Preliminary Geotechnical Investigation
Proposed Containment Cell Site
Clay Borrow Pit

Prepared for:
Hydro Aluminium Kurri Kurri Pty Ltd

Prepared by:
ENVIRON Australia Pty Ltd

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ENVIRON

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Contents

Acronyms and Abbreviations

CBP	Clay Borrow Pit
ha	hectare
m	metres
mAHD	metres in reference to the Australian Height Datum
m/sec	metres per second (hydraulic conductivity)
mbtoc	metres below top of casing
mbgl	metres below ground level
mg/L	milligrams per Litre
mS/cm	milli Siemans per centimetre (electrical conductivity)
SPL	Spent Pot Linings
SPT	Standard Penetration Testing

1 Introduction

1.1 Preface

The following report presents the results of a preliminary geotechnical investigation undertaken for an area immediately to the west of the Main Plant site of the Hydro Aluminium Kurri Kurri Smelter. The subject site comprises an approximately 7 ha cleared area known as the “Clay Borrow Pit” (CBP). This investigation was commissioned to assess this area for potential use as a containment cell.

The investigation was conducted in July and early August 2014 and comprised field works including the excavation of test pits and drilling of boreholes to identify and characterise the soil and groundwater conditions beneath the site. A series of in-situ tests were undertaken and representative soil samples were collected and submitted to a material testing laboratory for completion of a regime of soil characterisation testing.

The location of the Hydro smelter and CBP within the Smelter Buffer Zone is presented in **Figure 1**.

1.2 Aims and Objectives

The aim of the investigation was to provide a preliminary characterisation of the geotechnical conditions over the clay borrow pit site in order to assess the site’s suitability for location of a proposed containment cell.

The investigation addressed those conditions which will be critical in determining whether the CBP site is a feasible location for construction of the onsite containment cell.

Specifically:

- to investigate and characterise the nature of site soil profiles and assess the depth of clay materials;
- determine representative physical geotechnical parameters for the site clays to evaluate their suitability for containment cell construction and provide input to the containment cell design;
- establishing the extent of the clay resources in the CBP area;
- to investigate the nature of groundwater occurrence under the site, establishing depths to groundwater and conduct in-situ hydraulic conductivity (aquifer) testing to determine groundwater flow directions and velocities; and
- to identify any site geological/hydrogeological conditions which may constrain the suitability of the CBP for containment cell construction, which may include; the presence of hitherto undetected transmissive soils (eg sands, gravels etc) and/or underlying strata (eg highly fractured bedrock).

1.3 Scope of Work

In order to achieve the aim and objectives for the investigation, the following scope of work was undertaken over the period, mid-July and early August 2014:

- Drilling of five boreholes, located around and across the CBP site to investigate the soil and rock profiles and identify any encountered groundwater;
- In-situ testing within the boreholes assessing soil strength and providing a determination of the soil rock interface;
- Coring upper rock profiles to gain an understanding of rock-type and potential structures/defects which may have the potential for preferred pathway transmission of groundwater;
- Construction of groundwater monitoring wells in each of the boreholes;
- Single well aquifer tests in selected wells to ascertain preliminary aquifer parameters;
- Excavation of test pits across the Clay Borrow Pit site to expose soil, (clay), profiles (all pits were excavated until effective refusal or to extent of reach of backhoe);
- Logging of soil profile and collection of representative soil (clay), samples;
- Survey of all sample locations;
- Establishment of groundwater flow direction;
- Submission of clay samples to a testing laboratory for a range of clay characterisation tests, including Atterberg limits, grain-size analysis (sieving and hydrometer), moisture-density ratio, (compaction testing) and permeability testing using potable water and also a typical leachate mixture which may potentially result from emplacement of spent pot lining wastes (one of the waste streams proposed for the containment cell)[1]; and
- Preparation of this report summarising the results.

[1] The leachate was obtained from Hydro's leachate interception system for the existing waste containment, located on the eastern side of the plant site.

2 Background

2.1 Site Location and Description

The CBP site is located immediately west of the main smelter facility within Lot 319 in DP755321.

The topography of the site comprise a south-west-north-east trending ridge line with heights up to approx. 26 mAHD. The ridge rises towards the west-south-west and slopes away to the north-west, south-east and east, and is bisected by tributaries of Black Waterholes Creek in the lower valleys. (**Figure 2**).

The CBP is comprises a mainly open area surrounded on three side (north, west and south) by bushland of mature trees and lower scrub. The land slopes down towards the east where a water course and associated wetlands of Black Waterholes Creek (a tributary of Swamp Creek) separates the site from the main smelter area.

The open, cleared part of this area is approximately 7ha and is currently partially covered by stockpiles of construction wastes, including broken asphalt, concrete and refractory bricks. The stockpiles are spread out and around the access road and form an elevated filled layer across the central part of the site. The eastern part of the cleared portion was formerly excavated for the winning of clay for the purpose of capping a waste stockpile on the main smelter site. The resultant void has been backfilled with refractory brick and capped with topsoils. Refer to **Figure 2**.

Removal of construction materials from the CBP is proposed to be completed by mid 2015.

2.2 Site Geology and Hydrogeology

The 1:100,000 Newcastle Coalfields map indicates the geology of the Hydro site comprises the Lower Permian-aged Dalwood Group, a sequence of mudstones, sandstones, shales siltstones, conglomerate and tuff, which form the local bedrock.

Regional groundwater is expected to follow topography and flow northeast towards surface water bodies that feed into the Hunter River.

Boreholes were drilled in the CBP as part of the ENVIRON Phase 2 Study, (ENVIRON 2012). Well MW03 was drilled in the vicinity of the CBP and showed residual clays from the surface and groundwater encountered at a depth of approximately 9m below ground surface.

2.3 Previous Investigations

As part of the initial Phase 2 Environmental Assessment, (ENVIRON 2012), of the smelter site, the following scope of works was undertaken:

- Drilling of a total of five boreholes across the CBP area to depths of up to 16m depth, drilling to near refusal using solid augers. A groundwater monitoring well was constructed in each of the boreholes.
- Excavation of five test pits in the north-eastern area of the CBP, mainly targeting the filled area as shown on **Figure 2**.
- Sampling of groundwater and soils, and laboratory analysis of samples for a range of potential site contaminants.

Relevant findings from the 2012 investigation include:

- A profile of fill (bricks, concrete in a sandy silty matrix), observed to a maximum depth of 5m, overlying residual clay soils grading down to weathered siltstones and sandstones.
- The fill was at its thickest in the former filled void left by removal of clays in the 1990's.
- Groundwater was perched within the granular filled materials on top of the residual clays.
- Boreholes drilled outside of the filled area encountered a weathered profile, including residual clays grading to weathered siltstone/sandstone.
- Groundwater levels in the non-fill wells rose to within approximately 5 m of the surface, and were considered likely to be perched within the weathered zones in the residual/upper weathered rock profile.

The locations of the 2012 investigation pits and boreholes are shown in **Figure 2**. Borehole and test pit logs are presented in **Appendix A**.

3 Field and Laboratory Investigations

The following is a detailed description of the scope and methodology of the investigations undertaken for the preliminary geotechnical assessment.

3.1 Borehole Investigation

Over the period, 15 to 18 July 2014, a total of five boreholes were drilled at selected locations across the CBP site.

These included:

CBP1	north-west corner
CBP2	western boundary
CBP3	south-western area
CBP4	south-eastern area
CBP5	central Clay Borrow Pit

These locations were designed to provide an effective spread of data across the CBP allowing for the 2012 investigation locations.

All boreholes were drilled using solid augers to advance the hole through overlying soils. At regular intervals (nominally 1.5m – the end of each rod), Standard Penetration Testing, (SPT), was undertaken to assess soil strength and allow sampling/logging from specific depth.

At effective refusal of the SPT (and/or the auger bit), drilling was continued using a HQ-sized core barrel to recover two to three metres of rock core. As the coring process introduced water into the borehole, it was no longer possible to assess the presence of groundwater once coring had commenced.

Borelogs are contained in **Appendix A.** The location of boreholes across the CBP are shown in **Figure 2**. Photographs of recovered core are presented in **Appendix B**.

3.2 Groundwater Monitoring Well Installation and testing

At the completion of coring, boreholes were further extended to a maximum depth of 20m, using a blade bit, where there had been no indication of groundwater to the depth at which coring commenced.

A groundwater monitoring well was constructed in the completed borehole using 50mm PVC screens and casing, backfilled across the screened section, (over the bottom three metres), using select-size gravel pack, and then sealed within the borehole annulus using bentonite, (minimum one metre thickness). The remaining hole annulus was backfilled and then cemented to the surface. The well was completed by installation of a protective steel monument, concreted over the protruding PVC casing. Well construction details are presented on borelogs contained in **Appendix A**.

Each well was developed using a bailer to remove drilling water and sediment until either five bore volumes (ie, volume of water contained within the casing and surrounding gravel pack), had been removed or the well bailed dry.

In all cases, bailing water from the wells resulted in reduction of water levels to the bottom of the casing with very slow water level recovery.

Following the initial drilling works and well development, preliminary aquifer tests were undertaken in two selected wells to assess aquifer parameters. Water was rapidly removed from each well and water levels were regularly monitored until recovery had occurred. Recovery rates were assessed and transmissivity/hydraulic conductivities derived.

As part of the groundwater assessment, water levels in all wells (including wells from the 2012 investigation), were measured following groundwater stabilisation to provide groundwater levels and groundwater flow direction/s to be assessed.

3.3 Test Pit Investigation

A total of eight test pits, (designated TP101 – TP108), were excavated across the site using a backhoe, (Case 580), to provide information specific to the soil profile and also allow the collection of bulk soil, (clay) samples for testing. Two additional pits from a separate investigation into the fill layer, are also included , (RB 17 and RB 22).

The test pit investigation was conducted over the period, 6th to 7th August 2014.

Test pits were located to complement the borehole locations and investigation locations from the 2012 assessment. Each excavation was advanced to either practical refusal, or to the limit of the backhoe's reach. Each test pit was logged and representative samples of the soil profiles were collected in sufficient quantity to allow for the prescribed series of testing.

Test pit log are presented in **Appendix A**. The location of the test pits are shown in **Figure 2**. Photographs of test pit soil profiles are presented in **Appendix C**.

The table below provides a summary of the investigation test pits

Table 1 Test Pit Details

No.	Location	Total Depth	Termination	Notes
TP101	Central CBP (topographic high point)	3.7	Very hard digging	
TP102	North-west corner	2.9	Very hard digging	
TP103	Western CBP	2.15	Very hard digging	
TP104	South-western corner CBP (up track)	1.6	Very hard digging	
TP105	Southern CBP	2.5	Very hard digging	
TP106	South-eastern CBP	2.5	Very hard digging	
TP107	Eastern CBP (near base of slope)	2.6	Very hard digging	
TP108	North-eastern CBP(up fire trail)	1.7	Very hard	

			digging	
RB17	Mid-eastern slope of CBP area	2.0	Investigation of fill only	Fill layer overlying residual clays
RB22	Mid-eastern slope of CBP area	2.8	Investigation of fill only	Fill layer overlying residual clays. Water perched on clay

NB *CBP is Clay Borrow Pit*

3.4 Survey

All boreholes and wells (excluding MW02) were surveyed for location and levels (to the top of the casing and ground surface). All test pits were also surveyed for surface levels and location. Levels were given relative to the Australian Height Datum (AHD) and locations were expressed in the MGA 56 system.

The survey report is attached as **Appendix D** and reduced levels are also presented on the borelogs in **Appendix A**.

3.5 Laboratory Testing

A total of 10 samples, from the soil profiles exposed in the test pits, were submitted to SGS Australia Pty Ltd, (SGS).

The samples underwent testing to determine the following suite of physical parameters:

- moisture content (in-situ), (AS 1289.2.1.1) – *all samples*;
- atterberg limits, including liquid limit, plastic limit, plasticity index (AS 1289.3.1.2, 3.2.1, 3.3.1) – *all samples*;
- moisture density ratio (determination of maximum dry density and optimum moisture content under a standard compactive effort), (AS 1289.5.1.1) - *5 samples*;
- grain size analysis with sieving and hydrometer to determine clay/silt/sand/gravel fractions – *all samples*;
- constant head permeability (AS1289.6.7.3), using both potable water and supplied leachate[2] as a permeant - *5 samples*

Laboratory test results are summarized in **Table E1** and full laboratory reports are presented in **Appendix E**.

A brief discussion of the results is presented in the following sections.

[2] The leachate supplied was collected from the leachate interception system for the existing SPL containment on the eastern side of the site. The leachate contained elevated concentrations of fluoride (770 mg/L) and cyanide, (17 mg/L, total cyanide), and a pH of 10. The leachate typically has salinities of up to 27mS/cm

4 Investigation Results

The following presents the results of the investigation discussing sub-surface geology of the site, results of testing of clay materials identified and presence and nature of the groundwater.

4.1 Subsurface Conditions

The following generalised soil profile was encountered across the clay borrow pit site (as observed within the bore holes and test pits):

A veneer of topsoil and/or slopewash/colluvial soils comprising silty sands/sandy silts with some gravel (and in one case, clayey sand fill), was encountered, overlying a profile of weathered in-place siltstone/shale/sandstone as residual, sandy silty clays, and gravelly clays becoming extremely weathered rock. The clays had low to medium plasticity, with occasional higher plasticity and were generally very stiff to hard.

In the backhoe-excavated test pits, practical refusal (or in the case of TP101 – a combination of limit of reach and refusal for excavator bucket), was encountered at depths ranging from 1.6m (TP104 in the access track in the south-west CBP area) to 3.7m (TP101 in the central CBP area). Typically the deeper pit/s were towards the higher elevations, and the pits where refusal was encountered at a shallower depth (TP104 and TP108) were on the lower slopes.

The borehole testing was undertaken using standard penetration testing to estimate the beginning of rock. Typically harder drilling (indicating a profile more characteristic of extremely weathered rock), was encountered at depths between 4 to 6m again with the deeper soil profile present in the higher topographic areas (CBP5). Refusal of the SPT occurred at depths ranging from 4.5m (CBP1 and 4), to 8.5m (CBP5).

Table 2 summarizes the interpreted depth to rock (as defined by SPT refusal).

The implication is that the overlying soil materials primarily comprise clays and silty clays with layers/lenses of relict extremely weathered rock including iron cemented layers.

Table 2 Details of CPB Boreholes

Borehole	Location	Depth to Rock/Approximate Interpreted Clay Thickness (m)
CBP1	North-west corner of CBP (approx. 22mAHD)	4.5
CBP2	West CBP boundary (approx. 24mAHD)	7.5
CBP3	South-west corner of CBP (approx. 21mAHD)	6
CBP4	South-east CBP (approx. 19mAHD)	4.5
CBP5	Central CBP (approx. 19mAHD)	8.5

In general, the rock comprised massively-bedded sandstones, or more thinly bedded siltstones, down to laminated shales. The rock profiles exposed in the cored sections were generally tight, with few defects visible.

4.2 Groundwater

No test pits in the current investigation encountered groundwater, to a maximum depth of 2.8m.

The boreholes generally did not encounter free groundwater during the auger drilling through the surface soils (to a maximum depth of 8m). Minor traces of water were noted in CBP2 and CBP5 at 7.2m and 6.5m, respectively, however, after the boreholes were left open for several hours, no free groundwater developed. All boreholes were then cored from the soil/rock interface, (as defined by SPT refusal), for two to three meters, and subsequently reamed out to a depth of between 16 and 20m, where wells were installed.

Water levels in the wells, (including the 2012 wells), were measured following development, (25 July 2014).

Table 3 below presents groundwater levels in the 2014 wells, CBP1 to CPB5 and also in the 2012 wells, MW01, MW03, MW04 and MW05.

Table 3 Clay Borrow Pit Water Levels (25 July 2014)

Well	Water Level (mbtoc)	Water Level (mbgl)	Reduced Water Level (mAHD)	Depth to Rock (mbgl)
CBP1	13.10	12.47	9.36	4.5
CBP2	3.99	3.35	20.80	7.5
CBP3	4.99	4.34	16.39	6
CBP4	3.28	2.55	16.48	4.5
CBP5	4.17	3.63	22.12	8.5
MW1	3.27	2.51	19.58	10
MW2	na	na	na	9.5
MW3	5.07	4.32	19.05	9.5
MW4	1.60	0.84	18.1	9
MW5	2.52	1.77	22.30	not encountered

Notes:
mbtoc - metres below top of casing
mbgl - metres below ground level
mAHD - reduced levels to Australian Height Datum
na not applicable (MW02 did not encounter groundwater)

Measurements indicate that water levels in all wells had recovered to within about 3 to 5 m of the surface. The exception is CBP1 which had a water level more than 12m below surface.

Given that no indication of groundwater was encountered during drilling of the soil profile, it is considered that the groundwater represents an aquifer present in the secondary porosity of the underlying rock profile (ie, within the rock defects- -joints etc), confined by the overlying clays. The water levels represent the piezometric pressure produced by groundwater at higher topographic levels, up-hydraulic gradient.

This groundwater conceptual model is supported by MW02 which was drilled to a depth of 16m through residual clay soils and into weathered rock but which showed no evidence of groundwater, (although left open to test for groundwater production). No well was subsequently constructed in MW02.

The anomalously low water level in CBP1 may indicate the discontinuous nature of the aquifer.

It also should be noted that MW05, which is included in the above table, was constructed wholly within the filled profile and reflects a perched aquifer in those materials.

Comparison of water levels (reduced to AHD), indicating preliminary groundwater flow directions are presented in **Figure 2**. It should be noted that the interpreted groundwater contours have not included data from MW05 or CBP1 due to their anomalous water levels.

Following well construction and development, preliminary aquifer testing was undertaken to provide an indication of basic aquifer parameters.

A rising head test was conducted on wells, CBP2 and CBP3 and results were reviewed using the Hvorslev and Theis recovery methods (**Appendix F).**

The tests which involved rapid removal of water from the wells followed by monitoring of water level recovery indicated hydraulic conductivities of between $1E10^{-7}$ and $1E10^{-8}$ m/sec.

4.3 Clay Testing

Ten representative samples of clay recovered from the test pits were submitted to a materials testing laboratory for determination of a suite of physical geotechnical charateristics, including, moisture content, atterberg limits, grainsize analysis, moisture-density relationship (under a standard compactive effort), and intrinsic permeability (using both potable water and site-derived leachate as a permeant).

A summary of testing results is presented in **Table E-1.** Full laboratory testing results are attached as **Appendix E**.

Generally the results showed the clay materials to be a mixture of clayey silts and silty clays with low to medium plasticity and with very low permeabilities.

5 Conclusions

A preliminary geotechnical assessment was undertaken for the site of a containment cell, proposed to be constructed as part of the Hydro site remediation.

The aim of the investigation was to provide a preliminary characterisation of the geotechnical conditions over the clay borrow pit site in order to assess the site's suitability for location of a proposed containment cell.

This included assessment of:

- the nature of site soil profiles and assess the depth of clay materials;
- determine representative physical geotechnical parameters for the site clays to evaluate their suitability for containment cell construction and provide input to the containment cell design;
- establishing the extent of the clay resources in the CBP area;
- to investigate the nature of groundwater occurrence under the site, establishing depths to groundwater and conduct in-situ hydraulic conductivity (aquifer) testing to determine groundwater flow directions and velocities; and
- to identify any site geological/hydrogeological conditions which may constrain the suitability of the CBP for containment cell construction.

The investigation scope of included:

- Review of existing information;
- Drilling of five boreholes, installation of groundwater monitoring wells and excavation of eight test pits across the site;
- Conduct of in-situ strength testing in overlying clays and aquifer characetization testing to determine basic aquifer parameters;
- Collection of representative clay samples and submission for laboratory materials testing to characterize clay soils

The following conclusions were drawn, based on the results of the investigation:

- Drilling and excavation found (under a veneer of fill/topsoil/colluvium), a profile of weathered in-place residual clays overlying siltstones, shales and sandstones of the Lower Permian-aged Dalwood Group - a sequence of mudstones, sandstones, shales siltstones, conglomerate and tuff, which form the local bedrock. The cored rock was massive with minimal defects noted;
- The clays were encountered at all investigated locations across the site;
- No significant groundwater was encountered during drilling of the overlying residual clays, however once wells had been installed into the completed boreholes water levels, with the exception of CBP1, recovered to within 4 to 5m of the surface;

- Preliminary aquifer testing indicated hydraulic conductivities of approximately 1E-7m/sec to 1E-8 m/sec. The aquifer is assumed to be contained within the existing rock defects (joints/weathered zones).
- It was considered that the groundwater on site is present as a confined aquifer in the secondary porosity of the underlying rock mass, (in joints etc), and the depth of water below the ground surface reflects piezometric pressure. MW02 (from 2012 investigation), encountered clays and weathered rock but did not encounter groundwater, (no well was constructed) supporting the site conceptual groundwater model as a confined aquifer. The disparity in the water level in CBP1 (in the north-west corner of the site), also suggests a potentially discontinuous character to the aquifer;
- Testing of the soil samples from test pits indicated very low permeability clays.

6 References

ENVIRON, Environmental Site Assessment, Alcan Mound, Kurri Kurri Aluminium Smelter, December 2012 (ENVIRON 2012).

Department of Mineral Resources, “1:100,000 Newcastle Coalfield Regional Geology”, Edition 1 1994

7 Limitations

ENVIRON Australia prepared this report in accordance with the scope of work as outlined in our proposal to Hydro Aluminium Kurri Kurri Pty Ltd and in accordance with our understanding and interpretation of current regulatory standards.

A representative program of sampling and laboratory analyses was undertaken as part of this investigation, based on past and present known uses of the site. While every care has been taken, concentrations of contaminants measured may not be representative of conditions between the locations sampled and investigated. We cannot therefore preclude the presence of materials that may be hazardous.

Site conditions may change over time. This report is based on conditions encountered at the site at the time of the report and ENVIRON disclaims responsibility for any changes that may have occurred after this time.

The conclusions presented in this report represent ENVIRON’s professional judgment based on information made available during the course of this assignment and are true and correct to the best of ENVIRON’s knowledge as at the date of the assessment.

ENVIRON did not independently verify all of the written or oral information provided to ENVIRON during the course of this investigation. While ENVIRON has no reason to doubt the accuracy of the information provided to it, the report is complete and accurate only to the extent that the information provided to ENVIRON was itself complete and accurate.

This report does not purport to give legal advice. This advice can only be given by qualified legal advisors.

7.1 User Reliance

This report has been prepared exclusively for Hydro Aluminium Kurri Kurri Pty Ltd and may not be relied upon by any other person or entity without ENVIRON’s express written permission.

