Part C
Environmental Interactions

6 TRAFFIC AND TRANSPORT

A Traffic Impact Study was undertaken by RoadNet to investigate the impacts that the proposed expansion of Champions Quarry will have on the surrounding traffic and transport network. The primary findings of this report are summarized below, with the complete Traffic Impact Study provided as *Appendix F*.

This assessment focuses on three primary haulage routes:

- north to Lismore via Wyrallah Road, Wyrallah Ferry Road and Coraki Road to the Bruxner Highway, a distance of approximately 12.7km;
- along Wyrallah Road south to the Pacific Highway at Woodburn, a distance of approximately 15.8km; and
- south to Broadwater via Wyrallah Road and Broadwater Road, a distance of approximately 17.3km.

Figure 6.1 demonstrates these proposed haulage routes.

6.1 EXISTING CONDITIONS

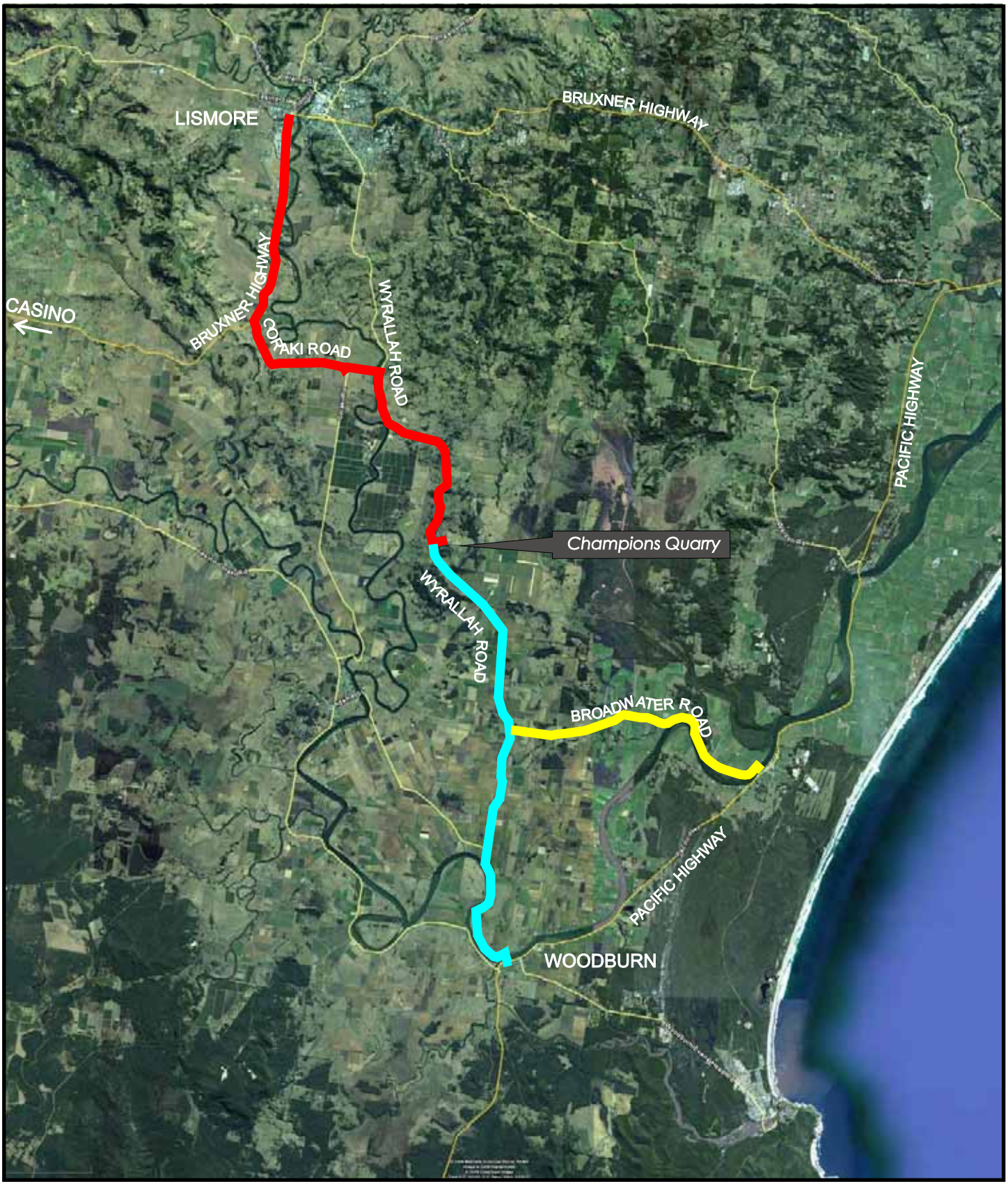
6.1.1 Existing Traffic Generation

The present operational approval for the quarry generates approximately 11 trucks per day on average leaving the quarry. These are a mixture of truck and trailer and body trucks. The number of trucks travelling on the local road network is double this figure as there is an empty truck movement associated with each delivery.

6.1.2 Existing Road Network

Wyrallah Road

Wyrallah Road is a Lismore City Council maintained main road (MR 147) connecting Lismore and the Pacific Highway. It is also a designated haulage route pursuant to Council's DCP as it relates to extractive industries. The quarry access is located approximately 12.7km south of the Bruxner Highway/Coraki Road intersection approximately 15.8km from the Pacific Highway at Woodburn and approximately 17.3km from the Pacific Highway at Broadwater.



Legend

- Route 1
- Route 2
- Route 3

Figure 6.1

Proposed Haulage Routes

Client:	Champions Quarry		
Project:	Champions Quarry Expansion		
Drawing No:	0008287pm_EA_F6.1		
Date:	26/08/09	Drawing size:	A4
Drawn by:	AM	Reviewed by:	WW
Source:	Google Earth Pro		
Scale:	Refer to Scale Bar - Approximate		

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Wyrallah Road is an undulating sealed road through a rural environment. The seal width varies between 6.5m and 7.5m and has narrow gravel shoulders. It has centre line markings, guideposts and speed advisory signposting on some curves. The pavement condition of the route is fair to good with some sections of rough surface.

Rural properties are located along the route with several dwellings located close to the road.

Broadwater Road

Broadwater Road is approximately 10km in length and provides access to Broadwater and the Pacific Highway. The road is generally in good condition, being level and winding through to the intersection with Wyrallah Road.

Wyrallah Ferry Road

Wyrallah Ferry Road meets Wyrallah Road at a T junction just over a bridge. The grading of the bridge is quite steep to gain clearance over the river. A 'T' junction warning sign is located before the bridge on the western approach however it is obscured by trees.

Coraki Road

Coraki Road is a two lane RTA funded regional road with a generally 6.5m to 7.0m seal plus centre line markings. It is on a level alignment with a number of gentle curves. It is in reasonable condition and is suitable for truck use including quarry trucks. It meets the Bruxner Highway at a 'T' junction which is well delineated and signposted.

Champions Quarry Intersection

The access to Champions Quarry is newly constructed and forms a CH (Channelised) type intersection with Wyrallah Road and is approximately 370m north of Tuckurimba Road. Wyrallah Road is on a straight alignment past the upgraded quarry access with the terrain rising on the western side necessitating the road to be cut into the side slope. The terrain is generally level around the access point on the eastern side before falling away to the quarry. The seal width is 7.5m with gravel shoulders, all in good condition.

6.1.3 Existing Traffic on Road Network

Traffic volumes on Wyrallah Road have remained static since counts conducted in 1998. The daily volume of traffic estimated using Wyrallah Road in 1998 was 2,658 vehicles per day (vpd). In a count conducted in 2007, Wyrallah Road was estimated to have a weekday average traffic volume of 2640 vpd.

Broadwater Road was observed to carry 419 vpd in April 2009.

Traffic counts undertaken for Wyrallah Ferry Road and Coraki Road in December 2007 indicated daily traffic volumes of 2370 vpd.

6.1.4 Intersection Capacity and Sight Distances

There are seven intersections along the haulage routes:

- quarry access;
- Wyrallah Ferry Road and Wyrallah Road;
- Wyrallah Ferry Road and Coraki Road;
- Coraki Road and Bruxner Highway;
- Pacific Highway and Wyrallah Road;
- Wyrallah Road and Broadwater Road; and
- Broadwater Road and Pacific Highway.

A detailed assessment of Wyrallah Road and the quarry access has been undertaken within *Appendix F*. The intersections of Wyrallah Ferry Road with Wyrallah Road and Wyrallah Road with Coraki Road have been assessed to have existing deficiencies with regard to intersection capacity and design requirements. All other intersections referred to were found to be acceptable for sight distance with relatively low traffic volumes.

6.2 TRAFFIC GENERATION

The present approval for Champions Quarry generates 11 trucks per day on average leaving the quarry. The proposed expansion of Champions Quarry will have an average volume of 30 trucks per day (90% truck and trailer combinations and 10% body trucks) leaving the quarry. The proposed increase in daily volumes will be:

- 10 extra trucks per leaving the quarry on average utilising route one (to Lismore);

- 4.5 extra trucks per day leaving the quarry on average utilising route two (to Broadwater); and

- 4.5 extra trucks per day leaving the quarry on average utilising route three (to Woodburn).

The forecast extra volume of 19 trucks per day leaving the quarry represents 0.71% of the 2007 Wyrallah Road traffic volumes and 0.55% of the predicted 2018 volumes.

6.3 MITIGATION MEASURES

6.3.1 Junction of Wyrallah Road and Quarry Access

Recently, in order to improve the safety of this intersection and to allow for increased storage turning into the quarry with any increase in production over and above the current proposal, a type CH intersection treatment has been constructed as the maximum treatment for this intersection. This treatment has ameliorated Approach Site Distance issues previously discussed with Lismore City Council and the Roads and Traffic Authority.

The current alignment of Wyrallah Road (horizontal, vertical and intersections) between Wyrallah and Tuckurimba past the quarry does not meet current road design guidelines for the posted speed limit of 100km/hr. To address these issues it is recommended that the posted speed of Wyrallah Road between Wyrallah and Tuckurimba, including the quarry intersection, be reduced to 80km/hr.

6.3.2 Junction of Wyrallah Ferry Road and Wyrallah Road

The intersection of Wyrallah Road and Wyrallah Ferry Road is currently substandard and will require upgrading in the form of widening for the left turn in for heavy vehicles from Wyrallah Road (refer to *Figure 6.2*).

6.3.3 Junction of Coraki Road and Wyrallah Ferry Road

Coraki Road and Wyrallah Ferry Road meet at a T-intersection. This intersection is currently substandard and will require upgrading in the form of widening for the left turn in to cater for heavy vehicles from Coraki Road (refer to *Figure 6.3*). The proposed design will require 90m^2 of pavement widening in conjunction with a two coat seal.

Figure 6.2 Proposed Intersection treatment for Wyrallah Road – Wyrallah Ferry Road (source: RoadNet, 2009)

Figure 6.3 Proposed Intersection treatment for Coraki Road – Wyrallah Ferry Road (source: RoadNet, 2009)

6.3.4 Funding of Proposed Works

Given that both intersections discussed in Sections *6.3.2* and *6.3.3* are already below the required AUSTROADS standard, it is considered unreasonable to require Champions Quarry to undertake all upgrade works required. It is proposed that Champions Quarry contribute to the intersection upgrades as negotiated with Lismore City Council in February 2009 as part of the previous Development Application (*Appendix* F).

6.4 CONCLUSION AND RECOMMENDATIONS

It is concluded that provided the following recommendations are implemented that the increase in traffic resulting from the proposed expansion of Champions Quarry will not have adverse impacts on traffic flow or safety along the nominated haulage routes:

- the primary route to and from Lismore to be via the Bruxner Highway, Coraki Road, Wyrallah Ferry Road and Wyrallah Road;
- the preferred route to and from the Pacific Highway to be Wyrallah Road or via Broadwater Road;
- the intersection of Wyrallah Road and Wyrallah Ferry Road is currently substandard and will require upgrading in the form of widening for the left turn in for heavy vehicles from Wyrallah Road (refer to Figure 18 in *Appendix F*);
- Coraki Road and Wyrallah Ferry Road meet at a T-intersection. This intersection is currently substandard and will require upgrading in the form of widening for the left turn in to cater for heavy vehicles from Coraki Road (refer to Figure 19 in *Appendix F*). The proposed design will require 90m^2 of pavement widening in conjunction with a two coat seal;
- the Proponent to pay a contribution towards intersection works listed above in accordance with previous negotiations with Lismore City Council (*Appendix F*);
- payment of road contribution in accordance the calculations provided within the Traffic Impact Assessment (*Appendix F*);
- reduction in the speed limit on Wyrallah Road from 100km/hr to 80km/hr from Wyrallah to the Tuckurimba intersection;
- vegetation be cleared that obscures the T-junction warning sign on Wyrallah Ferry Road on the approach to the Bridge;
- a '200m' distance plate be added to the T-junction warning sign on Wyrallah Ferry Road on the approach to the Bridge; and
- when the quarry has increased truck volumes forecast for a particular period, this information to be forwarded onto the local bus companies.

7 FLORA AND FAUNA

7.1 INTRODUCTION

A detailed Ecological Assessment for the site of the proposed expansion of Champions Quarry was undertaken by ERM. This report is provided as *Appendix C*. This chapter provides a summary of the key findings of the investigation.

7.2 FLORA AND ECOLOGICAL COMMUNITIES

As shown within *Figure 7.1* four vegetation communities were identified in and contiguous with the *Project Area*:

- Dry Rainforest;
- Wet Sclerophyll Forest;
- Regenerating Pink Bloodwood/Forest Oak Woodland; and
- Grassland.

During field investigations a total of 67 species of flora and fauna were identified of which 18 were exotic. No threatened flora species as listed under the Threatened Species Conservation Act 1995 or the Environmental Protection and Biodiversity Conservation Act 1999 were recorded in the *Project Area* and contiguous vegetation communities.

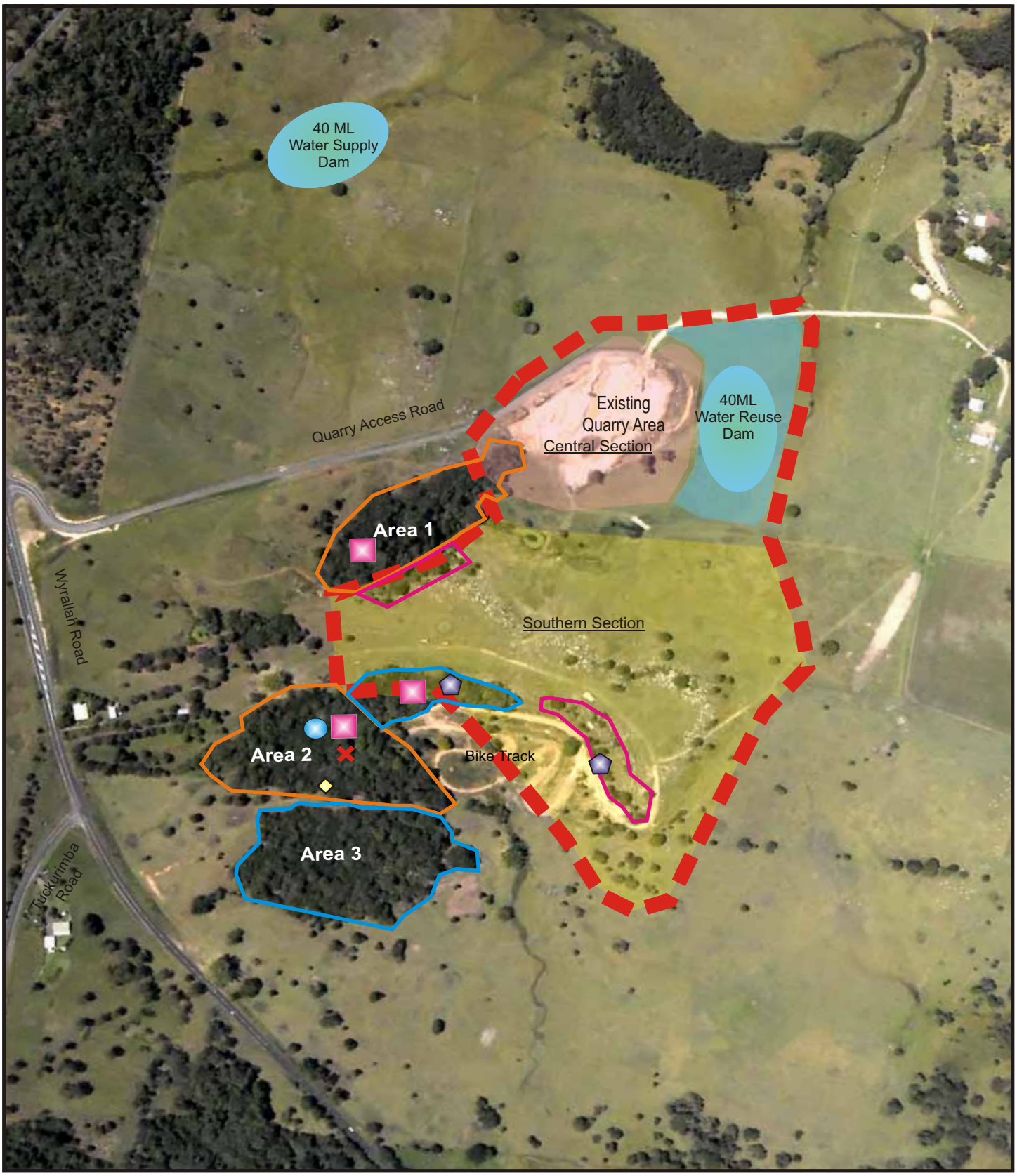
The rainforest communities identified are considered to be representative of the Lowland Rainforest on the NSW North Coast and Sydney Basin Endangered Ecological Community. Whilst this rainforest community is largely external to the proposed area to be disturbed, a small area will be disturbed in an area adjoining the *Central and Southern Sections*. An assessment of this community has been undertaken in accordance with the TSC Act.

7.3 FAUNA

During field investigations a total of 15 bird, 10 mammal and 1 amphibian species were recorded in or on land adjacent to the *Project Area*. Of these, three were exotic. Details of the species recorded are provided within *Appendix C*. Whilst most of these species are common and widespread across similar environs, three of these are listed as threatened species:

- Grey-headed Flying Fox (*Pteropus poliocephalus*);
- Fishing Bat (*Myotis macropus*); and
- Koala (*Phascolarctos cinereus*).

There is also an unconfirmed record of a bat species (*Nyctophilus sp.*) detected from Anabat surveys.



Legend

- Extent of Quarry Extraction and Operations (Project Area)
- Dry Rainforest
- Remnant Regenerating Pink Bloodwood/Forest Oak Woodland
- Wet Sclerophyll Forest
- Owl Call Playback
- Quadrat
- Anabat
- Unidentified Long-eared Bat
- Grey-headed Flying Fox
- Central Section
- Southern Section
- Water Management (Non-quarrying area)

Figure 7.1

Vegetation Communities and Survey Locations

Client:	Champions Quarry		
Project:	Champions Quarry Expansion		
Drawing No:	0098287pm_03_EA_F7.1		
Date:	26/11/09	Drawing size:	A4
Drawn by:	AM	Reviewed by:	WW
Source:	-		
Scale:	Refer to Scale Bar		

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7.4 *FAUNA HABITAT*

Field investigations revealed that a small area of potentially suitable habitat to be removed from within the *Project Area* includes:

- fallen hollow logs;
- lantana thickets;
- intermittent ponds and drainage channels;
- rocky outcrops.

Vegetation in the *Project Area* is limited and highly disturbed as a result of past clearing, grazing and weed invasion. The vegetation in the proposed quarry area is predominately grassland with a high percentage of introduced species with some regrowth vegetation present.

The Pink Bloodwoods are up to 20m in height and provide few hollows that may provide shelter and/or roosting sites for hollow dependant fauna.

Allocasuarina torulosa (Forest Oak) in the regenerating woodland may provide a foraging resource for a number of birds, including Cockatoos. However, no evidence of use of the trees for foraging (i.e. crushed cones) was evident during the field assessment. The higher slopes are characterised by rocky outcrops that may provide habitat for a range of reptiles. It is noted that no threatened reptile species have been previously recorded in the locality. Lantana thickets have the potential to provide suboptimal habitat for insectivorous bird species such as the Superb Fairy-wren which utilise dense species for shrubby species such as Lantana for shelter and foraging.

Habitats in the *Project Area* are connected to, or in close proximity to, higher quality areas of vegetation to the west and south west of the *Project Area*. The area of Dry Rainforest and Wet Sclerophyll Forest to the west of the proposed quarry is bisected by an intermittent drainage channel flanked by rocky slopes and supports a variety of rainforest species including Lilly Pilly to varying heights. This area provided foraging habitat for a range of species and also has the potential to provide roosting and breeding habitat in the form of hollow logs and tress, rocky overhanging outcrops and dense foliage for these species.

Rocky slopes and outcrops associated with the Dry Rainforest and Wet Sclerophyll Forest to the west and southwest of the *Project Area* also have the potential to provide suitable habitat for shelter and basking for a variety of reptile species including *Morelia spilota* (Diamond Python) which is known to occur in the locality (Baverstock, 2005a).

Further assessment of potential reptile habitat within the *Project Area* is to be undertaken prior to the granting of consent. It is again noted that no threatened reptile species have been previously recorded in the locality.

