Queensland Government

Memorandum

Our ref: MR2531 / FG6056
DMS No.: 497/00027
Date: 09 July 2013

To **Trevor Carter**
Principal Engineer (Dredging)
Hydraulics and Marine Studies
Engineering and Technology Branch

Subject Marine Infrastructure Works – Redlands City Council Toondah Harbour Northern Access Channel

1 Introduction

This memorandum has been prepared by Transport and Main Roads (TMR) Geotechnical Section in response to a request by Trevor Carter – Principal Engineer (Dredging) – Hydraulics and Marine Studies TMR to carry out geotechnical investigations at selected sites within the Moreton Bay Marine Park SE Qld. This component of works is additional to the original scope of works and is at the request of the Redlands City Council.

The site of this investigation is located at Toondah Harbour SE Qld. This investigation will provide factual geotechnical information on subsurface material properties. This information will assist in determining the materials to be dredged and also to facilitate the selection of suitable dredging plant. Subsequent capitol works will widen and deepen the existing channel. In addition to the dredging investigation several boreholes were also performed to provide information for a future commercial terminal and vessel turning basin area.

This investigation involved borehole drilling with in situ field testing and sampling from a floating barge. The retrieved samples were logged and retained for material identification and strength determination.

All procedures used in this investigation are in accordance with Queensland Transport and Main Roads policies, Materials Testing Manuals and relevant Australian Standards.

All necessary marine approvals and permits were obtained, including “Notification to mariners” via direct communication with the harbour master. All proposed testsites were checked for underground services prior to the investigation commencing.
Geotechnical Terms and Symbols are in accordance with Form F: GEOT017/5-2010 attached in **Appendix A**.

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2 Site Geology

According to the Beenleigh 1:100,000 Geology Sheet, published by Queensland Department of Natural Resources and Mines (2004), the surface and near surface geology of the site area comprises:

- Qhct – Holocene aged, tidal flats; sand and mud.
- Qhm – Quaternary aged, marine basin; thin veneer of muddy sand, sandy mud, and mud; over Pleistocene sediments.
- Qhmr – Holocene aged, fringing reef; coral, calcareous sand.
- Qmt – Quaternary aged, tidal delta, quartz sand.
- Tpb – Tertiary aged, Petrie Formation/b; olivine basalt.

3 Site Investigation

The geotechnical investigation was carried out in May-June 2013 and involved the drilling of Eight (8) boreholes by drilling contractors, Geodrill Pty Ltd, from a floating barge contracted by ABH Barge Pty Ltd. The works were under full time TMR departmental supervision.

The barge was transported by road from its Sydney base and reassembled on site at the Victoria Point ferry terminal car park. A 130tonne mobile crane was utilised to lift the pontoon sections (4 sections) into the water which were pinned and locked together to form the barge platform. The drilling rig and associated equipment was also lifted onto the barge and secured. This operations took place on Wednesday 8th May in a cordoned off section of the car park with traffic control management and approvals from the Redland Shire Council.

The location of the borehole testsites and relevant depth information is summarised below.

Table 1: Location of Boreholes

Borehole No.	Easting	Northing	Seabed Surface LAT (m)	Test Termination LAT (m)
R01	528283.3	6955184.4	0.800	-6.650
R02	528540.0	6955298.0	0.700	-4.750
R03	528525.4	6955460.8	0.700	-4.750
R04	528709.0	6955540.0	0.000	-5.450
R05	528857.5	6955552.3	-0.900	-6.350
R06	528362.5	6955011.9	0.600	-12.350
R07	528587.7	6955128.3	0.800	-9.650
R08	528559.6	6954857.6	0.600	-8.850

In addition to Table 1 the locations are also detailed in aerial and plan view in **Appendix B.**

The barge was accurately positioning over the proposed test site locations by an on-shore and on-board surveying team. The survey team also provide seabed surface LAT (Lowest Astronomical Tide) height datum at the individual test site locations. The LAT is assumed 1.243m below AHD (Australian Height Datum) based on Benchmark number PM21764 at Brisbane Bar Standard port.

The borehole drilling program involved testing at 0.5m intervals from the seabed surface and comprised of Standard Penetration Tests (SPT), Field Shear Vane (FSV) and Undisturbed tube sampling (U50) (where appropriate) to depths ranging from -3.5m to -12.5m LAT.

The detailed engineering borehole logs and SPT photographs are attached in **Appendix C.**

All SPT soil samples obtained during the investigation have been retained at TMR Herston Facilities and can be inspected upon request from the Senior Engineering Geologist.

4 Laboratory Testing

Selection of representative soil samples for laboratory testing was carried out on the basis of the ground conditions encountered at the site.

Laboratory testing included materials classification tests, as listed in Table 2 below. These tests were carried out in order to adequately define the properties of the different soil types and stratum encountered.

Table 2 – Laboratory Testing Methods.

Test Type	Test Method
Moisture Content & Density (MC & DD)	AS 1289.2.1.1
Atterberg Limits	AS 1289.3.1.1 / .2.1
Particle Size Distribution (PSD)	AS 1289.3.6.2 / 3

Laboratory test results are reported on the corresponding borehole logs.

Refer to **Appendix D** for the individual, detailed test reports.

5 Summary

The material characteristics and strengths within the areas of the investigation have been summarised. This will provide a general over view to assist in the determination of dredgable depths, dredging plant selection and piling depths and type.

A generalised subsurface profile determined from across all testsites is described in Table 3 below.

Table 3: Summary of Depths and Lithologies*

R01 (m)	R02 (m)	R03 (m)	R04 (m)	R05 (m)	R06 (m)	R07 (m)	R08 (m)	N Value Range	Unit (General Description)
0.80--0.30	0.70--1.30	-	0.00--2.50	-0.90--3.80	-	0.80--2.70	0.60--2.85	<1 - 1	Dark grey brown, very soft Silty/Sandy Clay with some gravel (Shallow Marine)
0.30--0.20	-	0.70--1.00	-	-	0.60--1.40	-	-	<1 - 7	Dark grey brown, very loose to loose Clayey Gravelly Sands and Clayey Sandy Gravel with some shell fragments (Shallow Marine)
-0.20--1.20	-	-	-	-	-	-	-	2 - 12	Red brown, very loose to medium dense Clayey Sandy Gravel (Alluvium)
-	-1.30--4.30	-	-	-	-	-	-	4 - 8	Grey mottled orange brown, firm Silty Clay (Alluvium)
-1.20--6.65	-4.30--4.75	-1.00--4.75	-2.50--5.45	-3.80--6.35	-1.40--11.40	-2.70--9.65	-2.85--8.85	3 - 24	Grey red brown with some white speckling, soft to very stiff Silty/Gravelly Clays and Clayey Silt (Residual)
-	-	-	-	-	-11.40--12.35	-	-	42	Brown red ironstained XW Basalt (engineering properties of hard Gravelly Sandy Clay)

* Depths are relative to LAT.

Should you have any further requirements regarding this investigation please contact TMR Geotechnical Section.

Simon Foley
Senior Engineering Geologist

APPENDIX A – GEOTECHNICAL TERMS AND SYMBOLS

Geotechnical Terms and Symbols

The following information is designed to assist in the interpretation of terms used in geotechnical borelogs, trench logs and reports. More detailed information can be obtained from an examination of relevant test methods in the Department of Main Roads Materials Testing Manual and the following codes AS1726 (Geotechnical Site Investigations) and AS1289 (Methods of Testing Soils for Engineering Purposes).

Soil Descriptions

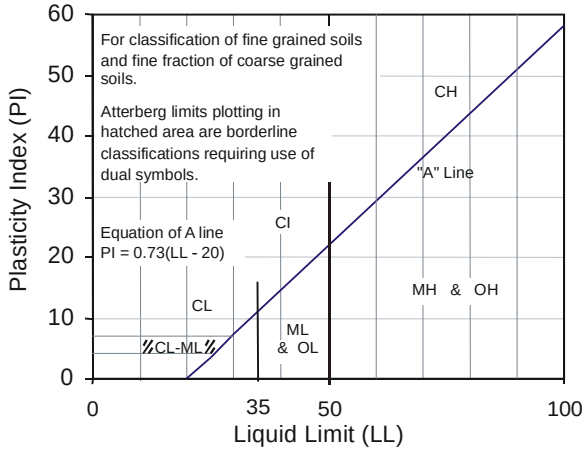
Soils for engineering purposes are the unconsolidated materials above bedrock. They can be residual, colluvial, aeolian or alluvial in origin.

Classification of material based on Unified Soil Classification System (refer Geotechnical Site Investigation Code AS1726 Appendix A). Note: Other Soil Classification systems, such as Northcote Factual key, do exist and these may be more appropriate to use in certain circumstances in conjunction with the USC system.

Unified Soil Classification System (Simplified)

Major Divisions		Particle size,mm	Group Symbol	Typical Names	Laboratory Classification				
					% < 0.075mm (2)	Plasticity of fine fraction	$Cu = \frac{D_{60}}{D_{10}}$	$Cc = \frac{(D_{30})^2}{D_{10}D_{60}}$	NOTES
COARSE GRAINED SOILS (more than half of material less than 63 mm is larger than 0.075 mm)	BOULDERS	____200							
	COBBLES	_____63							
	GRAVELS (more than half of coarse fraction is larger than 2.36mm)	coarse _____20	GW	Well graded gravels and gravel-sand mixtures, little or no fines	0-5	—	>4	Between 1 and 3	(1) Identify fines by the method given for fine-grained soils.
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines, uniform gravels	0-5	—	Fails to comply with above		
		medium _____6	GM	Silty gravels, gravel-sand-silt mixtures (1)	12-50	Below 'A' line or PI<4	—	—	
			GC	Clayey gravels, gravel-sand-clay mixtures (1)	12-50	Above 'A' line and PI>7	—	—	
		fine ___2.36	SW	Well graded sands and gravelly sands, little or no fines	0-5	—	>6	Between 1 and 3	(2) Borderline classifications occur when the percentage of fines (fraction smaller than 0.075mm size) is greater than 5% and less than 12%. Borderline classifications require the use of SP-SM, GW-GC
	SANDS (more than half of coarse fraction is smaller than 2.36mm)	coarse ____0.6	SP	Poorly graded sands and gravelly sands, little or no fines	0-5	—	Fails to comply with above		
		medium ____0.2	SM	Silty sands, sand silt mixtures (1)	12-50	Below 'A' line or PI<4	—	—	
		fine __0.075	SC	Clayey sands, sand-clay mixtures (1)	12-50	Above 'A' line and PI>7	—	—	
FINE GRAINED SOILS (more than half of material less than 63 mm is smaller than 0.075 mm)	SILTS & CLAYS (liquid limit ≤50%)		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity					
			CL CI	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays					
			OL	Organic silts and clays of low plasticity					
	SILTS & CLAYS (liquid limit >50%)		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts					
			CH	Inorganic clays of high plasticity, fat clays					
			OH	Organic silts and clays of high plasticity					
	HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils					

Use the gradation curve of material passing 63 mm for classification of fractions according to the criteria given in 'Major Divisions'



Consistency for cohesive soils is usually estimated using simple field tests (refer field guide), UCS (measured using penetrometer) or undrained shear strength as measured using triaxial test, shear vane or friction cone penetrometer. SPT 'N' value can also be used as an indication.

Consistency - Essentially Cohesive Soils

Term	Field Guide	Symbol	Undrained Shear Strength S_u (kPa)	SPT N Value	Unconfined Compressive Strength UCS (kPa)
Very soft	Oozes between fingers when squeezed in hand.	VS	<12	0-2	<20
Soft	Easily moulded with fingers.	S	12-25	2-4	20-50
Firm	Can be moulded by strong pressure of fingers.	F	25-50	4-8	50-100
Stiff	Not possible to mould in fingers.	St	50-100	8-15	100-200
Very stiff		VSt	100-200	15-30	200-400
Hard	Can be indented with difficulty by thumb nail.	H	>200	>30	>400

Basic Particle Sizes - Soils

Term	Size Range
BOULDERS	>200mm
COBBLES	63-200mm
Coarse GRAVEL	20-63mm
Medium GRAVEL	6-20mm
Fine GRAVEL	2.36-6mm
Coarse SAND	0.6-2.36mm
Medium SAND	0.2-0.6mm
Fine SAND	0.075-0.2mm
SILT	0.002-0.075mm
CLAY	<0.002mm

Based on AS1726.

Consistency for non-cohesive soils is generally based on the results of insitu Standard Penetration Tests.

Consistency - Essentially Non-Cohesive Soils

Term	Symbol	SPT N Value	Field Guide	Relative Density (%)
Very loose	VL	0-4	Foot imprints readily	0-15
Loose	L	4-10	Shovels easily	15-35
Medium dense	MD	10-30	Shovelling difficult	35-65
Dense	D	30-50	Pick required	65-85
Very dense	VD	>50	Picking difficult	85-100

Moisture condition based on appearance of soil.

Soil Moisture

Term	Description
Dry	Cohesive soils; hard and friable or powdery, well dry of plastic limit. Granular soils; cohesionless and free-running.
Moist	Soil feels cool, darkened in colour. Cohesive soils can be moulded. Granular soils tend to cohere.
Wet	Soil feels cool, darkened in colour. Cohesive soils usually weakened and free water forms on hands when handling. Granular soils tend to cohere and free water forms on hands when handling.

The **Colour** of a soil is determined in the moist condition using simple terms. These can be modified by the use of discriminators such as pale, dark, mottled, etc.

Rock Descriptions

Defect spacing: On the engineering borelog, a graphical representation of defect spacing is given. This corresponds to the cumulative measurements of all defect sets. The term defect includes all natural rock discontinuities, but not breaks induced by the drilling/handling of core.

Term	Symbol	Spacing (mm)
Extremely Close	EC	< 6
Very Close	VC	6 – 20
Close	C	20 – 60
Medium	M	60 – 200
Wide	W	200 – 600
Very Wide	VW	600 – 2000
Extremely Wide	EW	> 2000

Defect Persistence	
Term	**Length (m)**
Very High	> 10
High	5 – 10
Moderate	2 – 5
Low	0.5 – 2
Very Low	< 0.5

Defect Description uses terms contained in AS1726 Table A10 to describe the type of defect (i.e, bedding, foliation, cleavage, joint, sheared zone, crushed seam/zone, decomposed seam/zone, infilled seam/zone) and character (roughness, extent coating etc).

