NSW Department of Commerce | NSW Water Solutions

Manilla MPS and Health One Facilities (Manilla Hospital) RTF 0801673

Geotechnical Investigation

Geotechnical and Environmental
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ABSTRACT

The Geotechnical and Environmental Unit (Office of Public Works and Services – NSW Water Solutions) was commissioned by the Hunter & New England Region (Office of Public Works and Services – Tamworth Office), on behalf of the Department of Health, to carry out a geotechnical investigation for the proposed redevelopment within the existing Manilla Hospital at Manilla, New South Wales.

Fieldwork was carried out in two (2) stages during periods of 27th to 28th November and 4th to 9th December 2008, and comprised the drilling of eighteen (18) boreholes including rock coring in selected boreholes.

The main objectives of the investigation were to determine the subsurface and foundation conditions for the proposed redevelopment.

This report presents the data obtained from field investigation and laboratory testing, and discusses geotechnical aspects relevant to design and construction of the proposed development.

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MANILA HOSPITAL

Geotechnical Investigation

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1. Introduction

1.1 General

The Hunter & New England Region (Office of Public Works and Services – Tamworth Office), on behalf of the Department of Health, commissioned the Geotechnical and Environmental Unit to undertake a geotechnical investigation for the proposed redevelopment (Manilla MPS and Health One Facilities) within the existing Manilla Hospital complex at Manilla, in Manilla, NSW.

This report present the data obtained from the field investigation and laboratory testing and discusses relevant geotechnical aspects for design and construction of the proposed redevelopment.

1.2 Proposed Redevelopment

Based on site plans (dated 14 August 2008) provided by Project Manager, the proposed development will include the following:

- New single story buildings for Multi Purpose Service
- Health One Facilities
- New entry roadwork / parking /dock

1.3 Prior Work

Hunter Geotechnics has carried out a geotechnical assessment for the proposed facilities in 2007 (Report HGS 1031, September 2007). Where considered relevant, the information contained in the above report has been considered in the preparation of this report, and the test pit logs are reproduced in **Appendix E**.

1.4 Locality

Manilla is located in the northwestern part of New South Wales, approximately 50km north of Tamworth. The hospital complex is located in north eastern part of the town and is bounded by Court Street to the south and private properties to other boundaries (see **Figure 1)**.

The proposed redevelopment areas are located within the hospital complex. The existing hospital buildings are proposed to be demolished and replaced with the new buildings.

A site plan, showing conceptual layout of the proposed development, is presented in **Figure 2**.

1.5 Aims of the Investigation

The main aims of the investigation were to report on:

- subsurface conditions within the sites of the proposed structures,
- properties of subsurface materials,
- suitable footing systems and founding depths,
- allowable bearing capacities of footings,
- pavement design parameters, and
- excavation characteristics of the encountered strata, and
- earthwork requirements

1.6 Terminology

The methods used in this report to describe the soil profiles, including visual classification of material types encountered at discrete borehole locations, are generally in accordance with AS1726 - 1993 Geotechnical Site Investigation.

The descriptions of terminology used are presented in **Appendix A**.

2. Geology, Mine Subsidence and Flood Vulnerability

2.1 Geology

The Manilla 1:250,000 Geological Series Sheets SH56-9 (1973) indicates that Manilla is located within Noumea Beds of Upper Devonian in age and comprises massive sandstones, conglomerates and argillites.

Geological reference from the Manilla-Narrabri 1:250,000 Metallogenic Series Sheet SH/56-9, SH/55-12, (First Edition 1992), indicates that the Manilla Hospital is located within the Parry Group of Lowana Formation of Late Devonian in age and comprises of green-black siltstone and mudstone with thin, white tuffaceous beds.

Unconsolidated Quaternary alluvium associated with the Namoi and Manilla Rivers occur in a narrow floodplains in the area of Manilla twnship.

The current field investigation revealed that the subsurface profile comprises a layer of fill (including some topsoil), underlain by residual soils followed by weathered and highly fractured siltstone / mudstone and tuffaceous sandstone.

2.2 Mine Subsidence

The site does not lie within a proclaimed Mine Subsidence District (coal mining), and hence is not affected by associated subsidence.

2.3 Flood Vulnerability

Manilla is situated at the confluence of the Manilla and Namoi Rivers. Based on our prior investigation for Manilla High School site, which is located at close proximity of the hospital (bounded by Carinya Avenue and Warrego Street), the 1 in 100 years return period flood level for Manilla is RL 352.063m (AHD). The hospital site is located in an elevated part of the town with site RL's varying from approximately 373m to 375m. Therefore, the hospital site is not prone to flooding.

3. Summary of Investigations

Fieldwork was carried out in two (2) stages:

Stage 1 Auger Drilling

Stage 1 fieldwork was carried out during the period of 27th and 28h November 2008, and comprised the drilling of twelve (12) boreholes (B1 – B12) to depths ranging from 1.3m to 4.7m, for a total metreage of 42.69 metres.

The drilling was carried out by Earth Boring Services Pty. Ltd. using a Pioneer P80 drill rig mounted on the back of a utility. The boreholes were advanced using continuous, solid, spiral flight augers fitted with a tungsten carbide (TC) bit. All boreholes were terminated upon reaching their nominal target depths, or reaching TC bit refusal.

Standard Penetration Tests (SPTs) were carried out in all boreholes at varying intervals. This was supplemented by taking an undisturbed, thin-walled, tube (U50) sample and disturbed samples off the auger flights.

Stage 2 Diamond Core Drilling

Stage 2 fieldwork was carried out during the period of 4th to 9th December 2008, and comprised diamond core drilling at six (6) locations (B1A, B5A, B13, B14, B15 and B16).

The fieldwork for both stages was supervised full-time by a senior geotechnical engineer from our Unit who positioned and logged the boreholes and directed insitu testing. The recovered rock core was logged and photographed in Sydney by an engineering geologist from our Unit.

Detailed borehole logs and diamond core geological logs are presented in **Appendix B**. Summary of borehole data for Stage 1 and Stage 2 drilling are given in **Tables 1 and 2**, respectively.

Borehole locations are shown on **Figure 3**. The boreholes were located by tape measure from existing nearby features.

Table 1 Summary of borehole data for Stage 1 Drilling

Borehole No.	Drilled depth (m)	Fill thickness (m)	Depth to Rock (m)	TC Bit Refusal (m)	Rock Type
B1	3.1	2.6	-	3.1	
B2	4.7	0.45	3.6	4.7	Tuffaceous Sandstone
B3	4.09	0.8	2.6	4.09	Tuffaceous Sandstone
B4	4.4	2.1	3	4.4	Meta-Siltstone/Mudstone
B5	3.2	0.75	1.7	3.2	Tuffaceous Sandstone
B6	4.5	1.7	1.7	-	Meta-Siltstone/Mudstone
B7	3.3	0.45	1.0	3.3	Meta-Siltstone/Mudstone
B8	4.5	0.8	2.3	-	Tuffaceous Sandstone
B9	3.6	-	2.8	3.6	Tuffaceous Sandstone
B10	1.3	-	-	1.3	
B11	4.5	0.4	3.2	-	Tuffaceous Sandstone
B12	1.5	0.3	1.3	-	Tuffaceous Sandstone

Table 2 Summary of borehole data for Stage 2 Drilling

Borehole No.	Drilled depth (m)	Fill thickness (m)	Depth to Rock (m)	Rock Core (m)	Rock Type
B1A	6.03	2.5	3.64	2.39	
B5A	3.14	0.75	1.8	1.34	Tuffaceous Sandstone
B13	3.09	-	-	3.09	Tuffaceous Sandstone
B14	4.87	0.5	1.14	3.73	Meta-Siltstone/Mudstone
B15	2.7	-	0.3	2.4	Tuffaceous Sandstone
B16	2.8	-	0.88	1.92	Meta-Siltstone/Mudstone

4. Laboratory Testing

4.1 Geotechnical

Representative samples were selected and subjected to the following tests in accordance with the relevant methods of AS 1289:

- Aterberg limits
- Linear shrinkage
- Particle size analysis
- Shrink-swell index
- Standard compaction
- California Bearing Ratio (CBR)

The above tests were carried out by Australian Soil Testing Pty Ltd laboratory, at Rockdale. The results of the above tests are presented in **Appendix C**.

4.2 Chemical Aggressiveness

Two (2) soil samples collected from B3 (1.0m-1.2m) and B6 (1.45m-1.8m) were sent to the Sydney Environmental & Soil Laboratory Pty Ltd to determine soil aggressiveness.

Full results of the chemical tests with assessments are presented in **Appendix E**.

5. Site Description

The Manila Community Hospital is located on the north-eastern periphery of the town and at the east end of Court Street. Generally, the site is bounded by private properties to the north and west, Kanangra Road to the east and Court Street/water reservoir site to the south.

The existing development consists of a single storey, brick buildings including the hospital, administration, nurse's quarters, mortuary and a workshop. Between Court Street and the main building, the site is either grassed (lawn) with occasional trees or contains landscaped gardens. The lawns are bisected by a gravel access road (see **Plates 1 and 2**).

The entire complex is encircled by a bitumen access road for the ambulance and deliveries (see **Plates 1 and 3**). Along the northern/north-western periphery of the complex, the access road generally follows the edge of filled batter (see **Plate 3**).

To the north-east and south-east of the main building the site is grassed, with occasional trees, a brick garden bed and birdcage. The grassed strip is relatively narrow and is enclosed by a mesh fence (see **Plate 4**). To the north of the main building, there is a coal bin (see **Plate 5**), a water tower, concrete ambulance access ramps and a workshop building. The area between the main building and the workshop is bitumen paved (see **Plate 6**).

Generally, the site is located on the apex of a ridge spur/hill. The apex, containing the existing development is relatively flat, sloping very gently to the south-east. To the north, north-west the topography descends at steep and moderately steep gradients to a relatively flat alluvial terrace beyond the hospital grounds. To the north-east the slope leading to Kanangra Road is gentle to moderate.

The north-eastern to north-western periphery of the existing complex has been extensively filled. The fill batter slopes are steep behind the workshop building (see **Plates 7 and 8**), ranging to moderate in the north-western part of the site (see **Plate 9**) and gentle to moderate in north-eastern part of the site (see **Plate 10**).

The batters are generally overgrown with native grasses and weeds (see **Plates 8 and 11**). A steel post and wire fence generally runs parallel to the base of filled slope. The fence is tree-lined (see **Plates 7, 8 and 9**). Beyond the tree line, the natural slopes leading to private properties is overgrown with native grasses and weeds (see **Plate 12**).

There is an open, contour drain in close proximity to the private property boundaries. The drain has been excavated along the entire length of the northern/north-western perimeter of the site.

The fill materials exposed on the slope and along the fence line includes rubble (concrete fragments, bricks/brick fragments), pieces of steel, rock fragments, general litter and adjacent to the coal bin, furnace refuse including ash, burnt coal, etc. (see **Plate 13**).

6. Subsurface Conditions

6.1 General

The subsurface conditions within the investigated area may be extrapolated from data presented in the logs of augered boreholes B1 to B12 and diamond cored boreholes B1A, B5A and B13 to B16, inclusive (refer to **Appendix B**).

Generally, the site is located within a meta– sedimentary sequence of meta-siltstone / mudstone and tuffaceous sandstone bedrock. The bedrock is mantled by variable cover of fill and residual deposits.

For convenience of presentation, the subsurface profiles encountered at discrete borehole locations are described in terms of the following units:

Unit A - Fill

The unit materials are highly variable but dominated by clayey gravel and gravelly clay, probably won from excavations for existing development. Other material types encountered include cobbles and coarse gravel, meta-siltstone rock fragments, furnace refuse consisting of ash, slag, burnt coal fragments, silty sand and clayey silt.

The above fill may contain varying concentrations of foreign inclusions including building rubble, bricks/ brick fragments, concrete, iron pipes, tin, pieces of steel, wood, bituminous fragments.

Generally, the fill materials can change over very short distances with respect to material type, layer thickness and position within the profile. The distribution of the gravel within a clay matrix can also be sporadic.

Typically, the fill is uncontrolled being either soft to firm or loose to very loose.

Unit B - Cohesive Deposits

This unit materials consist of silty clays, sandy silty clays and clayey silts of medium and high plasticity. The cohesive deposits contain varying concentrations of embedded gravels and in instances, gravelly pockets.

Typically, the clays are stiff to very stiff, locally firm or hard.

Unit C - Gravel and Cobbles

This unit materials comprise gravels and cobbles in a clayey matrix. However, in instances the matrix can be minor, especially in the stratum overlying the bedrock.

Typically, these deposits are medium dense to very dense.

Unit D - Bedrock

The bedrock at the site comprises meta-sediments including fine to medium grained sandstone, fine grained siltstone/sandstone and shale. Typically, the sandstones and shales are laminated to thinly bedded and highly fractured; i.e. defect spacing (joints and partings) are very closely spaced to closely spaced.

In the diamond cored boreholes, the bedrock is generally moderately weathered with minor extremely weathered and highly weathered zones/interbeds. The rock substance strength has been assessed as medium strong, locally either weak or weak to medium strong.

In the augured boreholes, the degree of weathering and rock substance strength (as shown on the borehole logs) has been assessed on the basis of the ease of penetration of the bedrock by a TC bit. On this basis, identifying lithology and interbedded nature of the bedrock (as evidenced by diamond cored boreholes) was difficult.

Coalwash - this unit material is typically coarse sand to gravel-sized fragments with coal dust and in instances, hard coarse gravel-sized siltstone fragments.

6.2 Subsurface Profiles

6.2.1 South-western Part of Site

The subsurface conditions within this part of the site, which is to contain access driveway and carpark, may be extrapolated from data given in the logs of boreholes B9 and B10 (refer to **Appendix B**).

The site is covered by a 0.3m/0.25m horizon of gravelly silty sand topsoil, followed by an interbedded sequence of silty clays (Unit B) and gravels in a clayey matrix (Unit C) to depths of 2.8m (B9) and 1.3m (B10). Borehole B10 was terminated at 1.3m where TC bit refusal was recorded on a cobble.

The clays are stiff to hard while the gravelly strata are dense to very dense with SPT refusals.

In borehole B9, the gravel and cobbles stratum is underlain by highly weathered tuffaceous sandstone to TC bit refusal at 3.6m. TC bit refusal is inferred to have occurred on moderately weathered bedrock.

Groundwater was not intersected in either of the boreholes within the depths of drilling.

6.2.2 South-eastern Part of the Site

The subsurface conditions within this part of the site may be extrapolated from data presented in the log of borehole B12 (refer to **Appendix B**) and from test pit logs TP1 and TP2, from prior investigation by Hunter Geotechnics (refer to **Appendix E**).

In borehole B12, the subsurface profile consists of sandy topsoil (probably imported) to a depth of 0.3m, followed by Unit C gravels in a variable matrix to a depth of 1.3m and then extremely weathered sandstone bedrock (Unit D) to borehole termination depth of 1.5m.

The gravel strata are very loose to 0.8m and then becomes dense (N=R).

The condition reported in nearby test pits TP1 and TP2 were variable from those encountered in borehole B12.

In test pit TP1, the reported profile consists of gravelly clay topsoil, followed by a dense clayey gravel to test pit termination depth of 2.5m. In test pit TP2, the profile consist of fill to a depth of 0.8m, followed by hard/dense, clayey gravel/gravelly clay to test pit termination depth of 3m. The fill appears to be compact in upper 0.3m and then loose (uncontrolled) and contains building rubble, iron pipe, concrete etc.

Groundwater was not intersected in any of exploratory sites within the depths of drilling/excavation.

6.2.3 North-eastern Part of the Site

The subsurface conditions within this part of the site may be extrapolated from data presented in the log of borehole B11 (refer to **Appendix B**) and from test pit logs TP3 and TP4, from prior investigation by Hunter Geotechnics (refer to **Appendix E**).

In borehole B11, the subsurface profile consists of soft clayey silt fill (Unit A) to a depth of 0.4m, followed by soft to firm (N=8) and then stiff Unit B silty clay and gravelly clay to a depth of 1.5m and then dense to hard (N=R) Unit C gravels in variable matrix to a depth of 3.2m.

The gravels are underlain by interbedded sandstone and shale bedrock to TC bit refusal at 4.5m. Within the depth penetrated by a TC bit, the bedrock is assessed to be extremely weathered and highly weathered with a very weak rock substance strength.

The reported conditions in test pit TP4 were not too dissimilar; however, fill thicknesses are greater and bedrock was encountered at shallower depth. The profile consists of fill to a depth of 0.8m, followed by a hard sandy gravelly clay to a depth of 1.1m and then a highly weathered siltstone to pit termination depth of 2.6m.

The fill below 0.3m depth contains some cobbles and bricks and appears to be loosely compacted.

In the other test pit TP3, bedrock was not encountered within the depths of excavation. Here, the subsurface profile consists of gravelly clay fill to a depth of 0.4m, followed by hard gravelly clay, sandy gravelly clay/clayey gravel to termination depth of 2.8m.

Groundwater was not encountered within the depths of drilling.

6.2.4 North/North-western Part of the Site

This part of the site generally encompasses a narrow strip of land between the existing development and edge of the fill batter and lower slopes beyond the existing perimeter fence. The subsurface conditions within this area may be extrapolated from data presented in the logs of augered and diamond cored boreholes B1-B8, B1A and B5A and B13-B16 inclusive (refer to **Appendix B**); and, from test pit logs TP5 to TP9, from prior investigation by Hunter Geotechnics (refer to **Appendix E**).

(i) Edge of Filled Batter

Boreholes B1, B1A, B4, B6 and B8 were drilled along the edge of the fill batter.

In all boreholes Unit A forms the surficial horizons. The thickness of fill varies from 2.6m (B1) to 0.8m (B8); i.e. a general trend in reduction in fill thickness from the north-eastern edge (behind the workshop) to the west/south-west (proposed nurses quarters).

The fill is variable and uncontrolled (refer to individual borehole logs).

In each borehole, the fill is underlain by relatively thin deposits of Unit A clays and Unit B gravel and cobbles. These deposits extend to borehole termination depth of 3.1m (TC bit refusal) in borehole B1 and to depths varying from 1.7m (B6) to 3m (B4) in the remaining borehole. In diamond cored borehole 1A, the combination of Units A and B extend to a depth of 3.64m.

The above units are underlain by Unit D sandstone and shale to borehole termination depths of between 4.4m (B4) and 4.5m (B6 and B8). Within the depths penetrated by a TC bit, the bedrock is assessed to be extremely weathered and highly weathered with an extremely weak to weak rock substance strength.

In cored borehole B1A, between the depths of 3.64m and 6.03m, the bedrock is laminated to thinly bedded, fine to medium grained sandstone and fine grained siltstone/sandstone. The bedrock is moderately weathered with occasional, thin extremely weathered, interbeds. The rock substance strength is assessed as weak to medium strong.

In test pits TP5, TP6 and TP7 (prior investigation), the reported profiles comprise a surficial horizon of uncontrolled fill to depths of 2.5m (TP5), 2.3m (TP6) and 0.8m (TP7). As in the boreholes, the fill is variable including ash/refuse from boiler, gravelly clay, gravel and cobbles with brick rubble etc. Loose consistency is reflected in collapse of trench walls as reported in pits TP5, TP6 and TP7. The fill is underlain by siltstone bedrock (TP5 and TP7) or coarse gravel (0.4m thick) and then siltstone bedrock (TP6).

Groundwater was not intersected in any of the boreholes/test pits within the depths of drilling/excavation.

(ii) Edge of the Existing Development

Boreholes B2, B3, B5 and B7 were generally drilled on the southern side of the access road around the existing development.

Unit A fill also forms the surficial horizon in all boreholes; however, the thicknesses are not excessive ranging from 0.15m (B2) to 0.8m (B3).

The fill is underlain by a sequence of Unity B silty clays and sandy clays with gravel and gravels in clayey matrix to depths varying from 1.0m (B7) to 3.6m (B2). Generally, Units B and C deposits are of stiff to very stiff consistency and dense to very dense, respectively. SPTs within these units generally recorded refusals.

The exception to the above was encountered in borehole B2 where Unit B sandy silty clays are firm with a soft zone (N=5 and N=4) to a depth of 1.4m and then becomes stiff to 2m depth.

The above units are underlain by Unit D bedrock, comprising sandstone and shale, to borehole termination depths of 4.7m (B2), 4.1m (B3), 3.2m (B5) and 3.3m (B7). In all instances, the above depths correspond to TC bit refusal.

Within the depths penetrated by the TC bit, the bedrock is assessed as extremely weathered and highly weathered with rock substance strength varying from extremely weak to weak.

