

Report

Paling Yards Wind Farm Geotechnical Exploration, Review and Advice

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Prepared for

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Introduction

1.1 General

URS Australia Pty Ltd (URS) has undertaken a geotechnical assessment for the proposed Paling Yards Wind Farm, NSW. The assessment was commissioned by Union Fenosa Wind Australia Pty Ltd (UFWA), and was carried out in general accordance with the URS fee proposal referenced 3091144/01/02, revision B, dated 2 March 2011.

The subject site is located on the western extent of the Great Diving Range, 60km south of Oberon, 60km north of Goulburn in NSW and about 140km west of Sydney. The surrounding area consists predominantly of large rural properties and National Park with the eastern edge of the site in the proximity of Kanangra Boyd National Park and Abercrombie National Park to the west and south. The site is situated in the Oberon Local Government Area (LGA).

The site is approximately 40km to the northeast of the existing Crookwell 1 Wind Farm and the approved Crookwell 2 Wind Farm.

The proposed Paling Yards Wind Farm Project will comprise up to 59 wind turbine generators (WTGs) associated with a new cable network, a temporary concrete batching plant, upgrading the local road infrastructure, new control buildings, a new electrical substation, and other associated infrastructure. The proposed WTGs have a maximum height of up to 175m to blade tip and up to 4.5MW capacity each.

The report presents findings on a number of geotechnical aspects relevant to the proposed wind farm. These include the following:

- Details of the investigation
- Subsurface conditions and geotechnical considerations for the proposed wind turbine sites.
- Groundwater issues
- Potential slope stability considerations
- Construction considerations
- Recommendations for future investigations

1.2 Safety on Site

Prior to the commencement of the geotechnical investigation, URS prepared a Safe Work Method Statement (SWMS) that included a Health, Environmental & Safety Plan (HESP)

Prior to conducting fieldwork, URS carried out a "Dial Before You Dig (DBYD)" services search for existing services at all turbine/test pit locations. In addition to DBYD, the proposed test pit locations were checked on site for any services that may not have picked up on DBYD plans by an experienced URS Geotechnical Engineer with cross reference from the land owners and signed off that all locations are clear of services.

Prior to commencing work, all personnel working on site were given a Health & safety talk and required to sign off an "induction register" ensuring that each person was aware of their responsibilities and safety procedures. A daily toolbox meeting was conducted at the start of the day, which covered all activities and risks associated with the day's work.



1 Introduction

1.3 Scope of Work

Preliminary geotechnical investigations were carried out between 11 April 2011 and 21 July 2011 to identify and characterise the main geologic units at the site. All the geotechnical investigation work was carried out by an experienced URS geotechnical engineer. The following works were carried out to characterise the soil and rock properties of the main geologic units across the site.

- A walk over inspection of the site and surroundings.
- Drilling of two (2) geotechnical boreholes up to a depth of 20m.
- Excavation of sixty (60) test pits.
- A total of sixty (60) Dynamic Cone Penetrometer (DCP) tests were carried out, ensuring a DCP test adjacent to each test pit
- · Collection of representative soils samples for laboratory testing

The Test Pit and DCP locations were shown on Figure 1, Appendix A.

1.4 General Site Geology and Topography

1.4.1 Topography

The site is located on the western extent of the Great Diving Range, 60km south of the town of Oberon, 60km north of the city of Goulburn and comprises two separate land holdings totalling 3,900 hectares referred to as Mingary Park and Paling Yards. The majority of the site comprises farmland with farm houses and stock sheds present. The site is accessible via a network of unsealed farm roads and the existing Abercrombie road.

The site topography comprises plateau and hillcrest areas at an elevation of between 900m and 1065m surrounded by steeply sloping gullies and creek lines that flow to the Abercrombie River. The gently sloping plateau areas are generally cleared and used for grazing, while the more steeply sloping areas are generally uncleared and heavily vegetated.

1.4.2 Geology

Available geological information indicates that the plateau areas are underlain by Tertiary aged Volcanics which typically comprises residual clay, frequently with cobbles and boulders, overlying variably weathered basalt at relatively shallow depths. Tertiary aged alluvial deposits underlie the Tertiary Volcanics at depth, overlying Ordovician aged meta-siltstone basement.

Please see Figure 2, Appendix A for a site geological map.

Methodology

2.1 Test Pit Excavation

Test pit were excavated at each turbine location to provide an assessment of the likely subsurface materials and relevant geotechnical considerations. A total of sixty (60) test pits were excavated at/near along the proposed alignment of WTG across the site. The test pitting program was carried out between 11 April 2011 and 15 April 2011.

The test pits were excavated using a 5.5t small sized excavator which was operated by qualified personnel from Acclaimed Excavation Pty Ltd, fitted with an interchangeable 450mm wide toothed bucket. All test pits were terminated at effective refusal or targeted depth. Upon completion of test pit excavation, each test pit was made safe by backfilling with the excavated spoil and tamped with the excavator bucket.

The subsurface conditions encountered in the test pits, were logged and sampled by an experienced URS geotechnical engineer for visual assessment. The location of test pits are shown on Figure 1, Appendix A. The test pits were located using a handheld GPS unit to confirm the GPS co-ordinates provided by UFWA. The GPS co-ordinates of the test pit locations are recorded on the test pit logs. Test Pits TP1, TP10, TP11, and TP14 were offset from the proposed coordinates due to site accessibility issues.

Test Pit Logs and Photographs are attached in Appendix C together with notes regarding soil description and test methods.

2.2 Dynamic Cone Penetration (DCP) Testing

A total of sixty (60) Dynamic Cone Penetrometer (DCP) tests were performed along the proposed alignment of the WTG, ensuring a DCP test at/near each test pit location. The in-situ testing comprised the measurement of the consistency and in-situ strength of the subsurface materials to a steel rod driven into the ground by a dropped weight. The in-situ testing procedures are in accordance to AS 1289.F3.2. The equipment utilises a 9kg sliding weight with a drop height of 510mm and the rod is fitted with a conical tip. The test data are generally recorded as the number of blows (n) per 50mm of penetration. The test data are then processed by our in-house computer software.

DCP Logs are attached in Appendix D.



2 Methodology

2.3 Borehole Drilling

The fieldwork for the geotechnical assessment included the drilling of two boreholes at WTG 9 and 38, as requested by UFWA. The selection of boreholes was based on UFWAs consultation with landowners, and it was perceived that these two locations may have significantly different subsurface conditions. The borehole drilling program was carried out between 18 July 2011 and 22 July 2011.

Drilling was carried out using a 2010 Model CME 55LC track mounted drilling rig which was operated by qualified personnel from Strategic Drilling Services Pty Ltd. The boreholes were drilled initially using a TC-bit attached to solid flight augers (150mm diameter) to refusal in bedrock, with standard penetration tests (SPTs) carried out in the soils at regular depth intervals (approximately 1.5m). The boreholes were subsequently cased then extended into the underlying bedrock to a depth of approximately 20m using NMLC diamond coring. Further details of the methods and procedures employed in the investigations are presented in Appendix B, Report Explanatory Notes.

The locations of the boreholes are shown in Figure 1, Appendix A. Borehole logs with core photographs are presented in Appendix E.

2.4 Electrical Resistivity Survey

The purpose of the Electrical Resistivity Survey (ERS) is to determine the electrical resistivity of the subsurface by means of ground measurements. The apparent ground resistivity is dependent on geological parameters such as mineral type, moisture content, porosity and degree of water saturation.

URS carried out an Electrical Resistivity Survey on the 18th of July 2011 at turbines WTG 9 and 38. The machine used for resistivity sounding was called an Automatic Resistivity System (ARES) made by GF instruments. To measure the resistivity of the subsurface soils at the site, a total of 40 stainless steel rods (in a straight line) with a spacing of 2m each were inserted to a depth of roughly 200mm into the ground. Upon completion of the set-up, ARES equipment estimated the electrical resistivity of the subsurface soils using Wenner Alpha, Schlumberger and Dipole-Dipole models.

The subsurface profile based on Wenner Alpha, Schlumberger and Dipole-Dipole models was estimated after processing the data collected at the site using software RES2DINV. The location of Electrical Resistivity testing was shown on Figures presented in Appendix G.

2 Methodology

2.5 Laboratory Testing

Soil and rock testing were conducted on disturbed bulk soil and rock samples collected during the geotechnical field investigation. The results are summarised in the following section and attached in Appendix F.

Test	No. Tests
Moisture Content	20
Standard Compaction	10
California Bearing Ratio	10
Emerson Crumb	20
Soil thermal conductivity	10
Electrical Resistivity	6
Soil Aggressivity	10
Point Load Strength Index (Rock)	8

Table 2-1 Lab Testing Schedule



3.1 Test Pits Results

Based on the test pit investigations, two generalised soil profiles were inferred. Table 3-1 provides a summary of the Tertiary Volcanics encountered across the majority of the site. Table 3-2 provides a summary of Ordovician materials encountered across the site.

Unit	Unit Description	Depth to Top of Unit (m)	Unit Thickness (m)
	Topsoil : Silty SAND, fine grained, pale brown to dark brown, moist, medium dense to dense, few test pits encountered some gravel, cobble, and boulder basalt	0.0	0.2 to 0.4
	Residual Soils:	0.2 to 0.4	0.6 to 1.8
Tertiary Volcanics Profile	Clayey SAND and Gravely SAND, fine grained, brown and pale brown, dry to moist, dense to very dense, with some fine to coarse grained sub-angular gravel, cobble, and boulder basalt or Sandy CLAY and CLAY, medium to high plasticity, brown, red, pale brown, and pale grey, dry to moist, friable/very stiff to hard, with some fine to coarse grained sub-angular gravel and cobble basalt, Residual	0.2 to 0.4	0.4 to 3.1
	Bedrock: BASALT, medium to high strength, distinctly to extremely weathered, grey, dark grey, and greenish grey, Bedrock	0.4 to 3.2	NOT PENETRATED

Table 3-1 Subsurface Conditions - Tertiary Volcanics Profile

Table 3-1 is based on investigations TP4, TP12, TP15-TP45, TP47, and TP49-TP60. Variations to the above-generalised sequence were encountered in TP38, TP45, TP54 and TP60, where the Basalt bedrock stratum was deeper and not encountered within the investigation depths.

In-situ testing the Dynamic Cone Penetrometer (DCP) was carried out adjacent to each test pit location. The results of testing indicated that the strength of the subsurface residual soils profile to be of stiff to very stiff consistency, hence becoming hard with depth, underlain by weathered basalt bedrock.



Unit	Unit Description	Depth to Top of Unit (m)	Unit Thickness (m)
	Topsoil: Silty SAND, fine grained, pale brown, brown, and dark brown, moist, medium dense to dense, few test pits encountered some cobble basalt, Topsoil	0.0	0.2 to 0.3
s	Residual Soil:	0.2 to 0.3	0.6 to 1.4
Ordovician Materials	Sandy CLAY, medium to high plasticity, brown, pale brown, orange, dry to moist, very stiff to hard, with a trace of fine to medium grained sub-rounded gravel basalt	0.2 to 0.8	0.2 to 0.6
Ordovici	or Clayey SAND, fine grained, pale brown, dry to moist, dense to very dense, with a trace of fine to medium grained subrounded gravel basalt		
	Bedrock: SILTSTONE, low to medium strength, distinctly to extremely weathered, pale grey and pale brown, Bedrock	0.2 to 1.7	NOT PENETRATED

Table 3-2 Subsurface Conditions - Ordovician Materials

Table 3-2 is based on investigations TP1-TP3, TP5-TP11, TP13-TP14, TP46, and TP48. The subject test pits are generally with relative lower elevation level and located closer to the Abercrombie River.

In-situ testing of the Dynamic Cone Penetrometer (DCP) was carried out adjacent to each test pit location. The results of testing indicated that the consistency of the subsurface residual soils varied from stiff to very stiff, underlain by weathered basalt bedrock.

3.2 Boreholes Results

Based on the findings of the geotechnical borehole drilling, two generalised profiles were inferred. Table 3-3 provides a summary of the Ordovician Aged Alluvial Deposits encountered in BH1 (WTG location 8), and Table 5 provides a summary of Tertiary Aged Volcanics encountered in BH2 (WTG location 38).

Table 3-3 Subsurface Conditions in BH1 - Ordovician Materials

Unit	Unit Description	Depth to Top of Unit (m)	Unit Thickness (m)
rials	Topsoil: Clayey SAND, fine grained, dark brown, with some crushed sandstone and gravel with organics	0	0.4
Ordovician Materials	Bedrock: SILTSTONE, low to high strength, distinctly to slightly weathered, with some extremely weathered zones, pale brown to brown, with some fine to coarse grained sand, with some medium to gravel size quartz , with some clay infilling joints	0.4	BH1 terminated at 20m, targeted depth reached, no further penetrated

Table 3-4 Subsurface Condition in BH2 - Teriary Volcanics Profile

Unit	Unit Description	Depth to Top of Unit (m)	Unit Thickness (m)
file	Topsoil: Silty SAND, fine grained, pale brown, with organics	0	0.3
Volcanics Profile	Residual Soil: Sandy Silty CLAY, medium to high plasticity, pale brown and brown, with a trace of gravel	0.3	5.1
Tertiary Vo	Bedrock: BASALT, medium to high strength, slightly weathered to fresh rock, with some extremely weathered zones grey, dark grey to grey, massive, with a trace of iron staining and clay infilling along joints	5.1	BH2 terminated at 19.72m, targeted depth reached, no further penetrated



3.3 Groundwater Conditions

Groundwater was not observed in the test pits or boreholes during drilling. It should be noted that these observations were made at the time of the field investigation and actual groundwater levels may fluctuate significantly in response to seasonal effects, regional rainfall, and other factors that are not related to this investigation.

Based on past experience it is anticipated that the fractured Basalt and the underlying Tertiary sediments are typically water bearing and can form perched water tables on weathered Ordovician basement. The regional water table in fractured Ordovician bedrock is anticipated to be at a considerable depth.

3.4 Materials Properties of Geotechnical Soil Units

The soil unit distribution within this study area generally comprises the Tertiary Volcanics profiles and the Ordovician materials. The units are summarised and described based on analysis of the study area using a number of methods including field observation, test pits, borehole data and topographic analysis.

The soil unit distribution is listed in Table 3-5. Observations from field test pits along with laboratory results is summarised for each geotechnical soil unit in the following sections.

Soil Unit Description	Test Location Number	Sample Depth Range (m) below ground level		
Tertiary Volcanics	TP4, TP12, TP15-TP45, TP47, and TP49-TP60	0.4m to 1.7m		
Ordovician Materials	TP1-TP3, TP5-TP11, TP13-TP14, TP46, and TP48	0.4m to 0.7m		

Table 3-5 Soil Unit Distribution

3.4.1 Tertiary Volcanics Profiles

The Tertiary Volcanics profiles generally comprise residual soils and cover most of the valley floor areas within the subject site. Soils identified as residual soil unit in these areas are generally relatively shallow, typically less than 2.5m. However exceptions to this would be expected, for example test pit TP39 excavated in the central portion of the site, encountered 3.3m clay residual soils overlying basalt bedrock.

Residual soils observed at the site were predominantly high plasticity clays, with gravelly sandy clays usually encountered before underlying Basalt bedrock. Table 3-6 presents lab testing results for this unit.

Properties	Moisture Content (%)	Optimum Moisture Content (%)	Maximum Dry Density (t/m³)	CBR Value (%)	Chloride (mg/kg)	Sulphate (mg/kg)	рН	Emerson Class Number
Max Value	40	41	1.75	10	56	47	7	6
Min Value	14.4	17	1.25	1.5	2.4	0.5	5.7	3
No. of tests	18	9	9	9	9	9	9	18
Average	26.11	27.56	1.53	4.75	13.81	13.81	6.4	5

Table 3-6 Tertiary Volcanics Results Summary

3.4.2 Ordovician Materials

The Ordovician materials encountered within the study area comprise clay dominated soils, with exceptions such as sands and gravels. The clays soils were characteristically medium to high plasticity, brown-pale brown, and orange. The underlying siltstone bedrock is relative shallow, typically less than 1m. Table 3-7 presents lab testing results for this unit.

Table 3-7 Ordovician Aged Alluvial Deposits Results Summar	iry
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Properties	Moisture Content (%)	Optimum Moisture Content (%)	Maximum Dry Density (t/m ³)	CBR Value (%)	Chloride (mg/kg)	Sulphate (mg/kg)	рН	Emerson Class Number
Max Value	26.1	34	1.67	2.5	22	6.4	7	5
Min Value	17.6	18	1.38	2	22	6.4	7	5
No. of tests	2	2	2	2	1	1	1	2
Average	21.85	26	1.53	2.25	22	6.4	7	5



4.1 Geotechnical Comments

4.1.1 Subsoil Class for Earthquake Design

In accordance with AS 1170.4 – 2007, site's specific class parameters are as follows:

- Hazard factor (Z) of <0.09
- Sub-soil class of B_e Rock

4.1.2 Geomorphology, Tectonics and Fracturing

The site geomorphology comprises a dissected upland plateau at an elevation of between 900m and 1065m surrounded by steeply sloping gullies and creek lines that fall to the Abercrombie River. The plateau is covered by Tertiary Basaltic Volcanics that erupted onto a plateau formed in Ordovician Siltstones. Uplift occurred post Tertiary and has resulted in the weathering and erosion of both Basalt and Siltstone.

No major faults of shear zones cross the site and the boundaries between the rock units are erosional.

Both the Basalt and Siltstone are fractured on a regional scale, the Basalt due to cooling and the Siltstone due to folding and low grade metamorphism.

4.2 Geotechnical Recommendations

4.2.1 Bedrock Characteristics

Selected rock core samples recovered from boreholes were sent to a NATA accredited laboratory, SGS Australia Pty Ltd for Point Load Strength Index Testing. The point Load Strength indices of the rock cores and the estimated rock strength, in accordance with the Australian Standards (AS4133.4.1 2007), are summarised in the following Table 4-1.

Sample ID	Sample Source (m)	Lithology	Standard Dev Load Strengtl (MP	n Index I₅50	Rock Strength
			Diametric	Axial	
		Siltstone, slightly weathered,			
BH1-1	5.67 to 5.75	pale brown and pale grey	0.39	0.77	Medium
		Siltstone, slightly weathered,			
BH1-2	9.23 to 9.34	pale brown and pale grey	0.58	N/A	Medium
		Siltstone, slightly weathered,			
BH1-3	12.79 to 13	pale brown and pale grey	1.68	1.46	High
		Siltstone, slightly weathered,			
BH1-4	15.6 to 17	pale brown and pale grey	0.41	0.88	Medium

Table 4-1 Bedrock Point Load Strength Index Summary



Sample ID	Sample Source (m)	Lithology	Standard Deviation Point Load Strength Index I₅50 (MPa)		Rock Strength
			Diametric	Axial	
		Basalt, fresh rock, dark grey			Medium to
BH2-1	6.83 to 6.97	to black	1.92	3.83	High
		Claystone, extremely			
BH2-2	8.83 to 8.91	weathered, brown and red	0.18	0.21	Low
		Basalt, distinctly weathered,			
BH2-3	13.56 to 13.68	grey to dark grey	0.6	0.69	Medium
		Basalt, distinctly weathered,			
BH2-4	18.68 to 18.8	grey to dark grey	0.92	N/A	Medium

4.2.2 Wind Turbine Generators (WTGs) Foundation Design - General

The conventional WTGs foundations are reinforced concrete gravity footings founded 1.5m to 3m below the existing ground surface. The critical loading for this foundation system are lateral loads from a combination of wind and earthquake events. The footings are sized such that the maximum allowable bearing pressure is not exceeded on one side of the footing while the other side of the footing experiences uplift loads.

An alternative foundation system is to reduce the size of the footing and resist the uplift loads by installing anchors or piles below foundation level. As the footings are smaller, bearing pressures are greater, and this system is only suitable where sound rock extends from foundation level to the depth of the anchors.

Based on the current geotechnical investigation the potential foundation systems suitable for each WTG site has been summarised in Table 4-2:

WTG	Test Pit	Founding Conditions	Potential Foundation System	
1	TP-1 (50m offset) [*]	Basalt/Siltstone – Strength unknown	Anchored Footings/Gravity Footings	
2	TP2	Siltstone- Low to medium strength	Crowity Factions	
3	TP3	Siltstone- Low to medium strength	 Gravity Footings 	
4	TP4	Basalt – Medium to High Strength	Anchored Footings	
5	TP5	Siltstone- Low to medium strength		
6	TP6	Siltstone- Low to medium strength	Gravity Footings	
7	TP7	Siltstone- Low to medium strength		
8	TP8	Siltstone- Low to medium strength		
9	TP9	Siltstone- Low to medium strength		
10	TP10	Siltstone- Low to medium strength		
11	TP11	Siltstone- Low to medium strength		
12	TP12	Basalt – Medium to High Strength	Anchored Footings	
13	TP13	Siltstone- Low to medium strength	Crovity Ecotings	
14	TP14	Siltstone- Low to medium strength	 Gravity Footings 	

Table 4-2 Potential Foundation Systems for WTGs

WTG	Test Pit	Founding Conditions	Potential Foundation System	
15	TP15	Basalt – Medium to High Strength		
16	TP16	Basalt – Medium to High Strength		
17	TP17	Basalt – Medium to High Strength		
18	TP18	Basalt – Medium to High Strength		
19	TP19	Basalt – Medium to High Strength		
20	TP20	Basalt – Medium to High Strength		
21	TP21	Basalt – Medium to High Strength		
22	TP22	Basalt – Medium to High Strength	Anchored Footings	
23	TP23	Basalt – Medium to High Strength		
24	TP24	Basalt – Medium to High Strength		
25	TP25	Basalt – Medium to High Strength		
26	TP26	Basalt – Medium to High Strength		
27	TP27	Basalt – Medium to High Strength		
28	TP28	Basalt – Medium to High Strength		
29	TP29	Basalt – Medium to High Strength		
30	TP30	Basalt – Medium to High Strength		
31	TP31	Basalt – Medium to High Strength		
32	TP32	Basalt – Medium to High Strength		
33	TP33	Basalt – Medium to High Strength		
34	TP34	Basalt – Medium to High Strength	Anchored Footings	
35	TP35	Basalt – Medium to High Strength		
36	TP36	Basalt – Medium to High Strength		
37	TP37	Basalt – Medium to High Strength		
38	TP38	Clay –Soil depth 5m	Gravity Footing	
39	TP39	Basalt – Medium to High Strength		
40	TP40	Basalt – Medium to High Strength		
41	TP41	Basalt – Medium to High Strength	Anchored Footings	
42	TP42	Basalt – Medium to High Strength	Anchored Foolings	
43	TP43	Basalt – Medium to High Strength		
44	TP44	Basalt – Medium to High Strength		
45	TP45	Gravelly Sand – Soil depth >2.0m	Gravity Footings	
46	TP46	Siltstone- Low to medium strength	Gravity Footings	
47	TP47	Basalt – Medium to High Strength	Anchored Footings	
48	TP48	Siltstone- Low to medium strength	Gravity Footing	
49	TP49	Basalt – Medium to High Strength		
50	TP50	Basalt – Medium to High Strength		
51	TP51	Basalt – Medium to High Strength	Anchored Footings	
52	TP52	Basalt – Medium to High Strength		
53	TP53	Basalt – Medium to High Strength	1	
54	TP54	Gravelly Sand – Soil depth >1.5m	Gravity Footing	
55	TP55	Basalt – Medium to High Strength	Anchored Footings	
56	TP56	Basalt – Medium to High Strength		



WTG	Test Pit	Founding Conditions	Potential Foundation System
57	TP57	Basalt – Medium to High Strength	Anchored Footings
58	TP58	Basalt – Medium to High Strength	
59	TP59	Basalt – Medium to High Strength	
60	TP60	Sandy Clay –Soil depth >2.1m	Gravity Footing

*TP-1 was offset by 50m due to accessibility issues and foundation conditions at WTG1 cannot be assessed from current geotechnical investigations

It is not clear at this stage of the design process if anchored foundations represent a major cost saving over gravity foundations. It is recommended that a number of preliminary foundation designs for a range of tower heights be costed so that the most cost effective foundation system can be selected for each site and tower combination.

4.2.3 Wind Turbine Generators (WTGs) Foundation Design – Gravity Footings

Based on the current geotechnical investigation, distinctly to extremely weathered basalt and siltstone may be anticipated at the depth of about 1.5m to 3m. Gravity Footings may be designed based on the parameters given in Table 4-3:

Material	Allowable Bearing	Ultimate Bearing	Ult. Bond Stress
Medium Strength Siltstone or Basalt	1.0MPa	8.0MPa	500kPa
High Strength Basalt	3.5MPa	30MPa	2000kPa

Table 4-3 Foundation Design Parameters

It should be noted that at ultimate bearing capacity settlement values can exceed 5% of footing dimension and this needs to be taken into account in the design. Settlement values under allowable loading are not anticipated to exceed 1% of footing dimension.

It is possible that weaker materials (low strength rock) may be encountered locally within this depth range and all footings must be inspected by an experienced Geotechnical Engineer or Engineering Geologist to confirm appropriate founding materials and achievement of design socket lengths, that the recommended serviceability bearing pressures could be met and to ensure that all soft and wet materials have been removed from the foundation footprint prior to concrete placement.

4.2.4 Wind Turbine Generators (WTGs) Foundation Design – Anchored Footings

Anchored footing may be designed using the parameters for high strength Basalt in Table 4-3. The capacity of the anchors in uplift need to satisfy both the bond stress requirements and cone pull out assuming a 60 degree cone with its apex at the centre of the anchor bond zone. The impact of interfering cones may also need to be taken into account.

WTG sites with anchored footings require additional geotechnical investigation to confirm the anchor can be installed into sound rock. This generally comprises one bore within the foundation footprint to 1m below the maximum anchor depth.

4.2.5 **Proposed Foundations for Turbines**

Based on borehole drilling significantly different subsurface conditions were encountered at WTG38 in comparison to WTG9. URS understands that the preferred location for the substation is WTG38. However, recommendations on foundations at both the locations (WTG38 & WTG9) were provided in this section. The ground conditions at WTG38 and WTG9 are summarised in Table 4-4

Location	Test Pits	Bores	Subsurface Conditions
1	TP9	BH 1	Low to medium strength siltstone from shallow depth
2	TP38	BH 2	Stiff to very stiff clays over high strength Basalt at 5m depth

Table 4-4 Ground Conditions At WTG38 & WTG9

At Location 1, relevant infrastructure may generally be supported by shallow footings (pad or strip footings) founded in medium strength siltstone bedrock. The appropriate foundation parameters in Table 4-3 may be used for footing design.

At location 2 lightly loaded structures may be founded on Stiff Clays with an allowable bearing capacity of not less than 100kPa. For heavily loaded or settlement sensitive structures it is recommended that the loads be transferred to the high strength basalt bedrock using bored piles.

All footings must be inspected by an experienced Geotechnical Engineer or Engineering Geologist to confirm appropriate founding materials and achievement of recommended serviceability bearing pressures could be met and to ensure that all soft and wet materials have been removed from the foundation footprint prior to concrete placement.

With regards to shallow footings supported on the deep clay soils, it should be noted that such clays encountered in the study area are of high plasticity and are generally considered to have a high potential for expansion and swelling as a result of variation in moisture condition. The requirements of AS 2870 should be included in the design of shallow footings supported on the natural high plasticity clays.

4.2.6 Elastic Properties of Soils

Based on current geotechnical investigation, indicative preliminary values of geotechnical parameters that may be used for preliminary design purposes are provided in this section. The parameters estimated based on geotechnical investigations and our experience with similar materials are presented in Table 4-5 below.

Material	Undrained Shear Strength (kPa)	Elastic Modulus (MPa)	Friction Angle (Degree)	Bulk Density (kN/m³)
Topsoil Silty Sand or Clayey Sand, medium dense	n/a	20 to 30	27 to 30	17 to 19
Residual Sandy Clay, Clayey Sand, very stiff to high, with gravel	150 to 250	25 to 50	n/a	20
Siltstone, low to medium strength	n/a	500	n/a	22

Table 4-5 Geotechnical Design Parameters

Material	Undrained	Elastic	Friction	Bulk
	Shear Strength	Modulus	Angle	Density
	(kPa)	(MPa)	(Degree)	(kN/m³)
Basalt, medium to high strength	n/a	1000	n/a	24

The range of parameter in Table 4-5 reflects the variation and localised differences encountered at all the sixty test pit locations.

4.2.7 Soil Thermal Conductivity

Thermal resistivity testing was carried out on selected soil samples recovered from test pits by Chadwick T&T Pty Ltd. Summary of testing results are presented in Table 4-6. Full results are attached in Appendix F.

Sample ID	Sample Source (m)	Lithology	Moisture (%)	Compacted Density (t/m³)	Thermal Conductivity* (W/mK)
TP8	0.5 – 0.8	Sandy Clay, brown and pale brown	27	1.582	0.76
TP15	0.5 – 0.8	Sandy Clay, pale grey and pale brown	29	1.546	0.68
TP17	0.4 - 0.7	Sandy Clay, brown and pale brown	32.3	1.392	0.75
TP21	0.4 - 0.7	Sandy Clay, brown	32.3	1.529	0.95
TP25	0.5 – 0.8	Sandy Clay, brown and red	19.2	1.947	2.51
TP30	0.5 - 0.8	Sandy Clay, brown and pale brown	17.1	1.6	0.55
TP39	0.4 - 0.7	Sandy Clay, brown and red	13.7	1.82	1.36
TP41	0.5 – 0.8	Sandy Clay, brown	31	1.642	0.68
TP48	0.4 - 0.7	Sandy Clay and Siltstone, pale brown and orange	No Result received**	No Result received**	No Result received**
TP57	0.4 - 0.7	Sandy Clay, brown	32.3	1.596	0.86

Table 4-6 Thermal Conductivity Testing Results

* The subjected samples were tested in 100% compaction standard at the received moisture content.

** No result was received on TP48 sample as siltstone component.

4.2.8 Electrical Resistivity Survey

URS undertook a total of three resistivity surveys at each of the two proposed locations (near WTG 9 and 38). The purpose of this survey was to provide information about the existing ground resistivity for the design of the earthing grid at the proposed substation locations. The results and figures are available in Appendix G. These tests include the Wenner Alpha array which is reliable for determining

depth variations in 1-D earth, while Schlumberger Array is more sensitive to lateral variation in Earth and Dipole-Dipole array is reliable in estimating sensitivity to lateral variation at depth.

The first proposed substation location surveyed was at borehole 1 near WTG9. Due to the sloping area and out cropping rock in the way, the survey line had to be offset approximately 50 meters away from the borehole. The resistivity survey indicates areas of low resistivity within the first few meters of the ground subsurface. All the three tests indicate a consistent pocket of high resistivity near the north eastern region of the survey line (refer to figures in appendix G). The siltstone in this region is highly fractured, as a result water is able to seep through the voids and create pockets of low resistivity.

The second proposed substation location surveyed was at borehole 2 near WTG38. This site was relatively flat and the survey line was laid immediately adjacent to the borehole.

The electrical resistivity results at Borehole 2 are similar to the electrical resistivity results obtained at Borehole 1. In both locations areas of low resistivity exist within the first few meters of the strata.

At borehole 2 all three tests indicate a pocket of high resistive material around the borehole location.

The Wenner Alpha results of borehole 2 indicate a large continuous zone of low resistivity past a depth of approximately 2.5 meters. A possible explanation for this is the substantial amount of rain the area has received in the weeks leading up to our testing. Given that the first few meters of the strata is residual soil, the water would have soaked through the ground and settled on the top layers and the faults and defects of the basalt. This soaking of the ground could be a possible explanation for the anomalously low resistivity of the deeper strata.

The results of the electrical resistivity tests are presented in Table 4-7.

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Electrical Registivity Regulta

Lesstian	Description of Soil/Rock Layer	Lowest	Highest	Average	Anomaly
Location		(Ohm.m)	(Ohm.m)	(Ohm.m)	(Ohm.m)
	Siltstone and Sandstone, medium strength, distinctly weathered, slightly				
BH1	fractured	5.13	750	280	+ 15000
	Sandy Clay and Silty Clay, medium				
BH2	plasticity	100	350	175	+ 2000



5.1 Excavation Conditions

Based on the subsurface conditions assessed from the test pits, excavations for access roads, construction platform and foundations for the proposed WTGs would likely encounter a variable thickness of sandy clay/clayey sand with some basalt cobble and boulder, weathered basalt and siltstone bedrock.

Excavations within soil materials may be carried out using tracked excavators or bulldozers. Some basalt boulders may be encountered when excavating within first few meters, which may require larger plant and some over excavation to remove.

Bulk excavation in the extremely to distinctly weathered basalt or siltstone may be generally carried out using large excavation plant such as a heavy bulldozer or a heavy hydraulic excavator.

5.2 Cut Batter Slope Stability

For unsupported cuts, up to a height of 3m, the recommended batter slopes are presented in the following Table 5-1.

Materials	Temporary (Horizontal : Vertical)		Permanent (Horizontal : Vertical)		
	Exposed	Protected	Exposed	Protected	
Topsoil, Residual and Alluvial Soils	1.5H: 1.0V (34°)	1.0H : 1.0V (45°)	2.0H : 1.0V (27°)	1.5H : 1.0V (34°)	
Weathered Basalt and Siltstone	1.0V: 1.0V (45°)	1.0H : 1.5V (56°)	1.0H : 1.5V (56°)	1.0H : 2.0V (63°)	

Table 5-1 Recommended Batter Slopes for Unsupported Cuts

Subjected to the frequency of rainfall at site during construction, temporary surface protection may be provided for temporary cuts. All batter slopes will need to be assessed and confirmed on site as construction work proceeds.

The stability of batter slopes within the basalt and siltstone rock will depend on the orientation and spacing of joints and defects, which should be assessed during construction phase. For preliminary design purposes batter slopes within weathered basalt and siltstone may be adopted based on the recommended parameters presented in Table 5-1 above.

5.3 Fill Batter Stability

Fill batters up to 10m high may be supported by battering at 2H:1V. On sloping ground they shall be keyed into the slope using terraces not less than 1.0m high and 1.0m wide.

The footprint of embankments shall be inspected and proof rolled as per Section 5.5 to ensure they are founded on sound material and unsuitable material is not present.



5.4 Re-use of In-Situ Materials

The following comments are provided on the potential re-use of excavated materials for engineered fill:

- The performance of the residual sandy clay and clayey sand soils is likely to be sensitive to changes in moisture content and there is potential to heave or fail to compact under high moisture conditions. Careful moisture conditioning and compaction will be required to compact these materials effectively, all as indicated in Section 5.5 below.
- The extremely to distinctly weathered basalt and siltstone rock may be re-used as engineered fill if, during excavation, handling and re-compaction, the rock breaks down to fragments in the order of 100mm or less. Generally zones of rock fragments that are larger than 100mm, may only be used as rock fill. Alternatively, these materials may be used as engineered fill following processing of rock into an aggregate of particle size 100mm or less.

5.5 Sub-grade Preparation and Fill Placement

It is recommended that the following site preparation be carried out for pavement sub-grade and fill placement beneath structures and footings using predominantly residual sandy clay and clayey sand soils and broken up basalt and siltstone rock.

- 5.5.1 Bulk Earth Filling (Residual Soils and Extremely Low to Low Strength Rock)
- Remove any soft, wet, and highly compressible material or topsoil material and organics.
- Assess moisture contents of the bulk excavated soils and weathered rock. For compaction of any
 materials other than free draining sands, the moisture content should be in range OMC +/-2%
 (wet/dry), where OMC is the optimum moisture content at Standard Compaction.
- Test roll the complete surface of the sub-grade in order to detect the presence of any soft or loose zones, which should be excavated out and replaced with approved filling. Test rolling should be carried out with a smooth drum roller with a minimum static weight of 8 tonne.
- For pavements, compact the natural foundation soil to a minimum dry density ratio of 98% Standard for clay soils or a minimum density index of 75% for sand soils.
- For pavements, approved filling excavated from site, should be placed in layers not exceeding 250mm loose thickness, with each layer compacted to a minimum dry density ratio of 98% Standard or a minimum density index of 75% for filling greater than 0.5m below top of finished sub-grade level. It is recommended that the final upper 0.5m of filling sub-grade be compacted to a minimum dry density ratio of 100% Standard or 80% density index. Where filling has a clay content, moisture content within the filling should be maintained within OMC -2% (dry) to OMC +2% (wet) during and after compaction.
- All filling beneath structures and footings should be compacted to a dry density ratio of at least 100% Standard or relative density index of at least 80%. This compaction should apply to all filling extending from a nominal horizontal distance of 2m at the edge of each structure with a nominal zone of influence of 1H:1V down and away from the proposed sub-grade level.
- Any compaction of silty or sandy clay foundation soils at or close to footing formation level should be sealed or covered as soon as practicable, to reduce the opportunity for occurrence of desiccation and cracking.

- Level 1 testing and supervision of filling, in accordance with AS3798, is recommended where the filling is to be used for support of structural loads, within the 2m horizontal distance and spread from structures as outlined above.
- All weathered rock, excavated from site for re-use beneath structures and as pavement sub-grade filling, should be processed so that individual particles are in the order of 100mm or less.

5.5.2 Bulk Rock Filling (Medium to High Strength Rock)

For general bulk rock filling placed outside the area of influence of the various structures (refer Section 5.5.1 above), it is recommended that the following site preparation be carried out for sub-grade preparation and rock fill placement:

- Remove any soft, wet, and highly compressible material or topsoil material rich in organics or root matter.
- Assess moisture contents of the bulk excavated soils and weathered rock. For compaction of any
 materials other than free draining sands, the moisture content should be in range OMC -2% (dry) to
 OMC +2% (wet), where OMC is the optimum moisture content at Standard Compaction.
- Test roll the complete surface of the sub-grade in order to detect the presence of any soft or loose zones, which should be excavated out and replaced with approved filling. Test rolling should be carried out with a smooth drum roller with a minimum static weight of 8-tonne.
- All weathered rock, excavated from site for re-use beneath structures and as pavement sub-grade filling, should be processed so that individual particles are in the order of 100mm or less.
- Approved rock filling excavated from site should be placed in layers not exceeding 300mm loose thickness with care taken to minimise the occurrence of voids. Fine sands and dispersive clays should not be included in the fill due to the susceptibility to erosion.

Difficulty to measure the density of bulk rock fill layer using conventional earthworks testing equipment (ie. nuclear densometer and laboratory compaction testing) must be recognised and it may be necessary to establish a suitable roller routine to achieve 'acceptable' compaction level. It follows that, where strict settlement criteria are imposed on the proposed structure, there is a higher risk of settlement under bulk rock filling due to the potential of void creation during placement and due to the lack of conventional earthworks testing to confirm density levels.

5.5.3 Pavements over Bulk Rock Filling

- Where pavements are proposed over bulk rock filling placed in accordance with Section 5.5.2 above, it is recommended that the rock fill be covered with a non-woven, needle punched, continuous filament polyester geofabric of sufficient strength to avoid punching failure.
- Place a minimum 0.5m thick cover of granular bridging on the geofabric in two layers of 250mm loose thickness, to provide sub-grade support for the pavement. The bridging layers should be compacted to a minimum dry density ratio of 100% Standard or 80% density index.
- Granular bridging or sub-grade filling should comprise engineered fill material supplied and placed in accordance with Section 5.5.1 above.