Figures

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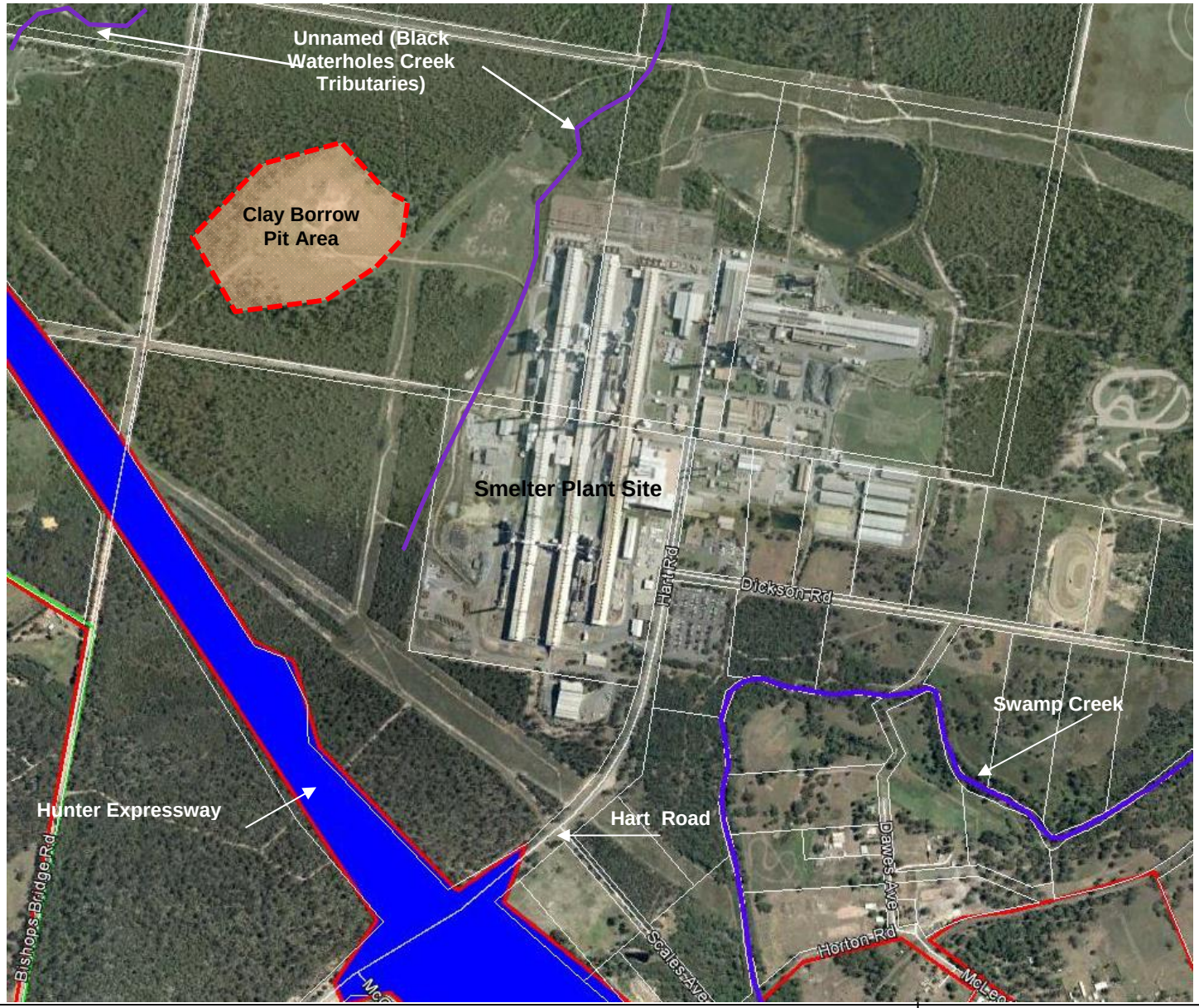

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Site Location

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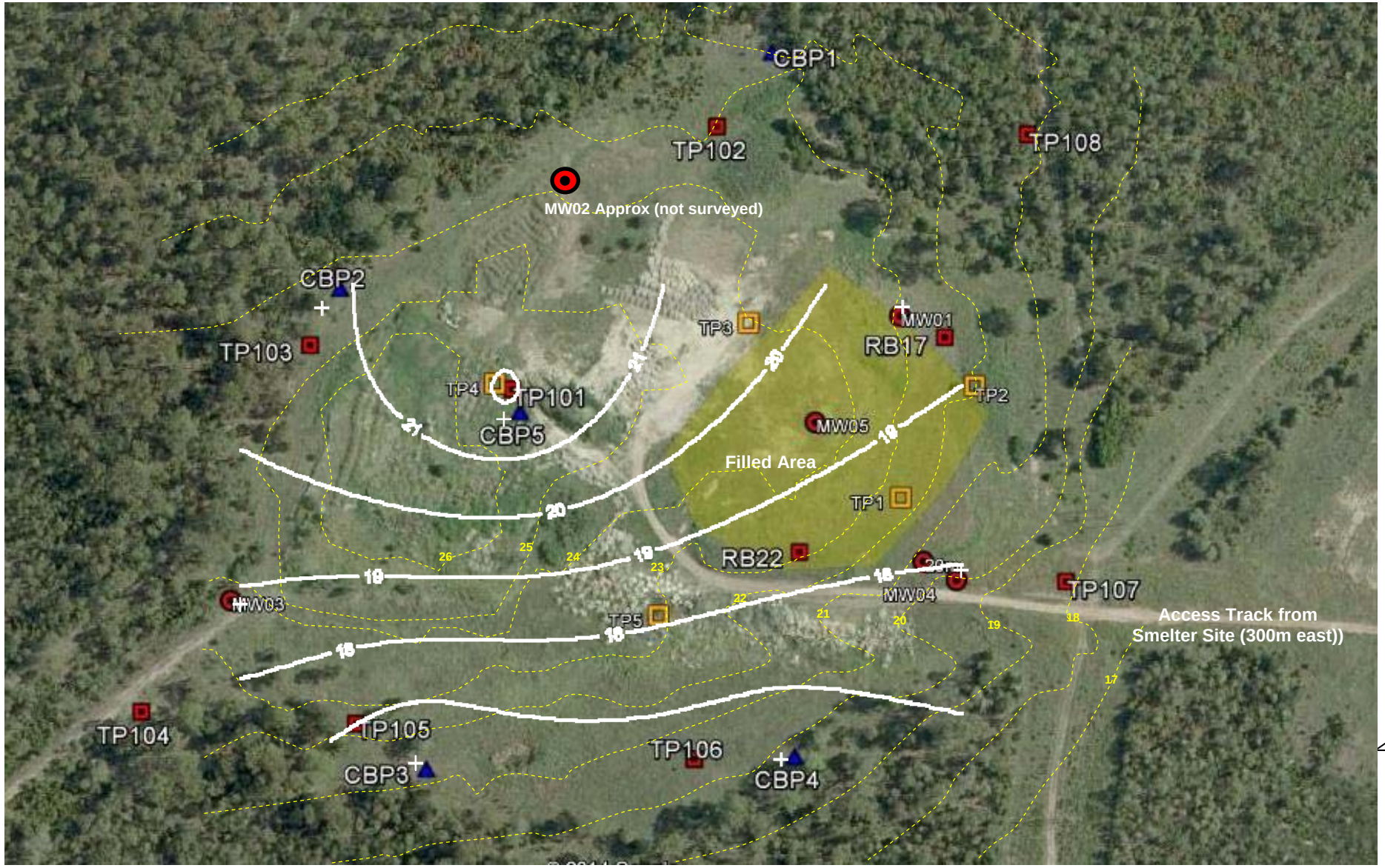
FIGURE 1



Hydro Aluminium Kurri Kurri – Preliminary Geotechnical Investigation, Clay Borrow Pit

Clay Borrow Pit - Investigation Locations

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FIGURE 2

Appendix A

Borehole/Test Pit Logs

BOREHOLE NUMBER MW01

ENVIRON

CLIENT Norsk Hydro ASA **PROJECT NAME** Phase 2 ESA

PROJECT NUMBER DE11HDR043 **PROJECT LOCATION** Kurri Kurri

DATE STARTED 11/4/12 **COMPLETED** 11/4/12 **R.L. SURFACE** _____ **DATUM** _____

DRILLING CONTRACTOR Terratest **SLOPE** 90° **BEARING** ---

EQUIPMENT _____ **HOLE LOCATION** Clay Borrow Pit

HOLE SIZE _____ **LOGGED BY** KJG **CHECKED BY** _____

NOTES _____

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
Pushtube							Fill Sandy Gravelly Clay: brown, med plasticity, angularcoarse gravel, clay, red with some gravel, wet.	0.3-0.4m PID 0 ppm	FILL
							Clay: black, high plasticity, moist.		ESTUARINE SEDIMENTS
				2			Clay: grey, high plasticity, some sand, moist	1.4-1.5m (DUP1) PID 0 ppm	
							Silty Clay: yellow, some sand, dry		RESIDUAL CLAY/EW SANDSTONE
				4			Clay: grey, high plasticity, some sand, moist.		
ADT	12/4/12						EW Sandstone/Residual Sandy Clay: brown-yellow, low plasticity, fine grained sand slightly moist.		
				6					
				8			grading to clay: brown, high plasticity, moist, moist to wet at 9m		
				10			EW Sandstone		EW SANDSTONE
				12			Borehole MW01 terminated at 11.5m		

BOREHOLE / TEST PIT KURRI KURRI.GPJ GINT STD AUSTRALIA.GDT 18/5/12

BOREHOLE NUMBER MW02

ENVIRON

CLIENT Norsk Hydro ASA **PROJECT NAME** Phase 2 ESA

PROJECT NUMBER DE11HDR043 **PROJECT LOCATION** Kurri Kurri

DATE STARTED 11/4/12 **COMPLETED** 12/4/12 **R.L. SURFACE** _____ **DATUM** _____

DRILLING CONTRACTOR Terratest **SLOPE** 90° **BEARING** ---

EQUIPMENT _____ **HOLE LOCATION** Clay Borrow Pit

HOLE SIZE _____ **LOGGED BY** KJG **CHECKED BY** _____

NOTES _____

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
Pushtube			0			Topsoil with some fill	0-0.05m (PID 0 ppm)	FILL
						Clay: grey, high plasticity, moist.	0.5-0.6m (PID 0 ppm)	RESIDUAL CLAY
			2			interbedded red/grey clay		
						Clay: grey, high plasticity, moist.		
ADT	None Encountered					Sandy Clay: red, low plasticity, dry.		
			4					
			6			grading to grey clay		
						EW Siltstone, grey, dry		EW SILTSTONE
			8					
			10					
			12					
			14					
			16					
						Borehole MW02 terminated at 16m		
			18					

BOREHOLE / TEST PIT KURRI KURRI.GPJ GINT STD AUSTRALIA.GDT 18/5/12

BOREHOLE NUMBER MW03b

ENVIRON

CLIENT Norsk Hydro ASA **PROJECT NAME** Phase 2 ESA

PROJECT NUMBER DE11HDR043 **PROJECT LOCATION** Kurri Kurri

DATE STARTED 12/4/12 **COMPLETED** 12/4/12 **R.L. SURFACE** **DATUM**

DRILLING CONTRACTOR Terratest **SLOPE** 90° **BEARING** ---

EQUIPMENT **HOLE LOCATION** Clay Borrow Pit

HOLE SIZE **LOGGED BY** KJG **CHECKED BY**

NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
ADT	▼			2			Topsoil: Gravelly Clay: brown, low plasticity	0-0.1m (PID 0 ppm)	TOPSOIL
							Clay: grey-brown, high plasticity, moist.		RESIDUAL CLAY
				4			Clay: grey, medium plasticity		
				6			Clay: red, medium plasticity, moist		
							Clay: brown, medium plasticity, moist		
				8			Clay: grey.		
							Clay: brown.		
							Clay: khaki, high plasticity, with some gravel. wet.		
				10			EW Siltstone as Clay: dark grey, medium plasticity, dry.		EW SILTSTONE
				12			Borehole MW03b terminated at 11.5m		

BOREHOLE NUMBER MW04

ENVIRON

CLIENT Norsk Hydro ASA **PROJECT NAME** Phase 2 ESA

PROJECT NUMBER DE11HDR043 **PROJECT LOCATION** Kurri Kurri

DATE STARTED 12/4/12 **COMPLETED** 12/4/12 **R.L. SURFACE** _____ **DATUM** _____

DRILLING CONTRACTOR Terratest **SLOPE** 90° **BEARING** ---

EQUIPMENT _____ **HOLE LOCATION** Clay Borrow Pit Entrance

HOLE SIZE _____ **LOGGED BY** KJG **CHECKED BY** _____

NOTES _____

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
ADT	▼			0			Silty Clay: black, high plasticity, moist.	0-0.1m (PID 0 ppm)	ESTUARINE SEDIMENTS
							Clay: red, low plasticity, dry.		RESIDUAL CLAY
				2					
				4					
				6			Clay: grey, low plasticity, dry.		
				8					
							EW Siltstone, grey fine grained.		EW SILTSTONE
				10					
				12			Borehole MW04 terminated at 11.5m		

BOREHOLE NUMBER MW05

ENVIRON

CLIENT Norsk Hydro ASA **PROJECT NAME** Phase 2 ESA

PROJECT NUMBER DE11HDR043 **PROJECT LOCATION** Kurri Kurri

DATE STARTED 12/4/12 **COMPLETED** 12/4/12 **R.L. SURFACE** **DATUM**

DRILLING CONTRACTOR Terratest **SLOPE** 90° **BEARING** ---

EQUIPMENT **HOLE LOCATION** Clay Borrow Pit in old dam fill

HOLE SIZE **LOGGED BY** KJG **CHECKED BY**

NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
ADT	▼			0			Fill: Clayey Silt: medium plasticity with some gravel.		FILL
							Fill: Clay: red-grey, high plasticity.		
							Fill: Gravelly Sandy Clay: low plasticity, with some brick (red).	0.6-0.8m (PID 0 ppm)	
				1			Fill: Gravelly Clay: brown, coarse grained, angular gravel (brick).		
				2			Fill: Gravelly Clay: brown, low plasticity with some brick.	1.8-2.0m (DUP3,3A), (PID 0 ppm)	
				3			Fill: Gravelly Sand: khaki, coarse grained, wet..		
				4			Fill: Gravel: khaki, fine grained, wet.		
Pushtube				5			Clay: grey/red, high plasticity, moist.		RESIDUAL CLAY
				6			Borehole MW05 terminated at 6m		
				7					
				8					
				9					
				10					

TEST PIT NUMBER TP1

ENVIRON

CLIENT Norsk Hydro ASA **PROJECT NAME** Phase 2 ESA

PROJECT NUMBER DE11HDR043 **PROJECT LOCATION** Kurri Kurri

DATE STARTED 12/4/12 **COMPLETED** 12/4/12 **R.L. SURFACE** _____ **DATUM** _____

EXCAVATION CONTRACTOR _____ **SLOPE** --- **BEARING** ---

EQUIPMENT Excavator 20T **TEST PIT LOCATION** Clay Borrow Pit

TEST PIT SIZE _____ **LOGGED BY** FR **CHECKED BY** SC

NOTES _____

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
E			0.5			FILL, silty SAND/sandy SILT, minor clay content, brown, moist		FILL
			1.0			FILL, sandy CLAY, brown, moist, bricks, concrete, timber, concrete to 0.2m in size. Hole unstable at 1.6m due to water ingress.		
	▼		1.5					
			2.0			Test Pit terminated at 1.8m (approx.) Borehole TP1 terminated at 1.8m		
			2.5					
			3.0					

TEST PIT NUMBER TP2

ENVIRON

CLIENT Norsk Hydro ASA **PROJECT NAME** Phase 2 ESA

PROJECT NUMBER DE11HDR043 **PROJECT LOCATION** Kurri Kurri

DATE STARTED 12/4/12 **COMPLETED** 12/4/12 **R.L. SURFACE** _____ **DATUM** _____

EXCAVATION CONTRACTOR _____ **SLOPE** --- **BEARING** ---

EQUIPMENT Excavator 20T **TEST PIT LOCATION** Clay Borrow Pit

TEST PIT SIZE _____ **LOGGED BY** FR **CHECKED BY** SC

NOTES _____

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
E	▼		0.5 1.0			FILL, silty SAND, includes broken concrete slabs up to ~0.8m, bricks, metal bar, brown, red to yellow, slightly moist. Water ingress, hole unstable.		FILL
			1.5 2.0 2.5 3.0			Test Pit terminated at 1.2m Borehole TP2 terminated at 1.2m		

TEST PIT NUMBER TP3

ENVIRON

CLIENT Norsk Hydro ASA **PROJECT NAME** Phase 2 ESA

PROJECT NUMBER DE11HDR043 **PROJECT LOCATION** Kurri Kurri

DATE STARTED 12/4/12 **COMPLETED** 12/4/12 **R.L. SURFACE** _____ **DATUM** _____

EXCAVATION CONTRACTOR _____ **SLOPE** --- **BEARING** ---

EQUIPMENT Excavator 20T **TEST PIT LOCATION** Clay Borrow Pit

TEST PIT SIZE _____ **LOGGED BY** FR **CHECKED BY** SC

NOTES _____

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
E			0.5			FILL, silty clayey SAND, orange/yellow, minor rubble content.		FILL
			1.0					
			1.5					
	▼					Testpit unstable at water ingress		
			2.0					
						Terminated at approx. 2.0m Borehole TP3 terminated at 2m		
			2.5					
			3.0					

TEST PIT NUMBER TP4

ENVIRON

CLIENT Norsk Hydro ASA **PROJECT NAME** Phase 2 ESA

PROJECT NUMBER DE11HDR043 **PROJECT LOCATION** Kurri Kurri

DATE STARTED 12/4/12 **COMPLETED** 12/4/12 **R.L. SURFACE** _____ **DATUM** _____

EXCAVATION CONTRACTOR _____ **SLOPE** --- **BEARING** ---

EQUIPMENT Excavator 20T **TEST PIT LOCATION** Clay Borrow Pit

TEST PIT SIZE _____ **LOGGED BY** FR **CHECKED BY** SC

NOTES Stockpiled concrete, refractory brick, bitumen around location

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
E	None encountered		0.5			FILL, sandy CLAY, some gravel cobbles including natural rock and slag		FILL
						silty SAND; relict topsoil		TOPSOIL
			1.0			sandy CLAY, moist, stiff, orange, mottled grey, EW SANDSTONE/RESIDUAL		EW SANDSTONE
			1.5					
			2.0			Test Pit terminated at 1.6m Borehole TP4 terminated at 1.6m		
			2.5					
			3.0					

TEST PIT NUMBER TP5

ENVIRON

CLIENT Norsk Hydro ASA **PROJECT NAME** Phase 2 ESA

PROJECT NUMBER DE11HDR043 **PROJECT LOCATION** Kurri Kurri

DATE STARTED 12/4/12 **COMPLETED** 12/4/12 **R.L. SURFACE** _____ **DATUM** _____

EXCAVATION CONTRACTOR _____ **SLOPE** --- **BEARING** ---

EQUIPMENT Excavator 20T **TEST PIT LOCATION** Clay Borrow Pit

TEST PIT SIZE _____ **LOGGED BY** FR **CHECKED BY** SC

NOTES _____

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
E	None encountered		0.5			silty SAND; topsoil, black, slightly moist		TOPSOIL
			1.0			sandy CLAY; stiff, slightly moist, mottled orange/brown/yellow, EW SANDSTONE/RESIDUAL		EW SANDSTONE
			1.5			Test pit terminated at 1.1m Borehole TP5 terminated at 1.1m		
			2.0					
			2.5					
			3.0					

BOREHOLE NUMBER CBP1

ENVIRON

CLIENT Hydro Aluminium Kurri Kurri Pty Ltd **PROJECT NAME** Clay Borrow Pit Geotechnical Investigation

PROJECT NUMBER AS130389 **PROJECT LOCATION** Kurri Kurri

DATE STARTED 15/7/14 **COMPLETED** 15/7/14 **R.L. SURFACE** 21.819 **DATUM** m AHD

DRILLING CONTRACTOR TerraTest **SLOPE** 90° **BEARING** ---

EQUIPMENT Commachio ADV **HOLE LOCATION** Clay Borrow Pit Hydro Buffer Zone

HOLE SIZE **LOGGED BY** SC **CHECKED BY** KG

NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm (30, 100, 300, 1000, 3000)	Defect Description
Auger	None Encountered		21	1		TOPSOIL; Silty SAND, brown RESIDUAL CLAY; brown, high plasticity, moist, mc=pl						SPT n > 14
						RESIDUAL CLAY; red-brown to grey, medium plasticity						SPT n = 25
			20	2		Fragments of EW siltstone (iron-stain)						
			19	3		Silty CLAY; brown and grey, slightly moist/dry, low-medium plasticity						SPT n = 60
			18	4		Fragments of extremely weathered/highly weathered siltstone						
HQ Cored			17	5		Very hard, remnant siltsone/sandstone texture, trace calcite Continued as cored HQ hole SILTSTONE; brown to grey, massive bedded Clay layer Grey	EW					SPT refusal Massively bedded, no visible defects
			16	6		Calcite inclusions	EW/HW					
			15	7		Calcite						
Blade Bit			14	8		Becoming coarser SANDSTONE Coring Terminated at 7.65m. Borehole reamed to 20.2m						
			13	9								
			12	10								
			11	11								

CORED BOREHOLE AS130389 CLAY BORROW PIT GEOTECH.GPJ GINT STD AUSTRALIA.GDT 1/10/14

BOREHOLE NUMBER CBP1

ENVIRON

CLIENT Hydro Aluminium Kurri Kurri Pty Ltd **PROJECT NAME** Clay Borrow Pit Geotechnical Investigation

PROJECT NUMBER AS130389 **PROJECT LOCATION** Kurri Kurri

DATE STARTED 15/7/14 **COMPLETED** 15/7/14 **R.L. SURFACE** 21.819 **DATUM** m AHD

DRILLING CONTRACTOR TerraTest **SLOPE** 90° **BEARING** ---

EQUIPMENT Commachio ADV **HOLE LOCATION** Clay Borrow Pit Hydro Buffer Zone

HOLE SIZE **LOGGED BY** SC **CHECKED BY** KG

NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm (30, 100, 300, 1000, 3000)	Defect Description
Blade Bit			10	12		SILTSTONE; brown to grey, massive bedded *(continued)*						
			9	13								
			8	14								
			7	15								
			6	16		Circulation loss noted at 16m						
			5	17								
			4	18								
			3	19								
			2	20								
			1	21		CBP1 terminated at 20.2m						
			0	22								

BOREHOLE NUMBER CBP2

ENVIRON

CLIENT Hydro Aluminium Kurri Kurri Pty Ltd **PROJECT NAME** Clay Borrow Pit Geotechnical Investigation

PROJECT NUMBER AS130389 **PROJECT LOCATION** Kurri Kurri

DATE STARTED 16/7/14 **COMPLETED** 16/7/14 **R.L. SURFACE** 24.055 **DATUM** m AHD

DRILLING CONTRACTOR TerraTest **SLOPE** 90° **BEARING** ---

EQUIPMENT Commachio ADV **HOLE LOCATION** Clay Borrow Pit, Hydro Buffer Zone

HOLE SIZE **LOGGED BY** SC **CHECKED BY** KG

NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm (30, 100, 300, 1000, 3000)	Defect Description
Auger						TOPSOIL; silty SAND, brown, dry						
						RESIDUAL CLAY; red-brown, brown and grey, high plasticity, mc>PL						
			23	1								SPT - n = 15
						Becoming grey-cream (siltstone fragments)						
			22	2								SPT - n = 22
						Becoming extremely weathered SILTSTONE as silty CLAY; cream to red-brown						
						Harder						
			21	3								SPT - n = 22
						Relict sandstone/siltstone, structure with iron (red), cemented layers ~10mm, as silty sandy CLAY						
			20	4								SPT - n = 53
			19	5								
			18	6		Silty CLAY with some sand; brown and grey, low-medium plasticity, moist mc<PL						SPT - n = 45
			17	7								
	▼					Extremely weathered SHALE; grey, laminated, horizontal bedded						SPT - refusal
HQ Core			16	8		SILTSTONE; grey, massively bedded, with some medium-coarse grained sand, becoming laminated horizontal sandy SILTSTONE						
						Sandy, horizontal and sub-horizontal laminar bedding						
			15	9								
												75 degrees, joint, planer, rough
			14	10								
						CBP2 terminated at 10.58m						
				11								

BOREHOLE NUMBER CBP3

ENVIRON

CLIENT Hydro Aluminium Kurri Kurri Pty Ltd **PROJECT NAME** Clay Borrow Pit Geotechnical Investigation

PROJECT NUMBER AS130389 **PROJECT LOCATION** Kurri Kurri

DATE STARTED 16/7/14 **COMPLETED** 16/7/14 **R.L. SURFACE** 20.714 **DATUM** m AHD

DRILLING CONTRACTOR TerraTest **SLOPE** 90° **BEARING** ---

EQUIPMENT Commachio ADV **HOLE LOCATION** Southern Clay Borrow Pit, Hydro Buffer Zone

HOLE SIZE **LOGGED BY** SC **CHECKED BY** KG

NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm (30, 100, 300, 1000, 3000)	Defect Description
Auger			20	1		TOPSOIL RESIDUAL CLAY; red-brown, brown and grey, medium-high plasticity, moist, mc>PL, trace sand and rock fragments						SPT - n = 17
			19	2		Pale cream and red/brown, medium-high plasticity						SPT - n = 23
			18	3		Relict sandy SILTSTONE structure as silty CLAY; grey, medium plasticity, moist mc~PL						SPT - n = 25
			17	4								SPT - n = 35
			16	5								
			15	6		Extremely weathered laminated SILTSTONE as silty CLAY, grey and brown, medium plasticity, moist<PL, trace sand and rock fragments Borehole continued as cored borehole log after SPT refusal at 6m	HW/MW					SPT - refusal Joints 35 degrees planar, sl-rough, Fe stained
HQ Core			14	7		SILTSTONE; grey, laminated, extremely weatherd bedding, horizontal to sub-horizontal.						65 degrees joint, rough, planar, Fe stained
			13	8		Becoming coarser, massive bedding, sandy SILTSTONE with some rounded pebbles (20mm) at 7.6m Clay zone (7.9-8.1m). Coring ceased at 8.82m. Borehole reamed to 20m.						
Blade Bit			12	9			MW					
			11	10								
			10	11								

