Golder Associates Pty Ltd
A.B.N. 64 006 107 857

25 McIlwraith Street
South Townsville, Qld 4810, Australia
(PO Box 5298, Townsville MC, 4810)
Telephone (07) 4724 0311
Fax (07) 4724 0511
http://www.golder.com

REPORT ON

TOWNSVILLE OCEAN TERMINAL PROJECT
PRELIMINARY GEOTECHNICAL AND ACID SULPHATE SOILS INVESTIGATION
TOWNSVILLE, QUEENSLAND

Submitted to :

City Pacific Limited
Santa Cruz House
Santa Cruz Boulevard
ISLAND QUAYS QLD 4226

DISTRIBUTION:

2 Copies	-	City Pacific Limited (1 bound & 1 CD)
1 Copy	-	Golder Associates Pty Ltd

July 2007 102-06692015

TABLE OF CONTENTS

SECTION **PAGE**

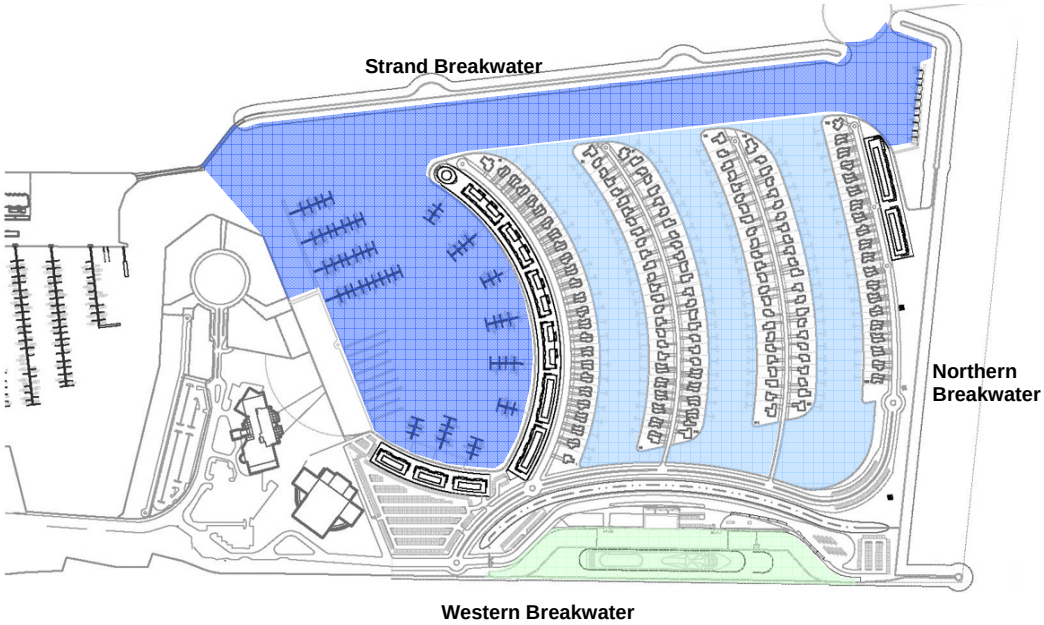
LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION

Golder Associates Pty Ltd has been retained as the geotechnical consultant for the Townsville Ocean Terminal Project by City Pacific Limited. The project consists of a dedicated Cruise Terminal and wharf cut into the existing Port Western Breakwater and an integrated residential and tourism development on reclaimed fingers of land. The following sketch shows the proposed development layout.



For construction of the project a significant volume of fill is required. Volumes in the order of 2.5 million m^3 are required for general filling requirements and approximately 220,000 m^3 of imported rock for revetments, core fill etc.

The shading on the above plan indicates the proposed excavation levels for the project.

This report has been prepared to provide geotechnical advice to the project for preliminary design purposes and to provide information for use within the Environmental Impact Statement (EIS).

This report has been divided into sections. The first section is the Geotechnical and Acid Sulphate Soils Report with all appendices and technical notes. The second section has been added to provide a direct response to the sections within project's EIS Terms of Reference.

2.0 THE SITE

The site is an area of approximately 70Ha adjacent to Townsville Breakwater. It is bounded to the East and North by existing rock revetment walls (Western and Northern Breakwaters) and to the south by Breakwater Island reclamation. The site is inundated by the sea except for small areas in the north-eastern and south-eastern corners which are partially exposed during very low tides. The site's location is shown in the figure below.

3.0 REGIONAL GEOLOGY

Review of the Queensland Department of Mines (1:250,000 scale) geological map of the Townsville Region indicates that the site is underlain by Quaternary-age alluvium and colluvium sediments, in turn underlain by Late-Palaeozoic age Granite.

3.1 Tides

The Maritime Safety Queensland's "Tide Tables and Boating Safety Guide 2006" notes the following tidal data for Townsville Port:

- Lowest Astronomical Tide (LAT) is 0.00 m LAT = -1.856 m AHD
- Highest Astronomical Tide (HAT) is 4.01 m LAT = +2.154 m AHD

4.0 THE INVESTIGATION

4.1 Investigation Methods

The investigation of the site has been undertaken in several phases, using a range of investigation techniques:

- A grid of 50 vibracore holes (BH-1 to BH-50)

- Six over-water geotechnical boreholes (TOT-1 to TOT-6) and one on-land borehole (TOT-7). TOT-1, TOT-2 and TOT-7 were subsequently converted to groundwater monitoring bores and prefixed with MW ie MWTOT-1, MWTOT-2 and MWTOT-7.

- Two bulk "ooze" (very soft surficial sediment) samples were taken using an excavator on a barge. This was undertaken for an option that is no longer to be considered and therefore is not discussed in any detail within this report's text.

4.1.1 Vibracore Holes

To investigate the properties of the sediments immediately on the sea floor (the ooze), 50 bores were undertaken using vibracoring techniques, from the James Cook University Research Vessel "The Kirby". The Kirby is shown anchored at the mouth of Ross River in the photograph below. The vibracoring equipment can be seen in the raised position protruding from the stern of the vessel.

The James Kirby and Vibracore equipment

These 50 bores (BH-1 to BH-50) sampled the full column of ooze. Refusal was met on the top of the stiff sandy clay below it. Continuous samples were recovered within 62mm diameter PVC tubes; these were sealed and stored below 4^0C.

4.1.2 Geotechnical Boreholes

Conventional over-water geotechnical drilling techniques were used to investigate locations TOT-1 to TOT-6. TOT-1 and TOT-2 were then converted to groundwater monitoring wells upon completion of drilling, testing and sampling. A single on-land borehole, TOT-7, was drilled and also converted to a monitoring well upon completion.

A Gemco 210B mounted on a modular barge system was used for the over-water drilling (see adjacent photograph).

Barge mounted Gemco 210B

4.1.3 Bulk Ooze Sampling

A third stage of sampling was undertaken at the request of City Pacific. An excavator mounted on a barge was used to take large volume samples of ooze material for blending and lime stabilisation trials. The adjacent photograph shows the sampling configuration used. Refer to Appendix E for details.

Barge mounted Excavator

4.2 Investigation Locations and Field Testing

The vibracore locations (BH-1 to BH-50) were chosen to provide a grid of sample locations across the site. The samples recovered from these locations were used to provide information on the geotechnical properties of the ooze and also to undertake Acid Sulphate Soils assessment.

The borehole locations for BH-1 to BH-50 are shown on the attached Figure 1. Borehole Reports are presented in Appendix A. Figure 2 shows boreholes TOT-1 to TOT-7. Borehole Reports are presented in Appendix B. These should all be read in conjunction with the accompanying explanatory notes.

Sea bed levels at BH-1 to BH-50 were recorded via a long shot laser level that was positioned on the existing rock revetment walls. The location of the laser was moved to different locations around the perimeter of the site during the investigation. A levelling staff and laser receiver were used off the side of the James Kirby to directly measure sea bed levels. The laser level locations were marked and later surveyed by Brazier & Motti to provide RLs for the laser locations. RLs were then calculated for each of the investigation locations.

Field tests (pH_F and pH_{FOX}) were conducted on all the soil samples recovered from BH-1 to BH-50 to depths of about 3m below sea bed level and on samples recovered from MWTOT-1 to MWTOT-6 to depths of about 7m below sea bed level. The pH_F tests were conducted on a portion of each recovered sample by mixing small individual subsamples of soil and deionised water (ratio of 1:5 respectively) and measuring the pH using a calibrated pH meter. The pH_{FOX} tests were conducted on recovered samples following the addition of 30% laboratory-grade hydrogen peroxide. A description of the strength of reaction with peroxide and the pH_{FOX} measured using a calibrated pH meter were recorded for each sample. The field test results (pH_F, pH_{FOX}, reaction strength) and interpreted PASS potential (high, moderate or low) are tabulated in Appendix C and shown on the cross sections in Figures 3 to 6.

Soil samples collected for the acid sulphate soil investigation were immediately sealed, labelled and stored on ice in the James Kirby on board cold room. The samples were then transported to Golder Associates' Townsville office. At the office, samples were stored in a regulated cold storage room until samples for laboratory analyses were selected.

Within the geotechnical investigation boreholes broad spectrum sampling for Acid Sulphate Soils was undertaken for materials below the surface ooze. Geotechnical field testing and sampling were undertaken at regular intervals down each borehole.

The three groundwater monitoring wells MWTOT-1, MWTOT-2 and MWTOT-7 were initially developed after installation, and groundwater samples were collected following purging of three borehole volumes. Collected water samples were stored in a chilled Esky until submitted to C&R Consulting for scheduling of analysis and interpretation of results.

All soil and groundwater sampling in the boreholes and monitoring bores, subsequent field testing on samples recovered from the boreholes, and storage and transportation of samples was carried out using methods which conform to the QASSIT Guidelines requirements (Reference 1).

5.0 GROUND CONDITIONS ENCOUNTERED

The ground conditions encountered at each investigation location are recorded in the borehole record sheets presented in Appendix A (BH-1 to BH-50) and Appendix B (TOT-1 to TOT-7). Cross sections of the conditions encountered are presented in Figures 3 to 6.

5.1 Ooze

From the 50 vibracore holes it was found that sea bed ooze sediments materials range from 1.3m to 3.1m thick across the site. Figure 4 presents a contoured plan showing this.

Examination of the cores recovered from these locations indicates a mixture of organic extremely soft to soft silty clay to clayey silt with very loose and loose sand to silty sand to clayey sand.

Clay and silt content represents approximately 70% of the ooze.

The ooze materials are highly compressible and would lead to high ground settlements if the ooze is not removed before site reclamation.

5.2 Below the Ooze

In general, stiff to hard clay and sandy clay was encountered below the ooze. Medium dense to very dense sands were encountered bedded within these clayey strata at the following depths in the bores.

TOT-1	TOT-2	TOT-3	TOT-4	TOT-5	TOT-6
RL -8.0 to -10.5m	RL -10.8 to -13m	RL -10.9 to -12.8m	RL -11.1 to -13.4m	RL -7.2 to -9.75m	RL -7.6 to -11.65m
Medium dense to dense sand	Medium dense to dense then dense sand/ clayey sand	Dense sand	Dense sand	Medium dense sand/ clayey sand	Dense to very dense sand

No soft compressible material was encountered below the surficial ooze deposits.

5.3 Groundwater

The site is below sea level and is inundated by the sea.

6.0 LABORATORY TESTING

6.1 Acid Sulphate Testing

Following a review of the field pH_F and pH_{FOX} tests and the soil profiles, a set of 43 soil samples were selected for laboratory chromium suite analysis. These tests were conducted by SGS Environmental Services Pty Ltd (SGS). Laboratory test certificates are presented in full and the Chromium Suite results are summarised in Table C-1, all in Appendix C.

6.2 Geotechnical Testing

Soil samples were selected from TOT-1 to TOT-6 and were submitted to a NATA registered laboratory for testing to determine plasticity, particle size distribution and dispersion characteristics. Laboratory test reports are presented in Appendix D.

7.0 DISCUSSION OF RESULTS

7.1 Acid Sulphate Soils

7.1.1 Stratigraphy

As discussed in Section 5.0 the site stratigraphy found comprises two distinct layers:

- Ooze. The surface layer of ooze material is comprised of recent marine sediments generally consisting of a mixture of organic extremely soft to soft silty clay to clayey silt with very loose and loose sand to silty sand to clayey sand. Shell fragments commonly occur within this layer. The ooze is easily identified by its dark hue and very soft and very loose consistency.

- Below the Ooze. Materials underlying the ooze are older stiff to hard clays and sandy clays and medium dense to very dense clayey sands and sands. These materials are much lighter in colour than the ooze.

Soil profiles across the site are shown on the inferred cross sections in Figures 4 to 6.

7.1.2 Field Tests

The field screening tests generally indicated the following:

- The field pH measurements on all soil samples were above 7 and therefore no indications of actual acid sulphate soils (AASS) were detected.

- A low PASS potential was indicated in all soil samples from the surface ooze layer. It should be noted however, that field tests in saturated soils from estuarine areas generally provide a poor indication of the presence of potential acid sulphate soils (PASS) due to the buffering capacity of saltwater within soil pore spaces.

- A low PASS potential was indicated in all soil samples collected from below the ooze layer.

Interpreted field test results are shown on the inferred cross sections in Figures 4 to 6.

7.1.3 Laboratory Chromium Suite Tests

Excavation for the wharf, canals, super yacht access, etc. will result in disturbances of greater than 1000 tonnes and thus an Action Criterion of 0.03%S will apply for this project. Table C-1 provides a summary of whether the samples tested are AASS or PASS based on this Action Criterion. Liming rates required to neutralise the Net Acidity (derived from the Chromium Suite tests) are also presented in Table C-1. As indicated in the table, a Fineness

Factor of 3 was adopted for the calculation of net acidity to account for shell materials in the soil profile. The Chromium Suite tests indicated the following:

- Existing acidity in all samples analysed were below the laboratory limit of reporting, indicating AASS conditions are not currently present within the depth of investigation at this site.
- Surficial ooze materials generally have concentrations of Chromium Reducible Sulfur exceeding the Action Criterion of 0.03%S. It is noted that laboratory tests indicate that these soils also have sufficient acid neutralising capacity to produce a calculated net acidity below the Action Criterion. This suggests that these soils would be "self neutralising" (i.e. additional neutralising treatment might not be required). However, experience with disturbance of large quantities of similar "self neutralising" soil has shown that some acidity is still produced in excavated stockpiles. Therefore it is recommended that management measures be adopted to deal with "incidental" acid generation (and associated impacts) where ooze materials are excavated, drained or dewatered for periods of greater than 24 hours.
- Testing of the deeper deposits of stiff to hard clays and dense sands underlying the ooze layer confirmed that these materials are not PASS. No specific management of these materials is required.

8.0 PROPOSED CONSTRUCTION METHODOLOGY

Advice provided, confirmed in a separate Construction Methodology Report (prepared by Hyder), is that the project will be constructed using the following generalised approach:

- A low permeability bund will be constructed around the site and the site dewatered by pumping out from inside. Construction is to undertaken "in the dry" using conventional earthworks techniques, plant and machinery.

- The ooze material will generally not be left in place under the reclaimed development fingers. The canals and waterways for the project will be over-excavated and the ooze material from the full footprint of the site will be buried in these over-excavated zones. The only exceptions to this will be for: an initial access road where the ooze will be left in place; and adjacent to the northern breakwater in an area to be parkland, which will have some volumes of ooze deposited as fill.

- The fill to be used for reclamation of the land fingers will be won from the deeper deposits of stiff to hard clays and dense sands that are excavated to form the canals (ie below the ooze). Any additional fill that is required for the project will be imported.

- For the wharf, piles will be installed "over water" from barge-mounted equipment after the berth has been excavated by cutter suction dredging (after the TOT berth has been flooded and the existing section of the Port Western Breakwater is relocated).

- Internal bridges etc will be constructed “in the dry”.

- Bridges for the Strand Breakwater will be constructed from floating platforms and barges.

9.0 EARTHWORKS

9.1 The Ooze

The ooze has very high moisture content and very low shear strength and therefore will be difficult to handle. Traffickability across this material will be very poor, possibly impossible.

Stockpiles of ooze will need to be confined within an excavation or bunds, as the angle of repose of this material is likely to be extremely flat if the material is fluidised after excavation.

The ooze will have a high potential to erode if exposed to rainfall and it is moderately dispersive.

9.2 Materials Below The Ooze

It is understood that the majority of the fill for the project will be won from strip mining the stiff to hard clays and dense sands from below the footprint of the canals and waterways. It is understood that these excavations will be in the order of 8-10m deep.

Excavations for canals and waterways into the stiff to hard clays and dense sands are expected to be achievable using high capacity hydraulic earthmoving plant such as heavy excavators.

Materials that are excavated from site are expected to be geotechnically suitable for re-use as fill provided any organic or oversize (>75 mm) materials are removed and the materials are appropriately moisture conditioned (ie moistened or dried as needed) on placement. Compacted clayey fills may be somewhat expansive after construction, and this will need to be assessed afterwards and taken into account in design.

Excavations should be battered or benched to a stable angle, or otherwise positively supported to prevent instability.

Canal excavations will require dewatering, both for construction “convenience” and traffickability, and for maintaining batter slope stability. In excavations in clayey soils, grading excavations to collect water and pumping from sumps, should be allowed for. Depressurisation will be needed in sandy layers prior to excavating to close above them, to prevent “blowing” of ground associated with trapped excess water pressure.

It should be noted that even after dewatering has been undertaken there is the potential for perched water to remain within some pockets in the natural ground.

9.3 Reuse of Materials – Fill Placement

Fill layer thickness on placement will depend upon the type of compaction equipment used by the contractor but should not be generally greater than 200 mm loose thickness. The following compaction standards are recommended for the project.

Table 1: Compaction Standards

	Compaction	Moisture Content
Clay or Sandy Clay Fill:		
General filling	98% Standard	+3% to - 1% OMC
Upper 1m under building envelopes and roadways	98% Standard	+3% to - 1% OMC
Sand or Clayey Sand Fill:		
General filling	75% density index	+3% to - 1% OMC
Upper 1m under building envelopes and roadways	75% density index	+3% to - 1% OMC

Note: OMC – Optimum Moisture Content.

It is recommended that the contractor selected for these earthworks should have demonstrated experience of a clear understanding of the requirements of placement of plastic clay fill. Close moisture content control will be required for compaction.

For construction of the canal fingers it is understood that localised short-term batter angles of 1:0.5 (v:h) are planned behind retaining wall backfill. At these locations it is recommended that the fill is over-placed at 1:1 (v:h) or flatter and then cut back to the required profile immediately prior to retaining wall construction and placement of backfill.

9.4 Dispersion and Erosion

Dispersibility and erosion potential for the development will be predominantly associated with any temporarily exposed materials during construction.

Past experience with similar sites indicates that the stiff sandy clays (etc) encountered below the ooze at the site in general have a low to moderate potential for dispersion. However, erosion and dispersion can still occur through rain-drop impact, rainfall run-off and run-off associated with water/groundwater redirected through the site. To reduce this potential, it is suggested that erosion and sediments generated from slope-wash could be managed and controlled with the following methods:

- compaction of exposed soils at an appropriate density and moisture content;
- silt fences at down-slope boundaries of construction works;

- perimeter diversion drains around earthworks;
- paving or re-vegetating exposed soils as soon as possible following their completion.

10.0 STABILITY OF REVETMENTS AND BATTER SLOPES

The stability of revetments and batter slopes of the project have been analysed. In brief summary, the findings are that the profiles proposed, as known to us at this stage of reporting, will have factors of safety against instability that are "adequate" according to normal practice.

This analysis is presented in some detail in Appendix F.

Note that additional detail-focused analyses will be needed at the detailed design stage of the project, and that additional testing will be warranted at that time to provide more refined and location-specific inputs for the analyses to be made.

11.0 SEEPAGE AND DEWATERING/DEPRESSURISATION

A detailed analysis has been made of potential for seepage and dewatering/depressurisation requirements for the project. These analyses are presented in some detail in Appendix G.

Note that the analyses confirm the need for some form of positive depressurisation of sand layers bedded within the stiff to hard clays (etc) within the proposed excavation depth for canals and waterways (and ooze disposal) on the site. The initial indication is that this could take the form of either "active" pumped-out wells or Passive" open wells on a grid across the site. Note that the spacing of this grid and the details of wells are likely to vary from those details postulated in Appendix G, after design-level analyses are made fro optimisation of this important aspect.

Note also that the analyses related to seepage through revetments indicated the need for heavy construction-period pumping to maintain the site in a dewatered site during the course of construction.

12.0 DEVELOPMENT FOUNDATIONS

The following all assumes that construction has been in accordance with the Construction Methodology Report, and with any guidelines presented in the foregoing (in particular in regard to earthworks and compaction).

12.1 Foundations – One And Two Storey Structures

Foundations for relatively lightweight domestic-style one and two storey structures (ie houses) could comprise stiffened rafts or driven piles of "light" structural capacity.

In accordance with Australian Standard AS2870-1993 "Residential slabs and footings – construction", the reclaimed land would be initially classified as "Class P" due to the presence of fill. However site-specific testing plus consideration of satisfactory earthworks materials and compaction records should permit reclassification to (say) Class H.

For houses up to two storeys high, it is suggested that, until shown to be otherwise, preliminary-planning of stiffened raft design be based on movements equivalent to a "Class H" site. This equivalent movement would be expected to include components of settlement of the materials within the fill and under the reclamation as well as shrink / swell (ie "expansive") type seasonal movements within the foundation materials.

Lot specific investigation will be required. However, based on the investigation work undertaken to date, an allowable bearing pressure of 50 kPa is suggested under raft slabs.

Structures supported on raft-slab footings should be located no closer than 10 m from the top of any proposed revetment wall, unless specific design and analysis has been undertaken to allow such placement for each occasion.

Alternatively structures could be supported on piles, founding in the stiff to very stiff clays/medium dense sands underlying the fill. The slab design of suspended slabs cast at ground level would then need to consider the potential for shrink-swell movements occurring.

12.2 Foundations – Three Storey Structures and Higher

For structures of three stories and higher, or lower-height movement-sensitive buildings, piled foundations will be required. Suitable pile types will include driven precast concrete or driven cast insitu piles. Such piles would be expected to be driven to found in, or socket into, the stiff to hard clays or the dense to very dense clayey sands and/or weathered granite encountered below the site, depending on capacities required.

Design of driven piles should be in accordance with Australian Standard AS2159-1995 "*Piling – Design and installation*".

It is recommended that piles are installed on a "design and construct" (D&C) basis and the pile capacities are made the responsibility of the contractor.

12.3 Wharf Structure

Foundations for the wharf structure will need to be piled. Driven concrete or hollow steel tube piles could be used for the project, although other driven or cast insitu pile types may also be suitable.

Driven piles would reach a "set" (ie penetration resistance) adequate to carry the design loads with penetration into the hard clays or sandy clays or the dense to very dense sands below

approximately RL-10m to RL-14m. Preboring or chopping & coring is likely to be required to achieve penetration into these materials especially where toe levels of piles are required to be below the depth of the proposed adjacent berth pocket (approx RL -13.6m AHD).

Design of piles should be in accordance with Australian Standard AS2159-1995 "*Piling – Design and installation*".

Assessment of foundation capacity should consider 'group action' where piles are closely spaced, with group capacity being possibly less than the sum of individual pile capacity.

It is recommended that piles are installed on a "design and construct" (D&C) basis and the pile capacities are made the responsibility of the contractor.

13.0 PAVEMENTS ON FILL (AND TRAFFICKABILITY)

Previous experience with pavements for the adjacent Breakwater Island development show that the fill materials for the project might have low CBRs, possibly less than 5. Once constructed, location-specific subgrade testing will be needed to permit rational design.

To help reduce traffickability problems associated with wet weather during construction, exposed subgrades should be graded such that they readily shed water and prevent ponding. Consideration should also be given to placing a granular traffickability layer over areas that require all-weather access.

14.0 SETTLEMENTS

14.1 The Developed Site - Generally

Settlements in properly filled areas will largely be dependant on the distribution of materials placed within the fill and the compaction achieved during construction. Assuming a reasonably uniform 98% standard compaction is achieved within a stiff to hard clay and/or sandy clay and/or clayey sand and/or sand fill material, the following swell/settlement movements are expected on the site generally:

- Total settlements/heaves for the site have been assessed to be in the order of +/-40mm assuming an additional 10kPa site load (structure and/or filling). Differential settlements should be around 50% of total settlements. Swelling (ie heave) is most likely within the placed fill material within the first year or so after site development, with settlement more likely in later years.

14.2 Areas Filled With Compressible Ooze

Very high settlements are anticipated where ooze material has been used as filling or left in place below fill, eg as proposed in the park land areas at the northern end of the site. Calculated settlements are presented below for these areas:

- 40-80mm per 1m of fill load per 1m thickness of ooze

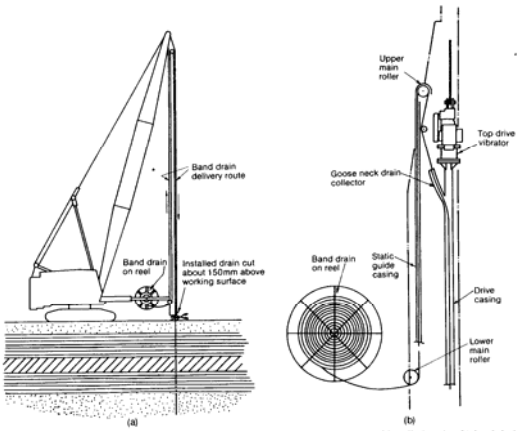


Fig. 2. Schematic sketch of a band drain installation rig: (a) general arrangement of installation rig; (b) band drain delivery arrangement

Differential settlements would probably be around 50% of total settlements.

Allowance should be made for methodical topping up the level of such areas from time-to-time after development, unless settlements are to be induced prior to the end of construction by preloading.

Batter slopes on the outside of any placed preload will need to be a maximum of 1:3 (h:v) to help reduce the potential for instability. Some half height berms may be required, dependent on planned preload height.

Consolidation could be accelerated markedly by installation of wick drains, which would act to allow rapid vertical drainage of pore water out of the ooze. Wick drains are available from a number of contractors in Queensland and have become relatively economical in recent years.

Note that, if wick drains are used, provision must be made for the pore water from each vertical wick to escape horizontally from the top of the wick. This could be achieved on this site by using more-or-less “clean” rock fill for the lowest 300-500mm thickness of preload material, also by coupling the tops of the wicks together by “stapled on” horizontal strips of wick material.

Wick drain spacing will influence the time required for consolidation to occur. This matter can theoretically be calculated, but such calculations are not reliable. Our experience-based assessment (which must be tested by analysis at the time of detailed design) is that a wick spacing of 1.2-1.5m would reduce the consolidation time of a deep ooze fill to about 1-2 years, with a 3m high preload surcharge.

Preload monitoring will be needed to provide information on degree of settlement achieved, to assess when any preload can be removed.

15.0 IMPORTANT INFORMATION

Your attention is drawn to the document - "Important Information about your Geotechnical Engineering Report", which is included in Appendix H of this report. This document has been prepared by the ASFE *(Professional Firms Practicing in the Geosciences)*, of which Golder Associates is a member. The statements presented in this document are intended to advise you of what your realistic expectations of this report should be, and to present you with recommendations on how to minimise the risks associated with the groundworks for this project. 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.We would be pleased to answer any questions about this important information from the reader of this report.

GOLDER ASSOCIATES PTY LTD

Wyn Binmore
Manager Townsville

CLIENT: City Pacific		PROJECT: Townsville Oceean Terminal	
DRAWN: AOB	DATE: 28/06/07	TITLE: **DUCK POND PROBE TEST LOCATIONS**	
CHECKED: WB*	DATE: 28/06/07		
SCALE: 1:10,000		PROJECT No: 06692015	FIGURE No: 1 / REV No: 0 / **A4**

File Location: \\Cns1-s-file01\Spatial (S:)\GIS_Jobs\Townsville.06\06692015-TOT\GIS\Projects\ArcGIS\06692015-DuckPond-Fig01-ProbeTestLocations-A4-Rev0.mxd
Note: The * beside the typed initials denotes the original drawing issue was signed or initialled by that respective person.

Golder Associates	CLIENT: City Pacific	PROJECT: Townsville Oceean Terminal	
	DRAWN: AOB — DATE: 28/06/07	TITLE: **DUCK POND BOREHOLE LOCATIONS**	
	CHECKED: WB* — DATE: 28/06/07		
	SCALE: 1:10,000	PROJECT No: 06692015	FIGURE No: 2 — REV No: 0 — **A4**

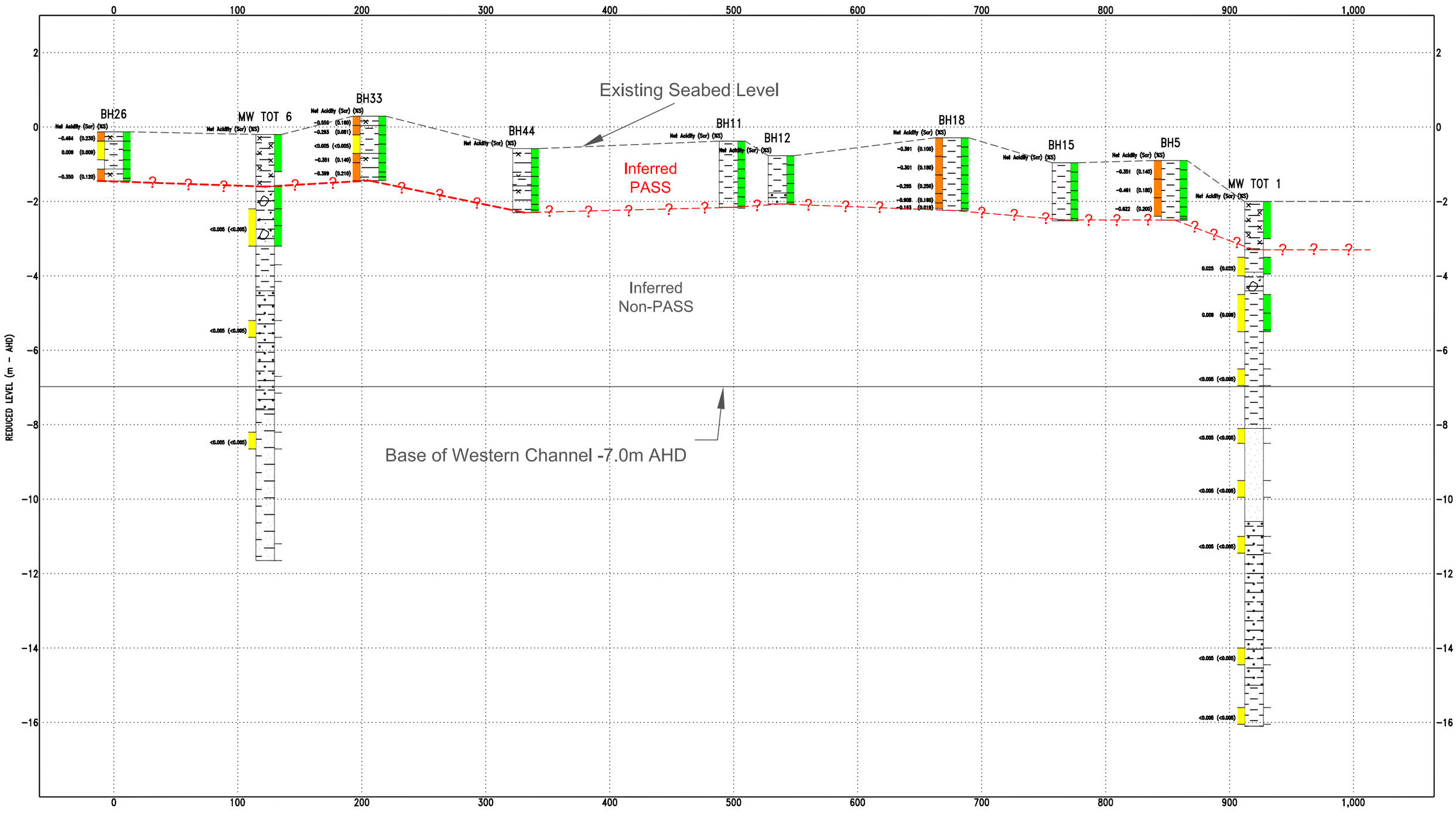
File Location: \\Cns1-s-file01\Spatial (S:)\GIS_Jobs\Townsville.06\06692015-TOT\GIS\Projects\ArcGIS\06692015-DuckPond-Fig02-BoreholeLocations-A4-Rev0.mxd

Note: The * beside the typed initials denotes the original drawing issue was signed or initialled by that respective person.

Golder Associates

CLIENT: City Pacific		PROJECT: Townsville Oceean Terminal	
DRAWN: AOB	DATE: 19/07/07	TITLE: **DUCK POND INVESTIGATION AND CROSS SECTION LOCATIONS**	
CHECKED: WB*	DATE: 19/07/07		
SCALE: 1:10,000		PROJECT No: 06692015	FIGURE No: 3 / REV No: 0 / **A4**

File Location: \\Cns1-s-file01\Spatial (S:)\GIS_Jobs\Townsville.06\06692015-TOT\GIS\Projects\ArcGIS\06692015-DuckPond-Fig03-InvestigationAndSectionLocations-A4-Rev0.mxd
Note: The * beside the typed initials denotes the original drawing issue was signed or initialled by that respective person.



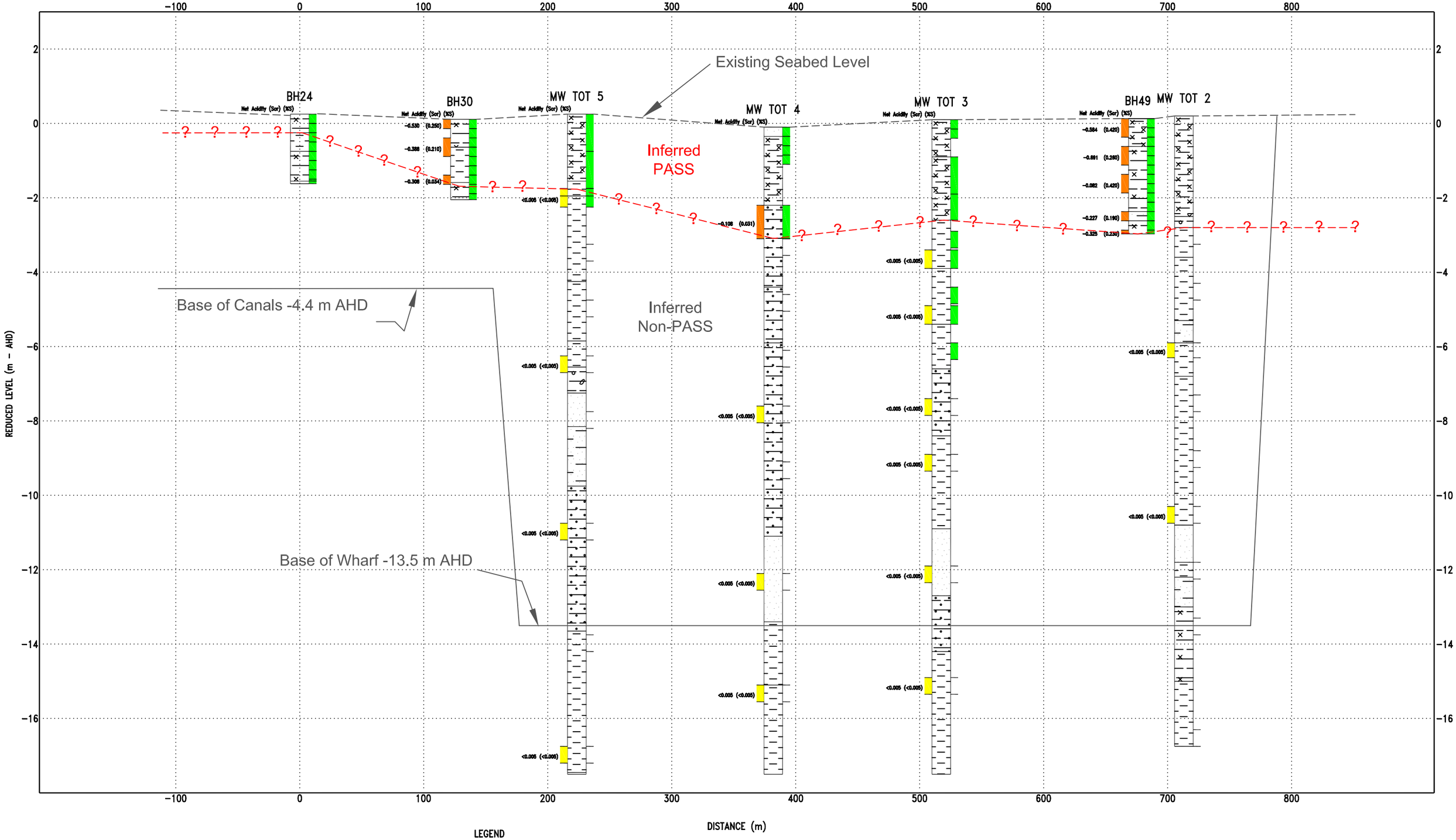
LEGEND

FIELD INDICATORS
- HIGH FIELD PASS POTENTIAL
- MODERATE FIELD PASS POTENTIAL
- LOW FIELD PASS POTENTIAL

LABORATORY TESTS
- EXCEEDS QASSIT ACTION LEVEL
- BELOW QASSIT ACTION LEVEL

- CLAY
- Sandy CLAY
- Silty CLAY
- Clayey SILT
- Sandy Gravelly CLAY
- SAND
- Clayey SAND

CLIENT: City Pacific Limited		PROJECT: Townsville Ocean Terminal – Project Site	
DRAWN: MYB	DATE: 18/07/2007	TITLE: CROSS SECTION A – A (WESTERN CHANNEL)	
CHECKED: PKS	DATE: 21/07/2007		
SCALE: H 1:3000 V 1:100	A3	PROJECT No: 06692015	FIGURE No: Figure 4



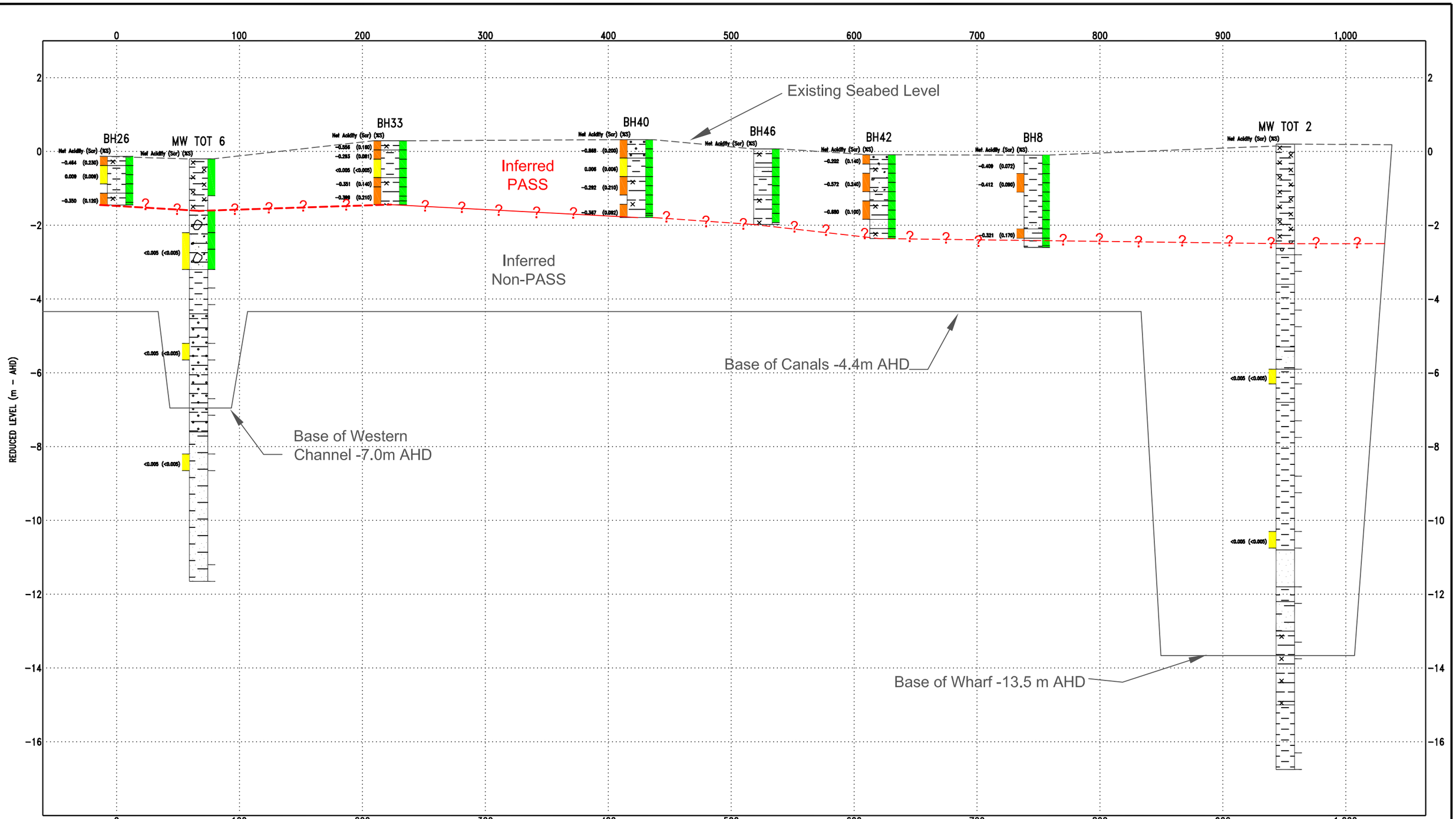
LEGEND

FIELD INDICATORS
- HIGH FIELD PASS POTENTIAL
- MODERATE FIELD PASS POTENTIAL
- LOW FIELD PASS POTENTIAL

LABORATORY TESTS
- EXCEEDS QASSIT ACTION LEVEL
- BELOW QASSIT ACTION LEVEL

- Silty CLAY
- CLAY
- SAND
- Clayey SILT
- Clayey SAND
- Gravelly CLAY
- Sandy CLAY

CLIENT: City Pacific Limited		PROJECT: Townsville Ocean Terminal – Project Site	
DRAWN: MYB	DATE: 18/07/2007	TITLE: CROSS SECTION B – B (WHARF)	
CHECKED: PKS	DATE: 21/07/2007		
SCALE: H 1:3000 V 1:100	A3	PROJECT No: 06692015	FIGURE No: Figure 5



FIELD INDICATORS
- HIGH FIELD PASS POTENTIAL
- MODERATE FIELD PASS POTENTIAL
- LOW FIELD PASS POTENTIAL

LABORATORY TESTS
- EXCEEDS QASSIT ACTION LEVEL
- BELOW QASSIT ACTION LEVEL

LEGEND
- Silty CLAY
- CLAY
- Sandy CLAY
- Sandy Silty CLAY
- SAND
- Clayey SAND
- Clayey SILT
- Gravelly CLAY
- Sandy Gravelly CLAY

Golder Associates

CLIENT	City Pacific Limited	PROJECT	Townsville Ocean Terminal – Project Site
DRAWN	MYB	DATE 18/07/2007	TITLE CROSS SECTION C – C
CHECKED	PKS	DATE 21/07/2007	
SCALE	H 1:3000 V 1:100 A3	PROJECT No 06692015	FIGURE No Figure 6

NOTE: THE * BESIDE THE TYPED INITIALS DENOTES THE ORIGINAL DRAWING ISSUE WAS SIGNED OR INITIALLED BY THAT RESPECTIVE PERSON.

APPENDIX A

Borehole Records BH1 – BH50

REPORT OF BOREHOLE: BH1

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 482149 m E 7872144 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: -0.26 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: AOB DATE: 27/9/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 1.93 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	-0.26	DS 0.00-0.25m				CLAY Grey			
					DS 0.25-0.50m							
			0.5		DS 0.50-0.75m							
					DS 0.75-1.00m							
			1.0		DS 1.00-1.25m					W		
				1.25 -1.51	DS 1.25-1.50m				- With some medium grained sand and trace of shell fragments			
			1.5	*1.50* -1.76	DS 1.50-1.75m				- Grey/brown			
					DS 1.75-1.83m							
					DS 1.83-1.93m							
				1.93 -2.19					END OF BOREHOLE @ 1.93 m Depths shown from current Bed Level			
			2.0									
			2.5									
			3.0									

REPORT OF BOREHOLE: BH2

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 482070 m E 7872193 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: -0.41 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: AOB DATE: 27/9/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 1.93 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	-0.41	DS 0.00-0.25m				CLAY Grey			
					DS 0.25-0.50m							
			0.5		DS 0.50-0.75m							
				0.75 -1.16	DS 0.75-1.00m				- With some medium grained sand	W		
			1.0		DS 1.00-1.25m							
					DS 1.25-1.50m							
			1.5		DS 1.50-1.75m							
					DS 1.75-1.83m							
				1.93	DS 1.83-1.93m							
				-2.34					END OF BOREHOLE @ 1.93 m Depths shown from current Bed Level			
			2.0									
			2.5									
			3.0									

REPORT OF BOREHOLE: BH3

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 482094 m E 7872273 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: -0.38 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: AOB DATE: 27/9/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 1.90 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	-0.38	DS 0.00-0.25m				CLAY Grey, trace medium grained sand			
					DS 0.25-0.50m							
			0.5		DS 0.50-0.75m							
					DS 0.75-1.00m							
			1.0		DS 1.00-1.25m					W		
				1.25 -1.63	DS 1.25-1.35m				Clayey SAND Fine to medium grained sand, grey			
				1.35 -1.73	DS 1.35-1.50m				CLAY Grey, with some medium grained sand			
			1.5		DS 1.50-1.80m							
					DS 1.80-1.90m							
				1.90 -2.28					END OF BOREHOLE @ 1.90 m Depths shown from current Bed Level			
			2.0									
			2.5									
			3.0									

REPORT OF BOREHOLE: BH4

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481942 m E 7872396 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: -0.53 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: AOB DATE: 27/9/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 1.70 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	-0.53	DS 0.00-0.25m				CLAY Grey			
					DS 0.25-0.50m							
				0.50								
			0.5	-1.03	DS 0.50-0.75m				With some medium grained sand			
					DS 0.75-1.00m					W		
			1.0		DS 1.00-1.25m							
					DS 1.25-1.50m							
			1.5		DS 1.50-1.60m							
					DS 1.60-1.70m							
				1.70								
				-2.23					END OF BOREHOLE @ 1.70 m Depths shown from current Bed Level			
			2.0									
			2.5									
			3.0									

REPORT OF BOREHOLE: BH5

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481934 m E 7872384 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: -0.9 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: AOB DATE: 27/9/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 1.60 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	-0.90	DS 0.00-0.25m				CLAY Grey			
					DS 0.25-0.50m							
			0.5		DS 0.50-0.75m							
				0.75 -1.65	DS 0.75-1.00m				- With some medium grained sand	W		
			1.0		DS 1.00-1.25m							
				1.25 -2.15	DS 1.25-1.50m				- Pale grey			
			1.5		DS 1.50-1.60m							
				1.60 -2.50					END OF BOREHOLE @ 1.60 m Depths shown from current Bed Level			
			2.0									
			2.5									
			3.0									

REPORT OF BOREHOLE: BH6

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 482239 m E 7872038 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: -0.08 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: AOB DATE: 27/9/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 2.20 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	-0.08	DS 0.00-0.25m				CLAY Grey			
					DS 0.25-0.50m							
			0.5		DS 0.50-0.75m							
					DS 0.75-1.00m					W		
			1.0		DS 1.00-1.25m							
				1.25 -1.33	DS 1.25-1.50m				- With somemedium grained sand and shell fragments			
			1.5	*1.50* -1.58	DS 1.50-1.75m				Sandy CLAY Grey, medium grained sand, with some shell fragments			
				1.75 -1.83	DS 1.75-2.00m				CLAY Pale brown/yellow			
			2.0	*2.00* -2.08	DS 2.00-2.10m				- Grey	M		
					DS 2.10-2.20m							
				2.20 -2.28					END OF BOREHOLE @ 2.20 m Depths shown from current Bed Level			
			2.5									
			3.0									

REPORT OF BOREHOLE: BH7

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 482159 m E 7871987 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: -0.07 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: AOB DATE: 27/9/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 2.10 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	-0.07	DS 0.00-0.25m				CLAY Grey			
				0.25 -0.32	DS 0.25-0.50m				Trace fine to medium grained sand			
			0.5		DS 0.50-0.75m							
				0.75 -0.82	DS 0.75-1.00m				With some medium grained sand and shell fragments			
			1.0		DS 1.00-1.25m					W		
					DS 1.25-1.50m							
			1.5		DS 1.50-1.75m							
					DS 1.75-2.00m							
			2.0		DS 2.00-2.10m							
				2.10 -2.17					END OF BOREHOLE @ 2.10 m Depths shown from current Bed Level			
			2.5									
			3.0									

REPORT OF BOREHOLE: BH8

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 482117 m E 7872084 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: -0.1 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: AOB DATE: 27/9/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 2.50 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	-0.10	DS 0.00-0.25m				CLAY Grey			
				0.25								
				-0.35	DS 0.25-0.50m				- With some medium grained sand and shell fragments			
			0.5		DS 0.50-0.75m							
					DS 0.75-1.00m							
			1.0		DS 1.00-1.25m							
					DS 1.25-1.50m							
			1.5		DS 1.50-1.75m							
					DS 1.75-2.00m							
				2.00								
			2.0	-2.10	DS 2.00-2.25m				Clayey SAND - Medium grained sand, grey, with some shell fragments			
				2.25								
				-2.35	DS 2.25-2.50m				CLAY Grey, with some medium grained sand			
			2.5	*2.50*								
				-2.60					END OF BOREHOLE @ 2.50 m Depths shown from current Bed Level			
			3.0									

REPORT OF BOREHOLE: BH9

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481987 m E 7872068 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: -0.44 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: AOB DATE: 27/9/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 1.88 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	-0.44	DS 0.00-0.25m				CLAY Grey, with some fine to medium grained sand and shell fragments			
					DS 0.25-0.50m							
			0.5		DS 0.50-0.75m							
					DS 0.75-1.00m							
			1.0		DS 1.00-1.25m							
					DS 1.25-1.50m							
			1.5		DS 1.50-1.75m							
				1.75 -2.19	DS 1.75-1.80m				Sandy CLAY Grey, medium grained sand, with some shell fragments			
					DS 1.80-1.88m							
				1.88 -2.32					END OF BOREHOLE @ 1.88 m Depths shown from current Bed Level			
			2.0									
			2.5									
			3.0									

REPORT OF BOREHOLE: BH10

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481859 m E 7872059 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: -0.27 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: AOB DATE: 27/9/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 1.87 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	-0.27	DS 0.00-0.25m				CLAY Grey, with some medium grained sand and shell fragments			
					DS 0.25-0.50m							
			0.5		DS 0.50-0.75m							
					DS 0.75-1.00m							
			1.0		DS 1.00-1.25m							
					DS 1.25-1.50m							
			1.5		DS 1.50-1.80m							
					DS 1.80-1.87m							
				1.87 -2.14					END OF BOREHOLE @ 1.87 m Depths shown from current Bed Level			
			2.0									
			2.5									
			3.0									

REPORT OF BOREHOLE: BH11

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481735 m E 7872088 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: -0.38 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: AOB DATE: 27/9/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 1.78 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	-0.38	DS 0.00-0.25m				CLAY Grey, with some fine grained sand			
					DS 0.25-0.50m							
			0.5		DS 0.50-0.75m							
					DS 0.75-1.00m					W		
				1.00								
			1.0	-1.38	DS 1.00-1.25m				- With some medium grained sand and shell fragments			
					DS 1.25-1.50m							
			1.5		DS 1.50-1.75m					M		
				1.78	DS 1.75-1.80m							
				-2.16					END OF BOREHOLE @ 1.78 m Depths shown from current Bed Level			
			2.0									
			2.5									
			3.0									

REPORT OF BOREHOLE: BH12

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481680 m E 7872174 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: -0.77 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: AOB DATE: 27/9/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 1.30 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	-0.77	DS 0.00-0.25m				CLAY Grey, trace fine to medium grained sand			
					DS 0.25-0.50m							
			0.5		DS 0.50-0.75m					W		
					DS 0.75-1.00m							
				1.00								
			1.0	-1.77	DS 1.00-1.25m				Sandy CLAY Grey/brown, medium grained sand	M		
				1.30	DS 1.25-1.30m							
				-2.07					END OF BOREHOLE @ 1.30 m Depths shown from current Bed Level			
			1.5									
			2.0									
			2.5									
			3.0									

REPORT OF BOREHOLE: BH13

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481809 m E 7872169 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: -0.42 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: AOB DATE: 27/9/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 1.73 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	-0.42	DS 0.00-0.25m				CLAY Grey, with trace fine to medium grained sand			
					DS 0.25-0.50m							
			0.5		DS 0.50-0.75m							
					DS 0.75-1.00m					W		
				1.00								
			1.0	-1.42	DS 1.00-1.25m				With some medium grained sand and shell fragments			
					DS 1.25-1.50m							
			1.5		DS 1.50-1.70m					M		
				1.73	DS 1.70-1.73m							
				-2.15					END OF BOREHOLE @ 1.73 m Depths shown from current Bed Level			
			2.0									
			2.5									
			3.0									

REPORT OF BOREHOLE: BH14

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481864 m E 7872275 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: -0.45 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: AOB DATE: 27/9/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 1.89 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	-0.45	DS 0.00-0.25m				CLAY Grey			
					DS 0.25-0.50m							
			0.5		DS 0.50-0.75m							
					DS 0.75-1.00m							
			1.0		DS 1.00-1.25m							
					DS 1.25-1.50m							
				1.50								
			1.5	-1.95	DS 1.50-1.75m				- With some medium grained sand and shell fragments			
					DS 1.75-1.89m							
				1.89								
				-2.34					END OF BOREHOLE @ 1.89 m Depths shown from current Bed Level			
			2.0									
			2.5									
			3.0									

REPORT OF BOREHOLE: BH15

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481808 m E 7872364 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: -0.96 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: AOB DATE: 27/9/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 1.56 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	-0.96	DS 0.00-0.25m				CLAY Grey			
					DS 0.25-0.50m							
				0.50								
			0.5	-1.46	DS 0.50-0.75m				- With some medium grained sand and shell fragments	W		
					DS 0.75-1.00m							
			1.0		DS 1.00-1.25m							
				1.25								
				-2.21	DS 1.25-1.50m				- Brown/grey, with some medium grained sand and shell fragments	M		
			1.5	*1.56*	DS 1.50-1.56m							
				-2.52					END OF BOREHOLE @ 1.56 m Depths shown from current Bed Level			
			2.0									
			2.5									
			3.0									

REPORT OF BOREHOLE: BH16

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481842 m E 7872495 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: -2 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: AOB DATE: 27/9/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 0.15 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	-2.00	DS 0.00-0.15m				CLAY Grey			
			0.15	-2.15					END OF BOREHOLE @ 0.15 m Depths shown from current Bed Level			

0.5
1.0
1.5
2.0
2.5
3.0

REPORT OF BOREHOLE: BH17

SHEET: 1 OF 1

CLIENT: City Pacific Limited
PROJECT: Townsville Ocean Terminal
LOCATION: Project Site
JOB NO: 06692015

COORDS: 481723 m E 7872292 m N 55 MGA94
SURFACE RL: -0.96 m DATUM: AHD
INCLINATION: -90°
HOLE DIA: 62 mm HOLE DEPTH: 1.45 m

DRILL RIG: James Kirby - Vibracore
DRILLER: James Cook University
LOGGED: AOB DATE: 27/9/06
CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	-0.96	DS 0.00-0.25m				CLAY Grey			
					DS 0.25-0.50m							
			0.5		DS 0.50-0.75m					W		
					DS 0.75-1.00m							
				1.00								
			1.0	-1.96	DS 1.00-1.25m				- With some fine to medium grained sand and shell fragments			
					DS 1.25-1.35m					M		
					DS 1.35-1.45m							
				1.45								
			1.5	-2.41					END OF BOREHOLE @ 1.45 m Depths shown from current Bed Level			
			2.0									
			2.5									
			3.0									

REPORT OF BOREHOLE: BH18

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481926 m E 7872175 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: -0.29 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: AOB DATE: 27/9/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 1.95 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	-0.29	DS 0.00-0.25m				CLAY Grey			
				0.25 -0.54	DS 0.25-0.50m				- With some fine to medium grained sand and shell fragments			
			0.5		DS 0.50-0.75m							
					DS 0.75-1.00m					W		
			1.0		DS 1.00-1.25m							
					DS 1.25-1.50m							
			1.5		DS 1.50-1.75m							
				1.75 -2.04	DS 1.75-1.90m				- Brown/grey	M		
				1.95 -2.24	DS 1.90-1.95m				END OF BOREHOLE @ 1.95 m Depths shown from current Bed Level			
			2.0									
			2.5									
			3.0									

REPORT OF BOREHOLE: BH19

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 482010 m E 7872367 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: -0.28 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: AOB DATE: 27/9/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 1.95 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	-0.28	DS 0.00-0.25m				CLAY Grey			
					DS 0.25-0.50m							
			0.5		DS 0.50-0.75m							
					DS 0.75-1.00m							
			1.0		DS 1.00-1.25m							
				1.25 -1.53	DS 1.25-1.50m				- With some fine to medium grained sand and shell fragments			
			1.5		DS 1.50-1.75m							
					DS 1.75-1.90m							
				1.95 -2.23	DS 1.90-1.95m				END OF BOREHOLE @ 1.95 m Depths shown from current Bed Level			
			2.0									
			2.5									
			3.0									

REPORT OF BOREHOLE: BH20

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481460 m E 7871586 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: 0.05 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 7/11/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 1.30 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description				
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
VVC	L	Ground level below water level	0.0	0.05	DS 0.00-0.25m				SILTY CLAY Very soft, dark grey, trace fine grained sand and shell fragments		VS	
					DS 0.25-0.50m							
			0.5	*0.50* -0.45 *0.60* -0.55	DS 0.50-0.75m				CLAY Very stiff to hard, dark grey some green, trace fine grained sand - Grey green, hard, trace fine gravel		VSt-H	
					DS 0.75-1.10m							
			1.0		HV 0.90 m VP=46kPa, VR=2kPa							
				1.10 -1.05	DS 1.10-1.25m				SILTY CLAY Firm, grey some brown, trace fine grained sand		F	
				1.30 -1.25	DS 1.25-1.30m				END OF BOREHOLE @ 1.30 m Depths shown from current Bed Level			
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

REPORT OF BOREHOLE: BH21

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481568 m E 7871567 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: -0.16 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 7/11/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 1.38 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
VVC	L	Ground level below water level	0.0	-0.16	DS 0.00-0.30m				SILTY CLAY Very soft, dark grey, some shell fragments, trace fine grained sand		VS	
				0.15								
				-0.31					- Soft to Firm		S-F	
				0.30								
				-0.46	DS 0.30-0.50m				CLAY Firm to stiff, grey green, trace fine gravel		F-St	
			0.5		DS 0.50-0.80m							
					HV 0.65 m VP=49kPa, VR=7kPa							
				0.80								
				-0.96	DS 0.80-1.00m				SILTY CLAY Very soft, grey brown, trace fine grained sand and shell fragments		VS	
			1.0		DS 1.00-1.25m							
					DS 1.25-1.35m							
				1.38	DS 1.35-1.38m							
				-1.54					END OF BOREHOLE @ 1.38 m Depths shown from current Bed Level			
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

REPORT OF BOREHOLE: BH22

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481698 m E 7871542 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: 0.12 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 7/11/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 1.80 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
VVC	L	Ground level below water level	0.0	0.12	DS 0.00-0.25m				CLAY Hard, grey green, trace fine to medium gravel and shell fragments		H	
					DS 0.25-0.50m							
			0.5	0.50 -0.38	DS 0.50-0.75m				- Some light brown			
					HV 0.70 m VP=23kPa, VR=2kPa							
				0.90 -0.78	DS 0.75-0.90m				SILTY CLAY Very soft to soft, grey brown, some shell fragments		VS-S	
			1.0		DS 0.90-1.25m							
					DS 1.25-1.50m							
			1.5		DS 1.50-1.75m							
					HV 1.60 m VP=1kPa							
				1.70 -1.58					SILTY CLAYEY SAND Loose to medium dense fine grained sand, grey, trace shell fragments		L-MD	
				1.80 -1.68	DS 1.75-1.80m				END OF BOREHOLE @ 1.80 m Depths shown from current Bed Level			
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