5.6 Pavement Sub-grade

The results of limited soaked CBR tests conducted on selected sub-grade samples of residual sandy clay, sandy or gravelly sand, indicated CBR values of between 1.5% and 10%.

Based on the findings of investigations, it is recommended that a CBR value of 2% to be adopted for sub-grade materials with a high clay content (such as where the Basalt outcrops), and a CBR value of 10% adopted for predominantly weathered siltstone bedrock in the design of flexible sealed or unsealed granular pavement.

These values are estimated to be close to a lower bound value of these materials and are based on the assumption that the topsoil will be stripped prior to pavement construction. It is also contingent upon adequate site preparation by proof rolling (to detect any unsuitable soft or loose materials) and sub-grade compaction procedures as recommended in Section 5.5 above.

Different values may be found where clay or rock fill is imported from elsewhere on the site and used in the road embankment. Such values can only be determined after a representative sample comprising similar plasticity content and particle size, as proposed to be used, is subjected to additional CBR testing.

The above recommendations are based on the provision and maintenance of adequate surface and subsurface drainage.

5.7 Slope Stability Assessment and Erosion

Slope instability issues have been found along the Abercrombie Road, adjacent to the southern central boundary of the site. The subject area and its hilly surrounds support mature, healthy native forest vegetation. Numerous mature trees surrounding and down and up slope of the Abercrombie Road have curved and leaning trunks, showing continued down slope soil creep. Small slope failure has occurred during the investigation period (refer to site photographs attached in Appendix C). No evidence of major slope instability was observed.

Slope instability issues are likely to be confined to steeply sloping land at the head of a gully. In generally the access roads should be designed to stay on the ridge crests and remain clear of potential land slips.

If crossing a potential land slip is required then the road formation should be designed to remove any potentially unstable material and found on stable bedrock.

The results of a limited number of laboratory Emerson Class dispersivity tests on selected near surface samples of residual soils indicate there is a low dispersion potential under acidic conditions.

It should be recognised, however, that there is a relatively high proportion of silty sands across the site, which can potentially scour under concentrated water flows. It is therefore recommended that site works, including excavation and filling, be planned accordingly to reduce the risk of high concentrated surface water runoff.

URS understands a Soil Erosion Management Plan will be prepared as part of the Construction Environmental Management Plan.

Further Geotechnical Investigations

The current study presents an appraisal of likely conditions across the Paling Yards Wind Farm site. Access at this relatively early stage in the project has been limited, to the extent that a fully representative sample of site conditions may not have been obtained. It is recommended that further detailed subsurface geotechnical investigation and analysis be conducted to provide information for the detailed design of footings, access road, slope stability, and other associated infrastructure.



Closure

This preliminary geotechnical investigation has provided a better understanding of the geological setting and its impacts on the proposed Paling Yards Wind Farm. It has revealed that from the investigations carried out, there are no major geological issues that would potential prevent the construction of the proposed development, provided the recommendations of this study are followed and further investigation is undertaken at a later stage where warranted.

The attached document titled "Appendix B - Report Explanatory Notes" presents additional information on the uses and limitations of this report.


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Limitations

URS Australia Pty Ltd (URS) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Union Fenosa Wind Australia Pty Ltd and only those third parties who have been authorised in writing by URS to rely on the report. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the Proposal dated 2nd March 2011.

The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works and URS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URS was false.

This report was prepared between 22nd April 2011 and 18th August 2011, and is based on the site conditions encountered and information reviewed at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

This report contains information obtained by inspection, sampling, testing or other means of investigation. This information is directly relevant only to the points in the ground where they were obtained at the time of the assessment. The borehole logs indicate the inferred ground conditions only at the specific locations tested. The precision with which conditions are indicated depends largely on the frequency and method of sampling, and the uniformity of conditions as constrained by the project budget limitations. The behaviour of groundwater and some aspects of contaminants in soil and groundwater are complex. Our conclusions are based upon the analytical data presented in this report and our experience. Future advances in regard to the understanding of chemicals and their behaviour, and changes in regulations affecting their management, could impact on our conclusions and recommendations regarding their potential presence on this site.

Where conditions encountered at the site are subsequently found to differ significantly from those anticipated in this report, URS must be notified of any such findings and be provided with an opportunity to review the recommendations of this report.

Whilst to the best of our knowledge information contained in this report is accurate at the date of issue, subsurface conditions, including groundwater levels can change in a limited time. Therefore this document and the information contained herein should only be regarded as valid at the time of the investigation unless otherwise explicitly stated in this report.



Appendix A Figures



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43167888/Paling Yards Geotechnical Report/3







LEGEND $\mathbf{ imes}$ TEST PIT TP1 TURBINES P1 BOREHOLES 33kV UNDERGROUND CABLE GEOLOGY*: Cainozoic (Tb), Basalt, dolerite Ordovician (Os), Silty sandstone, micaceous siltstone, phyllite, shale, slate quartzite and minor amount of porphyry 2 0.5 Km Datum: GDA94 Source: Aerial Image from Bing Maps Copyright © 2010 Microsoft Corporation and/or its suppliers *NSW1500K_UnitBoundaries_GDA94_Lamberts - Geoscience Australia Australia Whilst every care is taken by URS to ensure the accuracy of the digital data, URS makes no representation or warranties about its accuracy, reliability, completeness, suitability for any particular purpose and disclaims all responsibility and liability (including without limitation, liability in negligence) for any expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred as a result of data being inaccurate in any way for any reason. Electronic files are provided for information only. The data in these files is not PATH: T:\JOBS\43167888\WORKSPACES FILE NO: 43167888.002A.MXD DRAWN: AO/AY APPROVED: TH DATE: 25-07-2011 UNION FENOSA WIND AUSTRALIA PALING YARDS WIND FARM

GEOLOGICAL MAP





UNION FENOSA WIND AUSTRALIA

PALING YARDS WIND FARM

Site Locality Map



Appendix B Report Explanatory Notes

URS

B



REPORT EXPLANATORY NOTES

INTRODUCTION

These notes have been provided to amplify this Geotechnical Report in regard to investigation methodology, classification methods, field and laboratory procedures, the interpretation of the ground characteristics and the comments and recommendations based therein. Not all these notes are necessarily relevant to all reports.

LIMITATIONS ON INTERPRETATION, USE AND LIABILITY

The ground is a product of continuing natural and man-made processes and thus exhibits a variety of characteristics and properties that vary from place to place and can change with time. Geotechnical engineering involves gathering and assimilating limited facts about these characteristics and properties in order to understand and predict the behaviour of the ground on a particular site under certain conditions. This report may contain such facts obtained by inspection, drilling, excavation, probing, sampling, testing or other means of investigation. If so, they are directly relevant only to the ground at the place where, and the time when the investigation was carried out.

Any interpretation or recommendation given in this report shall be understood to be based on judgement and experience, not on greater knowledge of facts other than those reported. The interpretation and recommendations are therefore opinions provided for the Clients sole use in accordance with a specific brief. As such they do not necessarily address all aspects of the ground behaviour on the subject site.

The environmental investigation addresses the likelihood of hazardous substance contamination resulting from past and current known uses of the subject site. As a result, certain conditions such as those listed below may not be revealed:

- naturally occurring toxins in the subsurface soils, rock, water or the toxicity of the on-site flora;
- toxicity of substances common in current habitable environments such as stored

household products, building materials and consumables;

- subsurface contaminant concentrations that do not violate present regulatory standards but may violate such future standards; and
- unknown site contamination such as "midnight" dumping and/or accidental spillage which may occur following the site visit by URS.

There is no investigation which is thorough enough to preclude the presence of material which presently, or in the future, may be considered hazardous at the site. Because regulatory evaluation criteria are constantly changing, concentrations of contaminants presently considered low may, in the future, fall under different regulatory standards that require remediation.

Opinions and judgments expressed herein, which are based on our understanding and interpretation of current regulatory standards, should not be construed as legal opinions.

The responsibility of URS is solely to our client, as noted on the cover of the report. This report is not intended for, and should not be relied upon, by any third party. No liability is undertaken to any third party.

DESCRIPTION AND CLASSIFICATION METHODS

The methods of description and classification of soils and rocks used in this report are based on Australian Standard AS1726-1993, "Geotechnical Site Investigations".

In general, these descriptions cover the following properties - soil or rock type, structure, colour, strength/consistency or density, and inclusions.

Field identification and classification of soil and rock involves judgment and URS implies accuracy only to the extent that is common in current geotechnical practice.

Soil types are described according to the predominant particle size and material behaviour, qualified by the presence of other soil particles and materials (eg sandy clay).



Non-cohesive soils are classified on the basis of relative density, generally from the results of insitu tests or field classification.

Cohesive soils are classified on the basis of soil consistency and undrained shear strength, determined by insitu tests or field classification.

Rock types are classified by their geological names, together with descriptive terms regarding weathering, strength, discontinuities, etc. Where relevant, further information regarding rock classification is given in the text of the report.

SAMPLING

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

Disturbed soil samples are taken during field investigations to provide information on plasticity, grain size, colour, moisture content, minor constituents and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed soil samples are usually taken by pushing a thin-walled sample tube, usually 50mm to 100mm diameter (known as U50, U60, U75 etc.), into the soil and withdrawing it with a sample of the soil contained in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of soil strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

In very stiff or hard cohesive soils the URS driven ring lined sampler may be used to obtain samples. In some instances a thin wall extension tube is employed to minimise soil disturbance. The ring sampler is generally pushed hydraulically through 0.45 metres although in hard clays and dense sands it may be driven with the S.P.T. hammer. Where the sampler has been driven, an "equivalent N" value is shown on the borehole records.

Details of the type and method of sampling used during the field investigation are given on the engineering field logs provided with this report.

INVESTIGATION METHODS

The following is a brief summary of investigation methods currently adopted by URS with some comments on their use and application. All methods, except test pits, hand auger drilling and portable dynamic cone penetrometers, require the use of a mechanical drilling rig.

EXCAVATION AND DRILLING

Test pits - These are normally excavated with a backhoe or a tracked excavator. They allow close examination of the soils insitu condition up to a depth of about 1.5m, if safe, and collection of disturbed bulk samples from greater depths. The depth of penetration is limited to about 4m for a backhoe and up to 6m for an excavator. Care must be taken if construction is to be carried out near test pit locations to either properly recompact the backfill during construction (not generally possible) or locate the pit outside an area of possible influence or to design and construct the structure so that it is not adversely affected by poorly compacted backfill at the test pit location.

Hand Augers - Boreholes of 50mm to 100mm diameter may be advanced manually. Hand augers are generally used where only shallow soil profiles are required (ie. less than 1.5m) or in areas inexcessable to larger drilling or excavation equipment. Limited insitu testing can be carried out within hand auger boreholes.

Refusal during hand augering can occur in a variety of materials, such as hard clay or gravel, and does not necessarily indicate rock level.

Continuous Spiral Flight Augers - Boreholes are advanced using a 75mm to 115mm diameter continuous spiral flight auger, which is withdrawn at intervals to allow sampling and in situ testing.



This is a relatively economical means of drilling in clays and in sands above the water table. Samples are returned to the surface by the flights or may be collected by other techniques after the withdrawal of the auger flights, but they can be very disturbed and may be cross-contaminated.

Information from the drilling (as distinct from specific sampling by S.P.T.'s or undisturbed sampling) is of relatively low reliability due to remoulding, cross-contamination or softening of samples by groundwater or uncertainties as to the original depth of the materials. Augering below the groundwater table is of less reliability than augering above the water table.

Use can be made of a Tungsten Carbide (T.C.) bit for auger drilling into rock to indicate rock quality and continuity by variation in drilling resistance and from examination of recovered rock fragments.

Wash bore drilling - Boreholes are usually advanced by a mechanical or hydraulic rotary bit, with water or mud being pumped down the drill rods and returned up the annulus, carrying the drill cuttings.

The water or mud is also used to provide support to the borehole in difficult soil conditions. The term mud encompasses a range of products from bentonite to polymers such as Revert, foam or Biogel.

Only major changes in stratification can be determined from the cuttings returned, together with some information from "feel" and rate of penetration. The use of mud support may mask the identification of some soils from cuttings.

Generally, the use of wash bore drilling is carried out in conjunction with insitu testing and sampling at regular intervals to provide more accurate identification of changes in stratification.

Continuous Core Drilling - Continuous rock core samples are obtained using a diamond tipped core barrel.

Provided full core recovery is achieved (which is not always possible in very weak rocks and granular soils), this technique provides a reliable (but relatively expensive) method of field investigation. In rocks, an N.M.L.C. triple tube core barrel, which gives a core of about 50 mm diameter, is usually used with water flush. The length of core recovered is compared to the length drilled and any length not recovered is shown as core loss. The location of losses are determined on site by the inspecting engineer. Where the location is uncertain, the loss is indicated at the top end of the drill run.

The core recovery ratio (CRR) is the ratio of recovered core to length cored expressed as a percentage. The rock quality designation (RQD) is a modified core recovery ratio in which only pieces over 100mm long are summed and expressed as a percentage of the core length.

FIELD TESTS

Standard Penetration Tests

Standard Penetration Tests (S.P.T.) are used mainly in non-cohesive soils, but can also be used in cohesive soils as a means of indicating density or strength and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard AS1289, "Methods of Testing Soils for Engineering Purposes" - Test F3.1.

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

The test results are reported in the following form:

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



• In a case penetration is incomplete, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm, the distance penetrated is given as

15, 30 / 40 mm N > 30, [or Nx=225]

The results of the test can be related empirically to the engineering properties of soil.

Occasionally the drop hammer is used to drive 50mm diameter thin walled sample tubes (U50) in clays. In such circumstances, the test results are shown on the borehole logs in brackets.

A modification to the S.P.T. is where the same driving system is used with a solid 60 degree tipped steel cone of the same diameter as the S.P.T. hollow sampler. The solid cone can be continuously driven for some distance in soft clays or loose sands, or may be used where damage would otherwise occur to the hollow sampler. The results of this Dynamic Penetration Test are shown as "Nc" on the borehole logs, together with the number of blows per 150 mm penetration.

Static Cone Penetrometer Testing

Cone penetrometer testing (CPT) (sometimes referred to as a Dutch Cone Test) is used mainly in low strength soils as a means of determining a continuous profile of soil characteristics. The test is described in Australian Standard 1289, Test F5.1., and ASTM D3441-79.

In the tests, a 35 mm diameter rod with a conical tip is pushed continuously into the soil, the reaction being provided by a specifically designed truck or rig which is fitted with an hydraulic ram system. Measurements are made of the end bearing resistance on the cone and the frictional resistance on a separate sleeve, immediately behind the cone. Advanced CPT equipment may also measure soil piezometric pressures at the tip and variation in the inclination of the cone probe. Transducers in the tip of the assembly are electrically connected to recorder unit at the surface. As penetration occurs, (at a rate of about 20 mm per second) the information is output onto continuous chart recorders or stored on computer.

The information provided from CPT tests usually comprises:

- Cone resistance the actual end bearing force divided by the cross sectional area of the cone expressed in MPa.
- Sleeve friction the frictional force on the sleeve divided by the surface area expressed in kPa.
- Friction ratio the ratio of sleeve friction to cone resistance, expressed as a percentage.

In addition the following may be given:

- Piezometric pressure the pore water pressure at the cone tip expressed as kPa.
- Cone inclination some cones may provide a continuous recording of the cone inclination expressed in degrees from vertical to determine the exact location of the probe.

The test method provides a continuous profile of certain soil characteristics. Stratification can be inferred from the cone and friction traces, from experience and information from nearby boreholes etc.

The ratios of the sleeve resistance to cone resistance will vary with the type of soil encountered, with higher relative friction in clays than in sands. Friction ratios of 1% to 2% are commonly encountered in sands and occasionally very soft clays, rising to 4% to 10% in stiff clays and peats.

Where shown, soil profile information is presented for general guidance only. Soil descriptions based on friction ratios are only inferred and must be regarded as interpretive, not an exact profile. Where precise information on soil classification and engineering properties are required, direct sampling from drilling may be preferable.

Correlations between CPT and SPT values can be developed for both sands and clays but may



only be site specific. Interpretation of CPT values can be made to empirically estimate modulus or compressibility values to allow calculation of foundation settlements.

Portable Dynamic Penetrometers - Portable Dynamic Cone Penetrometer (DCP) tests are carried out by driving a rod into the ground with a falling weight hammer and measuring the blows for successive increments of penetration. The aim of the tests are to empirically estimate soil consistency and relative density.

Typically, DCP tests consist of driving a cone by the free-fall of a 9kg hammer. The number of blows for each 150mm of penetration is recorded. It is possible to relate these values obtained to empirical charts developed for soil consistency and relative density.

Two similar DCP tests are described by Australian Standards, AS1289 - F3.2 & F3.3. The major variation between these tests is the use of either a pointed or rounded penetration cone.

Interpretation of DCP results requires care and knowledge of local site conditions.

FIELD RECORDS/LOGS

The field logs or records attached with this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on the frequency of sampling and the method of drilling or excavation.

Ideally, continuous undisturbed sampling or core drilling will enable the most reliable assessment, but is not always practicable or possible to justify on economic grounds. In any case, the boreholes or test pits carried out during a field investigation represent only a very small sample of the overall subsurface conditions.

The attached explanatory notes for soil logs and rock logs define the terms and symbols used in preparation of the borehole or test pit records.

Interpretation of the information shown on the logs, and its application to design and construction should therefore take into account the spacing of boreholes or test pits, the method of drilling or excavation, the frequency of sampling and testing and the possibility of other than "straight line" variations between the boreholes or test pits (for example, in limestone). Subsurface conditions between boreholes or test pits may vary significantly from conditions encountered at the borehole or test pit locations.

GROUNDWATER

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

- Although groundwater may be present, in low permeability soils it may enter the hole slowly or perhaps not at all during the time the hole is left open.
- A localised perched water table may lead to an erroneous indication of the true water table.
- Water table levels will vary from time to time with seasons or recent weather changes and may not be the same at the time of construction.
- The use of water or mud as a drilling fluid may mask any groundwater inflow or outflow. Drilling water has to be removed from the hole and drilling mud must be washed out of the hole or "reverted" chemically if accurate water observations are to be made.

More reliable measurements can be made by installing standpipes which are read after stabilisation of water levels, which may take several days to perhaps weeks for low permeability soils.

Piezometers, sealed in a particular stratum, are advisable in low permeability soils or where there may be interference from perched water tables or surface water.

FILL MATERIALS

The presence of fill materials can often be determined only by the inclusion of foreign objects (e.g. bricks, steel etc.) or by distinctly unusual colour, texture or fabric.



Identification of the extent of fill materials will also depend on investigation methods and sampling frequency. Where natural soils similar to those at the site are used for fill, it may be difficult with limited testing and sampling to reliably determine the extent of fill.

The presence of fill materials is usually regarded with caution as the possible variation in density, strength and material type is much greater than with natural soil deposits. Consequently, there is an increased risk of adverse engineering characteristics or behaviour. If the volume and quality of fill is of importance to a project, then frequent test pit excavations are preferable to boreholes.

LABORATORY TESTING

Laboratory testing for engineering projects is normally carried out in accordance with the relevant Australian Standards. Details of each test procedure used will be provided on the individual report forms.

In order to maintain a high degree of quality control and assurance, URS utilise independent laboratories registered by the National Association of Testing Authorities (NATA).

ENGINEERING REPORTS

Engineering reports are prepared by qualified personnel and are based on the field information obtained and on current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal (e.g. a three storey building) the information and interpretation may not be relevant if the design proposal is changed (e.g. to a twenty storey building). If this situation occurs, URS would be pleased to review the report and the sufficiency of the field investigation work in relation to the proposed development.

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

- unexpected variations in ground conditions. The potential for this will be partially dependent on borehole spacing, sampling frequency and investigation technique as well as the time elapsed between investigation and construction;
- changes in policy or interpretation of policy by statutory authorities; and
- the actions of persons or contractors responding to commercial pressures.

If these occur, URS will be pleased to assist with investigation or advice to resolve any problems or disputes occurring.

SITE ANOMALIES

Our report, plans and specifications are prepared contingent to inspection of the site works by an experienced geotechnical engineer familiar with the report and the assumptions adopted in the design.

Should the conditions encountered during construction appear to vary from those which were expected, URS requests that it is notified immediately. This will enable URS to judge whether the actual conditions vary in significant extent and whether changes to the adopted design are required. Most problems are much more readily resolved when conditions are exposed, than at some later stage.

REPRODUCTION OF INFORMATION FOR CONTRACTUAL PURPOSES

Where information obtained from this investigation is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion of comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. URS would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.



REVIEW OF DESIGN

Designs based upon information and recommendations provided in our geotechnical report should be reviewed to ensure that the intent of our report is reflected in the proposed design.

Where major civil, mining or structural developments are proposed or where only limited investigation has been completed or where the geotechnical conditions/constraints are quite complex, it is prudent to have a joint design review which involves a senior geotechnical consultant.

We would be happy to assist in this regard as an extension of our investigation commission.

SITE INSPECTION

URS will always be pleased to provide engineering inspection services for geotechnical aspects of work to which this report is related.

Requirements could range from:

- a site visit to confirm that conditions exposed are no worse than those interpreted; to
- a visit to assist the contractor or other site personnel in identifying various soil/rock types such as appropriate footing or pier founding depths; or
- full-time engineering presence on site.

CORE DESCRIPTION SHEET

General

The intention of Core Log Sheets is to present FACTUAL information measured from the core or as recorded in the field. Some interpretative information is inevitable in the location of core loss, description of weathering and identification of drilling induced fractures. This should be noted in the use of Core Log Sheets and remembered in their utilisation.

Progress

Drilling and Casing

The types of drilling used to advance the drill hole are recorded for relevant intervals. The types of drilling may include: NMLC CORING, NQTT (NQ triple tube wire line), HW, HX, NW and NS casing, wash boring (tri-cone roller bit, TC drag bit, TC blade bit) or auger drilling (Vbit, TC drag bit).

Water

Water lost or water made during drilling is recorded and subsequent readings of water levels in the borehole or piezometers are recorded here with dates of observation.

Drill Depth

Drilling intervals are shown by depth increments and full horizontal marker lines.

Core Loss

Core loss is measured as a percentage of the drill run. If the location of the core loss is known or strongly suspected, it is shown in a region of the column bounded by horizontal lines. If unknown, core loss is assigned to the top of a coring run.

Samples and Field Tests

The location of samples taken for testing or the location of field tests are indicated by the appropriate symbol shown at the relevant location or over the relevant depth interval.

Reduced Level (RL)

Changes in rock types or the locations of piezometer tips, samples, test intervals, etc. are shown when information on the RL of the top of the hole is available.

Strata



Rock types are presented graphically using the symbols shown on the log.

Description

The rock type is described in accordance with AS1726, 1993.

Weathering

Weathering is described, by code letters, in accordance with the Standard Borehole Explanation Sheet (Rock). A weathering term or range of terms is usually assigned to various strata.

It is noted, however, that the assignment of a term of weathering is subjective and is normally used for identification and does NOT imply engineering behaviours (such behaviour being controlled principally by rock substance strength and defect frequency - collectively, rock mass strength). Consequently, boundaries are often not shown and weathering may even not be reported where potentially misleading.

Estimated Strength

The strength of the rock substance is estimated by a combination of Point Load testing and tactile appraisal in accordance with the Standard Borehole Explanation Sheet (Rock). The estimated strength is presented in a histogram form. Both axial and diametric point load test results can be presented on the logs by using symbols described below. The variation between axial and diametric is indicative of anisotropy of fissility of the rock unit.

Discontinuity Information

The identification of discontinuities requires an endeavour to exclude drilling induced breaks in the core and, as such, can be somewhat subjective. Natural fractures exist prior to coring the rock, whereas artificial fractures occur either during coring, during placing core in the core boxes, or during examination of core after being boxed.

The log of discontinuity description is presented as a combination of Discontinuity Spacing, Visual and Description. The spacing excludes bedding partings (unless there is evidence that separation of the partings was present prior to drilling) and is presented as a histogram. The creation of the histogram is also somewhat subjective. The visual log is presented using coding for brevity. Where fractures are suspected to be drilling induced, but this is not conclusive, the fracture is shown dashed in the visual log and noted accordingly.

GENERAL

Symbol Description

- D Disturbed Sample
- U Undisturbed Sample (suffixed by sample size or tube diameter in mm if applicable)
- SPT Standard Penetration Test (blows per 0.15 m)
- N SPT Value
- PP Pocket Penetrometer (suffixed by value in kPa)
- SV Shear Vane Test (suffixed by value in kPa)
- C Core Sample (suffixed by diameter in mm)
- CL Core Loss: indicates interval of no core recovery
- Tp Tensional Pull apart structure
- DI Drilling induced break
- NC Not continuous
- Point Load Test (axial)
- O Point Load Test (diametric)
- PBT Plate Bearing Test
- IMP Impression Device Test
- PZ Piezometer Installation
- PK Packer Test
- PM Pressure Meter Test
- R Rising Head Permeability test
- F Falling Head Test
- ✓ Final Water Level (and Date)
- ➤ Water Inflow
- ✓ Water Outflow

DISCONTINUITY DESCRIPTORS

- a) <u>Type:</u>
- FL Fault JN - Joint FO - Foliation VN - Vein



- BP Bedding Parting
- SH Shear
- CZ Crushed Zone
- FZ Fractured Zone
- DZ Decomposed Zone

b) <u>Defect Inclination:</u> Measured as dip/dip direction in exposure; or measured in degrees from core normal in boreholes (90° is vertical)

c) Defect Shape:

Pl – Planar

- Cu Curved
- Wa Wavy
- St Stepped
- Ir Irregular

d) Defect Roughness:

Slk – Slickensided / polished

- S-Smooth
- Sr-Slightly rough
- R Rough
- Vr Very rough

e) <u>Type of Infilling:</u>

- C Clay
- Ca Calcite
- Cb Carbonaceous material
- Ch Chlorite
- Fe Iron Oxide
- KL Clean
- Lm Limonite
- Qz Quartz
- No None
- Su-Sulphides
- Rf Rock fragments
- RC Rock/Clay mixture
- Uk Unknown
- e) Amount of Infilling:

Measured in mm or use -

St – Stain (for limonite) Vn – Veneer (for other infill types)

f) Spacing:

W –Widely spaced600 mm - 2mM – Moderately spaced200 - 600 mmC – Closely spaced60 - 200 mmVc – Very closely spaced20 - 60 mmEC – Extremely closely spaced<20 mm

Size Part Fresh

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h or staining

0.2

0.6

თ

60

200

Size (mm)

Clay

Siit

fne

medium Sand

coarse 2.0 fine

medium Gravel 8

coarse

Cobbles

Boulders

T.

Readily identified by colour, odour, spongy feel and generally by fibrous texture

Medium to high High to very high Low to medium Low to medium Medium to high

None to very slow

Low to Medium

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Peat muck and other highly organic soils

DATA FOR DESCRIPTION AND CLASSIFICATION OF SOILS URS

DENSITY	FIELD TEST	PSP	s	SPT(N-value)	RELATIVE	CPT q _e (Mpa)
		Blows/150mm			DENSITY (%)	
Very Loose	Easily penetrated with 13mm reinforcing rod pushed by hand Can be excavated with a spade; 50mm wooden peg can be driven easily	0 - 1		4	<15	0-2
Loose	Easily penetrated with 13mm reinforcing rod pushed by hand Can be excavated with a spade; 50mm wooden peg can be driven easily	1 - 3		4- 10	15 - 35	2 - 5
Medium Dense	Penetrated with 13mm reinforcing rod driven with 2kg hammer - hard shovelling	3 - 8		10 - 30	35 - 65	5 - 15
Dense	Penetrated 300mm with 13mm reinforcing rod driven with 2kg hammer, requires pick for excavation; 50mm wooden peg hard to drive	8 - 15		30 - 50	65 - 85	15 - 25
Very Dense	Penetrated only 25 - 50mm with 13mm reinforcing rod driven with 2kg hammer	>15		>50	>85	>25
SILT AND CLAY	SILT AND CLAY (ML, CL, OL, MH, CH, PH, Pt)	-	-		-	-
CONSISTENCY	Y FIELD TEST	DCP (blows/ 150mm)	(N)	UNDRAINED SHEAR STRENGTH (kPa)	DUCS (pocket H penetrom.)	СРТ
Very Soft	Easily penetrated 40mm by thumb. Exudes between thumb and fingers when squeezed	7	۵	<12	<25	0 - 180
Soft	Easily penetrated 10mm by thumb. Can be moulded by light finger pressure	1 - 1.5	2-4	12 - 25	25 - 50	180 - 375
Firm	Impression made by thumb with moderate effort. Can be moulded by strong finger pressure	1.5 - 3	4 - 8	25 - 50	50 - 100	375 - 750
Stiff	Slight impression made by thumb, cannot be moulded by fingers	4 - 6	8 - 16	50 - 100	100 - 200	750 - 1500
Very Stiff	Very tough. Readily indented by thumbnail	7 - 12	16 - 32	100 - 200	200 - 400	1500 - 3000
Hard	Brittle. Indented with difficulty by thumbnail	>12	>32	>200	>400	> 3000

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Waste Fill	Oli, Biturnen Dornesist Refuse Brickbass Concrete Rubble Fibrous Plaster Wood pieces, shavings, sawdust Iron flings, churns, steel scrap Bottes, troken glass Leather
Organic Matt	Fibrous Peat Charcoal Wood Fragments Roots (greater than 2mm dia) Root fibres (less than 2mm dia)
TYPE	PREFERRED TERMS

TYPICAL NAME Inorganic sits, very fine sands, rock flow, sity or clayer fine sands Inorganic casys of low to medium plasticity, gravelly clays, sandy clays and Organic sits and organic sit clays of low plasticity sit clays of low plasticity		Organic and Artificial Materials PREFERRED TERMS TY Fbrous Peat Transat Charceal Operation
clayey fine sands		
Inorganic clays of low to	Organic and Artificial I	Material
medium plasticity, gravelly		
clays, sandy clays etc	PREFERRED TERMS	TYPE
Organic silts and organic		
silt clays of low plasticity	Fibrous Peat	
	Charcoal	
Inorganic silts, micaceous	Wood Fragments	Organic N
or diatomaceous fine sands	Roots (greater than 2mm dia)	
or silts, elastic silts	Root fibres (less than 2mm dia)	
Inorganic clays of high		
plasticity	Oil, Bitumen	
	Domestic Refuse	
Organic clays of medium	Brickbats	
to high plasticity	Concrete Rubble	
	Fibrous Plaster	Waste F
Peat muck and other	Wood pieces, shavings, sawdust	
highly organic soils	Iron filings, drums, steel scrap	

	Brickbats
	Domestic Refuse
	Oil, Bitumen
	Root fibres (less than 2mm dia)
Organic Mat	Wood Fragments Roots (greater than 2mm dia)
	Charcoal
	Fibrous Peat
JAAL	PREFERRED TERMS
Materials	Organic and Artificial Materials

Organic and Artificial Materials	Materials
PREFERRED TERMS	TYPE
Fibrous Peat Charcoal Wood Fragments	Organic Matter
Roots (greater than 2mm dia) Root fibres (less than 2mm dia)	
Oil, Bitumen	

TABLE B: FINE GRAINED SOILS: more than half of the material less than 60mm is smaller than 0.06mm

DRY STRENGTH

None to Low

Quick to Slow

DILATANCY

TOUGHNESS

SYMBOL

None

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Soil

None to Very Slow

Medium

Slow

Low

Slow to none

Low to Medium

None

High

요 ₹ ρ β >50% finer than fine gravel

Sands

Predominantly one size or range of sizes

Clean materials (not enough fines to bind coarse grains)

Poor Good

Good to Fair

"Dirty" Materials (excess of Fines)

Fines are plastic Fines are non-plastic

Med to high None to med

sc

MS ş WS

Poorly graded sands and gravelly sands, little or no fines Silty Sand, sand-silt mixtures Clayey Sand, sand-clay mixtures

		Wet				Moist			Dry	
5%	hands when handling	colour. Free water form	Soil feels cool, darkene	cohere	be moulded. Granular s	colour. Cohesive soils c	Soils feel cool, darkened	running	friable, granular sands f	

F) Moisture Content	nt
CONDITION	CRITERIA
Dry	Cohesive soils hard and friable, granular sands free running
Moist	Soils feel cool, darkened ir colour. Cohesive soils can be moulded. Granular soils cohere
	Soil feels cool, darkened in

F) Moisture Content	#
CONDITION	CRITERIA
	Cohesive soils hard and
	running
	Soils feel cool, darkened in
Moist	colour. Cohesive soils can
	be moulded. Granular soils
	cohere
	Soil feels cool, darkened in
Wet	colour. Free water forms on
	hands when handling

F) Moisture Content	7
 F) MOISTURE CONTE 	н
CONDITION	CRITERIA
Dry	Cohesive soils hard and friable, granular sands free running
	Soils feel cool, darkened in
WOISt	colour. Conesive soils can

F) Moisture Content	nt
CONDITION	CRITERIA
	Cohesive soils hard and
Dıy	friable, granular sands fr
	running
	Soils feel cool, darkenec
Moist	colour. Cohesive soils ca

			L			
	0	F) Mi			>15	
	CONDITION	F) Moisture Content	sandy, or gravelly"	"silty, clayey,	prefix soil with	
Cohesive s	c	nt	ilv"		>30	

		[
CONDITION	F) Moisture Content	sanoy, or gravely

č		
	E) Proportion of Secondary & Minor Component	y & Minor Components
	COARSE GRAINED SOILS	FINE GRAINED SOILS
5		

Subrounded	1		
	E) Prop	E) Proportion of Secondary & Minc	ry &
Subangular	COARSE	COARSE GRAINED SOILS	FINE
o un our generation	% fines	Modifier	% coarse
	<5	"with a trace of"	<15
Angular	>5 <15	"with some"	>15 <30
	>15	prefix soil with	>30

Modifier

			ılar	
1		>15	>5 <15	<u>с</u> л
	"sility, clayey, sandy, or gravelly"	prefix soil with	"with some"	"with a trace of"
		×.	×15	4

C) Particle Shape	Angular	
v v	>5 <15	^5
"silty, clayey	"with some"	"with a trace

J	nd - gravel mixtures,	nd - gra
	Il graded gravels and	ell grac
	TYPICAL NAME	Ϋ́Γ
	C) Particle Shape	

			Ň
	C) Particle Shape		
		_	
TYPIC/	TYPICAL NAME		
raded (raded gravels and		
- gravel	-gravel mixtures,		_
r no finne			

er						>	50	% (202	arse	ər										
31	/el					tha				e sa	anc	1									
	-						G	Gra	-	s					r						
		Good			to Fair	Good			Poor			Good					,			,	
		Wide range in grain size			(excess of Fines)	"Dirty" Materials		or range of sizes	Predominantly one size			Wide range in grain size		GRADATIONS		A. COADSE GRAINED SOI			TABLE B		
finanto bind opprox auginal	Clean materials (not enough				Fines are plastic		Fines are non-plastic			fines to bind coarse grains)	Clean materials (not enough			NATURE OF FINES		1 C more than half of the material lea			TAI		
	None				Med to high		None to med				None			DRY STRENGTH SYMBOL		ee than 60mm ie lar			TABLE A		
		ws			GC		GM		GP			GW		SYMBOL		ter than 0.06					
Doorthing and only on the ond	no fines	gravelly sands, little or	Well graded sands and	sand - clay mixtures	Clayey Gravels, gravel -	 silt mixtures 	Sitty Gravels, gravel - sand	little or no fines	gravel - sand mixtures	Poorly graded gravels and	little or no fines	sand - gravel mixtures	Well graded gravels and	TYPICAL NAME				1			h 1
		tle or	1s and	res	yravel -		vel - sand		tures	avels and		tures,	els and	AME		C) P	•			10 100	Į

	8	Fraction finer than cobbles	ional details) MATERIAL
TABLE A	COARSE GRAINED SOIL	>50% coarser than sit	
) 📀	

O

Rounded

D) Colour

Described in the most condition, using simple terms (eg black, while, grey, red, brown, yellow etc, modified as necessary by pale, dark or motted. Bordenite colours may be described as a combination of these colours. (eg dark grey, red-brown)

8

FINE GRAINED SOIL	A) Main Soil Type (See over for additional details) MATERIAL + SO% finer than fine sand Fraction finer than cobbies	e.g. siny svytu (sio); meauningraned, poorly graded, rounded, yeilow-brown, wim a trace of the grane subangular gravel, dry, loose. O <i>ueternary Alluvium</i>
COARSE GRAINED SOIL	>50% coarser than sit	m, with a trace of line graine

ORDER OF DESCRIPTION

B) Plasticity (fine grained soils)

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DESCRIPTIVE TERM LIQUID LIMIT (%)

DESCRIPTIVE TERM Well graded Grading (coarse grained soils)

DEFINITION good representation of all particle size from largest to the smallest one or more intermediate size poorty represented one or more intermediate sizes absent

GRAVEL/SAND (GW, GP, GM, GC) G) Consistency or Density

Soils are described as follows:
A) MAIN SOIL TYPE & UNIFIED CLASSIFICATION SYMBOL (BLOCK LETTERS)
B) Pasticity if fire grained or Particle Size Distribution and Grading if coarse graned
D) Partick Shape
D) Partick Shape
D) Colour.
E) Secondary and Minor component(s): name, estimated proportion, plasticity, particle size, colour.
E) Secondary and Minor component(s): name, estimated proportion, plasticity, particle size, colour.
E) Secondary of density.
I) Geological Origin (FLL ALLUVIUM, COLLUVIUM, RESIDUAL etc.).
e.g. Sity SAND (SM): medium grained, poorly graded, rounded, yellow-brown, with a trace of fine grain subangular gravel, dry, loose. *Quaremary Alluvium* led

> Of high plasticity Of medium plasticity Of low plasticity

>50

Uniform Gap Graded Poorly graded

Essentially one size

SAND (SW, SP, SM,

ŝ

Fightly Packed _oosely Packed DESCRIPTION

Requires pick for removal, either as lumps or as disaggregated material Can be removed from exposure by hand or easily removed by shovel FIELD TEST

>35; <50 ^ 36

ORDER OF DESCRIPTION
K Material is described as follows:
IAIN ROCK TYPE (BLOCK LETTERS)
trength
leathering

E) Fabric

 bedding, cross bedding (sedimentary)
 flow banding (igneous)
 schistosity or foliation (metamorphic) Typical rock fabrics include but are not limited to:

Abbreviation

1. Defect Type iation Map Symbol

Rock Mass Defects

Order of Description: Type; inclination, shape, roughness, infill type, infill thickness

Description

2

Faun

tracture

along which displacement is recognisable

Shear - a fracture along which movement has taken place but no displacement is recognisable. Evidence for movement may be slickensides, polishing and/or clay gouge.

