



9 August 2012

GEOTECHNICAL INVESTIGATION - TOWNS RIVER REALIGNMENT

Roper Bar Iron Ore Project

Submitted to:
Western Desert Resources
Level 1 / 26 Greenhill Road
WAYVILLE SA 5034

REPORT



Report Number. 127646013-002-R-Rev1

Distribution:

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1.0 INTRODUCTION

This report presents the results of a geotechnical study carried out by Golder Associates Pty Ltd (Golder Associates) for the proposed realignment of a section of the Towns River as part of the Roper Bar Iron Ore Project, Northern Territory. The study was commissioned by Western Desert Resources (WDR) on 30 March 2012 (email Younge/Goode) and was undertaken in general accordance with our proposal (reference P27646012-001-L-Rev2) dated 23 March 2012.

An interim factual report was provided to WDR in June 2012 (Golder Associates reference 127646013-002-R-Rev0 dated 15 June 2012) as laboratory testing was still being undertaken and the results were not available. This interpretive report now includes the laboratory testing results as well as an interpretation of the geotechnical study.

The extent of the study area and the proposed alignments discussed below are shown in Figure 1. The original proposed realignment (Option A) was approximately 4.5 km long predominantly traversing east west, bypassing to the north of the Roper Bar iron ore deposits. The details of this original alignment were presented in Golder Associates working document Draft General Arrangement drawing D002 Revision A. Realignment Option A was the basis for the intrusive field investigations. The discussion within this report relates to the ground conditions encountered along this original realignment.

Following completion of the fieldwork, Golder Associates was informed (email Young/Thomas on 13 June 2012) that WDR had reduced the length of the alignment to the portion adjacent to the eastern section of the ore body (east of Wade's Crossing). Subsequent to this, the realignment was revised to incorporate existing sections of the Towns River and this is presented in Figure 1 as 'Option C', which was current at the time of preparing this report. Reference and comment has been made in this report to this current alignment which is located up to approximately 250 m south of both the original alignment and the investigated test pit locations.

The aim of the investigation was to make an assessment of the geotechnical conditions along the proposed realignment and identify potential geotechnical constraints that might affect or limit the proposed development.



2.0 METHODOLOGY

A desktop study was undertaken by assessing publicly available geological information including geological maps and publications from the Northern Territory Geological Survey and journal articles. We sourced GIS data from Geosciences Australia and reviewed data published by that organisation.

Fieldwork for the geotechnical investigation was carried out between 1 June and 5 June 2012. The fieldwork consisted of a walkover of the proposed original realignment on the first day followed by three days of targeted intrusive investigations. This involved excavating 15 test pits at locations along the proposed original (Option A) realignment, to a target depth of 0.5 m below the proposed invert level, where possible. Materials recovered during the investigation were logged and a number of samples from the test pits were taken for potential geotechnical laboratory testing.

The fieldwork was undertaken by an Engineering Geologist from Golder Associates who made general observations of the following to assist in the location of the intrusive investigations:

- geomorphological and topographic setting;
- location and extent of soil and rock exposures along the alignment and adjacent features, where observed;
- materials exposed at the ground surface;
- form and condition of the Towns River channel; and
- the distribution of vegetation along the realignment (Option A).



3.0 DESKTOP STUDY

The explanatory notes for the Mount Young 1:250,000 map sheet¹ indicate that the geology along the proposed realignments (Option A and also Option C) may be generalised as falling within the Gulf Fall zone. However we note that the eastern extent of the site is located very close to the boundary with the Coastal Plain zone.

The distinct topographical and geological features associated with each zone are outlined in the subsequent section. The zones are not continuous. Their geographical distribution is presented on Figure 2.

3.1 Topography and Geology

3.1.1 Gulf Fall

The Gulf Fall zone is located predominantly west of the Limmen River. A rock outcrop associated with the Gulf Fall zone is also present south of the Yiyintyi Range. Based on the available information the topography of the Gulf Fall zone has been shaped by differential erosion creating steep sided ridges of sandstone with valleys of less resistant rock in between. The ridges generally have an elevation 30m to 60m above the intervening valleys.

The Mount Young map sheet provides the following nomenclature for the geological materials which may be present in Gulf Fall zones of the proposed river realignment:

- *"JALBOI MEMBER: Quartzarenite and sublitharenite, very fine to medium grained with thinly interbedded, commonly micaceous siltstone and mudstone; common mudstone intraclasts and cross-beds."*
- *"Qa: Gravel, sand, silt: alluvium."*
- *"MOROAK SANDSTONE MEMBER: Mainly fine-grained sandstone, in places ferruginous; thin bedded to flaggy with some interbedded coarse-grained sandstone and minor conglomerate."*

3.1.2 Coastal Plain

The Coastal Plain zone is characterised as a wide, flat, low lying plain with elevations ranging from sea level up to about 30m AHD (Australian Height Datum). Northwest trending sand dunes with very low relief occur in places. Drainage in the Coastal Plain zone occurs through sub-parallel streams generally trending southwest to northeast.

The Mount Young geological map sheet and its explanatory notes indicate that the majority of the Coastal Plain zone contains a soil profile consisting of sand overlying a lateritic soil profile. In places the sands are cemented together to form lateritic rock outcrops. Alluvial soils comprising sands, gravels silts and clays may be expected near major streams and drainage channels. Calcrete outcrops are present between the Yiyintyi Ranges and the Nathan River.

¹ Northern Territory Geological Survey, Sheet SD 53-15, Mount Young



4.0 GEOTECHNICAL INVESTIGATION

Fieldwork for the investigation was carried out from the 1 June to 5 June 2012 and included a site walkover of the original (Option A) proposed realignment followed by excavating 15 test pits (GTP01 to GTP15) to at least 0.5m below the original proposed invert level at each location, or prior refusal at shallower depth. On 5 June 2012, a walkover was undertaken of a section of the Towns River that is adjacent and to the south of the current proposed realignment. Refer to Figure 1 for the chainage references herein.

Initially, test pit locations were positioned along the original proposed realignment (Option A) at approximately even spacings, progressing west to east (GTP01 to GTP10). A further five test pits were located between these pits in particular areas of interest (GTP11 to GTP15). The approximate test pit locations are shown on Figure 1.

The excavations were undertaken using a CAT 325 DL Excavator and CAT 432E Backhoe fitted with a 1.5m wide toothed bucket and 0.45m wide toothed bucket respectively. The test pits were backfilled with excavated spoil and tamped down with the back of the bucket.

The fieldwork was carried out in the presence of an Engineering Geologist from Golder Associates who located the test pits, logged and took samples of the materials encountered and performed the field testing.

4.1 Walkover

A site walkover along the alignment Option A was undertaken on 1 June 2012 by Andy Thomas of Golder Associates accompanied by a representative from WDR. The proposed alignment had been flagged by WDR prior.

The walkover commenced at CH0 at the existing Towns River. The existing form of the river was observed to be steep sided with a flat channel floor. The materials in the river embankment consisted clayey sands.

The original proposed alignment from this point to approximately CH1000 was proposed to be located centrally between east west trending rock outcrop ridgelines which are spaced about 200 m apart (crest to crest). The ridgeline to the south is described on the Mount Young map sheet to consist '*Mainly fine-grained sandstone, in places ferruginous; thin bedded to flaggy with some interbedded coarse-grained sandstone and minor conglomerate*'. Field observations indicated that this material was of high strength and of a 'blocky' structure with the dominant structural feature dipping steeply to the north.

The ridgeline to the north is described as '*Quartzarenite and sublitharenite, very fine to medium grained with thinly interbedded, commonly micaceous siltstone and mudstone; common mudstone intra-clasts and cross-beds*'. Field observations indicated that this material was of high strength and of a 'tabular' structure with the dominant structural feature dipping at approximately 45 degrees to the south.

The vegetation along this section was typically light saplings densely spaced. Surface hand excavations to less than 200 mm below the ground surface generally revealed fine to medium grained sand materials with organic matter. Figure 3 is a photograph taken along this section which shows the typical vegetation.



Figure 3 CH0 to CH1000 typical vegetation

The vegetation density along the Option A alignment from approximately CH1000 to the eastern end was markedly different from that between CH0 and CH1000. Dense low grasses were present between sparsely spaced mature trees. Figure 4 presents the typical vegetation in this section.



Figure 4 CH1000 to CH4570 typical vegetation



Near surface investigations along this section revealed silty, clayey and sandy materials containing organic matter.

The ground surface along the original proposed realignment appeared well drained except for locations where water bodies and swampy ground were observed at approximately CH3000 and from CH4300 to the end of the proposed realignment.

4.2 Subsurface Conditions

Descriptions of the materials encountered in the test pits are presented in the Reports of Test Pits in Appendix B. Our explanatory sheets of Terms and Abbreviations and Methods of Soil Classification used in preparing the Reports of Test Pits are also included. Consistencies and densities stated in test pit logs have been estimated from pocket penetrometer testing (in cohesive materials), visual observations, and from our assessment of excavation resistance. Coordinates provided on the Reports of Test Pits were obtained from a hand held GPS unit. Photographs of test pit excavations are presented with the test pit logs.

The test pits at the site all encountered topsoil materials that were generally less than 0.5 m in depth and comprised silt, clay and sand overlying predominantly clayey sand which generally overlies a mixture of soil and rock strength materials.

Pale brown, orange brown and red brown sands with varying levels of low plasticity clay and increasing gravel content with depth were observed in all test pits. Test pits GTP01-GTP06, GTP11, GTP14, and GTP15 were excavated within the western portion of the site and encountered silty and clayey sands from ground surface.

The mixture of soil and rock strength materials comprised low plasticity silty sand and lateritic sandstone / siltstone. Backhoe and excavator bucket penetration refusal was encountered on a hard lateritic rock layer in test pits GTP03, GTP04, GTP05, GTP06, GTP08, GTP09, GTP10, GTP12, GTP13 and GTP14. The depth of refusal was below the proposed channel invert level in most of these test pits. Refusal was encountered above (less than one metre) the proposed invert level of the channel presented in Option A in test pits GTP03, GTP06 and GTP14.

Table 1 provides a generalised description of materials observed in the test pits.

Table 1: Generalised Stratigraphy

Unit	Top Depth (mbgs*)	Description
A	0 – 0.5	Silty SAND / Sandy CLAY / Clayey SAND with organic matter
B	0.5 - 2	Silty / Clayey SAND, fine to medium grained, mottled grey, red brown, orange brown, low liquid limit / low plasticity fines, gravel where present is fine to medium grained
C	2 – test pit refusal or termination	Mixture of SOIL and ROCK: SOIL generally comprised Silty SAND, fine to coarse grained, mottled pale brown and orange brown, low liquid limit fines, with fine to medium gravel ROCK is LATERITIC SANDSTONE/SILTSTONE, fine to medium grained, granular, mottled grey, brown, orange brown, red, black, low strength, highly weathered, with refusal encountered on higher strength material

* mbgs – metres below ground surface

The composition of the materials observed in the test pits was relatively consistent, however the moisture content of the materials did vary. Groundwater inflow was encountered in GTP06 and GTP10 at depths of 1.2 m and 1.5 m respectively. Correspondingly, the moisture contents of the materials encountered in these



test pits were significantly higher than those observed in other pits. Both these test pits were positioned in close proximity to existing water bodies or areas of swampy ground.

The excavations remained open and the side walls vertical for the period of the investigation in all test pits with the exception of GTP10. The materials collapsing in GTP10 were due to the water inflow.

The soils containing mixtures of sand and clay generally behaved like cohesive materials presumably due to the relatively high clay content and/or the lateritic nature of the soils. Pocket penetrometer testing of the clayier soils from the test pits suggests that the consistency generally ranged from stiff to a very stiff. The clayey soils close to the ground surface were generally friable. Those at greater depth generally had a consistency of stiff to hard. The consistency of the clayey sand soils was observed to be dependent on moisture content; dry materials appeared medium dense to dense, whereas moist to wet materials were generally loose.

Summary details of the general excavation resistance of the materials encountered (referenced in Table 1) with the plant used for the investigation is provided in the Table 2 below.

Table 2: Generalised Excavation Resistance

Unit	Excavation Resistance
A	Low
B	Medium
C	High to Refusal

4.3 Towns River

The Towns River was visually assessed at the start (CH0) of the Option A alignment on 1 June 2012 and along a section to the south of the Option C alignment between CH1400 to CH1600. Access and time constraints prevented assessment of other sections of the river channel.

The river bank material was observed to consist of fine grained materials comprising sand and clay. Along the straighter sections of the river, the river banks were observed to be generally inclined steeper than two horizontal to one vertical (2H:1V). On the outer side of the river bends, where water flow had been concentrated, the banks were generally steep to sub-vertical. River banks were observed to be up to about 2.5 m high above the existing river bed. Roots of mature trees were commonly exposed on the face of the river banks indicating erosion of materials surrounding the roots had occurred.

The river bed generally had an approximately flat and horizontal (in cross section) profile and medium strength, highly weathered siltstone was exposed over the river bed surface in places. Weathering of this material had resulted in a 'pitted' surface. Gravel to cobble sized sandstone rock fragments were present on the river bed in sections of the river.

Figure 5 and Figure 6 are pictures of these sections of the river.



Figure 5 River bend with outer side of the river on the left side. Sub-vertical river bank with horizontal channel floor.



Figure 6 Straight section of the river. Steep sided river bank and horizontal channel floor with siltstone gravel and cobbles.



5.0 GEOTECHNICAL LABORATORY TESTING

Laboratory testing of selected samples recovered from the test pits was undertaken by Cardno, Ullman & Nolan via their Darwin laboratory. We understand that this laboratory is accredited by the National Association of Testing Authorities (NATA) in accordance with the various test methods set out in Australian Standard AS 1289 'Methods of Testing Soils for Engineering Purposes'. Some samples were subsequently forwarded onto other laboratories by Cardno, Ullman & Nolan. We understand that these other laboratories are also similarly accredited.

Samples and testing were selected on varying geographical distribution, material type, depth below ground surface and moisture content.

Geotechnical laboratory testing of eight samples was undertaken for the following tests:

- Atterberg Limits including Linear Shrinkage and Moisture Content;
- Particle Size Distribution (PSD) including Hydrometer;
- Emerson Class Number;
- Pinhole Dispersion; and
- Standard Compaction.

5.1 Summary of Results

Summary details of the laboratory testing results are presented in Table 3 below. The test reports can be found in Appendix C.



GEOTECHNICAL INVESTIGATION - TOWNS RIVER REALIGNMENT, ROPER BAR IRON ORE PROJECT

Table 3: Laboratory Test Results Summary

Sample No.	Unit	Atterberg Limits (%)			Linear Shrinkage (%)	Moisture Content (%)	Description based on Particle Size Distribution	Emerson Class Number	Pinhole Dispersion	Maximum Dry Density (t/m ³)	Optimum Moisture Content (%)	Clay Content (%)
		Liquid Limit	Plastic Limit	Plasticity Index								
GTP01-03 (2.5 m)	B	32	13	19	6.0	9.3	Clayey SAND with Gravel	5	PD2	1.91	12	38
GTP04-01 (2.6-2.8 m)	C	23	18	5	2.5	8.3	Silty Sandy GRAVEL and Clayey Silty SAND	8	D1	1.84	13	17
GTP06-01 (0.2 m)	A	N/A	N/A	N/A	N/A	5.3	Clayey Silty SAND	6	N/A	1.77	11.5	15
GTP06-02 (1.3-1.5 m)	B	17	13	4	1.5	15.4	Clayey Silty SAND	5	ND2	1.95	10.5	22
GTP07-02 (2.8 m)	C	21	17	4	1.5	11.7	Silty Sandy GRAVEL and Silty Clayey SAND	5	D1	1.85	13.5	19
GTP08-01 (2.1 m)	B	27	11	16	4.0	13.1	Silty Clayey SAND	2	ND1	1.94	11.5	34
GTP10-01 (2.0 m)	B	20	13	7	3.0	17.4	Silty Clayey SAND	5	D1	1.97	10.5	23
GTP12-01 (1.5 m)	B	26	18	8	3.0	8.3	Silty Sandy CLAY	5	ND1	1.89	11.5	37



6.0 DISCUSSION AND RECOMMENDATIONS

Due to a subsequent change in alignment, the field investigations were not undertaken along the current proposed river realignment. Therefore the discussion below is necessarily limited to observations made of the ground conditions encountered in test pits excavated along the previous Option A alignment and assessment of sections inspected along the Towns River.

It should be noted, that in accordance with our proposal, this investigation has not addressed the issues associated with the design of any flood protection and diversion embankments (levees) and there has been no materials search/assessment for use in levee embankment construction. Furthermore we understand that the assessment/analysis of seepage potential into the proposed pit from the proposed river realignment is being addressed by others.

6.1 Synopsis of Regional Ground Conditions

Based on the laboratory test results, the materials along the Option A alignment are predominantly lateritic sands. Minor components include clay, silt and gravel. Results of hydrometer testing, undertaken to differentiate between the silt and clay particles, indicate that the samples contained between 15% and 38% clay materials. Despite being characterised as granular soil, at these percentages, the clay minerals can have a significant effect on the behaviour of the soil.

The plasticity testing undertaken indicates that the clay minerals present in the soils are slightly to moderately reactive to changes in soil moisture content. As such, some shrink / swell behaviour and minor cracking may occur on the surface when exposed to seasonal moisture variations. Soil movement should be considered in the design of infrastructure along the river. If shrink / swell movements could be critical for particular infrastructure design, then it would be advisable to undertake specific undisturbed sampling and shrink / swell testing to quantify the potential movements that could occur.

Based on the limited observations undertaken along sections of the Towns River, the materials exposed along the river banks were relatively consistent with those seen in the test pit excavations. It is possible that the rock material in the floor of the Towns River is the same rock unit that the majority of the test pits encountered where backhoe/excavator bucket penetration refusal occurred.

6.2 Excavability

Based on our observation of the test pits, the materials ranged from soil strength materials to highly weathered rock of low to medium strength (and possibly of higher strength at depth).

We consider that excavation in Unit A and Unit B materials would be able to be excavated using conventional earthmoving equipment such as hydraulic excavators. However excavations in Unit B materials may yield quite low production rates, in places (e.g. where the test pit reports indicate dense to very dense materials).

Excavations in the materials described as lateritic siltstone / sandstone (Unit C) are expected to be much more difficult than in the overlying materials. It is expected that excavations in these materials will require the use of different plant. This material had a 'massive' structure devoid of lower strength material or defects to assist in the excavation process. Excavation in this material is likely to be more efficient by heavy ripping with a large dozer (similar to a CAT D9 or larger).

6.3 Erosion

6.3.1 Emerson Class

Emerson Class testing measures the tendency of the clay fraction of a soil to go into colloidal suspension in water, forming a cloud around the soil particle. Dispersive soils are those which by the nature of their mineralogy, and the chemistry of the water in the soil, are susceptible to separation of the individual clay



particles and subsequent erosion of the very small particles through fine fissures or cracks in the soil under seepage flows.

Five of the samples returned Emerson Class Number 5 (GTP01-03, GTP06-02, GTP07-02, GTP10-01 and GTP12-01). GTP04-01 and GTP06-01 which had the lowest clay content of all the samples (17% and 15% respectively) had Emerson Class Numbers greater than this at eight and six respectively. The Unit B material sample GTP08-01 had a clay content of 34% and an Emerson Class Number 2.

Emerson Class Numbers of 2 indicate a moderate potential for the soil, to disperse when inundated with water.

Emerson Class Numbers of 5 indicate that while the soil is non-dispersive, the remoulding and breaking down of soil bonds can result in dispersive behaviour. Remoulding of the soil at a moisture content near the optimum for compaction (simulating the use of these soils in a filling and compaction operation) does not increase the potential for dispersive behaviour, however further breakdown of the soil may occur, by water turbulence or concentrated rapid water flow. Under these circumstances this class of soil may disperse.

Emerson Class Numbers greater than 5 (6, 7 and 8) have a low potential for dispersive behaviour. Some swelling or slaking may occur but generally such soils are not readily dispersive.

6.3.2 Pinhole Dispersion

The Pinhole Dispersion Test presents a qualitative measurement of the dispersability and consequent erodibility of clay soils. The test is undertaken by causing water to flow through a small hole punched in a sample of the material.

The results are provided as ND (Non-Dispersive), PD (Potentially Dispersive) and D (Dispersive). The classifications are further divided with numbers 1 and 2. The dispersibility scale is bounded by ND1 which is completely erosion resistant (ND2 is less erosion resistant than ND1) and D1 which is highly dispersive (D2 is less dispersive than D1).

The Unit A materials (GTP06-01) were unable to be tested due to their low clay content. Unit B materials tested were generally non-dispersive (ND1 and ND2) with the exception of GTP01-03 which was potentially dispersive (PD1) and GTP10-01 which was dispersive (D1). It should be noted however that the sample from GTP10 was close to the boundary with Unit C materials and may be reflective of the chemical weathering that has occurred near the unit boundary. The Unit C materials tested were classified as dispersive (D1).

6.3.3 Erosion Considerations

Based on the results of the Emerson Class testing, the materials encountered along the Option A alignment are considered to generally have low dispersion potential. The Pinhole Dispersion testing of the Unit B materials generally support this conclusion. The Pinhole Dispersion testing of the Unit C materials indicate that they may be particularly susceptible to erosion.

During construction, the removal of vegetation (particularly the trees) within and near the constructed batters may lead to localised areas of loose disturbed material which should be removed and reinstated with engineered fill prior to construction proceeding further.

6.4 Realigned River Bank Batters

We recommend channels constructed in these materials have batters of three horizontal to one vertical (3H:1V) in the Unit A materials. The batters may be steepened to two horizontal to one vertical (2H:1V) in the Unit B and Unit C materials.



7.0 OPTION C ALIGNMENT

Review of the Mt Young 1:250,000 map sheet indicates that the Option C alignment appears to also be within the 'Qa' geological unit which is the same unit as the river realignment Option A. However it is close to the southern boundary of this unit and the Moraok Sandstone Member. With the limited information we have to date along the length of alignment C we cannot rule out the possibility that portions of the proposed current alignment may encounter the Moraok Sandstone at or very near surface level.

If the Option C alignment channel is constructed within the same materials observed in the field investigation and detailed above, the following discussion points will be relevant:

- A channel constructed in these materials subject to natural processes will likely form a similar profile, with steep banks and a flat channel floor (where lateritic "rock" is encountered), to the existing river profile.
- We consider that some erosion and scour will occur in the banks of the realigned river channel, particularly during flood events, and particularly in the soils immediately above the laterite siltstone / sandstone. This is expected to be more pronounced on the outer side of bends in the river. If this is unacceptable then scour protection measures such as the placement of rip-rap and geotextiles should be considered in the design to mitigate the prospect of this occurring.

To further assess the relevance of the information presented in this report to the Option C alignment and to exclude the likelihood of higher strength rock being encountered above the invert level of the proposed river channel realignment, it is considered necessary that some test pit investigations be undertaken along this route

Golder Associates would be pleased to assist WDR with these additional geotechnical investigations.

