Environmental Assessment

South Coast Concrete Crushing and Recycling Pty Ltd

ABN: 76 095 243 584

Prepared by:

R.W. CORKERY & CO. PTY. LIMITED

and

PLANNING
BUILDING
HERITAGE
LANDSCAPE
URBAN DESIGN
CITY PLAN SERVICES

Major Project Application No 07-0123

February 2009

South Coast Concrete Crushing and Recycling Pty Ltd

ABN: 76 095 243 584

Environmental Assessment

for the

Continuation and Expansion of Extractive Operations at the Nowra Brickworks Quarry, South Nowra

Lot 1, Deposited Plan 1126288

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February 2009

Ref No. 742/03

CITY PLAN SERVICES

R. W. CORKERY & CO. PTY. LIMITED

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Author's Declaration

for the submission of an Environmental Assessment prepared in accordance with the *Environmental Planning and Assessment Act 1979* (Part 3A – Section 75).

(a) EA prepared by:

name:	Mr Mitchell Bland	and	Mr Chris Outtersides
	Principal Environmental Consultant		Director
	R.W. Corkery & Co. Pty. Limited		City Plan Services
qualifications:	BSc(Hons), MEcon Geol		BA(Hons), DipTP
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(b) Project Approval application by:

applicant name: South Coast Concrete Crushing and Recycling Pty Ltd
applicant address: PO Box 192
OAK FLATS NSW 2529

(c) Application Number: 07-0123

(d) Address/land details

properties to be developed/ (ie. surface area only): Part Lot 1, DP1126288
Princes Highway
SOUTH NOWRA NSW 2541

land description:

(e) Project Outline: The Project would involve a number of component activities, namely:

- expansion of shale extraction, processing, blending, recycling and product despatch-related activities at the Nowra Brickworks Quarry;
- importation and placement of Virgin Excavated Natural Material ("VENM") to create a final landform that would mimic the pre-extraction landform; and
- progressive rehabilitation of areas no longer required for extraction or VENM placement-related activities.

(f) Assessment of Environmental Impact: The assessment of environmental impacts of this project includes the matters referred to in Director-General's Requirements provided to the Proponent on 20 September 2007 under Section 75F of the *Environmental Planning and Assessment Act 1979.*

(g) Declaration: I, Mitchell Bland, hereby declare that I have overseen the preparation of the contents of this assessment and to the best of my knowledge:

- it has addressed the Director-General's Requirements as provided by the Department on 20 September 2007;
- the assessment contains all available information that is relevant to the environmental assessment of the project; and
- the information contained in the statement is neither false nor misleading.

Signature: MBland

Name: Mitchell Bland Date: 9/2/2009.

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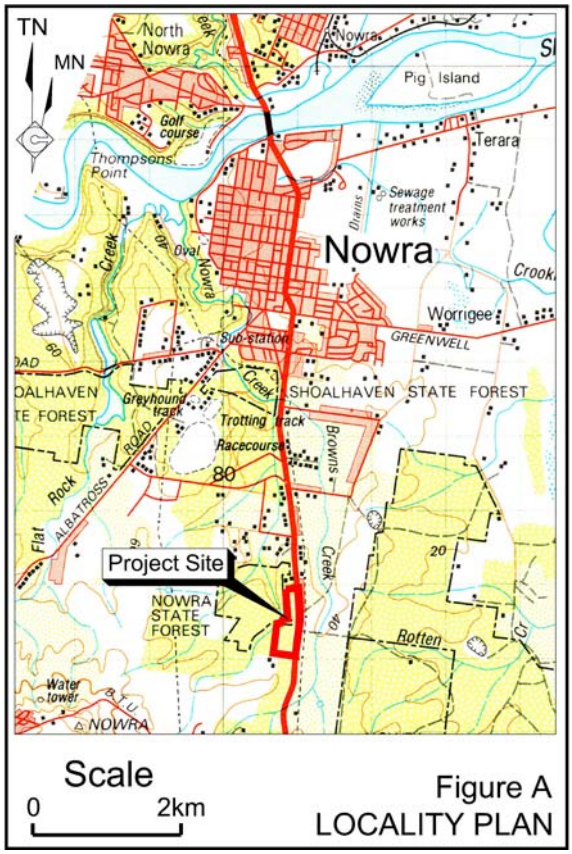
INTRODUCTION

This *Environmental Assessment* has been prepared by R.W. Corkery & Co. Pty. Limited and City Plan Services Pty Ltd to support an application for project approval by South Coast Concrete Crushing & Recycling Pty Ltd ("the Proponent") to expand extractive operations at the Nowra Brickworks Quarry, South Nowra ("the Project"). The Project includes the following activities.

- Expansion of shale extraction, processing, blending, recycling and product despatch-related activities at the Nowra Brickworks Quarry.
- Importation and placement of Virgin Excavated Natural Material ("VENM") to create a final landform that would mimic the pre-extraction landform.
- Progressive rehabilitation of areas no longer required for extraction or VENM placement-related activities.

For the purposes of this application, the Project Site comprises Mining Leases (MLs) 5087 and 6322 and is located approximately 5km south of the Nowra central business district (**Figure A**).



THE PROPONENT

The Proponent is an Australian private company that has operated the Nowra Brickworks Quarry ("the quarry") since the Mining Leases were acquired by Abib Pty Ltd (a company related to the Proponent) from the previous holder in 2002. The Proponent operates the quarry under an agreement with Abib Pty Ltd.

The Proponent's sole activities are the operation of the Nowra Brickworks Quarry and transportation of a proportion of quarry's products to the Proponent's customers.

PLANNING CONTEXT

The Project is classified as a "Major Project" under Clause 7 of Schedule 1 of *State Environmental Planning Policy (Major Projects) (2005)*. As a result, the Project is to be assessed under Part 3A of the *Environmental Planning and Assessment Act 1979* and the Minister for Planning is the approval authority. This *Environmental Assessment* has been prepared in accordance with the requirements of Section 75H of that Act.

PROJECT BACKGROUND

ML 5087 was originally granted on 8 January 1948 in accordance with the *Mining Act 1906* and has subsequently been renewed until 8 January 2019 in accordance with the *Mining Act 1992*. No further approvals were required under any other Act at that time to enable extraction operations to commence.

ML 6322 was granted on 8 March 1972, also in accordance with the *Mining Act 1906,* following the granting of approval for the extraction of clay and shale by the State Planning Authority and has been subsequently renewed until 8 March 2020 in accordance with the *Mining Act 1992*.

Abib Pty Ltd acquired the two leases on 20 December 2002 and extraction operations since that date have been undertaken by the Proponent. Throughout that period, the Proponent has paid royalties to the NSW Government for the extraction of shale material within the leases.

In October 2005, proceedings were brought in the Land and Environment Court of New South Wales by three of the Proponent's competitors, namely Normans Plant Hire, Tomerong Quarry and South Coast Resources Pty Ltd. The Court held that extraction operations within ML 5087 benefit from existing use rights under the *Environmental Planning and Assessment Act 1979* and were as a result lawful. However, the Court held that the development consent for extraction operations within ML 6322 granted on 24 September 1971 had lapsed prior to the commencement of the *Mining Act 1973*. As a result, extraction operations within ML 6322 were recognised not to have the required approval under the *Environmental Planning and Assessment Act 1979* and were discontinued.

EXISTING OPERATIONS

Existing operations within ML 5087 include the following.

- Extraction and direct loading or stockpiling of approximately 7 000t per year of weathered shale material ("rip shale material") using an excavator.
- Extraction of approximately 80 500t per year of unweathered shale material ("extracted materials") using drill and blast techniques.
- Importation of approximately 2 500t per year of selected construction, concrete and waste bitumen material ("recycling material") for crushing and recycling.

- Importation of approximately 35 000t per year of quarry products from other quarries ("blending materials") for blending operations.
- Crushing, screening and blending of extracted, recycling and blending materials to produce general and specialised quarry products.
- Stockpiling, loading and despatch of approximately 125 000t per year of quarry products.
- Progressive rehabilitation of areas no longer required for extraction-related purposes.

THE PROJECT SITE

The Project Site lies within part of Lot 464, DP1058778. The State of New South Wales is the registered owner of this land, with the Department of Lands administering the land for the Crown.

The Project Site covers a total area of approximately 21.5ha, incorporates all areas of proposed disturbance and would include the following principal components (**Figure B**).

- An existing extraction area covering approximately 2.0ha.
- An expanded extraction area covering approximately 15ha.
- A water storage facility
- An office, two weighbridges and visitor's carpark area.
- A site access road.
- A perimeter amenity bund.

Approximately 8.0ha, or 37%, of the Project Site is currently disturbed.

PRJECT DESCRIPTION

Introduction

The Project would involve the following activities, the locations of which are displayed on **Figure B**.

- Realignment and sealing of the section of the site access road from the site entrance from the Princes Highway for a distance of 150m.
- Construction of a wheel wash facility, dual weighbridge and office and a sealed visitor's carpark.
- Staged extraction of up to 14 000t per year of weathered shale material using an excavator for direct sale to the Proponent's customers or stockpiling for later sale without processing.
- Staged extraction of up to 350 000t per year of unweathered shale material ("extracted material") using drill and blast methods.
- Importation and stockpiling of up to approximately 50 000t per year of recycling materials.
- Importation and stockpiling of up to approximately 125 000t per year of blending materials.

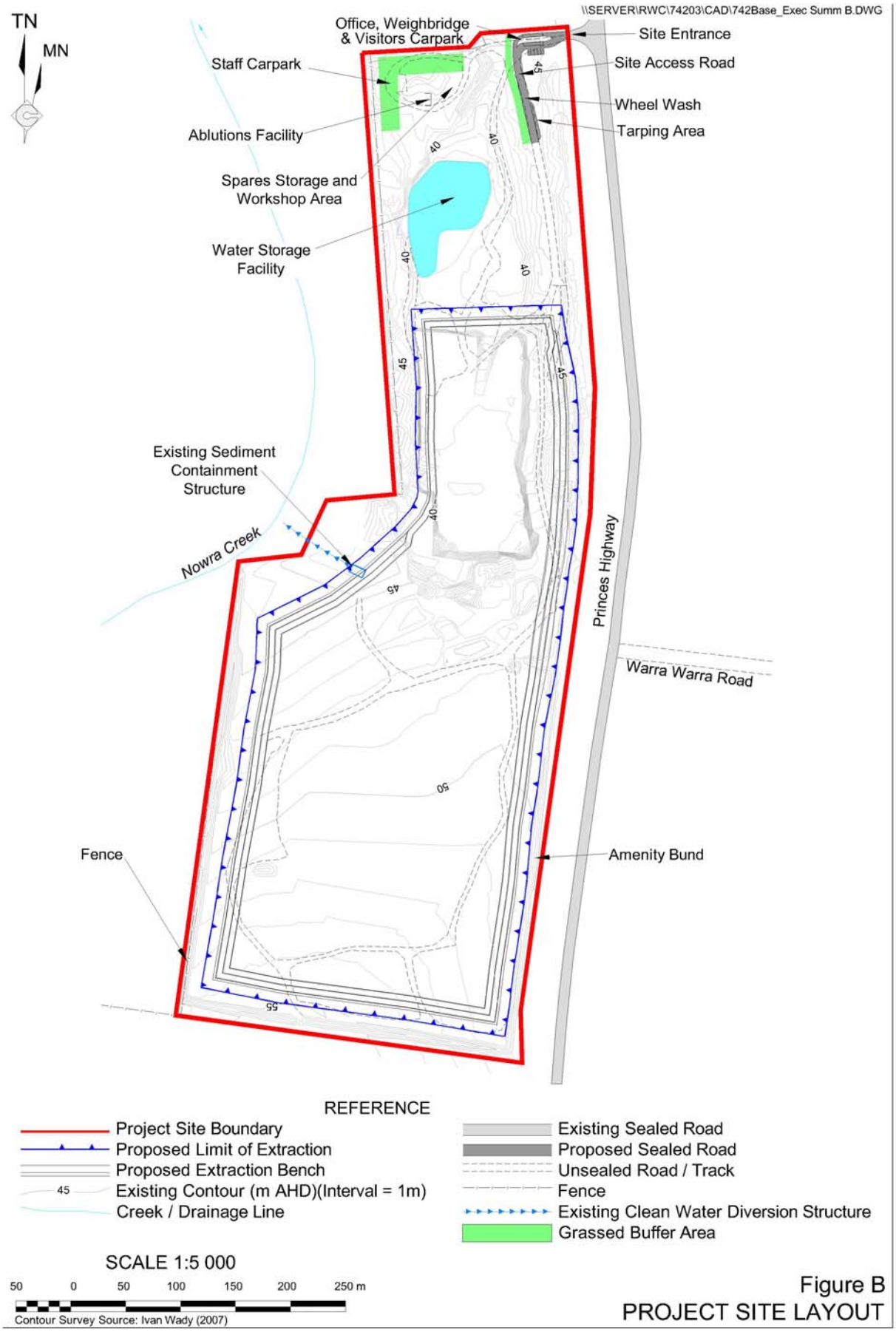


Figure B
PROJECT SITE LAYOUT

- Processing and blending of extracted, recycling and blending material to produce general and specialised products using a mobile processing plant.
- Stockpiling of quarry products.
- Loading, sale and despatch of an average of approximately 300 000t per year, to a maximum of approximately 500 000t per year, of quarry products using road registered heavy vehicles.
- Importation and placement of up to 200 000t per year of VENM. A small proportion of this material may be processed and blended with other materials to produce saleable products. The remainder would be placed within completed sections of the extraction area to establish a final landform that mimics the pre-extraction landform within the Project Site.
- Progressive rehabilitation of areas no longer required for extraction or VENM placement-related activities.

Site Construction

The Proponent would progressively increase the rate of product despatch from the present rate of 125 000t per year. The following construction-related activities would be completed prior to despatch of quarry products exceeding 250 000t per year.

- Widening of the site entrance to 11m.
- Construction and sealing of the site access road.
- Construction and installation of a wheel wash and shake down facility.
- Extension of the existing tarping area.
- Erection of a transportable office, second weighbridge and ablutions facility.
- Construction and sealing of the visitor's carpark.
- Construction of a bio-infiltration facility adjacent to the water storage facility.

Land Preparation

Land preparation would involve the removal of vegetation and soil from undisturbed sections of the Project Site to allow the expansion of the extraction area. The following procedures would be employed during vegetation removal operations.

- Vegetation would be cleared during the late spring to early autumn.
- All hollow-bearing trees would be identified, marked and inspected for fauna.
- Once the absence of native fauna is confirmed, large trees would be removed using a bulldozer. The cleared vegetation would be cut or broken into manageable lengths or coarsely mulched, and either placed on areas undergoing progressive rehabilitation or stockpiled for later use during rehabilitation.
- Smaller vegetation and groundcover would be removed during soil stripping operations.

Soil would be removed in two layers. Between 180mm and 250mm of topsoil and 175mm and 500mm of subsoil would be stripped and either placed immediately on areas undergoing progressive rehabilitation or used stockpiled for later use.

Extraction Operations

Weathered shale material would be extracted from below the base of the subsoil to a depth where the material becomes too hard to be extracted using an excavator, generally between 3m and 5m below the natural surface. The weathered shale material would continue to be loaded directly into road registered trucks for transportation to the Proponent's customers, stockpiled for subsequent sale and despatch, or used for rehabilitation-related purposes within the Project Site.

Once the hardness of the shale becomes too great to be ripped, ie. progression to unweathered shale material, drill and blast techniques would be direct loaded into the processing plant using an excavator.

All drilling and blasting-related activities would be supervised by a suitably qualified and experienced blasting engineer or shot firer. Drilling activities would continue to be undertaken using a hydraulic drill rig. Up to 13 blasts would be initiated each year and each blast would typically continue to break between 12 000 bank cubic metres (bcm) and 15 000bcm of shale material. Blasting would continue to be conducted between the hours of 9:00am and 4:00pm Monday to Friday and only one blast would be initiated on any given day. No explosives would be stored within the Project Site.

Recycling Operations

Recycling materials would be sourced from construction and demolition sites, primarily within the Shoalhaven and Illawarra areas, with some material sources from the Southern Highlands, Southern Sydney and South Coast areas. Procedures would be implemented to ensure that no material unsuitable for recycling into quarry products is received at the Project Site. Any such material that is received would be disposed of at an appropriate disposal facility.

Materials to be recycled would continue to be placed within a designated area within or adjacent to the extraction area. Non-recyclable materials, such as plastic linings and timber would continue to be removed and disposed of appropriately. Concrete material containing steel reinforcing would be broken using pulverising jaws on an excavator and the steel material would be removed and sold to a steel merchant.

Blending Operations

The Proponent would continue to import blending material from a number of quarries. Blending material would be transported to the Project Site primarily as part of a back loading operation, ie. utilising trucks returning to the Project Site that would otherwise be empty. The amount and timing of materials imported would depend on the demand for particular quarry products, the availability of trucks to back load the material to the Project Site and the quality and price of material produced at each of the quarries.

Processing Operations

All processing operations, as far as practicable, would be undertaken within the extraction area.

The mobile processing plant would be located immediately adjacent to the active extraction area to allow an excavator to directly load extracted, recycling and blending material in appropriate proportions into one or more primary jaw crushers. A proportion of the crushed material would not require any further processing and would be stockpiled for use as select fill or other purposes. The remaining crushed material would be transferred to the secondary cone crusher for further crushing and shaping and then a screening plant for final sizing.

Each component of the mobile crushing plant would continue to be equipped with dust and noise suppression equipment to limit the generation of airborne dust and reduce the potential for adverse noise impacts on the surrounding community.

VENM Placement Operations

The Proponent would import up to 200 000t of VENM per year, primarily from construction sites/projects from an area from Batemans Bay to the south, Wollongong to the north and the Southern Highlands to the west of the Project Site. In addition, depending on the availability of trucks for back loading, the Proponent may import limited VENM from southern Sydney.

The Proponent would implement procedures to ensure that all VENM received at the Project Site is free from contamination and that a record of the source, type and placement location of all material is maintained. If any contaminated material is received, it would be disposed of at an appropriate facility.

VENM would be placed in horizontal lifts approximately 3m high. Each lift would be levelled and compacted prior to construction of the next lift. When backfilling operations reach a point approximately 3.5m below the final landform, a single, uncompacted 3.0m high lift would be constructed. This final lift would preferentially include weathered shale material in the upper 0.5m of the lift to provide suitable growth medium for vegetation. Finally, approximately 0.45m of topsoil and subsoil would be placed on the final landform.

Transportation Operations

The site access road would be the primary access for heavy and light vehicles entering or leaving the Project Site. The site access road would continue to permit access for light and heavy vehicles to the extraction area and southern sections of the Project Site.

Quarry products would be transported from the Project Site via the Princes Highway to the following destinations in approximately the following proportions.

- Urban areas within Nowra to the south of the Shoalhaven River – 25%.

- Urban areas within Nowra, north of the Shoalhaven River and areas to the northwest of Nowra – 25%.
- Areas to the north of Nowra – 30%.
- Areas to the south of the Project Site – 20%.

Materials imported to or from the Project Site would be transported using road-registered rigid trucks, truck and dog trailers, semi-trailer tippers or B-Double trucks. The majority of materials transported to the Project Site would continue to be transported as back loads.

PROJECT DEVELOPMENT SEQUENCE

The Project Site would be developed in six stages (**Figure C**). In summary, extraction operations would progress generally from north to south, with extraction of unweathered shale material and establishment of final quarry faces completed within each stage of the development prior to commencement of the next stage of development.

HOURS OF OPERATION AND PROJECT LIFE

The proposed hours of operation would be 7:00am to 6:00pm, Monday to Friday and 7:00am to 4:00pm, Saturday with the following exceptions.

- Up to three unladen trucks would arrive at the Project Site after between 6:00am and 7:00am Monday to Saturday and a further three may return to the Project Site between 6:00pm and 8:00pm, Monday to Saturday and 4:00pm and 6:00pm on Saturday.
- Maintenance activities may be undertaken until 6pm on Saturday.

The quarry would not operate on Sundays or Public Holidays.

The Proponent is seeking project approval for a period of 30 years.

EMPLOYMENT AND ECONOMIC CONTRIBUTION

At a rate of 300 000t per year of products despatched, the Project would directly and indirectly employ approximately 20 and 7 full-time equivalent employees respectively. At a rate of 500 000t per year of products despatched, the Project would directly and indirectly employ approximately 25 and 12 full-time equivalent employees respectively.

The Proponent anticipates that at an annual rate of product despatch of 300 000t, the Project wound contribute approximately $7.7 and $2.5 million per year to the local/regional, and the wider State and National economies respectively. At an annual rate of product despatch of 500 000t, the Project is estimated to contribute approximately $11.3 and $4.1 million to the local/regional, and the wider State and National economies respectively.

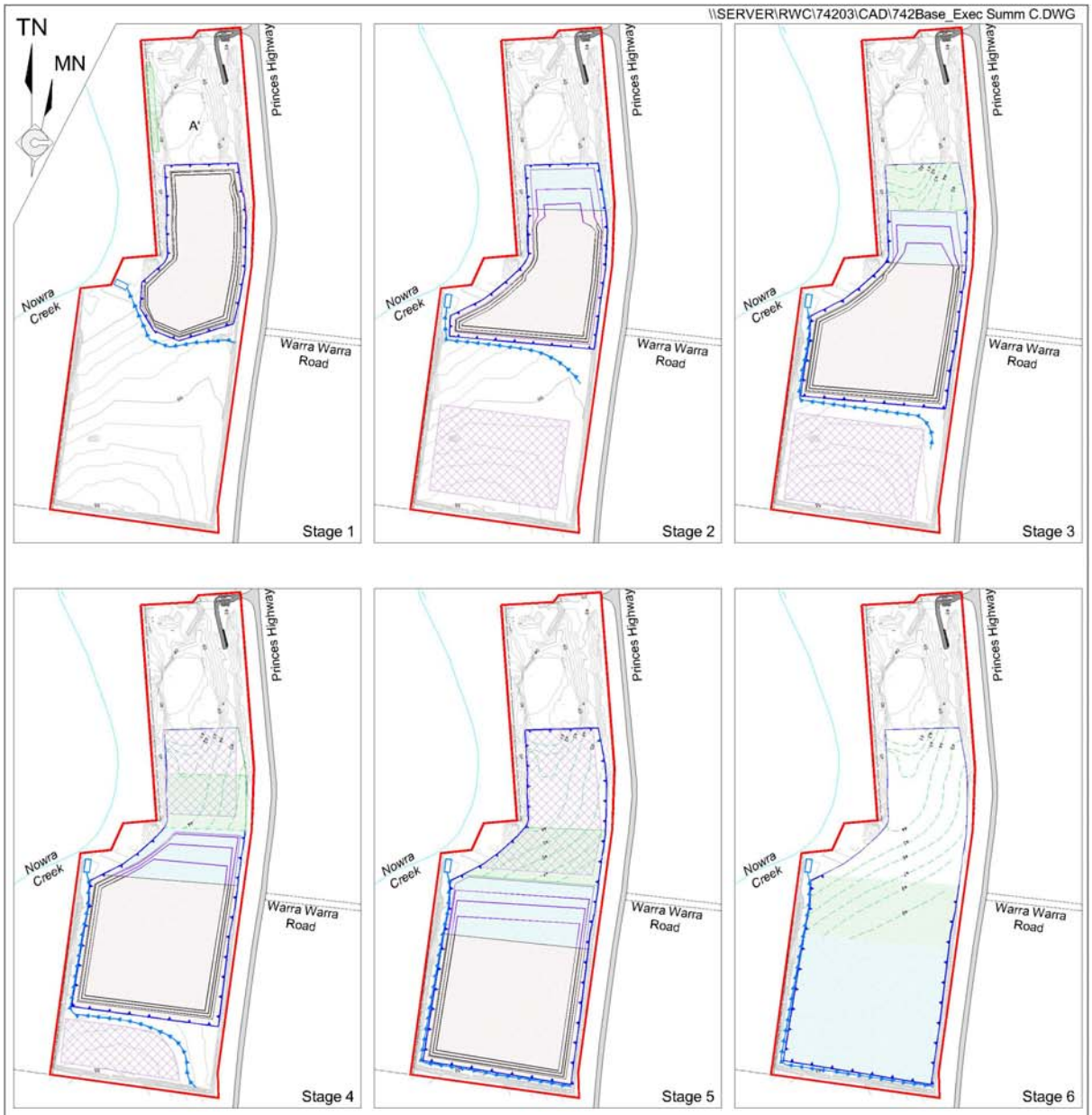


Figure C
PROPOSED DEVELOPMENT STAGES

SAFETY AND SECURITY

The Proponent would ensure that the existing 1.8m high site security fence is maintained and the site entrance gate is locked when the Project is not operating. In addition, all employees and visitors to the Project Site would be required to undergo a Project Site induction which would include training in safe working procedures.

REHABILITATION OPERATIONS

The Proponent would progressively rehabilitate the Project Site following completion of extraction and processing-related operations. The short-term objectives of the Project Site rehabilitation program would be to stabilise all earthworks, drainage lines and disturbed areas in order to minimise the risk of erosion, sedimentation and air quality impacts on the environment surrounding the Project Site, as quickly as possible.

The longer term objectives of the rehabilitation program would be to provide a low maintenance, stable and safe landform that mimics the pre-extraction landform and provides for the establishment of vegetation communities similar to communities in undisturbed areas adjacent to and surrounding the Project Site.

The final landform would include:

- a gently sloped re-created landform within the extraction area that mimics the pre-extraction landform;
- a fenced water storage facility;
- an access track to allow vehicular access to the water storage facility; and
- the retention of the existing perimeter amenity bund.

The Proponent would initially revegetate and stabilise disturbed sections of the Project Site using a non-regenerating cover crop. Final revegetation would be undertaken using species representative of the Spotted Gum forest within and adjacent to the Project Site.

Progressive rehabilitation would include the following activities.

- Following completion of placement activities, subsoil and topsoil would be placed over the final landform.
- Where required, surface water management structures would be constructed.
- Coarsely mulched or broken vegetation would be spread over the placed topsoil
- Revegetation with a temporary, non-regenerating cover crop to stabilise the area to be rehabilitated in the short-term.
- Species used during final revegetation would be a mixture of lower, mid and upper storey species, sourced from seed collected within or adjacent to the Project Site.
- The area to be rehabilitated would be fenced and signs erected to restrict access to the area.

Areas undergoing rehabilitation would be regularly inspected and assessed against the short- and long-term rehabilitation objectives and remedial action undertaken, where appropriate.

BIODIVERSITY OFFSET STRATEGY

In order to compensate for the removal of approximately 7.4ha of Spotted Gum Forest, the Proponent proposes to protect the following two areas of Spotted Gum Forest within and surrounding the Project Site (**Figure D**).

- Approximately 3.0ha within the Northern Biodiversity Offset Area.
- Approximately 17ha within the Southern Biodiversity Offset Area.

The aim of the proposed biodiversity offset strategy would be to maintain or improve the cumulative biodiversity values of the land within and surrounding the Project Site for the life of the anticipated impacts.

The Northern Biodiversity Offset Area incorporates part of Lot 464, DP1058778. The State of New South Wales is the registered owner of this land. The Proponent holds Mining Leases 5087 and 6322 over this land and retains access to that land through those leases. The Proponent or its successors in title would manage the Northern Biodiversity Offset Area in accordance with the management measures described below while ever the mining leases remain in force. In the event that the leases are relinquished or cancelled, the Proponent would provide sufficient resources for the on-going management of the Northern Biodiversity Offset Areas for the life of the offset strategy.

The Southern Biodiversity Offset Area comprises part of Lots 228 and 229 DP 755952. The land is owned by Mrs J. Goodsell and the Proponent has agreed with her to acquire a lease over the land for the term of the offset strategy, subject to the granting of project approval. The lease would include terms that would prevent the lease from being terminated by the lessor or subsequent owners of the land. The Proponent would secure the Southern Biodiversity Offset Area through a covenant or restriction on the use of the land to the satisfaction of the Department of Environment and Climate Change.

The following biodiversity management measures would be implemented during the life of the biodiversity offset strategy.

- Stock would removed and would continue to be excluded.
- Boundary fences would be erected or maintained.
- Appropriate fences would be erected to restrict wildlife from entering areas of active mining and rehabilitation-related operations. These fences would be removed once extraction and rehabilitation-related activities have ceased.
- Pest and weed control programs would be implemented and regular monitoring would be undertaken.

The life of the biodiversity offset strategy would be between 80 and 120 years.

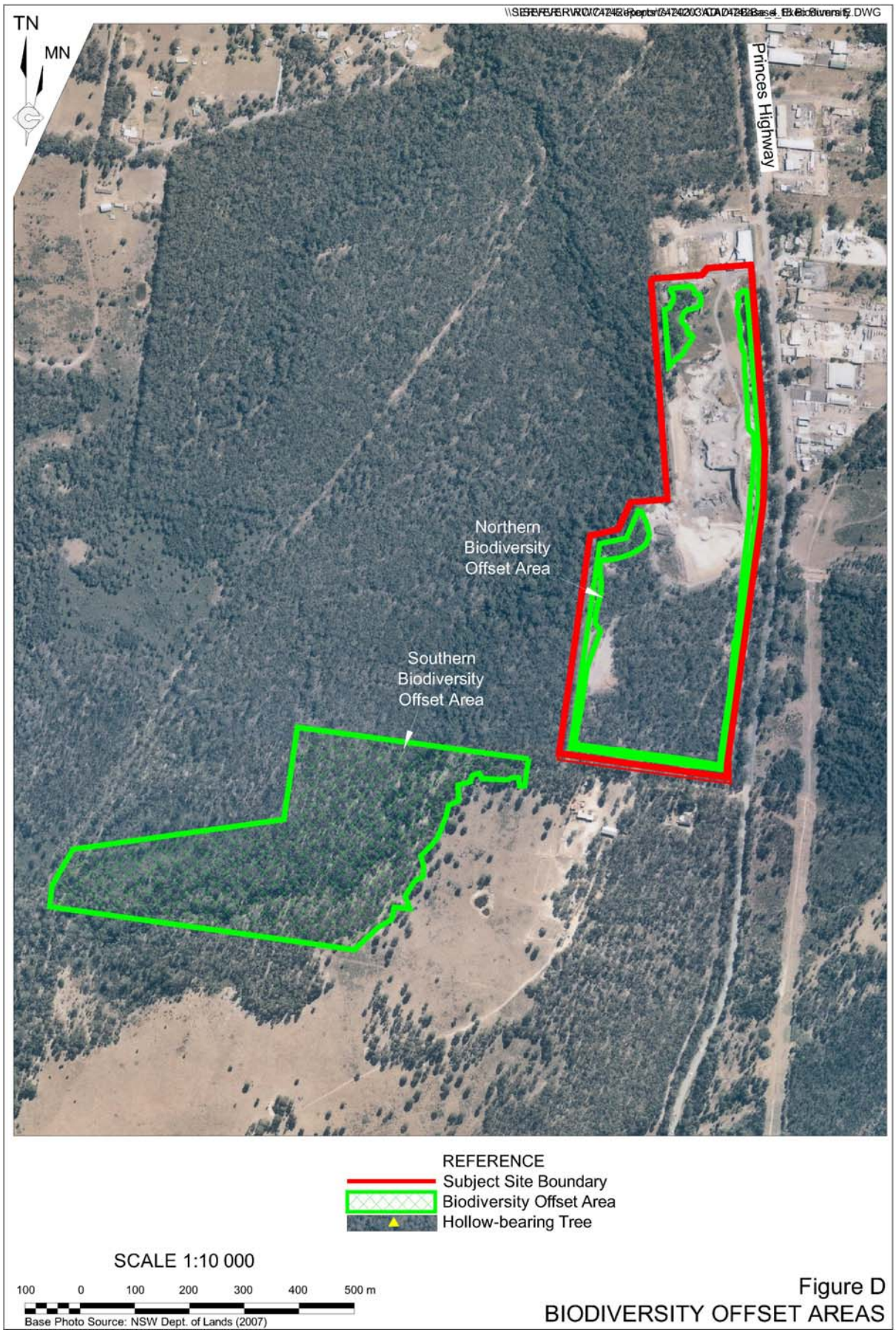


Figure D
BIODIVERSITY OFFSET AREAS

ISSUE IDENTIFICATION AND PRIORITISATION

In order to undertake a comprehensive environmental assessment of the Project, the Proponent undertook the following steps to identify and prioritise potential environmental impacts associated with the Project.

- Consultation with residents and other land users in the vicinity of the Project Site.
- Consultation with government agencies through a planning focus meeting.
- Review of relevant State Environmental Planning Policies.

This process identified 12 potential environmental issues as follows. These issues have been prioritised as follows based on potential environmental impacts and the frequency that each issue was identified during consultation with the community and relevant government agencies.

- Hydrology (groundwater and surface water).
- Ecology.
- Traffic and Transportation.
- Air Quality.
- Noise and Blasting.
- Aboriginal Heritage.
- Soils and Land Capability.
- Strategic Planning.
- Visual Amenity.
- Bushfire.
- European Heritage.
- Socio-economic impacts.

ENVIRONMENTAL SAFEGUARDS AND RESIDUAL IMPACTS

The components and features of the existing environment within and in the vicinity of the Project Site have been studied in detail and the Project designed to avoid or minimise impacts on the environment. A brief overview of the main components of the surrounding environment, the proposed safeguards and the residual impacts are set out below.

Hydrology

Potential Project-related surface water and groundwater impacts include adverse impacts on the quality and quantity of water within Nowra Creek (**Figure B**) and aquifers within and in the vicinity of the Project Site. In order to minimise the potential for such impacts, the Proponent would implement the following.

- Maintain and progressively relocate the existing and future surface water diversion structures to divert all surface water flows from undisturbed sections of the Project Site and areas where initial rehabilitation has been completed.
- Construct, maintain and relocate, as required, surface water diversion structures to ensure that all surface water flows within disturbed sections of the Project Site are directed to the extraction area or the water storage facility. The maximum area of this catchment would be 5.9ha.

- Construct a suitably sized sump within the active extraction area to collect all surface water runoff and groundwater inflows to the extraction area.
- Preferentially use water within the extraction area sump for dust suppression-related activities. Surplus water within the extraction area sump would be pumped to the water storage facility.
- Preferentially use water within the water storage facility for rehabilitation-related activities or for irrigation within the irrigation area (see below).
- Construct and relocate as required, an irrigation area of at least 4ha in the southern section of the Project Site (**Figure C**). The irrigation area would be irrigated preferentially using water from the water storage facility.
- Construct 'grassed buffer areas' adjacent to the site access road and other sealed sections of the Project Site as indicated on **Figure B**.

The hydrology assessment concluded the following.

- No water would be required to be discharged from the water storage facility to Nowra Creek.
- Surface waters from undisturbed sections of the Project Site, areas of completed rehabilitation/ stabilisation operations and the grassed buffer areas adjacent to the site access road and other sealed sections of the Project Site would continue to flow to Nowra Creek.
- Water that would be permitted to flow to Nowra Creek from the areas identified above would have Nitrogen, Phosphorous and suspended sediment concentrations of less than the concentrations currently within Nowra Creek.
- The Project would result in a decrease in the height of flood events within Nowra Creek of between 0.03m and 0.06m.
- The Project Site does not encroach upon flood liable land.
- The Project would result in a drawdown of the piezometric surface in the vicinity of the Project Site of a maximum of 18m. The 1m drawdown contour is anticipated to occur approximately 1 425m from the boundary of the extraction area.
- As the closest registered bore to the Project Site is 3.9km to the northeast, the anticipated drawdown of the piezometric surface would not impact on registered bores in the vicinity of the Project Site. In addition, the economic value of groundwater is likely to be low due to its saline nature.
- As the existing piezometric surface is 9m below the invert of Nowra Creek, the anticipated drawdown of the surface would be unlikely to have an impact of Nowra Creek.
- There are no anticipated impacts to groundwater dependent ecosystems in the vicinity of the Project Site.

- The anticpated salt concentration of water that would be permitted to flow to Nowra Creek would be from undisturbed, rehabilitated or impervious sections of the Project Site would be approximately 220mg/L.

  The median concentration of dissolved solids used for irrigation within the irrigation area would be approximately 760mg/L. The 85th percentile concentration of dissolved solids would be approximately 335mg/L Martens (2009) state that this water may be used for irrigation purposes without any significant detrimental effect on plants or soils within the Project Site.

As a result, the Project is not anticipated to have a significant adverse impact on the quality and quantity of water within Nowra Creek or groundwater resources within and in the vicinity of the Project Site.

Ecology

Eleven fauna species and three flora species listed on the schedules of the *Threatened Species Conservation Act 1995* (TSC Act) were recorded as occurring within 5km of the Project Site.

Vegetation within the Project Site comprises previously logged Spotted Gum forest, of which approximately 7.4ha would be disturbed by the Project. Eighty one species of plants were identified within the Project Site, including thirty species of exotic weeds. Approximately 49 hollow-bearing trees have been identified within the Project Site, of which approximately 37 would be disturbed by the Project. No Endangered Ecological Communities or species listed under the *Threatened Species Conservation Act 1995* were observed within the Project Site.

Sixty three species of fauna were observed within or surrounding the Project Site. One, the Square-tailed Kite, was observed adjacent to the Project Site.

The Proponent would implement the following measures to limit the risk of adverse Project-related impacts on flora and fauna.

- Limit the removal of native vegetation to those areas required for operational purposes during the subsequent 12 months.
- Mark all hollow-bearing trees to ensure they are readily identifiable.
- Clearly mark the boundaries of areas of native vegetation to be cleared. No clearing would occur outside these boundaries. Only the area required for extraction-related operations during the next 12 months would be disturbed.
- Set cage traps in the vicinity of hollow-bearing trees for three consecutive nights prior to clearing of native vegetation.
- Clear non-hollow bearing trees first, where practicable, to allow any remaining nesting or roosting to animals to leave the area to be disturbed prior to removing hollow-bearing trees.
- Ensure a qualified fauna consultant observes operations when hollow-bearing trees are being removed to rescue any remaining nesting or roosting fauna.

- Break or cut into manageable sections cleared vegetation to be placed on areas undergoing rehabilitation or within other areas of native vegetation surrounding the Project Site.
- Control noxious weeds within the Project Site.

The Ecology assessment concluded that no threatened species listed under the TSC Act or under the *Environment Protection and Biodiversity Conservation Act 1999* would be significantly impacted by the Project.

Traffic and Transportation

Potential Project-related impacts include increasing traffic levels on the Princes Highway and poor performance of the intersection between the site access road and highway. In order to minimise the potential for such impacts, the Proponent would implement the following.

- Transportation operations would adhere to the approved hours of operation.
- All speed limits would be strictly adhered to.
- All entering and exiting laden trucks would pass over the weighbridge.
- The Proponent would seal a 150m section of the site access road and construct a wheel wash facility prior to the amount of quarry products despatched from the Project Site exceeding 250 000t per year.
- The Proponent would ensure all loads are covered.
- The Proponent would require all truck drivers to sign a Driver's Code of Conduct.

The anticipated additional Project-related traffic would increase traffic levels on the Princes Highway by 0.1% or less. The operations of the existing site entrance would be good to satisfactory.

Air Quality

Potential air quality impacts include the dispersion of particulate material in the atmosphere. In order to reduce the generation of airborne dust, the Proponent would implement the following.

- Utilise a chemical dust-lift off suppression system along unsealed roads, tracks and working areas, as well as within the processing plant(s) during the life of the Project.
- Utilise efficient mist sprays and wind sheltering equipment on processing equipment.
- Maintain a maximum speed limit within the Project Site of 10km/h.
- Install a wheel wash on the site access road.
- Utilise dust aprons, dust extraction systems and/or water injection or sprays during drilling operations, as required.

- Adequately stem all blast holes with aggregates.
- Commence rehabilitation as soon as practicable once an area is no longer required for extraction or placement-related operations.

At the maximum rate of product despatch (500 000t per year), the anticipated rate of dust deposition from the Project alone would exceed the assessment criteria for sensitive receivers of 2g/m^2/month at two non-residential sites, namely at the Nowra Brickworks site adjacent to the northern boundary of the Project Site (2.2g/m^2/month) and at the conceptual roundabout at the intersection of Warra Warra Road and the Princes Highway (2.7g/m^2/month) (**Figure E**). In addition, the maximum cumulative daily $PM_{2.5}$ concentration would exceed the assessment criteria of 25µg/m^3 at one site, namely Residence A to the south of the Project Site (26.25µg/m^3) (**Figure E**). The Proponent has approached the owner of Residence A with a view to negotiating an appropriate arrangement. The owner of that residence has indicated that they would prefer to postpone such negotiations at the present time. The Proponent would seek to re-commence negotiations at an appropriate time.

Noise

Existing noise levels in the vicinity of the Nowra Brickworks Quarry are influenced by a range of sources including traffic on the Princes Highway, industrial noise from industrial and commercial operations to the east and north of the Project Site, noise from the Nowra Brickworks Quarry itself and naturally occurring noise, including noise from wind in trees, insects and birds. Project-specific noise assessment criteria were determined for four representative residences, namely Residences A to D (**Figure E**).

In order to reduce noise emissions, the Proponent would implement the following.

- Strictly adhere to the hours of operation.
- Use noise-mitigated mobile and processing equipment.
- Undertake all processing operations within the deepest section of the quarry.
- Maintain all mobile and processing equipment in accordance with the manufacturer's specifications.
- Progressively install frequency modulated reversing alarms on mobile equipment, as equipment is renewed.
- Negotiate an appropriate arrangement with the owner of Residence A prior to the completion of Stage 1 of the Project.

With the exception of Residence A during Stage 5 of the Project where the Project-specific assessment criteria (51dB(A)) would be exceeded by 5dB(A), Project-related noise emissions would be less than the Project-specific assessment criteria at all assessment locations.

Project-related road traffic noise at Residence E, the closest residence to the Princes Highway (**Figure E**), was determined to be within the relevant road noise criteria.

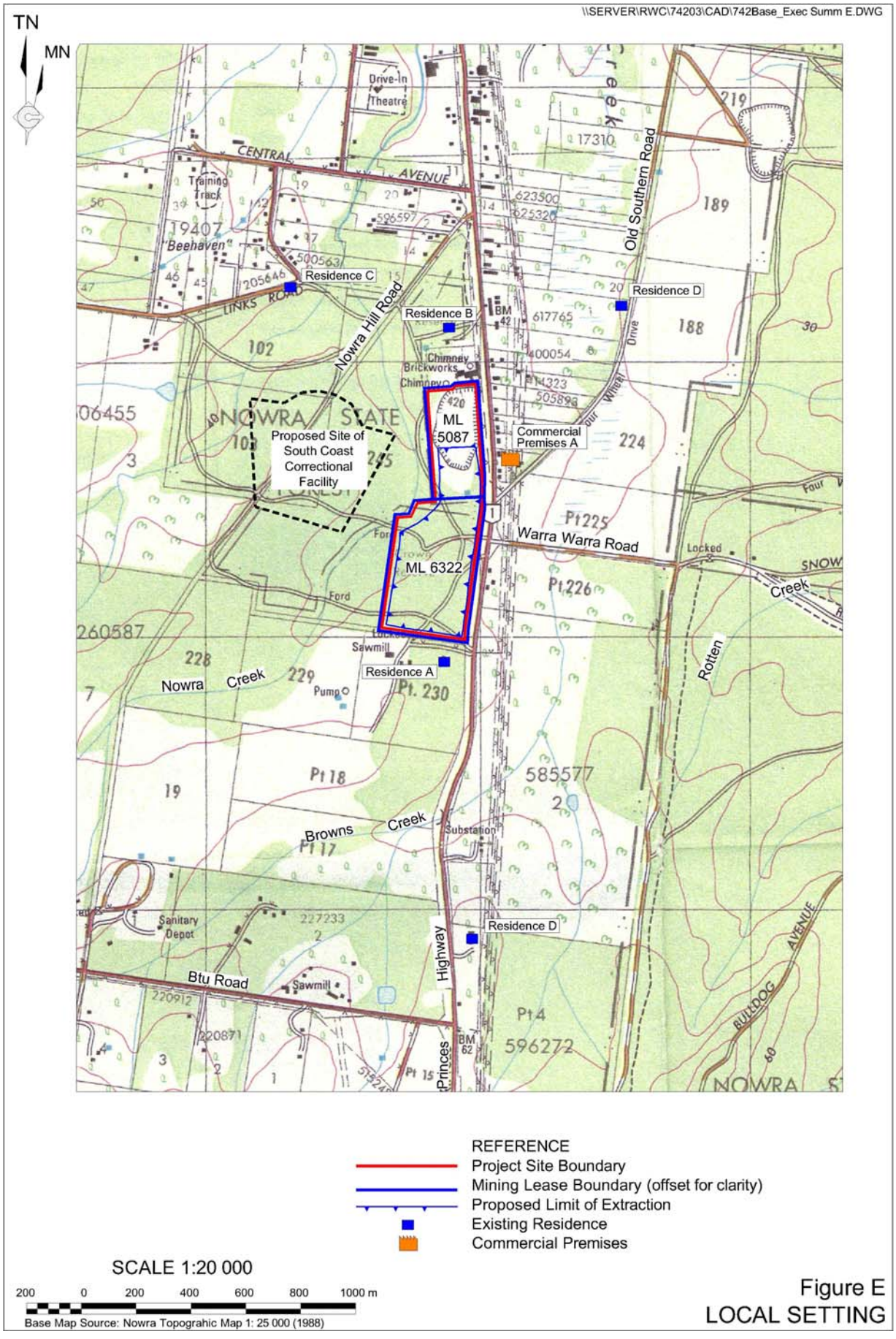


Figure E
LOCAL SETTING

Blasting

Blasting impacts primarily include ground vibration and airblast overpressure. In order to reduce blasting impacts, the Proponent would implement the following.

- Blasts would be designed and implemented by a suitably qualified blasting engineer and experienced shot-firer.
- All blasts would be designed to adhere to the following blasting assessment criteria.
  - Residential receivers – ANZEC recommended blasting limits, namely ground vibration less than 5mm/s for 95% of blasts and less than 10mm/s for all blasts and airblast overpressure less than 115dB Linear for 95% of blasts and less than 120dB Linear for all blasts.
  - Commercial receivers and the proposed South Coast Correctional Facility – Ground vibration less than the British Standard 7385: Part 2-1993 "*Evaluation and Measurement for Vibration in Buildings Part 2"* guide for structural damage to reinforced or heavy framed buildings of 50mm/s. Airblast overpressure less than the Australian Standard AS 2187.2-2006 recommended criterion of 133dB Linear.
- All blasts would be monitored at the existing blast monitoring location, the proposed South Coast Correctional Facility and elsewhere, as required.
- Blast designs, mitigation measures and operating procedures would be modified on the basis of monitoring results, if required.
- Blasting would continue to occur between the hours of 9:00am and 4:00pm, Monday to Saturday.
- An appropriate arrangement would be negotiated with the owner of Residence A prior to the completion of Stage 1 of the Project. As indicated previously, the owners of Residence A have requested that negotiation of a suitable arrangement be postponed.
- Notify relevant government agencies and residents on the working day prior to the blast being initiated.

The blasting assessment indicates that the existing blasting parameters would result in exceedances of the blasting assessment criteria at Residence A and B and Commercial Premises A (**Figure E**). However, the blasting parameters would be modified for each blast to ensure that all blasts comply with the assessment criteria at all non-Project related residential and commercial receivers surrounding the Project Site. As a result, the Project would have no significant blasting-related impacts on surrounding residential or commercial receivers.

Aboriginal Cultural Heritage

No sites of Aboriginal heritage significance were identified within the Project Site. As a result, the Project would have no impact on matters of Aboriginal heritage significance.

Visual Amenity

The Proponent would implement the following to limit the potential for adverse impacts on the visual amenity of the area in the vicinity of the Project Site.

- The existing perimeter amenity bunds, vegetated buffer within the Nowra Creek riparian zone and line of mature trees adjacent to the eastern Project Site boundary would be retained and enhanced.
- The Proponent would adopt a high standard of housekeeping.

The Project would have a negligible impact on the visual amenity of the area in the vicinity of the Project Site.

Bushfire

The Project Site is identified as bushfire prone land on the *Bushfire Prone Lands Map* published by the NSW Rural Fire Service. As a result, the Project is considered to be compliant with the requirements of Clause 46 of *Rural Fires Regulation 2002* and the document *Planning for Bushfire Protection* published by the NSW Rural Fire Service in 2006.

European Heritage

No items of European Heritage significance were identified within the Project Site or within 4.5km of the Project Site. As a result, the Project would have no impact on matters of European heritage significance.

Socio-economic

The Project Site is located within the Shoalhaven City Council Local Government Area (Shoalhaven LGA). The Proponent would implement the following to ensure the socio-economic benefits of the Project are maximised.

- Where ever practicable, preference would be given to suppliers of equipment, services or consumables located within the Shoalhaven LGA or Illawarra Region.
- Where ever practicable, when engaging new employees, the Proponent would hire candidates who live within the Shoalhaven LGA.
- The Proponent would continue to support community organisations.
- The Proponent would consult with the community, as required.
- The Proponent would advertise and maintain a community complaints telephone line and a Complaints Management Plan to ensure prompt response to issues identified by the public.

The Project is predicted to have the following social and economic benefits.

- Creation of 27 full-time equivalent positions at an annual rate of product despatch of 300 000t, increasing to 37 full-time equivalent positions at an annual product despatch rate of 500 000t.
- Injection of approximately $11.3 million per year into the local and regional economy, and approximately $4.1 million into the State and national economy at an annual product despatch rate of 500 000t. This expenditure is likely to generate additional economic activity and flow on effects, providing further employment opportunities.
- Provision of a range of competitively priced, high quality specialist and general quarry products.
- Provision of a competitively priced service to accept and recycle construction material, which may otherwise end up in regional landfills.
- Provision of a well managed facility to receive, process and place VENM at competitive prices.
- Ongoing availability of easily accessible water supplies, including pumps, for rapidly filling tankers, for use during emergencies.

The Proponent contends that any adverse socio-economic or environmental impacts, both actual and perceived, would be more than adequately countered by the positive effect that the Project would have on employment in the vicinity of the Project Site and contribution of the Project to the local and regional economy and community.

JUSTIFICATION AND EVALUATION

The Project has been evaluated and justified principally through consideration of its potential impacts on the environment and potential benefits to the local and wider community.

An evaluation of the Project was undertaken through consideration of the principles of ecologically sustainable development and on balance, it is concluded that the Project achieves a sustainable outcome for the local and wider environment.

The Project and associated activities have been assessed in terms of a wide range of biophysical, social and economic issues. The Project would have some minor adverse impacts, including the following.

- The short to medium-term loss of an area of Spotted Gum forest.
- More frequent blasting operations.
- A slight increase in the number of heavy vehicles using the Princes Highway.

These impacts can be justified in terms of the significant positive economic and social benefits to the local and wider community.

CONCLUSION

The proposed continuation and expansion of extraction operations at the Nowra Brickworks Quarry has, to the extent feasible, been designed to address the issues identified by the local community, all levels of government and a range of specialist consultants. The Project provides for the extraction of shale material within the Project Site, blending of products from other quarries and recycling of waste construction materials to produce a range of specialist and general quarry products for use in building and road construction and maintenance projects, providing benefits for, and boosting the economies of the local and wider community. In addition, the Project provides for the backfilling of the extraction area and the creation of a final landform that would mimic the pre-extraction landform. The post-extraction landform would be used for nature conservation, which, together with the proposed biodiversity offset strategy, would provide medium to long-term environmental benefits.

The *Environmental Assessment,* supported by the range of specialist consultant studies, has established that if the Project proceeds, it would:

- contribute to satisfying the demand for general and specialist quarry products;
- satisfy ecological sustainable development principles;
- have an acceptable and manageable impact on the biophysical environment; and
- contribute to the continued economic activity of the local and wider community.

PREAMBLE

Section 1

Introduction

This section introduces a proposal to continue and expand the extractive operations at the Nowra Brickworks Quarry, South Nowra located approximately 5km south of Nowra CBD.

This section provides:

- *an outline of the scope and format of the document;*
- *an introduction to the Proponent;*
- *relevant background to the Project, including a review of the history of quarrying at the Nowra Brickworks Quarry;*
- *a discussion on the proposed approach towards environmental management and documentation; and*
- *the identification of the personnel involved in the project design, document preparation and specialist consultant investigations.*

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1.1 SCOPE

This *Environmental Assessment* has been prepared by R.W. Corkery & Co. Pty Limited and City Plan Services Pty Ltd to support an application for project approval (application number 07-0123) by South Coast Concrete Crushing & Recycling Pty Ltd ("the Proponent") to continue and expand extractive operations at the Nowra Brickworks Quarry, South Nowra ("the Project"). A copy of the application for project approval is included as **Appendix 1**.

For the purposes of this document, the area that comprises Mining Leases (MLs) 5087 and 6322 is referred to as the "Project Site". **Figures 1.1 and 1.2** provide the location and local setting of the Project Site approximately 5km south of the Nowra CBD.

The Project would involve the following activities.

- Construction of a sealed site access road from the Princes Highway.
- Staged extraction by excavator of approximately 1w4 000t per year of weathered shale material for direct sale.
- Staged extraction by drill and blast methods of up to 350 000t per year of unweathered shale material ("extracted material") for processing and blending to produce quarry products.
- Importation and stockpiling of up to approximately 50 000t per year of selected construction, concrete and waste bitumen material ("recycling material").
- Importation and stockpiling of up to approximately 125 000t per year of quarry products from other quarries ("blending materials").
- Processing, blending and stockpiling of extracted, recycling and blending material to produce general and specialised quarry products.
- Loading, sale and despatch of an average of approximately 300 000t per year, to a maximum of approximately 500 000t per year, of quarry products using road registered heavy vehicles.
- Importation and placement of up to approximately 200 000t per year of Virgin Excavated Natural Material (VENM) to create a final landform that would mimic the pre-extraction landform.
- Progressive rehabilitation of areas no longer required for extraction or placement-related activities.
- Implementation of comprehensive systems to manage noise, vibration, air quality, water resources, Aboriginal heritage, flora, fauna, visibility and traffic-related issues.

\\SERVER\RWC\74203\CAD\742Base_1.1 Locality.DWG

Figure 1.1
LOCALITY PLAN

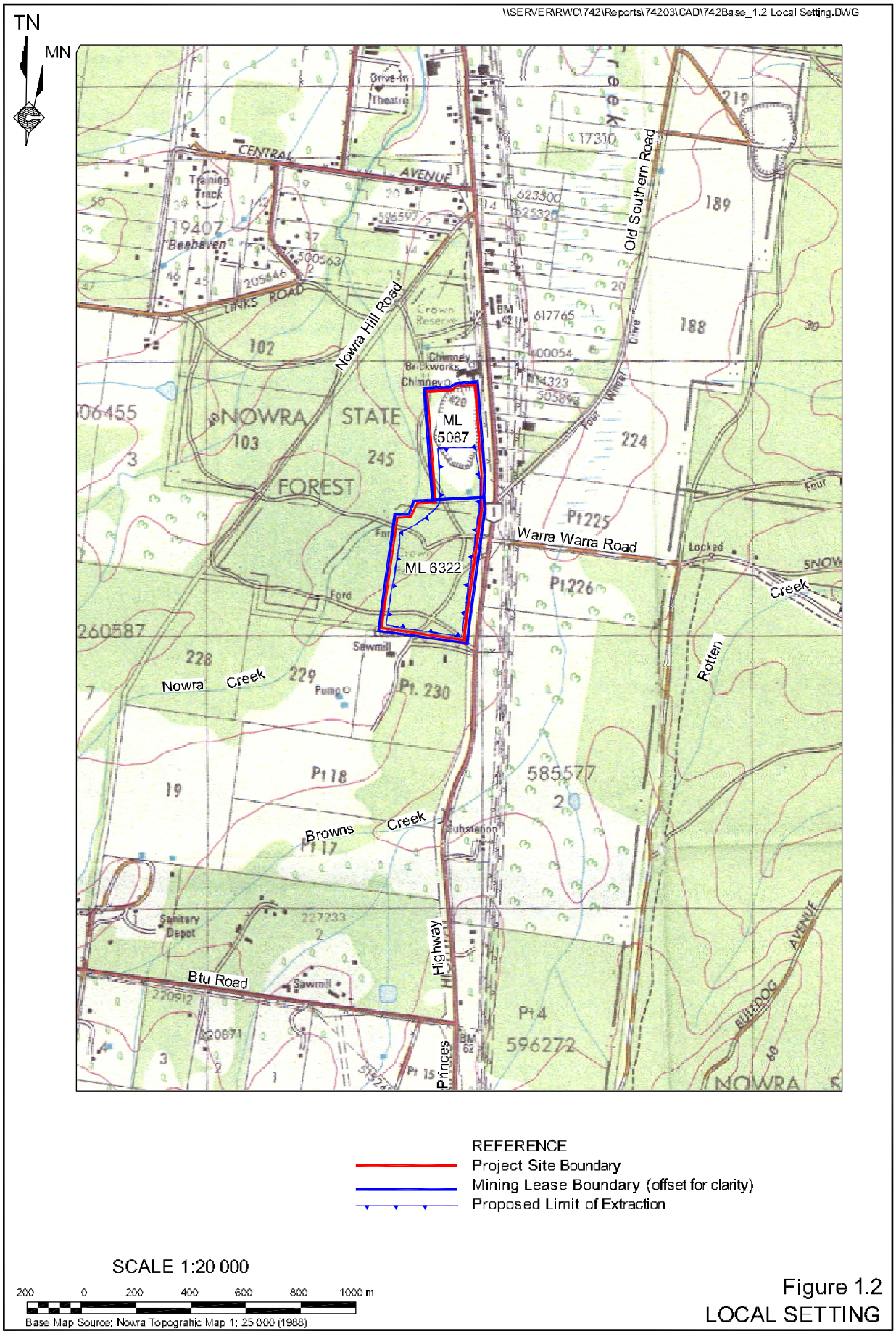

Figure 1.2
LOCAL SETTING

The Project is classified as a "Major Project" under Clause 7 of Schedule 1 of *State Environmental Planning Policy (Major Projects) (2005)*. As a result, the Project is to be assessed under Part 3A of the *Environmental Planning and Assessment Act 1979* and the Minister for Planning is the approval authority. This *Environmental Assessment* has been prepared in accordance with the requirements of Section 75H of that Act.

The information provided in this document is presented to a level of detail which adequately addresses all relevant issues identified by the various stakeholders including Government agencies, surrounding residents and the local community (refer to Section 3.2). Emphasis has been placed upon comprehensively addressing the key issues and limiting coverage of those issues that are not central to the determination of the project approval application. This approach is consistent with Director-General's Requirements issued for the Project (see **Appendix 2**).

1.2 THE PROPONENT

South Coast Concrete Crushing and Recycling Pty Ltd (the "Proponent") is an Australian private company that has operated the Nowra Brickworks Quarry since Mining Leases 5087 and 632 were acquired from the previous holder in 2002. The mining leases are held by Abib Pty Ltd, a company related to the Proponent, and the Proponent operates the quarry under agreement with that company.

The Proponent's sole activity is the operation of the Nowra Brickworks Quarry and transportation of a proportion of quarry's products to the Proponent's customers.

1.3 DOCUMENT FORMAT

The *Environmental Assessment* includes six sections of text, a glossary section, references and a set of appendices. The information presented in this document covers all aspects of the planning, development, operation, rehabilitation and environmental monitoring at the quarry at a level of detail dependent on the risk posed by each issue. The issues and their relevant importance to the assessment of the Project have been identified through consultation with government authorities, the local community, stakeholders, surrounding landowners and Specialist Consultant assessments.

The format of the *Environmental Assessment* is as follows.

Section 1: introduces the Project, the Proponent and Project Site. A brief overview is also provided of the history of the Nowra Brickworks Quarry and existing operations within the Project Site, the environmental management and documentation that would be implemented and details related to the management of the investigations.

Section 2: provides a description of the Project, including the Proponent's objectives, the shale resources and activities required to increase the quarry's production rate and allow for the importation and placement of VENM. Details of the proposed extraction, blending, processing, stockpiling despatch and backfilling operations are provided, together with an outline of the hours of operation and Project life, water management operations and progressive and final rehabilitation activities.

Section 3: provides a summary of the consultation undertaken with the local community and relevant government agencies along with a review of the relevant preliminary environmental studies. Key issues for assessment have been identified and prioritised based on the results of the consultation.

Section 4: provides a range of background information related to the existing environment in the vicinity of the Project Site. The section also provides a description of the proposed mitigation measures and management procedures, assessment of potential environmental impacts and monitoring that would be undertaken for the key issues identified in Section 3.

Section 5: provides a draft Statement of Commitments the Proponent would implement with respect to environmental management and monitoring for the Project.

Section 6: presents an evaluation of the Project assuming the adoption of all of the Proponent's commitments. The proposed direct and indirect impacts are then justified, particularly in light of the principles of Ecologically Sustainable Development.

Section 7: presents a glossary of technical terms, acronyms, symbols and units used throughout the *Environmental Assessment*.

Section 8: lists the various source documents referred to for information and data used during the preparation of the *Environmental Assessment*.

Appendices: present the following additional information.

Appendix 1: A copy of the Proponent's Major Projects Application.

Appendix 2: A copy of the Director-General's Requirements and a tabulated summary of those requirements and the *Environmental Assessment* requirements provided by other government agencies which identifies where each requirement is addressed in the *Environmental Assessment*.

1.4 PROJECT BACKGROUND AND EXISTING OPERATIONS

1.4.1 Project Background

Mining Lease (ML) 5087 was originally granted to Mr Claude Downs on 8 January 1948 in accordance with the *Mining Act 1906* to enable the extraction of brick clay. This lease has been renewed until 8 January 2019 in accordance with the *Mining Act 1992*. No further approvals were required under any other Act at that time to enable extraction operations to commence. The conditions of this lease permit extraction of the following minerals.

- Brick Clay.
- Clay Shale.
- Clay/Shale.
- Structural Clay.

ML 6322 was granted to Mr Downs on 8 March 1972 also in accordance with the *Mining Act 1906* and has been subsequently renewed until 8 March 2020 in accordance with the *Mining Act 1992*. Approval for the extraction of clay and shale from ML 6322 was granted by the State Planning Authority on 24 September 1971. The conditions of this lease permit extraction of the following minerals.

- Brick Clay.
- Structural Clay.

The two leases were transferred to Nowra Brickworks Pty Ltd on 30 June 1988. Abib Pty Ltd acquired the leases from Nowra Brickworks Pty Ltd. on 20 December 2002 and extraction operations since that date have been undertaken by the Proponent. During that period, the Proponent has paid royalties to the NSW Government for the extraction of shale material within the leases.

In October 2005, proceedings were brought in the Land and Environment Court of New South Wales by three of the Proponent's competitors, namely Normans Plant Hire, Tomerong Quarry and South Coast Resources Pty Ltd. The plaintiffs to that action sought a declaration that the Proponent's extractive operations on both ML5087 and ML6322 were unlawful. The Court held that extraction operations within ML5087 benefit from existing use rights under the *Environmental Planning and Assessment Act 1979* and were as a result lawful. However, the Court held that the development consent for extraction operations within ML6322 granted on 24 September 1971 had lapsed prior to the commencement of the Mining Act 1973. As a result, extraction operations within ML6322 were recognised not to have the required approval under the *Environmental Planning and Assessment Act 1979* and were discontinued.