The habitat assessment showed that the following threatened fauna species had a moderate likelihood of utilising or inhabiting the *Project Area* and contiguous habitats;

- *Calyptorhynchus lathami* (Glossy Black Cockatoo);
- *Ptilinopus magnificus* (Wompoo Fruit-Dove);
- *Ptilinopus regina* (Rose-crowned Fruit-Dove);
- *Miniopterus australis* (Little Bentwing-bat);
- *Nyctophilus bifax* (Eastern Long-eared Bat);
- *Phascolarctos cinereus* (Koala); and
- *Pteropus poliocephalus (*Grey-headed Flying Fox).

Targeted site surveys by ERM identified that the Grey-headed Flying Fox utilise vegetation in areas adjacent to the *Project Area* while Koala would utilise vegetation within the wider *Project Site*. It is possible that Koala may on occasion traverse the *Project Area*, however given that no feed and/or core habitat tree species exist within the *Project Area* or the immediate surrounds this is likely to be a rare occurrence.

Potential *Nuras atlas* habitat is not considered to be present within the *Project Area*, but there is considered to be a low potential for it to occur with the remnant rainforest area adjoining the *Project Area*. This species was not specifically targeted during the field activities. *N. atlas* is discussed further in *Section 5.4* of *Appendix C*.

These species are listed as Vulnerable under the *TSC Act* and the Grey-headed Flying Fox is also listed as Vulnerable under the *EPBC Act*.

Analysis of ultrasonic bat detection (Anabat) data by Glenn Hoye of Fly by Night Bat Surveys, revealed a recording of a species of *Nyctophilus sp*. (Long-eared Bat). There are two species of this genus known to occur within the locality: the *N. bifax* (Eastern Long-eared Bat) which is listed as Vulnerable under the *TSC Act*; and *N. gouldi* (Gould's Long-eared Bat) (not listed). Call characteristics of these species almost completely overlap making them indistinguishable using standard Anabat parameters (Pennay, Law & Reinhold, 2004). It is noted that Nyctophilus species do not roost in caves, rather in hollows and under bark. Anabat call detection also identified *Myotis macropus* syn *M. adversus* (Large-footed Myotis) as occurring in the *Project Area*.

A precautionary approach has been adopted for the purpose of this assessment and the Eastern Long-eared Bat has been included in the impact assessment to identify any potential impacts on that species associated with the proposal.

7.5 STATUTORY CONTEXT

7.5.1 State Environmental Planning Policy 44 – Koala Habitat Assessment

Site investigations have identified vegetation within the *Project Area* as Dry Rainforest, Wet Sclerophyll Forest and Pink Bloodwood/Forest Oak Woodland. Trees identified with the vegetation are not listed as Koala feed trees in Schedule 2 of SEPP 44. Accordingly vegetation in the *Project Area* is not identified as potential Koala habitat as defined by SEPP 44. Furthermore, no evidence of Koala occupation was noted during field investigations within the *Project Area* and contiguous rainforest and Wet Sclerophyll Forest habitat.

7.5.2 Threatened Species Conservation Act 1995

The following threatened species or endangered ecological communities were identified either as occurring on the *Project Site*, or having a high likelihood of occurrence in habitats in the *Project Area* that may be impacted by the proposed expansion of Champions Quarry:

- *Calyptorhynchus lathami* (Glossy Black Cockatoo);
- *Ptilinopus magnificus* (Wompoo Fruit Dove);
- *Ptilinopus regina* (Rose-crowned Fruit Dove);
- *Miniopterus australis* (Little Bentwing-bat);
- *Myotis macropus* syn *M. adversus* (Large-footed Myotis);
- *Nyctophilus bifax* (Eastern Long-eared Bat);
- *Phascolarctos cinereus* (Koala);
- *Pteropus poliocephalus (*Grey-headed Flying Fox);
- *Desmodium acanthocladium* (Thorny Pea);
- *Gossia fragrantissima* (Sweet Myrtle);
- *Marsdenia longiloba* (Slender Marsdenia); and
- Lowland Rainforest EEC.

The impacts of the proposal on these species or communities were considered against the Guidelines for Threatened Species Assessment (DEC & DPI 2005). The results of these assessments are provided within *Chapter 5* of *Appendix C*.

7.5.3 Environment Protection And Biodiversity Conservation Act 1999

The Grey-headed Flying Fox was recorded within vegetation to the south west of the *Project Area*. This species is listed as vulnerable under the EPBC Act. The nature and extent of the likely impact to this species from the proposed expansion of Champions Quarry has been assessed in accordance with the requirements of the EPBC Act in *Chapter 5* of *Appendix C*.

7.6 IMPACTS

The ecological assessment (*Appendix C*) identified and considered a number of potential direct and indirect impacts resulting from the proposed expansion of Champions Quarry. These included:

- clearing of 14.4ha of pasture grasslands;
- clearing of 0.44ha of wet sclerophyll forest;
- clearing of 0.95ha of highly modified regrowth Pink Bloodwood/Forest Oak Woodland;
- clearing of 0.18ha of regrowth buffering Dry Rainforest;
- the removal of contiguous vegetation with the potential to result in an increase in exposure to edge effects for retained vegetation adjoining the quarry footprint;
- disturbances to habitat connectivity;
- impacts to downstream water resources resulting from an increase in sediment loads or acidity in Tucki Tucki Creek;
- impacts from noise and lighting on nocturnal fauna; and
- vibration impacts resulting from the extraction and processing activities within the *Project Area*.

Assessment of these potential impacts (see *Chapter* 5 of *Appendix C*) concluded that with the implementation of appropriate mitigation measures including significant biodiversity offsets, these impacts can be mitigated, and the habitat value of the site enhanced from its present state. These management and mitigation measures are outlined below in *Section 7.7*.

7.7 MANAGEMENT AND MITIGATION MEASURES

7.7.1 Avoiding Impacts

One of the primary measures considered in the quarry expansion proposal to reduce ecological impacts was to avoid impacting on the core rainforest areas as described by Baverstock in 2005 and 2007 (see *Annex B of Appendix C*). The footprint of the proposed quarry has been restricted to avoid clearance of mature Hoop Pines and core rainforest habitat thereby avoiding direct impacts on Lowland Rainforest EEC and the footprint was reduced to avoid clearance of the larger remnant of Wet Sclerophyll Forest to the south of Dry Rainforest (Area 2).

The Dry Rainforest and Wet Sclerophyll Forest directly to the west of the *Project Area* will be retained and protected from disturbances associated with the proposed quarry operation. Weed management works will be undertaken to remove any current infestations and/or minimise establishment and invasion of weed species. A Plan of Management will be prepared to identify appropriate management measures to be implemented to maintain and improve habitat values of the area. This area is within the wider property holding and the proponent is committed to the ongoing management and protection of this area.

7.7.2 Mitigation Measures

A number of measures are to be implemented to minimise direct and indirect impacts associated with the proposed quarry operation and are detailed below.

Measures to minimise direct impacts associated with the clearance of vegetation and habitats within the quarry footprint include:

- Further assessment to confirm the species of Microbat identified in Area 2 (suspected to be *Myotis macropus*) and to consider the potential for *Nurus atlas* to be inhabiting the Dry Rainforest areas adjoining the *Project Area*. These works will be undertaken in accordance with the methods described in the DECCW Draft Threatened Biodiversity Survey and Assessment Guidelines;

- pre-clearance inspection of each 'work cell' prior to the commencement of clearing works to identify potential fauna habitat (e.g. fallen hollow logs, and hollow-bearing trees) and identify appropriate measures. Measures to minimise impact on fauna during clearing operations would include modified clearance of hollow-bearing trees by clearing up to the tree, nudging the tree then leaving the tree to be cleared at a later period to allow any resident fauna to relocate;

- where potential fauna habitat is identified a suitably qualified wildlife handler would be present during clearing operations to supervise clearance and rescue any individuals where required;

- pre-clearance inspection of trees to be felled for Koalas; and

- relocation of any fallen logs to adjoining areas and or rehabilitation areas.

Measures to minimise impact of traffic movement on fauna includes:

- limiting traffic movement to daylight hours;

- limiting the speed of haul trucks on site to 30km/h;

- selection of shrub species and/or tree species that do not provide a foraging resource for Koalas in visual screening proposed along the quarry access road; and

- providing a break in the screening planting near the junction of the haul road and Wyrallah Road to discourage directing terrestrial fauna on to the road.

It is proposed that the Dry Rainforest and most of the Wet Sclerophyll Forest to the west of the proposed quarry area will be avoided and managed. To minimise indirect impacts on these areas of retained habitat, the boundary of the quarry footprint and retained vegetation will be defined and maintained. The location of the boundaries will be determined in the field prior to clearing operations in proximate areas. The vegetation will be managed to remove weeds and minimise spread of weed species to retained vegetation and the integrity of the vegetation will be inspected regularly. This will be undertaken in accordance with a Plan of Management prepared for the management of the vegetation.

With respect to weed management it should be noted that Lantana is a declared Class 4 Noxious Weed within the *Far North Coast County Council* control area (2008) and a Class 5 Noxious Weed (Notifiable Weed) under the NSW *Noxious Weeds Act 1993* (*NW Act*). In accordance with the relevant legislation, measures will be taken to control the growth and spread of existing Lantana infestations in the *Project Site*. Camphor Laurel is also a declared Class 4 Noxious Weed within the *Far North Coast County Council* control area (2008) however it is also recognised as an important foraging resource for frugivores and the removal of Camphor Laurel must be offset by planting of fruiting rainforest trees.

The existing quarry has a *Rehabilitation and Final Landscape Plan (refer Environmental Management Plan - EP15* in the *Preliminary Quarry Management Plan* provided in *Appendix J)*. The principals of this plan will be applied to the expanded quarry operation. Work cells will be progressively rehabilitated. A large part of the proposed quarry will be rehabilitated with pasture species to grazing land as currently characterises the site. Any benches would be shaped and rehabilitated with locally occurring native species. The rehabilitation will be monitored monthly to assess establishment of vegetation and progress documented by the Environmental Officer.

7.7.3 Biodiversity Offset Strategy

The proposed quarry expansion will clear less than 1.5 ha vegetation including Dry Rainforest buffer zones and Wet Sclerophyll Forest, and including minor scattered stands of vegetation. The areas to be cleared has been minimised by the design of the quarry footprint, however these remnant and regenerating vegetation stands will not be avoided by the proposal. the loss of this relatively small amount vegetation will be offset through the management and protection of existing areas and areas of the same communities and habitat attributes in the immediate area to provide a net improvement in ecological values.

Identification of a suitable offset areas was guided by consideration of DECCW offsetting principles that an offset must:

- consider the structure, function and compositional elements of biodiversity including threatened species;
- enhance biodiversity;
- consider the conservation status of ecological communities; and
- ensure the long-term viability and functionality of biodiversity.

The offset areas should preferably be located on-site or in the locality, contain the same or equivalent vegetation communities and be in equivalent or better condition to provide for an offset of 'like for like'. Further, preference was given in identifying suitable offset areas, to areas that provide offset strategies through implementation of measures such as habitat enhancement and securing land for conservation as opposed to reconstruction of communities. The latter option is not preferred as it involves high risk and uncertainties for biodiversity outcomes in the short term and long term. It is noted, however, that significant areas of the existing identified vegetation to which the proposed offsets are to enhance are also to be locked-up and managed as offsets.

To ensure long term security and implementation of management measures, the offset area should be located on land owned by, or which can be purchased by the proponent. The proponent will commit to the protection and management of the offset areas through legal enforcement of the offset strategy.

Areas proposed to be identified and managed as biodiversity offset areas for the loss of the remnant and regenerating habitat in the *Project Area* are shown *on Figure 7.2*.

The offset areas will be managed in perpetuity. A vegetation management plan will be prepared for the offset areas. The management plan would include but not be limited to the following consideration:

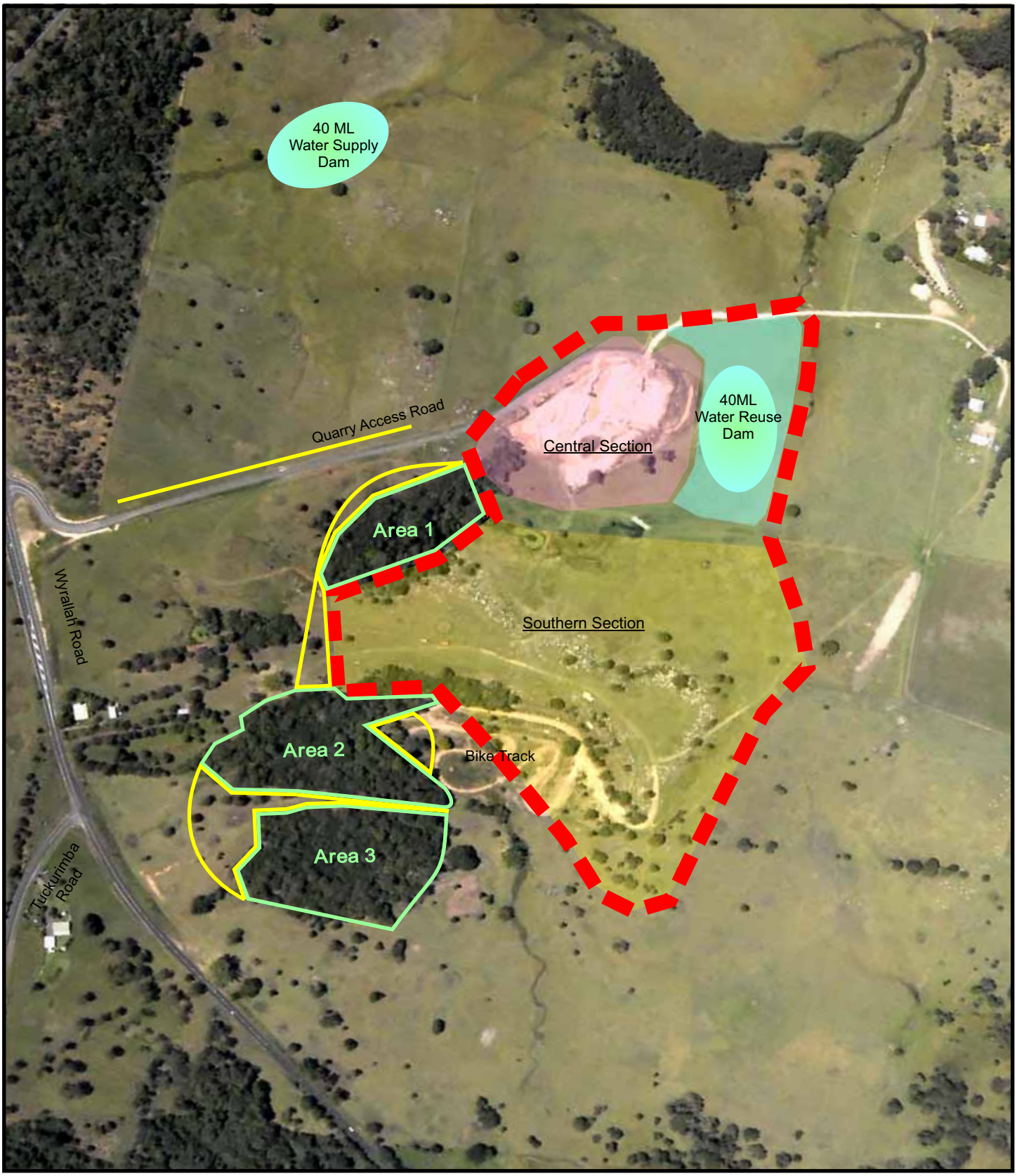
- baseline assessment of the community and habitat values of the offset area;
- identification of environmental weeds to be targeted in the weed management plan;
- any fencing reconfiguration requirements;
- safety issues for revegetation and weed management works on the steeper slopes; and
- ongoing monitoring program.

The identified biodiversity offset areas are all within the proponents ownership. In addition, the proponent will commit to the protection and management of the offset area secured through legal enforcement of the offset strategy via a voluntary conservation agreement under the *National Parks and Wildlife Act 1974* or Section 88B-E covenant of the *Conveyancing Act 1919* to be negotiated by the proponent and the DoP and DECCW.

The biodiversity offset areas are proposed as a means of ensuring that the proposal maintains or improves biodiversity in the local area. The biodiversity offset areas will support similar vegetation community and habitat structure within the immediate area of the proposal and provides for long term protection, management and conservation of an area of at least 10 ha of Dry Rainforest and Wet Sclerophyll Forest. The proposed offset will improve biodiversity values within the area through enhancing habitat connectivity.

7.7.4 Conclusion

The Ecological Assessment within *Appendix C* concludes that, with the implementation of appropriate management and mitigation measures, the proposed expansion of Champions Quarry will not significantly impact on any threatened species or their habitats or any endangered ecological communities.



Legend

- Extent of Quarry Extraction and Operations (Project Area)
- Protected Revegetation Zone
- Protection Areas
- Central Section
- Southern Section
- Water Management (Non-quarrying area)

Figure 7.2

Biodiversity Offsets

Client:	Champions Quarry		
Project:	Champions Quarry Expansion		
Drawing No:	0098287pm_03_ecology_V4		
Date:	25/11/09	Drawing size:	A4
Drawn by:	AM	Reviewed by:	WW
Source:	-		
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8 SOIL AND WATER MANAGEMENT

8.1 INTRODUCTION

A comprehensive assessment of soil and water (surface and subsurface) conditions has been undertaken and a Soil and Water Management Plan (SWMP) developed (ERM, 2009). A summary of this document is provided below. The entire document is included an *Appendix I*.

8.2 EXISTING CONDITIONS

8.2.1 Geology

The 1:250,000 geological map of Tweed Heads (SH56-2) shows that the site is underlain by the Jurassic age Kangaroo Creek Sandstone which is described as quartz sandstone and conglomerate. The higher elevations and western portions of the site are overlain by basaltic rocks of the Lismore Basalt, which is a tertiary age member of the Lamington Volcanics. Site observations of outcrop towards the southern extent of the site indicate that the basaltic rocks are limited to an area west of the *Project Area* and as a thin clay soil veneer above RL50m inside *Project Area*. The basal contact of the basalt appears to be sub horizontal, although regional experience indicates that lateral prediction of this contact for any great distance is unreliable (Coffey Geotechnics, 2008).

Geotechnical drilling undertaken by Coffey Geotechnics (refer *Appendix B of EA report*) has demonstrated that the geology of the Champions Quarry expansion area is underlain by Kangaroo Creek Sandstone which is the premier sandstone aggregate parent material in the Far North Coast of NSW. Typically this sandstone contains coarse quartz sandstone and conglomerate of varying characteristics.

Several thin coal seams and weathered siltstone interbeds were observed in the drill cores. Two thin bands of sulphide (pyrite) were encountered at one of the test drilling locations (BH5) undertaken by Coffey Geotechnics. These occurred at 12.15m depth below ground surface (50mm thick) and at 27.5m depth (20mm thick).

Pyrite (FeS_2) is commonly associated with coal and metal ore deposits. Its oxidation occurs spontaneously in nature and can cause Acid mine Drainage (AMD) and mine tailing leachate containing heavy metals (WA DMP, 2009). The overall chemical reaction governing pyrite oxidation is:

$FeS_2 + 15/4\ O_2 + 7/2\ H_20)$ --> $Fe(OH)_3 + 2SO_4$

Based on the small amounts of pyrite observed in the drilling cores the potential for AMD is considered to be low. Management measures should however been considered to mitigate against its occurrence and potential for discharge of AMD from the *Project Area*. This is discussed further in *Section 2.2.3* of *Appendix I*.

8.2.2 Soil Conditions

The *Soil Landscape of the Lismore-Ballina 1:100,000 Sheet* (Morand, 1994) identifies two soil landscapes occurring in the vicinity of the site comprising a variant of the 'Wollongbar' erosional and a variant of the 'Coffee Camp' colluvial landscapes. The erosional 'Wollongbar' soils are typically derived from basalts and are mostly deep (>200cm) Krasnozems and stonier Krasnozems on crest/ upper slope boundaries. The 'Coffee Camp' soil landscape is the dominant soil landscape within the defined operational area, which is consistent with the soil types encountered during the geological site investigations. Erosion hazard, soil structural breakdown, or other factors, including climate, are expected to limit the capacity of the land for cultivation.

Geological site investigations undertaken at the Champions Quarry site by Coffey Geotechnics (2007) indicated that the shallow topsoil and residual soil ranges from sand to sandy clay between 0.5 to 1.3 metres depth in the investigation areas. The sandy soil is described as medium grained orange brown with traces of clay and organic materials, while the sandy clay is described as medium plasticity, dark brown firm to stiff.

8.2.3 Existing Surface Water Conditions and Management

The site generally drains to the northeast towards low lying flood plain and Tucki Tucki Creek via several ephemeral drainage depressions into an unnamed intermittent water course along the eastern boundary of the site. The flood plain is located approximately 1.5km from the eastern boundary of the *Project Area*, which in turn drains into Tucki Tucki Creek approximately 2.5 kilometres from the *Project Area*. During flood events site water mixes with flood waters of Tucki Tucki Creek and flows downstream over flood plain land.

An area in the south of the site (the motocross track) naturally drains to the south. Proposed extraction activities in this area will result in some diversion of this surface flow back to the north.

A constructed drain exists from the floor of the existing quarry to two small sediment ponds to the east of the quarry pit. No large dams are currently present on the site.

Tucki Tucki Creek is the primary natural receiving waters for any discharges or runoff from the site. The waterway is affected by variable quality runoff from agricultural and urban sub-catchments.

