ACID SULFATE SOIL INVESTIGATION
PORTSIDE WHARF - STAGE 2
BUILDINGS 2, 4 & 5
HARBOUR ROAD
HAMILTON

Prepared for
Multiplex Developments Pty Ltd

Project No. 03900
13 March 2008

GEOTECHNICAL AND GEO-ENVIRONMENTAL CONSULTANTS

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SECTION 1 - INTRODUCTION

1.1 Project

It is understood that Stage 2 of the Portside Wharf development is to include the construction of Buildings 2, 4 and 5, which comprises multi-level, mixed use residential and commercial towers, over a single level basement carpark. Bulk excavation will be required to approximately RL0.6m AHD, which will involve a maximum of approximately 2.5m of excavation below existing ground surface levels. The approximate location of the site and extent of the basement are shown on Drawing No. 1, attached.

1.2 Proposed Scope of Work

Butler Partners have previously carried out investigations for acid sulfate soils (ASS) over the Portside Wharf site and it was proposed that ASS investigation for the proposed Buildings 2, 4 and 5 - Stage 2 development would comprise:

- collation of all previous ASS field and laboratory testing; and
- preparation of a report detailing:
  - field work methodology;
  - subsurface conditions;
  - laboratory testing program and results;
  - presence of ASS or potential acid sulfate soils (PASS); and
  - an Acid Sulfate Soil Management Plan (ASSMP).

This current ASS assessment is a compilation of all previous work conducted at the site; no additional fieldwork or laboratory testing has been undertaken for the Stage 2 development, as sufficient field and laboratory testing has previously been completed at the site to enable a thorough ASS assessment to be completed for the Stage 2 development.

1.3 Commission

Butler Partners Pty Ltd (Butler Partners) was commissioned by Multiplex Developments Pty Ltd to carry out the ASS investigation for Buildings 2, 4 and 5 of Stage 2 of the Portside Wharf development as proposed.

SECTION 2 - THE SITE

2.1 Background

2.1.1 Acid Sulfate Soil Assessments

Three previous ASS assessments have been completed at the Portside Wharf site by Butler Partners and the results are given in the following reports:

Acid Sulfate Soil Investigation
Portside Wharf – Brisbane Cruise Terminal
37 Harbour Road, Hamilton

Project No.: 03900 Dated: 22 May 2003

Acid Sulfate Soil Investigation
Second Level Basement Option
Portside Wharf – Brisbane Cruise Terminal
37 Harbour Road, Hamilton
Project No.: 03900 Dated: 26 August 2003

Acid Sulfate Soil Investigation
Proposed Extension to Portside Wharf
5 & 19 Hercules, Hamilton
Project No.: 03900H Dated: November 2006

In summary, the three investigations comprised (in total) the following:

- nine test pits and twenty-seven bores carried out to a maximum depth of 31.35m, with samples collected at 0.25m (2006 investigation) and 0.5m (2003 investigations) depth intervals (or where a new strata was identified) in the depth range 3m to 6m generally;
- field pH screening tests were undertaken for each disturbed sample; and
- testing of selected samples for Peroxide Oxidation – Combined Acidity and Sulfate (POCAS) testing and Chromium Suite based on the field pH results.

2.1.2 Groundwater

As part of the geotechnical assessment of the Portside Wharf site a groundwater modelling assessment was undertaken by Butler Partners and the results are given in the following report:

Groundwater Modelling
Portside Wharf
Project No.: 03900B Dated: 19 July 2004

In summary, the modelling study and groundwater level monitoring results indicated that the site groundwater level varied across the site and was considered to be generally indicative of groundwater flow from the north to south. In June 2003, it was recorded that groundwater levels were generally less than approximately RL0.6m across the site, based on borehole elevations estimated from site survey plans. Under steady state conditions, and assuming that approximately 33% of the annual rainfall recharges the aquifer, it was found by analysis that the groundwater levels on the site would vary from a maximum of approximately RL1.1m to the north of the site to RL0.0m at the Brisbane River.

2.2 Site Description

The site is currently undeveloped and comprises a combination of pavements and bare earth, with some remnant structure from prior site development.

Ground surface levels across the site varied between approximately RL3.0m to RL3.5m in the existing slab/pavement areas, and approximately RL1.0m to RL1.5m in the bare earth areas (that were generally present in the western portion of the site, adjacent to the existing wharf/Brisbane River).

2.3 Geology

Reference to the Geological Survey of Queensland's 1:31,680 Brisbane Series Maps indicates that the site is underlain by Quaternary Age alluvial clay, mud, silt, sand and gravel.

SECTION 3 - FIELD WORK

3.1 Field Work Methods

The field work for the investigation has been conducted in three stages (namely May 2003, June 2003 and September 2006), and comprised the drilling of twenty-seven bores using truck mounted Jacro 350, trailer mounted Gemco HP7 and HS7 and a track mounted Geoprobe 6610D7 drilling rigs, all operating solid flight augers to a maximum depth of 6.0m below ground level.

In areas of concrete slabs overlying voids (encountered within a former Cold Store area) and at locations where drilling refusal was encountered (on 'large' rubble/cobbles within the existing fill), nine test pits were excavated using a Caterpillar 330B excavator.

Strata identification was based on materials recovered on the augers flights or within the excavator bucket. Samples were collected at between 0.25m and 0.5m depth intervals in the bores to between 2.4m and 6.5m depth. Samples were placed in sealed bags with as much air as possible excluded, and stored in a cool esky prior to dispatch to the testing laboratory.

All bores and test pits were backfilled with spoil on completion.

3.2 Test Locations and Supervision

Test locations were set out by hand-held GPS and/or reference to existing site features, and are indicated approximately on the attached Drawing No. 1. Approximate ground surface levels at each test location were interpolated from the '*Contour & Detail Survey*' (Drawing Nos. 6121-04-01B,02B,03B,04B) prepared by Pike Mirls McKnoulty, consulting surveyors.

An experienced geo-environmental engineer set out the test locations, logged the stratigraphy encountered in the bores and supervised the field work.

SECTION 4 - INVESTIGATION RESULTS

4.1 Bore Reports

The subsurface conditions encountered at the test locations are presented on the Bore and Test Pit Report sheets attached in Appendix A, using classification and descriptive terms defined in the accompanying notes.

4.2 Stratigraphy

In summary, the strata encountered at the test locations to approximately 3m to 6m depth, comprised the following:

1. A surface layer of either concrete slabs or asphalt covered 'roadbase' and 'deco' pavements, with the exception of the bare-earth area within the western part of the site which was covered by concrete rubble (from previous wharf demolition works) and sands.

2. 'Obvious' fill comprising predominantly a mixture of sand, gravel, clay, silt and weathered rockfill with traces of charcoal and ash in places. The base of the 'obvious' fill was encountered at approximately RL0.5m to RL2.0m at test locations carried out in the northern part of the site and in the southern part of the site (adjacent to the Brisbane River), and between RL2.0m and RL3.0m at test locations over the balance of the site.

3. The 'obvious' fill was underlain by predominantly brown, dry to moist sands containing traces of silty clay nodules and shells in places. The consistency of this strata indicated either possibly dredge-placed fill or natural alluvial soils. The base level of this strata was difficult to determine, as these materials are similar in appearance and consistency to the underlying 'obvious' natural sand strata. At the test locations, it was broadly estimated that the base of the (possible fill/possible natural) sand strata was between approximately RL0.0m to RL0.5m at test locations in the northern and central southern parts of the site, and between approximately RL1.3m and RL2.3m at test locations across the balance of the site.

4. The 'obvious' natural soils encountered at the test locations comprised predominantly sands with 'pockets' of clayey sands, and bands of silty clay and shells in places.

For the depths sampled, no hydrogen sulphide (H_2S) odours were detected, and the sands underlying the site appeared free of organic matter.

4.3 Groundwater

A summary of groundwater depth/levels (where encountered during drilling/excavation) at test locations is given in Table 1. No results are included for test locations where free water was not encountered during drilling/excavation, nor where groundwater could not be observed due to the drilling process.

Table 1: Groundwater Depth/RL Observations

Test Location	Groundwater	
	Depth(m)	RL(m)
Bore 5	3.1	RL-0.2
Bore 6	2.6	RL0.4
Bore 7	3.1	RL0.1
Bore 9	3.0	RL0.2
Bore 12	3.5	RL-0.2
Bore 14	3.0	RL0.5
Bore 16	3.0	RL0.2
Bore 19	3.0	RL0.1
Bore 26	1.0	RL1.3
Bore 27	1.5	RL-0.2
Bore 31	3.0	RL0.4
Bore 32	2.6	RL0.3
Bore B25	3.0	RL0.0
Test Pit 1	2.2	RL0.0
Test Pit 2	1.3	RL0.0
Test Pit 3	1.4	RL-0.2
Test Pit 4	3.5	RL0.2
Test Pit 8	3.0	RL0.3
Test Pit 10	3.3	RL0.1
Test Pit 17	3.0	RL0.3
Test Pit 18	3.0	RL0.8

4.4 Laboratory Testing

4.4.1 Field pH Screening Tests

Field screening tests were undertaken on representative disturbed soil samples recovered from the bores in the depth interval of the second level basement option. Each screening test comprised two small sub-samples of soil, one mixed with approximately 10mL of deionised water and the other mixed with approximately 10mL of hydrogen peroxide (H_2O_2), buffered to a pH between 4.5 to 5.5 with sodium hydroxide.

The pH of the sub-samples was measured with a calibrated pH meter. The pH of the deionised water/soil 'slurry' (pH_F) was measured after 2 to 5 minutes, whilst the pH of the hydrogen peroxide/soil 'slurry' (pH_{FOX}) was measured after approximately 1 to 2 hours, or when reaction with the peroxide had visibly ceased. The results of the screening tests are tabulated in Appendix B.

In using the pH screening tests to identify a potential or actual ASS, a combination of three factors[1] are considered:

Trigger (a) The strength of the reaction with peroxide is a useful indicator but cannot be used alone. Organic matter and other soil constituents such as manganese oxides can also cause a reaction.

Trigger (b) A pH_{FOX} value at least one unit below pH_F may indicate a PASS. The greater the difference between the two measurements, the more indicative the value is of a PASS. The lower the final pH_{FOX} value is, the better the indication of a positive result.

Trigger (c) If the pH_{FOX} <3, and the other two conditions apply, then it strongly indicates a PASS. The more the pH_{FOX} drops below 3, the more positive the presence of sulfides.

An indication of which of the above factors (if any), were 'triggered' in each of the field pH screening tests undertaken, is given in the tabulated results attached in Appendix B.

4.4.2 POCAS Tests

Based on the field pH screening tests, seven samples were selected and submitted for POCAS analyses. The samples were refrigerated and then transported to Australian Laboratory Services Pty Ltd (ALS) under standard chain of custody protocol. ALS is registered with the National Association of Testing Authorities (NATA) for the relevant testing. A summary of the reported results are presented in Table 2.