8.0 LIMITATIONS

Your attention is drawn to the document – "Limitations" (LEG04 RL1), which is provided in Appendix C of this report. The statements presented in this document are intended to advise you of what your realistic expectations of this report should be. The document is not intended to reduce the level of responsibility accepted by Golder Associates, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in so doing.



Report Signature Page

GOLDER ASSOCIATES PTY LTD

A handwritten signature in blue ink, appearing to read 'Andy Thomas'.

Andy Thomas
Engineering Geologist

AT/DJM/rr

A.B.N. 64 006 107 857

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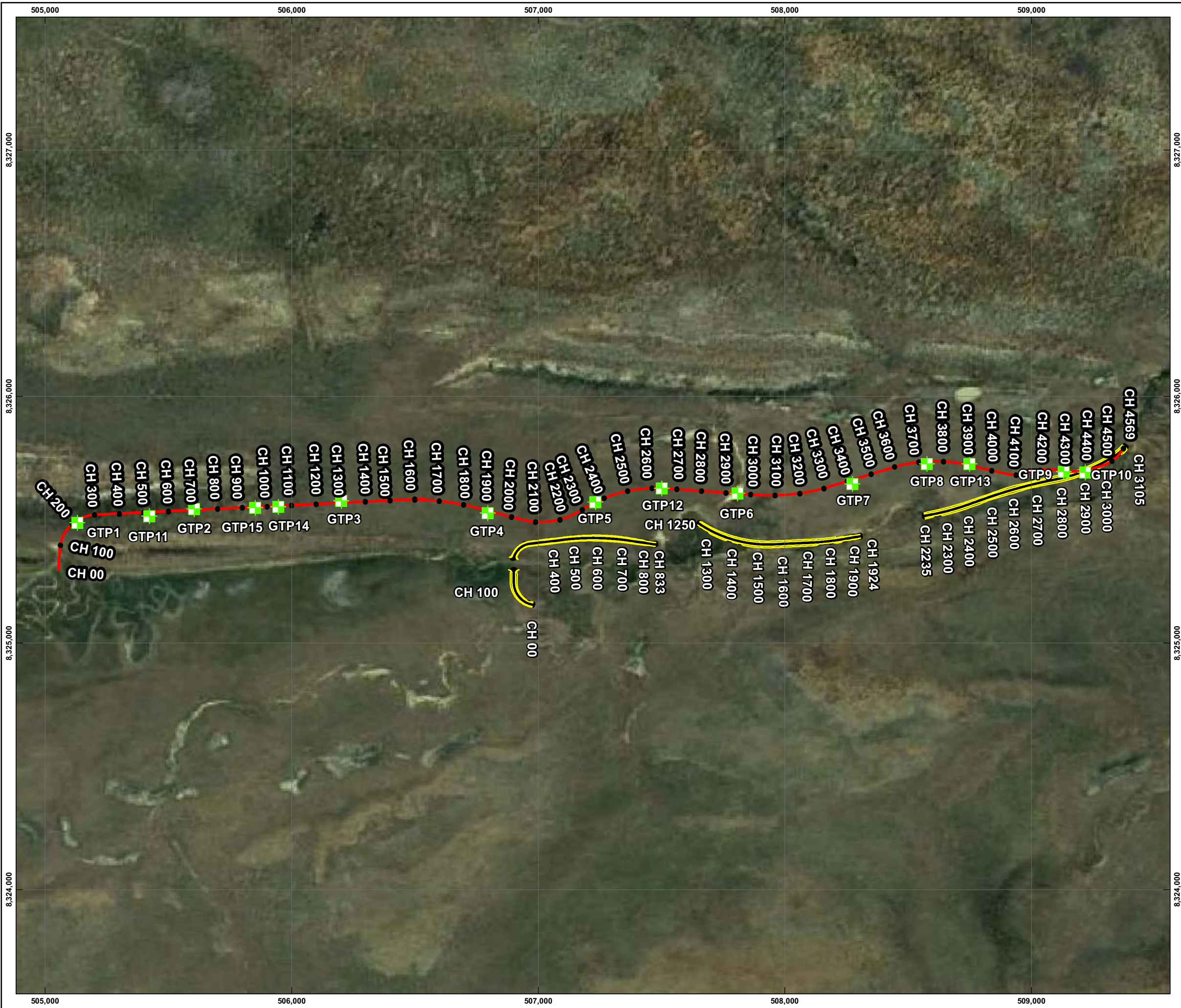
i:\geo\2012\interstate\127646013\127646013-002-r-rev1 - geotechnical investigation.docx



APPENDIX A

Figures 1 and 2

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ROPER BAR IRON ORE PROJECT - TOWNS RIVER REALIGNMENT

WESTERN DESERT RESOURCES LTD

RIVER REALIGNMENT AND TEST PIT LOCATIONS



LEGEND

- Option A (Golder Associates draft general arrangement drawing D002, Revision A)
- Option C (Golder Associates draft general arrangement drawing D001, Revision A)
- Test Pit Location

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Aerial image sourced from Bing Maps, date sourced 07.06.2011.

0 50 100 200 300 400 500 metres

SCALE (at A3) 1:15,000

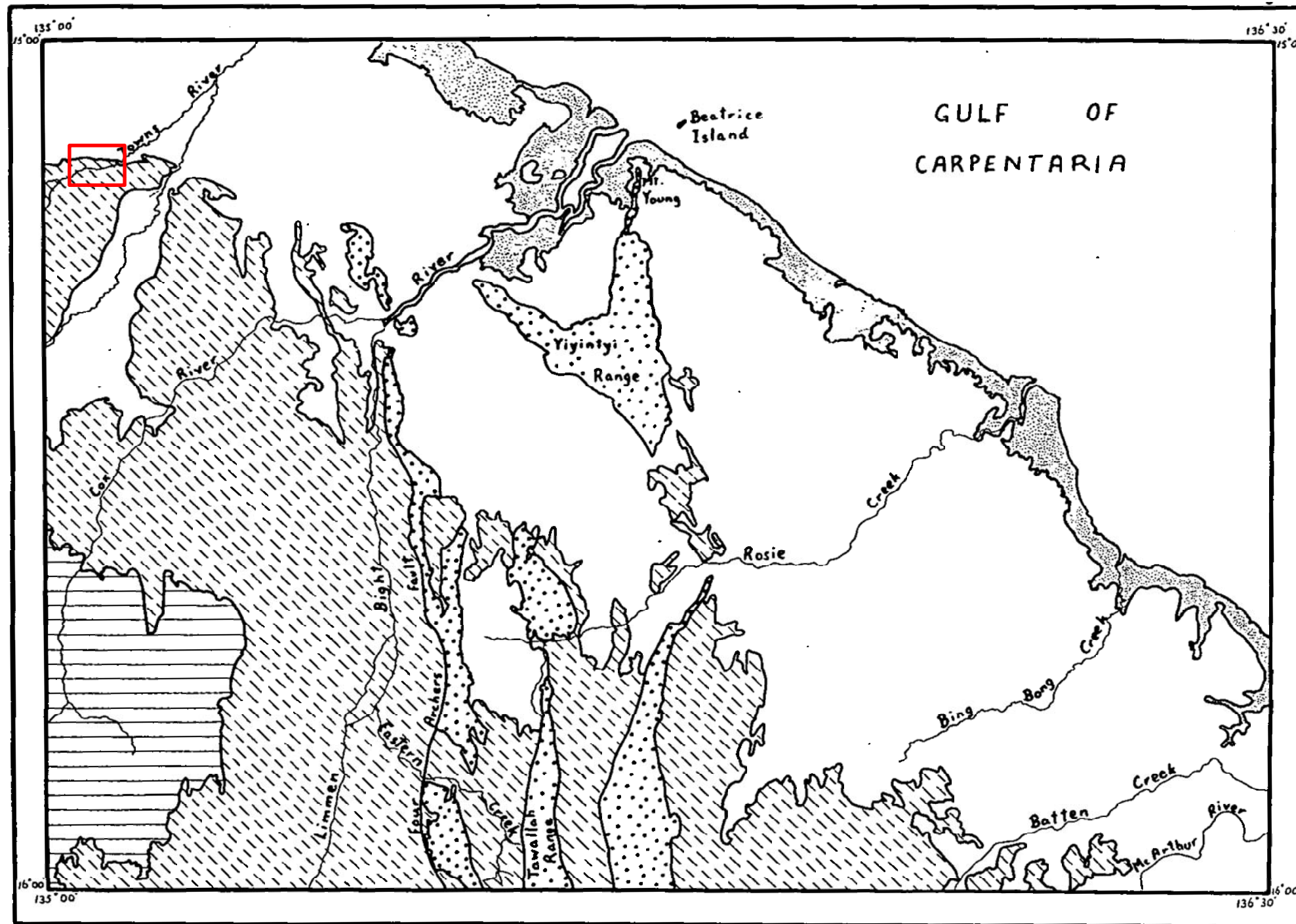
DATUM GDA 94, PROJECTION MGA Zone 53

PROJECT: 127646013
DATE: 03 AUG 2012
DRAWN: KB
CHECKED: AT

FIGURE 1

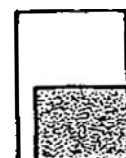


PHYSIOGRAPHIC SKETCH MAP – MT YOUNG SHEET AREA



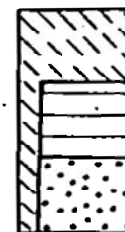
REFERENCE

COASTAL PLAIN



Tidal Flats

GULF FALL



Cox River Plateau

Main Ranges

ROPER BAR IRON ORE PROJECT -
TOWNS RIVER REALIGNMENT

WESTERN DESERT RESOURCES LTD

GEOLOGICAL ZONES

LEGEND

River Realignment Study Area

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Image sourced from Geoscience Australia, Commonwealth of Australia, date sourced 01.12.2011

SCALE (at A4) N.T.S

PROJECT: 127646013
DATE: 08 AUG 2012
DRAWN: KB
CHECKED: AT

FIGURE 2





APPENDIX B

Report of Test Pits

Explanation of Notes, Abbreviations & Terms Used on Borehole and Test Pit Reports

Method of Soil Description Used on Borehole and Test Pit Reports

Terms for Rock Material Strength & Weathering and Abbreviations for Defect Descriptions



REPORT OF TEST PIT: GTP01

CLIENT: Western Desert Resources Ltd
 PROJECT: Towns River Realignment
 LOCATION: Roper Bar
 JOB NO: 127646013

POSITION:
 COORDS: 505130.0 m E 8325487.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 3.30 m
 BUCKET TYPE: 1500 mm Toothed

SHEET: 1 OF 1
 MACHINE: CAT 325 D L Excavator
 CONTRACTOR: WDR
 LOGGED: AT DATE: 2/6/12
 CHECKED: DJM DATE: 7/8/12

Excavation				Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX	L		0.0		GTP01-01 0.00-0.40 m Rec = 400/400 mm			SM	Clayey Silty SAND, fine to medium grained, red grey brown, low plasticity fines	L	0.00 m - Grass on surface
			0.40					SC	Clayey SAND, fine to medium grained, pale brown with orange red staining, low plasticity fines Becoming mottled grey, orange and red brown		0.0-0.4 m - fine roots and organic material, inferred topsoil
	M		1.0		GTP01-02 1.00 m					D	
	H-R		2.20		GTP01-03 2.50 m			SC	Clayey SAND, fine to coarse grained, mottled grey, orange and red brown, low to medium plasticity fines, trace fine to medium gravel	D - VD	Excavator resistance very high - rocking back on tracks to dig 2.2 m - inferred weathered laterite material No structure observed
			3.0								
			3.5						TEST PIT DISCONTINUED @ 3.30 m GROUNDWATER NOT ENCOUNTERED Very slow excavation rate - practical refusal @ 3.30 m. Note: Density observations based on excavator resistance only.		
			4.0								
			4.5								
			5.0								

Sketch & Other Observations



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GAP gINT FN. F03e
 RL3



REPORT OF TEST PIT: GTP02

CLIENT: Western Desert Resources Ltd
PROJECT: Towns River Realignment
LOCATION: Roper Bar
JOB NO: 127646013

POSITION:
COORDS: 505604.0 m E 8325543.0 m N MGA94 53
SURFACE RL: DATUM: AHD
PIT DEPTH: 7.80 m
BUCKET TYPE: 1500 mm Toothed

SHEET: 1 OF 2
MACHINE: CAT 325 D L Excavator
CONTRACTOR: WDR
LOGGED: AT DATE: 2/6/12
CHECKED: DJM DATE: 7/8/12

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	STRUCTURE AND ADDITIONAL OBSERVATIONS		
EX	L		0.0		GTP02-01 1.00 m		SM	Clayey Silty SAND, fine to medium grained, grey brown, low plasticity fines	L		Grass on surface		
	M-H	0.5	0.50	SC			Clayey SAND, fine to coarse grained, mottled pale brown, orange and red brown, low to medium plasticity fines Becoming mottled red grey yellow and orange brown with depth	0-0.4 m - fine roots and organic material, inferred topsoil					
		1.0	1.30	SC			Clayey SAND, fine to medium grained, mottled red, grey, yellow and orange brown, low plasticity fines	0.5 m - Inferred weathered laterite material					
	H	1.5		GTP02-02 3.00 m				as above, increasing grey colour	D	D	Inferred lateritic soil, iron indurated		
		2.0									D - M	D - VD	1.3-3.0m - very slow penetration rate
		2.5											
		3.0	3.00										
		3.5							D				
		4.0											
		4.5	4.30										
		5.0	5.00										

Sketch & Other Observations



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GAP gINT FN. F03e
RL3



REPORT OF TEST PIT: GTP02

CLIENT: Western Desert Resources Ltd
 PROJECT: Towns River Realignment
 LOCATION: Roper Bar
 JOB NO: 127646013

POSITION:
 COORDS: 505604.0 m E 8325543.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 7.80 m
 BUCKET TYPE: 1500 mm Toothed

SHEET: 2 OF 2
 MACHINE: CAT 325 D L Excavator
 CONTRACTOR: WDR
 LOGGED: AT DATE: 2/6/12
 CHECKED: DJM DATE: 7/8/12

Excavation				Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX	H		5.0	5.75	GTP02-03 6.00 m				as above, mottled pale grey, orange brown, red brown and red	D - M	D - VD	Boundaries are indistinct and, due to the depth of excavation, have been inferred from samples only 5.5-6.5 m - material is lateritic siltstone/claystone - evidence of laminated structure	
			5.5										
			6.0										
			6.25			as above, mottled pale grey and red brown							
			6.5			as above, mottled brown, orange brown and white							
			7.0										
			7.5										
			8.0	GTP02-04 7.80 m				TEST PIT DISCONTINUED @ 7.80 m GROUNDWATER NOT ENCOUNTERED Terminated @ 7.80 m at target depth. Note: Density observations based on excavator resistance only.					
			8.5										
			9.0										
9.5													
10.0													

Sketch & Other Observations



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GAP gINT FN. F03e
 RL3



REPORT OF TEST PIT: GTP03

CLIENT: Western Desert Resources Ltd
PROJECT: Towns River Realignment
LOCATION: Roper Bar
JOB NO: 127646013

POSITION:
COORDS: 506200.0 m E 8325577.0 m N MGA94 53
SURFACE RL: DATUM: AHD
PIT DEPTH: 3.10 m
BUCKET TYPE: 1500 mm Toothed

SHEET: 1 OF 1
MACHINE: CAT 325 D L Excavator
CONTRACTOR: WDR
LOGGED: AT DATE: 3/6/12
CHECKED: DJM DATE: 7/8/12

Excavation					Sampling		Field Material Description								
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION		MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	
EX	L		0.0	0.10	GTP03-01 1.50 m		SC	Clayey SAND, fine to medium grained, brown, low plasticity fines	D	L	Grass on surface 0.1-3.1 m - Material recovered in clods in part - gravel to cobble size				
			CL	Sandy CLAY, low plasticity, mottled yellow brown and orange brown, fine to medium grained sand, sand size particles are clay nodules and laterite pisolites				M	H						
	M-H		0.5	0.70			SC	Clayey SAND, fine to coarse grained, mottled yellow brown and orange brown, sand particles are hard clay nodules and laterite pisolites	D - M	D					
			1.0												
			1.5												
	H-R		2.0	2.00			SM	Silty SAND, fine to coarse grained, mottled yellow brown and orange brown, low liquid limit fines, with fine to medium gravel. Sand and gravel particles are laterite pisolites	D						
			2.5												
			3.0	3.10						GTP03-02 3.00 m					
				3.5						Refusal on higher strength rock material @ 3.1 m TEST PIT DISCONTINUED @ 3.10 m GROUNDWATER NOT ENCOUNTERED Note: Density observations based on excavator resistance only.					
				4.0											
		4.5													
		5.0													

Sketch & Other Observations



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GAP gINT FN. F03e
RL3



REPORT OF TEST PIT: GTP04

CLIENT: Western Desert Resources Ltd
PROJECT: Towns River Realignment
LOCATION: Roper Bar
JOB NO: 127646013

POSITION:
COORDS: 506795.0 m E 8325527.0 m N MGA94 53
SURFACE RL: DATUM: AHD
PIT DEPTH: 2.80 m
BUCKET TYPE: 1500 mm Toothed

SHEET: 1 OF 1
MACHINE: CAT 325 D L Excavator
CONTRACTOR: WDR
LOGGED: AT DATE: 2/6/12
CHECKED: DJM DATE: 7/8/12

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION		MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX	L-M		0.0	0.10	GTP04-01 2.60-2.80 m Rec = 200/200 mm			SC	Clayey SAND, fine to medium grained, brown, low plasticity fines	D	L	0.0-0.4 m fine roots and organic matter		
			CL	Sandy CLAY, low plasticity, pale brown, fine grained sand					H					
	M		0.5	0.50				SC	Clayey SAND, fine to medium grained, mottled brown, orange brown, grey and red brown, low plasticity fines	M	MD			
			1.0											
			2.0											
H-R	2.5	2.30	SM	Recovered as a mixture of SOIL (80%) and ROCK (20%)		MD - D	2.3-2.8 m - Recovered as granular material							
	2.80			SOIL is: Silty SAND, fine to coarse grained, grey brown, low liquid limit fines, with fine to medium gravel	D									
			3.0					ROCK is: LATERITIC SANDSTONE/SILTSTONE, fine to medium grained, granular, low strength, highly weathered, recovered as angular 'sheet-like' rock						
			3.5					Refusal on higher strength rock material @ 2.8 m TEST PIT DISCONTINUED @ 2.80 m GROUNDWATER NOT ENCOUNTERED Note: Density observations based on excavator resistance only.						
			4.0											
			4.5											
			5.0											

Sketch & Other Observations



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GAP gINT FN. F03e
RL3



REPORT OF TEST PIT: GTP05

CLIENT: Western Desert Resources Ltd
PROJECT: Towns River Realignment
LOCATION: Roper Bar
JOB NO: 127646013

POSITION:
COORDS: 507232.0 m E 8325571.0 m N MGA94 53
SURFACE RL: DATUM: AHD
PIT DEPTH: 2.10 m
BUCKET TYPE: 1500 mm Toothed

SHEET: 1 OF 1
MACHINE: CAT 325 D L Excavator
CONTRACTOR: WDR
LOGGED: AT DATE: 2/6/12
CHECKED: DJM DATE: 7/8/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX	L-M		0.0		GTP05-01 1.80 m			CL / CI	Sandy CLAY, low to medium plasticity, orange brown with red brown staining, fine to medium sand, trace fine gravel laterite nodules	M	St	Grass on surface 0-0.4 m - fine roots
			0.5	0.50				CL / CI	Sandy CLAY, low to medium plasticity, mottled grey, orange brown, fine to medium sand Increasing sand and gravel content with depth, with fine to coarse sand, with fine to medium gravel, sand and gravel sized particles are laterite pisolites		St - H	
	M		1.0									
			1.5									
	H-R		2.0	1.90 2.10				SM	Recovered as a mixture of SOIL(80%) and ROCK (20%)	D		1.9-2.1 m - Recovered as granular material
			2.5						SOIL is Silty SAND, fine to coarse grained sand, orange, pale brown, low liquid limit fines, with fine to coarse gravel ROCK is LATERITIC SANDSTONE/SILTSTONE, fine to medium grained, granular, massive, pale grey, brown and red brown, low strength, highly weathered, pisolite nodules within rock material Refusal on higher strength rock material @ 2.1 m Additional excavation adjacent with backhoe which also refused @ 2.1 m TEST PIT DISCONTINUED @ 2.10 m GROUNDWATER NOT ENCOUNTERED			
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations



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GAP gINT FN. F03e
RL3



REPORT OF TEST PIT: GTP06

CLIENT: Western Desert Resources Ltd
PROJECT: Towns River Realignment
LOCATION: Roper Bar
JOB NO: 127646013

POSITION:
COORDS: 507808.0 m E 8325607.0 m N MGA94 53
SURFACE RL: DATUM: AHD
PIT DEPTH: 1.80 m
BUCKET TYPE: 450 mm Toothed

SHEET: 1 OF 1
MACHINE: CAT 432E Backhoe
CONTRACTOR: WDR
LOGGED: AT DATE: 2/6/12
CHECKED: DJM DATE: 7/8/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX	L		0.0	0.20	GTP06-01 0.00-0.20 m Rec = 200/200 mm			SM	Clayey Silty SAND, fine to medium grained, grey brown, non plastic fines	D	L	Grass on surface
			0.5				SM	Clayey Silty SAND, fine to medium, mottled grey, brown and orange, low liquid limit fines		MD	0.0-0.3 - Roots and organic matter	
	1.0							M	L			
	M		1.5	1.70	GTP06-02 1.30-1.50 m Rec = 200/200 mm							
	H-R		1.80						LATERITIC SANDSTONE/SILTSTONE, fine to medium grained, grey brown and orange brown, granular, sheet structure, low strength, highly weathered	D		
		03/06/12	2.0						Refusal on higher strength rock material @ 1.8 m			
			2.5						Groundwater encountered at 1.2 m			
			3.0						Inflow at a rate of approximately 2-5 litres/minute TEST PIT DISCONTINUED @ 1.80 m Note: Density observations based on excavator resistance only.			
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations



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GAP gINT FN. F03e
RL3



REPORT OF TEST PIT: GTP07

CLIENT: Western Desert Resources Ltd
 PROJECT: Towns River Realignment
 LOCATION: Roper Bar
 JOB NO: 127646013

POSITION:
 COORDS: 508274.0 m E 8325645.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 2.80 m
 BUCKET TYPE: 450 mm Toothed