EAL laboratories of Lismore have undertaken preliminary surface water sampling on behalf of Champions Quarry during February 2007, with samples collected from Tucki Tucki Creek. The samples were collected at locations within the upper tributary to the east of the existing quarry and both up and down hydraulic gradient of the main intersection with Tucki Tucki Creek (refer *Figure 8.1* below). The analytical results appear typical of a disturbed watercourse within a rural catchment. The pH of the water in the creek is generally slightly acidic (as are the surrounding soils), while the presence of slightly elevated levels of nutrients and ammonia are consistent with what would be expected given the surrounding agricultural (cattle grazing and sugar cane) land usage.

The analytical reports for surface water samples and groundwater samples are provided in *Appendix I*.

Legend

— —	Extent of Quarry Extraction and Operations (Project Area)
Bh3	Bore Hole Location
SW3	Surface Water Sample Location
Windmill	Windmill Water Sample Location

Figure 8.1

Surface Water and Groundwater Sampling Locations

Client:	Champions Quarry	
Project:	Champions Quarry Expansion	
Drawing No:	0098287pm_GIS_Boreholes_v2	
Date:	14/08/2009	Drawing size: A4
Drawn by:	AM	Reviewed by: WW
Source:	-	
Scale:	Refer to Scale Bar	

N

0 100 200 300 400 500m

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8.3 POTENTIAL IMPACTS OF THE PROPOSAL ON SOIL AND SURFACE WATERS

There a number of potential impacts on soil and surface water regimes within the operational quarry areas which in the absence of appropriate mitigation measures, could adversely affect soils. These are outlined below.

Soils

There is a potential for soil erosion from quarry pit, stockpiles and unsealed access roads. If this takes the form of wind erosion, topsoil could potentially be transported offsite. However, a significant portion of the site is already denuded of vegetation and topsoil covering as a result of current quarry operations and as a result the extent of erosion is not expected to show any significant increase.

Heavy vehicle movements can cause soil compaction which would be most likely to manifest itself as a cumulative impact.

The site will be returned to an agricultural use following rehabilitation. As the site soils have been identified as having limited capacity to support long-term cropping, the impact of the proposed continuation of quarrying activities would not significantly degrade this resource any further.

Landforms

The proposed quarry expansion will impact on the topography of the site via excavation of the sandstone resource and assembly of in-pit and out-of-pit emplacement areas for overburden and excess product. Construction of infrastructure, namely new internal access roads, processing area and weighbridge (including levelling) and water management structures, will result in minor impacts upon landform. Landform alterations will be confined to the operational area of quarry operations (the *Project Area*) and the remainder of the surrounding *Project Site* will be unaffected.

Following site rehabilitation, the areas used for stockpiling of materials and access would be returned to grazing land, with soil stockpiles reallocated over the benches of the quarry pit to allow for revegetation. The final proposed landform is displayed in *Figures 2.4 to 2.6*.

Water Quality and Environmental Flows

Appropriate site management will ensure there are minimal impacts on water quality and on the quantity of runoff.

Discharges from the pit and other disturbed areas have the potential to adversely affect water quality unless the water is adequately treated. The primary concern for water quality is in relation to increased sediment loads in Tucki Tucki Creek. It is intended to divert all water from disturbed areas to

settling ponds and reed beds to control all potentially dirty water prior to it leaving the site.

Given the location of the *Project Area* within the upper reaches of the catchment, the distance to Tucki Tucki Creek, and the limited area to be disturbed for the quarry operations, it is unlikely that the quarry will cause significant changes to the environmental flows in the tributaries or Tucki Tucki Creek.

Diversions and Downstream Drainage

Clean water will be diverted around disturbed areas in contour drains or modified channels. This will have minor effects to local flows. Appropriate design in accordance with Landcom, NSW (2004) *Managing Urban Stormwater - Soils and Construction* and management of contour drains and reed beds will minimise potential for erosion as well as offsite transport of suspended sediments. Dirty water will be retained in settling ponds and the 40ML water recycling dam located below the active 3 hectare work cells.

Water Supply

The proposed quarry expansion and operations will significantly increase the annual water demand as discussed in *Section 8.4.3 below*.

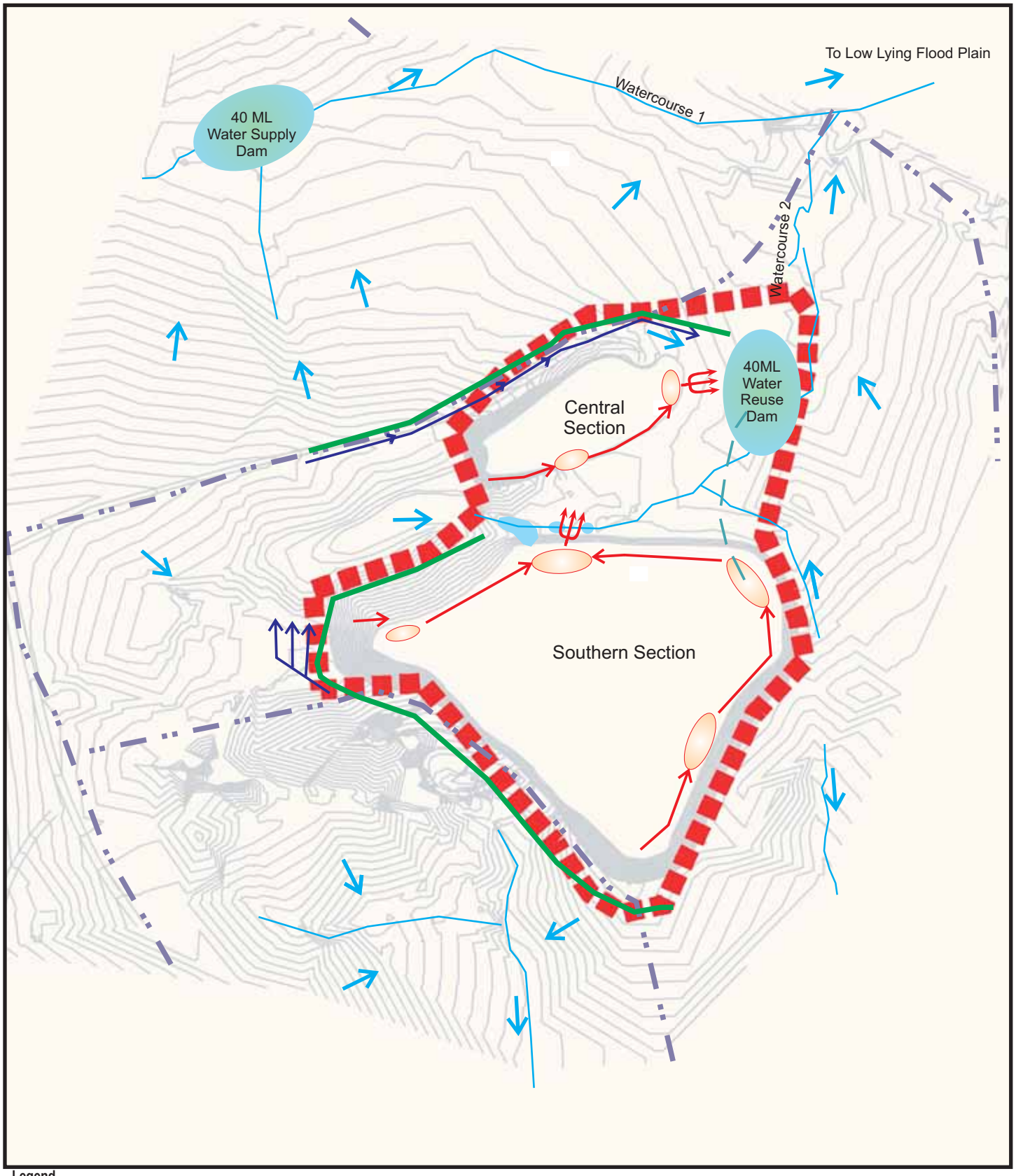
8.4 SURFACE WATER MANAGEMENT STRATEGY

8.4.1 Introduction

A water management plan for the quarry was developed to:

- retain and clean quarry water;
- safeguard the integrity of downstream watercourses and lowlands;
- ensure adequate water supplies under most climatic conditions.

The proposed site water management measures and catchment characteristics are presented on *Figure 8.2* below. The development of this plan is discussed in greater detail in the below sections.



Legend

- Access & Haul Roads
- New Dams
- Existing Dams
- Sediment Basins (Indicative)
- 2 metre contours
- Ephemeral Creeks
- Contour Bank
- Gravity pipeline
- Subcatchment Boundary
- Direction of Surface Drainage
- Catch Drain (dirty water)
- Level Spreader
- Level Spreader
- Upslope Clean Water Diversion

Figure 8.2

Conceptual Drainage Plan

Client:	Champions Quarry		
Project:	Champions Quarry Expansion		
Drawing No:	0098287pm_GIS04		
Date:	25/08/09	Drawing size:	A4
Drawn by:	AM	Reviewed by:	WW
Source:	VGT		
Scale:	Refer to Scale Bar		

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0 40 80 120 160 200m

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8.4.2 *Climate*

Long term climate data is available from Bureau of Meteorology (BoM) weather stations located in Lismore and Alstonville, approximately 15 km north and north east of the site respectively.

On average, January is the warmest month in Lismore with a mean daily maximum of 29.9ºC (refer *Figure 8.3* below). The coolest month is July with a mean daily minimum temperature of 6.5ºC.

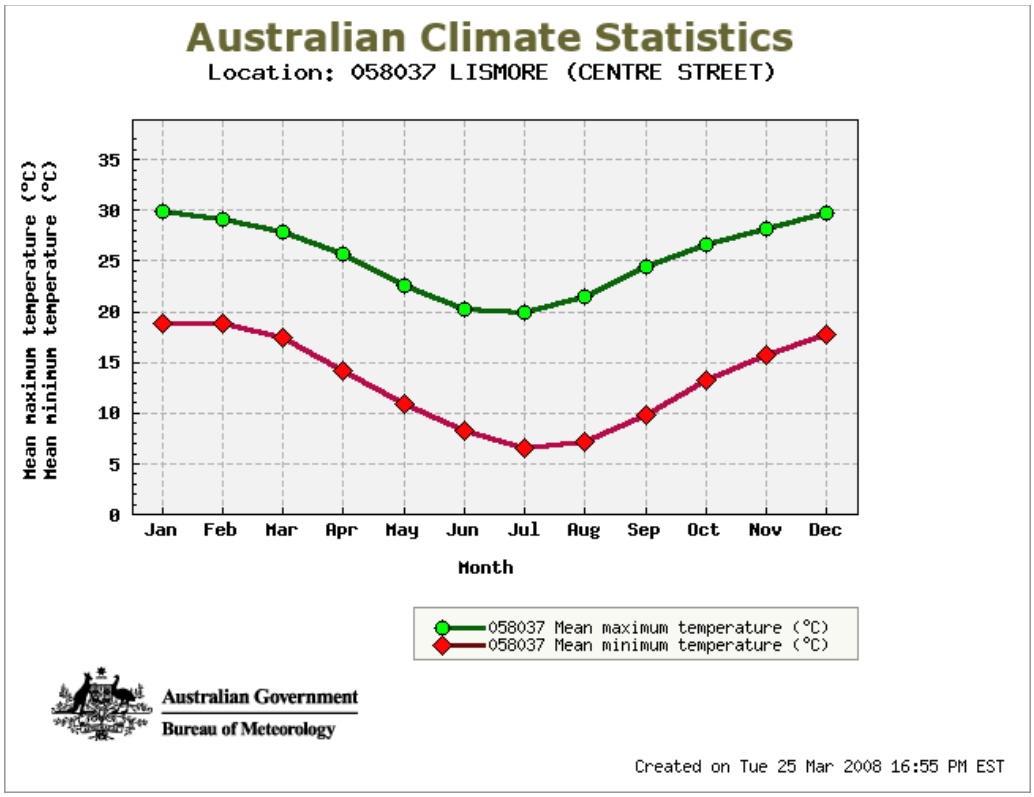

Figure 8.3 Mean Monthly Temperatures in Lismore (BoM, 2008).

The mean annual rainfall at Lismore is 1343.1 mm. The mean number of rain days annually over this period is 104.4 days. On average, March is the wettest month with a mean monthly rainfall of 188.4 mm, whilst September is the driest month with an average of 50.4 mm. *Table 8.1* below, provides summary annual rainfall and evaporation data for the region. Evaporation exceeds rainfall for seven months of the year.

Table 8.1 Rainfall & Evaporation

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann.
Mean monthly rainfall (mm)[1]	155	184	188	129	115	97	80	55	50	73	94	121	1343
Mean monthly evaporation (mm) [2]	177	140	136	105	84	72	84	102	140	150	167	177	1533

1. Rainfall recorded at BoM station 058037 (Lismore, 1907 - 2003)

2. Evaporation recorded at BoM Station 058131 (Alstonville, 1971 – 2007)

8.4.3 Water Demands

Water requirements at the quarry are as follows:

Potable Water

Champions Quarry site is not connected to mains water supply, however connection is available if required. Drinking water for quarry staff will be supplied through bottled water stored at the site office. Water will be required for toilet and hand basin use with smaller quantities being used for personal consumption. An average of 50 litres per person per working day has been assumed for design purposes. A workforce of 10 will have a daily demand of 500 L and an annual demand of up to 0.25 megalitres (ML).

Non Potable Water Demand

Non-potable demands will be supplied from on-site storages, both sediment basins, one recycling dam and one large clean water catchment dam. These will serve all non-potable water requirements for the site including product washing, dust control, vehicle washing and product moisture control. Groundwater may be sourced form an existing bore in situations where supply of non-potable water is low, e.g. during extended dry weather.

Process Water

The proposal would see water used in the processing plant during screening and washing, and for dust suppression at conveyor transfer points. Water would also be used during crushing, however as crushing is expected to occur only infrequently the quantities of water used would be low compared with other processes, and are ignored within the water balance.

Estimates of process water consumption were made in consultation with the quarry operator (refer *Table 4.1* of *SWMP* in *Appendix I*). The estimates are based on a worst-case scenario. It is also noted that a high recycle percentage (estimate at 90% efficiency) is achievable by collecting, treating and reusing wash water and this is included in the water balance. It is estimated that up to 40 ML of process water would be used annually, the majority of this consumed during production of washed sand.

Dust Suppression

Water will be required for dust suppression on the haul roads and on stockpiles within the quarry. Water demand for dust suppression has been estimated at 33,000 L/day, or 6.6 ML/year.

Product Moisture

Certain types of material such as road bases and washed sand are required to have a moisture content of around five to seven percent. Quarried material is wetted during screening and washing and in most cases this will supply the necessary moisture content. Nevertheless, an allowance is made for a worst-case scenario where the washed sand is stockpiled, dries completely and needs rewetting to 5% moisture. At an annual washed sand production rate of 50,000 T the required volume of water to obtain 5% moisture is 2.5 ML.

Truck Washing Facilities

Mobile plant used in quarry operations will need to be cleaned as part of general maintenance and prior to servicing. Water used in vehicle washing will be treated to remove coarse grit before being recycled back into the quarry water system by discharging to the process area sediment dam. A nominal allowance of 10,000 litres a month (0.12 ML/year) is made to allow for water lost through evaporation and vehicle wetting.

Total Water Demand

The total site water demand for processing, dust suppression, adding product moisture, and truck washing is estimated at approximately 50 ML/year. Water of different qualities can be used to meet quarry demands. Drinkable quality water (potable) will be used for domestic and employee uses while poorer quality water (non-potable) will be used for all other purposes. The majority of demand is for non-potable water that could be sourced from stormwater harvesting, or pumped from groundwater. A very small component is potable water (0.12 ML/year) that could be sourced from roof water collection in tanks, or purchased.

8.4.4 Water Storage

Two major storages are proposed (yet to be constructed), one being situated within a natural drainage paths comprising largely undisturbed (clean water) catchments, the second being an off stream dam. They are referred to as the *Water Reuse Dam* and the *Water Supply Dam* with approximate sizes of 40ML each. The objective is to construct the *Water Reuse Dam* first, building the *Water Supply Dam* when required as the quarry develops.

Additional storage will be provided by quarry pit sediment basins, whose number and size will vary throughout the operation. At any one time there may be between 3ML and 6ML of storage available in sediment basins.

8.4.5 Catchment Yields

Annual catchment yields were estimated for the *Water Reuse Dam* and *Water Supply Dam* for dry, normal and wet years, using long term annual rainfall statistics from Lismore (Bureau of Meteorology station No. 058037). The 10-percentile annual rainfall at Lismore (a dry year) is 900 mm; the 50-percentile annual rainfall (a normal year) is 1270 mm and the 90-percentile annual rainfall (a wet year) is 1922 mm.

The results are summarised in *Table 8.2* below.

Table 8.2 Catchment Yields for Major Storages

	Water Supply Dam	*Water Reuse Dam*	**Total**
Catchment Area (ha)	19	13	32
Annual Runoff Coefficient (Cv)	0.09	0.2	
		Catchment Yields (ML)	
10%ile rain year (900mm)	15.4	23.4	38.8
50%ile rain year (1270mm)	21.7	33.0	54.7
90%ile rain year (1922mm)	32.9	50.0	82.8

The water management strategy outlined in this SWMP incorporates advice given by DWE, which confirmed the following:

- the Maximum Harvestable Right Dam Capacity (MHRDC) for the properties "Reavill Farm Pty Ltd" and "Tucki Hills Pty Ltd" are 27.2ML and 12.68ML, respectively;
- the proposed 40 ML *Water Reuse Dam* that would be used for collection and recirculation of quarry stormwater runoff is exempt from licensing and calculation of harvestable right use;

- the proposed 40 ML *Water Supply Dam* must be considered in the calculation of harvestable right use and must be licensed to be constructed larger than the MHRDC capacity. However, a pipe should be installed to set the top water level at the MHRDC;

- to utilise the full capacity of the *Water Supply Dam* an annual volumetric entitlement must be obtained by purchasing an existing water license to the satisfaction of DWE and the top water level set to the aggregate of the available MHRDC and purchased allocation; or

- the two properties Reavill Farm Pty Ltd and Tucki Hills Pty Ltd can be treated as one for MHRDC calculations provided Reavill Farm Pty Ltd takes a lease out over the Tucki Hills Pty Ltd property.

It is proposed that Reavill Farm Pty Ltd will lease the property from Tucki Hills Pty Ltd so that the MHRDC of the two properties can be combined. The combined MHRDC is 39.88 ML. This is approximately equal to the capacity of proposed *Water Supply Dam* (40 ML).

8.4.6 Dam Construction

Water Supply Dam

The *Water Supply Dam* (40 ML) is to be constructed at the confluence of two intermittently flowing first-order streams to the north of the main access road. It would have a catchment area of approximately 19 ha comprising moderately sloping bush and grassland. Harvested water would be delivered from the *Water Supply Dam* to supplement the *Water Reuse Dam* by gravity pipeline, where levels permit, or if necessary by pumping using a high flow diesel pump.

The *Water Supply Dam* would require a water license with the DWE under the Water Act. The licensing provisions of the WM Act do not yet apply to the area as a Water Sharing Plan is not in place. Once a Water Sharing Plan for the catchment is gazetted the water license would be converted to a water access license under the WM Act.

Water Reuse Dam

The *Water Reuse Dam* (40 ML) is to be constructed "off-line" in a position down hydraulic gradient of the proposed *Central* section quarry pit. The function of the *Water Reuse Dam* is to collect and recycle process water and stormwater runoff from the *Central* and *Southern* quarry pit primary sediment basins. Process water for the crushing and washing plants and for dust suppression would be pumped from the *Water Reuse Dam* to the processing plant.

The sediment basins and associated sediment control devices will provide the primary means sediment capture and water quality control prior to reaching the *Water Reuse Dam*.

It is the intention to use this *Water Reuse Dam* to mediate between recycling and using runoff, to manage water levels at 36ML permanent storage capacity such that during peak rainfall events the smaller sediment basins will drain to the *Water Reuse Dam*. It is considered that the *Water Reuse Dam* qualifies as "excluded works" under *Schedule 1, Section 3,* of the WM Act, being a dam "*solely for the capture, containment and recirculation of drainage and/or effluent*". As such the *Water Reuse Dam* is exempt from licensing and calculation of harvestable right use.

8.4.7 Water Balance

A preliminary annual water balance was used to compare quarry water demands with the volume of water which could be realistically collected within the site, and is used to predict the security of supply and the magnitude of any water surplus, or deficit.

On the basis of total annual water demand for processing and site management of approximately 50 ML, this demand could be met in a dry (10%ile) year using just the Water Reuse and Water Supply Dams (combined yield approx. 50.2 ML), providing the collection system is efficient and the dams are sufficiently large to minimise overflow losses. During normal and wet years there will be a significant surplus of water.

Groundwater seepage is not expected to add significantly to the overall water balance at the site.

Given the location of the site within the upper reaches of the catchment, and the limited area to be disturbed for the quarry operations, it is unlikely that the quarry will cause significant changes to the environmental flows in the tributaries or Tucki Tucki Creek.

In order to confirm the findings of the preliminary water balance and adequacy of the proposed surface water management system a detailed water balance (MUSIC) model and a wet weather storage model were prepared by Strategic Environmental and Engineering Consulting (SEEC).

The MUSIC model predicted that the water supply confidence, with consideration of the 40ML *Water Reuse Dam* only (i.e. 36ML permanent storage), could meet almost all demand with little requirement to draw on other sources of water.