FABRIC SPACING

Rock Material is described as follows: A) MAIN ROCK TYPE (BLOCK LETTERS) B) Strength C) Weathering D) Colour e.g. black, white, grey, red, brown, orange, yellow, green, or blue - using pale, dark or mottled. B) Fabric (spacing and development) F) Particle Size (in cause grained) G) Inclusions or minor components H) Degree of Fracturing (drill core) or Defect spacing (outcrop) (control Numeric (section)

Geological Name (optional)

eg. GRANODIORITE, very high strength, slightly weathered, light pink-grey, massive, coarse sand sized. Jointing widely spaced. Mowamba Granodiorite

Thinly laminated Laminated Very thinly bedded Thinly bedded Medium bedded

Thinly foliated Foliated Very thinly layered Thinly layered Medium layered Thickly layered Very thickly layered

< 6mm 6mm to 20mm 20 to 60mm 60mm to 0.2m 0.2m to 0.6m 0.6m to 2m >2m

Sedimentar

TERM

Igneous/Metamorphic

SEPARATION OF STRATIFICATION PLANES

Very thickly bedded

FABRIC DEVELOPMENT

Thickly bedded

A) Main Rock Type B) Strength SEE OVER PAGE

Rock Strength is defined by the Point Load Strength Index (Is50) and refers to the strength of the rock substance in the direction normal to the fabric

Massive

No obvious fabric - rock appears homogenous abric is barely obvious as faint mineralogical layering or

BSH

Bedding plane shear - a shear formed along a bedding plane

晖

Bedding parting - arrangement in layers of mineral grains or crystals parallel to surface of deposition along which a continuous observable parting occurs.

SZ ЯH

Ø

are typically smooth, polished or slickensided; and curved.

Sheared Zone - zone of multiple closely spaced fracture planes with roughly parallel plana boundaries usually forming blocks of lenticular or wedge shaped intact material. Fractures

Very well developed Well developed Poorly developed

mineralogical or grain size layering. Fabric is often marked by a distinct colour banding as well Fabric is apparent as distinct layers or lines marked by

> £ ž

Contact - surface between two lithologies.

Joint - a single fracture across which rock has little or no tensile strength and is not obviously related to rock fabric.

grain size banding.

as by mineralogical or grain size layering.

C) Weathering

	TERM	SYM- -BOL	DEFINITION	H) Degre
	Residual Soil	RS	Soil developed on extremely weathered rock; the mass structure and substance fabric are no longer evident; there is a large change in volume but the soil has not been significantly transported.	Degree
_			-	TERM
	Extremely Weathered	WX	Rock is weathered to such an extent that it has 'soll' properties, i.e. it either disintegrates or can be remoulded, in water.	Fragmented
	Distinctly	DW	Rock strength usually changed by weathering. The rock may be highly discoloured usually	Highly Fractured
	Weathered		by ironstaining. Pronsity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.	Fractured
	Slightly Weathered	SW	Rock is slightly dicoloured but shows little or no change in strength from fresh rock.	Slightly Fractured

Fresh

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Rock shows no sign of decomposition or staining.

Unbroken

fractures

DATA FOR DESCRIPTION AND CLASSIFICATION OF ROCKS

URS

RC

Rock/Clay mixture

ą ₽

high plasticity

low plasticity

及

Rock fragments

c N s G

Clay Silt Sand

between 100 to 300mm The core does not contain any

longer sections Core lengths are generally 300 -100mm with occasional longer sections and occasional sections between 100 to 300mm

Widely spaced Moderately spaced Closely spaced spaced Very closely spaced Extremely closely

600mm - 2m 200 - 600mm

S õ Ę ç ទ Ca Ā

Sulphides Quartz 60 - 200m 20 - 60mm

> Chlorite Carbonaceous material

Limonite

Gravel clayey -

6. Infill Thickness measured in mm or use "St" (stain) - Limonite or (veneer) - other infill types

silty sandy gravelly

Calcite Clear

Extremely High	Very High	High	Medium	Low	Very Low	Extremely Low
표	¥	т	Z	F	٢	Ē
>10	>3 - 10	>1 - 3	>0.3 - 1.0	>0.1 - 0.3	0.03 - 0.1	<0.03
>240	70 - 240	24 - 70	7 - 24	2.4 - 7	0.7 - 2.4	>0.7
Specimen requires many blows with geological pick to break through intact material; rock rings under hammer	Hand specimen breaks with geological hammer after more than one blow; rock rings under hammer	A piece of core 150mm long by 50mm diameter cannot be broken by hand but can be broken in one blow by a geologica harmer	Readly scored with a knile: a piece of core 150nm long by 50nm diameter can be broken by hand with difficulty	Easily soured with a knife; indentations from to 3mm show in the specimen with firm boyes of the pick point has dull sound under hammer. A piece of core 150mm long and 50m diameter may be broken by hand.	Material crumbles under firm blows with sharp end of pick: can be peeled by a knife. Pieces up to 30mm thick can be broken by finger pressure.	Easily remoulded by hand to a material with soil properties

Sandstone - Use sand terms Conglomerate - Use gravel terms Shale, Sitstone Claystone - No description of grain size is necessary Sedimentary rocks: F) Particle Size fine medium Sand 0.6 coarse fine Gravel Coarse Metamorphic and Igneous Rocks:

Cobbles

Size (mm) Boulders

> 2 F٥

Cleavage - plane of mechanical fracture in a rock normally sufficiently closely spaced to form parallel-sided slices. Foliation – a planar arrangement of textural or structural features in any type of rock especially the planar orientation of platy minerals.

Crushed Zone - zone with roughly parallel, planar boundaries (commonly slickensided) containing disoriented usually angular rock fragments of variable size often in a soil matrix

Vein - fracture in which a tabular or sheet-like body of minerals have been intruded

 $\mathbf{\lambda}$

Either record the grain size in millimetres or use appropriate sedimentary term, for example, "fine sand sized crystals", medium gravel sized crystals"

믿

Luecomposed Zone - zone of any shape but commonly with parallel boundaries containing moderately to extremely weathered rock, typically with gradational boundaries into fresher rock.

Fractured Zone - a zone of closely spaced defects (mainly joints, bedding, cleavage and/or schistosity) comprised of core lengths in the order of 50mm or less.

Sym-

Term

Description

Sik

Slickensidec /polished

smooth glassy finish lisual evidence of striations or a ٧N СZ

1

Fz

G) Inclusions or Minor Components

Any isolated minor components within the rock material may be described using the appropriate terms. Some examples are given in the table below.

2. Defect Inclination

measured as dip/dipdirection in

exposure

Ironstone Band	Concretions	Sedimentary Rocks
Xenoliths	Vesicles	Igneous Rocks

Symbol

Term

Description

⊵

Planar

Forms a continuous plane without variation in orientation

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Slightly Rough Smooth

s

Surface appears smooth and feels so to the touch

π

Rough

Some ridges and angle steps are evident; asperities are clearly visible and surface feels very abrasive Asperities on the defect are distinguishable and can be felt measured in degrees from core normal in boreholes (90° is vertical)

3. Defect Shape 4. Defect Roughness

Tea leaf structure Phenocrysts

ree of Fracturing or Defect Spacing

ş Wa ß

orabbar

Has one or more well defined ridges

Wavy CUIVE

Has a wavy surface shape Has a gradual change in ori

Irregular

Many changes of orientation

۲r

Very Rough

Near right angle steps and ridges occur on the surface

Symbol 5. Defect Infill

Description

Symbol

Description

e of Fracturing (borehole core)

DESCRIPTION The core is composed primarily of fragments of length less than 20mm, and mostly of width less than the

Defect Spacing (Outcrop)

TERM

SPACING (mm)

20

core diameter Core lengths are generally less than 20mm - 40mm with occasional Core lengths are mainly 30 - 100mm with occasional shorter and

Inaginetic

Appendix C Test Pit Logs and Photographs

С

URS Test Pit Log					Sheet 1 of 1 TEST PIT TP-01									
	stralia Pty Ltd 407 Pacific Highway,	Artarmon NSW	Phone +61 2 8925 5500 Fax +61 2 8925 5555	Project No.: Project 43167888					Project Re	oject Reference: Paling Yards Wind Farm Project				
Excavation Method:Logged By:TH450mm BucketChecked By:DTExcavator (5.5t)Date Started:11-4-11Date Finished:11-4-11								Client: Union Fenosa Wind Aus				stralia		
GEOLOGICAL DESCRIPTION		SCRIPTION			GRAPHIC LOG	O DEPTH (m)	MOISTURE CONDTION	SAMPLE		- Section PENET.	Ducs - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUND WATER DATA AND COMMENTS	
	-	dium plasticity, b rse grained subro	rown and pale brown, wi unded gravel, Alluvium	th		-1	M D/M		MD VSt				- -	
	Sil TSTONE, me distinctly weather Test Pit 1 Termir	red	ale grey and pale brown, a to refusal	/		-2							Dry upon completio	
						-3								
		·	. .			4								
		TEST PI	T SECTION			-5		TES		LAN				
												TEST PIT TER Target Depth Refusal Flooding Caving/collaps	X	
												SAMPLE TYPE Bulk Sample Tube Sample Disturbed San Contamination	BS TS 1ple DS	

URS Test Pit Log	Sheet 1 o TEST PIT TP-02							
URS Australia Pty Ltd Phone +61 2 8925 5500 Level 4, 407 Pacific Highway, Artarmon NSW Fax +61 2 8925 5555 Contractor: Acclaimed Excavations	Project No.: Project Reference: 43167888 Paling Yards Wind Farm Project							
Contractor: Acclaimed Excavations Excavation Method: Logged By: TH 450mm Bucket Checked By: DT Excavator (5.5t) Date Started: 12-4-11 Date Finished: 12-4-11	Relative Level: 876 mRL Coordinates: 6214436.95 mN 748312.15 mE Permit No:	Client: Union Fenosa Wi	ind Australia					
NOIL UPUSOIDOIDOIDOIDOIDOIDOIDOIDOIDOIDOIDOIDOIDO	GRAPHIC LOG O DEPTH (m) MOISTURE CONDTION SAMPLE		PLING DTHER DATA AND COMMENTS					
Silty SAND, fine grained, dark brown, with some cobbles, SILTSTONE, low to medium strength, extremely weathere		D						
Test Pit 2 Terminated at 0.4m due to refusal	× × ×		Dry upon completion					
		Target Refusa Floodin Caving SAMPI Bulk S Tube S Disturi	II X ng II Voollapse II <u>LE TYPE:</u> ample BS					

U	IRS	TEST PIT TP-03										
	stralla Pty Ltd 407 Pacific Highway, <i>i</i> stor: Acc	Artarmon NSW	Phone +61 2 8925 5500 Fax +61 2 8925 5555 ons	Project N		Project Reference: Paling Yards Wind Farm Project						
Excavation Method:Logged By:TH450mm BucketChecked By:DTExcavator (5.5t)Date Started:11-4-11Date Finished:11-4-11				Relative Level: 862 mRL Coordinates: 6214803.26 mN 748519.7 mE Permit No:				Client:	Un	ion Fen	osa Wind Aus	stralia
GEOLOGICAL DESCRIPTION	DE	SCRIPTION (OF STRATA		GRAPHIC LOG	O DEPTH (m) MOISTURE		1	No reststance Soft Modum PENET. 	UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUND WATER DATA AND COMMENTS
	Sandy CLAY, low with a trace of fin Residual	dium plasticity, br subrounded grave to medium plasti e to medium grain	wn, Topsoil own, with some fine to el, Residual city, pale grey and pale ned subrounded gravel, pib. pale grey and pale.			D	л 'М 'М	MD VSt TT H			DS at 0.4m	
	distinctly weather		to refusal	/		2						Dry upon complet
	· · · · · · · · · · · · · · · · · · ·					·3 ·4						
		TECT DI	C SECTION			-5	TE	ST PIT F				
			<u>r Section</u>								TEST PIT TERI Target Depth Refusal Flooding Caving/collaps SAMPLE TYPE Bulk Sample Tube Sample Disturbed Sam Contamination	se X

T	IRS	Tes	t Pit Log								et 1 of 1			
	ustralla Pty Ltd , 407 Pacific Highway, / ctor: Acc	Artarmon NSW	Phone +61 2 8925 5500 Fax +61 2 8925 6555	Project N		7888			roject Refe	erence	:	s Wind Farm	Project	
450mm	ation Method: n Bucket ator (5.5t)	Relative CoordIna Permit N	74		12 mN		Client: Union Fenosa Wind Australia							
GEOLOGICAL DESCRIPTION			OF STRATA		GRAPHIC LOG	DEPTH (m)	MOISTURE CONDTION	SAMPLE	CONSISTENCY/ DENSITY		UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROU WATE DATA / COMME	ER \ND
	to coarse grained	subangulargrav	brown and pale brown, el basalt, Residual n, extremely weathered,			-0	D -		D					
	Test Pit 4 Termin	ated at 0.8m dua	e to refusal			-1		<u>, , , , , , , , , , , , , , , , , , , </u>	Σ			DS at 1m	Dry upon co	mpletion
				·										
						- 4								
						-5								
		TEST PI	TSECTION					res	T PIT PI	<u>_AN</u>		TEST PIT TER Target Depth Refusal Flooding Caving/collaps SAMPLE TYPE Bulk Sample Tube Sample Disturbed Sam	se <u>:</u> ıple	BS TS DS
					-							Contamination	oampie	CS

U	RS	Test	t Pit Log	TEST PIT TP-05								Sheet 1 of 1
	stralia Pty Ltd 407 Pacific Highway, / ctor: Acc	Artarmon NSW	Phone +61 2 8925 5500 Fax +61 2 8925 5555 ions	Project N	io.: 4316788	8	-	Project Re			s Wind Farm I	Project
Excavation Method:Logged By:TH450mm BucketChecked By:DTExcavator (5.5t)Date Started:12-4-11Date Finished:12-4-11								Client: Union Fenosa Wind Australia				
GEOLOGICAL DESCRIPTION		SCRIPTION			GRAPHIC LOG		SAMPLE		- Soft 	UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUND WATER DATA AND COMMENTS
	Clayey SAND, fin medium grained	dium plasticity, b subrounded grav- e grained, pale b subrounded grav	wn, Topsoil rown, with a trace of fin el, Alluvium rown, with a trace of fin el, Residual gth, pale grey and pale	e to		D/M		MD VSt D				
	distinctly weather Test Pit 5 Termin	ed			-2							Dry upon completio
		<u>IEST P</u>						<u>37 PIT F</u>			TEST PIT TER Target Depth Refusal Flooding Caving/collaps SAMPLE TYPE Bulk Sample Tube Sample Disturbed San Contamination	se

U	RS	Test	t Pit Log					TE	EST	PIT	TP-(06		
	stralia Pty Ltd 407 Pacific Highway, tor: Acc	Artarmon NSW	Phone +61 2 8925 5500 Fax +61 2 8925 5555 ions	Project N	Project No.: Project Reference: 43167888 Paling Yards								Project	
150mm	tion Method: I Bucket Itor (5.5t)	TH DT 11-4-11 11-4-11	Relative Coordina Permit N	74	3 mRL 13666. 9245.3			Client:	Un	ion Fen	osa Wind Aus	stralia		
GEOLOGICAL DESCRIPTION			OF STRATA		GRAPHIC LOG	o DEPTH (m)		SAMPLE		Modum PENET.	UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUI WATE DATA A COMME	R
	medium grained	dium plasticity, b subrounded grav	rown, with some fine to	of fine —			M D/M D/M		MD VSt H					
	SILTSTONE, Iow dictinetly weather Test Pit 6 Termin	rod	ngth, pale grey and pale e to refusal	brown,	××××	-2	-						Dry upon co	mplei
						4								
		TEST PI	TSECTION			-5		res		PLAN				
												TEST PIT TER Target Depth Refusal Flooding Caving/collaps SAMPLE TYPE Bulk Sample Tube Sample Disturbed Sam	se <u>=:</u> nple	BS TS DS
												Contamination	n Sample	C

U	RS	Tes	t Pit Log	Sheet 1 of TEST PIT TP-07									
	stralia Pty Ltd 407 Pacific Highway, /	Artarmon NSM	Phone +61 2 8925 5500 Fax +61 2 8925 5555	Project N	ło.:			Project Re					
Contrac		laimed Excavat		1	431678	88			Pali	ng Yard	s Wind Farm	Project	
450mm	ition Method: n Bucket ator (5.5t)	Logged By: Checked By: Date Started: Date Finished:	TH DT 11-4-11 11-4-11	1				Client:	Ur	iion Fen	oosa Wind Aus	stralia	
GEOLOGICAL DESCRIPTION			OF STRATA		GRAPHIC LOG		SAMPLE		We resultance Soft Madum PENET.	Denetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUND WATER DATA AND COMMENTS	
-	- -	dium to high plas medium grained	wn, Topsoll sticity, pale brown and o I subrounded gravel, Allu gth, pale grey and pale			M D/M))	MD VSt			DS at 0.7m		
	distinctly weather Test Pit 7 Termin	red				3						Dry upon completion	
				·	F						<u> </u>		
			TSECTION				TES	<u>ST PIT F</u>	2 <u>LAN</u>		TEST PIT TER Target Depth Refusal Flooding Caving/collaps SAMPLE TYPI Bulk Sample Tube Sample Disturbed San Contamination	se E: BS TS nple DS	

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U	RS	Test	Pit Log	Sheet 1 of 1 TEST PIT TP-08											
	istralia Pty Ltd 407 Pacific Highway, / ctor: Acc	Artarmon NSW	Phone +61 2 8925 5500 Fax +61 2 8925 5555	Project N	^{o.:} 43167	888		Proj	ect Ref			s Wind Farm	Project		
450mn	ation Method: n Bucket ator (5.5t)	TH DT 12-4-11 12-4-11	Coordina	Relative Level: 869 mRL Coordinates: 6214879.49 mN 749637.93 mE Permit No:					Client: Union Fenosa Wind Australia						
GEOLOGICAL DESCRIPTION	DE	SCRIPTION C	OF STRATA		GRAPHIC LOG		CONDTION	SAMPLE	CONSISTENCY/ DENSITY		UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUND WATER DATA AND COMMENTS		
	Sandy CLAY, me with some fine to Sandy CLAY, me mottled orange, v subrounded grav	dium to high plasti coarse grained su dium plasticity, pa vith a trace of fine el, Residual	n, with some cobbles, icity, brown and pale br ibrounded gravel, Alluv le grey and pale brown to medium grained	own, ium				ЦЧ	MD VSt H			BS at 0.4m DS at 0.8m			
	distinctly weather	to medium streng ed nated at 1.5m due	th, pale grey and pale I	brown,		-2	-						Dry upon completion		
						-4									
		TEST PIT	SECTION				Т	EST	PIT P			TEST PIT TER Target Depth Refusal Flooding Caving/collaps SAMPLE TYPI Bulk Sample Tube Sample Disturbed Sam Contamination	se BS TS nple DS		

Tes	t Pit Log	TEST PIT TP-						TP-(09	Shee	et 1 of 1			
	Phone +61 2 8925 5500 Fax +61 2 8925 5555	Project N		7888		Proje				s Wind Farm	Project			
Checked By: Date Started:	TH DT 12-4-11 12-4-11	Coordina	Coordinates: 6215202.86 mN 750045.99 mE					Client: Union Fenosa Wind Australia						
			GRAPHIC LOG	DEPTH (m)					UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROU WATE DATA COMME	ER AND		
IE, low to medium stre pale grey	ngth, extremely weathere		× × × × × × × × × × × ×		Ð -						Dry цров се	ampletion		
				-1 -2 -3 -4 -5										
TEST P	IT SECTION	: :			TE	ST P	IT PL	AN						
										Target Depth Refusal Flooding Caving/collaps <u>SAMPLE TYPE</u> Bulk Sample Tube Sample Disturbed Sam	se <u>:</u> :	AT: X BS TS DS CS		
	ghway, Artarmon NSW Acclaimed Excava Logged By: Checked By: Date Started: Date Finished: DESCRIPTION O, fine grained, pale bri RE, low to medium stree pale grey Terminated at 0.6m du	Phone +61 2 8925 5500 Fax +61 2 8925 5555 Acclaimed Excavations Logged By: TH Checked By: DT Date Started: 12-4-11 Date Finished: 12-4-11 DESCRIPTION OF STRATA	Phone +61 2 8925 5500 Fax +61 2 8925 5555 Project N Acclaimed Excavations Relative Logged By: TH Relative Date Started: 12-4-11 Permit N Date Finished: 12-4-11 Permit N DESCRIPTION OF STRATA Permit N D, fine grained, pale brown, with some cobbles, Topsoll IE, low to medium strength, extremely weathered, pale pale grey Terminated at 0.6m due to refusal State of the state of	ghway, Artarmon NSW Phone +61 2 6925 5500 Fax +61 2 8925 5555 Project No.: 4316 Acclaimed Excavations 4316 Logged By: TH Checked By: Relative Level: 870 Coordinates: Date Started: 12-4-11 Date Finished: 12-4-11 Date Finished: 12-4-11 Desscription OF STRATA 90 UH UH UH UH UH UH UH UH UH UH UH UH UH	Phone + 61 2 8925 5550 Fax + 61 2 8925 5555 Project No.: 43167888 Acclaimed Excavations 43167888 Logged By: TH Checked By: DT Date Started: 12-4-11 Date Finished: 12-4-11 Permit No: Of pate Finished: O T DESCRIPTION OF STRATA Description of streate SO O T Description of module to refusal SO O T Description Streategittee Description Streategittee <td>Phone +61 2 8925 5505 Fax +61 2 8925 5505 Project No.: 43167868 Acclaimed Excavations Relative Level: 870 mRL Coordinates: 6215202.86 mN 750045.99 mE Date Started: 12-4-11 Date Started: 12-4-11 Date Finished: 12-4-11 Dets Started: 12-4-11 Dets Started: 12-4-11 Dets GRIPTION OF STRATA 90 UL: UL: pale grey 0, fine grained, pale brown, with some cobbles, Topsoll 1 1E, low to medium strength, extremely weathered, pale * * * * * × * * -2 -3 -3 -4 -5 -5</td> <td>Phone +61 2 8825 5550 Project No.: Project No.: Acclaimed Excavations H Relative Level: 870 mRL Coordinates: 6215202.86 mN Tobe Stated: 12-4-11 Coordinates: 621520.86 mN Tobe Stated: 12-4-11 <th< td=""><td>Project No.: Project No.: Project Refer Acclaimed Excevations 43167888 Project Refer Logged By: TH Relative Level: 870 mRL Condinates: 6215202.86 mN Date Started: 12.4-11 Permit No: Clent: Clent: DescRiption OF STRATA SO TO HAVE STRUCK Understand Struck Understand Struck Understand Struck 0, fine grained, pale brown, with some cobbles, Topsoll Clent: No No No E: tow to medium strength, extremely weathered, pale X × X × No No No Terminated at 0.6m due to refusal -1 -1 -2 -3 -4 -5</td><td>ghway, Artamon NSW Phone +61 2 8925 5555 Project No.:: Project Reference: Palin Acclaimed Excavations 13167888 Project Reference: Palin Logged By: TH Chacked By: DT Date Started: 12-4-11 Relative Level: 870 mRL Coordinates: Cilent: Unit DESCRIPTION OF STRATA Image: Started: 12-4-11 Permit No: Image: Started: Image: Started:</td><td>Image: Antamon NSW Phone -161 2 8825 8500 Fax +31 2 8825 8500 Fax +31 2 8825 8500 Acctaimed Excavations Project No:: 43167888 Project Reference:: Paling Yard Logged By: Date Startes: 12-4-11 TH Checked Dy: Date Finished: 12-4-11 Relative Level: 870 mRL Coordinates: 12-4-11 Client: Coordinates: 12-4-11 Client: Description OF STRATA DESCRIPTION OF STRATA SO DIH By: SIND 2015</td><td>Project No: Project No: Project No: Acclaimed Excavations 43167688 Polect Reference: Lagged Sy: TH Coordinate: 62167088 Calarded Statust: 12-411 Description Coordinate: 62167088 Description OF STRATA 0 Union Fenosa Wind Aus Temmated at 0.6m due to relusal -1 Mo -2 -3 -4 -5 -5 -5</td><td>Test Pit Log TEST PIT TP-09 max, Atternor NW Prove 41 2 863 5600 Prove 41 2 863 56000 Prove 41 2 863 560000 Prove 41 2 863 560000 Prove 41 2 863 560000 Prove 41 2 863 5600000000000000000000000000000000000</td></th<></td>	Phone +61 2 8925 5505 Fax +61 2 8925 5505 Project No.: 43167868 Acclaimed Excavations Relative Level: 870 mRL Coordinates: 6215202.86 mN 750045.99 mE Date Started: 12-4-11 Date Started: 12-4-11 Date Finished: 12-4-11 Dets Started: 12-4-11 Dets Started: 12-4-11 Dets GRIPTION OF STRATA 90 UL: UL: pale grey 0, fine grained, pale brown, with some cobbles, Topsoll 1 1E, low to medium strength, extremely weathered, pale * * * * * × * * -2 -3 -3 -4 -5 -5	Phone +61 2 8825 5550 Project No.: Project No.: Acclaimed Excavations H Relative Level: 870 mRL Coordinates: 6215202.86 mN Tobe Stated: 12-4-11 Coordinates: 621520.86 mN Tobe Stated: 12-4-11 <th< td=""><td>Project No.: Project No.: Project Refer Acclaimed Excevations 43167888 Project Refer Logged By: TH Relative Level: 870 mRL Condinates: 6215202.86 mN Date Started: 12.4-11 Permit No: Clent: Clent: DescRiption OF STRATA SO TO HAVE STRUCK Understand Struck Understand Struck Understand Struck 0, fine grained, pale brown, with some cobbles, Topsoll Clent: No No No E: tow to medium strength, extremely weathered, pale X × X × No No No Terminated at 0.6m due to refusal -1 -1 -2 -3 -4 -5</td><td>ghway, Artamon NSW Phone +61 2 8925 5555 Project No.:: Project Reference: Palin Acclaimed Excavations 13167888 Project Reference: Palin Logged By: TH Chacked By: DT Date Started: 12-4-11 Relative Level: 870 mRL Coordinates: Cilent: Unit DESCRIPTION OF STRATA Image: Started: 12-4-11 Permit No: Image: Started: Image: Started:</td><td>Image: Antamon NSW Phone -161 2 8825 8500 Fax +31 2 8825 8500 Fax +31 2 8825 8500 Acctaimed Excavations Project No:: 43167888 Project Reference:: Paling Yard Logged By: Date Startes: 12-4-11 TH Checked Dy: Date Finished: 12-4-11 Relative Level: 870 mRL Coordinates: 12-4-11 Client: Coordinates: 12-4-11 Client: Description OF STRATA DESCRIPTION OF STRATA SO DIH By: SIND 2015</td><td>Project No: Project No: Project No: Acclaimed Excavations 43167688 Polect Reference: Lagged Sy: TH Coordinate: 62167088 Calarded Statust: 12-411 Description Coordinate: 62167088 Description OF STRATA 0 Union Fenosa Wind Aus Temmated at 0.6m due to relusal -1 Mo -2 -3 -4 -5 -5 -5</td><td>Test Pit Log TEST PIT TP-09 max, Atternor NW Prove 41 2 863 5600 Prove 41 2 863 56000 Prove 41 2 863 560000 Prove 41 2 863 560000 Prove 41 2 863 560000 Prove 41 2 863 5600000000000000000000000000000000000</td></th<>	Project No.: Project No.: Project Refer Acclaimed Excevations 43167888 Project Refer Logged By: TH Relative Level: 870 mRL Condinates: 6215202.86 mN Date Started: 12.4-11 Permit No: Clent: Clent: DescRiption OF STRATA SO TO HAVE STRUCK Understand Struck Understand Struck Understand Struck 0, fine grained, pale brown, with some cobbles, Topsoll Clent: No No No E: tow to medium strength, extremely weathered, pale X × X × No No No Terminated at 0.6m due to refusal -1 -1 -2 -3 -4 -5	ghway, Artamon NSW Phone +61 2 8925 5555 Project No.:: Project Reference: Palin Acclaimed Excavations 13167888 Project Reference: Palin Logged By: TH Chacked By: DT Date Started: 12-4-11 Relative Level: 870 mRL Coordinates: Cilent: Unit DESCRIPTION OF STRATA Image: Started: 12-4-11 Permit No: Image: Started: Image: Started:	Image: Antamon NSW Phone -161 2 8825 8500 Fax +31 2 8825 8500 Fax +31 2 8825 8500 Acctaimed Excavations Project No:: 43167888 Project Reference:: Paling Yard Logged By: Date Startes: 12-4-11 TH Checked Dy: Date Finished: 12-4-11 Relative Level: 870 mRL Coordinates: 12-4-11 Client: Coordinates: 12-4-11 Client: Description OF STRATA DESCRIPTION OF STRATA SO DIH By: SIND 2015	Project No: Project No: Project No: Acclaimed Excavations 43167688 Polect Reference: Lagged Sy: TH Coordinate: 62167088 Calarded Statust: 12-411 Description Coordinate: 62167088 Description OF STRATA 0 Union Fenosa Wind Aus Temmated at 0.6m due to relusal -1 Mo -2 -3 -4 -5 -5 -5	Test Pit Log TEST PIT TP-09 max, Atternor NW Prove 41 2 863 5600 Prove 41 2 863 56000 Prove 41 2 863 560000 Prove 41 2 863 560000 Prove 41 2 863 560000 Prove 41 2 863 5600000000000000000000000000000000000		

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U	IRS	Tes	t Pit Log				-	T	EST I	기	TP-	10	Sheet 1 of		
	istralia Pty Ltd 407 Pacific Highway, ctor: Ac	Artarmon NSW	Phone +61 2 8925 5500 Fax +61 2 8925 5555	Project N		67888			Project Reference: Paling Yards Wind Farm Project						
450mn	ation Method: n Bucket ator (5.5t)	Logged By: Checked By: Date Started: Date Finished:	TH DT 12-4-11 12-4-11	Relative Level: 877 mRL Coordinates: 6215343 mN 750540 mE Permit No:					Client: Union Fenosa Wind Australia						
GEOLOGICAL DESCRIPTION		ESCRIPTION		· · · ·	GRAPHIC LOG	O DEPTH (m)	MOISTURE CONDTION	SAMPLE	2		UCS - Pocket Penetrom, (KPa)	SAMPLING AND OTHER TESTING	GROUND WATER DATA AND COMMENTS		
	Silty SAND, fine	grained, pale bro				F	D		MD D						
	brown and pale		ngth, extremely weathere ue to refusal	u, pale	× × × × × ×	<u>-</u> -	-						Dry upon comple		
						-1-2									
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:		TEST P	T SECTION	: :				TES	ST PIT PI	AN		·			
												TEST PIT TER Target Depth Refusal Flooding Caving/collaps SAMPLE TYPI Bulk Sample Tube Sample Disturbed Sam Contamination	se X		

Bis Auchinering University of the sector of	Name Exc. +E 2 8055 000 (action to the second balance second balance) Pailing Yards Wind Farm Project Academic types, Aream, Will Strengton, Mathieut Strengton, Mathieut Str	U	RS	Test Pit Log					TE	ST	PIT	TP-	11	Sheet 1 of 1
Bitsmenuelsking koewwarr (5.31) Choolense Size 20 mB Union Fenosa Wind Australia Des Gluidet 13-4-11 Permi Ne: Union Fenosa Wind Australia Des Chulpt 11 13-4-11 Permi Ne: Union Fenosa Wind Australia Des Chulpt 11 13-4-11 Permi Ne: Union Fenosa Wind Australia Des Chulpt 11 13-4-11 Permi Ne: Permi Ne: Stay SARD, The general part for ward brown, topool Image 11 10 10 10 10 10 10 10 10 10 10 10 10	Stamm Buckting waveward (5.51) Condensities Date Functions: 13-411 Condensities Stamm Buckting Determines: Union Fenosa Wind Australia Union Fenosa Wind Australia Determines: 13-411 Determines: Stamp Buckting Stamp Buck	evel 4, 4	107 Pacific Highway,	Artarmon NSW Fax +61 2 8925 5555			67888	i 	P	roject Re			s Wind Farm	Project
Silly SAND, fine grained, pale brown, ropcoll Image: additional participation of the part	Silly SAND, fine grained, pale brown, ropcoll Image: additional participation of the part	50mm	Bucket	Checked By: DT Date Started: 13-4-11	Coordina	ates: 6	216820	mN	C	lient:	Un	ion Fen	iosa Wind Au	stralia
Structure	Structure	DESCRIPTION	DE	SCRIPTION OF STRATA		GRAPHIC LOG		MOISTURE CONDTION	SAMPLE		æ	UCS - Pocket Penetrom. (KPa)	AND OTHER	WATER DATA AND
Base-and geld gray Test Pri 1 Terminated at 0.5m due to refusal	Base-and geld gray Test Pri 1 Terminated at 0.5m due to refusal				d nale		F			DM				
-3 -3 -3 -4 -4 -4 -4 -4 -4 -4 -5 <td< td=""><td>-3 -3 -3 -4 -4 -4 -4 -4 -4 -4 -5 <td< td=""><td></td><td>- brown and pale of</td><td>wov</td><td></td><td></td><td>-</td><td></td><td></td><td>1</td><td></td><td></td><td></td><td>Dry upon completion</td></td<></td></td<>	-3 -3 -3 -4 -4 -4 -4 -4 -4 -4 -5 <td< td=""><td></td><td>- brown and pale of</td><td>wov</td><td></td><td></td><td>-</td><td></td><td></td><td>1</td><td></td><td></td><td></td><td>Dry upon completion</td></td<>		- brown and pale of	wov			-			1				Dry upon completion
3 3 3 4 4 4 5 5 5 5 5 -	-3 -3 -3 -3 -4 -4 -4 -4 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -6 <													
TEST PIT SECTION TEST PIT PLAN Test PIT Section Test PIT PLAN Test Pit Section Test Pit PLAN Target Depth Petual Petual Petual Test Pit Section Test Pit PLAN SAMPLE TYPE: Bulk Sample Bulk Sample Ts Disturbed Sample Ts Disturbed Sample Ds	TEST PIT SECTION TEST PIT PLAN Sample Sample Sample Time Section Sample Time Sample						-2							
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Target Depth Image: Depth Refusal X Flooding Image: Depth Caving/collapse Image: Depth SAMPLE TYPE: Bulk Sample BS Tube Sample TS Disturbed Sample DS	Target Depth Image: Depth Refusal X Flooding Image: Depth Caving/collapse Image: Depth SAMPLE TYPE: Bulk Sample BS Tube Sample TS Disturbed Sample DS	:		TEST PIT SECTION					TES	<u>t pit f</u>	PLAN			
Bulk Sample BS Tube Sample TS Disturbed Sample DS	Bulk Sample BS Tube Sample TS Disturbed Sample DS												Target Depth Refusal Flooding	
													Bulk Sample Tube Sample Disturbed San	BS TS nple DS

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	tralia Pty Ltd 107 Pacific Highway, A or: Acc	Artarmon NSW	Phone +61 2 8925 5500 Fax +61 2 8925 5555 ions		ło.: 4316	7888		F	Project Rel			s Wind Farm I	Project	
150mm	ion Method: Bucket tor (5.5t)	Logged By: Checked By: Date Started: Date Finished:	TH DT 12-4-11 12-4-11						Client:	Un	ion Fen	osa Wind Aus	itralia	
GEULUGIUAL DESCRIPTION	DE	SCRIPTION	OF STRATA		GRAPHIC LOG	o DEPTH (m)	MOISTURE CONDTION	SAMPLE	4	-Soft -Modlum PENET.	UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUI WATE DATA A COMME	R
	Topsoil Sandy CLAY, me medium to coarse of boulder basalt,	dium to high plas grained subang Residual	wn, with some boulder l sticity, brown, with some ular gravel basait, with ale brown and pale gre angular gravel basait, R	e of a trace		-1	M D/M D	<u>) </u>	MD VSt Π			DS at 0.5m		
	BASALT, mediun dark gray Test Pit 12 Termi		n, distinctly weathered, g	grey and	88	-2		<u>, , , , , , , , , , , , , , , , , , , </u>	Σ			DS at 1.6m	Dry upon co	mple
	- - -					4								-
			۰.			5								
:		TEST PI	T SECTION	: :			: :	TES	<u>T PIT P</u>	LAN	÷			
												TEST PIT TERM Target Depth Refusal Flooding Caving/collaps		<u>x</u> X
						· · · · · · · · · · · · · · · · · · ·						SAMPLE TYPE Bulk Sample Tube Sample Disturbed Sam Contamination	ple	BS TS DS CS
						· · · · · · · · · · ·						· .		

