Proposed Carpark – New Maitland Hospital Preliminary Geotechnical Investigation

Metford Road, Metford

NEW18P-0242A-AA
6 February 2019

Qualtest
LABORATORY (NSW) PTY LTD

GEOTECHNICAL I LABORATORY I EARTHWORKS I QUARRY I CONSTRUCTION MATERIAL TESTING

6 February 2019

CSR Limited
C/- Catalyst Project Consulting Pty Ltd
10 King Street,
NEWCASTLE NSW 2300

Attention: Mr Milos Rastovic

Dear Sir

RE: PROPOSED CARPARK – NEW MAITLAND HOSPITAL – METFORD ROAD, METFORD PRELIMINARY GEOTECHNICAL INVESTIGATION & TESTING

Please find enclosed our report on preliminary geotechnical investigation and testing for the proposed carpark as a part of the New Maitland Hospital Project.

The report includes factual data from the field and laboratory testing, a summary of surface and subsurface conditions, and recommendations for the ground preparation for the future carpark, including anticipated scope of works required, specification for earthworks, and pavement design and construction recommendations.

If you have any questions regarding this report, please do not hesitate to contact Ben Bunting or the undersigned.

For and on behalf of Qualtest Laboratory (NSW) Pty Ltd

Jason Lee
Principal Geotechnical Engineer

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Attachments:

1.0 Introduction

Qualtest Laboratory NSW Pty Ltd (Qualtest) is pleased to present this preliminary geotechnical investigation report for the construction of the proposed carpark as part of the New Maitland Hospital project, for Catalyst Project Consulting Pty Ltd (Catalyst) behalf of CSR Limited (CSR).

In general accordance with the brief provided by NSW Health and Catalyst, the scope of work for the preliminary geotechnical investigation was as follows:

- *Provide report summarising available information, detailing test results, advice and recommendations for the ground preparation for the future carpark, including detailed scope of works required and specification for works and pavement design. The works are likely to include removal of the top metre (approx.) of fill, impact compaction of the area, installation of a new bridging layer of compacted material and the carpark basecourse / subbase layers and AC finish;*
- *Advise on the expected suitability of the excavated material to be reused in the bridging layer and specific treatment, compaction and testing requirements.*

This report presents the results of the field work investigations and laboratory testing, and provides recommendations for the scope outlined above.

2.0 Field Work

Field work was carried out on 11 December, 2018 and comprised of:

- Safety documentation including a Site Risk Assessment and Safe Work Method Statements specific to the project and site conditions for proposed investigation works;
- DBYD search to check proposed test pit locations for the presence of buried services;
- Excavation of 9 test pits using a 30 tonne steel tracked excavator equipped with a 2200mm width bucket to depths varying between 0.50m and 2.10m, with bulk disturbed samples taken for subsequent laboratory testing;
- Dynamic Cone Penetrometer (DCP) tests were carried out each test pit (TP1 to TP9), and at an additional 10 locations across the site (DCP10 to DCP19), to aid in the assessment of in-situ density of site soils;
- 6 Nuclear Densometer tests were undertaken within the deeper fill profiles within test pits locations TP1, TP2 and TP3 for correlation between DCP results; and,
- Test pits were backfilled with the excavation spoil, and compacted with the excavator bucket and tracks.

Investigations were carried out by an experienced Principal Geotechnical Engineer, Geotechnical Engineer and Senior Geotechnician from Qualtest, who located the test pits and DCP test locations using handheld GPS and relative to existing site features, carried out the sampling and testing, and provided field logs.

Approximate test pit locations are shown on the attached Figure AA1.

Engineering logs of the test pits and results of DCP testing are presented in Appendix A.

Results of Hilf Density testing are presented in Appendix B.

3.0 Site Description

3.1 Surface Conditions

The subject site is located within the site of the proposed carpark area associated with the proposed New Maitland Hospital project at Metford. Filling associated with remediation of previous mining works undertaken on the site has taken place across the site, with depth of fill understood to extend to significant depths, beyond the extent of the current investigations.

Surface slopes are relatively flat in the order of about 1° to 5° in the northern, western and central area of the site, with steeper slopes of up to 10° to 20° in the southern and eastern portion of the site associated with a large fill batter.

Parts of the site are vegetated by moderate to established grass cover. Trafficability by way of 4WD vehicle was judged to be good at the time of the site investigations. Photographs of the site taken on the day of the site investigations are shown below.

Photograph 1: From north-western boundary, facing south (TP3 spoil pile visible).

Photograph 2: From north-western boundary, facing southwest (from near TP3 location).

Photograph 3: From south-western boundary, facing north-west (TP1 spoil pile visible).

Photograph 4: From near middle of south-western boundary, facing north.

Photograph 5: From near middle of south-western boundary, facing north-east.

Photograph 6: From south-western boundary, facing east (TP7 location visible).

Photograph 7: From near the centre of site, facing northwest (TP9 spoil pile visible).

Photograph 8: From near centre of site, facing north (TP9 spoil pile visible).

Photograph 9: From near centre of south-eastern boundary, facing southwest (from near location of DCP12).

Photograph 10: From near centre of south-eastern boundary, facing west up fill embankment (from near location of DCP12).

3.2 Subsurface Conditions

Reference to the 1:100,000 Newcastle Coalfield Regional Geology Series Sheet 9231 indicates most of the site to be underlain by the Tomago Coal Measures, which is characterised by Siltstone, Sandstone, Coal, Tuff, and Claystone rock types.

Table 1 presents a summary of the typical soil types encountered at test pit locations during the field investigation, divided into representative geotechnical units.

Table 2 contains a summary of the distribution of the above geotechnical units at the test pit locations.

TABLE 1 – SUMMARY OF GEOTECHNICAL UNITS AND SOIL TYPES

Unit No.	Unit Type	Soil Description
1	Fill – Uncontrolled	Gravelly Sandy CLAY – low to high plasticity, pale brown, pale grey-brown to dark brown / dark grey to black with black pockets in places, fine to coarse grained sand, fine to coarse grained angular to sub-angular gravel, with some cobbles up to ~200mm in diameter, trace boulders up to ~500mm in size, with some broken brick, plastic, and coal. Sandy CLAY – low to medium plasticity, pale grey-brown to dark brown with some pale orange-brown, fine to coarse grained sand. Silty CLAY / CLAY – medium plasticity, black.
2	Residual Soil	CLAY – medium to high plasticity, pale grey with some pale yellow-brown and dark grey. Sandy CLAY – medium to high plasticity, pale grey and orange-brown, fine grained sand.
3	Extremely Weathered (EW) Rock with Soil Properties	Silty Sandstone with soil properties; breaks down into Gravelly Sandy CLAY – medium plasticity, pale grey and orange-brown, fine to coarse grained sand, fine to medium grained angular gravel. Silty Sandstone with soil properties; breaks down into Clayey Sandy GRAVEL / Sandy GRAVEL – fine to coarse grained (mostly fine to medium grained) sub-angular to angular, pale orange-brown to pale yellow-brown and pale grey, fine to coarse grained sand, fines of low plasticity. Silty Sandstone with soil properties; breaks down into Gravelly Clayey SAND – fine to coarse grained, pale grey and pale yellow-brown, fine to coarse grained angular (mostly fine to medium grained) gravel, fines of low plasticity.
4	Highly Weathered Rock	Silty SANDSTONE – fine grained, pale grey with some pale yellow-brown and dark grey, estimated low to medium rock strength. SANDSTONE – fine to medium grained orange-brown to pale red-brown, estimated low rock strength.

No water inflows or groundwater levels were encountered in the boreholes during the limited time that they remained open on the day of the field investigation.

It should be noted that groundwater conditions can vary due to rainfall and other influences including regional groundwater flow, temperature, permeability, recharge areas, surface condition, and subsoil drainage.

TABLE 2 – SUMMARY OF GEOTECHNICAL UNITS ENCOUNTERED AT EACH TEST PIT LOCATION

Borehole Location	Unit 1 Fill - Uncontrolled	Unit 2 Residual Soil	Unit 3 Extremely Weathered Rock	Unit 4 Highly Weathered Rock
	Depth in metres (m)			
TP1	0.00 – 2.10	-	-	-
TP2	0.00 – 2.00	-	-	-
TP3	0.00 – 2.00	-	-	-
TP4	0.00 – 0.70	0.70 – 1.25	-	1.25 – 1.35*
TP5	0.00 – 0.40	0.40 – 0.50	0.50 – 0.55^	-
TP6	0.00 – 0.20	-	0.20 – 0.50^	-
TP7	0.00 – 0.55	-	0.55 – 0.60^	-
TP8	0.00 – 1.15	-	-	1.15 – 1.20^
TP9	0.00 – 0.50	-	0.50 – 0.90^	-

Notes: * = Refusal or Practical refusal of 30 tonne excavator bucket.
^ = Slow to very slow progress of 30 tonne excavator bucket.