Table 2: Summary of POCAS Results

Test Locations	Depth (m)	Material	pH_{KCL}	pH_{Ox}	Oxidisable Sulfur -S_{POS} (%)	Calcium (%)	Total Potential Acidity	Total Sulfidic Acidity	Total Actual Acidity
							(Mol H^+/Tonne)		
Bore 14	5.5-6.0	Sand (SSL)	-	2.8	-	-	37	-	-
Bore 15	4.0	Clayey Sand	6.3	3.8	0.02	<0.02	<2	<2	<2
Bore 19	5.5-6.0	Sand (SCL)	7.1	3.6	0.33	0.12	6	6	<2
Bore 27	4.5-5.0	Sand	-	3.9	-	-	17	-	-
	5.5-6.0	Sand & Gravel (SGL)	7.0	3.1	0.20	0.08	39	39	<2
Bore 30	3.0-3.45	Sand (SCL)	6.9	5.1	0.22	0.21	<2	<2	<2
	3.45-4.0	Clayey sand & Clayey silt	-	2.6	-	-	158	-	-
	4.5-5.0	Clayey sand & Clayey silt	6.4	3.0	0.13	0.02	25	25	<2
Test Pit 9	3.1	Sand	5.9	4.4	0.02	<0.02	<2	<2	<2
Test Pit 13	2.6	Clay	7.4	6.6	0.32	0.16	<2	<2	<2

NOTE: SGL – Sand and gravel with silty/clay lenses, SCL – Sand with silt/clay lenses, SSL – Sand with sandy silt lenses

[1] Ahern C.R., Ahern M.R., Powell B. 'Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland 1988'

Samples were submitted for Chromium Suite analyses to confirm the results of the screening tests, and the previous POCAS testing and to provide quantitative data on ASS (if/where present). Samples were transported to ALS for analyses under standard chain of custody protocol. A summary of results is given in Table 3.

Table 3: Summary of Chromium Suite Laboratory Test Results

Bore	Depth (m)	Material	pH_{KCL}	Titratable Actual Acidity % Pyrite S	Chromium Reducible Sulfur – (S_{CR}) %S	Acid Neutralising Capacity % Pyrite S	Net Acidity %S	Liming Rate (kg/t)
BPB-13	3.0-3.25	Fill – Sand/Clay	5.9	<0.02	**0.14**	-	**0.14**	7
	4.5-4.75	Fill - Sand	6.6	<0.02	<0.02	0.14	<0.02	-
B24	2.25-2.4	Fill - Sand	7.3	<0.02	0.02	0.17	<0.02	-
B25	1.2-1.5	Fill - Sand	6.5	<0.02	<0.02	0.22	<0.02	-
	2.6-2.75	Fill - Sand	6.7	<0.02	<0.02	0.14	<0.02	-
	5.5-5.8	Fill - Sand	7.2	<0.02	0.03	0.1	<0.02	-
B26	0.75-1.0	Fill - Sand	7.3	<0.02	<0.02	0.19	<0.02	-
	3.25-3.5	Fill - Sand	6.5	<0.02	<0.02	0.14	<0.02	-
	4.75-5.0	Fill - Sand	6.8	<0.02	0.03	0.22	<0.02	-
B27	1.0-1.25	Fill - Sand	7.6	<0.02	<0.02	0.12	<0.02	-
	3.0-3.25	Fill - Sand	7.0	<0.02	<0.02	0.15	<0.02	-
	5.75-6.0	Fill - Sand	8.7	<0.02	<0.02	0.13	<0.02	-

Notes: Results in **Bold** exceed the QASSIT Action Criteria for disturbance of >1000 tonnes of soil (Section 5.1)

SECTION 5 - COMMENTS AND DISCUSSION

5.1 Acid Sulfate Soil Assessment Criteria

ASS in Queensland are assessed in accordance with the Queensland Acid Sulfate Soils Investigation Team (QASSIT) *Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland 1998* (QASSIT Guidelines) and the State Planning Policy 2/02 Guideline *Planning and Managing Development Involving Acid Sulfate Soils*. The State Planning Policy 2/02 Guideline provides Action Criteria for assessing the results of laboratory testing quantifying the acid producing effects based on the sum of existing plus potential acidity. These action criteria are presented in Table 4.

Table 4: Action Criteria based on ASS Analysis for Three Broad Texture Categories

Type of Material		Action Criteria (1 – 1000 tonnes disturbed)		Action Criteria (> 1000 tonnes disturbed)	
		Existing + Potential Acidity		Existing + Potential Acidity	
Texture Range	Approx. Clay Content (%)	Equivalent Sulfur %S	Equivalent Acidity Mol H^+/tonne	Equivalent Sulfur %S	Equivalent Acidity Mol H^+/tonne
Coarse Texture Sands to loamy sands	<5	0.03	18	0.03	18
Medium Texture Sandy loams to light clays	5-40	0.06	36	0.03	18
Fine Texture Medium to heavy clays, silty clays	>40	0.1	62	0.03	18

It has been assumed that the volume of natural soil to be disturbed during site development works will exceed 1,000 tonnes and the *'> than 1,000 tonnes disturbed Action Criteria'* from Table 4 has therefore been used as the basis for assessment of the disturbed soils.

5.2 Proposed Excavations

It is understood that bulk excavation will be undertaken to form a basement level at RL0.6m, with localised deeper zones of potential disturbance (for footing excavations, underslab drainage and other services).

5.3 Discussion of Results

In broad summary, whilst the soils encountered at the test locations did not show any visible/obvious signs of being ASS or PASS (i.e. no hydrogen sulphides and free of organic matter), the results of the field pH screening tests did indicate that some of the materials were potentially ASS or PASS.

The results of the POCAS and Chromium Suite analyses indicate levels of oxidisable sulfur and potential acidity above the QASSIT Action Criteria for the sandy material tested that contained silt/clay. These materials have the potential to generate appreciable levels of acidity if allowed to oxidise. Some inherent neutralising capacity appears to be present within the samples tested however, past experience indicates that it would be prudent not to rely on this neutralising capacity. As such, application of a neutralising agent will be required to ensure that the potential acidity of any disturbed natural silt and clay soils is adequately treated.

5.4 Acid Sulfate Soil Management

The dark grey silt/clay soils can be classified as ASS and therefore require treatment and management. All of the test locations carried out across the site encountered interbedded layers of silt and clay in the sandy strata. Management for ASS will be required where excavations are undertaken in these materials including silt and clay lenses. Based on the anticipated works, the best method for management of ASS risk is to neutralise the acidity by adding lime to excavated materials, which is to be undertaken at an approved off-site ASS treatment facility, under that facilitie's ASSMP; no treatment is to be undertaken on-site at Portside Wharf.

A summary of the procedures required to manage the potential acidity of these soils during the proposed works is given below. The summary is provided for guidance only, and excavation at the site will need to be undertaken under an approved acid sulfate soil management plan (ASSMP). A proposed ASSMP for site earthworks is attached in Appendix D.

5.4.1 Confirmatory Testing

Since the levels of oxidisable sulfur in the silt and clay soils exceed the QASSIT criteria, additional laboratory (SPOCAS or Chromium Suite) analyses will be required to confirm the requirements and rates of treatment. The additional laboratory analyses can be undertaken prior to, or during, excavation works at the site at a minimum rate of one test per 300m^3 of natural clay soils excavated.

5.4.2 Liming

The liming rate for the natural clays encountered on the site to the depths sampled/tested will probably be variable however, based on the work completed to date, the POCAS testing indicates a maximum required liming rate of 20kg of fine ag-lime per dry tonne of soil. The liming rate has been based on a factor of safety of 1.5 and a neutralising value of 80% for the ag-lime used. Additional confirmatory SPOCAS or Chromium Suite testing (discussed in Section 5.4.1above) prior to, or during construction, may result in some variation to this liming rate being required.

Bases of excavations in materials identified as ASS will also require treatment, at a minimum rate of 5kg per square metre, spread evenly over the surface of exposed ASS.

5.4.3 Disposal of Ponded Runoff Water

If, during construction, water collected within the work areas is required to be discharged (say in excess of $5m^3$), then this water should be tested for at least pH, turbidity and dissolved oxygen before discharge. If the pH is below 6.5, add small amounts of dissolved slaked lime (calcium hydroxide) or a slurry of hydrated lime to raise pH quickly. Discharge pH should be in the range 6.5 to 8.5. It is recommended that if personnel are inexperienced with handling and use of slaked lime/hydrated lime solutions (which are caustic) they should seek professional advice.

Laboratory analysis for the following parameters should also be performed (as per the State Planning Policy 2/02 *'Planning and Managing Development involving Acid Sulfate Soils'*) if the pH <6.5.

- Bicarbonate
- Calcium
- Carbonate
- Chloride
- Colour
- Dissolved magnesium
- Filtered aluminium
- Magnesium
- Sulfate
- Total and dissolved iron

Turbid waters must not be pumped off site. If water requiring discharge from site exceeds 20NTU then a flocculant will need to be added to reduce the turbidity below 20NTU.

If the volume of water to be discharged from site is greater than $10m^3$, then the dissolved oxygen content should also be checked prior to discharge. If it is less than 80% saturation, then the spraying of the pumped water into the air to oxygenate the water is recommended prior to discharge off-site.

Depending on rainfall, it may be advisable to excavate a (temporary) holding pond for collection of site run-off during excavation and earthworks. The pH of the water within the holding pond should be checked frequently, and not allowed to fall below 6.5pH units. Once excavations are finished, the water should be checked for the above parameters, treated if necessary, and then discharged.

5.4.4 On-Site Monitoring

It is suggested that on-site liming be monitored, and that sampling and testing be undertaken, in order to:

- assess the effectiveness of treatment (mixing of lime) of acid soils;
- confirm that the appropriate liming rates are applied; and
- confirm that the run-off from the work areas is within the recommended discharge requirements.

5.4.5 Construction

As the soils which require treatment for ASS are those that comprise (or contain bands of) silts and clays, it will be necessary to control site excavation works so that these soils are not mixed with non-ASS materials, otherwise the volumes of soil requiring treatment for ASS will substantially increase.

5.4.6 Groundwater Drawdown

Based on the results of groundwater level monitoring and groundwater modelling, it is considered that bulk excavation to RL0.6m will have no affect on the 'average' groundwater levels at the site.

5.5 Conclusions

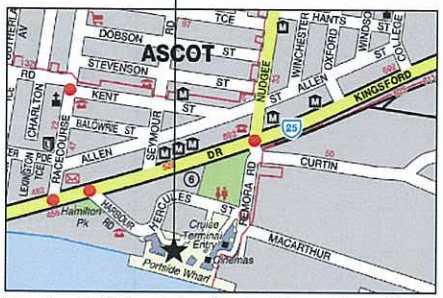
The results of this investigation for soils to RL0.6m indicate that:

- the natural silt and clay materials encountered at the test locations are ASS;
- excavated natural silts/clays (or sands containing lenses/layers of these soils) will need to be treated to neutralise potential acidity;
- natural sands not mixed with silts/clays do not require treatment;
- confirmatory and validation testing will be required during construction;
- care will be required during excavation to avoid mixing ASS with non-ASS;
- excavation of the natural silt and clay material should be undertaken under an ASSMP; and
- the proposed bulk excavation level will not effect 'average' site groundwater levels.