Degree of fracturing as applied to drill cores is described by the Rock Quality Designation (RQD).

Rock quality designation (RQD*)* is the ratio of length of rock core recovered in pieces of 100mm or longer to length of core run drilled (usually 1.5m or 3.0m) expressed as a percentage. RQD is related to rock-mass properties.

Weathering is the destructive process or group of processes whereby rocks on exposure to atmospheric agents and groundwater at or near the surface are changed in character. The changes such as colour, texture and composition are brought about by physical, chemical and biotic processes. The degree of weathering can be a continuum from soil to fresh rock with boundaries between weathered grades often blurred. Usually rock strength decreases with an increase in weathering grade but it is not used as a primary basis of the weathering classification.

The following table summarises the criteria for describing weathering grade.

Rock Material Weathering Classification		
Term	**Symbol**	**Definition**
Residual Soil	RS	Soil like material developed on extremely weathered rock; the mass structure and substance fabric are no longer evident; there is a large change in volume but the material has not been significantly transported.
Extremely weathered rock	XW	Rock is weathered to such an extent that it has 'soil' properties, i.e. it either disintegrates or can be remoulded in water, but substance fabric and rock structure still recognisable.
Highly weathered rock	HW	Weathering penetrates deeply inwards from defects usually with major discolouration throughout the rock fabric and major change in constituent minerals. The intact rock is usually much weaker than the fresh rock. Corestones, if present, form a minor component of the rock mass.
Moderately weathered rock	MW	Weathering penetrates inwards from defects often with significant discolouration of the rock fabric and minor change of constituent minerals. The rock is a continuous framework and is usually noticeably weaker than the fresh rock. Corestones, if present, form a major component of the rock mass.
Slightly weathered rock	SW	Rock is slightly discoloured but shows little or no change of strength from fresh rock.
Fresh Rock	FR	Rock shows no sign of decomposition or staining.

Notes:
1. The above criteria generally apply and variations will be noted on the Engineering Borelogs.
2. Extremely weathered rock is described in terms of soil engineering properties.

Strength is based on point load strength index, corrected to 50mm diameter – $I_S(50)$. Field guide used if no tests available. (Ref. AS 4133.4.1).

Strength of Rock Material			
Term	**Letter symbol**	**Point load index (MPa) I_s50**	**Field Guide to Strength**
Extremely low	EL	≤0.03	Easily remoulded by hand to a material with soil properties.
Very low	VL	>0.03 - ≤0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 3cm thick can be broken by finger pressure.
Low	L	>0.1 - ≤0.3	Easily scored with a knife; indentations 1mm to 3mm show in the specimen with firm blows of the pick point; has dull sound under hammer. A piece of core 150mm long by 50mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
Medium	M	>0.3 - ≤1.0	Readily scored with a knife; a piece of core 150mm long by 50mm diameter can be broken by hand with difficulty.
High	H	>1 - ≤3	A piece of core 150mm long by 50mm diameter cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.
Very high	VH	>3 - ≤10	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
Extremely high	EH	>10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

Notes:
1. These terms refer to the strength of the rock material and not to the strength of the rock mass which may be considerably weaker due to the effect of rock defects.
2. Anisotropy of rock material samples may affect the field assessment of strength.
3. Approximate correlation UCS = 24 x $I_s(50)$.

Insitu Test Methods

Standard Penetration Test (SPT) - (Ref. AS 1289.6.3.1). The penetration resistance for each 150mm interval and the derived N value is recorded on the borelog as one of:

(i)	4, 7, 11 N=18	(normal test)
(ii)	4, 18, 30/15 mm *N>50	(partial penetration)
(iii)	30/080 mm *N>50	(partial penetration - seating drive)
(iv)	RW N<1	(rod weight only caused penetration)
(v)	HW N<1	(hammer and rod weight only caused penetration)
(vi)	HB *N>50	(hammer bouncing)

* **Note:** N>50, is Main Roads terminology only.

Static Cone Penetration Test (CPT) - (Ref. AS 1289.6.5.1). The soil descriptions shown on the CPT plots have been inferred from the measured resistances using one of the recognised classification systems (eg. Robertson and Campanella) and correlated boreholes from the site.

Piezocone (CPTU) - Renders the same information as the CPT but in addition gives clearer definition of sand lenses and enables assessment of insitu consolidation behaviour through measurement of pore pressure.

Variable Energy Dynamic Cone Penetrometer (VDCP) – Similar to dynamic cone penetrometer (DCP) but penetration is carried out using variable energy to drive the probe (also called Panda Probe).

Field Shear Vane Test (FSV) – (Ref. AS 1289.6.2.1).

Water Pressure / Packer Test (WPT) – (Ref. Houlsby, A.C., 1976, *Routine Interpretation of the Lugeon Water Test*, Quarterly Journal of Engineering Geology, Volume 9, pp 303-313).

Symbols

The list below gives an explanation of the terms and symbols used on the borelogs, trench logs and penetrometer logs.

Test Results		**Test Results Continued**		**Test Symbols**	
PI	- Plasticity Index	c'	- Effective Cohesion	SPT	- Standard Penetration Test
LL	- Liquid Limit	ϕ_u	- Undrained Angle of Internal Friction	U50	- Undisturbed Sample 50 mm diameter
LI	- Liquidity Index	ϕ'	- Effective Angle of Internal Friction	U100	- Undisturbed Sample 100mm diameter
DD	- Dry Density	A,B	- Skempton's Pore Pressure Parameters	UCS	- Unconfined Compressive Strength
WD	- Wet Density	c_v	- Coefficient of Consolidation	Pm	- Pressuremeter
LS	- Linear Shrinkage	m_v	- Coefficient of Volume Decrease	FSV	- Field Shear Vane
MC	- Moisture Content	$c_{\alpha\varepsilon}$	- Coefficient of Secondary Compression	LSV	- Laboratory Shear Vane
OC	- Organic Content	e	- Voids Ratio	DST	- Direct Shear Test
WPI	- Weighted Plasticity Index	c'_R	- Residual Cohesion	X	- Point Load Strength (diametral)
WLS	- Weighted Linear Shrinkage	ϕ'_R	- Residual Friction Angle	O	- Point Load Strength (axial)
DoS	- Degree of Saturation	ϕ'_{cv}	- Angle of Effective Stress at Constant Volume	L	- Point Load Strength (irregular lump)
APD	- Apparent Particle Density	q_t / q_c	- Piezocone Resistance	PP	- Pocket Penetrometer
S_u	- Undrained Shear Strength	q_d	- VDCP (Panda Probe) Cone Resistance	WPT	- Water Pressure Test
c_u	- Undrained Cohesion	uL	- Lugeon Value of Water Pressure Testing	Petro.	- Petrographic Analysis
				PR	- Penetration Rate

Defect Description Abbreviations

Type		**Roughness**		**Wall Alterations**		**Other**	
J, Js	Joint, Joints	R	Rough	FeSt	Iron Stained	CInf	Clay Infill
B	Bedding	SR	Slightly Rough	Wth	Weathered	CLy	Clayey
BP	Bedding Parting	S	Smooth	Smn	Secondary Mineralisation	Co	Coal Seam
FP	Foliation Parting	SL	Slickensided	Cn	Clean	Carb	Carbonaceous
LP	Lamination Parting	PO	Polished			SInf	Sand Infill
CLV	Cleavage					QZ	Quartz
Fr	Fracture	**Planarity**		**Aperture**		CA	Calcite
SZ	Sheared Zone	Pl	Planar	C	Closed	Chl	Chlorite
CZ	Crushed Zone	St	Stepped	O	Open	In	Incipient
BZ	Broken Zone	Un	Undulating	F	Filled	Int	Intersecting
HFZ	Highly Fractured Zone	Cu	Curved	T	Tight	Lam (s)	Lamination (s)
WS	Weathered Seam	Ir	Irregular			DI	Drilling Induced
VN	Vein					H	Horizontal
						V	Vertical

Graphic Symbols

12/10/86

Water level on date shown

Water Inflow

Water Outflow

Note: Other symbols used on the borelogs and trench logs referring to the unified soil classification, soil consistency, rock weathering, rock defect spacing and intact rock strength are shown in the relevant preceding tables.

APPENDIX B – SITE PLAN & TEST SITE LOCATIONS


R04
R05
R03
R02
R01
R07
R06
R08

APPENDIX C – ENGINEERING BORELOGS & SAMPLE PHOTOS

Queensland Government

ENGINEERING BOREHOLE LOG

FOR GEOTECHNICAL TERMS AND SYMBOLS REFER FORM F:GEOT 017/6-2010

BOREHOLE No TH RO1
SHEET 1 of 2
REFERENCE No H11501

PROJECT Marine Project
LOCATION Redlands Northern Channel
COORDINATES 528283.3 E; 6955184.4 N
PROJECT No FG6056
SURFACE R.L. 0.80m
PLUNGE
DATE STARTED 1/6/13
GRID DATUM GDA94
JOB No 50-010031.I.I
HEIGHT DATUM LAT*
BEARING
DATE COMPLETED 1/6/13
DRILLER Geodrill

DEPTH (m)	R.L. (m)	RQD ( )% CORE REC %	SAMPLE	MATERIAL DESCRIPTION	LITHOLOGY	USC	WEATHERING	INTACT STRENGTH (EH VH H M L VL EL)	DEFECT SPACING (mm) (20 60 200 600 2000)	GRAPHIC LOG	ADDITIONAL DATA AND TEST RESULTS	SAMPLES	TESTS
0	0.80		A	**Sandy CLAY (SHALLOW MARINE):** Dark grey, wet, very soft. Low plasticity. Fine grained sand.		(CL)					RW,RW,RW N<1		SPT
	0.30		B	**Clayey Gravelly SAND (SHALLOW MARINE):** Dark brown, wet, very loose. Fine to coarse grained sand with shell fragments throughout. Gravel is fine grained, sub-rounded.		(GC)					No Sample Recovery		U50
1	-0.20		C	**Clayey Sandy GRAVEL (ALLUVIUM):** Red brown, wet, very loose to medium dense. Gravel is fine to medium grained, sub-rounded to rounded.		(GC)					RW,1,1 N=2		SPT
			D								5,8,4 N=12		SPT
2	-1.20		E	**Silty CLAY (RESIDUAL):** Grey mottled with red, moist, stiff to very stiff. High plasticity with iron concretions throughout.							4,4,6 N=10		SPT
			F								5,5,5 N=10		SPT
3			G								2,4,5 N=9		SPT
			H			(CH)					PP(Su) = 177 kPa MC = 47.4% WD = 2.50 t/m^3 DD = 1.70 t/m^3 %Pass 2.36=100 %Pass 0.075=97		U50
4			J								5,7,16 N=23		SPT
5													

REMARKS *R.L on this log represents the Lowest Astronomical Tide (LAT)

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Queensland Government

ENGINEERING BOREHOLE LOG

FOR GEOTECHNICAL TERMS AND SYMBOLS REFER FORM F:GEOT 017/6-2010

BOREHOLE No TH RO1
SHEET 2 of 2
REFERENCE No H11501

PROJECT Marine Project
LOCATION Redlands Northern Channel COORDINATES 528283.3 E; 6955184.4 N
PROJECT No FG6056 SURFACE R.L. 0.80m PLUNGE DATE STARTED 1/6/13 GRID DATUM GDA94
JOB No 50-010031.l.l HEIGHT DATUM LAT* BEARING DATE COMPLETED 1/6/13 DRILLER Geodrill

DEPTH (m)	R.L. (m)	RQD ( )% CORE REC %	SAMPLE	MATERIAL DESCRIPTION	LITHOLOGY	USC	WEATHERING	INTACT STRENGTH EH VH H M L VL EL	DEFECT SPACING (mm) 20 60 200 600 2000	GRAPHIC LOG	ADDITIONAL DATA AND TEST RESULTS	SAMPLES	TESTS
5	-4.20		K	**Silty CLAY (RESIDUAL):** Cont'd. Becoming grey only.		(CH)					5,6,9 N=15		SPT
6	-5.20		L	**Clayey SILT (RESIDUAL):** Pale grey, moist, very stiff. Low plasticity.		(ML)					4,6,9 N=15		SPT
7	-6.65		M								5,8,13 N=21		SPT
				Borehole terminated at 7.45m									
8													
9													
10													

REMARKS *R.L on this log represents the Lowest Astronomical Tide (LAT)

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ENGINEERING BOREHOLE LOG

FOR GEOTECHNICAL TERMS AND SYMBOLS REFER FORM F:GEOT 017/6-2010

BOREHOLE No **TH RO2**
SHEET 1 of 2
REFERENCE No **H11502**

PROJECT Marine Project
LOCATION Redlands Northern Channel COORDINATES 528540.0 E; 6955298.0 N
PROJECT No FG6056 SURFACE R.L. 0.70m PLUNGE DATE STARTED 30/5/13 GRID DATUM GDA94
JOB No 50-010031.l.l HEIGHT DATUM LAT* BEARING DATE COMPLETED 30/5/13 DRILLER Geodrill

DEPTH (m)	R.L. (m)	CASING / WASH BORING	RQD ( )% CORE REC %	SAMPLE	MATERIAL DESCRIPTION	LITHOLOGY	USC	WEATHERING	INTACT STRENGTH (EH VH H M L VL EL)	DEFECT SPACING (mm) (20 60 200 600 2000)	GRAPHIC LOG	ADDITIONAL DATA AND TEST RESULTS	SAMPLES	TESTS
0	0.70			A	**Sandy Gravelly CLAY (SHALLOW MARINE):** Dark grey to brown, wet, very soft. Low plasticity. Sand and gravel is of broken shell fragments.							3,RW,RW N<1		SPT
1				B	Trace shell sand and gravel fragments.		(CL)					RW,RW,RW N<1		SPT
2	-1.30			C	**Silty CLAY (ALLUVIUM):** Grey mottled with orange brown, moist, firm. High plasticity. Trace gravel comprising iron concretions.							PP(Su) = 32 kPa MC = 31.4% WD = 2.00 t/m^3 DD = 1.52 t/m^3		U50
3				D			(CH)					1,2,2 N=4		SPT
4				E	Becoming very stiff.							PP(Su) = 162 kPa MC = 48.6% WD = 1.60 t/m^3 DD = 1.08 t/m^3		U50
5	-4.30													