In diamond cored borehole B5A, the bedrock between 1.9m and 3.14m consists of laminated to very thinly bedded sandstone and shale. The bedrock is moderately weathered with an estimated medium strong rock substance strength.

Groundwater was not intersected in any of the boreholes within the depths of drilling.

(iii) Lower Slopes to the North of Perimeter Fence

The subsurface conditions along the lower northern/north-western slopes may be extrapolated from data presented in the logs of diamond cored boreholes B13 to B16 inclusive (refer to **Appendix B**) and test pit logs TP8 and TP9 from prior investigation by Hunter Geotechnics (refer to **Appendix E**). All of the above boreholes were drilled in the contour drain.

Generally, Unit D bedrock was encountered at shallow depths ranging from 0.11m (B13) to 1.5m (B14). In boreholes B13, B15 and B16, the shallow soil cover comprises firm clayey silt with high to moderate concentration of angular rock fragments and minor sub-rounded coarse gravel/small cobbles. In borehole B14, fill was encountered at a depth of 0.5m followed by a clayey silt with rock fragments to 1.5m depth. The fill is similar to the underlying material being spoil from the excavation of the drainage channel.

The bedrock comprises an interbedded sequence of thinly laminated to laminated shale, thinly laminated to very thinly bedded, fine grained siltstone/sandstone and very thinly bedded fine to medium grained sandstone. Typically, when first encountered, the bedrock is highly weathered to moderately weathered, locally (B14) becoming extremely weathered. This quality bedrock occurs for shallow depths (thickness of up to 0.5m). Below depths of 0.6m/1.7m, the bedrock is dominantly moderately weathered.

The rock substance strength varies from weak to medium strong with rare interbeds of medium strong to strong bedrock and extremely weak seams (refer to individual engineering geology logs).

Generally, the bedrock is highly fractured with fragmented zones. That is, the defect spacing (joints and partings) are extremely closely spaced (less than 20mm) to closely spaced (60mm-200mm). In all boreholes the Rock Quality Designation (RQD), for the full depth of coring is 0%.

Similar conditions were reported in test pits TP8 and TP9, with highly weathered siltstone being encountered at 0.8m/0.5m depths and persisting to the depths of excavation of 1.5m. The soil cover is reported as a clayey gravel fill.

Groundwater was not intersected in any of the boreholes or test pits within the depths of drilling/excavation. However, the subgrade in the contour drain near a drainage depression (vicinity of B14) was in a wet state.

7 Discussions and Recommendations

7.1 Site Classification

The investigation revealed that the site is covered by fill material to depths of 0.3m to 0.8m. The thickness of fill increases towards north/north-western part of the site, and varies from 0.8m to 2.6m along the edge of filled batter area. The exception is at south western part of the site, fill is 0.3m/0.25m thick.

Because of the presence of fill, in accordance with Australian Standard AS 2870-1996 "*Residential Slabs and Footings – Construction*", the area should be designated as Class 'P', in the current state.

If the existing fill is removed and replaced with engineered fill, the site classification will be based on the reactive potential of the cohesive soils / engineered fill.

Shrink swell tests were performed on one (1) undisturbed cohesive soil sample (silty clay) from borehole B9 (0.45m-0.75m). The recorded shrink-swell index was 0.9%. Adopting the method described in Section 2 of AS2870-1996, the predicted characteristic ground surface movement (y_s) for the tested soil would be about 10mm. In accordance with the above standard, a movement of this magnitude is applicable to a Class "S" site (slightly reactive clay site).

Please note that during the prior work by Hunter Geotechnics, shrink-swell tests were performed on three (3) soil samples, one each fromTP2 (1.0m-1.3m), TP3 (0.4m-0.7m) and TP3 (0.8m-1.5m). The recorded shrink-swell indices were 0.3%, 1.6% and 1.4%, respectively. For a shrink-swell index of 1.6%, the estimated characteristic ground surface movement 'y_s' is expected to be in the order of 25mm in the current state. A movement of this magnitude is applicable to a Class 'M' site (moderately reactive clay site).

Furthermore, during the current investigation three (3) soil samples, one each from boreholes B8 (1.5m-1.95m), B11 (0.65m-1.1m) and B14 (0.6m–1.1m), are assessed to possess a moderate to high potential for volume change with moisture content fluctuations (LL = 43%-66%, PI = 21%-42% and LS = 12%-18.5%).

Therefore, the cohesive soils are considered to be moderately reactive clay site and a Class "M" should be applicable for natural ground, with an estimated characteristic ground surface movement 'y_s' of the order of 25mm.

It should be noted that the site works might affect the actual classification of the site. If the footing system is founded in engineered fill material, the site classification will depend on the reactive potential and thicknesses of the fill material under the footing. If the footing is founded on bedrock, the area should be classified as Class 'A', in accordance with Section 2 of the above code.

7.2 Earthworks

A preliminary sketch drawing, provided by the project manager, shows finished floor level of the proposed buildings at RL374.0m.

The hospital site is located on the apex of a ridge spur/hill, with site RL's varying from approximately 373m to 375m, hence a cut and fill approximately 1m is required.

The interbedded nature of the sequence and diverse characteristics of the rock types will have a major influence on the excavation conditions that may be encountered in the area in general. The mudstones are generally weathered to a significant depth, and are highly fractured.

Excavation in all materials including extremely weathered rock to TC bit refusal should be readily achievable using conventional earthmoving equipment such as backhoes and small to medium sized bulldozers. Generally, excavation to TC bit refusal including highly weathered rock is expected to be slow. Excavation below TC bit refusal would require a larger hydraulic excavator possibly with some assistance from a rock breaker or a ripper.

The excavated local soil is considered to have fair to good compaction characteristics for use as engineered fill. If used, the materials should be placed in maximum 200mm (loose) layers, and be compacted to the following minimum standard dry density ratios (AS 1289.5.4.1- 1993) at a moisture content within 2% of optimum:

Fill under building floor	=	98%
Fill under pavement	=	100%
General fill around the site	=	95%

The locally excavated weathered rock is considered suitable for use as engineering fill provided that the maximum particle size of any rocks within the layer, after compaction, should not exceed two-third of compacted layer thickness. These material can be placed in maximum 300mm (loose) layers and compacted to the above minimum standard dry density ratios (AS 1289.5.4.1- 1993) at a moisture content within 2% of optimum.

If required, any imported material should be validated in accordance with the NSW EPA Sampling Design guidelines (1995) and *Guidelines for Assessing Service Station Sites'* (1994); and NSWDEC *Guidelines for NSW Site Auditor Scheme* (2nd Edition, April 2006). The fill material should not contain asbestos and not be acid sulphate soil or saline soil. The imported fill material should be "virgin excavated natural materials" (VENM), as defined in the DEC's waste guidelines because of their low risk of contamination.

7.3 Footing Systems

The hospital site is located on the apex of a ridge spur/hill, encircled by a bitumen access road forming an upper terrace. The north-eastern to north-western periphery of the upper terrace has been extensively filled. The topography descends at steep and moderately steep gradients to a relatively flat to a lower terrace beyond the hospital grounds.

Considering that the proposed buildings will be generally located either within the upper terrace or encroaching over steep and moderately steep slopes, two (2) different cases could be considered.

i. Buildings located within upper terrace

It is understood that the proposed buildings will be single storey, concrete floor, brick walls and metal roof construction.

Existing fill is not considered to be suitable founding material. It should be excavated and replaced with suitable materials in an engineered manner to the minimum dry densities as specified in **Section 7.2**.

Footings founded on engineered fill and natural cohesive soils should fulfil the requirements in Section 3 and 4 of AS2870-1996 for a Class "M" site. Therefore footings should be designed in accordance with engineering principles allowing for a predicted ground surface movement (ys) of 25mm.

A shallow footing system such as Stiffened (SR) or Strip footing with suspended concrete floor (ST) may be adopted and designed from engineering principles allowing for a characteristic surface movement (ys) of say 25mm.

Alternatively, standard designs of the SR/ST footing may be adopted and proportioned in accordance with Section 3 of AS 2870 - 1996 for the site classification of "M", subject to restrictions given in the code, checking of adequacy and site preparation as recommended below. The strips should be founded within the residual soil of stiff in consistency.

The allowable bearing capacity for beam footing founded on engineered fill / stiff residual soil should be limited to 100kPa.

The following foundation preparation is recommended for construction:

- Strip the fill (including topsoil) and the underlying soils to the required level. The excavated topsoil is to be stockpiled separately for possible future re-use subject to meeting any environmental requirements.
- Examine the exposed surface for consistency; if required, proof roll the subgrade with a smooth static roller by typically 6 to 8 passes. Any soft spots detected in the subgrade should be excavated out by at least 0.3m and be recompacted to a standard as described in **Section 7.2**.

- Backfill with locally excavated residual soils (free from organic matters) or suitable imported fill materials. The imported fill materials should satisfy the requirements stated in **Section 7.2**.

Footings founded on bedrock, should fulfil the requirements in Section 3 and 4 of AS2870-1996 for a Class "A" site.

The allowable bearing capacity for beam footing founded on extremely weathered bedrock should be limited to 400kPa.

For detailing and construction requirements, reference should be made to Section 5 and 6 of AS 2870-1996, respectively. For performance requirements and foundation maintenance, reference should be made to Appendix B of the above code.

ii. Buildings located within edge of filled batter and encroaching over slope areas

Considering that part of the proposed buildings will be located within uncontrolled fill and over slope areas, the following two (2) issues, which are not independent, should be discussed separately:

- Slope stability
- Footing systems

Slope stability

The investigation revealed that the edge and upper part of batter slopes are extensively filled and the fill is highly variable and uncontrolled. The fill comprises cobbles and coarse gravel, meta-siltstone rock fragments, furnace refuse consisting of ash, slag, burnt coal fragments, silty sand and clayey silt and contain varying concentrations of foreign inclusions including building rubble, bricks/ brick fragments, concrete, iron pipes, tin, pieces of steel, wood and bituminous fragments.

The slopes are moderately steep to steep. Currently, though there is no strong sign of slope instability observed, it should be cautious that there is a potential for slope instability, especially if the existing conditions of slope and the site are to be altered. It is recommended that any construction traffic to be confined to the existing road.

Please note that during the prior investigation, side of test pits (TP5 to TP7) were unstable and had collapsing experience. Any excavation or pilling within batter slope and edge of filled batter may incur slope instability and hence cause landslide. A safe batter slope of 1(V):2(H) may be considered for natural ground during construction period. Earthworks and construction of footings in this area should be under supervision of an experienced geotechnical engineer.

The fill material is not considered to be suitable founding material neither suitable for slope stabilisation. The fill material from within building area should be excavated and put in spoil, and the batter slope be stabilised under supervision of

an experienced geotechnical engineer. Alternatively, risk assessment should be carried out in accordance with the Australian Geomechanics guidelines. Prior to undertaking any redevelopment in this area, the client should be informed of the risk level involved due to future redevelopment. The decision on risk acceptability must be determined by the client in consultation with geotechnical consultant. We have extensive experience in risk assessment and risk management in landslides areas, and will be happy to undertake this task, if the client wishes.

Footing Systems

Footing systems, design and construction methodology should be assessed and evaluated by an experienced geotechnical engineer, prior to construction. As discussed above, it is assumed that the fill material from building area is excavated and the batter slope is stabilised.

The area designated as Class 'P', in the current state. Therefore footings should be designed in accordance with engineering principles.

Considering the sloping ground pier/pile with suspended slab footing system should be adopted. Sketch drawing provided by the project manager shows typical pile load 260KN (SLS).

Piers/piles should be carried down to highly and moderately weathered meta-sediments and installed in this material with a minimum embedment of 1000mm. Due to highly fractured nature of bedrock, design parameters should be downgraded. The allowable end bearing capacity should be limited to a maximum of 800kPa. For moderately weathered meta-siltstone (below TC bit refusal) with a minimum embedment 1200mm, allowable end bearing capacity should be limited to a maximum 1200kPa.

The shaft adhesion within the top 1.5m, and the fill material, should be neglected. An allowable shaft adhesion of 20kPa and 50kPa could be considered within cohesive soil and extremely to highly weathered meta-siltstone sockets, respectively. Piers/piles should be concreted as soon as possible after drilling in order to avoid possible softening, and strength losses due to relaxation.

As a first approach, for a capacity of 260KN, bored pile of 600mm diameter with a minimum embedment of 1000mm within extremely to highly weathered meta-siltstone could be considered.

For building encroaching over slopes, differential settlements are expected between with two (2) different footing systems. For uniformity of the foundation and to avoid any differential settlement, it is recommended that all footing systems (shallow and deep footing) should be founded on bedrock. Alternatively, soil materials may be excavated out and replaced with mass concrete, if preferred. The intention should be that a combined footing system consisting of pier-and-beam, strip footing or stiffened raft/footing slab should transfer structural loading to the bedrock.

It is recommended that foundation conditions and pier/pile augering be inspected by an experienced geotechnical engineer or engineering geologist, in order to

For detailing and construction requirements, reference should be made to Section 5 and 6 of AS 2870-1996, respectively. For performance requirements and foundation maintenance, reference should be made to Appendix B of the above code.

7.4 Pavement

New entry roadwork / parking /dock

One (1) bulk sample was taken from B10 (0.3m-0.7m) for CBR testing. In the laboratory the above tested sample has been described as "gravelly silty clay". The sample was remoulded to dry density ratio of 100% standard, and a soaked CBR value of 7% was obtained. Considering likely variations on site conditions a CBR value of 5% is recommended for pavement design.

The recommendations are also made on the assumption that:

- After stripping any fill and subsurface materials to the required subgrade level, the excavated surface will be carefully examined and proof rolled to ensure subgrade strength and consistency. Any soft spots detected in the subgrade should be excavated out by at least 0.3m and be recompacted to a standard as described in **Section 7.2**.

- Backfill with suitable locally excavated material (free from organic matter and debris), or suitable imported fill materials (preferably granular). The imported fill material should satisfy the requirements as stated in **Section 7.2**.

- Adequate subsoil drainage will be provided in order to prevent ingress of water into the subgrade.

The thickness of pavement will depend on the design traffic loading (equivalent standard axles, ESA). For example, if the type of pavement selected is unbound granular materials with thin bituminous surfacing, and if the exposed subgrade material is local soil, then based on Figure 8.4 of "Pavement Design: A Guide to the Structural Design of Road Pavement" by Austroads (2008), the thickness of granular materials is as follows:

Design Traffic (ESAs)	Minimum thickness of Granular Materials (mm) (CBR = 5%)
1×10^5	290
1×10^6	390

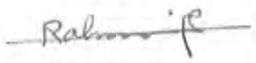
Alternatively, a suitably thick asphaltic concrete wearing course with appropriate thickness of granular materials may be adopted. The final design selected will depend on the economy and life expectancy of the pavement.

Please note that the finished level of the proposed carpark is not known at the time of reporting. The above recommendation and the thickness of pavement is based on the current ground levels, assuming that subgrade comprises stiff gravelly silty

clay. If the pavement to be constructed over new fill material, then the CBR value will depend on the type of fill material to be used for the construction of the carpark.

8 General Remarks

It should be noted that this report is based on extrapolation of data from discrete borehole locations and may not represent actual conditions between them. If different conditions are encountered during the course of construction, the contractor should seek advice from a suitably qualified geotechnical consultant.



M. Rahimi, CPEng, NPER
Senior Geotechnical Engineer

FIGURES

MANILLA IS LOCATED APPROXIMATELY 448 Km NORTH OF SYDNEY

DETAILS OF AMENDMENTS	APPROVED	DATE	GRAEME HEAD Director General – NSW Department of Commerce	GEOTECHNICAL AND ENVIRONMENTAL	PROJECT ENGINEER	NSW Department of Commerce	MANILLA MPS & HEALTH ONE Site Location Plan	FILE No. GO37B
			NEW SOUTH WALES WATER SOLUTIONS WATER TECHNOLOGIES LEVEL 12, MAXELL BUILDING 2-24 RAWSON PLACE SYDNEY 2000 PHONE (02) 82021929 FAX (02) 82021937		SUPERVISOR			FIGURE No. 1
					DRAFTED J.D.EDWARDS			
					CHECKED	DECEMBER 2008		

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A	ISSUED FOR TENDER		
PK	DETAILS OF AMENDMENTS	APPROVED	DATE

GRAEME HEAD
Director General - NSW Department of Commerce
NEW SOUTH WALES WATER SOLUTIONS
DAMS AND CIVIL TECHNOLOGIES
LEVEL 13E, McKELL BUILDING
2-24 RAWSON PLACE
SYDNEY 2000
PHONE (02) 93727068 FAX (02) 93727877

GEOTECHNICAL & ENVIRONMENTAL ENGINEERING

PROJECT ENGINEER: P SHAW
SUPERVISOR:
DRAFTED:
CHECKED:
FEBRUARY 2009

NSW Department of Commerce

MANILLA MPS & HEALTH ONE
Site Plan

FILE NO. GO37B
DRAWING NO. 2

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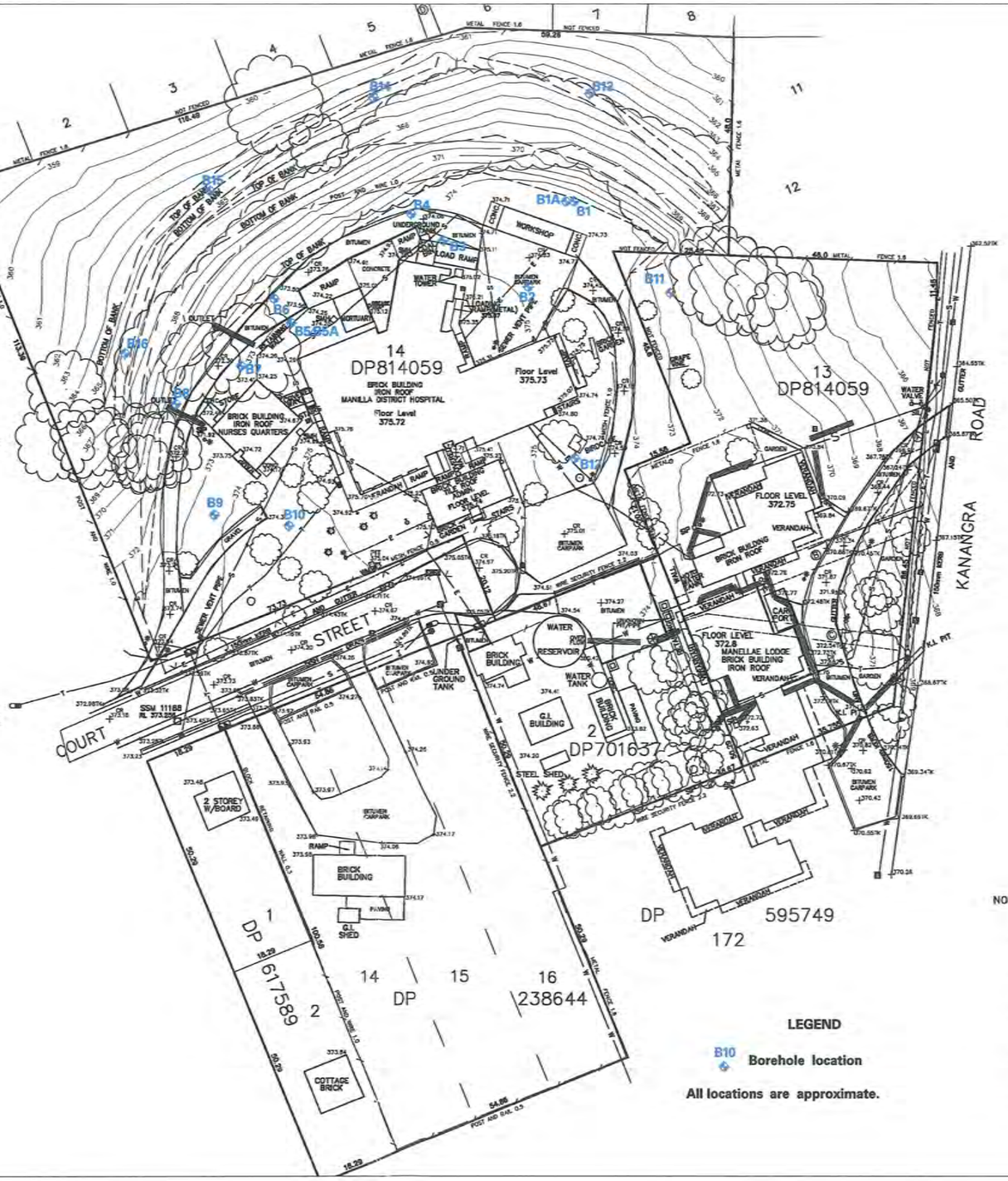

SSM 11188
RL 373.256
E. 282848.045
N. 6596314.054

LEGEND

- WATER TAP
- ELECTRIC LIGHT POLE
- TELECOMMUNICATIONS PITS
- FENCE(TYPE AND HEIGHT)
- TELEPHONE CABLES (INCLUDING OPTIC FIBRE) (APPROXIAMATE POSITION)
- OVERHEAD ELECTRICITY (APPROX. POSITION)(POLE)
- UNDERGROUND ELECTRICITY
- WATER
- STORMWATER PIPE
- SEWER
- TREE – DRIP LINE
- TREE – DIAMETER AND SPREAD INDICATIVE SEE SHEET 3 FOR HEIGHTS
- SHRUB
- SIP SURFACE INLET PIT
- HYDRANT
- SEWER MANHOLE
- SIL SEWER INSPECTION LID
- K.I. PIT KERB INLET PIT
- WM WATER METER
- TOP OF KERB LEVEL
- CROWN OF ROAD LEVEL

Ⓐ EXISTING EASEMENT FOR RISING MAIN AND OVERFLOW PIPE (VIDE DP 186472)
Ⓑ EASEMENT FOR RISING MAIN AND OVERFLOW PIPE 5 WIDE
Ⓒ EASEMENT FOR OVERFLOW PIPE 3 WIDE
Ⓓ EASEMENT TO DRAIN WATER 3 WIDE

NOTES:–
1. KNOWN SERVICES HAVE BEEN LOCATED WHERE VISIBLE AND/OR BY SERVICE AUTHORITY PLANS WHERE AVAILABLE AND/OR BY SERVICE LOCATOR WHERE POSSIBLE.
BEFORE ANY CONSTRUCTION OR DEMOLITION TAKES PLACE AN UP TO DATE INVESTIGATION OF SERVICES SHOULD BE CARRIED OUT.
2. ORIGIN OF AHD LEVELS AND MGA COORDINATES SSM11188.
3. FOR ROOF,WINDOW AND GUTTTIER DETAILS REFER SHEET 2.
4. FOR EXTRA DETAILS OF SERVICES REFER SHEET 3.

