13 October 2015

Mr Howard Reed
Director, Resource Assessments
Department of Planning and Environment
GPO Box 39
SYDNEY NSW 2001

Our ref: 22/17528
16665
Your ref:

Dear Howard

SSD 6624 - Slys Quarry expansion proposal
Response to submissions

In response to your letter dated 20 July 2015, please find below and attached our response to submissions received in regard to SSD6624. Due to the time involved in addressing the biodiversity and Aboriginal heritage comments, a separate response to these issues will be provided under separate cover at a later date.

1. General information

Access to R3 is restricted due to locked gates but we believe it is an old sawmill. R6 is on the same property as R5 and we believe it is a shed.

The greenhouse gas assessment was based on work completed for another quarry with very similar characteristics as the current proposal. As the results suggest the impact is likely to be insignificant, we considered the information provided would be sufficient. If a detailed assessment is required, please let me know.

2. Biodiversity

As mentioned, a response to the biodiversity issues will be provided at a later date.

3. Soil and water

The MUSIC model was used in response to the Department of Planning and Environments (DPE) original comments on the Environmental Impact Statement (EIS) dated 01 April 2015. As mentioned in the *Surface and Groundwater Assessment*, MUSIC is more appropriate for urban catchments. Regardless, as committed to in the EIS, the proposal would comply with the requirements of *Managing Urban Stormwater Soils and Construction - Volume 2e Mines and quarries*. A number of additional water management actions are committed to in Section 5.2.4 of the EIS. If the proposal is approved, all these management actions would be detailed in a Water Management Plan (WMP) which would form part of the Environmental Management Plan (EMP) for the quarry.

The proposal would also be subject to an Environmental Protection Licence (EPL) which would dictate the quality of water that could be released from the site. As is reflected in Slys Quarry existing EPL

GHD Pty Ltd ABN 39 008 488 373
230 Harbour Drive Coffs Harbour NSW 2450 PO Box 1340 Coffs Harbour NSW 2450 Australia
T 61 2 6650 5600 **F** 61 2 6650 5601 **E** cfsmail@ghd.com **W** www.ghd.com

(11649), all water discharging from the site will need to meeting a pH of 6.5-8.5 and a total suspended solids concentration of 50mg/L up until the design rainfall is experienced. It is considered these criteria are consistent with current best practice and would ensure the protection of the downstream environment.

In relation to the SEPP 14 wetland, as it is 3.5km downstream, it is expected the discharges from the quarry would have no impact because of the above water quality requirements of any discharges and the time the runoff would take to reach the wetland.

The size of the quarry changed numerous times during the preparation of the EIS, the reference to 18.3 hectares on page 29 of the *Surface and Groundwater Assessment* reflects the area of an earlier layout and is incorrect.

The impacts of sand washing would not change from the existing situation. The main impacts would be in relation to sediment laden runoff and water use. Water for the sand washing operation would be sourced from the sediment basins and as mentioned in the EIS, the site would generate an excess of water, so this is not considered to be an issue. Water from the sand washing process passes through a series of small sediment basins (located adjacent to the access road) before entering the main basin. As mentioned above, water from this basin is not to be discharged until it achieves the quality requirements of the EPL.

Erosion and sediment controls would be inspected weekly and following rain. The monitoring requirements would be detailed in the WMP and EMP.

4. Traffic

a) As suggested in the *Traffic Impact Assessment*, Tullymorgan-Jackybulbin Road is expected to be able to accommodate the increase in vehicle numbers. An increase in maintenance may be required but this is accounted for via the Section 94 contributions. Also, it is expected that the quarry would operate at the proposed peak for short periods, for the majority of the time, the number of trucks would be similar to the current situation.

b) Sand washing is one of the processes used on site to produce sand. Transporting sand would not involve additional truck movements.

c) In accordance with the *Austroads Guide to Road Design Part 4A* the sight distance required for a 100km/hr speed environment is 248m. This is not achieved at the quarry access but as mentioned in the *Traffic Impact Assessment* “the available sight distance is adequate in both directions for an 80 km/h speed environment, which is commensurate with the expected speed of traffic past the site access”.

d) As mentioned above, the quarry is only likely to operate at its peak for short periods. Regardless, at its peak, the quarry would result in an additional 180 vehicle movements per day. Over a 10 hour day, this equates to one vehicle approximately every 3 minutes. This would still provide ample opportunity for fauna to cross the road. Additionally, the quarry would only operate during the day when there is less likelihood for vehicle strike.

Appropriate controls would be included in the Traffic Management Plan and Drivers Code of Conduct that would warn drivers to be conscious of fauna crossing the road.

Another contributing factor to consider is the length of road with habitat on both sides and likely to have fauna crossing it is only 1.5km long which further limits the likelihood of fauna and vehicle interaction.

e) Newmans Quarrying own and operate one truck which would be refuelled on site. Basic servicing would also be performed on site. At times, this truck may return to site outside the proposed operating hours. The remaining trucks would be operated by contractors which would not be permitted to arrive onsite outside the proposed operating hours.

f) Clarence Valley Council have advised their *S.94 Contribution Plan for Maintenance of Quarry Roads* would apply and Newmans Quarrying have accepted this contribution.

We trust the above and attached sufficiently addresses the comments raised but please let the undersigned know if you require anything further.

Sincerely
GHD Pty Ltd

Ben Luffman
Senior Environmental Scientist/Planner
02 6650 5600

Attachment: Response to agency comments
Geological Resource Assessment – Supplementary Report (GHD, October 2015)
Rehabilitation Plan

Table 1 Response to agency comments

Agency comment	Response
Crown Lands	
Crown Lands requests the following conditions of approval be considered: • There should be no obstruction of legal public access along the Crown Public road (in accordance with public rights of access under the Roads Act 1993) • The Crown public road within Lot 2 DP 1055044 to be fenced out of the adjoining Lot 2 DP 1055044	No action required but Newman Quarrying have no objection with the proposed conditions
Department of Primary Industries - Fisheries	
Strict adherence to sediment and erosion control and water quality parameters is recommended to minimise impacts on aquatic biodiversity	The EIS commits to the implementation of sediment and erosion control measures in accordance with *Managing Urban Stormwater Soils and Construction - Volume 2e Mines and quarries.* If the proposal is approved, the soil and erosion controls would be detailed in a Water Management Plan (WMP) prepared as part of an Environmental Management Plan (EMP) for the operation.
Department of Primary Industries – NSW Office of Water	
NoW make two groundwater and one surface water recommendations	No action required but Newman Quarrying have no objection with the recommendations
Department of Resources and Energy	
DRE requested a copy of the Hensel Geosciences resource assessment report	We have previously provided the Hensel Geosciences report but DRE have requested further information. In this respect, please find attached a *Geological Resource Assessment – Supplementary Report (GHD, October 2015).*
Request that the proponent be required to provide annual production data for the subject site to DTIRIS – Mineral Resources	No action required but Newman Quarrying have no objection with the request.
Environment Protection Authority	
The EPA raise no objection but recommend a range of conditions	No action required but Newman Quarrying has no objection with most of the recommendations. If the proposal is approved, these recommendations would be detailed in

Agency comment	Response
	the EMP. It is requested that the hours of operation, recommended by the EPA are amended to be consistent with those proposed in the EIS ie. Weekdays – 6:30am - 6.00pm Saturdays – 6:30am - 4.00pm Sundays or public holidays - No work Excavation, crushing or loading would not commence until after 7am. Blasting would only occur on weekdays between the hours of 10am and 4pm.
Office of Environment and Heritage	
The applicant must amend the errors in the BioBanking credit calculations and include indirect impacts as specified by OEH.	To be provided under separate cover
The applicant should clarify whether clearing of native vegetation for Stage 1 of the quarry has impacted on the areas proposed to be cleared for Stage 2. Any areas in proposed Stage 2 impacted by clearing for Stage 1 must be incorporated into the BioBanking credit calculations as fully vegetated land	To be provided under separate cover
The applicant should provide further detail within the Biodiversity Offset Strategy in accordance with the Framework for Biodiversity Assessment.	To be provided under separate cover
A detailed rehabilitation plan should be submitted for approval by the DPE	Please refer to the attached updated Concept Rehabilitation Plan. Please note that due to the quarry layout, it is not possible to rehabilitate the site in stages, as all areas would be used, once exposed, until the quarry ceases operation. It is anticipated that, if the proposal is approved, the Concept Rehabilitation Plan would be further refined during the preparation of the EMP.
Further consultation with Aboriginal cultural heritage knowledge holders should be undertaken in accordance with the SEARs to ensure that the consent authority is provided with adequate evidence to inform their decision	To be provided under separate cover

Agency comment	Response
The results of the consultation with Aboriginal cultural heritage knowledge holders should be incorporated into the existing Aboriginal cultural heritage assessment to inform and support the revised report recommendation s and the name of the report should be amended to reflect its purpose as the Aboriginal cultural heritage component of the environmental assessment.	To be provided under separate cover
The Aboriginal cultural heritage assessment report should include an assessment of the potential for Aboriginal objects to be present in areas referred to as disturbed land.	To be provided under separate cover
Roads and Maritime Service	
Consideration should be given to include a condition requiring a Code of Conduct relating to the transport of materials on public roads as referred to under the Mining SEPP.	No action required but Newman Quarrying has no objection with the recommendation. If the proposal is approved, this recommendation would be detailed in the EMP.
A contribution should be made for maintenance of the adjoining road network.	Refer to 4(f)
Clarence Valley Council	
The CVC response is the same as that provided in the EARs	Refer to Table 4-3 of the EIS

09 October 2015

Mark Newman
Newman Quarrying Pty Ltd
PO Box 70
WOODBURN NSW 2472

Our ref: 22/17528
Your ref: 16657

Dear Mark

Sly's Quarry Expansion Project (SSD6624)
Geological Resource Assessment - Supplementary Report

1 Introduction

This report has been prepared to provide further geological data and information to supplement the earlier Hensel Geosciences report of 27 May 2014 (attached), in line with the request from NSW Trade and Investment (DTIRIS) – Geological Survey of New South Wales (GSNSW) in their letter of 9 June 2015 (reference OUT15/12615).

Following review of the GSNSW request, GHD discussed the request with GSNSW representatives to gain a detailed understanding of GSNSW's actual needs. During our discussions GHD was requested to provide further information on the nature, extent and resource available at Slys Quarry and to provide a geological map and cross section with our report to assist GSNSW's assessment of the proposal.

This letter has been informed by a site walkover undertaken by the author on 9 September 2015. The walkover covered the extent of the current quarry and the proposed expansion area to the north and south of the existing pit area. Given the ample exposure of sandstone outcrops at ground surface drilling data was not assessed to be required to inform this assessment. We understand that this is in line with GSNSW expectations.

2 Geological Setting

The site is located within the southern end of the Clarence Moreton Basin, in NSW. The basin comprises Jurasic to Cretaceous aged sedimentary rocks that from a broad basin. Regionally, the sedimentary rocks dip from east to west around the coastline, and from west to east from the west of around Grafton, forming a broad syncline that trends generally north-west.

In the 1970 Maclean Geological sheet the stratigraphy describes the sandstone unit that crops out at Slys Quarry as Kangaroo Creek Sandstone. This sandstone member has been recently reclassified as the Orara Formation. Stratigraphically the Orara Formation, the lower unit of which is the Kangaroo Creek Sandstone Member, overlies the Walloon Coal Measures. The Kangaroo Creek Sandstone Member is in turn overlain by the Bungawalbin Member. The contact between the two members is gradational.

GHD Pty Ltd ABN 39 008 488 373
230 Harbour Drive Coffs Harbour NSW 2450 PO Box 1340 Coffs Harbour NSW 2450 Australia
T 61 2 6650 5600 **F** 61 2 6650 5601 **E** cfsmail@ghd.com **W** www.ghd.com

The Kangaroo Creek Sandstone is now thought to be Late Jurassic in age, and was likely deposited in a fluvial channel environment. The lower contact of the member, with the Walloon Coal Measures, is unconformable and represents an erosional break in the depositional environment. Based on information presented in the Australian Stratigraphic Units Database, Geoscience Australia, the Kangaroo Creek Sandstone has been estimated to be some 290 m to 870 m thick.

Figure 1: Extract from Maclean Geology Map - 1:250,000 Geological Series Sheet SH56-7, first edition 1970, compiled by the Geological Survey of NSW. The location of the quarry is noted.

The geology mapped at the site is KJk unit, described as the Cretaceous – Jurasic aged Kangaroo Creek Sandstone – Quartz sandstone with some conglomerate.

3 Local Geology

Based on our walkover, the sandstone that crops out at Slys Quarry is observed to be the Kangaroo Creek Sandstone Member. The sandstone comprises several distinct beds of medium to coarse grained sandstone, with minor lenses of conglomerate. Within some areas of the quarry, the sandstone beds are separated by thin carbonaceous inter-beds, with minor coal lenses which are rarely laterally continuous.

Generally the sandstone beds present as several metres thick, with distinct cross bedding. A weak fining up sequence is generally present in the beds. The lower intervals of some beds are defined by pebbly lenses, with the upper contacts defined by carbonaceous inter-beds and coaly lenses. The amount of carbonaceous material is greatest in the south eastern corner of the quarry. This is the stratigraphically lowest level. Photo 1 shows a view of the quarry.

Photo 1: View of the quarry from the western cut face. Benches are spaced at around 10 m in height and the base of the quarry at around 44 m AHD. The dip of the sandstone beds to the north west, the left of the image is clearly visible.

The sandstone generally presents as a pale grey sandstone which dips 8° to 10° to the north-west. The upper units exposed in the quarry face appear to be oxidised to pale yellow brown, possibly from the oxidation of disseminated sulphides within the rock mass.

Two dominant joint sets define fracturing in the quarry, and these sets are generally orthogonal to each other, with one set around 010° and a secondary set oriented around 270° to 300°.

A weathered basaltic dyke transects the quarry and is visible in both pit walls. The dyke ranges in thickness from around 1 m to 2 m, and has been distinctly weathered. Observation of a gravel marker bed either side of the dyke indicates that little to no vertical displacement of the sedimentary rocks has occurred across the dyke.

Photo 2: Weathered basaltic dyke in the northern wall of the quarry. The dyke is around 1 to 2 m wide and deeply weathered. No vertical displacement of the sandstone appears to have occurred across the dyke. Cross bedding within the sandstone beds is clearly visible.

The soil profile at the crest of the existing quarry has been stripped back in places. Observation of the edge of the stripped area indicates that the soils that overly the sandstone are generally residual in nature and comprise clayey sand and sandy clay. In drainage lines and low points in the topography silty sands are observed. These sand deposits are not laterally continuous, and are considered to be localised fluvial deposits from the surrounding hills. In general the soil profile is assessed to range from 1 m to 3 m in thickness below the ground surface.

Distant from the quarry face, regular sandstone outcrops are observed within the bushland. Photograph 3 shows one such outcrop. The outcrops are numerous and inidicatate that the Kangaroo Creek Sandstone can be reasonably expected to underlie the whole of the proposed expansion area. Photo 3 shows one observed outcrop.

Photo 3: A sandstone outcrop within the expansion area north of the existing quarry. The sandstone was interpreted to be Kangaroo Creek Sandstone.

Based on the geology we have prepared a geology map and interpreted geological sections as Figures 1 and 2 respectively.

4 Size and Quality of the Resource

The resource comprises Kangaroo Creek Sandston and residual soils that can be extracted to form construction materials and aggregates.

The geological mapping indicates that the quarry comprises high quality sandstone rock over the full extent of the proposed quarry. A thin basaltic dyke transects the sandstone. Experience has shown that this basalt material can be blended to form a saleable construction material. Our expectation is that there is a very high likelihood that the Kangaroo Creek Sandstone underlies the full extent of the proposed quarry expansion area.

The size of the resource is the total volume proposed to be extracted. GHD has estimated the volume based on the existing surface survey and the proposed quarry footprint and benching profile (indicated graphically in Figures 1 and 2). Comparison of these two surfaces by CAD allows estimation of the total volume of the quarry at around 4.3 million m^3 of material (in-situ volume).

Section 5 below provides further information on the resource volume and extraction staging proposed.

5 Products, Markets and Growth

The existing quarry has been in operation since the 1950's and in its current format operated by Newman Quarrying since the late 1990's. The quarry has supplied products to varied markets, ranging from local Councils to major Pacific Highway upgrade contractors. The sandstone resource differs from the sandstone found in other quarries in the region as it has a lower variability in strength between wet and dry states. This is important for road construction products and means it can comply with more RMS specifications than sandstone from other locations.

The quarry produces a wide range of products from all the materials within the current extraction area. No overburden is excluded from potential sale by its materials properties – the quarry owners have used good quarrying and marketing techniques to ensure that all of the resource is saleable.

Table 1 provides a summary of the products produced by the quarry, the specifications met and the potential market growth into the future. Appendix 1 attached includes a selection of test results on the quarries' products to support parts of this table.

The growth of the quarry in the short term is heavily tied to the potential supply of materials to the Pacific Highway upgrade project. The upgrade proposes to double the highway width from single carriageway to dual carriageway between Woolgoolga and Ballina by 2020. One of the major challenges for these works is the large numbers of floodplains to be crossed that will need to be built up to reduce the effects of flooding on the road network. Sly's Quarry supplies materials that are suited to various components of the RMS specifications for the highway upgrade, and therefore the resource will be in high demand. The rural location between Harwood and New Italy and the proximity of the quarry to the highway provides excellent access to market.