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	ustralia Pty Ltd , 407 Pacific Highway, J ctor: Acc	Artarmon NSW	Phone +61 2 8925 55 Fax +61 2 8925 55			67888			Project Ref			s Wind Farm I	Project
450mm	ation Method: n Bucket ator (5.5t)	Logged By: Checked By: Date Started: Date Finished:	TH DT 12-4-11 12-4-11		7;	215277.	mRL Client: 5277.14 mN 1856.37 mE Union Fenosa Wind Austra						stralia
GEOLOGICAL DESCRIPTION			OF STRATA		GRAPHIC LOG	O DEPTH (m)	MOISTURE CONDTION	SAMPLE	2	-soft Hard Hard	UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUND WATER DATA AND COMMENTS
		strength, distinc	wn and brown, Topso tły weathered, pale b ue to refusal		× × × × × ×	-	- -		MD				Dry upon completio
						-2							
						-3							
						4							
		TEST D	T SECTION	-		<u>-</u> -		TES	ST PIT P				
												<u>TEST PIT TER</u> Target Depth Refusal Flooding Caving/collaps	X.
												SAMPLE TYPE Bulk Sample Tube Sample Disturbed San Contamination	BS TS 1ple DS
U	RS	Test	t Pit Log					TE	EST	PIT	' TP-'	14	Sheet 1 of 1
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	stralia Pty Ltd 407 Pacific Highway, / ctor: Acc	Artarmon NSW	Phone +61 2 8925 5500 Fax +61 2 8925 5555 ions	Project N		7888		F	Project Re			s Wind Farm	Project
450mm	ation Method: n Bucket ator (5.5t)	Logged By: Checked By: Date Started: Date Finished:	TH DT 12-4-11 12-4-11						Client:	Un	ion Fen	osa Wind Aus	stralia
GEOLOGICAL DESCRIPTION		SCRIPTION			GRAPHIC LOG	DEPTH (m)		SAMPLE	CONSISTENCY/ DENSITY		teetusal UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUND WATER DATA AND COMMENTS
	with some fine to	dium to high plas medium grained	ticity, pale brown and b subrounded gravel, Allu	vium)_)_	MD VSt Σ			DS at 0.6m	
	band, very low st SILTSTONE, low distinctly weather	rength, extremely to medium stren red	y and orange, with some el and interbeded siltsto v weathered, Residual gth, pale grey and pale		××× ×××	-	D/M -		H				
	Test Pit 14 Termi	inated at 1.8m dt	ue to refusal			-2							Dry upon completion
						-3							
						-4							
		-				[-5 [-						~	
		rest Pl							<u>T PIT P</u>			TEST PIT TER Target Depth Refusal Flooding Caving/collaps SAMPLE TYPE Bulk Sample Tube Sample Disturbed Sam Contamination	se BS TS nple DS

U	RS	Tes	t Pit Log	J				TE	EST	PIT	TP-	15	Sheet 1 of 1
	stralia Pty Ltd 407 Pacific Highway,	Artamon NSW	Phone +61 2 8925 Fax +61 2 8925			7888		F	Project Ret			s Wind Farm I	Project
Contrac	stor: Acr	claimed Excavat	lions		4310	000				raiii	יש דמוט	ə walu r'drift	
450mn	ation Method: n Bucket ator (5.5t)	Logged By: Checked By: Date Started: Date Finished:	TH DT 11-4-11 11-4-11		75		06 mN		Client:	Un	ion Fen	osa Wind Aus	stralia
GEOLOGICAL DESCRIPTION			OF STRATA		GRAPHIC LOG	O DEPTH (m)	MOISTURE CONDTION	SAMPLE		—soft —Madum PENET. —Had	UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUND WATER DATA AND COMMENTS
	Residual	dium plasticity, p to coarse grained	pale grey and pale b d subangular gravel			-	M D/M D	1)	MD VSt T			DS at 0.7m	
	BASALT, mediur		brown, with a trace of basalt, Residual n, extremely weathe				- -	,					
	and dark grey Test Pit 15 Term				- 623	-2							Dry upon completion
						3							
		•				4							
						-5						<i>.</i>	
:		TEST PI	T SECTION	: :	: : :		: :	TES	T PIT P	LAN			
						· · · · · · · · · · · · · · · · · · ·						TEST PIT TERI Target Depth Refusal Flooding Caving/collaps	
						· · · · · · · · · · · · · · · · · · ·						SAMPLE TYPE Bulk Sample Tube Sample Disturbed Sam Contamination	BS TS Iple DS

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U	JRS	Test	Pit Log					Т	EST	PIT	TP-	16	Sheet 1 of 1
	istralia Pty Ltd 407 Pacific Highway, /	Artarmon NSW	Phone +61 2 8925 5500 Fax +61 2 8925 5555	Project N	No.:				Project Re				
Contrac		laimed Excavati			4316	7888				Palir	ıg Yard	s Wind Farm I	Project
450mn	ation Method: n Bucket ator (5.5t)	Logged By: Checked By: Date Started: Date Finished:	TH DT 11-4-11 11-4-11	Relative Coordina Permit N	75	8 mRL 14432.9 1180.7			Client:	Uni	on Fen	osa Wind Aus	stralia
GEOLOGICAL DESCRIPTION	DE	SCRIPTION	OF STRATA		GRAPHIC LOG	o DEPTH (m)	MOISTURE CONDTION	SAMPLE	CONSISTENCY/ DENSITY		UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUND WATER DATA AND COMMENTS
	Silly SAND, fine <u>c</u> Sandy CLAY, me with a trace of me basalt, Residual grading to mediu	dium to high plas edium to coarse g	ticity, brown and pale br rained subangular grav	own, el			M D/M D	<u>,</u>	MD VSt			DS at 0.6m	
	BASALT, medium	n to high strength	, extremely weathered,	grey	88		-						
	Test Pit 16 Term	inated at 1.5m du	e to refusal			-							Dry upon completion
				•									
			• •	·		-5							
		TEST PI	SECTION	-				TE	ST PIT F	PLAN			·
												TEST PIT TER Target Depth Refusal Flooding Caving/collaps	
												SAMPLE TYPE Bulk Sample Tube Sample Disturbed San Contamination	BS TS 1ple DS

U	RS	Test	t Pit Log				T	EST	PIT	TP-	17	Sheet 1 of 1
Level 4,	stralia Pty Ltd 407 Pacific Highway, /		Phone +61 2 8925 5500 Fax +61 2 8925 5555		lo.: 43167 8	388		Project Re			s Wind Farm	Project
Contrac		laimed Excavati		 	Laura 670	-01		Cliente				
450mm	ation Method: n Bucket ator (5.5t)	Logged By: Checked By: Date Started:	TH DT 11-4-11	Coordina	7514	nRL 787.11 mN 25 mE		Client:	Un	ion Fen	losa Wind Aus	stralia
		Date Finished:	11-4-11	Permit N		-					·····	
GEOLOGICAL DESCRIPTION		SCRIPTION				O DEPTH (m) MOISTURE	SAMPLE		-Soli -Medium PENET.	UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUND WATER DATA AND COMMENTS
	basalt, Residual	dium to high plas adium to coarse o	vn, Topsoil ticity, brown and pale b grained subangular grav rown, with a trace of m- basalt, Residual			о м D/M		MD VSt) D D			DS at 0.3m BS at 0.4m DS at 0.9m	
	BASALT, mediun and dark grey	n to high strength	, extremely weathered,	grey		·	1					-
	Test Pit 17 Termi	inated at 1.5m du	e to refusal					-				Dry upon completion
						2						
						3						
						4		-				
			÷			5		-				-
		TEST PI	T SECTION		<u> </u>		TES		LAN		<u> </u>	I
											TEST PIT TER	MINATED AT:
											Target Depth Refusal	X
											Flooding Caving/collaps	se
											SAMPLE TYPE Bulk Sample Tube Sample Disturbed San Contamination	BS TS npie DS

U	RS	Tes	t Pit Log					Т	EST	PI'	T '	TP-	18	Sheet 1 of 1
	stralia Pty Ltd 407 Pacific Highway,	Artarmon NSW	Phone +61 2 8925 5500 Fax +61 2 8925 5555	Project N		7888	···		Project R			Vard	s Wind Farm I	Project
Contract	tor: Ac	claimed Excavat	ions		4310	0000				га	mić	, raiu	S WING Parent	
450mm	tion Method: Bucket ttor (5.5t)	Logged By: Checked By: Date Started: Date Finished:	TH DT 11-4-11 11-4-11				62 mN		Client:	U	Inic	on Fen	osa Wind Aus	tralia
GEOLOGICAL DESCRIPTION	DE	SCRIPTION	OF STRATA	· • • • • • • • •	GRAPHIC LOG	DEPTH (m)	MOISTURE CONDTION	SAMPLE	CONSISTENCY/ DENSITY	No resistance —Soft —Medium PENET,		UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUND WATER DATA AND COMMENTS
		edium plasticity, p d subangular grav	wn, Topsoll ale brown, with some m el basalt, Residual 1, extremely weathered,			0	M D/M	77	MD VSt				DS at 0.5m	
	Test Pit 18 Term	inated at 0.9m di	ue to refusal			-1								Dry upon completio
- y y - j - Anna and A				. *		3.								
		- -	ж.			4	-							
						5								
		TEST PI	T SECTION			_	: · :	IE:	<u>ST PIT I</u>		N E	:		
													TEST PIT TERI Target Depth Refusal Flooding Caving/collaps	
									· · · · · · · · · · · · · · · · · · ·	· • • • • • • • • • • • • • • • • • • •			SAMPLE TYPE Bulk Sample Tube Sample Disturbed Sam Contamination	BS TS Iple DS

U	RS	Test Pi	t Log					TE	ST	PIT	TP- ⁻	19	Sheet 1 of 1
	stralia Pty Ltd 407 Pacific Highway, /		+61 2 8925 5500 +61 2 8925 5555	Project N	o.:			P	Project Ref	erence:			
Contrac		laimed Excavations			4316	7888				Palin	g Yard	s Wind Farm I	Project
450mm	ation Method: n Bucket ator (5.5t)	Logged By: TH Checked By: DT Date Started: 11-4- Date Finished: 11-4-		Relative I Coordinat Permit No	tes: 62 75	3 mRL 15480.3 1765.12			Dient:	Uni	on Fen	osa Wind Aus	stralia
GEOLOGICAL DESCRIPTION		SCRIPTION OF S			GRAPHIC LOG	O DEPTH (m)	MOISTURE CONDTION	SAMPLE			UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUND WATER DATA AND COMMENTS
•	Sandy CLAY, me grey, with a trace basalt, Residual BASALT, mediun and dark grey	rained, pale brown, Top dium to high plasticity, p of medium to coarse gr n to high strength, extren	ale brown and pa ained subangular nely weathered, g			-1	M D/M	<u>, , ,</u>	MD VSt			DS at 0.9m	
	Test Pit 19 Termi	fusal			-2							Dry upon completion	
		TEST PIT SEC						TES	T PIT P			TEST PIT TERI Target Depth Refusal Flooding Caving/collaps SAMPLE TYPE Bulk Sample Tube Sample Disturbed Sam Contamination	se X

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U	RS	Tes	t Pit Log					Т	EST	PIT	TP-	20	Sheet 1 of 1
	stralla Pty Ltd 407 Pacific Highway ctor: At	, Artarmon NSW	Phone +61 2 8925 5500 Fax +61 2 8925 5555 tions	Project I		67888			Project R			s Wind Farm	Project
450mm	ation Method: n Bucket ator (5.51)	Logged By: Checked By: Date Started: Date Finished:	TH DT 11-4-11 11-4-11				25 mN		Client:	Ur	ion Fer	iosa Wind Aus	stralia
GEOLOGICAL DESCRIPTION	D	ESCRIPTION	OF STRATA		GRAPHIC LOG	DEPTH (m)	MOISTURE CONDTION	SAMPLE	CONSISTENCY/ DENSITY	vo rasistance Soft 	uCS - Pocket Penetrom, (KPa)	SAMPLING AND OTHER TESTING	GROUND WATER DATA AND COMMENTS
	Sandy CLAY, m trace of medium Residual		sticity, brown and red, wi d subangular gravel base				M. D/M	77	VSt			DS at 0.6m	
	and dark grey	um to high strengt	h, extremely weathered, we to refusal	grey		- - - - - - -							Dry upon completio
						- - - - - - - - - - - - - - - - - - -							
						5							
		TEST P	IT SECTION					TE	<u>ST PIT </u>	PLAN		<u>TEST PIT TER</u> Target Depth Refusal Flooding Caving/collaps	X
												SAMPLE TYPE Bulk Sample Tube Sample Disturbed San Contamination	BS TS 1ple DS

URS	Test Pit Log		Т		- 21	Sheet 1 of 1
URS Australia Pty Ltd Level 4, 407 Pacific Highway, Ar	Phone +61 2 8925 5500 farmon NSW Fax +61 2 8925 5555	Project No.:	200	Project Reference:	ards Wind Farm Pr	alaat
Contractor: Accla	aimed Excavations	431678	88	Paling t		
450mm Bucket C Excavator (5.5t)	Logged By: TH Checked By: DT Date Started: 12-4-11 Date Finished: 12-4-11		nRL 376.75 mN 58.57 mE	Client: Union	Fenosa Wind Austr	alia
GEOLOGICAL DESCRIPTION	SCRIPTION OF STRATA	1 1	9 DEPTH (m) MOISTURE CONDTION SAMPI F	2 4	Lengtrom (KPa) SAMPLING AND OTHER TESTING Penetrom	GROUND WATER DATA AND COMMENTS
Sandy CLAY, medi medium to coarse Residual	ained, brown, Topsoil ium to high plasticity, brown, with some grained subangular gravel basalt and c	bobles,			BS at 0.4m DS at 0.7m	
and dark grey	to high strength, extremely weathered, ated at 1.1m due to refusal	grey <u> >< ><</u> []				ry upon completion
			2 3			
			5			
	TEST PIT SECTION		TE	ST PIT PLAN		•
					TEST PIT TERMI Target Depth Refusal Flooding Caving/collapse	NATED AT:
					SAMPLE TYPE: Bulk Sample Tube Sample Disturbed Sampl Contamination S	
					···	

	IRS	Test	t Pit Log					TI	EST	PIT	TP-2	22	Sheet 1 of 1
	istralia Pty Ltd		Phone +61 2 8925 5500	Project I	No.:				Project Re	ference:			
Level 4, Contrac	407 Pacific Highway, A	Artarmon NSW	Fax +61 2 8925 5555		4316	67888				Palin	g Yard	s Wind Farm	Project
450mn	ation Method: n Bucket ator (5.5t)	Logged By: Checked By: Date Started: Date Finished:	TH DT 12-4-11 12-4-11	Relative Coordin Permit N	75	24 mRL 214652. 52945.2	27 mN	-	Client:	Uni	on Fen	osa Wind Aus	stralia
GEOLOGICAL DESCRIPTION			OF STRATA		GRAPHIC LOG	o DEPTH (m)	MOISTURE CONDTION	SAMPLE	1	No reststance — Soft — Medium PENET. — Hard Behinkel	UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUND WATER DATA AND COMMENTS
	Silty SAND, fine c Clayey SAND, fin grained subangul Grading to pale b	e grained, pale b ar gravel basalt,	rown, with a trace of fine Residual	3			M D/M	11	а Д			DS at 0.6m	
	some fine to med interbeded siltsto	lium arained sub	ale brown and pale grey angular gravel basalt an w strength, distinctly wea	d			D -	<u> </u>	ב ^{vst}			DS at 1.4m	
	Residual	n to high strength inated at 1.8m du	n, extremely weathered, ue to refusal	/		-2							Dry upon completion
		TEST PI	T SECTION					TES	<u>ST PIT F</u>	PLAN			
												TEST PIT TER Target Depth Refusal Flooding Caving/collaps SAMPLE TYPE Bulk Sample Tube Sample Disturbed San Contamination	se X

Ľ	JRS	Tes	t Pit Log					TI	EST	PIT	TP-2	23	Shee	et 1 of 1
	ustralia Pty Ltd , 407 Pacific Highway, /	Artermon KiQW	Phone +61 2 8925 5500 Fax +61 2 8925 5555	£ -	No.:				Project Re	ference:				
Contra		artarmon NSW			4316	7888				Palir	ng Yard	s Wind Farm I	Project	
450mr	ation Method: n Bucket rator (5.5t)	Logged By: Checked By: Date Started: Date Finished:	TH DT 12-4-11 12-4-11	Relative Coordina Permit N	75	5 mRL 15076. 3153.9			Client:	Uni	ion Fen	osa Wind Aus	tralia	
GEOLOGICAL DESCRIPTION			OF STRATA		GRAPHIC LOG	O DEPTH (m)	MOISTURE CONDTION	SAMPLE		nu issued ute —Soft —Madium PENET. Andruad	UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROU WATE DATA / COMME	ER AND
	some medium to Residual BASALT, medium	dium plasticity, b coarse grained s	opsoil rown and pale brown, w subangular gravel basalt 1, extremely weathered,	3			M D/M -		MD VSt					
	Test Pit 23 Termi	nated at 0.9m du	ue to refusal										Dry upon o	mpletion
		TEST PI	T SECTION					TES	ST PIT P	LAN	· · · · · · · · · · · · · · · · · · ·	TEST PIT TERI Target Depth Refusal Flooding Caving/collaps		AT: X
												SAMPLE TYPE Bulk Sample Tube Sample Disturbed Sam Contamination	<u>i:</u> iple	BS TS DS CS

U	RS	Tes	t Pit Lo	g					ΤE	ST	PIT	TP-2	24	Sheet 1
Level 4, 4	ralia Pty Ltd 07 Pacific Highway,	Artarmon NSW	Phone +61 2 892 Fax +61 2 892		Project N		7888	<u>.</u>	Pi	roject Re			s Wind Farm I	Project
450mm	on Method:	Logged By: Checked By: Date Started: Date Finished:	TH DT 12-4-11	c				19 mN	c	lient:	Uni	on Fen	osa Wind Aus	tralia
GEOLOGICAL DESCRIPTION	DE	SCRIPTION	OF STRATA			GRAPHIC LOG	DEPTH (m)	MOISTURE CONDTION	SAMPLE	CONSISTENCY/ DENSITY	vvo řešistance — Sott — Medum PENET. — Hard	UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUNI WATER DATA AN COMMEN
	Silty SAND, fine Clayey SAND, fir medium grained	÷	-	e of fine t I	0				<u>,,,</u>				DS at 0.5m	
	BASALT, mediu dark grey Test Pit 24 Term			ered, gre	y and	[SS	-	-	777				DS at 1.2m	Dry upon com
-							-2							
	•												· · · · · · · · · · · · · · · · · · ·	
							- - - - - 4							
-		·												· .
							5							
		TEST P	T SECTION						TES	<u>T PIT F</u>	PLAN			
													TEST PIT TER Target Depth Refusal Flooding Caving/collaps	[[[
													SAMPLE TYPE Bulk Sample Tube Sample Disturbed San	

U	RS	Tes	t Pit Log					TE	EST	PIT	TP-2	25	Sheet	1 of 1
	stralia Pty Ltd 407 Pacific Highway, A	Artarmon NSW	Phone +61 2 8925 5500 Fax +61 2 8925 5555	Project N				F	Project Ref					
Contrac	stor: Acc	laimed Excavat	ions		4316	7888				Palir	ng Yard	s Wind Farm I	Project	
450mm	ation Method: n Bucket ator (5.5t)	Logged By: Checked By: Date Started: Date Finished:	TH DT 11-4-11 11-4-11	Relative Coordina Permit N	75	9 mRL 16108. 2936.9			Olient:	Un	ion Fen	osa Wind Aus	stralia	
\square					(5				\$	H.	a)			
GEOLOGICAL DESCRIPTION			OF STRATA		GRAPHIC LOG	O DEPTH (m)	MOISTURE CONDTION	SAMPLE	CONSISTENCY/ DENSITY		UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUN WATER DATA AN COMMEN	R ND
	Silty SAND, fine c Sandy CLAY, me fine to coarse gra	dium plasticity, b	wn, Topsoil rown and red, with a tra gravel basalt, Residual	ce of			M D/M	B	MD VSt Σ			DS at 0.4m BS at 0.5		
	· · · · · · · · · · · · · · · · · · ·													
	Clayey SAND, fin					-	D		D					
	and dark grey		n, extremely weathered,	grey	XX	-2	-							nnlotion
	Test Pit 25 Termi	inated at 2.2m di	Je to refusal			-							Dry upon con	nhierioù
						-3								
						-								
						-					1			
						-4						· .		
		·										· .		
						-								
						-5 -								
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		TEST PI	T SECTION	: :				IES	T PIT P	LAN				
												TEST PIT TER	MINATED A	<u>T:</u>
												Target Depth		
												Refusal Flooding		
												Caving/collaps	se	
												SAMPLE TYPE	<u>i:</u>	
			·····									Bulk Sample Tube Sample		BS TS
												Disturbed San	-	DS
												Contamination	n Sample	CS
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U	RS	Test	t Pit Log				¥	TE	EST I	PIT	TP-2	26	Shee	t 1 of 1
URS Au Level 4,	istralia Pty Ltd 407 Pacific Highway, /	Artarmon NSW	Phone +61 2 8925 5500 Fax +61 2 8925 5555	Project N				F	Project Refe		÷			
Contrac	ctor: Acc	laimed Excavat	ons		4316	7888				Palir	ng Yard	s Wind Farm	Project	
450mm	ation Method: n Bucket ator (5.5t)	Logged By: Checked By: Date Started: Date Finished:	TH DT 11-4-11 11-4-11	Relative I Coordina Permit No	tes: 62 75				Client:	Un	ion Fen	osa Wind Aus	stralia	
GEOLOGICAL DESCRIPTION		SCRIPTION			GRAPHIC LOG	O DEPTH (m)	MOISTURE CONDTION	SAMPLE	CONSISTENCY/ DENSITY Moreaselence		UCS - Pocket Penetrom, (KPa)	SAMPLING AND OTHER TESTING	GROU WATE DATA A COMME	ER AND
	Residual	dium plasticity, b o coarse grainec	opsoil rown and pale brown, w subangular gravel basi , extremely weathered,				M D/M	<u>))</u>	MD VSt			DS at 0.8m		
	Test Pit 26 Term	inated at 1.6m du	ie to refusal			3							Dry upon oc	mpletion
		TEST PI	T SECTION					TES	T PIT PI	<u>AN</u>		<u>TEST PIT TER</u> Target Depth	MINATED	<u>AT:</u>
												Refusal Flooding Caving/collaps	se	
												SAMPLE TYPE Bulk Sample Tube Sample Disturbed San Contamination	nple	BS TS DS CS

U	RS	Tes	t Pit Log				TE	EST I	PIT	TP-2	27	Sheet 1 of 1
	stralia Pty Ltd 407 Pacific Highway, ttor: Acc	Artarmon NSW	Phone +61 2 8925 5500 Fax +61 2 8925 5555 ions		No.: 4316788	8	F	Project Refe			s Wind Farm	Project
450mm	tion Method: a Bucket ator (5.5t)	Logged By: Checked By: Date Started: Date Finished:	TH DT 11-4-11 11-4-11		Level: 977 mF ates: 621632 752654	4.83 mN		Client:	Un	ion Fen	osa Wind Aus	stralia
GEOLOGICAL. DESCRIPTION		SCRIPTION		,	GRAPHIC LOG		SAMPLE			UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUND WATER DATA AND COMMENTS
	Residual	edium to high plas m to coarse grair	wn, Topsoll sticity, brown and pale b ned subangular gravel b n, extremely weathered,			M D/M _ -	2.7	мD VSt H			DS at 0.3m	
		inated at 1.7m di	ue to refusal									Dry upon completion
					-3							
-												
			T SECTION					<u>T PIT PI</u>			TEST PIT TER Target Depth Refusal Flooding Caving/collaps SAMPLE TYPE Bulk Sample Tube Sample Disturbed San Contamination	se

U	RS	Tes	t Pit Log					TE	ST	PI٦	TP-	28	Shee	et 1 o
	stralia Pty Ltd 407 Pacific Highway, tor: Ac e	Artarmon NSW	Phone +61 2 8925 556 Fax +61 2 8925 555 tions			67888		P	roject Re			Is Wind Farm	Project	
450mm	ttion Method: 1 Bucket ator (5.5t)	Logged By: Checked By: Date Started: Date Finished:	TH DT 11-4-11 11-4-11	Relative Coordin Permit N	7	72 mRL 216398 52167.1	8 mN	C	lient:	U	nion Fer	nosa Wind Aus	stralia	
GEOLOGICAL DESCRIPTION			OF STRATA		GRAPHIC LOG	O DEPTH (m)	MOISTURE CONDTION	SAMPLE		Nő resstance — Sott — Medium PENET.	netical UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROU WATE DATA A COMME	ER ANE
	•	edium to high pla dium grained sub	sticity, brown and red, angular gravel basalt,				D/M		MD VSt			DS at 0.5m DS at 1m		
	medium grained BASALT, mediu dark grey Test Pit 28 Term	n to high strengt	brown, with some fine el basalt, Residual h, distinctly weathered	, grey and	88	F 	-	·					Dry upon co	ompl
-				•		2								
						-3								
		TEST P	T SECTION			<u>}</u>		TEST	 T PIT F	PLAN				
												<u>TEST PIT TER</u> Target Depth Refusal Flooding Caving/collaps		<u>ат:</u> [] [Г
										· · · · · · · · · · · · · · · · · · ·		SAMPLE TYPE Bulk Sample Tube Sample Disturbed San Contamination	<u>E:</u> nple	B T D C

ſ	Ü	RS	Test	Pit Log					TE	STI	PIT	TP-2	29	Sheet 1 of 1
Le		stralia Pty Ltd 407 Pacific Highway, / tor: Acc	Artarmon NSW	Phone +61 2 8925 5500 Fax +61 2 8925 5555 ons	Project N	√o.: 4316	7888		P	roject Ref			s Wind Farm I	Project
E) 4	kcava 50mm	tion Method: I Bucket ator (5.5t)	Logged By: Checked By: Date Started:	TH DT 11-4-11 11-4-11					c	lient:	Un	ion Fen	osa Wind Aus	tralia
GEOLOGICAL	DESCRIPTION	DE	SCRIPTION	OF STRATA		GRAPHIC LOG	DEPTH (m)	MOISTURE CONDTION	SAMPLE	CONSISTENCY/ DENSITY		UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUND WATER DATA AND COMMENTS
	-	Silty SAND, fine g Clayey SAND, fin fine grained suba	e grained inale hi	rown and brown, with a	trace of		-0	M D/M	<u></u>	MD D	-		DS at 0.3m	
	a a a a strikt state a strikt st	trace of fine to m	edium grained su ne band, very low	ale brown and pale grey bangular gravel basalt a strength, extremetly	, with a and		- 	D.		- H			DS at 0.9m	
		BASALT, mediun	n to high strength	, distinctly weathered, g	rey and		-2	-						
		dark groy Test Pit 29 Term	inated at 2.7m du	e to refusal			-3							Dry upon completior
*								-						
	-		TEST PI	SECTION			-		TES			 	· ·	· ·
													TEST PIT TERI Target Depth	MINATED AT:
													Refusal Flooding Caving/collaps	
													SAMPLE TYPE Bulk Sample Tube Sample Disturbed Sam Contamination	BS TS Iple DS
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U	RS	Te	st Pit Log					T	EST	PIT	TP-	30	Shee	t1 of 1
URS Au Level 4, Contrac		ay, Artarmon NSW	Phone +61 2 8925 5 Fax +61 2 8925 5			67888			Project R			Is Wind Farm	Project	
Excava 450mm	ation Method: n Bucket ator (5.5t)	Logged By: Checked By: Date Started: Date Finished	TH DT 11-4-11	1			.14 mN		Client:	Ur	nion Fer	nosa Wind Aus	stralia	
GEOLOGICAL DESCRIPTION			N OF STRATA		GRAPHIC LOG	o DEPTH (m)	MOISTURE CONDTION	SAMPLE	CONSISTENCY/	Nor resistancia — Solt — Madlum PENET.	Pentest UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUI WATE DATA A COMME	R
	Sandy CLAY, trace of fine to	ium to high stren	rown, Topsoll , pale brown and brown subangular gravel basa gth, distinctly weathere				D/M					DS at 0.4m BS at 0.5m		
-		rminated at 1.5m	due to refusal			-2							Dry upon co	mpletic
			- - -											
			. <i>.</i> .					-						
		TEST	PIT SECTION					TE	ST PIT	PLAN				
				· · · · · · · · · · · · · · · · · · ·								TEST PIT TER Target Depth Refusal Flooding Caving/collaps		AT: X
												SAMPLE TYPE Bulk Sample Tube Sample Disturbed Sam Contamination	nple	BS TS DS CS

U	RS	Tes	t Pit Log					TE	EST	ΡΙΤ	TP-	31	Sheet 1 of
	stralia Pty Ltd 407 Pacific Highway, tor: Ac o	Artarmon NSW	Phone +61 2 8925 55 Fax +61 2 8925 55 lions			7888		F	Project Re			ls Wind Farm	Project
150mm	tion Method: Bucket Itor (5.5t)	Logged By: Checked By: Date Started: Date Finished:	TH DT 13-4-11 13-4-11				08 mN		Client:	Ur	nion Fei	nosa Wind Aus	stralia
GEOLOGICAL DESCRIPTION			OF STRATA		GRAPHIC LOG	o DEPTH (m)	MOISTURE CONDTION	SAMPLE		Mo restance 	Betreal UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUND WATER DATA AND COMMENTS
	Topsoil Sandy CLAY, me coarse grained s Clayey SAND, fir coarse grained s	dium plasticity, b ubangular gravel e grained, pale b ubangular gravel	wn, with some bould prown, with a trace of basalt, Residual prown, with a trace of basalt, Residual h, extremely weatherd	medium to			M D/M D	<u>.</u>	MD VSt D			DS at 0.4m	
	And dark grey					- 2							Dry upon complet
	- - -					- 5							
		TEST PI	TSECTION					TES	T PIT F	<u>'LAN</u>		TEST PIT TER Target Depth Refusal Flooding Caving/collaps SAMPLE TYPE	se
												Bulk Sample Tube Sample Disturbed San Contamination	

U	RS	Tes	st Pit Lo	g	1				TE	EST	PIT	TP-	32	Sheet 1 of 1
	stralia Pty Ltd 407 Pacific Highway,	Artamon NISW	Phone +61 2 892 Fax +61 2 892			No.:			F	Project Re	ference:		-	
Contract		claimed Excava				431f	67888	i			Palir	ıg Yard	is Wind Farm I	Project
	tion Method:	Logged By:	тн			e Level: 95			(Client:				
	Bucket	Checked By: Date Started:	DT 13-4-11	-	Coordina		217233. /51654.0	3.66 mN 02 mE			Uni	ion Fer	nosa Wind Aus	stralia
		Date Finished:	13-4-11		Permit N	10:					<u> </u>	<u> </u>		
			•			g				l≥ 1		a)	ſ	
GEOLOGICAL DESCRIPTION	DE	ESCRIPTION	I OF STRATA	. ·		GRAPHIC LOG	(m	ION NON	i	CONSISTENCY/ DENSITY	PENET.	UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER	GROUND WATER
SCRI	_			·		HdPH	DEPTH (m)	MOISTURE CONDTION	SAMPLE	NSIS	ance Lite	SS - P	TESTING	DATA AND COMMENTS
GE	City SAND fine	arained brown	with some boulder	re hasal	11			Σö D/M	SA		Nb resistance Soft Medum Hard Betusal	Pe C		
	- Topsoil		t, with some boulder		~		Ē	D	i	VD				
	grained subangu	ilar gravei basan,	, with some coople	3S, Hes⊪	duai	o			1					
							· 1							
		•			-	ο α	ŀ							
						0	-2	.						
·	BASALT mediu	im to high streng	th distinctly weath	oered, g	rev and	, <u>1</u> , 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2,				<u>7</u>			DS at 2.3m	
	dark grey	ninated at 2.4m d			/									Dry upon completion
							-3							
									ĺ					
					•		F							
							-4							
									ĺ					
					-		Ē							
				• .			-5							
							ŕ							
		TEST P	PIT SECTION						TES	T PIT P	LAN			-
													TEST PIT TER	MINATED AT:
													Target Depth	
													Refusal Flooding	X
						· · · · · · · · · · · · · · · · · · ·							Caving/collaps	se
													SAMPLE TYPE	<u> </u>
		····			····›	· · · · · · · · · · · · · · · · · · ·						····)•·	Bulk Sample	BS
													Tube Sample Disturbed San	
						·····							Contamination	
I					1 - i - i h - i - i - j			·						

U	RS	Tes	t Pit Log					TE	EST	PIT	TP-:	33	Shee	et 1 of 1
Level 4,	istralla Pty Ltd 407 Pacific Highway, A		Phone +61 2 8925 5500 Fax +61 2 8925 5555	Project N	No.: 4316	7888		F	Project Re			s Wind Farm i	Project	
Contrac		laimed Excavat			······.								-	
450mm	ation Method: n Bucket ator (5.5t)	Logged By: Checked By: Date Started:	TH DT 13-4-11	Coordina	75 [.]	6 mRL 17474. 1942.3			Client:	Un	ion Fen	osa Wind Aus	stralia	
\square		Date Finished:	13-4-11	Permit N	10:		-							
GEOLOGICAL DESCRIPTION			OF STRATA		GRAPHIC LOG	o DEPTH (m)	MOISTURE CONDTION	SAMPLE	CONSISTENCY/ DENSITY	-Soft Madium PENET, Hard	UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROU WATE DATA A COMME	ER AND
	basalt, Topsoil Gravely SAND, fit subangular grave	ne grained, brow I basalt, with som	vith some cobbles and b n, medium to coarse gra ne cobbles, Residual	ined	· · · · · · · · · · · · · · · · · · ·		M D/M	В	MD VSt			BS at 0.4m		
	ABSALT, medium and dark grey Test Pit 33 Termi		n, extremely weathered, to refusal	/		<u>1</u>							Dry upon co	ompletion
												· · ·		·
						4								
			:			-5								
	I	TEST PI	T SECTION					TES	T PIT P	LAN		1		
												TEST PIT TERI Target Depth Refusal Flooding Caving/collaps		
						· · · · · · · · · · · · · · · · · · ·						SAMPLE TYPE Bulk Sample Tube Sample Disturbed Sam Contamination	ple	BS TS DS CS

URS	Tes	t Pit Log				TE	EST	PIT	TP-:	34	
RS Australia Pty Ltd vel 4, 407 Pacífic Highwa		Phone +61 2 8925 55 Fax +61 2 8925 55		No.: 4316788	8	F	Project Re			s Wind Farm	Project
cavation Method: 50mm Bucket xcavator (5.5t)	Acclaimed Excava Logged By: Checked By: Date Started: Date Finished:	TH DT 13-4-11 13-4-11		Level: 994 mF ates: 621776 752209 No:	6.32 mN		Client:	Uni	on Fen	osa Wind Aus	tralia
DESCRIPTION	DESCRIPTION	OF STRATA		GRAPHIC LOG DEPTH (m)	MOISTURE CONDTION	SAMPLE	CONSISTENCY/ DENSITY	- Sofi Sofi Medium PENET, Hard	UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUND WATER DATA AND COMMENTS
Topsoil Gravely SANE grained suban	, fine grained, pale gular gravel basalt, medium plasticity, j m to coarse graine	with some boulders ba brown, medium to co with some cobbles, F Dale brown and pale g d subangular gravel b	arse lesidual	° ° 1	D/M	<u> </u>	D D VSt			DS at 1.4m	
orange, with a gravel basalt a Grading to pa	trace of medium to and cobbles, Residu e grey	ey and pale brown, mo o coarse grained suba ual h, distinctly weathered	ngular	2		<u> </u>	Z			DS at 2.1m	
Test Pit 34 Te	rminated at 3m due	e to refusal									Dry upon compl
	TEST P	IT SECTION		5		TES	T PIT F	<u>PLAN</u>			
										TEST PIT TER Target Depth Refusal Flooding Caving/collaps	
										SAMPLE TYPE Bulk Sample Tube Sample Disturbed San Contamination	B Ti Iple D

U	RS	Tes	t Pit Log				-	TI	EST	PIT	TP-	35	She	et 1 of 1
	istralia Pty Ltd 407 Pacific Highway, / stor: Acc	Artarmon NSW	Phone +61 2 8925 5500 Fax +61 2 8925 5555 ions	Project N		67888	.		Project Re			s Wind Farm	Project	
Excava 450mm	ation Method: n Bucket ator (5.5t)	Logged By: Checked By: Date Started: Date Finished:	TH DT 13-4-11 13-4-11	Relative Coordina Permit N	75		.61 mNi		Client:	Un	ion Fen	iosa Wind Aus	stralia	
GEOLOGICAL DESCRIPTION		·	OF STRATA		GRAPHIC LOG	DEPTH (m)	MOISTURE	SAMPLE	K	Hard PENET.	UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROU WAT DATA COMMI	ER AND
	Clayey SAND, fin coarse grained su BASALT, mediun	dium to high plas e grained subang e grained, pale b Ibangular gravel	opsoil sticity, brown, with a trac- jular gravel basalt, Resic rown, with a trace of me basalt, Residual n, extremely weathered,	edium to			M D/M		MD VSt H					
	<u>and dark grey</u> Test Pit 35 Termi					-2							Dry upon c	ompletion
						4		-						
		TEST PI	T SECTION					TES	T PIT P			TEST PIT TERI Target Depth Refusal Flooding Caving/collaps SAMPLE TYPE Bulk Sample Tube Sample Disturbed Sam	se E:	BS TS DS
												Contamination	i sample	CS

Ľ	IRS	Tes	t Pit I	Log					TI	EST	PIT	TP-	36	Sheet 1 of
	stralia Pty Ltd 407 Pacific Highway, ctor: Ac d	Artarmon NSW	Fax +61	2 8925 5500 2 8925 5555	Project N		67888			Project Re			Is Wind Farm	Project
450m	ttion Method: 1 Bucket ator (5.5t)	Logged By: Checked By: Date Started: Date Finished:	TH DT 13-4-11 13-4-11		Relative Coordina Permit N	ites: 6	85 mRL 217980. 53234.4	31 mN		Client:	Un	nion Fer	nosa Wind Au	stralia
GEOLOGICAL DESCRIPTION	DE	SCRIPTION	I OF STR/	ATA		GRAPHIC LOG	DEPTH (m)	MOISTURE CONDTION	SAMPLE	CONSISTENCY/ DENSITY	uo resistâricoe — Soit — Madium PENET. — Hard	ucs - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUND WATER DATA AND COMMENTS
	Silty SAND, fine Topsoil Gravely SAND, fi subangular grave				~	0 0 0		M D/M		MD D		4		
	Clayey SAND, fir coarse grained s BASALT, mediur								<u>))</u>				DS at 0.9m	
	dark groy Test Pit 36 Term						-2							Dry upon completi
							3							
· .							4							
		·					- - - - -							
		TEET D					<u>⊢</u> 5 [[TEG			-		
													<u>TEST PIT TER</u> Target Depth Refusal Flooding Caving/collaps	
				· · · · · · · · · · · · · · · · · · ·							· · · · · · · · · · · · · · · · · · ·		SAMPLE TYPE Bulk Sample Tube Sample Disturbed Sam Contamination	BS TS nple DS
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URS	Test Pit Log		Т	EST PI	Г ТР-:	37	Sheet 1 of 1
IRS Australia Pty Ltd evel 4, 407 Pacific Highwa Contractor:	y, Artarmon NSW Fax +61 2 8925 5555 Fax +61 2 8925 5555 Acclaimed Excavations	Project No.: 4316788	38	Project Reference Pal		Is Wind Farm I	Project
Excavation Method: I50mm Bucket Excavator (5.5t)	Logged By: TH Checked By: DT Date Started: 13-4-11 Date Finished: 13-4-11		nRL 95.67 mN 4.26 mE	Client: U	nion Fen	osa Wind Aus	stralia
DESCRIPTION	DESCRIPTION OF STRATA	GRAPHIC LOG			tron	SAMPLING AND OTHER TESTING	GROUND WATER DATA AND COMMENTS
	e grained, brown, Topsoil fine grained, brown, with a trace of medium I subangular gravel basalt, Residual e brown	to - 1	M D/M	MD D			
and dark groy	ium to high strength, extremely weathered, or rminated at 1.4m due to refusal	grey	- <u>)</u>			DS at 1.2m	Dry upon completion
			Ļ				
			5				
	TEST PIT SECTION		TE	ST PIT PLAN	N		
						TEST PIT TER Target Depth Refusal Flooding Caving/collaps	
						SAMPLE TYP Bulk Sample Tube Sample Disturbed Sam	BS TS nple DS
						Contamination	n Sample CS

URS	Tes	t Pit Log		TEST PIT TP-38
URS Australia Pty Ltd Level 4, 407 Pacific Highwa	ay, Artarmon NSW	Phone +61 2 8925 5500 Fax +61 2 8925 5555		Project Reference:
Contractor:	Acclaimed Excava	tions	43167888	Paling Yards Wind Farm Project
Excavation Method: 450mm Bucket Excavator (5.5t)	Logged By: Checked By: Date Started:	TH DT 13-4-11	Relative Level: 1000 mRL Coordinates: 6217768.2 mN 753669.52 mE	Client: Union Fenosa Wind Australia
	Date Finished:	13-4-11	Permit No:	