LEGEND

B10 Borehole location

All locations are approximate.

REV	DETAILS OF AMENDMENTS	APPROVED	DATE
A	ISSUED FOR TENDER		

SCALE 0 25 50 75 100m

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THE ORIGINAL OF THIS DRAWING WAS SIGNED BY THE PERSON WHOSE NAME APPEARS IN THE ASSIGNMENT BLOCK

ENVIRONMENTAL & MECHANICAL ENGINEERING
WATER TECHNOLOGIES

PROJECT ENGINEER
P SHAW
SUPERVISOR
DRAFTED
CHECKED
FEBRUARY 2009

NSW Department of Commerce

MANILLA MPS & HEALTH ONE
Survey Plan showing location of Boreholes

FILE NO. GO37B
DRAWING NO. 3

$DATE$ $TIME$ $FILE$ B1 679 960 © CROWN COPYRIGHT NSW MINISTER FOR DEPARTMENT OF COMMERCE 100 200 300 $FILE$

PHOTOGRAPHIC PLATES

Plate 1: General view of the hospital complex, looking north from the entrance drive in Court Street

Plate 2: General view of partially filled and natural slope to the north of the existing perimeter fence (looking north-west)

Plate 3: View of the access road, looking north-east from the rear of nurses quarters.

Plate 4: General view of the hospital complex in central, northern part of the site.

Plate 5: View of the existing coal bin.

Plate 6: View of the bitumen paved area between existing workshop and main hospital buildings.

Plate 7: View of the filled batter, opposite the coal bin, looking east/north-east towards the workshop. Batter is overgrown with native grasses. The perimeter fence is tree-lined.

Plate 8: View of the fill batter at the rear of the workshop, looking north-west.

Plate 9: General view of filled batter slope, looking north-east form proposed nurses quarters.

Plate 10: General view of the slope, looking south-east from the workshop.

Plate 11: View of the filled batter slope in the north-western part of the complex. The site of proposed nurses quarters.

Plate 12: View of grassed slope beyond fence line

Plate 13: Close up of fill materials in the batter at the rear of the workshop.

APPENDIX A

Definition of Terms

CHARACTERISATION OF GEOTECHNICAL DATA

Geotechnical data generally fall into the categories of fact, interpretation and opinion, as defined by the Institution of Engineers, Australia, 1987 - Guidelines for the Provision of Geotechnical Information in Construction Contracts.

Facts are defined as the materials, statistics and properties which may be seen, measured or identified by means of accepted and preferably standardised criteria, classifications and tests. Examples of facts include: exploration locations, outcrop locations, samples and drill core, lithological names/descriptions of soils and rocks, measured water levels, laboratory test results and seismic time/distance plots.

Interpretative data is defined as information derived from competently made interpretation of facts using accepted and proven techniques, or reasonable judgement exercised in the knowledge of geological conditions or processes evident at the site. Examples of interpretative data are: borehole and test pit logs, inferred stratigraphy and correlations between boreholes or test pits, material and rock mass properties used in analysis (e.g. permeability), and seismic interpretation (yielding velocity and layer depths).

Opinion is derived from consideration of relevant available facts, interpretations and analysis and/or the exercise of judgement. Examples of opinions based on geotechnical/geological interpretations include bearing capacity and foundation suitability, need for foundation treatment, settlements, potential for grouting, excavation stability, ease of excavation, and suitability of construction materials.

SOIL DESCRIPTION

The methods of description and classification of soils are based on Australian Standard 1726, the SAA Site Investigation Code. The description of a soil is based on particle size distribution and plasticity as shown in the "GUIDE TO THE DESCRIPTION, IDENTIFICATION AND CLASSIFICATION OF SOILS".

SOIL CLASSIFICATION

The basic soil types and their subdivisions are defined by their particle sizes:

MAJOR SOIL CATEGORIES

Soil Classification	Particle Size
Boulders	Greater than 200mm
Cobbles	63 - 200mm
Gravel	2.36 - 63mm
Sand	0.075 - 2.36mm
Silt	0.002 - 0.075mm
Clay	Less than 0.002mm

MINOR SOIL CONSTITUENTS

As most natural soils are combinations of various constituents, the primary soil is further described and modified by its minor components:

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 'sand/gravelly', as applicable

COHESIVE SOILS

Clay and silt may be described according to their plasticity:

Descriptive Term	**Range of liquid limit (percent)**
Of low plasticity	≤ 35
Of medium plasticity	> 35 ≤ 50
Of high plasticity	> 50

MOISTURE CONDITION

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

CONSISTENCY - NON-COHESIVE SOILS

Term	Density index %		SPT "N" value
Very loose		≤ 15	< 5
Loose	> 15	≤ 35	5 - 10
Medium dense	> 35	≤ 65	10 - 30
Dense	> 65	≤ 85	30 - 50
Very dense	> 85		> 50

CONSISTENCY - COHESIVE SOILS

Term	Undrained shear strength (kPa)		Field guide to consistency	SPT "N" value
Very soft		≤ 12	Exudes between the fingers when squeezed in hand.	< 2
Soft	> 12	≤ 25	Can be moulded by light finger pressure.	2 - 4
Firm	> 25	≤ 50	Can be moulded by strong finger pressure.	4 - 8
Stiff	> 50	≤ 100	Cannot be moulded by fingers; can be indented by thumb	8 - 16
Very stiff	> 100	≤ 200	Can be indented by thumb nail.	16 - 32
Hard	> 200		Can be indented with difficulty by thumb nail.	> 32

GRAPHICAL SYMBOLS USED FOR GEOTECHNICAL BOREHOLE AND TEST PIT LOGS

SOIL - COARSE GRAINED


GW


GP


GM


GC


SW


SP


SM


SC

SOIL - FINE GRAINED


MH


MI


ML


CH


CI


CL


OH


OL


Pt

ROCK


Sedimentary rock


Igneous rock


Metamorphic rock

FILL MATERIAL


Fill

GROUNDWATER


Level


Inflow

NGE No Groundwater Encountered

SOIL HORIZON BOUNDARIES

——— Boundary measured or determined from drilling conditions

..... Diffuse or uncertain boundary

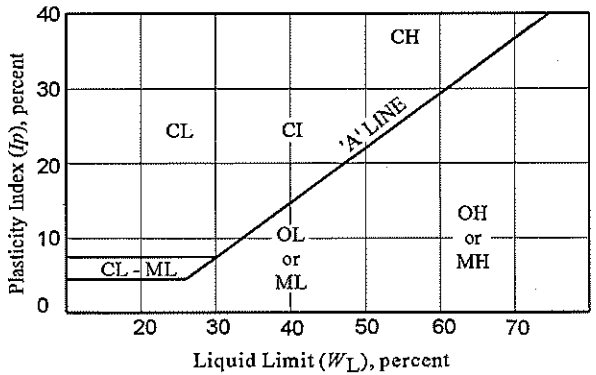
GUIDE TO THE DESCRIPTION IDENTIFICATION AND CLASSIFICATION OF SOILS

Major Divisions		Particle Size (mm)	Group Symbol	Typical Names	Field Identification Sand and Gravels	Laboratory Classification				
						% < 0.06mm (see note 2)	Plasticity of Fine Fraction	$C_u = \frac{D_{50}}{D_{10}}$	$C_c = \frac{(D_{30})^2}{D_{10}D_{60}}$	Notes
COARSE GRAINED SOILS (more than half of material less than 63 mm is larger than 0.075 mm)	BOULDERS	200				—	—	—	—	
	COBBLES	63				—	—	—	—	
	GRAVELS (more than half of coarse fraction is larger than 2.36mm)	coarse 20	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength	0-5	—	> 4	between 1 and 3	1. Identify lines by the method given for fine grained soils.
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines, uniform gravels	Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength	0-5	—	Fails to comply with above	—	
		medium 6	GM	Silty gravels, gravel-sand-silt mixtures	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength	12-50	Below 'A' line or $I_p < 4$	—	—	2. Borderline classifications occur when the percentage of fines (fraction smaller than 0.06mm size) is greater than 5% and less than 12%.
			GC	Clayey gravels, gravel-sand-clay mixtures	'Dirty' materials with excess of plastic fines, medium to high dry strength	12-50	Above 'A' line or $I_p > 7$	—	—	Borderline classifications require the use of dual symbols e.g. SP-SM, GW-GC
		fine 2.36								
	SANDS (more than half of coarse fraction is smaller than 2.36mm)	coarse 0.6	SW	Well graded sands, gravelly sands, little or no fines	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength	0-5	—	> 6	between 1 and 3	3. I_p = Plasticity Index
			SP	Poorly graded sands and gravelly sands; little or no fines	Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength	0-5	—	Fails to comply with above	Fails to comply with above	
		medium 0.2	SM	Silty sands, sand-silt mixtures	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength	12-50	Below 'A' line or $I_p < 4$	—	—	
		fine 0.075	SC	Clayey sands, sand-clay mixtures	'Dirty' materials with excess of plastic fines, medium to high dry strength	12-50	Above 'A' line or $I_p > 7$	—	—	

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

GUIDE TO THE DESCRIPTION, IDENTIFICATION AND CLASSIFICATION OF SOILS (CONT.)

Major Divisions		Particle Size (mm)	Group Symbol	Typical Names	Field Identification			Laboratory Classification			Notes
					Dry* Strength	Dilatancy†	Toughness ‡			Plasticity of Fine Fraction	
FINE GRAINED SOILS (more than half of material less than 63 mm is smaller than 0.075 mm)	SILTS & CLAYS (liquid limit < 50%)	<0.075	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	None to low	Quick to slow	None	Use the gradation curve of material passing 63mm for classification of fractions according to the criteria given in "Major Divisions"	More than 50% passing 0.06 mm	Below 'A' line	PLASTICITY CHART FOR CLASSIFICATION OF FINE GRAINED SOILS
			CL, CI	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	Medium to high	None to very slow	Medium			Above 'A' line	
			OL[◈]	Organic silts and organic silty clays of low plasticity	Low to medium	Slow	Low			Below 'A' line	
	SILTS & CLAYS (liquid limit > 50%)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	Low to medium	Slow to none	Low to medium			Below 'A' line	
			CH	Inorganic clays of high plasticity, fat clays	High to very high	None	High			Above 'A' line	
			OH[◈]	Organic clays of medium to high plasticity, organic silts	Medium to high	None to very slow	Low to medium			Below 'A' line	
	HIGHLY ORGANIC SOILS		Pt[◈]	Peat and other highly organic soils	Identified by colour, odour, spongy feel and generally by fibrous texture					—	◈ Effervesces with H_2O_2



FIELD IDENTIFICATION PROCEDURE FOR FINE GRAINED SOILS OR FRACTIONS

THESE PROCEDURES ARE TO BE PERFORMED ON THE MINUS 0.2MM SIZE PARTICLES. FOR FIELD CLASSIFICATION PURPOSES, SCREENING IS NOT INTENDED, SIMPLY REMOVE BY HAND THE COARSE PARTICLES THAT INTERFERE WITH THE TESTS.

*** Dry strength (Crushing characteristics)**

After removing particles larger than 0.2mm size, mould a pat of soil to the consistency of putty, adding water if necessary. Allow the pat to dry completely by oven, sun or air drying, and then test its strength by breaking and crumbling between the fingers. This strength is a measure of the character and quantity of the colloidal fraction contained in the soil. The dry strength increases with increasing plasticity. High dry strength is characteristic for clays of the CH group.

A typical inorganic silt possesses only very slight dry strength.

Silty fine sands and silts have about the same slight dry strength, but can be distinguished by the feel when powdering the dried specimen. Fine sand feels gritty whereas a typical silt has the smooth feel of flour.

† Dilatancy (Reaction to shaking)

After removing particles larger than 0.2mm size, prepare a pat of moist soil with a volume of 10 cm³. Add enough water if necessary to make the soil soft but not sticky.

Place the pat in the open palm of one hand and shake horizontally, striking vigorously against the other hand several times. A positive reaction consists of the appearance of water on the surface of the pat which changes to a livery consistency and becomes glossy. When the sample is squeezed between the fingers, the water and gloss disappear from the surface, the pat stiffens, and finally it cracks or crumbles.

The rapidity of appearance of water during shaking and of its disappearance during squeezing assist in identifying the character of the fines in a soil.

Very fine clean sands give the quickest and most distinct reaction whereas a plastic clay has no reaction. Inorganic silts, such as a typical rock flour, shows a moderately quick reaction.

‡ Toughness (Consistency near plastic limit)

After removing particles larger than 0.2mm size, a specimen of soil about 10cm³ in size is moulded to the consistency of putty. If too dry, water must be added and if sticky, the specimen should be spread out in a thin layer and allowed to lose some moisture by evaporation. The specimen is then rolled out by hand on a smooth surface or between the palms into a thread about 3mm in diameter. The thread is then folded and re-rolled repeatedly. During this manipulation the moisture content is gradually reduced and the specimen stiffens, finally loses its plasticity, and crumbles when the plastic limit is reached.

After the thread crumbles, the pieces should be lumped together with a slight kneading action continued until the lump crumbles. The tougher the thread near the plastic limit and the stiffer the lump when it finally crumbles, the more potent is the colloidal clay fraction in the soil.

Weakness of the thread at the plastic limit and quick loss of coherence of the lump below the plastic limit indicate either inorganic clay of low plasticity, or materials such as kaolin-type clays and organic clays which occur below the A-line. Highly organic clays have a very weak and spongy feel at the plastic limit.

EXPLANATION OF LOGGING TERMS FOR ENGINEERING GEOLOGY BOREHOLE LOGGING

ROCK SUBSTANCE WEATHERING CLASSIFICATION

RS	Residual soil
EW	Extremely weathered
HW	Highly weathered
MW	Moderately weathered
SW	Slightly weathered
F(s)	Fresh (stained defects)
F	Fresh

ESTIMATED STRENGTH CLASSIFICATION

EW	Extremely weak
VW	Very weak
W	Weak
MS	Medium strong
S	Strong
VS	Very strong
ES	Extremely strong

DEFECTS

Defects include all joints, bedding planes, fracture zones, seams, veins and cleavage partings.

RQD

Rock quality designation:

$$RQD = \frac{\text{length of core in pieces 100mm or longer}}{\text{length of run}} \times 100\%$$

WATER

Water table, with date

Water inflow

Partial drilling water loss

Complete drilling water loss

Angles of joint inclination (and other geological features and drill holes) are angles between the feature and a horizontal plane. In core, angles of joints (and other geological structures) are angles between the structure and the plane normal to the axis of the core. In vertical holes these angles are then the true inclination (dip) of the structure.

STRUCTURAL AND GEOTECHNICAL ENGINEERING

GEOTECHNICAL ENGINEERING GROUP

Definitions of Engineering Geological Terms

and

Explanation of Logging Terms

Compiled By
Geotechnical Engineering Group
May 1993

DEFINITIONS OF ENGINEERING GEOLOGICAL TERMS

This classification system provides a standard terminology for the engineering description of rock.

DEGREE OF WEATHERING [1]

TERM	SYMBOL	DEFINITION
Residual Soil	RS	Rock is converted to soil. The mass structure and material fabric are destroyed. There is a large change in volume, but the soil has not been significantly transported.
Extremely Weathered	EW	Rock substance affected by weathering to the extent that the rock exhibits soil properties - i.e. it can be remoulded and can be classified according to the Unified Classification System, but the texture of the original rock is still evident.
Highly Weathered	HW	Rock substance affected by weathering to the extent that limonite staining or bleaching affects the whole of the rock substance, and other signs of chemical or physical decomposition are evident. Porosity and strength may be increased or decreased compared to the fresh rock, usually as a result of iron bleaching or deposition. The colour and strength of the original substance is no longer recognisable.
Moderately Weathered	MW	Rock substance affected by weathering to the extent that staining extends throughout the whole of the rock substance, and the original colour of the fresh rock is no longer recognisable.
Slightly Weathered	SW	Rock substance affected by weathering to the extent that partial staining or discolouration of the rock substance, usually by limonite has taken place. The colour and texture of the fresh rock is recognisable.
Fresh (stained)	F_S	Rock substance unaffected by weathering. Weathering is limited to the surface of major discontinuities, for example an iron-stained joint.
Fresh	F	Rock substance unaffected by weathering.

ROCK STRENGTH [2]

Rock strength is defined by the Point Load Strength Index (Is (50)), and refers to the strength of the rock substance in the direction normal to the bedding.

TERM	Is (50)	FIELD GUIDE	APPROX. qu MPa *
Extremely Weak (EW)		Easily remoulded by hand to a material with soil properties.	
	0.03		0.7
Very weak (VW)		May be crumbled in the hand. Sandstone is "sugary" and friable.	
	0.1		2.4
Weak (W)		A piece of core 150mm long x 50mm dia. may be broken by hand and easily scored with a knife. Sharp edges of core may be friable and break during handling.	
	0.3		7
Medium Strong (MS)		A piece of core 150mm long x 50mm dia. may be broken by hand with considerable difficulty. Readily scored with a knife.	
	1		24
Strong (S)		A piece of core 150mm long x 50mm dia. cannot be broken by unaided hands, may be slightly scratched or scored with knife.	
	3		70
Very Strong (VS)		A piece of core 150mm long x 50mm dia. may be broken readily with hand held hammer. Cannot be scratched with pen knife.	
	10		240
Extremely Strong (ES)		A piece of core 150mm long x 50mm dia. is difficult to break with hand held hammer. Rings when struck with hammer.	

* The approximate unconfined compressive strength (qu) shown in the table is based on an assumed ratio to the point load index of 24:1. This ratio may vary widely and should be calibrated on site.

STRATIFICATION SPACING [2]

TERM	SEPARATION OF STRATIFICATION PLANES
Thinly laminated	< 6mm
Laminated	6mm - 20mm
Very thinly bedded	20mm - 60mm
Thinly bedded	60mm - 200mm
Medium bedded	200mm - 600mm
Thickly bedded	600mm - 2m
Very thickly bedded	> 2m

DISCONTINUITY SPACING [3]

TERM	SPACING
Very widely spaced	> 2m
Widely spaced	600mm - 2m
Moderately widely spaced	200mm 600mm
Closely spaced	60mm - 200mm
Very closely spaced	20mm - 60mm
Extremely closely spaced	< 20mm

APERTURE OF DISCONTINUITY SURFACES [4]

The degree to which a discontinuity is open, or to which the faces of the discontinuity have been separated and the space subsequently infilled (such as in a vein, fault or joint).