QLD_DMR_LIB_01A.GLB Log A_ENGINEERING BOREHOLE LOG W LITHOLOGY FG6056 - MARINE PROJECT.GPJ <<DrawingFile>> Datgel CPT Tool gINt Add-In 09/07/2013 09:56

REMARKS *R.L on this log represents the Lowest Astronomical Tide (LAT)

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ENGINEERING BOREHOLE LOG

FOR GEOTECHNICAL TERMS AND SYMBOLS REFER FORM F:GEOT 017/6-2010

BOREHOLE No TH RO2
SHEET 2 of 2
REFERENCE No H11502

PROJECT Marine Project
LOCATION Redlands Northern Channel COORDINATES 528540.0 E; 6955298.0 N
PROJECT No FG6056 SURFACE R.L. 0.70m PLUNGE DATE STARTED 30/5/13 GRID DATUM GDA94
JOB No 50-010031.l.l HEIGHT DATUM LAT* BEARING DATE COMPLETED 30/5/13 DRILLER Geodrill

DEPTH (m)	R.L. (m)	CASING / WASH BORING	RQD ( )% CORE REC %	SAMPLE	MATERIAL DESCRIPTION	LITHOLOGY	USC	WEATHERING	INTACT STRENGTH (EH VH H M L VL EL)	DEFECT SPACING (mm) (20 60 200 600 2000)	GRAPHIC LOG	ADDITIONAL DATA AND TEST RESULTS	SAMPLES	TESTS
5	-4.30			F	**Gravelly CLAY (RESIDUAL):** Grey brown, moist, stiff. Low plasticity. Gravel is iron cemented concretions.		(CL)					5,6,8 N=14		SPT
	-4.75				Borehole terminated at 5.45m									
6														
7														
8														
9														
10														

QLD_DMR_LIB_01A.GLB Log A_ENGINEERING BOREHOLE LOG W LITHOLOGY FG6056 - MARINE PROJECT.GPJ <<DrawingFile>> Datgel CPT Tool gINt Add-In 09/07/2013 09:56

REMARKS *R.L on this log represents the Lowest Astronomical Tide (LAT)

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ENGINEERING BOREHOLE LOG

FOR GEOTECHNICAL TERMS AND SYMBOLS REFER FORM F:GEOT 017/6-2010

BOREHOLE No **TH RO3**
SHEET 1 of 2
REFERENCE No **H11503**

PROJECT Marine Project
LOCATION Redlands Northern Channel (+/- 3m from fixing) COORDINATES 528525.4 E; 6955460.8 N
PROJECT No FG6056 SURFACE R.L. 0.70m PLUNGE DATE STARTED 30/5/13 GRID DATUM GDA94
JOB No 50-010031.l.l HEIGHT DATUM LAT* BEARING DATE COMPLETED 30/5/13 DRILLER Geodrill

DEPTH (m)	R.L. (m)	CASING / WASH BORING	RQD ( )% CORE REC %	SAMPLE	MATERIAL DESCRIPTION	LITHOLOGY	USC	WEATHERING	INTACT STRENGTH (EH VH H M L VL EL)	DEFECT SPACING (mm) (20 60 200 600 2000)	GRAPHIC LOG	ADDITIONAL DATA AND TEST RESULTS	SAMPLES	TESTS
0	0.70			A	**Clayey Gravelly SAND (SHALLOW MARINE):** Dark grey, wet, very loose to loose. Sand and gravel are of broken shell fragments. Strong Sulphuric odour.		(GC)					1,4,3 N=7		SPT
1				B								1,0,0 N<1		SPT
	-1.00				**Gravelly CLAY (RESIDUAL):** Grey mottled with red, moist, stiff to very stiff. High plasticity. Gravel is sub-angular, iron cemented concrection.								
2				C								2,4,10 N=14		SPT
3				D			(CH)					6,10,14 N=24		SPT
4				E	Becoming grey with speckled white.							5,7,12 N=19		SPT
5	-4.30													

QLD_DMR_LIB_01A.GLB Log A_ENGINEERING BOREHOLE LOG W LITHOLOGY FG6056 - MARINE PROJECT.GPJ <<DrawingFile>> Datgel CPT Tool gINt Add-In 09/07/2013 09:56

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ENGINEERING BOREHOLE LOG

FOR GEOTECHNICAL TERMS AND SYMBOLS REFER FORM F:GEOT 017/6-2010

BOREHOLE No TH RO3
SHEET 2 of 2
REFERENCE No H11503

PROJECT Marine Project
LOCATION Redlands Northern Channel (+/- 3m from fixing) COORDINATES 528525.4 E; 6955460.8 N
PROJECT No FG6056 SURFACE R.L. 0.70m PLUNGE DATE STARTED 30/5/13 GRID DATUM GDA94
JOB No 50-010031.l.l HEIGHT DATUM LAT* BEARING DATE COMPLETED 30/5/13 DRILLER Geodrill

DEPTH (m)	R.L. (m)	CASING / WASH BORING	RQD ( )% CORE REC %	SAMPLE	MATERIAL DESCRIPTION	LITHOLOGY	USC	WEATHERING	INTACT STRENGTH (EH VH H M L VL EL)	DEFECT SPACING (mm) (20 60 200 600 2000)	GRAPHIC LOG	ADDITIONAL DATA AND TEST RESULTS	SAMPLES	TESTS
5	-4.30			F	**Silty CLAY (RESIDUAL):** Pale grey to brown, moist, stiff. High plasticity.		(CH)					4,5,8 N=13		SPT
	-4.75				Borehole terminated at 5.45m									
6														
7														
8														
9														
10														

REMARKS *R.L on this log represents the Lowest Astronomical Tide (LAT)

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ENGINEERING BOREHOLE LOG

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FOR GEOTECHNICAL TERMS AND SYMBOLS REFER FORM F:GEOT 017/6-2010

BOREHOLE No TH RO4
SHEET 1 of 2
REFERENCE No H11504

PROJECT Marine Project
LOCATION Redlands Northern Channel
COORDINATES 5286709.0 E; 6955540.0 N
PROJECT No FG6056
SURFACE R.L. 0.00m
PLUNGE
DATE STARTED 31/5/13
GRID DATUM GDA94
JOB No 50-010031.l.l
HEIGHT DATUM LAT*
BEARING
DATE COMPLETED 31/5/13
DRILLER Geodrill

DEPTH (m)	R.L. (m)	CASING / WASH BORING	RQD ( )% CORE REC %	SAMPLE	MATERIAL DESCRIPTION	LITHOLOGY	USC	WEATHERING	INTACT STRENGTH (EH VH H M L VL EL)	DEFECT SPACING (mm) (20 60 200 600 2000)	GRAPHIC LOG	ADDITIONAL DATA AND TEST RESULTS	SAMPLES / TESTS
0	0.00			A	**Gravelly Sandy CLAY (SHALLOW MARINE):** Dark grey, wet, very soft. Low plasticity, sand grains are of broken sand/coral fragments. Strong sulphuric odour.							RW,RW,RW N<1	SPT
1				B			(CL)					PP(Su) = 0 kPa MC = 88.6% WD = 1.48 t/m^3 DD = 0.78 t/m^3 %Pass 2.36=96 %Pass 0.075=79	U50
2				C								RW,RW,RW N<1	SPT
	-2.50			D	**Silty CLAY (RESIDUAL):** Pale grey speckled white, orange/red iron staining throughout, moist, stiff to very stiff. Intermediate to high plasticity. Trace iron cemented gravel.							PP(Su) = 103 kPa MC = 50.8% WD = 1.70 t/m^3 DD = 1.12 t/m^3	U50
3				E								3,7,10 N=17	SPT
4				F			(CI-CH)					3,5,8 N=13	SPT
5				G								5,7,10 N=17	SPT

REMARKS *R.L on this log represents the Lowest Astronomical Tide (LAT)

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ENGINEERING BOREHOLE LOG

FOR GEOTECHNICAL TERMS AND SYMBOLS REFER FORM F:GEOT 017/6-2010

BOREHOLE No TH RO4
SHEET 2 of 2
REFERENCE No H11504

PROJECT Marine Project
LOCATION Redlands Northern Channel COORDINATES 5286709.0 E; 6955540.0 N
PROJECT No FG6056 SURFACE R.L. 0.00m PLUNGE DATE STARTED 31/5/13 GRID DATUM GDA94
JOB No 50-010031.l.l HEIGHT DATUM LAT* BEARING DATE COMPLETED 31/5/13 DRILLER Geodrill

DEPTH (m)	R.L. (m)	CASING WASH BORING	RQD ( )% CORE REC %	SAMPLE	MATERIAL DESCRIPTION	LITHOLOGY	USC	WEATHERING	INTACT STRENGTH (EH VH H M L VL EL)	DEFECT SPACING (mm) (20 60 200 600 2000)	GRAPHIC LOG	ADDITIONAL DATA AND TEST RESULTS	SAMPLES	TESTS
5	-5.00			H	**Silty CLAY (RESIDUAL):** Cont'd.		(CI-CH)					5,6,8 N=14		SPT
	-5.45				Borehole terminated at 5.45m									
6														
7														
8														
9														
10														

REMARKS *R.L on this log represents the Lowest Astronomical Tide (LAT)

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ENGINEERING BOREHOLE LOG

Queensland Government

FOR GEOTECHNICAL TERMS AND SYMBOLS REFER FORM F:GEOT 017/6-2010

BOREHOLE No TH RO5
SHEET 1 of 2
REFERENCE No H11505

PROJECT Marine Project
LOCATION Redlands Northern Channel
COORDINATES 528857.5 E; 6955552.3 N
PROJECT No FG6056 SURFACE R.L. -0.90m PLUNGE DATE STARTED 31/5/13 GRID DATUM GDA94
JOB No 50-010031.l.l HEIGHT DATUM LAT* BEARING DATE COMPLETED 31/5/13 DRILLER Geodrill

DEPTH (m)	R.L. (m)	CASING / WASH BORING	RQD ( )% CORE REC %	SAMPLE	MATERIAL DESCRIPTION	LITHOLOGY	USC	WEATHERING	INTACT STRENGTH (EH VH H M L VL EL)	DEFECT SPACING (mm) (20 60 200 600 2000)	GRAPHIC LOG	ADDITIONAL DATA AND TEST RESULTS	SAMPLES	TESTS
0	-0.90			A	**Sandy CLAY (SHALLOW MARINE):** Dark grey, wet, very soft. Low plasticity, sand is mainly broken shell fragments. Trace gravel sized shell fragments. Strong organic odour.							RW,RW,RW N<1		SPT
1				B			(CL)					PP(Su) = 0 kPa MC = 84.4% WD = 1.50 t/m^3 DD = 0.80 t/m^3 %Pass 2.36=100 %Pass 0.075=91		U50
2				C								RW,RW,RW N<1		SPT
	-3.80													
3				D	**Silty CLAY (RESIDUAL):** Grey speckled with white, moist, stiff. High plasticity. Occasional iron cemented gravel.							PP(Su) = 88 kPa MC = 36.6% WD = 1.88 t/m^3 DD = 1.38 t/m^3		U50
4				E			(CH)					3,4,6 N=10		SPT
5														

REMARKS *R.L on this log represents the Lowest Astronomical Tide (LAT)

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ENGINEERING BOREHOLE LOG

FOR GEOTECHNICAL TERMS AND SYMBOLS REFER FORM F:GEOT 017/6-2010

BOREHOLE No TH RO5
SHEET 2 of 2
REFERENCE No H11505

PROJECT Marine Project
LOCATION Redlands Northern Channel COORDINATES 528857.5 E; 6955552.3 N
PROJECT No FG6056 SURFACE R.L. -0.90m PLUNGE DATE STARTED 31/5/13 GRID DATUM GDA94
JOB No 50-010031.I.I HEIGHT DATUM LAT* BEARING DATE COMPLETED 31/5/13 DRILLER Geodrill

DEPTH (m)	R.L. (m)	CASING / WASH BORING	RQD ( )% CORE REC %	SAMPLE	MATERIAL DESCRIPTION	LITHOLOGY	USC	WEATHERING	INTACT STRENGTH (EH VH H M L VL EL)	DEFECT SPACING (mm) (20 60 200 600 2000)	GRAPHIC LOG	ADDITIONAL DATA AND TEST RESULTS	SAMPLES	TESTS
5	-5.90			F	**Silty CLAY (RESIDUAL):** Cont'd.		(CH)					3,5,5 N=10		SPT
	-6.35				Borehole terminated at 5.45m									
6														
7														
8														
9														
10														

REMARKS *R.L on this log represents the Lowest Astronomical Tide (LAT)

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ENGINEERING BOREHOLE LOG

Queensland Government

FOR GEOTECHNICAL TERMS AND SYMBOLS REFER FORM F:GEOT 017/6-2010

BOREHOLE No TH RO6
SHEET 1 of 3
REFERENCE No H11506

PROJECT Marine Project
LOCATION Redlands Northern Channel COORDINATES 528362.5 E; 6955011.9 N
PROJECT No FG6056 SURFACE R.L. 0.60m PLUNGE DATE STARTED 29/5/13 GRID DATUM GDA94
JOB No 50-010031.l.l HEIGHT DATUM LAT* BEARING DATE COMPLETED 29/5/13 DRILLER Geodrill

