

Drilling contractor:	J & K	**R.L. surface:**	48 m	**Vertical datum:**	
Equipment type:	JK500, Truck Mounted Rig	**Easting:**		**Horizontal datum:**	
		Northing:		**Inclination / azimuth:**	Vertical /

Method	Samples	Water	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material (SOIL TYPE; plasticity or particle characteristics, colour, secondary and minor components / ROCK TYPE; weathering, particle characteristics, colour, secondary and minor components)	Moisture Condition	Estimated Strength	Structure and Additional Observations
Auger			48.0	0.0		CL	TOPSOIL - Sandy CLAY; low plasticity, dark brown, fine grained sand	W	F	Rootlets present down to 0.35 m
							CLAY; low to medium plasticity, orange brown, trace of fine grained sand		ST	
							Silty CLAY; low to medium plasticity, orange brown		VST	
			47.0	1.0			SANDSTONE; highly weathered, fine to medium grained sand, light grey with some orange bits, iron staining		R1	
									R0	SPT @ 1.5 m - [10 blows for 100 mm penetration, bouncing]
			46.0	2.0			Traces of ironstone fragments appearing			
							IRONSTONE; highly weathered, dark grey with orange iron staining			Auger crunching
			45.0	3.0			SHALE; extremely to highly weathered, dark grey with iron staining		R1	
			44.0	4.0			SHALE; moderately weathered, dark grey		R2	Iron staining ceases
			43.0	5.0				D	R1	Auger resistance decreasing
			42.0	6.0					R2	Auger resistance increasing
			41.0	7.0			SHALE; moderately to slightly weathered, fine grained, light grey			Augercrunching, increasing in resistance
			40.0	8.0					R3	Auger visibly shaking
			39.0	9.0			EOH @ 9.0 m - Target depth [Piezometer installed]			No groundwater observed

File Name: PSM1473 SOIL BOREHOLE LOGS.GPJ Print Date: 25/6/10

Refer to Explanation Sheets Attached for Classification Systems

Pells Sullivan Meynink

Engineering Consultants
Rock-Soil-Water

Borehole Log

Borehole No: **BH2**
Sheet: 1 of 2
Job No: PSM1473

Client:	Wilson Constructions	**Date commenced:**	09/06/2010
Principal:		**Date completed:**	09/10/2010
Project:	Bakers Lane Industrial Estate - Geotechnical and Salinity Investigation	**Logged by:**	RT
Site location:	Erskine Park	**Checked by:**	

Drilling contractor:	J & K	**R.L. surface:**	83 m	**Vertical datum:**	
Equipment type:	JK500, Truck Mounted Rig	**Easting:**		**Horizontal datum:**	
		Northing:		**Inclination / azimuth:**	Vertical /

Method	Samples	Water	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material (SOIL TYPE; plasticity or particle characteristics, colour, secondary and minor components / ROCK TYPE; weathering, particle characteristics, colour, secondary and minor components)	Moisture Condition	Estimated Strength	Structure and Additional Observations
Auger			83.0	0.0		CL	TOPSOIL - Sandy CLAY, low to medium plasticity, dark brown, with some rootlets	M	ST	
							Sandy CLAY; low to medium plasticity, yellow brown, with trace of shale fragments			
			82.0	1.0			SANDSTONE; moderately weathered, fine to medium grained, dark grey, weathers to yellow brown sandstone		R2	Auger crunching
			81.0	2.0			Becoming very low to low strength		R1	Auger going in a bit easier
										Auger crunching again
			80.0	3.0						
			79.0	4.0			SHALE; extremely to highly weathered, dark grey, possibly hard CLAY?		R0	Rock pieces can be indented with thumbnail
			78.0	5.0		CH	Shaley CLAY; extremely to highly weathered, dark brown, iron staining	D		Chips easily broken by hand
			77.0	6.0			CLAY; high plasticity, grey with red brown iron staining		H	
							SHALE; extremely to highly weathered, grey with iron staining		R0	
			76.0	7.0			SHALE; extremely to highly weathered, dark grey with iron staining		R1	Auger going down easily
			75.0	8.0						
							Becoming low strength?		R2	Auger resistance increasing slightly
			74.0	9.0						

File Name: PSM1473 SOIL BOREHOLE LOGS.GPJ Print Date: 25/6/10

Refer to Explanation Sheets Attached for Classification Systems

Pells Sullivan Meynink

Engineering Consultants
Rock-Soil-Water

Borehole Log

Borehole No: **BH2**

Sheet: 2 of 2

Job No: PSM1473

Client:	Wilson Constructions	**Date commenced:**	09/06/2010
Principal:		**Date completed:**	09/10/2010
Project:	Bakers Lane Industrial Estate - Geotechnical and Salinity Investigation	**Logged by:**	RT
Site location:	Erskine Park	**Checked by:**	

Drilling contractor:	J & K	**R.L. surface:**	83 m	**Vertical datum:**	
Equipment type:	JK500, Truck Mounted Rig	**Easting:**		**Horizontal datum:**	
		Northing:		**Inclination / azimuth:**	Vertical /

Method	Samples	Water	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material (SOIL TYPE; plasticity or particle characteristics, colour, secondary and minor components / ROCK TYPE; weathering, particle characteristics, colour, secondary and minor components)	Moisture Condition	Estimated Strength	Structure and Additional Observations
Auger			72.0	11.0			Becoming moderately weathered, iron staining evident in rock chips	D	R2	Auger starting to crunch
							Becoming slightly weathered to fresh		R3	
			71.0	12.0			Start coring @ 12.0 m			
			70.0	13.0						
			69.0	14.0						
			68.0	15.0						
			67.0	16.0						
			66.0	17.0						
			65.0	18.0						
			64.0	19.0						

File Name: PSM1473 SOIL BOREHOLE LOGS.GPJ Print Date: 25/6/10

Pells Sullivan Meynink

Engineering Consultants
Rock-Soil-Water

Borehole No: **BH2**

Sheet: 1 of 2

Job No: PSM1473

Cored Borehole Log

Client:	Wilson Constructions	**Date commenced:**	09/06/2010
Principal:		**Date completed:**	11/06/2010
Project:	Bakers Lane Industrial Estate - Geotechnical & Salinity Investigation	**Logged by:**	VHL/RT
Site location:	Erskine Park	**Checked by:**	