TERM	APERTURE THICKNESS (Discontinuities, veins, faults, joints)
Wide	> 200mm
Moderately wide	60mm - 200mm
Moderately narrow	20mm - 60mm
Narrow	6mm - 20mm
Very narrow	2mm - 6mm
Extremely narrow	> 0 - 2 mm
Tight	Zero

BLOCK SHAPE AND SIZE [4]

The following descriptive terms define shape:

Blocky	- approximately equidimensional.
Tabular	- one dimension considerably shorter than the other two.
Columnar	- one dimension considerably larger than the other two.

Block sizes are defined by the following descriptive terms:

TERM	BLOCK SIZE	EQUIVALENT DISCONTINUITY SPACINGS IN BLOCKY ROCK
Very large	$> 8m^3$	Extremely wide
Large	$> 0.2m^3$ - $8m^3$	Very wide
Medium	$> 0.008m^3$ - $0.2m^3$	Wide
Small	$> 0.0002m^3$ - $0.008m^3$	Moderately wide
Very small	$\leq 0.0002m^3$	Less than moderately wide

REFERENCES

1. Modifications of:
   (a) McMahon, B.K., Douglas, D.J., & Burgess, P.J., 1975. Engineering classification of sedimentary rocks in the Sydney area. Australian Geomechanics Journal, G5 (1), 51-53.
   (b) Geological Society Engineering Group Working Party, 1977. The description of rock masses for engineering purposes. Quarterly Jour. Engg. Geology, 10 (4), 355-388.

2. McMahon, B.K., Douglas , D.J., & Burgess, P. J., 1975. Engineering classification of sedimentary rocks in the Sydney area. Australian Geomechanics Journal, G5 (1), 51 -53.

3. ISRM Commission on Standardisation of Laboratory and Field Tests, 1978. Suggested methods for the quantitative description of discontinuities in rock masses. J1. Rock Mechanics Min. Sci. and Geomech. Abstra., 15, 319-368.

4. Geological Society Engineering Group Working Party, 1977. The description of rock masses for engineering purposes. Quarterly Journ. Engg Geology, 10 (4), 355-388.

APPENDIX B

Borehole Logs

NSW Department of Commerce

GEOTECHNICAL & ENVIRONMENTAL

BOREHOLE B1

PROJECT: MANILLA MPS & HEALTH ONE
DATE: 27.11.08
LOCATION: COURT STREET, MANILLA
SURFACE RL:
CONTRACTOR: E.B.S.
OPERATOR: R.LOVETT
EQUIPMENT: PIONEER P80

DEPTH (m)	WATER	BIT	SAMPLE or TEST	SOIL GROUP	GRAPHIC LOG	SOIL DESCRIPTION (Soil type, colour, consistency, grainsize, moisture, remarks)
0	No Groundwater Encountered	TC		FILL		SILTY SAND with some clay; brown; very loose; moist. — 0.20
			SPT 1,2,3 N = 5	FILL		GRAVEL in a clayey silt matrix; gravel is meta-silstone, angular fragments to 50mm; yellow brown, brown and dark brown; uncontrolled (soft to firm). — 1.00
1			SPT 1,2,1 N = 3	FILL		SILTY SAND with some clay; contains some embedded rock fragments and rounded pebbles; with pockets/interbeds of furnace refuse - ash, burnt coal and wood, also includes small brick fragments; brown grey, brown, black and light grey; uncontrolled (very loose); dry. — 2.00
2				FILL		GRAVEL in a clayey silt matrix; gravel is coarse, ranging to small cobble size; brown and grey brown. — 2.60
			SPT 7,3/30,- N = R	CI (v)		CLAYEY SILT with some gravel; gravel is fine, angular rock fragments; grey brown; stiff; dry. — 2.80
3				GM (v)		GRAVEL and COBBLES; dense; dry. — END at 3.10
4						NOTE: Very hard drilling for a TC bit below 2.8m. TC bit refusal at 3.1m is inferred to have occurred on a cobble. No cuttings appearing at the surface and any matrix is not known. Borehole was moved 0.5m and re-drilled. Profile was slightly variable. Gravel fill with very minor silty matrix between 0.7m and 1.4m. Gravel and cobbles encountered at 2.6m with TC bit refusal at 2.8m.
5						

SAMPLE OR TEST
U.....Undisturbed
D.....Disturbed
SPT....Standard Penetration Test
CPT....Cone Penetration Test

v : visual
l : laboratory

WATER
Water Table
Water Inflow

FIELD SUPERVISOR: C.KARWAJ
PROJECT COORDINATOR: M.RAHIMI
SHEET 1 OF 1 SHEETS
SCALE 1 : 25

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NSW Department of Commerce

GEOTECHNICAL & ENVIRONMENTAL

BOREHOLE B1A

PROJECT: MANILLA MPS & HEALTH ONE
DATE: 04.12.08
LOCATION: COURT STREET, MANILLA
SURFACE RL:
CONTRACTOR: E.B.S.
OPERATOR: R.LOVETT
EQUIPMENT: PIONEER P80

DEPTH (m)	WATER	BIT	SAMPLE or TEST	SOIL GROUP	GRAPHIC LOG	SOIL DESCRIPTION Soil type, colour, consistency, grainsize, moisture, remarks
0	No Groundwater Encountered	TC		FILL		**GRAVELLY SILTY SAND;** brown; loose; dry.
						0.30
				FILL		**GRAVELLY CLAYEY SILT;** rock fragments are angular to sub-angular, generally to 50mm size; yellow brown, brown and dark brown; firm; moist.
1						
						1.30
				FILL		**SILTY SAND, some clay;** with pockets of furnace refuse (ash and burnt coal) and gravelly clayey silt; brown, grey brown and black; very loose; dry.
2						
						2.00
				FILL		**GRAVEL** in clayey silt matrix; gravel is coarse, ranging to small cobble size; brown and grey brown; firm to stiff; moist.
						2.50
				CI/CH (v)		**CLAYEY SILT;** contains some engular rock fragments; stiff; just moist.
3						
						3.00
				GC (v)		**GRAVEL/COBBLES** in clayey matrix; yellow grey brown; dense; just moist.
						3.64
4		NMLC		ROCK		**REFER TO ENGINEERING GEOLOGY BOREHOLE LOG**
5						

SAMPLE OR TEST
U.....Undisturbed
D.....Disturbed
SPT....Standard Penetration Test
CPT....Cone Penetration Test

v : visual
l : laboratory

WATER
Water Table
Water Inflow

FIELD SUPERVISOR: C.KARWAJ
PROJECT COORDINATDR: M.RAHIMI
SHEET 1 OF 2 SHEETS
SCALE 1 : 25

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NSW Department of Commerce

GEOTECHNICAL & ENVIRONMENTAL

BOREHOLE B1A

PROJECT: MANILLA MPS & HEALTH ONE
DATE: 04.12.08
LOCATION: COURT STREET, MANILLA
SURFACE RL:
CONTRACTOR: E.B.S.
OPERATOR: R.LOVETT
EQUIPMENT: PIONEER P80

DEPTH (m)	WATER	BIT	SAMPLE or TEST	SOIL GROUP	GRAPHIC LOG	SOIL DESCRIPTION Soil type, colour, consistency, grainsize, moisture, remarks
5				ROCK		REFER TO ENGINEERING GEOLOGY BOREHOLE LOG
6						END at 6.03
7						
8						
9						
10						

SAMPLE OR TEST
U.....Undisturbed
D.....Disturbed
SPT....Standard Penetration Test
CPT....Cone Penetration Test

v : visual
l : laboratory

WATER
Water Table
Water Inflow

FIELD SUPERVISOR: C.KARWAJ
PROJECT COORDINATOR: M.RAHIMI
SHEET 2 OF 2 SHEETS
SCALE 1 : 25

NSW Department of Commerce

GEOTECHNICAL & ENVIRONMENTAL ENGINEERING
ENGINEERING GEOLOGY BOREHOLE LOG

BOREHOLE No. B1A

Sheet 1 of 1 Sheets

PROJECT MANILLA MPS
LOCATION HEALTH ONE FACILITY
CO-ORDINATES E N
R.L. COLLAR
DATUM
BEARING
INCLINATION VERTICAL

DRILL PIONEER P60 CONTRACTOR EARTH BORING SERVICES COMMENCED 4.12.2008
CORE BARRELL NMLC DRILLER R. LOVETT COMPLETED 4.12.2008

DRILLING DATA				ROCK SUBSTANCE				ROCK MASS DEFECTS				
DEPTH (R.L.) METRES	Method	Casing, Run	Water	GRAPHIC LOG	DESCRIPTION ROCK TYPE Grainsize, texture, colour, composition, structure, hardness	WEATHERING	ESTIMATED STRENGTH	DEFECT SPACING (mm) 2000 600 200 60 20	VISUAL LOG	DEFECT DESCRIPTION TYPE Inclination, planarity, roughness, coatings or infillings	R.Q.D.	TESTS
2	AUGER				NOT CORED.							
3												
3.64		R1			CORE LOSS; 0.11m							
3.75												
3.81					META-SANDSTONE; fine to medium grained; brown/orange-brown with some dark brown Fe-staining; laminated to very thinly bedded.	MW	W to MS			3.80 PARTING; 5°; sub-planar; rough.		
4		RUN 2								3.87 } PARTINGS; 10° to 20°; planar to sub-planar; Fe-stained. 4.04		
4.10						EW	EW			4.10 } FRAGMENTS.		
4.15					CORE LOSS; 0.14m							
4.26		R3										
4.29					METASANDSTONE; as above.	MW	W/MS					
4.39					CORE LOSS; 0.09m							
4.43		RUN 4			META-SILTSTONE/META-SANDSTONE; fine grained; brown + mid to dark grey with some light grey + dark brown Fe-staining; laminated to very thinly bedded.	MW	W to MS			4.49 - JOINT; 50°; sub-planar; rough; Fe-stained. 4.55 } PARTINGS; 5° to 10°; sub-planar; smooth to rough 4.61 4.67 } FRAGMENTS 4.74		
4.74										4.84 - JOINT; 45°; sub-planar; smooth. 4.86 } FRAGMENTS.		
4.94		RUN 5			CORE LOSS; 0.06m							
5					META-SILTSTONE/META-SANDSTONE	MW	W/MS					
5.04		R6			CORE LOSS; 0.10m.							
5.14	DIAMOND CORING	RUN 7			META-SILTSTONE/META-SANDSTONE; fine grained; as above.	MW	MS			5.22 } FRAGMENTS. 5.26 - JOINTS; 40°; sub-planar; rough; Fe-stained. 5.35 5.37 - PARTING; 5°; sub-planar; rough; Fe-stained.		
5.60										5.50 5.58 5.60 } PARTINGS; 5°; sub-planar; rough; Fe-stained		
5.66		RUN 8			META-SANDSTONE; fine to medium grained; brown + mid grey with some light grey + dark brown Fe-staining; becomes fine grained at 5.90m.					5.66 } FRAGMENTS. 5.79 5.77 } JOINTS; 40° to 50°; planar; rough; Fe-stained 5.88		
6										6.00 } FRAGMENTS.		
6.03					END OF HOLE AT 6.03m							
7												

R.Q.D.: RQD=23% | RQD=0% | RQD=19% | RQD=0% | RQD=0%

Remarks: END OF HOLE AT 6.03m. Job / Report No. G037A

Logged by: P. ANDERSON Date: 21.1.2009 Site Supervisor C. KARWAS


MANILLA MPS
HEALTH ONE FACILITY
B1A: 3.64m to 6.03m
B1A
3.64m
CORE LOSS 0.11m
3.81m
CORE LOSS 0.10m
4.75m
CORE LOSS 0.04
4.79
CORE LOSS 0.09
CORE LOSS 0.05
5.0m
LOSS 0.1m
5.14
END 6.03

NSW Department of Commerce

GEOTECHNICAL & ENVIRONMENTAL

BOREHOLE B2

PROJECT: MANILLA MPS & HEALTH ONE
DATE: 27.11.08
LOCATION: COURT STREET, MANILLA
SURFACE RL:
CONTRACTOR: E.B.S.
OPERATOR: R.LOVETT
EQUIPMENT: PIONEER P80

DEPTH (m)	WATER	BIT	SAMPLE or TEST	SOIL GROUP	GRAPHIC LOG	SOIL DESCRIPTION (Soil type, colour, consistency, grainsize, moisture, remarks)
0	No Groundwater Encountered	TC		FILL		BITUMEN over gravelly silty sand; brown and grey brown; compact (medium dense); dry. — 0.45
1			SPT 4,3,2 N = 5	CH (v)		SANDY SILTY CLAY, some gravel; red brown and yellow brown; firm with soft zone at 1 - 1.4m; dry to 1m, then moist. (possibly fill)
			SPT 1,1,3 N = 4			— 1.40
				CH (v)		SANDY SILTY CLAY; with thin gravelly interbeds/pockets; gravel is fine, angular rock fragments; orange red brown with grey brown interbeds; stiff with hard lenses; moist. — 2.00
2			SPT 9/90,-,- N = R	GC (v)		GRAVEL in a sandy clay matrix; contains rare clayey silt interbed to 100mm thick; gravel is subrounded, subangular and angular rock fragments to 40mm; stiff to very stiff, with hard pockets; orange brown, light grey and grey brown; just moist.
			SPT 10,6/50,- N = R			— 3.20
3			SPT 9,12,- N = R	CI/CH (v)		CLAYEY SILT; with occasional embedded gravel (subrounded) and subangular rock fragments; orange brown and light grey; very stiff with hard pockets; dry. — 3.60
				ROCK		SANDSTONE (tuffaceous); extremely weathered to highly weathered; extremely weak; fine grained; yellow brown — 4.20
4			D	ROCK		- becomes highly weathered; very weak; yellow brown and dark brown, interbedded with meta-siltstone/mudstone.. — END at 4.70
5						NOTE: Hard drilling for a TC bit below 4.5m.TC bit refusal at 4.7m on what is inferred to be moderately weathered, weak bedrock. SPT refusals generally occurred in gravelly pockets.

SAMPLE OR TEST
U.....Undisturbed
D.....Disturbed
SPT....Standard Penetration Test
CPT....Cone Penetration Test

v : visual
l : laboratory

WATER
Water Table
Water Inflow

FIELD SUPERVISOR: C.KARWAJ
PROJECT COORDINATOR: M.RAHIMI
SHEET 1 OF 1 SHEETS
SCALE 1 : 25

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NSW Department of Commerce

GEOTECHNICAL & ENVIRONMENTAL

BOREHOLE B3

PROJECT: MANILLA MPS & HEALTH ONE
DATE: 27.11.08
LOCATION: COURT STREET, MANILLA
SURFACE RL:
CONTRACTOR: E.B.S.
OPERATOR: R.LOVETT
EQUIPMENT: PIONEER P80

DEPTH (m)	WATER	BIT	SAMPLE or TEST	SOIL GROUP	GRAPHIC LOG	SOIL DESCRIPTION (Soil type, colour, consistency, grainsize, moisture, remarks)
0	No Groundwater Encountered	TC		FILL		BITUMEN (15mm) over sandy gravel; red brown; compact (medium dense); dry. — 0.20
				FILL		CLAYEY GRAVEL; red brown, yellow brown and grey brown pockets; compact; (medium dense to dense); just moist. — 0.80
1			5/90,-,- N = R SPT; 11,10/60,- N = R SPT	CH/CI (v)		GRAVELLY SILTY CLAY, with some sand; contains pockets/thin interbeds of clayey gravel; high gravel concentration at 1.2m; occasional coarse gravel/cobbles between 1.5m and 1.7m; red brown, light grey and yellow brown; very stiff with hard pockets/interbeds; dry to moist. — 2.00
2				GC (v)		GRAVEL in clayey matrix; gravel is coarse, ranging to small cobble size; very high concentration 2.4 to 2.6m; mid grey, red brown and yellow brown; dense; dry. — 2.60
			6/70,-,- N = R SPT	ROCK		SANDSTONE (tuffaceous); extremely weathered to highly weathered; extremely weak; fine grained; dark brown/brown. — 3.50
3			D	ROCK		- becomes highly weathered; very weak to weak; fractured, interbedded with meta-siltstone/mudstone. — 4.1
4						NOTE: All SPT's refused in gravelly pockets. Hard drilling for a TC bit below 3.8m. TC bit refusal at4.1m on what is inferred to be moderately weathered, weak bedrock.
5						

SAMPLE OR TEST
U.....Undisturbed
D.....Disturbed
SPT....Standard Penetration Test
CPT....Cone Penetration Test

v : visual
l : laboratory

WATER
Water Table
Water Inflow

FIELD SUPERVISOR: C.KARWAJ
PROJECT COORDINATOR: M.RAHIMI
SHEET 1 OF 1 SHEETS
SCALE 1 : 25

NSW Department of Commerce

GEOTECHNICAL & ENVIRONMENTAL

BOREHOLE B4

PROJECT: MANILLA MPS & HEALTH ONE
DATE: 27.11.08
LOCATION: COURT STREET, MANILLA
SURFACE RL:
CONTRACTOR: E.B.S.
OPERATOR: R.LOVETT
EQUIPMENT: PIONEER P80

DEPTH (m)	WATER	BIT	SAMPLE or TEST	SOIL GROUP	GRAPHIC LOG	SOIL DESCRIPTION (Soil type, colour, consistency, grainsize, moisture, remarks)
0	No Groundwater Encountered	TC		FILL		CLAYEY SILTY SAND, some gravel; red brown; loose; moist. — 0.15
				FILL		FURNACE REFUSE; ash, slag, gravel sized burnt coal fragments; black and grey brown; very loose (uncontrolled); dry. — 0.50
1			SPT 3,3,5 N = 8	FILL		GRAVELLY SANDY CLAY; contains high concentration of rock fragments in pockets; red brown; moderately compact (firm); moist. — 1.30
				FILL		SANDY CLAYEY GRAVEL; coarse grained rock fragments; loose to medium dense; moist. — 1.50
2			SPT 2,3,4 N = 7	FILL		FURNACE REFUSE; ash, burnt coal, some gravel sized rock fragments; one-off piece of steel; uncontrolled (loose); dry. — 2.10
				CI (v)		GRAVELLY SANDY CLAY; red brown; firm; moist. (interpreted to be in-situ). — 2.40
				GC (v)		GRAVEL and COBBLES in clayey matrix; dark grey brown; medium dense; moist. — 3.00
3			SPT 9/-,- N = R	ROCK		SANDSTONE (tuffaceous); extremely weathered to highly weathered; extremely weak; fine grained; yellow brown and dark brown. — 4.00
4				ROCK		META-SILTSTONE/MUDSTONE; becomes highly weathered; very weak to weak; dark brown. — END at 4.40
5						NOTE: Hard drilling for a TC bit below 4m. TC bit refusal at 4.4m inferred to be on moderately weathered, weak bedrock.