SHEET: 1 OF 1
 MACHINE: CAT 432E Backhoe
 CONTRACTOR: WDR
 LOGGED: AT DATE: 2/6/12
 CHECKED: DJM DATE: 7/8/12

Excavation					Sampling	Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX	L-M		0.0		GTP07-01 2.00 m			SC	Clayey SAND, fine to medium grained, yellow brown, low plasticity fines	M	D - VD	Grass on surface
			0.30					SC	Clayey SAND, fine to medium grained, mottled yellow brown, orange and red brown, low plasticity fines. Sand particles are laterite pisolites	M - W	D	
			0.5									
	1.0											
	M-H		1.5									2.4 m - Rock recovered as fine to coarse grained, gravel to cobble sized
2.0												
			2.40					GW	Mixture of SOIL (80%) and ROCK (20%)	D		Soil and laterite nodules can be worked with water
									SOIL is Sandy GRAVEL, fine to medium, orange brown, grey and red brown, fine to coarse grained sand, with low plasticity fines			
									ROCK is LATERITE, fine grained, grey, orange brown, red brown, granular, massive, very low strength, highly weathered			
									TEST PIT DISCONTINUED @ 2.80 m GROUNDWATER NOT ENCOUNTERED Terminated @ 2.80 m at target depth. Note: Density observations based on excavator resistance only.			
			3.0		GTP07-02 2.80 m							

Sketch & Other Observations



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GAP gINT FN. F03e
 RL3



REPORT OF TEST PIT: GTP08

CLIENT: Western Desert Resources Ltd
PROJECT: Towns River Realignment
LOCATION: Roper Bar
JOB NO: 127646013

POSITION:
COORDS: 508576.0 m E 8325727.0 m N MGA94 53
SURFACE RL: DATUM: AHD
PIT DEPTH: 2.30 m
BUCKET TYPE: 450 mm Toothed

SHEET: 1 OF 1
MACHINE: CAT 432E Backhoe
CONTRACTOR: WDR
LOGGED: AT DATE: 2/6/12
CHECKED: DJM DATE: 7/8/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX	L-M		0.0		GTP08-01 2.10 m			SC	Clayey SAND, fine to medium grained, mottled pale brown and red brown, low plasticity fines	M		Grass on surface
			0.5				SC	Clayey Silty SAND, fine to medium, mottled pale brown and red brown, low plasticity fines			0.0-0.3 m - fine roots and organic material	
	M		1.0									0.4-2.1 m - Consistency generally variable
			1.5							M - W	L - MD	
			2.0									
	M-H		2.20							D		2.2 m - Contains iron pisolites, no obvious structure breaks through material mass
	H-R								LATERITIC SILTSTONE/SANDSTONE, fine to medium grained, granular, massive, orange brown and grey brown with black and red staining, very low strength, highly weathered			
			2.5						Refusal on higher strength rocka material @ 2.3 m TEST PIT DISCONTINUED @ 2.30 m GROUNDWATER NOT ENCOUNTERED Note: Density observations based on excavator resistance only.			
			3.0									
			3.5									
		4.0										
		4.5										
		5.0										

Sketch & Other Observations



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GAP gINT FN. F03e
RL3



REPORT OF TEST PIT: GTP09

CLIENT: Western Desert Resources Ltd
PROJECT: Towns River Realignment
LOCATION: Roper Bar
JOB NO: 127646013

POSITION:
COORDS: 509131.0 m E 8325694.0 m N MGA94 53
SURFACE RL: DATUM: AHD
PIT DEPTH: 2.20 m
BUCKET TYPE: 450 mm Toothed

SHEET: 1 OF 1
MACHINE: CAT 432E Backhoe
CONTRACTOR: WDR
LOGGED: AT DATE: 3/6/12
CHECKED: DJM DATE: 7/8/12

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION		MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX	L		0.0		GTP09-01 1.50 m			CL / CI	CLAY, low to medium plasticity, pale brown, with fine grained sand	D	H	Grass on surface	
			0.30					SC	Clayey SAND, fine to medium grained, mottled brown, red brown, grey and orange brown, low plasticity fines			0.0-0.2 m - fine roots	
	M		1.0							M	MD - D		
			1.5										
	H-R		2.0	2.00	GTP09-02 2.00-2.20 m Rec = 200/200 mm			SM	Recovered as a mixture of SOIL (80%) and ROCK (20%)	D - M		2.0-2.2 m - laterite rock in tabular form - cobble sized	
			2.5						SOIL is Silty SAND, fine to coarse grained, orange pale brown, low liquid limit fines, with fine to coarse gravel				
			3.0						ROCK is LATERITIC SANDSTONE/SILTSTONE, fine to medium grained, granular, massive, pale grey, brown and red brown, low strength, highly weathered, pisolite nodules within rock material				
			3.5						Refusal on higher strength rock material @ 2.2 m TEST PIT DISCONTINUED @ 2.20 m GROUNDWATER NOT ENCOUNTERED Note: Density observations based on excavator resistance only.				
			4.0										
			4.5										
			5.0										

Sketch & Other Observations



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GAP gINT FN. F03e
RL3

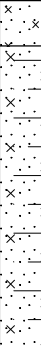
CLIENT: Western Desert Resources Ltd
PROJECT: Towns River Realignment
LOCATION: Roper Bar
JOB NO: 127646013

REPORT OF TEST PIT: GTP10

POSITION:
 COORDS: 509219.0 m E 8325692.0 m N MGA94 53
 SURFACE RL: DATUM: AHD

 PIT DEPTH: 2.50 m
 BUCKET TYPE: 450 mm Toothed

SHEET: 1 OF 1
MACHINE: CAT 432E Backhoe
CONTRACTOR: WDR
LOGGED: AT DATE: 3/6/12
CHECKED: DJM DATE: 7/8/12

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS		
EX	L	▽	0.0		GTP10-01 2.00 m			ML	Sandy SILT, low liquid limit, brown, fine grained sand	D - M	S	Thick grasses on surface		
			0.30	SC				Silty Clayey SAND, fine to medium, grey, orange and red brown, low plasticity fines	L - MD		0.0-0.2 m - Roots and organic material			
			0.5	M				L	Pit walls collapsing below 1.0 m					
			1.0											
			1.5											
			2.0											
			2.30											
			2.50											
			2.5								SM	Recovered as a mixture of SOIL and ROCK	D - M	Recovered as granular material
			3.0								SOIL is Silty SAND, fine to coarse grained, grey brown, low liquid limit fines, with fine to medium gravel ROCK is LATERITIC SANDSTONE/SILTSTONE, fine to medium grained, granular, massive, low to medium strength, highly weathered, recovered as gravel and cobbles Terminated @ 2.5 m at target depth Groundwater inflow encountered @ 1.5 m. Groundwater pooling in base of test pit TEST PIT DISCONTINUED @ 2.50 m Note: Density observations based on excavator resistance only.		Gravel is laterite pisolites	
3.5														
4.0														
4.5														
5.0														

Sketch & Other Observations



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GAP gINT FN. F03e
RL3



REPORT OF TEST PIT: GTP11

CLIENT: Western Desert Resources Ltd
PROJECT: Towns River Realignment
LOCATION: Roper Bar
JOB NO: 127646013

POSITION:
COORDS: 505422.0 m E 8325514.0 m N MGA94 53
SURFACE RL: DATUM: AHD
PIT DEPTH: 6.00 m
BUCKET TYPE: 1500 mm Toothed

SHEET: 1 OF 2
MACHINE: CAT 325 D L Excavator
CONTRACTOR: WDR
LOGGED: AT DATE: 3/6/12
CHECKED: DJM DATE: 7/8/12

Excavation					Sampling		Field Material Description				
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX	L		0.0				SM	Silty SAND, fine grained, dark grey brown, low liquid limit fines, topsoil		L	Grass on surface
			0.30				SM	Silty SAND, fine to medium grained, pale brown, with orange brown staining, low liquid limit fines			0.0-0.5 - Fine to medium sized roots
	M-H		0.5							D	
			1.0		GTP11-01 1.00 m						
			1.5	1.50			CL / CI	Gravelly CLAY, low to medium plasticity, mottled grey, orange brown and red brown, fine to medium gravel, with fine to coarse grained sand, gravel is sub-rounded			1.5-6.0 m - Gravel and sand nodules are lateritic pisolites and hard clay nodules. Clay nodules can be broken down when worked with water
H-R			2.0								2.0-6.0 m - Material excavated in clods - gravel to cobble sized
			2.5							D	
			3.0		GTP11-02 3.00 m						
			3.5								
			4.0	4.00			CL / CI	Gravelly CLAY, low to medium plasticity, mottled grey, purple, black and orange brown, fine to medium gravel with fine to coarse sand, gravel is sub-rounded		H	2.5 m - Minor side wall spalling
H			4.5								
			5.0								

Sketch & Other Observations



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GAP gINT FN. F03e
RL3

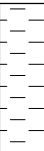


REPORT OF TEST PIT: GTP11

CLIENT: Western Desert Resources Ltd
PROJECT: Towns River Realignment
LOCATION: Roper Bar
JOB NO: 127646013

POSITION:
COORDS: 505422.0 m E 8325514.0 m N MGA94 53
SURFACE RL: DATUM: AHD
PIT DEPTH: 6.00 m
BUCKET TYPE: 1500 mm Toothed

SHEET: 2 OF 2
MACHINE: CAT 325 D L Excavator
CONTRACTOR: WDR
LOGGED: AT DATE: 3/6/12
CHECKED: DJM DATE: 7/8/12

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION		MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX	H		5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0	6.00	GTP11-03 5.00 m			CL / CI	Gravelly CLAY, low to medium plasticity, mottled grey, purple, black and orange brown, fine to medium gravel with fine to coarse sand, gravel is sub-rounded			H	
									Test pit terminated @ 6.0 m due to burst excavator hydraulic hose TEST PIT DISCONTINUED @ 6.00 m GROUNDWATER NOT ENCOUNTERED Note: Density observations based on excavator resistance only.				

Sketch & Other Observations



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GAP gINT FN. F03e
RL3



REPORT OF TEST PIT: GTP12

CLIENT: Western Desert Resources Ltd
PROJECT: Towns River Realignment
LOCATION: Roper Bar
JOB NO: 127646013

POSITION:
COORDS: 507501.0 m E 8325627.0 m N MGA94 53
SURFACE RL: DATUM: AHD
PIT DEPTH: 2.30 m
BUCKET TYPE: 450 mm Toothed

SHEET: 1 OF 1
MACHINE: CAT 432E Backhoe
CONTRACTOR: WDR
LOGGED: AT DATE: 3/6/12
CHECKED: DJM DATE: 7/8/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX	L		0.0	0.10	GTP12-01 1.50 m			CL	Sandy CLAY, low plasticity, dark grey brown, fine grained sand, topsoil	D	Fb	Grass on surface
			0.5				CL / CI	Sandy CLAY, low to medium plasticity, mottled pale brown, orange brown and red brown, fine to medium sand			0.0-0.2 m - fine roots	
	M-H		1.0						D - M	Fb - H		
			1.5	1.60								
			2.0	2.20				CL	Sandy Silty CLAY, low plasticity, mottled pale brown and orange brown, fine to medium sand, low liquid limit fines	D	H - Fb	
	H-R		2.5					SM	Mixture of SOIL (80%) and ROCK (20%)			
			3.0						SOIL is Silty SAND, fine to coarse grained, orange, pale brown, low liquid limit fines, with fine to coarse gravel			
			3.5						ROCK is LATERITIC SANDSTONE/SILTSTONE, fine to medium grained, granular, mottled grey, brown, orange brown, red, black, low strength, highly weathered			
			4.0						Refusal on higher strength rock material @ 2.3 m TEST PIT DISCONTINUED @ 2.30 m GROUNDWATER NOT ENCOUNTERED			
			4.5									
			5.0									

Sketch & Other Observations



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GAP gINT FN. F03e
RL3



REPORT OF TEST PIT: GTP13

CLIENT: Western Desert Resources Ltd
PROJECT: Towns River Realignment
LOCATION: Roper Bar
JOB NO: 127646013

POSITION:
COORDS: 508749.0 m E 8325727.0 m N MGA94 53
SURFACE RL: DATUM: AHD
PIT DEPTH: 2.30 m
BUCKET TYPE: 450 mm Toothed

SHEET: 1 OF 1
MACHINE: CAT 432E Backhoe
CONTRACTOR: WDR
LOGGED: AT DATE: 3/6/12
CHECKED: DJM DATE: 7/8/12

Excavation				Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX	L		0.0	0.10				CL	Sandy CLAY, low plasticity, dark grey brown, fine grained sand	D	Grass on surface
			0.5					SC	Clayey Silty SAND, fine to medium, mottled pale brown, red brown and orange brown, low plasticity fines	F	0.0-0.2 m fine roots
	M		1.0							M	
	H-R		2.0	2.00				SM	Mixture of SOIL (80%) and ROCK (20%)	D	Recovered as granular material - gravel to cobble sized
			2.30						SOIL is Silty SAND, fine to coarse grained, mottled pale brown and orange brown, low liquid limit fines, with fine to coarse gravel ROCK is LATERITIC SANDSTONE/SILTSTONE, fine to medium grained, granular, mottled grey, brown, orange brown, red, black, low strength, highly weathered Refusal on higher strength rock material @ 2.3 m TEST PIT DISCONTINUED @ 2.30 m GROUNDWATER NOT ENCOUNTERED Note: Density observations based on excavator resistance only.		
			2.5								
			3.0								
			3.5								
			4.0								
			4.5								
			5.0								

Sketch & Other Observations



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GAP gINT FN. F03e
RL3



REPORT OF TEST PIT: GTP14

CLIENT: Western Desert Resources Ltd
PROJECT: Towns River Realignment
LOCATION: Roper Bar
JOB NO: 127646013

POSITION:
COORDS: 505945.0 m E 8325553.0 m N MGA94 53
SURFACE RL: DATUM: AHD
PIT DEPTH: 3.40 m
BUCKET TYPE: 450 mm Toothed

SHEET: 1 OF 1
MACHINE: CAT 432E Backhoe
CONTRACTOR: WDR
LOGGED: AT DATE: 4/6/12
CHECKED: DJM DATE: 7/8/12

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS		
EX	L		0.0	0.10			SM CL	Silty SAND, fine to medium grained, dark grey brown, low liquid limit fines, topsoil	D	L	Grass on surface		
			0.5	0.60				CL / CI		Sandy CLAY, low plasticity, mottled grey brown and orange brown, fine to medium grained sand		0.0-0.3 m - Fine to medium roots	
	M		1.0						Gravelly CLAY, low to medium plasticity, mottled red brown, orange brown and grey, fine to medium gravel, with fine to coarse grained sand	D - M	H	2.0-2.1 m (approx) - laterised siltstone rock, low to medium strength, highly weathered.	
	1.5												
	2.0												
	2.5		2.50										
	H		3.0						as above, pale red brown, pale grey and orange brown, increasing gravel content, becoming fine to coarse	D		Gravel and sand component is hard clay nodules, can be worked to clay with effort.	
	3.5		3.30										
	H-R		3.40						LATERITIC SILTSTONE, fine grained, granular, layered, red brown, pale brown and grey in layers, highly weathered, medium to high strength fractures through matrix				
			4.0						Refusal on higher strength rock material @ 3.4 m TEST PIT DISCONTINUED @ 3.40 m GROUNDWATER NOT ENCOUNTERED				
		4.5											
		5.0											

Sketch & Other Observations



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GAP gINT FN. F03e
RL3



REPORT OF TEST PIT: GTP15

CLIENT: Western Desert Resources Ltd
PROJECT: Towns River Realignment
LOCATION: Roper Bar
JOB NO: 127646013

POSITION:
COORDS: 505851.0 m E 8325548.0 m N MGA94 53
SURFACE RL: DATUM: AHD
PIT DEPTH: 4.10 m
BUCKET TYPE: 450 mm Toothed

SHEET: 1 OF 1
MACHINE: CAT 432E Backhoe
CONTRACTOR: WDR
LOGGED: AT DATE: 4/6/12
CHECKED: DJM DATE: 7/8/12

Excavation				Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX	L		0.0		GTP15-01 1.00-1.10 m Rec = 100/100 mm			SC	Clayey SAND, fine to medium grained, grey brown, low plasticity fines	D	Grass on surface
			0.5	0.50				GC	Clayey GRAVEL, fine to coarse, pale brown, orange brown and red brown, low plasticity fines, rounded gravel	D	0.0-0.3 m - Small to medium roots
	M-H		1.0	1.10				SC	Clayey SAND, fine to medium grained, mottled grey, red brown and orange brown, low plasticity fines	VD	
			1.5	1.60						D - M	
			2.0					SM	Mixture of SOIL (80%) and ROCK (20%) SOIL is Silty SAND, fine to coarse grained, mottled grey, red brown and orange brown, low liquid limit fines ROCK is LATERITIC SILTSTONE, fine grained, granular, layered, red brown with orange brown and black staining, highly weathered, low strength		
	M		4.0	4.10						D	
			4.5						Test pit terminated @ 4.1 m at limit of backhoe TEST PIT DISCONTINUED @ 4.10 m GROUNDWATER NOT ENCOUNTERED Note: Density observations based on excavator resistance only.		
			5.0								

Sketch & Other Observations



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GAP gINT FN. F03e
RL3

EXPLANATION OF NOTES, ABBREVIATIONS & TERMS USED ON BOREHOLE AND TEST PIT REPORTS

DRILLING/EXCAVATION METHOD

AS*	Auger Screwing	RD	Rotary blade or drag bit	NQ	Diamond Core - 47 mm
AD*	Auger Drilling	RT	Rotary Tricone bit	NMLC	Diamond Core - 52 mm
*V	V-Bit	RAB	Rotary Air Blast	HQ	Diamond Core - 63 mm
*T	TC-Bit, e.g. ADT	RC	Reverse Circulation	HMLC	Diamond Core - 63mm
HA	Hand Auger	PT	Push Tube	BH	Tractor Mounted Backhoe
ADH	Hollow Auger	CT	Cable Tool Rig	EX	Tracked Hydraulic Excavator
DTC	Diatube Coring	JET	Jetting	EE	Existing Excavation
WB	Washbore or Bailer	NDD	Non-destructive digging	HAND	Excavated by Hand Methods

PENETRATION/EXCAVATION RESISTANCE

- L Low resistance.** Rapid penetration possible with little effort from the equipment used.
- M Medium resistance.** Excavation/possible at an acceptable rate with moderate effort from the equipment used.
- H High resistance** to penetration/excavation. Further penetration is possible at a slow rate and requires significant effort from the equipment.
- R Refusal or Practical Refusal.** No further progress possible without the risk of damage or unacceptable wear to the digging implement or machine.

These assessments are subjective and are dependent on many factors including the equipment power, weight, condition of excavation or drilling tools, and the experience of the operator.

WATER



Water level at date shown



Partial water loss



Water inflow



Complete water loss

GROUNDWATER NOT OBSERVED The observation of groundwater, whether present or not, was not possible due to drilling water, surface seepage or cave in of the borehole/test pit.

GROUNDWATER NOT ENCOUNTERED The borehole/test pit was dry soon after excavation. However, groundwater could be present in less permeable strata. Inflow may have been observed had the borehole/test pit been left open for a longer period.

SAMPLING AND TESTING

SPT	Standard Penetration Test to AS1289.6.3.1-2004
4,7,11 N=18	4,7,11 = Blows per 150mm. N = Blows per 300mm penetration following 150mm seating
30/80mm	Where practical refusal occurs, the blows and penetration for that interval are reported
RW	Penetration occurred under the rod weight only
HW	Penetration occurred under the hammer and rod weight only
HB	Hammer double bouncing on anvil
DS	Disturbed sample
BDS	Bulk disturbed sample
G	Gas Sample
W	Water Sample
FP	Field permeability test over section noted
FV	Field vane shear test expressed as uncorrected shear strength (s_v = peak value, s_r = residual value)
PID	Photoionisation Detector reading in ppm
PM	Pressuremeter test over section noted
PP	Pocket penetrometer test expressed as instrument reading in kPa
U63	Thin walled tube sample - number indicates nominal sample diameter in millimetres
WPT	Water pressure tests
DCP	Dynamic cone penetration test
CPT	Static cone penetration test
CPTu	Static cone penetration test with pore pressure (u) measurement

Ranking of Visually Observable Contamination and Odour (for specific soil contamination assessment projects)

R = 0	No visible evidence of contamination	R = A	No non-natural odours identified
R = 1	Slight evidence of visible contamination	R = B	Slight non-natural odours identified
R = 2	Visible contamination	R = C	Moderate non-natural odours identified
R = 3	Significant visible contamination	R = D	Strong non-natural odours identified

ROCK CORE RECOVERY

TCR = Total Core Recovery (%)

SCR = Solid Core Recovery (%)

RQD = Rock Quality Designation (%)

$$= \frac{\text{Length of core recovered}}{\text{Length of core run}} \times 100$$

$$= \frac{\sum \text{Length of cylindrical core recovered}}{\text{Length of core run}} \times 100$$

$$= \frac{\sum \text{Axial lengths of core} > 100 \text{ mm}}{\text{Length of core run}} \times 100$$



METHOD OF SOIL DESCRIPTION USED ON BOREHOLE AND TEST PIT REPORTS



FILL



GRAVEL (GP or GW)



SAND (SP or SW)



SILT (ML or MH)



CLAY (CL, CI or CH)



ORGANIC SOILS (OL or OH or Pt)



COBBLES or BOULDERS

Combinations of these basic symbols may be used to indicate mixed materials such as sandy clay.

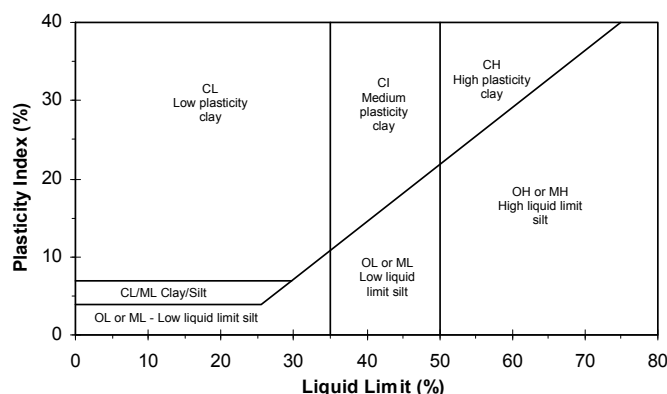
CLASSIFICATION AND INFERRED STRATIGRAPHY

Soil and Rock is classified and described in Reports of Boreholes and Test Pits using the preferred method given in AS1726 – 1993, (Amdt1 – 1994 and Amdt2 – 1994), Appendix A. The material properties are assessed in the field by visual/tactile methods.