Drilling contractor:	J & K	**R.L. surface:**	83 m	**Vertical datum:**	
Equipment type:	JK500, Truck Mounted Rig	**Easting:**	m	**Horizontal datum:**	
Coring size / method:	HQ	**Northing:**	m	**Inclination / azimuth:**	/

Testing	Water	RL (m)	Depth (m)	Graphic Log	Material Description (ROCK TYPE; particle characteristics, colour, structure, secondary and minor components)	Weathering	Estimated Strength (S0 S1 S2 S3 S4 S5 R0 R1 R2 R3 R4 R5)	Point Load Index Is (50) (MPa)	RQD (%)	Defect Spacing (mm) (10 30 100 300 1000)	Defect Description / Comments (Type, Inclination, Shape, Roughness, Infill Type, Infill Thickness, Number)
		72.0	11.0								
		71.0	12.0		Continued from non-cored borehole log						
					Start of coring @ 12.2 m. SHALE; fine grained, laminated, grey with iron staining						JN, 50°, IR, Ro3, RF, 1 - 5mm BG, 5°, CU, Ro2, KL BG, 5°, CU, Ro3, FE, ST BG, 10°, IR, Ro3, FE, ST JN, 45°, PL, Ro2, CL, 1 - 5mm
		70.0	13.0								JN, 60°, IR, Ro3, FE, ST BG, 3°, IR, Ro3, FE, ST JN, 70°, PL, Ro3, FE, ST
		69.0	14.0		SANDSTONE; fine to medium grained, with shale bands up to 15 mm, brown				58		BG, 5°, ST, Ro3, FE, ST, 2 BG, 5°, IR, Ro3, FE, ST, 3 JN, 85°, UN, Ro3, FE, ST
					SHALE band						CN, 0°, ST, Ro1, KL
		68.0	15.0		SANDSTONE; fine to medium grained, with shale bands up to 15 mm, brown	MW					JN, 20°, ST, Ro4, FE, ST BG, 3°, IR, Ro2, CL, 1 - 5mm
					250 mm core loss						
					SHALE; fine grained, laminated,grey with iron staining						BG, 5°, UN, Ro3, FE, ST
		67.0	16.0								BG, 3°, PL, Ro3, FE, ST JN, 22°, UN, Ro3, FE, ST JN, 25°, CU, Ro3, FE, ST BG, 3°, IR, Ro2, CL, 1 - 5mm, 2 JN, 20°, IR, Ro2, CL, 1 - 5mm BG, 10°, UN, Ro3, FE, ST
		66.0	17.0						73		BG, 10°, IR, Ro3, FE, ST JN, 60°, CU, Ro2, KL JN, 70°, ST, Ro3, FE, ST
						HW					CN, 0-5, PL, Ro3, CL, 10 - 50mm
		65.0	18.0		SHALE; fine grained, massive, dark grey						
						FR					
		64.0	19.0						100		
		63.0									

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Borehole No: **BH2**

Sheet: 2 of 2

Job No: PSM1473

Cored Borehole Log

Client:	Wilson Constructions	**Date commenced:**	09/06/2010
Principal:		**Date completed:**	11/06/2010
Project:	Bakers Lane Industrial Estate - Geotechnical & Salinity Investigation	**Logged by:**	VHL/RT
Site location:	Erskine Park	**Checked by:**	

Drilling contractor:	J & K	**R.L. surface:**	83 m	**Vertical datum:**	
Equipment type:	JK500, Truck Mounted Rig	**Easting:**	m	**Horizontal datum:**	
Coring size / method:	HQ	**Northing:**	m	**Inclination / azimuth:**	/

Testing	Water	RL (m)	Depth (m)	Graphic Log	Material Description ROCK TYPE; particle characteristics, colour, structure, secondary and minor components	Weathering	Estimated Strength S0 S1 S2 S3 S4 S5 R0 R1 R2 R3 R4 R5	Point Load Index Is (50) (MPa)	RQD (%)	Defect Spacing (mm) 10 30 100 300 1000	Defect Description / Comments Type, Inclination, Shape, Roughness, Infill Type, Infill Thickness, Number
		62.0	21.0		SHALE; fine grained, massive, dark grey	FR			100		
					End of Hole at 21.5m.						
		61.0	22.0								
		60.0	23.0								
		59.0	24.0								
		58.0	25.0								
		57.0	26.0								
		56.0	27.0								
		55.0	28.0								
		54.0	29.0								
		53.0									

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Rock-Soil-Water

Borehole Log

Borehole No: **BH3**
Sheet: 1 of 1
Job No: PSM1473

Client:	Wilson Constructions	**Date commenced:**	11/06/2010
Principal:		**Date completed:**	11/06/2010
Project:	Bakers Lane Industrial Estate - Geotechnical and Salinity Investigation	**Logged by:**	RT
Site location:	Erskine Park	**Checked by:**	

Drilling contractor:	J & K	**R.L. surface:**	60 m	**Vertical datum:**	
Equipment type:	JK500, Truck Mounted Rig	**Easting:**		**Horizontal datum:**	
		Northing:		**Inclination / azimuth:**	Vertical /

Method	Samples	Water	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material (SOIL TYPE; plasticity or particle characteristics, colour, secondary and minor components / ROCK TYPE; weathering, particle characteristics, colour, secondary and minor components)	Moisture Condition	Estimated Strength	Structure and Additional Observations
Auger			59.0	1.0			TOPSOIL - Sandy CLAY; low plasticity, dark brown, fine to medium grained sand			Rootlets up to 0.35 m
							Silty CLAY; low to medium plasticity, orange brown, trace of fince grained sand. Becoming dry with depth	M	VST	
									H	
							Sandy CLAY; low to medium plasticity, orange brown, with some silt and trace of shale fragments up to 5 mm			SPT @ 1.5 m [9, 12, 12], N = 24
			58.0	2.0		CL	Becoming gravelly, gravel is shale up to 10 mm, angular to subangular	D		
							Sandy CLAY; low to medium plasticity, brown to red brown, medium grained sand, with trace of gravel	M	VST	Becoming moist again
			57.0	3.0						SPT @ 3.0 m [5, 6, 8], N = 14
			56.0	4.0		CH	CLAY; medium to high plasticity, light grey mottled red brown, iron staining		H	
							SHALE; extremely to highly weathered, fine grained, grey with iron staining			
										SPT @ 4.5 m [bouncing/refusal]
			55.0	5.0					R0	Drilling resistance increasing slightly
							Iron staining ceases at approximately 5.2 m			
							Strength increasing with depth	D		Auger crunching
			54.0	6.0					R1	Auger crunching
							Strength increasing with depth		R2	Auger crunching and starting to visibly shake
		▼	53.0	7.0				W		Groundwater observed
									R3	
			52.0	8.0						Auger near refusal
			51.0	9.0			EOH @ 8.1 m, auger refusal [Piezometer installed]			