The modelling undertaken predicts that the *Water Reuse Dam* would not be expected to overflow at maximum very often. The dry and mean models demonstrate no maximum capacity weir overflow at all, with all discharge to be via the temporary storage level low-flow orifice.

There is expected to be a clear beneficial effect in terms of mean annual pollutant loads from the pre-development runoff from agricultural grazing land when compared to the proposed controlled surface water management system. In other words, the actual pollutant concentrations modelled in MUSIC (suspended Solids and nutrients) are predicted to be less or no worse than under existing conditions.

8.4.8 Soil and Water Management Plan

Runoff from undisturbed areas will be diverted around areas disturbed or affected by quarry activities. This will reduce the potential for clean runoff to be polluted by quarry activities. Diversion of clean water will be affected by diversion drains, contour drains and, where necessary, bunds, and pipe culverts designed in accordance with the *Managing Urban Stormwater - Soils and Construction 'Blue Book'* (Landcom, NSW 2004). The conceptual drainage plan is provided in *Figure 8.2.*

As far as possible, all water runoff within the pit, including any minor seepage groundwater inflow, will be directed to sediment basins to be constructed in the bottom of each active quarry pit.

The proposed Water Management System has been designed taking into account the regional setting and climatic conditions, the *Project Area* and *Project Site* conditions, operational factors and consideration for relevant guidelines, policies and legislation. A conservative approach was taken throughout the design process particularly with regard to the control and detainment of on-site water. The following provides a summary of the system design aspects:

- the *Water Storage Dam* will only collect 'clean' water (i.e. not from the *Project Area*) for the purpose of supplementing quarry operational water needs during dryer periods, and as such will be treated as any other on-farm harvestable rights dam;

- the *Water Reuse Dam* will only collect water from the disturbed quarry and operational areas, including all water harvested from the smaller sedimentation ponds located in the *Central Section* and *Southern Section* quarry pits;

- the preliminary water balance and verification modelling undertaken demonstrates that water demand of the quarry for the majority of the recorded range of local annual rainfall can be met via water collected in the *Water Reuse Dam* alone, which in turn can be supplemented by the *Water Supply Dam* giving even greater water security;

- the smaller settlement ponds (designed for the 3ha operational areas) have been conservatively designed for primary treatment for the removal of sediment up to the 80th percentile, 5 day rainfall event beyond which drain to the *Water Reuse Dam*. The performance of the settling ponds is to be

optimised via harvesting of water for the *Water Reuse Dam* and by regularly removing sediment;

- the water levels in the *Water Reuse Dam* will be managed via operational reuse (including processing and dust suppression), and also via land application on the *Project Site.* This will be undertaken as required to ensure a minimum 6ML of freeboard is available to receive stormwater runoff from the operational site. The 6ML of temporary detention is the approximate requirement for capturing *Project Area* runoff from the 95th percetile 5-day rainfall depth as is required by Volume 2e of *Managing Urban Stormwater* (Landcom, 2004). Under normal circumstances all operational site water is to be detained on-site for reuse or for land application;

- it is noted that if water quality objectives are satisfied that it is appropriate for water to discharge to the environment (if required);

- based on the need to harvest water for operational purposes and to treat active *Project Area* runoff, the proposed *Water Reuse Dam* has been shown to be sufficient to control and treat all runoff from the active *Project Area*. It is considered that water quality of discharge from the *Water Reuse Dam* will carry lower pollutant loads or will be no worse off than under existing conditions; and

- the system for treating *Project Area* runoff has been conservatively modelled and designed assuming 13ha of disturbed area. It is noted that in the early operational stages and as quarry cells are progressively rehabilitated that the actual disturbed area will likely be significantly less at any one time. Where possible runoff from undisturbed or rehabilitated sections of the *Project Area* will be diverted around the *Water Management Systems*.

It is also recommended that an additional small settling pond be constructed at upslope side of the main clean water pond.

Long-term material stockpiles and bunds (i.e. topsoil and overburden) will be stabilised by seeding with seasonal grasses. All shorter term material stockpiles will be bunded to reduce run-on and to capture runoff. Appropriate sediment control measures (i.e. silt fencing, check dams etc.) will be established in accordance with *Managing Urban Stormwater - Soils and Construction 'Blue Book'* (Landcom, NSW 2004) where necessary to reduce the potential for sediment run-off

All water used as part of the quarry and sand washing operations is to be diverted via catch drains to the series of linked settling ponds. Sediment control devices will be installed between the sediment ponds in the form of rock filters (refer *Figure 8.4* and *Figure 8.5*). This will allow the removal of sediment from the catch drains, adjacent to each rock filter as part of routine site maintenance.

Rock filters will be designed and installed to allow regular desilting maintenance to ensure that they are operating effectively. Additional sediment control devices including plant filter strips and smaller settling ponds, designed as a pond-riffle flow system are to be installed upslope of the *Water Reuse Dam*.

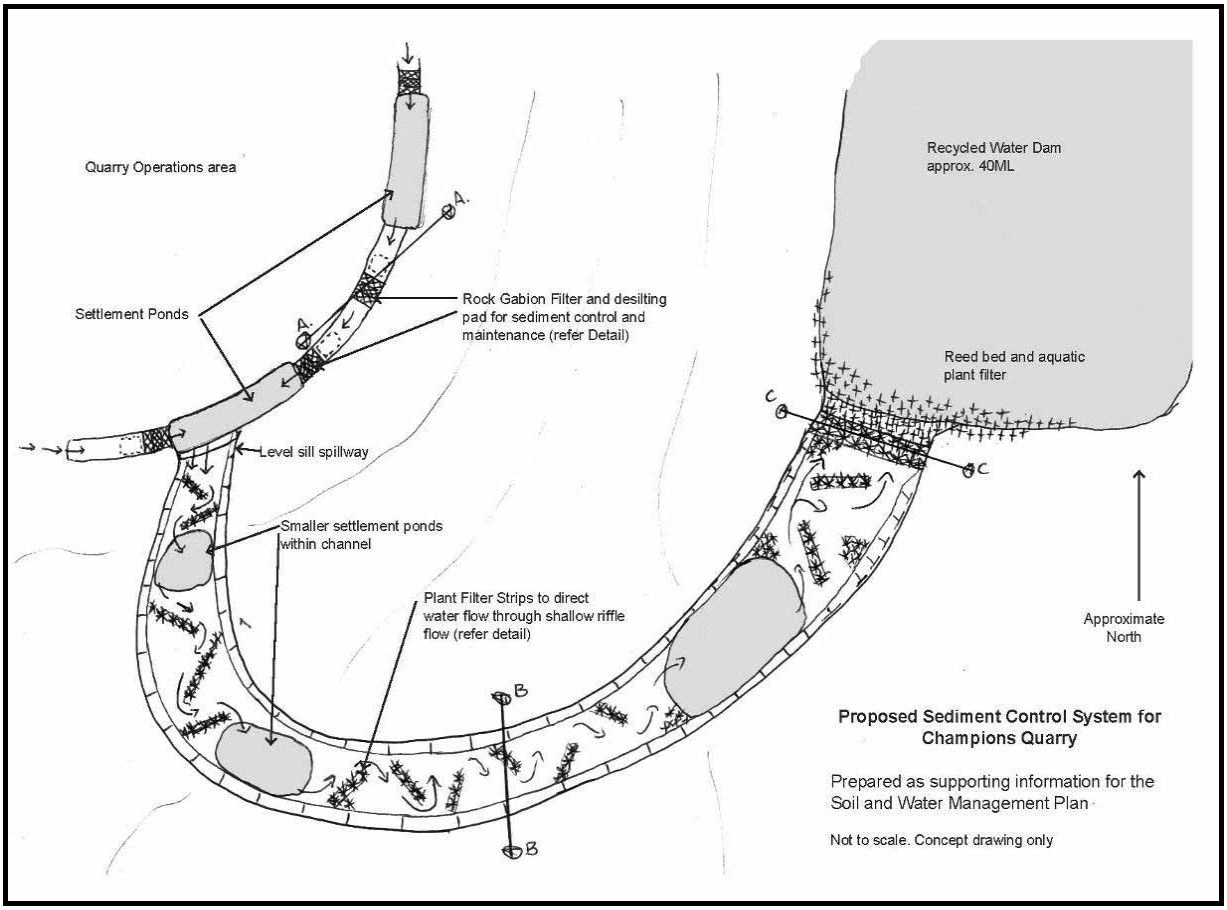

Figure 8.4 Indicative Sediment Control System

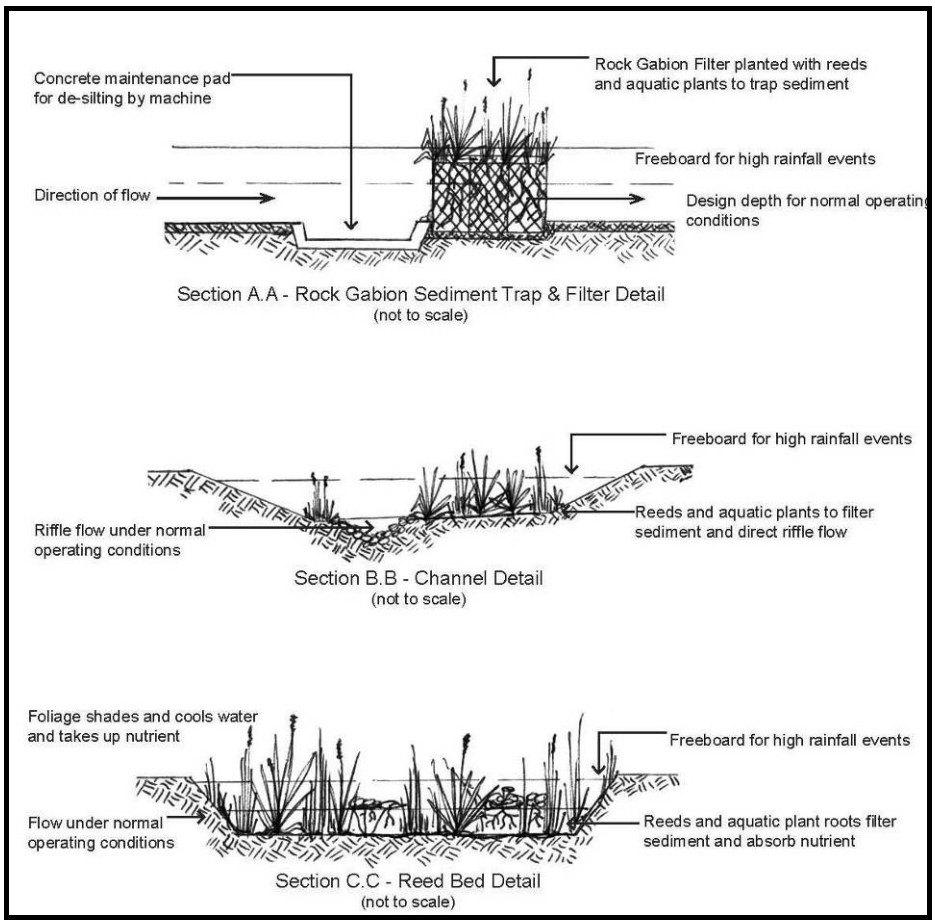

Figure 8.5– Indicative Sediment Control System

All potentially contaminating materials used or stored on the site during quarrying activities will be prevented from entering the groundwater or surface water systems. This will be achieved through storage in designated bunded areas (i.e. internally bunded shipping containers).

Provision of spill kits and training of site personnel in their use will ensure that in the event of any spills appropriate action can be taken rapidly to prevent and minimise impacts to surface waters or groundwater. Wherever possible, activities that have potential for spills will be located in areas that drain to the pit; otherwise appropriate safeguards and spill containment facilities will be installed.

8.4.9 Surface Water Monitoring

An operational surface water monitoring program will be designed and implemented as part of the quarry environmental management procedures. Water quality monitoring is proposed to be undertaken as outlined below on an ongoing basis. This monitoring will be refined where necessary based on the results of previous monitoring and ongoing quarry operations.

Objectives

Surface water quality monitoring will comprise sample collection and testing by a National Association of Testing Authorities (NATA) registered laboratory and will provide a mechanism to:

- ensure the quarry is operating as anticipated with respect to water quality protection;
- assess the effectiveness of site water management strategies in protecting downstream water quality;
- identify any unforseen impacts from the quarry operations;
- implement measures to prevent any as yet unforseen impacts from the scheme; and
- verify that the quarry is achieving its environmental objectives.

Sampling Locations and Frequency

Water quality monitoring will be undertaken within the tributary of Tucki Tucki Creek or within Tucki Tucki Creek itself at a point immediately upstream and downstream of Tucki Tucki Creek to confirm that site operations are not impacting receiving waters.

Monitoring will initially be undertaken on a regular (i.e. quarterly) basis with additional monitoring following known discharges from the site. It is likely, given the dry conditions of the drainage channel on-site, that samples would only be able to be collected following rain events. After an initial sampling period to understand the existing water quality, monitoring frequency may be reduced to (say) half yearly, provided water quality meets the performance criteria. Monitoring will be commenced immediately upon Project approval to gain an ongoing understanding of water quality in the tributary from the proposed quarry operations.

The Water Reuse Dam will be monitored regularly (i.e. weekly at minimum) for pH to identify any trends toward acidic conditions. Discharge water quality monitoring will also be conducted in the dam and the downstream reed beds. This will be undertaken to ensure all water discharged from the *Project Area* meets the relevant DECCW water quality criteria (i.e. for pH and suspended solids).

Surface Water Monitoring Parameters

A comprehensive suite of water quality parameters will be monitored initially to assist in gaining a comprehensive understanding of existing water quality conditions. Once the critical water quality parameters have been determined, regular monitoring will focus on these and the frequency of comprehensive

monitoring will be reduced. The key water quality parameters for testing will to include pH, electrical conductivity (salinity), total suspended solids, and oil and grease (hydrocarbons) and selected heavy metals.

It is noted that heavy metals are not an expected feature of the identified sandstone resource. Geochemical investigation undertaken on sand materials from the site (refer *Appendix B*) have demonstrated the presence of iron oxide coated grains of sand. Some of this iron may be displaced during sand washing process and returned to the *Water Reuse Dam* where it will be expected to settle out in sediments. As such, iron levels in any water discharges would not be expected to be in exceedance of the relevant water quality criteria for the protection of receiving waters.

As previously noted, the presence of thin veins of material containing pyrite in one core sample (refer Coffey Geotechnics, 2008 as provided in *Appendix B*) is a potential very minor source for generation of AMD. Given the relatively small amount material potentially containing pyrite in relation to the whole sandstone resource, and as all *Project Area* water is to be collected for reuse, monitoring and treatment (if required), it is concluded that AMD will not be a significant issue at the quarry.

Specific parameters (i.e. pH) may need to be reviewed during the monitoring program to evaluate the optimum outcome for the water quality of discharge waters. It is noted that the pH of nearby soil and receiving waters are mildly acidic.

As discussed in a letter from Professor Ian White FTSE the natural acidic soil conditions encountered at the *Project Site* and the subsequent influence on runoff may require that maintenance of ambient condition is the preferred water quality goal (refer *Annex I* for letter and Soiltec soil testing report). As stated in the letter adjusting the pH to neutral conditions may result in unintended impacts on down stream aquatic ecosystems.

Performance Criteria

Results of the surface water quality monitoring will be compared to guideline values provided in *Australian and New Zealand Guidelines for Fresh and Marine Waters Quality* (ANZECC & ARMCANZ, 2000). Should any sample fail to meet these guidelines further assessment and/or quarry management may be required to ascertain the reason(s) for failure and initiate remedial measures to correct any problems identified. Additional testing may also be required to confirm the effectiveness of remedial actions. It is noted that in some cases (i.e. pH) the performance criteria may need to be established on a site specific basis to reflect source and receiving soil and water conditions.

Specific parameters (i.e. pH) may need to be reviewed during the monitoring program to evaluate the optimum outcome for the water quality of discharge waters. It is noted that the pH of nearby receiving water are generally mildly acidic. As discussed in a letter from Professor Ian White FTSE the natural

acidic soil conditions encountered at the site (and in the area generally) and the subsequent influence on runoff may require that maintenance of ambient condition is the preferred water quality goal (refer *Annex I* of *Appendix I* for letter and *Soiltec* soil testing report). As stated in the letter adjusting the pH to neutral conditions may result in unintended impacts on down stream aquatic ecosystems.

Any water discharged to the receiving water courses from the operational *Project Area* will be required to meet DECCW requirements for water quality as defined in an *Environmental Protection Licence* under the provisions of the Protection of the Environment Operations Act 1997.

8.4.10 Summary

The proposed Surface Water Management System has been designed taking into account the regional setting and climatic conditions, the *Project Area* and *Project Site* conditions, operational factors and consideration for relevant guidelines, policies and legislation. A conservative approach was taken throughout the design process particularly with regard to the control and detainment of on-site water. The design underwent verification modelling to confirm it will be adequate to meet the water quality and supply requirements for the *Project Area*. The following provides a summary of the system:

- the *Water Storage Dam* will only collect 'clean' water (i.e. not from the *Project Area*) for the purpose of supplementing quarry operational water needs during dryer periods, and as such will be treated as any other on-farm harvestable rights dam;

- the *Water Reuse Dam* will only collect water from the disturbed quarry and operational areas, including all water harvested from the smaller sedimentation ponds located in the *Central Section* and *Southern Section* quarry pits, except during extreme rainfall events;

- the water balance and verification modelling undertaken demonstrates that water demand of the quarry for the majority of the recorded range of local annual rainfall can be met via water collected in the *Water Reuse Dam* alone, which is to be further supplemented by the *Water Supply Dam*;

- the smaller settlement ponds (designed for the 3ha operational areas) have been conservatively designed for primary treatment for the removal of sediment up to the 80th percentile, 5 day rainfall event beyond which drain to the *Water Reuse Dam*. The performance of the settling ponds is to be optimised via harvesting of water for the *Water Reuse Dam* and by regularly removing sediment;

- the water levels in the *Water Reuse Dam* will be managed via operational reuse (including processing and dust suppression), and also via land application on the *Project Site. This* will be undertaken as required to ensure a minimum 6ML of freeboard is available to receive stormwater

runoff from the operational site. Under most operating conditions all operational site water is to be detained on-site for reuse or for land application;

- it is noted that if water quality objectives are satisfied that it is appropriate for water to discharge to the environment (if required);

- based on the need to harvest water for operational purposes and to treat *Project Area* runoff, the proposed *Water reuse Dam* has been shown to be sufficient to control and treat all runoff from the active *Project Area*. It is considered that water quality of discharge from the dam will carry lower pollutant loads (sediment and nutrients) or will be no worse off than under existing conditions; and

- the system for treating *Project Area* runoff has been conservatively modelled and designed assuming 13ha of disturbed area. It is noted that in the early operational stages and as quarry cells are progressively rehabilitated that the actual disturbed area will likely be significantly less at any one time. Where possible runoff from undisturbed or rehabilitated sections of the *Project Area* will be diverted around the *Water Management Systems*.

Based on the above information the proposed Water Management System is considered to be adequate, as it not only accounts for site operational water needs, but provides for conservative design measures for the detaining and treatment of active *Project Area* runoff and washing plant reuse water.

8.5 GROUNDWATER

Geological investigations undertaken encountered groundwater in six boreholes advanced across the site (Coffey Geotechnics, 2007). Relatively high standing water levels were recorded, following a significant rainfall event in excess of 500mm, in the three boreholes that were converted to monitoring wells (BH3, BH5 and BH6, refer *Figure 8.1*).

Hydraulic conductivity analysis results indicate very low recharge rates and low calculated conductivity (K = E^{-7}m/s to E^{-8}m/s) in the four monitoring bores. This suggests that the groundwater encountered is likely to represent shallow perched seepage water in the sandstone.

In the absence of information on groundwater flow data for the site, it can be reasonably assumed that shallow perched groundwater will generally follow the landform and flow in an east to north easterly direction towards the low lying flood plain.

The pH of shallow perched groundwater across the site is slightly to mildly acidic and contains low levels of nutrients and non-organics.

As the quarry expands laterally and vertically it is not expected to intercept the groundwater table. Based on the hydrogeological properties encountered during site investigations, shallow perched groundwater identified within the extraction zones is not expected to result in significant levels of seepage into the quarry pits. This is further supported by the conditions experienced in the existing quarry pit where significant seepage is not encountered. It is considered likely that the extraction of the sandstone resource will result in a lowering of the perched water table profile, with any minor seepage from quarry walls likely to be lost via evaporation.

8.5.1 Groundwater Monitoring

Objectives

Groundwater quality monitoring will comprise water level gauging along with sample collection and testing by a National Association of Testing Authorities (NATA) registered laboratory and will provide a mechanism to:

- ensure the quarry is operating as anticipated with respect to groundwater quality protection;
- gauge the impact (if any) of the groundwater level across the site;
- identify any unforseen impacts from the quarry operations;
- implement measures to prevent any as yet unforseen impacts from the scheme; and
- verify that the quarry is achieving its environmental objectives.

Sampling Locations and Frequency

Groundwater quality monitoring will be undertaken within three (BH3, BH5 and BH6) available cased groundwater bores across and adjacent to the *Project Area*. Monitoring will initially be undertaken on a regular (i.e. quarterly) basis to evaluate the influence of rainfall and quarrying activities on groundwater levels and quality. After an initial sampling period to understand the existing water quality, monitoring frequency may be reduced to (say) half yearly, provided water quality meets the performance criteria.