Table 1 Sly's Quarry products, specifications and expected market growth summary

Product	Material	Specification	Market	Expected market growth
Sand for septic trenches	Washed Sand	No specification - To buyers orders	Coarse sand for trench bedding, washed to remove fines	Continued growth as Councils tighten compliance to AS1547-2012
Sandy Loam	Alluvial Sand and overburden sand	No specification - To buyers orders	Topsoil for gardens and developments / rehabilitation	Continued growth with housing densification / subdivision growth in the region.
Trench bedding sand	Washed Sand	Various, includes AS/NZS 2566.1:1998	Country energy sand backfill for trenches, and Local Government for pipeline backfill.	
Engineered fill	Overburden sand and crushed weathered sandstone	AS2870-2011	Subdivision and controlled filling works to AS2870-2011 / AS3789-2007	
Concrete sand	Washed Sand	AS2758.1	Concrete suppliers – includes Pacific Highway pavement.	Considerable opportunity throughout market in particular in Pacific Highway upgrades
Gabion / Mattress Rock	Coarse crushed rock	RMS R55 / T215	Gabion walls and culvert drainage for Council , subdivision and Pacific Highway upgrade.	
Sub Base Course	Blended product	Aus Spec CSB40 RMS 3051N 2 part 5	Pacific Highway, RMS Owned Roads and Council roads	
Base Course	Blended product	Aus Spec CSS40 RMS3051N 2 part 5	Pacific Highway, RMS Owned Roads and Council roads	
R44 materials	Blended Products Clean rock fill	RMS R44 RMS R31 RMS R11	Pacific Highway, RMS Owned Roads and Council roads	
Reinforced Soil Materials	Blended products	RMS R57	Reinforced soil retaining walls for Pacific Highway upgrade	
Dimension	Blocks of	To buyers orders	Stonemasons and	Growing as the

Product	Material	Specification	Market	Expected market growth
Stone	Sandstone		landscapers. There are few dimension stone suppliers north of Newcastle. Growing Market	affluence of northern NSW, particularly Byron Lennox region continues.
Sandstone Aggregates	Crushed rock / Screened	Various – to buyers orders	Decorative landscapes, drainage aggregate for septic systems and rural driveways	Continued growth with housing densification / subdivision growth in the region.
Break wall Rock	Large blocks of rock	AS2578.6-2008 guideline	Break walls at Iluka / Ballina / Yamba / Coffs Harbour / Evans Head / Brunswick Heads.	Climate change will require considerable amounts of break wall rock and wall reinforcement.
Riverbank protection rock	Various sized rock	To buyers orders	Clarence River and Richmond River floodplain works	Climate change is expected to increase the requirement for riverbank protection works
Asphalt Sand	Washed Sand	RMS3152 Ashphalt Aggregates	RMS and Council asphalt roads	Need to contact buyers to begin selling product. Considerable growth potential

6 Indicative Resource

The primary purpose of the quarry would be to supply a portion of the substantial quantity of quarry materials required for current and proposed Pacific Highway works, and for supply to local councils and contractors.

The quarry operation would be carried out in stages and in response to demand. It is therefore difficult to predict exactly how the resource would be extracted. In general, the extraction is proposed to move north and east initially, to the extent of the currently approved quarry. The eastern extent of the excavation would remain 10 m from the road reserve located along the eastern boundary and a safety fence would be installed. A 5 m wide buffer would be established around the remaining perimeter of the quarry to cater for access and stormwater controls. The extraction of all stages would progress in 10 m wide by 10 m high benches to a final depth of 44 m AHD. The approximate benching profile is indicated in section in Figure 2. (GHD is not aware as to whether pit slope stability assessments have assessed this geometry

proposed and we expect that such assessments would be undertaken prior to expansion beyond Stage 1. Therefor the pit geometry assessed here is considered preliminary).

Our expectation based on the site walkover mapping and historic extraction patterns or quarry sales is that:

- All materials extracted from the quarry can be used and sold as quarry products. Therefore the total resource is the proposed extraction volume. Our calculations of the resource do not include allowances for overburden or the effects of the basaltic dyke within the sandstone, as historically all soil and rock extracted can be blended and sold.
- The products will be extracted for high value sales, such as RMS specification materials and Base and Sub-Base products for road construction. Some dimension stone may also be extracted.
- Materials that do not meet the high value specifications will be sold as lower value products such as select and general fill.
- Benches will comprise 10 m high and wide stepped profiles, cut by blasting.
- The base of the quarry will extend to around 44 m AHD.
- Groundwater levels are below the base of the quarry, and will not restrict resource extraction.

The indicative extractable resource is therefore estimated to comprise a total of 4.3 million m^3 of material (in-situ volume), allowing for the final Stage 3 batter profiles shown in Figure 2[1].

Stage 1 would cover an area of 6.9 hectares and extract approximately 1.43 million m^3 (in-situ volume). Stage 1 encompasses the area previously approved for a quarry.

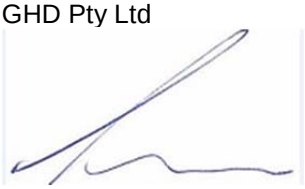
Stage 2 would involve expanding the quarry to the north and south and to a depth of 44 m AHD. This would expand the quarry by 5.7 hectares and involve the extraction of approximately 1.77 million m^3 in-situ. Stage 2 (south) would be exhausted prior to Stage 2 (north) being developed.

Stage 3 would be the final stage and would expand the quarry further north and south. Stage 3 would involve an expansion of 5.4 hectares to a depth of 44 m AHD. This would involve extracting approximately 1.1 million m^3 in-situ of material. Stage 3 (south) would be exhausted prior to Stage 3 (north) being developed.

Should you require any further information or assistance, please do not hesitate to contact us.

[1] The total volume reported here has been assessed based on the batter profiles at the final extents of Stage 3 of extraction. Volume estimates for the stages within the total extraction volume are based on vertical pit sidewalls and have not included the benching profile indicated in the attached sections within each stage. Therefore the volumes reported here for individual stages are necessarily rough estimates only.

Sincerely
GHD Pty Ltd



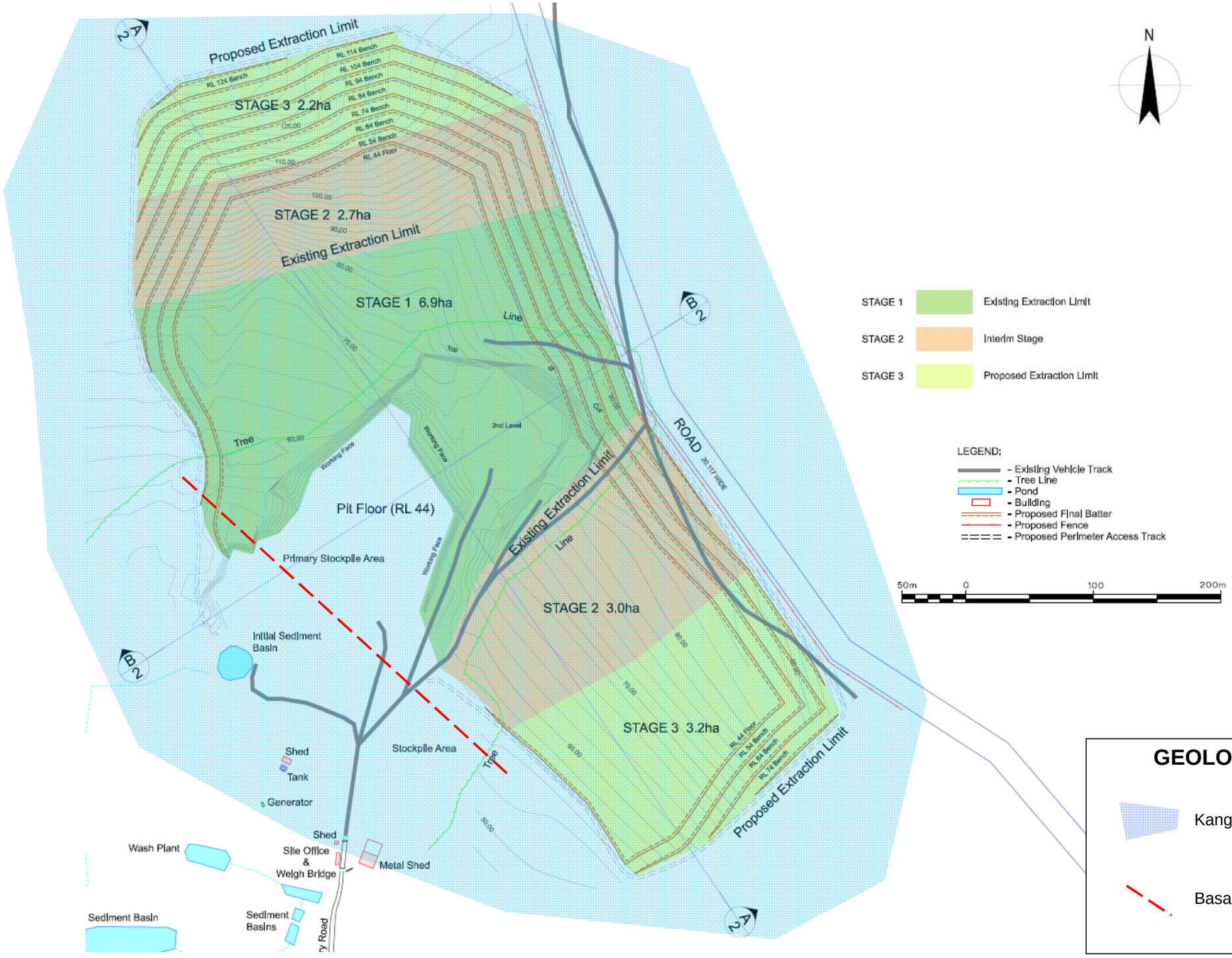
Tom Nicholson
Principal Engineering Geologist
(02) 6650 5600

Attachments:

Figure 1: Geology Map
Figure 2: Geology Sections

Hensel Geosciences Report (5 pages)

Laboratory Test Results (44 pages)



GHD CLIENTS | PEOPLE | PERFORMANCE

GHD

230 Harbour Drive, Coffs harbour NSW 2450 T 61 2 6650 5600 Web www.ghd.com.au

Newman Quarrying Pty Ltd

Sly's Quarry Expansion Project – Geological Resource Assessment – Supplementary Report

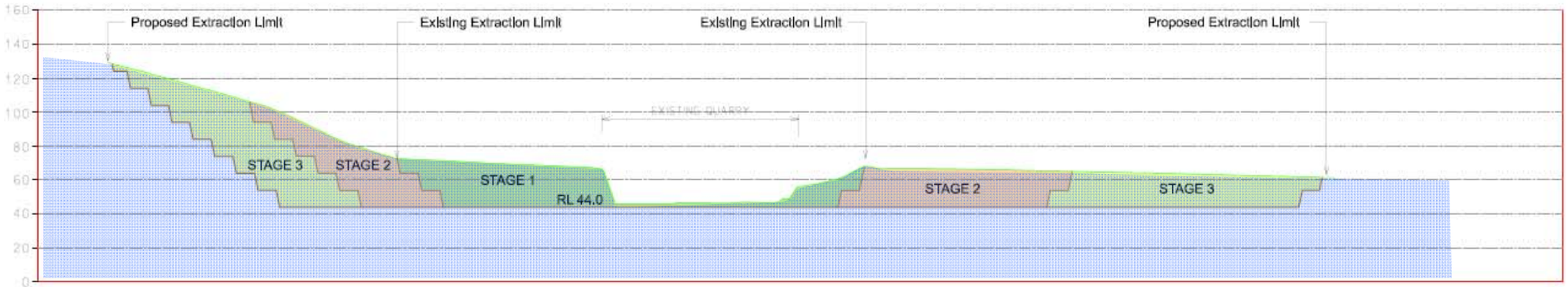
Geology Map

job no 22-17528

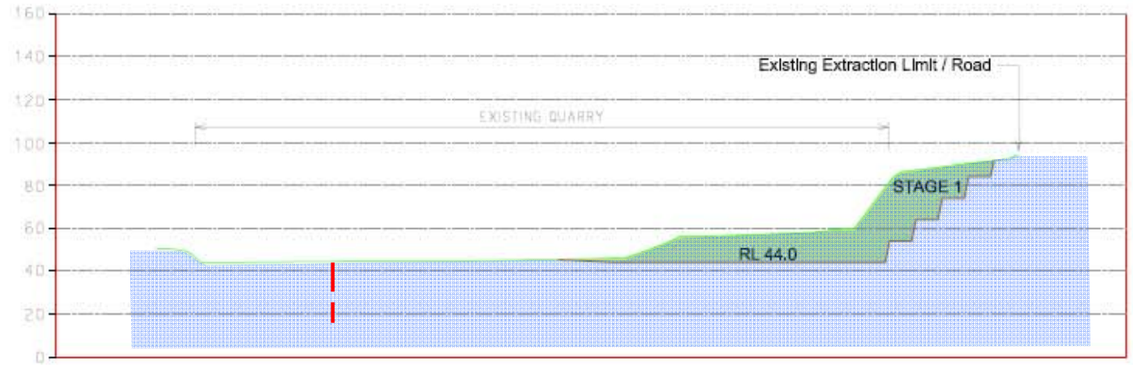
file ref 22-17528_16657_Fig1.ppt

scale As shown date Ocotober 2015

Figure 1



SECTION A - A



SECTION B - B

GEOLOGY LEGEND

Kangaroo Creek Sandstone

Basalt Dyke

GHD CLIENTS | PEOPLE | PERFORMANCE

GHD

230 Harbour Drive, Coffs harbour NSW 2450 T 61 2 6650 5600 Web www.ghd.com.au

Newman Quarrying Pty Ltd

Sly's Quarry Expansion Project – Geological Resource Assessment – Supplementary Report

Geology Sections

job no 22-17528

file ref 22-17528_16657_Fig2.ppt

scale As shown date Ocotober 2015

Figure 2

Overview of Present and Proposed Newman's Sandstone Quarry Resources, Woodburn, NSW

Purpose of report

This report has been prepared to provide an overview of the local geology of the proposed quarry extensions and the relationship to the existing quarry resource and operations. This stand-alone report can be used to accompany an application to the Department of Planning to obtain the "Director General's Requirements (ie specifications) for the Environmental Impact Statement (EIS) that has to be prepared to support the development application for the expansion of the quarry.

Introduction

At the southern end of the Clarence-Moreton Basin, NSW, are extensive deposits of quartzose sandstone. One particular unit, the Kangaroo Creek Sandstone, occur mostly west of the Pacific Highway, strikes roughly N-S, and covers an area of many kilometers. Roughly 30km south of Woodburn, NSW and about 2km west of the Highway is an operating sandstone quarry belonging to Newman Quarries Pty Ltd. The sandstone deposits in this area are generally well-exposed, quite accessible and easily worked. The principal product is a medium- to coarse-grained siliceous sandstone that is used in a number of engineering applications, particularly roadworks.

The company seeks to extend their northern and north-eastern boundaries by a short distance in order to continue to produce good quality product. Although the sandstone formation continues at depth there is a danger of intersecting the water-table. This would seriously impact on the quarry operations and on the product.

General geology

The sandstone unit has long been assigned to the Kangaroo Creek Formation but recent work has demoted its status to a member that belongs to the Orara Formation. Surprisingly, the geology of this Formation is not well known. The Orara Formation overlies the Walloon Coal Measures. Contacts may be gradational or unconformable. Another newly named unit, the Bungawalbin Member, overlies the Kangaroo Creek sandstone. Previously, the Orara Formation has been overlain by the Grafton Formation, but this also has been divided into two new Members.

All the above-named rock units are part of the southern end of the Clarence-Moreton Basin. They constitute the higher (more recent) rock units of this Basin. The Kangaroo Creek sandstone is believed to be mid- to late-Jurassic although there is doubt and dispute with some suggesting a much younger age of mid- to late-Cretaceous. This younger age is the more unlikely.

Many of the sedimentological features suggest a braided stream deposit with channels and flat, overflow lagoons as the most likely depositional environment.

Detailed Geology

Again there appears to be doubt regarding the thickness of the Kangaroo Creek sandstone, with estimates ranging from 150m to 500m. For the most part it has a gentle dip to the south, west and southwest.

An examination of the quarry faces revealed a variety of arenaceous rock types and several, very minor, lithologically distinct interbeds. The sandstone ranges from medium-grained to quite coarse-grained. The former tends to have a pale pinkish colour and is distinctly cross-bedded. Individual layers are lighter and darker in colour and can be measured in mm. The majority of beds are less than

1m in thickness. In contrast, there are several prominent beds of the coarser sandstone between 2 and 3m thick. The general colour of the coarse-grained sandstone is medium- to light-greyish. Common reference has been made that the coarser-grained sandstone sparkles in the sun. Some people have suggested that this is due to the presence of mica, but this is untrue: the sparkles are due to reflective crystal faces of quartz. Because of the coarse grainsize it is assumed that the large crystals of quartz, and particularly the crystal faces, are the result of post-depositional fluid activity depositing additional silica onto the framework grains during lithification.

Separating the beds are thin layers of fine sandstone, siltstone and carbonaceous material. Plant fossils are not uncommonly associated with the coaly layers. In the processing of the sandstone for the desired engineering or construction application these secondary rock types are fully accommodated with little or no measurable detriment to the final product. Indeed, they provide a small amount of plasticity,

Proposed extension to the quarry

Newmans Quarries propose a minor extension of the existing quarry to the north and north-east. To the north-east there is a shallow cover rarely exceeding 3m, whereas to the north, where there has been an original pit, there is essentially no cover. Photograph 6 shows the track from the top of the existing quarry to the original pit. Note the almost continuous solid outcrop of sandstone. A small depression between the top of the existing quarry and the original pit (to the west of the track) requires clearing, as does the track and area to the east.

Importantly, the northern limit of the proposed extension remains concealed from public view by dense bushland.

Geologically, there is little to no doubt that the sandstones exposed in the existing quarry are continuous into the proposed extension. All the sedimentological characteristics of the exposed sandstone will certainly be present in the areas proposed for extension. This also includes the interbeds. There is no indication that the bed sequence (stratigraphy) will be any different from what is exposed. There is no indication that there has been any structural dislocation of the strata to modify the resource.

Product

As noted previously the existing quarry produces both solid and blended crushed sandstone products that can be used in a variety of engineering and construction applications. Testing has shown that the sandstone is highly siliceous and with only very small amounts of phyllosilicates (mica, illite, chlorite) and carbonaceous material. This virtually categorizes the sandstone as inert chemically and physically under most normal natural conditions. It is shown to be well-cemented and quite strong. The proposed extension is very likely to represent a resource that is continuous with the present quarry resource.

Conclusions

The areas proposed by Newmans Quarries for extentions to their on-going operations are logical, very reasonable, restricted and environmentally sustainable. A resource essentially identical to the existing quarry resource has been identified.

Dr. H. D. Hensel
(HENSEL GEOSCIENCES)
26th May, 2014

Rear (northern) wall of Newman's sandstone quarry. The wooded area behind is part of the proposed extention.

Eastern wall of Newman's sandstone quarry. The wooded regrowth area behind is part of the proposed extention.