DEPTH (m)	R.L. (m)	CASING / WASH BORING	RQD ( )% CORE REC %	SAMPLE	MATERIAL DESCRIPTION	LITHOLOGY	USC	WEATHERING	INTACT STRENGTH (EH VH H M L VL EL)	DEFECT SPACING (mm) (20 60 200 600 2000)	GRAPHIC LOG	ADDITIONAL DATA AND TEST RESULTS	SAMPLES	TESTS
0	0.60			A	**Gravelly Clayey SAND (SHALLOW MARINE):** Dark grey, wet, very loose. Fine to coarse grained, subrounded. Sulphuric odour.		(GC)					HW,HW,HW N<1		SPT
1	-0.40			B	**Clayey Sandy GRAVEL (SHALLOW MARINE):** Brown, wet, loose. Gravel is fine grained, subrounded.		(GC)					1,4,1 N=5		SPT
2	-1.40			C	**Silty CLAY (RESIDUAL):** Grey to brown mottled with red iron staining, moist, firm to very stiff. Intermediate plasticity, trace fine sand.		(CI-CH)					PP(Su) = 58 kPa LL=70.2% PI=41.4% LS=14.8% MC = 35.6% WD = 1.92 t/m^3 DD = 1.42 t/m^3		U50
3				D								No test.		SPT
4				E	4.5m: Becoming very stiff.							11,10,11 N=21		SPT
5														

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ENGINEERING BOREHOLE LOG

FOR GEOTECHNICAL TERMS AND SYMBOLS REFER FORM F:GEOT 017/6-2010

BOREHOLE No TH RO6
SHEET 2 of 3
REFERENCE No H11506

PROJECT Marine Project
LOCATION Redlands Northern Channel COORDINATES 528362.5 E; 6955011.9 N
PROJECT No FG6056 SURFACE R.L. 0.60m PLUNGE DATE STARTED 29/5/13 GRID DATUM GDA94
JOB No 50-010031.l.l HEIGHT DATUM LAT* BEARING DATE COMPLETED 29/5/13 DRILLER Geodrill

DEPTH (m)	R.L. (m)	CASING / WASH BORING	RQD ( )% CORE REC %	SAMPLE	MATERIAL DESCRIPTION	LITHOLOGY	USC	WEATHERING	INTACT STRENGTH (EH VH H M L VL EL)	DEFECT SPACING (mm) (20 60 200 600 2000)	GRAPHIC LOG	ADDITIONAL DATA AND TEST RESULTS	SAMPLES	TESTS
5	-4.40				**Silty CLAY (RESIDUAL):** Cont'd.									
				F								5,8,10 N=18		SPT
6														
				G	Iron staining increasing.							3,7,8 N=15		SPT
7														
				H	Becoming stiff.		(CI-CH)					4,5,7 N=12		SPT
8														
				J	Becoming high plasticity.							2,3,5 N=8		SPT
9														
				K								4,2,5 N=7		SPT
10														

REMARKS *R.L on this log represents the Lowest Astronomical Tide (LAT)

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ENGINEERING BOREHOLE LOG

FOR GEOTECHNICAL TERMS AND SYMBOLS REFER FORM F:GEOT 017/6-2010

BOREHOLE No TH RO6
SHEET 3 of 3
REFERENCE No H11506

PROJECT Marine Project
LOCATION Redlands Northern Channel COORDINATES 528362.5 E; 6955011.9 N
PROJECT No FG6056 SURFACE R.L. 0.60m PLUNGE DATE STARTED 29/5/13 GRID DATUM GDA94
JOB No 50-010031.l.l HEIGHT DATUM LAT* BEARING DATE COMPLETED 29/5/13 DRILLER Geodrill

DEPTH (m)	R.L. (m)	CASING / WASH BORING	RQD ( )% CORE REC %	SAMPLE	MATERIAL DESCRIPTION	LITHOLOGY	USC	WEATHERING	INTACT STRENGTH (EH VH H M L VL EL)	DEFECT SPACING (mm) (20 60 200 600 2000)	GRAPHIC LOG	ADDITIONAL DATA AND TEST RESULTS	SAMPLES	TESTS
10	-9.40				**Silty CLAY (RESIDUAL):** Cont'd.									
11				L			(CI-CH)					2,4,5 N=9		SPT
12	-11.40				**BASALT** **Fine grained extrusive igneous rock of mafic composition.** **XW:** Exhibits engineering properties of a dark brown red, moist, hard, Gravelly Sandy CLAY.		XW							
	-12.35			M								8,17,25 N=42		SPT
13					Borehole terminated at 12.95m									
14														
15														

REMARKS *R.L on this log represents the Lowest Astronomical Tide (LAT)

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ENGINEERING BOREHOLE LOG

FOR GEOTECHNICAL TERMS AND SYMBOLS REFER FORM F:GEOT 017/6-2010

BOREHOLE No TH RO7
SHEET 1 of 3
REFERENCE No H11507

PROJECT Marine Project
LOCATION Redlands Northern Channel
COORDINATES 528587.7 E; 6955128.3 N
PROJECT No FG6056
SURFACE R.L. 0.80m
PLUNGE
DATE STARTED 28/5/13
GRID DATUM GDA94
JOB No 50-010031.I.I
HEIGHT DATUM LAT*
BEARING
DATE COMPLETED 28/5/13
DRILLER Geodrill

DEPTH (m)	R.L. (m)	CASING / WASH BORING	RQD ( )% CORE REC %	SAMPLE	MATERIAL DESCRIPTION	LITHOLOGY	USC	WEATHERING	INTACT STRENGTH (EH VH H M L VL EL)	DEFECT SPACING (mm) (20 60 200 600 2000)	GRAPHIC LOG	ADDITIONAL DATA AND TEST RESULTS	SAMPLES	TESTS
0	0.80			A	**Sandy CLAY (SHALLOW MARINE):** Dark grey, wet, very soft. Low plasticity; sand is mainly fine grained and of broken shell fragments		(CL)					RW,RW,RW N<1		SPT
1	-0.20			B	**Silty CLAY (SHALLOW MARINE):** Dark grey, wet, very soft. Intermediate platicity; trace shell fragments sizing up to 10mm.							RW,RW,RW N<1		SPT
2				C			(CI)					PP(Su) = 10 kPa MC = 89.8% WD = 1.52 t/m^3 DD = 0.80 t/m^3 %Pass 2.36=99 %Pass 0.075=94		U50
3				D								HW,HW,1 N=1		SPT
	-2.70				**Silty CLAY (RESIDUAL):** Grey mottled with orange/red, moist, firm to mainly stiff. Intermediate to high plasticity; trace sand.									
4				E			(CI-CH)					PP(Su) = 58 kPa MC = 34.2% WD = 1.88 t/m^3 DD = 1.40 t/m^3		U50
5														

REMARKS *R.L on this log represents the Lowest Astronomical Tide (LAT)

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ENGINEERING BOREHOLE LOG

Queensland Government

FOR GEOTECHNICAL TERMS AND SYMBOLS REFER FORM F:GEOT 017/6-2010

BOREHOLE No TH RO7
SHEET 2 of 3
REFERENCE No H11507

PROJECT Marine Project
LOCATION Redlands Northern Channel
COORDINATES 528587.7 E; 6955128.3 N
PROJECT No FG6056 SURFACE R.L. 0.80m PLUNGE DATE STARTED 28/5/13 GRID DATUM GDA94
JOB No 50-010031.l.l HEIGHT DATUM LAT* BEARING DATE COMPLETED 28/5/13 DRILLER Geodrill

DEPTH (m)	R.L. (m)	CASING / WASH BORING	RQD ( )% CORE REC %	SAMPLE	MATERIAL DESCRIPTION	LITHOLOGY	USC	WEATHERING	INTACT STRENGTH (EH VH H M L VL EL)	DEFECT SPACING (mm) (20 60 200 600 2000)	GRAPHIC LOG	ADDITIONAL DATA AND TEST RESULTS	SAMPLES	TESTS
5	-4.20			F	**Silty CLAY (RESIDUAL):** Cont'd.							1,3,4 N=7		SPT
6				G								3,4,7 N=11		SPT
7				H			(CI-CH)					2,4,6 N=10		SPT
8				J	Becoming pale grey mottled with orange/red, silt content increasing.							4,5,6 N=11		SPT
9				K								2,4,6 N=10		SPT
10														

REMARKS *R.L on this log represents the Lowest Astronomical Tide (LAT)

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ENGINEERING BOREHOLE LOG

FOR GEOTECHNICAL TERMS AND SYMBOLS REFER FORM F:GEOT 017/6-2010

BOREHOLE No TH RO7
SHEET 3 of 3
REFERENCE No H11507

PROJECT Marine Project
LOCATION Redlands Northern Channel COORDINATES 528587.7 E; 6955128.3 N
PROJECT No FG6056 SURFACE R.L. 0.80m PLUNGE DATE STARTED 28/5/13 GRID DATUM GDA94
JOB No 50-010031.l.l HEIGHT DATUM LAT* BEARING DATE COMPLETED 28/5/13 DRILLER Geodrill

DEPTH (m)	R.L. (m)	CASING / WASH BORING	RQD ( )% CORE REC %	SAMPLE	MATERIAL DESCRIPTION	LITHOLOGY	USC	WEATHERING	INTACT STRENGTH (EH VH H M L VL EL)	DEFECT SPACING (mm) (20 60 200 600 2000)	GRAPHIC LOG	ADDITIONAL DATA AND TEST RESULTS	SAMPLES	TESTS
10	-9.20			L	**Silty CLAY (RESIDUAL):** Cont'd. Becoming soft.		(CI-CH)					1,1,2 N=3		SPT
	-9.65				Borehole terminated at 10.45m									
11														
12														
13														
14														
15														

REMARKS *R.L on this log represents the Lowest Astronomical Tide (LAT)

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ENGINEERING BOREHOLE LOG

Queensland Government

FOR GEOTECHNICAL TERMS AND SYMBOLS REFER FORM F:GEOT 017/6-2010

BOREHOLE No TH RO8
SHEET 1 of 2
REFERENCE No H11508

PROJECT Marine Project
LOCATION Redlands Northern Channel
COORDINATES 528559.6 E; 6954857.6 N
PROJECT No FG6056 SURFACE R.L. 0.60m PLUNGE DATE STARTED 27/5/13 GRID DATUM GDA94
JOB No 50-010031.l.l HEIGHT DATUM LAT* BEARING DATE COMPLETED 27/5/13 DRILLER Geodrill

DEPTH (m)	R.L. (m)	CASING / WASH BORING	RQD ( )% CORE REC %	SAMPLE	MATERIAL DESCRIPTION	LITHOLOGY	USC	WEATHERING	INTACT STRENGTH (EH VH H M L VL EL)	DEFECT SPACING (mm) (20 60 200 600 2000)	GRAPHIC LOG	ADDITIONAL DATA AND TEST RESULTS	SAMPLES	TESTS
0	0.60			A	**Sandy CLAY (SHALLOW MARINE):** Dark grey, wet, very soft. Low to intermediate plasticity; sand is mainly broken shell fragments.							RW,RW,RW N<1		SPT
1				B			(CL-CI)					RW,RW,RW N<1		PR
2				C								PP(Su) = 0 kPa MC = 104.6% WD = 1.42 t/m^3 DD = 0.70 t/m^3 %Pass 2.36=99 %Pass 0.075=85		U50
3				D	Becoming silty clay of high plasticity.							RW,HW,HW N<1		SPT
	-2.85				**Silty CLAY (RESIDUAL):** Dark grey mottled with orange and red iron staining, moist, firm to stiff. Intermediate to high plasticity.									
4				E			(CI-CH)					PP(Su) = 77 kPa MC = 32.4% WD = 1.94 t/m^3 DD = 1.46 t/m^3		U50
5														

QLD_DMR_LIB_01A.GLB Log A_ENGINEERING BOREHOLE LOG W LITHOLOGY FG6056 - MARINE PROJECT.GPJ <<DrawingFile>> Datgel CPT Tool gINt Add-In 09/07/2013 09:56

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FOR GEOTECHNICAL TERMS AND SYMBOLS REFER FORM F:GEOT 017/6-2010

BOREHOLE No TH RO8
SHEET 2 of 2
REFERENCE No H11508

PROJECT Marine Project
LOCATION Redlands Northern Channel COORDINATES 528559.6 E; 6954857.6 N
PROJECT No FG6056 SURFACE R.L. 0.60m PLUNGE DATE STARTED 27/5/13 GRID DATUM GDA94
JOB No 50-010031.l.l HEIGHT DATUM LAT* BEARING DATE COMPLETED 27/5/13 DRILLER Geodrill

DEPTH (m)	R.L. (m)	CASING / WASH BORING	RQD ( )% CORE REC %	SAMPLE	MATERIAL DESCRIPTION	LITHOLOGY	USC	WEATHERING	INTACT STRENGTH (EH VH H M L VL EL)	DEFECT SPACING (mm) (20 60 200 600 2000)	GRAPHIC LOG	ADDITIONAL DATA AND TEST RESULTS	SAMPLES	TESTS
5	-4.40			F	**Silty CLAY (RESIDUAL):** Cont'd.							HW,3,3 N=6		SPT
6				G								1,3,4 N=7		SPT
7				H	Becoming pale grey mottled with orange red; silt content increasing.		(CI-CH)					5,5,7 N=12		SPT
8				J								2,4,5 N=9		SPT
9				K	Becoming very stiff.							XW Rock? 4,8,11 N=19		SPT
	-8.85				Borehole terminated at 9.45m									
10														

REMARKS *R.L on this log represents the Lowest Astronomical Tide (LAT)

LOGGED BY JA

SPT PHOTO LOG

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Geotechnical Section
35 Butterfield Street, HERSTON Qld 4006
Phone 07 3066 3336

Queensland Government

Department of Transport and Main Roads

Project Name	Toondah Harbour Northern Channel Borehole Investigation		
Project No.	FG 6056	Date	01/06/13
Borehole No.	RO1	TMR H No.	H11501
Location	E528283 N 6955184	Start Depth / LAT (m)	0.0 / 0.80
Detail	Redlands Northern Channel	Finish Depth / LAT (m)	7.45 / -6.65
Chainage		Submitted By	BW
Remarks			

SPT A 0.00-0.45m RW ,-, N>1

U50 B 0.5-0.90 (No Sample Recovered)

