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GEOTECHNICAL INVESTIGATION AND SOIL STUDY

Sheep Hill Marine Port Facility Baseline Study

Submitted to:
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REPORT



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Executive Summary

Golder Associates Pty Ltd (Golder Associates) was engaged by Centrex Metals Ltd (Centrex) to undertake a preliminary geotechnical investigation and soil study at the site of a proposed deep water marine port. The site is located on the Eyre Peninsula at Sheep Hill, approximately 20 km north east of Tumbly Bay.

Based on our investigations, the port site may be separated into three zones, each with distinct geotechnical characteristics. The zones are shown in the figure below.



We understand that the presently proposed port site development includes three storage sheds, a filter plant and a jetty with ship loading facilities. It will also include access roads, hardstand areas and ancillary structures. Based on the conceptual layout of the port site, the majority of development will be in geotechnical Zone C. We understand that Centrex is considering building the storage sheds in excavations up to about 6 m deep to reduce their visual impact.

The proposed transport access corridor will support a slurry pipeline and road and rail services to the port.

Geotechnical

The aims of the geotechnical investigation were to assess the subsurface conditions at the proposed port site and potential road and rail transport access corridor and to provide comments relating to the design and construction of the facility, and the geotechnical risks associated with the project.

On the basis of the investigations we expect that shallow footings (pad, raft, strip) will be suitable for use on this site.

In Zone A we expect conditions to be fairly uniform. Recommendations for footing design are presented in Sections 5.2.1 and 5.3.1 of the report.



The present development plan does not indicate structures in geotechnical Zone B. We expect that conditions there will be so variable that providing design recommendations at this preliminary stage would not be reasonable and could potentially be misleading. If structures are proposed for this area we recommend further and more detailed investigations at the specific sites of the proposed development.

The significant variation in the depth of soil within Zone C means that ground movements under structures will also vary significantly. While it is possible to provide reliable footing design recommendations on the basis of the present investigation (refer to Sections 5.2.2 and 5.3.3 of the report), further and more detailed investigations will be required to allow final design. We expect that these will include geophysical surveys to map the boundary between soil and rock.

These geophysical surveys will also be useful in assessing the extent to which rock excavation will be required. The present investigations suggest this will be necessary but are not sufficient to allow reliable estimate of the extent or cost. They may also inform the necessary assessment of excavation stability.

Pavement design recommendations are presented in Section 5.4 of the report. Further investigations are likely to be necessary in the transport access corridor.

Soil Study

The aims of the soil study were to assess the erosion hazard potential of the soils types identified at the site, characterise the soil landscapes and profiles, assess for the presence of highly sodic or saline soils, and potential constraints the soil types may pose to development and revegetation.

Laboratory testing of samples recovered from the test pits indicated:

- The majority of the soil profiles present at the port site and within the transport access corridor are *Sodosols*, sodic soils with clearly defined, alkaline sub-soil ('B' Horizons).
- Saline soils are present within zone B of the site.
- The soils contain little organic matter.

The soil chemistry of the samples analysed indicate low quality soils that are not suited to conventional agriculture, and would prove difficult to sustain continuous grass cover without improvement such as addition of low levels of nutrients and vegetation mulch. Whilst it is more likely that indigenous coastal species will be utilised, soil quality and chemistry should be considered when assessing revegetation options for the site.

Despite the high incidence of sodic soils, generally, signs of soil erosion within the proposed transport access corridor and at the Port site were fairly minimal. However, conventional erosion and sediment control (ESC) management measures are recommended and are presented in Section 6.3 of the report.



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1.0 INTRODUCTION

1.1 General

Golder Associates Pty Ltd (Golder Associates) was engaged by Centrex Metals Ltd (Centrex) to undertake a preliminary geotechnical investigation and soil study at the site of a proposed deep water marine port. The site is located on the Eyre Peninsula at Sheep Hill, approximately 20 km north east of Tumby Bay. Its location is shown on Figure 1.

The investigation program was completed in general accordance with the Golder proposal, "*Sheep Hill Marine Port Facility – Development Approval and Baseline Study Proposal*", dated 11 August 2008 (Reference P87663074).

The aims of the geotechnical investigation were to assess the subsurface conditions at the proposed port site and potential road and rail transport access corridor and to provide comments relating to the design and construction of the facility, and the geotechnical risks associated with the project.

The aims of the soil study were to assess the erosion hazard potential of the soils types identified at the site, characterise the soil landscapes and profiles, identifying any highly sodic or saline soils and potential constraints on development and revegetation.

This report includes details of the geotechnical investigation and the soil study, the results of these investigations and discussions and recommendations based on the investigation results.

In addition, analysis was undertaken on a limited number of soil samples for a general suite of potential contaminants to establish a 'baseline' of potential contaminants at the site. The findings of that investigation are reported separately (Golder report '*Environmental Site Assessment, Sheep Hill Marine Port Facility Baseline Study*', reference 087661006 030 R Rev0).

1.2 Background

Centrex is an iron ore explorer on Eyre Peninsula with a number of exploration interests. The Wilgerup Mine is currently in start up phase.

Centrex requires a deep water marine port to facilitate transport of mined product to overseas markets. Current marine shipping facilities within the Eyre Peninsula may not be suitable. Centrex has purchased 2 blocks of land at Sheep Hill with a view to developing a deep water marine port. Centrex has not provided a detailed project description or design to Golder, at the time of report preparation.

The Sheep Hill proposed port site includes approximately 105 ha of coastal land and a potential road and rail transport access corridor approximately 8km long x 0.3 km wide generally following the alignment of the existing Swaffers Road.



2.0 SITE DESCRIPTION

2.1 Geology

The Lincoln mapsheet¹ indicates that the proposed port site and transport corridor is underlain by Archean age “*Undifferentiated metasediments, coarse grained augen gneisses, granitoid gneisses, amphibolites, mica schists, sericite schists. Doleritic dykes abundant along eastern coast.*” This description of the site geology is consistent with the Tumby² and Neill³ mapsheets.

Based on discussions with Wolfgang Preiss (PIRSA), we understand that the site is located in the Kalinjala Shear Zone. This is a large-scale crustal structure on the Eyre Peninsula which separates the Donington Suite granites to the east from metasedimentary schist, quartzite, dolomite marble and banded iron formations of the Hutchison Group to the west.

The rocks beneath the site and exposed at the nearby beach are granite, granitic gneiss (deformed and metamorphosed granite), and schist (extremely deformed sheared granite). The granites and gneiss are likely to belong to the Donington Suite. These were intruded in a long belt along the east coast of the Eyre Peninsula, under the southern Spencer Gulf and outcrop also at the foot of the Yorke Peninsula. The schists may represent a subsidiary shear zone, possibly splintering off the main shear zone.

2.2 Topography

The site is flanked to the north, west and south by rounded hills approximately 50 m in elevation. The coastline to the north of the port site consists of a small bay with a sandy beach. The aerial photograph of the site (Figure 2A) shows an intertidal zone to the west of the small bay in the northern part of the site.

The western portion of the site slopes down gently towards an unsealed access track extending approximately north-south along the eastern allotment boundary. The headland on which the proposed port will be constructed rises from the track to approximately 25 m elevation. The headland is characterised by rocky outcrops. To the east it slopes steeply to a rocky shoreline.

The aerial photograph also shows a surface water drainage path extending from the south west of the site and curving towards the centre of the site where it becomes less well defined.

In the proposed Transport Access Corridor, Swaffers Road rises from its eastern end along a valley until it reaches a high point at the Coast Road intersection. Between Coast Road and the Lincoln Highway, Swaffers Road gradually falls through a series of hills and valleys. A surface water drainage path was present along one section of Swaffers Road near the eastern end of the road.

Two areas along Swaffers Road were identified as natural water collection areas (although these were dry at the time of the investigation) by the greener vegetation and surface salinity. One of these was located 1 km west of Coast Road and the other was located at the Swaffers Road – Lincoln Highway intersection, to the north of Swaffers Road.

¹ Johns et al, Scale 1:250,000, Geological Survey of South Australia (1958)

² Johns R. K., Scale 1:63,360, Geological Survey of South Australia (1958)

³ John & Thatcher, Scale 1:63,360, Geological Survey of South Australia (1958)



2.3 Regional Soils

The Soil Map of South Australia⁴ suggests that the dominant soil type in the area of the site (and most of the east coast of the Eyre Peninsula) is 'Calcareous Sands: Coorong coastal dune formations'.

The soil profiles local to the Sheep Hill area classified in accordance with 'The Australian Soil Classification'⁵ system as predominantly:

- Sodosols – soils with strong texture contrast between the 'A' Horizon and sodic 'B' Horizon; and
- Tenosols – Soils with generally weak pedologic organisation, except in the 'A' Horizon.

The CSIRO Australian Soil Resource Information System⁶ (ASRIS) contains data on the probability of acid sulfate soils across Australia. The ASRIS data shows that for some land on the western side of the site, there is 'Extremely Low Probability' of the presence of acid sulphate soils. The remainder of the site is unmapped for acid sulphate soils. Around 500 m to the south of the site there are two areas with 'Extremely High Probability' of the presence of acid sulphate soils.

3.0 METHODS OF INVESTIGATION

Fieldwork for both the geotechnical investigation and the soil study was conducted between 21 October 2008 and 7 November 2008 and included:

- excavating 32 test pits (TP01 to TP32) using a JCB backhoe to depths between 0.6 m (practical refusal) and 2.4 m below the existing ground level. Test pits TP01 to TP24 were excavated at the port site. Test pits TP25 to TP32 were excavated at approximately 1 km intervals along the proposed transport access corridor;
- drilling 8 boreholes (BH01 to BH08) using a Sonic drill rig to depths between 10.3 m and 21.5 m below the existing ground level;
- performing Standard Penetration Tests (SPT) at selected depth intervals within the boreholes;
- logging of the materials encountered in the test pits and boreholes;
- collecting samples of materials from the test pits for laboratory analysis (geotechnical and chemical testing);
- collecting six surface samples along Swaffers Road, within the proposed transport access corridor, for chemical analysis; and
- performing Dynamic Cone Penetrometer (DCP) tests at selected test pit locations to depths between 0.4 m (practical refusal) and 2.1 m below the existing ground level.

The field work was performed in the presence of a geotechnical engineer or scientist from Golder who logged the materials, recovered samples and performed field tests.

The boreholes were completed with standpipes to allow groundwater level measurements. Further information relating to groundwater can be found in our report 'Environmental Site Assessment, Sheep Hill Marine Port Facility Baseline Study', reference 087661006 030 R Rev0 (the 'ESA').

⁴ Northcote, K.H., Scale 1:2,000,000, CSIRO Division of Soils (1968)

⁵ "Australian Soils and Landscapes" – CSIRO Press (2004)

⁶ www.asris.csiro.au



4.0 RESULTS OF THE INVESTIGATION

4.1 Subsurface Conditions – Port site

Reports of Boreholes BH01 to BH08, Test Pits TP01 to TP32 and DCP Tests are provided in Appendix A.

Based on our investigations, the port site may be separated into three zones, each with distinct geotechnical characteristics. The zones are shown in the figure below.



The boundaries between the zones cannot be interpreted accurately on the basis of the relatively few widely spaced test pits and boreholes placed during the present investigation and hence the interzone boundaries shown on the figure 2A must be regarded as approximate only.

Descriptions of the subsurface conditions for the site zones are presented below.

4.1.1 Zone A

Zone A included Test Pits TP01 to TP04, TP06 to TP09 and Boreholes BH07 and BH08. These were located within the same cadastral boundary - the paddocks on the western half of the site, although Test Pit TP06 was to the east of that boundary. The aerial photo suggests that TP06 is in a surface water drainage path.

The soil profile in Zone A generally included topsoil - dark brown clayey sand or silty sand - to depths between 0.05m and 0.15m. Underlying the topsoil was dark red/brown medium to high plasticity sandy clay, present to depths between 0.1m and 0.3m. Below this we encountered brown/orange brown clayey sand or gravelly clayey sand to the base of the test pits between 1.9 m and 2.3 m below ground level. TP07 and TP08 encountered layers of calcrete gravel, cobbles or boulders in a matrix of clayey sand or sandy clay.



BH07 contained pale brown clayey sand, sand and sandy clay layers to 8 m depth. BH08 generally contained red brown high plasticity sandy clay or clay to 8 m depth. Below 8m depth in both boreholes we encountered yellow low plasticity silty sandy clay. This persisted to 11 m (termination) in BH07 and 9.5 m in BH08. Granite was present in BH08 from 9.5 m to the end of the borehole at 11 m.

Groundwater was not encountered in the test pits in Zone A. Groundwater levels in Boreholes BH07 and BH08 were around 6.6 m and 9.2 m below ground level (approximately 1.1 m AHD and 1.3 m AHD respectively).

The DCP tests gave blow counts ranging from 1 per 100 mm of penetration to practical refusal (>40 blows).

Measured SPT "N" and Pocket Penetrometer values in soil strength materials indicate that the natural soils were dense (sands) or of very stiff to hard consistency (clays).

4.1.2 Zone B

This is the low-lying intertidal zone in the north-east area of the site. Test pits TP05 and TP19 were located in Zone B.

The upper layers of TP05 and TP19 were dissimilar. TP05 encountered orange brown then dark brown low plasticity sandy clay to 0.6 m depth, underlain by pale grey/brown silty sand to 0.9 m depth. TP19 encountered orange brown sand to 0.7 m depth, underlain by orange brown sandy clay/clayey sand (high plasticity clay and fine to medium grained sand) to 1.5 m depth.

Beneath that the underlying materials were similar in both pits - high plasticity clay to between 1.6 m and 2.0 m depth underlain by grey clayey sand or silty sand to the base of the pits at 2.0 m and 2.4 m depth. In TP05 the high plasticity clay was striped grey, brown and white in layers, and the underlying sand layer collapsed during excavation. Excavation resistance in TP05 and TP19 was low to medium for their full depth.

Groundwater seepage was observed in both test pits. The observed groundwater level in TP05 was 1.65 m below ground level 1 hour after excavation was complete and 2.0 m below ground level in TP19 20 minutes after excavation was complete.

The DCP tests gave blow counts of 1 to 7 blows per 100 mm of penetration.

4.1.3 Zone C

Zone C comprises the headlands on the eastern half of the site. Test Pits TP10 to TP18, TP20 to TP24 and Boreholes BH01 to BH06 are located in this Zone.

The test pits encountered one to three near-surface layers of dark brown low plasticity clayey sand up to 0.5 m depth. Underlying this we generally observed pale orange brown silty sand or clayey sand, often including layers of grey/brown extremely weathered rock. Gravel, cobbles and boulders of calcrete, gneiss, schist, quartz or other weathered rocks were present at various depths throughout the pits, and as outcropping and scattered rocks on the ground surface. Weathered rock intrusions into upper test pit layers were occasionally present. Most of the test pits in Zone C contained calcareous soils or inclusions.

Ten of the fourteen test pits in Zone C met practical refusal at depths between 0.6 m and 1.8 m. Test Pits TP11, TP13, TP14 and TP20 did not meet refusal and were terminated at depths between 1.9 m and 2.35 m in inferred weathered rock or brown gravelly sand (TP13).

The boreholes in Zone C encountered topsoil generally underlain by soil strength materials (extremely weathered rock) to depths between 1.0 m and 11.5 m. The extremely weathered rock was generally clayey



sand, silty sand or gravelly sand and often contained cobbles. The boreholes indicate significant variability in the depth of weathering. We do not consider that there are sufficient boreholes across the site to allow reliable assessment of the contact between soil and rock across the site.

The soil was underlain by distinctly weathered to slightly weathered granite or schist to the base of the boreholes at between 10.3 m and 21.5 m below ground level. The granite in the boreholes was generally high to very high strength while the schist ranged from medium to very high strength.

Based on the core recovered from the boreholes and limited geological mapping of rock outcrops at the site we make the following comments regarding the rock:

- The average defect spacing in the recovered core generally ranged between about 100 mm and 300 mm. There were a number of highly fractured zones.
- The main defect sets included sub-vertical foliation generally dipping in either east-southeast or west-northwest directions (dependent on dip angle) and sub-vertical cleavage. Occasional joint sets (approximately 45° to 65° dip) were observed in the recovered core. However, we were unable to assess their dip direction from the vertical boreholes drilled.

Groundwater was not encountered in the test pits in Zone C. Groundwater level measurements in boreholes BH01 to BH06 as part of the ESA were between approximately 0.9 m AHD (GW03) and 2.3 m AHD m (GW04 and GW06).

The DCP tests at the test pit locations gave blow counts ranging from 3 per 100 mm of penetration to practical refusal (>40 blows). Measured SPT "N" and Pocket Penetrometer values in soil strength materials indicate that these were dense (sands) or of very stiff to hard consistency (clays).

4.2 Subsurface Conditions – Transport Access Corridor

Test Pits TP01, TP03 and TP04 and Borehole BH07 were located at the eastern end of the transport access corridor. These test pits generally encountered clayey sand/sandy clay topsoil to between 0.15 and 0.3 m depth, underlain by orange/brown to brown clayey sand to the full extent of the pits - 1.9 to 2.3 m depth. BH07 contained pale brown clayey sand, sand and sandy clay to 8 m depth, underlain by yellow silty sandy clay of low plasticity to the base of the borehole at 11 m.

Test Pits TP25 to TP32 were located along the Transport Access Corridor (refer to Figure 2B), in numerical order from east to west:

- TP25 was located in a valley close to the base of a hill and encountered refusal on inferred calcrete at 0.9 m depth. We observed brown/dark brown clayey sand to 0.3 m depth, underlain by calcrete gravel and cobbles in a matrix of brown clayey sand.
- TP26 and TP27 were located in a valley. These pits contained brown or dark brown and fine to coarse grained clayey sand to 2 m depth. There were calcareous inclusions and pale brown or pale orange/white mottling from around 0.5 m to 1.5 m depth.
- TP28 was placed on a saddle, with the ground rising towards the north along Coast Road, and dropping in other directions. This pit encountered dark brown clayey sand to 0.4 m depth, underlain by pale brown gravelly clayey sand to 0.9 m depth. Beneath that there was red/white/yellow mottled silty sand to the base of the pit at 2.0 m.



- Test Pits TP29 to TP32 were located to the west of Coast Road in a series of hills and valleys. Pits TP29, TP31 and TP32 encountered practical refusal at between 1.1m and 1.6m. We observed topsoil up to 0.5 m depth in these pits. This was underlain by a mixture of gravel, cobbles and boulders (inferred to be calccrete, gneiss and sandstone) in a matrix of soil (clayey sandy gravel, clayey sand, gravelly clayey sand or sandy clay) in which we met refusal at various depths. TP30 encountered dark brown clayey sand to 0.4 m depth, underlain by low plasticity sandy clay to 2 m depth.

Groundwater was not encountered in the test pits at the time of the investigation.

The DCP tests at the test pit locations gave blow counts ranging from 3 per 100 mm of penetration to practical refusal (>40 blows). Measured Pocket Penetrometer values indicate that the soils encountered were of very stiff to hard consistency.

4.3 Laboratory Testing

A summary of the test results is presented in Appendix B. Table 1 in the Appendix presents geotechnical soil testing results, Table 2 presents rock testing results and Table 3 presents soil chemical testing results.

Laboratory certificates are available on file, if required. References to the testing procedures adopted are shown on the test certificates.

Geotechnical Investigation

Twenty-eight (28) samples from Test Pits TP01 to TP32 were tested in accordance with AS1289 to measure the following:

- Particle Size Distribution (PSD), 28 samples;
- Consistency Limits, 28 samples;
- Standard Compaction using potable water, 13 samples; and
- Soaked Californian Bearing Ratio (CBR), 13 samples, remoulded to a target dry density ratio of 98% relative to Standard compaction and a 9 kg surcharge applied. Potable water was used to soak the samples, to as far as reasonably practical match the field condition of soaking with stormwater.

The testing was performed in Golder Associates' Adelaide laboratory which is NATA accredited for the tests.

Five samples of the recovered rock core were submitted to Rocktest Consulting for Point Load Strength Index testing. A summary of the results is presented in Table 2.

Soil Study

The aim of the chemical testing program was to characterise the shallow soil profile(s) and assess current sodicity and salinity as part of a limited 'baseline' study of the soil chemistry in the project area.

One hundred and eight (108) samples from Test Pits TP01 to TP32 and Surface Samples G01 to G06 were screened for pH and EC. The pH value and EC are indicators of soil acidity/alkalinity and soil salinity, respectively.

A number of representative soil types from both the Port Site and proposed Transport Corridor were then selected for the following laboratory analyses. Testing for Emerson Class Number was performed in Golder Associates' Adelaide laboratory, and chemical testing was performed at ALS's Sydney Environmental laboratory. Both are NATA accredited for the testing carried out.



■ **Emerson Class Number** - 18 samples

The Emerson Class test assists in the identification of dispersive soils. Soils are graded according to class, Class 1 being highly dispersive, Class 8 non dispersive. Class 1 through 4 are susceptible to erosion, particularly where concentrated surface water flows exist. Class 4 indicates the presence of calcite or gypsum, which can mask the overall long term dispersion potential of the soil, as the calcite/gypsum temporarily buffers the high sodium content in the soil matrix, preventing dispersion from occurring. This effect can 'wear off' once the calcite/gypsum is eventually dissolved and/or absorbed into the soil matrix.

■ **Total Organic Carbon (TOC)** - 20 samples

Available organic matter (OM) is expressed in terms of TOC. A TOC of 3% or higher is considered desirable in good agricultural soils. At least some (measurable) OM is required to sustain healthy surface vegetative cover.

■ **Chloride** - 13 samples

■ **Cation Exchange Capacity (CEC)** - 13 samples

The CEC is a calculated value that is an estimate of the soils ability to attract, retain, and exchange cation elements. In order for a plant to absorb nutrients, the nutrients must be dissolved. When nutrients are dissolved (as when in soil), they are in ionic form, and possess either a positive or negative electrical charge which obey the fundamental rules of attraction and repulsion. Consequently, soil nutrients in the ionic form can be attracted to opposite-charged particle. Soil is made up of many components, and typically significant percentage of most soils is clay. Organic matter, while a small percentage of most soil is also important. Both of these soil fractions have a large number of negative charges on their surface and they attract cationic elements and contribute to a higher CEC. At the same time, they also repel anionic nutrients.

Higher CEC values indicate that a soil has a greater capacity to hold cations. Therefore, it requires higher rates of fertilizer or lime application to exert a change in the availability of nutrients in a soil of high CEC. A high CEC soil requires a higher soil cation level to provide adequate crop nutrition.

■ **Exchangeable Sodium Percentage (ESP)** - 13 samples

The ESP is an expression of available sodium as a percentage of available cations generally. An ESP of greater than 6 is considered indicative of sodic soils, and greater than 15, highly sodic soils, which are generally considered poor for agricultural purposes, prone to erosion and can have an influential (adverse) effect upon groundwater quality (salinity).

Results of soils screening tests and sodicity analyses are presented on four cross-sections across the transport corridor and two sections through the Port site on Figures 3A to 3D.



5.0 DISCUSSION

5.1 General

We understand that the presently proposed port site development includes three storage sheds, a filter plant and a jetty with ship loading facilities. It will also include access roads, hardstand areas and ancillary structures. Based on the conceptual layout of the port site, the majority of development will be in geotechnical Zone C. We understand that Centrex is considering building the storage sheds in excavations up to about 6 m deep to reduce their visual impact.

The proposed transport access corridor will support a slurry pipeline and road and rail services to the port.

5.2 Soil Movements

We expect variable soil profile response to changes in the soil moisture condition. In Zone A the soil profile will be reactive to changes in moisture regime, swelling in wetter and shrinking during drier times. In Zone B, the effects of the nearby sea is likely to mean that reactive soil movements are negligible. In Zone C, the moisture-related soil movements are expected to be small.

Australian Standard AS2870-1996 'Residential Slabs and Footings – Construction' recommends assuming a depth of suction change (H_s) for the Adelaide region of 4 m, but it does not provide guidance on moisture changes for the Sheep Hill area. In the absence of other information and having regard to the climate which is similar to the Adelaide region we have assumed a depth of suction change of 4 m for the port site.

5.2.1 Zone A

We calculated characteristic surface movements (y_s) between 10 mm (TP06) and 50 mm (BH08) for Zone A. Based on a statistical analysis of the calculated surface movements for the boreholes and test pits in Zone A we judge that the y_s of 50 mm calculated for BH08 is likely to be the largest movement that could reasonably be expected at the site. The mean calculated y_s for Zone A was around 20 mm.

We have undertaken additional calculations which attempt to assess the likely effects of tree plantings in accordance with methods described in the "Special Provisions for the Design of Residential Slabs and Footings for South Australia" issued by the Footings Group of the South Australian Division of the Institute of Engineers, Australia. These suggest that the increase in surface soil movements would be up to about 5 mm in the vicinity of a single tree and 15 mm in the vicinity of a group of trees.

For structures located within Zone A we recommend assuming a characteristic soil movement of 25 mm for preliminary design. Further and more detailed investigations will be required during final design to confirm the soil movement at each structural site.

5.2.2 Zone C

We calculate characteristic surface movements (y_s) between 5 mm (TP22) and 10 mm for Zone C with the exception of Test Pit TP13 where the calculated movement is 30 mm.

We have undertaken additional calculations which attempt to assess the likely effects of tree plantings in accordance with methods described in the "Special Provisions for the Design of Residential Slabs and Footings for South Australia" issued by the Footings Group of the South Australian Division of the Institute of Engineers, Australia. These suggest that the increase in surface soil movements would be less than 5 mm in the vicinity of a single tree and 5 mm in the vicinity of a group of trees.



For structures located within Zone C we recommend assuming a characteristic soil movement of 15 mm for preliminary design. Where structures are founded completely on weathered rock we recommend assuming zero soil movement from moisture effects. Further and more detailed investigations will be required during final design to confirm the soil movement at each structural site.

5.3 Footing Design

On the basis of the investigations we expect that shallow footings (pad, raft, strip) will be suitable for use on this site.

5.3.1 Zone A

In Zone A we expect shallow footings will generally be founded in clayey sand. The load-bearing capacity of shallow footings on sand is affected by their size, shape and embedment. The allowable stress is generally controlled by serviceability (settlement) considerations.

The ultimate (rupture) bearing pressure (in kPa) for a square footing under vertical loading in this part of the corridor may be calculated for preliminary design as

$$q_u = 523 * D + 121 * B$$

where B and D are the breadth and embedment depth of the footing respectively (in metres).

The ultimate (rupture) bearing pressure (in kPa) for a strip footing under vertical loading may be calculated as

$$q_u = 312 * D + 190 * B$$

We assume that the design of the structures will be limit-state based. There is no Australian Standard that mandates a geotechnical strength reduction factor for limit-state design of shallow (i.e. not piled) footings. AS2159 -1995 'Piling – Design and Installation' documents a limit state approach to the design of pile footings. It recommends that the ultimate geotechnical strength of a pile be multiplied by a geotechnical strength reduction factor (ϕ_g) to calculate the design geotechnical strength of the footing. If pile footings were proposed for the structures at the site, we would recommend a ϕ_g value of 0.4 based on the investigation undertaken. On that basis we suggest adopting a maximum geotechnical strength reduction factor of 0.4 for the design of the recommended shallow footings.

We have calculated the elastic settlement of a square pad founded close to the surface, varying the assumed soil deformation parameters within ranges chosen on the basis of previous experience and published data. The elastic settlement of a square footing (in mm) on this site may be estimated as being

$$0.03 * p * B < S < 0.09 * p * B$$

where p is the working bearing stress in kPa and B is the footing breadth in metres.

The elastic settlement of a strip footing (in mm) on this site may be estimated as being

$$0.08 * p * B < S < 0.16 * p * B$$

We can provide advice on other shapes of footings should their use be contemplated.

5.3.2 Zone B

The present development plan does not indicate structures in geotechnical Zone B. We expect that conditions there will be so variable that providing design recommendations at this preliminary stage would



not be reasonable and could potentially be misleading. If structures are proposed for this area we recommend further and more detailed investigations at the specific sites of the proposed development.

5.3.3 Zone C

We expect that the founding conditions for buildings in Zone C will be variable, because the depth of soil is variable (the range was 0.6 m to 11 m in the test pits and boreholes). In addition, the investigation indicates variable weathering of the underlying rock.

For preliminary design, we recommend assuming that the footings will be founded in extremely weathered rock, and that the weathered rock will have an ultimate (rupture) bearing pressure of 1,000 kPa.

We assume that the design will be limit-state based. There is no Australian Standard that mandates a geotechnical strength reduction factor for limit-state design of shallow (i.e. not piled) footings. AS2159 -1995 'Piling – Design and Installation' documents a limit state approach to the design of pile footings. It recommends that the ultimate geotechnical strength of a pile be multiplied by a geotechnical strength reduction factor (ϕ_g) to calculate the design geotechnical strength of the footing. If pile footings were proposed, we would recommend a ϕ_g value of 0.4 based on the investigation undertaken. On that basis we suggest adopting a maximum geotechnical strength reduction factor of 0.4 for the design of the recommended shallow footings.

We have calculated the elastic settlement of a square pad founded on weathered rock, varying the assumed material deformation parameters within ranges chosen on the basis of previous experience and published data. The elastic settlement of a square footing (in mm) founded in the weathered rock on this site may be estimated as being

$$0.01 * p * B < S < 0.03 * p * B$$

where p is the working bearing stress in MPa and B is the footing breadth in metres.

Due to the variability of the depth of weathering of rock observed in the boreholes, we think it likely that there will be differences in ground response within building footprints which will result in differential settlements.

Higher bearing pressures are likely to be achievable on the distinctly and slightly weathered rock, together with more uniform ground response. The investigations undertaken have not generated sufficient information to assess the geographical distribution of the weathering extent and depth within Zone C. For that reason, we suggest that preliminary design consider the full range of elastic settlements defined by the above equation.

We consider that geophysical surveys are likely to provide useful data to assist in the refinement of footing design. Further refinement could be achieved by undertaking geological mapping during excavation.

5.4 Pavement Design

5.4.1 Port Site

At the port site, soaked CBR values for samples of granular soils tested ranged from 12% (TP12, 0.2 to 0.5 m) to 35% (TP06, 0.4 to 0.8 m depth). A CBR of 5% was measured on the single sample of sandy clay tested (TP13, 0.4 to 0.7 m).