CORED BOREHOLE AS130389 CLAY BORROW PIT GEOTECH.GPJ GINT STD AUSTRALIA.GDT 1/10/14

BOREHOLE NUMBER CBP3

ENVIRON

CLIENT Hydro Aluminium Kurri Kurri Pty Ltd **PROJECT NAME** Clay Borrow Pit Geotechnical Investigation

PROJECT NUMBER AS130389 **PROJECT LOCATION** Kurri Kurri

DATE STARTED 16/7/14 **COMPLETED** 16/7/14 **R.L. SURFACE** 20.714 **DATUM** m AHD

DRILLING CONTRACTOR TerraTest **SLOPE** 90° **BEARING** ---

EQUIPMENT Commachio ADV **HOLE LOCATION** Southern Clay Borrow Pit, Hydro Buffer Zone

HOLE SIZE **LOGGED BY** SC **CHECKED BY** KG

NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm (30, 100, 300, 1000, 3000)	Defect Description
Blade Bit			9	12		SILTSTONE; grey, laminated, extremely weatherd bedding, horizontal to sub-horizontal. *(continued)*						
			8	13								
			7	14								
			6	15								
			5	16								
			4	17								
			3	18								
			2	19								
			1	20								
						CBP3 terminated at 20m						
			0	21								
			-1	22								

BOREHOLE NUMBER CBP4

ENVIRON

CLIENT Hydro Aluminium Kurri Kurri Pty Ltd **PROJECT NAME** Clay Borrow Pit Geotechnical Investigation

PROJECT NUMBER AS130389 **PROJECT LOCATION** Kurri Kurri

DATE STARTED 17/7/14 **COMPLETED** 17/7/14 **R.L. SURFACE** 19.092 **DATUM** m AHD

DRILLING CONTRACTOR TerraTest **SLOPE** 90° **BEARING** ---

EQUIPMENT Commachio ADV **HOLE LOCATION** South East Clay Borrow Pit, Hydro Buffer Zone

HOLE SIZE **LOGGED BY** SC **CHECKED BY** KG

NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm (30, 100, 300, 1000, 3000)	Defect Description
Auger			19	0		TOPSOIL						
						RESIDUAL CLAY; red-brown, medium-high plasticity, mc>PL, trace of fine sand and extremely weathered siltstone fragments						SPT - n = 14
			18	1								
			17	2								SPT - n = 18
				3		Harder, silty sandy CLAY; grey and brown, low-medium plasticity mc<PL, very fine sand						SPT - n = 42
			16			Extremely weathered SILTSTONE; grey ~3.5, laminated, horizontal bedding						
			15	4			EW					
Cored						SILTSTONE; grey, laminated, with horizontal/sub horizontal bedding, brown, iron stained clay bands 4.5-4.8m						SPT refusal
			14	5			EW					
			13	6			EW/HW					No visible defects
			12	7								
Blade Bit						Coring stopped at 7.22m. Drilling continued to ream borehole down to 20m.						
			11	8								
			10	9								
			9	10								
				11								

CORED BOREHOLE AS130389 CLAY BORROW PIT GEOTECH.GPJ GINT STD AUSTRALIA.GDT 1/10/14

BOREHOLE NUMBER CBP4

ENVIRON

CLIENT Hydro Aluminium Kurri Kurri Pty Ltd **PROJECT NAME** Clay Borrow Pit Geotechnical Investigation

PROJECT NUMBER AS130389 **PROJECT LOCATION** Kurri Kurri

DATE STARTED 17/7/14 **COMPLETED** 17/7/14 **R.L. SURFACE** 19.092 **DATUM** m AHD

DRILLING CONTRACTOR TerraTest **SLOPE** 90° **BEARING** ---

EQUIPMENT Commachio ADV **HOLE LOCATION** South East Clay Borrow Pit, Hydro Buffer Zone

HOLE SIZE **LOGGED BY** SC **CHECKED BY** KG

NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm (30, 100, 300, 1000, 3000)	Defect Description
Blade Bit			8	12								
			7	13								
			6	14								
			5	15								
			4	16								
			3	17								
			2	18								
			1	19								
			0	20								
			-1			CBP4 terminated at 20m						
			-2	21								
				22								

BOREHOLE NUMBER CBP5

ENVIRON

CLIENT Hydro Aluminium Kurri Kurri Pty Ltd **PROJECT NAME** Clay Borrow Pit Geotechnical Investigation

PROJECT NUMBER AS130389 **PROJECT LOCATION** Kurri Kurri

DATE STARTED 15/7/14 **COMPLETED** 15/7/14 **R.L. SURFACE** 25.648 **DATUM** m AHD

DRILLING CONTRACTOR TerraTest **SLOPE** 90° **BEARING** ---

EQUIPMENT Commachio ADV **HOLE LOCATION** Clay Borrow Pit, Hydro Buffer Zone

HOLE SIZE **LOGGED BY** SC **CHECKED BY** KG

NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm (30, 100, 300, 1000, 3000)	Defect Description
Auger			25	1		TOPSOIL; Silty SAND RESIDUAL CLAY; brown and red-brown, medium-high plasticity, moist						SPT - n = 7
			24	2		Red-brown and grey, rootlets, angular fragments of extremely weathered Siltstone						SPT - n = 11
			23	3		Red-brown and light grey clay, high plasticity, LL>mc>PL, trace fragments of angular rock						SPT - n = 15
			22	4		Becoming extremely weathered Siltstone as silty CLAY; red brown, low plasticity, moist, mc<PL, fragments of iron stained siltstone, trace white calcite						SPT - n = 32
			21	5								
			20	6		Very slight water at base ~6m, hard brown silty CLAY (extremely weathered siltstone)						SPT - n = 46
	▶		19	7								
			18	8		Silty CLAY and extremely weathered SILTSTONE, brown and red-brown, low-medium plasticity, mc<PL	EW					SPT - refusal
Cored			17	9		SANDSTONE; grey, medium grained, extremeley weathered, massively bedded (0.5-0.6 clay layer), very weak - crumbles under touch Coarse grained	EW					
			16	10								
			15	11		Sandstone cobble clast						

BOREHOLE NUMBER CBP5

ENVIRON

CLIENT Hydro Aluminium Kurri Kurri Pty Ltd **PROJECT NAME** Clay Borrow Pit Geotechnical Investigation

PROJECT NUMBER AS130389 **PROJECT LOCATION** Kurri Kurri

DATE STARTED 15/7/14 **COMPLETED** 15/7/14 **R.L. SURFACE** 25.648 **DATUM** m AHD

DRILLING CONTRACTOR TerraTest **SLOPE** 90° **BEARING** ---

EQUIPMENT Commachio ADV **HOLE LOCATION** Clay Borrow Pit, Hydro Buffer Zone

HOLE SIZE **LOGGED BY** SC **CHECKED BY** KG

NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm (30, 100, 300, 1000, 3000)	Defect Description
Cored			14	12		SANDSTONE; grey, medium grained, extremeley weathered, massively bedded (0.5-0.6 clay layer), very weak - crumbles under touch *(continued)* Coarse grained						
Overbored			13	13								
			12	14								
			11	15								
			10	16								
			9	17								
			8	18								
			7	19								
			6	20		CBP5 terminated at 20m						
			5	21								
			4	22								

TEST PIT NUMBER TP101

ENVIRON

CLIENT Hydro Aluminium Kurri Kurri Pty Ltd **PROJECT NAME** Clay Borrow Pit Geotechnical Investigation

PROJECT NUMBER AS130389 **PROJECT LOCATION** Kurri Kurri

DATE STARTED 7/8/14 **COMPLETED** 7/8/14 **R.L. SURFACE** 25.735AHD **DATUM**

EXCAVATION CONTRACTOR **SLOPE** --- **BEARING** ---

EQUIPMENT Backhoe **TEST PIT LOCATION** Next to CBP5

TEST PIT SIZE **LOGGED BY** SC **CHECKED BY** KG

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm (30, 100, 300, 1000, 3000)	Defect Description
			0.0		FILL; Clayey SAND; brown, fine to medium grained, low plasticity fines, trace bricks etc., moist						
			0.5		Resiual CLAY; grey and red-brown, high-medium plasticity, moist, very stiff-hard, mc<pl						
	None Encountered		1.0		CLAY/sandy CLAY; brown to light frey and red-brown, medium to high plasticity, pockets of Fe cemented EW sandstone, slightly moist, mc<pl, hard						
			1.5								
			2.0								
			2.5								
			3.0		Becoming extremely weathered sandstone/siltstone						
			3.5								
			3.7		TP101 terminated at 3.7m						
			4.0								
			4.5								
			5.0								

TEST PIT NUMBER TP102

ENVIRON

CLIENT Hydro Aluminium Kurri Kurri Pty Ltd **PROJECT NAME** Clay Borrow Pit Geotechnical Investigation

PROJECT NUMBER AS130389 **PROJECT LOCATION** Kurri Kurri

DATE STARTED 7/8/14 **COMPLETED** 7/8/14 **R.L. SURFACE** 22.627 AHD **DATUM**

EXCAVATION CONTRACTOR **SLOPE** --- **BEARING** ---

EQUIPMENT Backhoe **TEST PIT LOCATION** ~30m South of CBP1

TEST PIT SIZE **LOGGED BY** SC **CHECKED BY** KG

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm (30, 100, 300, 1000, 3000)	Defect Description
			0.0		Sandy SILT; dark grey, low plasticity, fine grained, moist, soft/firm						
			0.5		Residual CLAY/Sandy CLAY/ red-brown and grey, light grey, medium-high plasticity, moist, mc=pl, fragments of Fe stained EW siltstone/sandstone, hard, very hard digging						
			1.0								
			1.5								
			2.0								
			2.5								
			3.0		TP102 terminated at 2.9m						
			3.5								
			4.0								
			4.5								
			5.0								

TEST PIT NUMBER TP103

ENVIRON

CLIENT Hydro Aluminium Kurri Kurri Pty Ltd **PROJECT NAME** Clay Borrow Pit Geotechnical Investigation

PROJECT NUMBER AS130389 **PROJECT LOCATION** Kurri Kurri

DATE STARTED 7/8/14 **COMPLETED** 7/8/14 **R.L. SURFACE** 24.725 AHD **DATUM**

EXCAVATION CONTRACTOR **SLOPE** --- **BEARING** ---

EQUIPMENT Backhoe **TEST PIT LOCATION** ~30m South of CBP2

TEST PIT SIZE **LOGGED BY** SC **CHECKED BY** KG

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm (30, 100, 300, 1000, 3000)	Defect Description
	None Encountered		0.5		TOPSOIL; sandy SILT, brown, dry Residual CLAY; brown/red-brown, high plasticity, moist, very stiff/hard						
			1.0 1.5 2.0		Sandy CLAY; light grey and red brown, medium-high plasticity, fine sand, fragments of Fe stained EW siltstone/sandstone, moist, mc<pl, hard						
			2.5 3.0 3.5 4.0 4.5 5.0		becoming EW siltstone (very hard digging) TP103 terminated at 2.15m						

TEST PIT NUMBER TP104

ENVIRON

CLIENT Hydro Aluminium Kurri Kurri Pty Ltd **PROJECT NAME** Clay Borrow Pit Geotechnical Investigation

PROJECT NUMBER AS130389 **PROJECT LOCATION** Kurri Kurri

DATE STARTED 7/8/14 **COMPLETED** 7/8/14 **R.L. SURFACE** 21.868 AHD **DATUM**

EXCAVATION CONTRACTOR **SLOPE** --- **BEARING** ---

EQUIPMENT Backhoe **TEST PIT LOCATION** SW off track to Bishops Bridge Rd

TEST PIT SIZE **LOGGED BY** SC **CHECKED BY** KG

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm (30, 100, 300, 1000, 3000)	Defect Description
	None Encountered		0.0		FILL (road base); Gravelly sandy SILT; cream						
			0.5		Residual Sandy CLAY; light grey and red-brown, medium to high plasticity, fine grained sand, slightly moist to moist, mc<pl, very stiff to hard, fragments of EW siltstone						
			1.0								
			1.5		TP104 terminated at 1.6m						
			2.0								
			2.5								
			3.0								
			3.5								
			4.0								
			4.5								
			5.0								

TEST PIT NUMBER TP105

ENVIRON

CLIENT Hydro Aluminium Kurri Kurri Pty Ltd **PROJECT NAME** Clay Borrow Pit Geotechnical Investigation

PROJECT NUMBER AS130389 **PROJECT LOCATION** Kurri Kurri

DATE STARTED 7/8/14 **COMPLETED** 7/8/14 **R.L. SURFACE** 21.585 AHD **DATUM**

EXCAVATION CONTRACTOR **SLOPE** --- **BEARING** ---

EQUIPMENT Backhoe **TEST PIT LOCATION** ~30m West of CBP3

TEST PIT SIZE **LOGGED BY** SC **CHECKED BY** KG

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm (30, 100, 300, 1000, 3000)	Defect Description
			0.0		Slopewash; Gravelly Snady SILT; grey, slightly moist, soft						
			0.3		Residual CLAY; red/brown and brown, high plasticity, moist, mc=pl						
	None Encountered		0.5		Sandy CLAY; light grey and red-brown, medium to high plasticity, moist, mc=pl and >p, very stiff to hard, fragments of Fe stained EW siltstone (mottled)						
			2.5		TP105 terminated at 2.5m						
			3.0								
			3.5								
			4.0								
			4.5								
			5.0								

TEST PIT NUMBER TP106

ENVIRON

CLIENT Hydro Aluminium Kurri Kurri Pty Ltd **PROJECT NAME** Clay Borrow Pit Geotechnical Investigation

PROJECT NUMBER AS130389 **PROJECT LOCATION** Kurri Kurri

DATE STARTED 7/8/14 **COMPLETED** 7/8/14 **R.L. SURFACE** 19.687 AHD **DATUM**

EXCAVATION CONTRACTOR **SLOPE** --- **BEARING** ---

EQUIPMENT Backhoe **TEST PIT LOCATION** ~30m West of CBP4

TEST PIT SIZE **LOGGED BY** SC **CHECKED BY** KG

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm (30, 100, 300, 1000, 3000)	Defect Description
			0.0		Silty SANDY slopewash/Topsoil; silghtly moist						
			0.5		Residual CLAY and Sandy CLAY; red-brown then light grey/cream and red-brown, medium to high plasticity, fine, sandy, moist, mc=pl, very stiff to hard, fragments of EW siltstone (EW Fe stained)						
			1.0								
			1.5								
			2.0								
			2.5		TP106 terminated at 2.5m						
			3.0								
			3.5								
			4.0								
			4.5								
			5.0								

CORED BOREHOLE AS130389 CLAY BORROW PIT GEOTECH.GPJ GINT STD AUSTRALIA.GDT 1/10/14

TEST PIT NUMBER TP107

ENVIRON

CLIENT Hydro Aluminium Kurri Kurri Pty Ltd **PROJECT NAME** Clay Borrow Pit Geotechnical Investigation

PROJECT NUMBER AS130389 **PROJECT LOCATION** Kurri Kurri

DATE STARTED 7/8/14 **COMPLETED** 7/8/14 **R.L. SURFACE** 17.358 AHD **DATUM**

EXCAVATION CONTRACTOR **SLOPE** --- **BEARING** ---

EQUIPMENT Backhoe **TEST PIT LOCATION** SE Corner

TEST PIT SIZE **LOGGED BY** SC **CHECKED BY** KG

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm (30, 100, 300, 1000, 3000)	Defect Description
			0.0		TOPSOIL; slightly moist						
					CLAY and Sandy CLAY; red-brown, becoming light grey, medium to high plasticity, fine sand, moist						
			0.5								
			1.0		Sandy CLAY as above with EW siltstone fragments						
			1.5								
			2.0								
			2.5								
					TP107 terminated at 2.6m						
			3.0								
			3.5								
			4.0								
			4.5								
			5.0								

TEST PIT NUMBER TP108

ENVIRON

CLIENT Hydro Aluminium Kurri Kurri Pty Ltd **PROJECT NAME** Clay Borrow Pit Geotechnical Investigation

PROJECT NUMBER AS130389 **PROJECT LOCATION** Kurri Kurri

DATE STARTED 7/8/14 **COMPLETED** 7/8/14 **R.L. SURFACE** 20.532 AHD **DATUM**

EXCAVATION CONTRACTOR **SLOPE** --- **BEARING** ---

EQUIPMENT Backhoe **TEST PIT LOCATION** NE Track

TEST PIT SIZE **LOGGED BY** SC **CHECKED BY** KG

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm (30, 100, 300, 1000, 3000)	Defect Description
			0.0		Topsoil/Slopewash; Silty SAND						
			0.5		CLAY; red-brown and grey, medium-high plasticity, some sand, moist						
			1.0								
			1.5		EW SILTSTONE; hard digging						
					TP108 terminated at 1.7m						
			2.0								
			2.5								
			3.0								
			3.5								
			4.0								
			4.5								
			5.0								

Appendix B

Core Photographs: CPB1 – CPB5

AS130389
CBP1

4.50 to 7.65m

15/7/14

AS130389
15/7/14

CBP1: 4.5 to 7.65m

7.65m (END OF CORING)

AS130389
CBP1

4.50 to 7.65m

15/7/14

AS130389
15/7/14 CBP1: 4.5 to 7.65m

7.65m (END OF CORING)

AS130389
CBP 2

7.50 to 10.58m

16/7/14

AS130389 16/7/14 7.50 to 10.58m

10.58m EOH

AS130389
CBP 2

7.50 to 10.58m

16/7/14

AS130389 16/7/14 7.50 to 10.58m

10.58m FOH

AS130389
CBP 2

7.50 to 10.58m

16/7/14

AS130389 16/7/14 7.50 to 10.58m

10.58m EOH

AS130389
CBP3
6.00 to 8.82 m

17/7/14

17/7/14 AS130389 CBP3 6.00 to 8.82m

8.82m

AS130389
CBP3
6.00 to 8.82 m

17/7/14

17/7/14 AS130389 CBP3 6.00 to 8.82m

8.82m

AS130389
CBP4
4.50 to 7.22m.

17/7/14

17/7/14 AS130389 CBP4 4.50 to 7.22m

7.22m.

AS130389
CBP4
4.50 to 7.22m.
17/7/14

17/7/14 AS130389 CBP4 4.50 to 7.22m

7.22m.

AS130389
CBPS
8.53 to 12.02m
15/7/14

AS130389 CBPS
15/7/14
8.53
to 12.02m

AS1303B9 CBP5
15/7/14
8.53
to 12.02m

AS1303B9
CBP5
8.53 to 12.02m
15/7/14

Appendix C

Pit Soil Profile Photographs

Photograph 1 Test Pit TP101

Photograph 2 Test Pit TP102

Photograph 3 Test Pit TP103

Photograph 4 Test Pit TP104

Photograph 5 Test pit TP105

Photograph 6 Test Pit TP106

Photograph 7 Test Pit TP107

Photograph 8 Test Pit TP108

Photograph 9 Test Pit RB 17

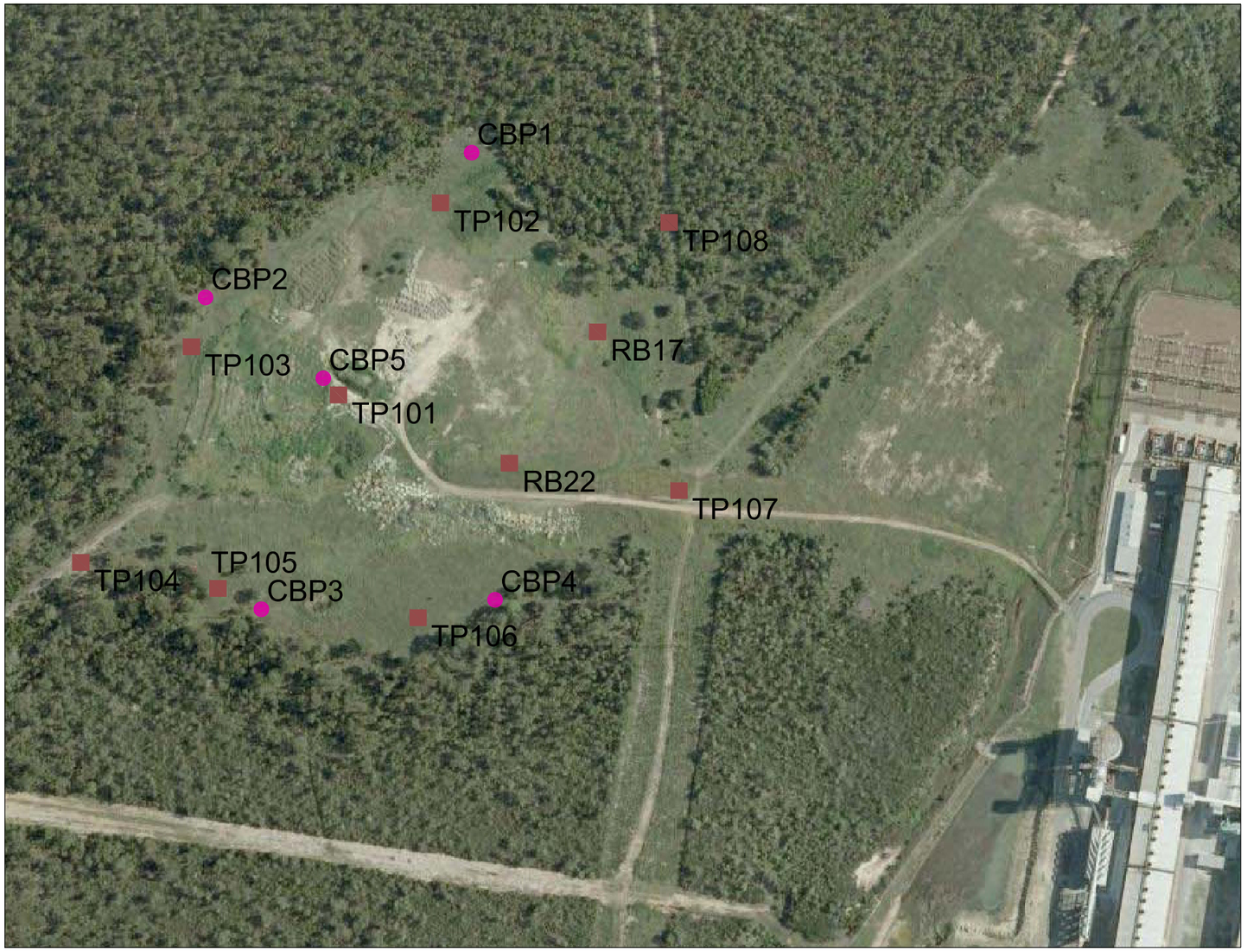
Photograph 10 Test Pit RB 22

Appendix D

Site Survey Report

DIAL 1100
BEFORE YOU DIG

MGA



MONITORING WELLS 11 SEPTEMBER 2014

EASTING (MGA)	NORTHING (MGA)	RL (AHD)	MONITORING WELL / TEST PIT
357083.544	6371595.722	22.463	CBP1
		21.819	NS
356930.905	6371506.336	24.793	CBP2
		24.055	NS
356966.106	6371330.37	21.378	CBP3
		20.714	NS
357103.594	6371331.861	19.762	CBP4
		19.092	NS
356999.421	6371463.604	26.285	CBP5
		25.648	NS
357003.279	6371460.459	25.735	TP101
357068.687	6371569.812	22.627	TP102
356921.072	6371477.3	24.725	TP103
356856.133	6371351	21.868	TP104
356941.283	6371346.35	21.585	TP105
357066.109	6371330.664	19.687	TP106
357204.923	6371397.008	17.358	TP107
357193.294	6371564.899	20.532	TP108
357151.003	6371489.16	22.377	RB17
357106.056	6371410.328	22.237	RB22

- Note -

1. Plan not to scale
2. A complete investigation of services has not been undertaken for this survey.
3. Services shown hereon have been located by field survey of visible surface features.
4. Depths and inverts are only shown where access is reasonable.
5. Designers are to inform themselves of the location of services. This plan should not be used for critical design dimensions in relation to existing structures and services. Confirmation of critical positions and boundaries should be obtained from RPS Australia East Pty Ltd.
6. The location and depth of all underground services whether shown on the drawing(s) or not, shall be precisely determined before any demolition, excavation or construction work commences and appropriate measures taken to protect these services from damage. Prior to carrying out any onsite works, all utility authorities are to be contacted and consulted by contractors and builders to determine the location of services, and any engineering and OHS requirements as applicable.