SPT C 1.0-1.45m RW,1,1 N=2 (No Sample Recovered)

SPT D 1.5-1.95m 5,8,4 N=12

SPT E 2.0-2.45m 4,4,6 N=10

SPT F 2.5-2.95m 5,5,5 N=10

SPT PHOTO LOG

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Department of Transport and Main Roads

Project Name	Toondah Harbour Northern Channel Borehole Investigation		
Project No.	FG 6056	Date	01/06/13
Borehole No.	RO1	TMR H No.	H11501
Location	E528283 N 6955184	Start Depth / LAT (m)	0.0 / 0.80
Detail	Redlands Northern Channel	Finish Depth / LAT (m)	7.45 / -6.65
Chainage		Submitted By	BW
Remarks			

SPT G 3.0-3.45m 2,4,5 N=9

U50 H 3.5-3.90m PP(kg/cm2) 3.6, 3.0, 4.0

SPT J 4.0-4.45m 5,7,16 N=23

SPT K 5.0-5.45m 5,6,9 N=15

SPT L 6.0-6.45m 4,6,9 N=15

SPT PHOTO LOG

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Project Name	Toondah Harbour Northern Channel Borehole Investigation		
Project No.	FG 6056	Date	01/06/13
Borehole No.	RO1	TMR H No.	H11501
Location	E528283 N 6955184	Start Depth / LAT (m)	0.0 / 0.80
Detail	Redlands Northern Channel	Finish Depth / LAT (m)	7.45 / -6.65
Chainage		Submitted By	BW
Remarks			

SPT M 7.0-7.45m 5,8,13 N=21

SPT PHOTO LOG

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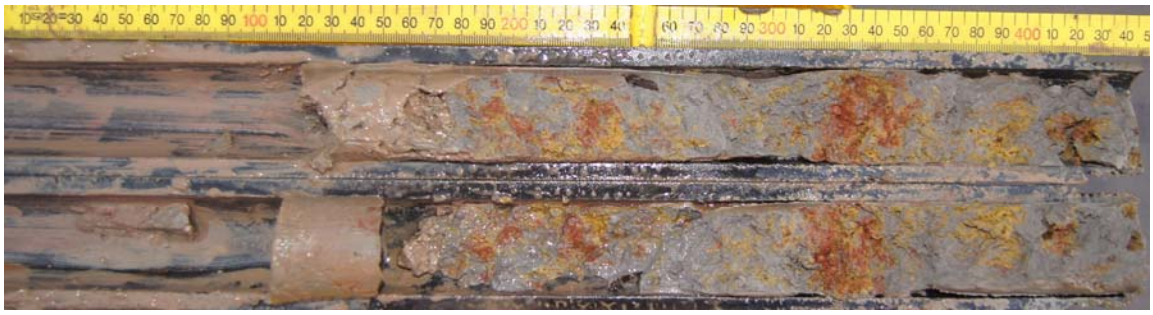
Department of Transport and Main Roads

Project Name	Toondah Harbour Northern Channel Borehole Investigation		
Project No.	FG 6056	Date	30/05/13
Borehole No.	RO2	TMR H No.	H11502
Location	E528540 N 6955298	Start Depth / LAT (m)	0.0 / 0.7
Detail	Redlands Northern Channel	Finish Depth / LAT (m)	5.45 / -4.75
Chainage		Submitted By	BW
Remarks			

SPT A 0.00-0.45m 3,RW,RW N<1

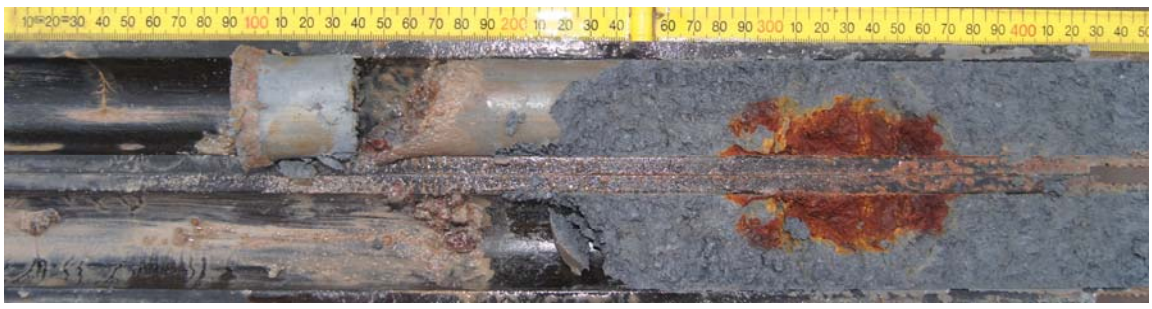
SPT B 1.0-1.45m RW,-,- N<1

U50 C 2.0-2.40m PP(kg/cm2) 0.7, 0.6, 0.6



SPT D 3.0-3.45m 1,2,2 N=4

U50 E 4.0-4.40m PP(kg/cm2) 2.6, 3.5, 3.6



SPT F 5.0-5.45m 5,6,8 N=14

SPT PHOTO LOG

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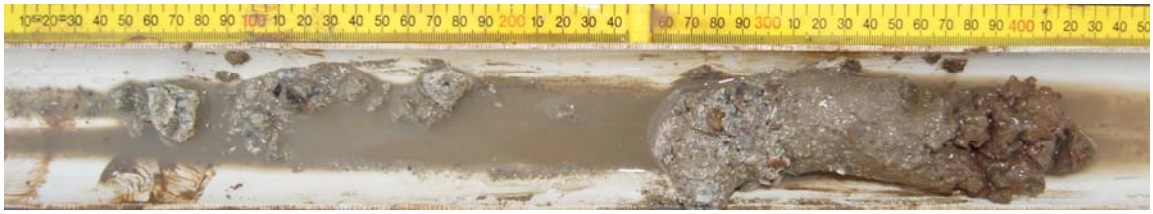
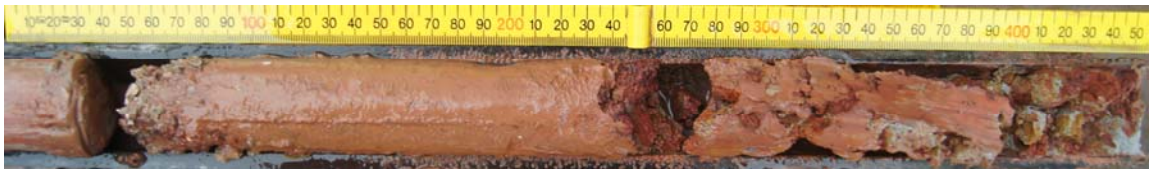
Department of Transport and Main Roads

Project Name	Toondah Harbour Northern Channel Borehole Investigation		
Project No.	FG 6056	Date	30/05/13
Borehole No.	RO3	TMR H No.	H11503
Location	E528525 N6955460	Start Depth / LAT (m)	0.0 / 0.70
Detail	Redlands Northern Channel	Finish Depth / LAT (m)	5.45 / -4.75
Chainage		Submitted By	BW
Remarks			

SPT A 0.00-0.45m 1,4,3 N=7



SPT B 1.0-1.45m 1,-,- N<1



SPT C 2.0-2.45m 2,4,10 N=14

SPT D 3.0-3.45m 6,10,14 N=24

SPT PHOTO LOG

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Phone 07 3066 3336

Queensland Government

Department of Transport and Main Roads

Project Name	Toondah Harbour Northern Channel Borehole Investigation		
Project No.	FG 6056	Date	30/05/13
Borehole No.	RO3	TMR H No.	H11503
Location	E528525 N6955460	Start Depth / LAT (m)	0.0 / 0.70
Detail	Redlands Northern Channel	Finish Depth / LAT (m)	5.45 / -4.75
Chainage		Submitted By	BW
Remarks			

SPT E 4.0-4.45m 5,7,12 N=19

SPT F 5.0-5.45m 4,5,8 N=13

SPT PHOTO LOG

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Department of Transport and Main Roads

Project Name	Toondah Harbour Northern Channel Borehole Investigation		
Project No.	FG 6056	Date	31/05/13
Borehole No.	RO4	TMR H No.	H11504
Location	E528709 N 6955540	Start Depth / LAT (m)	0.0 / -0.00
Detail	Redlands Northern Channel	Finish Depth / LAT (m)	5.45 / -5.45
Chainage		Submitted By	BW
Remarks	Test location moved 32.0m East Due to low tide		

SPT A 0.00-0.45m RW, RW, RW N<1

U50 B 1.0-1.40m PP(kg/cm2) 0, 0, 0

SPT C 2.0-2.45m RW,-,- N<1 (No Sample Recovered)

U50 D 2.5-2.90m PP(kg/cm2) 1.9, 1.9, 2.4

SPT E 3.0-3.45m 3,7,10 N=17

SPT F 3.5-3.95m 3,5,8 N=13

SPT PHOTO LOG

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Queensland Government

Department of Transport and Main Roads

Project Name	Toondah Harbour Northern Channel Borehole Investigation		
Project No.	FG 6056	Date	31/05/13
Borehole No.	RO4	TMR H No.	H11504
Location	E528709 N 6955540	Start Depth / LAT (m)	0.0 / -0.00
Detail	Redlands Northern Channel	Finish Depth / LAT (m)	5.45 / -5.45
Chainage		Submitted By	BW
Remarks	Test location moved 32.0m East Due to low tide		

SPT G 4.0-4.45m 5,7,10 N=17

SPT H 5.0-5.45m 5,6,8 N=14

SPT PHOTO LOG

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Phone 07 3066 3336

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Department of Transport and Main Roads

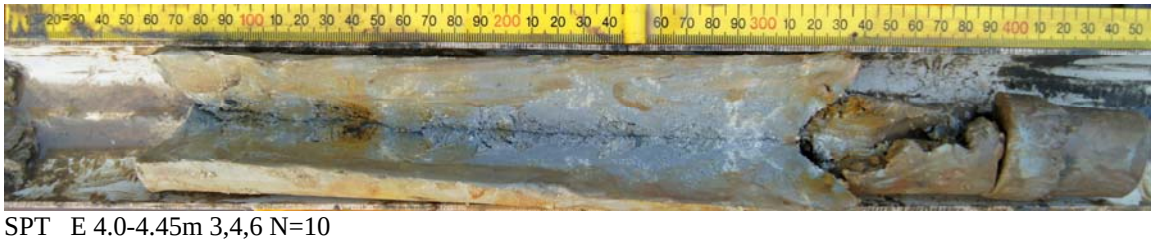
Project Name	Toondah Harbour Northern Channel Borehole Investigation		
Project No.	FG 6056	Date	31/05/13
Borehole No.	RO5	TMR H No.	H11505
Location	E528859 N 6955561	Start Depth / LAT (m)	0.0 / -0.90
Detail	Redlands Northern Channel	Finish Depth / LAT (m)	5.45 / -6.35
Chainage		Submitted By	BW
Remarks			

SPT A 0.00-0.45m RW,-,- N<1

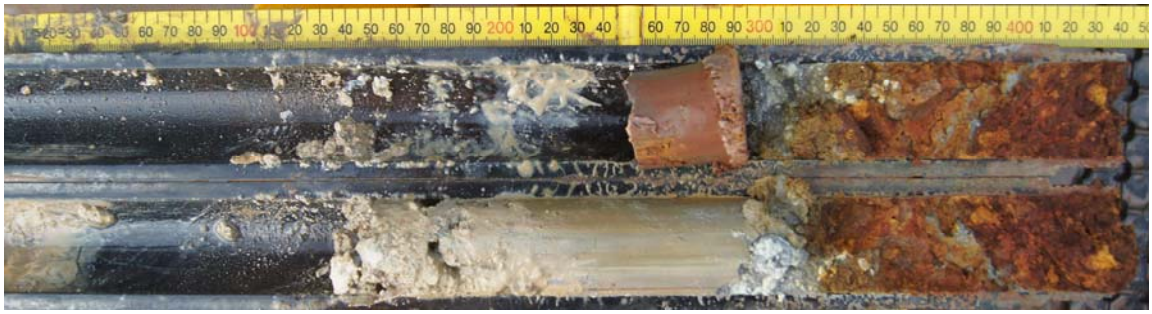
U50 B 1.0-1.40m PP(kg/cm2) 0, 0, 0

SPT C 2.0-2.45m RW,-,- N<1

U50 D 3.0-3.40m PP(kg/cm2) 1.8, 1.8, 1.7



SPT E 4.0-4.45m 3,4,6 N=10



SPT F 5.0-5.45m 3,5,5 N=10

CORE PHOTO LOG

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Geotechnical Section
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Phone 07 3066 3336

Queensland Government

Department of Transport and Main Roads

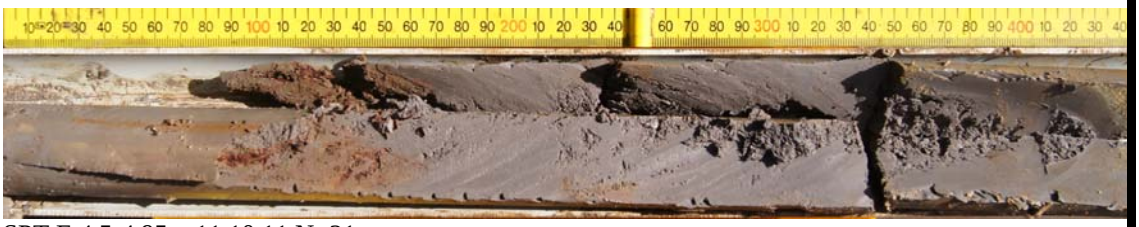
Project Name	Toondah Harbour Northern Channel Borehole Investigation		
Project No.	FG 6056	Date	29/05/13
Borehole No.	RO6	TMR H No.	H11506
Location	E528362 N 6955012	Start Depth / LAT (m)	0.00 / 0.60
Detail	Redlands Northern Channel	Finish Depth / LAT (m)	12.95 / -12.35
Chainage		Submitted By	BW
Remarks			