4.0 Laboratory Testing

Samples collected during the field investigations were returned to our NATA accredited Warabrook Laboratory for testing which comprised of:

- (4 no.) California Bearing Ratio tests (4 day soaked) and Standard Compactions;
- (6 no.) Standard Hilf Density tests.

Results of the laboratory testing are appended, with a summary of the HILF Density Ratio and California Bearing Ratio (CBR) test results presented in Table 3 and Table 4, respectively.

TABLE 3 - SUMMARY OF HILF DENSITY TESTING RESULTS

Location	Sample Depth (m)	Field Moisture Content (%)	Optimum Moisture Content (%)	Relationship of Field MC to OMC (%)	Hilf Density Ratio (%)
TP1	1.00 – 1.30	17.4	17.0	0.4 WET	101.5
TP1	1.50 – 1.80	13.1	14.0	0.9 DRY	104.5
TP2	1.00 – 1.30	12.7	14.5	1.8 DRY	106.0
TP2	1.50 – 1.80	13.4	14.0	0.6 DRY	106.0
TP3	1.00 – 1.30	16.3	16.5	0.2 DRY	91.5
TP3	1.50 – 1.80	17.6	18.0	0.4 DRY	97.0

TABLE 4 – SUMMARY OF CBR TESTING RESULTS

Location	Sample Depth (m)	Material Type	Field Moisture Content (%)	Optimum Moisture Content (%)	Relationship of Field MC to OMC (%)	CBR (%)
TP1	0.70 – 0.90	Fill	14.3	15.0	0.7 DRY	7
TP3	0.60 – 0.80	Fill	13.7	13.5	0.2 WET	10
TP8	0.60 – 0.80	Fill	17.1	17.5	0.4 DRY	11
TP9	0.70 – 0.90	EW Rock	9.5	12.5	3.0 DRY	8

At the time of the field investigation, moisture content for the subgrade material tested varied from about 3.0% dry to 0.4% wet of standard Optimum Moisture Content (OMC).

5.0 Discussion and Recommendations

5.1 Existing Uncontrolled Fill Material

Based on the field and laboratory testing, the following comments are made with regards to the condition of the existing Uncontrolled Fill (Unit 1) on site.

- The fill material predominantly comprises of Gravelly Sandy CLAY, of typically very stiff or better consistency.
- In some locations, oversize material comprising cobbles up to ~200mm in diameter and trace boulders up to ~500mm in size were encountered, together with some broken brick, plastic, and coal.
- HILF Density testing in areas of deep fill from 1.0m or greater below existing ground levels returned Standard Compaction results of 101.5% and 104.5% (TP1), 106.0% and 106.0% (TP2) and 91.5% and 97.0% (TP3).
- Results of DCP testing indicates the fill to typically be well compacted. Some lower blow count results were encountered in TP03, which correlates with the lower HILF Density tests at that location.
- Laboratory CBR tests on representative samples of the existing fill material returned results varying from 7% to 11%.
- Moisture content of the fill was generally in the range of 1.8% dry to 0.4% wet of OMC.
- There are no records of the placement or compaction of the fill material; therefore, it has been assessed to be uncontrolled fill. However based on anecdotal evidence of the placement and compaction of the fill in layers, together with the results of the field and laboratory testing, the uncontrolled fill is relatively uniform and compact in nature.

5.2 Suitability of Materials for Re-Use

The following comments are made with respect to suitability of site materials for re-use as fill:

- Unit 1 - Uncontrolled Fill
    - The material generally comprises of Gravelly Sandy CLAY, and based on the test pit profiles, it is anticipated that the majority of the material would be suitable for re-use as general fill for engineering purposes.

  - In localised areas, materials may be variable, including some over size material (cobbles and boulders of 200mm to 500mm size), and potentially deleterious material (broken brick, plastic, and coal). Selective sorting of this material may be required prior to re-use as general fill for engineering purposes.
  - If more Silty soils or Coal is encountered within the fill, these material may be subject to softening and loss of strength when saturated. Therefore if such materials are encountered, it is recommended they be blended with other more cohesive materials from within the fill or residual soils excavated on site prior to re-use.
  - Fill material affected by significant roots/vegetation or other deleterious material (if encountered), is **not suitable** as engineering fill and is expected to be suitable for landscaping purposes only. Based on the test pit profiles observed, the fill did not generally contain areas of significant roots or vegetation.
- Unit 2 - Residual Soils are generally expected to be suitable for re-use as general fill for engineering purposes;
- Unit 3 - Extremely Weathered Rock are generally expected to be suitable for re-use as general fill for engineering purposes;
- Unit 4 - Highly Weathered Rock is generally expected to be suitable for re-use as general fill for engineering purposes. These materials may require sorting or processing by crushing / screening depending upon excavation methods, source material characteristics and proposed uses.

The existing site materials may require some moisture conditioning.

Final selection of fill materials should consider properties such as reactivity. The suitability of material for re-use should be assessed and confirmed by the geotechnical authority at the time of bulk excavation and/or during construction.

5.3 Site Preparation

Based on discussions at a preliminary site meeting, and extract from the brief provided by NSW Health, it is understood the proposed pavement construction strategy is as follows:

> *"This strategy is based on requirements for compaction to the following levels, and to have geotechnical advice provided for an on ground carpark;*
>
> - *95% SDD +/- 2% OMC for fill deeper than 1m;*
> - *98% SSD +/- 2% OMC for fill under on grade pavement within 1m pavement level (this requirement could be deleted if we have the bridging layer);*
> - *DCP testing across the site and an estimate of settlement on the existing fill;*
> - *Testing rates as per AS 3798 for level 1 testing would be preferred;*

Based on the above strategy and the fill / natural soil and rock profiles encountered, the following proposed general construction methodology is proposed:

- Stripping of existing uncontrolled fill to a nominal depth of 1.0m below design subgrade level, or to approved natural residual subgrade if at shallower depth, (i.e. maximum depth of 1.0m plus design pavement thickness below finished pavement levels).
- Selectively stockpile material won from excavations for re-use as general fill.
- Compact the exposed subgrade (existing fill profile) with an 'Impact Roller' or equivalent, to provide a uniformly compacted surface and deep compaction of the layer.

- Based on previous experience, impact rolling is generally effective to depths of up to about 1m in cohesive materials, depending on the size of compaction plant and rolling pattern.
- It is recommended that additional density testing be carried out at the time of construction to assess the effectiveness of compaction by Impact Roller. This may include testing the exposed subgrade at various locations and depth intervals (e.g. 0.0 – 0.3m and 0.5 – 0.8m), to compare results prior to and after compaction takes place. Detail survey should also be carried out prior to and after compaction to allow assessment of settlement and compaction achieved within the subgrade soils.
- Based on the density test results achieved at test pit locations TP1 to TP3 from 1.0m to 1.8m below existing ground levels, the fill is already reasonably well compacted with 5 of the 6 density tests returning results of greater than 95% Standard Compaction. TP3 (1.0 - 1.3m) was the only result of less than 95% Standard Compaction. On this basis, it is anticipated that deep compaction with an Impact Roller would be suited to this site.
- There is a risk of causing vibration-induced damage to any existing or adjacent buildings or structures using an Impact Roller. Vibration monitoring and dilapidation survey on nearby structures prior to any compaction works are recommended if an Impact Roller is used.
- Following stripping, bulk excavation, and compaction, the exposed prepared subgrade should be proof rolled (minimum 10 tonne static roller), to identify any poor, wet, saturated, or excessively deflecting material. Any such areas should be over excavated and backfilled with an approved select material;
- The moisture content of the subgrade materials and therefore the need for moisture conditioning or over-excavation and replacement, will be largely dependent on pre-existing and prevailing weather conditions at the time of construction;
- Place and compact approved fill to design subgrade level, placed and compacted to 'Level 1' criteria as defined in Clause 8.2 – Section 8, of AS3798-2007.
- Protect the area after subgrade preparation to maintain moisture content as far as practicable. The placement of subbase gravel would normally provide adequate protection;
- Site preparation should include provision of drainage and erosion control as required, as well as sedimentation control measures.

Subgrade soils are likely to have a propensity to soften relatively quickly with moisture ingress; therefore, it is particularly important that care be taken to ensure that the subgrade is not exposed to wet conditions.

At the time of the field investigation, moisture content for the clay subgrade material tested varied from 3.0% dry to 0.4% wet of standard Optimum Moisture Content (OMC). It should therefore be anticipated that some moisture conditioning of the subgrade may be necessary prior to compaction and placement of pavement materials.