BUTLER PARTNERS PTY LTD

BRUCE BUTLER
Principal

SITE



LEGEND

- 1 Test Pit
- 5 Bore
- Approximate Extent of Proposed Basement
- Site Boundary

Reference: PMM's 'Wharf Column and Slab Location and Levels', Drawing No.6121-03, dated 24.01.2002

CLIENT:
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ACID SULFATE SOIL INVESTIGATION
PORTSIDE WHARF - STAGE 2
BUILDINGS 2, 4 & 5
HARBOUR ROAD, HAMILTON

LOCALITY PLAN AND TEST LOCATIONS

NORTH

0 10 20 30 40 50m

SCALE: 1:1250 (A3)

DATE: MARCH 2008

DRAWN BY: FD

APPROVED:

PROJECT No: 03900

DRAWING No: 1 REV: C

APPENDIX A

BORE REPORTS WITH EXPLANATORY NOTES

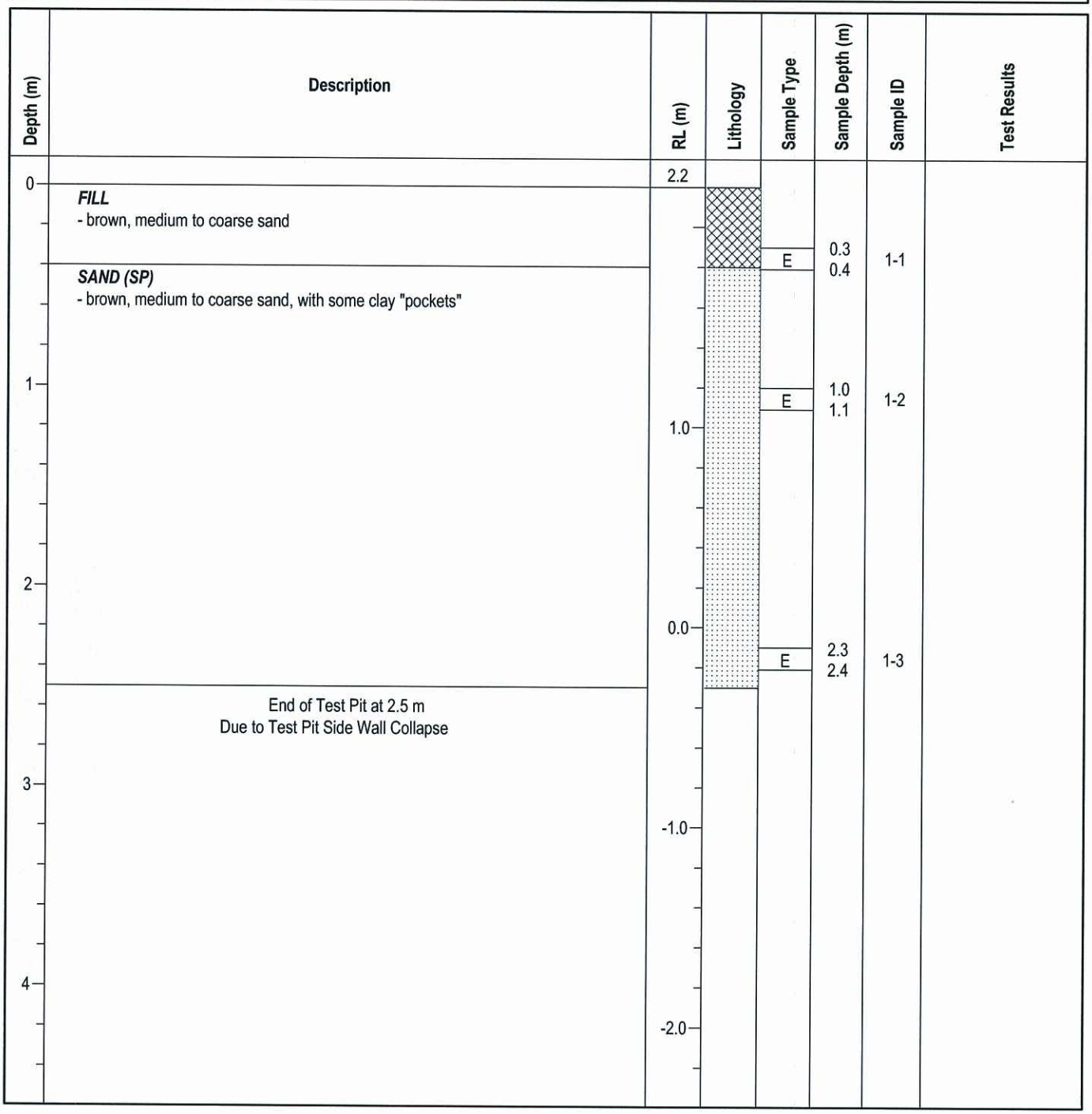
TEST PIT REPORT

BUTLER PARTNERS

Client: Multiplex Portside Wharf (Qld) Pty Ltd
Project: Portside Wharf - The Brisbane Cruise Terminal
Location: Harbour Road, Hamilton
Project No: 03900 / 03900A

TEST PIT 1

Page No: 1 of 1
Date: 15 May, 2003
Ground Surface Level: RL 2.2m*



D Disturbed Sample
U Undisturbed Tube (50mm diameter)
B Bulk Sample
pp Pocket Penetrometer Test (kPa)
E Environmental Sample
Is(50) Point Load Test Result (MPa)

Rig: Caterpillar 330B Excavator
Bucket Size: 1000mm
Groundwater: Measured at 2.2m depth during excavation
Remarks: * Interpolated from Pike Mirls McKnoulty "Contour & Detail Survey", Drawing Nos. 6121-04-01B,02B,03B,04B

TEST PIT REPORT

BUTLER PARTNERS

Client: Multiplex Portside Wharf (Qld) Pty Ltd
Project: Portside Wharf - The Brisbane Cruise Terminal
Location: Harbour Road, Hamilton
Project No: 03900 / 03900A

TEST PIT 2

Page No: 1 of 1
Date: 15 May, 2003
Ground Surface Level: RL 1.3m*

Depth (m)	Description	RL (m)	Lithology	Sample Type	Sample Depth (m)	Sample ID	Test Results
0		1.3					
	FILL - brown and black, medium to coarse sand	1.0		E	0.3 0.4	2-1	
1	***SAND (SP)*** - brown, fine to coarse sand, with clay	0.0		E	0.8 0.9	2-2	
				E	1.5 1.6	2-3	
2	End of Test Pit at 1.7 m Due to Test Pit Side Wall Collapse	-1.0					
3		-2.0					
4		-3.0					

D Disturbed Sample
U Undisturbed Tube (50mm diameter)
B Bulk Sample
pp Pocket Penetrometer Test (kPa)
E Environmental Sample
Is(50) Point Load Test Result (MPa)

Rig: Caterpillar 330B Excavator
Bucket Size: 1000mm
Groundwater: Measured at 1.3m depth during excavation
Remarks: * Interpolated from Pike Mirls McKnoulty "Contour & Detail Survey", Drawing Nos. 6121-04-01B,02B,03B,04B

TEST PIT REPORT

BUTLER PARTNERS

Client: Multiplex Portside Wharf (Qld) Pty Ltd
Project: Portside Wharf - The Brisbane Cruise Terminal
Location: Harbour Road, Hamilton
Project No: 03900 / 03900A

TEST PIT 3

Page No: 1 of 1
Date: 15 May, 2003
Ground Surface Level: RL 1.2m*

Depth (m)	Description	RL (m)	Lithology	Sample Type	Sample Depth (m)	Sample ID	Test Results
0		1.2					
	CONCRETE						
	FILL - brown, fine to medium sand			E	0.4 0.5	3-1	
1	***SAND (SW)*** - brown, fine to coarse sand, with clay	0.0		E	0.9 1.0	3-2	
	SAND (SP) - grey-brown, fine to medium sand, with clay, wet			E	1.4 1.5	3-3	
2	End of Test Pit at 1.8 m Due to Test Pit Side Wall Collapse	-1.0					
3		-2.0					
4		-3.0					

D Disturbed Sample
U Undisturbed Tube (50mm diameter)
B Bulk Sample
pp Pocket Penetrometer Test (kPa)
E Environmental Sample
Is(50) Point Load Test Result (MPa)

Rig: Caterpillar 330B Excavator
Bucket Size: 1000mm
Groundwater: Measured at 1.4m depth during excavation
Remarks: * Interpolated from Pike Mirls McKnoulty "Contour & Detail Survey", Drawing Nos. 6121-04-01B,02B,03B,04B

TEST PIT REPORT

BUTLER PARTNERS

Client: Multiplex Portside Wharf (Qld) Pty Ltd
Project: Portside Wharf - The Brisbane Cruise Terminal
Location: Harbour Road, Hamilton
Project No: 03900 / 03900A

TEST PIT 4

Page No: 1 of 1
Date: 15 May, 2003
Ground Surface Level: RL 3.7m*

Depth (m)	Description	RL (m)	Lithology	Sample Type	Sample Depth (m)	Sample ID	Test Results
0	***CONCRETE***	3.7					
	FOAM						
	CONCRETE			E	0.6 0.7	4-1	
	FILL	3.0					
	- brown, medium to coarse sand, with fine gravel, dry						
1	- brown, fine to coarse sand, with pockets of silt and gravel, dry			E	1.0 1.1	4-2	
				E	1.5 1.6	4-3	
	- pale brown, fine to medium sand, trace of shells, dry	2.0					
2							
				E	2.4 2.5	4-4	
		1.0					
3							
	SAND (SP)						
	- grey, fine to medium sand, with silt, wet			E	3.5 3.6	4-5	
	End of Test Pit at 3.6 m	0.0					
	Due to Test Pit Side Wall Collapse						
4							

D Disturbed Sample
U Undisturbed Tube (50mm diameter)
B Bulk Sample
pp Pocket Penetrometer Test (kPa)
E Environmental Sample
Is(50) Point Load Test Result (MPa)

Rig: Caterpillar 330B Excavator
Bucket Size: 1000mm
Groundwater: Observed at approximately 3.5m depth during excavation
Remarks: * Interpolated from Pike Mirls McKnoulty "Contour & Detail Survey", Drawing Nos. 6121-04-01B,02B,03B,04B

BORE REPORT

BUTLER PARTNERS

Client: Multiplex Portside Wharf (Qld) Pty Ltd
Project: Portside Wharf - The Brisbane Cruise Terminal
Location: Harbour Road, Hamilton
Project No: 03900 / 03900A

BORE 5

Page No: 1 of 1
Date: 15 May, 2003
Ground Surface Level: RL 2.9m*

Depth (m)	Description	RL (m)	Sample Type	Sample Depth (m)	Sample ID	Test Results
0		2.9				
	FILL - asphalt seal over light brown, gravelly sand, fine to coarse sand, fine gravel, moist ("roadbase")		E	0.1 0.2	5-1	
	- gravel and cobbles		E	0.4 0.5	5-2	
	- light brown, sandy gravel, fine gravel and fine to coarse sand, trace of shells, wet		E		5-3	
1		2.0		1.0		11,12,9
			S			N=21
				1.45		
	SAND (SW) - medium dense, light brown, fine to coarse sand, with silt and fine gravel, moist			1.5		
2		1.0	E		5-4	
			D	2.0		
	SAND (SW) - medium dense, light brown, medium to coarse sand, wet			2.5		
			E		5-5	
3		0.0		3.0		5,9,11
			S			N=20
				3.45		
4		-1.0				
	End of Bore at 4 m					

D Disturbed Sample
B Bulk Sample
U Undisturbed Tube (50mm diameter)
pp Pocket Penetrometer Test (kPa)

E Environmental Sample
S Standard Penetrometer Test (SPT)
SPT Hammer Bouncing
( ) No Sample Recovery

C NMLC Coring
Is(50) Point Load Test Result (MPa)
(d) Diametral Point Load Strength Test
(a) Axial Point Load Strength Test

Rig: Gemco HS7
Drilling Method: Auger
Groundwater: Observed at approximately 3.1m depth during drilling
Remarks: * Interpolated from Pike Mirls McKnoulty "Contour & Detail Survey", Drawing Nos. 6121-04-01B,02B,03B,04B