We analysed the DCP test results with reference to Figure 5.2 in Austroads⁷. At the port site the testing generally suggests in-situ CBR between around 4% and 12% within about 0.4 m of the surface, probably due

⁷ A Guide to the Structural Design of Road Pavements (1992)



to relatively low density materials in that depth range. Below 0.4 m depth, the DCP testing indicates in-situ CBR of 20% or more.

The DCP tests conducted adjacent to test pits TP05 and TP19, located in Zone B suggest in-situ CBR between 2% and 4% for about 2 m depth from the surface.

We recommend a subgrade CBR of 5% be adopted for preliminary pavement design. This assumes the subgrade is compacted to a dry density ratio of at least 98% relative to Standard Compaction to a depth of 0.2 m.

Selection of a design subgrade CBR must consider the risk of the subgrade becoming soaked. This recommendation also assumes the risk of the subgrade becoming soaked will be managed by suitable design of surface and subgrade drainage.

5.4.2 Transport Access Corridor

CBR testing of samples recovered from test pits within the proposed transport access corridor measured soaked CBR's between 3% (TP28, 0.4 to 0.8 m depth) and 25% (TP30, 0.4 to 0.6 m). The results of CBR testing on samples of similar particle size distribution and plasticity showed some variability. This is usual for CBR testing.

Within the transport access corridor the DCP testing generally suggests in-situ CBR between around 8% and 14% within about 0.3 m of the surface. Below 0.3 m depth, the DCP testing indicates in-situ CBR of 20% or more. In test pit TP28, testing suggests an in-situ CBR of 10% to a depth of about 1.5 m.

Based on the variability of the soaked CBR's and the relatively few investigation locations within the transport access corridor, we recommend a subgrade CBR of 5% be adopted for preliminary pavement design. This assumes the subgrade is compacted to a dry density ratio of at least 98% relative to Standard Compaction to a depth of 0.2 m.

Selection of a design subgrade CBR must consider the risk of the subgrade becoming soaked. This recommendation also assumes the risk of the subgrade becoming soaked will be managed by suitable design of surface and subgrade drainage.

Further investigations are likely to be necessary in the proposed transport access corridor.

5.5 Construction Issues

5.5.1 Excavatability

The natural soils in the test pits generally provided low to high resistance to excavation using a backhoe. Refusal on rock strength materials occurred in Zone C at depths ranging from 0.6 m to 1.8 m and in the transport access corridor between 0.9 m and 1.6 m depth.

Based on our observations of test pit excavation and presence of rock we expect that the soils will be diggable with conventional excavating machinery (excavators, backhoes). However, the presence of cobbles and boulders (encountered at locations within Zone C below depths ranging from 0.1 m to 0.8 m and within the transport access corridor below depths ranging from 0.15 m to 0.9 m) is likely to affect the use of scrapers. We expect that at least some, and potentially a significant proportion, of the excavations will encounter rock strength materials that will require rock excavation techniques.

The boreholes indicate significant variability in the depth of soil strength materials (including extremely weathered rock) within Zone C. Based on our observations, it is likely that these materials will be rippable. We think that some of the underlying distinctly to slightly weathered rock may be rippable but we do not have



sufficient information to assess the proportion or the geographical distribution of rippable material. If more reliable information was required we consider that seismic surveys would provide useful data at reasonable cost.

5.5.2 Excavation Stability

With the exception of test pit TP05 excavated within Zone B, the test pits did not collapse and their sides remained stable for short periods during the investigation. That should not be taken to demonstrate that this ground will be stable at such steep angles over longer periods.

We recommend assuming that the average slope in construction excavations in soil strength materials within Zones A and C will be no steeper than 1V:1H (45°), which might be obtained with a flat face or by benching. We doubt that the stability of excavated slopes steeper than around 1V:2H will be acceptable in the construction situation in dry ground in soil materials within Zone B.

Groundwater was observed at depths of 1.65 m and 2.0 m in TP05 and TP19 respectively. If excavations intercepting groundwater are not dewatered, we doubt that stability will be acceptable for the construction situation where slopes steeper are than around 1V:4H. Further and more detailed investigations would be required to justify adoption of steeper slope angles.

The stability of excavations in rock strength materials is dependent on the nature, orientation and infill properties of defects in the rock. Site observations and the boreholes undertaken at the port site indicate the presence of dominant sub-vertical defects, and weathered and highly fractured zones within the rock. Excavations into the rock will need to consider the risk of toppling failure. It is likely that excavations will need to be scaled to remove loose and unstable material. We recommend that the stability of excavated faces in rock be assessed by a suitably experienced geotechnical practitioner during construction. Golder would be pleased to assist with these services.

Effective management of stormwater may be expected to be critical in maintaining adequate stability in excavations.

5.5.3 Suitability of Material for Re-use

We expect that some of the excavation spoil from the site will be suitable for use in bulk filling. The uppermost material should be suitable for re-use as fill on site depending on the specification requirements and subject to effective moisture conditioning.

The laboratory testing results suggest that the soils on the site are generally well below their optimum moisture content for compaction, so we expect that significant moisture conditioning will be required during earthworks.

We did encounter significant proportions of material over 100 mm size in the test pits below depths ranging from 0.1 m to 0.9 m. Materials over 100 mm are generally considered unsuitable for use in filling unless specialised equipment is used. We would therefore expect that sorting of portions of the excavation spoil will be required to produce suitable fill materials.

It may be possible to use larger sized materials for appropriate purposes such as erosion protection.



6.0 SOIL STUDY FINDINGS

6.1 Acid Sulfate Soils

A preliminary 'desktop study' of the Port site and proposed transport corridor. The CSIRO Australian Soil Resource Information System (ASRIS) contains data on the probability of acid sulfate soils across Australia. The ASRIS data shows that for a portion of the site on the western side, there is 'Extremely Low Probability' of the presence of acid sulphate soils. The remainder of the site is unmapped for acid sulphate soils.

Areas underlying the port site are situated at above 1 0m AHD and the proposed transport corridor, above 20 m AHD. Neither contain any mapped Holocene alluvium and are unlikely to contain any coastal ASS.

Soils encountered during this investigation show none of the common indicators of ASS (eg. dark grey, soft, alluvial/estuarine clays) and are alkaline in nature (some highly alkaline), this strongly suggests the absence of ASS at the site.

6.2 Soil Chemistry

A limited suite of soils analysis comprising pH, EC, CEC, ESP and TOC was conducted on topsoils and subsoils from selected locations within the Port site and along the proposed transport corridor.

Soil Acid/Alkalinity Balance

Soil acidity/alkalinity is measured by pH. Strongly acidic or alkaline soils are considered undesirable for agriculture. The majority of the soil profiles present are *Sodosols*, (soil profiles with clearly defined, alkaline sub-soil ('B' Horizons).

Alkaline subsoils were identified in the 32 test pits screened.

Soil Sodicity/Salinity Indicators

High CEC values (>10) were detected in all but one (TP2 0.0-0.15m) of the 13 samples analysed.

The laboratory testing indicated that these soils are sodic, potentially dispersive and generally not suited to agriculture. Of the 13 samples analysed, five had an ESP greater than 15%. Samples with high ESP include those recovered from TP28 and TP30 in the central part of the proposed transport corridor, and TP5, TP13 and TP15 within the Port site. Only three samples (TP21 0.0-0.7m, TP26 0.0-0.3m and TP32 0.0-0.1m) returned ESP values less than 6 and could therefore be considered as 'non-sodic'.

Laboratory results for samples recovered from test pits TP5 and TP19, and field observations indicate that saline soils are present within zone B of the site (refer to Figure 2A).

Organic Matter Content

Of the 20 soil samples analysed, all returned relatively low TOC values ranging from <0.5% (almost void of organic matter) to 1.6% (TP22 0.0-0.5m). Only the sample from TP22 and a surface sample G03 contained greater than 1% OM.

The soil chemistry of the samples analysed indicates low quality soils that are not suited to conventional agriculture, and would prove difficult to sustain continuous grass cover without improvement such as addition of low levels of nutrients and vegetation mulch. Whilst it is more likely that indigenous coastal species will be utilised we suggest that soil quality and chemistry be considered when assessing revegetation options for the site.



6.3 Soil Erosion Potential

Signs of surface erosion were noted at several locations along the proposed transport corridor, likely to have been propagated by surface runoff down local slopes during previous rainfall events. Given the high incidence of sodic soils, generally, signs of soil erosion within the proposed corridor and at the Port site were generally fairly minimal.

Results of Emerson Class Number testing undertaken are inconclusive. A number of samples returned Class 4. The remaining results were mainly Class 8, indicating non-dispersive soils. These results may be correct for specific samples, but are unlikely to be representative of the overly sodic soil profiles in general. Four samples returned Emerson Class 5 (slightly dispersive), which also appear high, given the generally high ESP of the soils analysed.

Given the prevalence of sodic soils along the proposed transport corridor and at the Port site, trenches constructed in these soils may not remain stable without either shoring or battering back of the trench at a gradient not exceeding 1V:2H. This latter method will result in disturbance of approximately three times as much spoil as using vertical walls and shoring. Edge batters of any fill platforms should similarly be constructed at relatively shallow grades of the order of 1V:3H, with medium to long term protection by grassing or other means.

Trenches constructed in these materials may not remain stable in the short term without either shoring or battering back of the trench at a gradient not exceeding 1V:1H. This latter method will result in disturbance of approximately twice as much spoil as using vertical walls and shoring. Given the alkalinity of the soils and low organic matter content in general, it is recommended that a low dose of gypsum (2-3 kg/m³) and 1-2% organic matter (mulch or similar) be mixed into near surface soils prior to seeding or attempting turfing. Areas stabilised by use of hard surfaces or other physical means, would not require any specific measures.

The following conventional erosion and sediment control (ESC) management measures are recommended for disturbed areas including:

- Areas cleared of vegetation – require temporary mulching of exposed surfaces and prompt revegetation or sealing (pavements etc.) following construction;
- Stockpiled spoil – requires either perimeter catch drains and low bunds or in the case of trench spoil, placement parallel to and up gradient of the excavation, so that any runoff will be trapped in the trench;
- Creek banks and crossings (if applicable) – if disturbed, require temporary stabilisation using pinned geotextile or turf, until more permanent stabilisation is carried out (re-vegetation, gabions etc.);
- Any access roads or other local corridors – require local catch drains parallel to and down gradient of the road/corridor to direct runoff away from any down gradient water bodies within 100m of the corridor.

At time of final design, it will be beneficial to prepare an ESC Plan to document ESC management measures and set performance criteria.

7.0 LIMITATIONS OF THIS REPORT

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



Report Signature Page

Tom Hills
Senior Geotechnical Engineer

Lyndon Sanders
Principal Geotechnical Engineer

THH&HP/LJS&AWH/hh

A.B.N. 64 006 107 857

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FIGURES

Figure 1 – Site Location Plan

Figure 2A – Investigation Locations (Test Pits TP01 to TP24 and Boreholes BH01 to BH08)

Figure 2B – Investigation Locations (Test Pits TP25 to TP32)

Figures 3A to 3D – Cross Sections for Soil Study



CENTREX METALS LIMITED

SHEEP HILL MARINE PORT FACILITY
DEVELOPMENT APPROVAL AND
BASELINE STUDY

SITE LOCATION PLAN

Legend

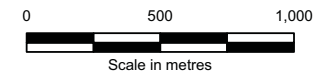
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-  Lipson Island Conservation Park
-  Rogers Beach: Development Exclusion Zone
-  Sheep Hill Marine Port Site Study Area
-  Three Sisters Marine Wreck
-  Transport Corridor Study Area

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SCALE 1:20,000



Project: 087661006 Figure No: F0001_Rev0
Drawn: KB Date: 23.01.2009
Checked: TH Date: 23.01.2009



199 FRANKLIN STREET
ADELAIDE SA 5000 AUSTRALIA
PH (08) 8213 2100
FAX (08) 8213 2101

DATUM GDA 1994
PROJECTION MGA Zone 53

FIGURE 1



CENTREX METALS LIMITED

**SHEEP HILL MARINE PORT FACILITY
DEVELOPMENT APPROVAL AND
BASELINE STUDY**

INVESTIGATION LOCATION PLAN

Legend

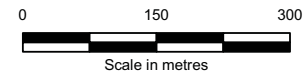
- Borehole Location
- Test Pit Location
- Approximate Zone Boundary
- Lands Title Cadastral Boundary
- Rogers Beach: Development Exclusion Zone
- Sheep Hill Marine Port Site Study Area
- Transport Corridor Study Area

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FAX (08) 8215 2101

DATUM GDA 1994
PROJECTION MGA Zone 53

FIGURE 2A







CENTREX METALS LIMITED

SHEEP HILL MARINE PORT FACILITY
DEVELOPMENT APPROVAL AND
BASELINE STUDY

INVESTIGATION LOCATION PLAN

Legend

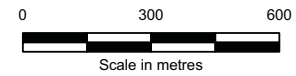
-  Test Pit Location
-  Grab Sample Location
-  Lands Title Cadastral Boundary
-  Sheep Hill Marine Port Site Study Area
-  Transport Corridor Study Area

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Project: 087661006 Figure No: F0002B_Rev0
Drawn: KB Date: 23.01.2009
Checked: TH Date: 23.01.2009

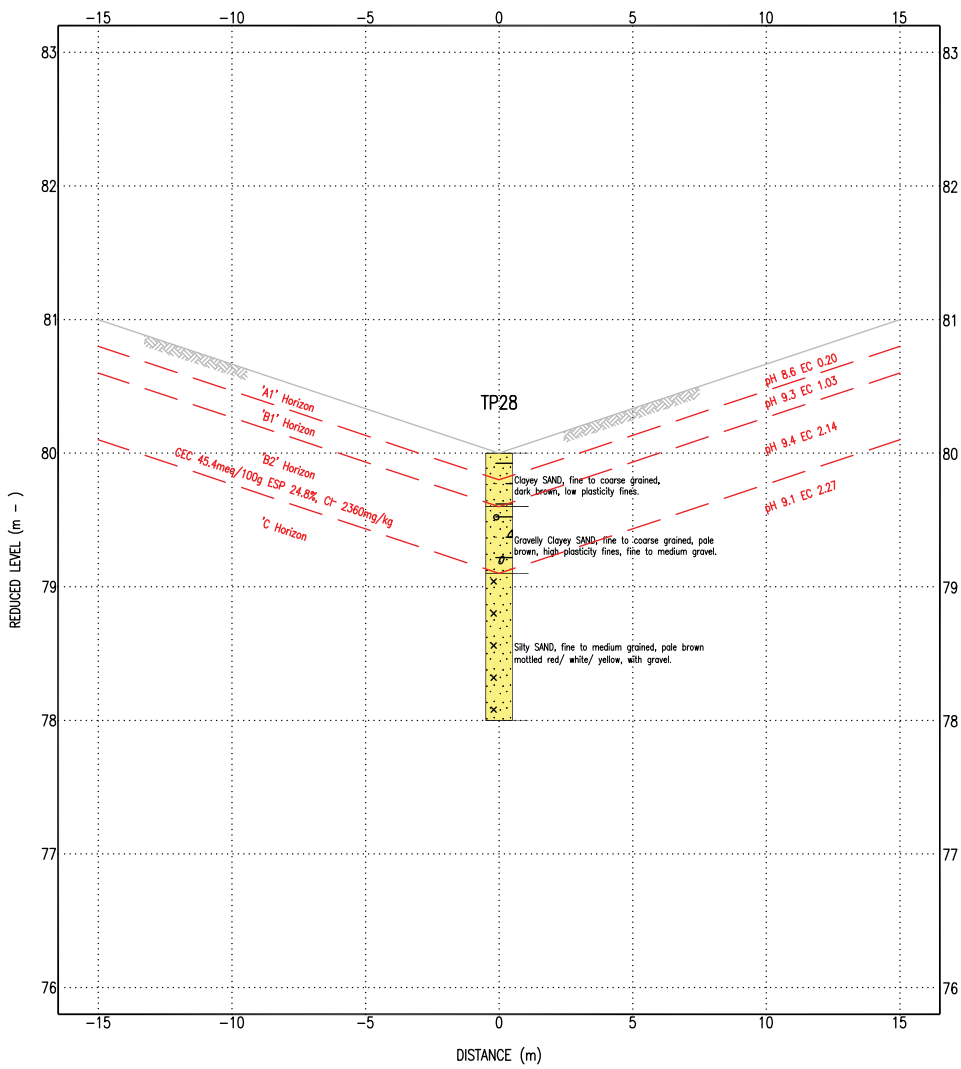


199 FRANKLIN STREET
ADELAIDE SA 5000 AUSTRALIA PH (08) 8213 2100
FAX (08) 8213 2101

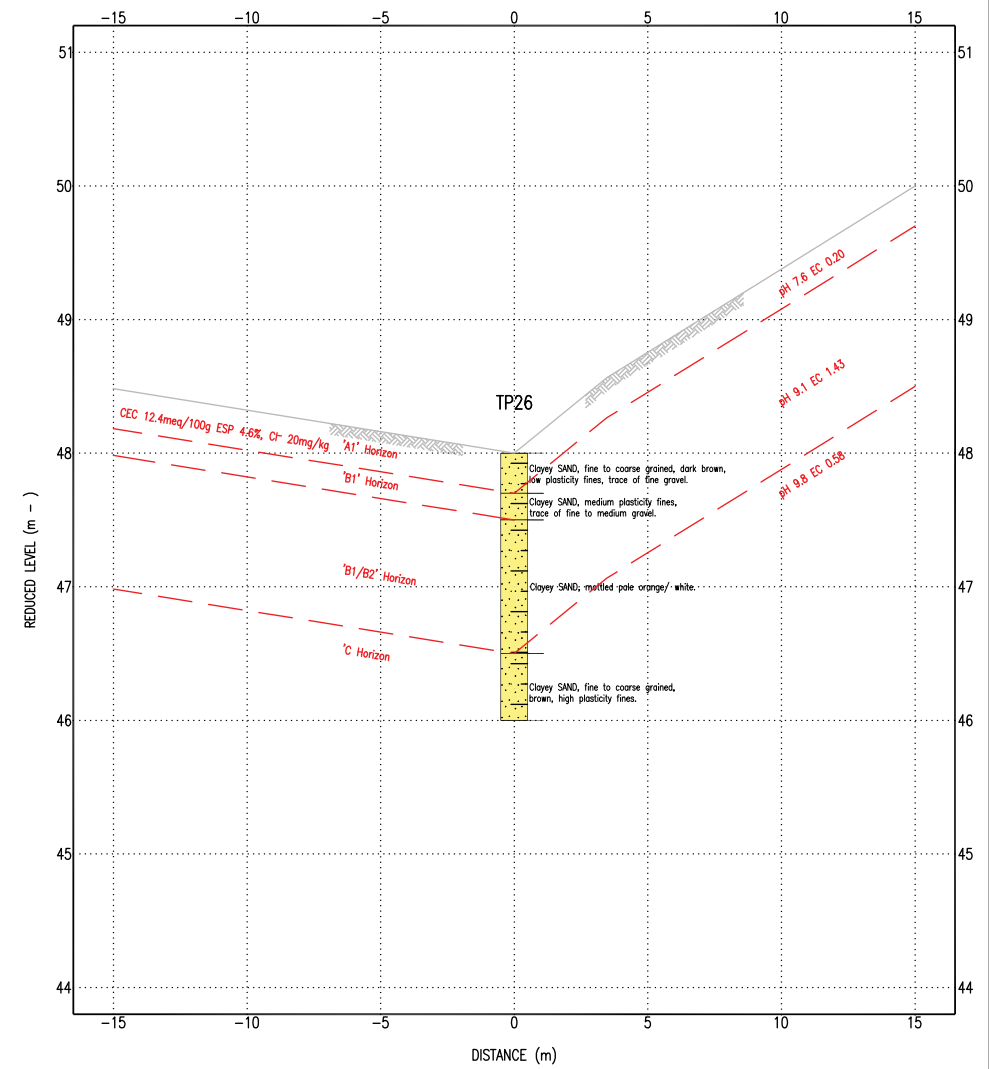
DATUM GDA 1994
PROJECTION MGA Zone 53

FIGURE 2B

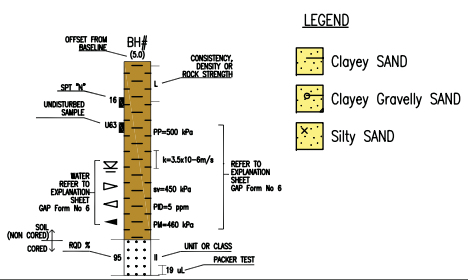
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SECTION B-B



SECTION A-A

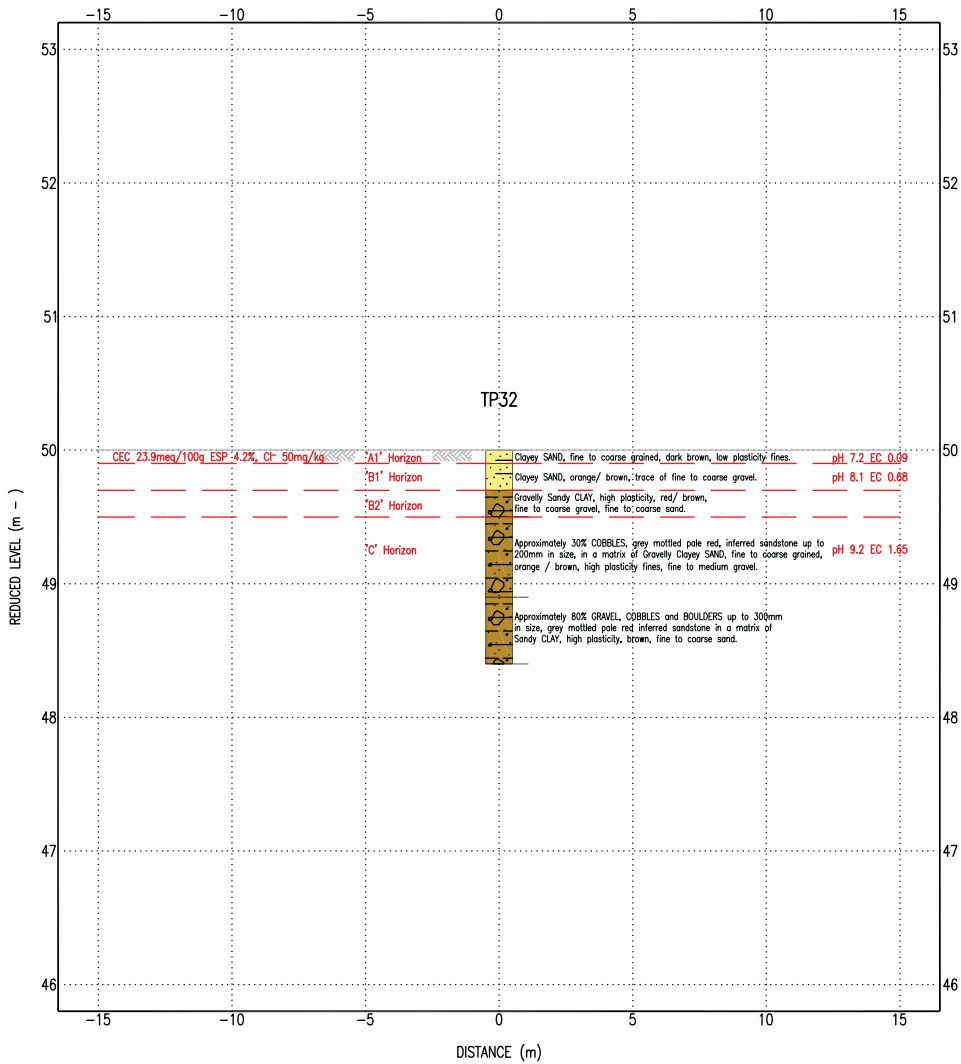


PRELIMINARY

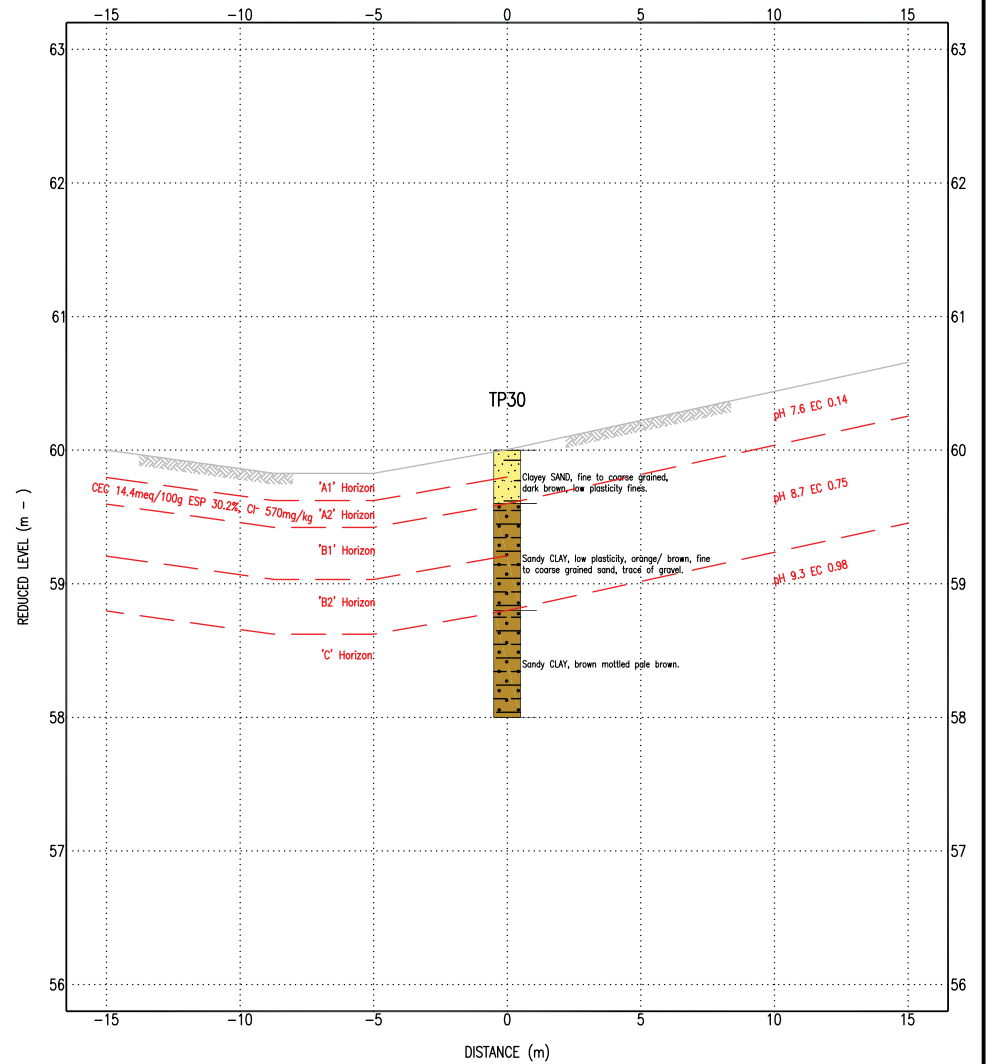
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CHECKED *HEP	DATE 10/02/2009	PROJECT No 087661006-001		FIGURE No 3A
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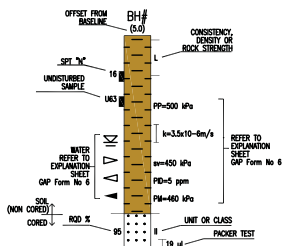
SECTION D-D'



SECTION C-C'

LEGEND

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- Sandy Gravelly CLAY
- Sandy CLAY

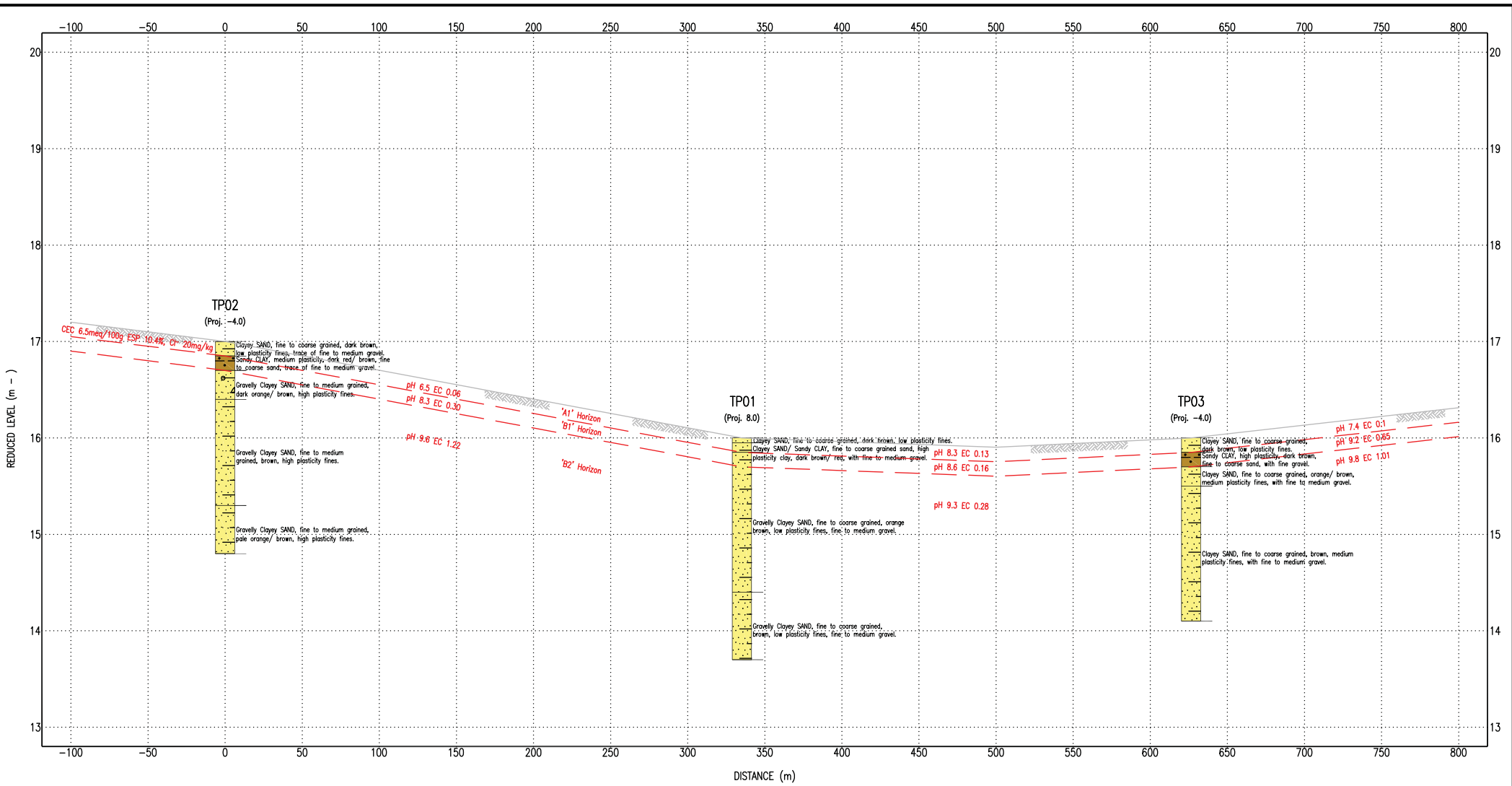


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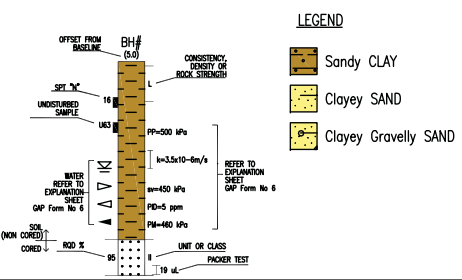
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CHECKED *HEP	DATE 10/02/2009	PROJECT No 087661006-001			FIGURE No 3B
SCALE H 1:200 V 1:40		REV No A		A3	