File Name: PSM1473 SOIL BOREHOLE LOGS.GPJ Print Date: 25/6/10

Refer to Explanation Sheets Attached for Classification Systems

Pells Sullivan Meynink Pty Ltd
Engineering Consultants
Rock - Soil - Water

JOB: **PSM1473**
PROJECT: **Bakers Ln, Erskine Park**

PIEZOMETER CONSTRUCTION RECORD

HOLE NUMBER:	BH1	DRILLING CONTRACTOR:	J & K
PIEZOMETER:	STANDPIPE	RIG:	JK500
COLLAR EASTING:	294687	DEPTH OF HOLE (m):	9.0
COLLAR NORTHING:	6253745	BOREHOLE INCLINATION:	VERTICAL
COLLAR RL(m):	46	PIEZO INSTALLATION DATE:	11/06/2010
DATUM:		SUPERVISED BY:	RT/VHL

Tick boxes

Gattic cover ☑
Plug ☑
Concrete colar ☑

Back fill type:
Cement bentonite ☐
Soil ☑
None ☐

Seal:
Bentonite pellets ☑
Other ☐

Gravel type:
2-5mm gravel ☑
Other ☐

Perforation type:
Drill holes ☐
Hack saw cuts ☐
40um machine slots ☑

Complete dimensions if appropriate

Height of stickup (m)	Ground Level
Diameter of PVC (mm)	60 mm
Depth to top of seal	2.1 m
Depth to top of gravel pack	3.6 m
Depth to top of screen	4.1 m
Depth to base of screen	7.1 m
Depth to base of piezo	7.1 m
Depth to base of gravel	9.0 m

COMMENTS: 20 kg bags of gravel

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Rock - Soil - Water

JOB: **PSM1473**
PROJECT: **Bakers Ln, Erskine Park**

PIEZOMETER CONSTRUCTION RECORD

HOLE NUMBER:	BH2	DRILLING CONTRACTOR:	J & K
PIEZOMETER:	STANDPIPE	RIG:	JK500
COLLAR EASTING:	295024	DEPTH OF HOLE (m):	21.5
COLLAR NORTHING:	6253962	BOREHOLE INCLINATION:	VERTICAL
COLLAR RL(m):	83	PIEZO INSTALLATION DATE:	11/06/2010
DATUM:		SUPERVISED BY:	RT/VHL

Tick boxes

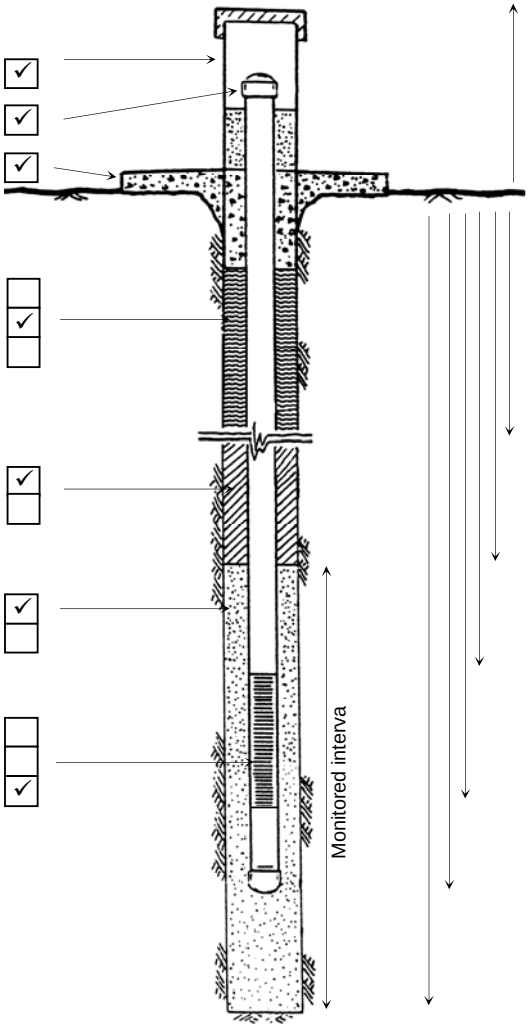
Gattic cover ☑
Plug ☑
Concrete colar ☑

Back fill type:
Cement bentonite ☐
Soil ☑
None ☐

Seal:
Bentonite pellets ☑
Other ☐

Gravel type:
2-5mm gravel ☑
Other ☐

Perforation type:
Drill holes ☐
Hack saw cuts ☐
40um machine slots ☑



Complete dimensions if appropriate

Height of stickup (m)	Ground Level
Diameter of PVC (mm)	60 mm
Depth to top of seal	9.2 m
Depth to top of gravel pack	10.4 m
Depth to top of screen	14.0 m
Depth to base of screen	20.0 m
Depth to base of piezo	20.0 m
Depth to base of gravel	21.5 m

COMMENTS: 20 kg bags of gravel

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Engineering Consultants
Rock - Soil - Water

JOB: **PSM1473**
PROJECT: **Bakers Ln, Erskine Park**

PIEZOMETER CONSTRUCTION RECORD

HOLE NUMBER:	BH3	DRILLING CONTRACTOR:	J & K
PIEZOMETER:	STANDPIPE	RIG:	JK500
COLLAR EASTING:	295518	DEPTH OF HOLE (m):	8.1
COLLAR NORTHING:	6253772	BOREHOLE INCLINATION:	VERTICAL
COLLAR RL(m):	64	PIEZO INSTALLATION DATE:	11/06/2010
DATUM:		SUPERVISED BY:	RT/VHL