Particle Size

Major Division	Sub Division	Particle Size
BOULDERS		> 200 mm
COBBLES		63 to 200 mm
GRAVEL	Coarse	20 to 63 mm
	Medium	6.0 to 20 mm
	Fine	2.0 to 6.0 mm
SAND	Coarse	0.6 to 2.0 mm
	Medium	0.2 to 0.6 mm
	Fine	0.075 to 0.2 mm
SILT		0.002 to 0.075 mm
CLAY		< 0.002 mm

Plasticity Properties



MOISTURE CONDITION

AS1726 - 1993

Symbol	Term	Description
D	Dry	Sands and gravels are free flowing. Clays & Silts may be brittle or friable and powdery.
M	Moist	Soils are darker than in the dry condition & may feel cool. Sands and gravels tend to cohere.
W	Wet	Soils exude free water. Sands and gravels tend to cohere.

CONSISTENCY AND DENSITY

AS1726 - 1993

Symbol	Term	Undrained Shear Strength	Symbol	Term	Density Index %	SPT "N" #
VS	Very Soft	0 to 12 kPa	VL	Very Loose	Less than 15	0 to 4
S	Soft	12 to 25 kPa	L	Loose	15 to 35	4 to 10
F	Firm	25 to 50 kPa	MD	Medium Dense	35 to 65	10 to 30
St	Stiff	50 to 100 kPa	D	Dense	65 to 85	30 to 50
VSt	Very Stiff	100 to 200 kPa	VD	Very Dense	Above 85	Above 50
H	Hard	Above 200 kPa				

In the absence of test results, consistency and density may be assessed from correlations with the observed behaviour of the material.

SPT correlations are not stated in AS1726 – 1993, and may be subject to corrections for overburden pressure and equipment type.



TERMS FOR ROCK MATERIAL STRENGTH & WEATHERING AND ABBREVIATIONS FOR DEFECT DESCRIPTIONS

STRENGTH

Symbol	Term	Point Load Index, $I_s(50)$ (MPa)	Field Guide
EL	Extremely Low	< 0.03	Easily remoulded by hand to a material with soil properties.
VL	Very Low	0.03 to 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 30 mm can be broken by finger pressure.
L	Low	0.1 to 0.3	Easily scored with a knife; indentations 1 mm to 3 mm show in the specimen with firm blows of pick point; has dull sound under hammer. A piece of core 150 mm long by 50 mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
M	Medium	0.3 to 1	Readily scored with a knife; a piece of core 150 mm long by 50 mm diameter can be broken by hand with difficulty.
H	High	1 to 3	A piece of core 150 mm long by 50 mm diameter cannot be broken by hand but can be broken with pick with a single firm blow; rock rings under hammer.
VH	Very High	3 to 10	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
EH	Extremely High	>10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

ROCK STRENGTH TEST RESULTS

▼	Point Load Strength Index, $I_s(50)$, Axial test (MPa)
◀	Point Load Strength Index, $I_s(50)$, Diametral test (MPa)
Relationship between $I_s(50)$ and UCS (unconfined compressive strength) will vary with rock type and strength, and should be determined on a site-specific basis. UCS is typically 10 to 30 x $I_s(50)$, but can be as low as 5.	

ROCK MATERIAL WEATHERING

Symbol	Term	Field Guide
RS	Residual Soil	Soil developed on extremely weathered rock; the mass structure and substance fabric are no longer evident; there is a large change in volume but the soil has not been significantly transported.
EW	Extremely Weathered	Rock is weathered to such an extent that it has soil properties - i.e. it either disintegrates or can be remoulded, in water.
DW	HW	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores. In some environments it is convenient to subdivide into Highly Weathered and Moderately Weathered, with the degree of alteration typically less for MW.
	MW	
SW	Slightly Weathered	Rock is slightly discoloured but shows little or no change of strength relative to fresh rock.
FR	Fresh	Rock shows no sign of decomposition or staining.

ABBREVIATIONS FOR DEFECT TYPES AND DESCRIPTIONS

Defect Type	Coating or Infilling	Roughness
B Bedding parting	Cn Clean	Sl Slickensided
X Foliation	Sn Stain	Sm Smooth
C Contact	Vr Veneer	Ro Rough
L Cleavage	Ct Coating or Infill	
J Joint	Planarity	
SS/SZ Sheared seam/zone (Fault)	Pl Planar	Vertical Boreholes – The dip (inclination from horizontal) of the defect is given. Inclined Boreholes – The inclination is measured as the acute angle to the core axis.
CS/CZ Crushed seam/zone (Fault)	Un Undulating	
DS/DZ Decomposed seam/zone	St Stepped	
IS/IZ Infilled seam/zone		
S Schistosity		
V Vein		



APPENDIX C

Laboratory Test Reports (listed in Test Pit order)



CARDNO ULLMAN & NOLAN (NT) PTY LTD
GEOTECHNIC (NT) PTY LTD
76 BENISON ROAD WINNELLIE NT

UNGR 41 N
(-/08/10)

Sheet 1 of 1

Darwin Laboratory

CLIENT: Golder Associates Pty Ltd **JOB NO.:** U32972 **LAB REF NO.:** 121786
PROJECT: Geotechnical Lab Testing – Roper Bar Stream **SAMPLED BY:** Client **DATE:** 4/6/12
LOCATION: Various **TESTED BY:** AT **DATE:** 13/6/12
MATERIAL: Investigation **CHECKED BY:** AT **DATE:** 15/6/12
TEST PROCEDURES: AS 1289.2.1.1 **CLIENT REF:**

Sample Identification Number	Sampling Location	Moisture Content (%)	For Subsidiary Methods	
			Original Value	Amended Value
121710	GTP04-01 2.6-2.8m	8.3	-	-
121715	GTP06-01 0.2m	5.3	-	-
121723	GTP01-03 2.5m	9.3	-	-
121731	GTP08-01 2.1m	13.1	-	-



Accredited No. 1855
Certificate No. 121786
Date of Issue 15/6/12

This document is issued in accordance with NATA's accreditation requirements

Authorised Signatory:

Matthew Dunkley

CARDNO ULLMAN & NOLAN GEOTECHNIC (NT) PTY LTD

76 Benison Road Winnellie NT
REPORT ON SOIL CLASSIFICATION

UNGR 1 N

(-10/05)

Sheet 1 of 3

Darwin Laboratory

CLIENT: Golder Associates Pty Ltd

JOB NO: U32972

LAB REF NO: 121723

PROJECT: Geotechnical Lab Testing - Roper Bar Stream

SAMPLED BY: Client

DATE: 4/6/12

LOCATION: GTP 01-03; 2.5m

TESTED BY: AT

DATE: 15/6/12

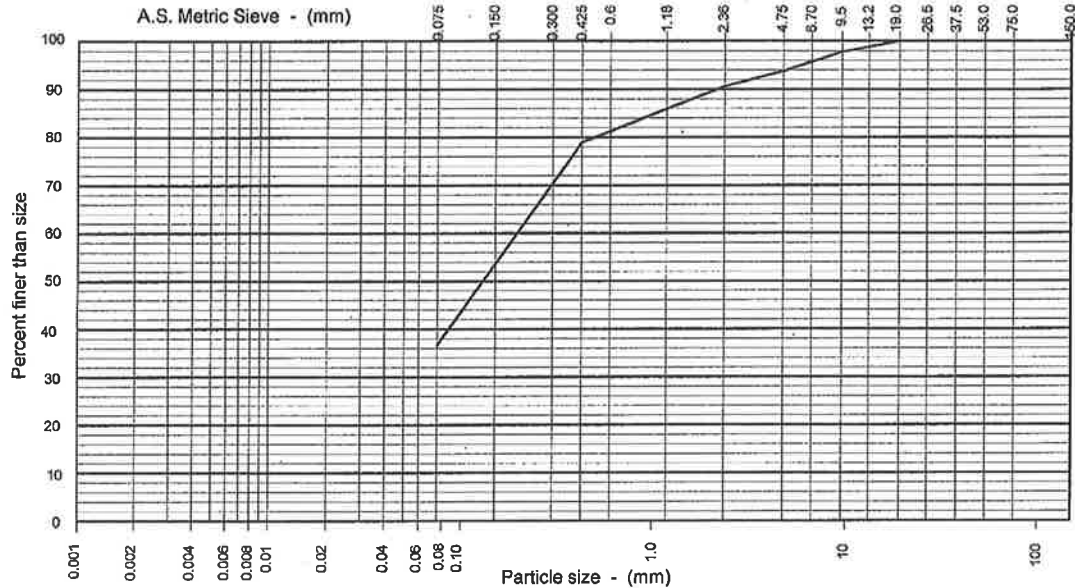
MATERIAL: Clayey Sand with Gravel

CHECKED BY: JD

DATE: 15/6/12

TEST PROCEDURES: AS1289 3.1.2,3.2.1,3.3.1,3.4.1,3.6.1

CLIENT REF: -



clay	silt			sand			gravel			cobbles
	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	
	37			24	21	9	5	5	0	0

Particle Size (mm)	Percent Passing (%)	Particle Size (mm)	Percent Passing (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)	Specific Gravity (g/cm ³)	
150.0				32	13	19	6.0		
75.0				Classification:					
37.5									
26.5									
19.0	100								
9.5	98								
4.75	94			Preparation History of Atterberg Limits					
2.36	91			Sample : Air-Dried					
1.18				Sieved: Wet					
0.600				Linear Shrinkage Data					
0.425	79			Length of Mould (mm) : 250					
0.300				Sample					
0.150				Curled/Crumbled: Y					
0.075	37								

	Accredited No. 1855
	Certificate No. 121723
	Date of Issue 15/06/12
This document is issued in accordance with NATA's accreditation requirements.	
Authorised Signatory	

A Tucker

Certificate of Analysis

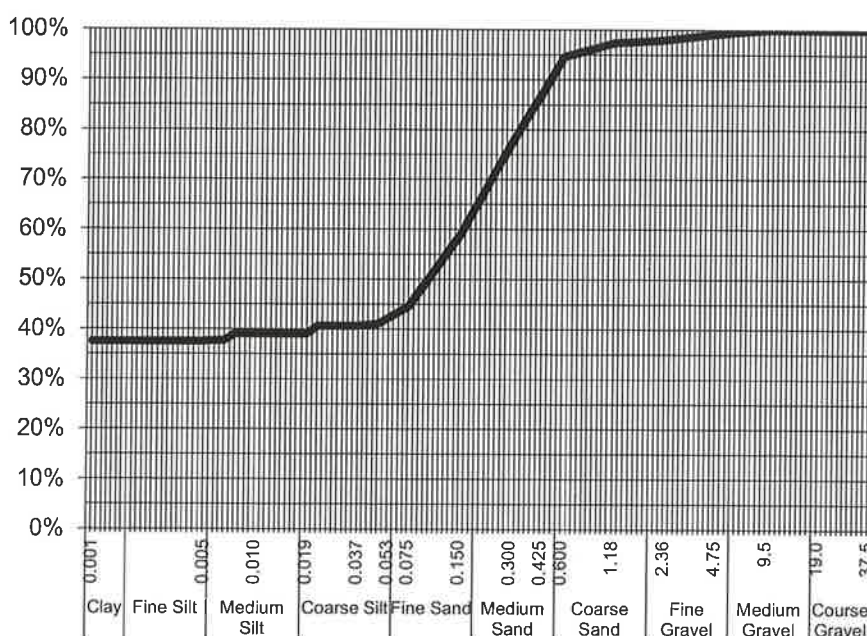
ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Ben Parry **DATE REPORTED:** 22-Jun-2012
COMPANY: Cardno Ullman & Nolan **DATE RECEIVED:** 15-Jun-2012
ADDRESS: Geotechnic Pty Ltd **REPORT NO:** EN1202205-002 / PSD
PO Box 39623
Winnelli, NT, Australia 0821
PROJECT: 32972 **SAMPLE ID:** 121723

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	99%
2.36	98%
1.18	97%
0.600	95%
0.425	88%
0.300	77%
0.150	59%
0.075	45%
Particle Size (microns)	
53	42%
37	41%
19	39%
10	39%
5	38%
3	38%
1	38%

Samples analysed as received.

Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results.

Median Particle Size (mm)	0.075
---------------------------	-------

Sample Comments:

Analysed: 19-Jun-12

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: Medium fine sand and silty clay

Dispersion Method Shaker

Test Method: AS1289.3.6.1/AS1289.3.6.3

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.65 g/cm³

NATA Accreditation: 825 Site: Newcastle
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Hamish Murray

Hamish Murray
Laboratory Technician, Newcastle
Authorised Signatory



CARDNO ULLMAN & NOLAN
GEOTECHNIC PTY LTD
71 CONNORS ROAD MACKAY QLD

UNGR 53 G
(10/10)

REPORT ON PINHOLE DISPERSION CLASSIFICATION OF A SOIL

Sheet 1 of 1

Mackay Laboratory

CLIENT:	Golder Associates Pty Ltd	JOB NO.:	U32972	LAB REF NO.:	12-3478A
PROJECT:	Roper Bar Stream	SAMPLED BY:	Client	DATE:	4.6.12
LOCATION:	GTP01-03; 2.5m	TESTED BY:	AR	DATE:	17.7.12
MATERIAL:	Clayey Sand	CHECKED BY:	NJR	DATE:	18.7.12
TEST PROCEDURES:	AS 1289.3.8.3	CLIENT REF:	121723		

Pinhole Dispersion Classification: PD2

Source of Material: Not Supplied

Soil Description: Clayey Sand

Natural Moisture Content of the Soil: 7.7 %

Initial Moisture Content of the Soil Sample before Testing: 12.9 %

Initial Dry Density of the Soil Sample before Testing: 1.81 t/m³

Maturing Time of the Sample in the Soil Specimen Cylinder: >24 H

Source of Water: Potable

MDD/OMC and Atterberg limits supplied by Cardno UNG NT

MDD: 1.91 t/m³

OMC: 12.0 %

% retained 19.0mm sieve: 0 %

LL: 32 %

PL: 13 %

PI: 19 %

LS: 6.0 %



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Date of Issue 18.7.12

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M. J. Richardson



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REPORT ON EMERSON CLASS NUMBER OF A SOIL

Sheet 2 of 3

Darwin Laboratory

CLIENT:	Golder Associates Pty Ltd	JOB NO.:	U32972	LAB REF NO.:	121723
PROJECT:	Geotechnical Lab Testing – Roper Bar Stream	SAMPLED BY:	Client	DATE:	04/06/12
LOCATION:	GTP 01-03; 2.5m	TESTED BY:	AT	DATE:	14/06/12
MATERIAL:	Clayey Sand	CHECKED BY:	AT	DATE:	14/06/12
TEST PROCEDURES:	AS 1289.3.8.1	CLIENT REF:			

Soil Description: Clayey Sand

Type of Water Used: Distilled

Temperature of Water: 24.5 °C

Emerson Class Number: 5



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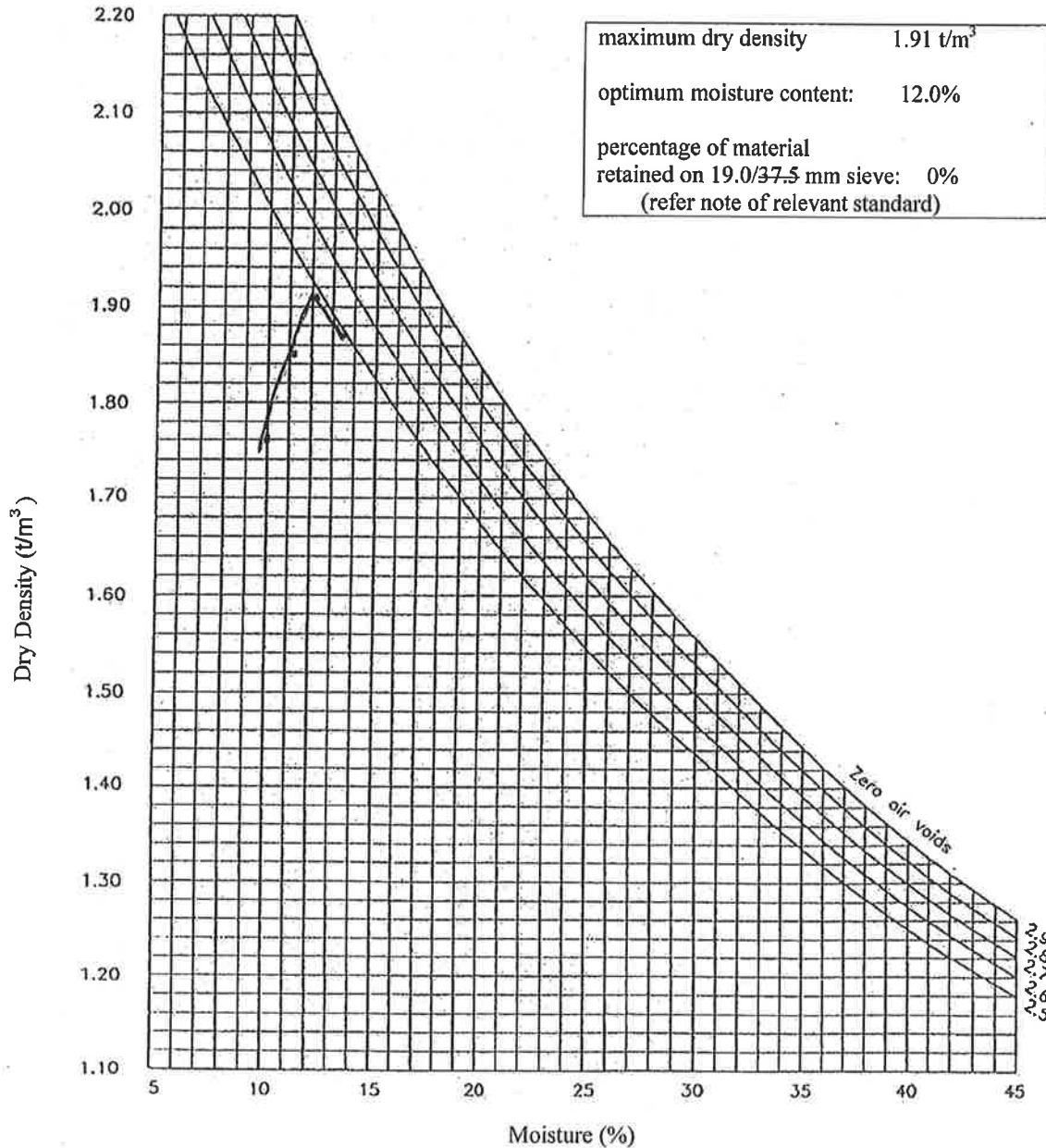
-/08/10)

REPORT ON MAXIMUM DRY DENSITY/OPTIMUM MOISTURE CONTENT

Sheet 3 of 3

Darwin Laboratory

CLIENT:	Golder Associates Pty Ltd	JOB NO.:	U32972	LAB REF. NO.:	121723
PROJECT:	Geotechnical Lab Testing - Roper Bar Stream	SAMPLED BY:	Client	DATE:	04/06/12
LOCATION:	GTP 01-03; 2.5m	TESTED BY:	AJ	DATE:	14/06/12
MATERIAL:	Clayey Sand	CHECKED BY:	JD	DATE:	15/06/12
TEST PROCEDURES:	AS1289.5.1.1	CLIENT REF:			



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Date of Issue: 15/06/12

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[Signature]
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(-08/10)

Sheet 1 of 1

Darwin Laboratory

CLIENT: Golder Associates Pty Ltd **JOB NO.:** U32972 **LAB REF NO.:** 121786
PROJECT: Geotechnical Lab Testing – Roper Bar Stream **SAMPLED BY:** Client **DATE:** 4/6/12
LOCATION: Various **TESTED BY:** AT **DATE:** 13/6/12
MATERIAL: Investigation **CHECKED BY:** AT **DATE:** 15/6/12
TEST PROCEDURES: AS 1289.2.1.1 **CLIENT REF:**

Sample Identification Number	Sampling Location	Moisture Content (%)	For Subsidiary Methods	
			Original Value	Amended Value
121710	GTP04-01 2.6-2.8m	8.3	-	-
121715	GTP06-01 0.2m	5.3	-	-
121723	GTP01-03 2.5m	9.3	-	-
121731	GTP08-01 2.1m	13.1	-	-



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Date of Issue 15/6/12

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Matthew Dunkley

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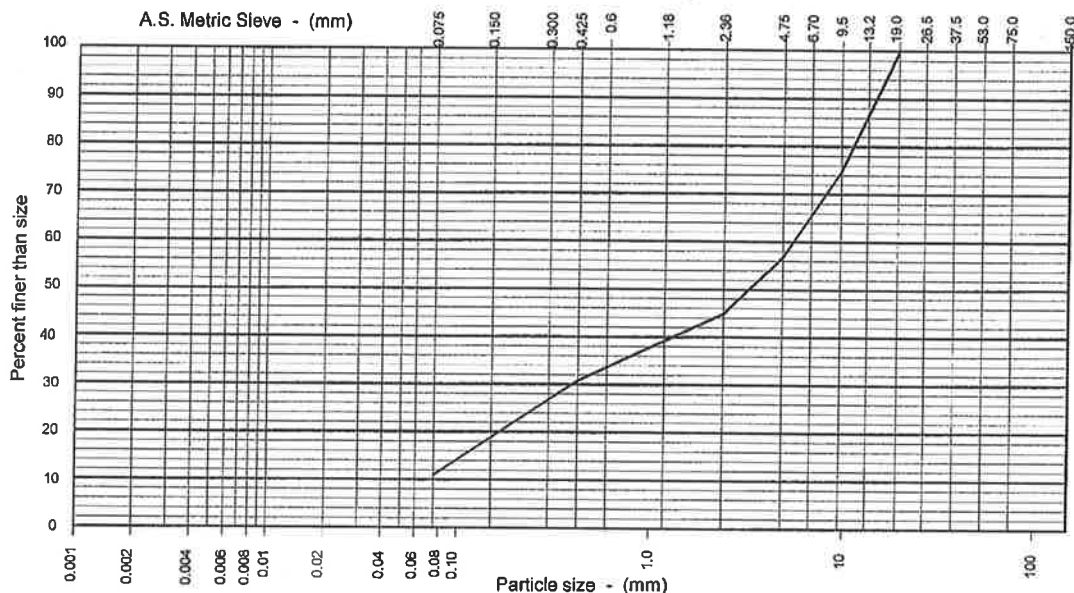
76 Benison Road Winnellie NT
REPORT ON SOIL CLASSIFICATION

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(-/10/05)

Sheet 1 of 3

Darwin Laboratory

CLIENT: Golder Associates Pty Ltd JOB NO: U32972 LAB REF NO: 121710
PROJECT: Geotechnical Lab Testing - Roper Bar Stream SAMPLED BY: Client DATE: 4/6/12
LOCATION: GTP 04-01; 2.6 - 2.8m TESTED BY: AT DATE: 15/6/12
MATERIAL: Sandy Silty Gravel CHECKED BY: JD DATE: 15/6/12
TEST PROCEDURES: AS1289 3.1.2,3.2.1,3.3.1,3.4.1,3.6.1 CLIENT REF: -



clay	silt			sand			gravel			cobbles
	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	
	11			11	11	11	18	37	0	0

Particle Size (mm)	Percent Passing (%)	Particle Size (mm)	Percent Passing (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)	Specific Gravity (g/cm ³)	
150.0				23	18	5	2.5		
75.0				Classification:					
37.5									
26.5									
19.0	100								
9.5	75			Preparation History of Atterberg Limits					
4.75	57								
2.36	45								
1.18									
0.600				Linear Shrinkage Data					
0.425	31								
0.300									
0.150									
0.075	11			Length of Mould (mm) : 250					
				Sample					
				Cured/Crumbled: Y					



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Certificate of Analysis

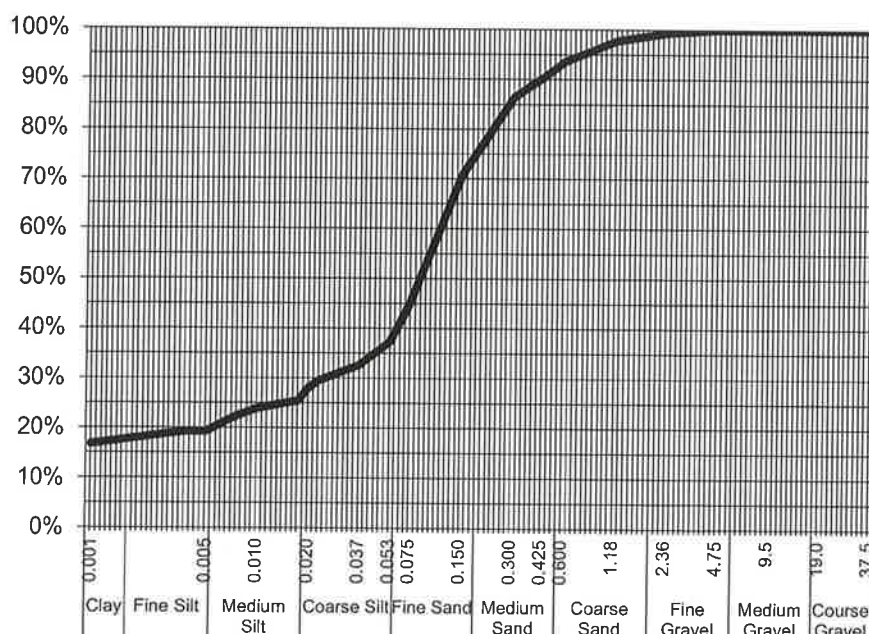
ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Ben Parry
DATE REPORTED: 22-Jun-2012
COMPANY: Cardno Ullman & Nolan
Geotechnic Pty Ltd
DATE RECEIVED: 15-Jun-2012
ADDRESS: PO Box 39623
Winnelli, NT, Australia 0821
REPORT NO: EN1202205-003 / PSD
PROJECT: 32972
SAMPLE ID: 121710

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	99%
1.18	98%
0.600	94%
0.425	90%
0.300	86%
0.150	71%
0.075	45%
Particle Size (microns)	
53	37%
37	33%
20	28%
10	24%
5	19%
3	19%
1	17%

Median Particle Size (mm)	0.075
---------------------------	-------

Samples analysed as received.

Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Sample Comments:

Analysed: 19-Jun-12

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: Medium fine sand and silty clay

Dispersion Method Shaker

Test Method: AS1289.3.6.1/AS1289.3.6.3

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.65 g/cm³

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Laboratory Technician, Newcastle
Authorised Signatory



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(10/10)

REPORT ON PINHOLE DISPERSION CLASSIFICATION OF A SOIL

Sheet 1 of 1

Mackay Laboratory

CLIENT:	Golder Associates Pty Ltd	JOB NO.:	U32972	LAB REF NO.:	12-3476A
PROJECT:	Roper Bar Stream	SAMPLED BY:	Client	DATE:	4.6.12
LOCATION:	GTP04-01; 2.6 – 2.8m	TESTED BY:	AR	DATE:	17.7.12
MATERIAL:	Sandy Silty Gravel	CHECKED BY:	NJR	DATE:	18.7.12
TEST PROCEDURES:	AS 1289.3.8.3			CLIENT REF:	121710

Pinhole Dispersion Classification: D1

Source of Material: Not Supplied

Soil Description: Sandy Silty Gravel

Natural Moisture Content of the Soil: 8.3 %

Initial Moisture Content of the Soil Sample before Testing: 11.4 %

Initial Dry Density of the Soil Sample before Testing: 1.74 t/m³

Maturing Time of the Sample in the Soil Specimen Cylinder: >24 H

Source of Water: Potable

MDD/OMC and Atterberg limits supplied by Cardno UNG NT

MDD: 1.84 t/m³

OMC: 13.0 %

% retained 19.0mm sieve: 0 %

LL: 23 %

PL: 18 %

PI: 5 %

LS: 2.5 %



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M. J. Richardson



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REPORT ON EMERSON CLASS NUMBER OF A SOIL

Sheet 2 of 3

Darwin Laboratory

CLIENT:	Golder Associates Pty Ltd	JOB NO.:	U32972	LAB REF NO.:	121710
PROJECT:	Geotechnical Lab Testing – Roper Bar Stream	SAMPLED BY:	Client	DATE:	04/06/12
LOCATION:	GTP 04-01; 2.6 – 2.8m	TESTED BY:	AT	DATE:	14/06/12
MATERIAL:	Sandy Silty Gravel	CHECKED BY:	AT	DATE:	14/06/12
TEST PROCEDURES:	AS 1289.3.8.1	CLIENT REF:			

Soil Description: Sandy Silty Gravel

Type of Water Used: Distilled

Temperature of Water: 24.5 °C

Emerson Class Number: 8



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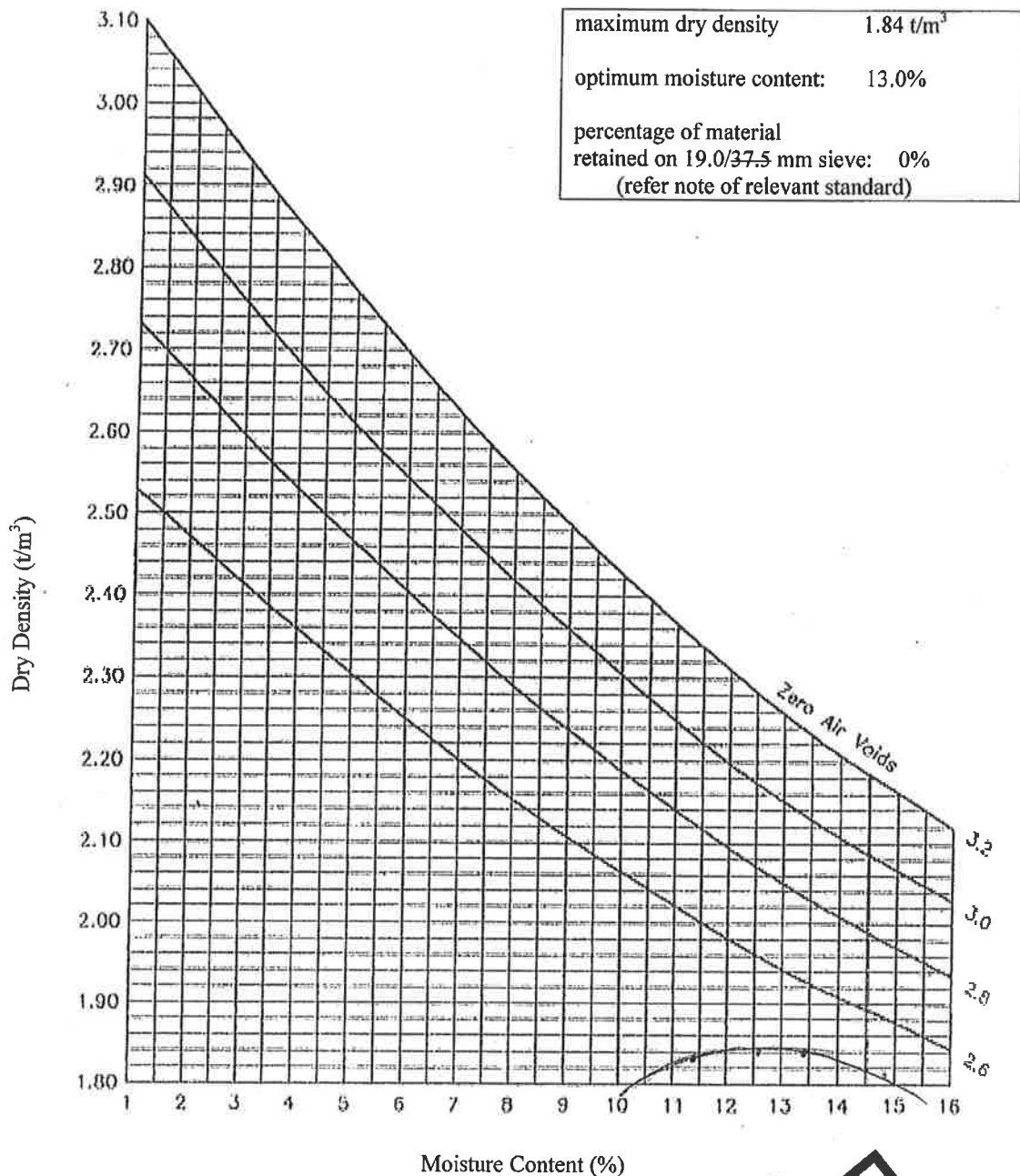
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REPORT ON MAXIMUM DRY DENSITY/OPTIMUM MOISTURE CONTENT

Sheet 3 of 3

Darwin Laboratory

CLIENT:	Golder Associates Pty Ltd	JOB NO.:	U32972	LAB REF. NO.:	121710
PROJECT:	Geotechnical Lab Testing – Roper Bar Steam	SAMPLED BY:	Client	DATE:	04/06/12
LOCATION:	GTP 04-01; 2.6 – 2.8m	TESTED BY:	AJ	DATE:	14/06/12
MATERIAL:	Sandy Silty Gravel	CHECKED BY:	JD	DATE:	15/06/12
TEST PROCEDURES:	AS1289.5.1.1	CLIENT REF:			



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Sheet 1 of 1

Darwin Laboratory

CLIENT: Golder Associates Pty Ltd **JOB NO.:** U32972 **LAB REF NO.:** 121786
PROJECT: Geotechnical Lab Testing – Roper Bar Stream **SAMPLED BY:** Client **DATE:** 4/6/12
LOCATION: Various **TESTED BY:** AT **DATE:** 13/6/12
MATERIAL: Investigation **CHECKED BY:** AT **DATE:** 15/6/12
TEST PROCEDURES: AS 1289.2.1.1 **CLIENT REF:**

Sample Identification Number	Sampling Location	Moisture Content (%)	For Subsidiary Methods	
			Original Value	Amended Value
121710	GTP04-01 2.6-2.8m	8.3	-	-
121715	GTP06-01 0.2m	5.3	-	-
121723	GTP01-03 2.5m	9.3	-	-
121731	GTP08-01 2.1m	13.1	-	-



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Date of Issue 15/6/12

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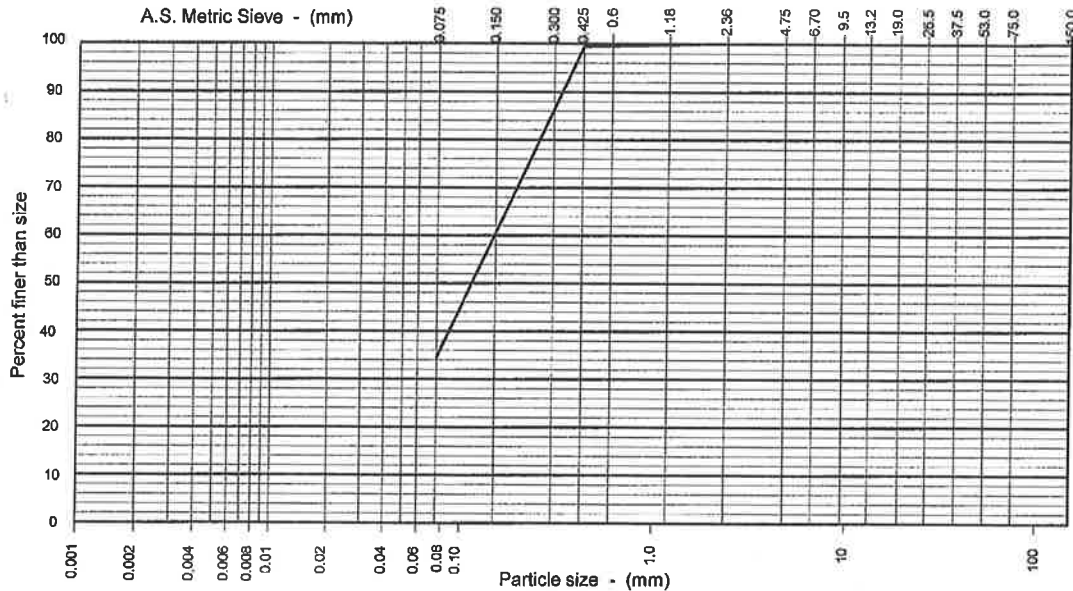
76 Benison Road Winnellie NT
REPORT ON SOIL CLASSIFICATION

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Sheet 1 of 3

Darwin Laboratory

CLIENT: Golder Associates Pty Ltd JOB NO: U32972 LAB REF NO: 121715
PROJECT: Geotechnical Lab Testing - Roper Bar Stream SAMPLED BY: Client DATE: 4/6/12
LOCATION: GTP 06-01; 0.2m TESTED BY: AT DATE: 15/6/12
MATERIAL: Silty Sand CHECKED BY: JD DATE: 15/6/12
TEST PROCEDURES: AS1289 3.1.2,3.2.1,3.3.1,3.4.1,3.6.1 CLIENT REF: -

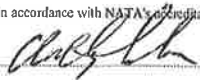


clay	silt			sand			gravel			cobbles
	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	
	35			37	28	0	0	0	0	0

Particle Size (mm)	Percent Passing (%)	Particle Size (mm)	Percent Passing (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)	Specific Gravity (g/cm ³)	
150.0				ND	NO	NP	0.0		
75.0				Classification:					
37.5									
26.5									
19.0									
9.5									
4.75				Preparation History of Atterberg Limits					
2.36	100			Sample : Air-Dried					
1.18				Sieved: Wet					
0.600				Linear Shrinkage Data					
0.425	99			Length of Mould (mm) :					
0.300				Sample					
0.150				Curled/Crumbled: N					
0.075	35								

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	Certificate No.	121715
	Date of Issue	15/06/12

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Certificate of Analysis

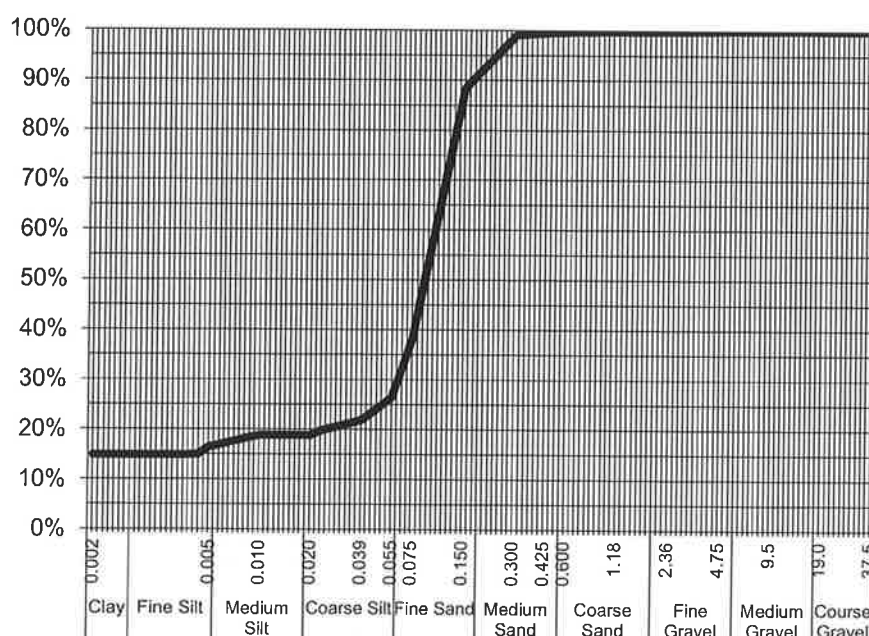
ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Ben Parry **DATE REPORTED:** 22-Jun-2012
COMPANY: Cardno Ullman & Nolan **DATE RECEIVED:** 15-Jun-2012
ADDRESS: PO Box 39623 **REPORT NO:** EN1202205-001 / PSD
Winnelli, NT, Australia 0821
PROJECT: 32972 **SAMPLE ID:** 121715

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	100%
0.600	100%
0.425	100%
0.300	99%
0.150	88%
0.075	38%
Particle Size (microns)	
55	26%
39	22%
20	19%
10	19%
5	16%
4	15%
2	15%

Samples analysed as received.

Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Median Particle Size (mm)	0.075
---------------------------	-------

Sample Comments:

Analysed: 19-Jun-12

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: Fine sand and silty clay

Dispersion Method Shaker

Test Method: AS1289.3.6.1/AS1289.3.6.3

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.65 g/cm³

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REPORT ON EMERSON CLASS NUMBER OF A SOIL

Sheet 2 of 3

Darwin Laboratory

CLIENT:	Golder Associates Pty Ltd	JOB NO.:	U32972	LAB REF NO.:	121715
PROJECT:	Geotechnical Lab Testing – Roper Bar Stream	SAMPLED BY:	Client	DATE:	04/06/12
LOCATION:	GTP 06-01; 0.2m	TESTED BY:	AT	DATE:	14/06/12
MATERIAL:	Silty Sand	CHECKED BY:	AT	DATE:	14/06/12
TEST PROCEDURES:	AS 1289.3.8.1	CLIENT REF:			

Soil Description: Silty Sand

Type of Water Used: Distilled

Temperature of Water: 24.5 °C

Emerson Class Number: 6



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Date of Issue 15/06/12

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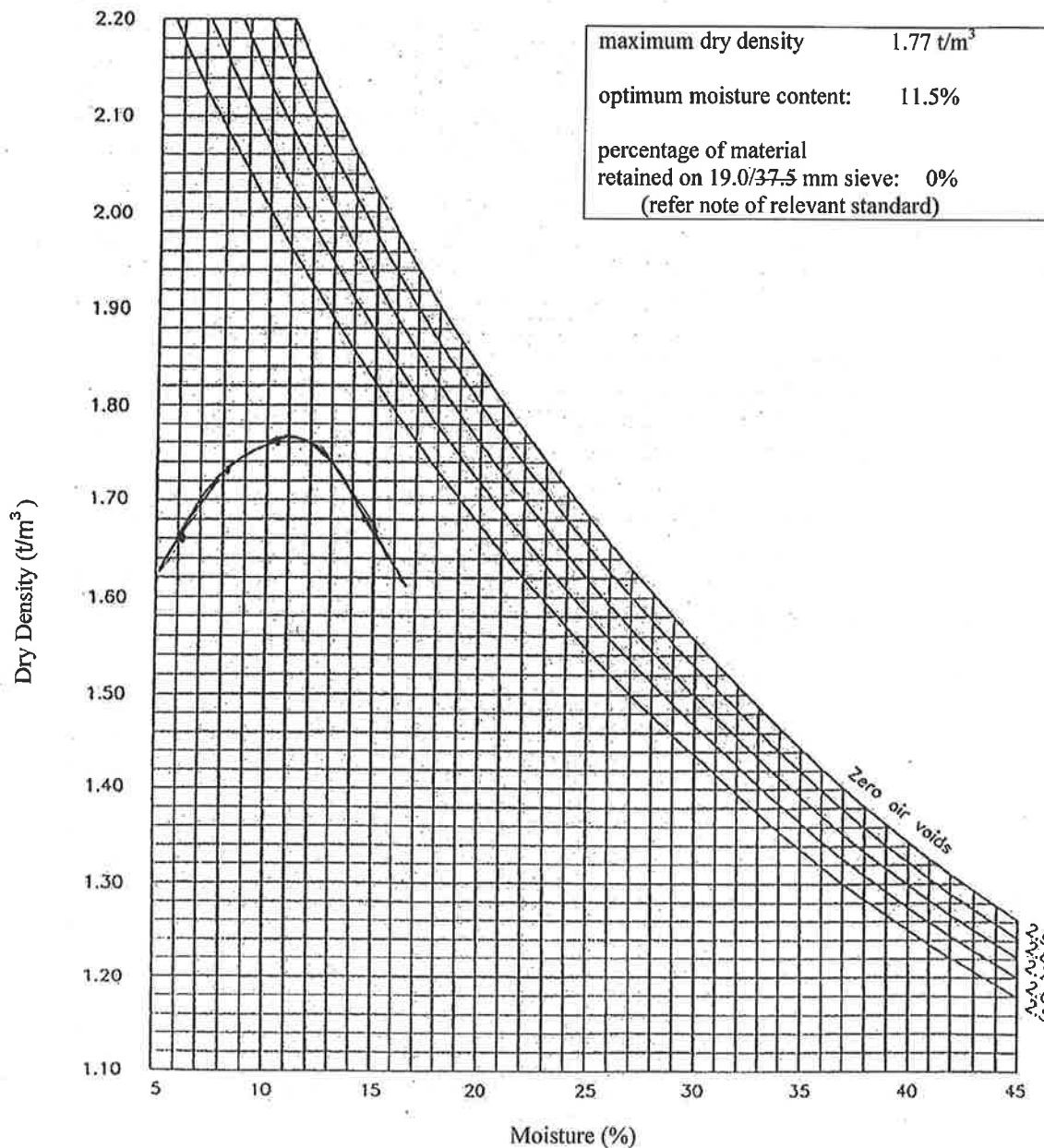
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REPORT ON MAXIMUM DRY DENSITY/OPTIMUM MOISTURE CONTENT

Sheet 3 of 3

Darwin Laboratory

CLIENT:	Golder Associates Pty Ltd	JOB NO.:	U32972	LAB REF. NO.:	121715
PROJECT:	Geotechnical Lab Testing - Roper Bar Stream	SAMPLED BY:	Client	DATE:	04/06/12
LOCATION:	GTP 06-01; 0.2m	TESTED BY:	AJ	DATE:	14/06/12
MATERIAL:	Silty Sand	CHECKED BY:	JD	DATE:	15/06/12
TEST PROCEDURES:	AS1289.5.1.1	CLIENT REF:			



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Date of Issue: 15/06/12

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Authorised Signatory: *[Signature]*

A Tucker

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REPORT ON SOIL CLASSIFICATION