BORE REPORT

BUTLER PARTNERS

Client: Multiplex Portside Wharf (Qld) Pty Ltd
Project: Portside Wharf - The Brisbane Cruise Terminal
Location: Harbour Road, Hamilton
Project No: 03900 / 03900A

BORE 6

Page No: 1 of 1
Date: 14 May, 2003
Ground Surface Level: RL 3.0m*

Depth (m)	Description	RL (m)	Lithology	Sample Type	Sample Depth (m)	Sample ID	Test Results
0		3.0					
	FILL - asphalt seal over light brown, sandy fine to medium gravel, dry ("roadbase")				0.25		
	- brown, silty sand and fine to coarse gravel, trace of cobbles, dry			E		6-1	
					0.5		
	- light brown, medium to coarse sand, with silt, dry (Possible Natural)				0.6		
				E		6-2	
1		2.0			1.0		12,14,12
				S			N=26
					1.45		
	SAND (SP) - medium dense, light brown, medium to coarse sand, with clay nodules in places, dry to moist				1.5		
				E		6-3	
2		1.0			2.0		
				D			
	- becoming grey, wet				2.5		
				E		6-4	
3		0.0			3.0		4,7,6
				S			N=13
					3.45		
4		-1.0					
	End of Bore at 4 m						

D Disturbed Sample
B Bulk Sample
U Undisturbed Tube (50mm diameter)
pp Pocket Penetrometer Test (kPa)
E Environmental Sample
S Standard Penetrometer Test (SPT)
SPT Hammer Bouncing
( ) No Sample Recovery
C NMLC Coring
Is(50) Point Load Test Result (MPa)
(d) Diametral Point Load Strength Test
(a) Axial Point Load Strength Test

Rig: Gemco HS7
Drilling Method: Auger
Groundwater: Measured at 2.6m depth during drilling
Remarks: * Interpolated from Pike Mirls McKnoulty "Contour & Detail Survey", Drawing Nos. 6121-04-01B,02B,03B,04B

BORE REPORT

BUTLER PARTNERS

Client: Multiplex Portside Wharf (Qld) Pty Ltd
Project: Portside Wharf - The Brisbane Cruise Terminal
Location: Harbour Road, Hamilton
Project No: 03900 / 03900A

BORE 7

Page No: 1 of 1
Date: 14 May, 2003
Ground Surface Level: RL 3.2m*

Depth (m)	Description	RL (m)	Sample Type	Sample Depth (m)	Sample ID	Test Results
0		3.2				
	FILL - asphalt seal over light brown, sandy fine to medium gravel, dry ("roadbase")		E	0.04	7-1	
				0.2		
	- brown, fine to coarse sand, with fine gravel, dry ("deco")		E		7-2	
	- brown, coarse sand and fine gravel, with shell finds, dry			0.5		
			E		7-3	
1				1.0		10,11,11
	- medium to coarse sand, with fine gravel and fine shell fragments, dry	2.0	S			N=22
				1.45		
	SAND (SP) - medium dense, medium to coarse sand, with fine gravel, moist (Possible Fill)			1.5		
			E		7-4	
2		1.0		2.0		
				2.5		
			E		7-5	
3				3.0		7,7,7
		0.0	S			N=14
	SAND (SP) - medium dense, grey, medium to coarse sand, with clay, wet			3.45		
				3.5		
			D			
4	End of Bore at 4 m			4.0		
		-1.0				

D Disturbed Sample
B Bulk Sample
U Undisturbed Tube (50mm diameter)
pp Pocket Penetrometer Test (kPa)
E Environmental Sample
S Standard Penetrometer Test (SPT)
SPT Hammer Bouncing
( ) No Sample Recovery
C NMLC Coring
Is(50) Point Load Test Result (MPa)
(d) Diametral Point Load Strength Test
(a) Axial Point Load Strength Test

Rig: Gemco HS7
Drilling Method: Auger
Groundwater: Measured at 3.1m depth during drilling
Remarks: * Interpolated from Pike Mirls McKnoulty "Contour & Detail Survey", Drawing Nos. 6121-04-01B,02B,03B,04B

TEST PIT REPORT

BUTLER PARTNERS

Client: Multiplex Portside Wharf (Qld) Pty Ltd
Project: Portside Wharf - The Brisbane Cruise Terminal
Location: Harbour Road, Hamilton
Project No: 03900 / 03900A

TEST PIT 8

Page No: 1 of 1
Date: 15 May, 2003
Ground Surface Level: RL 3.3m*

Depth (m)	Description	RL (m)	Lithology	Sample Type	Sample Depth (m)	Sample ID	Test Results
0		3.3					
	CONCRETE						
	FILL						
	- grey and pale brown, sandy gravel (crushed rockfill)	3.0					
	- orange-brown, gravelly clayey sand ("deco")			E	0.4 0.5	8-1	
	- brown, fine to coarse sand, with shells						
1				E	0.9 1.0	8-2	
		2.0					
	- shells and brown, fine to coarse sand						
	SAND (SP)						
2	- brown, fine to coarse sand			E	1.9 2.0	8-3	
		1.0					
3				E	2.9 3.0	8-4	
		0.0					
	End of Test Pit at 3.3 m Due to Test Pit Side Wall Collapse						
4		-1.0					

D Disturbed Sample
U Undisturbed Tube (50mm diameter)
B Bulk Sample
pp Pocket Penetrometer Test (kPa)
E Environmental Sample
Is(50) Point Load Test Result (MPa)

Rig: Caterpillar 330B Excavator
Bucket Size: 1000mm
Groundwater: Observed at approximately 3.0m depth during excavation
Remarks: * Interpolated from Pike Mirls McKnoulty "Contour & Detail Survey", Drawing Nos. 6121-04-01B,02B,03B,04B

BORE REPORT

BUTLER PARTNERS

Client: Multiplex Portside Wharf (Qld) Pty Ltd
Project: Portside Wharf - The Brisbane Cruise Terminal
Location: Harbour Road, Hamilton
Project No: 03900 / 03900A

BORE 9

Page No: 1 of 1
Date: 15 May, 2003
Ground Surface Level: RL 3.2m*

Depth (m)	Description	RL (m)	Lithology	Sample Type	Sample Depth (m)	Sample ID	Test Results
0		3.2					
	FILL - asphalt seal over light brown, sandy fine to medium gravel, with coarse gravel, dry ("roadbase")			E	0.25	9-1	
	- orange-light brown, gravelly fine to coarse sand, dry ("deco")				0.5		
	- brown-grey, gravelly clayey sand, fine to coarse gravel, fine to coarse sand, dry			E	0.6	9-2	
					0.9		
1	- grey and brown, silty, fine to coarse sand and fine to coarse gravel, dry				1.0	9-3	10,16,10
	- dark grey, fine to coarse grained sandy clay, moist	2.0		S,E	1.1	9-4	N=26
	- grey, red, green and brown, mixture of sand, clay and fine to coarse gravel, dry				1.3		
					1.45		
	- grey and brown, clayey fine to coarse sand, with fine to medium gravel, dry				1.5		
				E		9-5	
2					2.0		
	- cobble/boulder rockfill and dark grey silty clay with shells (Drilling Refusal at 1.4-2.2m on 4 attempts)	1.0					
	- grey, fine to coarse sand, with gravel			E	2.3	9-6	
					2.4		
					2.8		
				E	2.9	9-7	
3	***SAND (SP)***				3.1		
	- grey, fine to coarse sand, wet	0.0		E	3.2	9-8	
	End of Bore at 3.3 m Caving of Excavation Side Walls						
4		-1.0					

D Disturbed Sample
B Bulk Sample
U Undisturbed Tube (50mm diameter)
pp Pocket Penetrometer Test (kPa)

E Environmental Sample
S Standard Penetrometer Test (SPT)
SPT Hammer Bouncing
( ) No Sample Recovery

C NMLC Coring
Is(50) Point Load Test Result (MPa)
(d) Diametral Point Load Strength Test
(a) Axial Point Load Strength Test

Rig: Gemco HS7 (to 2.2m) then Caterpillar 330B excavator
Drilling Method: Auger (rig), 1000mm bucket (excavator)
Groundwater: Measured at 3.0m depth during excavation
Remarks: * Interpolated from Pike Mirls McKnoulty "Contour & Detail Survey", Drawing Nos. 6121-04-01B,02B,03B,04B

TEST PIT REPORT

BUTLER PARTNERS

Client: Multiplex Portside Wharf (Qld) Pty Ltd
Project: Portside Wharf - The Brisbane Cruise Terminal
Location: Harbour Road, Hamilton
Project No: 03900 / 03900A

TEST PIT 10

Page No: 1 of 1
Date: 15 May, 2003
Ground Surface Level: RL 3.4m*

Depth (m)	Description	RL (m)	Lithology	Sample Type	Sample Depth (m)	Sample ID	Test Results
0	***CONCRETE***	3.4					
	FILL - orange brown, clayey gravelly sand ("deco")	3.0		E	0.4 0.5	10-1	
1	- grey-brown, sandy gravelly clay, with cobbles, trace of asphalt			E	0.8 0.9	10-2	
	- brown, fine to coarse sand, with shells and cobbles			E	1.2 1.3	10-3	
2		2.0		E	1.9 2.0	10-4	
		1.0					
3	***SAND (SP)*** - grey, fine to medium sand, with pockets of clay	0.0		E	3.3 3.4	10-5	
	End of Test Pit at 3.5 m Due to Test Pit Side Wall Collapse						
4		-1.0					

D Disturbed Sample
U Undisturbed Tube (50mm diameter)
B Bulk Sample
pp Pocket Penetrometer Test (kPa)
E Environmental Sample
Is(50) Point Load Test Result (MPa)

Rig: Caterpillar 330B Excavator
Bucket Size: 1000mm
Groundwater: Measured at 3.3m depth during excavation
Remarks: * Interpolated from Pike Mirls McKnoulty "Contour & Detail Survey", Drawing Nos. 6121-04-01B,02B,03B,04B

BORE REPORT

BUTLER PARTNERS

Client: Multiplex Portside Wharf (Qld) Pty Ltd
Project: Portside Wharf - The Brisbane Cruise Terminal
Location: Harbour Road, Hamilton
Project No: 03900

BORE 30

Date: 13-18 June 2003
Ground Surface Level: RL 3.4m*

Depth (m)	Description	RL (m)	Lithology	Sample/Test Type	Sample/Test Depth (m)	Test Results
		-15.0		S	18.0	5,6,8 N=14
19	***SAND (SP)*** - medium dense, grey, medium to coarse sand, with fine gravel and trace of medium to coarse gravel, interbedded with soft, dark grey clayey silt bands/lenses, with shells	-16.0			18.45	
20		-17.0				
21		-18.0		S	21.0	9,7,4 N=11
22	***CLAYEY SILT (MH)*** - stiff, dark grey, with medium to coarse sand and shells	-19.0			21.45	
23	***SAND (SP)*** - medium dense, grey, medium to coarse sand	-20.0				
24	***CLAYEY SILT (MH)*** - firm, dark grey, trace of shells	-21.0		S	24.0	0,2,2 N=4 pp=70-110
25	***SAND (SP) AND GRAVEL (GP)*** - loose to medium dense, grey, medium to coarse sand and fine to medium gravel, with coarse gravel	-22.0			24.45	
26		-23.0				
27	***SAND (SP)*** - loose, grey, medium to coarse sand					