As a result of recent changes to the Mining Act 1992 in relation to Existing Use Rights, the existing operations on ML 5087 were required to obtain approval under the *Environmental Planning & Assessment Act 1979* by the end of 2007. As a result, in consultation with the Department of Planning, an application for project approval for the continuation and expansion of extractive operations within both MLs has been prepared.

A number of separate development consents are held for the Project Site and are summarised as follows. These activities form a component of the application for project approval and would be surrendered in favour of the project approval, should it be granted.

- Development Consent DA 02/3807 issued by Shoalhaven City Council on 14 July 2003 and modified permitting the importation, crushing and recycling of up to 5 000t of demolition material.
- Development Consent DA 07/1230 issued by Shoalhaven City Council on 21 May 2007 for the use of a portable weighbridge.
- Development Consent DA 07/1321 issued by Shoalhaven City Council on 24 May 2007 for the stockpiling and storage of materials within ML 6322.
- Development Consent DA 07/1322 issued by Shoalhaven City Council on 24 May 2007 for the provision of earthen bunds around the perimeter of ML 6322.

In addition, a development application was submitted to Shoalhaven City Council on 12 October 2007 for the continuation of extraction operations within ML5087 until this application for project approval is received.

1.4.2 Existing Operations

Existing operations within ML5087 include the following.

- Extraction of approximately 7 000t per year weathered shale material using an excavator. This material is either loaded directly into road registered trucks for transportation to the Proponent's customers, or is stockpiled for later despatch and sale.
- Extraction of approximately 87 500t per year of unweathered shale material ("extracted materials") using drill and blast techniques.
- Importation of approximately 2 500t per year of brick, concrete and waste bitumen materials ("recycling materials") for crushing and recycling operations.
- Importation of approximately 35 000t per year of quarry products from other quarries ("blending products") for blending operations.
- Crushing, screening and blending of extracted, recycling and blending materials to produce general and specialised quarry products.
- Stockpiling, loading and despatch of approximately 125 000t per year of quarry products.
- Progressive rehabilitation of areas no longer required for extraction-related purposes.

1.5 ENVIRONMENTAL MANAGEMENT AND DOCUMENTATION

Ongoing environmental management at Nowra Brickworks Quarry, including the Proponent's performance with respect to this document and the implementation of all relevant approval, licence or lease conditions, would be the responsibility of the Quarry Manager.

An important component of the ongoing environmental management of the Nowra Brickworks Quarry would be the continued development and use of the documentation required by the Department of Primary Industries - Mineral Resources and Department of Planning, including the Mining Operations Plan and Annual Environmental Management Reports.

Mining Operations Plan (MOP)

A MOP, accepted by Department of Primary Industries – Mineral Resources, would be required prior to the expansion of extraction operations. The MOP would provide a greater level of detail with respect to extraction operations, rehabilitation and site environmental management than the *Environmental Assessment*, as well as including any additional procedures or management controls required to meet relevant project approval conditions. A MOP would be prepared to cover each seven year period of the Project life, with a final MOP prepared to address extraction operations and mine closure requirements during the last two years of the Project life.

The MOP would include the following information.

- **Introduction** - including a brief history of the operation, approvals, leases and licences and background information, site geology, land ownership and consultation, reporting procedures and management responsibilities.
- **Pre-MOP Environment** - providing a brief description of topography, drainage, groundwater, soils, heritage, ecology, surrounding residences and services. This information would effectively be drawn from this *Environmental Assessment*.
- **Land Preparation** - providing details on vegetation clearing, soil types and their physical and chemical characteristics, soil stripping, stockpiling and management.
- **Mining-related Activities** - describing buildings, facilities and services to be installed and maintained, and detailing extraction operations.
- **Rehabilitation** - describing short-term and long-term rehabilitation objectives, the final landform and land uses, the VENM placement and rehabilitation operations and procedures to be employed together with the sequence of progressive rehabilitation.

- **Environmental and Rehabilitation Risk Assessment** - presenting an evaluation of the risk of environmental harm as a result of each of the quarry's component activities.

- **Environmental Management Controls**
  - describing the management, ie. diversion, storage and disposal of clean and/or sediment-laden water, and erosion and sediment management. Design details for all water management structures to be installed throughout the life of the mine would be presented.
  - describing the noise and air quality design controls for each stage of the Project.
  - outlining the ecological controls to provide for the appropriate clearing, storage, re-spreading of vegetation.
  - outlining the monitoring program for aspects such as hydrology, air quality, blasting and meteorology and the contingency plans to respond to emergencies, incidents or any deficiency in environmental performance identified through monitoring or consultation.

Annual Environmental Management Report (AEMR)

An AEMR would be required annually for submission to the Department of Planning, Department of Primary Industries – Mineral Resources, Department of Environment and Climate Change, Department of Water and Energy and Shoalhaven City Council. Each AEMR would provide the opportunity to record actual performance and environmental impacts and to compare the impacts against those predicted in this *Environmental Assessment,* as well as to evaluate the effectiveness of the environmental management controls and monitoring and amend them, as required.

Each AEMR would provide the following information, where relevant.

- **Introduction:** - Environmental objectives of the Project and reporting period for the report.

- **Summary of Operations:**
  - Information on extraction, recycling, blending and placement operations during the reporting period.
  - Plans for the following 12 months of operations relating extraction, recycling, blending, placement and rehabilitation operations and final landform preparation.

- **Environmental Management and Monitoring:**
  - Monitoring data and a comparison with statutory criteria and predictions.
  - Alterations/improvements to environmental management.
  - An assessment of compliance with lease, licence and project approval conditions.
- **Community Relations**
  - Results of consultation with stakeholders.
- **Rehabilitation**
  - Activities undertaken during the reporting period including a review of progress with previous rehabilitation activities.

The AEMRs would be submitted in September each year in line with the current AEMR reporting period.

1.6 MANAGEMENT OF INVESTIGATIONS

This document has been prepared jointly by Mr Mitchell Bland (BSc(Hons), MEcon Geol) Principal Environmental Consultant with R.W. Corkery & Co Pty. Limited and Mr Chris Outtersides (BA(Hons), DipTP) with City Plan Services Pty Limited. Mr Rob Corkery, (B.Sc.(Hons), M.Appl.(Sc)) undertook a review of the document.

On behalf of the Proponent, Mr John Green (Quarry Manager), Mr Budd Green, and Mr Graham Tranter (Quarry Surveyor) have provided further technical information on the proposed development and assisted with finalising the document. Mr Tom Ellicott (Solicitor) of Access Business Lawyers assisted during preparation of the document.

Strong emphasis has been placed upon a multi-disciplinary approach to the design of the Project, the description of the existing environment, identification of design and operational safeguards and resultant impact assessment. The following specialist consultants were commissioned by the Proponent to prepare specialist consultant studies for the Project. The various specialist consultant reports prepared for the Project are presented in the *Specialist Consultant Studies Compendium.*

- Hydrological Assessment: Martens & Associates Pty Limited
  (Mr Daniel Martens PhD, MEngSc, BSc(Hons1), MAWA, FIEAust, CPEng, NPER and Mr Ben Rose BEnvMgt)
- Air Quality Assessment: Heggies Pty Limited
  (Ms Yvonne Scorgie MSc)
- Noise and Blasting Assessment: Heggies Pty Limited
  (Mr John Sleeman MSc(Acoustics) BSc(Eng) and Mr Dick Godson BSc(Eng), MSc(Eng))

- Traffic and Transportation Assessment: John Coady Consulting Pty Ltd
  (Mr John Coady B Sc (Tech); Dip TCP and Mr Mick Logan L&ES Cert)
- Flora and Fauna Assessment: Gaia Environmental Research
  (Mr Garry Daley BSc (Zoology), Dip Ed)
- Aboriginal Heritage Assessment: Cultural Heritage Management Australia
  (Mr Robert Paton – BA (Hons)
- Soils Assessment: SEEC Morse McVey
  (Mr Andrew Macleod – BSc(Hons), CPSS, CPESC)

The geological information presented in the document was provided by Mr John Braybrooke (BSc(Hons), MSc, DIC) of Douglas & Partners Pty Ltd.

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PREAMBLE

Section 2

Description of the Project

This section of the Environmental Assessment describes the proposed continuation and expansion of extractive operations at the Nowra Brickworks Quarry, including:

- *the Proponent's objectives;*
- *the approvals required;*
- *the geological setting;*
- *proposed quarry design and operations, including extraction, recycling, blending, processing, transportation, importation and placement operations; and*
- *the proposed rehabilitation and final landform.*

The proposed quarry design, operation and rehabilitation procedures described within this section reflect all environmental constraints identified and recommendations made throughout the environmental impact assessment process.

The information presented in this section is presented at a level of detail sufficient for the Minister to determine the Major Projects Application.

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2.1 OUTLINE OF THE PROJECT

2.1.1 Objectives

The Proponent's principal objectives for the continuation and expansion of extractive operations at the Nowra Brickworks Quarry, South Nowra, centre upon the following.

- To ensure continued long-term, economically viable access to shale resources within the Project Site for the production of a range of high quality general and specialised products for construction, road maintenance and agricultural purposes.
- To undertake the activities associated with proposed extraction, blending, processing, transportation, placement and rehabilitation operations in a manner that avoids or minimises the impact(s) of these activities upon the environment within and surrounding the Project Site and upon residents and other land users in the vicinity of the Project Site.
- To implement mitigation measures and management procedures that ensure compliance with relevant statutory requirements, environmental criteria and reasonable community expectations.
- To allow for the continued recycling of construction, concrete and other similar waste materials for blending and re-use in a number of the quarry products produced by the Proponent.
- To provide for the recycling and placement within the extraction area of virgin excavated natural material (VENM).
- To establish a final landform that mimics the pre-extraction landform within the Project Site and to undertake progressive rehabilitation of areas disturbed by the proposed activities.

2.1.2 The Project Site

The Project Site **(Figure 2.1**) incorporates all areas of disturbance associated with the proposed Project-related activities and includes the following components.

- An existing extraction area covering approximately 2.0ha.
- An expanded extraction area covering approximately 15ha.
- A water storage facility to store surface water runoff from the disturbed section(s) of the Project Site and groundwater inflows to the extraction area.
- An office, two weighbridges and visitor's carpark area.

- A site access road that would be sealed from the intersection of the site access road and the Princes Highway for a distance of approximately 150m.
- An ablutions facility.
- A staff carpark.
- A spares storage and workshop area.
- A perimeter amenity bund.

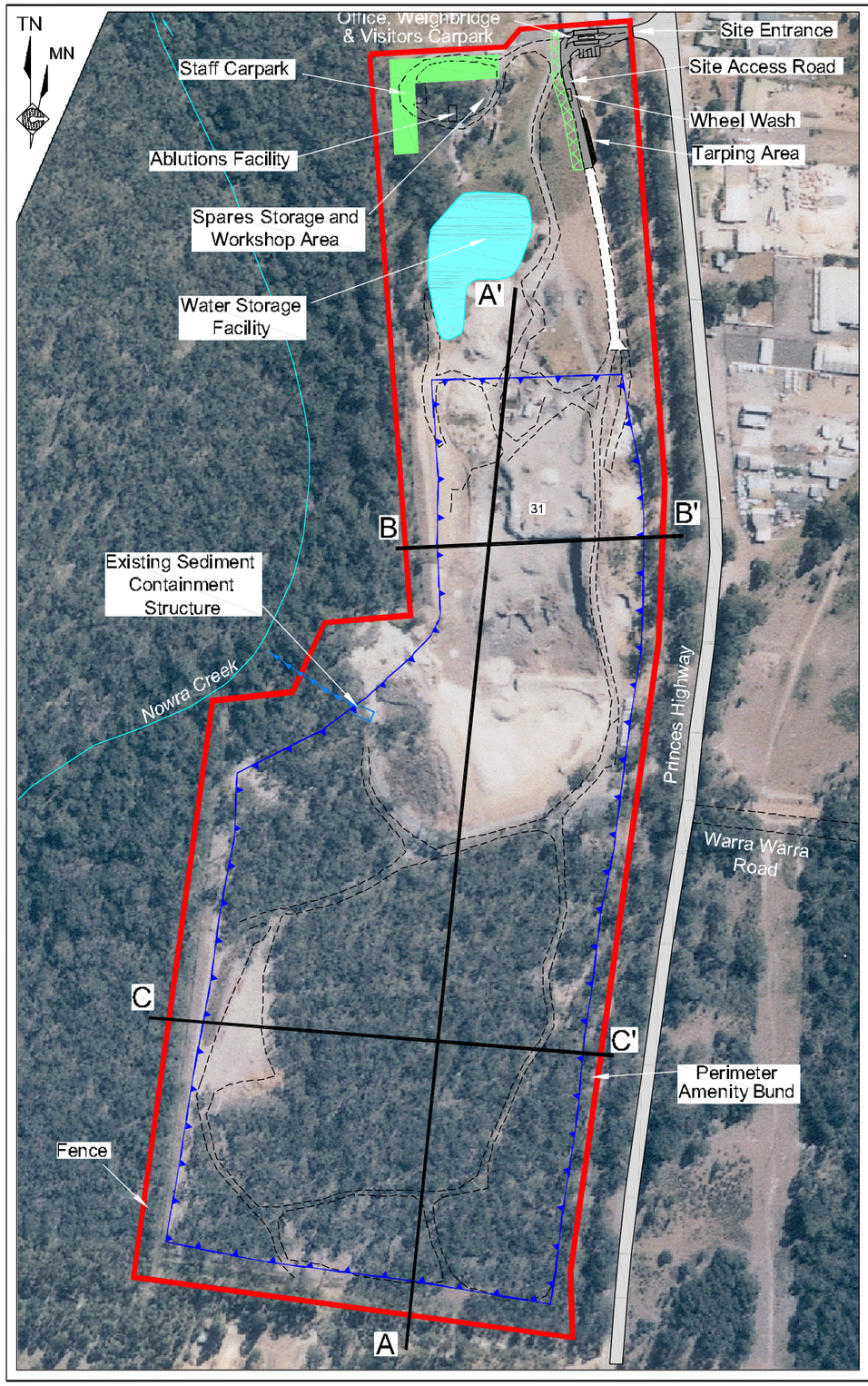
The Project Site is incorporated by Mining Leases (ML's) 5087 and 6322. The Project Site covers a total area of approximately 21.5ha. Approximately 8.0ha, or 37%, of the Project Site is currently disturbed.

The Project Site lies within part of Lot 1, DP1126288. The State of New South Wales is the registered owner of this land, with the Department of Lands administering the land for the Crown. It is noted that this Lot was previously registered as Lot 464, DP1058778. It is the previous Lot and DP number that was referred to on the Major Projects Application signed on 10 September 2007 and included and Appendix 1.

2.1.3 Overview of the Project

The Proponent proposes to continue and expand the extraction, blending, processing, transportation, placement and progressive rehabilitation operations at the Nowra Brickworks Quarry for a period of 30 years. In summary, the proposed continued and expanded use of the Nowra Brickworks Quarry would incorporate the following activities (**Figure 2.1**).

- Construction of a sealed site access road from the intersection of the site access road and the Princes Highway for a distance of approximately 150m.
- Construction of a wheel wash facility, dual weighbridge and office and a sealed visitor's carpark before the amount of quarry products despatched from the Project Site exceeds 250 000t per year.
- Staged extraction of up to 14 000t per year of weathered shale material using an excavator from a proposed extraction area of approximately 15ha, incorporating an existing extraction area of approximately 2ha for stockpiling or direct sale to the Proponent's customers.
- Staged extraction of up to 350 000t per year of unweathered shale material ("extracted material") using drill and blast methods from the above extraction area for processing and blending to produce quarry products.
- Importation and stockpiling of up to approximately 50 000t per year of selected construction, concrete and waste bitumen material ("recycling material") for recycling by crushing and blending with extracted material to produce quarry products.
- Importation and stockpiling of up to approximately 125 000t per year of quarry products from other quarries ("blending materials") for blending with extracted and recycling materials to produce saleable products.



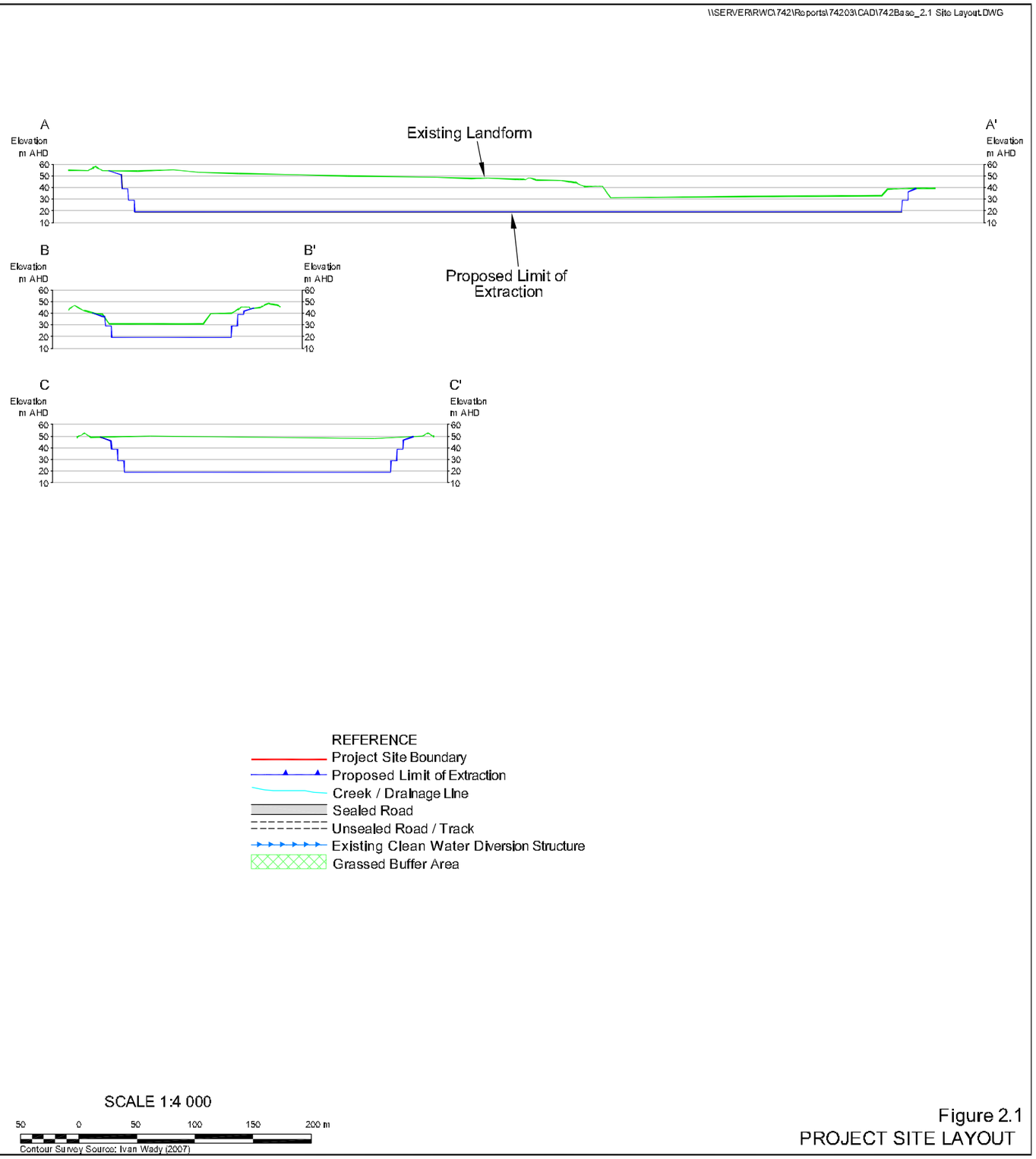


Figure 2.1
PROJECT SITE LAYOUT

- Processing and blending of extracted, recycling and blending material to produce general and specialised products for construction, road maintenance and other purposes. Processing operations would be undertaken with a mobile processing plant which would be located as close as practicable to the active extraction area and would be relocated regularly within the extraction area.
- Stockpiling of quarry products within the extraction area.
- Loading, sale and dispatch of an average of approximately 300 000t per year, to a maximum of approximately 500 000t per year, of quarry products using road registered heavy vehicles.
- Importation and placement of up to approximately 200 000t per year of VENM. A proportion of this material would be processed and blended with other materials to produce saleable products. The remainder would be placed within completed sections of the extraction area to establish a final landform that mimics the pre-extraction landform within the Project Site. Placement operations would generally progress from north to south.
- Progressive rehabilitation of areas no longer required for extraction or placement-related activities.
- Implementation of comprehensive systems to manage noise, vibration, air quality, hydrology, traffic, ecology, noise and blasting, air quality, Aboriginal heritage, soils and land capability-related issues.

2.1.4 Approvals Required

As indicated in Section 4.1.5.2, land within the Project Site is zoned "Zone 1(b) – Rural Arterial and Main Road Protection", with a small section of the Project Site zoned "Zone 1(f) – Forest" under the *Shoalhaven LEP 1985*.

Extractive industry is a permitted land use with consent within both zones.

The following approvals would be required for the continued and expanded operation of the Nowra Brickworks Quarry.

1. Project Approval – Minister for Planning.

   Project approval is required from the Minister for Planning for the Project under Part 3A of the *Environmental Planning and Assessment Act 1979*.

2. Environment Protection Licence – Department of Environment and Climate Change (Environment Protection Agency).

   The Proponent currently holds an Environment Protection Licence (EPL 11765) for "Hard Rock Gravel Quarrying" between 50 000t to 100 000t obtained per year and for "Crushing, Grinding or Separating Works" between 30 000t and 100 000t processed per year. The Proponent would apply to amend the licence to reflect the level and type of proposed activities.

3. Water Access Licence – Department of Water and Energy.

   An aquifer access licence would be required under Sections 56 and 57 of the *Water Management Act 2000* for the groundwater that would be expected to seep into the extraction area and require dewatering. Subject to the timing and implementation of the *Water Management Act 2000*, an Aquifer Interference Approval may also be required.

Subsequent approvals would be required in accordance with the Mining Operations Plan requirements of the *Mining Act 1992* and mining lease conditions.

2.2 GEOLOGY, SHALE RESOURCES AND PRODUCTS

2.2.1 Geology

The shale resource within the Nowra Brickworks Quarry forms part of the Berry Siltstone, a Permian aged siltstone unit within the Shoalhaven Group. This unit, in the vicinity of the Project Site, is overlain by Permian sandstone and tuff in all directions except to the northeast. To the northeast the Berry Siltstone is overlain by recent alluvial deposits associated with the Shoalhaven River (Wollongong 1:250 000 Geological Map, 1966) (**Figure 2.2**).

The rocks within the quarry site comprise fine to moderately well bedded shale.

The upper natural surface within the Project Site comprises up to 720mm of soil (see Section 2.3.5.2). Below the soil profile, weathered shale extends to a depth of between 3m and 5m below the surface. The upper sections of this material are typically white coloured, grading to brown between 2m and 2.5m below the surface. This material is extracted and blended to produce a single quarry product and is locally referred to as 'rip shale.' Below the rip shale, there is a sharp transition from weathered to unweathered shale (**Figure 2.2**).

2.2.2 Shale Resources

Nine boreholes were drilled within the Project Site during the hydrogeological assessment during two drilling programs. Following the initial program of three boreholes, Douglas Partners prepared a report entitled "*Report on Geological Studies for the South Coast CCR Quarry* dated August 2007. That report stated that below the base of weathering, shale material within the Project Site comprises massive, "dark blue-grey, high strength, slightly sandy siltstone". Jointing is generally steeply dipping, with two joint sets apparent, one striking "slightly east of north" and the other "south of east".

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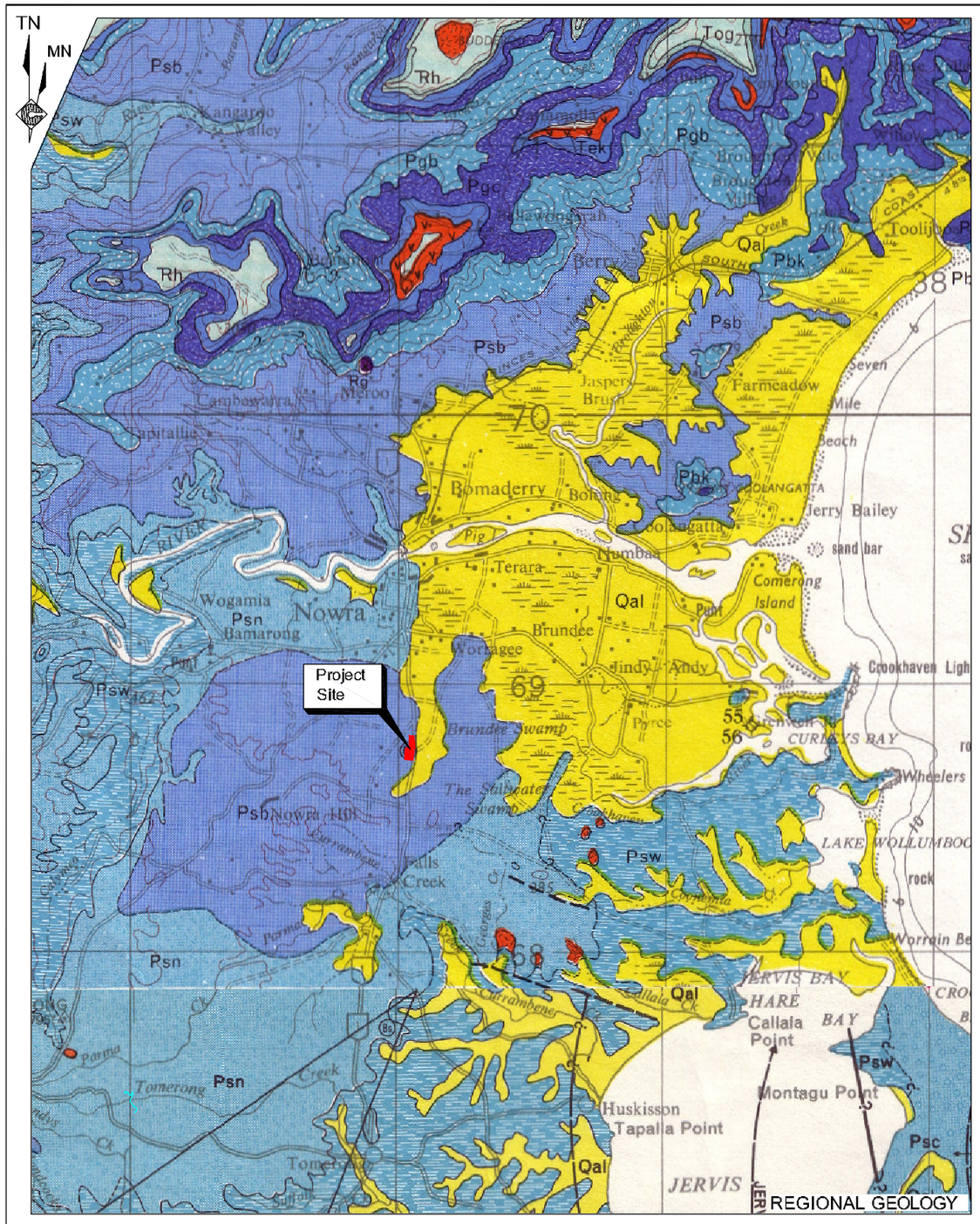

SCALE 1:200 000

2 0 2 4 6 8 10km

Source: Rose G. (1966) - Wollongong Geological Map Sheet 1: 250 000 (second edition)

REFERENCE

- Qal — Alluvium, gravel, swamp deposits and sand dunes
- Tob — Basalt and basanite
- Tek — Basanite
- Pt — Shale, sandstone, conglomerate, tuff, chert, coal, and torbanite seams
- Poc — Latite, intrusive and extrusive
- Pbj — Trachytic tuff with pebbly bands
- Pgb — Trachytic tuff and tuffaceous sandstone
- Psn — Quartz sandstone
- Psw — Siltstone, silty sandstone, pebbly in part
- Psc — Conglomerate, sandstone, silty sandstone

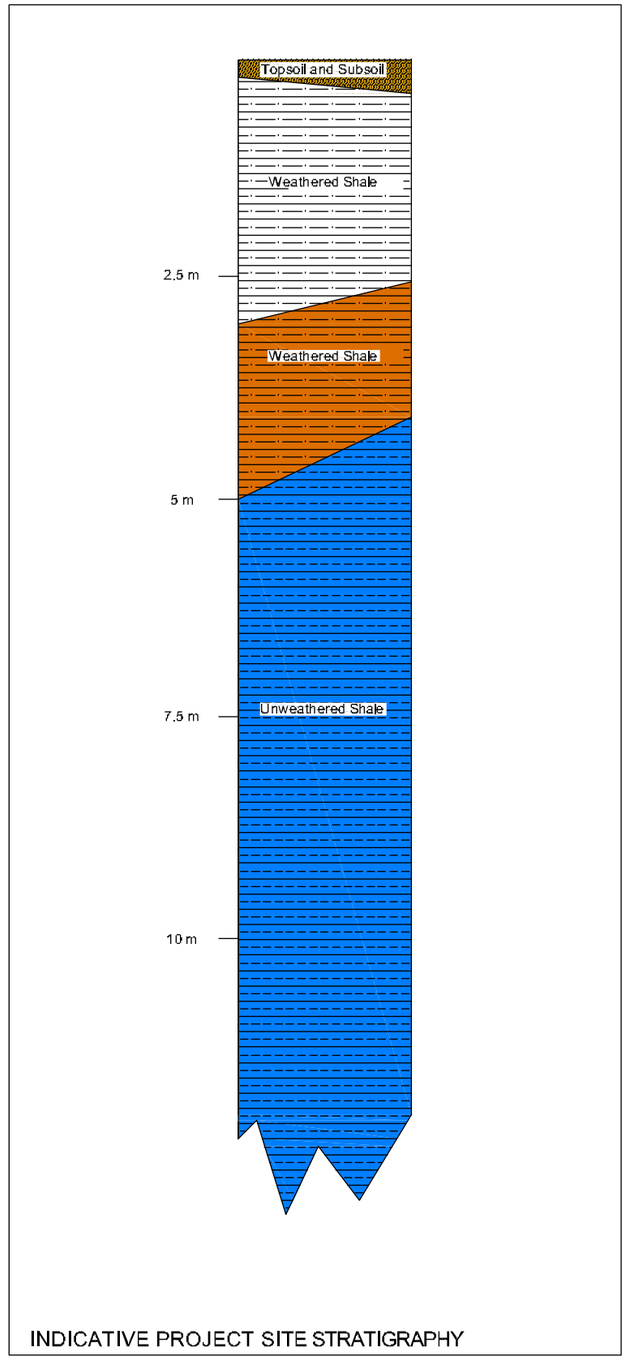

Figure 2.2
REGIONAL GEOLOGY AND
PROJECT SITE STRATIGRAPHY

CITY PLAN SERVICES

R. W. CORKERY & CO. PTY. LIMITED

Subsequently, drilling confirmed that this shale material occurs throughout the Project Site and extends below the base of the proposed extraction area.

The in-situ density of the unweathered and weathered shale material has previously been established by the Proponent to be approximately 2.4t/m^3 and 1.9t/m^3 respectively.

Based on the boreholes drilled for the hydrology assessment, the average depth of weathering within the Project Site is approximately 4m. The extraction area has a volume of approximately 3.37million m^3. As a result, the following shale reserves exist within the Project Site.

- Weathered Shale – approximately 0.47 million m^3 or 0.95 million tonnes.
- Unweathered Shale – approximately 2.9m^3 or 7.0 million tonnes.

2.2.3 Products

The Proponent would continue to produce the following range of products from the Nowra Brickworks Quarry for use for construction, road maintenance and other purposes.

- 40mm Road Base.
- 20mm Road Base.
- USPM Road Base Blend.
- 200mm Sub-grade Replacement.
- 175 Sub-grade Replacement.
- 100mm Sub-grade Replacement.
- 75mm Sub-grade Replacement.
- 200mm Aggregates.
- 150mm Aggregates.
- 100mm Aggregates.
- 75mm Aggregates.
- 25/35mm Aggregates.
- 7mm Aggregate.
- 10mm Aggregate.
- 14mm Aggregate.
- <14mm Dust.
- Crusher Dust.
- <3mm Dust.
- <6mm Dust.
- Clay Overburden.
- Rip Shale.
- Sand.
- DGB 20.
- DGS 20.
- DGS 40.
- Crushed Concrete.
- Crushed Brick.

2.3 SITE ESTABLISHMENT

2.3.1 Existing Infrastructure

As the Nowra Brickworks Quarry is currently an operational quarry, a number of existing items of infrastructure would continue to be utilised following the receipt of project approval, if it is granted. The location of these items of infrastructure are indicated on **Figure 2.1** and include the following.

- Water Storage Facility.
- Spares Storage and Workshop Area.
- Ablutions Facility.
- Staff Carpark.
- Tarping Area.
- Weighbridge and Office.
- Visitor's Carpark.
- Site Access Road.

It is noted, however, that the weighbridge and office, visitor's carpark and site access road would be upgraded prior to the annual rate of production reaching 250 000t.

2.3.2 Construction

Following provision and acceptance of all required approvals to enable site establishment to commence, the Proponent would undertake the following construction-related activities. Each of the activities and their locations are indicated on **Figure 2.1**. With the exception of surveying and marking the extraction area boundary, which would occur within 6 weeks of the receipt and acceptance of project approval, each of the following construction-related activities would be undertaken prior to despatch of quarry products exceeding 250 000t per year.

- The footprint of the approved extraction area would be surveyed and clearly marked with concrete blocks (approximately 0.5m^3) placed at 50m intervals and painted to be highly visible.
- Construction and sealing of the site access road from the intersection of the site access road and the Princes Highway for a distance of approximately 150m.
- Construction and installation of a wheel wash and shake down facility comprising a concrete bath with a depth of approximately 300mm.
- Extension of the existing tarping area to allow two truck and dog trailer heavy vehicles to use the area concurrently.
- Erection of a transportable office, second weighbridge and ablutions facility to the south of the existing weighbridge.
- Construction and sealing of the visitor's carpark.
- Widening of the site entrance to 11m to allow B-double trucks to enter and leave the Project Site at the same time prior to annual production reaching 250 000t.

2.3.3 Land Preparation

Land preparation activities would be undertaken, where practicable, on an ongoing annual campaign basis, with the area to be prepared limited to the area required for extraction-related activities during the subsequent 12 month period.

The following procedures would be implemented during land preparation activities.

- The area to be prepared would be surveyed and clearly marked.
- Where required, surface water and/or sediment and erosion controls would be installed or constructed prior to or during vegetation removal and soil stripping activities in accordance with the Sediment and Erosion Control Plan presented in Section 4.9 of this document and as Part 7B of the *Specialist Consultant Studies Compendium*.

2.3.4 Vegetation Removal

Following identification and marking of each area to be prepared, the following procedures would be employed during vegetation removal operations, if required.

- Where practicable, vegetation would be cleared during the winter to limit the potential for nesting or roosting fauna to be impacted by the proposed clearing operations.
- Re-identification and of previously marked hollow-bearing trees within the area to be cleared by a suitably qualified and experienced ecological consultant.
- Prior to vegetation removal operations commencing, the identified hollow-bearing trees would be inspected by a suitably qualified and experienced ecological consultant for nesting or roosting fauna. Any fauna found would be relocated to a suitable location in the vicinity of the area to be cleared. Where the inspection of hollows is not immediately followed by vegetation removal, a procedure would be developed to temporarily prevent re-occupation of the hollows prior to commencement of such operations.
- Vegetation suitable for commercial timber or firewood and not required for rehabilitation, if present, would be harvested and removed from site.
- Removal of the remaining larger vegetation would be undertaken by bulldozer, with the blade positioned just above the ground to minimise soil disturbance.
- Once felled, logs and branches to be retained for rehabilitation would be cut or broken into manageable lengths or coarsely mulched and placed on areas undergoing progressive rehabilitation or stockpiled for later use during rehabilitation. No vegetation would be burnt or removed from site other than that to be used for firewood or commercial timber.
- Smaller vegetation would be removed during soil stripping operations.

No additional areas of vegetation would be disturbed or removed prior to the identification and commencement of implementation of a Biodiversity Offset Strategy. This strategy would be designed in agreement with the relevant government agencies and is described in additional detail in Section 2.15.9.

2.3.5 Soil Stripping

2.3.5.1 Introduction

SEEC Morse McVey prepared the Soils Assessment for the Project. A copy of this report is presented as Part 7A of the *Specialist Consultant Studies Compendium* and is referred to hereafter at SEEC (2008). That report describes the soils of the Project Site and identifies appropriate soil stripping, stockpiling and placement procedures. These descriptions and procedures are summarised in the following subsections.

2.3.5.2 Project Site Soils

Nine soil test pits were excavated in undisturbed sections of the Project Site during the soils assessment as indicated on **Figure 2.3.** These soils were analysed on site and selected samples were collected for laboratory analysis.

SEEC (2008) states that soils within undisturbed sections of the Project Site are moderately homogenous, with two layers as described in **Table 2.1**.

Table 2.1
Soil Descriptions

Layer (Horizon)	Lower depth range (mm below surface)	Average layer thickness (mm)	Description
Topsoil (A)	110 to 310	215	Dark brown massive to weakly pedal silty clay loam, with 5% coarse fragments.
Subsoil (B2)	330 to 720	290	Olive-brown to reddish-brown, weakly pedal , sodic, medium-heavy clay, with less than 5% coarse fragments. Sodic. Occasional grey mottling.
Source: SEEC (2008) – Section 3.2.2.			

A third layer, below the subsoil, consists of pallid, grey clay and comprises the uppermost layer of weathered shale extracted to produce quarry products.

Figure 2.3
TEST PIT LOCATIONS AND SOIL STRIPPING DEPTHS

Physical and laboratory testing indicates the soils within the Project Site have the following characteristics.

- Soils may be classified as infertile with available phosphorus values for all layers 1.0 mg/kg or less.
- Soil pH is relatively uniform and ranges from 5.0 to 5.3.
- Topsoils have low Cation Exchange Capacity (CEC), but subsoils have high CEC.
- Topsoils and subsoils have moderate and high levels respectively of exchangeable sodium.
- Physical testing suggests that the soil structure is important for limiting erosion potential. As a result, disruption of the soil structure may lead to dispersion problems.
- Soils have adequate exchangeable potassium and will not require application of potassium fertilizers.
- Soils are calcium deficient.
- Aluminium toxicity is marginal for topsoils, but is acceptable for subsoils.
- Soils are non-saline.
- Topsoils and subsoils have low to moderate and high phosphorus sorption potential respectively.

SEEC (2008) states that the implications of the soil characteristics are as follows.

- Limited fertility will result in native species being the most appropriate species to use during rehabilitation.
- Subsoils contain more readily-available nutrients and have a greater capacity to retain fertilizer materials than topsoils and, as a result, will be critical for successful rehabilitation of the Project Site.
- Applications of lime may be required during rehabilitation to increase pH and calcium content of the soils.
- The structure of the soils of the Project Site is fragile and is important for reducing the dispersion potential of the soils.
- Biosolids could be lightly applied without adversely impacting on the salinity of the soils.

SEEC (2008) states that the soils within disturbed sections of the Project Site have been extensively disturbed, with much of the resource used to construct the perimeter bunds. During construction of these bunds, topsoil and subsoil has been intermixed. As a result, the bunds would provide suitable subsoil but not topsoil material for use during rehabilitation operations.

2.3.5.3 Soil Stripping Procedures

The following soil stripping procedures would be implemented throughout the life of the Project.

- Soils would be stripped only when they are moist to preserve their structure.
- Topsoils would be stripped using a scraper, excavator or bulldozer to a depth of between 180mm and 250mm below the surface as indicated on **Figure 2.3**.
- Subsoils would be stripped to a depth of between 175mm and 500mm below the base of the topsoil as indicated on **Figure 2.3**.

2.3.5.4 Soil Placement and Stockpiling Procedures

The following soil placement and stockpiling procedures would be implemented throughout the life of the Project.

- Wherever practicable, soils would be placed directly on areas undergoing progressive rehabilitation.
- Virgin Excavated Natural Material (VENM) placement operations would be undertaken as described in Section 2.9.5. In summary, placement and compaction of VENM would occur to within 3.5m of the final landform. Above this, namely from approximately 3.5m to approximately 1.0m below the final landform, weathered material would be preferentially placed. Core would be taken not to compact this material during placement. Above this, approximately 0.5m of weathered shale material found within the Project Site would be placed.
- Subsoil would be placed over the VENM to a thickness of approximately 250mm, with the upper surface left scarified to assist 'keying-in' of the topsoil.
- Topsoil would be placed to a thickness of approximately 200mm.
- The upper surface of the topsoil would be left in an even but 'roughened' condition to facilitate the absorption of moisture and retention of seed.
- If required, biosolids would be applied to the topsoil at a rate of less than 20 dry tonnes per hectare.
- Between 20mm to 40mm of mulched native vegetation, broken tree debris or bitumen sprayed straw mulch would be placed over the topsoil or hydroseed or hydromulch techniques would be used to limit erosion. If required, a quick-growing, sterile cover crop would be planted to minimise erosion of the placed topsoil in the short term.

When direct placement of stripped soils is not possible, soils would be stockpiled. The following procedures would be implemented during soil stockpiling operations.

- Stockpiles would be placed at least 2m from existing vegetation, areas of concentrated surface water flows, roads or other hazardous areas such as the margin of the extraction area.
- Topsoil and subsoil stockpiles would be low (less than 2m high), flat, elongated mounds. Where practicable, topsoil stockpiles would be less than 1m high.
- Where stockpiles are to be in place for more than 3 months, they would be stabilised through the application of mulched or broken vegetation, hydroseeding, hydromulching or equivalent.
- Stockpiles would have side slopes no greater than 1:3(V:H).
- A sediment fence would be constructed approximately 1m from the toe on the downslope side of the stockpile.
- As far as is practical, stockpiled soil material would be used for rehabilitation-related operations within 6 months of being stockpiled.

2.3.5.5 Soil Inventory

Soil covering approximately 10ha is available for stripping and use during rehabilitation operations within the Project Site. The area to be rehabilitated following completion of extraction and placement-related operations within the Project Site is approximately 14.7ha. **Table 2.2** presents the soil inventory and anticipated soil balance for the Project Site.

Table 2.2
Indicative Soil Inventory

	Average thickness to be stripped	Bulk Density	Soil Available	Thickness to be placed	Soil Required	Soil Deficit
Topsoil	215mm	1.3t/m^3	27 950t	200mm	38 220t	10 270t
Subsoil	290mm	1.5t/m^3	43 500t	250mm	55 125t	11 625t

As indicated in **Table 2.2**, approximately 10 270t and 11 625t of additional topsoil and subsoil respectively would be required during rehabilitation operations.

SEEC (2008) states that soil material used to construct the Project Site perimeter bunds would be suitable for use as subsoil material. This material, however, would be required to be spread approximately 500mm thick, compared with 250mm for directly stripped or stockpiled subsoil material. It is the Proponent's intention that the site perimeter bunds would be retained at the end of the Project life and that they would not be used a source of subsoil material.

As a result of the deficit of available soil for rehabilitation operation, soil material would be required to be imported to the Project Site. The following procedures would be implemented during importation of soil material.

- Where practicable, soil material would be sourced from within the "Nowra Soil Landscape" as indicated in Hazelton (1992).
- Soil material would be sourced from areas gently sloped, coastal areas within 100km of the Project Site.

2.4 EXTRACTION OPERATIONS

2.4.1 Introduction

Project approval is being sought for the extraction and processing of clay and shale material. The following subsections describe the design of the extraction area, the extraction procedures, the extraction sequence that would be employed and the proposed production levels.

2.4.2 Design of the Extraction Area

The boundaries of the extraction area would be set back a minimum of:

- approximately 5m from the base of existing visual and acoustic bunds adjacent to the perimeter of the Project Site;
- approximately 15m from the boundary of the Project Site; and
- approximately 55m from the top bank of Nowra Creek.

It is acknowledged that improvements to the Princes Highway are proposed by the NSW Roads and Traffic Authority (RTA) in the vicinity of the Project Site. These improvements are understood to include:

- construction of a roundabout at the intersection of the Princes Highway and Warra Warra Road (also known as Western Road);
- widening of the Princes Highway to accommodate a heavy vehicle inspection bay; and
- construction of a median strip or wire-rope traffic dividing structure between the intersections of Warra Warra Road and Central Avenue with the Princes Highway to limit vehicular access to premises along this section of the Highway, including the Project Site, to left in/left out (**Figure 1.2**).

While these works have been identified by the RTA, no final approved plans have been made publicly available. As a result, the proposed works have not been taken into account during design of the extraction area.

The Proponent acknowledges, however, that improvements to the Princes Highway, in particular the Warra Warra Road roundabout, may encroach upon sections of the Project Site. In this event, the Proponent would seek to negotiate an appropriate arrangement with the relevant government agency to adjust the eastern boundary of the extraction area, as well as the location of other relevant features such as the Amenity Bund. The remaining boundaries of the extraction area would remain unchanged.

As a result, the approach taken in this *Environmental Assessment* has been a conservative one, namely, in the absence of detailed proposal regarding the Princes Highway improvements, to assume a maximum area of Project-related disturbance when assessing Project-related environmental impacts, recognising that the actual impacts may be less that those assessed.

2.4.3 Extraction of Weathered Shale Material

Figure 2.4 provides schematic sections of the ongoing extraction and placement operations that would be undertaken within the extraction area.

Extraction would commence with the extraction of weathered shale material following a survey to mark out the area to be prepared, construction of surface water management structures, removal of vegetation and stripping of the topsoil and subsoil as described in Section 2.3.

As described in Section 2.2.1, weathered shale extends from the below the topsoil/subsoil profile to a depth of between 3m and 5m below the surface. The upper section of this material is typically white coloured, grading to brown between 2m and 2.5m below the surface. "White Shale" and "Brown Shale" may on occasions be extracted separately, however, in most cases this material is blended to produce a single product.

Weathered shale material is generally amenable to extraction with an excavator and would continue to be extracted by this method (**Figure 2.4**). The extracted material would continue to be loaded directly into road registered trucks for transportation to the Proponent's customers, stockpiled for subsequent sale and despatch, or used for rehabilitation-related purposes within the Project Site. Weathered shale material would be stockpiled within the extraction area in a location where the stockpile(s) would be unlikely to be affected by surface water flows and where surface water flows from the stockpile(s) would be directed to the active extraction area.

Weathered shale material would continue to be extracted to a depth where the material becomes too hard to be extracted using an excavator. Typically, extraction of weathered shale material would be expected to continue to a depth of between 3m and 5m below the natural ground surface.

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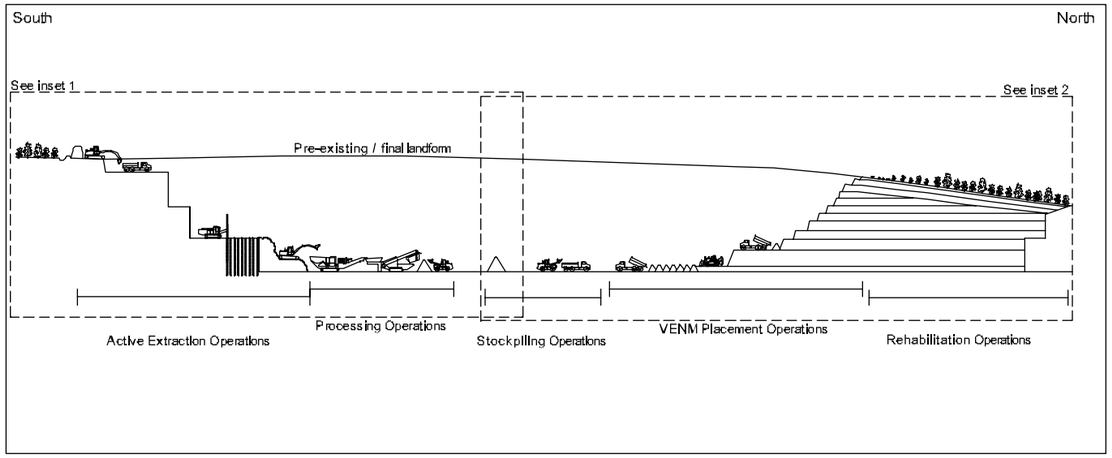

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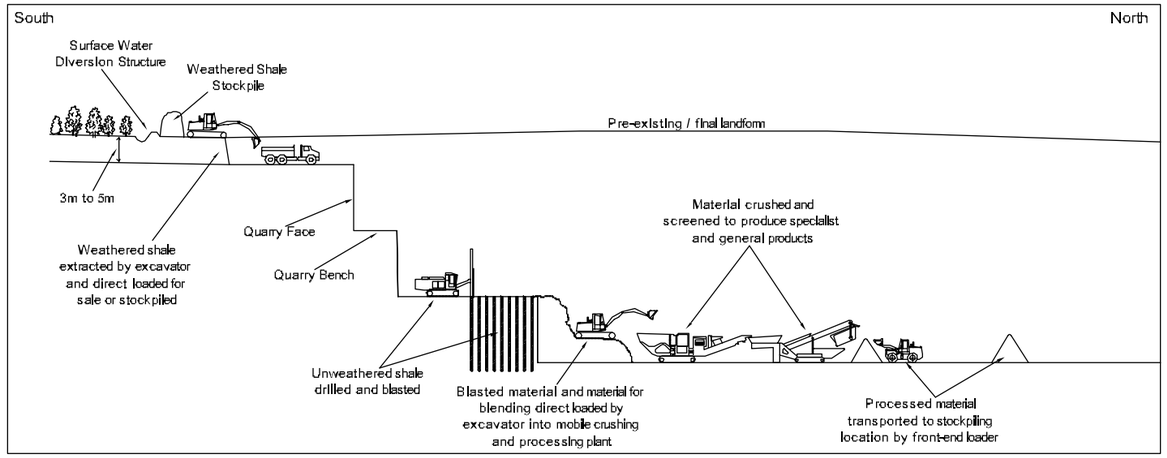

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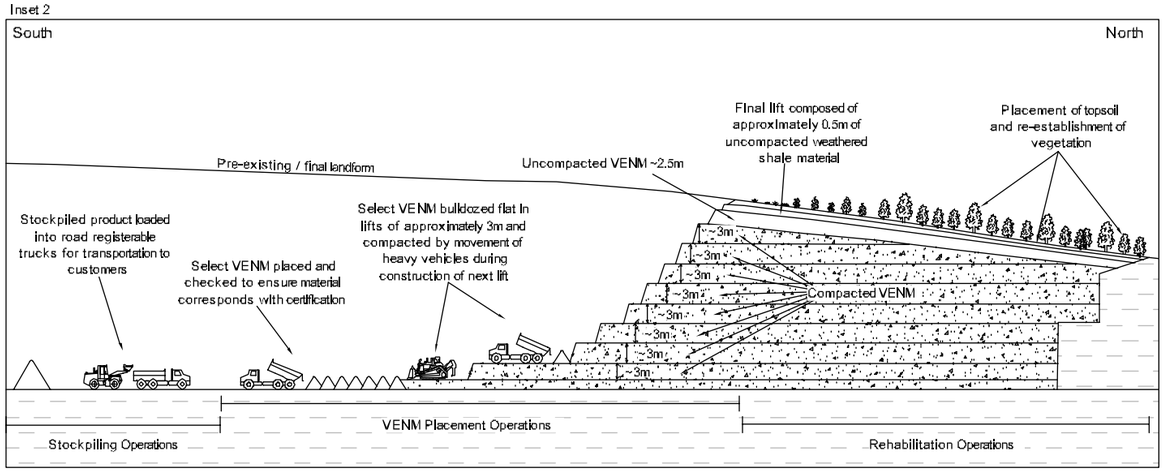

Not to Scale

Source: South Coast Concrete Crushing & Recycling Pty Ltd

Figure 2.4
SCHEMATIC EXTRACTION, PROCESSING, STOCKPILING AND BACKFILLING OPERATIONS

2.4.4 Extraction of Unweathered Shale Material

2.4.4.1 Introduction

Following removal of weathered shale material, the underlying unweathered shale material that is too hard to be extracted using an excavator would be fragmented using drill and blast techniques. Blasted material would then be directly loaded into a mobile processing plant using an excavator.

2.4.4.2 Drill and Blast Operations

With the exception of the uppermost bench where the bench height would vary due to changes in topography, all benches would be near horizontal with faces approximately 10m high. The top bench would have a face height that would vary from approximately 3m to approximately 13m. The following indicative design parameters would apply for the blast faces.

- Face height: the uppermost bench height would vary between 3m and 13m. The remaining benches would be approximately 10m high.
- Face angle: vertical.
- Bench width: approximately 5m, with the exception of the uppermost bench which would be approximately half the face height.

All drilling and blasting-related activities would be supervised by a suitably qualified and experienced blasting engineer or shot firer. Blasting has been undertaken within the Project Site since 2001. Each blast is and would be continue to be designed to:

- achieve the required degree of fragmentation;
- satisfy all environmental criteria; and
- contain all blast flyrock within the nominated blast envelope.

Drilling activities would continue to be undertaken using a hydraulic drill rig which would drill vertical holes of the same length or slightly greater than the proposed face height, ie. the majority of holes would be drilled to a depth of approximately 10m, with the exception the uppermost bench where the depth of the holes drilled would vary with surface topography. The drill rig would be equipped with dust and noise suppression equipment, including dust aprons, dust extraction equipment and sound dampened engine compartments. The drilling pattern would be determined by the blast supervisor and would be designed to meet the blasting criteria identified previously.

Typically, each blast would continue to break between 12 000 bank cubic metres (bcm) and 15 000bcm of shale material. It is anticipated that in order to produce an average of 300 000t of quarry products per year approximately 210 000t per year of unweathered shale material would be extracted. This would necessitate between six and eight blasts annually. For a maximum production rate of 500 000t per annum, approximately 350 000t per year of unweathered shale material would be extracted. This would necessitate between nine and thirteen blasts annually.

Blasting would continue to be conducted between the hours of 9:00am and 5:00pm Monday to Friday, except where, due to misfire or other exceptional and/or safety related circumstances, blasting is required after 5:00pm or on the weekend. Only one blast would be initiated on any given day.

Table 2.3 presents the indicative blast parameters currently used during blasting operations. These parameters may vary throughout the life of the Project based on variations in bench height, location and size and shape of each blast as well as changes in blasting technology.

Table 2.3
Existing and Proposed Blast Design Parameters

Parameter	Design Level
Blast Hole Diameter	76mm
Blast Hole Depth	up to 12m
Blast Hole Spacing	3m x 3m
Depth of Stemming	2.7m
Blast Hole Burden	2m
Area of Blast	1 200m^2 to 1 500m^2
Size of Blast	12 000bcm to 15 000bcm
Bulk Explosive Type	Emulsion
Maximum Instantaneous Charge (MIC)	112kg
Maximum Charge per Hole	56kg
Initiation System	None
Source: SCCCR	

Explosives required for blasting operations would continue to be brought to site on the day of the proposed blast by the blasting contractor. No explosives would be stored within the Project Site.

The Proponent would continue to notify the following organisations and individuals verbally on the working day prior to each planned blast.

- Shoalhaven City Council.
- NSW Police.
- NSW Roads and Traffic Authority.

- The owner of the residence immediately to the south of the Project Site.
- Environment Protection Authority.

In addition, as described in Section 4.1.5.3, the Department of Corrective Services proposes to build a correctional facility approximately 500m to the west of the Project Site. Once construction commences, the Proponent would also notify the correctional facility of proposed blasts verbally on the working day prior to each planned blast.

2.4.4.3 Loading Operations

Fragmented material would be directly loaded into the mobile crushing and processing plant using an excavator. Following initiation of the blast, the excavator would be used to create a working platform approximately 3m above the floor of the extraction area. The excavator would then load extracted, recycling and blending material into the crushing and processing plant in the appropriate proportions to produce quarry products with the required specifications.

The working platform and location of the mobile crushing and processing plant would be relocated, as required, to ensure the distance between the fragmented shale material and the processing plant is suitable for loading operations.

2.4.5 Extraction Sequence

Figure 2.5 presents the indicative Project development sequence. In summary, extraction operations would progress generally from north to south, with extraction of unweathered shale material and establishment of final quarry faces completed within each stage of the development prior to commencement of the next stage of development. Notwithstanding this, however, some land preparation activities, including vegetation and soil removal and extraction of weathered shale material would be undertaken in the next stage of development prior to completion of the previous stage.

The amount of time that would be required to complete extraction-related operations within each stage of development would depend on production levels and the proportion of imported material blended with extracted shale to produce quarry products, as well as the amount of VENM imported to the Project Site.

It is noted that an irrigation area of approximately 4ha would be initially constructed in the southern-most section of the Project Site. This area would be used to manage surface waters within the Project Site as described in Section 4.2.4. This irrigation area would be progressively relocated to areas undergoing rehabilitation as extraction and VENM-placement operations progress to the south.

2.4.6 Rate of Extraction

The Proponent proposes to produce an average of approximately 300 000t of quarry products per year. However, at times there may be a requirement for additional quarry products as a result of increased demand caused by significant road construction maintenance or other construction-related projects. In these circumstances, the Proponent proposes to produce up to 500 000t of quarry products per year.

As highlighted in Sections 2.5 and 2.6, the Proponent currently blends recycled construction, concrete and bitumen waste ("recycling materials") and imported quarry products ("blending materials") with shale material extracted within the Project Site ("extracted materials") to produce quarry products with the required specifications for specialist applications such as road bases. At present, blended materials comprise approximately 30% of quarry products. Using this proportion, at an average production rate of 300 000t per year, approximately 210 000t, or 87 500 bank cubic metres (bcm), of unweathered shale material would be extracted within the Project Site annually.

At a maximum extraction rate of approximately 500 000t per year, approximately 350 000t, or 145 750bcm, of unweathered shale material would be extracted within the Project Site annually.

It is acknowledged, however, that the rate of blending of imported material may vary throughout the life of the Project. As a result, the rate of extraction may vary from the rates identified above.

2.5 IMPORTATION OF RECYCLING MATERIAL

2.5.1 Introduction

The Proponent proposes to import, crush and recycle up to 50 000t of select waste construction, concrete and bitumen material per year during the life of the Project.

2.5.2 Recycling Material Selection and Receipt Procedures

Recycling materials would be sourced from construction and demolition sites, primarily within the Shoalhaven and Illawarra areas, with some material sources from the Southern Highlands, Southern Sydney and South Coast areas.

The following procedures would be implemented to ensure that no material unsuitable for recycling into quarry products is received at the Project Site.

- Upon delivery to the Project Site, the material would be inspected visually and by smell prior to the load being weighed. The driver would be required to complete and sign a recycling material record sheet.

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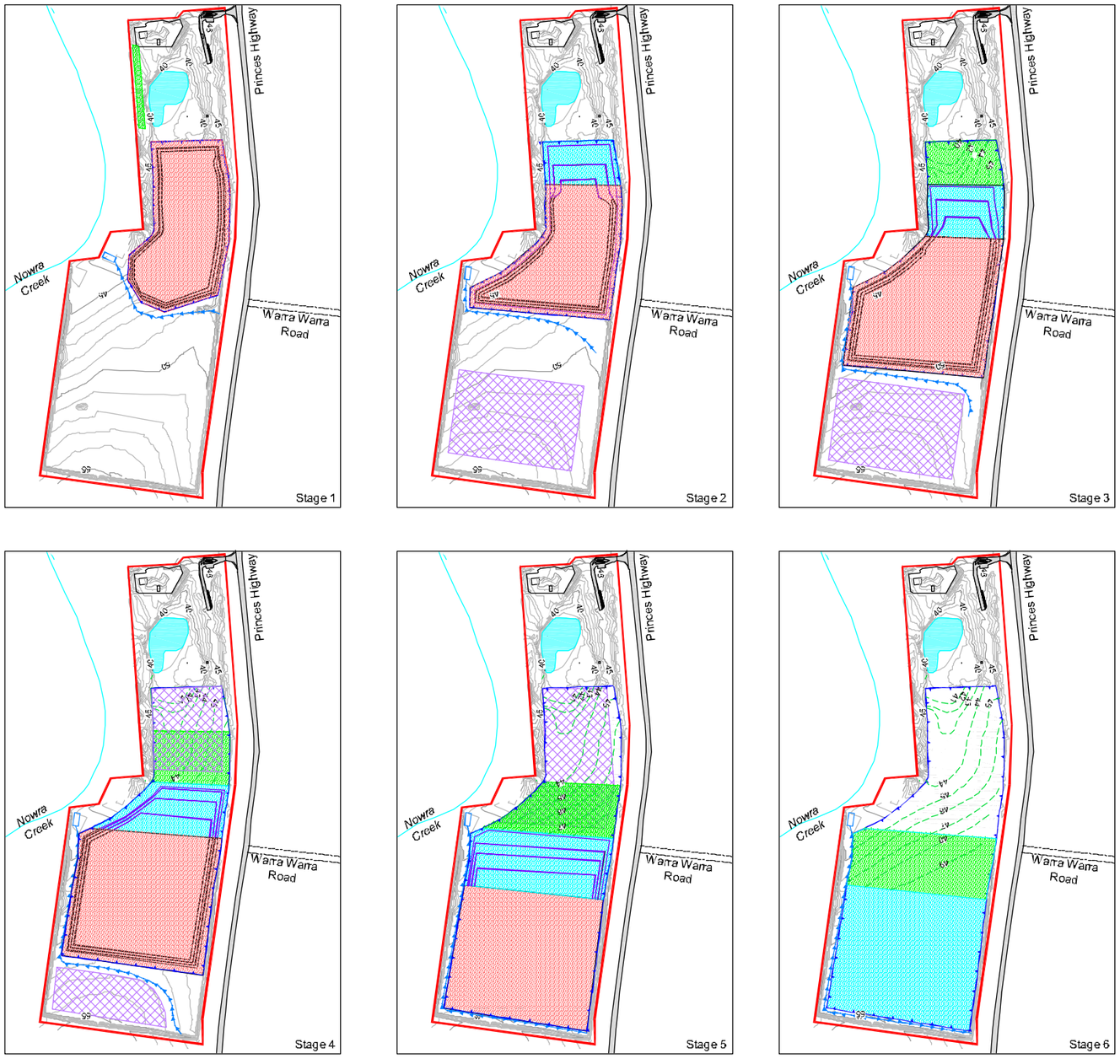

REFERENCE
- Project Site Boundary
- Proposed Limit of Extraction
- Proposed Extraction / Placement Bench
- Existing Contour (m AHD)(Interval = 1m)
- Final Contour (m AHD)(Interval = 1m)
- Sealed Road
- Unsealed Road / Track
- Clean Water Diversion
- Sediment Containment Structure
- Extraction and Processing - related Operations
- Placement and Processing - related Operations
- Rehabilitation and Processing - related Operations
- Irrigation Area

SCALE 1:10 000

100 0 100 200 300 400 500 m

Contour Survey Source: Ian Wady (2007)

Figure 2.5
INDICATIVE PROJECT DEVELOPMENT SEQUENCE

CITY PLAN SERVICES

R. W. CORKERY & CO. PTY. LIMITED

- The driver would be directed to a dedicated unloading area where the load would be tipped and inspected visually and by smell for a second time.
- Any contaminated loads would be rejected and the drivers would be advised of the nearest licenced disposal facility.