REPORT OF BOREHOLE: BH23

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481805 m E 7871550 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: 0.19 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 7/11/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 1.80 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
VVC	L	Ground level below water level	0.0	0.19	DS 0.00-0.25m				SILTY CLAY Very soft, dark grey		VS	
				0.25								
				0.30	DS 0.25-0.30m				CLAYEY GRAVELLY SAND Loose, grey, medium to coarse grained sand with fine to medium gravel, some shell fragments		L-MDL	
				-0.11	DS 0.30-0.40m							
				0.40								
				-0.21	DS 0.40-0.50m							
				0.50					CLAYEY SAND Loose to medium dense, grey, fine grained sand, some shell fragments			
			0.5	-0.31	DS 0.50-0.75m				CLAY Hard, grey, some fine grained sand and shell fragments - Grey green, some fine gravel		H	
					DS 0.75-1.10m							
					HV 0.95 m							
			1.0	*1.10*								
				-0.91	DS 1.10-1.50m				SILTY CLAY Very soft, grey brown some green, trace shell fragments		VS	
			1.5		DS 1.50-1.80m							
					HV 1.65 m VP=1kPa							
				1.80								
				-1.61					END OF BOREHOLE @ 1.80 m Depths shown from current Bed Level			
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

REPORT OF BOREHOLE: BH24

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481928 m E 7871541 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: 0.25 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 7/11/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 1.87 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description				
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
VVC	L	Ground level below water level	0.0	0.25	DS 0.00-0.25m				SILTY CLAY Very soft, dark grey, trace fine to medium grained sand and shell fragments		VS	
					DS 0.25-0.50m							
			0.5	*0.50* -0.25	DS 0.50-0.75m				CLAY Hard, grey green, some fine gravel and shell fragments		H	
					DS 0.75-1.00m HV 0.80 m VP=53kPa, VR=7kPa							
			1.0	*1.00* -0.75	DS 1.00-1.25m				SILTY CLAY Stiff, grey brown some green, trace fine to medium grained sand and shell fragments		St	
					DS 1.25-1.50m							
			1.5		DS 1.50-1.75m							
					HV 1.70 m VR=1kPa							
				1.80 *1.87* -1.62	DS 1.75-1.80m DS 1.80-1.87m				SAND Loose fine grained trace medium to coarse grained sand, grey, with some shell fragments		L	
			2.0						END OF BOREHOLE @ 1.87 m Depths shown from current Bed Level			
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

REPORT OF BOREHOLE: BH25

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 482005 m E 7871543 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: 0.35 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 7/11/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 2.23 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
VVC	L	Ground level below water level	0.0	0.35					SILTY CLAY Very soft, dark grey, trace shell fragments		VS	
				0.10 0.25	DS 0.10-0.30m				SILTY CLAYEY SAND Loose to medium dense, dark grey, fine grained sand, trace shell fragments		L-MD	
				0.30 0.05	DS 0.30-0.50m				CLAY Very stiff to hard, grey some green, trace fine to coarse grained sand and shell fragments		VSt-H	
			0.5		DS 0.50-0.75m							
				0.80 -0.45	HV 0.70 m VP=46kPa,				- Trace fine to medium gravel			
				0.90 -0.55	VR=5kPa DS 0.75-0.90m				SILTY CLAY Very soft, dark grey, trace shell fragments			
			1.0		DS 0.90-1.25m						VS	
					DS 1.25-1.50m							
			1.5		DS 1.50-1.75m							
					HV 1.60 m							
				1.75 -1.40	VP=1kPa DS 1.75-1.90m				SAND Loose fine to coarse grained sand, grey brown, some shell fragments		L	
				1.90 -1.55	DS 1.90-2.23m				SILTY CLAY Very soft, grey some brown, trace coarse grained sand		VS	
			2.0		HV 2.10 m							
				2.23 -1.88	VP=1kPa				END OF BOREHOLE @ 2.23 m Depths shown from current Bed Level			
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

REPORT OF BOREHOLE: BH26

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481501 m E 7871647 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: -0.13 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 7/11/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 1.32 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
VVC	L	Ground level below water level	0.0	-0.13	DS 0.00-0.25m				SILTY CLAY Very soft, dark grey, trace shell fragments		VS	
				0.25								
				-0.38	DS 0.25-0.50m				CLAY Stiff, dark grey, trace coarse grained sand and shell fragments			
			0.5	*0.50*								
				-0.63	DS 0.50-0.75m				- Grey some green		St	
					DS 0.75-1.00m HV 0.80 m VP=55kPa, VR=5kPa							
			1.0	*1.00*								
				-1.13	DS 1.00-1.25m				SILTY CLAY Very soft, brown some grey		VS	
					HV 1.20 m VP=1kPa							
				1.32								
				-1.45	DS 1.25-1.32m				END OF BOREHOLE @ 1.32 m Depths shown from current Bed Level			
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

REPORT OF BOREHOLE: BH27

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481629 m E 7871656 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: 0.46 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 7/11/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 1.63 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
VVC	L	Ground level below water level	0.0	0.46	DS 0.00-0.30m				SILTY SANDY CLAY Very soft, dark grey, fine grained sand, trace shell fragments and organics		VS	
				0.30 0.16	DS 0.30-0.50m				CLAY Firm, dark grey, trace fine gravel and shell fragments		F	
			0.5	*0.50* -0.04	DS 0.50-0.75m				- Stiff, grey green		St	
					DS 0.75-1.00m							
			1.0		HV 0.95 m VP=65kPa, VR=14kPa							
				1.20 -0.74	DS 1.00-1.20m DS 1.20-1.50m				SILTY CLAY Very soft, grey brown, some shell fragments		VS	
			1.5		HV 1.45 m VP=6kPa							
				1.63 -1.17	DS 1.50-1.55m				END OF BOREHOLE @ 1.63 m Depths shown from current Bed Level			
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

REPORT OF BOREHOLE: BH28

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481742 m E 7871665 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: 0.54 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 7/11/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 1.75 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
VVC	L	Ground level below water level	0.0	0.54	DS 0.00-0.25m				SILTY CLAY Very soft, dark grey, trace fine grained sand and shell fragments		VS	
				0.25								
				0.29	DS 0.25-0.50m				CLAY Firm to stiff, grey green, trace coarse grained sand, fine gravel and shell fragments		F-St	
			0.5		DS 0.50-0.75m							
					HV 0.70 m VP=58kPa, VR=16kPa							
				0.90								
				-0.36	DS 0.75-0.90m				SILTY CLAY Very soft, grey brown, trace shell fragments			
			1.0		DS 0.90-1.25m							
				1.30	DS 1.25-1.50m						VS	
				-0.76					- Dark grey, trace fine grained sand			
			1.5		DS 1.50-1.70m							
					HV 1.60 m VP=2kPa							
				1.75								
				-1.21	DS 1.70-1.75m				END OF BOREHOLE @ 1.75 m Depths shown from current Bed Level			
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

REPORT OF BOREHOLE: BH29

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481862 m E 7871652 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: 0.02 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 7/11/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 1.95 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
VVC	L	Ground level below water level	0.0	0.02	DS 0.00-0.25m				SILTY CLAY Very soft, dark grey, some fine grained sand and shell fragments		VS	
				0.25 -0.23	DS 0.25-0.50m				CLAY Hard, grey some green and brown, some fine to coarse grained sand and shell fragments, trace fine gravel		H	
			0.5		DS 0.50-0.75m							
					DS 0.75-1.00m HV 0.80 m VP=79kPa, VR=14kPa							
			1.0	*1.00* -0.98	DS 1.00-1.25m				SILTY CLAY Very soft, grey some brown, some fine grained sand and shell fragments		VS	
					DS 1.25-1.50m							
			1.5	*1.50* -1.48	DS 1.50-1.75m				- Dark grey			
					DS 1.75-1.95m HV 1.80 m VP=3kPa							
				1.95 -1.93					END OF BOREHOLE @ 1.95 m Depths shown from current Bed Level			
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

REPORT OF BOREHOLE: BH30

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481994 m E 7871653 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: 0.11 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 7/11/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 2.16 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
VVC	L	Ground level below water level	0.0	0.11	DS 0.00-0.25m				SILTY CLAY Very soft, dark grey, some organics, trace fine grained sand and shell fragments		VS	
					DS 0.25-0.50m							
			0.5		DS 0.50-0.75m							
				0.75								
				-0.64	DS 0.75-1.00m				CLAY Hard, grey to dark grey, trace coarse grained sand and organics		H	
			1.0		DS 1.00-1.25m							
				1.20								
				-1.09	DS 1.25-1.50m				- Grey green some brown, some fine gravel			
					HV 1.35 m VP=85kPa, VR=21kPa							
			1.5		DS 1.50-1.75m							
				1.70								
				-1.59	DS 1.75-2.00m				SILTY CLAY Very soft, light brown		VS	
				1.90								
				-1.79	HV 1.90 m VP=5kPa				- Grey to dark grey, trace shell fragments			
			2.0		DS 2.00-2.16m							
				2.16								
				-2.05					END OF BOREHOLE @ 2.16 m Depths shown from current Bed Level			
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

REPORT OF BOREHOLE: BH31

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 482076 m E 7871643 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: 0.25 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 7/11/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 2.34 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description				
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
VVC	L	Ground level below water level	0.0	0.25	DS 0.00-0.25m				SILTY SANDY CLAY Very soft, dark grey, some fine grained sand and shell fragments		VS	
					DS 0.25-0.50m							
			0.5	*0.50* -0.25	DS 0.50-0.75m				CLAY Stiff, grey green, some coarse grained sand, fine gravel and shell fragments		St	
					DS 0.75-1.00m HV 0.85 m VP=58kPa,							
			1.0	*1.00* -0.75	VR=6kPa DS 1.00-1.25m				SILTY CLAY Very soft, light brown some grey, some shell fragments, trace organics		VS	
					DS 1.25-1.50m							
			1.5	*1.50* -1.25	DS 1.50-1.75m				- Grey			
				1.75 -1.50	DS 1.75-2.00m				- Some fine to coarse grained sand			
					HV 1.90 m							
			2.0	*2.00* -1.75	VP=2kPa DS 2.00-2.25m				- Light brown			
					DS 2.25-2.30m							
				2.34 -2.09	DS 2.30-2.34m				END OF BOREHOLE @ 2.34 m Depths shown from current Bed Level			
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

REPORT OF BOREHOLE: BH32

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481558 m E 7871758 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: -0.2 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 7/11/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 1.60 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
VVC	L	Ground level below water level	0.0	-0.20	DS 0.00-0.25m				SILTY CLAY Very soft, dark grey, trace fine grained sand, shell and organics		VS	
					DS 0.25-0.40m							
				0.40								
			0.5	-0.60	DS 0.40-0.75m				CLAY Stiff, dark grey, some fine to coarse grained sand and shell fragments		St	
				0.75								
				-0.95	DS 0.75-1.00m				- Grey some green and brown			
					HV 0.90 m VP=60kPa, VR=9kPA							
			1.0	*1.00*								
				-1.20	DS 1.00-1.25m				SILTY CLAY Very soft, brown			
				1.25								
				-1.45	DS 1.25-1.50m				- Grey, trace shell fragments		VS	
			1.5		HV 1.45 m VP=2kPa							
				1.60	DS 1.50-1.55m							
				-1.80	DS 1.55-1.60m				END OF BOREHOLE @ 1.60 m Depths shown from current Bed Level			
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

This report of borehole must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

REPORT OF BOREHOLE: BH33

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481690 m E 7871767 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: 0.29 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 7/11/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 1.73 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
VVC	L	Ground level below water level	0.0	0.29	DS 0.00-0.25m				SILTY CLAY Very soft, dark grey, some fine grained sand, trace coarse grained sand and shell fragments		VS	
				0.25								
				0.04	DS 0.25-0.50m				CLAY Firm, dark grey, trace shell fragments and organics		F	
			0.5	*0.50*								
				-0.21	DS 0.50-0.75m				- Firm to stiff, grey green, trace coarse grained sand		F-St	
					HV 0.70 m VP=67kPa, VR=16kPa							
					DS 0.75-1.00m							
			1.0	*1.00*								
				-0.71	DS 1.00-1.25m				SILTY CLAY Very soft, grey brown, trace shell fragments		VS	
				1.25								
				-0.96	DS 1.25-1.50m				- Dark grey, some fine grained sand			
			1.5		DS 1.50-1.63m							
					HV 1.60 m VP=5kPa							
				1.73								
				-1.44	DS 1.63-1.73m				END OF BOREHOLE @ 1.73 m Depths shown from current Bed Level			
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

REPORT OF BOREHOLE: BH34

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481806 m E 7871757 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: 0.41 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 7/11/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 1.83 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description				
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
		Ground level below water level	0.0	0.41	DS 0.00-0.25m				SILTY CLAY Very soft, dark grey, lenses of medium to coarse grained sand between 0.1m and 0.25m and lenses of fine grained sand and shell fragments between 0.25m and 0.5m		VS	
					DS 0.25-0.50m							
			0.5	*0.50* -0.09	DS 0.50-0.75m				CLAY Firm to stiff, grey green, trace fine gravel		F-St	
					DS 0.75-1.00m							
					HV 0.85 m VP=51kPa, VR=14kPa							
			1.0	*1.00* -0.59	DS 1.00-1.25m				SILTY CLAY Soft, grey brown some green, trace fine grained sand		S	
				1.25 -0.84	DS 1.25-1.50m				- Very soft, dark grey		VS	
			1.5		DS 1.50-1.75m							
					HV 1.70 m VP=5kPa							
				1.83 -1.42	DS 1.75-1.83m				END OF BOREHOLE @ 1.83 m Depths shown from current Bed Level			
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

REPORT OF BOREHOLE: BH35

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481926 m E 7871755 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: -0.03 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 7/11/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 1.96 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
VVC	L	Ground level below water level	0.0	-0.03	DS 0.00-0.25m				SILTY CLAY Very soft, grey brown, trace shell fragments		VS	
					DS 0.25-0.50m							
			0.5	*0.50* -0.53	DS 0.50-0.75m				CLAYEY SAND Loose to medium dense, dark grey, fine grained sand, trace coarse grained sand		L-MD	
				0.75 -0.78	DS 0.75-1.00m				CLAY Very stiff, grey to dark grey, some organics		VSt	
			1.0		DS 1.00-1.25m HV 1.10 m VP=53kPa, VR=3kPa DS 1.25-1.50m							
			1.5	*1.50* -1.53	DS 1.50-1.75m				SILTY CLAY Very soft, dark grey, trace shell fragments		VS	
					DS 1.75-1.96m HV 1.80 m VP=1kPa							
				1.96 -1.99					END OF BOREHOLE @ 1.96 m Depths shown from current Bed Level			
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

REPORT OF BOREHOLE: BH36

SHEET: 1 OF 1

CLIENT: City Pacific Limited
PROJECT: Townsville Ocean Terminal
LOCATION: Project Site
JOB NO: 06692015

COORDS: 482032 m E 7871766 m N 55 MGA94
SURFACE RL: 0.04 m DATUM: AHD
INCLINATION: -90°
HOLE DIA: 62 mm HOLE DEPTH: 2.20 m

DRILL RIG: James Kirby - Vibracore
DRILLER: James Cook University
LOGGED: TJC DATE: 7/11/06
CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
VVC	L	Ground level below water level	0.0	0.04	DS 0.00-0.25m				SILTY CLAY Very soft, dark grey, trace shell fragments		VS	
				0.25 -0.21	DS 0.25-0.50m				SILTY CLAYEY SAND Loose to medium dense, dark grey, fine grained sand, some shell fragments		L-MD	
			0.5	*0.50* -0.46	DS 0.50-0.75m				CLAY Very stiff, dark grey some green, trace organics		VSt	
				0.75 -0.71	DS 0.75-1.00m HV 0.80 m VP=44kPa, VR=2kPa				- Grey green, some coarse grained sand			
			1.0	*1.00* -0.96	DS 1.00-1.25m				SILTY CLAY Soft to firm, dark grey, some medium to coarse grained sand and shell fragments		S-F	
					DS 1.25-1.50m							
			1.5	*1.50* -1.46	DS 1.50-1.60m				SAND Loose, grey brown orange, fine to coarse grained sand, some shell fragments		L	
				1.60 -1.56	DS 1.60-2.00m				SILTY CLAY Soft to firm, dark grey, some medium to coarse grained sand and shell fragments		S-F	
					HV 1.90 m VP=1kPa							
			2.0	*2.00* -1.96	DS 2.00-2.15m				- Very soft to soft		VS-S	
				2.20 -2.16	DS 2.15-2.20m				END OF BOREHOLE @ 2.20 m Depths shown from current Bed Level			
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

REPORT OF BOREHOLE: BH37

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 482154 m E 7871754 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: 0.22 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 7/11/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 2.55 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
VVC	L	Ground level below water level	0.0	0.22	DS 0.00-0.25m				SILTY CLAY Very soft, dark grey, trace shell fragments		VS	
				0.25								
				-0.03	DS 0.25-0.50m				SILTY CLAYEY SAND Loose to medium dense, dark grey, fine grained sand, some shell fragments		L-MD	
			0.5		DS 0.50-0.75m							
				0.75	HV 0.70 m VP=37kPa, VR=5kPa							
				-0.53	DS 0.75-1.00m				CLAY Very stiff, grey green		VSt	
			1.0	1.00								
				-0.78	DS 1.00-1.25m				SILTY CLAY Very soft, dark grey, some medium grained sand		VS	
					DS 1.25-1.40m							
				1.40								
				-1.18	DS 1.40-1.75m				SAND Loose, grey brown orange, fine to coarse grained sand, some shell fragments		L	
			1.5		HV 1.60 m VP=2kPa							
				1.75								
				-1.53	DS 1.75-1.90m				SILTY SANDY CLAY Very soft, dark grey, fine to medium grained sand, some shell fragments		VS	
				1.90								
				-1.68	DS 1.90-2.25m				SILTY CLAY Very soft, grey to dark grey, trace fine to medium grained sand and shell fragments			
			2.0									
					DS 2.25-2.50m							
					HV 2.40 m VP=2kPa							
			2.5	2.55								
				-2.33	DS 2.50-2.55m				END OF BOREHOLE @ 2.55 m Depths shown from current Bed Level			
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

REPORT OF BOREHOLE: BH38

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481613 m E 7871851 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: -0.18 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 7/11/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 1.66 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description				
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
VVC	L	Ground level below water level	0.0	-0.18	DS 0.00-0.25m				SILTY CLAY Very soft, dark grey, some fine grained sand and shell fragments		VS	
					DS 0.25-0.50m							
			0.5	0.50 -0.68	DS 0.50-0.60m				SILTY CLAYEY SAND Loose to medium dense fine grained sand, dark grey, some shell fragments		L-MD	
				0.60 -0.78	DS 0.60-0.95m							
				0.70 -0.88					CLAY Firm, dark grey some green, trace shell and organics		F	
					HV 0.80 m VP=28kPa,				- Grey green, some fine gravel			
				0.95 -1.13	VR=1kPa				SILTY CLAY			
			1.0		DS 0.95-1.25m				Very soft, grey brown, some fine grained sand and shell fragments between 1.2m -1.3m		VS	
					DS 1.25-1.50m							
			1.5		DS 1.50-1.60m							
					HV 1.55 m							
				1.66 -1.84	VP=1kPa DS 1.60-1.66m				END OF BOREHOLE @ 1.66 m Depths shown from current Bed Level			
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

REPORT OF BOREHOLE: BH39

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481747 m E 7871883 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: 0.12 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 7/11/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 1.62 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
VVC	L	Ground level below water level	0.0	0.12	DS 0.00-0.25m				SILTY CLAY Very soft, dark grey, trace fine grained sand and shell fragments		VS	
					DS 0.25-0.50m							
			0.5		DS 0.50-0.75m							
				0.80 -0.68	DS 0.75-1.00m				- Increasing sand content			
			1.0	*1.00* -0.88	HV 0.95 m VP=51kPa,				CLAY Firm to stiff, grey brown some red, trace coarse grained sand and fine gravel		F-St	
				1.15 -1.03	VR=7kPa DS 1.00-1.15m							
				1.30 -1.18	DS 1.15-1.50m				SILTY CLAY Very soft, grey brown - Dark grey some shell fragments		VS	
			1.5	*1.62* -1.50	HV 1.45 m VP=1kPa DS 1.50-1.55m DS 1.55-1.62m				END OF BOREHOLE @ 1.62 m Depths shown from current Bed Level			
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

REPORT OF BOREHOLE: BH40

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481865 m E 7871865 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: 0.32 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 7/11/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 2.11 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description				
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
VVC	L	Ground level below water level	0.0	0.32	DS 0.00-0.25m				SILTY SANDY CLAY Very soft to soft, dark grey, fine to medium grained sand, some shell fragments		VS	
					DS 0.25-0.50m							
			0.5	*0.50* -0.18	DS 0.50-0.75m				CLAY Firm to stiff, grey green, trace fine gravel and shell fragments		F-St	
					HV 0.70 m VP=51kPa, VR=9kPa							
					DS 0.75-1.00m							
			1.0	*1.00* -0.68	DS 1.00-1.25m				SILTY CLAY Very soft, dark grey, trace fine grained sand and shell fragments		VS	
					DS 1.25-1.50m							
			1.5		DS 1.50-1.75m							
					HV 1.60 m VP=3kPa							
				1.75 -1.43	DS 1.75-2.00m				- Some light brown			
			2.0		DS 2.00-2.05m							
				2.11 -1.79	DS 2.05-2.11m				END OF BOREHOLE @ 2.11 m Depths shown from current Bed Level			
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

REPORT OF BOREHOLE: BH41

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481989 m E 7871856 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: 0.08 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 7/11/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 2.50 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description				
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
VVC	L	Ground level below water level	0.0	0.08	DS 0.00-0.25m				SILTY CLAY Very soft, dark grey		VS	
				0.25 -0.17	DS 0.25-0.50m				- Trace fine grained sand and shell fragments			
			0.5	*0.50* -0.42	DS 0.50-0.75m				SILTY CLAYEY SAND Loose to medium dense fine grained sand, dark grey, some shell fragments		L-MD	
				0.75 -0.67	DS 0.75-1.00m				CLAY Firm to stiff, grey to dark grey some green, trace coarse grained sand		F-St	
			1.0		DS 1.00-1.25m							
					DS 1.25-1.50m							
			1.5		HV 1.45 m VP=51kPa, VR=4kPa							
				1.70 -1.62	DS 1.50-1.70m DS 1.70-2.00m				SILTY SANDY CLAY Soft, grey green some pale brown, fine to medium grained sand		S	
			2.0	*2.00* -1.92	DS 2.00-2.25m				- Dark grey, fine grained sand only			
					DS 2.25-2.50m							
					HV 2.35 m VP=2kPa							
			2.5	*2.50* -2.42					END OF BOREHOLE @ 2.50 m Depths shown from current Bed Level			
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

REPORT OF BOREHOLE: BH42

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 482090 m E 7871855 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: -0.09 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 7/11/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 2.27 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description				
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
VVC	L	Ground level below water level	0.0	-0.09	DS 0.00-0.25m				SILTY SANDY CLAY Very soft, dark grey some brown, fine to coarse grained sand		VS	
				0.25								
				-0.34	DS 0.25-0.50m				SILTY CLAYEY SAND Loose to medium dense fine grained sand, grey, trace shell fragments		L-MD	
			0.5		DS 0.50-0.75m							
					DS 0.75-1.00m							
				1.00								
			1.0	-1.09	DS 1.00-1.25m HV 1.05 m VP=46kPa, VR=2kPa				CLAY Firm to stiff, grey green, some medium to coarse grained sand and fine to medium gravel		F-St	
				1.25								
				-1.34	DS 1.25-1.50m				SILTY CLAY Soft, grey to dark grey some green, some fine to coarse grained sand and shell fragments		S	
			1.5		DS 1.50-1.75m							
				1.75								
				-1.84	DS 1.75-2.00m				SAND Loose fine to coarse grained sand, grey brown, some shell fragments		L	
				2.00								
			2.0	-2.09	DS 2.00-2.22m HV 2.10 m VP=2kPa				SILTY CLAY Very soft, dark grey, some fine to medium grained sand and shell		VS	
				2.27	DS 2.22-2.27m							
				-2.36					END OF BOREHOLE @ 2.27 m Depths shown from current Bed Level			
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

REPORT OF BOREHOLE: BH43

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 482223 m E 7871855 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: -0.05 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 7/11/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 2.55 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description				
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
VVC	L	Ground level below water level	0.0	-0.05	DS 0.00-0.25m				SILTY CLAY Very soft to soft, dark grey, some shell fragments, trace fine grained sand and organics		VS-S	
			0.5		DS 0.25-0.50m							
					DS 0.50-0.75m							
					DS 0.75-1.00m							
			1.0	*1.00*								
				-1.05	DS 1.00-1.25m				CLAYEY SILTY SAND Loose to medium dense fine grained sand, green grey, some shell fragments		L-MD	
				1.25								
				-1.30	DS 1.25-1.50m				SANDY CLAY Stiff, green grey, fine grained sand		St	
			1.5	*1.50*								
				-1.55	DS 1.50-1.75m				SAND Loose, light brown, fine to coarse grained sand		L	
				1.75								
				-1.80	DS 1.75-2.00m				SILTY CLAY Very soft, dark grey, trace fine grained sand, shell fragments and organics		VS	
			2.0		DS 2.00-2.25m							
					DS 2.25-2.50m							
			2.5	*2.55*	DS 2.50-2.55m							
				-2.60					END OF BOREHOLE @ 2.55 m Depths shown from current Bed Level			
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

REPORT OF BOREHOLE: BH44

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481581 m E 7871992 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: -0.58 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 7/11/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 1.72 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description				
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
VVC	L	Ground level below water level	0.0	-0.58	DS 0.00-0.25m				SILTY CLAY Very soft to soft, grey to dark grey, some shell fragments		VS-S	
					DS 0.25-0.50m							
			0.5	0.50 -1.08	DS 0.50-0.75m				- Soft to firm, dark grey		S-F	
				0.75 -1.33	DS 0.75-1.00m				CLAY Firm, green grey		F	
			1.0	1.00 -1.58	DS 1.00-1.25m				SILTY CLAY Very soft, dark grey, trace shell fragments		VS	
					DS 1.25-1.50m							
			1.5		DS 1.50-1.65m							
				1.72	DS 1.65-1.72m							
				-2.30					END OF BOREHOLE @ 1.72 m Depths shown from current Bed Level			
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

REPORT OF BOREHOLE: BH45

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481807 m E 7871968 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: -0.09 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 7/11/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 1.94 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
VVC	L	Ground level below water level	0.0	-0.09	DS 0.00-0.30m				SILTY CLAY Very soft, dark grey, some shell fragments		VS	
				0.30								
				-0.39	DS 0.30-0.50m				SILTY CLAYEY SAND Loose fine grained sand, dark grey, trace coarse grained sand and shell fragments		L	
			0.5	*0.50*								
				-0.59	DS 0.50-0.75m				CLAY Stiff, grey green, trace coarse grained sand, fine gravel and shell fragments		St	
					DS 0.75-1.00m							
			1.0		DS 1.00-1.25m HV 1.05 m VP=55kPa, VR=7kPa							
				1.25								
				-1.34	DS 1.25-1.50m				SILTY CLAY Very soft, grey brown, trace shell fragments		VS	
				1.50								
			1.5	-1.59	DS 1.50-1.75m				- Dark grey, trace fine grained sand			
					DS 1.75-1.90m HV 1.80 m VP=7kPa							
				1.94								
				-2.03	HV 1.90-1.94m				END OF BOREHOLE @ 1.94 m Depths shown from current Bed Level			
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

REPORT OF BOREHOLE: BH46

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481932 m E 7871962 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: 0.07 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 7/11/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 2.05 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
VVC	L	Ground level below water level	0.0	0.07	DS 0.00-0.25m				SILTY CLAY Very soft, dark grey, trace fine grained sand and shell fragments		VS	
					DS 0.25-0.50m							
			0.5	0.50 -0.43	DS 0.50-0.75m				SILTY CLAYEY SAND Loose fine grained sand, dark grey, some coarse grained sand and shell fragments		L	
				0.75 -0.68	DS 0.75-1.00m				CLAY Stiff to very stiff, grey some green, trace fine gravel and shell fragments		St-VSt	
			1.0		DS 1.00-1.25m							
					HV 1.10 m VP=102kPa, VR=14kPa							
				1.25 -1.18	DS 1.25-1.50m				SILTY CLAY Very soft, grey brown, trace shell fragments		VS	
			1.5		DS 1.50-1.75m							
				1.75 -1.68	DS 1.75-2.00m				- Dark grey			
					HV 1.90 m VP=6kPa							
			2.0	2.05 -1.98	DS 2.00-2.05m				END OF BOREHOLE @ 2.05 m Depths shown from current Bed Level			
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

REPORT OF BOREHOLE: BH47

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 482048 m E 7871967 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: -0.32 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 7/11/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 2.14 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description				
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
VVC	L	Ground level below water level	0.0	-0.32	DS 0.00-0.30m				SILTY CLAY Very soft, dark grey, some shell fragments, trace organics		VS	
				0.30								
				-0.62	DS 0.30-0.45m				SAND Loose fine to coarse grained sand, grey brown, some shell fragments		L	
				0.45								
			0.5	-0.77	DS 0.45-0.60m				SILTY CLAY Very soft, dark grey, some shell fragments		VS	
				0.60								
				-0.92	DS 0.60-1.00m				CLAYEY SILTY SAND Loose to medium dense fine grained sand, dark grey green, some shell fragments		L-MD	
			1.0		DS 1.00-1.20m							
				1.20								
				-1.52	DS 1.20-1.50m				SAND Loose fine to coarse grained sand, grey green brown, some shell fragments		L	
				1.50								
			1.5	-1.82	DS 1.50-1.75m				SILTY CLAY Very soft to soft, dark grey, trace fine grained sand and shell fragments		VS-S	
					DS 1.75-2.00m							
			2.0		DS 2.00-2.05m							
				2.14	DS 2.05-2.14m							
				-2.46					END OF BOREHOLE @ 2.14 m Depths shown from current Bed Level			
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

REPORT OF BOREHOLE: BH48

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 482279 m E 7871982 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: -0.13 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 7/11/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 2.68 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
VVC	L	Ground level below water level	0.0	-0.13	DS 0.00-0.25m				SILTY SANDY CLAY Very soft, dark grey, fine to coarse grained sand, some shell fragments		VS	
				0.25								
				-0.38	DS 0.25-0.50m				CLAY Soft to firm, green some light brown, trace fine to medium grained sand and shell fragments			
				0.40								
				-0.53					- Light brown some orange		S-F	
			0.5		DS 0.50-0.70m							
				0.70								
				-0.83	DS 0.70-1.00m				SILTY SANDY CLAY Very soft, dark grey, fine grained sand			
			1.0		DS 1.00-1.25m							
					DS 1.25-1.50m							
			1.5		DS 1.50-1.75m							
					DS 1.75-2.00m						VS	
			2.0		DS 2.00-2.25m							
					DS 2.25-2.50m							
			2.5		DS 2.50-2.60m							
				2.68	DS 2.60-2.68m							
				-2.81					END OF BOREHOLE @ 2.68 m Depths shown from current Bed Level			
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

REPORT OF BOREHOLE: BH49

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 482352 m E 7872068 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: 0.13 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 7/11/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 3.10 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
VVC	L	Ground level below water level	0.0	0.13	DS 0.00-0.25m				CLAYEY SILT Very soft, dark grey		VS	
					DS 0.25-0.50m							
			0.5		DS 0.50-0.75m							
				0.75								
				-0.62	DS 0.75-1.00m				SILTY CLAY Very soft, dark grey, some fine grained sand, trace shell fragments and organics			
			1.0		DS 1.00-1.25m							
					DS 1.25-1.50m							
			1.5		DS 1.50-1.75m							
					DS 1.75-2.00m							
				2.00								
			2.0	-1.87	DS 2.00-2.25m				- Grey some green			
					DS 2.25-2.50m							
				2.50								
			2.5	-2.37	DS 2.50-2.75m				CLAYEY SAND Loose fine grained sand, grey some green, trace organics		L	
				2.75								
				-2.62	DS 2.75-3.00m				SILTY CLAY Very soft, grey some green, some fine grained sand, trace organics		VS	
			3.0	*3.10*	DS 3.00-3.10m							
				-2.97					END OF BOREHOLE @ 3.10 m Depths shown from current Bed Level			
			3.5									
			4.0									
			4.5									
			5.0									

REPORT OF BOREHOLE: BH50

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 482260 m E 7872176 m N 55 MGA94	DRILL RIG: James Kirby - Vibracore
PROJECT:	Townsville Ocean Terminal	SURFACE RL: -0.21 m DATUM: AHD	DRILLER: James Cook University
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 7/11/06
JOB NO:	06692015	HOLE DIA: 62 mm HOLE DEPTH: 2.70 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description				
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
VVC	L	Ground level below water level	0.0	-0.21	DS 0.00-0.25m				SILTY SANDY CLAY Very soft, dark grey some pale green, fine to coarse grained sand, some shell and organics		VS	
					DS 0.25-0.40m							
				0.40								
				-0.61	DS 0.40-0.50m				SAND Loose fine to coarse grained sand, grey, trace fine gravel and shell fragments		L	
			0.5	*0.50* -0.71	DS 0.50-1.00m				SILTY SANDY CLAY Soft, grey some brown, fine to medium grained sand, trace shell fragments		S	
				1.00								
			1.0	-1.21	DS 1.00-1.30m				CLAYEY SAND Loose fine grained sand, grey green		L	
				1.30								
				-1.51	DS 1.30-1.50m				SILTY CLAY Very soft, dark grey, some fine grained sand and shell fragments		VS	
			1.5		DS 1.50-1.75m							
				1.75								
				-1.96	DS 1.75-2.10m				SAND Loose fine to coarse grained sand, grey brown some orange, some fine gravel and shell fragments		L	
			2.0	*2.10*								
				-2.31	DS 2.10-2.25m				SILTY CLAY Very soft, dark grey some brown		VS	
					DS 2.25-2.50m							
			2.5		DS 2.50-2.65m							
				2.70	DS 2.65-2.70m							
				-2.91					END OF BOREHOLE @ 2.70 m Depths shown from current Bed Level			
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

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

DRILLING/EXCAVATION METHOD

AS*	Auger Screwing	RD	Rotary blade or drag bit	HQ	Diamond Core - 63 mm
AD*	Auger Drilling	RT	Rotary Tricone bit	NMLC	Diamond Core - 52 mm
*V	V-Bit	RAB	Rotary Air Blast	NQ	Diamond Core - 47 mm
*T	TC-Bit, e.g. ADT	RC	Reverse Circulation	BH	Tractor Mounted Backhoe
HA	Hand Auger	PT	Push Tube	EX	Tracked Hydraulic Excavator
DTC	Diatube Coring	CT	Cable Tool Rig	EE	Existing Excavation
WB	Washbore or Bailer	JET	Jetting	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 AS1289.6.3.1-1993
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

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 (%)

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

SCR = Solid Core Recovery (%)

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

RQD = Rock Quality Designation (%)

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

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.

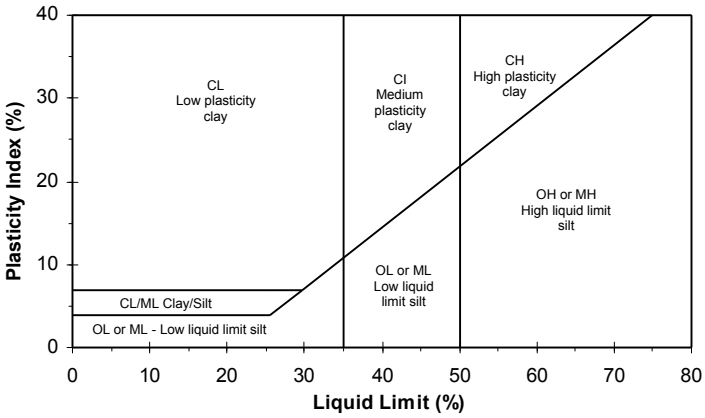
CLASSIFICATION AND INFERRED STRATIGRAPHY

Soil and Rock is classified and described in Reports of Boreholes and Test Pits using the preferred method given in AS1726 – 1993, 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
VS	Very Soft	0 to 12 kPa
S	Soft	12 to 25 kPa
F	Firm	25 to 50 kPa
St	Stiff	50 to 100 kPa
VSt	Very Stiff	100 to 200 kPa
H	Hard	Above 200 kPa

Symbol	Term	Density Index %	SPT "N" #
VL	Very Loose	Less than 15	0 to 4
L	Loose	15 to 35	4 to 10
MD	Medium Dense	35 to 65	10 to 30
D	Dense	65 to 85	30 to 50
VD	Very Dense	Above 85	Above 50

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.

APPENDIX B

Borehole Records TOT-1 to TOT-7

REPORT OF BOREHOLE: TOT 1

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481912 m E 7872481 m N 55 MGA94	DRILL RIG: Gemco 210B
PROJECT:	Townsville Ocean Terminal	SURFACE RL: -2 m AHD	DRILLER: Baconbird
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 24/10/06
JOB NO:	06692015	HOLE DIA: 78 mm HOLE DEPTH: 14.10 m	CHECKED: WSB DATE: 1/11/06

Drilling					Sampling		Field Material Description				
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
WB	L	Ground level below water level	0.0	-2.00	DS 0.00-1.00m				CLAYEY SILT Very soft, dark grey, trace organics		VS	
				1.30								
				-3.30					CLAY Very stiff to hard, pale grey some mottled orange and black, low to medium plasticity		VSt-H	
				1.90	SPT 1.50-1.95m 12,19,19 N = 38							
				-3.90					GRAVELLY SANDY CLAY Very stiff to hard, pale grey to grey some mottled orange and brown, fine to medium grained sand, fine gravel			
				2.40								
	M		2.5	-4.40	DS 2.50-3.50m SPT 3.00-3.45m 9,16,14 N = 30				CLAY Hard, pale grey some mottled orange and black, low to medium plasticity, trace occasional lense of fine grained gravel * occassional very stiff zones		H	
			5.0		SPT 4.50-4.95m 5,6,9 N = 15							
				6.10								
	L-M			-8.10	SPT 6.10-6.50m 7,15,15 N = 30				SAND Medium to medium dense, pale yellow orange and brown, fine to medium grained sand		MD-D	
			7.5		SPT 7.50-7.95m 8,12,15 N = 27							
				8.60								
				-10.60	SPT 9.00-9.45m 7,13,17 N = 30				SANDY CLAY Hard, pale grey some orange, fine grained sand, trace fine grained gravel		H	
				10.00								
			10.0	-12.00					- No gravel			
	M			*11.50*								
				-13.50					- Clay content increasing with depth			
					SPT 12.00-12.45m 12,17,18 N = 35							
			12.5	*13.00*								
				-15.00					CLAY Hard, pale grey some mottled orange and white, low to medium plasticity, trace fine grained sand		H	
				14.10	SPT 13.60-14.05m 8,13,18 N = 31							
				-16.10					END OF BOREHOLE @ 14.10 m Depths shown from current Bed Level			
			15.0									
			17.5									
			20.0									

REPORT OF BOREHOLE: TOT 2

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 482318 m E 7872140 m N 55 MGA94	DRILL RIG: Gemco 210B
PROJECT:	Townsville Ocean Terminal	SURFACE RL: 0.2 m AHD	DRILLER: Baconbird
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 25/10/06
JOB NO:	06692015	HOLE DIA: 78 mm HOLE DEPTH: 16.95 m	CHECKED: WSB DATE: 1/11/06

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
WB	L	Ground level below water level	0.0	0.20					CLAYEY SILT Very soft, dark grey, some organics		VS	
			2.5	*2.70*								
				3.00					GRAVELLY CLAY Very soft, grey, fine to medium grained gravel		VSt	
				-2.80	SPT 3.00-3.45m 6,15,18 N = 33				CLAY Hard, pale grey orange and brown, low to medium plasticity, trace fine grained gravel		H	
				3.80								
	L-M			-3.60	SPT 4.50-4.95m 6,6,8 N = 14				CLAY Very stiff, pale grey orange some black mottle, medium plasticity, trace fine grained gravel		VSt	
			5.0	*5.50*								
				-5.30					CLAYEY SAND / SANDY CLAY Pale grey some orange, fine grained sand, medium plasticity, loose/soft		S	
				6.10								
				-5.90	SPT 6.10-6.50m RW/160mm,3,5 N = 8				CLAY Stiff, pale grey orange some black mottle, low to medium plasticity, trace coarse grained sand and fine grained gravel		St	
				7.00								
				-6.80								
	M		7.5		SPT 7.50-7.95m 8,14,16 N = 30				CLAY Hard, pale grey some orange and white mottle, low plasticity, trace fine grained sand		H	
					SPT 9.00-9.45m 13,19,24 N = 43							
			10.0									
					SPT 10.50-10.95m 13,17,20 N = 37							
				11.00								
	L			-10.80					SAND Medium dense to dense, pale grey yellow, fine to medium grained with trace coarse grained sand		MD-D	
				12.00								
				12.40	SPT 12.00-12.45m 16,16,18 N = 34				CLAY Hard, pale grey, medium plasticity, trace fine grained sand		H	
			12.5	-12.20							D	
				13.20					CLAYEY SAND Dense, orange and grey, fine to coarse grained sand			
	M-H			-13.00	SPT 13.50-13.95m 6,8,10 N = 18				SILTY CLAY Very stiff, pale grey some orange, low plasticity, trace fine grained sand		VSt	
			15.0	*15.20*								
	H			-15.00					CLAY Hard, pale grey trace orange and black mottle, medium plasticity		H	
				16.95	SPT 16.50-16.95m 20,24,32 N = 56							
				-16.75					END OF BOREHOLE @ 16.95 m Depths shown from current Bed Level			
			17.5									
			20.0									

REPORT OF BOREHOLE: TOT 3

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 482261 m E 7871938 m N 55 MGA94	DRILL RIG: Gemco 210B
PROJECT:	Townsville Ocean Terminal	SURFACE RL: 0.1 m AHD	DRILLER: Baconbird
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 26/10/06
JOB NO:	06692015	HOLE DIA: 78 mm HOLE DEPTH: 18.45 m	CHECKED: WSB DATE: 1/11/06

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
WB	L	Ground level below water level	0.0	0.10	DS 0.00-0.25m DS 0.25-0.50m				SANDY CLAYEY SILT Very soft, dark grey, medium grained sand, some shell fragments and trace organics		VS	
				1.00								
				-0.90	DS 1.00-2.00m				CLAYEY SILT Very soft, dark grey, trace shell fragments			
					DS 2.00-2.70m							
			2.5	*2.70*								
				-2.60	SPT 3.00-3.45m 9,13,20 N = 33 DS 3.50-4.00m				CLAY Hard, pale grey brown trace orange mottle, low plasticity		H	
				4.00								
				-3.90	SPT 4.50-4.95m 5,6,7 N = 13 DS 5.00-5.50m				CLAY Very stiff, pale grey orange some black mottle, medium to high plasticity, trace silt and fine grained gravel		VSt	
			5.0	*5.50*								
				-5.40	SPT 6.00-6.45m 4,5,7 N = 12				CLAY Very stiff, pale grey orange, medium plasticity, some fine grained sand with trace medium to coarse grained sand, fine grained gravel and shell fragments			
				6.70								
	M			-6.60					SANDY CLAY Hard, pale grey some orange, fine to medium grained sand, trace fine grained gravel			
			7.5		SPT 7.50-7.95m 11,13,17 N = 30							
				8.50								
				-8.40	SPT 9.00-9.45m 16,24,22 N = 46				CLAY Hard, pale grey some orange, low plasticity, some fine grained sand		H	
			10.0									
				11.00								
				-10.90					SAND Dense, pale yellow grey, fine to coarse grained sand			
	L				SPT 12.00-12.45m 17,23,25 N = 48						D	
			12.5	*12.80*								
				-12.70					SANDY CLAY Hard, pale grey some orange, fine to medium grained sand			
				14.30								
				-14.20					CLAY Hard, pale grey some orange and brown, medium plasticity, trace fine grained gravel			
			15.0		SPT 15.00-15.45m 17,23,24 N = 47							
	H										H	
			17.5									
				18.45	SPT 18.00-18.45m 11,16,21 N = 37							
				-18.35					END OF BOREHOLE @ 18.45 m Depths shown from current Bed Level			
			20.0									

REPORT OF BOREHOLE: TOT 4

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 482130 m E 7871867 m N 55 MGA94	DRILL RIG: Gemco 210B
PROJECT:	Townsville Ocean Terminal	SURFACE RL: -0.1 m AHD	DRILLER: Baconbird
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 27/10/06
JOB NO:	06692015	HOLE DIA: 78 mm HOLE DEPTH: 18.45 m	CHECKED: WSB DATE: 1/11/06

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
WB	L	Ground level below water level	0.0	0.25 -0.35	DS 0.00-0.25m DS 0.25-0.50m DS 0.50-0.75m DS 0.75-1.00m				SAND Very loose, dark grey, fine grained with some medium to coarse grained sand, some shell fragments		VD	
				2.10					CLAYEY SILT Very soft, dark grey, trace fine to medium grained sand and shell fragments		VSo	
			2.5	-2.20	DS 2.10-3.00m SPT 3.00-3.45m 7,10,16 N = 26				SILTY SANDY CLAY Hard, light grey, interbedded with medium dense grey sandy clay			
				4.30 -4.40	SPT 4.50-4.95m 8,10,15 N = 25				SANDY CLAY Hard, grey some mottled light brown			
	M		5.0	5.80 -5.90	SPT 6.00-6.45m 4,8,13 N = 21				SANDY CLAY Hard, pale grey, high sand content with occasional fine grained sand inclusions		H	
			7.5		SPT 7.50-7.95m 11,12,15 N = 27							
					SPT 9.00-9.45m 9,9,13 N = 22							
			10.0	11.00 -11.10					SAND Dense, pale yellow grey, fine to coarse grained sand		D	
	L		12.5		SPT 12.00-12.45m 14,20,25 N = 45							
				13.30 -13.40					CLAY Hard, pale grey orange some mottled black, medium plasticity, some fine to medium grained sand, trace fine grained gravel			
			15.0	15.00 -15.10	SPT 15.00-15.45m 17,21,28 N = 49				CLAY Hard, pale grey some orange, medium plasticity, trace fine to coarse grained sand		H	
	H		17.5									
				18.45 -18.55	SPT 18.00-18.45m 16,20,30 N = 50				END OF BOREHOLE @ 18.45 m Depths shown from current Bed Level			
			20.0									

REPORT OF BOREHOLE: TOT 5

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 482099 m E 7871692 m N 55 MGA94	DRILL RIG: Gemco 210B
PROJECT:	Townsville Ocean Terminal	SURFACE RL: 0.25 m AHD	DRILLER: Baconbird
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 30/10/06
JOB NO:	06692015	HOLE DIA: 78 mm HOLE DEPTH: 20.45 m	CHECKED: WSB DATE: 1/11/06

Drilling					Sampling		Field Material Description				
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
WB	L	Ground level below water level	0.0	0.25	DS 0.00-1.00m				SANDY CLAYEY SILT Very soft, dark grey, medium to coarse grained sand, some shell fragments		VS	
					DS 1.00-2.00m							
				1.80								
	M		2.5	2.20 -1.95	SPT 2.00-2.45m 11,14,18 N = 32 DS 2.20-2.50m				CLAY Hard, green grey, medium plasticity, trace fine grained gravel		H	
									CLAY Hard, pale grey some orange and black mottle, medium plasticity			
				3.80 -3.55	SPT 3.50-3.95m 5,6,12 N = 18				- Some medium to coarse grained sand and trace fine grained gravel			
				4.50 -4.25					CLAY Stiff, pale brown some orange and light grey, medium to high plasticity, some silt			
	L-M		5.0		SPT 5.00-5.45m 3,3,4 N = 7						St	
				6.10 -5.85					CLAY Very stiff, light grey, low plasticity, trace coarse grained sand and fine grained gravel		VSt	
	M			6.80 -6.55	SPT 6.50-6.95m 5,10,16 N = 26				GRAVELLY CLAY Hard, light grey some orange and white, fine to medium grained gravel		H	
			7.5	7.50 -7.25					SAND Medium dense, light orange to orange, fine to medium grained sand		MD	
				8.40 -8.15	SPT 8.00-8.45m 5,9,14 N = 23				CLAYEY SAND Medium dense, grey orange, fine to medium grained sand			
				10.00 -9.75					SANDY CLAY Hard, pale grey some orange, high content of fine to medium grained sand		H	
	L-M		10.0		SPT 11.00-11.45m 14,19,25 N = 44							
			12.5	12.50 -12.25					- Medium to coarse grained sand			
				13.90 -13.65	SPT 14.00-14.45m 19,25,30/140mm				CLAY Hard, pale grey to grey some orange mottle, low plasticity, trace coarse grained sand and fine grained gravel			
	M		15.0									
			17.5	17.70 -17.45	SPT 17.00-17.45m 18,27,30/120mm				CLAYEY SAND Very dense, pale grey some orange mottle, fine to coarse grained sand		VD	
	L-M											
	H		20.0	20.30 -20.20	SPT 20.00-20.45m 15,26,28 N = 54				CLAY Hard, pale grey some orange, low to medium plasticity END OF BOREHOLE @ 20.45 m Depths shown from current Bed Level		H	

REPORT OF BOREHOLE: TOT 6

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481503 m E 7871794 m N 55 MGA94	DRILL RIG: Gemco 210B
PROJECT:	Townsville Ocean Terminal	SURFACE RL: -0.2 m AHD	DRILLER: Baconbird
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: TJC DATE: 31/10/06
JOB NO:	06692015	HOLE DIA: 78 mm HOLE DEPTH: 11.45 m	CHECKED: WSB DATE: 1/11/06

Drilling					Sampling		Field Material Description				
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
WB	L	Ground level below water level	0.0	-0.20	DS 0.00-1.00m				CLAYEY SILT Very soft, dark grey, trace organics and shell fragments		VSo	
				1.40								
	M			-1.60	DS 1.40-2.00m				SANDY GRAVELLY CLAY Very stiff, light grey some orange and brown, medium to coarse grained sand with fine to medium grained gravel		VSt	
			2.5		SPT 2.00-2.45m 7,10,13 N = 23							
				3.00	DS 2.45-3.00m							
				3.25					CLAY Very stiff, pale grey orange some black mottle, medium plasticity - Trace fine grained sand and fine grained gravel			
	L-M			-3.45	SPT 3.50-3.95m 3,6,10 N = 16							
				4.20								
				-4.40					SANDY CLAY Hard, pale grey some red and orange mottle, fine grained sand with occasional very sandy lenses			
	M		5.0		SPT 5.00-5.45m 12,15,25 N = 40						H	
					SPT 6.50-6.95m 10,13,22 N = 35							
				7.40								
			7.5	-7.60					CLAYEY SAND Dense to very dense, light grey trace orange and yellow, fine grained sand with occasional coarse grained sand lenses			
	L-M				SPT 8.00-8.45m 15,22,29 N = 51						D-VD	
			10.0									
				11.45	SPT 11.00-11.45m 12,17,23 N = 40							
				-11.65					END OF BOREHOLE @ 11.45 m Depths shown from current Bed Level			
			12.5									
			15.0									
			17.5									
			20.0									

REPORT OF BOREHOLE: TOT 7

SHEET: 1 OF 1

CLIENT:	City Pacific Limited	COORDS: 481834 m E 7871495 m N 55 MGA94	DRILL RIG: Gemco 210B
PROJECT:	Townsville Ocean Terminal	SURFACE RL: 3 m AHD	DRILLER: Baconbird
LOCATION:	Project Site	INCLINATION: -90°	LOGGED: MKC DATE: 12/6/07
JOB NO:	06692015	HOLE DIA: 100 mm HOLE DEPTH: 15.00 m	CHECKED: WSB DATE: 30/6/07

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	PIEZOMETER DETAILS
			0.0	2.90					ASPHALT - Bitumen Fill:- Sandy Clay/Clayey SAND Fine to coarse sand, medium plasticity, brown, moist			Gatic Cover Concrete Bentonite
				2.00 1.00					Fill:- Clayey SAND Fine to coarse sand, brown, medium dense			
			2.5	*3.00* 0.00					Fill:- Sandy CLAY Fine to coarse sand, grey/brown, with some gravel			Class 18 Threaded, Acid Washed, Blank Screen
			5.0	*5.00* -2.00					CLAY Grey, soft			Class 3 Washed Graded Filter Sand
				6.00 -3.00					Clayey SAND Fine to coarse sand, grey brown, medium dense			
			7.5									
			10.0	*11.00* -8.00					Sandy CLAY Brown/grey, fine to coarse sand, hard			Class 18 Threaded, Acid Washed, Machine Slotted Screen
			12.5	*14.00* -11.00					SAND Fine to medium sand, brown, dense to very dense			
			15.0	*15.00* -12.00					END OF BOREHOLE @ 15.00 m			
			17.5									
			20.0									

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

DRILLING/EXCAVATION METHOD

AS*	Auger Screwing	RD	Rotary blade or drag bit	HQ	Diamond Core - 63 mm
AD*	Auger Drilling	RT	Rotary Tricone bit	NMLC	Diamond Core - 52 mm
*V	V-Bit	RAB	Rotary Air Blast	NQ	Diamond Core - 47 mm
*T	TC-Bit, e.g. ADT	RC	Reverse Circulation	BH	Tractor Mounted Backhoe
HA	Hand Auger	PT	Push Tube	EX	Tracked Hydraulic Excavator
DTC	Diatube Coring	CT	Cable Tool Rig	EE	Existing Excavation
WB	Washbore or Bailer	JET	Jetting	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 AS1289.6.3.1-1993
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

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 (%)

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

SCR = Solid Core Recovery (%)

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

RQD = Rock Quality Designation (%)

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

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.

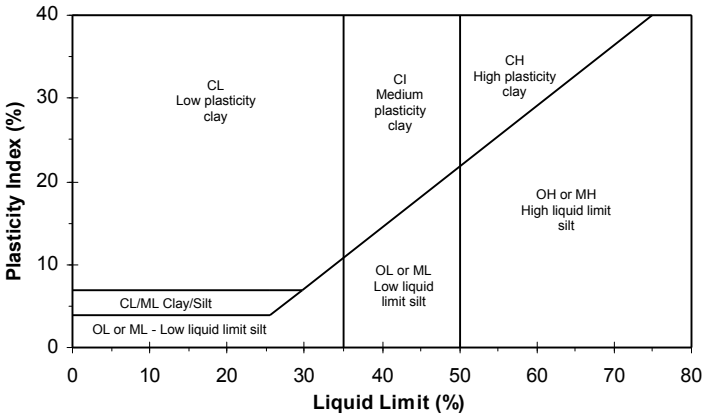
CLASSIFICATION AND INFERRED STRATIGRAPHY

Soil and Rock is classified and described in Reports of Boreholes and Test Pits using the preferred method given in AS1726 – 1993, 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
VS	Very Soft	0 to 12 kPa
S	Soft	12 to 25 kPa
F	Firm	25 to 50 kPa
St	Stiff	50 to 100 kPa
VSt	Very Stiff	100 to 200 kPa
H	Hard	Above 200 kPa

Symbol	Term	Density Index %	SPT "N" #
VL	Very Loose	Less than 15	0 to 4
L	Loose	15 to 35	4 to 10
MD	Medium Dense	35 to 65	10 to 30
D	Dense	65 to 85	30 to 50
VD	Very Dense	Above 85	Above 50

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.