D	Disturbed Sample	E	Environmental Sample	C	NMLC Coring
B	Bulk Sample	S	Standard Penetrometer Test (SPT)	Is(50)	Point Load Test Result (MPa)
U	Undisturbed Tube (50mm diameter)	HB	SPT Hammer Bouncing	(d)	Diametral Point Load Strength Test
pp	Pocket Penetrometer Test (kPa)	( )	No Sample Recovery	(a)	Axial Point Load Strength Test

Rig: Jacro 350
Drilling Method: Auger to 0.8m (auger refusal), then wash bore with mud circulation
Groundwater: No free groundwater encountered during drilling
Remarks: * Interpolated from PMM Contour and Detail Survey, Drawing Nos. 6121-04-01B,02B,03B,04B. Groundwater monitoring bore installed

BORE REPORT

BUTLER PARTNERS

BORE 30

Client: Multiplex Portside Wharf (Qld) Pty Ltd
Project: Portside Wharf - The Brisbane Cruise Terminal
Location: Harbour Road, Hamilton
Project No: 03900

Page No: 4 of 4
Date: 13-18 June 2003
Ground Surface Level: RL 3.4m*

Depth (m)	Description	RL (m)	Lithology	Sample/Test Type	Sample/Test Depth (m)	Test Results
28	***CLAYEY GRAVEL (GC)*** - dense, grey, fine to coarse gravel, with firm, dark grey silty clay lenses	-24.0		S	27.0 27.45	2,21,15 N=36
29	***GRAVEL (GW)*** - dense, grey and brown - with cobbles	-25.0 -26.0				
30	End of Bore at 30 m Due to Significant Bore Sidewall Collapse in Gravels/Cobbles	-27.0				
31		-28.0				
32		-29.0				
33		-30.0				
34		-31.0				
35		-32.0				
36						

D	Disturbed Sample	E	Environmental Sample	C	NMLC Coring
B	Bulk Sample	S	Standard Penetrometer Test (SPT)	Is(50)	Point Load Test Result (MPa)
U	Undisturbed Tube (50mm diameter)	HB	SPT Hammer Bouncing	(d)	Diametral Point Load Strength Test
pp	Pocket Penetrometer Test (kPa)	( )	No Sample Recovery	(a)	Axial Point Load Strength Test

Rig: Jacro 350
Drilling Method: Auger to 0.8m (auger refusal), then wash bore with mud circulation
Groundwater: No free groundwater encountered during drilling
Remarks: * Interpolated from PMM Contour and Detail Survey, Drawing Nos. 6121-04-01B,02B,03B,04B. Groundwater monitoring bore installed

BORE REPORT

BUTLER PARTNERS

Client: Multiplex Portside Wharf (Qld) Pty Ltd

Project: Portside Wharf - The Brisbane Cruise Terminal

Location: Harbour Road, Hamilton

Project No: 03900

BORE 31

Page No: 1 of 4

Date: 4 and 5 June 2003

Ground Surface Level: RL 3.4m*

Depth (m)	Description	RL (m)	Lithology	Structures	Average Number of Defects/m	Sample Type	Sample Depth (m)	Is(50) (MPa)	Core Recovery	Test Results
0		3.4								
	FILL - asphalt slab over light orange-brown, gravelly, fine to coarse sand, "deco", moist									
1	- brown, clay, fine to coarse sand and fine to coarse gravel, with cobbles, moist									
	- grey, with cobbles and boulders/high strength rock fragments	2.0								
2	***SAND (SW)*** - medium dense, grey-brown, fine to coarse sand, with silt/clay nodules and shells	1.0								
3		0.0				S	3.0 3.45			4,6,5 N=11
4	***SAND (SP)*** - loose, grey, medium to coarse sand, with fine gravel, interbedded with soft, dark grey silt/clay bands up to 200mm thick, trace of shells	-1.0								
5		-2.0								
6		-3.0				S	6.0 6.45			1,1,6 N=7
7		-4.0								
8	***SILTY CLAYEY SAND (SM/SC)*** - loose, grey, medium to coarse sand, with fine gravel and soft clayey silt bands, medium gravel in places	-5.0								
9										

D	Disturbed Sample	E	Environmental Sample	C	NMLC Coring
B	Bulk Sample	S	Standard Penetrometer Test (SPT)	Is(50)	Point Load Test Result (MPa)
U	Undisturbed Tube (50mm diameter)	HB	SPT Hammer Bouncing	(d)	Diametral Point Load Strength Test
pp	Pocket Penetrometer Test (kPa)	( )	No Sample Recovery	(a)	Axial Point Load Strength Test

Rig: Jacro 350

Drilling Method: Auger to 3.0m, wash bore with mud circulation to 26.25m, then NMLC

Groundwater: Free groundwater encountered at 3.0m during drilling

Remarks: * Interpolated from PMM Contour and Detail Surver, Drawing Nos. 6121-04-01B,02B,03B,04B

BORE REPORT

BUTLER PARTNERS

Client: Multiplex Portside Wharf (Qld) Pty Ltd

Project: Portside Wharf - The Brisbane Cruise Terminal

Location: Harbour Road, Hamilton

Project No: 03900

BORE 31

Page No: 2 of 4

Date: 4 and 5 June 2003

Ground Surface Level: RL 3.4m*

Depth (m)	Description	RL (m)	Lithology	Structures	Average Number of Defects/m	Sample Type	Sample Depth (m)	Is(50) (MPa)	Core Recovery	Test Results
10	***SILTY CLAYEY SAND (SM/SC)*** - loose, grey, medium to coarse sand, with fine gravel and soft clayey silt bands, medium gravel in places	-6.0				S	9.0			1,2,1 N=3
							9.45			
11		-7.0								
		-8.0								
12		-9.0				S	12.0			3,4,4 N=8
							12.45			
13	***CLAYEY SILT (MH)*** - firm, dark grey	-10.0								
	CLAYEY GRAVEL (GC)									
14	***CLAYEY SILT (MI)*** - stiff, brown, with fine to medium sand	-11.0								
15		-12.0				U	15.0			
							15.4			pp=170-260
16		-13.0								
17	- very stiff	-14.0								
18										

D	Disturbed Sample	E	Environmental Sample	C	NMLC Coring
B	Bulk Sample	S	Standard Penetrometer Test (SPT)	Is(50)	Point Load Test Result (MPa)
U	Undisturbed Tube (50mm diameter)	HB	SPT Hammer Bouncing	(d)	Diametral Point Load Strength Test
pp	Pocket Penetrometer Test (kPa)	( )	No Sample Recovery	(a)	Axial Point Load Strength Test

Rig: Jacro 350

Drilling Method: Auger to 3.0m, wash bore with mud circulation to 26.25m, then NMLC

Groundwater: Free groundwater encountered at 3.0m during drilling

Remarks: * Interpolated from PMM Contour and Detail Surver, Drawing Nos. 6121-04-01B,02B,03B,04B

BORE REPORT

BUTLER PARTNERS

Client: Multiplex Portside Wharf (Qld) Pty Ltd

Project: Portside Wharf - The Brisbane Cruise Terminal

Location: Harbour Road, Hamilton

Project No: 03900

BORE 31

Page No: 3 of 4

Date: 4 and 5 June 2003

Ground Surface Level: RL 3.4m*

Depth (m)	Description	RL (m)	Lithology	Structures	Average Number of Defects/m	Sample Type	Sample Depth (m)	Is(50) (MPa)	Core Recovery	Test Results
19	***CLAYEY SILT (MI)*** - very stiff, brown, with fine to medium sand	-15.0				S	18.0 18.45			5,8,10 N=18 pp=320-360
20	***SANDY CLAYEY SILT (MI)*** - stiff, brown, fine to medium sand	-16.0 -17.0								
21	***CLAYEY SILT (MH)*** - firm, dark grey					S	21.0 21.45			4,7,6 N=13
22		-18.0 -19.0								
23	***SANDY CLAY (CI)*** - very stiff, mottled grey and brown, fine to coarse sand	-20.0								
24						S	24.0 24.37			7,8,20/70mm (HB)
25	***SAND (SP) AND GRAVEL (GW)*** - dense, grey and brown, medium to coarse sand, fine to coarse gravel, with clay and cobbles	-21.0 -22.0								
26	***SANDSTONE (DW)*** - low strength, brown, medium to coarse grained	-23.0				C	26.25		100%	RQD=100%
27										

D	Disturbed Sample	E	Environmental Sample	C	NMLC Coring
B	Bulk Sample	S	Standard Penetrometer Test (SPT)	Is(50)	Point Load Test Result (MPa)
U	Undisturbed Tube (50mm diameter)	HB	SPT Hammer Bouncing	(d)	Diametral Point Load Strength Test
pp	Pocket Penetrometer Test (kPa)	( )	No Sample Recovery	(a)	Axial Point Load Strength Test

Rig: Jacro 350

Drilling Method: Auger to 3.0m, wash bore with mud circulation to 26.25m, then NMLC

Groundwater: Free groundwater encountered at 3.0m during drilling

Remarks: * Interpolated from PMM Contour and Detail Surver, Drawing Nos. 6121-04-01B,02B,03B,04B

BORE REPORT

BUTLER PARTNERS

Client: Multiplex Portside Wharf (Qld) Pty Ltd

Project: Portside Wharf - The Brisbane Cruise Terminal

Location: Harbour Road, Hamilton

Project No: 03900

BORE 31

Page No: 4 of 4

Date: 4 and 5 June 2003

Ground Surface Level: RL 3.4m*

Depth (m)	Description	RL (m)	Lithology	Structures	Average Number of Defects/m	Sample Type	Sample Depth (m)	Is(50) (MPa)	Core Recovery	Test Results
		-24.0			0.9		27.35			
28	***SANDSTONE (XW)*** - extremely low to very low strength, brown, fine to coarse grained, with clayey bands					C			25%	RQD=0%
							27.95			
	SANDSTONE (DW) - low strength, grey, fine to coarse grained	-25.0					28.25			
29						C			110%	RQD=90%
	SANDSTONE (XW) - extremely low to very low strength, grey, with low strength bands	-26.0				C	29.35		66%	RQD=0%
30					5	C	29.65		13%	RQD=0%
	SANDSTONE AND MUDSTONE (XW) - extremely low to very low strength, interbedded bands of light grey sandstone and dark brown mudstone, some coal bands	-27.0					30.05			
31						C			19%	RQD=0%
	End of Bore at 31.35 m	-28.0					31.35			
32		-29.0								
33										
		-30.0								
34										
		-31.0								
35										
		-32.0								
36										

D	Disturbed Sample	E	Environmental Sample	C	NMLC Coring
B	Bulk Sample	S	Standard Penetrometer Test (SPT)	Is(50)	Point Load Test Result (MPa)
U	Undisturbed Tube (50mm diameter)	HB	SPT Hammer Bouncing	(d)	Diametral Point Load Strength Test
pp	Pocket Penetrometer Test (kPa)	( )	No Sample Recovery	(a)	Axial Point Load Strength Test

Rig: Jacro 350

Drilling Method: Auger to 3.0m, wash bore with mud circulation to 26.25m, then NMLC

Groundwater: Free groundwater encountered at 3.0m during drilling

Remarks: * Interpolated from PMM Contour and Detail Surver, Drawing Nos. 6121-04-01B,02B,03B,04B