Several thick beds of coarse-grained sandstone on the eastern quarry face

Western wall of Newman’s sandstone quarry showing the typical bedding style including the prominent cross-bedding

Track from northern quarry face to an original sandstone quarry/pit to show the northern limit of the proposed extension. Note the almost continuous exposure of sandstone

Looking east along the track above the existing quarry marking the eastern portion of the proposed extension

Chandler Morrison Geotechnical Pty Ltd
34/22 Lawson Crescent, Coffs Harbour NSW 2450
Tel: +61 2 6651 5777 Fax: +61 2 6651 5755 ABN 55 139 985 050

CMG

Client:	Newman Quarrying	Project No:	CH15-232	Report No:	6097
Address:	PO Box 70	Sample Date:	21/05/2015	By	CMG Staff - BO
	Woodburn NSW 2472	Test Date:	2/06/2015	By	DD,AS,TS,LC
Project:	Rock Assessment	Stockpile Number:	-		
Location:	Newmans Quarry	Lot No:	A	Page	1 of 1
Material:	Breakwall Armour Rock				

MATERIAL REPORT

Test Method	Test Description			TEST RESULTS					Specification Requirements
Sample No.				A					
Sample Description									
AS1141.11.1	Sieve Size			% passing by mass					
	26.5mm								
	19.0mm								
	13.2mm								
	9.5mm								
	6.7mm								
	4.75mm								
	2.36mm								
	1.18mm								
	600µm								
	425µm								
	300µm								
	150µm								
	75µm								
AS1141.12	Material Finer than 75µm		%						
AS1141.14	Particle Shape (proportional calliper)	2:1 Ratio	%						
		3:1 Ratio	%						
AS1141.20.1	Average Least Dimension	9.5-6.7mm	mm						
		6.7-4.75mm	mm						
AS1141.32	Weak Particles (including clay lumps,soft & friable particles)		%						
	Passing 2.36		%						
RMS T239	Separating Sieve Size		mm						
	Passing Separating Sieve		%						
	Freshly Fractured Faces - F0 (Rounded)		%						
	Freshly Fractured Faces - F1 (≥1 Face)		%						
	Freshly Fractured Faces - F2 (≥2 Face)		%						
AS1141.24	Individual Weighted Loss	75.0-53.0mm	%	0.0					
		53.0-37.5mm	%	0.0					
		26.5-19.0mm	%	0.8					
		19.0-13.2mm	%	0.7					
	Soundness (total weighted loss)		%	0.4					
AS1141.6.1	Bulk Density and Water Absorbtion of Coarse Aggregate	Apparent Particle Density	t/m3						
		Particle Density Dry	t/m3						
		Particle Density (S.S.D.)	t/m3						
		Water Absorption	%						
AS1141.5	Bulk Density and Water Absorbtion of Fine Aggregate	Apparent Particle Density	t/m3						
		Particle Density Dry	t/m3						
		Particle Density (S.S.D.)	t/m3						
		Water Absorption	%						
AS1141.4	Unit Mass	Loose	t/m^3						
		Compacted	t/m3						
AS1012.12.2	Mass per Unit Volume	Specimen Description		Rock Core					
		Moisture Condition		SSD					
		Mass per Unit Volume	kg/m3	2600					
		Specimen volume Description		Less than Std					
Remarks	Sample history & preparation: Sampling Method: AS1141.3.1- 8.4.1								

Approved Signatory: **D Dengate** Date: 9/06/2015

NATA Accredited Laboratory No. 17240

Accredited for compliance with ISO/IEC 17025.

AUSTRALIAN SOIL AND CONCRETE TESTING P/L A.B.N. 49 050 539 930

Unit 7/17 Southern Cross Drive, Ballina NSW 2478. Ph (02) 6686 8567 Fax (02) 6686 8396

ASCT Doc. No. R05 Rev. 05 – 10/2/11 - BH

Report on Soil pH

Client: Newman Quarrying	**Project no:** 051-009	**Project:** Tabbimoble Quarry, Tabbimoble
	Report no: 051-009-562	

Testing & Sampling

Sampled By: Client	**Sampling Method:** Client
Date Sampled: 5/10/2011	**Test Method:** AS1289.4.3.1

Test Data

Lab No.	Test No.	Date Tested	Sample Description	pH
14307	1	5/10/2011	Crushed Rubble: Grey	**4.07**

Signed: _____ **Date: 6/10/11**

Brian Dick
(Approved Signatory)

Testing performed at ASCT P/L Ballina Laboratory, NATA Accredited Laboratory No. 3229.

AUSTRALIAN SOIL AND CONCRETE TESTING P/L A.B.N.49 050 539 930

Unit 7/17 Southern Cross Drive, Ballina 2478. Telephone: (02)66868 567, Mob: 0408079826, Fax:(02)66868 396

Wet/Dry Strength Variation & Crushing Value of Aggregate & 10% Fines

Client: Newman Quarrying	**Project no:** 051-009	**Project:** Tabbimoble Quarry
Test methods: RTA T215	**Report no:** 051-009-574	**Date sampled:** 17/10/2011

Sampled by: ASCT P/L

Sampling method: AS1141.3.1.6.9.3

Sample preparation: RTA T105

Pre-treatment: Nil

Sample location: 50mm S/base Stockpile, Sample #1

Sample description: Crushed Sandstone: Grey

Lab. Number	Date Tested	Fraction Tested (mm)	Amount of Breakdown (%)	Average Wet Strength (note 1) (kN)	Average Dry Strength (note 1) (kN)	Wet/Dry Strength Variation (%)	Aggregate Crushing Value
14387	24/10/11	26.5-19.0	Nil	**50**	**63**	**21**	-

note 1: Average wet and dry strength determined from duplicate testing.

Nominal size of aggregate/rock (mm): 50

Amount of breakdown after wash (%): Nil

Test cylinder diameter (mm): 150

Comments:

ACCREDITED FOR TECHNICAL COMPETENCE

This document is issued in accordance with NATA's Accreditation requirements. Accredited for compliance with ISO/IEC 17025.

Signed: _____ **Date: 26/10/11**

Brian Dick
(Approved Signatory)

AUSTRALIAN SOIL AND CONCRETE TESTING P/L A.B.N. 49 050 539 930
Unit 7/17 Southern Cross Drive, Ballina 2478. ph (02) 6686 8567 fax: (02) 6686 8396

Particle Size Distribution Report

Client: **Newman Quarrying**	Project No: **051-009**
Project: **Tabbimoble Quarry**	Report No: **051-009-712**

Lab Number:	15404		
Sieve Size (mm)	Passing (%)	Upper Limit (%)	Lower Limit (%)
100.0		100	100
75.0		95	100
53.0	**100**		
37.5	**98**		
26.5	**91**		
19.0	**81**	50	85
13.20	**72**		
9.50	**65**		
6.70	**60**	40	80
4.75	**56**		
2.36	**52**	35	70
1.180			
0.600			
0.425			
0.300			
0.150			
0.075			
0.0135			
A Ratio			
B Ratio			
C Ratio			

Sampled By: ASCT P/L

Date Sampled: 8/6/2012

Sample Location: Select Stockpile JHS 9

Sampling Method: AS1141.3.1:6.9.5b

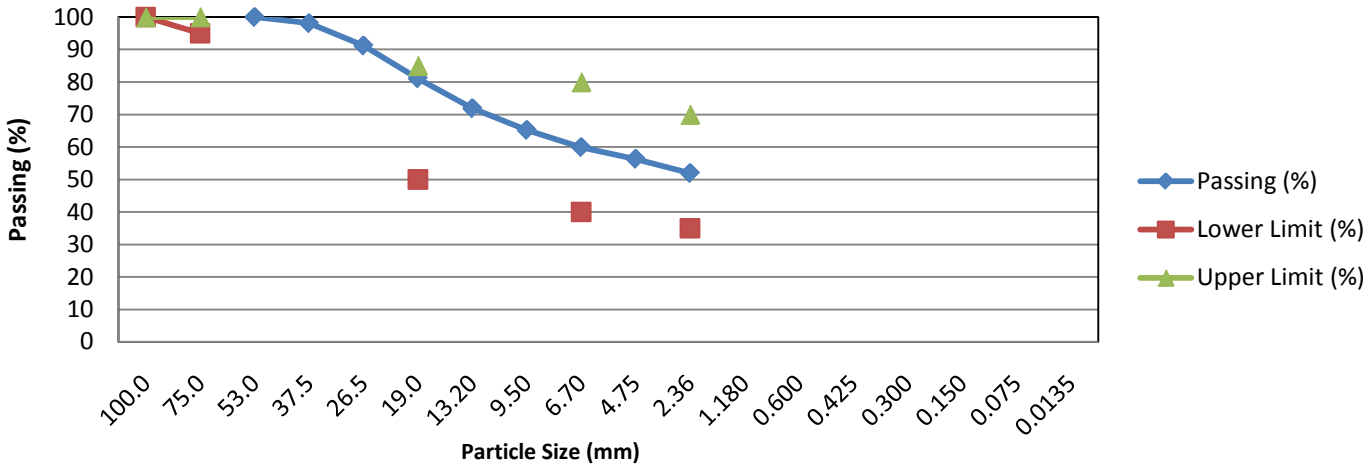
Sample Preparation: RTA T105

Pretreatment: RTA T102 (CA3)

Test Methods: RTA T106

Date Tested: 13/6/12

Sample Description: Crushed Sandstone: Grey



NATA ACCREDITED FOR TECHNICAL COMPETENCE

This document is issued in accordance with NATA's accreditation requirements. Accredited for compliance with ISO/IEC 17025.

Signed: _____ Date: 19/06/2012

Brian Dick
(Approved Signatory)

AUSTRALIAN SOIL AND CONCRETE TESTING P/L A.B.N 49 050 539 930
Unit 7/17 Southern Cross Drive, Ballina 2478. ph: (02) 6686 8567 fax: (02) 6686 8396

Plasticity Index and Linear Shrinkage Report

Client: **Newman Quarrying**	Project No: **051-009**
Project: **Tabbimoble Quarry**	Report No: **051-009-712**

Sample and Test Information

Sampled By:	ASCT P/L	**Sampling Method:**	AS1141.3.1:6.9.5b
Date Sampled:	8/6/2012	**Sample Preparation:**	RTA T105
Sample Location:	Select Stockpile JHS 9	**Pretreatment:**	RTA T102 (CA3)
Sample Description:	Crushed Sandstone: Grey	**Test Method:**	RTA T108, T109, T120

Plasticity Index

Lab Number	Date Tested	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
15404	13/6/12	**19**	**15**	**4**

Linear Shrinkage

Lab Number	Date Tested	Mould Length (mm)	Linear Shrinkage (%)	Sample Defects
-	-	-	**-**	**-**

NATA ACCREDITED FOR TECHNICAL COMPETENCE

This document is issued in accordance with NATA's accreditation requirements. Accredited for compliance with ISO/IEC 17025.

Signed: Brian Dick

Brian Dick
(Approved Signatory)

Date: 19/06/2012

AUSTRALIAN SOIL AND CONCRETE TESTING P/L A.B.N.49 050 539 930
7/17 Southern Cross Drive, Ballina NSW 2478. PH: 02 6686 8567 FAX: 02 6686 8396 MOB: 0408 079 826

Californian Bearing Ratio Report

Client:	**Newman Quarrying**	Project No:	**051-009**
Project:	**Tabbimoble Quarry**	Report No:	**051-009-712**

Sample and Test Information

Sampled By:	ASCT P/L	**Sampling Method:**	AS1141.3.1:6.9.5b
Date Sampled:	8/6/2012	**Test Method:**	RTA T117, T120
Sample Location:	Select Stockpile JHS 9	**Date Tested:**	18/6/12
Sample Description:	Crushed Sandstone: Grey	**Pretreatment:**	RTA T102 (CA3)

CBR Value 2.5mm Penetration (top): **45**

CBR Value 5.0mm Penetration (top): **60**

Test Data

Lab No: 15404

Sample Preparation	**RTA T105**	
Compaction Standard Number	**RTA T111**	
Compaction Specification	**100 Standard**	%
Moisture Specification	**100 Standard**	%
Oversize Proportion (>19.0mm)	**19**	%
Oversize Broken Down (<19.0mm, >4.75mm)	**NIL**	%
Applied Surcharge	**4.5**	kg
Soaking Period	**4**	Days
Maximum Dry Density (MDD)	**2.02**	t/m^3
Optimum Moisture Content (OMC)	**10.0**	%
Dry Density Before Soaking	**2.04**	t/m^3
Dry Density After Soaking	**2.05**	t/m^3
Laboratory Density Ratio (LDR)	**101**	%
Moisture Content Before Soaking	**9.9**	%
Moisture Content After Soaking - Top 30mm of Sample	**10.8**	%
Moisture Content After Soaking - Whole Sample	**9.8**	%
Laboratory Moisture Ratio (LMR)	**99**	%
Swell After Soaking	**-0.2**	%

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

This document is issued in accordance with NATA's accreditation requirements. Accredited for compliance with ISO/IEC 17025

Signed: _____ **Date:** 19/06/2012

Brian Dick
(Approved Signatory)

AUSTRALIAN SOIL AND CONCRETE TESTING A.B.N. 49 050 539 930

7/17 Southern Cross Drive, Ballina NSW 2478. ph: (02) 6686 8567 fax: (02) 6686 8396

Wet/Dry Strength Variation Report

Client:	**Newman Quarrying**	Project No:	**051-009**
Project:	**Tabbimoble Quarry**	Report No:	**051-009-771**

Sampling & Testing Information

Sampled By:	ASCT P/L	**Sampling Method:**	AS1141.3.1.8.4.3
Date Sampled:	17/10/2012	**Sample Preparation:**	Washed & Oven Dried
Sample Location:	Drainage Blanket Stockpile NDB 1	**Test Method:**	RMS T215
Sample Description:	Crushed Sandstone: Grey		

Test Data

Laboratory Number	**15972**
Date Tested	**24/10/2012**
Nominal Size of Rock/Aggregate (mm)	**20**
Test Cylinder Diameter (mm)	**150**
Amount of Breakdown During Preparation (%)	**Nil**
Test Fraction (mm)	**26.5 - 19.0**
Average Wet Strength (kN)	**42**
Average Dry Strength (kN)	**54**
Wet/Dry Strength Variation	**22**

NATA ACCREDITED FOR TECHNICAL COMPETENCE

This document is issued in accordance with NATA's accreditation requirements. Accredited for compliance with ISO/IEC 17025.

Signed: _____ Date: 29/10/2012

Brian Dick

(Approved Signatory)

AUSTRALIAN SOIL AND CONCRETE TESTING P/L
A.S.C.T.

PO Box 5120
Ballina Mail Centre, Ballina NSW 2478
7/17 Southern Cross Drive, Ballina

Telephone: (02) 6686 8567
Fax: (02) 6686 8396
Mob: 0408 079 826
A.B.N. 49 050 539 930

Concrete Sand Test Requirements
Australian Soil and Concrete Testing P/L (ASCT) at your request tested Tabbimoble Quarry sand for compliance for use as concrete/asphalt sand. The testing requirements are detailed below.

Table 1: Concrete sand testing requirements

Test Method	Your Recent Result (sample no. 16299)	Test Requirement (AS2758.1)
Material finer than 75μm (AS1141.12)	1%	<5%
Material finer than 2μm (AS1141.13)	Not applicable[note 1]	<1%
Detection of sugar (AS1141.35)	Not detected	Aggregate shall test negative to the presence of sugar
Presence of chloride ion (AS1012.20)	0.003%	<0.04%
Presence of sulfate ion (AS1012.20)	0.02%	<5%[note 2]
Sodium sulfate soundness (AS1141.24)	0.9%	<6%
Llight particles (AS1141.31)	0%	<1%
Organic impurities (AS1141.34)	Pass	Pass[note 3]
Accelerated mortar bar test (RMS T363)	0.156%[note 4]	<0.45%[note 5]
Petrographic analysis	Suitable for use in concrete and asphalt sand	Suitable for use in concrete and asphalt sand[note 6]

Note 1: your sample had less than 1% finer than 75μm, therefore it is given that it will have less than 1% finer than 2μm.
Note 2: some specifications list the allowable sulfate content as low as <0.2%.
Note 3: this test delivers a pass or fail verdict, your material passed.
Note 4: result means that your sample is classified as slowly reactive and blended cement would need to be used with this material according to RMS B80 specification.
Note 5: I have viewed a Holcim specification that listed the upper limit as 0.45%.
Note 6: RMS specification 3152 for asphalt aggregates states that asphalt sand should not have more than 2.5% bonded quartz and the petrographic analysis determined the material had 3% bonded quartz.

Other Testing
Other tests conducted on your sample included a particle size distribution (PSD) and all the limits for the PSD were displayed on the report. Also, the sand was tested for an indication of weak particles (AS1141.32) which is normally done on coarse aggregate. The sample had 1.7% weak particles, however only 4% of the sample comprised the test fraction (*i.e.* >2.36mm). Therefore, the weighted percentage of weak particles would only be 0.07%. AS2758.1 specifies that the proportion of weak particles should not exceed 0.5%.

AUSTRALIAN SOIL AND CONCRETE TESTING P/L A.B.N.49 050 539 930
7/17 Southern Cross Drive, Ballina NSW 2478. PH: 02 6686 8567 FAX: 02 6686 8396 MOB: 0408 079 826

Californian Bearing Ratio Report

Client:	**Newman Quarrying**	Project No:	**501-009**
Project:	**Tabbimobile Quarry**	Report No:	**051-009-781**

Sample and Test Information

Sampled By:	ASCT P/L	**Sampling Method:**	AS1141.3.1:9.3
Date Sampled:	26/2/2014	**Test Method:**	RMS T111, T117, T120
Sample Location:	50mm Sub-base Stockpile Sample #1	**Date Tested:**	7/03/14
Sample Description:	Crushed Sandstone: Grey	**Pretreatment:**	Nil

CBR Value 2.5mm Penetration (top): **50** CBR Value 5.0mm Penetration (top): **60**

Test Data

Lab No: 18328

Sample Preparation	**RMS T105**	
Compaction Standard Number	**RMS T111**	
Compaction Specification	**100 Standard**	%
Moisture Specification	**100 Standard**	%
Oversize Proportion (>19.0mm)	**46**	%
Oversize Broken Down (<19.0mm, >4.75mm)	**NIL**	%
Applied Surcharge	**4.5**	kg
Soaking Period	**4**	Days
Maximum Dry Density (MDD)	**2.01**	t/m^3
Optimum Moisture Content (OMC)	**9.7**	%
Dry Density Before Soaking	**2.00**	t/m^3
Dry Density After Soaking	**2.03**	t/m^3
Laboratory Density Ratio (LDR)	**100**	%
Moisture Content Before Soaking	**9.8**	%
Moisture Content After Soaking - Top 30mm of Sample	**10.4**	%
Moisture Content After Soaking - Whole Sample	**9.8**	%
Laboratory Moisture Ratio (LMR)	**101**	%
Swell After Soaking	**0.0**	%

NATA ACCREDITED FOR TECHNICAL COMPETENCE

Accredited for compliance with ISO/IEC 17025. The results of the tests included in this document are traceable to Australian/national standards.

