



PROJECT CHINA STONE

Mine Waste Storage Facility
Conceptual Design Report





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PROJECT CHINA STONE

MINE WASTE STORAGE FACILITY CONCEPTUAL DESIGN REPORT

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REPORT



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1.0 INTRODUCTION

Golder Associates Pty Ltd (Golder) was commissioned by Hansen Bailey on behalf of MacMines Austasia Pty Ltd (the proponent) to complete a conceptual design report for mine waste storage facilities as part of the Environmental Impact Statement (EIS) for Project China Stone (the project).

The project involves the construction and operation of a large-scale coal mine on a greenfield site in Central Queensland. The project site (the area that will ultimately form the mining leases for the project) is remote, being located approximately 270 km south of Townsville and 300 km west of Mackay at the northern end of the Galilee Basin (Figure 1). The closest townships are Charters Towers, approximately 285 km by road to the north, and Clermont, approximately 260 km by road to the south-east. The project site comprises approximately 20,000 ha of well vegetated land, with low-lying scrub in the south and east and a densely vegetated ridgeline, known as 'Darkies Range', running north to south through the western portion of the site.

The mine will produce up to approximately 55 million tonnes per annum (Mtpa) of Run of Mine (ROM) thermal coal. Coal will be mined using both open cut and underground mining methods (Figure 2). Open cut mining operations will involve multiple draglines and truck and shovel pre-stripping. Underground mining will involve up to three operating longwalls. Coal will be washed and processed on site and product coal will be transported from site by rail. It is anticipated that mine construction will commence in 2016 and the mine life will be in the order of 50 years.

The majority of the mine infrastructure will be located in the eastern portion of the project site (Figure 2). Infrastructure will include coal handling and preparation plants (CHPPs), stockpiles, conveyors, rail loop and train loading facilities, workshops, dams, tailings storage facility (TSF) and a power station. A workforce accommodation village and private airstrip will also be located in the eastern part of the project site.

2.0 SCOPE OF WORK

The project includes a conventional wet tailings storage facility (TSF) for life-of-mine out-of-pit tailings storage and a power station waste storage facility (PSWSF) with capacity to store dry coal ash generated in the first ten years of operations by the on-site power station. The layout of the TSF and PSWSF are shown in Figure 3.

Coarse reject generated from the Coal Handling and Preparation Plant (CHPP) over the life of the mine and dry coal ash from the power station, after the first ten years of operations, will be stored within the open cut mine overburden emplacement and are not discussed further in this report.

The scope of work undertaken by Golder for this conceptual design report included:

- Calculation of the volume of life-of-mine tailings and power station waste produced in the first ten years of operations.
- Sizing of the TSF and PSWSF and associated ultimate footprint areas.
- Preparation of staged development plans and operating methods for the TSF and PSWSF.
- Geotechnical field investigations of the TSF and PSWSF foundation area.
- Design analyses of the TSF and PSWSF.

A number of other technical studies that address elements of tailings and power station waste storage have been undertaken as part of the EIS. These include an assessment of the geochemical properties of the tailings and power station waste materials, a groundwater assessment and a mine water management study. These studies are reported in separate specialist reports that form appendices to the EIS and the EIS main volume provides an overview of all the environmental issues that are relevant to tailings and power station waste storage. For this reason, this conceptual design report does not address the geochemistry of the waste materials, potential seepage from the TSF, or management of surface water (other than providing a high level overview).



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3.0 DESIGN BASIS

3.1 Design drivers and criteria

The design parameters for the TSF and PSWSF are as follows:

- Minimum static Factor of Safety (FoS) of 1.3 at the end of construction.
- Minimum FoS of 1.5 under long term steady state conditions.
- Assuming an average dry density of 1.0 t/m³ the total tailings volume corresponds to approximately 96 Mm³.
- Downstream slopes for the TSF and PSWSF of 1V:6H at closure.
- Upstream slopes for the TSF of 1V:2H.
- Downstream slopes for the TSF (other than the north-eastern embankment) and temporary slopes for the PSWSF of 1V:4H during operations.
- Maximum embankments height of 34 m and 30 m for the TSF and PSWSF, respectively. The PSWSF crest elevation is lower than the adjacent TSF, commensurate with the lower elevation of the natural ground surface at the PSWSF.
- An assumed beach slope of 1V:500H for the deposited tailings in the TSF.
- Inclusion of a seepage collection system around the perimeter of both the TSF and PSWSF.

3.2 Input parameters

Table 1 summarises the life-of-mine volume of tailings and the volume of power station waste generated in the first ten years of operations. Plate 1 illustrates the annual and cumulative tailings and power station waste volumes to be stored in the TSF and PSWSF. The volume of tailings and power station waste has been calculated using a final average dry density of 1 t/m³.

Table 1: Total cumulative volume of tailings and power station waste

Tailings (Mm ³)	Power Station Waste (Mm ³)
96.1	16.4



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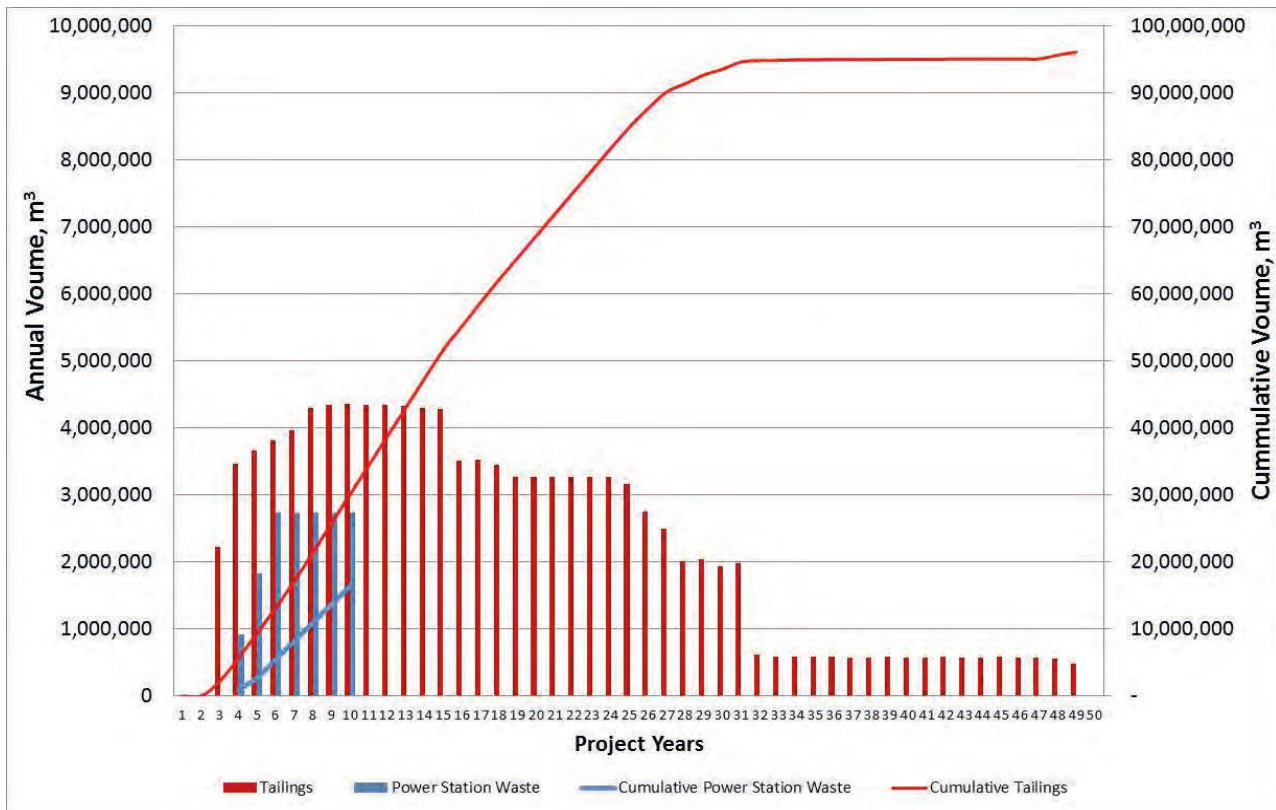


Plate 1: Annual and cumulative tailings and power station waste volumes.

4.0 MATERIAL CHARACTERISATION

4.1 Overview

Design of the TSF and PSWSF requires characterisation of the foundation soils at the site in order to assess the geotechnical stability of the facilities. A field investigation program to assess the geotechnical characteristics of the foundation soils has been undertaken as part of this assessment.

Geotechnical testing and characterisation of the tailings and power station waste has not been undertaken at this stage due to lack of availability of representative samples. The current assessment has been based on Golder's experience with similar facilities. Further analyses based on representative samples of the waste materials will be conducted during the detailed design phase.

The testing and characterisation of foundation soils are provided in the following sections.

4.2 Foundation

4.2.1 Geology

Two bores (MB 20 and MB 32) were drilled by others in this area to investigate the nature of the underlying strata (Figure 4).

The foundation area of the TSF/PSWF site is characterised by highly weathered Tertiary sediments of claystone and fine to medium grained, weakly indurated sandstone. Highly localised Quaternary sediments of fluvial origin are associated with present drainage features. A thin cover of sandy soils covers the surface.

The Tertiary sediments are underlain by the Joe Joe Group. The Joe Joe Group comprises conglomerate, lithic sandstone, siltstone, minor mudstone and coal. The Joe Joe Group is the base unit of the Galilee Basin. The younger sediments of the Clematis Sandstone, Rewan Formation and the Betts Creek Beds all outcrop west of the TSF/PSWSF site.



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4.2.2 Field investigation

Fieldwork was carried out between the 6th and 13th of February 2014 and included:

- The investigation of 35 sites (Figure 4) within the proposed TSF/PSWSF footprint by:
 - Excavation of 23 test pits.
 - Drilling of 12 boreholes.
 - The performance of dynamic cone penetrometer tests adjacent to test pits and boreholes.
- Inspections of visible drainage lines within the footprint.

The test pits were excavated using a backhoe and a 450 mm standard bucket. The auger holes were drilled using a Landcruiser mounted drill rig and a 90 mm diameter auger.

The excavation of the testing locations was supervised by an engineering geologist from Golder and the locations were discontinued at a maximum depth of 3.5 m, with prior refusal being encountered in the majority of the locations. Strata identification was based on inspection of the excavated materials. Geotechnical samples of selected subsurface materials were recovered for laboratory testing, as described in the following sections. Test pit and boreholes reports are provided in Appendix A.

4.2.3 Laboratory testing

Laboratory testing was carried out on representative disturbed and undisturbed samples to assess soil classification (particle size distribution, moisture content and plasticity), Emerson Class, compaction and permeability.

A summary of the laboratory test results along with the detailed report sheets are included in Appendix B.

4.2.4 Surface conditions

The TSF/PSWSF footprint is located in the south-eastern section of the project site (Figure 2).

At the time of the investigation, the site was being used for cattle grazing. The footprint area is traversed by two drainage lines that drain to the east to an upper tributary of Tomahawk Creek (Figure 4). These drainage lines were dry at the time of the field investigation.

The site was mostly grassed and densely populated with medium mature to mature, native trees. There had been only small amounts of rainfall at the site leading up to the time of the investigation and the bare ground surface was mostly dry and hardset, whilst the vegetated ground surface was dry to moist. The hardness of the subgrade materials is expected to vary with seasonal conditions, with both the surface and subsurface soils being susceptible to softening during wet weather periods.

4.2.5 Subsurface conditions

The investigation revealed that the site is typically underlain by a silty or clayey sand soil of medium density. The sandy soil became cemented near surface and the cemented material increased in density until refusal was reached at most sites within 3.5 m.

Site geology and investigation by others, confirms that highly weathered claystone and fine to medium grained, weakly indurated sandstone underlies the soil strata and that there is no shallow groundwater in the area. Groundwater was encountered at only one of the geotechnical investigation sites, undertaken adjacent to a drainage line.

4.2.6 Engineering assessment

The findings of the field investigation are typically consistent with the expected geological conditions at the site and indicate a relatively shallow soil cover over the weathered lateritic sedimentary soil profiles. The key engineering features of the foundation conditions, as they relate to the TSF and PSWSF, are summarised as follows:



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- **Soil Strength** – Other than the surface soils, which will be removed or reworked as part of the site preparation, the soils are typically at least dense or very stiff and this increases with depth as the strata becomes more cemented. For the conceptual design, soil strength parameters have been selected for two layers to represent the uncemented and cemented soils. A layer thickness of 1 m has been selected for the uncemented zone and is deemed to reflect the ground conditions as identified in the field investigation.
- **Rock Strength** – It is expected that highly weathered claystone and fine to medium grained, weakly indurated sandstone underlies the site at depth; however the investigation did not penetrate the dense cemented clayey sands that are likely to represent the weathered zone of the underlying lithified materials. For the design, the rock has not been included in the modelling and this is considered a conservative assumption.
- **Soil Permeability** – The near surface soils vary from clays to clayey sands which will lead to some natural variability in permeability. Testing of two undisturbed samples from 1.2 m depth gave coefficient of permeability values of 1.6×10^{-10} m/s and 9.3×10^{-10} m/s, which is consistent with literature values for clays (for example Bowles¹ provides a range of 10^{-9} to 10^{-11} m/s). The permeability of clayey sands is expected to be greater, though still relatively low as the clay content typically exceeds 20%.
- **Dispersivity** – Testing indicates that the soil at the site does not disperse when immersed in distilled water, even when remoulded and therefore standard erosion control measures are likely to be effective.
- **Construction Materials** – Soils that are mixtures of sand and clay are typically good construction materials as they can be readily handled and in the right proportions, can be compacted to achieve relatively low permeability and high strength fills. The clays are typically of medium plasticity which reduces the likelihood of shrinkage cracking. The clay has a low permeability when compacted (around 1.9×10^{-10} m/s from testing) making it suitable for embankment construction and preparation of a low permeability foundation layer.

5.0 DESIGN ANALYSES

5.1 Geotechnical stability

Slope stability analyses were undertaken for the TSF and PSWSF with the intent of estimating the FoS of the proposed closure and temporary slopes under a variety of load conditions. The closure slope will be at 1V:6H while the temporary slopes have been designed as 1V:4H, as shown on Figure 5.

The minimum FoS required to meet the design basis and standard engineering practice for each case are:

- FoS > 1.5 for long-term (closure) conditions.
- FoS > 1.3 for short-term conditions (i.e. immediately after placement or after a rainfall event).

The analyses undertaken for both the closure and temporary slopes included:

- Case 1. Tailings placed with no clay liner and elevated water table – long-term conditions.
- Case 2. Tailings placed with clay liner and elevated water table – long-term conditions
- Case 3. Tailings with clay liner and elevated water table – short-term conditions.
- Case 4. Tailings with no clay liner and elevated water table – short-term conditions.
- Case 5. PSWSF

The material parameters used during the analysis are based on the findings of the site specific investigations and laboratory testing and Golder experience. The material parameters are shown in Table 2.

¹ Bowles, J.E., Foundation Analysis and Design, Mc Graw-Hill, USA, 1996



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Table 2: Material Parameters

Materials	Unit Weight (kN/m ³)	Effective Stress		Total Stress
		Cohesion (kPa)	Friction Angle (degrees)	Undrained Shear Strength (kPa)
Power station waste	18	0	33	-
Tailings	16	0	28	-
Foundation	18	2	30	-
Very Dense Sand	20	10	34	-
Clay Liner	18	10	26	150

The analysis was undertaken using Slope/W 2012 which uses limit equilibrium methods to solve for FoS, and the Morgenstern-Price method was adopted. The Slope/W analyses indicate that both the closure and temporary slopes exceed the minimum FoS requirements, as summarised in Table 3.

Table 3: Summary of Stability Analyses Results

Case	Estimated FoS	Target FoS
1	3.39	1.5
2	3.39	1.5
3	2.50	1.3
4	2.51	1.3
5	3.75	1.5

The results of the analyses are provided in Appendix C.

Analysis of the permanent slopes indicates that the factors of safety exceed target values and are expected to be stable in the long term. The temporary slopes also have factors of safety against instability that exceed the target value, suggesting that 1V:4H is a suitable maximum steepness for these slopes.

5.2 Consequence Category Assessment

A preliminary consequence category assessment of the conceptual TSF has been undertaken in accordance with DEHP (2014)².

The findings are summarised as follows:

- Dams are located such that loss of life is not expected as a result of TSF failure.
- No surface water or drinking water supplies are known within the project surroundings or downstream catchment. TSF failure is therefore unlikely to contaminate water supplies used for human consumption.
- No significant or sensitive environmental features or important public facilities/utilities are present in the likely TSF failure path.
- The cost for rehabilitation of land in the TSF failure path and compensation is expected to cost between \$1 million and \$10 million.

² Manual for Assessing Consequence Categories and Hydraulic Performance of Structures, EM635 Version 4, April 2014, Queensland Government Department of Environment and Heritage Protection.



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The water management system has been configured to ensure tailings and mine-affected water are contained. The preliminary assessment concludes that the proposed TSF is considered a 'significant' consequence category structure and will be considered a 'regulated structure' under the *Environmental Protection Act 1994* (EP Act). A further detailed consequence category assessment including a full dam break analysis will be conducted at the detailed design stage to confirm the consequence category and regulated status under the EP Act.

Hydraulic design criteria including the Design Storage Allowance (DSA), Extreme Storm Storage (ESS) and Mandatory Reporting Level (MRL) have been determined for the TSF in accordance with the Manual requirements for significant consequence category dams. This approach is considered to be appropriate and conservative for the current conceptual design phase. The TSF consequence category will be reevaluated during the detailed design phase considering the three failure event scenarios;

- 1) Failure to contain - seepage.
- 2) Failure to contain – overtopping.
- 3) Dam break.

The ESS, MRL and DSA requirements for regulated storages are shown in Plate 2.

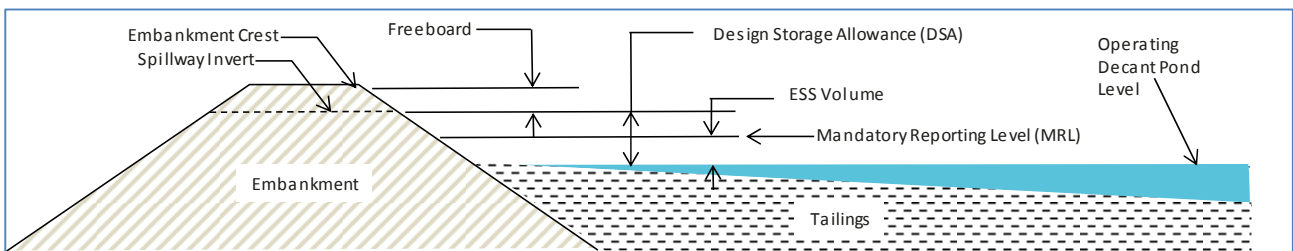


Plate 2: Design storm storage requirements.

In accordance with DEHP (2014)² the definitions for the DSA, ESS and MRL are:

- The ESS is a storm storage allowance determined based on the 72 hour duration 1:10 AEP storm event for a significant consequence category dam. The ESS is equivalent to 202 mm of rainfall.
- The MRL is a level at which the dam has a remaining available volume equivalent to the ESS allowance and this must be marked in a clearly visible location.
- The DSA is an available volume provided in a dam as at 1 November each year in order to prevent a discharge from that dam up to a specified annual exceedance probability (AEP) wet season event. For a significant consequence category dam a 1:20 AEP wet season is appropriate and this corresponds to 690 mm of rainfall.

An allowance has been made in the TSF design for storage of the DSA rainfall. The detailed design of the TSF will include engineered spillways and the staged construction of the TSF will accommodate the ESS below the spillway level.



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6.0 TSF AND PSWSF DESIGN

6.1 Site preparation

6.1.1 Topsoil and cover material

At the commencement of construction of the PSWSF and each stage of the TSF, the footprint area will be cleared and grubbed. Grubbing will be followed by the removal and stockpiling of available soil resources from the TSF/PSWSF foundation areas, including materials suitable for reuse as topsoil and/or capping material. The EIS Soils and Land Suitability Report provides further information on available topsoil and capping material resources.

The existing topsoil resource (i.e. the best quality growth medium) is approximately 1.3 m thick across the TSF/PSWSF footprint. Material intended for reuse in TSF/PSWSF rehabilitation as a plant growth medium (i.e. topsoil and selected subsoil) will be removed and stockpiled in a manner that will aim to preserve the overall structure of these materials. The EIS Rehabilitation Section describes the way in which this material will be managed.

6.1.2 Foundation preparation

After the topsoil and cover material, and any embankment material, have been removed from the TSF/PSWSF footprint, the foundation will be inspected and suitable preparation measures taken to provide a low permeability foundation. It is anticipated that this will involve:

- Ripping the upper soil layers.
- Moisture conditioning (i.e. watering) of the clay liner materials to achieve close to optimum moisture condition so that a low permeability layer is formed during compaction.
- Compaction of the clay liner using a pad-foot or sheeps-foot roller of sufficient weight to achieve compaction of at least 95% of standard dry density.

Should the inspection show that insufficient clay soils are present to achieve design requirements an alternative design solution would be developed and this may include imported clay materials or an engineered liner solution.

6.1.3 Seepage collection system

A perimeter seepage collection system will be installed along the downstream toe of the TSF embankment and along the downstream toe of the external PSWSF slopes to collect and transport any water seeping from the TSF and PSWSF. Typical cross-sections of the seepage collection drains are shown on Figure 5. The location of the perimeter seepage collection system is shown in Figures 6 and 7.

The seepage drain would be lined with geofabric material and will include slotted pipes surrounded by gravel.

The seepage collection system will drain to a series of collection sumps. Seepage water from the collection sumps will be pumped to the TSF.

6.2 TSF

6.2.1 TSF Staging

A conceptual TSF operating plan has been developed for EIS purposes. A comprehensive operational plan will be developed during detailed design and maintained over the life of the facility.

The conceptual TSF operating plan is described in the remainder of this section and shown on Figures 6 and 7. The operating plan demonstrates that the TSF can be developed to accommodate life-of-mine tailings in a manner that ensures that tailings are properly contained.



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The progressive development of the TSF is illustrated at seven stages over the life of the mine, including closure, in Figures 6 and 7. The TSF embankments will be raised in stages using the downstream construction method.

Table 4 presents the tailings volumes to be stored at the selected years of mine operation, including closure, as well as both the TSF embankment elevation and maximum embankment height required.

Table 4: TSF staged layout plan

Stage	Project Year	Cumulative Tailings (m ³)	Embankment Elevation (RL m)	Max Embankment Height (m)
1	5	9,353,341	315.9	12.4
2	10	30,124,955	322.8	19.3
3	15	51,683,638	327.7	24.2
4	20	68,690,125	331.5	28.0
5	30	93,537,121	336.8	33.3
6	49	96,112,024	337.5	34.0
7	Closure	96,112,024	337.5	34.0

The required maximum footprint area for the TSF corresponds to 603 ha for the closure stage and requires a maximum embankment height of approximately 34 m.

6.2.2 Tailings delivery system

Tailings would be delivered from the CHPP to the TSF as a slurry via a pipeline system. The pipeline system would be distributed around the inner crest of the TSF embankment walls and full pipe spigot off-takes would be set at approximately 100 m centres. Flow into the off-takes would be controlled by valves and the flow would discharge into a slotted pipe laid down the inner slope of the TSF embankments to the base of the facility.

6.2.3 Tailings deposition strategy

The tailings deposition strategy will involve sequencing of the active tailings discharge spigots in order to progressively develop a beach around the perimeter embankment towards the centre of the TSF. This method will maintain a tailings decant water pond in the centre of the active TSF area. Tailings water will collect in the decant pond following deposition of solids from the tailings slurry on the beach areas. Rainfall runoff from within the active TSF area will also collect in the decant pond.