BORE REPORT

BUTLER PARTNERS

Client: Multiplex Portside Wharf (Qld) Pty Ltd

Project: Portside Wharf - The Brisbane Cruise Terminal

Location: Harbour Road, Hamilton

Project No: 03900

BORE 32

Page No: 1 of 4

Date: 30 May and 2 June 2003

Ground Surface Level: RL 2.9m*

Depth (m)	Description	RL (m)	Lithology	Structures	Average Number of Defects/m	Sample Type	Sample Depth (m)	Is(50) (MPa)	Core Recovery	Test Results
0		2.9								
	FILL - asphalt seal over light brown, cobbles, fine to coarse gravel and fine to coarse sand, dry to moist									
1	- brown, medium to coarse sand, with fine sand and fine gravel, dry	2.0								
2	***SAND (SW)*** - medium dense, brown, fine to coarse sand, moist (possible fill) - becoming wet	1.0								
		0.0				S	3.0			5,9,14 N=23
3							3.45			
4	***CLAYEY SILTY SAND (SM/SC)*** - loose, dark grey, fine to coarse sand, trace of shells	-1.0								
5		-2.0								
	CLAYEY SILT (MH) - soft, dark grey	-3.0								
6						U,D	6.0			
	SILTY SAND (SM) AND CLAYEY SILT (MH) - interbedded bands of loose, dark grey, fine to coarse sand and soft, dark grey, clayey silt, trace of organic matter						6.4			pp=30-40
7		-4.0								
	SAND (SP) AND GRAVEL (GP) - medium dense, grey and brown, medium to coarse sand and fine gravel, with dark grey silty/clayey zones	-5.0								
8										
		-6.0								
9										

D	Disturbed Sample	E	Environmental Sample	C	NMLC Coring
B	Bulk Sample	S	Standard Penetrometer Test (SPT)	Is(50)	Point Load Test Result (MPa)
U	Undisturbed Tube (50mm diameter)	HB	SPT Hammer Bouncing	(d)	Diametral Point Load Strength Test
pp	Pocket Penetrometer Test (kPa)	( )	No Sample Recovery	(a)	Axial Point Load Strength Test

Rig: Jacro 350

Drilling Method: Auger to 3.0m, wash bore with mud circulation to 28.5m, then NMLC

Groundwater: Free groundwater encountered at 2.6m during drilling

Remarks: * Interpolated from PMM Contour and Detail Survey, Drawing Nos. 6121-04-01B,02B,03B,04B

BORE REPORT

BUTLER PARTNERS

Client: Multiplex Portside Wharf (Qld) Pty Ltd

Project: Portside Wharf - The Brisbane Cruise Terminal

Location: Harbour Road, Hamilton

Project No: 03900

BORE 32

Date: 30 May and 2 June 2003

Ground Surface Level: RL 2.9m*

Depth (m)	Description	RL (m)	Lithology	Structures	Average Number of Defects/m	Sample Type	Sample Depth (m)	Is(50) (MPa)	Core Recovery	Test Results
10	***SAND (SP) AND GRAVEL (GP)*** - medium dense, grey and brown, medium to coarse sand and fine gravel, with dark grey silty/clayey zones	-7.0				(S)	9.0 9.45			4,6,6 N=12
11		-8.0								
12		-9.0				S	12.0 12.45			7,6,6 N=12
13	***GRAVEL (GW) AND SAND (SW)*** - medium dense, brown and grey, fine to coarse gravel and fine to coarse sand, with silty/clayey zones/bands	-10.0								
14		-11.0								
15	***SANDY CLAYEY SILT (MH)*** - firm, dark grey, fine to medium sand	-12.0				S	15.0 15.45			0,1,6 N=7 pp=90-140
16	***SILTY SAND (SM)*** - medium dense, grey, fine to coarse sand	-13.0								
17	***SANDY CLAYEY SILT (MH)*** - firm, dark grey, fine to medium sand	-14.0								
18	***SILTY SAND (SM)*** - medium dense, grey, fine to coarse sand, with shells and clay/silt bands in places	-15.0								

D	Disturbed Sample	E	Environmental Sample	C	NMLC Coring
B	Bulk Sample	S	Standard Penetrometer Test (SPT)	Is(50)	Point Load Test Result (MPa)
U	Undisturbed Tube (50mm diameter)	HB	SPT Hammer Bouncing	(d)	Diametral Point Load Strength Test
pp	Pocket Penetrometer Test (kPa)	( )	No Sample Recovery	(a)	Axial Point Load Strength Test

Rig: Jacro 350

Drilling Method: Auger to 3.0m, wash bore with mud circulation to 28.5m, then NMLC

Groundwater: Free groundwater encountered at 2.6m during drilling

Remarks: * Interpolated from PMM Contour and Detail Survey, Drawing Nos. 6121-04-01B,02B,03B,04B

BORE REPORT

BUTLER PARTNERS

Client: Multiplex Portside Wharf (Qld) Pty Ltd

Project: Portside Wharf - The Brisbane Cruise Terminal

Location: Harbour Road, Hamilton

Project No: 03900

BORE 32

Page No: 3 of 4

Date: 30 May and 2 June 2003

Ground Surface Level: RL 2.9m*

Depth (m)	Description	RL (m)	Lithology	Structures	Average Number of Defects/m	Sample Type	Sample Depth (m)	Is(50) (MPa)	Core Recovery	Test Results
19	***SILTY SAND (SM)*** - medium dense, grey, fine to coarse sand, with shells and clay/silt bands in places	-16.0				S	18.0			6,8,6 N=14
20		-17.0					18.45			
21	***CLAYEY SILT (MH)*** - firm, dark grey	-18.0				S	21.0			0,2,3 N=5 pp=80-90
22		-19.0					21.45			
23		-20.0								
24		-21.0				U	24.0			
25		-22.0					24.4			pp=100
26		-23.0								
27	***GRAVEL AND COBBLES (GW)*** - dense, brown and grey, with sand	-24.0								

D	Disturbed Sample	E	Environmental Sample	C	NMLC Coring
B	Bulk Sample	S	Standard Penetrometer Test (SPT)	Is(50)	Point Load Test Result (MPa)
U	Undisturbed Tube (50mm diameter)	HB	SPT Hammer Bouncing	(d)	Diametral Point Load Strength Test
pp	Pocket Penetrometer Test (kPa)	( )	No Sample Recovery	(a)	Axial Point Load Strength Test

Rig: Jacro 350

Drilling Method: Auger to 3.0m, wash bore with mud circulation to 28.5m, then NMLC

Groundwater: Free groundwater encountered at 2.6m during drilling

Remarks: * Interpolated from PMM Contour and Detail Survey, Drawing Nos. 6121-04-01B,02B,03B,04B

BORE REPORT

BUTLER PARTNERS

Client: Multiplex Portside Wharf (Qld) Pty Ltd

Project: Portside Wharf - The Brisbane Cruise Terminal

Location: Harbour Road, Hamilton

Project No: 03900

BORE 32

Page No: 4 of 4

Date: 30 May and 2 June 2003

Ground Surface Level: RL 2.9m*

Depth (m)	Description	RL (m)	Lithology	Structures	Average Number of Defects/m	Sample Type	Sample Depth (m)	Is(50) (MPa)	Core Recovery	Test Results
	GRAVEL AND COBBLES (GW) - dense, brown and grey, with sand					S	27.0			22,16,15 N=31
							27.45			
28	***SANDSTONE (DW)*** - very low strength, pale grey, medium to coarse grained, with conglomeritic bands	-25.0								
		-26.0			0	C	28.5		100%	RQD=100%
29	***SANDSTONE (XW)*** - extremely low strength, grey									
	SANDSTONE (DW) - very low strength, grey, fine to coarse sand and fine gravel						29.4			
30		-27.0			0.8	C			100%	RQD=100%
31	- low strength, pale grey, medium to coarse grained	-28.0					31.0			
					3	C			100%	RQD=100%
32	- very low to low strength, grey and pale grey, medium to coarse grained, with conglomeritic bands, clay coating in defects	-29.0			5		32.55			
	- low strength, grey, medium to coarse sand and fine gravel	-30.0			0	C			100%	RQD=100%
33							33.5			
	End of Bore at 33.5 m									
34		-31.0								
35		-32.0								
36		-33.0								

D	Disturbed Sample	E	Environmental Sample	C	NMLC Coring
B	Bulk Sample	S	Standard Penetrometer Test (SPT)	Is(50)	Point Load Test Result (MPa)
U	Undisturbed Tube (50mm diameter)	HB	SPT Hammer Bouncing	(d)	Diametral Point Load Strength Test
pp	Pocket Penetrometer Test (kPa)	( )	No Sample Recovery	(a)	Axial Point Load Strength Test

Rig: Jacro 350

Drilling Method: Auger to 3.0m, wash bore with mud circulation to 28.5m, then NMLC

Groundwater: Free groundwater encountered at 2.6m during drilling

Remarks: * Interpolated from PMM Contour and Detail Survey, Drawing Nos. 6121-04-01B,02B,03B,04B

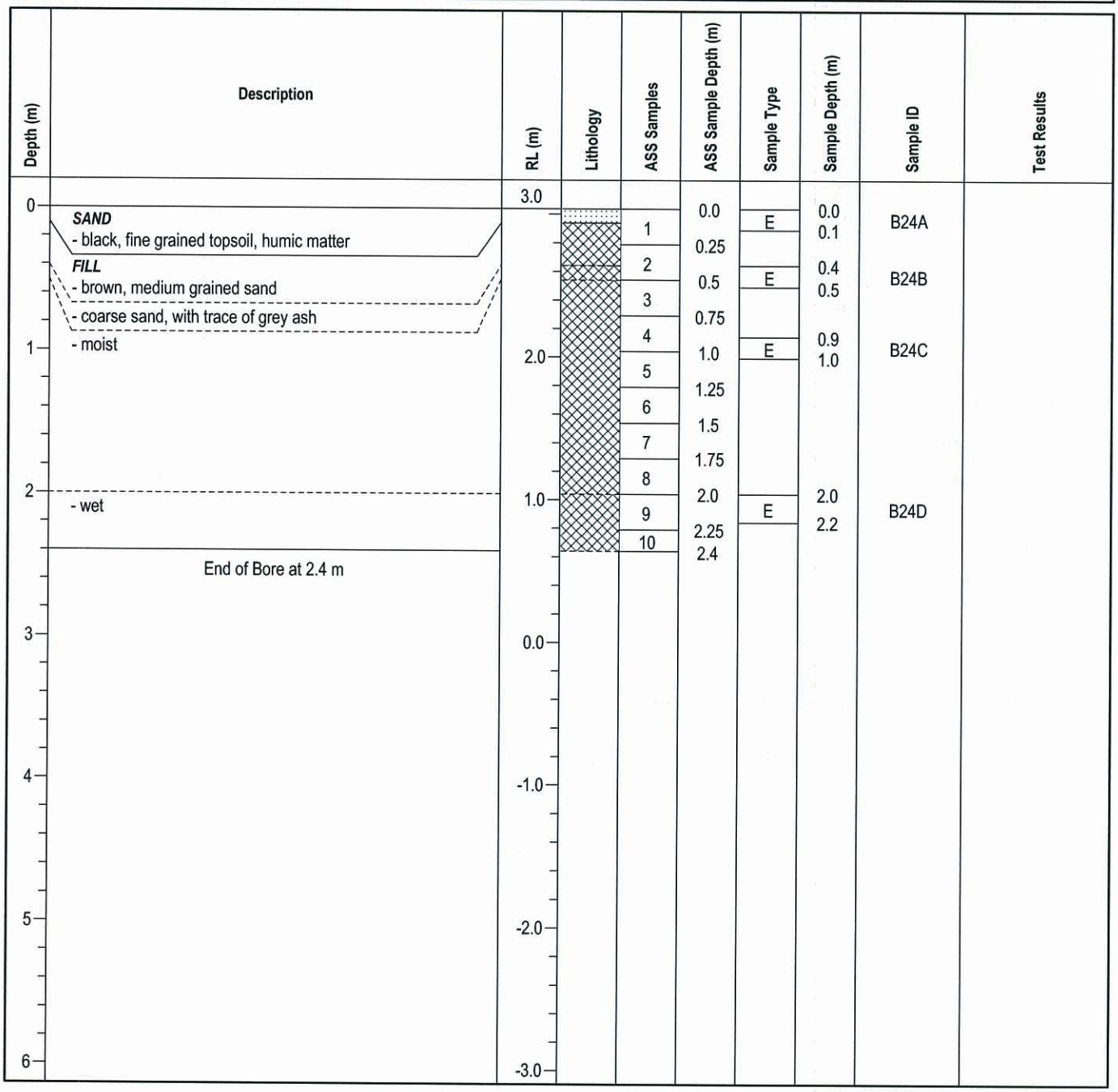
BORE REPORT

BUTLER PARTNERS

Client: Multiplex Developments Australia Pty Ltd
Project: DPI & F Portside
Location: 19 Hercules Street, Hamilton
Project No: 03900G