Tick boxes

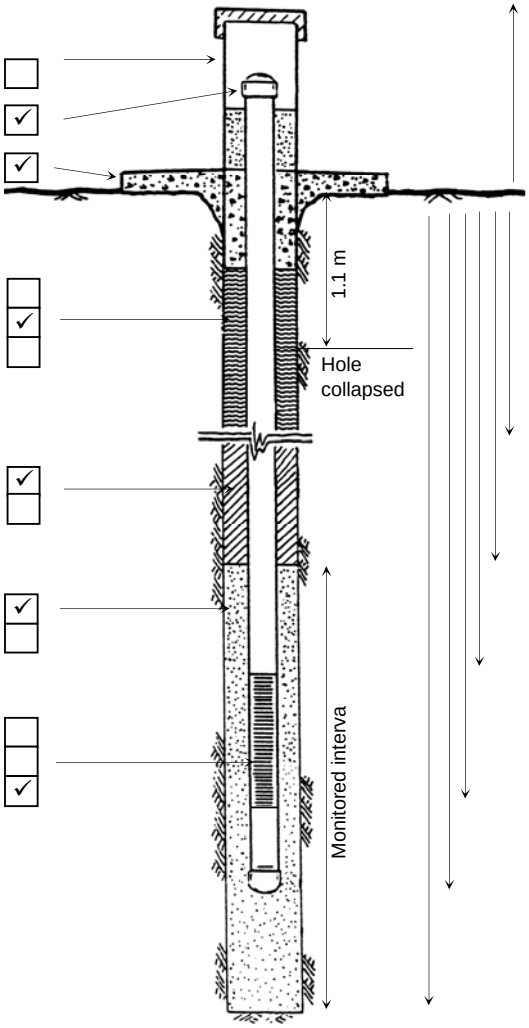
Steel protective well cover ☐
PVC cap ☑
Concrete colar ☑

Back fill type:
Cement bentonite ☐
Soil ☑
None ☐

Seal:
Bentonite pellets ☑
Other ☐

Gravel type:
2-5mm gravel ☑
Other ☐

Perforation type:
Drill holes ☐
Hack saw cuts ☐
40um machine slots ☑



Complete dimensions if appropriate

Height of stickup (m)	1.0 m
Diameter of PVC (mm)	60 mm
Depth to top of seal	Ground Level?
Depth to top of gravel pack	?
Depth to top of screen	5.0 m
Depth to base of screen	8.0 m
Depth to base of piezo	8.0 m
Depth to base of gravel	8.1 m

COMMENTS:	20 kg bags of gravel
	Hole collapsed after pouring 1.5 bags of gravel, at 1.1 m deep

APPENDIX C

BULK EARTHWORKS PLAN (BUCKTON LYSENKO DRAWING 249910 BEW1 REV1)

A1

BAKERS LANE

MAMRE ROAD

BLD 1
RL 55.00

BLD 2
RL 59.00

BLD 3
RL 61.00

BLD 4
RL 63.00

OFFICE
RL 63.15

CARPARK

METCASH
RL 64.50

BLD 8
RL 53.00

BLD 7
RL 54.55

BLD 6
RL 60.00

BLD 5
RL 62.00

COLD STORE
RL 64.50

BULK EARTHWORKS PLAN
SCALE 1:2000

REFERENCE DOCUMENT REGISTER Q.A.

BUCKTON LYSENKO REV									
DISCIPLINE DRAWING NO.	REVISION OR DATE								
ARCH									
STRUCT									
MECH									
ELECT									
SURVEY									

Do not scale off this drawing.
Use dimensions from latest architectural drawings only.
Proposed surface and invert levels shown are indicative only and are to be checked at tender stage against current civil or architectural drawings. Report descrepancies at tender stage
Authorities mains and existing services are to be located and connection approval obtained prior to commencement of any works.
The installation of services must only commence after drawings have been issued for contract purposes.

DRAWING STATUS LEGEND

0 PRELIMINARY DESIGN DRAWING
1 DEVELOPMENT APPLICATION
2 AUTHORITY APPROVAL
3 TENDER PURPOSES
C CONTRACT PURPOSES

NOTE: DRAWINGS ISSUED FROM STATUS 0 TO 3 SHALL NOT BE USED FOR CONTRACT PURPOSES

STATUS/ REVISION	DESCRIPTION	DRAWN	DATE
0-0	PRELIMINARY DESIGN	RW	1.7.10
0-1	ISSUED FOR INFORMATION	RW	4.8.10

ARCHITECT

CLIENT

CONSULTANT
BUCKTON LYSENKO
CONSULTING ENGINEERS
284 Great North Road
Abbotsford NSW 2046
Telephone: (02) 9712 1511
Facsimile: (02) 9712 1910
E-Mail: e-mail@bucktonlysenko.com.au

PROJECT
BAKERS LANE, KEMPS CREEK

DRAWING TITLE
CIVIL SERVICES
BULK EARTHWORKS PLAN

DESIGNER	DRAWN	SCALE	CAD FILE
RW	RW	AS SHOWN	24991RTA ROAD

PROJECT	STATUS	REVISION	DRAWING No.
24991	0	- 1	BEW1

\\THEBEAST\I-Drive\24991\Civil 3D PROJECT\24991 RTA ROAD DESIGN and OPTION 10 REV A.dwg, 24991BEW1_ 01

APPENDIX D

SOIL LABORATORY TEST RESULTS

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **ES1011579**	Page	: 1 of 6
Client	: **PELLS SULLIVAN MEYNINK PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MR RONALD TAN	Contact	: Charlie Pierce
Address	: G3, 56 DELHI ROAD NORTH RYDE NSW, AUSTRALIA 2113	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ronald.tan@psmconsult.com.au	E-mail	: sydney.enviro.services@alsglobal.com
Telephone	: +61 02 9812 5000	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 9812 5001	Facsimile	: +61-2-8784 8500
Project	: PSM1473	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 15-JUN-2010
Sampler	: RT	Issue Date	: 22-JUN-2010
Site	: ----		
		No. of samples received	: 29
Quote number	: SY/306/10	No. of samples analysed	: 20