For each TSF development stage the spigot off-take system would be set around the inner crest of the TSF embankments to ensure the tailings beach can be maintained, ensuring the efficient placement of tailings solids within the TSF and maintenance of the central decant pond.

This deposition strategy will also allow for the progressive drying and consolidation of successive layers of deposited tailings which will increase the shear strength of the final tailings beach. This deposition strategy is well-established and commonly used in conventional wet tailings storage facilities in the coal mine mining industry.

6.2.4 Decant pond management

A pontoon mounted return water pump will be moored in the TSF decant pond. The pump will operate automatically to maintain a low water level within the decant pond. The pump will transfer water from the decant pond to the Return Water Dam. The Return Water Dam will be a priority water supply for the CHPP.



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6.2.5 Spillway

The TSF will include temporary spillway structures during the TSF staging. The north embankment of the TSF has been selected as the location of the temporary spillway structures. The initial temporary spillway will be required once the TSF embankment perimeter is enclosed in Year 15. The temporary spillways will be constructed as part of the staged TSF embankment raising. The spillways will be sized to handle the 1:100 AEP flow event in accordance with DEHP (2014) requirements for a significant consequence category dam.

6.2.6 Surface drainage

Water management for the project, including the TSF, is addressed in greater detail in the EIS Surface Water Section. The broad principles for surface drainage management for the TSF area are described below.

- Prior to the construction of the TSF embankment around the full perimeter of the TSF, diversion drains will be constructed at the northern end of the TSF to isolate the active TSF catchment (Figure 6).
- Once the full embankment is constructed around the perimeter of the TSF it will isolate the TSF catchment (Figure 6).
- Runoff from the external slopes of the TSF embankment will be collected in toe drains and directed to sediment traps for control of suspended sediment prior to draining from site. Drainage from established rehabilitation on the external TSF embankment slopes will be allowed to drain from site.

6.2.7 Monitoring

A monitoring program will be designed to monitor key environmental and design performance indicators. It will include:

- Regular inspections and annual survey of the deposited tailings beach and decant pond.
- Regular inspection of the spigot off-takes system, tailings deposition and operation of the decant pumping system.
- Regular inspection of the surface drainage around the perimeter of the TSF and the seepage collection system.
- Annual inspection of the TSF embankment and spillways.
- Surface water monitoring including TSF decant pond water quality and return water volumes pumped to the Return Water Dam (refer to EIS Surface Water section for details).
- Monitoring of pore water pressures in the TSF embankment.
- Monitoring of groundwater levels and water quality in the vicinity of the TSF (refer EIS Groundwater Report).

The results of the monitoring will be used to assess the performance of the TSF and to undertake regular reviews of the design and operating plans.

6.3 PSWSF

6.3.1 PSWSF staging

A conceptual PSWSF operating plan has been developed for EIS purposes. A detailed operational plan will be developed and maintained over the life of the facility.

The conceptual PSWSF is described in the remainder of this section and shown on Figures 6 and 7. Based on the assigned footprint area and embankment slopes for the PSWSF, the operating plan has been developed to accommodate the amount of power station waste estimated to be generated over the first ten years of operations. Table 5 includes the volumes to be stored during mine operation and closure for the PSWSF.



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Table 5: PSWSF staged layout plan

Project Year	Cumulative Power station waste (m ³)	Embankment Elevation (RL m)	Embankment Height (m)
5	2,737,800	307	9.5
10	16,426,800	320	30.5
Closure	16,426,800	320	30.5

The assigned footprint area for the PSWSF for closure corresponds to 80 ha and requires a maximum embankment height of approximately 30 m. The PSWSF has a storage capacity of approximately 16.4 Mm³. The remaining power station waste will be stored within the open cut mine overburden emplacement.

6.3.2 Power station waste placement

The dry power station waste will be placed using trucks in a similar fashion to development of an out-of-pit overburden emplacement. Each truck will be loaded at the power station and transported to the designated fill area of the PSWSF. Initially, the material will be paddock dumped across the site at a specified lift height. Subsequent lifts will continue to be placed, with the extent of each lift designated to form the ultimate 1V:6H external slopes.

6.3.3 Surface drainage

Water management for the project, including the PSWSF, is addressed in greater detail in the EIS Surface Water Section. The broad principles for surface drainage management for the PSWSF area are described below.

- Diversion drains will be constructed around the perimeter of the PSWSF to isolate the active PSWSF catchment (Figure 6).
- The active emplacement areas will be developed so that surface runoff drains to internal collection sumps. Runoff that collects in these internal sumps will be pumped to the TSF.
- Runoff from the external slopes of the PSWSF embankment will be collected in toe drains and directed to sediment traps for control of suspended sediment prior to draining from site. Drainage from established rehabilitation on the external PSWSF embankment slopes will be allowed to drain from site.

6.3.4 Monitoring

A monitoring program will be designed to monitor key environmental and design performance indicators. It will include:

- Regular and annual surveys of the emplaced power station waste including assessment of storage capacity and monument survey to assess settlement of the facility with annual engineering survey reports.
- Regular inspection of the surface drainage around the perimeter of the PSWSF and the seepage collection system.
- Regular inspection of the internal drainage collection system and monitoring of internal surface runoff quality.
- Monitoring of pore water pressures in the PSWSF.
- Monitoring of groundwater quality in the vicinity of the PSWSF (refer EIS Groundwater Report).

The results of the monitoring will be used to assess the performance of the PSWSF and to undertake regular reviews of the design and operating plans.



PROJECT CHINA STONE EIS - REJECTS MANAGEMENT

7.0 REHABILITATION AND CLOSURE

7.1 Closure and final landform

At closure any remaining decant water will be pumped out of the TSF decant pond and mine overburden or coarse rejects will be used to fill the TSF to the embankment crest level. The final surface will be profiled with a 2% grade to promote runoff and minimise ponding of water on the final surface of the TSF. Mine overburden will also be placed on any external 1V:4H embankment slopes of the TSF to provide final slopes of 1V:6H.

The external slopes of the PSWSF will be shaped to provide an overall slope of 1V:6H at closure. This will be achieved by dozing any temporary benches and inter-bench slopes. The top surface of the PSWSF will be profiled with a 2% grade to promote runoff.

Both facilities will have maximum final rehabilitation slopes of 1V:6H with maximum slope heights of 34 m. Based on successful rehabilitation experience at other mine sites these slopes and maximum slope heights should result in a stable landform.

7.2 Revegetation

The geochemical characterisation of the tailings and power station coal ash is discussed in detail in the EIS Geochemistry Report. The report concluded that these waste materials have relatively benign geochemistry and no special management measures are required for their handling and permanent storage.

In order to ensure the successful revegetation of the TSF and PSWSF, the final surface of stored waste material in each facility will be covered with a total of 1.3 m of topsoil and growth medium. This level of soil cover will provide sufficient rooting depth and enable successful revegetation and a stable final landform.

The EIS Soils and Land Suitability Report describes the availability of topsoil and cover material.

7.3 Runoff management

The TSF and PSWSF will be shaped at closure to promote runoff and runoff control structures will be installed to manage design flows. Runoff will be controlled using contour drains constructed at regular spacing on the slopes. The contour drains will be constructed with a gradient of approximately 1% and will be topsoiled and seeded with grass.

8.0 LIMITATIONS

Your attention is drawn to the document - "Limitations", which is included in Appendix D of this report. The statements presented in this document are intended to advise you of what your realistic expectations of this report should be, and to present you with recommendations on how to minimise the risks associated with the services provided for this project. The document is not intended to reduce the level of responsibility accepted by Golder Associates, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in so doing.



PROJECT CHINA STONE EIS - REJECTS MANAGEMENT

Report Signature Page

GOLDER ASSOCIATES PTY LTD

A handwritten signature in black ink, appearing to read 'A. Barrett', followed by a horizontal line.

Amanda Barrett
Associate, Principal Geotechnical Engineer

AB/PJC

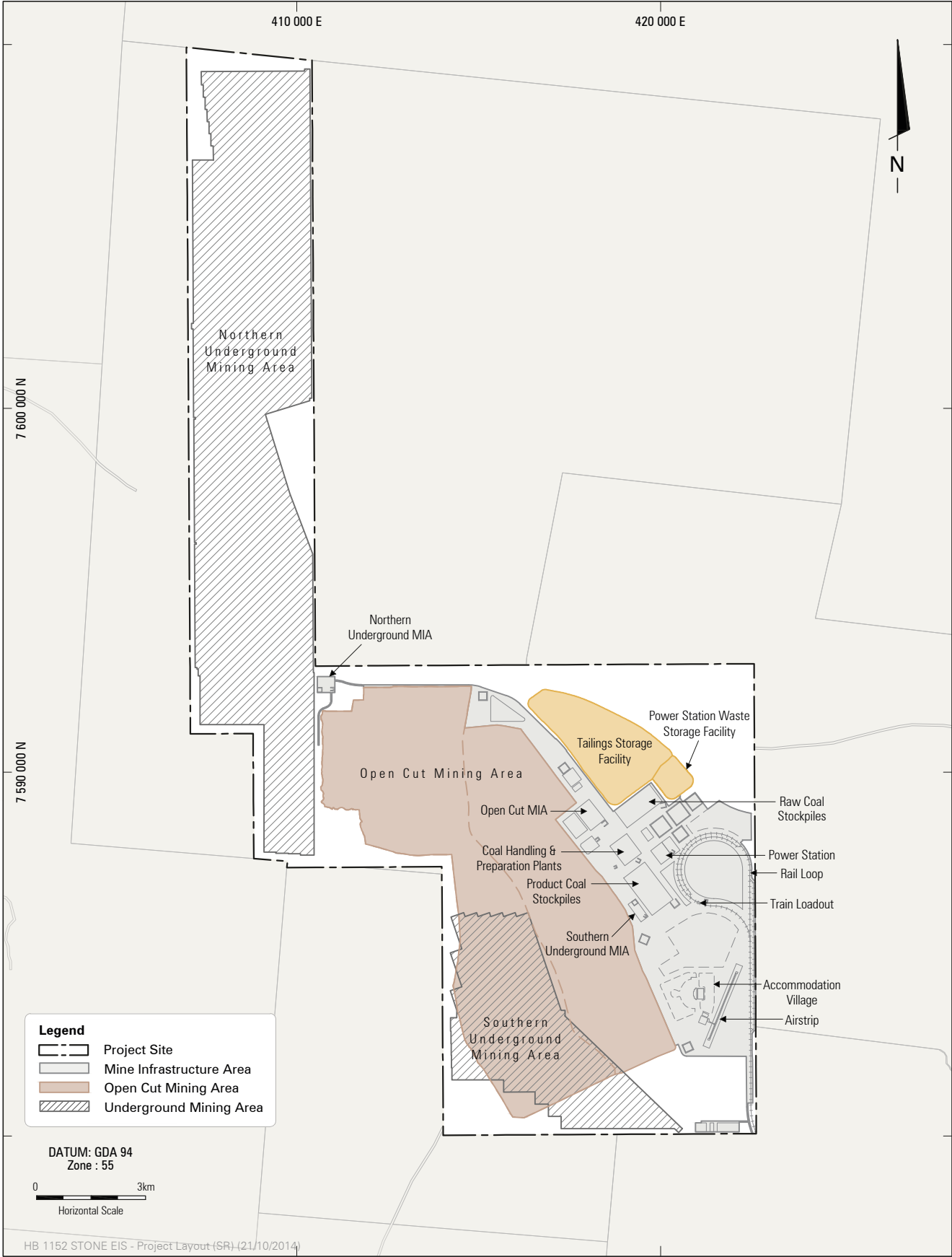
A.B.N. 64 006 107 857

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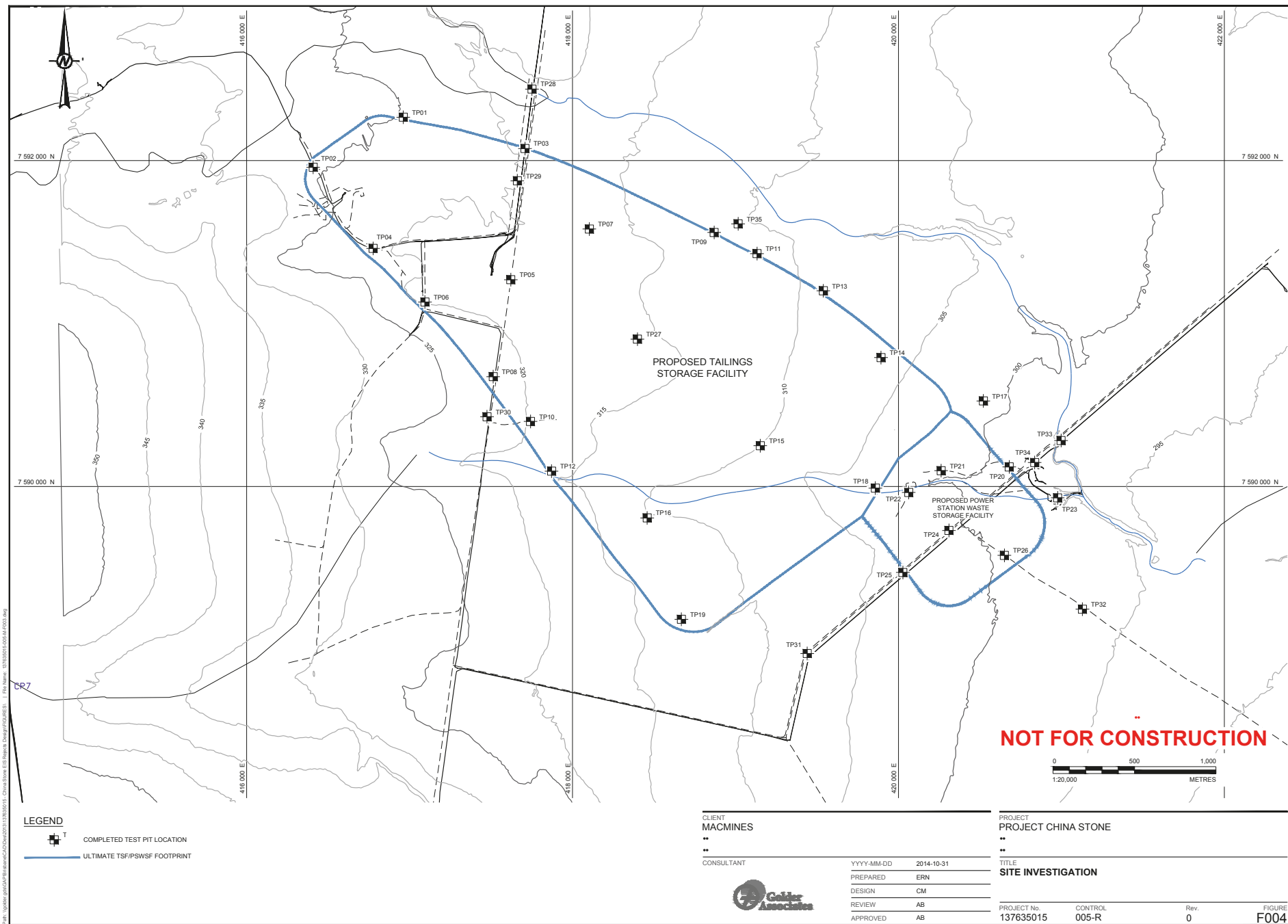


PROJECT CHINA STONE

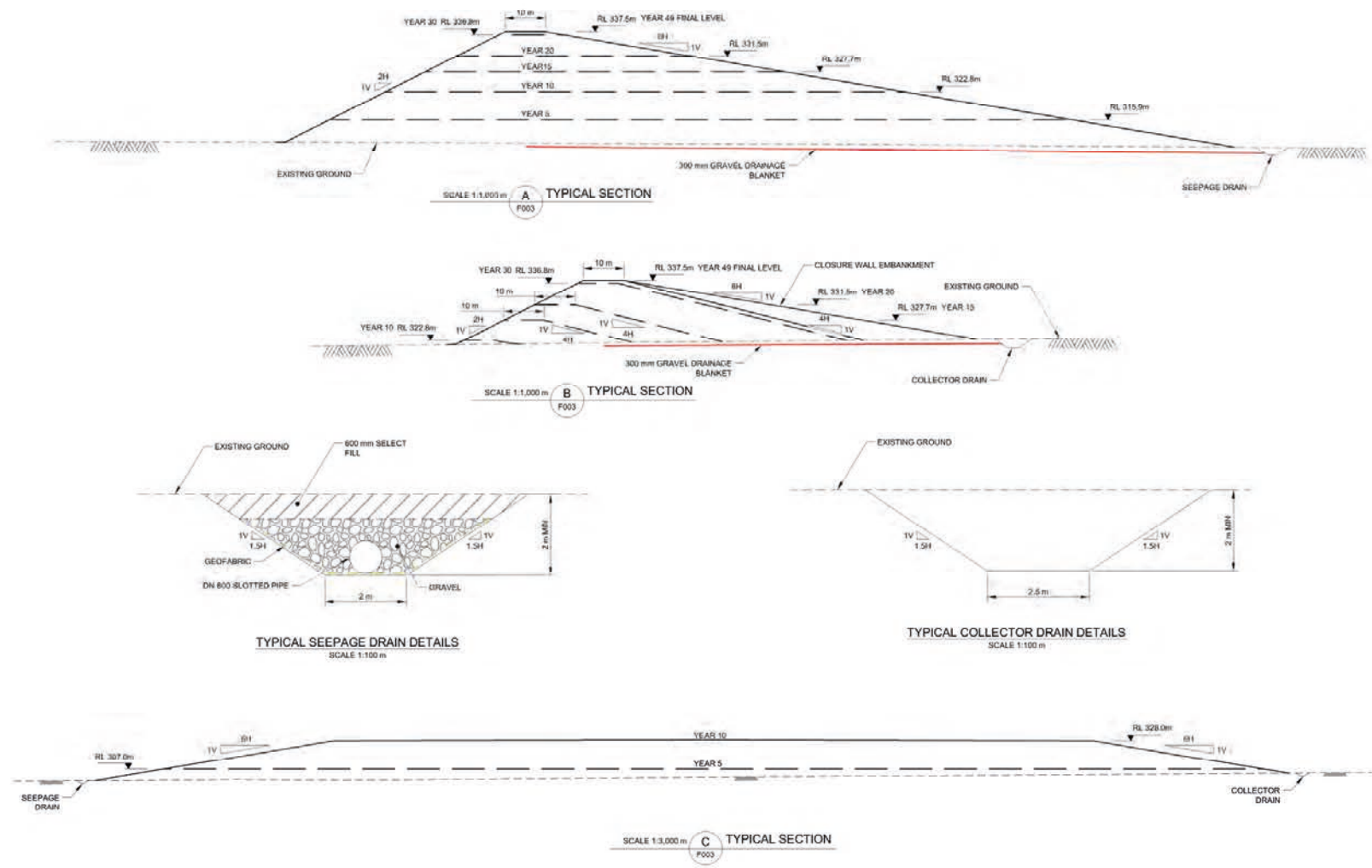


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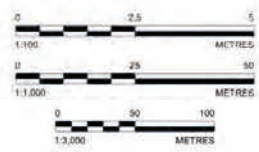




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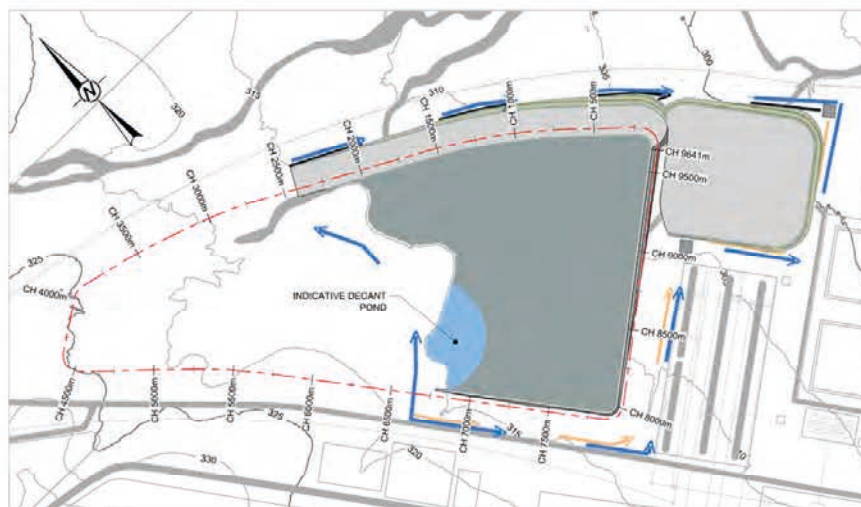


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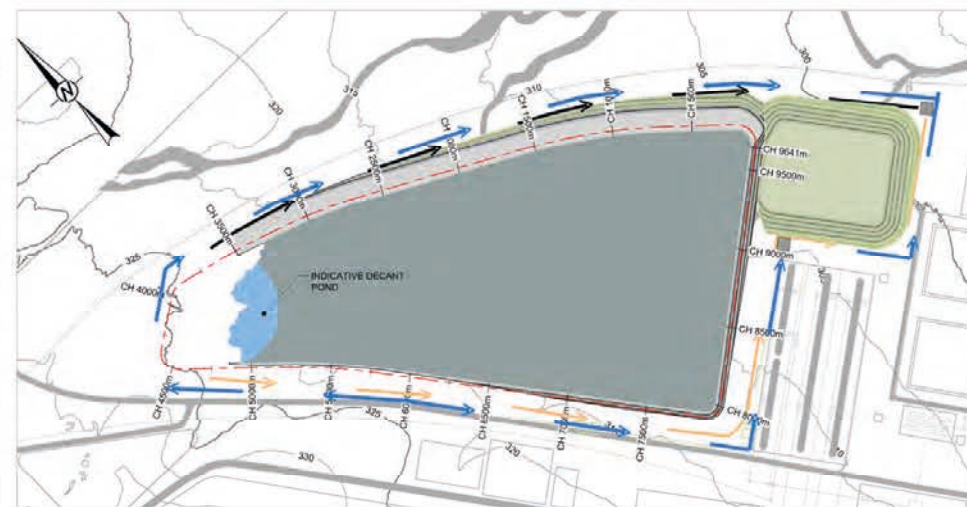


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DESIGN CM		CONTROL 005-R	
REVIEW AB		Rev. 0	
APPROVED AB		FIGURE F005	

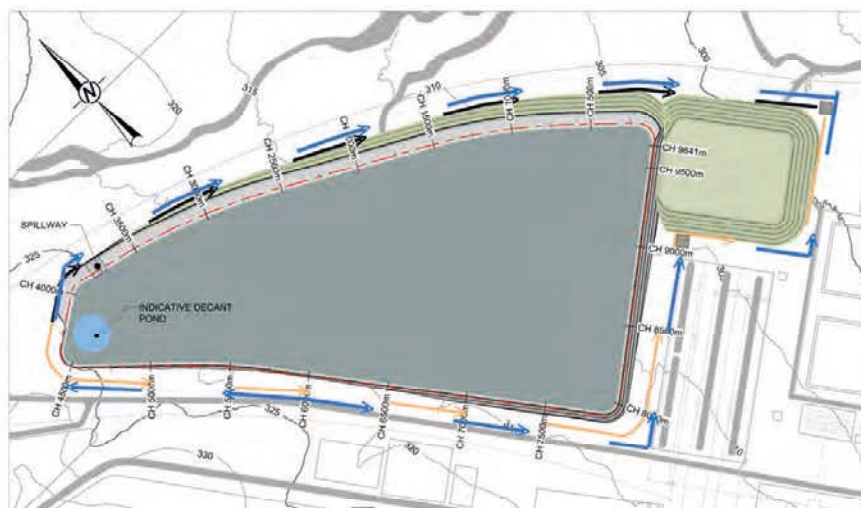




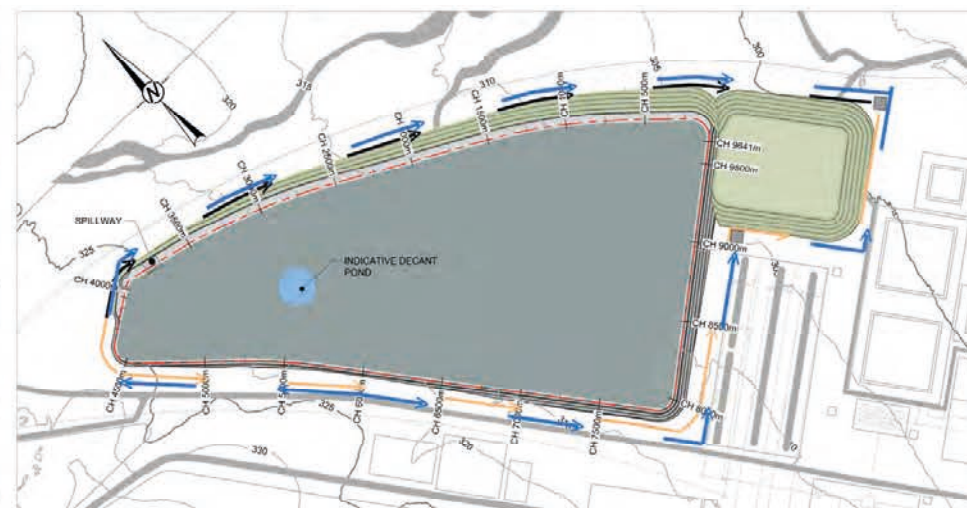
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YEAR 10
SCALE 1:30,000 m