Signed: _____ **Date:** 25/03/2014
Brian Dick
(Authorised Signatory)

AUSTRALIAN SOIL AND CONCRETE TESTING P/L A.B.N. 49 050 539 930
Unit 7/17 Southern Cross Drive, Ballina 2478. ph (02) 6686 8567 fax: (02) 6686 8396

Particle Size Distribution Report

Client: **Newman Quarrying**	Project No: **501-009**
Project: **Tabbimobile Quarry**	Report No: **051-009-781**

Lab Number:	18328		
Sieve Size (mm)	Passing (%)	Lower Limit (%)	Upper Limit (%)
100.0			
75.0			
53.0	**100**	100	100
37.5	**90**	90	100
26.5	**77**	74	96
19.0	**64**	62	86
13.20	**54**		
9.50	**48**	42	66
6.70	**44**		
4.75	**41**	28	50
2.36	**37**	20	39
1.180			
0.600			
0.425	**14**	8	21
0.300			
0.150			
0.075	**8**	3	11
0.0135			
A Ratio			
B Ratio			
C Ratio			

Sampled By: ASCT P/L

Date Sampled: 26/2/2014

Sample Location: 50mm Sub-base Stockpile Sample #1

Sampling Method: AS1141.3.1:9.3

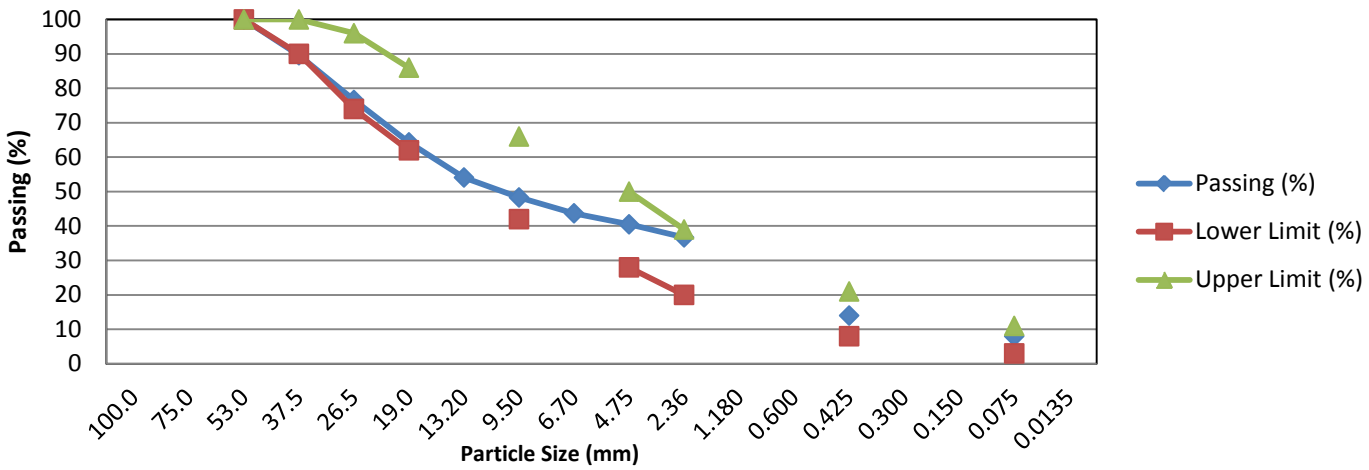
Sample Preparation: RMS T105

Pretreatment: Nil

Test Methods: RMS T106

Date Tested: 04/03/2014

Sample Description: Crushed Sandstone: Grey



NATA ACCREDITED FOR TECHNICAL COMPETENCE

Accredited for compliance with ISO/IEC 17025. The results of the tests included in this document are traceable to Australian/national standards.

Signed: _____ Date: 25/03/2014

Brian Dick
(Authorised Signatory)

AUSTRALIAN SOIL AND CONCRETE TESTING P/L A.B.N 49 050 539 930
Unit 7/17 Southern Cross Drive, Ballina 2478. ph: (02) 6686 8567 fax: (02) 6686 8396

Plasticity Index and Linear Shrinkage Report

Client: **Newman Quarrying**	Project No: **501-009**
Project: **Tabbimobile Quarry**	Report No: **051-009-781**

Sample and Test Information

Sampled By:	ASCT P/L	**Sampling Method:**	AS1141.3.1:9.3
Date Sampled:	26/2/2014	**Sample Preparation:**	RMS T105
Sample Location:	50mm Sub-base Stockpile Sample #1	**Pretreatment:**	Nil
Sample Description:	Crushed Sandstone: Grey	**Test Method:**	RMS T108, T109, T120

Plasticity Index

Lab Number	Date Tested	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
18328	11/03/2014	**0**	**0**	**NP (non plastic)**

Linear Shrinkage

Lab Number	Date Tested	Mould Length (mm)	Linear Shrinkage (%)	Sample Defects
-	-	-	**-**	**-**

NATA ACCREDITED FOR TECHNICAL COMPETENCE

Accredited for compliance with ISO/IEC 17025. The results of the tests included in this document are traceable to Australian/national standards.

Signed: 

Brian Dick
(Authorised Signatory)

Date: 25/03/2014

AUSTRALIAN SOIL AND CONCRETE TESTING P/L A.B.N.49 050 539 930
7/17 Southern Cross Drive, Ballina NSW 2478. PH: 02 6686 8567 FAX: 02 6686 8396 MOB: 0408 079 826

Californian Bearing Ratio Report

Client:	**Newman Quarrying**	Project No:	**501-009**
Project:	**Tabbimobile Quarry**	Report No:	**051-009-782**

Sample and Test Information

Sampled By:	ASCT P/L	**Sampling Method:**	AS1141.3.1:9.3
Date Sampled:	26/2/2014	**Test Method:**	RMS T111, T117, T120
Sample Location:	30mm Base Stockpile Sample #1	**Date Tested:**	7/03/14
Sample Description:	Crushed Sandstone: Grey	**Pretreatment:**	Nil

CBR Value 2.5mm Penetration (top): **45** CBR Value 5.0mm Penetration (top): **60**

Test Data

Lab No: 18329

Sample Preparation	**RMS T105**	
Compaction Standard Number	**RMS T111**	
Compaction Specification	**100 Standard**	%
Moisture Specification	**100 Standard**	%
Oversize Proportion (>19.0mm)	**23**	%
Oversize Broken Down (<19.0mm, >4.75mm)	**NIL**	%
Applied Surcharge	**4.5**	kg
Soaking Period	**4**	Days
Maximum Dry Density (MDD)	**2.03**	t/m^3
Optimum Moisture Content (OMC)	**8.6**	%
Dry Density Before Soaking	**2.04**	t/m^3
Dry Density After Soaking	**2.07**	t/m^3
Laboratory Density Ratio (LDR)	**101**	%
Moisture Content Before Soaking	**8.6**	%
Moisture Content After Soaking - Top 30mm of Sample	**8.8**	%
Moisture Content After Soaking - Whole Sample	**8.9**	%
Laboratory Moisture Ratio (LMR)	**101**	%
Swell After Soaking	**0.0**	%

NATA ACCREDITED FOR TECHNICAL COMPETENCE

Accredited for compliance with ISO/IEC 17025. The results of the tests included in this document are traceable to Australian/national standards.

Signed: _____ **Date:** 25/03/2014
Brian Dick
(Authorised Signatory)

AUSTRALIAN SOIL AND CONCRETE TESTING P/L A.B.N. 49 050 539 930
Unit 7/17 Southern Cross Drive, Ballina 2478. ph (02) 6686 8567 fax: (02) 6686 8396

Particle Size Distribution Report

Client: **Newman Quarrying**	Project No: **501-009**
Project: **Tabbimobile Quarry**	Report No: **051-009-782**

Lab Number:	18329		
Sieve Size (mm)	Passing (%)	Lower Limit (%)	Upper Limit (%)
100.0			
75.0			
53.0			
37.5	**100**	100	100
26.5	**96**	95	100
19.0	**77**	73	93
13.20	**66**		
9.50	**60**	53	73
6.70	**55**		
4.75	**51**	36	56
2.36	**46**	25	43
1.180			
0.600			
0.425	**13**	10	21
0.300			
0.150			
0.075	**4**	4	10
0.0135			
A Ratio			
B Ratio			
C Ratio			

Sampled By: ASCT P/L

Date Sampled: 26/2/2014

Sample Location: 30mm Base Stockpile Sample #1

Sampling Method: AS1141.3.1:9.3

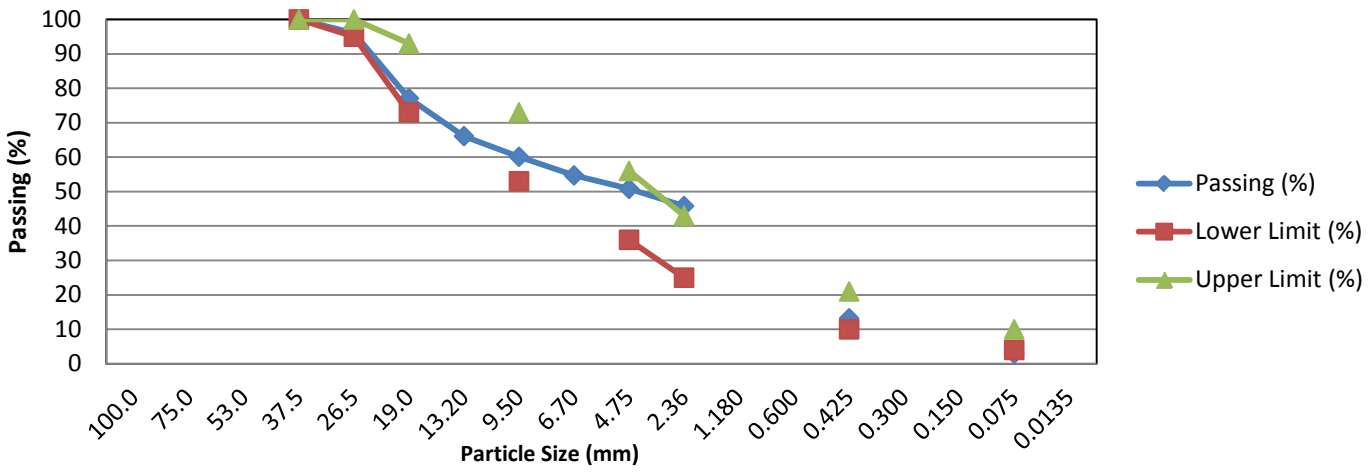
Sample Preparation: RMS T105

Pretreatment: Nil

Test Methods: RMS T106

Date Tested: 4/3/2014

Sample Description: Crushed Sandstone: Grey



NATA ACCREDITED FOR TECHNICAL COMPETENCE

Accredited for compliance with ISO/IEC 17025. The results of the tests included in this document are traceable to Australian/national standards.

Signed: _____ Date: 25/03/2014

Brian Dick
(Authorised Signatory)

AUSTRALIAN SOIL AND CONCRETE TESTING P/L A.B.N 49 050 539 930
Unit 7/17 Southern Cross Drive, Ballina 2478. ph: (02) 6686 8567 fax: (02) 6686 8396

Plasticity Index and Linear Shrinkage Report

Client: **Newman Quarrying**	Project No: **501-009**
Project: **Tabbimobile Quarry**	Report No: **051-009-782**

Sample and Test Information

Sampled By:	ASCT P/L	**Sampling Method:**	AS1141.3.1:9.3
Date Sampled:	26/2/2014	**Sample Preparation:**	RMS T105
Sample Location:	30mm Base Stockpile Sample #1	**Pretreatment:**	Nil
Sample Description:	Crushed Sandstone: Grey	**Test Method:**	RMS T108, T109, T120

Plasticity Index

Lab Number	Date Tested	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
18329	11/03/2014	**0**	**0**	**NP (non plastic)**

Linear Shrinkage

Lab Number	Date Tested	Mould Length (mm)	Linear Shrinkage (%)	Sample Defects
-	-	-	**-**	**-**

NATA ACCREDITED FOR TECHNICAL COMPETENCE

Accredited for compliance with ISO/IEC 17025. The results of the tests included in this document are traceable to Australian/national standards.

Signed: _____ Date: 25/03/2014

Brian Dick
(Authorised Signatory)

GEOCHEMPET SERVICES, BRISBANE

Geochempet Services

ABN 980 6945 3445
PETROLOGICAL and GEOCHEMICAL CONSULTANTS
Principals: K.E. Spring BSc(Hons), MAppSc and H.M. Spring B.Sc

5/14 Redcliffe Gardens Drive
Clontarf, QLD 4019

Telephone: (07) 3284 0020
Fax: (07) 3284 0018

Email: info@geochempet.com
www.geochempet.com

PETROGRAPHIC ANALYSIS ON A SAND SAMPLE (16299) FROM TABBIMOBLE QUARRY

prepared for

AUSTRALIAN SOIL AND CONCRETE TESTING PTY LTD BALLINA

Order Number:

Invoice Number: 00004787

Client Ref: Ben Hart

Issued by

K. E. Spring B.Sc.(Hons), MAppSc
16 January 2013

Sample Label: 16299 **Date Sampled**: 03/12/12

Sample Type: Washed Sand **Date Supplied**: 07/12/12

Sampling Loc.: Washed sand stockpile

Source: Tabbimoble Quarry

Client: Newman Quarrying

Work Requested Petrographic analysis in relation to suitability for use as a concrete sand and as a fine component in asphalt

Method Account taken of ASTM C295 Standard Guide for *Petrographic Assessment of Aggregates for Concrete,* the AS2758.1 – 1998 *Aggregates and rock for engineering purposes part 1; Concrete aggregates (Appendix B),* the AS1141 Standard Guide for the *Method for sampling and testing aggregates,* of the content of the 1996 joint publication of the Cement and Concrete Association of Australia and Standards Australia, entitled *Alkali Aggregate Reaction - Guidelines on Minimising the Risk of Damage to Concrete Structures in Australia*

Identification Quartz medium sand

Description

The sample consisted of about 2kg of clean, damp, very pale orange and composed of sub-angular to less commonly sub-rounded grains of quartz and minor other minerals, including obvious quartz sandstone clasts. In a crude test of a small subsample, about 0.3% of the sample was finer than a 0.075 mm sieve, 9.8% was coarser than 0.075 mm and finer than 0.3 mm sieve, 80.0% was found to be coarser than 0.3 mm and finer than 1.18 mm, and the remaining 9.9% ranges from 1.18 mm to about 6 mm in size which are quartz sandstone clasts some of which can be crushed by finger pressure. There are no apparent deleterious mineral coatings.

When a sub-sample was swirled in water, it resulted in a very light persistent turbidity implying a little silt and clay is present and some argillized scum were observed.

An approximate composition of the sand, expressed in volume percent of clast types and based on microscopic identification and brief counting of 100 points falling within sectioned fragments, is:

64%	quartz as unstrained or mildly strained free grains (53%) and simple crystalline composite grains (11%)
32%	quartz as moderately strained free grains or simple crystalline composites
<1%	other free mineral grains (including opaque oxide, feldspars and chlorite)
1%	lithic clasts of acid volcanic/tuff
3%	lithic clasts of quartz sandstone (3% quartz and <1% clay and secondary iron oxides)

Free silica content (quartz plus chert content) amounted to 99%, comprising of 96% quartz as free grains of simple crystalline composite grains, 3% quartz locked within lithic clasts of quartz arenite; and <1% finely microcrystalline quartz within lithic clasts of acid volcanic/tuff.

The most common clasts are simple crystalline composites of a few unstrained or more commonly mildly strained quartz grains (53%) and crystalline composite of quartz (11%). Moderately strained single or crystalline composite grains of quartz amount to an additional 32%.

Other free mineral grains include opaque oxide (ilmenite and/or magnetite), feldspar and chlorite.

The sand also carries about 3% lithic clasts quartz sandstone and 1% lithic clasts of acid volcanic/tuff.

Comments

The supplied washed sand sample (16299) from Tabbimoble quarry is considered to consist to be a quartz sand which may be described broadly as a medium sand for engineering purpose which is fairly narrowly graded. Grain shapes and a trace of clay and secondary iron oxide coatings suggest that the sand has been recycled from a quartz sandstone source.

The sand has a **free silica content (or quartz plus chert content) of about 99%,** comprising 96% quartz as free grains of simple crystalline composite grains, 3% quartz locked within lithic clasts of quartz sandstone; and less than 1% finely microcrystalline quartz within lithic clasts of acid tuff.

The sand consists largely of hard, strong, durable, siliceous fragments and is interpreted to be **physically suitable for use in concrete and asphalt**. It does carry about 3% quartz sandstone fragments which are bonded by clay but the amount of clay is considered to be <1%. These bound quartz grains may be an issue for high impact use in asphalts as they may breakdown under loading.

Individual components in the sand which are interpreted to have some potential for alkali-silica reaction are moderately strained quartz as free composite grains (32%) and fine microcrystalline quartz (<1% in acid volcanic fragments. This would petrographically that the sand has **potential for mild or slow deleterious alkali-silica reactivity in concrete**.

Free Silica Content

The free silica content is about 99%.