GEOLOGICAL DESCRIPTION	DESCRIPTION OF STRATA	GRAPHIC LOG	O DEPTH (m)	MOISTURE	SAMPLE	CONSISTENCY/ DENSITY	mo resistance — solt — Madum PENET. Belutant	UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUND WATER DATA AND COMMENTS
	Silty SAND, fine grained, pale brown, Topsoil			M		MD			•	
	Sandy CLAY, medium to high plasticity, brown, with a trace of medium to coarse grained subangular gravel, Residual			D/M	<u>,,,</u>	VSt			DS at 0.6m	
	·		[1							
	Grading to brown and pale brown, mottled orange, medium plasticity			1	<u> </u>	H			DS at 1.3m	
	CLAY, medium plasticity, pale grey and brown, mottled orange, with a trace of fine to medium grained subangular gravel, Residual		2			H			DS at 2.4m	
			3							
	Test Pit 38 Terminated at 3.4m		E							Dry upon completion
			Ē							
			-4 -							
			-							
			Ę							
			-5							
	TEST PIT SECTION	. F			TEST	PIT F	PLAN	,	I	
									TEST PIT TER	MINATED AT:
									Target Depth	X
					••••				Refusal Flooding	
									Caving/collaps	ie 🗌
						· · · · ·			SAMPLE TYPE	
			: : · · · ·		····				Bulk Sample	BS
					· · · · · · · · ·				Tube Sample	TS
		l							Disturbed San	
									Contamination	Sample CS
Ĺ		:	:	: :	:	: :				

U	RS	Te	st Pit Log					TE	EST	PIT	TP-	39	Sheet 1 of 1
	istralia Pty Ltd 407 Pacific Highway ctor: A d	v, Artarmon NSW	Phone +61 2 8925 5500 Fax +61 2 8925 5555 vations	· ·		67888	ŀ		Project Re			s Wind Farm	Project
450mn	ation Method: n Bucket ator (5.51)	Logged By: Checked By: Date Started: Date Finished	-				49 mN		Client:	Un	ion Fer	losa Wind Au	stralia
GEOLOGICAL DESCRIPTION	D	ESCRIPTIO	N OF STRATA		GRAPHIC LOG	DEPTH (m)	MOISTURE CONDTION	SAMPLE	CONSISTENCY/ DENSITY	w restelance — Soft — Madium PENET.	UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUND WATER DATA AND COMMENTS
	Silty SAND, fine Sandy CLAY, m fine to coarse g	redium plasticity	rown, Topsoil , brown and red, with a tra ar gravel, Residual	ice of			M D/M	В	MD VSt			BS at 0.4m	
•	with a trace of f Residual	ine to medium ç siltstone band,	arey and brown, mottled or grained subangular gravel, very low strength, extreme n			2 2 3	D/M		H				-

				1.1
with inter weathere	beded siltstone i d, pale grey and	oand, very low s I brown	trength, extren	ıely

	· · · · · · · · · · · · · · · · · · ·		ŀ	<u> </u>				
+	BASALT, medium to high strength, distinctly weathered, grey and dark grey	$\mathbf{P} \times \mathbf{P}$	 F				<u>DS at 3.2m</u>	Dry upon completion
	Test Pit 38 Terminated at 3.3m		F					
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UR	S	Tes	t Pit Log	9					TI	EST	ΓΡ	IT	TP-4	40	Shee	et 1 of 1
URS Australia Pt Level 4, 407 Pac Contractor:	ific Highway,	Artarmon NSW	Phone +61 2 8925 Fax +61 2 8925 lions		Project N		67888			Project			g Yard	s Wind Farm	Project	
Excavation Me 450mm Bucke Excavator (5.8	et	Logged By: Checked By: Date Started: Date Finished:	TH DT 14-4-11 14-4-11		Relative Coordina Permit N	7!	93 mRL 219305 53832 n	mN		Client:		Uni	on Fen	osa Wind Au	stralia	
GEOLOGICAL DESCRIPTION			OF STRATA			GRAPHIC LOG	DEPTH (m)	MOISTURE CONDTION	SAMPLE				UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROU WATI DATA COMME	ER AND
Sand some cobbl	y CLAY, me medium to les, Residua	al	prown and pale bro subangular gravel l					M D/M	<u>))</u>	VS T				DS at 0.5m		
- and c	lark grey	n to high strengt	h, extremely weath	erea, ç	Jrey		2		<u>, ,</u>	7				DS at 1.1m	Dry upon co	ompletion
							3	· .								
											-					
		TEST PI	T SECTION						TES	<u>37 PI</u>		<u>IN</u>		TEST PIT TER Target Depth Refusal Flooding Caving/collaps SAMPLE TYPE Bulk Sample Tube Sample Disturbed San Contamination	se E:	AT: X BS TS DS CS

U	RS	Tes	t Pit Log		-		TE	ST	PIT	TP-4	41	She	et 1 of 1
	istralia Pty Ltd 407 Pacific Highway, A ctor: Acc	Artarmon NSW	Phone +61 2 8925 5500 Fax +61 2 8925 5555 lions		43167888	3	P	roject Ref			s Wind Farm	Project	
450mm	ation Method: n Bucket ator (5.5t)	Logged By: Checked By: Date Started: Date Finished:	TH DT 13-4-11 13-4-11	Relative Lee Coordinates Permit No:	vel: 1005 mi s: 6218710 753755.	.05 mN	c	lient:	Un	ion Fen	osa Wind Aus	stralia	
GEOLOGICAL DESCRIPTION			OF STRATA		GRAPHIC LOG	MOISTURE CONDTION	SAMPLE		—soft BENET.	UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROU WATI DATA COMME	ER AND
		dium plasticity, b ubangular gravel	Fopsoil prown, with a trace of me basalt and cobbles, Rea h, distinctly weathered, g			M D/M	B	MD VSt			BS at 0.5m		
	dark grey Test Pit 41 Term			X	<u>\$</u> }							Dry upon a	ompletion
					-2								·
	· · · · · · · · · · · · · · · · · · ·	TEST PI	T SECTION				TES	T PIT P	LAN				
											TEST PIT TER Target Depth Refusal Flooding Caving/collaps SAMPLE TYPE Bulk Sample Tube Sample Disturbed San Contamination	se <u>:</u> nple	AT: X BS TS DS CS

U	RS	Tes	t Pit Log					T	EST	PIT	TP-	42	Sheet 1 of 1
	stralia Pty Ltd 407 Pacific Highway, tor: Ac c	Artarmon NSW	Phone +61 2 8925 5500 Fax +61 2 8925 5555 t lons	Project N	lo.: 4316	7888			Project Re			Is Wind Farm	Project
450mm	tion Method: Bucket ator (5.5t)	Logged By: Checked By: Date Started: Date Finished:	TH DT 13-4-11 13-4-11	Relative Coordina Permit N	75		06 mN		Client:	Un	ion Fe	nosa Wind Aus	stralia
GEOLOGICAL DESCRIPTION	DE	SCRIPTION	OF STRATA		GRAPHIC LOG	DEPTH (m)	MOISTURE CONDTION	SAMPLE	CONSISTENCÝ/ DENSITY	we reststairce —aoti —Medium PENET, —Hard	UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUND WATER DATA AND COMMENTS
	Silty SAND, fine Sandy CLAY, me coarse grained s	edium plasticity, b	prown, with a trace of me	dium to			M D/M		MD VSt				
	Grading to pale (n, distinctly weathered, g	rey and			-	11	Н			DS at 1.2m DS at 1.6m	
	dark grey	ninated at 2m due		/		2							Dry upon completion
						-3		·					
						-4							
						5							
						F							
			T SECTION			· · · · · · · · · · · · · · · · · · ·			ST PIT F			<u>TEST PIT TER</u> Target Depth Refusal Flooding Caving/collaps	
										· · · · · · · · · · · · · · · · · · ·		SAMPLE TYPE Bulk Sample Tube Sample Disturbed San Contamination	BS TS DS

U	RS	Test	t Pit Log				T	EST	ΡΙΤ	TP-4	43	Sheet '	1 of 1
	stralia Pty Ltd 407 Pacific Highway, A	Artarmon NSW	Phone +61 2 8925 5500 Fax +61 2 8925 5555	Project N		00		Project Re			o Mined From	Project	
Contrac	tor: Acc	laimed Excavati	ions		431678	00			ralin	iy yard	s Wind Farm I	riuject	
450mm	ution Method: n Bucket ator (5.5t)	Logged By: Checked By: Date Started: Date Finished:	TH DT 14-4-11 14-4-11	Relative Coordina Permit N	75398	nRL 195.01 mN 19.92 mE		Client:	Uni	on Fen	iosa Wind Aus	stralia	
\sum		<u>.</u>				1							\equiv
GEOLOGICAL DESCRIPTION		SCRIPTION			GRAPHIC LOG		SAMPLE	∽ −	ND resistance — Soft — Medium PENET. Hard	UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUN WATEF DATA AN COMMEN	₹ VD
	🗠 and cobbles, Hesi	r to medium plasti m to coarse grain idual	icity, brown and pale bro ned subangular gravel br	Г Г		D/M		MD VSt					
	BASALT, medium \and dark grey Test Pit 43 Termin	n to high strength	extremely weathered,	grev								Dry upon com	npletion
	rest rit 43 Termi	niaittu al U./M											
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						3							
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		TEST PI	T SECTION	- : :			TES	<u>ST PIT P</u>	LAN				
											TEST PIT TERI		T:
											Target Depth		
											Refusal Flooding	ļ	
											Caving/collaps	ie	
											SAMPLE TYPE	2	
							····¢	••••			Bulk Sample		BS
											Tube Sample Disturbed Sam	nple	TS DS
											Contamination		CS

U	RS	Tes	t Pit Lo	g					TI	EST	PIT	TP-4	44	Shee	et 1 of 1
URS Australia Level 4, 407 I	ia Pty Ltd Pacific Highway, /	Artarmon NSW	Phone +61 2 89 Fax +61 2 89		Project N					Project Re					
Contractor:	Acc	laimed Excava	tions			4316	57888				Pali	ng Yard	s Wind Farm	Project	
Excavation 450mm But Excavator	icket	Logged By: Checked By: Date Started: Date Finished:	TH DT 14-4-11 14-4-11		Relative Coordina Permit N	75		.61 mN		Client:	Un	ion Fen	osa Wind Aus	stralia	
GEOLOGICAL DESCRIPTION			OF STRATA			GRAPHIC LOG	DEPTH (m)	MOISTURE CONDTION	SAMPLE		No resistance — Soft — Medium PENET,	UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROU WATI DATA COMME	ER AND
Gr Su in	opsoil ravely SAND, fii Jbangular grave size, Residual	ne grained, brov I basalt, with soi	with some boulde wn, medium to co me boulders, 100	arse gra Imm to 4	ined I00mm	0		D		D VD					
\an	ASALT, medium nd dark grey est Pit 44 Termi		h, extremely wea e to refusal	thered, (grey/	2 2 2								Dry upon or	ompletion
							- 2						-		
													· · ·		•
					·		5								
<u> </u>		TEST P	IT SECTION						TES	ST PIT F	PLAN	<u> </u>			
													TEST PIT TER Target Depth Refusal Flooding Caving/collaps <u>SAMPLE TYPE</u> Bulk Sample Tube Sample Disturbed San Contaminatior	56, <u>:</u> :	AT: X BS TS DS

Ū	IRS	Tes	t Pit Log					TE	EST	PIT	TP-4	45	Shee	et 1 of 1
	ustralia Pty Ltd 407 Pacific Highway,	Artarmon NSW	Phone +61 2 8925 556 Fax +61 2 8925 556	1 1				F	Project Re					
Contra		claimed Excaval			4316	7888				Palir	ng Yard	s Wind Farm	Project	
450mm	ation Method: n Bucket ator (5.5t)	Logged By: Checked By: Date Started: Date Finished:	TH DT 14-4-11 14-4-11	Relative Coordina Permit N	- 75		71 mN		Client:	Un	ion Fen	iosa Wind Aus	stralia	
GEOLOGICAL DESCRIPTION			OF STRATA		GRAPHIC LOG	O DEPTH (m)	MOISTURE CONDTION	SAMPLE	CONSISTENCY/ DENSITY	No resultance — Soft — Madlum PENET.	UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROU WATE DATA COMME	ER AND
	Topsoil Gravely SAND, f subangular grav in size, Residual	ine grained, brow el basalt, with sor	vith some boulders ba			- 1	M D/M	Ŗ	MD			BS at 0.4m DS at 0.7m		
	Test Pit 45 Tern	inated at 2m due	≥ to refusal			3							Dry upon co	
		TEST PI	T SECTION				······································	TES	T PIT F	LAN				
· · · · · · · · · · · · · · · · · · ·												TEST PIT TERI Target Depth Refusal Flooding Caving/collaps SAMPLE TYPE Bulk Sample Tube Sample Disturbed Sam Contamination	se <u>::</u> iple	AT: X BS TS DS CS

URS Test Pit Log					Sheet 1 of 1 TEST PIT TP-46									
	ustralia Pty Ltd , 407 Pacific Highway, A ctor: Acc	0 Project î 5		57888		P	Project Reference: Paling Yards Wind Farm Project							
450mm	450mm Bucket Checked By: DT Excavator (5.5t) Date Started: 14-4-11				Relative Level: 972 mRL Coordinates: 6220153.76 mN 754723.69 mE Permit No:				Client: Union Fenosa Wind Australia					
GEOLOGICAL DESCRIPTION		SCRIPTION			GRAPHIC LOG	DEPTH (m)	MOISTURE	SAMPLE		-Soft PENET.	UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUND WATER DATA AND COMMENTS	
		dium to high plas medium grained ne band, Alluviun	sticity, pale brown and subrounded gravel and n				M D/M	 	MD H L			DS at 0.6m DS at 1.1m		_
	extremely weather Test Pit 46 Termi	inated at 1.2m du	igth, pale grey and pale										Dry upon complet	lion .
						- 4						·	· ·	
		TEST PI	TSECTION					TES		LAN		TEST PIT TER Target Depth Refusal Flooding Caving/collaps <u>SAMPLE TYPE</u> Bulk Sample Tube Sample Disturbed Sam Contamination	se	

U	IRS	Test Pit Log	TEST PIT TP-47									
	stralia Pty Ltd 407 Pacific Highway,	Phone +61 2 8925 550 Artarmon NSW Fax +61 2 8925 555		Project Reference: Paling Yards Wind Farm Project								
Contrac	ctor: Ac	claimed Excavations										
450mn	ation Method: n Bucket ator (5.5t)	Logged By: TH Checked By: DT Date Started: 14-4-11 Date Finished: 14-4-11	Relative Level: 976 mRL Coordinates: 6220558.81 mN 754672.54 mE Permit No:	Client: Union Fenosa Wind Australia								
GEOLOGICAL DESCRIPTION	DESCRIPTION OF STRATA		GRAPHIC LOG DEPTH (m) MOISTURE CONDTION	SAMPLE CONSISTENCY/ DENSITY momentary momentary Mathematical DCS - Pocket UCS - Pocket	SAMPLING AND OTHER TESTING GROUND WATER DATA AND COMMENTS							
	Topsoll Sandy CLAY, m some medium to cobbles, Residu Grading to low p	Diasticity	ait,	D VSt H								
	and dark groy-	im to high strength, extremely weathered ninated at 1.9m due to refusal	grey		Dry upon completior							
			-3									
	· · · · · · · · · · · · · · · · · · ·	TEST PIT SECTION	1	EST PIT PLAN								
					TEST PIT TERMINATED AT:Target Depth							

								•							
U	RS	Tes	t Pit Log		·			TI	EST	PIT	TP-	48	Shee	et 1 of 1	
Level 4, 407 Pacific Highway, Artarmon NSW Fax +61 2 8925 5555 Contractor: Acclaimed Excavations Excavation Method: Logged By: TH 450mm Bucket Checked By: DT Excavator (5.5t) Date Started: 11-4-11					43167888					Project Reference: Paling Yards Wind Farm Project Client: Union Fenosa Wind Australia					
	siltstone band, A	edium plasticity, p rse grained subro Iluvium	ale brown and orange, v unded gravel and interb				D/M	P	H			BS at 0.4m			
	SILTSTONE, low to medium strength, pale grey and pale b extremely weathered Test Pit 48 Terminated at 1.5m due to refusal				× × × × × × × × ×		-						Dry upon com	amalation	
			TSECTION					TES	ST PIT F	PLAN					
												TEST PIT TER Target Depth Refusal Flooding Caving/collaps			
										· · · · · · · · · · · · · · · · · · ·		SAMPLE TYPE Bulk Sample Tube Sample Disturbed San Contamination	nple	BS TS DS CS	

URS Test Pit Log					Sheet 1 of 1 TEST PIT TP-49									
URS Australia Pty Ltd Phone +61 2 8925 5500 Level 4, 407 Pacific Highway, Artarmon NSW Fax +61 2 8925 5555 Contractor: Acclaimed Excavations					Project No.: Project Reference 43167888 Palir						e: ing Yards Wind Farm Project			
Excavation Method: Logged By: TH I 450mm Bucket Checked By: DT I Excavator (5.5t) Date Started: 14-4-11					Relative Level: 991 mRL Coordinates: 6220445.7 mN 755526.92 mE Permit No:				Olient:	Un	ion Fenosa Wind Australia			
GEOLOGICAL DESCRIPTION	· .		OF STRATA		GRAPHIC LOG	O DEPTH (m)		SAMPLE	2		Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUND WATER DATA AND COMMENTS	
	Sandy CLAY, low medium to coarse BASALT, mediun	dium plasticity, b ubangular gravel to medium plast e grained subang	opsoil rown, with some mediu basalt and cobbles, Re licity, pale brown, with a gular gravel basalt, Res n, extremely weathered,	i trace of idual		-	D/M D/M		D VSt					
	and dark grey Test Pit 49 Termi					-2 -3 -4							Dry upon completio	
		TEST PI	T SECTION					TES	T PIT P	LAN		TEST PIT TER Target Depth Refusal Flooding Caving/collaps SAMPLE TYPI Bulk Sample Tube Sample Disturbed Sam Contamination	se	
U	RS	Test	Pit Log					TE	EST	PIT	TP-	50		t1 of
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	stralia Pty Ltd 407 Pacific Highway		Phone +61 2 8925 5500 Fax +61 2 8925 5555	Project N				F	Project Rel				.	
Contract	ior: Ac	claimed Excavatio	ns	1	4316	7888				Palir	ng Yard	s Wind Farm I	Project	
50mm	tion Method: Bucket tor (5.5t)	Checked By: I Date Started: 1	rh DT 14-4-11 14-4-11	Relative Coordina Permit N	750		27 mN		Olient:	Un	ion Fen	iosa Wind Aus	stralia	
GEOLOGICAL DESCRIPTION		ESCRIPTION O			GRAPHIC LOG	O DEPTH (m)	MOISTURE CONDTION	SAMPLE	CONSISTENCY/ DENSITY	Medium PENET.	UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROU WATE DATA A COMME	ER ND
	Topsoil	edium plasticity, bro coarse grained sub	, with some boulders wn and pale brown, w pangular gravel basalt			-	M D/M		MD VSt			:		
	• •								Н					
	BASALT mediu	m to high strength	distinctly weathered, g	rev and		-2	-							
	_dark-grey	ninated at 2.3m due			$\frac{1}{1}$						+		Dry upon co	mple
		· · · · · · · · · · · · · · · · · · ·				-3								
		TEST PIT	SECTION					TES	T PIT P	LAN	÷			
												TEST PIT TER Target Depth Refusal Flooding Caving/collaps SAMPLE TYPE Bulk Sample Tube Sample Disturbed Sam Contamination	se <u>::</u> 1ple	AT: X X BS TS DS CS
:								÷						

U	RS	Tes	t Pit Log					TE	EST	PIT	TP-	51	Sheet 1 of
	stralia Pty Ltd 407 Pacific Highway, tor: Acc	Artarmon NSW	Phone +61 2 8925 5500 Fax +61 2 8925 5555 ions	Project N		7888		ŀ	⊃roject Ref			s Wind Farm I	Project
50mm	tion Method: Bucket stor (5.5t)	Logged By: Checked By: Date Started: Date Finished:	TH DT 14-4-11 14-4-11				2 mN		Olient:	Uni	ion Fen	osa Wind Aus	stralia
GEOLOGICAL DESCRIPTION		SCRIPTION			GRAPHIC LOG	O DEPTH (m)	MOISTURE CONDTION	SAMPLE	2		UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUND WATER DATA AND COMMENTS
	- Topsoil	dium plasticity, b coarse grained s	vith some boulders basal rown and pale brown, wi ubangular gravel basalt	~		-1	M D/M	<u>}</u>	MD VSt T			DS at 0.7m	
	dark grey	n to high strengtr inated at 2m due	n, distinctly weathered, g to refusal	rey and		2	-	77	2			DS at 1.9m	Dry upon comple
						3							
						4		-					
		TEST P	T SECTION			<u> </u>	-	TES	T PIT P				
												TEST PIT TERI Target Depth Refusal Flooding Caving/collaps SAMPLE TYPE Bulk Sample Tube Sample Disturbed Sam	e X
												Contamination	i sample CS

U	IRS	Test Pit Log		Т	EST PIT TP	-52
	istralia Pty Ltd , 407 Pacific Highway, A	Phone +61 2 8925 5500 Artarmon NSW Fax +61 2 8925 5555	Project No.:		Project Reference:	· · · · · · · · · · · · · · · · · · ·
Contrac		claimed Excavations	43167	888	Paling Ya	rds Wind Farm Project
	ation Method:	Logged By: TH	Relative Level: 982 I	mRL	Client:	
1	n Bucket	Checked By: DT Date Started: 15-4-11		1304.77 mN 159.69 mE	Union Fe	enosa Wind Australia
LAGAVA	ator (5.5t)	Date Finished: 15-4-11	Permit No:			
GEOLOGICAL DESCRIPTION			GRAPHIC LOG	ΞЩZ	CONSISTENCY/ DENSITY D	SAMPLING GROUND WATER
CRIP.	DE:	SCRIPTION OF STRATA		DEPTH (m) MOISTURE CONDTION SAMPI F		AND OTHER DATA AND TESTING COMMENTS
GEO DES(
	Silty SAND, fine g	grained, brown, Topsoll		0 M	MD VSt	
	Coarse grained su	edium plasticity, brown, with a trace of me ubangular gravel basalt and cobbles, Res	idual			DS at 0.4m
	- dark groy	n to high strength, distinctly weathered, g	rey and			DS at 0.7m Dry upon completion
	Test Pit 52 Termi	inated at 0.8m due to refusal		1		Dry upon completion
				2		
		:				
			ļ Ē.	3		
		· · · · ·				
				4		
				•5		
		TEST PIT SECTION	F I	TE	ST PIT PLAN	
						TEST PIT TERMINATED AT:
						Target Depth Refusal X
						Flooding
						Caving/collapse
						SAMPLE TYPE:
· · · · · · · · · · ·						Bulk Sample BS
·····			-			Tube Sample TS Disturbed Sample DS
						Contamination Sample CS
a 1						

U	RS	Test	t Pit Log					T	EST	PIT	TP-	53	5.100	et 1 of 1
	stralia Pty Ltd 407 Pacific Highway, <i>J</i> tor: Acc	Artarmon NSW	Phone +61 2 8925 5500 Fax +61 2 8925 5555	Project №		7888			Project Ref			s Wind Farm I	Project	
150mm	tion Method: Bucket ator (5.5t)	Logged By: Checked By: Date Started: Date Finished:	TH DT 15-4-11 15-4-11	Relative Coordina Permit N	75	09 mR 19024. 7574.5	68 mN		Client:	Un	ion Fen	osa Wind Aus	stralia	
GEOLOGICAL DESCRIPTION		SCRIPTION	÷		GRAPHIC LOG	D DEPTH (m)	MOISTURE CONDTION	SAMPLE		Soft Medium PENET.	UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROU WATI DATA COMME	ER AND
		•	ith boulders basalt, Top rown, with some mediun basalt and cobbles, Res				M D/M		MD VSt					
-			y and pale brown, with s jular gravel basali, Resid				D/M	<u>))</u>	н			DS at 0.9m DS at 1.5m	Data	
	∖dark grey Test Pit 53 Termi	inated at 1.8m du	ie to refusal			-2							Dry upon o	ompie
						-3			· · · · · · · · · · · · · · · · · · ·					
						4								
-		TEST PI	T SECTION			-5		TES						
										-		<u>TEST PIT TERI</u> Target Depth	MINATED	<u>AT:</u>
											· · · · · · · · · · · · · · · · · · ·	Refusal Flooding Caving/collaps SAMPLE TYPE		
												Bulk Sample Tube Sample Disturbed Sam Contamination	nple	BS TS DS CS

U	RS	Test	Pit Log		-			TE	EST	PIT	TP-	54	Sheet 1	1 of 1
	ralia Pty Ltd 07 Pacific Highway, Arta or: Acclai	armon NSW	Phone +61 2 8925 5500 Fax +61 2 8925 5555 ons	Project N	vo.: 43167	7888		F	Project Ref			s Wind Farm	Project	
Excavation 450mm I Excavato	Bucket C or (5.5t) D	ogged By: hecked By: late Started: late Finished:	TH DT 15-4-11 15-4-11				36 mN	(Client:	Un	ion Fen	osa Wind Au	stralia	
GEOLOGICAL DESCRIPTION			OF STRATA		GRAPHIC LOG	Ó DEPTH (m)	MOISTURE CONDTION	SAMPLE			Ducs - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUN WATEF DATA AN COMMEN	۶ ND
			ith boulders basalt, Top d, brown, medium to co with some boulders, 100			-1	M D/M		D VD					
	Test Pit 53 Termina	ated at 1.5m d⊾	ie to refusal			-2							Dry upon com	npletion
		• •				-4								·
		TEST P	T SECTION			-5		TES	ST PIT P	LAN	 			-
												TEST PIT TER Target Depth Refusal Flooding Caving/collap SAMPLE TYPI Bulk Sample Tube Sample Disturbed Sar Contamination	se <u>=:</u> nple	I: X BS TS DS CS

T	RS	Test	Pit Log	-				TF	EST	PIT	TP-	55	Sheet 1 of
URS Aus	stralia Pty Ltd 407 Pacific Highway, <i>i</i>		Phone +61 2 8925 5500 Fax +61 2 8925 5555	Project N	No.: 4316	7888			Project Re	erence		s Wind Farm	Project
450mm	tion Method: Bucket tor (5.5t)	Checked By: I Date Started:	TH DT 15-4-11 15-4-11	Relative Coordina Permit N	75	32 mR 18414. 7564.5	1 mN		Olient:	Un	ion Fer	osa Wind Aus	stralia
GEOLOGICAL DESCRIPTION	DE	SCRIPTION C	F STRATA		GRAPHIC LOG	DEPTH (m)	MOISTURE CONDTION	SAMPLE	CONSISTENCY/ DENSITY	-Soft -Medium PENET.	UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUND WATER DATA AND COMMENTS
	Sandy CLAY, me some medium to Residual Grading to low pl	asticity, pale brown	wn and pale brown, w bangular gravel basalt,			-0	M D/M		MD VSt		Ξ 		· · ·
	_dark grey	inated at 2.3m due				3			-		· · ·		Dry upon complet
	· ·	• • •	•			- 4							
		TEST PIT	SECTION					TES	T PIT P	LAN			
												TEST PIT TER Target Depth Refusal Flooding Caving/collaps	
												SAMPLE TYPE Bulk Sample Tube Sample Disturbed San Contamination	BS TS nple DS

U	RS	Те	st Pit Log					TI	EST	PIT	- TP-{	56	Sheet 1 of 1
	stralia Pty Ltd 407 Paciflc Highway	Artarmon NSW	Phone +61 2 8925 5500 Fax +61 2 8925 5555	Project N		67888			Project Re			s Wind Farm	Project
Contrac	otor: Ac	claimed Excav	vations		431	97000	•			ган	ng ranu	5 WING FAIM	rioject
150mm	ition Method: n Bucket ator (5.5t)	Logged By: Checked By: Date Started: Date Finished		Relative Coordina Permit N	7:	022 mR 218234. 57293.2	.95 mN		Client:	Ur	nion Fer	osa Wind Au	stralia
GEOLOGICAL DESCRIPTION	D Silty SAND, fine		N OF STRATA		GRAPHIC LOG	O DEPTH (m)	<pre> MOISTURE CONDTION </pre>	SAMPLE	CONSISTENCY/ DENSITY	No resistance — Sott — Medium · PENET.	Betreal UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUND WATER DATA AND COMMENTS
	with some medi Residual Grading to med	um to coarse gr ium plasticity	asticity, pale grey and pale ained subangular gravel b gth, distinctly weathered, ç	asalt,		1	D/M	<u> </u>	VSt T			DS at 0.8m DS at 1m	Dry upon completic
	∖ <u>dark grey</u> Test Pit 56 ⊤err	ninated at 1.1m	due to refusal	/									bry open complex
						- 3					•		
			· · · · · · · · · · · · · · · · · · ·			5							

	·							-																			
				1	res ⁻	T PI	ΤS	EC1		N							T	ST	PI1	ΓP	LA	N					
	 														 	 									TEST PIT TE	RMINATED	AT:
	 		; ;	<u>.</u>									<u>.</u>		 	 									Target Dept	Ł	
	 														 	 									Refusal		X
	 														 	 				<u>.</u>					Flooding		
	 		: 										: :		 	 			: :	 					Caving/colla	pse	
	 		: : :	: 											 	 			;	 :		•••••••••••••••••••••••••••••••••••••••			SAMPLE TY	PE:	
•••	 	 		 					• • • • •						 	 • • • • •							•••		Buik Sample		BS
	 		÷										••••• •	 	 > · · · · ·	 			 						Tube Sample		TS
						· · · · · ·						•••••) :	<u>}</u>	 · · · · ·	 	(* · · · ·	 							Disturbed Sa		DS
	 	•	 		 		•••••				·····	· · · ·	· · · · ·	•••••	 · · · · ·	 		(•••• 						1	Contaminati	on Sample	CS
	 														 · · · · ·	• • • • •		:						1			
	 											•••••			 	 								1			
		Ĩ													 					-				1			

U	RS	Tes	t Pit Log	3					TE	EST	ΡΙΤ	TP-	57	Sheet 1 of 1
	stralia Pty Ltd 407 Pacific Highway, tor: Ac	Artarmon NSW	Phone +61 2 8925 Fax +61 2 8925		Project N		67888		F	 Project Re			Is Wind Farm I	Project
450mm	tion Method: Bucket tor (5.5t)	Logged By: Checked By: Date Started: Date Finished:	TH DT 15-4-11 15-4-11		Relative Coordina Permit N	75	042 mR 217956 57116.8	.78 mN	(Client:	Ur	iion Fen	nosa Wind Aus	stralia
GEOLOGICAL DESCRIPTION			OF STRATA			GRAPHIC LOG	o DEPTH (m)	MOISTURE CONDTION	SAMPLE		No resistance Soli 	Perintal UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUND WATER DATA AND COMMENTS
	•	edium to high pla e grained suban	Topsoil sticity, brown, with gular gravel basalt, h, distinctly weather					M D/M	В	MD VSt			BS at 0.5m	
	dark groy Test Pit 57 Term						2							Dry upon completion
		TEST P	IT SECTION						TES	T PIT F	9 <u>LAN</u>		TEST PIT TERI Target Depth Refusal Flooding Caving/collaps SAMPLE TYPE Bulk Sample Tube Sample Disturbed Sam Contamination	se

T	Ustralia Pty Ltd 4, 407 Pacific Highway, A actor: Accl				Ţ	es	st I	Pit	Ľ	og					·			Ť	EST	P	Ţ	TP-	58	She	et 1 of 1
	, 407 Paci			-				Fax		8925 5 8925 5		Proj	ect N		6788	38			Project R				s Wind Farm	Project	
450mr	ation Me m Bucke vator (5.5	et		Che Dat	ged B cked e Star e Fini	By: ted:	Tł D1 15 15	r i- 4-1 1				Coo	ative Irdina mit N	7	031 n 521786 756710	69.7	6 mN		Client:		Uni	ion Fen	osa Wind Au	stralia	
GEOLOGICAL DESCRIPTION							I OF			ΓA				GRAPHIC LOG	O DFPTH (m)		MOISTURE CONDTION	SAMPLE	CONSISTENCY/ DENSITY	No resistance Soft 	- Hard - Hard Political	UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROU WAT DATA COMME	ER AND
	Silty S Sandy some Resid	y CLA' mediu lual	Y, ma um to	- coar:	plast se gra	licity, ained	brow suba	n anc ngula	i pale ar gra	vel ba	asalt,						M D/M		MD VSt H						-
	BASA dark Test I	groy -			-						30, gi		nd 			· · ·								Dry upon c	ompletion
					TES	<u>ST P</u>	IT S	EC		N								TES	<u>37 PIT I</u>		N		TEST PIT TER Target Depth Refusal Flooding Caving/collaps SAMPLE TYPI Bulk Sample Tube Sample Disturbed San Contamination	se <u>:</u> :	AT: X BS TS DS CS

.

							·						
U	RS	Tes	t Pit Log			·		Т	EST	PIT	TP-	59	Sheet 1 of 1
	istralia Pty Ltd 407 Pacific Highway, ctor: Ac	Artarmon NSW	Phone +61 2 8925 5500 Fax +61 2 8925 5555 ions	Project N		67888			Project Re			s Wind Farm I	Project
450mn	ation Method: n Bucket ator (5.5t)	Logged By: Checked By: Date Started: Date Finished:	TH DT 15-4-11 15-4-11	Relative Coordina Permit N	75		13 mN		Client:	Un	ion Fen	osa Wind Aus	stralia
GEOLOGICAL DESCRIPTION		ESCRIPTION			GRAPHIC LOG	O DEPTH (m)	MOISTURE CONDTION	SAMPLE		Medium PENET.	UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUND WATER DATA AND COMMENTS
	Sandy CLAY, m coarse grained s		opsoil rown, with some mediur basalt and cobbles, Res n, distinctly weathered, ç				M D/M		MD VSt				
	dark grey	m to high strengt				- 							Dry upon completion
						2							
						- 4							
		TEST PI	TSECTION			ŀ		TE	ST PIT P	PLAN			<u> </u>
												TEST PIT TER Target Depth Refusal Flooding Caving/collaps	x x
					· · · · · · · · · · · · · · · · · · ·							Bulk Sample Tube Sample Disturbed San Contamination	BS TS nple DS

.