The required time period to prepare the subgrade is likely to be dependent on the prevailing weather conditions at the time of construction.

If over wet subgrades exist at the time of construction or deleterious fill materials are encountered at subgrade level, these materials should be over-excavated and be replaced with a minimum depth of 300mm of well graded granular select material with CBR of greater than 15%, or a 2% cement stabilised subbase material. The selection of select material where required will be dependent on moisture condition of subgrades at the time of construction.

5.4 Fill Construction Procedures

Earthworks for pavement construction should consist of the following measures:

- Approved fill beneath pavements should be compacted in layers not exceeding 300mm loose thickness to 95% Standard Compaction (AS1289 5.1.1);
- The top 300mm of natural subgrade below pavements or the final 300mm of road subgrade fill should be compacted to 100% Standard Compaction (AS1289 5.1.1);
- The top 300mm of natural subgrade below pavements or the final 300mm of road subgrade fill should be compacted to provide a subgrade that is within the moisture range of 60% to 90% of Optimum Moisture Content (OMC);
- All fill should be supported by properly designed and constructed retaining walls or else battered at 1V:2H or flatter and protected against erosion;
- Where fill is to be placed on slopes in excess of 1V:8H (7°), a prepared surface should be benched or stepped into the natural slope; and,
- Earthworks should be carried out in accordance with the recommendations outlined in AS3798-2007 '*Guidelines for Earthworks for Commercial and Residential Developments*'.

It is generally recommended that all uncontrolled fill is removed or replaced as controlled fill to 'Level 1' criteria as defined in Clause 8.2 – Section 8, of AS3798-2007 prior to placement of additional fill and construction of residential structures or other settlement sensitive developments. Based on the existing compact nature of the fill, it is anticipated that the methodology proposed above is suitable for construction of a flexible carpark pavement (i.e. excavation of uncontrolled fill to a depth of up to 1.0m below design subgrade level, compaction of the underlying fill material from the surface, then replacement of fill placed and compacted as controlled fill to 'Level 1' criteria as defined in AS3798-2007).

5.5 Pavement Design Recommendations

5.5.1 Design Subgrade CBR Value

Subgrade CBR test results from the current investigation at the site ranged from 7% to 11% within the uncontrolled fill and extremely weathered rock encountered. The residual clay soils if encountered at subgrade level may have a slightly lower CBR in the order of 5%.

Therefore, based on the results of the field work, laboratory testing, and previous experience in the surrounding area, the following design California Bearing Ratio (CBR) values have been recommended for preliminary pavement thickness design purposes.

- Residual Clay, Controlled Fill – Design Subgrade CBR = 5%
- Weathered Rock – Design Subgrade CBR = 8%

Fill placed at road subgrade level should be assessed by a geotechnical authority. If the fill is assessed to have CBR different to that of the design CBR, then a revised pavement design will be required for that section.

Due to potential variability within the fill, and limited testing conducted as part of this preliminary assessment, it is anticipated that additional sampling and CBR testing of the placed and compacted subgrade will take place during construction to confirm design subgrade CBR values, and subsequent pavement thickness design requirements.

5.5.2 Design Traffic Loadings

Qualtest are not aware of the design traffic loading for preliminary pavement design.

Hospital carparks may have design traffic volumes higher than a normal public carpark. Therefore it is anticipated that with reference to Maitland City Council (MCC) specifications for subdivision roads in terms of equivalent standard axles (ESA's), design traffic loadings may be in the order of $1x10^5$ ESA's to $5x10^5$ ESA's.

Confirmation should be obtained from NSW Health, MCC, or the responsible authority with respect to the design traffic loading to be adopted.

5.5.3 Flexible Pavement Thickness Design

Based on the above design subgrade CBR values and assumed design traffic loading values, for preliminary planning and budgeting purposes, flexible pavement thickness design in the order of 300mm to 400mm is anticipated for carpark areas.

A bridging layer should be allowed for beneath the pavement where road pavement crosses any areas where poor, wet or saturated subgrade conditions are encountered.

If over wet subgrades exist at the time of construction or deleterious fill materials are encountered at subgrade level, these materials should be over-excavated and be replaced with a minimum depth of 300mm of well graded granular select material with CBR of greater than 15%, or a 2% cement stabilised subbase material. The selection of select material where required will be dependent on moisture condition of subgrades at the time of construction.

Any areas of uncontrolled fill should be replaced as controlled fill in accordance with AS3798-2007 prior to pavement construction.

If rock subgrade materials are encountered, the rock should be ripped and re-compacted for a minimum depth of 300mm to break-up preferential drainage paths and provide a dense homogenous surface on which to construct the pavement

It is recommended that each construction length be boxed out to the minimum subgrade level required by the relevant pavement thickness design. Prior to pavement construction, the exposed subgrade should be assessed by the geotechnical authority to confirm the pavement thickness requirement for that section.

5.6 Excavation Conditions

The depths of uncontrolled fill, residual soils and weathered rock, together with depths of practical refusal of the excavator where encountered are summarised in Table 2.

In terms of excavation conditions, site materials can generally be divided into:

- Clayey and Granular Soils (Units 1 & 2). It is anticipated that these materials could be excavated by a conventional excavator or backhoe bucket;
- Weathered Rock (Units 3 & 4). Rippability is dependent on rock strength, degree of weathering and number of defects within the rock mass which can vary significantly.

It is anticipated that the Weathered Rock (Unit 3 & 4) material encountered could be excavated by conventional 30 tonne excavator or equivalent at least to the depths indicated on the appended test pit logs.

The use of toothed buckets, ripping tines, and/or hydraulic rock hammers may be required if hard bands of weathered rock are encountered or for deep confined excavations such as for service trenches. Higher strength rock or randomly occurring hard bands within the rock mass if encountered, are likely to occur towards the base of deeper cuts.

It is recommended that targeted investigations are carried out if significant excavations are proposed where bedrock depth or excavatability is important to design or construction.

There is potential for groundwater to exist at other localised areas of the site such as within the topsoil profile, or from water perched above the clay / bedrock profile. It is possible that water inflow may be encountered from such layers, particularly if earthworks are carried out during or following periods of wet weather. If groundwater is encountered, it is generally expected to be manageable by de-watering by sump and pump methods.

Excavations should be supported by properly designed and constructed retaining walls or else battered at 1V:2H or flatter and protected from erosion.

Temporary excavations should be battered at 1V:1H or flatter in cohesive soils, or 1V:1.5H or flatter in granular soils, and protected from erosion. Steeper excavations may be supported by means of temporary shoring.

Temporary excavations to depths of up to 1.2m in competent compact material with sufficient cohesion, such as clay of stiff consistency or better may be battered vertically, subject to inspection during excavation by the geotechnical authority.

The safe working procedures of Work Cover NSW Excavation work code of practice, dated July 2015 should be followed.

Care should be taken not to disturb or destabilise existing underground services or structures.

5.7 Special Construction Requirements and Site Drainage

The enclosed pavement thickness design and construction recommendations assume the provision of adequate surface and subsurface drainage of the pavement and adjacent areas. As a minimum, it is recommended that subsoil drains be installed:

- Along the high side of roads aligned across site slopes; and,
- Along both sides of roads aligned down slope.

Pavement surface and subsurface drainage should be carried out in accordance with Maitland City Council requirements.

Adequate surface and subsurface drainage should be installed and connected to the stormwater disposal system.

Inspection should be carried out by a geotechnical authority during construction to confirm the conditions assumed in this report and in the design.

6.0 Limitations

The findings presented in the report and used as the basis for recommendations presented herein were obtained using normal, industry accepted geotechnical design practices and standards. To our knowledge, they represent a reasonable interpretation of the general conditions of the site.

The extent of testing associated with this assessment is limited to discrete test pit locations. It should be noted that subsurface conditions between and away from the test pit locations may be different to those observed during the field work and used as the basis of the recommendations contained in this report.

If subsurface conditions encountered during construction differ from those given in this report, further advice should be sought without delay.

Data and opinions contained within the report may not be used in other contexts or for any other purposes without prior review and agreement by Qualtest. If this report is reproduced, it must be in full.