YEAR 15
SCALE 1:30,000 m



YEAR 20
SCALE 1:30,000 m

LEGEND

- SEEPAGE DRAIN
- COLLECTOR DRAIN
- STORMWATER DRAIN
- DEPOSITED TAILINGS SURFACE AREA
- REHABILITATED EMBANKMENT
- CONTACT WATER PUMP

NOT FOR CONSTRUCTION



CLIENT
MACMINES

CONSULTANT



YYYY-MM-DD	2014-10-31
PREPARED	ERN
DESIGN	CM
REVIEW	AB
APPROVED	AB

PROJECT
PROJECT CHINA STONE

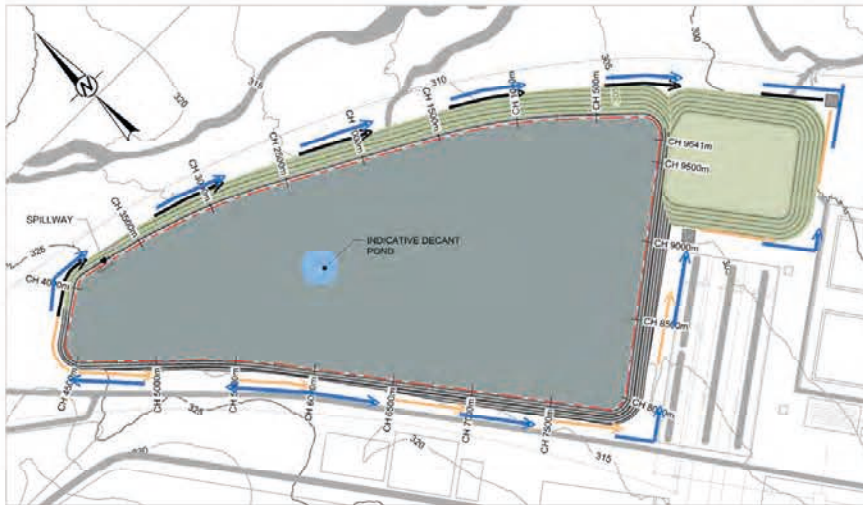
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STAGING PLAN SHEET 1 OF 2

PROJECT No
137635015

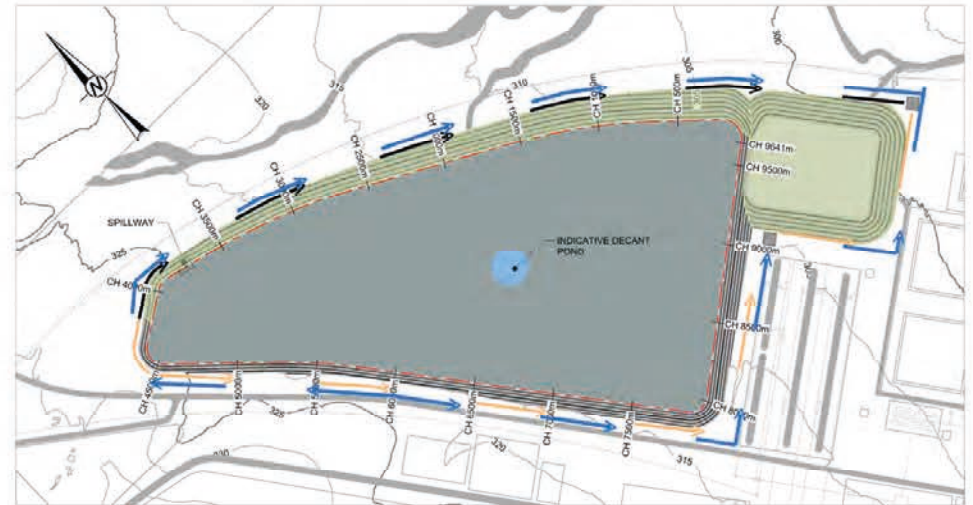
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005-R

Rev.
0

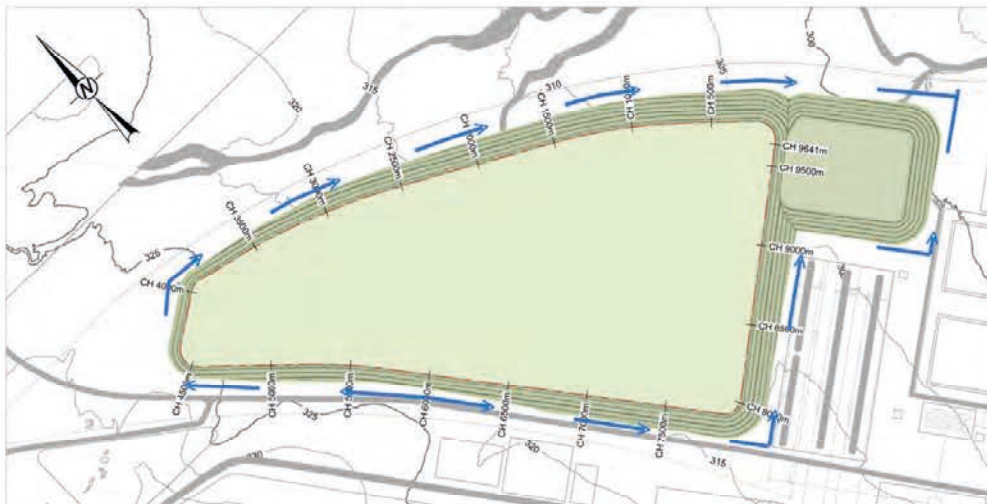
FIGURE
F006



YEAR 30
SCALE 1:30,000 m



YEAR 49
SCALE 1:30,000 m



CLOSURE
SCALE 1:30,000 m

LEGEND

- SEEPAGE DRAIN
- COLLECTOR DRAIN
- STORMWATER DRAIN
- DEPOSITED TAILINGS SURFACE AREA
- REHABILITATED TAILINGS EMBANKMENT
- CONTACT WATER SUMP

LEGEND

NOT FOR CONSTRUCTION



CLIENT
MACMINES

CONSULTANT



YYYY-MM-DD	2014-10-31
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DESIGN	CM
REVIEW	AB
APPROVED	AB

PROJECT
PROJECT CHINA STONE

TITLE
STAGING PLAN SHEET 2 OF 2

PROJECT No	CONTROL	Rev.	FIGURE
137635015	005-R	0	F007



PROJECT CHINA STONE EIS - REJECTS MANAGEMENT

APPENDIX A

Test Pit and Borehole Reports



REPORT OF BOREHOLE: TP001

CLIENT: Hansen Bailey
PROJECT: TSF Investigation
LOCATION: China Stone Project
JOB NO: 137635015

COORDS: 416961.0 m E 7592266.0 m N MGA94 56
SURFACE RL: DATUM: AHD
INCLINATION: -90°
HOLE DEPTH: 1.90 m

SHEET: 1 OF 1

DRILL RIG: Landcruiser Drill Rig
CONTRACTOR: Cardno

LOGGED: SE DATE: 13/2/14
CHECKED: AB DATE: 6/11/14

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	DCP TEST (AS1289.6.3.2) Blows per 100 mm							
												0	5	10	15	20	25		
ADT	L	Groundwater not encountered	0.0		DS 0.50-0.80 m			SM	Silty SAND fine to medium grained, pale brown to grey, with some roots	D - M	L								
			0.30																
			0.50					SC	Clayey SAND fine to medium grained, pale grey and orange brown, trace roots	D - M	D								
			0.90						trace fine to medium grained gravel										
			1.00								with some fine to medium, sub-rounded to rounded gravel, moderately cemented band not cemented	D	VD						
			1.30								weakly cemented								
	1.70				moderately cemented	D - M													
			R		2.0					END OF BOREHOLE @ 1.90 m REFUSAL GROUNDWATER NOT ENCOUNTERED									
					2.5														
			3.0																
			3.5																
			4.0																
			4.5																
			5.0																

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GAP gINT FN. F01b
RL3



REPORT OF TEST PIT: TP002

CLIENT: Hansen Bailey
PROJECT: TSF Investigation
LOCATION: China Stone Project
JOB NO: 137635015

COORDS: 416408.0 m E 7591959.0 m N MGA94 56
SURFACE RL: DATUM: AHD
PIT DEPTH: 2.80 m
BUCKET TYPE: 450mm Standard

SHEET: 1 OF 1
MACHINE: Cat 432E
CONTRACTOR:
LOGGED: SE DATE: 6/2/14
CHECKED: AB DATE: 6/11/14

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	DCP TEST (AS1289.6.3.2) Blows per 100 mm							
												0	5	10	15	20	25		
BH	L	Groundwater not encountered	0.0				x x x x x	ML	SILT low liquid limit, brown to dark brown, with some fine grained sand, with some roots	D	F								
			0.30	DS 0.30-0.60 m		x x x x x	SC	Clayey SAND fine grained, pale brown and pale orange, trace medium grained sand, weakly cemented, trace roots											
	0.5				0.70					trace black, medium, sub-angular to sub-rounded gravel	D								
	1.0				1.00					with pockets of moderately cemented material									
	1.5				1.60	BDS 1.30-2.00 m				with no roots	D - M								
	2.0				2.20					trace medium to coarse, rounded gravel	VD								
	M-H		2.5			DS 2.60-2.80 m													
	H																		
					3.0					TEST PIT DISCONTINUED @ 2.80 m REFUSAL GROUNDWATER NOT ENCOUNTERED									27
					3.5														
			4.0																
			4.5																
			5.0																

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GAP gINT FN. F01f
RL3



REPORT OF TEST PIT: TP003

CLIENT: Hansen Bailey
PROJECT: TSF Investigation
LOCATION: China Stone Project
JOB NO: 137635015

COORDS: 417708.0 m E 7592074.0 m N MGA94 56
SURFACE RL: DATUM: AHD

PIT DEPTH: 3.00 m
BUCKET TYPE: 450mm Standard

SHEET: 1 OF 1
MACHINE: Cat 432E
CONTRACTOR:
LOGGED: SE DATE: 6/2/14
CHECKED: AB DATE: 6/11/14

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GAP gINT FN. F01f
RL3

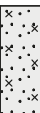


REPORT OF TEST PIT: TP004

CLIENT: Hansen Bailey
PROJECT: TSF Investigation
LOCATION: China Stone Project
JOB NO: 137635015

COORDS: 416776.0 m E 7591461.0 m N MGA94 56
SURFACE RL: DATUM: AHD
PIT DEPTH: 1.75 m
BUCKET TYPE: 450mm Standard

SHEET: 1 OF 1
MACHINE: Cat 432E
CONTRACTOR:
LOGGED: SE DATE: 6/2/14
CHECKED: AB DATE: 6/11/14

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	DCP TEST (AS1289.6.3.2) Blows per 100 mm						
														0	5	10	15	20	25	
BH	L	Groundwater not encountered	0.0					SM	Silty SAND fine grained, brown, low liquid limit, trace clay, with some roots			MD								
			0.40																	
			0.5					CI	Sandy CLAY medium plasticity, orange and pale grey			St - VSt								
	0.75						GP	Sandy GRAVEL fine to coarse grained, red/orange and yellow/brown, with some sub-rounded to rounded cobbles			VD	HB								
	1.00			BDS 1.00-1.20 m			CI	Sandy CLAY medium plasticity, red/grey and red/yellow												
	M-H		1.5		U50 1.20-1.30 m 1.30 m PP = 500 kPa						M									
	R		1.70						SANDSTONE fine grained, red/purple and pale grey, very low to low strength, extremely weathered											
			2.0						TEST PIT DISCONTINUED @ 1.75 m REFUSAL GROUNDWATER NOT ENCOUNTERED Possible perched aquifer at 0.75-1.0 m after rainfall, moist to wet during investigation											
			2.5																	
			3.0																	
			3.5																	
			4.0																	
			4.5																	
			5.0																	

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GAP gINT FN. F01f
RL3



REPORT OF TEST PIT: TP005

CLIENT: Hansen Bailey
 PROJECT: TSF Investigation
 LOCATION: China Stone Project
 JOB NO: 137635015

COORDS: 417094.0 m E 7591132.0 m N MGA94 56
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 1.30 m
 BUCKET TYPE: 450mm Standard

SHEET: 1 OF 1
 MACHINE: Cat 432E
 CONTRACTOR:
 LOGGED: SE
 CHECKED: AB
 DATE: 6/2/14
 DATE: 6/11/14

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	DCP TEST (AS1289.6.3.2) Blows per 100 mm
											0 5 10 15 20 25
BH	L	Groundwater not encountered	0.0				CI	Silty CLAY medium plasticity, pale brown to grey, with some roots			
			0.30		BDS 0.30-1.00 m U50 0.40-0.75 m		CI	Sandy CLAY medium plasticity, orange/brown and grey, fine grained sand, trace roots	F		
			0.5		U50 0.80-1.05 m				M		
			1.0		DS 1.10-1.30 m			SANDSTONE fine, granular, pale grey to grey brown, well cemented, with some macro-pores	VSt		
	H		1.10						H	HB	
	R							TEST PIT DISCONTINUED @ 1.30 m REFUSAL GROUNDWATER NOT ENCOUNTERED			
			1.5								
			2.0								
			2.5								
			3.0								
			3.5								
			4.0								
			4.5								
			5.0								

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GAP gINT FN. F01f
 RL3



REPORT OF TEST PIT: TP006

CLIENT: Hansen Bailey
PROJECT: TSF Investigation
LOCATION: China Stone Project
JOB NO: 137635015

COORDS: 417094.0 m E 7891132.0 m N MGA94 56
SURFACE RL: DATUM: AHD
PIT DEPTH: 1.35 m
BUCKET TYPE: 450mm Standard

SHEET: 1 OF 1
MACHINE: Cat 432E
CONTRACTOR:
LOGGED: SE
CHECKED: AB
DATE: 7/2/14
DATE: 6/11/14

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
BH	L	Groundwater not encountered	0.0					SM	Silty SAND fine to medium grained, brown, with some roots	M	L
	L-M		0.30					SC	Clayey SAND fine grained, pale brown, with some gravel, trace roots	D - M	MD
	M		0.50		DS 0.50-0.70 m				becomes weakly cemented		
	H		0.90		BDS 0.90-1.30 m				becomes moderately cemented, pale grey and pale brown with pockets of red/brown	D - M	VD
	R										HB
			1.5						TEST PIT DISCONTINUED @ 1.35 m REFUSAL GROUNDWATER NOT ENCOUNTERED		
			2.0								
			2.5								
			3.0								
			3.5								
			4.0								
			4.5								
			5.0								

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GAP gINT FN. F01f
RL3



REPORT OF BOREHOLE: TP007

CLIENT: Hansen Bailey
PROJECT: TSF Investigation
LOCATION: China Stone Project
JOB NO: 137635015

COORDS: 418103.0 m E 7591580.0 m N MGA94 56
SURFACE RL: DATUM: AHD
INCLINATION: -90°
HOLE DEPTH: 2.40 m

SHEET: 1 OF 1

DRILL RIG: Landcruiser Drill Rig
CONTRACTOR: Cardno

LOGGED: SE DATE: 11/2/14
CHECKED: AB DATE: 6/11/14

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
ADT	L	Groundwater not encountered	0.0		DS 0.40-0.70 m			ML	SILT low liquid limit, pale brown to grey, with some fine grained sand, trace roots	D		Topsoil
	M		0.30	CL				Sandy CLAY low plasticity, pale brown, fine grained sand, with some fine to medium, sub-rounded to rounded gravel	D			
			0.5					weakly cemented				
			1.00					moderately cemented				
	M-H		1.30					with some gravelly lenses				
	H		1.80					CI	medium plasticity, well cemented			
R	2.00		DS 2.20-2.40 m									
			2.5						END OF BOREHOLE @ 2.40 m REFUSAL GROUNDWATER NOT ENCOUNTERED			
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

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GAP gINT FN. F01a
RL3



REPORT OF TEST PIT: TP008

CLIENT: Hansen Bailey
PROJECT: TSF Investigation
LOCATION: China Stone Project
JOB NO: 137635015

COORDS: 417513.0 m E 7590674.0 m N MGA94 56
SURFACE RL: DATUM: AHD
PIT DEPTH: 2.20 m
BUCKET TYPE: 450mm Standard

SHEET: 1 OF 1
MACHINE: Cat 432E
CONTRACTOR:
LOGGED: SE DATE: 8/2/14
CHECKED: AB DATE: 6/11/14

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	DCP TEST (AS1289.6.3.2) Blows per 100 mm					
												0	5	10	15	20	25
BH	L	08/02/14	0.0	DS 0.30-0.50 m				SM	Silty SAND fine grained, brown, with some roots	M	L						
			0.25					SC	Clayey SAND fine grained, medium to high plasticity, pale brown/orange		VL						
			0.5					with some fine to medium, sub-rounded gravel									
	M-H		0.70	DS 0.90-1.20 m			GP	GRAVEL fine to coarse, grey and pale grey, sub-rounded to rounded	M - W	L							
	0.90		W				D - VD	HB									
	1.0								1.20								
	L-M		1.5	BDS 1.30-1.70 m			CI	Sandy CLAY medium plasticity, grey and orange, with some fine to medium, sub-rounded to rounded gravel, fine grained sand	D - M								
	M-H		1.70				SC	Clayey SAND fine grained, pale grey and pale brown, with pockets of red / black, moderately cemented	D								
			2.0													2.00	CI
	H		R		DS 2.00-2.20 m												
			2.5						TEST PIT DISCONTINUED @ 2.20 m REFUSAL GROUNDWATER ENCOUNTERED @ 0.90 m DEPTH								
			3.0														
			3.5														
			4.0														
			4.5														
			5.0														

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GAP gINT FN. F01f
RL3



REPORT OF BOREHOLE: TP009

CLIENT: Hansen Bailey
PROJECT: TSF Investigation
LOCATION: China Stone Project
JOB NO: 137635015

COORDS: 418869.0 m E 7591559.0 m N MGA94 56
SURFACE RL: DATUM: AHD
INCLINATION: -90°
HOLE DEPTH: 1.70 m

SHEET: 1 OF 1

DRILL RIG: Landcruiser Drill Rig
CONTRACTOR: Cardno

LOGGED: SE DATE: 11/2/14
CHECKED: AB DATE: 6/11/14

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	DCP TEST (AS1289.6.3.2) Blows per 100 mm
											0 5 10 15 20 25
ADT	L	Groundwater not encountered	0.0				ML	Sandy SILT low liquid limit, pale brown, fine with some roots		Vst	
			0.30				ML	SILT low liquid limit, pale brown, with some fine grained sand, trace roots		F	
			0.50		DS 0.50-0.80 m		SC	Clayey SAND fine grained, pale brown, medium plasticity clay		MD	
			0.80					trace fine to medium, sub-rounded to rounded gravel, and weakly cemented		VD	
			1.30		BDS 1.30-1.70 m		CL	Sandy CLAY low plasticity, pale brown, fine grained sand, trace fine to medium sub-rounded gravel, trace of sandy lenses, moderately cemented		H	
			1.5								
			2.0					END OF BOREHOLE @ 1.70 m REFUSAL GROUNDWATER NOT ENCOUNTERED			
			2.5								
			3.0								
			3.5								
			4.0								
			4.5								
			5.0								

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GAP gINT FN. F01b
RL3



REPORT OF TEST PIT: TP010

CLIENT: Hansen Bailey
PROJECT: TSF Investigation
LOCATION: China Stone Project
JOB NO: 137635015

COORDS: 417742.0 m E 7590399.0 m N MGA94 56
SURFACE RL: DATUM: AHD
PIT DEPTH: 1.50 m
BUCKET TYPE: 450mm Standard

SHEET: 1 OF 1
MACHINE: Cat 432E
CONTRACTOR:
LOGGED: SE DATE: 8/2/14
CHECKED: AB DATE: 6/11/14

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
											DCP TEST (AS1289.6.3.2) Blows per 100 mm
											0 5 10 15 20 25
BH	L	Groundwater not encountered	0.0					SM	Silty SAND fine grained, brown to dark brown, with some roots	L	
			0.30		DS 0.30-0.70 m			SM / SC	Silty SAND fine grained, pale brown, with some medium plasticity clay, trace roots	L - MD	
	M		0.5							D	
	M-H		1.0	1.00				SM	Silty SAND fine grained, pale grey and grey with pockets of red / yellow/black, moderately cemented, trace fine to medium, sub-rounded to rounded red gravel	VD	
	H		1.30		DS 1.30-1.50 m				becomes gravelly, fine to coarse, sub-rounded, grey and grey / red		
	R		1.5						TEST PIT DISCONTINUED @ 1.50 m REFUSAL GROUNDWATER NOT ENCOUNTERED		
			2.0								
			2.5								
			3.0								
			3.5								
			4.0								
			4.5								
			5.0								

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GAP gINT FN. F01f
RL3



REPORT OF BOREHOLE: TP011

CLIENT: Hansen Bailey
PROJECT: TSF Investigation
LOCATION: China Stone Project
JOB NO: 137635015

COORDS: 419132.0 m E 7591429.0 m N MGA94 56
SURFACE RL: DATUM: AHD
INCLINATION: -90°
HOLE DEPTH: 1.20 m

SHEET: 1 OF 1

DRILL RIG: Landcruiser Drill Rig
CONTRACTOR: Cardno

LOGGED: SE DATE: 11/2/14
CHECKED: AB DATE: 6/11/14

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
ADT	L	Groundwater not encountered	0.0		DS 0.20-0.40 m			SM	Silty SAND fine grained, pale brown / pale grey, with some roots	D	D - M		Topsoil
			0.20	SC				Clayey SAND fine to medium grained, pale brown / brown, trace roots					
			0.50					with some fine to medium, sub-rounded to rounded, red / brown and black gravel					
	0.70			pale brown and orange, weakly cemented	D	Laterite							
	1.00		DS 1.00-1.20 m		moderately cemented								
	M												
H													
R													
			1.5						END OF BOREHOLE @ 1.20 m REFUSAL GROUNDWATER NOT ENCOUNTERED				
			2.0										
			2.5										
			3.0										
			3.5										
			4.0										
			4.5										
			5.0										

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GAP gINT FN. F01a
RL3



REPORT OF BOREHOLE: TP012

CLIENT: Hansen Bailey
PROJECT: TSF Investigation
LOCATION: China Stone Project
JOB NO: 137635015