APPENDIX C

ASS/PASS Field Screening and Laboratory Test Records

Test Location	Depth Range (m - BGL)		Material Description	pH_{KCl}	TAA (kg H_2SO_4/tonne)	sTAA Converted to %S*	S_{NAS} (if pH less than 4.5)	Existing Acidity %S (sTAA + 0.75 x S_{NAS})	Chromium Reduceable Sulfur (S_{Cr}) %S	Acid Neutralising Capacity %CaCO3 (if pH > 6.5 and > 0.03%S)	Net Acidity %S (S_{CR}+Existing Acidity - ANC/FF)	Is This ASS	Is This PASS	Liming Rate for Existing Acidity (Neutralises AASS only) (kg/m3)	Liming Rate for Net Acidity (Neutralises both AASS & PASS) (kg/m3)
BH5	0.00	0.50	CLAY	8.6	< 0.5	< 0.016		0.000	0.140	4.6	-0.351	No	YES	No Additional Lime Required	No Additional Lime Required
BH5	0.50	1.00	CLAY	8.9	< 0.5	< 0.016		0.000	0.180	6	-0.461	No	YES	No Additional Lime Required	No Additional Lime Required
BH5	1.00	1.50	CLAY	9.0	< 0.5	< 0.016		0.000	0.200	7.7	-0.622	No	YES	No Additional Lime Required	No Additional Lime Required
BH8	0.00	0.50	CLAY	8.9	< 0.5	< 0.016		0.000	0.072	4.5	-0.409	No	YES	No Additional Lime Required	No Additional Lime Required
BH8	0.50	1.00	CLAY	9.1	< 0.5	< 0.016		0.000	0.090	4.7	-0.412	No	YES	No Additional Lime Required	No Additional Lime Required
BH8	2.00	2.25	CLAYEY SAND	8.7	< 0.5	< 0.016		0.000	0.170	4.6	-0.321	No	YES	No Additional Lime Required	No Additional Lime Required
BH18	0.00	0.50	CLAY	8.9	< 0.5	< 0.016		0.000	0.100	4.6	-0.391	No	YES	No Additional Lime Required	No Additional Lime Required
BH18	0.50	1.00	CLAY	8.9	< 0.5	< 0.016		0.000	0.180	4.5	-0.301	No	YES	No Additional Lime Required	No Additional Lime Required
BH18	1.00	1.50	CLAY	9.1	< 0.5	< 0.016		0.000	0.250	5.1	-0.295	No	YES	No Additional Lime Required	No Additional Lime Required
BH18	1.50	1.75	CLAY	9.2	< 0.5	< 0.016		0.000	0.160	10	-0.908	No	YES	No Additional Lime Required	No Additional Lime Required
BH18	1.75	1.90	CLAY	9.1	< 0.5	< 0.016		0.000	0.019	1.7	-0.163	No	No	No Additional Lime Required	NA
BH26	0.00	0.25	SILTY CLAY	8.8	< 0.5	< 0.016		0.000	0.230	6.5	-0.464	No	YES	No Additional Lime Required	No Additional Lime Required
BH26	0.25	0.75	CLAY	8.3	< 0.5	< 0.016		0.000	0.009		0.009	No	No	NA	NA
BH26	1.00	1.32	SILTY CLAY	8.6	< 0.5	< 0.016		0.000	0.120	4.4	-0.350	No	YES	No Additional Lime Required	No Additional Lime Required
BH30	0.00	0.25	SILTY CLAY	8.8	< 0.5	< 0.016		0.000	0.250	7.3	-0.530	No	YES	No Additional Lime Required	No Additional Lime Required
BH30	0.50	1.00	SILTY CLAY	8.8	< 0.5	< 0.016		0.000	0.210	5.6	-0.388	No	YES	No Additional Lime Required	No Additional Lime Required
BH30	1.50	1.75	CLAY	8.8	< 0.5	< 0.016		0.000	0.034	3.2	-0.308	No	YES	No Additional Lime Required	No Additional Lime Required
BH33	0.00	0.25	SILTY CLAY	9.1	< 0.5	< 0.016		0.000	0.160	6.7	-0.556	No	YES	No Additional Lime Required	No Additional Lime Required
BH33	0.25	0.50	CLAY	8.8	< 0.5	< 0.016		0.000	0.081	3.5	-0.293	No	YES	No Additional Lime Required	No Additional Lime Required
BH33	0.50	1.00	CLAY	8.2	< 0.5	< 0.016		0.000	< 0.005		< 0.005	No	No	NA	NA
BH33	1.00	1.25	SILTY CLAY	9.0	< 0.5	< 0.016		0.000	0.140	4.6	-0.351	No	YES	No Additional Lime Required	No Additional Lime Required
BH33	1.25	1.73	SILTY CLAY	9.0	< 0.5	< 0.016		0.000	0.210	5.7	-0.399	No	YES	No Additional Lime Required	No Additional Lime Required
BH40	0.00	0.50	SILTY SANDY CLAY	9.1	< 0.5	< 0.016		0.000	0.200	10	-0.868	No	YES	No Additional Lime Required	No Additional Lime Required
BH40	0.50	1.00	CLAY	8.8	< 0.5	< 0.016		0.000	0.006		0.006	No	No	NA	NA
BH40	1.00	1.50	SILTY CLAY	9.0	< 0.5	< 0.016		0.000	0.210	4.7	-0.292	No	YES	No Additional Lime Required	No Additional Lime Required
BH40	1.75	2.11	SILTY CLAY	8.9	< 0.5	< 0.016		0.000	0.092	4.3	-0.367	No	YES	No Additional Lime Required	No Additional Lime Required
BH42	0.00	0.25	SILTY SANDY CLAY	9.0	< 0.5	< 0.016		0.000	0.140	3.2	-0.202	No	YES	No Additional Lime Required	No Additional Lime Required
BH42	0.50	1.00	SILTY CLAYEY SAND	9.1	< 0.5	< 0.016		0.000	0.240	7.6	-0.572	No	YES	No Additional Lime Required	No Additional Lime Required
BH42	1.25	1.75	SILTY CLAY	9.1	< 0.5	< 0.016		0.000	0.100	7.3	-0.680	No	YES	No Additional Lime Required	No Additional Lime Required
BH49	0.00	0.50	CLAYEY SILTY	8.8	< 0.5	< 0.016		0.000	0.420	9.4	-0.584	No	YES	No Additional Lime Required	No Additional Lime Required
BH49	0.75	1.25	SILTY CLAY	9.1	< 0.5	< 0.016		0.000	0.260	8.9	-0.691	No	YES	No Additional Lime Required	No Additional Lime Required
BH49	1.50	2.00	SILTY CLAY	8.8	< 0.5	< 0.016		0.000	0.420	4.7	-0.082	No	YES	No Additional Lime Required	No Additional Lime Required
BH49	2.50	2.75	CLAYEY SAND	9.1	< 0.5	< 0.016		0.000	0.190	3.9	-0.227	No	YES	No Additional Lime Required	No Additional Lime Required
BH49	3.00	3.10	SILTY CLAY	9.1	< 0.5	< 0.016		0.000	0.230	5.2	-0.325	No	YES	No Additional Lime Required	No Additional Lime Required
MW TOT 1	1.50	2.00	CLAY	9.4	< 0.5	< 0.016		0.000	0.025		0.025	No	No	NA	NA
MW TOT 1	2.50	3.50	CLAY	9.1	< 0.5	< 0.016		0.000	0.009		0.009	No	No	NA	NA
MW TOT 1	4.50	4.95	CLAY	6.0	< 0.5	< 0.016		0.000	< 0.005		< 0.005	No	No	NA	NA
MW TOT 1	6.10	6.50	SAND	6.6	< 0.5	< 0.016		0.000	< 0.005		< 0.005	No	No	NA	NA
MW TOT 1	7.50	7.95	SAND	6.5	< 0.5	< 0.016		0.000	< 0.005		< 0.005	No	No	NA	NA
MW TOT 1	9.00	9.45	SANDY CLAY	6.3	< 0.5	< 0.016		0.000	< 0.005		< 0.005	No	No	NA	NA
MW TOT 1	12.00	12.45	SANDY CLAY	6.4	< 0.5	< 0.016		0.000	< 0.005		< 0.005	No	No	NA	NA
MW TOT 1	13.60	14.05	CLAY	6.7	< 0.5	< 0.016		0.000	< 0.005		< 0.005	No	No	NA	NA
MW TOT 2	6.10	6.50	CLAY	8.6	< 0.5	< 0.016		0.000	< 0.005		< 0.005	No	No	NA	NA
MW TOT 2	10.50	10.95	CLAY	8.7	< 0.5	< 0.016		0.000	< 0.005		< 0.005	No	No	NA	NA
MW TOT 3	3.50	4.00	CLAY	7.8	< 0.5	< 0.016		0.000	< 0.005		< 0.005	No	No	NA	NA
MW TOT 3	5.00	5.50	CLAY	9.0	< 0.5	< 0.016		0.000	< 0.005		< 0.005	No	No	NA	NA
MW TOT 3	7.50	7.95	SANDY CLAY	8.5	< 0.5	< 0.016		0.000	< 0.005		< 0.005	No	No	NA	NA
MW TOT 3	9.00	9.45	CLAY	8.8	< 0.5	< 0.016		0.000	< 0.005		< 0.005	No	No	NA	NA
MW TOT 3	12.00	12.45	SAND	7.7	< 0.5	< 0.016		0.000	< 0.005		< 0.005	No	No	NA	NA
MW TOT 3	15.00	15.45	CLAY	8.9	< 0.5	< 0.016		0.000	< 0.005		< 0.005	No	No	NA	NA
MW TOT 4	2.10	3.00	SILTY SANDY CLAY	9.2	< 0.5	< 0.016		0.000	0.031	1.3	-0.108	No	YES	No Additional Lime Required	No Additional Lime Required
MW TOT 4	7.50	7.95	SANDY CLAY	7.6	< 0.5	< 0.016		0.000	< 0.005		< 0.005	No	No	NA	NA
MW TOT 4	12.00	12.45	SAND	7.8	< 0.5	< 0.016		0.000	< 0.005		< 0.005	No	No	NA	NA
MW TOT 4	15.00	15.45	CLAY	7.9	< 0.5	< 0.016		0.000	< 0.005		< 0.005	No	No	NA	NA
MW TOT 4	18.00	18.45	CLAY	7.2	< 0.5	< 0.016		0.000	< 0.005		< 0.005	No	No	NA	NA
MW TOT 5	2.00	2.20	CLAY	9.0	< 0.5	< 0.016		0.000	< 0.005		< 0.005	No	No	NA	NA
MW TOT 5	2.20	2.50	CLAY	7.7	< 0.5	< 0.016		0.000	< 0.005		< 0.005	No	No	NA	NA
MW TOT 5	6.50	6.95	CLAY	8.6	< 0.5	< 0.016		0.000	< 0.005		< 0.005	No	No	NA	NA
MW TOT 5	11.00	11.45	SANDY CLAY	7.5	< 0.5	< 0.016		0.000	< 0.005		< 0.005	No	No	NA	NA
MW TOT 5	17.00	17.45	CLAY	8.9	< 0.5	< 0.016		0.000	< 0.005		< 0.005	No	No	NA	NA
MW TOT 5	20.00	20.45	CLAYEY SAND	7.5	< 0.5	< 0.016		0.000	< 0.005		< 0.005	No	No	NA	NA
MW TOT 6	2.00	3.00	SANDY GRAVELLY CLAY	9.0	< 0.5	< 0.016		0.000	< 0.005		< 0.005	No	No	NA	NA
MW TOT 6	5.00	5.45	SANDY CLAY	7.1	< 0.5	< 0.016		0.000	< 0.005		< 0.005	No	No	NA	NA
MW TOT 6	8.00	8.45	CLAYEY SAND	8.2	< 0.5	< 0.016		0.000	< 0.005		< 0.005	No	No	NA	NA

Note: * Equivalent oxidisable sulphur calculated as TAA/30.59

Liming rates assume a bulk density of 1.6t/m ^{3}

Fineness Factor = 3

Golder Associates

TABLE C-1

SUMMARY OF ACID SULFATE TEST RESULTS

Client: **CITY PACIFIC LIMITED**

Job Title: **TOWNSVILLE OCEAN TERMINAL**

Location: **6692015**

Input By: ???
Date: 20/07/2007
Checked By: ???
Date: 20/07/2007

Golder Associates Pty Ltd

pH FIELD TESTS

Method: As per State Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland 1998.

Client :	City Pacific Limited	**Project Number :**	06692015
Project :	Townsville Ocean Terminal	**Tested By:**	AJ / BB
Location :	Project Site	**Checked By:**	WSB

Hole No.	Depth (m-BGL)		Soil Type	pH	pHfoX	reaction	Interpreted PASS Potential		
	From	To					high	medium	low
BH1	0	0.25	CLAY	8.7	6.4	Slight			x
BH1	0.25	0.5	CLAY	9.0	6.6	Slight			x
BH1	0.5	0.75	CLAY	8.8	6.3	Slight			x
BH1	0.75	1	CLAY	8.8	6.9	Slight			x
BH1	1	1.25	CLAY	8.9	6.4	Slight			x
BH1	1.25	1.5	CLAY	9.0	8.6	Strong			x
BH1	1.5	1.75	CLAY	8.9	6.3	Slight			x
BH1	1.75	1.83	CLAY	8.9	6.4	Slight			x
BH1	1.83	1.93	CLAY	9.2	6.4	Slight			x
BH2	0	0.25	CLAY	9.1	6.5	Slight			x
BH2	0.25	0.5	CLAY	9.1	6.4	Slight			x
BH2	0.5	0.75	CLAY	8.9	6.5	Slight			x
BH2	0.75	1	CLAY	8.7	6.3	Slight			x
BH2	1	1.25	CLAY	9.0	6.3	Slight			x
BH2	1.25	1.5	CLAY	8.8	6.2	Slight			x
BH2	1.5	1.75	CLAY	8.8	6.1	Slight			x
BH2	1.75	1.83	CLAY	8.9	6.4	Slight			x
BH2	1.83	1.93	CLAY	9.6	6.6	Slight			x
BH3	0	0.25	CLAY	8.8	6.5	Moderate			x
BH3	0.25	0.5	CLAY	8.9	6.5	Slight			x
BH3	0.5	0.75	CLAY	9.1	6.5	Slight			x
BH3	0.75	1	CLAY	9.0	6.4	Slight			x
BH3	1	1.25	CLAY	8.9	6.4	Slight			x
BH3	1.25	1.35	Clayey SAND	9.1	6.3	Slight			x
BH3	1.35	1.5	CLAY	8.9	6.2	Slight			x
BH3	1.5	1.8	CLAY	9.2	6.4	Slight			x
BH3	1.8	1.9	CLAY	9.6	6.5	Slight			x
BH4	0	0.25	CLAY	9.1	6.6	Slight			x
BH4	0.25	0.5	CLAY	9.2	6.6	Slight			x
BH4	0.5	0.75	CLAY	9.0	6.4	Slight			x
BH4	0.75	1	CLAY	9.1	6.5	Slight			x
BH4	1	1.25	CLAY	9.5	6.6	Slight			x
BH4	1.25	1.5	CLAY	8.7	6.4	Slight			x
BH4	1.5	1.6	CLAY	8.9	6.5	Slight			x
BH4	1.6	1.7	CLAY	9.0	6.5	Slight			x
BH5	0	0.25	CLAY	8.9	6.6	Slight			x
BH5	0.25	0.5	CLAY	9.1	6.6	Slight			x
BH5	0.5	0.75	CLAY	9.2	6.4	Slight			x
BH5	0.75	1	CLAY	9.1	6.5	Slight			x
BH5	1	1.25	CLAY	8.9	6.4	Slight			x
BH5	1.25	1.5	CLAY	9.0	6.6	Moderate			x
BH5	1.55	1.6	CLAY	10.0	6.4	Slight			x
BH6	0	0.25	CLAY	9.3	6.6	Moderate			x
BH6	0.25	0.5	CLAY	9.4	6.6	Moderate			x
BH6	0.5	0.75	CLAY	9.0	6.6	Moderate			x
BH6	0.75	1	CLAY	9.3	6.6	Moderate			x
BH6	1	1.25	CLAY	9.0	6.5	Slight			x
BH6	1.25	1.5	CLAY	9.2	6.5	Slight			x
BH6	1.5	1.75	Sandy CLAY	9.0	6.6	Slight			x
BH6	1.75	2	CLAY	9.1	6.6	Slight			x
BH6	2	2.1	CLAY	9.5	6.6	Slight			x
BH6	2.1	2.2	CLAY	9.0	6.5	Slight			x
BH7	0	0.25	CLAY	9.0	6.6	Moderate			x
BH7	0.25	0.5	CLAY	8.9	6.6	Moderate			x

Input By: AOB
Date: 19/07/2007
Checked By: WSB
Date: 19/07/2007

Golder Associates Pty Ltd

pH FIELD TESTS

Method: As per State Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland 1998.

Client :	City Pacific Limited	**Project Number :**	06692015
Project :	Townsville Ocean Terminal	**Tested By:**	AJ / BB
Location :	Project Site	**Checked By:**	WSB

Hole No.	Depth (m-BGL)		Soil Type	pH	pHfoX	reaction	Interpreted PASS Potential		
	From	To					high	medium	low
BH7	0.5	0.75	CLAY	8.9	6.6	Moderate			x
BH7	0.75	1	CLAY	8.9	6.5	Moderate			x
BH7	1	1.25	CLAY	9.0	6.2	Moderate			x
BH7	1.25	1.5	CLAY	9.0	6.6	Moderate			x
BH7	1.5	1.75	CLAY	8.9	6.3	Moderate			x
BH7	1.75	2	CLAY	8.7	6.3	Slight			x
BH7	2	2.1	CLAY	9.7	6.4	Slight			x
BH8	0	0.25	CLAY	9.0	6.5	Slight			x
BH8	0.25	0.5	CLAY	8.9	6.5	Slight			x
BH8	0.5	0.75	CLAY	9.1	6.4	Slight			x
BH8	0.75	1	CLAY	8.9	6.4	Slight			x
BH8	1	1.25	CLAY	9.0	6.2	Slight			x
BH8	1.25	1.5	CLAY	9.0	6.5	Slight			x
BH8	1.5	1.75	CLAY	9.0	6.3	Slight			x
BH8	1.75	2	CLAY	9.1	6.3	Slight			x
BH8	2	2.25	Clayey SAND	8.7	6.4	Slight			x
BH8	2.25	2.45	CLAY	8.8	6.4	Slight			x
BH8	2.45	2.5	CLAY	8.8	6.3	Slight			x
BH9	0	0.25	CLAY	9.2	6.6	Slight			x
BH9	0.25	0.5	CLAY	9.2	6.5	Slight			x
BH9	0.5	0.75	CLAY	9.2	6.5	Slight			x
BH9	0.75	1	CLAY	9.2	6.4	Slight			x
BH9	1	1.25	CLAY	9.1	6.6	Slight			x
BH9	1.25	1.5	CLAY	9.2	6.4	Slight			x
BH9	1.5	1.75	CLAY	8.8	6.3	Slight			x
BH9	1.75	1.8	Sandy CLAY	9.3	6.4	Slight			x
BH9	1.8	1.88	Sandy CLAY	9.3	6.3	Slight			x
BH10	0	0.25	CLAY	9.1	6.4	Slight			x
BH10	0.25	0.5	CLAY	9.1	6.4	Slight			x
BH10	0.5	0.75	CLAY	9.1	6.5	Slight			x
BH10	0.75	1	CLAY	9.1	6.6	Slight			x
BH10	1	1.25	CLAY	8.8	6.4	Slight			x
BH10	1.25	1.5	CLAY	9.4	7.0	Slight			x
BH10	1.5	1.8	CLAY	9.1	6.8	Slight			x
BH10	1.8	1.87	CLAY	9.3	6.3	Slight			x
BH11	0	0.25	CLAY	8.9	6.6	Slight			x
BH11	0.25	0.5	CLAY	9.0	6.4	Slight			x
BH11	0.5	0.75	CLAY	9.2	6.4	Slight			x
BH11	0.75	1	CLAY	9.3	6.3	Slight			x
BH11	1	1.25	CLAY	9.1	6.4	Slight			x
BH11	1.25	1.5	CLAY	9.1	6.3	Slight			x
BH11	1.5	1.75	CLAY	9.6	6.8	Slight			x
BH11	1.75	1.8	CLAY	8.6	5.9	Slight			x
BH12	0	0.25	CLAY	9.2	6.5	Moderate			x
BH12	0.25	0.5	CLAY	9.1	6.4	Slight			x
BH12	0.5	0.75	CLAY	8.8	6.3	Moderate			x
BH12	0.75	1	CLAY	9.0	6.3	Slight			x
BH12	1	1.25	Sandy CLAY	9.0	6.5	Slight			x
BH12	1.25	1.3	Sandy CLAY	8.4	6.4	Strong			x
BH13	0	0.25	CLAY	9.2	6.5	Slight			x
BH13	0.25	0.5	CLAY	9.2	6.4	Slight			x
BH13	0.5	0.75	CLAY	9.2	6.5	Slight			x
BH13	0.75	1	CLAY	9.2	6.4	Slight			x
BH13	1	1.25	CLAY	9.1	6.4	Slight			x

Input By: AOB
Date: 19/07/2007
Checked By: WSB
Date: 19/07/2007

Golder Associates Pty Ltd

pH FIELD TESTS

Method: As per State Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland 1998.

Client :	City Pacific Limited	**Project Number :**	06692015
Project :	Townsville Ocean Terminal	**Tested By:**	AJ / BB
Location :	Project Site	**Checked By:**	WSB

Hole No.	Depth (m-BGL)		Soil Type	pH	pHfoX	reaction	Interpreted PASS Potential		
	From	To					high	medium	low
BH13	1.25	1.5	CLAY	9.1	6.4	Slight			x
BH13	1.5	1.7	CLAY	9.1	6.6	Slight			x
BH13	1.7	1.73	CLAY	9.5	6.6	Slight			x
BH14	0	0.25	CLAY	9.1	6.6	Slight			x
BH14	0.25	0.5	CLAY	9.3	6.6	Slight			x
BH14	0.5	0.75	CLAY	9.3	6.6	Moderate			x
BH14	0.75	1	CLAY	9.2	6.6	Slight			x
BH14	1	1.25	CLAY	9.3	6.4	Slight			x
BH14	1.25	1.5	CLAY	9.4	6.4	Slight			x
BH14	1.5	1.75	CLAY	9.4	6.5	Slight			x
BH14	1.75	1.89	CLAY	9.6	6.5	Slight			x
BH15	0	0.25	CLAY	9.0	6.8	Slight			x
BH15	0.25	0.5	CLAY	9.2	6.5	Slight			x
BH15	0.5	0.75	CLAY	9.3	6.5	Slight			x
BH15	0.75	1	CLAY	9.3	6.4	Slight			x
BH15	1	1.25	CLAY	9.1	6.5	Slight			x
BH15	1.25	1.5	CLAY	9.1	6.5	Slight			x
BH15	1.5	1.56	CLAY	8.7	8.4	Moderate			x
BH16	0	0.15	CLAY	9.1	6.4	Slight			x
BH17	0	0.25	CLAY	9.3	6.5	Nil			x
BH17	0.25	0.5	CLAY	9.4	6.4	Nil			x
BH17	0.5	0.75	CLAY	9.3	6.5	Nil			x
BH17	0.75	1	CLAY	9.3	6.5	Nil			x
BH17	1	1.25	CLAY	9.2	6.6	Nil			x
BH17	1.25	1.35	CLAY	9.7	6.6	Nil			x
BH17	1.35	1.45	CLAY	8.6	5.9	Nil			x
BH18	0	0.25	CLAY	9.0	7.4	Strong			x
BH18	0.25	0.5	CLAY	9.4	6.5	Nil			x
BH18	0.5	0.75	CLAY	9.3	6.5	Nil			x
BH18	0.75	1	CLAY	9.2	6.4	Nil			x
BH18	1	1.25	CLAY	9.3	6.5	Nil			x
BH18	1.25	1.5	CLAY	9.3	6.4	Nil			x
BH18	1.5	1.75	CLAY	9.3	6.6	Nil			x
BH18	1.75	1.9	CLAY	9.5	6.6	Nil			x
BH18	1.9	1.95	CLAY	9.1	6.2	Nil			x
BH19	0	0.25	CLAY	8.6	6.9	Slight			x
BH19	0.25	0.5	CLAY	8.6	6.9	Slight			x
BH19	0.5	0.75	CLAY	8.6	6.8	Slight			x
BH19	0.75	1	CLAY	9.2	6.6	Slight			x
BH19	1	1.25	CLAY	8.6	6.8	Slight			x
BH19	1.25	1.5	CLAY	8.6	6.6	Slight			x
BH19	1.5	1.75	CLAY	8.4	6.4	Slight			x
BH19	1.75	1.9	CLAY	8.6	6.6	Slight			x
BH19	1.9	1.95	CLAY	9.6	6.7	Slight			x
BH20	0	0.25	Silty CLAY	8.9	6.4	Moderate			x
BH20	0.25	0.5	Silty CLAY	8.7	6.5	Slight			x
BH20	0.5	0.75	CLAY	9.3	6.1	Slight			x
BH20	0.75	1	CLAY	8.8	6.4	Slight			x
BH20	1	1.25	Silty CLAY	8.3	8.3	Strong			x
BH20 (refusal)	1.25	1.3	Silty CLAY	9.0	6.3	Slight			x
BH21	0	0.3	Silty CLAY	8.8	6.3	Slight			x
BH21	0.3	0.5	CLAY	9.1	6.6	Slight			x

Input By: AOB
Date: 19/07/2007
Checked By: WSB
Date: 19/07/2007

Golder Associates Pty Ltd

pH FIELD TESTS

Method: As per State Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland 1998.

Client :	City Pacific Limited	**Project Number :**	06692015
Project :	Townsville Ocean Terminal	**Tested By:**	AJ / BB
Location :	Project Site	**Checked By:**	WSB

Hole No.	Depth (m-BGL)		Soil Type	pH	pHfoX	reaction	Interpreted PASS Potential		
	From	To					high	medium	low
BH21	0.5	0.8	CLAY	9.1	6.3	Slight			x
BH21	0.8	1	Silty CLAY	8.8	6.3	Slight			x
BH21	1	1.25	Silty CLAY	8.9	6.2	Slight			x
BH21	1.25	1.35	Silty CLAY	8.6	6.4	Slight			x
BH21 (refusal)	1.35	1.38	Silty CLAY	9.0	6.8	Slight			x
BH22	0	0.25	CLAY	9.0	6.7	slight			x
BH22	0.25	0.5	CLAY	8.8	6.4	slight			x
BH22	0.5	0.75	CLAY	8.5	6.4	slight			x
BH22	0.75	1	CLAY	8.7	6.4	moderate			x
BH22	1	1.25	Silty CLAY	8.6	6.3	moderate			x
BH22	1.25	1.5	Silty CLAY	8.9	6.3	slight			x
BH22	1.5	1.75	Silty CLAY	8.8	6.3	slight			x
BH22	1.75	1.8	Silty clayey SAND	8.3	6.1	slight			x
BH23	0	0.25	Silty CLAY	8.7	6.4	slight			x
BH23	0.25	0.3	Clayey gravelly SAND	8.7	6.6	moderate			x
BH23	0.3	0.4	Clayey SAND	9.1	6.4	slight			x
BH23	0.4	0.5	CLAY	8.8	6.5	slight			x
BH23	0.5	0.75	CLAY	8.9	6.6	moderate			x
BH23	0.75	1.1	Silty CLAY	8.9	6.4	slight			x
BH23	1.1	1.5	CLAY	8.4	6.6	slight			x
BH23	1.5	1.8	Silty CLAY	8.7	6.6	slight			x
BH24	0	0.25	Silty CLAY	8.7	6.1	slight			x
BH24	0.25	0.5	Silty CLAY	8.6	5.5	moderate			x
BH24	0.5	0.75	CLAY	9.0	7.2	slight			x
BH24	0.75	1	CLAY	9.0	6.5	slight			x
BH24	1	1.25	Silty CLAY	8.7	6.8	slight			x
BH24	1.25	1.5	Silty CLAY	8.9	6.5	moderate			x
BH24	1.5	1.75	Silty CLAY	8.8	6.4	moderate			x
BH24	1.75	1.8	Silty CLAY	8.7	6.3	slight			x
BH24 (refusal)	1.8	1.87	SAND	9.1	6.4	slight			x
BH25	0.1	0.3	Silty Clayey SAND	8.6	5.6	moderate			x
BH25	0.3	0.5	CLAY	9.4	6.4	slight			x
BH25	0.5	0.75	CLAY	9.2	6.5	slight			x
BH25	0.75	0.9	CLAY	8.9	6.6	slight			x
BH25	0.9	1.25	Silty CLAY	8.8	6.3	moderate			x
BH25	1.25	1.5	Silty CLAY	8.9	6.4	slight			x
BH25	1.5	1.75	Silty CLAY	8.9	6.3	slight			x
BH25	1.75	1.9	SAND	8.7	6.2	slight			x
BH25	1.9	2.23	Silty CLAY	8.8	6.4	moderate			x
BH26	0	0.25	Silty CLAY	8.9	6.4	slight			x
BH26	0.25	0.5	CLAY	9.4	6.8	slight			x
BH26	0.5	0.75	CLAY	9.1	7.0	moderate			x
BH26	0.75	1	CLAY	9.0	6.7	slight			x
BH26	1	1.25	Silty CLAY	8.9	6.6	moderate			x
BH26	1.25	1.32	Silty CLAY	9.0	6.5	moderate			x
BH27	0	0.3	Silty Sandy CLAY	8.9	6.6	slight			x
BH27	0.3	0.5	CLAY	9.5	6.8	slight			x
BH27	0.5	0.75	CLAY	9.2	7.2	slight			x
BH27	0.75	1	CLAY	9.0	6.8	slight			x
BH27	1	1.2	CLAY	9.0	6.8	slight			x
BH27	1.2	1.5	Silty CLAY	8.6	6.8	Strong			x
BH27	1.5	1.55	Silty CLAY	8.8	7.1	Strong			x
BH27 (refusal)	1.55	1.63	Silty CLAY	8.8	6.6	slight			x

Input By: AOB
Date: 19/07/2007
Checked By: WSB
Date: 19/07/2007

Golder Associates Pty Ltd

pH FIELD TESTS

Method: As per State Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland 1998.

Client :	City Pacific Limited	**Project Number :**	06692015
Project :	Townsville Ocean Terminal	**Tested By:**	AJ / BB
Location :	Project Site	**Checked By:**	WSB

Hole No.	Depth (m-BGL)		Soil Type	pH	pHfoX	reaction	Interpreted PASS Potential		
	From	To					high	medium	low
BH28	0	0.25	Silty CLAY	8.7	6.3	moderate			x
BH28	0.25	0.5	CLAY	9.2	6.8	slight			x
BH28	0.5	0.75	CLAY	9.3	6.6	slight			x
BH28	0.75	1	CLAY	8.6	6.5	slight			x
BH28	1	1.25	Silty CLAY	8.8	6.7	moderate			x
BH28	1.25	1.5	Silty CLAY	8.9	6.6	moderate			x
BH28	1.5	1.7	Silty CLAY	8.9	6.4	moderate			x
BH28 (refusal)	1.7	1.75	Silty CLAY	8.9	6.4	slight			x
BH29	0	0.25	Silty CLAY	8.6	6.4	slight			x
BH29	0.25	0.5	CLAY	9.3	6.7	slight			x
BH29	0.5	0.75	CLAY	9.0	6.8	slight			x
BH29	0.75	1	CLAY	8.8	6.7	slight			x
BH29	1	1.25	Silty CLAY	8.9	6.7	moderate			x
BH29	1.25	1.5	Silty CLAY	8.9	6.6	moderate			x
BH29	1.5	1.75	Silty CLAY	8.8	6.5	moderate			x
BH29	1.75	1.95	Silty CLAY	8.9	6.4	moderate			x
BH30	0	0.25	Silty CLAY	8.9	6.4	moderate			x
BH30	0.25	0.5	Silty CLAY	8.6	6.3	moderate			x
BH30	0.5	0.75	Silty CLAY	8.5	6.2	moderate			x
BH30	0.75	1	CLAY	9.3	7.1	slight			x
BH30	1	1.25	CLAY	9.1	7.1	slight			x
BH30	1.25	1.5	CLAY	9.0	7.6	moderate			x
BH30	1.5	1.75	CLAY	8.9	7.2	slight			x
BH30	1.75	2	Silty CLAY	8.9	6.7	moderate			x
BH30	2	2.16	Silty CLAY	9.0	6.6	moderate			x
BH31	0	0.25	Silty Sandy CLAY	8.6	6.3	moderate			x
BH31	0.25	0.5	Silty Sandy CLAY	8.8	6.6	slight			x
BH31	0.5	0.75	CLAY	9.1	7.5	slight			x
BH31	0.75	1	CLAY	9.2	7.2	slight			x
BH31	1	1.25	Silty CLAY	8.5	7.0	Strong			x
BH31	1.25	1.5	Silty CLAY	8.8	6.5	slight			x
BH31	1.5	1.75	Silty CLAY	8.7	6.5	moderate			x
BH31	1.75	2	Silty CLAY	8.7	6.4	slight			x
BH31	2	2.25	Silty CLAY	8.6	6.7	moderate			x
BH31	2.25	2.3	Silty CLAY	8.7	6.6	moderate			x
BH31 (refusal)	2.3	2.34	Silty CLAY	9.1	6.5	slight			x
BH32	0	0.25	Silty CLAY	8.9	6.5	moderate			x
BH32	0.25	0.4	Silty CLAY	8.7	6.5	moderate			x
BH32	0.4	0.75	CLAY	9.3	7.1	slight			x
BH32	0.75	1	CLAY	8.9	6.8	slight			x
BH32	1	1.25	Silty CLAY	8.8	6.5	moderate			x
BH32	1.25	1.5	Silty CLAY	8.9	6.4	moderate			x
BH32	1.5	1.55	Silty CLAY	9.0	6.5	moderate			x
BH32 (refusal)	1.55	1.6	Silty CLAY	8.9	6.4	slight			x
BH33	0	0.25	Silty CLAY	8.9	7.3	moderate			x
BH33	0.25	0.5	CLAY	9.3	7.0	slight			x
BH33	0.5	0.75	CLAY	9.2	6.7	slight			x
BH33	0.75	1	CLAY	9.0	7.4	slight			x
BH33	1	1.25	Silty CLAY	8.8	6.9	moderate			x
BH33	1.25	1.5	Silty CLAY	8.7	6.8	moderate			x
BH33	1.5	1.63	Silty CLAY	8.9	6.7	moderate			x
BH33 (refusal)	1.63	1.73	Silty CLAY	9.0	6.4	slight			x
BH34	0	0.25	Silty CLAY	8.8	6.6	moderate			x
BH34	0.25	0.5	Silty CLAY	8.6	6.2	moderate			x

Input By: AOB
Date: 19/07/2007
Checked By: WSB
Date: 19/07/2007

Golder Associates Pty Ltd

pH FIELD TESTS

Method: As per State Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland 1998.

Client :	City Pacific Limited	**Project Number :**	06692015
Project :	Townsville Ocean Terminal	**Tested By:**	AJ / BB
Location :	Project Site	**Checked By:**	WSB

Hole No.	Depth (m-BGL)		Soil Type	pH	pHfoX	reaction	Interpreted PASS Potential		
	From	To					high	medium	low
BH34	0.5	0.75	CLAY	9.2	7.1	slight			x
BH34	0.75	1	CLAY	9.2	7.0	slight			x
BH34	1	1.25	Silty CLAY	8.8	6.7	slight			x
BH34	1.25	1.5	Silty CLAY	8.6	6.9	moderate			x
BH34	1.5	1.75	Silty CLAY	8.8	6.7	moderate			x
BH34 (refusal)	1.75	1.83	Silty CLAY	8.7	6.6	slight			x
BH35	0	0.25	Silty CLAY	8.9	7.1	Strong			x
BH35	0.25	0.5	Silty CLAY	8.7	6.5	moderate			x
BH35	0.5	0.75	Clayey SAND	8.8	7.1	slight			x
BH35	0.75	1	CLAY	9.1	7.6	slight			x
BH35	1	1.25	CLAY	9.3	7.4	slight			x
BH35	1.25	1.5	CLAY	9.1	7.6	slight			x
BH35	1.5	1.75	Silty CLAY	8.7	7.1	slight			x
BH35	1.75	1.9	Silty CLAY	8.9	7.1	moderate			x
BH35 (refusal)	1.9	1.96	Silty CLAY	9.0	6.7	moderate			x
BH36	0	0.25	Silty CLAY	8.8	6.5	moderate			x
BH36	0.25	0.5	Silty Clayey SAND	8.8	7.7	slight			x
BH36	0.5	0.75	CLAY	9.3	7.9	slight			x
BH36	0.75	1	CLAY	9.0	7.0	slight			x
BH36	1	1.25	Silty CLAY	8.8	7.2	moderate			x
BH36	1.25	1.5	Silty CLAY	8.8	6.9	slight			x
BH36	1.5	1.6	SAND	8.8	7.0	slight			x
BH36	1.6	2	Silty CLAY	9.1	7.2	slight			x
BH36	2	2.15	Silty CLAY	8.7	7.1	strong			x
BH36 (refusal)	2.15	2.2	Silty CLAY	9.1	6.4	slight			x
BH37	0	0.25	Silty CLAY	8.6	5.3	moderate			x
BH37	0.25	0.5	Silty Clayey SAND	8.7	7.0	moderate			x
BH37	0.5	0.75	Silty Clayey SAND	8.7	7.6	slight			x
BH37	0.75	1	CLAY	9.2	7.0	slight			x
BH37	1	1.25	Silty CLAY	8.9	6.9	slight			x
BH37	1.25	1.4	Silty CLAY	8.9	7.4	slight			x
BH37	1.4	1.75	SAND	8.7	6.5	slight			x
BH37	1.75	1.9	Silty Sandy CLAY	8.8	4.6	slight			x
BH37	1.9	2.25	Silty CLAY	8.7	7.1	moderate			x
BH37	2.25	2.5	Silty CLAY	8.9	6.7	strong			x
BH37 (refusal)	2.5	2.55	Silty CLAY	9.2	6.7	slight			x
BH38	0	0.25	Silty CLAY	8.9	6.9	moderate			x
BH38	0.25	0.5	Silty CLAY	8.8	7.0	moderate			x
BH38	0.5	0.6	Silty Clayey SAND	8.9	7.2	moderate			x
BH38	0.6	0.95	CLAY	9.0	7.7	slight			x
BH38	0.95	1.25	Silty CLAY	8.8	6.8	strong			x
BH38	1.25	1.5	Silty CLAY	8.8	6.8	strong			x
BH38	1.5	1.6	Silty CLAY	8.8	6.8	strong			x
BH38 (refusal)	1.6	1.66	Silty CLAY	8.9	6.5	slight			x
BH39	0	0.25	Silty CLAY	9.0	6.5	slight			x
BH39	0.25	0.5	Silty CLAY	8.9	6.3	slight			x
BH39	0.5	0.75	Silty CLAY	8.9	6.3	slight			x
BH39	0.75	1	Silty CLAY	8.9	6.4	moderate			x
BH39	1	1.15	CLAY	8.9	6.6	moderate			x
BH39	1.15	1.5	Silty CLAY	8.9	6.5	slight			x
BH39	1.5	1.55	Silty CLAY	9.1	6.4	slight			x
BH39 (refusal)	1.55	1.62	Silty CLAY	8.7	6.4	slight			x
BH40	0	0.25	Silty Sandy CLAY	9.1	6.6	moderate			x
BH40	0.25	0.5	Silty Sandy CLAY	9.0	6.5	moderate			x

Input By: AOB
Date: 19/07/2007
Checked By: WSB
Date: 19/07/2007

Golder Associates Pty Ltd

pH FIELD TESTS

Method: As per State Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland 1998.

Client :	City Pacific Limited	**Project Number :**	06692015
Project :	Townsville Ocean Terminal	**Tested By:**	AJ / BB
Location :	Project Site	**Checked By:**	WSB

Hole No.	Depth (m-BGL)		Soil Type	pH	pHfoX	reaction	Interpreted PASS Potential		
	From	To					high	medium	low
BH40	0.5	0.75	CLAY	9.4	6.7	slight			x
BH40	0.75	1	CLAY	9.2	6.4	slight			x
BH40	1	1.25	Silty CLAY	8.8	6.6	moderate			x
BH40	1.25	1.5	Silty CLAY	8.9	6.5	moderate			x
BH40	1.5	1.75	Silty CLAY	9.0	6.4	moderate			x
BH40	1.75	2	Silty CLAY	9.0	6.9	moderate			x
BH40	2	2.05	Silty CLAY	8.9	6.6	slight			x
BH40 (refusal)	2.05	2.11	Silty CLAY	9.0	6.6	slight			x
BH41	0	0.25	Silty CLAY	8.9	6.9	moderate			x
BH41	0.25	0.5	Silty CLAY	8.8	7.0	moderate			x
BH41	0.5	0.75	Silty Clayey SAND	8.8	7.3	slight			x
BH41	0.75	1	CLAY	9.3	7.4	slight			x
BH41	1	1.25	CLAY	8.9	7.2	slight			x
BH41	1.25	1.5	CLAY	9.0	6.7	slight			x
BH41	1.5	1.7	CLAY	8.8	6.7	slight			x
BH41	1.7	2	Silty Sandy CLAY	8.8	6.7	slight			x
BH41	2	2.25	Silty Sandy CLAY	8.4	7.0	moderate			x
BH41	2.25	2.45	Silty Sandy CLAY	8.8	6.3	moderate			x
BH41 (refusal)	2.45	2.5	Silty Sandy CLAY	8.8	6.7	slight			x
BH42	0	0.25	Silty Sandy CLAY	8.9	7.2	strong			x
BH42	0.25	0.5	Silty Clayey SAND	8.9	6.8	moderate			x
BH42	0.5	0.75	Silty Clayey SAND	8.9	6.7	moderate			x
BH42	0.75	1	Silty Clayey SAND	8.8	6.8	slight			x
BH42	1	1.25	CLAY	9.2	6.9	slight			x
BH42	1.25	1.5	Silty CLAY	9.0	6.8	slight			x
BH42	1.5	1.75	Silty CLAY	9.0	6.8	slight			x
BH42	1.75	2	SAND	8.9	6.6	slight			x
BH42	2	2.2	Silty CLAY	8.9	6.6	slight			x
BH42 (refusal)	2.2	2.27	Silty CLAY	9.2	6.5	slight			x
BH43	0	0.25	Silty CLAY	9.0	6.7	slight			x
BH43	0.25	0.5	Silty CLAY	8.8	6.8	slight			x
BH43	0.5	0.75	Silty CLAY	8.9	6.8	slight			x
BH43	0.75	1	Silty CLAY	8.9	6.6	moderate			x
BH43	1	1.25	Clayey Silty SAND	9.0	6.9	slight			x
BH43	1.25	1.5	Sandy CLAY	9.2	7.1	slight			x
BH43	1.5	1.75	SAND	8.8	6.4	slight			x
BH43	1.75	2	Silty CLAY	9.0	6.7	slight			x
BH43	2	2.25	Silty CLAY	9.0	6.7	slight			x
BH43	2.25	2.5	Silty CLAY	8.8	6.9	moderate			x
BH43 (refusal)	2.5	2.55	Silty CLAY	9.3	6.7	slight			x
BH44	0	0.25	Silty CLAY	9.0	6.8	moderate			x
BH44	0.25	0.5	Silty CLAY	8.6	6.7	moderate			x
BH44	0.5	0.75	Silty CLAY	9.4	7.6	slight			x
BH44	0.75	1	CLAY	9.1	7.2	slight			x
BH44	1	1.25	Silty CLAY	8.9	7.0	moderate			x
BH44	1.25	1.5	Silty CLAY	9.0	6.9	slight			x
BH44	1.5	1.65	Silty CLAY	9.0	6.8	slight			x
BH44 (refusal)	1.65	1.72	Silty CLAY	9.0	6.6	slight			x
BH45	0	0.3	Silty CLAY	8.9	6.6	Moderate			x
BH45	0.3	0.5	Silty clayey SAND	9.2	6.7	Slight			x
BH45	0.5	0.75	CLAY	9.4	7.4	Slight			x
BH45	0.75	1	CLAY	9.5	6.8	Slight			x
BH45	1	1.25	CLAY	9.1	6.8	Slight			x
BH45	1.25	1.5	Silty CLAY	8.8	6.9	Moderate			x
BH45	1.5	1.75	Silty CLAY	8.8	7.0	Moderate			x

Input By: AOB
Date: 19/07/2007
Checked By: WSB
Date: 19/07/2007

Golder Associates Pty Ltd

pH FIELD TESTS

Method: As per State Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland 1998.

Client :	City Pacific Limited	**Project Number :**	06692015
Project :	Townsville Ocean Terminal	**Tested By:**	AJ / BB
Location :	Project Site	**Checked By:**	WSB

Hole No.	Depth (m-BGL)		Soil Type	pH	pHfoX	reaction	Interpreted PASS Potential		
	From	To					high	medium	low
BH45	1.75	1.9	Silty CLAY	8.9	6.9	Moderate			x
BH45 (refusal)	1.9	1.94	Silty CLAY	9.1	6.6	slight			x
BH46	0	0.25	Silty CLAY	8.6	6.9	Moderate			x
BH46	0.25	0.5	Silty CLAY	8.8	6.6	Moderate			x
BH46	0.5	0.75	Silty clayey SAND	8.9	7.3	Moderate			x
BH46	0.75	1	CLAY	9.5	7.1	Slight			x
BH46	1	1.25	CLAY	9.4	7.0	Moderate			x
BH46	1.25	1.5	Silty CLAY	8.6	6.9	Moderate			x
BH46	1.5	1.75	Silty CLAY	8.8	6.8	Slight			x
BH46	1.75	2	Silty CLAY	9.0	7.2	Moderate			x
BH46 (refusal)	2	2.05	Silty CLAY	9.1	6.5	slight			x
BH47	0	0.3	Silty CLAY	8.8	5.9	moderate			x
BH47	0.3	0.45	SAND	9.0	6.3	moderate			x
BH47	0.45	0.6	Silty CLAY	8.9	6.7	moderate			x
BH47	0.6	1	Clayey Silty SAND	8.7	6.9	moderate			x
BH47	1	1.2	Clayey Silty SAND	8.8	7.0	slight			x
BH47	1.2	1.5	SAND	8.9	6.8	slight			x
BH47	1.5	1.75	Silty CLAY	8.9	7.0	slight			x
BH47	1.75	2	Silty CLAY	9.0	7.0	moderate			x
BH47	2	2.05	Silty CLAY	9.0	7.0	slight			x
BH47 (refusal)	2.05	2.14	Silty CLAY	9.0	6.5	slight			x
BH48	0	0.25	Silty Sandy CLAY	8.9	6.6	slight			x
BH48	0.25	0.5	CLAY	8.8	7.9	moderate			x
BH48	0.5	0.7	CLAY	8.6	7.3	slight			x
BH48	0.7	1	Silty Sandy CLAY	8.9	6.9	moderate			x
BH48	1	1.25	Silty Sandy CLAY	8.9	6.9	slight			x
BH48	1.25	1.5	Silty Sandy CLAY	8.8	6.8	slight			x
BH48	1.5	1.75	Silty Sandy CLAY	9.1	6.9	slight			x
BH48	1.75	2	Silty Sandy CLAY	9.2	6.8	slight			x
BH48	2	2.25	Silty Sandy CLAY	8.8	6.7	moderate			x
BH48	2.25	2.5	Silty Sandy CLAY	9.0	6.7	slight			x
BH48	2.5	2.6	Silty Sandy CLAY	8.9	6.7	slight			x
BH48 (refusal)	2.6	2.68	Silty Sandy CLAY	9.3	6.8	slight			x
BH49	0	0.25	Clayey SILT	8.9	6.8	strong			x
BH49	0.25	0.5	Clayey SILT	8.9	6.7	moderate			x
BH49	0.5	0.75	Clayey SILT	8.9	6.7	moderate			x
BH49	0.75	1	Silty CLAY	8.8	6.8	slight			x
BH49	1	1.25	Silty CLAY	8.8	6.6	moderate			x
BH49	1.25	1.5	Silty CLAY	8.8	6.8	moderate			x
BH49	1.5	1.75	Silty CLAY	8.9	6.8	moderate			x
BH49	1.75	2	Silty CLAY	8.8	6.8	moderate			x
BH49	2	2.25	Silty CLAY	9.2	7.0	slight			x
BH49	2.25	2.5	Silty CLAY	9.0	6.8	slight			x
BH49	2.5	2.75	Clayey SAND	8.9	6.6	slight			x
BH49	2.75	3	Silty CLAY	9.3	6.8	moderate			x
BH49 (refusal)	3	3.1	Silty CLAY	8.8	6.8	moderate			x
BH50	0	0.25	Silty Sandy CLAY	8.9	7.3	moderate			x
BH50	0.25	0.4	Silty Sandy CLAY	8.5	5.3	moderate			x
BH50	0.4	0.5	Silty Sandy CLAY	8.9	6.8	slight			x
BH50	0.5	1	Silty Sandy CLAY	9.0	7.0	slight			x
BH50	1	1.3	Clayey SAND	8.8	7.1	slight			x
BH50	1.3	1.5	Silty CLAY	8.9	7.0	slight			x
BH50	1.5	1.75	Silty CLAY	8.9	6.8	slight			x
BH50	1.75	2.1	SAND	8.8	7.0	slight			x
BH50	2.1	2.25	Silty CLAY	8.9	6.9	moderate			x

Input By: AOB
Date: 19/07/2007
Checked By: WSB
Date: 19/07/2007

Golder Associates Pty Ltd

pH FIELD TESTS

Method: As per State Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland 1998.

Client :	City Pacific Limited	**Project Number :**	06692015
Project :	Townsville Ocean Terminal	**Tested By:**	AJ / BB
Location :	Project Site	**Checked By:**	WSB

Hole No.	Depth (m-BGL)		Soil Type	pH	pHfoX	reaction	Interpreted PASS Potential		
	From	To					high	medium	low
BH50	2.25	2.5	Silty CLAY	8.8	6.9	moderate			x
BH50	2.5	2.65	Silty CLAY	8.8	7.0	moderate			x
BH50 (refusal)	2.65	2.7	Silty CLAY	9.1	6.8	slight			x
MWTOT 01	0	1	Clayey SILT	8.6	6.3	slight			x
MWTOT 01	1.5	2	CLAY	8.5	6.2	slight			x
MWTOT 01	2	2.5	Gravelly Sandy CLAY	8.1	6.1	slight			x
MWTOT 01	2.5	3.5	CLAY	8.0	8.6	moderate			x
MWTOT 03	0	0.25	Sandy Clayey SILT	8.8	6.6	moderate			x
MWTOT 03	0.25	0.5	Sandy Clayey SILT	8.9	6.3	moderate			x
MWTOT 03	1	2	Clayey SILT	8.6	6.6	moderate			x
MWTOT 03	2	2.7	Clayey SILT	8.5	6.9	moderate			x
MWTOT 03	3.5	4	CLAY	8.5	6.3	slight			x
MWTOT 03	5	5.5	CLAY	7.9	6.6	slight			x
MWTOT 03	6.5	6.7	CLAY	7.6	6.2	strong			x
MWTOT 04	0	0.25	SAND	8.8	6.5	slight			x
MWTOT 04	0.25	0.5	Clayey SILT	8.9	6.4	moderate			x
MWTOT 04	0.5	0.75	Clayey SILT	8.9	6.3	slight			x
MWTOT 04	0.75	1	Clayey SILT	9.0	6.4	slight			x
MWTOT 04	2.1	3	Silty Sandy CLAY	8.5	6.3	slight			x
MWTOT 05	0	1	Sandy Clayey SILT	8.6	6.3	slight			x
MWTOT 05	1	1.8	Sandy Clayey SILT	8.7	6.2	slight			x
MWTOT 05	2	2.2	CLAY	9.0	6.5	slight			x
MWTOT 05	2.2	2.5	CLAY	8.1	5.5	slight			x
MWTOT 06	0	1	Clayey SILT	8.3	6.1	moderate			x
MWTOT 06	1.4	2	Sandy Gravelly CLAY	8.1	7.7	strong			x
MWTOT 06	2	3	Sandy Gravelly CLAY	8.0	8.5	strong			x

Input By: AOB
Date: 19/07/2007
Checked By: WSB
Date: 19/07/2007

LABORATORY REPORT COVERSHEET

Date: 22 January 2007

To: Golder Associates Pty Ltd
25 McIllwraith St
TOWNSVILLE QLD 4810

Attention: Ms Marissa Cameron

Your Reference:	06692015-02 Ocean Terminal
Laboratory Report No:	54547
Samples Received:	16/01/2007
Samples / Quantity:	11 Soils

The above samples were received intact and analysed according to your written instructions. Unless otherwise stated, solid samples are reported on a dry weight basis and liquid samples as received.

Shey Goddard
Administration Manager
CAIRNS

Jon Dicker
Manager
CAIRNS

SGS Australia Pty Ltd
ABN 44 000 964 278
Environmental Services Unit 2, 58 Comport Street, Portsmith 4870 QLD Australia www.au.sgs.com
t +61 (0)7 4035 5111 f +61 (0)7 4035 5122

CLIENT: Golder Associates Pty Ltd **Laboratory Report No:** 54547
PROJECT: 06692015-02 Ocean Terminal

LABORATORY REPORT

Chromium Suite Our Reference Your Reference Date Sampled	Units	54547-1 BH5 0.0-0.5 27/09/2006	54547-2 BH5 0.5-1.0 27/09/2006	54547-3 BH5 1.0-1.5 27/09/2006
Moisture *	% w/w	44	32	27
pH KCl	pH Units	8.6	8.9	9.0
TAA pH 6.5	kg H_2SO_4/tonne	<0.5	<0.5	<0.5
Chromium Reducible Sulfur (SCR)	% w/w	0.14	0.18	0.20
Acid Neutralisation Capacity*	% $CaCO_3$	4.6	6.0	7.7

Chromium Suite Our Reference Your Reference Date Sampled	Units	54547-4 BH8 0.0-0.5 27/09/2006	54547-5 BH8 0.5-1.0 27/09/2006	54547-6 BH8 2.0-2.25 27/09/2006
Moisture *	% w/w	43	31	26
pH KCl	pH Units	8.9	9.1	8.7
TAA pH 6.5	kg H_2SO_4/tonne	<0.5	<0.5	<0.5
Chromium Reducible Sulfur (SCR)	% w/w	0.072	0.090	0.17
Acid Neutralisation Capacity*	% $CaCO_3$	4.5	4.7	4.6

Chromium Suite Our Reference Your Reference Date Sampled	Units	54547-7 BH18 0.0-0.5 27/09/2006	54547-8 BH18 0.5-1.0 27/09/2006	54547-9 BH18 1.0-1.5 27/09/2006
Moisture *	% w/w	40	32	27
pH KCl	pH Units	8.9	8.9	9.1
TAA pH 6.5	kg H_2SO_4/tonne	<0.5	<0.5	<0.5
Chromium Reducible Sulfur (SCR)	% w/w	0.10	0.18	0.25
Acid Neutralisation Capacity*	% $CaCO_3$	4.6	4.5	5.1

CLIENT: Golder Associates Pty Ltd **Laboratory Report No:** 54547

PROJECT: 06692015-02 Ocean Terminal

LABORATORY REPORT

Chromium Suite Our Reference Your Reference Date Sampled	Units	54547-10 BH18 1.5-1.75 27/09/2006	54547-11 BH18 1.75-1.9 27/09/2006
Moisture *	% w/w	21	21
pH KCl	pH Units	9.2	9.1
TAA pH 6.5	kg H_2SO_4/tonne	<0.5	<0.5
Chromium Reducible Sulfur (SCR)	% w/w	0.16	0.019
Acid Neutralisation Capacity*	% $CaCO_3$	10	1.7

CLIENT: Golder Associates Pty Ltd **Laboratory Report No:** 54547

PROJECT: 06692015-02 Ocean Terminal

LABORATORY REPORT

TEST PARAMETERS	UNITS	LOR	METHOD
Chromium Suite			
Moisture *	% w/w	1	CEP-003
pH KCl	pH Units	0.1	ASSMAC_23A / CEI-401
TAA pH 6.5	kg H_2SO_4/tonne	0.5	ASSMAC_23F / CEI-401
Chromium Reducible Sulfur (S_{CR})	% w/w	0.005	ASSMAC_22B / CEI-405
Acid Neutralisation Capacity*	% $CaCO_3$	0.1	CEI-402

CLIENT: Golder Associates Pty Ltd **Laboratory Report No:** 54547

PROJECT: 06692015-02 Ocean Terminal

LABORATORY REPORT

QUALITY CONTROL	UNITS	Blank	Replicate Sm#	Replicate Sample||Replicate
Moisture *	% w/w	[NT]	54547-1	44 || [N/T]
pH KCl	pH Units	5.8	54547-1	8.6 || 8.8 || RPD: 2
TAA pH 6.5	kg H_2SO_4/ tonne	[NT]	54547-1	<0.5 || <0.5
Chromium Reducible Sulfur (S_{CR})	% w/w	[NT]	54547-1	0.14 || 0.13 || RPD: 7
Acid Neutralisation Capacity*	% $CaCO_3$	[NT]	54547-1	4.6 || 4.2 || RPD: 9
QUALTY CONTROL	UNITS	Blank	Replicate Sm#	Replicate Sample||Replicate
Moisture *	% w/w	[NT]	54547-11	21 || [N/T]
pH KCl	pH Units	[NT]	54547-11	9.1 || 8.9 || RPD: 2
TAA pH 6.5	kg H_2SO_4/ tonne	[NT]	54547-11	<0.5 || <0.5
Chromium Reducible Sulfur (S_{CR})	% w/w	[NT]	54547-11	0.019 || 0.019 || RPD: 0
Acid Neutralisation Capacity*	% $CaCO_3$	[NT]	54547-11	1.7 || 1.7 || RPD: 0

NOTES:

LOR - Limit of Reporting.

* This test is not covered by our current NATA accreditation.

* This test is not covered by our current NATA accreditation.

Analysis Date: **Between** 16/01/07 **and** 22/01/07

SGS Terms and Conditions are available from www.au.sgs.com

LABORATORY REPORT COVERSHEET

Date: 25 January 2007

To: Golder Associates Pty Ltd
25 McIllwraith St
TOWNSVILLE QLD 4810

Attention: Ms Marissa Cameron

Your Reference:	06692015-02 Ocean Terminal
Laboratory Report No:	54574
Samples Received:	18/01/2007
Samples / Quantity:	32 Soils

The above samples were received intact and analysed according to your written instructions. Unless otherwise stated, solid samples are reported on a dry weight basis and liquid samples as received.

Shey Goddard
Administration Manager
CAIRNS

Jon Dicker
Manager
CAIRNS

SGS Australia Pty Ltd
ABN 44 000 964 278
Environmental Services Unit 2, 58 Comport Street, Portsmith 4870 QLD Australia www.au.sgs.com
t +61 (0)7 4035 5111 f +61 (0)7 4035 5122

CLIENT: Golder Associates Pty Ltd **Laboratory Report No:** 54574
PROJECT: 06692015-02 Ocean Terminal

LABORATORY REPORT

Chromium Suite Our Reference Your Reference Date Sampled	Units	54574-1 BH26 0.0-0.25 28/09/2006	54574-2 BH26 0.25-0.75 28/09/2006	54574-3 BH26 1.0-1.32 28/09/2006
Moisture *	% w/w	31	22	45
pH KCl	pH Units	8.8	8.3	8.6
TAA pH 6.5	kg H_2SO_4/tonne	<0.5	<0.5	<0.5
Chromium Reducible Sulfur (SCR)	% w/w	0.23	0.009	0.12
Acid Neutralisation Capacity*	% $CaCO_3$	6.5	NA	4.4

Chromium Suite Our Reference Your Reference Date Sampled	Units	54574-4 BH30 0.0-0.25 28/09/2006	54574-5 BH30 0.5-1.0 28/09/2006	54574-6 BH30 1.5-1.75 28/09/2006
Moisture *	% w/w	32	32	20
pH KCl	pH Units	8.8	8.8	8.8
TAA pH 6.5	kg H_2SO_4/tonne	<0.5	<0.5	<0.5
Chromium Reducible Sulfur (SCR)	% w/w	0.25	0.21	0.034
Acid Neutralisation Capacity*	% $CaCO_3$	7.3	5.6	3.2

Chromium Suite Our Reference Your Reference Date Sampled	Units	54574-7 BH33 0.0-0.25 29/09/2006	54574-8 BH33 0.25-0.5 29/09/2006	54574-9 BH33 0.5-1.0 29/09/2006
Moisture *	% w/w	25	23	20
pH KCl	pH Units	9.1	8.8	8.2
TAA pH 6.5	kg H_2SO_4/tonne	<0.5	<0.5	<0.5
Chromium Reducible Sulfur (SCR)	% w/w	0.16	0.081	<0.005
Acid Neutralisation Capacity*	% $CaCO_3$	6.7	3.5	NA

CLIENT: Golder Associates Pty Ltd **Laboratory Report No:** 54574

PROJECT: 06692015-02 Ocean Terminal

LABORATORY REPORT

Chromium Suite Our Reference Your Reference Date Sampled	Units	54574-10 BH33 1.0-1.25 29/09/2006	54574-11 BH33 1.25-1.73 29/09/2006	54574-12 BH40 0.0-0.5 29/09/2006
Moisture *	% w/w	33	30	25
pH KCl	pH Units	9.0	9.0	9.1
TAA pH 6.5	kg H_2SO_4/tonne	<0.5	<0.5	<0.5
Chromium Reducible Sulfur (SCR)	% w/w	0.14	0.21	0.20
Acid Neutralisation Capacity*	% $CaCO_3$	4.6	5.7	10

Chromium Suite Our Reference Your Reference Date Sampled	Units	54574-13 BH40 0.5-1.0 29/09/2006	54574-14 BH40 1.0-1.5 29/09/2006	54574-15 BH40 1.75-2.11 29/09/2006
Moisture *	% w/w	22	32	34
pH KCl	pH Units	8.8	9.0	8.9
TAA pH 6.5	kg H_2SO_4/tonne	<0.5	<0.5	<0.5
Chromium Reducible Sulfur (SCR)	% w/w	0.006	0.21	0.092
Acid Neutralisation Capacity*	% $CaCO_3$	NA	4.7	4.3

Chromium Suite Our Reference Your Reference Date Sampled	Units	54574-16 BH42 0.0-0.25 28/09/2006	54574-17 BH42 0.5-1.0 28/09/2006	54574-18 BH42 1.0-1.25 28/09/2006
Moisture *	% w/w	26	32	19
pH KCl	pH Units	9.0	9.1	9.1
TAA pH 6.5	kg H_2SO_4/tonne	<0.5	<0.5	<0.5
Chromium Reducible Sulfur (SCR)	% w/w	0.14	0.24	<0.005
Acid Neutralisation Capacity*	% $CaCO_3$	3.2	7.6	NA

CLIENT: Golder Associates Pty Ltd **Laboratory Report No:** 54574

PROJECT: 06692015-02 Ocean Terminal

LABORATORY REPORT

Chromium Suite Our Reference Your Reference Date Sampled	Units	54574-19 BH42 1.25-1.75 28/09/2006	54574-20 BH49 0.0-0.5 28/09/2006	54574-21 BH49 0.75-1.25 28/09/2006
Moisture *	% w/w	34	38	31
pH KCl	pH Units	9.1	8.8	9.1
TAA pH 6.5	kg H_2SO_4/tonne	<0.5	<0.5	<0.5
Chromium Reducible Sulfur (SCR)	% w/w	0.10	0.42	0.26
Acid Neutralisation Capacity*	% $CaCO_3$	7.3	9.4	8.9

Chromium Suite Our Reference Your Reference Date Sampled	Units	54574-22 BH49 1.5-2.0 28/09/2006	54574-23 BH49 2.5-2.75 28/09/2006	54574-24 BH49 3.0-3.1 28/09/2006
Moisture *	% w/w	39	28	33
pH KCl	pH Units	8.8	9.1	9.1
TAA pH 6.5	kg H_2SO_4/tonne	<0.5	<0.5	<0.5
Chromium Reducible Sulfur (SCR)	% w/w	0.42	0.19	0.23
Acid Neutralisation Capacity*	% $CaCO_3$	4.7	3.9	5.2

Chromium Suite Our Reference Your Reference Date Sampled	Units	54574-25 MW TOT 4 2.1-3.0 27/10/2006	54574-26 MW TOT 5 2.0-2.2 30/10/2006	54574-27 MW TOT 5 2.2-2.5 30/10/2006
Moisture *	% w/w	20	17	18
pH KCl	pH Units	9.2	9.0	7.7
TAA pH 6.5	kg H_2SO_4/tonne	<0.5	<0.5	<0.5
Chromium Reducible Sulfur (SCR)	% w/w	0.031	<0.005	<0.005
Acid Neutralisation Capacity*	% $CaCO_3$	1.3	NA	NA

CLIENT: Golder Associates Pty Ltd **Laboratory Report No:** 54574

PROJECT: 06692015-02 Ocean Terminal

LABORATORY REPORT

Chromium Suite Our Reference Your Reference Date Sampled	Units	54574-28 MW TOT 6 2.0-3.0 31/10/2006	54574-29 MW TOT 1 1.5-2.0 24/10/2006	54574-30 MW TOT 1 2.5-3.5 24/10/2006
Moisture *	% w/w	37	23	30
pH KCl	pH Units	9.0	9.4	9.1
TAA pH 6.5	kg H_2SO_4/tonne	<0.5	<0.5	<0.5
Chromium Reducible Sulfur (SCR)	% w/w	<0.005	0.025	0.009
Acid Neutralisation Capacity*	% $CaCO_3$	NA	NA	NA

Chromium Suite Our Reference Your Reference Date Sampled	Units	54574-31 MW TOT 3 3.5-4.0 26/10/2006	54574-32 MW TOT 3 5.0-5.5 26/10/2006
Moisture *	% w/w	22	18
pH KCl	pH Units	7.8	9.0
TAA pH 6.5	kg H_2SO_4/tonne	<0.5	<0.5
Chromium Reducible Sulfur (SCR)	% w/w	<0.005	<0.005
Acid Neutralisation Capacity*	% $CaCO_3$	NA	NA

CLIENT: Golder Associates Pty Ltd **Laboratory Report No:** 54574

PROJECT: 06692015-02 Ocean Terminal

LABORATORY REPORT

TEST PARAMETERS	UNITS	LOR	METHOD
Chromium Suite			
Moisture *	% w/w	1	CEP-003
pH KCl	pH Units	0.1	ASSMAC_23A / CEI-401
TAA pH 6.5	kg H_2SO_4/tonne	0.5	ASSMAC_23F / CEI-401
Chromium Reducible Sulfur (S_{CR})	% w/w	0.005	ASSMAC_22B / CEI-405
Acid Neutralisation Capacity*	% $CaCO_3$	0.1	CEI-402

CLIENT: Golder Associates Pty Ltd **Laboratory Report No:** 54574

PROJECT: 06692015-02 Ocean Terminal

LABORATORY REPORT

QUALITY CONTROL	UNITS	Blank	Replicate Sm#	Replicate Sample||Replicate
Moisture *	% w/w	[NT]	54574-1	31 || [N/T]
pH KCl	pH Units	5.7	54574-1	8.8 || 8.9 || RPD: 1
TAA pH 6.5	kg H_2SO_4/ tonne	[NT]	54574-1	<0.5 || <0.5
Chromium Reducible Sulfur (S_{CR})	% w/w	[NT]	54574-1	0.23 || 0.23 || RPD: 0
Acid Neutralisation Capacity*	% $CaCO_3$	[NT]	54574-1	6.5 || 6.5 || RPD: 0
QUALTY CONTROL	UNITS	Blank	Replicate Sm#	Replicate Sample||Replicate
Moisture *	% w/w	[NT]	54574-21	31 || [N/T]
pH KCl	pH Units	[NT]	54574-21	9.1 || 9.1 || RPD: 0
TAA pH 6.5	kg H_2SO_4/ tonne	[NT]	54574-21	<0.5 || <0.5
Chromium Reducible Sulfur (S_{CR})	% w/w	[NT]	54574-21	0.26 || 0.27 || RPD: 4
Acid Neutralisation Capacity*	% $CaCO_3$	[NT]	54574-21	8.9 || 9.0 || RPD: 1

NOTES:

LOR - Limit of Reporting.