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
		Inorganics
Ankit Joshi	Inorganic Chemist	Inorganics
Stephen Hislop	Senior Inorganic Chemist	Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

Analytical Results

Sub-Matrix: SOIL			Client sample ID	TP04 TOPSOIL	TP04 0.3M	TP04 2.5 TO 2.6M	TP09 TOPSOIL	TP09 0.5 TO 0.6M
			Client sampling date / time	14-JUN-2010 15:00	14-JUN-2010 15:00	14-JUN-2010 15:00	14-JUN-2010 15:00	14-JUN-2010 15:00
Compound	CAS Number	LOR	Unit	ES1011579-001	ES1011579-002	ES1011579-003	ES1011579-004	ES1011579-005
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	8.0	8.0	7.3	7.4	7.5
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	17	80	737	20	240
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1.0	%	18.0	20.2	15.4	20.9	16.7
ED007: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	4.2	5.0	0.3	8.5	9.2
^ Exchangeable Magnesium	----	0.1	meq/100g	4.1	12.1	13.2	5.0	11.8
^ Exchangeable Potassium	----	0.1	meq/100g	0.4	0.9	1.0	0.8	0.7
^ Exchangeable Sodium	----	0.1	meq/100g	0.6	2.7	9.4	0.5	4.1
^ Cation Exchange Capacity	----	0.1	meq/100g	9.4	20.8	23.9	14.8	25.9
^ Exchangeable Sodium Percent	----	0.1	%	6.7	12.9	39.3	3.2	16.0
ED009: Anions								
Chloride	16887-00-6	1.0	mg/kg	3.8	42.9	1020	3.6	250
Sulfate	14808-79-8	1.0	mg/kg	5.4	11.3	246	4.5	77.7

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: TP09 0.7 TO 0.8M	TP07 TOPSOIL	TP07 0.6M	TP07 0.35 TO 0.04M	TP12 TOPSOIL
				Client sampling date / time: 14-JUN-2010 15:00	14-JUN-2010 15:00	14-JUN-2010 15:00	14-JUN-2010 15:00	14-JUN-2010 15:00
				ES1011579-006	ES1011579-007	ES1011579-008	ES1011579-009	ES1011579-010
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**6.1**	**6.6**	**7.1**	**8.7**	**8.4**
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**542**	**95**	**32**	**41**	**13**
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1.0	%	**13.5**	**16.6**	**19.1**	**20.2**	**18.3**
ED007: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	**5.3**	**10.6**	**17.1**	**14.1**	**2.1**
^ Exchangeable Magnesium	----	0.1	meq/100g	**9.7**	**6.1**	**10.8**	**9.1**	**2.1**
^ Exchangeable Potassium	----	0.1	meq/100g	**1.6**	**1.2**	**1.2**	**0.8**	**0.6**
^ Exchangeable Sodium	----	0.1	meq/100g	**6.5**	**0.4**	**2.1**	**1.2**	**0.5**
^ Cation Exchange Capacity	----	0.1	meq/100g	**23.2**	**18.4**	**31.3**	**25.3**	**5.3**
^ Exchangeable Sodium Percent	----	0.1	%	**28.2**	**2.2**	**6.7**	**4.9**	**9.4**
ED009: Anions								
Chloride	16887-00-6	1.0	mg/kg	**729**	**90.4**	**15.0**	**21.4**	**3.3**
Sulfate	14808-79-8	1.0	mg/kg	**293**	**17.0**	**6.1**	**14.2**	**5.8**

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: TP12 0.6TO 0.65M Client sampling date / time: 14-JUN-2010 15:00 ES1011579-011	Client sample ID: TP12 1.2 TO 1.3M Client sampling date / time: 14-JUN-2010 15:00 ES1011579-012	Client sample ID: TP122.2 TO 2.3M Client sampling date / time: 14-JUN-2010 15:00 ES1011579-013	Client sample ID: TP20 TOPSOIL Client sampling date / time: 14-JUN-2010 15:00 ES1011579-014	Client sample ID: TP20 0.4TO0.5M Client sampling date / time: 14-JUN-2010 15:00 ES1011579-015
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**7.8**	**5.8**	**8.1**	**6.7**	**8.9**
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**50**	**630**	**599**	**23**	**26**
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1.0	%	**17.2**	**16.0**	**16.4**	**17.7**	**17.4**
ED007: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	**0.4**	<0.1	<0.1	**9.7**	**14.4**
^ Exchangeable Magnesium	----	0.1	meq/100g	**10.8**	**4.7**	**12.1**	**2.5**	**3.4**
^ Exchangeable Potassium	----	0.1	meq/100g	**0.5**	**0.8**	**0.8**	**2.8**	**1.2**
^ Exchangeable Sodium	----	0.1	meq/100g	**2.3**	**5.1**	**9.0**	**0.3**	**0.3**
^ Cation Exchange Capacity	----	0.1	meq/100g	**14.0**	**10.7**	**22.0**	**15.3**	**19.3**
^ Exchangeable Sodium Percent	----	0.1	%	**16.6**	**47.9**	**40.8**	**1.8**	**1.6**
ED009: Anions								
Chloride	16887-00-6	1.0	mg/kg	**70.4**	**930**	**752**	**3.8**	**5.2**
Sulfate	14808-79-8	1.0	mg/kg	**29.2**	**233**	**170**	**3.2**	**6.2**