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SECTION E-E'

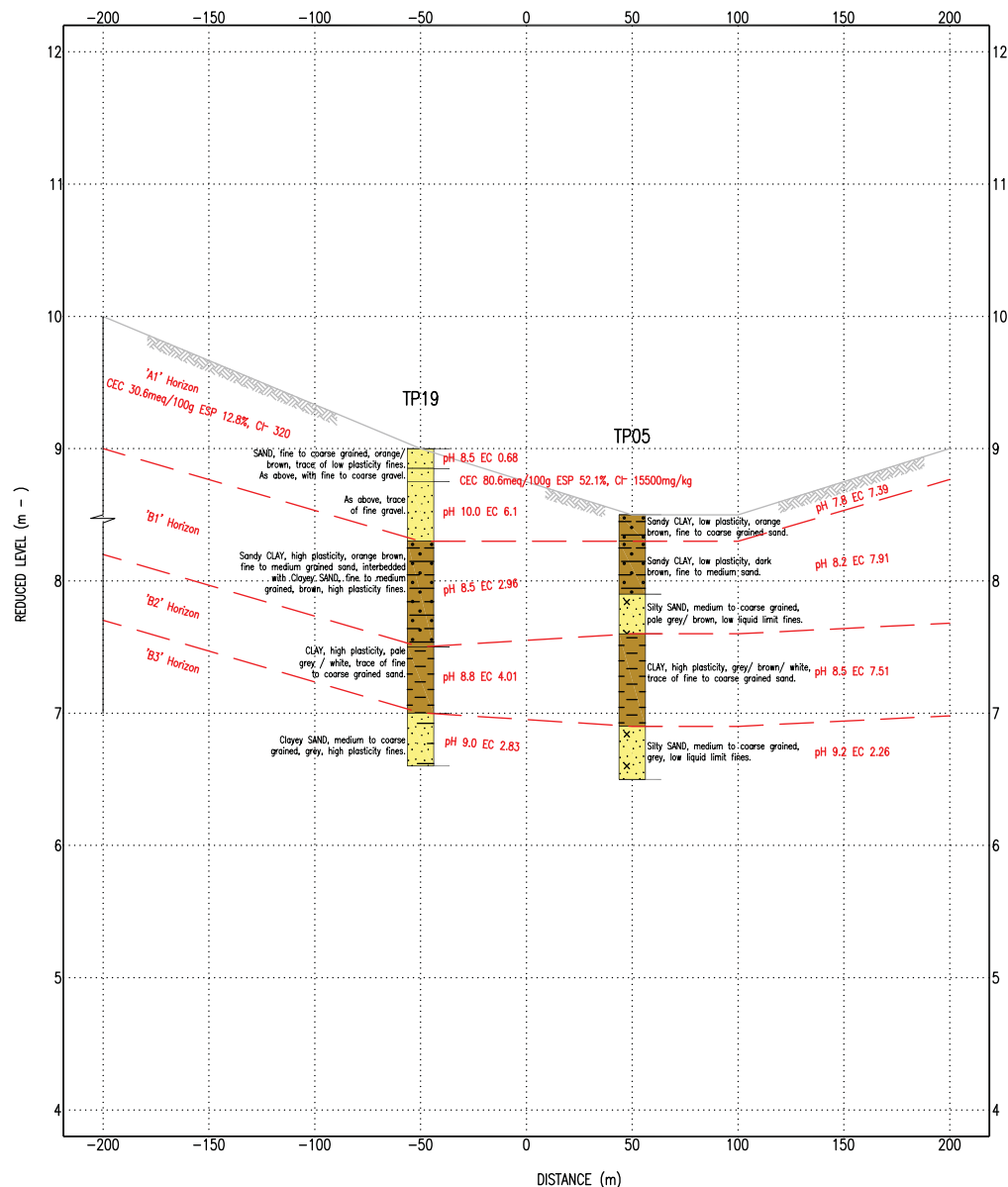
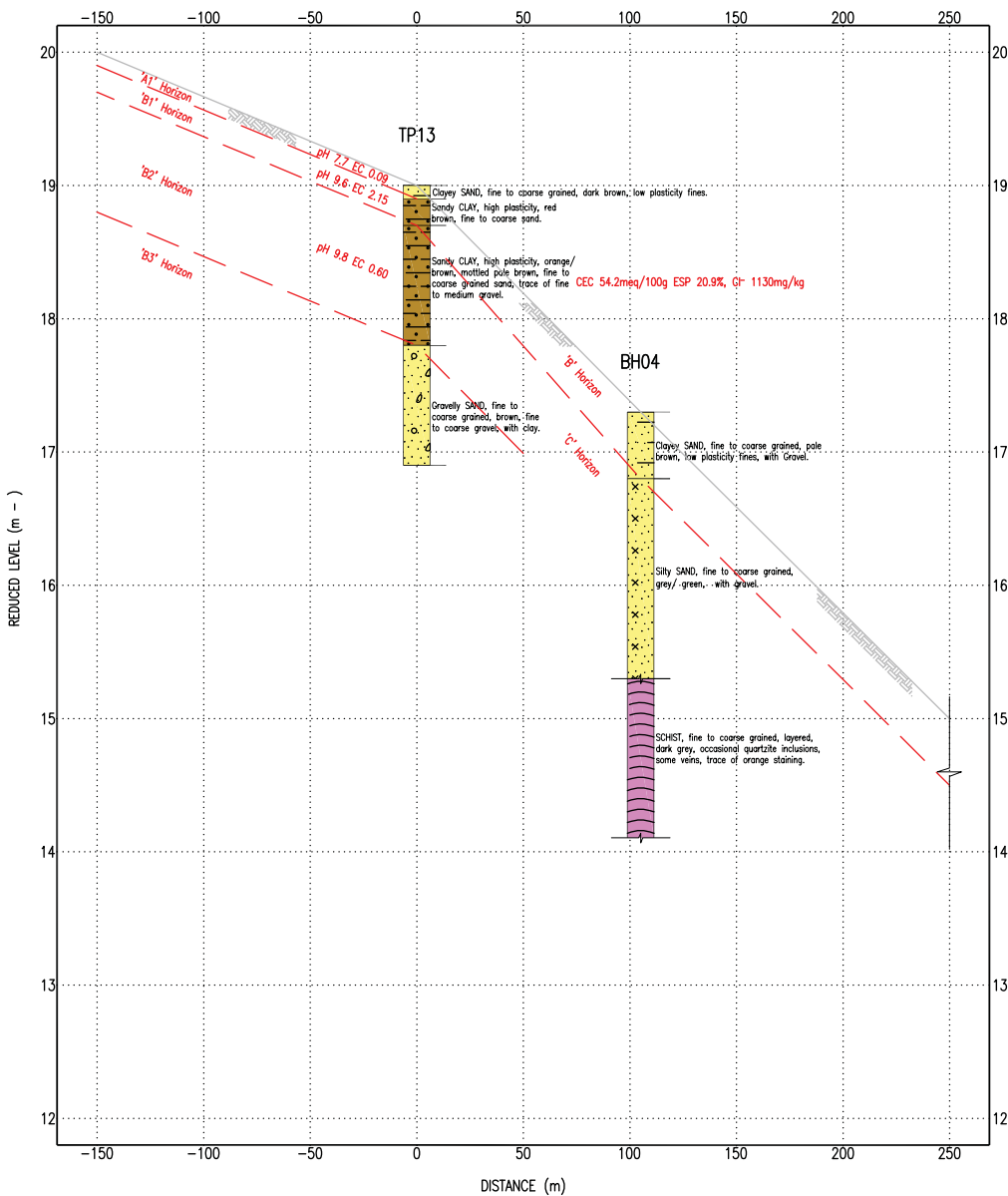


PRELIMINARY

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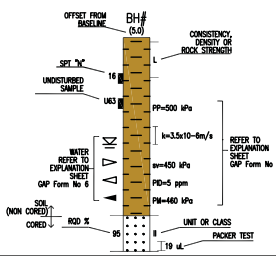
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SECTION F-F'

PRELIMINARY



- LEGEND**
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 - SAND
 - Silty SAND
 - Clayey SAND
 - Gravelly SAND
 - SCHIST












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CHECKED *HEP	DATE 10/02/2009	PROJECT No 087661006-001	FIGURE No 3D
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APPENDIX A

**Reports of Test Pits TP01 to TP32,
Reports of Boreholes BH01 to BH08 and
Report of DCP Testing**

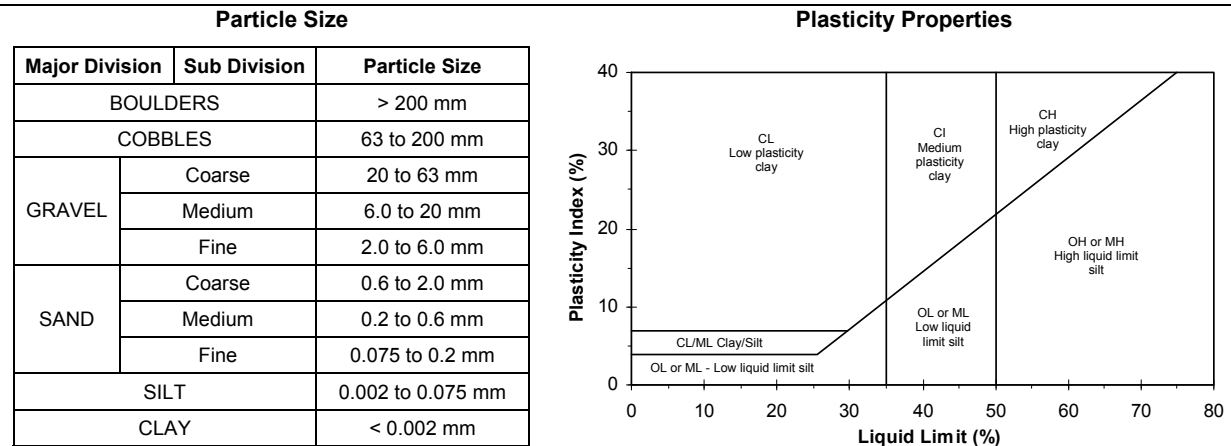
METHOD OF SOIL DESCRIPTION USED ON BOREHOLE AND TEST PIT REPORTS

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	FILL														
	GRAVEL (GP or GW)														
	SAND (SP or SW)														
	SILT (ML or MH)														
	CLAY (CL, CI or CH)														
	ORGANIC SOILS (OL or OH or Pt)														
	COBBLES or BOULDERS														

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

CLASSIFICATION AND INFERRED STRATIGRAPHY

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



MOISTURE CONDITION

AS1726 - 1993

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

CONSISTENCY AND DENSITY

AS1726 - 1993

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

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

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

DRILLING/EXCAVATION METHOD

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

PENETRATION/EXCAVATION RESISTANCE

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

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

WATER


Water level at date shown



Partial water loss



Water inflow



Complete water loss

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

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

SAMPLING AND TESTING

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

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

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

ROCK CORE RECOVERY

TCR = Total Core Recovery (%)	SCR = Solid Core Recovery (%)	RQD = Rock Quality Designation (%)
$= \frac{\text{Length of core recovered}}{\text{Length of core run}} \times 100$	$= \frac{\sum \text{Length of cylindrical core recovered}}{\text{Length of core run}} \times 100$	$= \frac{\sum \text{Axial lengths of core} > 100 \text{ mm}}{\text{Length of core run}} \times 100$



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

STRENGTH

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

ROCK STRENGTH TEST RESULTS

- ▼ Point Load Strength Index, $I_s(50)$, Axial test (MPa)
- ◀ Point Load Strength Index, $I_s(50)$, Diametral test (MPa)

Relationship between $I_s(50)$ and UCS (unconfined compressive strength) will vary with rock type and strength, and should be determined on a site-specific basis. UCS is typically 10 to 30 x $I_s(50)$, but can be as low as 5.

ROCK MATERIAL WEATHERING

Symbol	Term	Field Guide
RS	Residual Soil	Soil developed on extremely weathered rock; the mass structure and substance fabric are no longer evident; there is a large change in volume but the soil has not been significantly transported.
EW	Extremely Weathered	Rock is weathered to such an extent that it has soil properties - i.e. it either disintegrates or can be remoulded, in water.
DW	HW	Distinctly Weathered
	MW	
SW	Slightly Weathered	Rock is slightly discoloured but shows little or no change of strength relative to fresh rock.
FR	Fresh	Rock shows no sign of decomposition or staining.

ABBREVIATIONS FOR DEFECT TYPES AND DESCRIPTIONS

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



REPORT OF TEST PIT: TP01

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 615900.0 m E 6210000.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 2.30 m
 BUCKET TYPE: 600mm Toothed

SHEET: 1 OF 1
 MACHINE: JCB BACKHOE
 CONTRACTOR:
 LOGGED: AJB
 CHECKED: *th*
 DATE: 7/11/08
 DATE: 2/2/09

Excavation			Sampling			Field Material Description								
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS		
L-M			0.0		TP01-01 0.00-0.05 m PID=0 Jar, SB Duplicates TP01-101, TP01-201		SC	Clayey SAND, fine to coarse grained, dark brown, low plasticity fines.	D - M			Inferred topsoil, wheat at surface.		
			0.05		TP01-02 0.05-0.15 m PID=0 Jar, 2 x SB PP 0.15 m >500 kPa		SC/CH	Clayey SAND/ Sandy CLAY, fine to coarse grained sand, high plasticity clay, dark brown/ red, with fine to medium gravel.	D	H				
			0.15		TP01-03 0.35-0.60 m PID=0 Jar, SB, LB		SC	Gravelly Clayey SAND, fine to coarse grained, orange brown, low plasticity fines, fine to medium gravel.					Inferred calcrete up to 100mm in size.	
			0.5		TP01-04 1.00-1.40 m PID=0 SB, LB									Cemented zones. Calcareous.
			1.0		TP01-05 1.80-2.00 m PID=0 Jar, SB									
			1.60				SC	As above, brown.						
			2.0											
			2.5					TEST PIT DISCONTINUED @ 2.30 m GROUNDWATER NOT ENCOUNTERED						

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REPORT OF TEST PIT: TP02

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 615750.0 m E 6209700.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 2.20 m
 BUCKET TYPE: 600mm Toothed

SHEET: 1 OF 1
 MACHINE: JCB BACKHOE
 CONTRACTOR:
 LOGGED: AJB DATE: 7/11/08
 CHECKED: *H* DATE: 2/2/09

Excavation			Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
L-M			0.0		TP02-01 0.00-0.15 m PID = 0 Jar, 2 x SB		SC	Clayey SAND, fine to coarse grained, dark brown, low plasticity fines, trace of fine to medium gravel.	D - M	Inferred topsoil, wheat at surface, scattered quartz cobbles at surface.
			0.15		TP02-02 0.15-0.30 m Duplicates TP02-102, TP02-202 PID = 0 Jar 2 x SB		CI	Sandy CLAY, medium plasticity, dark red/ brown, fine to coarse sand, trace of fine to medium gravel.	D	Fb - H Contains vesicules. Roots
			0.30		TP02-03 0.30-0.60 m PP 0.20 m >500 kPa Duplicates TP02-103, TP02-203 PID = 0 Jar, SB, LB		SC	Gravelly Clayey SAND, fine to medium grained, dark orange/ brown, high plasticity fines.		Calcareous, gravel is inferred calcrite, cemented zones.
			0.60				SC	As above, brown.		
BH	M		1.0							
			1.5		TP02-04 1.50-2.00 m Jar, SB, LB					
			1.70				SC	As above, pale orange/ brown.		
			2.0							
			2.5					TEST PIT DISCONTINUED @ 2.20 m GROUNDWATER NOT ENCOUNTERED		

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REPORT OF TEST PIT: TP03

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 616050.0 m E 6210250.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 1.90 m
 BUCKET TYPE: 600mm Toothed

SHEET: 1 OF 1
 MACHINE: JCB BACKHOE
 CONTRACTOR:
 LOGGED: AJB
 CHECKED: *lh*
 DATE: 7/11/08
 DATE: 2/2/09

Excavation				Sampling			Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	L		0.0		TP03-01 0.00-0.15 m PID=0 Jar, 2 x SB		SC	Clayey SAND, fine to coarse grained, dark brown, low plasticity fines.	D - M			Inferred topsoil, wheat.
			0.15		TP03-02 0.15-0.30 m PID=0 Jar, 2 x SB PP 0.20 m >500 kPa		CH	Sandy CLAY, high plasticity, dark brown, fine to coarse sand, with fine gravel.	D	Fb - H	Roots.	
			0.30		TP03-03 0.30-0.60 m PID=0 Duplicates TP03-103, TP03-203 Jar, SB, LB		SC	Clayey SAND, fine to coarse grained, orange/ brown, medium plasticity fines, with fine to medium gravel.			Calcareous. Cemented zones. Gravel is inferred calcrete.	
			0.50				SC	As above, brown.				
BH	M-H		1.0		TP03-04 1.00-1.40 m PID=0 SB, LB							
			1.5									
			2.0					TEST PIT DISCONTINUED @ 1.90 m GROUNDWATER NOT ENCOUNTERED				
			2.5									

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REPORT OF TEST PIT: TP04

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 616250.0 m E 6210200.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 2.10 m
 BUCKET TYPE: 600mm Toothed

SHEET: 1 OF 1
 MACHINE: JCB BACKHOE
 CONTRACTOR:
 LOGGED: AJB
 CHECKED: *th*
 DATE: 7/11/08
 DATE: 2/2/09

Excavation			Sampling			Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	
L-M			0.0		TP04-01 0.00-0.10 m PID=0 Jar, 2 x SB		SC	Clayey SAND, fine to coarse grained, dark brown, low plasticity fines, with fine gravel.	D - M		Cobbles at surface - inferred granite, calcrete. Inferred top soil, wheat.	
			0.10		TP04-02 0.10-0.20 m PID=0 Jar, 2 x SB		CH	Sandy CLAY, high plasticity, red brown, fine to medium grained sand.	D			
			0.20		TP04-03 0.20-0.50 m PID=0 SB, LB		SC	Clayey SAND, fine to medium, orange/ brown.				Calcareous
			0.50				SC	As above, brown.				
BH	M		1.0									
			1.60		TP04-04 1.60-2.10 m PID=0 Jar, SB, LB	SC	As above, medium to coarse grained.					
			2.0									
			2.5					TEST PIT DISCONTINUED @ 2.10 m GROUNDWATER NOT ENCOUNTERED				

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REPORT OF TEST PIT: TP05

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 616450.0 m E 621050.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 2.00 m
 BUCKET TYPE: 600mm Toothed

SHEET: 1 OF 1
 MACHINE: JCB BACKHOE
 CONTRACTOR:
 LOGGED: AJB
 CHECKED: *th*
 DATE: 4/11/08
 DATE: 4/21/09

Excavation				Sampling			Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	L-M		0.0		TP05-01 0.00-0.20 m Jar, 2 x SB		CL	Sandy CLAY, low plasticity, orange brown, fine to coarse grained sand.	M			
			0.20				CL	Sandy CLAY, low plasticity, dark brown, fine to medium sand.				
			0.5		TP05-02 0.30-0.60 m Jar, SB, LB							
			0.60		TP05-03 0.60-0.90 m Jar, 2 x SB		SM	Silty SAND, medium to coarse grained, pale grey/ brown, low liquid limit fines.				
			0.90				CH	CLAY, high plasticity, grey/ brown/ white, trace of fine to coarse grained sand.				
1.0		TP05-04 1.00-1.30 m Jar, SB, LB			M-W			Grey/ brown/ white striped in layers.				
1.5		TP05-05 1.70-2.00 m Jar, SB	SM	Silty SAND, medium to coarse grained, grey, low liquid limit fines.			Collapsing sand.					
1.60												
2.0												TEST PIT DISCONTINUED @ 2.00 m GROUNDWATER ENCOUNTERED @ 1.65m
2.5												

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REPORT OF TEST PIT: TP06

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 616300.0 m E 6209950.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 2.30 m
 BUCKET TYPE: 600mm Toothed

SHEET: 1 OF 1
 MACHINE: JCB BACKHOE
 CONTRACTOR:
 LOGGED: AJB
 CHECKED: *th*
 DATE: 4/11/08
 DATE: 2/2/09

Excavation				Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	L-M		0.0		TP06-01 0.00-0.05 m PID=0 Jar, 2 x SB		SP	Gravelly SAND, medium to coarse grained, brown, fine to coarse gravel, with clay.	M			Gravel, cobbles at surface up to 100mm in size.
			SP	As above, fine to medium grained sand.								
			SP	As above, medium to coarse grained sand.								
			SP	Gravelly SAND, fine to coarse grained, grey, fine to medium gravel, trace of non-plastic fines.				1 cobble 150mm in size.				
			0.05									
			0.15									
			0.25									
			0.40		TP06-02 0.40-0.80 m PID=0 Jar, SB, LB		SP	As above, grey/brown.	D-M			
			0.80									
			1.0									
			1.5		TP06-03 1.40-1.80 m PID=0 Jar, SB, LB		SC	Clayey SAND, fine to coarse grained, orange brown, high plasticity fines with fine to coarse gravel.				Gravel is inferred sandstone.
			2.0									
			2.5					TEST PIT DISCONTINUED @ 2.30 m GROUNDWATER NOT ENCOUNTERED				

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REPORT OF TEST PIT: TP07

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 616100.0 m E 6209900.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 2.10 m
 BUCKET TYPE: 600mm Toothed

SHEET: 1 OF 1
 MACHINE: JCB BACKHOE
 CONTRACTOR:
 LOGGED: AJB DATE: 6/11/08
 CHECKED: HL DATE: 2/2/09

Excavation			Sampling			Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
L-M			0.0		TP07-01 0.00-0.15 m PID=0 Jar, SB		SM	Silty SAND, fine to coarse grained, dark brown, low liquid limit fines.	D-M			
			0.15		TP07-02 0.15-0.30 m PID=0 Jar, 2 x SB PP 0.20 m >500 kPa		CH	Sandy CLAY, high plasticity, red/ brown, fine to medium grained sand.	D			
			0.30		TP07-03 0.30-0.60 m PID=0 Jar, SB, LB PP 0.50 m >500 kPa		CH	Approximately 20% GRAVEL and COBBLES up to 200mm in size, inferred calcrete, in matrix of Sandy CLAY, high plasticity, orange brown, fine to coarse grained sand.	H			Calcareous, cemented zones up to 150mm in size.
			0.60				SC	Gravelly clayey SAND, fine to coarse grained, brown, high plasticity fines, fine to coarse gravel.				As above.
BH			1.0		TP07-04 1.00-1.40 m PID=0 Jar, SB, LB				D-M			
M			1.5									
			2.0									
			2.5					TEST PIT DISCONTINUED @ 2.10 m GROUNDWATER NOT ENCOUNTERED				

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REPORT OF TEST PIT: TP08

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661008

COORDS: 616050.0 m E 6209600.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 2.00 m
 BUCKET TYPE: 600mm Toothed

SHEET: 1 OF 1
 MACHINE: JCB BACKHOE
 CONTRACTOR:
 LOGGED: AJB DATE: 5/11/08
 CHECKED: *th* DATE: 2/2/09

Excavation			Sampling			Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	M		0.0		TP08-01 0.00-0.30 m Jar, SB		SC	Approximately 40% GRAVEL and COBBLES, inferred calcareous, white, in a matrix of clayey SAND, fine to medium grained, brown, low plasticity fines.			Inferred topsoil. Rock is inferred calcareous, white.
			0.30		TP08-02 0.30-0.60 m Jar, SB, LB		SC	Approximately 40% GRAVEL, COBBLES and BOULDERS up to 400mm in size, inferred calcareous, in matrix of Clayey SAND, fine to coarse grained, pale brown, high plasticity fines.		Inferred calcareous.	
			0.70				SC	Clayey SAND, fine to coarse grained, orange/ brown, mottled pale brown, high plasticity fines, mottled pale brown.		Contains cobbles, grey with black specks.	
			1.0		TP08-03 1.00-1.40 m Jar, SB, LB						
			1.5		TP08-04 1.60-2.00 m Jar, SB						
			2.0		TEST PIT DISCONTINUED @ 2.00 m GROUNDWATER NOT ENCOUNTERED						
			2.5								

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REPORT OF TEST PIT: TP09

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 616100.0 m E 6209450.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 2.00 m
 BUCKET TYPE: 600mm Toothed

SHEET: 1 OF 1
 MACHINE: JCB BACKHOE
 CONTRACTOR:
 LOGGED: AJB
 CHECKED: *th*
 DATE: 5/11/08
 DATE: 2/2/09

Excavation			Sampling		Field Material Description								
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	
L			0.0		TP09-01 0.00-0.15 m PID=0 Jar, 2 x SB		SC	Clayey SAND, fine to medium grained, dark brown, low plasticity fines, with fine gravel.	D - M			Inferred topsoil.	
			0.15		TP09-02 0.15-0.30 m PID=0 Jar, 2 x SB		SC / CH	Clayey SAND/ Sandy CLAY, fine to medium grained sand, high plasticity fines, red/ brown.	D	H - Fb			
			0.30		TP09-03 0.30-0.60 m PID=0 Jar, SB, LB		SC	Clayey SAND, fine to coarse grained, brown, mottled pale brown, high plasticity fines, with fine to coarse gravel.					Calcareous.
			0.5		PP 0.50 m >550 kPa								
BH	M		1.0										
			1.5		TP09-04 1.20-1.50 m PID=0 Jar, SB, LB								
			2.0					TEST PIT DISCONTINUED @ 2.00 m GROUNDWATER NOT ENCOUNTERED					
			2.5										

GAP 8_02.LIB.GLB.L09 GAP NON-CORED FULL PAGE 087661006 - CENTREX SHEEP HILL.GPJ <<DrawingFiles>> 30/01/2009 16:00 8.1.025

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REPORT OF TEST PIT: TP10

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 616300.0 m E 6209700.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 1.05 m
 BUCKET TYPE: 600mm Toothed

SHEET: 1 OF 1
 MACHINE: JCB BACKHOE
 CONTRACTOR:
 LOGGED: AJB
 CHECKED: *HL*
 DATE: 4/11/08
 DATE: 2/2/09

Excavation				Sampling			Field Material Description				
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	L		0.0	TP10-01 0.00-0.30 m PID=0 Jar, 2 x SB		SC	Clayey SAND, fine to coarse grained, dark brown, low plasticity fines, with fine to coarse gravel.				Inferred topsoil, roots, calcareous inclusions, crystals. Cobbles, pale orange with black specks, inferred gneiss.
			0.30	TP10-02 0.30-0.45 m PID=0 Jar, SB		SM	Silty SAND, fine to medium grained, brown/ yellow, low liquid limit fines, with gravel.			Moderately cemented zones up to 150mm in size, roots, vesicles.	
			0.5	TP10-03 0.50-0.80 m PID=0 LB							
			0.80	TP10-04 0.80-1.05 m PID=0 Jar, SB, LB		SM	Approximately 50% GRAVEL and COBBLES, pale grey with crystals, in matrix of Silty SAND, brown, fine to medium grained, low liquid limit fines, with gravel.				
			1.0	TEST PIT DISCONTINUED @ 1.05 m GROUNDWATER NOT ENCOUNTERED PRACTICAL REFUSAL @ 1.05m							
			1.5								
			2.0								
			2.5								

GAP 8_02.LIB.GLB Log GAP NON-CORED FULL PAGE 087661006 - CENTREX SHEEP HILL.GPJ <<DrawingFile>> 30/01/2009 16:00 8.1.025

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REPORT OF TEST PIT: TP11

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 616250.0 m E 6209400.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 2.20 m
 BUCKET TYPE: 600mm Toothed

SHEET: 1 OF 1
 MACHINE: JCB BACKHOE
 CONTRACTOR:
 LOGGED: AJB
 CHECKED: *h*
 DATE: 4/11/08
 DATE: 2/2/09

Excavation			Sampling		Field Material Description								
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	
L-M			0.0										
			0.05		TP11-01 0.00-0.05 m Jar, 2 x SB PP 0.05 m >500 kPa TP11-02 0.05-0.20 m Jar, SB, LB		SC	Gravelly clayey SAND, fine to coarse grained, dark brown, low plasticity fines, fine to coarse gravel.				Inferred top soil, wheat and cobbles at surface.	
			0.20		PP 0.20 m >500 kPa		SC	Approximately 60% GRAVEL and COBBLES inferred calcareous up to 200mm in size, in a matrix of Clayey SAND, fine to coarse grained, brown, high plasticity fines.				Contains vesicles, roots.	
			0.5		TP11-03 0.40-0.70 m PID=0 Jar, LB								
			0.80		TP11-04 0.80-1.00 m PID=0 Jar, SB, LB		SC	Gravelly clayey SAND, fine to coarse grained pale brown, high plasticity fines, fine to coarse gravel.					Inferred calcareous. Gravel and cobbles are inferred calcareous.
M			1.20				SC	Approximately 40% GRAVEL and COBBLES up to 100mm in size, laminated, brown, in a matrix of Clayey SAND, fine to coarse grained, brown, low plasticity fines.				Inferred weathered rock.	
			2.0		TP11-05 1.90-2.20 m PID=0 Jar, 2 x SB								
			2.5					TEST PIT DISCONTINUED @ 2.20 m GROUNDWATER NOT ENCOUNTERED					