TEST PIT

MONITORING WELL

RL'S TAKEN ON TOP OF PVC UNLESS NOTED OTHERWISE

TITLE: MONITORING WELL & TEST PIT
HYDRO ALUMINIUM

LOCATION: " HYDRO ALUMINIUM "
HART ROAD , LOXFORD

DATUM: AHD
PROJECTION: MGA 56

DATE: 11 SEPTEMBER 2014
PURPOSE: MONITORING WELLS & PITS

AUTOCAD REF: 112931 - 1A (11-09-14)
VERSION (PLAN BY): MONITORING WELLS 11-09-14

CLIENT: ENVIRON AUSTRALIA PTY LTD
JOB REF: 112931

RPS AUSTRALIA EAST PTY LTD (ABN 44 140 292 762)
241 DENISON STREET BROADMEADOW PO BOX 428 HAMILTON NSW 2303
T: 02 4940 4200 F: 02 4961 6794 www.rpsgroup.com.au

creativepeople
making a difference

RPS

Survey data for wells installed in 2012

EASTING	NORTHING	RL (AHD)	Monitoring Well
357149.835	6371507.024	22.848	MW01
		22.054	NS
356899.84	6371391.648	24.117	MW03
		23.335	NS
357171.681	6371404.848	19.71	MW04
		18.882	NS
357115.113	6371457.767	24.813	MW05
		23.962	NS
NS Natural Surface All well RL's taken from top of PVC casing			

Appendix E

Laboratory Results Summary and Laboratory Reports

Table E1 Summary of Testing Results

Sample Name	Sample Depth (mbgl)	Sample Depth (mAHD)	Pit/Bore Location [4]	Soil Description - Origin[5]	Clay Thickness metres (approx)	Moisture Content	Liquid Limit	Plastic Limit	Plasticity index	MDD (Standard) [1]	OMC [1]	permeability (w/leachate) [3]	permeability [2]	% passing 0.002mm	% passing 0.075mm	% passing 1.18 mm	Clay	Silt	Sand	Gravel	Description	USGS
RB17	*1.5-2*	*20.9-20.4*	Mid-eastern slope of CBP area	Silty Clay - residual	-[6]	27.6	43	11	32	1.66	20	5.00E-12	1.00E-11	50	71	97	50	21	26	3	Silty Sandy CLAY with trace gravel	CL
RB22	*1-1.5*	*21.2-20.7*	Mid-eastern slope of CBP area	Silty Clay - residual	-[6]	25.3	66	16	50					60	82	99	60	22	17	1	Sandy Silty CLAY with trace of Gravel	CH
RB22	*2.5-2.8*	*19.7-19.4*	Mid-eastern slope of CBP area	Silty Clay - residual	-[6]	19.8	48	26	22					40	85	100	40	45	15	0	Sandy Clayey SILT	CL
TP101	*1.2-1.8*	*24.5-23.9*	mid-CBP - topographic high point	Silty Clay - residual	3	18.2	43	14	29	1.68	18	8.00E-11	5.00E-10	37	75	93	37	38	18	7	Sandy Clayey SILT with some Gravel	CL
TP102	*0.9-1.5*	*21.7-21.1*	NW CBP	Silty Clay - residual	2	16.5	36	13	23					22	60	85	22	38	25	15	Gravelly Clayey Sandy SILT	CL
TP103	*0.2-0.6*	*24.5-24.1*	Western CBP	Silty Clay - residual	1.5	21.6	48	14	34	1.59	23		2.00E-11	60	86	98	60	26	12	2	Silty CLAY with some Sand and trace of Gravel	CL
TP104	*0.6-1*	*21.3-20.9*	South-western corner CBP (up track)	Silty Clay - residual	1.5	18.2	62	15	47					60	87	99	60	27	12	1	Silty CLAY with some Sand and trace of Gravel	CH
TP105	*1-1.5*	*20.6-20.1*	Southern CBP	Silty Clay - residual	2	20.3	53	20	33	1.64	21		4.00E-11	40	85	91	40	45	6	9	Clayey SILT with some Sand and Gravel	CH
TP106	*0.8-1.4*	*18.9-18.3*	South-eastern CBP	Silty Clay - residual	2	13.6	35	12	23					35	80	96	35	45	16	4	Sandy Clayey SILT with trace Gravel	CL
TP107	*0.5-1*	*16.9-16.4*	Eastern CBP (near base of slope)	Silty Clay - residual	1.5	22.3	45	13	32	1.66	19	3.00E-11		40	72	97	40	32	25	3	Sandy Silty CLAY with trace of Gravel	CL

Notes.

1. Moisture density testing (ASTM D698) - MDD - Maximum Dry Density, OMC Optimum Moisture Content, under Standard Compaction
2. Permeability (remoulded flexible wall) – ASTM D5804) with potable water
3. Permeability (remoulded flexible wall) – ASTM D5804) with supplied Leachate (fluoride, cyanide, sodium)
4. See Figure 2
5. See logs in Appendix A For detailed soil descriptions
6. RB17 and RB22 were part of an associated investigation which did not excavate full clay profiles.

TEST CERTIFICATE

Aaron.Lacey@sgs.com
ABN: 44 000 964 278
ph: +61 (0)2 8594 0481
fx: +61 (0)2 8594 0499

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

Client:	ENVIRON AUSTRALIA PTY LTD	Client Job No:	
Order No:		Project:	AS130389
Tested Date:	9/09/2014	Location:	
SGS Job Number:	14-32-383	Sample No:	14-AC-2764
Lab:	Alexandria CMT	Sample ID:	RB17 1.50-2.00m

Moisture Content of a Soil

AS 1289.2.1.1

Sample Description:	SILTY CLAY: Black/Brown
Moisture Content:	27.6%

Note: Sample supplied by client.

Approved Signatory: (Aaron.Lacey, Business Manager) Date: 10/09/2014

Accredited for compliance with ISO/IEC 17025

Accreditation No.: 2418
Client Address: Level 2 Adelaide Terrace East Perth Perth WA 6004

Site No.: 2418
Cert No.: 14-AC-2764-AN010
Form No.PF-AU-INDCMT-GEN-AN-010

Aaron.Lacey@sgs.com
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TEST CERTIFICATE

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

Client:	ENVIRON AUSTRALIA PTY LTD	Client Job No:	
Order No:		Project:	AS130389
Tested Date:	9/09/2014	Location:	
SGS Job Number:	14-32-383	Sample No:	14-AC-2764
Lab:	Alexandria CMT	Sample ID:	RB17 1.50-2.00m

Atterberg Limits (1 Point Casagrande Method)

AS 1289.3.1.2, 3.2.1, 3.3.1

Sample Description:	SILTY CLAY: Black/Brown
Liquid Limit:	43%
Plastic Limit:	11%
Plasticity Index:	32%
History of Sample:	Air-Dried
Method of Preparation:	Dry-Sieved

Note: Sample supplied by client.

Approved Signatory: (Aaron.Lacey, Business Manager) Date: 10/09/2014

Accredited for compliance with ISO/IEC 17025

Site No.: 2418
Cert No.: 14-AC-2764-AN013
Form No.PF-AU-INDCMT-GEN-AN-013

Accreditation No.: 2418
Client Address: Level 2 Adelaide Terrace East Perth Perth WA 6004

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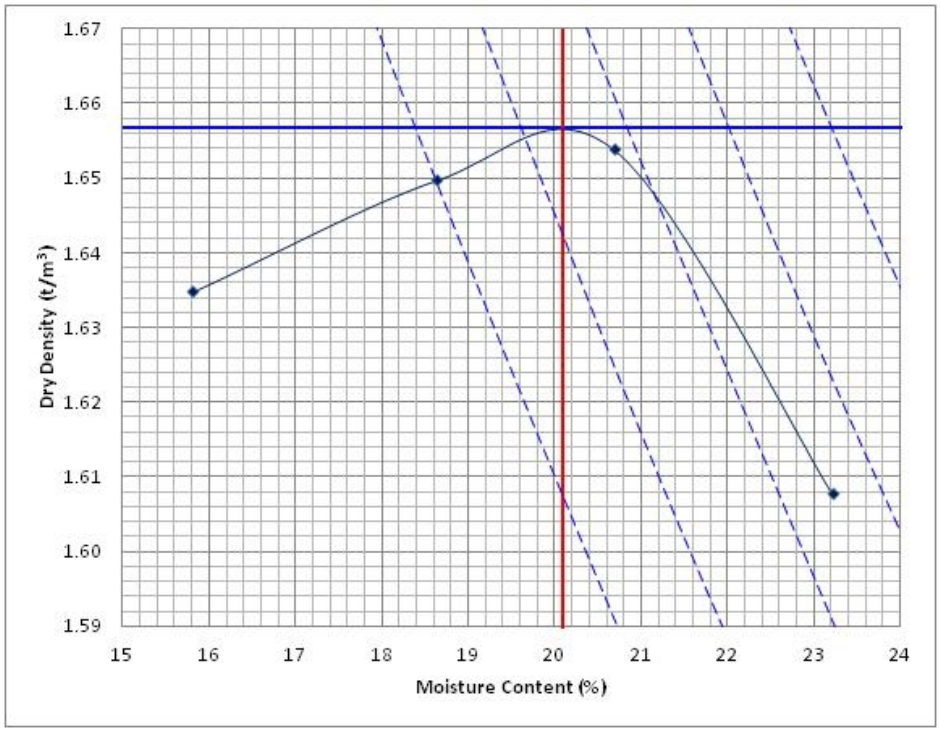
SGS Australia Pty Ltd
PO Box 6432 Alexandria NSW 2015
Unit 15, 33 Maddox Street
Alexandria NSW 2015

Client:	ENVIRON AUSTRALIA PTY LTD	Client Job No:	
Order No:		Project:	AS130389
Tested Date:	9/09/2014	Location:	
SGS Job Number:	14-32-383	Sample No:	14-AC-2764
Lab:	Alexandria CMT	Sample ID:	RB17 1.50-2.00m

Dry Density / Moisture Content Relation of a Soil

AS 1289.5.1.1 - Standard Compactive Effort



Sample Description:	SILTY CLAY: Black/Brown
Maximum Dry Density:	1.66t/m³
Optimum Moisture Content:	20.0%
Percent Oversize:	0%
Sieve Size:	19.0mm

Note: Sample supplied by client.

Approved Signatory: (Aaron.Lacey, Business Manager) Date: 10/09/2014

Accredited for compliance with ISO/IEC 17025

Site No.: 2418
Cert No.: 14-AC-2764-AN027.1
Form No.PF-AU-INDCMT-GEN-AN-027

Accreditation No.: 2418
Client Address: Level 2 Adelaide Terrace East Perth Perth WA 6004

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SGS Australia Pty Ltd
Unit 15, 33 Maddox Street
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Alexandria NSW 2015
Australia

CONSTANT HEAD PERMEABILITY USING A FLEXIBLE WALL PERMEAMETER

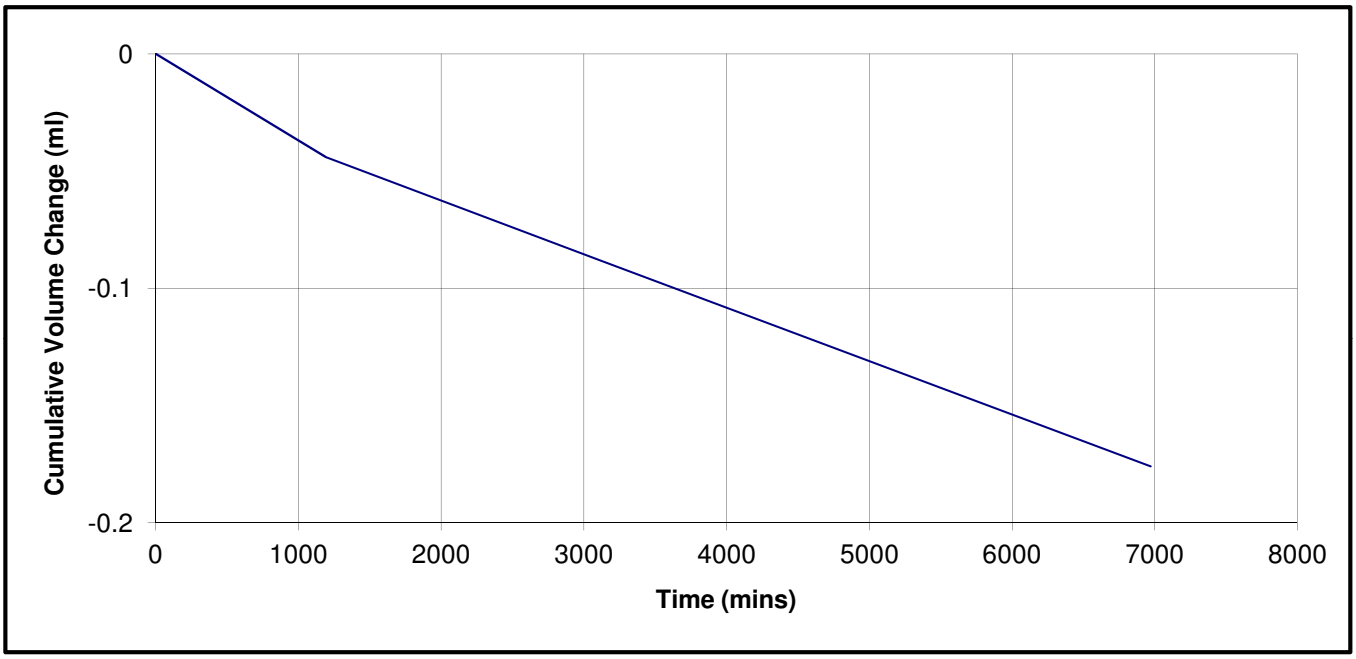
CLIENT: **ENVIRON AUSTRALIA PTY LTD**
Level 2 Adelaide TerraceEast PerthPerth WA 6004
PROJECT: **AS130389**
LOCATION:

Job Number: 14-32-383
Date Tested: 27.08.14

Laboratory Number: 14-AC-2764
Sampled By: Client

Sample Source: RB17 1.50-2.00m

Sample Description: SILTY CLAY: Black/Brown



Coefficient of Permeability	5E-12	(metres/second)
Mean Effective Stress	100	(kPa)
Permeant Used	Leachate supplied by client	
SAMPLE DETAILS		
Diameter of Specimen	50.3	(mm)
Height of Specimen	49.5	(mm)
REMOULD DATA		
Laboratory Moisture Ratio	100.1	(%)
Laboratory Density Ratio	100.3	(%)
Retained on 19mm Sieve	-	(%)
Compactive Effort	Standard	

Test Method: Constant head method using a flexible wall permeameter AS1289.6.7.3
Comments:

Approved Signatory: Corey Papu-Gread **Date:** 09.09.2014

Accredited for Compliance with ISO/IEC 17025

Accreditation No. 2418

TEST CERTIFICATE

ABN 44 000 964 278
ph: +61 (0)2 8594 0481

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

CONSTANT HEAD PERMEABILITY USING A FLEXIBLE WALL PERMEAMETER

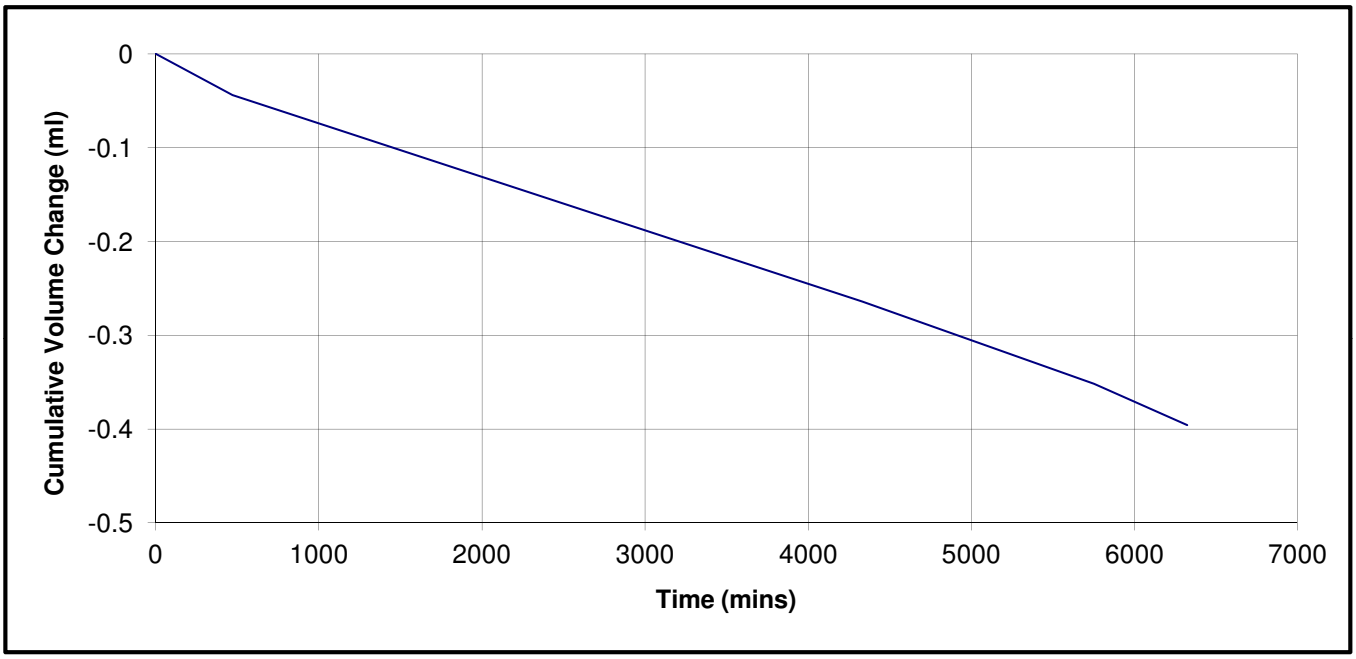
CLIENT: **ENVIRON AUSTRALIA PTY LTD**
Level 2 Adelaide TerraceEast PerthPerth WA 6004
PROJECT: **AS130389**
LOCATION:

Job Number: 14-32-383
Date Tested: 27.08.14

Laboratory Number: 14-AC-2764
Sampled By: Client

Sample Source: RB17 1.50-2.00m

Sample Description: SILTY CLAY: Black/Brown



Coefficient of Permeability	1E-11	(metres/second)
Mean Effective Stress	100	(kPa)
Permeant Used	Sydney Tap Water	
SAMPLE DETAILS		
Diameter of Specimen	50.0	(mm)
Height of Specimen	50.0	(mm)
REMOULD DATA		
Laboratory Moisture Ratio	100.1	(%)
Laboratory Density Ratio	99.4	(%)
Retained on 19mm Sieve	-	(%)
Compactive Effort	Standard	

Test Method: Constant head method using a flexible wall permeameter AS1289.6.7.3
Comments:

Approved Signatory: Corey Papu-Gread **Date:** 09.09.14

Accredited for Compliance with ISO/IEC 17025

Accreditation No. 2418

TEST CERTIFICATE

ABN 44 000 964 278
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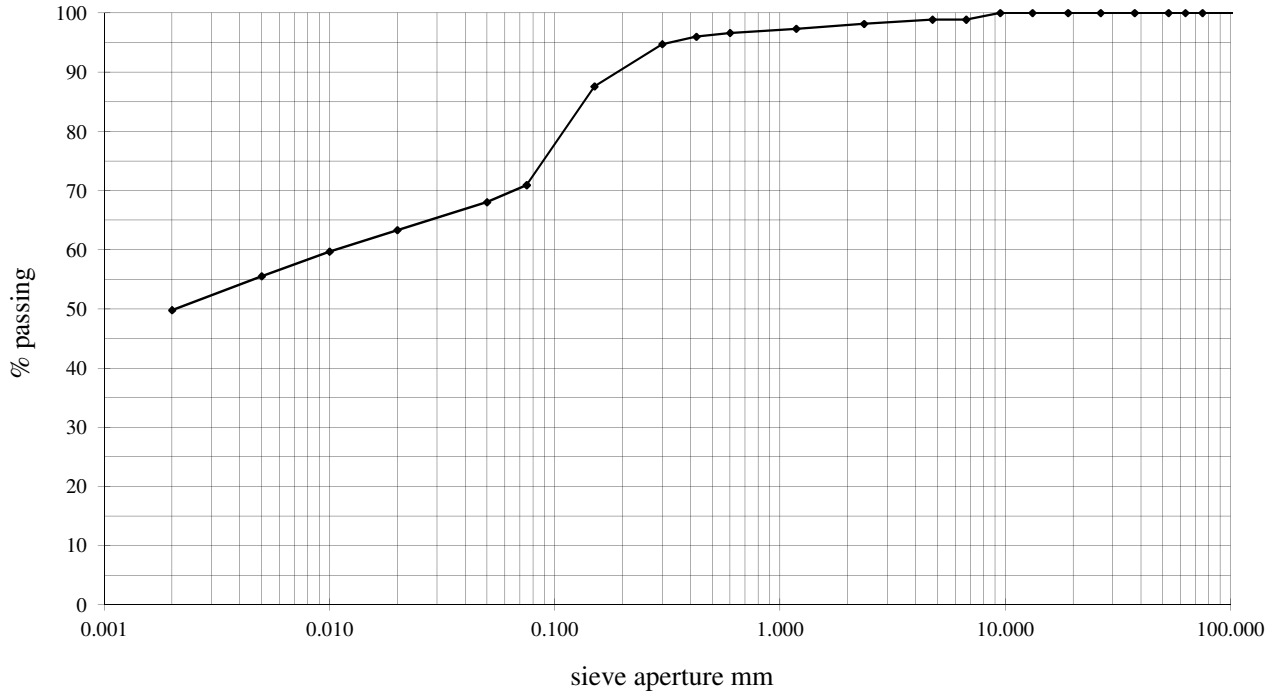
SGS Australia Pty Ltd
Unit 15, 33 Maddox Street
(PO Box 6432)
Alexandria NSW 2015
Australia

PARTICLE SIZE DISTRIBUTION

Client: ENVIRON AUSTRALIA PTY LTD
Address: Level 2 Adelaide TerraceEast PerthPerth WA 6004
Project: AS130389
Location:
Test Method: **AS 1289 3.6.1 / 3**
Job Number: 14-32-383
Sample Source: RB17 1.50-2.00m
Sampled By: Client

Lab Number: 14-AC-2764
Date Tested: 22.8.14
Checked By: ME



Clay	Silt	Sand	Gravel

Sample Description: SILTY CLAY: Black/Brown

Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
150.0		1.18	**97**
75.0		0.600	**97**
63.0		0.425	**96**
53.0		0.300	**95**
37.5		0.150	**88**
26.5		0.075	**71**
19.0		0.050	**68**
13.2		0.020	**63**
9.5	**100**	0.010	**60**
6.7	**99**	0.005	**56**
4.75	**99**	0.002	**50**
2.36	**98**		

Hydrometer Type: ASTM 152H
Dispersant Type: Sodium Hexametaphosphate
Pretreatment: None
Loss on Pretreatment: None
Remarks:

Approved Signatory: Aaron Lacey Date: 10/09/2014

Accredited for Compliance with ISO/IEC 17025

TEST CERTIFICATE

Aaron.Lacey@sgs.com
ABN: 44 000 964 278
ph: +61 (0)2 8594 0481
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SGS Australia Pty Ltd
PO Box 6432 Alexandria NSW 2015
Unit 15, 33 Maddox Street
Alexandria NSW 2015

Client:	ENVIRON AUSTRALIA PTY LTD	Client Job No:	
Order No:		Project:	AS130389
Tested Date:	10/09/2014	Location:	
SGS Job Number:	14-32-383	Sample No:	14-AC-2765
Lab:	Alexandria CMT	Sample ID:	RB22 1.00-1.50m

Moisture Content of a Soil

AS 1289.2.1.1

Sample Description:	SILTY CLAY:Brown
Moisture Content:	25.3%

Note: Sample supplied by client.

Approved Signatory: (Aaron.Lacey, Business Manager) Date: 10/09/2014

Accredited for compliance with ISO/IEC 17025

Accreditation No.: 2418
Client Address: Level 2 Adelaide Terrace East Perth Perth WA 6004

Site No.: 2418
Cert No.: 14-AC-2765-AN010
Form No.PF-AU-INDCMT-GEN-AN-010

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TEST CERTIFICATE

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

Client:	ENVIRON AUSTRALIA PTY LTD	Client Job No:	
Order No:		Project:	AS130389
Tested Date:	9/09/2014	Location:	
SGS Job Number:	14-32-383	Sample No:	14-AC-2765
Lab:	Alexandria CMT	Sample ID:	RB22 1.00-1.50m

Atterberg Limits (1 Point Casagrande Method)

AS 1289.3.1.2, 3.2.1, 3.3.1

Sample Description:	SILTY CLAY:Brown
Liquid Limit:	66%
Plastic Limit:	16%
Plasticity Index:	50%
History of Sample:	Air-Dried
Method of Preparation:	Dry-Sieved

Note: Sample supplied by client.