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: TP20 1.0 TO 1.1M Client sampling date / time: 14-JUN-2010 15:00 ES1011579-016	Client sample ID: TP10 TOP SOIL Client sampling date / time: 14-JUN-2010 15:00 ES1011579-017	Client sample ID: TP10 0.3 TO 0.4M Client sampling date / time: 14-JUN-2010 15:00 ES1011579-018	Client sample ID: TP10 0.6TO 0.7M Client sampling date / time: 14-JUN-2010 15:00 ES1011579-019	Client sample ID: TP10 O.3 TO1.0M Client sampling date / time: 14-JUN-2010 15:00 ES1011579-020
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**7.5**	**9.3**	**6.3**	**6.8**	**7.8**
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**631**	**27**	**209**	**465**	**621**
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1.0	%	**7.9**	**16.8**	**20.2**	**21.4**	**17.5**
ED007: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	**24.2**	**4.8**	**1.2**	**0.3**	**2.3**
^ Exchangeable Magnesium	----	0.1	meq/100g	**5.9**	**4.6**	**9.9**	**10.5**	**7.6**
^ Exchangeable Potassium	----	0.1	meq/100g	**0.8**	**0.4**	**0.9**	**0.6**	**0.3**
^ Exchangeable Sodium	----	0.1	meq/100g	**1.5**	**0.7**	**3.9**	**7.3**	**1.5**
^ Cation Exchange Capacity	----	0.1	meq/100g	**32.4**	**10.5**	**15.9**	**18.6**	**11.7**
^ Exchangeable Sodium Percent	----	0.1	%	**4.6**	**6.3**	**24.6**	**39.2**	**13.0**
ED009: Anions								
Chloride	16887-00-6	1.0	mg/kg	**23.6**	**5.5**	**192**	**508**	**700**
Sulfate	14808-79-8	1.0	mg/kg	**44.2**	**3.4**	**106**	**452**	**580**

Environmental Division

QUALITY CONTROL REPORT

Work Order	: **ES1011579**	Page	: 1 of 5
Client	: **PELLS SULLIVAN MEYNINK PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MR RONALD TAN	Contact	: Charlie Pierce
Address	: G3, 56 DELHI ROAD NORTH RYDE NSW, AUSTRALIA 2113	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ronald.tan@psmconsult.com.au	E-mail	: sydney.enviro.services@alsglobal.com
Telephone	: +61 02 9812 5000	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 9812 5001	Facsimile	: +61-2-8784 8500
Project	: PSM1473	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 15-JUN-2010
Sampler	: RT	Issue Date	: 22-JUN-2010
Order number	: ----		
		No. of samples received	: 29
Quote number	: SY/306/10	No. of samples analysed	: 20

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
		Inorganics
Ankit Joshi	Inorganic Chemist	Inorganics
Stephen Hislop	Senior Inorganic Chemist	Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR:- No Limit; Result between 10 and 20 times LOR:- 0% - 50%; Result > 20 times LOR:- 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA002 : pH (Soils) (QC Lot: 1387077)									
ES1011579-001	TP04 TOPSOIL	EA002: pH Value	----	0.1	pH Unit	8.0	8.0	0.0	0% - 20%
ES1011579-011	TP12 0.6TO 0.65M	EA002: pH Value	----	0.1	pH Unit	7.8	7.8	0.0	0% - 20%
EA010: Conductivity (QC Lot: 1387078)									
ES1011579-001	TP04 TOPSOIL	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	17	17	0.0	0% - 50%
ES1011579-011	TP12 0.6TO 0.65M	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	50	51	0.0	0% - 20%
EA055: Moisture Content (QC Lot: 1382337)									
ES1011504-001	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	8.2	7.6	6.6	No Limit
ES1011579-002	TP04 0.3M	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	20.2	19.8	2.3	0% - 50%
EA055: Moisture Content (QC Lot: 1382338)									
ES1011579-013	TP122.2 TO 2.3M	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	16.4	16.7	1.3	0% - 50%
ED007: Exchangeable Cations (QC Lot: 1385459)									
ES1011579-001	TP04 TOPSOIL	ED007: Exchangeable Calcium	----	0.1	meq/100g	4.2	4.3	0.0	0% - 20%
		ED007: Exchangeable Magnesium	----	0.1	meq/100g	4.1	4.1	0.0	0% - 20%
		ED007: Exchangeable Potassium	----	0.1	meq/100g	0.4	0.4	0.0	No Limit
		ED007: Exchangeable Sodium	----	0.1	meq/100g	0.6	0.6	0.0	No Limit
ES1011579-009	TP07 0.35 TO 0.04M	ED007: Exchangeable Calcium	----	0.1	meq/100g	14.1	14.3	1.5	0% - 20%
		ED007: Exchangeable Magnesium	----	0.1	meq/100g	9.1	9.2	0.0	0% - 20%
		ED007: Exchangeable Potassium	----	0.1	meq/100g	0.8	0.8	0.0	No Limit
		ED007: Exchangeable Sodium	----	0.1	meq/100g	1.2	1.2	0.0	0% - 50%
ED009: Anions (QC Lot: 1387079)									
ES1011579-001	TP04 TOPSOIL	ED009: Chloride	16887-00-6	1.0	mg/kg	3.8	4.4	15.3	No Limit
		ED009: Sulfate	14808-79-8	1.0	mg/kg	5.4	4.9	10.7	No Limit
ES1011579-010	TP12 TOPSOIL	ED009: Chloride	16887-00-6	1.0	mg/kg	3.3	3.7	10.7	No Limit
		ED009: Sulfate	14808-79-8	1.0	mg/kg	5.8	5.6	3.6	No Limit
ED009: Anions (QC Lot: 1387080)									
ES1011579-012	TP12 1.2 TO 1.3M	ED009: Chloride	16887-00-6	1.0	mg/kg	930	931	0.2	0% - 20%
		ED009: Sulfate	14808-79-8	1.0	mg/kg	233	240	3.1	0% - 20%

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA010: Conductivity (QCLot: 1387078)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	1412 µS/cm	99.8	70	130
ED007: Exchangeable Cations (QCLot: 1385459)								
ED007: Exchangeable Calcium	----	0.1	meq/100g	<0.1	1.47 meq/100g	87.2	70.2	106
ED007: Exchangeable Magnesium	----	0.1	meq/100g	<0.1	0.77 meq/100g	94.6	76.4	112
ED007: Exchangeable Potassium	----	0.1	meq/100g	<0.1	0.20 meq/100g	71.3	70	100
ED007: Exchangeable Sodium	----	0.1	meq/100g	<0.1	0.51 meq/100g	74.5	70	104
ED007: Cation Exchange Capacity	----	0.1	meq/100g	----	2.95 meq/100g	85.8	70.1	104
ED009: Anions (QCLot: 1387079)								
ED009: Chloride	16887-00-6	1	mg/kg	<1.0	4 mg/kg	87.3	70	130
ED009: Sulfate	14808-79-8	1	mg/kg	<1.0	4 mg/kg	102	70	130
ED009: Anions (QCLot: 1387080)								
ED009: Chloride	16887-00-6	1	mg/kg	<1.0	4 mg/kg	90.1	70	130
ED009: Sulfate	14808-79-8	1	mg/kg	<1.0	4 mg/kg	113	70	130