COORDS: 417871.0 m E 7590094.0 m N MGA94 56
SURFACE RL: DATUM: AHD
INCLINATION: -90°
HOLE DEPTH: 1.90 m

SHEET: 1 OF 1

DRILL RIG: Landcruiser Drill Rig

CONTRACTOR: Cardno

LOGGED: SE DATE: 10/2/14

CHECKED: AB DATE: 6/11/14

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
											DCP TEST (AS1289.6.3.2) Blows per 100 mm
											0 5 10 15 20 25
ADT	L	Groundwater not encountered	0.0					SM	Silty SAND fine to medium grained, brown, with some roots		
			0.30						pale brown to brown, trace roots	L	
			0.60		DS 0.60-0.80 m			SC	Clayey SAND fine grained, pale brown and orange, medium plasticity clay, with some silt	D	
			1.00						trace fine to medium, sub-rounded gravel		
			1.30		BDS 1.30-1.90 m				becomes weakly cemented	VD	
			1.80						becomes moderately cemented	D - M	
			2.0						END OF BOREHOLE @ 1.90 m REFUSAL GROUNDWATER NOT ENCOUNTERED		
			2.5								
			3.0								
			3.5								
			4.0								
			4.5								
			5.0								

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GAP gINT FN. F01b
RL3



REPORT OF BOREHOLE: TP013

CLIENT: Hansen Bailey
PROJECT: TSF Investigation
LOCATION: China Stone Project
JOB NO: 137635015

COORDS: 419539.0 m E 7591201.0 m N MGA94 56
SURFACE RL: DATUM: AHD
INCLINATION: -90°
HOLE DEPTH: 1.60 m

SHEET: 1 OF 1

DRILL RIG: Landcruiser Drill Rig
CONTRACTOR: Cardno

LOGGED: SE DATE: 11/2/14
CHECKED: AB DATE: 6/11/14

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
ADT	L	Groundwater not encountered	0.0		DS 0.50-0.70 m			ML	SILT low liquid limit, pale grey to brown, with some fine grained sand	D			Topsoil
			0.30	CL				Sandy CLAY low plasticity, pale brown to brown, fine grained sand, trace roots					
			0.50					with some medium plasticity clay, trace roots					
			0.80					with some fine to medium, sub-rounded to rounded gravel					
			1.00	SC				Clayey SAND fine to medium grained, pale brown to grey, medium plasticity clay					
			1.20	CI				Sandy CLAY medium plasticity, orange brown, fine grained sand, with some fine to medium, sub-rounded to rounded gravel, moderately cemented					
	1.5												
									END OF BOREHOLE @ 1.60 m REFUSAL GROUNDWATER NOT ENCOUNTERED				

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GAP gINT FN. F01a
RL3



REPORT OF BOREHOLE: TP014

CLIENT: Hansen Bailey
 PROJECT: TSF Investigation
 LOCATION: China Stone Project
 JOB NO: 137635015

COORDS: 419893.0 m E 75090791.0 m N MGA94 56
 SURFACE RL: DATUM: AHD
 INCLINATION: -90°
 HOLE DEPTH: 1.00 m

SHEET: 1 OF 1
 DRILL RIG: Landcruiser Drill Rig
 CONTRACTOR: Cardno
 LOGGED: SE DATE: 11/2/14
 CHECKED: AB DATE: 6/11/14

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
ADT	L	Groundwater not encountered	0.0		DS 0.30-0.80 m			SM	Silty SAND fine to medium grained, pale brown to grey, with some roots	D			Topsoil
			0.20				SP	SAND fine to medium grained, orange brown, with some clay, trace roots					
			0.5										
			0.80				SC	Clayey SAND fine to medium grained, brown, medium plasticity clay, trace roots, moderately cemented					
	R		1.0						END OF BOREHOLE @ 1.00 m REFUSAL GROUNDWATER NOT ENCOUNTERED				
			1.5										
			2.0										
			2.5										
			3.0										
			3.5										
			4.0										
			4.5										
			5.0										

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GAP gINT FN. F01a
 RL3



REPORT OF BOREHOLE: TP015

CLIENT: Hansen Bailey
 PROJECT: TSF Investigation
 LOCATION: China Stone Project
 JOB NO: 137635015

COORDS: 419152.0 m E 7590250.0 m N MGA94 56
 SURFACE RL: DATUM: AHD
 INCLINATION: -90°
 HOLE DEPTH: 1.10 m

SHEET: 1 OF 1

DRILL RIG: Landcruiser Drill Rig
 CONTRACTOR: Cardno

LOGGED: SE DATE: 13/2/14
 CHECKED: AB DATE: 6/11/14

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	
ADT	L	Groundwater not encountered	0.0		DS 0.70-0.90 m			SM	Silty SAND fine to medium grained, brown / grey, with some roots	D	D - M			Topsoil	
	L-M			SC			Clayey SAND fine to medium grained, brown to brown orange								
	M-H			SC			Clayey SAND fine grained, red / orange / brown, with some fine to medium, sub-rounded to rounded gravel, weakly cemented								
	H						moderately cemented								
	R														
			1.5						END OF BOREHOLE @ 1.10 m REFUSAL GROUNDWATER NOT ENCOUNTERED						
			2.0												
			2.5												
			3.0												
			3.5												
			4.0												
			4.5												
			5.0												

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GAP gINT FN. F01a
 RL3



REPORT OF BOREHOLE: TP016

CLIENT: Hansen Bailey
 PROJECT: TSF Investigation
 LOCATION: China Stone Project
 JOB NO: 137635015

COORDS: 418458.0 m E 7589807.0 m N MGA94 56
 SURFACE RL: DATUM: AHD
 INCLINATION: -90°
 HOLE DEPTH: 2.00 m

SHEET: 1 OF 1

DRILL RIG: Landcruiser Drill Rig
 CONTRACTOR: Cardno

LOGGED: SE DATE: 13/2/14
 CHECKED: AB DATE: 6/11/14

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
ADT	L	Groundwater not encountered	0.0					SM	Silty SAND fine grained, brown / grey, with some roots	D - M		Topsoil
			0.30	DS 0.30-0.70 m			SP	SAND fine grained, pale brown, with some clay, trace roots				
	M-H		0.70	DS 0.70-0.90 m			SC	Clayey SAND fine grained, pale brown / orange, trace fine to medium, sub-rounded to rounded gravel	D		Laterite	
			0.90					with some fine to medium, sub-rounded to rounded gravel, weakly cemented				
	H		1.10	BDS 1.30-2.00 m								becoming red / brown
R			2.0						END OF BOREHOLE @ 2.00 m REFUSAL GROUNDWATER NOT ENCOUNTERED			
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

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GAP gINT FN. F01a
 RL3



REPORT OF TEST PIT: TP017

CLIENT: Hansen Bailey
 PROJECT: TSF Investigation
 LOCATION: China Stone Project
 JOB NO: 137635015

COORDS: 420521.0 m E 7590525.0 m N MGA94 56
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 1.80 m
 BUCKET TYPE: 450mm Standard

SHEET: 1 OF 1
 MACHINE: Cat 432E
 CONTRACTOR:
 LOGGED: SE
 CHECKED: AB
 DATE: 7/2/14
 DATE: 6/11/14

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	DCP TEST (AS1289.6.3.2) Blows per 100 mm								
												0	5	10	15	20	25			
BH	L	Groundwater not encountered	0.0		DS 0.30-0.80 m			SM	Silty SAND fine to medium grained, brown, with some roots	M	L									
			0.30	SC				Clayey SAND fine to medium grained, pale brown, trace roots	D - M											
			0.80	CL	Sandy CLAY low plasticity, brown / yellow and orange / red, fine grained sand, trace cemented lenses becomes sandy	M	H													
			1.00																	
			1.40																	
	H			U50 1.20-1.45 m																
	R				BDS 1.40-1.80 m 1.45 m PP = 500 kPa				becoming brown, orange and grey, with red pockets and trace fine to medium, sub-rounded gravel											
									TEST PIT DISCONTINUED @ 1.80 m REFUSAL GROUNDWATER NOT ENCOUNTERED											

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GAP gINT FN. F01f
RL3



REPORT OF BOREHOLE: TP018

CLIENT: Hansen Bailey
PROJECT: TSF Investigation
LOCATION: China Stone Project
JOB NO: 137635015

COORDS: 419858.0 m E 7589990.0 m N MGA94 56
SURFACE RL: DATUM: AHD
INCLINATION: -90°
HOLE DEPTH: 1.00 m

SHEET: 1 OF 1

DRILL RIG: Landcruiser Drill Rig
CONTRACTOR: Cardno

LOGGED: SE DATE: 13/2/14
CHECKED: AB DATE: 6/11/14

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
BH	L	Groundwater not encountered	0.0					SM	Silty SAND fine to medium grained, brown / grey, with some roots	D - M	H	Topsoil
	L-M		0.20	DS 0.20-0.40 m		CI	Sandy CLAY medium plasticity, brown, fine grained sand, trace roots	M				
	M-H		0.70	DS 0.70-0.90 m			becoming hard	D - M				
	H		0.90				becoming hard to drill	D				
	R		0.95	DS 0.95-1.00 m		CI-CH	CLAY medium to high plasticity, pale brown to brown, with some fine to coarse gravel, well cemented END OF BOREHOLE @ 1.00 m REFUSAL GROUNDWATER NOT ENCOUNTERED					
			1.0									
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

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GAP gINT FN. F01a
RL3



REPORT OF BOREHOLE: TP019

CLIENT: Hansen Bailey
 PROJECT: TSF Investigation
 LOCATION: China Stone Project
 JOB NO: 137635015

COORDS: 418668.0 m E 7589185.0 m N MGA94 56
 SURFACE RL: DATUM: AHD
 INCLINATION: -90°
 HOLE DEPTH: 1.90 m

SHEET: 1 OF 1

DRILL RIG: Landcruiser Drill Rig
 CONTRACTOR: Cardno

LOGGED: SE DATE: 10/2/14
 CHECKED: AB DATE: 6/11/14

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	DCP TEST (AS1289.6.3.2) Blows per 100 mm						
													0	5	10	15	20	25	
ADT	L	Groundwater not encountered	0.0		DS 1.30-1.60 m			SM	Silty SAND fine to medium grained, brown to dark brown, with some roots	D - M	MD								
			0.30					SC	Clayey SAND fine to medium grained, brown to pale brown, trace roots										
	M		0.5	0.50					fine grained, pale brown										
	M-H		0.80					trace fine to medium gravel, weakly cemented											
			1.0																
	H		1.5	1.60					moderately cemented										
R			2.0					END OF BOREHOLE @ 1.90 m REFUSAL GROUNDWATER NOT ENCOUNTERED											
			2.5																
			3.0																
			3.5																
			4.0																
			4.5																
			5.0																

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GAP gINT FN. F01b
 RL3



REPORT OF TEST PIT: TP020

CLIENT: Hansen Bailey
PROJECT: TSF Investigation
LOCATION: China Stone Project
JOB NO: 137635015

COORDS: 420680.0 m E 7590120.0 m N MGA94 56
SURFACE RL: DATUM: AHD
PIT DEPTH: 1.40 m
BUCKET TYPE: 450mm Standard

SHEET: 1 OF 1
MACHINE: Cat 432E
CONTRACTOR:
LOGGED: SE DATE: 7/2/14
CHECKED: AB DATE: 6/11/14

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
												DCP TEST (AS1289.6.3.2) Blows per 100 mm
			0.0					SM	Silty SAND brown / grey, and roots			
			0.30		DS 0.30-1.20 m			SP	SAND fine to medium grained, pale brown to pale orange, with some clay, and roots			
			0.90		DS 1.20-1.40 m			SC	Clayey SAND fine grained, pale brown, pale grey and pale orange, trace clay, and roots			
			1.5						TEST PIT DISCONTINUED @ 1.40 m REFUSAL GROUNDWATER NOT ENCOUNTERED			
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

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GAP gINT FN. F01f
RL3



REPORT OF TEST PIT: TP021

CLIENT: Hansen Bailey
PROJECT: TSF Investigation
LOCATION: China Stone Project
JOB NO: 137635015

COORDS: 420262.0 m E 7590097.0 m N MGA94 56
SURFACE RL: DATUM: AHD
PIT DEPTH: 1.40 m
BUCKET TYPE: 450mm Standard

SHEET: 1 OF 1
MACHINE: Cat 432E
CONTRACTOR:
LOGGED: SE
CHECKED: AB
DATE: 7/2/14
DATE: 6/11/14

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	DCP TEST (AS1289.6.3.2) Blows per 100 mm					
												0	5	10	15	20	25
BH	L	Groundwater not encountered	0.0		DS 0.30-0.60 m		</										

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GAP gINT FN. F01f
RL3



REPORT OF TEST PIT: TP022

CLIENT: Hansen Bailey
PROJECT: TSF Investigation
LOCATION: China Stone Project
JOB NO: 137635015

COORDS: 420063.0 m E 7589963.0 m N MGA94 56
SURFACE RL: DATUM: AHD
PIT DEPTH: 1.00 m
BUCKET TYPE: 450mm Standard

SHEET: 1 OF 1
MACHINE: Cat 432E
CONTRACTOR:
LOGGED: SE DATE: 7/2/14
CHECKED: AB DATE: 6/11/14

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
BH	L	Groundwater not encountered	0.0					ML	Sandy SILT fine, low liquid limit, brown, with some roots	M		
	H		0.40		DS 0.40-0.60 m			CL	Sandy CLAY low plasticity, pale brown, pale grey and red, fine grained sand, moderately cemented with well cemented pockets	VSt		
	H-R		0.5							D		
	R		1.0							H		
			1.0						TEST PIT DISCONTINUED @ 1.00 m REFUSAL GROUNDWATER NOT ENCOUNTERED			
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

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GAP gINT FN. F01f
RL3



REPORT OF TEST PIT: TP023

CLIENT: Hansen Bailey
 PROJECT: TSF Investigation
 LOCATION: China Stone Project
 JOB NO: 137635015

COORDS: 420977.0 m E 7589930.0 m N MGA94 56
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 1.70 m
 BUCKET TYPE: 450mm Standard

SHEET: 1 OF 1
 MACHINE: Cat 432E
 CONTRACTOR:
 LOGGED: SE
 CHECKED: AB
 DATE: 7/2/14
 DATE: 6/11/14

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	DCP TEST (AS1289.6.3.2) Blows per 100 mm
											0 5 10 15 20 25
BH	L	Groundwater not encountered	0.0				SM	Silty SAND fine to medium grained, brown, with some roots	M		
			0.40		DS 0.40-0.70 m		SC	Clayey SAND fine grained, pale brown, trace roots, weakly cemented	L		
	M		0.5						D - M		
	H		1.00					becomes moderately cemented			
	H-R		1.30		BDS 1.30-1.60 m		SC	Clayey SAND fine grained, pale grey and pale brown with some red pockets, medium plasticity clay, trace fine to medium, sub-rounded to rounded gravel	VD		
R			1.5						D	HB	
			2.0		BDS 1.80-2.00 m (collected from adjacent stream cutting)			TEST PIT DISCONTINUED @ 1.70 m REFUSAL GROUNDWATER NOT ENCOUNTERED			
			2.5								
			3.0								
			3.5								
			4.0								
			4.5								
			5.0								

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GAP gINT FN. F01f
 RL3



REPORT OF TEST PIT: TP024

CLIENT: Hansen Bailey
PROJECT: TSF Investigation
LOCATION: China Stone Project
JOB NO: 137635015

COORDS: 420310.0 m E 7589730.0 m N MGA94 56
SURFACE RL: DATUM: AHD
PIT DEPTH: 3.00 m
BUCKET TYPE: 450mm Standard

SHEET: 1 OF 1
MACHINE: Cat 432E
CONTRACTOR:
LOGGED: SE
CHECKED: AB
DATE: 7/2/14
DATE: 6/11/14

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	DCP TEST (AS1289.6.3.2) Blows per 100 mm					
														0	5	10	15	20	25
BH	L	Groundwater not encountered	0.0					SM	Silty SAND fine to medium grained, brown, trace clay, with some roots			L							
			0.5	0.50			SC	Clayey SAND fine to medium grained, pale brown orange, trace roots											
	L-M		1.0	1.00	DS 1.00-1.30 m			trace fine to medium, sub-rounded red gravel, with no roots, becomes weakly cemented											
			1.5		DS 1.40-1.80 m						D - M								
	M		2.0	1.90	DS 2.00-2.30 m			trace moderately cemented lenses			VD								
			2.5		DS 2.70-3.00 m														
			3.0						TEST PIT DISCONTINUED @ 3.00 m REFUSAL GROUNDWATER NOT ENCOUNTERED										
			3.5																
			4.0																
			4.5																
			5.0																

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GAP gINT FN. F01f
RL3



REPORT OF TEST PIT: TP025

CLIENT: Hansen Bailey
 PROJECT: TSF Investigation
 LOCATION: China Stone Project
 JOB NO: 137635015

COORDS: 420028.0 m E 7589472.0 m N MGA94 56
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 1.70 m
 BUCKET TYPE: 450mm Standard

SHEET: 1 OF 1
 MACHINE: Cat 432E
 CONTRACTOR:
 LOGGED: SE
 CHECKED: AB
 DATE: 7/2/14
 DATE: 6/11/14

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	DCP TEST (AS1289.6.3.2) Blows per 100 mm					
													0	5	10	15	20	25
BH	L	Groundwater not encountered	0.0		DS 0.00-0.50 m		SM	Silty SAND fine to medium grained, brown, with some roots	M	L								
			0.50		pale brown, trace roots			D										
	L-M		0.90		DS 1.30-1.50 m		SC	Clayey SAND fine grained, pale brown, pale grey, with pockets of orange / red, with some silt, with some clay, weakly cemented	D - M	VD								
	M		1.10					with some fine to medium, sub-rounded to rounded, red gravel										
			1.50					DS 1.50-1.70 m		CI								
			2.0						TEST PIT DISCONTINUED @ 1.70 m REFUSAL GROUNDWATER NOT ENCOUNTERED									
			2.5															
			3.0															
			3.5															
			4.0															
			4.5															
			5.0															

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GAP gINT FN. F01f
RL3

CLIENT: Hansen Bailey
PROJECT: TSF Investigation
LOCATION: China Stone Project
JOB NO: 137635015

BUCKET TYPE: 450mm Standard

CHECKED: AB

DATE: 6/11/14

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GAP gINT FN. F01f
RL3



REPORT OF BOREHOLE: TP027

CLIENT: Hansen Bailey
PROJECT: TSF Investigation
LOCATION: China Stone Project
JOB NO: 137635015

COORDS: 418398.0 m E 7590904.0 m N MGA94 56
SURFACE RL: DATUM: AHD
INCLINATION: -90°
HOLE DEPTH: 1.30 m

SHEET: 1 OF 1

DRILL RIG: Landcruiser Drill Rig
CONTRACTOR: Cardno

LOGGED: SE DATE: 13/2/14
CHECKED: AB DATE: 6/11/14

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
ADT	L	Groundwater not encountered	0.0		DS 0.50-0.90 m			SM	Silty SAND fine grained, brown grey, with some roots	D - M			Topsoil
	L-M		0.30				SC	Clayey SAND fine to medium grained, brown to pale brown, trace roots					
	0.50			SC			Clayey SAND fine to medium grained, brown to red brown, with some fine to medium, sub-rounded to rounded gravel, weakly cemented						
	M-H		1.00	DS 1.00-1.30 m				moderately cemented	D				
			1.5						END OF BOREHOLE @ 1.30 m REFUSAL GROUNDWATER NOT ENCOUNTERED				
			2.0										
			2.5										
			3.0										
			3.5										
			4.0										
			4.5										
			5.0										

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GAP gINT FN. F01a
RL3



REPORT OF TEST PIT: TP028

CLIENT: Hansen Bailey
PROJECT: TSF Investigation
LOCATION: China Stone Project
JOB NO: 137635015

COORDS: 417751.0 m E 7592439.0 m N MGA94 56
SURFACE RL: DATUM: AHD
PIT DEPTH: 1.80 m
BUCKET TYPE: 450mm Standard

SHEET: 1 OF 1
MACHINE: Cat 432E
CONTRACTOR:
LOGGED: SE
CHECKED: AB
DATE: 8/2/14
DATE: 6/11/14

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	DCP TEST (AS1289.6.3.2) Blows per 100 mm						
													0	5	10	15	20	25	
BH	L		0.0					SM	Silty SAND fine to medium grained, brown to brown / red		MD								
			0.40		DS 0.40-0.90 m			CI	Sandy CLAY medium plasticity, red / brown and grey, with some silt		M								
	L-M		0.90		U50 0.80-0.90 m				becomes red / brown / yellow		St - VSt								
			1.40		DS 1.30-1.70 m			SC	Clayey SAND fine to medium grained, grey, medium plasticity clay		W MD								
	L	08/02/14	1.50					CI	Sandy CLAY medium plasticity, red, grey and orange / brown		D - M VSt								
	H				U50 1.70-1.95 m														
	R																		
				2.0					TEST PIT DISCONTINUED @ 1.80 m REFUSAL GROUNDWATER ENCOUNTERED @ 1.40 m DEPTH										
				2.5															
				3.0															
			3.5																
			4.0																
			4.5																
			5.0																

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GAP gINT FN. F01f
RL3



REPORT OF TEST PIT: TP029

CLIENT: Hansen Bailey
 PROJECT: TSF Investigation
 LOCATION: China Stone Project
 JOB NO: 137635015

COORDS: 417661.0 m E 7591876.0 m N MGA94 56
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 3.50 m
 BUCKET TYPE: 450mm Standard

SHEET: 1 OF 1
 MACHINE: Cat 432E
 CONTRACTOR:
 LOGGED: SE
 CHECKED: AB
 DATE: 8/2/14
 DATE: 6/11/14

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	DCP TEST (AS1289.6.3.2) Blows per 100 mm						
											DENSITY	0	5	10	15	20	25	
BH	L	Groundwater not encountered	0.0					SM	Silty SAND fine to medium grained, brown, with some roots	M	MD							
			0.30	DS 0.40-0.60 m			CL	Sandy CLAY low plasticity, pale brown to brown, fine grained sand, friable, with trace roots		St - VSt								
	0.5																	
	1.00								trace sandy lenses and roots									
	1.30		DS 1.30-1.70 m					SC	Clayey SAND fine to medium grained, pale brown									
	1.5																	
	2.00								with some coarse grained sand	D								
	2.5		DS 2.50-3.00 m															
	3.0																	
			L		3.5						TEST PIT DISCONTINUED @ 3.50 m GROUNDWATER NOT ENCOUNTERED Pit walls remained stable after being left open for 5 minutes							
			4.0															
			4.5															
			5.0															

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GAP gINT FN. F01
R1

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GAP gINT FN. F01f
RL3



REPORT OF TEST PIT: TP030

CLIENT: Hansen Bailey
PROJECT: TSF Investigation
LOCATION: China Stone Project
JOB NO: 137635015

COORDS: 417475.0 m E 7590428.0 m N MGA94 56
SURFACE RL: DATUM: AHD
PIT DEPTH: 1.60 m
BUCKET TYPE: 450mm Standard

SHEET: 1 OF 1
MACHINE: Cat 432E
CONTRACTOR:
LOGGED: SE
CHECKED: AB
DATE: 8/2/14
DATE: 6/11/14

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	DCP TEST (AS1289.6.3.2) Blows per 100 mm					
													0	5	10	15	20	25
BH	L	Groundwater not encountered	0.0															

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GAP gINT FN. F01f
RL3



REPORT OF TEST PIT: TP031

CLIENT: Hansen Bailey
 PROJECT: TSF Investigation
 LOCATION: China Stone Project
 JOB NO: 137635015

COORDS: 419440.0 m E 7588975.0 m N MGA94 56
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 2.05 m
 BUCKET TYPE: 450mm Standard