* This test is not covered by our current NATA accreditation.

Analysis Date: **Between** 18/01/07 **and** 25/01/07

SGS Terms and Conditions are available from www.au.sgs.com

LABORATORY REPORT COVERSHEET

Date: 9 July 2007

To: Golder Associates Pty Ltd
25 McIllwraith St
TOWNSVILLE QLD 4810

Attention: Ms Marissa Cameron

Your Reference:	06692015-02 Ocean Terminal
Laboratory Report No:	56259
Samples Received:	5/07/2007
Samples / Quantity:	22 Soil

The above samples were received intact and analysed according to your written instructions. Unless otherwise stated, solid samples are reported on a dry weight basis and liquid samples as received.

Shey Goddard
Administration Manager
CAIRNS

Jon Dicker
Manager
CAIRNS

SGS Australia Pty Ltd
ABN 44 000 964 278
Environmental Services Unit 2, 58 Comport Street, Portsmith 4870 QLD Australia www.au.sgs.com
t +61 (0)7 4035 5111 f +61 (0)7 4035 5122

CLIENT: Golder Associates Pty Ltd **Laboratory Report No:** 56259
PROJECT: 06692015-02 Ocean Terminal

LABORATORY REPORT

Chromium Suite Our Reference Your Reference Date Sampled	Units	56259-1 MWTOT14.5-4.95 24/10/2006	56259-2 MWTOT1 6.1-6.5 24/10/2006	56259-3 MWTOT1 7.5-7.95 24/10/2006
Moisture *	% w/w	18	19	19
pH KCl	pH Units	6.0	6.6	6.5
TAA pH 6.5	kg H_2SO_4/tonne	<0.5	<0.5	<0.5
Chromium Reducible Sulfur (SCR)	% w/w	<0.005	<0.005	<0.005

Chromium Suite Our Reference Your Reference Date Sampled	Units	56259-4 MWTOT1 9.0-9.45 24/10/2006	56259-5 MWTOT1 12.0-12.45 24/10/2006	56259-6 MWTOT1 13.6-14.05 24/10/2006
Moisture *	% w/w	18	18	13
pH KCl	pH Units	6.3	6.4	6.7
TAA pH 6.5	kg H_2SO_4/tonne	<0.5	<0.5	<0.5
Chromium Reducible Sulfur (SCR)	% w/w	<0.005	<0.005	<0.005

Chromium Suite Our Reference Your Reference Date Sampled	Units	56259-7 MWTOT 2 6.1-6.5 25/10/2007	56259-8 MWTOT2 10.5-10.95 25/10/2006	56259-9 MWTOT3 7.5-7.95 26/10/2006
Moisture *	% w/w	19	26	12
pH KCl	pH Units	8.6	8.7	8.5
TAA pH 6.5	kg H_2SO_4/tonne	<0.5	<0.5	<0.5
Chromium Reducible Sulfur (SCR)	% w/w	<0.005	<0.005	<0.005

CLIENT: Golder Associates Pty Ltd **Laboratory Report No:** 56259

PROJECT: 06692015-02 Ocean Terminal

LABORATORY REPORT

Chromium Suite Our Reference Your Reference Date Sampled	Units	56259-10 MWTOT3 9.0-9.45 26/10/2006	56259-11 MWTOT3 12.0-12.45 26/10/2006	56259-12 MWTOT3 15.0-15.45 26/10/2006
Moisture *	% w/w	15	16	11
pH KCl	pH Units	8.8	7.7	8.9
TAA pH 6.5	kg H_2SO_4/tonne	<0.5	<0.5	<0.5
Chromium Reducible Sulfur (SCR)	% w/w	<0.005	<0.005	<0.005

Chromium Suite Our Reference Your Reference Date Sampled	Units	56259-13 MWTOT4 7.5-7.95 27/10/2006	56259-14 MWTOT4 12.0-12.45 27/10/2007	56259-15 MWTOT4 15.0-15.45 27/10/2008
Moisture *	% w/w	16	12	13
pH KCl	pH Units	7.6	7.8	7.9
TAA pH 6.5	kg H_2SO_4/tonne	<0.5	<0.5	<0.5
Chromium Reducible Sulfur (SCR)	% w/w	<0.005	<0.005	<0.005

Chromium Suite Our Reference Your Reference Date Sampled	Units	56259-16 MWTOT4 18.0-18.45 27/10/2006	56259-17 MWTOT5 6.50-6.95 30/10/2006	56259-18 MWTOT5 11.0-11.45 30/10/2006
Moisture *	% w/w	15	17	14
pH KCl	pH Units	7.2	8.6	7.5
TAA pH 6.5	kg H_2SO_4/tonne	<0.5	<0.5	<0.5
Chromium Reducible Sulfur (SCR)	% w/w	<0.005	<0.005	<0.005

CLIENT: Golder Associates Pty Ltd **Laboratory Report No:** 56259

PROJECT: 06692015-02 Ocean Terminal

LABORATORY REPORT

Chromium Suite Our Reference Your Reference Date Sampled	Units	56259-19 MWTOT5 17.0-17.45 30/10/2006	56259-20 MWTOT5 20.0-20.45 30/10/2006	56259-21 MWTOT6 5.0-5.45 31/10/2007
Moisture *	% w/w	12	11	12
pH KCl	pH Units	8.9	7.5	7.1
TAA pH 6.5	kg H_2SO_4/tonne	<0.5	<0.5	<0.5
Chromium Reducible Sulfur (SCR)	% w/w	<0.005	<0.005	<0.005

Chromium Suite Our Reference Your Reference Date Sampled	Units	56259-22 MWTOT6 8.0-8.45 31/10/2007
Moisture *	% w/w	16
pH KCl	pH Units	8.2
TAA pH 6.5	kg H_2SO_4/tonne	<0.5
Chromium Reducible Sulfur (SCR)	% w/w	<0.005

CLIENT: Golder Associates Pty Ltd **Laboratory Report No:** 56259

PROJECT: 06692015-02 Ocean Terminal

LABORATORY REPORT

TEST PARAMETERS	UNITS	LOR	METHOD
Chromium Suite			
Moisture *	% w/w	1	CEP-003
pH KCl	pH Units	0.1	ASSMAC_23A / CEI-401
TAA pH 6.5	kg H_2SO_4/tonne	0.5	ASSMAC_23F / CEI-401
Chromium Reducible Sulfur (S_{CR})	% w/w	0.005	ASSMAC_22B / CEI-405

CLIENT: Golder Associates Pty Ltd **Laboratory Report No:** 56259

PROJECT: 06692015-02 Ocean Terminal

LABORATORY REPORT

QUALITY CONTROL	UNITS	Blank	Replicate Sm#	Replicate Sample||Replicate
Moisture *	% w/w	[NT]	56259-1	18 || NT
pH KCl	pH Units	[NT]	56259-1	6.0 || 6.1 || RPD: 2
TAA pH 6.5	kg H_2SO_4/tonne	[NT]	56259-1	<0.5 || <0.5
Chromium Reducible Sulfur (SCR)	% w/w	[NT]	56259-1	<0.005 || <0.005
QUALTY CONTROL	UNITS	Blank	Replicate Sm#	Replicate Sample||Replicate
Moisture *	% w/w	[NT]	56259-11	16 || NT
pH KCl	pH Units	[NT]	56259-11	7.7 || 7.5 || RPD: 3
TAA pH 6.5	kg H_2SO_4/tonne	[NT]	56259-11	<0.5 || <0.5
Chromium Reducible Sulfur (SCR)	% w/w	[NT]	56259-11	<0.005 || <0.005
QUALTY CONTROL	UNITS	Blank	Replicate Sm#	Replicate Sample||Replicate
Moisture *	% w/w	[NT]	56259-21	12 || NT
pH KCl	pH Units	[NT]	56259-21	7.1 || 7.0 || RPD: 1
TAA pH 6.5	kg H_2SO_4/tonne	[NT]	56259-21	<0.5 || <0.5
Chromium Reducible Sulfur (SCR)	% w/w	[NT]	56259-21	<0.005 || <0.005

NOTES:

LOR - Limit of Reporting.

* This test is not covered by our current NATA accreditation.

Analysis Date: **Between** 5/07/07 **and** 9/07/07

APPENDIX D

Geotechnical Laboratory Records

Golder Associates Pty Ltd
NORTH QUEENSLAND LABORATORY
216 Draper Street, CAIRNS, QLD, 4870
NATA Accreditation No: 3732

Golder Associates

CLASSIFICATION TEST RESULTS REPORT

Client	City Pacific Project Management Pty Ltd	**Job Number**	06692015-3
Client Address	PO Box 1653, Southport, Qld 4215	**Date**	23-Nov-06
Project	Townsville Ocean Terminal	**Report Number**	**Summary**
Location	Breakwater, Townsville	**Page**	1 of 1
Sampling Method	As Supplied to Laboratory		

Test Method			*2.1.1*	*3.1.2*	*3.2.1*	*3.3.1*	*3.4.1*	*3.6.1*	*3.6.1*	*AS1726*
AS1289.										
Lab Ref	BH	Depth-m	mc %	w_L %	w_P %	I_P %	LS %	%-2.36mm	%-.075mm	USC Symbol
06/1116	22	0-0.85	28.0	46	16	30	11.0	98	84	CI
06/1117	22	0.85-1.75	58.0	45	19	26	10.5	100	92	CI
06/1118	25	0-1.0	35.5	43	16	27	14.5	100	76	CI
06/1119	26	1.0-1.36	53.6	43	17	26	12.0	100	93	CI
06/1120	26	1.0-2.35	65.0	45	19	26	11.5	100	89	CI
06/1121	29	0-1.0	31.0	50	18	32	16.0	95	78	CH
06/1122	29	1.0-1.95	50.1	38	19	19	9.5	100	89	CI
06/1123	33	0-0.9	29.3	49	16	33	14.0	98	81	CI
06/1124	33	0.9-1.73	58.7	39	20	19	9.0	100	90	CI
06/1125	36	0-1.0	40.4	39	16	23	10.5	100	84	CI
06/1126	36	1.0-2.0	42.3	37	18	19	8.0	97	69	CI
06/1127	37	0-1.4	47.8	38	15	23	9.5	98	82	CI
06/1128	37	1.4-2.5	36.1	47	16	31	13.0	95	37	SC
06/1129	38	0-1.6	52.9	48	16	32	14.5	100	94	CI
06/1130	40	0-0.9	33.8	42	15	27	13.0	100	97	CI
06/1131	40	1.0-2.1	48.4	37	20	17	8.0	100	88	CI
06/1132	42	0-1.2	36.7	36	17	19	9.5	96	65	CI
06/1133	42	1.2-2.2	42.8	36	17	19	8.0	95	61	CI
06/1134	45	0-1.25	40.5	45	16	29	14.0	99	95	CI
06/1135	45	1.25-1.94	51.8	39	19	20	7.5	100	89	CI
06/1136	46	0-1.25	30.9	40	16	24	11.5	100	86	CI
06/1137	46	1.25-2.05	60.7	49	19	30	13.0	100	90	CI

NATA

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its terms of accreditation.

THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL

Darryl Murphy Laboratory Manager — AUTHORISED SIGNATORY

25-Nov-06 — DATE

Golder Associates Pty Ltd
NORTH QUEENSLAND LABORATORY
216 Draper Street, CAIRNS, QLD, 4870
NATA Accreditation No: 3732

PARTICLE SIZE DISTRIBUTION & CONSISTENCY LIMITS TEST REPORT

Client	City Pacific Project Management Pty Ltd	**Job Number**	06692015-3
Client Address	PO Box 1653, Southport, Qld 4215	**Date**	23-Nov-06
Project	Townsville Ocean Terminal	**Report Number**	NQ-06578 Page No 1 of 1
Location	Breakwater, Townsville	**Sampling Method**	As Supplied to Laboratory
Lab Ref No.	06/1116	**Sample Identification**	BH 22 0.0-0.85m

Laboratory Specimen Description (AS1726, App A, Sect 2) CI CLAY, medium plasticity, grey, with some sand.

PARTICLE SIZE DISTRIBUTION AS1289 3.6.1

Sieve Size	% Passing	Spec. Lower	Spec. Upper
150 mm	100		
100 mm	100		
75 mm	100		
53 mm	100		
37.5 mm	100		
26.5 mm	100		
19.0 mm	100		
13.2 mm	100		
9.5 mm	100		
6.7 mm	100		
4.75 mm	100		
2.36 mm	98		
1.18 mm	97		
0.600mm	96		
0.425mm	95		
0.300mm	94		
0.150mm	90		
0.075mm	84		

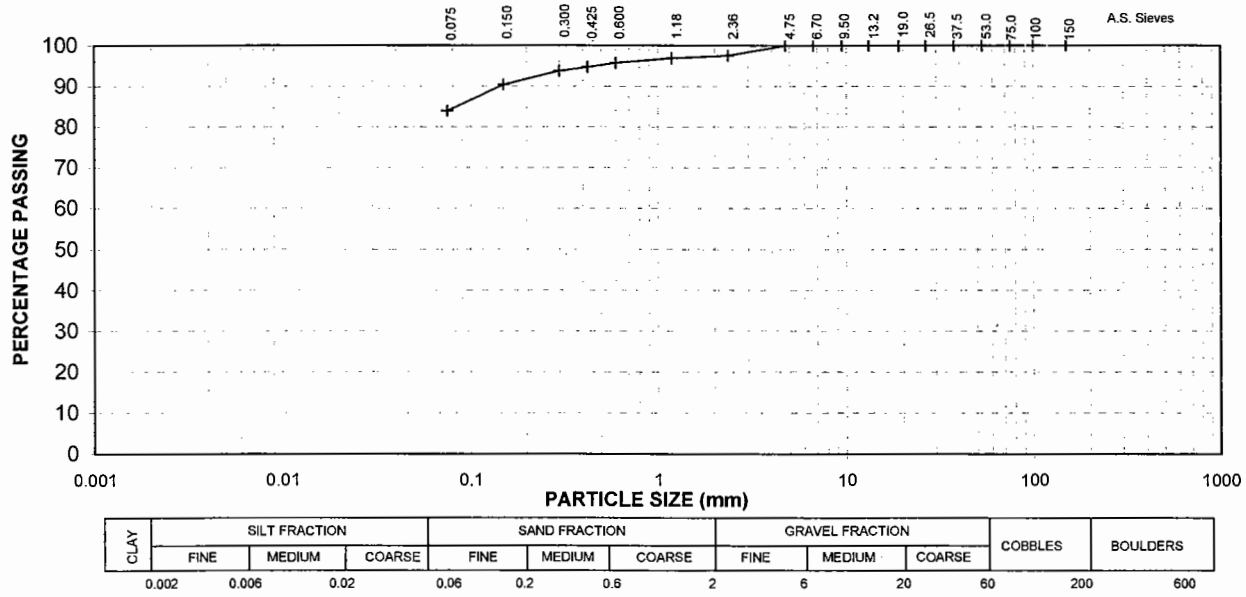
CLASSIFICATION LIMITS AND MOISTURE CONTENT

Test		Method	Result	Spec. Lower	Spec. Upper
Liquid Limit	%	AS1289 3.1.2	46		
Plastic Limit	%	AS1289 3.2.1	16		
Plasticity Index	%	AS1289 3.3.1	30		
Linear Shrinkage	%	AS1289 3.4.1	11.0		
Moisture Content	%	AS1289 2.1.1	28.0		

Sample History :	Natural State
Preparation Method :	Wet sieved
Crumbling / Curling of Linear Shrinkage :	No
Linear Shrinkage Mould Length :	250mm

NP = non-plastic NO = not obtainable ND = not determined

PARTICLE SIZE DISTRIBUTION



NATA

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its scope of accreditation.

Darryl Murphy Laboratory Manager — AUTHORISED SIGNATORY

25-Nov-06 — DATE

J:\Townsville Jobs\06692015-3\2015-3_578

Golder Associates Pty Ltd
NORTH QUEENSLAND LABORATORY
216 Draper Street, CAIRNS, QLD, 4870
NATA Accreditation No: 3732

PARTICLE SIZE DISTRIBUTION & CONSISTENCY LIMITS TEST REPORT

Client	City Pacific Project Management Pty Ltd	**Job Number**	06692015-3
Client Address	PO Box 1653, Southport, Qld 4215	**Date**	23-Nov-06
Project	Townsville Ocean Terminal	**Report Number**	NQ-06579 Page No 1 of 1
Location	Breakwater, Townsville	**Sampling Method**	As Supplied to Laboratory
Lab Ref No.	06/1117	**Sample Identification**	BH 22 0.85-1.75m

Laboratory Specimen Description CI CLAY, medium plasticity, grey, with trace of sand.
(AS1726, App A, Sect 2)

PARTICLE SIZE DISTRIBUTION AS1289 3.6.1

Sieve Size	% Passing	Spec. Lower	Spec. Upper
150 mm	100		
100 mm	100		
75 mm	100		
53 mm	100		
37.5 mm	100		
26.5 mm	100		
19.0 mm	100		
13.2 mm	100		
9.5 mm	100		
6.7 mm	100		
4.75 mm	100		
2.36 mm	100		
1.18 mm	99		
0.600mm	99		
0.425mm	99		
0.300mm	99		
0.150mm	98		
0.075mm	92		

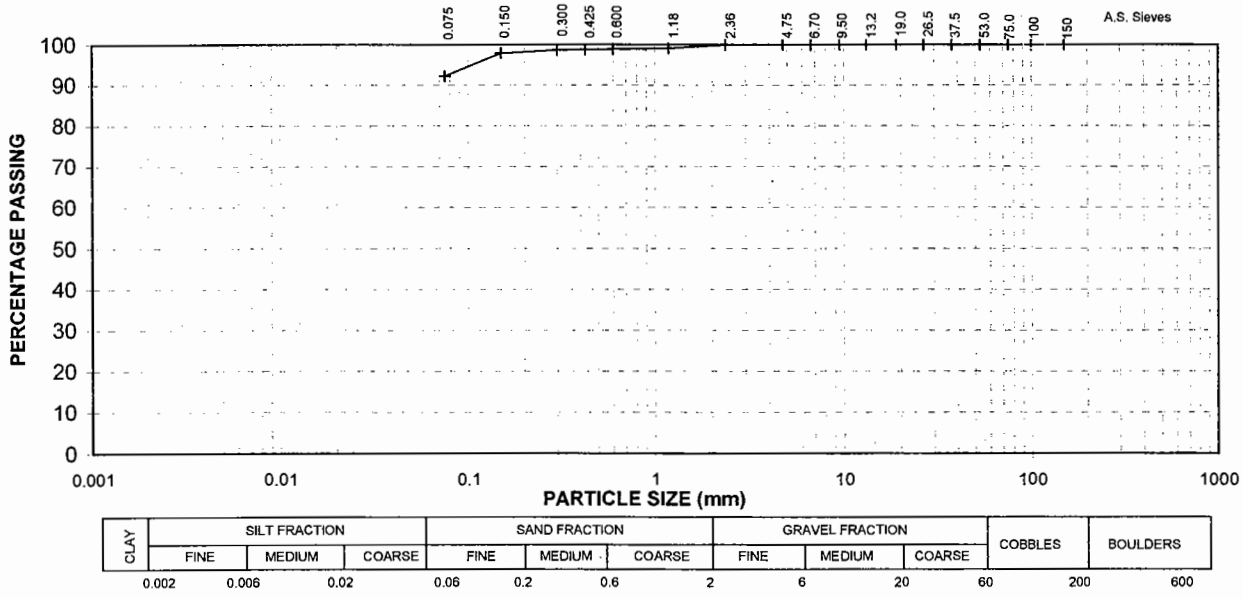
CLASSIFICATION LIMITS AND MOISTURE CONTENT

Test		Method	Result	Spec. Lower	Spec. Upper
Liquid Limit	%	AS1289 3.1.2	45		
Plastic Limit	%	AS1289 3.2.1	19		
Plasticity Index	%	AS1289 3.3.1	26		
Linear Shrinkage	%	AS1289 3.4.1	10.5		
Moisture Content	%	AS1289 2.1.1	58.0		

Sample History :	Natural State
Preparation Method :	Wet sieved
Crumbling / Curling of Linear Shrinkage :	No
Linear Shrinkage Mould Length :	250mm

NP = non-plastic NO = not obtainable ND = not determined

PARTICLE SIZE DISTRIBUTION



NATA

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its scope of accreditation.

THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL

Darryl Murphy Laboratory Manager — AUTHORISED SIGNATORY

25-Nov-06 — DATE

J:\Townsville Jobs\06692015-3\2015-3_579

Golder Associates Pty Ltd
NORTH QUEENSLAND LABORATORY
216 Draper Street, CAIRNS, QLD, 4870
NATA Accreditation No: 3732

PARTICLE SIZE DISTRIBUTION & CONSISTENCY LIMITS TEST REPORT

Client	City Pacific Project Management Pty Ltd	**Job Number**	06692015-3
Client Address	PO Box 1653, Southport, Qld 4215	**Date**	23-Nov-06
Project	Townsville Ocean Terminal	**Report Number**	NQ-06580 Page No 1 of 1
Location	Breakwater, Townsville	**Sampling Method**	As Supplied to Laboratory
Lab Ref No.	06/1118	**Sample Identification**	BH 25 0-1.0m

Laboratory Specimen Description CI CLAY, medium plasticity, grey and yellow grey, with some sand.
(AS1726, App A, Sect 2)

PARTICLE SIZE DISTRIBUTION AS1289 3.6.1

Sieve Size	% Passing	Spec. Lower	Spec. Upper
150 mm	100		
100 mm	100		
75 mm	100		
53 mm	100		
37.5 mm	100		
26.5 mm	100		
19.0 mm	100		
13.2 mm	100		
9.5 mm	100		
6.7 mm	100		
4.75 mm	100		
2.36 mm	100		
1.18 mm	99		
0.600mm	98		
0.425mm	97		
0.300mm	96		
0.150mm	95		
0.075mm	76		

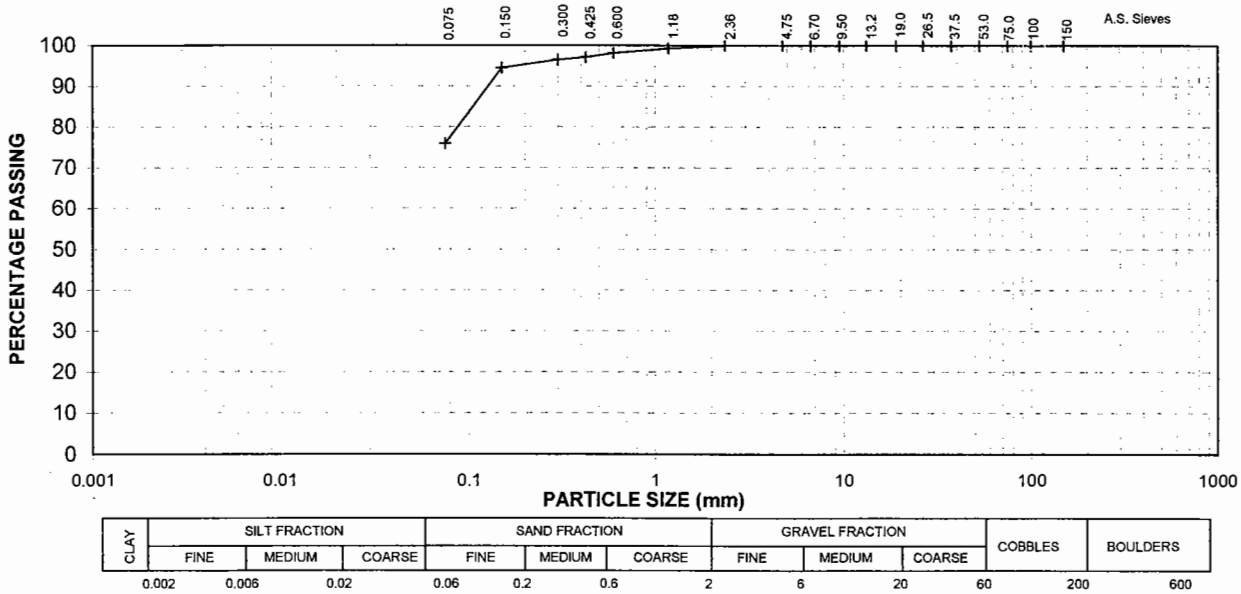
CLASSIFICATION LIMITS AND MOISTURE CONTENT

Test		Method	Result	Spec. Lower	Spec. Upper
Liquid Limit	%	AS1289 3.1.2	43		
Plastic Limit	%	AS1289 3.2.1	16		
Plasticity Index	%	AS1289 3.3.1	27		
Linear Shrinkage	%	AS1289 3.4.1	14.5		
Moisture Content	%	AS1289 2.1.1	35.5		

Sample History :	Natural State
Preparation Method :	Wet sieved
Crumbling / Curling of Linear Shrinkage :	NO
Linear Shrinkage Mould Length :	150mm

NP = non-plastic NO = not obtainable ND = not determined

PARTICLE SIZE DISTRIBUTION



NATA

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its scope of accreditation.

THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL

Darryl Murphy Laboratory Manager — AUTHORISED SIGNATORY

25-Nov-06 — DATE

J:\Townsville Jobs\06692015-3\2015-3_580

Golder Associates Pty Ltd
NORTH QUEENSLAND LABORATORY
216 Draper Street, CAIRNS, QLD, 4870
NATA Accreditation No: 3732

PARTICLE SIZE DISTRIBUTION & CONSISTENCY LIMITS TEST REPORT

Client	City Pacific Project Management Pty Ltd	**Job Number**	06692015-3
Client Address	PO Box 1653, Southport, Qld 4215	**Date**	23-Nov-06
Project	Townsville Ocean Terminal	**Report Number**	NQ-06581 Page No 1 of 1
Location	Breakwater, Townsville	**Sampling Method**	As Supplied to Laboratory
Lab Ref No.	06/1119	**Sample Identification**	BH 26 1.0-1.36m

Laboratory Specimen Description CI CLAY, medium plasticity, grey, with trace of sand.
(AS1726, App A, Sect 2)

PARTICLE SIZE DISTRIBUTION AS1289 3.6.1

Sieve Size	% Passing	Spec. Lower	Spec. Upper
150 mm	100		
100 mm	100		
75 mm	100		
53 mm	100		
37.5 mm	100		
26.5 mm	100		
19.0 mm	100		
13.2 mm	100		
9.5 mm	100		
6.7 mm	100		
4.75 mm	100		
2.36 mm	100		
1.18 mm	100		
0.600mm	99		
0.425mm	99		
0.300mm	99		
0.150mm	98		
0.075mm	93		

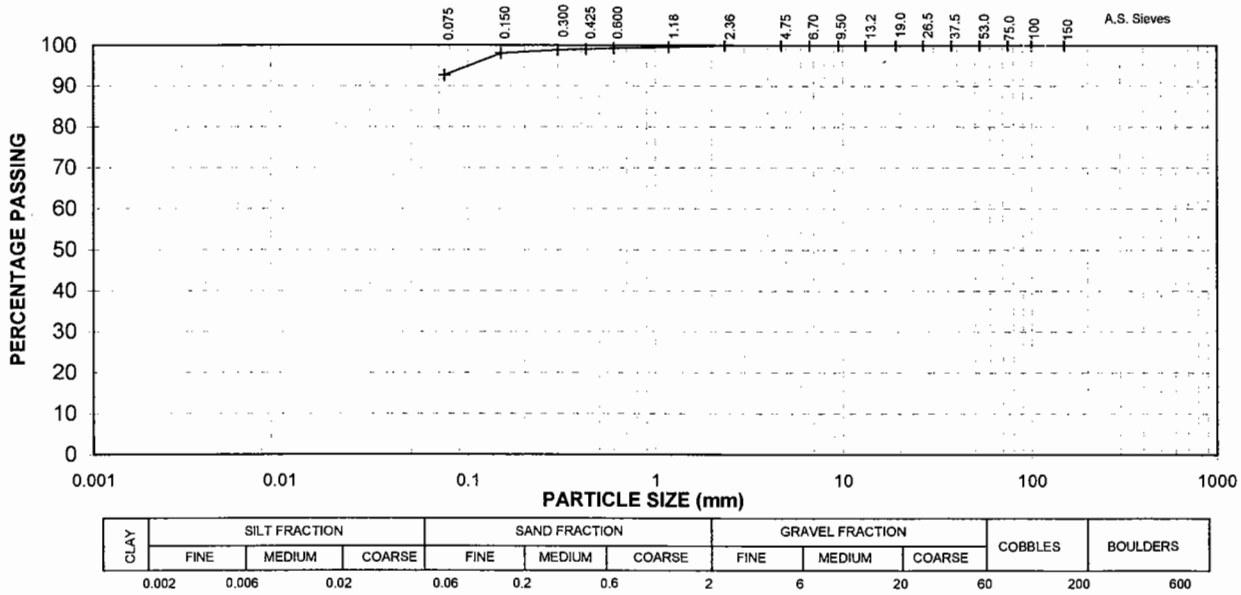
CLASSIFICATION LIMITS AND MOISTURE CONTENT

Test		Method	Result	Spec. Lower	Spec. Upper
Liquid Limit	%	AS1289 3.1.2	43		
Plastic Limit	%	AS1289 3.2.1	17		
Plasticity Index	%	AS1289 3.3.1	26		
Linear Shrinkage	%	AS1289 3.4.1	12.0		
Moisture Content	%	AS1289 2.1.1	53.6		

Sample History :	Natural State
Preparation Method :	Wet sieved
Crumbling / Curling of Linear Shrinkage :	No
Linear Shrinkage Mould Length :	150mm

NP = non-plastic NO = not obtainable ND = not determined

PARTICLE SIZE DISTRIBUTION



NATA

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its scope of accreditation.

THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL

Darryl Murphy Laboratory Manager — AUTHORISED SIGNATORY

25-Nov-06 — DATE

J:\Townsville Jobs\06692015-3\2015-3_581

Golder Associates Pty Ltd
NORTH QUEENSLAND LABORATORY
216 Draper Street, CAIRNS, QLD, 4870
NATA Accreditation No: 3732

PARTICLE SIZE DISTRIBUTION & CONSISTENCY LIMITS TEST REPORT

Client	City Pacific Project Management Pty Ltd	**Job Number**	06692015-3
Client Address	PO Box 1653, Southport, Qld 4215	**Date**	23-Nov-06
Project	Townsville Ocean Terminal	**Report Number**	NQ-06582 Page No 1 of 1
Location	Breakwater, Townsville	**Sampling Method**	As Supplied to Laboratory
Lab Ref No.	06/1120	**Sample Identification**	BH 26 1.0-2.35m

Laboratory Specimen Description CI CLAY, medium plasticity, grey, with trace of sand.
(AS1726, App A, Sect 2)

PARTICLE SIZE DISTRIBUTION AS1289 3.6.1

Sieve Size	% Passing	Spec. Lower	Spec. Upper
150 mm	100		
100 mm	100		
75 mm	100		
53 mm	100		
37.5 mm	100		
26.5 mm	100		
19.0 mm	100		
13.2 mm	100		
9.5 mm	100		
6.7 mm	100		
4.75 mm	100		
2.36 mm	100		
1.18 mm	97		
0.600mm	96		
0.425mm	95		
0.300mm	94		
0.150mm	92		
0.075mm	89		

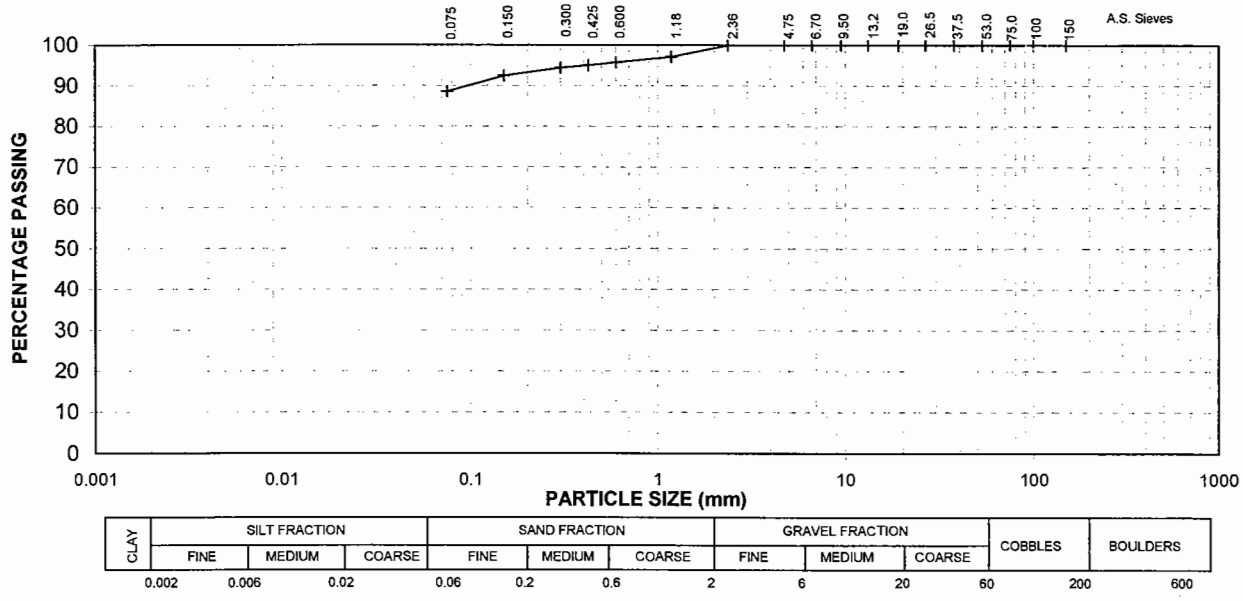
CLASSIFICATION LIMITS AND MOISTURE CONTENT

Test		Method	Result	Spec. Lower	Spec. Upper
Liquid Limit	%	AS1289 3.1.2	45		
Plastic Limit	%	AS1289 3.2.1	19		
Plasticity Index	%	AS1289 3.3.1	26		
Linear Shrinkage	%	AS1289 3.4.1	11.5		
Moisture Content	%	AS1289 2.1.1	65.0		

Sample History :	Natural State
Preparation Method :	Wet sieved
Crumbling / Curling of Linear Shrinkage :	No
Linear Shrinkage Mould Length :	250mm

NP = non-plastic NO = not obtainable ND = not determined

PARTICLE SIZE DISTRIBUTION



NATA

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its scope of accreditation.

THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL

Darryl Murphy Laboratory Manager — AUTHORISED SIGNATORY

25-Nov-06 — DATE

J:\Townsville Jobs\06692015-3\2015-3_582

Golder Associates Pty Ltd
NORTH QUEENSLAND LABORATORY
216 Draper Street, CAIRNS, QLD, 4870
NATA Accreditation No: 3732

PARTICLE SIZE DISTRIBUTION & CONSISTENCY LIMITS TEST REPORT

Client	City Pacific Project Management Pty Ltd	**Job Number**	06692015-3
Client Address	PO Box 1653, Southport, Qld 4215	**Date**	23-Nov-06
Project	Townsville Ocean Terminal	**Report Number**	NQ-06583 Page No 1 of 1
Location	Breakwater, Townsville	**Sampling Method**	As Supplied to Laboratory
Lab Ref No.	06/1121	**Sample Identification**	BH 29 0-1.0m

Laboratory Specimen Description CH CLAY, high plasticity, grey, with some sand.
(AS1726, App A, Sect 2)

PARTICLE SIZE DISTRIBUTION AS1289 3.6.1

Sieve Size	% Passing	Spec. Lower	Spec. Upper
150 mm	100		
100 mm	100		
75 mm	100		
53 mm	100		
37.5 mm	100		
26.5 mm	100		
19.0 mm	100		
13.2 mm	100		
9.5 mm	100		
6.7 mm	100		
4.75 mm	99		
2.36 mm	95		
1.18 mm	90		
0.600mm	86		
0.425mm	84		
0.300mm	83		
0.150mm	82		
0.075mm	78		

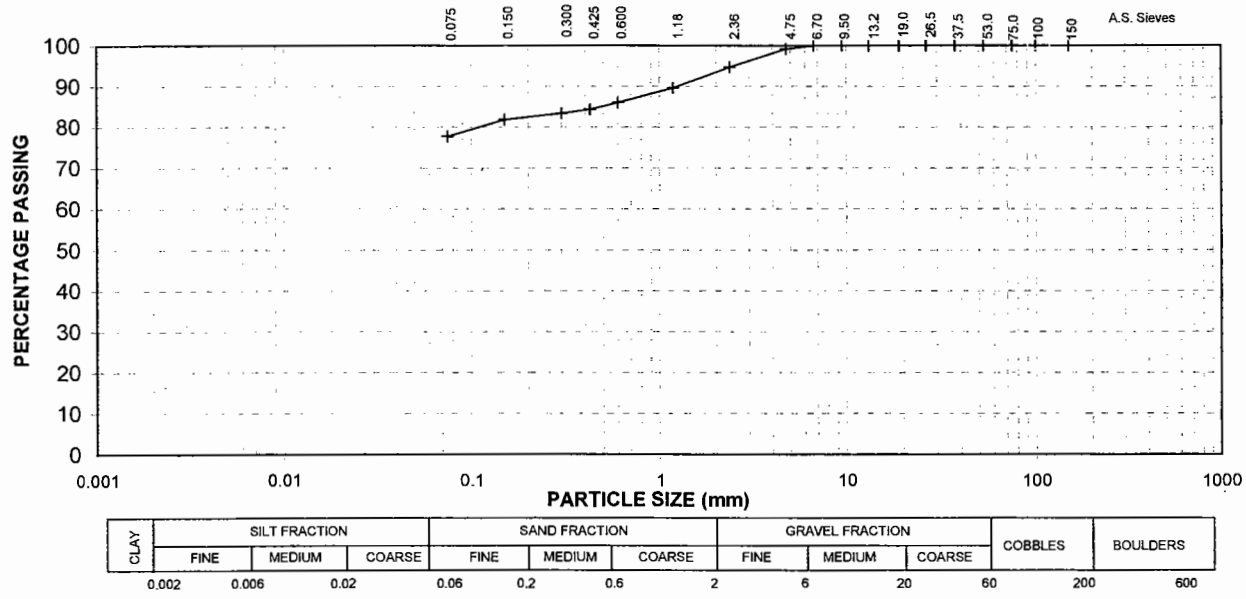
CLASSIFICATION LIMITS AND MOISTURE CONTENT

Test		Method	Result	Spec. Lower	Spec. Upper
Liquid Limit	%	AS1289 3.1.2	50		
Plastic Limit	%	AS1289 3.2.1	18		
Plasticity Index	%	AS1289 3.3.1	32		
Linear Shrinkage	%	AS1289 3.4.1	16.0		
Moisture Content	%	AS1289 2.1.1	31.0		

Sample History :	Natural State
Preparation Method :	Wet sieved
Crumbling / Curling of Linear Shrinkage :	No
Linear Shrinkage Mould Length :	250mm

NP = non-plastic NO = not obtainable ND = not determined

PARTICLE SIZE DISTRIBUTION



NATA

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its scope of accreditation.

THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL

Darryl Murphy Laboratory Manager — AUTHORISED SIGNATORY

25-Nov-06 — DATE

J:\Townsville Jobs\06692015-3\2015-3_583

Golder Associates Pty Ltd
NORTH QUEENSLAND LABORATORY
216 Draper Street, CAIRNS, QLD, 4870
NATA Accreditation No: 3732

PARTICLE SIZE DISTRIBUTION & CONSISTENCY LIMITS TEST REPORT

Client	City Pacific Project Management Pty Ltd	**Job Number**	06692015-3
Client Address	PO Box 1653, Southport, Qld 4215	**Date**	23-Nov-06
Project	Townsville Ocean Terminal	**Report Number**	NQ-06584 Page No 1 of 1
Location	Breakwater, Townsville	**Sampling Method**	As Supplied to Laboratory
Lab Ref No.	06/1122	**Sample Identification**	BH 29 1.0-1.95m

Laboratory Specimen Description CI CLAY, medium plasticity, grey, with trace of sand.
(AS1726, App A, Sect 2)

PARTICLE SIZE DISTRIBUTION AS1289 3.6.1

Sieve Size	% Passing	Spec. Lower	Spec. Upper
150 mm	100		
100 mm	100		
75 mm	100		
53 mm	100		
37.5 mm	100		
26.5 mm	100		
19.0 mm	100		
13.2 mm	100		
9.5 mm	100		
6.7 mm	100		
4.75 mm	100		
2.36 mm	100		
1.18 mm	100		
0.600mm	99		
0.425mm	99		
0.300mm	99		
0.150mm	97		
0.075mm	89		

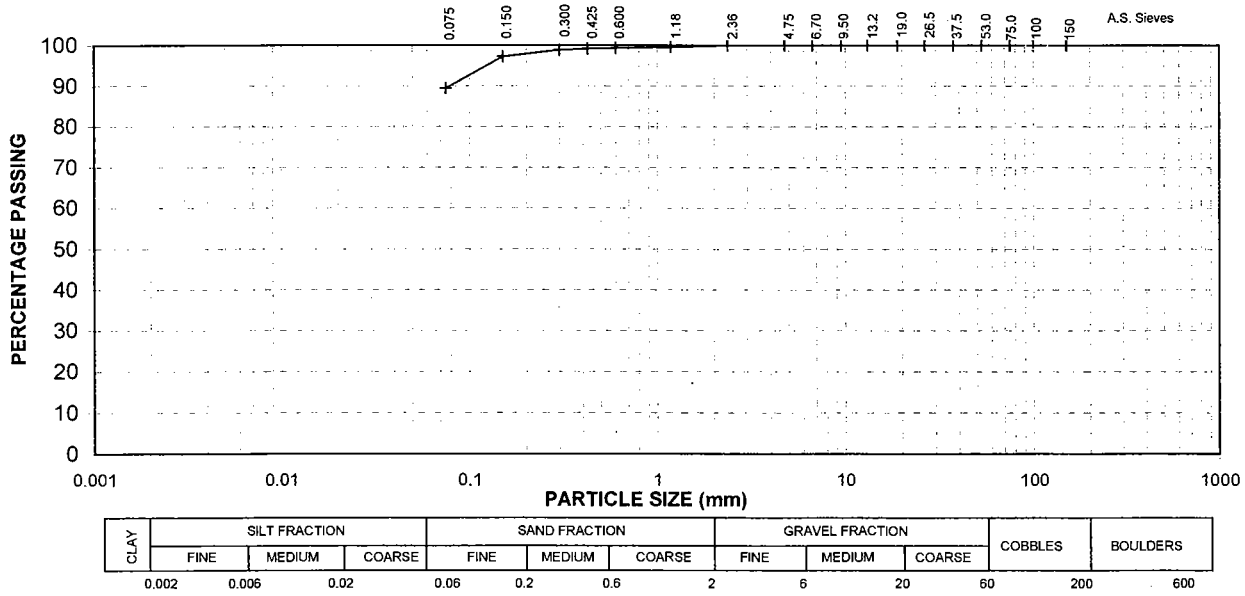
CLASSIFICATION LIMITS AND MOISTURE CONTENT

Test		Method	Result	Spec. Lower	Spec. Upper
Liquid Limit	%	AS1289 3.1.2	38		
Plastic Limit	%	AS1289 3.2.1	19		
Plasticity Index	%	AS1289 3.3.1	19		
Linear Shrinkage	%	AS1289 3.4.1	9.5		
Moisture Content	%	AS1289 2.1.1	50.1		

Sample History :	Natural State
Preparation Method :	Wet sieved
Crumbling / Curling of Linear Shrinkage :	No
Linear Shrinkage Mould Length :	250mm

NP = non-plastic NO = not obtainable ND = not determined

PARTICLE SIZE DISTRIBUTION



NATA

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its scope of accreditation.

THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL

Darryl Murphy Laboratory Manager — AUTHORISED SIGNATORY

25-Nov-06 — DATE

J:\Townsville Jobs\06692015-3\2015-3_584

Golder Associates Pty Ltd
NORTH QUEENSLAND LABORATORY
216 Draper Street, CAIRNS, QLD, 4870
NATA Accreditation No: 3732

PARTICLE SIZE DISTRIBUTION & CONSISTENCY LIMITS TEST REPORT

Client	City Pacific Project Management Pty Ltd	**Job Number**	06692015-3
Client Address	PO Box 1653, Southport, Qld 4215	**Date**	23-Nov-06
Project	Townsville Ocean Terminal	**Report Number**	NQ-06585 Page No 1 of 1
Location	Breakwater, Townsville	**Sampling Method**	As Supplied to Laboratory
Lab Ref No.	06/1123	**Sample Identification**	BH 33 0-0.9m

Laboratory Specimen Description CI CLAY, medium plasticity, grey, with some sand.
(AS1726, App A, Sect 2)

PARTICLE SIZE DISTRIBUTION AS1289 3.6.1

Sieve Size	% Passing	Spec. Lower	Spec. Upper
150 mm	100		
100 mm	100		
75 mm	100		
53 mm	100		
37.5 mm	100		
26.5 mm	100		
19.0 mm	100		
13.2 mm	100		
9.5 mm	100		
6.7 mm	100		
4.75 mm	100		
2.36 mm	98		
1.18 mm	96		
0.600mm	94		
0.425mm	93		
0.300mm	92		
0.150mm	91		
0.075mm	81		

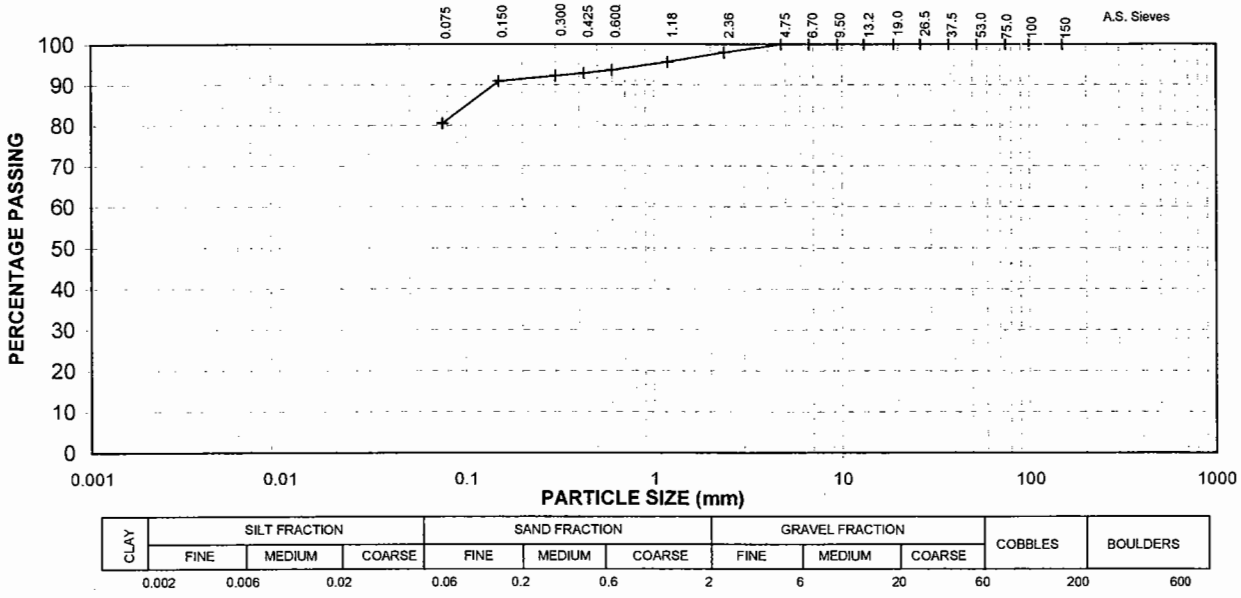
CLASSIFICATION LIMITS AND MOISTURE CONTENT

Test		Method	Result	Spec. Lower	Spec. Upper
Liquid Limit	%	AS1289 3.1.2	49		
Plastic Limit	%	AS1289 3.2.1	16		
Plasticity Index	%	AS1289 3.3.1	33		
Linear Shrinkage	%	AS1289 3.4.1	9.0		
Moisture Content	%	AS1289 2.1.1	29.3		

Sample History :	Natural State
Preparation Method :	Wet sieved
Crumbling / Curling of Linear Shrinkage :	No
Linear Shrinkage Mould Length :	250mm

NP = non-plastic NO = not obtainable ND = not determined

PARTICLE SIZE DISTRIBUTION



NATA

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its scope of accreditation.

THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL

Darryl Murphy Laboratory Manager — AUTHORISED SIGNATORY

25-Nov-06 — DATE

J:\Townsville Jobs\06692015-3\2015-3_585

Golder Associates Pty Ltd
NORTH QUEENSLAND LABORATORY
216 Draper Street, CAIRNS, QLD, 4870
NATA Accreditation No: 3732

PARTICLE SIZE DISTRIBUTION & CONSISTENCY LIMITS TEST REPORT

Client	City Pacific Project Management Pty Ltd	**Job Number**	06692015-3
Client Address	PO Box 1653, Southport, Qld 4215	**Date**	25-Nov-06
Project	Townsville Ocean Terminal	**Report Number**	NQ-06588 Page No 1 of 1
Location	Breakwater, Townsville	**Sampling Method**	As Supplied to Laboratory
Lab Ref No.	06/1125	**Sample Identification**	BH 36 0-1.0m

Laboratory Specimen Description CI CLAY, medium plasticity, grey, with some sand.
(AS1726, App A, Sect 2)

PARTICLE SIZE DISTRIBUTION AS1289 3.6.1

Sieve Size	% Passing	Spec. Lower	Spec. Upper
150 mm	100		
100 mm	100		
75 mm	100		
53 mm	100		
37.5 mm	100		
26.5 mm	100		
19.0 mm	100		
13.2 mm	100		
9.5 mm	100		
6.7 mm	100		
4.75 mm	100		
2.36 mm	100		
1.18 mm	100		
0.600mm	99		
0.425mm	99		
0.300mm	99		
0.150mm	98		
0.075mm	84		

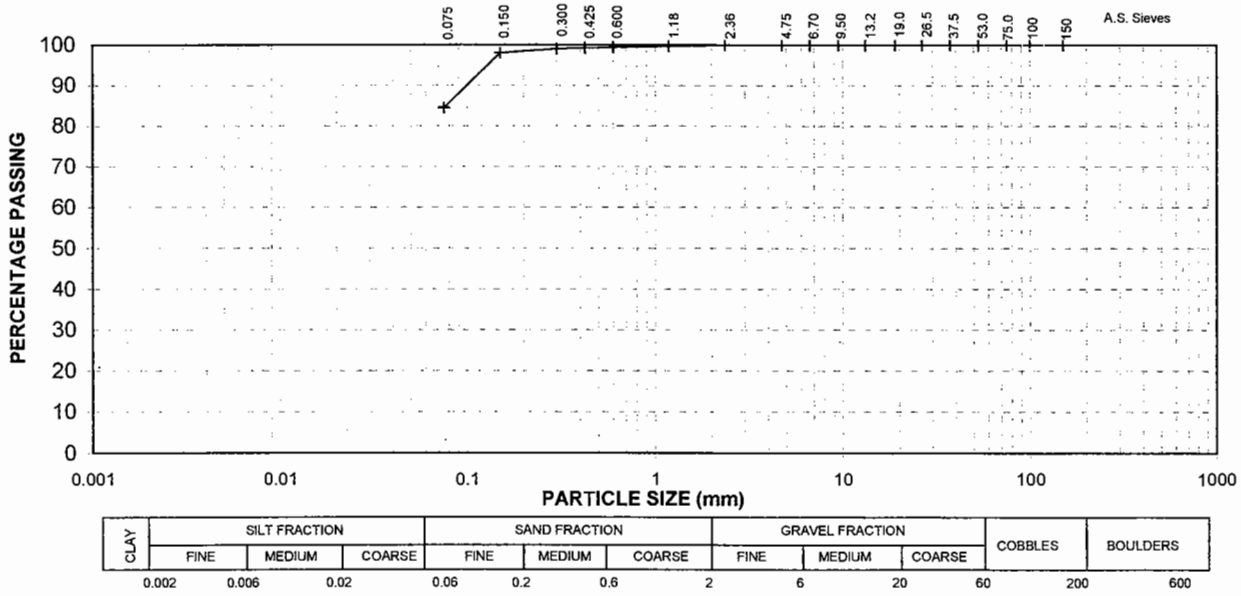
CLASSIFICATION LIMITS AND MOISTURE CONTENT

Test		Method	Result	Spec. Lower	Spec. Upper
Liquid Limit	%	AS1289 3.1.2	39		
Plastic Limit	%	AS1289 3.2.1	16		
Plasticity Index	%	AS1289 3.3.1	23		
Linear Shrinkage	%	AS1289 3.4.1	10.5		
Moisture Content	%	AS1289 2.1.1	40.4		

Sample History :	Natural State
Preparation Method :	Wet sieved
Crumbling / Curling of Linear Shrinkage :	No
Linear Shrinkage Mould Length :	150mm

NP = non-plastic NO = not obtainable ND = not determined

PARTICLE SIZE DISTRIBUTION



NATA

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its scope of accreditation.

THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL

Darryl Murphy Laboratory Manager — AUTHORISED SIGNATORY

27-Nov-06 — DATE

J:\Townsville Jobs\06692015-3\2015-3_588

Golder Associates Pty Ltd
NORTH QUEENSLAND LABORATORY
216 Draper Street, CAIRNS, QLD, 4870
NATA Accreditation No: 3732

PARTICLE SIZE DISTRIBUTION & CONSISTENCY LIMITS TEST REPORT

Client	City Pacific Project Management Pty Ltd	**Job Number**	06692015-3
Client Address	PO Box 1653, Southport, Qld 4215	**Date**	25-Nov-06
Project	Townsville Ocean Terminal	**Report Number**	NQ-06589 Page No 1 of 1
Location	Breakwater, Townsville	**Sampling Method**	As Supplied to Laboratory
Lab Ref No.	06/1126	**Sample Identification**	BH 36 1.0-2.0m

Laboratory Specimen Description CI Sandy CLAY, medium plasticity, grey.
(AS1726, App A, Sect 2)

PARTICLE SIZE DISTRIBUTION AS1289 3.6.1

Sieve Size	% Passing	Spec. Lower	Spec. Upper
150 mm	100		
100 mm	100		
75 mm	100		
53 mm	100		
37.5 mm	100		
26.5 mm	100		
19.0 mm	100		
13.2 mm	100		
9.5 mm	100		
6.7 mm	100		
4.75 mm	98		
2.36 mm	97		
1.18 mm	93		
0.600mm	86		
0.425mm	83		
0.300mm	81		
0.150mm	79		
0.075mm	69		

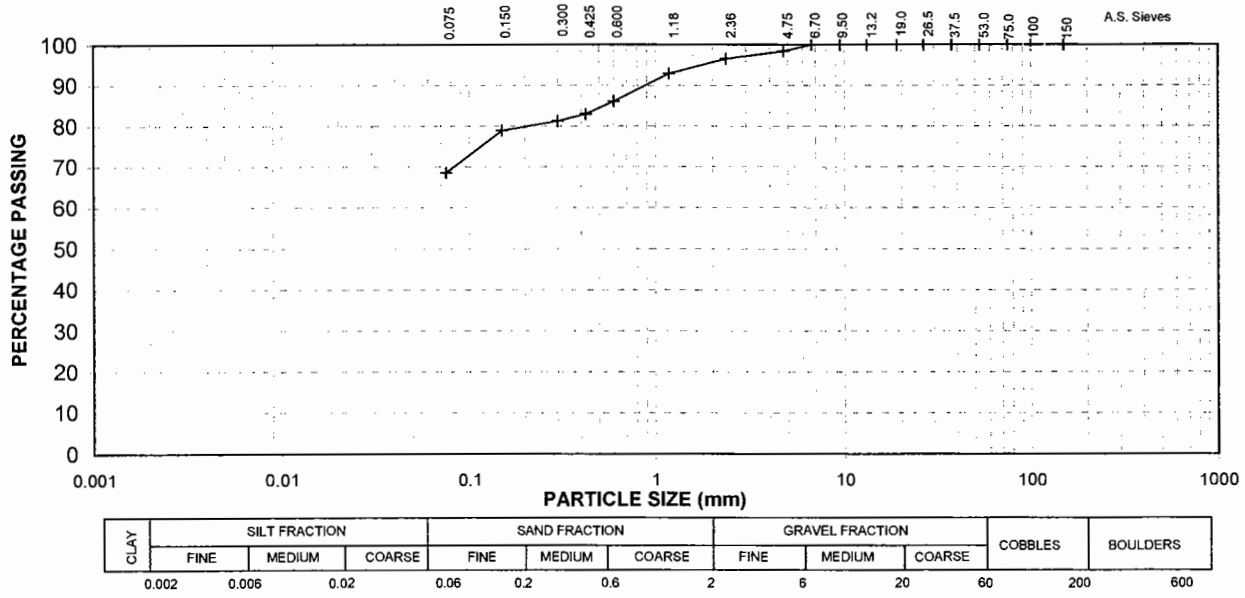
CLASSIFICATION LIMITS AND MOISTURE CONTENT

Test		Method	Result	Spec. Lower	Spec. Upper
Liquid Limit	%	AS1289 3.1.2	37		
Plastic Limit	%	AS1289 3.2.1	18		
Plasticity Index	%	AS1289 3.3.1	19		
Linear Shrinkage	%	AS1289 3.4.1	8.0		
Moisture Content	%	AS1289 2.1.1	42.3		

Sample History :	Natural State
Preparation Method :	Wet sieved
Crumbling / Curling of Linear Shrinkage :	No
Linear Shrinkage Mould Length :	125mm

NP = non-plastic NO = not obtainable ND = not determined

PARTICLE SIZE DISTRIBUTION



NATA

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its scope of accreditation.

THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL

Darryl Murphy Laboratory Manager — AUTHORISED SIGNATORY

27-Nov-06 — DATE

J:\Townsville Jobs\06692015-3\2015-3_589

Golder Associates Pty Ltd
NORTH QUEENSLAND LABORATORY
216 Draper Street, CAIRNS, QLD, 4870
NATA Accreditation No: 3732

PARTICLE SIZE DISTRIBUTION & CONSISTENCY LIMITS TEST REPORT

Client	City Pacific Project Management Pty Ltd	**Job Number**	06692015-3
Client Address	PO Box 1653, Southport, Qld 4215	**Date**	25-Nov-06
Project	Townsville Ocean Terminal	**Report Number**	NQ-06590 Page No 1 of 1
Location	Breakwater, Townsville	**Sampling Method**	As Supplied to Laboratory
Lab Ref No.	06/1127	**Sample Identification**	BH 37 0-1.4m

Laboratory Specimen Description CI CLAY, medium plasticity, grey, with some sand.
(AS1726, App A, Sect 2)

PARTICLE SIZE DISTRIBUTION AS1289 3.6.1

Sieve Size	% Passing	Spec. Lower	Spec. Upper
150 mm	100		
100 mm	100		
75 mm	100		
53 mm	100		
37.5 mm	100		
26.5 mm	100		
19.0 mm	100		
13.2 mm	100		
9.5 mm	100		
6.7 mm	100		
4.75 mm	99		
2.36 mm	98		
1.18 mm	97		
0.600mm	95		
0.425mm	95		
0.300mm	94		
0.150mm	92		
0.075mm	82		

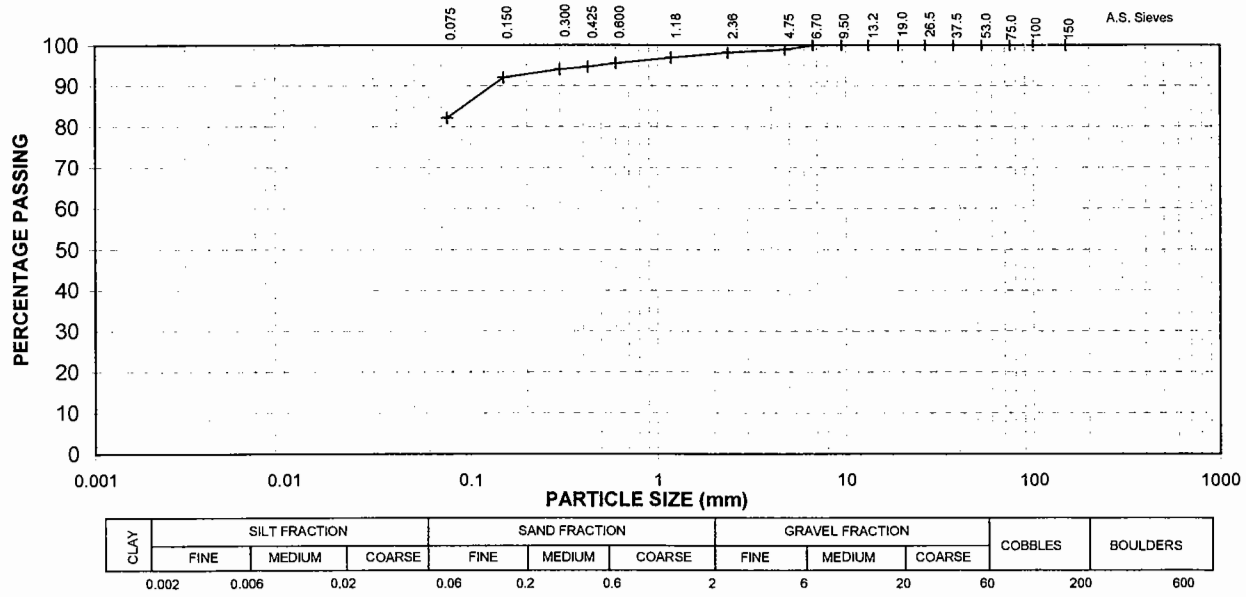
CLASSIFICATION LIMITS AND MOISTURE CONTENT

Test		Method	Result	Spec. Lower	Spec. Upper
Liquid Limit	%	AS1289 3.1.2	38		
Plastic Limit	%	AS1289 3.2.1	15		
Plasticity Index	%	AS1289 3.3.1	23		
Linear Shrinkage	%	AS1289 3.4.1	9.5		
Moisture Content	%	AS1289 2.1.1	47.8		

Sample History :	Natural State
Preparation Method :	Wet sieved
Crumbling / Curling of Linear Shrinkage :	No
Linear Shrinkage Mould Length :	250mm

NP = non-plastic NO = not obtainable ND = not determined

PARTICLE SIZE DISTRIBUTION



NATA

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its scope of accreditation.

THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL

Darryl Murphy Laboratory Manager — AUTHORISED SIGNATORY

27-Nov-06 — DATE

J:\Townsville Jobs\06692015-3\2015-3_590

Golder Associates Pty Ltd
NORTH QUEENSLAND LABORATORY
216 Draper Street, CAIRNS, QLD, 4870
NATA Accreditation No: 3732

PARTICLE SIZE DISTRIBUTION & CONSISTENCY LIMITS TEST REPORT

Client	City Pacific Project Management Pty Ltd	**Job Number**	06692015-3
Client Address	PO Box 1653, Southport, Qld 4215	**Date**	25-Nov-06
Project	Townsville Ocean Terminal	**Report Number**	NQ-06591 Page No 1 of 1
Location	Breakwater, Townsville	**Sampling Method**	As Supplied to Laboratory
Lab Ref No.	06/1128	**Sample Identification**	BH 37 1.4-2.5m

Laboratory Specimen Description SC Clayey SAND, medium to coarse grained, grey.
(AS1726, App A, Sect 2)

PARTICLE SIZE DISTRIBUTION AS1289 3.6.1

Sieve Size	% Passing	Spec. Lower	Spec. Upper
150 mm	100		
100 mm	100		
75 mm	100		
53 mm	100		
37.5 mm	100		
26.5 mm	100		
19.0 mm	100		
13.2 mm	100		
9.5 mm	100		
6.7 mm	100		
4.75 mm	99		
2.36 mm	95		
1.18 mm	85		
0.600mm	64		
0.425mm	52		
0.300mm	45		
0.150mm	39		
0.075mm	37		

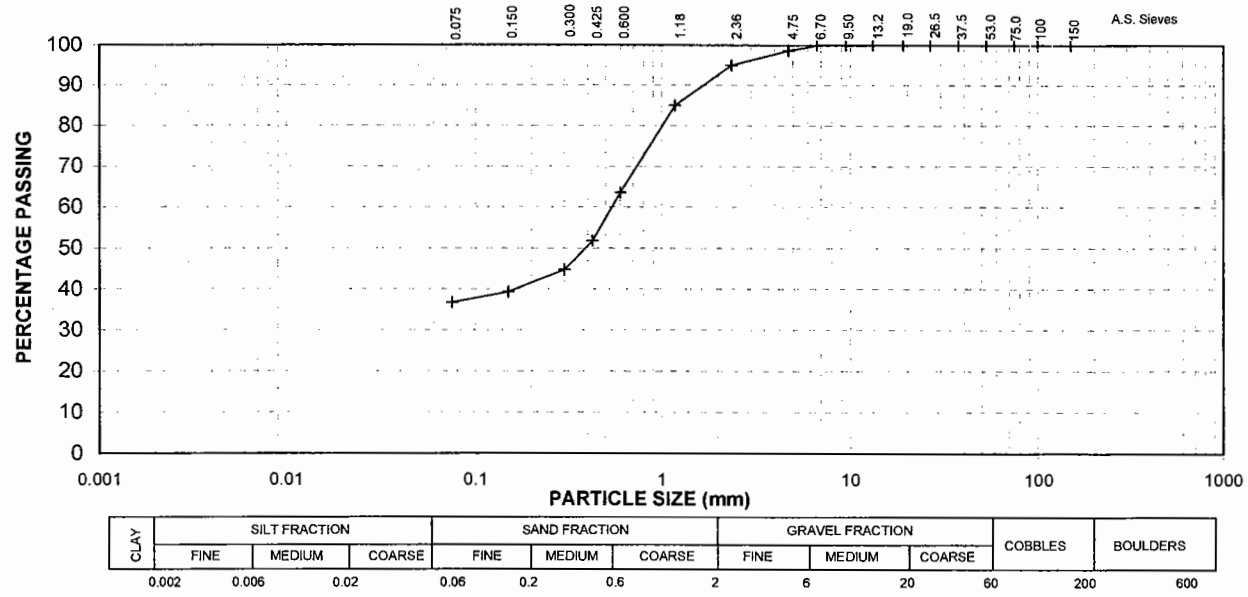
CLASSIFICATION LIMITS AND MOISTURE CONTENT

Test		Method	Result	Spec. Lower	Spec. Upper
Liquid Limit	%	AS1289 3.1.2	47		
Plastic Limit	%	AS1289 3.2.1	16		
Plasticity Index	%	AS1289 3.3.1	31		
Linear Shrinkage	%	AS1289 3.4.1	13.0		
Moisture Content	%	AS1289 2.1.1	36.1		

Sample History :	Natural State
Preparation Method :	Wet sieved
Crumbling / Curling of Linear Shrinkage :	No
Linear Shrinkage Mould Length :	125mm

NP = non-plastic NO = not obtainable ND = not determined

PARTICLE SIZE DISTRIBUTION



NATA

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its scope of accreditation.

THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL

Darryl Murphy Laboratory Manager — AUTHORISED SIGNATORY

27-Nov-06 — DATE

J:\Townsville Jobs\06692015-3\2015-3_591

Golder Associates Pty Ltd
NORTH QUEENSLAND LABORATORY
216 Draper Street, CAIRNS, QLD, 4870
NATA Accreditation No: 3732

PARTICLE SIZE DISTRIBUTION & CONSISTENCY LIMITS TEST REPORT

Client	City Pacific Project Management Pty Ltd	**Job Number**	06692015-3
Client Address	PO Box 1653, Southport, Qld 4215	**Date**	25-Nov-06
Project	Townsville Ocean Terminal	**Report Number**	NQ-06592 Page No 1 of 1
Location	Breakwater, Townsville	**Sampling Method**	As Supplied to Laboratory
Lab Ref No.	06/1129	**Sample Identification**	BH 38 0-1.6m

Laboratory Specimen Description CI CLAY, medium plasticity, grey, with trace of sand.
(AS1726, App A, Sect 2)

PARTICLE SIZE DISTRIBUTION AS1289 3.6.1

Sieve Size	% Passing	Spec. Lower	Spec. Upper
150 mm	100		
100 mm	100		
75 mm	100		
53 mm	100		
37.5 mm	100		
26.5 mm	100		
19.0 mm	100		
13.2 mm	100		
9.5 mm	100		
6.7 mm	100		
4.75 mm	100		
2.36 mm	100		
1.18 mm	100		
0.600mm	99		
0.425mm	99		
0.300mm	99		
0.150mm	98		
0.075mm	94		

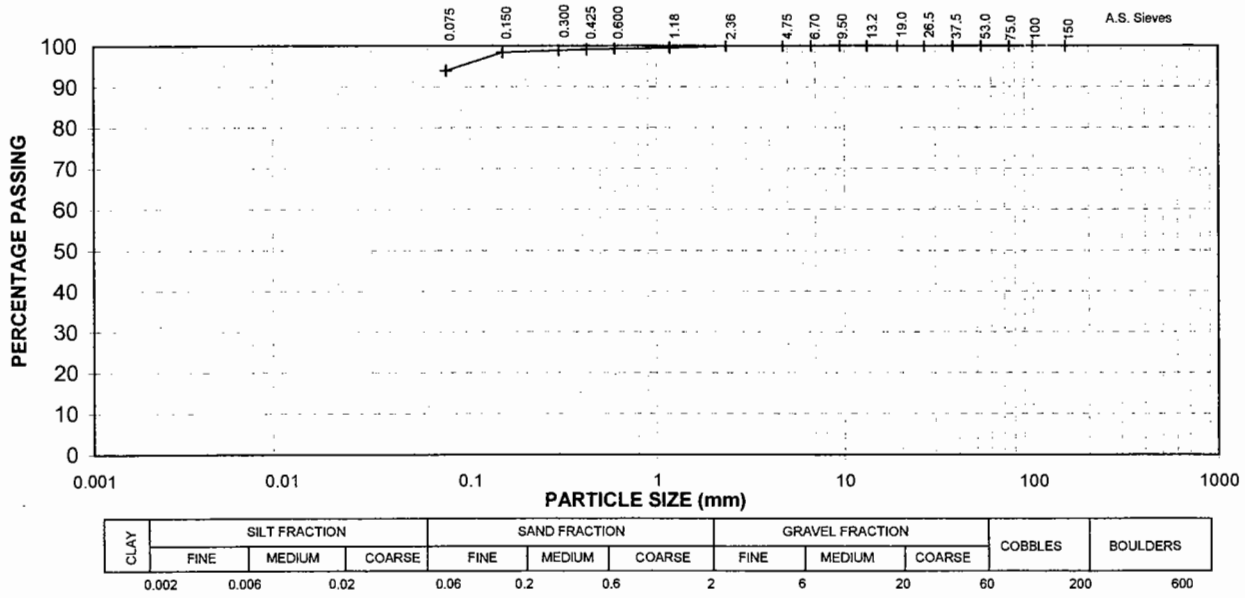
CLASSIFICATION LIMITS AND MOISTURE CONTENT

Test		Method	Result	Spec. Lower	Spec. Upper
Liquid Limit	%	AS1289 3.1.2	48		
Plastic Limit	%	AS1289 3.2.1	16		
Plasticity Index	%	AS1289 3.3.1	32		
Linear Shrinkage	%	AS1289 3.4.1	14.5		
Moisture Content	%	AS1289 2.1.1	52.9		

Sample History :	Natural State
Preparation Method :	Wet sieved
Crumbling / Curling of Linear Shrinkage :	No
Linear Shrinkage Mould Length :	250mm

NP = non-plastic NO = not obtainable ND = not determined

PARTICLE SIZE DISTRIBUTION



NATA

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its scope of accreditation.

THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL

Darryl Murphy Laboratory Manager — AUTHORISED SIGNATORY

27-Nov-06 — DATE

J:\Townsville Jobs\06692015-3\2015-3_592

Golder Associates Pty Ltd
NORTH QUEENSLAND LABORATORY
216 Draper Street, CAIRNS, QLD, 4870
NATA Accreditation No: 3732

PARTICLE SIZE DISTRIBUTION & CONSISTENCY LIMITS TEST REPORT

Client	City Pacific Project Management Pty Ltd	**Job Number**	06692015-3
Client Address	PO Box 1653, Southport, Qld 4215	**Date**	25-Nov-06
Project	Townsville Ocean Terminal	**Report Number**	NQ-06593 Page No 1 of 1
Location	Breakwater, Townsville	**Sampling Method**	As Supplied to Laboratory
Lab Ref No.	06/1130	**Sample Identification**	BH 40 0-0.9m

Laboratory Specimen Description CI CLAY, medium plasticity, grey.
(AS1726, App A, Sect 2)

PARTICLE SIZE DISTRIBUTION AS1289 3.6.1

Sieve Size	% Passing	Spec. Lower	Spec. Upper
150 mm	100		
100 mm	100		
75 mm	100		
53 mm	100		
37.5 mm	100		
26.5 mm	100		
19.0 mm	100		
13.2 mm	100		
9.5 mm	100		
6.7 mm	100		
4.75 mm	100		
2.36 mm	100		
1.18 mm	100		
0.600mm	100		
0.425mm	99		
0.300mm	99		
0.150mm	99		
0.075mm	97		

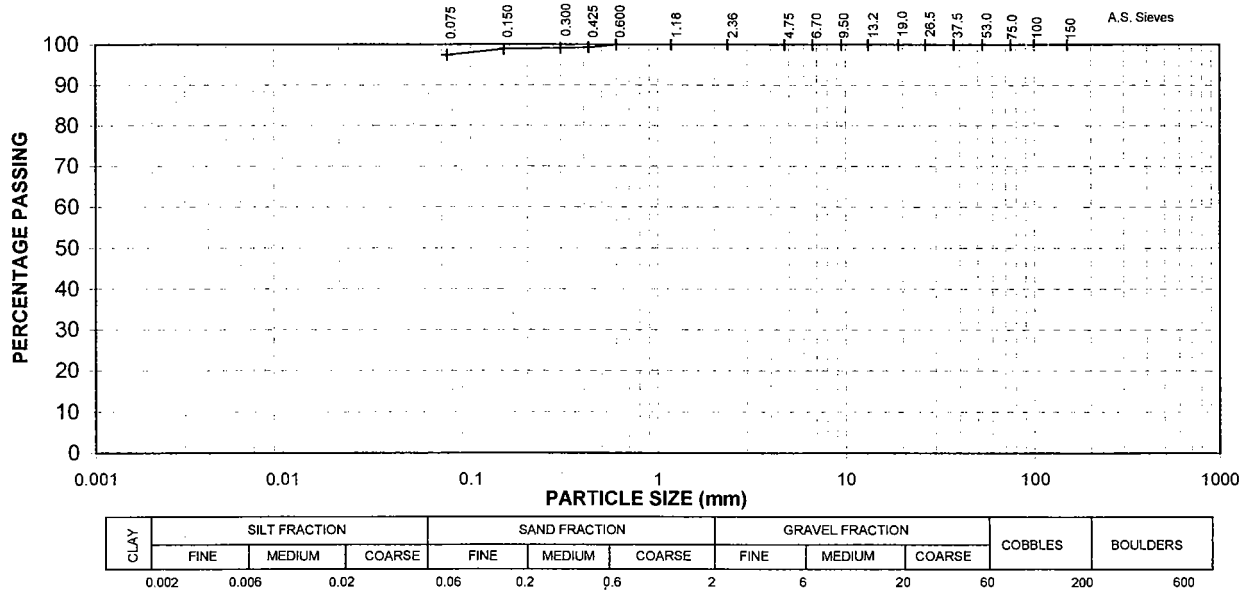
CLASSIFICATION LIMITS AND MOISTURE CONTENT

Test		Method	Result	Spec. Lower	Spec. Upper
Liquid Limit	%	AS1289 3.1.2	42		
Plastic Limit	%	AS1289 3.2.1	15		
Plasticity Index	%	AS1289 3.3.1	27		
Linear Shrinkage	%	AS1289 3.4.1	13.0		
Moisture Content	%	AS1289 2.1.1	33.8		

Sample History :	Natural State
Preparation Method :	Wet sieved
Crumbling / Curling of Linear Shrinkage :	No
Linear Shrinkage Mould Length :	250mm

NP = non-plastic NO = not obtainable ND = not determined

PARTICLE SIZE DISTRIBUTION



NATA

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its scope of accreditation.

THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL

Darryl Murphy Laboratory Manager — AUTHORISED SIGNATORY

27-Nov-06 — DATE

J:\Townsville Jobs\06692015-3\2015-3_593

Golder Associates Pty Ltd
NORTH QUEENSLAND LABORATORY
216 Draper Street, CAIRNS, QLD, 4870
NATA Accreditation No: 3732

PARTICLE SIZE DISTRIBUTION & CONSISTENCY LIMITS TEST REPORT

Client	City Pacific Project Management Pty Ltd	**Job Number**	06692015-3
Client Address	PO Box 1653, Southport, Qld 4215	**Date**	25-Nov-06
Project	Townsville Ocean Terminal	**Report Number**	NQ-06594 Page No 1 of 1
Location	Breakwater, Townsville	**Sampling Method**	As Supplied to Laboratory
Lab Ref No.	06/1131	**Sample Identification**	BH 40 1.0-2.1m

Laboratory Specimen Description CI CLAY, medium plasticity, grey, with trace of sand.
(AS1726, App A, Sect 2)

PARTICLE SIZE DISTRIBUTION AS1289 3.6.1

Sieve Size	% Passing	Spec. Lower	Spec. Upper
150 mm	100		
100 mm	100		
75 mm	100		
53 mm	100		
37.5 mm	100		
26.5 mm	100		
19.0 mm	100		
13.2 mm	100		
9.5 mm	100		
6.7 mm	100		
4.75 mm	100		
2.36 mm	100		
1.18 mm	100		
0.600mm	99		
0.425mm	99		
0.300mm	99		
0.150mm	98		
0.075mm	88		

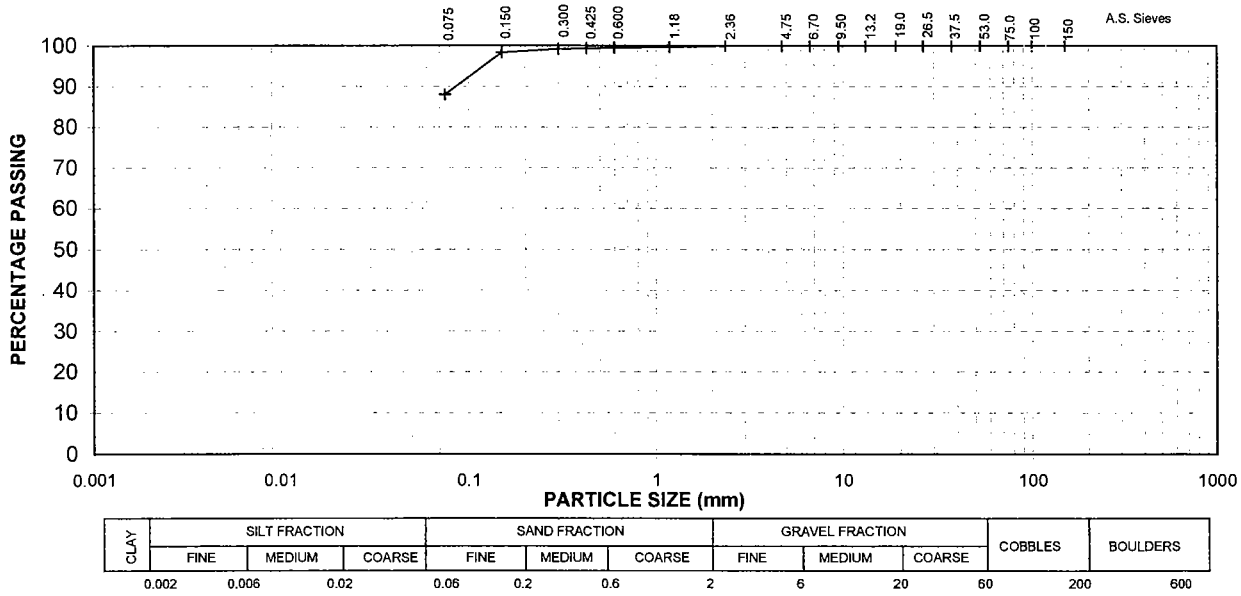
CLASSIFICATION LIMITS AND MOISTURE CONTENT

Test		Method	Result	Spec. Lower	Spec. Upper
Liquid Limit	%	AS1289 3.1.2	37		
Plastic Limit	%	AS1289 3.2.1	20		
Plasticity Index	%	AS1289 3.3.1	17		
Linear Shrinkage	%	AS1289 3.4.1	8.0		
Moisture Content	%	AS1289 2.1.1	48.4		

Sample History :	Natural State
Preparation Method :	Wet sieved
Crumbling / Curling of Linear Shrinkage :	No
Linear Shrinkage Mould Length :	150mm

NP = non-plastic NO = not obtainable ND = not determined

PARTICLE SIZE DISTRIBUTION



NATA

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its scope of accreditation.

THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL

Darryl Murphy Laboratory Manager — AUTHORISED SIGNATORY

27-Nov-06 — DATE

J:\Townsville Jobs\06692015-3\2015-3_594

Golder Associates Pty Ltd
NORTH QUEENSLAND LABORATORY
216 Draper Street, CAIRNS, QLD, 4870
NATA Accreditation No: 3732

PARTICLE SIZE DISTRIBUTION & CONSISTENCY LIMITS TEST REPORT

Client	City Pacific Project Management Pty Ltd	**Job Number**	06692015-3
Client Address	PO Box 1653, Southport, Qld 4215	**Date**	27-Nov-06
Project	Townsville Ocean Terminal	**Report Number**	NQ-06596 Page No 1 of 1
Location	Breakwater, Townsville	**Sampling Method**	As Supplied to Laboratory
Lab Ref No.	06/1132	**Sample Identification**	BH 42 0-1.2m

Laboratory Specimen Description Cl Sandy CLAY, medium plasticity, grey.
(AS1726, App A, Sect 2)

PARTICLE SIZE DISTRIBUTION AS1289 3.6.1

Sieve Size	% Passing	Spec. Lower	Spec. Upper
150 mm	100		
100 mm	100		
75 mm	100		
53 mm	100		
37.5 mm	100		
26.5 mm	100		
19.0 mm	100		
13.2 mm	100		
9.5 mm	100		
6.7 mm	100		
4.75 mm	98		
2.36 mm	96		
1.18 mm	93		
0.600mm	91		
0.425mm	89		
0.300mm	88		
0.150mm	85		
0.075mm	65		

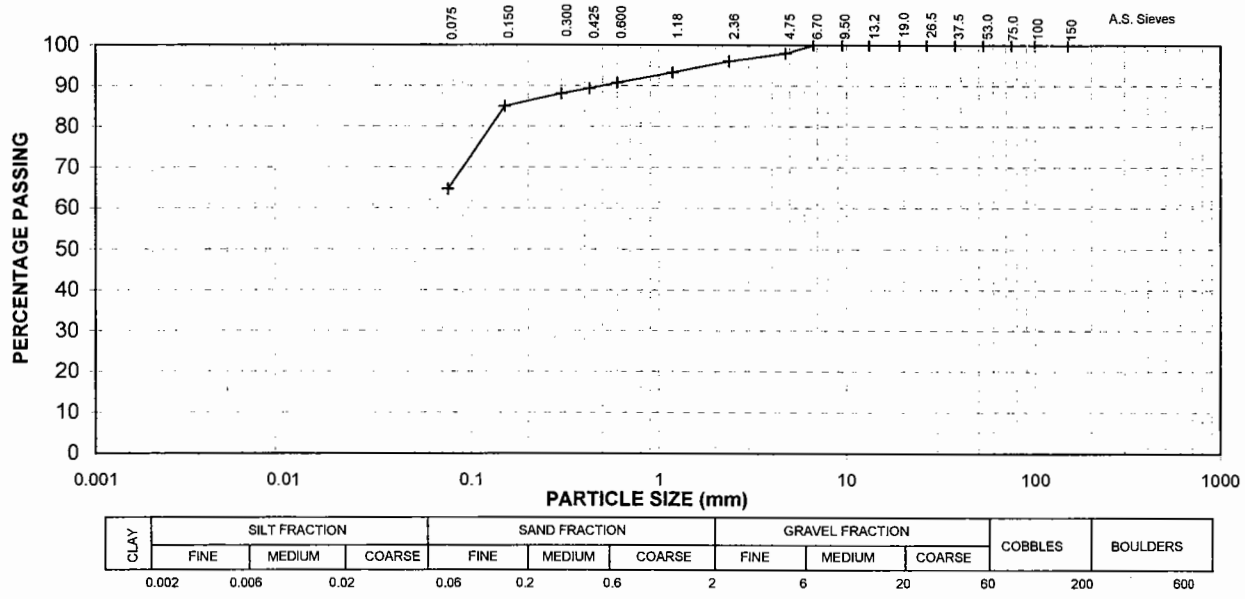
CLASSIFICATION LIMITS AND MOISTURE CONTENT

Test		Method	Result	Spec. Lower	Spec. Upper
Liquid Limit	%	AS1289 3.1.2	36		
Plastic Limit	%	AS1289 3.2.1	17		
Plasticity Index	%	AS1289 3.3.1	19		
Linear Shrinkage	%	AS1289 3.4.1	9.5		
Moisture Content	%	AS1289 2.1.1	36.7		

Sample History :	Natural State
Preparation Method :	Wet sieved
Crumbling / Curling of Linear Shrinkage :	No
Linear Shrinkage Mould Length :	150mm

NP = non-plastic NO = not obtainable ND = not determined

PARTICLE SIZE DISTRIBUTION



NATA

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its scope of accreditation.

Darryl Murphy Laboratory Manager — AUTHORISED SIGNATORY

28-Nov-06 — DATE

J:\Townsville Jobs\06692015-3\2015-3_596

Golder Associates Pty Ltd
NORTH QUEENSLAND LABORATORY
216 Draper Street, CAIRNS, QLD, 4870
NATA Accreditation No: 3732

PARTICLE SIZE DISTRIBUTION & CONSISTENCY LIMITS TEST REPORT

Client	City Pacific Project Management Pty Ltd	**Job Number**	06692015-3
Client Address	PO Box 1653, Southport, Qld 4215	**Date**	27-Nov-06
Project	Townsville Ocean Terminal	**Report Number**	NQ-06597 Page No 1 of 1
Location	Breakwater, Townsville	**Sampling Method**	As Supplied to Laboratory
Lab Ref No.	06/1133	**Sample Identification**	BH 42 1.2-2.2m

Laboratory Specimen Description Cl Sandy CLAY, medium plasticity, grey.
(AS1726, App A, Sect 2)

PARTICLE SIZE DISTRIBUTION AS1289 3.6.1

Sieve Size	% Passing	Spec. Lower	Spec. Upper
150 mm	100		
100 mm	100		
75 mm	100		
53 mm	100		
37.5 mm	100		
26.5 mm	100		
19.0 mm	100		
13.2 mm	100		
9.5 mm	100		
6.7 mm	100		
4.75 mm	98		
2.36 mm	95		
1.18 mm	89		
0.600mm	84		
0.425mm	80		
0.300mm	78		
0.150mm	74		
0.075mm	61		

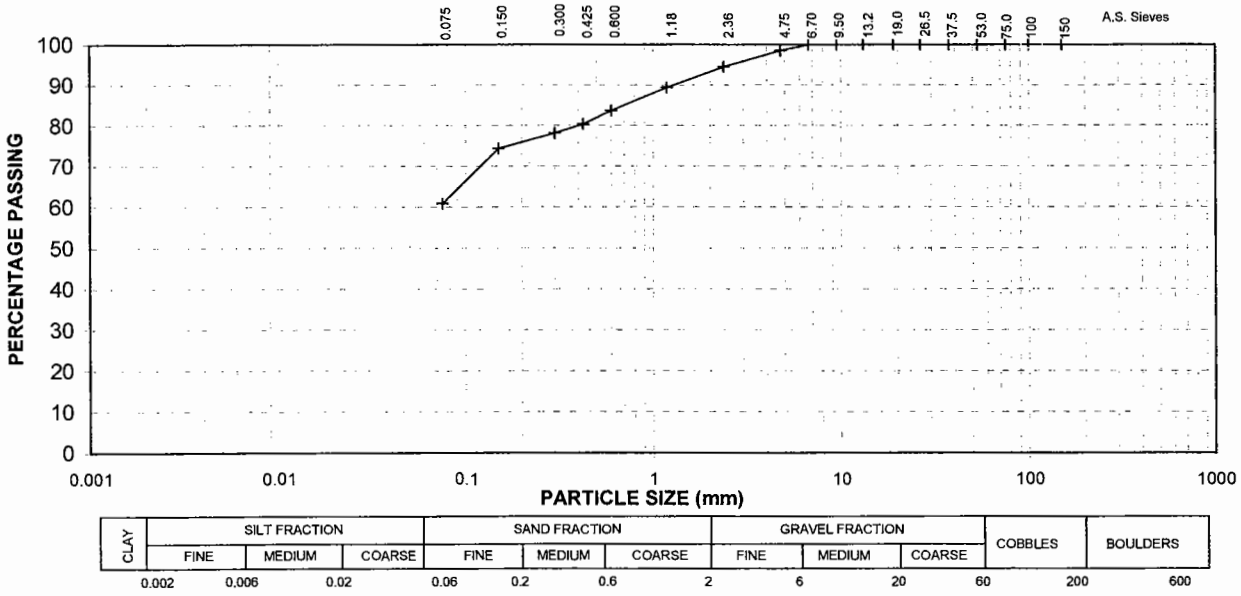
CLASSIFICATION LIMITS AND MOISTURE CONTENT

Test		Method	Result	Spec. Lower	Spec. Upper
Liquid Limit	%	AS1289 3.1.2	36		
Plastic Limit	%	AS1289 3.2.1	17		
Plasticity Index	%	AS1289 3.3.1	19		
Linear Shrinkage	%	AS1289 3.4.1	8.0		
Moisture Content	%	AS1289 2.1.1	42.8		

Sample History :	Natural State
Preparation Method :	Wet sieved
Crumbling / Curling of Linear Shrinkage :	No
Linear Shrinkage Mould Length :	125mm

NP = non-plastic NO = not obtainable ND = not determined

PARTICLE SIZE DISTRIBUTION



NATA

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its scope of accreditation.

THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL

Darryl Murphy Laboratory Manager — AUTHORISED SIGNATORY

28-Nov-06 — DATE

J:\Townsville Jobs\06692015-3\2015-3_597

Golder Associates Pty Ltd
NORTH QUEENSLAND LABORATORY
216 Draper Street, CAIRNS, QLD, 4870
NATA Accreditation No: 3732

PARTICLE SIZE DISTRIBUTION & CONSISTENCY LIMITS TEST REPORT

Client	City Pacific Project Management Pty Ltd	**Job Number**	06692015-3
Client Address	PO Box 1653, Southport, Qld 4215	**Date**	27-Nov-06
Project	Townsville Ocean Terminal	**Report Number**	NQ-06598 Page No 1 of 1
Location	Breakwater, Townsville	**Sampling Method**	As Supplied to Laboratory
Lab Ref No.	06/1134	**Sample Identification**	BH 45 0-1.25m

Laboratory Specimen Description CI CLAY, medium plasticity, grey, with trace of sand.
(AS1726, App A, Sect 2)

PARTICLE SIZE DISTRIBUTION AS1289 3.6.1

Sieve Size	% Passing	Spec. Lower	Spec. Upper
150 mm	100		
100 mm	100		
75 mm	100		
53 mm	100		
37.5 mm	100		
26.5 mm	100		
19.0 mm	100		
13.2 mm	100		
9.5 mm	100		
6.7 mm	100		
4.75 mm	100		
2.36 mm	99		
1.18 mm	99		
0.600mm	98		
0.425mm	98		
0.300mm	97		
0.150mm	97		
0.075mm	95		

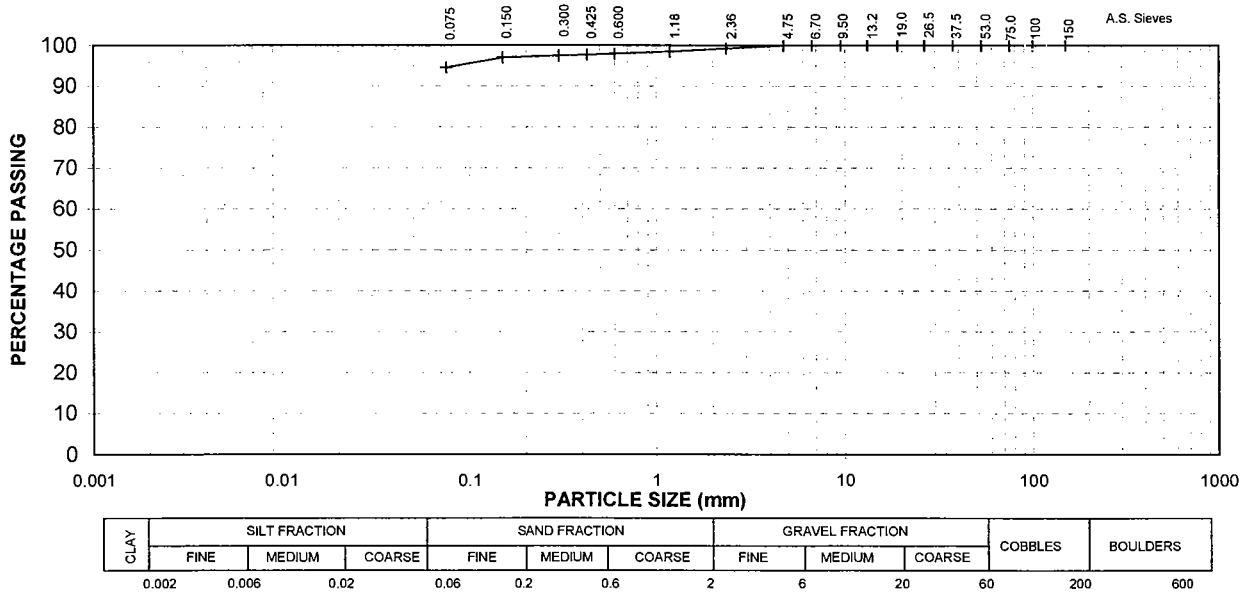
CLASSIFICATION LIMITS AND MOISTURE CONTENT

Test		Method	Result	Spec. Lower	Spec. Upper
Liquid Limit	%	AS1289 3.1.2	45		
Plastic Limit	%	AS1289 3.2.1	16		
Plasticity Index	%	AS1289 3.3.1	29		
Linear Shrinkage	%	AS1289 3.4.1	14.0		
Moisture Content	%	AS1289 2.1.1	40.5		

Sample History :	Natural State
Preparation Method :	Wet sieved
Crumbling / Curling of Linear Shrinkage :	No
Linear Shrinkage Mould Length :	150mm

NP = non-plastic NO = not obtainable ND = not determined

PARTICLE SIZE DISTRIBUTION



NATA

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its scope of accreditation.

THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL

Darryl Murphy Laboratory Manager — AUTHORISED SIGNATORY

28-Nov-06 — DATE

J:\Townsville Jobs\06692015-3\2015-3_598

Golder Associates Pty Ltd
NORTH QUEENSLAND LABORATORY
216 Draper Street, CAIRNS, QLD, 4870
NATA Accreditation No: 3732

PARTICLE SIZE DISTRIBUTION & CONSISTENCY LIMITS TEST REPORT

Client	City Pacific Project Management Pty Ltd	**Job Number**	06692015-3
Client Address	PO Box 1653, Southport, Qld 4215	**Date**	27-Nov-06
Project	Townsville Ocean Terminal	**Report Number**	NQ-06599 Page No 1 of 1
Location	Breakwater, Townsville	**Sampling Method**	As Supplied to Laboratory
Lab Ref No.	06/1135	**Sample Identification**	BH 45 1.25-1.94m

Laboratory Specimen Description Cl CLAY, medium plasticity, grey, with trace of sand.
(AS1726, App A, Sect 2)

PARTICLE SIZE DISTRIBUTION AS1289 3.6.1

Sieve Size	% Passing	Spec. Lower	Spec. Upper
150 mm	100		
100 mm	100		
75 mm	100		
53 mm	100		
37.5 mm	100		
26.5 mm	100		
19.0 mm	100		
13.2 mm	100		
9.5 mm	100		
6.7 mm	100		
4.75 mm	100		
2.36 mm	100		
1.18 mm	100		
0.600mm	100		
0.425mm	100		
0.300mm	99		
0.150mm	99		
0.075mm	89		

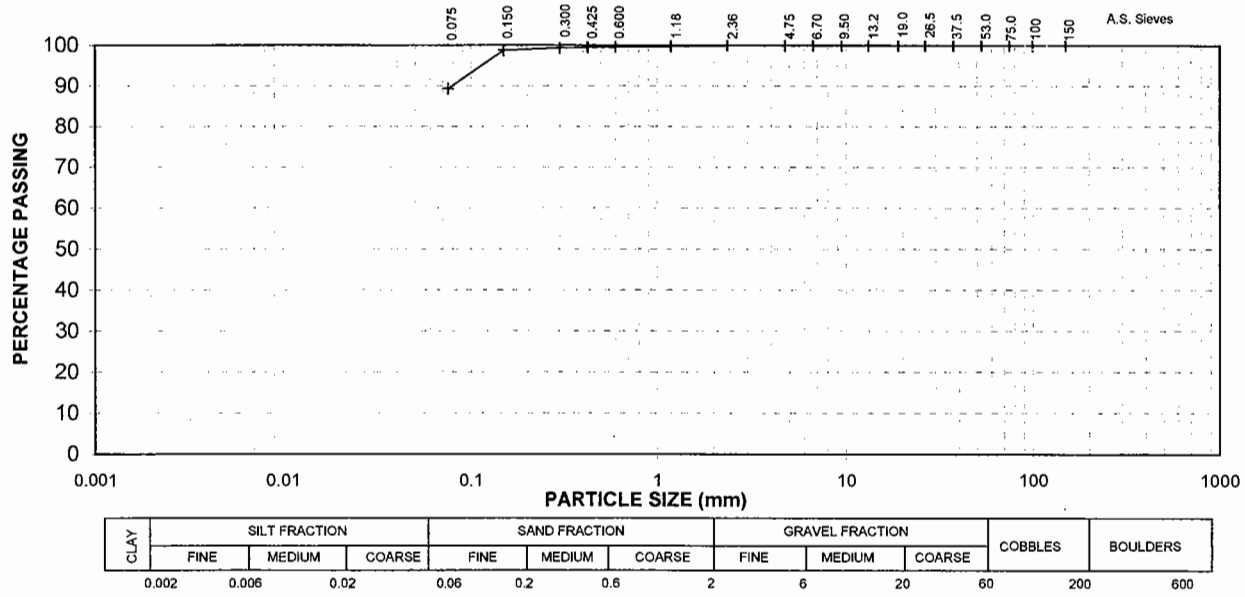
CLASSIFICATION LIMITS AND MOISTURE CONTENT

Test		Method	Result	Spec. Lower	Spec. Upper
Liquid Limit	%	AS1289 3.1.2	39		
Plastic Limit	%	AS1289 3.2.1	19		
Plasticity Index	%	AS1289 3.3.1	20		
Linear Shrinkage	%	AS1289 3.4.1	7.5		
Moisture Content	%	AS1289 2.1.1	51.8		

Sample History :	Natural State
Preparation Method :	Wet sieved
Crumbling / Curling of Linear Shrinkage :	No
Linear Shrinkage Mould Length :	125mm

NP = non-plastic NO = not obtainable ND = not determined

PARTICLE SIZE DISTRIBUTION



NATA

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its scope of accreditation.

THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL

Darryl Murphy Laboratory Manager — AUTHORISED SIGNATORY

28-Nov-06 — DATE

J:\Townsville Jobs\06692015-3\2015-3_599

Golder Associates Pty Ltd
NORTH QUEENSLAND LABORATORY
216 Draper Street, CAIRNS, QLD, 4870
NATA Accreditation No: 3732

Golder Associates

PARTICLE SIZE DISTRIBUTION & CONSISTENCY LIMITS TEST REPORT

Client	City Pacific Project Management Pty Ltd	**Job Number**	06692015-3
Client Address	PO Box 1653, Southport, Qld 4215	**Date**	27-Nov-06
Project	Townsville Ocean Terminal	**Report Number**	NQ-06600 Page No 1 of 1
Location	Breakwater, Townsville	**Sampling Method**	As Supplied to Laboratory
Lab Ref No.	06/1136	**Sample Identification**	BH 46 0-1.25m

Laboratory Specimen Description (AS1726, App A, Sect 2) CI CLAY, medium plasticity, grey, with trace of sand.

PARTICLE SIZE DISTRIBUTION AS1289 3.6.1

Sieve Size	% Passing	Spec. Lower	Spec. Upper
150 mm	100		
100 mm	100		
75 mm	100		
53 mm	100		
37.5 mm	100		
26.5 mm	100		
19.0 mm	100		
13.2 mm	100		
9.5 mm	100		
6.7 mm	100		
4.75 mm	100		
2.36 mm	100		
1.18 mm	96		
0.600mm	92		
0.425mm	90		
0.300mm	89		
0.150mm	88		
0.075mm	86		

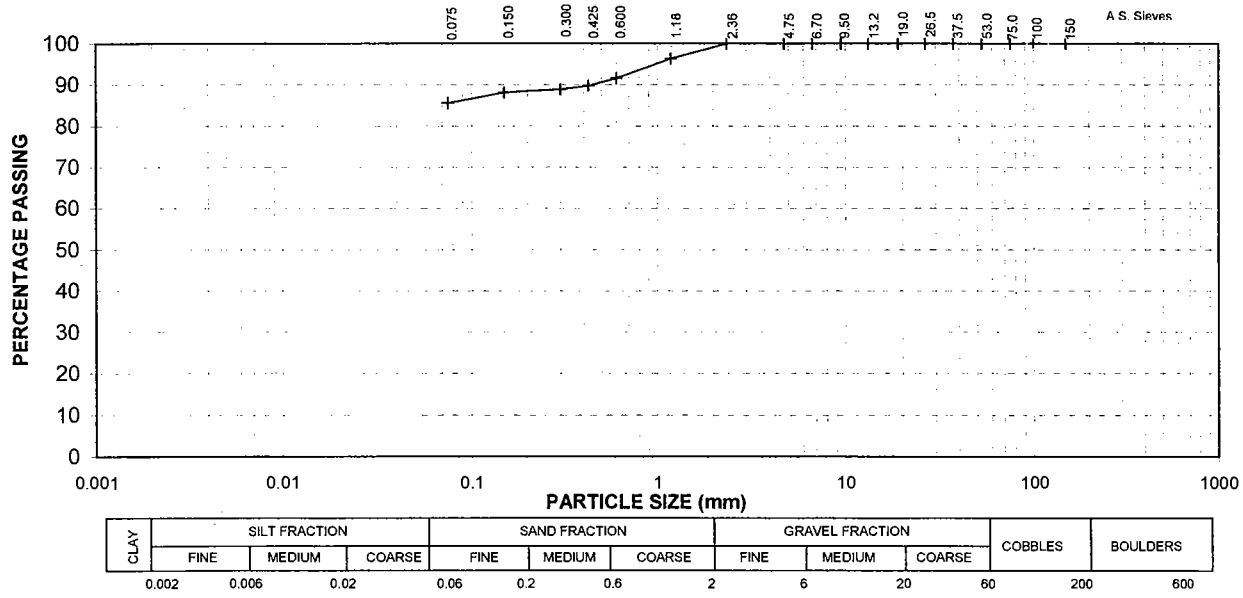
CLASSIFICATION LIMITS AND MOISTURE CONTENT

Test		Method	Result	Spec. Lower	Spec. Upper
Liquid Limit	%	AS1289 3.1.2	40		
Plastic Limit	%	AS1289 3.2.1	16		
Plasticity Index	%	AS1289 3.3.1	24		
Linear Shrinkage	%	AS1289 3.4.1	11.5		
Moisture Content	%	AS1289 2.1.1	30.9		

Sample History :	Natural State
Preparation Method :	Wet sieved
Crumbling / Curling of Linear Shrinkage :	No
Linear Shrinkage Mould Length :	150mm

NP = non-plastic NO = not obtainable ND = not determined

PARTICLE SIZE DISTRIBUTION



NATA

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its scope of accreditation.

THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL

Darryl Murphy Laboratory Manager — AUTHORISED SIGNATORY

28-Nov-06 — DATE

J:\Townsville Jobs\06692015-3\2015-3_600

Golder Associates Pty Ltd
NORTH QUEENSLAND LABORATORY
216 Draper Street, CAIRNS, QLD, 4870
NATA Accreditation No: 3732

PARTICLE SIZE DISTRIBUTION & CONSISTENCY LIMITS TEST REPORT

Client	City Pacific Project Management Pty Ltd	**Job Number**	06692015-3
Client Address	PO Box 1653, Southport, Qld 4215	**Date**	27-Nov-06
Project	Townsville Ocean Terminal	**Report Number**	NQ-06601 Page No 1 of 1
Location	Breakwater, Townsville	**Sampling Method**	As Supplied to Laboratory
Lab Ref No.	06/1137	**Sample Identification**	BH 46 1.25-2.05m

Laboratory Specimen Description CI CLAY, medium plasticity, grey, with trace of sand.
(AS1726, App A, Sect 2)

PARTICLE SIZE DISTRIBUTION AS1289 3.6.1

Sieve Size	% Passing	Spec. Lower	Spec. Upper
150 mm	100		
100 mm	100		
75 mm	100		
53 mm	100		
37.5 mm	100		
26.5 mm	100		
19.0 mm	100		
13.2 mm	100		
9.5 mm	100		
6.7 mm	100		
4.75 mm	100		
2.36 mm	100		
1.18 mm	100		
0.600mm	100		
0.425mm	100		
0.300mm	100		
0.150mm	99		
0.075mm	90		

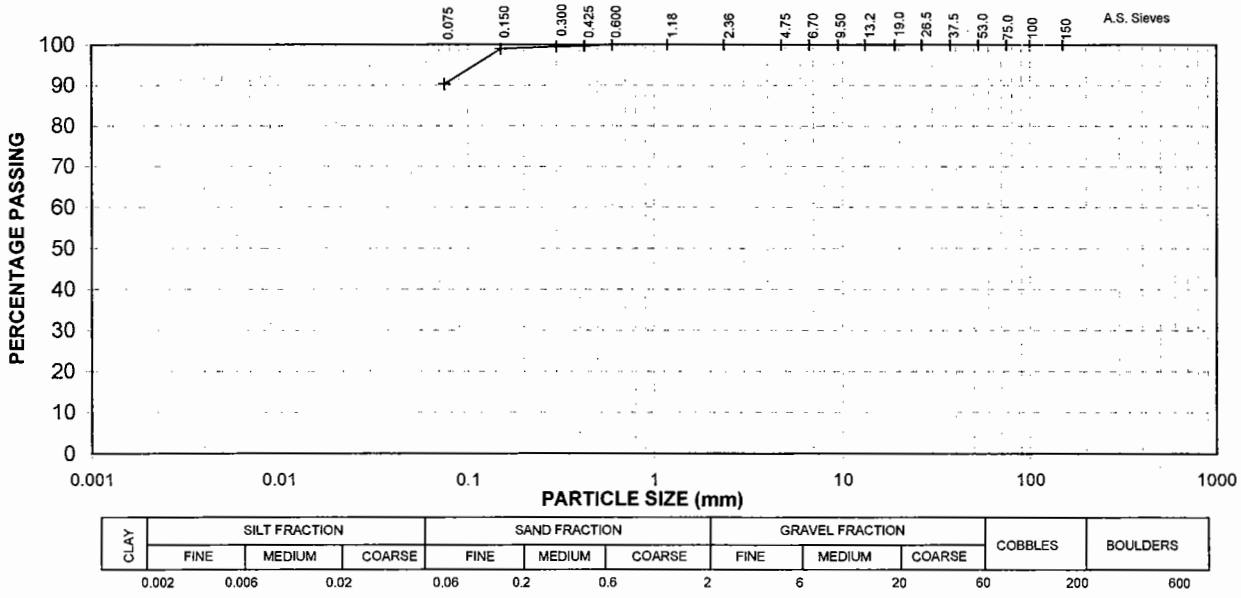
CLASSIFICATION LIMITS AND MOISTURE CONTENT

Test		Method	Result	Spec. Lower	Spec. Upper
Liquid Limit	%	AS1289 3.1.2	49		
Plastic Limit	%	AS1289 3.2.1	19		
Plasticity Index	%	AS1289 3.3.1	30		
Linear Shrinkage	%	AS1289 3.4.1	13.0		
Moisture Content	%	AS1289 2.1.1	60.7		

Sample History :	Natural State
Preparation Method :	Wet sieved
Crumbling / Curling of Linear Shrinkage :	No
Linear Shrinkage Mould Length :	150mm

NP = non-plastic NO = not obtainable ND = not determined

PARTICLE SIZE DISTRIBUTION



NATA

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its scope of accreditation.

THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL

Darryl Murphy Laboratory Manager — AUTHORISED SIGNATORY

28-Nov-06 — DATE

J:\Townsville Jobs\06692015-3\2015-3_601

APPENDIX E

Ooze Blending / Lime Stabilisation Trials

E1 BLENDING TRIALS – OOZE

As part of the development of the construction methodology City Pacific requested that small scale trials be undertaken of potential ground treatment methods for improving the geotechnical performance of the ooze material. Two trials were initiated:

- Blending of Ooze material with quarry rock.
- Lime Stabilisation of Ooze Material.

The project construction methodology evolved through many different options and prior to the completion and reporting of these trials, Golder was instructed to halt the assessment. The following is a summary of the assessment completed for these trials.

E2 BLENDING WITH QUARRY ROCK

As requested Golder Associates undertook a laboratory blending test of Ooze material recovered from the Duck Pond and a crushed rock product supplied by CEC from Pinnacles Quarry.

The ooze material was collected from two sites within the duck pond by use of an excavator mounted on a large barge and consisted of a silty clay material with some sand. The crushed rock product supplied from Pinnacles quarry was found to be a 300mm minus material produced from the crushing of apparently high strength pink granite.

E3 SAMPLING

The locations at which the samples were taken are indicated on the attached sketch plan E-1.

The sampling process was as follows:

- The barge was towed into position with the excavator mounted at one end of the barge with a 1.5m bucket attached.
- The excavator extracted a bucket of the ooze material from the sea bed and slowly lifted to the water's surface.
- The excess water was then allowed to drain from the top of the bucket and the material was then brought onto the barge.
- A total of 12 large sample bags were filled with material from the bucket at each location. Care was taken to gain representative samples from the ooze sediments.
- GPS coordinates were recorded for each sampling location

E4 METHODOLOGY

1. After consideration and discussions the following methodology was adopted to try and replicate what might be attempted in the field:

2. A 100mm thick layer of ooze material was placed in the base of a large dust bin. The material was weighed and an estimate of the volume made (1.5 X 5litre buckets of material added).

3. A 5 litre bucket of quarry product was then weighed and added to the dust bin. (Note: due to the diameter of the dust bin used particles greater than 150mm diameter were removed).

4. The materials were then mixed by ramming with a 9.5kg square ended rammer until the material appeared well mixed.

5. A tape measure that had been fixed to the side of the dust bin was then used to assess the increase in thickness of the layer of material within the dust bin

6. The material produced was then photographed.

7. Step 3 onwards was then repeated until a material was produced which would have low compressibility and where the quarry product interlocked, providing point to point contacts and increasing the shear strength of the blended product to a "suitable" level.

E5 BLENDING QUANTITIES

The following table shows the mix progression:

Ooze Material	**Quarry Product**	**Blend Thickness**	**Ratio (Mass) Ooze: Product**	**Ratio (Volume) Ooze: Product**
25.667 kg 0.01 m^3	-	100mm	-	-
25.667 kg 0.01 m^3	14.092 kg 0.005 m^3	140mm	1 : 1.8	2:1
25.667 kg 0.01 m^3	27.528 kg 0.01 m^3	170mm	1 : 0.9	1 : 1
25.667 kg 0.01 m^3	40.642 kg 0.015 m^3	190mm	1 : 0.63	2:3
25.667 kg 0.01m^3	50.542 kg 0.02 m^3	230mm	1: 0.51	1 : 2

25.667 kg 0.01m^3	62.396 kg 0.025 m^3	290mm	1 : 0.41	1 : 2.5

E6 THE BLENDING PROCESS

The following is a visual record of the trial ratios as blending was undertaken.

0.01 m^3 Ooze

0.005 m^3 Quarry Product

0.01 m^3 Ooze

0.01 m^3 Quarry Product

Products being blended

Rammer being used to blend materials

0.01 m^3 Ooze

0.015 m^3 Quarry Product

0.01 m^3 Ooze

0.02 m^3 Quarry Product

Blended material

0.01 m^3 Ooze

0.025 m^3 Quarry Product

Blended material

E7 OBSERVATIONS

The materials require relatively high mechanical effort to blend once a 1:1 ratio is reached

A well graded product appears to produce a “better” product than a gap graded material but requires more mechanical effort to mix.

Maximum particle size will likely be dependant on thickness of layer being blended and plant used.

Blended product must become “a gravel” ie point to point contacts are achieved and are evenly blended through mix

E6 LIME STABILISATION TRIALS

Assessment was initiated for potential treatment of the ooze material with lime. This was undertaken to help assess the potential for improvement of the geotechnical performance of ooze.

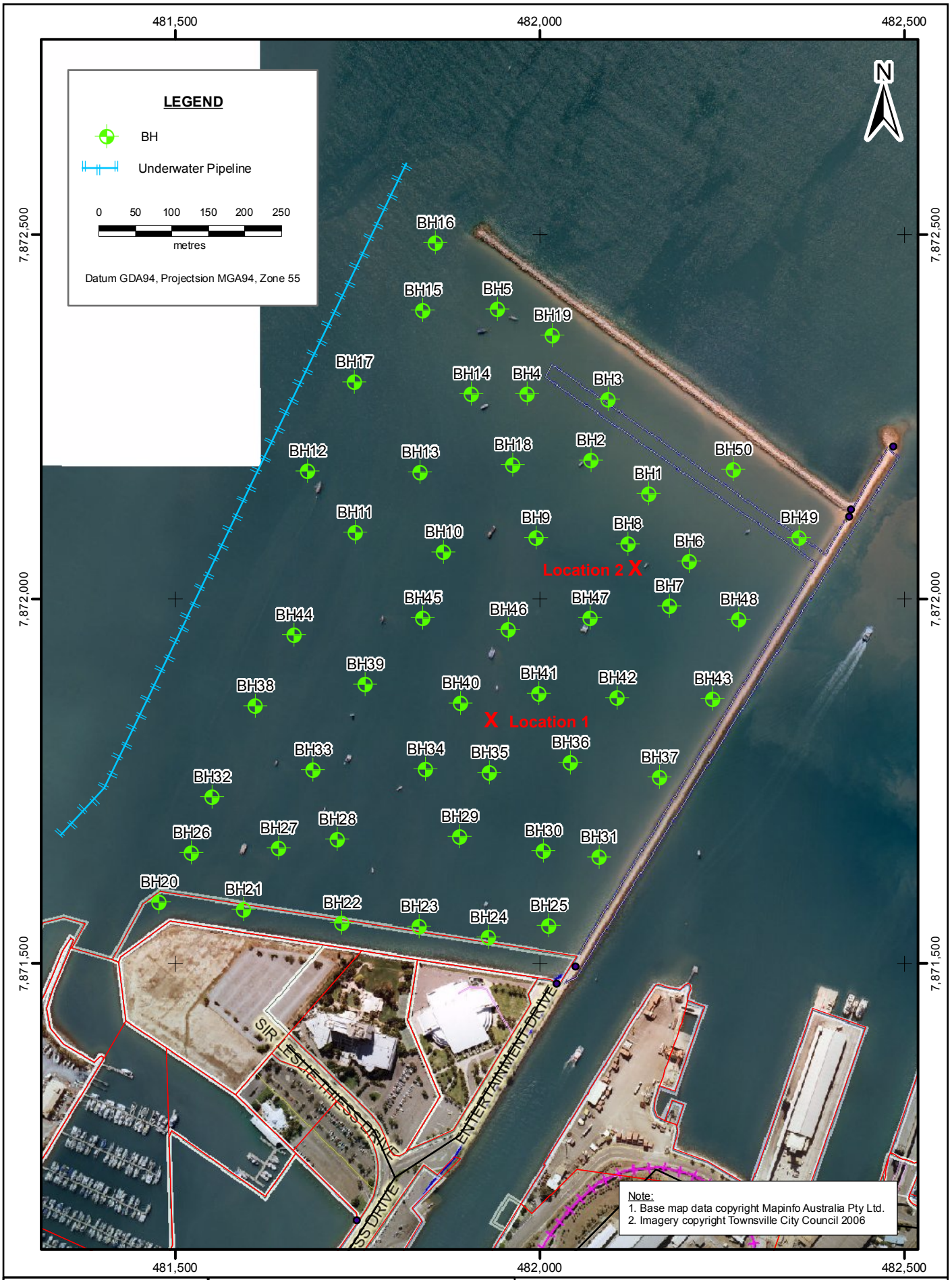
The following testing/ trials were undertaken:

- Atterberg Tests on unblended ooze material
- Treatment of ooze sub-samples with 2%, 3% and 5% GP cement (by weight)

- Treatment of ooze sub-samples with 3%, 4% and 6% lime (by weight).
- Atterberg limit tests on all six sets of treated sub-samples
- Unconfined compressive strength testing of each of the six treated sub-samples at 7 days after treatment and 28 days after treatment.

E7 TEST RESULTS

Laboratory test results for the above detailed assessment are included within this appendix.



Golder Associates	CLIENT: City Pacific	PROJECT: Townsville Ocean Terminal	
	DRAWN: AOB — DATE: 04/10/06	TITLE: **DUCKPOND TEST LOCATIONS**	
	CHECKED: WB* — DATE: 04/10/06		
	SCALE: 1:7,000	PROJECT No: 06692015 — FIGURE No: E-1 — REV No: 0	A4

File Location: \\Tvl-server\data (d)\Data\Townsville\AA Files Current\06692015 City Pacific - TOT\Figures\GIS\Projects\ArcGIS\Draft\06692015_DuckPond_FieldworkSiteplan.mxd
Note: The * beside the typed initials denotes the original drawing issue was signed or initialled by that respective person.