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REPORT OF TEST PIT: TP12

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 616350.0 m E 6209400.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 1.80 m
 BUCKET TYPE: 600mm Toothed

SHEET: 1 OF 1
 MACHINE: JCB BACKHOE
 CONTRACTOR:
 LOGGED: AJB
 CHECKED: *th*
 DATE: 4/11/08
 DATE: 2/2/09

Excavation				Sampling			Field Material Description				
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	L-M		0.0		TP12-01 0.00-0.20 m Jar, SB, LB		SC	Clayey SAND, fine to coarse grained, dark brown, low plasticity fines, with gravel.			Inferred topsoil, grass, wheat at surface. Inferred calcareous. Contains cobbles.
			0.20		TP12-02 0.20-0.50 m Jar, SB, LB		SC	Clayey SAND, fine to coarse grained, pale brown, low plasticity fines, with fine to medium grey gravel.			Cemented zones up to 150mm in size.
			0.80				SC	Approximately 50% GRAVEL and COBBLES up to 200mm in size, laminated, grey/ brown with gold specks, in a matrix of Clayey SAND, fine to coarse grained, brown, low plasticity fines.			Inferred weathered rock, breaks apart with hand pressure.
			1.5		TP12-03 1.50-1.80 m Jar, SB, LB						
			2.0					TEST PIT DISCONTINUED @ 1.80 m GROUNDWATER NOT ENCOUNTERED PRACTICAL REFUSAL @ 1.8m			
			2.5								

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REPORT OF TEST PIT: TP13

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 616300.0 m E 6209500.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 2.10 m
 BUCKET TYPE: 600mm Toothed

SHEET: 1 OF 1
 MACHINE: JCB BACKHOE
 CONTRACTOR:
 LOGGED: AJB
 CHECKED: *h*
 DATE: 3/11/08
 DATE: 2/2/09

Excavation			Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	L-M		0.0		TP13-01 0.00-0.10 m Jar, SB		SC	Clayey SAND, fine to coarse grained, dark brown, low plasticity fines.	D - M	Inferred topsoil.
			0.10		PP 0.10 m >450 kPa TP13-02 0.10-0.30 m Jar, SB, LB		CH	Sandy CLAY, high plasticity, red brown, fine to coarse sand.	Fb - H	Roots.
			0.30		PP 0.30 m >450 kPa TP13-03 0.40-0.70 m Jar, SB, LB		CH	Sandy CLAY, high plasticity, orange/brown, mottled pale brown, fine to coarse grained sand, trace of fine to medium gravel.	D	Calcareous.
			1.20		TP13-04 1.60-1.90 m Jar, SB		SP	Gravelly SAND, fine to coarse grained, brown, fine to coarse gravel, with clay.	D - M	
			2.0		TEST PIT DISCONTINUED @ 2.10 m GROUNDWATER NOT ENCOUNTERED					
			2.5							

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REPORT OF TEST PIT: TP14

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 616550.0 m E 6209600.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 1.90 m
 BUCKET TYPE: 600mm Toothed

SHEET: 1 OF 1
 MACHINE: JCB BACKHOE
 CONTRACTOR:
 LOGGED: AJB
 CHECKED: *th*
 DATE: 3/11/08
 DATE: 2/2/09

Excavation			Sampling			Field Material Description				
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	L-M		0.0		TP14-01 0.00-0.25 m PID = 0 Duplicates TP14-011, TP14-012 Jar, 2 x SB		SC	Clayey SAND, fine to coarse grained, dark brown, low plasticity fines, fine to coarse gravel.	D - M	Weakly cemented zones up to 200mm in size, inferred topsoil, roots.
			0.25		TP14-02 0.30-0.60 m PID = 0 Duplicates TP14-021, TP14-022 Jar, SB, LB		SM	Approximately 20% GRAVEL and COBBLES, brown, shiny up to 100mm in size in a matrix of Silty SAND, fine to medium grained, brown/ pale brown, low liquid limit fines.		Inferred weathered rock.
			0.60		TP14-03 0.70-1.00 m PID = 0 LB		SC	Approximately 40% GRAVEL and COBBLES up to 150mm in size, brown/ red, shiny, in a matrix of Clayey SAND, fine to coarse grained, grey/ brown, low plasticity fines.		Inferred weathered rock.
			1.0		TP14-04 1.10-1.40 m PID = 0 Duplicates TP14-041, TP14-042 Jar, SB				D	
			2.0		TEST PIT DISCONTINUED @ 1.90 m GROUNDWATER NOT ENCOUNTERED					
			2.5							

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REPORT OF TEST PIT: TP15

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 616500.0 m E 6209900.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 1.00 m
 BUCKET TYPE: 600mm Toothed

SHEET: 1 OF 1
 MACHINE: JCB BACKHOE
 CONTRACTOR:
 LOGGED: AJB DATE: 6/11/08
 CHECKED: *AL* DATE: 2/2/09

Excavation				Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
L			0.0		TP15-01 0.00-0.10 m PID=0 Jar, SB		SC	Clayey SAND, fine to coarse grained, dark brown, low plasticity fines.	D - M		Roots, inferred topsoil.
			0.10		TP15-02 0.10-0.30 m PID=0 Jar, 2 x SB		SC	Clayey SAND, fine to coarse grained, dark grey/ brown, low plasticity fines.			Strongly cemented zones, roots.
			0.30		TP15-03 0.40-0.60 m PID=0 Jar, SB, LB		SC	Clayey Gravelly SAND, fine to coarse grained, pale orange/ brown, fine to coarse gravel, high plasticity fines.			Calcareous. Contains cobbles and boulders up to 600mm in size, inferred gneiss. Zones of weathered rock observed.
M			0.5								
BH									D		
M-H			1.0					TEST PIT DISCONTINUED @ 1.00 m GROUNDWATER NOT ENCOUNTERED PRACTICAL REFUSAL @ 1.0m			
			1.5								
			2.0								
			2.5								

GAP 8 02 LIB.GLB Log GAP NON-CORED FULL PAGE 087661006 - CENTREX SHEEP HILL.GPJ <<DrawingFile>> 30/07/2009 16:00 6.1.025

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REPORT OF TEST PIT: TP16

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 616600.0 m E 6209900.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 0.85 m
 BUCKET TYPE: 600mm Toothed

SHEET: 1 OF 1
 MACHINE: JCB BACKHOE
 CONTRACTOR:
 LOGGED: AJB
 CHECKED: *lh*
 DATE: 6/11/08
 DATE: 2/2/09

Excavation				Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	
BH	L L-M H		0.0		TP16-01 0.00-0.10 m PID=0 Jar, SB		SC	Clayey SAND, fine to coarse grained, dark brown, low plasticity fines, with fine to coarse gravel.	D - M				
			0.10		TP16-02 0.10-0.25 m PID=0 Jar, 2 x SB		CH	Sandy CLAY, high plasticity, red/ brown, fine to coarse grained sand, with gravel.	D	Fb - H		Contains orange/ white cobbles of inferred gneiss, some inferred quartz.	
			0.25		TP16-03 0.25-0.35 m PID=0 Jar, SB		SC	Clayey SAND, fine to coarse grained, brown, high plasticity fines, with gravel.				Intruded by weathered rock. Calcareous. Contains cobbles.	
			0.35		TP16-04 0.50-0.80 m PID=0 Jar, SB, LB		SM	Silty SAND, fine to coarse grained, pale brown, low plasticity fines, with gravel.				Intruded by inferred weathered rock. Contains dark, flaky and grey inferred gneiss, shiny, throughout layer. Calcareous. Contains cobbles.	
			0.5										
			1.0										
			1.5										
			2.0										
			2.5										
								TEST PIT DISCONTINUED @ 0.85 m GROUNDWATER NOT ENCOUNTERED PRACTICAL REFUSAL @ 0.85m					

GAP 8_02 LIB GLB Log GAP NON-CORED FULL PAGE 087661006 - CENTREX SHEEP HILL GPJ <<DrawingFile>> 30/01/2009 16:00 8.1.025

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REPORT OF TEST PIT: TP17

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 616700.0 m E 6209900.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 1.00 m
 BUCKET TYPE: 600mm Toothed

SHEET: 1 OF 1
 MACHINE: JCB BACKHOE
 CONTRACTOR:
 LOGGED: AJB DATE: 6/11/08
 CHECKED: *th* DATE: 2/2/09

Excavation			Sampling		Field Material Description									
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS		
BH	L		0.0		TP17-01 0.00-0.20 m Jar, 2 x SB		SC	Clayey Gravelly SAND, fine to coarse grained, dark brown, fine to coarse gravel, low plasticity fines.				D - M	Inferred topsoil, cemented zones up to 100mm in size, roots, 10 cobbles, inferred quartz, or grey rock.	
			0.20		TP17-02 0.20-0.30 m PID=0 Jar, 2 x SB		SM	Silty SAND, fine to medium grained, pale orange/ brown, low liquid limit fines.					Cemented zones, up to 150mm in size.	
					TP17-03 0.30-0.50 m PID=0 Jar, SB, LB		SC	Clayey SAND, fine to coarse grained, dark grey, low plasticity fines, interbedded with material described in the above layer.						Intruded by grey weathered rock. 1 quartz cobble 200mm in size.
			0.50		TP17-04 0.50-1.00 m PID=0 Jar SB		SC	Clayey SAND, fine to coarse grained, dark grey, low plasticity fines, interbedded with material described in the above layer.						D
			1.0		TEST PIT DISCONTINUED @ 1.00 m GROUNDWATER NOT ENCOUNTERED PRACTICAL REFUSAL @ 1.00m									
			1.5											
			2.0											
			2.5											

GAP 8_02 LIB.GLB Log GAP NON-CORED FULL PAGE 087661006 - CENTREX SHEEP HILL.GPJ <<Drawn/for/Plot>> 30/01/2009 16:00 8.1.025

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REPORT OF TEST PIT: TP18

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 616650.0 m E 6209800.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 0.90 m
 BUCKET TYPE: 600mm Toothed

SHEET: 1 OF 1
 MACHINE: JCB BACKHOE
 CONTRACTOR:
 LOGGED: AJB
 CHECKED: *th*
 DATE: 6/11/08
 DATE: 2/2/09

Excavation				Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	L		0.0		TP18-01 0.00-0.15 m PID=0 Jar, SB		SC	Clayey SAND, fine to medium grained, dark brown, low plasticity fines, with fine to coarse gravel.	D - M			Inferred topsoil, calcareous gravel.
			0.15		TP18-02 0.15-0.45 m PID=0 Jar, SB, LB		SC	Approximately 20% GRAVEL and COBBLES, inferred calcrete up to 200mm in size in a matrix of Clayey SAND, fine to medium grained, dark brown, low plasticity fines.				Calcareous. Vesicles, roots. Interbedded with inferred weathered rock.
			0.45		TP18-03 0.45-0.90 m PID=0 Jar, 2 x SB		SP	Gravelly SAND, fine to coarse grained, grey, fine to medium gravel, with low plasticity fines.				Cemented zones up to 200mm in size. Inferred weathered rock. Contains cobbles up to 200mm in size.
			1.0		TEST PIT DISCONTINUED @ 0.90 m GROUNDWATER NOT ENCOUNTERED PRACTICAL REFUSAL @ 0.90m							
			1.5									
			2.0									
			2.5									

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REPORT OF TEST PIT: TP19

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 616400.0 m E 6210050.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 2.40 m
 BUCKET TYPE: 600mm Toothed

SHEET: 1 OF 1
 MACHINE: JCB BACKHOE
 CONTRACTOR:
 LOGGED: AJB
 CHECKED: *th* DATE: 4/11/08
 DATE: 2/2/09

Excavation			Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	L-M		0.0		TP19-01 0.00-0.10 m Jar		SP	SAND, fine to coarse grained, orange/ brown, trace of low plasticity fines.				
			0.15				SP	As above, with fine to coarse gravel.				
			0.25				SP	As above, trace of fine gravel.				
			0.70		TP19-02 0.30-0.70 m Jar, SB, LB		CH/SC	Sandy CLAY, high plasticity, orange brown, fine to medium grained sand, interbedded with Clayey SAND, fine to medium grained, brown, high plasticity fines.	D-M			
			1.0		PP 0.70 m =100 kPa TP19-03 0.70-1.00 m CLAY Sample and SAND Sample Jar, SB, LB PP 0.71 m =90 kPa							
1.50		TP19-04 1.50-2.00 m Jar, 2 x SB		CH	CLAY, high plasticity, pale grey / white, trace of fine to coarse grained sand.	M					Pockets of pale brown, fine to coarse grained sand.	
2.00		TP19-05 2.00-2.40 m Jar, 2 x SB		SC	Clayey SAND, medium to coarse grained, grey, high plasticity fines.							W
2.5							TEST PIT DISCONTINUED @ 2.40 m GROUNDWATER ENCOUNTERED @ 2.0m					

GAP 8.02 LIB.GLB Log GAP NON-CORED FULL PAGE 087661006 - CENTREX SHEEP HILL.GPJ <<DrawingFile>> 30/01/2009 16:00 8.1.025

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REPORT OF TEST PIT: TP20

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 616400.0 m E 6209500.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 2.35 m
 BUCKET TYPE: 600mm Toothed

SHEET: 1 OF 1
 MACHINE: JCB BACKHOE
 CONTRACTOR:
 LOGGED: AJB
 CHECKED: *th*
 DATE: 3/11/08
 DATE: 2/2/09

Excavation			Sampling			Field Material Description								
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS		
BH	L		0.0		TP20-01 0.00-0.20 m Jar, 2 x SB		SC	Clayey SAND, fine to coarse grained, dark brown, low plasticity fines.						
			0.20				SM	Approximately 40% GRAVEL and COBBLES, up to 150mm in size, pale grey, in a matrix of Silty SAND, fine grained, brown/pale brown, low liquid limit fines.						
			0.5		TP20-02 0.40-0.70 m Jar, 2B, LB									
			0.75		TP20-03 0.75-1.00 m Jar, SB, LB			SC	Approximately 40% GRAVEL, COBBLES and BOULDERS up to 250mm in size, brown, subangular, in a matrix of Clayey SAND, fine to coarse grained, pale brown, low plasticity fines.				Inferred weathered rock.	
	M		1.0											
			1.5											
	M-H		2.0		TP20-04 2.00-2.35 m SB									
			2.5					TEST PIT DISCONTINUED @ 2.35 m GROUNDWATER NOT ENCOUNTERED						

GAP 9. 02 LIB.GLB Log GAP NON-CORED FULL PAGE 087661006 - CENTREX SHEEP HILL.GPJ <<DrawingFile>> 30/01/2009 16:00 8.1.025

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REPORT OF TEST PIT: TP21

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 616450.0 m E 6209600.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 1.00 m
 BUCKET TYPE: 600mm Toothed

SHEET: 1 OF 1
 MACHINE: JCB BACKHOE
 CONTRACTOR:
 LOGGED: AJB
 CHECKED: *th*
 DATE: 3/11/08
 DATE: 2/2/09

Excavation			Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	L		0.0		TP21-01 0.00-0.07 m PID=0 Jar, SB		SC	Clayey SAND, fine to coarse grained, dark brown, low plasticity fines.	M			Inferred topsoil.
			0.07		TP21-02 0.10-0.20 m PID=0 Jar, SB		SC	As above, brown.				
	M		0.20		TP21-03 0.30-0.40 m PID=0 Jar, SB, LB		SM	Silty SAND, fine to medium grained, pale brown, low liquid limit fines.				Cemented sand zones, up to 200mm in size.
			0.50		TP21-04 0.50-0.70 m PID=0 Jar, SB, LB		SC	Approximately 20% GRAVEL COBBLES and BOULDERS up to 250mm in size, black or grey inferred schist, in a matrix of Clayey SAND, fine to coarse grained, grey/ brown, low plasticity fines.	D			
			1.0		TEST PIT DISCONTINUED @ 1.00 m GROUNDWATER NOT ENCOUNTERED PRACTICAL REFUSAL @ 1.00m							

GAP B. 02 LIB.GLB Log GAP NON-CORED FULL PAGE 087661006 - CENTREX SHEEP HILL.GPJ <<DrawingFile>> 30/01/2008 16:00 8.1.025

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REPORT OF TEST PIT: TP22

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 616500.0 m E 6209700.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 1.30 m
 BUCKET TYPE: 600mm Toothed

SHEET: 1 OF 1
 MACHINE: JCB BACKHOE
 CONTRACTOR:
 LOGGED: AJB DATE: 3/11/08
 CHECKED: *th* DATE: 2/2/09

Excavation			Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	L-M		0.0							
			0.05	TP22-01 0.00-0.05 m Jar, SB		SP	SAND, fine to coarse grained, orange/ brown, with clay.		Many roots, inferred topsoil.	
				TP22-02 0.10-0.20 m Jar, SB		SC	Gravely Clayey SAND, fine to medium grained, dark brown, low plasticity fines, fine to coarse gravel.		Many roots.	
			0.20	TP22-03 0.20-0.30 m Jar, SB		SC	Clayey SAND, fine to medium grained, brown, low plasticity fines.			
			0.30	TP22-04 0.40-0.60 m Jar, SB TP22-05 0.40-0.70 m LB		SM	Approximately 40% GRAVEL and COBBLES up to 200mm in size, black and shiny inferred schist or mottled white and pale red inferred gneiss in a matrix of Silty SAND, fine to medium grained, pale brown/ white, low liquid limit fines.			
			0.5	TP22-06 1.10-1.30 m Jar, SB, LB						
			1.0							
			1.5					TEST PIT DISCONTINUED @ 1.30 m GROUNDWATER NOT ENCOUNTERED PRACTICAL REFUSAL @ 1.30m		
			2.0							
			2.5							

GAP 8. 02.LIB.GLB Log_GAP_NON-CORED FULL PAGE 087661006-CENTREX SHEEP HILL.GPJ <<DrawingFiles>> 30/01/2009 16:00 8.1.025

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REPORT OF TEST PIT: TP23

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 616450.0 m E 6209800.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 0.60 m
 BUCKET TYPE: 600mm Toothed

SHEET: 1 OF 1
 MACHINE: JCB BACKHOE
 CONTRACTOR:
 LOGGED: AJB
 CHECKED: *th*
 DATE: 6/11/08
 DATE: 2/2/09

Excavation				Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	L		0.0		TP23-01 0.00-0.15 m Jar, SB	[Symbol]	[Symbol]	SC	Clayey SAND, fine to coarse grained, dark brown, low plasticity fines, trace of fine to coarse gravel.	D - M			Inferred topsoil, weeds at surface, scattered quartz.
			0.15		TP23-02 0.15-0.30 m Jar, SB			SC	Gravelly Clayey SAND, fine to coarse grained, brown, low plasticity fines, fine to coarse gravel.				Contains pale orange mottled white. Cobbles, inferred gneiss. Contains inferred calcrete.
			0.30		TP23-03 0.30-0.45 m Jar, SB, LB			SC	Approximately 50% GRAVEL and COBBLES, pale orange mottled white, inferred gneiss, in a matrix of Clay SAND, fine to coarse grained, brown, low plasticity fines.				
			0.45		TP23-04 0.45-0.60 m Jar, SB			SC	Gravelly Clayey SAND, fine to coarse grained, grey/ brown, low plasticity fines, fine to coarse gravel.				Inferred weathered rock, shiny.
			0.5					TEST PIT DISCONTINUED @ 0.60 m GROUNDWATER NOT ENCOUNTERED PRACTICAL REFUSAL @ 0.60m					
			1.0										
			1.5										
			2.0										
			2.5										

GAP 8_02_LJB_GLB_L091 GAP NON-CORED FULL PAGE 087661006 - CENTREX SHEEP HILL GPJ <<DrawingFiles>> 30/01/2009 16:00 8.1.025

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REPORT OF TEST PIT: TP24

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 618550.0 m E 6209800.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 0.70 m
 BUCKET TYPE: 600mm Toothed

SHEET: 1 OF 1
 MACHINE: JCB BACKHOE
 CONTRACTOR:
 LOGGED: AJB
 CHECKED: *fh*
 DATE: 6/11/08
 DATE: 2/2/09

Excavation				Sampling			Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	
BH	L		0.0		TP24-01 0.00-0.20 m PID=0 Jar, 2 x SB		SC	Gravelly Clayey SAND, fine to medium grained, dark brown, fine to coarse gravel, low plasticity fines.				D - M	Calcareous.
			0.20		TP24-02 0.20-0.50 m PID=0 Jar, SB, LB		SC	As above, pale brown.					
			0.50		TP24-03 0.50-0.70 m PID=0 Jar, 2 x SB		SM	Gravelly Silty SAND, fine to medium grained, pale brown/ white, low liquid limit fines.					
								TEST PIT DISCONTINUED @ 0.70 m GROUNDWATER NOT ENCOUNTERED PRACTICAL REFUSAL @ 0.70m					

GAP 3.02 LUB.GLB Log GAP NON-CORED FULL PAGE 087661006 - CENTREX SHEEP HILL GP.J <<DrawingFile>> 30/01/2009 16:00 8.1.025

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REPORT OF TEST PIT: TP25

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 615314.0 m E 6210419.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 0.90 m
 BUCKET TYPE: 600mm Toothed

SHEET: 1 OF 1
 MACHINE: JCB BACKHOE
 CONTRACTOR:
 LOGGED: AJB
 CHECKED: *th*
 DATE: 5/11/08
 DATE: 2/2/09

Excavation			Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	L		0.0		TP25-01 0.00-0.15 m PID=0 Jar, 2 x SB		SC	Clayey SAND, fine to coarse grained, dark brown, low plasticity fines.	D - M			Inferred topsoil
	M-H		0.15		TP25-02 0.15-0.30 m PID=0 Jar, SB		SC	As above, brown, with white calcareous gravel.				Weakly cemented zones up to 150mm in size.
	H		0.30		TP25-03 0.30-0.50 m PID=0 Duplicates: TP25-103, TP25-203 Jar, SB, LB		SC	Approximately 40% COBBLES up to 200mm in size, inferred calcrete, includes grey cobbles from 0.5m depth, in a matrix of Clayey Gravelly SAND, fine to coarse grained, brown, fine to coarse gravel, low plasticity fines.				
			0.5						D			
			1.0					TEST PIT DISCONTINUED @ 0.90 m GROUNDWATER NOT ENCOUNTERED PRACTICAL REFUSAL @ 0.90m				
			1.5									
			2.0									
			2.5									

GAP 8_02.LB.GLB Log GAP NON-CORED FULL PAGE 087661006 - CENTREX SHEEP HILL.GPJ <<DrawingFile>> 3001/2008 16:00 6.1.025

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REPORT OF TEST PIT: TP26

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 614640.0 m E 6210436.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 2.00 m
 BUCKET TYPE: 600mm Toothed

SHEET: 1 OF 1
 MACHINE: JCB BACKHOE
 CONTRACTOR:
 LOGGED: AJB DATE: 5/11/08
 CHECKED: *th* DATE: 2/2/09

Excavation			Sampling			Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	L-M		0.0		TP26-01 0.00-0.30 m PID=0 Jar, SB		SC	Clayey SAND, fine to coarse grained, dark brown, low plasticity fines, trace of fine gravel.				
			0.30		PP 0.20 m =90 kPa							
			0.50		TP26-02 0.30-0.50 m PID = 0 Jar, SB, LB		SC	As above, medium plasticity fines, trace of fine to medium gravel.				
			0.50		PP 0.50 m >500 kPa		SC	As above, mottled pale orange/ white.				Inferred calcareous inclusions.
			1.0		TP26-03 0.70-1.00 m PID=0 Jar, SB							
			1.50		PP 1.00 m =440 kPa							
			1.5		TP26-04 1.70-2.00 m PID=0 Jar SB, LB		SC	Clayey SAND, fine to coarse grained, brown, high plasticity fines.				
			2.0		TEST PIT DISCONTINUED @ 2.00 m GROUNDWATER NOT ENCOUNTERED							

GAP 8. 02.LB.GLB Log GAP NON-CORED FULL PAGE 087661006 - CENTREX SHEEP HILL.GPJ <<DrawingFile>> 30/01/2009 16:00 8.1.025

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REPORT OF TEST PIT: TP27

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 614233.0 m E 6210789.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 2.00 m
 BUCKET TYPE: 600mm Toothed

SHEET: 1 OF 1
 MACHINE: JCB BACKHOE
 CONTRACTOR:
 LOGGED: AJB
 CHECKED: *fh*
 DATE: 5/11/08
 DATE: 2/2/09

Excavation			Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	L-M		0.0		TP27-01 0.00-0.10 m PID=0 Jar, SB		SC	Clayey SAND, fine to coarse grained, dark brown, low plasticity fines.		Inferred topsoil, grass at surface.
		0.10	TP27-02 0.10-0.30 m PID=0 Jar, SB	SC	As above, fine to medium grained sand, brown.		D - M	Moderately cemented zones up to 200mm in size, contained vesicules, roots.		
		0.30	TP27-03 0.30-0.60 m PID=0 Jar, SB, LB PP 0.40 m >500 kPa	SC	Clayey SAND, fine to coarse grained, dark brown, high plasticity fines.		D			
		0.60	TP27-04 0.60-1.00 m PID=0 Jar, SB, LB PP 0.70 m =150 kPa	SC	Clayey SAND, fine to coarse grained, brown mottled pale brown, medium plasticity fines, with fine to medium gravel.			Calcareous.		
		1.30	TP27-05 1.70-2.00 m PID=0 Jar, SB	SC	Clayey SAND, fine to coarse grained, brown, low plasticity fines.		D - M			
			2.0		TEST PIT DISCONTINUED @ 2.00 m GROUNDWATER NOT ENCOUNTERED					
			2.5							

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REPORT OF TEST PIT: TP28

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 613619.0 m E 6211060.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 2.00 m
 BUCKET TYPE: 600mm Toothed

SHEET: 1 OF 1
 MACHINE: JCB BACKHOE
 CONTRACTOR:
 LOGGED: AJB DATE: 5/11/08
 CHECKED: *kh* DATE: 2/2/09

Excavation			Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	L		0.0		TP28-01 0.00-0.10 m Duplicates TP28-101, TP28-201 Jar, SB		SC	Clayey SAND, fine to coarse grained, dark brown, low plasticity fines.				Inferred topsoil, wheat at surface, roots.
					TP28-02 0.20-0.40 m Jar, SB, LB					Moderately cemented zones up to 100mm in size.		
			0.40		TP28-03 0.40-0.80 m Jar, SB, LB		SC	Gravelly Clayey SAND, fine to coarse grained, pale brown, high plasticity fines, fine to medium gravel.	D - M			
					TP28-04 1.00-1.40 m Jar, SB, LB		SM	Silty SAND, fine to medium grained, pale brown mottled red/white/yellow, with gravel.	M	Contains cobbles.		
			0.90									
			1.0									
			1.5									
			2.0					TEST PIT DISCONTINUED @ 2.00 m GROUNDWATER NOT ENCOUNTERED				
			2.5									

GAP 8 02 LIB.GLB Log GAP NON-CORED FULL PAGE 087661006 - CENTREX SHEEP HILL.GPJ <<DrawingFile>> 30/07/2009 16:00 8.1.025

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REPORT OF TEST PIT: TP29

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 612983.0 m E 6211054.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 1.30 m
 BUCKET TYPE: 600mm Toothed

SHEET: 1 OF 1
 MACHINE: JCB BACKHOE
 CONTRACTOR:
 LOGGED: AJB
 CHECKED: *th*
 DATE: 5/11/08
 DATE: 2/2/09

Excavation				Sampling		Field Material Description				
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	L		0.0	TP29-01 0.00-0.15 m Jar, 2 x SB		CL	Sandy CLAY, low plasticity, dark brown, fine to coarse sand.			Inferred topsoil.
			0.15	TP29-02 0.15-0.35 m Jar, 2 x SB		GC	Approximately 50% COBBLES and BOULDERS, inferred calcrete, white, up to 100mm in size or inferred gneiss, pale orange up to 600mm in size, in a matrix of Clayey Sandy GRAVEL, fine to coarse grained, orange brown, fine to coarse grained sand, high plasticity fines.			
			0.5	TP29-03 0.40-0.70 m Duplicates: TP29-103, TP29-203 Jar, SB, LB						
			1.0							
			1.5							
			2.0							
			2.5				TEST PIT DISCONTINUED @ 1.30 m GROUNDWATER NOT ENCOUNTERED PRACTICAL REFUSAL @ 1.30m			

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REPORT OF TEST PIT: TP30

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 612511.0 m E 6210845.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 2.00 m
 BUCKET TYPE: 600mm Toothed

SHEET: 1 OF 1
 MACHINE: JCB BACKHOE
 CONTRACTOR:
 LOGGED: AJB
 CHECKED: *h*
 DATE: 5/11/08
 DATE: 2/2/09

Excavation				Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0		TP30-01 0.05-0.40 m PID=0 Jar, SB		SC	Clayey SAND, fine to coarse grained, dark brown, low plasticity fines.				Inferred topsoil, wheat.
			0.40		TP30-02 0.40-0.60 m PID=0 Jar, SB, LB		CL	Sandy CLAY, low plasticity, orange/ brown, fine to coarse grained sand, trace of gravel.				Cemented zones up to 400mm in size.
			0.5									Inferred calcareous.
			1.0		TP30-03 0.70-1.00 m PID=0 SB							
			1.20									
			1.5									
			2.0		TP30-04 1.70-2.00 m PID=0 Jar, SB, LB							
			2.0		TEST PIT DISCONTINUED @ 2.00 m GROUNDWATER NOT ENCOUNTERED							
			2.5									

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REPORT OF TEST PIT: TP31

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 611980.0 m E 6210951.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 1.10 m
 BUCKET TYPE: 600mm Toothed