SHEET: 1 OF 1
 MACHINE: Cat 432E
 CONTRACTOR:
 LOGGED: SE DATE: 9/2/14
 CHECKED: AB DATE: 6/11/14

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	Groundwater not encountered	0.0		DS 0.00-0.30 m		SM	Silty SAND fine to medium grained, brown, with some roots	M	Laterite	Topsoil	
			0.30		DS 0.30-0.80 m		SC	Clayey SAND fine to medium grained, brown to pale brown, with some medium plasticity clay, trace roots				
			0.80				CL	Sandy CLAY low plasticity, fine grained sand, yellow / brown with red pockets	D - M			
			1.30		DS 1.30-1.60 m			with some fine to medium, sub-rounded to rounded, red and red / black gravel, becomes weakly cemented				
			1.60					becomes moderately cemented	D			
					DS 1.80-2.00 m							
	M-H											
	H											
	R		2.0									
			2.5						TEST PIT DISCONTINUED @ 2.05 m REFUSAL GROUNDWATER NOT ENCOUNTERED Refusal at 2.05 m on cemented beds			
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

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GAP gINT FN. F01e
RL3



REPORT OF TEST PIT: TP032

CLIENT: Hansen Bailey
PROJECT: TSF Investigation
LOCATION: China Stone Project
JOB NO: 137635015

COORDS: 421129.0 m E 7589247.0 m N MGA94 56
SURFACE RL: DATUM: AHD
PIT DEPTH: 2.20 m
BUCKET TYPE: 450mm Standard

SHEET: 1 OF 1
MACHINE: Cat 432E
CONTRACTOR:
LOGGED: SE
CHECKED: AB
DATE: 9/2/14
DATE: 6/11/14

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	Groundwater not encountered	0.0					SM	Silty SAND fine to medium grained, brown, with some roots	M		Topsoil
			0.30	SC				Clayey SAND fine to medium grained, pale brown / orange	D - M			
			0.5	pale brown and grey / white, trace roots, weakly cemented								
			1.0									
			1.10	with some fine to coarse, pale grey to white, sub-rounded to rounded gravel, with no roots				D				
1.5	moderately cemented											
	M		1.60									
	M-H		2.0	2.00								
	H											
	R											
			2.5						TEST PIT DISCONTINUED @ 2.20 m REFUSAL GROUNDWATER NOT ENCOUNTERED			
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

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GAP gINT FN. F01e
RL3



REPORT OF TEST PIT: TP033

CLIENT: Hansen Bailey
 PROJECT: TSF Investigation
 LOCATION: China Stone Project
 JOB NO: 137635015

COORDS: 420998.0 m E 7590282.0 m N MGA94 56
 SURFACE RL: DATUM: AHD
 PIT DEPTH: 2.50 m
 BUCKET TYPE: 450mm Standard

SHEET: 1 OF 1
 MACHINE: Cat 432E
 CONTRACTOR:
 LOGGED: SE
 CHECKED: AB
 DATE: 9/2/14
 DATE: 6/11/14

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	DCP TEST (AS1289.6.3.2) Blows per 100 mm						
												0	5	10	15	20	25	
BH	L	Groundwater not encountered	0.0		DS 1.30-1.50 m		SM	Silty SAND fine to medium grained, brown to brown / orange, trace clay, with some roots										
			0.40	SP			SAND fine to medium grained, orange / brown, with some silt, trace roots											
			0.5															
			1.0															
			1.5	1.50				trace fine to medium, sub-rounded to rounded gravel, with no roots										
			2.0	2.00				with no gravel										
			2.30					with some fine to coarse, sub-angular to sub-rounded red / black / grey gravel										
M			2.00	DS 2.00-2.30 m					VD									
H			2.30															
R			2.40							D								
			2.5						TEST PIT DISCONTINUED @ 2.50 m REFUSAL GROUNDWATER NOT ENCOUNTERED Pit walls were unstable between 0.4 and 1.3 m depth									
			3.0															
			3.5															
			4.0															
			4.5															
			5.0															

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GAP gINT FN. F01f
RL3



REPORT OF TEST PIT: TP034

CLIENT: Hansen Bailey
PROJECT: TSF Investigation
LOCATION: China Stone Project
JOB NO: 137635015

COORDS: 420836.0 m E 7590147.0 m N MGA94 56
SURFACE RL: DATUM: AHD
PIT DEPTH: 2.00 m
BUCKET TYPE: 450mm Standard

SHEET: 1 OF 1
MACHINE: Cat 432E
CONTRACTOR:
LOGGED: SE
CHECKED: AB
DATE: 9/2/14
DATE: 6/11/14

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
												DCP TEST (AS1289.6.3.2) Blows per 100 mm
												0 5 10 15 20 25
BH	L	Groundwater not encountered	0.0					SM	Silty SAND fine to medium grained, brown, with some roots			
			0.30					SC	Clayey SAND fine grained, brown / orange, trace roots			
			0.5									
			1.0									
			1.30		DS 1.30-1.60 m			SC	Clayey SAND fine grained, pale brown, with some fine to medium, sub-rounded to rounded gravel, weakly cemented			
	M		1.5						becomes pale brown / grey			
	M-H		1.60									
	H		1.80		DS 1.80-2.00 m				becomes with some red / orange pockets, medium cemented, with some macro pores			
	R		2.0									
			2.0						TEST PIT DISCONTINUED @ 2.00 m REFUSAL GROUNDWATER NOT ENCOUNTERED Located between two drainage channels			
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

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GAP gINT FN. F01f
RL3



REPORT OF BOREHOLE: TP035

CLIENT: Hansen Bailey
 PROJECT: TSF Investigation
 LOCATION: China Stone Project
 JOB NO: 137635015

COORDS: 419016.0 m E 7591612.0 m N MGA94 56
 SURFACE RL: DATUM: AHD
 INCLINATION: -90°
 HOLE DEPTH: 2.00 m

SHEET: 1 OF 1

DRILL RIG: Landcruiser Drill Rig
 CONTRACTOR: Cardno

LOGGED: SE DATE: 11/2/14
 CHECKED: AB DATE: 6/11/14

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
ADT	L-M	Groundwater not encountered	0.0		DS 0.50-1.00 m			ML	Clayey SILT low liquid limit, pale brown, medium plasticity clay, trace fine grained sand	D	H	
			0.30	trace fine to medium, sub-angular to sub-rounded gravel								
			0.50									
			1.00									
			1.30-1.60 m									
			1.80									
			1.90									
			1.80 m									
								END OF BOREHOLE @ 2.00 m REFUSAL GROUNDWATER NOT ENCOUNTERED Located in stream bed				
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

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GAP gINT FN. F01a
 RL3



METHOD OF SOIL DESCRIPTION USED ON BOREHOLE AND TEST PIT REPORTS



FILL



GRAVEL (GP or GW)



SAND (SP or SW)



SILT (ML or MH)



CLAY (CL, CI or CH)



ORGANIC SOILS (OL or OH or Pt)



COBBLES or BOULDERS

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

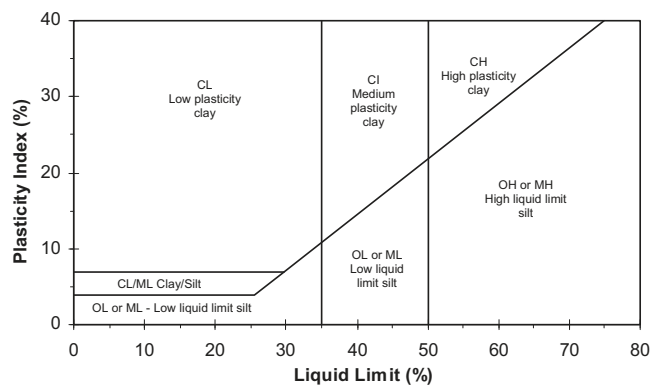
CLASSIFICATION AND INFERRED STRATIGRAPHY

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

Particle Size

Major Division	Sub Division	Particle Size
BOULDERS		> 200 mm
COBBLES		63 to 200 mm
GRAVEL	Coarse	20 to 63 mm
	Medium	6.0 to 20 mm
	Fine	2.0 to 6.0 mm
SAND	Coarse	0.6 to 2.0 mm
	Medium	0.2 to 0.6 mm
	Fine	0.075 to 0.2 mm
SILT		0.002 to 0.075 mm
CLAY		< 0.002 mm

Plasticity Properties



MOISTURE CONDITION

AS1726 - 1993

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

CONSISTENCY AND DENSITY

AS1726 - 1993

Symbol	Term	Undrained Shear Strength	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.



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

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	4,7,11 = Blows per 150mm. N = Blows per 300mm penetration following 150mm seating
30/80mm	Where practical refusal occurs, the blows and penetration for that interval are reported
RW	Penetration occurred under the rod weight only
HW	Penetration occurred under the hammer and rod weight only
HB	Hammer double bouncing on anvil
DS	Disturbed sample
BDS	Bulk disturbed sample
G	Gas Sample
W	Water Sample
FP	Field permeability test over section noted
FV	Field vane shear test expressed as uncorrected shear strength (s_v = peak value, s_r = residual value)
PID	Photoionisation Detector reading in ppm
PM	Pressuremeter test over section noted
PP	Pocket penetrometer test expressed as instrument reading in kPa
U63	Thin walled tube sample - number indicates nominal sample diameter in millimetres
WPT	Water pressure tests
DCP	Dynamic cone penetration test
CPT	Static cone penetration test
CPTu	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	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores. In some environments it is convenient to subdivide into Highly Weathered and Moderately Weathered, with the degree of alteration typically less for MW.
	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 Slickensided
X Foliation	Sn Stain	Sm Smooth
C Contact	Vr Veneer	Ro Rough
L Cleavage	Ct Coating or Infill	
J Joint	Planarity	
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		



PROJECT CHINA STONE EIS - REJECTS MANAGEMENT

APPENDIX B

Laboratory Test Results



PROJECT CHINA STONE EIS - REJECTS MANAGEMENT

Table 6: Laboratory test summary

Borehole	Depth (m)		Field MC	Emerson Class Number	Plasticity				Particle Size Distribution (Percentage Passing) mm										Compaction Test Moisture Density Report		Permeability
					LL	PL	PI	LS	FINES	SAND					GRAVEL			MDD	OMC	Coefficient of Permeability	
	From	To	%		%	%	%	%	0.075	0.15	0.3	0.425	0.6	1.18	2.36	4.75	9.5	19	(t/m ³)		(%)
TP004	1.20	1.50	14.4	5	44	18	26	10.5	63	69	85	91	95	98	100						1.60E ⁻¹⁰
TP006	0.90	1.30	8.0	5	40	16	24	9.5	24	30	43	48	50	53	56	68	89	100			
TP007	1.30	1.80	8.1	5	26	12	14	7.5	56	65	84	90	93	96	98	100					
TP008	1.30	1.70	16.8	5	26	12	14	7.5	54	61	75	81	83	86	89	95	99	100	1.834	13.2	
TP009	1.30	1.70	6.0	5	25	13	12	6.5	54	65	89	96	98	99	100	100			1.782	12.1	1.90E ⁻¹⁰
TP013	1.00	1.20	5.9	5	20	10	10	5.5	44	54	74	82	85	88	92	96	100				
TP016	1.30	2.00	8.0	3	22	11	11	5.0	41	50	69	77	83	89	93	99	100				
TP017	1.20	1.45	10.1	6	25	12	13	6.5	50	59	80	88	93	98	100						9.30E ⁻¹⁰
TP026	1.70	2.00	8.6	5	22	11	11	5.5	44	53	73	81	86	91	95	98	100		2.010	9.7	



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Moisture Content Report

Client :	Hansen Bailey	Report Number:	137635015-5000 - 1
Client Address:	GPO Box 3285 Brisbane QLD 4001	Report Date:	14/03/2014
Job Number :	137635015-5000	Order Number:	
Project :	China Stone	Test Method:	AS1289.2.1.1
Location :	MacMines ,		

Page 1 of 3

Lab No :	14300425	14300426	14300427	14300428
ID No :	-	-	-	-
Lot No :	-	-	-	-
Item No :	-	-	-	-
Date Sampled / Received :	6/3/2014	6/3/2014	6/3/2014	6/3/2014
Date Tested :	10/3/2014	10/3/2014	10/3/2014	10/3/2014
Material Source :	Insitu	Insitu	Insitu	Insitu
For Use As :	Investigation	Investigation	Investigation	Investigation
Sample Location :	TP004 (1.2-1.5 m) U50	TP006 (0.9-1.3 m) BDS	TP007 (1.3-1.8 m) DS	TP008 (1.3-1.7 m) BDS
Drying Temperature(°C):	105 to 110	105 to 110	105 to 110	105 to 110
Moisture Content(%):	14.4	8.0	8.1	16.8
Remarks :				

Lab Number:	Soil Description
14300425	
14300426	
14300427	
14300428	



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Moisture Content Report

Client :	Hansen Bailey	Report Number:	137635015-5000 - 1
Client Address:	GPO Box 3285 Brisbane QLD 4001	Report Date:	14/03/2014
Job Number :	137635015-5000	Order Number:	
Project :	China Stone	Test Method:	AS1289.2.1.1
Location :	MacMines ,		

Page 2 of 3

Lab No :	14300429	14300430	14300432	14300433
ID No :	-	-	-	-
Lot No :	-	-	-	-
Item No :	-	-	-	-
Date Sampled / Received :	6/3/2014	6/3/2014	6/3/2014	6/3/2014
Date Tested :	10/3/2014	10/3/2014	10/3/2014	10/3/2014
Material Source :	Insitu	Insitu	Insitu	Insitu
For Use As :	Investigation	Investigation	Investigation	Investigation
Sample Location :	TP009 (1.3-1.7 m) BDS	TP013 (1.0-1.2 m) DS	TP016 (1.3-2.0 m) BDS	TP017 (1.2-1.45 m) U50
Drying Temperature(°C):	105 to 110	105 to 110	105 to 110	105 to 110
Moisture Content(%):	6.0	5.9	8.0	10.1
Remarks :				

Lab Number:	Soil Description
14300429	
14300430	
14300432	
14300433	



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Moisture Content Report

Client :	Hansen Bailey	Report Number:	137635015-5000 - 1
Client Address:	GPO Box 3285 Brisbane QLD 4001	Report Date:	14/03/2014
Job Number :	137635015-5000	Order Number:	
Project :	China Stone	Test Method:	AS1289.2.1.1
Location :	MacMines ,		

Page 3 of 3

Lab No :	14300434			
ID No :	-			
Lot No :	-			
Item No :	-			
Date Sampled / Received :	6/3/2014			
Date Tested :	10/3/2014			
Material Source :	Insitu			
For Use As :	Investigation			
Sample Location :	TP026 (1.7-2.0 m) BDS			
Drying Temperature(°C):	105 to 110			
Moisture Content(%):	8.6			
Remarks :				

Lab Number:	Soil Description
14300434	



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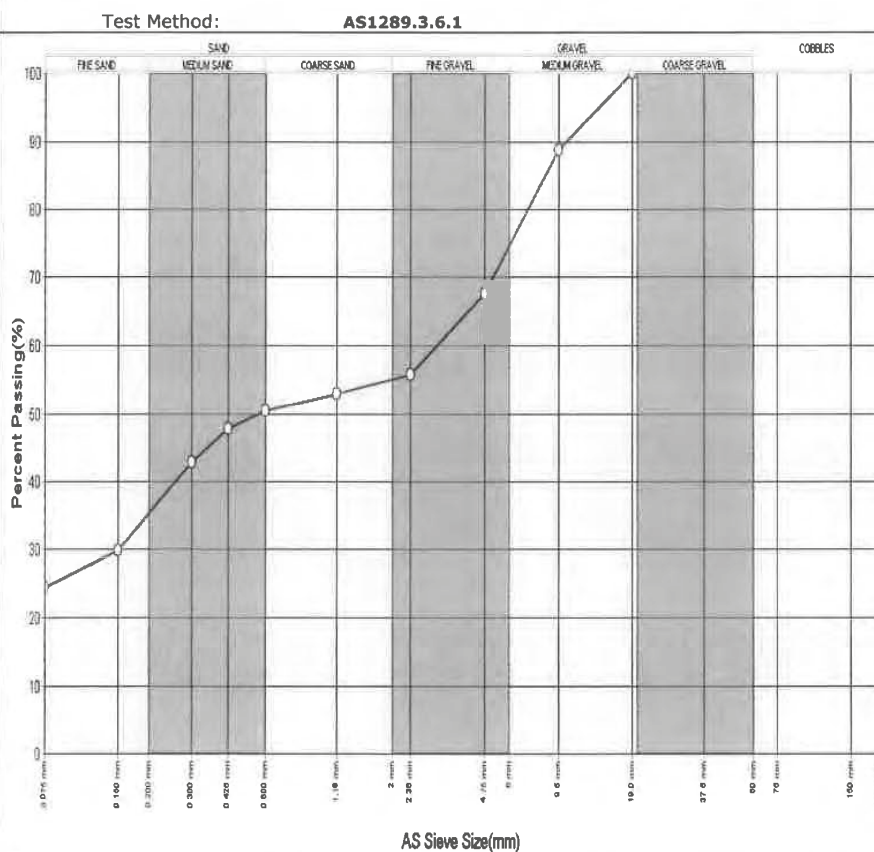
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Particle Size Distribution Report

Client:	Hansen Bailey	Job Number:	137635015-5000
Client Address:	GPO Box 3285 Brisbane QLD 4001	Report Number:	137635015-5000 - 2
Project:	China Stone	Report Date:	14/03/2014
Location:	MacMines ,	Page 1 of 7	
Lab No:	14300426	Sample Location	
Date Sampled / Received:	6/03/2014	TP006	
Date Tested:	11/03/2014	(0.9-1.3 m)	
Sampled By:	Golder	BDS	
Sample Method:	-		
Material Source:	Insitu		
For Use As:	Investigation		
Remarks:	-		



A.S. Sieve Sizes	Percent Passing
75.00 mm	
53.00 mm	
37.50 mm	
26.50 mm	
19.00 mm	100
13.2 mm	-
9.50 mm	89
4.75 mm	68
2.36 mm	56
1.18 mm	53
0.600 mm	50
0.425 mm	48
0.300 mm	43
0.150 mm	30
0.075 mm	24
Moisture Content (%)	8.0

Visual Classification:



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Particle Size Distribution Report

Client:	Hansen Bailey	Job Number:	137635015-5000
Client Address:	GPO Box 3285 Brisbane QLD 4001	Report Number:	137635015-5000 - 2
Project:	China Stone	Report Date:	14/03/2014
Location:	MacMines ,	Page 2 of 7	
Lab No:	14300427	Sample Location	
Date Sampled / Received:	6/03/2014	TP007	
Date Tested:	11/03/2014	(1.3-1.8 m)	
Sampled By:	Golder	DS	
Sample Method:	-		
Material Source:	Insitu		
For Use As:	Investigation		
Remarks:	-		

Test Method: AS1289.3.6.1		A.S. Sieve Sizes	Percent Passing
AS Sieve Size(mm)		75.00 mm	
		53.00 mm	
		37.50 mm	
		26.50 mm	
		19.00 mm	
		13.2 mm	
		9.50 mm	100
		4.75 mm	100
		2.36 mm	98
		1.18 mm	96
		0.600 mm	93
		0.425 mm	90
		0.300 mm	84
		0.150 mm	65
		0.075 mm	56
		Moisture Content (%)	8.1

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Particle Size Distribution Report

Client:	Hansen Bailey	Job Number:	137635015-5000
Client Address:	GPO Box 3285 Brisbane QLD 4001	Report Number:	137635015-5000 - 2
Project:	China Stone	Report Date:	14/03/2014
Location:	MacMines ,	Page 3 of 7	
Lab No:	14300428		
Date Sampled / Received:	6/03/2014	Sample Location	
Date Tested:	11/03/2014	TP008	
Sampled By:	Golder	(1.3-1.7 m)	
Sample Method:	-	BDS	
Material Source:	Insitu		
For Use As:	Investigation		
Remarks:	-		

Test Method: AS1289.3.6.1		A.S. Sieve Sizes	Percent Passing
AS Sieve Size(mm)		75.00 mm	
		53.00 mm	
		37.50 mm	
		26.50 mm	
		19.00 mm	100
		13.2 mm	-
		9.50 mm	99
		4.75 mm	95
		2.36 mm	89
		1.18 mm	86
		0.600 mm	83
		0.425 mm	81
		0.300 mm	75
		0.150 mm	61
		0.075 mm	54
		Moisture Content (%)	16.8

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Particle Size Distribution Report

Client:	Hansen Bailey	Job Number:	137635015-5000
Client Address:	GPO Box 3285 Brisbane QLD 4001	Report Number:	137635015-5000 - 2
Project:	China Stone	Report Date:	14/03/2014
Location:	MacMines ,	Page 4 of 7	
Lab No:	14300429	Sample Location	
Date Sampled / Received:	6/03/2014	TP009	
Date Tested:	11/03/2014	(1.3-1.7 m)	
Sampled By:	Golder	BDS	
Sample Method:	-		
Material Source:	Insitu		
For Use As:	Investigation		
Remarks:	-		

Test Method: AS1289.3.6.1		A.S. Sieve Sizes	Percent Passing
Percent Passing(%) AS Sieve Size(mm)		75.00 mm	
		53.00 mm	
		37.50 mm	
		26.50 mm	
		19.00 mm	
		13.2 mm	
		9.50 mm	100
		4.75 mm	100
		2.36 mm	100
		1.18 mm	99
		0.600 mm	98
		0.425 mm	96
		0.300 mm	89
		0.150 mm	65
		0.075 mm	54
		Moisture Content (%)	6.0

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Particle Size Distribution Report

Client:	Hansen Bailey	Job Number:	137635015-5000
Client Address:	GPO Box 3285 Brisbane QLD 4001	Report Number:	137635015-5000 - 2
Project:	China Stone	Report Date:	14/03/2014
Location:	MacMines ,	Page 5 of 7	
Lab No:	14300430	Sample Location	
Date Sampled / Received:	6/03/2014	TP013	
Date Tested:	11/03/2014	(1.0-1.2 m)	
Sampled By:	Golder	DS	
Sample Method:	-		
Material Source:	Insitu		
For Use As:	Investigation		
Remarks:	-		

Test Method: AS1289.3.6.1		A.S. Sieve Sizes	Percent Passing
AS Sieve Size(mm)		75.00 mm	
		53.00 mm	
		37.50 mm	
		26.50 mm	
		19.00 mm	
		13.2 mm	
		9.50 mm	100
		4.75 mm	96
		2.36 mm	92
		1.18 mm	88
		0.600 mm	85
		0.425 mm	82
		0.300 mm	74
		0.150 mm	54
		0.075 mm	44
		Moisture Content (%)	5.9

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Particle Size Distribution Report

Client:	Hansen Bailey	Job Number:	137635015-5000
Client Address:	GPO Box 3285 Brisbane QLD 4001	Report Number:	137635015-5000 - 2
Project:	China Stone	Report Date:	14/03/2014
Location:	MacMines ,	Page 6 of 7	
Lab No:	14300432	Sample Location	
Date Sampled / Received:	6/03/2014	TP016	
Date Tested:	11/03/2014	(1.3-2.0 m)	
Sampled By:	Golder	BDS	
Sample Method:	-		
Material Source:	Insitu		
For Use As:	Investigation		
Remarks:	-		

Test Method: AS1289.3.6.1		A.S. Sieve Sizes	Percent Passing
Visual Classification: SAND		75.00 mm	
		53.00 mm	
		37.50 mm	
		26.50 mm	
		19.00 mm	
		13.2 mm	
		9.50 mm	100
		4.75 mm	99
		2.36 mm	93
		1.18 mm	89
		0.600 mm	83
		0.425 mm	77
		0.300 mm	69
		0.150 mm	50
		0.075 mm	41
		Moisture Content (%)	8.0



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Particle Size Distribution Report