The Proponent would implement a system to record the following information for each load of recycling material received.

- The source of the material.
- The type of material received.
- The amount of material received.
- The date and time of delivery.
- The name of the transportation contractor delivering the material.
- The name and signature of the driver certifying the information as accurate.
- The name and signature of the employee of the Proponent certifying the information as accurate.

2.5.3 Recycling Procedures

Materials to be recycled would continue to be placed within a designated area within or adjacent to the extraction area, with construction waste, concrete and bitumen materials stockpiled separately.

Material to be recycled would continue to have non-recyclable materials, such as plastic linings and small amounts of timber, removed. This material would continue to be placed within a skip bin which would be removed as required to an appropriate disposal facility. At present, approximately two skip bins with a capacity of $9m^3$ are removed from Project Site each year. At a maximum rate of importation of recycling material, it is anticipated that approximately 20 such skip bins would be removed from the Project Site annually.

Concrete material containing steel reinforcing would continue to be broken using pulverising jaws on an excavator and the steel material would be removed. This material would continue to be placed within steel recycling bins and sold to a steel merchant for recycling. At present, approximately 40t of this material is sold and removed from site each year.

Following removal of non-recyclable material and steel from the materials, the recycling material would be crushed using the mobile processing plant. The crushed material would continue to be stockpiled within or adjacent to the active extraction area and would be added to the extracted material in specified proportions to produce quarry products with the required specifications.

2.6 IMPORTATION OF BLENDING MATERIAL

2.6.1 Introduction

At present, the Proponent imports approximately 50 000t of quarry products per year from quarries in the vicinity of the Project Site for the purpose of blending with material extracted and recycled within the Project Site to produce specialist quarry products with the required specifications. The Proponent proposes to continue and expand the importation of up to 125 000t of such material per annum.

2.6.2 Sources of Blending Material

The names of the quarries currently supplying blending material, the types of material currently imported and the products produced from those materials are presented in **Table 2.4.** The Proponent would continue to import blending material from the quarries listed in **Table 2.4.** The amount of material imported annually from each quarry would depend on the demand for the particular quarry products produced from the respective blending material, the availability of back loads to transport material to the Project Site and the quality and price of material produced at each of the quarries. In addition, it is possible that some of the quarries listed in **Table 2.4** may cease to operate and additional quarries may be developed during the life of the Project. As a result, the sources and types of blending material imported to the Project Site may vary throughout the life of the Project.

Table 2.4
Sources and Types of Blending Material

Quarry Name	Location	Type of Material Imported
Cemex	Albion Park	Crusher Dust; overburden and 20mm road base.
ASMS	Wollongong	Crusher Dust; 20mm and 10mm road base.
Boral	Dunmore	Crusher Dust
Permian Resources	Bombo	Crusher Dust; 14mm, 20mm and 40mm road base.
Hiedleberg	Bass Point	Crusher Dust and 6mm road base
Source: SCCCR		

2.6.3 Blending Materials Receipt and Stockpiling Procedures

Blending material would be transported to the Project Site primarily using back loads, or trucks returning to the Project Site that would otherwise be empty. The gross and tare weights of these vehicles would be determined and the drivers would be directed to a clearly identified blending material stockpiling area within the extraction area. Sufficient stockpiles would generally be maintained to provide material for 180 days processing.

2.7 PROCESSING AND STOCKPILING OPERATIONS

2.7.1 Introduction

The Proponent would continue to stockpile weathered shale material, imported recycling and blending materials and quarry products within the extraction area.

2.7.2 Processing and Stockpiling Area Layout

All processing and stockpiling operations, as far as practicable, would be undertaken within the extraction area. **Figure 2.6** presents an indicative layout of the extraction, stockpiling and processing operations during Stage 1 of the Project. While this layout is likely to vary significantly during the life of the Project, the processing and stockpiling area would be likely to incorporate the following principal components.

- An area to be prepared for blasting operations.
- An active extraction area incorporating one or more excavators used to load the extracted, recycling and blending materials into the crushing plant.
- A processing and blending area immediately adjacent to the active extraction area incorporating blending and recycling stockpiles, a mobile crushing and screening plant and short-term product stockpiles.
- A blending materials stockpile area.
- A recycling materials stockpile area, incorporating a raw recycling materials stockpile area, a mobile crushing and screening plant and a crushed recycling materials stockpiling area.
- A product stockpile area.

Finally, during Stages 2 to 5, a VENM placement area would be located immediately to the north of the processing and stockpiling area.

2.7.3 Crushing, Blending and Screening Operations

The Proponent would continue to process the extracted, recycling and blending materials using two mobile primary jaw crushers, one secondary cone crusher and two mobile screening plants. This equipment would be combined in varying configurations depending on the material to be processed and the product specifications required. It is possible, depending on the products required and equipment availability, that the Proponent may operate two processing streams concurrently.

The processing equipment would be located immediately adjacent to the active extraction area to allow an excavator to directly load fragmented material into the primary jaw crusher(s). The primary jaw crusher(s) would continue to be positioned on a pad of blasted or crushed material approximately 1m high to provide sufficient working clearance under the conveyors. Stockpiles of blending and recycling materials would be located adjacent to the primary jaw crushed to allow this material to also be direct loaded into the crushing plant (**Figure 2.6**). Extracted, blending and recycling material would be loaded into the primary jaw crusher in the appropriate proportions to produce quarry products with the required specifications.

The crushed material would then be stockpiled without further processing for use as select fill or other purposes. Crushed material not stockpiled for direct sale would be transferred to the secondary cone crusher for further crushing and shaping and then the screening plants. Alternatively, crushed material from the primary jaw crusher would be transferred directly to the screening plants for separation into the relevant size fractions to produce quarry products with the required specifications.

Each component of the mobile crushing plant would continue to be equipped with dust and noise suppression equipment to limit the generation of airborne dust and reduce the potential for adverse noise impacts on the surrounding community.

2.7.4 Product Stockpiling

Each component of the processing plant would continue to be equipped with one or more conveyors that would be used to transfer crushed or screened material either to another component of the processing plant or to primary product stockpiles adjacent to the processing plant.

The conveyors are relatively short and, as a result, the size of the primary product stockpiles is limited. As a result, the Proponent would continue to relocate these stockpiles to secondary product stockpiles using a front-end loader. These secondary product stockpiles would be positioned such that there is sufficient area to safely load trucks transporting product and minimise the number of vehicles required to travel in the vicinity of the processing area.

2.8 WASTE MANAGEMENT

2.8.1 Introduction

The waste materials produced by the Proponent would include production and non-production wastes. Production wastes would include oversize materials, as well as wastes generated during recycling operations. Non-production wastes would include waste oil, recyclable materials, domestic waste and waste water from the ablutions facility.

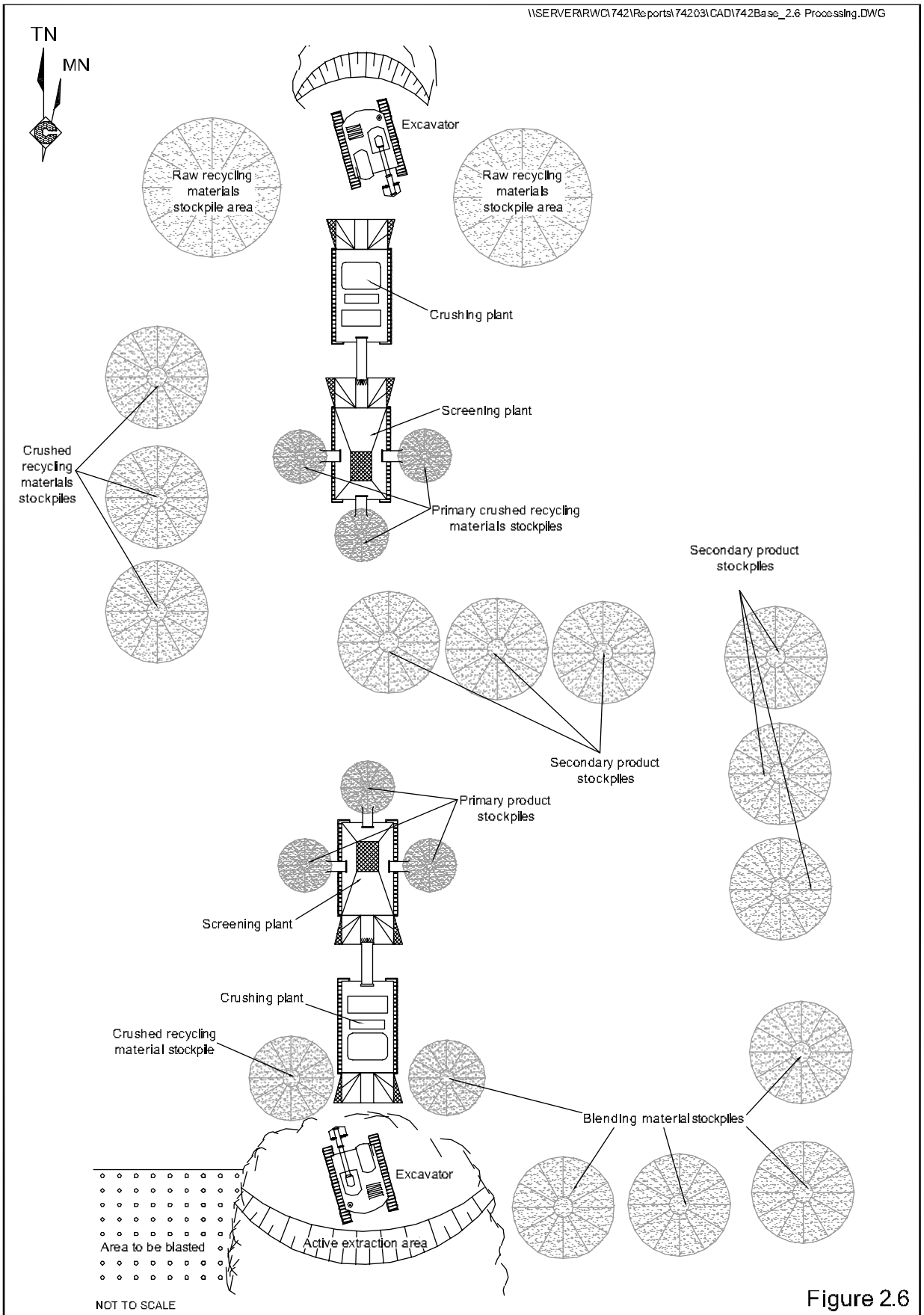

Figure 2.6
INDICATIVE PROCESSING AND STOCKPILING AREA LAYOUT

Souce: South Coast Concrete Crushing & Recycling Pty Ltd

2.8.2 Production Wastes

2.8.2.1 Oversize materials

Each blast within the Project Site would continue to be designed to achieve the appropriate level of fragmentation. However, it is likely that a small proportion of blasted material would continue to be too large to be passed through the primary jaw crusher. Oversize material, when it is produced, would be stockpiled separately and broken when a sufficient quantity of material has accumulated using an excavator-mounted rock hammer, preferentially on the quarry floor near a vertical face to reduce noise propagation.

2.8.2.2 Waste from Recycling Operations

As described in Section 2.5.3, recycling operations would continue to yield a small proportion of recyclable and non-recyclable wastes.

Recyclable wastes would continue to include steel reinforcing in concrete. This material would be recovered by breaking up the concrete using an excavator-mounted pulveriser jaw. The recovered steel would continue to be placed within scrap steel bins for sale to a steel merchant for recycling.

Non-recyclable wastes include plastic used as a liner for concrete slabs and small amounts of timber and other non-hazardous wastes. This material would be removed from the recycling material prior to crushing and would continue to be placed with a skip bin for collection and disposal off site.

2.8.3 Non-production Wastes

Non-production wastes that would be produced throughout the life of the Project, their storage and removal procedures are outlined in **Table 2.5**.

Table 2.5
Non-production Waste Management

Waste Type	Storage	Removal
Waste Oil and Grease	Placed within a bunded storage tank.	Collected on a regular basis by a licensed waste contractor.
Scrap Steel/Metal	Placed within specified metal recycling bins.	Sold on a regular basis to a metal merchant/recycler.
General Recyclables	Covered bins.	Transported as required to the Shoalhaven Disposal Facility by employees of the Proponent.
General Waste	Covered bins.	Transported as required to the Shoalhaven Disposal Facility by employees of the Proponent.

The Proponent has approval for and would construct a biocycle treatment facility should the Project receive project approval. The treated waste water would be used for watering areas undergoing rehabilitation or gardens in the vicinity of the ablutions facility.

2.9 VENM IMPORTATION AND PLACEMENT

2.9.1 Introduction

The Proponent proposes to receive a range of Virgin Excavated Natural Material (VENM) at the Project Site. A small proportion of this material would be processed and blended with other materials to produce quarry products. VENM materials not processed and used to make quarry products would be placed within the exhausted extraction area to ultimately establish a final landform which mimics the pre-extraction landform. At present, VENM generated in the vicinity of the Project Site is delivered and placed at licenced facilities, including Dunmore Sand and Soil Quarry on the Princes Highway between Shellharbour and Kiama and Soilco on Wogamia Road, West Nowra. In addition, VENM is delivered to unlicensed sites in the vicinity of the Project Site, including building sites and areas of public land.

The Proponent is of the view that it is far more desirable for VENM to be placed in licensed, professionally managed facilities than ad-hoc placement on local farms, beside roads and on residential blocks where there is limited opportunity to manage or verify the composition and placement of this material or process it into useable products.

The following subsections identify the definition of VENM and licencing requirements, the likely sources of VENM material, briefly describe the certification, transportation, receipt and placement procedures that would be employed and identifies the records that would be maintained.

2.9.2 Definition and Licensing Requirements

VENM is defined by Part 2(1) of the Appendix to Schedule 1 of the *Protection of the Environment Operations Act 1997* as follows.

> *Natural material (eg clay, gravel, sand, soil and rock) that is not mixed with any other waste and that:*
> *(a) has been excavated from areas that are not contaminated, as the result of industrial, commercial, mining or agricultural activities, with manufactured chemicals and that does not contain sulphidic ores or soils, or*
> *(b) consists of excavated natural materials that meet such criteria as may be approved by the EPA.*

Part 1 of the above Schedule states that VENM is not classified as waste. As a result, a facility receiving and placing VENM is not classified as a waste disposal facility and does not require an Environment Protection Licence (EPL) for this activity. However, as described in Section 2.1.4, an EPL will continue to be required for 'Extractive industries' and 'Crushing, grinding or separating works'.

The Proponent anticipates that VENM imported to site would include the following materials.

- Weathered soil, clay, silt, sand and gravel and alluvial material.
- Unweathered rock, including shale, siltstone, sandstone, basalt and other material.

The proportions of each material imported to site would vary throughout the life of the Project depending on the location of development activities in the vicinity of the Project Site at the time.

2.9.3 Sources of VENM

VENM is commonly generated during construction of residential and commercial buildings and infrastructure projects. As a result, the sources of VENM imported to the Project Site throughout the life of the Project are likely to vary. The Proponent anticipates VENM material would be sourced from an area that stretches from Batemans Bay to the south, to Wollongong to the north and the Southern Highlands to the west of the Project Site. In addition, the Proponent and associated companies are presently delivering quarry products to Southern Sydney. As a result, the Proponent anticipates receiving limited VENM from construction projects in that area of Sydney.

2.9.4 Certification and Receipt Procedures

As the Proponent estimates that VENM importation would not commence until Stage 3 of the Project (see Section 2.4.5), detailed consideration of the certification and receipt procedures that would apply at that time is not appropriate. Notwithstanding this, however, the following general procedures would be implemented to ensure material received within the Project Site may be classified as VENM. These procedures are based upon those procedures identified by the Department of Environment and Climate Change for identification and classification of VENM.

- All VENM accepted at the Project Site would be certified at its source and the certification verified on receipt in accordance with the relevant guidelines applicable at the time of receipt. This would include a visual inspection for signs of contamination and the presence of any other waste materials, such as bricks, concrete, timber, tiles and vegetation as well as odours that may indicate chemical contamination. A VENM certification sheet as described in Section 2.9.6 would be prepared, dated and signed by the person certifying the material.

- The history of the site from which the material is to be excavated would be determined and recorded on the site certification sheet. The following procedures would be implemented depending on previous land uses.
  - Where the site has been used for commercial, industrial, mining or agricultural purposes at any time in its history, or if the site contains fill material, or there is potential for chemical contamination from past or current uses, a testing regime would be implemented to establish that material sourced from the site may be classified as VENM.
  - If the site is, and has always been, used for residential or agricultural purposes then excavated material from the site, with the exception of the surface layers that may be contaminated with physical debris, vegetation, chemicals, fertilisers or asbestos) would be presumed to be classified as VENM.
- Upon arrival at the Project Site, the Proponent would require the drivers delivering VENM material to complete and sign a VENM record sheet as described in Section 2.9.6.
- The Proponent would direct the driver to a clearly identified receival area where the load would be inspected to ensure that it corresponds with the description of the material included on the certification sheet before it is accepted. Any unsuitable loads would not be accepted and the driver would be advised to take the load to the closest licenced facility.

2.9.5 VENM Placement Procedures

VENM that is accepted would be placed within a clearly identified active VENM placement area. Alternatively, where the material is suitable for processing, it would be placed within the stockpiling and processing area until such time as the material is processed, incorporated into quarry products and removed from the Project Site.

VENM to be used during backfilling operations would be 'paddock dumped' within the active VENM placement area or cell (**Figure 2.4**). When sufficient material is available, it would be pushed flat using a bulldozer and additional material would then be placed on top of the earlier placed material. VENM placement would typically occur in horizontal lifts approximately 3m high. Placement would generally progress from north to south, with the size of each placement cell determined at the time of placement. Each 3m lift would be compacted initially by the bulldozer used to flatten the placed material. Further compaction would be achieved through the operation of heavy vehicles placing material for the next lift.

As placement operations progress, the site access road within the placement area would be temporarily diverted to allow placement of VENM within the area of the access road. Once placement operations are complete within this area, the access road would be relocated to its final location, namely on the eastern margin of the extraction area.

In order to assist with the success of rehabilitation operations, placement and compaction of VENM would not occur within approximately 3.5m of the proposed final landform (**Figure 2.4**). Above this elevation, namely between approximately 3.5m and 1.0m of the final landform, approximately 2.5m of VENM would be placed. This material would preferentially be composed of weathered material and care would be taken not to overly compact this material during placement. Following placement of the selected VENM, approximately 0.5m of weathered shale material would be placed between approximately 1.0m and 0.5m below the proposed final landform. This material would be sourced from within the Project Site or would be imported VENM with a similar composition to the weathered shale found within the Project Site. Again, care would be taken to avoid compaction of this material. Finally, approximately 250mm of subsoil and approximately 200mm topsoil would be placed and shaped to create the final landform.

The use of weathered VENM and shale material in the upper 3.5m of the final landform would provide a subsoil growth medium for the re-established vegetation. In addition, the use of weathered shale material from the Project Site would assist the development of a vegetation community with a similar composition and structure to the vegetation community within undisturbed areas currently adjacent to the Project Site.

2.9.6 Record Keeping

During all VENM importation operations, the following records would be maintained for each site where imported VENM is to be sourced and for each load of material received.

- Individually numbered VENM certification sheets would be prepared for VENM to be transported to the Project Site. This sheet would record the following information.
  - The address of the source of the VENM.
  - A sketch plan of the site indicating the location of the material to be certified.
  - An indication of the approximate amount of material, in cubic metres or tonnes that may be classified as VENM.
  - A statement describing previous land uses within the site.
  - A statement indicating that no signs of contamination, such as bricks, concrete, timber, tiles or vegetation or the presence of odours were observed associated with the material to be certified during the site inspection.
  - The results of any test work undertaken.
  - The date of the site inspection.
  - The name and signature of the person certifying the material.

- An individually numbered VENM record sheet would be prepared for each load of VENM received within the Project Site. This sheet would record the following information.
  - The number of the VENM certification sheet related to the load received.
  - The address of the source of the VENM.
  - The date and time of delivery.
  - The gross and tare weight of the truck and the weight of VENM delivered.
  - A statement that the source of the material to be received was extracted from the site identified on the certification sheet and that the load does not include any contaminated material. This statement is to be accompanied by the name of the transportation contactor and the name and signature of the driver delivering the material.
  - A statement indicating that no signs of contamination, such as bricks, concrete, timber, tiles or vegetation, or the presence of odours were observed during unloading of the VENM.
  - A statement indicating the location where the material was placed on site.
  - The name and signature of the person verifying the classification and placement of the VENM.

2.10 MOBILE AND PROCESSING EQUIPMENT

Table 2.6 presents the mobile and processing equipment currently used within the Project Site. The Proponent would continue to use the existing or similar equipment during the remaining life of the Project.

It should be noted that the Proponent intends to use five road registered trucks for the delivery of quarry products and the importation of recycling and blending materials. These vehicles may be parked overnight within the Project Site.

2.11 PRODUCT TRANSPORTATION

2.11.1 Introduction

An important element in consideration in the design of the Project has been the recognition that the Project Site is adjacent to the Princes Highway (State Highway 1) and all Project-related traffic would continue to access the Project Site from this road.

Table 2.6
Current Mobile and Processing Equipment

Equipment	Number	Use
Primary jaw crusher	2	• Crushing and blending of extracted, blending and recycling materials.
Secondary cone crusher	1	
Screening plants	2	• Screening of crushed material.
20t Excavators	5	• Stripping of topsoil and subsoil material. • Loading of weathered shale material. • Loading of extracted, blending and recycling materials. • Breaking oversize material. • Breaking concrete and removing steel reinforcing.
Front-end loaders	3	• Stockpile management. • Loading of quarry products.
Bulldozer	2	• Rehabilitation operations. • Stripping topsoil and subsoil.
Unregistered water carts	2	• Dust suppression.
Road-registered trucks	5	• Transportation of quarry products.
Light vehicles	8	• Transportation of personnel and equipment.
Source: South Coast Concrete Crushing and Recycling Pty Ltd		

The following subsections review the design of the internal road network, describe the site entrance and intersection, identify the proposed transportation routes and outline the anticipated traffic types and levels.

As identified in Section 2.4.2, it is acknowledged that improvements to the Princes Highway have been proposed by the NSW Roads and Traffic Authority (RTA) in the vicinity of the Project Site. These improvements are understood to include:

- construction of a roundabout at the intersection of the Princes Highway and Warra Warra Road (also known as Western Road);
- widening of the Princes Highway to accommodate a heavy vehicle inspection bay; and
- construction of a median strip or wire-rope traffic dividing fence between the intersections of Warra Warra Road and Central Avenue with the Princes Highway to limit vehicular access to premises along this section of the Highway, including the Project Site, to left in/left out.

While these works have been identified by the RTA, no final plans have been made publicly available. Notwithstanding this, however, the proposed traffic and transportation operations have been designed to ensure that the operations would be compatible with the anticipated upgrades as described by the RTA.

2.11.2 Internal Road Network

Internal roads would include the site access road and other tracks to permit vehicular access to sections of the Project Site.

The site access road would be the primary access for heavy and light vehicles entering or leaving the Project Site. **Figure 2.7** presents conceptual design of the site access road. The principal components of the conceptual design are as follows.

- An 11m wide site entrance. The existing site entrance is approximately 10m wide (with gates currently 8m wide) at the Project Site boundary, increasing to approximately 52m where the site entrance merges with the Princes Highway.
- The site access road would be sealed for a distance of approximately 150m from the intersection of the Princes Highway and would have a sealed width of approximately 6m.
- The site access road would incorporate dual weighbridges with a central weighbridge office.
- A sealed visitor's carpark and weighbridge bypass would be provided to the south of the dual weighbridges.
- A wheel wash facility and shaker would be incorporated within the site access road to ensure material is not tracked onto the Princes Highway.
- The existing tarping area would be expanded to allow two truck and dog trailer vehicles to use the area concurrently and would be designed to allow drivers to cover their loads in an area where there is no risk of collisions between mobile equipment and stationary heavy vehicles.

With the exception of the tarping area, which is already in existence, each of the components of the conceptual design of the site access road would be constructed or erected prior to the annual production rate reaching 250 000t.

Other internal roads would include an unsealed section of the site access road constructed to allow all-weather access to the extraction area, as well as unsealed tracks to allow access to the staff carpark, facilities area, spares storage area, water storage facility and the southern section of the Project Site (**Figure 2.1**).

The extraction area access road would continue to permit access for light and heavy vehicles to the extraction area and southern sections of the Project Site. While the exact location of the extraction area access road would vary depending on extraction and VENM placement operations, the road would generally be located as close as practicable to the eastern boundary of the extraction area.

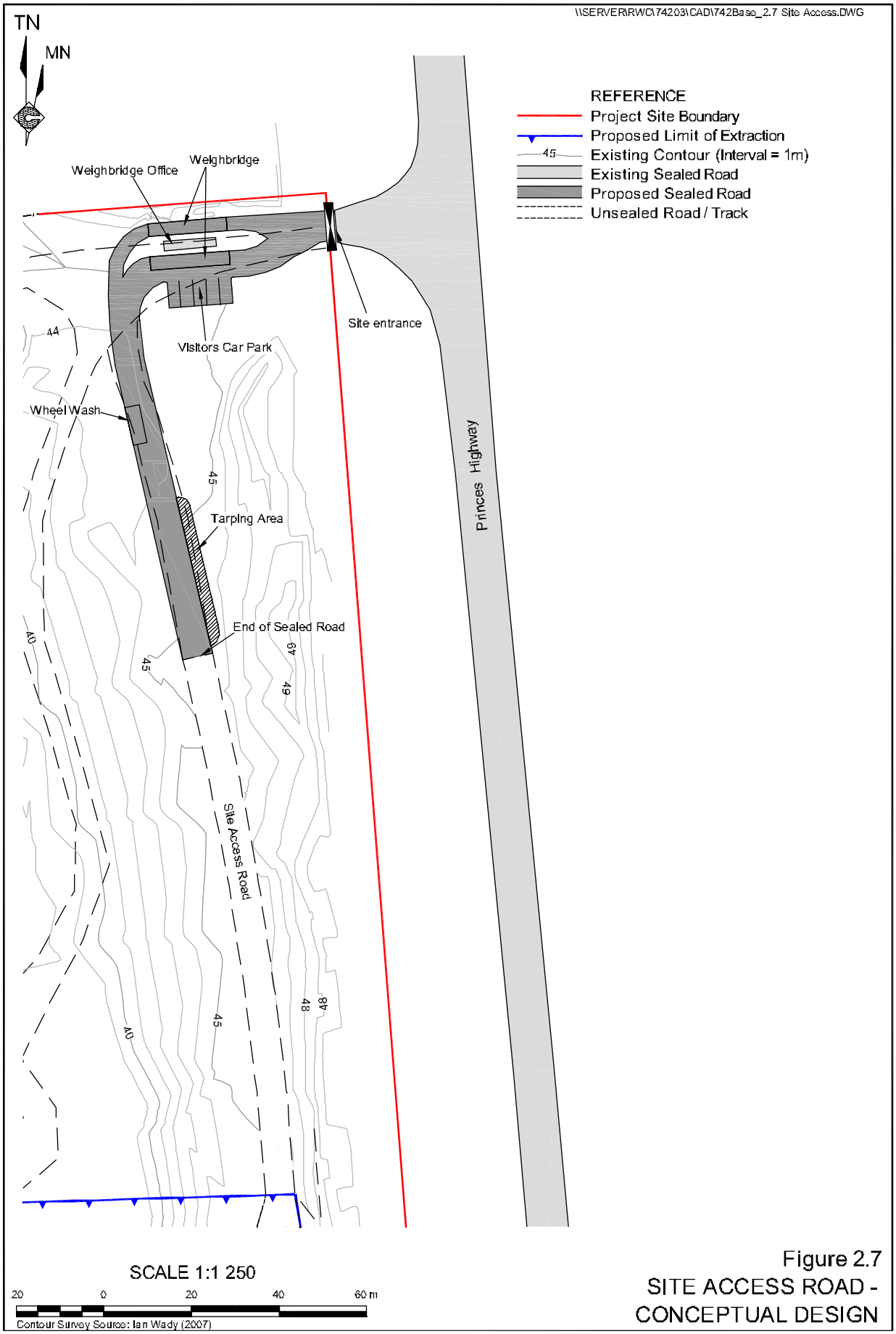

Figure 2.7
SITE ACCESS ROAD - CONCEPTUAL DESIGN

Access to the southern sections of the Project Site is presently via an unsealed access track to the east of the extraction area (**Figure 2.1**). However, this access track would be removed to permit extraction of the unweathered shale material under the road. Following removal of the existing access track, access to the southern sections of the Project Site would be via a ramp at the southern end of the extraction area. The location of this ramp would vary depending on extraction-related activities, however, the ramp would generally be located in the southeastern or southwestern corner of the extraction area. The slope of the ramp would be sufficient to allow road-registered heavy vehicles to access areas of weathered overburden extraction.

All internal roads would be clearly marked, appropriately drained and surfaced with gravel to ensure all weather access.

2.11.3 Site Entrance and Intersection

At present, access to the Project Site is via a sealed site entrance. At the boundary to the Project Site, the site entrance is approximately 11m wide, with gates approximately 8m wide. The site entrance gates would be increased to the full width of the site entrance to permit the entry and exit of B-Double trucks to the Project Site. The site entrance, where it merges with the Princes Highway, is approximately 52m wide.

The Proponent acknowledges that the Roads and Traffic Authority proposes to upgrade sections of the Princes Highway in the vicinity of the Project Site. In the event that the proposed upgrade impacts upon the existing site entrance, the Proponent would seek to negotiate an appropriate arrangement with the RTA to ensure the site entrance remains suitable for concurrent entry to and exit from the Project Site by B-double trucks, taking into account the proposed design for the upgraded Princes Highway.

2.11.4 Transport Routes

Material to be transported to or from the Project Site would continue to include the following.

- Recycling materials sourced from numerous construction and demolition sites and transported to the Project Site.
- Blending material sourced from a limited number of quarries, transported to the Project Site.
- VENM sourced from numerous construction sites, transported to the Project Site.
- Quarry products produced within the Project Site and transported to numerous locations from the Project Site.

Figure 2.8 provides an overview of the principal transportation routes and product destinations. In summary, approximately 25% of quarry products would be delivered to urban areas within Nowra to the south of the Shoalhaven River. Approximately 25% of the quarry products would be delivered to the urban areas within Nowra, north of the Shoalhaven River and areas to the northwest of Nowra. A further 30% of quarry products would be transported to the north of Nowra via the Princes Highway, with the remaining 20% of quarry products transported to the south of the Project Site via the Princes Highway.

2.11.5 Traffic Types and Levels

Materials imported to or despatched from the Project Site would be transported using road-registered heavy rigid trucks, truck and dog trailers, semi-trailer tippers or B-Double trucks. A very small component of quarry products despatched from the quarry site would be transported using road-registered light trucks, trailers or utility vehicles.

At present, most materials transported to the Project Site are transported as back loads, namely, imported material is transported using vehicles that would be travelling unladen to the Project Site. It is anticipated that this would continue for the life of the Project. As a result, while importation of blending and recycling materials to the Project Site would increase the number of daily laden truck movements, this activity would not increase the total number of daily truck movements.

Approximately 40% of material transported to or from the Project Site would continue to be transported in vehicles controlled by the Proponent, with the remaining material transported from the site by independent transport contractors.

In addition to heavy vehicle movements, the Project would generate a number of light vehicle movements related to employee travel to and from the Project Site, delivery of consumables and supplies and visitors to site.

Table 2.7 presents the anticipated 85th percentile vehicle movements at a maximum annual rate of product despatch of 500 000t.

Table 2.7
Anticipated Project-related Vehicle Movements [1,2]

	Daily	Quarry Peak (1.00-2.00pm)	AM Peak (8.15-9.15am)	PM Peak (4.30-5.30pm)
Cars	45	2	9	6
Light Rigid Trucks (2 axle)	144	20	0	0
Heavy Rigid Trucks (3+ axles)	134	34	12	0
Articulated Vehicles	96	22	0	0
TOTAL	**419**	**78**	**21**	**6**
Note 1: 2 x movements = one return trip. Note 2: Vehicle movements = 85th percentile movements.				
Source: John Coady (2007) – Table 8				

Figure 2.8
PRODUCT DISTRIBUTION AND INDICATIVE TRANSPORT ROUTES

2.12 HOURS OF OPERATION AND PROJECT LIFE

2.12.1 Hours of Operations

The proposed continued and expanded Nowra Brickworks Quarry would operate between the following hours.

- Extraction, processing and VENM backfilling-related activities.
  - 7:00am to 6:00pm, Monday to Friday.
  - 7:00am to 4:00pm, Saturday
- Product despatch.
  - 7:00am to 6:00pm, Monday to Friday.
  - 7:00am to 4:00pm, Saturday.
  - A maximum of three unladen trucks would arrive at the Project Site between 6:00am and 7:00am, with a maximum of a further three unladen trucks returning to the Project Site between 6:00pm and 8:00pm, Monday to Friday.
  - A maximum of three unladen trucks would arrive at the Project Site between 6:00am and 7:00am, with a maximum of a further three unladen trucks returning to the Project Site between 4:00pm and 6:00pm, Saturday.
- Maintenance-related activities.
  - 7:00am to 6:00pm, Monday to Saturday.

The quarry would not operate on Sundays or Public Holidays.

2.12.2 Project Life

The volume of the proposed extraction area is approximately 3.37 million cubic metres. At an annual average production rate of 300 000t, the proposed extraction area will provide sufficient material for approximately 30 years.

2.13 SERVICES, EMPLOYMENT AND ECONOMIC CONTRIBUTION

2.13.1 Services

Power

The Project Site would continue to be serviced by 240V mains power supplied to the weighbridge office. All equipment operating within the extraction area is and would continue to be diesel-powered.

Water

There is no reticulated water to the Project Site and none is proposed.

All processing water requirements would be drawn from water that has accumulated within the extraction area or is stored within the water storage facility. This water would be used for dust suppression and rehabilitation operations. The hydrology assessment indicates sufficient water would be available within the Project Site to adequately meet the requirements for extraction-related water without the need for additional water to be sourced from off site.

Water for the ablutions facility would be supplied by a rainwater tank adjacent to the ablutions facility. If required, this tank would be supplemented by water from the water storage facility.

Potable water requirements would continue to be met by water purchased in 20L or similar containers and/or transported to site in bulk.

Communications

The Project Site would continue to be serviced by two telephone lines which provide voice, facsimile and data communications on site. Additional telephone lines may be installed, if required.

Communications within the Project Site would continue to be provided by mobile phones and two-way radio. All vehicles controlled by the Proponent would continue to be equipped with two-way radios and hand held units would continue to be provided to truck drivers whose vehicles are not so equipped.

Fuel

Diesel for unregistered mobile and processing equipment would continue to be brought to site in bulk by a local diesel supply contractor and transferred directly to the equipment every two to three days. Road registered mobile plant, principally the road registered trucks, would continue to be refuelled off site.

Petrol for use in pumps and other small equipment would continue to be stored in 20L containers which would be refilled off site, as required.

Sewage/Ablutions

A biocycle septic system has been approved by Shoalhaven City Council (DA 05/2201) and would be installed to service the ablutions facility should project approval for the Project be granted.

2.13.2 Employment

The Proponent currently provides employment for approximately 13 people to undertake the on-site activities. **Table 2.8** presents the anticipated full-time positions equivalent positions that would be attributable directly and indirectly to the Project when the annual production rate reaches 300 000tpa or 500 000tpa.

Table 2.8
Project-related Full-time Equivalent Positions

Activity	Annual Production Rate	
	300 000t	**500 000t**
Direct		
Extraction, processing and stockpiling	14	17
Transportation	6	8
Sub-total	**20**	**25**
Indirect		
Transportation	5	8
Maintenance, delivery of consumables, etc	2	4
Sub-total	**7**	**12**
Total	**27**	**37**
Source: SCCCR		

2.13.3 Economic Contribution

Table 2.9 details the anticipated Project-related annual economic contribution to the local, regional, State and National economies throughout the life of the Project. The estimated contributions have been established based on actual expenditures during the 12 months to 30 June 2006. During this period, production from the Nowra Brickworks Quarry was 125 000t. In order to estimate the anticipated annual economic contribution of the Project, actual expenditure figures were adjusted on a pro-rata basis to production rates of 300 000t and 500 000t per year.

2.14 SAFETY AND SECURITY

The Proponent recognises that the proximity of the Nowra Brickworks Quarry to the Princes Highway and surrounding urban and industrial areas would require the continued implementation of procedures and controls to protect the safety of the public. Measures would also be required to ensure the safety of employees, contractors and visitors to the Project Site.

It is the Proponent's policy that each person employed on, or visiting the Project Site, is provided with a safe and healthy working environment. In order to achieve this, the Proponent has implemented and would continue to implement an induction and training program to achieve the following objectives.

- Ensure compliance with statutory regulations.
- Eliminate or control safety and health hazards in the working environment.

- Provide relevant occupational health and safety information and training to all personnel.
- Develop and review safe working practices and job training.
- Ensure all contractors adopt and maintain the Proponent's policy objectives and safety standards at all times.

Table 2.9
Anticipated Annual Economic Contribution

Item	Annual Production Rate	
	300 000t	**500 000t**
Local and Regional Contributions - Direct		
Wages (gross wages, superannuation, etc)	$2 280 000	$3 7000 000
Consumables (fuel, oils, tyres, office consumables, etc)	$750 000	$1 215 000
Services (blasting, surveying, environmental management, maintenance, communications, etc)	$820 000	$1 265 000
Capital (equipment and building replacement)	$3 085 000	$3 855 000
Local Government Taxes (rates, contributions, etc)	$12 000	$20 000
Community support (sponsorships, donations, in-kind support, etc)	$13 000	$21 000
Sub-total	**$6 960 000**	**$10 076 000**
Local and Regional Contributions – Indirect		
Transportation, including: • drivers wages; • consumables (fuel, tyres, maintenance) ; and • capital (equipment/vehicle replacement).	$755 000	$1 225 000
Sub-total	**$755 000**	**$1 225 000**
State and National Contributions		
State taxes (payroll tax, etc)	$100 000	$185 000
Royalties	$105 000	$175 000
Consumables, services and capital	$2 255 000	$3 760 000
Sub-total	**$2 460 000**	**$4 120 000**
Total	**$10 175 000**	**$15 421 000**
Source: SCCCR		

Specifically, the following safety and security measures would continue to be implemented.

- The existing 1.8m high security perimeter fence would be maintained.
- The existing perimeter amenity bund would be maintained and extended (**Figure 2.5**).
- The existing lockable site entrance gate would be enlarged. This would continue to be the only public access to the Project Site and would be locked whenever the Project Site is unoccupied. Other gates in the perimeter fence would be kept locked at all times.
- Existing security and warning signs would continue to be positioned at strategic locations around or within the Project Site indicating the presence of earthmoving equipment, deep excavations, steep slopes and deep water. The positioning of signs would depend on the location of the extraction and placement activities at any one time.

- Employee and visitor inductions would include safe working practices and regular follow-up safety meetings and reviews.
- Where internal roads are adjacent to steep slopes, bunds would continue to be installed and maintained along the downslope margins of these roads to a minimum half the wheel height of the largest item of mobile equipment on-site. Alternatively, large concrete blocks would continue to be used to prevent vehicular access to steep slopes.
- Implementation of appropriate controls with respect to the use of explosives to ensure compliance with statutory requirements at all times.
- Ensuring that no explosives are stored within the Project Site. The explosives, boosters and detonators required for blasting would all be transported to the Project Site by the blasting contractor on the day of the blast.
- Ensuring that the blasting contractor utilises correct blasting procedures to contain the fragmented rock within the design blast envelope and to minimise the generation of excessive ground and air vibrations.
- Strict compliance with all project approval, mining lease and licence conditions.

2.15 SITE REHABILITATION AND FINAL LANDFORM

2.15.1 Introduction

The Proponent would adopt a progressive approach to the rehabilitation of disturbed areas within the Project Site to ensure that, where practicable, areas where extraction and placement-related activities are completed are quickly shaped and vegetated to provide a stable landform. The progressive formation of the post-extraction landform and the establishment of a vegetative cover would also minimise the potential for quarry-related air quality and surface water impacts on the surrounding environment.

The following subsections describe the Proponent's rehabilitation objectives and procedures and the proposed final landform on completion of all proposed extraction and placement-related activities. The proposed rehabilitation procedures and the revegetation species nominated have been developed based on the recommendations of the Proponent's ecological consultant, Gaia Research Pty Ltd. Refinements to these procedures, if required, would be undertaken on the basis of operational experience gained by the Proponent during progressive rehabilitation. These refinements would be reported in the relevant Annual Environmental Management Report and/or any Mining Operations Plans prepared by the Proponent throughout the life of the Project.

2.15.2 Rehabilitation Objectives

The Proponent's rehabilitation objectives for all areas of quarry-related surface disturbance within the Project Site can be defined in the short term and long term.

In the short term, the objectives would be to stabilise all earthworks, drainage lines and disturbed areas no longer required for extraction-related activities in order to minimise the risk of erosion, sedimentation and air quality impacts on the environment surrounding the Project Site.

In addition, as noted in Section 4.2.4, Martens (2008), who undertook the hydrology assessment for the Project, have estimated that in order to ensure that potentially salt-laden water is not discharged to Nowra Creek, the maximum catchment for the extraction area and water storage facility would be required to be less than 5.9ha. As a result, the Proponent would ensure that progressive rehabilitation is undertaken as soon as practicable once an area is no longer required for extraction or placement-related operations. Once the rehabilitated areas have been stabilised, surface water flows from those areas would be directed away from the extraction area to suitable sediment containment structures before being discharged from the Project Site.

In the longer term, the Proponent's objectives are to progressively provide a low maintenance, stable and safe landform that mimics the pre-extraction landform and provides, through re-establishment of land capabilities comparable with the pre-extraction land capabilities, for the establishment of vegetation communities similar to communities in undisturbed areas adjacent to and surrounding the Project Site.

2.15.3 Final Landform

An important component in the rehabilitation of areas disturbed by extraction-related activities is the reconstruction of a landform that can support the proposed vegetation and subsequent land uses. **Figure 2.9** presents the final landform following the completion of all extraction and placement-related activities.

The features of the final landform would be as follows.

- A recreated landform within the extraction area that mimics the pre-extraction landform, namely a gently north-sloping landform with an average slope of approximately 1:35 (V:H) and a maximum slope of approximately 1:8 (V:H).
- A fenced water storage facility with a capacity of approximately 42ML.
- An access track to allow vehicular access to the water storage facility.
- The existing perimeter amenity bund would remain in place.

The procedures for construction of the final landform are presented in Section 2.9.5.

2.15.4 Final Land Use

The final land use is proposed to be nature conservation through the use solely of endemic native vegetation. In order to achieve this, the Proponent would establish vegetation communities within areas undergoing progressive rehabilitation in accordance with the procedures described in Section 2.15.5. These communities would be similar in composition to vegetation communities adjacent to and surrounding the Project Site.

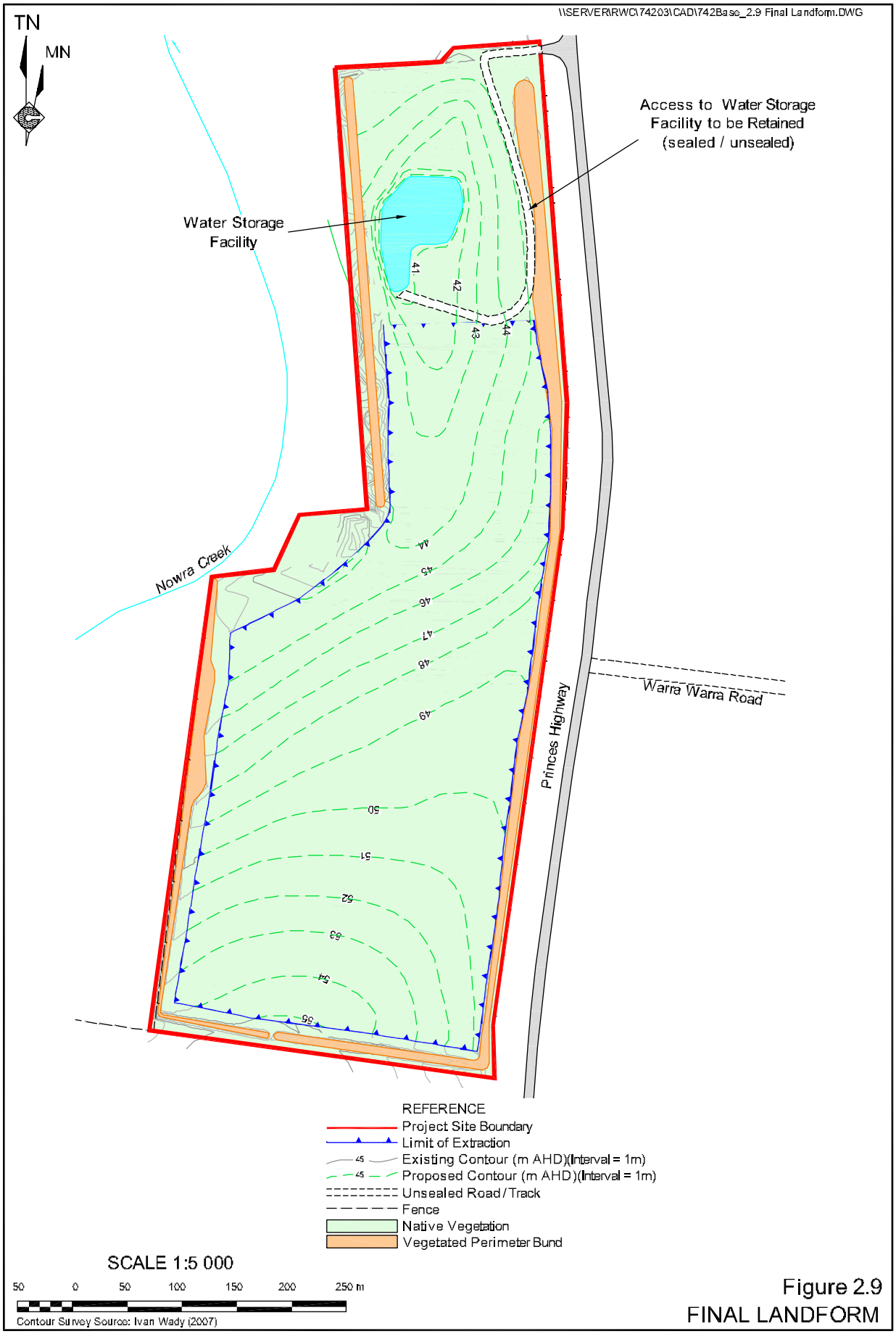

Figure 2.9
FINAL LANDFORM

The use of the Project Site for nature conservation would be compatible with the proposed Nowra Correctional Facility proposed to be constructed approximately 500m to the west of the Project Site. The Project Site would, following completion of the Project, extend the vegetated buffer between the proposed correctional facility and the highway.

2.15.5 Rehabilitation Activities

Rehabilitation would be undertaken progressively as soon as practicable after sections of the Project Site are no longer required for extraction or placement-related activities. The following procedures would be implemented during rehabilitation to ensure the rehabilitation objectives identified in Section 2.15.2 are achieved.

- Following completion of placement activities identified in Section 2.9.5, subsoil and topsoil would be placed on the constructed landform in accordance with the procedures identified in Section 2.3.5.4.
- The surface of the placed topsoil would be left even but 'roughened' to assist with infiltration of water and seed retention.
- Where required, surface water management structures would be constructed to minimise the potential for erosion and to contain any potentially sediment-laden surface water within the Project Site.
- Coarsely mulched or broken vegetation would be spread over the topsoil, or hydromulch, hydroseed or bitumen sprayed straw mulch techniques would be used to limit the potential for erosion of the newly placed soil material.
- A temporary, non-regenerating cover crop would be used to stabilise the area to the rehabilitated in the short-term to allow diversion of surface waters away from the extraction area in accordance with the recommendations of Martens (2009) (see Sections 4.2.4 and 4.2.5).
- Species used during final revegetation would be a mixture of lower, mid and upper storey species.
- Seed for use during final revegetation operations would continue to be collected in the vicinity of the Project Site, generally during Summer and Autumn.
- Collected seed would be broadcast over each area to be revegetated, generally during Autumn.
- Direct seeding would be supplemented by placement of whole or coarsely mulched vegetation sourced from clearing operations on the areas to be rehabilitated.
- Where appropriate, tube stock would be planted to supplement direct seeding and natural revegetation.
- The area to be rehabilitated would be fenced and signs erected to restrict access to the area.
- Rehabilitation would be monitored regularly as described in Section 2.15.8.

As rehabilitation operations would be progressively implemented throughout the life of the Project, and the Proponent would continue to receive payment for receipt of VENM following cessation of extraction-related operations during Stage 6 of the Project, sufficient resources would be available to complete rehabilitation and undertake the ongoing management of the Project Site.

2.15.6 Infrastructure and Services

Following the completion of extraction and placement activities, the Project-related infrastructure and services, such as the weighbridges, office, ablutions facility, spares storage area, site access road and visitor's and employee's carpark would be removed. All concrete footings and foundations would be removed and the area re-profiled. Sections of the site access road not required for ongoing site access would be ripped. The section of the site access road from the site entrance to the water storage facility would be retained for subsequent land management purposes. Topsoil would be spread over the areas to be rehabilitated and these areas would be seeded and/or planted as described in Section 2.15.5.

2.15.7 Other Areas of Disturbance

Following completion of all extraction and placement-related activities, the Proponent would:

- remove and rip all remaining internal roads and other access tracks no longer required, spread subsoil and topsoil and revegetate the disturbed areas in accordance with the procedure outlined in Section 2.15.5; and
- install appropriate drainage controls.

Appropriate access tracks, including sections of the site access road and fire tracks, would remain following completion of all extraction and placement-related activities to allow vehicular access to the water storage facility and to permit appropriate management of the Project Site

2.15.8 Rehabilitation Monitoring, Maintenance and Reporting

The Proponent's commitment to effective rehabilitation would involve an ongoing monitoring and maintenance program through and immediately following the life of the Project. Areas undergoing progressive rehabilitation would be regularly inspected and assessed against the short and long term rehabilitation objectives outlined in Section 2.15.2.

During regular inspections, the following would be monitored.

- Evidence of any erosion or sedimentation from areas with establishing vegetation cover.
- Success of initial cover crop establishment.
- Success of tree and shrub plantings.
- Natural regeneration of native species.
- Adequacy of drainage controls.
- General stability of the rehabilitation areas.

Throughout the life of the Project, the following rehabilitation maintenance activities would be undertaken.

- Where monitoring indicates that rehabilitation success appears limited, the following maintenance activities would be initiated.
  - Re-seeding, re-topsoiling and/or the application of specialised treatments such as composted mulch to areas with poor vegetation establishment.
  - Installation of tree guards should grazing by native animals be excessive.
  - Repair or reconstruction of drainage controls should existing controls be found to be inadequate.
  - Erection of temporary fences to exclude native fauna should grazing appear to be excessive.
- Where monitoring identifies excessive erosion and sedimentation, remedial works such as importation of additional fill, subsoil or topsoil material, or redesigning of water management structures would be undertaken.
- Where monitoring identifies actual or potential weed infestations, the Proponent would undertake appropriate weed control or eradication programs.

No time limit has been placed on post-extraction rehabilitation monitoring and maintenance. Rather, these activities would continue until such time as the rehabilitation objectives outlined in Section 2.15.2 are met to the satisfaction of the relevant government agencies. It is anticipated both MLs 5087 and 6322 would not be relinquished until the DPI-MR is satisfied that the standard of revegetation on the Project Site would be sustainable in the long term.

The status of rehabilitation activities would be reported annually in the Annual Environmental Management Report that is prepared for the Department of Primary Industries – Mineral Resources as required under the conditions of Mining Leases 5087 and 6322.

2.15.9 Biodiversity Offset Strategy

2.15.9.1 Introduction

In order to compensate for the removal of approximately 7.4ha of Spotted Gum Forest within the Project Site, the Proponent proposes to protect the following areas of Spotted Gum Forest within and surrounding the Project Site (**Figure 2. 10**).

- Approximately 3.0ha within the Northern Biodiversity Offset Area.
- Approximately 17ha within the Southern Biodiversity Offset Area.

The aim of the proposed biodiversity offset strategy would be to maintain or improve the cumulative biodiversity values of the land within and surrounding the Project Site for the life of the anticipated impacts.

2.15.9.2 Northern Biodiversity Offset Area

The Northern Biodiversity Offset Area incorporates part of Lot 1, DP1126288 (**Figure 2.10**). The State of New South Wales is the registered owner of this land, with the Department of Lands administering the land for the Crown. The Proponent holds Mining Leases 5087 and 6322 over this land and retains access to that land through those leases. As the Proponent's rights in relation to the land are dependent on the existing mining leases remaining in force, it would not be appropriate to secure the Northern Biodiversity Offset Area through a covenant on the title or similar arrangement. However, the Proponent or its successors in title would manage the Northern Biodiversity Offset Area in accordance with the management measures described below while ever the mining leases remain in force. In the event that the leases are relinquished or cancelled, the Proponent would provide sufficient resources for the on-going management of the Northern Biodiversity Offset Areas for the life of the offset strategy (see Section 2.15.9.5). The Proponent envisages that an amount to secure the appropriate management of the Northern Biodiversity Offset Area would be included in the security required under the *Mining Act 1992* in relation to the mining leases.

2.15.9.3 Southern Biodiversity Offset Area

The Southern Biodiversity Offset Area comprises part of Lots 228 and 229 DP 755952 and is adjacent to and to the southwest of the Project Site (**Figure 2.10**). The Proponent has agreed with the landowner to acquire a lease over the land for the term of the offset strategy, subject to the granting of project approval. The lease would include terms that would prevent the lease from being terminated by the lessor or subsequent owners of the land.

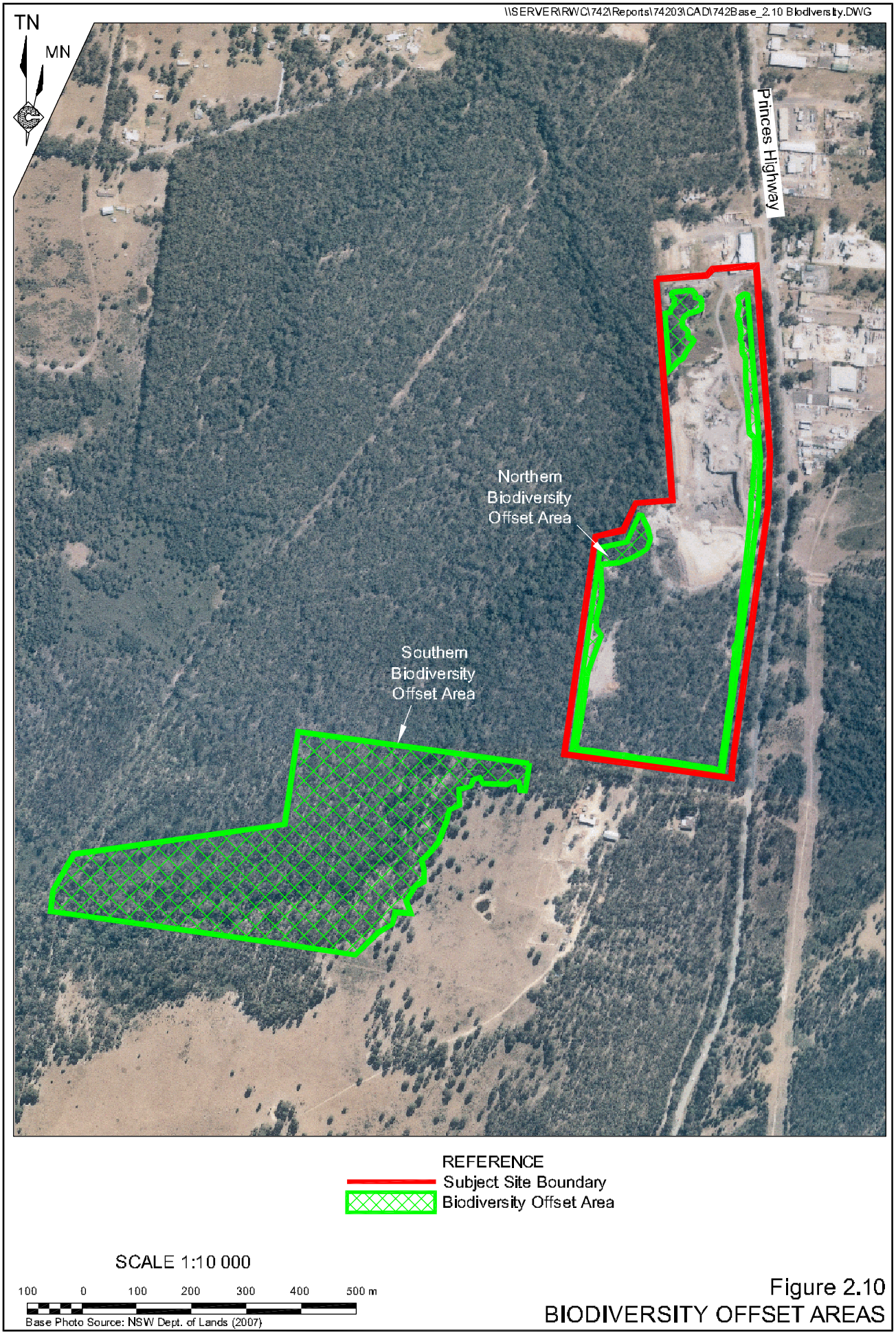

Figure 2.10
BIODIVERSITY OFFSET AREAS

The Proponent would manage the Southern Biodiversity Offset Area for at least the term of the lease of the land for the purposes of nature conservation and enhancement of the biodiversity values of the land.

The Proponent would secure the Southern Biodiversity Offset Areas through a term on the lease that would restrict the use of the Southern Biodiversity Offset Area to those purposes identified in the project approval.

2.15.9.4 Management of the Biodiversity Offset Areas

The following biodiversity management measures would be implemented throughout the life of the biodiversity offset strategy.

- Appropriate fences would be erected to restrict wildlife from entering areas of active extraction and rehabilitation-related operations. These fences would be removed once extraction and rehabilitation-related activities have ceased.
- Ongoing implementation, in conjunction with neighbouring landowners, of pest control programs, including for rabbits, European Red Foxes and feral cats.
- Ongoing implementation, in conjunction with neighbouring landowners, of weed control programs, including for noxious weeds such as Bitou Bush , Blackberry , Crofton Weed, Fireweed, Honey Suckle, Madeira Vine, Moth Vine and Turkey Rhubarb. These weed control programs would be generally in accordance with the procedures described in Gaia Research (2007).
- Regular monitoring of the biodiversity offset areas for fauna species utilising the areas, weeds and feral pests.

Should the Proponent relinquish Mining Leases 5087 and 6322, an appropriate arrangement for the ongoing management of the Northern Biodiversity Offset Area would be negotiated with the appropriate government agency prior to the leases being relinquished.

2.15.9.5 Life of the Biodiversity Offset Strategy

The Proponent notes that the aim of the Biodiversity Strategy would be to maintain or improve the biodiversity values of the land within and surrounding the Project Site for the life of the anticipated impacts of the Project. The Proponent anticipates that the biodiversity impacts of the Project would continue until such time as the rehabilitated final landform has biodiversity values that are similar or better than the biodiversity values of the existing landform. As rehabilitation operations within sections of the Project Site would not commence until extraction operations are complete and it is anticipated that hollows suitable for habitat for a variety of species generally take between 50 and 90 years to form, the Proponent anticipates that the life of the Biodiversity Offset Strategy would be between 80 and 120 years.

PREAMBLE

Section 3

Consultation, Issue Identification and Prioritisation

This section of the Environmental Assessment provides information outlining the steps undertaken to identify and prioritise the relevant environmental issues that are required to be addressed to allow an assessment of the Project.

The steps undertaken to identify environmental issues include:

- *consultation with the local community;*
- *consultation with State and local government authorities; and*
- *a review of relevant State, Regional and Local Planning policies.*

This section concludes with an assessment of the priorities of each of the identified environmental issues to be addressed.

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3.1 INTRODUCTION

In order to prepare a comprehensive *Environmental Assessment* for the Project, appropriate emphasis needs to be placed on those issues likely to be of greatest significance to the local environment, neighbouring landowners and business operators and the wider community. In order to ensure this has occurred, a program of community and government consultation, preliminary environmental studies and a literature review was undertaken to identify relevant environmental issues and potential impacts. This information was used to prioritise the assessment of the identified environmental issues within this *Environmental Assessment*.

3.2 CONSULTATION

3.2.1 Community Consultation

Community consultation in relation to the Project has included both informal and formal consultation.

The Proponent has operated the Nowra Brickworks Quarry since the mining leases were purchased from the previous owners in 2002. During this time, the Proponent has undertaken informal consultation with the owners and occupiers of land in the vicinity of the Project Site. This has included consultation with the owners of the residence to the south of the southern boundary of the Project Site in relation to blasting and noise impacts of the quarry operations. In addition, the Proponent has consulted with the operator of Nowra Brickworks to the north of the Project Site in relation to blasting impacts. Other informal consultation with the owners and occupiers of land to the east of the Princes Highway in relation to noise, blasting and dust aspects of the quarry's operation have been undertaken on an ad-hoc basis.

Formal consultation with surrounding landowners and occupiers was undertaken during October and November 2007. Landowners and residents on properties adjacent to the Project Site and landowners and business operators along the Princes Highway were contacted by Mr Chris Outtersides of City Plan Services.

During the consultation, Mr Outtersides met with the following.

- The occupants of Residences A and B to the north and south of the Project Site on the western side of the Princes Highway.
- The operator of the Nowra Brickworks adjacent to the northern boundary of the Project Site.
- The operator of the saw mill adjacent to the southern boundary of the Project Site.
- The operators of a number of businesses to the east of the Project Site on the eastern side of the Princes Highway.

The consultation was structured into two parts. During Part 1, Mr Outtersides discussed the existing operations with each of the individuals consulted to establish whether there were any previous or outstanding environmental and/or amenity concerns in relation to the current operation of the quarry over the past 5 years since it was operated by the Proponent.

During Part 2 of the consultation, each person consulted was provided with a brief description of the proposal to continue and extend the extractive operations at Nowra Brickworks Quarry and asked to provide comment on the proposal and whether there were any environmental and/or amenity issues that may adversely impact on their commercial operations.

Contact details and follow-up information were then left with each of the individuals in the event that additional concerns came to light after the consultation meeting.