SHEET: 1 OF 1
 MACHINE: JCB BACKHOE
 CONTRACTOR:
 LOGGED: AJB
 CHECKED: *h*
 DATE: 6/11/08
 DATE: 2/2/09

Excavation				Sampling			Field Material Description				
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	L-M		0.0	TP31-01 0.00-0.10 m		SC	Clayey SAND, fine to medium grained, dark brown, low plasticity fines.	D-M			Inferred topsoil, grass at surface.
			0.15	PP 0.15 m =260 - =320 kPa TP31-02 0.20-0.50 m		SC	Clayey Gravelly SAND, fine to coarse grained, brown mottled pale brown, fine to coarse gravel, medium plasticity fines.				Cemented zones up to 100mm in size. Calcareous inclusions.
			0.50	TP31-03 0.70-1.00 m		SC	Approximately 60% GRAVEL and COBBLES, inferred calccrete or grey gravel and cobbles up to 200mm in size, in a matrix of Clayey SAND, fine to coarse grained, brown mottled pale brown, medium plasticity fines.				Zones of inferred weathered rock observed.
			1.0	TP31-04 1.00-1.10 m							
			1.5	TEST PIT DISCONTINUED @ 1.10 m GROUNDWATER NOT ENCOUNTERED PRACTICAL REFUSAL @ 1.10m							
			2.0								
			2.5								

GAP 8_02.LIB.GLB Log GAP NON-CORED FULL PAGE 087661006 - CENTREX SHEEP HILL GPJ <DrawingFile> 30/01/2009 16:00 8.1.025

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



REPORT OF TEST PIT: TP32

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 611434.0 m E 6210945.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 1.60 m
 BUCKET TYPE: 600mm Toothed

SHEET: 1 OF 1
 MACHINE: JCB BACKHOE
 CONTRACTOR:
 LOGGED: AJB
 CHECKED: *th*
 DATE: 6/11/08
 DATE: 2/2/09

Excavation			Sampling			Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
L-M			0.0		TP32-01 0.00-0.10 m PID=0 Jar, SB		SC	Clayey SAND, fine to coarse grained, dark brown, low plasticity fines.				Inferred topsoil.
			0.10		TP32-02 0.10-0.30 m PID=0 Duplicates: TP32-102, TP32-202 Jar, 2 x SB		SC	As above, orange/ brown, trace of fine to coarse gravel.			Cemented zones up to 100mm in size. Gravel is inferred quartz.	
			0.30		PP 0.30 m >500 kPa		CH	Gravelly Sandy CLAY, high plasticity, red/ brown, fine to coarse gravel, fine to coarse sand.			Calcareous.	
			0.50		TP32-03 0.50-0.80 m PID=0 Jar, SB, LB		SC	Approximately 30% COBBLES, grey mottled pale red, inferred sandstone up to 200mm in size, in a matrix of Gravelly Clayey SAND, fine to coarse grained, orange / brown, high plasticity fines, fine to medium gravel.				
M			1.0		TP32-04 1.20-1.40 m PID=0 Jar, SB		CH	Approximately 80% GRAVEL, COBBLES and BOULDERS up to 300mm in size, grey mottled pale red inferred sandstone in a matrix of Sandy CLAY, high plasticity, brown, fine to coarse sand.				
			1.5									
BH								TEST PIT DISCONTINUED @ 1.60 m GROUNDWATER NOT ENCOUNTERED PRACTICAL REFUSAL @ 1.60m				
			2.0									
			2.5									

GAP_02.LIB.GLB_Log_GAP_NON-CORED FULL PAGE_087661006 - CENTREX SHEEP HILL.GPJ <<DrawingFile>> 30/01/2009 16:01 8.1.025

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REPORT OF BOREHOLE: BH01

SHEET: 1 OF 3
 DRILL RIG: SONIC
 CONTRACTOR: BOART LONGYEAR
 LOGGED: MH DATE: 23/10/08
 CHECKED: *h* DATE: 30/1/09

CLIENT: CENTREX COORDS: 616712.0 m E 6209958.0 m N MGA94 53
 PROJECT: SHEEP HILL PORT INVESTIGATION SURFACE RL: 8.70 m DATUM: AHD
 LOCATION: SHEEP HILL INCLINATION: -90°
 JOB NO: 087661006 HOLE DIA: 150 mm HOLE DEPTH: 13.50 m

Drilling			Sampling			Field Material Description				
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
Sonic			0	8.70 0.20	BH01-01 DS 0.00-0.20 m 0A 0.00 m PID = 0.4 ppm		SC	Clayey SAND, fine to coarse grained, brown, low plasticity fines, trace of fine to coarse grained gravel.		Trace of gravel up to 10mm in size.
			0.40	8.50	BH01-02 DS 0.40-0.50 m 0A 0.40 m PID = 0.2 ppm		SC	Clayey SAND, fine to coarse grained, pale brown/ white, low plasticity fines, trace of fine to coarse gravel.		Recovered as extremely weathered rock, fine to coarse granite and quartz gravel up to 70mm in size. Mica flecks in a matrix of Clayey Sand.
			1.50	7.20	BH01-03 DS 1.50-1.80 m 0A 1.50 m PID = 0.1 ppm		SM	Silty SAND, fine to coarse grained, white, low plasticity fines.		Quartz gravel up to 70mm in size.
			2.00	1.90	BH01-04 DS 1.90-2.00 m 0A 1.90 m PID = 0.1 ppm		SC	Clayey SAND, fine to coarse grained, pale brown/ white, low plasticity fines, trace of fine to coarse gravel. For Continuation Refer to Sheet 2		Recovered as extremely weathered rock, fine to coarse granite and quartz gravel up to 70mm in size. Mica flecks in a matrix of Clayey Sand.
			3							
			4							
			5							
			6							
			7							
			8							
			9							
			10							

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GAP 8_02.LIB.GLB Log_GAP_NON-CORED FULL PAGE 087661006 - CENTREX SHEEP HILL GP1 <<DrawingFile>> 30/01/2009 12:41 8.1.011



REPORT OF BOREHOLE: BH01

SHEET: 2 OF 3

CLIENT: CENTREX COORDS: 616712,0 m E 6209958,0 m N MGA94 53
 PROJECT: SHEEP HILL PORT INVESTIGATION SURFACE RL: 8.70 m DATUM: AHD
 LOCATION: SHEEP HILL INCLINATION: -90°
 JOB NO: 087661006 HOLE DIA: 150 mm HOLE DEPTH: 13.50 m

DRILL RIG: SONIC
 CONTRACTOR: BOART LONGYEAR
 LOGGED: MH DATE: 23/10/08
 CHECKED: *h* DATE: 30/1/09

Drilling					Field Material Description			Defect Information				
METHOD	WATER	TCR	ROD (SCR)	RECOVERED	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH Is ₅₀ MPa	DEFECT DESCRIPTION & Additional Observations	AVERAGE DEFECT SPACING (mm)
												10
					0	2.00 6.70		Continuation of Sheet 1				
					1							
					2			GRANITE, fine to coarse grained, layered, pale grey, white quartzite inclusions (up to 100mm) and veins of Mica Schist, some orange staining.	DW		2.00-7.60: Inferred drill breaks approx. every 100mm, 2.0 to 7.6m.	
					3							
					4						4.00-4.50: Recovered as subangular gravel, inferred highly fractured zone.	
					5							
					6							
					7							
					8	7.60 1.10 8.00 0.70		Gravelly SAND, pale brown, Quartz inclusions up to 5mm. Inferred RS/EW GRANITE	RS			
					9	8.60 0.10		GRANITE, fine to coarse grained, layered pale grey, white, quartzite inclusions up to 100mm and veins of mica schist, with some orange staining.	DW		8.00-8.60: Inferred drill breaks approx. every 100mm.	
					9			SCHIST, fine to coarse grained, layered, dark grey, occasional quartzite veins up to 5mm, trace of orange staining.	SW		8.60-9.00: X, 50-55°, St, Sm, Cn 9.00-10.00: J, 90°, St, Sm, Cn	
					10							

GAP 8.02 LIB G/LB Log GAP CORED BOREHOLE 087661006 - CENTREX SHEEP HILL.gpj <<DrawingFile>> 30/01/2009 12:32 8.1 011

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REPORT OF BOREHOLE: BH01

SHEET: 3 OF 3
 DRILL RIG: SONIC
 CONTRACTOR: BOART LONGYEAR
 LOGGED: MH DATE: 23/10/08
 CHECKED: *th* DATE: 20/11/09

CLIENT: CENTREX COORDS: 616712.0 m E 6209958.0 m N MGA94 53
 PROJECT: SHEEP HILL PORT INVESTIGATION SURFACE RL: 8.70 m DATUM: AHD
 LOCATION: SHEEP HILL INCLINATION: -90°
 JOB NO: 087661006 HOLE DIA: 150 mm HOLE DEPTH: 13.50 m

Drilling					Field Material Description					Defect Information				
METHOD	WATER	TCR	ROD (SOR)	RECOVERED	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH Is(50) MPa	DEFECT DESCRIPTION & Additional Observations		AVERAGE DEFECT SPACING (mm)	
Sonic			85		10			SCHIST, fine to coarse grained, layered, dark grey, occasional quartzite veins up to 5mm, trace of orange staining.	SW					
					11						10.60-10.80: X, 50-55°, St, Sm, Cn			
			60		12						11.00-11.50: J, 50-55°, Pl, Sm, Sn			
					13						12.00-12.40: J, 50-55°, Pl, Sm, Sn			
					13.50	-4.80		END OF BOREHOLE @ 13.50 m TARGET DEPTH STANDPIPE INSTALLED						
					14									
					15									
					16									
					17									
					18									
					19									
					20									

GAP_E_02_LIB_GLB_Log_GAP_CORED_BOREHOLE_087661006 - CENTREX_SHEEP_HILL.GPJ <<DrawingFile>> 30/01/2009 12:32 8.1.011



REPORT OF BOREHOLE: BH02

SHEET: 1 OF 3

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 616476,0 m E 6209979,0 m N MGA94 53
 SURFACE RL: 8,91 m DATUM: AHD
 INCLINATION: -90°
 HOLE DIA: 150 mm HOLE DEPTH: 13,00 m

DRILL RIG: SONIC
 CONTRACTOR: BOART LONGYEAR
 LOGGED: MH DATE: 23/10/08
 CHECKED: *lh* DATE: 30/1/09

Drilling				Sampling			Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
Sonic			0	0.10	BH02-01 DS		SC	Clayey SAND, fine to medium grained, brown, low plasticity fines, trace of Gravel.				Gravel up to 10mm in size.
			8.81	0.00-0.10 m 0A 0.00 m PID = 0 ppm			SC	Clayey SAND, fine to coarse grained, pale brown, low plasticity fines, trace of fine to coarse Gravel.				Inferred extremely weathered rock, schist gravel up to 10mm in size and quartz gravel up to 15mm in size.
			1	0.80	BH02-02 DS		SM	Gravelly Silty SAND, fine to coarse grained, grey/ green, fine to coarse Gravel, low plasticity fines.				Inferred extremely weathered rock, quartz & granite gravel up to 40mm in size.
		8.11	0.40-0.70 m 0A 0.40 m PID = 0 ppm									
			2		BH02-03 DS							
					0.90-1.20 m 0A 0.90 m PID = 0 ppm							
								For Continuation Refer to Sheet 2				
			3									
			4									
			5									
			6									
			7									
			8									
			9									
			10									

GAP_B_02_LIB_GLB_Log_GAP_NON-CORED_FULL_PAGE_087661006 - CENTREX SHEEP HILL.GPJ <<DrawingFile>> 30/01/2009 12:41 8.1.011

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GAP gINT FN. F01a
RL3



REPORT OF BOREHOLE: BH02

CLIENT: CENTREX COORDS: 616476,0 m E 6209979,0 m N MGA94 53 SHEET: 2 OF 3
 PROJECT: SHEEP HILL PORT INVESTIGATION SURFACE RL: 8,91 m DATUM: AHD DRILL RIG: SONIC
 LOCATION: SHEEP HILL INCLINATION: -90° CONTRACTOR: BOART LONGYEAR
 JOB NO: 087661006 HOLE DIA: 150 mm HOLE DEPTH: 13,00 m LOGGED: MH DATE: 23/10/08
 CHECKED: JL DATE: 30/11/09

Drilling						Field Material Description				Defect Information		
METHOD	WATER	TCR	ROD (SCR)	RECOVERED	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH Is,001 MPa	DEFECT DESCRIPTION & Additional Observations	AVERAGE DEFECT SPACING (mm)
					0							
					1							
					2	2.00 6.91		Continuation of Sheet 1				
					3		+	GRANITE, fine to coarse grained, layered, pale grey, white, gravel-sized quartzite inclusions, veins of mica schist, some orange staining.	DW		2.00-4.10: Recovered as subangular Gravel and Cobbles up to 100mm in size, inferred, highly fractured zone.	
				4		+						
				5		+						
				6		+						
				7		+						
				8		+						
				9		+						
				10		+						

GAP 8 02 LIBGLB Log GAP CORED BOREHOLE 087661006 - CENTREX-SHEEP HILL.GPJ <<DrawingFile>> 30/01/2009 12:32 8.1.011
 Sonic

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GAP gINT FN. F02a
 RL3



REPORT OF BOREHOLE: BH02

SHEET: 3 OF 3
 DRILL RIG: SONIC
 CONTRACTOR: BOART LONGYEAR
 LOGGED: MH DATE: 23/10/08
 CHECKED: H DATE: 30/1/09

CLIENT: CENTREX COORDS: 616476.0 m E 6209979.0 m N MGA94 53
 PROJECT: SHEEP HILL PORT INVESTIGATION SURFACE RL: 8.91 m DATUM: AHD
 LOCATION: SHEEP HILL INCLINATION: -90°
 JOB NO: 087661006 HOLE DIA: 150 mm HOLE DEPTH: 13.00 m

Drilling					Field Material Description					Defect Information		
METHOD	WATER	TOR	ROD (SCR)	RECOVERED	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH Is ₅₀ MPa	DEFECT DESCRIPTION & Additional Observations	AVERAGE DEFECT SPACING (mm)
Sonic			33		10							
					10.50							
					-1.69			SCHIST, fine to coarse grained, layered, dark grey.				
					11			GRANITE, fine to coarse grained, layered, pale grey, white, gravel-sized quartzite inclusions, veins of mica schist, some orange staining.			11.20-11.40: J, 50-55°, St, Sm, Cn 11.40-12.00: Recovered as subangular Gravel and Cobbles up to 100mm in size, possible inferred, highly fractured zone.	
			100		12						12.60-13.00: Mica content increasing with depth.	
					13	13.00		END OF BOREHOLE @ 13.00 m TARGET DEPTH STANDPIPE INSTALLED				
					-4.09							
					14							
					15							
					16							
					17							
					18							
					19							
				20								

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GAP_8_02.LIB.GLB Log GAP CORED BOREHOLE 087661006 - CENTREX SHEEP HILL.GPJ <<DrawingFile>> 30/01/2009 12:32 8 1 011



REPORT OF BOREHOLE: BH03

SHEET: 1 OF 3

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 616334.0 m E 6209804.0 m N MGA94 53
 SURFACE RL: 8.05 m DATUM: AHD
 INCLINATION: -90°
 HOLE DIA: 150 mm HOLE DEPTH: 10.30 m

DRILL RIG: SONIC
 CONTRACTOR: BOART LONGYEAR
 LOGGED: MH DATE: 24/10/08
 CHECKED: *h* DATE: 20/1/09

Drilling				Sampling	Field Material Description									
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS		
Sonic			0	8.05	SPT 0.00-0.45 m		SC	Clayey SAND, fine to coarse grained, brown, low plasticity fines, trace of gravel up to 5mm in size.						
			0.20	7.85	N=29 BH03-01 DS 0.00-0.20 m 0A 0.00 m PID = 0 ppm			SC	Clayey SAND, fine to coarse grained, red brown, low plasticity fines.					
			1		BH03-02 DS 0.40-0.60 m 0A 0.40 m PID = 0 ppm									
			2	1.90	BH03-03 DS 1.40-1.50 m 0A 1.40 m PID = 0 ppm			CH	Sandy CLAY, high plasticity, red brown, fine to coarse sand.					
			3	6.15	SPT 2.00-2.30 m 23, 15/150mm HB N>15 BH03-04 DS 2.00-2.20 m 0A 2.00 m PID = 0 ppm									
			4	4.00				SP	Gravelly SAND, fine to coarse grained, pale brown, fine to coarse Gravel, trace of low plasticity fines.					Inferred extremely weathered granite with Mica flecks, trace of quartz gravel up to 40mm in size.
			4	4.05										
			5											
			6											
			7											
		7						For Continuation Refer to Sheet 2						
		8												
		9												
		10												

GAP 8_02 LUB GLB Log GAP NON-CORED FULL PAGE 087661006 - CENTREX SHEEP HILL GPJ <<DrawingFile>> 30/01/2009 12:41 & 1.011

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REPORT OF BOREHOLE: BH03

SHEET: 2 OF 3

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 616334.0 m E 6209804.0 m N MGA94 53
 SURFACE RL: 8.05 m DATUM: AHD
 INCLINATION: -90°
 HOLE DIA: 150 mm HOLE DEPTH: 10.30 m

DRILL RIG: SONIC
 CONTRACTOR: BOART LONGYEAR
 LOGGED: MH DATE: 24/10/08
 CHECKED: *jh* DATE: 20/1/09

Drilling						Field Material Description						Defect Information			
METHOD	WATER	TCR	ROD (SCR)	RECOVERED	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH I_s (MPa)	DEFECT DESCRIPTION & Additional Observations		AVERAGE DEFECT SPACING (mm)		
					0										
					1										
					2										
					3										
					4										
					5										
					6										
					7	7.00 1.05	+	Continuation of Sheet 1							
			100				+	GRANITE, fine to coarse grained, layered, pale grey, white, gravel-sized quartzite inclusions, veins of mica schist, some orange staining.	DW			7.00-8.00: Recovered as subangular Gravel and Cobbles up to 100mm in size, inferred, highly fractured zone.			
					8	8.00 0.05	+	Inferred extremely low to high strength, 8.0 to 10.3 m.	EW - DW			8.00-10.30: Poor recovery, inferred highly fractured zone. Inferred extremely low to high strength.			
			20		9		+								
					10		+								

GAP & 02.LIB.GLB Log GAP CORED BOREHOLE 087661006 - CENTREX SHEEP HILL GPJ <<DrawingFile>> 30/01/2009 12:32 & 1.011



REPORT OF BOREHOLE: BH03

SHEET: 3 OF 3

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 616334.0 m E 6209804.0 m N MGA94 53
 SURFACE RL: 8.05 m DATUM: AHD
 INCLINATION: -90°
 HOLE DIA: 150 mm HOLE DEPTH: 10.30 m

DRILL RIG: SONIC
 CONTRACTOR: BOART LONGYEAR
 LOGGED: MH DATE: 24/10/08
 CHECKED: *h* DATE: 20/1/09

Drilling					Field Material Description					Defect Information			
METHOD	WATER	TCR	ROD (SCR)	RECOVERED	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $I_{s(0)}$ MPa	DEFECT DESCRIPTION & Additional Observations		AVERAGE DEFECT SPACING (mm)
					10		+ +						
		20				10.30	+ +	END OF BOREHOLE @ 10,30 m TARGET DEPTH STANDPIPE INSTALLED					
						-2.25							
					11								
					12								
					13								
					14								
					15								
					16								
					17								
					18								
					19								
					20								

GAP 8_02 LUB.GLB Log GAP CORED BOREHOLE 087661006 - CENTREX SHEEP HILL GPJ <<DrawingFile>> 30/01/2009 12:32 & 1:011

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GAP gINT FN. F02a
RL3



REPORT OF BOREHOLE: BH04

SHEET: 1 OF 3

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 616329.0 m E 6209601.0 m N MGA94 53
 SURFACE RL: 17.30 m DATUM: AHD
 INCLINATION: -90°
 HOLE DIA: 150 mm HOLE DEPTH: 18.00 m

DRILL RIG: SONIC
 CONTRACTOR: BOART LONGYEAR
 LOGGED: MH DATE: 26/10/08
 CHECKED: *fl* DATE: 30/1/09

Drilling			Sampling		Field Material Description							
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
Sonic			0	17.30	SPT 0.00-0.45 m 11, 14, 33 N=47		SC	Clayey SAND, fine to coarse grained, pale brown, low plasticity fines, with Gravel.				Gravel up to 75mm in size.
			0.50	16.80	BH04-01 0.00-0.20 m 0A 0.00 m PID = 0 ppm		SM	Silly SAND, fine to coarse grained, grey/ green, with gravel.				Inferred extremely weathered micaceous schist, quartz & granite gravel up to 50mm in size.
			1		BH04-02 0.50-0.80 m 0A 0.50 m PID = 0 ppm							
			2		BH04-03 1.50-1.60 m 0A 1.50 m PID = 0 ppm							
								For Continuation Refer to Sheet 2				
			3									
			4									
			5									
			6									
			7									
			8									
			9									
			10									

GAP 8 02 LIB GLB Log GAP NON-CORED FULL PAGE 087661006 - CENTREX SHEEP HILL.GPJ <<DrawingFile>> 30/01/2009 12:41 8.1.011

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GAP gINT FN, F01a
RL3



REPORT OF BOREHOLE: BH04

SHEET: 2 OF 3

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 616329.0 m E 6209601.0 m N MGA94 53
 SURFACE RL: 17.30 m DATUM: AHD
 INCLINATION: -90°
 HOLE DIA: 150 mm HOLE DEPTH: 18.00 m

DRILL RIG: SONIC
 CONTRACTOR: BOART LONGYEAR
 LOGGED: MH
 CHECKED: *th*
 DATE: 26/10/08
 DATE: 20/1/09

Drilling						Field Material Description				Defect Information		
METHOD	WATER	TCR	RQD (SCR)	RECOVERED	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH Is(50) MPa	DEFECT DESCRIPTION & Additional Observations	AVERAGE DEFECT SPACING (mm)
					0							
					1							
					2	2.00 15.30		Continuation of Sheet 1 SCHIST, fine to coarse grained, layered, dark grey, occasional quartzite inclusions, some veins, trace of orange staining.	SW		2.00-2.40: Recovered as subangular Gravel and Cobbles, possible drill breaks or highly fractured rock. 2.40-2.60: J, 85-90°, St, Sm, Cn 2.60-3.60: Recovered as subangular Gravel and Cobbles, possible drill breaks or fractures.	
		100			3						3.60-3.80: J, 55-60°, St, Sm, Cn 3.80-4.00: J, 55-60°, St, Sm, Cn	
					4						4.00-4.10: X, 90°, St, Sm, Cn 4.10-4.20: X, 90°, St, Sm, Sn 4.20-4.40: X, 90°, St, Sm, Sn	
					5	4.50 12.80		GRANITE, fine to coarse grained, layered, pale grey, pink, white, quartzite inclusions, veins of micaceous schist, some orange staining.	DW		4.50-5.20: Recovered as subangular Gravel and Cobbles, possible drill breaks or highly fractured rock.	
		100			6						5.20-5.60: Inferred drill breaks every 50mm, 5.2m to 5.6m. 5.60-5.80: J, 55-60°, St, Ro, Cn 5.80-6.10: Inferred drill breaks every 50mm, 5.8m to 6.1m.	
		60			7						6.10-6.50: Recovered as subangular Gravels and Cobbles, inferred fractured zone. 6.50-6.80: J, 50°, St, Ro, Cn 6.80-7.50: Inferred drill breaks, or highly fractured zone.	
					8						7.50-7.60: J, 55-60°, St, Ro, Cn 7.60-7.80: J, 55-60°, St, Ro, Cn 7.80-8.00: Recovered as subangular Gravel and Cobbles. 8.00-8.20: J, 55-60°, St, Ro, Cn	
		100			9						8.50-9.00: J, 50-55°, St, Ro, Cn 9.00-9.90: Recovered as subangular Gravel and Cobbles, inferred drill break or highly fractured zone.	
					10						9.90-10.30: J, 50-55°, St, Ro, Cn	

GAP & DZ LIB.GLB Log GAP CORED BOREHOLE 087661006 - CENTREX SHEEP HILL.GPJ <<DrawingFile>> 30/01/2009 12:22 & 1.011

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REPORT OF BOREHOLE: BH04

CLIENT: CENTREX
PROJECT: SHEEP HILL PORT INVESTIGATION
LOCATION: SHEEP HILL
JOB NO: 087661006

COORDS: 616329.0 m E 6209601.0 m N MGA94 53
SURFACE RL: 17.30 m **DATUM:** AHD
INCLINATION: -90°
HOLE DIA: 150 mm **HOLE DEPTH:** 18.00 m

SHEET: 3 OF 3
DRILL RIG: SONIC
CONTRACTOR: BOART LONGYEAR
LOGGED: MH **DATE:** 26/10/08
CHECKED: *h* **DATE:** 31/1/09

Drilling					Field Material Description				Defect Information					
METHOD	WATER	TCR	RQD (SCR)	RECOVERED	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH Is (50) MPa	DEFECT DESCRIPTION & Additional Observations	AVERAGE DEFECT SPACING (mm)		
												10 30 100 300 1000 3000		
Sonic			100		10			GRANITE, fine to coarse grained, layered, pale grey, pink, white, quartzite inclusions, veins of micaceous schist, some orange staining.	DW		10,30-10,50: X, 90°, St, Ro, Cn 10,50-10,70: X, 90°, St, Ro, Cn 10,70-11,00: X, 90°, St, Ro, Sn 11,00-12,00: Recovered as subangular Gravel and Cobbles, possible drill breaks. 12,00-12,10: J, 50-55°, St, Ro, Cn 12,30-13,80: Inferred drill breaks, or highly fractured zone. 13,80-14,00: X, 90°, St, Sm, Sn 14,00-14,20: J, 55°, St, Ro, Cn 14,40-14,40: X, 90°, St, Sm, Cn 14,40-14,50: X, 90°, St, Sm, Cn 14,50-14,80: X, 90°, St, Sm, Cn 15,00-15,20: X, 90°, St, Sm, Cn 15,50-16,50: Drill breaks and possible subhorizontal joints approx. 50mm spacings. 16,60-16,80: X, 90°, Un, Ro, Cn 17,20-17,30: X, 85°, Un, Ro, Ct 17,50-17,80: Extently weathered micacious schist in a sandy zone with trace of low plasticity fines, trace of quarts gravel. 17,80-18,00: J, 50-55°, St, Ro, Cn			
			100		11									
						12								
						13								
						14		14.00 3.30		SCHIST, fine to coarse grained, layered dark grey, occasional quartzite inclusions, some trace of orange staining.				
						15		15.00 2.30		GRANITE, fine to coarse grained, layered pale grey, pink, white, quartzite inclusions, veins of micaceous schist, patches of orange staining.				
						16								
						17								
						18		18.00 -0.70		END OF BOREHOLE @ 18.00 m TARGET DEPTH STANDPIPE INSTALLED	EW DW			
						19								
					20									

GAP 8_02 LIB 61B Log GAP CORED BOREHOLE 087661006 - CENTREX SHEEP HILL GPJ <<DrawingFile>> 30/01/2009 12:32 8:1,011

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REPORT OF BOREHOLE: BH05

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 616497,0 m E 6209493,0 m N MGA94 53
 SURFACE RL: 14,62 m DATUM: AHD
 INCLINATION: -90°
 HOLE DIA: 150 mm HOLE DEPTH: 15,00 m

SHEET: 1 OF 3
 DRILL RIG: SONIC
 CONTRACTOR: BOART LONGYEAR
 LOGGED: MH DATE: 28/10/08
 CHECKED: *H* DATE: 30/1/09

Drilling			Sampling		Field Material Description								
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
Sonic			0	14.62	SPT 0.00-0.45 m 6, 13, 25 N=38			SC	Clayey SAND, fine to coarse grained, brown, low plasticity fines, with subangular gravel up to 15 mm in size. Silty SAND, fine to coarse grained, grey/ green, with gravel.				Inferred extremely weathered micaceous schist, quartz & granite gravel up to 30mm in size.
			0	0.20	BH05-01 0.00-0.20 m 0A 0.00 m PID = 0 ppm			SM					
			1	14.42	BH05-02 0.40-0.60 m 0A 0.40 m PID = 0 ppm				For Continuation Refer to Sheet 2				
			2		BH-05-03 0.80-1.00 m 0A 0.80 m PID = 0 ppm								
			3										
			4										
			5										
			6										
			7										
			8										
			9										
			10										

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REPORT OF BOREHOLE: BH05

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 616497,0 m E 6209493,0 m N MGA94 53
 SURFACE RL: 14.62 m DATUM: AHD
 INCLINATION: -90°
 HOLE DIA: 150 mm HOLE DEPTH: 15,00 m

SHEET: 2 OF 3
 DRILL RIG: SONIC
 CONTRACTOR: BOART LONGYEAR
 LOGGED: MH
 CHECKED: *HL*
 DATE: 28/10/08
 DATE: 30/1/09

Drilling					Field Material Description				Defect Information			
METHOD	WATER	TCR	ROD (SCR)	RECOVERED	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $I_{s(9)}$ MPa	DEFECT DESCRIPTION & Additional Observations	AVERAGE DEFECT SPACING (mm)
					0							
					1.00	13.62		Continuation of Sheet 1				
								SCHIST, fine to coarse grained, layered dark grey, occasional quartzite inclusions up to 50mm, quartzite veins up to 5mm width, trace of granite inclusions.	DW		1.00-1.20: X, 85-90°, St, Sm, Sn, Inferred drill breaks every every 200mm, 1.0m and 3.0m at breaks subangular Gravel and Cobbles up to 100mm recovered.	
		100			2						2.30-2.40: X, 85-90°, St, Sm, Sn	
					3						2.50-2.60: X, 85-90°, St, Sm, Sn	
					4						2.90-3.00: X, 85-90°, St, Sm, Sn	
					5						3.40-3.50: X, 85-90°, St, Sm, Sn	
		100			6	6.00		SCHIST, fine to coarse grained, layered, dark grey, occasional quartzite inclusions, quartzite veins up to 5mm width.			3.80: Possible joint or drill break, 3.80-4.00: X, 80-85°, St, Sm, Sn 4.00: Inferred drill break.	
					7	8.62					4.60: Inferred drill break. 4.60-4.70: X, 80-85°, St, Sm, Cn	
					8						5.00-5.30: X, 80-85°, St, Sm, Cn	
					9						5.30-5.40: J, 90°, St, Sm, Cn 5.40-5.50: Inferred drill break. 5.50-6.00: X, 85-90°, St, Sm, Cn	
		100			10						6.00: Inferred drill break. 6.00-6.30: X, 85-90°, St, Sm, Cn 6.30: Inferred drill break.	
											6.60: Inferred drill break. 6.70-7.00: X, 70-75°, St, Sm, Sn	
											7.00-7.30: X, 70-75°, St, Sm, Sn	
											7.60-7.80: X, 90°, St, Sm, Cn	
											7.80-7.90: Inferred drill breaks.	
											8.00-8.30: X, 70-75°, St, Sm, Cn	
											8.30-8.40: X, 65-70°, St, Sm, Ct 8.40-8.60: Inferred drill breaks.	
											8.70-9.00: X, 90°, St, Sm, Ct	
											9.00-10.00: X, 90°, St, Sm, Ct	