BORE B24

Page No: 1 of 1
Date: 23 September 2006
Ground Surface Level: RL 3.04m*



D	Disturbed Sample	E	Environmental Sample	C	NMLC Coring
B	Bulk Sample	S	Standard Penetrometer Test (SPT)	Is(50)	Point Load Test Result (MPa)
U	Undisturbed Tube (50mm diameter)	HB	SPT Hammer Bouncing	(d)	Diametral Point Load Strength Test
pp	Pocket Penetrometer Test (kPa)	( )	No Sample Recovery	(a)	Axial Point Load Strength Test

Rig: 6610 D7 Geoprobe
Drilling Method: Pushtube
Groundwater: No free groundwater encountered during drilling
Remarks: * Interpolated from unreferenced plan provided by Multiplex Developments Australia Pty Ltd

BORE REPORT

BUTLER PARTNERS

Client: Multiplex Developments Australia Pty Ltd
Project: DPI & F Portside
Location: 19 Hercules Street, Hamilton
Project No: 03900G

BORE B25

Page No: 1 of 1
Date: 23 September 2006
Ground Surface Level: RL 3.04m*

Depth (m)	Description	RL (m)	Lithology	ASS Samples	ASS Sample Depth (m)	Sample Type	Sample Depth (m)	Sample ID	Test Results
0		3.0							
	SAND					E	0.0	B25A	
	FILL						0.1		
	- brown, medium grained sand			1	0.25				
	- coarse sand, with trace of grey ash				0.5				
	- moist			2					
1					1.0		1.0		
					1.2	E		B25B	
				3			1.3		
					1.5				
						E	1.8	B25C	
2	- wet				2.0		2.0		
				4					
					2.25				
					2.4		2.4		
				5	2.5	E		B25D	
					2.6		2.6		
				6	2.75				
				7	2.8				
3					3.0				
				8	3.2				
				9					
					3.5				
				10	3.6				
				11	3.75				
				12	4.0				
4				13					
					4.25				
				14	4.5				
				15					
					4.75				
					5.0				
5				16					
					5.25				
				17	5.5				
				18					
					5.75				
				19	6.0				
6	End of Bore at 6 m								

D	**Disturbed Sample**	**E**	**Environmental Sample**	**C**	**NMLC Coring**
B	**Bulk Sample**	**S**	**Standard Penetrometer Test (SPT)**	**Is(50)**	**Point Load Test Result (MPa)**
U	**Undisturbed Tube (50mm diameter)**	**HB**	**SPT Hammer Bouncing**	**(d)**	**Diametral Point Load Strength Test**
pp	**Pocket Penetrometer Test (kPa)**	**( )**	**No Sample Recovery**	**(a)**	**Axial Point Load Strength Test**

Rig: 6610 D7 Geoprobe
Drilling Method: Pushtube
Groundwater: Free groundwater encountered at 3.0m depth
Remarks: * Interpolated from unreferenced plan provided by Multiplex Developments Australia Pty Ltd. Loose sands running into hole at 4.0m depth

BORE REPORT

BUTLER PARTNERS

Client: Multiplex Developments Australia Pty Ltd
Project: DPI & F Portside
Location: 19 Hercules Street, Hamilton
Project No: 03900G

BORE B26

Page No: 1 of 1
Date: 23 September 2006
Ground Surface Level: RL 3.04m*

Depth (m)	Description	RL (m)	Lithology	ASS Samples	ASS Sample Depth (m)	Sample Type	Sample Depth (m)	Sample ID	Test Results
0		3.0							
	CLAY - grey, moderate plasticity					E	0.05	B26A	
					0.25		0.15		
	FILL - black, medium grained sand, with ash, slightly moist			2	0.5	E	0.5	B26B	
	- brown, coarse sand, with shell fragments			3	0.75		0.7		
1				4	1.0				
					1.25				
				6	1.5	E	1.5	B26C	
					1.75		1.7		
2				8	2.0				
				9	2.25	E	2.2	B26D	
	- fine grained sand, moist						2.4		
					2.75				
3				12	3.0				
	- fine grained clayey sand			13	3.25				
	- brown, medium grained sand, wet			14	3.5				
				15	3.75				
4				16	4.0				
				17	4.25				
	SAND - loose, brown, coarse grained, wet			18	4.5				
				19	4.75				
5				20	5.0				
				21	5.25				
	End of Bore at 5.25 m								
6									

D Disturbed Sample
B Bulk Sample
U Undisturbed Tube (50mm diameter)
pp Pocket Penetrometer Test (kPa)

E Environmental Sample
S Standard Penetrometer Test (SPT)
HB SPT Hammer Bouncing
( ) No Sample Recovery

C NMLC Coring
Is(50) Point Load Test Result (MPa)
(d) Diametral Point Load Strength Test
(a) Axial Point Load Strength Test

Rig: 6610 D7 Geoprobe
Drilling Method: Pushtube
Groundwater: No free groundwater encountered during drilling
Remarks: * Interpolated from unreferenced plan provided by Multiplex Developments Australia Pty Ltd

BORE REPORT

BUTLER PARTNERS

BORE B27

Client: Multiplex Developments Australia Pty Ltd
Project: DPI & F Portside
Location: 19 Hercules Street, Hamilton
Project No: 03900G

Page No: 1 of 1
Date: 23 September 2006
Ground Surface Level: RL 3.04m*

Depth (m)	Description	RL (m)	Lithology	ASS Samples	ASS Sample Depth (m)	Sample Type	Sample Depth (m)	Sample ID	Test Results
0		3.0							
	CLAY - grey, moderate plasticity					E	0.05	B27A	
							0.15		
	FILL - medium grained sand, slightly moist					E	0.4	B27B	
	- brown, coarse sand						0.5		
				4	0.75				
1				5	1.0				
				6	1.25	E	1.2	B27C D1	
					1.5		1.4	D2	
2									
				11	2.5				
	- medium grained sand, minor clay, moist			12	2.75				
3				13	3.0				
				14	3.25				
				15	3.5				
	- fine grained sand, wet			16	3.75				
4				17	4.0				
				18	4.25				
	SAND - loose, brown, coarse grained, wet			19	4.5				
				20	4.75				
5				21	5.0				
				22	5.25				
				23	5.5				
				24	5.65				
6	End of Bore at 5.8 m				5.8				

D	**Disturbed Sample**	**E**	**Environmental Sample**	**C**	**NMLC Coring**
B	**Bulk Sample**	**S**	**Standard Penetrometer Test (SPT)**	**Is(50)**	**Point Load Test Result (MPa)**
U	**Undisturbed Tube (50mm diameter)**	**HB**	**SPT Hammer Bouncing**	**(d)**	**Diametral Point Load Strength Test**
pp	**Pocket Penetrometer Test (kPa)**	**( )**	**No Sample Recovery**	**(a)**	**Axial Point Load Strength Test**

Rig: 6610 D7 Geoprobe

Drilling Method: Pushtube

Groundwater: No free groundwater encountered during drilling

Remarks: * Interpolated from unreferenced plan provided by Multiplex Developments Australia Pty Ltd. Sands running into hole at 5.75m depth

BORE REPORT

BUTLER PARTNERS

Client: Multiplex Developments Australia Pty Ltd
Project: Proposed Extension to Portside Wharf
Location: 5 Hercules Street, Hamilton
Project No: 03900G

BORE BPB-13

Page No: 1 of 1
Date: 5 September 2006
Ground Surface Level: RL 2.99m*

Depth (m)	Description	RL (m)	Lithology	ASS Samples	ASS Sample Depth (m)	Sample Type	Sample Depth (m)	Sample ID	Test Results
0		3.0			0.0				
	CONCRETE - 120mm thick pavement			1	0.25	E	0.25	BP-13A	
	FILL - brown, coarse sand, occasional gravel, slightly moist			2	0.5	E	0.5	BP-13B	
	- brown, coarse sand, slightly moist			3	0.75				
1	- brown, coarse sand, occasional gravel, slightly moist	2.0		4	1.0	E	0.9	BP-13C	
				5	1.25		1.0		
				6	1.5				
				7	1.75				
2	- brown, coarse sand, slightly moist	1.0		8	2.0	E	1.9	BP-13D	
				9	2.25		2.0		
				10	2.5				
				11	2.75				
3		0.0		12	3.0	E	2.9	BP-13E	
				13	3.25		3.0		
	CLAY - grey, with coarse sand, medium plasticity, moist			14	3.5	E	3.2	BP-13F	
	SAND - pale brown, coarse sand, occasional high plasticity clay lenses			15	3.75		3.5		
4		-1.0		16	4.0				
				17	4.25				
				18	4.5				
				19	4.75				
5		-2.0		20	5.0				
				21	5.25				
				22	5.5				
				23	5.75				
6		-3.0		24	6.0		6.0		
				25	6.25	E		BP-13G	
				26	6.5		6.5		
	End of Bore at 6.5 m								

D	**Disturbed Sample**	**E**	**Environmental Sample**	**C**	**NMLC Coring**
B	**Bulk Sample**	**S**	**Standard Penetrometer Test (SPT)**	**Is(50)**	**Point Load Test Result (MPa)**
U	**Undisturbed Tube (50mm diameter)**	**HB**	**SPT Hammer Bouncing**	**(d)**	**Diametral Point Load Strength Test**
pp	**Pocket Penetrometer Test (kPa)**	**( )**	**No Sample Recovery**	**(a)**	**Axial Point Load Strength Test**

Rig: Hand equipment
Drilling Method: Auger
Groundwater: No free groundwater encountered during auger drilling
Remarks: * Approximte ground surface level interpolated from unreferenced plan provided by Multiplex Developments Australia Pty Ltd

Notes on Description and Classification of Soil

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

Soil description is based on an assessment of disturbed samples, as recovered from bores and excavations, or from undisturbed materials as seen in excavations and exposures or in undisturbed samples. Descriptions given on report sheets are an interpretation of the conditions encountered at the time of investigation.

In the case of cone or piezocone penetrometer tests, actual soil samples are not recovered and soil description is inferred based on published correlations, past experience and comparison with bore and/or test pit data (if available).

Soil classification is based on the particle size distribution of the soil and the plasticity of the portion of the material finer than 0.425mm. The description of particle size distribution and plasticity is based on the results of visual field estimation, laboratory testing or both. When assessed in the field, the properties of the soil are estimated; precise description will always require laboratory testing to define soil properties.