In response to Part 1 of the consultation process, three issues were identified as concerning the respondents, namely:

- air quality;
- blasting and vibration; and
- vehicle movements.

In response to Part 2 of the consultation process, the majority of individuals consulted expressed no objection to the Project, provided it was undertaken to a high standard of environmental management.

3.2.2 Government Agency Consultation

A Planning Focus Meeting for the Project was convened by the Department of Planning on 23 August 2007 and was attended by representatives from the following government agencies.

- Department of Planning.
- Department of Water and Energy,
- Department of Environment and Climate Change.
- NSW Roads and Traffic Authority.
- Shoalhaven City Council.

The Planning Focus Meeting included a site visit and a presentation describing the Project. The meeting allowed the relevant government agencies the opportunity to visit the Project Site and obtain an understanding of the Project as it was then envisaged. Following the meeting, the Department of Planning requested and received formal written requirements from all government agencies in attendance. A summary of these requirements, together with those of the Director-General of the Department of Planning are presented in **Appendix 2**. The frequency that each issue was raised is presented in **Table 3.1.**

3.3 ISSUE IDENTIFICATION

3.3.1 Preliminary Environmental Studies

During the design phase of the Project, the following preliminary environmental studies were undertaken by the specialist consultants identified below to identify the constraints posed by the local environment and what elements of the local environment would require further consideration and assessment during preparation of the *Environmental Assessment*.

- Hydrology (Martens and Associates Pty Ltd).
- Noise (Heggies Pty Ltd).
- Air Quality (Heggies Pty Ltd).
- Geology (Douglas Partners Pty Ltd).
- Traffic and Transportation (John Coady Consulting Pty Ltd).
- Ecology (Gaia Research Pty Ltd).
- Aboriginal Heritage (Australian Archaeological Survey Consultants Pty Ltd).

The results of each of the above studies were incorporated into the *Preliminary Environmental Assessment* that was prepared to accompany the Major Projects Application for the Project. The above studies concluded that, in the absence of appropriate safeguards and mitigation measures, the proposed activities could potentially have an impact upon the following aspects of the local environment.

- Hydrology.
- Traffic and transportation.
- Ecology.

3.3.2 State Planning and Environmental Guidelines and Policies

3.3.2.1 Introduction

The Project is identified as a Major Project under Paragraph 5, Schedule 1 of the *State Environment Planning Policy (Major Projects) 2005*. Under Section 75D of the *Environmental Planning and Assessment Act 1979* (EP&A Act), the Minister for Planning is the approval authority.

Relevant State Environmental Planning Policies (SEPPs) are outlined below.

In addition, the NSW Government has released a number of other policies and guidelines that need to be taken into account during the planning and assessment of new projects. Where relevant, these policies are referred to throughout Section 4 of this document in the context of the discussion relating to each environmental issue.

3.3.2.2 State Environmental Planning Policy (Major Projects) 2005

State Environmental Planning Policy (Major Projects) 2005 was gazetted on 25 May 2005 and applies to applications for all projects satisfying nominated criteria made following that date. Clause 6 of this SEPP states that development described in Schedule 1 of the SEPP is a Project to which Part 3A of the *Environmental Planning and Assessment Act 1979* applies. Schedule 1, paragraph 7 of this SEPP identifies:

> *"development for the purpose of extractive industry that extracts more than 200,000 tonnes of extractive materials per year, or extracts from a total resource ... of more than 5 million tonnes."*

As the proposed continued and expanded use of the Nowra Brickworks Quarry meets both thresholds described above, the Project is classified as a Major Project under the SEPP and will be assessed under Part 3A of the *Environmental Planning and Assessment Act 1979*.

3.3.2.3 State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 was gazetted and commenced on 16 February 2007. Part 3 of this SEPP sets out a number of matters that must be considered when determining an application for project approval for an extractive industry. These matters to be considered include the following.

- The compatibility of proposed the extractive industry with other land uses.
- Whether impacts on significant water resources or threatened species and biodiversity are avoided, or are minimised to the greatest extent practicable.

- Whether greenhouse gas emissions are minimised to the greatest extent practicable.
- Whether the project optimises the efficiency of recovery and to minimises the creation of waste in association with the extraction of extractive materials.
- Whether conditions should be imposed to ensure the rehabilitation of land that will be affected by the development.

In addition, Paragraph 16 of the SEPP requires that where materials are to be transported by public road, the consent authority is to provide the relevant roads authority with a copy of the application and must not determine the application within 21 days of the roads authority being supplied with the application. The Project Site would be accessed via the Princes Highway. As this road is a State Highway, the relevant roads authority is the NSW Roads and Traffic Authority.

3.3.2.4 State Environmental Planning Policy No. 33 – Hazardous and Offensive Development

Hazardous and offensive industries, and potentially hazardous and offensive industries, relate to industries that, without the implementation of appropriate impact minimisation measures would, or potentially would, pose a significant risk in relation to the locality, to human health, life or property, or to the biophysical environment.

The Project would involve the storage of small amounts of hydrocarbons including, unleaded petrol lubricating oils and grease, Class 3 C2 combustible liquids. No diesel would be stored on site. As the hydrocarbons and lubricating oils and greases would not be stored adjacent to any other hazardous materials of the same class, DUAP (1997) does not require these to be considered further. As a result, the Project would be unlikely to be considered potentially hazardous under SEPP 33. As such, there is no requirement to undertake a Preliminary Hazard Analysis for the Project.

3.3.2.5 State Environmental Planning Policy No. 44 - Koala Habitat Protection

The Shoalhaven Local Government Area (LGA) is listed under Schedule 1 of this SEPP. This requires an investigation be carried out to determine if "core" or "potential" Koala habitat is present within the Project Site and whether it is likely to be disturbed. "Core Koala habitat" comprises land with an identified resident population of Koala. "Potential Koala habitat" comprises land with known Koala feed trees listed under Schedule 2 constituting at least 15% of the total number of trees present on a site.

The Ecology Assessment (see Section 4.3 of this document and Part 2A *Specialist Consultant Studies Compendium*) did not identify any Koala nor signs of Koala within the Project Site. In addition, only one species of koala feed tree, namely the Grey Gum, was identified within the Project Site and it occurs at abundances less than 15% of all trees. As a result, this SEPP does not apply to this Project.

3.3.2.6 State Environmental Planning Policy No. 55 – Remediation of Land

No parts of the land within the Project Site are known to be contaminated, or have been identified as such. Hence this SEPP does not apply.

3.3.3 Regional and Local Planning and Environmental Guidelines and Policies

3.3.3.1 Introduction

Section 75R(3) of the *Environmental Planning and Assessment Act 1979* states that environmental planning instruments, other than SEPPs, do not apply to or in respect of an approved project. However, the Director-Generals Requirement's state that the *Environmental Assessment* is required to assess "the potential impacts of the project on any strategic land use planning initiative that Council may have for the Nowra Bomaderry area".

Shoalhaven City Council has prepared a draft document entitled the "Nowra Bomaderry Structure Plan" (dated January 2006) (the "structure plan"). This subsection provides a summary of this document and assesses the potential impacts of the Project upon the structure plan.

3.3.3.2 Nowra Bomaderry Structure Plan

The goals of the structure plan are as follows.

- *Sustainable Living - manage development and change to accommodate economic and population growth, in a manner which endorses community values, conserves natural resources and safeguards ecological systems.*
- *Economic Vitality - facilitate the diversification and expansion of Nowra Bomaderry's economy by building on the town's human resources, skills base and environmental quality of the Shoalhaven whilst strengthening regional linkages, providing efficient support networks, fostering innovation and rewarding enterprise.*
- *Community Wellbeing - provide living areas in Nowra Bomaderry, which maximise lifestyle quality and choice by engendering a healthy, caring and harmonious society where both individual and collective rights are respected and there is fair and reasonable access to facilities and services.*

Section 6.4 assesses the ecological sustainability of the Project. The economic contributions of the Project are described in Section 2.1.3 and the socio-economic contributions are assessed in Section 4.13. In summary, the Proponent contends that the Project would promote the goals of the structure plan.

The Plan identifies the following principles to guide development of the Nowra Bomaderry area towards these goals.

- *Facilitate the delivery of environmental benefits.*
- *Respond to local features.*
- *Respect the past and present when creating the future.*
- *Engender continuing adaption and change.*
- *Facilitate the achievement of high quality design.*
- *Plan for the 'post industrial economy'.*
- *Provide for the traditional 'industrial economy'.*
- *Develop the urban areas in a cost-effective manner.*
- *Endeavour to distribute benefits widely within the community.*
- *Respond to community needs.*
- *Engage the interest of the community.*

The Proponent contends that the Project would, through the reestablishment of a final landform and vegetation community that would mimic the pre-extraction landform and vegetation community, provide environmental benefits and would be consistent with the above principles.

Section 3 of the Plan identifies conservation goals and recommendations related to conservation of biodiversity in the Nowra Bomaderry area. Biodiversity Recommendation 4 states that stands of Spotted Gum should be reserved. Map 3.1 identifies the Project Site an area where this recommendation may apply. Section 3.5 of the structure plan identifies the requirement for the establishment of a network of 90m wide riparian corridors for the maintenance of stream water quality and for providing opportunities for biodiversity connectivity.

The Biodiversity Offset Strategy would preserve an area of Spotted Gum forest to compensate for the removal of approximately 7.4ha of Spotted Gum forest within the Project Site. In addition, the Project would not impact upon the riparian corridor within 45m of Nowra Creek.

Section 6 of the Plan describes the existing and future planning challenges presented by transportation-related issues in the Nowra/Bomaderry area. Section 6.1 of that document identifies the following objectives for transportation facilities.

- *Make provision for a transport system that maximises accessibility to activity areas which is equitable and affordable.*
- *Provide for a system of roads which can provide for the efficient, safe and convenient movement of people and goods.*
- *Implement a network that offers and encourages safe and efficient alternatives for mode choice other than the private passenger car.*
- *Facilitate the development and operation of public transport.*
- *Allow road network planning to provide for a system of practical staging with adequate capacity.*
- *Provide network planning for a hierarchy of roads with provision of safe, efficient and logical public transport (bus) routes with good connectivity to the local and main road network.*
- *Ensure road network planning provides for safe, efficient and logical pedestrian and cyclist routes with good connectivity to the local and main road network.*

In addition, the Plan identifies the following objectives related to providing for the efficient movement of people and goods within the Nowra/Bomaderry area.

- *Minimise total private passenger vehicle travel (offer attractive, safe and efficient mode choice alternatives other than the private passenger car and encourage/promote alternatives to private passenger vehicle travel).*
- *Minimise total vehicle travel (time/kilometres/costs).*
- *Determine optimum staging of residential expansion and infrastructure.*
- *Determine implication of greater public transport usage and urban consolidation on the need for additional transport infrastructure (rail, roads, paths, and parking).*

Section 6.2.1 of the Plan describes the major infrastructure required in the short to medium term to assist with capacity issues associated with the road network in the Nowra/Bomaderry area. These items of major infrastructure include:

- construction of a North Nowra to Bomaderry link road;
- upgrades to the Princes Highway intersections immediately to the north and south of the Shoalhaven River Bridges;
- construction of the East Nowra Sub-Arterial road linking Greenwell Point Road to the Princes Highway; and
- development of a South Nowra Road Strategy.

The Plan identifies a number of proposed road network links, one of which includes linking the Princes Highway to the east of the Project Site with the Flinders Industrial Estate to the northwest of the Project Site in the vicinity of Warra Warra Road. **Figure 3.1** presents the conceptual location of this road in the context of the Project and the proposed South Coast Correctional Facility.

Figure 3.1 identified that the structure plan identifies a conceptual western extension of Warra Warra Road that would pass through the Project Site. This conceptual road would also pass through the proposed South Coast Correctional Facility, a project which has previously received public support from the Shoalhaven City Council.

The Proponent contends that construction of the conceptual western extension of Warra Warra Road would result in sterilisation of shale resource and disruption to the Council-supported proposal to construct the South Coast Correctional Facility. In addition, as the Proponent would progressively re-establish the pre-extraction landform within the Project Site, the Project would only temporarily limit the construction of the conceptual western extension of Warra Warra Road until Stage 5 of the Project has been completed.

3.3.4 Summary of Identified Issues

Table 3.1 presents a summary of the environmental issues identified, and the frequency with which each was identified, as part of the issue identification process. The frequency of identification provides an initial indication of those environmental aspects perceived to be at greatest risk and hence of greatest priority and **Table 3.1** has been ordered accordingly (from most to least frequently identified).

Based on the summary of identified environmental issues in **Table 3.1**, the identified environmental issues have been prioritised in order if decreasing priority. This order of priority has been used to inform the level of assessment undertaken for each identified environmental issues and the order in which each issue is addressed in Section 4 of this *Environmental Assessment.*

1. Hydrology (groundwater and surface water).
2. Ecology.
3. Traffic and Transportation.
4. Air Quality.
5. Noise and Blasting.
6. Aboriginal Heritage.
7. Soils and Land Capability.
8. Strategic Planning.
9. Visual Amenity.
10. Bushfire.
11. European Heritage.
12. Socio-economic impacts.

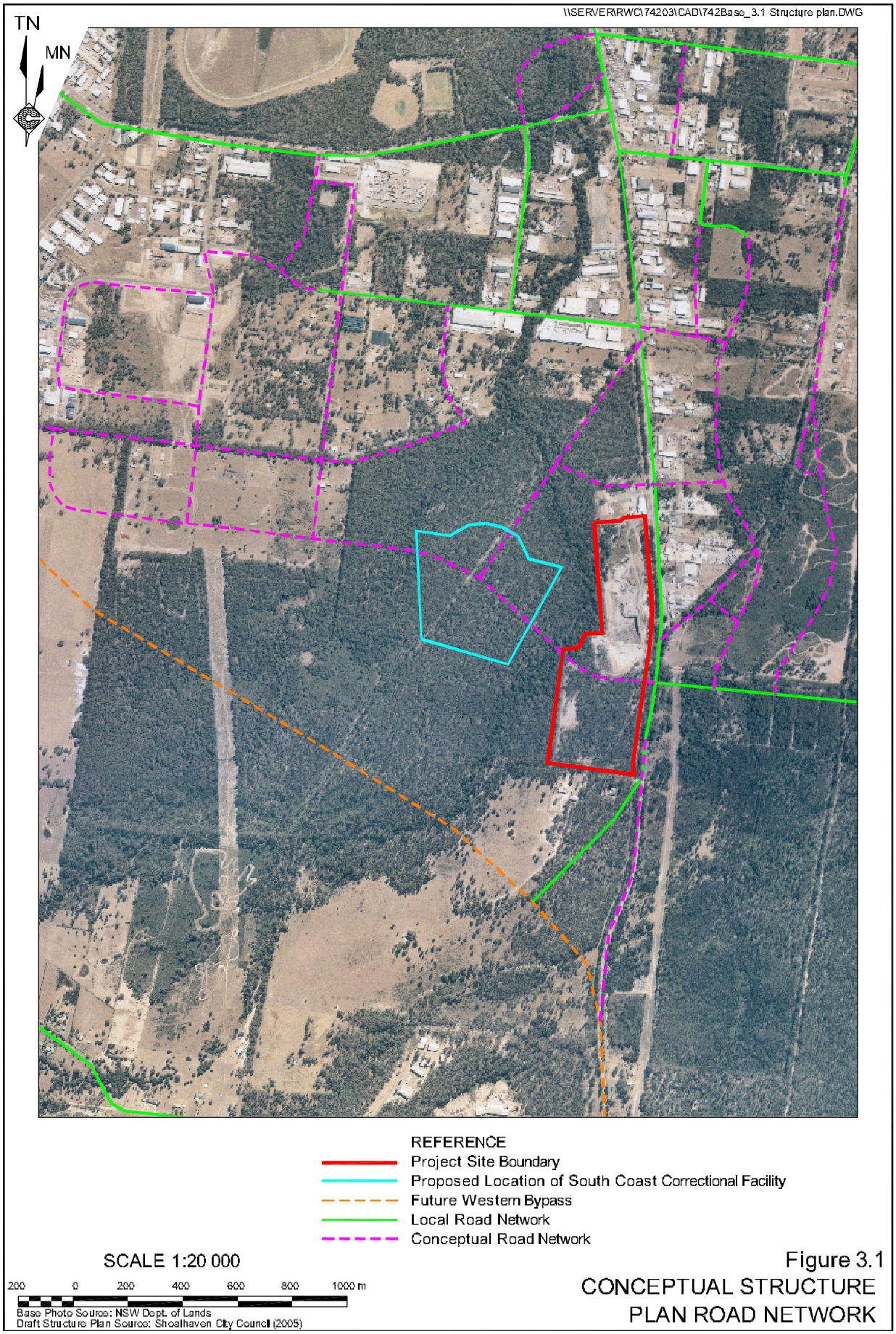

Figure 3.1
CONCEPTUAL STRUCTURE PLAN ROAD NETWORK

Table 3.1
Identified Environmental Issues

Environmental Issue	Source and Frequency of Identification			
	Community Consultation	**Government Consultation**	**Planning Policies & Guidelines**	**Preliminary Environmental Studies**
Hydrology (groundwater + surface water)		27	2	1
Ecology		17	4	1
Traffic and Transportation	1	5	3	1
Air Quality	1	7	2	
Noise and Blasting	1	6		
Aboriginal Heritage		7		
Soils and Land Capability		3		
Strategic Planning		2		
Visual amenity		2	1	
Bushfire		1	1	
European Heritage		1		
Socio-economic impacts		1	2	
Rehabilitation, final landform		2	1	
Waste management				
Contaminated land		1		
VENM importation and placement		3	2	

Other identified environmental issues, namely rehabilitation/final landform, waste management, contaminated land and VENM importation and placement are addressed to the level considered appropriate throughout the *Environmental Assessment*.

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PREAMBLE

Section 4

Assessment and Management of Key Environmental Issues

This section of the Environmental Assessment provides relevant background information relating to the environmental aspects identified in Section 3.3. The following subsections provide information related to the existing environment and the proposed mitigation measures and management procedures that would be implemented throughout the life of the Project with respect to the following environmental issues.

- *Hydrology*
- *Traffic and Transportation*
- *Noise*
- *Aboriginal Heritage*
- *Visibility*
- *European Heritage*
- *Ecology*
- *Air Quality*
- *Blasting*
- *Soils and Land Capability*
- *Bushfire*
- *Socio-Economic Environment*

A detailed assessment of the likely residual impacts, and where relevant, programs to monitor the potential environmental impacts, are also outlined.

Information is presented in sufficient detail to enable readers to fully understand the potential impacts of the Project, should it be approved. The extent of detail provided reflects the potential likelihood and severity of impacts and the priority for each environmental issue determined in Section 3.3.4.

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4.1 BACKGROUND INFORMATION

4.1.1 Introduction

The descriptions of various environmental aspects of the Project throughout this section are reliant upon a range of background information common to many of the key environmental issues. In this subsection, background information is provided on the topography, climate, land ownership, land uses and residences and the community surrounding the Project Site.

4.1.2 Topography

4.1.2.1 Regional and Local Topography

The Project Site is located approximately 6km south of the Shoalhaven River, approximately 15km from the Pacific Ocean at Culburra and 12km from Jervis Bay at Callala Beach (**Figure 4.1**).

The foothills of the Great Dividing Range are located approximately 9km to the west of the Project Site. The foothills are generally steeply sloped with numerous deeply incised valleys and plateaus, with elevations varying from 10m AHD on the banks of the Shoalhaven River to 381m AHD at the Yalwal Plateau approximately 20km to the west-southwest of the Project Site.

The topography in the vicinity of the Project Site is generally flat to gently undulating, with elevations varying from 0m AHD at the coast and along the banks of the Shoalhaven River to 197m AHD at Nowra Hill, approximately 3km to the southwest of the Project Site.

4.1.2.2 Local Topography

The topography in the vicinity of the Project Site is gently sloping, with slopes varying from 1:4 (V:H) on the slopes of a northeast orientated ridgeline located approximately 1.7km to the southeast of the Project Site, to approximately 1:40 (V:H) in the area to the north of the Project Site (**Figure 4.2**). The area in the vicinity of the Project Site generally slopes towards a number of variably well to poorly defined drainage lines. To the west of the Project Site is Nowra Creek while to the south and east of the Project Site are a number of tributaries that form Browns Creek. Browns Creek enters a swamp area to the northeast of the Project Site before merging with Nowra Creek approximately 2.5km to the north of the Project Site.

Elevations in the vicinity of the Project Site vary from 25m AHD in the vicinity of the junction between Browns and Nowra Creeks to approximately 80m AHD along a ridgeline approximately 1.7km to the southeast of the Project Site.

\\SERVER\RWC\742\03\CAD\742Base_4.1 Regional.DWG

REFERENCE
Project Site Boundary

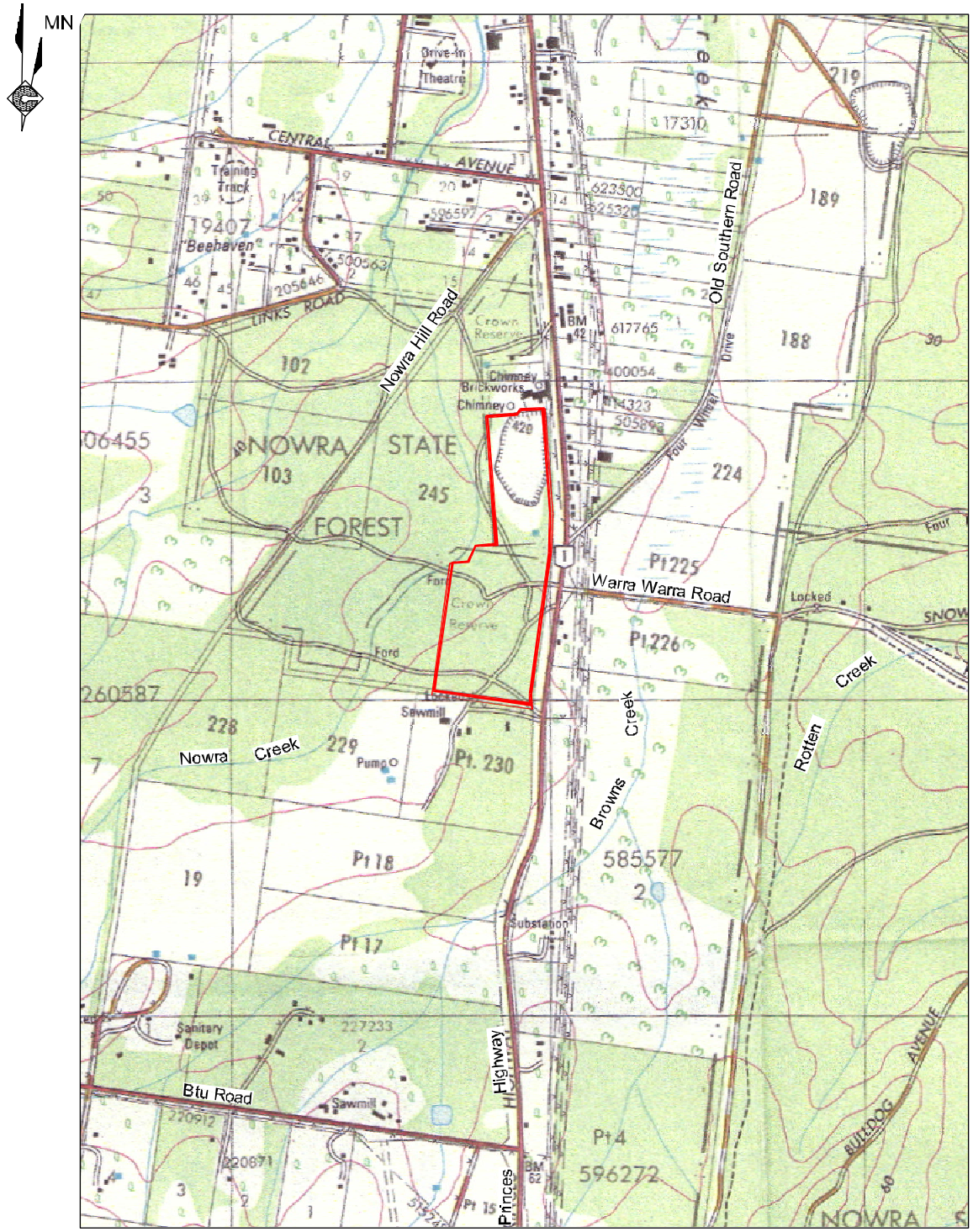
SCALE 1:150 000

2.5 0 2.5 5.0 7.5 km

Base Map Source: Kiama and Jervis Bay 1: 100 000 Topographic Maps (1983)

Figure 4.1
REGIONAL TOPOGRAPHY

\\SERVER\RWC\742\Reports\74203\CAD\742Base_4.2 Local Topography.DWG



REFERENCE
Project Site Boundary

SCALE 1:20 000

200 0 200 400 600 800 1000 m

Base Map Source: Nowra Topographic Map 1: 25 000 (1988)

Figure 4.2
LOCAL TOPOGRAPHY

4.1.2.3 Project Site Topography

Topography within the northern section of the Project Site has been heavily modified by previous extraction-related activities and is dominated by the extraction area (**Figure 4.3**). The extraction area has faces that are near vertical and between 8m to 12m high, with a generally flat floor with an elevation of approximately 31m AHD. The floor of the extraction area is composed of approximately 2m of blasted shale material. As a result, the base of the blasted material within the Project Site is approximately 29m AHD.

To the north of the extraction area, the water storage facility has walls that are also near vertical and between 8m and 12m high, with a near horizontal floor with an elevation of approximately 27m AHD.

The remainder of the Project Site to the north of the extraction area generally slopes towards the water storage facility, with slopes ranging from 1:4 (V:H) to 1:15 (V:H) and elevations ranging from 37m AHD to 51m AHD.

The southern section of the Project Site is largely undisturbed and is dominated by a low, northeast-orientated ridge. The southern section of the Project Site generally slopes gently to the north and northwest with the southeastern section sloping gently to the northeast. Slopes vary between 1:20 (V:H) and 1:60 (V:H).

A perimeter bund has been constructed on the eastern, southern and sections of the western perimeters of the Project Site. This bund is between 3m and 5m high, with slopes between 1:1 (V:H) and 1:2 (V:H).

The highest section of the Project Site, with an elevation of approximately 55m AHD, occurs on the southern boundary of the Project Site, with the lowest undisturbed section of the Project Site with an elevation of approximately 42m AHD, on the western boundary of the Project Site adjacent to Nowra Creek. The lowest point within the Project Site is the floor of the extraction area, with an elevation of approximately 31m AHD.

4.1.3 Climate

4.1.3.1 Introduction

Long-term climate data presented in the following subsections has been sourced from the Bureau of Meteorology's Nowra Royal Australian Navy Station (Station number 068076 – 1955 to 2000) and the Nowra Royal Australian Navy Automatic Weather Station (Station number 068072 – 2000 to present) located at HMAS Albatross, approximately 5km to the west-southwest of the Project Site (**Figure 4.1**).

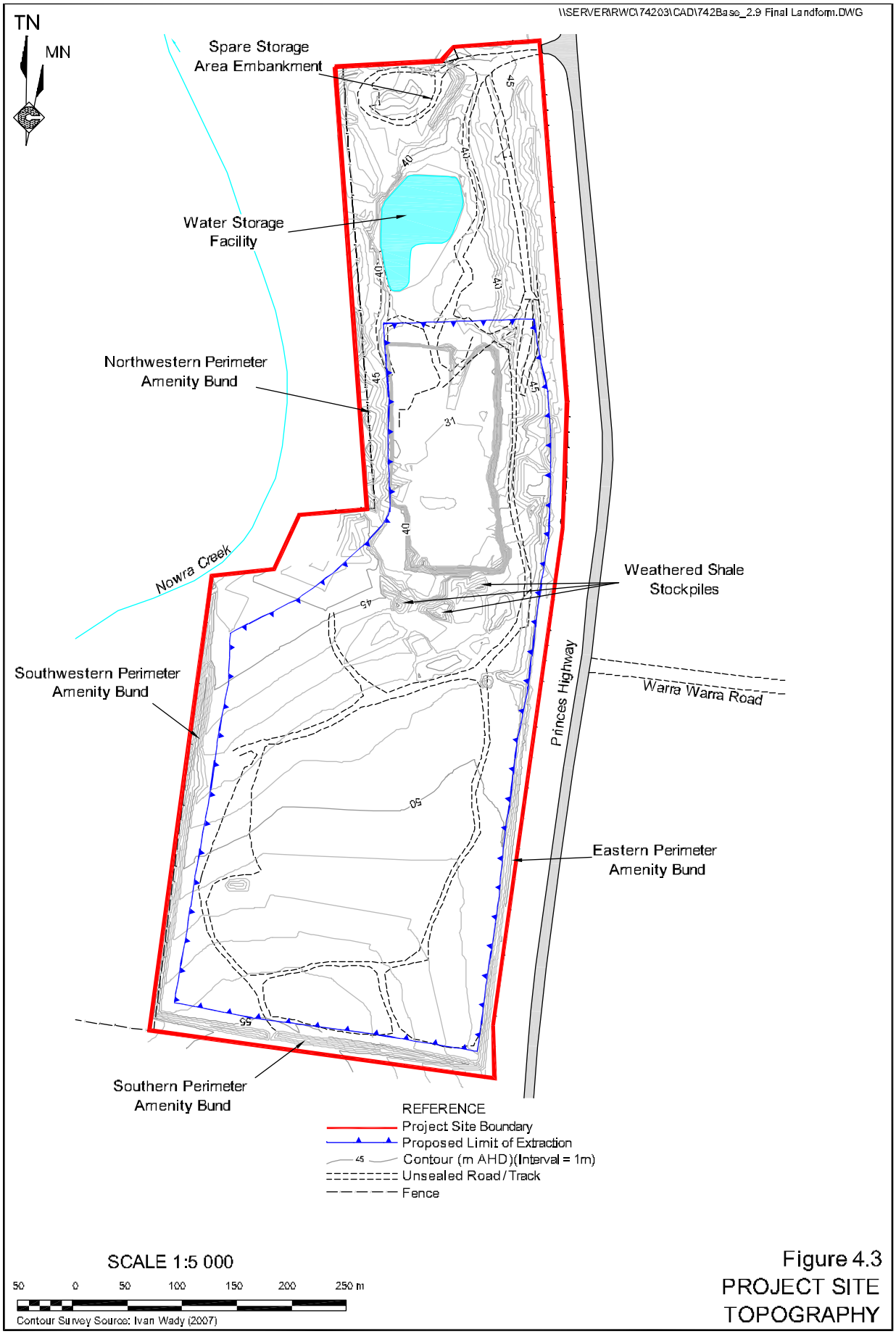


Figure 4.3
PROJECT SITE TOPOGRAPHY

4.1.3.2 Temperature and Humidity

Table 4.1 presents the long-term monthly average temperatures at HMAS Albatross for the period 1955 to 2000. On average, February is the hottest month, with a mean maximum temperature of 25.8°C and a mean minimum temperature of 16.3°C, while July is the coldest month, with a mean maximum temperature of 15.8°C and a mean minimum temperature of 6.2°C.

Late winter (July, August and September), with an average 3:00pm relative humidity of 53%, tends to be marginally less humid that the remainder of the year, with an average 3:00pm relative humidity of 60%.

Table 4.1
Average Monthly Climate Statistics

Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Temperature													
Mean maximum temperature (°C)	25.8	25.8	24.5	22.1	19	16.4	15.8	17.1	19.3	21.5	23.1	25.1	21.3
Mean minimum temperature (°C)	16.1	16.3	14.8	12.1	9.7	7.6	6.2	6.7	8.3	10.7	12.6	14.6	11.3
Relative Humidity													
Mean 9am relative humidity (%)	72	76	74	71	74	75	72	68	63	64	66	68	70
Mean 3pm relative humidity (%)	62	63	63	59	59	59	54	52	52	57	58	59	58
Rainfall and Cloud Cover													
Mean rainfall (mm)	91.3	119.7	124.4	97.1	90.5	107	57	75.8	65.6	107.5	98.1	73.1	1110.1
Decile 5 (median) rainfall (mm)	73.2	70.9	76.6	51.6	72.2	62.1	40.5	35.2	47.7	68.8	64.4	63.1	1092.8
Mean number of days of rain ≥ 1 mm	6.4	6.2	6.3	4.9	5.3	5.2	3.9	4.3	4.8	6.3	6.8	5.4	65.8
Wind Speed													
Mean 9am wind speed (km/h)	8.2	7.8	8.5	10.8	12.9	14.9	15.5	15.4	14.6	12.1	10.5	9.2	11.7
Mean 3pm wind speed (km/h)	17.7	17.3	15.8	14.9	14.2	15	16.9	19	20.5	19.7	19.7	19.2	17.5
Source: Bureau of Meteorology's Nowra RAN Air Station (No. 068076)													

4.1.3.3 Rainfall

Table 4.1 presents the mean monthly rainfall data at HMAS Albatross for the period 1955 to 2000. On average, annual rainfall is 1 110mm, with Spring (October and November) and late Summer (February, March and April) experiencing higher rainfall than other times of the year.

4.1.3.4 Evaporation

Evaporation is a function of ambient temperature, wind and the saturation deficit of the air. Heggies Pty Ltd, who undertook the air quality assessment for the Project (Heggies, 2007) estimate that the Nowra experiences a water deficit with evaporation exceeding rainfall for all months of the year except July. Calculated monthly moisture surplus/deficits are in the range of 37 mm (July) to -136mm (December), with average annual deficits estimated to be approximately -660 mm.

4.1.3.5 Wind

Wind direction and speed data have been collected from the Nowra Royal Australian Navy Automatic Weather Station at HMAS Albatross since 2000. **Figure 4.4** presents the seasonal and diurnal wind roses for 2006.

Figure 4.4 indicates that during winter north-westerly to northwesterly winds prevail, with relatively frequent south-southwesterly airflow also apparent. During spring, the incidence of northerly and west-northwesterly airflow is reduced and there is an increase in the frequency of southerly wind. During summer months, there is a further increase in the frequency of occurrence of southerly airflow, with further reductions in northwesterly flow. Easterly and east-northeasterly winds are also apparent during the summer. During autumn, southerly and easterly flow components reduce and the incidence of westerly and west-northwesterly wind increases.

During the night, weak, westerly (off-shore) winds prevail. This is characteristic of coastal environments where land-sea breeze circulation systems occur. During the daytime, the wind shifts, with an increase in southerly and easterly (on-shore) airflow, with frequent north-northwesterly and westerly winds apparent. Average wind speeds of 3.1m/s and frequent calm periods (6.2%) occur during the night-time compared to stronger winds (average of 4.7m/s) and fewer calms (1.1%) during the daytime.

4.1.4 Atmospheric Stability Classes

Figure 4.5 presents the frequency of occurrence of stability classes determined from data from the Nowra Royal Australian Navy Automatic Weather Station at HMAS Albatross during 2001. Stability classes are a measure of the stability of the atmosphere surrounding the Project Site. Class A represents very unstable atmospheric conditions, while Class F represents very stable atmospheric conditions.

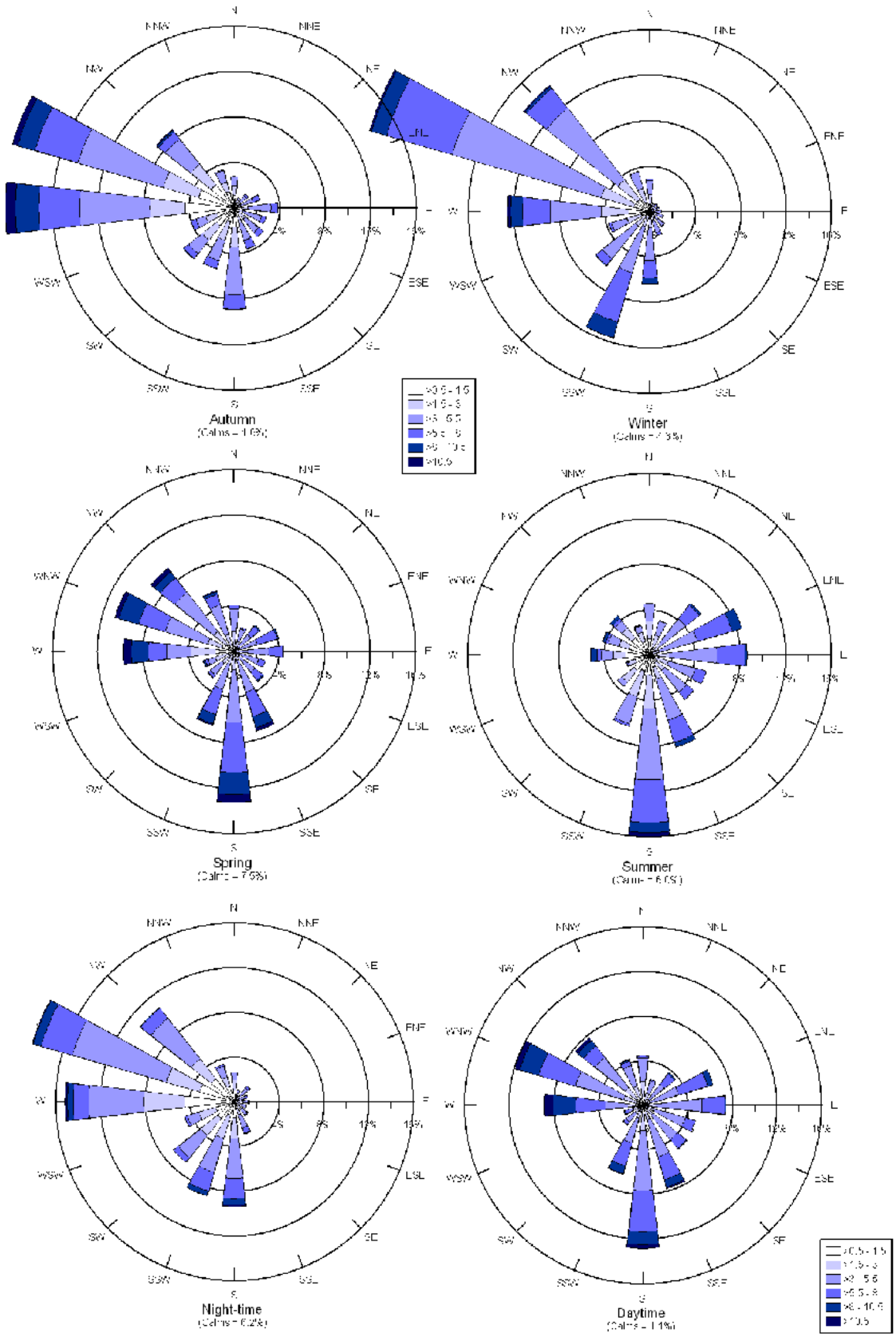
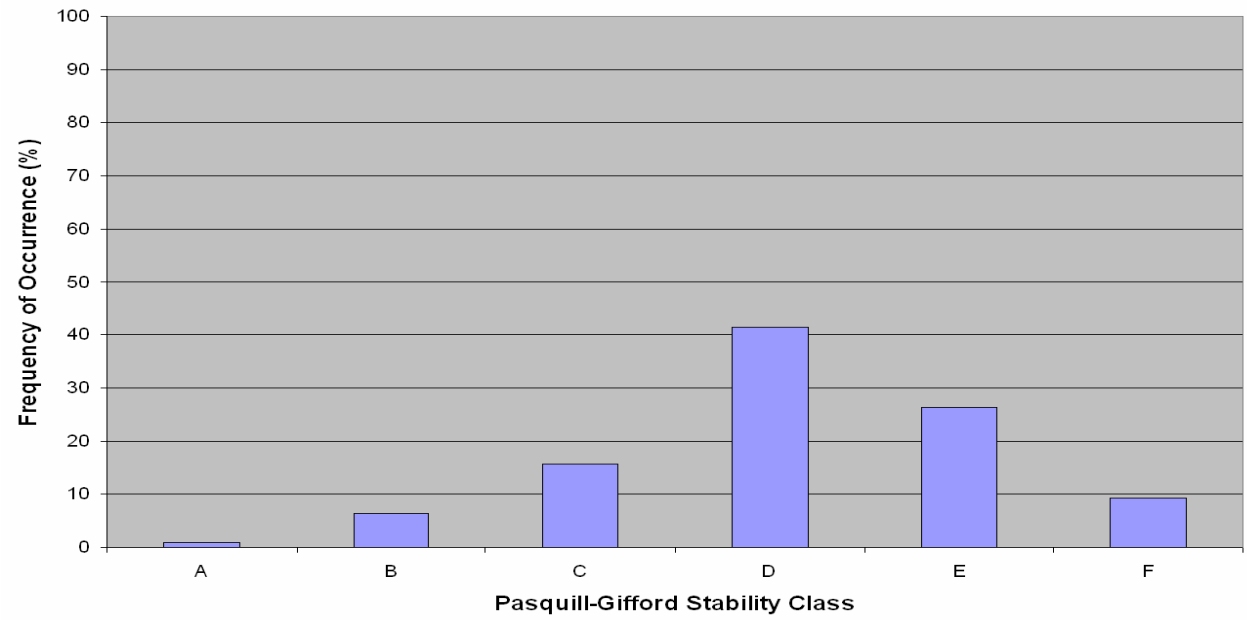


Figure 4.4
2006 SEASONAL AND DIURNAL WIND ROSES

Source: Heggies (2007) - Figures 7 & 8
Note: A colour version of this figure is available on the project CD

Figure 4.5
Annual Stability Class Distribution



Source: Heggies (2007) – Figure 9

4.1.5 Surrounding Land Ownership, Land Zoning, Land Uses and Residences

4.1.5.1 Surrounding Land Ownership

Figure 4.6 presents land ownership in the vicinity of the Project Site. All the land within the Project Site and to the west of the Project Site, is Crown Land or land registered to the Minister for Commerce. Land adjoining the northern boundary of the Project Site is owned by Ostavest Pty Limited and Chimney Rock Hill Pty Limited. Land adjoining the southern boundary of the Project Site is owned by J. Goodsell. Immediately to the east of the Project Site is the Princes Highway. To the east of the Princes Highway and north of Old Southern Road are a number of privately owned parcels of land. To the east of the Princes Highway and south of Old Southern Road are a number of larger parcels of land, including five parcels owned by P. Corves to the south of Warra Warra Road.

4.1.5.2 Land Zoning

Figure 4.6 presents the land zoning in the vicinity of the Project Site. The Project Site is largely zoned Zone 1(b) – Rural Arterial and Main Road Protection, with a small section of the Project Site zones Zone 1(f) – Forest under the *Shoalhaven Local Environment Plan 1985*.

Land surrounding the Project Site is zoned:

- Zone 1(c) – Rural Residential;
- Zone 1(d) – General Rural;
- Zone 2(c) – Residential Living Areas;
- Zone 3(g) – Business Transitional;
- Zone 4(a) – Industrial General; and
- Zone 6(a) – Recreation "A" (existing).

4.1.5.3 Land Uses

Land within the vicinity of the Project Site is used for a variety of different purposes, including:

- extracting shale material and producing quarry products;
- saw mill;
- brickworks;
- light industrial and bulky goods;
- rural-residential;
- transportation (Princes Highway); and
- nature conservation.

In addition, the NSW Department of Corrective Services proposes to construct the South Coast Correctional Facility on land adjacent to the western boundary of the Project Site. The location of the proposed correctional facility is indicated on **Figure 4.6**.

4.1.5.4 Surrounding Residences

Figure 4.6 indicates the locations of residences surrounding the Project Site identified through reference to recent aerial photography and site inspections. The closest residence to the Project Site is Residence A, which is located approximately 45m south of the southern boundary of the Project Site. A second residence, Residence B, is located approximately 80m to the north of the northern boundary of the Project Site, adjacent to the Nowra Brickworks operation. A cluster of rural-residential residences are located between 300m and 400m to the northwest of the Project Site, with additional residences located between 250m and 450m to the northeast of the Project Site beyond the light industrial/warehouse area. Residences C and D have been selected to be representative of the clusters of residences to the northwest and northeast.

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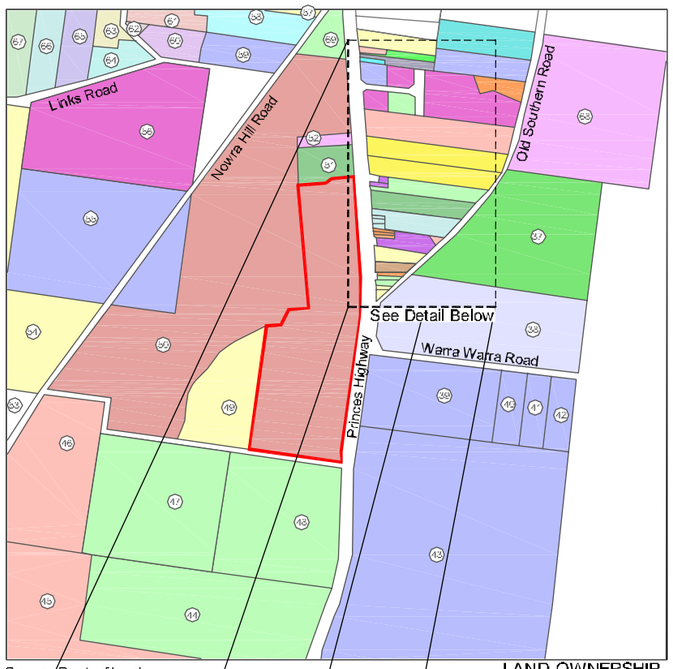
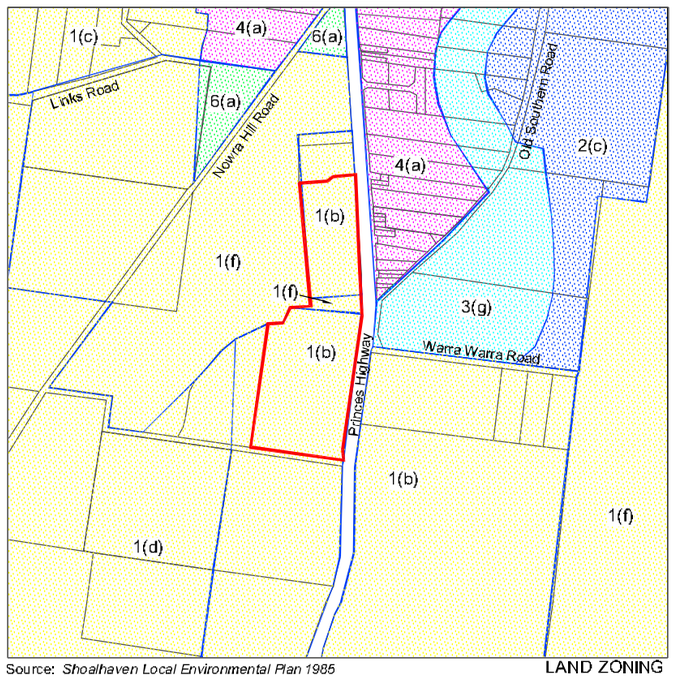
MN



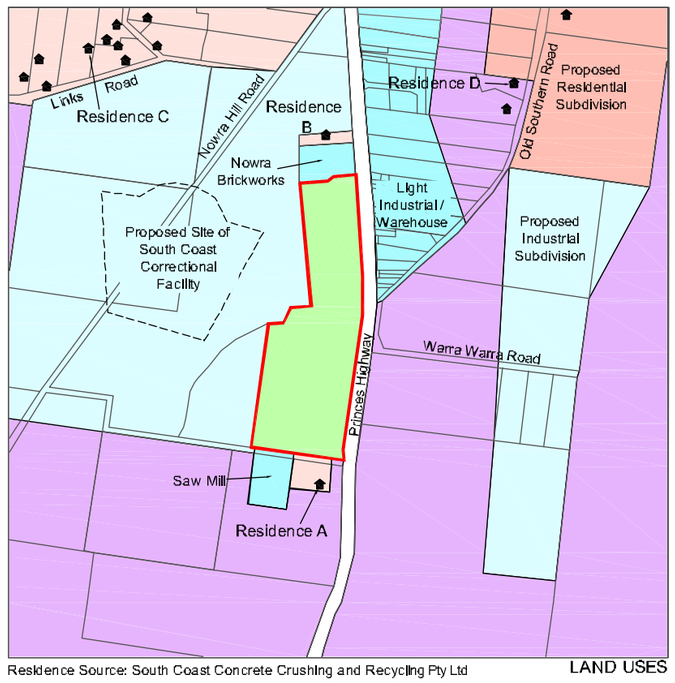
Source: Dept. of Lands

LAND OWNERSHIP



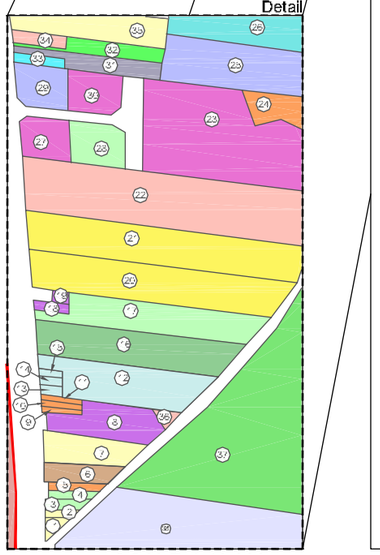
Source: *Shoalhaven Local Environmental Plan 1985*

LAND ZONING



Residence Source: South Coast Concrete Crushing and Recycling Pty Ltd

LAND USES



LAND OWNERSHIP TABLE

Reference	Lot / DP	Owner/s
1	1/830546	H. & J. Plumb
2	4/504262	H. & J. Plumb
3	3/504262	A. & S. Hornsby
4	1/815141	A. & S. Hornsby
5	1/607503	J. & C. Greenaway Pty Limited
6	3/209924	D. & J. Spresser
7	2/209924	Beloit Pty Limited
8	4/746784	F. & L. Bartelt
9	3/503544	A. & L. Martin
10	2/503544	A. & L. Martin
11	1/503544	A. & L. Martin
12	1/652361	C. & M. Brick Pty Ltd
13	1/505147	C. & M. Brick Pty Ltd
14	2/505147	C. & M. Brick Pty Ltd
15	3/505147	C. & M. Brick Pty Ltd
16	G/405059	Rlregl Pty Ltd
17	4/505893	I. Young
18	1/203508	J. & J. Rattenbury
19	3/618882	J. & J. Rattenbury
20	J/414323	D. Berry
21	K/414323	Dera Developments Pty Ltd, W. Rapicano, Wrar Pty Limited.
22	B/400054	M. Brooks
23	16/1052869	K. & M. Wilkinson
24	17/857796	G. & C. Sheffield
25	20/17310	Newkem Pty Limited
26	21/17310	Newkem Pty Limited
27	16/1053869	K. & M. Wilkinson
28	14/1036585	M. Lawrence
29	15/1053869	Bradtrust Pty Limited
30	16/1053869	K. & M. Wilkinson
31	4/627249	Jadamax Pty Limited
32	3/627249	C. Edwards
33	2/627249	E. & J. Bortolazzo
34	1/627249	N. & D. O'Neill

Reference	Lot / DP	Owner/s
35	18/596154	Regional Publishers Pty Limited
36	3/746784	The Council of the City of Shoalhaven
37	224/755952	Ison & Co. Pty Limited
38	225/755952	Lysand Pty Limited
39	1/1108043	P. Curvers
40	2/1108043	P. Curvers
41	3/1108043	P. Curvers
42	4/1108043	P. Curvers
43	2/585577	P. Curvers
44	18/755952	J. Goodsell
45	19/755952	V. Goodsell
46	228/755952	V. Goodsell
47	229/755952	J. Goodsell
48	230/755952	J. Goodsell
49	444/823204	Minister for Commerce (Dept. of Corrective Services)
50	464/1058778	The State of New South Wales
51	42/842326	Ostavest Pty Limited & Chimney Rock Hill Pty Limited
52	41/842326	R. Downes & T. & H. Cole
53	7/260587	G. & L. Meeson
54	3/606455	B. & P. O'Keefe
55	103/755952	Unknown
56	102/755952	Unknown
57	A/411406	K. Emery
58	14/19407	DSGRB Pty Limited
59	15/19407	M. Groenewege, R. Chapman, P. Lawrence
60	2/500563	E. Cushlerl
61	17/19407	V. & T. Brown
62	1/500563	H. Linke
63	1/207847	J. Rainford
64	2/205646	J. Pugh
65	44/19407	N. Chapman
66	45/19407	A. & L. Bowmaker
67	46/19407	R. Foyel
68	188/755952	B. & B. Gramolgia, Yarsona Pty Limited, Ukella Pty Limited
69	463/1058778	New South Wales Aboriginal Land Council

REFERENCE
Project Site Boundary

LAND OWNERSHIP
Land Ownership Reference Number

LAND ZONING
Zone Boundary
Rural
1b Arterial and Main Road Protection
1c Rural Lifestyle
1d General Rural
1f Forest
Residential
2c Living Areas
Business
3g Transitional
Industrial
4a General
Open Space - Recreational
6a Recreation 'A' (Existing) Zone

LAND USES
Project Site
Industrial
Proposed Industrial
Residential / Rural Residential
Proposed Residential
Nature Conservation / Agriculture
Conceptual South Coast Correctional Facility
Existing Residence

Figure 4.6
LAND OWNERSHIP, ZONING AND USES

4.1.6 Surrounding Community

4.1.6.1 Introduction

Information presented in the following subsections has been obtained from census figures produced by the Australian Bureau of Statistics from the 1996 and 2006 Census.

4.1.6.2 Population and Population Growth

Table 4.2 presents summary population statistics for the Shoalhaven Local Government Area (LGA) compared with statistics for NSW. The data indicates that while the dominant age group in the Shoalhaven LGA is people aged between 25 and 54 years, that this age group comprises a smaller proportion (35%) of the population within the Shoalhaven LGA than within NSW (42%). By contrast, the proportion of people aged over 55 in the Shoalhaven LGA (35.2%) is larger than the proportion of people of this age group within NSW (24.8%). This is likely to be a result of people over the age of 55 retiring to the Shoalhaven LGA. This is also reflected in the labour force participation statistics presented in **Table 4.4** which indicate a lower labour force participation rate in the Shoalhaven LGA compared with NSW as a whole.

The median age of people in the Shoalhaven LGA is 44 years, while the median age for people in NSW as a whole is 37 years.

Table 4.2
Population Statistics

	Shoalhaven LGA		NSW	
Age groups:	**Persons**	**Percentage**	**Persons**	**Percentage**
0-4 years	4 842	6.5%	420 431	6.4%
5-14 years	12 188	13.8%	878 485	13.4%
15-24 years	9 359	10.6%	871 716	13.3%
25-54 years	30 906	35.0%	2 753 224	42.0%
55-64 years	12 407	14.0%	719 546	11.0%
65 years and over	18 702	21.2%	905 775	13.8%
Total Persons	**88 404**		**6 549 177**	
Source: Australian Bureau of Statistics				

The census data indicate that in 1996, 76 726 persons lived within the Shoalhaven Local Government Area (LGA). In 2006, this figure had increased to 88 404, an increase of 11 678 people, or an annual growth rate of approximately 1.5%. This compares with a growth rate over the same period for NSW of approximately 0.9%. This indicates that the population of the Shoalhaven LGA is increasing at a significantly greater rate than the population of NSW as a whole. As a result, it can be expected that demand for quarry products within the area surrounding the Project Site will continue to grow strongly.

4.1.6.3 Employment, Occupation and Industries

Table 4.3 presents employment statistics from the 2006 Census for the Shoalhaven LGA and NSW. This data indicates that the unemployment rate within the Shoalhaven LGA at 9% on the date of the census was higher than for NSW as a whole at 6%. In addition, there were higher rates of part-time work in the Shoalhaven LGA than within NSW as a whole. Finally, the data also indicates that labour force participation rates in the Shoalhaven LGA at 39% were lower than for NSW as a whole at 47.2%. These statistics may reflect the greater proportion of the population aged over 55 within the Shoalhaven LGA than NSW as a whole, meaning that a higher percentage of the population is retired or working part-time. These statistics may also indicate that the availability of full-time employment may be lower in the vicinity of the Project Site than elsewhere in NSW.

Table 4.3
Employment Statistics – June, 2006

	Shoalhaven LGA		NSW	
	Persons	**Percentage**	**Persons**	**Percentage**
Employed				
Full-time(a)	17 451	51%	1 879 628	61%
Part-time	11 691	34%	842 713	27%
Unknown	2 151	6%	187 103	6%
Total Employed	*31 293*	*91%*	*2 909 444*	*94%*
Unemployed, looking for:				
Full-time work	2 147	6%	115 165	4%
Part-time work	1 039	3%	67 994	2%
Total Unemployed	*3 186*	*9%*	*183 159*	*6%*
Labour Force Participation				
Total labour force	34 479		3 092 603	
Total persons	88 404		6 549 177	
Labour force participation	**39.0%**		**47.2%**	
Source: Australian Bureau of Statistics - 2006				

Table 4.4 presents a summary of the 2006 Census statistics related to occupations within the Shoalhaven LGA and NSW. **Table 4.4** indicates that there is a higher proportion of 'Technicians and trades workers' and 'Community and personal service workers' and a lower proportion of "Professionals,' and 'Clerical and Administrative Workers' within the Shoalhaven LGA compared with NSW as a whole.

Table 4.5 presents employment statistics by industry for the Shoalhaven LGA and for NSW as a whole. In the Shoalhaven LGA, the industries employing the greatest number of people are the retail, health care and social assistance and construction industries. By contrast, the industries employing the greatest number of people within NSW as a whole are the manufacturing, education and training and 'professional, scientific and technical services' industries.

Table 4.4
Occupation Statistics

Occupation	Shoalhaven LGA		NSW	
	Persons	Percentage	Persons	Percentage
Managers	4 041	12.9%	396 460	13.6%
Professionals	5 086	16.3%	616 276	21.2%
Technicians & trades workers	5 570	17.8%	396 721	13.6%
Community & personal service workers	3 480	11.1%	249 578	8.6%
Clerical & administrative workers	3 894	12.4%	447 951	15.4%
Sales workers	3 372	10.8%	282 290	9.7%
Machinery operators and drivers	1 820	5.8%	187 135	6.4%
Labourers	3 562	11.4%	277 549	9.5%
Other	466	1.5%	55 480	1.9%
Total	**31,291**		**2,909,440**	
Source: Australian Bureau of Statistics				

Table 4.5
Industry Employment Statistics

Industry	Shoalhaven LGA		NSW	
	Persons	Percentage	Persons	Percentage
Agriculture, forestry & fishing	715	2.3%	78 661	2.7%
Mining	119	0.4%	20 318	0.7%
Manufacturing	2 611	8.3%	277 986	9.6%
Electricity, gas, water & waste services	329	1.1%	29 184	1.0%
Construction	3 116	10.0%	212 729	7.3%
Wholesale trade	672	2.1%	136 761	4.7%
Retail trade	4 459	14.3%	323 929	11.1%
Accommodation & food services	2 741	8.8%	190 454	6.5%
Transport, postal & warehousing	1 142	3.6%	145 518	5.0%
Information media & telecommunications	387	1.2%	68 976	2.4%
Financial & insurance services	538	1.7%	144 867	5.0%
Rental, hiring & real estate services	585	1.9%	50 588	1.7%
Professional, scientific & technical services	1 307	4.2%	213 247	7.3%
Administrative & support services	974	3.1%	90 431	3.1%
Public administration & safety	2 959	9.5%	174 915	6.0%
Education & training	2 444	7.8%	219 679	7.6%
Health care & social assistance	3 678	11.8%	304 335	10.5%
Arts & recreation services	487	1.6%	39 574	1.4%
Other services	1 316	4.2%	110 094	3.8%
Inadequately described/Not stated	712	2.3%	77 194	2.7%
Total	**31 291**		**2 909 440**	
Source: Australian Bureau of Statistics				

4.1.6.4 Income

Table 4.6 presents income statistics for the Shoalhaven LGA and NSW as a whole. The data indicates that median individual, family and household incomes within the Shoalhaven LGA are between 24% and 36% lower than within NSW as a whole. This may reflect the lower levels of labour force participation and higher proportion of part-time employees within the Shoalhaven LGA compared with NSW as a whole.

Table 4.6
Income Statistics – June, 2006

	Shoalhaven LGA	NSW
Median individual income	$348	$460
Median family income	$849	$1 181
Median household income	$661	$1 034
Source: Australian Bureau of Statistics - 2006		

4.1.6.5 Housing

Table 4.7 presents housing growth statistics between 1996 and 2006 for the Shoalhaven LGA and NSW as a whole. The data indicates that the number of 'separate houses' and 'flats, units or apartments' increased by 21.8% and 27.7% respectively between 1996 and 2006 within the Shoalhaven LGA, while throughout NSW, the number of separate houses fell by 4.1% and the number of 'flats, units or apartments' increased by only 2.8%. This is most likely a reflection of the higher population growth rate experienced within the Shoalhaven LGA than for the NSW as a whole, and probably accounts for the higher proportion of persons employed within the construction industry within the Shoalhaven LGA than with NSW as a whole.

Table 4.7
Housing Growth Statistics – June, 1996 and 2006

	Shoalhaven LGA			NSW		
	1996	**2006**	**% change**	**1996**	**2006**	**% change**
Separate house	26,172	31,889	21.8%	76,823	73,711	-4.1%
Semi-detached, row or terrace house,	1,035	1,273	23.0%	3,337	4,273	28.0%
Flat, unit or apartment:	1,181	1,508	27.7%	2,465	2,534	2.8%
Other dwelling:	1,063	827	-22.2%	562	312	-44.5%
Dwelling structure not stated	276	11	-96.0%	1,431	50	-96.5%
Total	**29,727**	**35,508**	**19.4%**	**84,618**	**80,880**	**-4.4%**
Source: Australian Bureau of Statistics – 1996 and 2006 Census Data						

Table 4.8 presents a summary of the housing cost and statistics for the Shoalhaven LGA and NSW as a whole. The data indicates that housing costs are approximately 20% lower within the Shoalhaven LGA than within NSW as a whole. In addition, the average household size within the Shoalhaven LGA is marginally lower that the average household size in NSW, probably as a result of the higher proportion of the persons over the age of 55 within the Shoalhaven LGA.

Table 4.8
Housing Cost and Size Statistics – June, 2006

	Shoalhaven LGA	NSW
Median housing loan repayment ($/monthly)	$1,200	$1,517
Median rent ($/weekly)	$166	$210
Average household size	2.4	2.6
Source: Australian Bureau of Statistics – 2006 Census Data		

4.2 HYDROLOGY

4.2.1 Introduction

The hydrology assessment was undertaken by Martens and Associates Pty Ltd covering both the surface water and groundwater assessments of the Project. The resulting report, entitled *Nowra Brickworks Quarry, South Nowra – Hydrology Assessment,* is presented in full as Part 1 of the *Specialist Consultants Studies Compendium* and is referred to hereafter as "Martens (2008)". This section of the *Environmental Assessment* provides a summary of that report.