GAP & 02.LIB.GLB Log GARD COURED BOREHOLE 087661006 - CENTREX-SHEEP HILL.GPJ <<DrawingFile>> 30/01/2009 12:32 8.1.011

Sonic

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REPORT OF BOREHOLE: BH05

CLIENT: CENTREX COORDS: 616497,0 m E 6209493,0 m N MGA94 53 SHEET: 3 OF 3
 PROJECT: SHEEP HILL PORT INVESTIGATION SURFACE RL: 14,62 m DATUM: AHD DRILL RIG: SONIC
 LOCATION: SHEEP HILL INCLINATION: -90° CONTRACTOR: BOART LONGYEAR
 JOB NO: 087661006 HOLE DIA: 150 mm HOLE DEPTH: 15,00 m LOGGED: MH DATE: 28/10/08
 CHECKED: FL DATE: 30/11/09

Drilling					Field Material Description				Defect Information			
METHOD	WATER	TCR	ROD (SCR)	RECOVERED	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH I_s (20) MPa	DEFECT DESCRIPTION & Additional Observations	AVERAGE DEFECT SPACING (mm)
Sonic					10			SCHIST, fine to coarse grained, layered, dark grey, occasional quartzite inclusions, quartzite veins up to 5mm width.	DW		10.00-10.40: X, 90°, St, Sm, Ct 10.40-10.50: Inferred drill break. 10.90-11.00: Inferred drill breaks, 10.9m to 11.0m, subangular Gravel and Cobbles. 11.00-11.30: X, 90°, St, Sm, Cn 11.30: Inferred drill break at 11.3m. 11.30-12.00: X, 90°, St, Sm, Ct 12.00-13.00: X, 85°, St, Sm, Ct 13.10-13.20: Inferred drill breaks. 13.20-13.80: J, 50-55°, St, Sm, Ct 13.90: Inferred drill break. 14.30: Inferred drill break. 14.50: Inferred drill break. 14.80: Inferred drill break.	
		100			11							
					12							
		100			13							
					14							
					15	15.00 -0.38		END OF BOREHOLE @ 15.00 m TARGET DEPTH STANDPIPE INSTALLED				
					16							
					17							
					18							
					19							
					20							

GAP 8_02 LUB.GLB Log GAP CORED BOREHOLE 087661006 - CENTREX SHEEP HILL.GPJ <<DrawingFile>> 30/01/2009 12:32 & 1:011

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GAP gINT FN. F02a
RL3



REPORT OF BOREHOLE: BH06

CLIENT: CENTREX COORDS: 616584.0 m E 6209704.0 m N MGA94 53
 PROJECT: SHEEP HILL PORT INVESTIGATION SURFACE RL: 20.54 m DATUM: AHD
 LOCATION: SHEEP HILL INCLINATION: -90°
 JOB NO: 087661006 HOLE DIA: 150 mm HOLE DEPTH: 21.50 m

SHEET: 1 OF 4
 DRILL RIG: SONIC
 CONTRACTOR: BOART LONGYEAR
 LOGGED: MH DATE: 21/10/08
 CHECKED: *th* DATE: 30/1/09

Drilling			Sampling	Field Material Description				
METHOD	PENETRATION RESISTANCE	DEPTH (metres)	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
		0	BH06-01 0.00-0.10 m 0A PID = 0 ppm		SC	Clayey SAND, fine to medium grained, brown, low plasticity fines, trace of Gravel up to 10 mm in size.		Inferred extremely weathered rock, fine to coarse granite & quartz gravel in a matrix of clayey sand with mica flecks.
		0.30 20.34	0.00 m PID = 0 ppm		SP	SAND, fine to medium grained, pale brown, trace of low plasticity fines.		
		0.70	BH06-02 0.30-0.50 m 0A PID = 0 ppm		GP	Clayey Gravelly SAND, fine to coarse grained, pale brown, fine to coarse Gravel, low plasticity fines.		
		19.84 0.90 19.64	0.30 m PID = 0 ppm		SM	Sandy GRAVEL, fine to coarse grained, pale brown, fine to coarse Sand, trace cobbles up to 80 mm. Granite & quartz gravel, mica flecks. Silty SAND, fine to coarse grained, grey/green, with granite & quartz gravel up to 30 mm.		Inferred extremely weathered micaceous schist.
		2.90 3.00	BH06-03 0.80-0.90 m 0A PID = 0 ppm		SC	Clayey Gravelly SAND, fine to coarse grained, brown, low plasticity fines, fine to coarse granite & quartz Gravel.		
		17.54			GP	Clayey Gravelly SAND, fine to coarse grained, pale brown, low plasticity fines, fine to coarse granite & quartz Gravel.		Inferred extremely weathered gneiss / granite.
		3.50 17.04			SC	Clayey Gravelly SAND, fine to coarse grained, brown, low plasticity fines, fine to coarse granite & quartz Gravel.		
		4.10 16.44			SC-SM	Clayey Silty SAND, fine to coarse grained, pale brown, low plasticity fines, with fine to coarse granite & quartz Gravel and Cobbles up to 70 mm. Mica flecks.		
		5.00 15.54			SC	Clayey SAND, fine to coarse grained, pale brown, low plasticity fines, with fine to coarse granite & quartz Gravel and Cobbles up to 80 mm. Mica flecks.	D	
		5.50 15.04			SM	Gravelly Silty SAND, fine to coarse grained, grey/green, fine to coarse granite & quartz Gravel and Cobbles up to 90 mm.		Inferred extremely weathered micaceous schist.
		9.50 11.04			CL	Sandy CLAY, low to medium plasticity, green/brown, fine to coarse Sand, with Gravel.		
		10						

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REPORT OF BOREHOLE: BH06

SHEET: 2 OF 4

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 616584,0 m E 6209704,0 m N MGA94 53
 SURFACE RL: 20,54 m DATUM: AHD
 INCLINATION: -90°
 HOLE DIA: 150 mm HOLE DEPTH: 21,50 m

DRILL RIG: SONIC
 CONTRACTOR: BOART LONGYEAR
 LOGGED: MH DATE: 21/10/08
 CHECKED: *h* DATE: 20/1/09

Drilling				Sampling	Field Material Description								
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
Sonic			10					CL	Sandy CLAY, low to medium plasticity, green/ brown, fine to coarse Sand, with Gravel.		D		Inferred extremely weathered micaceous schist.
			11	11.00 9.54				CH	Sandy CLAY, medium to high plasticity, brown, fine to coarse Sand, with gneiss/schist Gravel up to 80mm, trace fine quartz gravel.		M		Inferred extremely weathered gneiss / schist.
			12						For Continuation Refer to Sheet 3				
			13										
			14										
			15										
			16										
			17										
			18										
			19										
			20										

GAP 8.02.LIB.GLB Log GAP NON-CORED FULL PAGE 087661006 - CENTREX SHEEP HILL GPJ <<DrawingFile>> 30/01/2009 12:42 8.1.011

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REPORT OF BOREHOLE: BH06

CLIENT: CENTREX COORDS: 616584.0 m E 6209704.0 m N MGA94 53
 PROJECT: SHEEP HILL PORT INVESTIGATION SURFACE RL: 20.54 m DATUM: AHD
 LOCATION: SHEEP HILL INCLINATION: -90°
 JOB NO: 087661006 HOLE DIA: 150 mm HOLE DEPTH: 21.50 m

SHEET: 3 OF 4
 DRILL RIG: SONIC
 CONTRACTOR: BOART LONGYEAR
 LOGGED: MH DATE: 21/10/08
 CHECKED: *h* DATE: 30/11/09

Drilling					Field Material Description				Defect Information			
METHOD	WATER	TCR	RQD (SCR)	RECOVERED	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH I_s (MPa)	DEFECT DESCRIPTION & Additional Observations	AVERAGE DEFECT SPACING (mm)
									EL _{0.03} V _{0.01} L _{0.3} W ₁ U ₃ U ₁₀ F ₁₀		10 20 30 40 50 60 70 80 90 100	
					10							
					11							
					11.50	9.04		Continuation of Sheet 2				
					12			SCHIST, fine to coarse grained, layered dark grey, occasional quartzite inclusions up to 50mm in size and veins up to 5mm width.	DW		11.50-12.50: Recovered as subangular Gravel and cobbles.	
		30			13						12.50-12.75: X, 90°, St, Sm, Cn	
		55			14				SW		12.75-13.70: Recovered as sub angular Gravels, inferred highly fractured zone.	
		100			15						13.70-14.00: X, 85-90°, Un, Sm, Cn 13.80: Inferred drill break. 13.90: J, 50-55°, Pl, Sm, Cn 14.00-14.60: X, 85-90°, Un, Sm, Sn, Inferred drill break at 14.35m.	
					16	16.00	4.54	SCHIST, fine to coarse grained, layered dark grey, occasional quartzite inclusions and veins, trace of orange staining.			14.60-14.80: X, 80-85°, Un, Sm, Sn, Inferred drill break at 14.8m. 14.80-15.00: X, 85-90°, Pl, Sm, Sn 15.00-15.50: Recovered as subangular Gravel, inferred highly fractured zone.	
		95			17						15.50-15.80: X, 85-90°, Un, Sm, Sn, Inferred drill break at 15.8m.	
					18						16.00-16.40: J, 50-55°, Un, Sm, Sn, Inferred drill break at 16.0m.	
					19						16.50: Inferred drill break. 16.50-17.00: J, 65-70°, Un, Sm, Sn	
					20						17.00-17.50: J, 50-55°, Un, Sm, Sn	
		75									17.50-17.80: J, 45-50°, Un, Sm, Sn, Inferred drill break at 17.8m. 17.80-18.00: X, 75-80°, Pl, Sm, Cn, Possible drill break at 18.00m. 18.00-19.00: Poor recovery	
											19.00-20.00: X, 80-85°, Un, Sm, Cn	

GAP 8_02 LIB GLB Log GAP CORED BOREHOLE_087661006 - CENTREX SHEEP HILL GPJ <<DrawingFiles>>_3001/2009_12_32_8_1.011

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REPORT OF BOREHOLE: BH06

CLIENT: CENTREX COORDS: 616584,0 m E 6209704,0 m N MGA94 53
 PROJECT: SHEEP HILL PORT INVESTIGATION SURFACE RL: 20,54 m DATUM: AHD
 LOCATION: SHEEP HILL INCLINATION: -90°
 JOB NO: 087661006 HOLE DIA: 150 mm HOLE DEPTH: 21,50 m

SHEET: 4 OF 4
 DRILL RIG: SONIC
 CONTRACTOR: BOART LONGYEAR
 LOGGED: MH DATE: 21/10/08
 CHECKED: *h* DATE: 30/1/09

Drilling					Field Material Description				Defect Information			
METHOD	WATER	TCR	ROD (SCR)	RECOVERED	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $I_{s(50)}$ MPa	DEFECT DESCRIPTION & Additional Observations	AVERAGE DEFECT SPACING (mm)
												10 50 100 200 300 1000 3000
Sonic			100		20			SCHIST, fine to coarse grained, layered dark grey, occasional quartzite inclusions and veins, trace of orange staining.	SW		20.00-20.10: Recovered as subangular Gravel and Cobbles, inferred fractured zone. 20.10-20.80: J, 90°, Un, Sm, Cn 20.80-21.00: X, 70-75°, Pl, Sm, Cn 21.00-21.30: X, 70-75°, Pl, Sm, Cn 21.30-21.40: X, 70-75°, Pl, Sm, Cn 21.40-21.50: Recovered as subangular Gravel and Cobbles, inferred fractured zone or multiple drill breaks.	
					21.50	-0.96		END OF BOREHOLE @ 21,50 m TARGET DEPTH STANDPIPE INSTALLED				
					22							
					23							
					24							
					25							
					26							
					27							
					28							
					29							
					30							

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REPORT OF BOREHOLE: BH07

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 616089.0 m E 6210042.0 m N MGA94 53
 SURFACE RL: 7.27 m DATUM: AHD
 INCLINATION: -90°
 HOLE DIA: 150 mm HOLE DEPTH: 11.00 m

SHEET: 1 OF 2
 DRILL RIG: SONIC
 CONTRACTOR: BOART LONGYEAR
 LOGGED: MH
 CHECKED: *h*
 DATE: 29/10/08
 DATE: 30/1/09

Drilling			Sampling		Field Material Description						
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0	7.27	SPT 0.00-0.45 m 4, 8, 10 N=18 BH07-01 0.00-0.20 m 0A 0.00 m PID = 0 ppm		SC	Clayey SAND, fine to coarse grained, pale brown, low plasticity fines, trace of Gravel up to 10 mm.		D	
			1	1.00							
				6.27	BH07-02 1.20-1.40 m 0A 1.20 m PID = 0 ppm		SC	Clayey SAND, fine to coarse grained, pale brown, low plasticity fines, with Gravel up to 10 mm,			
				1.50							
				5.77	BH07-03 1.90-2.00 m 0A 1.90 m PID = 0 ppm SPT 2.00-2.45 m 6, 7, 9 N=16		CL	Sandy CLAY, low plasticity, pale brown, fine to coarse Sand.		VSt-H	
			2	3.00							
				4.27	BH07-04 3.00-3.20 m 0A 3.00 m PID = 0 ppm		SP	SAND, fine to coarse grained, pale brown, with low plasticity fines.		D	
				3.50							
				3.77	PP 3.80 m >600 kPa		CH	Sandy CLAY, high plasticity, pale brown, fine to coarse Sand.		VSt-H	
			4	4.00							
				3.27	BH07-05 4.00-4.20 m 0A 4.00 m PID = 0 ppm		SP	SAND, fine to coarse grained, pale brown, with low plasticity fines.		D	
				4.80							
				2.47	PP 4.80 m =310 kPa		CH	Sandy CLAY, high plasticity, pale brown, fine to coarse Sand.		D	
			5	8.00	SPT 5.00-5.45 m 6, 10, 13 N=23						
					BH07-06 5.80-6.00 m 0A 5.80 m PID = 0 ppm PP 6.00 m =210 kPa						
			6								
					PP 7.50 m =210 kPa					H	
			7								
			8	-0.73	SPT 8.00-8.45 m 10, 19, 25 N=44		CL	Silty sandy CLAY, low plasticity, yellow, fine to coarse Sand, trace of Gravel and Cobbles.			Subangular Gravel and Cobbles up to 100mm in size.
			9								
			10								

GAP & .02 LIB.GLB Log GAP NON-CORED FULL PAGE 087661006 - CENTREX SHEEP HILL.GPJ <<DrawingFile>> 30/01/2009 12:42 & 1.011

Sonic

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REPORT OF BOREHOLE: BH07

SHEET: 2 OF 2
 DRILL RIG: SONIC
 CONTRACTOR: BOART LONGYEAR
 LOGGED: MH DATE: 29/10/08
 CHECKED: *th* DATE: 30/1/09

CLIENT: CENTREX COORDS: 616089.0 m E 6210042.0 m N MGA94 53
 PROJECT: SHEEP HILL PORT INVESTIGATION SURFACE RL: 7.27 m DATUM: AHD
 LOCATION: SHEEP HILL INCLINATION: -90°
 JOB NO: 087661006 HOLE DIA: 150 mm HOLE DEPTH: 11.00 m

Drilling			Sampling		Field Material Description							
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
Sonic			10				CL	Silty sandy CLAY, low plasticity, yellow, fine to coarse Sand, trace of Gravel and Cobbles.				Subangular Gravel and Cobbles up to 100mm in size.
			11	-3.73				END OF BOREHOLE @ 11.00 m TARGET DEPTH STANDPIPE INSTALLED				
			12									
			13									
			14									
			15									
			16									
			17									
			18									
			19									
			20									





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

GAP & 02 LIB.GLB Log GAP NON-CORED FULL PAGE 087661006 - CENTREX-SHEEP HILL.GPJ <<DrawingFiles>> 30/01/2009 12:42 8.1.011

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 615963,0 m E 6209706,0 m N MGA94 53
 SURFACE RL: 9.73 m DATUM: AHD
 INCLINATION: -90°
 HOLE DIA: 150 mm HOLE DEPTH: 11,00 m

SHEET: 1 OF 3
 DRILL RIG: SONIC
 CONTRACTOR: BOART LONGYEAR
 LOGGED: MH DATE: 30/10/08
 CHECKED: PL DATE: 30/11/09

Drilling			Sampling		Field Material Description							
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	
Sonic			0	9.73	SPT 0.00-0.45 m 6, 11, 12 N=23 BH08-01 0.00-0.20 m OA 0.00 m PID = 0 ppm PP 0.20 m =340 kPa BH08-02 0.40-0.50 m OA 0.40 m PID = 0 ppm PP 0.50 m =530 kPa 1.80 m PID = 0 ppm PP 1.80 m =550 kPa SPT 2.00-2.45 m 9, 12, 13 N=25		CH	Sandy CLAY, high plasticity, red brown, fine to coarse Sand, trace of Gravel.	VSt			
			3.50	6.23	BH08-04 3.50-3.80 m OA 3.50 m PID = 0 ppm PP 3.80 m =210 kPa		SC	Clayey SAND, fine to coarse grained, red brown, high plasticity fines, trace of Gravel.				
			4.00	5.73	BH08-05 4.50-4.80 m OA 4.50 m PID = 0 ppm PP 4.80 m >600 kPa SPT 5.00-5.45 m 4, 4, 16 N=20 BH08-06 5.50-5.80 m OA 5.50 m PID = 0 ppm PP 5.80 m >600 kPa		CH	Sandy CLAY, high plasticity, red brown, fine to coarse Sand, with Gravel.	D			
			5.00	4.73			CH	CLAY, high plasticity, red brown, fine to coarse Sand.				
			6							H		
			7									With Gravel from 7.0m to 7.5m.
			7.50	2.23	BH08-07 7.50-7.80 m OA 7.50 m PID = 0 ppm SPT 8.00-8.30 m 20, 50/150mm HB N>50		SC	Clayey SAND, fine to coarse grained, high plasticity fines, trace of Gravel.				Trace of Quartz Gravel up to 20mm in size.
			8.00	1.73			CL	Silty Sandy CLAY, low plasticity, yellow, fines, fine to coarse Sand, trace of Gravel.				
			9								H	
			10									For Continuation Refer to Sheet 2

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REPORT OF BOREHOLE: BH08

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

COORDS: 615963.0 m E 6209706.0 m N MGA94 53
 SURFACE RL: 9.73 m DATUM: AHD
 INCLINATION: -90°
 HOLE DIA: 150 mm HOLE DEPTH: 11.00 m

SHEET: 3 OF 3
 DRILL RIG: SONIC
 CONTRACTOR: BOART LONGYEAR
 LOGGED: MH DATE: 30/10/08
 CHECKED: *h* DATE: 30/11/09

Drilling					Field Material Description					Defect Information			
METHOD	WATER	TCR	ROD (SCR)	RECOVERED	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH Is (50) MPa	DEFECT DESCRIPTION & Additional Observations		AVERAGE DEFECT SPACING (mm)
Sonic		100			10		+ + + + + + + + + + + +	GRANITE, fine to coarse grained, layered, pale grey, pink, white, quartzite inclusions, veins of micaceous schist, some orange staining.	DW				
					11	11.00 -1.27		END OF BOREHOLE @ 11.00 m TARGET DEPTH STANDPIPE INSTALLED					
					12								
					13								
					14								
					15								
					16								
					17								
					18								
					19								
					20								

GAP_8_02_LIB_GLB_Log_GAP_CORED_BOREHOLE_087661006 - CENTREX SHEEP HILL GPJ <<DrawingFile>> 30/01/2009 12:32 8.1.011

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REPORT OF DCP TESTS

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

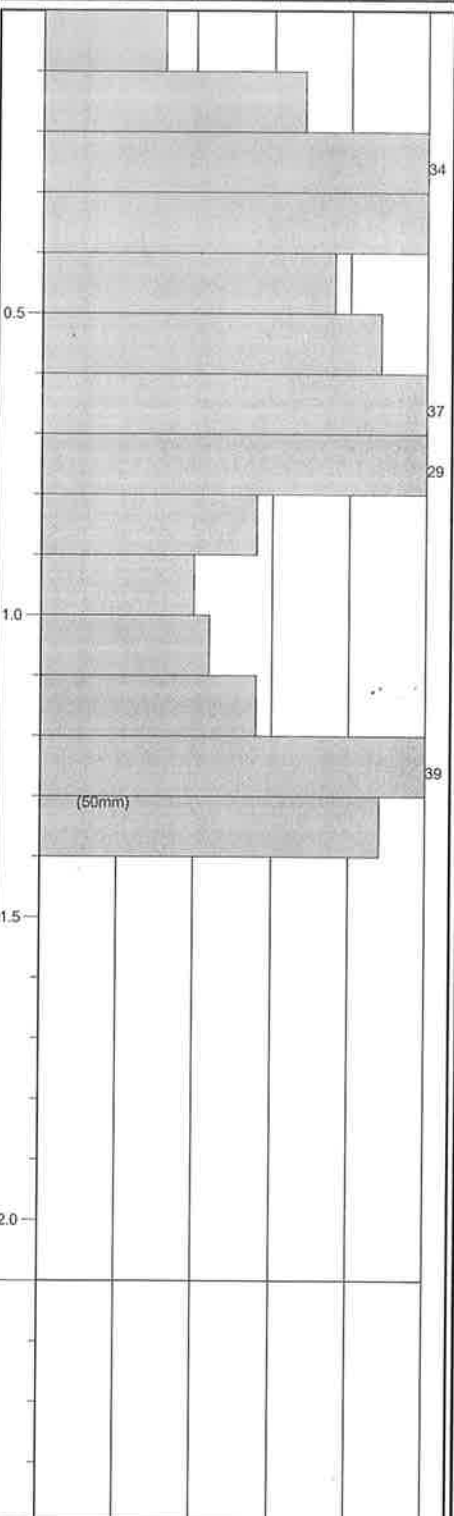
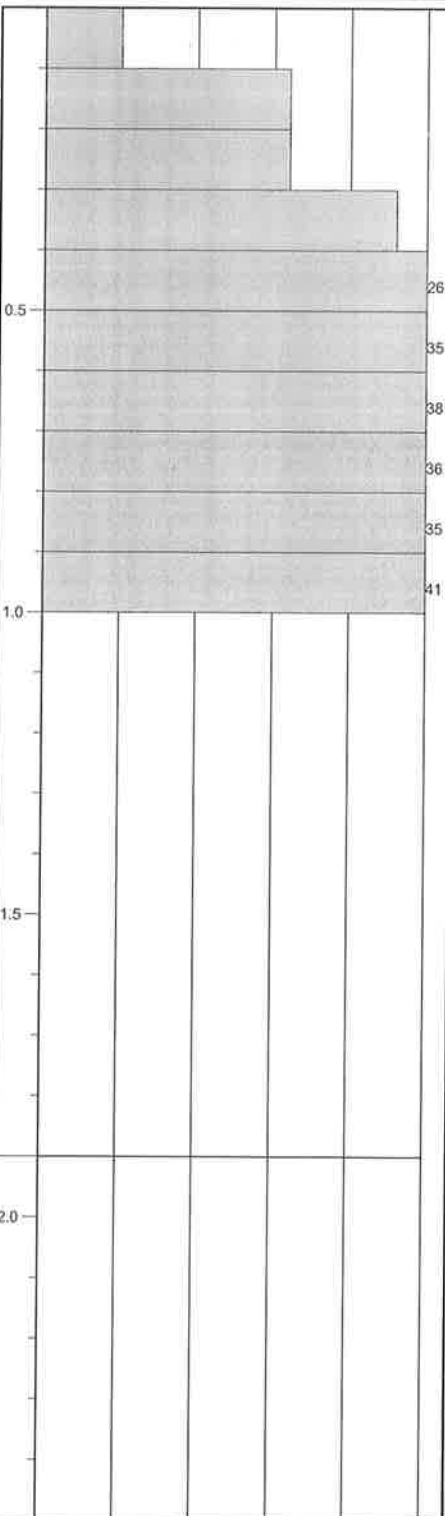
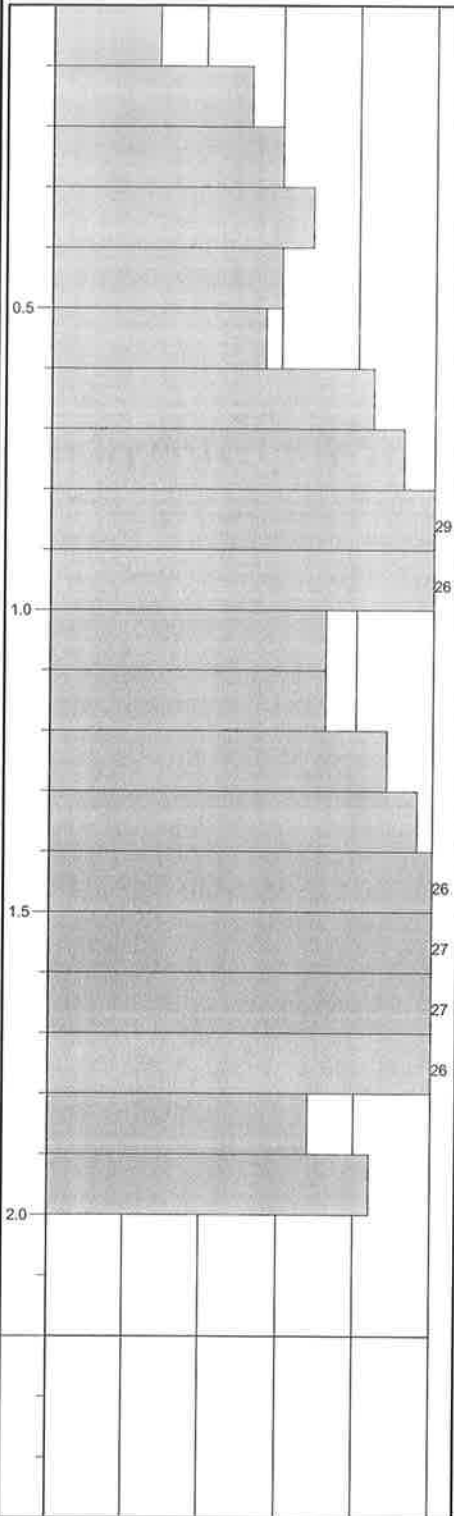
SHEET: 1 OF 9

CHECKED: *h* DATE: 4/2/09

TESTED: AJB DATE: 07/11/2008 **TEST: TP02**
 COORDS: 615750.0 m E 6209700.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 (AS1289.6.3.2) Blows per 100 mm

TESTED: AJB DATE: 07/11/2008 **TEST: TP03**
 COORDS: 616050.0 m E 6210250.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 (AS1289.6.3.2) Blows per 100 mm

TESTED: AJB DATE: 07/11/2008 **TEST: TP04**
 COORDS: 616250.0 m E 6210200.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 (AS1289.6.3.2) Blows per 100 mm



GAP_8_02.LIB.GLB Log GAP DCP PSP_087661006 - CENTREX SHEEP HILL.GPJ <<DrawingFile>> 04/02/2009 10:47 8.1.025

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REPORT OF DCP TESTS

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

SHEET: 2 OF 9

CHECKED: *HL* DATE: 4/2/09

TESTED: AJB DATE: 04/11/2008 TEST: TP05 COORDS: 616450.0 m E 621050.0 m N MGA94 53 SURFACE RL: DATUM: AHD	TESTED: AJB DATE: 04/11/2008 TEST: TP06 COORDS: 616300.0 m E 6209950.0 m N MGA94 53 SURFACE RL: DATUM: AHD	TESTED: AJB DATE: 05/11/2008 TEST: TP08 COORDS: 616050.0 m E 6209600.0 m N MGA94 53 SURFACE RL: DATUM: AHD
(AS1289.6.3.2) Blows per 100 mm DEPTH (metres) 0 5 10 15 20 25	(AS1289.6.3.2) Blows per 100 mm DEPTH (metres) 0 5 10 15 20 25	(AS1289.6.3.2) Blows per 100 mm DEPTH (metres) 0 5 10 15 20 25



GAP 8_02 LIB GUB Log GAP DCP PSP 087661006 - CENTREX SHEEP HILL GPJ <<DrawingFiles>> 04/02/2009 10:47 & 1.025

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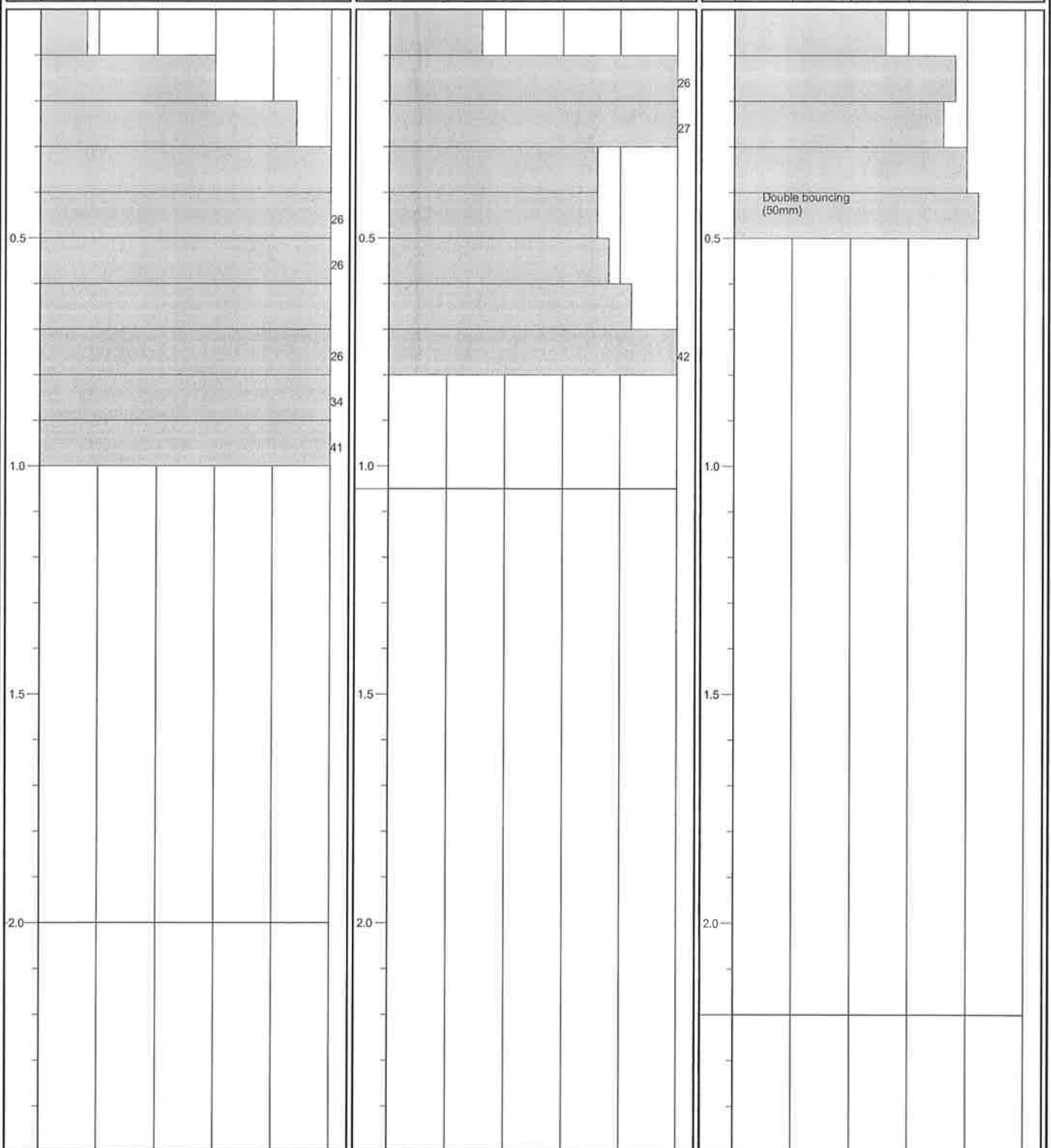