SOIL, AGGREGATE & CONCRETE TESTING
SES
Soil Engineering Services
HALL CORP PTY LTD A.C.N 066 449 769 A.B.N 34 149 057 182 ATF HALL FAMILY TRUST TA
P.O. BOX 7760, GARBUTT B.C. Q. 4814. PHONE: (07) 4774 7888, FAX: (07) 4774 7677
9 Catalyst Court, Mt St John, TOWNSVILLE Q. 4818.
ses01@bigpond.com

Unconfined Compressive Strength Report

Client :	**GOLDER & ASSOCIATES PTY LTD**	Report Number:	**TV3087 - 2**
Client Address:	**P.O. Box 5298 Townsville M.C QLD 4810**		
Job Number :	**TV3087**	Report Date:	**22/02/2007**
Project :	**Proposed Marina Development**	Order Number:	
Location :	**Townsville , North Queensland**	Test Method:	**AS1141.51**

Lab No :	A6	A7	A8	A335
ID No :	-	-	-	-
Lot No :	GP	GP	GP	GP
Item No :	-	-	-	-
Date Sampled :	15/12/2006	15/12/2006	15/12/2006	15/12/2006
Date Tested :	31/1/2007	31/1/2007	31/1/2007	21/2/2007
Material Source :	From Site	From Site	From Site	From Site
For Use As :	-	-	-	-
Sample Location :	Duck Pond' combined Samples 1 & 2 2% GP cement 7 days	Duck Pond' combined Samples 1 & 2 3% GP cement 7 days	Duck Pond' combined Samples 1 & 2 5% GP cement 7 days	Duck Pond' combined Samples 1 & 2 2% GP cement 28 days
Moisture Content (%) :	15.57	15.09	13.89	14.99
Compactive Effort :	Standard	Standard	Standard	Standard
Dry Density (t/m³) :	1.743	1.727	1.736	1.72
Unconfined Compressive Strength (Mpa):	**0.34**	**0.36**	**0.56**	**0.44**
Remarks :				

NATA

This Laboratory is accredited by the National Association of Testing Authorities, Australia. The test(s) reported herein have been performed in accordance with its scope of accreditation. This document shall not be reproduced, except in full.

APPROVED SIGNATORY

Don Byers
NATA Accred No:2856

FORM NUMBER

REP AUCS-1-16

SES
Soil Engineering Services
HALL CORP PTY LTD A.C.N 066 449 769 A.B.N 34 149 057 182 ATF HALL FAMILY TRUST TA
P.O. BOX 7760, GARBUTT B.C. Q. 4814. PHONE: (07) 4774 7888, FAX: (07) 4774 7677
9 Catalyst Court, Mt St John, TOWNSVILLE Q. 4818.
ses01@bigpond.com

Unconfined Compressive Strength Report

Client :	**GOLDER & ASSOCIATES PTY LTD**	Report Number:	**TV3087 - 2**
Client Address:	**P.O. Box 5298 Townsville M.C QLD 4810**		
Job Number :	**TV3087**	Report Date:	**22/02/2007**
Project :	**Proposed Marina Development**	Order Number:	
Location :	**Townsville , North Queensland**	Test Method:	**AS1141.51**

Lab No :	A336	A337		
ID No :	-	-		
Lot No :	GP	GP		
Item No :	-	-		
Date Sampled :	15/12/2006	15/12/2006		
Date Tested :	21/2/2007	21/2/2007		
Material Source :	From Site	From Site		
For Use As :	-	-		
Sample Location :	Duck Pond' combined Samples 1 & 2 3% GP cement 28 days	Duck Pond' combined Samples 1 & 2 5% GP cement 28 days		
Moisture Content (%) :	15.58	13.35		
Compactive Effort :	Standard	Standard		
Dry Density (t/m³) :	1.718	1.736		
Unconfined Compressive Strength (Mpa):	**0.5**	**0.84**		
Remarks :				

NATA

This Laboratory is accredited by the National Association of Testing Authorities, Australia. The test(s) reported herein have been performed in accordance with its scope of accreditation. This document shall not be reproduced, except in full.

APPROVED SIGNATORY

Don Byers
NATA Accred No:2856

FORM NUMBER

REP AUCS-1-16

SES
Soil Engineering Services
HALL CORP PTY LTD A.C.N 066 449 769 A.B.N 34 149 057 182 ATF HALL FAMILY TRUST TA
P.O. BOX 7760, GARBUTT B.C. Q. 4814. PHONE: (07) 4774 7888, FAX: (07) 4774 7677
9 Catalyst Court, Mt St John, TOWNSVILLE Q. 4818.
ses01@bigpond.com

Unconfined Compressive Strength Report

Client :	**GOLDER & ASSOCIATES PTY LTD**	Report Number:	**TV3087 - 1**
Client Address:	**P.O. Box 5298 Townsville M.C QLD 4810**		
Job Number :	**TV3087**	Report Date:	**22/02/2007**
Project :	**Proposed Marina Development**	Order Number:	
Location :	**Townsville , North Queensland**	Test Method:	**AS1141.51**

Lab No :	A3	A4	A5	A332
ID No :	-	-	-	-
Lot No :	Lime	Lime	Lime	Lime
Item No :	-	-	-	-
Date Sampled :	15/12/2006	15/12/2006	15/12/2006	15/12/2006
Date Tested :	31/1/2007	31/1/2007	31/1/2007	21/2/2007
Material Source :	From Site	From Site	From Site	From Site
For Use As :	-	-	-	-
Sample Location :	Duck Pond' combined Samples 1 & 2 3% Lime 7 days	Duck Pond' combined Samples 1 & 2 4% Lime 7 days	Duck Pond' combined Samples 1 & 2 6% Lime 7 days	Duck Pond' combined Samples 1 & 2 3% lime 28 days
Moisture Content (%) :	16.41	14.46	17.37	15.42
Compactive Effort :	Standard	Standard	Standard	Standard
Dry Density (t/m³) :	1.688	1.722	1.663	1.704
Unconfined Compressive Strength (Mpa):	**0.3**	**0.3**	**0.4**	**0.32**
Remarks :				

NATA

This Laboratory is accredited by the National Association of Testing Authorities, Australia. The test(s) reported herein have been performed in accordance with its scope of accreditation. This document shall not be reproduced, except in full.

APPROVED SIGNATORY

Don Byers
NATA Accred No:2856

FORM NUMBER

REP AUCS-1-16

SOIL, AGGREGATE & CONCRETE TESTING
SES
Soil Engineering Services
HALL CORP PTY LTD A.C.N 066 449 769 A.B.N 34 149 057 182 ATF HALL FAMILY TRUST TA
P.O. BOX 7760, GARBUTT B.C. Q. 4814. PHONE: (07) 4774 7888, FAX: (07) 4774 7677
9 Catalyst Court, Mt St John, TOWNSVILLE Q. 4818.
ses01@bigpond.com

Unconfined Compressive Strength Report

Client :	**GOLDER & ASSOCIATES PTY LTD**	Report Number:	**TV3087 - 1**
Client Address:	**P.O. Box 5298 Townsville M.C QLD 4810**		
Job Number :	**TV3087**	Report Date:	**22/02/2007**
Project :	**Proposed Marina Development**	Order Number:	
Location :	**Townsville , North Queensland**	Test Method:	**AS1141.51**

Lab No :	A333	A334		
ID No :	-	-		
Lot No :	Lime	Lime		
Item No :	-	-		
Date Sampled :	15/12/2006	15/12/2006		
Date Tested :	21/2/2007	21/2/2007		
Material Source :	From Site	From Site		
For Use As :	-	-		
Sample Location :	Duck Pond' combined Samples 1 & 2 4% lime 28 days	Duck Pond' combined Samples 1 & 2 6% lime 28 days		
Moisture Content (%) :	17.21	17.44		
Compactive Effort :	Standard	Standard		
Dry Density (t/m³) :	1.685	1.675		
Unconfined Compressive Strength (Mpa):	**0.38**	**0.5**		
Remarks :				

NATA

This Laboratory is accredited by the National Association of Testing Authorities, Australia. The test(s) reported herein have been performed in accordance with its scope of accreditation. This document shall not be reproduced, except in full.

APPROVED SIGNATORY

Don Byers
NATA Accred No:2856

FORM NUMBER

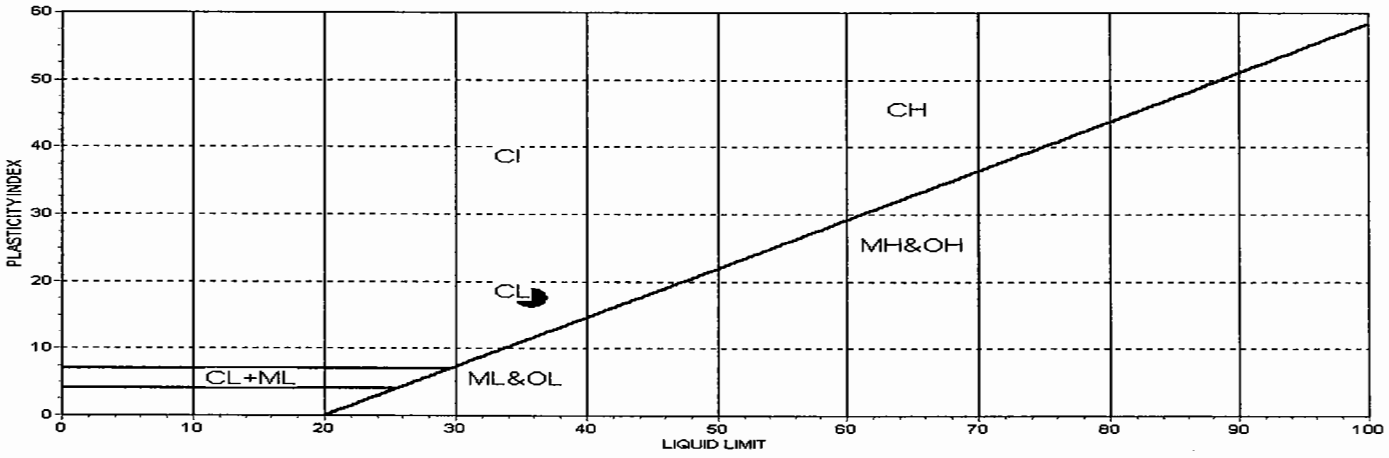
REP AUCS-1-16

SOIL / AGGREGATE & CONCRETE TESTING
SES
Soil Engineering Services
HALL CORP PTY LTD A.C.N 066 449 769 A.B.N 34 149 057 182 ATF HALL FAMILY TRUST TA
P.O. BOX 7760, GARBUTT B.C. Q. 4814. PHONE: (07) 4774 7888, FAX: (07) 4774 7677
9 Catalyst Court, Mt St John, TOWNSVILLE Q. 4818.
ses01@bigpond.com

Atterberg Limits Report

Client:	**GOLDER & ASSOCIATES PTY LTD**	Report Number:	**TV3087 - 3**
Client Address:	**P.O. Box 5298 Townsville M.C QLD 4810**		
Job Number:	**TV3087**	Report Date:	**22/02/2007**
Project:	**Proposed Marina Development**	Order Number:	-
Location	**Townsville , North Queensland**	**Page 1 of 7**	
Lab No:	**A2**	Sample Location	
Date Sampled:	**15/12/2006**	Duck Pond' combined	
Date Tested:	**30/01/2007**	Samples 1 & 2	
Sampled By:	**CL**	No Additives	
Sample Method:			
Material Source:	**From Site**	Spec Description:	-
For Use As:	-	Lot Number:	-
Remarks:	-	Spec Number:	-

Plasticity Tests	Test Method	Specification Minimum	Result	Specification Maximum
Liquid Limit (%)	**AS1289.3.1.2**		**36**	
Plastic Limit (%)	**AS1289.3.2.1**		**18**	
Plastic Index	**AS1289.3.3.1**		**18**	
Linear Shrinkage (%)	**AS1289.3.4.1**		**10.0**	



NATA

This Laboratory is accredited by the National Association of Testing Authorities, Australia. The test(s) reported herein have been performed in accordance with its scope of accreditation. This document shall not be reproduced, except in full.

APPROVED SIGNATORY

Don Byers
NATA Accred No:2856

FORM NUMBER

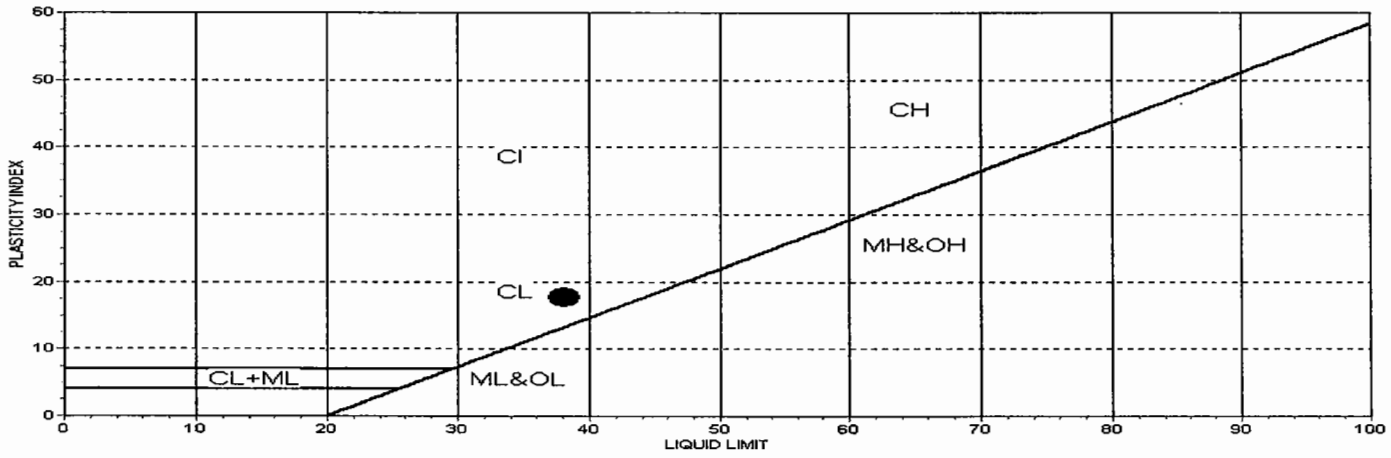
REP ATT-1-24

SOIL, AGGREGATE & CONCRETE TESTING
SES
Soil Engineering Services
HALL CORP PTY LTD A.C.N 066 449 769 A.B.N 34 149 057 182 ATF HALL FAMILY TRUST TA
P.O. BOX 7760, GARBUTT B.C. Q. 4814. PHONE: (07) 4774 7888, FAX: (07) 4774 7677
9 Catalyst Court, Mt St John, TOWNSVILLE Q. 4818.
ses01@bigpond.com

Atterberg Limits Report

Client:	**GOLDER & ASSOCIATES PTY LTD**	Report Number:	**TV3087 - 3**
Client Address:	**P.O. Box 5298 Townsville M.C QLD 4810**		
Job Number:	**TV3087**	Report Date:	**22/02/2007**
Project:	**Proposed Marina Development**	Order Number:	-
Location	**Townsville , North Queensland**	**Page 2 of 7**	
Lab No:	**A3**	Sample Location	
Date Sampled:	**15/12/2006**	Duck Pond' combined	
Date Tested:	**02/02/2007**	Samples 1 & 2	
Sampled By:	**CL**	3% Lime	
Sample Method:		7 days	
Material Source:	**From Site**	Spec Description:	-
For Use As:	-	Lot Number:	Lime
Remarks:	-	Spec Number:	-

Plasticity Tests	Test Method	Specification Minimum	Result	Specification Maximum
Liquid Limit (%)	**AS1289.3.1.2**		**38**	
Plastic Limit (%)	**AS1289.3.2.1**		**21**	
Plastic Index	**AS1289.3.3.1**		**17**	
Linear Shrinkage (%)	**AS1289.3.4.1**		**10.5**	



NATA

This Laboratory is accredited by the National Association of Testing Authorities, Australia. The test(s) reported herein have been performed in accordance with its scope of accreditation. This document shall not be reproduced, except in full.

APPROVED SIGNATORY
Don Byers
NATA Accred No:2856

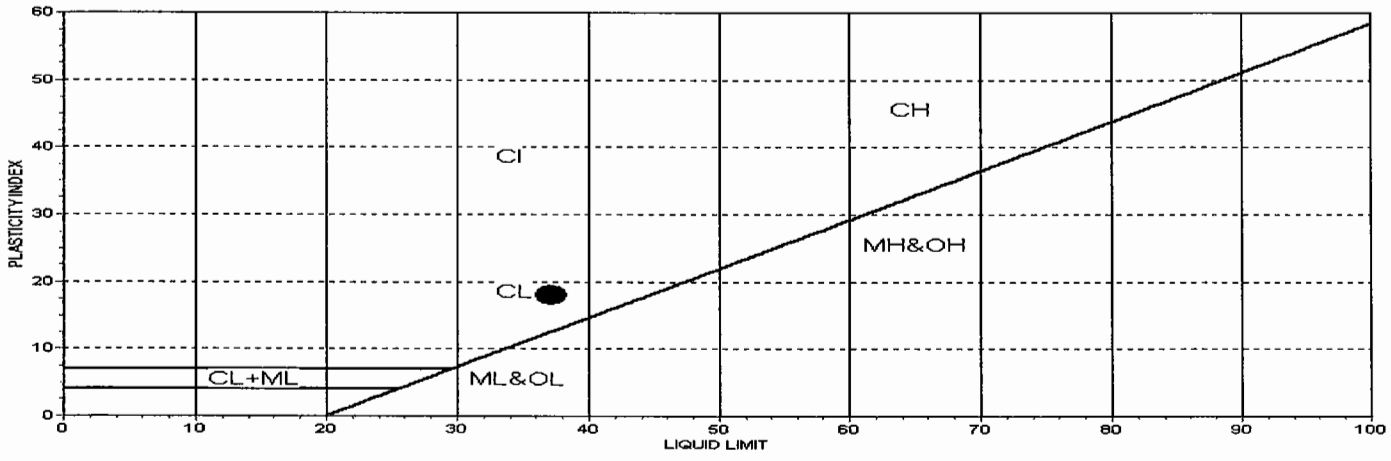
FORM NUMBER
REP ATT-1-24

HALL CORP PTY LTD A.C.N 066 449 769 A.B.N 34 149 057 182 ATF HALL FAMILY TRUST TA
P.O. BOX 7760, GARBUTT B.C. Q. 4814. PHONE: (07) 4774 7888, FAX: (07) 4774 7677
9 Catalyst Court, Mt St John, TOWNSVILLE Q. 4818.
ses01@bigpond.com

Atterberg Limits Report

Client:	**GOLDER & ASSOCIATES PTY LTD**	Report Number:	**TV3087 - 3**
Client Address:	**P.O. Box 5298 Townsville M.C QLD 4810**		
Job Number:	**TV3087**	Report Date:	**22/02/2007**
Project:	**Proposed Marina Development**	Order Number:	-
Location	**Townsville , North Queensland**	**Page 3 of 7**	
Lab No:	**A4**	Sample Location	
Date Sampled:	**15/12/2006**	Duck Pond' combined	
Date Tested:	**05/02/2007**	Samples 1 & 2	
Sampled By:	**CL**	4% Lime	
Sample Method:		7 days	
Material Source:	**From Site**	Spec Description:	-
For Use As:	-	Lot Number:	Lime
Remarks:	-	Spec Number:	-

Plasticity Tests	Test Method	Specification Minimum	Result	Specification Maximum
Liquid Limit (%)	**AS1289.3.1.2**		**37**	
Plastic Limit (%)	**AS1289.3.2.1**		**19**	
Plastic Index	**AS1289.3.3.1**		**18**	
Linear Shrinkage (%)	**AS1289.3.4.1**		**9.0**	



NATA

This Laboratory is accredited by the National Association of Testing Authorities, Australia. The test(s) reported herein have been performed in accordance with its scope of accreditation. This document shall not be reproduced, except in full.

APPROVED SIGNATORY
Don Byers
NATA Accred No:2856

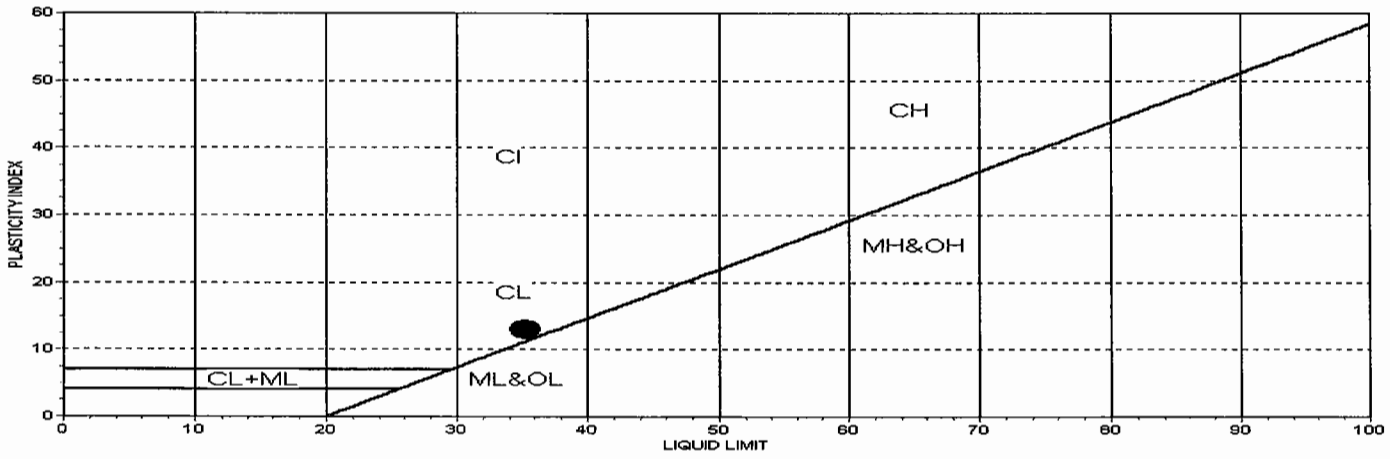
FORM NUMBER
REP ATT-1-24

SOIL, AGGREGATE & CONCRETE TESTING
SES
Soil Engineering Services
HALL CORP PTY LTD A.C.N 066 449 769 A.B.N 34 149 057 182 ATF HALL FAMILY TRUST TA
P.O. BOX 7760, GARBUTT B.C. Q. 4814. PHONE: (07) 4774 7888, FAX: (07) 4774 7677
9 Catalyst Court, Mt St John, TOWNSVILLE Q. 4818.
ses01@bigpond.com

Atterberg Limits Report

Client:	**GOLDER & ASSOCIATES PTY LTD**	Report Number:	**TV3087 - 3**
Client Address:	**P.O. Box 5298 Townsville M.C QLD 4810**		
Job Number:	**TV3087**	Report Date:	**22/02/2007**
Project:	**Proposed Marina Development**	Order Number:	-
Location	**Townsville , North Queensland**	**Page 4 of 7**	
Lab No:	**A5**	Sample Location	
Date Sampled:	**15/12/2006**	Duck Pond' combined	
Date Tested:	**05/02/2007**	Samples 1 & 2	
Sampled By:	**CL**	6% Lime	
Sample Method:		7 days	
Material Source:	**From Site**	Spec Description:	-
For Use As:	-	Lot Number:	Lime
Remarks:	-	Spec Number:	-

Plasticity Tests	Test Method	Specification Minimum	Result	Specification Maximum
Liquid Limit (%)	**AS1289.3.1.2**		**35**	
Plastic Limit (%)	**AS1289.3.2.1**		**22**	
Plastic Index	**AS1289.3.3.1**		**13**	
Linear Shrinkage (%)	**AS1289.3.4.1**		**6.5**	



NATA

This Laboratory is accredited by the National Association of Testing Authorities, Australia. The test(s) reported herein have been performed in accordance with its scope of accreditation. This document shall not be reproduced, except in full.

APPROVED SIGNATORY
Don Byers
NATA Accred No:2856

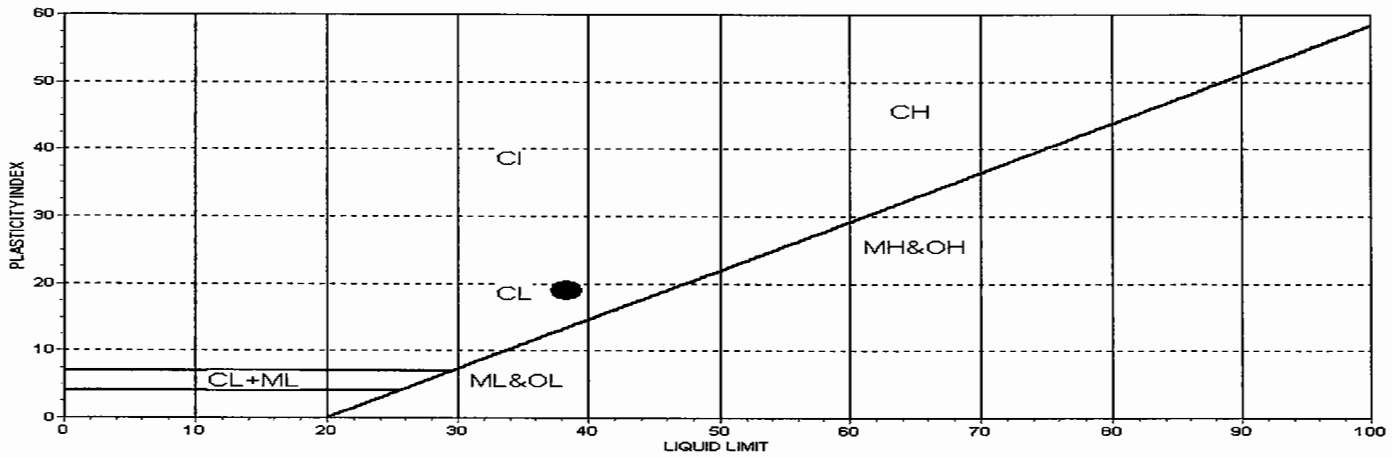
FORM NUMBER
REP ATT-1-24

SOIL, AGGREGATE & CONCRETE TESTING
SES
Soil Engineering Services
HALL CORP PTY LTD A.C.N 066 449 769 A.B.N 34 149 057 182 ATF HALL FAMILY TRUST TA
P.O. BOX 7760, GARBUTT B.C. Q. 4814. PHONE: (07) 4774 7888, FAX: (07) 4774 7677
9 Catalyst Court, Mt St John, TOWNSVILLE Q. 4818.
ses01@bigpond.com

Atterberg Limits Report

Client:	**GOLDER & ASSOCIATES PTY LTD**	Report Number:	**TV3087 - 3**
Client Address:	**P.O. Box 5298 Townsville M.C QLD 4810**		
Job Number:	**TV3087**	Report Date:	**22/02/2007**
Project:	**Proposed Marina Development**	Order Number:	-
Location	**Townsville , North Queensland**	**Page 5 of 7**	
Lab No:	**A6**	Sample Location	
Date Sampled:	**15/12/2006**	Duck Pond' combined	
Date Tested:	**05/02/2007**	Samples 1 & 2	
Sampled By:	**CL**	2% GP cement	
Sample Method:		7 days	
Material Source:	**From Site**	Spec Description:	-
For Use As:	-	Lot Number:	GP
Remarks:	-	Spec Number:	-

Plasticity Tests	Test Method	Specification Minimum	Result	Specification Maximum
Liquid Limit (%)	**AS1289.3.1.2**		**38**	
Plastic Limit (%)	**AS1289.3.2.1**		**20**	
Plastic Index	**AS1289.3.3.1**		**18**	
Linear Shrinkage (%)	**AS1289.3.4.1**		**9.0**	



NATA

This Laboratory is accredited by the National Association of Testing Authorities, Australia. The test(s) reported herein have been performed in accordance with its scope of accreditation. This document shall not be reproduced, except in full.

APPROVED SIGNATORY
Don Byers
NATA Accred No:2856

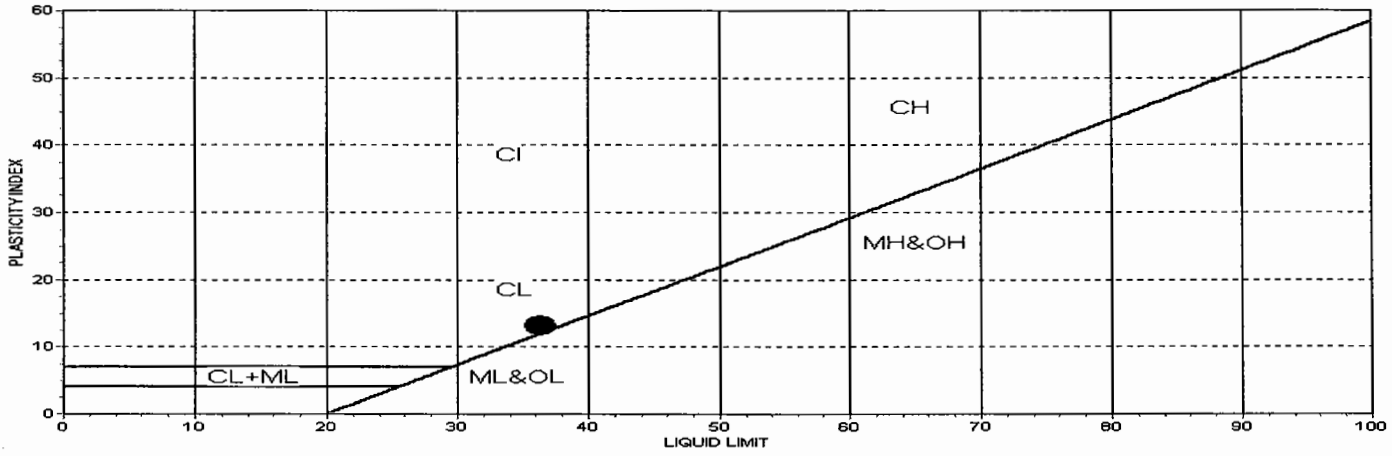
FORM NUMBER
REP ATT-1-24

SOIL, AGGREGATE & CONCRETE TESTING
SES
Soil Engineering Services
HALL CORP PTY LTD A.C.N 066 449 769 A.B.N 34 149 057 182 ATF HALL FAMILY TRUST TA
P.O. BOX 7760, GARBUTT B.C. Q. 4814. PHONE: (07) 4774 7888, FAX: (07) 4774 7677
9 Catalyst Court, Mt St John, TOWNSVILLE Q. 4818.
ses01@bigpond.com

Atterberg Limits Report

Client:	**GOLDER & ASSOCIATES PTY LTD**	Report Number:	**TV3087 - 3**
Client Address:	**P.O. Box 5298 Townsville M.C QLD 4810**		
Job Number:	**TV3087**	Report Date:	**22/02/2007**
Project:	**Proposed Marina Development**	Order Number:	-
Location	**Townsville , North Queensland**	**Page 6 of 7**	
Lab No:	**A7**	Sample Location	
Date Sampled:	**15/12/2006**	Duck Pond' combined	
Date Tested:	**05/02/2007**	Samples 1 & 2	
Sampled By:	**CL**	3% GP cement	
Sample Method:		7 days	
Material Source:	**From Site**	Spec Description:	-
For Use As:	-	Lot Number:	GP
Remarks:	-	Spec Number:	-

Plasticity Tests	Test Method	Specification Minimum	Result	Specification Maximum
Liquid Limit (%)	**AS1289.3.1.2**		**36**	
Plastic Limit (%)	**AS1289.3.2.1**		**23**	
Plastic Index	**AS1289.3.3.1**		**13**	
Linear Shrinkage (%)	**AS1289.3.4.1**		**7.5**	



NATA

This Laboratory is accredited by the National Association of Testing Authorities, Australia. The test(s) reported herein have been performed in accordance with its scope of accreditation. This document shall not be reproduced, except in full.

APPROVED SIGNATORY
Don Byers
NATA Accred No:2856

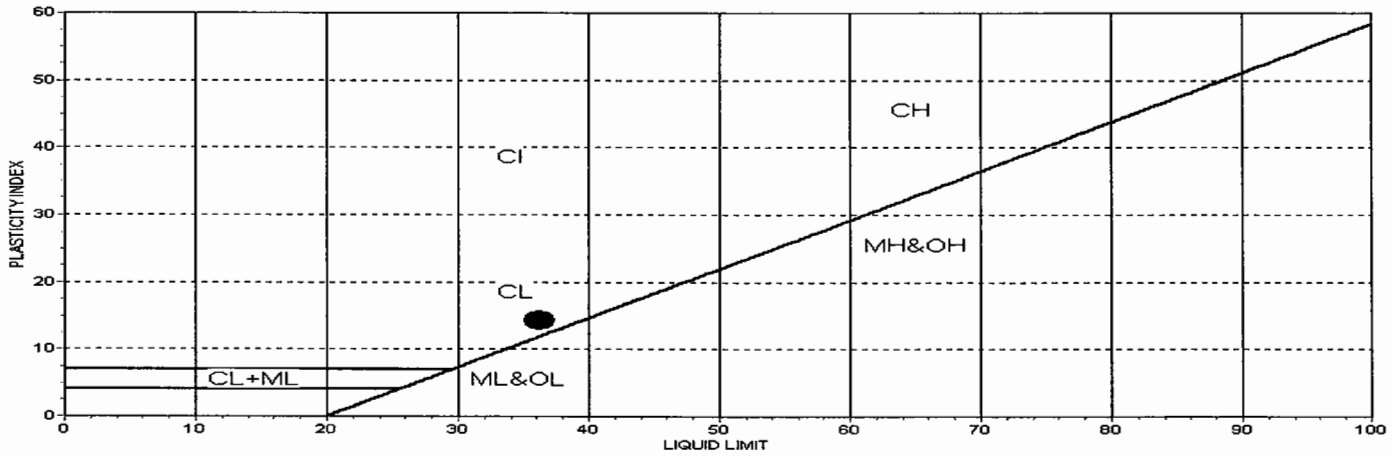
FORM NUMBER
REP ATT-1-24

SOIL, AGGREGATE & CONCRETE TESTING
SES
Soil Engineering Services
HALL CORP PTY LTD A.C.N 066 449 769 A.B.N 34 149 057 182 ATF HALL FAMILY TRUST TA
P.O. BOX 7760, GARBUTT B.C. Q. 4814. PHONE: (07) 4774 7888, FAX: (07) 4774 7677
9 Catalyst Court, Mt St John, TOWNSVILLE Q. 4818.
ses01@bigpond.com

Atterberg Limits Report

Client:	**GOLDER & ASSOCIATES PTY LTD**	Report Number:	**TV3087 - 3**
Client Address:	**P.O. Box 5298 Townsville M.C QLD 4810**		
Job Number:	**TV3087**	Report Date:	**22/02/2007**
Project:	**Proposed Marina Development**	Order Number:	-
Location	**Townsville , North Queensland**	**Page 7 of 7**	
Lab No:	**A8**	Sample Location	
Date Sampled:	**15/12/2006**	Duck Pond' combined	
Date Tested:	**02/02/2007**	Samples 1 & 2	
Sampled By:	**CL**	5% GP cement	
Sample Method:		7 days	
Material Source:	**From Site**	Spec Description:	-
For Use As:	-	Lot Number:	GP
Remarks:	-	Spec Number:	-

Plasticity Tests	Test Method	Specification Minimum	Result	Specification Maximum
Liquid Limit (%)	**AS1289.3.1.2**		**36**	
Plastic Limit (%)	**AS1289.3.2.1**		**22**	
Plastic Index	**AS1289.3.3.1**		**14**	
Linear Shrinkage (%)	**AS1289.3.4.1**		**7.0**	



NATA

This Laboratory is accredited by the National Association of Testing Authorities, Australia. The test(s) reported herein have been performed in accordance with its scope of accreditation. This document shall not be reproduced, except in full.

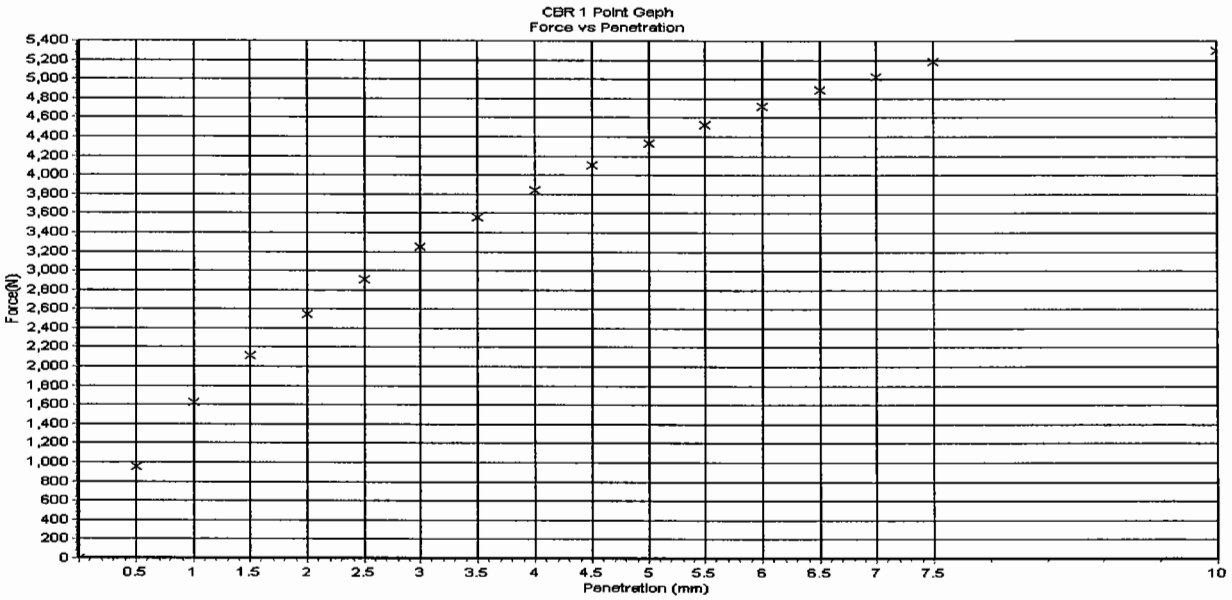
APPROVED SIGNATORY
Don Byers
NATA Accred No:2856

FORM NUMBER
REP ATT-1-24

SOIL, AGGREGATE & CONCRETE TESTING
SES
Soil Engineering Services
HALL CORP PTY LTD A.C.N 066 449 769 A.B.N 34 149 057 182 ATF HALL FAMILY TRUST TA
P.O. BOX 7760, GARBUTT B.C. Q. 4814. PHONE: (07) 4774 7888, FAX: (07) 4774 7677
9 Catalyst Court, Mt St John, TOWNSVILLE Q. 4818.
ses01@bigpond.com

California Bearing Ratio Report (1 Point)

Client:	**GOLDER & ASSOCIATES PTY LTD**	Report Number:	**TV3087 - 4**
Client address:	**P.O. Box 5298 Townsville M.C QLD 4810**		
Job Number:	**TV3087**	Report Date:	**22/02/2007**
Project:	**Proposed Marina Development**	Order Number:	
Location	**Townsville , North Queensland**		**Page 1 of 6**
Lab No:	**A3**	Sample Location	
Date Sampled:	**15/12/2006**	Duck Pond' combined	
Date Tested:	**25/01/2007**	Samples 1 & 2	
Sampled By:	**CL**	3% Lime	
Sample Method:		7 days	
Material Source:	**From Site**	Test Method :	AS1289.6.1.1
For Use As:	-	Lot Number:	**Lime**
Remarks:	-	Item Number :	-



Maximum Dry Density - MDD (t/m³) :	**1.695**	Dry Density after Soak (t/m³) :	-
Optimum Moisture Content - OMC (%) :	**17.8**	Moisture Content after Soak (%) :	**0**
Compactive Effort :		Density Ratio after Soak (%) :	
Nominated % Maximum Dry Density Compaction :	**100**	Field Moisture Content (%) :	-
Nominated % Optimum Moisture Content Compaction :	**100**	Moisture Content (Top) after Penetration (%) :	**24.1**
Achieved Dry Density before Soak (t/m³) :	**1.569**	Optional Moisture Content (Remainder) after Penetration (%) :	**42.7**
Achieved Percentage of Maximum Dry Density (%) :	**93**	CBR 2.5mm (%) :	**20**
Achieved Moisture Content (%) :	**19.4**	CBR 5.0mm (%) :	**20**
Achieved Percentage of Optimum Moisture Content (%) :	**109**	Minimum Specified CBR Value (%) :	-
Test Condition (Soaked/Unsoaked) / Soaking Period (Days) :	**Soaked / 4 days**	**CBR Value (%) :**	**20**
Swell (%) / Surcharge (kg):	**1.5 / 4.5 kg**	+19mm Material (%)	Oversize replacement

Soil Description :

NATA

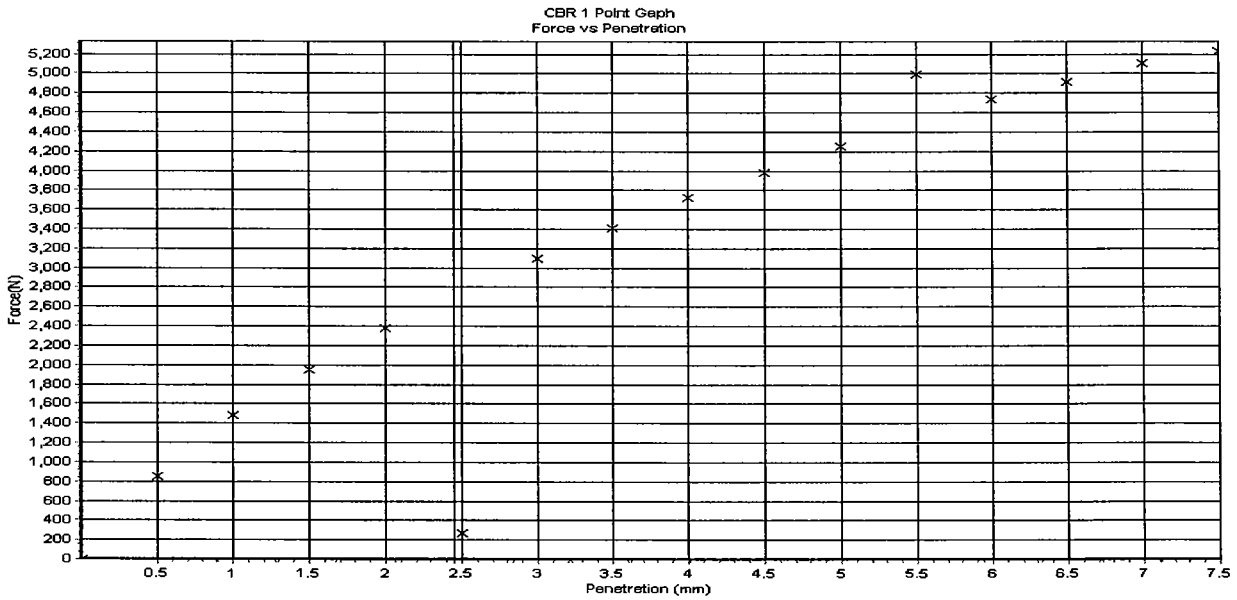
Approved Signatory
Don Byers
NATA Accred No:2856

Form Number
CBR_1_3-1-33

SOIL, AGGREGATE & CONCRETE TESTING
SES
Soil Engineering Services
HALL CORP PTY LTD A.C.N 066 449 769 A.B.N 34 149 057 182 ATF HALL FAMILY TRUST TA
P.O. BOX 7760, GARBUTT B.C. Q. 4814. PHONE: (07) 4774 7888, FAX: (07) 4774 7677
9 Catalyst Court, Mt St John, TOWNSVILLE Q. 4818.
ses01@bigpond.com

California Bearing Ratio Report (1 Point)

Client:	**GOLDER & ASSOCIATES PTY LTD**	Report Number:	**TV3087 - 4**
Client address:	**P.O. Box 5298 Townsville M.C QLD 4810**		
Job Number:	**TV3087**	Report Date:	**22/02/2007**
Project:	**Proposed Marina Development**	Order Number:	
Location	**Townsville , North Queensland**		**Page 2 of 6**
Lab No:	**A4**	Sample Location	
Date Sampled:	**15/12/2006**	Duck Pond' combined	
Date Tested:	**25/01/2007**	Samples 1 & 2	
Sampled By:	**CL**	4% Lime	
Sample Method:		7 days	
Material Source:	**From Site**	Test Method :	AS1289.6.1.1
For Use As:	-	Lot Number:	**Lime**
Remarks:	-	Item Number :	-



Maximum Dry Density - MDD (t/m³) :	**1.695**	Dry Density after Soak (t/m³) :	-
Optimum Moisture Content - OMC (%) :	**17.8**	Moisture Content after Soak (%) :	**0**
Compactive Effort :		Density Ratio after Soak (%) :	
Nominated % Maximum Dry Density Compaction :	**100**	Field Moisture Content (%) :	-
Nominated % Optimum Moisture Content Compaction :	**100**	Moisture Content (Top) after Penetration (%) :	**25.3**
Achieved Dry Density before Soak (t/m³) :	**1.573**	Optional Moisture Content (Remainder) after Penetration (%) :	**23.5**
Achieved Percentage of Maximum Dry Density (%) :	**93**	CBR 2.5mm (%) :	**30**
Achieved Moisture Content (%) :	**19.1**	CBR 5.0mm (%) :	**25**
Achieved Percentage of Optimum Moisture Content (%) :	**107**	Minimum Specified CBR Value (%) :	-
Test Condition (Soaked/Unsoaked) / Soaking Period (Days) :	**Soaked / 4 days**	**CBR Value (%) :**	**30**
Swell (%) / Surcharge (kg):	**1.5 / 4.5 kg**	+19mm Material (%)	Oversize replacement

Soil Description :

NATA

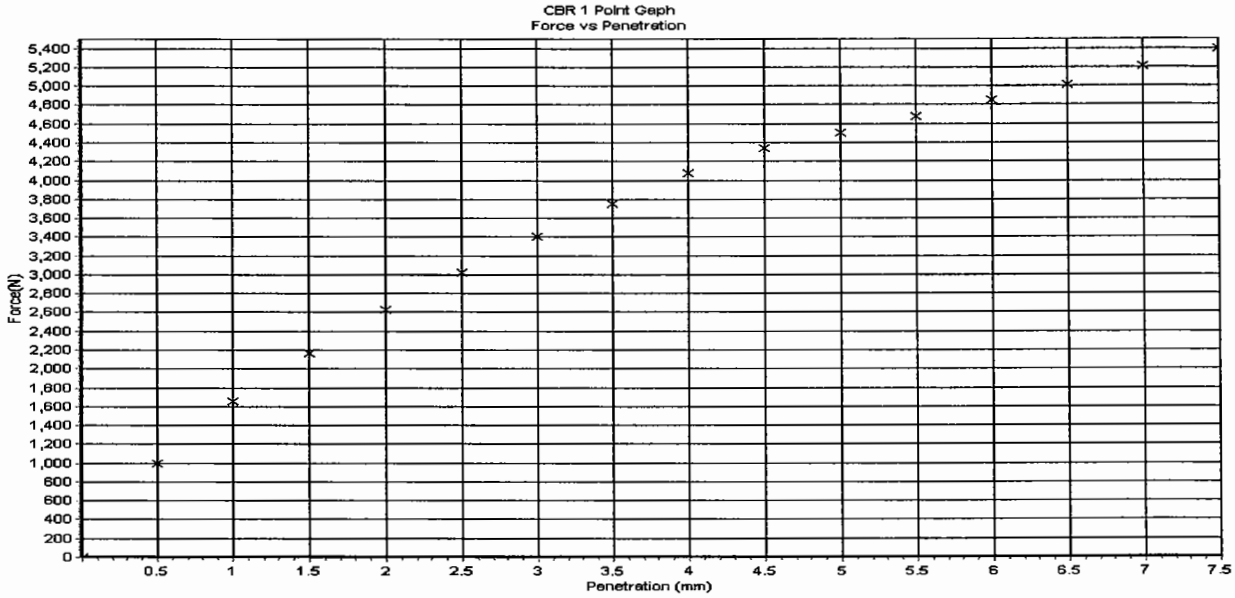
Approved Signatory
Don Byers
NATA Accred No:2856

Form Number
CBR_1_3-1-33

SOIL, AGGREGATE & CONCRETE TESTING
SES
Soil Engineering Services
HALL CORP PTY LTD A.C.N 066 449 769 A.B.N 34 149 057 182 ATF HALL FAMILY TRUST TA
P.O. BOX 7760, GARBUTT B.C. Q. 4814. PHONE: (07) 4774 7888, FAX: (07) 4774 7677
9 Catalyst Court, Mt St John, TOWNSVILLE Q. 4818.
ses01@bigpond.com

California Bearing Ratio Report (1 Point)

Client:	**GOLDER & ASSOCIATES PTY LTD**	Report Number:	**TV3087 - 4**
Client address:	**P.O. Box 5298 Townsville M.C QLD 4810**		
Job Number:	**TV3087**	Report Date:	**22/02/2007**
Project:	**Proposed Marina Development**	Order Number:	
Location	**Townsville , North Queensland**		**Page 3 of 6**
Lab No:	**A5**	Sample Location	Duck Pond' combined
Date Sampled:	**15/12/2006**		Samples 1 & 2
Date Tested:	**25/01/2007**		6% Lime
Sampled By:	**CL**		7 days
Sample Method:		Test Method :	AS1289.6.1.1
Material Source:	**From Site**	Lot Number:	**Lime**
For Use As:	-	Item Number :	-
Remarks:	-		



Maximum Dry Density - MDD (t/m³) :	**1.695**	Dry Density after Soak (t/m³) :	-
Optimum Moisture Content - OMC (%) :	**17.8**	Moisture Content after Soak (%) :	**0**
Compactive Effort :		Density Ratio after Soak (%) :	
Nominated % Maximum Dry Density Compaction :	**100**	Field Moisture Content (%) :	-
Nominated % Optimum Moisture Content Compaction :	**100**	Moisture Content (Top) after Penetration (%) :	**25.8**
Achieved Dry Density before Soak (t/m³) :	**1.590**	Optional Moisture Content (Remainder) after Penetration (%) :	**24.9**
Achieved Percentage of Maximum Dry Density (%) :	**94**	CBR 2.5mm (%) :	**25**
Achieved Moisture Content (%) :	**17.8**	CBR 5.0mm (%) :	**25**
Achieved Percentage of Optimum Moisture Content (%) :	**100**	Minimum Specified CBR Value (%) :	-
Test Condition (Soaked/Unsoaked) / Soaking Period (Days) :	**Soaked / 4 days**	**CBR Value (%) :**	**25**
Swell (%) / Surcharge (kg):	**1.5 / 4.5 kg**	+19mm Material (%)	Oversize replacement

Soil Description :

NATA

This Laboratory is accredited by the National Association of Testing Authorities, Australia. The test(s) reported herein have been performed in accordance with its scope of accreditation. This document shall not be reproduced, except in full.

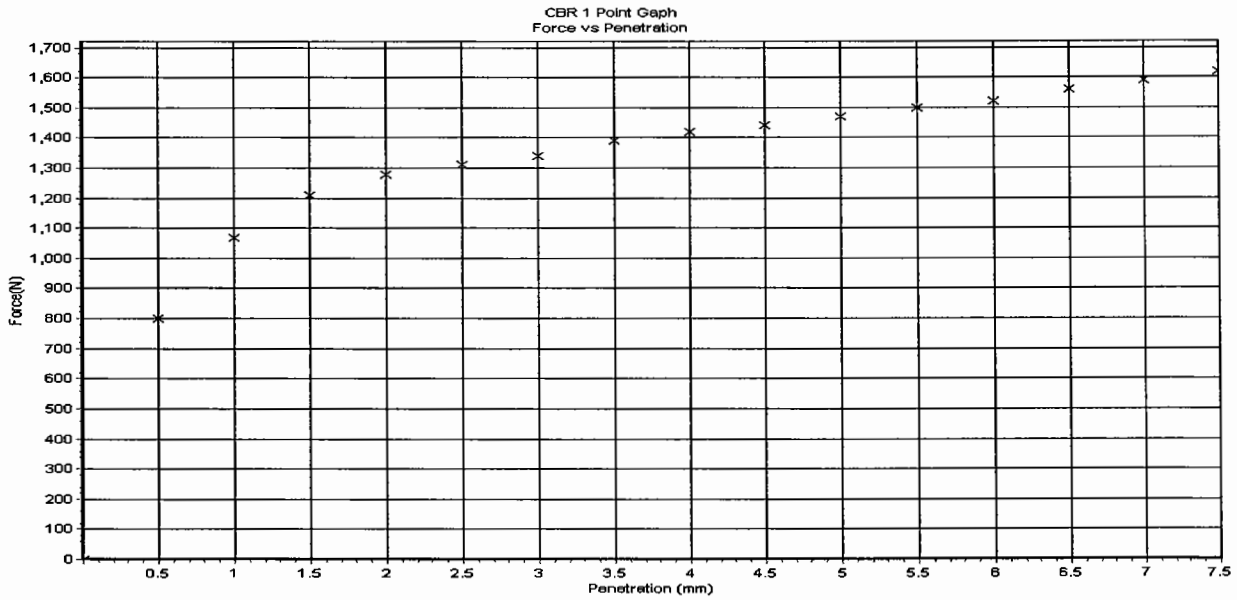
Approved Signatory
Don Byers
NATA Accred No:2856

Form Number
CBR_1_3-1-33

SOIL, AGGREGATE & CONCRETE TESTING
SES
Soil Engineering Services
HALL CORP PTY LTD A.C.N 066 449 769 A.B.N 34 149 057 182 ATF HALL FAMILY TRUST TA
P.O. BOX 7760, GARBUTT B.C. Q. 4814. PHONE: (07) 4774 7888, FAX: (07) 4774 7677
9 Catalyst Court, Mt St John, TOWNSVILLE Q. 4818.
ses01@bigpond.com

California Bearing Ratio Report (1 Point)

Client:	**GOLDER & ASSOCIATES PTY LTD**	Report Number:	**TV3087 - 4**
Client address:	**P.O. Box 5298 Townsville M.C QLD 4810**		
Job Number:	**TV3087**	Report Date:	**22/02/2007**
Project:	**Proposed Marina Development**	Order Number:	
Location	**Townsville , North Queensland**		**Page 4 of 6**
Lab No:	**A6**	Sample Location	
Date Sampled:	**15/12/2006**	Duck Pond' combined	
Date Tested:	**25/01/2007**	Samples 1 & 2	
Sampled By:	**CL**	2% GP cement	
Sample Method:		7 days	
Material Source:	**From Site**	Test Method :	AS1289.6.1.1
For Use As:	-	Lot Number:	**GP**
Remarks:	-	Item Number :	-



Maximum Dry Density - MDD (t/m³) :	**1.695**	Dry Density after Soak (t/m³) :	-
Optimum Moisture Content - OMC (%) :	**17.8**	Moisture Content after Soak (%) :	**0**
Compactive Effort :		Density Ratio after Soak (%) :	
Nominated % Maximum Dry Density Compaction :	**100**	Field Moisture Content (%) :	-
Nominated % Optimum Moisture Content Compaction :	**100**	Moisture Content (Top) after Penetration (%) :	**22.9**
Achieved Dry Density before Soak (t/m³) :	**1.574**	Optional Moisture Content (Remainder) after Penetration (%) :	**23.4**
Achieved Percentage of Maximum Dry Density (%) :	**93**	CBR 2.5mm (%) :	**10**
Achieved Moisture Content (%) :	**19.1**	CBR 5.0mm (%) :	**7**
Achieved Percentage of Optimum Moisture Content (%) :	**107**	Minimum Specified CBR Value (%) :	-
Test Condition (Soaked/Unsoaked) / Soaking Period (Days) :	**Soaked / 4 days**	**CBR Value (%) :**	**10**
Swell (%) / Surcharge (kg):	**1.0 / 4.5 kg**	+19mm Material (%)	Oversize replacement

Soil Description :

NATA

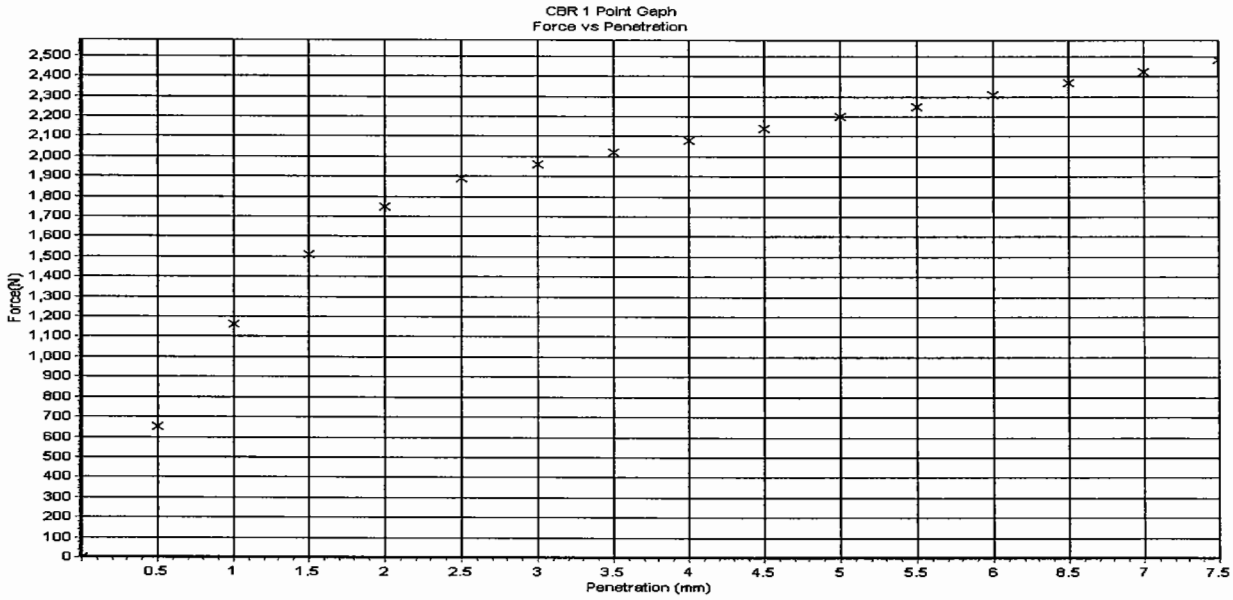
Approved Signatory
Don Byers
NATA Accred No:2856

Form Number
CBR_1_3-1-33

SOIL, AGGREGATE & CONCRETE TESTING
SES
Soil Engineering Services
HALL CORP PTY LTD A.C.N 066 449 769 A.B.N 34 149 057 182 ATF HALL FAMILY TRUST TA
P.O. BOX 7760, GARBUTT B.C. Q. 4814. PHONE: (07) 4774 7888, FAX: (07) 4774 7677
9 Catalyst Court, Mt St John, TOWNSVILLE Q. 4818.
ses01@bigpond.com

California Bearing Ratio Report (1 Point)

Client:	**GOLDER & ASSOCIATES PTY LTD**	Report Number:	**TV3087 - 4**
Client address:	**P.O. Box 5298 Townsville M.C QLD 4810**		
Job Number:	**TV3087**	Report Date:	**22/02/2007**
Project:	**Proposed Marina Development**	Order Number:	
Location	**Townsville , North Queensland**		**Page 5 of 6**
Lab No:	**A7**	Sample Location	Duck Pond' combined
Date Sampled:	**15/12/2006**		Samples 1 & 2
Date Tested:	**25/01/2007**		3% GP cement
Sampled By:	**CL**		7 days
Sample Method:		Test Method :	AS1289.6.1.1
Material Source:	**From Site**	Lot Number:	**GP**
For Use As:	-	Item Number :	-
Remarks:	-		



Maximum Dry Density - MDD (t/m³) :	**1.695**	Dry Density after Soak (t/m³) :	-
Optimum Moisture Content - OMC (%) :	**17.8**	Moisture Content after Soak (%) :	**0**
Compactive Effort :		Density Ratio after Soak (%) :	
Nominated % Maximum Dry Density Compaction :	**100**	Field Moisture Content (%) :	-
Nominated % Optimum Moisture Content Compaction :	**100**	Moisture Content (Top) after Penetration (%) :	**24.5**
Achieved Dry Density before Soak (t/m³) :	**1.559**	Optional Moisture Content (Remainder) after Penetration (%) :	**21.9**
Achieved Percentage of Maximum Dry Density (%) :	**92**	CBR 2.5mm (%) :	**14**
Achieved Moisture Content (%) :	**20.2**	CBR 5.0mm (%) :	**11**
Achieved Percentage of Optimum Moisture Content (%) :	**113**	Minimum Specified CBR Value (%) :	-
Test Condition (Soaked/Unsoaked) / Soaking Period (Days) :	**Soaked / 4 days**	**CBR Value (%) :**	**14**
Swell (%) / Surcharge (kg):	**0.5 / 4.5 kg**	+19mm Material (%)	Oversize replacement

Soil Description :

NATA

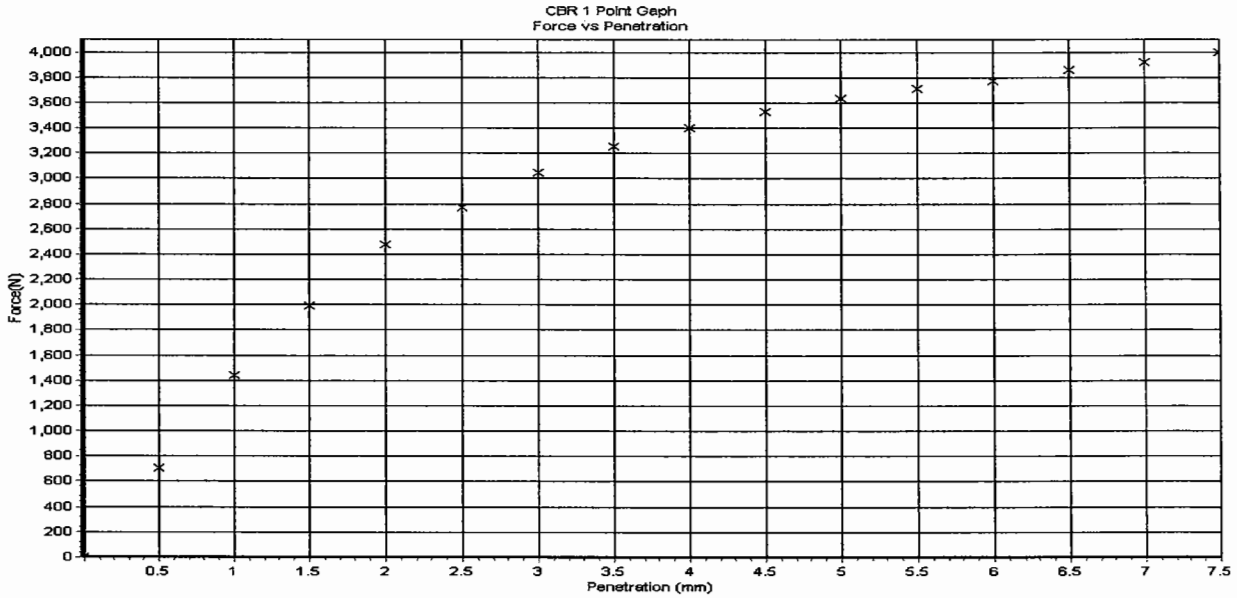
Approved Signatory
Don Byers
NATA Accred No:2856

Form Number
CBR_1_3-1-33

SOIL, AGGREGATE & CONCRETE TESTING
SES
Soil Engineering Services
HALL CORP PTY LTD A.C.N 066 449 769 A.B.N 34 149 057 182 ATF HALL FAMILY TRUST TA
P.O. BOX 7760, GARBUTT B.C. Q. 4814. PHONE: (07) 4774 7888, FAX: (07) 4774 7677
9 Catalyst Court, Mt St John, TOWNSVILLE Q. 4818.
ses01@bigpond.com

California Bearing Ratio Report (1 Point)

Client:	**GOLDER & ASSOCIATES PTY LTD**	Report Number:	**TV3087 - 4**
Client address:	**P.O. Box 5298 Townsville M.C QLD 4810**		
Job Number:	**TV3087**	Report Date:	**22/02/2007**
Project:	**Proposed Marina Development**	Order Number:	
Location	**Townsville , North Queensland**		**Page 6 of 6**
Lab No:	**A8**	Sample Location	
Date Sampled:	**15/12/2006**	Duck Pond' combined	
Date Tested:	**25/01/2007**	Samples 1 & 2	
Sampled By:	**CL**	5% GP cement	
Sample Method:		7 days	
Material Source:	**From Site**	Test Method :	AS1289.6.1.1
For Use As:	-	Lot Number:	**GP**
Remarks:	-	Item Number :	-



Maximum Dry Density - MDD (t/m³) :	**1.695**	Dry Density after Soak (t/m³) :	-
Optimum Moisture Content - OMC (%) :	**17.8**	Moisture Content after Soak (%) :	**0**
Compactive Effort :		Density Ratio after Soak (%) :	
Nominated % Maximum Dry Density Compaction :	**100**	Field Moisture Content (%) :	-
Nominated % Optimum Moisture Content Compaction :	**100**	Moisture Content (Top) after Penetration (%) :	**24.1**
Achieved Dry Density before Soak (t/m³) :	**1.544**	Optional Moisture Content (Remainder) after Penetration (%) :	**24.5**
Achieved Percentage of Maximum Dry Density (%) :	**91**	CBR 2.5mm (%) :	**20**
Achieved Moisture Content (%) :	**21.3**	CBR 5.0mm (%) :	**18**
Achieved Percentage of Optimum Moisture Content (%) :	**120**	Minimum Specified CBR Value (%) :	-
Test Condition (Soaked/Unsoaked) / Soaking Period (Days) :	**Soaked / 4 days**	**CBR Value (%) :**	**20**
Swell (%) / Surcharge (kg):	**1.0 / 4.5 kg**	+19mm Material (%)	Oversize replacement

Soil Description :

NATA

Approved Signatory
Don Byers
NATA Accred No:2856

Form Number
CBR_1_3-1-33

Appendix F
Stability Analysis

F1.0 STABILITY – REVETMENT WALLS AND TOT BERTH

In the following, where stability analysis has been undertaken and reported, this analysis was done using Morgenstein and Price Method, via the computer program SLOPE/W[1]. This is a well-accepted method of analysing for stability of slopes. In the method, the slope is divided into a large number of slices, each of which is subjected to calculation of "disturbing moment" and "available restoring moment". These moments are then expressed as a ratio to provide a calculated Factor of Safety (FOS) for a particular potential failure surface.