SPT A 0.00-0.45m HW,-,- N<1

SPT B 1.0-1.45m 1,4,1 N=5

U50 C 2.0-2.40m PP(kg/cm2) 1.2, 1.2, 1.1

No Test D



SPT E 4.5-4.95m 11,10,11 N=21

SPT F 5.5-5.95m 5,8,10 N=18

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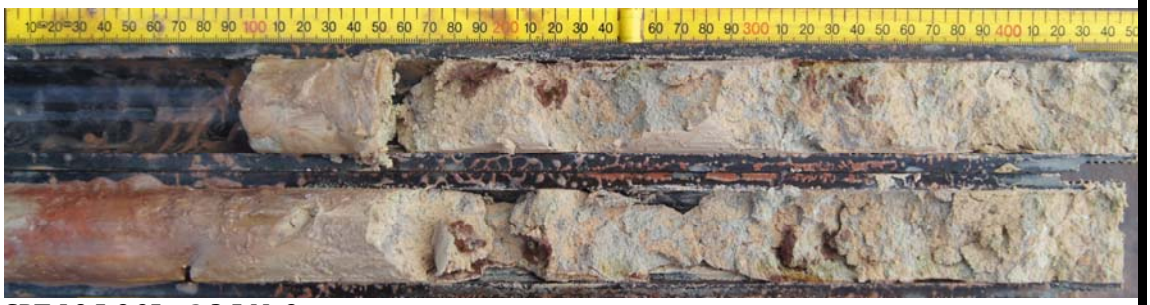
Project Name	Toondah Harbour Northern Channel Borehole Investigation		
Project No.	FG 6056	Date	29/05/13
Borehole No.	RO6	TMR H No.	H11506
Location	E528362 N 6955012	Start Depth / LAT (m)	0.00 / 0.60
Detail	Redlands Northern Channel	Finish Depth / LAT (m)	12.95 / -12.35
Chainage		Submitted By	BW
Remarks			

SPT G 6.5-6.95m 3, 7, 8 N=15

SPT H 7.5-7.95m 4,5,7 N=12



SPT J 8.5-8.95m 2,3,5 N=8

SPT K 9.5-9.95m 4,2,5 N=7

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Department of Transport and Main Roads

Project Name	Toondah Harbour Northern Channel Borehole Investigation		
Project No.	FG 6056	Date	29/05/13
Borehole No.	RO6	TMR H No.	H11506
Location	E528362 N 6955012	Start Depth / LAT (m)	0.00 / 0.60
Detail	Redlands Northern Channel	Finish Depth / LAT (m)	12.95 / -12.35
Chainage		Submitted By	BW
Remarks			

SPT L 11.0-11.45m 2,4,5 N=9

SPT M 12.50-12.95m 8,17,25 N=42

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Queensland Government

Department of Transport and Main Roads

Project Name	Toondah Harbour Northern Channel Borehole Investigation		
Project No.	FG 6056	Date	28/05/13
Borehole No.	RO7	TMR H No.	H11507
Location	E528588 N6955128	Start Depth / LAT (m)	0.00 / 0.80
Detail	Redlands Northern Channel	Finish Depth / LAT (m)	10.45 / -9.65
Chainage		Submitted By	BW
Remarks			

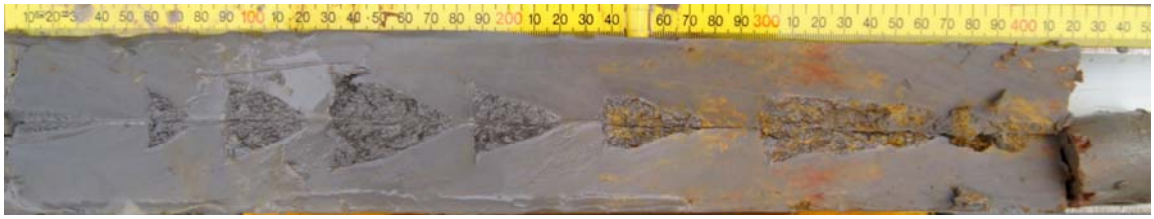
SPT A 0.00-0.45m RW,-,- N<1

SPT B 1.0-1.45m RW,-,- N<1

U50 C 2.00-2.40m PP(kg/cm2) 0.2, 0.2, 0.2

SPT D 3.0-3.45m HW,HW,1 N<2

U50 E 4.0-4.40m PP(kg/cm2) 1.2, 1.2, 1.1



SPT F 5.0-5.45m 1,3,4 N=7

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Department of Transport and Main Roads

Project Name	Toondah Harbour Northern Channel Borehole Investigation		
Project No.	FG 6056	Date	28/05/13
Borehole No.	RO7	TMR H No.	H11507
Location	E528588 N6955128	Start Depth / LAT (m)	0.00 / 0.80
Detail	Redlands Northern Channel	Finish Depth / LAT (m)	10.45 / -9.65
Chainage		Submitted By	BW
Remarks			

SPT G 6.0-6.45m 3,4,7 N=11

SPT H 7.0-7.45m 2,4,6 N=10

SPT J 8.0-8.45m 4,5,6 N=11

SPT K 9.0-9.45m 2,4,6 N=10

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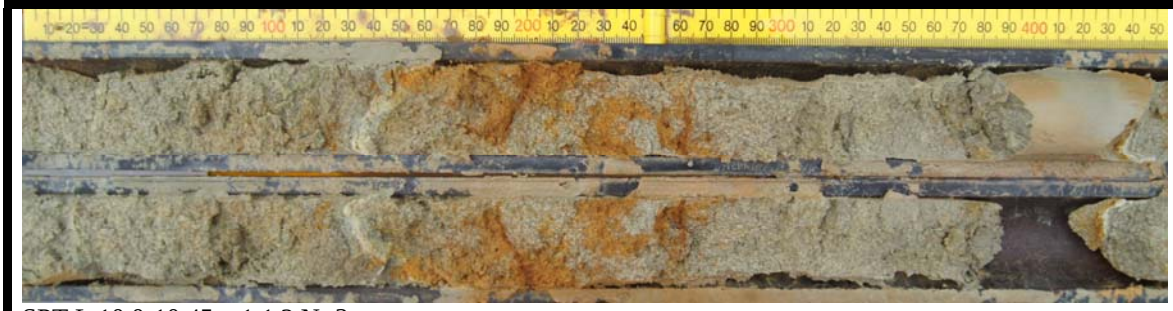
Project Name	Toondah Harbour Northern Channel Borehole Investigation		
Project No.	FG 6056	Date	28/05/13
Borehole No.	RO7	TMR H No.	H11507
Location	E528588 N6955128	Start Depth / LAT (m)	0.00 / 0.80
Detail	Redlands Northern Channel	Finish Depth / LAT (m)	10.45 / -9.65
Chainage		Submitted By	BW
Remarks			



SPT L 10.0-10.45m 1,1,2 N=3

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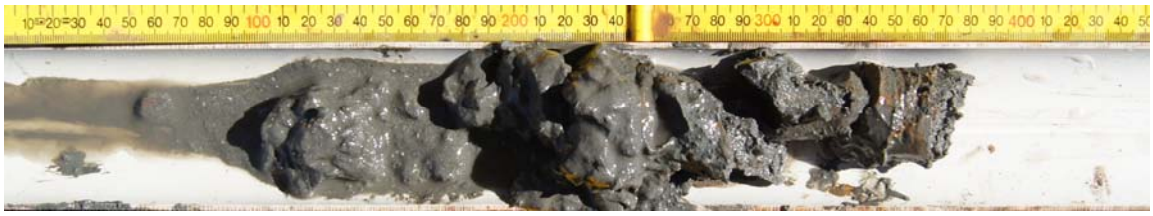
Phone 07 3066 3336

Queensland Government

Department of Transport and Main Roads

Project Name	Toondah Harbour Northern Channel Borehole Investigation		
Project No.	FG 6056	Date	28/05/13
Borehole No.	RO8	TMR H No.	H11508
Location	E 528560 N 6954858	Start Depth / LAT (m)	0.00 / 0.60
Detail	Redlands Northern Channel	Finish Depth / LAT (m)	9.45 /-8.85
Chainage		Submitted By	BW
Remarks			

SPT A 0.00-0.45m RW,-,- N<1



SPT B 1.0-1.45m RW,-,- N<1

U50 C 2.00-2.40m PP(kg/cm2) 0, 0, 0

SPT D 3.0-3.45m RW,HW,HW N<1

U50 E 4.0-4.40m PP(kg/cm2) 1.1, 1.6, 1.9

SPT F 5.0-5.45m HW,3,3 N=6

SPT G 6.0-6.45m 1,3,4 N=7

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Geotechnical Section
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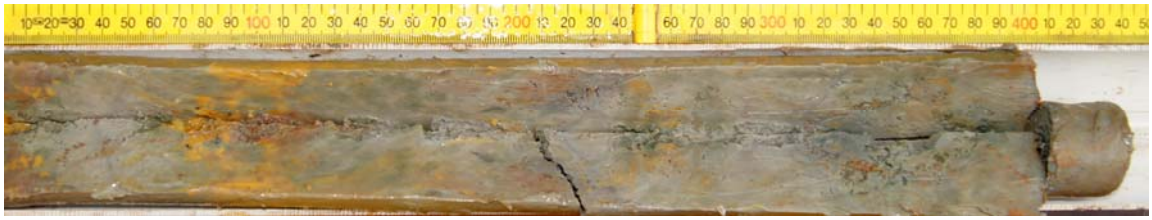
Phone 07 3066 3336

Queensland Government

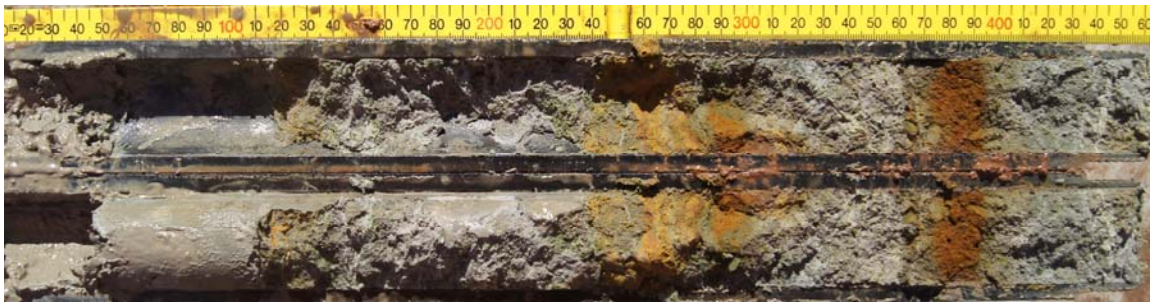
Department of Transport and Main Roads

Project Name	Toondah Harbour Northern Channel Borehole Investigation		
Project No.	FG 6056	Date	28/05/13
Borehole No.	RO8	TMR H No.	H11508
Location	E 528560 N 6954858	Start Depth / LAT (m)	0.00 / 0.60
Detail	Redlands Northern Channel	Finish Depth / LAT (m)	9.45 /-8.85
Chainage		Submitted By	BW
Remarks			

SPT H 7.0-7.45m 5,5,7 N=12



SPT J 8.0-8.45m 2,4,5 N=9



SPT K 9.0-9.45m 4,8,11 N=19

APPENDIX D – LABORATORY TEST REPORTS

Department of Transport and Main Roads
Materials Services - Brisbane
35 Butterfield Street, Herston QLD 4006
PH: +61 7 31153035 FAX: +61 7 31153011

REPORT ON MOISTURE CONTENT AND DENSITY

Queensland Government

Test Method: Q171 - 1989

Project : **Marine Infrastructure Works - Redlands**

Project Number : **FG5902 / 2788**

Location	Article Number	Sender's Number	Date Sampled	Date Tested	Moisture Content (%)	Wet Density (t/m^3)	Dry Density (t/m^3)	Sample Description
R01 "H" @ 3.5-3.9 m	GS13-0344	N/A	01/06/2013	17/06/2013	**47.4**	**2.50**	**1.70**	Mottled Grey brown Silty CLAY (Ironstone Inclusions)
R02 "C" @ 2.0-2.4 m	GS13-0345	N/A	30/05/2013	17/06/2013	**31.4**	**2.00**	**1.52**	Mottled Grey Red Brown Silty CLAY
R02 "E" @ 4.0-4.4 m	GS13-0346	N/A	30/05/2013	17/06/2013	**48.6**	**1.60**	**1.08**	Grey Clayey SILT
R04 "B" @ 1.0-1.4 m	GS13-0347	N/A	31/05/2013	17/06/2013	**88.6**	**1.48**	**0.78**	Grey Silty CLAY
R04 "D" @ 2.5-2.90 m	GS13-0348	N/A	31/05/2013	17/06/2013	**50.8**	**1.70**	**1.12**	Mottled Orange Grey Silty CLAY
R05 "B" @ 1.0-1.4 m	GS13-0349	N/A	31/05/2013	17/06/2013	**84.4**	**1.50**	**0.80**	Grey Silty CLAY
R05 "D" @ 3.0-3.4 m	GS13-0350	N/A	31/05/2013	17/06/2013	**36.6**	**1.88**	**1.38**	Grey Brown Silty CLAY with some Gravel
R06 "C" @ 2.0-2.4 m	GS13-0351	N/A	29/05/2013	17/06/2013	**35.6**	**1.92**	**1.42**	Mottled Red Orange Grey Silty CLAY
R07 "C" @ 2.0-2.45 m	GS13-0352	N/A	28/05/2013	17/06/2013	**89.8**	**1.52**	**0.80**	Grey Silty CLAY
R07 "E" @ 4.0-4.4 m	GS13-0353	N/A	28/05/2013	17/06/2013	**34.2**	**1.88**	**1.40**	Mottled Yellow Grey Silty CLAY

Variation(s) : -

Remark(s) : Client Reference : Project No.: FG6056. Sample supplied by client.