Approved Signatory: (Aaron.Lacey, Business Manager) Date: 10/09/2014

Accredited for compliance with ISO/IEC 17025

Accreditation No.: 2418
Client Address: Level 2 Adelaide Terrace East Perth Perth WA 6004

Site No.: 2418
Cert No.: 14-AC-2765-AN013
Form No.PF-AU-INDCMT-GEN-AN-013

TEST CERTIFICATE

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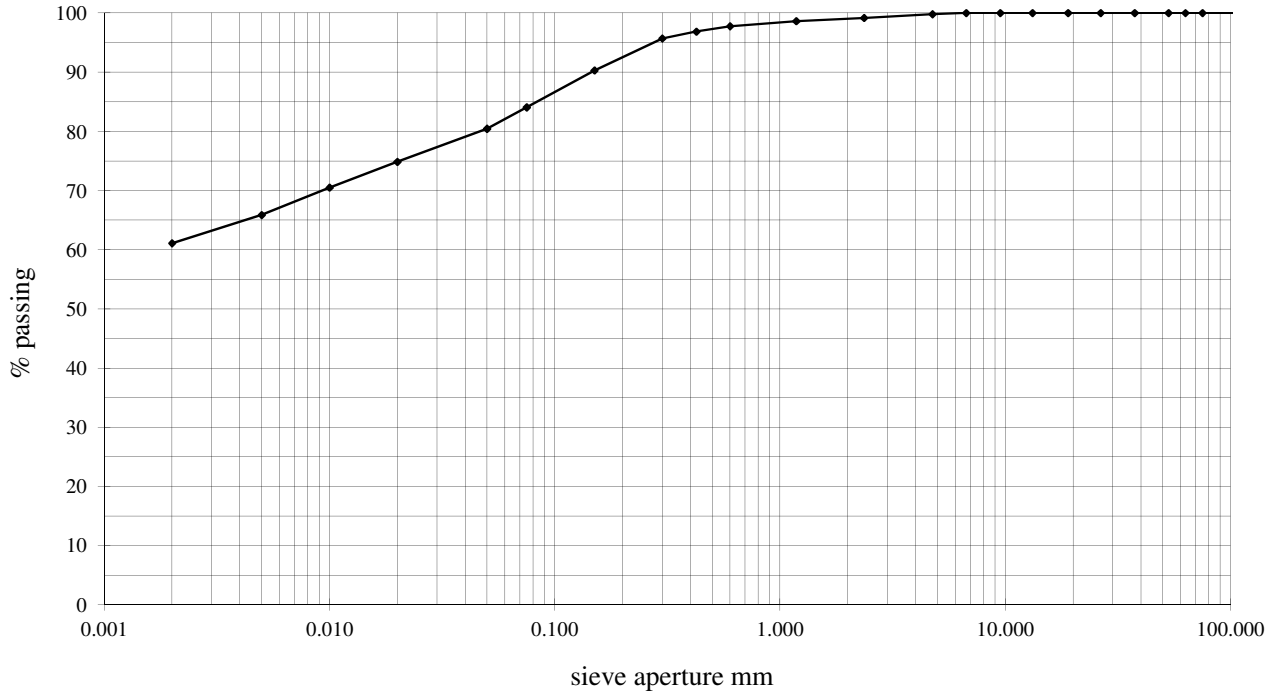
SGS Australia Pty Ltd
Unit 15, 33 Maddox Street
(PO Box 6432)
Alexandria NSW 2015
Australia

PARTICLE SIZE DISTRIBUTION

Client: ENVIRON AUSTRALIA PTY LTD
Address: Level 2 Adelaide TerraceEast PerthPerth WA 6004
Project: AS130389
Location:
Test Method: **AS 1289 3.6.1 / 3**
Job Number: 14-32-383
Sample Source: RB22 1.00-1.50m
Sampled By: Client
Lab Number: 14-AC-2765
Date Tested: 22/08/2014
Checked By: ME



Clay	Silt	Sand	Gravel

Sample Description: SILTY CLAY:Brown

Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
150.0		1.18	**99**
75.0		0.600	**98**
63.0		0.425	**97**
53.0		0.300	**96**
37.5		0.150	**90**
26.5		0.075	**84**
19.0		0.050	**80**
13.2		0.020	**75**
9.5		0.010	**71**
6.7		0.005	**66**
4.75	**100**	0.002	**61**
2.36	**99**		

Hydrometer Type: ASTM 152H
Dispersant Type: Sodium Hexametaphosphate
Pretreatment: None
Loss on Pretreatment: None
Remarks:

Approved Signatory: Aaron Lacey Date: 10/09/2014

Accredited for Compliance with ISO/IEC 17025

TEST CERTIFICATE

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

Client:	ENVIRON AUSTRALIA PTY LTD	Client Job No:	
Order No:		Project:	AS130389
Tested Date:	8/09/2014	Location:	
SGS Job Number:	14-32-383	Sample No:	14-AC-2766
Lab:	Alexandria CMT	Sample ID:	RB22 2.50-2.80m

Moisture Content of a Soil

AS 1289.2.1.1

Sample Description:	SILTY CLAY:Grey/Brown
Moisture Content:	19.8%

Note: Sample supplied by client.

Approved Signatory: (Aaron.Lacey, Business Manager) Date: 10/09/2014

Accredited for compliance with ISO/IEC 17025

Accreditation No.: 2418
Client Address: Level 2 Adelaide Terrace East Perth Perth WA 6004

Site No.: 2418
Cert No.: 14-AC-2766-AN010
Form No.PF-AU-INDCMT-GEN-AN-010

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Unit 15, 33 Maddox Street
Alexandria NSW 2015

Client:	ENVIRON AUSTRALIA PTY LTD	Client Job No:	
Order No:		Project:	AS130389
Tested Date:	9/09/2014	Location:	
SGS Job Number:	14-32-383	Sample No:	14-AC-2766
Lab:	Alexandria CMT	Sample ID:	RB22 2.50-2.80m

Atterberg Limits (1 Point Casagrande Method)

AS 1289.3.1.2, 3.2.1, 3.3.1

Sample Description:	SILTY CLAY:Grey/Brown
Liquid Limit:	48%
Plastic Limit:	26%
Plasticity Index:	22%
History of Sample:	Air-Dried
Method of Preparation:	Dry-Sieved

Note: Sample supplied by client.

Approved Signatory: (Aaron.Lacey, Business Manager) Date: 10/09/2014

Accredited for compliance with ISO/IEC 17025

Site No.: 2418
Cert No.: 14-AC-2766-AN013
Form No.PF-AU-INDCMT-GEN-AN-013

Accreditation No.: 2418
Client Address: Level 2 Adelaide Terrace East Perth Perth WA 6004

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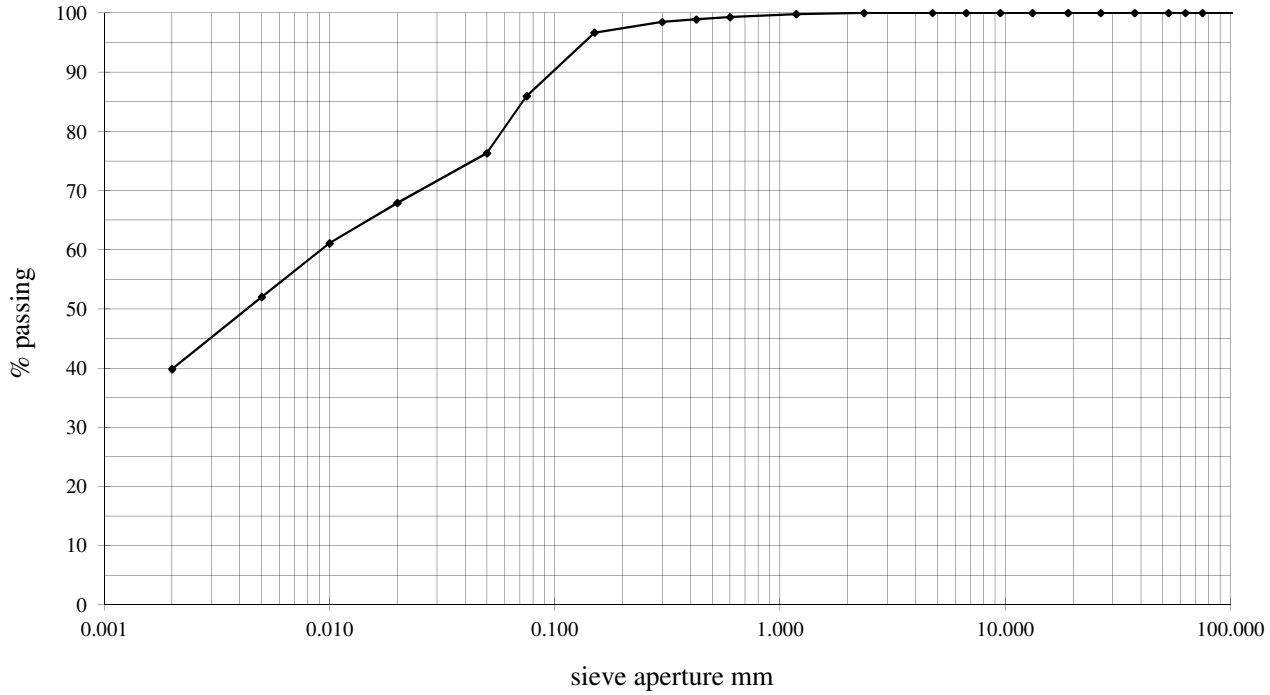
SGS Australia Pty Ltd
Unit 15, 33 Maddox Street
(PO Box 6432)
Alexandria NSW 2015
Australia

PARTICLE SIZE DISTRIBUTION

Client: ENVIRON AUSTRALIA PTY LTD
Address: Level 2 Adelaide TerraceEast PerthPerth WA 6004
Project: AS130389
Location:
Test Method: **AS 1289 3.6.1 / 3**
Job Number: 14-32-383
Sample Source: RB22 2.50-2.80m
Sampled By: Client
Lab Number: 14-AC-2766
Date Tested: 22/08/2014
Checked By: ME



Clay	Silt	Sand	Gravel

Sample Description: SILTY CLAY:Grey/Brown

Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
150.0		1.18	**100**
75.0		0.600	**99**
63.0		0.425	**99**
53.0		0.300	**98**
37.5		0.150	**97**
26.5		0.075	**86**
19.0		0.050	**76**
13.2		0.020	**68**
9.5		0.010	**61**
6.7		0.005	**52**
4.75		0.002	**40**
2.36			

Hydrometer Type: ASTM 152H
Dispersant Type: Sodium Hexametaphosphate
Pretreatment: None
Loss on Pretreatment: None
Remarks:

Approved Signatory: Aaron Lacey Date: 10/09/2014

Accredited for Compliance with ISO/IEC 17025

TEST CERTIFICATE

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SGS Australia Pty Ltd
PO Box 6432 Alexandria NSW 2015
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Alexandria NSW 2015

Client:	ENVIRON AUSTRALIA PTY LTD	Client Job No:	
Order No:		Project:	AS130389
Tested Date:	9/09/2014	Location:	
SGS Job Number:	14-32-383	Sample No:	14-AC-2767
Lab:	Alexandria CMT	Sample ID:	TP101 1.20-1.80m

Moisture Content of a Soil

AS 1289.2.1.1

Sample Description:	SILTY CLAY:Grey/Red-Brown
Moisture Content:	18.2%

Note: Sample supplied by client.

Approved Signatory: (Aaron.Lacey, Business Manager) Date: 10/09/2014

Accredited for compliance with ISO/IEC 17025

Accreditation No.: 2418
Client Address: Level 2 Adelaide Terrace East Perth Perth WA 6004

Site No.: 2418
Cert No.: 14-AC-2767-AN010
Form No.PF-AU-INDCMT-GEN-AN-010

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TEST CERTIFICATE

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

Client:	ENVIRON AUSTRALIA PTY LTD	Client Job No:	
Order No:		Project:	AS130389
Tested Date:	9/09/2014	Location:	
SGS Job Number:	14-32-383	Sample No:	14-AC-2767
Lab:	Alexandria CMT	Sample ID:	TP101 1.20-1.80m

Atterberg Limits (1 Point Casagrande Method)

AS 1289.3.1.2, 3.2.1, 3.3.1

Sample Description:	SILTY CLAY:Grey/Red-Brown
Liquid Limit:	43%
Plastic Limit:	14%
Plasticity Index:	29%
History of Sample:	Air-Dried
Method of Preparation:	Dry-Sieved

Note: Sample supplied by client.

Approved Signatory: (Aaron.Lacey, Business Manager) Date: 10/09/2014

Accredited for compliance with ISO/IEC 17025

Site No.: 2418
Cert No.: 14-AC-2767-AN013
Form No.PF-AU-INDCMT-GEN-AN-013

Accreditation No.: 2418
Client Address: Level 2 Adelaide Terrace East Perth Perth WA 6004

TEST CERTIFICATE

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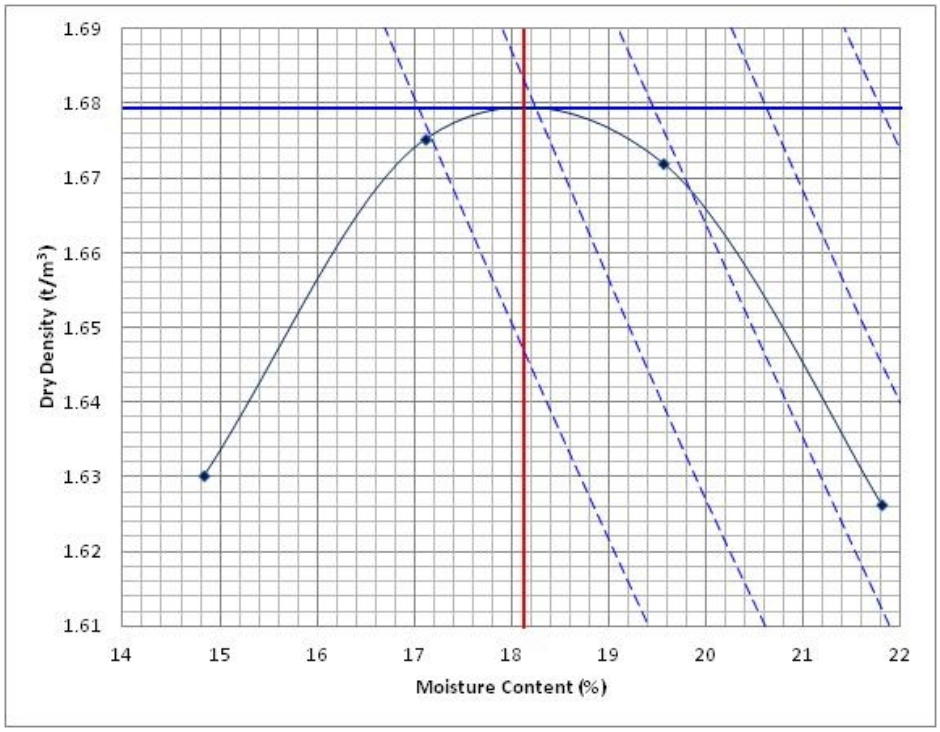
SGS Australia Pty Ltd
PO Box 6432 Alexandria NSW 2015
Unit 15, 33 Maddox Street
Alexandria NSW 2015

Client:	ENVIRON AUSTRALIA PTY LTD	Client Job No:	
Order No:		Project:	AS130389
Tested Date:	9/09/2014	Location:	
SGS Job Number:	14-32-383	Sample No:	14-AC-2767
Lab:	Alexandria CMT	Sample ID:	TP101 1.20-1.80m

Dry Density / Moisture Content Relation of a Soil

AS 1289.5.1.1 - Standard Compactive Effort



Sample Description:	SILTY CLAY:Grey/Red-Brown
Maximum Dry Density:	1.68t/m³
Optimum Moisture Content:	18.0%
Percent Oversize:	0%
Sieve Size:	19.0mm

Note: Sample supplied by client.

Approved Signatory: (Aaron.Lacey, Business Manager) Date: 10/09/2014

Accredited for compliance with ISO/IEC 17025

Site No.: 2418
Cert No.: 14-AC-2767-AN027.1
Form No.PF-AU-INDCMT-GEN-AN-027

Accreditation No.: 2418
Client Address: Level 2 Adelaide Terrace East Perth Perth WA 6004

TEST CERTIFICATE

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

CONSTANT HEAD PERMEABILITY USING A FLEXIBLE WALL PERMEAMETER

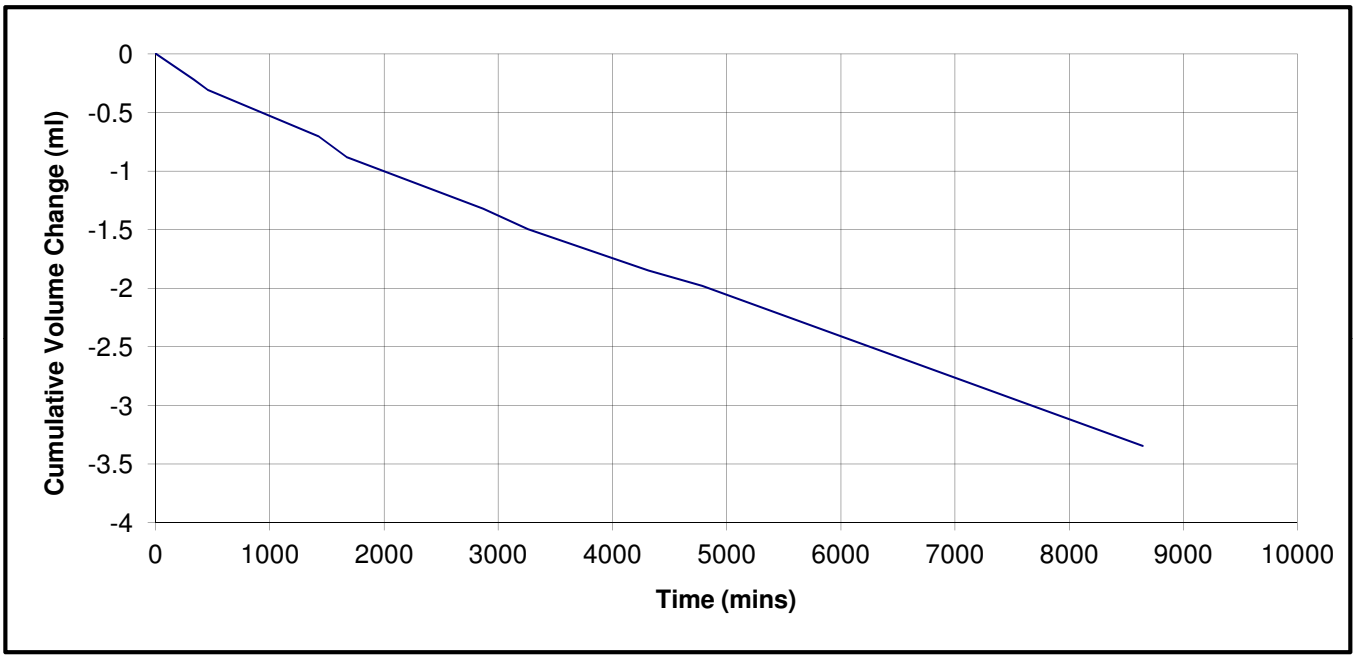
CLIENT: **ENVIRON AUSTRALIA PTY LTD**
Level 2 Adelaide TerraceEast PerthPerth WA 6004
PROJECT: **AS130389**
LOCATION:

Job Number: 14-32-383
Date Tested: 27.08.14

Laboratory Number: 14-AC-2767
Sampled By: Client

Sample Source: TP101 1.20-1.80m

Sample Description: SILTY CLAY:Grey/Red-Brown



Coefficient of Permeability	8E-11	(metres/second)
Mean Effective Stress	100	(kPa)
Permeant Used	Leachate supplied by client	
SAMPLE DETAILS		
Diameter of Specimen	50.0	(mm)
Height of Specimen	49.4	(mm)
REMOULD DATA		
Laboratory Moisture Ratio	99.7	(%)
Laboratory Density Ratio	100.4	(%)
Retained on 19mm Sieve	-	(%)
Compactive Effort	Standard	

Test Method: Constant head method using a flexible wall permeameter AS1289.6.7.3
Comments:

Approved Signatory: Corey Papu-Gread **Date:** 09.09.2014

Accredited for Compliance with ISO/IEC 17025

Accreditation No. 2418

TEST CERTIFICATE

ABN 44 000 964 278
ph: +61 (0)2 8594 0481

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

CONSTANT HEAD PERMEABILITY USING A FLEXIBLE WALL PERMEAMETER

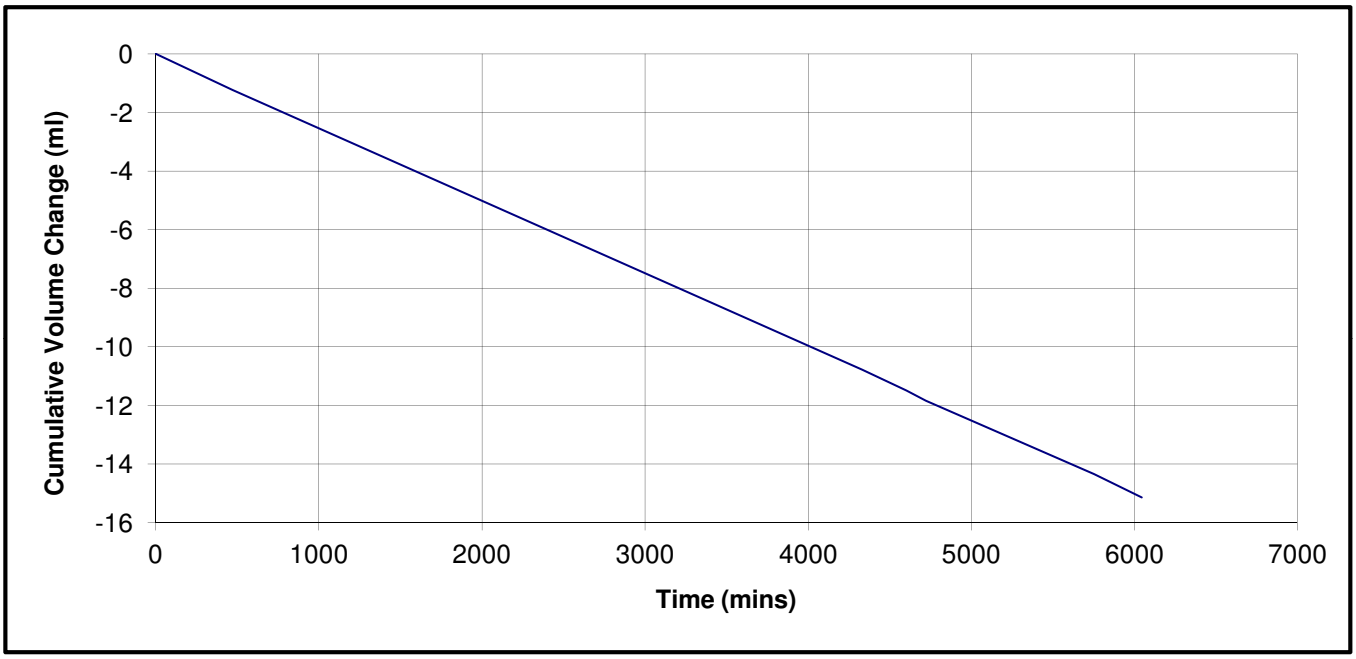
CLIENT: **ENVIRON AUSTRALIA PTY LTD**
Level 2 Adelaide TerraceEast PerthPerth WA 6004
PROJECT: **AS130389**
LOCATION:

Job Number: 14-32-383
Date Tested: 27.08.14

Laboratory Number: 14-AC-2767
Sampled By: Client

Sample Source: TP101 1.20-1.80m

Sample Description: SILTY CLAY:Grey/Red-Brown



Coefficient of Permeability	5E-10	(metres/second)
Mean Effective Stress	100	(kPa)
Permeant Used	Sydney Tap Water	
SAMPLE DETAILS		
Diameter of Specimen	50.1	(mm)
Height of Specimen	50.6	(mm)
REMOULD DATA		
Laboratory Moisture Ratio	99.7	(%)
Laboratory Density Ratio	100.5	(%)
Retained on 19mm Sieve	-	(%)
Compactive Effort	Standard	