Monitoring should be commenced immediately upon Project approval to gain an ongoing understanding of water quality in the tributary from the existing quarry operations.

Groundwater Monitoring Parameters

A comprehensive suite of water quality parameters will be monitored initially to assist in gaining a comprehensive understanding of existing water quality conditions. Once the critical site water quality parameters have been determined, regular monitoring will focus on these and the frequency of comprehensive monitoring will be reduced. The key water quality parameters are expected to include pH, electrical conductivity (salinity), and oil and grease (hydrocarbons).

Performance Criteria

Results of the water quality monitoring will be compared to background groundwater quality data. Should the groundwater quality change significantly from the background conditions quarry management will be required to ascertain the reason(s) for failure and initiate remedial measures to correct any problems identified.

8.6 ACID MINE DRAINAGE (AMD)

8.6.1 Impact Assessment

There exists what is expected to be minor potential for AMD at the site. Geotechnical assessment identified veins containing pyrite at the site are considered very minor (to insignificant) due to their thickness in relation to the total sandstone resource. In addition, they were only identified in one of the four drilling cores located in the proposed *Southern Section* extraction area (at BH5 located to the west).

It is noted that heavy metals are not a feature of the sandstone resource and as such are not expected to present a significant issue with regard to mobilisation.

8.6.2 Mitigation Measures

As all operational site runoff is to be contained within the *Project Area*, the Water Reuse Dam will provide a means for capturing and treating (if required) any AMD. In order to prevent the generation of AMD, where possible material from the very thin veins containing pyrite will be separated, excavated and stockpiled for treatment. Given the inconsistency and thinness of these veins, this may not always be practical, however the simple extraction methods utilised at the quarry does allow for this management strategy to be implemented where possible.

Where pyrite material can be separated it will be stored with the *Project Area* (and hence within the Water Management System) and be immediately

covered with clay overburden sourced from the *Project Area*. This will limit the potential for oxidation and aim to prevent the production of AMD. The storage area, to be contained with the quarry pit, will be monitored and where AMD is detected Aglime (or equivalent) will be used to neutralise the materials.

In addition to the above, the Water Reuse Dam will be regularly monitored for pH to ensure AMD is not creating acidic conditions. If the pH of the Water Reuse Dam is outside relevant discharge criteria, Aglime ($CaCO_3$) (or equivalent) will need to be broadcast over the dam in order to raise the pH. Monitoring of the Water Reuse Dam is discussed further in *Section 8.4*. To retain design capacity, options for discharge from the Water Reuse Dam include on-site irrigation over the wider *Project Site*, and/or discharge downstream once monitoring confirms dam water is shown to meet DECCW discharge criteria. Management of the Water Reuse Dam is discussed in *Section 8.4*.

9 NOISE

A detailed Noise Impact Assessment was undertaken by ERM to assess the potential noise impacts of the proposed expansion of Champions Quarry on the surrounding environment. This report is summarised below, with a complete version provided within *Appendix D*.

9.1 INTRODUCTION

The noise assessment considered the following:

- potential noise impact at noise assessment locations from proposed operation noise from the quarry using a range of operational "worst case" scenario; and
- potential noise impact at noise assessment locations due to increased traffic flows to and from the quarry expansion.

As no blasting is proposed to be undertaken at any stage of quarrying operations, a blast impact assessment has not been undertaken.

Noise modelling was conducted in accordance with the Environmental Noise Model (ENM). Guidelines utilized for the noise assessment as required by the Department of Environment, Climate Change and Water (DECCW) include the Environmental Criteria for Road Traffic Noise (ECRTN) (1999), Industrial Noise Policy (INP) (2000) and the Australian and New Zealand Environment and Conservation Councils (ANZECC) Guidelines to Minimise Annoyance Due to Blasting Over

9.2 QUARRYING OPERATIONS

9.2.1 Methodology

Four residential properties were identified as being potentially affected by noise associated with the quarry expansion and were designated as *Noise Assessment Locations (NAL) 1* to *4* in *Appendix D*. Their locations are illustrated within *Figure 9.1*below.

Legend

- 4 — Noise Assessment Location
- 1 — Noise Logger Location
- — — Extent of Quarry Extraction and Operations (Project Area)

Figure 9.1

Sensitive Receptor Locations

Client:	Champions Quarry	
Project:	Champions Quarry Expansion	
Drawing No:	0098287pm_GIS_Noise_2.1	
Date:	25/08/2009	Drawing size: A4
Drawn by:	AM	Reviewed by: WW
Source:	-	
Scale:	Refer to Scale Bar	

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0 100 200 300m

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Nine noise modelling scenarios including six base operation scenarios were created for the assessment:

A. *Model Validation/Existing Operations Scenario* is representative of the operations measured during model validation and is also representative of the typical existing operations. Plant equipment has been modelled in the *Central Section* pit at the existing pit depth.

B. *Central Section Scenario* is as per *Existing Operation* scenario but includes a dozer and excavator operating in the *Central Section* pit area and road trucks collecting product.

C. *Central Section Processing Operations Scenario* is representative of crushing, screening and washing of the extracted material in the *Central Section*. This will be undertaken separately to extractive works and has therefore been modelled separately. Processing plant has been located at the western end of the *Central Section* pit.

D. *Southern Section Processing Scenario* is representative of crushing and/or screening of the extracted material in the southern section. This will be undertaken separately to extractive works and has therefore been modelled separately. Processing plant has been located at the north western cell of the southern pit.

E. *Southern Section: Overburden Stripping Scenario* is indicative of the first three to six months (approximately) of operation that will be undertaken in the initial 3 ha cells, at the surface whilst overburden stripping occurs. Shielding will be provided by earth bunds directly adjacent to items of plant during this period. Noise levels will be progressively reduced as topsoil bunding and quarry benches are increased in height. The extractive equipment is located in the north western edge of the *Southern Section,* which is where the overburden stripping will be most exposed to residences (NAL 4 in particular).

F. *Southern Section Scenario* is indicative of the operations in 5 to 10 years once the benching has been established. Extractive plant is generally located in the pit, which will provide shielding from noise at the assessment locations. A dump truck is moving material between the pits on the haul road between the *Central* and *Southern Section* pits. There are road trucks in both *Central* and *Southern Section* pits being loaded with material.

G. *Processing and Extraction Scenario* represents a combination of Scenarios C and F, combining extractive plant located in the southern pit and crushing and processing being undertaken simultaneously within the *Central Section* processing area.

H. *Rock Hammer operation* represents a combination of *Scenario F* with a rock hammer being utilised in the central pit;

I. *Rock Saw operation* represents a combination of *Scenario F* with a rock saw being used in the central pit.

All equipment described within this EA has been included within the modelling, with a detailed outline of which particular item of plant has been used in which modelling scenario included within *Table 9.1*.

Based on the analysis of all noise sources, and in particular the impact hammer and rock saw, the modifying factors contained in the INP were not deemed applicable.

9.2.2 Results

An initial noise model was developed. This included no mitigation measures and is provided below.

Table 9.1 Noise Modelling Summary

Assessment Location	Predicted Daytime $L_{eq,15minute}$ Noise Levels, dB(A)								
	B	**C**	**D**	**E**	**F**	**G**	**H**	**I**	***PSNC***
NAL 1	33	31	30	32	33	35	35	34	*40*
NAL 2	**42**	**41**	35	**38**	**40**	**44**	**43**	**41**	*37*
NAL 3	34	36	34	34	**38**	**40**	**40**	**39**	*37*
NAL 4	**42**	40	38	**43**	**44**	**46**	**44**	**44**	*40*

Note : Exceedences of the PSNC are in BOLD

Following the identification of a number exceedances of the Project Specific Noise Criteria, a model which included the provision of extensive bunding, as shown within *Figure 9.2.* The modelling results are presented below.

Table 9.2 Noise Modelling Summary

Assessment Location	Predicted Daytime $L_{eq,15minute}$ Noise Levels, dB(A)								
	B	**C**	**D**	**E**	**F**	**G**	*H*	*I*	***PSNC***
NAL 1	28	26	30	29	30	31	35	31	*40*
NAL 2	32	35	34	33	34	**38**	**39**	36	*37*
NAL 3	32	34	34	33	33	37	**39**	35	*37*
NAL 4	37	33	38	36	36	38	39	37	*40*

Note : Exceedences of the PSNC are in BOLD

Modelling identifies a 1 dBA exceedance at *NAL 2* for *Scenario G,* which is acoustically insignificant, especially considering the 2 dBA tolerance shown in the model validation (*See Section 6.5 of Appendix D*).

These results also indicate that the noise levels associated with the use of the rock hammer will result in exceedances of the PSNL for receivers NAL2 and NAL3 by 2 dBA. Using the rock hammer (with noise control) in isolation from other plant would remove the cumulative noise impacts on neighbouring receivers. *Table 9.3* presents the results of modelling showing the rock hammer working in isolation (i.e. no other plant working in tandem with rock breaking).

Table 9.3 Revised Noise Modelling Summary– Rock hammer Only (with mitigation)

Assessment Location	**Predicted Daytime $L_{eq,15minute}$ Noise Levels, dB(A)**	
	H	***PSNC***
NAL 1	33	*40*
NAL 2	37	*37*
NAL 3	**38**	*37*
NAL 4	35	*40*

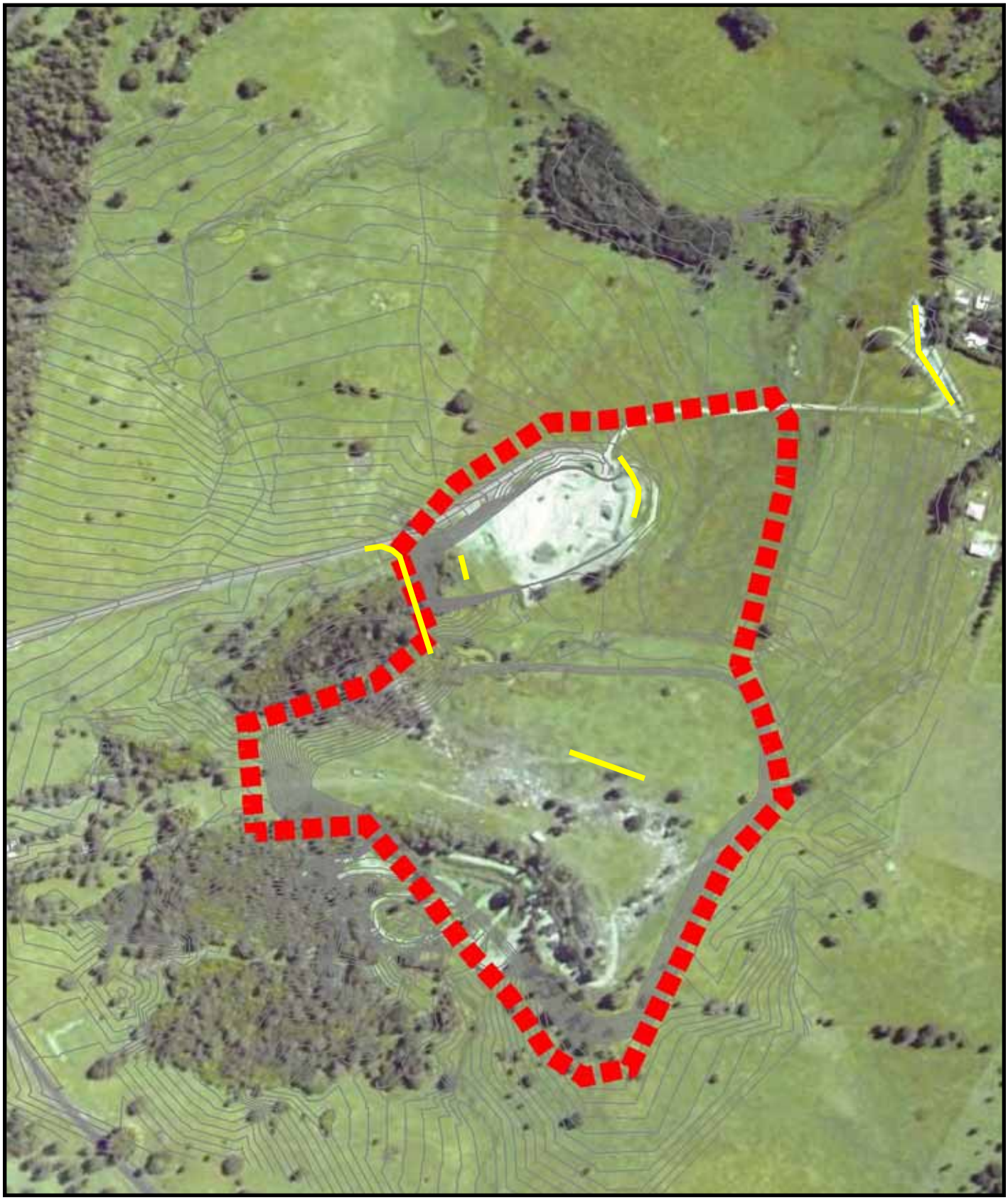
Note : Exceedances of the PSNC are in BOLD

The above results indicate that it would be preferable to use a rock saw for sandstone quarrying as the resulting noise impacts are below the PSNC for all criteria. Notwithstanding this, if the rock hammer (with mitigation) is used in isolation the project specific noise criteria would be met at all receptors, with the exception of NAL3 where a 1dBA exceedance is identified, which is within the noise modelling resolution.

To further ameliorate any impacts associated with the rock hammer and rock saw, it is proposed to implement the following mitigation measures:

- no other on-site plant is to be operational when the rock saw or rock hammer is in use;
- use of the rock hammer to be limited to between 9:00am to 12.00pm and 2.00pm to 4.00pm; and
- in-situ noise monitoring of the operational rock hammer to take place to verify results of the model and to determine success of mitigation measures to be implemented.

In consideration of the application of modifying factors as outlined in *Section 4* of the INP (2000), it is noted that in the event that the rock hammer and/or saw were to be used, any adjustment for intermittent noise would be applied for night-time periods only. The proposed quarrying would be undertaken during the hours of 7:00am-5:30pm weekdays and 7:30am -3pm Saturdays, and therefore the modifying factor would not be applied.



Legend

Noise Control Bund Locations

Extent of Quarry Extraction and Operations (Project Area)

Figure 9.2

Noise Control and Bund Locations

Client:	Champions Quarry	
Project:	Champions Quarry Expansion	
Drawing No:	0098287pm_GIS_Noise_6.1	
Date:	25/08/2009	Drawing size: A4
Drawn by:	AM	Reviewed by: WW
Source:	-	
Scale:	Refer to Scale Bar	

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0 100 200 300m

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9.3 ROAD TRAFFIC NOISE

The haul trucks enter and leave Champions Quarry via Wyrallah Road. The existing operations (as per *DA 2005/999)* had an average of 11 truck loads leaving the quarry per day. The proposed expansion is expected to increase to an average of 30 truck loads leaving the quarry each day with approximately 50% travelling north and 50% travelling south. The truck movements are between 7.00am and 5.30pm Weekdays and 7.30am and 3.00pm Saturdays during the operational hours of the quarry.

Noise assessment locations 1 and 4 are representative of the most exposed residences to Wyrallah Road and are both located approximately 20 metres from the road.

Traffic noise has been modelled using the Calculation of Road Traffic Noise (CoRTN). All noise predictions have been made to 1 metre in front of the most exposed façade of a dwelling, at a height of 1.5 metres above floor level.

The contribution from non-site related traffic on Wyrallah Road has been calculated at 64dB(A) L_{eq15hr} for location 1 and 4, based on a daily traffic volume of 2640 vehicles per day (*Roadnet Traffic Impact Study, Appendix F*). The contribution from site vehicles has been calculated at 56dB(A) L_{eq15hr} for location 1 and 4, based on 30 trucks leaving the quarry per day. The total combined road traffic noise level is 64dB(A) L_{eq15hr}. This complies with ECRTN criteria as site related traffic noise on Wyrallah Road will not increase existing road traffic noise on average over a 15-hour period.

9.4 MITIGATION MEASURES

In addition to the provision of bunding as shown in *Figure 9.2*, a number of other noise controls will be. These measures are summarised as follows:

- the operating hours of the quarry are restricted from 7am to 5.30pm. This time restriction prevents noise emissions during the evening and night periods, at which time background noise levels are lower. It also avoids potential sleep disturbance to the residents;
- road traffic noise created by the haul trucks accessing the site is ameliorated by imposing a speed limit of 30km/h and prohibiting haul trucks from using compression braking on-site;
- effective placement and stockpiling of product so that where possible, plant equipment can be working behind stockpiles;
- a 4m earth bund adjacent to plant that is not shielded by permanent bunding;
- modern, well maintained industrial equipment will be used;

- plant operations personnel will undergo induction training into best practice quarry operations (i.e. lean manufacturing training), the benefits of which help to minimise unnecessary noise emissions from plant equipment;
- for compliance purposes, attended noise monitoring (at established permanent noise assessment locations) and plant equipment audits will be undertaken on an annual basis; and
- sealing of the main access road from the site entrance intersection to the *Central Section* pit and to the southern pit after 12 months.

Noise experienced at sensitive receivers is expected to be progressively reduced as the quarry expansion proceeds, through implementation of the following measures:

- plant is to be progressively moved in-pit where the pit walls will act to shield receiver locations from noise generated;
- plant will be relocated to greater pit depths throughout the life of the quarry to further reduce noise at receiver locations;
- the earth bund adjacent to the existing pit will be progressively increased in height and consequently increase shielding to the residences nearest to the quarry; and
- no additional noise producing activities, plant or equipment will be introduced at the site.

To further ameliorate any impacts associated with the rock hammer and rock saw, it is proposed to implement the following mitigation measures:

- no other plant is to be operational when the rock saw or rock hammer is in use;
- use of the rock hammer to be limited to between 9:00am to 12.00pm and 2.00pm to 4.00pm; and
- in-situ noise monitoring of the operational rock hammer to take place to verify results of the modelling and to determine success of mitigation measures.

By adopting the above management measures, noise emissions from the quarry are expected to be controlled.

10 AIR QUALITY

10.1 INTRODUCTION

A detailed Air Quality Assessment was undertaken by Environmental Resources Management Australia for the proposed expansion of Champions Quarry. The report is provided as *Appendix E*, with this Chapter providing a summary of the key findings of the investigation.

10.2 GENERAL APPROACH TO AIR QUALITY ASSESSMENT

A Level 2 impact assessment, as described by the NSW DECCW (DECC, 2005) was carried out to determine potential impacts from the quarry expansion, this is a realistic and comprehensive assessment based on site specific input data.

A typical Level 2 air quality impact assessment study for a large scale development involves the gathering, processing and presentation of information on:

- emission source details such as types, locations, dimensions, flow characteristics and rates of contaminant release to the atmosphere. Identification of significant or potentially significant contaminants is required, based on their expected rates of release and inherent properties to potentially cause environmental harm;
- meteorological conditions, which affect the dispersion of contaminant plumes released into the atmosphere;
- local geographical details such as topography and surface characteristics including land use and vegetation types;
- the existing levels of selected contaminants in the receiving environment;
- predicted future ambient concentrations, taking into account the existing baseline conditions. The prediction of ambient (usually ground-level) concentrations requires the use of mathematical models that simulate the release and dispersion of contaminant plumes;
- a basis for determining whether predicted contaminant concentrations are acceptable. This generally involves the use of air quality guidelines prepared by the relevant regulatory authorities; and
- measures incorporated into the design and/or management of the proposed development to mitigate air quality impacts, and in particular to mitigate the risks of adverse impacts under abnormal operating conditions.

The key contaminants considered in this assessment are:

- total suspended particulates (TSP);
- particulate matter less than 10 microns (PM_{10}); and
- deposited dust.

10.3 METEOROLOGY

Data on wind speed, wind direction and ambient temperature from an Automatic Weather Station (AWS) at Casino 20km to west was gathered and used for modelling using the AUSPLUME program.

Long-term climate data on temperature and rainfall was soured from the Bureau of Meteorology (BoM) weather station in Lismore, approximately 16km to the north of the site. On average, January is the warmest month in Lismore with a mean daily maximum of 29.9ºC. The coolest month is July with a mean daily minimum temperature of 6.5ºC. The mean annual rainfall at Lismore is 1343.1 mm. The mean number of rain days annually over this period is 104.4 days. On average, March is the wettest month with a mean monthly rainfall of 188.4 mm, while September is the driest month with an average of 50.4 mm.

10.4 EXISTING AIR QUALITY AND IMPACTS

10.4.1 Existing Monitoring

A review of the State of the Environment Report (SOE) for the Lismore City Council (2004) indicated that the Shire did not undertake any air monitoring within the reporting period (July 2003/June 2004) and therefore definitive statements based on monitoring data within the region cannot be made.

A desktop review of the National Pollutant Inventory (NPI) of reported emissions from fixed and mobile sources in the vicinity of the site was also undertaken to obtain an indication of existing industries in the project area. No facilities within the Lismore region are reporting emissions of particulate matter under the NPI reporting scheme.

10.4.2 Concentration

The NSW DECCW does not monitor particulate matter in Lismore or the surrounding region. In the absence of site specific background data, particular in the form of PM_{10} recorded through a TEOM in Tamworth approximately 300km southwest of the site, has been used as a 'worst case'.

The Tamworth monitoring data, in the absence of data recorded at Lismore, is anticipated to represent elevated concentrations of particulate matter due to the proximity of rural industrial and transport sources. The use of this data is therefore considered a 'high' background PM_{10} concentration.