U	RS	Test Pit Log		•	٦	rest	PIT	TP-(60	Sheet 1 of
	tralla Pty Ltd 407 Pacific Highway, / tor: Acc	Phone +61 2 8925 5500 Ariarmon NSW Fax +61 2 8925 5555 slaimed Excavations Fax +61 2 8925 5555		No.: 43167888		Project Re			s Wind Farm	Project
450mm	ion Method: Bucket tor (5.5t)	Logged By: TH Checked By: DT Date Started: 15-4-11 Date Finished: 15-4-11	Relative Coordina Permit N	757375.2	88 mN	Client:	Uni	ion Fen	osa Wind Aus	stralia
GEOLOGICAL DESCRIPTION		SCRIPTION OF STRATA		GRAPHIC LOG O DEPTH (m)		SAMPLE CONSISTENCY/ DENSITY	No resistance 	UCS - Pocket Penetrom. (KPa)	SAMPLING AND OTHER TESTING	GROUND WATER DATA AND COMMENTS
	Clayey SAND, fin coarse grained si	grained, pale brown, Topsoil e grained, pale brown, with a trace of me ubangular gravel basalt and boulders, Re dium plasticity, pale brown and brown, w to coarse grained subangular gravel bas al			M D/M 	MD D VSt			DS at 1.5m	
	Test Pit 60 Term	inated at 2.1m due to refusal		-3						Dry upon comple
:		TEST PIT SECTION			<u></u>	<u>EST PIT I</u>	PLAN	1		
									TEST PIT TER Target Depth Refusal Flooding Caving/collaps SAMPLE TYPE Bulk Sample Tube Sample Disturbed Sam Contamination	se
										-


























































































































Site Condition Near Test Pit 11



Siltstone Outcrop Near Test Pit 13

2 I	TITLE:		
	Site Photographs Paling Yards Wind Farm Project		
3 3 5 3			
URS	DATE: 11/04/2011	PROJECT NO: 43167888	REV:


Site Condition Near Test Pit 14

	TITLE:	80. A	18	
	а ⁸ .	Site Photographs	5	
		Paling Yards Wind Farm F	Project	
TTDC	DATE:	PROJECT NO:	REV:	-
UND	11/04/2011	43167888	A	
			÷	



Site Condition Near Test Pit 15



Site Condition Near Test Pit 29

. 5	TITLE:	· · · · · · · · · · · · · · · · · · ·	
	35 ST	Site Photographs	
	* ^{- 2}	Paling Yards Wind Farm P	roject
URS	DATE: 11/04/2011	PROJECT NO: 43167888	REV:
* · · · · ·			



Site Condition Near Test Pit 53



Rock Failure Along Abercrombie Road, Adjacent To Southern Central Site Boundary

40 40	**************************************	TITLE:		
			Site Photographs	•
	2	50	Paling Yards Wind Farm F	Project
TTDC		DATE:	PROJECT NO:	REV:
UILS		11/04/2011	43167888	A
0	i). 10	÷		3

Appendix D DCP Logs and Results



Project:							Projec	t No.			Testi	ng Type					
Paling Yards V	Vind Fa	arm					43167	888			Dynai	mic Cone Penetr	ometer	(DCP)			Х
Client:						•	Test B	sy:	4	0	Dynamic	Perth Sand Pen	etrome	ter (PS	P)		
Union Fenosa							ΤН										
Location:						-	Date:		_	Locati	ion:			Sheet	t:		
Paling Yards G	Goulbu	rn, NSV	V				21/04	4/2011		Refer	to Figur	e 1		1 of 1	2		
-		1	-	1	-	-	-	T	-	-	Ť.		-	-	-	Î	r
DCP No.	1	2	3	4	5		1	2	3	4	5		1	2	3	4	5
Penetration (mm)	Nur		f Blows enetrati	per 50 ion	mm	Penetration (mm)	Nur	nber of Pe	Blows) mm	Penetration (mm)	Nur		Blows		mm
50	2	4	3	3	2	950	7					1850					
100	2	10	1	16	2	1000	8					1900					
150	4	12	11	н	4	1050	10					1950					
200	3	R	12		5	1100	R					2000					
250	5		12		10	1150						2050					
300	5		н		9	1200						2100					
350	3				7	1250						2150					
400	4				5	1300						2200					
450	4				6	1350						2250					
500	6				6	1400						2300					
550	4				7	1450						2350					
600	5				7	1500						2400					
650	5				7	1550						2450					
700	6				8	1600						2500					
750	6				12	1650						2550					
800	7				н	1700						2600					
850	7					1750						2650					
900	6					1800						2700					
		Test	Proced	dure: A	S 1289	.6.3.2											

Comments: R - Refusal H - High Resistance







Number of Blows per 50 mm Penetration

PI	ENE	TRA	TION	N RE	SIST	ANCE O	F SC	IL T	EST	FIEI	_D S	HEET				JR	ĽS
Project:							Projec	t No.			Testii	пд Туре					
Paling Yards \	Vind Fa	rm					43167	888			Dynai	nic Cone Penetr	ometer	(DCP)			Х
Client:						-	Test B	By:		0)ynamic	Perth Sand Pen	etrome	ter (PS	P)		
Union Fenosa							ΤН										
Location:						-	Date:		-	Locati	on:			Sheet			
Paling Yards (Goulbu	rn, NSV	V				21/04	4/2011		Refer t	o Figur	e 1		2 of 1	2		
DCP No.	6	7	8	9	10		6	7	8	9	10						
Penetration (mm)	Nur		f Blows enetrati		mm	Penetration (mm)	Nur	nber of Pe	Blows		mm	Penetration (mm)	Nur		f Blows enetrat	per 50 ion	mm
50	1	1	2	2	2	950	7	6				1850					
100	2	2	4	3	4	1000											
150	3	3	3	4	8	1050	6	6				1950					
200	2	2	4	8	8	1100	7	7				2000					
250	2	3	5	R	8	1150	7	7				2050					
300	3	3	4		9	1200	7	9				2100					
350	4	4	11		11	1250	7	11				2150					
400	3	7	10		R	1300	8	н				2200					
450	4	4	8			1350	11					2250					
500	4	4	8			1400	н					2300					
550	5	4	9			1450						2350					
600	5	5	11			1500						2400					
650	5	6	н			1550						2450					
700	5	5				1600						2500					<u> </u>
750	5	6				1650						2550					<u> </u>
800	5	6				1700						2600					
850	6	7				1750						2650					<u> </u>
900	6	6				1800						2700					
		Test	Proced	dure: A	S 1289	.6.3.2											





PI	ENE	TRA	TION	I RE	SIST	ANCE O	F SC	DIL T	EST	FIEI	_D S	HEET			l	JR	S
Project:							Projec	ct No.	-		Testir	пд Туре					
Paling Yards V	Nind Fa	ırm					43167	888			Dynar	nic Cone Penetr	ometer	(DCP)			Х
Client:						-	Test E	By:	-	C)ynamic	Perth Sand Pen	etrome	ter (PS	P)		
Union Fenosa							ΤН										
Location:						-	Date:		-	Locati				Sheet	t:		
Paling Yards (Goulbu	'n, NSV	V				21/04	4/2011		Refer t	o Figuro	e 1		3 of 1	2		
DCP No.	11	12	13	14	15		11	12	13	14	15						
Penetration (mm)	Nur		f Blows enetrati		mm	Penetration (mm)	Nur	mber of Pe	Blows enetrati		mm	Penetration (mm)	Nur		f Blows enetrat	per 50 ion	mm
50	2	4	4	2	2	950				6	6	1850					
100	2	5	4	3	4	1000											
150	4	3	5	3	3	1050				6	6	1950					
200	7	4	5	4	2	1100				6	6	2000					
250	8	4	10	4	4	1150				7	7	2050					
300	R	5	14	7	4	1200				8	7	2100					
350		8	R	4	3	1250				9	7	2150					
400		9		5	3	1300				8	8	2200					
450		8		8	4	1350				10	7	2250					
500		11		7	4	1400				10	9	2300					
550		14		8	4	1450				13	10	2350					
600		н		6	5	1500				R	10	2400					
650				7	5	1550					14	2450					
700				7	6	1600					R	2500					
750				7	5	1650						2550					
800				8	7	1700						2600					
850				8	6	1750						2650					
900				8	6	1800						2700					
		Test	Proced	dure: A	AS 1289	.6.3.2											





PI	ENE	TRA	TION	I RE	SIST	ANCE O	FSC	IL T	EST	FIEI	_D S	HEET			l	JR	S
Project:						•	Projec	t No.			Testir	пд Туре					
Paling Yards \	Wind Fa	ırm					431678	888			Dynar	nic Cone Penetr	ometer	(DCP)		2	X
Client:							Test B	sy:		C)ynamic	Perth Sand Pen	etrome	ter (PS	P)		
Union Fenosa							ТΗ										
Location:							Date:			Locati	on:			Sheet			
Paling Yards (Goulbu	rn, NSV	V				21/04	1/2011		Refer t	o Figure	e 1		4 of 1	2		
DCP No.	16	17	18	19	20		16	17	18	19	20						
Penetration (mm)	Nur		f Blows enetrati		mm	Penetration (mm)	Nur	nber of Pe	Blows		mm	Penetration (mm)	Nur		Blows	per 50 ion	mm
50	2	2	2	2	1	950	8	8		8	7	1850					
100	2	3	4	3	1	1000	1900										
150	3	3	3	3	9	1050											
200	3	5	4	3	8	1100	8	14		8	7	2000					
250	4	4	4	4	5	1150	9	R		9	7	2050					
300	5	5	4	5	3	1200	10			10	8	2100					
350	8	7	4	5	3	1250	11			12	11	2150					
400	6	6	5	5	4	1300	R			R	12	2200					
450	6	8	7	6	4	1350					R	2250					
500	6	9	11	5	5	1400						2300					
550	4	6	14	5	6	1450						2350					
600	5	7	R	6	5	1500						2400					
650	6	6		6	6	1550						2450					
700	5	8		7	7	1600						2500					
750	6	7		6	7	1650						2550					
800	7	7		6	6	1700						2600					
850	7	8		6	8	1750						2650					
900	7	9		7	7	1800						2700					
	-	Test	Proced	dure: A	S 1289	.6.3.2	-										





Project:							Projec	t No.			Testir	пд Туре					
Paling Yards V	Vind Fa	ırm					43167	888			Dynar	nic Cone Penetr	ometer	(DCP))	K
Client:						-	Test B	sy:		C)ynamic	Perth Sand Per	etrome	ter (PSI	>)		
Union Fenosa							ΤН										
Location:						_	Date:		_	Locati	on:		_	Sheet	:		
Paling Yards G	ioulbur	m, NSV	V				21/04	4/2011		Refer t	o Figure	e 1		5 of 12	2		
		1	1		1			1						1			
DCP No.	21	22	23	24	25		21	22	23	24	25		21	22	23	24	25
Penetration (mm)	Nur		Blows		mm	Penetration (mm)	Nur	nber of Pe	Blows		mm	Penetration (mm)	Nur		Blows enetrati	per 50 on	mm
50	1	1	2	2	3	950	9	н		9	6	1850					14
100	2	3	4	2	2	1000	9			11	7	1900					R
150	3	4	11	2	3	1050	11			10	6	1950					
200	3	4	11	3	4	1100	12			11	7	2000					
250	4	6	7	4	4	1150	R			10	8	2050					
300	5	7	6	3	4	1200				14	7	2100					
350	4	8	5	3	3	1250				15	7	2150					
400	5	6	7	4	4	1300				R	6	2200					
450	4	6	12	4	7	1350					7	2250					
500	6	6	11	5	6	1400					8	2300					
550	6	6	8	5	7	1450					7	2350					
600	6	6	7	4	7	1500					8	2400					
650	8	7	10	6	8	1550					9	2450					
700	8	10	11	5	6	1600					8	2500					
750	9	9	R	7	7	1650					7	2550					
800	10	12		8	7	1700					9	2600					
850	10	14		7	8	1750					10	2650					
900	9	15		9	8	1800					11	2700					







Project:							Projec	t No.			Testir	ng Type					
Paling Yards V	Vind Fa	ırm					43167	888			Dynai	mic Cone Penetr	ometer	(DCP)		2	X
Client:						-	Test B	sy:		0	ynamic	Perth Sand Per	etrome	ter (PSI	P)		
Union Fenosa							ТΗ										
Location:						_	Date:		_	Locati	on:		_	Sheet	:		
Paling Yards G	ioulbur	'n, NSV	V				21/04	4/2011		Refer t	o Figur	e 1		6 of 12	2		
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
DCP No.	26	27	28	29	30		26	27	28	29	30		26	27	28	29	30
Penetration (mm)	Nur		Blows		mm	Penetration (mm)	Nur	nber of Pe	Blows		mm	Penetration (mm)	Nur	nber of Pe	Blows		mm
50	1	1	1	2	1	950	7		н	5	8	1850					
100	2	2	2	2	3	1000	8			6	10	1900					
150	2	2	2	3	3	1050	8			6	R	1950					
200	3	3	3	4	3	1100	8			7		2000					
250	3	3	3	4	4	1150	7			6		2050					
300	3	4	3	5	3	1200	8			6		2100					
350	4	8	4	4	4	1250	9			6		2150					
400	3	8	5	6	4	1300	10			7		2200					
450	4	9	4	7	5	1350	12			9		2250					
500	4	12	4	7	5	1400	R			10		2300					
550	5	н	5	6	6	1450				11		2350					
600	5		6	7	5	1500				14		2400					
650	5		5	8	5	1550				н		2450					
700	6		5	9	5	1600						2500					
750	5		6	8	5	1650						2550					
800	5		8	7	6	1700						2600					
850	6		9	8	5	1750						2650					
900	6		12	7	7	1800						2700	<u> </u>				







Project:							Projec	t No.			Testi	пд Туре					
Paling Yards V	Vind Fa	ırm					43167	888			Dynai	nic Cone Penetr	ometer	(DCP)		3	X
Client:						-	Test B	sy:		0	Dynamic	Perth Sand Per	netrome	ter (PSI	P)		
Union Fenosa							ТΗ										
Location:						_	Date:		_	Locati	on:		_	Sheet	:		
Paling Yards G	ioulbur	'n, NSV	V				21/04	4/2011		Refer t	to Figur	e 1		7 of 1	2		
	1	1	1	1	1	1	1	1	1	1	1	1	1		1		1
DCP No.	31	32	33	34	35		31	32	33	34	35		31	32	33	34	35
Penetration (mm)	Nur		Blows		mm	Penetration (mm)	Nur	nber of Pe	Blows		mm	Penetration (mm)	Nur		Blows	per 50 ion	mm
50	2	4	2	10	2	950	11		R	5	7	1850					
100	3	10	4	5	2	1000	14			6	8	1900					
150	3	14	12	5	3	1050	11			6	8	1950					
200	3	12	11	12	3	1100	10			7	9	2000					
250	3	н	3	7	4	1150	10			6	12	2050					
300	4		3	7	5	1200	11			6	R	2100					
350	4		4	5	4	1250	10			6		2150					
400	5		5	5	4	1300	R			7		2200					
450	6		4	5	4	1350				9		2250					
500	6		4	6	4	1400				10		2300					
550	7		5	7	4	1450				11		2350					
600	6		6	7	5	1500				14		2400					
650	7		5	7	7	1550				н		2450					
700	7		5	7	5	1600						2500					
750	8		6	8	6	1650						2550					
800	12		8	7	7	1700						2600				<u> </u>	
850	11		9	9	7	1750						2650				<u> </u>	
900	10		12	10	6	1800						2700					







Project:							Projec	t No.			Testi	ng Type					
Paling Yards V	Vind Fa	ırm					43167	888			Dynai	mic Cone Penetr	ometer	(DCP)		2	X
Client:						•	Test B	sy:		C	ynamic	Perth Sand Per	etrome	ter (PSI	P)		
Union Fenosa							ΤĦ										
Location:						_	Date:		_	Locati	on:		_	Sheet	:		
Paling Yards G	ioulbur	'n, NSV	V				21/04	4/2011		Refer t	o Figur	e 1		8 of 12	2		
	1	1	1	1	1	1		1				1	1				1
DCP No.	36	37	38	39	40		36	37	38	39	40		36	37	38	39	40
Penetration (mm)	Nur		Blows enetrati		mm	Penetration (mm)	Nur	nber of Pe	Blows enetrati		mm	Penetration (mm)	Nur	nber of Pe	Blows		mm
50	2	2	2	2	2	950			6	9		1850					
100	12	3	2	3	3	1000			7	8		1900					
150	н	6	3	3	4	1050			7	8		1950					
200		8	3	4	4	1100			9	9		2000					
250		6	3	4	5	1150			10	12		2050					
300		5	4	4	7	1200			8	16		2100					
350		6	4	4	6	1250			8	н		2150					
400		7	4	5	7	1300			8			2200					
450		8	4	4	6	1350			8			2250					
500		12	4	5	6	1400			9			2300					
550		н	5	6	7	1450			8			2350					
600			5	6	9	1500			7			2400					
650			6	8	8	1550			8			2450					
700			6	9	11	1600			10			2500					
750			6	11	14	1650			9			2550					
800			7	8	н	1700			11			2600					
850			6	10		1750			14			2650					
900			6	12		1800			Н			2700					







Project:							Projec	t No.			Testir	ng Type					
Paling Yards V	Vind Fa	ırm					43167	888			Dynai	mic Cone Penetr	ometer	(DCP)		2	X
Client:						-	Test B	sy:		C	ynamic	Perth Sand Per	etrome	ter (PSI	P)		
Union Fenosa							ΤН										
Location:						_	Date:		_	Locati	on:		_	Sheet	:		
Paling Yards G	ioulbur	m, NSV	V				21/04	4/2011		Refer t	o Figur	e 1		9 of 12	2		
		1	1	1				1									1
DCP No.	41	42	43	44	45		41	42	43	44	45		41	42	43	44	45
Penetration (mm)	Nur		Blows		mm	Penetration (mm)	Nur	nber of Pe	Blows enetrati		mm	Penetration (mm)	Nur	nber of Pe	Blows		mm
50	2	2	2	3	2	950	14	9				1850					
100	3	4	4	4	4	1000	R	10				1900					
150	3	3	6	9	10	1050		9				1950					
200	3	4	7	10	9	1100		8				2000					
250	4	4	6	14	6	1150		8				2050					
300	4	4	10	R	6	1200		9				2100					
350	6	5	8		6	1250		12				2150					
400	9	4	8		7	1300		14				2200					
450	7	5	11		14	1350		н				2250					
500	7	6	R		R	1400						2300					
550	9	6				1450						2350					
600	7	7				1500						2400					
650	7	6				1550						2450					
700	6	4				1600						2500					
750	7	6				1650						2550					
800	7	7				1700						2600					
850	9	8				1750						2650					
900	11	8				1800						2700					







PE	ENE	rra ⁻	TION	I RE	SIST	ANCE O	F SC	IL T	EST	FIEI	_D S	HEET			J	JR	LS
Project:							Projec	t No.			Testir	пд Туре					
Paling Yards V	Vind Fa	rm					43167	888			Dynar	nic Cone Penetr	ometer	(DCP)			Х
Client:						-	Test B	sy:	•	C)ynamic	Perth Sand Per	etrome	eter (PSI)		
Union Fenosa							ΤН										
Location:						_	Date:		-	Locati	on:		-	Sheet	:		
Paling Yards G	Goulbur	m, NSV	V				21/04	/2011		Refer t	o Figuro	e 1		10 of	12		
DCP No.	46	47	48	49	50		46	47	48	49	50		46	47	48	49	50
Penetration (mm)	Nur		Blows		mm	Penetration (mm)	Nur	Number of Blows per 50 mm Penetration			Penetration (mm)	Nui	mber of Pe	Blows		mm	
50	2	2	2	2	2	950				11	7	1850					
100	2	3	2	2	3	1000				12	8	1900					
150	3	4	3	3	4	1050				R	7	1950					
200	4	4	3	2	4	1100					8	2000					
250	10	6	4	4	5	1150					9	2050					
300	9	7	6	4	4	1200					9	2100					
350	12	7	11	5	5	1250					10	2150					
400	R	11	12	7	5	1300					11	2200					
450		8	16	8	5	1350					10	2250					
500		7	н	7	6	1400					9	2300					
550		6		8	7	1450					12	2350					
600		12		7	6	1500					14	2400					
650		14		9	6	1550					н	2450					
700		н		9	7	1600						2500					
750				7	8	1650						2550					
800				8	8	1700						2600					
850				7	8	1750						2650					
900				10	9	1800						2700					





Project:						_	Projec	t No.	_		Testi	пд Туре					
Paling Yards V	Vind Fa	ırm					43167	888			Dynai	nic Cone Penetr	ometer	(DCP)		3	Х
Client:						-	Test B	sy:		C	ynamic	Perth Sand Per	etrome	ter (PSI	P)		
Union Fenosa							ΤН										
Location:						_	Date:		_	Locati	on:		_	Sheet	:		
Paling Yards G	Goulbur	'n, NSV	V				21/04	/2011		Refer t	o Figur	e 1		11 of 1	12		
	1	1	1	1			1	1									
DCP No.	51	52	53	54	55		51	52	53	54	55		51	52	53	54	55
Penetration (mm)	Nur		Blows	per 50 ion	mm	Penetration (mm)	Nur	nber of Pe	Blows		mm	Penetration (mm)	Nur		er of Blows per 50 mm Penetration		
50	1	2	2	2	2	950	9		10		6	1850					9
100	2	2	4	4	2	1000	10		12		6	1900					10
150	2	3	4	14	3	1050	12		н		8	1950					10
200	2	4	3	12	3	1100	R				7	2000					12
250	3	4	4	н	3	1150					7	2050					R
300	3	4	5		3	1200					7	2100					
350	4	5	5		4	1250					6	2150					
400	4	7	5		4	1300					7	2200					
450	5	9	6		4	1350					8	2250					
500	6	11	5		4	1400					7	2300					
550	6	10	6		4	1450					8	2350					
600	6	R	7		5	1500					7	2400					
650	6		6		6	1550					8	2450					
700	7		7		5	1600					7	2500					
750	6		11		5	1650					7	2550					
800	7		12		6	1700					8	2600					
850	7		9		5	1750					8	2650				<u> </u>	<u> </u>
900	8		9		6	1800					8	2700					







Project:							Projec	t No.			Testi	ng Type					
Paling Yards V	Vind Fa	ırm					43167	888			Dynai	mic Cone Penetr	ometer	(DCP)		3	x
Client:						-	Test B	sy:		C	ynamic	Perth Sand Per	etrome	ter (PSI	>)		
Union Fenosa							TH										
Location:						_	Date:		_	Locati	on:		_	Sheet	:		
Paling Yards G	ioulbur	m, NSV	V				21/04	4/2011		Refer t	o Figur	e 1		12 of 1	12		
	r	1		1	1	1		1		1	1	1	1	1		1	1
DCP No.	56	57	58	59	60		56	57	58	59	60		56	57	58	59	60
Penetration (mm)	Nur		f Blows enetrati		mm	Penetration (mm)	Nur	nber of Pe	Blows enetrati		mm	Penetration (mm)	Nur	nber of Pe	Blows enetrati		mm
50	1	1	1	1	1	950	9		9			1850					
100	2	2	1	2	3	1000	11		9			1900					
150	3	2	2	2	4	1050	R		8			1950					
200	2	4	4	3	3	1100			9			2000					
250	3	3	4	4	3	1150			10			2050					
300	3	3	4	4	3	1200			R			2100					
350	4	4	5	7	3	1250						2150					
400	5	5	5	4	4	1300						2200					
450	4	8	5	3	6	1350						2250					
500	5	6	6	4	4	1400						2300					
550	6	6	6	5	5	1450						2350					
600	5	7	6	5	6	1500						2400					
650	6	6	5	6	5	1550						2450					
700	7	7	7	8	7	1600						2500					
750	7	7	7	10	14	1650						2550					
800	6	8	6	12	13	1700						2600					
850	8	12	7	R	н	1750						2650					
900	9	н	8			1800						2700					







Number of Blows per 50 mm Penetration

Appendix E Non-Cored and Cored Borehole Logs and Photographs

URS

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43167888/Paling Yards Geotechnical Report/3

IND NO	on-cored Hole	BO	REHOLE BH-01	Sheet 1 of 1
ustralia Pty Ltd 07 Pacific Highway, Artarmon, M Contractor: Strategic D	Phone: +61.2.8925 5500 NSW Fax: +61.2.8925 5555 Drilling Services	Reference: Farm	Client: Union Fenosa Wind Australia Location: Paling Yards, NSW	
By: T Huang ad By: D Tulasi tarted: 18-7-11 nished: 20-7-11	Bore Size: 150 mm Total Depth: 1.40 m Casing Size: mm	Project No.: 43167888 Relative Level: 870.00 mRL Coordinates: 6215202.86 mN 750045.99 mE Permit No:	Drill Type: SFA Auger "TC" Bit Drill Model: CME 55LC track mounted drilling rig Drill Fluid: N/A	3
RUN (m) FIELD SHEAR STRENGTH (kPa) PENETROMETER BLOWS (N)	SAMPLING AND OTHER TESTING COMMENTS	GRAPH	NOILIGNOS BUDLSIOW	GOUSISTENCY/ DENSITY GEOLOGICAL DESCRIPTION
RUN STREE		0 Clayey SAND, fine gr crushed siltstone and Topsoil 	ained, dark brown, with some M/W d gravel, grass covered, overburden medium strength, distinctly	Topsoi

SYDNEY_GEOTECH J:JUDBS/4316788815 WORKS/BOREHOLE LOGS AND PHOTOS/43167888-BH NON-CORED LOGS. GPJ URS1. GDT 28/7/11

URS Cored Borehole

BOREHOLE BH-01

Sheet 1 of 4

URS Australia PT Lv4, 407 Pacific H	Y LTD wy, Artarmon NSW 2064	Phone: +61 2 8925 5500 Fax: +61 2 8925 5555		Paling Yards Wind Farm	Client:	Union Fenosa Wind Australia						
Drilling Contracto	or: Strategic Drilling	g Services	Project No.:	43167888	Location:	Paling Yards, NSW						
Logged By:	T Huang	Bore Size: 100 mm	Relative Leve	el: 870.00 mRL	Drill Type:	NMLC - Diamond Impreg. Bit						
Checked By:	D Tulasi	Casing Size: mm Total Depth: 20.00 m	Coordinates:		Drill Model:	CME 55LC track mounted drilling rig						
Date Started:	18-7-11	Borehole Inclination and		750045.99 mE								
Date Finished:	20-7-11	Bearing: 90° from horizontal at ° True North	Permit No:		Drill Fluid:	N/A						

	DR	ILLING			MATERIAL DESCRIPTIO	DISCONTINUITY DESCRIPTION					
MEIHOU	WATER RUN/RECOVERY	FIELD TESTS/ SAMPLING	O DEPTH (m)	GRAPHIC LOG	DESCRIPTION OF STRATA (Rock type, strength, Weathering, color, fabric, grain size, inclusions, degree of fracturing)	WEATHERING	STRENGTH Is (50) MPa [©] ⊖⊖⊖⊖⊖ ⊐⊃→≥±∑⊒	RQD (%)	0-19 20-49 50-99 100-199 SPACING 200-599 (mm) 2600	DEFECT LOG	DEFECT DESCRIPTION (Defect type, inclination, shape, roughness, infill, thickness)
EGNATED BIT					Continues from Non-Cored Log at 1.4m SANDSTONE, medium to high strength, distinctly weathered, pale grey and pale brown, fine to coarse grained sand, with a trace of medium to gravel size quartz, with a trace of clay infilling along joints, slight fractured SILTSTONE, medium to high strength, extremely weathered to distinctly weathered, pale brown to orange, with some fine to coarse grained sand, with some medium to gravel size quartz, with some clay infilling along joints, slightly fractured With iron staining, 2.63 to 2.72m	DW		1.4 58 2 35			 JN, 80*, PI, SR, Qz JN, 45', PI, SR, Qz DZ, 20*, 1.72 to 1.77m JN, 60*, PI-Ir, SR, Qz Hand Break Organic Roots JN, 45', PI, SR, along with CS, 2mm thick JN, 45', PI, SR, along with CS, 8mm thick JN, 60', PI, SR, Qz Drilling Induced Break JN, 60*, PI, SR, Fe JN, 60*, PI, SR, Fe JN, 60*, PI, SR, Qz
NMLC - UIAMOND IMPREGNATED BIT			- - - - - - - - - - - -		Colour changes to pale grey, mottled pale brown and orange	xw Dw Xw		16			Drilling Induced Break DZ, 0 [°] , 3.21 to 3.23m JN, 60°, PI, SR JN, 60°, Ir, SR JN, 70°, PI, SR DZ, 60°, 3.54 to 3.8m JN, 70°, PI, SR JN, 70°, PI, SR Hand Break DZ, 70°, 4 to 4.23m
			-		SILTSTONE, high strength, slightly weathered, pale brown and pale grey, with some fine to coarse grained sand, with some interbeded sandstone band and medium to gravel size quartz, with some clay infilling along joints, slightly fractured	sw		66			— Hand Break — JN, 60*, PI, SR, Qz

Cored Borehole

BOREHOLE BH-01

URS Australia PTY LTD Lv4, 407 Pacific Hwy, Artarmon NSW 2064

RS

Phone: +61 2 8925 5500 Fax: +61 2 8925 5555 Project No.

43167888

Project Reference: Paling Yards Wind Farm Sheet 2 of 4



BOREHOLE BH-01

URS Australia PTY LTD Lv4, 407 Pacific Hwy, Artarmon NSW 2064

DRILLING

Phone: +61 2 8925 5500 Fax: +61 2 8925 5555

Cored Borehole

Project 43167888 No.

MATERIAL DESCRIPTION

Project Reference: Paling Yards Wind Farm

DISCONTINUITY DESCRIPTION

DEFECT SPACING (mm) RUN/RECOVER' LOG NEATHERING E DEFECT LOG STRENGTH FIELD TEST **DESCRIPTION OF STRATA DEFECT DESCRIPTION** DEPTH (Is (50) MPa GRAPHIC RQD (%) METHOD WATER 0.03 (Defect type, inclination, shape, (Rock type, strength, Weathering, color, fabric, grain size, inclusions, degree of fracturing) 0-19 20-49 50-99 100-199 200-599 roughness, infill, thickness) 009 ΞF לב SILTSTONE; as above SW Quartz Band, 60*, 4 to 5mm thick Quartz Band, 70*, 2 to 6mm thick 92 Quartz Band, 70*, 2 to 6mm thick 12 -Hand Break -JN, 45*, PI, SR, Fe 93 -JN, 60*, PI-Ir, SR, Fe - Drilling Induced Break SYD GEOTECH & MINING CORED J: UOBS/4316788815 WORKS/APPENDIX E - BOREHOLE LOGS AND PHOTOS/43167888-BH CORED LOG (GPJ URS1, GDT 3/8/1 D=1.68 A=1.46 13 -Hand Break Quartz Band, 55*, 4 to 6mm thick Quartz Band, 70*, 2 to 5mm thick 71 NMLC - DIAMOND IMPREGNATED BIT -JN, 45*, PI-Ir, R, Fe, Qz שח SW Quartz Band, 70-80*, 2 to 15mm thick - Drilling Induced Break - Hand Break 14 14 - Drilling Induced Break Quartz Band, 70*, 2 to 3mm thick 67 DZ, 45*, 14.47 to 14.6m, along with CS Quartz Band, 50*, 2 to 4mm thick DW -JN, 60*, PI-Ir, R, Qz -Drilling Induced Break SW -JN, 45*, PI-Ir, R, Fe, Qz JN, 60*, PI, SR, Fe, Qz 15 -Hand Break SILTSTONE, high strength, distinctly to slightly - Drilling Induced Break `JN, 70*, PI, SR, Fe weathered, pale brown and pale grey, with some fine to coarse grained sand, with some interbeded sandstone band and medium to gravel size quartz and quartz band, with some clay infilling along joints, with some iron clay infiniting along joints, with some staining, factured Quartz Band, 70*, 3 to 6mm thick Quartz Band, 70*, 3 to 8mm thick Quartz Band, 70*, 3 to 12mm thick 34 -JN, 60*, PI-Ir, R, Fe, Qz D=0.41 A=0.88 -DZ, 60*, 15.74 to 15.87m DW -JN, 60*, PI, SR, Fe 16 -Hand Break 16 Quartz Band, 70*, 5 to 20mm thick - Drilling Induced Break - DZ, 10*, 16.28 to 16.44m 42 Quartz Band, 70*, 2 to 5mm thick -JN, 45*, PI, SR, Fe

Quartz Band, 60*, 5 to 6mm thick

PS

Sheet 3 of 4

BOREHOLE BH-01

URS Australia PTY LTD Lv4, 407 Pacific Hwy, Artarmon NSW 2064

URS

Phone: +61 2 8925 5500 Fax: +61 2 8925 5555

Cored Borehole

Project No.:

43167888

Project Reference: Paling Yards Wind Farm

DRILLING		MATERIAL DESCRIPTION	DISCONTINUITY DESCRIPTION						
METHOD WATER RUN/RECOVERY FIELD TESTS/ SAMPLING	GRAPHIC LOG	DESCRIPTION OF STRATA (Rock type, strength, Weathering, color, fabric, grain size, inclusions, degree of fracturing)	WEATHERING	STRENGTH Is (50) MPa	3QD (%)	19 0-49 0-49 00-199 00-599 00-599 00-599 00-599 (mm)	DEFECT LOG	DEFECT DESCRIPTION (Defect type, inclination, shape, roughness, infill, thickness)	
NMLC - DIAMOND IMPREGNATED BIT	8 8 8 8 8 8 8 8 8 9 9 9 9 9	(Rock type, strength, Weathering, color, fabric,	WEATHE		(%) GON 33 18 50 19 42		DEFECT	(Defect type, inclination, shape,	
	22								

SYD GEOTECH & MINING CORED J; JOBS/4316788% WORKS/APPENDIX E - BOREHOLE LOGS AND PHOTOS/4316788-BH CORED LOG. GPJ URS1. GDT 3/8/11

Sheet 4 of 4
	Project: Paling Yards			
	Drilled Date: 18/7/201 Title: BH1 1.4m to 6m Box: 1 of 4		T	
	BH I STARTS CORING AT 1.4m			
	200	71 A PAL		
	3m Charles and a second and as second and a		MALL	
	47 33 34	TRANK		
	3m LORE Loss 390mm			
	TITLE:	CLIENTS:	PROJECT: Paling Yards W	/ind Farm
URS	CORE PHOTOGRAPHY BH1 1.4m to 5m Box 1 of 4	Union Fenosa Wind Australia	DATE: 26/07/2011	PROJECT NO: 43167888





	Drilled Date: 20/7/2011 Title: BH1 15m to 20m Box: 4 of 4			
	13"		CORE LOSS BOOM	
URS	TITLE: CORE PHOTOGRAPHY BH1 15m to 20m Box 4 of 4	CLIENTS: Union Fenosa Wind Australia	PROJECT: Paling Yards V DATE: 26/07/2011	Vind Farm PROJECT NO: 43167888

	U	J	R	S	No	n-c	orec	d Hole				DREH	OLE BH-02			Sheet ⁻	I OF 2
Ľ	vl 4, 4	07 Pa		ighway, A			Fax: +	-61.2.8925 5500 -61.2.8925 5555	Project Refere	t nce:	Paling Yards Wind Farm	Client: Location:	Union Fenosa Wind A Paling Yards, NSW	ustra	lia		
Li C D	oggec becke bate Si bate Fi	l By: ed By artec	/: I d: 7	Stra T Huang D Tulasi 7-7-11 7-7-11	-	B	Services ore Size: otal Depth: asing Size:			re Leve nates:	43167888 I: 1000.00 mRL 6217768.20 mN 753669.52 mE	Drill Type:	SFA Auger "TC" Bit CME 55LC track mounted N/A	drillinț	g rig		
	SAMPI E TVPE		RUN (m)	FIELD SHEAR STRENGTH (kPa)	PENETROMETER BLOWS (N)	AND	IPLING OTHER STING	GROUND WATER DATA AND COMMENTS	DEPTH (m)	GRAPHIC LOG	DESCRIPT			MOISTURE CONDITION	NSCS	CONSISTENCY/ DENSITY	GEOLOGICAL
SYDNEY_GEOTECH J:JUOBS\43167888\5 WORKS\BOREHOLE LOGS AND PHOTOS\43167888-BH NON-CORED LOGS.GPJ URS1.GDT 2877/11		SPT SPT SPT			n = 18 n = 12	6, 8, 10	0		- 1 1 		brown, with a trace of	m to high pla f gravel, Re	asticity, brown and pale	M/W	- CH		Residua

SYDNEY GEOTECH J: JOBS/43167888/5 WORKS/BOREHOLE LOGS AND PHOTOS/43167888-BH NON-CORED LOGS, GPJ URS1, GDT 28/7/11

RS **Non-cored Hole**

BOREHOLE BH-02

URS Australia Pty Ltd Lvl 4, 407 Pacific Highway, Artarmon, NSW

SYDNEY_GEOTECH J:JUDBS/4316788815 WORKS/BOREHOLE LOGS AND PHOTOS/43167888-BH NON-CORED LOGS. GPJ URS1. GDT 28/7/11

Phone: +61.2.8925 5500 Fax: +61.2.8925 5555

Project No.:

43167888

Project Reference: Paling Yards Wind Farm

O D <thd< th=""> <thd< th=""> <thd< th=""> <thd< th=""></thd<></thd<></thd<></thd<>	SAMPLE TYPE	RUN (m)	FIELD SHEAR STRENGTH (kPa)	PENETROMETER BLOWS (N)	Sampling And other Testing	GROUND WATER DATA AND COMMENTS	GRAPHIC LOG	DESCRIPTION OF STRATA	MOISTURE CONDITION	NSCS	CONSISTENCY/ DENSITY	GEOLOGICAL DESCRIPTION
								Silty CLAY, medium plasticity, pale brown, mottled orange, TC Bit Refusal, End of Non-Cored Log at 5.1m, Continues as Cored Log	D/M	CL	VSt	Residual

URS Core	d Borehole	BC	OREH	IOLE BH-02
URS Australia PTY LTD Lv4, 407 Pacific Hwy, Artarmon NSW 2064	Phone: +61 2 8925 5500 Fax: +61 2 8925 5555	Paling Yards Wind Farm	Client:	Union Fenosa Wind Australia

Drilling Contract	or: Strategic Drillin	g Services	Project No.: 4	3167888	Location:	Paling Yards, NSW
Logged By:	T Huang	Bore Size: 100 mm	Relative Level	: 1000.00 mRL	Drill Type:	NMLC - Diamond Impreg. Bit
Checked By:	D Tulasi	Casing Size: mm	Coordinates:	6217768.20 mN	Drill Modely	CME 551 C treak mounted drilling via
Date Started:	20-7-11	Total Depth: 19.72 m Borehole Inclination and		753669.52 mE		CME 55LC track mounted drilling rig
Date Finished:	21-7-11	Bearing: 90° from horizontal at ° True North	Permit No:		Drill Fluid:	N/A

Sheet 1 of 3



Cored Borehole

BOREHOLE BH-02

URS Australia PTY LTD Lv4, 407 Pacific Hwy, Artarmon NSW 2064

RS

Phone: +61 2 8925 5500 Fax: +61 2 8925 5555

Project **43167888** No.: Project Reference: Paling Yards Wind Farm



SYD GEOTECH & MINING CORED J: UOBS/4316788815 WORKS/APPENDIX E - BOREHOLE LOGS AND PHOTOS/43167888-BH CORED LOG (GPJ URS1, GDT 3/8/1

Sheet 2 of 3

Cored Borehole

BOREHOLE BH-02

URS Australia PTY LTD Lv4, 407 Pacific Hwy, Artarmon NSW 2064

URS

Fax: +61 2 8925 5555

43167888

Project Reference: Paling Yards Wind Farm

						MATERIAL DESCRIPTION	I				IS	CONTINUITY DESCRIPTION	
METHOD	WATED		HUN/HECOVERY	FIELD TESTS/ SAMPLING	– 10 DEPTH (m)	GRAPHIC LOG	DESCRIPTION OF STRATA (Rock type, strength, Weathering, color, fabric, grain size, inclusions, degree of fracturing)	WEATHERING	STRENGTH Is (50) MPa	HQU (%)	00-19 50-99 DEFECT 100-199 SPACING 200-599 (mm)	DEFECT LOG	DEFECT DESCRIPTION (Defect type, inclination, shape, roughness, infill, thickness)
					-		BASALT, medium to high strength, distinctly weathered, grey to dark grey, massive, with a trace of iron staining and clay infilling along joints, fragmented			4	22		— DZ, 0*, 16.09 to 16.23m — DZ, 0*, 16.28 to 17m -
ATED BIT					17 - - - -		Core Loss 17 to 17.13m BASALT; as above	-	17.	.15			– DZ, 0*, 17.13 to 17.7m
					- - - - - - - - -		Become fractured to slightly fractured			8			- DZ, 0*, 17.77 to 17.85m - JN, 45*, Ir, R, Fe - Drilling Induced Break JN, 15-20*, Ir, R, Fe - Drilling Induced Break - DZ, 0*, 18.35 to 18.59m
				D=0.92 A=N/A	- - - - - - - - -				<u>t</u>	9 8			- Drilling Induced Break - DZ, 0*, 18.92 to 19m - JN, Sub-Vertical, 19.19 to 19.42m, Ir, SR, Fe - JN, 45*, PI, R, Fe - DZ, 0*, 19.4 to 19.5m - IN 20* Ir, B, Ee
					- - 20 - - - -	525	BH2 Coring Terminated at 19.72m, Target Depth Reached						–, N, 20*, Ir, R, Fe ~ JN, 20*, Ir, R, Fe -
					- - 21 - - - - - -								
									<u> ::::::</u>		:::::		

SYD GEOTECH & MINING CORED J: UOBS/43167888/5 WORKS/APPENDIX E - BOREHOLE LOGS AND PHOTOS/43167888-BH CORED LOG (GPJ URS1 (GDT 3/8/11

Sheet 3 of 3

Phone: +61 2 8925 5500

Project No.:







Appendix F Laboratory Test Results



F

43167888/Paling Yards Geotechnical Report/3



ANALYTICAL REPORT

9 June 2011

SGS Industrial CMT Eastern Sydney Unit 15, 33 Maddox Street PO Box 6432 ALEXANDRIA NSW 2015

Attention:	Simon Rosam		
Your Reference:	URS Aust Paling Yards Wind Far	m Project 4316	57888
Our Reference:	SE88017	Samples: Received:	10 Soils 2/06/2011
Preliminary Report S	Sent: Not Issued	10001/041	2,00,2011

These samples were analysed in accordance with your written instructions.