4.2.2 Existing Surface Water Environment

4.2.2.1 Regional and Local Drainage Network

Prior to the commencement of extraction-related operations within the Project Site, the northwestern section of the Project Site would have formed part of the catchment of Nowra Creek (**Figure 4.7**). The headwaters of Nowra Creek occur on the northern and western flanks of Nowra Hill, approximately 2.5km to the southwest of the Project Site. The upper reaches of the creek flow generally to the northeast to a point adjacent to the western boundary of the Project Site. From that point, the Creek then flows generally to the north and northwest, passing to the west of the Princes Highway before merging with the Shoalhaven River approximately 1.5km upstream of the Princes Highway Bridge (**Figure 4.1**). Nowra Creek flows through a generally open to very open valley. Land uses adjacent to the creek upstream of the Project Site include agriculture and nature conservation. Land uses adjacent to the creek downstream from the Project Site include nature conservation and industrial, rural-residential and residential/urban development.

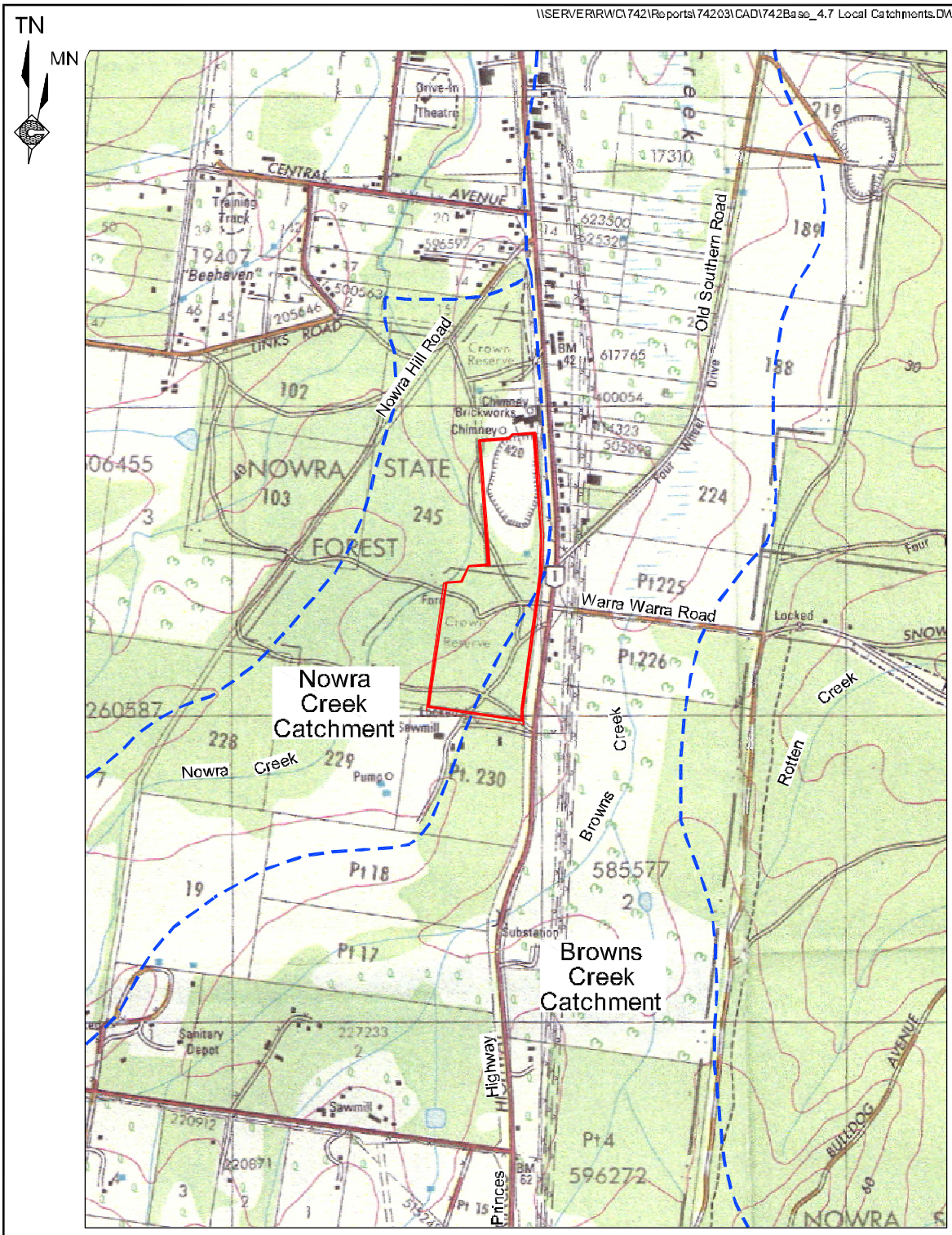


Figure 4.7
LOCAL SURFACE WATER CATCHMENTS

Prior to the commencement of extraction-related operations within the Project Site, the southeastern section of the Project Site would have formed part of the catchment of Browns Creek (**Figure 4.7**). Browns Creek is composed of a number of tributaries that have their headwaters to the east of Nowra Hill (**Figure 4.1**). These tributaries merge to the south and southeast of the Project Site to form Browns Creek. The Creek then flows generally to the north before crossing Warra Warra Road. From this point, the Creek channel becomes indistinct and the Creek enters an area of swampy ground, before reforming approximately 1.5km to the northeast of the Project Site. The creek then continues to flow to the north, before turning to the northwest and merging with Nowra Creek approximately 2.5km north of the Project Site. Browns Creek flows through a generally open to very open valley. Land uses adjacent to the creek upstream of the Project Site include agriculture and native vegetation conservation. Land uses adjacent to the creek downstream from the Project Site include nature conservation and industrial and rural residential development.

4.2.2.2 Project Site Drainage

The surface water flows within the Project Site are controlled by the existing perimeter bunds and the site topography. **Figure 4.8** presents the surface water sub-catchments within the Project Site. In summary, five sub-catchments occur within the Project Site, as follows.

- Sub-catchment 1 – This sub-catchment drains the eastern portion of the undisturbed section of the Project Site. Prior to construction of the perimeter bunds, this sub-catchment would have drained to the surface water drainage system adjacent to the Princes Highway, or directly to Browns Creek. However, surface water flows within this sub-catchment are now diverted to the north by the perimeter bund and then to the west by the surface water diversion structure to the south of the extraction area and enter Nowra Creek to the west of the Project Site.
- Sub-catchment 2 – This sub-catchment drains the central portion of the undisturbed section of the Project Site. Surface water flows within the sub-catchment flow either directly to Nowra Creek or are diverted to the west by the surface water diversion structure and enter Nowra Creek to the west of the Project Site.
- Sub-catchment 3 – This sub-catchment drains the disturbed section of the Project Site. Surface water within this catchment reports to either the sump in the active extraction area or the water storage facility. At present, all surface water within this sub-catchment is used for extraction-related purposes and none is permitted to flow off site.
- Sub-catchment 4 – This sub-catchment drains the western portion of the undisturbed section of the Project Site. Surface water flows are diverted to the north by the western perimeter bund and enter Nowra Creek adjacent to the northern end of the bund.

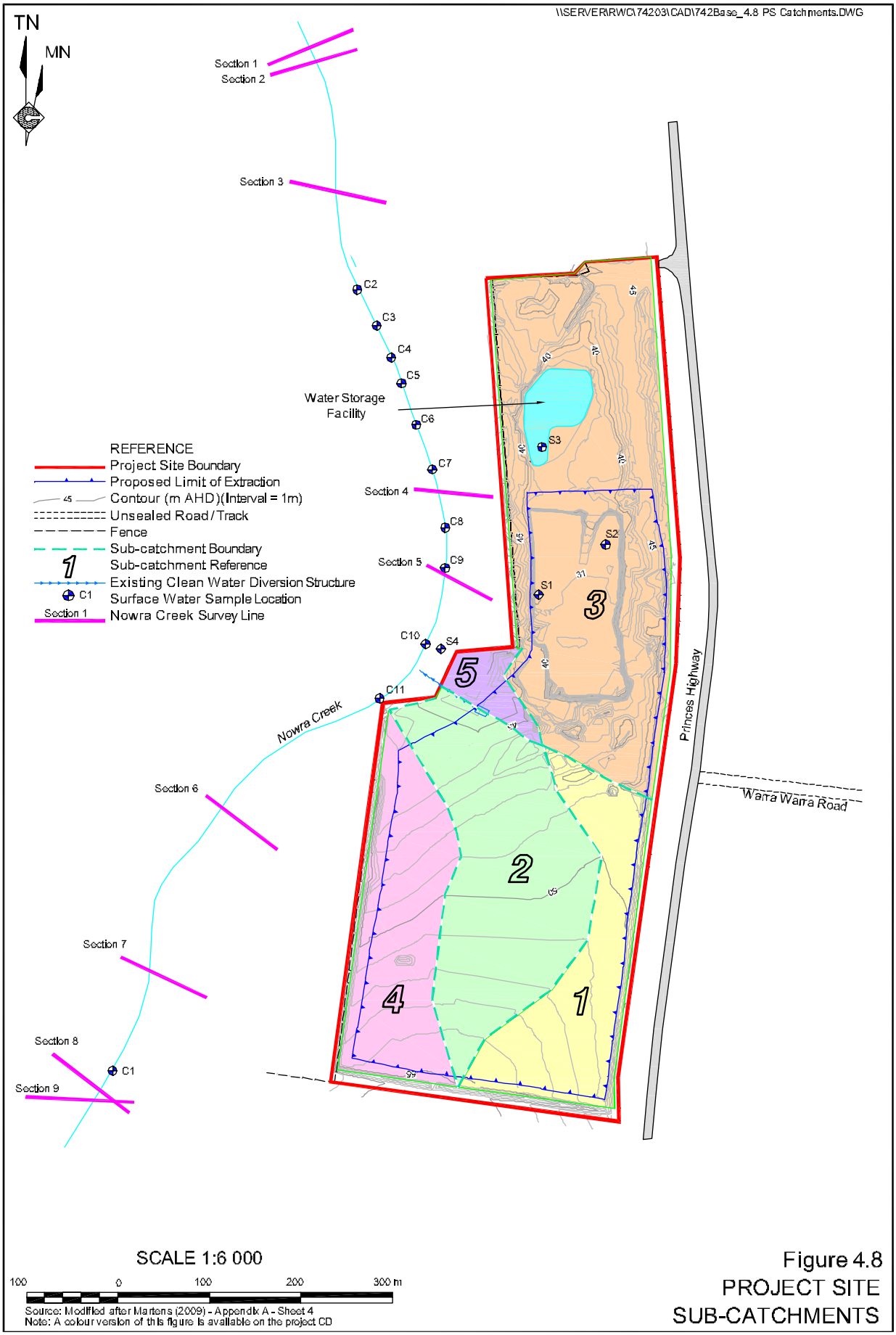


Figure 4.8
PROJECT SITE
SUB-CATCHMENTS

- Sub-catchment 5 – This sub-catchment drains the undisturbed section of the Project Site to the north of the surface water diversion structure.

4.2.2.3 Nowra Creek Morphology

The section of Nowra Creek adjacent to the Project Site was inspected visually on 24 October 2007 to determine the morphology of this section of the creek. In addition, nine cross sections across the creek were surveyed as part of the flooding component of the Hydrology Assessment (see Section 4.2.5.4 and **Figure 4.8**). The results of this survey are as follows.

- Nowra Creek, at the point closest to the Project Site boundary, has an average channel bed width of approximately 1.5m and a depth of between approximately 0.8m and 1.0m. Channel width from top of bank to top of bank is estimated to average approximately 1.6m to 1.8m.
- Significant riparian vegetation and woody debris surround and occupy the channel of the Creek. In detail:
  - the channel bed is occupied by some vegetation, occasional woody debris and leaf litter;
  - the creek banks are well vegetated, with grasses present towards the top of the bank; and
  - overbank vegetation is dominated by a dense coverage of woody vegetation.
- Limited channel incision, bank erosion, channel widening and the presence of significant woody debris within the Nowra Creek channel, suggest the creek is in generally good condition.
- Channel sinuosity (channel distance/straight line distance between the two points) was estimated to be approximately 1.11, indicating a slight to moderate meandering form.

4.2.2.4 Surface Water Quality

The following surface water quality samples were collected within and in the vicinity of the Project Site.

- Two samples within the extraction area (Samples S1 and S2).
- One sample from the water storage facility (Sample S3).
- One sample from a depression to the west of the Project Site (Sample S4).
- Eleven samples from Nowra Creek adjacent to the Project Site (Samples C1 to C11).

The location of each sample is indicated on **Figure 4.8** and the results of the analyses are presented in **Table 4.9**.

Table 4.9
Surface Water Quality Analyses

Sample	pH	Electrical Conductivity (µs/cm)	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)	Biochemical Oxygen Demand[1] (mg/L)	Total Suspended Solids (mg/L)
S1	8.20	7 900	<0.6	<0.05	<4	8
S2	8.20	6 500	0.7	<0.05	<4	<5
S3	7.90	8 000	53	<0.05	<4	29
S4	5.16	130	na	na	na	na
C1	6.60	250	1.7	0.080	<4	15
C2	7.80	3 200	21	<0.05	4.0	20
C3	6.41	2 050	na	na	na	na
C4	6.96	654	na	na	na	na
C5	6.90	1 168	na	na	na	na
C6	6.87	1 096	na	na	na	na
C7	5.97	290	na	na	na	na
C8	6.23	380	na	na	na	na
C9	5.93	247	na	na	na	na
C10	5.64	137	na	na	na	na
C11	5.72	123	na	na	na	na

Note 1: Five day biochemical oxygen demand
Note 2: na = not analysed.

Source: Martens (2008) – After Table 6.

The results of the surface water quality analyses may be summarised as follows.

- Surface waters within the Project Site (Samples S1 to S3) are more alkaline than waters within Nowra Creek.
- Surface waters within the Project Site have electrical conductivities between 6 500µS/cm and 8 000µS/cm. Surface waters within Nowra Creek, however, have electrical conductivities that vary from 123µS/cm to 3 200µS/cm. The waters within Nowra Creek generally become increasingly saline downstream.
- Total Nitrogen concentrations of samples S2 and S3, collected within the Project Site are higher than the Australian and New Zealand Environment and Conservation Council (ANZECC) recommended limit of 0.5mg/L. Sample S3 was collected adjacent to operating machinery and in the vicinity of a fuel container, possibly accounting for the very high Total Nitrogen concentration in this sample. Total Nitrogen concentrations within samples C1 and C2, collected from Nowra Creek, are also higher than the ANZECC recommended concentration.

- Total Phosphorus concentrations in Samples S1, S2, S3 and C2 were equal to or less than the ANZECC recommended total Phosphorus concentrations for slightly disturbed ecosystems in southeast Australia of 0.5mg/L. Sample C1, collected upstream of the Project Site returned a total Phosphorus concentration marginally in excess of the ANZECC recommended concentration.
- Five day biochemical oxygen demand and total suspended solid concentrations of Samples S1, S2, S3, C1 and C2 were all less than the relevant criteria for discharge to streams.

4.2.3 Existing Groundwater Environment

4.2.3.1 Regional Groundwater Setting

Figure 4.9 and **Table 4.10** present the location and details of all bores registered on the NSW Department of Water and Energy Natural Resources Atlas within approximately 8km of the Project Site. The search of the Atlas revealed approximately 20 registered bores within the search radius, with the closest bore located approximately 3.9km from the Project Site.

4.2.3.2 Project Site Groundwater Setting

4.2.3.2.1 Piezometer Installation

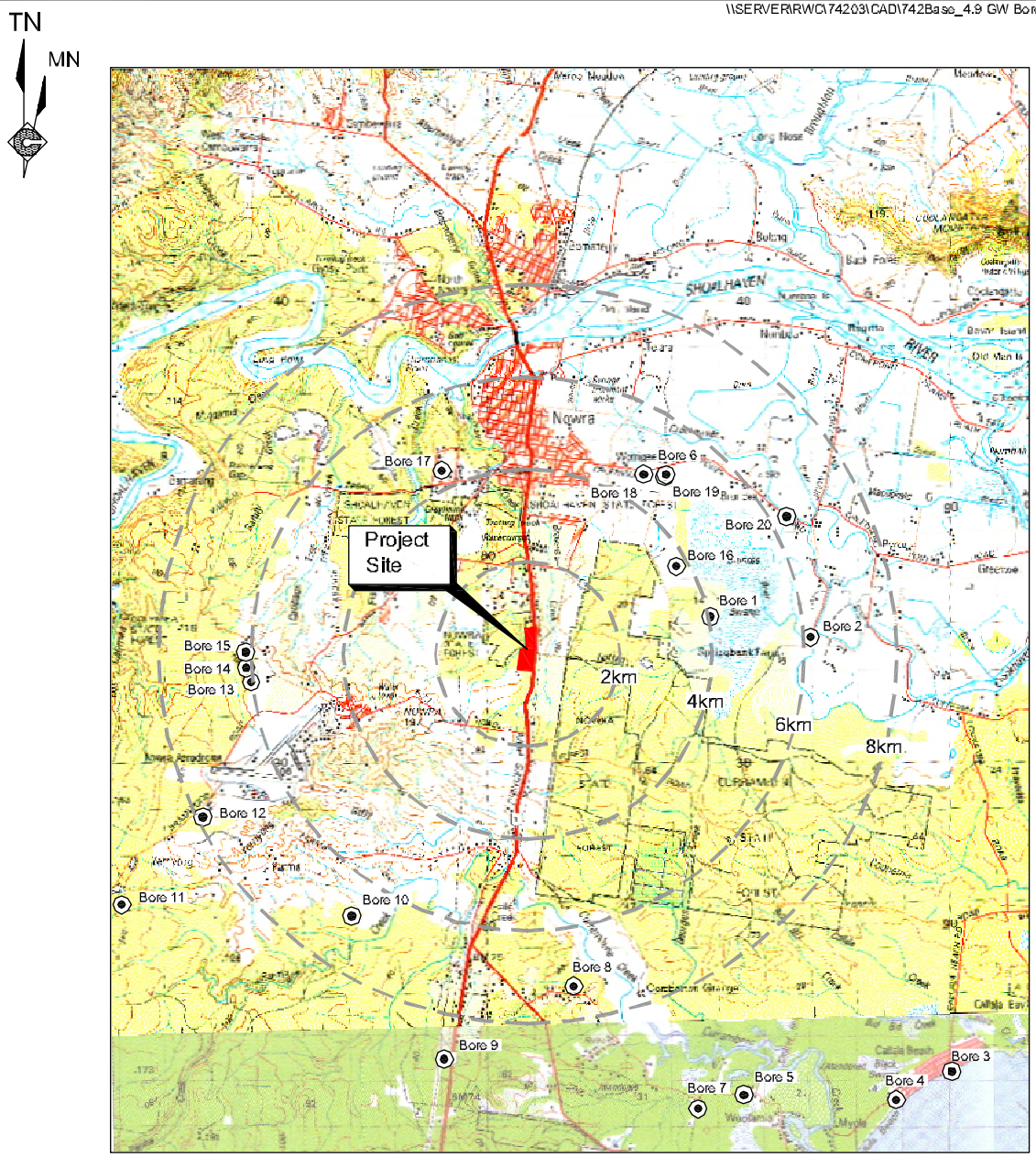
Eight piezometers were constructed within the Project Site during the hydrogeological assessment. The location of each piezometer is presented in **Figure 4.10** and summary details are presented in **Table 4.11**.

Table 4.10
Registered Bores

Page 1 of 2

Borehole Number	Distance[1] (km)	Location		Total depth (m)	Standing Water Level (m below ground level)	Yield (L/s)
		Longitude	Latitude			
1	4.1	150 38’ 44’’	34 55’ 10’’	36.0	18.0	0.08
2	6.1	150 40’ 9’’	34 55’ 26’’	6.0	NA	NA
3	11.6	150 42’ 1’’	35 0’ 33’’	6.1	NA	NA
4	10.8	150 41’ 13’’	35 0’ 52’’	6.5	NA	NA
5	8.8	150 39’ 3’’	35 0 46’’	22.75	9.0	0.20
6	10.3	150 38’ 8’’	34 53’ 31’’	NA	NA	NA
7	10.1	150 38’ 20’’	35 0’ 55’’	29.0	NA	0.51
8	7.3	150 36’ 40’’	34 59’ 27’’	120.0	9.0	0.30
9	8.5	150 34’ 48’’	35 0’ 16’’	66.7	12.0	0.25
10	6.8	150 33’ 32’’	34 58’ 34’’	24.0	6.0	7.0

\\SERVER\RWC\74203\CAD\742Base_4.9 GW Bores.DWG



Source: Modified after Martens (2009) - Figure 13
Base Map Source: Kiama and Jervis Bay 1:100 000 Topographic Maps

Figure 4.9
LOCATION OF REGISTERED BORES

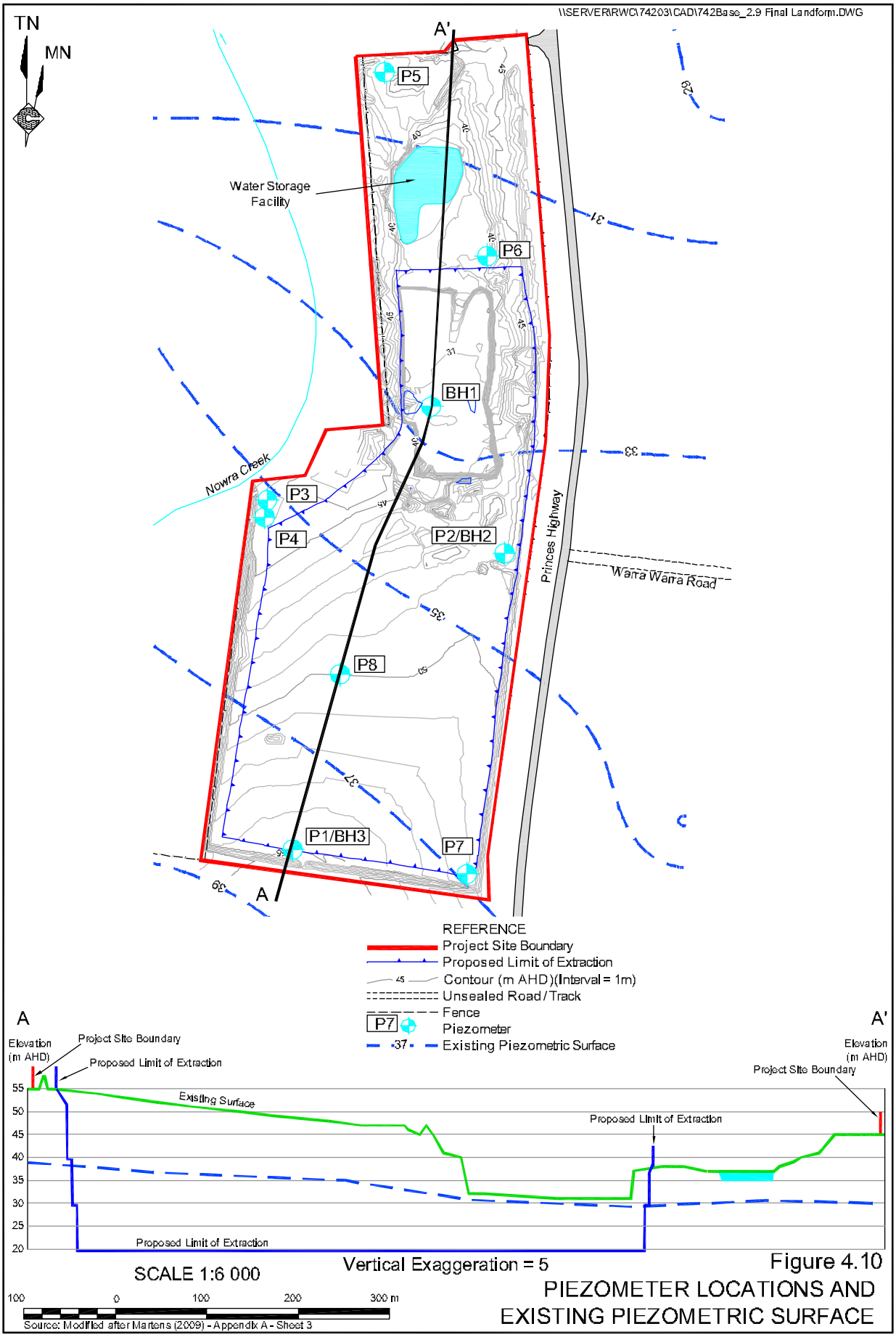


Figure 4.10
PIEZOMETER LOCATIONS AND EXISTING PIEZOMETRIC SURFACE

Table 4.10 (Cont'd)
Registered Bores

Borehole Number	Distance[1] (km)	Location		Hole depth (m)	Standing Water Level (m below ground level)	Yield (L/s)
		Longitude	Latitude			
11	10.0	150 30' 16''	34 58' 22''	83.2	48.70	5.05
12	7.9	150 31' 27''	34 57' 22''	57.0	4.5	0.38-0.57
13	6.0	150 32' 11''	34 55' 48''	42.0	NA	1.80
14	6.0	150 32' 7''	34 55' 38''	54.3	9.1	0.38
15	6.0	150 32' 7''	34 55' 27''	52.1	18.2	0.76
16	3.8	150 38' 16''	34 54' 34''	44.0	3.0	1.05
17	4.3	150 34' 58''	34 53' 23''	66.60	NA	NA
18	4.7	150 37' 50''	34 53' 29''	210.0	2.5	0.17
19	4.9	150 38' 8''	34 53' 31''	NA	NA	NA
20	6.3	150 39' 51''	34 54' 1''	8.0	NA	NA

Note 1: Distance from Project Site boundary.
Note 2: NA – Not available.
Source: Martens (2008) – Table 7.

Table 4.11
Summary of Piezometer Installations

Piezometer Number	Location			Penetration depth (m)	Well Invert (m AHD)
	Longitude	Latitude	Elevation (m AHD)		
P1	150°36'01.49""	34°55'42.56""	55.3	28	27.3
P2	150°36'11.88""	34°55'32.94""	48.7	28	20.7
P3	150°36'02.23""	34°55'30.49""	43.97	29	14.97
P4	150°36'02.23""	34°55'30.49""	43.97	3.5	40.47
P5	150°36'06.69""	34°55'16.05""	42.77	24.5	18.27
P6	150°36'11.24""	34°55'22.75""	38.88	23	15.88
P7	150°36'09.67""	34°55'44.30""	50.99	35	15.99
P8	150°36'05.60""	34°55'38.70""	50	33.6	16.4

Source: Martens (2008) – Tables 1.

4.2.3.3 Project Site Groundwater Levels

Groundwater levels within each of the piezometers on the Project Site measured manually during June, October and December 2007. In addition, groundwater 'divers' were installed in Piezometers P7 from 4 October 2007 to 7 December 2007 and Piezometer P3 from 4 October 2007 to 24 October 2007 . Finally, barometric pressure was measured using a 'barodiver' installed within Piezometer P1 and rainfall data was obtained from the Bureau of Meteorology automated weather station at HMAS Albatross.

The results of the groundwater level monitoring are presented in **Figure 4.11** and are summarised below.

- Groundwater levels showed a general decreasing trend over the monitoring period of between 0.5m to 1.0m.
- Minor daily fluctuations in groundwater levels of between 0.05m and 0.10m were observed.
- Very minor (<0.02m) diurnal groundwater level fluctuations were observed.
- Seasonal fluctuations in groundwater levels within the Project Site are likely to be in the order of between 1m to 2m.

The interpreted existing piezometric surface is presented on **Figure 4.10**. From the data presented in **Table 4.11** and on **Figure 4.10**, the hydraulic gradient of groundwater within the Project Site is to the northeast.

4.2.3.4 Pump Testing

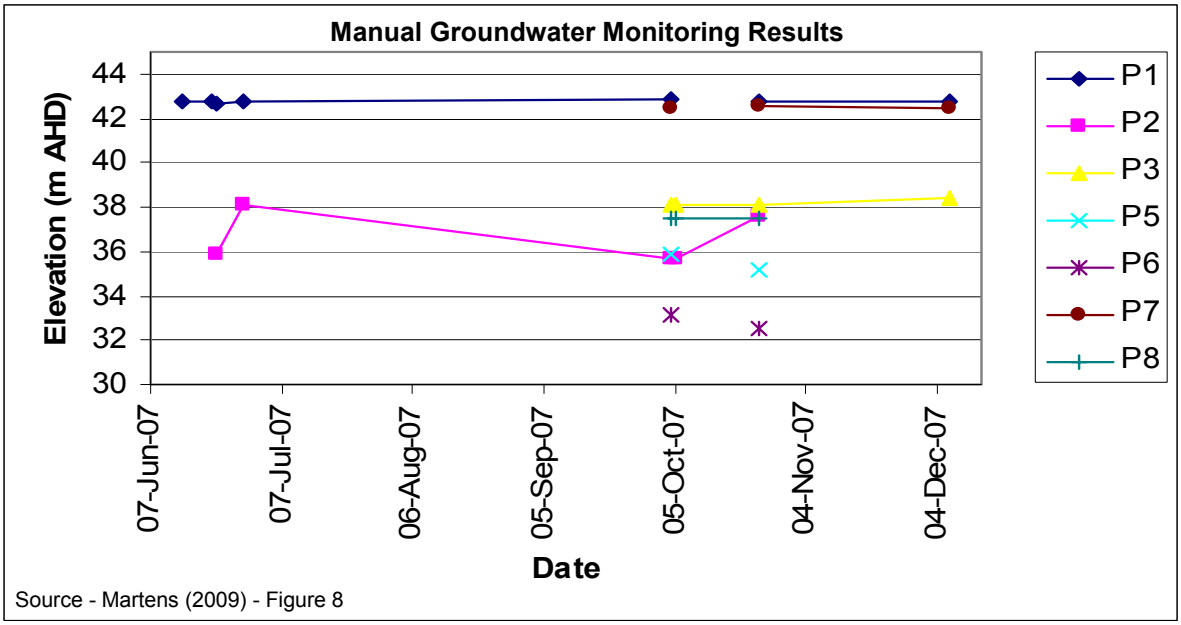
A drawdown test was undertaken on 21 June 2007. This test involved pumping water for a period of 4 hours from Piezometer P8 (**Figure 4.10**). During this period, the groundwater level within Piezometer P8 was lowered by approximately 14m. Groundwater levels during the pump test were monitored at Piezometers P2, P3, P7 and P8. Monitoring detected no change in groundwater levels within Piezometers P2, P3 and P7 during the pump test, indicating that these piezometers were outside the radius of influence of the pumping from Piezometer P8.

4.2.3.5 Hydraulic Conductivity

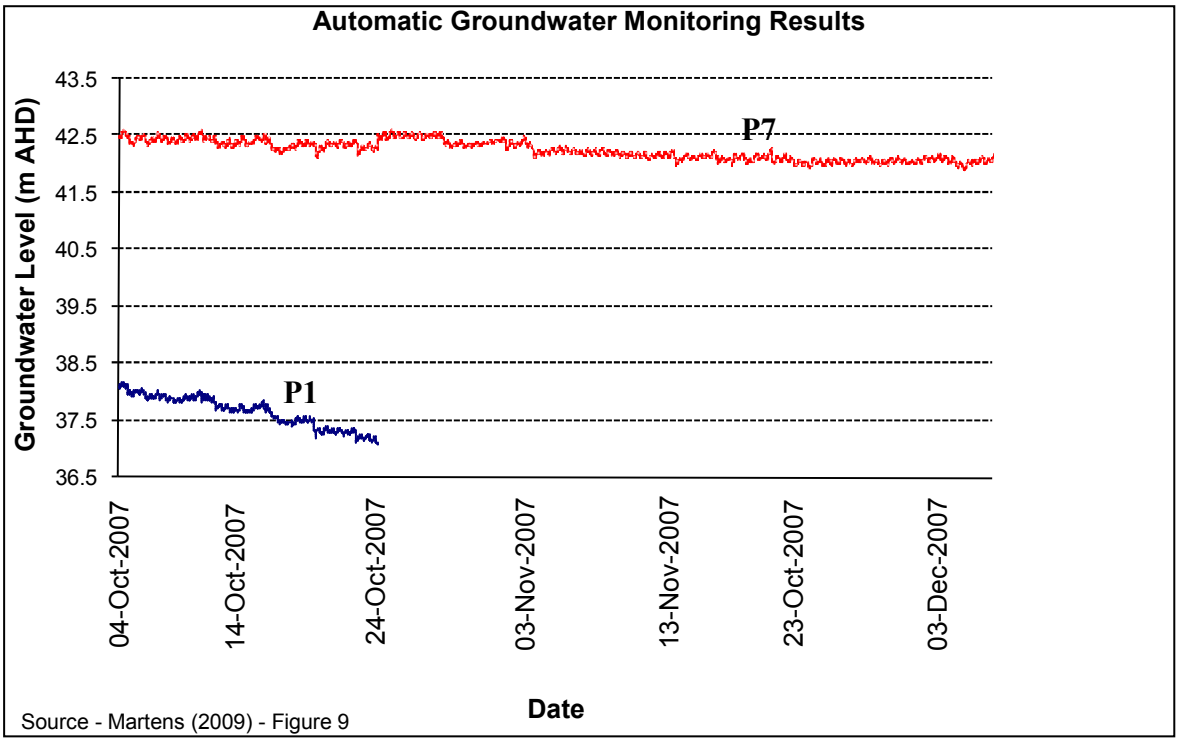
Hydraulic conductivity was determined for the following piezometers.

- P2 – Horizontal K_{sat} = 0.00445m/day.
- P3 – Horizontal K_{sat} = 0.00331m/day.
- P8 – Horizontal K_{sat} = 0.07000m/day.

Horizontal K_{sat} for the purposes of groundwater modelling was determined to be 0.01014m/day. Vertical K_{sat} was estimated from visual inspection of the drill cuttings returned during drilling of the boreholes that house the piezometers to be approximately 0.001014m/day.



Source - Martens (2009) - Figure 8



Source - Martens (2009) - Figure 9

Figure 4.11
GROUNDWATER LEVEL MONITORING RESULTS

4.2.3.6 Groundwater Quality

Groundwater samples were collected for analysis from each piezometer on 4 October 2007. The results of the groundwater quality analysis are presented in **Table 4.12**.

Table 4.12
Groundwater Quality Analyses

Parameter	P1	P2	P3	P5	P6	P7	P8	Geometric mean
pH	6.8	7.7	7.2	7.3	7.4	7.0	7.2	7.20
Electrical Conductivity (µS/cm)	9 100	5 700	12 000	9 500	5 400	11 000	11 000	8729
Total Dissolved Solids (mg/L)	5,005	3,135	6,600	5,225	2,970	6,050	6,050	4,801
Nitrate-N (mg/L)	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10
Nitrite-N (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Kjeldahl -N (mg/L)	0.6	1.3	1.2	2.0	1.1	1.1	1.1	1.14
Total N (mg/L)	0.7	1.4	1.3	2.1	1.2	1.2	1.2	1.24
Ammonia-N (mg/L)	0.30	0.80	0.60	1.0	<0.10	0.90	1.0	≤0.54
Total P (mg/L)	<0.05	<0.05	<0.05	1.0	<0.05	<0.05	0.05	≤0.08
Five Day Biological Oxygen Demand (mg/L)	24	34	78	100	14	33	<4	≤27.46
Total Suspended Solids (mg/L)	13	23	14	140	38	52	86	37.19
Note 1: Piezometer P4 remained dry throughout the study period and therefore was not analysed.								
Source: Martens (2008) – Table 15								

The results of the groundwater quality analyses may be summarised as follows.

- pH ranges from 6.8 to 7.7, indicating that groundwater within the Project Site are neutral to slightly alkaline
- Groundwater within the Project Site is moderately to highly saline, with electrical conductivity results between 5 400µS/cm and 12 000µS/cm and calculated concentrations of total dissolved solids of between 2 970mg/L and 6 600mg/L.
- Nitrite and nitrate were near to or below detection levels for all samples.
- Kjeldahl Nitrogen concentrations range from 0.6mg/L to 1.1mg/L.
- Total Nitrogen concentrations range from 0.7mg/L to 2.1mg/L.
- Total Phosphorus concentration was ≤0.05mg/L for all samples with the exception of P5 which may have been contaminated with sediment from the surface.
- Five day biochemical oxygen demand levels range from <4mg/L to 100mg/L.
- Total suspended solid concentrations range from 13mg/L to 140mg/L.

In summary, groundwater with the Project Site is moderately to highly saline with low levels of other pollutants.

4.2.4 Mitigation Measures and Management Procedures

The Proponent would implement the following mitigation measures and management procedures to minimise Project-related impacts on surface and groundwater resources within and surrounding the Project Site.

- Maintain and progressively relocate, as required, the existing and future surface water diversion structures to divert all surface water flows from undisturbed sections of the Project Site and areas where initial rehabilitation has been completed to an appropriately constructed sediment containment structures prior to discharge to Nowra Creek.
- Construct, maintain and relocate, as required, surface water diversion structures to ensure that all surface water flows within disturbed sections of the Project Site are directed to the extraction area or the water storage facility. Martens (2009) note that to ensure no discharge of potentially sediment or salt-laden water to Nowra Creek that the maximum catchment area for the water storage area would be required to be less than 5.9ha. To achieve this, the Proponent would ensure that progressive rehabilitation is undertaken as soon as practicable on sections of the Project Site no longer required for extraction-related operations. Section 2.15.5 provides a full description of the proposed progressive rehabilitation operations
- Construct temporary surface water diversion structures on the upslope side of all soil stockpiles or other disturbed areas to limit erosion.
- Install sediment fencing the down-slope toe of all soil stockpiles or other disturbed areas.
- Regularly inspect all surface water and sediment control structures for adequacy and repair or upgrade, where required.
- Construct a suitably sized sump within the active extraction area to collect all surface water runoff and groundwater inflows to the extraction area.
- Preferentially use water within the extraction area sump for dust suppression-related activities. Surplus water within the extraction area sump would be pumped to the water storage facility.
- Preferentially use water within the water storage facility for rehabilitation-related activities or for irrigation within the irrigation area.
- Construct an irrigation area of at least 4ha in the southern section of the Project Site as indicated on **Figure 4.12**. The irrigation area would be irrigated preferentially using water from the water storage area and would be irrigated using drip and/or spray irrigation methods. When the proposed extraction operations begin to encroach on the irrigation area, the irrigation area would be relocated to a location to the north of the extraction area with areas that have been previously rehabilitated.

- Construct 'grassed buffer areas' adjacent to the site access road and other sealed sections of the Project Site as indicated on **Figure 4.12**. The grassed buffer area adjacent to the site access road would be approximately 105m long and 5m wide while the grassed buffer area adjacent to the other sealed areas of the Project Site would be approximately 145m long and 16m wide. The grassed buffer strips would be stabilised initially, if required, with a non-persistent cover crop, and planted with suitable native grass species.

These measures and procedures have been implemented in accordance with the recommendations or standards included in the following documents.

- *National Water Quality Management Strategy: Australian Guidelines for Urban Stormwater Management* published by ANZECC in 2000.
- *Statement of Intent for the Shoalhaven River System - Incorporating Decisions of the NSW Government on the Report of the Healthy Rivers Commission on the Shoalhaven River System* prepared by the NSW Government.

4.2.5 Hydrology Assessment Criteria and Impact Assessment

4.2.5.1 Introduction

This sub-section presents the relevant hydrology assessment criteria and assesses Project-related impacts on the surface water and groundwater resources within and surrounding the Project Site after the implementation of the mitigation measures and management procedures outlined previously. The information presented in this sub-section has been separated into the following components.

- Water Balance Assessment – This component determines the likely site water balance at Stage 5 of the Project (maximum area of disturbance) to determine the likely site water balance.
- Discharge water quality assessment – This component assesses the likely quality, not including the likely salt content, of water to be discharged to Nowra Creek, taking into account the proposed stormwater mitigation measures and management procedures described above and in Section 4.9.3.
- Flood Assessment – This component determines the extent of influence that the Project would have on flooding behaviour within Nowra Creek in the vicinity of the Project Site and any impacts that local flooding would have on the Project.
- Groundwater Assessment – This component determines the inflows to the proposed extraction area and the impacts of dewatering on groundwater resources within the vicinity of the Project Site.

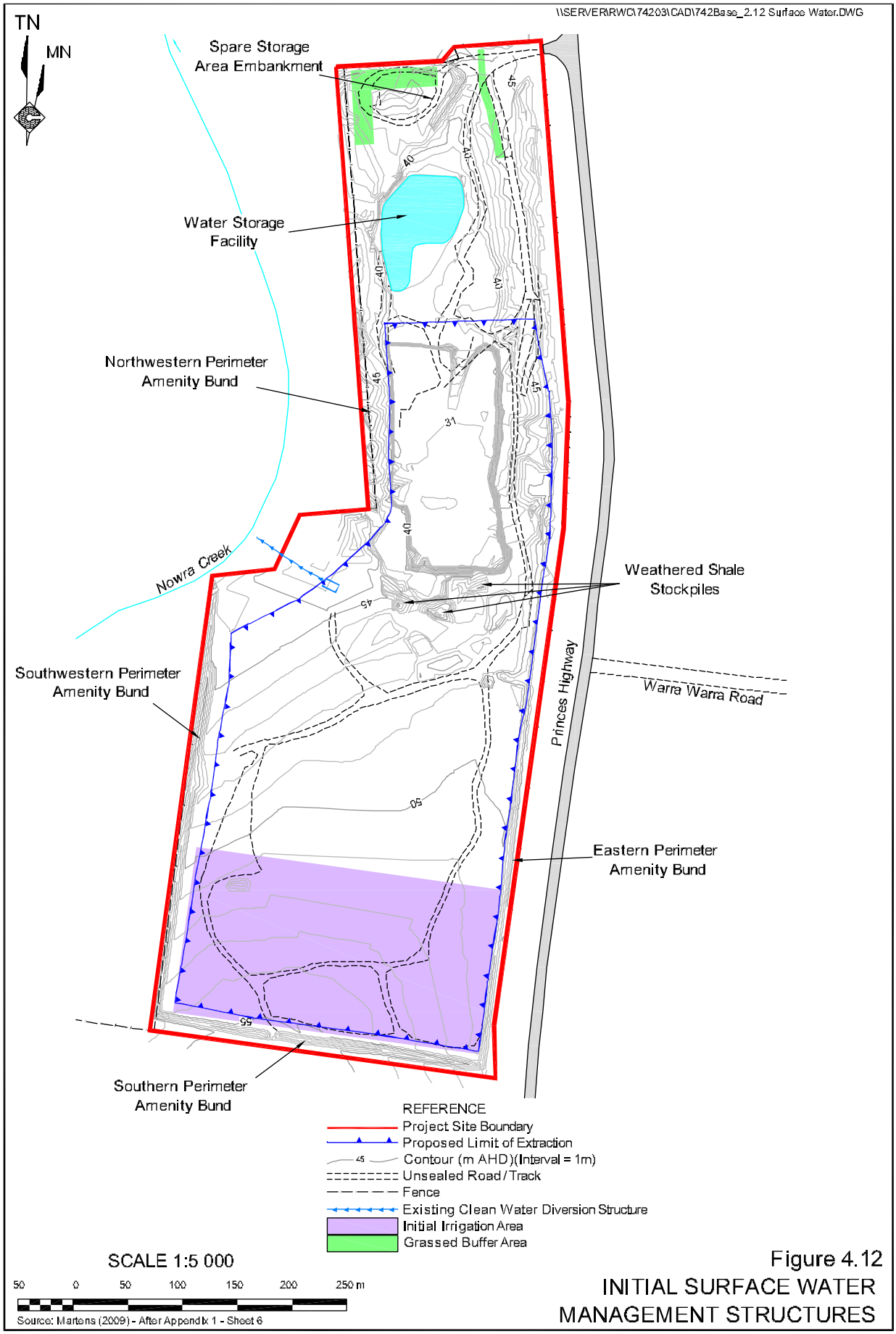


Figure 4.12
INITIAL SURFACE WATER MANAGEMENT STRUCTURES

- Nowra Creek Salt Load Assessment – In light of the elevated salinity concentrations in groundwater within the Project Site, and, as a result, the likely elevated salinity of water that would be required to be discharged from the Project Site, this component determines the impact of the anticipated additional salt loads within Nowra Creek that would result from discharge of water from the Project Site.

4.2.5.2 Water Balance Assessment

4.2.5.2.1 Assessment Methodology

A site water balance was undertaken to take into account each of the surface water and groundwater inputs and outputs to determine the annual Project Site surplus or deficit of water, and, as a result, whether water would be required to be discharged to Nowra Creek. The water balance assessment was based on the following.

- A 50 year record of daily rainfall and evaporation from 1955 to 2004 from the Bureau of Meteorology's HMAS Albatross weather Station was imported into the daily time-step water balance model "WATCYCLE".
- The following catchments as illustrated in **Figure 4.13**.
  - An active extraction area of 2.95ha.
  - A disturbed area of 2.95ha. Surface waters within this area were assumed to flow to either the active extraction area or the water storage facility.
  - Surface waters within all other areas of the Project Site were assumed to flow to Nowra Creek.

  It is noted that Stage 5 of the Project (see Section 2.4.5) was selected for estimating the site water balance because this stage represents the greatest area of disturbance throughout the life of the Project.
- Operation of an irrigation area approximately 4ha in size. Modelling assumed that irrigation would cease if there was more than 20 mm rainfall in the preceding day. In practice, irrigation would be undertaken on a demand basis and would be required, notably during summer periods even when substantially more rain falls than has been assumed. Assumed monthly volumes of water pumped to the irrigation field are presented in **Table 4.13**.

Table 4.13
Monthly Irrigation Volumes

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.576	3.813	4.027	4.431	3.670	3.244	3.763	6.011	6.639	7.242	5.657	5.798
Note 1: Units = ML											
Source: Martens (2009) - Table 10.											

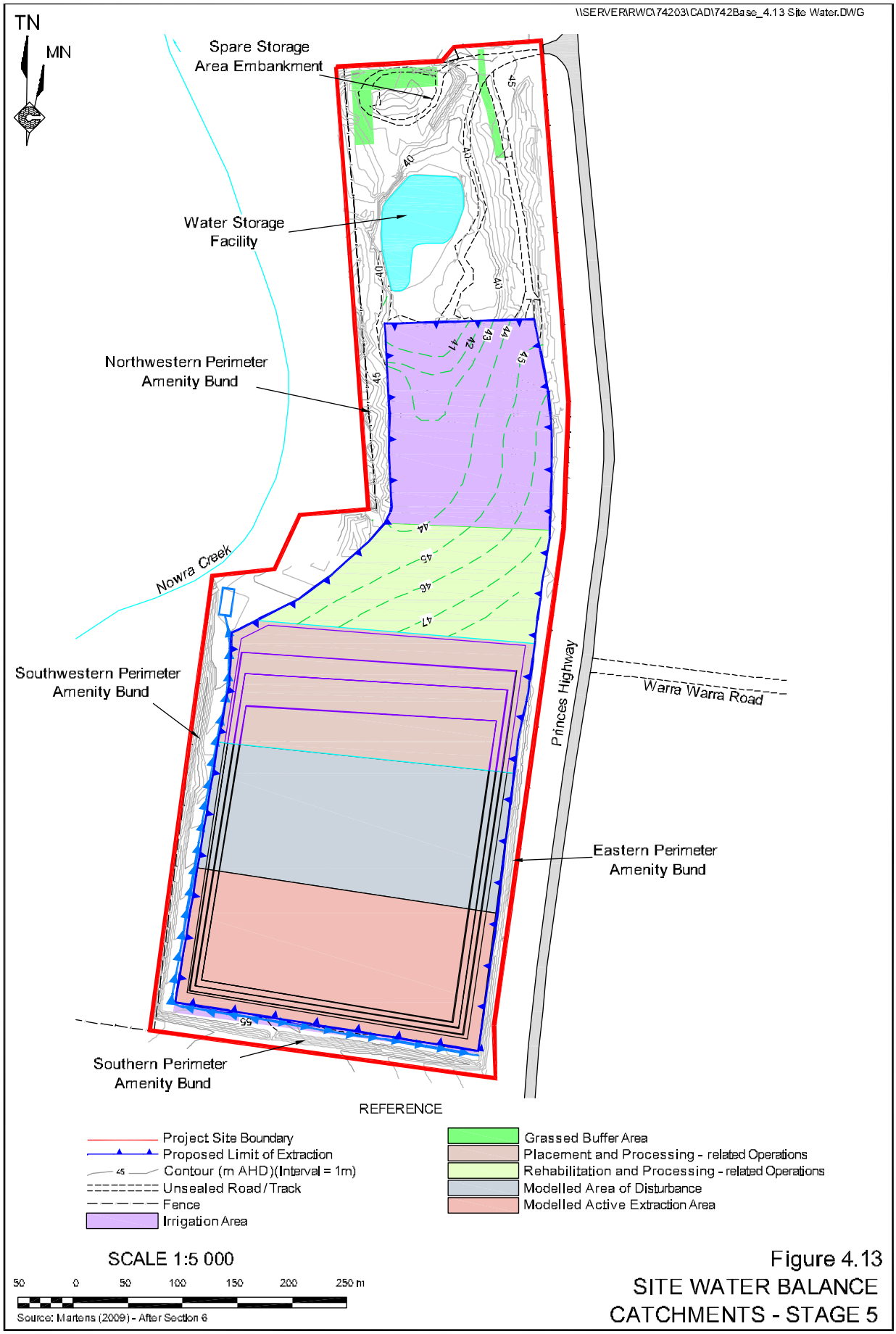


Figure 4.13
SITE WATER BALANCE CATCHMENTS - STAGE 5

Table 4.14 presents the assumed water inputs and outputs used during the water balance assessment. The water balance model assumed that the water storage facility was initially empty and then ran the daily rainfall and evaporation combined with the identified assumptions to determine the frequency, volume and salt concentration of water within the water storage facility and whether water would be required to be discharged from the facility.

Table 4.14
Water Balance Inputs and Outputs

	Source	Volume (kL/day)	Comment
Inputs	Groundwater	40	Based on groundwater modelling
	Surface water	Varies with rainfall/run-off	Modelled on a daily basis based on rainfall and evaporation data.
	Process water reuse	21.6	Excess run-off re-entering system
Outputs	Dust suppression	72	Current use (48kL/day) multiplied by 1.5 to take into account the proposed higher production rate. Demand only occurs on work days with rainfall <5mm
	Processing operations	64.8	Water lost to evaporation, stockpile storage and transported off-site
	Site irrigation	Demand varies with evapotranspiration rate and season	Mean irrigation rate of 4 mm/day
Source: Martens (2009) - After Table 21			

The site water balance is likely to be a conservative estimate for the following reasons.

- The irrigation area was assumed to be 4ha in size. In reality, the Proponent would also irrigate all areas under rehabilitation. As a result, the actual volume of water used during irrigation operations would be likely to be higher than that modelled.
- The amount of water used for dust suppression was assumed to be 1.5 times the current amount of water used for dust suppression. In reality, this is likely to be a conservative assumption because the proposed average production rate would be approximately 300 000t per year, or approximately three times the current production rate.
- The water balance modelling assumed groundwater inflows of 40 kL/day. This figure was derived assuming that the full extraction area was open to the maximum proposed depth of extraction, namely approximately 19m AHD, over the maximum proposed area of extraction, namely approximately 10ha. However, the Proponent would ensure that the maximum size of the extraction areas open to 19m AHD would be 2.95ha and it would be likely that only a portion of this would be open to 19m AHD. As a result, the actual groundwater inflows are likely to be significantly less than the assumed 40kL/day.

4.2.5.2.2 Impact Assessment

The water balance assessment indicates that, taking into account 50 years of daily rainfall and evaporation data from the Bureau of Meteorology HMAS Albatross weather station, there would be no requirement to discharge water from the water storage facility to Nowra Creek. The modelling indicates that the maximum storage volume required during that period would be approximately 39ML and the mean storage volume would be approximately 4ML. The capacity of the water storage facility would be approximately 50ML. As a result, the water storage facility would have approximately 11ML surge capacity to allow for any periods of rainfall higher than those recorded during the period from 1955 to 2005.

Surface waters from undisturbed sections of the Project Site, areas of completed rehabilitation/stabilisation operations and the grassed buffer areas adjacent to the site access road and other sealed sections of the Project Site would continue to flow to Nowra Creek. The quality of this water to be discharged is discussed further in Section 4.2.5.3.

4.2.5.3 Discharge Water Quality Assessment

4.2.5.3.1 Introduction

The purpose of the discharge water quality assessment is to determine:

- the relevant water quality assessment criteria for water to be discharged from the Project Site, should discharge be required; and
- the likely quality of the treated waters to be discharged.

It should be noted that the discharge water quality assessment did not include an assessment of the salinity of the waters that may be discharged to Nowra Creek. An assessment of potential discharge of waters from the Project Site on the salt load of Nowra Creek is presented in Section 4.2.5.6.

4.2.5.3.2 Assessment Criteria

Table 4.15 presents the assessment criteria adopted for the purpose of this assessment.

4.2.5.3.3 Assessment Methodology

The pollutant concentrations of waters to be discharged from the Project Site, with the exception of salt concentrations, were determined using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC Model) (version 3.0.1) developed by the CRC for Catchment Hydrology. The following scenarios were modelled.

- Scenario DW1 - Catchment conditions prior to commencement of extraction operations within the Project Site..

Table 4.15
Discharge Water Quality Assessment Criteria

	Assessment Criteria	
	Concentration Criteria	**Total Load Criteria**
Total Nitrogen	0.72mg/L[1]	57.75 (kg/year)[2]
Total Phosphorous	0.03mg/L[1]	3.44 (kg/year)[2]
Suspended Solids	9mg/L[1]	2820 (kg/year)[3]
Note 1: Based on existing concentration of pollutants in Nowra Creek (see Table 4.9).		
Note 2: Based on 45 % retention of average annual load.		
Note 3: Based on 85 % retention of average annual load.		
Source: Martens (2008) – Table 7		

- Scenario DW2 - Stage 5 development without treatment (see Section 2.4.5). This scenario assumes the maximum area of disturbance, without surface water management and mitigation measures implemented.
- Scenario DW3 - Stage 5 development with treatment. This scenario assumes the maximum area of disturbance, with the previously described management and mitigation measures implemented.

Table 8 of Martens (2008) presents the detailed parameters used during modelling of the discharge water quality. In summary, Martens (2009) assumes that all surface water flows within an area of approximately 5.9ha comprising the extraction, VENM-placement and active rehabilitation areas would be retained within the water storage facility. Surface waters within the remaining sections of the Project Site were assumed to flow to Nowra Creek via the following surface water control structures.

- Surface waters within undisturbed sections of the Project Site would be diverted away from disturbed sections of the Project Site and would be permitted to flow to Nowra Creek via an appropriately constructed sediment containment structure.
- Surface waters within the impervious sections of the Project Site, as well as the spares storage and workshop area, would be permitted to flow to Nowra Creek via the grassed buffer areas as described in Section 4.2.4.

4.2.5.3.4 Impact Assessment

Table 4.16 presents the results of the discharge water quality impact assessment for both concentration and total load of pollutants, with the exception of dissolved salt..

Table 4.16 Discharge Water Quality Impact Assessment Results	Total Nitrogen		Total Phosphorus		Total Suspended Solids	
	Concentration (mg/L)	Total Load (kg/yr)	Concentration (mg/L)	Total Load (kg/yr)	Concentration (mg/L)	Total Load (kg/yr)
Criteria	**0.72**	**57.75**	**0.03**	**3.44**	**9**	**2820**
Scenario DW1	0.72	48.5	0.03	3.81	9	3260
Scenario DW2	1.10	105.0	0.03	6.25	70	14100
Scenario DW3	0.70	36.1	0.03	3.18	9	2270
Source: Martens (2009) - After Tables 11 and 12.						

In summary, the proposed mitigation measures, including no discharge from the proposed surface water storage facility to Nowra Creek, would reduce the mean pollutant concentration and load to less than or equal to the assessment criteria. As a result, Martens (2009) state that the Project would not result in adverse surface water quality-related impacts on Nowra Creek.

4.2.5.4 Flood Assessment

4.2.5.4.1 Introduction

A flood assessment was undertaken to determine the extent of influence that the Project would have on flooding behaviour within Nowra Creek in the vicinity of the Project Site and any impacts that local flooding would have on the Project.

4.2.5.4.2 Assessment Methodology

The following methodology was utilised to determine the impact of the Project on the Nowra Creek flood regime and visa versa.

- Nine profiles or sections of Nowra Creek were surveyed as indicated on **Figure 4.8**.
- The morphology of Nowra Creek adjacent to the Project Site was determined during a visual inspection on 24 October 2007. A description of the morphology of this section of the creek is provided in Section 4.2.2.3.
- Run-off flow rates were calculated using the RAFTS hydrological model. Hydrologic modelling inputs were determined in order to allocate appropriate flow rates for various sections of Nowra Creek as follows.

- The total catchment of Nowra Creek was determined to be currently approximately 142.8ha. During Stage 5 of the Project (see Section 2.4.5), the total catchment of the creek was determined to be approximately 135.1ha.
- Manning's 'n' friction coefficient values for each sub-catchment and percentage of impervious area were estimated based on aerial photography and visual field observations.
- Peak flow rates were determined for the critical duration (1:100 year ARI) and probable maximum flood (PMF) (one in a million year ARI) flood events. Critical rainfall duration was determined by running a range of storm durations and was determined to be 120 minutes.

The Hydrologic Engineering Centre River Analysis System (HECRAS) hydrological model (version 3.1.1) was used to determine the anticipated flood heights for the 1:100 ARI critical duration and PMF flood events for the existing development and Stage 5 of the Project for each survey creek section.

4.2.5.4.3 Impact Assessment

Table 4.17 presents the results of the HECRAS modelling for Nowra Creek and indicates the following.

- The Project would result in a decrease in the height of 1:100 ARI critical duration and PMF flood events of between 0.03m and 0.06m. Martens (2008) state that this is a negligible impact.
- the Project Site does not encroach upon flood liable land.

Table 4.17
Anticipated Flood Elevation Results (m AHD)

Flood Event	Scenario	Nowra Creek Section Number*								
		1	2	3	4	5	6	7	8	9
Critical Duration	Existing development	37.20	37.42	38.03	40.27	40.98	43.46	46.20	46.95	47.32
	Stage 5 Development	37.17	37.41	38.01	40.25	40.95	43.42	46.20	46.95	47.32
	Change (m)	-0.03	-0.01	-0.02	-0.02	-0.03	-0.04	0	0	0
PMF	Existing development	38.10	38.45	38.92	41.22	42.10	44.74	46.62	47.88	48.37
	Stage 5 Development	38.07	38.41	38.88	41.18	42.04	44.68	46.62	47.88	48.37
	Change (m)	-0.03	-0.04	-0.04	-0.04	-0.06	-0.06	0	0	0

Source: Martens (2008) – Table 14. *see Figure 4.8

4.2.5.5 Groundwater Assessment

4.2.5.5.1 Introduction

The purpose of the groundwater assessment was to determine the likely groundwater inflows into the extraction area and quantify the potential Project-related impacts on groundwater resources within and in the vicinity of the Project Site. The existing groundwater resources within and in the vicinity of the Project Site have been described in Section 4.2.3

4.2.5.5.2 Assessment Methodology

The anticipated Project-related groundwater impacts were modelled using Visual ModFlow (Version 4.2). The following parameters were used to establish the groundwater model for the Project Site and surrounds.

- Topographic data within the Project Site was sourced from surveys of the Project Site, while topographic data for areas outside the Project Site were incorporated from the Nowra 1:25 000 topographic map.
- Groundwater levels and hydraulic conductivity determined during the groundwater assessment (see Section 4.2.3) were utilised.
- Evapotranspiration rates were based on existing conditions which include forest areas (undisturbed sections of the Project Site) and cleared areas (disturbed sections of the Project Site).
- The boundary of the model is presented in **Figure 4.14.**

Two development scenarios were created as follows.

- Scenario GW1 - based on the existing site layout.
- Scenario GW2 - Stage 5 development. This scenario assumed the following.
  - No VENM backfilling operations.
  - A daily groundwater inflow of 40kL estimated using the pit analytical inflow model of Marinelli and Niccoli (2000) assuming a steady state, unconfined, horizontally flowing, radial flowing and uniformly recharging aquifer. A coefficient of 0.75 was applied to the above model to address the flow direction and grade of the existing aquifer. . Sichardt's equation (Powers, 1992) of $R_o = 3000(H-h)\sqrt{K}$ was used to confirm the radius of influence as this value was required for use in the Marinelli and Niccoli (2000) model. It is noted that this approach is likely to be conservative as the maximum area of the proposed open cut that would open to the maximum depth of extraction, namely approximately 19m AHD , would be 2.95ha.
  - A Project life of 40 years.

The groundwater modelling determined the existing and Stage 5 piezometric surfaces and the anticipated Project-related cone of depression.

4.2.5.5.3 Impact Assessment Groundwater Resources

The results of the groundwater modelling are presented in **Figure 4.14** and may be summarised as follows.

Scenario GW1 - Existing

- The modelled existing piezometric surface mimics the surface topography, with groundwater levels between 5.5m and 13m below ground level. Within the Project Site, the elevation of the piezometric surface varies from approximately 39m AHD at the southwestern boundary of the Project Site to approximately 30m AHD in the vicinity of the northern boundary of the Project Site.
- Groundwater within the Project Site currently flows towards the north to northeast with a gradient of approximately 0.008 (m/m).

Scenario GW2 - Stage 5

- The anticipated Stage 5 piezometric surface within the Project Site would be lower than the existing piezometric surface, with the elevation of the surface at the southwestern and northern boundaries of the Project Site approximately 36mAHD and 30mAHD lower respectively.
- Comparing the modelled existing and Stage 5 piezometric surfaces indicates that a steep cone of depression would be formed during Stage 5 of the Project, with the Stage 5 piezometric surface a maximum of approximately 18m lower than the modelled existing piezometric surface. However, at a distance of approximately 250m from the Stage 5 extraction area, the modelled Stage 5 piezometric surface is anticipated to be approximately 4m below the modelled existing piezometric surface. At a distance of approximately 1 425m from the Stage 5 extraction area, the piezometric surface is anticipated to be approximately 1m below the modelled existing piezometric surface. It is noted by Martens (2009) that the resolution of the piezometric surface modelling is approximately 1m.
- The maximum drawdown of the piezometric surface in the vicinity of Nowra Creek is anticipated to be approximately 9m.
- Groundwater modelling indicates that Stage 5 groundwater flow directions are anticipated to be:
  - to the east-northeast to the west of the Project Site;
  - to the north-northeast to the south of the Project Site; and
  - towards the extraction area to the east and north of the Project Site.

However, Martens (2009) state that the regional groundwater flow directions would be unlikely to be significantly impacted by the Project.

- The gradient of piezometric surface would be anticipated to increase in the southern section of the Project Site from approximately 0.0183m/m to approximately 0.025m/m, while to the west of the Project Site the gradient would be expected to increase from 0.0094 m/m to 0.0171 m/m.

In light of the groundwater modelling results, the following groundwater-related conclusions may be reached.