The Tamworth station records 24-hour concentrations of PM_{10}; daily data for 2004 has been provided by the NSW DECCW in order to undertake a contemporaneous assessment of 24 hour PM_{10} cumulative concentrations, in accordance with the NSW DECCW Approved Methods (DECC, 2005).

To undertake a cumulative assessment of annual PM_{10} ground level concentrations, the annual average of the 24 hour Tamworth records has been used. This gives a background concentration of 20.7µg/m^3.

A background concentration for TSP has been estimated at 52.9 µg/m^3, based on a particle size distribution with PM_{10} being approximately 39.1% of TSP.

10.4.3 Deposition

There is no dust deposition monitoring program currently undertaken in the vicinity of the site. No public information regarding background dust deposition levels in the Lismore region. The site is located in a well vegetated agricultural area, as such it is anticipated that background dust deposition levels will be low, and a cumulative assessment of dust deposition has not been undertaken.

10.5 ESTIMATED EMISSIONS

Particulate emissions are anticipated to arise from the following activities at the quarry;

- bulldozers working on topsoil, overburden, and sandstone material;
- loading unprocessed sandstone to haul and road trucks;
- transfer of unprocessed material to the washing and screening plant;
- wheel generated dust from road trucks, and on site haul trucks; and
- wind generated dust from exposed areas and stockpiles.

Emissions have been estimated using published emission factors from the Australian National Pollutant Inventory (NPI) emission estimation technique manual for Mining and Processing of Non-metallic Materials (2000), and the US EPA AP 42 document 'Compilation of Air Pollutant Emission Factors'.

Modelling was undertaken using the AUSPLUME v6.0 program as approved by the DECCW within "*Approved Methods and Guidelines for the Modelling and Assessment of Air Pollutants in NSW*" (DEC 2005). Modelling parameters used within AUSPLUME include:

- roughness height;
- meteorological data;
- terrain;
- wind profile elements;
- sensitive receiver locations;
- background concentrations;
- building wakes; and
- particle size distribution.

The results presented in *Appendix E* show that the predicted impact of increased throughput at the proposed development are below the NSW DECCW nominated criteria.

In addition, the concentration contours presented in *Appendix E* below show that the predicted concentrations are localised around the site and decrease rapidly with distance from the site.

The predicted incremental ground level dust deposition rates comply with the NSW assessment criterion of an increment of 2g/m^2/month at modeled sensitive receptors. The maximum predicted increment was 0.13 g/m^2/month, which represents 6.4% of the incremental criteria. Dispersion modeling of dust deposition has included atmospheric dry depletion.

10.6 MITIGATION MEASURES

A number of management measures are already in place and proposed as part of the expansion of operations to reduce the generation of particulate emissions. These measures are outlined below:

Nature of the Material

The sandstone being extracted is 'soft sandstone' and therefore its inherent properties reduce potential for dust emissions to atmosphere compared to other extracted materials. It is high in moisture (estimated at 8%), and low in silt (1%).

Watering Of Haul Roads

The main site access road is to be sealed and is not anticipated to be a source of dust emissions. Within the site there is one haulage road which connects the main quarry pit with the processing area this haul routes will be laid with gravel on top of a sandstone roadbase. This road base will have a higher moisture content and a lower silt content than a standard dirt road. In addition a water tanker will be used to maintain a watering rate of 3L/m^2/minute.

Management of Exposed Areas

Exposed areas will consist of one quarry area up to a maximum of 9 hectares in area and the existing processing area (~1.5 hectares). These constitute a maximum – and this has formed the basis of the modelling assessment – and site operations will minimise exposed areas.

In addition overburden and top soil will be used to develop bunds around the cells providing a 'wind shield' for parts of the exposed cell.

The overburden used to create bunds will be vegetated to minimise dust emissions and will be retained for future rehabilitation of the site. Remaining topsoil and overburden will be kept as material for sale or used for rehabilitation.

Storage Areas

Storage bays in the processing area will be used to store processed material and aggregate.

Offsite Transport

Current practice requires all road trucks to have tarpaulin covers in place prior to leaving the site.

10.7 CONCLUSIONS

The air quality assessment of the proposed expansion of the sandstone quarry highlights that the proposed operations as modelled would meet the NSW DECCW air quality impact criteria for PM_{10} and TSP short and long-term averages and dust deposition.

11 ABORIGINAL HERITAGE

11.1 INTRODUCTION

A detailed Aboriginal Heritage Assessment was previously undertaken by Everick Heritage Consultants Pty Ltd in 2008 and is provided as *Appendix G*. This report was adequately undertaken and has been reviewed by the DECCW. However, ERM undertook additional works considered necessary for the Part 3A process, in particular adherence to the DECCW's Interim consultation guidelines (*Appendix H*). These guidelines ensure all relevant Aboriginal stakeholder groups have the opportunity to identify any heritage issues or concerns they may have with the proposed expansion of Champions Quarry.

The DGR's specified five aspects of Aboriginal cultural heritage that should be addressed by the Environmental Assessment:

- follow the "Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation;
- identify nature and extent for impacts on Aboriginal cultural heritage values across the project area;
- the extent and significance of the site assessed and avoidance of disturbance of the of the site preferred;
- describe action of avoidance of mitigation to impacts or compensate for unavoidable impacts; and
- demonstrate the effective community consultation undertaken with the Aboriginal communities.

11.2 BACKGROUND RESEARCH AND CONSULTATION

In 2007/08 Everick undertook an Indigenous and non-Indigenous heritage assessment at Champions Quarry. For the assessment two sets of fieldwork, with two Aboriginal Community Elders, was undertaken. The first fieldwork was undertaken with Dean Bolt from Ngulingah Local Aboriginal Land Council (NLALC) on 7 November 2007. The first survey found no evidence of Aboriginal occupation and this is reiterated in the letter dated 21 January 2008 from Dallas Donnelly (acting CEO) of NLALC. The NLALC letter stated that two additional individuals may hold information on the area: Mr Murray John Roberts and Mr. Sheldon Harrington.

As a result Mr Murray John Roberts was contacted and an additional fieldwork day undertaken on 15 February 2008. The result of this consultation was an offer by the applicant that two 3 ha extraction cells would have a precautionary survey after approval and prior to commencement of quarrying activities including topsoil removal.

The 2008 Everick report found no Aboriginal heritage sites within the study area. It recommended further heritage work, as described above, to be undertaken with Murray John Roberts.

As part of the previous Development Application (DA) process the Everick report underwent review by the DECCW. The review found the report adequate. Therefore, the only additional task was for ERM to undertake is the appropriate level of Aboriginal community consultation in line with the DECCW's *Interim Community Consultation Guidelines,* as required by the EARs for the Part 3A application.

Each group that was initially identified during the Everick report was provided with a written letter, by post and email, between 24 April 2009 and 1 May 2009, stating that ERM were updating the consultation process for this project and was interested in registering Aboriginal community groups for involvement. Registration for involvement in the process was received from the following groups:

- Ngulingah Local Aboriginal Land Council;
- Dianne Harrington;
- Jenny Smith;
- Tracey King; and
- Auntie Patricia Cook.

11.3 SITE SURVEY

A site meeting and survey commenced at 10.00am on 19 May 2009 at the entrance to Champions Quarry. One community representative attended the meeting, Mr John Roberts who declined an offer to inspect the quarry site and wider farm area.

The main concern voiced by the Aboriginal representative, Mr Murray John Roberts, was a lack of ethnographic and wider survey in the area. There were several sites referred to, including the Tucki Tucki Bora Ring, and springs and camp sites that are known to have special Aboriginal significance in the area, but not specifically on the subject site.

Another issue raised during conversations with Murray John Roberts was the potential for Aboriginal burials in the area. While John was not willing during this meeting to walk on the subject site he indicated it may contain burials, his belief is that there is local oral tradition suggesting that Aboriginal burials are present across the wider area.

The option of probing the ground prior to extraction was discussed. Probing can evaluate if there is the likely hood of burial in the area (through determining the depth of topsoil above the bedrock). If any areas of with potential burial were located there destruction could be mitigated, limiting the potential of chance finds of burials. It was agreed that a methodology for probe testing of the site be developed and distributed to the Aboriginal community for comment.

11.4 PROBE TESTING

The probe methodology (as outlined in *Appendix H*) was sent to all registered community groups on 5 June 2009. A follow up phone call or email was made or sent to the community member on 24 June 2009 to gain community responses.

Only one response was received. This response is included in *Appendix H*. It posed a series of questions of the project and suggested that there was little top soil left in which burials could be located.

11.5 COMMENTS ON REPORT

A draft copy of this report was made available to all registered stake holders in accordance with the DECCW guidelines. Two responses were received, the first from Mr Murray John Roberts (on NLALC letter head) in which he raised a number of issues regarding the consultation process, the failure of the report to recognise the importance of the site to the broader cultural landscape, and states that there are indeed Aboriginal burials on the site. These concerns were also raised in correspondence received from the Environmental Defenders Office submitted on behalf of the NLALC. Both letters are provided within *Appendix H*. The issues raised within these separate pieces of communication are addressed in *Section 11.6*.

11.6 COMMUNITY CONSULTATION OUTCOMES

The outcomes of the community consultation undertaken for this project have shown that there is some disagreement within the Aboriginal community on the potential for the study area to contain Aboriginal burials.

It can be confirmed that there are no previously recorded Aboriginal sites within the *Project Site*. The formal heritage assessment of the study area determined that no new archaeological sites were identified.

Table 1.1 and *Table 1.2* within *Appendix H* provide detailed responses to all matters raised by Mr Murray John Roberts, the NLALC and the Environmental Defenders Office.

In looking at these matters, DECCW stated during adequacy assessment of the overall Environmental Assessment (EA) report that given the differences of opinion that exist regarding the potential for sites and site types within the area, it is imperative that the proponent makes every effort to discuss with the local Aboriginal community the implications of the cultural heritage context for the Project.

The proponent extended an invitation to Mr Roberts to discuss matters raised during the course of the consultation. Additionally, correspondence from Mr Roberts and the Environmental Defenders Office requested meetings be held with the NLALC, the proponent and the Department of Planning to investigate further Aboriginal heritage impacts from the proposed quarry expansion. ERM considers that involvement of the Department of Planning during the impact assessment phase is improper as it is the role of the Department to assess independently prepared documents, not aid in their preparation. However an invitation was put forward to the Department of Planning to attend a meeting. The Department of Planning declined the offer of a meeting. Subsequently, Mr Roberts, the NLALC and the Environmental Defenders Office have refused to meet with the proponent and ERM.

An assessment of the geotechnical work (Coffey 2008) and prior archaeological reports discussing Aboriginal burials in the region, indicates that there is no scientific reasoning for the probe testing. The bore hole logs and a site walk over have shown that there is very little intact soil horizons remaining. Erosion of the soil horizons across the study area suggest that there is little to no potential for stone tools or any other Aboriginal site types to be present in the study area.

Therefore, on scientific grounds and following an absence of Aboriginal community support for the probe testing, it is considered that further impact assessment in the form of probe testing is not required.

11.7 MANAGEMENT AND MITIGATION MEASURES

The following recommendations are made in light of the findings of the survey undertaken, the background research, the predictive modelling, and the relevant NSW legislation protecting historic and Aboriginal heritage.

The geotechnical conditions at the *Project Area* and prior archaeological reports discussing Aboriginal burials in the region, indicates that there is no scientific reasoning to expect burials within the proposed quarry expansion area.

All Champions Quarry workers should be informed regarding potential Aboriginal heritage sites and objects, prior to all work commencing. In the event of any Aboriginal heritage sites and/or objects being uncovered during the course of clearing or excavation of the site, all sites works within the vicinity of the find are to cease and the Local Aboriginal Land Council and a qualified archaeologist should be contacted.

DECCW has recommended that an Aboriginal Cultural Heritage Management Plan be developed in consultation with community stakeholders. This plan is to outline proposed management and mitigation measures in the event that Aboriginal burials or objects are located during the development works. To date, the key identified stakeholders, through the EDO, have refused further meetings to progress any Aboriginal cultural heritage matters. It is recommend that the proponent commit to developing such a plan and undertake further consultation.

The Aboriginal Cultural Heritage Management Plan should include:

- a description of the measures that would be implemented to salvage any identified chance find Aboriginal sites within the disturbance area;

- description of the measures that would be implemented to protect any Aboriginal sites identified within the *Project Site* outside of the disturbance area; and

- a description of the measures that would be implemented if any new Aboriginal objects or skeletal remains are discovered during the project.

An example concept flow chart of burial management protocols that should be contained in the plan is provided within *Appendix H*.

12 WASTE MANAGEMENT

12.1 INTRODUCTION

This section investigates the expected waste generation and subsequent waste management of the operation of the expanded Champions Quarry. Opportunities for waste recycling and reuse are identified, as well as methods for disposal for waste streams that cannot be effectively reused.

The Sustainability Programs Division of the DECCW has responsibility for initiating waste avoidance and resource recovery strategies as a method of ensuring ecological sustainability.

The primary objectives of these schemes are to:

- minimise the consumption of natural resources;
- encourage resource recovery, including reuse, recycling and energy recovery;
- provide for continual reduction in waste generation; and
- minimise the final disposal of waste.

The NSW Waste Management hierarchy will be incorporated into the waste reduction and resource recovery strategies for the operation of the quarry. The hierarchy is formed on the principles: avoid, reuse, recycle/reprocess and dispose.

12.2 IDENTIFIED WASTE STREAMS

The proposed quarrying operations as part of the proposed expansion of Champions Quarry will involve the handling and production of waste from a number of sources, including:

- small amounts of vegetative matter during the development of the southern pit;
- topsoil and overburden;
- dust and fines from washing and crushing;
- wastewater from runoff and plant processing;
- used oils, filters and machinery parts;
- domestic sewage; and
- general office and administrative waste.

12.3 MANAGEMENT PROCEDURES

12.3.1 Solid Waste

Excavated Materials

Excavated materials include soil and weathered rock waste from the removal of top soil and overburden during development of extraction cells.

Soil based materials are intended to be used in on-site activities such as construction of bunds, water management structures, rehabilitation or sold. Sediment control measures will be employed to prevent the loss of sediment into drains and water storages during quarrying activities.

Overburden will be reused on-site if it is considered a 'virgin excavated natural material not mixed with any other waste that has been excavated from an uncontaminated area' as classified by *Waste Classification Guidelines, Part 1: Classifying Waste* (DECC, 2008).

Processing Waste

Given the intended scope of materials to be produced by the quarry, all solid products from quarry processing are intended for market. Therefore there is considered to be minimal scope for processing waste to be generated.

Domestic Waste

Domestic waste is classified as *Solid Waste (putrescibles)* in accordance with DECCW guidelines (DECC, 2008), and is composed of everyday waste items such as food scraps, paper, aluminium cans, plastics, packaging and other materials generated by on – site staff. Collection bins will be provided for recyclable materials (including paper and cardboard, glass bottles and aluminium cans). General domestic and recyclable waste generated by on-site staff will be appropriately managed via the regular waste collection service.

Green Waste

Both putrescibles waste such as food waste and green waste are classified as Solid Waste (putrescibles) in accordance with DECCW guidelines (DECC, 2008).

Vegetation stripped during clearing will be reused to rehabilitate specific areas of the site (i.e. bunds) to allow for stabilization of soils.

12.3.2 Liquid Waste

Effluent

Effluent from on–site staff amenities will be managed via an on-site waste water management system. This will be designed to the AS 1547 and be installed prior to commencement of excavation.

Lubricants

Grease and lubricants are classified as *Liquid Waste* in accordance with DECCW guidelines (DECC 2008). Small quantities of these wastes may be generated in the operations of the quarry. To prevent any environmental harm, wastes of this type will be stored in designated drums in an appropriately bunded area. They will be reused where possible, or disposed of at an appropriate off-site recycling facility.

Waste oils arising from the maintenance of heavy machinery will be disposed of by the machinery maintenance contractor when works are being undertaken. Waste oil contractors and maintenance and refuelling contractors will be required to have spill protection protocols in place. Spill response equipment will be stored on the site.

Water

The water supply at Champions Quarry has been designed to be self sufficient and maximize water recycling opportunities within quarry operations. This will ensure no additional demands on local water supplies and minimise the potential for impacts on local receiving waters. Measures will be implemented to ensure that all water demands are met.

12.4 MITIGATION MEASURES AND SAFEGUARDS

Mitigation measures to be implemented to minimize wastes generated by the quarry are as follows:

- separation of recyclable and non recyclable materials will take place where possible and be stored in appropriately designated receptacles;
- waste receptacles will be collected on a regular basis by licensed contractors or Council collection services, where appropriate, or quarry staff and transported for off–site disposal at an appropriately licensed landfill or recycling facility;

- all waste disposal will be in accordance with the Protection of the Environment Operations Act 1997 and DECCW Waste Classification Guidelines (DECC 2008); and

- waste management will be incorporated into any required site Environmental Management Plan, which will outline measures to avoid waste generation and promote reuse, recycling and reprocessing of waste where possible.

12.5 CONCLUSIONS

Waste will be generated in both the site set up and ongoing operations of the expanded Champions Quarry. The wastes generated will be recycled wherever possible or disposed of in an environmental acceptable manner in accordance with the appropriate operational or environmental management plan.

13 SOCIO - ECONOMIC CONSIDERATIONS

13.1 INTRODUCTION

The increased production within Champions Quarry will result in considerable social and economic benefits at both the local and regional level. The principle economic benefit of the proposal is related to the security of construction materials for the northern New South Wales market. Local economic benefits include increased employment opportunities resulting from both the increase in annual production capacity and the increase in quarry life. Additionally, the centralised location of the quarry will decrease the distance of road transportation required, thus making the product cheaper and less fossil fuel intensive. This will have significant flow on effects to the local community.

Potential social issues primarily relate to social amenity and quality of life in the surrounding locality. Detailed noise, air and visual assessments have been undertaken as part of this EA to outline potential issues to surrounding areas. This chapter will provide a summary of the findings of these studies to the amenity values of the surrounding locality.

13.2 ECONOMIC CONSIDERATIONS

The primary economic benefit arising from the proposed expansion of Champions Quarry is the provision of surety in the supply of sand for construction purposes to meet the demands of the Far North Coast region. The Far North Coast Regional Strategy (Department of Planning, 2006) recognises the importance of the regions natural resources base to the continued sustainable growth and development of the region. Champions Quarry, as a regionally significant sand and sandstone resource, is in a strong position to provide quality construction materials for the provision of vital infrastructure and urban development. The ongoing supply of these materials to the Far North Coast market is critical in ensuring increased demand for sand and sandstone products are met, thus contributing to the affordability of major infrastructure projects such as Pacific Highway upgrades as well as urban development projects.

The operation of the quarry will continue to contribute to the local economy through ongoing operational expenditure and employment. Currently, the quarry provides employment for 2 full time workers. With the proposed expansion it is expected that approximately 8 additional jobs will be created. As a result of the 25 year increase in quarry life expectancy, the long term security of these 10 full time jobs will be enhanced. Flow-on and multiplier effects can also be expected to occur as a result of the additional expenditure which will be injected into the local economy.

Resource Value

The majority of quarries in the Lismore and Ballina area provide products derived from basalt. There are relatively few sand and sandstone quarries in the region, particularly those that provide the range of materials that may be supplied by Champions Quarry. A marketing assessment was undertaken by AVKO Mining (2009, provided as *Appendix L*) which discussed the quality of the products potentially available at the Champions Quarry. This report found that the resource available at this quarry is quite scarce in the area for the reasons outlined within *Section 13.4.2* of this EA.

It is therefore considered that the potential resource of the Champions Quarry is extremely valuable and currently in short supply. It will greatly assist in providing materials for infrastructure in the region, particularly Pacific Highway upgrades. Champions Quarry's centralized location will lead to a decrease in haulage distances and subsequently green house gas emissions.

13.3 SOCIAL AMENITY

The Champions Quarry is located approximately 16km south of Lismore on Wyrallah Road in a region dominated by agricultural land uses including cropping and grazing. A sandstone quarry has been in operation on the site since 1959, with the present operations allowing for extraction up to 29,000m^3 (approximately 64,000 tonnes) of sandstone material per annum over a period of up to 15 years. The quarry is located on the mid slope of a large ridge (up to 50m AHD). The area of land presently disturbed by the quarry is approximately 2ha with a floor level of between 12m and 14m AHD. The face of the quarry is up to nine metres high at 25m AHD. There is an internal gravel haulage road within the site leading to the quarry floor. There are a number of rural residences in the vicinity of the quarry with the closest residence approximately 300 metres to the *Project Area*.

Rural residents typically place value on the quality of life in terms of amenity issues including noise, dust, visual amenity and road safety. Whilst the quarry is a long established element of the existing environment, the proposal will result in an intensification and increase in life expectancy of the existing quarry. Given that residents surrounding the quarry may have had the perception that the quarry would cease operations at the end of its existing approval (in 2022), a substantial increase in production and quarry life has the potential to impact upon resident's view of the quarries contribution to their social amenity.

Public consultation has been undertaken as outlined within *Chapter 4* in an attempt to reach all potentially affected residents to provide them with full access to information and the opportunity to provide comment regarding the proposed expansion of Champions Quarry. Residents identified the following issues as being key to the preservation of their social amenity:

- traffic and transport (in particular road safety and road pavement impacts);
- acoustics and vibration;
- air quality;
- water quality;
- local ecology;
- preservation of heritage;
- ecologically sustainable development; and
- socio–economic impacts.