For and on Behalf of: SGS ENVIRONMENTAL SERVICES

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

Results Approved and/or Authorised by:

Dong Liang Inorganic/Metal Supervisor



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PROJECT: URS Aust Paling Yards Wind Farm Project 43167888 REPORT NO: SE88017

Inorganics						
Our Reference:	UNITS	SE88017-1	SE88017-2	SE88017-3	SE88017-4	SE88017-5
Your Reference		TP08	TP17	TP25	TP33	TP39
		0.4-0.7m	0.4-0.7m	0.5-0.8m	0.4-0.7m	0.4-0.7m
Sample Matrix		Soil	Soil	Soil	Soil	Soil
Date Extracted- (pH 1:5 soil: Water)		9/06/2011	9/06/2011	9/06/2011	9/06/2011	9/06/2011
Date Analysed (pH 1:5 Soil: Water)		9/06/2011	9/06/2011	9/06/2011	9/06/2011	9/06/2011

Inorganics Our Reference:	UNITS	SE88017-6	SE88017-7	SE88017-8	SE88017-9	SE88017-1 0
Your Reference		TP53 0.4-0.7m	TP12 1.6-1.7m	TP16 1.1-1.2m	TP38 1.3-1.4m	TP60 1.5-1.6m
Sample Matrix		Soil	Soil	Soil	Soil	Soil
Date Extracted- (pH 1:5 soil: Water)		9/06/2011	9/06/2011	9/06/2011	9/06/2011	9/06/2011
Date Analysed (pH 1:5 Soil: Water)		9/06/2011	9/06/2011	9/06/2011	9/06/2011	9/06/2011
pH 1:5 soil:water	pH Units	6.2	6.8	6.9	6.0	5.9



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PROJECT: URS Aust Paling Yards Wind Farm Project 43167888

Anions in soil						
Our Reference:	UNITS	SE88017-1	SE88017-2	SE88017-3	SE88017-4	SE88017-5
Your Reference		TP08	TP17	TP25	TP33	TP39
		0.4-0.7m	0.4-0.7m	0.5-0.8m	0.4-0.7m	0.4-0.7m
Sample Matrix		Soil	Soil	Soil	Soil	Soil
Date Extracted		9/06/2011	9/06/2011	9/06/2011	9/06/2011	9/06/2011
Date Analysed		9/06/2011	9/06/2011	9/06/2011	9/06/2011	9/06/2011
Chloride, Cl 1:5 soil:water	mg/kg	22	14	3.7	30	56
Sulphate, SO4 1:5 soil:water	mg/kg	6.4	47	11	12	16

Anions in soil Our Reference:	UNITS	SE88017-6	SE88017-7	SE88017-8	SE88017-9	SE88017-1
Your Reference		TP53 0.4-0.7m	TP12 1.6-1.7m	TP16 1.1-1.2m	TP38 1.3-1.4m	0 TP60 1.5-1.6m
Sample Matrix		Soil	Soil	Soil	Soil	Soil
Date Extracted		9/06/2011	9/06/2011	9/06/2011	9/06/2011	9/06/2011
Date Analysed		9/06/2011	9/06/2011	9/06/2011	9/06/2011	9/06/2011
Chloride, Cl 1:5 soil:water	mg/kg	4.3	23	2.4	4.8	7.3
Sulphate, SO4 1:5 soil:water	mg/kg	27	8.7	1.4	0.7	<0.5



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PROJECT: URS Aust Paling Yards Wind Farm Project 43167888

REPORT NO: SE88017

Moisture						
Our Reference:	UNITS	SE88017-1	SE88017-2	SE88017-3	SE88017-4	SE88017-5
Your Reference		TP08	TP17	TP25	TP33	TP39
		0.4-0.7m	0.4-0.7m	0.5-0.8m	0.4-0.7m	0.4-0.7m
Sample Matrix		Soil	Soil	Soil	Soil	Soil
Date Analysed (moisture)		7/06/2011	7/06/2011	7/06/2011	7/06/2011	7/06/2011
Moisture	%	18	25	16	17	11

Moisture Our Reference:	UNITS	SE88017-6	SE88017-7	SE88017-8	SE88017-9	SE88017-1 0
Your Reference		TP53 0.4-0.7m	TP12 1.6-1.7m	TP16 1.1-1.2m	TP38 1.3-1.4m	TP60 1.5-1.6m
Sample Matrix		Soil	Soil	Soil	Soil	Soil
Date Analysed (moisture)		7/06/2011	7/06/2011	7/06/2011	7/06/2011	7/06/2011
Moisture	%	18	19	21	25	19



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Page 4 of 7 Environmental Services Unit 16/33 Maddox Street Alexandria NSW 2015 Australia t+61 (0)2 8594 0400 f+61 (0)2 8594 0499 www.au.sgs.com

Method ID	Methodology Summary
AN101	pH - Measured using pH meter and electrode based on APHA 21st Edition, 4500-H+. For water analyses the results reported are indicative only as the sample holding time requirement specified in APHA was not met (APHA requires that the pH of the samples are to be measured within 15 minutes after sampling).
AN245	A water sample is injected into an eluent stream that passes through the ion chromatographic system where the anions of interest ie Br, Cl, NO2, NO3 and SO4 are separated on their relative affinities for the active sites on the column packing material. Changes to the conductivity and the UV-visible absorbance of the eluent enable identification and quantitation of the anions based on their retention time and peak height or area. APHA 4110 B
AN002	



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 Environmental Services
 Unit 16/33 Maddox Street
 Alexandria NSW 2015
 Australia

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 www.au.sgs.com

PROJECT: URS Aust Paling Yards Wind Farm Project 43167888 REPORT NO: SE88017

QUALITY CONTROL	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate
Inorganics						Base + Duplicate + %RPD
Date Extracted- (pH 1:5 soil: Water)				[NT]	SE88017-1 0	9/06/2011 9/06/2011
Date Analysed (pH 1:5 Soil: Water)				[NT]	SE88017-1 0	9/06/2011 9/06/2011
pH 1:5 soil:water	pH Units	0	AN101	[NT]	SE88017-1 0	5.9 5.9 RPD: 0

QUALITY CONTROL Anions in soil	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Date Extracted				9/06/20 11	SE88017-1	9/06/2011 9/06/2011	SE88017-2	9/06/2011
Date Analysed				9/06/20 11	SE88017-1	9/06/2011 9/06/2011	SE88017-2	9/06/2011
Chloride, Cl 1:5 soil:water	mg/kg	0.25	AN245	<0.2	SE88017-1	22 22 RPD: 0	SE88017-2	101%
Sulphate, SO4 1:5 soil:water	mg/kg	0.5	AN245	<0.5	SE88017-1	6.4 6.7 RPD: 5	SE88017-2	99%

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



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Result Codes [INS] Insufficient Sample for this test : [NR] Not Requested [NT] Not tested :

[LOR] :

Report Comments

[RPD] : Relative Percentage Difference : Not part of NATA Accreditation [N/A] : Not Applicable

Samples analysed as received. Solid samples expressed on a dry weight basis.

Date Organics extraction commenced:

Limit of reporting

NATA Corporate Accreditation No. 2562, Site No 4354

Note: Test results are not corrected for recovery (excluding Air-toxics and Dioxins/Furans*) This document is issued by the Company subject to its General Conditions of Service (www.sgs.com/terms_and_conditions.htm). Attention is drawn to the limitations of liability, indemnification and jurisdictional issues established therein.

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Quality Control Protocol

Method Blank: An analyte free matrix to which all reagents are added in the same volume or proportions as used in sample processing. The method blank should be carried through the complete sample preparation and analytical procedure. A method blank is prepared every 20 samples.

Duplicate: A separate portion of a sample being analysed that is treated the same as the other samples in the batch. One duplicate is processed at least every 10 samples.

Surrogate Spike: An organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples. Surrogates are added to samples before extraction to monitor extraction efficiency and percent recovery in each sample.

Internal Standard: Added to all samples requiring analysis for organics (where relevant) or metals by ICP after the extraction/digestion process; the compounds/elements serve to give a standard of retention time and/or response, which is invariant from run-to-run with the instruments.

Laboratory Control Sample: A known matrix spiked with compound(s) representative of the target analytes. It is used to document laboratory performance. When the results of the matrix spike analysis indicates a potential problem due to the sample matrix itself, the LCS results are used to verify that the laboratory can perform the analysis in a clean matrix.

Matrix Spike: An aliquot of sample spiked with a known concentration of target analyte(s). The spiking occurs prior to sample preparation and analysis. A matrix spike is used to document the bias of a method in a given sample matrix.

Quality Acceptance Criteria

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: http://www.au.sgs.com/sgs-mp-au-env-qu-022-ga-gc-plan-en-09.pdf



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POINT LOAD STRENGTH INDEX

CLIENT: **URS Australia Pty Ltd**

Level 4, 407 Pacific Highway Artarmon NSW 2064

PROJECT: Paling Yard Wind Farm

LAB.	SAMPLE	LITHOLOGY		ATEN	TEST	POINT	POINT	Туре
NO.	SOURCE			RATION	ORIENTATION	LOAD	LOAD	OF
			DIAM (mm)	HEIGHT (mm)		Is (MPa)	STRENGTH Is ₍₅₀₎ (MPa)	FAILURE
68234	BH1-1 5.67 to 5.75m	Not supplied.	60.7	38.2	Diametral Axial	0.36 0.74	0.39 0.77	FOB FOB
68235	BH1-2 9.23 to 9.34m	"	61.1	*	Diametral Axial	0.53 -	0.58 -	FOB -
68236	BH1-3 12.79 to 13m	"	60.7	39.9	Diametral Axial	1.54 1.39	1.68 1.46	FOB FOB
68237	BH1-4 15.6 to 15.7m		61.1	46.0	Diametral Axial	0.38 0.82	0.41 0.88	FIP FIP
68238	BH2-1 6.83 to 6.97m	"	60.7	43.5	Diametral Axial	1.76 3.59	1.92 3.83	FOB FOB
68239	BH2-2 8.83 to 8.91m	"	60.9	41.0	Diametral Axial	0.17 0.20	0.18 0.21	CPF FOB
68240	BH2-3 13.56 to 13.68m		61.1	42.4	Diametral Axial	0.55 0.65	0.60 0.69	FOB FOB
68241	BH2-4 18.68 to 18.8m	"	60.2	*	Diametral Axial	0.84 -	0.92 -	FIP -
NOTES	TO TESTING				I			
Testing Sample	Device History	ELE Point Load Tester Unsoaked	Failure T FOB	Fracture	through fabric of s		ique to beddi	ng
Sample		Client	FB FIP	Fracture Fracture	along bedding influenced by pre- mical alteration		e, microfractu	ure,
Job Nu	mber:	119-259	CPF		partial fracture			
Date Te	ested:	02.08.11	* Insuffic	cient samp	ble to test due to fa	ailure on dian	netral test.	
Test Me	ethod:	AS 4133.4.1 2007					Page 1 of	1
Approv	ved Signatory:	Chris Lloyd			Date: 03	3.08.11		
and the second		This document is issued in acc	cordance with NA	TA's accredi	tation requirements			7

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This is a re-issue of the report dated 02.08.11

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SGS Australia Pty Ltd Unit 15, 33 Maddox Street (PO Box 6432) Alexandria NSW 2015 Australia

EMERSON CRUMB TEST

CLIENT: URS Australia Pty Ltd

Level 4, 407 Pacific Highway Artarmon NSW 2064 PROJECT: Paling Yards Wind Farm Project (43167888)

d by the Company subject to its General Conditions of Se

Laboratory Number:	65694					
Sample Source:	TP08 0.4m to 0.7m	1				
Sample Description:	SILTY CLAY: light	brown, high plasticity,	with fine to coarse gra	avel, trace of fine	e to coarse	sand.
1. IMMERSION						
Doe	es not slake –		Class 7 swells (O	rganic Soils)		
Sla	kes	X	Class 8 does not	swell (Laterised	d)	
2. COMPLETE D	ISPERSION					
Cla	ss 1 complete ss 2 partial Dispersion	x				
3. REMOULDING	G					
	ss 3 disperses es not disperse	X				
4. CARBONATE	& GYPSUM (Acid	Indicator)				
	lss 4 present sent	X				
5. VIGOROUS S	HAKING					
	ss 5 disperses ss 6 no dispersion	X				
EMERSION CLA	SS NO.:	5				
Water used: Dist	tilled water at 20°C		Date Tested:	3.5.11		
Tested By: AB			Sampled By:	Client		
Test Procedure: AS	1289 3.8.1		Job Number:	119-253		
Approved Signatory:	This document is is:	Chris Lloyd	ATA's accreditation requir	ements	Date:	10.5.11

Accreditation No. 1459

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SGS Australia Pty Ltd Unit 15, 33 Maddox Street (PO Box 6432) Alexandria NSW 2015 Australia

DRY DENSITY/MOISTURE CONTENT RELATION

CLIENT: URS Australia Pty Ltd

Level 4, 407 Pacific Highway Artarmon NSW 2064 PROJECT: Paling Yards Wind Farm Project (43167888)



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SGS Australia Pty Ltd Unit 15, 33 Maddox Street (PO Box 6432) Alexandria NSW 2015 Australia

CALIFORNIA BEARING RATIO

CLIENT: URS Australia Pty Ltd

Level 4, 407 Pacific Highway Artarmon NSW 2064

PROJECT: Paling Yards Wind Farm Project (43167888)

Sample Source: Sample Description:	TP08 0.4-0.7m SILTY CLAY: light brown, high plasticity, with fine to	coarse	
	gravel, trace of fine to coarse sand.		
Job Number:	119-253		
Laboratory Number:	65694		
CBR Value @ 2.5mm	3.0	(%)	
CBR Value @ 5.0mm	2.5	(%)	
Sample Data			
Compaction Specification	95% of MDD at OMC		
Maximum Dry Density (MDD)	1.38	(t/m ³)	
Optimum Moisture Content (OMC)	34.0	(%)	
Mass of Surchages	4.5	(kg)	
Number of Days Soaked	4		
Sample Preparation			
Dry Density - Before Soaking	1.31	(t/m ³)	
Dry Density - After Soaking	1.29	(t/m ³)	
Retained on 19mm Sieve	7% excluded	(%)	
Moisture Content - Before Soaking	33.1	(%)	
Laboratory Density Ratio	95.0	(%)	
Laboratory Moisture Ratio	97.0	(%)	
Moisture Content - After Soaking			
Top 30mm of Test Sample	44.8	(%)	
Remainder of Test Sample	36.9	(%)	
Swell After Soaking	1.5	(%)	
Compactive Effort	Standard		
Number of Layers	3		
Blows per Layer	50		
Mass of Rammer	2.7	(kg)	
Drop of Rammer	300	(mm)	
Comments			
Date Tested:	9.5.11		
	Determination of the California Bearing Ratio of a soil		
Standard Laboratory Method for a remo			
Approved Signatory:	Chris Lloyd	Date:	10.5.11
This docum	ent is issued in accordance with NATA's accreditation requirements		

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SGS Australia Pty Ltd Unit 15, 33 Maddox Street (PO Box 6432) Alexandria NSW 2015 Australia

EMERSON CRUMB TEST

CLIENT: URS Australia Pty Ltd

Level 4, 407 Pacific Highway Artarmon NSW 2064 PROJECT: Paling Yards Wind Farm Project (43167888)

d by the Company subject to its General Conditions of Se

Laboratory Number:	65695					
Sample Source:	TP17 0.4m to 0.7m	1				
Sample Description:	SILTY CLAY: red-b	prown, high plasticity, t	race of fine to coarse	sand, trace of fir	ne to coars	e gravel.
1. IMMERSION						
D	oes not slake —		Class 7 swells (O	rganic Soils)		
S	lakes	X	Class 8 does not	swell (Laterised	d) (t	
2. COMPLETE	DISPERSION					
С	lass 1 complete lass 2 partial o Dispersion	x				
3. REMOULDIN	IG					
	lass 3 disperses oes not disperse	X				
4. CARBONAT	E & GYPSUM (Acid	Indicator)				
	lass 4 present bsent	X				
5. VIGOROUS	SHAKING					
	lass 5 disperses lass 6 no dispersion	X				
EMERSION CL	ASS NO.:	5				
Water used: Di	istilled water at 20°C		Date Tested:	3.5.11		
Tested By: Al	В		Sampled By:	Client		
Test Procedure: A	S 1289 3.8.1		Job Number:	119-253		
Approved Signatory:	This document is is:	Chris Lloyd	ATA's accreditation requir		Date:	10.5.11

Accreditation No. 1459

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DRY DENSITY/MOISTURE CONTENT RELATION

CLIENT: URS Australia Pty Ltd

Level 4, 407 Pacific Highway Artarmon NSW 2064 PROJECT: Paling Yards Wind Farm Project (43167888)



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SGS Australia Pty Ltd Unit 15, 33 Maddox Street (PO Box 6432) Alexandria NSW 2015 Australia

CALIFORNIA BEARING RATIO

CLIENT: URS Australia Pty Ltd

Level 4, 407 Pacific Highway Artarmon NSW 2064

PROJECT: Paling Yards Wind Farm Project (43167888)

Sample Source: Sample Description:	TP17 0.4-0.7m SILTY CLAY: red-brown, high plasticity, trace of fine gravel, trace of fine to coarse sand.	to coarse sand,	
Job Number: Laboratory Number:	119-253 65695		
CBR Value @ 2.5mm CBR Value @ 5.0mm	1.5 1.5	(%) (%)	
Sample Data			
Compaction Specification Maximum Dry Density (MDD) Optimum Moisture Content (OMC) Mass of Surchages	95% of MDD at OMC 1.25 41.0 4.5	(t/m ³) (%) (kg)	
Number of Days Soaked	4		
Sample Preparation			
Dry Density - Before Soaking Dry Density - After Soaking	1.17 1.13	(t/m ³) (t/m ³)	
Retained on 19mm Sieve	2% excluded	(%)	
Moisture Content - Before Soaking	41.6	(%)	
Laboratory Density Ratio	94.0	(%)	
Laboratory Moisture Ratio	101.0	(%)	
Moisture Content - After Soaking			
Top 30mm of Test Sample Remainder of Test Sample	54.2 46.1	(%) (%)	
Swell After Soaking	3.9	(%)	
Compactive Effort	Standard		
Number of Layers Blows per Layer Mass of Rammer Drop of Rammer	3 50 2.7 300	(kg) (mm)	
Comments Date Tested:	9.5.11		
Tested in accordance with AS1289.6.1.1 Standard Laboratory Method for a remo	Determination of the California Bearing Ratio of a soil ulded specimen.		
Approved Signatory:	Chris Lloyd	Date:	10.5.11
	ent is issued in accordance with NATA's accreditation requirements		

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EMERSON CRUMB TEST

CLIENT: URS Australia Pty Ltd

Level 4, 407 Pacific Highway Artarmon NSW 2064 PROJECT: Paling Yards Wind Farm Project (43167888)

ed by the Company subject to its General Conditions of Se

Laboratory Numbe	r: 65696					
Sample Source:	TP21 0.4m to 0.7	'n				
Sample Description	n: SILTY CLAY: bro	wn, high plasticty, trace	of fine to coarse sa	nd, trace of fine to	o coarse gr	avel.
1. IMMERSI	ON					
	Does not slake		Class 7 swells (Organic Soils)		
	Slakes	X	Class 8 does no	t swell (Laterise	d)	
2. COMPLE	TE DISPERSION					
	Class 1 complete Class 2 partial No Dispersion	X				
3. REMOUL	DING					
	Class 3 disperses Does not disperse	X				
4. CARBON	ATE & GYPSUM (Aci	d Indicator)				
	Class 4 present Absent	x				
5. VIGOROL	JS SHAKING					
	Class 5 disperses Class 6 no dispersion	X				
EMERSION	CLASS NO.:	5				
Water used:	Distilled water at 20°C		Date Tested:	3.5.11		
Tested By:	AB		Sampled By:	Client		
Test Procedure	e: AS 1289 3.8.1		Job Number:	119-253		
Approved Signatory	in and	Chris Lloyd			Date:	10.5.11
Accreditation No. 1459	This document is	issued in accordance with N	ATA's accreditation requ	uirements]	

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DRY DENSITY/MOISTURE CONTENT RELATION

CLIENT: URS Australia Pty Ltd

Level 4, 407 Pacific Highway Artarmon NSW 2064 PROJECT: Paling Yards Wind Farm Project (43167888)



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SGS Australia Pty Ltd Unit 15, 33 Maddox Street (PO Box 6432) Alexandria NSW 2015 Australia

CALIFORNIA BEARING RATIO

CLIENT: URS Australia Pty Ltd

Level 4, 407 Pacific Highway Artarmon NSW 2064

PROJECT: Paling Yards Wind Farm Project (43167888)

Sample Source:	TP210407m				
Sample Source: Sample Description:	TP21 0.4-0.7m SILTY CLAY: brown, high plasticty, trace of fine to				
	gravel, trace of fine to coarse sand.				
Job Number:	119-253				
Laboratory Number:	65696				
CBR Value @ 2.5mm	1.5	(%)			
CBR Value @ 5.0mm	1.5	(%)			
Sample Data					
Compaction Specification	95% of MDD at OMC				
Maximum Dry Density (MDD)	1.27	(t/m ³)			
Optimum Moisture Content (OMC)	37.5	(%)			
Mass of Surchages	4.5	(kg)			
Number of Days Soaked	4				
Sample Preparation					
Dry Density - Before Soaking	1.21	(t/m ³)			
Dry Density - After Soaking	1.18	(t/m ³)			
Retained on 19mm Sieve	11% excluded	(%)			
Moisture Content - Before Soaking	35.4	(%)			
Laboratory Density Ratio	96.0	(%)			
Laboratory Moisture Ratio	94.0	(%)			
Moisture Content - After Soaking					
Top 30mm of Test Sample	48.5	(%)			
Remainder of Test Sample	44.6	(%)			
Swell After Soaking	3.1	(%)			
Compactive Effort	Standard				
Number of Layers	3				
Blows per Layer	50				
Mass of Rammer	2.7	(kg)			
Drop of Rammer	300	(mm)			
Comments					
Date Tested:	9.5.11				
Tested in accordance with AS1289.6.1.1 D	etermination of the California Bearing Ratio of a soil				
Standard Laboratory Method for a remoul	ded specimen.				
Approved Signatory:	Chris Lloyd	Date:	10.5.11		
This document	is issued in accordance with NATA's accreditation requirements				

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EMERSON CRUMB TEST

CLIENT: URS Australia Pty Ltd

Level 4, 407 Pacific Highway Artarmon NSW 2064 PROJECT: Paling Yards Wind Farm Project (43167888)

d by the Company subject to its General Conditions of Se

Laboratory Number:	65697					
Sample Source:	TP25 0.5m to 0.8i	TP25 0.5m to 0.8m				
Sample Description	: SILTY CLAY: darl gravel.	SILTY CLAY: dark red-brown, medium plasticity, trace of fine to coarse sand, tra gravel.			trace of fine	e to coarse
1. IMMERSIO						
	Does not slake -		Class 7 swells (Organic Soils)		
	Slakes	X	Class 8 does no	t swell (Laterise	ed)	
2. COMPLET	E DISPERSION					
	Class 1 complete Class 2 partial No Dispersion	x				
3. REMOULD	ING					
	Class 3 disperses Does not disperse	X				
4. CARBONA	TE & GYPSUM (Acid	d Indicator)				
	Class 4 present Absent	x				
5. VIGOROUS	S SHAKING					
	Class 5 disperses Class 6 no dispersion	X				
EMERSION C	LASS NO.:	6				
Water used:	Distilled water at 20°C		Date Tested:	3.5.11		
Tested By:	AB		Sampled By:	Client		
Test Procedure:	AS 1289 3.8.1		Job Number:	119-253		
Approved Signatory:	Cigol	Chris Lloyd			Date:	10.5.11
Accreditation No. 1459	This document is i	ssued in accordance with N	ATA's accreditation requ	irements		

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DRY DENSITY/MOISTURE CONTENT RELATION

CLIENT: URS Australia Pty Ltd

Level 4, 407 Pacific Highway Artarmon NSW 2064 PROJECT: Paling Yards Wind Farm Project (43167888)



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SGS Australia Pty Ltd Unit 15, 33 Maddox Street (PO Box 6432) Alexandria NSW 2015 Australia

CALIFORNIA BEARING RATIO

CLIENT: URS Australia Pty Ltd

Level 4, 407 Pacific Highway Artarmon NSW 2064

PROJECT: Paling Yards Wind Farm Project (43167888)

Sample Source:	TP25 0.5-0.8m		
Sample Description:	SILTY CLAY: dark red-brown, medium plasticity, trace	e of	
	gravel, trace of fine to coarse sand.		
Job Number:	119-253		
Laboratory Number:	65697		
CBR Value @ 2.5mm	8	(%)	
CBR Value @ 5.0mm	6	(%)	
Sample Data			
Compaction Specification	95% of MDD at OMC		
Maximum Dry Density (MDD)	1.73	(t/m ³)	
Optimum Moisture Content (OMC)	20.0	(%)	
Mass of Surchages	4.5	(kg)	
Number of Days Soaked	4		
Sample Preparation			
Dry Density - Before Soaking	1.64	(t/m ³)	
Dry Density - After Soaking	1.63	(t/m ³)	
Retained on 19mm Sieve	0	(%)	
Moisture Content - Before Soaking	19.8	(%)	
Laboratory Density Ratio	95.0	(%)	
Laboratory Moisture Ratio	99.0	(%)	
Moisture Content - After Soaking			
Top 30mm of Test Sample	23.7	(%)	
Remainder of Test Sample	22.2	(%)	
Swell After Soaking	0.1	(%)	
Compactive Effort	Standard		
Number of Layers	3		
Blows per Layer	50		
Mass of Rammer	2.7	(kg)	
Drop of Rammer	300	(mm)	
Comments			
Date Tested:	9.5.11		
Tested in accordance with AS1289.6.1.1	1 Determination of the California Bearing Ratio of a soil		
Standard Laboratory Method for a remo	bulded specimen.		
Approved Signatory:	Chris Lloyd	Date:	10.5.11
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EMERSON CRUMB TEST

CLIENT: URS Australia Pty Ltd

Level 4, 407 Pacific Highway Artarmon NSW 2064 PROJECT: Paling Yards Wind Farm Project (43167888)

any subject to its General Conditions of Se

Laboratory Number	: 65698					
Sample Source:	TP30 0.5m to 0.8	m				
Sample Description	SILTY CLAY: red	SILTY CLAY: red brown, medium plasticity, trace of fine to coarse sand, trace			of fine to co	oarse gravel.
1. IMMERSIC	ON					
	Does not slake -		Class 7 swells (Organic Soils)		
	Slakes	X	Class 8 does no	t swell (Laterised	d)	
2. COMPLET	E DISPERSION					
	Class 1 complete Class 2 partial No Dispersion	x				
3. REMOULI	DING					
	Class 3 disperses Does not disperse	x				
4. CARBON	ATE & GYPSUM (Aci	d Indicator)				
	Class 4 present Absent	X				
5. VIGOROU	S SHAKING					
	Class 5 disperses Class 6 no dispersion	X				
EMERSION	CLASS NO.:	5				
Water used:	Distilled water at 20°C		Date Tested:	3.05.11		
Tested By:	AB		Sampled By:	Client		
Test Procedure	: AS 1289 3.8.1		Job Number:	119-253		
Approved Signatory	and the	Chris Lloyd			Date:	10.5.11
Accreditation No. 1459	This document is	issued in accordance with N.	ATA's accreditation requ	uirements		

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DRY DENSITY/MOISTURE CONTENT RELATION

CLIENT: URS Australia Pty Ltd

Level 4, 407 Pacific Highway Artarmon NSW 2064 PROJECT: Paling Yards Wind Farm Project (43167888)



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SGS Australia Pty Ltd Unit 15, 33 Maddox Street (PO Box 6432) Alexandria NSW 2015 Australia

CALIFORNIA BEARING RATIO

CLIENT: URS Australia Pty Ltd

Level 4, 407 Pacific Highway Artarmon NSW 2064

PROJECT: Paling Yards Wind Farm Project (43167888)

Sample Source:	TP30 0.5-0.8m SILTY CLAY: red-brown, medium plasticity, trace of fi		
Sample Description:	ne		
Job Number:	gravel, trace of fine to coarse sand. 119-253		
Laboratory Number:	65698		
CBR Value @ 2.5mm	8	(%)	
CBR Value @ 5.0mm	6	(%)	
Sample Data			
Compaction Specification	95% of MDD at OMC		
Maximum Dry Density (MDD)	1.63	(t/m ³)	
Optimum Moisture Content (OMC)	22.5	(%)	
Mass of Surchages	4.5	(kg)	
Number of Days Soaked	4		
Sample Preparation			
Dry Density - Before Soaking	1.54	(t/m ³)	
Dry Density - After Soaking	1.53	(t/m ³)	
Retained on 19mm Sieve	0	(%)	
Moisture Content - Before Soaking	22.7	(%)	
Laboratory Density Ratio	94.0	(%)	
Laboratory Moisture Ratio	101.0	(%)	
Moisture Content - After Soaking			
Top 30mm of Test Sample	28.0	(%)	
Remainder of Test Sample	13.2	(%)	
Swell After Soaking	0.3	(%)	
Compactive Effort	Standard		
Number of Layers	3		
Blows per Layer	50		
Mass of Rammer	2.7	(kg)	
Drop of Rammer	300	(mm)	
Comments			
Date Tested:	9.5.11		
	Determination of the California Bearing Ratio of a soil		
Standard Laboratory Method for a remou	_		
Approved Signatory:	Chris Lloyd	Date:	10.5.11
		-	
This documer	nt is issued in accordance with NATA's accreditation requirements		

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EMERSON CRUMB TEST

CLIENT: URS Australia Pty Ltd

Level 4, 407 Pacific Highway Artarmon NSW 2064 PROJECT: Paling Yards Wind Farm Project (43167888)

d by the Company subject to its General Conditions of Se

Laboratory Numbe	r: 65699					
Sample Source:	TP33 0.4m to 0.7	7m				
Sample Descriptio	n: CLAYEY SANDY	GRAVEL: brown, fine t	o coarse gravel, fine	to coarse sand,	low plastict	t y .
1. IMMERSI	ON					
	Does not slake		Class 7 swells (Organic Soils)		
	Slakes	X	Class 8 does no	t swell (Laterise	d)	
2. COMPLE	TE DISPERSION					
	Class 1 complete Class 2 partial No Dispersion	x				
3. REMOUL	DING					
	Class 3 disperses Does not disperse	X				
4. CARBON	ATE & GYPSUM (Ac	id Indicator)				
	Class 4 present Absent	x				
5. VIGOROL	JS SHAKING					
	Class 5 disperses Class 6 no dispersion	X				
EMERSION	CLASS NO.:	5				
Water used:	Distilled water at 20°C		Date Tested:	3.05.11		
Tested By:	AB		Sampled By:	Client		
Test Procedure	e: AS 1289 3.8.1		Job Number:	119-253		
Approved Signatory	i Gyd	Chris Lloyd			Date:	10.5.11
Accredition No. 1459	This document is	issued in accordance with N	ATA's accreditation requ	irements]	



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DRY DENSITY/MOISTURE CONTENT RELATION

CLIENT: URS Australia Pty Ltd

Level 4, 407 Pacific Highway Artarmon NSW 2064 PROJECT: Paling Yards Wind Farm Project (43167888)







SGS Australia Pty Ltd Unit 15, 33 Maddox Street (PO Box 6432) Alexandria NSW 2015 Australia

CALIFORNIA BEARING RATIO

CLIENT: URS Australia Pty Ltd

Level 4, 407 Pacific Highway Artarmon NSW 2064

PROJECT: Paling Yards Wind Farm Project (43167888)

Sample Source:	TP33 0.4-0.7m					
Sample Source: Sample Description:	vel, fine to					
	CLAYEY SANDY GRAVEL: brown, fine to coarse gra coarse sand, low plasticty.					
Job Number:	119-253					
Laboratory Number:	65699					
CBR Value @ 2.5mm	10	(%)				
CBR Value @ 5.0mm	12	(%)				
Sample Data						
Compaction Specification	95% of MDD at OMC					
Maximum Dry Density (MDD)	1.61	(t/m ³)				
Optimum Moisture Content (OMC)	24.5	(%)				
Mass of Surchages	4.5	(kg)				
Number of Days Soaked	4					
Sample Preparation						
Dry Density - Before Soaking	1.55	(t/m ³)				
Dry Density - After Soaking	1.55	(t/m ³)				
Retained on 19mm Sieve	0	(%)				
Moisture Content - Before Soaking	25.2	(%)				
Laboratory Density Ratio	96.0	(%)				
Laboratory Moisture Ratio	103.0	(%)				
Moisture Content - After Soaking						
Top 30mm of Test Sample	25.4	(%)				
Remainder of Test Sample	26.9	(%)				
Swell After Soaking	0	(%)				
Compactive Effort	Standard					
Number of Layers	3					
Blows per Layer	50					
Mass of Rammer	2.7	(kg)				
Drop of Rammer	300	(mm)				
Comments						
Date Tested:	9.5.11					
Tested in accordance with AS1289.6.1.1 D	etermination of the California Bearing Ratio of a soil					
Standard Laboratory Method for a remoul	ded specimen.					
Approved Signatory:	Chris Lloyd	Date:	10.5.11			
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EMERSON CRUMB TEST

CLIENT: URS Australia Pty Ltd

Level 4, 407 Pacific Highway Artarmon NSW 2064 PROJECT: Paling Yards Wind Farm Project (43167888)

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Laboratory Numbe	r: 65700					
Sample Source:	TP39 0.4m to 0.7r	n				
Sample Description	n: SILTY CLAY: red-	brown, medium plastic	ty, trace of fine coar	se sand, trace of	fine to coa	rse gravel.
1. IMMERSI	ON					
	Does not slake -		Class 7 swells (Organic Soils)		
	Slakes	X	Class 8 does no	t swell (Laterise	ed)	
2. COMPLE	TE DISPERSION					
	Class 1 complete Class 2 partial No Dispersion	x				
3. REMOUL	DING					
	Class 3 disperses Does not disperse	X				
4. CARBON	ATE & GYPSUM (Acid	d Indicator)				
	Class 4 present Absent	x				
5. VIGOROL	JS SHAKING					
	Class 5 disperses Class 6 no dispersion	X				
EMERSION	CLASS NO.:	6				
Water used:	Distilled water at 20°C		Date Tested:	3.05.11		
Tested By:	AB		Sampled By:	Client		
Test Procedure	e: AS 1289 3.8.1		Job Number:	119-253		
Approved Signatory	in a start	Chris Lloyd			Date:	10.5.11
Accreditation No. 1459	This document is i	ssued in accordance with Na	ATA's accreditation requ	irements		



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DRY DENSITY/MOISTURE CONTENT RELATION

CLIENT: URS Australia Pty Ltd

Level 4, 407 Pacific Highway Artarmon NSW 2064 PROJECT: Paling Yards Wind Farm Project (43167888)







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CLIENT: URS Australia Pty Ltd

Level 4, 407 Pacific Highway Artarmon NSW 2064

PROJECT: Paling Yards Wind Farm Project (43167888)

Sample Description: Job Number: Laboratory Number: CBR Value @ 2.5mm CBR Value @ 5.0mm Sample Data Compaction Specification Maximum Dry Density (MDD) Optimum Moisture Content (OMC) Mass of Surchages Number of Days Soaked Sample Preparation Dry Density - Before Soaking	SILTY CLAY: red-brown, medium plasticity, trace of f trace of fine to coarse gravel. 119-253 65700 5 4	ine coarse sar (%)	nd,				
Laboratory Number: CBR Value @ 2.5mm CBR Value @ 5.0mm Sample Data Compaction Specification Maximum Dry Density (MDD) Optimum Moisture Content (OMC) Mass of Surchages Number of Days Soaked Sample Preparation Dry Density - Before Soaking	119-253 65700 5	(%)					
Laboratory Number: CBR Value @ 2.5mm CBR Value @ 5.0mm <u>Sample Data</u> Compaction Specification Maximum Dry Density (MDD) Optimum Moisture Content (OMC) Mass of Surchages Number of Days Soaked <u>Sample Preparation</u> Dry Density - Before Soaking	65700 5	(%)					
CBR Value @ 2.5mm CBR Value @ 5.0mm Sample Data Compaction Specification Maximum Dry Density (MDD) Optimum Moisture Content (OMC) Mass of Surchages Number of Days Soaked Sample Preparation Dry Density - Before Soaking	5	(%)					
CBR Value @ 5.0mm <u>Sample Data</u> Compaction Specification Maximum Dry Density (MDD) Optimum Moisture Content (OMC) Mass of Surchages Number of Days Soaked <u>Sample Preparation</u> Dry Density - Before Soaking		(%)					
Sample Data Compaction Specification Maximum Dry Density (MDD) Optimum Moisture Content (OMC) Mass of Surchages Number of Days Soaked Sample Preparation Dry Density - Before Soaking	4						
Compaction Specification Maximum Dry Density (MDD) Optimum Moisture Content (OMC) Mass of Surchages Number of Days Soaked <u>Sample Preparation</u> Dry Density - Before Soaking		(%)					
Maximum Dry Density (MDD) Optimum Moisture Content (OMC) Mass of Surchages Number of Days Soaked <u>Sample Preparation</u> Dry Density - Before Soaking							
Optimum Moisture Content (OMC) Mass of Surchages Number of Days Soaked <u>Sample Preparation</u> Dry Density - Before Soaking	95% of MDD at OMC						
Mass of Surchages Number of Days Soaked <u>Sample Preparation</u> Dry Density - Before Soaking	1.75	(t/m ³)					
Number of Days Soaked <u>Sample Preparation</u> Dry Density - Before Soaking	17.0	(%)					
Sample Preparation Dry Density - Before Soaking	4.5	(kg)					
Dry Density - Before Soaking	4						
	1.66	(t/m ³)					
Dry Density - After Soaking	1.66	(t/m ³)					
Retained on 19mm Sieve	0	(%)					
Moisture Content - Before Soaking	17.6	(%)					
Laboratory Density Ratio	95.0	(%)					
Laboratory Moisture Ratio	104.0	(%)					
Moisture Content - After Soaking							
Top 30mm of Test Sample	21.8	(%)					
Remainder of Test Sample	21.6	(%)					
Swell After Soaking	0.2	(%)					
Compactive Effort	Standard						
Number of Layers	3						
Blows per Layer	50						
Mass of Rammer	2.7	(kg)					
Drop of Rammer	300	(mm)					
Comments							
Date Tested:	9.5.11						
Tested in accordance with AS1289.6.1.1 Determ	nination of the California Bearing Ratio of a soil						
Standard Laboratory Method for a remoulded s	pecimen.						
Approved Signatory:	Chris Lloyd	Date:	10.5.11				
This document is issu							

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Laboratory Numbe	r: 65701					
Sample Source:	TP48 0.4m to 0.7	'n				
Sample Description	n: SANDY GRAVEL	LY CLAY: yellow-browr	ı, medium plasticity,	fine to coarse gra	vel, fine to	coarse sand.
1. IMMERSIO	ON					
	Does not slake		Class 7 swells (Organic Soils)		
	Slakes	X	Class 8 does no	t swell (Laterise	d)	
2. COMPLE	TE DISPERSION					
	Class 1 complete Class 2 partial No Dispersion	X				
3. REMOUL	DING					
	Class 3 disperses Does not disperse	X				
4. CARBON	ATE & GYPSUM (Aci	d Indicator)				
	Class 4 present Absent	x				
5. VIGOROL	JS SHAKING					
	Class 5 disperses Class 6 no dispersion	X				
EMERSION	CLASS NO.:	5				
Water used:	Distilled water at 20°C		Date Tested:	3.5.11		
Tested By:	AB		Sampled By:	Client		
Test Procedure	e: AS 1289 3.8.1		Job Number:	119-253		
Approved Signatory	in Compare	Chris Lloyd			Date:	10.5.11
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Level 4, 407 Pacific Highway Artarmon NSW 2064

PROJECT: Paling Yards Wind Farm Project (43167888)