SAMPLE OR TEST
U.....Undisturbed
D.....Disturbed
SPT....Standard Penetration Test
CPT....Cone Penetration Test

v : visual
l : laboratory

WATER
Water Table
Water Inflow

FIELD SUPERVISOR: C.KARWAJ
PROJECT COORDINATOR: M.RAHIMI
SHEET 1 OF 1 SHEETS
SCALE 1 : 25

NSW Department of Commerce

GEOTECHNICAL & ENVIRONMENTAL

BOREHOLE B5

PROJECT: MANILLA MPS & HEALTH ONE
DATE: 27.11.08
LOCATION: COURT STREET, MANILLA
SURFACE RL:
CONTRACTOR: E.B.S.
OPERATOR: R.LOVETT
EQUIPMENT: PIONEER P80

DEPTH (m)	WATER	BIT	SAMPLE or TEST	SOIL GROUP	GRAPHIC LOG	SOIL DESCRIPTION (Soil type, colour, consistency, grainsize, moisture, remarks)
0	No Groundwater Encountered	TC		FILL		BITUMEN (10mm) over silty sandy gravel; red brown; compact (medium dense); moist. — 0.15
				GC/GM (v)		SILTY CLAYEY GRAVEL; matrix varies in pockets; grey brown and orange brown; loose to medium dense; dry. (possibly fill) — 0.75
1			SPT 5,14,2/5 N = R	CI (v)		CLAYEY SILT, trace of gravel; orange brown; stiff; dry. — 0.95
				GC (v)		GRAVEL in a sandy silty clay matrix; angular to subrounded rock fragments to 40mm; matrix light grey and orange brown; dense; dry. — 1.40
				GM (v)		GRAVEL becomes coarse, ranging to small cobble size; lesser matrix; dense; dry. — 1.70
2			SPT 7/50,-,- N = R	ROCK		SANDSTONE (tuffaceous); extremely weathered to highly weathered; extremely weak to very weak; fine grained; dark brown and yellow brown. — 2.00
				ROCK		- becomes highly weathered; very weak to weak.
3						END at 3.20
4						NOTE: TC bit refusal at 3.2m.
5						

SAMPLE OR TEST
U.....Undisturbed
D.....Disturbed
SPT....Standard Penetration Test
CPT....Cone Penetration Test

V : visual
L : laboratory

WATER
Water Table
Water Inflow

FIELD SUPERVISOR: C.KARWAJ
PROJECT COORDINATOR: M.RAHIMI
SHEET 1 OF 1 SHEETS
SCALE 1 : 25

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GEOTECHNICAL & ENVIRONMENTAL

BOREHOLE B5A

PROJECT: MANILLA MPS & HEALTH ONE
DATE: 09.12.08
LOCATION: COURT STREET, MANILLA
SURFACE RL:
CONTRACTOR: E.B.S.
OPERATOR: R.LOVETT
EQUIPMENT: PIONEER P80

DEPTH (m)	WATER	BIT	SAMPLE or TEST	SOIL GROUP	GRAPHIC LOG	SOIL DESCRIPTION Soil type, colour, consistency, grainsize, moisture, remarks
0	No Groundwater Encountered	TC		FILL		BITUMEN (10mm) over silty sandy gravel; red borwn; compact (medium dense); moist. — 0.15
				GC/GM (v)		SILTY CLAYEY GRAVEL; matrix varies in pockets; grey brown and orange brown; loose to medium dense; dry (possibly fill). — 0.75
1				CI (v)		CLAYEY SILT, trace of gravel; orange brown; stiff; dry. — 0.95
				GC (v)		GRAVEL in a sandy silty clay matrix; angular to subrounded rock fragments to 40mm; matrix light grey and orange brown; dense; dry. — 1.40
				GM (v)		GRAVEL becomes coarse, ranging to small cobble size; lesser matrix; dene; dry. — 1.80
2		NMLC		ROCK		REFER TO ENGINEERING GEOLOGY BOREHOLE LOG
3						END at 3.14
4						
5						

SAMPLE OR TEST
U.....Undisturbed
D.....Disturbed
SPT....Standard Penetration Test
CPT....Cone Penetration Test

v : visual
l : laboratory

WATER
Water Table
Water Inflow

FIELD SUPERVISOR: C.KARWAJ
PROJECT COORDINATOR: M.RAHIMI
SHEET 1 OF 1 SHEETS
SCALE 1 : 25

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NSW Department of Commerce

GEOTECHNICAL & ENVIRONMENTAL ENGINEERING
ENGINEERING GEOLOGY BOREHOLE LOG

BOREHOLE No. B5A
Sheet 1 of 1 Sheets

PROJECT MANILLA MPS
LOCATION HEALTH ONE FACILITY
CO-ORDINATES E N
R.L. COLLAR
DATUM
BEARING
INCLINATION VERTICAL

DRILL PIONEER P60
CORE BARRELL NMLC
CONTRACTOR EARTH BORING SERVICES
DRILLER R. LOVETT
COMMENCED 9.12.2008
COMPLETED 9.12.2008

DRILLING DATA				ROCK SUBSTANCE				ROCK MASS DEFECTS				
DEPTH (R.L.) METRES	Method	Casing, Run	Water	GRAPHIC LOG	DESCRIPTION ROCK TYPE Grainsize, texture, colour, composition, structure, hardness	WEATHERING	ESTIMATED STRENGTH	DEFECT SPACING (mm) 2000 600 200 60 20	VISUAL LOG	DEFECT DESCRIPTION TYPE Inclination, planarity, roughness, coatings or infillings	R.Q.D.	TESTS
0					NOT CORED.							
1	AUGER											
1.80					CHEATY ROCK FRAGMENTS	MW	MS		XXX	FRAGMENTS	10	
1.70		2			META-SANDSTONE; see below.	MW	W/MS				10	
1.96					CORE LOSS: 0.05m							
2.01	DIAMOND CORING	RUN 3			META-SANDSTONE; fine to medium grained; brown/orange-brown with some dark grey & black. Fe-staining; laminated to very thinly bedded	MW	MS			2.07 2.12 2.20 2.25 2.29 2.33 2.37 2.42 FRAGMENTS; PARTINGS; 5° to 15°; planar to sub-planar; smooth to rough; Fe-stained; some with clayey silt infill.	RQD = 0%	
2.50		RUN 4			META-SHALE; with thin metasandstone interbeds fine grained; dark grey to mid grey with light grey interbeds & brown staining; thinly laminated to laminated					2.50 JOINTS; 70° to 80°; planar; rough; Fe-stained. 2.60 FRAGMENTS. 2.66 PARTINGS; 10° to 15°; planar; smooth; some clayey silt infill.	0%	
2.63												
2.82					CORE LOSS; 0.04m							
2.97		RUN 5			META-SHALE; as above.	MW	MS			3.00 FRAGMENTS 3.04 FRAGMENTS	0%	
3												
3.14					END OF HOLE AT 3.14m							
4												
5												

Remarks: END OF HOLE AT 3.14m
Job / Report No. G037A

Logged by: P. ANDERSON
Date: 21.1.2009
Site Supervisor C. KARWAS


MANILLA MPS
HEALTH ONE FACILITY
B5A: 1.80m to 3.14m
BORE 5A
START 1.8
1.9m
CORE LOSS 0.05
2.01
2.63
CORE LOSS 0.04
2.87
END 3.14

NSW Department of Commerce

GEOTECHNICAL & ENVIRONMENTAL

BOREHOLE B6

PROJECT: MANILLA MPS & HEALTH ONE
DATE: 28.11.08
LOCATION: COURT STREET, MANILLA
SURFACE RL:
CONTRACTOR: E.B.S.
OPERATOR: R.LOVETT
EQUIPMENT: PIONEER P80

DEPTH (m)	WATER	BIT	SAMPLE or TEST	SOIL GROUP	GRAPHIC LOG	SOIL DESCRIPTION (Soil type, colour, consistency, grainsize, moisture, remarks)
0	No Groundwater Encountered	TC	SPT 2,2,2 N = 4	FILL		**GRAVEL** in a minor clayey matrix; mantled by a veneer of silty topsoil with organics; orange brown; uncontrolled (very loose); dry.
1						1.20
			SPT 4,9,5/50 N = R	Cl (v)		**GRAVELLY SILTY CLAY;** high gravel concentration to 1.5m; reddish brown and grey; firm to stiff; dry. (possibly a combination of fill and in-situ).
						1.70
2			SPT 9,3/20,- N = R	ROCK		**SANDSTONE** (tuffaceous); highly weathered with extremely weathered interbeds, occasional clayey seams; extremely weak; fine grained; yellow brown and dark brown.
3						3.50
4				ROCK		**META-SILTSTONE/MUDSTONE;** with tuffaceous sandstone laminations; moderately weathered; thinly bedded; fractured; dark grey/dark grey brown.
						END at 4.50
5						**NOTE:** Slow drilling for a TC bit below 3.5m. No refusal - borehole terminated at 4.5m.

SAMPLE OR TEST
U.....Undisturbed
D.....Disturbed
SPT....Standard Penetration Test
CPT....Cone Penetration Test

v : visual
l : laboratory

WATER
Water Table
Water Inflow

FIELD SUPERVISOR: C.KARWAJ
PROJECT COORDINATOR: M.RAHIMI
SHEET 1 OF 1 SHEETS
SCALE 1 : 25

NSW Department of Commerce

GEOTECHNICAL & ENVIRONMENTAL

BOREHOLE B7

PROJECT: MANILLA MPS & HEALTH ONE
DATE: 28.11.08
LOCATION: COURT STREET, MANILLA
SURFACE RL:
CONTRACTOR: E.B.S.
OPERATOR: R.LOVETT
EQUIPMENT: PIONEER P80

DEPTH (m)	WATER	BIT	SAMPLE or TEST	SOIL GROUP	GRAPHIC LOG	SOIL DESCRIPTION Soil type, colour, consistency, grainsize, moisture, remarks
0	No Groundwater Encountered	TC	SPT 7,13,5/80 N = R	FILL		**GRAVEL** in clayey silty sand matrix; brown; loose; dry.
0.45						
				Cl/GC (v)		**GRAVELLY SILTY CLAY;** red brown and yellow brown; very stiff; dry.
1.00						
1				ROCK		**SANDSTONE** (tuffaceous); extremely weathered; extremely weak; yellow brown
1.20						
				ROCK		- becomes highly weathered; extremely weak to very weak; with thin interveds of meta-siltstone/ shale; yellow brown and dark brown.
3.00						
				ROCK		**META-SILTSTONE/MUDSTONE;** highly weathered to moderately weathered; medium strong; fractured; dark grey brown.
END at 3.30						
4						**NOTE:** Hard drilling for TC bit below 3m. TC bit refusal at 3.3m.
5						

SAMPLE OR TEST
U.....Undisturbed
D.....Disturbed
SPT....Standard Penetration Test
CPT....Cone Penetration Test

v : visual
l : laboratory

WATER
Water Table
Water Inflow

FIELD SUPERVISOR: C.KARWAJ
PROJECT COORDINATOR: M.RAHIMI
SHEET 1 OF 1 SHEETS
SCALE 1 : 25

NSW Department of Commerce

GEOTECHNICAL & ENVIRONMENTAL

BOREHOLE B8

PROJECT: MANILLA MPS & HEALTH ONE
DATE: 28.11.08
LOCATION: COURT STREET, MANILLA
SURFACE RL:
CONTRACTOR: E.B.S.
OPERATOR: R.LOVETT
EQUIPMENT: PIONEER P80

DEPTH (m)	WATER	BIT	SAMPLE or TEST	SOIL GROUP	GRAPHIC LOG	SOIL DESCRIPTION (Soil type, colour, consistency, grainsize, moisture, remarks)
0	No Groundwater Encountered	TC		FILL		**SILTY SAND** with gravel; small boulder sized concrete fragments; grey brown; very loose; dry. — 0.30
				GC/Cl (v)		**GRAVEL** in a sandy silty clay matrix; gravel concentration varies - red brown, brown and yellow brown; firm; moist. (possibly fill) — 0.80
1			SPT 3,8,9 N = 17	Cl (v)		**SANDY SILTY CLAY** with gravel; red brown and brown; stiff to very stiff; just moist. (appears to be in-situ) — 1.20
				GC (v)		**CLAYEY GRAVEL**; gravel is coarse grained; matrix is red brown; very stiff; just moist. — 1.40
2			SPT 5,7,11 N = 18	Cl/CH (v)		**SILTY CLAY**; with some embedded gravel; red brown and dark brown, minor yellow brown; very stiff; just moist. — 2.30
3			D	ROCK		**SANDSTONE** (tuffaceous); highly weathered; extremely weak to very weak; fine grained; dark brown/dark grey brown.
4						END at 4.50
5						NOTE: Firm to hard drilling conditions for a TC bit. No refusal - borehole terminated at 4.5m.

SAMPLE OR TEST
U.....Undisturbed
D.....Disturbed
SPT....Standard Penetration Test
CPT....Cone Penetration Test

v : visual
l : laboratory

WATER
Water Table
Water Inflow

FIELD SUPERVISOR: C.KARWAJ
PROJECT COORDINATOR: M.RAHIMI
SHEET 1 OF 1 SHEETS
SCALE 1 : 25

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NSW Department of Commerce

GEOTECHNICAL & ENVIRONMENTAL

BOREHOLE B9

PROJECT: MANILLA MPS & HEALTH ONE
DATE: 28.11.08
LOCATION: COURT STREET, MANILLA
SURFACE RL:
CONTRACTOR: E.B.S.
OPERATOR: R.LOVETT
EQUIPMENT: PIONEER P80

DEPTH (m)	WATER	BIT	SAMPLE or TEST	SOIL GROUP	GRAPHIC LOG	SOIL DESCRIPTION Soil type, colour, consistency, groinsize, moisture, remarks
0	No Groundwater Encountered	TC		GM (v)		GRAVEL in silty sand matrix; dark brown; medium dense; dry. — 0.30
			U	CI/CH (v)		SILTY CLAY, some sand; red brown; stiff; dry. — 0.70
				CI/CH (v)		- becomes purplish red and yellow brown; appears to be extremely lightly cemented (hard); dry. — 0.95
1			SPT 12,2/10,- N = R	CI/GC (v)		GRAVEL in a clay matrix; coarse at start of layer, then finer, angular and subrounded rock fragments; yellow brown, grey and red brown; very stiff; just moist. — 1.30
				GC (v)		GRAVEL becomes coarser; higher concentration. — 1.90
2			SPT 6,14,- N = R	CI (v)		SILTY CLAY, some sand, trace of gravel; mottled pale grey, yellow orange brown and grey brown; very stiff to hard; dry. — 2.40
				GC (v)		GRAVEL & COBBLES in clayey matrix; very dense; dry. — 2.80
3				ROCK		SANDSTONE (tuffaceous); highly weathered; very weak; dark brown/dark grey brown. — END at 3.60
4						NOTE: Hard drilling for a TC bit below 2.4m. TC bit refusal at 3.6m on what is inferred to be moderately weathered, weak bedrock.
5						

SAMPLE OR TEST
U.....Undisturbed
D.....Disturbed
SPT....Standard Penetration Test
CPT....Cone Penetration Test

v : visual
l : laboratory

WATER
Water Table
Water Inflow

FIELD SUPERVISOR: C.KARWAJ
PROJECT COORDINATOR: M.RAHIMI
SHEET 1 OF 1 SHEETS
SCALE 1 : 25

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NSW Department of Commerce

GEOTECHNICAL & ENVIRONMENTAL

BOREHOLE B10

PROJECT: MANILLA MPS & HEALTH ONE
DATE: 28.11.08
LOCATION: COURT STREET, MANILLA
SURFACE RL:
CONTRACTOR: E.B.S.
OPERATOR: R.LOVETT
EQUIPMENT: PIONEER P80

DEPTH (m)	WATER	BIT	SAMPLE or TEST	SOIL GROUP	GRAPHIC LOG	SOIL DESCRIPTION Soil type, colour, consistency, grainsize, moisture, remarks
0	No Groundwater Encountered	TC	B	GM (v)		GRAVEL in a silty matrix, with roots; dark brown and brown grey; loose; dry. 0.25
				CI/GC (v)		GRAVELLY SILTY CLAY; red brown, some yellow brown and grey; stiff; dry to moist 0.70
1			10/140,-,- N = R SPT	CH (v)		SILTY CLAY, some fine gravel; yellow brown, brown and red brown; very stiff; dry. 1.10
				GC (v)		GRAVEL and COBBLES in a clayey matrix; very dense; dry. END at 1.30
2						NOTE: Very hard drilling conditions for a TC bit below 1.1m. TC bit refusal on a cobble at 1.3m.
3						
4						
5						

SAMPLE OR TEST
U.....Undisturbed
D.....Disturbed
SPT....Standard Penetration Test
CPT....Cone Penetration Test

v : visual
l : laboratory

WATER
Water Table
Water Inflow

FIELD SUPERVISOR: C.KARWAJ
PROJECT COORDINATOR: M.RAHIMI
SHEET 1 OF 1 SHEETS
SCALE 1 : 25

NSW Department of Commerce

GEOTECHNICAL & ENVIRONMENTAL

BOREHOLE B11

PROJECT: MANILLA MPS & HEALTH ONE
DATE: 28.11.08
LOCATION: COURT STREET, MANILLA
SURFACE RL:
CONTRACTOR: E.B.S.
OPERATOR: R.LOVETT
EQUIPMENT: PIONEER P80

DEPTH (m)	WATER	BIT	SAMPLE or TEST	SOIL GROUP	GRAPHIC LOG	SOIL DESCRIPTION Soil type, colour, consistency, grainsize, moisture, remarks
0	No Groundwater Encountered	TC		FILL		**CLAYEY SILT** with gravel; dark grey; uncontrolled (soft); very moist.
						0.40
				CH (v)		**SILTY CLAY**, trace of embedded gravel; red brown; soft to firm; very moist.
			SPT 2,3,5 N = 8			
						0.90
1				CH (v)		**GRAVELLY SILTY CLAY**; red brown and yellow brown; stiff; moist.
						1.50
			SPT 6,5/50,- N = R	GC (v)		**GRAVEL** in a clayey matrix; yellow brown, grey and red brown; very stiff; moist.
						1.90
2				GC (v)		- higher concentration of gravel; grevel becomes coarse, ranging to small cobble size.
						2.50
				GC (v)		- gravel becomes fine to coarse; matrix is hard.
3			SPT 4/5,-,- N = R			
						3.20
				ROCK		**SANDSTONE** (tuffaceous); extremely weathered; extremely weak; (behaves as a very dense silty sand with clay and evident rock structure); orange brown and light grey.
						3.60
4				ROCK		**SANDSTONE**; very weak; dark brown and yellow brown; highly weathered with rare extremely weathered with interbeds of meta-siltstone/mudstone.
						END at 4.50
5						NTOE: Only firm to hard drilling condtions for a TC bit. No refusal - borehole terminated at 4.5m. SPT refusals in gravel.

SAMPLE OR TEST
U.....Undisturbed
D.....Disturbed
SPT....Standard Penetration Test
CPT....Cone Penetration Test

v : visual
l : laboratory

WATER
Water Table
Water Inflow

FIELD SUPERVISOR: C.KARWAJ
PROJECT COORDINATOR: M.RAHIMI
SHEET 1 OF 1 SHEETS
SCALE 1 : 25

NSW Department of Commerce

GEOTECHNICAL & ENVIRONMENTAL

BOREHOLE B12

PROJECT: MANILLA MPS & HEALTH ONE
DATE: 28.11.08
LOCATION: COURT STREET, MANILLA
SURFACE RL:
CONTRACTOR: E.B.S.
OPERATOR: R.LOVETT
EQUIPMENT: PIONEER P80

DEPTH (m)	WATER	BIT	SAMPLE or TEST	SOIL GROUP	GRAPHIC LOG	SOIL DESCRIPTION Soil type, colour, consistency, grainsize, moisture, remarks
0	No Groundwater Encountered	TC		FILL		**SILTY SAND** with some clay (topsoil) and roots; dark brown; very loose; moist. 0.30
				GM (v)		**GRAVEL** in a minor clayey silt matrix, tree roots; dark brown; very loose; moist. 0.80
1			SPT 19,-,- N = R	GC/CI (v)		**GRAVEL** in a silty clay matrix; matrix varies - grades in pockets/lenses to gravelly clay; red brown and yellow brown; very stiff/dense; dry. 1.30
				ROCK		**SANDSTONE** (tuffaceous); extremely weathered; extremely weak; fine grained; yellow brown and dark brown. END at 1.50
2						**NOTE:** Borehole terminated at 1.5m - no refusal.
3						
4						
5						

SAMPLE OR TEST
U.....Undisturbed
D.....Disturbed
SPT....Standard Penetration Test
CPT....Cone Penetration Test

v : visual
l : laboratory

WATER
Water Table
Water Inflow

FIELD SUPERVISOR: C.KARWAJ
PROJECT COORDINATOR: M.RAHIMI
SHEET 1 OF 1 SHEETS
SCALE 1 : 25

NSW Department of Commerce

GEOTECHNICAL & ENVIRONMENTAL

BOREHOLE B13

PROJECT: MANILLA MPS & HEALTH ONE
DATE: 05.12.08
LOCATION: COURT STREET, MANILLA
SURFACE RL:
CONTRACTOR: E.B.S.
OPERATOR: R.LOVETT
EQUIPMENT: PIONEER P80

DEPTH (m)	WATER	BIT	SAMPLE or TEST	SOIL GROUP	GRAPHIC LOG	SOIL DESCRIPTION Soil type, colour, consistency, grainsize, moisture, remarks
0	No Groundwater Encountered	NMLC		ROCK		REFER TO ENGINEERING GEOLOGY BOREHOLE LOG
1						
2						
3						END at 3.09
4						
5						