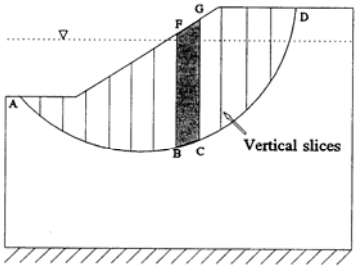


Figure 1 Circular Soil Mass Divided into Vertical Slices

By using a computer, a large number of potential failure surfaces can be analysed, leading to determination of a "critical slip circle" (surface) with the lowest calculated Factor of Safety for the set of conditions being analysed. In the modelling undertaken, discussed in the following, a minimum of 20,000 potential slip surfaces were analysed for each case modelled.

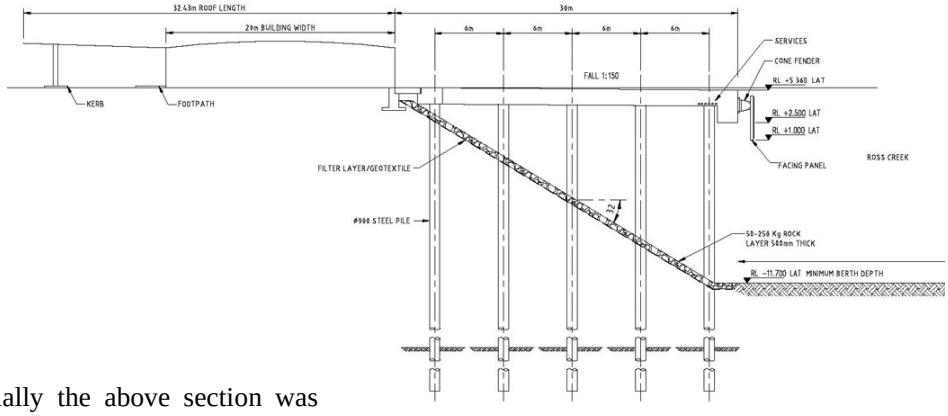
Analyses were made for both static and earthquake conditions. The earthquake case was modelled using the method recommended by ANCOLD in their publication "Guidelines for Design Of Dams For Earthquake Loading" – 1998. Using this method a FOS of 1.0 or higher is considered "stable".

[1] SLOPE/W 2004 by GEO-SLOPE International Ltd

Stability assessment was undertaken on three cross-sections. Each cross-section is discussed in the following.

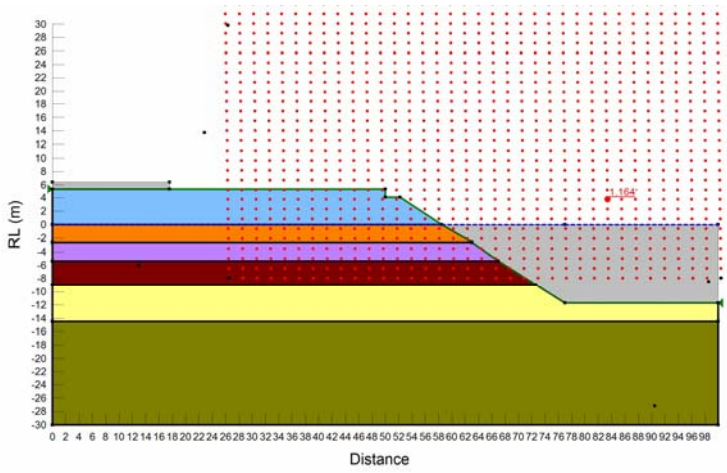
F1.1 TOT Berth – Cross Section 1

The following excerpt from the design drawings shows the profile assessed for TOT berth.



Initially the above section was assessed with a constant batter face angle of 32^0

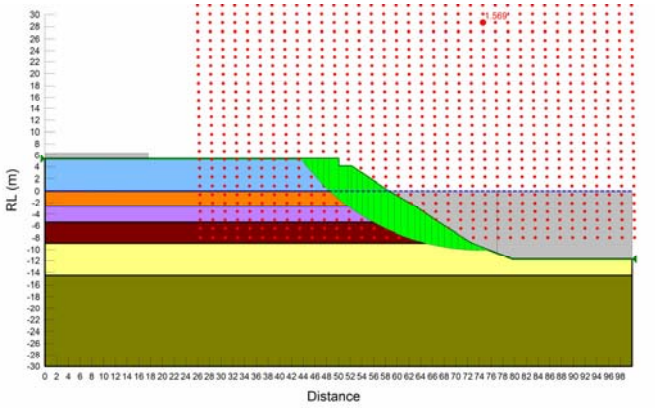
The calculated factor of safety for this slope is 1.16, which is less than the industry standard of FOS=1.5. The critical slip circle for this section was found to be through the sands at depth.



Therefore, the batter slope was flattened to 1:2 (v:h) through the sands, all other parameters were unchanged. The assessment results for the revised profile follow:

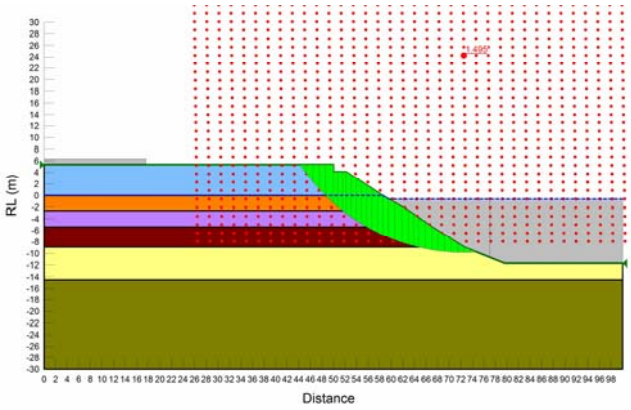
Calculated FOS ~ 1.6

In the long term with balanced groundwater conditions



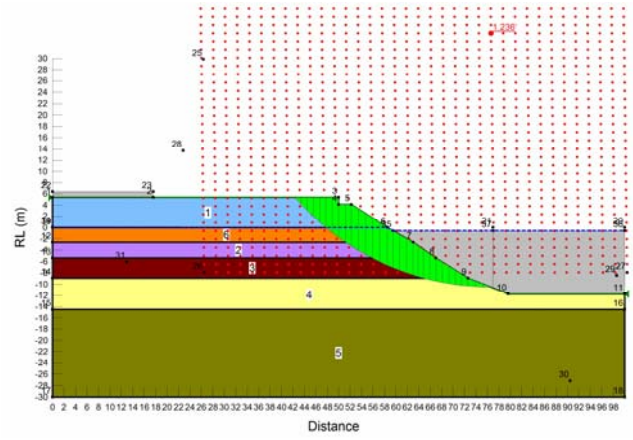
Calculated FOS ~ 1.5

In the long term with 1m drawdown (head difference) external to the slope



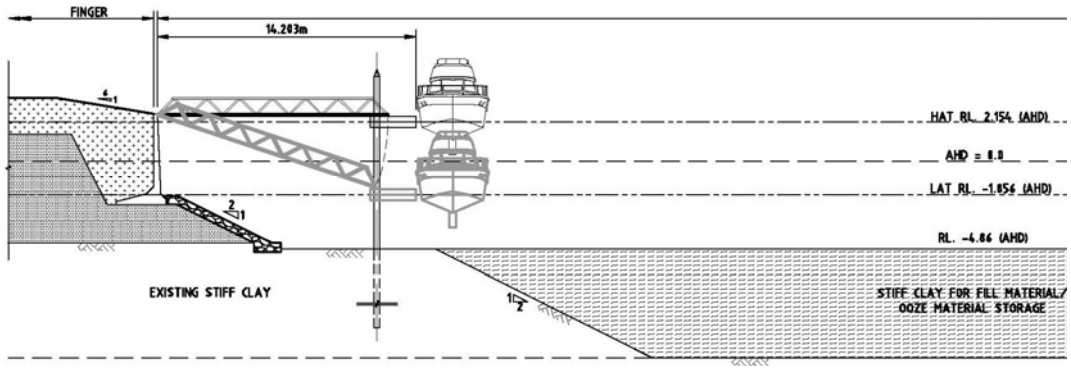
Calculated FOS ~ 1.2

In the long term with 1m drawdown (head difference) external to the slope and a horizontal seismic acceleration of 0.07g.



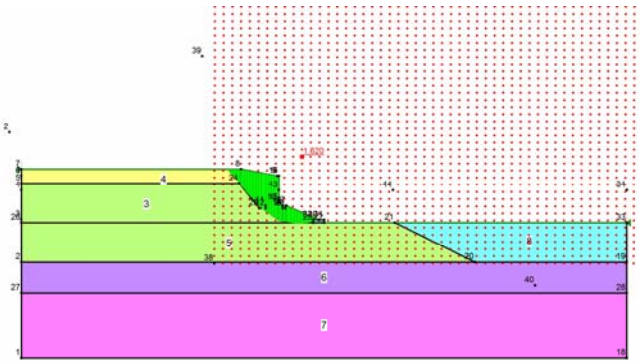
F1.2 Canals – Section 2

The following excerpt from the design drawings shows the profile assessed for canals:



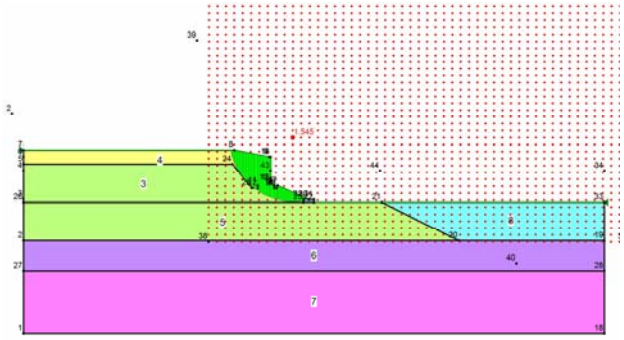
FOS~1.6

For short term conditions (during construction)



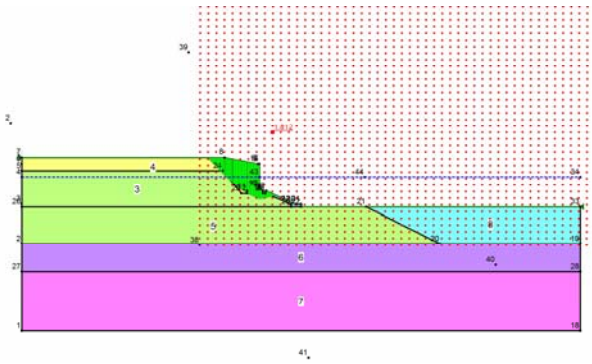
FOS~1.5

For short term conditions (during construction) and a horizontal seismic acceleration of 0.07g.



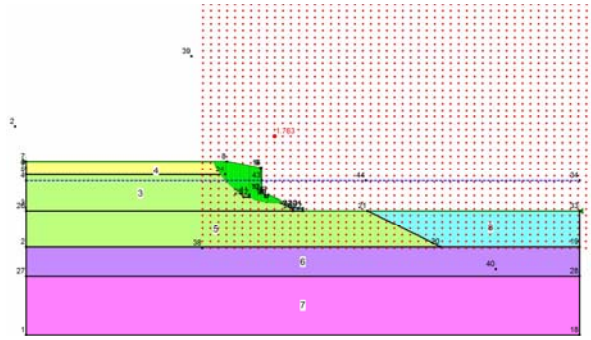
FOS~1.8

In the long term with balanced groundwater conditions



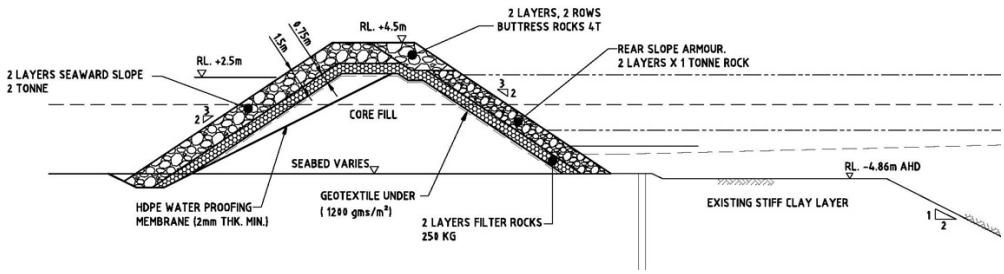
FOS~1.7

For conditions in the long term with a seismic acceleration of 0.07g



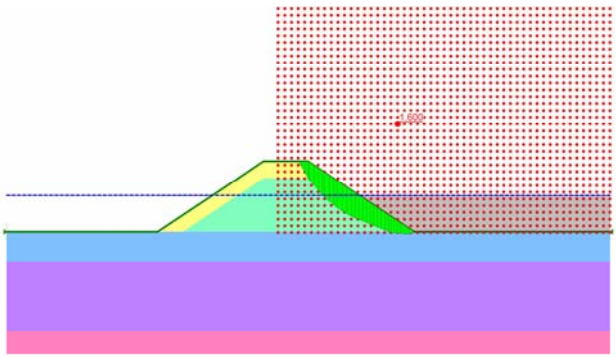
F1.3 Revetment Wall – Section 3

The following excerpt from the design drawings shows the profile assessed for revetment walls:



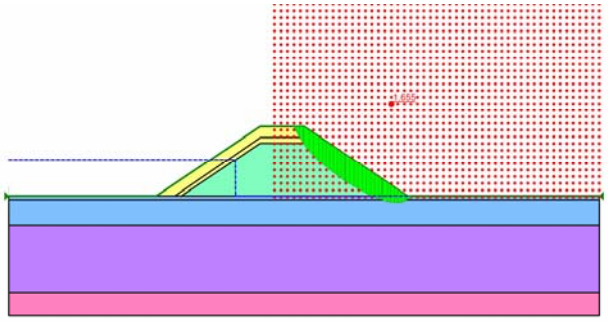
FOS ~ 1.6

For conditions in the short term (during construction) with water on both sides of the bund wall.



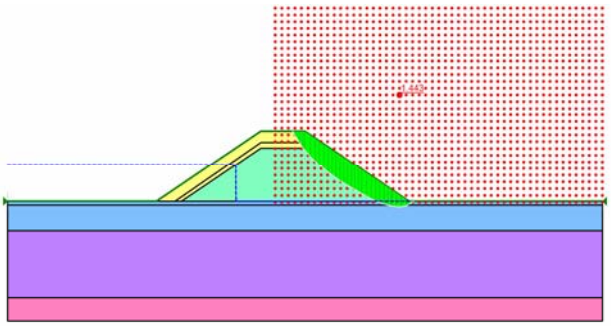
FOS ~ 1.6

Long term conditions, dry inside of revetment wall



FOS ~ 1.4

Long term conditions, dry inside of revetment wall with a seismic acceleration of 0.07g.



F1.4 Further Testing

For long term analysis effective strength, drained, parameters have been used based on the conditions encountered in the field and on previous experience. It is therefore recommended that further laboratory testing is undertaken during the design stage to confirm parameters.

Appendix G
Seepage Assessment

G SEEPAGE ASSESSMENT

G1.0 Scope

The scope has been extracted from a document containing conceptual figures, the captions of which give an indication of the scope which is given in the following points:

- Derive potential seepage from the sea into work area through the proposed breakwater wall; and
- Estimate requirements to dewater the canal excavation. Requirements include the number of wells and pump sizing.

Dewatering will be necessary:

- For stability of the canal excavations,
- For safe trafficking on the working surface, and
- To encourage consolidation of the materials emplaced to form the canal housing blocks and the underlying natural sediments.

G2.0 Method

Potential seepage, through the proposed wall, into the work area from the sea was estimated using a two-dimensional, SEEP/W, vertical section model. The model assumed that the breakwater walls were uniformly underlain by stiff clays with low permeability. And the purpose of the model was to estimate seepage through the liner not through other parts of the system.

Dewatering requirements were evaluated using a similar section model that included sand and clay layers below the breakwater wall. These sediment layers will influence dewatering requirements for excavation.

Specific analysis might be necessary to assess settlement or slope stability. Analysis for these aspects is beyond the scope of this groundwater modelling exercise.

Two different models were developed for the analysis; they are described separately in the following sections.

G3.0 Seepage Through The Breakwater Wall

G3.1 Conceptual Hydrogeology

The groundwater system is believed to be controlled by the following conditions:

- The area is currently submerged under about 4 m of seawater in Cleveland Bay off Townsville.
- The subsoils consist of:
  - Soft estuarine mud about 0.3 m thick;
  - Stiff clay underlying the estuarine mud with sandy lenses;
- The seabed is relatively flat at elevation of about -4.5 mAHD; and
- The estuarine sediments are saturated.

Most of the breakwater is made up of coarse pebbles and cobbles that give physical support to the walls but are so permeable that that they do not influence groundwater pressure, they therefore do not need to be included in the model. The HDPE liner is assumed to be overlapped but not welded. It leaks at overlap joins and at defects such as tears and punctures a few of which are reported to be inevitable during placement of the liner.

The HDPE liner has no storage, as it controls seepage in the model, a steady state solution is all that is required. The main difference between a transient and steady state solution of groundwater flow equations is that the transient solution uses water from storage, if the material has no storage the solution reverts to a steady state solution.

The conceptual model on which this analysis is based is given in Figure F-1.

G3.2 Model Structure and Parametisation

The model arrangement is as follows:

- A section through the breakwater wall with dimensions as shown in Figure F-2;
- Four layers representing: HDPE liner, HDPE bedding sand, soft estuarine mud and silt, stiff sandy, silty clay;
- The rock fill of the breakwater walls is not included in the model;
- The ocean side has constant heads at the average ocean water elevation 0 m AHD;
- A gradient is imposed from the ocean side across the breakwater wall with a constant head node in the base of the canal excavation at -10.8 m AHD; and

- Seepage is assumed to be the same at any point across any of the breakwater walls, since they are to be constructed similarly, the water pressure on the barrier is the same since it will be surrounded by ocean, and it was assumed that underlying material properties are uniform.
- Model calibration and initial runs showed that the model was insensitive to changes in the hydraulic properties of the soft estuarine mud and silt that occurs at the top of the sediment profile. This is possibly because the HDPE liner is bedded through the mud into the underlying stiff clay. The model geometry was based on a scale section that has mud elevation and thickness that is different from the depths reported from the sea bed "ooze" investigation. As the model is insensitive to this material differences in thickness will not influence model results.

Model parameters are uncertain, they were based on typical values for the described materials. Seepage across the HDPE barrier is therefore based on a likely case using typical values for the described materials and sensitivity to the parameters was checked by running scenarios with other possible parameter values, the result is a range of possible seepage values. The scenarios and related parameters are listed in the following points:

Model 1 Investigates possible seepage assuming that the HDPE liner leaks at 3× the highest leakage rate from published values. The higher leakage is probable because the joins are overlapped rather than welded.

Material	Thickness (m)	K (m/s)	Remarks
Soft estuarine mud	Up to 0.3	2.5×10^{-8} to 8.4×10^{-9}	Material values based on SeepW clayey silt and clay/silt SeepW database Nos. 24 and 16
Stiff clay with sand lenses	More than 10	1.4×10^{-7}	Material values based on SeepW sandy silty clay SeepW database No. 13
Sand for bedding geomembrane	About 0.5	1×10^{-4}	Material values based on SeepW uniform sand SeepW database No. 18
Geomembrane (HDPE liner)	3 mm	3×10^{-7}	Material values based on high end of published values

Model 2 Investigates expected seepage if fine sand layers dominate the hydraulic conductivity of the underlying stiff clay

Material	Thickness (m)	K (m/s)	Remarks
Soft estuarine mud	Up to 0.3	2.5×10^{-8} to 8.4×10^{-9}	Material values based on SeepW clayey silt and clay/silt (SeepW database Nos. 24 and 16)
Stiff clay with sand lenses	More than 10	1×10^{-6}	Material values based on SeepW silt (SeepW database No. 9)
Sand for bedding geomembrane	About 0.5	1×10^{-4}	Material values based on SeepW uniform sand SeepW database No. 18
Geomembrane (HDPE liner)	3 mm	3×10^{-7}	Material values based on high end of published values

Model 3 Investigates expected seepage if fine sand layers dominate the hydraulic conductivity of the underlying stiff clay and the HDPE liner has 10× the leakage of Model 1 and 2

Material	Thickness (m)	K (m/s)	Remarks
Soft estuarine mud	Up to 0.3	2.5×10^{-8} to 8.4×10^{-9}	Material values based on SeepW clayey silt and clay/silt SeepW database Nos. 24 and 16
Stiff clay with sand lenses	More than 10	1×10^{-6}	Material values based on SeepW silt (SeepW database No. 9)
Sand for bedding geomembrane	About 0.5	1×10^{-4}	Material values based on SeepW uniform sand SeepW database No. 18
Geomembrane (HDPE liner)	3 mm	3×10^{-6}	Extreme material value tested

G3.3 Model Results

The section model gives results as seepage rate per meter. Based on the assumed uniform conditions, seepage across the breakwater perimeter was assumed to be the rate per meter multiplied by the breakwater length these results are given in Table 4.

Table 4 Seepage Predictions across the Breakwater Wall

Seepage position	Length	Model 1		Model 2		Model 3	
		Typical liner leakage with underlying clay permeability that of sandy silty clay		Typical liner leakage and underlying clay permeability that of clean fine sand or silt		High liner leakage and underlying clay permeability that of clean fine sand or silt	
	(m)	m^3/day	L/s	m^3/day	L/s	m^3/day	L/s
Seepage per m	1	0.0053	6.1×10^{-5}	0.0348	4.0×10^{-4}	0.0358	4.14×10^{-4}
Eastern breakwater	724	3.80	0.044	25.16	0.291	25.90	0.30
Western breakwater	858	4.51	0.052	29.83	0.345	30.70	0.36
Northern Breakwater	886	4.66	0.054	30.81	0.357	31.71	0.37
Temp. wall across marina entrance	91	0.48	0.006	3.17	0.037	3.27	0.04
Temp. wall across current marina entrance	156	0.82	0.009	5.42	0.063	5.58	0.06
Total Perimeter	2715	14.27	0.165	94.40	1.093	97.16	1.12

Note: Seepage from the Casino wall which is 650 m long is assumed to be 0 since it is not a sea wall, this wall is excluded from the assessment in this table.

The underlying clay in these models has been assumed to be a uniformly mixed gravel, sand, silt and clay with hydraulic properties governed by the fine fractions. The real situation is layered with possible fine sand, silt, gravel and clay laminations. If sand layers are the dominant water conduits in this layered sequence and if they connect between the ocean and the work site, seepage could pass through the sea-bed under the breakwater wall, the liner would have little influence and seepage rates up to 50 L/s are possible.

G4.0 Dewatering Requirements

G4.1 Conceptual Hydrogeology and Design Implications

The groundwater system is believed to be controlled by the same conditions as described in Section 17.4.1 but in since the dewatering is influenced by deeper sediments they must be included.

The conceptual model on which this analysis is based is given in Figure F-5. This model is may be too simplistic and may only be suitable for a first pass at evaluating the dewatering requirements.

The results will be influenced by the construction sequence and by the nature of the subsurface sediments including their hydraulic properties and distribution. The given conceptual; model includes dewatering bores that are in the base of the excavation, these would have to be installed once the excavation is complete, at which time they will not be necessary. For this reason development has been assumed to follow the following sequence:

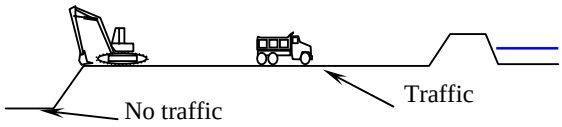
1. The breakwater walls are constructed creating a basin;

2. Ocean water is pumped out;

3. Dewatering wells are installed to lower the “groundwater” in formerly saturated shallow marine sediments;

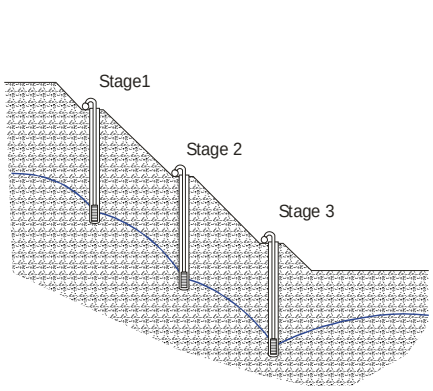
4. The natural sediments are excavated to the base of loose silty clay, to form a flat uniform surface at approximately -4.5 to -4.86 m AHD at the top of the stiff clay; and

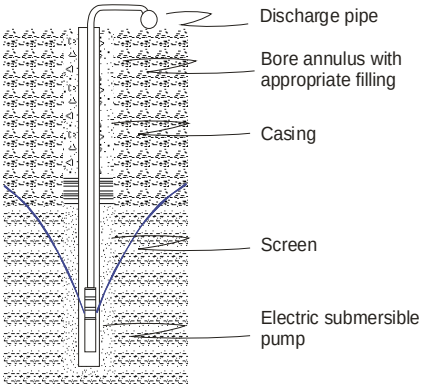
5. The canals are constructed using excavators working on the surface created in the previous step, i.e. the base and slopes of the canal excavations will not carry traffic.



The following considerations are important and influence modelling:

- The base of the canal will be at 10.8 m AHD, this means that dewatering will be required to more than 11 m below the natural surface (which is at about -0.12 m AHD). Shallow groundwater extraction using wellpoints can only lower the water table (in fine grained sediments) to about 4 m below surface. To achieve deeper dewatering a multi-staged wellpoint system, deep wells, or ejector wells will be required.

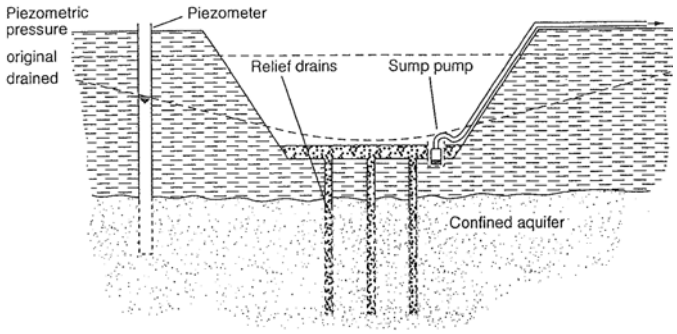




- The layering, particularly as shown in the conceptual model (Figure F-5), suggests that wells placed in the sand layers will have the greatest dewatering influence.

- If the conceptual model structure is accurate the sand layers may be confined, if groundwater is under pressure in confined layers, dewatering may be achieved passively but depending on the layer structiure may not achieve the desired outcome.

The sand layers are probably inter-fingering lenses, so rather than the straightforward

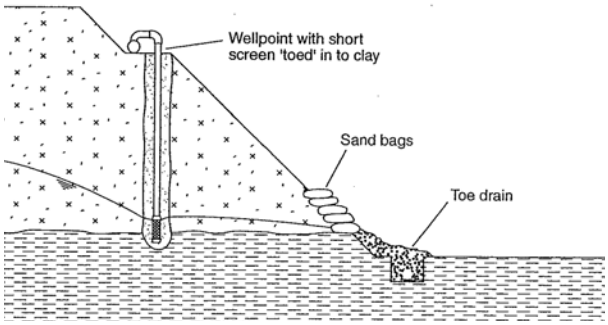


horizontal layers suggested by the conceptual model, sand distribution is expected to be quite complex.

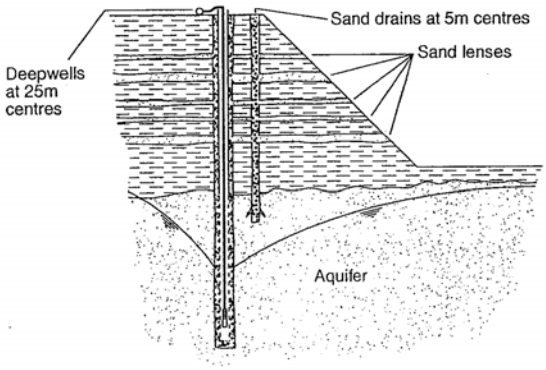
- Connection of sand to sea water in the bay may introduce large flow volumes.

- Geotechnical logs describe a variety of silt, sand, clay and gravel mixes. Rather than being mixed these sediments are possibly finely layered or laminated, this may mean that dewatering would be difficult since some layers may remain saturated while others are dewatered.

- In layered systems it may not be possible to draw the water down completely or a perched watertable may remain above clay layers, this can cause seepage at the layer interface and may cause erosion or slumping of the material. In these cases the slope must be protected for example with a gravel berm, sandbags and surface drains.



- In some layered systems dewatering might require vertical drains or deep wells that are gravel packed over the whole sequence these would “join” isolated layers.



- In layered sediments of this type settlement, possibly differential settlement, is likely.

- For dewatering the rate of drawdown is important thus transient models are required. The material properties have not been measured so transient models increase the uncertainty of the results since they introduce additional "guessed" values for the water retention characteristics (storage) of the sediments.

- Modelling has used SeepW that simulates a section through the system. The layers were modified to conform to the conceptual model but the model extent is the same as the seepage model because the system is assumed to be symmetrical.

G4.2 Model Structure and Parametisation

The model arrangement is similar to that described in Section 17.4.2 but differs in the following ways:

- The model has seven layers representing: HDPE liner, HDPE bedding sand, soft estuarine mud and silt, stiff sandy, silty clay, and dense sand;

- The depths to dense sand layers were calculated from drill logs for Geotechnical boreholes TOT-1 to TOT-6. The descriptions were interpreted to define consistently sandy material and the elevations of the top and bottom of those layers were averaged to give average depths to the top and base of two consistently sandy zones. This produced layers that largely conform to the conceptual model. The assumption that there are two horizontal layers might not be valid, but provides an initial conceptual model for this evaluation.

- Dewatering wells were installed to test the influence of different dewatering arrangements, particularly different pump positions and depths; and

- Seepage is assumed to be the same at any point across any of the breakwater walls. This is based on the assumption that the walls will be constructed similarly, the water pressure

on the barrier is the same everywhere since it will be surrounded by ocean, and the material properties are uniform through each layer.

Model parameters are uncertain, they were based on typical values for the described materials. The uncertainty, layers, and different pump positions means that there are many combinations that could be tested. Material types that were used are listed in Table 5 and shown in Figure F-6.

Table 5 Material Properties used in Dewatering Model

Material	Thickness (m)	K (m/s)	Remarks
Geomembrane (HDPE liner)	3 mm	3×10^{-7}	Expected material value tested. This value did not change between model runs
Sand for bedding geomembrane	± 0.5	1×10^{-4}	Material values based on SeepW uniform sand. SeepW database No. 18. This value did not change between model runs
Soft estuarine mud	<0.3	2.5×10^{-8}	Material values based on SeepW clay/silt. SeepW database No. 16. This value did not change between model runs
Stiff clay layers	>10	Run 1 and 2 1.4×10^{-7}	Material values based on SeepW sandy silty clay. SeepW database No. 13
		Run 3 2.5×10^{-8}	Material values based on SeepW clay/silt. SeepW database No. 16.
Sand layers	Upper sand 1 Lower sand 5.5	Run 1 and 3 5×10^{-7}	Material values based on SeepW silty sand. SeepW database No. 6
		Run 2 4.3×10^{-6}	Material values based on SeepW fine sand. SeepW database No. 20

The following situations have been modelled:

- Steady state runs to test the influence of different bore positions with different combinations of material.

- Transient runs to determine the rate of pumping. Transient runs were necessary because pumping rates will decrease over time and steady state results show final (low) pumping rates that develop once the materials have been dewatered.

G5.0 Model Results

G5.1 Pump positions

The sand layers were targeted for dewatering. Shallow sand could be dewatered using a well point system while the deeper sands require a deep well or ejector wells.

Model pumps were simulated using constant head nodes one at the base of the upper sand and a second at the base of the lower sand layer. Initial model runs showed that the deep "pump" lowers the water table below the shallow pump so that the shallow "pump" starts putting water into the model thus giving a wrong pumping rate (this happens because the "pump" is a constant head). An example of such a model result is given in Figure F-7. Subsequent models were run with deep dewatering wells only.

Apart from the model requirements there are practical advantages of a deep well system:

- It makes use of the natural underdrain characteristics of the deeper sand layer;
- Deep wells can be spaced further apart and so require fewer well installations; and
- Without the wellpoints there will be less surface infrastructure to get in the way of construction.

The model results are based on a single dewatering well in the deeper sand layer that can draw water down to -16.47 m AHD. (This depth is dimensionally correct relative to the sea bed elevation of -4.5 m AHD given in the dimensioned drawing.)

G5.2 Drawdown Development

From the transient model drawdown results were recorded at 3.6 hours, 1 day, 2 days 8 hours, 30 days, 4 months and 6 months.

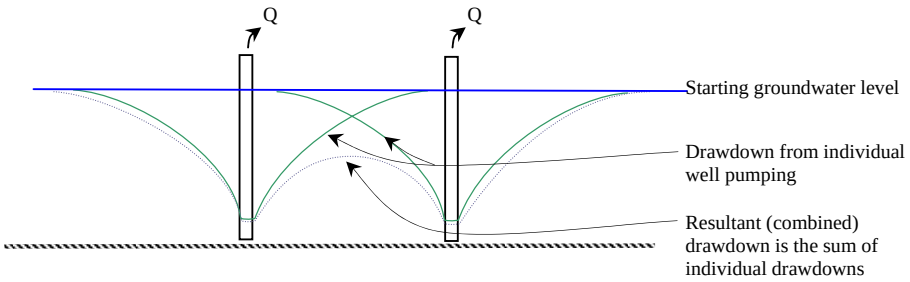
The results of these models are shown for the three transient model runs in Figures F-8 to F-10.

The figures show that dewatering is almost complete for run 1 and 2 conditions by 4 months, in both cases dewatering progresses rapidly and between four and six months there is little change. This shows that a steady state is reached in about four months for the conditions simulated in model runs 1 and 2.

Model run 3 is different, it has assumed that the materials between the sand layers have low permeability, in this case it is difficult to dewater the upper sediment and a relatively persistent perched water layer remains even after fairly prolonged pumping. The perched layer will cause bleeding and erosion or stability problems in the upper sand layer, this will have to be controlled with drains and slope support. Perched water may have to be controlled with shallow wells or vertical drains as described and illustrated in Section 17.5.1.

G5.3 Bore spacing

The section modelling used for this assessment considers a 1 m wide slice. The results are therefore 2-dimensional and cannot be used to test the bore spacing. The drawdown curve development shown in Figures F-8 to F-10 however can be used to give an indication of the required bore spacing for the different modelled conditions. The theory of superposition states that drawdown from adjacent bores is cumulative, this is explained in the following sketch.



The aim of spacing the bores is to create sufficient overlap of the cone of dewatering so that the target water levels are achieved.

Based on Figures F-8 to F-10 the indicated bore spacing's are given in Table 6.

Table 6 Dewatering Bore Spacing Inferred from Model Drawdown Curves

Figure No.	Model Run	Layer Materials	Dewatering bore spacing[1] (centres) m	Comment
Figure 8	Transient Model Run 1	stiff clay = sandy silty clay aquifers = silty sand	17	Low bore spacing because of relatively low permeability materials
Figure 9	Transient Model Run 2	stiff clay = sandy silty clay aquifers = fine sand	30	High bore spacing because of relatively high permeability materials
Figure 10	Transient Model Run 3	stiff clay = clay/silt aquifers = silty sand	<20	Low but difficult to determine because of persistent perched groundwater in shallow layers

[1]*Indicative bore spacing is based on the drawdown curves produced in a section across the breakwater walls. In this section the drawdown is controlled by the presence of constant head nodes along the breakwater. In section, parallel to the breakwater, the constant heads would have less influence and drawdown would be greater, in which case, wider bore spacing could be used. The bore spacings given in this table are therefore conservative estimates.*

Better determination of how bore spacing influences drawdown in 3 dimensions might require additional analytical calculations or 3 dimensional modelling.

G5.4 Pumping rates

The section model gives results assuming that the model is 1 m wide. To estimate pumped volumes over an area requires multiplying the section results by the length measurements in the dimension not considered in the model. This assumes that the material properties and construction geometry is the same as that of the section everywhere else.

To calculate the pumped volume the section result must be multiplied by the distance that each bore influences the drawdown. For example assuming everything is symmetrical, with a bore spacing of 20 m the distance each bore influences the drawdown is 10 m radially around (on either side of the bore) the bore. An estimate of the pumping rate is therefore the section pumping rate multiplied by the bore spacing.

In a similar way the perimeter of the area can be used to get an indication of the requirements to dewater the perimeter. The central part of the development would require fewer bores to achieve the same result as the perimeter. Section modelling has not been used to investigate the central part of the development, it therefore does not give an indication of the dewatering requirements for the whole area.

Estimates of pumping rates are given in Table 7, the rates reduce over time as the water level falls as shown in Figure F-11.

Table 7 Dewatering (Pumping) Rates at two Bore Spacings Estimated from Section Model Results

	Pumping rate m^3/day (L/s) Bore spacing = 20 m		**Pumping rate m^3/day (L/s) Bore spacing = 30 m**	
Model Run	First Day	After 6 Months (Approaches steady abstraction)	First Day	After 6 Months (Approaches steady abstraction)
Run 1 Stiff clay = Sandy silty clay, & sand = silty sand	2.69 (0.03)	1.82 (0.02)	4.03 (0.05)	2.73 (0.03)
Run 2 Stiff clay = Sandy silty clay, & sand = fine sand	12.55 (0.15)	6.73 (0.08)	18.82 (0.22)	10.09 (0.12)
Run 3 Stiff clay = Clay/silt, & sand = fine sand	10.01 (0.12)	3.18 (0.04)	15.1 (0.17)	4.77 (0.06)

The relatively low pumping rates indicated in Table 7 are more suited to an ejector well system than to use of electric submersible pumps.

With the range of modelled values the total pumping from bores around the perimeter could be between 4 and 30 L/s depending on the hydraulic properties of the underlying sediments.

Additional dewatering bores will be required in the central part of the development, but these could not be determined from the section modelling approach.

G6.0 Discussion of Results

Seepage through an HDPE liner has been estimated using a seepage section model. Seepage estimation has assumed that the liner is not joined (heat welded), rather that successive liner sheets overlap. Seepage through such a liner will depend on the number of accidentally formed holes and the smoothness of the underlying bedding sand, the latter influences leakage through the joins.

Hydraulic properties of the underlying sediments have not been tested and typical values for materials matching the underlying material descriptions were used for model parametisation. The section models showed low sensitivity to leakage through the liner but were sensitive to hydraulic properties of the underlying natural clays and sands. Depending on the properties of the underlying materials seepage through the liner could be between 0.17 and 1.12 L/s for the ocean bound perimeter (i.e. total perimeter minus the casino wall).

Dewatering requirements in terms of pump spacing and possible pumping rates were tested using a similar section model. This section model considered a layered sequence of clay and sand below the proposed development. The layering was assumed to be relatively simple horizontal layers. Layer positions were based on average values from six geotechnical boreholes. The hydraulic properties were not known but were selected from materials with similar descriptions in the modelling software database.

The material distribution as well as hydraulic properties will have an influence on dewatering. Theoretical considerations of some of the options have been discussed in this report and some of the aspects of these considerations have been included in the models. Some of the implications are:

- The sand layers may act as an underdrain, if the clayey materials have appreciable hydraulic conductivity dewatering from the main sand layer will dewater the system;
- The underdrain sands appear to be about 2 to 7 m thick and occur at about -14 m AHD. At these depths dewatering will require deep wells with a pumping system capable of about 14 m of lift;
- If the clayey materials have very low hydraulic conductivity, perched groundwater may develop. This will cause unstable conditions in the saturated sediments above the dewatered zone, in such cases surface drains and slope stability control may be needed;
- If the sediments are finely laminated silts, sand and clays (a common occurrence in estuarine and similar sedimentary sequences) perched conditions will also develop and dewatering may be difficult;

- Dewatering difficulty may be overcome in layered sequences by using vertical drains or dewatering boreholes designed to connect the porous zones;

- Modelling tested situations that developed perched and more freely draining conditions. The successful dewatering conditions show that dewatering may be achieved with bore spacing at about 20 to 30 m and pumping at up to about 0.2 L/s per bore. The pumping rate decreases over time so that after about six months the rate may be up to about 0.1 L/s per bore; and

- A pumping system specifically designed to deal with these low pumping rates and drawdowns of about 10 m would be required. Shallow well-point dewatering systems have a drawdown limit of about 4 m and deep submersible pumps cannot be used at these low rates. Suction wells or ejector wells are systems that might work in this environment.

G7.0 Conclusions and Recommendations

This investigation was required to determine possible seepage rates through an HDPE lined breakwater wall and estimate the dewatering requirements such as pump spacing and pumping rates to dewater the sediments that must be excavated to create the marina and canal development.

Seepage:

- Seepage modelling suggests that groundwater seepage through the HDPE lined breakwater wall could be about 10 to 14 m3/per day with possible high flows, if the stiff clay has hydraulic conductivity like silt rather than clay of about 94 m3/per day.

- Groundwater seepage is likely at the toe of the breakwater wall and on the excavated embankments particularly at the base of embankment benches. The sediments are likely to be saturated unless they are dewatered.

Dewatering requirements:

- The deepest canal excavations require dewatering to below 10.8 mAHD, this is more than 6 m below the natural surface this excludes shallow spear point dewatering systems that usually have a maximum depth of about 6 m, but in clayey sediments might only be successful to 3 or 4 m;

- The sediments are layered sands, silts and clays, there is a possibility that the sand layers may behave like an underdrain and assist dewatering. Dewatering bores in the sand would have to be 10 to 15 m deep;

- Dewatering bore spacing would have to be at 20 to 30 m centres;

- Dewatering rates could be between 0.1 and 0.2 L/s per bore and drawdown is expected to stabilise within 4 to 6 months;

- The total volume of water pumped from the system cannot be determined from 2-dimensional section modelling, but an indication based on an ocean bound perimeter length of about 2700 m suggests that 90 to 135 dewatering bores would be required, the total volume from these bores could be up to 30 L/s depending on the hydraulic properties of the underlying sediments. Additional bores would be required in the interior parts of the development.

The modelling used for this assessment is based on many assumptions, as a consequence the results presented in this report are uncertain. Assumptions include:

- Hydraulic conductivity and volumetric water content of the underlying sediments;

- The sequence of development and methods of excavation;

- Depths and arrangement of sedimentary layers; and

- The system is assumed to be symmetrical and isotropic so that the results from 2-dimensional modelling can be expanded to give 3-dimensional results.

Each of these assumptions influence the estimates presented in this report, if more accurate or verifiable estimates are required, additional testing and description would be necessary.

For proper evaluation of the combined impact of many dewatering points across an area with complex underlying aquifer arrangements 3-dimensional modelling may be required. However the requirement must be carefully considered since for dewatering the unsaturated zone must be included. Three dimensional unsaturated/saturated zone modelling is not available in all modelling packages and may require significant development before reliable predictions are achieved.

Analytical evaluation of seepage is also possible, the methods have not been used in this evaluation. It is recommended that some analytical checks of the predictions in this report be performed.

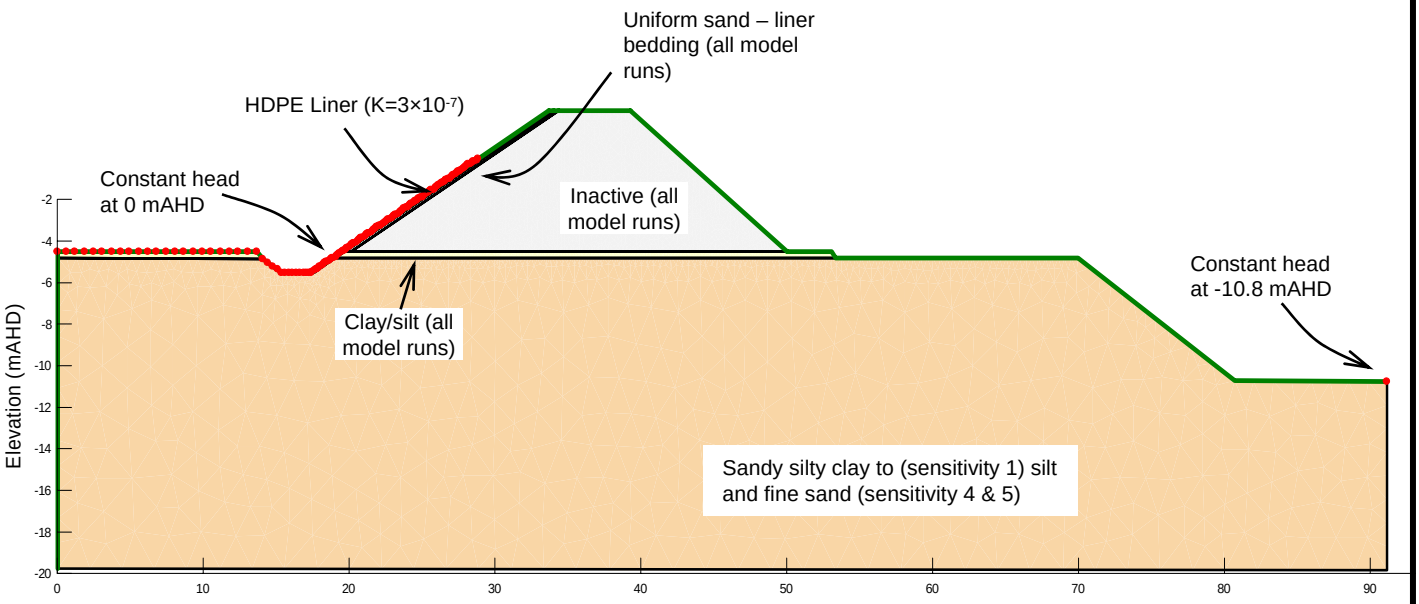


Figure F-3

Seepage model material distribution and boundary conditions

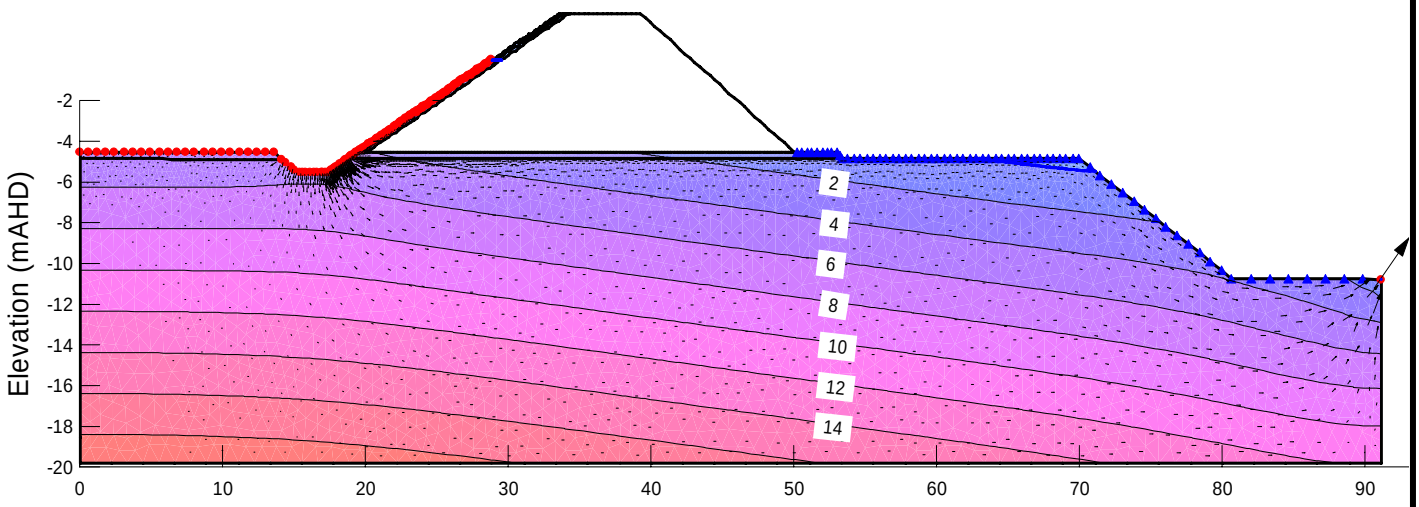


Figure F-4

Seepage Model 2, Sensitivity Run 4.