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Sheet 1 of 3

Darwin Laboratory

CLIENT: Golder Associates Pty Ltd

JOB NO: U32972

LAB REF NO: 121722

PROJECT: Geotechnical Lab Testing - Roper Bar Stream

SAMPLED BY: Client

DATE: 4/6/12

LOCATION: GTP 06-02, 1.3-1.5m

TESTED BY: AT

DATE: 29/6/12

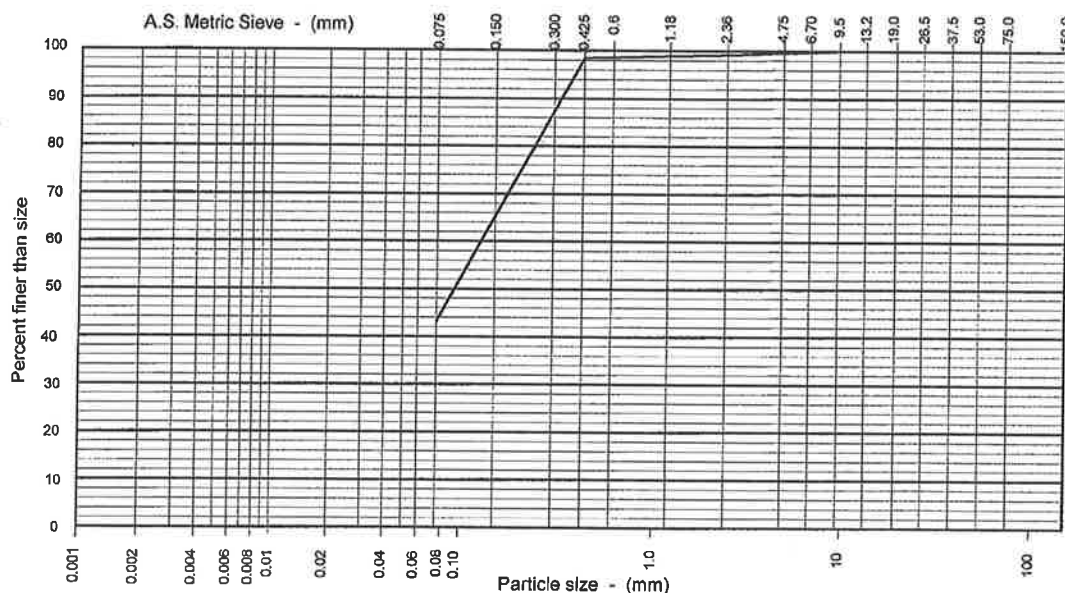
MATERIAL: Silty Sand

CHECKED BY: JD

DATE: 29/6/12

TEST PROCEDURES: AS1289 3.1.1,3.2.1,3.3.1,3.4.1,3.6.1

CLIENT REF: -



clay	silt			sand			gravel			cobbles
	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	
	43			31	24	1	0	0	0	0

Particle Size (mm)	Percent Passing (%)	Particle Size (mm)	Percent Passing (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)	Specific Gravity (g/cm ³)	
150.0				17	13	4	1.5		
75.0				Classification:					
37.5									
26.5									
19.0	100								
9.5	100								
4.75	100								
2.36	99								
1.18									
0.600									
0.425	99								
0.300									
0.150									
0.075	43								

Preparation History of Atterberg Limits			
Sample : Air-Dried			
Sieved: Wet			
Linear Shrinkage Data			
Length of Mould (mm) : 250			
Sample			
Curled/Crumbled: Y			

	Accredited No.	1855
	Certificate No.	121722
	Date of Issue	29/06/12
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ANTHONY TUCKER		

Certificate of Analysis

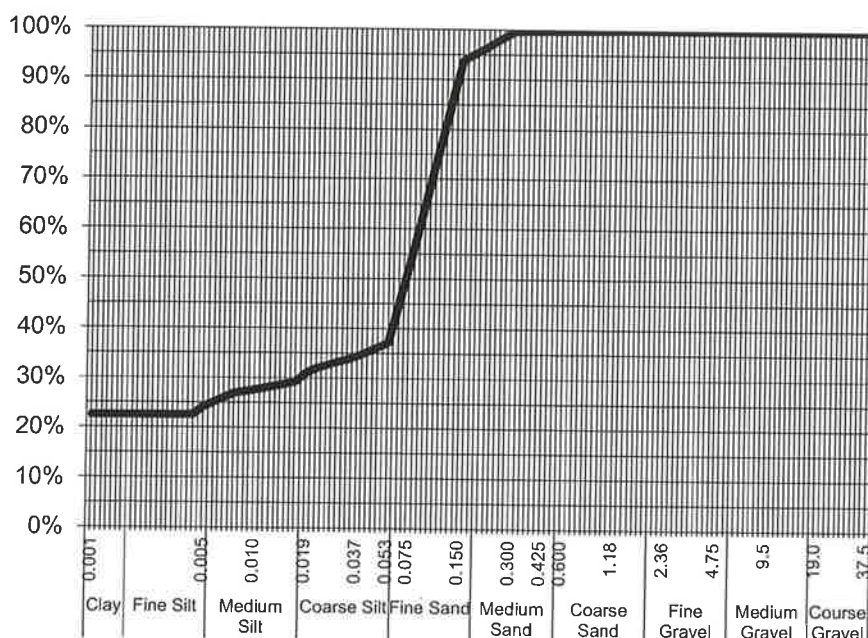
ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Ben Parry
DATE REPORTED: 22-Jun-2012
COMPANY: Cardno Ullman & Nolan
Geotechnic Pty Ltd
DATE RECEIVED: 15-Jun-2012
ADDRESS: PO Box 39623
Winnelli, NT, Australia 0821
REPORT NO: EN1202205-007 / PSD
PROJECT: 32972
SAMPLE ID: 121722

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	100%
0.600	100%
0.425	100%
0.300	100%
0.150	94%
0.075	52%
Particle Size (microns)	
53	37%
37	34%
19	31%
10	28%
5	24%
3	22%
1	22%

Median Particle Size (mm)	0.064
---------------------------	-------

Samples analysed as received.

Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Sample Comments:

Loss on Pretreatment NA

Sample Description: Fine sand and silty clay

Test Method: AS1289.3.6.1/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.65 g/cm³

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Analysed: 19-Jun-12

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

Hamish Murray
Laboratory Technician, Newcastle
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GEOTECHNIC PTY LTD
71 CONNORS ROAD MACKAY QLD

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(10/10)

REPORT ON PINHOLE DISPERSION CLASSIFICATION OF A SOIL

Sheet 1 of 1

Mackay Laboratory

CLIENT:	Golder Associates Pty Ltd	JOB NO.:	U32972	LAB REF NO.:	12-3477A
PROJECT:	Roper Bar Stream	SAMPLED BY:	Client	DATE:	4.6.12
LOCATION:	GTP06-02; 1.3 – 1.5m	TESTED BY:	AR	DATE:	17.7.12
MATERIAL:	Silty Sand	CHECKED BY:	NJR	DATE:	18.7.12
TEST PROCEDURES:	AS 1289.3.8.3	CLIENT REF:	121722		

Pinhole Dispersion Classification: ND2

Source of Material: Not Supplied

Soil Description: Silty Sand

Natural Moisture Content of the Soil: 0.6 %

Initial Moisture Content of the Soil Sample before Testing: 13.7 %

Initial Dry Density of the Soil Sample before Testing: 1.85 t/m³

Maturing Time of the Sample in the Soil Specimen Cylinder: >24 H

Source of Water: Potable

MDD/OMC and Atterberg limits supplied by Cardno UNG NT

MDD: 1.95 t/m³

OMC: 10.5 %

% retained 19.0mm sieve: 0 %

LL: 17 %

PL: 13 %

PI: 4 %

LS: 1.5 %



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Authorised Signatory

M. J. Richardson



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REPORT ON EMERSON CLASS NUMBER OF A SOIL

Sheet 2 of 3

Darwin Laboratory

CLIENT:	Golder Associates Pty Ltd	JOB NO.:	U32972	LAB REF NO.:	121722
PROJECT:	Geotechnical Lab Testing – Roper Bar Stream	SAMPLED BY:	Client	DATE:	04/06/12
LOCATION:	GTP 06-02; 1.3-1.5m	TESTED BY:	AT	DATE:	29/06/12
MATERIAL:	Silty Sand	CHECKED BY:	AT	DATE:	29/06/12
TEST PROCEDURES:	AS 1289.3.8.1	CLIENT REF:			

Soil Description: Silty Sand

Type of Water Used: Distilled

Temperature of Water: 25.0 °C

Emerson Class Number: 5



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Anthony Tucker
ANTHONY TUCKER



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76 BENISON ROAD WINNELLIE NT

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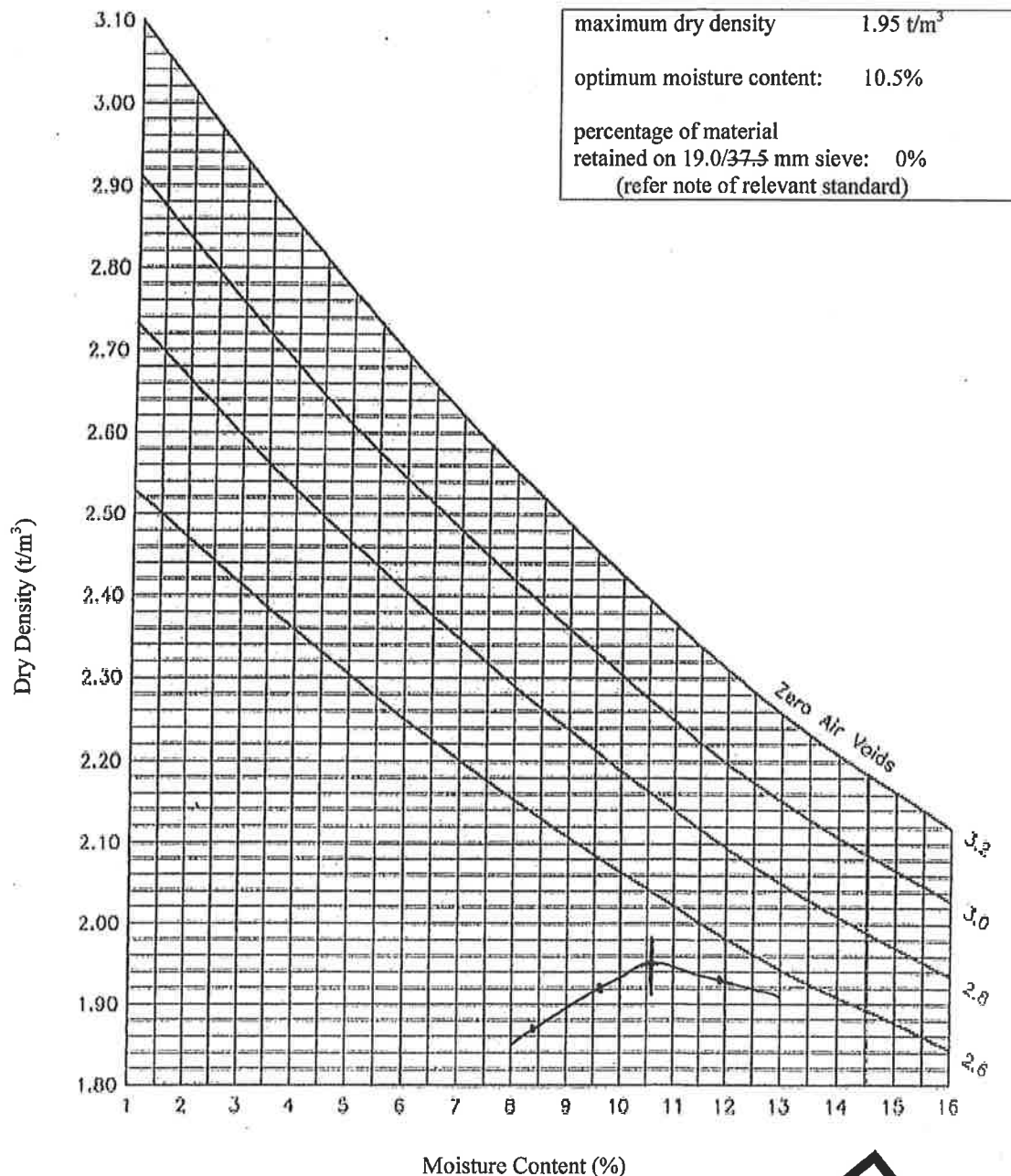
-/08/10)

REPORT ON MAXIMUM DRY DENSITY/OPTIMUM MOISTURE CONTENT

Sheet 3 of 3

Darwin Laboratory

CLIENT:	Golder Associates Pty Ltd	JOB NO.:	U32972	LAB REF. NO.:	121722
PROJECT:	Geotechnical Lab Testing - Roper Bar Steam	SAMPLED BY:	Client	DATE:	04/06/12
LOCATION:	GTP 06-02; 1.3-1.5m	TESTED BY:	ML	DATE:	26/06/12
MATERIAL:	Silty Sand	CHECKED BY:	JD	DATE:	29/06/12
TEST PROCEDURES:	AS1289.5.1.1	CLIENT REF:			



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Certificate No. 121722
Date of Issue: 29/6/12

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Authorised Signatory:

ANTHONY TUCKER

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REPORT ON SOIL CLASSIFICATION

UNGR 1 N

(-1/10/05)

Sheet 1 of 3

Darwin Laboratory

CLIENT: Golder Associates Pty Ltd

JOB NO: U32972

LAB REF NO: 121724

PROJECT: Geotechnical Lab Testing - Roper Bar Stream

SAMPLED BY: Client

DATE: 4/6/12

LOCATION: GTP 07-02, 2.8m

TESTED BY: AT

DATE: 29/6/12

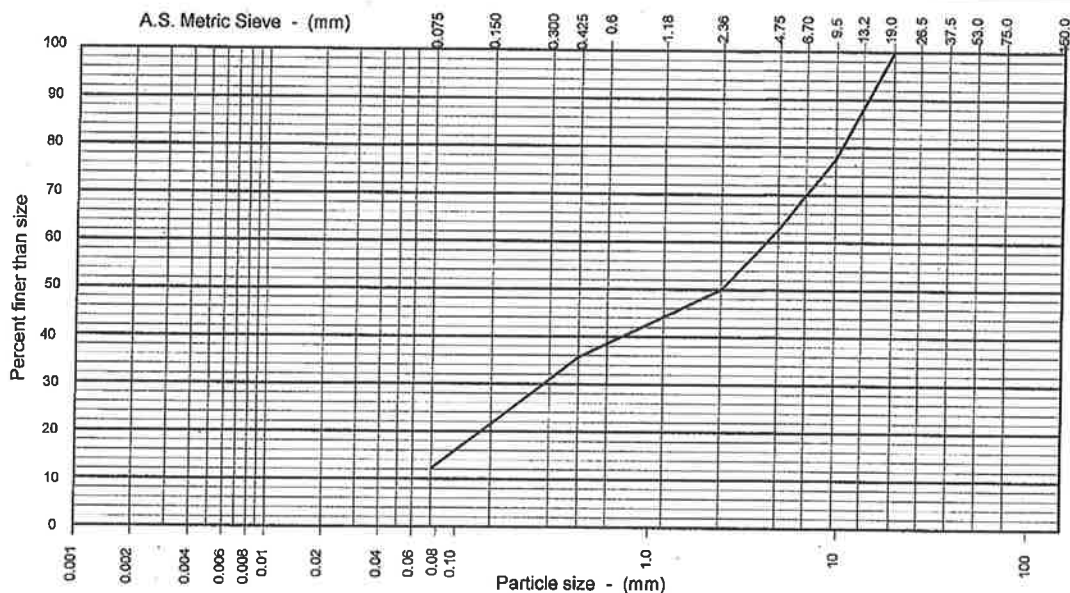
MATERIAL: Sandy Silty Gravel

CHECKED BY: JD

DATE: 29/6/12

TEST PROCEDURES: AS1289 3.1.1,3.2.1,3.3.1,3.4.1,3.6.1

CLIENT REF: -



clay	silt			sand			gravel			cobbles
	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	
	12			13	13	11	18	32	0	0

Particle Size (mm)	Percent Passing (%)	Particle Size (mm)	Percent Passing (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)	Specific Gravity (g/cm ³)	
150.0				21	17	4	1.5		
75.0				Classification:					
37.5									
26.5									
19.0	100								
9.5	78			Preparation History of Atterberg Limits					
4.75	63								
2.36	50								
1.18									
0.600				Linear Shrinkage Data					
0.425	36								
0.300									
0.150									
0.075	12			Length of Mould (mm) : 250					
				Sample					
				Curled/Crumbled: Y					



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Certificate No. 121724

Date of Issue 29/06/12

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Authorised Signatory *[Signature]*

ANTHONY TUCKER

Certificate of Analysis

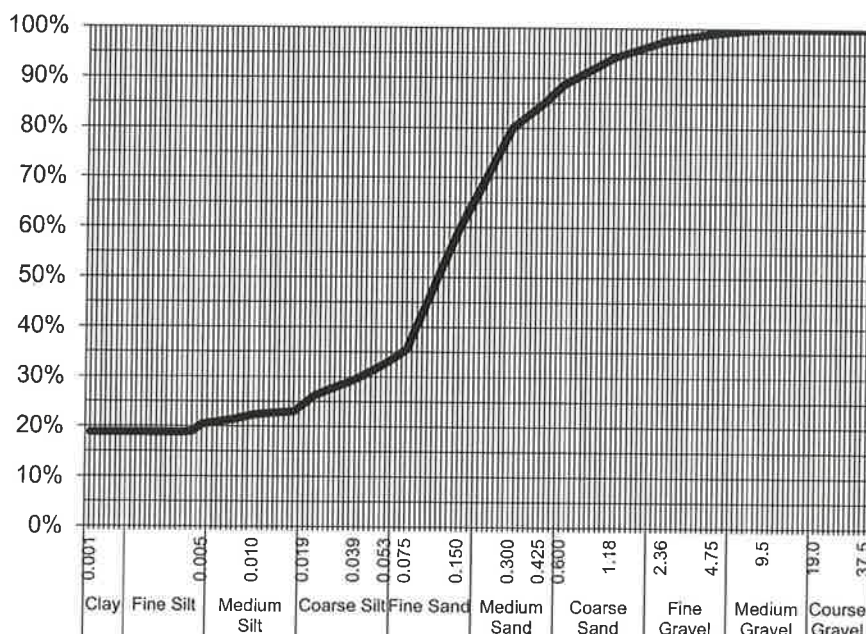
ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Ben Parry
DATE REPORTED: 22-Jun-2012
COMPANY: Cardno Ullman & Nolan
Geotechnic Pty Ltd
DATE RECEIVED: 15-Jun-2012
ADDRESS: PO Box 39623
Winnelli, NT, Australia 0821
REPORT NO: EN1202205-006 / PSD
PROJECT: 32972
SAMPLE ID: 121724

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	99%
2.36	98%
1.18	94%
0.600	89%
0.425	85%
0.300	80%
0.150	60%
0.075	36%
Particle Size (microns)	
53	33%
39	30%
19	25%
10	22%
5	20%
3	19%
1	19%

Median Particle Size (mm)	0.075
---------------------------	-------

Samples analysed as received.

Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Sample Comments:

Loss on Pretreatment NA

Sample Description: Sand and silty clay

Test Method: AS1289.3.6.1/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.65 g/cm³

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Analysed: 19-Jun-12

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

Hamish Murray
Laboratory Technician, Newcastle
Authorised Signatory



CARDNO ULLMAN & NOLAN
GEOTECHNIC PTY LTD
71 CONNORS ROAD MACKAY QLD

UNGR 53 G
(10/10)

REPORT ON PINHOLE DISPERSION CLASSIFICATION OF A SOIL

Sheet 1 of 1

Mackay Laboratory

CLIENT:	Golder Associates Pty Ltd	JOB NO.:	U32972	LAB REF NO.:	12-3479A
PROJECT:	Roper Bar Stream	SAMPLED BY:	Client	DATE:	4.6.12
LOCATION:	GTP07-03; 2.8m	TESTED BY:	AR	DATE:	17.7.12
MATERIAL:	Sandy Silty Gravel	CHECKED BY:	NJR	DATE:	18.7.12
TEST PROCEDURES:	AS 1289.3.8.3	CLIENT REF:	121724		

Pinhole Dispersion Classification: D1

Source of Material: Not Supplied

Soil Description: Sandy Silty Gravel

Natural Moisture Content of the Soil: 2.4 %

Initial Moisture Content of the Soil Sample before Testing: 16.9 %

Initial Dry Density of the Soil Sample before Testing: 1.75 t/m³

Maturing Time of the Sample in the Soil Specimen Cylinder: >24 H

Source of Water: Potable

MDD/OMC and Atterberg limits supplied by Cardno UNG NT :

MDD: 1.85 t/m³

OMC: 13.5 %

% retained 19.0mm sieve: 0 %

LL: 21 %

PL: 17 %

PI: 4 %

LS: 1.5 %



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[Signature]
M. J. Richardson



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76 BENISON ROAD WINNELLIE NT

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(-08/10)

REPORT ON EMERSON CLASS NUMBER OF A SOIL

Sheet 2 of 3

Darwin Laboratory

CLIENT:	Golder Associates Pty Ltd	JOB NO.:	U32972	LAB REF NO.:	121724
PROJECT:	Geotechnical Lab Testing – Roper Bar Stream	SAMPLED BY:	Client	DATE:	04/06/12
LOCATION:	GTP 07-02; 2.8m	TESTED BY:	AT	DATE:	29/06/12
MATERIAL:	Sandy Silty Gravel	CHECKED BY:	AT	DATE:	29/06/12
TEST PROCEDURES:	AS 1289.3.8.1	CLIENT REF:			

Soil Description: Sandy Silty Gravel

Type of Water Used: Distilled

Temperature of Water: 25.0 °C

Emerson Class Number: 5



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Certificate No. 121724.

Date of Issue 29/06/12

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accreditation requirements.