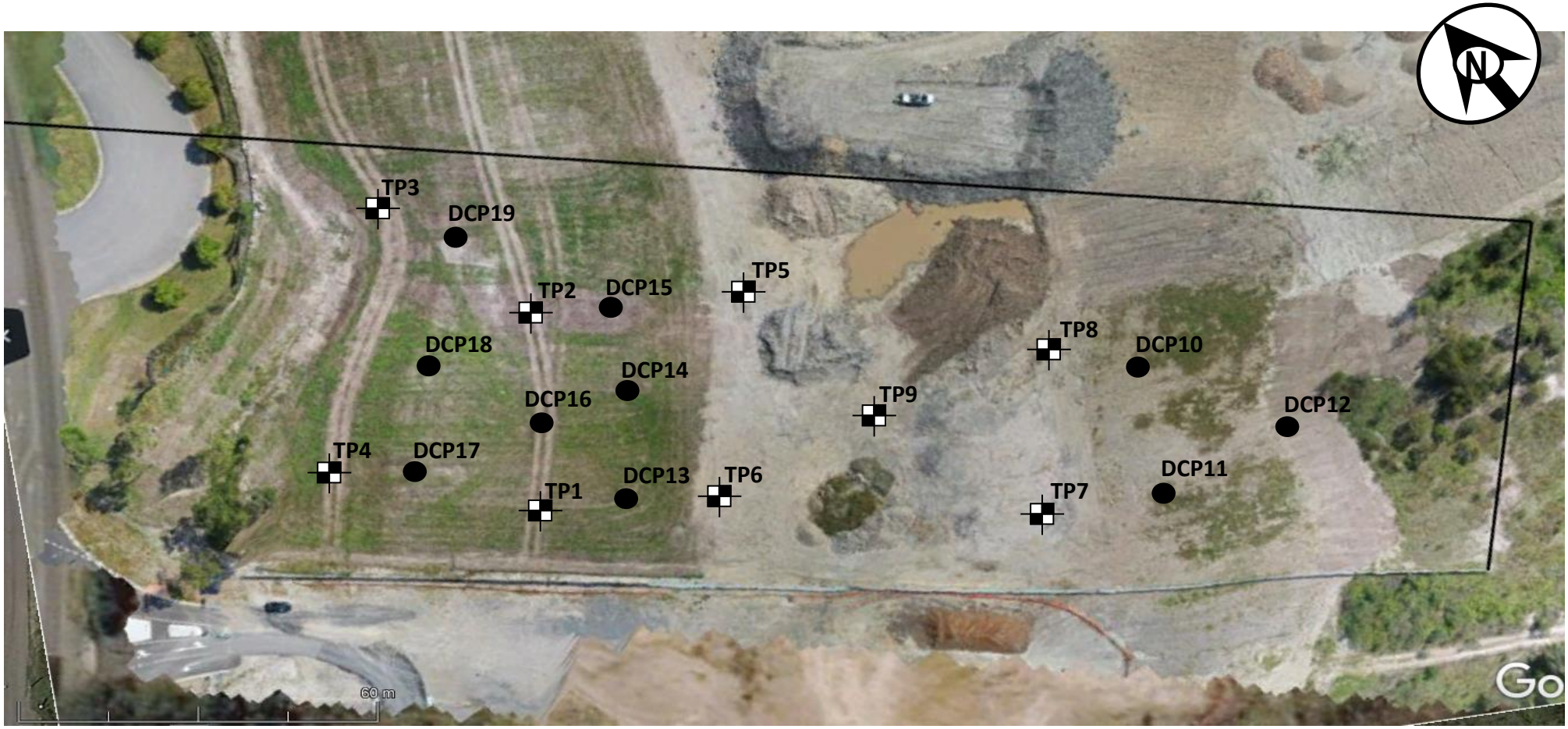
If you have any further questions regarding this report, please do not hesitate to contact Shannon Kelly or the undersigned.

For and on behalf of Qualtest Laboratory (NSW) Pty Ltd.

Jason Lee
Principal Geotechnical Engineer

FIGURES:

Figure AA1 – Site Plan and Approximate Test Locations



LEGEND:

Approximate Test Pit and DCP Test Location.

Approximate DCP Test Location.

Figure AA1 based on Aerial Image provided by Client, taken 10/12/2018.

Qualtest LABORATORY (NSW) PTY LTD	Client:	CSR C/- CATALYST PROJECT CONSULTING PTY LTD	Drawing No:	FIGURE AA1
	Project:	NEW MAITLAND HOSPITAL	Project No:	NEW18P-0242A
	Location:	METFORD ROAD, METFORD	Scale:	AS SHOWN
	Title:	SITE PLAN AND APPROXIMATE TEST LOCATIONS	Date:	30/01/19

APPENDIX A:

Results of Field Investigations

ENGINEERING LOG - TEST PIT

CLIENT: CSR LIMITED C/- CATALYST
PROJECT: NEW MAITLAND HOSPITAL
LOCATION: METFORD ROAD, METFORD

TEST PIT NO: TP1
PAGE: 1 OF 1
JOB NO: NEW18P-0242A
LOGGED BY: BB
DATE: 11/12/18

EQUIPMENT TYPE: 30 TONNE EXCAVATOR
TEST PIT LENGTH: 4.0 m **WIDTH:** 2.2 m
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered	0.70m CBR 0.90m 1.00m HILF 1.30m 1.50m HILF 1.80m		0.5 1.0 1.5 2.0		CL	FILL: Gravelly Sandy CLAY - low to medium plasticity, pale brown, fine to coarse grained sand, fine to coarse grained angular to sub-angular gravel, with some cobbles, with some broken brick, plastic and coal. Becoming brown to dark brown. Becoming dark grey. 2.10m Hole Terminated at 2.10 m	M < w_P M ~ w_P	VSt - H	HP HP HP HP HP HP HP HP HP HP	350 420 300 380 460 >600 380 420 250 380	FILL - UNCONTROLLED

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

CLIENT: CSR LIMITED C/- CATALYST
PROJECT: NEW MAITLAND HOSPITAL
LOCATION: METFORD ROAD, METFORD

TEST PIT NO: TP2
PAGE: 1 OF 1
JOB NO: NEW18P-0242A
LOGGED BY: BB
DATE: 11/12/18

EQUIPMENT TYPE: 30 TONNE EXCAVATOR
TEST PIT LENGTH: 4.0 m **WIDTH:** 2.2 m
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
E	Not Encountered	0.60m CBR 0.80m		0.0		CL	FILL: Sandy CLAY - low to medium plasticity, brown to dark brown, fine to coarse grained sand, with some rootlets.			HP	>600	FILL - TOPSOIL
							0.20m			HP	>600	FILL - UNCONTROLLED
						CL	FILL: MIXTURE OF SOIL (~60%), COBBLES/BOULDERS (~40%): Gravelly Sandy CLAY - low to medium plasticity, pale grey-brown to pale brown with some pale orange-brown, fine to coarse grained sand, fine to coarse grained angular to sub-angular gravel, with some cobbles and coal, trace boulders.			HP	550	
				0.5			0.50m			HP	380	
						CL	FILL: Gravelly Sandy CLAY - low to medium plasticity, grey to brown, pale orange-brown and white, fine to coarse grained sand, fine to coarse grained angular to sub-angular gravel, trace cobbles.			HP	420	
										HP	320	
		1.00m		1.0			Becoming brown with some black pockets, nodules of pale brown, white, and black.	$M < w_P$	VSt - H	HP	>600	
		HILF 1.30m				CL	Becoming dark brown.			HP	>600	
		1.50m		1.5						HP	>600	
		HILF 1.80m										
				2.0			2.00m					
							Hole Terminated at 2.00 m					

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

CLIENT: CSR LIMITED C/- CATALYST
PROJECT: NEW MAITLAND HOSPITAL
LOCATION: METFORD ROAD, METFORD

TEST PIT NO: TP3
PAGE: 1 OF 1
JOB NO: NEW18P-0242A
LOGGED BY: BB
DATE: 11/12/18

EQUIPMENT TYPE: 30 TONNE EXCAVATOR
TEST PIT LENGTH: 4.0 m **WIDTH:** 2.2 m
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered					CL	FILL: Sandy CLAY - low to medium plasticity, brown, fine to medium grained sand.					FILL - UNCONTROLLED
							0.15m					
						CL	FILL: MIXTURE OF SOIL (60%) AND COBBLES/BOULDERS (~40%): Gravelly Sandy CLAY - low to medium plasticity, dark brown to black with some orange-brown, fine to coarse grained sand, fine to coarse grained angular to sub-angular gravel, with some cobbles (~30%), trace boulders.			HP	>600	
										HP	>600	
				0.5								
		0.60m					0.60m			HP	240	
		CBR					FILL: Gravelly Sandy CLAY - low to medium plasticity, pale grey-brown, fine to coarse grained sand, fine to coarse grained angular to sub-angular gravel, with some cobbles (~15%).					
		0.80m								HP	>600	
						CL		M < w_P	VSt - H			
		1.00m		1.0						HP	>600	
		HILF					1.20m					
		1.30m					FILL: Gravelly Sandy CLAY - medium to high plasticity, dark brown, fine to coarse grained sand, fine to coarse grained angular to sub-angular gravel, with some cobbles (~15%).			HP	380	
										HP	350	
		1.50m		1.5								
		HILF				CH						
		1.80m										
				2.0			2.00m					
							Hole Terminated at 2.00 m					