Following this consultation, significant environmental assessment was undertaken with regards to these issues. The outcomes of this assessment process are presented in this EA. These assessments have clearly demonstrated that with the provision of appropriate mitigation measures, impacts can be minimized such that the local amenity of the area will not be substantially affected. It is therefore concluded that the quarry will be able to operate without causing major disruption to local residents and should continue to be seen as a non intrusive element of the rural landscape.

13.4 RESOURCE DEMAND ASSESSMENT

13.4.1 Introduction

Following on from the characterization of the impact of the proposal on the identified communities, it is necessary to gain an appreciation of the physical demand for the product to be quarried. In doing so, the following will be considered:

- characterization of the resource;
- assessment of potential market types for each product type;
- estimation of demands for each major market type within the Local Government Areas of Lismore, Ballina, Byron and Richmond Valley;
- research into approved supply sources within the Local Government Areas of Lismore, Ballina, Byron and Richmond Valley;
- identification of deficiencies between demand and supply and contribution of the quarry to rectifying any deficiency; and
- consequences of not proceeding with the Project.

13.4.2 Characterization of the Resource

In geological terms, the Lismore Ballina region of the Far North Coast of New South Wales is basalt dominated soil landscape. The sandstone occurring on the site is an isolated outcrop of the Kangaroo Creek Formation which extends from Coffs Harbour to the Queensland border, but is generally overlaid with basalt in this region. In this area, extraction of sand resources are limited to dunal resources and river bed dredging, which provide generally rounder particles than fractured face sandstones, which are generally subject to higher levels of environmental constraints Assessment of the resource undertaken by Coffey Geotechnics (*Appendix B*) and AVKO Mining (*Appendix L*) indicates that within the proposed quarry footprint, approximately 40% of the sandstone present has been classified as "Very High Strength" interspersed with medium and lower strength materials. The sand was observed to contain both fine and coarse particles and described as either "sub angular" or "sub rounded". The resource at Champions Quarry can be differentiated from all other sand resources within the Far North Coast area due to it having the following characteristics:

- most coastal and river bed sands posses round particles and are less valuable than the fractured face sands found at Champions Quarry which are required for the concrete market;

- generally sources of washed sand provide either fine sand or coarse sand. Champions Quarry has both fine and coarse sand present;

- most dunal and river bed sands posses little or no Plasticity Index rating (PI). PI is necessary for products such as high quality road base, blended road base, certified engineers fill, and bricklayers loam. The resource at Champions Quarry shows consistent PI in the yellow sandstone; and

- the Champions Quarry resource possesses a highly desirable combination of Californian Bearing Ration (CBR) for strength, a high level of fines, excellent PI, zero reactivity (wet to dry) and the product has self cementing properties – all qualities not present in basalt products and rarely found in sandstone in the region. These qualities are required for road base, RTA specification blended road base and certified engineer fill.

The resource at Champions Quarry is thus able to be characterized as being able to supply all types of sand generally required within the construction industry within a single location.

13.4.3 Demand Estimation and Potential Markets

The report from AVKO Mining (*Appendix L*) provides a demand estimation based upon potential use of product from the quarry in the following LGAs:

- Lismore City;
- Ballina;
- Byron Shire;
- Richmond Valley; and
- Kyogle.

An estimated demand of between 3 and 4 tonnes per annum per capita of sand products (including washed sand, certified engineer and general fill, road base, bricklayers sand and specialty sand products) was calculated. Based on regional population figures, this equates to a demand for sand products in the order of 470,000 to 620,000 tonnes per annum. Resource demand in the region is a combination of larger civil engineering projects, as well as residential housing developments required to accommodate the increases in population as project by the Far North Coast Regional Strategy.

When considering the maximum haulage distance that material won from the quarry can be transported at a competitive cost, AVKO Mining provides the following factors to be taken into account (*Appendix L*):

- product availability – is a similar product available in the required quantity within close proximity eg 15 – 30km;
- the product value – is the product priced competitively for the distance it needs to travel, for example, haul distance is not an issue for dimensioned stone and boulders (approximate worth of $1800/load) which may be transported up to 250km while fill and low value products may be limited to 30 – 40km haul distance; and
- green house gas emissions (as discussed comprehensively within Chapter 15).

Based on these limitations, a number of potential markets were identified, all within an optimal haulage distance of 16 – 38km from the quarry.

Concrete Plants

Potential markets for Champions Quarry's washed sand include concrete plants. Research has revealed the following plants within the area:

Boral – Alstonville, Ballina, Casino, Evans Head and Lismore;

Cemex – Ballina, Byron Bay, Casino and Lismore; and

Hanson's – Ballina, Byron Bay and Lismore.

Based on some basic demand assumptions and a review of Environmental Protection Licences on the DECCW website, it was calculated that approximately 240,000 tonnes of fine and coarse sand is required in the adopted region for concrete plants.

This demand assessment has not considered smaller operations which are not required to be licensed. The demand may therefore be substantially higher than this figure.

Asphalt Plants

Potential markets for Champions Quarry's washed sand also includes asphalt plants. Research indicates that there are two asphalt plants in the region:

Boral – Gap Road, Alstonville; and

Northern Rivers Quarry and Asphalt – Blakebrook Quarry (owned and operated by Lismore City Council).

These two plants produce in the order of 30,000 tonnes of asphalt each per annum (AVKO Mining 2009). Based on this, and assuming that the volume of washed sand required is 17%, approximately 10,000 tonnes of sand is required annually.

Road Base and Engineer Fill

As indicated previously, the resource at Champions Quarry is capable of being utilized for both sub grade fill and for final grades of road base, either on its own or blended with basalt for RTA specification works (AVKO Mining 2009). Whilst basalt is a common material in the region, it does not generally perform well as a road base unless blended with other materials such as sandstone. RTA testing on the material in Champions Quarry has confirmed that if blended with basalt, it provides a premium road base which meets the RTA Northern Region Specifications for DGS and DGB road base (AVKO Mining 2009).

Additionally, Champions Quarry material is uniquely placed to provide structural or engineer fill, thus providing enormous opportunity to provide to large construction projects such as Pacific Highway upgrades.

13.4.4 Existing Approved Resources

Introduction

Generally speaking, it has been recognised that the sustainability of the supply of construction materials has the potential to be major limiting factor in the future development of the North Coast Region of New South Wales. Cost and uncertainty in gaining development consent is perhaps the largest single issue faced by the industry (DPI, 2004). The Primary Industries in the North Coast Region of New South Wales (DPI, 2004) summarizes the key pressures being faced by presently approved quarry operations:

- few existing sources of supply are naturally replenished, and therefore most sources would eventually be depleted;
- many existing sources of supply will apparently exhaust their resources within the term of their existing development consents, which will generally be within a generation (20-25 years);
- even with unlimited development consent, most existing sources would be exhausted within two generations (40-45 years), leaving only a few very large sources still active;
- not all existing sources would be fully exploited because of the cost and uncertainty of gaining additional development consent owing to land use pressures and environmental sensitivities in the North Coast and to provisions for third party appeals;
- sensitivity to transport costs plus access constraints elsewhere will limit the feasibility of supply from neighbouring regions or distant parts of the North Coast; and
- population growth and development in the region are likely to maintain or increase demand for construction materials over time.

Given these identified limiting factors, a review of the existing approved sources of sand within the local government areas of Lismore, Ballina, Byron, and Richmond Valley has been undertaken. Where potential limitations to the capacity of these resources have been identified, these have been noted and discussed. The result of this assessment is provided within *Table 13.1* below.

Table 13.1 Significant Sand/Sandstone Quarries in the Lismore Ballina Region

Local Government Area	Site	Material Type	Approved Extraction Rate	Comments
Ballina Shire Council	South Ballina Sand Quarry	Fine Sand only for the concrete market.	50,000 t/a	Limited Resource of 550,000 tonnes. Limited life of 10 – 12 years
	AMA Sand Pit	Filling sand Not Suitable for concrete sand of engineered fill.	11,000 m3 /a	Limited Resource of 100,000 m3. Life of 10 years.
	Lennox Head Sand Pit	Filling sand Not Suitable for concrete sand of engineered fill.	10,000m3 /a	Limited Resource of 210,000m3 Life of 20 years.
Byron Shire Council	Broken Head	Washed sand for the Concrete market, engineered fill & bricklayers sand.	140,000 t/a Consent determined by Minister of Planning in 1999 for 25 years.	In October 2008 an Order pursuant to the EP&A Act was placed over the quarry by the DoP requiring it to construct a major intersection on Broken Head Road by 31 January 2009 or cease operations. This intersection was not constructed.
Lismore City Council	Champions Quarry	Sandstone Roadbase, engineered fill, filling sand and topsoil.	64,000 t/a over 15 years.	Total resource 12 million tonnes. Current consent does not permit production of fine & course washed sand although huge quantities are present on site.
Richmond Valley Shire Council	Boral Sand – Swan Bay	Washed coarse sand for the Concrete market	30,000 t/a ongoing river bed lease.	Used exclusively by Boral.
	Newmans Quarry (formally known as Robinsons Quarry) - Bungawalbin	Hard sandstone product (blast & crush) producing road base, fill.	30,000 m3/a Granted in 1997 for an unknown number of years.	The quarry had a shutdown order placed on it by Richmond Valley Shire Council in 2008 for illegal operation.

1. There are also a number of smaller and existing use rights sand quarries in the region which have not been listed as they are not considered to be operational, operating illegally or do not represent a significant resource.

Resources from Farther Afield

There are large approved sources of sand in the Tweed Shire Local Government Area. This being the Cudgen Lakes sand extraction project, which was subject to a Part 3A approval from the Department of Planning. This is situated approximately 100km to the north of Champions Quarry.

Additionally, the following potential new quarries have been identified (*Appendix L*):

- Ramtech (Pottsville) Fine Construction Sand up to 200,000 tonners per annum. This resource is located approximately 100km to the north of Champions Quarry and is affected by acid sulphate soils and requires the addition of lime

- Glenreagh Sandstone (Kangaroo Creek Sandstone) variable sandstone and sand products located approximately 130km south of Champions Quarry.

13.4.5 Demand Deficiencies

There is a serious deficiency in the region for sand and sandstone capable of providing the following:

- washed sand for the concrete and bitumen markets;

- structural and engineer fill;

- sandstone road base for blending with basalt for RTA DGS and DGB;

- bricklayers loam; and

- specialty dimensioned sandstone.

In addition to providing a local source of these materials capable of being utilized within large scale construction projects such the Ballina Bypass Pacific Highway Upgrade Project, the capacity of the project to provide a large scale, reliable source of washed sand cannot be underestimated. Based on a basic analysis of the figures above, there is a resource deficiency of approximately 150,000 tonnes per annum. The Champions Quarry project will be able to provide in the order of 50,000 tonnes (*Appendix L*) towards rectifying this deficiency. The remainder will continue to be brought in from farther afield (up to 100km), thus increasing cost of construction products in the area and contributing to green house gas emissions.

13.5 CONCLUSION

Based on this socio economic assessment, it is concluded that utilization of the resource that would be produced by the expanded Champions Quarry is a vital element of the sustainable development of the Far North Coast region. It presents an opportunity to contribute considerably to the identified resource deficiency within the region, providing a highly centralised source of quality sand products.

14 VISUAL

14.1 INTRODUCTION

Given the alteration in the landscape that can occur as the result of extractive industries, a visual impact assessment was undertaken to provide a description of the likely range of landscape and visual impacts of the proposed quarry and subsequent rehabilitation work. This report is provided as *Appendix K*. A summary of this report is provided below.

The objectives of this report were to:

- describe the project;
- locate the subject site;
- describe the proposed quarry works;
- describe the surrounding landscape and the site;
- identify a view shed;
- locate key viewpoints within the view shed based on an understanding of existing site conditions;
- described the proposed tree planting which is proposed to assist in the mitigation of visual impacts of the proposed expansion of Champions Quarry; and
- assess the overall visual impact.

14.2 VIEWSHED

From an initial assessment of the proposal and its surrounds, the following points were noted:

- the site is located in a rural area;
- Lismore is the nearest town and is located approximately 16km north of the site;
- Wyrallah Road is the main road in the area and is located on a local ridgeline, west of the site;
- the site is located on the eastern side of a ridgeline which is surrounded by low lying valleys containing predominately cleared farmland; and

- an assessment of rural dwellings within a 1km radius of the proposed development boundary indicates that the site is likely to be visible from four rural dwellings.

Nine viewpoints were identified, including the four identified rural dwellings. These are shown in *Figure 14.1*. Photographs were taken from publically accessible locations within the view shed. As such, they provide a reasonable range of views on which to evaluate the likely visual impacts. With regards to the dwellings, photographs were taken and views assessed from publically accessible locations adjoining the identified dwelling, considered best representative of the dwellings views over the site.

The photographic images taken from viewpoints and assessment of impacts are discussed in detailed in *Appendix K*.

Legend

- Project Area
- Viewpoint Locations
- Distance from Site
- Existing Major Roads

Figure 14.1

Viewpoints Surrounding the Project Area

Client:	Champions Quarry		
Project:	Champions Quarry Expansion		
Drawing No:	0098287pm_Fig14.1	Suffix No:	A0
Date:	08/09/09	Drawing size:	A4
Drawn by:	TH	Reviewed by:	MC
Source:	-		
Scale:	Refer to Scale Bar		

N

0 0.33 0.66 1km

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ERM

14.3 LIKELY RANGE OF LANDSCAPE AND VISUAL IMPACTS

The following table is a summary of the likely range of visual impacts from the viewpoints assessed.

Table 14.1 Summary of Potential Visual Impact

Viewpoint	Likely Range of Visual Impact	Proposed Mitigation Measures
1	None. • Quarry not visible.	Not required
2	None. • Quarry not visible.	Not required
3	Low. • View is between a gap in roadside vegetation along Wyrallah Road. • Quarry forms a relatively small percentage of the overall field of view from this location.	The proponent has constructed bunds adjacent to the existing quarry which will be tree planted, as will the entire length of the site access road. Proponent is willing to fund further mitigation works such as tree planting on adjoining land with permission of land owners if agreed. Quarry site to be reinstated to pasture land following quarry operations. This remediation will be undertaken at the completion of each stage.
4	Low. • Site terrain falls away to valley from this location. • Main views are to the distant hills and vegetation to the east.	Tree planting along access road and Wyrallah Road site boundary.
5	None. • Quarry not visible.	Not required
6	High/Low. • Proposed quarry development likely to be visible in approximately 27% of the horizontal field of view, including the site water management area. The extractive areas represent in the order of 20% or less of the field of view. • High to moderate during some stages of the proposed development. • Low following completion of bunds and tree planting.	The proponent has constructed bunds to the north of the existing quarry which will be tree planted, as will the entire length of the access road. Proponent is willing to fund further mitigation works such as tree planting on adjoining land with permission of land owners if agreed. Quarry site to be reinstated to pasture land following quarry operations. This remediation will be undertaken progressively.
7	None. • Existing tree planting along common boundary with rural dwelling. Living areas oriented away from the quarry. Quarry not visible following implementation of earthen bunds and tree planting.	Further earthen bund works and tree planting.

Viewpoint	Likely Range of Visual Impact	Proposed Mitigation Measures
8	Low. • The majority of the *Project Area* is not visible from this location and is obscured from view by the existing ridgeline between Receiver 3 and the *Project Area*.	Tree planting and bunding along ridgeline will mitigate views to the proposed development.
9	Low • Quarry barely visible	Not required

14.4 PROPOSED TREE PLANTING

It is proposed to undertake extensive tree planting on the *Project Site* which has been specifically designed to achieve to following objectives:

- assist in the mitigation of visual impacts from the proposed expansion of Champions Quarry from sensitive viewpoints; and
- make a positive contribution to the landscape and biodiversity of the area by adding to the existing Koala habitat tree planting which has already been successfully undertaken by the proponent in other areas of their broader rural holding.

The proposed tree planting includes three typical treatments, being:

- Koala habitat tree planting;
- non Koala tree planting; and
- tree planting on approved earthen bunds.

Figure 14.2 below demonstrates the proposed tree planting on the site.

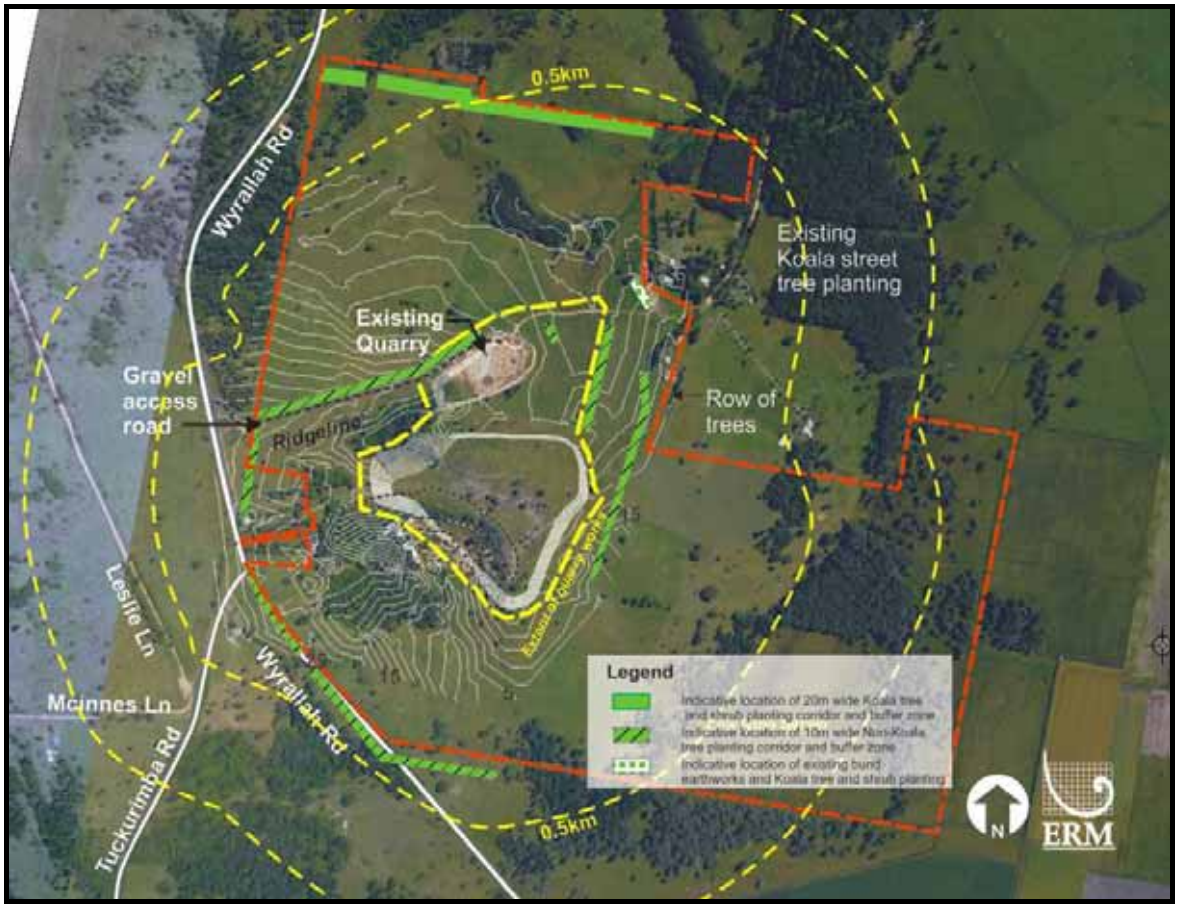

Figure 14.2 Proposed bund construction and tree planting

14.5 CONCLUSION

In conclusion the visual impact of the proposed quarry works will be minimal. This conclusion was reached based on the following considerations:

- the topography of the site and surrounds is undulating;
- the undulating topography restricts views to the site from Wyrallah Road and the surrounding area to the immediate vicinity of the site near the site boundaries;
- the site would be visible from the following locations:
  - Wyrallah Road near Receiver 1 described in Viewpoint 3 & 6;
  - Receiver 3 to the south east of the site described in Viewpoint 8;
  - Wyrallah Road at the entrance gate into the site on the western boundary as described in Viewpoint 4;
  - Viewpoint 9 on Tuckurimba Hill; and
- the visual impact of the quarry from these locations can be mitigated and reduced through the planting of trees on the site to create a visual buffer between the proposed works and these locations.

Following the completion of rehabilitation works, the site is to be restored to pasture land. This landscape type will integrate with the surrounding rural landscape character. The provision of additional tree planting will provide an overall improvement in the landscape quality of the site and surrounds.

15 CLIMATE CHANGE

15.1 INTRODUCTION

It is presently understood that activities undertaken by humans, particularly the burning of fossil fuels, is contributing to increasing the concentration of greenhouse gases within the earth's atmosphere. The heat that is radiated by the earth's oceans and land masses then becomes trapped by the greenhouse gases in the atmosphere, therefore increasing temperatures on the earth. The increase in the earth's temperatures has effects on the intricate web of life on earth and alters weather patterns, ocean currents and the distribution of plant and animal species.

15.2 GREENHOUSE GAS EMISSIONS

Emissions of greenhouse gases will result from activities associated with the Project. This section outlines the approach used to estimate emissions of greenhouse gases from the Project as well as an interpretation of the magnitude of these emissions.

In the context of this assessment, greenhouse gas emissions refer to the 'basket of six' greenhouse gases regulated by the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol[1].