Authorised Signatory:

Anthony Tucker
ANTHONY TUCKER



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76 BENISON ROAD WINNELLIE NT

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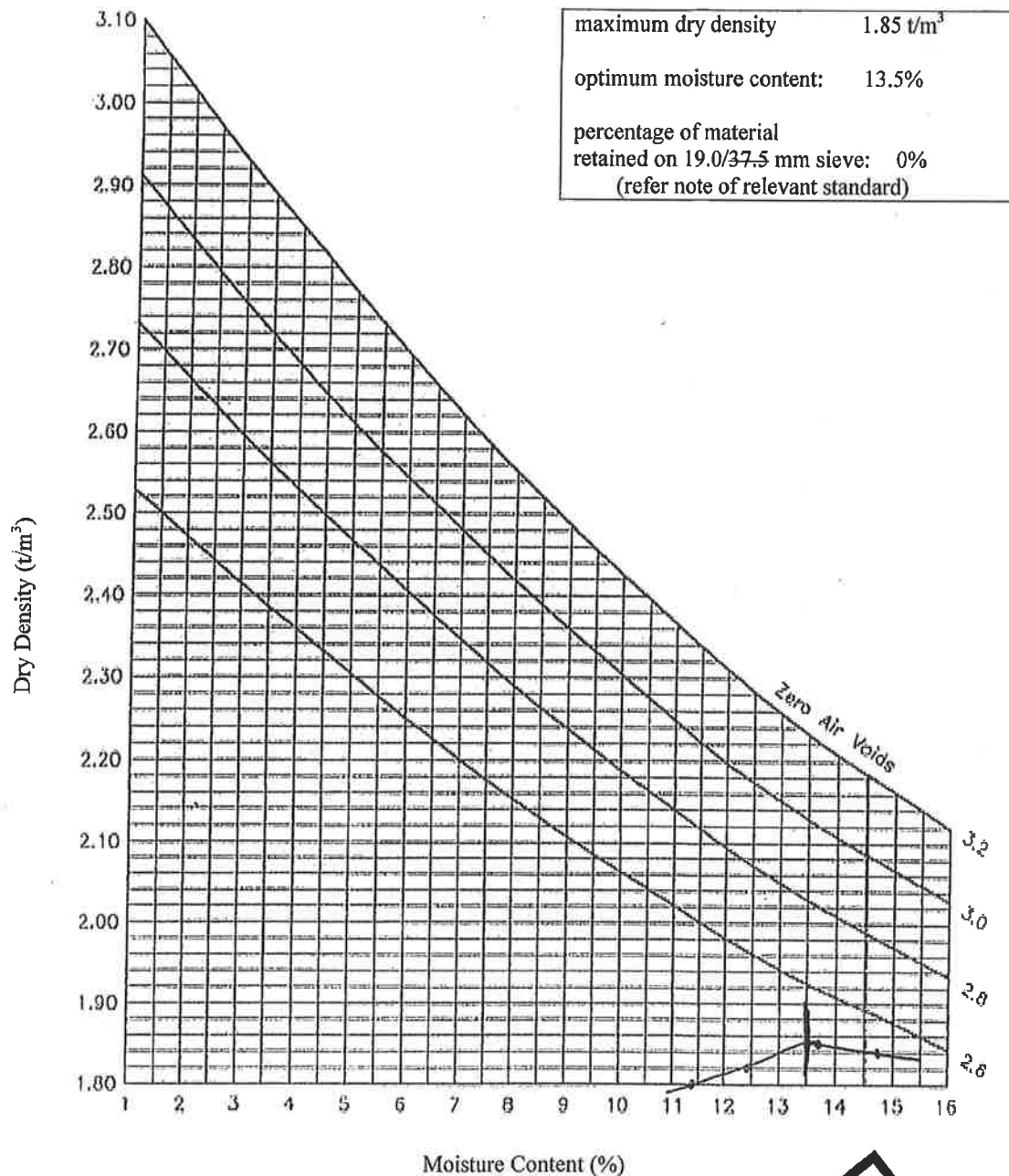
-/08/10)

REPORT ON MAXIMUM DRY DENSITY/OPTIMUM MOISTURE CONTENT

Sheet 3 of 3

Darwin Laboratory

CLIENT:	Golder Associates Pty Ltd	JOB NO.:	U32972	LAB REF. NO.:	121724
PROJECT:	Geotechnical Lab Testing - Roper Bar Steam	SAMPLED BY:	Client	DATE:	04/06/12
LOCATION:	GTP 07-02; 2.8m	TESTED BY:	ML	DATE:	22/06/12
MATERIAL:	Sandy Silty Gravel	CHECKED BY:	JD	DATE:	29/06/12
TEST PROCEDURES:	AS1289.5.1.1	CLIENT REF:			



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Date of Issue: 29/6/12

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Authorised Signatory:
ANTHONY TUCKER



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76 BENISON ROAD WINNELLIE NT

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(-08/10)

Sheet 1 of 1

Darwin Laboratory

CLIENT: Golder Associates Pty Ltd **JOB NO.:** U32972 **LAB REF NO.:** 121786
PROJECT: Geotechnical Lab Testing - Roper Bar Stream **SAMPLED BY:** Client **DATE:** 4/6/12
LOCATION: Various **TESTED BY:** AT **DATE:** 13/6/12
MATERIAL: Investigation **CHECKED BY:** AT **DATE:** 15/6/12
TEST PROCEDURES: AS 1289.2.1.1 **CLIENT REF:**

Sample Identification Number	Sampling Location	Moisture Content (%)	For Subsidiary Methods	
			Original Value	Amended Value
121710	GTP04-01 2.6-2.8m	8.3	-	-
121715	GTP06-01 0.2m	5.3	-	-
121723	GTP01-03 2.5m	9.3	-	-
121731	GTP08-01 2.1m	13.1	-	-



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Date of Issue 15/6/12

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Authorised Signatory:

Matthew Dunkley

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REPORT ON SOIL CLASSIFICATION

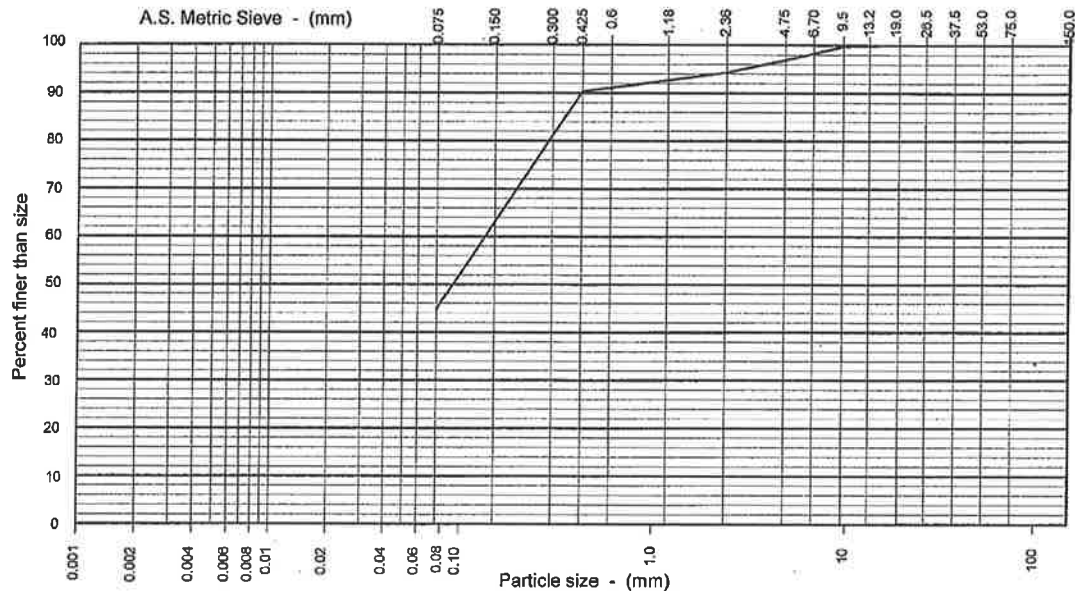
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Sheet 1 of 3

Darwin Laboratory

CLIENT: Golder Associates Pty Ltd JOB NO: U32972 LAB REF NO: 121731
PROJECT: Geotechnical Lab Testing - Roper Bar Stream SAMPLED BY: Client DATE: 4/6/12
LOCATION: GTP 08-01; 2.1m TESTED BY: AT DATE: 15/6/12
MATERIAL: Silty Sand CHECKED BY: JD DATE: 15/6/12
TEST PROCEDURES: AS1289 3.1.2,3.2.1,3.3.1,3.4.1,3.6.1 CLIENT REF: -



clay	silt			sand			gravel			cobbles
	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	
	45			26	21	3	4	2	0	0

Particle Size (mm)	Percent Passing (%)	Particle Size (mm)	Percent Passing (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)	Specific Gravity (g/cm ³)	
150.0				27	11	16	4.0		
75.0				Classification:					
37.5									
26.5									
19.0	100								
9.5	100								
4.75	97			Preparation History of Atterberg Limits					
2.36	94			Sample : Air-Dried					
1.18				Sieved: Wet					
0.600									
0.425	90			Linear Shrinkage Data					
0.300				Length of Mould (mm) : 250					
0.150				Sample					
0.075	45			Curled/Crumbled: Y					



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A Tucker

Certificate of Analysis

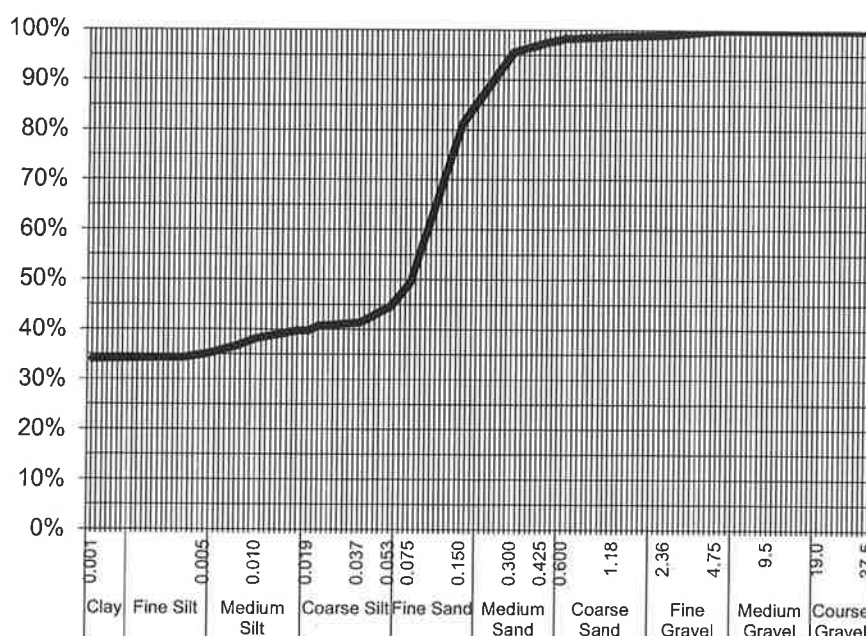
ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Ben Parry
DATE REPORTED: 22-Jun-2012
COMPANY: Cardno Ullman & Nolan
Geotechnic Pty Ltd
DATE RECEIVED: 15-Jun-2012
ADDRESS: PO Box 39623
Winnelli, NT, Australia 0821
REPORT NO: EN1202205-004 / PSD
PROJECT: 32972
SAMPLE ID: 121731

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	99%
1.18	99%
0.600	98%
0.425	97%
0.300	96%
0.150	81%
0.075	49%
Particle Size (microns)	
53	45%
37	41%
19	40%
10	38%
5	35%
3	34%
1	34%

Median Particle Size (mm)	0.075
---------------------------	-------

Samples analysed as received.

Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Sample Comments:

Analysed: 19-Jun-12

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: Medium fine sand and silty clay

Dispersion Method Shaker

Test Method: AS1289.3.6.1/AS1289.3.6.3

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.65 g/cm³

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Hamish Murray
Laboratory Technician, Newcastle
Authorised Signatory



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(10/10)

REPORT ON PINHOLE DISPERSION CLASSIFICATION OF A SOIL

Sheet 1 of 1

Mackay Laboratory

CLIENT:	Golder Associates Pty Ltd	JOB NO.:	U32972	LAB REF NO.:	12-3482A
PROJECT:	Roper Bar Stream	SAMPLED BY:	Client	DATE:	4.6.12
LOCATION:	GTP08-01; 2.1m	TESTED BY:	AR	DATE:	17.7.12
MATERIAL:	Silty Sand	CHECKED BY:	NJR	DATE:	18.7.12
TEST PROCEDURES:	AS 1289.3.8.3	CLIENT REF:	121731		

Pinhole Dispersion Classification: ND1

Source of Material: Not Supplied

Soil Description: Silty Sand

Natural Moisture Content of the Soil: 1.8 %

Initial Moisture Content of the Soil Sample before Testing: 12.2 %

Initial Dry Density of the Soil Sample before Testing: 1.84 t/m³

Maturing Time of the Sample in the Soil Specimen Cylinder: >24 H

Source of Water: Potable

MDD/OMC and Atterberg limits supplied by Cardno UNG NT :

MDD: 1.94 t/m³

OMC: 11.5 %

% retained 19.0mm sieve: 0 %

LL: 27 %

PL: 11 %

PI: 16 %

LS: 4.0 %



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N. J. Richardson



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(-08/10)

REPORT ON EMERSON CLASS NUMBER OF A SOIL

Sheet 2 of 3

Darwin Laboratory

CLIENT:	Golder Associates Pty Ltd	JOB NO.:	U32972	LAB REF NO.:	121731
PROJECT:	Geotechnical Lab Testing – Roper Bar Stream	SAMPLED BY:	Client	DATE:	04/06/12
LOCATION:	GTP 08-01; 2.1m	TESTED BY:	AT	DATE:	14/06/12
MATERIAL:	Silty Sand	CHECKED BY:	AT	DATE:	14/06/12
TEST PROCEDURES:	AS 1289.3.8.1	CLIENT REF:			

Soil Description: Silty Sand

Type of Water Used: Distilled

Temperature of Water: 24.5 °C

Emerson Class Number: 2



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Date of Issue 15/06/12

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Authorised Signatory

A Tucker
A Tucker



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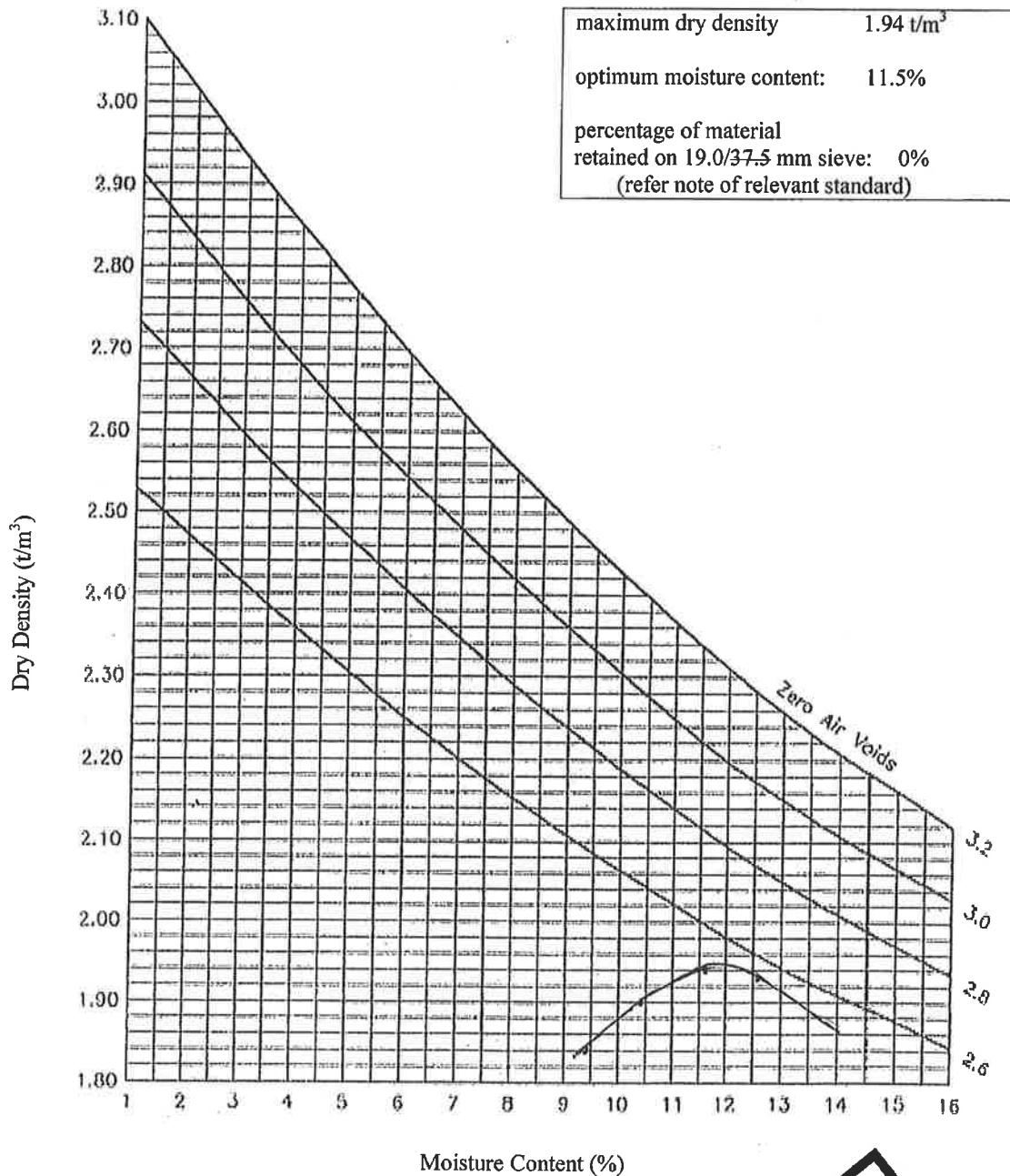
-/08/10)

REPORT ON MAXIMUM DRY DENSITY/OPTIMUM MOISTURE CONTENT

Sheet 3 of 3

Darwin Laboratory

CLIENT:	Golder Associates Pty Ltd	JOB NO.:	U32972	LAB REF. NO.:	121731
PROJECT:	Geotechnical Lab Testing - Roper Bar Steam	SAMPLED BY:	Client	DATE:	04/06/12
LOCATION:	GTP 08-01; 2.1m	TESTED BY:	AJ	DATE:	14/06/12
MATERIAL:	Silty Sand	CHECKED BY:	JD	DATE:	15/06/12
TEST PROCEDURES:	AS1289.5.1.1	CLIENT REF:			



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Date of Issue: 15/6/12

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Authorised Signatory: *[Signature]*
A Tucker



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(-08/10)

Sheet 1 of 1

Darwin Laboratory

CLIENT: Golder Associates Pty Ltd	JOB NO.: U32972	LAB REF NO.: 122063
PROJECT: Geotechnical Lab Testing – Roper Bar Stream	SAMPLED BY: Client	DATE: 4/6/12
LOCATION: Various	TESTED BY: AT	DATE: 14/6/12
MATERIAL: Investigation	CHECKED BY: AT	DATE: 29/6/12
TEST PROCEDURES: AS 1289.2.1.1	CLIENT REF:	

Sample Identification Number	Sampling Location	Moisture Content (%)	For Subsidiary Methods	
			Original Value	Amended Value
121729	GTP12-01 1.5m	8.3	-	-
121722	GTP06-02 1.3-1.5m	15.4	-	-
121728	GTP10-01 2.0m	17.4	-	-
121724	GTP07-04 2.8m	11.7	-	-



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ANTHONY TUCKER

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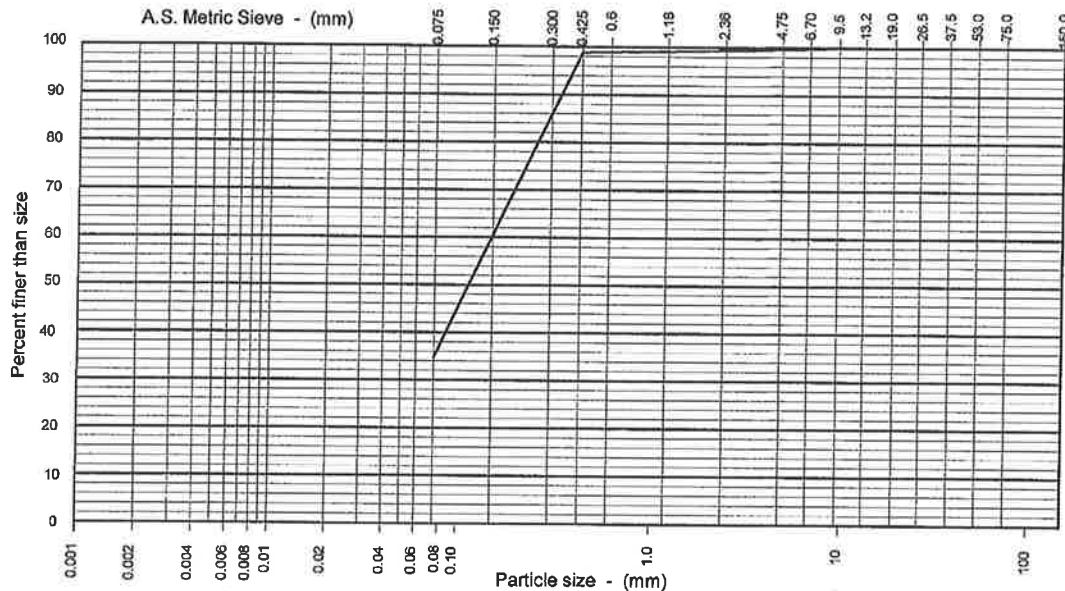
76 Benison Road Winnellie NT
REPORT ON SOIL CLASSIFICATION

UNGR 1 N
(-10/05)

Sheet 1 of 3

Darwin Laboratory

CLIENT: Golder Associates Pty Ltd JOB NO: U32972 LAB REF NO: 121728
PROJECT: Geotechnical Lab Testing - Roper Bar Stream SAMPLED BY: Client DATE: 4/6/12
LOCATION: GTP 10-01, 2.0m TESTED BY: AT DATE: 29/6/12
MATERIAL: Silty Sand CHECKED BY: JD DATE: 29/6/12
TEST PROCEDURES: AS1289 3.1.1,3.2.1,3.3.1,3.4.1,3.6.1 CLIENT REF: -



clay	silt			sand			gravel			cobbles
	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	
	35			36	28	0	0	0	0	0

Particle Size (mm)	Percent Passing (%)	Particle Size (mm)	Percent Passing (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)	Specific Gravity (g/cm ³)	
150.0				20	13	7	3.0		
75.0				Classification:					
37.5									
26.5									
19.0	100								
9.5	100								
4.75	100			Preparation History of Atterberg Limits					
2.36	99			Sample : Air-Dried					
1.18				Sieved: Wet					
0.600				Linear Shrinkage Data					
0.425	99			Length of Mould (mm) : 250					
0.300				Sample					
0.150				Curled/Crumbled: Y					
0.075	35								



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Date of Issue 29/06/12

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ANTHONY TUCKER

Certificate of Analysis

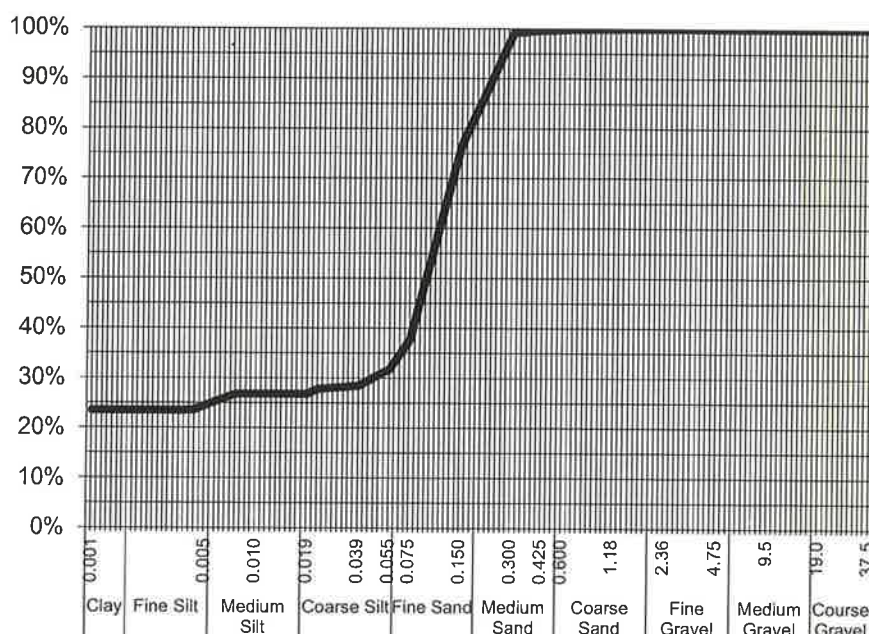
ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Ben Parry
DATE REPORTED: 22-Jun-2012
COMPANY: Cardno Ullman & Nolan
Geotechnic Pty Ltd
DATE RECEIVED: 15-Jun-2012
ADDRESS: PO Box 39623
Winnelli, NT, Australia 0821
REPORT NO: EN1202205-008 / PSD
PROJECT: 32972
SAMPLE ID: 121728

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	100%
0.600	100%
0.425	100%
0.300	99%
0.150	77%
0.075	38%
Particle Size (microns)	
55	32%
39	28%
19	27%
10	27%
5	24%
3	23%
1	23%

Median Particle Size (mm)	0.075
---------------------------	-------

Samples analysed as received.

Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Sample Comments:

Analysed: 19-Jun-12

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: Medium fine sand and silty clay

Dispersion Method Shaker

Test Method: AS1289.3.6.1/AS1289.3.6.3

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.65 g/cm³

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Hamish Murray
Laboratory Technician, Newcastle
Authorised Signatory



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GEOTECHNIC PTY LTD
71 CONNORS ROAD MACKAY QLD

UNGR 53 G
(10/10)

REPORT ON PINHOLE DISPERSION CLASSIFICATION OF A SOIL

Sheet 1 of 1

Mackay Laboratory

CLIENT:	Golder Associates Pty Ltd	JOB NO.:	U32972	LAB REF NO.:	12-3480A
PROJECT:	Roper Bar Stream	SAMPLED BY:	Client	DATE:	4.6.12
LOCATION:	GTP I0-01; 2.0m	TESTED BY:	AR	DATE:	17.7.12
MATERIAL:	Silty Sand	CHECKED BY:	NJR	DATE:	18.7.12
TEST PROCEDURES:	AS 1289.3.8.3	CLIENT REF:	121728		

Pinhole Dispersion Classification: D1

Source of Material: Not Supplied

Soil Description: Silty Sand

Natural Moisture Content of the Soil: 0.6 %

Initial Moisture Content of the Soil Sample before Testing: 13.1 %

Initial Dry Density of the Soil Sample before Testing: 1.87 t/m³

Maturing Time of the Sample in the Soil Specimen Cylinder: >24 H

Source of Water: Potable

MDD/OMC and Atterberg limits supplied by Cardno UNG NT :

MDD: 1.97 t/m³

OMC: 10.5 %

% retained 19.0mm sieve: 0 %

LL: 20 %

PL: 13 %

PI: 7 %

LS: 3.0 %



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Authorised Signatory

M. J. Richards



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REPORT ON EMERSON CLASS NUMBER OF A SOIL

Sheet 2 of 3

Darwin Laboratory

CLIENT:	Golder Associates Pty Ltd	JOB NO.:	U32972	LAB REF NO.:	121728
PROJECT:	Geotechnical Lab Testing – Roper Bar Stream	SAMPLED BY:	Client	DATE:	04/06/12
LOCATION:	GTP 10-01 2.0m	TESTED BY:	AT	DATE:	29/06/12
MATERIAL:	Silty Sand	CHECKED BY:	AT	DATE:	29/06/12
TEST PROCEDURES:	AS 1289.3.8.1	CLIENT REF:			

Soil Description: Silty Sand

Type of Water Used: Distilled

Temperature of Water: 25.0 °C

Emerson Class Number: 5



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Authorised Signatory:

Anthony Tucker
ANTHONY TUCKER



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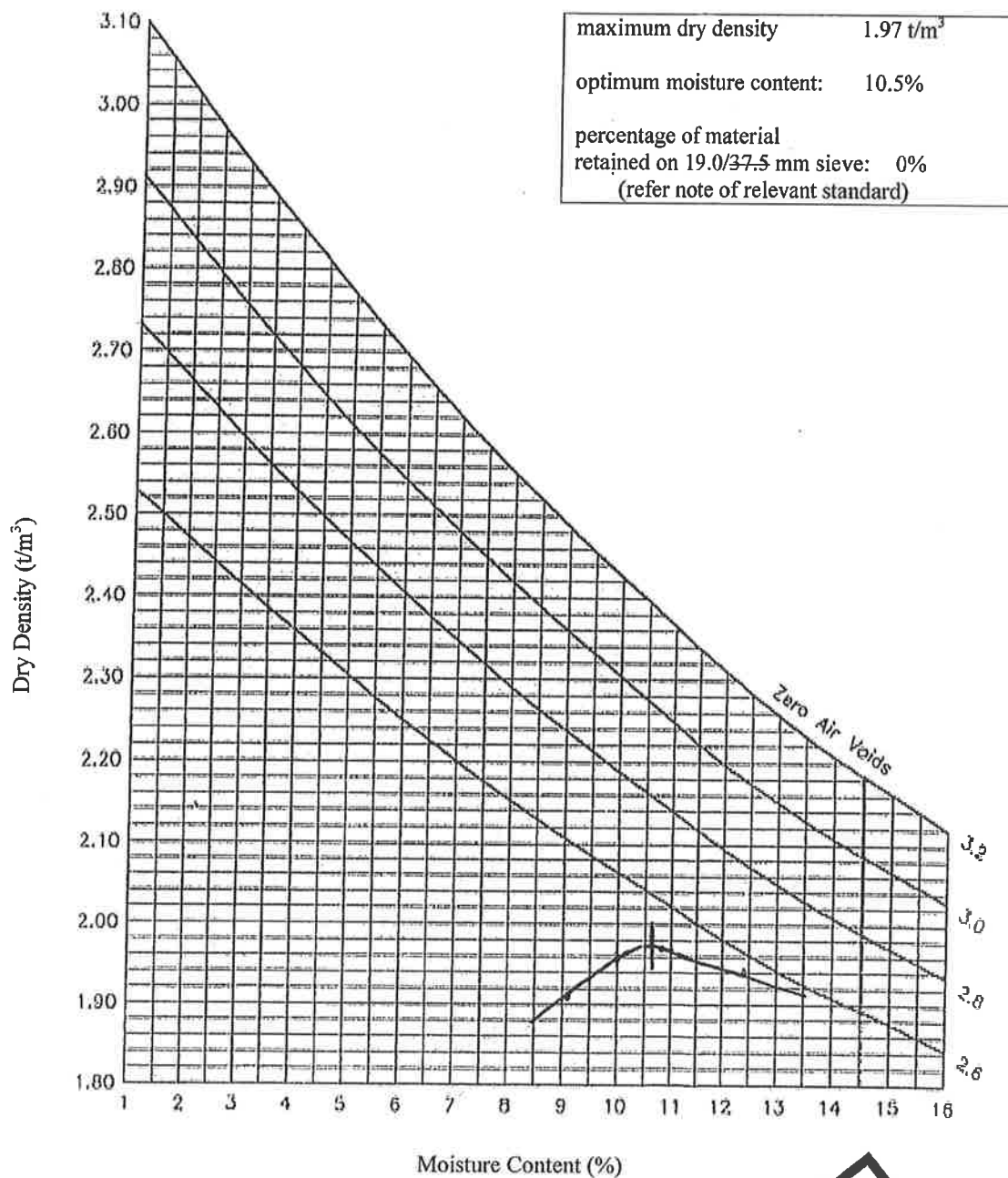
-/08/10)

REPORT ON MAXIMUM DRY DENSITY/OPTIMUM MOISTURE CONTENT

Sheet 3 of 3

Darwin Laboratory

CLIENT:	Golder Associates Pty Ltd	JOB NO.:	U32972	LAB REF. NO.:	121728
PROJECT:	Geotechnical Lab Testing - Roper Bar Steam	SAMPLED BY:	Client	DATE:	04/06/12
LOCATION:	GTP 10-01; 2.0m	TESTED BY:	ML	DATE:	26/06/12
MATERIAL:	Silty Sand	CHECKED BY:	JD	DATE:	29/06/12
TEST PROCEDURES:	AS1289.5.1.1	CLIENT REF:			



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Certificate No. 121728
Date of Issue: 29/6/12

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Sheet 1 of 1

Darwin Laboratory

CLIENT: Golder Associates Pty Ltd **JOB NO.:** U32972 **LAB REF NO.:** 122063
PROJECT: Geotechnical Lab Testing - Roper Bar Stream **SAMPLED BY:** Client **DATE:** 4/6/12
LOCATION: Various **TESTED BY:** AT **DATE:** 14/6/12
MATERIAL: Investigation **CHECKED BY:** AT **DATE:** 29/6/12
TEST PROCEDURES: AS 1289.2.1.1 **CLIENT REF:**

Sample Identification Number	Sampling Location	Moisture Content (%)	For Subsidiary Methods	
			Original Value	Amended Value
121729	GTP12-01 1.5m	8.3	-	-
121722	GTP06-02 1.3-1.5m	15.4	-	-
121728	GTP10-01 2.0m	17.4	-	-
121724	GTP07-04 2.8m	11.7	-	-



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REPORT ON SOIL CLASSIFICATION

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(-110/05)

Sheet 1 of 3

Darwin Laboratory

CLIENT: Golder Associates Pty Ltd

JOB NO: U32972

LAB REF NO: 121729

PROJECT: Geotechnical Lab Testing - Roper Bar Stream

SAMPLED BY: Client

DATE: 4/6/12

LOCATION: GTP 12-01, 1.5m

TESTED BY: AT

DATE: 29/6/12

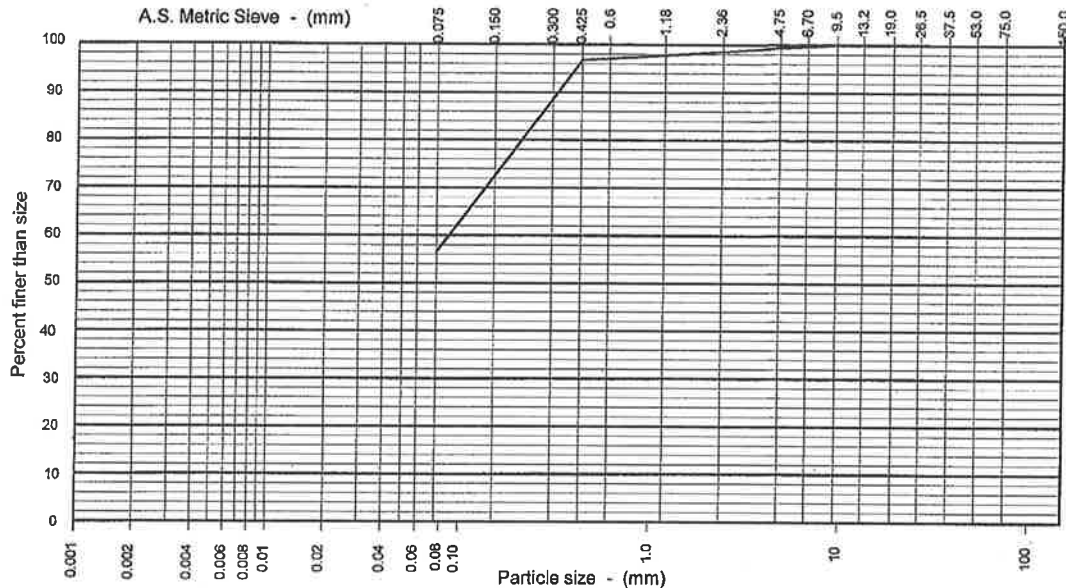
MATERIAL: Sandy Silt

CHECKED BY: JD

DATE: 29/6/12

TEST PROCEDURES: AS1289 3.1.1,3.2.1,3.3.1,3.4.1,3.6.1

CLIENT REF: -



clay	silt			sand			gravel			cobbles
	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	
	57			23	18	1	1	0	0	0

Particle Size (mm)	Percent Passing (%)	Particle Size (mm)	Percent Passing (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)	Specific Gravity (g/cm ³)
150.0				26	18	8	3.0	
75.0				Classification:				
37.5								
26.5								
19.0	100							
9.5	100							
4.75	99							
2.36	99							
1.18								
0.600								
0.425	97							
0.300								
0.150								
0.075	57							

Preparation History of Atterberg Limits			
Sample : Air-Dried			
Sieved: Wet			
Linear Shrinkage Data			
Length of Mould (mm) : 250			
Sample			
Curled/Crumbled: Y			

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		Certificate No.	121729
		Date of Issue	29/06/12

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Certificate of Analysis

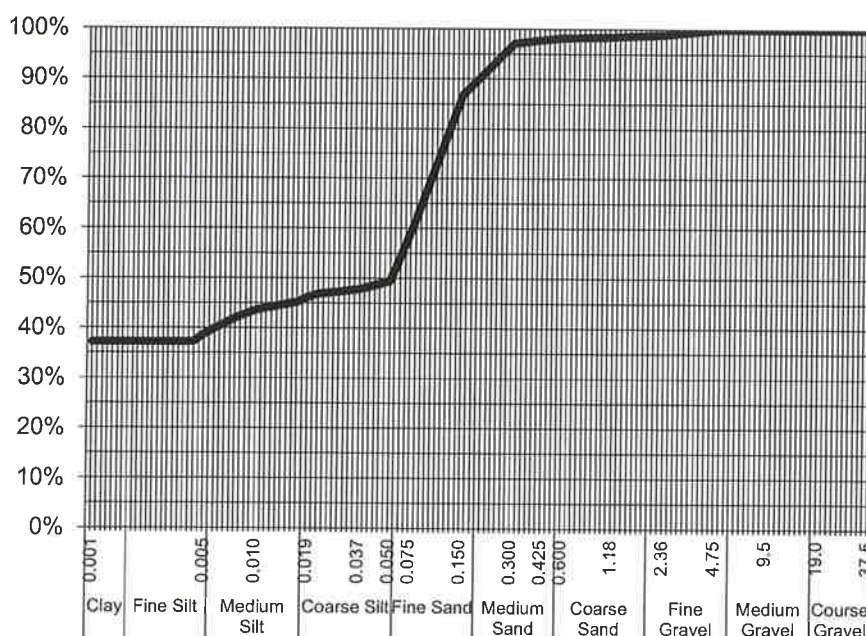
ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Ben Parry
DATE REPORTED: 22-Jun-2012
COMPANY: Cardno Ullman & Nolan
Geotechnic Pty Ltd
DATE RECEIVED: 15-Jun-2012
ADDRESS: PO Box 39623
Winnelli, NT, Australia 0821
REPORT NO: EN1202205-005 / PSD
PROJECT: 32972
SAMPLE ID: 121729

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	99%
1.18	98%
0.600	98%
0.425	98%
0.300	97%
0.150	87%
0.075	59%
Particle Size (microns)	
50	49%
37	48%
19	46%
10	44%
5	39%
3	37%
1	37%

Median Particle Size (mm)	0.050
---------------------------	-------

Samples analysed as received.

Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Sample Comments:

Analysed: 19-Jun-12

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: Silty clay and medium fine sand

Dispersion Method Shaker

Test Method: AS1289.3.6.1/AS1289.3.6.3

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.65 g/cm³

NATA Accreditation: 825 Site: Newcastle
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Hamish Murray
Laboratory Technician, Newcastle
Authorised Signatory



CARDNO ULLMAN & NOLAN
GEOTECHNIC PTY LTD
71 CONNORS ROAD MACKAY QLD

UNGR 53 G
(10/10)

REPORT ON PINHOLE DISPERSION CLASSIFICATION OF A SOIL

Sheet 1 of 1

Mackay Laboratory

CLIENT:	Golder Associates Pty Ltd	JOB NO.:	U32972	LAB REF NO.:	12-3481A
PROJECT:	Roper Bar Stream	SAMPLED BY:	Client	DATE:	4.6.12
LOCATION:	GTP12-01; 1.5m	TESTED BY:	AR	DATE:	17.7.12
MATERIAL:	Sandy Silt	CHECKED BY:	NJR	DATE:	18.7.12
TEST PROCEDURES:	AS 1289.3.8.3	CLIENT REF:	121729		

Pinhole Dispersion Classification: ND1

Source of Material: Not Supplied

Soil Description: Sandy Silt

Natural Moisture Content of the Soil: 1.7 %

Initial Moisture Content of the Soil Sample before Testing: 17.3 %

Initial Dry Density of the Soil Sample before Testing: 1.79 t/m³

Maturing Time of the Sample in the Soil Specimen Cylinder: >24 H

Source of Water: Potable

MDD/OMC and Atterberg limits supplied by Cardno UNG NT

MDD: 1.89 t/m³

OMC: 11.5 %

% retained 19.0mm sieve: 0 %

LL: 26 %

PL: 18 %

PI: 8 %

LS: 3.0 %



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N. J. Richardson



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(-08/10)

REPORT ON EMERSON CLASS NUMBER OF A SOIL

Sheet 2 of 3

Darwin Laboratory

CLIENT:	Golder Associates Pty Ltd	JOB NO.:	U32972	LAB REF NO.:	121729
PROJECT:	Geotechnical Lab Testing -- Roper Bar Stream	SAMPLED BY:	Client	DATE:	04/06/12
LOCATION:	GTP 12-01; 1.5m	TESTED BY:	AT	DATE:	29/06/12
MATERIAL:	Sandy Silt	CHECKED BY:	AT	DATE:	29/06/12
TEST PROCEDURES:	AS 1289.3.8.1	CLIENT REF:			

Soil Description: Sandy Silt

Type of Water Used: Distilled

Temperature of Water: 25.0 °C

Emerson Class Number: 5



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Authorised Signatory

Anthony Tucker
ANTHONY TUCKER



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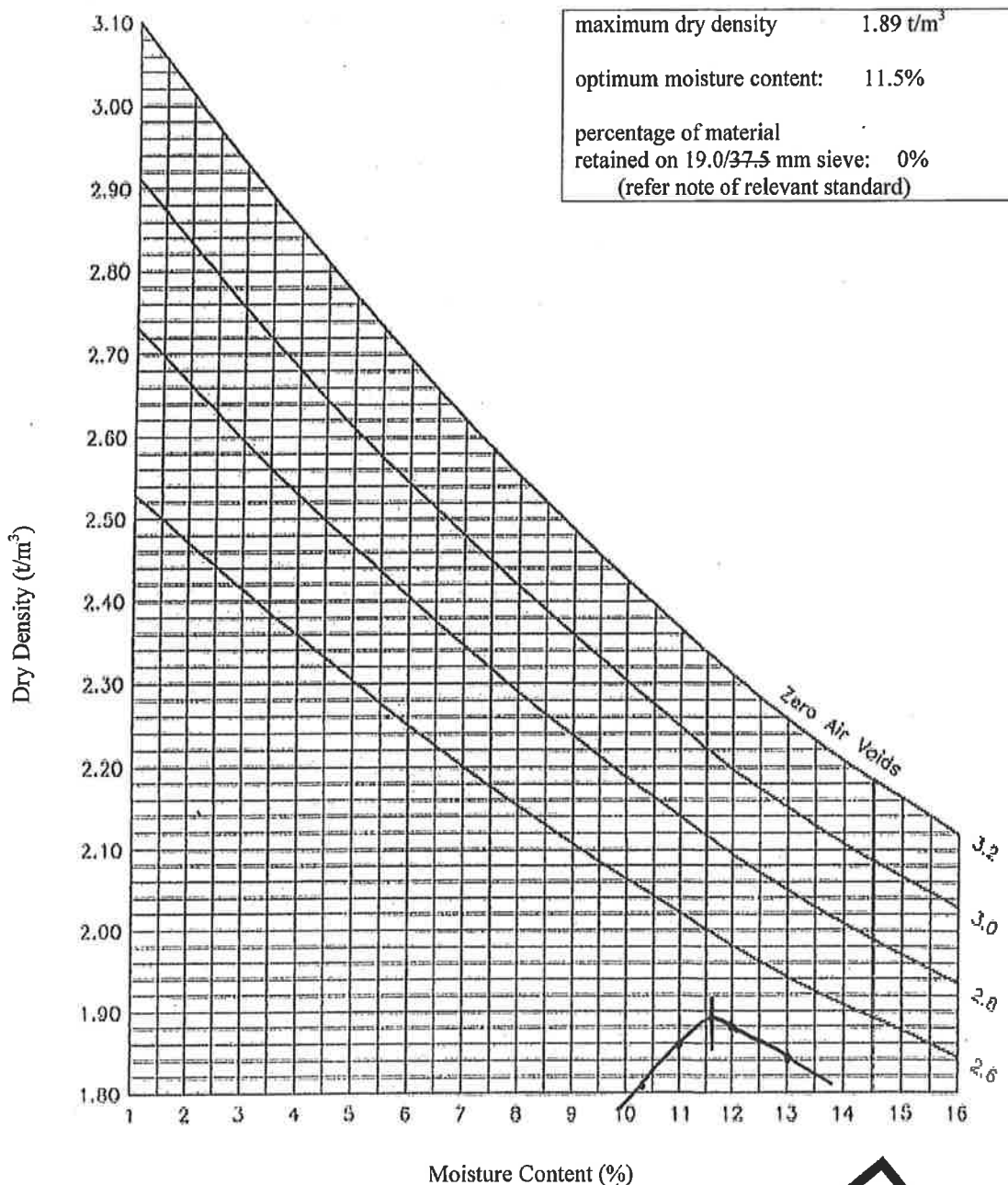
-/08/10)

REPORT ON MAXIMUM DRY DENSITY/OPTIMUM MOISTURE CONTENT

Sheet 3 of 3

Darwin Laboratory

CLIENT:	Golder Associates Pty Ltd	JOB NO.:	U32972	LAB REF. NO.:	121729
PROJECT:	Geotechnical Lab Testing – Roper Bar Steam	SAMPLED BY:	Client	DATE:	04/06/12
LOCATION:	GTP 12-01; 1.5m	TESTED BY:	ML	DATE:	22/06/12
MATERIAL:	Sandy Silt	CHECKED BY:	JD	DATE:	29/06/12
TEST PROCEDURES:	AS1289.5.1.1	CLIENT REF:			



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Date of Issue: 29/6/12

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APPENDIX D

Limitations (LEG04 RL1)

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