- The existing piezometric surface is interpreted to be between 6.5m and 8.5m below the invert of Nowra Creek. As a result, Nowra Creek may be considered a "losing stream." As a result, further lowering of the piezometric surface in the vicinity of this creek is unlikely to have an adverse impact on Nowra Creek.
- The closest registered bore to the Project Site is located approximately 3.9km from the Project Site. As the 1m drawdown contour is anticipated to occur approximately 1.4km from the boundary of the extraction area, the impact of Project-related drawdown of the piezometric surface, assuming that the aquifers intersected within the Project Site and those intersected by the registered bores are linked, is considered to be negligible.
- Martens (2009) state that groundwater in the vicinity of the Project Site is generally of poor quality and slightly to moderately saline (see Section 4.2.3.6). It therefore represents a low value potential resource. As a result, potential future groundwater users within 1km of the extraction area are not expected and the Project would not affect future potential uses of the resource.
- Martens (2008) state that considering the material that hosts the aquifer, namely siltstone, that the risk of adverse Project-related impacts on the foundations or structure of buildings surrounding the Project Site is considered negligible.
- All potentially contaminated waters would be detained and treated on site prior to discharge and appropriate mitigation measures and management procedures would be implemented throughout the life of the Project. As a result, the potential for contamination of the groundwater resource is considered to be low.
- Martens (2008) state that provided VENM used to backfill the extraction area is placed appropriately and is free of contamination, it is considered unlikely that changes to the groundwater flow following completion of VENM placement operations will result in decreased groundwater value.

4.2.5.5.4 Impact Assessment - Groundwater Dependant Ecosystems

In addition to the potential groundwater-related impacts described above, the Project may adversely impact groundwater dependent ecosystems (GDEs), if they are present, in the vicinity of the Project Site. Martens (2009) state that there have been no GDEs identified within the vicinity of the Project Site. However, the following classes of GDEs are recognised. The following also provides an assessment of the likelihood of occurrence of these GDEs in the vicinity of the Project Site and, if they were to occur, the likely Project-related impacts.

- Terrestrial Vegetation – Vegetation may depend on shallow groundwater to sustain transpiration.
- Martens (2009) state that this class of ecosystem would be very unlikely to occur in the vicinity of the Project Site because the aquifer within the Project Site is hosted by siltstone and occurs between approximately 5.5m to 13m below the ground surface at a depth that is considered too deep for terrestrial vegetation. Consequently, terrestrial vegetation in the vicinity of the Project Site is not likely to be dependent on the aquifer.

- River Base Flow Systems – Base flow of certain streams may be important to stream character and ecosystems which rely on a certain stream character. However, groundwater monitoring indicates that Nowra Creek is a 'loosing stream,' namely that the piezometric surface is lower that the lowest point of the creek bed. As a result, the aquifer in the vicinity of the Project Site would not contribute to base flows in Nowra Creek and, as a result, the Project would have no adverse impact on this class of GDE.

- Aquifer and Cave Systems – Hypogean life exists within different types of fractured/porous aquifers and cave systems. However, the aquifer in the vicinity of the Project Site comprises fractured siltstone material and is not conducive to the formulation of caves. In addition, the saline environment is considered unlikely to provide a suitable ecosystem for the majority of hypogean life.

- Wetlands – In some ecosystems, groundwater discharge contributes to wetland flow. However, Martens (2009) note that no wetlands exist in the vicinity of the Project Site. As a result, the Project would not result in adverse impacts on this class of GDEs.

- Seepage/Springs – In some areas, groundwater discharge springs can provide habitat for various ecosystems. However, Martens (2009) note that groundwater monitoring indicates that the piezometric surface is between 5.5m and 13m below ground level. As a result, springs or surface seepage is unlikely to occur in the vicinity of the Project Site.

4.2.5.6 Salt Load Assessment

4.2.5.6.1 Introduction

In light of the elevated salt concentration of groundwater within the Project Site, this subsection determines the impact of the likely additional salt loads on Nowra Creek that would result from discharge of water from the Project Site, together with the impact of salt loads that would be pumped onto the irrigation and rehabilitation areas.

4.2.5.6.2 Assessment Criteria

Table 4.18 presents typical electrical conductivity and salt concentrations ranges for various classes of waters.

Table 4.18
Typical Electrical Conductivities and Salt Concentration Ranges

Water type	Electrical conductivity (µS/cm)	Salt Concentration (mg/L)
Deionised water	0.5 - 3	0.28 – 1.65
Pure rainwater	<15	<8.25
Freshwater rivers	0 - 800	0 - 440
Marginal river water	800 -1 600	440 - 880
Brackish water	1 600 – 4 800	880 – 2 640
Saline water	>4 800	>2 640
Seawater	51 500	28 325
Note 1: Salt concentration = electrical conductivity x 0.55		
Source: Modified after Martens (2008) – Table 16		

4.2.5.6.3 Assessment Methodology

The following assumptions were used to determine the salt budget for the Creek.

- Annual flows for Nowra Creek were determined using the RAFTS model described in Section 4.2.5.4.2.
- Annual surface water and groundwater flows within the Project Site were determined during the water balance assessment described in Section 4.2.5.2.
- Salt concentrations used in the salt load assessment are presented in **Table 4.19**.
- Water for extraction and processing-related operations was assumed to be preferentially drawn from the sump within the extraction area. This water was assumed to be primarily groundwater. Water for rehabilitation related operations was assumed to be preferentially drawn from the water storage facility to ensure rehabilitation operations are not hampered by the use of water with elevated salt concentrations.

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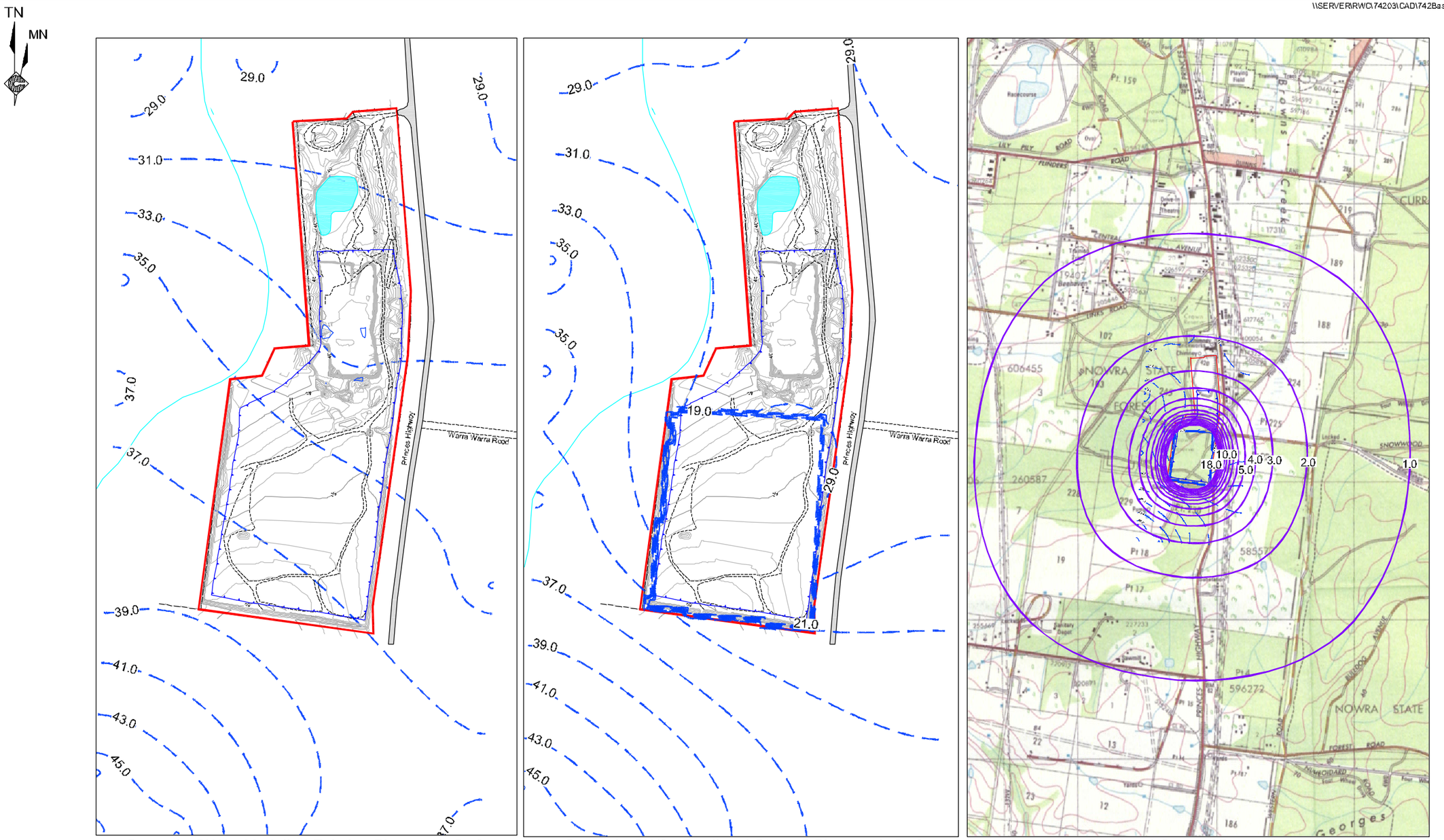


Scenario GW1 - Modelled Existing Piezometric Surface

Scenario GW2 - Predicted Stage 5 Piezometric Surface

Predicted Cone of Depression

Source: Modified after Martens (2009) - Appendix A - Sheets 9 & 10

Figure 4.14
GROUNDWATER
MODELLING RESULTS

- Surface waters from the undisturbed sections of the Project Site, areas of completed rehabilitation and the grassed buffer strips was assumed to flow via appropriately constructed sediment control structures, where required, to Nowra Creek.

Table 4.19
Assumed Salt Load Concentrations

Source Area	Salt Concentration (mg/L)	Comment
Pervious surface runoff	220	Assumed based on creek concentration
Impervious surface runoff	40	Assumed
Groundwater	4801	Based on site testing
Rainfall	25	Assumed
Nowra Creek	220	Actual geometric mean based on monitoring = 282 mg/L.
Source: Martens (2009) - After Table 21		

4.2.5.6.4 Impact Assessment

The results of the salt load assessment are summarised below.

- As indicated in Section 4.2.5.2, the site water balance indicates that there would be no requirement to discharge water from the water storage facility to Nowra Creek. As all saline groundwater would be intercepted and stored within the extraction area or the water storage facility, no groundwater would be discharged to Nowra Creek.
- Martens (2009) state that the salt concentration of water to be discharged from undisturbed sections of the Project Site, areas of completed rehabilitation and the grassed buffer areas would be approximately 220mg/L and would be suitable to be permitted to flow to Nowra Creek.
- Martens (2009) state that the median concentration of dissolved solids within the water storage facility is anticipated to be 760mg/L and the anticipated 85th percentile concentration, or the concentration that would only be exceeded on 15 days out of ever 100 days, is anticipated to be 1 335mg/L. The maximum concentration of dissolved solids is anticipated to be 3 875mg/L. The Martens (2009) note that elevated salinity levels are only anticipated during periods of low rainfall when water storage levels are low and stored water is dominated by groundwater inflows. During such times, it is likely that the Proponent would conserve water within the water storage facility for operational purposes and would cease to pump water to the irrigation field. In light of the above, Martens (2009) state that water within the water storage facility may be used for irrigation purposes without any significant detrimental effect on plants or soils within the Project Site.

4.2.6 Monitoring and Documentation

The following surface and groundwater monitoring would be undertaken throughout the life of the Project.

- Groundwater levels within Piezometers P1 to P8 would initially be monitored monthly. Following completion of 12 months of monitoring, the frequency of groundwater level monitoring may be adjusted to reflect the results of the initial monitoring in consultation with the Department of Primary Industries – Mineral Resources. Access to Piezometers P6 and P8 would be lost as Project development progresses.
- Groundwater quality within Piezometers P2, P3, P5, P6 and P7 would initially be analysed quarterly.
- Groundwater seepage on rock faces would be monitored initially every six months by a geotechnical engineer. Following 12 months of monitoring, the frequency of groundwater quality monitoring may be adjusted to reflect the results of the initial monitoring in consultation with the Department of Primary Industries – Mineral Resources.
- Surface water quality would be determined monthly within the extraction area sump, the water storage facility, the sediment containment structure and within Nowra Creek upstream and downstream of the Project-site discharge point.
- The quality of water pumped from the water storage facility to the bio-infiltration facility would be determined during each pumping campaign.
- The quality of water flowing from the sediment containment structure to Nowra Creek would be determined during or immediately following significant rainfall events.
- The volumes of water pumped from the extraction area sump to the water storage facility, from the water storage facility to the bio-infiltration facility and from the bio-infiltration facility to Nowra Creek would be measured using in-line meters and recorded. In addition, the daily volume of water used for extraction, processing, placement and rehabilitation-related operations would also be measured and recorded.
- The results of the above surface water and groundwater monitoring program would be documented in the Annual Environmental Management Report that would be prepared for the Department of Primary Industries – Mineral Resources. A copy of that report would be provided to the Department of Planning and Department of Environment & Climate Change if requested.

4.3 ECOLOGY

4.3.1 Introduction

The ecology assessment was undertaken by Gaia Research Pty Ltd. Gaia Research Pty Ltd prepared two ecology assessment reports.

The first report, entitled *Nowra Brickworks Quarry, South Nowra - Ecological Assessment,* is presented in full as Part 2A of the *Specialist Consultants Studies Compendium* and is referred to hereafter as "Gaia Research (2008)". That report:

- describes the fauna and flora species and Endangered Ecological Communities (EECs) within and surrounding the Project Site;
- identifies and documents the significance of any anticipated Project-related impacts upon such species and EECs;
- describes and assesses the proposed biodiversity offset strategy; and
- provides recommendations related to management and mitigation measures that would need to be adopted throughout the life of the Project.

The second report, entitled *Nowra Brickworks Quarry, South Nowra - Weed Management and Rehabilitation Strategy,* is presented in full as Part 2B of the *Specialist Consultants Studies Compendium* and is referred to hereafter as "Gaia Research (2007)". That report:

- describes the abundance and distribution of weed species that occur within the Project Site;
- provides recommendations related to the management and monitoring of weeds within the Project Site; and
- provides recommendations related to rehabilitation actions required to ensure appropriate reestablishment of native vegetation on the reconstructed final landform and other areas no longer required for extraction-related activities.

This section of the *Environmental Assessment* provides a summary of the above assessment reports

4.3.2 Preparation of the Ecology Assessment Reports

The ecology assessment reports were prepared by Mr Garry Daly, Director of Gaia Research Pty Ltd. Mr Daly has a BSc majoring in zoology and a Graduate Diploma in Education and has undertaken ecology assessments since 1991. Mr Daly has published 30 scientific papers and is the lead author of a book entitled *Threatened Fauna of the Shoalhaven (*Daly *et al,* 2000) published by the Shoalhaven Catchment Management Authority and the NSW National Parks and Wildlife Service. Mr Daly is the holder of the following licences.

- Scientific Investigation Licence No. S10470.
- Animal Research Authority Issued by the Director General of NSW Agriculture No. 05/2371 to conduct fauna surveys utilising a variety of techniques.

Mr Daly was assisted during preparation of the assessment reports by Ms Rebecca Rudd and Mr Alan Stephenson. Ms Rudd has been employed in various roles in the areas of horticultural and ecological management since 1986.

Mr Stephenson has been a member of the NSW National Parks and Wildlife Service *Prasophyllum affine* Recovery Team since 2001 and assisted with identification of threatened orchid species within and surrounding the Project Site.

Gaia Research has provided ecological advice to the Proponent and has undertaken ecological assessments of the Project Site since 1995. These assessments include targeted searches for the Yellow-bellied Glider and Green and Golden Bell Frog, as well as preparation of vegetation clearing and weed management procedures which have been progressively implemented by the Proponent.

4.3.3 Regional Flora and Fauna

A search of the Atlas of NSW Wildlife and records maintained by Gaia Research Pty Ltd was conducted to identify listed threatened flora and fauna species within a radius of 5km of the Project Site. Identified species are listed in **Table 4.20**. In addition, the Department of Environment and Climate Change (DECC) note that potential project-related impacts should also be considered for the Midge Orchid and Grey-headed Flying Fox. These species are also recorded in **Table 4.20.**

Table 4.20
Threatened Species Recorded within 5km of the Project Site

Common name	Scientific name	Status
Fauna		
Koala	*Phascolarctos cinereus*	Vulnerable
Yellow-bellied Glider	*Petaurus australis*	Vulnerable
Black Bittern	*Ixobrychus flavicollis*	Vulnerable
Australasian Bittern	*Botaurus poiciloptilus*	Vulnerable
Square-tailed Kite	*Lophoictinia isura*	Vulnerable
Bush-stone Curlew	*Burhinus grallarius*	Endangered
Glossy Black Cockatoo	*Calyptorhynchus lathami*	Vulnerable
Gang-gang Cockatoo	*Callocephalon fimbriatum*	Vulnerable
Powerful Owl	*Ninox strenua*	Vulnerable
Regent Honeyeater	*Xanthomyza phrygia*	Endangered
Green and Golden Bell Frog	*Litoria aurea*	Endangered
Flora		
Illawarra Greenhood Orchid	*Oligochaetochilus gibbosus*	Endangered
Leafless Tongue Orchid	*Cryptostylis hunteriana*	Endangered
Nowra Heath Myrtle	*Triplarina nowraensis*	Vulnerable
Source: Gaia Research (2008) – Table 1		

4.3.4 Fauna Survey Methodology

4.3.4.1 Introduction

In addition to previous surveys of the Project Site undertaken by Gaia Research Pty Ltd, systematic and targeted surveys of the Project Site for flora and fauna were undertaken between 2 August 2007 and 11 March 2008. The following subsections identify the survey methodology and effort, as well as the dates and times of the surveys, where relevant. In addition, fauna and flora species where they were observed opportunistically were recorded during each phase of the survey.

4.3.4.2 Elliott and Cage Trapping

Three transects, each consisting of ten A size Elliott traps, were set for three consecutive days between 25 and 27 September 2007 (**Figure 4.15**). The traps were set on the ground at approximately 20m intervals and were baited with a mixture of peanut butter and rolled oats.

The traps were placed under bushes or other vegetation so that they were protected from direct sunlight and were checked daily during the early morning to minimise stress to captured animals from heat and ants.

Two cage traps (55 x 20 x 20 cm) were set at one end and in the mid-point of each transect identified on **Figure 4.15**. The cage traps were baited with the above mixture and set for the same period.

4.3.4.3 Harp Trapping

Three harp traps were erected at locations indicated on **Figure 4.15** between 25 and 27 September 2007, with an additional trap erected between 26 and 27 September 2007. The traps were checked daily in the early morning. Combined trapping effort was 11 trap nights.

ANABAT recordings were not undertaken because, in Mr Daly's opinion, based on more than 10 years experience surveying for bats in the Shoalhaven Region and more than 5 years surveying using ANABAT ultrasonic recording technology, this method is not appropriate for assessing the presence or otherwise of bats within a relatively small area such the Project Site. Mr Daly notes that ANABAT recorders may record individual bats as they fly over the survey area or in the vicinity of the survey area rather than bats utilising resources within the survey area. As a result, Mr Daly states that harp trapping is, in his opinion, considered to be a more appropriate technique for determining the species of bats that may be present within the Project Site. Notwithstanding the above however, the presence within the Project Site of a number of microbats has been assumed based on habitat preference (see Section 4.3.8.2).

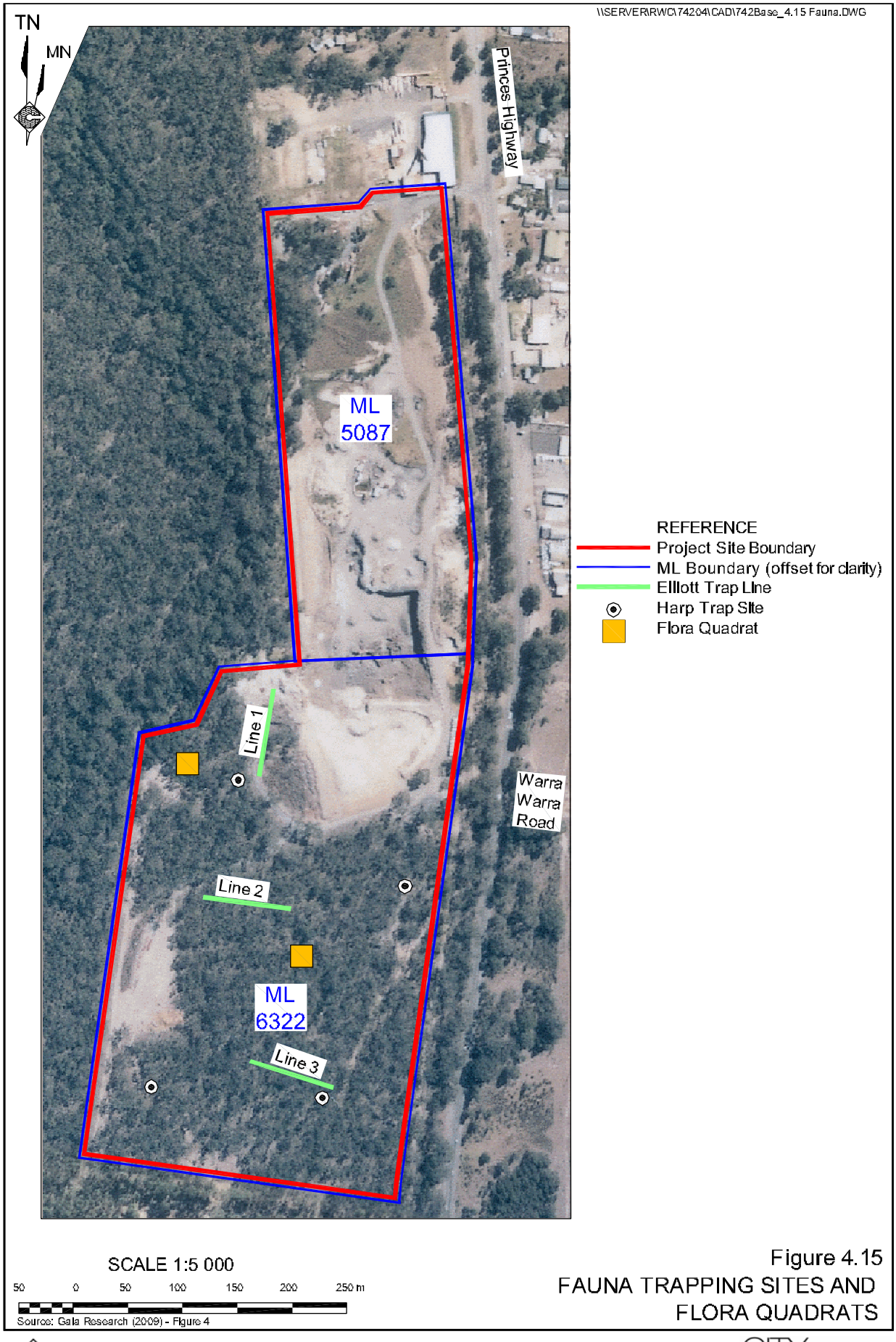


Figure 4.15
FAUNA TRAPPING SITES AND FLORA QUADRATS

4.3.4.4 Diurnal Herpetofauna Census

The herpetofauna census involved a search on 25 September 2007 between approximately 9.00am and 10.00am EST between Elliott trap Lines 1 and 2 (**Figure 4.13**). During the search, active animals were observed as they basked or foraged and searches were conducted beneath fallen logs, corrugated iron, rubbish and leaf litter.

4.3.4.5 Diurnal Bird Census

A targeted search for diurnal birds was undertaken for approximately 20 minutes on the morning of 25 September 2007 within a 2ha area along Elliot trap Line 3 in the Spotted Gum forest. Birds opportunistically observed or detected outside this time were also recorded. During the targeted and opportunistic surveys, birds were identified by their species-specific calls and by observation.

4.3.4.6 Spotlighting

Spotlighting was conducted for arboreal mammals for approximately 40 minutes adjacent to the Elliot trap transects from approximately 6.15pm on 2 August 2007. In addition, spotlighting was undertaken within the entire area of remnant vegetation within the Project Site for a period of 40 minutes from 7.00pm on 11 March 2008.

4.3.4.7 Nocturnal Call Playback

Calls of selected species were broadcast on 2 August 2007. The area in the vicinity of the broadcast site was searched with a spotlight immediately after completion of the call broadcast. Calls for the following species were broadcast in the order indicated below.

- Powerful Owl.
- Barking Owl.
- Masked Owl.
- Sooty Owl.
- Koala.
- Bush Stone Curlew.
- Yellow-Bellied Glider.

4.3.4.8 Amphibian Survey

Targeted nocturnal survey of amphibians was undertaken for 30 minutes on 2 October 2007 and for 7 minutes from 7.50pm on 11 March 2008 in the vicinity of the dams within the Project Site. Additional surveys were made during the day at ephemeral ponds beside the perimeter bunds. The surveys conducted around the ponds involved the identification of tadpoles, whereas those conducted around the dams involved the identification of adult frogs, tadpoles and species-specific calls.

4.3.4.9 Targeted Surveys

Yellow-bellied Gliders

Targeted surveys were conducted for Yellow-bellied Gliders *Petaurus australis* within and in the vicinity of the Project Site by searching for incised trees. This glider incises certain species of 'gum' tree to procure sap, which forms parts of the species' diet. In the Shoalhaven Local Government Area south of Tomerong, the Yellow-bellied Glider primarily incise Red Bloodwood trees. Searches for incised trees were made during rolling foot censuses.

Dusk surveys for Yellow-bellied Gliders as they emerged from hollow-bearing trees were conducted between 5.50pm and 6.15pm on 2 August 2007 and from 6.40pm and 7.05pm on 22 October 2007.

Glossy Black Cockatoo

Targeted searches were made for Glossy Black Cockatoos by searching for the chewed cones of the Black She Oak. The chewed cones give an indication that the species feed at certain sites. In addition, dusk surveys were conducted for birds returning to nesting hollows. In addition, searches for Glossy Black Cockatoos returning to nesting hollows were undertaken for a period of 25 minutes from 5.50pm on 2 August 2007 and 49 minutes from 6.11pm on 11 March 2008. Gaia Research (2008) notes that the breeding season for this species is from March to August.

Gang Gang Cockatoo

Targeted searches were made for Gang Gang Cockatoos returning to nesting hollows for a period of 25 minutes from 6.40pm on 22 October 2007. Gaia Research (2008) notes that the breeding season for this species is from October to January.

Forest Owls

Targeted searches were made for trees utilised by large forest owls for nesting by searching the base of all hollow-bearing trees for 'white-wash'.

Koala

Targeted searches were made for Koala by searching for their scats at the base of large gum trees. In addition, scratches on smooth barked trees, such as Spotted Gum and Grey Gum were examined as Koala make many small scratch marks on the trees that they climb as opposed to large scratch marks made by the Lace Monitor.

4.3.5 Flora Survey Methodology

4.3.5.1 Introduction

The flora surveys were conducted on 3 April and during August, September, October and December 2007.

Flora surveys comprised two components. The first survey method utilised the standard botanic survey method described by York, Binns and Shields (1991) to establish an inventory of most plant species occurring with the Project Site and to determine the location and extent of vegetation types within the same area. In accordance with DEC (2004), a combined total of 200m of traverses was undertaken within the 7.4ha area of undisturbed vegetation within the Project Site. Specific searches for plant species of conservation significance were then carried out in potential habitat using the "Random Meander Technique" of Cropper (1993).

The second survey method included the collection of floristic, structural, and physical data from two 400m^2 quadrats as described by Taws (1997), Thomas *et al.* (2000) and NPWS (2002). The location of the quadrat surveyed is indicated on **Figure 4.15**. Within the quadrat, all species of vascular plants and their abundance were recorded.

In addition, the location of all hollow-bearing trees were recorded and are presented on **Figure 4.16.**

Gaia Research (2008) notes that both survey efforts are in accordance with the requirements of DEC (2004).

4.3.5.2 Targeted surveys

Mr A. Stevenson, a terrestrial orchid specialist, conducted searches for *Oligochaetochilus gibbosus* (syn *Pterostylis gibbosa*) by walking transects over the Project Site on 3 August 2007, 17 and 27 September 2007 and 22 October 2007. During the surveys, a site in the vicinity of the Project Site where the orchids are known to occur was checked to confirm the orchids were in flower during the days of the survey.

Searches for *Cryptostlis hunteriana* were conducted on 14 December 2007.

Searches could not be conducted for *Genoplesium baueri* as this species is found in flower from late February to almost mid-April. However, the Proponent would undertake a search for this species within the Project Site during the 2009 flowering season. In the event that the species is observed within the Project Site, an appropriate management plan would be developed in consultation with Department of Environment & Climate Change.

4.3.6 Existing Environment

4.3.6.1 Fauna

During the fauna survey, 63 species of fauna were observed within or surrounding the Project Site, including:

- five species of frogs;
- four species of reptiles;
- forty-five species of birds, including one species, the threatened Square-tailed Kite observed adjacent to the Project Site; and
- ten species of mammals, including three species of bats and two species of non-native mammals.

A complete list of all species observed within or surrounding the Project Site is provided in Appendix 2 of Gaia Research (2008).

The results of each of the survey methods identified in Section 4.3.4 are provided below.

- Elliott and Cage Trapping - No animals were caught in the Elliott traps. One Lace Monitor (*Varanus varius)* was caught in the cage traps. Gaia Research (2008) notes that the capture rate was very low for the Shoalhaven region.
- Harp Trapping - Three Little Forest Bats *Vespadelus vulturnus* were caught in the harp traps over eleven trap nights.
- Diurnal Herpetofauna Census - Nine individual Grass Skink (*Lampropholis delicata*) were the only reptiles observed during the diurnal herpetofauna census. In addition, the species specific scratch marks of the Lace Monitor were observed on large hollow Spotted Gums.
- Diurnal Bird Census - Twenty species of bird were detected during the diurnal survey, with an additional 24 species recorded within and adjacent to the Project Site as a result of incidental observations and indirect evidence. Gaia Research (2008) notes that the Project Site has a relatively high diversity of bird species.
- Spotlighting - A Common Brushtail Possum (*Trichosurus vulpecula*) and Grey-headed Flying Fox were observed during the spotlight survey conducted on the 11 March 2008.
- Amphibian Surveys - Five species of frog were detected during the amphibian surveys. Gaia Research (2008) notes that no Green and Golden Bell Frogs were detected during the amphibian surveys and that if they were present within the Project Site, it is highly likely that they would have been observed during the survey.

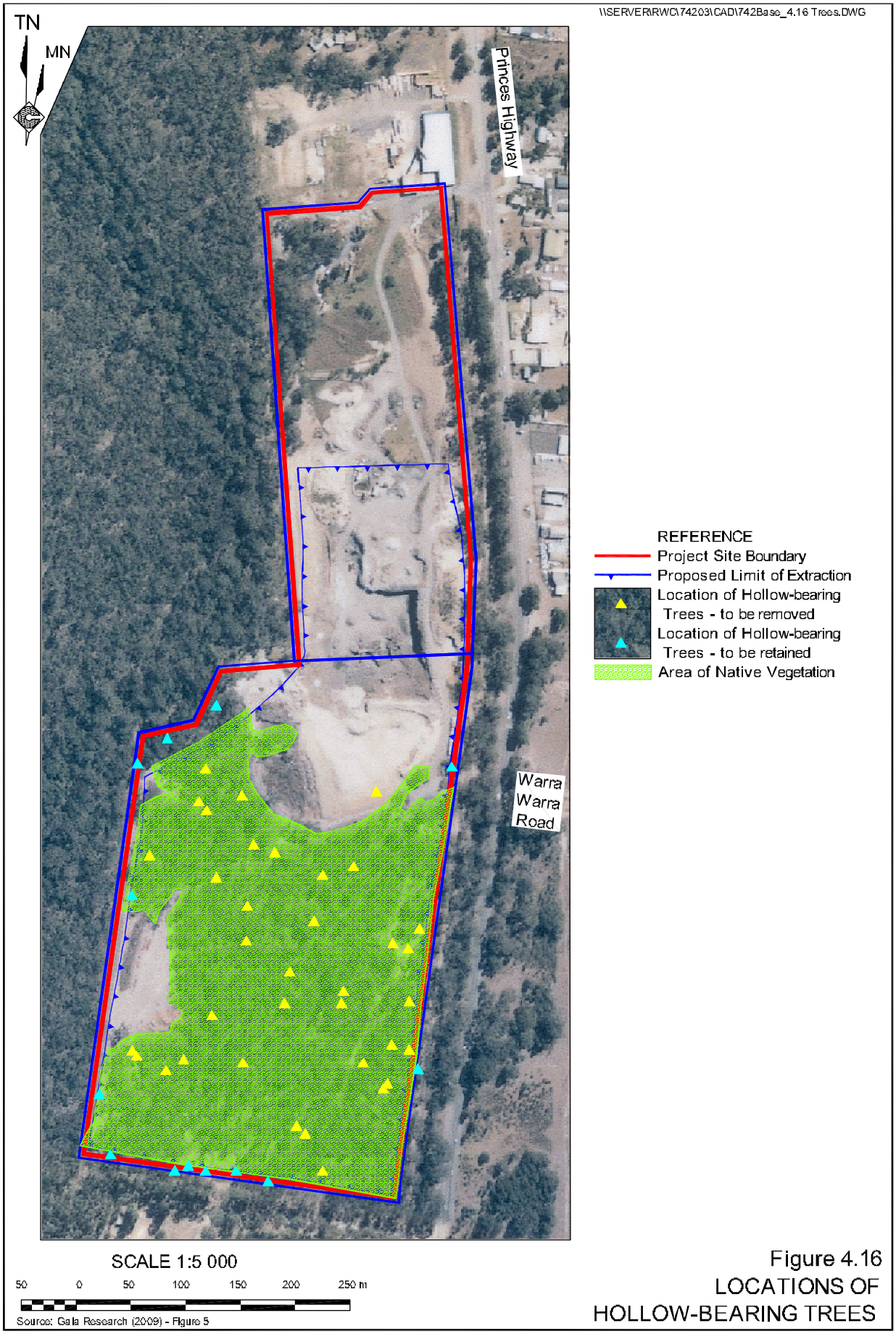


Figure 4.16
LOCATIONS OF HOLLOW-BEARING TREES

- Targeted Surveys
  - Yellow-bellied Gliders - no trees located on or adjacent to the Project Site had been incised by the Yellow-bellied Glider.
  - Glossy Black Cockatoo - no cracked cones of Black She Oak were located within the Project Site. In addition, the dusk surveys on 2 August 2007 and 11 March 2008 did not identify any Glossy Black Cockatoos.
  - Gang Gang Cockatoo - No Gang Gang Cockatoos were observed returning to nests during the dusk survey on 22 October 2007 or flying within or in the vicinity of the Project Site during any of the survey periods.
  - Forest Owls - no forest owls were observed or responded to call play backs.
  - Koala - no Koala or signs of Koala were observed during the survey.

4.3.6.2 Flora

4.3.6.2.1 General Flora Survey Results

Gaia Research (2008) states that approximately 50% of the area of the Project Site is currently disturbed. The undisturbed, vegetated sections of the Project Site comprise Spotted Gum forest of various age classifications. This vegetation has been previously logged and most trees represent regrowth from those logging operations.

According to the classification of Thomas *et al.* (2000), the Spotted Gum forest may be classified as Forest Ecosystem 9: Coastal Lowlands Cycad Dry Shrub Dry Forest - *Corymbia maculata/Macrozamia communis.* Spotted Gum is the tallest and most abundant species, with the following species also occurring as isolated trees or small stands.

- Grey Ironbark *Eucalyptus paniculata.*
- Woollybutt *Eucalyptus longifolia.*
- White Stringybark *Eucalyptus globoidea.*
- Red Bloodwood *C. gummifera*.
- Grey Gum *E. punctata*.

The tree canopy is approximately 25m in height, with individual Spotted Gums reaching to 30m. The midcanopy and shrub layers are sparse and the ground cover consists of primarily of *Lepidosperma laterale* and several species of *Lomandra.*

Eighty-one species of plants were identified within the Project Site, including thirty species of exotic weeds. No Endangered Ecological Communities or species listed under the *Threatened Species Conservation Act 1995* were located within the Project Site. A complete list of flora species observed within the Project Site is presented as Appendix 3 of Gaia Research (2008).

Gaia Research (2007) notes that eight species of noxious weeds, namely weeds classified as a key threatening process and weeds of national significance, have been identified within the Project Site (**Table 4.21**).

4.3.6.2.2 Targeted Flora Survey Results

The targeted surveys for the Illawarra Greenhood Orchid, on 3 August, 17 and 27 September and 22 October 2007 identified 13 species of terrestrial orchid within the Project Site, however, *O. gibbosus* was not identified. An inspection of the Worrigee Nature Reserve, approximately 1.8km to the northeast of the Project Site on the same days as the survey of the Project Site, identified rosettes of *P. gibbosa*, indicating that the species would have been observed had it been present within the Project Site.

Table 4.21
Weed Species Observed within the Project Site

Common name	Scientific name	Category		
		Noxious	Key Threatening Process[2]	Weed of National Significance[3]
Bitou Bush	*Chrysanthemoides monilifera*	W4[1]		Yes
Blackberry	*Rubus fruticosus*	W4[1]		Yes
Crofton Weed	*Ageratina adenophora*	W4[1]		
Fireweed	*Senecio madagascariensis*	W4[1]		
Honey Suckle	*Lonicera japonica*		Yes	
Madeira Vine	*Anredera cordifolia*		Yes	
Moth Vine	*Araujia sericifera*		Yes	
Turkey Rhubarb	*Acetosa sagittata*		Yes	

Note 1: Noxious weeds are species declared under the *Noxious Weeds Act 1993.* W4 Class weeds are Locally Controlled Weeds which must be controlled in accordance with a management plan specified by the relevant local government authority.
Note 2: Listed under Schedule 3 of *Threatened Species Conservation Act 1995.*
Note 3: Identified under the National Weeds Strategy.
Source: Gaia Research (2007) – Table 2

A targeted search for the Leafless Tongue Orchid, *Cryptostylis hunteriana*, on 14 December 2007 did not identify any individuals of this species within the Project Site. Gaia Research (2008) states that this species prefers thin, often waterlogged, sandy soils and usually occurs in conjunction with heath-sedgeland vegetation. As the Project Site has clayey soils and an overstory of Spotted Gum forest with sparse ground cover, Gaia Research (2008) states that this species is unlikely to occur within the Project Site.

Similarly, Gaia Research (2008) states that the Project Site is considered unsuitable for the Midge Orchid, *Genoplesium baueri*, based on soil type and associated vegetation.

4.3.7 Flora and Fauna Management

4.3.7.1 Design and Operational Safeguards

The following design and operational safeguards have been and would continue to be adopted to minimise or ameliorate any adverse Project-related impacts on fauna and flora within or in the vicinity of the Project Site.

- The proposed extraction area has been designed to avoid a stand of mature vegetation in the northwestern section of ML6322 adjacent to Nowra Creek.
- Shale extraction activities would be staged such that they preferentially progress from disturbed sections of the Project Site to undisturbed sections. In particular, extraction activities would be near completion within Stage 1 of the Project (**Figure 2.5**) before extraction progressing to undisturbed sections of the Project Site (Stages 2 to 5).
- Processing operations would be undertaken using mobile equipment within the active extraction area, thereby removing the requirement to disturb areas of native vegetation to enable construction of a fixed processing area.
- The removal of native vegetation would be confined to those areas required for operational purposes during the subsequent 12 months.
- Marked hollow-bearing trees would be checked regularly to ensure they are readily identifiable.
- The boundaries of areas of native vegetation to be cleared would be clearly marked. No clearing would occur outside these boundaries.
- Cage traps would be set in the vicinity of hollow-bearing trees for three consecutive nights prior to clearing of native vegetation in order to capture any gliders, possums or goanna that may be using those trees. Any trapped animal would be kept in captivity by animal carers for the period of clearing. The animals would then be released adjacent to the Project Site after completion of clearing operations.
- Non-hollow-bearing trees would be cleared first, where practicable, to allow any remaining nesting or roosting to animals to leave the area to be disturbed prior to removing hollow-bearing trees.
- A qualified fauna consultant would be commissioned to observe land preparation operations when hollow-bearing trees are being removed to rescue any remaining nesting or roosting fauna. Any injured animals would be taken to a local animal carer. Non-injured animals would be held in cloth bags for a short period and released within the riparian area beside Nowra Creek adjacent to the Project Site after clearing operations have been completed.

- Cleared vegetation would be broken or cut into manageable sections to be placed on areas undergoing rehabilitation or within other areas of native vegetation surrounding the Project Site.

4.3.7.2 Weed Management and Rehabilitation Procedures

The following weed management and rehabilitation procedures have been and would continue to be adopted to minimise or ameliorate any adverse Project-related impacts on flora and fauna within or in the vicinity of the Project Site.

- Control noxious weeds, weeds classified as a key threatening process and weeds of national significance as a high priority in accordance with the 'specifications for control' for each species provided in Appendix 2 of Gaia Research (2007).
- Control of other weeds during routine weed management operations in accordance with the 'specifications for control' for each species provided in Appendix 2 of Gaia Research (2007).
- Strip, stockpile and spread topsoil and subsoil in accordance with Section 2.3.5.
- Progressively rehabilitate all areas of disturbance no longer required for extraction or placement-activities in accordance with Section 2.15.

4.3.8 Impact Assessment

4.3.8.1 Introduction

In accordance with the *Draft Guidelines for Threatened Species Assessment* published by the Department of Primary Industries and Department of Environment and Conservation in 2005, this sub-section provides an assessment of the likelihood of each of the species listed in **Table 4.20** occurring within the Project Site and whether the impacts upon each species are likely to be significant.

For each species listed in **Table 4.20**, a preliminary impact assessment to determine if the species may use the habitat within the Project Site, and therefore whether the species may potentially be impacted by the Project. For each species identified as potentially impacted by the Project, a detailed impact assessment is provided, based upon the 'seven-part test' identified in Section 5A of the *Environmental Planning and Assessment Act 1979*.

This sub-section concludes with an assessment of the likely impacts associated with the Project upon Koala habitat.

4.3.8.2 Preliminary Impact Assessment

Table 4.22 provides an assessment of the likelihood of the threatened species listed in **Table 4.20** occurring within the Project Site and a preliminary assessment of the potential impact of the Project on the species.

4.3.8.3 Detailed Impact Assessment

4.3.8.3.1 Grey-headed Flying Fox

This sub-section provides a detailed assessment of the likely Project-related impacts upon the Grey-headed Flying Fox in accordance with Section 5A of the *Environmental Planning and Assessment Act 1979.*

- *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.*

  The Grey-headed Flying Fox is primarily a summer breeding migrant to the Shoalhaven Local Government Area and the population size is highly dependent on the flowering of particular species of trees, including Spotted Gum and Red Bloodwood. Ten temporary camps have been located between Helensburgh, approximately 100km north of the Project Site, and Batemans Bay, approximately 100km to the south of the Project Site (**Figure 4.17**). The most significant camps (based on estimation of size) are those at Yatteyattah and Kioloa, approximately 70km and 30km south of the Project Site respectively. The closest camps are located at Bomaderry Creek and Comerong Island, approximately 9km to the north and 11km to the northeast of the Project Site.

Table 4.22
Likelihood of Occurrence of Listed Species

Page 1 of 3

Species	Potential Impact		Comment
	None Likely	Possible	
Koala	✓		There are very few trees of species listed under Schedule 2 of *State Environmental Planning Policy 44 – Koala Habitat Protection* present within the Project Site (see Section 4.3.8.7). As a result, this species is not likely to occur within the Project Site.
Yellow-bellied Glider	✓		The Project Site may have provided suitable habitat for this species prior to European settlement, however, previous land use activities, including logging operations, are likely to have resulted in the Project Site becoming unsuitable for this species. Targeted searches for this species were conducted and no evidence of individuals of this species or incised feed trees were observed.

Table 4.22 (Cont'd)
Likelihood of Occurrence of Listed Species

Species	Potential Impact		Comment
	None Likely	Possible	
Grey-headed Flying Fox		✓	This species prefers Rainforest, Red Bloodwood and Spotted Gum forests on the coastal plain. This species was observed foraging within the Project Site. As a result the species may potentially be impacted by the Project.
Black Bittern	✓		This species prefers forests containing She-oaks beside flowing creeks and rivers. The Project Site does not contain areas of this habitat. As a result, this species is unlikely to occur within the Project Site.
Australasian Bittern	✓		This species prefers wetlands containing emergent vegetation. The Project Site does not contain areas of this habitat. As a result, this species is unlikely to occur within the Project Site.
Bush-stone Curlew	✓		This species nests on the ground and is highly susceptible to predation by Red Fox. While a pair of nesting birds were observed a few kilometres to the northwest of the Project Site a number of years ago. This species is extremely rare in the vicinity of the Project Site. As a result, the species is considered unlikely to occur within the Project Site.
Square-tailed Kite		✓	This species was observed flying adjacent to the Project Site and may utilise habitat within or adjacent to the Project Site. As a result the species may potentially be impacted by the Project.
Glossy Black Cockatoo	✓		This species prefers coastal woodland and open forest with an abundance of Black She-oak. As there were no Black She-oaks present within the Project Site, the likelihood of the Glossy Black Cockatoo occurring within the Project Site is considered low.
Gang-gang Cockatoo		✓	This species prefers eucalypt forests on the coast and ranges. As this habitat type is present within the Project Site, it is possible that the species may potentially be impacted by the Project.
Powerful Owl	✓		This species prefers tall open forests with an abundance of ground-dwelling and arboreal mammals. The low density of such prey items indicates that this species is unlikely to occur within the Project Site.
Regent Honeyeater	✓		This species prefers River Oak forest, Blackbutt forest and coastal woodlands and is known to feed from flowering Spotted Gum. However, Gaia Research (2008) notes that as a result of a drastic decline in the population of the this species, it is now a rare vagrant in the Shoalhaven Local Government Area and the absence of preferred habitat for this species within the Project Site, this species is unlikely to occur within the Project Site.
Green & Golden Bell Frog	✓		This species prefers coastal freshwater and semi-saline wetlands and lagoons. Potential habit for this species occurs within the Project Site. However, Gaia Research (2008) notes that the range of this species has decreased markedly in the last 40 years. While this species has been observed approximately 2km to the east of the Project Site in the catchment to Rotten Creek, it has not been identified within the Project Site during this survey or a previous survey undertaken in 1995. As a result, this species is unlikely to be significantly impacted by the Project.
Large Bentwing Bat		✓	Gaia Research (2008) indicate that this species may occur within the Project Site.
Eastern Free-tail Bat		✓	Gaia Research (2008) indicate that this species may occur within the Project Site.
Greater Broad-nosed Bat		✓	Gaia Research (2008) indicate that this species may occur within the Project Site.
Fishing Bat		✓	Gaia Research (2008) indicate that this species may occur within the Project Site.
Yellow-bellied Sheathtail Bat		✓	Gaia Research (2008) indicate that this species may occur within the Project Site

Table 4.22 (Cont'd)
Likelihood of Occurrence of Listed Species

Species	Potential Impact		Comment
	None Likely	Possible	
Pouched Greenhood Orchid	✓		In the Worrigee Nature Reserve, approximately 1.8km to the northeast of the Project Site this species prefers open Spotted Gum forest and thin, poorly drained, clayey soils. Targeted searches for this species did not identify it within the Project Site, despite it being emergent within the Worrigee Nature Reserve at the time of the search. As a result, this species is unlikely to occur within the Project Site.
Leafless Tongue Orchid	✓		This species prefers thin, often waterlogged, sandy soils and with associated heath-sedgeland vegetation. A targeted search for this species failed to identify it within the Project Site. In addition, no suitable habitat is present within the Project Site. As a result, this species is unlikely to occur within the Project Site.
Midge Orchid	✓		This species prefers woodland and open forest on sandy soils. No suitable habitat is present within the Project Site. As a result, this species is unlikely to occur within the Project Site.
Nowra Heath Myrtle	✓		This species prefers wet sedgeland or heathland on heavy, boggy soils. No suitable habitat is present within the Project Site. As a result, this species is unlikely to occur within the Project Site.

This species was observed foraging in flowering Spotted Gum within the Project Site on 11 March 2008. Gaia Research (2008) notes that Spotted Gum do not flower every year and that the Bomaderry Creek camp includes approximately 30 individuals. Gaia Research (2008) notes that the removal of approximately 7.4ha of this Spotted Gum habitat for this highly nomadic and migratory species is not likely to have an impact that would place a viable local population of this species is at risk of extinction.

- *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.*

  This species is not listed as an endangered population under Part 2 of Schedule 1 of the *Threatened Species Conservation Act 1995.*

- *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
  - *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
  - *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.*

  No endangered or critically endangered ecological community listed under Part 3 of Schedule 1 or Part 2 of Schedule 1A of the *Threatened Species Conservation Act 1995* occurs within the Project Site.

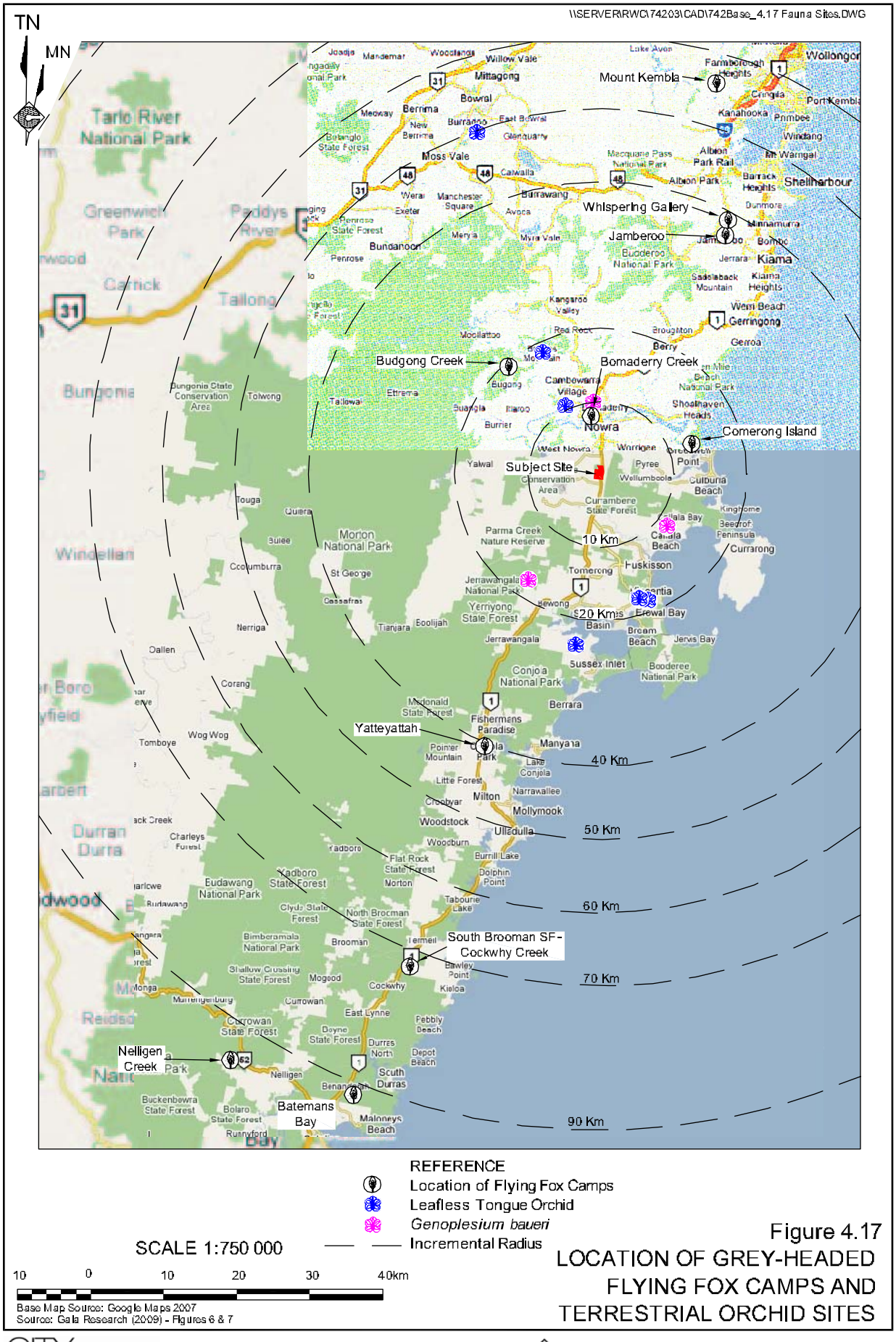


Figure 4.17
LOCATION OF GREY-HEADED FLYING FOX CAMPS AND TERRESTRIAL ORCHID SITES

- *In relation to the habitat of a threatened species, population or ecological community:*
  - *the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
  - *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
  - *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.*

  The Project would remove approximately 7.4ha of Spotted Gum forest. While removal of this vegetation would further fragment the existing habitat, the habitat to be removed is not critically important to the long-term survival of the Grey-headed Flying-fox in the vicinity of the Project Site.

- *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).*

  No critical habitat has been identified by the Department of Environment and Climate Change in the vicinity of the Project Site. As a result, the Project will not have an adverse effect on critical habitat for any species.

- *Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.*

  A recovery plan has not been prepared for this species.

- *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

  The Project would remove approximately 7.4ha of Spotted Gum forest. The removal of native vegetation is considered a key threatening process under Part 4 of the *Threatened Species Conservation Act 1995*.

In conclusion, the Project is not considered likely to result in significant adverse impacts on a viable local population of the Grey-headed Flying Fox.

4.3.8.3.2 Square-tailed Kite

This sub-section provides a detailed assessment of the likely Project-related impacts upon the Square-tailed Kite in accordance with Section 5A of the *Environmental Planning and Assessment Act 1979.*

- *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.*

The Square-tailed Kite is a seasonal migrant to the Shoalhaven Local Government Area and prefers coastal and sub-coastal forests. The species feeds primarily on small birds and insects, but will occasionally take small mammals and lizards. A pair of Square-tailed Kites were

observed approximately 500m to the west of the Project Site. Gaia Research (2008) states that the bird's behaviour was suggestive of a nuptial flight, implying that they may nest in the vicinity of the Project Site. However, Gaia Research (2008) concludes that, as this species regularly migrates and has a large range, the removal of approximately 7.4ha of Spotted Gum forest habitat is not considered likely place a viable local population of this species is at risk of extinction.

- *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.*

This species is not listed as an endangered population under Part 2 of Schedule 1 of the *Threatened Species Conservation Act 1995.*

- *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
  - *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
  - *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.*

  No endangered or critically endangered ecological community listed under Part 3 of Schedule 1 or Part 2 of Schedule 1A of the *Threatened Species Conservation Act 1995* occurs within the Project Site.
- *In relation to the habitat of a threatened species, population or ecological community:*
  - *the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
  - *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
  - *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.*

  The Project would remove approximately 7.4ha of Spotted Gum forest. While removal of this vegetation would further fragment the existing habitat, the habitat to be removed is not critically important to the long-term survival of the Square-tailed Kite in the vicinity of the Project Site.

- *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).*

  No critical habitat has been identified by the Department of Environment and Climate Change in the vicinity of the Project Site. As a result, the Project will not have an adverse effect on critical habitat for any species.

- *Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.*

  A recovery plan has not been prepared for this species.

- *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

  The Project would remove approximately 7.4ha of Spotted Gum forest. The removal of native vegetation is considered a key threatening process under Part 4 of the *Threatened Species Conservation Act 1995*.

In conclusion, the Project is not considered likely to result in significant adverse impacts on a viable population of the Square-tailed Kite.

4.3.8.3.3 Gang-gang Cockatoo

This sub-section provides a detailed assessment of the likely Project-related impacts upon the Gang-gang Cockatoo in accordance with Section 5A of the *Environmental Planning and Assessment Act 1979.*

- *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.*

During Summer, this species occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests, while in Winter, the species occurs at lower altitudes in drier, more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas. The species ranges widely from southern Victoria through south, central and eastern New South Wales. The species requires hollows in the trunks or large limbs of large trees to breed, usually in tall mature sclerophyll forests that have a dense understorey and occasionally in coastal forests. Breeding usually occurs between October and January.

Gaia Research (2008) states that the Spotted Gum forest within the Project Site provides suitable foraging habitat for this species. However, during the breeding season, the species prefers higher altitudes. Gaia Research (2008) notes that a pair of birds displaying breeding behaviours were observed on 2 November 2007 to the south of Braidwood at an elevation of approximately 600m AHD and that Mr Daly has never detected breeding Gang Gang Cockatoo on the Coastal Plain in the vicinity the Project Site. As a result, considering the nomadic and wide ranging nature of this species and the relatively small area of Spotted Gum forest to be disturbed (approximately 7.4ha), the Project is not considered likely place a viable local population of this species is at risk of extinction.

- *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.*

This species is not listed as an endangered population under Part 2 of Schedule 1 of the *Threatened Species Conservation Act 1995.*

- *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
  - *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
  - *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.*

  No endangered or critically endangered ecological community listed under Part 3 of Schedule 1 or Part 2 of Schedule 1A of the *Threatened Species Conservation Act 1995* occurs within the Project Site.

- *In relation to the habitat of a threatened species, population or ecological community:*
  - *the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
  - *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
  - *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.*

  The Project would remove approximately 7.4ha of Spotted Gum forest. While removal of this vegetation would further fragment the existing habitat, the habitat to be removed is not critically important to the long-term survival of the Gang-gang Cockatoo in the vicinity of the Project Site.

- *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).*

  No critical habitat has been identified by the Department of Environment and Climate Change in the vicinity of the Project Site. As a result, the Project will not have an adverse effect on critical habitat for any species.

- *Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.*

  A recovery plan has not been prepared for this species.

- *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

  The Project would remove approximately 7.4ha of Spotted Gum forest. The removal of native vegetation is considered a key threatening process under Part 4 of the *Threatened Species Conservation Act 1995*.

In conclusion, the Project is not considered likely to result in significant adverse impacts on a viable local population of the Gang-gang Cockatoo.

4.3.8.3.4 Threatened Microbats

This sub-section provides a detailed assessment of the likely Project-related impacts upon the following threatened microbat species in accordance with Section 5A of the *Environmental Planning and Assessment Act 1979.*

- Large Bentwing Bat.
- Eastern Free-tail Bat.
- Greater Broad-nosed Bat.
- Fishing Bat.
- Yellow-bellied Sheathtail Bat.

- *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.*

  Gaia Research (2008) notes that no adverse impacts on the lifecycle of the threatened microbat species would be expected for the following reasons.

  - Large Bentwing Bat - this species spends winters in cave roosts and the primary activity that may impact on this species, namely the removal of vegetation, would occur during winter. As a result the Project would be unlikely to have an adverse impact on the lifecycle of this species.
  - Eastern Free-tail Bat - removal of native vegetation during winter would ensure that this species is not roosting within the Project Site during vegetation clearing operations. As a result the Project would be unlikely to have an adverse impact on the lifecycle of this species.
  - Greater Broad-nosed Bat - removal of native vegetation during winter would ensure that this species is not roosting within the Project Site during vegetation clearing operations. As a result, the Project would be unlikely to have an adverse impact on the lifecycle of this species.
  - Fishing Bat - this species relies on water courses for foraging habitat. The Project would preserve a 50m wide zone of native vegetation adjacent to Nowra Creek. As a result, the Project would be unlikely to have an adverse impact on the lifecycle of this species.
  - Yellow-bellied Sheathtail Bat - this species migrates widely and would not be present in the vicinity of the Project Site during the period when native vegetation would be cleared. As a result, the Project would be unlikely to have an adverse impact on the lifecycle of this species.

- *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.*

  These species are not listed as an endangered population under Part 2 of Schedule 1 of the *Threatened Species Conservation Act 1995.*

- *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
  - *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
  - *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.*

  No endangered or critically endangered ecological community listed under Part 3 of Schedule 1 or Part 2 of Schedule 1A of the *Threatened Species Conservation Act 1995* occurs within the Project Site.

- *In relation to the habitat of a threatened species, population or ecological community:*
  - *the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
  - *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
  - *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.*

  The Project would remove approximately 7.4ha of Spotted Gum forest. While removal of this vegetation would further fragment the existing habitat, the habitat to be removed is not critically important to the long-term survival of these species in the vicinity of the Project Site.

- *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).*

  No critical habitat has been identified by the Department of Environment and Climate Change in the vicinity of the Project Site. As a result, the Project will not have an adverse effect on critical habitat for any species.

- *Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.*

  A recovery plan has not been prepared for these species.

- *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

The Project would remove approximately 7.4ha of Spotted Gum forest. The removal of native vegetation is considered a key threatening process under Part 4 of the *Threatened Species Conservation Act 1995*.

In conclusion, the Project is not considered likely to result in significant adverse impacts on a viable local population of these threatened microbats.

4.3.8.4 EPBC Act Considerations

Part 9 of the *Environment Protection and Biodiversity Conservation Act 1999* requires that any action that is likely to have a significant impact upon the following matters of National environmental significance must be referred to the Commonwealth Minister for the Environment.

- World Heritage properties.
- National Heritage places.
- Ramsar wetlands of international importance.
- Listed threatened species and ecological communities.
- Listed migratory species.
- Commonwealth marine areas.
- Nuclear actions.

As the Project would not impact upon any World or National Heritage areas, Ramsar wetlands, Commonwealth marine areas, does not include any nuclear actions and no Commonwealth-listed threatened or migratory species were observed or are likely to occur within the Project Site, referral of the Project to the Commonwealth Minister for the Environment is not required.

4.3.8.5 SEPP 44 – Koala Habitat Assessment

State Environmental Planning Policy 44 – Koala Habitat Protection (SEPP 44) requires that a Plan of Management be developed for any development within Local Government Areas identified within Schedule 1 that will affect core Koala habitat. "Core Koala Habitat" is defined as an area of land with a resident population of Koala. "Potential Koala Habitat" is defined as habitat where more than 15% of the trees are Koala feed tree species defined in Schedule 2 of the SEPP.

The only listed Koala feed tree species listed in Schedule 2 of SEPP 44 within the Project Site is Grey Gum. Gaia Research (2008) states that the abundance of this species is less than 15% of the trees within the Project Site.

4.3.8.6 Biodiversity Offset Assessment

4.3.8.6.1 Introduction

The proposed biodiversity offset strategy is described in detail in Section 2.15.9. In summary, to compensate for the removal of approximately 7.4ha of Spotted Gum forest, the Proponent proposes to protect the following areas of Spotted Gum forest within and surrounding the Project Site (**Figure 4. 18**).

- Approximately 3ha within the Northern Biodiversity Offset Area.
- Approximately 17ha within the Southern Biodiversity Offset Area.

4.3.8.6.2 Northern Biodiversity Offset Area

Gaia Research (2008) states that the vegetation within the Northern Biodiversity Offset Area is similar to the vegetation that would be preserved, with approximately 13 hollow-bearing trees occurring within this offset area.