15.2.1 Greenhouse Gas Legislation and Guidance

In Australia, the principal guidance for greenhouse gas emissions estimation is the Commonwealth Department of Climate Change's (DCC) *National Greenhouse and Energy Reporting (Measurement) Technical Guidelines 2008*. The Technical Guidelines use emission factors from the DCC *National Greenhouse Accounts (NGA) Factors,* updated in June 2009. The NGA Factors provide a single source of current greenhouse gas emission factors for use by Australian organisations. The emission factors are also designed to be consistent with the emissions estimates reported in Australia's *National Greenhouse Gas Inventory*.

Direct and Indirect Emissions

Emissions of greenhouse gases from the Project can be categorised as 'direct' and 'indirect' emissions.

- [1] carbon dioxide (CO_2); methane (CH_4); nitrous oxide (N_2O); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs); and sulphur hexafluoride (SF_6).

The *NGA Factors* adopts the emissions categories of the international reporting framework of *The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard* (WRI/WBCSD). These emission categories are as follows:

- ***Scope 1*** covers direct emissions from sources within the boundary of an organisation such as fuel combustion, manufacturing and landfill processes.

- ***Scope 2*** covers indirect emissions from the consumption of purchased electricity, steam or heat produced by another facility. Scope 2 emissions result from the combustion of fuel to generate the electricity, steam or heat and do not include emissions associated with the production of the fuel. Scopes 1 and 2 are carefully defined to ensure that two or more organisations do not report the same emissions in the same scope.

- ***Scope 3*** includes all other indirect emissions that are a consequence of an organisation's activities but are not from sources owned, or controlled, by the organisation (i.e. produced by third-party organisations outside of the Project).

Boundary of Assessment

The boundary for this greenhouse gas impact assessment has been defined as those emissions directly attributable to the proposed quarrying activities at the *Project Area*, defined as 'the Project'.

For the Project, the largest source of Scope 1 or, direct emissions, will result from the combustion of diesel from equipment used on-site during on-site operations; that being, clearing, winning, processing and stockpiling of materials.

Scope 2, indirect emissions, will primarily result from electricity consumption at the Sand Washing Plant.

In addition to Scope 1 and Scope 2 emissions, this assessment will also considers Scope 3 emissions indirectly associated with the Project. Scope 3 emissions considered within the boundary of this assessment will result from indirect emissions associated with the haulage of product from the site to end point user destinations in the region.

Table 15.1 details the greenhouse gas emission sources included in this assessment.

Table 15.1 Greenhouse Gas Emission Sources included in this Assessment

Scope 1 – Direct Emissions	Scope 2 –Indirect Emissions from Purchased Energy	Scope 3 – Other Indirect Emissions
Fuel use on-site – Diesel	Electricity usage (sand washing plant)	Transport of product by road

Of the emission sources identified in *Table 15.1* it is important to note that Scope 1 and 2 sources are those under direct management control of the Proponent. That is, the Project can implement measures which will directly effect emissions associated with these sources - in the case of electricity usage through reducing consumption.

Scope 3 sources are not under direct management control and therefore the opportunity to reduce emissions from these sources is less direct.

15.2.2 Methodology

The following assumptions have been made for the purposes of this assessment:

- approximately 6.25 million tonnes of sandstone material will be extracted over 25 years.
- averaged over 25 year, annual consumption is assumed to be 250,000 tonnes.

Table 15.2 details the emission estimates for Scope 1 sources.

Table 15.2 Scope 1 Source Emission Estimates

Source	Timeframe	Activity Level	Scope 1 Emission Factor	Estimated Emissions (t CO_2-e)
Diesel Use – On-Site Operations	1 Year of Production : 250,000 t	6,564 GJ	0.0699 - Emission Factor (t CO2-e/GJ)[2]	458.83
			Total	**458.83**

1- *Scope 1* Diesel fuel combustion emission factor from Table 4; NGA Factors, June 2009.

As highlighted in *Table 15.2,* fugitive emissions from the combustion of diesel fuel during quarrying operations represent the only source of Scope 1 emissions considered in this assessment.

Table 15.3 details the emission estimates for Scope 2.

Table 15.3 Scope 2 Source Emission Estimates

Source	Timeframe	Activity Level	Emission Factor	Estimated Emissions (t CO_2-e/ annum)
Energy from electricity consumption (Sand Washing Plant)	1 Year of Production: 250,000 t	6.37 MWh	0.89 tCO_{2-e} /MWh [1]	5.67
			Total	**5.67**

1. *Scope 2* NSW emission factor for consumption of purchased electricity from Table 5; NGA Factors, June 2009.

Table 15.4 shows the emission estimates for Scope 3 sources associated with the road transportation of product to end-point destinations in the Lismore Ballina region. Road transportation is considered as a Scope 3 emission source in this assessment given that the transportation fleet will be externally owned and therefore is outside of the direct control and ownership of the Project.

Table 15.4 Scope 3 Source Emission Estimates

Source	Timeframe	Activity Level	Emission Factor	Estimated Emissions (t CO_2/annum)
ROUTE 1: Wyrallah Road via Bruxner Highway-Coraki Road to Lismore and surrounds – 50% of vehicle movements	1 Year of Production : 250,000 tonnes	127,273 km	2.8 kg CO_2/km [1]	357.07
ROUTE 2: Wyrallah Road to Woodburn and district – 25% of vehicle movements	1 Year of Production : 250,000 tonnes	63,636 km	2.8 kg CO_2/km	179.53
ROUTE 3: Broadwater Road to Pacific Hwy for use and distribution – 25% of vehicle movements	1 Year of Production : 250,000 tonnes	63,636 km	2.8 kg CO_2/km	179.53
			Total	**714.13**

1. Diesel consumption emission factors from AGO Factors and Methods Workbook 2006 (Table 4). Assuming 90% 'Heavy Trucks', and 10% 'Medium Trucks'.

15.2.3 Summary of Emissions

Figure 15.1 Greenhouse Emissions Sources – Scopes 1, 2 and 3

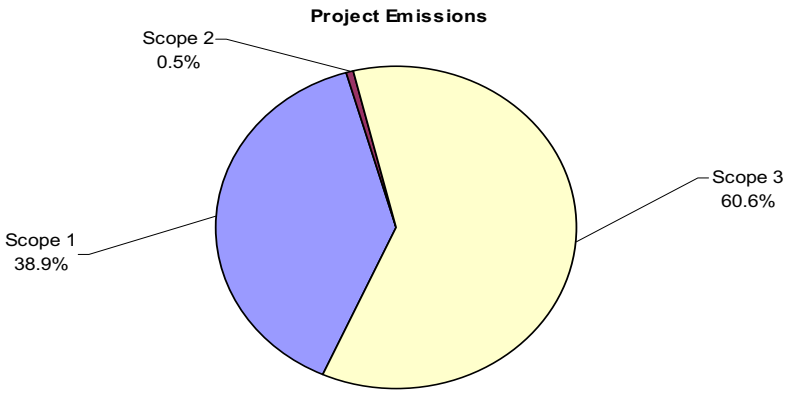

Figure 15.1 presents the percentage contributions of Scope 1, 2 and 3 emissions sources. Of Scope 1 and 2 emissions, fugitive emissions from the combustion of diesel fuel on-site are in the order of 458.8 tonnes of CO_2-e/annum, representing 13.9 percent of overall greenhouse gas emissions attributable to the Project. Emissions from electricity consumption are in the order of 5.67 tonnes of CO_2-e/annum, representing 0.05 percent of overall emissions over the life of the Project. Scope 3 emissions represent 714.13 tonnes of CO_2-e/annum, or approximately 86.1 percent of total greenhouse gas emissions associated with the Project.

Table 15.5 summarises the total estimated Scope 1, 2 and 3 emissions due to the Project.

Table 15.5 Summary of Greenhouse Gas Emissions

Source	Estimated Total Emissions (t CO_{2-e}/)
Scope 1 – diesel consumption	458.83
Scope 2 – electricity consumption	5.67
Total Scope 1 + 2	**464.50**
Scope 3 - transport of product to port - Truck Movements	714.13
Cumulative Total for Scopes 1,2 & 3	**1,178.63**

15.2.4 Impact Assessment

The Project is anticipated to quarry 6.25 million tonnes of sandstone material over a 25-year operational lifetime. Total greenhouse gas emissions for a single year of operations, representing 250,000 tonnes of extracted product, have been calculated at approximately 1,179 tonnes of CO_2-e, or; 29,466 tonnes aggregated over the lifetime of the Project.

Total direct greenhouse gases emissions (Scope 1 and 2) per annum are estimated to be approximately 465 tonnes $CO_{2\text{-}e}$ meaning that the greenhouse intensity of the Project equates to approximately 0.0019 tonnes of $CO_{2\text{-}e}$/tonne of sandstone material extracted.

National Emissions Comparison

National annual greenhouse gas emissions were estimated for Australia in 2007 at **597,156,550** tonnes of CO_2-e. Total NSW emissions for the same period were estimated at **162,720,510** tonnes of CO_2-e.[3] Therefore, emissions from the Project (Scope 1 and 2) represent approximately 0.00008% of the Australian annual total and 0.0003% of NSW emissions.

15.2.5 Minimising Energy Consumption and Greenhouse Gas Emissions

Reducing Carbon Emissions of Other Operations in the Lismore Region

The Project is anticipated to supply a variety of construction materials for infrastructure projects within the Lismore Ballina region. Primarily, the Project will create a local source of:

- washed sand for concrete and hotmix plants,
- sandstone for premium and blended road base, and
- sand for a variety of construction needs, including certified engineering fill.

Washed Sand and Engineering Fill

According to the AVKO Mining Report (July 2009), there are only limited quantities of washed sand and engineered fill available from quarries in the Lismore Ballina region.

It concludes that due to this shortage, some material is being imported from distance of over 100 km (the lower Gold Coast) to supply concrete and hotmix plants; and other projects requiring engineered fill in the Lismore Ballina region.

This project will represent a new source of washed sand and engineered fill materials in the Lismore Ballina region and will result in reduced reliance on materials imported from outside of the local area.

Shorter haulage distances would reduce the greenhouse emissions associated with transport of product.

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[3] Reporting year 2007, Kyoto framework, Australian Greenhouse Emissions Information System http://www.ageis.greenhouse.gov.au/

It is anticipated that the project will be able supply approximately 50,000t of washed sand and approximately 150,000t of engineered fill annually. Assuming that these quantities of material sourced from the Project will directly replace material currently sourced at greater distances from outside of the Lismore Ballina region. Anticipated greenhouse savings associated with shorter haulage distances are displayed in *Table 15.6* and *Table 15.7* below.

Table 15.6 Annual GHG Savings due to Reduced Haulage – Washed Sand

		Travel Distance (km)	Volume (t)	Number of Trips	Average Fuel Consumption Rate (L/km)	Total Fuel Consumption (L)	t-CO2-e
Current Distance	**Haulage**	75	50,000	1,603	0.5199.[1]	62,488	168.60
Proposed Distance	**Haulage**	30	50,000	1,603	0.5199	24,995	67.44
1 AGO Factors and Methods Workbook 2006 (Table 4). Assuming 90% 'Heavy Trucks', and 10% 'Medium Trucks'.						**Greenhouse Saving**	**101.16**

Table 15.7 Annual GHG Savings due to Reduced Haulage – Engineered Fill

		Travel Distance (km)	Volume (t)	Number of Trips	Average Fuel Consumption Rate (L/km)	Total Fuel Consumption (L)	t-CO2-e
Current Distance	**Haulage**	60	150,000	4,807	0.5199[1]	149,950	404.58
Proposed Distance	**Haulage**	30	150,000	4,807	0.5199	74,975	202.29
1 AGO Factors and Methods Workbook 2006 (Table 4). Assuming 90% 'Heavy Trucks', and 10% 'Medium Trucks'.						**Greenhouse Saving**	**202.29**

15.2.6 Reducing Direct Project Emissions

A number of options have also been identified to reduce the greenhouse gas intensity of the Project's on site operations. These include:

- The efficiency of all upgraded mobile and fixed equipment has been considered during procurement for fuel-powered equipment and it is anticipated that there will be some fuel efficiency gains associated with upgraded equipment.
- The increased scale of the proposed operation will likely enable site management to achieve greater economies of scale in production and therefore increase production efficiency. This would contribute to reduce the greenhouse intensity of the operations for example a 20 tonne, as against 40 tonne excavator would result in a fuel saving of 30% per tonne of material produced.
- Site management will ensure that equipment is maintained to retain energy efficiency.
- The inventory of emissions developed for this assessment will be maintained.

These greenhouse mitigation and monitoring mechanisms and programmes will be used throughout the life of the proposed operations.

15.2.7 Conclusions

This chapter has provided an assessment of the greenhouse gas emissions from the proposed expansion of the existing Champions Quarry. The impact assessment has presented estimates of direct emissions and indirect emissions beyond the operational control of the Project.

In this assessment, total emissions over the lifetime of the Project (25 years) have been calculated as being 29,466 tonnes of CO_2–e, representing an emissions profile of 1,179 tonnes of CO2–e aggregated annually.

Direct (Scope 1 and 2) emissions from diesel consumption on site (Scope 1) and electricity consumption on site (Scope 2) are calculated at 4,112.5 tonnes of CO_{2e} over the lifetime of the project, or approximately 13.9 percent of total emissions. Aggregated annually, direct emissions from the site have been estimated at 464.5tonnes of CO_2-e.

Scope 3, or indirect emissions comprise greenhouse gas emissions from road transportation of saleable product to end-point locations in the Lismore Ballina region. Indirect emissions contribute approximately 86.1 percent of all emissions from the Project.

In calculating the direct emissions profile, it is anticipated that the Project will contribute approximately 0.00008 percent of emissions to the Australian annual greenhouse gas emissions total and approximately 0.0003 percent of emissions to the NSW annual total. The greenhouse intensity of the Project equates to approximately 0.0019 tonnes of $CO_{2\text{-}e}$/tonne of sandstone material extracted.

It is anticipated that the Project will significantly increase supply of washed sand and engineered fill available from within the Lismore Ballina region. It is expected that local infrastructure projects, currently relying on materials from outside of the local region, will be able to use materials from this Project and reduce product haulage distances.

15.3 PRACTICAL CONSIDERATIONS OF CLIMATE CHANGE

The document entitled *Practical Considerations of Climate Change* accompanies the New South Wales Floodplain Risk Management Guidelines developed by the DECCW. This document provides advice in considering climate change in managing potential flood risk by:

- assessing climate change impacts through modelling sensitivity analysis;
- determining whether climate change is a key issue at a particular location. This depends upon the impacts on flood damages and increased frequency of exposure of people to flood hazards;
- incorporating climate change in floodplain risk management plan development considerations and in new and current works projects and planning strategies; and
- outlining some potential climate change management strategies for existing and future development and associated practical issues.

There are two key elements arising from this document with regards to the proposed expansion of the quarry. These are:

- climate change induced variations in flood planning levels; and
- climate change induced variations to surface water management methods.

15.3.1 Variations in Flood Planning Levels

The above referenced document contains consideration for development of floodplain areas with regards to the potential for flood levels to increase as a result of climate change induced sea level rises and meteorological fluctuations. Lismore City Council's mapping of flood prone rural land indicates that the land below the 20m AHD contour is subject to inundation to a 1% ARI flood. This mapping is considered to be inaccurate, given that the site is significantly down hydraulic gradient of the Wilsons River from the CBD of Lismore, where the 1% ARI flood peaks at between 12.5m and 12.7m AHD.

15.3.2 Variations in Surface Water Management Methods

Climate change impacts on flood producing rainfall events demonstrate a trend for larger scale storms (rainfall totals for the 40 year average recurrence interval (ARI) 1 day storm event) tend to increase by 2030 and 2070. The document indicates that the variations for the Northern Rivers Catchment Area are between -10% and 5% for 2030, and up to between 5% and 10% for 2070. This may potentially require changes in design of surface water management measures to accommodate these greater intensity rainfall events. However the soil and water management plan (*Appendix I*) has been developed on a conservative modelling scenario, thus taking into account extra capacity to accommodate for an increase in surface water run off associated with increased intensity storms.

15.4 MITIGATION MEASURES

To minimize greenhouse gas emissions, and therefore reduce the proposed quarry expansions contribution to climate change, the following mitigation measures are proposed:

- the proposed development will include plantings of large numbers of trees in areas of the site which have been historically cleared for agricultural use (refer to the Ecological Assessment in *Appendix C*);
- large vehicles will be utilised where possible for handling and transportation of quarry product as they are more fuel efficient in terms of fuel used per tonne delivered;
- vehicles and machinery will be maintained in accordance with manufacturers requirements and regularly serviced to ensure optimal performance;
- late model machinery will be utilised to aid in the increase of fuel efficiency;

- all machinery noted to be producing excessive emissions will be stood down for maintenance; and
- where practical, vehicles and machinery when not in use will be turned off.

16 REHABILITATION AND FINAL LAND USE

The operators of Champions Quarry are committed to the best practice in the rehabilitation and development of the best end use for the quarry. The present objective is the rehabilitation of the site to its pre–quarrying, agricultural state such that its agricultural carrying capacity is not permanently lost. Previous rehabilitation works on site, utilising the methodology outline within *Section 16.2*, below, have resulted in an excellent landform and pasture cover suitable for cattle grazing activities following previous quarrying activities.

Given the approach taken to quarrying (utilisation of 3ha active quarry cells) the rehabilitation of disturbed areas is able to be continually undertaken during the life of the quarry. Quarry rehabilitation works will be undertaken in accordance with *Mine Rehabilitation* (Commonwealth Department of Industry, Tourism and Resources , 2006), *Best Practice in Landform Design for Rehabilitation* (Commonwealth Department of Environment and Water Resources) and based upon the proponents past experience in rehabilitation activities on the site.

A detailed rehabilitation strategy is outlined within the preliminary quarry management plan (*Appendix J*). A basic summary of the rehabilitation component of this document is provided below. The key objective of quarry rehabilitation is to return the site to its original agricultural capacity.

Additionally, as outlined in the ecological (*Appendix C*) and visual (*Appendix K*) impact assessments, there are a number of vegetation plantings proposed outside of the proposed quarry footprint to provide for both ecological offsets and visual amelioration.

16.1 REHABILITATION STRATEGIES

16.1.1 Progressive Approach

A progressive approach for implementation of the rehabilitation strategy, commensurate with the overall quarry plan, has been developed. As previously outlined, the quarrying of the sandstone resource will be undertaken in up to three by 3 hectare cells within the defined sections of the quarry operation area. The quarry will be progressively rehabilitated as each 'work cell' is completed.

16.2 REHABILITATION PLAN

16.2.1 Final Landform

The final landform is expected to be of a type that allows for the present grazing practices to recommence upon completion of quarrying activities. Depending on site conditions and the type of product requested from a given 3ha 'work cell', it will be excavated to provide of working face which is able to be rehabilitated to a final quarry face batter of 45 degrees, or benched.

16.2.2 Topsoil and Overburden Management

Top soil and overburden management will occur in accordance with the methods outlined within *Section 2.4.2*.

16.2.3 Revegetation

Stored overburden, loose quarry material and 20% of the stored topsoil will be utilised to cover the completed quarry cell. The area will then be prepared for sowing and planted with a mixture of grasses (i.e. Seteria, Rhodes Grass and Millet or Rye Grass) and legumes, (Wyn Cassia and clovers). These will then be rolled with a 'cambridge' corrugated roller on the contours to promote germination.

Within one to two weeks the Millet or Rye Grass would be expected to have germinated and commenced holding the soil. The other grasses and legumes take from four to eight weeks to germinate to a useful size to further cover the site. Cattle will be kept of the area for approximately 12 months to allow for successful stabilization of the area.

16.2.4 Quarry Closure

Given the progressive nature of the rehabilitation proposed for Champions Quarry, it is expected that minimal rehabilitation activities will need to occur post closure.

16.3 PERFORMANCE OBJECTIVES

The overall objective of the rehabilitation plan is to develop an area of improved pasture commensurate with that of the pre existing conditions or better, such that cattle grazing activities are able to resume post extraction. A preliminary quarry management plan to reflect this (*Appendix J*).

16.4 FUNDING FOR REHABILITATION ACTIVITIES

Given the past history of rehabilitation works by the Proponent, and the progressive nature of rehabilitation activities, as well as the relatively minimal demand on resources and time, funding for rehabilitation activities will be able to be incorporated into the ongoing operational budget of the quarry. There is not considered to be any requirement to set aside a yearly budgetary allocation for post closure activities as most rehabilitation will be completed by the time that the resource is exhausted. Additionally, given that the post rehabilitation land use will be primary cattle grazing, a monetary benefit will be able to be obtained such that any long-term maintenance of the site.

Funding for establishment and maintenance of vegetation plantings will also be included within the day to day operational budget for the quarry.

16.5 MAINTENANCE AND MONITORING

The rehabilitation plan developed in the preliminary quarry plan of management (*Appendix J*) is based on the outcomes of historical quarry rehabilitation undertaken on the property. The return of the *Project Area* to pasture will require some monitoring as part of quarry management, as well as routine farm maintenance. The Mine Rehabilitation Handbook (Commonwealth Department of Industry Tourism and Resources 2006) outlines some basic maintenance activities to be undertaken:

- soil testing to determine the required rates of fertilizer;
- focus placed on determining long term management guidelines (stocking intensities, fertilizer requirements) to ensure that the intended land use is sustainable; and
- capacity to undertake any soil amendments to produce the best outcome.

It is considered that these are inbuilt into the preliminary quarry plan of management.