Client Details : DTMR- Geotechnical Branch
Floor 2 35 Butterfield Street Herston QLD 4006

Checked By

Signatory

Devinder Pal
Senior Technologist

Date **25/06/2013**

Report No. GS13-0285

NATA TECHNICAL COMPETENCE

Accreditation Number: 2302

Accredited for compliance with ISO/IEC 17025

Department of Transport and Main Roads
Materials Services - Brisbane
35 Butterfield Street, Herston QLD 4006
PH: +61 7 31153035 FAX: +61 7 31153011

REPORT ON MOISTURE CONTENT AND DENSITY

Queensland Government

Test Method: Q171 - 1989

Project : **Marine Infrastructure Works - Redlands**

Project Number : **FG5902 / 2788**

Location	Article Number	Sender's Number	Date Sampled	Date Tested	Moisture Content (%)	Wet Density (t/m^3)	Dry Density (t/m^3)	Sample Description
R08 "C" @ 2.0-2.4 m	GS13-0354	N/A	27/05/2013	17/06/2013	**104.6**	**1.42**	**0.70**	Grey Silty CLAY
R08 "E" @ 4.0-4.40 m	GS13-0355	N/A	27/05/2013	17/06/2013	**32.4**	**1.94**	**1.46**	Mottled Red Grey Silty CLAY

Variation(s) : -

Remark(s) : Client Reference : Project No.: FG6056. Sample supplied by client.

Client Details : DTMR- Geotechnical Branch
Floor 2 35 Butterfield Street Herston QLD 4006

Checked By

Signatory

Devinder Pal
Senior Technologist

Date **25/06/2013**

Report No. GS13-0284

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Qld Dept of Transport and Main Roads
35 Butterfield St Herston 4006

Materials Services Brisbane

REPORT ON ATTERBERG LIMITS LL, PI, LS

Job Number : FG5902/2788
Submitted by : CLIENT
Item number : -
Samp. Method : -

Mat Source : -
Item Desc. :

Lab Number / Senders No	Sampled By	Samp Date / Test Date	Lot Number	Chainage & Sample Location	Depth	LL % (Q104A/B)	PI % (Q105)	LS % (Q106)
GS13/351 / -	CLIENT	14/06/13 / 24/06/13	-	- / Redlands - R06 C	2.0-2.4m	70.2	41.4	14.8

REMARKS Tested as received

Checked By : Anthony Neary

Signatory : Anthony Neary

Page: 1 of 1 **Report No : 30163** Date : 26/06/13 CF/0790/S31

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Qld Dept of Transport and Main Roads
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REPORT ON GRADING GEOTECHNICAL

Lab Number	: GS13/344	Request No	: -
Job Number	: FG5902/2788	Submitted by:	CLIENT
Item number	: -	Senders No	: -
Lot number	: -	Sampled By	: CLIENT
Chainage	: - -	Samp. Method:	-
Sample Loc.	: Redlands - R01 H	Mat Source	: -
Level/Depth	: 3.5-3.9m	Item Desc.	:
Date sampled	: 14/06/13		
Date tested	: 25/06/13		

A.S. Sieve Size	Grading Test Method		% Passing by Mass
37.5 mm	Q103A		---
26.5 mm			---
19.0 mm			---
9.5 mm			---
4.75 mm			100
2.36 mm			100
1.18 mm			99
0.600 mm			99
0.425 mm			98
0.300 mm			98
0.150 mm			97
0.075 mm			97

Test Results	Units	Test Method		Result
Liquid Limit	%	Q104A/D		-
Plastic Index	%	Q105		-
Linear Shrinkage	%	Q106		-
Dust Ratio				0.98
PI x Passing 425				-
LS x Passing 425				-

Comments
Tested as received

Comments :

Signatory : Anthony Neary

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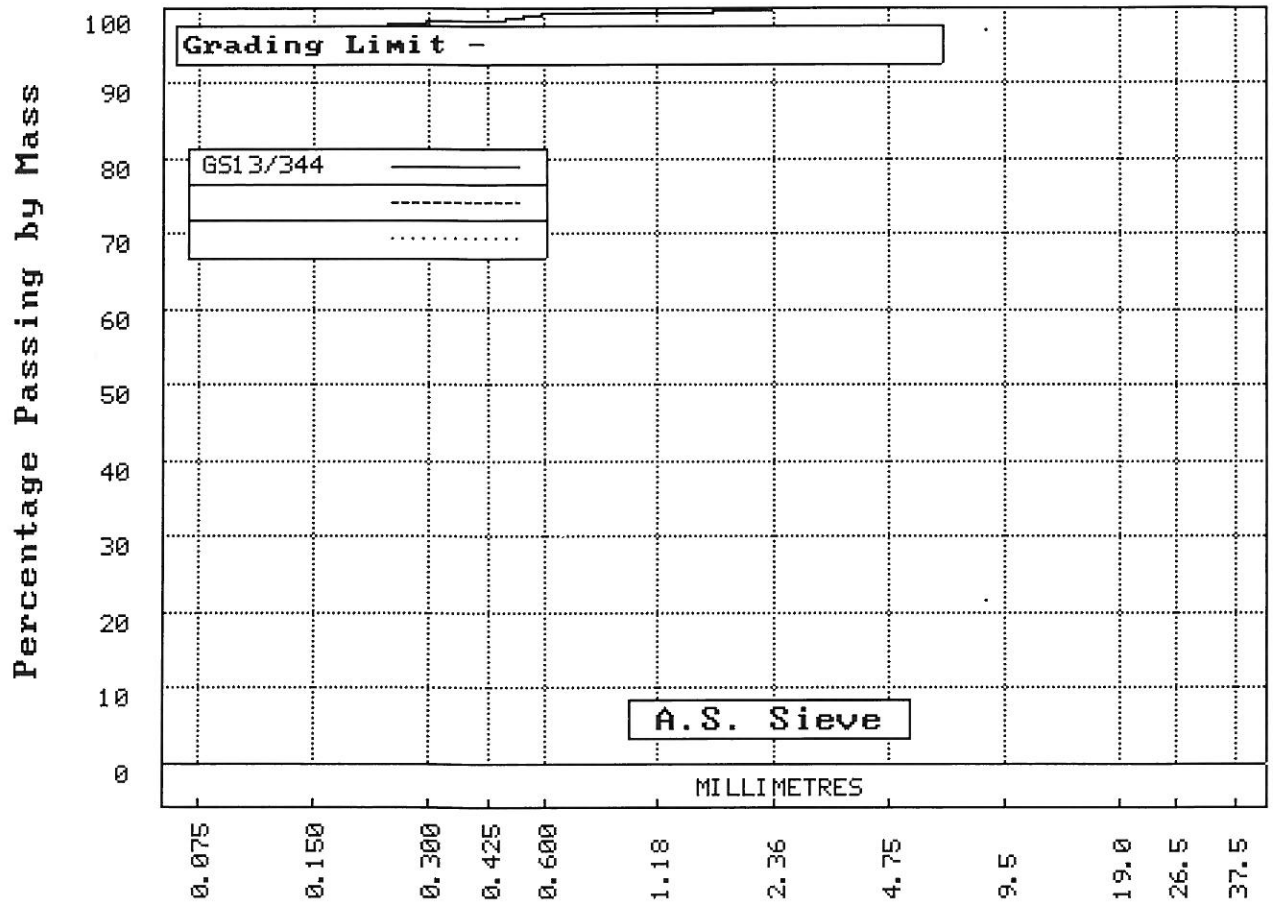
REPORT ON GRADING GEOTECHNICAL



Checked By : Anthony Neary	Signatory : Anthony Neary

Qld Dept of Transport and Main Roads
35 Butterfield St Herston 4006

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REPORT ON GRADING GEOTECHNICAL

Lab Number	: GS13/347	Request No	: -
Job Number	: FG5902/2788	Submitted by:	CLIENT
Item number	: -	Senders No	: -
Lot number	: -	Sampled By	: CLIENT
Chainage	: - -	Samp. Method:	-
Sample Loc.	: Redlands - R04 A	Mat Source	: -
Level/Depth	: 1.0-1.4m	Item Desc.	:
Date sampled	: 14/06/13		
Date tested	: 21/06/13		

A.S. Sieve Size	Grading Test Method		% Passing by Mass
37.5 mm	Q103A		---
26.5 mm			---
19.0 mm			---
9.5 mm			---
4.75 mm			100
2.36 mm			96
1.18 mm			94
0.600 mm			92
0.425 mm			91
0.300 mm			90
0.150 mm			85
0.075 mm			79

Test Results	Units	Test Method		Result
Liquid Limit	%	Q104A/D		-
Plastic Index	%	Q105		-
Linear Shrinkage	%	Q106		-
Dust Ratio				0.86
PI x Passing 425				-
LS x Passing 425				-

Comments
Tested as received

Comments :

Signatory : Anthony Geary

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35 Butterfield St Herston 4006

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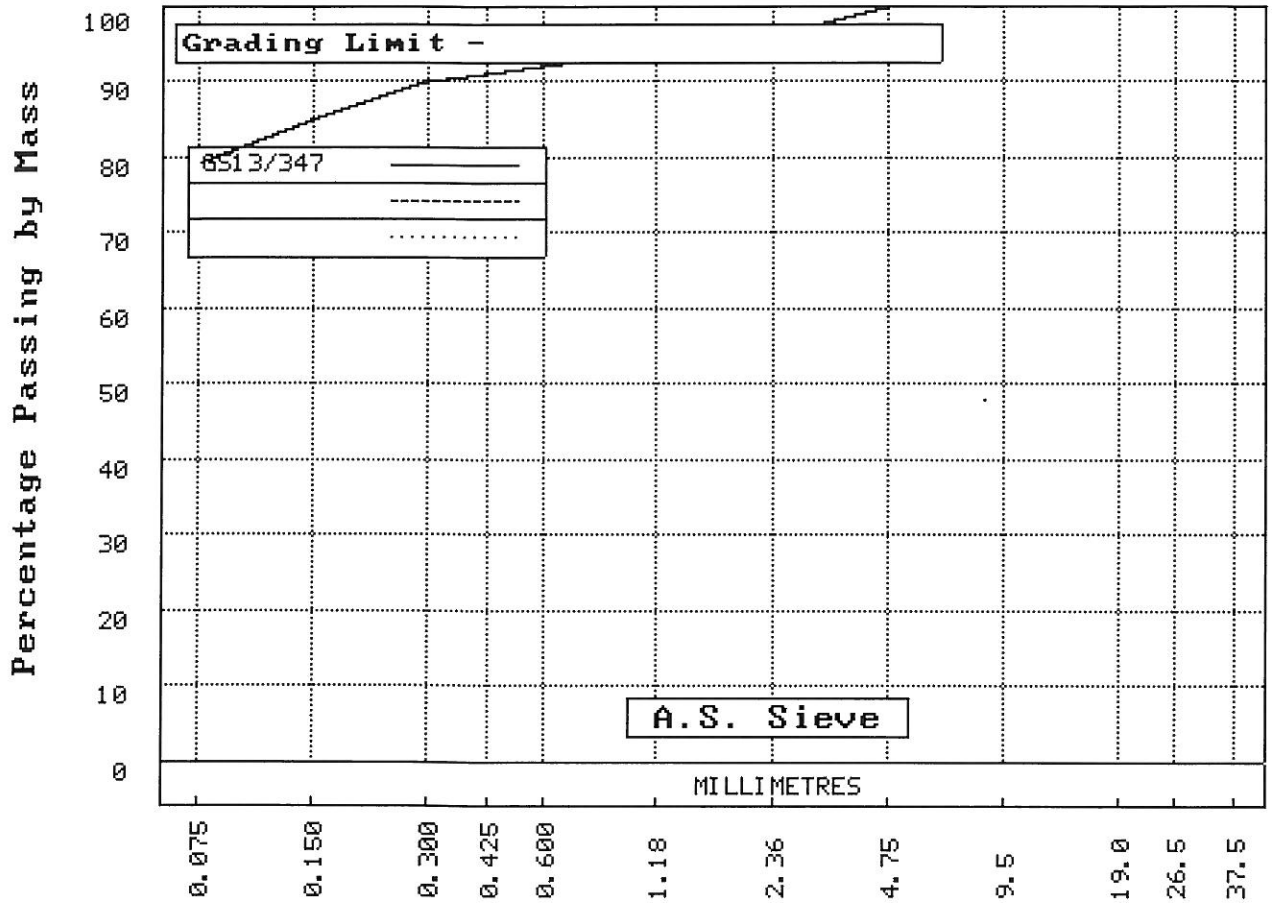
REPORT ON GRADING GEOTECHNICAL



Checked By : Anthony Neary

Signatory : Anthony Neary

 Report No : 30165 Date : 26/06/13 SAC001

Qld Dept of Transport and Main Roads
35 Butterfield St Herston 4006

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REPORT ON GRADING GEOTECHNICAL

Lab Number	: GS13/349	Request No	: -
Job Number	: FG5902/2788	Submitted by:	CLIENT
Item number	: -	Senders No	: -
Lot number	: -	Sampled By	: CLIENT
Chainage	: - -	Samp. Method:	-
Sample Loc.	: Redlands - R05 B	Mat Source	: -
Level/Depth	: 1.0-1.4m	Item Desc.	:
Date sampled	: 14/06/13		
Date tested	: 25/06/13		

A.S. Sieve Size	Grading Test Method		% Passing by Mass
37.5 mm	Q103A		---
26.5 mm			---
19.0 mm			---
9.5 mm			---
4.75 mm			100
2.36 mm			100
1.18 mm			99
0.600 mm			99
0.425 mm			98
0.300 mm			98
0.150 mm			96
0.075 mm			91

Test Results	Units	Test Method		Result
Liquid Limit	%	Q104A/D		-
Plastic Index	%	Q105		-
Linear Shrinkage	%	Q106		-
Dust Ratio				0.92
PI x Passing 425				-
LS x Passing 425				-

Comments
Tested as received

Comments :

Signatory : Anthony Neary

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35 Butterfield St Herston 4006