REPORT OF DCP TESTS

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

SHEET: 3 OF 9
 CHECKED: *th* DATE: 4/2/09

TESTED: AJB DATE: 05/11/2008 TEST: TP09 COORDS: 616100.0 m E 6209450.0 m N MGA94 53 SURFACE RL: DATUM: AHD (AS1289.6.3.2) Blows per 100 mm	TESTED: AJB DATE: 04/11/2008 TEST: TP10 COORDS: 616300.0 m E 6209700.0 m N MGA94 53 SURFACE RL: DATUM: AHD (AS1289.6.3.2) Blows per 100 mm	TESTED: AJB DATE: 04/11/2008 TEST: TP11 COORDS: 616250.0 m E 6209400.0 m N MGA94 53 SURFACE RL: DATUM: AHD (AS1289.6.3.2) Blows per 100 mm
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GAP 8.02 LIB GLOB Log GAP DCP PSP 087661006 - CENTREX SHEEP HILL GPJ <<DrawingFile>> 04/02/2009 10:47 8 1.025

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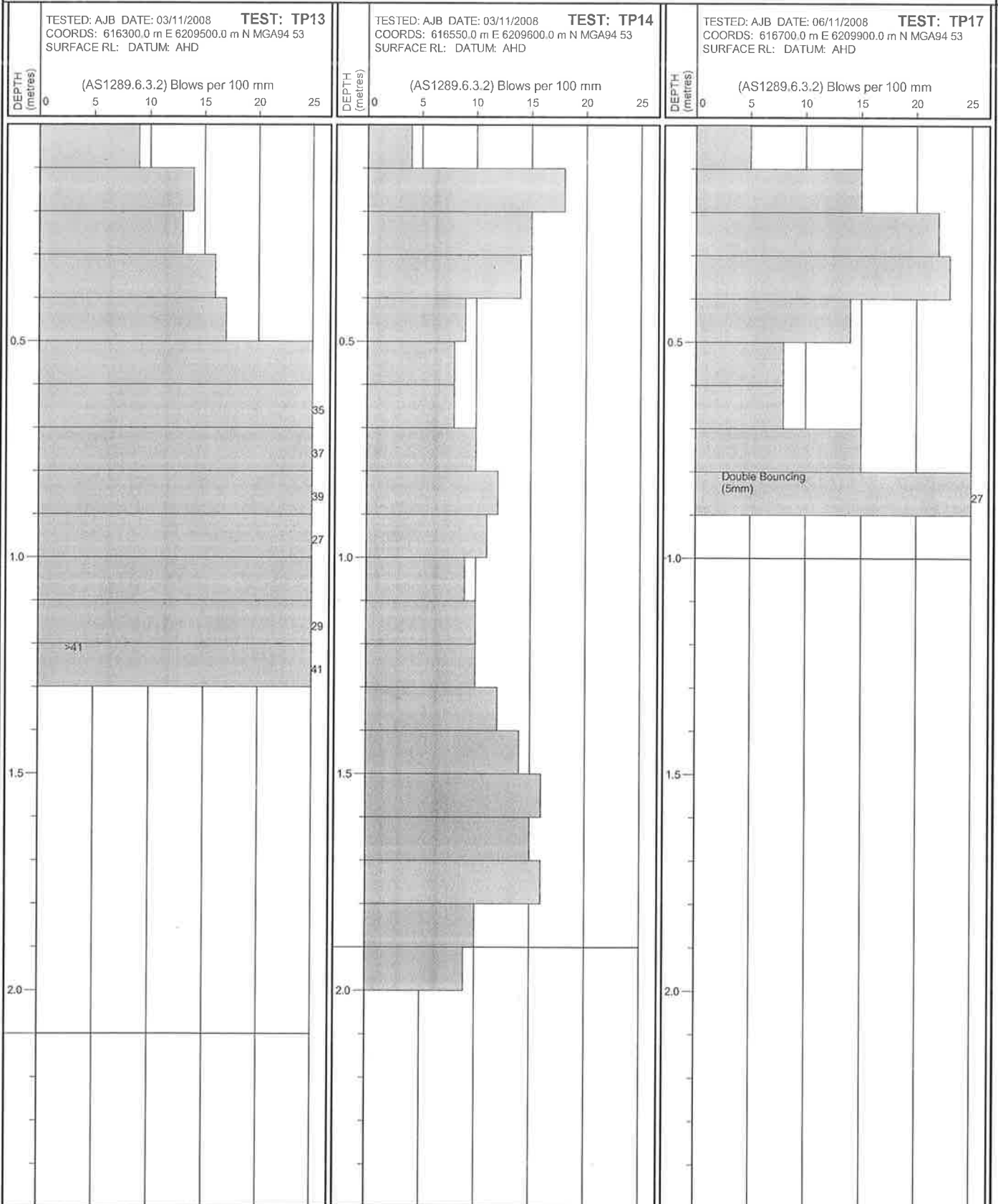


REPORT OF DCP TESTS

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

SHEET: 4 OF 9

CHECKED: *h* DATE: 4/2/09



GAP 8_02_LIB_GLB_Log_GAP DCP FSP 087661006 - CENTREX SHEEP HILL GPJ <<DrawingFile>> 04/02/2009 10:47: 8.1.025

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GAP gINT FN. F04a
RL3



REPORT OF DCP TESTS

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

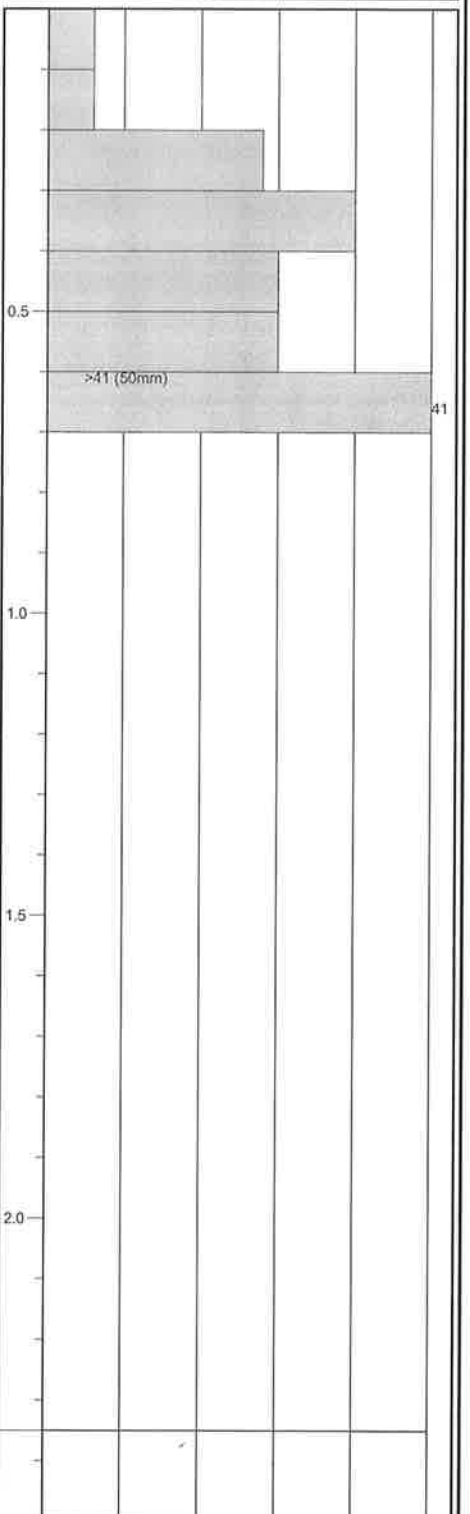
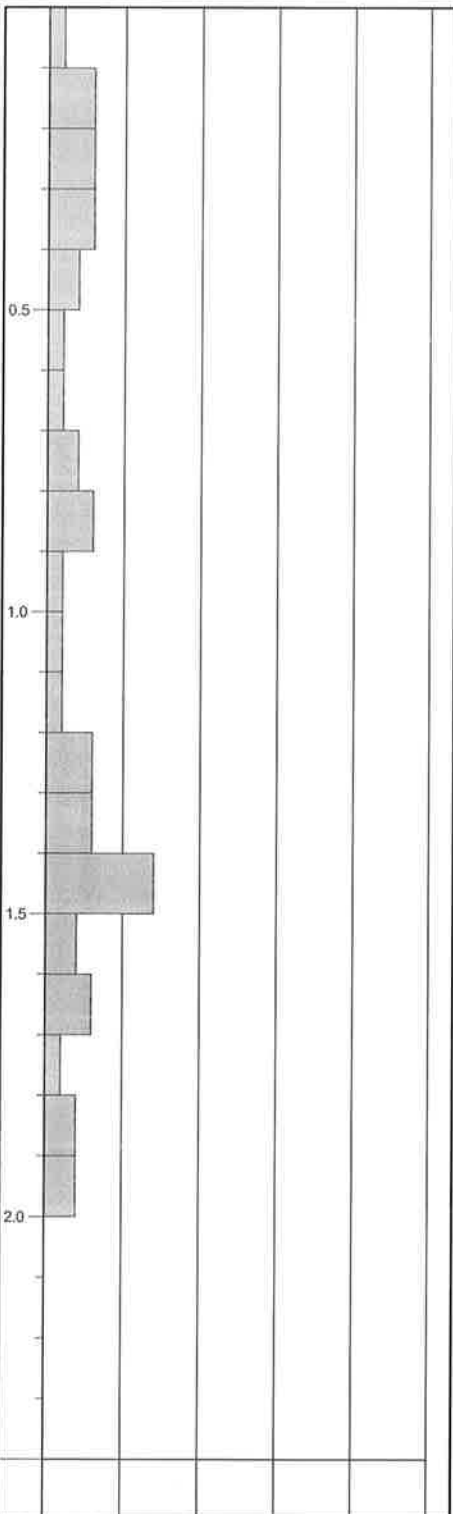
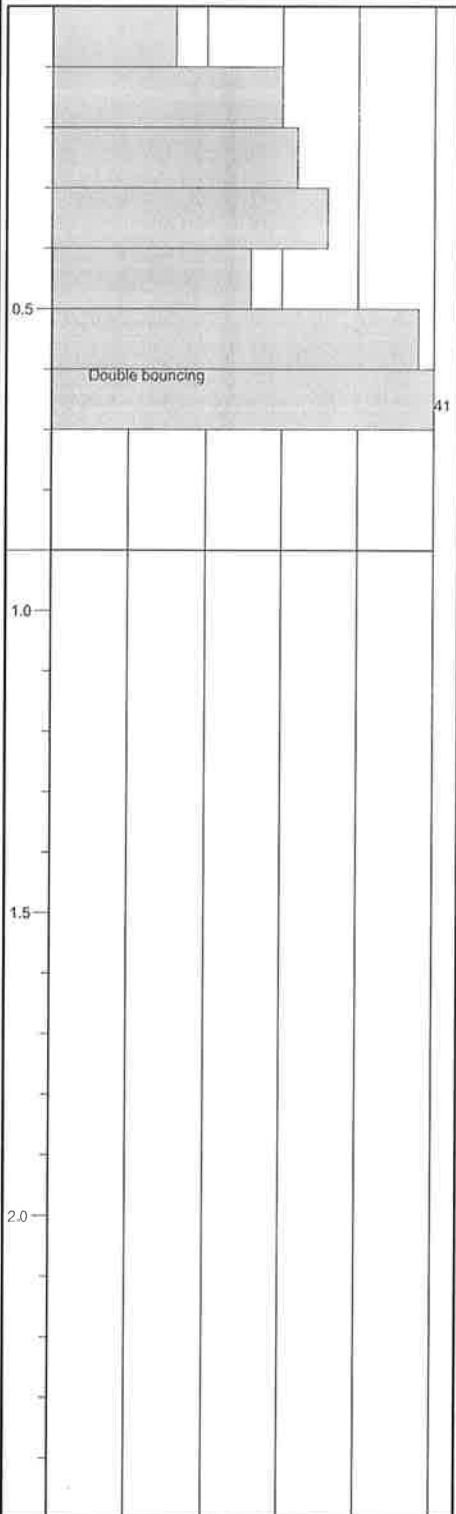
SHEET: 5 OF 9

CHECKED: *HL* DATE: 4/2/09

TESTED: AJB DATE: 06/11/2008 TEST: TP18
 COORDS: 616650,0 m E 6209800,0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 (AS1289,6,3,2) Blows per 100 mm

TESTED: AJB DATE: 04/11/2008 TEST: TP19
 COORDS: 616400,0 m E 6210050,0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 (AS1289,6,3,2) Blows per 100 mm

TESTED: AJB DATE: 03/11/2008 TEST: TP20
 COORDS: 616400,0 m E 6209500,0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 (AS1289,6,3,2) Blows per 100 mm



GAP 8_02 LIB GUB Log GAP DCP FSP 087661006 - CENTREX SHEEP HILL GPJ <<DrawingFile>> 04/02/2009 10:47 8.1.025

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GAP gINT FN. F04a
RL3



REPORT OF DCP TESTS

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

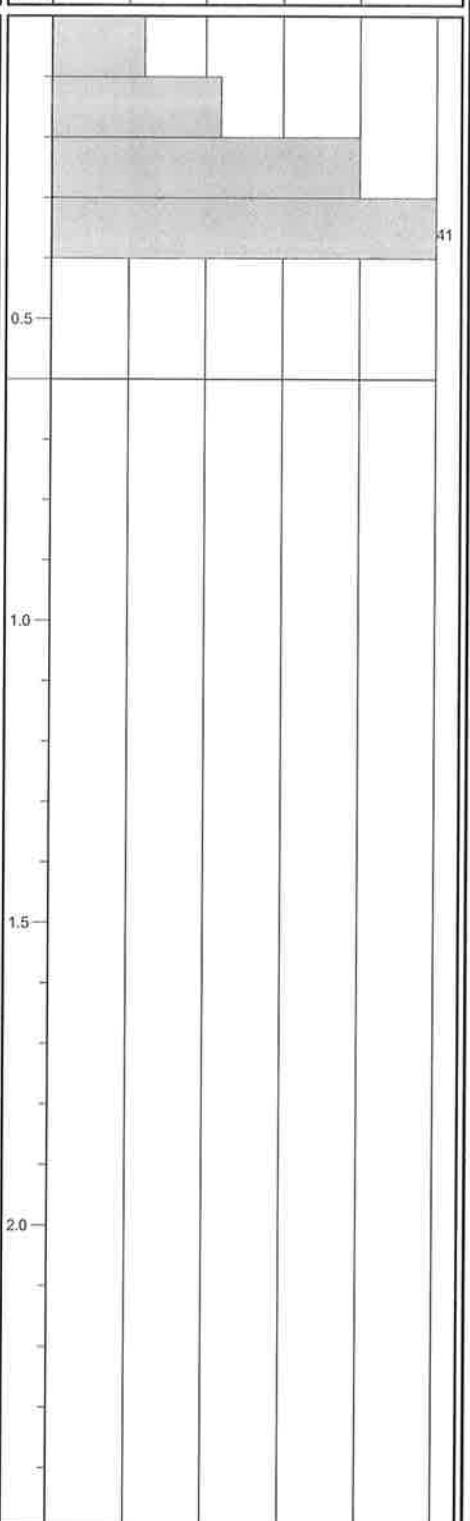
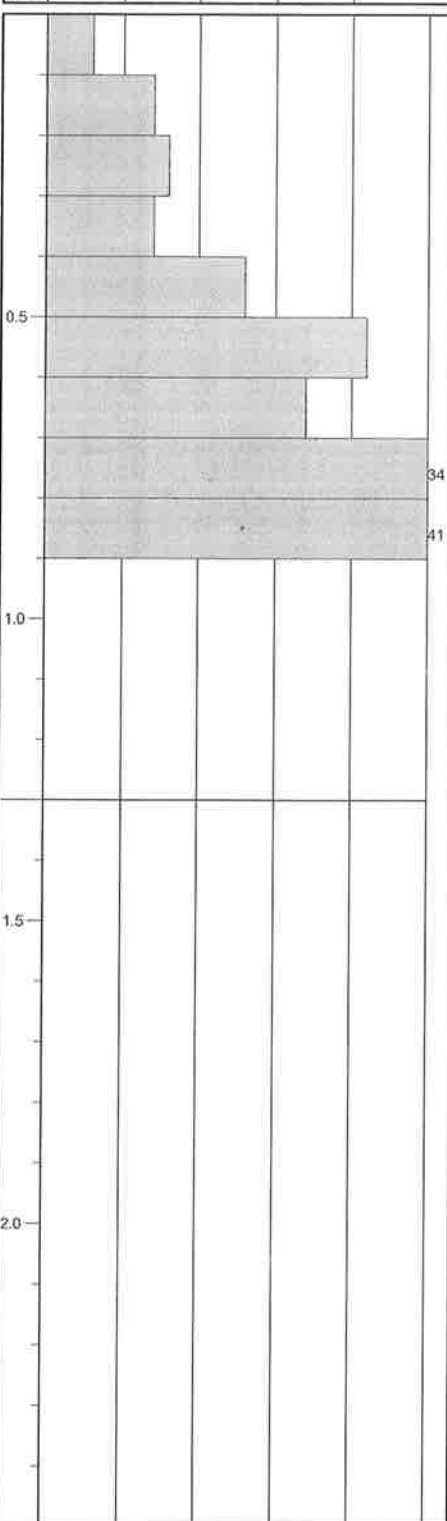
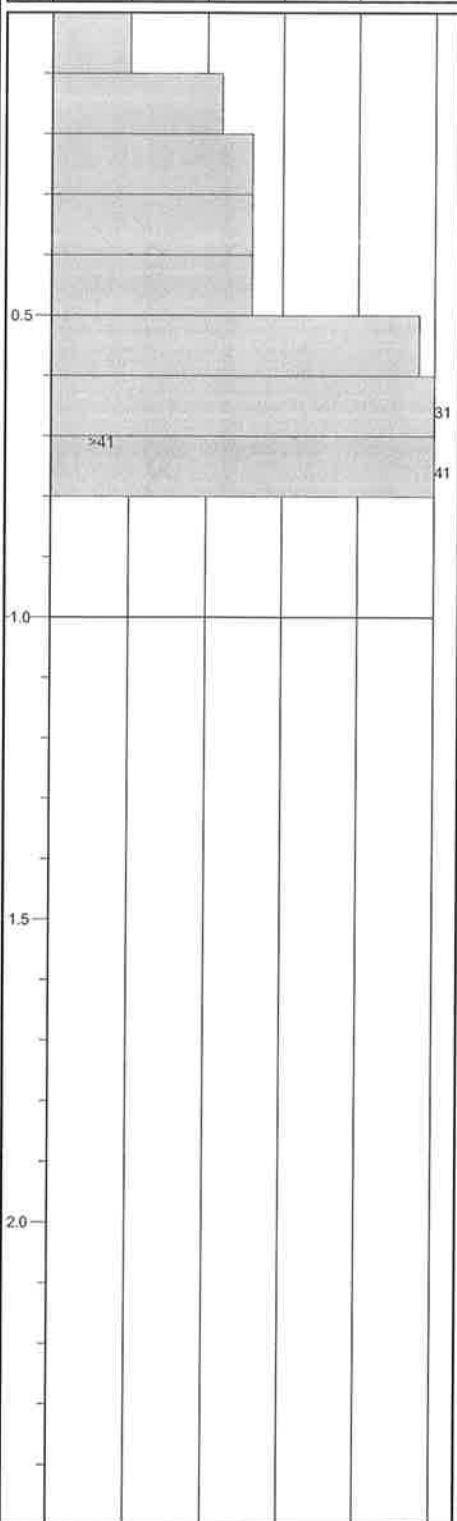
SHEET: 6 OF 9

CHECKED: *h* DATE: 4/2/09

TESTED: AJB DATE: 03/11/2008 TEST: TP21
 COORDS: 616450.0 m E 6209600.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 (AS1289.6.3.2) Blows per 100 mm

TESTED: AJB DATE: 03/11/2008 TEST: TP22
 COORDS: 616500.0 m E 6209700.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 (AS1289.6.3.2) Blows per 100 mm

TESTED: AJB DATE: 06/11/2008 TEST: TP23
 COORDS: 616450.0 m E 6209800.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 (AS1289.6.3.2) Blows per 100 mm



GAP_6_02_LIB_GLB_Log_GAP_DCP_PSP_087661006 - CENTREX SHEEP HILL.GPJ <<DrawingFile>> 04/02/2009 10:47 8.1.025

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GAP gINT FN. F04a
RL3



REPORT OF DCP TESTS

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

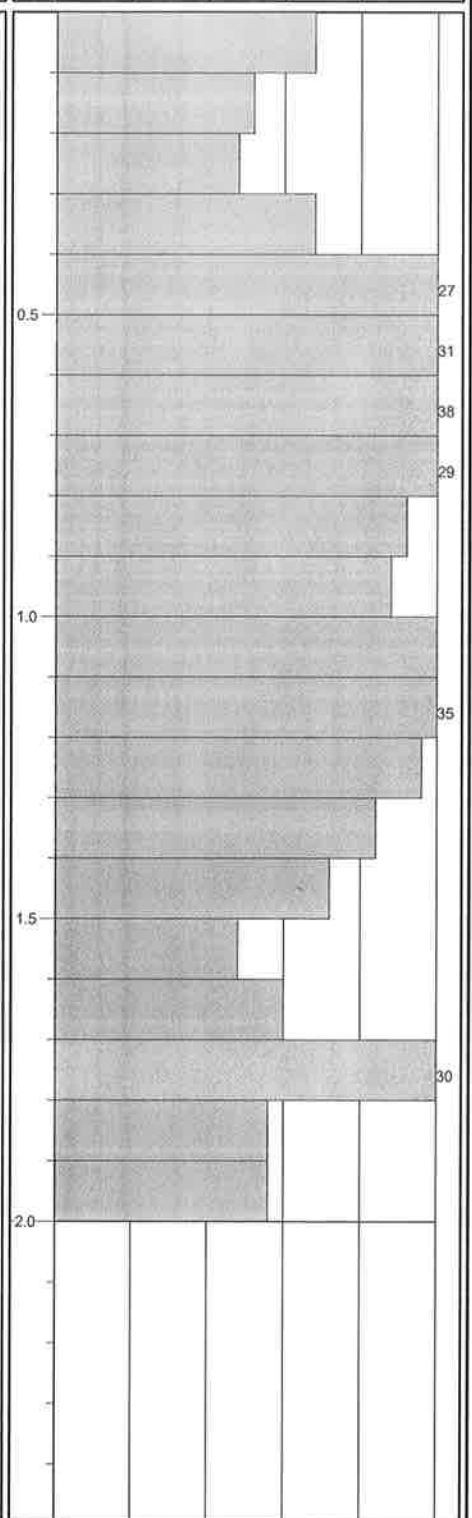
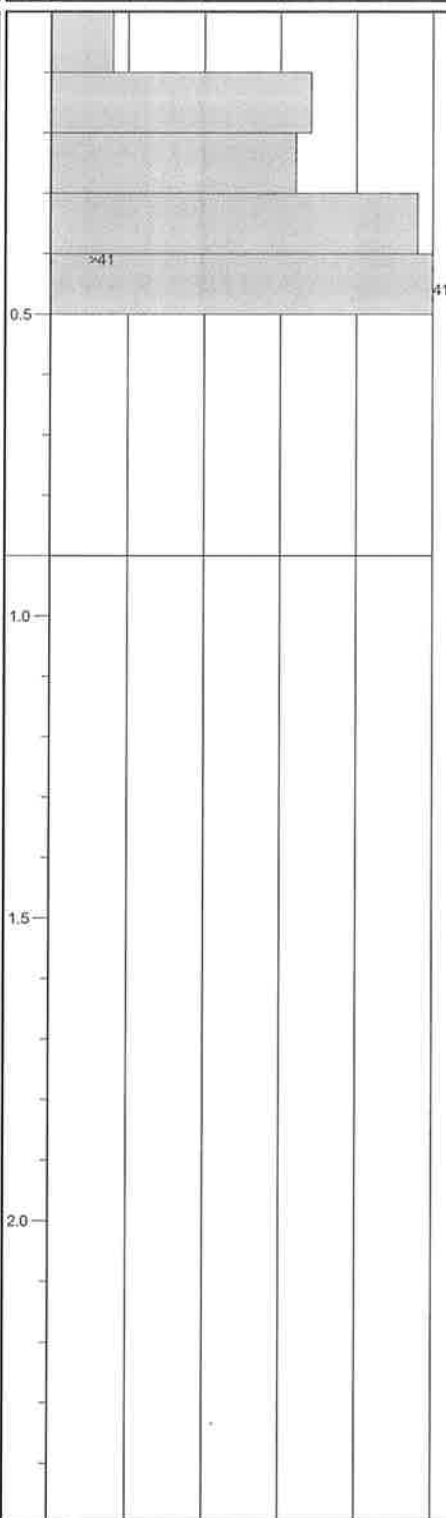
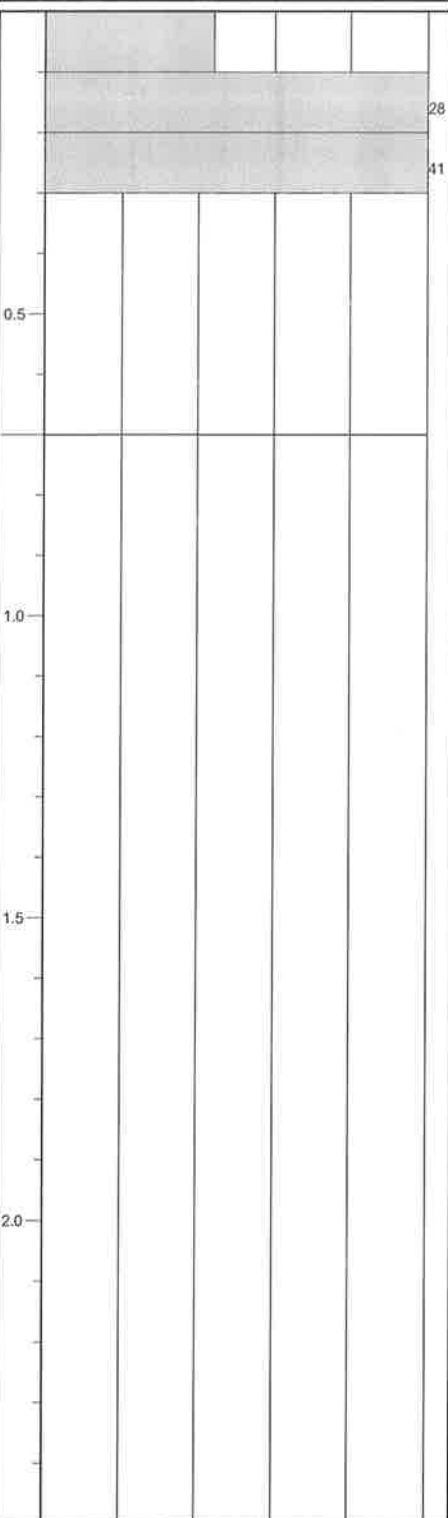
SHEET: 7 OF 9

CHECKED: *HL* DATE: 4/2/09

TESTED: AJB DATE: 06/11/2008 **TEST: TP24**
 COORDS: 616550.0 m E 6209800.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 (AS1289.6.3.2) Blows per 100 mm

TESTED: AJB DATE: 05/11/2008 **TEST: TP25**
 COORDS: 615314.0 m E 6210419.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 (AS1289.6.3.2) Blows per 100 mm

TESTED: AJB DATE: 05/11/2008 **TEST: TP26**
 COORDS: 614640.0 m E 6210436.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 (AS1289.6.3.2) Blows per 100 mm



GAP & 02 LIB.GLB Log GAP DCP PSP 087661006 - CENTREX SHEEP HILL GPJ <<DrawingFile>> 04/02/2009 10:47 & 1.025