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	Spike Recovery (%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
ED009: Anions (QCLot: 1387079)							
ES1011579-001	TP04 TOPSOIL	ED009: Chloride	16887-00-6	200 mg/kg	86.0	70	130
		ED009: Sulfate	14808-79-8	200 mg/kg	104	70	130
ED009: Anions (QCLot: 1387080)							
ES1011579-012	TP12 1.2 TO 1.3M	ED009: Chloride	16887-00-6	4 mg/kg	# Not Determined	70	130
		ED009: Sulfate	14808-79-8	4 mg/kg	# Not Determined	70	130

Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **ES1011579**	Page	: 1 of 6
Client	: PELLS SULLIVAN MEYNINK PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: MR RONALD TAN	Contact	: Charlie Pierce
Address	: G3, 56 DELHI ROAD NORTH RYDE NSW, AUSTRALIA 2113	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
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Telephone	: +61 02 9812 5000	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 9812 5001	Facsimile	: +61-2-8784 8500
Project	: PSM1473	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 15-JUN-2010
Sampler	: RT	Issue Date	: 22-JUN-2010
Order number	: ----		
		No. of samples received	: 29
Quote number	: SY/306/10	No. of samples analysed	: 20

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers

Analysis Holding Time Compliance

The following report summarises extraction / preparation and analysis times and compares with recommended holding times. Dates reported represent first date of extraction or analysis and precludes subsequent dilutions and reruns. Information is also provided re the sample container (preservative) from which the analysis aliquot was taken. Elapsed period to analysis represents number of days from sampling where no extraction / digestion is involved or period from extraction / digestion where this is present. For composite samples, sampling date is assumed to be that of the oldest sample contributing to the composite. Sample date for laboratory produced leachates is assumed as the completion date of the leaching process. Outliers for holding time are based on USEPA SW 846, APHA, AS and NEPM (1999). A listing of breaches is provided in the Summary of Outliers.

Holding times for leachate methods (excluding elutriates) vary according to the analytes being determined on the resulting solution. For non -volatile analytes, the holding time compliance assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These soil holding times are: Organics (14 days); Mercury (28 days) & other metals (180 days). A recorded breach therefore does not guarantee a breach for all non-volatile parameters.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA002 : pH (Soils)								
Soil Glass Jar - Unpreserved								
TP04 TOPSOIL,	TP04 0.3M,	**14-JUN-2010**	**21-JUN-2010**	21-JUN-2010	✓	**21-JUN-2010**	21-JUN-2010	✓
TP04 2.5 TO 2.6M,	TP09 TOPSOIL,							
TP09 0.5 TO 0.6M,	TP09 0.7 TO 0.8M,							
TP07 TOPSOIL,	TP07 0.6M,							
TP07 0.35 TO 0.04M,	TP12 TOPSOIL,							
TP12 0.6TO 0.65M,	TP12 1.2 TO 1.3M,							
TP122.2 TO 2.3M,	TP20 TOPSOIL,							
TP20 0.4TO0.5M,	TP20 1.0 TO 1.1M,							
TP10 TOP SOIL,	TP10 0.3 TO 0.4M,							
TP10 0.6TO 0.7M,	TP10 O.3 TO1.0M							
EA010: Conductivity								
Soil Glass Jar - Unpreserved								
TP04 TOPSOIL,	TP04 0.3M,	**14-JUN-2010**	**21-JUN-2010**	21-JUN-2010	✓	**21-JUN-2010**	19-JUL-2010	✓
TP04 2.5 TO 2.6M,	TP09 TOPSOIL,							
TP09 0.5 TO 0.6M,	TP09 0.7 TO 0.8M,							
TP07 TOPSOIL,	TP07 0.6M,							
TP07 0.35 TO 0.04M,	TP12 TOPSOIL,							
TP12 0.6TO 0.65M,	TP12 1.2 TO 1.3M,							
TP122.2 TO 2.3M,	TP20 TOPSOIL,							
TP20 0.4TO0.5M,	TP20 1.0 TO 1.1M,							
TP10 TOP SOIL,	TP10 0.3 TO 0.4M,							
TP10 0.6TO 0.7M,	TP10 O.3 TO1.0M							

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content								
Soil Glass Jar - Unpreserved								
TP04 TOPSOIL,	TP04 0.3M,	**14-JUN-2010**	**----**	----	----	**16-JUN-2010**	21-JUN-2010	✓
TP04 2.5 TO 2.6M,	TP09 TOPSOIL,							
TP09 0.5 TO 0.6M,	TP09 0.7 TO 0.8M,							
TP07 TOPSOIL,	TP07 0.6M,							
TP07 0.35 TO 0.04M,	TP12 TOPSOIL,							
TP12 0.6TO 0.65M,	TP12 1.2 TO 1.3M,							
TP122.2 TO 2.3M,	TP20 TOPSOIL,							
TP20 0.4TO0.5M,	TP20 1.0 TO 1.1M,							
TP10 TOP SOIL,	TP10 0.3 TO 0.4M,							
TP10 0.6TO 0.7M,	TP10 O.3 TO1.0M							
ED007: Exchangeable Cations								
Pulp Bag								
TP04 TOPSOIL,	TP04 0.3M,	**14-JUN-2010**	**18-JUN-2010**	11-DEC-2010	✓	**22-JUN-2010**	11-DEC-2010	✓
TP04 2.5 TO 2.6M,	TP09 TOPSOIL,							
TP09 0.5 TO 0.6M,	TP09 0.7 TO 0.8M,							
TP07 TOPSOIL,	TP07 0.6M,							
TP07 0.35 TO 0.04M,	TP12 TOPSOIL,							
TP12 0.6TO 0.65M,	TP12 1.2 TO 1.3M,							
TP122.2 TO 2.3M,	TP20 TOPSOIL,							
TP20 0.4TO0.5M,	TP20 1.0 TO 1.1M,							
TP10 TOP SOIL,	TP10 0.3 TO 0.4M,							
TP10 0.6TO 0.7M,	TP10 O.3 TO1.0M							
ED009: Anions								
Soil Glass Jar - Unpreserved								
TP04 TOPSOIL,	TP04 0.3M,	**14-JUN-2010**	**21-JUN-2010**	21-JUN-2010	✓	**21-JUN-2010**	11-DEC-2010	✓
TP04 2.5 TO 2.6M,	TP09 TOPSOIL,							
TP09 0.5 TO 0.6M,	TP09 0.7 TO 0.8M,							
TP07 TOPSOIL,	TP07 0.6M,							
TP07 0.35 TO 0.04M,	TP12 TOPSOIL,							
TP12 0.6TO 0.65M,	TP12 1.2 TO 1.3M,							
TP122.2 TO 2.3M,	TP20 TOPSOIL,							
TP20 0.4TO0.5M,	TP20 1.0 TO 1.1M,							
TP10 TOP SOIL,	TP10 0.3 TO 0.4M,							
TP10 0.6TO 0.7M,	TP10 O.3 TO1.0M							