Sample Source:	TP48 0.4-0.7m					
Sample Description:	SANDY GRAVELLY CLAY: yellow-brown, medium plasticity, fine					
lab Number	to coarse gravel, fine to coarse sand.					
Job Number:	119-253					
Laboratory Number:	65701					
CBR Value @ 2.5mm	2.0	(%)				
CBR Value @ 5.0mm	2.5	(%)				
Sample Data						
Compaction Specification	95% of MDD at OMC					
Maximum Dry Density (MDD)	1.67	(t/m ³)				
Optimum Moisture Content (OMC)	18.0	(%)				
Mass of Surchages	4.5	(kg)				
Number of Days Soaked	4					
Sample Preparation						
Dry Density - Before Soaking	1.60	(t/m ³)				
Dry Density - After Soaking	1.56	(t/m ³)				
Retained on 19mm Sieve	0	(%)				
Moisture Content - Before Soaking	17.6	(%)				
Laboratory Density Ratio	96.0	(%)				
Laboratory Moisture Ratio	98.0	(%)				
Moisture Content - After Soaking						
Top 30mm of Test Sample	28.4	(%)				
Remainder of Test Sample	24.5	(%)				
Swell After Soaking	2.2	(%)				
Compactive Effort	Standard					
Number of Layers	3					
Blows per Layer	50					
Mass of Rammer	2.7	(kg)				
Drop of Rammer	300	(mm)				
Comments						
Date Tested:	9.5.11					
Tested in accordance with AS1289.6.1.1	Determination of the California Bearing Ratio of a soil					
Standard Laboratory Method for a remou	Ided specimen.					
Approved Signatory:	Chris Lloyd	Date:	10.5.11			
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Laboratory Number	: 65702					
Sample Source:	TP53 0.4m to 0.7r	n				
Sample Description	: GRAVELLY CLAY	1: dark brown, medium	plasticity, fine to coar	se gravel, trace of f	ine to coa	arse sand.
1. IMMERSIC	DN					
	Does not slake -		Class 7 swells (C	Organic Soils)		
	Slakes	X	Class 8 does not	swell (Laterised)		
2. COMPLET	E DISPERSION					
	Class 1 complete Class 2 partial No Dispersion	x				
3. REMOULD	DING					
	Class 3 disperses Does not disperse	X				
4. CARBONA	ATE & GYPSUM (Acid	d Indicator)				
	Class 4 present Absent	x				
5. VIGOROU	S SHAKING					
	Class 5 disperses Class 6 no dispersion	X				
EMERSION (CLASS NO.:	5				
Water used:	Distilled water at 20°C		Date Tested:	3.05.11		
Tested By:	AB		Sampled By:	Client		
Test Procedure:	AS 1289 3.8.1		Job Number:	119-253		
Approved Signatory:		Chris Lloyd ssued in accordance with N.	ATA's accreditation requi		ate:	10.5.11

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PROJECT: Paling Yards Wind Farm Project (43167888)

Sample Source:	TP53 0.4-0.7m						
Sample Description: GRAVELLY CLAY: dark brown, medium plasticity, fine to							
	coarse gravel, trace of fine to coarse sand.						
Job Number:	119-253						
Laboratory Number:	65702						
CBR Value @ 2.5mm	6	(%)					
CBR Value @ 5.0mm	5	(%)					
Sample Data							
Compaction Specification	95% of MDD at OMC						
Maximum Dry Density (MDD)	1.60	(t/m ³)					
Optimum Moisture Content (OMC)	25.5	(%)					
Mass of Surchages	4.5	(kg)					
Number of Days Soaked	4						
Sample Preparation							
Dry Density - Before Soaking	1.53	(t/m ³)					
Dry Density - After Soaking	1.53	(t/m ³)					
Retained on 19mm Sieve	24% excluded	(%)					
Moisture Content - Before Soaking	24.2	(%)					
Laboratory Density Ratio	96.0	(%)					
Laboratory Moisture Ratio	95.0	(%)					
Moisture Content - After Soaking							
Top 30mm of Test Sample	30.6	(%)					
Remainder of Test Sample	26.2	(%)					
Swell After Soaking	0	(%)					
Compactive Effort	Standard						
Number of Layers	3						
Blows per Layer	50						
Mass of Rammer	2.7	(kg)					
Drop of Rammer	300	(mm)					
Comments							
Date Tested:	9.5.11						
Tested in accordance with AS1289.6.1.1	Determination of the California Bearing Ratio of a soil						
Standard Laboratory Method for a remo	ulded specimen.						
Approved Signatory:	Chris Lloyd	Date:	10.5.11				
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Laboratory Numbe	r: 65703					
Sample Source:	TP57 0.4m to 0.7	'n				
Sample Description	n: SILTY CLAY: dar	k brown, high plasticity,	trace of fine to coar	se sand, trace of	fine to coa	rse gravel.
1. IMMERSI	ON					
	Does not slake		Class 7 swells (Organic Soils)		
	Slakes	X	Class 8 does no	t swell (Laterise	ed)	
2. COMPLE	TE DISPERSION					
	Class 1 complete Class 2 partial No Dispersion	X				
3. REMOUL	DING					
	Class 3 disperses Does not disperse	X				
4. CARBON	ATE & GYPSUM (Aci	d Indicator)				
	Class 4 present Absent	x				
5. VIGOROL	JS SHAKING					
	Class 5 disperses Class 6 no dispersion	X				
EMERSION	CLASS NO.:	5				
Water used:	Distilled water at 20°C		Date Tested:	3.05.11		
Tested By:	AB		Sampled By:	Client		
Test Procedure	e: AS 1289 3.8.1		Job Number:	119-253		
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Level 4, 407 Pacific Highway Artarmon NSW 2064

PROJECT: Paling Yards Wind Farm Project (43167888)

Sample Source:	TP57 0.4-0.7m				
Sample Description:	-				
	fine to coarse sand, trace of fine to coarse gravel.				
Job Number:	119-253				
Laboratory Number:	65703				
CBR Value @ 2.5mm	4.0	(%)			
CBR Value @ 5.0mm	4.0	(%)			
Sample Data					
Compaction Specification	95% of MDD at OMC				
Maximum Dry Density (MDD)	1.41	(t/m ³)			
Optimum Moisture Content (OMC)	32.5	(%)			
Mass of Surchages	4.5	(kg)			
Number of Days Soaked	4				
Sample Preparation					
Dry Density - Before Soaking	1.34	(t/m ³)			
Dry Density - After Soaking	1.31	(t/m ³)			
Retained on 19mm Sieve	1% excluded	(%)			
Moisture Content - Before Soaking	32.4	(%)			
Laboratory Density Ratio	95.0	(%)			
Laboratory Moisture Ratio	100.0	(%)			
Moisture Content - After Soaking					
Top 30mm of Test Sample	40.9	(%)			
Remainder of Test Sample	35.7	(%)			
Swell After Soaking	1.8	(%)			
Compactive Effort	Standard				
Number of Layers	3				
Blows per Layer	50				
Mass of Rammer	2.7	(kg)			
Drop of Rammer	300	(mm)			
Comments					
Date Tested:	9.5.11				
Tested in accordance with AS1289.6.1.1	Determination of the California Bearing Ratio of a soil				
Standard Laboratory Method for a remou	-				
Approved Signatory:	Chris Lloyd	Date:	10.5.11		
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Sample Source: TP12 1.6m to 1.7m Sample Description: SILTY GRAVELLY SAND: yellow-brown, fine to coarse sand, fine to med 1. IMMERSION Does not slake → Class 7 swells (Organic So Slakes X Class 8 does not swell (Lat 2. COMPLETE DISPERSION Class 1 complete Class 2 partial No Dispersion X 3. REMOULDING Image: Complete	
1. IMMERSION Does not slake → Class 7 swells (Organic So Slakes X Class 8 does not swell (Lat 2. COMPLETE DISPERSION Class 1 complete Class 2 partial X No Dispersion X	
Does not slake → Class 7 swells (Organic So Slakes X Class 8 does not swell (Lat 2. COMPLETE DISPERSION Class 1 complete Class 2 partial X No Dispersion X	
Slakes X Class 8 does not swell (Lat 2. COMPLETE DISPERSION Class 1 complete Class 1 complete Class 2 partial No Dispersion X	
2. COMPLETE DISPERSION Class 1 complete Class 2 partial No Dispersion X	IS)
Class 1 complete Class 2 partial No Dispersion X	erised)
Class 2 partial No Dispersion X	
3. REMOULDING	
Class 3 disperses Does not disperse X	
4. CARBONATE & GYPSUM (Acid Indicator)	
Class 4 present Absent X	
5. VIGOROUS SHAKING	
Class 5 disperses X Class 6 no dispersion	
EMERSION CLASS NO.: 5	
Water used: Distilled water at 20°C Date Tested: 3.05.11	
Tested By: AB Sampled By: Client	
Test Procedure: AS 1289 3.8.1 Job Number: 119-253	
Approved Signatory: Chris Lloyd This document is issued in accordance with NATA's accreditation requirements	

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Laboratory Numbe	er: 65705					
Sample Source:	TP16 1.1m to 1.2	2m				
Sample Descriptio	n: SILTY CLAY: bro	own, high plasticity, trace	e of fine to coarse sa	and, with fine to me	dium grav	el.
1. IMMERSI	ON					
	Does not slake		Class 7 swells (Organic Soils)		
	Slakes	X	Class 8 does no	ot swell (Laterised	i)	
2. COMPLE	TE DISPERSION					
	Class 1 complete Class 2 partial No Dispersion	x				
3. REMOUL	DING					
	Class 3 disperses Does not disperse	X				
4. CARBON	ATE & GYPSUM (Ac	id Indicator)				
	Class 4 present Absent	x				
5. VIGOROU	JS SHAKING					
	Class 5 disperses Class 6 no dispersion	X				
EMERSION	CLASS NO.:	5				
Water used:	Distilled water at 20°C		Date Tested:	3.05.11		
Tested By:	AB		Sampled By:	Client		
Test Procedure	e: AS 1289 3.8.1		Job Number:	119-253		
Approved Signatory	i cont	Chris Lloyd			Date:	10.5.11
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Laboratory Numbe	r: 65706					
Sample Source:	TP22 1.4m to 1.4	5m				
Sample Descriptio	n: SILTY CLAY: ye	llow-brown, medium plas	sticity, trace of fine to	o coarse sand and	d fine to co	arse gravel.
1. IMMERSI	ON					
	Does not slake	>	Class 7 swells (Organic Soils)		
	Slakes	X	Class 8 does no	ot swell (Laterise	ed)	
2. COMPLE	TE DISPERSION					
	Class 1 complete Class 2 partial No Dispersion	x				
3. REMOUL	DING					
	Class 3 disperses Does not disperse	X				
4. CARBON	ATE & GYPSUM (Ac	id Indicator)				
	Class 4 present Absent	X				
5. VIGOROL	JS SHAKING					
	Class 5 disperses Class 6 no dispersion	x				
EMERSION	CLASS NO.:	6				
Water used:	Distilled water at 20°C		Date Tested:	3.05.11		
Tested By:	AB		Sampled By:	Client		
Test Procedure	e: AS 1289 3.8.1		Job Number:	119-253		
Approved Signatory	i Copel	Chris Lloyd			Date:	10.5.11
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Laboratory Numbe	r: 65707					
Sample Source:	BH24 1.2 to 1.3m					
Sample Descriptio	n: CLAYEY SAND: d	lark-brown, fine to coar	rse sand, low plastici	ty, trace of fine g	ravel.	
1. IMMERSI	ON					
	Does not slake –		Class 7 swells (Organic Soils)		
	Slakes	Χ	Class 8 does no	t swell (Laterise	ed)	
2. COMPLE	TE DISPERSION					
	Class 1 complete Class 2 partial No Dispersion	x				
3. REMOUL	DING					
	Class 3 disperses Does not disperse	X				
4. CARBON	ATE & GYPSUM (Acid	Indicator)				
	Class 4 present Absent	X				
5. VIGOROL	JS SHAKING					
	Class 5 disperses Class 6 no dispersion	X				
EMERSION	CLASS NO.:	5				
Water used:	Distilled water at 20°C		Date Tested:	3.05.11		
Tested By:	АВ		Sampled By:	Client		
Test Procedure	e: AS 1289 3.8.1		Job Number:	119-253		
Approved Signatory	i Cipel	Chris Lloyd			Date:	03.08.11
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Laboratory Number	: 65708					
Sample Source:	TP28 1.1m to 1.2r	n				
Sample Description	SILTY CLAY: red-	brown, high plasticity,	race of fine to coars	e sand and fine g	gravel.	
1. IMMERSIO	DN					
	Does not slake -		Class 7 swells (Organic Soils)		
	Slakes	Χ	Class 8 does no	t swell (Laterise	ed)	
2. COMPLET	E DISPERSION					
	Class 1 complete Class 2 partial No Dispersion	x				
3. REMOULD	DING					
	Class 3 disperses Does not disperse	X				
4. CARBONA	ATE & GYPSUM (Acid	d Indicator)				
	Class 4 present Absent	x				
5. VIGOROU	S SHAKING					
	Class 5 disperses Class 6 no dispersion	X				
EMERSION	CLASS NO.:	6				
Water used:	Distilled water at 20°C		Date Tested:	3.05.11		
Tested By:	AB		Sampled By:	Client		
Test Procedure	: AS 1289 3.8.1		Job Number:	119-253		
Approved Signatory:	and	Chris Lloyd			Date:	10.5.11
Accreditation No. 1459	This document is i	ssued in accordance with N	ATA's accreditation requ	irements		

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Level 4, 407 Pacific Highway Artarmon NSW 2064 PROJECT: Paling Yards Wind Farm Project (43167888)

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Laboratory Numbe	r: 65709					
Sample Source:	TP34 1.4m to 1.5	ōm				
Sample Descriptio	n: SILTY CLAY: gre	ey-brown/ brown, high pl	asticity, trace of fine	to coarse sand a	Ind fine gra	vel.
1. IMMERSI	ON					
	Does not slake		Class 7 swells (Organic Soils)		
	Slakes	X	Class 8 does no	ot swell (Laterise	ed)	
2. COMPLE	TE DISPERSION					
	Class 1 complete Class 2 partial No Dispersion	x				
3. REMOUL	DING					
	Class 3 disperses Does not disperse	X				
4. CARBON	ATE & GYPSUM (Aci	d Indicator)				
	Class 4 present Absent					
5. VIGOROL	JS SHAKING					
	Class 5 disperses Class 6 no dispersion					
EMERSION	CLASS NO.:	3				
Water used:	Distilled water at 20°C		Date Tested:	3.05.11		
Tested By:	AB		Sampled By:	Client		
Test Procedure	e: AS 1289 3.8.1		Job Number:	119-253		
Approved Signatory	in a start	Chris Lloyd			Date:	10.5.11
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EMERSON CRUMB TEST

CLIENT: URS Australia Pty Ltd

Level 4, 407 Pacific Highway Artarmon NSW 2064 PROJECT: Paling Yards Wind Farm Project (43167888)

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Laboratory Number	r: 65710					
Sample Source:	TP38 1.3m to 1.4	m				
Sample Description	n: SANDY SILT: rec	l-brown, low plasticity, f	ine to medium sand.			
1. IMMERSIO	NC					
	Does not slake -		Class 7 swells (Organic Soils)		
	Slakes	X	Class 8 does no	t swell (Laterise	ed)	
2. COMPLET	TE DISPERSION					
	Class 1 complete Class 2 partial No Dispersion	x				
3. REMOULI	DING					
	Class 3 disperses Does not disperse	X				
4. CARBON	ATE & GYPSUM (Aci	d Indicator)				
	Class 4 present Absent	x				
5. VIGOROU	IS SHAKING					
	Class 5 disperses Class 6 no dispersion	X				
EMERSION	CLASS NO.:	6				
Water used:	Distilled water at 20°C		Date Tested:	3.05.11		
Tested By:	AB		Sampled By:	Client		
Test Procedure	: AS 1289 3.8.1		Job Number:	119-253		
Approved Signatory	light	Chris Lloyd			Date:	10.5.11
Accreditation No. 1459	This document is	issued in accordance with N	ATA's accreditation requ	lirements		

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EMERSON CRUMB TEST

CLIENT: URS Australia Pty Ltd

Level 4, 407 Pacific Highway Artarmon NSW 2064 PROJECT: Paling Yards Wind Farm Project (43167888)

ny subject to its General Co

Laboratory Numbe	r: 65711					
Sample Source:	TP42 1.2m to 1.3	m				
Sample Description	n: SILTY CLAY: dar	k red-brown, high plasti	city, trace of fine to	coarse sand, trace	of fine to c	coarse gravel.
1. IMMERSI	ON					
	Does not slake		Class 7 swells (Organic Soils)		
	Slakes	X	Class 8 does no	t swell (Laterised)	
2. COMPLE	TE DISPERSION					
	Class 1 complete Class 2 partial No Dispersion	x				
3. REMOUL	DING					
	Class 3 disperses Does not disperse	X				
4. CARBON	ATE & GYPSUM (Aci	d Indicator)				
	Class 4 present Absent	x				
5. VIGOROL	JS SHAKING					
	Class 5 disperses Class 6 no dispersion	X				
EMERSION	CLASS NO.:	5				
Water used:	Distilled water at 20°C		Date Tested:	3.05.11		
Tested By:	AB		Sampled By:	Client		
Test Procedure	e: AS 1289 3.8.1		Job Number:	119-253		
Approved Signatory	i Cogol	Chris Lloyd		I	Date:	10.5.11
Accreditation No. 1459	This document is	issued in accordance with N.	ATA's accreditation requ	uirements		

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CLIENT: URS Australia Pty Ltd

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Laboratory Numbe	er: 65712					
Sample Source:	TP50 1.5m to	1.6m				
Sample Descriptio	n: SILTYCLAY:	brown, high plasticity, tr	ace of fine to medium s	and.		
1. IMMERSI	ON					
	Does not slake		 Class 7 swells (Organic Soils)		
	Slakes	X	Class 8 does no	t swell (Lateris	ed)	
2. COMPLE	TE DISPERSION					
	Class 1 complete Class 2 partial No Dispersion	x				
3. REMOUL	DING					
	Class 3 disperses Does not disperse	X				
4. CARBON	ATE & GYPSUM (/	Acid Indicator)				
	Class 4 present Absent	x				
5. VIGOROU	JS SHAKING					
	Class 5 disperses Class 6 no dispers	ion X				
EMERSION	CLASS NO.:	5				
Water used:	Distilled water at 20°	С	Date Tested:	3.05.11		
Tested By:	AB		Sampled By:	Client		
Test Procedure	e: AS 1289 3.8.1		Job Number:	119-253		
Approved Signatory	1: Copel	Chris Lloyd			Date:	10.5.11
Accreditation No. 1459	This document	nt is issued in accordance wit	th NATA's accreditation requ	uirements		

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tion and jurisdictional issues established therein.



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EMERSON CRUMB TEST

CLIENT: URS Australia Pty Ltd

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Laboratory Numbe	e r: 65713					
Sample Source:	TP60 1.5m to 1.6r	n				
Sample Descriptio	n: SILTYCLAY: brow	n, high plasticity, trace	of fine to coarse sa	nd, trace of fine g	ravel.	
1. IMMERSI	ON					
	Does not slake -		Class 7 swells (Organic Soils)		
	Slakes	X	Class 8 does no	t swell (Laterise	d)	
2. COMPLE	TE DISPERSION					
	Class 1 complete Class 2 partial No Dispersion	x				
3. REMOUL	DING					
	Class 3 disperses Does not disperse	X				
4. CARBON	ATE & GYPSUM (Acid	Indicator)				
	Class 4 present Absent	X				
5. VIGOROU	JS SHAKING					
	Class 5 disperses Class 6 no dispersion	X				
EMERSION	CLASS NO.:	6				
Water used:	Distilled water at 20°C		Date Tested:	3.05.11		
Tested By:	АВ		Sampled By:	Client		
Test Procedure	e: AS 1289 3.8.1		Job Number:	119-253		
Approved Signatory	i Cipel	Chris Lloyd			Date:	10.5.11
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SOIL CLASSIFICATION TEST DATA

CLIENT: URS Australia Pty Ltd

Level 4, 407 Pacific Highway Artarmon NSW 2064

Paling Yards Wind Farm Project (43167888)

LAB NO.	SAMPLE SOURCE	SAMPLE DESCRIPTION	MOISTURE CONTENT (%)	DRY DENSITY (t/m ³)	liquid Limit	PLASTIC INDEX	PREPAR- ATION & HISTORY	LINEAR SHRINK (%)
			1		2	3	4	5
65694	TP08 0.4m to 0.7m	SILTY CLAY: light brown, high plasticity, plasticity, with fine to coarse gravel, trace trace of fine to coarse sand.	26.1	-	-	-	-	-
65695	TP17 0.4m to 0.7m	SILTY CLAY: red-brown, high plasticity, plasticity, trace of fine to coarse sand and fine to coarse gravel.	32.6	-	-	-	-	-
65696	TP21 0.4m to 0.7m	SILTY CLAY: red-brown, high plasticity, plasticity, trace of fine to coarse sand and fine to coarse gravel.	32.6	-	-	-	-	-
65697	TP25 0.5m to 0.8m	SILTY CLAY: dark red-brown, medium plasticity, trace of fine to coarse sand and fine to coarse grav.	19.6	-	-	-	-	-
65698	TP30 0.5m to 0.8m	SILTY CLAY: red-brown, medium plasticity, trace of fine to coarse sand and fine to coarse gravel.	16.1	-	-	-	-	-
65699	TP33 0.4m to 0.7m	CLAYEY SANDY GRAVEL: brown, fine to coarse gravel, fine to coarse sand, low plasticity.	19.7	-	-	-	-	-
65700	TP39 0.4m to 0.7m	SILTY CLAY: red-brown, medium plasticity, trace of fine to coarse sand and fine to coarse gravel.	14.4	-	-	-	-	-
65701	TP48 0.4m to 0.7m	SANDY GRAVELLY CLAY: yellow- brown, medium plasticity, fine to coarse gravel, fine to coarse sand.	17.6	-	-	-	-	-
NOTES "	TO TESTING		1			1		
	Test Method:	AS 1289 2.1.1		Sampled	By:	Client		
				Job Numb	ber:	119-253		
				Date Test	od.	3.5.11		
Appro	oved Signatory:	Cipe	Chris Lloyd				Date: 10.5.11	

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Level 4, 407 Pacific Highway Artarmon NSW 2064

Paling Yards Wind Farm Project (43167888)

LAB NO.	SAMPLE SOURCE	SAMPLE DESCRIPTION	MOISTURE CONTENT (%) 1	DRY DENSITY (t/m³)	LIQUID LIMIT 2	PLASTIC INDEX 3	PREPAR- ATION & HISTORY 4	LINEAR SHRINK. (%) 5
65702	TP53 0.4m to 0.7m	GRAVELLY CLAY: dark-brown, medium plasticity, fine to coarse gravel, trace of fine to coarse sand.	24.2	-	-	-	-	-
65703	TP57 0.4m to 0.7m	SILTY CLAY: dark-brown, high plasticity, trace of fine to coarse sand and fine to coarse gravel.	28.5	-	-	-	-	-
65704	TP12 1.6m to 1.7m	SILTY GRAVELLY SAND: yellow-brown, fine to coarse sand, fine to medium gravel, low plasticity.	26.8	-	-	-	-	-
65705	TP16 1.1m to 1.2m	SILTY CLAY: brown, high plasticity, trace of fine to coarse sand, with fine to medium gravel.	32.5	-	-	-	-	-
65706	TP22 1.4m - 1.5m	SILTY CLAY: yellow-brown, medium plasticity, trace of fine to coarse sand and fine to coarse gravel.	22.7	-	-	-	-	-
65707	TP24 1.2m to 1.3m	CLAYEY SAND: dark-brown, fine to coarse sand, low plasticity, trace of fine gravel.	17.8	-	-	-	-	-
65708	TP28 1.1m to 1.2m	SILTY CLAY: red-brown, high plasticity, trace of fine to coarse sand and fine gravel.	28.0	-	-	-	-	-
65709	TP34 1.4m to 1.5m	SILTY CLAY: grey-brown/ brown, high plasticity, trace of fine to coarse sand and fine gravel.	40.0	-	-	-	-	-
NOTES 1	TO TESTING							
	Test Method:	AS 1289 2.1.1		Sampled	By:	Client		
				Job Numb	ber:	119-253		
				Date Test	ed:	3.5.11		
Appro	oved Signatory:	cipe	Chris Lloyd				Date: 10.5.11	



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Paling Yards Wind Farm Project (43167888)

LAB	SAMPLE	SAMPLE DESCRIPTION	MOISTURE			PLASTIC		LINEAR
NO.	SOURCE		CONTENT		LIMIT	INDEX	ATION &	SHRINK.
			(%)	(t/m ³)			HISTORY	(%)
			1		2	3	4	5
65710	TP38 1.3m to 1.4m	SANDY SILT: red-brown, low plasticity, fine to medium sand.	31.8	-	-	-	-	-
65711	1.2m to 1.3m	SILTY CLAY: dark red-brown, high plasticity, trace of fine to coarse sand, trace of fine gravel.	26.1	-	-	-	-	-
65712		SILTY CLAY: brown, high plasticity, trace of fine to medium sand.	35.9	-	-	-	-	-
65713		SILTY CLAY: brown, high plasticity, trace of fine to coarse sand, trace of fine gravel.	20.7	-	-	-	-	-
NOTES	TO TESTING Test Method:	AS 1289 2.1.1		Sampled	By:	Client		
				Job Numb	ber:	119-253		
				Date Test	ed:	3.5.11		
Appro	oved Signatory:	Cigal	Chris Lloyd				Date: 10.5.11	
ilac	MRA NAT	This document is issued in accordance with NATA	A's accreditation	n requirements				
Accreditation	No. 1459							



		- h . N	200540			Oceanala No.	440000	
		ob No.:	306540	arda Wind Form		_ Sample No.: Date:	1103299 11/08/11	
	Project: Client:			ards Wind Farm stralia Pty Ltd		Date.	11/00/11	
	•.		01107100			_		
	Test Pit No:		8		Depth:	0.50 - 0.80m		
est N	lethod	I Used :	Reference	Doc. IEEE Guide for Soil F	Resistivity Measurer	ments. (IEEE Std 442 - 1981)	
	S	Sample History	y:	100% Standard E	Effort @ as re	cieved Moisture Co	ntent	
Resi	stivity	Meter:	TC1396	Needle ID.:	0239	Needle Resistance:	82.93 Ohm/m	
Sam	ple D	escription:	Clay					
				1	EST RESULTS	;		
Μ	loistu	ure Content	Compa	cted Wet Density	Thermal Co	-	Thermal Resistivity	
		<u>(%)</u> 2.3	t/m ³		(W / r 0.2		(m K / W) 4.76	
		9.9	 1.582		0.2		2.86 2.63 1.32	
		12.5 27.0			0.3			
	6 -	Thermal F	Resistivity Dr	ry Out Curve	Ther	mal Resistivity Dry Out Cu	rve - Log Scale	
Thermal Resistivity (m K/W)	6 - 4 - 2 -	Thermal F	Resistivity Dr	y Out Curve		mal Resistivity Dry Out Cu	rve - Log Scale	



	Thermal Resistivi	ty Dryout (Curve Reports	Page 1 of 1	
Job No.:	306540		Sample No.:	1103338	
Project:	Paling Yards Wind Farm		Date:	15/08/11	
Client:	URS Australia Pty Ltd		_		
Test Pit No:	15	Depth:	0.50 - 0.80m		
Method Used :	Reference Doc. IEEE Guide for Soil I	Resistivity Measurer	nents. (IEEE Std 442 - 1981))	
Sample History	100% Standard I	Effort @ as re	cieved Moisture Co	ntent	
stivity Meter:	TC1396 Needle ID.:	0239	Needle Resistance:	82.93 Ohm/m:	
ple Description:	Clay				
loisture Content				Thermal Resistivity	
			-	(m K / W) 4.55	
12.4				3.03	
19.4				2.44	
4		srmal Resistivity (m KW)			
0 10	20 30 40 Moisture Content (%)	ب 0 ــــــــــــــــــــــــــــــــــــ	10 Moisture Conte	100 Pont (%)	
5	Project: Client: Test Pit No: lethod Used : Sample History stivity Meter: ole Description: oisture Content (%) 3.5 12.4 19.4 29.0 Thermal Re 6 4 2 2 1 2	Job No.: 306540 Project: Paling Yards Wind Farm Client: URS Australia Pty Ltd Test Pit No: 15 Identified Used : Reference Doc. IEEE Guide for Soll I Sample History: 100% Standard I Sample History: TC1396 Sample History: Clay oisture Content Compacted Wet Density (%) t/m³ 3.5 12.4 19.4 29.0 1.546	Job No.: 306540 Project: Paling Yards Wind Farm Client: URS Australia Pty Ltd Test Pit No: 15 Depth: lethod Used : Reference Doc. IEEE Guide for Soil Resistivity Measurer Sample History: 100% Standard Effort @ as re- stivity Meter: TC1396 Needle ID.: 0239 ble Description: Clay TEST RESULTS oisture Content Compacted Wet Density Thermal Co (%) (W/r 3.5 0.2 12.4 0.4 29.0 1.546 0.6 Thermal Resistivity Dry Out Curve Ther for for for for for for for for for for	Project: Paling Yards Wind Farm Date: Client: URS Australia Pty Ltd Date: Test Pit No: 15 Depth: 0.50 - 0.80m lethod Used : Reference Doc. IEEE Guide for Soil Resistivity Measurements. (IEEE Std 442 - 1981) Sample History: 100% Standard Effort @ as recieved Moisture Co stivity Meter: T C1396 Needle ID.: 0239 Needle Resistance: ole Description: Clay Test RESULTS Thermal Conductivity (W / m K) 3.5 0.41 0.68 Depth 0.68 Thermal Resistivity Dry Out Curve Thermal Resistivity Dry Out Curve Thermal Resistivity Dry Out Curve Thermal Resistivity Dry Out Curve	



			GEOTECHNICS		Page 1 of 1	
		Thermal Resistiv	ity Dryout (Curve Reports		
Job No.:		306540		Sample No.:	1103300	
	Project:	Paling Yards Wind Farm		Date:	11/08/11	
	Client:	URS Australia Pty Ltd		-		
	Test Pit No:	17	Depth:	0.50 - 0.80m		
est N	Method Used :	Reference Doc. IEEE Guide for Soil	Resistivity Measurer	nents. (IEEE Std 442 - 1981)	
	Sample Histor	ry: 100% Standard	Effort @ as re	cieved Moisture Co	ontent	
lesi	stivity Meter:	TC1396 Needle ID.:	0239	Needle Resistance:	82.93 Ohm/m:	
Sam	ple Description:	Clay				
		TEST RESUL				
N	loisture Content (%)	Compacted Wet Density t/m ³	Thermal Co (W / r	•	Thermal Resistivity (m K / W) 4.00 2.38 2.17 1.33	
	4.3		0.2			
	11.7		0.4			
	<u>14.4</u> 32.3	1.392	0.4 0.7			
Thermal Resistivity (m K/W)			Thermal Resistivity (m K/W)			
Rem	0 10 0 10	20 30 40 Moisture Content (%)	0	Moisture Cont	tent (%)	
est	ed by : AC/Kł	C Date : 5 - 10-Aug-11	Checked by	AC Date:	: 11-Aug-11	



	Job No.:	306540			Sample No.:	1103301	
Project:			ards Wind Farm		Date:	11/08/11	
	Client:		stralia Pty Ltd		_		
					_		
Т	est Pit No:	21		Depth:	0.50 - 0.80m		
t Meth	od Used :	Reference	Doc. IEEE Guide for Soil I	Resistivity Measure	ments. (IEEE Std 442 - 198 ⁻)	
	Sample History	<i>r</i> :	100% Standard I	Effort @ as re	cieved Moisture Co	ontent	
sistiv	ity Meter:	TC1396	Needle ID.:	0239	Needle Resistance:	82.93 Ohm/m	
mple	Description:	Clay					
			TEST RESUL	TS			
Mois	sture Content	Compacted Wet Density		Thermal Co	-	Thermal Resistivity	
	(%) 2.9		t/m ³	(W / 1 0.2	•	(m K / W) 4.00	
	11.3			0.2		2.70	
	13.9			0.4		2.44	
	32.3		1.529	0.95		1.05	
e 4 2	4	×		Thermal Resistivity (m K/W)			
C	0 10	20 Moisture Co	30 40 ntent (%)	0	10 Moisture Con	tent (%)	



Job No.: Project:		306540 Paling Yards Wind Farm			Sample No.: Date:	1103302 11/08/11	
	Client			tralia Pty Ltd		Date.	11/00/11
	Test Pit	t No:	25		Donth		
	Test FI	L NO.	25		Depth:	0.50 - 0.80m	
est M	ethod Use	d :	Reference	Doc. IEEE Guide for Soil	Resistivity Measu	rements. (IEEE Std 442 - 198	1)
	Sam	ple History	/:	100% Standard	Effort @ as	recieved Moisture Co	ontent
Resis	tivity Me	ter:	TC1396	Needle ID.:	0239	Needle Resistance:	82.93 Ohm/m:
Samp	ole Descr	ription:	Clay				
				TEST RESUL	TS		
M	oisture (Content	Compacted Wet Density t/m³ 1.947			Conductivity	Thermal Resistivity
	(%))			(W	/ m K)	(m K / W)
	2.).55	1.82
	5.).77	1.30
	<u>6.</u> 19.).84 2.51	1.19 0.40
Thermal Resistivity (m K/W)	2			0	Thermal Resistivity (m K/W)		
	0		0 Moisture Co	20 30 ntent (%)	0 -	10 Moisture Con	100 tent (%)



						/	Page 1 of 1
			The	rmal Resistiv	ity Dryout	Curve Reports	
Job No.:		306540			Sample No.:	1103303	
		oject:	¥	ards Wind Farm		Date:	11/08/11
Client: Test Pit No:		URS Aus	stralia Pty Ltd		_		
		30		Depth:	0.50 - 0.80m		
st N	lethod	Used :	Reference Doc. IEEE Guide for Soil Resistivity Measurem			ements. (IEEE Std 442 - 198	31)
	S	Sample History	/:	100% Standard	Effort @ as re	cieved Moisture C	ontent
sis	stivity	Meter:	TC1396	Needle ID.:	0239	Needle Resistance:	82.93 Ohm/m:
١m	ple D	escription:	Clay				
				TEST RESUL	тѕ		
Μ	oistu	ire Content	Compa	cted Wet Density		onductivity	Thermal Resistivity
		(%)	t/m ³ 1.600		(W /	m K)	(m K / W)
		2.4				24	4.17
		6.4				.3	3.33
		8.0 17.1			0 0.:	39	2.56 1.82
I nermal kesistivity (m k/w)	6 - 4 - 2 -				Thermal Resistivity (m K/W)		
	0 -	0	10 Moisture Co	20 ntent (%)	0 1	Moisture Con	ntent (%)
	arks:						
ste	ed by	: AC/KK	Date :	5 - 10-Aug-11	Checked b	y: AC Date	e: 11-Aug-11



	Job No.:		306540			Sampl	e No.:	1103305	
	Project:		Paling Ya	ards Wind Farm		Da	te:	11/08/11	
		ient:		tralia Pty Ltd					
				-					
	Tes	t Pit No:	39		Dept	h: 0.50 - 0.80ı	n		
est N	lethod	Used :	Reference	Doc. IEEE Guide for Soil I	Resistivity Mea	surements. (IEEE Std	442 - 1981)	
	S	Sample Histor	y:	100% Standard I	Effort @ as	s recieved Mois	ture Co	ntent	
Resi	stivity	Meter:	TC1396	Needle ID.:	0239	Needle Res	istance:	82.93 Ohm	n/m:
Sam	ple De	escription:	Clay						
				TEST RESUL	TS				
N	loistu	re Content	Compacted Wet Density t/m ³ 1.820			I Conductivity		Thermal Resistivity	
		(%)			(W / m K) 0.5 0.62 0.63 1.36			(m K / W)	
		2.6 4.1						2.00	
		4.9					1.59		
		13.7						0.74	
Thermal Resistivity (m K/W)	2 -	0			Thermal Resistivity (m K/W) 5				
	0 -)	10 Moisture Co	20 ntent (%)	0 1	Mo	10 sture Cont	ent (%))
Head Office: 32 Fiveways Boulevard

KEYSBOROUGH VIC 3173



		Thermal Resistivi	ity Dryout (Curve Reports	Page 1 of 1	
Job No.: 306540			Sample No.:		1103339	
	Project: Client:	Paling Yards Wind Farm URS Australia Pty Ltd		_ Date:	15/08/11	
	Test Pit No:	41	Depth:	– 0.50 - 0.80m		
Test Method Used :		Reference Doc. IEEE Guide for Soil	Resistivity Measurer	nents. (IEEE Std 442 - 1981)	
	Sample History	100% Standard	Effort @ as re	cieved Moisture Co	ntent	
Resistivity Meter:		TC1396 Needle ID.:	0239	Needle Resistance:	82.93 Ohm/m:	
Sam	ple Description:	Clay				
			TEST RESULTS			
Moisture Content (%)		Compacted Wet Density t/m ³	Thermal Co (W / n	-	Thermal Resistivity (m K / W)	
	0.0		0.2		4.17	
	11.4		0.41		3.03 2.44 1.47	
	20.3 31.0	1.642				
Thermal Resistivity (m K/W)			Thermal Resistivity (m K/W)			
	0 10	20 30 40	0	10 Moisture Cont	ent (%)	

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			Ther	mal Resistiv	ity Dryout	Curve Reports	
Job No.: Project:		306540 Paling Yards Wind Farm			Sample No.:	1103308	
					Date:	11/08/11	
	C	lient:	URS Austr	alia Pty Ltd			
	Test Pit No:		57		Depth:	0.50 - 0.80m	
est N	Vethod	Used :	Reference D	oc. IEEE Guide for Soil	Resistivity Measur	ements. (IEEE Std 442 - 19	81)
	S	Sample History	/:	100% Standard	Effort @ as r	ecieved Moisture C	content
₹esi	stivity	Meter:	TC1396	Needle ID.:	0239	Needle Resistance	: 82.93 Ohm/m:
Sam	ple D	escription:	Clay				
				TEST RESUL	TS		
N	loistu	are Content	Compac	ted Wet Density	Thermal C	onductivity	Thermal Resistivity
		<u>(%)</u> 4.3		t/m ³		m К) .3	(m K / W) 3.33
		4.3				42	2.38
		14.5				45	2.22
		32.3		1.596	0.86		1.16
Thermal Resistivity (m K/W)	4 -		Resistivity Dry	Out Curve	Thermal Resistivity (m K/W)	ermal Resistivity Dry Out (Curve - Log Scale
	0 -	0 10	20 Moisture Cont	30 40 ent (%)	0 	Moisture Co	100 ntent (%)
Rem	arks:	:					
est	ed by	: AC/KK	Date :	5 - 10-Aug-11	Checked b	y: AC Dat	e: 11-Aug-11

Appendix G Electrical Resistivity Results



G





WTG 38 Location and ERS line



Appendix G – Dipole-Dipole ERS Cross-Sectional Results near BH2 at WTG38



WTG 38 Location and ERS line









Appendix G – Schlumberger ERS Cross-Sectional Results near BH1 at WTG9





Appendix G – Dipole-Dipole ERS Cross-Sectional Results near BH1 at WTG9



WTG 9 Location and ERS line



Appendix G – Wenner Alpha ERS Cross-Sectional Results near BH1 at WTG9



WTG 9 Location and ERS line





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