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GAP gINT FN. F04a
 RL3



REPORT OF DCP TESTS

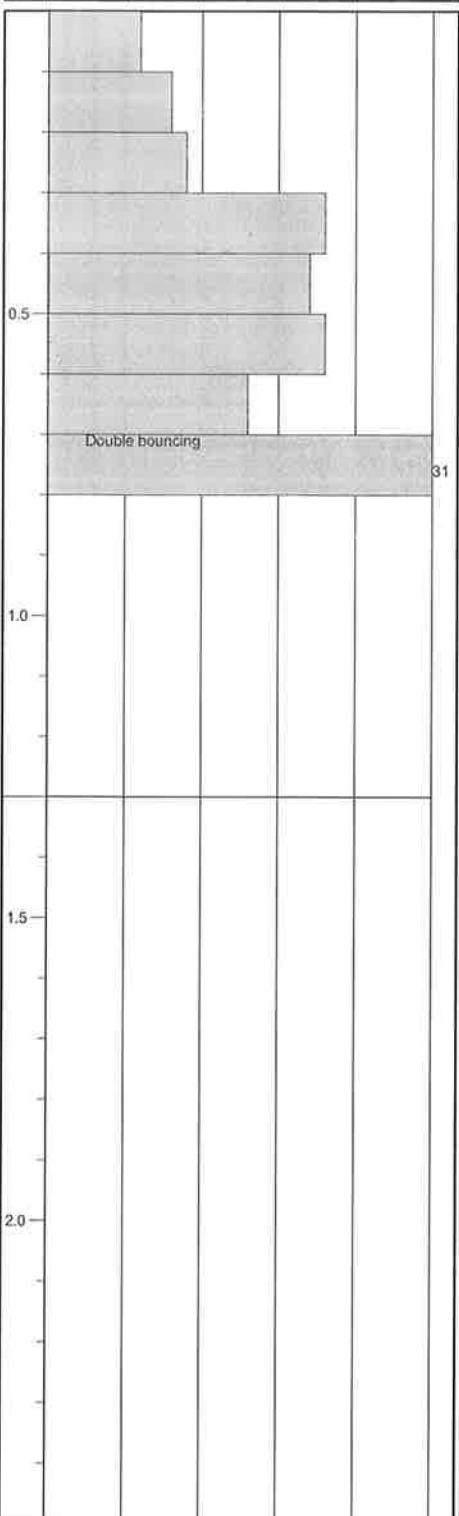
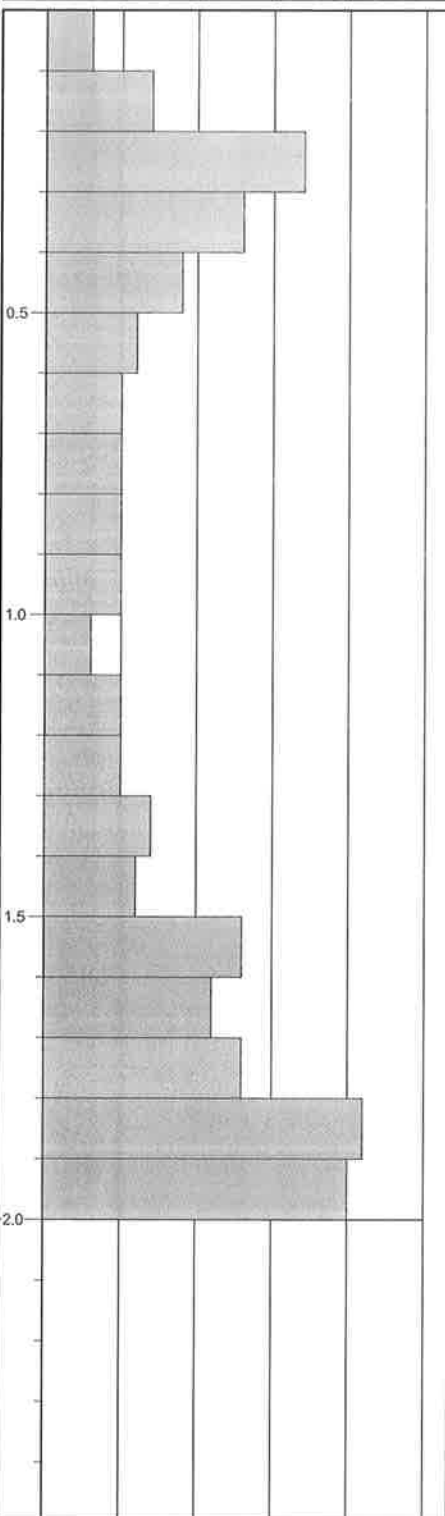
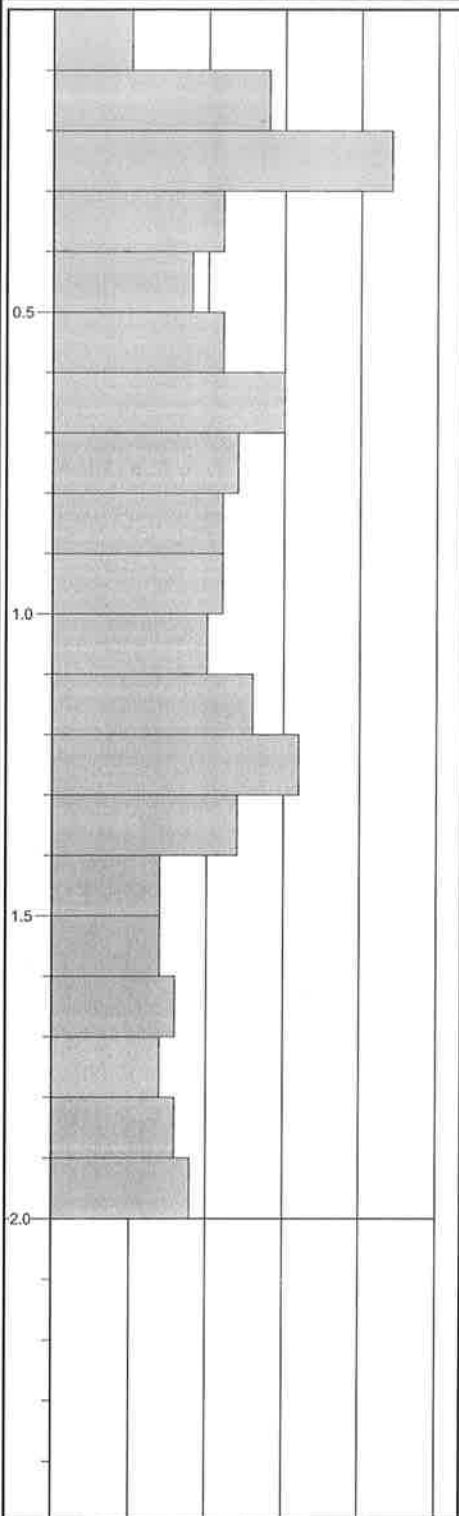
CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

SHEET: 8 OF 9
 CHECKED: *Hh* DATE: 7/2/09

TESTED: AJB DATE: 05/11/2008 **TEST: TP27**
 COORDS: 614233.0 m E 6210789.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 (AS1289.6.3.2) Blows per 100 mm

TESTED: AJB DATE: 05/11/2008 **TEST: TP28**
 COORDS: 613619.0 m E 6211060.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 (AS1289.6.3.2) Blows per 100 mm

TESTED: AJB DATE: 05/11/2008 **TEST: TP29**
 COORDS: 612983.0 m E 6211054.0 m N MGA94 53
 SURFACE RL: DATUM: AHD
 (AS1289.6.3.2) Blows per 100 mm



GAP 8.02 LIB.GLB Log GAP DCP PSP 087661006 - CENTREX SHEEP HILL GPJ - DrawingFiles - 04/02/2009 10:47 8.1.025

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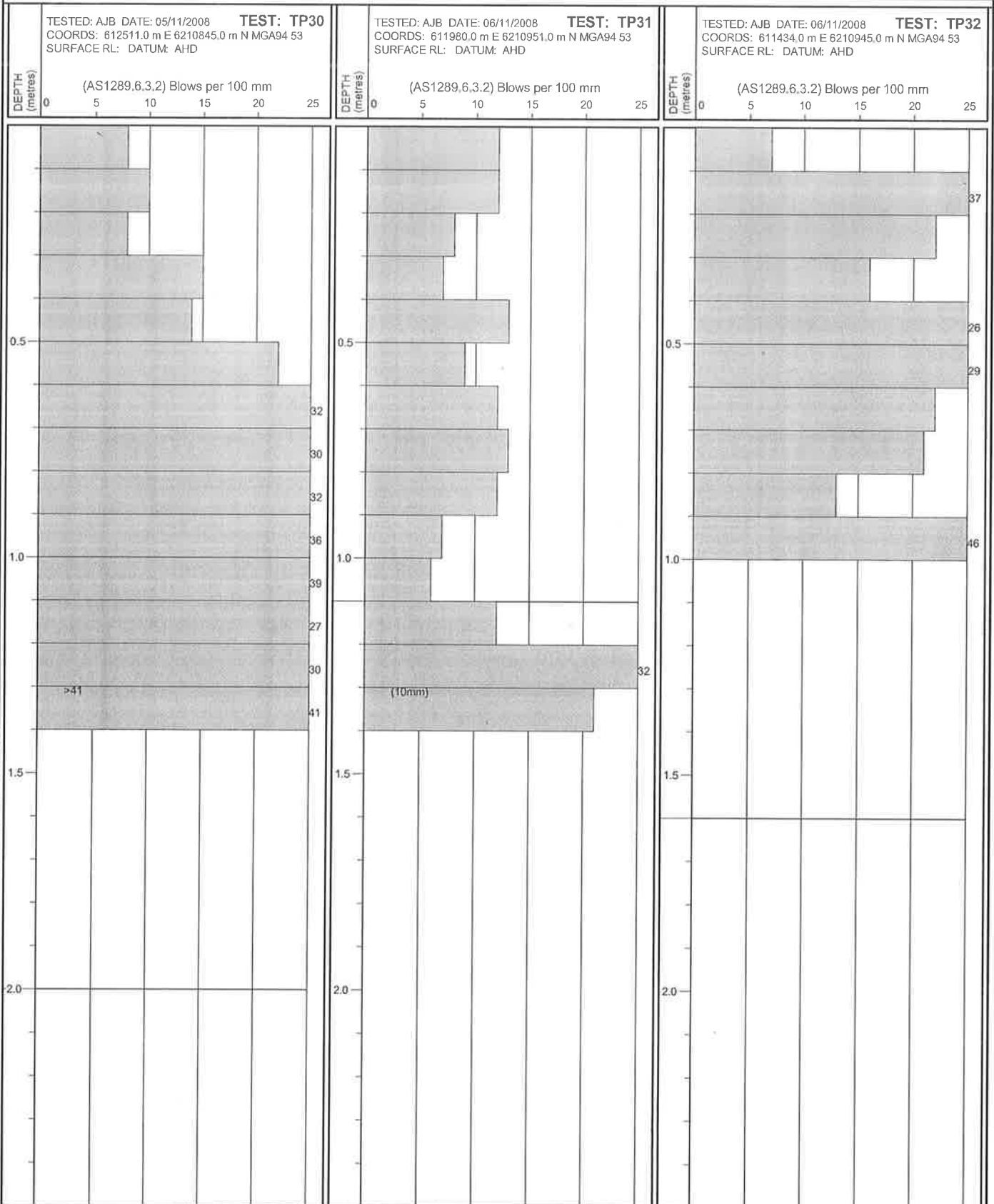


REPORT OF DCP TESTS

CLIENT: CENTREX
 PROJECT: SHEEP HILL PORT INVESTIGATION
 LOCATION: SHEEP HILL
 JOB NO: 087661006

SHEET: 9 OF 9

CHECKED: *h* DATE: 4/2/09



GAP 8_02 LIB GLB Log GAP DCP PSP 087661006 - CENTREX SHEEP HILL GPJ <<DrawingFiles>> 04/02/2009 10:47 8.1.025

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GAP gINT FN. F04a
RL3



APPENDIX B

Summary of Laboratory Testing



APPENDIX B

Table 1: Summary of Laboratory Test Results for Geotechnical Investigation

Sample	General Description	Particle Size Distribution			Consistency Limits			CBR (%)	MC (%)	OMC (%)	MDD (%)
		Gravel (%)	Sand (%)	<75µm (%)	W _L (%)	I _p (%)	L _s (%)				
TP01/03 (0.35 – 0.6 m)	(SC) Gravellv Clavev SAND	19	55	26	27	10	4.0	25.0	6.0	14.5	1.84
TP02/01 (0.0 – 0.15 m)	(SC) Clavev SAND	3	75	22	16	1	0.5		3.8		
TP02/02 (0.15 – 0.3 m)	(CI) Sandv CLAY	3	46	51	41	22	11.5		10.6		
TP03/03 (0.3 – 0.6 m)	(SC) Clavev SAND	11	44	45	46	26	11.0		11.0		
TP05/01 (0.0 – 0.2 m)	(CL) Sandv CLAY	0	45	55	23	6	1.0		22.2		
TP05/04 (1.0 – 1.3 m)	(CH) CLAY	1	18	81	85	56	19.0		65.9		
TP06/02 (0.4 – 0.8 m)	(SP) Gravellv SAND	15	75	10	N.O	N.P	NIL	35.0	1.8	8.5	1.99
TP07/01 (0.0 – 0.15 m)	(SM) Silty SAND	1	78	21	N.O	N.P	NIL		4.3		
TP12/02 (0.2 – 0.5 m)	(SC) Clavev SAND	11	54	35	34	8	3.5	12.0	6.8	20.0	1.60
TP13/03 (0.4 – 0.7 m)	(CH) Sandv CLAY	5	39	56	67	45	13.5	5.0	13.6	24.0	1.56
TP15/03 (0.4 – 0.6 m)	(SC) Clavev Gravellv SAND	37	46	17	51	18	6.0	13.0	8.5	15.5	1.79
TP17/01 (0.0 – 0.2 m)	(SC) Clavev Gravellv SAND	24	59	17	24	9	4.0		4.8		
TP18/03 (0.45 – 0.9 m)	(SP) Gravellv SAND	14	75	11	26	1	0.5		1.7		
TP19/02 (0.3 – 0.7 m)	(SP) SAND	2	88	10	19	3	NIL	17.0	3.8	13.5	1.72
TP25/03 (0.3 – 0.5 m)	(SC) Clavev Gravellv SAND	33	47	20	28	7	4.0		6.9		
TP26/01 (0.0 – 0.3 m)	(SC) Clavev SAND	3	65	32	19	5	2.5		4.8		
TP26/02 (0.3 – 0.5 m)	(SC) Clavev SAND	6	55	39	45	25	12.0	7.0	12.1	19.0	1.70
TP26/03 (0.7 – 1.0 m)	(CI) CLAY	-	-	-	39	22	10		ND		
TP27/03 (0.3 – 0.6 m)	(SC) Clavev SAND	0	65	35	58	34	15.5		19.8		
TP27/04 (0.6 – 1.0 m)	(SC) Clavev SAND	9	46	45	49	26	12.0	4.0	15.9	20.0	1.61
TP28/02 (0.2 – 0.4 m)	(SC) Clavev SAND	0	77	33	31	17	7.0		9.8		
TP28/03 (0.4 – 0.8 m)	(SC) Gravellv Clavev SAND	13	46	41	52	29	7.0	3.0	19.3	22.0	1.58
TP29/03 (0.4 – 0.7 m)	(GC)Clavev Sandv GRAVEL	47	33	20	51	20	7.5	20.0	8.3	18.5	1.59
TP30/01 (0.05 – 0.4 m)	(SC) Clavev SAND	4	82	14	ND	ND	ND		4.1		
TP30/02 (0.4 – 0.6 m)	(CL) Sandv CLAY	2	42	56	16	4	1.0	25.0	6.8	11.0	2.01
TP31/02 (0.2 – 0.5 m)	(SC) Clavev Gravellv SAND	28	48	24	42	19	8.5	13.0	12.6	17.0	1.72
TP32/01 (0.0 – 0.1 m)	(SC) Clavev SAND	4	79	17	21	4	0.5		4.3		
TP32/03 (0.5 – 0.8 m)	(SC) Gravellv Clavev SAND	22	50	28	50	27	12.0	5.0	18.1	17.5	1.76

W_L – Liquid Limit, I_p – Plasticity Index, L_s – Linear Shrinkage, MC – Moisture Content, OMC – Optimum Moisture Content, MDD – Maximum Dry Density, NO – Not Obtainable, NP – Non Plastic, ND – Not Determined.



APPENDIX B

Table 2: Summary of Point Load Strength Index Testing

Sample	General Description	No. of Tests	Point Load Strength Index (Is(50))			Inferred Strength
			Minimum	Maximum	Average	
BH01 2.5 to 2.6 m	Granite	3	1.7	4.1	3.3	High
BH02 4.85 to 5.0 m	Granite	4	2.5	6.3	4.8	Very High
BH04 9.5 to 9.6 m	Schist	3	3.0	8.7	5.1	Very High
BH05 5.2 to 5.3 m	Schist	3	5.7	10.3	7.6	Very High
BH06 15.8 to 16 m	Schist	3	4.6	6.5	5.4	Very High



APPENDIX B

Table 3 : Summary of Laboratory Testing for Soil Study

Sample	Soil Description	Emerson Class	pH	TOC (%)	EC (mS/cm)	CEC (meq/100g)	ESP (%)	Cl ⁻ (mg/kg)
Port Site								
TP01/01 (0.0 – 0.05m)	SC (Clayey SAND)	-	8.3	<0.5	0.13	-	-	-
TP01/02 (0.05-0.15m)	(SC/CH) Clayey SAND/CLAY	-	8.6	-	0.16	-	-	-
TP01/03 (0.35 – 0.6m)	(SC) Gravelly Clayey SAND	-	9.3	-	0.28	-	-	-
TP01/05 (1.8 – 2.0m)	(SC) Gravelly Clayey SAND	-	10.1	-	0.48	-	-	-
TP02/01 (0.0 – 0.15m)	(SC) Clayey SAND	5	6.5	-	0.06	6.5	10.4	20
TP02/02 (0.15 – 0.3m)	(CI) Sandy CLAY	-	8.3	<0.5	0.30	-	-	-
TP02/03 (0.3 – 0.6 m)	(SC) Gravelly Clayey SAND	-	9.6	-	1.22	-	-	-
TP03/01 (0.0 – 0.15 m)	(SC) Clayey SAND	-	7.4	<0.5	0.10	-	-	-
TP03/02 (0.15 – 0.3m)	(CH) Sandy CLAY	-	9.2	-	0.65	-	-	-
TP03/03 (0.3 – 0.6 m)	(SC) Clayey SAND	4	9.8	-	1.01	45.5	14.3	800
TP04/01 (0.0 – 0.1m)	(SC) Clayey SAND	-	7.2	<0.5	0.09	-	-	-
TP04/04 (1.6 – 2.1m)	(SC) Clayey SAND	-	10.0	-	0.55	-	-	-
TP05/01 (0.0 – 0.2 m)	(CL) Sandy CLAY	5	7.8	0.5	7.39	80.6	52.1	15500
TP05/02 (0.3 – 0.6m)	(CL) Sandy CLAY	-	8.2	-	7.91	-	-	-
TP05/04 (1.0 – 1.3 m)	(CH) CLAY	-	8.5	-	7.51	-	-	-
TP05/05 (1.7 – 2.0 m)	(SM) Silty SAND	-	9.2	-	2.26	-	-	-
TP06/01 (0.0 – 0.05 m)	(SP) Gravelly SAND	-	9.3	0.9	0.07	-	-	-
TP06/02 (0.4 – 0.8 m)	(SP) Gravelly SAND	8	8.8	-	0.03	-	-	-
TP06/03 (1.4 – 1.8 m)	(SC) Clayey SAND	-	10.0	-	0.38	-	-	-
TP07/01 (0 – 0.15 m)	(SM) Silty SAND	-	7.3	0.5	0.06	-	-	-
TP07/02 (0.15 – 0.3m)	(CH) Sandy CLAY	-	8.3	-	0.55	-	-	-
TP07/04 (1.0 – 1.4 m)	(SC) Gravelly Clayey SAND	-	-	-	-	-	-	-
TP08/01 (0.0 – 0.3m)	(SC) Clayey SAND	-	9.2	-	0.13	-	-	-
TP08/02 (0.3 – 0.6m)	(SC) Clayey SAND	-	9.4	-	0.22	-	-	-
TP08/04 (1.6 – 2.0m)	(SC) Clayey SAND	-	9.9	-	0.74	-	-	-
TP09/01 (0.0 – 0.15m)	(SC) Clayey SAND	-	7.7	0.6	0.06	-	-	-
TP09/02 (0.15 – 0.3m)	(SC/CH) Clayey SAND/CLAY	-	8.6	-	0.53	-	-	-
TP09/04 (1.2 – 1.5m)	(SC) Clayey SAND	-	9.8	-	1.25	-	-	-
TP10/01 (0.0 – 0.3 m)	(SC) Clayey SAND	-	8.3	-	0.16	-	-	-
TP10/02 (0.3 – 0.45m)	(SM) Silty SAND	-	9.8	-	0.61	-	-	-
TP10/04 (0.8 – 1.05m)	(SM) Silty SAND	-	10.0	-	0.54	-	-	-
TP11/01 (0.0 – 0.05 m)	(SC) Gravelly Clayey SAND	-	8.3	-	0.18	-	-	-
TP11/02 (0.05 – 0.2m)	(CH) Sandy CLAY	-	8.6	-	0.28	-	-	-
TP11/04 (0.8 – 1.0m)	(SC) Gravelly Clayey SAND	-	10.2	-	0.62	-	-	-

TOC – Total Organic Carbon, EC – Electrical Conductivity, CEC – Cation Exchange Capacity, ESP – Exchangeable Sodium Percentage.



APPENDIX C

Sample	Soil Description	Emerson Class	pH	TOC	EC	CEC	ESP	Cl ⁻
				(%)	(mS/cm)	(meq/100g)	(%)	(mg/kg)
TP12/01 (0.0 – 0.2 m)	(SP) Gravelly SAND	8	8.4	<0.5	0.15	14.8	11.0	40
TP12/02 (0.2 – 0.5 m)	(SC) Clayey SAND	4	9.5	-	0.54	42.1	7.6	730
TP12/03 (1.5 – 1.8 m)	(SC) Clayey SAND	-	10.1	-	0.48	-	-	-
TP13/01 (0.0 – 0.1 m)	(SC) Clayey SAND	-	7.7	-	0.09	-	-	-
TP13/03 (0.4 – 0.7 m)	(CH) Sandy CLAY	4	9.6	-	2.15	54.2	20.9	1130
TP13/04 (1.6 – 1.9m)	(SP) Gravelly SAND	-	9.8	-	0.60	-	-	-
TP14/01 (0.0 – 0.25 m)	(SC) Clayey SAND	-	9.0	-	0.26	-	-	-
TP14/02 (0.3 – 0.6 m)	(SM) Silty SAND	-	9.9	-	1.02	-	-	-
TP14/04 (1.1 – 1.4 m)	(SC) Clayey SAND	-	10.1	-	0.82	-	-	-
TP15/01 (0.0 – 0.1 m)	(SC) Clayey SAND	-	7.3	0.5	0.15	-	-	-
TP15/02 (0.1 – 0.3 m)	(SC) Clayey SAND	-	8.9	-	1.25	-	-	-
TP15/03 (0.4 – 0.6 m)	(SC) Clayey Gravelly SAND	4	9.5	-	1.76	53.4	15.3	1980
TP16/01 (0.0 – 0.1 m)	(SC) Clayey SAND	-	7.8	-	0.07	-	-	-
TP16/02 (0.1 – 0.2 m)	(CH) Sandy CLAY	-	8.4	-	0.25	-	-	-
TP16/04 (0.5 – 0.8 m)	(SM) Silty SAND	-	9.9	-	1.02	-	-	-
TP17/01 (0.0 – 0.2m)	(SC) Clayey Gravelly SAND	8	9.1	0.6	0.56	-	-	-
TP17/02 (0.2 – 0.3 m)	(SM) Silty SAND	-	9.4	-	1.53	-	-	-
TP17/03 (0.3 – 0.5 m)	(SM) Silty SAND	-	9.6	-	1.16	-	-	-
TP18/01 (0.0 – 0.15 m)	(SC) Clayey SAND	-	10.0	-	0.42	-	-	-
TP18/02 (0.15–0.45m)	(SC) Clayey SAND	-	9.6	-	0.25	-	-	-
TP18/03 (0.45 – 0.9m)	(SC) Gravelly SAND	4	9.4	-	0.21	-	-	-
TP19/01 (0.0 – 0.1m)	(SP) SAND	-	8.5	0.6	0.68	-	-	-
TP19/02 (0.3– 0.7m)	(SP) SAND	4	10.0	-	0.61	30.6	12.8	320
TP19/03 (0.7– 1.0m)	(SC/CH) Clayey SAND/CLAY	-	8.5	-	2.96	-	-	-
TP19/04 (1.5– 2.0m)	(ML) Sandy SILT	-	8.8	-	4.01	-	-	-
TP19/05 (2.0– 2.4m)	(SC) Clayey SAND	-	9.0	-	2.83	-	-	-
TP20/01 (0.0 – 0.2m)	(SC) Clayey SAND	-	8.5	-	0.19	-	-	-
TP20/02 (0.4– 0.7m)	(SM) Silty SAND	-	9.7	-	0.55	-	-	-
TP20/03 (0.25-1.0m)	(SC) Clayey SAND	-	10.3	-	0.68	-	-	-
TP21/01 (0.0-0.07m)	(SC) Clayey SAND	8	9.1	-	0.19	34.2	3.3	50
TP21/02 (0.1– 0.2m)	(SC) Clayey SAND	-	9.1	-	0.19	-	-	-
TP21/04 (0.5– 0.7m)	(SC) Clayey SAND	-	10.0	-	0.40	-	-	-
TP22/01 (0.0 – 0.5 m)	(SP) SAND	-	8.6	1.6	0.16	-	-	-
TP22/02 (0.1 –0.2m)	(SC) Gravelly Clayey SAND	-	9.0	-	0.20	-	-	-
TP22/04 (0.4– 0.6m)	(SM) Silty SAND	-	9.0	-	1.31	-	-	-
TP23/01 (0 – 0.15m)	(SC) Clayey SAND	-	7.8	-	0.23	-	-	-
TP23/02 (0.15-0.3m)	(SC) Gravelly Clayey SAND	-	7.6	-	0.12	-	-	-
TP24/01 (0.0 – 0.2m)	(SC) Gravelly Clayey SAND	-	8.6	<0.5	0.36	-	-	-
TP24/02 (0.2– 0.5m)	(SC) Gravelly Clayey SAND	-	9.3	-	0.30	-	-	-
TP24/03 (0.5– 0.7m)	(SM) Gravelly Silty SAND	-	9.9	-	0.45	-	-	-

TOC – Total Organic Carbon, EC – Electrical Conductivity, CEC – Cation Exchange Capacity, ESP – Exchangeable Sodium Percentage.



APPENDIX B

Table 3 (Cont.): Summary of Laboratory Testing for Soil Study

Sample	Soil Description	Emerson Class	pH	TOC (%)	EC (mS/cm)	CEC (meq/100g)	ESP (%)	Cl ⁻ (mg/kg)
Proposed Transport Corridor								
TP25/01 (0.0–0.15m)	(SC) Clayey SAND	-	9.1	-	0.14	-	-	-
TP25/02 (0.15–0.3m)	(SC) Clayey SAND	-	9.4	-	0.16	-	-	-
TP25/03 (0.3– 0.5m)	(SC) Clayey Gravel SAND	8	9.3	-	0.20	-	-	-
TP26/01 (0.0– 0.3m)	(SC) Clayey SAND	5	7.6	0.7	0.06	12.4	4.6	20
TP26/03 (0.7– 1.0m)	(SC) Clayey SAND	-	9.1	-	1.43	-	-	-
TP26/04 (1.7– 2.0m)	(SC) Clayey SAND	-	9.8	-	0.58	-	-	-
TP27/01 (0.0 – 0.1m)	(SC) Clayey SAND	-	7.3	0.9	0.12	-	-	-
TP27/02 (0.1– 0.3m)	(SC) Clayey SAND	-	8.6	-	0.53	-	-	-
TP27/03 (0.3 – 0.6 m)	(SC) Clayey SAND	5	-	-	-	-	-	-
TP27/05 (1.7 – 2.0m)	(SC) Clayey SAND	-	9.7	-	1.13	-	-	-
TP28/01 (0.0 – 0.1 m)	(SC) Clayey SAND	-	8.6	-	0.20	-	-	-
TP28/02 (0.2 – 0.4 m)	(SC) Clayey SAND	-	9.3	-	1.03	-	-	-
TP28/03 (0.4 – 0.8 m)	(SC) Gravelly Clayey SAND	4	9.4	-	2.14	45.4	24.8	2360
TP28/04 (1.0 – 1.4 m)	(SM) Silty SAND	-	9.1	-	2.27	-	-	-
TP29/01 (0.0 – 0.15 m)	(CL) Sandy CLAY	-	8.3	1.5	0.13	-	-	-
TP29/02 (0.15 – 0.3m)	(SC) Clayey SAND	-	8.8	-	0.20	-	-	-
TP29/03 (0.4 – 0.7 m)	(SC) Clayey SAND	-	9.2	-	0.41	-	-	-
TP30/01 (0.05 – 0.4m)	(SC) Clayey SAND	8	7.6	-	0.14	-	-	-
TP30/02 (0.4 – 0.6 m)	(CL) Sandy CLAY	-	8.7	-	0.75	14.4	30.2	570
TP30/03 (0.7– 1.0m)	(SC) Clayey SAND	4	-	-	-	-	-	-
TP30/04 (1.7 – 2.0 m)	(CL) Sandy CLAY	-	9.3	-	0.98	-	-	-
TP31/01 (0.0 – 0.1 m)	(SC) Clayey SAND	-	7.4	-	0.26	-	-	-
TP31/02 (0.2 – 0.5 m)	(SC) Clayey Gravelly SAND	-	8.5	-	1.65	-	-	-
TP31/03 (0.7 – 1.0 m)	(SC) Clayey SAND	-	8.5	-	1.50	-	-	-
TP32/01 (0.0 – 0.1 m)	(SC) Clayey SAND	8	7.2	-	0.09	23.9	4.2	50
TP32/02 (0.1 – 0.3 m)	(SC) Clayey SAND	-	8.1	-	0.68	-	-	-
TP32/04 (1.2 – 1.4 m)	(CH) Sandy CLAY	-	9.2	-	1.65	-	-	-
G01 (surface)	-	-	9.3	0.5	0.14	-	-	-
G02 (surface)	-	-	8.2	-	0.14	-	-	-
G03 (surface)	-	-	8.4	1.3	0.12	-	-	-
G04 (surface)	-	-	7.6	-	0.11	-	-	-
G05 (surface)	-	-	8.3	<0.5	0.14	-	-	-
G06 (surface)	-	-	8.5	-	0.15	-	-	-

TOC – Total Organic Carbon, EC – Electrical Conductivity, CEC – Cation Exchange Capacity, ESP – Exchangeable Sodium Percentage.



APPENDIX C

Limitations (LEG01, RL4)

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