Test Method: Constant head method using a flexible wall permeameter AS1289.6.7.3
Comments:

Approved Signatory: Corey Papu-Gread **Date:** 09.09.2014

Accredited for Compliance with ISO/IEC 17025

Accreditation No. 2418

TEST CERTIFICATE

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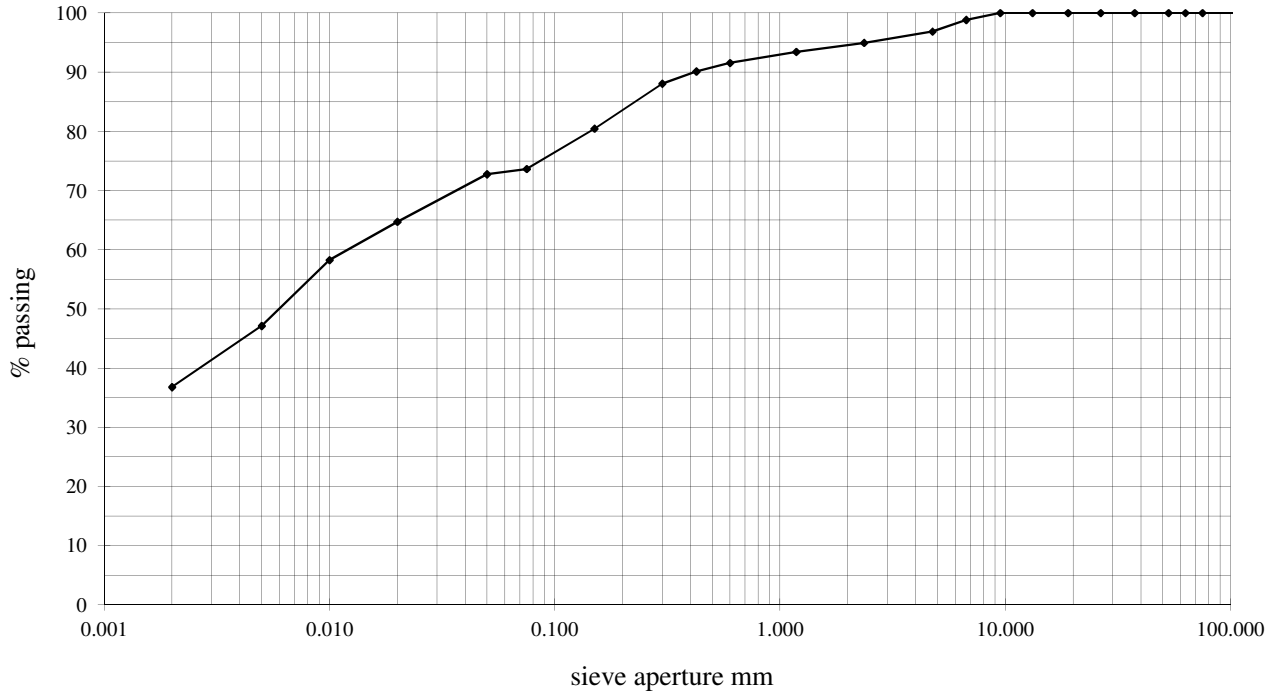
SGS Australia Pty Ltd
Unit 15, 33 Maddox Street
(PO Box 6432)
Alexandria NSW 2015
Australia

PARTICLE SIZE DISTRIBUTION

Client: ENVIRON AUSTRALIA PTY LTD
Address: Level 2 Adelaide TerraceEast PerthPerth WA 6004
Project: AS130389
Location:
Test Method: **AS 1289 3.6.1 / 3**
Job Number: 14-32-383
Sample Source: TP101 1.20-1.80m
Sampled By: Client
Lab Number: 14-AC-2767
Date Tested: 22.8.14
Checked By: AL



Clay	Silt	Sand	Gravel

Sample Description: SILTY CLAY:Grey/Red-Brown

Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
150.0		1.18	**93**
75.0		0.600	**92**
63.0		0.425	**90**
53.0		0.300	**88**
37.5		0.150	**80**
26.5		0.075	**74**
19.0		0.050	**73**
13.2		0.020	**65**
9.5	**100**	0.010	**58**
6.7	**99**	0.005	**47**
4.75	**97**	0.002	**37**
2.36	**95**		

Hydrometer Type: ASTM 152H
Dispersant Type: Sodium Hexametaphosphate
Pretreatment: None
Loss on Pretreatment: None
Remarks:

Approved Signatory: Aaron Lacey Date: 10/09/2014

Accredited for Compliance with ISO/IEC 17025

TEST CERTIFICATE

Aaron.Lacey@sgs.com
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SGS Australia Pty Ltd
PO Box 6432 Alexandria NSW 2015
Unit 15, 33 Maddox Street
Alexandria NSW 2015

Client:	ENVIRON AUSTRALIA PTY LTD	Client Job No:	
Order No:		Project:	AS130389
Tested Date:	9/09/2014	Location:	
SGS Job Number:	14-32-383	Sample No:	14-AC-2768
Lab:	Alexandria CMT	Sample ID:	TP102 0.90-1.50m

Moisture Content of a Soil

AS 1289.2.1.1

Sample Description:	SILTY CLAY: Grey/Red Brown
Moisture Content:	16.5%

Note: Sample supplied by client.

Approved Signatory: (Aaron.Lacey, Business Manager) Date: 10/09/2014

Accredited for compliance with ISO/IEC 17025

Accreditation No.: 2418
Client Address: Level 2 Adelaide Terrace East Perth Perth WA 6004

Site No.: 2418
Cert No.: 14-AC-2768-AN010
Form No.PF-AU-INDCMT-GEN-AN-010

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TEST CERTIFICATE

SGS Australia Pty Ltd
PO Box 6432 Alexandria NSW 2015
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Alexandria NSW 2015

Client:	ENVIRON AUSTRALIA PTY LTD	Client Job No:	
Order No:		Project:	AS130389
Tested Date:	9/09/2014	Location:	
SGS Job Number:	14-32-383	Sample No:	14-AC-2768
Lab:	Alexandria CMT	Sample ID:	TP102 0.90-1.50m

Atterberg Limits (1 Point Casagrande Method)

AS 1289.3.1.2, 3.2.1, 3.3.1

Sample Description:	SILTY CLAY: Grey/Red Brown
Liquid Limit:	36%
Plastic Limit:	13%
Plasticity Index:	23%
History of Sample:	Air-Dried
Method of Preparation:	Dry-Sieved

Note: Sample supplied by client.

Approved Signatory: (Aaron.Lacey, Business Manager) Date: 10/09/2014

Accredited for compliance with ISO/IEC 17025

Accreditation No.: 2418
Client Address: Level 2 Adelaide Terrace East Perth Perth WA 6004

Site No.: 2418
Cert No.: 14-AC-2768-AN013
Form No.PF-AU-INDCMT-GEN-AN-013

TEST CERTIFICATE

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fax: +61 (0)2 8594 0499

SGS Australia Pty Ltd
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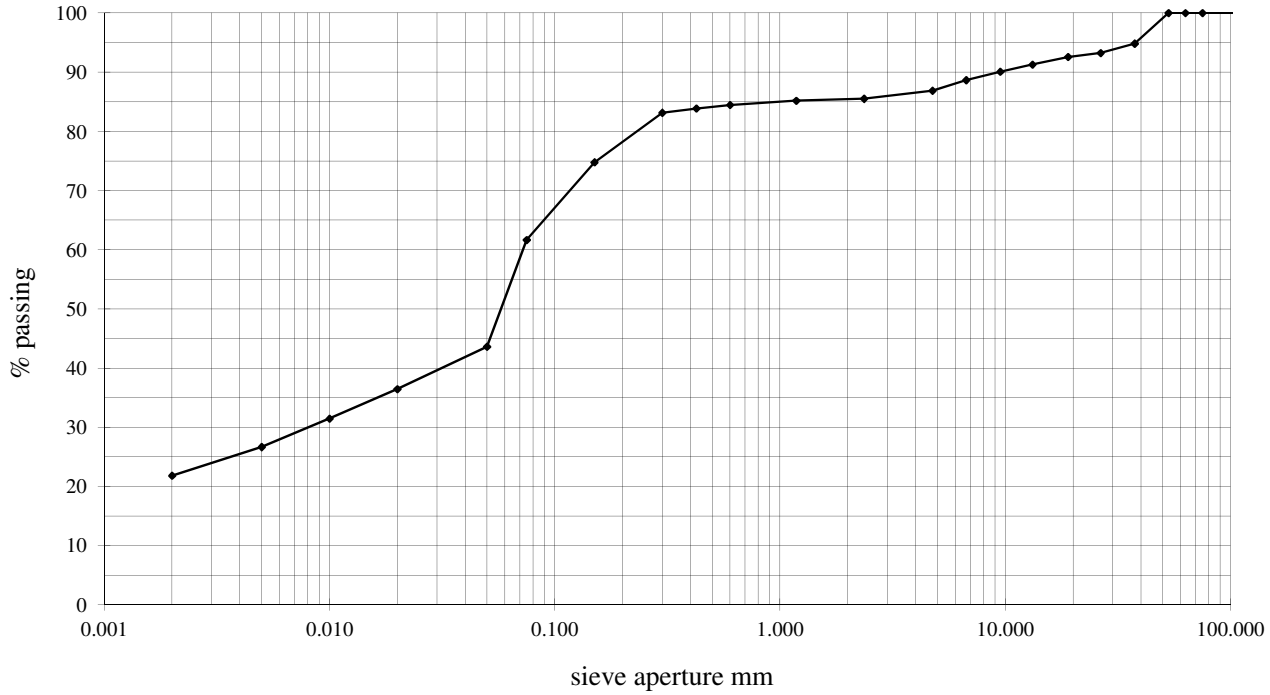
(PO Box 6432)
Alexandria NSW 2015
Australia

PARTICLE SIZE DISTRIBUTION

Client: ENVIRON AUSTRALIA PTY LTD
Address: Level 2 Adelaide TerraceEast PerthPerth WA 6004
Project: AS130389
Location:
Test Method: **AS 1289 3.6.1 / 3**
Job Number: 14-32-383
Sample Source: TP102 0.90-1.50m
Sampled By: Client
Lab Number: 14-AC-2768
Date Tested: 19/08/2014
Checked By: AL



Clay	Silt	Sand	Gravel

Sample Description: SILTY CLAY: Grey/Red Brown

Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
150.0		1.18	**85**
75.0		0.600	**84**
63.0		0.425	**84**
53.0	**100**	0.300	**83**
37.5	**95**	0.150	**75**
26.5	**93**	0.075	**62**
19.0	**93**	0.050	**44**
13.2	**91**	0.020	**36**
9.5	**90**	0.010	**31**
6.7	**89**	0.005	**27**
4.75	**87**	0.002	**22**
2.36	**86**		

Hydrometer Type: ASTM 152H
Dispersant Type: Sodium Hexametaphosphate
Pretreatment: None
Loss on Pretreatment: None
Remarks:

Approved Signatory: Aaron Lacey Date: 10/09/2014

Accredited for Compliance with ISO/IEC 17025

TEST CERTIFICATE

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

Client:	ENVIRON AUSTRALIA PTY LTD	Client Job No:	
Order No:		Project:	AS130389
Tested Date:	9/09/2014	Location:	
SGS Job Number:	14-32-383	Sample No:	14-AC-2769
Lab:	Alexandria CMT	Sample ID:	TP103 0.20-0.60m

Moisture Content of a Soil

AS 1289.2.1.1

Sample Description:	SILTY CLAY:Red-Brown
Moisture Content:	21.6%

Note: Sample supplied by client.

Approved Signatory: (Aaron.Lacey, Business Manager) Date: 10/09/2014

Accredited for compliance with ISO/IEC 17025

Accreditation No.: 2418
Client Address: Level 2 Adelaide Terrace East Perth Perth WA 6004

Site No.: 2418
Cert No.: 14-AC-2769-AN010
Form No.PF-AU-INDCMT-GEN-AN-010

TEST CERTIFICATE

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SGS Australia Pty Ltd
PO Box 6432 Alexandria NSW 2015
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Alexandria NSW 2015

Client:	ENVIRON AUSTRALIA PTY LTD	Client Job No:	
Order No:		Project:	AS130389
Tested Date:	9/09/2014	Location:	
SGS Job Number:	14-32-383	Sample No:	14-AC-2769
Lab:	Alexandria CMT	Sample ID:	TP103 0.20-0.60m

Atterberg Limits (1 Point Casagrande Method)

AS 1289.3.1.2, 3.2.1, 3.3.1

Sample Description:	SILTY CLAY:Red-Brown
Liquid Limit:	48%
Plastic Limit:	14%
Plasticity Index:	34%
History of Sample:	Air-Dried
Method of Preparation:	Dry-Sieved

Note: Sample supplied by client.

Approved Signatory: (Aaron.Lacey, Business Manager) Date: 10/09/2014

Accredited for compliance with ISO/IEC 17025

Site No.: 2418
Cert No.: 14-AC-2769-AN013
Form No.PF-AU-INDCMT-GEN-AN-013

Accreditation No.: 2418
Client Address: Level 2 Adelaide Terrace East Perth Perth WA 6004

TEST CERTIFICATE

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ph: +61 (0)2 8594 0481
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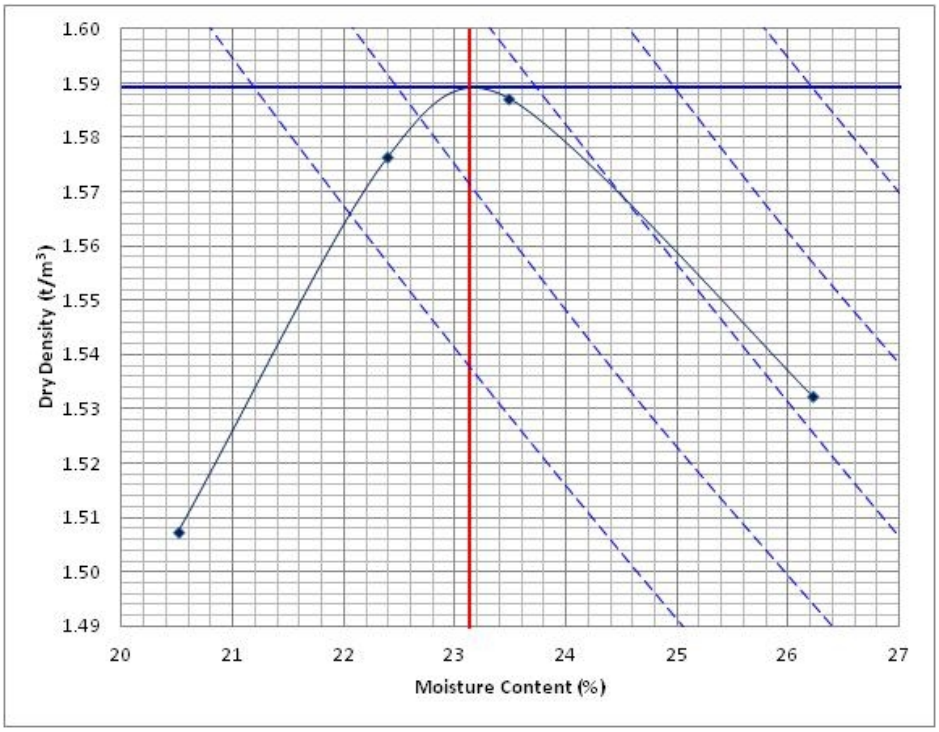
SGS Australia Pty Ltd
PO Box 6432 Alexandria NSW 2015
Unit 15, 33 Maddox Street
Alexandria NSW 2015

Client:	ENVIRON AUSTRALIA PTY LTD	Client Job No:	
Order No:		Project:	AS130389
Tested Date:	9/09/2014	Location:	
SGS Job Number:	14-32-383	Sample No:	14-AC-2769
Lab:	Alexandria CMT	Sample ID:	TP103 0.20-0.60m

Dry Density / Moisture Content Relation of a Soil

AS 1289.5.1.1 - Standard Compactive Effort



Sample Description:	SILTY CLAY:Red-Brown
Maximum Dry Density:	1.59t/m³
Optimum Moisture Content:	23.0%
Percent Oversize:	0%
Sieve Size:	19.0mm

Note: Sample supplied by client.

Approved Signatory: (Aaron.Lacey, Business Manager) Date: 10/09/2014

Accredited for compliance with ISO/IEC 17025

Site No.: 2418
Cert No.: 14-AC-2769-AN027.1
Form No.PF-AU-INDCMT-GEN-AN-027

Accreditation No.: 2418
Client Address: Level 2 Adelaide Terrace East Perth Perth WA 6004

TEST CERTIFICATE

ABN 44 000 964 278
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SGS Australia Pty Ltd
Unit 15, 33 Maddox Street
(PO Box 6432)
Alexandria NSW 2015
Australia

CONSTANT HEAD PERMEABILITY USING A FLEXIBLE WALL PERMEAMETER

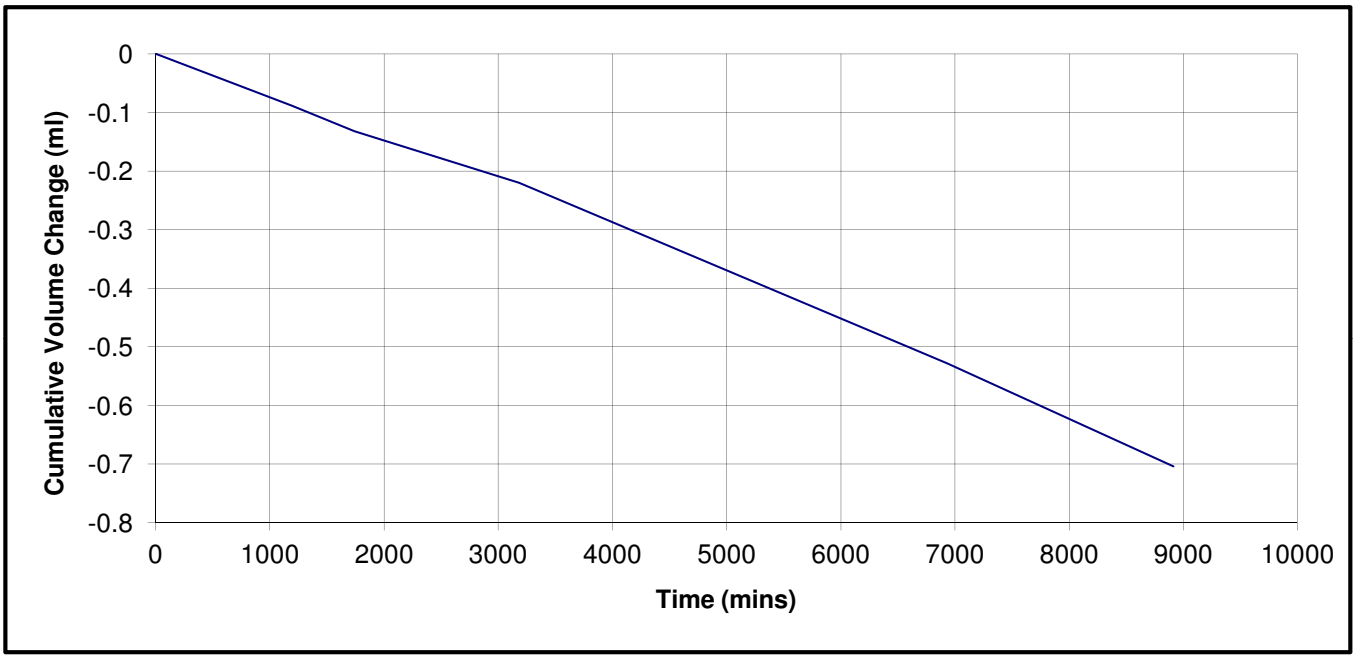
CLIENT: **ENVIRON AUSTRALIA PTY LTD**
Level 2 Adelaide TerraceEast PerthPerth WA 6004
PROJECT: **AS130389**
LOCATION:

Job Number: 14-32-383
Date Tested: 16/09/2014

Laboratory Number: 14-AC-2769
Sampled By: Client

Sample Source: TP103 0.20-0.60m

Sample Description: SILTY CLAY:Red-Brown



Coefficient of Permeability	2E-11	(metres/second)
Mean Effective Stress	100	(kPa)
Permeant Used	Sydney Tap Water	
SAMPLE DETAILS		
Diameter of Specimen	50.0	(mm)
Height of Specimen	49.0	(mm)
REMOULD DATA		
Laboratory Moisture Ratio	100.0	(%)
Laboratory Density Ratio	100.7	(%)
Retained on 19mm Sieve	-	(%)
Compactive Effort	Standard	

Test Method: Constant head method using a flexible wall permeameter AS1289.6.7.3
Comments:

Approved Signatory: Corey Papu-Gread **Date:** 23/09/2014

Accredited for Compliance with ISO/IEC 17025

Accreditation No. 2418

TEST CERTIFICATE

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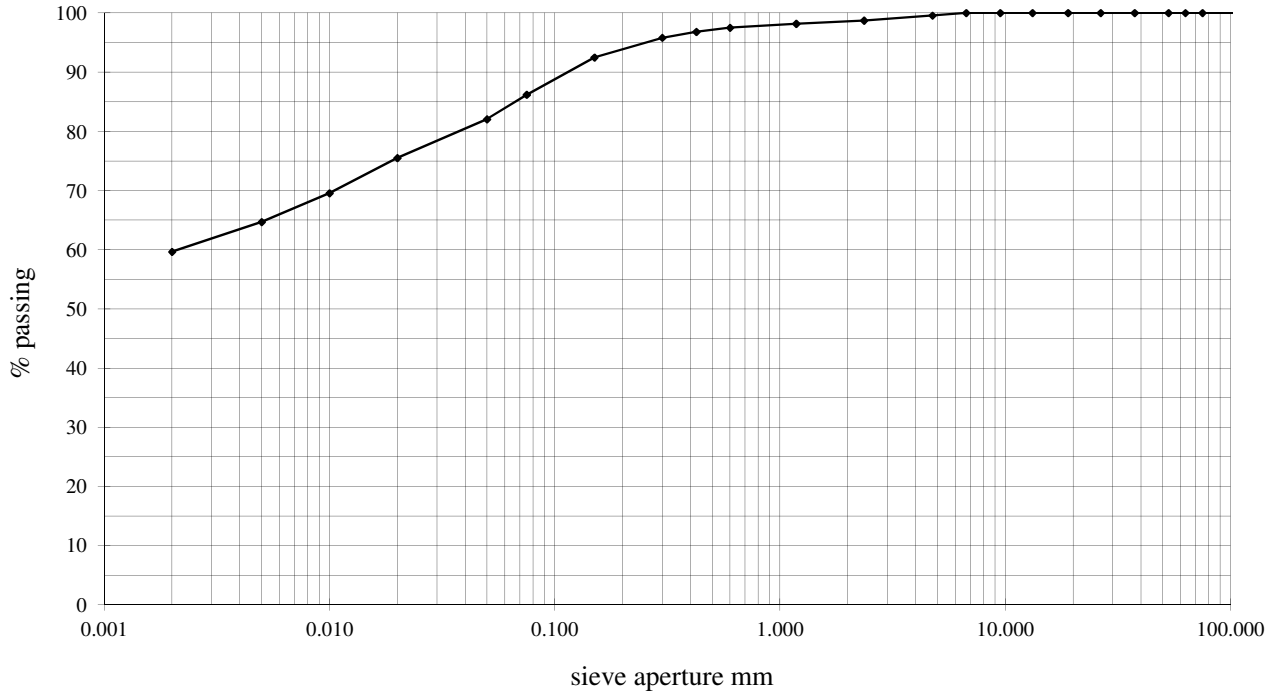
SGS Australia Pty Ltd
Unit 15, 33 Maddox Street
(PO Box 6432)
Alexandria NSW 2015
Australia

PARTICLE SIZE DISTRIBUTION

Client: ENVIRON AUSTRALIA PTY LTD
Address: Level 2 Adelaide TerraceEast PerthPerth WA 6004
Project: AS130389
Location:
Test Method: **AS 1289 3.6.1 / 3**
Job Number: 14-32-383
Sample Source: TP103 0.20-0.60m
Sampled By: Client
Lab Number: 14-AC-2769
Date Tested: 22/08/2014
Checked By: AL



Clay	Silt	Sand	Gravel

Sample Description: SILTY CLAY:Red-Brown

Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
150.0		1.18	**98**
75.0		0.600	**97**
63.0		0.425	**97**
53.0		0.300	**96**
37.5		0.150	**92**
26.5		0.075	**86**
19.0		0.050	**82**
13.2		0.020	**75**
9.5		0.010	**70**
6.7		0.005	**65**
4.75	**100**	0.002	**60**
2.36	**99**		

Hydrometer Type: ASTM 152H
Dispersant Type: Sodium Hexametaphosphate
Pretreatment: None
Loss on Pretreatment: None
Remarks:

Approved Signatory: Aaron Lacey Date: 10/09/2014

Accredited for Compliance with ISO/IEC 17025

Accreditation No. 2418

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Unit 15, 33 Maddox Street
Alexandria NSW 2015

Client:	ENVIRON AUSTRALIA PTY LTD	Client Job No:	
Order No:		Project:	AS130389
Tested Date:	9/09/2014	Location:	
SGS Job Number:	14-32-383	Sample No:	14-AC-2770
Lab:	Alexandria CMT	Sample ID:	TP104 0.60-1.00m

Moisture Content of a Soil

AS 1289.2.1.1

Sample Description:	SILTY CLAY: Red/Grey
Moisture Content:	18.2%

Note: Sample supplied by client.