Client:	Hansen Bailey	Job Number:	137635015-5000
Client Address:	GPO Box 3285 Brisbane QLD 4001	Report Number:	137635015-5000 - 2
Project:	China Stone	Report Date:	14/03/2014
Location:	MacMines ,	Page 7 of 7	
Lab No:	14300434		
Date Sampled / Received:	6/03/2014	Sample Location	
Date Tested:	11/03/2014		
Sampled By:	Golder	TP026 (1.7-2.0 m) BDS	
Sample Method:	-		
Material Source:	Insitu		
For Use As:	Investigation		
Remarks:	-		

Test Method: AS1289.3.6.1		A.S. Sieve Sizes	Percent Passing
AS Sieve Size(mm)		75.00 mm	
		53.00 mm	
		37.50 mm	
		26.50 mm	
		19.00 mm	
		13.2 mm	
		9.50 mm	100
		4.75 mm	98
		2.36 mm	95
		1.18 mm	91
		0.600 mm	86
		0.425 mm	81
		0.300 mm	73
		0.150 mm	53
		0.075 mm	44
		Moisture Content (%)	8.6

Visual Classification:



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Geoff Hooper - Senior Technical Officer

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Particle Size Distribution Report

Client:	Hansen Bailey	Job Number:	137635015-5000
Client Address:	GPO Box 3285 Brisbane QLD 4001	Report Number:	137635015-5000 - 3
Project:	China Stone	Report Date:	18/03/2014
Location:	MacMines ,	Page 1 of 2	
Lab No:	14300425	Sample Location	
Date Sampled / Received:	6/03/2014	TP004	
Date Tested:	13/03/2014	(1.2-1.5 m)	
Sampled By:	Golder	U50	
Sample Method:	-		
Material Source:	Insitu		
For Use As:	Investigation		
Remarks:	-		

Test Method: AS1289.3.6.1		A.S. Sieve Sizes	Percent Passing
Visual Classification: SAND		75.00 mm	
		53.00 mm	
		37.50 mm	
		26.50 mm	
		19.00 mm	
		13.2 mm	
		9.50 mm	
		4.75 mm	
		2.36 mm	100
		1.18 mm	98
		0.600 mm	95
		0.425 mm	91
		0.300 mm	85
		0.150 mm	69
		0.075 mm	63
		Moisture Content (%)	14.4

Visual Classification:



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Approved Signatory

Mike Sandilands - Laboratory Manager

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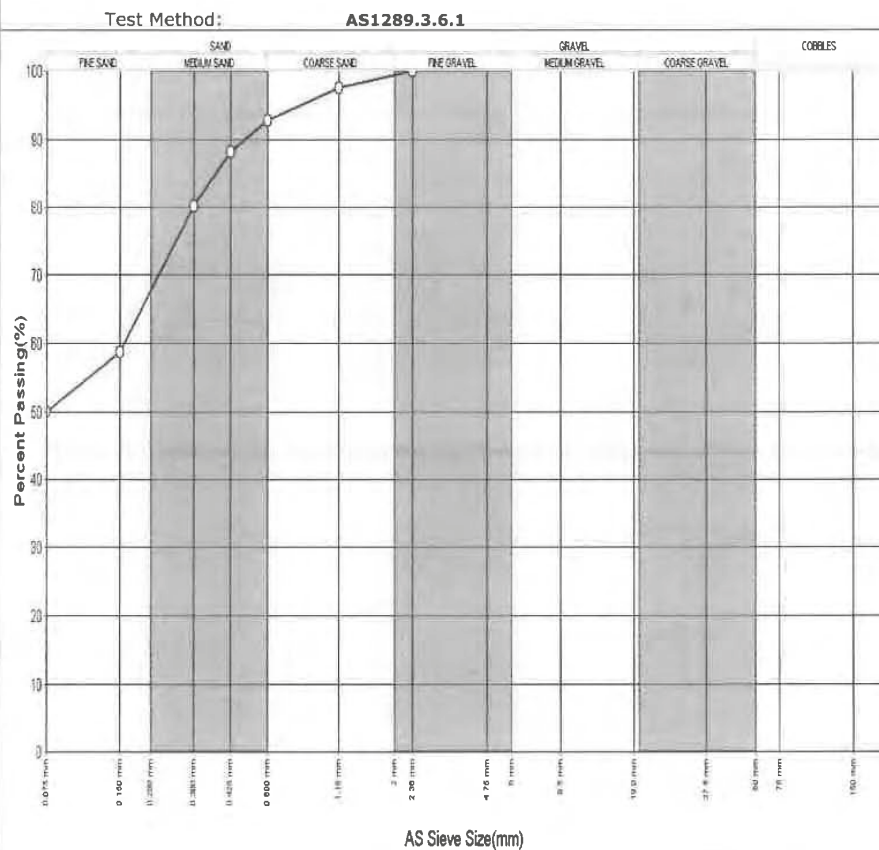
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E: BNElab@golder.com.au

Particle Size Distribution Report

Client:	Hansen Bailey	Job Number:	137635015-5000
Client Address:	GPO Box 3285 Brisbane QLD 4001	Report Number:	137635015-5000 - 3
Project:	China Stone	Report Date:	18/03/2014
Location:	MacMines ,	Page 2 of 2	
Lab No:	14300433	Sample Location	
Date Sampled / Received:	6/03/2014	TP017	
Date Tested:	13/03/2014	(1.2-1.45 m)	
Sampled By:	Golder	U50	
Sample Method:	-		
Material Source:	Insitu		
For Use As:	Investigation		
Remarks:	-		



A.S. Sieve Sizes	Percent Passing
75.00 mm	
53.00 mm	
37.50 mm	
26.50 mm	
19.00 mm	
13.2 mm	
9.50 mm	
4.75 mm	
2.36 mm	100
1.18 mm	98
0.600 mm	93
0.425 mm	88
0.300 mm	80
0.150 mm	59
0.075 mm	50
Moisture Content (%)	10.1

Visual Classification:



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Approved Signatory

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Form Number :

R77-RL-16

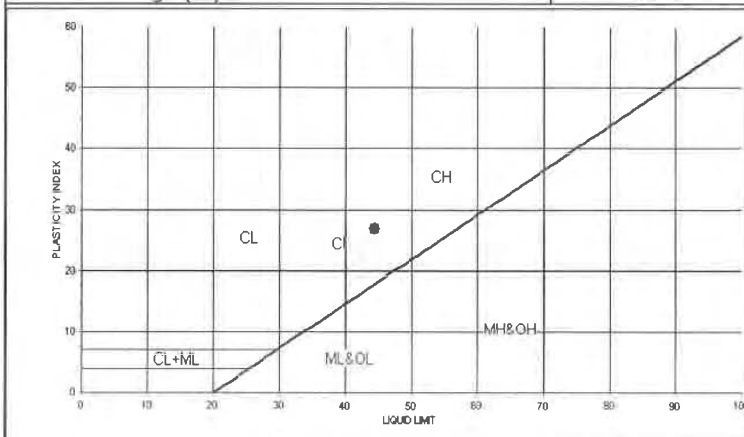


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Atterberg Limits Report

Client:	Hansen Bailey	Report Number:	137635015-5000 - 4
Client Address:	GPO Box 3285 Brisbane QLD 4001	Report Date:	18/03/2014
Job Number:	137635015-5000	Order Number:	-
Project:	China Stone	Page 1 of 9	
Location:	MacMines ,	Sample Location	
Lab No:	14300425	TP004	
Date Sampled / Received:	6/03/2014	(1.2-1.5 m)	
Date Tested:	17/03/2014	U50	
Sampled By:	Golder	Spec Description: -	
Sample Method:	-	Lot Number: -	
Material Source:	Insitu	Spec Number: -	
For Use As:	Investigation		
Remarks:	-		

Plasticity Tests	Test Method	Specification Minimum	Result	Specification Maximum
Sample History: Oven Dried low temp.				
Moisture Content (%):°C 105 to 110	AS1289.2.1.1	-	14.4	-
Liquid Limit (%)	AS1289.3.1.2		44	
Plastic Limit (%)	AS1289.3.2.1		18	
Plasticity Index (%)	AS1289.3.3.1		26	
Linear Shrinkage (%)	AS1289.3.4.1		10.5	



Linear Shrinkage State
after drying

No crumbling or curling



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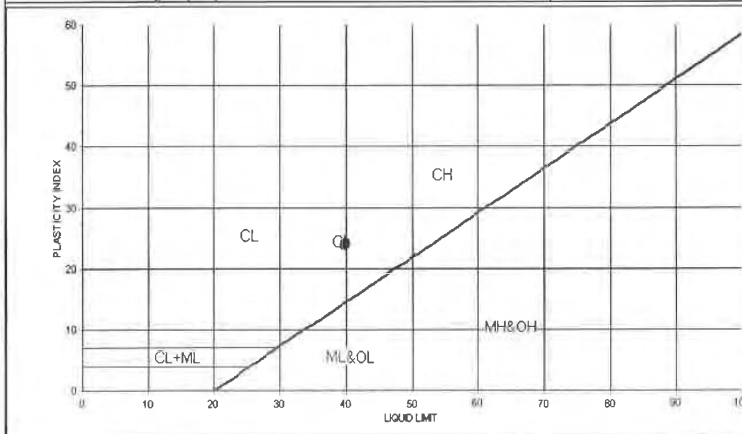


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Atterberg Limits Report

Client:	Hansen Bailey	Report Number:	137635015-5000 - 4
Client Address:	GPO Box 3285 Brisbane QLD 4001	Report Date:	18/03/2014
Job Number:	137635015-5000	Order Number:	-
Project:	China Stone	Page 2 of 9	
Location:	MacMines ,	Sample Location	
Lab No:	14300426	TP006	
Date Sampled / Received:	6/03/2014	(0.9-1.3 m)	
Date Tested:	12/03/2014	BDS	
Sampled By:	Golder	Spec Description: -	
Sample Method:	-	Lot Number: -	
Material Source:	Insitu	Spec Number: -	
For Use As:	Investigation		
Remarks:	-		

Plasticity Tests	Test Method	Specification Minimum	Result	Specification Maximum
Sample History: Oven Dried low temp.				
Moisture Content (%):°C 105 to 110	AS1289.2.1.1	-	8.0	-
Liquid Limit (%)	AS1289.3.1.2		40	
Plastic Limit (%)	AS1289.3.2.1		16	
Plasticity Index (%)	AS1289.3.3.1		24	
Linear Shrinkage (%)	AS1289.3.4.1		9.5	



Linear Shrinkage State after drying
 No crumbling or curling



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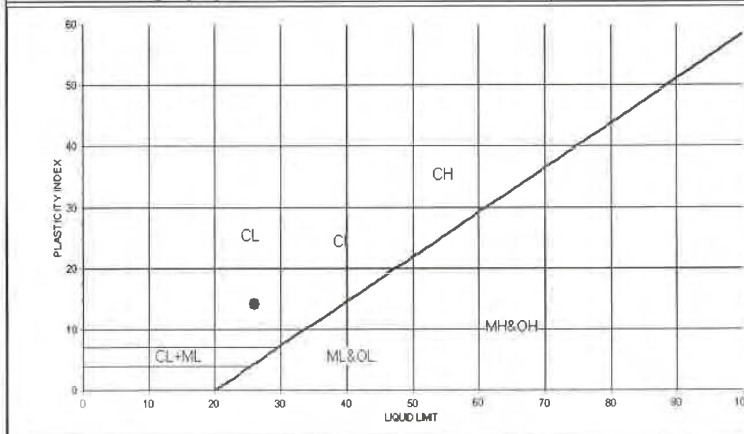


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Atterberg Limits Report

Client:	Hansen Bailey	Report Number:	137635015-5000 - 4
Client Address:	GPO Box 3285 Brisbane QLD 4001	Report Date:	18/03/2014
Job Number:	137635015-5000	Order Number:	-
Project:	China Stone	Page 3 of 9	
Location:	MacMines ,	Sample Location	
Lab No:	14300427	TP007	
Date Sampled / Received:	6/03/2014	(1.3-1.8 m)	
Date Tested:	12/03/2014	DS	
Sampled By:	Golder	Spec Description: -	
Sample Method:	-	Lot Number: -	
Material Source:	Insitu	Spec Number: -	
For Use As:	Investigation		
Remarks:	-		

Plasticity Tests	Test Method	Specification Minimum	Result	Specification Maximum
Sample History: Oven Dried low temp.				
Moisture Content (%):°C 105 to 110	AS1289.2.1.1	-	8.1	-
Liquid Limit (%)	AS1289.3.1.2		26	
Plastic Limit (%)	AS1289.3.2.1		12	
Plasticity Index (%)	AS1289.3.3.1		14	
Linear Shrinkage (%)	AS1289.3.4.1		7.5	



Linear Shrinkage State after drying: No crumbling or curling



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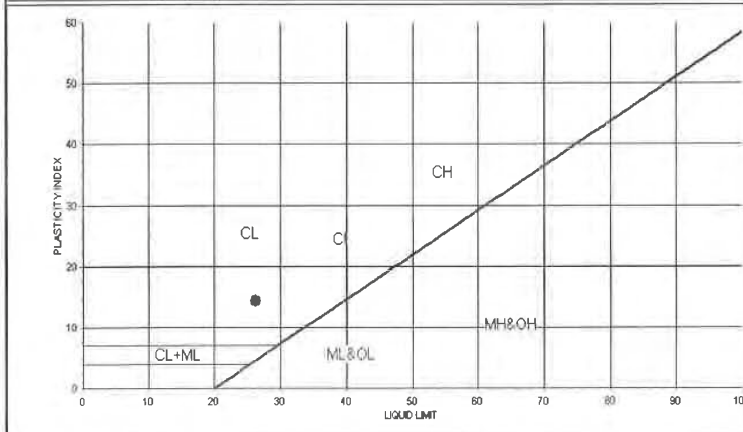


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Atterberg Limits Report

Client:	Hansen Bailey	Report Number:	137635015-5000 - 4
Client Address:	GPO Box 3285 Brisbane QLD 4001	Report Date:	18/03/2014
Job Number:	137635015-5000	Order Number:	-
Project:	China Stone	Page 4 of 9	
Location:	MacMines ,	Sample Location	
Lab No:	14300428	TP008	
Date Sampled / Received:	6/03/2014	(1.3-1.7 m)	
Date Tested:	13/03/2014	BDS	
Sampled By:	Golder	Spec Description: -	
Sample Method:	-	Lot Number: -	
Material Source:	Insitu	Spec Number: -	
For Use As:	Investigation		
Remarks:	-		

Plasticity Tests	Test Method	Specification Minimum	Result	Specification Maximum
Sample History: Oven Dried low temp.				
Moisture Content (%):°C 105 to 110	AS1289.2.1.1	-	16.8	-
Liquid Limit (%)	AS1289.3.1.2		26	
Plastic Limit (%)	AS1289.3.2.1		12	
Plasticity Index (%)	AS1289.3.3.1		14	
Linear Shrinkage (%)	AS1289.3.4.1		7.5	



Linear Shrinkage State after drying	No crumbling or curling
-------------------------------------	-------------------------



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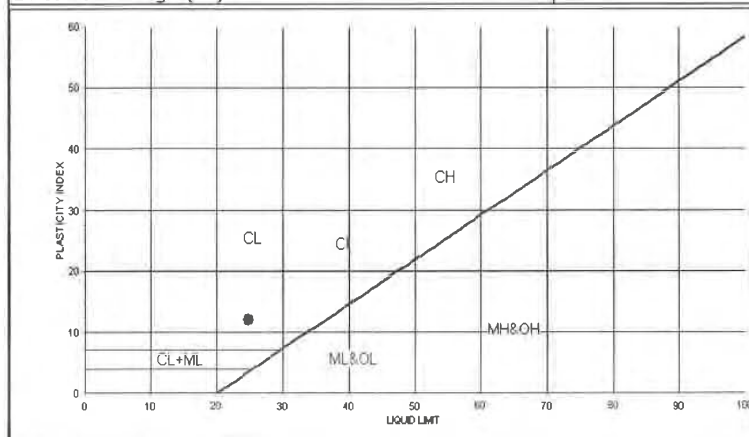


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Atterberg Limits Report

Client:	Hansen Bailey	Report Number:	137635015-5000 - 4
Client Address:	GPO Box 3285 Brisbane QLD 4001	Report Date:	18/03/2014
Job Number:	137635015-5000	Order Number:	-
Project:	China Stone	Page 5 of 9	
Location:	MacMines ,	Sample Location	
Lab No:	14300429	TP009	
Date Sampled / Received:	6/03/2014	(1.3-1.7 m)	
Date Tested:	12/03/2014	BDS	
Sampled By:	Golder	Spec Description: -	
Sample Method:	-	Lot Number: -	
Material Source:	Insitu	Spec Number: -	
For Use As:	Investigation		
Remarks:	-		

Plasticity Tests	Test Method	Specification Minimum	Result	Specification Maximum
Sample History: Oven Dried low temp.				
Moisture Content (%):°C 105 to 110	AS1289.2.1.1	-	6.0	-
Liquid Limit (%)	AS1289.3.1.2		25	
Plastic Limit (%)	AS1289.3.2.1		13	
Plasticity Index (%)	AS1289.3.3.1		12	
Linear Shrinkage (%)	AS1289.3.4.1		6.5	



Linear Shrinkage State after drying: No crumbling or curling



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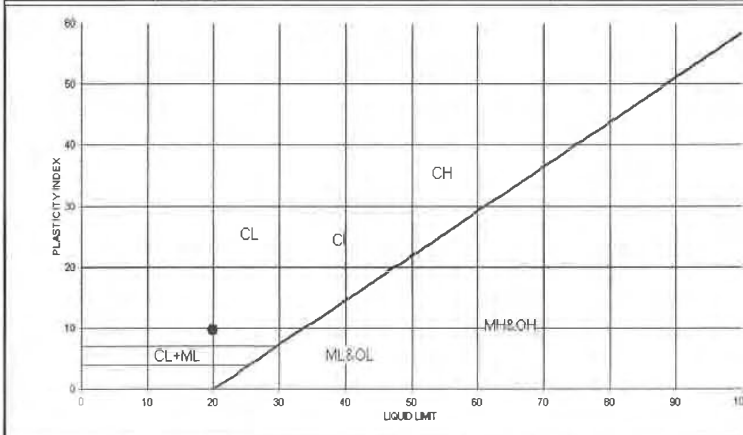


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Atterberg Limits Report

Client:	Hansen Bailey	Report Number:	137635015-5000 - 4
Client Address:	GPO Box 3285 Brisbane QLD 4001	Report Date:	18/03/2014
Job Number:	137635015-5000	Order Number:	-
Project:	China Stone	Page 6 of 9	
Location:	MacMines ,	Sample Location	
Lab No:	14300430	TP013	
Date Sampled / Received:	6/03/2014	(1.0-1.2 m)	
Date Tested:	12/03/2014	DS	
Sampled By:	Golder	Spec Description: -	
Sample Method:	-	Lot Number: -	
Material Source:	Insitu	Spec Number: -	
For Use As:	Investigation		
Remarks:	-		

Plasticity Tests		Test Method	Specification Minimum	Result	Specification Maximum
Sample History:	Oven Dried low temp.				
Moisture Content (%):°C	105 to 110	AS1289.2.1.1		5.9	-
Liquid Limit (%)		AS1289.3.1.2		20	
Plastic Limit (%)		AS1289.3.2.1		10	
Plasticity Index (%)		AS1289.3.3.1		10	
Linear Shrinkage (%)		AS1289.3.4.1		5.5	



Linear Shrinkage State after drying

No crumbling or curling



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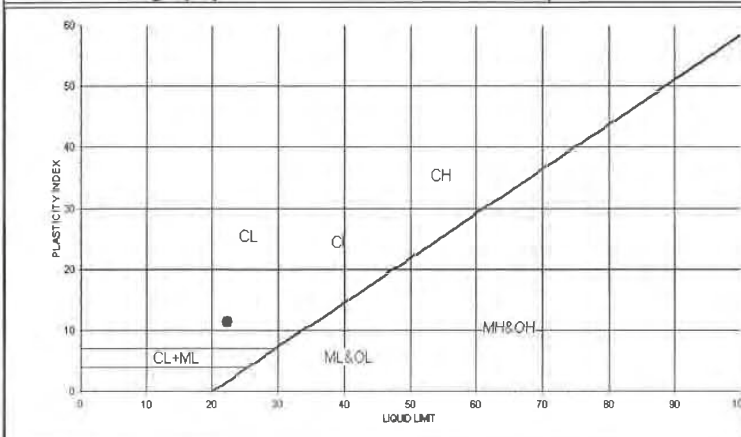


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Atterberg Limits Report

Client:	Hansen Bailey	Report Number:	137635015-5000 - 4
Client Address:	GPO Box 3285 Brisbane QLD 4001	Report Date:	18/03/2014
Job Number:	137635015-5000	Order Number:	-
Project:	China Stone	Page 7 of 9	
Location:	MacMines ,	Sample Location	
Lab No:	14300432	TP016	
Date Sampled / Received:	6/03/2014	(1.3-2.0 m)	
Date Tested:	13/03/2014	BDS	
Sampled By:	Golder	Spec Description: -	
Sample Method:	-	Lot Number: -	
Material Source:	Insitu	Spec Number: -	
For Use As:	Investigation		
Remarks:	-		

Plasticity Tests	Test Method	Specification Minimum	Result	Specification Maximum
Sample History: Oven Dried low temp.				
Moisture Content (%):°C 105 to 110	AS1289.2.1.1	-	8.0	-
Liquid Limit (%)	AS1289.3.1.2		22	
Plastic Limit (%)	AS1289.3.2.1		11	
Plasticity Index (%)	AS1289.3.3.1		11	
Linear Shrinkage (%)	AS1289.3.4.1		5.0	



Linear Shrinkage State after drying: No crumbling or curling



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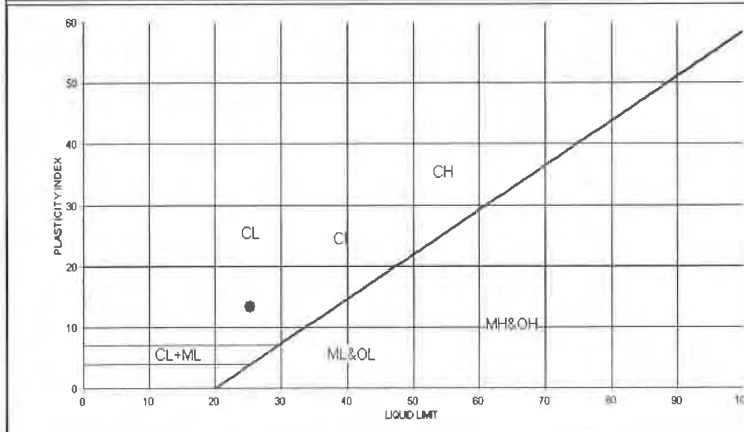


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Atterberg Limits Report

Client:	Hansen Bailey	Report Number:	137635015-5000 - 4
Client Address:	GPO Box 3285 Brisbane QLD 4001	Report Date:	18/03/2014
Job Number:	137635015-5000	Order Number:	-
Project:	China Stone	Page 8 of 9	
Location:	MacMines ,	Sample Location	
Lab No:	14300433	TP017	
Date Sampled / Received:	6/03/2014	(1.2-1.45 m)	
Date Tested:	17/03/2014	U50	
Sampled By:	Golder	Spec Description: -	
Sample Method:	-	Lot Number: -	
Material Source:	Insitu	Spec Number: -	
For Use As:	Investigation		
Remarks:	-		

Plasticity Tests	Test Method	Specification Minimum	Result	Specification Maximum
Sample History: Oven Dried low temp.				
Moisture Content (%):°C 105 to 110	AS1289.2.1.1	-	10.1	-
Liquid Limit (%)	AS1289.3.1.2		25	
Plastic Limit (%)	AS1289.3.2.1		12	
Plasticity Index (%)	AS1289.3.3.1		13	
Linear Shrinkage (%)	AS1289.3.4.1		6.5	



Linear Shrinkage State after drying	No crumbling or curling
-------------------------------------	-------------------------