In addition, Gaia Research (2008) notes that the riparian area adjacent to Nowra Creek would help to protect water quality within Nowra Creek and would preserve:

- several large hollow-bearing Spotted Gum;
- one large Grey Ironbark that supports Ironbark Orchids *Tropilis aemula*; and
- a stand of mature Burrawangs *Macrozamia communis,* that are host to Birds Nest Ferns *Asplenium australasicum,* Necklace Fern *Asplenium flabellifolium,* Hares Foot Fern *Davallia pyxidata* and Elk Horn *Platycerium bifurcatum* subsp *bifurcatum*.

4.3.8.6.3 Southern Biodiversity Offset Area

Vegetation within the Southern Biodiversity Offset Area was assessed for species composition, structure and in particular the number of hollow-bearing trees. The vegetation may be classified as Spotted Gum forest with a higher density of Grey Ironbark and Woollybutt than the Project Site. Like the vegetation with the Project Site, the vegetation within the Southern Biodiversity Offset Area has also been logged and, in general, the trees are not as large in diameter as those that occur on the Project Site. However, approximately 38 hollow bearing trees occur within the Southern Biodiversity Offset Area (**Figure 4.18**).

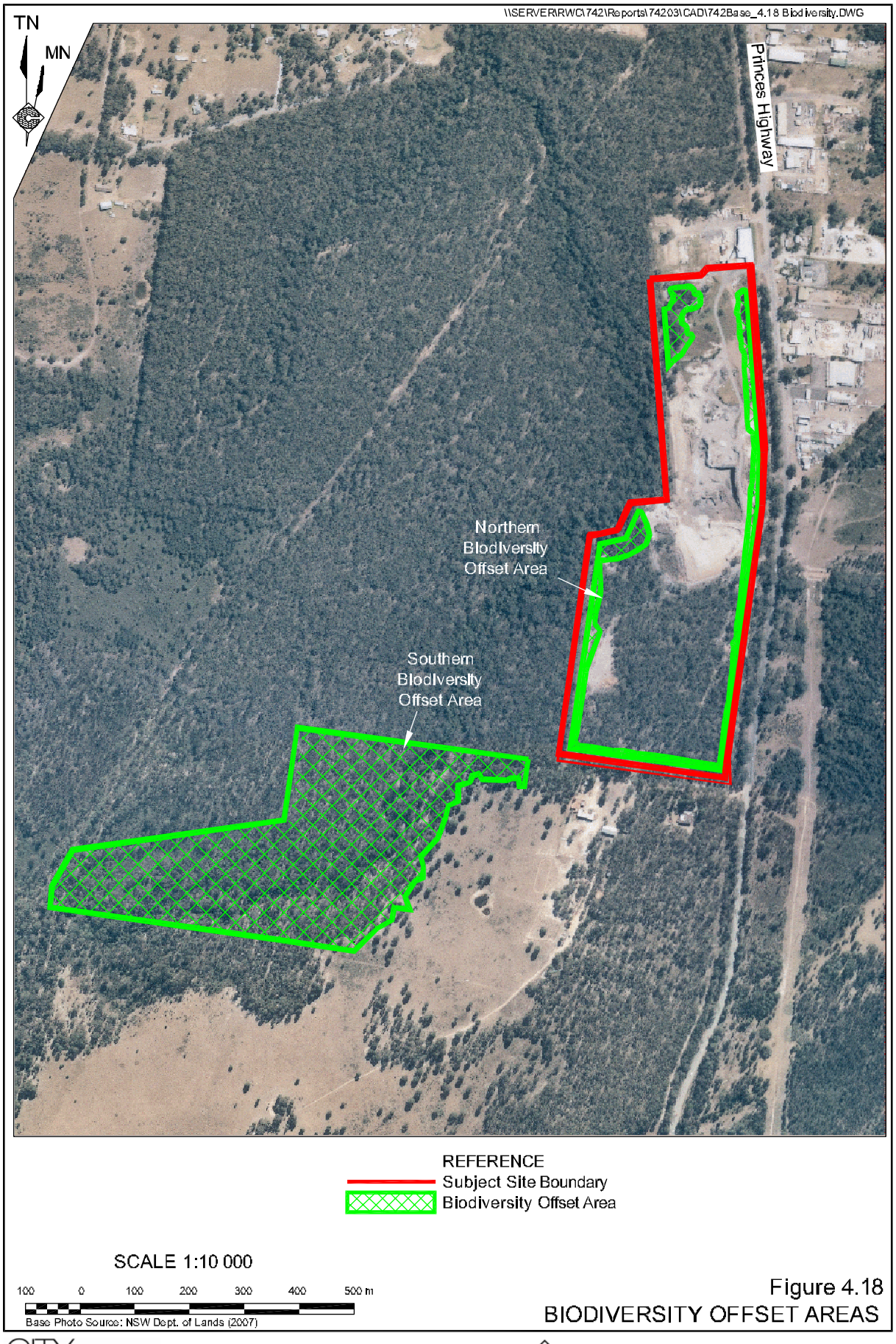


Figure 4.18
BIODIVERSITY OFFSET AREAS

The Southern Biodiversity Offset Area incorporates the upper portions of Nowra Creek and, as a result, a wide variation in soil moisture content. Consequently, the offset area includes a greater variation in species diversity than the Project Site, with Paperbarks *Melaleuca decora* and *M. styphelioides* and Woollybutt being common within the creek bed and Grey Ironbark being common on the banks. Fallen timber is abundant and the proposed offset area has an intact and diverse canopy and shrub layer. However, grazing has resulted in impacts to the ground cover.

In addition, the proposed offset area is contiguous with retained riparian bushland adjacent to Nowra Creek within the South Coast Correctional Facility site located to the north of the offset area and west of the Project Site, as well as riparian vegetation within the Northern Biodiversity Offset Area. Downstream (to the north) of the Project Site, the Nowra Creek riparian zone provides a riparian corridor bounded on both sides by industrial development. Given this constraint, the riparian zone, including land within the biodiversity offset areas and land to be protected as part of the South Coast Correctional Facility site, would form the main linkage from areas of native vegetation in the vicinity and to the south of the Project Site and larger portions of bushland, such as Shoalhaven State Forests and Depot Farm Council Reserve beside Shoalhaven River to the north of the Project Site.

Diurnal searches within the Southern Biodiversity Offset Area indicate that it supports a similar suite of species to the Project Site, including habitat that may potentially be utilised by Bush Stone Curlew.

4.3.8.6.4 Assessment of the Biodiversity Offset Strategy

The following assesses the proposed biodiversity offset areas against the 13 principles presented in Appendix 2 of the document *Guidelines for Biodiversity Certification of Environmental Planning Instruments* published by the DECC.

1. **Impacts must be avoided first by using prevention and mitigation measures.**

   The Project has been designed to ensure that the minimum area is disturbed. Measures that would be implemented include the following.

   - Maximising the use of disturbed sections of the Project Site.
   - Ensuring, as far as practicable, that areas of high quality vegetation within the Project Site, including areas adjacent to Nowra Creek, are preserved.
   - Ensuring, through sequencing of extraction operations, that areas of vegetation that would be disturbed are preserved for as long as possible.

2. **All regulatory requirements must be met.**

   The Proponent states that all regulatory requirements for the existing operation have been complied with and that all such requirements applicable to the Project would continue to be complied with.

3. Offsets must never reward ongoing poor performance.

The Proponent contends that the environmental performance of the existing Nowra Brickworks Quarry has been acceptable. For example, the perimeter bunds around the Project Site were required to have a rehabilitation plan as a requirement of the Shoalhaven City Council development consent (DA07/1322). The plan was prepared by Gaia Research and to date actions against this plan include the following.

- Removal of earthen material from the root zones of two hollow-bearing Spotted Gum trees and one Grey Ironbark tree.
- Spot spraying of weeds with Glyphosate.
- Revegetation of the bunds with endemic species of ground cover and shrubs (direct planting and broadcasting of endemic seed).
- Compilation of regular reports to Shoalhaven City Council as per the schedule of works detailed in the rehabilitation plan.

4. Offsets will complement other government programs.

The offset strategy would complement existing NSW Government conservation objectives as the offset areas would protect water quality within the upper catchment of Nowra Creek. The areas are located in the vicinity of and provide linkages between the existing reserves of Triplarina Nature Reserve (158ha) and Worrigee Nature Reserve (232ha). Triplarina Nature Reserve is located 4km to the northwest of the Project Site and Worrigee Nature Reserve is located 3km to the northeast. The offset areas are contiguous with a riparian corridor that will be retained within land to be used for the South Coast Correctional Centre.

5. Offsets must be underpinned by sound ecological principles.

The proposed biodiversity offset strategy:

- takes into account the structure, function and compositional elements of the Project Site, including threatened species habitat, and to the greatest extent possible, attempts to replicate those components within the offset areas;
- enhances biodiversity at a range of scales;
- considers the conservation status of ecological communities; and
- ensures the long-term viability and functionality of biodiversity.

The enhancement of existing habitat within the Project Site would be ongoing. In addition, the proposal would secure and manage the biodiversity offset areas for the sole purpose of conservation of biodiversity until such time as areas of rehabilitation within the Project Site have achieved biodiversity values similar to greater than the biodiversity values of the existing landform.

6. Offsets should aim to result in a net improvement in biodiversity over time.

The offset strategy aims to improve the biodiversity over time by conservation of approximately 20ha of Spotted Gum forest in order to compensate for the disturbance of approximately 7.4ha of the same vegetation type. It is noted that vegetation within both the Project Site and the proposed offset areas has been previously logged. The protection of the biodiversity offset areas would allow the forest within these areas to mature. In the long term, the offset areas would support a greater number of hollow-bearing trees and, consequently, would have a greater biodiversity value than the 7.4ha of native vegetation that would be lost as a consequence of the Project.

The Southern Biodiversity Offset Area would be secured through a term on the lease that would restrict the use of the Southern Biodiversity Area to those purposes identified in the project approval, should it be granted.

The Northern Biodiversity Offset Area comprises Crown land within the mining leases held by the Proponent. On surrender or cancellation of those leases, the Proponent, or its successor in title, would provide sufficient resources for the ongoing management of the offset area for the life of the offset. The Proponent anticipates that an amount sufficient to ensure compliance with the above commitments will be included in the security held by the Department of Primary Industries - Mineral Resources in relation to the mining leases.

7. Offsets must be enduring and they must offset the impact of the development for the period that the impact occurs.

The Proponent anticipates that the impacts associated with the Project would occur for a period of approximately 80 to 120 years. In establishing this time frame, the Proponent notes that hollows of the size and type that currently occur within the Project Site are generally believed to take between 50 and 90 years to develop. Taking into account the 30 year life of the Project, the Proponent anticipates that the term of the offset strategy would be between 80 to 120 years.

During that period, the Proponent would allocate adequate resources to manage the biodiversity offset areas, including for fencing and weed and feral animal control.

8. Offsets should be agreed prior to the impact occurring.

The Proponent would secure an appropriate lease over the Southern Biodiversity Offset Area and would implement an appropriate arrangement for the use of that land following receipt of project approval. An in-principal agreement with the owner of the land has been negotiated.

9. Offsets must be quantifiable and the impacts and benefits must be reliably estimated.

The following comments are made in relation to the areas of proposed disturbance and the proposed offset areas.

- The area of native vegetation to be disturbed would be approximately 7.4ha. The area of native vegetation that would be preserved within the offset areas would be approximately 20ha.
- The ecological community within both the area to be disturbed and the proposed biodiversity offset areas is Spotted Gum forest: Forest Ecosystem 9: Coastal Lowlands Cycad Dry Shrub Dry Forest - Corymbia maculata/ Macrozamia communis (Thomas et al. 2000).
- The proposed areas to be disturbed and the offset areas are contiguous with bushland to be retained beside Nowra Creek for the South Coast Correctional Facility.
- The habitat of the biodiversity offset areas has been described previously and information in relation to their floristic species diversity and structure is presented in Appendix 3 and Appendix 4 of Gaia Research (2008) respectively. The habitat within the offset areas is considered by Gaia Research (2008) to be similar in composition and structure to the native vegetation that is proposed to be removed.
- Forest Ecosystem 9: Coastal Lowlands Cycad Dry Shrub Dry Forest is not listed on the *Threatened Species Conservation Act 1995* as an endangered ecological community.
- The management actions for the biodiversity offset areas, include weed control as described by Gaia Research (2007), fencing, monitoring, feral animal control, retention of fallen and standing timber and fire control.
- The Southern Biodiversity Offset Area would be secured through a term on the lease that would restrict the use of the Southern Biodiversity Offset Area to those purposes identified in the project approval. .

  The purpose of such a covenant or conservation agreement would be to restrict the use of the Southern Biodiversity Offset Area for the purposes of native vegetation conservation.

10. Offsets must be targeted.

The proposed biodiversity offset strategy is aimed at preserving and protecting similar habitat in respect to floristic diversity, age of the forest, number of hollow-bearing trees and level of disturbance to the habitat that would be disturbed. The proposed biodiversity offset strategy is considered to improve the biodiversity values in the vicinity of the Project Site for the following reasons.

- The biodiversity offset areas are located adjacent to and to the southwest of the areas of proposed disturbance and are very similar floristically and structurally.
- The biodiversity offset areas are located adjacent to Nowra Creek to maximise the linkages between vegetation within the Project Site and surrounding areas of vegetation.

- The biodiversity offset areas include a variety of soil moisture levels providing a greater range of habitats than the Project Site.
- Paperbarks grow beside Nowra Creek within the offset areas, a feature that is not present within the area to be disturbed.
- The section of the Northern Biodiversity Offset Area adjacent to Nowra Creek supports mature cycads with epiphytic ferns and several species of terrestrial orchids. One large Grey Ironbark would be retained in this area that is host to Ironbark Orchids *Tropilis aemula*.

11. Offsets must be located appropriately.

Where possible, the offsets are located within the Project Site. In addition, the Southern Biodiversity Offset Area is located adjacent to and to the southwest of the Project Site and consequently has similar ecological characteristics as the area affected by the development

12. Offsets must be supplementary.

The proposed biodiversity offset areas are not already protected by existing covenants or other measures The Southern Biodiversity Offset Area has not been subject to incentive funds or protected under previous management actions such as voluntary conservation agreements or catchment management bushland incentives schemes.

13. Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or a contract.

The Proponent anticipates that the project approval, should it be granted, would include a requirement to implement the proposed offset strategy, including securing the biodiversity offset areas to the satisfaction of the DECC.

In addition, the Proponent would undertake internal audits and monitoring of the biodiversity offset strategy and areas to determine that the proposed actions are leading to positive biodiversity outcomes.

The Proponent has also agreed with the owner of the Southern Biodiversity Offset Area to acquire a lease over the over the proposed biodiversity offset area, subject to the granting of project approval. The lease would include terms that would prevent the lease from being terminated by the lessor or subsequent owners of the land. The Proponent would enter into an appropriate arrangement as described previously to ensue the above commitments are implemented.

In the event that the mining leases are relinquished or cancelled, the Proponent would provide sufficient resources for the on-going management of the Northern Biodiversity Offset Area for the life of the offset strategy.

4.3.9 Monitoring and Record Keeping

The following monitoring program would be implemented within the Project Site, the results of which would be used to refine the Proponent's management procedures. The results of the monitoring program would be reported in each Annual Environmental Management Report (AEMR) prepared for the Project.

- Undertake regular monitoring of areas undergoing rehabilitation and the biodiversity offset areas would be undertaken to determine the success or otherwise of the management, mitigation and ameliorative measures and the rehabilitation programs.
- A set of photographic reference points would be established and photographs taken at six monthly intervals to document activities within the Project Site, including rehabilitation progress.
- An annual weed inspection would be undertaken within the Project Site and the biodiversity offset areas to enable weed control activities to be planned and implemented for the following 12 months.

Records would be maintained of the following activities and would be presented in the AEMR for the Project.

- Species of weeds treated and the method and timing of control.
- Species of seed collected and timing of collection.
- Species, quantities, methods and location of revegetation programs.

4.4 TRAFFIC AND TRANSPORTATION

4.4.1 Introduction

The traffic and transportation assessment was undertaken by John Coady Consulting Pty Ltd. The resulting report, entitled *Nowra Brickworks Quarry, South Nowra – Traffic and Transportation Assessment,* is presented in full as Part 3 of the *Specialist Consultants Studies Compendium* and is referred to hereafter as "John Coady (2007)". This section of the *Environmental Assessment* provides a summary of that report.

4.4.2 Existing Traffic and Transportation Environment

4.4.2.1 Site Entrance

The Project Site is located adjacent to the Princes Highway, South Nowra. Access to and from the Princes Highway from the Project Site is via the sealed site entrance. The site entrance at the Project Site boundary is approximately 10m wide with 1m wide, unsealed shoulders each side.

The site entrance gate is approximately 8m wide. The site entrance at the point where it merges with the Princes Highway is approximately 52m wide. The distance from the site entrance gate to the edge of the Princes Highway is 28m.

All traffic entering and departing the Project Site does so via the site entrance.

4.4.2.2 Local Road Network

Local roads surrounding the Project Site are indicated on **Figure 4.19**. The Princes Highway is classified by the Roads and Traffic Authority (RTA) as a "State Road." In the vicinity of the Project Site, the Princes Highway is a two lane road, with one lane in each direction and a variable width bitumen sealed shoulder. The Highway, in the vicinity of the site entrance is approximately 6.2m wide between edge line white lines. The sealed western and eastern shoulders in the vicinity of the site entrance are approximately 2.8m and 4.5m wide respectively. The speed limit on the section of the Princes Highway adjacent to the Project Site is 80km/h.

Local roads in the vicinity of the Project Site include (**Figure 4.19)**.

- Central Avenue which intersects the Princes Highway approximately 700m north of the site entrance. The intersection of Central Avenue and the Princes Highway is a two lane roundabout.
- Links Road which intersects the Princes Highway approximately 625m north of the site entrance. The intersection of Links Road and the Princes Highway is a T-intersection.
- Warra Warra Road which intersects the Princes Highway approximately 550m south of the site entrance. The intersection of Warra Warra Road and the Princes Highway is a T-intersection.
- Btu Road which intersects the Princes Highway approximately 2.3km south of the site entrance. The intersection of Btu Road and the Princes Highway is a T-intersection.

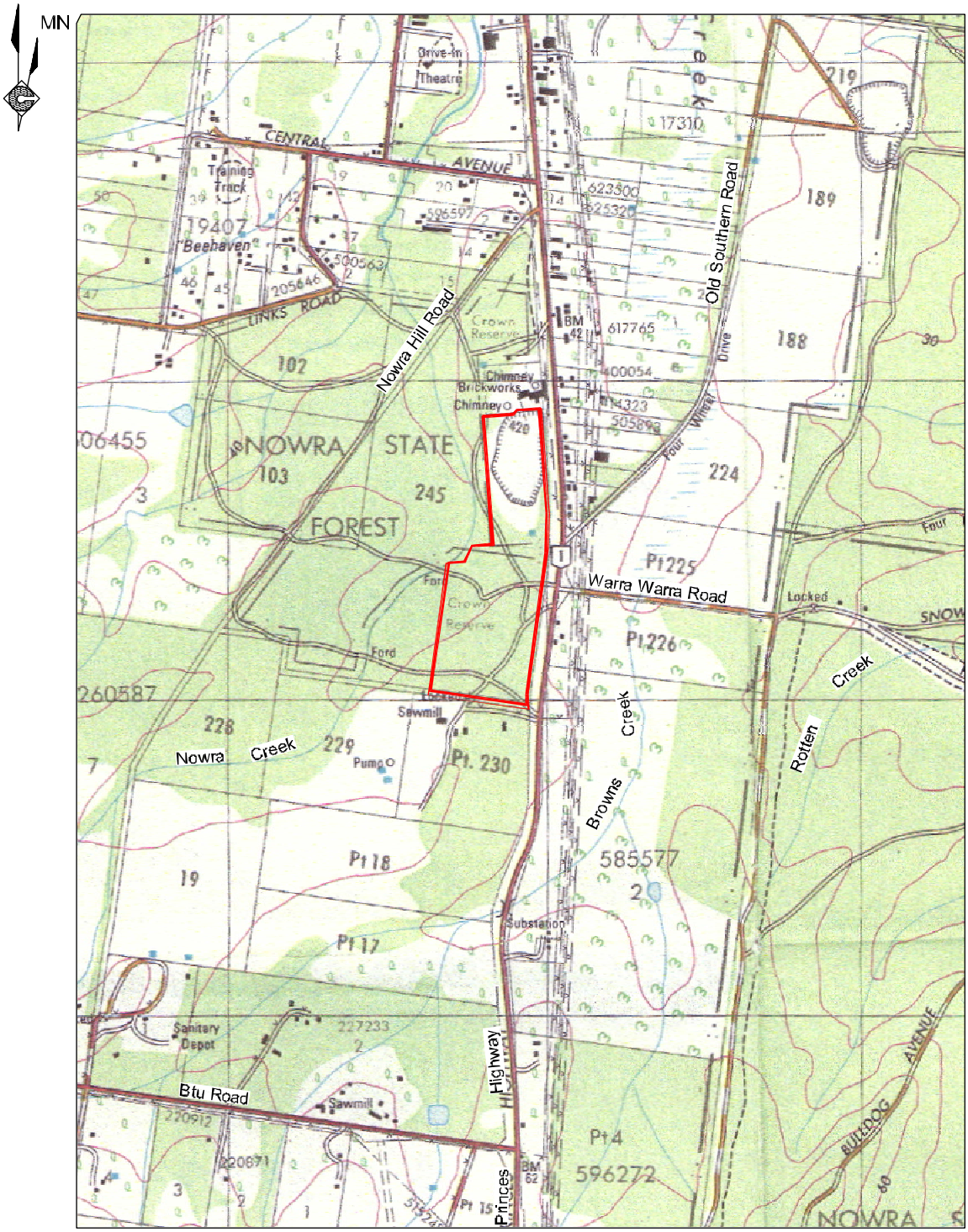


Figure 4.19
LOCAL ROAD NETWORK

4.4.3 Existing and Projected Princes Highway Traffic Levels

The document *Traffic Volume Data for Southern Region* published by the RTA in 2003 provides the results of traffic counts undertaken in 1997, 2000 and 2003. **Table 4.23** presents the adjusted average daily traffic data from surveys conducted in the vicinity of the bridge over Browns Creek, approximately 2.5km north of the Project Site. The data presented in **Table 4.23** indicates an annual traffic growth rate of approximately 3.5%. **Table 4.23** also presents estimated 2007 and 2017 traffic levels based on an annual growth traffic growth rate of 3.5%.

Table 4.23
Measured and Estimated Traffic Levels – Princes Highway

Year	Vehicles per Day
1997	21 443
2000	23 144
2003	26 366
2007	30 247
2017	42 667
Source: John Coady (2007) – modified after Table 4.1.	

In addition, a traffic count was undertaken between 7.00am and 7.00pm on 29 October 2007 at the intersection of the Princes Highway with Central Avenue (**Figure 4.19**). The detailed results of the traffic count are presented as Appendix 3 of John Coady (2007). In summary, during the survey period, on the section of the Princes Highway south of the intersection with Central Avenue, a total of 16 167 vehicles comprising 8 347 vehicles southbound and 7 820 northbound were counted.

4.4.3.1 Existing Project-related Traffic Levels

Table 4.24 presents the monthly Project-related laden heavy vehicle movements and tonnages of material transported to and from the Project Site for the 12 month period to 30 June 2007. During that period, May 2007 was the busiest month, with 14 967t despatched from the Project Site and 6 827t imported to the Project Site, for a total of 21 794t. During that month a total of 1 443 heavy vehicle movements were recorded, comprising 761 rigid truck and 682 articulated truck movements. February 2007 was the least busy month, with 5 677t despatched from the Project Site and 2 588t imported to the Project Site for a total of 8 266t. During that month a total of 548 heavy vehicle movements were recorded, comprising 289 rigid truck and 259 articulated truck movements.

Table 4.24
Laden Heavy Vehicle Movements – 1 July 2006 to 30 June 2007

Month	Loaded Truck Movements (In & Out)			Net Tonnage		
	Rigid Truck Movements	Truck/Trailer Movements	Total Loaded Movements	Net Tonne In	Net Tonne Out	Total Net Tonnage
July	644	371	1015	4439	9735	14 174
August	854	619	1473	6223	13 646	19 869
September	525	396	921	4079	8944	13 023
October	409	610	1019	6382	13 995	20 377
November	396	499	895	3926	8609	12 535
December	458	451	909	4423	9701	14 125
January	299	268	567	2681	5880	8562
February	289	259	548	2588	5677	8266
March	324	291	615	2907	6376	9284
April	477	428	905	4279	9384	13 664
May	761	682	1443	6827	14 967	21 794
June	745	668	1413	6682	14 653	21 336
Totals	**6181**	**5542**	**11 723**	**55 442**	**121 572**	**177 015**
Note 1: The 85th percentile month for the year is October (based on monthly tonnage).						
Note 2: The October Total Tonnage (20 377T) represents 11.5% of the Yearly Tonnage (121 572T).						
Note 3: During October, 40% of truck movements were rigid trucks, 60% were articulated vehicles.						
Source: John Coady (2007) – Table 1						

John Coady (2007) indicates that for the purposes of modelling heavy vehicle movements, October 2006 was assumed to be the 85th percentile month. During that month, 13 995t of quarry products were despatched from the Project Site and 6 382t of material imported to the Project Site, for a total of 20 337t. Average daily material despatched from or received at the Project Site during that month was 813t. A total of 1019 heavy vehicle movements were recorded during October 2006, comprising 409 rigid truck and 610 articulated truck movements. The average load per laden heavy vehicle movement during October 2006 was 20.0t.

A traffic survey was conducted at the site entrance from 7:00am to 7:00pm on 29 October 2007 to determine the composition of heavy and light vehicle movements to and from the Project Site. **Table 4.25** presents the results of the survey.

Table 4.25
Site Entrance Traffic Survey – 29 October 2007

	Daily	Quarry peak (1.00-2.00pm)	AM Peak (8.15-9.15am)	PM Peak (4.30-5.30pm)
Cars	31	1	6	4
Light Rigid Trucks (2 axle)	32	4	0	0
Heavy Rigid Trucks (3+ axles)	42	10	4	0
Articulated vehicles	30	7	0	0
TOTAL	**135**	**22**	**10**	**4**
Source: John Coady (2007) – Table 3.				

A total of 72 heavy vehicle movements were recorded comprising 42 rigid truck movements (21 return trips) and 30 articulated truck movements (15 return trips). The Proponent indicated that 712t and 4.5t were despatched from and received at the Project Site respectively on the day of the survey. The average load per laden heavy vehicle was 19.7t. The material despatched from and received at the Project Site is 87.3% of the average daily material movements during October 2006.

4.4.3.2 Proposed Princes Highway Upgrade

The Proponent understands that the RTA proposes to upgrade the section the Princes Highway in the vicinity of the Project Site as follows.

- Widening of the road from one lane in each direction to two lanes in each direction.
- Installation of a wire rope safety barrier on the median strip between opposing lanes of traffic.
- Installation of a two lane roundabout at the intersection of Warra Warra Road and the Princes Highway.
- Installation of a heavy vehicle inspection bay adjacent to the Princes Highway.

The proposal, to the Proponent's knowledge, has not been finalised and is not publicly available. As a result, the traffic and transportation assessment has assessed the impacts of the Project based on the current condition of the Princes Highway.

4.4.4 Mitigation Measures and Management Procedures

The Proponent would implement the following traffic and transportation-related mitigation measures and management procedures to minimise the impact of the Project on motorists and others in the vicinity of the Princes Highway and other local roads.

- Transportation operations would adhere to the approved hours of operation, namely, no heavy vehicles would enter or leave the site outside the designated hours of 7:00am to 6:00pm, Monday to Friday and 7:00am to 4:00pm on Saturday. The exception to this would be unladen trucks, of which a maximum of three may enter the Project Site between 6:00am and 7:00am Monday to Saturday, with a further three returning to the Project Site between 6:00pm and 8:00pm Monday to Friday or;00pm and 6:00pm Saturday .
- All speed limits would be strictly adhered to.
- The Proponent would establish a complaints register, advertised in the local telephone directory, to allow concerned residents or motorists to report any traffic-related incidents, unsafe operation or general concern. The Proponent would investigate all complaints and act decisively on substantiated incidents.

- All entering and exiting laden trucks would pass over the weighbridge to ensure all weight restrictions are adhered to.
- The Proponent would increase the width of the sealed section of the site entrance at the Project Site boundary to 11m and the width of the site entrance gate to the full width of the sealed section of the site entrance at the Project Site boundary prior to the amount of quarry products despatched from the Project Site exceeding 250 000t.
- The Proponent would seal a 150m section of the site access road and construct a wheel wash facility to limit the tracking of material onto the Princes Highway prior to the amount of quarry products despatched from the Project Site exceeding 250 000t per year.
- The Proponent would ensure all loads are covered and would provide a safe tarping area for this purpose to minimise dust, particulate matter and debris emissions.
- The Proponent's expectations of all truck drivers would be explicitly recorded in a Driver's Code of Conduct that each driver would be required to sign prior to leaving site for the first time.

The transport operation, and the Project in general, would be operated in an open and transparent fashion. Through the establishment of the complaints register and ongoing consultation with the local community, the Proponent would maintain and improve its performance against all transport-related criteria.

4.4.5 85th Percentile Traffic Movements

4.4.5.1 Existing 85th Percentile Traffic Movements

Annual laden heavy vehicle movements for the 12 months to 30 June 2007 are presented in **Table 4.24**. In addition, the results of a traffic survey undertaken on 29 October 2007 are presented in **Table 4.25**.

The existing 85th percentile traffic movements for the current operation of the Nowra Brickworks Quarry were determined as follows and are presented in **Table 4.26**.

- The number car movements recorded during the traffic survey were adopted.
- The number of light truck (2 axle) movements recorded during the traffic survey were increased by 13.7%.
- The number of heavy truck movements recorded during the survey were adopted.

Table 4.26
Existing 85th Percentile Traffic Movements

	Daily	Quarry peak (1.00-2.00pm)	AM Peak (8.15-9.15am)	PM Peak (4.30-5.30pm)
Cars	31	1	6	4
Light Rigid Trucks (2 axle)	36	5	0	0
Heavy Rigid Trucks (3+ axles)	42	10	4	0
Articulated vehicles	30	7	0	0
TOTAL	**139**	**23**	**10**	**4**
Source: John Coady (2007) – Table 4				

4.4.5.2 Proposed 85th Percentile Traffic Movements

The proposed 85th percentile traffic movements were determined as follows and are presented in **Table 4.27**.

- The number car movements was increased by 44% to reflect the proposed increase in the number of employees.
- The number of light truck (2 axle) movements was increased by 400% to reflect the proposed increase in products despatched from approximately 125 000t per year to 500 000t per year.
- The number of heavy truck movements (3 axle and articulated) was increased to reflect the proposed increase in products despatched from approximately 125 000t per year to 500 000t per year.

Table 4.27
Proposed 85th Percentile Traffic Movements

	Daily	Quarry peak (1.00-2.00pm)	AM Peak (8.15-9.15am)	PM Peak (4.30-5.30pm)
Cars	45	2	9	6
Light Rigid Trucks (2 axle)	144	20	0	0
Heavy Rigid Trucks (3+ axles)	134	34	12	0
Articulated vehicles	96	22	0	0
TOTAL	**419**	**78**	**21**	**6**
Source: John Coady (2007) – Table 8				

4.4.6 Traffic Impact Assessment

4.4.6.1 Introduction

Potential traffic and transportation-related impacts of the Project include:

- increased traffic levels on the Princes Highway; and
- the operation of the site entrance.

The following subsections address each of these issues separately.

4.4.6.2 Increased Traffic Levels

Table 4.28 presents the estimated 2007 and 2017 traffic levels for the Princes Highway and the proposed additional Project-related 85th percentile traffic movements. This table indicates that the proposed additional Project-related traffic movements would increase traffic levels on the Princes Highway by 0.1% based on 2007 traffic levels and 0.06% based on 2017 traffic levels. John Coady (2007) contends that these increases are insignificant.

Table 4.28
Increased Traffic Levels Results

Year	Estimated Traffic Level (vehicles per day)	Total 85th Percentile Traffic Movements			Increase
		Existing	Proposed	Additional	
2007	30 247	139	419	280	0.1%
2017	42 667	139	419	280	0.06%
Source: John Coady (2007) – Modified after Section 6					

4.4.6.3 Construction of the Site Entrance

The design of the existing site entrance is described in Section 4.4.2.1. John Coady (2007) indicates that in order to accommodate the proposed increase in heavy vehicle movements, the site entrance would be required to be constructed to the following standard.

- Width at the Project Site boundary – 11m.
- Width at the edge of the Princes Highway – 40m.

The existing site entrance exceeds or would be modified to exceed these requirements.

In addition, should the proposed upgrade of the Princes Highway proceed, a new site entrance designed to meet the specification of the RTA at that time would be constructed as part of that project.

4.4.6.4 Operation of the Site Entrance

The operation of the site entrance was assessed using the INTANAL traffic model. Four scenarios were assessed as follows.

- Scenario T1 - 2007 traffic flows on the existing Princes Highway (2-lane) and the existing 85th percentile Project-related traffic movements.
- Scenario T2 - 2007 traffic flows on the existing Princes Highway (2-lane) and the proposed 85th percentile Project-related traffic movements.
- Scenario T3 - 2017 traffic flows on the existing Princes Highway (2-lane) and the projected 85th percentile Project-related traffic movements.
- Scenario T4 – 2017 traffic flows on the proposed upgraded Princes Highway (4 lane) and projected 85th percentile Project-related traffic movements.

Table 4.29 presents the results of the site entrance impact assessment, a summary of which is presented below.

- Good operation of the site entrance is indicated for Scenarios 1 and 2.
- Satisfactory operation of the site entrance is indicated for Scenario T3, however, it is noted that the level of service between 8:15am and 9:15am is classified as "C", or "satisfactory, but accident study required." The total average vehicle delay during this period is estimated to be approximately 25 seconds. John Coady (2007) indicates that this primarily relates to delays for Project-related vehicles turning left out of the site entrance onto the Princes Highway.
- Good operation of the site entrance is indicated for Scenario T4.

Table 4.29
Site Entrance Impact Assessment Results

Scenario	Time of Day	Level of Service[1]	Degree of Saturation	Total Average Vehicle Delay (seconds)
Scenario T1	8:15am to 9:15am	B	0.05	12.7
	1:00pm to 2:00pm	A	0.06	7.1
	4:30pm to 5:30pm	A	0.01	8.1
Scenario T2	8:15am to 9:15am	B	0.1	12.7
	1:00pm to 2:00pm	A	0.2	8.0
	4:30pm to 5:30pm	A	0.02	8.9
Scenario T3	8:15am to 9:15am	C	0.2	24.9
	1:00pm to 2:00pm	B	0.28	11.7
	4:30pm to 5:30pm	B	0.02	12.8
Scenario T4	8:15am to 9:15am	A	0.05	7.4
	1:00pm to 2:00pm	A	0.14	5.5
	4:30pm to 5:30pm	A	0.02	5.6
Note 1: Level of Service A = good operation B = good operation with acceptable delays and spare capacity C = Satisfactory but accident study required.				
Source: Modified after John Coady (2007) – Tables 6.2, 6.3, 6.4 and 6.5.				

In summary, the while the anticipated level of service in 2017 for the operation of the existing site entrance would fall to "C" or "satisfactory but accident study required," it is likely that the Princes Highway upgrade (Scenario T4) would be complete by this time. As a result, John Coady (2007) contends that the operation of the site entrance throughout the life of the Project would be satisfactory.

4.5 AIR QUALITY

4.5.1 Introduction

The air quality assessment was undertaken by Heggies Pty Ltd. The resulting report, entitled *Nowra Brickworks Quarry, South Nowra – Air Quality Assessment,* is presented in full as Part 4 of the *Specialist Consultants Studies Compendium* and is referred to hereafter as "Heggies (2007)". This section of the *Environmental Assessment* provides a summary of that report.

4.5.2 Existing Air Quality Environment

4.5.2.1 Introduction

The term “dust”, or “particulate matter” (PM), is the term used to describe the range of particles in the air. Particulate matter exists naturally in the atmosphere (ie. dust from natural sources, sea-salt spray and pollens), but can also be increased through human activities such as vehicle exhausts, industrial processes, power stations, mining, farming, or smoke from heaters or bush fires.

Concentrations of particulate matter in the atmosphere need to be considered for a number of health and aesthetics reasons. Exposure to particulate matter can be associated with health impacts, with the likely risk of these impacts depending on a range of factors including the size, chemical make-up and concentration of the particles, as well as the general health of the individual person. In general, particles smaller than 10 micrometres (μm) may potentially enter sensitive parts of the lungs, potentially resulting in health impacts. However, particles larger than 10μm may settle on surfaces and may soil materials and degrade the aesthetic elements of the environment.

The following definitions are routinely used with respect to particulate matter.

- Total suspended particles (TSP) – all particles suspended in the air.
- Deposited dust - the weight of dust falling on a given area over a defined period of time (typically reported in g/m^2/month).
- PM_{10} – the concentration of all particles less than 10μm in diameter suspended in the air. Concentrations of PM_{10} are expressed in $\mu g/m^3$.
- $PM_{2.5}$ – the concentration of all particles less than 2.5μm in diameter suspended in the air. Concentrations of $PM_{2.5}$ are expressed in $\mu g/m^3$.

4.5.2.2 Dust Emission Sources

Existing sources of dust in the vicinity of the Project Site include:

- extraction-related activities within the Project Site;
- industrial operations in the vicinity of the Project Site, including the Nowra Brickworks and the saw mill adjacent to the northern and southern boundaries of the Project Site, as well as various industrial operations to the east of the Princes Highway;
- vehicle movements on the Princes Highway, particularly entraining material that may have been transported onto the sealed surface of the highway from the highway shoulders and elsewhere;
- vehicle movements on unsealed roads and tracks in the vicinity of the Project Site;
- agricultural operations in the vicinity of the Project Site, including movement of livestock, ploughing, etc; and
- wind action on disturbed areas within and surrounding the Project Site (**Figure 4.5)**.

4.5.2.3 Existing Dust Deposition Rates

Three dust deposition gauges were installed within the Project Site at locations depicted on **Figure 4.20.** The deposited dust gauges were positioned with the Project Site and not at neighbouring residences. Heggies (2007) advise that deposited dust gauges located at neighbouring residences would be unlikely to accurately reflect the dust emissions from the Project Site for the following reasons.

- The presence of the existing vegetated perimeter bunds limits the transportation of airborne dust beyond the boundaries of the Project Site.
- Dust emission sources un-related to the Nowra Brickworks Quarry in the vicinity of the Project Site would contribute particulate material to the deposited dust measured at residences surrounding the Project Site.

As a result, the deposited dust gauges were erected within the Project Site to enable more effective monitoring of dust deposition rates attributable to the Proponent's extraction-related operations.

Dust deposition monitoring commenced on 23 August 2007. The results of the monitoring program from 23 August to 19 October 2007 are presented in **Table 4.30.**

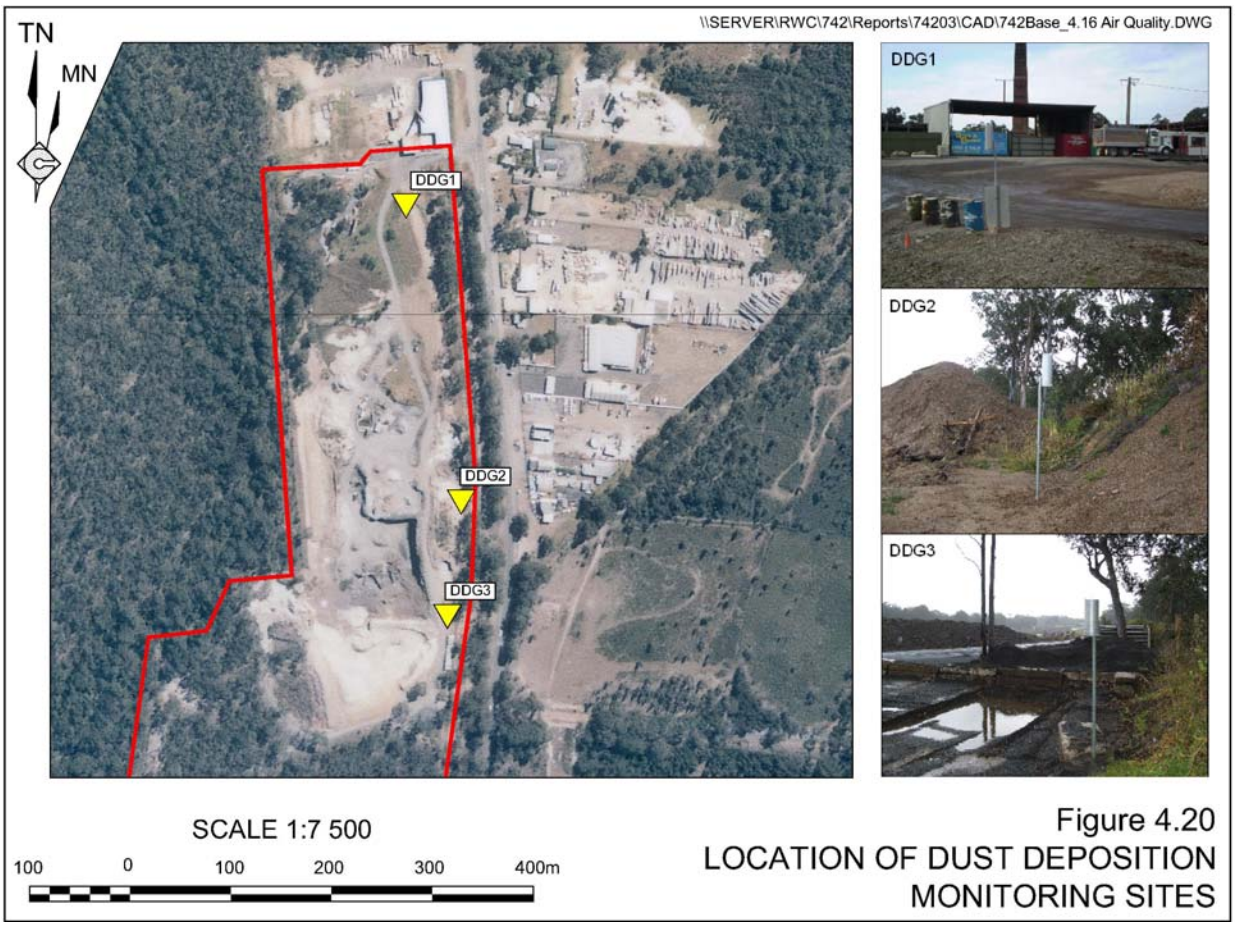


Table 4.30
Deposited Dust Rates

Sampling Period	Dust Deposition Rate (g/m²/month)		
	DDG1	DDG2	DDG3
23 Aug – 23 Sep 2007	3.5	1.6	0.7
24 Sep – 19 Oct 2007	5.3	3.2	1.1
Source: Heggies (2007) – Table 11			

4.5.2.4 Existing PM_{10} Concentration

Ambient PM_{10} concentrations are measured using a high-volume sampler. Such a high-volume sampler was used to monitor ambient PM_{10} concentrations at the Nowra Sewage Treatment Works, approximately 6km to the north-northwest of the Project Site (**Figure 4.1**), between July 1996 and December 2001. Maximum daily and annual average PM_{10} concentrations recorded during this period are provided in **Table 4.31**.

Table 4.31
PM_{10} Concentrations – Nowra Sewage Treatment Works

	PM_{10} Concentration (µg/m³)	
Year	**Maximum Daily Average**	**Annual Average**
1996 (Jul – Dec)	42.1	14.4
1997	39.0	13.9
1998	29.5	10.6
1999	44.0	8.4
2000	23.6	10.0
2001	25.4	10.0
1997 - 2001	**44.0**	**10.8**
Source: Heggies (2007) – Table 10		

4.5.2.5 Existing $PM_{2.5}$ Concentration

The closest $PM_{2.5}$ monitoring station with publicly available monitoring data is a monitoring station operated by the DECC at Wollongong, approximately 60km to the north-northeast of the Project Site. Data available for 2005 indicates:

- the maximum daily $PM_{2.5}$ concentration was 25.2µg/m^3; and
- the average annual $PM_{2.5}$ concentration was 8.7µg/m^3.

4.5.3 Air Quality Assessment Criteria

The air quality assessment criteria that would be adopted for the Project are presented in **Table 4.32** and have been drawn from criteria identified by the DECC and the National Environment Protection Council.

4.5.4 Mitigation Measures and Management Procedures

The Proponent would undertake the following air quality mitigation measures and management procedures throughout the life of the Project.

- Utilise water sprays and water trucks in all areas of potential dust lift-off to minimise potential dust emissions.
- Utilise a chemical dust-lift off suppression system along unsealed roads, tracks and working areas, as well as within the processing plant(s) throughout the life of the Project.

Table 4.32
NSW DECC Dust Assessment Criteria

Pollutant	Averaging period	Assessment Criteria
Deposited dust[a]	Annual Annual	2 g/m^2/month[b] 4 g/m^2/month[c]
PM_{10}[a]	24 hours Annual	50$\mu g/m^3$ 30$\mu g/m^3$
$PM_{2.5}$[d]	24 hours Annual	25$\mu g/m^3$ 8$\mu g/m^3$
Note a: Assessment criteria from DEC (2005) Note b: Dust deposition assessment criteria attributable to the Project alone. Note c: Dust deposition assessment criteria attributable to the Project and other sources. Note d: Advisory reporting standard from NEPC (2003).		
Source: Heggies (2007) – Table 4.		

- Stabilise the unsealed shoulders of the site access road.
- Utilise efficient mist sprays and wind sheltering equipment on processing equipment.
- Maintain a maximum speed limit within the Project Site of 10km/h.
- Install a wheel wash on the site access road to limit tracking of material onto the Princes Highway.
- Disturb only the minimum area required for operation of the quarry during the subsequent 12 months.
- Stabilise soil stockpiles to be in place for more than 3 months through the application of cleared vegetation, hydroseeding, hydromulching or equivalent.
- Minimise the creation of minor roads and access tracks.
- Utilise dust aprons, dust extraction systems and/or water injection or sprays during drilling operations, as required.
- Adequately stem all blast holes with aggregates.
- Commence rehabilitation as soon as practicable once an area is no longer required for extraction or placement-related operations.
- Maintain a dust deposition monitoring program for the life of the Project, albeit re-locating the gauges, where and when required.

4.5.5 Assessment Methodology

4.5.5.1 Modelling Methodology

The air quality assessment utilised the Ausplume Gaussian Plume Dispersion Model software (Version 6.0) developed by the Environmental Protection Agency of Victoria. This software has been approved by the DECC for assessing simple, near-field applications in NSW, where coastal effects and complex terrain are of no concern. Heggies (2007) state that this software is appropriate for assessing air quality impacts associated with the Project for the following reasons.

- The topography in the vicinity of the Project Site is flat to gently undulating.
- The Bureau of Meteorology's automated weather station at HMAS Albatross is located approximately 5km to the south-southwest of the Project Site, and climatic conditions at the weather station are likely to be representative of those experienced at the Project Site.
- The potential atmospheric emissions associated with the Project would occur at or near the ground surface and are non-buoyant. As a result, potential impacts are likely to occur in the vicinity of the Project Site.

Input data used during the air quality assessment are provided in Section 3 and Appendix 2 of Heggies (2007).

4.5.5.2 Modelling Scenarios

Three operational scenarios were assessed as follows.

- Scenario A1 - Existing Operations.
- Scenario A2 - Proposed Operations – Existing Dust Control Measures.
- Scenario A3 - Proposed Operations – Additional Dust Control Measures.

In the absence of long-term monitoring data identifying the air quality impacts associated with the Nowra Brickworks Quarry, Scenario A1 was assessed to determine the performance of the existing quarry and establish a baseline with which to identify the potential incremental impacts associated with the Project. This scenario assumed a production rate of approximately 195 000t per year, with approximately 55 000t of material imported to the Project Site for recycling and blending purposes. It is noted that the assumed production rate is higher than the actual production rate, which for the 12 months to 30 June 2007, was approximately 121 500t.

Figure 4.21 identifies the location of the various emission sources used during the assessment of Scenarios A2 and A3. In summary, the following activities were assumed to be occurring within the Project Site during Scenarios A2 and A3.

- A production rate of approximately 500 000t per year.
- A rate of importation of materials for blending and recycling of approximately 155 000t per year.
- A rate of importation of VENM of approximately 200 000t per year.
- Vegetation clearing, land preparation and extraction of weathered shale within the southernmost section of the Project Site.
- Drilling, blasting, processing, loading and transportation of quarry products from an area to the north of the land preparation and weathered shale extraction operations.
- Placement of VENM within an area to the north of the extraction and processing area.
- Transportation of quarry products along an unsealed Site Access Road.

During Scenarios A1 and A2, existing dust suppression procedures were assumed. These include the use of:

- water sprays on processing equipment; and
- a water cart to water unpaved sections of the Site Access Road and other sections of the Project Site.

However, following identification of likely exceedances of the air quality assessment criteria, a third scenario was modelled. Scenario A3 assumed additional dust control measures would be implemented, including:

- use of a suitable chemical suppression system; and
- the timely removal of material deposited on the Site Access Road.

Potential air quality impacts were assessed for 13 receptors in the vicinity of the Project Site. **Table 4.33** presents a description of each modelled receptor and **Figure 4.22** presents the location of each modelled receptor.

It is noted that the air quality assessment included dust emissions for the entire length of the site access road. However, the Proponent intends to seal the section of the site access road from the site entrance for a distance of approximately 150m and would install a wheel wash facility. As a result, the air quality assessment is likely to be conservative.

Table 4.33
Description of Modelled Receptors

Receptor No.	Receptor Description
1	Residence B
2	Residence A
3	Saw mill
4	Brickworks
5	Butchery
6	Light industry (to east, pt 1)
7	Light industry (to east, pt 2)
8	Warra Warra Roundabout (proposed)
9	South Coast Correctional Centre (proposed)
10	Low density residential north
11	Low density residential NNW
12	Low density residential NW
13	Low density residential WNW
Source: Modified after Heggies (2007) – Table 15	

4.5.6 Impact Assessment

Table 4.34, 4.35 and **4.36** present the results of the air quality assessment. In addition, areas of exceedances of the air quality assessment criteria are presented on **Figure 4.23** and **4.24**.

Table 4.34
Predicted PM_{10} Concentrations and Dust Deposition Rates for Scenario A1

Receptor No.	Project Alone				Project and Other Sources		
	PM_{10} Concentration (µg/m³)			Dust Deposition (g/m²/month)	PM_{10} Concentration (µg/m³)		
	Maximum daily	Annual Average	Frequency of Exceedance of Daily PM_{10} Guideline (days/year)		Maximum daily PM_{10} Concentrations	Annual Average PM_{10} Concentrations	Frequencies of Exceedance of Daily PM_{10} Guideline (days/year)
Assessment Criteria	**50**	**30**		**4**	**30**	**50**	
1	14	1.5	0	0.76	30	11.4	0
2	12	0.2	0	0.06	31	10.1	0
3	6	0.2	0	0.06	25	10.1	0
4	33	5.1	0	3.46	46	15.0	0
5	19	5.1	0	3.72	34	15.0	0
6	30	5.4	0	3.63	42	15.3	0
7	33	6.1	0	2.64	41	16.0	0
8	13	1.4	0	0.27	33	11.3	0
9	14	0.6	0	0.16	27	10.5	0
10	5	0.4	0	0.17	25	10.3	0
11	4	0.2	0	0.06	25	10.1	0
12	2	0.1	0	0.02	25	10.0	0
13	2	0.1	0	0.03	25	10.0	0
Note: Numbers in **Bold** indicate an exceedance of the air quality assessment criteria.							
Source: Heggies (2007) – Table 15							

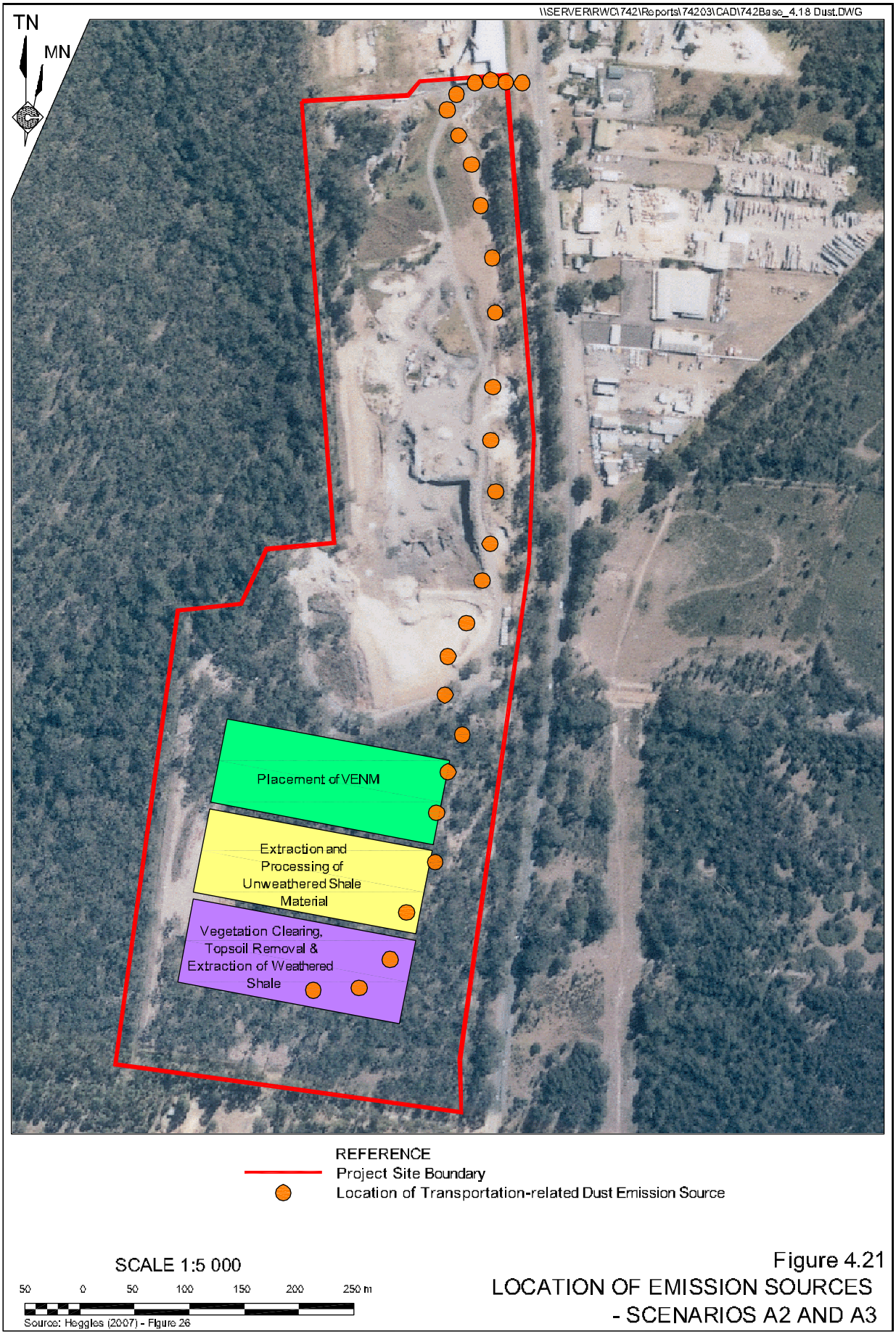
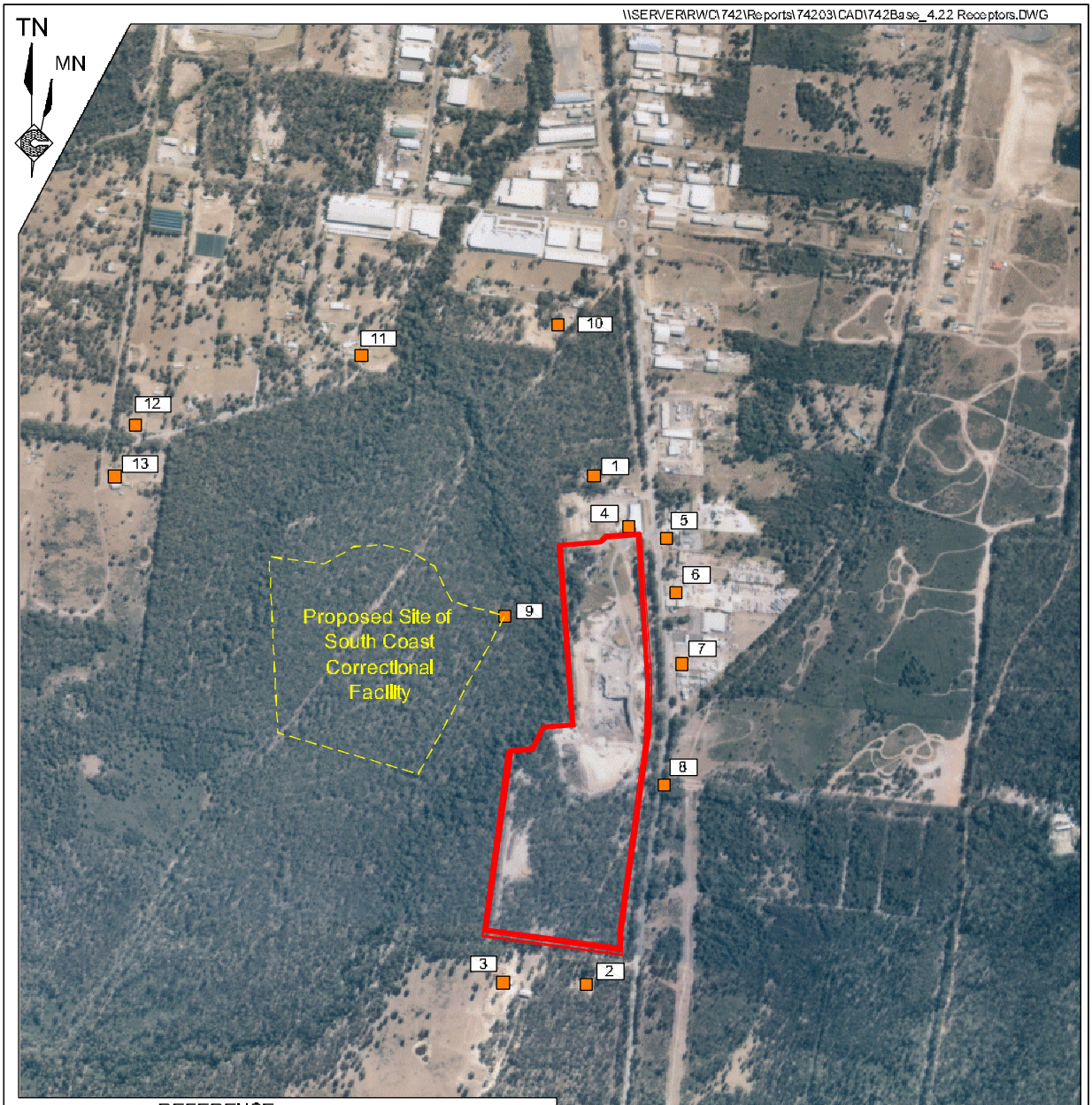


Figure 4.21
LOCATION OF EMISSION SOURCES - SCENARIOS A2 AND A3



REFERENCE
Project Site Boundary
1 Location of Modelled Receptor

Receptor No.	Description
1	Residence B
2	Residence A
3	Saw mill
4	Brickworks
5	Butchery
6	Light industry (to east, pt 1)
7	Light industry (to east, pt 2)
8	Warra Warra traffic circle (proposed)
9	South Coast Correctional Centre (proposed)
10	Low density residential north
11	Low density residential NNW
12	Low density residential NW
13	Low density residential WNW

SCALE 1:15 000

250 0 250 500 750 m

Base Photo Source: NSW Dept. of Lands (2007)

Figure 4.22
LOCATION OF MODELLED RECEPTORS

Table 4.35
Predicted PM_{10} Concentrations and Dust Deposition Rates for Scenario A2

Receptor No.	Project Alone				Project and Other Sources		
	PM_{10} Concentration (µg/m³)			Dust Deposition (g/m²/month)	PM_{10} Concentration (µg/m³)		
	Maximum daily	Annual Average	Frequency of Exceedance of Daily PM_{10} Guideline (days/year)		Maximum daily PM_{10} Concentrations	Annual Average PM_{10} Concentrations	Frequencies of Exceedance of Daily PM_{10} Guideline (days/year)
Assessment Criteria	**50**	**30**		**2**	**50**	**30**	
1	23	2.3	0	1.16	35	12.2	0
2	**94**	3.3	**1**	0.84	**113**	13.2	**1**
3	**63**	3.9	**2**	1.06	**70**	13.8	**4**
4	**68**	8.0	**2**	**5.41**	**71**	17.9	**8**
5	35	7.8	0	**5.73**	44	17.7	0
6	27	6.4	0	**4.27**	39	16.3	0
7	30	5.6	0	**2.42**	41	15.5	0
8	50	9.6	0	1.80	**61**	19.5	**5**
9	30	1.7	0	0.48	39	11.6	0
10	12	0.8	0	0.36	26	10.7	0
11	9	0.5	0	0.17	28	10.4	0
12	8	0.3	0	0.09	26	10.2	0
13	8	0.3	0	0.09	25	10.2	0

Note: Numbers in **Bold** indicate an exceedance of the air quality assessment criteria.
Source: Heggies (2007) – Table 16

Table 4.36
Predicted PM_{10} Concentrations and Dust Deposition Rates for Scenario A3

Receptor No.	Project Alone	Project and Other Sources					
		PM_{10} Concentration (µg/m³)			$PM_{2.5}$ Concentration (µg/m³)		
	Dust Deposition (g/m²/month)	Maximum daily	Annual Average	Frequency of Exceedance of Daily PM_{10} Guideline (days/year)	Maximum daily $PM_{2.5}$ Concentrations	Annual Average $PM_{2.5}$ Concentrations	Frequencies of Exceedance of Daily $PM_{2.5}$ Guideline (days/year)
Assessment Criteria	**2**	**30**	**50**		**8**	**25**	
1	0.6	27	11.00	0	5.36	13.20	0
2	0.6	34	11.60	0	5.78	**26.25**	**1**
3	0.8	42	12.00	0	5.90	19.23	0
4	**2.2**	39	14.20	0	5.81	14.00	0
5	2.0	31	14.60	0	5.87	13.94	0
6	2.0	27	12.70	0	5.56	13.50	0
7	1.7	27	12.40	0	5.57	13.35	0
8	**2.7**	36	14.50	0	6.04	14.33	0
9	0.3	25	10.80	0	5.39	14.28	0
10	0.2	25	10.30	0	5.24	13.20	0
11	0.1	25	10.20	0	5.21	13.20	0
12	0.1	25	10.10	0	5.18	13.20	0
13	0.1	25	10.10	0	5.18	13.20	0

Note: Numbers in **Bold** indicate an exceedance of the air quality assessment criteria.
Source: Heggies (2007) – Table 17

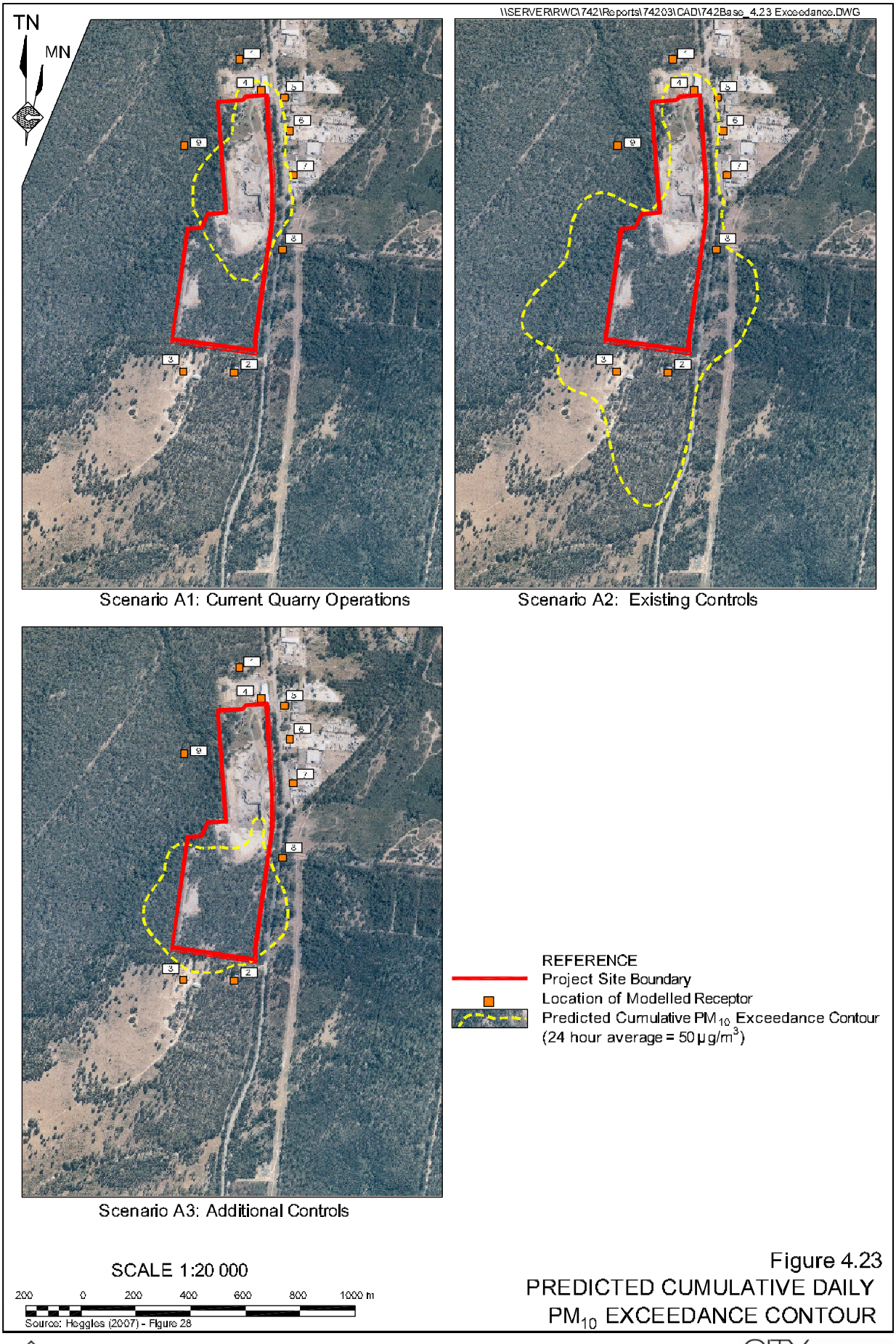
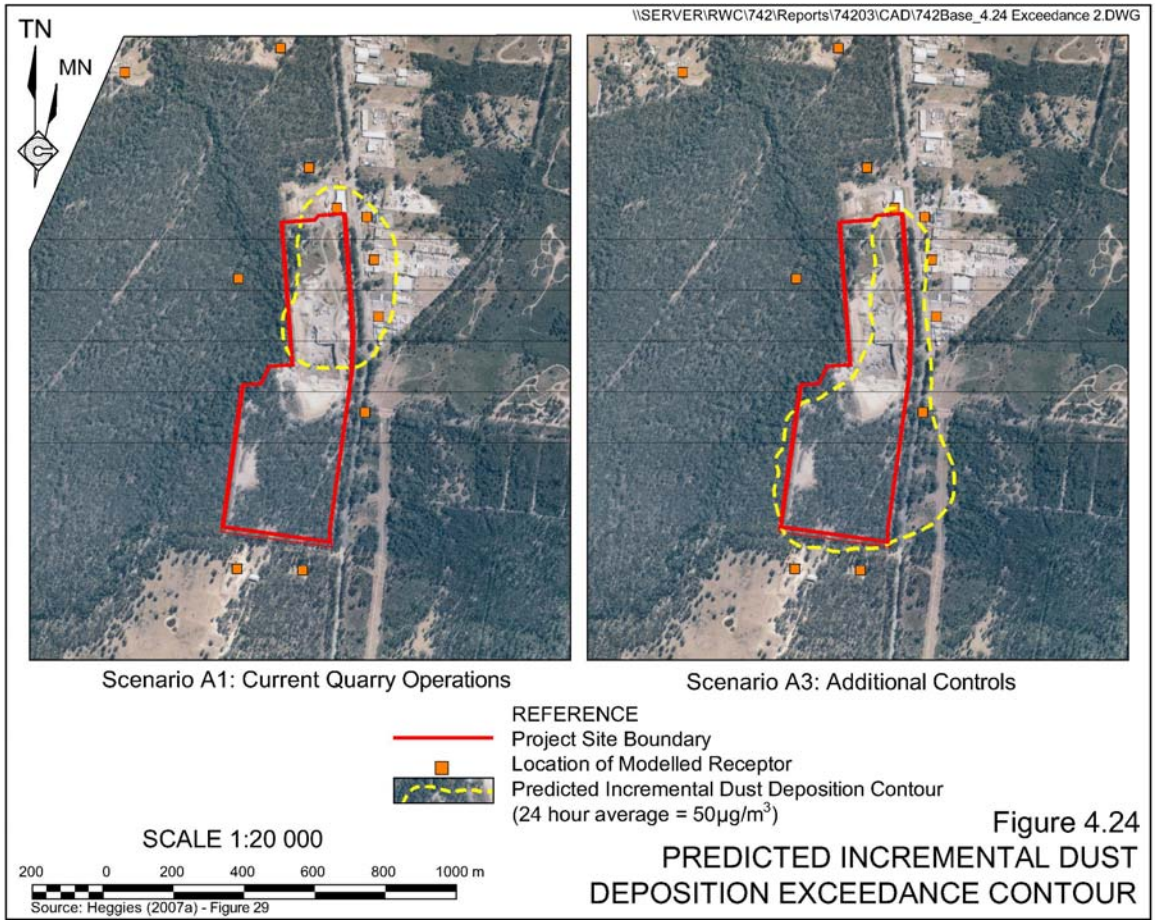


Figure 4.23
PREDICTED CUMULATIVE DAILY PM_{10} EXCEEDANCE CONTOUR



The results of the air quality assessment indicate that for Scenario A1, namely the existing quarry operations, no exceedances of the air quality assessment criteria are predicted.