Upper Zone Fill (Imported) Material Conformance
R44 cl2.8.2

				CBR																										
Stockpile	**Hold Point**	**Lot Number**	**Size (m3)**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**Mean**	**Std. Dev.**	**k**	**Q_{Lower}**
JHI 1 (Newman Testing)	N/A	DP/EW/MC/ZA/0001	3000	50	20	50																							40.0	14.14	0.52	32.6
JHI 2 (Newman Testing)	N/A	DP/EW/MC/ZA/0002	4000	30	50	60	45																						46.3	10.83	0.62	39.5
JHI 3 (Newman Testing)	N/A	DP/EW/MC/ZA/0007	4000	40	40	60	35																						43.8	9.60	0.62	37.8
JHI 3A (Cardno Testing)	N/A	DP/EW/MC/ZA/0003	5000	60	60	90	70	100																					76.0	16.25	0.67	65.1
JHI 3B (Cardno Testing)	N/A	DP/EW/MC/ZA/0004	5000	80	70	60	60	45																					63.0	11.66	0.67	55.2
JHI 3C (Cardno Testing)	N/A	DP/EW/MC/ZA/0006	5000	90	110	70	80	70																					84.0	14.97	0.67	74.0
JHI 4 (Cardno Testing)	N/A	DP/EW/MC/ZA/0005	25000	60	50	80	70	70	90	90	70	70	80	60	80	80	60	90	70	80	45	50	70	80	60	50	60	50	68.6	13.38	0.95	55.9
JHI 5 (Cardno Testing)	N/A	DP/EW/MC/ZA/0008	10000	50	70	70	60	60	35	110	110	90	35																69.0	25.77	0.83	47.6
JHI 6 (Cardno Testing)	N/A	DP/EW/MC/ZA/0009	4000	100	70	90	70																						82.5	12.99	0.62	74.4

PI																									Swell (%)																								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
0	7	1																							0.0	-0.2	0.0																							
0	0	0	2																						-1.0	0.0	-0.9	-1.0																				
0	0	1	0																						0.0	-0.1	-1.1	0.1																				
0	0	2	0	0																					-0.1	-0.3	0.0	-1.0	-0.4																			
0	0	0	0	0																					-0.4	-0.3	-0.3	-0.1	-0.3																			
0	0	0	0	0																					-0.2	-0.2	-0.1	-0.1	0.0																			
0	1	0	0	0	2	1	0	0	3	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	-0.3	-0.6	0.0	-0.1	-0.2	-0.1	-0.4	-0.1	-0.2	-0.1	-0.2	-0.3	-0.2	-0.4	-0.1	-0.1	-0.3	0.0	-0.4	-0.2	-0.2	-0.4	-0.2	-0.2	-0.3
2	0	0	0	0	3	0	0	0	3																-0.3	-0.1	-0.2	-0.3	0.2	-0.5	0.0	-0.2	-0.2	-0.1																
0	0	0	0																						0.0	0.0	0.0	0.1																				

PSD (19mm Sieve)																								Conformance	Conformance
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25		
70	72	71																							CONFORMS	YES
69	68	64	72																						CONFORMS	YES
75	82	76	82																						CONFORMS	YES
71	72	80	70	76																					CONFORMS	YES
67	71	69	74	79																					CONFORMS	YES
59	75	77	71	70																					CONFORMS	YES
78	74	74	72	62	62	71	64	63	89	61	62	67	76	64	72	71	79	61	80	70	74	81	79	73	CONFORMS	YES
78	78	73	84	71	75	78	68	74	56																CONFORMS	YES
68	83	71	80																						CONFORMS	YES

Cardno Bowler
Shaping the Future

Cardno Bowler Pty Ltd
ABN: 74 128 806 735

Address:
, Lot 1, Pacific Highway
Jacky Bulbin Flat NSW 2463

Telephone: 0410 082 616
Facsimile: TBA
Email: adam.christiansen@cardno.com.au
Website: www.cardno.com.au

PARTICLE SIZE DISTRIBUTION REPORT

Client:	John Holland	Report Number:	21203/R/908-1
Client Address:	Lot 1, Pacific Highway, Jacky Bulbin Flat	Project Number:	21203/P/1
Project:	Devils Pulpit Pacific Highway Upgrade	Lot Number:	DP/EW/MC/ZA/0009
Location:	Devils Pulpit	Report Date:	15/02/2013
Component:	UZF Stockpile 6	Client Reference/s:	JHG-C670-ITP-005-1 IJ-193
Area Description:	Newmans Quarry	Page Number:	Page 1 of 4

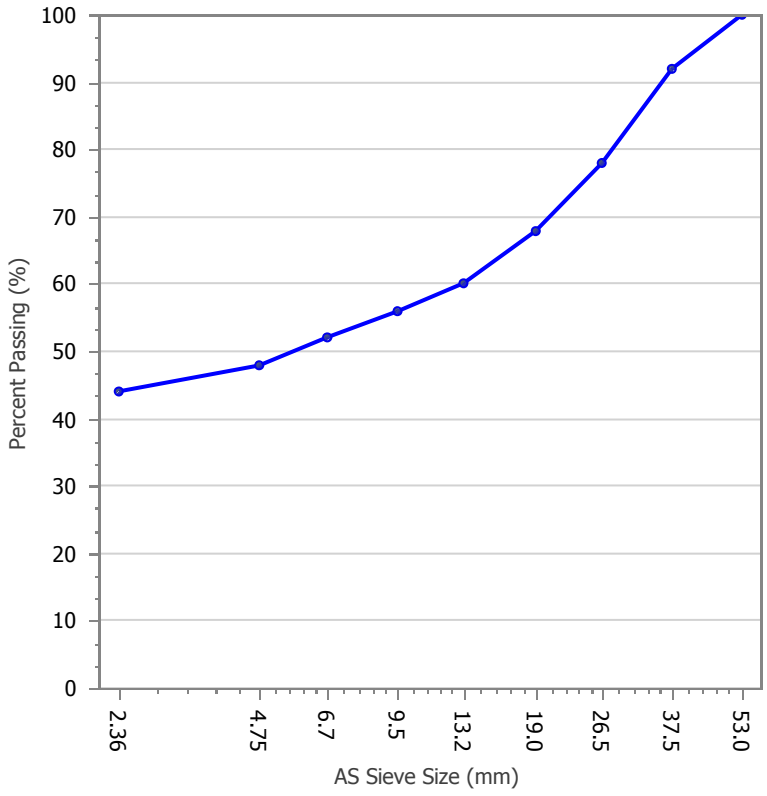
Test Procedures: T106, T102(CA3), T105

Sample Number	21203/S/2210	Sample Location	
Sampling Method	AS1141.3.1 Cl 8.4.3	Stockpile	UZF Stockpile 6
Date Sampled	25/01/2013 12:30	Location	Location 1
Sampled By	Alexander Paynter		
Date Tested	01/02/2013		
Material Source	Newmans Quarry	Material Type	Proposed UZF

AS Sieve (mm)	Specification Minimum	**Percent Passing (%)**	Specification Maximum
53.0		**100**	
37.5		**92**	
26.5		**78**	
19.0		**68**	
13.2		**60**	
9.5		**56**	
6.7		**52**	
4.75		**48**	
2.36		**44**	

Grading Result Analysis			
0.075/0.425 Ratio		-	
D10 (mm)		-	
D60 (mm)		**13.11**	
UC (D60/D10)		-	

PARTICLE SIZE DISTRIBUTION GRAPH



Remarks: Primary Pretreatment - T102 Initial percentage retained on 53.0mm sieve - 0%

NATA

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards

Accredited for compliance with ISO/IEC 17025

Annex Laboratory Accred. Number: 21203
Base Laboratory Accred. Number: 10830

Approved Signatory: Adam Christiansen
Form ID: W9Rep Rev 1

Cardno Bowler Pty Ltd
ABN: 74 128 806 735
Address:
, Lot 1, Pacific Highway
Jacky Bulbin Flat NSW 2463
Telephone: 0410 082 616
Facsimile: TBA
Email: adam.christiansen@cardno.com.au
Website: www.cardno.com.au

PARTICLE SIZE DISTRIBUTION REPORT

Client:	John Holland	Report Number:	21203/R/908-1
Client Address:	Lot 1, Pacific Highway, Jacky Bulbin Flat	Project Number:	21203/P/1
Project:	Devils Pulpit Pacific Highway Upgrade	Lot Number:	DP/EW/MC/ZA/0009
Location:	Devils Pulpit	Report Date:	15/02/2013
Component:	UZF Stockpile 6	Client Reference/s:	JHG-C670-ITP-005-1 IJ-193
Area Description:	Newmans Quarry	Page Number:	Page 2 of 4

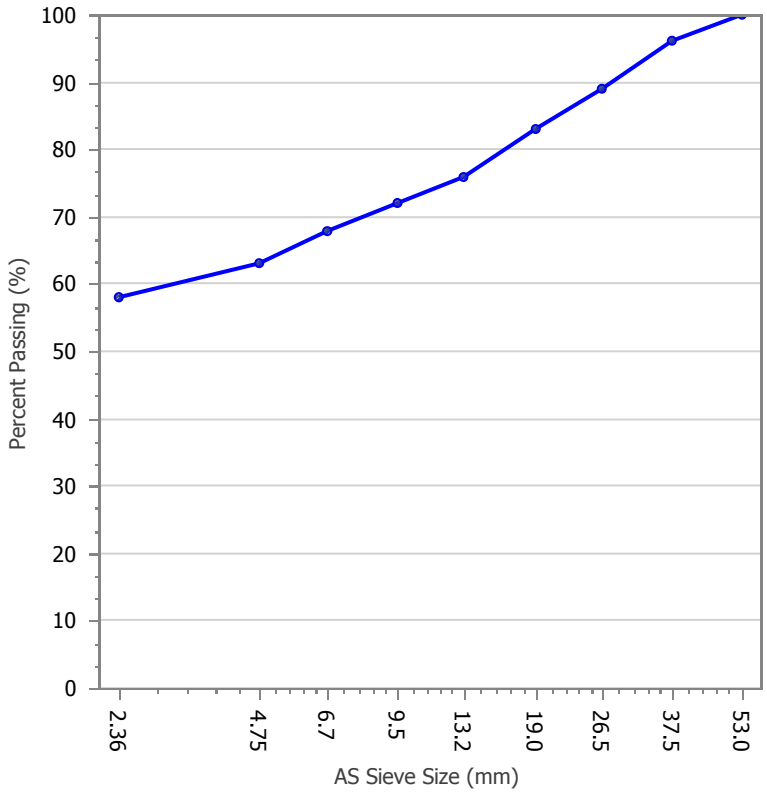
Test Procedures: T106, T102(CA3), T105

Sample Number	21203/S/2211	Sample Location	
Sampling Method	AS1141.3.1 Cl 8.4.3	Stockpile	UZF Stockpile 6
Date Sampled	25/01/2013 12:30	Location	Location 2
Sampled By	Alexander Paynter		
Date Tested	05/02/2013		
Material Source	Newmans Quarry	Material Type	Proposed UZF

AS Sieve (mm)	Specification Minimum	**Percent Passing (%)**	Specification Maximum
53.0		**100**	
37.5		**96**	
26.5		**89**	
19.0		**83**	
13.2		**76**	
9.5		**72**	
6.7		**68**	
4.75		**63**	
2.36		**58**	

Grading Result Analysis			
0.075/0.425 Ratio		-	
D10 (mm)		-	
D60 (mm)		**3.40**	
UC (D60/D10)		-	

PARTICLE SIZE DISTRIBUTION GRAPH



Remarks: Primary Pretreatment - T102 Initial percentage retained on 53.0mm sieve - 0%

NATA

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards

Accredited for compliance with ISO/IEC 17025

Annex Laboratory Accred. Number: 21203
Base Laboratory Accred. Number: 10830

Approved Signatory: Adam Christiansen
Form ID: W9Rep Rev 1

Cardno Bowler
Shaping the Future

Cardno Bowler Pty Ltd
ABN: 74 128 806 735

Address:
, Lot 1, Pacific Highway
Jacky Bulbin Flat NSW 2463

Telephone: 0410 082 616
Facsimile: TBA
Email: adam.christiansen@cardno.com.au
Website: www.cardno.com.au

PARTICLE SIZE DISTRIBUTION REPORT

Client:	John Holland	Report Number:	21203/R/908-1
Client Address:	Lot 1, Pacific Highway, Jacky Bulbin Flat	Project Number:	21203/P/1
Project:	Devils Pulpit Pacific Highway Upgrade	Lot Number:	DP/EW/MC/ZA/0009
Location:	Devils Pulpit	Report Date:	15/02/2013
Component:	UZF Stockpile 6	Client Reference/s:	JHG-C670-ITP-005-1 IJ-193
Area Description:	Newmans Quarry	Page Number:	Page 3 of 4

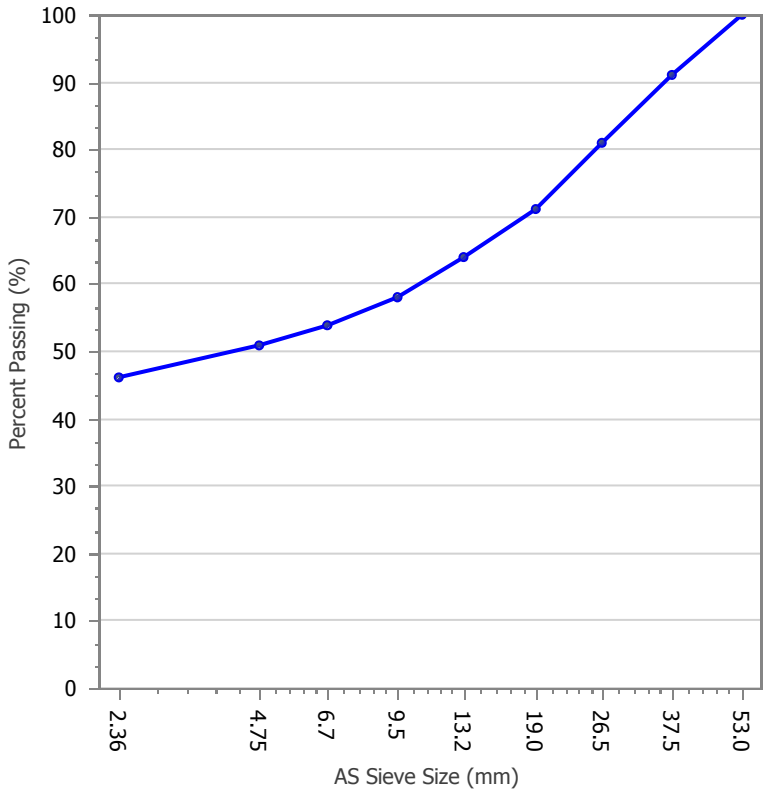
Test Procedures: T106, T102(CA3), T105

Sample Number	21203/S/2212	Sample Location	
Sampling Method	AS1141.3.1 Cl 8.4.3	Stockpile	UZF Stockpile 6
Date Sampled	25/01/2013 12:30	Location	Location 3
Sampled By	Alexander Paynter		
Date Tested	04/02/2013		
Material Source	Newmans Quarry	Material Type	Proposed UZF

AS Sieve (mm)	Specification Minimum	**Percent Passing (%)**	Specification Maximum
53.0		**100**	
37.5		**91**	
26.5		**81**	
19.0		**71**	
13.2		**64**	
9.5		**58**	
6.7		**54**	
4.75		**51**	
2.36		**46**	

Grading Result Analysis			
0.075/0.425 Ratio		-	
D10 (mm)		-	
D60 (mm)		**10.69**	
UC (D60/D10)		-	

PARTICLE SIZE DISTRIBUTION GRAPH



Remarks: Primary Pretreatment - T102 Initial percentage retained on 53.0mm sieve - 0%

NATA

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards

Accredited for compliance with ISO/IEC 17025

Annex Laboratory Accred. Number: 21203
Base Laboratory Accred. Number: 10830

Approved Signatory: Adam Christiansen
Form ID: W9Rep Rev 1

Cardno Bowler Pty Ltd
ABN: 74 128 806 735

Address:
, Lot 1, Pacific Highway
Jacky Bulbin Flat NSW 2463

Telephone: 0410 082 616
Facsimile: TBA
Email: adam.christiansen@cardno.com.au
Website: www.cardno.com.au

PARTICLE SIZE DISTRIBUTION REPORT

Client:	John Holland	Report Number:	21203/R/908-1
Client Address:	Lot 1, Pacific Highway, Jacky Bulbin Flat	Project Number:	21203/P/1
Project:	Devils Pulpit Pacific Highway Upgrade	Lot Number:	DP/EW/MC/ZA/0009
Location:	Devils Pulpit	Report Date:	15/02/2013
Component:	UZF Stockpile 6	Client Reference/s:	JHG-C670-ITP-005-1 IJ-193
Area Description:	Newmans Quarry	Page Number:	Page 4 of 4

Test Procedures: T106, T102(CA3), T105

Sample Number	21203/S/2213
Sampling Method	AS1141.3.1 Cl 8.4.3
Date Sampled	25/01/2013 12:30
Sampled By	Alexander Paynter
Date Tested	05/02/2013
Material Source	Newmans Quarry

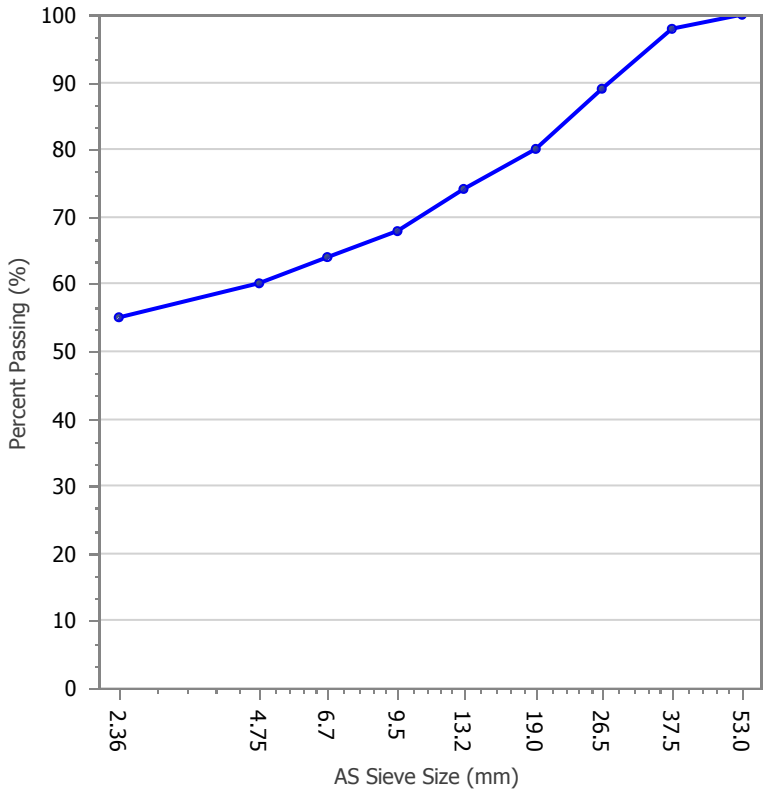
Sample Location

Stockpile	UZF Stockpile 6
Location	Location 4
Material Type	Proposed UZF

AS Sieve (mm)	Specification Minimum	**Percent Passing (%)**	Specification Maximum
53.0		**100**	
37.5		**98**	
26.5		**89**	
19.0		**80**	
13.2		**74**	
9.5		**68**	
6.7		**64**	
4.75		**60**	
2.36		**55**	