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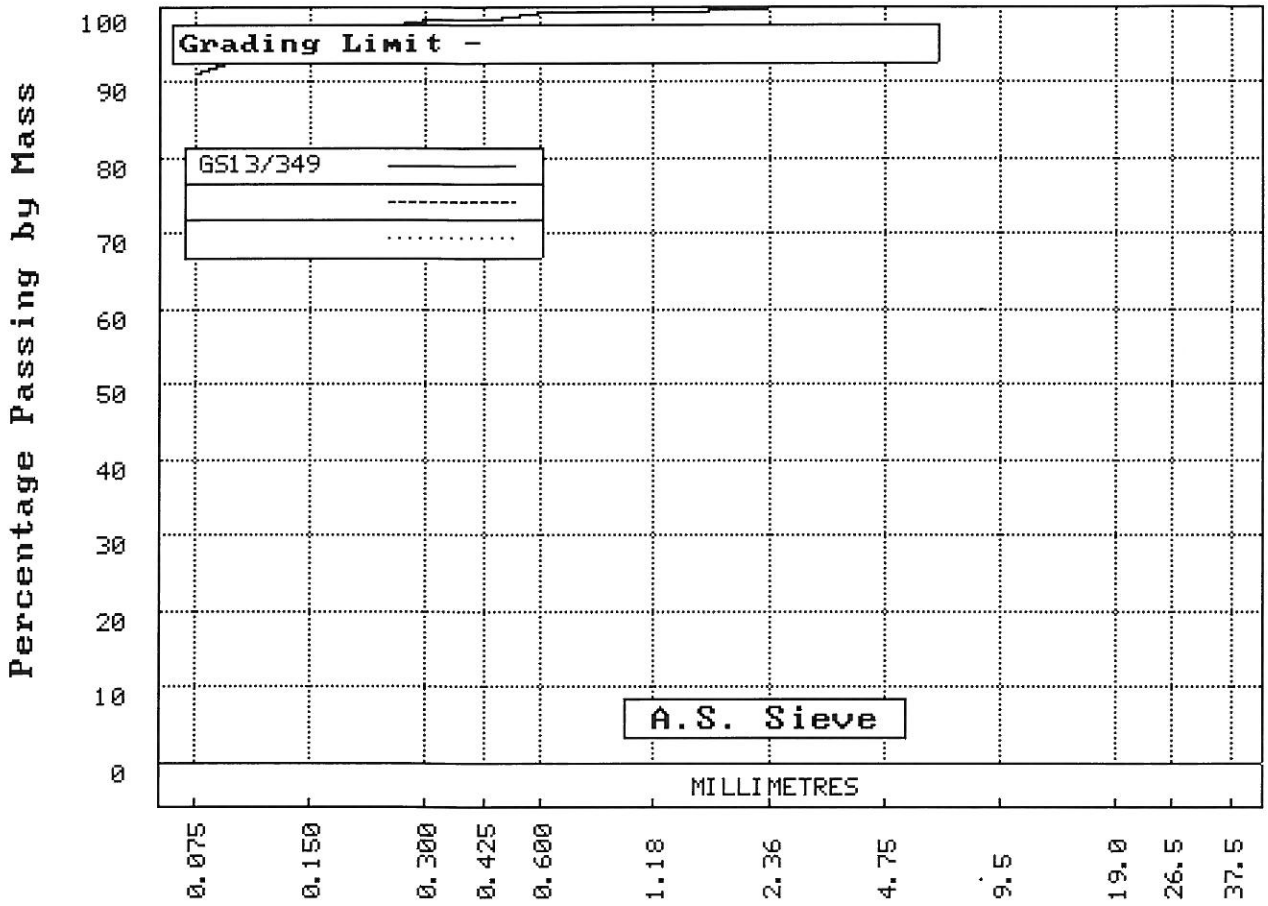
REPORT ON GRADING GEOTECHNICAL



Checked By : Anthony Neary

Signatory : Anthony Neary

 Report No : 30166 Date : 26/06/13 SAC001

Qld Dept of Transport and Main Roads
35 Butterfield St Herston 4006

Materials Services Brisbane

REPORT ON GRADING GEOTECHNICAL

Lab Number	: GS13/352	Request No	: -
Job Number	: FG5902/2788	Submitted by:	CLIENT
Item number	: -	Senders No	: -
Lot number	: -	Sampled By	: CLIENT
Chainage	: - -	Samp. Method:	-
Sample Loc.	: Redlands - R07 C	Mat Source	: -
Level/Depth	: 2.0-2.4m	Item Desc.	:
Date sampled	: 14/06/13		
Date tested	: 25/06/13		

A.S. Sieve Size	Grading Test Method		% Passing by Mass
37.5 mm	Q103A		---
26.5 mm			---
19.0 mm			---
9.5 mm			---
4.75 mm			100
2.36 mm			99
1.18 mm			99
0.600 mm			98
0.425 mm			98
0.300 mm			98
0.150 mm			96
0.075 mm			94

Test Results	Units	Test Method		Result
Liquid Limit	%	Q104A/D		-
Plastic Index	%	Q105		-
Linear Shrinkage	%	Q106		-
Dust Ratio				0.96
PI x Passing 425				-
LS x Passing 425				-

Comments
Tested as received

Comments :

Signatory : Anthony Neary

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35 Butterfield St Herston 4006

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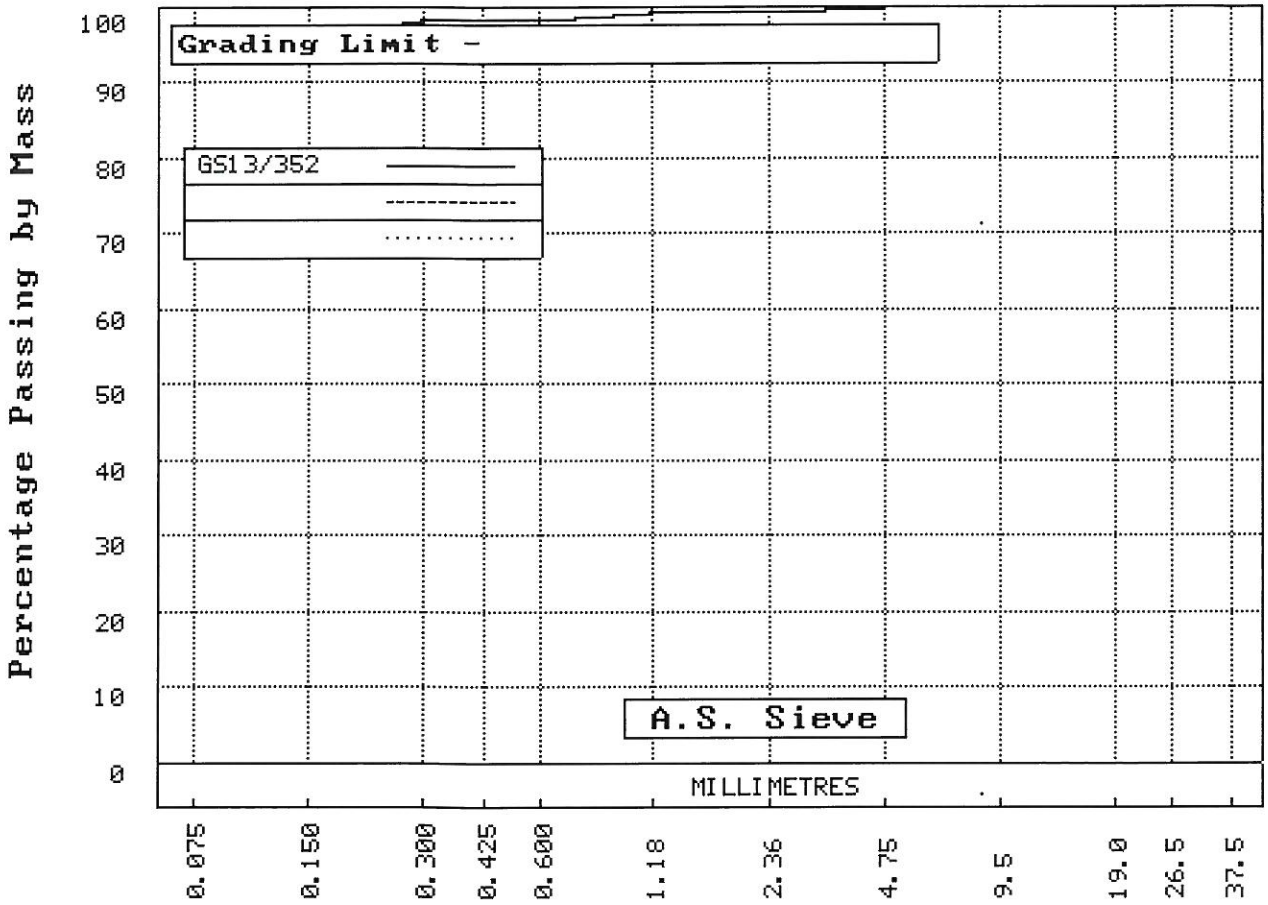
REPORT ON GRADING GEOTECHNICAL



Checked By : Anthony Neary

Signatory : Anthony Neary

Page : 2 of 2 **Report No : 30167** Date : 26/06/13 SAC001

Accreditation Number: 2302

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35 Butterfield St Herston 4006

Materials Services Brisbane

REPORT ON GRADING GEOTECHNICAL

Lab Number	: GS13/354	Request No	: -
Job Number	: FG5902/2788	Submitted by:	CLIENT
Item number	: -	Senders No	: -
Lot number	: -	Sampled By	: CLIENT
Chainage	: - -	Samp. Method:	-
Sample Loc.	: Redlands - R08 C	Mat Source	: -
Level/Depth	: 2.0-2.4m	Item Desc.	:
Date sampled	: 14/06/13		
Date tested	: 25/06/13		

A.S. Sieve Size	Grading Test Method		% Passing by Mass
37.5 mm	Q103A		---
26.5 mm			---
19.0 mm			---
9.5 mm			---
4.75 mm			100
2.36 mm			99
1.18 mm			98
0.600 mm			96
0.425 mm			94
0.300 mm			92
0.150 mm			88
0.075 mm			85

Test Results	Units	Test Method		Result
Liquid Limit	%	Q104A/D		-
Plastic Index	%	Q105		-
Linear Shrinkage	%	Q106		-
Dust Ratio				0.90
PI x Passing 425				-
LS x Passing 425				-

Comments
Tested as received

Comments :

Signatory : Anthony Neary

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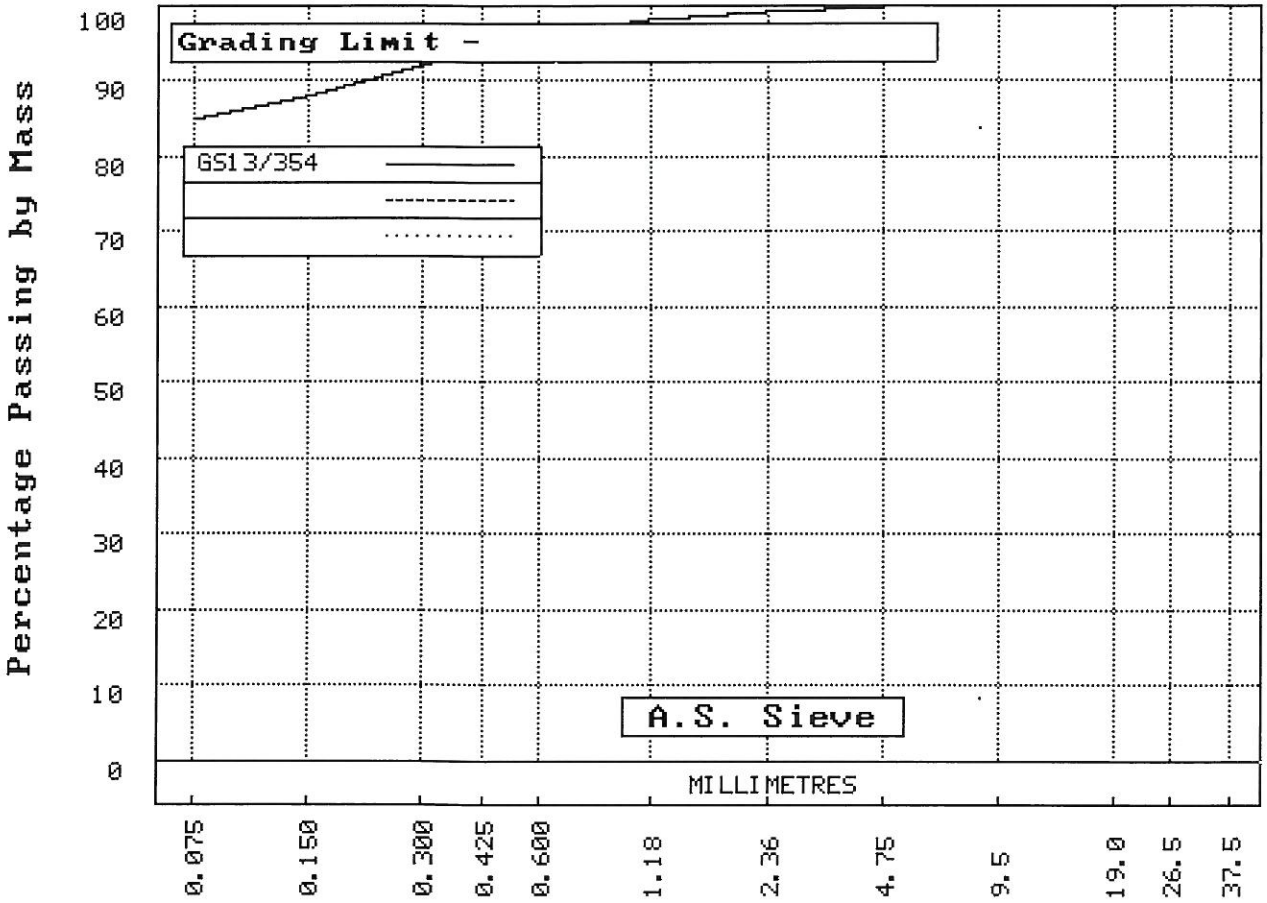
REPORT ON GRADING GEOTECHNICAL



Checked By : Anthony Neary

Signatory : Anthony Neary

 Report No : 30168 Date : 26/06/13 SAC001