Approved Signatory: (Aaron.Lacey, Business Manager) Date: 10/09/2014

Accredited for compliance with ISO/IEC 17025

Accreditation No.: 2418
Client Address: Level 2 Adelaide Terrace East Perth Perth WA 6004

Site No.: 2418
Cert No.: 14-AC-2770-AN010
Form No.PF-AU-INDCMT-GEN-AN-010

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TEST CERTIFICATE

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

Client:	ENVIRON AUSTRALIA PTY LTD	Client Job No:	
Order No:		Project:	AS130389
Tested Date:	9/09/2014	Location:	
SGS Job Number:	14-32-383	Sample No:	14-AC-2770
Lab:	Alexandria CMT	Sample ID:	TP104 0.60-1.00m

Atterberg Limits (1 Point Casagrande Method)

AS 1289.3.1.2, 3.2.1, 3.3.1

Sample Description:	SILTY CLAY: Red/Grey
Liquid Limit:	62%
Plastic Limit:	15%
Plasticity Index:	47%
History of Sample:	Air-Dried
Method of Preparation:	Dry-Sieved

Note: Sample supplied by client.

Approved Signatory: (Aaron.Lacey, Business Manager) Date: 10/09/2014

Accredited for compliance with ISO/IEC 17025

Site No.: 2418
Cert No.: 14-AC-2770-AN013
Form No.PF-AU-INDCMT-GEN-AN-013

Accreditation No.: 2418
Client Address: Level 2 Adelaide Terrace East Perth Perth WA 6004

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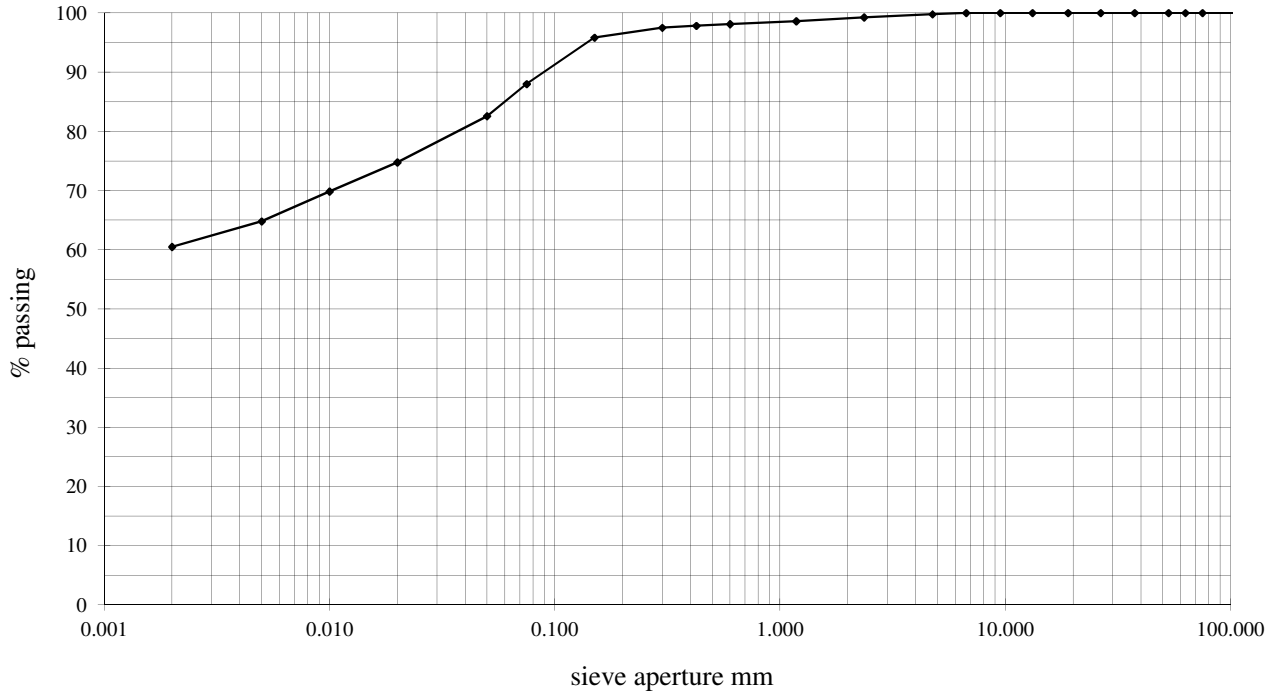
SGS Australia Pty Ltd
Unit 15, 33 Maddox Street
(PO Box 6432)
Alexandria NSW 2015
Australia

PARTICLE SIZE DISTRIBUTION

Client: ENVIRON AUSTRALIA PTY LTD
Address: Level 2 Adelaide TerraceEast PerthPerth WA 6004
Project: AS130389
Location:
Test Method: **AS 1289 3.6.1 / 3**
Job Number: 14-32-383
Sample Source: TP104 0.60-1.00m
Sampled By: Client
Lab Number: 14-AC-2770
Date Tested: 22.8.14
Checked By: ME



Clay	Silt	Sand	Gravel

Sample Description: SILTY CLAY: Red/Grey

Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
150.0		1.18	**99**
75.0		0.600	**98**
63.0		0.425	**98**
53.0		0.300	**98**
37.5		0.150	**96**
26.5		0.075	**88**
19.0		0.050	**83**
13.2		0.020	**75**
9.5		0.010	**70**
6.7		0.005	**65**
4.75	**100**	0.002	**60**
2.36	**99**		

Hydrometer Type: ASTM 152H
Dispersant Type: Sodium Hexametaphosphate
Pretreatment: None
Loss on Pretreatment: None
Remarks:

Approved Signatory: Aaron Lacey Date: 10/09/2014

Accredited for Compliance with ISO/IEC 17025

Accreditation No. 2418

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Unit 15, 33 Maddox Street
Alexandria NSW 2015

Client:	ENVIRON AUSTRALIA PTY LTD	Client Job No:	
Order No:		Project:	AS130389
Tested Date:	9/09/2014	Location:	
SGS Job Number:	14-32-383	Sample No:	14-AC-2771
Lab:	Alexandria CMT	Sample ID:	TP105 1.00-1.50m

Moisture Content of a Soil

AS 1289.2.1.1

Sample Description:	SILTY CLAY: Grey/Red Brown
Moisture Content:	20.3%

Note: Sample supplied by client.

Approved Signatory: (Aaron.Lacey, Business Manager) Date: 10/09/2014

Accredited for compliance with ISO/IEC 17025

Site No.: 2418
Cert No.: 14-AC-2771-AN010
Form No.PF-AU-INDCMT-GEN-AN-010

Accreditation No.: 2418
Client Address: Level 2 Adelaide Terrace East Perth Perth WA 6004

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Alexandria NSW 2015

Client:	ENVIRON AUSTRALIA PTY LTD	Client Job No:	
Order No:		Project:	AS130389
Tested Date:	9/09/2014	Location:	
SGS Job Number:	14-32-383	Sample No:	14-AC-2771
Lab:	Alexandria CMT	Sample ID:	TP105 1.00-1.50m

Atterberg Limits (1 Point Casagrande Method)

AS 1289.3.1.2, 3.2.1, 3.3.1

Sample Description:	SILTY CLAY: Grey/Red Brown
Liquid Limit:	53%
Plastic Limit:	20%
Plasticity Index:	33%
History of Sample:	Air-Dried
Method of Preparation:	Dry-Sieved

Note: Sample supplied by client.

Approved Signatory: (Aaron.Lacey, Business Manager) Date: 10/09/2014

Accredited for compliance with ISO/IEC 17025

Site No.: 2418
Cert No.: 14-AC-2771-AN013
Form No.PF-AU-INDCMT-GEN-AN-013

Accreditation No.: 2418
Client Address: Level 2 Adelaide Terrace East Perth Perth WA 6004

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PO Box 6432 Alexandria NSW 2015
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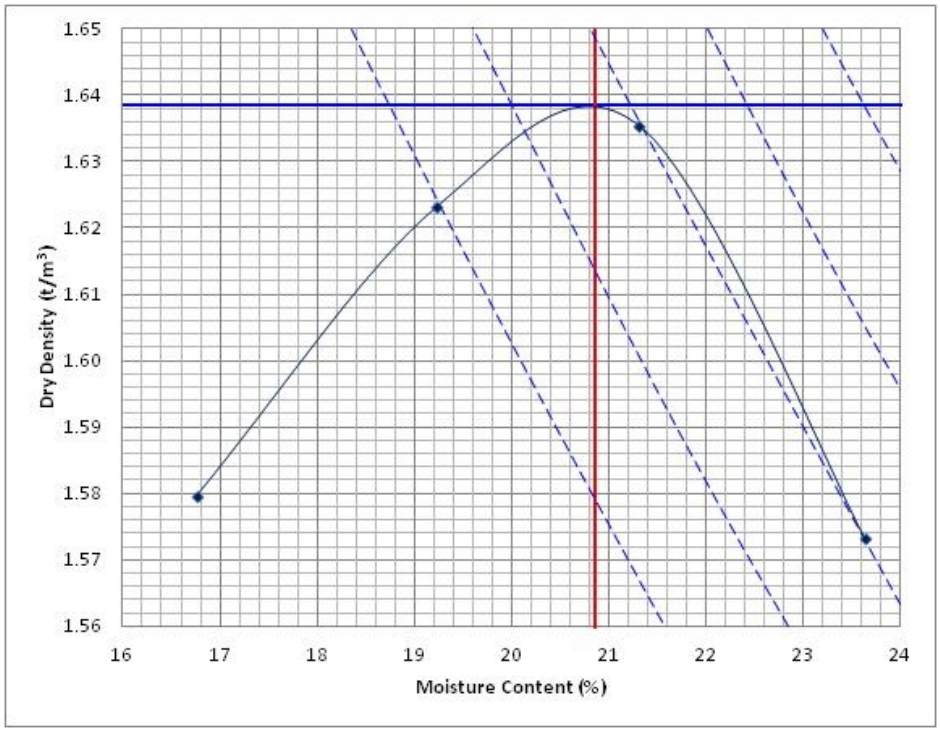
Alexandria NSW 2015

Client:	ENVIRON AUSTRALIA PTY LTD	Client Job No:	
Order No:		Project:	AS130389
Tested Date:	9/09/2014	Location:	
SGS Job Number:	14-32-383	Sample No:	14-AC-2771
Lab:	Alexandria CMT	Sample ID:	TP105 1.00-1.50m

Dry Density / Moisture Content Relation of a Soil

AS 1289.5.1.1 - Standard Compactive Effort



Sample Description:	SILTY CLAY: Grey/Red Brown
Maximum Dry Density:	1.64t/m³
Optimum Moisture Content:	21.0%
Percent Oversize:	0%
Sieve Size:	19.0mm

Note: Sample supplied by client.

Approved Signatory: (Aaron.Lacey, Business Manager) Date: 10/09/2014

Accredited for compliance with ISO/IEC 17025

Site No.: 2418
Cert No.: 14-AC-2771-AN027.1
Form No.PF-AU-INDCMT-GEN-AN-027

Accreditation No.: 2418
Client Address: Level 2 Adelaide Terrace East Perth Perth WA 6004

TEST CERTIFICATE

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

CONSTANT HEAD PERMEABILITY USING A FLEXIBLE WALL PERMEAMETER

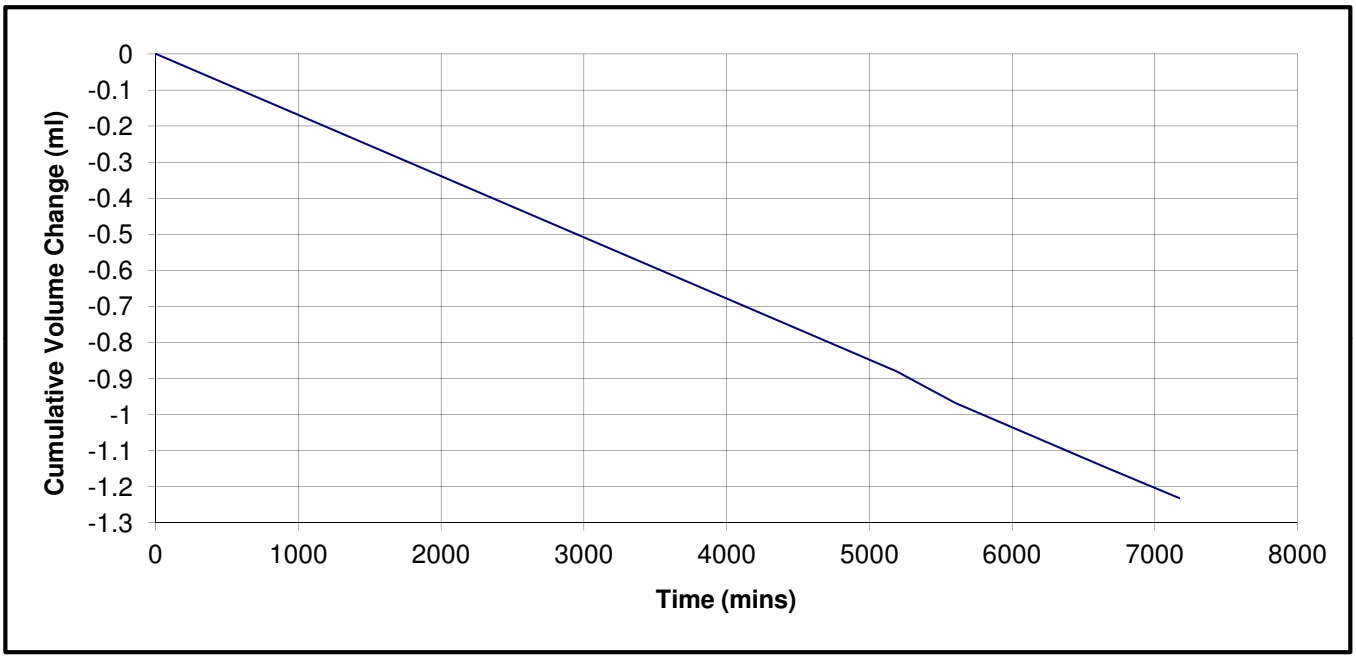
CLIENT: **ENVIRON AUSTRALIA PTY LTD**
Level 2 Adelaide TerraceEast PerthPerth WA 6004
PROJECT: **AS130389**
LOCATION:

Job Number: 14-32-383
Date Tested: 12/09/2014

Laboratory Number: 14-AC-2771
Sampled By: Client

Sample Source: TP105 1.00-1.50m

Sample Description: SILTY CLAY: Grey/Red Brown



Coefficient of Permeability	4E-11	(metres/second)
Mean Effective Stress	100	(kPa)
Permeant Used	Sydney Tap Water	
SAMPLE DETAILS		
Diameter of Specimen	50.2	(mm)
Height of Specimen	49.6	(mm)
REMOULD DATA		
Laboratory Moisture Ratio	100.0	(%)
Laboratory Density Ratio	99.6	(%)
Retained on 19mm Sieve	-	(%)
Compactive Effort	Standard	

Test Method: Constant head method using a flexible wall permeameter AS1289.6.7.3
Comments:

Approved Signatory: Corey Papu-Gread **Date:** 23/09/2014

Accredited for Compliance with ISO/IEC 17025

Accreditation No. 2418

TEST CERTIFICATE

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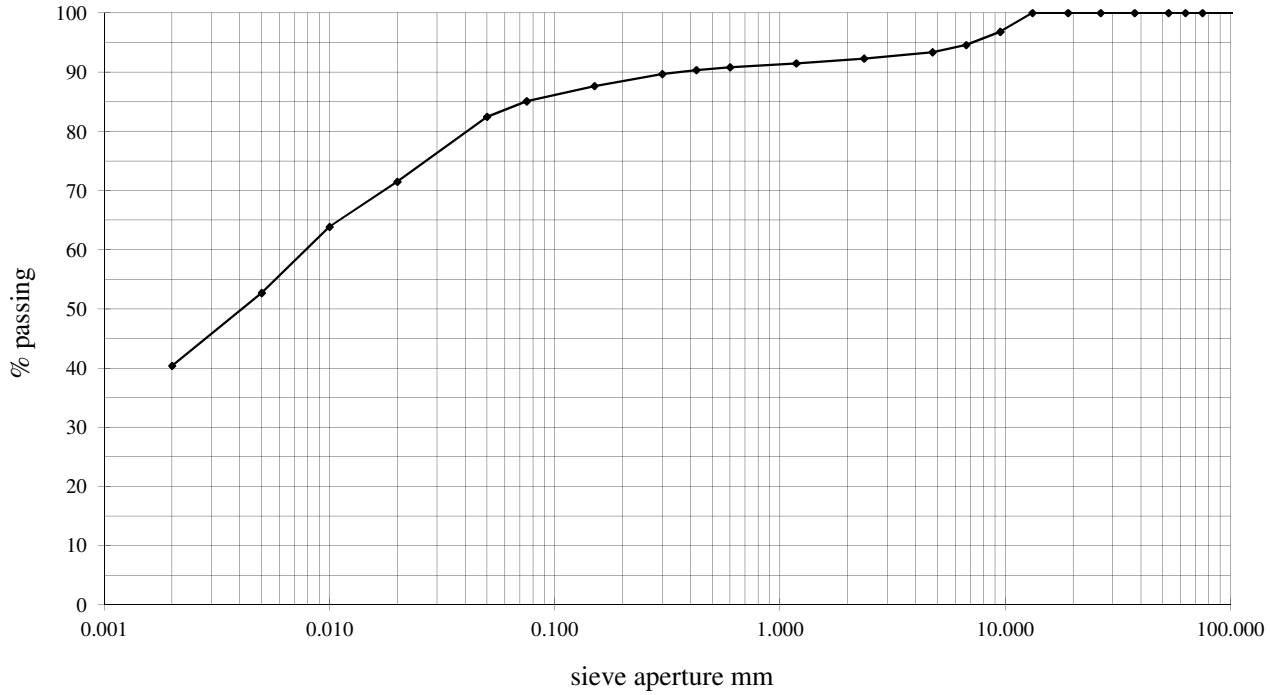
SGS Australia Pty Ltd
Unit 15, 33 Maddox Street
(PO Box 6432)
Alexandria NSW 2015
Australia

PARTICLE SIZE DISTRIBUTION

Client: ENVIRON AUSTRALIA PTY LTD
Address: Level 2 Adelaide TerraceEast PerthPerth WA 6004
Project: AS130389
Location:
Test Method: **AS 1289 3.6.1 / 3**
Job Number: 14-32-383
Sample Source: TP105 1.00-1.50m
Sampled By: Client
Lab Number: 14-AC-2771
Date Tested: 22/08/2014
Checked By: ME



Clay	Silt	Sand	Gravel

Sample Description: SILTY CLAY: Grey/Red Brown

Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
150.0		1.18	**91**
75.0		0.600	**91**
63.0		0.425	**90**
53.0		0.300	**90**
37.5		0.150	**88**
26.5		0.075	**85**
19.0		0.050	**82**
13.2	**100**	0.020	**71**
9.5	**97**	0.010	**64**
6.7	**95**	0.005	**53**
4.75	**93**	0.002	**40**
2.36	**92**		

Hydrometer Type: ASTM 152H
Dispersant Type: Sodium Hexametaphosphate
Pretreatment: None
Loss on Pretreatment: None
Remarks:

Approved Signatory: Aaron Lacey Date: 10/09/2014

Accredited for Compliance with ISO/IEC 17025

Accreditation No. 2418

TEST CERTIFICATE

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

Client:	ENVIRON AUSTRALIA PTY LTD	Client Job No:	
Order No:		Project:	AS130389
Tested Date:	9/09/2014	Location:	
SGS Job Number:	14-32-383	Sample No:	14-AC-2772
Lab:	Alexandria CMT	Sample ID:	TP106 0.80-1.40m

Moisture Content of a Soil

AS 1289.2.1.1

Sample Description:	SILTY CLAY:Light Brown
Moisture Content:	13.6%

Note: Sample supplied by client.

Approved Signatory: (Aaron.Lacey, Business Manager) Date: 10/09/2014

Accredited for compliance with ISO/IEC 17025

Accreditation No.: 2418
Client Address: Level 2 Adelaide Terrace East Perth Perth WA 6004

Site No.: 2418
Cert No.: 14-AC-2772-AN010
Form No.PF-AU-INDCMT-GEN-AN-010

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TEST CERTIFICATE

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PO Box 6432 Alexandria NSW 2015
Unit 15, 33 Maddox Street
Alexandria NSW 2015

Client:	ENVIRON AUSTRALIA PTY LTD	Client Job No:	
Order No:		Project:	AS130389
Tested Date:	9/09/2014	Location:	
SGS Job Number:	14-32-383	Sample No:	14-AC-2772
Lab:	Alexandria CMT	Sample ID:	TP106 0.80-1.40m

Atterberg Limits (1 Point Casagrande Method)

AS 1289.3.1.2, 3.2.1, 3.3.1

Sample Description:	SILTY CLAY:Light Brown
Liquid Limit:	35%
Plastic Limit:	12%
Plasticity Index:	23%
History of Sample:	Air-Dried
Method of Preparation:	Dry-Sieved

Note: Sample supplied by client.