SAMPLE OR TEST
U.....Undisturbed
D.....Disturbed
SPT....Standard Penetration Test
CPT....Cone Penetration Test

v : visual
l : laboratory

WATER
Water Table
Water Inflow

FIELD SUPERVISOR: C.KARWAJ
PROJECT COORDINATOR: M.RAHIMI
SHEET 1 OF 1 SHEETS
SCALE 1 : 25

NSW Department of Commerce

GEOTECHNICAL & ENVIRONMENTAL ENGINEERING
ENGINEERING GEOLOGY BOREHOLE LOG

BOREHOLE No. B13

Sheet 1 of 1 Sheets

PROJECT MANILLA MPS

LOCATION HEALTH ONE FACILITY

CO-ORDINATES E N

R.L. COLLAR DATUM BEARING INCLINATION VERTICAL

DRILL PIONEER P60 CONTRACTOR EARTH BORING SERVICES COMMENCED 5.12.2008

CORE BARRELL NMLC DRILLER R. LOVETT COMPLETED 5.12.2008

DRILLING DATA				ROCK SUBSTANCE				ROCK MASS DEFECTS				
DEPTH (R.L.) METRES	Method	Casing, Run	Water	GRAPHIC LOG	DESCRIPTION ROCK TYPE Grainsize, texture, colour, composition, structure, hardness	WEATHERING	ESTIMATED STRENGTH	DEFECT SPACING (mm) 2000 600 200 60 20	VISUAL LOG	DEFECT DESCRIPTION TYPE Inclination, planarity, roughness, coatings or infillings	R.Q.D.	TESTS
0					CORE LOSS; 0.11m.							
0.11	DIAMOND CORING	RUN 1			META-SILTSTONE/META-SANDSTONE; (fine grained) with thin shale interbeds/laminations; dark grey and brown with some minor light grey; thinly laminated to very thinly bedded.	HW to MW	W to MS			FRAGMENTS; with clayey silt infill and thin zones (to 20mm) of clayey silt from 0.35-0.37, 0.47-0.49, 0.53 to 0.55m.	AQD=0%	
0.60		RUN 2								0.60 PARTINGS; 15° + 20°; sub-planar; rough; Fe-stained. 0.65 0.70 0.72 - JOINT; 40°; sub-planar; rough; Fe-stained. 0.76 JOINTS; 50° + 55°; sub-planar; rough; Fe-stained. 0.84		
0.88					CORE LOSS; 0.07m							
0.95		R3			META-SILTSTONE/META-SANDSTONE; as above.	MW	MS			1.0 - PARTING; 20°; sub-planar; rough; Fe-stained. 1.05 - JOINTS; 50° to 60°; sub-planar; rough; Fe-stained, with clayey silt coatings. 1.10 1.13 FRAGMENTS. PARTINGS; 5° to 15°; sub-planar; rough; Fe-stained 1.29	0%	
1.10		RUN 4								1.40 - PARTINGS; 10° to 15°; irregular; rough. 1.46 1.55 JOINTS; 40° to 50°; sub-planar; rough; Fe-stained. 1.69 - JOINTS; 20° + 40°; sub-planar; rough; clayey silt infill in upper joint.	RQD=14%	
1.76					MUDSTONE; brown; hard.					1.76 PARTINGS; 5° to 15°; planar to sub-planar; smooth; some Fe-stained.		
1.80					SILTSTONE/SANDSTONE; fine grained; brown with some dark grey.							
1.91		RUN 5			META-SHALE; dark grey with brown + light grey; thinly laminated to laminated.					2.02 PARTINGS; 15° to 20°; planar; smooth; clayey silt infill. 2.20 FRAGMENTS; with clayey silt zone 2.2-2.24m.	RQD=0%	
2												
2.08												
2.30					CORE LOSS; 0.08m							
2.38					META-SHALE (as above).	MW	MS			2.45 FRAGMENTS with clayey silt infill. PARTINGS; 20°; planar; smooth; clayey silt coatings.	AQD=0%	
2.55		RUN 6				HW to MW with EW zones	W with EW zones			2.55 FRAGMENTS; with minor clayey silt infill. 2.73 CLAYEY SILT with minor fragments. 2.80 2.83 2.87 CLAYEY SILT with minor fragments.		
2.87						HW to MW	W to MS			PARTINGS; 10° to 20°; planar to sub-planar; rough; some clayey silt infill/coatings		
3												
3.09					END OF HOLE AT 3.09m							
4												
5												

Remarks: END OF HOLE AT 3.09m

Job / Report No. G037A

Logged by: P. ANDERSON

Date: 20.1.2009

Site Supervisor C. KARWAS


MANILLA MPS
HEALTH ONE FACILITY
B13: 0.00m to 3.09m
B13 START 0.00m
0.11 LOSS
0.6
LOSS 0.05
0.95
1.1
1.00
CORE LOSS 0.08m
2.38
END 3.09m

NSW Department of Commerce

GEOTECHNICAL & ENVIRONMENTAL

BOREHOLE B14

PROJECT: MANILLA MPS & HEALTH ONE
DATE: 06.12.08
LOCATION: COURT STREET, MANILLA
SURFACE RL:
CONTRACTOR: E.B.S.
OPERATOR: R.LOVETT
EQUIPMENT: PIONEER P80

DEPTH (m)	WATER	BIT	SAMPLE or TEST	SOIL GROUP	GRAPHIC LOG	SOIL DESCRIPTION Soil type, colour, consistency, grainsize, moisture, remarks
0	No Groundwater Encountered	NMLC	D	FILL		CLAYEY SILT with gravel; gravel is angular meta-siltstone rock fragments. (Spoil from excavation for the drain); red orange brown; soft; very moist. 0.50
1				CH/CI (v)		CLAYEY SILT with some gravel; red brown and oragne brown; firm; moist. 1.14
2				ROCK		REFER TO ENGINEERING GEOLOGY BOREHOLE LOG
3						
4						
5						END at 4.87

SAMPLE OR TEST
U.....Undisturbed
D.....Disturbed
SPT....Standard Penetration Test
CPT....Cone Penetration Test

v : visual
l : laboratory

WATER
Water Table
Water Inflow

FIELD SUPERVISOR: C.KARWAJ
PROJECT COORDINATOR: M.RAHIMI
SHEET 1 OF 1 SHEETS
SCALE 1 : 25

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KTW Department of Commerce

GEOTECHNICAL & ENVIRONMENTAL ENGINEERING
ENGINEERING GEOLOGY BOREHOLE LOG

BOREHOLE No. B14

Sheet 1 of 1 Sheets

PROJECT MANILLA MPS
LOCATION HEALTH ONE FACILITY
CO-ORDINATES E N
R.L. COLLAR
DATUM
BEARING
INCLINATION VERTICAL

DRILL PIONEER P60 CONTRACTOR EARTH BORING SERVICES COMMENCED 6.12.2008
CORE BARRELL NMLC DRILLER R. LOVETT COMPLETED 6.12.2008

DRILLING DATA				ROCK SUBSTANCE			ROCK MASS DEFECTS				
DEPTH (R.L.) METRES	Method	Casing, Run	Water	GRAPHIC LOG	DESCRIPTION ROCK TYPE Grainsize, texture, colour, composition, structure, hardness	WEATHERING	ESTIMATED STRENGTH	DEFECT SPACING (mm) 2000 600 200 60 20	VISUAL LOG	DEFECT DESCRIPTION TYPE Inclination, planarity, roughness, coatings or infillings	R.Q.D.	TESTS
0					NOT CORED.							
1	AUGER											
1.14		RUN 1			META-SHALE; interbedded with fine grained meta-sandstone; brown with some light grey and dark grey; thinly laminated to laminated.	EW	EW			CLAYEY SILT with fragments. 1.30 1.32 CLAYEY SILT with fragments. 1.38 1.40 CLAYEY SILT with fragments. 1.50 FRAGMENTS with minor clayey silt infill.	RQD=0%	
1.50 1.55						MW	W to MS					
1.65		R2			CORE LOSS; 0.06m							
1.71		RUN 3			META-SHALE; as above.	MW	W to MS			FRAGMENTS 1.87 CLAYEY SILT 1.92 FRAGMENTS with clayey silt infill.	0% RQD=0%	
1.97 1.98						EW mw	EW W					
2					CORE LOSS; 0.12m							
2.10		RUN 4			META-SANDSTONE; fine to medium grained; brown, dark grey, light brown + light grey.		MS to S			2.16 PARTINGS; 5° to 15°; planar to sub-planar; rough. 2.27 JOINT; 30°; sub-planar; rough. 2.31 PARTINGS; 5° + 10°; sub-planar; rough. 2.38 FRAGMENTS with minor clay silt infill.	RQD=32%	
2.41		RUN 5			META-SHALE; brown with dark grey + trace light grey; thinly laminated to very thinly bedded.	MW	MS			2.56 PARTINGS; 15° to 20°; planar; smooth. 2.63 2.68 FRAGMENTS 2.81 PARTINGS; 15° to 20°; planar; smooth to rough; minor clayey silt infill. JOINTS; 60° to 70°; planar to sub-planar; smooth; Fe-stained + some clayey silt infill	RQD=0%	
2.70		RUN 6			META-SHALE; interbedded with fine grained metasandstone; dark grey with brown + light grey; thinly laminated to laminated		W to MS					
3					CORE LOSS; 0.03m							
3.11 3.14	DIAMOND CORING	RUN 7			META-SHALE; as above; thinly laminated to very thinly bedded.	MW	MS			FRAGMENTS with some clayey silt infill. 3.66 PARTINGS; 10° to 15°; sub-planar; smooth JOINTS; 50° to 70°; sub-planar; clayey silt infill 3.77 FRAGMENTS with minor clayey silt infill. 4.00 PARTINGS; 15° to 20°; planar; smooth; Fe-st. CLAY SEAM ~15mm wide at 4.07m. 4.18 FRAGMENTS	0% RQD=0%	
3.24		RUN 8										
3.44		RUN 9										
3.54		RUN 10										
3.77		RUN 11										
3.87		RUN 12										
4												
4.27					CORE LOSS; 0.06m.							
4.33		RUN 13			META-SHALE; as above; thinly laminated to laminated.	MW	MS			4.38 FRAGMENTS PARTINGS; 10° to 20°; planar; smooth to rough; minor clayey silt coatings. JOINTS; 40° to 70°; planar to sub-planar; smooth to rough; Fe-stained.	RQD=0%	
4.79		14										
4.87					END OF HOLE AT 4.87m							
5												

Remarks: END OF HOLE AT 4.87m. Job / Report No. G037A

Logged by: P. ANDERSON Date: 21.1.2009 Site Supervisor C. KARWAS


MANILLA MPS
HEALTH ONE FACILITY
B14: 1.14m to 4.87m
B14 START 1.14m
1.55
CORE LOSS 0.06m
1.71
CORE LOSS 0.12m
2.1
2.41
2.7
3.14
3.24
3.44
3.54
3.77
3.87
CORE LOSS 0.06
4.33
4.79
END 4.87m

NSW Department of Commerce

GEOTECHNICAL & ENVIRONMENTAL

BOREHOLE B15

PROJECT: MANILLA MPS & HEALTH ONE
DATE: 07.12.08
LOCATION: COURT STREET, MANILLA
SURFACE RL:
CONTRACTOR: E.B.S.
OPERATOR: R.LOVETT
EQUIPMENT: PIONEER P80

DEPTH (m)	WATER	BIT	SAMPLE or TEST	SOIL GROUP	GRAPHIC LOG	SOIL DESCRIPTION Soil type, colour, consistency, grainsize, moisture, remarks
0	No Groundwater Encountered	NMLC		CI (v)		CLAYEY SILT with gravel; gravel is angular meta-siltstone fragments; red orange brown; firm; moist. 0.30
1				ROCK		REFER TO ENGINEERING GEOLOGY BOREHOLE LOG
2						END at 2.70
3						
4						
5						

SAMPLE OR TEST
U.....Undisturbed
D.....Disturbed
SPT....Standard Penetration Test
CPT....Cone Penetration Test

v : visual
l : laboratory

WATER
Water Table
Water Inflow

FIELD SUPERVISOR: C.KARWAJ
PROJECT COORDINATOR: M.RAHIMI
SHEET 1 OF 1 SHEETS
SCALE 1 : 25

NSW Department of Commerce

GEOTECHNICAL & ENVIRONMENTAL ENGINEERING
ENGINEERING GEOLOGY BOREHOLE LOG

BOREHOLE No. B15

Sheet 1 of 1 Sheets

PROJECT MANILLA MPS
LOCATION HEALTH ONE FACILITY
CO-ORDINATES E N
R.L. COLLAR
DATUM
BEARING
INCLINATION VERTICAL

DRILL PIONEER P60
CONTRACTOR EARTH BORING SERVICES
COMMENCED 7.12.2008
CORE BARRELL NMLC
DRILLER R.LOVETT
COMPLETED 7.12.2008

DRILLING DATA					ROCK SUBSTANCE				ROCK MASS DEFECTS				
DEPTH (R.L.) METRES	Method	Casing, Run	Water	GRAPHIC LOG	DESCRIPTION ROCK TYPE Grainsize, texture, colour, composition, structure, hardness	WEATHERING	ESTIMATED STRENGTH	DEFECT SPACING (mm) 2000 600 200 60 20	VISUAL LOG	DEFECT DESCRIPTION TYPE Inclination, planarity, roughness, coatings or infillings	R.Q.D.		TESTS
0	AUGER				NOT CORED.								
0.30					META-SILTSTONE/SANDSTONE; fine grained; dark grey, mid grey + brown; thinly laminated.	HW to MW	W			FRAGMENTS; with some clayey silt infill.			
0.45													
0.50		12	R1										
0.60					META-SANDSTONE; fine to medium grained; brown + dark grey with some light grey; laminated to very thinly bedded.		W to MS			0.60 - JOINT; 50°; planar; rough; clayey silt infill.			
										PARTINGS; 5° to 20°; sub-planar; rough. Minor silty infill/coating on some.			
1												AQD = 0%	
1.10		RUN 3	R4		becomes fine grained; dark grey + brown; thinly laminated.	MW				1.06			
1.25										FRAGMENTS; with minor clayey silt infill.			
1.35					META-SHALE; dark grey with brown + some light grey; thinly laminated.		W						
1.52		RUN 5	R4										
										1.59 PARTINGS; 20° to 30°; planar; rough.			
1.70		RUN 6	R7		CORE LOSS; 0.04m					1.70 FRAGMENTS; with minor clayey silt infill.			
1.76													
1.80					META-SHALE; as above	MW	W to MS			FRAGMENTS.			
1.93										1.97 PARTINGS; 45° + 40°; planar to sub-planar; rough			
1.97					META-SANDSTONE; medium grained.		MS						
2													
2.05		RUN 8	R7		CORE LOSS; 0.11m								
2.16													
2.31		RUN 10	R9		META-SHALE with thin META-SANDSTONE (fine grained) interbeds; brown with dark grey some minor mid grey; thinly laminated to laminated.	MW	MS			2.25 - JOINT; 50°; planar; smooth; Fe-stained.			
										2.34 FRAGMENTS.			
										2.41 PARTINGS; 5° to 30°; planar to sub-planar; smooth.			
										2.56 - JOINT; 40°; planar; rough; Fe-stained.			
										PARTINGS; 20° to 30°; planar; smooth.			
2.70					END OF HOLE AT 2.7m								
3													
4													
5													

Remarks: END OF HOLE AT 2.7m.

Job / Report No. G037A

Logged by: P.ANDERSON

Date: 20-1-2009

Site Supervisor C. KARWAS

NSW Department of Commerce

GEOTECHNICAL & ENVIRONMENTAL

BOREHOLE B16

PROJECT: MANILLA MPS & HEALTH ONE
DATE: 08.12.08
LOCATION: COURT STREET, MANILLA
SURFACE RL:
CONTRACTOR: E.B.S.
OPERATOR: R.LOVETT
EQUIPMENT: PIONEER P80

DEPTH (m)	WATER	BIT	SAMPLE or TEST	SOIL GROUP	GRAPHIC LOG	SOIL DESCRIPTION Soil type, colour, consistency, grainsize, moisture, remarks
0	No Groundwater Encountered	NMLC		CI (v)		**CLAYEY SILT with gravel; gravel is angular meta-siltstone fragments; red brown and orange brown; firm; moist.**
0.88						
1				ROCK		**REFER TO ENGINEERING GEOLOGY BOREHOLE LOG**
2						
END at 2.80						
3						
4						
5						

SAMPLE OR TEST
U.....Undisturbed
D.....Disturbed
SPT....Standard Penetration Test
CPT....Cone Penetration Test

v : visual
l : laboratory

WATER
Water Table
Water Inflow

FIELD SUPERVISOR: C.KARWAJ
PROJECT COORDINATOR: M.RAHIMI
SHEET 1 OF 1 SHEETS
SCALE 1 : 25

NSW Department of Commerce

GEOTECHNICAL & ENVIRONMENTAL ENGINEERING
ENGINEERING GEOLOGY BOREHOLE LOG

BOREHOLE No. B16
Sheet 1 of 1 Sheets

PROJECT MANILLA MPS
LOCATION HEALTH ONE FACILITY
CO-ORDINATES E N
R.L. COLLAR
DATUM
BEARING
INCLINATION VERTICAL

DRILL PIONEER P60 CONTRACTOR EARTH BORING SERVICES COMMENCED 8.12.2008
CORE BARRELL NMLC DRILLER R. LOVETT COMPLETED 8.12.2008

DRILLING DATA				ROCK SUBSTANCE				ROCK MASS DEFECTS				
DEPTH (R.L.) METRES	Method	Casing, Run	Water	GRAPHIC LOG	DESCRIPTION ROCK TYPE Grainsize, texture, colour, composition, structure, hardness	WEATHERING	ESTIMATED STRENGTH	DEFECT SPACING (mm) 2000 600 200 60 20	VISUAL LOG	DEFECT DESCRIPTION TYPE Inclination, planarity, roughness, coatings or infillings	R.Q.D.	TESTS
0	AUGER				NOT CORED.							
0.88	DIAMOND CORING	RUN 2 | R1			META-SHALE; dark grey with light grey laminations and brown staining; thinly laminated to laminated; contains some fine grained light grey and brown meta-sandstone laminations; and clayey silt infill + coatings.	MW	W to MS			0.98 FRAGMENTS; with minor clayey silt infill. 1.00 JOINTS; 70° to 75°; irregular to sub-planar; smooth; with clayey silt infill. 1.12 PARTINGS; 20° to 30°; planar to sub-planar; smooth; with clayey silt infill/coatings. 1.52 FRAGMENTS; with minor clayey silt infill.	RQD=0%	
0.98 1		RUN 3 | R4									
1.34												
1.68 1.72		RUN 5 | R4		CORE LOSS; 0.04m							
1.89 2						MW	W to MS			FRAGMENTS; with minor clayey silt infill. 1.93 2.00 JOINTS; 50° & 60°; planar to sub-planar; smooth; clayey silt infill in lower joint. 2.18 PARTINGS; 10° to 20°; planar to sub-planar; smooth; minor clayey silt infill/coatings 2.52 JOINT; 50°; sub-planar; rough; Fe-Stained.	0% | RQD=0%	
2.33 2.40		RUN 7 | 6									
2.76					END OF HOLE AT 2.76m							
3												
4												
5												

Remarks: END OF HOLE AT 2.76m. Job / Report No. G037A

Logged by: P. ANDERSON Date: 20.1.2009 Site Supervisor C. KARWAS


HANDY pail
MANILLA MPS
HEALTH ONE FACILITY
B15: 0.30m to 2.70m
AND
B16: 0.88m to 2.76m
B15 START 0.3
SPACER
CORE LOSS 0.11
END 2.7m
B16 0.88m
CORE LOSS 0.04

APPENDIX C

Results of Geotechnical Testing

AUSTRALIAN SOIL TESTING PTY LTD. A.B.N. 79 003 493 623
24 Bermill Street, Rockdale, NSW, 2216 P.O. Box 2014, Rockdale D.C. NSW 2216
Tel: 9597 5599, 9597 3286 Fax: 9597 3442 Email: austst@bigpond.com

SOIL CLASSIFICATION TEST DATA

CLIENT: **Department of Commerce**
Level 13 McKell Building 2 - 24 Rawson Place Sydney NSW 2000

PROJECT: **Manilla Hospitol (Job Reference Number: GO37A)**

LAB. NO.	SAMPLE SOURCE	SAMPLE DESCRIPTION	MOISTURE CONTENT (%) 1	DRY DENSITY (t/m^3)	LIQUID LIMIT 2	PLASTIC INDEX 3	LINEAR SHRINKAGE (%) 4
50749	B8 1.5 - 1.95m	SILTY CLAY: yellow-brown/ light red-brown, high plasticity, with fine to medium gravel (mudstone), with fine to coarse sand.	-	-	58	36	14.5
50752	6676 B11 0.65 - 1.1m	GRAVELLY SILTY CLAY: red-brown/ yellow-brown, high plasticity, fine to medium gravel, with fine to coarse sand.	-	-	66	42	12.0
50753	6676A B14	GRAVELLY SILTY CLAY: yellow-brown, medium plasticity, fine to coarse gravel, with fine to coarse sand.	-	-	43	21	18.5