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Electrical Conductivity (1:5)	EA010	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Exchangeable Cations	ED007	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Moisture Content	EA055-103	3	27	**11.1**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
pH (1:5)	EA002	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Standard Anions	ED009	3	20	**15.0**	**10.5**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Electrical Conductivity (1:5)	EA010	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Exchangeable Cations	ED007	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Standard Anions	ED009	2	20	**10.0**	**5.3**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Electrical Conductivity (1:5)	EA010	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Exchangeable Cations	ED007	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Standard Anions	ED009	2	20	**10.0**	**5.3**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Standard Anions	ED009	2	20	**10.0**	**5.3**	✓	ALS QCS3 requirement

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
pH (1:5)	EA002	SOIL	(APHA 21st ed., 4500H+) pH is determined on soil samples after a 1:5 soil/water leach. This method is compliant with NEPM (1999) Schedule B(3) (Method 103)
Electrical Conductivity (1:5)	EA010	SOIL	(APHA 21st ed., 2510) Conductivity is determined on soil samples using a 1:5 soil/water leach. This method is compliant with NEPM (1999) Schedule B(3) (Method 104)
Moisture Content	EA055-103	SOIL	A gravimetric procedure based on weight loss over a 12 hour drying period at 103-105 degrees C. This method is compliant with NEPM (1999) Schedule B(3) (Method 102)
Exchangeable Cations	ED007	SOIL	Rayment & Higginson (1992) Method 15A1. Cations are exchanged from the sample by contact with Ammonium Chloride. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil. This method is compliant with NEPM (1999) Schedule B(3) (Method 301)
Standard Anions	ED009	SOIL	APHA 21st ed., 4110. A soil sample is leached with 1 part to five parts of deionised water and the leachate subject to analysis by ion chromatography with conductivity detection. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)

Preparation Methods	Method	Matrix	Method Descriptions
Exchangeable Cations Preparation Method	ED007PR	SOIL	Rayment & Higginson (1992) method 15A1. A 1M NH4Cl extraction by end over end tumbling at a ratio of 1:20. There is no pretreatment for soluble salts. Extracts can be run by ICP for cations.
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of distilled water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.

Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW 846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
ED009: Anions	ES1011579-012	TP12 1.2 TO 1.3M	**Chloride**	16887-00-6	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
ED009: Anions	ES1011579-012	TP12 1.2 TO 1.3M	**Sulfate**	14808-79-8	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

- **For all matrices, no Method Blank value outliers occur.**
- **For all matrices, no Duplicate outliers occur.**
- **For all matrices, no Laboratory Control outliers occur.**

Regular Sample Surrogates

- **For all regular sample matrices, no surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

- **No Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

- **No Quality Control Sample Frequency Outliers exist.**

APPENDIX E

GROUNDWATER LABORATORY TEST RESULTS

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **ES1012873**	Page	: 1 of 3
Client	: **PELLS SULLIVAN MEYNINK PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: VOON LEE	Contact	: Charlie Pierce
Address	: G3, 56 DELHI ROAD NORTH RYDE NSW, AUSTRALIA 2113	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: voon.lee@psmconsult.com.au	E-mail	: sydney.enviro.services@alsglobal.com
Telephone	: +61 02 9812 5000	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 9812 5001	Facsimile	: +61-2-8784 8500
Project	: PSM1473	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 01-JUL-2010
Sampler	: VL	Issue Date	: 08-JUL-2010
Site	: ----		
		No. of samples received	: 3
Quote number	: SY/306/10	No. of samples analysed	: 3

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Inorganics
Celine Conceicao	Spectroscopist	Inorganics
Sarah Millington	Senior Inorganic Chemist	Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID: PSM 1473-BH1	PSM 1473-BH2	PSM 1473-BH3	----	----
				Client sampling date / time: [01-JUL-2010]	[01-JUL-2010]	[01-JUL-2010]	----	----
				ES1012873-001	ES1012873-002	ES1012873-003	----	----
EA005: pH								
pH Value	----	0.01	pH Unit	**7.17**	**7.69**	**7.28**	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**13700**	**1960**	**19400**	----	----
ED009: Anions								
Chloride	16887-00-6	0.50	mg/L	**4900**	**451**	**7330**	----	----
Sulfate	14808-79-8	0.50	mg/L	**398**	**45.4**	**329**	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**814**	**359**	**1480**	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**814**	**359**	**1480**	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**156**	**29**	**120**	----	----
Magnesium	7439-95-4	1	mg/L	**433**	**43**	**548**	----	----
Sodium	7440-23-5	1	mg/L	**2610**	**379**	**4070**	----	----
Potassium	7440-09-7	1	mg/L	**37**	**9**	**26**	----	----
EN055: Ionic Balance								
^ Total Anions	----	0.01	meq/L	**163**	**20.8**	**243**	----	----
^ Total Cations	----	0.01	meq/L	**158**	**21.7**	**229**	----	----
^ Ionic Balance	----	0.01	%	**1.52**	**1.98**	**3.07**	----	----