Grading Result Analysis			
0.075/0.425 Ratio		-	
D10 (mm)		-	
D60 (mm)		**4.80**	
UC (D60/D10)		-	

PARTICLE SIZE DISTRIBUTION GRAPH



Remarks: Primary Pretreatment - T102 Initial percentage retained on 53.0mm sieve - 0%

NATA

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards

Accredited for compliance with ISO/IEC 17025

Annex Laboratory Accred. Number: 21203
Base Laboratory Accred. Number: 10830

Approved Signatory: Adam Christiansen
Form ID: W9Rep Rev 1

Cardno Bowler Pty Ltd
ABN: 74 128 806 735

Address:
, Lot 1, Pacific Highway
Jacky Bulbin Flat NSW 2463

Telephone: 0410 082 616
Facsimile: TBA

Email: adam.christiansen@cardno.com.au
Website: www.cardno.com.au

CALIFORNIA BEARING RATIO REPORT

Client:	John Holland	Report Number:	21203/R/910-1
Client Address:	Lot 1, Pacific Highway, Jacky Bulbin Flat	Project Number:	21203/P/1
Project:	Devils Pulpit Pacific Highway Upgrade	Lot Number:	DP/EW/MC/ZA/0009
Location:	Devils Pulpit	Report Date:	15/02/2013
Component:	UZF Stockpile 6	Client Reference/s:	JHG-C670-ITP-005-1 IJ-193
Area Description:	Newmans Quarry	Page Number:	Page 1 of 4

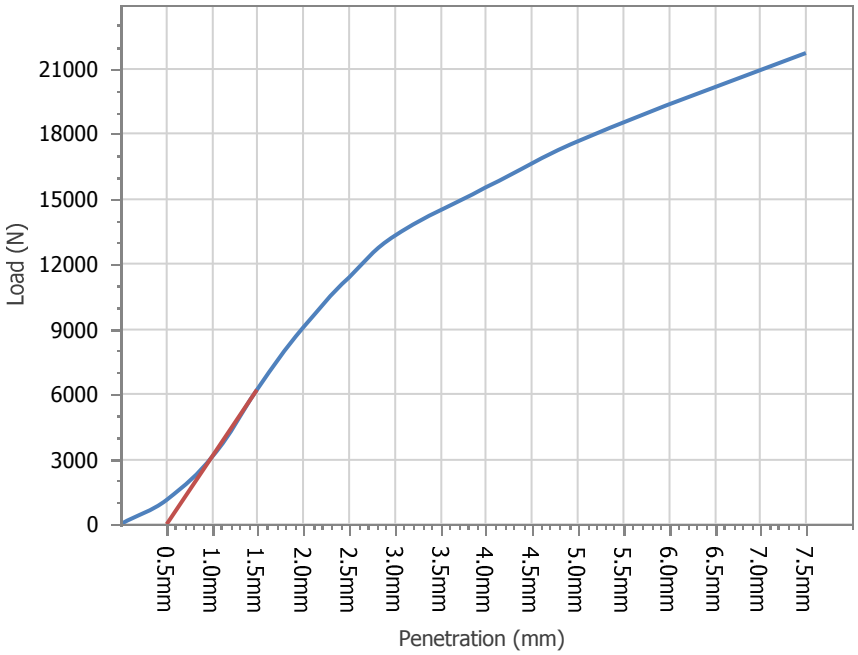
Test Procedures	T117, T105, T102(CA3), T111, T120

Sample Number	21203/S/2210	Sample Location	
Sampling Method	AS1141.3.1 Cl 8.4.3	Stockpile	UZF Stockpile 6
Date Sampled	25/01/2013	Location	Location 1
Sampled By	Alexander Paynter		
Date Tested	01/02/2013		
Material Source	Newmans Quarry	Material Limit Start	-
Material Type	Proposed UZF	Material Limit End	-
Client Reference	IJ-193	Compactive Effort	Standard

Material Description	Crushed Sandstone

Maximum Dry Density (t/m³):	2.052
Optimum Moisture Content (%):	9.1
Field Moisture Content (%):	-
Sample Oversize (19mm / 53mm) (%)	33.8 / 0.0
Oversize Included / Excluded	Excluded
Target Density Ratio (%):	100
Target Moisture Ratio (%):	100
Placement Dry Density (t/m³):	2.041
Placement Dry Density Ratio (%):	100
Placement Moisture Content (%):	9.0
Placement Moisture Ratio (%):	99
Test Condition / Soaking Period:	Soaked / 10 Days
CBR Surcharge (kg)	-
Dry Density After Soak (t/m³):	2.042
Moisture (top 30mm) After Soak (%)	10.2
Moisture (full depth) After Soak (%)	9.7
CBR Swell (%):	0.0
Minimum CBR Specification (%):	-
CBR Value @ 2.5mm (%):	**100**

CBR PENETRATION PLOT



Remarks	Primary Pretreatment - T102 Initial percentage retained on 53.0mm sieve - 0%

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards

Accredited for compliance with ISO/IEC 17025

Annex Laboratory Accred. Number: 21203
Base Laboratory Accred. Number: 10830

Approved Signatory: Adam Christiansen
Form ID: W7Rep Rev 1

Cardno Bowler Pty Ltd
ABN: 74 128 806 735
Address:
, Lot 1, Pacific Highway
Jacky Bulbin Flat NSW 2463
Telephone: 0410 082 616
Facsimile: TBA
Email: adam.christiansen@cardno.com.au
Website: www.cardno.com.au

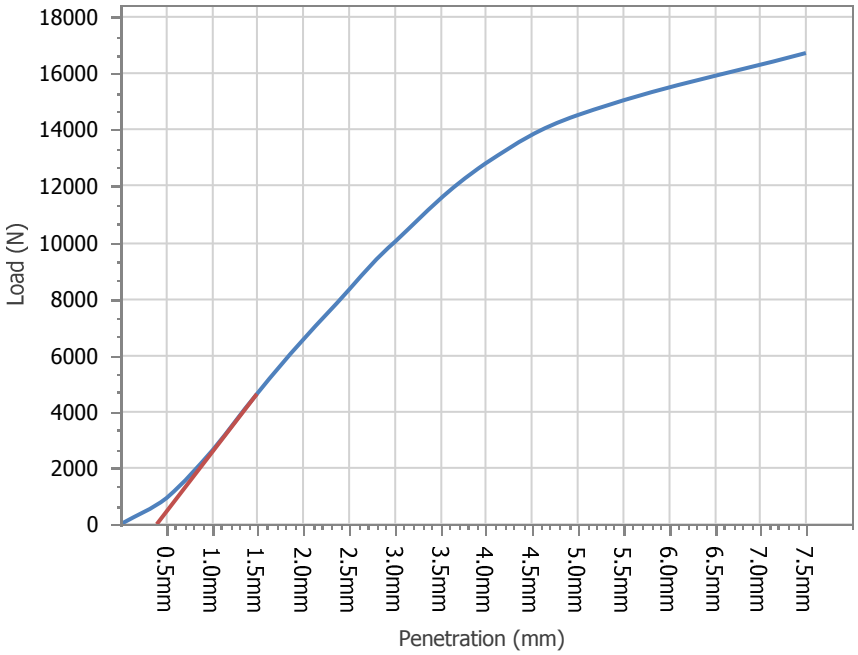
CALIFORNIA BEARING RATIO REPORT

Client:	John Holland	Report Number:	21203/R/910-1
Client Address:	Lot 1, Pacific Highway, Jacky Bulbin Flat	Project Number:	21203/P/1
Project:	Devils Pulpit Pacific Highway Upgrade	Lot Number:	DP/EW/MC/ZA/0009
Location:	Devils Pulpit	Report Date:	15/02/2013
Component:	UZF Stockpile 6	Client Reference/s:	JHG-C670-ITP-005-1 IJ-193
Area Description:	Newmans Quarry	Page Number:	Page 2 of 4

Test Procedures	T117, T105, T102(CA3), T111, T120		
Sample Number	21203/S/2211	Sample Location	
Sampling Method	AS1141.3.1 Cl 8.4.3	Stockpile	UZF Stockpile 6
Date Sampled	25/01/2013	Location	Location 2
Sampled By	Alexander Paynter		
Date Tested	01/02/2013		
Material Source	Newmans Quarry	Material Limit Start	-
Material Type	Proposed UZF	Material Limit End	-
Client Reference	IJ-193	Compactive Effort	Standard
Material Description	Crushed Sandstone		

Maximum Dry Density (t/m³):	1.995
Optimum Moisture Content (%):	10.4
Field Moisture Content (%):	-
Sample Oversize (19mm / 53mm) (%)	20.8 / 0.0
Oversize Included / Excluded	Excluded
Target Density Ratio (%):	100
Target Moisture Ratio (%):	100
Placement Dry Density (t/m³):	1.997
Placement Dry Density Ratio (%):	100
Placement Moisture Content (%):	10.3
Placement Moisture Ratio (%):	99
Test Condition / Soaking Period:	Soaked / 10 Days
CBR Surcharge (kg)	-
Dry Density After Soak (t/m³):	1.997
Moisture (top 30mm) After Soak (%)	11.5
Moisture (full depth) After Soak (%)	11.0
CBR Swell (%):	0.0
Minimum CBR Specification (%):	-
CBR Value @ 5.0mm (%):	**70**

CBR PENETRATION PLOT



Remarks: Primary Pretreatment - T102 Initial percentage retained on 53.0mm sieve - 0%

NATA

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards

Accredited for compliance with ISO/IEC 17025

Annex Laboratory Accred. Number: 21203
Base Laboratory Accred. Number: 10830

Approved Signatory: Adam Christiansen
Form ID: W7Rep Rev 1

Cardno Bowler Pty Ltd
ABN: 74 128 806 735
Address:
, Lot 1, Pacific Highway
Jacky Bulbin Flat NSW 2463
Telephone: 0410 082 616
Facsimile: TBA
Email: adam.christiansen@cardno.com.au
Website: www.cardno.com.au

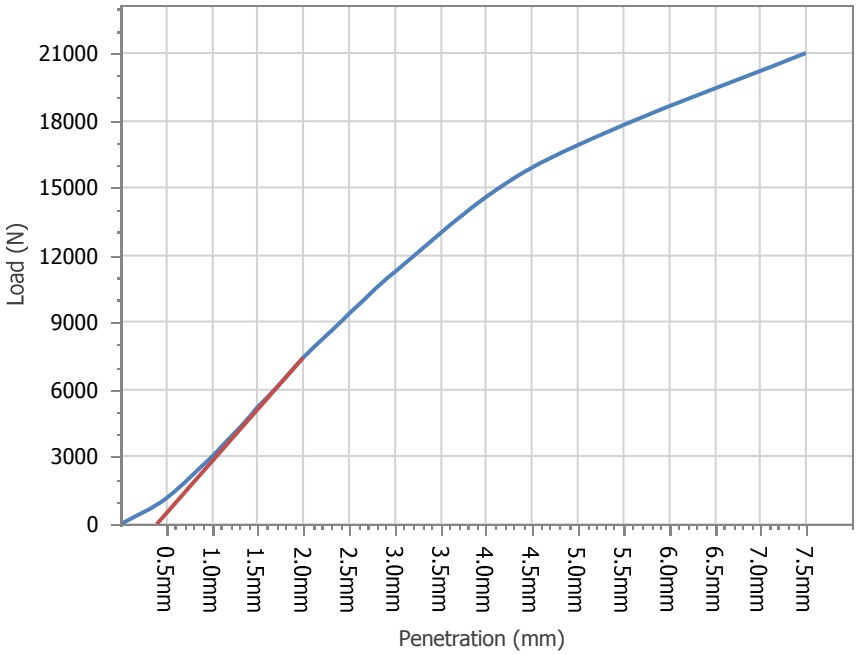
CALIFORNIA BEARING RATIO REPORT

Client:	John Holland	Report Number:	21203/R/910-1
Client Address:	Lot 1, Pacific Highway, Jacky Bulbin Flat	Project Number:	21203/P/1
Project:	Devils Pulpit Pacific Highway Upgrade	Lot Number:	DP/EW/MC/ZA/0009
Location:	Devils Pulpit	Report Date:	15/02/2013
Component:	UZF Stockpile 6	Client Reference/s:	JHG-C670-ITP-005-1 IJ-193
Area Description:	Newmans Quarry	Page Number:	Page 3 of 4

Test Procedures	T117, T105, T102(CA3), T111, T120		
Sample Number	21203/S/2212	Sample Location	
Sampling Method	AS1141.3.1 Cl 8.4.3	Stockpile	UZF Stockpile 6
Date Sampled	25/01/2013	Location	Location 3
Sampled By	Alexander Paynter		
Date Tested	01/02/2013		
Material Source	Newmans Quarry	Material Limit Start	-
Material Type	Proposed UZF	Material Limit End	-
Client Reference	IJ-193	Compactive Effort	Standard
Material Description	Crushed Sandstone		

Maximum Dry Density (t/m³):	2.049
Optimum Moisture Content (%):	9.6
Field Moisture Content (%):	-
Sample Oversize (19mm / 53mm) (%)	28.3 / 0.0
Oversize Included / Excluded	Excluded
Target Density Ratio (%):	100
Target Moisture Ratio (%):	100
Placement Dry Density (t/m³):	2.062
Placement Dry Density Ratio (%):	101
Placement Moisture Content (%):	9.5
Placement Moisture Ratio (%):	99
Test Condition / Soaking Period:	Soaked / 10 Days
CBR Surcharge (kg)	-
Dry Density After Soak (t/m³):	2.062
Moisture (top 30mm) After Soak (%)	10.7
Moisture (full depth) After Soak (%)	10.0
CBR Swell (%):	0.0
Minimum CBR Specification (%):	-
CBR Value @ 5.0mm (%):	**90**

CBR PENETRATION PLOT



Remarks	Primary Pretreatment - T102 Initial percentage retained on 53.0mm sieve - 0%

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards

Accredited for compliance with ISO/IEC 17025

Annex Laboratory Accred. Number: 21203
Base Laboratory Accred. Number: 10830

Approved Signatory: Adam Christiansen
Form ID: W7Rep Rev 1

Cardno Bowler Pty Ltd
ABN: 74 128 806 735
Address:
, Lot 1, Pacific Highway
Jacky Bulbin Flat NSW 2463
Telephone: 0410 082 616
Facsimile: TBA
Email: adam.christiansen@cardno.com.au
Website: www.cardno.com.au

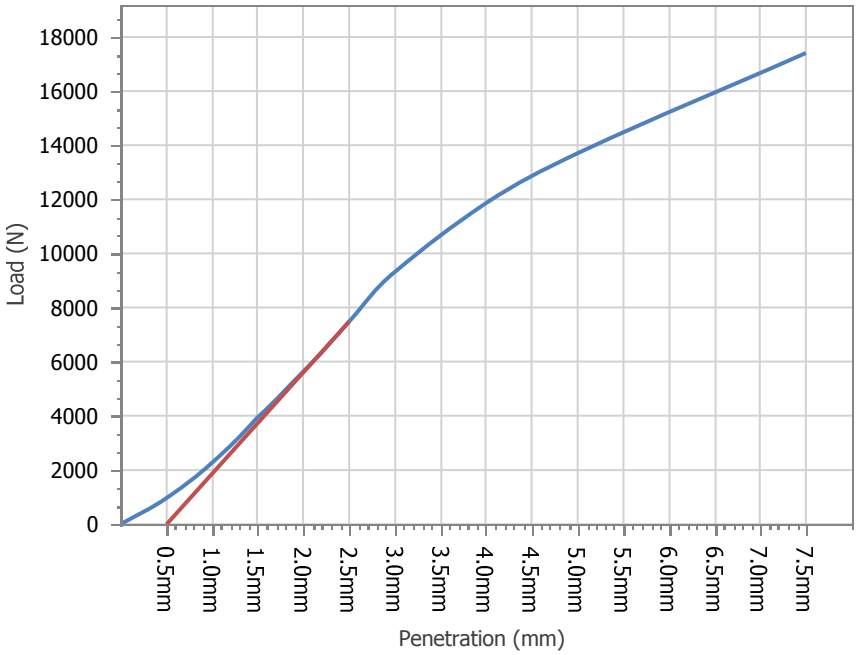
CALIFORNIA BEARING RATIO REPORT

Client:	John Holland	Report Number:	21203/R/910-1
Client Address:	Lot 1, Pacific Highway, Jacky Bulbin Flat	Project Number:	21203/P/1
Project:	Devils Pulpit Pacific Highway Upgrade	Lot Number:	DP/EW/MC/ZA/0009
Location:	Devils Pulpit	Report Date:	15/02/2013
Component:	UZF Stockpile 6	Client Reference/s:	JHG-C670-ITP-005-1 IJ-193
Area Description:	Newmans Quarry	Page Number:	Page 4 of 4

Test Procedures	T117, T105, T102(CA3), T111, T120		
Sample Number	21203/S/2213	Sample Location	
Sampling Method	AS1141.3.1 Cl 8.4.3	Stockpile	UZF Stockpile 6
Date Sampled	25/01/2013	Location	Location 4
Sampled By	Alexander Paynter		
Date Tested	01/02/2013		
Material Source	Newmans Quarry	Material Limit Start	-
Material Type	Proposed UZF	Material Limit End	-
Client Reference	IJ-193	Compactive Effort	Standard
Material Description	Crushed Sandstone		

Maximum Dry Density (t/m³):	2.049
Optimum Moisture Content (%):	9.3
Field Moisture Content (%):	-
Sample Oversize (19mm / 53mm) (%)	16.1 / 0.0
Oversize Included / Excluded	Excluded
Target Density Ratio (%):	100
Target Moisture Ratio (%):	100
Placement Dry Density (t/m³):	2.050
Placement Dry Density Ratio (%):	100
Placement Moisture Content (%):	9.5
Placement Moisture Ratio (%):	102
Test Condition / Soaking Period:	Soaked / 10 Days
CBR Surcharge (kg)	-
Dry Density After Soak (t/m³):	2.048
Moisture (top 30mm) After Soak (%)	10.0
Moisture (full depth) After Soak (%)	9.9
CBR Swell (%):	0.1
Minimum CBR Specification (%):	-
CBR Value @ 5.0mm (%):	**70**

CBR PENETRATION PLOT



Remarks	Primary Pretreatment - T102 Initial percentage retained on 53.0mm sieve - 0%