NOTES TO TESTING

1	Test Method:	AS 1289 2.1.1
2	Test Method:	AS 1289 3.1.2
	Preparation:	Dry sieved
	Sample History:	Air dried
3	Test Method:	AS 1289 3.2.1, 3.3.1
	Preparation	Dry sieved
	Sample History:	Air dried
4	Test Method:	AS 1289 3.4.1
	Preparation:	Dry sieved
	Sample History:	Air dried
	Mould Size:	125mm
	Dry State:	Linear*/ Curling

Sampled by: Client
Job Number: 003-107
Date Tested: 20.01.2009

Form C01 File C\Excel Reports\C01 Classification Issue 5 February 2008 CL

Signed: ..... Name: C Lloyd
Title: LM Date: 3/2/09

AUSTRALIAN SOIL TESTING PTY LTD. A.B.N. 79 003 493 623
24 Bermill Street, Rockdale, NSW, 2216 P.O. Box 2014, Rockdale D.C. NSW 2216
Tel: 9597 5599, 9597 3286 Fax: 9597 3442 Email: austst@bigpond.com

SHRINK-SWELL INDEX TEST REPORT

CLIENT	**Department of Commerce** Level 13 McKell Building 2-24 Rawson Place, Sydney NSW 2000
PROJECT	**Manilla Hospital (Job Reference Number: GO37A)**

SAMPLE SOURCE	6672 B9 Depth 0.45m to 0.75m	
SAMPLE DESCRIPTION	SILTY CLAY: red brown, medium to high plasticity, with fine to coarse sand, trace of fine to medium gravel.	
LABORATORY NUMBER	50750	
SHRINK-SWELL INDEX (I_{ss})	**0.9**	
SAMPLE DATA		
Total Shrinkage (E_{sh})	1.7	%
Total Swell (E_{sw})	0.0	%
Shrink Specimen		
Measured Moisture Content (w_3)	20.3	%
Dry Density	1.23	t/m^3
Inert Inclusions	5	%
Crumbling	Moderate	
Cracking	Moderate	
Swell Specimen		
Initial Moisture Content (w_1)	19.2	%
After Test Moisture Content (w_2)	30.9	%
Date Tested	19.1.09	
Sampled By	Client	
Job Number	003-1007	

Tested in Accordance with AS 1289 7.1.1 - 2003 Determination of the shrinkage index of a soil - Shrink-swell Index

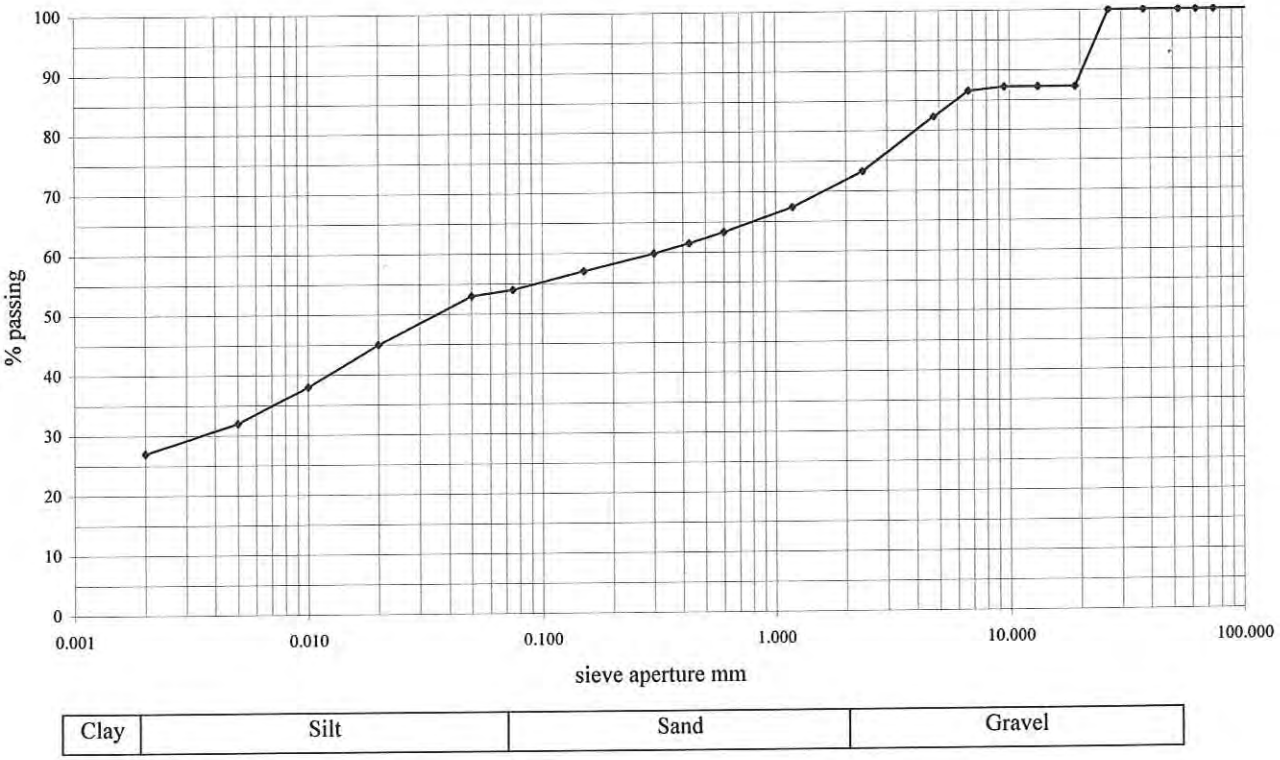
Form c02 File c02 Issue 4 July 2001

Signed: ..... Name: A Lloyd
Title: LM Date: 10/2/09

AUSTRALIAN SOIL TESTING PTY LTD. A.B.N. 79 003 493 623
24 Bermill Street, Rockdale, NSW, 2216 P.O. Box 2014, Rockdale D.C. NSW 2216
Tel: 9597 5599, 9597 3286 Fax: 9597 3442 Email: austst@bigpond.com

PARTICLE SIZE DISTRIBUTION TEST REPORT

Client:	**Department of Commerce**		
Address:	**Level 13 McKell Building 2-24 Rawson Place Sydney NSW 2000**		
Project:	**Manila Hospitol (Job Reference Number: GO37A)**		
Test Method:	**AS 1289: 3.6.1/3**		
Job Number:	**003-107**	Lab Number:	**50753**
Sample Source:	**6676A B14 0.6 - 1.1m**	Date Tested:	**16.01.2009**
Sampled by:	**Client**	Checked By:	**KT**



Sample Description: **GRAVELLY SILTY CLAY: yellow-brown, medium plasticity, fine to coarse gravel, with fine to coarse sand.**

Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
150.0		1.18	67
75.0		0.600	63
63.0		0.425	62
53.0		0.300	60
37.5		0.150	57
26.5	100	0.075	54
19.0	87	0.050	53
13.2	87	0.020	45
9.5	87	0.010	38
6.7	87	0.005	32
4.75	82	0.002	27
2.36	73		

Hydrometer Type: **ASTM 152H**
Dispersant Type: **Sodium Hexametaphosphate**
Pretreatment: **None**
Loss on Pretreatment: **None**
Remarks:

Signed: ..... Name: C Lloyd
Title: LM Date: 3/3/09

AUSTRALIAN SOIL TESTING PTY LTD. A.B.N. 79 003 493 623
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Tel: 9597 5599, 9597 3286 Fax: 9597 3442 Email: austst@bigpond.com

PARTICLE SIZE DISTRIBUTION TEST REPORT

Client: Department of Commerce

Address: Level 13 McKell Building 2-24 Rawson Place Sydney NSW 2000

Project: Manila Hospital (Job Reference Number: GO37A)

Test Method: **AS 1289: 3.6.1/3**

Job Number: **003-107**

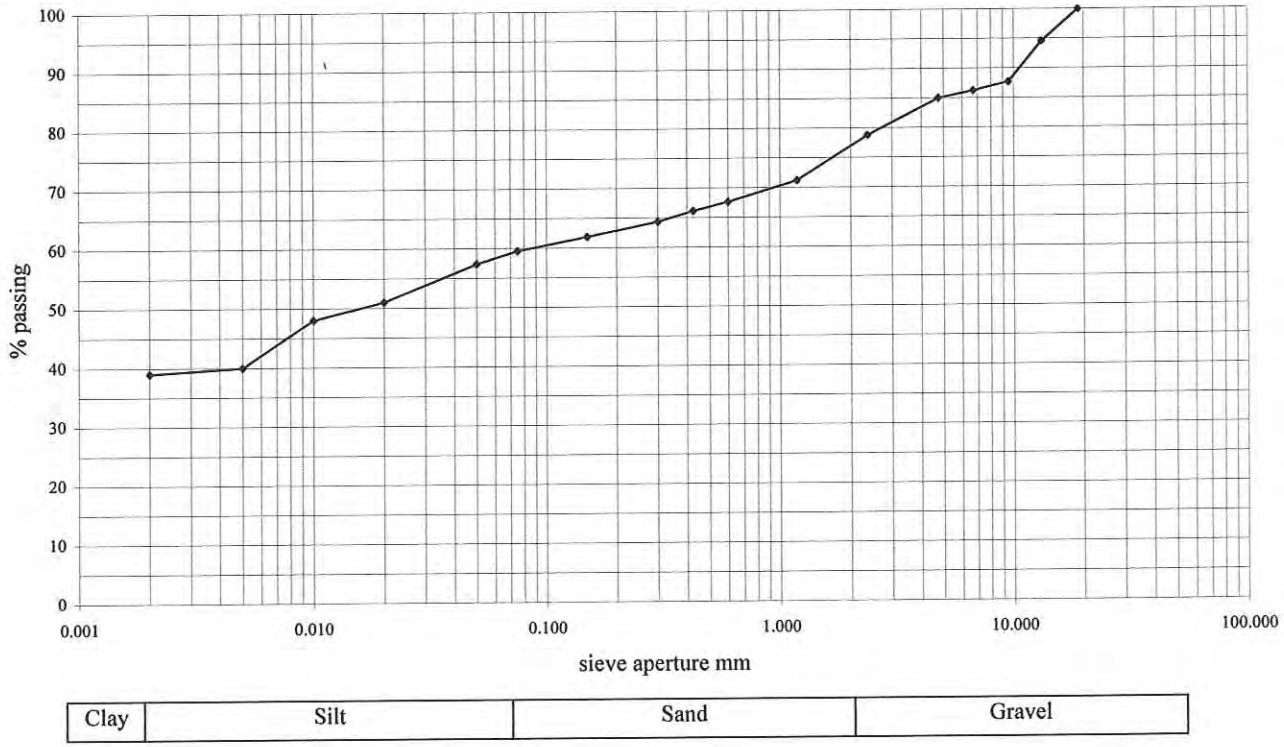
Sample Source: **6676 B11 0.65 - 1.1m**

Sampled by: **Client**

Lab Number: **50752**

Date Tested: **16.01.2009**

Checked By: **KT**



Sample Description: **GRAVELLY SILTY CLAY: red-brown/ yellow-brown, high plasticity, fine to medium gravel, with fine to coarse sand.**

Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
150.0		1.18	71
75.0		0.600	68
63.0		0.425	66
53.0		0.300	64
37.5		0.150	62
26.5		0.075	60
19.0	100	0.050	57
13.2	95	0.020	51
9.5	88	0.010	48
6.7	86	0.005	40
4.75	85	0.002	39
2.36	79		

Hydrometer Type: ASTM 152H
Dispersant Type: Sodium Hexametaphosphate
Pretreatment: None
Loss on Pretreatment: None
Remarks:

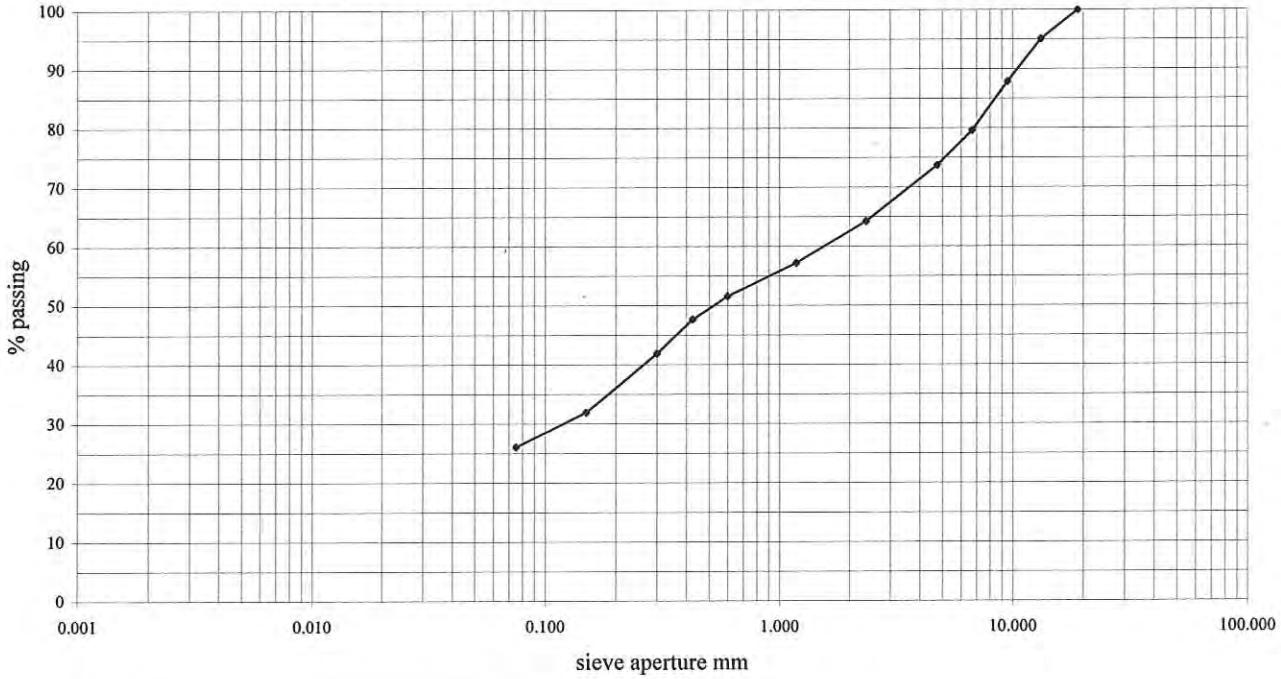
Form C06 File C:\Excel Reports\C06 Particle Size Distribution -19mm No Riffle Issue 2 June 2008 CL

Signed: .....
Title: LM
Name: C. Lloyd
Date: 10/2/09

AUSTRALIAN SOIL TESTING PTY LTD. A.B.N. 79 003 493 623
24 Bermill Street, Rockdale, NSW, 2216 P.O. Box 2014, Rockdale D.C. NSW 2216
Tel: 9597 5599, 9597 3286 Fax: 9597 3442 Email: austst@bigpond.com

PARTICLE SIZE DISTRIBUTION TEST REPORT

Client:	**Department of Commerce**		
Address:	**Level 13 McKell Building 2-24 Rawson Place Sydney NSW 2000**		
Project:	**Manila Hospital (Job Reference Number: GO37A)**		
Test Method:	**AS 1289 3.6.1**		
Job Number:	**003-107**	Lab Number:	**50748**
Sample Source:	**B1 1.5 - 1.95m**	Date Tested:	**16.01.2009**
Sampled by:	**Client**	Checked By:	**KT**



Clay	Silt	Sand	Gravel

Sample Description: **SILTY GRAVELLY SAND: dark-brown, fine to coarse sand, non-plastic, fine to medium gravel, trace of organics .**

Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
150.0		1.18	57
75.0		0.600	52
63.0		0.425	48
53.0		0.300	42
37.5		0.150	32
26.5		0.075	26
19.0	100	0.050	
13.2	95	0.020	
9.5	88	0.010	
6.7	80	0.005	
4.75	74	0.002	
2.36	64		

Hydrometer Type: **N/A**
Dispersant Type: **N/A**
Pretreatment: **None**
Loss on Pretreatment: **None**
Remarks:

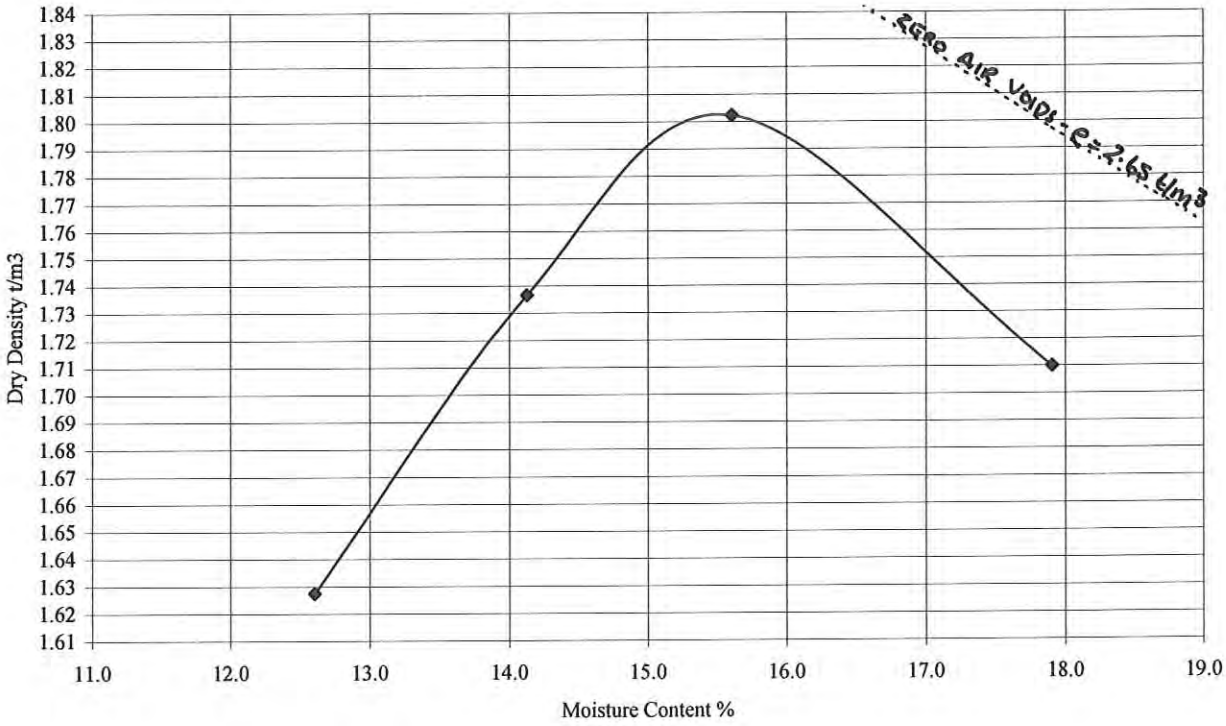
Form C06 File C:\Excel Reports\C06 Particle Size Distribution -19mm No Riffle Issue 2 June 2008 CL

Signed: ..... Name: C. Lloyd
Title: Lab ..... Date: 10/2/09

AUSTRALIAN SOIL TESTING PTY LTD. A.B.N. 79 003 493 623
24 Bermill Street, Rockdale, NSW, 2216 P.O. Box 2014, Rockdale D.C. NSW 2216
Tel: 9597 5599, 9597 3286 Fax: 9597 3442 Email: austst@bigpond.com

Client: **Department of Commerce**
Address: Level 13 McKell Building 2-24 Rawson Place, Sydney NSW 2000
Project: **Manilla Hospital (Job Reference Number: GO37A)**

DRY DENSITY / MOISTURE RELATION TEST REPORT



Laboratory Number:	50751	
Sample Source:	6675 - B10 Depth 0.3m to 0.7m	
Sample Description:	GRAVELLY SILTY CLAY: brown red, medium plasticity, fine gravel with fine to coarse sand.	
Maximum Dry Density:	**1.80**	t/m^3
Optimum Moisture Content:	**15.5**	%
Oversize Material	19.0	mm
% Oversize	5	%
Date Tested	14.1.09	
Sampled by:	Client	
Compactive Effort	Standard	
Test Method	**AS 1289 5.1.1**	
No of layers	3	
Blows per layer	25	
Mass of rammer	2.7	kg
Drop of rammer	300	mm

Comments

Form E04 File C:\E04 Maximum Dry Density Moisture Content Relation Issue 2 Jan 1997 CL

Signed: ..... Name: C. Lloyd
Title: LM Date: 10/2/09

AUSTRALIAN SOIL TESTING PTY LTD. A.B.N. 79 003 493 623
24 Bermill Street, Rockdale, NSW, 2216 P.O. Box 2014, Rockdale D.C. NSW 2216
Tel: 9597 5599, 9597 3286 Fax: 9597 3442 Email: austst@bigpond.com

CALIFORNIA BEARING RATIO TEST REPORT

CLIENT: **Department of Commerce**
Level 13 McKell Building 2-24 Rawson Place, Sydney NSW 2000

PROJECT: **Manilla Hospital (Job Reference Number: GO37A)**

Sample Source	6675 - B10 Depth 0.3m to 0.7m	
Sample Description	GRAVELLY SILTY CLAY: brown red, medium plasticity, fine gravel with fine to coarse sand.	
Laboratory Number	50751	
CBR Value @ 2.5mm	**7**	(%)
CBR Value @ 5.0mm	**6**	(%)

Sample Data

Compaction Specification	100% of MDD at OMC	
Maximum Dry Density (MDD)	1.80	(t/m^3)
Optimum Moisture Content (OMC)	15.5	(%)
Field Moisture Content (FMC)	10.3	(%)
Mass of Surcharges	4.5	(kg)
Number of Days Soaked	4	

Sample Preparation

Dry Density - Before Soaking	1.79	(t/m^3)
Dry Density - After Soaking	1.78	(t/m^3)
% Retained on 19 mm sieve:	5% excluded from test	
Moisture Content - Before Soaking	15.7	(%)
Laboratory Density Ratio	99.5	(%)
Laboratory Moisture Ratio	101.5	(%)
Moisture Content After Soaking		
Top 30mm of Test Sample	19.5	(%)
Remainder of Test Sample	17.0	(%)
Swell After Soaking	0.6	(%)
Compactive Effort:	Standard	
Number of layers	3	
Blows per layer	53	
Mass of rammer	2.7	(kg)
Drop of rammer	300	(mm)

Comments

Date Tested:	27.1.09
Sampled By:	Client

Tested in accordance with AS1289.6.1.1 Determination of the California Bearing Ratio of a soil - Standard Laboratory Method for a remoulded specimen.