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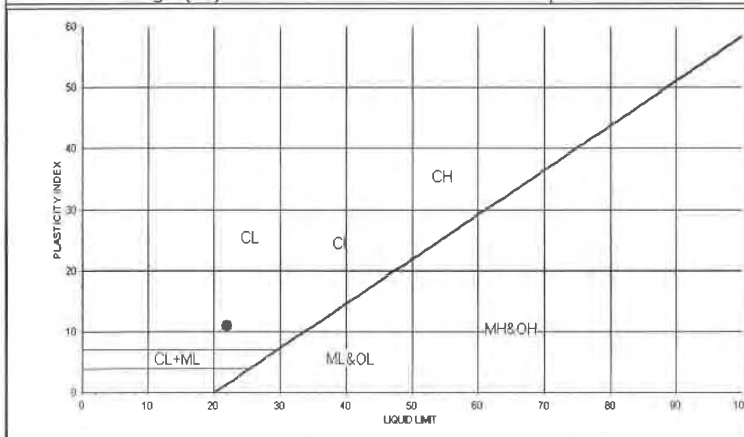


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Atterberg Limits Report

Client:	Hansen Bailey	Report Number:	137635015-5000 - 4
Client Address:	GPO Box 3285 Brisbane QLD 4001	Report Date:	18/03/2014
Job Number:	137635015-5000	Order Number:	-
Project:	China Stone	Page 9 of 9	
Location:	MacMines ,	Sample Location	
Lab No:	14300434	TP026	
Date Sampled / Received:	6/03/2014	(1.7-2.0 m)	
Date Tested:	13/03/2014	BDS	
Sampled By:	Golder	Spec Description: -	
Sample Method:	-	Lot Number: -	
Material Source:	Insitu	Spec Number: -	
For Use As:	Investigation		
Remarks:	-		

Plasticity Tests	Test Method	Specification Minimum	Result	Specification Maximum
Sample History: Oven Dried low temp.				
Moisture Content (%):°C 105 to 110	AS1289.2.1.1	-	8.6	-
Liquid Limit (%)	AS1289.3.1.2		22	
Plastic Limit (%)	AS1289.3.2.1		11	
Plasticity Index (%)	AS1289.3.3.1		11	
Linear Shrinkage (%)	AS1289.3.4.1		5.5	



Linear Shrinkage State after drying: No crumbling or curling



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FORM NUMBER: R37-RL-25

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Emerson Class Number Report

Client :	Hansen Bailey	Report Number:	137635015-5000 - 5
Address :	GPO Box 3285 Brisbane QLD 4001	Report Date:	18/03/2014
Job Number :	137635015-5000	Order Number:	
Project :	China Stone	Test Method:	AS1289.3.8.1
Location :	MacMines ,		

Page 1 of 3

Lab No :	14300425	14300426	14300427	14300428
ID No :	-	-	-	-
Lot No :	-	-	-	-
Item No :	-	-	-	-
Sampling Method :	-	-	-	-
Date Sampled/Received :	6/3/2014	6/3/2014	6/3/2014	6/3/2014
Date Tested :	12/3/2014	12/3/2014	12/3/2014	12/3/2014
Material Source :	Insitu	Insitu	Insitu	Insitu
For Use As :	Investigation	Investigation	Investigation	Investigation
Sample Location :	TP004 (1.2-1.5 m) U50	TP006 (0.9-1.3 m) BDS	TP007 (1.3-1.8 m) DS	TP008 (1.3-1.7 m) BDS
Soil Description :	(CI) Sandy CLAY, yellow brown	(GC) Clayey GRAVEL, brown, with sand	(CL) Sandy CLAY, brown	(CL) Sandy CLAY, brown
Type of Water Used :	Distilled Water	Distilled Water	Distilled Water	Distilled Water
Temperature of Water (°C) :	24	24	24	24
Emerson Class Number :	Class 5	Class 5	Class 5	Class 5
Remarks :				



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Emerson Class Number Report

Client :	Hansen Bailey	Report Number:	137635015-5000 - 5
Address :	GPO Box 3285 Brisbane QLD 4001	Report Date:	18/03/2014
Job Number :	137635015-5000	Order Number:	
Project :	China Stone	Test Method:	AS1289.3.8.1
Location :	MacMines ,		

Page 2 of 3

Lab No :	14300429	14300430	14300432	14300433
ID No :	-	-	-	-
Lot No :	-	-	-	-
Item No :	-	-	-	-
Sampling Method :	-	-	-	-
Date Sampled/Received :	6/3/2014	6/3/2014	6/3/2014	6/3/2014
Date Tested :	12/3/2014	12/3/2014	12/3/2014	12/3/2014
Material Source :	Insitu	Insitu	Insitu	Insitu
For Use As :	Investigation	Investigation	Investigation	Investigation
Sample Location :	TP009 (1.3-1.7 m) BDS	TP013 (1.0-1.2 m) DS	TP016 (1.3-2.0 m) BDS	TP017 (1.2-1.45 m) USO
Soil Description :	(CL) Sandy CLAY, brown	(SC) Clayey SAND, brown	(SC) Clayey SAND, brown	(CL) Sandy CLAY, brown
Type of Water Used :	Distilled Water	Distilled Water	Distilled Water	Distilled Water
Temperature of Water (°C) :	24	24	24	24
Emerson Class Number :	Class 5	Class 5	Class 3	Class 6
Remarks :				



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Emerson Class Number Report

Client :	Hansen Bailey	Report Number:	137635015-5000 - 5
Address :	GPO Box 3285 Brisbane QLD 4001	Report Date:	18/03/2014
Job Number :	137635015-5000	Order Number:	
Project :	China Stone	Test Method:	AS1289.3.8.1
Location :	MacMines ,		

Page 3 of 3

Lab No :	14300434			
ID No :	-			
Lot No :	-			
Item No :	-			
Sampling Method :	-			
Date Sampled/Received :	6/3/2014			
Date Tested :	12/3/2014			
Material Source :	Insitu			
For Use As :	Investigation			
Sample Location :	TP026 (1.7-2.0 m) BDS			
Soil Description :	(SC) Clayey SAND, brown			
Type of Water Used :	Distilled Water			
Temperature of Water (°C) :	24			
Emerson Class Number :	Class 5			
Remarks :				



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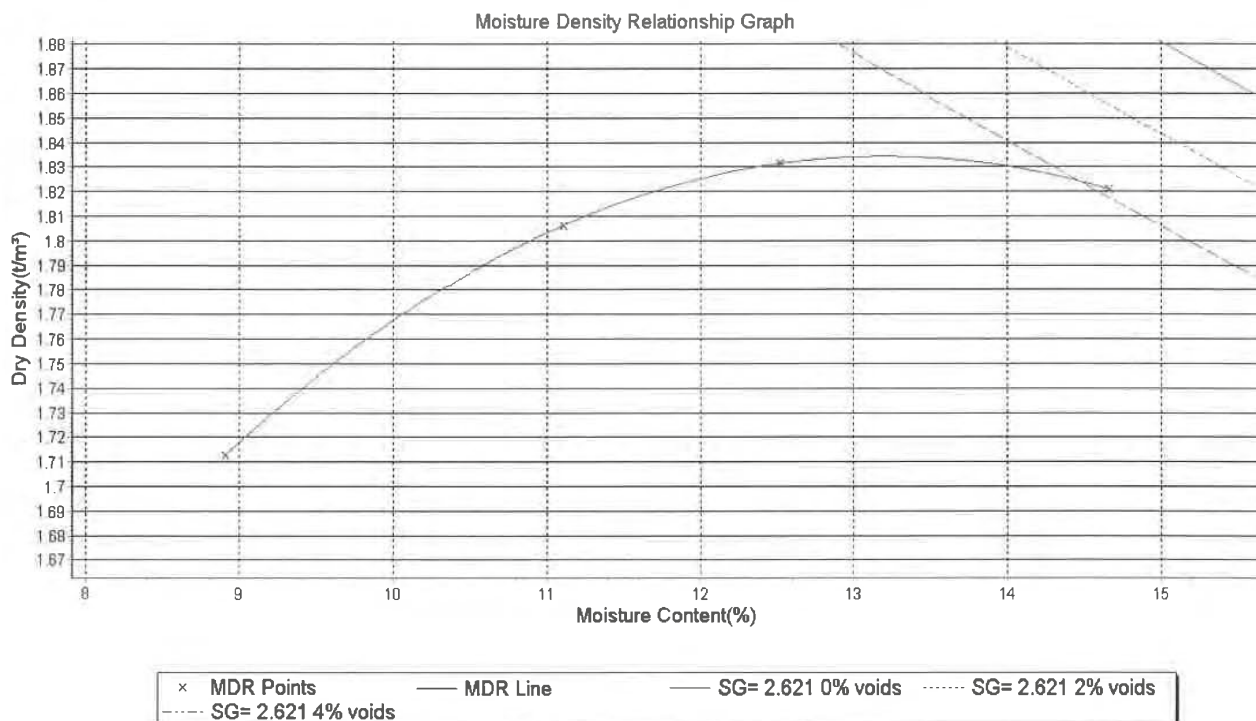
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Dry Density Moisture Relationship Report

Client:	Hansen Bailey	Report Number:	137635015-5000 - 6
Client Address:	GPO Box 3285 Brisbane QLD 4001	Report Date:	18/03/2014
Job Number:	137635015-5000	Order Number:	
Project:	China Stone	Test Method:	AS1289.5.1.1
Location:	MacMines ,	Sample Location	
Lab No:	14300428	TP008	
Date Sampled /Received:	6/03/2014	(1.3-1.7 m)	
Date Tested:	12/03/2014	BDS	
Sampled By:	Golder	Lot Number:	-
Sample Method:	-	Item Number:	-
Material Source:	Insitu		
For Use As:	Investigation		
Remarks:	-		

Page 1 of 3

Maximum Size (mm) :	19.0	Moisture Content Test Method :	AS1289.2.1.1
Oversize (%) :	-	As Received Moisture Content (%) :	16.8
MDD (t/m³) :	1.834	Oversize Test Method :	-
OMC(%) :	13.2	Oversize Density (t/m ³) :	



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Approved Signatory

Mike Sandilands - Laboratory Manager

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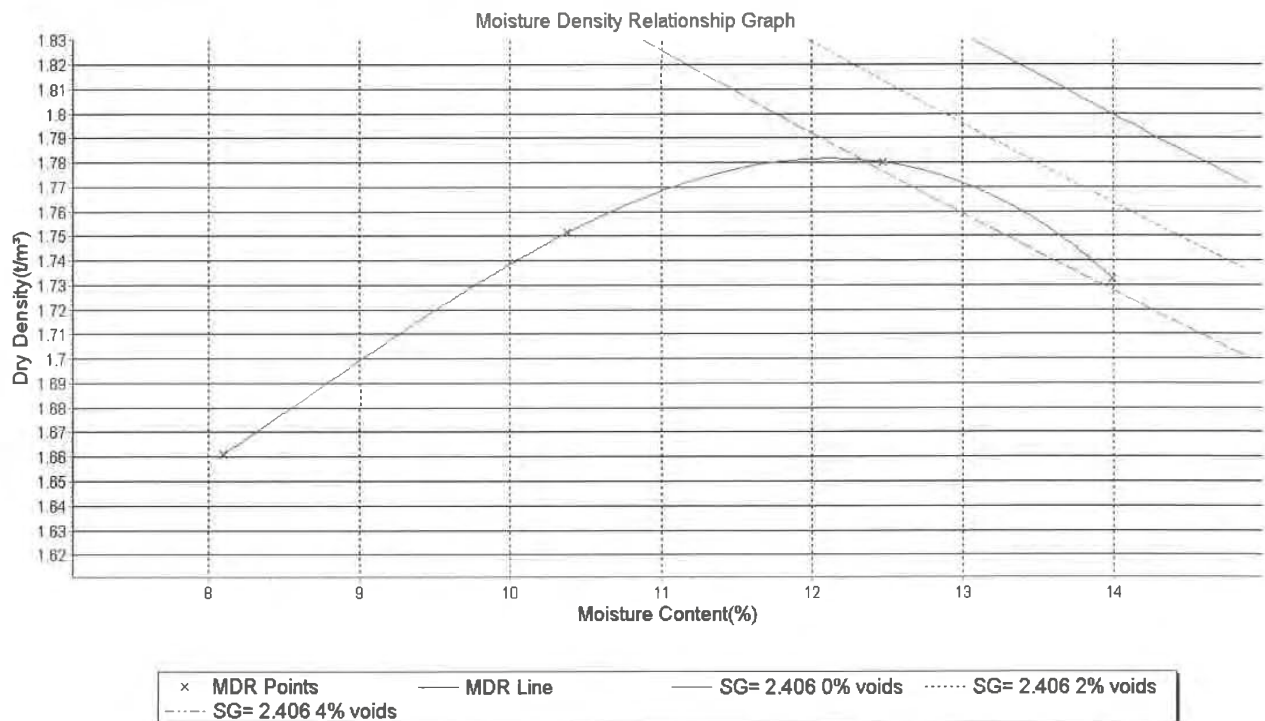
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Dry Density Moisture Relationship Report

Client:	Hansen Bailey	Report Number:	137635015-5000 - 6
Client Address:	GPO Box 3285 Brisbane QLD 4001	Report Date:	18/03/2014
Job Number:	137635015-5000	Order Number:	
Project:	China Stone	Test Method:	AS1289.5.1.1
Location:	MacMines ,	Sample Location	
Lab No:	14300429	TP009	
Date Sampled /Received:	6/03/2014	(1.3-1.7 m)	
Date Tested:	12/03/2014	BDS	
Sampled By:	Golder	Lot Number:	-
Sample Method:	-	Item Number:	-
Material Source:	Insitu		
For Use As:	Investigation		
Remarks:	-		

Page 2 of 3

Maximum Size (mm) :	19.0	Moisture Content Test Method :	AS1289.2.1.1
Oversize (%) :	-	As Received Moisture Content (%) :	6
MDD (t/m ³) :	1.782	Oversize Test Method :	-
OMC(%) :	12.1	Oversize Density (t/m ³) :	



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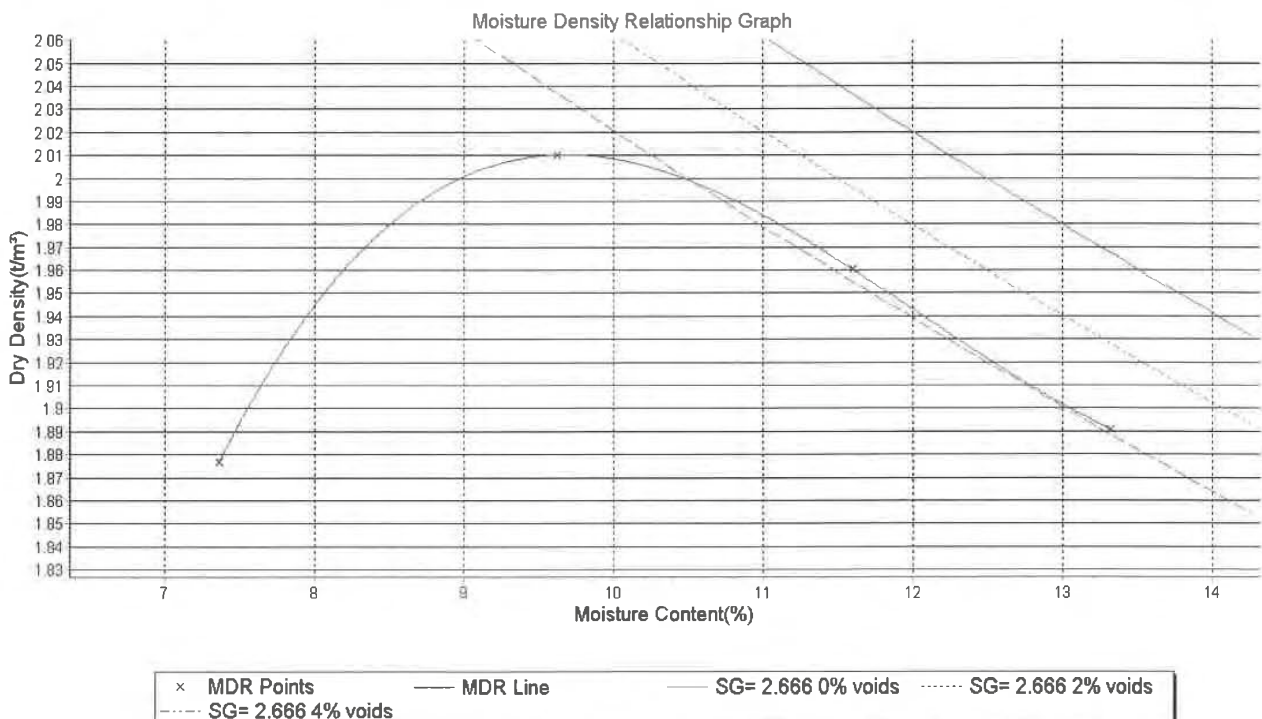
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Dry Density Moisture Relationship Report

Client:	Hansen Bailey	Report Number:	137635015-5000 - 6
Client Address:	GPO Box 3285 Brisbane QLD 4001	Report Date:	18/03/2014
Job Number:	137635015-5000	Order Number:	
Project:	China Stone	Test Method:	AS1289.5.1.1
Location:	MacMines	Sample Location	
Lab No:	14300434	TP026	
Date Sampled /Received:	6/03/2014	(1.7-2.0 m)	
Date Tested:	11/03/2014	BDS	
Sampled By:	Golder	Lot Number:	-
Sample Method:	-	Item Number:	-
Material Source:	Insitu		
For Use As:	Investigation		
Remarks:	-		

Page 3 of 3

Maximum Size (mm) :	19.0	Moisture Content Test Method :	AS1289.2.1.1
Oversize (%) :	-	As Received Moisture Content (%) :	8.6
MDD (t/m ³) :	2.010	Oversize Test Method :	-
OMC(%) :	9.7	Oversize Density (t/m ³) :	



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California Bearing Ratio Report (1 Point)

Client:	Hansen Bailey	Report Number:	137635015-5000 - 7
Client Address:	GPO Box 3285 Brisbane QLD 4001	Report Date:	24/03/2014
Job Number:	137635015-5000	Order Number:	Page 1 of 2
Project:	China Stone		
Location:	MacMines ,		
Lab No:	14300428	Sample Location:	TP008
Date Sampled:	6/03/2014		(1.3-1.7 m)
Date Tested:	21/03/2014		BDS
Sampled By:	Golder	Test Method :	AS1289.6.1.1
Sample Method:	-	Lot Number:	-
Material Source:	Insitu	Item Number :	-
For Use As:	Investigation		
Remarks:	-		

	Maximum Dry Density - MDD (t/m ³) :	1.834
	Optimum Moisture Content - OMC (%) :	13.2
	Compactive Effort :	Standard
	Nominated % Maximum Dry Density Compaction :	98
	Nominated % Optimum Moisture Content Compaction :	100
	Achieved Dry Density before Soak (t/m ³) :	1.795
	Achieved Percentage of Maximum Dry Density (%) :	98
	Achieved Moisture Content (%) :	12.9
	Achieved Percentage of Optimum Moisture Content (%) :	98
	Test Condition (Soaked/Unsoaked) / Soaking Period (Days) :	Soaked / 4 days
	Swell (%) / Surcharge (kg):	2.2 / 4.5 kg
	Dry Density after Soak (t/m ³) :	1.757
	Moisture Content after Soak (%) :	14.7
	Density Ratio after Soak (%) :	96
	Field Moisture Content (%) :	-
	Moisture Content (Top) after Penetration (%) :	15.2
	Moisture Content (Remainder) after Penetration (%) :	14.0
	CBR 2.5mm (%) :	2.5
	CBR 5.0mm (%) :	2.5
	Minimum Specified CBR Value (%) :	-
	CBR Value (%) :	2.5

Soil Description :



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Approved Signatory

Geoff Hooper - Senior Technical Officer
NATA Accred No:1961

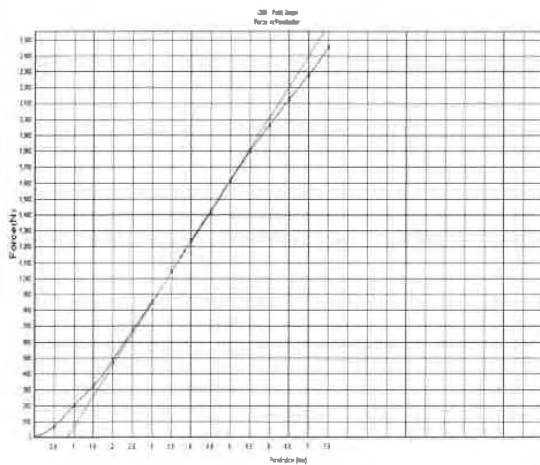
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California Bearing Ratio Report (1 Point)

Client:	Hansen Bailey	Report Number:	137635015-5000 - 7
Client Address:	GPO Box 3285 Brisbane QLD 4001	Report Date:	24/03/2014
Job Number:	137635015-5000	Order Number:	Page 2 of 2
Project:	China Stone		
Location:	MacMines		
Lab No:	14300434	Sample Location:	TP026
Date Sampled:	6/03/2014		(1.7-2.0 m)
Date Tested:	21/03/2014		BDS
Sampled By:	Golder	Test Method:	AS1289.6.1.1
Sample Method:	-	Lot Number:	-
Material Source:	Insitu	Item Number:	-
For Use As:	Investigation		
Remarks:	-		



Maximum Dry Density - MDD (t/m ³) :	2.010
Optimum Moisture Content - OMC (%) :	9.7
Compactive Effort :	Standard
Nominated % Maximum Dry Density Compaction :	98
Nominated % Optimum Moisture Content Compaction :	100
Achieved Dry Density before Soak (t/m ³) :	1.964
Achieved Percentage of Maximum Dry Density (%) :	98
Achieved Moisture Content (%) :	9.6
Achieved Percentage of Optimum Moisture Content (%) :	99
Test Condition (Soaked/Unsoaked) / Soaking Period (Days) :	Soaked / 4 days
Swell (%) / Surcharge (kg) :	2.4 / 4.5 kg
Dry Density after Soak (t/m ³) :	1.918
Moisture Content after Soak (%) :	12.1
Density Ratio after Soak (%) :	95
Field Moisture Content (%) :	-
Moisture Content (Top) after Penetration (%) :	13.5
Moisture Content (Remainder) after Penetration (%) :	11.5
CBR 2.5mm (%) :	7.0
CBR 5.0mm (%) :	10.0
Minimum Specified CBR Value (%) :	-
CBR Value (%) :	10.0

Soil Description :



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Form Number : R24-RL-13



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COEFFICIENT OF PERMEABILITY

Client :	Hansen Bailey	Report No. :	R16796
Address :	GPO Box 3285, Brisbane	Job No. :	137635015-5000
Project :	China Stone	Reg'n No. :	14300425
Location/Sample ID :	MacMines, TP004 (1.2-1.5 m), U50	Senders No. :	
		Date Received :	06-Mar-14
		Sampled By :	Golder

SPECIMEN PREPARATION			
Type of Sample :	Undisturbed	Specimen Size :	64 mm × 47.7 mm dia.
Specimen Preparation :	Cut from U50 tube		

SPECIMEN DETAILS					
Before Test			After Test		
Moisture Content (%)	Dry Density (t/m ³)	Degree of Saturation (%)	Moisture Content (%)	Dry Density (t/m ³)	Degree of Saturation (%)
14.4	1.94	90	15.9	1.94	100

TEST DETAILS		
Cell Pressure (kPa)	Inlet Pressure (kPa)	Outlet Pressure (kPa)
400	350	300
Type of Water Used in Test	Effective Stress Level (kPa)	Length/Diameter Ratio
Deionised	75	1.3

COEFFICIENT OF PERMEABILITY		
Trial No.	Duration (mins)	Coefficient of Permeability (m/sec)
1	480	1.6×10^{-10}
Average Coefficient of Permeability (m/sec)		1.6×10^{-10}