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

CLIENT: CSR LIMITED C/- CATALYST
PROJECT: NEW MAITLAND HOSPITAL
LOCATION: METFORD ROAD, METFORD

TEST PIT NO: TP4
PAGE: 1 OF 1
JOB NO: NEW18P-0242A
LOGGED BY: BB
DATE: 11/12/18

EQUIPMENT TYPE: 30 TONNE EXCAVATOR
TEST PIT LENGTH: 4.0 m **WIDTH:** 2.2 m
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered	0.50m CBR 0.70m		0.5		CL	FILL: Sandy CLAY - low to medium plasticity, brown, fine to medium grained sand.	M < w_P	VSt - H	HP	>600	FILL - UNCONTROLLED
							0.15m FILL: Gravelly Sandy CLAY - low to medium plasticity, pale brown, fine to coarse grained sand, fine to coarse grained (mostly fine to medium grained) angular to sub-angular gravel.			HP	>600	
						CL				HP	>600	
							0.65m					
						CI	0.70m FILL: CLAY - medium plasticity, black.					FILL / POSSIBLE RESIDUAL
							CLAY - medium to high plasticity, pale grey with some pale yellow-brown and dark grey.					RESIDUAL SOIL
		1.00m HILF 1.30m		1.0		CH			H	HP	>600	
										HP	>600	
										HP	>600	
							1.25m Sandy SILTSTONE - fine grained sand, pale grey with some pale yellow brown and dark grey, estimated low to medium strength. 1.35m	D				HIGHLY WEATHERED ROCK
				1.5			Hole Terminated at 1.35 m Refusal					
				2.0								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

CLIENT: CSR LIMITED C/- CATALYST
PROJECT: NEW MAITLAND HOSPITAL
LOCATION: METFORD ROAD, METFORD

TEST PIT NO: TP5
PAGE: 1 OF 1
JOB NO: NEW18P-0242A
LOGGED BY: BB
DATE: 11/12/18

EQUIPMENT TYPE: 30 TONNE EXCAVATOR
TEST PIT LENGTH: 4.0 m **WIDTH:** 2.2 m
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered					CL	FILL: Gravelly Sandy CLAY - low to medium plasticity, pale grey-brown to pale brown, fine to coarse grained sand, fine to coarse grained angular to sub-angular gravel, with some cobbles (~10%).	$M < w_P$	VSt - H	HP	350 - 420	FILL - UNCONTROLLED
							0.40m					
				0.5		CH	Sandy CLAY - medium to high plasticity, pale grey and orange-brown, fine grained sand.		H	HP	>600	RESIDUAL SOIL
							0.50m					
						CI	0.55m Extremely Weathered Silty Sandstone with soil properties; breaks down into Gravelly Sandy CLAY - medium plasticity, pale grey and orange-brown, fine to coarse grained sand, fine to medium grained angular gravel, with some highly weathered pockets.					EXTREMELY WEATHERED ROCK
							Hole Terminated at 0.55 m Very slow progress					
				1.0								
				1.5								
				2.0								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

CLIENT: CSR LIMITED C/- CATALYST
PROJECT: NEW MAITLAND HOSPITAL
LOCATION: METFORD ROAD, METFORD

TEST PIT NO: TP6
PAGE: 1 OF 1
JOB NO: NEW18P-0242A
LOGGED BY: BB
DATE: 11/12/18

EQUIPMENT TYPE: 30 TONNE EXCAVATOR
TEST PIT LENGTH: 4.0 m **WIDTH:** 2.2 m
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered					CL	FILL: Gravelly Sandy CLAY - low to medium plasticity, grey-brown to pale grey-brown, fine to coarse grained sand, fine to medium grained angular to sub-angular gravel.	M < w_P	VSt - H			FILL - UNCONTROLLED
							0.20m					
						GP	Extremely Weathered Silty Sandstone with soil properties; breaks down into Sandy GRAVEL - fine to coarse grained (mostly fine to medium grained) sub-angular to angular, pale orange-brown to pale yellow-brown and pale grey, fine to coarse grained sand, with some highly weathered pockets.		H			EXTREMELY WEATHERED ROCK
				0.5			0.50m					
							Hole Terminated at 0.50 m Very slow progress					
				1.0								
				1.5								
				2.0								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

CLIENT: CSR LIMITED C/- CATALYST
PROJECT: NEW MAITLAND HOSPITAL
LOCATION: METFORD ROAD, METFORD

TEST PIT NO: TP7
PAGE: 1 OF 1
JOB NO: NEW18P-0242A
LOGGED BY: BB
DATE: 11/12/18

EQUIPMENT TYPE: 30 TONNE EXCAVATOR
TEST PIT LENGTH: 4.0 m **WIDTH:** 2.2 m
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered					CL	0.05m FILL: Gravelly Sandy CLAY - low to medium plasticity, pale grey-brown, fine to coarse grained sand, fine to coarse grained angular to sub-angular gravel, with some cobbles (~10%).					FILL - UNCONTROLLED
						CL	FILL: Gravelly Sandy CLAY - low to medium plasticity, black, fine to coarse grained sand, fine to coarse grained angular to sub-angular gravel.	M < w_P	VSt - H			
							0.40m					
				0.5		CI	FILL: Gravelly Sandy CLAY - medium plasticity, brown to dark red-brown, fine to coarse grained sand, fine to coarse grained angular to sub-angular gravel, trace plastic (PVC pipe ~20mm diameter).					
							0.55m					
						SC	0.60m Extremely Weathered Silty Sandstone with soil properties; breaks down into Gravelly Clayey SAND - fine to coarse grained, pale grey and pale yellow-brown, fine to coarse grained angular (mostly fine to medium grained) gravel, fines of low plasticity, with some highly weathered pockets.	D	VD			EXTREMELY WEATHERED ROCK
							Hole Terminated at 0.60 m Very slow progress					
				1.0								
				1.5								
				2.0								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

CLIENT: CSR LIMITED C/- CATALYST
PROJECT: NEW MAITLAND HOSPITAL
LOCATION: METFORD ROAD, METFORD

TEST PIT NO: TP8
PAGE: 1 OF 1
JOB NO: NEW18P-0242A
LOGGED BY: BB
DATE: 11/12/18

EQUIPMENT TYPE: 30 TONNE EXCAVATOR
TEST PIT LENGTH: 4.0 m **WIDTH:** 2.2 m
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered	0.60m CBR 0.80m		0.5 1.0		CL	FILL: Gravelly Sandy CLAY - low to medium plasticity, pale grey-brown, fine to coarse grained sand, fine to coarse grained angular to sub-angular gravel, with cobbles (~10%) and coal.	$M < w_P$	VSt - H	HP	300	FILL - UNCONTROLLED
							Becoming dark grey brown and black, trace sticks.			HP	500	
							Becoming pale brown.			HP	420	
										HP	500	
							1.15m					
							1.20m SANDSTONE - fine to medium grained, orange-brown to pale red-brown, estimated low strength.	D				HIGHLY WEATHERED ROCK
				1.5 2.0			Hole Terminated at 1.20 m Very slow progress					

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

CLIENT: CSR LIMITED C/- CATALYST
PROJECT: NEW MAITLAND HOSPITAL
LOCATION: METFORD ROAD, METFORD

TEST PIT NO: TP9
PAGE: 1 OF 1
JOB NO: NEW18P-0242A
LOGGED BY: BB
DATE: 11/12/18

EQUIPMENT TYPE: 30 TONNE EXCAVATOR
TEST PIT LENGTH: 4.0 m **WIDTH:** 2.2 m
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered			0.0		CL	FILL: Gravelly Sandy CLAY - low to medium plasticity, pale grey-brown to grey-brown, fine to coarse grained sand, fine to coarse grained angular to sub-angular gravel, trace cobbles (~5%).	M < w_P	VSt - H	HP	500	FILL - UNCONTROLLED
				0.5			0.50m					
		0.70m				GC	Extremely Weathered Sandy Siltstone with soil properties; breaks down into Clayey Sandy GRAVEL - fine to coarse grained angular, pale grey and pale orange-brown to pale yellow-brown, fine to coarse grained sand, fines of low plasticity, with some highly weathered pockets.	D	VD			EXTREMELY WEATHERED ROCK
		CBR										
		0.90m					0.90m					
				1.0			Hole Terminated at 0.90 m Very slow progress					
				1.5								
				2.0								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Qualtest LABORATORY (NSW) PTY LTD