Form E03 File C:\Excel Reports\E03 California Bearing Ratio Issue 13 August 2008 CWS

Signed: ..... Name: C. Lloyd
Title: LM Date: 10/2/09

APPENDIX D

Results of Chemical Testing

Corrosion & Scaling Assessment: Soil Reporting Profile

CLIENT: **NSW Department of Commerce**
Level 13, McKell Building
2-24 Rawson Place
SYDNEY NSW 2000
Attn: Mohsen Rahimi

PROJECT: Name: **Manilla Hospital**
Location:
SESL Quote N°: Client Job N°: Order N°:
Date Received: **15/01/2009**

SAMPLE: Batch N°: **8996** Sample N°: **1**
Name: **6665 / B6 / 1.45-1.8m**
Test Type: **pHEC, SO4, Cl, Text**

Certified System
Quality
ISO 9001

Sydney Environmental and Soil Laboratory

Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Tests are performed under a quality system certified as complying with ISO 9001: 2000. Results and conclusions assume that sampling is representative. This document shall not be reproduced except in full.

Sydney Environmental & Soil Laboratory Pty Ltd
ABN 70 106 810 708
16 Chilvers Road
Thornleigh NSW 2120
Australia
Address mail to:
PO Box 357
Pennant Hills NSW 1715
Tel: 02 9980 6554
Fax: 02 9484 2427
Em: info@sesl.com.au
Web: www.sesl.com.au

TEST	RESULT	COMMENTS
pH in water (1:5)	7.4	Slight Alkalinity
EC mS/cm (1:5)	.05	Low Salinity
Texture Class	Silty Loam	
Soil Permeability Class	Low	
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) mgSO_4 / kg	510	Low Sulphate
Chloride (1:5) mgCl / kg	60	Low Chloride

* Resistivity Ω.m

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/L = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows slight alkalinity, low salinity, low sulphate and low chloride levels.

According to AS2159:1995, the slight alkalinity is considered non-aggressive towards concrete and non-corrosive towards steel. The low sulphate and low chloride levels are considered non-aggressive towards concrete and non-corrosive towards steel.

If you would like to discuss further please contact me at the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:1995; **Resistivity,** AS1289.4.4.1:1997,

Consultant
Ryan Jacka

Authorised Signatory
Murray Fraser

Date of Report
02/02/2009

Corrosion & Scaling Assessment: Soil Reporting Profile

CLIENT: **NSW Department of Commerce**
Level 13, McKell Building
2-24 Rawson Place
SYDNEY NSW 2000
Attn: Mohsen Rahimi

PROJECT: Name: **Manilla Hospital**
Location:
SESL Quote N°: Client Job N°: Order N°:
Date Received: **15/01/2009**

SAMPLE: Batch N°: **8996** Sample N°: **2**
Name: **6656 / B3 / 1-1.2m**
Test Type: **pHEC, SO4, Cl, Text**

Certified System
Quality
ISO 9001

Sydney Environmental and Soil Laboratory
Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Sydney Environmental & Soil Laboratory Pty Ltd
ABN 70 106 810 708
16 Chilvers Road
Thornleigh NSW 2120
Australia
Address mail to:
PO Box 357
Pennant Hills NSW 1715
Tel: 02 9980 6554
Fax: 02 9484 2427
Em: info@sesl.com.au
Web: www.sesl.com.au

TEST	RESULT	COMMENTS
pH in water (1:5)	8.7	Strong Alkalinity
EC mS/cm (1:5)	.08	Low Salinity
Texture Class	Sandy Clay Loam	
Soil Permeability Class	Low	
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) $mgSO_4$ / kg	910	Low Sulphate
Chloride (1:5) mgCl / kg	110	Low Chloride

* Resistivity Ω.m

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/L = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows strong alkalinity, low salinity, low sulphate and low chloride levels.

According to AS2159:1995, the strong alkalinity is considered non-aggressive towards concrete and non-corrosive towards steel. The low sulphate and low chloride levels are considered non-aggressive towards concrete and non-corrosive towards steel.

If you would like to discuss further please contact me at the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:1995; **Resistivity,** AS1289.4.4.1:1997,

Consultant
Ryan Jacka

Authorised Signatory
Murray Fraser

Date of Report
02/02/2009

APPENDIX E

Test Pits Logs and Locations Extracted from Prior Investigation 2007 by Hunter Geotechnics Pty Ltd

Hunter Geotechnics Pty Limited
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Unit 5 Walter St
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Singleton NSW 2330

EXCAVATION LOG

	Project No: HGS 1031
	Hole No: TP1
	Sheet: 1 of 1
Client: NSW Department of Commerce	**Started:** 13.08.07
Project: Site Investigation for proposed New Hospital Extensions	**Finished:** 13.08.07
Location: Manilla Hospital	**Logged:** RT
Test Location: Refer to Site Plan	**Checked:** V Da Silva
Equipment type: Bob Cat Mini Excavator	**RL surface:**

method	water	Samples, tests etc	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency / relative	Comments Notes, structure and additional observations
EXCAVATOR	NO GROUNDWATER OBSERVED		0.35		CL	TOPSOIL: Gravelly Sandy Silty CLAY, low To medium plasticity, fine grained sand, fine Gravel, dark brown.	M<Wp	H	ALLUVIAL
			1.0		GC	Clayey GRAVEL :medium to coarse gravel, Orange brown,low to medium plasticity Fines.	D	D	ALLUVIAL
			2.0			Test Pit TP 1 Terminated at 2.5m			

REFER TO IMPORTANT INFORMATION SHEETS FOR DESCRIPTIONS OF SOIL AND ROCK

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Singleton NSW 2330

EXCAVATION LOG

	Project No: HGS 1031
	Hole No: TP2
	Sheet: 1 of 1
Client: NSW Department of Commerce	**Started:** 13.08.07
Project: Site Investigation for proposed new Hospital Extensions	**Finished:** 13.08.07
Location: Manilla Hospital	**Logged:** RT
Test Location: Refer to Site Plan	**Checked:** V Da Silva
Equipment type: Bob Cat Mini Excavator	**RL surface:**

method	water	Samples, tests etc	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency / relative	Comments Notes, structure and additional observations
EXCAVATOR	NO GROUNDWATER OBSERVED				CL	FILL: Gravelly CLAY, medium plasticity, Red brown, medium to coarse gravel.	M<Wp	H	Building rubble, iron pipe, fence wire, concrete
			0.35		GC	FILL: Clayey Sandy GRAVEL, medium to coarse gravel, brown –red brown, low to medium plasticity clay fines.	D	L	Appeared Loosely Compacted Building Rubble
		Sample 0.7 to 0.9m	0.8		GC/CL	Clayey GRAVEL/Gravelly CLAY : low to Medium plasticity, medium to coarse gravel, Pale Orange & yellow.	M=Wp	H/D	ALLUVIAL
		Sample 1.0 to 1.3m	1.0						
			2.0						
						Test Pit TP 2 Terminated at 3.0m			

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EXCAVATION LOG

	Project No: HGS 1031
	Hole No: TP 3
	Sheet: 1 of 1
Client: NSW Department of Commerce	**Started:** 13.08.07
Project: Site Investigation for proposed New Hospital Extensions	**Finished:** 13.08.07
Location: Manilla Hospital	**Logged:** RT
Test Location: Refer to Site Plan	**Checked:** V Da Silva
Equipment type: Bob Cat Mini Excavator	**RL surface:**

method	water	Samples, tests etc	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency / relative	Comments Notes, structure and additional observations
EXCAVATOR	NO GROUNDWATER OBSERVED	Sample 0.2 to 0.4m	0.4		CL	FILL: Gravelly Silty CLAY, low to medium plasticity, dark brown, fine to medium gravel.	M<Wp	H	TOPSOIL
		Sample 0.4 to 0.7m	0.8		CL	GRAVELLY CLAY, medium plasticity, Red brown,, medium to coarse gravel Fines.	M=Wp	H	ALLUVIAL
		Sample 0.8 to 1.5m	1.0 2.0		CL/GC	Sandy Gravelly CLAY/Clayey GRAVEL Medium plasticity, orange & pale brow Coarse sand, medium to coarse gravel.	M=Wp	H	ALLUVIAL
						Test Pit TP 3 Terminated at 2.8m			

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EXCAVATION LOG

	Project No: HGS 1031
	Hole No: TP 4
	Sheet: 1 of 1
Client: NSW Department of Commerce	**Started:** 13.08.07
Project: Site Investigation for proposed New Hospital Extensions	**Finished:** 13.08.07
Location: Manilla Hospital	**Logged:** RT
Test Location: Refer to Site Plan	**Checked:** V Da Silva
Equipment type: Bob Cat Mini Excavator	**RL surface:**

method	water	Samples, tests etc	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency / relative	Comments Notes, structure and additional observations
EXCAVATOR	NO GROUNDWATER OBSERVED				CL	FILL: Gravelly CLAY, low to medium plasticity, dark brown, and red, fine to fine to medium gravel.	M<Wp	H	TOPSOIL
			0.3		CL	FILL: Gravelly CLAY, medium plasticity, dark brown,, medium to coarse gravel Fines.	M=Wp		Containing Cobbles & bricks,appeared loosely compacted
			0.8		CL/GC	Sandy Gravelly CLAY/Clayey GRAVEL Medium plasticity, orange & pale brow Coarse sand, medium to coarse gravel.	M<Wp	H	ALLUVIAL
			1.0 1.1			SILTSTONE; pale brown & dark brown			Highly Weathered
			2.0			Test Pit TP 4 Terminated at 2.6m			

REFER TO IMPORTANT INFORMATION SHEETS FOR DESCRIPTIONS OF SOIL AND ROCK

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EXCAVATION LOG

	Project No: HGS 1031
	Hole No: TP 5
	Sheet: 1 of 1
Client: NSW Department of Commerce	**Started:** 13.08.07
Project: Site Investigation for proposed New Hospital Extensions	**Finished:** 13.08.07
Location: Manilla Hospital	**Logged:** RT
Test Location: Refer to Site Plan	**Checked:** V Da Silva
Equipment type: Bob Cat Mini Excavator	**RL surface:**
	Datum:

method	water	Samples, tests etc	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency / relative	Comments Notes, structure and additional observations
EXCAVATOR	NO GROUNDWATER OBSERVED				CL	FILL: Gravelly CLAY, medium plasticity, Red brown and dark brown, medium to coarse gravel.	M<Wp D	H L	Appeared well Compacted
		Sample 0.8 to 0.9m Sample 0.9 to 2.2m	0.7 1.0 2.0		GP	FILL: GRAVEL, Cobbles to coarse gravel, Red brown, dark brown	D		Appeared Loosely Compacted. Containing building Rubble, bricks,concrete Tin, wood, pipes Sides of test pit unstable collapsing
			2.5			SILTSTONE; pale brown & dark brown			Highly Weathered
			3.0			Test Pit TP 5 Terminated at 3.0m			

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EXCAVATION LOG

	Project No: HGS 1031
	Hole No: TP 6
	Sheet: 1 of 1
Client: NSW Department of Commerce	**Started:** 13.08.07
Project: Site Investigation for proposed New Hospital Extensions	**Finished:** 13.08.07
Location: Manilla Hospital	**Logged:** RT
Test Location: Refer to Site Plan	**Checked:** V Da Silva
Equipment type: Bob Cat Mini Excavator	**RL surface:**
	Datum:

method	water	Samples, tests etc	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency / relative	Comments Notes, structure and additional observations
EXCAVATOR	NO GROUNDWATER OBSERVED	Sample 0.2 to 0.4m Sample 0.4 to 1.5m	1.0		GM	FILL: Silty GRAVEL, (ASH) medium Gravel, grey pale grey,	D D	L	Appeared Loosely compacted . Ash from old boiler Sides of test pit unstable collapsing
			2.0						
			2.3		GP	GRAVEL:coarse to cobbles , pale brown			ALLUVIAL
			2.7			SILTSTONE; pale brown & dark brown			Highly Weathered
			3.0			Test Pit TP 6 Terminated at 3.0m			

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Singleton NSW 2330

EXCAVATION LOG

	Project No: HGS 1031
	Hole No: TP 7
	Sheet: 1 of 1
Client: NSW Department of Commerce	**Started:** 13.08.07 .
Project: Site Investigation for proposed New Hospital Extensions	**Finished:** 13.08.07
Location: Manilla Hospital	**Logged:** RT
Test Location: Refer to Site Plan	**Checked:** V Da Silva
Equipment type: Bob Cat Mini Excavator	**RL surface:**

method	water	Samples, tests etc	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency / relative	Comments Notes, structure and additional observations
EXCAVATOR	NO GROUNDWATER OBSERVED				GP	FILL: GRAVEL, Siltstone, orange brown, With bitumen fragments.	D	L	Appeared Loosely compacted Sides of test pit unstable collapsing
			0.8			SILTSTONE; pale brown .			Highly Weathered
			1.0						
			2.0						
			2.3		GP	SILTSTONE; pale brown & dark brown			Highly Weathered
						Test Pit TP 7 Terminated at 2.8m			

REFER TO IMPORTANT INFORMATION SHEETS FOR DESCRIPTIONS OF SOIL AND ROCK

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EXCAVATION LOG

	Project No: HGS 1031
	Hole No: TP 8
	Sheet: 1 of 1
Client: NSW Department of Commerce	**Started:** 13.08.07
Project: Site Investigation for proposed New Hospital Extensions	**Finished:** 13.08.07
Location: Manilla Hospital	**Logged:** RT
Test Location: Refer to Site Plan	**Checked:** V Da Silva
Equipment type: Bob Cat Mini Excavator	**RL surface:**

method	water	Samples, tests etc	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency / relative	Comments Notes, structure and additional observations
EXCAVATOR	NO GROUNDWATER OBSERVED				GP	FILL: Clayey GRAVEL, medium to coarse Gravel, pale brown, low to medium , Plasticity fines	D		ALLUVIAL
			0.8			SILTSTONE; pale brown .			Highly Weathered
						Test Pit TP 8 Terminated at 1.5m			

REFER TO IMPORTANT INFORMATION SHEETS FOR DESCRIPTIONS OF SOIL AND ROCK

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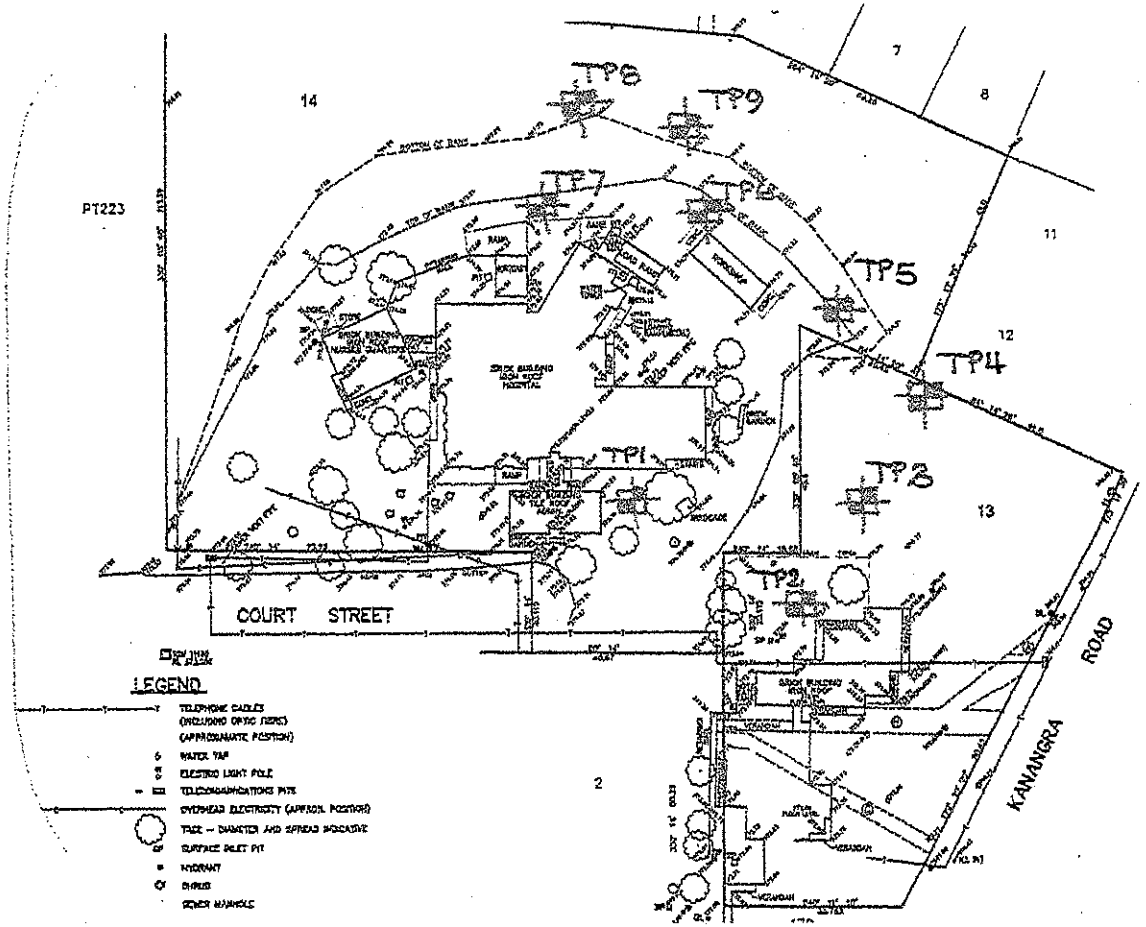
EXCAVATION LOG

	Project No: HGS 1031
	Hole No: TP 9
	Sheet: 1 of 1
Client: NSW Department of Commerce	**Started:** 13.08.07
Project: Site Investigation for proposed New Hospital Extensions	**Finished:** 13.08.07
Location: Manilla Hospital	**Logged:** RT
Test Location: Refer to Site Plan	**Checked:** V Da Silva
Equipment type: Bob Cat Mini Excavator	**RL surface:**

method	water	Samples, tests etc	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency / relative	Comments Notes, structure and additional observations
EXCAVATOR	NO GROUNDWATER OBSERVED		0.5		GP	FILL: Clayey GRAVEL, medium to coarse Gravel, pale brown, low to medium , Plasticity fines	D		ALLUVIAL
			1.0			SILTSTONE; pale brown & grey.			Highly Weathered
						Test Pit TP 9 Terminated at 1.5m			

REFER TO IMPORTANT INFORMATION SHEETS FOR DESCRIPTIONS OF SOIL AND ROCK



Test Pit Location

Hunter Geotechnics Pty Ltd **ABN: 80 088 399 124** Unit 5 Walter Street Singleton NSW 2330 Ph: 02 6572123 Fax: 02 65721572	**Drawn By:** RT **Job No:** HGS 1031 **Scale** NTS **Date:** September 2007	**Drawing No:** HGS 1031-1 NSW DEPT OF COMMERCE PROPOSED EXTENSIONS TO MANILLA HOSPITAL SITE PLAN