Pressure Head (m) distribution with seepage through the breakwater liner

Golder Associates	CLIENT: City Pacific Ltd		PROJECT: Proposed Cruise Ship Terminal, Townsville		
	DRAWN: RS	DATE: 5/07/07	TITLE: **Seepage Model Sections**		
	CHECKED	DATE			
	SCALE: As Shown		PROJECT No: 06692015	FIGURE No: **F-3 & F-4**	REV No: **D** **A4**

I:\Figure Templates\Powerpoint\A4 portrait.ppt

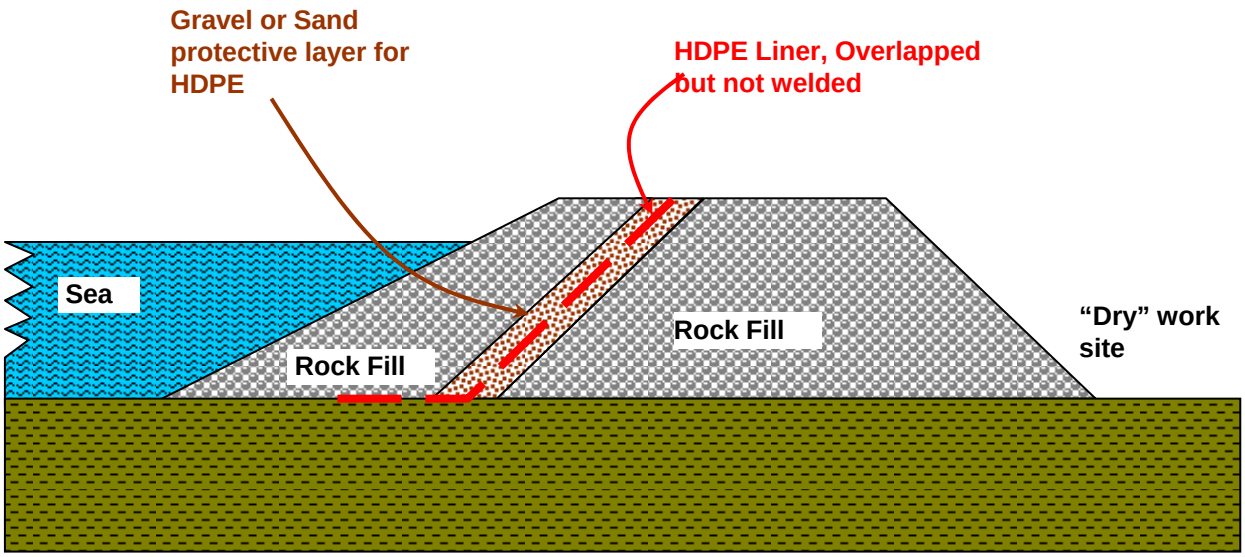


Figure F-1

Conceptual Seepage Model Section as Supplied

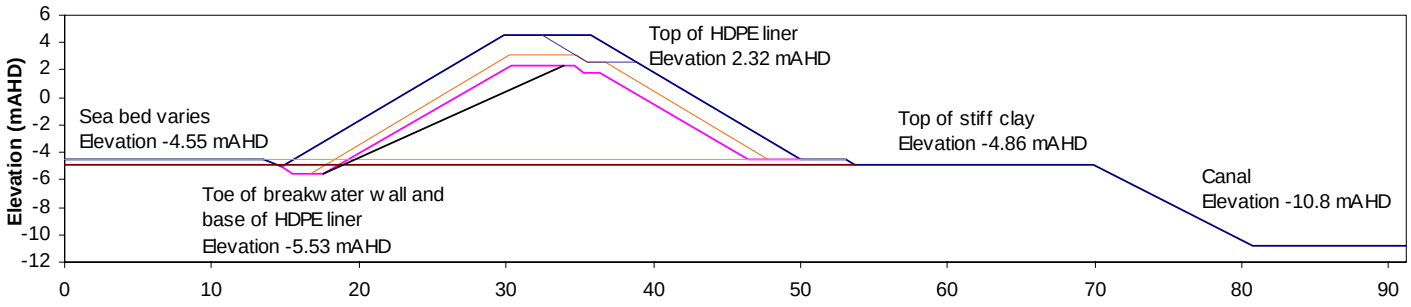


Figure F-2

Section dimensions based on Hyder Consulting "Typical Canal Sections" drawing No. K021

Golder Associates	CLIENT: City Pacific Ltd		PROJECT: Proposed Cruise Ship Terminal, Townsville
	DRAWN: RS	DATE: 5/07/07	TITLE: **Conceptual Section and Dimensions**
	CHECKED:	DATE:	
	SCALE: As Shown	PROJECT No: 06692015	FIGURE No: **F-1 & F-2** / REV No: / **A4**

I:\Figure Templates\Powerpoint\A4 portrait.ppt

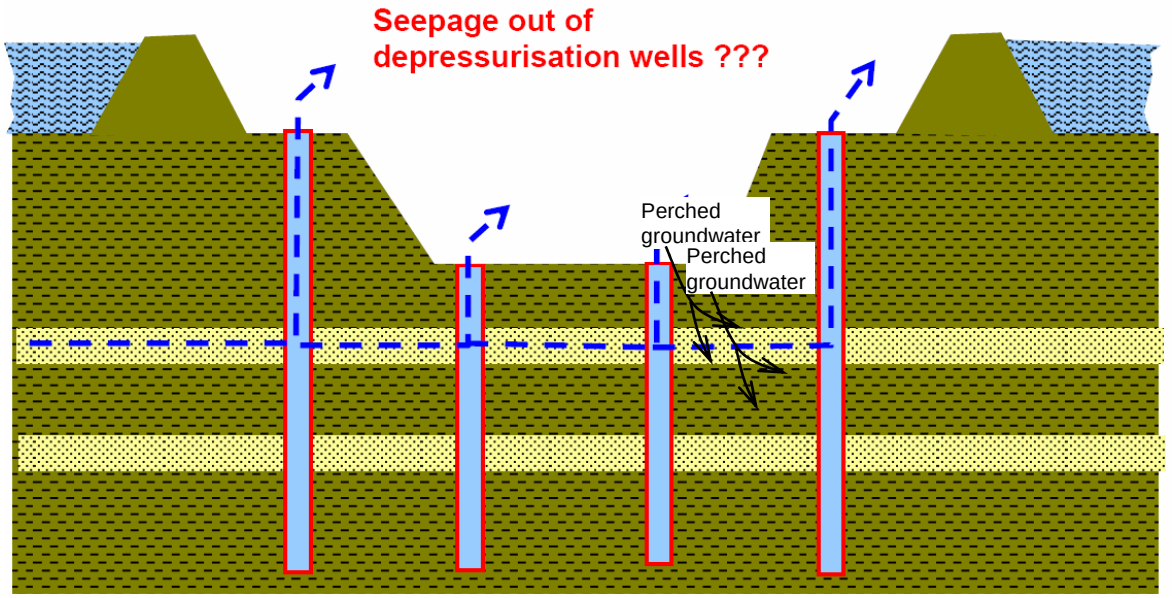


Figure F-5

Conceptual Dewatering Model Section as Supplied

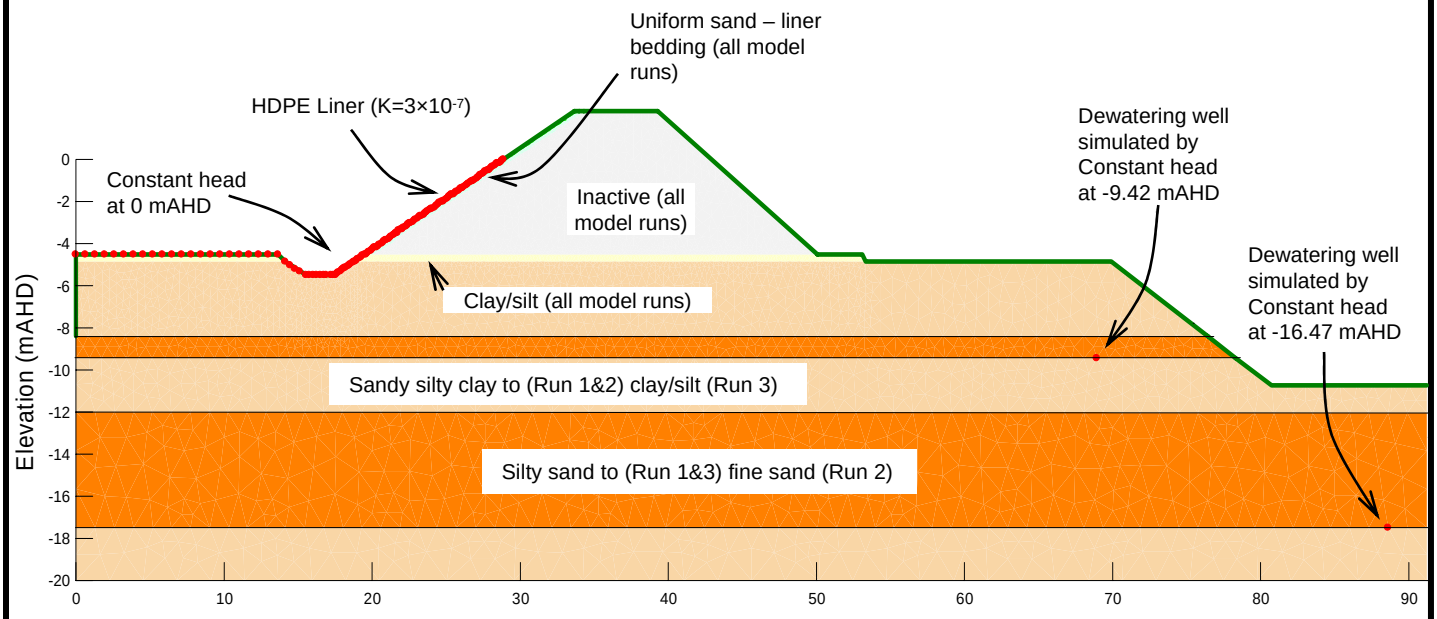


Figure F-6

Dewatering model material distribution and boundary conditions

Golder Associates	CLIENT: City Pacific Ltd		PROJECT: Proposed Cruise Ship Terminal, Townsville		
	DRAWN: RS	DATE: 5/07/07	TITLE: **Model Sections**		
	CHECKED	DATE			
	SCALE: As Shown		PROJECT No: 06692015	FIGURE No: **F-5 & F-6**	REV No: **D** **A4**

I:\Figure Templates\Powerpoint\A4 portrait.ppt

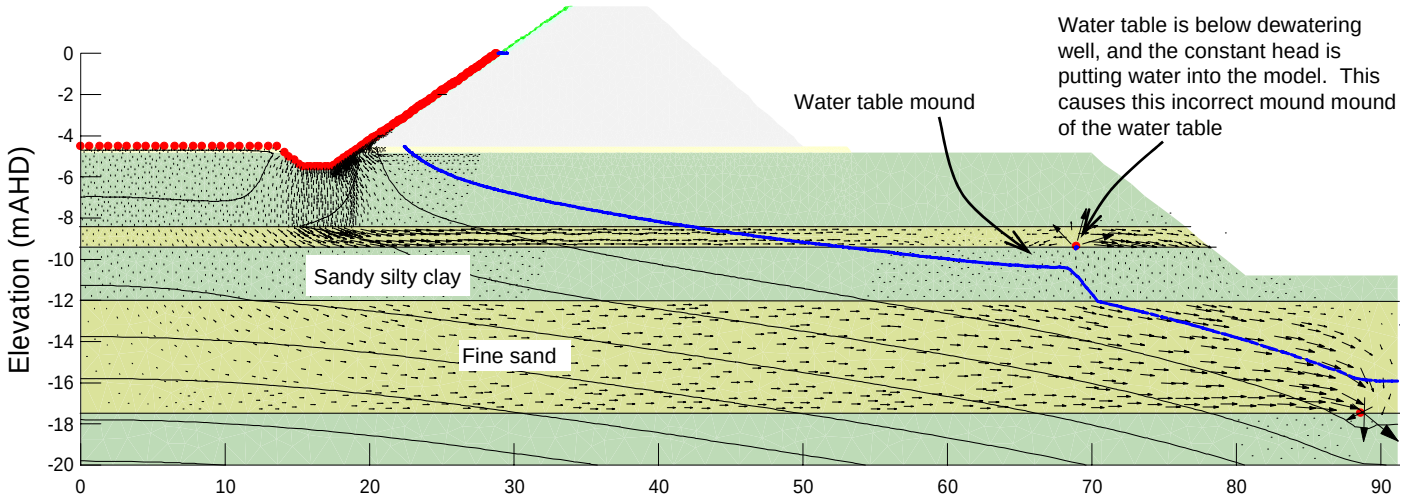


Figure F-7

Dewatering model Result of Steady State Model Run 3

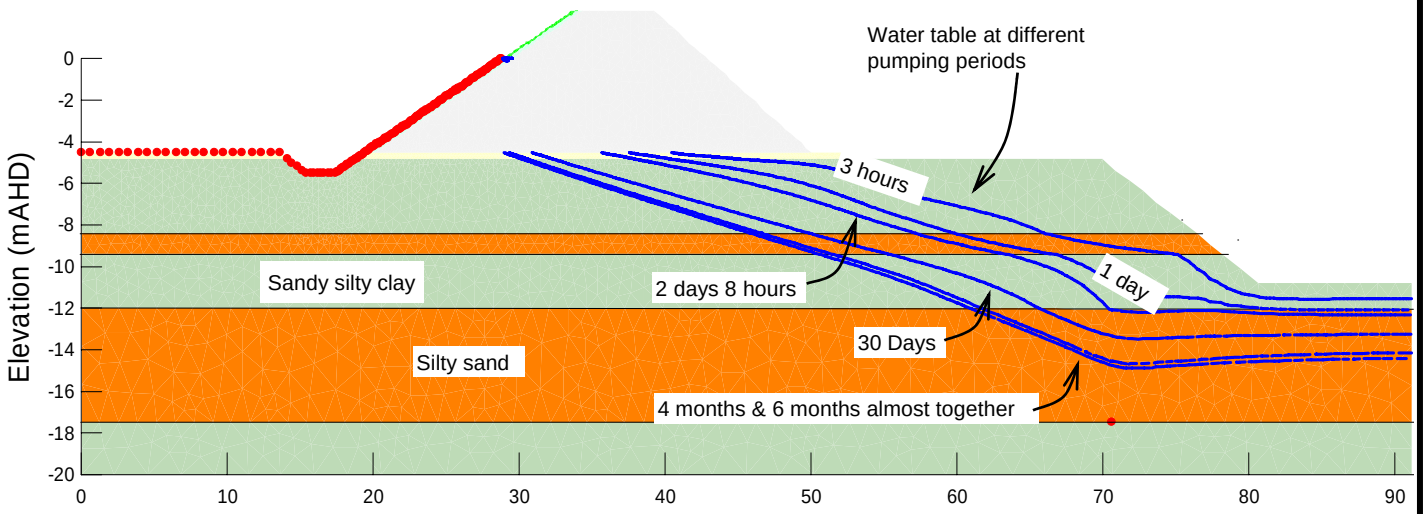


Figure F-8

Dewatering model Result of Transient Model Run 1

Golder Associates	CLIENT: City Pacific Ltd		PROJECT: Proposed Cruise Ship Terminal, Townsville		
	DRAWN: RS	DATE: 5/07/07	TITLE: **Model Results**		
	CHECKED:	DATE:			
	SCALE: As Shown		PROJECT No: 06692015	FIGURE No: **F-7 & F-8**	REV No: **D** **A4**

I:\Figure Templates\Powerpoint\A4 portrait.ppt

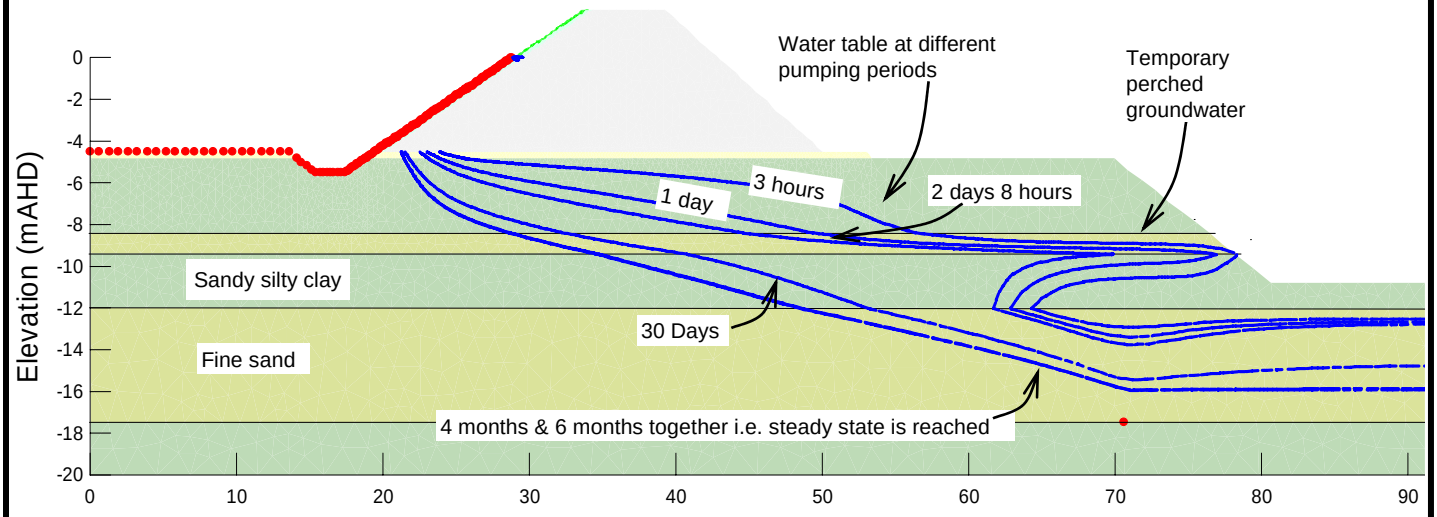


Figure F-9

Dewatering model Result of Transient Model Run 2

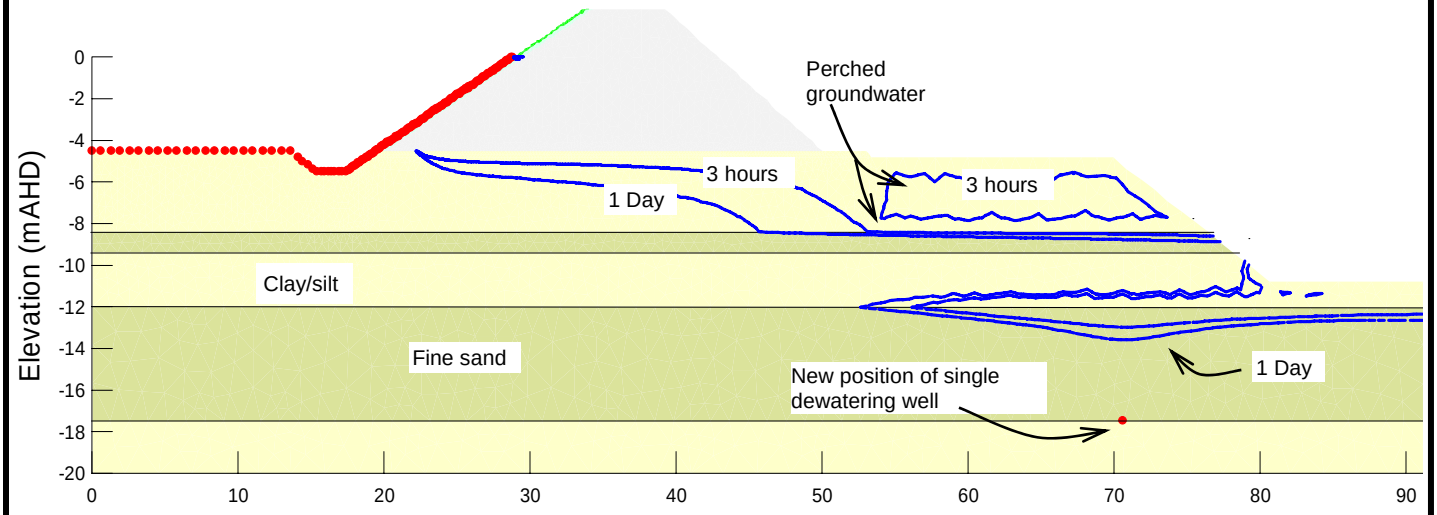


Figure F-10A

Result of transient model Run 3 after 3.7 hours and 1 day of pumping

Golder Associates	CLIENT: City Pacific Ltd		PROJECT: Proposed Cruise Ship Terminal, Townsville
	DRAWN: RS	DATE: 5/07/07	TITLE: **Transient Model Results**
	CHECKED:	DATE:	
	SCALE: As Shown	PROJECT No: 06692015	FIGURE No: **F-9 & F-10A** / REV No: **D** / **A4**

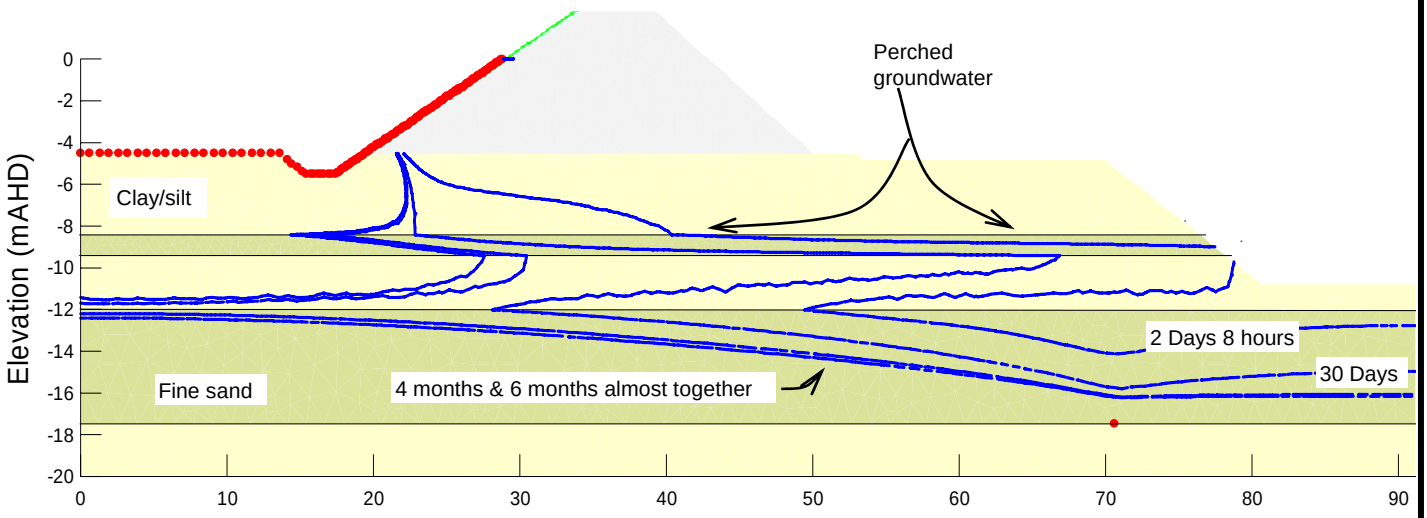
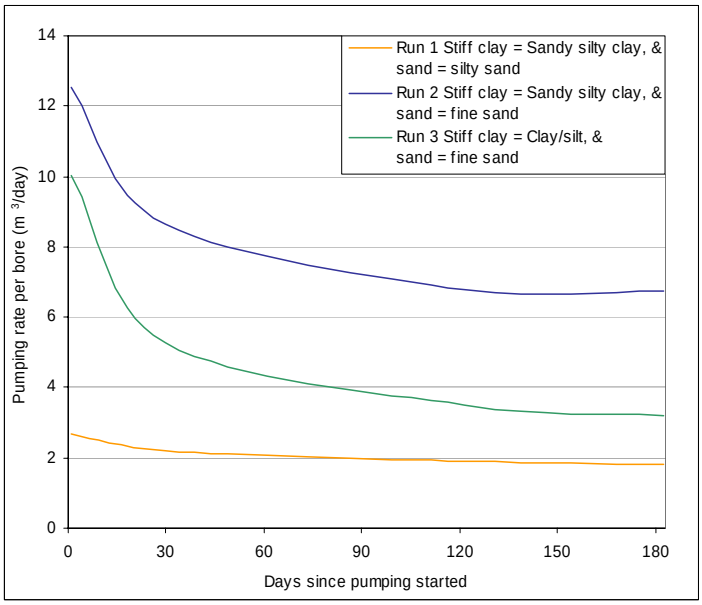
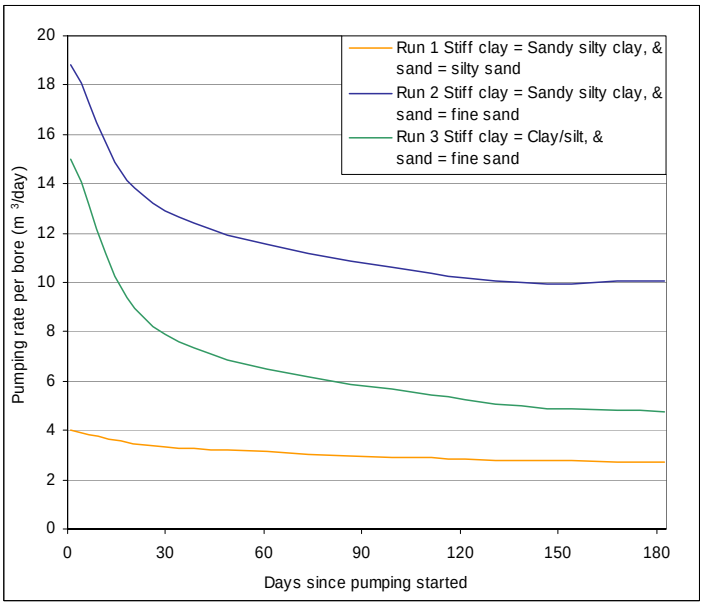


Figure F-10B

Result of transient model Run 3 after 2 days 8 hours, 30 days, 4 months, and 6 months of pumping



20 m bore spacing



30 m bore spacing

Figure F-11

Pumping rate decrease over time for three transient model runs (m^3/day per bore)

Golder Associates	CLIENT: City Pacific Ltd		PROJECT: Proposed Cruise Ship Terminal, Townsville		
	DRAWN: RS	DATE: 5/07/07	TITLE: **Transient Model Results**		
	CHECKED	DATE			
	SCALE: As Shown		PROJECT No: 06692015	FIGURE No: F-10B & F-11	REV No: D / A4

I:\Figure Templates\Powerpoint\A4 portrait.ppt

Appendix H
Important Information about your Geo-Environmental Report

Important Information About Your

Geo-environmental Report

These notes have been prepared by Golder Associates Pty Ltd using guidelines prepared by ASFE; The Association of Engineering Firms Practising in the Geosciences, of which Golder Associates Pty Ltd is a member. They are offered to help you in the interpretation of your Geo-environmental Report.

Geo-environmental studies are commissioned to gain information about environmental conditions on and beneath the surface of a site. The more comprehensive the study, the more reliable the assessment is likely to be. But remember, any such assessment is to a greater or lesser extent based on professional opinions about conditions that cannot be seen or tested. Accordingly, no matter how much data is accumulated, risks created by unanticipated conditions will always remain. *Have realistic expectations.* Work with your Geo-environmental consultant to manage known and unknown risks. Part of that process should already have been accomplished, through the risk allocation provisions you and your Geo-environmental professional discussed and included in your contract's general terms and conditions. This document is intended to explain some of the concepts that may be included in your agreement, and to pass along information and suggestions to help you manage your risk.

Beware of Change; Keep Your Geo-environmental Professional Advised

The design of a Geo-environmental study considers a variety of factors that are subject to change. Changes can undermine the applicability of a report's findings, conclusions, and recommendations. *Advise your Geo-environmental professional about any changes you become aware of them.* Geo-environmental professionals cannot accept responsibility or liability for problems that occur because a report fails to consider conditions that did not exist when the study was designed. Ask your Geo-environmental professional about the types of changes you should be particularly alert to. Some of the most common include:

- modification of the proposed development or ownership group,
- sale or other property transfer,
- replacement of or additions to the financing entity,
- amendment of existing regulations or introduction of new ones, or
- changes in the use or condition of adjacent property

Should you become aware of any change, *do not rely on an existing Geo-environmental report.* Advise your Geo-environmental professional immediately; follow the professional's advice.

Recognize the Impact of Time

A Geo-environmental professional's findings, recommendations, and conclusions cannot remain valid indefinitely. The more time that passes, the more likely it is that important latent changes may occur. *Do not rely on a Geo-environmental report if too much time has elapsed since it was completed.* Ask your environmental professional to define "too much time." In the case of Phase I Environmental Site Assessments (ESAs), for example, more than 180 days after submission is generally considered "too much."

Prepare To Deal with Unanticipated Conditions

The findings. recommendations, and conclusions of a Phase I ESA report typically are based on a review of historical information, interviews, a site "walkover," and other forms of noninvasive research. When site subsurface conditions are not sampled in any way, the risk of unanticipated conditions is higher than it would otherwise be.

While borings, installation of monitoring wells, and similar invasive test methods can help reduce the risk of unanticipated conditions, *do not overvalue the effectiveness of testing.* Testing provides information about actual conditions only at the precise locations where samples are taken, and only when they are taken. Your Geo-environmental professional has applied that specific information to develop a general opinion about environmental conditions. *Actual conditions in areas not sampled may differ (sometimes sharply) from those predicted in a report.* For example, a site may contain an unregistered underground storage tank that shows no surface trace of its existence. *Even conditions in areas that were tested can change*, sometimes suddenly, due to any number of events, not the least of which include occurrences at adjacent sites. Recognize, too, that *even some conditions in tested areas may go undiscovered*, because the tests or analytical methods used were designed to detect only those conditions assumed to exist.

Manage your risks by retaining your Geo-environmental professional to work with you as the project proceeds. Establish a contingency fund or other means to enable your Geo-environmental professional to respond rapidly, in order to limit the impact of unforeseen conditions. To help prevent any misunderstanding, identify those

empowered to authorize changes and the administrative procedures that should be followed.

Do Not Permit Any Other Party To Rely on the Report

Geo-environmental professionals design their studies and prepare their reports to meet the specific needs of the clients who retain them, in light of the risk management methods that the client and Geo-environmental professional agree to, and the statutory, regulatory, or other requirements that apply. The study designed for a developer may differ sharply from one designed for a lender, insurer, public agency ... or even another developer. *Unless the report specifically states otherwise, it was developed for you and only you.* Do not unilaterally permit any other party to rely on it. The report and the study underlying it may not be adequate for another party's needs, and you could be held liable for shortcomings your Geo-environmental professional was powerless to prevent or anticipate. Inform your Geo-environmental professional when you know or expect that someone else - a third-party will want to use or rely on the report. *Do not permit third-party use or reliance until you first confer with the Geo-environmental professional who prepared the report.* Additional testing, analysis, or study may be required and, in any event, appropriate terms and conditions should be agreed to so both you and your Geo-environmental professional are protected from third-party risks. *Any party who relies on a Geo-environmental report without the express written permission of the professional who prepared it and the client for whom it was prepared may be solely liable for any problems that arise.*

Avoid Misinterpretation of the Report

Design professionals and other parties may want to rely on the report in developing plans and specifications. They need to be advised, in writing, that their needs may not have been considered when the study's scope was developed, and, even if their needs were considered, they might misinterpret Geo-environmental findings, conclusions, and recommendations. *Commission your Geo-environmental professional to explain pertinent elements of the report to others who are permitted to rely on it, and to review any plans, specifications or other instruments of professional service that incorporate any of the report's findings, conclusions, or recommendations.* Your Geo-environmental professional has the best understanding of the issues involved, including the fundamental assumptions that determined the study's scope.

Give Contractors Access to the Report

Reduce the risk of delays, claims, and disputes by giving contractors access to the full report, *providing that it is accompanied by a letter of transmittal that can protect you* by making it unquestionably clear that: 1) the study was not conducted and the report was not prepared for purposes of bid development, and 2) the findings, conclusions, and recommendations included in the report are based on a variety of opinions, inferences, and assumptions and are subject to interpretation. Use the letter to also advise contractors to consult with your Geo-environmental professional to obtain clarifications, interpretations, and guidance (a fee may be required for this service), and that-in any event-they should conduct additional studies to obtain the specific type and extent of information each prefers for preparing a bid or cost estimate. Providing access to the full report, with the appropriate caveats, helps prevent formation of adversarial attitudes and claims of concealed or differing conditions. If a contractor elects to ignore the warnings and advice in the letter of transmittal, it would do so at its own risk. Your Geo-environmental professional should be able to help you prepare an effective letter.

Do Not Separate Documentation from the Report

Geo-environmental reports often include supplementary documentation, such as maps and copies of regulatory files, permits, registrations, citations, and correspondence with regulatory agencies. If subsurface explorations were performed, the report may contain final boring logs and copies of laboratory data. If remediation activities occurred on site, the report may include: copies of daily field reports, waste manifests, and information about the disturbance of subsurface materials, the type and thickness of any fill placed on site, and fill placement practices, among other types of documentation. *Do not separate supplementary documentation from the report. Do not, and do not permit any other party to redraw or modify any of the supplementary documentation for incorporation into other professionals' instruments of service.*

Understand the Role of Standards

Unless they are incorporated into statutes or regulations, standard practices and standard guides developed by the American Society for Testing and Materials (ASTM) and other recognized standards-developing organizations (SDOs) are little more than aspirational methods agreed to by a consensus of a committee. The committees that develop standards may not comprise those best qualified to establish methods and, no matter what, no standard method can possibly consider the infinite client and project-specific variables that fly in the face of the theoretical "standard conditions" to which standard practices and standard guides apply. In fact, these variables can be so pronounced that Geo-environmental professionals who comply with every directive of an ASTM or other standard procedure could run foul of local custom and practice, thus violating the standard of care.

Accordingly, when Geo-environmental professionals indicate in their reports that they have performed a service "in general compliance" with one standard or another, it means they have applied professional judgement in creating and implementing a scope of service designed for the specific client and project involved, and which follows some of the general precepts laid out in the referenced standard. To the extent that a report indicates "general compliance" with

a standard, you may wish to speak with your Geo-environmental professional to learn more about what was and was not done. *Do not assume a given standard was followed to the letter*. Research indicates that that seldom is the case.

Realize That Recommendations May Not Be Final

The technical recommendations included in a Geo-environmental report are based on assumptions about actual conditions, and so are preliminary or tentative. Final recommendations can be prepared only by observing actual conditions as they are exposed. For that reason, you should retain your Geo-environmental professional to observe construction and/or remediation activities on site, to permit rapid response to unanticipated conditions. *The Geo-environmental professional who prepared the report cannot assume responsibility or liability for the report's recommendations if that professional is not retained to observe relevant site operations.*

Understand That Geotechnical Issues Have Not Been Addressed

Unless geotechnical engineering was specifically included in the scope of professional service, a report is not likely to relate any findings, conclusions, or recommendations about the suitability of subsurface materials for construction purposes, especially when site remediation has been accomplished through the removal, replacement, encapsulation, or chemical treatment of on-site soils. The equipment, techniques, and testing used by geotechnical engineers differ markedly from those used by Geo-environmental professionals; their education, training, and experience are also significantly different. If you plan to build on the subject site, but have not yet had a geotechnical engineering study conducted, your Geo-environmental professional should be able to provide guidance about the next steps you should take. The same firm may provide the services you need.

Read Responsibility Provisions Closely

Geo-environmental studies cannot be exact; they are based on professional judgement and opinion. Nonetheless, some clients, contractors, and others assume Geo-environmental reports are or certainly should be unerringly precise. Such assumptions have created unrealistic expectations that have led to wholly unwarranted claims and disputes. To help prevent such problems, Geo-environmental professionals have developed a number of report provisions and contract terms that explain who is responsible for what, and how risks are to be allocated. Some people mistake these for "exculpatory clauses," that is, provisions whose purpose is to transfer one party's rightful responsibilities and liabilities to someone else. Read the responsibility provisions included in a report and in the contract you and your Geo-environmental professional agreed to. They are important.

Rely on Your Geo-environmental Professional for Additional Assistance

Membership in ASFE exposes Geo-environmental professionals to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a Geo-environmental project. Confer with your ASFE-member Geo-environmental professional for more information.

Appendix I
McConnell Consulting – Preliminary Geotechnical Investigation – Townsville Ocean Terminal Report (T03-05-07).

Ocean Terminal Project

For Port of Townsville

T03-05-07(a)

19 August, 2003

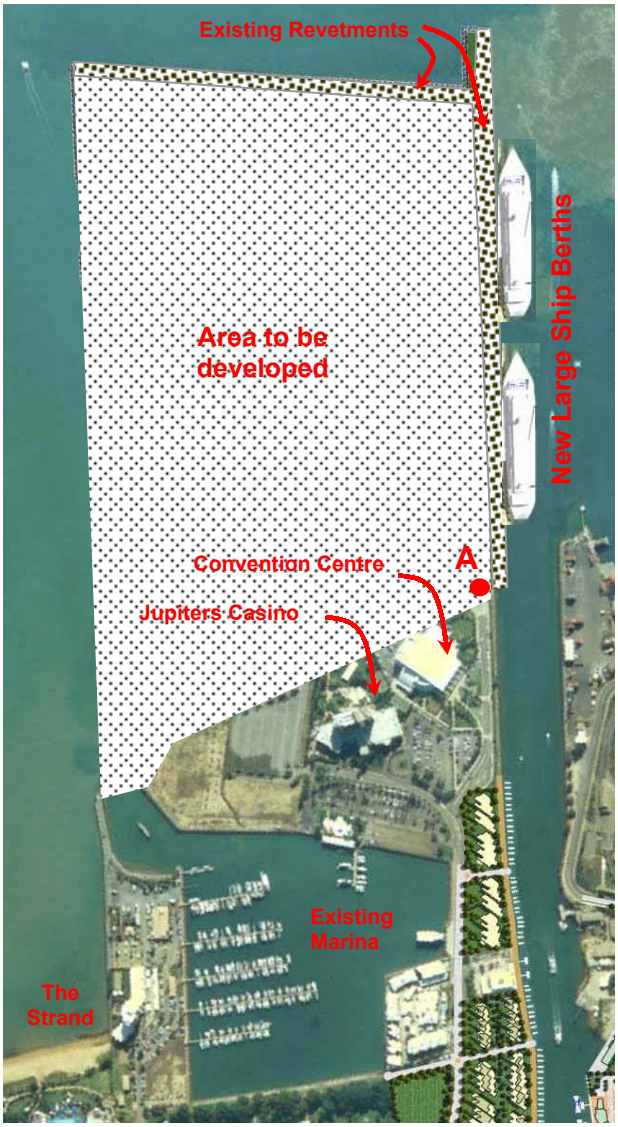
Preliminary Investigation

1 THE SITE AND THE PROJECT

The site is shown in the adjacent plan and the photograph below.

The proposed project comprises a waterways or marina type reclamation plus a cruise ship terminal.

- The reclamation will be constructed within an area defined by two existing rock wall revetments. It will involve development of land for buildings, and canals and waterways for boating.
- The cruise ship terminal will be developed within Ross Creek's entrance, alongside the creek's edge revetment. It is possible that part of this revetment may be re-aligned or otherwise modified for this part of the project. Dredging will be required.
- There is currently relatively shallow water depth within the reclamation and waterways area. Some parts will need to be dredged to provide navigable conditions for boats.



2 THE SITE INVESTIGATION

Three boreholes were drilled at nominated locations, one in the cruise terminal area in Ross Creek and the other in the reclamation and waterways area.

Borehole locations are shown on Fig 1, page 2 of this report, along with a diagrammatic summary of the borehole findings.

Detailed results of these boreholes are presented in Appendix A.

3 FINDINGS

Refer to Figure 1, page 2.

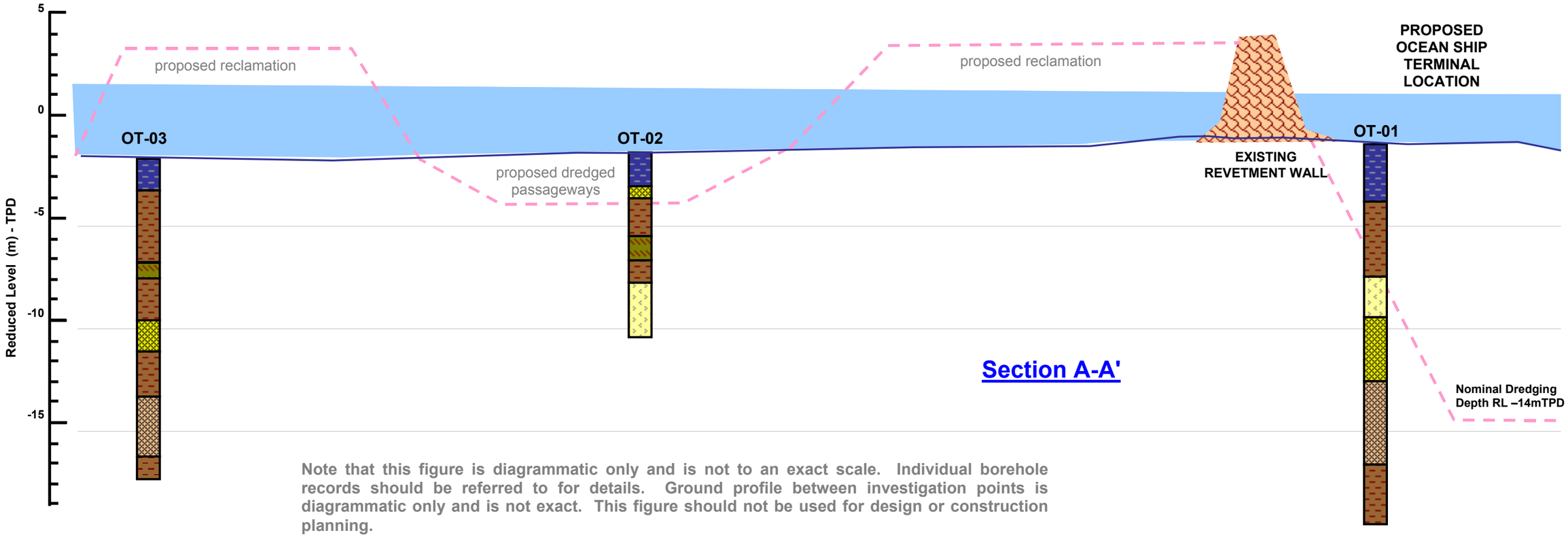
All bores found an upper veneer of "extremely" soft organic clay "ooze" then interbedded bands of stiff to very stiff & hard clay, and medium dense to very dense sand.

Detailed results are presented in Appendix A.

Consequences are discussed in the following pages.

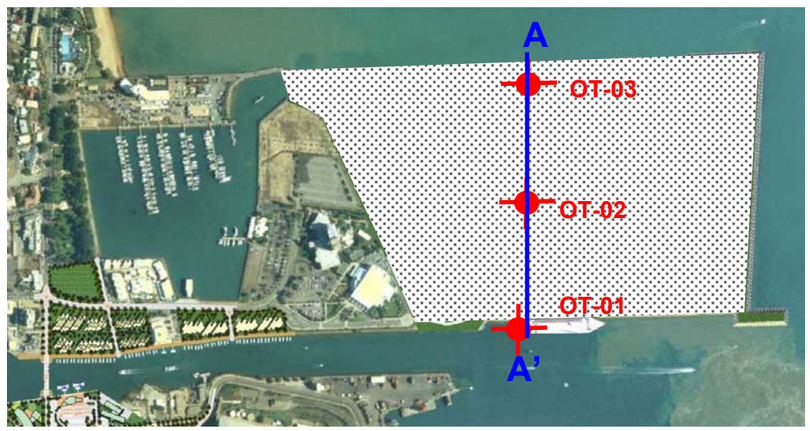
Geotechnical & Geo-Environmental Consultants
PO Box 5298 Townsville M.C Qld 4810, Australia
Phone: (07) 4724-0311 Fax: (07) 4724-0511
Also in Brisbane, Phone (07) 3358-6152, Fax (07) 3358-4366
ABN 43 206 950 752

McConnell Consulting



Section A-A'

Note that this figure is diagrammatic only and is not to an exact scale. Individual borehole records should be referred to for details. Ground profile between investigation points is diagrammatic only and is not exact. This figure should not be used for design or construction planning.



LEGEND

- Very ("extremely") Soft Organic Clay
- Stiff Sandy Clay
- Very Stiff / Hard Clay/ Sandy Clay
- Medium Dense Sand
- Dense Sand/ Clayey Sand
- Very Dense Sand

BOREHOLE PROFILE DIAGRAM

Figure 1

4 SUMMARY OF INDIVIDUAL BOREHOLE FINDINGS

The conditions encountered in each individual borehole are depicted diagrammatically in Figure 1 (page 2) and are summarised below. See detailed borehole reports in Appendix A.

OT–01 (Ross Creek – Cruise Terminal Area)

BL – 2.8m:	Very ("extremely") soft organic clay "ooze".
2.8m – 6.3m :	Very stiff clay and sandy clay.
6.3m – 15.4m	Medium dense then dense and very dense sand and clayey sand. Interlayered with hard sandy clay from 8.3m to 11.6m.
15.4m – 18.45m	Hard sandy clay

OT-02 (Approximate Centre of Reclamation Site)

BL – 1.6m:	Very ("extremely") soft organic clay and clayey silt "ooze".
1.6m – 6.2m :	Stiff, very stiff and hard clay and sandy clay. Dense sand layer between 1.6m to 2.1m
6.3m – 8.95m	Medium dense sand with some dense clayey sand bands

OT-03 (North Western Side Of Reclamation Site)

BL – 1.5m:	Very ("extremely") soft organic clay "ooze".
1.5m – 11.5m:	Stiff, very stiff and hard clay and sandy clay. Dense sand layer between 7.8m to 9.4m
11.5m – 14.5m:	Dense sand with very dense bands
14.5m – 15.45m	Hard silty clay

5 COMMENTS - DREDGING CONDITIONS & SPOIL PROPERTIES

No unusual difficulty would be expected in dredging any of the materials found in the boreholes to the depths presently envisaged, using normal heavy cutter-suction dredging methods. However, attention is drawn to the rock revetment walls and the possibility that loose rocks from these walls may exist within the development area. Such rocks could become obstructions to dredging.

Excavated materials will vary in type and properties with depth and also laterally across the area, as follows:

- The very soft organic clays that make up a surface veneer as found in the bores at 1.5-2.8m thickness would not make a useful quality of fill material. These materials are also likely to have acid sulphate potential.

- The stiff to hard clays will form into small lumps unless dredged by excavator, dragline or clamshell equipment. They would make potentially useful fill where they can be placed "in the dry". Underwater placement would however lead to a voidy, lumpy, fill that would soften as it absorbed water. If placed in the dry, these stiffer clays would be a relatively good fill, but they would need very careful moisture content control during compaction. Use of these clays as fill may result in a somewhat expansive foundation for structures. This would need to be managed by methods normally used for expansive sites.

- The sands would likely provide a good quality fill that could potentially be placed through water as well as in the dry. There may be some fines content that would need to be managed by normal ponding and settlement methods if placed through water or placed by pumping.

Attention is drawn to the fact that there is inadequate site investigation data available at this time to determine whether there is lateral continuity in the layering of strata identified in the boreholes. The presence or lack of such continuity will be an important consideration in planning and execution of a dredging program if reliance is to be placed on re-use of the materials won from dredging as fill on the project.

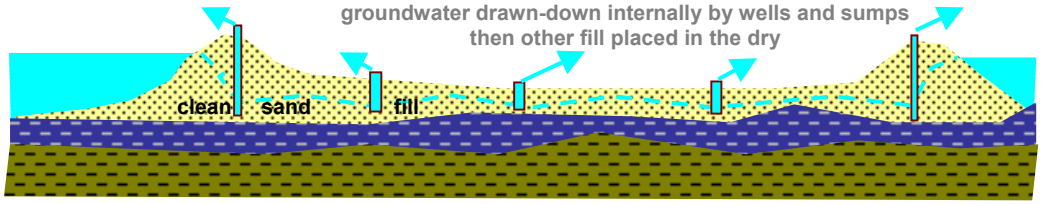
6 COMMENTS – RECLAMATION CONDITIONS

The following options exist for reclamation works for this project:

Either: **A.** Construction of full-depth low-permeability bunds or some other form of stable water-retaining system, dewatering, and then fill placement in the dry. With this system, conventional earthworks procedures could then be used, and conventional fill of a range of types could be considered for the project. It is considered relatively unlikely however that this approach will be deemed practical for the project given the depth of water, the tidal range and the need for weather protection for the project.

Or: **B.** Placement of all fill by dredging or other means into and through water. This approach is common for marine reclamations. However, fill placement through water is only successful at an "engineering" level if the fill used is of a clean granular type such as clean sand, gravel or similar. Clayey fill placed in this way would soften in contact with water and would lead to a very weak and highly compressible and unstable platform. Thus, if this approach is to be taken, a source of clean granular fill will be needed.

Or: **C.** A combination of A & B where clean granular fill is used to fill the reclamation areas to above water level, then other fill might be used, placed and compacted conventionally, for the above-water works. We understand that there will likely be a shortage of clean granular fill available for the project, so this combined method may be found most suitable. The volume of clean granular fill needed might be minimised by contouring the reclamation profile with high edges to act as a restraint to lateral flow of water, then dewatering between those raised edges to allow construction in the dry from a lower-than-otherwise level. This is shown in concept in the sketch figure below.



7 COMMENTS – LEAVE THE ORGANIC CLAY IN PLACE?

As mentioned in Section 5, the very soft organic clay veneer that presently forms the sea bed is likely to be of acid sulphate potential, and it will in other ways be unsuitable for use as fill (on this or any other project). There are good reasons to remove the veneer and thee are competing reasons to leave it in place below the new reclamation works, as summarised below.

For Removal	Against Removal
– These weak soils could lead to edge instability under fill loadings. Their removal would eliminate this potential problem. Instability problems could be eliminated however by removal just around the edges of the reclamation area. – These clays are highly compressible and will lead to ground settlement under reclamation fill weight and other applied loadings. – Compaction of new fill on top of compressible organic clays will be inhibited by the "springiness" of the materials. However, this would not be a problem if clean granular sand fill is used for the lower reclamation zone.	– Acid sulphate soils, particularly very soft "ooze"-like materials, are a problem to dispose of. They can be very expensive to remove from site. – Removal of these materials will increase the volume of fill required to reclaim the site. In particular this would apply to the volume of the lowest levels of fill, and these will need to be clean sand or other granular type. – While they will produce settlement, preloading with a surcharge could be used to avoid this problem. As the compressible layer thickness appears reasonably thin, preloading times would not be great.

8 COMMENTS – PROJECT FOUNDATION SYSTEMS

8.1 General Comments

The type of foundation systems used for any engineered development on the reclaimed site will depend on:

(a) the structures or features to be supported,

(b) the fill material that has been used for the reclamation,

(c) and the success of the operation overall.

For example, if:

– a good quality clean granular fill has been used for the lower layers of the fill, and

– good compaction has been achieved in any fill placed above it, and

– the very soft clays have been removed or properly preloaded,

then purpose-designed lightly-loaded raft footing systems, roads, car parks, services etc, could be satisfactorily supported within the fill platform, using normal engineering methods.

However, if the reclamation has not been so successfully implemented, then special ground improvement procedures such as stone columns or dynamic replacement might possibly be needed to support critical project elements. Alternatively piles could be used.

8.2 Pile Foundations

Pile foundations will probably be needed for any heavy or settlement–sensitive project elements on the site, such as brittle structures, multi-level buildings, etc. Piles might also be needed if the reclamation works are not done to a high enough standard.

Driven piles would be most suitable for the project as there would be prohibitive construction difficulties with installation of normal un-cased bored piles due to non-cohesive fill, very soft clays, and copious groundwater.

Driven piles would reach a "set" (ie penetration resistance) adequate to carry their design loads with a penetration into the very stiff to hard clays and/or the dense and very dense sands.

The founding level and load capacity of piles will need to be assessed on a project-by-project basis, based on location-specific site investigations.

9 COMMENTS - REVETMENT WALL STABILITY AT CRUISE TERMINAL

9.1 Analysis Method

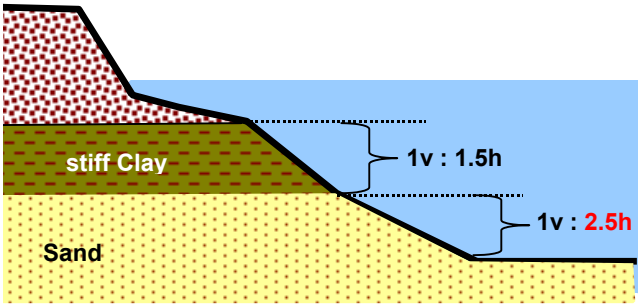
Stability analysis was done for two presumptive trial cross-sections for the proposed cruise terminal dredging area, using Bishop's Simplified Method, via the computer program XSLOPE Version 9.0[1].

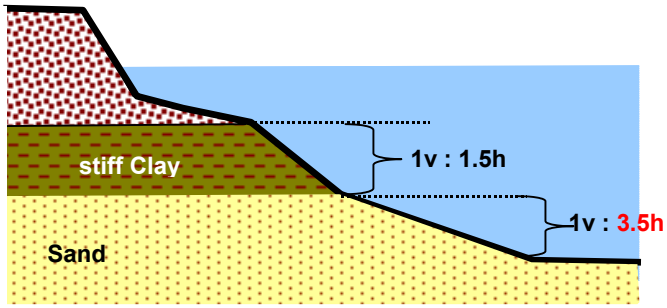
Analyses were made for both static and earthquake conditions. The earthquake case was modelled using the method recommended by ANCOLD[2] in their publication "Guidelines for Design Of Dams For Earthquake Loading" – 1998.

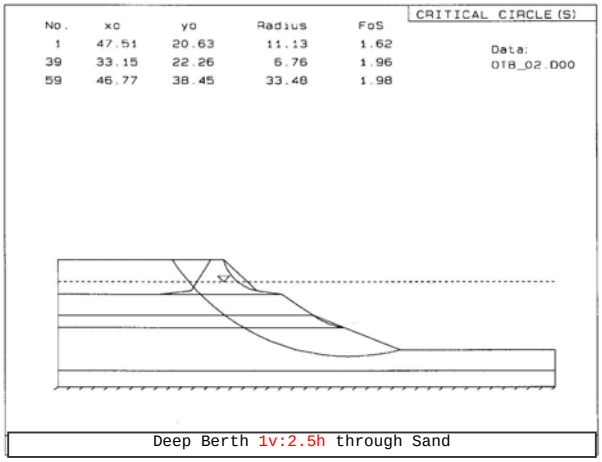
The presumptive trial cross-sections assessed and the results of this assessment are shown on the following page.

[1] Centre for Geotechnical Research, University of Sydney (Author Dr N P Balaam)

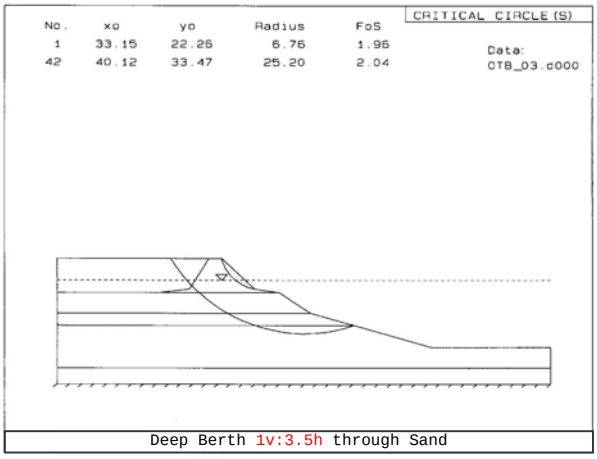
[2] **A**ustralian **N**ational **C**ommittee **O**n **L**arge **D**ams



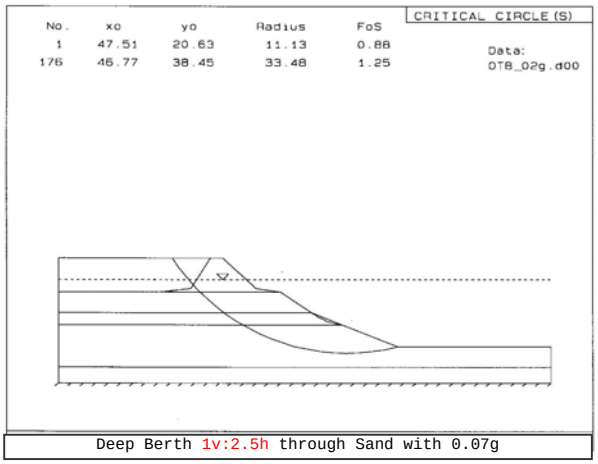




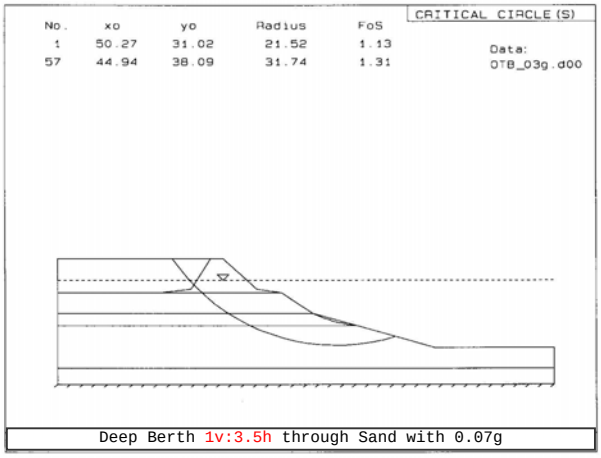
The existing revetment wall with a berth dredged to –14m TPD with a 1:2.5 (v:h) batter through the sand was found to have a calculated Factor of Safety = 1.6 under static conditions.



The existing revetment wall with a berth dredged to –14m TPD with a 1:3.5 (v:h) batter through the sand was found to have a calculated Factor of Safety = 2.0 under static conditions.



The existing revetment wall with a berth dredged to –14m TPD with a 1:2.5 (v:h) batter through the sand was found to have a calculated Factor of Safety = 0.9 under earthquake conditions.



The existing revetment wall with a berth dredged to –14m TPD with a 1:3.5 (v:h) batter through the sand was found to have a calculated Factor of Safety = 1.1 under earthquake conditions.

On the basis of the above analysis, preliminary indications are that a dredged cross-section similar to that shown above would be stable under normal static conditions. However, instability could develop due to earthquake if the under-water slope of batters through the sands was too steep. Based on this preliminary-level analysis an under-water slope of 1:3.5 (v:h) in the sands will be needed for the earthquake case.

Note that this stability analysis has been at a very preliminary level. More detailed analysis will be needed, based on detailed site investigations, for the design phase of the project.

10 COMMENTS – THE NEED FOR ADDITIONAL SITE INVESTIGATION

This report is for a preliminary level site investigation based on only three boreholes and with limited information on the detail of the project (as this detail has not yet been decided).

For the project to proceed with a normal level of geotechnical risk, and for consideration to be properly given to aspects that will impact significantly on the economics of the project, additional site investigation and analysis will be needed.

Future site investigation should:

- Be based on a good site coverage by geotechnical tests such as boreholes.
- Include laboratory testing to confirm materials' classifications made in the field and quantitatively determine important design parameters such as soil compressibility, strength plasticity, etc.
- Sample for and properly assess the veneer of organic clay at sea bed level, for acid sulphate potential and other possible contaminant issues.
- Investigate for and properly consider possible on-site and off-site fill sources, especially clean granular fills that might be used for under-water reclamation works.
- Include detailed analysis of all data, taking specific account of the project details decided or desired for the project.

Wyn Binmore

Appendix A

Borehole Record Sheets

Port Of Townsville
Ocean Terminal Project

Bore OT-01

Job No:	T03-05-07	550482049 E *	7871458 N *	Date: 03/06/03
Elevation:	RL –1.0m TPD approx	Supervised: ALT	Checked: WSB	Sheet: 1 of 1

Depth (m)	Interpreted Ground Conditions		Sampling, Testing & Notes
Bed Level	**Very Soft Silty Clay "Ooze"**	Very ("extremely") soft dark grey silty clay "ooze" with a little sand • sand fine to coarse grained • occasional shell fragments • becoming sandy and firmer below 2.4m	Bulk sample 0-1.0m SPT 1.00-1.50 0/500mm SPT 2.00-2.50 0/500mm
2.8	**Very Stiff Sandy Clay**	Very stiff orange brown and grey sandy clay with pockets of gravel • sand fine grained • gravel fine to medium grained	SPT 3.50-3.95 7,9,10 **N=19** SPT 4.50-4.95 4,6,6 **N=12**
5.3	**Very Stiff Clay**	Very stiff pale brown silty clay with some sand and a little gravel • sand fine to coarse grained • gravel fine to medium grained rock fragments	SPT 5.50-5.95 4,7,9 **N=16**
6.3	**Medium Dense Sand**	Medium dense orange sand with a trace of silt • sand fine to coarse grained • occasional shell fragments	SPT 6.50-6.95 3,6,10 **N=16** SPT 8.00-8.45 13,19,24 **N=43**
8.3	**Interlayered Dense Sand And Hard Sandy Clay**	Interlayered dense pale brown sand and hard sandy clay • sand fine to coarse grained • occasional gravel	SPT 9.50-9.95 12,19,21 **N=40** SPT 11.50-11.95 10,13,16 **N=29**
11.6	**Very Dense Clayey Sand**	Very dense orange and pale brown clayey sand with a trace of gravel • sand fine grained	SPT 15.00-15.30 10,30/150mm
15.4	**Hard Sandy Clay**	Hard orange and pale brown sandy clay • sand fine grained	SPT 18.00-18.43 13,26,30/130mm
18.45	**Terminated at 18.45m**		

This is a text record of interpreted conditions from testing and observations, not a scaled graphic log.

Groundwater: Borehole drilled overwater

Method: Rotary mud flush to 18.45m

Comments: *coordinated by hand held GPS to Port Grid system (AMG 66)
Depths are below sea bed level.

McConnell Consulting

Port Of Townsville
Ocean Terminal Project

Bore OT-02

Job No: T03-05-07(a) 550481894 E* 7871726 N* Date: 28/05/03
Elevation: RL –1.06m TPD approx Supervised: WSB Checked: AJM Sheet: 1 of 1

Depth (m)	Interpreted Ground Conditions		Sampling, Testing & Notes
Bed Level	**Very Soft Silty Clay "ooze"**	Very ("extremely") soft dark grey silty clay "ooze" • some fine gravel and shell fragments in layers • becoming sandy from 0.5m	Bulk BL-0.5m SPT 0.50-1.00 0/500mm
1.0	**Very Soft Clayey Silt**	Very soft dark grey clayey sandy silt • occasional shell fragments and gravel • sand fine grained • stiffer clay band from 1.4 to 1.5m	SPT 1.00-1.45 0,0,1 **N=1**
1.6	**Dense Clayey Sand**	Dense grey clayey sand with some gravel • sand fine to coarse grained • gravel fine grained	SPT 1.50-1.95 4,15,20 **N=35** SPT 2.00-2.45 2,2,8 **N=10**
2.1	**Very Stiff Clay**	Very stiff orange-brown/ grey silty clay • occasional fine gravel and sand bands • some hard bands	SPT 2.50-2.95 6,8,13 **N=21** SPT 3.00-3.45 5,8,12 **N=20** SPT 3.50-3.95 9,11,16 **N=27**
4.0	**Stiff Sandy Clay**	Stiff brown sandy clay some gravel with depth • sand fine grained	SPT 4.00-4.45 4,6,9 **N=15** SPT 4.50-4.95 5,5,12 **N=17** SPT 5.00-5.45 6,10,11 **N=21**
5.2	**Hard Silty Clay**	Hard pale grey silty clay • occasional sand and fine gravel	SPT 5.50-5.95 5,8,14 **N=22** SPT 6.00-6.45 7,12,16 **N=28**
6.2	**Medium Dense Sand**	Medium dense orange brown silty sand • sand fine grained • some dense clayey sand bands 7-8m	SPT 6.50-6.95 5,9,14 **N=23** SPT 7.00-7.45 8,12,21 **N=33** SPT 7.50-7.95 8,12,17 **N=29** SPT 8.50-8.95 3,5,7 **N=12**
8.95	**Borehole terminated at 8.95m**		

This is a text record of interpreted conditions from testing and observations, not a scaled graphic log.

Groundwater: Borehole drilled over water

Method: Rotary mud flush to 8.95m

Comments: *coordinated by hand held GPS to Port Grid system (AMG 66)
Depths are below sea bed level.

McConnell Consulting

Port Of Townsville
Ocean Terminal Project

Bore OT-03

Job No: T03-05-07(a) 550481612 E * 7871925 N * Date: 29/05/03
Elevation: RL –1.36m TPD approx Supervised: ALT Checked: WSB Sheet: 1 of 1

Depth (m)	Interpreted Ground Conditions		Sampling, Testing & Notes
Bed Level	**Very Soft Silty Clay "Ooze"**	Very ("extremely") soft dark grey very silty clay "ooze" with a trace of sand • sand fine grained • some shell fragments	Bulk BL-0.35m SPT 0.50-1.00 0/500mm SPT 1.00-1.50 0/500mm
1.5	**Very Stiff Clay**	Very stiff brown clay with a little sand and a trace of gravel • sand fine to coarse grained • gravel fine grained • thin gravelly bands	SPT 1.50-1.95 3,6,8 **N=14** SPT 2.00-2.45 3,5,15 **N=20** SPT 2.50-2.95 5,10,16 **N=26** SPT 3.00-3.45 5,9,13 **N=22**
3.2	**Very Stiff Clay**	Very stiff orange brown and grey clay with a trace of sand • sand fine grained • becoming more sandy with depth	SPT 4.00-4.45 5,8,9 **N=17**
5.0	**Stiff Sandy Clay**	Stiff orange-brown sandy clay with pockets of gravel • sand fine grained • gravel fine to medium grained black rock fragments	SPT 5.00-5.45 5,7,9 **N=16**
5.8	**Very Stiff Silty Clay**	Very stiff pale brown silty clay with a little sand some gravel • sand fine grained • gravel fine to medium grained black rock fragments • thin bands of fine grained sand	SPT 6.00-6.45 6,6,8 **N=14** SPT 7.50-7.95 7,12,18 **N=30**
7.8	**Dense Sand**	Dense orange sand with some silt • sand fine to medium grained	SPT 9.0-9.45 11,17,23 **N=40**
9.4	**Hard Sandy Clay**	Hard pale brown sandy clay • sand fine grained	SPT 10.50-10.95 8,12,16 **N=28**
11.5	**Dense Sand**	Dense orange and pale brown sand with a trace of silt • very dense bands • sand fine to coarse grained • becoming clayey with depth	SPT 12.00-12.45 14,22,33 **N=55** SPT 13.50-13.95 15,11,12 **N=23**
14.5	**Hard Silty Clay**	Hard pale grey and orange brown fissured silty clay with a trace of sand • sand fine to coarse grained • occasional small fragments of wood	
15.45	**Borehole terminated at 15.45m**		SPT 15.00-15.45 10,15,16 **N=31**

This is a text record of interpreted conditions from testing and observations, not a scaled graphic log.

Groundwater: Borehole drilled over water

Method: Rotary mud flush to 15.45m

Comments: * coordinated by hand held GPS to Port Grid system (AMG 66)
Depths are below seabed level.

McConnell Consulting