8 Ironbark Close Warabrook NSW 2304
T: 02 4968 4468
F: 02 4960 9775
E: admin@qualtest.com.au
W: www.qualtest.com.au
ABN: 98 153 268 896

DYNAMIC CONE PENETROMETER - TEST REPORT

Client:	**CATALYST PROJECT CONSULTING PTY LTD**	**Project Number:**	*NEW18P-0242A*
Principal:	**CSR LIMITED**	**Sheet No:**	*1 of 3*
Project:	**NEW MAITLAND HOSPITAL**	**Test Date:**	11/12/2018
Location:	**METFORD ROAD, METFORD**	**Tested By:**	BB

Test Method: **AS1289 6.3.2** ☑ **Cone Tip**
Drop Height: **510 ± 5mm** ☐ **Blunt Tip**

Depth Below Surface (mm)	Test Number								Test Location / Comments
	TP1	TP2	TP3	TP4	TP5	TP6	TP7	TP8	
									DCP locations as shown on Figure AA1.
150	6	17	10	8	26	13*	10	20	
300	14	11	15	10	32		16	21	
450	6	9*/100mm	9	12			9	9	
600	6	-	5	14			12	8	
750	13	-	9	10			9*/75mm	4	
900	18	-	22					4	
1050	19	16	8*/15mm					8*/50mm	
1200	28	10	4						
1350	18	9	4						
1500	14	8	5						
1650	25	15	4						
1800	22	34	3						
1950	18	18	2						
2100	19	5*/50mm	4						
2250			5						
2400									
2550									
2700									
2850									
3000									
3150									
3300									
3450									
3600									
3750									
3900									
4050									
4200									
4350									
4500									

Comments: Readings recorded in blows per 150mm increments.

Qualtest LABORATORY (NSW) PTY LTD

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T: 02 4968 4468
F: 02 4960 9775
E: admin@qualtest.com.au
W: www.qualtest.com.au
ABN: 98 153 268 896

DYNAMIC CONE PENETROMETER - TEST REPORT

Client:	**CATALYST PROJECT CONSULTING PTY LTD**	**Project Number:**	*NEW18P-0242A*
Principal:	**CSR LIMITED**	**Sheet No:**	*2 of 3*
Project:	**NEW MAITLAND HOSPITAL**	**Test Date:**	11/12/2018
Location:	**METFORD ROAD, METFORD**	**Tested By:**	BB

Test Method: **AS1289 6.3.2** ☑ **Cone Tip**
Drop Height: **510 ± 5mm** ☐ **Blunt Tip**

Depth Below Surface (mm)	Test Number								Test Location / Comments
	TP9	DCP10	DCP11	DCP12	DCP13	DCP14	DCP15	DCP16	
150	25	3	6	12	6	12	8	6	DCP locations as shown on Figure AA1.
300	26	11	13	8	5	13	8	11	
450	27	19	14	4	8	19	11	11	
600		7	12	6	9	5	16	8	
750		3*/50mm	13	5	7	9	15*	8	
900			17	6	8	8*/75mm		9	
1050			12	10	9			6	
1200			11	8	12*/75mm			8	
1350			17	6				14	
1500			13	9				19	
1650			9	12				17	
1800			13	10				9*/50mm	
1950			16	7					
2100			11	8					
2250									
2400									
2550									
2700									
2850									
3000									
3150									
3300									
3450									
3600									
3750									
3900									
4050									
4200									
4350									
4500									

Comments: Readings recorded in blows per 150mm increments.

8 Ironbark Close Warabrook NSW 2304
T: 02 4968 4468
F: 02 4960 9775
E: admin@qualtest.com.au
W: www.qualtest.com.au
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DYNAMIC CONE PENETROMETER - TEST REPORT

Client:	**CATALYST PROJECT CONSULTING PTY LTD**	**Project Number:**	*NEW18P-0242A*
Principal:	**CSR LIMITED**	**Sheet No:**	*3 of 3*
Project:	**NEW MAITLAND HOSPITAL**	**Test Date:**	11/12/2018
Location:	**METFORD ROAD, METFORD**	**Tested By:**	BB

Test Method: **AS1289 6.3.2** ☑ **Cone Tip**
Drop Height: **510 ± 5mm** ☐ **Blunt Tip**

Depth Below Surface (mm)	Test Number								Test Location / Comments
	DCP17	DCP18	DCP19						
									DCP locations as shown on Figure AA1.
150	10	7	6						
300	13	4	7						
450	6	6*/50mm	9						
600	9		7						
750	6		11*75mm						
900	16								
1050	13								
1200	11								
1350	13								
1500	16								
1650	9								
1800	13								
1950	16								
2100	17								
2250									
2400									
2550									
2700									
2850									
3000									
3150									
3300									
3450									
3600									
3750									
3900									
4050									
4200									
4350									
4500									

Comments: Readings recorded in blows per 150mm increments.

APPENDIX B:

HILF Density Ratio Reports

QUALTEST Laboratory (NSW) Pty Ltd (20708)
8 Ironbark Close Warabrook NSW 2304
T: 02 4968 4468
F: 02 4960 9775
E: admin@qualtest.com.au
W: www.qualtest.com.au
ABN: 98 153 268 896

Report No: HDR:NEW18W-3981
Issue No: 1

HILF Density Ratio Report

Client: CSR
C/- Catalyst Project Consulting
110 King Street, Newcastle NSW 2300

Principal:
Project No.: NEW18P-0242A
Project Name: New Maitland Hospital

Approved Signatory: Jeremy Betz
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 13/12/2018

Sample Details

Location:	Metford Road, Metford
Client Request ID:	-
Specification Requirements:	Minimum HILF Density Ratio of 95% Standard (as advised by client)
Field Test procedures:	AS 1289.5.8.1
Laboratory Test procedures:	AS 1289.5.7.1, AS 1289.2.1.1
Sampling Method::	AS1289.1.2.1 cl 6.4b
Source::	On-Site
Material::	Existing Fill
Lot No.:	-
Test Request No.:	-

Sample Data

Sample ID:	NEW18W-3981--S01	NEW18W-3981--S02	NEW18W-3981--S03
Date Tested:	11/12/2018	11/12/2018	11/12/2018
Time Tested:	09:00	09:05	09:10
Location:	TP01	TP01	TP02
	See Attached Plan	See Attached Plan	See Attached Plan
	1.0m Below Ground Level	1.5m Below Ground Level	1.0m Below Ground Level
Soil Description:	Sandy CLAY	Sandy CLAY	Sandy CLAY
Field and Laboratory Data			
Depth of Test (mm)	300	300	300
Depth of Layer (mm)	300	300	300
AS Sieve Size (mm)	19.0	19.0	19.0
Oversize Wet (%)	3	4	2
Field Moisture Content (%)	17.4	13.1	12.7
Field Wet Density (t/m³)	2.12	2.18	2.10
Field Dry Density (t/m³)	1.80	1.93	1.86
Peak Converted Wet Density (t/m³)	2.08	2.08	1.97
Optimum Moisture Content (%)	17.0	14.0	14.5
Compactive Effort	Standard	Standard	Standard
Moisture Ratio (%)	103.0	95.0	87.0
Moisture Variation (%)	0.5 wet	0.5 dry	2.0 dry
Hilf Density Ratio (%)	**101.5**	**104.5**	**106.0**

Comments

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Report No: HDR:NEW18W-3981
Issue No: 1

HILF Density Ratio Report

Client: CSR
C/- Catalyst Project Consulting
110 King Street, Newcastle NSW 2300

Principal:
Project No.: NEW18P-0242A
Project Name: New Maitland Hospital

Approved Signatory: Jeremy Betz
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 13/12/2018

Sample Details

Location:	Metford Road, Metford
Client Request ID:	-
Specification Requirements:	Minimum HILF Density Ratio of 95% Standard (as advised by client)
Field Test procedures:	AS 1289.5.8.1
Laboratory Test procedures:	AS 1289.5.7.1, AS 1289.2.1.1
Sampling Method::	AS1289.1.2.1 cl 6.4b
Source::	On-Site
Material::	Existing Fill
Lot No.:	-
Test Request No.:	-

Sample Data

Sample ID:	NEW18W-3981--S04	NEW18W-3981--S05	NEW18W-3981--S06
Date Tested:	11/12/2018	11/12/2018	11/12/2018
Time Tested:	09:15	09:55	10:00
Location:	TP02	TP03	TP03
	See Attached Plan	See Attached Plan	See Attached Plan
	1.5m Below Ground Level	1.0m Below Ground Level	1.5m Below Ground Level
Soil Description:	Sandy CLAY	Sandy CLAY	Sandy CLAY
Field and Laboratory Data			
Depth of Test (mm)	300	300	300
Depth of Layer (mm)	300	300	300
AS Sieve Size (mm)	19.0	19.0	19.0
Oversize Wet (%)	4	2	2
Field Moisture Content (%)	13.4	16.3	17.6
Field Wet Density (t/m³)	2.12	1.88	1.94
Field Dry Density (t/m³)	1.87	1.61	1.65
Peak Converted Wet Density (t/m³)	2.01	2.06	1.99
Optimum Moisture Content (%)	14.0	16.5	18.0
Compactive Effort	Standard	Standard	Standard
Moisture Ratio (%)	94.5	98.0	96.5
Moisture Variation (%)	1.0 dry	0.5 dry	0.5 dry
Hilf Density Ratio (%)	**106.0**	**91.5**	**97.0**