Approved Signatory: (Aaron.Lacey, Business Manager) Date: 10/09/2014

Accredited for compliance with ISO/IEC 17025

Site No.: 2418
Cert No.: 14-AC-2772-AN013
Form No.PF-AU-INDCMT-GEN-AN-013

Accreditation No.: 2418
Client Address: Level 2 Adelaide Terrace East Perth Perth WA 6004

TEST CERTIFICATE

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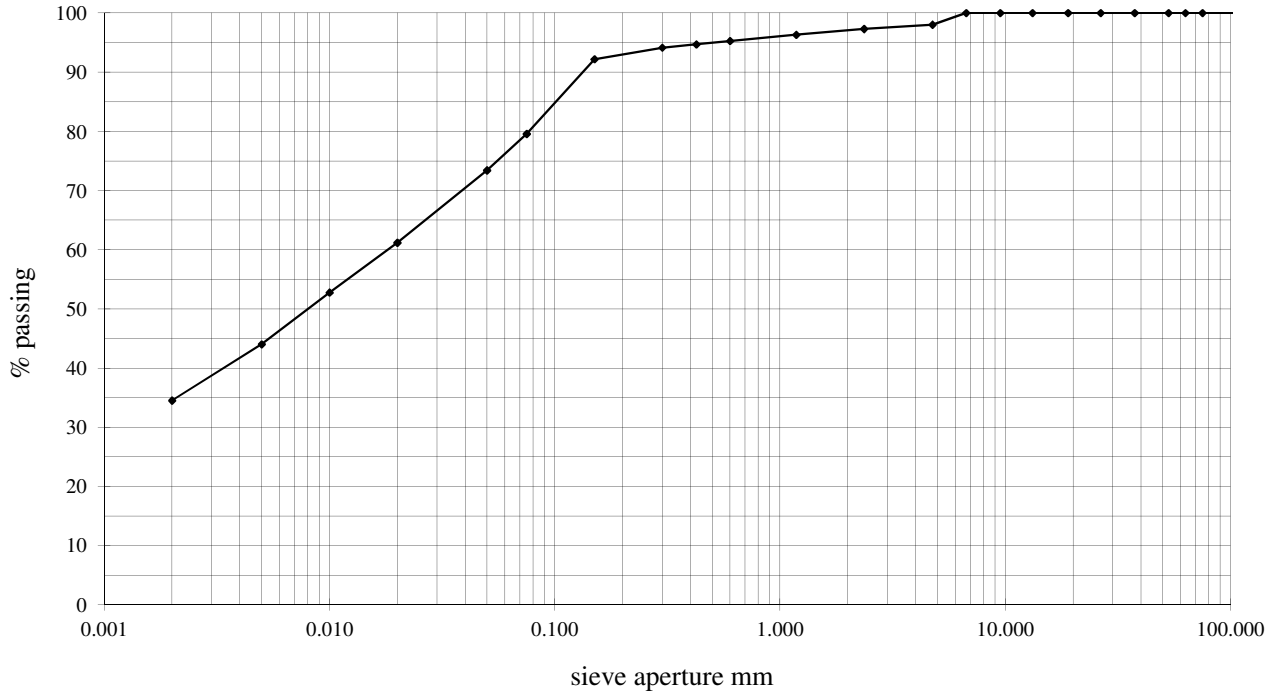
SGS Australia Pty Ltd
Unit 15, 33 Maddox Street
(PO Box 6432)
Alexandria NSW 2015
Australia

PARTICLE SIZE DISTRIBUTION

Client: ENVIRON AUSTRALIA PTY LTD
Address: Level 2 Adelaide TerraceEast PerthPerth WA 6004
Project: AS130389
Location:
Test Method: **AS 1289 3.6.1 / 3**
Job Number: 14-32-383
Sample Source: TP106 0.80-1.40m
Sampled By: Client
Lab Number: 14-AC-2772
Date Tested: 22.8.14
Checked By: AL



Clay	Silt	Sand	Gravel

Sample Description: SILTY CLAY:Red-Brown

Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
150.0		1.18	**96**
75.0		0.600	**95**
63.0		0.425	**95**
53.0		0.300	**94**
37.5		0.150	**92**
26.5		0.075	**80**
19.0		0.050	**73**
13.2		0.020	**61**
9.5		0.010	**53**
6.7	**100**	0.005	**44**
4.75	**98**	0.002	**35**
2.36	**97**		

Hydrometer Type: ASTM 152H
Dispersant Type: Sodium Hexametaphosphate
Pretreatment: None
Loss on Pretreatment: None
Remarks:

Approved Signatory: Aaron Lacey Date: 10/09/2014

Accredited for Compliance with ISO/IEC 17025

Accreditation No. 2418

TEST CERTIFICATE

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

Client:	ENVIRON AUSTRALIA PTY LTD	Client Job No:	
Order No:		Project:	AS130389
Tested Date:	9/09/2014	Location:	
SGS Job Number:	14-32-383	Sample No:	14-AC-2773
Lab:	Alexandria CMT	Sample ID:	TP107 0.50-1.00m

Moisture Content of a Soil

AS 1289.2.1.1

Sample Description:	SILTY CLAY: Red/Yellow-brown
Moisture Content:	22.3%

Note: Sample supplied by client.

Approved Signatory: (Aaron.Lacey, Business Manager) Date: 10/09/2014

Accredited for compliance with ISO/IEC 17025

Accreditation No.: 2418
Client Address: Level 2 Adelaide Terrace East Perth Perth WA 6004

Site No.: 2418
Cert No.: 14-AC-2773-AN010
Form No.PF-AU-INDCMT-GEN-AN-010

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TEST CERTIFICATE

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

Client:	ENVIRON AUSTRALIA PTY LTD	Client Job No:	
Order No:		Project:	AS130389
Tested Date:	9/09/2014	Location:	
SGS Job Number:	14-32-383	Sample No:	14-AC-2773
Lab:	Alexandria CMT	Sample ID:	TP107 0.50-1.00m

Atterberg Limits (1 Point Casagrande Method)

AS 1289.3.1.2, 3.2.1, 3.3.1

Sample Description:	SILTY CLAY: Red/Yellow-brown
Liquid Limit:	45%
Plastic Limit:	13%
Plasticity Index:	32%
History of Sample:	Air-Dried
Method of Preparation:	Dry-Sieved

Note: Sample supplied by client.

Approved Signatory: (Aaron.Lacey, Business Manager) Date: 10/09/2014

Accredited for compliance with ISO/IEC 17025

Accreditation No.: 2418
Client Address: Level 2 Adelaide Terrace East Perth Perth WA 6004

Site No.: 2418
Cert No.: 14-AC-2773-AN013
Form No.PF-AU-INDCMT-GEN-AN-013

TEST CERTIFICATE

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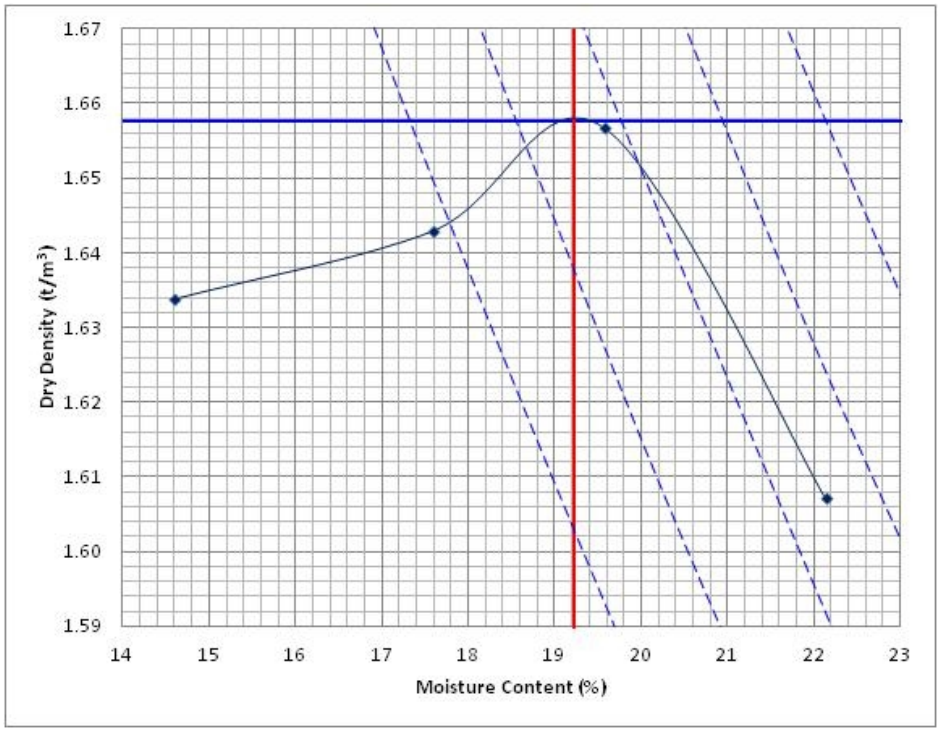
SGS Australia Pty Ltd
PO Box 6432 Alexandria NSW 2015
Unit 15, 33 Maddox Street
Alexandria NSW 2015

Client:	ENVIRON AUSTRALIA PTY LTD	Client Job No:	
Order No:		Project:	AS130389
Tested Date:	9/09/2014	Location:	
SGS Job Number:	14-32-383	Sample No:	14-AC-2773
Lab:	Alexandria CMT	Sample ID:	TP107 0.50-1.00m

Dry Density / Moisture Content Relation of a Soil

AS 1289.5.1.1 - Standard Compactive Effort



Sample Description:	SILTY CLAY: Red/Yellow-brown
Maximum Dry Density:	1.66t/m³
Optimum Moisture Content:	19.0%
Percent Oversize:	0%
Sieve Size:	19.0mm

Note: Sample supplied by client.

Approved Signatory: (Aaron.Lacey, Business Manager) Date: 10/09/2014

Accredited for compliance with ISO/IEC 17025

Site No.: 2418
Cert No.: 14-AC-2773-AN027.1
Form No.PF-AU-INDCMT-GEN-AN-027

Accreditation No.: 2418
Client Address: Level 2 Adelaide Terrace East Perth Perth WA 6004

TEST CERTIFICATE

ABN 44 000 964 278
ph: +61 (0)2 8594 0481

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

CONSTANT HEAD PERMEABILITY USING A FLEXIBLE WALL PERMEAMETER

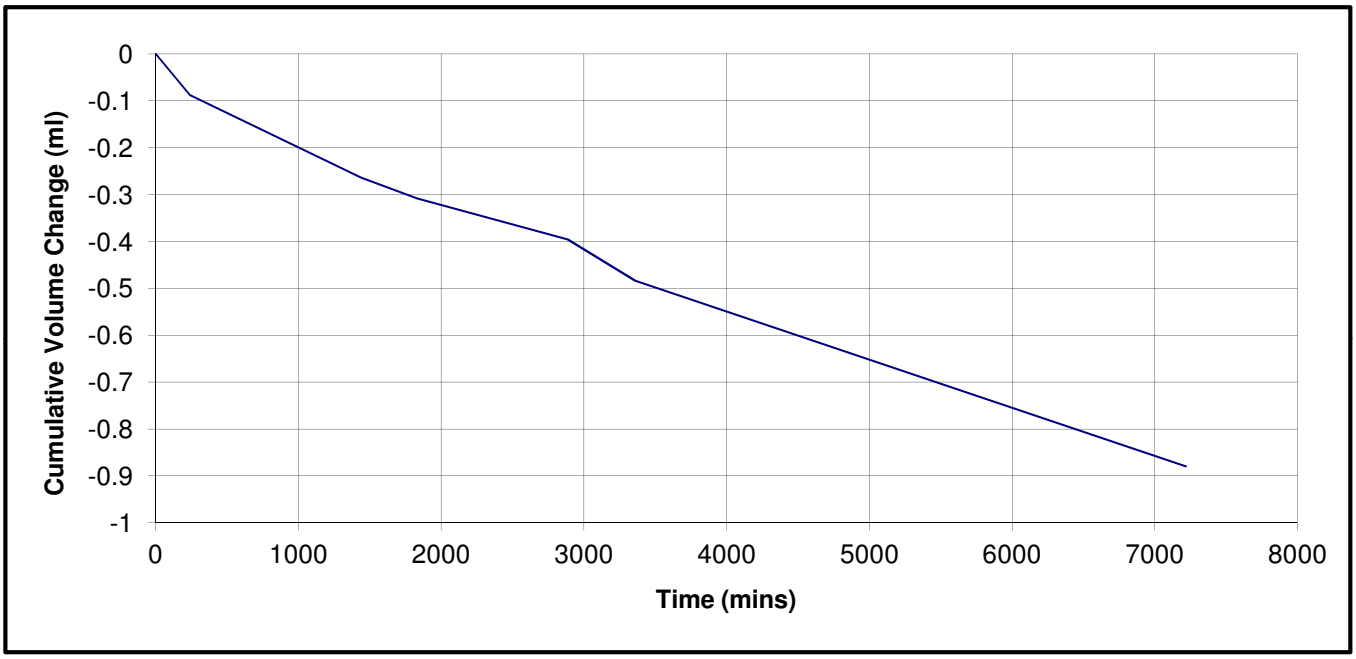
CLIENT: **ENVIRON AUSTRALIA PTY LTD**
Level 2 Adelaide TerraceEast PerthPerth WA 6004
PROJECT: **AS130389**
LOCATION:

Job Number: 14-32-383
Date Tested: 27.08.14

Laboratory Number: 14-AC-2773
Sampled By: Client

Sample Source: TP107 0.50-1.00m

Sample Description: SILTY CLAY: Red/Yellow-brown



Coefficient of Permeability	3E-11	(metres/second)
Mean Effective Stress	100	(kPa)
Permeant Used	Leachate supplied by client	
SAMPLE DETAILS		
Diameter of Specimen	50.0	(mm)
Height of Specimen	50.0	(mm)
REMOULD DATA		
Laboratory Moisture Ratio	100.1	(%)
Laboratory Density Ratio	100.3	(%)
Retained on 19mm Sieve	-	(%)
Compactive Effort	Standard	

Test Method: Constant head method using a flexible wall permeameter AS1289.6.7.3
Comments:

Approved Signatory: Corey Papu-Gread **Date:** 09.09.2014

Accredited for Compliance with ISO/IEC 17025

Accreditation No. 2418

TEST CERTIFICATE

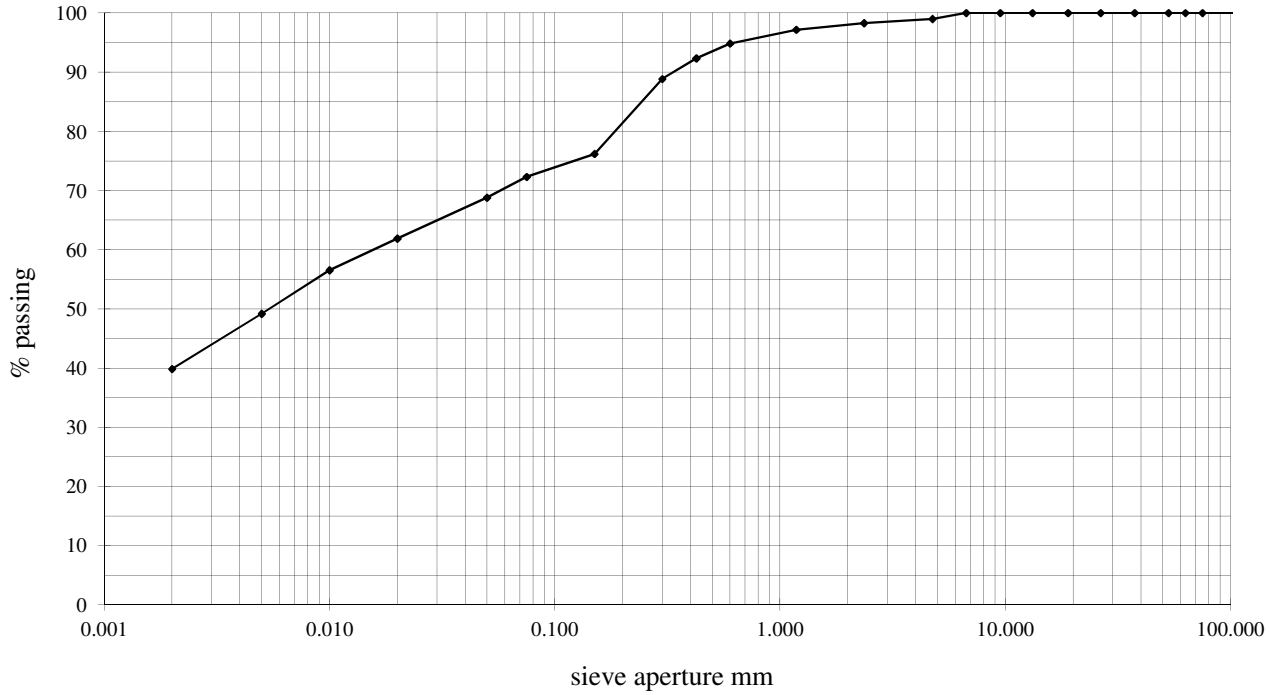
ABN 44 000 964 278
ph: +61 (0)2 8594 0481
fax: +61 (0)2 8594 0499

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

PARTICLE SIZE DISTRIBUTION

Client: ENVIRON AUSTRALIA PTY LTD
Address: Level 2 Adelaide TerraceEast PerthPerth WA 6004
Project: AS130389
Location:
Test Method: **AS 1289 3.6.1 / 3**
Job Number: 14-32-383
Sample Source: TP107 0.50-1.00m
Sampled By: Client

Lab Number: 14-AC-2773
Date Tested: 22.8.14
Checked By: AL



Clay	Silt	Sand	Gravel

Sample Description: SILTY CLAY: Red/Yellow-brown

Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
150.0		1.18	**97**
75.0		0.600	**95**
63.0		0.425	**92**
53.0		0.300	**89**
37.5		0.150	**76**
26.5		0.075	**72**
19.0		0.050	**69**
13.2		0.020	**62**
9.5		0.010	**57**
6.7	**100**	0.005	**49**
4.75	**99**	0.002	**40**
2.36	**98**		

Hydrometer Type: ASTM 152H
Dispersant Type: Sodium Hexametaphosphate
Pretreatment: None
Loss on Pretreatment: None
Remarks:

Approved Signatory: Aaron Lacey Date: 10/09/2014

Accredited for Compliance with ISO/IEC 17025

Appendix F

Aquifer Testing Results

PIEZOMETER TEST

Client	Hydro	Job No.	AS130389
Project	Clay Borrow Pit Geotech	Bore	CBP2

Bore Details

Bore No.		
Piezometer length (L)	3	m
Piezometer radius (r)	0.025	m
Bore radius (R)	0.1	m
Depth of piezometer	10.58	m
Static water level	4.031	m
Lag time (To)	1690	sec
(70% recovery)		

Test Method

Rising Head

Falling Head

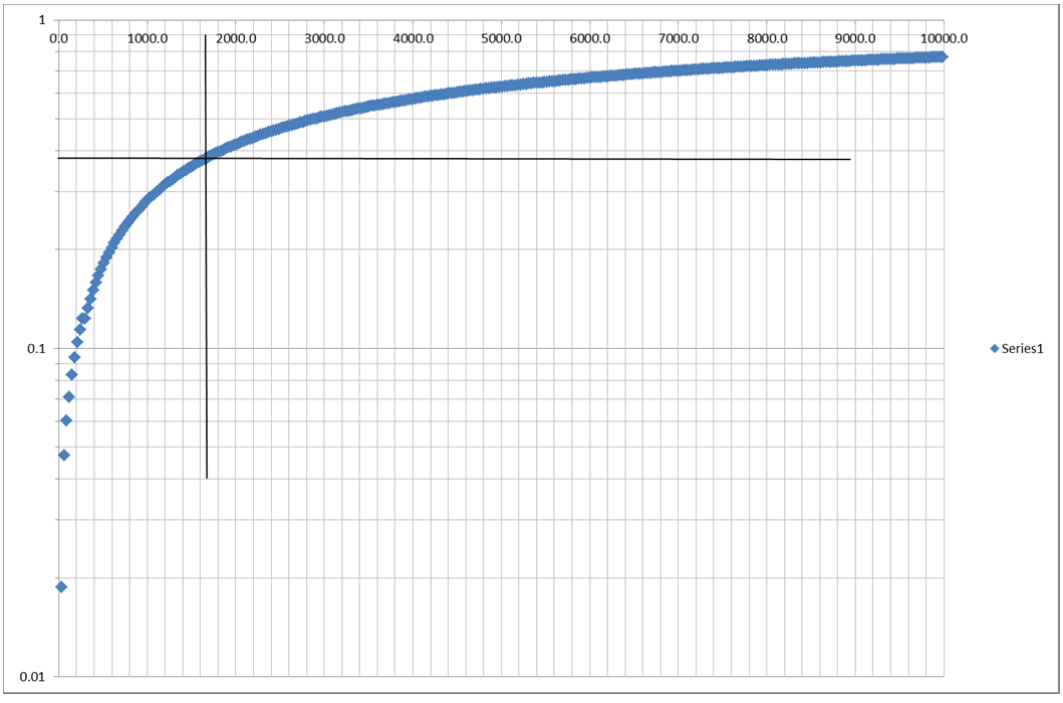
Based on Hvorslev method

$$K = \frac{r^2 \ln(L/R)}{2LTo}$$

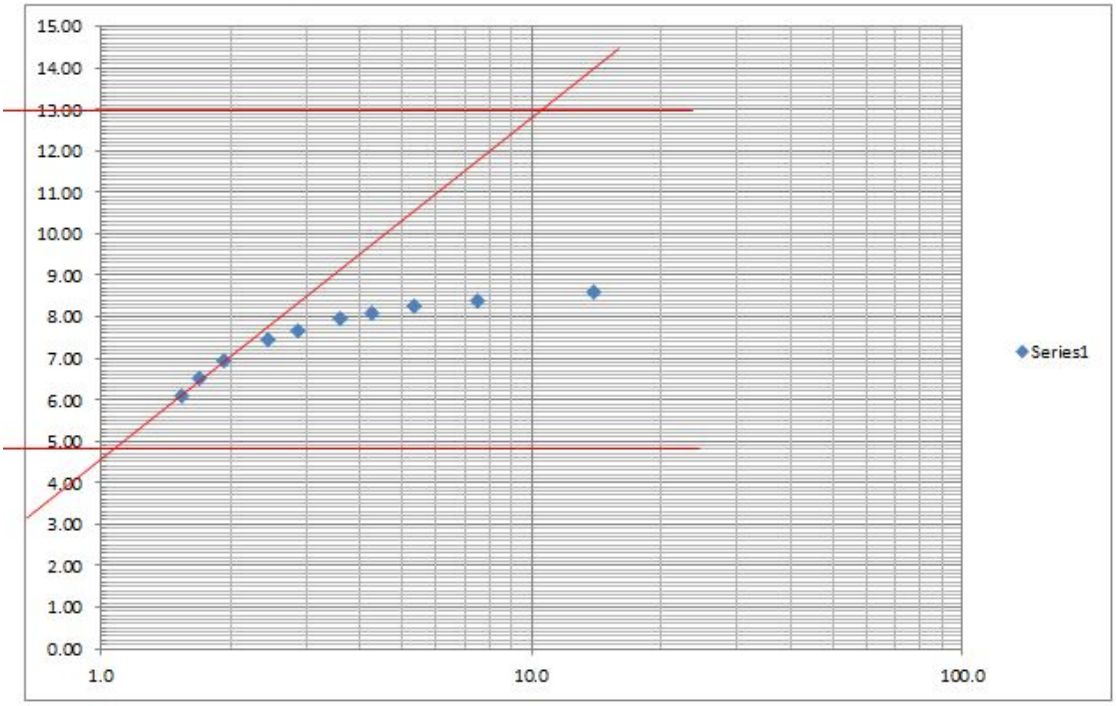
Calculated Permeability 2.1E-07 **m / sec**

1.8E-02 **m/day**

ENVIRON Australia



CPB3 Theis recovery



r	0.025	m
Δs	8.2	m
Q	1.9	Lmin-1
	2.736	m^3/day

T=2.3Q/4πΔs

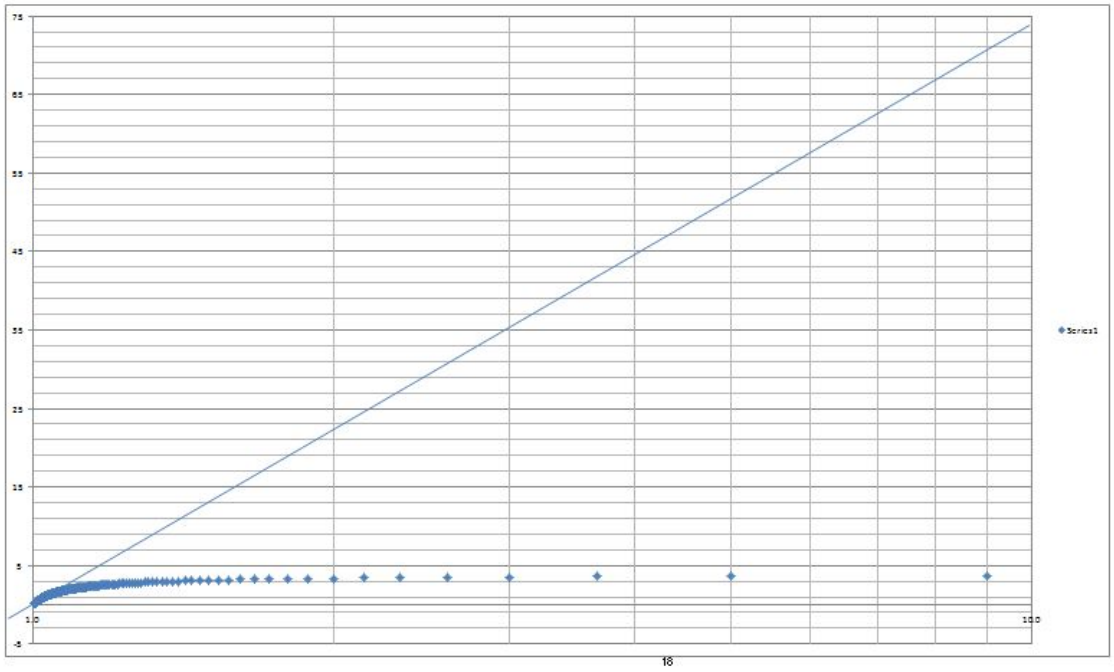
T	**0.061**	**m^2/day**

7.07E-07	**m^2/sec**	

assume D	10

K	7.07E-08	**m/sec**

CPB2 Theis Recoverg



r	0.025	m
Δs	75	m
Q	2.4	Lmin-1
	3.456	m^3day

T=2.3Q/4πΔs

T	0.008	m^2/day

9.76E-08	m^2/sec

assume D	10

K	9.76E-09	m/sec