NATA

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards

Accredited for compliance with ISO/IEC 17025

Annex Laboratory Accred. Number: 21203
Base Laboratory Accred. Number: 10830

Approved Signatory: Adam Christiansen
Form ID: W7Rep Rev 1

Cardno Bowler Pty Ltd
ABN: 74 128 806 735

Address:
, Lot 1, Pacific Highway
Jacky Bulbin Flat NSW 2463

Telephone: 0410 082 616
Facsimile: TBA

Email: adam.christiansen@cardno.com.au
Website: www.cardno.com.au

ATTERBERG LIMITS REPORT

Client:	John Holland	Report Number:	21203/R/919-1
Client Address:	Lot 1, Pacific Highway, Jacky Bulbin Flat	Project Number:	21203/P/1
Project:	Devils Pulpit Pacific Highway Upgrade	Lot Number:	DP/EW/MC/ZA/0009
Location:	Devils Pulpit	Report Date:	19/02/2013
Component:	UZF Stockpile 6	Client Reference/s:	JHG-C670-ITP-005-1 IJ-193
Area Description:	Newmans Quarry	Page Number:	Page 1 of 4

Test Procedures:	T109, T105		
Sample Number	21203/S/2210	Sample Location	
Sampling Method	AS1141.3.1 Cl 8.4.3	Stockpile	UZF Stockpile 6
Date Sampled	25/01/2013	Location	Location 1
Sampled By	Alexander Paynter		
Date Tested	19/02/2013		
Att. Drying Method	Oven Dried	Material Source	Newmans Quarry
Atterberg Preparation	Dry Sieved	Material Type	Proposed UZF
Material Description			

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)	-	**Not Obtainable**	-
Plastic Limit (%)	-	**Not Determined**	-
Plasticity Index (%)	-	**Non Plastic**	-
Linear Shrinkage (%)	-	**-**	-

Remarks	Primary Pretreatment - T102 Initial percentage retained on 53.0mm sieve - 0%

NATA

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards

Accredited for compliance with ISO/IEC 17025

Annex Laboratory Accred. Number: 21203
Base Laboratory Accred. Number: 10830

Approved Signatory: Adam Christiansen
Form ID: W11bRep Rev 1

Cardno Bowler Pty Ltd
ABN: 74 128 806 735

Address:
, Lot 1, Pacific Highway
Jacky Bulbin Flat NSW 2463

Telephone: 0410 082 616
Facsimile: TBA

Email: adam.christiansen@cardno.com.au
Website: www.cardno.com.au

ATTERBERG LIMITS REPORT

Client:	John Holland	Report Number:	21203/R/919-1
Client Address:	Lot 1, Pacific Highway, Jacky Bulbin Flat	Project Number:	21203/P/1
Project:	Devils Pulpit Pacific Highway Upgrade	Lot Number:	DP/EW/MC/ZA/0009
Location:	Devils Pulpit	Report Date:	19/02/2013
Component:	UZF Stockpile 6	Client Reference/s:	JHG-C670-ITP-005-1 IJ-193
Area Description:	Newmans Quarry	Page Number:	Page 2 of 4

Test Procedures:	T109, T105		
Sample Number	21203/S/2211	Sample Location	
Sampling Method	AS1141.3.1 Cl 8.4.3	Stockpile	UZF Stockpile 6
Date Sampled	25/01/2013	Location	Location 2
Sampled By	Alexander Paynter		
Date Tested	19/02/2013		
Att. Drying Method	Oven Dried	Material Source	Newmans Quarry
Atterberg Preparation	Dry Sieved	Material Type	Proposed UZF
Material Description			

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)	-	**Not Obtainable**	-
Plastic Limit (%)	-	**Not Determined**	-
Plasticity Index (%)	-	**Non Plastic**	-
Linear Shrinkage (%)	-	**-**	-

Remarks	Primary Pretreatment - T102 Initial percentage retained on 53.0mm sieve - 0%

NATA

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards

Accredited for compliance with ISO/IEC 17025

Annex Laboratory Accred. Number: 21203
Base Laboratory Accred. Number: 10830

Approved Signatory: Adam Christiansen
Form ID: W11bRep Rev 1

Cardno Bowler Pty Ltd
ABN: 74 128 806 735

Address:
, Lot 1, Pacific Highway
Jacky Bulbin Flat NSW 2463

Telephone: 0410 082 616
Facsimile: TBA

Email: adam.christiansen@cardno.com.au
Website: www.cardno.com.au

ATTERBERG LIMITS REPORT

Client:	John Holland	Report Number:	21203/R/919-1
Client Address:	Lot 1, Pacific Highway, Jacky Bulbin Flat	Project Number:	21203/P/1
Project:	Devils Pulpit Pacific Highway Upgrade	Lot Number:	DP/EW/MC/ZA/0009
Location:	Devils Pulpit	Report Date:	19/02/2013
Component:	UZF Stockpile 6	Client Reference/s:	JHG-C670-ITP-005-1 IJ-193
Area Description:	Newmans Quarry	Page Number:	Page 3 of 4

Test Procedures:	T109, T105		
Sample Number	21203/S/2212	Sample Location	
Sampling Method	AS1141.3.1 Cl 8.4.3	Stockpile	UZF Stockpile 6
Date Sampled	25/01/2013	Location	Location 3
Sampled By	Alexander Paynter		
Date Tested	19/02/2013		
Att. Drying Method	Oven Dried	Material Source	Newmans Quarry
Atterberg Preparation	Dry Sieved	Material Type	Proposed UZF
Material Description			

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)	-	**Not Obtainable**	-
Plastic Limit (%)	-	**Not Determined**	-
Plasticity Index (%)	-	**Non Plastic**	-
Linear Shrinkage (%)	-	**-**	-

Remarks: Primary Pretreatment - T102 Initial percentage retained on 53.0mm sieve - 0%

NATA

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards

Accredited for compliance with ISO/IEC 17025

Annex Laboratory Accred. Number: 21203
Base Laboratory Accred. Number: 10830

Approved Signatory: Adam Christiansen
Form ID: W11bRep Rev 1

Cardno Bowler Pty Ltd
ABN: 74 128 806 735

Address:
, Lot 1, Pacific Highway
Jacky Bulbin Flat NSW 2463

Telephone: 0410 082 616
Facsimile: TBA

Email: adam.christiansen@cardno.com.au
Website: www.cardno.com.au

ATTERBERG LIMITS REPORT

Client:	John Holland	Report Number:	21203/R/919-1
Client Address:	Lot 1, Pacific Highway, Jacky Bulbin Flat	Project Number:	21203/P/1
Project:	Devils Pulpit Pacific Highway Upgrade	Lot Number:	DP/EW/MC/ZA/0009
Location:	Devils Pulpit	Report Date:	19/02/2013
Component:	UZF Stockpile 6	Client Reference/s:	JHG-C670-ITP-005-1 IJ-193
Area Description:	Newmans Quarry	Page Number:	Page 4 of 4

Test Procedures:	T109, T105		
Sample Number	21203/S/2213	Sample Location	
Sampling Method	AS1141.3.1 Cl 8.4.3	Stockpile	UZF Stockpile 6
Date Sampled	25/01/2013	Location	Location 4
Sampled By	Alexander Paynter		
Date Tested	19/02/2013		
Att. Drying Method	Oven Dried	Material Source	Newmans Quarry
Atterberg Preparation	Dry Sieved	Material Type	Proposed UZF
Material Description			

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)	-	**Not Obtainable**	-
Plastic Limit (%)	-	**Not Determined**	-
Plasticity Index (%)	-	**Non Plastic**	-
Linear Shrinkage (%)	-	**-**	-

Remarks: Primary Pretreatment - T102 Initial percentage retained on 53.0mm sieve - 0%

NATA

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards

Accredited for compliance with ISO/IEC 17025

Annex Laboratory Accred. Number: 21203
Base Laboratory Accred. Number: 10830

Approved Signatory: Adam Christiansen
Form ID: W11bRep Rev 1

Sydney Laboratory
57 Herbert St
Artarmon NSW 2064
email: artarmon@ghd.com.au
web: ghd.com.au/ghdgeotechnics
Tel: (02) 9462 4860
Fax: (02) 9462 4710

CLIENTS | PEOPLE | PERFORMANCE

GHD GEOTECHNICS

Uniaxial Compressive Strength - Report

Report No: SYD1500815.1
Issue No: 1

Client:	Chandler Morrison Geotechnical
Project:	Rock Assessment
Location:	Newman Quarry
Job No.:	2122145/00

Accredited for compliance with ISO / IEC 17025
Laboratory Accreditation No. 679

Authorised signatory: D. Brooke

Date of Issue: 3/06/2015

Sample Details

Test Method: AS4133.4.2.1 - UCS greater than 50MPa
Storage History: Tested as received

Sample ID:	SYD15-21668
Client Sample ID:	n/a
Borehole No.:	6097
Depth (m):	B
Date Sampled:	21/05/2015
Date Tested:	1/06/2015
Sample Description:	Breakwall Armour Rock

Test Results

Sample Height (mm):	153.4
Sample Diameter (mm):	55.7
Sample Height/Diameter Ratio:	2.8
Sample Dry Density (t/m3):	2.529
Moisture Content (%):	0.6
Time of Failure (min):	13.0
Uniaxial compressive strength (MPa):	**84.9**
Mode of Failure:	Single Shear
Specimen Comments:	

Comments (if applicable):

Note 1	The length to diameter ratio falls outside the test method limits of 2.5:1 to 3:1.
Note 2	Specimen sides not straight to within 0.3mm
Note 3	Specimen ends not parallel or at right angles
Note 4	(RTA) The length to diameter ratio falls outside the test method limits of 2.0:1 to 2.5:1.
Note 5	Maximum load falls below the limit of performance of compression machine (25kN)

Testing machine Wykeham Farrance - 2000 kN

CLIENTS | PEOPLE | PERFORMANCE

GHD GEOTECHNICS

Sydney Laboratory
57 Herbert St
Artarmon NSW 2064
email: artarmon@ghd.com.au
web: ghd.com.au/ghdgeotechnics
Tel: (02) 9462 4860
Fax: (02) 9462 4710

Uniaxial Compressive Strength - Report

Report No: SYD1500815.1
Issue No: 1

Client:	Chandler Morrison Geotechnical
Project:	Rock Assessment
Location:	Newman Quarry
Job No.:	2122145/00

Accredited for compliance
with ISO / IEC 17025
Laboratory Accreditation No. 679

Photographs

6097
B

GEOCHEMPET SERVICES, BRISBANE

Geochempet Services

ABN 980 6945 3445
PETROLOGICAL and GEOCHEMICAL CONSULTANTS
Principals: K.E. Spring BSc(Hons), MAppSc and H.M. Spring B.Sc

5/14 Redcliffe Gardens Drive
Clontarf, QLD 4019

Telephone: (07) 3284 0020
Fax: (07) 3284 0018

Email: info@geochempet.com
www.geochempet.com

PETROGRAPHIC ANALYSIS ON A SAND SAMPLE (16299) FROM TABBIMOBLE QUARRY

prepared for

AUSTRALIAN SOIL AND CONCRETE TESTING PTY LTD BALLINA

Order Number:

Invoice Number: 00004787

Client Ref: Ben Hart

Issued by

K. E. Spring B.Sc.(Hons), MAppSc
16 January 2013

Sample Label: 16299 **Date Sampled**: 03/12/12

Sample Type: Washed Sand **Date Supplied**: 07/12/12

Sampling Loc.: Washed sand stockpile

Source: Tabbimoble Quarry

Client: Newman Quarrying

Work Requested Petrographic analysis in relation to suitability for use as a concrete sand and as a fine component in asphalt

Method Account taken of ASTM C295 Standard Guide for *Petrographic Assessment of Aggregates for Concrete,* the AS2758.1 – 1998 *Aggregates and rock for engineering purposes part 1; Concrete aggregates (Appendix B),* the AS1141 Standard Guide for the *Method for sampling and testing aggregates,* of the content of the 1996 joint publication of the Cement and Concrete Association of Australia and Standards Australia, entitled *Alkali Aggregate Reaction - Guidelines on Minimising the Risk of Damage to Concrete Structures in Australia*

Identification Quartz medium sand

Description

The sample consisted of about 2kg of clean, damp, very pale orange and composed of sub-angular to less commonly sub-rounded grains of quartz and minor other minerals, including obvious quartz sandstone clasts. In a crude test of a small subsample, about 0.3% of the sample was finer than a 0.075 mm sieve, 9.8% was coarser than 0.075 mm and finer than 0.3 mm sieve, 80.0% was found to be coarser than 0.3 mm and finer than 1.18 mm, and the remaining 9.9% ranges from 1.18 mm to about 6 mm in size which are quartz sandstone clasts some of which can be crushed by finger pressure. There are no apparent deleterious mineral coatings.

When a sub-sample was swirled in water, it resulted in a very light persistent turbidity implying a little silt and clay is present and some argillized scum were observed.

An approximate composition of the sand, expressed in volume percent of clast types and based on microscopic identification and brief counting of 100 points falling within sectioned fragments, is:

64%	quartz as unstrained or mildly strained free grains (53%) and simple crystalline composite grains (11%)
32%	quartz as moderately strained free grains or simple crystalline composites
<1%	other free mineral grains (including opaque oxide, feldspars and chlorite)
1%	lithic clasts of acid volcanic/tuff
3%	lithic clasts of quartz sandstone (3% quartz and <1% clay and secondary iron oxides)

Free silica content (quartz plus chert content) amounted to 99%, comprising of 96% quartz as free grains of simple crystalline composite grains, 3% quartz locked within lithic clasts of quartz arenite; and <1% finely microcrystalline quartz within lithic clasts of acid volcanic/tuff.

The most common clasts are simple crystalline composites of a few unstrained or more commonly mildly strained quartz grains (53%) and crystalline composite of quartz (11%). Moderately strained single or crystalline composite grains of quartz amount to an additional 32%.

Other free mineral grains include opaque oxide (ilmenite and/or magnetite), feldspar and chlorite.

The sand also carries about 3% lithic clasts quartz sandstone and 1% lithic clasts of acid volcanic/tuff.

Comments

The supplied washed sand sample (16299) from Tabbimoble quarry is considered to consist to be a quartz sand which may be described broadly as a medium sand for engineering purpose which is fairly narrowly graded. Grain shapes and a trace of clay and secondary iron oxide coatings suggest that the sand has been recycled from a quartz sandstone source.

The sand has a **free silica content (or quartz plus chert content) of about 99%,** comprising 96% quartz as free grains of simple crystalline composite grains, 3% quartz locked within lithic clasts of quartz sandstone; and less than 1% finely microcrystalline quartz within lithic clasts of acid tuff.

The sand consists largely of hard, strong, durable, siliceous fragments and is interpreted to be **physically suitable for use in concrete and asphalt**. It does carry about 3% quartz sandstone fragments which are bonded by clay but the amount of clay is considered to be <1%. These bound quartz grains may be an issue for high impact use in asphalts as they may breakdown under loading.

Individual components in the sand which are interpreted to have some potential for alkali-silica reaction are moderately strained quartz as free composite grains (32%) and fine microcrystalline quartz (<1% in acid volcanic fragments. This would petrographically that the sand has **potential for mild or slow deleterious alkali-silica reactivity in concrete**.

Free Silica Content

The free silica content is about 99%.

GEOCHEMPET SERVICES, MALENY

Sample Label :	5256	**Sample Description** :	Sandstone
Sample Type :	Rock core	**Project No.** :	051-009
Source :	Tabbimoble Quarry	**Date Sampled** :	29/11/05
Identification :	Siliceous Sandstone		
Work Requested :	Quantitative X-ray diffraction analysis of rock core sample (5256)		

Method :

The rock sample was investigated by quantitative X-ray diffraction analysis by Mr A Raftery, a Senior Technologist, using QUT facilities. A small portion of the original sample was dispersed in water and allowed to settle, some of the suspension was transferred to a glass slide as a preferentially orientated clay mount to enable any clay components to be sensitively and positively identified. The orientated sample was examined in a Philips vertical diffractometer. Another subsample was crushed in an steel swing mill. Approximately 3 g of the crushed sample was then micronized with sufficient corundum (internal standard) to produce 10% by weight of the internal standard. The spiked sample was then examined as a randomly orientated powder mount in a Philips vertical diffractometer. Mineral identifications were undertaken using Jade (Materials Data Inc.) and quantitative analyses used SiroQuant (Version 2.5, Sietronics).

Results:

The results indicated (in weight percent):

88%	quartz
3%	plagioclase feldspar
3%	K-feldspar
3%	chlorite
3%	illite/glauconite mixed layer
<1%	dolomite or ankerite

Comments :

The supplied sanstone core sample (5256) is considered to consist of siliceous sandstone, a sedimentary rock.

Components regarded as essentially durable within the rock amount to about 94%: specifically they comprise 88% quartz and 6% feldspar.

Components regarded as undesirable because they are weak sheet silicate minerals, amount to a total of about 6% : specifically they comprise 3% chlorite and 3% illite/glauconite mixed layer.

A trace amount of carbonate minerals were also detected.

In short, rock essentially equivalent to supplied sample (5256) is predicted to be **durable**.