Comments

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Report No: HDR:NEW18W-3981
Issue No: 1

HILF Density Ratio Report

Client: CSR
C/- Catalyst Project Consulting
110 King Street, Newcastle NSW 2300

Principal:
Project No.: NEW18P-0242A
Project Name: New Maitland Hospital

Approved Signatory: Jeremy Betz
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 13/12/2018

APPENDIX C:

Results of Laboratory Testing

QUALTEST Laboratory (NSW) Pty Ltd (20708)
8 Ironbark Close Warabrook NSW 2304
T: 02 4968 4468
F: 02 4960 9775
E: admin@qualtest.com.au
W: www.qualtest.com.au
ABN: 98 153 268 896

California Bearing Ratio Test Report

Report No: CBR:NEW19W-0022--S01
Issue No: 1

Client: CSR
C/- Catalyst Project Consulting
110 King Street, Newcastle NSW 2300

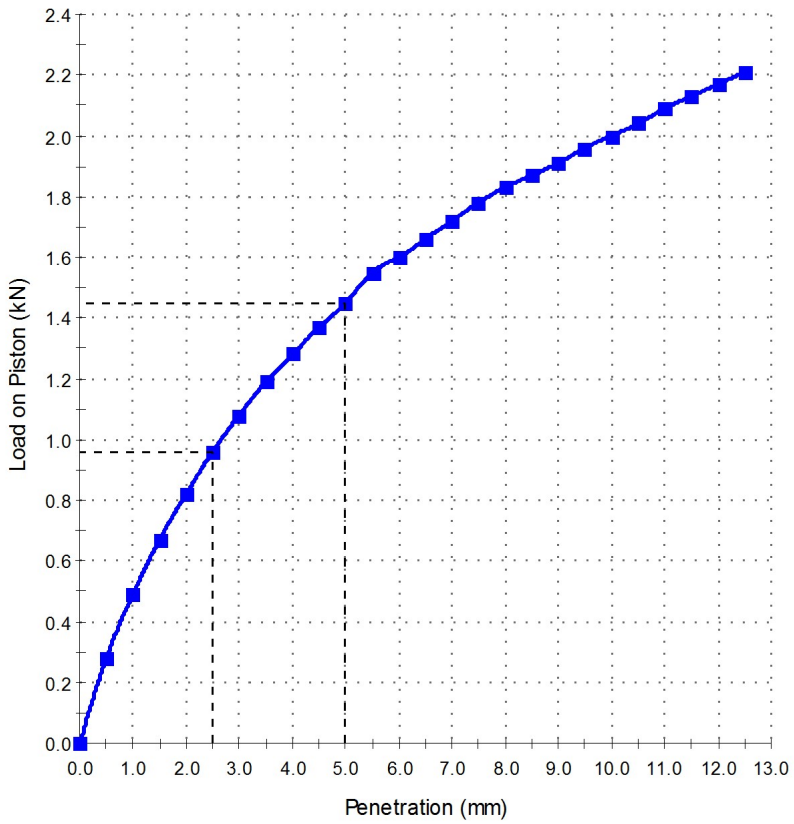
Principal:
Project No.: NEW18P-0242A
Project Name: New Maitland Hospital

Approved Signatory: Brent Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 23/01/2019

Sample Details

Sample ID:	NEW19W-0022--S01	**Date Sampled:**	11/12/2018
Sampling Method:	AS1289.1.2.1 cl 6.5		
Specification:	No Specification	**Source:**	On Site
Location:	TP1 - (0.7 - 0.9m)	**Material:**	Gravelly Sandy Clay
Project Location:	Metford Road, Metford (East Maitland), NSW		

Load vs Penetration



Test Results

AS 1289.6.1.1 - 2014

CBR At 5.0mm (%):	**7**
Maximum Dry Density (t/m³):	1.79
Optimum Moisture Content (%):	15.0
Dry Density before Soaking (t/m³):	1.80
Density Ratio before Soaking (%):	100.0
Moisture Content before Soaking (%):	15.1
Moisture Ratio before Soaking (%):	99.0
Dry Density after Soaking (t/m³):	1.77
Density Ratio after Soaking (%):	99.0
Swell (%):	1.5
Moisture Content of Top 30mm (%):	18.3
Moisture Content of Remaining Depth (%):	17.1
Compactive Effort:	Standard AS 1289.5.1.1
Surcharge Mass (kg):	9.00
Period of Soaking (Days):	4
Oversize Material:	Excluded
Oversize Material (%):	1
CBR Moisture Content Method:	AS 1289.2.1.1
Field Moisture Content (%):	14.3
Curing Time (hrs) :	48

Comments

Method of establishing plasticity level: Visual Assessment

QUALTEST Laboratory (NSW) Pty Ltd (20708)
8 Ironbark Close Warabrook NSW 2304
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F: 02 4960 9775
E: admin@qualtest.com.au
W: www.qualtest.com.au
ABN: 98 153 268 896

California Bearing Ratio Test Report

Report No: CBR:NEW19W-0022--S02
Issue No: 1

Client: CSR
C/- Catalyst Project Consulting
110 King Street, Newcastle NSW 2300

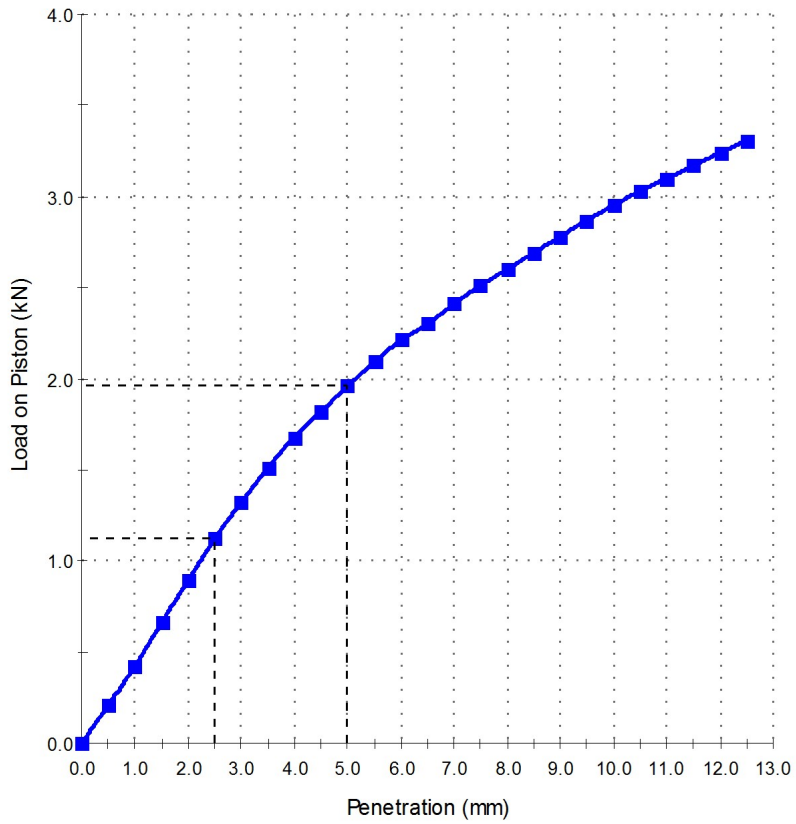
Principal:
Project No.: NEW18P-0242A
Project Name: New Maitland Hospital

Approved Signatory: Brent Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 23/01/2019

Sample Details

Sample ID:	NEW19W-0022--S02	**Date Sampled:**	11/12/2018
Sampling Method:	AS1289.1.2.1 cl 6.5		
Specification:	No Specification	**Source:**	On Site
Location:	TP3 - (0.6 - 0.8m)	**Material:**	Gravelly Sandy Clay
Project Location:	Metford Road, Metford (East Maitland), NSW		