Where soil can be clearly identified as FILL this will be noted as the main soil type followed by a description of the composition of the fill (eg. FILL – yellow-brown, fine to coarse grained gravelly clay fill with concrete rubble). If the soil is assessed as possibly being fill this will be noted as an additional observation.

Soils are generally described using the following sequence of terms. In certain instances, not all of the terms will be included in the soil description.

MAIN SOIL TYPE (CLASSIFICATION GROUP SYMBOL)
- strength/density, colour, structure/grain size, secondary and minor components, additional observations

Information on the definition of descriptive and classification terms follows.

SOIL TYPE and CLASSIFICATION GROUP SYMBOLS

	Major Divisions	Particle Size	Classification Group Symbol	Typical Names
COARSE GRAINED SOILS (more than half of material is larger than 0.075 mm)	BOULDERS	> 200mm		
	COBBLES	63 – 200mm		
	GRAVELS (more than half of coarse fraction is larger than 2.36 mm)	Coarse: 20 – 63 mm Medium: 6 – 20 mm Fine: 2.36 – 6 mm	GW	Well graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines, uniform gravels.
			GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (more than half of coarse fraction is smaller than 2.36mm)	Coarse: 0.6 – 2.36 mm Medium: 0.2 – 0.6 mm Fine: 0.075 – 0.2 mm	SW	Well graded sands, gravelly sands, little or no fines.
			SP	Poorly graded sands and gravelly sands; little or no fines, uniform sands.
			SM	Silty sands, sand-silt mixtures.
			SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS (more than half of material is smaller than 0.075 mm)	SILTS & CLAYS (liquid limit <50 %)		ML	Inorganic silts and very fine sands, silty/clayey fine sands or clayey silts with low plasticity.
			CL and CI	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays.
			OL	Organic silts and organic silty clays of low plasticity.
	SILTS & CLAYS (liquid limit >50 %)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils.
			CH	Inorganic clays of high plasticity.
			OH	Organic clays of medium to high plasticity, organic silts.
	HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils.

Notes on Description and Classification of Soil

DESCRIPTIVE TERMS FOR MATERIAL PROPORTIONS

Coarse Grained Soils		Fine Grained Soils	
% Fines	Modifier	% Coarse	Modifier
< 5	Omit, or use 'trace'	< 15	Omit, or use trace.
5 – 12	Describe as 'with clay/silt' as applicable.	15 – 30	Describe as 'with sand/gravel' as applicable.
> 12	Prefix soil as 'silty/clayey' as applicable	> 30	Prefix soil as 'sandy/gravelly' as applicable.

STRENGTH TERMS – COHESIVE SOILS

Strength Term	Undrained Shear Strength	Field Guide to Strength
Very soft	< 12 kPa	Exudes between the fingers when squeezed in hand.
Soft	12 – 25 kPa	Can be moulded by light finger pressure.
Firm	25 – 50 kPa	Can be moulded by strong finger pressure.
Stiff	50 – 100 kPa	Cannot be moulded by fingers, can be indented by thumb.
Very stiff	100 – 200 kPa	Can be indented by thumb nail.
Hard	> 200 kPa	Can be indented with difficulty by thumb nail.

DENSITY TERMS – NON COHESIVE SOILS

Density Term	Density Index	SPT "N"	CPT Cone Resistance
Very loose	< 15 %	0 – 5	0 – 2 MPa
Loose	15 – 35 %	5 – 10	2 – 5 MPa
Medium dense	35 – 65 %	10 – 30	5 – 15 MPa
Dense	65 – 85 %	30 – 50	15 – 25 MPa
Very dense	> 85 %	> 50	> 25 MPa

COLOUR

The colour of a soil will generally be described in a 'moist' condition using simple colour terms (eg. black, grey, red, brown etc.) modified as necessary by "pale", "dark", "light" or "mottled". Borderline colours will be described as a combination of colours (eg. grey-brown).

EXAMPLE

eg: CLAYEY SAND (SC) – medium dense, grey-brown, fine to medium grained with silt.

Indicates a medium dense, grey-brown, fine to medium grained clayey sand with silt.

APPENDIX B

FIELD SCREENING TEST RESULTS

Summary of Field pH Screening Test Results

Test No.	Sample Depth (m)	Material Type	Reaction	pH_F	pH_{FOX}	Screening Test Indicators		
						Moderate or strong reaction with peroxide	$pH_F - pH_{FOX}>1$	$pH_{FOX}<3$
1	1.0	Sand	None	7.5	5.2		✓	
1	2.3	Sand	None	7.4	6.1		✓	
2	0.8	Sand	None	7.7	5.9		✓	
2	1.5	Sand	None	8.5	6.0		✓	
3	0.9	Sand	Strong	7.0	6.2	✓		
3	1.4	Sand	Weak to Moderate	6.9	4.4		✓	
4	3.5	Sand	None	8.1	5.7		✓	
5	1.0	Gravel (Fill)	None	6.8	4.9		✓	
5	2.0	Sand	None	7.8	5.7		✓	
5	3.0	Sand	None	7.3	5.3		✓	
6	1.0	Sand (Fill)	None	7.7	6.8			
6	2.0	Sand	None	7.6	5.5		✓	
6	3.0	Sand	None	7.9	5.7		✓	
7	1.0	Sand (Fill)	Strong	8.1	7.6	✓	✓	
7	3.0	Sand	None	8.5	6.1		✓	
7	3.7	Sand	None	8.2	5.3		✓	
8	2.9	Sand	Weak to Moderate	7.5	6.5			
9	1.0	Sand, Clay & Gravel (Fill)	None	6.7	3.1		✓	
9	2.3	Sand (Fill)	Strong	8.3	4.3	✓	✓	
9	3.1	Sand	None	7.5	3.5		✓	
10	1.2	Clay (Fill)	None	8.3	5.6		✓	
10	1.9	Sand (Fill)	None	8.3	7.2		✓	
10	3.3	Sand	None	7.1	5.8		✓	
11	1.0	Clay & Gravel (Fill)	None	6.0	3.4		✓	
11	1.7	Sand (Fill)	None	8.3	6.2		✓	
11	2.5	Sand	Strong	8.0	5.4	✓	✓	
11	3.0	Sand	Strong	8.1	5.6	✓	✓	
12	1.0	Rock (Fill)	None	6.8	4.5		✓	
12	3.0	Clayey Sand	None	6.8	4.5		✓	
12	3.5	Clayey Sand	None	8.2	3.5		✓	
13	1.7	Sand	None	7.4	6.4			
13	2.6	Clay	Strong	7.8	3.7	✓	✓	
14	1.0	Sand (Fill)	Strong	7.7	7.3	✓		
14	3.0	Sand	None	8.8	7.7		✓	
15	1.0	Sand (Fill)	None	7.3	6.4			
15	3.0	Sand (Fill)	Weak to Moderate	8.7	6.9		✓	
15	4.0	Clayey Sand	Weak to Moderate	8.5	2.2		✓	✓
16	1.0	Sand (Fill)	Weak to Moderate	8.7	7.9			
16	2.0	Sand (Fill)	None	7.3	6.9			
16	3.0	Sand (Fill)	None	8.0	6.7		✓	
17	3.0	Sand	None	7.4	5.6		✓	

Summary of Field pH Screening Test Results

Test No.	Sample Depth (m)	Material Type	Reaction	pH_F	pH_{FOX}	Screening Test Indicators		
						Moderate or strong reaction with peroxide	$pH_F - pH_{FOX} > 1$	$pH_{FOX} < 3$
18	2.1	Sand	None	7.7	6.7			
18	3.3	Sand	None	7.3	5.3		✓	
19	1.0	Sand (Fill)	None	8.4	7.1		✓	
19	2.0	Sand (Fill)	Weak to Moderate	8.5	7.7			
19	3.0	Sand	Weak to Moderate	8.0	6.3		✓	
20	1.0	Gravel & Clay (Fill)	None	8.8	5.8		✓	
20	2.0	Sand	None	8.4	6.3		✓	
20	3.0	Sand	None	5.8	4.4		✓	
22	1.0	Sand (Fill)	None	6.1	5.4			
22	2.0	Sand	None	7.8	5.4		✓	

Summary of Field pH Screening Test Results

Bore No.	Sample Depth (m)	Material Type	Reaction	pH_F	pH_{FOX}	Screening Test Indicators		
						Moderate or strong reaction with peroxide	pH_F - pH_{FOX}>1	pH_{FOX}<3
14	4.0-4.5	Sand	Weak	8.8	5.4		✓	
	4.5-5.0	Sand	Weak	8.9	4.8		✓	
	5.0-5.5	Sand	Moderate	9.1	3.9		✓	
	5.5-6.0	Sand (SSL)	Very Strong	9.4	2.2	✓	✓	✓
19	3.0-3.45	Sand	Very Weak	9.1	6.2		✓	
	3.45-4.0	Sand	Very Weak	8.4	6.2		✓	
	4.0-4.5	Sand	Weak	8.5	5.7		✓	
	4.5-5.0	Sand	Very Weak	8.9	5.8		✓	
	5.0-5.5	Sand (SCL)	Very Strong	9.3	2.6	✓	✓	✓
	5.5-6.0	Sand (SCL)	Very Strong	9.4	2.5	✓	✓	✓
22	3.0-3.45	Sand (SCL)	Weak	6.6	4.9		✓	
	3.45-4.0	Sand (SCL)	Weak	5.6	4.6		✓	
	4.0-4.5	Sand (SCL)	Weak	4.9	3.8		✓	
	4.5-5.0	Sand (SCL)	Weak	4.7	3.0		✓	✓
	5.0-5.5	Sand (SCL)	Very Strong	6.8	2.4	✓	✓	✓
	5.5-6.0	Sand (SCL)	Weak	6.9	1.7		✓	✓
26	3.0-3.45	Sand	Weak	8.1	5.7		✓	
	3.45-4.0	Sand	Weak	9.4	5.0		✓	
	4.0-4.5	Sand	Weak	8.9	6.0		✓	
	4.5-5.0	Sand	Weak	8.7	1.7		✓	✓
	5.0-5.5	Sand	Weak	8.6	1.7		✓	✓
	5.5-6.0	Sand	Weak	8.7	5.7		✓	
27	2.0-2.5	Sand	Weak	8.8	4.4		✓	
	3.0-3.45	Sand	Moderate	8.4	2.4		✓	✓
	3.45-4.0	Sand	Weak	8.6	2.1		✓	✓
	4.0-4.5	Sand	Very Strong	8.0	2.3	✓	✓	✓
	4.5-5.0	Sand	Very Strong	8.1	1.9	✓	✓	✓
	5.0-5.5	Sand & Gravel (SGL)	Weak	7.9	1.9		✓	✓
	5.5-6.0	Sand & Gravel (SGL)	Weak	7.9	2.1		✓	✓
30	3.0-3.45	Sand (SCL)	Very Strong	8.0	3.9	✓	✓	
	3.45-4.0	Clayey Sand & Clayey Silt	Very Strong	7.0	2.6	✓	✓	✓
	4.0-4.5	Clayey Sand & Clayey Silt	strong	6.7	2.5	✓	✓	✓
	4.5-5.0	Clayey Sand & Clayey Silt	Moderate	7.7	2.0		✓	✓
	5.0-5.5	Clayey Sand & Clayey Silt	Moderate	8.4	2.2		✓	✓
	5.5-6.0	Clayey Sand & Clayey Silt	Very Strong	8.6	2.6	✓	✓	✓