Remarks :	
Test Procedure :	AS1289.6.7.3
Prepared by	Checked by

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Nick Farrer
Approved Signatory

14/3/14

Senior Technical Officer
NATA Accred. No. : 1961



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COEFFICIENT OF PERMEABILITY

Client :	Hansen Bailey	Report No. :	R16797
Address :	GPO Box 3285, Brisbane	Job No. :	137635015-5000
Project :	China Stone	Reg'n No. :	14300433
Location/Sample ID :	MacMines, TP017 (1.7-2.0 m), U50	Senders No. :	
		Date Received :	06-Mar-14
		Sampled By :	Golder

SPECIMEN PREPARATION

Type of Sample :	Undisturbed	Specimen Size :	63.5 mm × 47.5 mm dia.
Specimen Preparation :	Cut from U50 tube		

SPECIMEN DETAILS

Before Test			After Test		
Moisture Content (%)	Dry Density (t/m ³)	Degree of Saturation (%)	Moisture Content (%)	Dry Density (t/m ³)	Degree of Saturation (%)
10.1	1.98	74	13.8	1.98	100

TEST DETAILS

Cell Pressure (kPa)	Inlet Pressure (kPa)	Outlet Pressure (kPa)
400	350	300
Type of Water Used in Test	Effective Stress Level (kPa)	Length/Diameter Ratio
Deionised	75	1.3

COEFFICIENT OF PERMEABILITY

Trial No.	Duration (mins)	Coefficient of Permeability (m/sec)
1	480	9.3×10^{-10}
Average Coefficient of Permeability (m/sec)		9.3×10^{-10}

Remarks :

Test Procedure : AS1289.6.7.3

Prepared by *[Signature]*

Checked by *[Signature]*

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Nick Farrer

Approved Signatory

[Signature] 14/3/14

Senior Technical Officer

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COEFFICIENT OF PERMEABILITY

Client :	Hansen Bailey	Report No. :	R16801
Address :	GPO Box 3285, Brisbane	Job No. :	137635015-5000
Project :	China Stone	Reg'n No. :	14300429
Location/Sample ID :	MacMines, TP009 (1.3-1.7 m), BDS	Senders No. :	
		Date Received :	06-Mar-14
		Sampled By :	Golder

SPECIMEN PREPARATION

Type of Sample :	Disturbed	Specimen Size :	59.1 mm × 48 mm dia.
Specimen Preparation :	Remoulded to 98 % Standard MDD at OMC		

SPECIMEN DETAILS

Before Test			After Test		
Moisture Content (%)	Dry Density (t/m ³)	Degree of Saturation (%)	Moisture Content (%)	Dry Density (t/m ³)	Degree of Saturation (%)
12.1	1.75	74	16.4	1.75	100

TEST DETAILS

Cell Pressure (kPa)	Inlet Pressure (kPa)	Outlet Pressure (kPa)
400	350	300
Type of Water Used in Test	Effective Stress Level (kPa)	Length/Diameter Ratio
Deionised	75	1.2

COEFFICIENT OF PERMEABILITY

Trial No.	Duration (mins)	Coefficient of Permeability (m/sec)
1	360	1.9×10^{-10}
Average Coefficient of Permeability (m/sec)		1.9×10^{-10}

Remarks : Material passing 4.75 mm used in test

Test Procedure : AS1289.6.7.3

Prepared by  Checked by 

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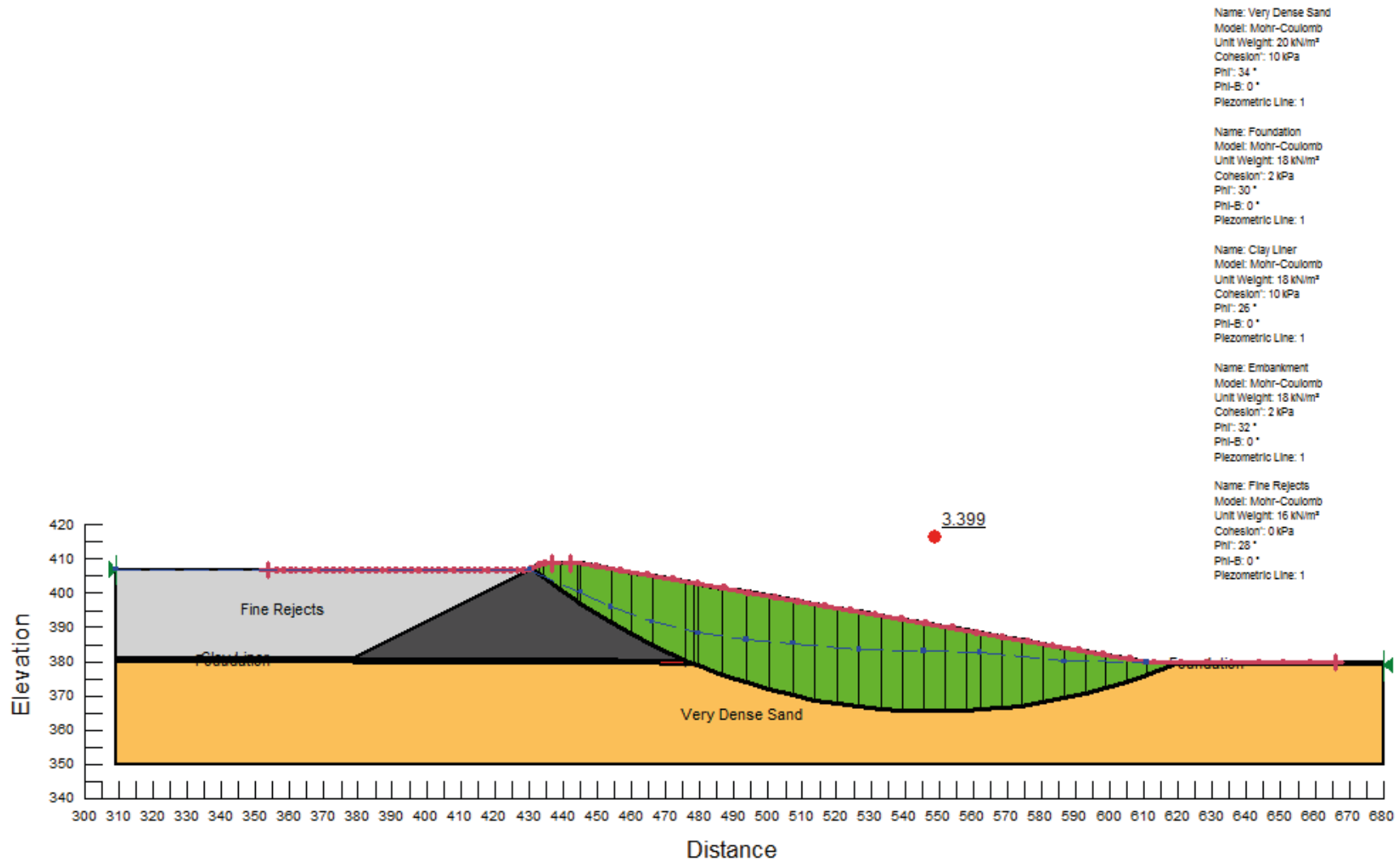
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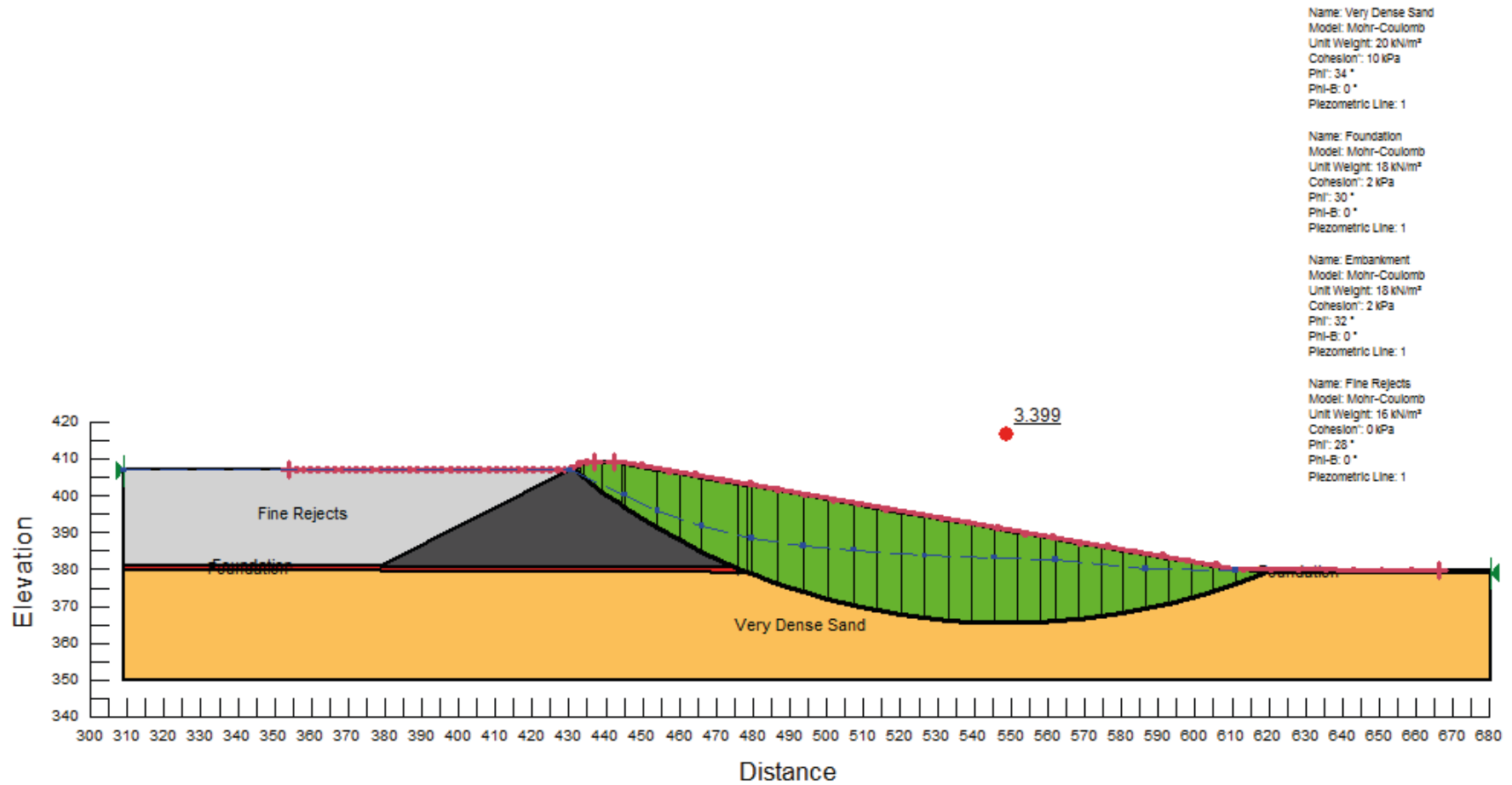


APPENDIX C

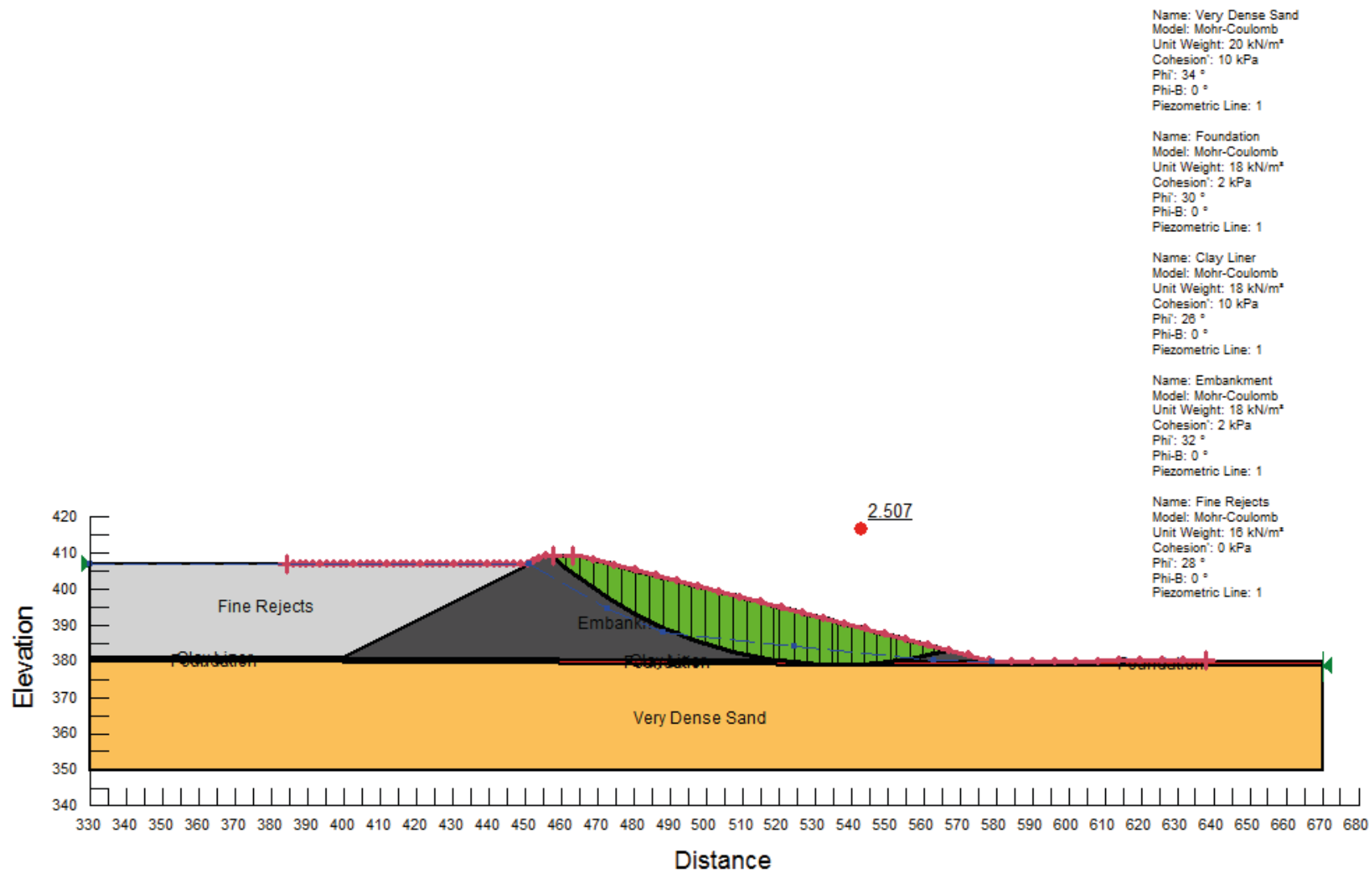
Results of Slope Stability Analysis



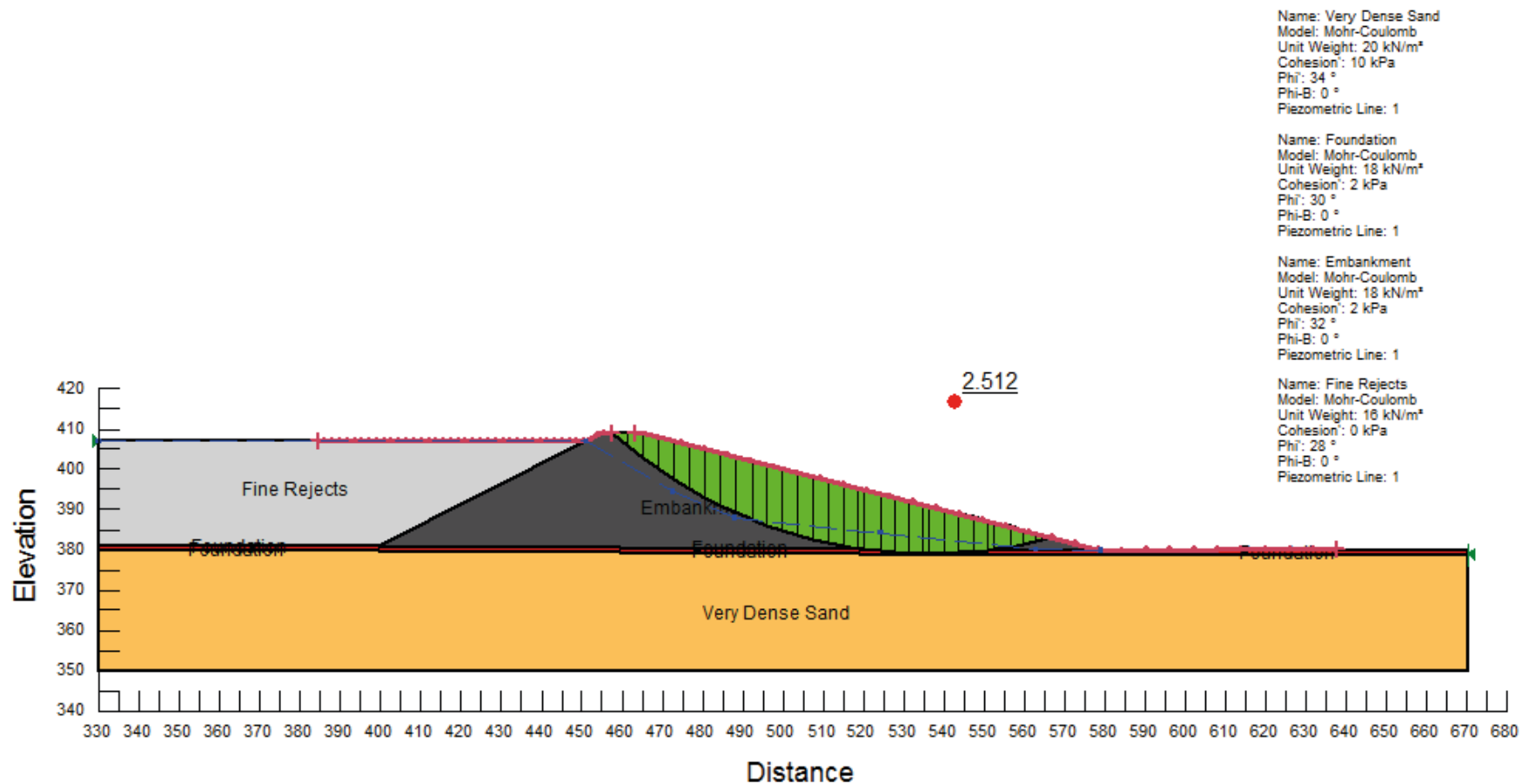
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	DRAWN CM	DATE July 2014	TITLE Slope Stability Analysis Case 1: TSF permanent slope-liner		
	CHECKED AB	DATE Nov 2014			
	SCALE NTS		PROJECT No 137635015-005	FIGURE No C-1	REV No 0 A4



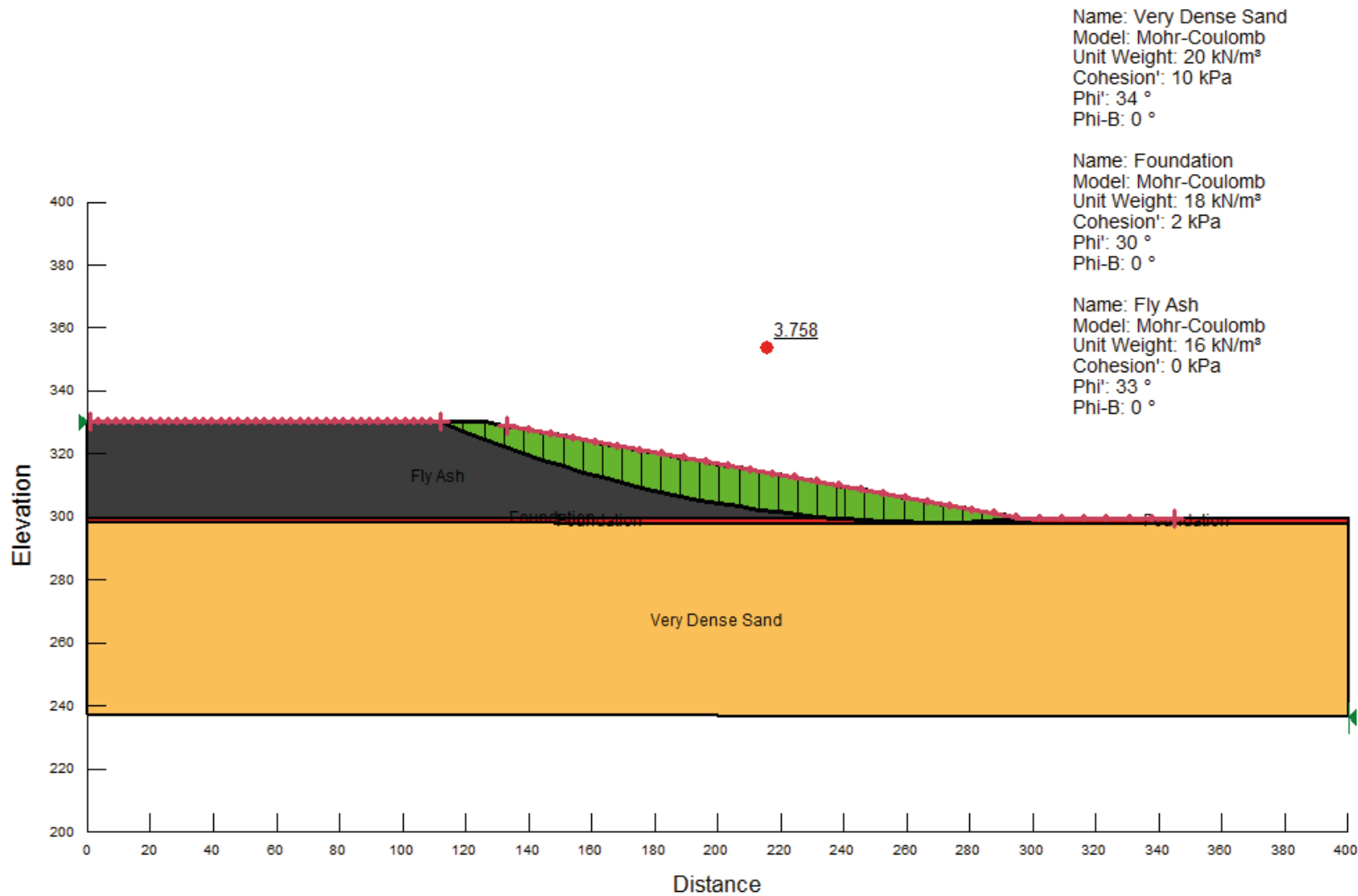
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	SCALE NTS		PROJECT No 137635015-005	FIGURE No C-2	REV No 0



	CLIENT MACMINES AUSTASIA		PROJECT China Stone Project - Mine Waste Storage		
	DRAWN CM	DATE July 2014	TITLE Slope Stability Analysis Case 3: TSF Operational slope- liner		
	CHECKED AB	DATE Nov 2014			
	SCALE NTS		PROJECT No 137635015-005	FIGURE No C-3	REV No 0 A4



	CLIENT MACMINES AUSTASIA		PROJECT China Stone Project - Mine Waste Storage			
	DRAWN CM	DATE July 2014	TITLE Slope Stability Analysis Case 4: TSF Operational slope- No Liner			
	CHECKED AB	DATE Nov 2014				
	SCALE NTS		PROJECT No 137635015-005	FIGURE No C-4	REV No 0	A4



CLIENT MACMINES AUSTASIA		PROJECT China Stone Project - Mine Waste Storage	
DRAWN CM	DATE July 2014	TITLE Slope Stability Analysis Case 5: Power station waste storage facility	
CHECKED AB	DATE Nov 2014		
SCALE NTS		PROJECT No 137635015-005	FIGURE No C-5
		REV No 0	A4



APPENDIX D

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