Load vs Penetration



Test Results

AS 1289.6.1.1 - 2014

CBR At 5.0mm (%):	**10**
Maximum Dry Density (t/m³):	1.76
Optimum Moisture Content (%):	13.5
Dry Density before Soaking (t/m³):	1.76
Density Ratio before Soaking (%):	100.0
Moisture Content before Soaking (%):	13.5
Moisture Ratio before Soaking (%):	101.5
Dry Density after Soaking (t/m³):	1.73
Density Ratio after Soaking (%):	98.5
Swell (%):	1.5
Moisture Content of Top 30mm (%):	19.3
Moisture Content of Remaining Depth (%):	17.6
Compactive Effort:	Standard AS 1289.5.1.1
Surcharge Mass (kg):	9.00
Period of Soaking (Days):	4
Oversize Material:	Excluded
Oversize Material (%):	1
CBR Moisture Content Method:	AS 1289.2.1.1
Field Moisture Content (%):	13.7
Curing Time (hrs) :	48

Comments

Method of establishing plasticity level: Visual Assessment

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F: 02 4960 9775
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W: www.qualtest.com.au
ABN: 98 153 268 896

California Bearing Ratio Test Report

Report No: CBR:NEW19W-0022--S03
Issue No: 1

Client: CSR
C/- Catalyst Project Consulting
110 King Street, Newcastle NSW 2300

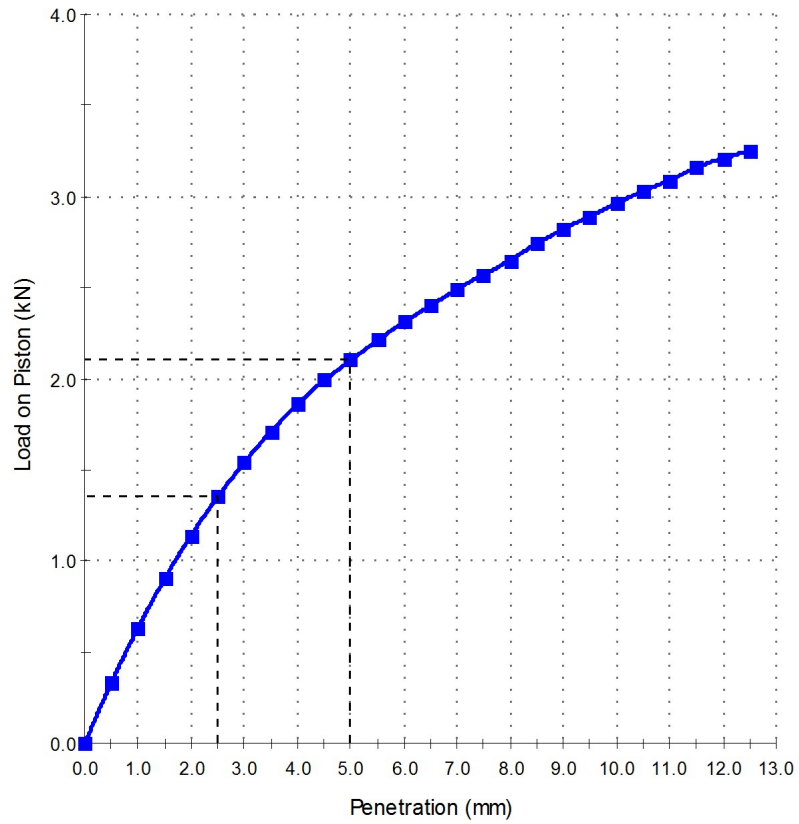
Principal:
Project No.: NEW18P-0242A
Project Name: New Maitland Hospital

Approved Signatory: Brent Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 23/01/2019

Sample Details

Sample ID:	NEW19W-0022--S03	**Date Sampled:**	11/12/2018
Sampling Method:	AS1289.1.2.1 cl 6.5		
Specification:	No Specification	**Source:**	On Site
Location:	TP8 - (0.6 - 0.8m)	**Material:**	Gravelly Sandy Clay
Project Location:	Metford Road, Metford (East Maitland), NSW		

Load vs Penetration



Test Results

AS 1289.6.1.1 - 2014

CBR At 5.0mm (%):	**11**
Maximum Dry Density (t/m³):	1.69
Optimum Moisture Content (%):	17.5
Dry Density before Soaking (t/m³):	1.69
Density Ratio before Soaking (%):	100.0
Moisture Content before Soaking (%):	17.7
Moisture Ratio before Soaking (%):	101.5
Dry Density after Soaking (t/m³):	1.68
Density Ratio after Soaking (%):	99.5
Swell (%):	0.5
Moisture Content of Top 30mm (%):	20.9
Moisture Content of Remaining Depth (%):	19.1
Compactive Effort:	Standard AS 1289.5.1.1
Surcharge Mass (kg):	9.00
Period of Soaking (Days):	4
Oversize Material:	Excluded
Oversize Material (%):	1
CBR Moisture Content Method:	AS 1289.2.1.1
Field Moisture Content (%):	17.1
Curing Time (hrs) :	48

Comments

Method of establishing plasticity level: Visual Assessment

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California Bearing Ratio Test Report

Report No: CBR:NEW19W-0022--S04
Issue No: 1

Client: CSR
C/- Catalyst Project Consulting
110 King Street, Newcastle NSW 2300

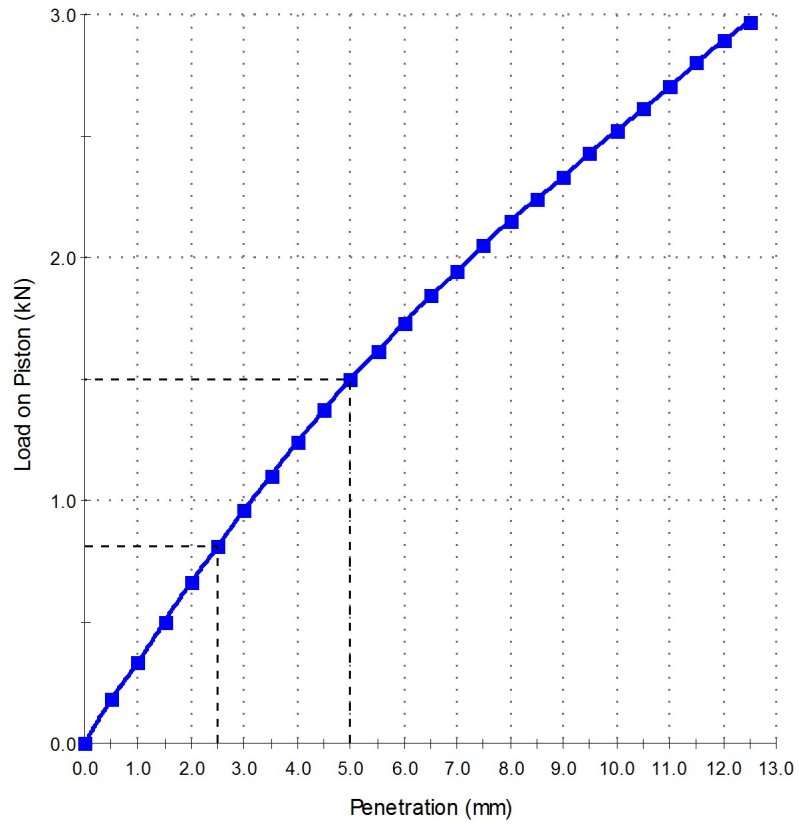
Principal:
Project No.: NEW18P-0242A
Project Name: New Maitland Hospital

Approved Signatory: Brent Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 23/01/2019

Sample Details

Sample ID:	NEW19W-0022--S04	**Date Sampled:**	11/12/2018
Sampling Method:	AS1289.1.2.1 cl 6.5		
Specification:	No Specification	**Source:**	On Site
Location:	TP9 - (0.7 - 0.9m)	**Material:**	Gravelly Sandy Clay
Project Location:	Metford Road, Metford (East Maitland), NSW		

Load vs Penetration



Test Results

AS 1289.6.1.1 - 2014

CBR At 5.0mm (%):	**8**
Maximum Dry Density (t/m³):	1.83
Optimum Moisture Content (%):	12.5
Dry Density before Soaking (t/m³):	1.83
Density Ratio before Soaking (%):	99.5
Moisture Content before Soaking (%):	12.7
Moisture Ratio before Soaking (%):	103.0
Dry Density after Soaking (t/m³):	1.79
Density Ratio after Soaking (%):	97.5
Swell (%):	2.0
Moisture Content of Top 30mm (%):	18.6
Moisture Content of Remaining Depth (%):	16.2
Compactive Effort:	Standard
	AS 1289.5.1.1
Surcharge Mass (kg):	4.50
Period of Soaking (Days):	4
Oversize Material (%):	0
CBR Moisture Content Method:	AS 1289.2.1.1
Field Moisture Content (%):	9.5
Curing Time (hrs) :	48

Comments

Method of establishing plasticity level: Visual Assessment