Free Silica Content :

About 88% (in the form of quartz grains)

AUSTRALIAN SOIL AND CONCRETE TESTING P/L A B N 49 050 539 930
7/17 Southern Cross Drive, Ballina NSW 2478. ph: (02) 6686 8567 fax: (02) 6686 8396

ASCT Doc. No. R43 Rev. 04 - 25/1/13 - BH

Point Load Strength Index Report

Client: **Newman Quarrying** | Project No: **051-009**
Project: **Tabbimoble Quarry** | Report No: **051-009-776**

Sample and Test Information

Sampled By: ASCT P/L
Date Sampled: 1/7/2013
Sample Location: Armour Rock Stockpile
Sampling Method: Client
Sample Preparation: 24hr Immersion
Test Method: RTA T223

Test Data

Lab Number	17350	17350	17350	
Test Number	1	2	3	
Date Tested	2/7/2013	2/7/2013	2/7/2013	
Sample Location	Armour Rock S/P	Armour Rock S/P	Armour Rock S/P	
Sample Description (note 1)	Sandstone: grey Saturated	Sandstone : grey Saturated	Sandstone: grey Saturated	
Moisture Condition (note 2)	W	W	W	
Test Type (note 3)	I	I	I	
Dimension D (mm)	70.0	77.0	75.0	
Dimension L (mm)	0.0	0.0	0.0	
Dimension W (mm)	83.2	84.7	78.5	
Dimension D_e (mm)	86.1	91.1	86.6	
Load at Failure P (kN)	12.6	17.3	14.3	
Failure Mode (note 4)	3	3	3	
Uncorrected Point Load Strength I_s (Mpa)	1.7	2.1	1.9	
Point Load Strength Index $I_{s(50)}$ **(Mpa)**	**2.2**	**2.7**	**2.4**	
Descriptive Strength (note 5)	**H**	**H**	**H**	

Note 1 (Sample Description)

Note 2 (Moisture Condition)

Wet	W
Moist	M
Dry	D
As Drilled	AD
As Received	AR

Note 3 (Test Type)

Diametral	D
Axial	A
Block or Irregular Lump	I

Note 4 (Failure Mode)

1 Fracture through fabric oblique to bedding
2 Fracture along bedding
3 Fracture through rock mass
4 Fracture influenced by pre-existing:
(J) Joint Plane, (M) Microfracture, (F) Foliation, (V) Vein
5 Partial fracture of chip (invalid result)

Note 5 (Descriptive Strength)

Extremely Low	EL
Very Low	VL
Low	L
Medium	M
High	H
Very High	VH
Extremely High	EH

NATA TECHNICAL COMPETENCE

Accredited for compliance with ISO/IEC 17025. The results of the tests included in this document are traceable to Australian/national standards.

Signed: Brian Dick Date: 3/07/2013
Brian Dick
(Approved Signatory)

Testing performed at ASCT P/L Ballina, NATA accredited laboratory number 3229.

RESULTS OF SODIUM SULPHATE SOUNDNESS

Fraction Tested:	-26.5mm +19.0mm
Individual Percentage Loss:	0.50%
Overall Weighted Average Loss:	0.5%
Sample Details:	PM609 Crushed sandstone ex Grafton

Client:	Noel Newman
Project:	Material Evaluation
Location:	Grafton
Test Method:	AS 1141, Sect 24
Project No:	54636
Report No:	N94-046a
Date Reported:	1.3.94
Tested By:	P.B.
Checked By:	C.W.

Laboratory: Newcastle 1670

G. Eastwood

D.J.Douglas & Partners

AUSTRALIAN SOIL AND CONCRETE TESTING P/L A.B.N.49 050 539 930

7/17 Sothern Cross Drive Ballina NSW 2478 PH: 02-66868567 FAX:02-66868396 Mob:0408079826

ASCT Doc. No. R17 Rev. 02 - 26/8/02 - BD

Unconfined Compressive Strength Report

Client: Noel Newman	Project no: 051 - 009	Project: Tabbimoble Quarry
Date sampled : 27/4/05	Report no: 051 - 009 - 231	Test methods: AS1141.51
Date tested: 28/4/05	Fraction tested : Rock Core	Compactive Effort : Nil No. of Layers : -

SAMPLE & ADDITIVE DATA

Additive type :	Additive source :	Additive content (%) :
Curing method : Wet	Curing period : 1 days	Sample source : Sandstone Rock
Maximum dry density : 2.59 t/m^3	Optimum moisture content : - %	Sampled by: A.S.C.T
Sampling method: AS1012.14	Sample description: Sandstone Rock	
Elapsed Time between binding to compaction :		Prep. of Bound Sample:

TEST DATA

Lab. Number	Nominal Diameter Mm	Nominal Height mm	Additive %	Dry Density at Compaction (t/m^3) 0.01	Moisture Content at compaction (%) 0.5	UCS Pair Average (Mpa) <1.0 : 0.02 1.0-2.0 : 0.1 >2.0 : 0.2
2596A	96.0	189	Dry	2.59	-	83.5
2596B	95.6	240	Wet	2.59	-	99.5

omments :.

This Laboratory is Accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its scope of accreditation. This document shall not be reproduced except in full.

Signed : Brian Dick Date : 28/4/05

Brian Dick
(Approved Signatory)

CMG

Chandler Morrison Geotechnical Pty Ltd
Coffs Harbour Laboratory
34 / 22 Lawson Crs Coffs Harbour NSW - 2450
Phone: (02) 6651 5777
Fax: (02) 6651 5755
Email: john.morrison@cmgeotechnical.com.au

Accredited for compliance with ISO/IEC 17025

Approved Signatory: Doug Dengate
Nata Accredited Laboratory Number: 17240

Report Number:	**R15-0016**
Issue Number:	3
	This version supercedes all previous issues
Date Issued:	25/08/2015
Client:	Newman Quarrying
	PO Box 70, Woodburn,
Contact:	Mark Newman
Work Request:	447
Sample Number:	15-442B
Sample Location:	Newman Quarry
Date Sampled:	13/08/2015
Sampling Method:	AS1141.3.1 8.4.1 - Sampling aided by power equipment - not backblading
Remarks:	
Tested By:	CMG Technician
Specification:	
Lot No:	B
Material:	R44 Bridging Rock

Wet / Dry Strength Variation (AS 1141.22)		Min	Max
Dry Strength (kN)	70		
Wet Strength (kN)	45		
Variation %	36		
Fraction Tested (mm)	26.5-19.0		

CMG

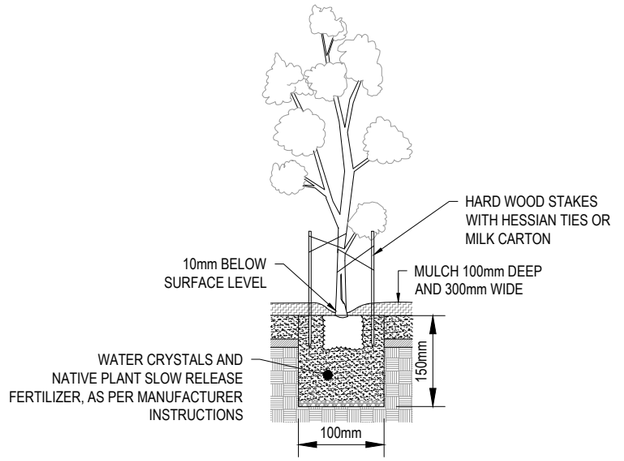
Chandler Morrison Geotechnical Pty Ltd
Coffs Harbour Laboratory
34 / 22 Lawson Crs Coffs Harbour NSW - 2450
Phone: (02) 6651 5777
Fax: (02) 6651 5755
Email: john.morrison@cmgeotechnical.com.au

Accredited for compliance with ISO/IEC 17025

Approved Signatory: Doug Dengate
Nata Accredited Laboratory Number: 17240

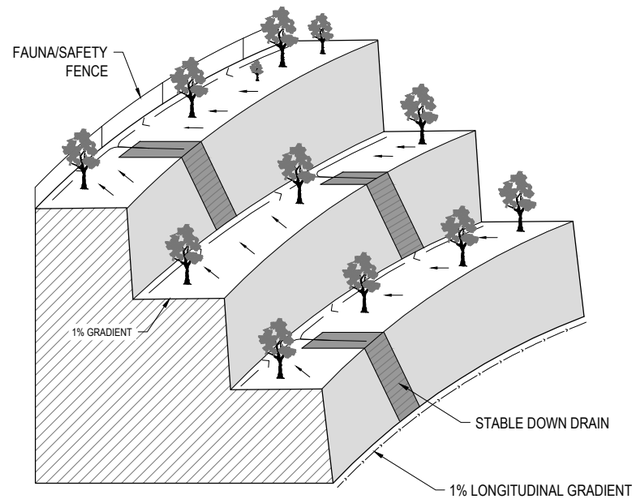
Report Number: R15-0016
Issue Number: 3
This version supercedes all previous issues
Date Issued: 25/08/2015
Client: Newman Quarrying
PO Box 70, Woodburn,
Contact: Mark Newman
Work Request: 447
Sample Number: 15-442A
Sample Location: Newman Quarry
Date Sampled: 13/08/2015
Sampling Method: AS1141.3.1 8.4.1 - Sampling aided by power equipment - not backblading
Remarks:
Tested By: CMG Technician
Specification:
Lot No: A
Material: R31 Drainage Blanket

Wet / Dry Strength Variation (AS 1141.22)		Min	Max
Dry Strength (kN)	65		
Wet Strength (kN)	41		
Variation %	37		
Fraction Tested (mm)	26.5-19.0		



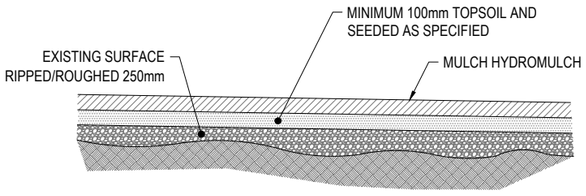
PLANTING DETAILS

SCALE : NTS



REHABILITATION BENCHING DETAILS

SCALE : NTS



SITE PREPARATION DETAILS

SCALE : NTS

0 50 100 150m

SCALE 1:5000 AT ORIGINAL SIZE

ZONE A

ZONE B

PRECISION INDUSTRIES PTY LTD
NEWMANS QUARRY

REHABILITATION PLAN

Job Number 22-17528
Revision A
Date FEB. 2015

Figure 01

230 Harbour Drive Coffs Harbour NSW 2450 Australia **T** 61 2 6650 5600 **F** 61 2 6650 5601 **E** cfsmail@ghd.com **W** www.ghd.com

Plot Date: 17 February 2015 - 4:22 PM Plotted by: Ian Gould Cad File No: G:\22\17528\CADD\Drawings\22-17528-FIG 01 & 02.dwg

Rehabilitation Plan

Aim

To provide a plan to improve the environmental condition of the site after quarrying activities have ceased.

Objectives
The objectives of the rehabilitation plan are to:

- Describe topsoil stripping and stockpiling methods
- Describe the site preparation, revegetation and weed control methods required
- Describe the maintenance activities
- Provide a schedule for the proposed works

Topsoil Stripping and Stockpiling
The following measures should be adopted for soil stripping and stockpiling:

- Soils should be stripped in a slightly moist condition (neither too dry nor wet) thus reducing dust generation and deterioration in topsoil quality
- Topsoil should be stockpiled only when disturbed areas are not available for immediate rehabilitation
- Soil stockpiles should be constructed to minimise the stockpile area in a discrete two metre high (maximum) pile, with a working face battered down at 30 degrees
- Stockpiles should be trimmed, deep ripped to 500 mm, immediately sown with permanent pasture species, and fertilised

Site Preparation

- The perimeter of the quarry should be fenced for safety and to exclude fauna. Fencing should include 'one-way fauna gates' which allow fauna to escape from the former quarry area
- To delineate the restoration area, temporary fencing should be installed until restoration is completed. No machines will be allowed inside the restoration area other than for works associated with planting and weeding
- Benches should be constructed with in fall drainage, a non-erodible longitudinal grade (approximately 1%) and stable down drains
- The benches are to be ripped/roughed to a depth of 250mm to key in topsoil
- Topsoil stripped from the site prior to the quarry operations commencing should be respread across the benches to form a minimum of 100mm deep layer
- Sediment and erosion controls should be maintained until the site is stable

Revegetation
The area to be revegetated has been divided into two zones:

- Zone A is the disturbed area to be revegetated following the completion of the quarry.
- Zone B is swampy disturbed area to be revegetated following the completion of the quarry.

The extent of the two zones is to be confirmed onsite based on site conditions, prior to commencing revegetation works. Revegetation in Zones A and B will be via a mix of planting tube stock or hiko cells and seeding.

Seeding and planting details are provided below. The desired density of each stratum is provided in the species table. This may be altered in consultation with CVC.

Seeding

Seed is to be purchased from local suppliers or collected locally. All seed collection, management, cleaning and storage will be in accordance with *Guideline 5: Seed Collection from Woody Plants for Local Revegetation (FloraBank, 1999)*.

Seeding should be done prior to planting. Seed broadcasting is to be done by hand or mechanical means at the sowing rates indicated below. The seed should be raked following sowing to cover the seed and improve success rates. The seed should be watered weekly until established.

Planting

Ideally, planting should be done at the start of autumn but due to the mild climate of the area, planting at any time during the year should not cause a significant problem. The tube stock, where possible, should be sourced from nurseries that use local seed stock, ideally from within the Clarence Valley area.

The planting method includes:

- Soak all plants before planting.
- Make a hole large enough for the tube stock.
- Add water crystals and a slow release fertiliser suitable for native species.
- Remove the plant from the container being careful not to damage the roots.
- Insert the plant into the hole so that the base of the stem is a little below the surrounding ground.
- Firm the soil around the root ball to remove air gaps.
- Water the plant with at least 2L of water.
- Mulch the plant using native tree mulch, weed mats or saw dust. Make sure the mulch is not against the stem of the plant.
- Install a protective guard using wooden/bamboo stakes or milk carton.
- Water weekly for the first month. Further watering may be required if there is no rain.

Species List
Recommended species and planting densities are provided below. The recommended species are based on those to be removed. If the recommended species are unavailable consult CVC for suitable replacement species.

Recommended Species for Zone A

Species List	Seed Rate[1]	Plant Number[1, 2]	Desired Density[1]
Upper storey/canopy	2 kg/ha	2030	1/15m^2
Blackbutt *(Eucalyptus pilularis)*			
Red Mahogany (*Eucalyptus resinifera*)			
Pink Bloodwood (*Corymbia intermedia*)			
Turpentine *(Syncarpia glomerata)*			
Mid storey	2 kg/ha	3040	1/10m^2
Black Wattle *(Acacia leiocalyx)*			
Red Ash (*Alphitonia excelsa*)			
Cheese Tree (*Glochidion ferdinandi*)			
Lower storey/groundcover	4 kg/ha	6080	1/5m^2
Blue Flax-lily (*Dianella caerulea*)			
Rough Saw Sedge (*Gahnia aspera)*			
Many-flowered Mat-rush *(Lomandra multiflora)*			
Sterile Cover Crop	10 kg/ha	NA	NA
Rye *(Lolium rigidum)*			
Japanese Millet *(Echinochloa esculenta)*			

[1] This relates to the storey not the individual species.
[2] This assumes the desired density will be achieved by seeding and natural regeneration.

Recommended Species for Zone B

Species List	Seed Rate[1]	Plant Number[1, 2]	Desired Density[1]
Upper storey/canopy	2 kg/ha	125	1/15m^2
Swamp Mahogany *(Eucalyptus robusta)*			
Brush box *(Lophostemon suaveolens)*			
Broad Leaved-paperbark *(Melaleuca quinquenervia)*			
Turpentine *(Syncarpia glomerata)*			
Mid storey	2 kg/ha	190	1/10m^2
Cheese Tree *(Glochidion ferdinandi)*			
Lily Pilly *(Acmena smithii)*			
Cabbage Palm *(Livistona australis)*			
Red Ash *(Alphitonia excelsa)*			
Lower storey/groundcover	4 kg/ha	380	1/5m^2
Saw-sedge *(Gahnia clarkii)*			
Rainbow Fern *(Calochlaena dubia)*			
Harsh Ground Fern *(Hypolepis muelleri)*			
Sterile Cover Crop	10 kg/ha	NA	NA
Rye *(Lolium rigidum)*			
Japanese Millet *(Echinochloa esculenta)*			

[1] This relates to the storey not the individual species.
[2] This assumes the desired density will be achieved by seeding and natural regeneration.

Maintenance and Monitoring
Regular maintenance activities will include:

- Follow-up watering
- Repairing damaged tree guards
- Monitoring survival rates and installing replacement plants where required to achieve the densities above
- Weed control and continued follow-up spot spraying, hand removal, etc as required

Weed Control
Weed control is vital to the success of the revegetation. The noxious and environmental weed species likely to be at the site and their recommended control method are provided below.

Scientific Name	Common Name	Noxious	Control Methods				
			Cut and paint[1]	Scape and Paint[1]	Direct Inject[1]	Spot Spraying[1]	Manual Remove
Ageratina adenophora	Crofton Weed	Class 4				v[2, (4+7)]	v
Ageratum houstonianum	Blue Billy Goat Weed					v	v
Baccharis halimifolia	Grounsel Bush	Class 3	v[4]			v[7]	v[3]
Bidens pilosa	Farmers Friends					v	v
Cinnamomum camphora	Camphor Laurel	Class 4	v		v		
Eragrostis curvula	African Love Grass	Class 4				v	
Ipomea indica	Morning Glory			v[4]		v	v
Lantana camara	Pink/Red Lantana	Class 4	v			v	v
Ligustrum lucidum	Large Leaf Privet	Class 4	v[4]		v[4]	v[2,8]	v[2]
Ligustrum sinense	Small Leaf Privet	Class 4	v[4]		v[4]	v[2,8]	v[2]
Pennisetum clandestinum	Kikuyu					v	
Rubus fruticosus	Blackberry	Class 3				v[8]	
Senecio madagascariensis	Fireweed					v[11]	v
Senna pendula var. glabrata	Eastern Cassia/Senna		v		v[4]	v[5]	
Solanum mauritianum	Tobacco Bush		v				
Sporobolus indica var. major	Giant Parramatta Grass	Class 3				v[5]	v[6]

[1] Glyphosphate unless specified; [2] Seedlings; [3] Saplings; [4] Mature plants; [5] Large infestations; [6] Small infestations; [7] Grazon; [8] Metsulfuron-methyl; [9] Glyphosate & Metasulfuron-methyl mix, [10] Penetrant, [11] Bromoxynil

Reporting
Reporting may be required at the following stages:

- Completion of initial planting
- After each maintenance and monitoring period
- At completion of 5 year maintenance and monitoring period

Revegetation Schedule
The following table provides an indicative schedule for the revegetation works. Maintenance and monitoring may continue for longer than 5 years depending on the success of the revegetation. Revegetation will be considered complete once all densities in the species table have been achieved. Completion of the revegetation works is the responsibility of the landowner but it is recommended that a qualified bush regenerator contractor be engaged to do the works.

Task*	Year 1				Year 2				Year 3				Year 4				Year 5			
Site Preparation																				
Seeding/Planting		■																		
Maintenance/Monitoring				■		■			■			■				■				■

* See details for requirements of each task

230 Harbour Drive Coffs Harbour NSW 2450 Australia **T** 61 2 6650 5600 **F** 61 2 6650 5601 **E** cfsmail@ghd.com **W** www.ghd.com

Plot Date: 13 October 2015 - 12:35 PM Plotted by: Ian Gould Cad File No: G:\22\17528\CADD\Drawings\22-17528-FIG 01 & 02.dwg