The results of the air quality assessment for Scenario A2, namely an annual production rate of 500 000t with dust control measures limited to those measures currently employed by the Proponent, indicate the following exceedances of the air quality assessment criteria.

- The maximum daily PM_{10} concentration as a result of the Project alone would exceed the assessment criteria of 50µg/m^3 at three receptors, namely Residence A and the saw mill to the south of the Project Site and the Nowra Brickworks site to the north of the Project Site.
- The rate of dust deposition from the Project alone would exceed the assessment criteria of 2g/m^2/month at four receptor sites, namely at the Nowra Brickworks site to the north of the Project Site and at three receptors to the east of the Princes Highway.

In light of the air quality assessment results for Scenario A2, additional dust control measures were incorporated into the air quality modelling as Scenario A3.

The results of the air quality assessment for Scenario A3, namely an annual production rate of 500 000t with additional dust control measures identified in Sections 4.5.4 and 4.5.5.2, indicate the following minor exceedances of the air quality assessment criteria.

- The rate of dust deposition from the Project alone would marginally exceed the assessment criteria of 2g/m^2/month at two receptor sites, namely at the Nowra Brickworks site adjacent to the northern boundary of the Project Site (2.2g/m^2/month) and at the proposed Warra Warra Road roundabout (2.7g/m^2/month) adjacent to the eastern boundary of the Project Site.
- The maximum cumulative daily $PM_{2.5}$ concentration would exceed the assessment criteria of 25µg/m^3 at one receptor, namely Residence A to the south of the Project Site (26.25µg/m^3).

The air quality assessment for Scenario A3 is likely to be a conservative assessment of the likely impacts because it would be unlikely that the Project would produce quarry products at the maximum rate of production of 500 000t per year, while concurrently receiving VENM the maximum rate of 200 000t per year. As a result, the actual air quality impacts are likely to be less than the assessed impacts, and, as a result, as the anticipated air quality exceedances are relatively minor, the likely actual air quality impacts are likely to be less than the assessment criteria.

In addition, the receptors that would experience dust deposition rates in excess of the assessment criteria are in two of the three anticipated cases a commercial premise and a public road, ie. the receptors are not residential receptors.

In addition, the $PM_{2.5}$ assessment criteria have been drawn from advisory reporting standards specified within *National Environmental Protection Measure for Ambient Air Quality* published by the National Environment Protection Council in 2003. As a result, the criteria do not form a component of the DECC Assessment Criteria and have been provided for information purposed only.

Finally, as identified in Section 4.6.7 and 4.7.6, Project-related noise and blasting impacts are also likely to exceed the assessment criteria at Residence A. As a result, the Proponent would undertake to negotiate a suitable arrangement with the owner of Residence A prior to completing Stage 1 of the Project (see **Figure 2.5**).

4.5.7 Monitoring

The following air quality and meteorological monitoring program would be implemented for the life of the Project.

- The existing network of deposited dust monitoring gauges would be maintained, with additional dust deposition gauges erected, or the existing gauges relocated, as extraction-related activities progress to the south.

- A meteorological station capable of measuring temperature at the surface and at a height of 10m, wind direction and speed and rainfall would be erected within the Project Site within 6 months of project approval being received.

The results of the monitoring program would be regularly reviewed to ensure that the data being collected is meaningful. Operating and management measures would be modified on the basis of this monitoring, where appropriate. The results of the monitoring program would be presented in the Annual Environmental Management Report prepared for the Department of Primary Industries – Mineral Resources and Department of Planning.

4.6 NOISE

4.6.1 Introduction

The noise assessment was undertaken by Heggies Pty Ltd. The resulting report, entitled *Nowra Brickworks Quarry, South Nowra – Noise and Blasting Assessment,* is presented in full as Part 5 of the *Specialist Consultants Studies Compendium* and is referred to hereafter as "Heggies (2008)". This section of the *Environmental Assessment* provides a summary of that report.

4.6.2 Environmental Noise Control General Objectives

4.6.2.1 Industrial Noise Objectives

The Department of Environment and Climate Change (DECC), as the former Environment Protection Authority, released the State's Industrial Noise Policy (INP) in January 2000. The INP provides a framework and process for deriving noise criteria for project approvals and development consents under the *Environmental Planning and Assessment Act 1979* and limits specified in Environment Protection Licences under the *Protection of the Environment Operations Act 1997* (POEO Act). The proposed continuation and expansion of extractive operations at the Nowra Brickworks Quarry is a scheduled activity under Schedule 1 of this latter Act.

The policy objectives of the INP are to:

- establish noise criteria that would protect the community from excessive intrusive noise, and preserve amenity for specific land uses;
- use these criteria as the basis for deriving Project-specific noise criteria;
- promote uniform methods to estimate and measure noise impacts, including a procedure for evaluating meteorological effects;

- outline a range of mitigation measures that could be used to minimise noise impacts;
- provide a formal process to guide the determination of feasible and reasonable noise limits for consents or licences that reconcile noise impacts with the economic, social and environmental considerations of industrial development; and
- carry out functions relating to the prevention, minimisation and control of noise from premises scheduled under the POEO Act.

The INP provides non-mandatory procedures for setting acceptable intrusive and amenity noise levels for various localities, as well as guidelines for assessing noise impacts from on-site noise sources. It also provides non-mandatory cumulative noise assessment guidelines by setting acceptable and maximum cumulative amenity levels for all industrial (ie. non-transport related) noise in an area.

4.6.2.2 Road Traffic Noise Objectives

Road traffic noise within the Project Site has been assessed as an operational or industrial noise source. However, on public roads, different noise assessment criteria apply to Project-related vehicles.

In June 1999, the DECC (then the EPA) issued a document entitled "*Environmental Criteria for Road Traffic Noise*" (ECRTN) which controls off-site traffic-related noise impacts associated with particular developments and defines noise criteria based on the type of road and identifies procedures to be implemented where those criteria are already exceeded.

4.6.3 Existing Noise Environment

4.6.3.1 Introduction

Noise levels in the vicinity of the Nowra Brickworks Quarry are influenced by a range of sources including traffic on the Princes Highway, industrial noise from industrial and commercial operations to the east and north of the Project Site, noise from the Nowra Brickworks Quarry and naturally occurring noise, including noise from wind in trees, insects and birds.

In order to characterise the existing noise environment, ambient noise measurements were undertaken at three locations in the vicinity of the Project Site using unattended (two locations) and operator-attended (three locations) techniques.

4.6.3.2 Unattended Noise Monitoring

Unattended noise monitoring was undertaken at the following locations as indicated on **Figure 4.25**.

- Residence C - 80 Links Road.
- Residence D - 371 Old Southern Road.

Monitoring was undertaken from 7:30pm on 24 July 2007 to 4:15pm on 25 July 2007 using automated noise loggers to continuously record the ambient noise levels in 15 minute intervals. Operations within the Nowra Brickworks Quarry commenced at 12:00 noon on 25 July 2007. As a result, the ambient noise environment prior to that time was measured in the absence of quarry operations.

The results of the noise monitoring were processed in accordance with the procedures contained in the INP. **Table 4.37** presents the measured ambient noise environment at both monitoring locations.

Table 4.37
Measured Ambient Noise Environment[1]

Monitoring Location	Daytime 7.00am - 6.00pm		Evening 6.00pm - 10.00pm		Night 10.00pm - 7.00pm	
	L_{A90}[2]	L_{Aeq}[3]	L_{A90}[2]	L_{Aeq}[3]	L_{A90}[2]	L_{Aeq}[3]
Residence C	39	48	36	42	31	41
Residence D	46	51	41	45	35	45

Note 1: Units = dB(A) re 20µPa.
Note 2: L_{A90} = the lowest 10 percent value of the 15 minute background noise level measurements taken over the assessment period.
Note 3: L_{Aeq} = the logarithmic average of the 15 minute sample in each assessment period, excluding noise identified as extraneous noise.
Source: Heggies (2008) – Table 1

4.6.3.3 Attended Noise Monitoring

Attended noise monitoring was undertaken on the morning of 25 July 2007 at Residences A, C and D. The background noise levels at these locations, in the absence of noise emissions from the Nowra Brickworks Quarry, were controlled by distant traffic noise. **Table 4.38** presents the results of the attended noise monitoring survey.

4.6.4 Noise Assessment Criteria

4.6.4.1 Construction Noise Assessment Criteria

As all land preparation activities would be undertaken as part of the operational phase of the Project, no construction noise assessment has been undertaken.

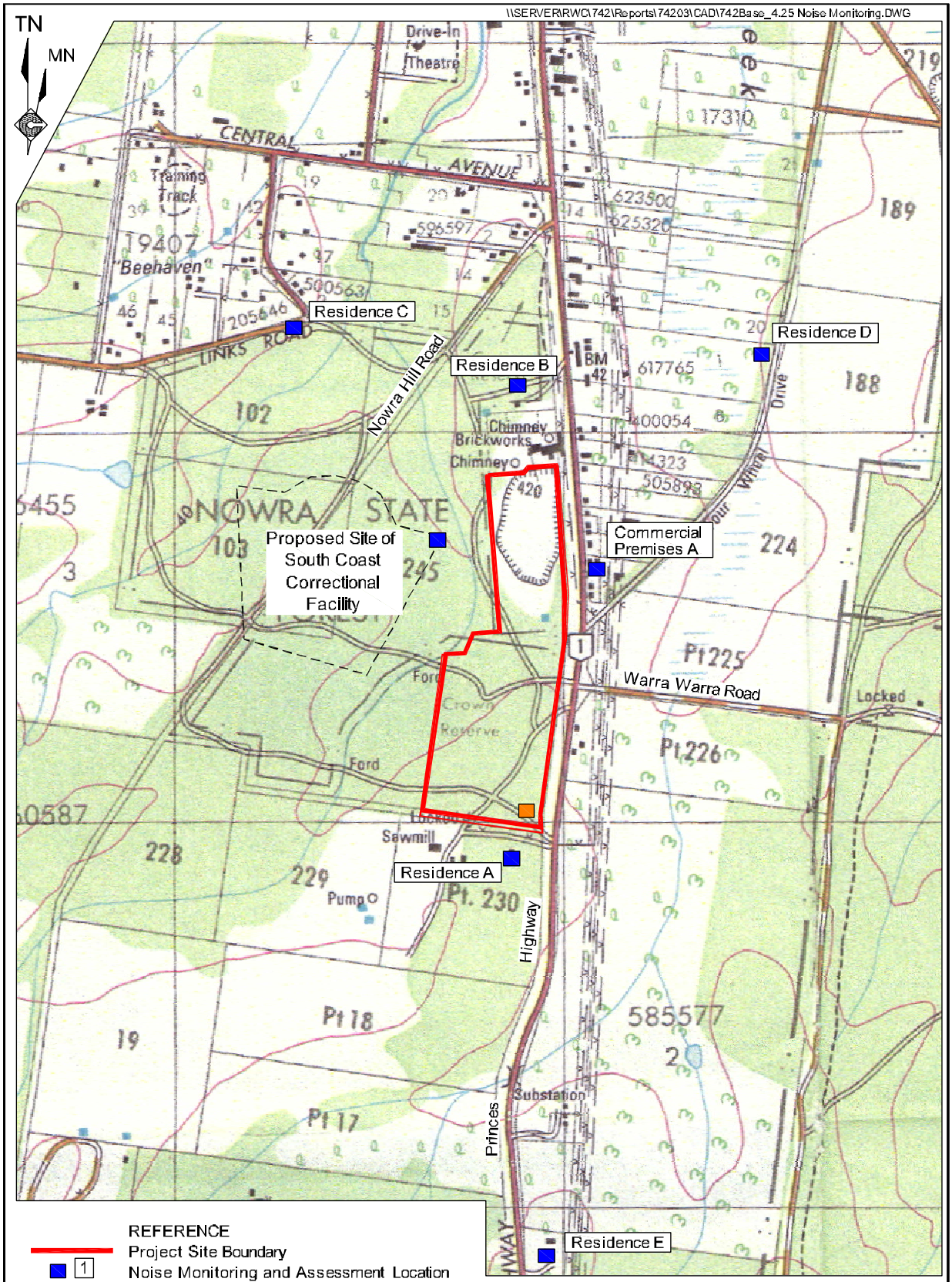


Figure 4.25
NOISE AND BLASTING MONITORING AND ASSESSMENT LOCATIONS

Table 4.38
Attended Ambient Noise Survey Results – 25 July 2007

Location #	Sample Time	Noise Level (dB(A))				Comments
		L_{Aeq} (15min)	L_{A1} (15min)	L_{10} (15min)	L_{A90} (15min)	
Residence A	11:39 am	52	59	53	47	Ambient dominated by Princess Hwy traffic, saw mill and on occasion, birds.
	14:35 pm[1]	52	57	54	48	Ambient dominated by Princess Hwy traffic, birds. Sawmill 54dB(A) to 56dB(A).
Residence C	8:38 am	46	56	46	41	Ambient dominated distant traffic, birds, occasional reversing alarms from the north.
	11:06 am	49	61	51	40	Ambient by distant traffic, birds, wind in trees.
Residence D	9:06 am	49	55	51	46	Ambient dominated distant traffic, birds, frogs dumping of aggregate at the concrete batching plant to the west.
	10:27 am	50	60	50	44	Ambient dominated distant traffic, birds, Helicopter 55dB(A) to 60dB(A). Traffic typically 45dB(A) to 47dB(A).

Note 1 The Nowra Brickworks Quarry was operational after 12 noon on 25 July 2007. #See **Figure 4.25**
Source: Heggies (2008) – Table 2

4.6.4.2 Operational Noise Assessment Criteria

In order to assess the noise-related impacts of the Project, noise levels were predicted at six representative sensitive receivers around the Project Site. The assessed noise sensitive receivers are described below and are presented on **Figure 4.22**.

- Residence A – the closest noise sensitive-receiver to the south of the Project Site.
- Residence B – the closest noise sensitive-receiver to the north of the Project Site.
- Residence C – this residence is considered to be representative of residences on Links Road and Central Avenue.
- Residence D – This residence is considered to be representative of residences on Old Southern Road.
- Residence E - This residence is located approximately 2km to the south of the Project Site entrance and approximately 85m to the east of the Princes Highway. This residence is the closest residence to the highway in the vicinity of the Project Site and was used to assess the Project-related road traffic noise impacts.
- Proposed South Coast Correctional Facility (SCCF) – the closest point of the proposed SCCF to the Project Site was selected to be representative of noise sensitive receivers within the facility.

It is noted that the intrusive noise criteria was not determined for the SCCF because the nature of the facility is markedly different to that of a residence, namely, the facility would have limited windows facing the Project Site, would be constructed of heavier materials that most residences and would generate its own noise emissions that would be significantly higher than the those generated at a residence. As a result, the amenity criteria was adopted as the assessment criteria for the SCCF as described below.

In order to achieve the objectives of the INP, the Policy describes procedures for establishing an Intrusive and an Amenity Noise Criteria.

The Intrusive Noise Assessment Criteria is the Rating Background Level (RBL) plus 5dB(A). The RBL is the L_{A90} background noise levels in the absence of the noise source to be modelled. The Intrusive Noise Assessment Criteria for the Project are presented in **Table 4.40**.

The background noise environment at those assessment locations where the background noise levels were not measured was assumed based on the following criteria.

- Residence A – the background noise environment was assumed to be the same as for Residence D based on the similarity of the noise environment determined during the attended noise monitoring at these locations.
- Residence B – the background noise environment was assumed to be the same as Residences A and D based on the proximity of the residences to the Princes Highway.

An objective of the INP is to ensure that the cumulative or amenity noise levels ($L_{Aeq(period)}$) do not exceed an 'acceptable' or 'maximum' level appropriate for a particular locality and land use. In the present case, Heggies (2008) states that the land in the vicinity of the Project Site may be classified as "Suburban". In addition, Heggies (2009) state that the SCCF may be classified as a "Commercial Premises." The "acceptable" and "maximum" $L_{Aeq(period)}$ amenity noise levels, as stipulated by the INP, for the areas surrounding the Project Site are presented in **Table 4.39**.

Table 4.39
Recommended Amenity Industrial Noise Levels

Type of Receiver and Area	Time of Day	Recommended Noise Level dB(A)	
		Acceptable	Maximum
Suburban	Day	55	60
	Evening	45	50
	Night	40	45
Commercial Premises	When in Use	65	70

Source: Heggies (2008) – Table 3

Table 4.40 presents the intrusive and acceptable amenity noise assessment criteria for the Project based on the requirements of the INP. The INP states that the Project-specific Noise Assessment Criteria is the lower of the Intrusive and the Amenity Assessment Criteria (**Table 4.40)**.

Table 4.40
Project-specific Noise Assessment Criteria

Assessment Location #	Intrusive Noise Assessment Criteria (L_{A90})			Amenity Noise Assessment Criteria ($L_{Aeq(day)}$)		
	Day[1]	Evening[2]	Night[3]	Day[1]	Evening[2]	Night[3]
Residence A	**51**	**45**	**45**	53	37	35
Residence B	**51**	**45**	**45**	53	37	35
Residence C	**44**	**41**	**40**	55	43	32
Residence D	**51**	**45**	**45**	53	37	35
SCCF	**-**	**-**	**-**	**65**	**65**	**65**

Note: **Bold** indicates the Project-specific Assessment Criteria. #See **Figure 4.25**
SCCF = proposed South Coast Correctional Facility
Note 1: Day = 7.00am to 6.00pm
Note 2: Evening = 6.00pm to 10.00pm
Note 3: Night = 10.00pm to 7.00am
Source: Heggies (2008) – Table 4

4.6.4.3 Road Transport Noise Assessment Criteria

The ECRTN identifies different classes of roads when allocating traffic noise assessment criteria. All traffic would enter and leave the Project Site via the Princes Highway. That road would be classified as an "arterial road" under the ECRTN.

The road transport noise assessment criteria for developments that would create additional traffic on existing arterial roads is as follows.

- Daytime (7.00am to 10.00pm) – 60dB(A) ($L_{Aeq(15\ hour)}$)
- Night-time (10.00pm to 7.00am) – 55dB(A) ($L_{Aeq(9\ hour)}$)

In addition, the ECRTN specifies that in all cases, development should not increase the existing L_{Aeq} noise levels by more than 2dB(A).

4.6.4.3.1 Mitigation Measures and Management Procedures

The following mitigation measures and management procedures would be implemented throughout the life of the Project.

- Limit the hours of operation of the Project to 7:00am to 6:00pm Monday to Friday and 7:00am to 4:00pm Saturday, with no operations on Sundays or Public Holidays.

- A maximum of three unladen trucks may arrive at the Project Site during each of the following time periods.
  - Between the hours of 6.00am and 7.00am, Monday to Saturday.
  - Between the hours of 6.00pm and 8.00pm, Monday to Friday.
  - Between the hours of 4.00pm and 6.00pm, Saturday.
- Use noise-mitigated mobile and processing equipment. The earthmoving and processing equipment used would meet the sound power levels presented in Section 7.2 of Heggies (2008).
- Undertake all processing operations within the deepest section of the quarry, where practicable, including the use of the hydraulic hammer.
- Maintain all mobile and processing equipment in accordance with the manufacturers' specifications.
- Preferential selection of equipment with lower sound power levels over equipment with higher sound power levels as equipment renewal is required
- Install frequency-modulated reversing alarms on mobile equipment progressively, as equipment is renewed.

4.6.5 Assessment Methodology

4.6.5.1 Operational Noise Assessment Methodology

Noise modelling was conducted using the 'SoundPLAN' noise prediction software. This software is based on the 'CONCAWE" industrial noise algorithm. This algorithm accounts for the octave band sound power levels of the sources, their heights, the distances to the receivers, the natural topography, noise barriers and buildings, air absorption, ground effects and meteorological conditions.

Initially, a three dimensional computer model was developed, including:

- the location of noise sources and receivers;
- the topography within and surrounding the Project Site; and
- the location of acoustical shielding effects of buildings, bund walls, etc.

The operational noise assessment included two components. The first component comprised an assessment of the daytime operation noise emissions with extraction, processing, product dispatch and transportation-related operations occurring. The second component assessed the operation of the proposed quarry between the hours of 6.00am and 7.00am and 6.00pm and 8.00pm when the only Project-related activity would be the arrival of a maximum of three unladen trucks during each period.

During the assessment of the daytime operation of the Project, three assessment scenarios were assessed, as follows. These are presented on **Figure 4.26**.

- **Scenario N1** - Existing operations. This scenario includes concurrent operation of the mobile crushing and screening plant, one front-end loader, one hydraulic drill rig and one excavator at an elevation of 14.5m below the natural surface.
- **Scenario N2** – Stage 3 operations (500 000t/year). This scenario includes concurrent operation of the mobile crushing and screening plant, two front-end loaders, one hydraulic drill rig and two excavators at an elevation of 14.5m below the natural surface within the western section of the active extraction area indicated on **Figure 4.26**. Additionally, a bulldozer was modelled at the natural surface within the eastern section of the active extraction area. Finally, a compactor and a second bulldozer were modelled within the active placement area indicated on **Figure 4.26**.
- **Scenario N3** – Stage 5 Operations (500 000t/year). This scenario includes concurrent operation of the mobile crushing and screening plant, two front-end loaders, one hydraulic drill rig and two excavators at an elevation of 14.5m below the natural surface within the western section of the active extraction area indicated on **Figure 4.26**. Additionally, a bulldozer was modelled at the natural surface within the eastern section of the active extraction area. Finally, a compactor and a second bulldozer were modelled within the active placement area indicated on **Figure 4.26**.

For each scenario, road-registered trucks were modelled travelling from the site entrance, adjacent to the eastern boundary of the proposed extraction area to the active extraction area. Truck movements were modelled at 74 movements per day for Scenario T1, and 120 movements per day for Scenarios 2 and 3.

During the life of the Project, a hydraulic rockhammer would be used to break rocks that are too large to be crushed. As this would only be an intermittent activity, it has been modelled separately and the noise emissions of the Project with and without a rock hammer operating are presented in Section 4.6.7.1.

As climate data from the Bureau of Meteorology weather station at HMAS Albatross does not indicate the presence of adverse weather conditions, the climatic conditions were modelled as 'acoustically neutral', namely:

- temperature of 20°C;
- relative humidity of 70%;
- calm winds; and
- Pasquill Stability Class D.

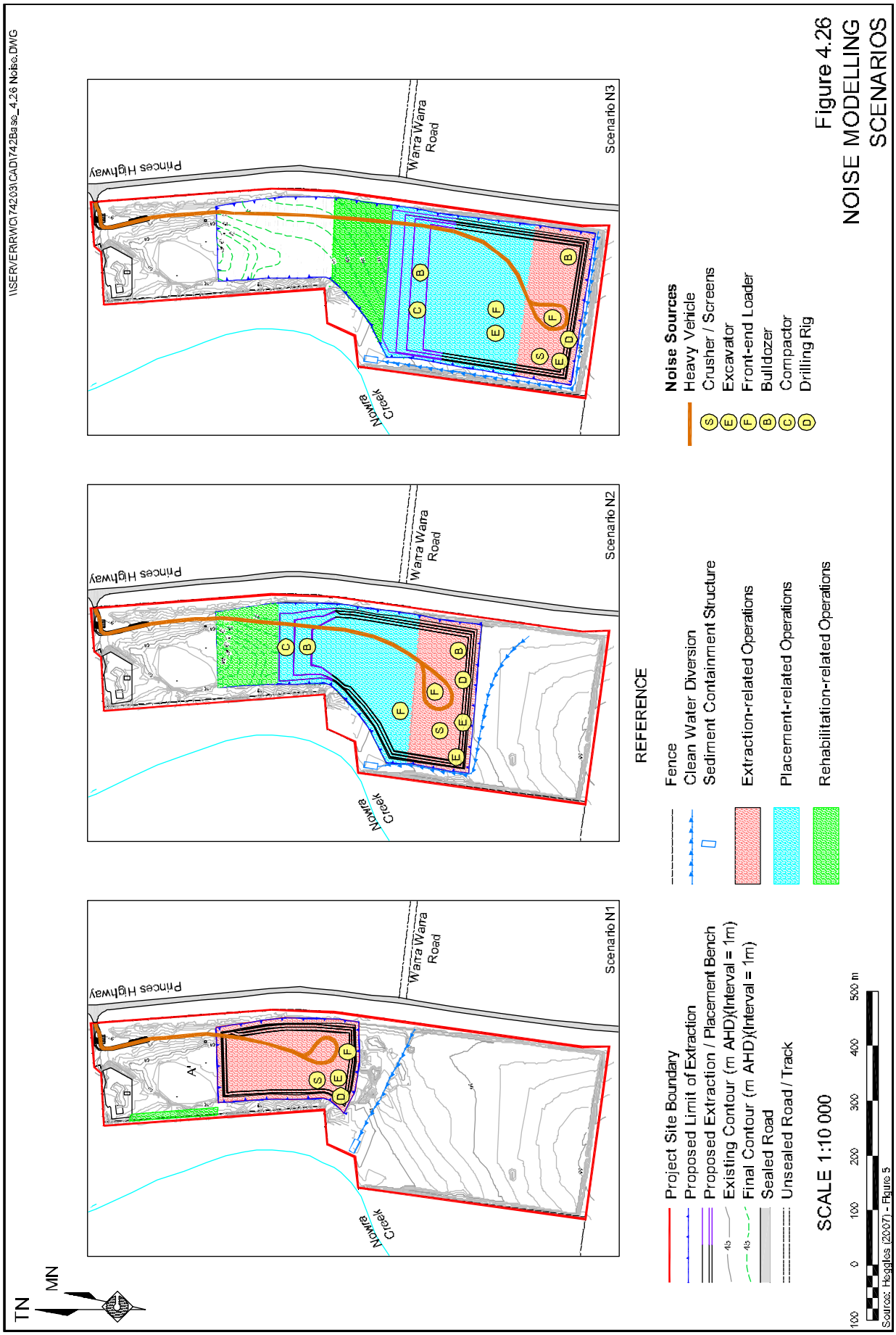


Figure 4.26
NOISE MODELLING SCENARIOS

During the evening and night-time assessment, the arrival of three unladen trucks between 6.00pm and 8.00pm and a further three unladen trucks between the hours of 6.00am and 7.00am were the only activities assumed to be occurring within the Project Site.

4.6.5.2 Road Traffic Noise Assessment Methodology

Road traffic noise was assessed using the method identified by the US Environment Protection Agency. This method is an internationally accepted theoretical traffic noise prediction model which takes into account:

- the LAmax vehicle noise levels (light and heavy vehicles;
- receiver offset distance;
- passby duration;
- vehicle speed;
- ground absorption (based on the ratio of soft ground and average height of propagation);
- number of hourly vehicle movements;
- receiver height;
- truck exhaust height; and
- the height and location of any intervening barriers.

Table 4.41 presents the existing and anticipated hourly traffic volumes on the Princes Highway in the vicinity of the Project Site. The road traffic noise assessment assumed approximately 10% of total traffic volume is or will be heavy vehicles. This data was sourced from Coady (2007).

Table 4.41
Average Hourly Traffic Movements - Princes Highway

Vehicle Classification	Existing traffic levels		Anticipated traffic levels
	Excluding quarry – related traffic	Including quarry-related traffic	
Light	1 280	1 283	1 284
Heavy	131	143	169
Source: Heggies (2008) - Table 11			

4.6.6 Impact Assessment

4.6.6.1 Operational Noise Assessment - Daytime

Table 4.42 presents the results of the point-to-point noise assessment for the daytime operation of the Project.

Table 4.42
Daytime Operational Noise Assessment Results

Assessment Location #	Project-specific Assessment Criteria (dB(A))	Predicted $L_{Aeq(15\ minute)}$ Noise Levels (dB(A))					
		Scenario N1		Scenario N2		Scenario N3	
		Without RH	With RH	Without RH	With RH	Without RH	With RH
Residence A	51	28	29	42	42	**56**	**56**
Residence B	51	41	42	46	46	45	45
Residence C	44	22	23	34	35	34	34
Residence D	51	29	30	39	40	38	39
SCCF	65	38	39	48	49	49	49

Note: **Bold** indicates an exceedance of the Project-specific Noise Assessment Criteria #See **Figure 4.25**
SCCF = South Coast Correctional Facility (Proposed)
RH = Rock Hammer

Source: Heggies (2008) – After Table 9

In summary, Project-related noise emissions would be less than the Project-specific assessment criteria at all assessment locations during each of the modelled Scenarios, with the exception of Residence A during Scenario N3 where the Project-specific assessment criteria would be exceeded by 5dB(A).

The modelled exceedance is attributed by Heggies (2008) to the operation of the bulldozer within the active extraction area at the natural surface. Excluding the operation of the bulldozer, the modelled, Project-related noise emissions that would be experienced at Residence A are predicted to be 45dB(A). As operation of the bulldozer at the natural surface would only be undertaken intermittently during Stage 5 of the Project (**Figure 2.5**), the anticipated exceedances of the project-specific assessment criteria would also be anticipated to be intermittent in nature.

Notwithstanding the above, the Proponent proposes to negotiate an appropriate arrangement with owners of Residence A prior to the completion of Stage 1 of the Project. Such an arrangement would result in Residence A becoming a Project-related residence for the purposes of this noise assessment.

4.6.6.2 Operational Noise Assessment – Evening and Night-time

Table 4.43 presents the results of the operational noise assessment during the evening and night-time.

Table 4.43 indicates that noise levels at all assessment locations would be less than the relevant assessment criteria during the evening and night-time.

Table 4.43
Evening and Night-time Operational Noise Assessment Results

Assessment Location #	Project Specific Assessment Criteria (dBAdB(A))		Predicted LAeq(15 minute) Noise Levels (dBAdB(A))	
	Evening[1]	Night[2]	Evening[1]	Night[2]
Residence A	45	45	19	19
Residence B	45	45	36	36
Residence D	41	40	17	17
Residence C	45	45	21	21
SCCF	65	65	29	29

Note: **Bold** indicates an exceedance of the Project-specific Noise Assessment Criteria #See **Figure 4.25**
SCCF = South Coast Correctional Facility (Proposed)
Note 1: Evening = 6.00pm to 10.00pm
Note 2: Night = 10.00pm to 7.00am
Source: Heggies (2008) – After Table 10

4.6.7 Road Traffic Noise Assessment

Table 4.44 presents the results of the road traffic noise assessment for Residence E, located approximately 2km to the south of the Project Site entrance and approximately 85m to the east of the Princes Highway (

Figure 4.25).

Table 4.44
Day-time Road Traffic Noise Assessment Results

Operations	Assessment Criteria ($L_{Aeq(15\ hour)}$)	Daytime (15 hour) Traffic Noise Levels
2007 highway traffic without existing quarry-related traffic	-	58.1dB(A)
2007 highway traffic with existing quarry-related traffic	-	58.3dB(A)
2007 highway traffic with proposed Project-related traffic	60dB(A)	58.8dB(A)
Source: After Heggies (2009) - Table 12		

Review of the road traffic noise level predictions presented in **Table 4.44** indicate that the Project would result in an increase in the anticipated road traffic noise levels at the closest residence to the Princes Highway would be less that the assessment criteria for arterial roads identified in the ECRTN.

4.7 BLASTING

4.7.1 Introduction

The blasting assessment was undertaken by Heggies Pty Ltd. The resulting report, entitled *Nowra Brickworks Quarry, South Nowra – Noise and Blasting Assessment,* is presented in full as Part 5 of the *Specialist Consultants Studies Compendium* and is referred to hereafter as "Heggies (2008)". This section of the *Environmental Assessment* provides a summary of that report.

4.7.2 Existing Environment

Since the Proponent acquired MLs 5087 and 6322 from the previous holder, approximately five to ten blasts per year have been initiated within the Project Site. Blasting operations are designed and supervised by a suitably qualified and experienced blasting engineer.

As required by the Department of Environment and Climate Change (DECC), each blast is monitored at a blast monitoring location within the Project Site as indicated on **Figure 4.26**. **Table 4.45** presents the monitoring results of all blasts within the Project Site during the period April 2006 to October 2007.

Table 4.45
Blast Monitoring Results – April 2006 to October 2007

Date of Blast	Time of Blast	Ground Vibration (mm/s)	Airblast Overpressure (dB)	Comment
26 April 2006	2:45pm	1.73	102	
2 August 2006	12:44pm	2.30	100	
12 October 2006	10:58am	2.33	100	
10 January 2007	9:36am	1.55	100	
23 February 2007	11:35am	1.98	100	
9 May 2007	11:21am	2.35	119	Heavy, low cloud cover resulted in elevated air blast overpressure levels.
8 June 2007	10:25am	1.73	107	
13 July 2007	11:19am	1.76	100	
19 October 2007	12:07pm	1.65	100	
Source: SCCCR.				

4.7.3 Mitigation Measures and Management Procedures

Section 2.4.4.2 of this *Environmental Assessment* provides a description of the proposed blasting operations. In summary, each blast would be designed to:

- achieve the required degree of fragmentation;
- satisfy all environmental criteria;

- contain all blast flyrock within the nominated blast envelope; and
- ensure that there is no requirement to close the Princes Highway during blasting operations.

The Proponent would implement the following blasting mitigation measures and management procedures throughout the life of the Project.

- Blasts would be designed and implemented by a suitably qualified blasting engineer and experienced shot-firer. Each blast would be designed to ensure the assessment criteria described in Section 4.7.4.5 are complied with at all residential and commercial receivers in the vicinity of the Project Site.
- Blast designs, mitigation measures and operating procedures would be modified on the basis of monitoring results, if required.
- Blasting would continue to occur between the hours of 9:00am and 4:00pm, Monday to Saturday. No blasts would be initiated outside these hours, except for safety or emergency reasons.
- An appropriate arrangement would be negotiated with the owner of Residence A prior to completing Stage 1 of the Project (see **Figure 2.5**).
- The following organisations would continue to be notified verbally of each blast on the working day prior to the blast being initiated.
  - Shoalhaven City Council.
  - NSW Police.
  - NSW Roads and Traffic Authority.
  - The owner of Residence A.
  - Environment Protection Authority.
  - The South Coast Correctional Facility (when constructed).
- The existing main telephone number (02 4421 7766) for the quarry would continue to operate as an environmental complaints line.
- A register of complaints made would be maintained and stored in weighbridge office in accordance with the conditional requirements of the Proponent's Environmental Protection Licence.
- The Proponent would respond promptly to any issue of concern.

4.7.4 Blasting Assessment Criteria

4.7.4.1 Introduction

Blasting-related impacts may be related to ground vibrations or airblast overpressure and may result in structural damage to buildings or discomfort to people.

4.7.4.2 Ground Vibration - Structural Damage

Australian Standard AS 2187:Part 2-2006 recommends that the standard for blast vibration damage criteria should be based on British Standard 7385:Part 2-1993 "*Evaluation and Measurement for Vibration in Buildings Part 2"*. This standard sets guide values for building vibration based on the lowest vibration levels above which damage has been credibly demonstrated. These levels are judged to give a minimum risk of vibration-induced damage, where minimal risk for a named effect is usually taken as a 95% probability of no effect. **Table 4.46** presents the recommended criteria for ground vibration that would result in minimal risk of cosmetic damage to residential and industrial buildings.

Table 4.46
Ground Vibration – Cosmetic Damage Criteria

Type of Building	**Peak Component Particle Velocity in Frequency Range of Predominant Pulse**	
	4 Hz to 15 Hz	**15 Hz and above**
Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
Unreinforced or light framed structures Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above
Source: Heggies (2008) – Table 6		

4.7.4.3 Air Blast Overpressure - Structural Damage

Australian Standard AS 2187.2-2006 recommends an assessment criterion of 133 dB Linear for structural damage to buildings as a result of air blast overpressure. Heggies (2008) state that this figure is consistent with information from the US Bureau of Mines which indicates windows are the component of a building that are most likely to fail in response to an air blast overpressure event. At 140dB Linear, the probability of window damage is estimated to be 0.01%.

4.7.4.4 Ground Vibration and Air Blast Overpressure – Human Comfort

The Environmental Noise Control Manual (Chapter 154) published by the DECC recommends advisory limits published by the then Australian and New Zealand Environment Council (ANZEC) for assessing potential discomfort and disturbance to residents from blast emissions. These advisory limits are presented in **Table 4.47.**

Table 4.47
Advisory Limits for Blasting

	Acceptable[1.]	Maximum
Airblast (dBLinear)	115	120
Ground Vibration (mm/s)[2.]	5	10
Note 1: The guidelines recommend that the Acceptable Criteria should be achieved by at least 95% of blasts in a 12 month period.		

4.7.4.5 Blasting Assessment Criteria

The Proponent would adopt the following blasting assessment criteria.

- ANZEC recommended human comfort limits presented in **Table 4.47** for all residential receivers for airblast overpressure and ground vibration.
- The British Standard 7385: Part 2 guide value for ground vibration of 50mm/s at 4Hz for all commercial receivers, including the proposed South Coast Correctional Facility.
- Australian Standard AS 2187.2-2006 assessment criterion for airblast overpressure of 133dB Linear for all commercial receivers, including the proposed South Coast Correctional Facility

4.7.5 Blasting Assessment Methodology

Blasting site laws were initially developed by Heggies Pty Ltd during trial blasting conducted within the Project Site during September 2002. These site laws have been progressively updated during the intervening period. The resulting blasting site law formulae are presented below.

- Ground Vibration
  $PVS\ (mm/s)\ (5\%) = 2{,}789\ (SD)^{-1.68}$
- Airblast
  $SPL\ (dBL)\ (5\%) = 147.0 - 15.4 \log (SD)$

  where

  PVS = Peak Vector Sum ground vibration level (mm/s)
  dB = Peak airblast level (dBLinear)
  R = Distance between charge and receiver (m)
  Q = Charge mass per delay (kg)

4.7.6 Impact Assessment

Table 4.48 presents the results of the blasting assessment at Residences A to D, Commercial Premises A and the proposed South Coast Correctional Facility. The calculated blasting impacts presented in **Table 4.48** were estimated based on the smallest distance between the extraction area and the receiver.

Table 4.48
Blasting Assessment Results

Residence/ Receiver #	Distance from Blasting (m)	Assessment Criteria		Assessment Results	
		Ground Vibration (mm/s)	Peak Airblast (dB Linear)	Ground Vibration (mm/s)	Peak Airblast (dB Linear)
Residence A	80	5 (10)[1]	115 (120)[1]	**93.2**	**128**
Residence B	380	5 (10)[1]	115 (120)[1]	**6.8**	**118**
Residence C	850	5 (10)[1]	115 (120)[1]	1.8	112
Residence D	630	5 (10)[1]	115 (120)[1]	2.9	114
Commercial Premises A	90	50	133	**76.5**	127
Proposed Correctional Facility	210	50	133	18.4	122

Note 1: Acceptable criteria (maximum criteria). #See **Figure 4.25**
Note 2: **Bold** indicates an exceedance of the assessment criteria.
Source; after Heggies (2008) – Table 14

The blasting assessment presented in **Table 4.48** assumes the blasting parameters presented in **Table 2.3,** including a Maximum Instantaneous Charge (MIC) of 112kg, would be implemented. However, as blasting operations approach sensitive receivers, the Proponent would modify the blasting procedures to ensure compliance with the blasting assessment criteria. By way of illustration, **Table 4.49** presents the MIC that would be required to achieve compliance with the blasting assessment criteria when blasting is occurring at the point within the extraction area that is closest to the identified sensitive receivers**.**

Table 4.49
MIC Required to Achieve Compliance with Criteria

Residence/ Receiver #	Distance from Blasting	Acceptable Criterion[1]		Maximum Criterion[2]	
		Criterion	MIC	Criterion	MIC
Residence A	80m	115dBLinear	0.3kg	120dBLinear	2.9kg
Residence B	380m	115dBLinear	33kg	10mm/s	178kg
Residence C	850m	115dBLinear	380kg	10mm/s	890kg
Residence D	630m	115dBLinear	154kg	10mm/s	485kg
SCCF	210m	50mm/s	367kg	50mm/s	367kg
Commercial Premises A	90m	50mm/s	68kg	50mm/s	68kg

Note 1: to be achieved by 95% of blasts. #See **Figure 4.25**
Note 2: to be achieved by 100% of blasts.
Source: Heggies (2009) - Table 15

Table 4.49 indicates that to achieve compliance with the general criterion at Residence A and B when blasting in the southern-most and northern-most sections respectively of the Extraction Area, an MIC of approximately 0.3kg and 33kg respectively would be required.

The Proponent notes that a commitment has previously been made that Residence A would become a Project-related residence prior to completion of Stage 1 of the Project. In addition, the Proponent notes that MICs of 33kg may be achieved through modification of blasting and extraction procedures, including firing single holes, decking of blast holes and utilising smaller bench heights. The Proponent also notes that compliance with the relevant criteria becomes a matter for the Proponent to establish through monitoring of all blasting operations and development of site blasting laws. Finally, the Proponent notes that improvements in blasting technology and techniques will inevitably reduce the blasting-related impacts for a given MIC. As a result, the Proponent states that blasting criteria would be achieved at all sensitive receptors, including Residence A, while ever it remains a non-Project-related residence.

Finally, the results of the blasting assessment may be summarised as follows.

- The anticipated ground vibration and airblast overpressure impacts at Residence A would be greater than the relevant assessment criterion. The Proponent would negotiate an appropriate arrangement with the owners of Residence A prior to the completion of Stage 1 of the Project.
- The anticipated ground vibration and airblast overpressure impacts at Residence B with an MIC of 112kg would be greater than the ANZEC recommended acceptable advisory limits for blasting. The impacts would however be less than the maximum criterion limits for blasting. The Proponent would modify the blasting parameters to ensure the assessment criteria are complied with at Residence B.
- The anticipated ground vibration impacts at Commercial Premises A using an MIC of 112kg would be greater than the assessment criteria. The Proponent would modify the blasting parameters to ensure the assessment criteria are complied with at Commercial Premises A.

4.7.7 Blast Monitoring

Each blast would be monitored at the existing blast monitoring location, as well as at the proposed South Coast Correctional Facility and elsewhere, as required.

4.8 ABORIGINAL CULTURAL HERITAGE

4.8.1 Introduction

The Aboriginal heritage assessment was undertaken by Cultural Heritage Management Australia (CHMA). The resulting report, entitled *Nowra Brickworks Quarry, South Nowra – Aboriginal Heritage Assessment,* is presented in full as Part 6 of the *Specialist Consultants Studies Compendium* and is referred to hereafter as "CHMA (2007)". This section of the *Environmental Assessment* provides a summary of that report.

4.8.2 Existing Environment

4.8.2.1 Background Research

A search of the National Parks and Wildlife Service *Aboriginal Heritage Information Management System* (AHIMS) heritage register was undertaken to identify previously registered sites of Aboriginal heritage significance within or in the vicinity of the Project Site. The search revealed 15 sites within a 10km by 10km area centred on the Project Site. **Table 4.50** presents a classification of the sites identified within the search area.

Table 4.50
Registered Aboriginal Sites

NPWS Site No	Site Type
48-6-2540	Isolated Find
52-2-1874	Isolated Find
52-2-1875	Isolated Find
52-5-0031	Shelter with deposit
52-5-0033	Axe Grinding Groove, Shelter with Art
52-5-0037	Axe Grinding Groove
52-5-0038	Shelter with Deposit
52-5-0110	Shelter with Art
52-5-0214	Open Camp Site
52-5-0285	Open Camp Site
52-5-0298	Open Camp Site
52-5-0299	Open Camp Site
52-5-0361	Open Camp Site
52-5-0362	Open Camp Site
52-5-0364	Open Camp Site
Source: CHMA (2007) – Table 1	

In summary, none of the registered sites were located within the Project Site. Of the 15 sites registered, five sites are located approximately 5km south of the Project Site. These sites, consisting two shelters with artefact deposits, an axe grinding groove and two open camp sites, were recorded during four separate investigations. Another six sites are located approximately 3km to 4km northwest of the Project Site, with these sites also consisting of axe grinding grooves, shelters with deposits and open camp sites. The closest registered site to the Project Site, an open camp site, is located approximately 2km southwest of the Project Site.

In addition to a search of the AHIMS database, a review of published information related to the occurrence of Aboriginal sites and cultural material within the Shoalhaven area was undertaken. The review indicated that in the vicinity of the Project Site, away from coastal areas, Aboriginal sites and cultural material tend to be located on elevated, level landscape features, in close proximity to watercourses. Typically, artefact scatters are small and sparse.

4.8.2.2 Community Consultation

In accordance with the then Department of Environment and Conservation (DEC) *Interim Guidelines of Aboriginal Community Consultation for Applicants* (IGACC) published in 2004, the following steps were undertaken to identify Aboriginal groups interested in participating in the Aboriginal heritage consultation and assessment process.

- An advertisement was published in the Public Notices section of the South Coast Register on 27 October 2007, providing details of the Project and the proposed Aboriginal heritage assessment and seeking registrations of interest. The closing date provided in the advertisement for Registration of Interests was 16 November 2007.
- Written notification regarding the Project and the proposed Aboriginal heritage assessment was supplied to the DECC, Shoalhaven City Council, the Nowra Local Aboriginal Land Council (Nowra LALC) and Native Title Services on 30 and 31 October 2007.
- A representative of CHMA spoke with Mr Adam Black of the Department of Aboriginal Affairs regarding sending notification of the Project and the proposed Aboriginal heritage assessment to the Registrar of Aboriginal Owners. Mr Black advised that such notification was not required.

Expressions of interest in the Project and the proposed Aboriginal heritage assessment were received from the Nowra LALC and Mr Jason Davidson of Dungarn Consultancy on 31 October 2007.

Mr Stuart Huys of CHMA met with Mr Sonny Simms of the Nowra LALC and Mr Davidson of Dungarn Consultancy on 21 November 2007 to discuss the assessment methodology. Both Mr Simms and Mr Davidson indicated that they were satisfied with the proposed scope and timing of the assessment.

4.8.3 Assessment Methodology

The field survey was carried out over two days, namely 21 and 26 November 2007. The field survey on 21 November was undertaken by Mr Huys of CHMA and Mr Jason Davidson of Dungarn Consultancy. The field survey on 26 November was undertaken by Ms Charmain O'Halloran of CHMA and Mr Peter Moore of Nowra LALC.

Approximately 4.5km of transects were surveyed within the Project Site. The locations of the surveyed transects are indicated on **Figure 4.27**. The survey transects were limited to those sections of the Project Site that have not been disturbed by previous extraction-related activity (the "survey area") (**Figure 4.27**). CHMA estimate the survey area to be approximately 12ha. Each transect was approximately 20m in width. As a result, approximately 90 000m^2 were surveyed during the field survey. CHMA state that the effective coverage of the survey area was approximately 33%.

4.8.4 Survey Results

No Aboriginal sites or cultural heritage material were identified within the Project Site during the field survey.

Two sites with shell material were identified within the Project Site. The representatives CHMA and the Aboriginal community agreed that the association of the shell material with material of European origin, namely bricks and general waste, indicates that the shell material is not material of Aboriginal heritage significance.

CHMA (2007) notes that Aboriginal site and cultural heritage material, if it was present within the Project Site, would be likely to occur at low to very low densities. However, CHMA (2007) also note that a section of the Project Site adjacent to Nowra Creek would be likely to have slightly higher densities of Aboriginal site and cultural heritage material due to the proximity of Nowra Creek. The location of the identified area of elevated Aboriginal heritage potential is indicated on **Figure 4.27**.

4.8.5 Mitigation Measures and Management Procedures

The following Aboriginal heritage mitigation measures and management procedures would be implemented throughout the life of the Project.

- Activities that would disturb the surface to a depth of 10cm in the area indicated on
- Figure 4.27 as being of low to very low archaeological significance would be monitored by representatives of the Nowra LALC and Dungarn Consultancy.
- If items of suspected Aboriginal heritage significance are identified throughout the life of the Project, the following procedures would be implemented.
  - **Step 1** - No further earth disturbing works would be undertaken in the vicinity of the suspected item of Aboriginal heritage significance.
  - **Step 2** - A buffer of 20m x 20m would be established around the suspected item of Aboriginal heritage significance. No unauthorised entry or earth disturbance would be allowed with this buffer zone until the area has been assessed.
  - **Step 3** - A qualified archaeologist or the DECC would be contacted to make an assessment of the discovery. Mitigation procedures would then be developed and implemented based on the assessment.

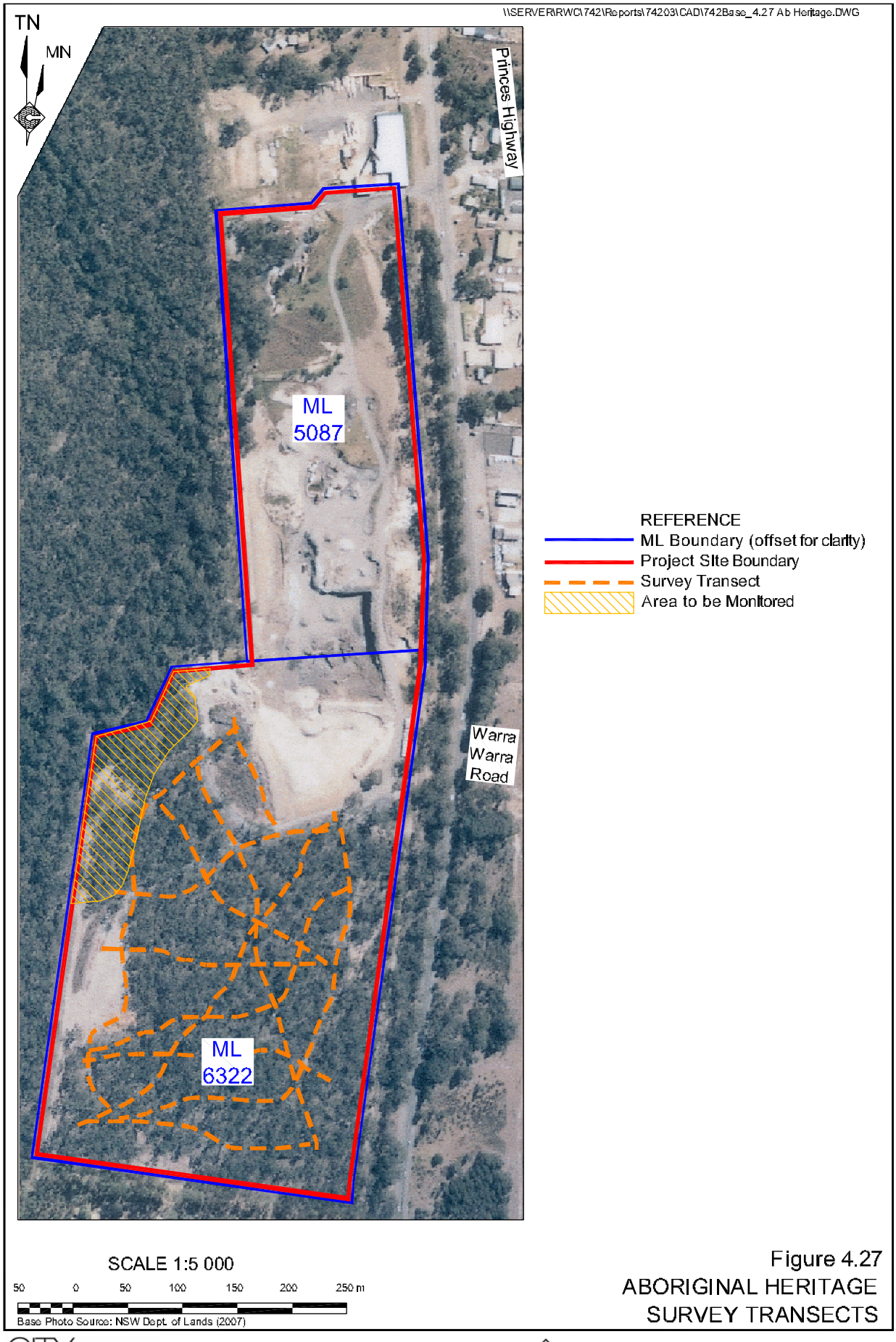


Figure 4.27
ABORIGINAL HERITAGE SURVEY TRANSECTS

- If, throughout the life of the Project, suspected human remains are identified, the following procedures would be implemented.
  - **Step 1 - the** suspected skeletal remains would not be touched or disturbed.
  - **Step 2** -A buffer zone of 50m x 50m would be established around the suspected **remains** and all work in the vicinity of the suspected remains would be suspended until the area has been assessed.
  - **Step 3** - The NSW **Police** and the DECC would be contacted to make an assessment of the **discovery**. If appropriate, mitigation procedures would then be developed in consultation with the Nowra LALC and Dungarn Consultancy.

4.8.6 Assessment of Impacts

The likelihood of adverse Project-related impacts on Aboriginal sites or items of cultural heritage significance within the Project Site is considered to be negligible for the following reasons.

- The field survey did not identify any Aboriginal sites or items of cultural heritage significance within the Project Site.
- CHMA (2007) state that the density of any unidentified Aboriginal sites or items of cultural heritage significance would be likely to be low to very low within the majority of the Project Site.
- The mitigation measures and management procedures identified in Section 4.8.5 would ensure that any identified Aboriginal sites or items of cultural heritage significance would be appropriately protected.

The Nowra LALC and Dungarn Consultancy were provided with a draft of CHMA (2007) and were requested to respond to the draft. Responses were received from both groups. The responses indicated that both groups agree with the recommendations of the Aboriginal heritage assessment.

4.9 SOILS AND LAND CAPABILITY

4.9.1 Introduction

The soils and land capability assessment was undertaken by SEEC Morse McVey. SEEC Morse McVey prepared two assessment reports.

The first report, entitled *Nowra Brickworks Quarry, South Nowra – Soils Assessment,* is presented in full as Part 7A of the *Specialist Consultants Studies Compendium* and is referred to hereafter as "SEEC (2008)". That report:

- describes the soils within the Project Site;
- recommends soil stripping, handling, stockpiling, placement and importation procedures; and
- identifies the agricultural land capability of the Project Site.

The second report, entitled *Nowra Brickworks Quarry, South Nowra – Erosion and Sediment Control Plan,* is presented in full as Part 7B of the *Specialist Consultants Studies Compendium* and is referred to hereafter as "SEEC (2007)". That report:

- describes the relevant background information used during preparation of the Erosion and Sediment Control Plan; and
- recommends surface water control structures and operating procedures that would be implemented throughout the life of the Project to minimise the potential for sediment-laden water to be discharged from the Project Site.

A description of the soils within the Project Site, together with the procedures that would be used during soil stripping, handling, stockpiling, placement and importation operations is provided in Section 2.3.5. This section of the *Environmental Assessment* provides a summary of the land capability of the Project Site and summarises the requirements of the Erosion and Sediment Control Plan.

4.9.2 Agricultural Land Capability

SEEC (2008) states that for the undisturbed sections of the Project Site, site conditions are generally favourable. However, soil conditions, namely low fertility, low pH, calcium deficiency and marginal topsoil aluminium toxicity negatively impact upon land capability. As a result, SEEC (2008) consider the Project Site would not be suitable for cultivation but would support grazing with appropriate management measures. As a result the Project Site has a land capability of Class IV, or land not suitable for regular cultivation but suitable grazing with occasional cultivation.

Land capability of disturbed sections of the Project Site would be Class VII, or land incapable of sustaining agricultural or pastoral production.

SEEC (2008) state that if soils are appropriately managed and the recommendations in SEEC (2008) adhered to, the agricultural land capability classification of the final landform would be similar to the classification of the existing undisturbed sections of the Project Site, namely Class IV.

4.9.3 Erosion and Sediment Control Procedures

A detailed Erosion and Sediment Control Plan would be incorporated into the Mining Operations Plan that would be prepared following receipt of project approval, should it be granted. This subsection of the *Environmental Assessment* provides a brief summary of that Plan.

The objectives of the Erosion and Sediment Control Plan would be to:

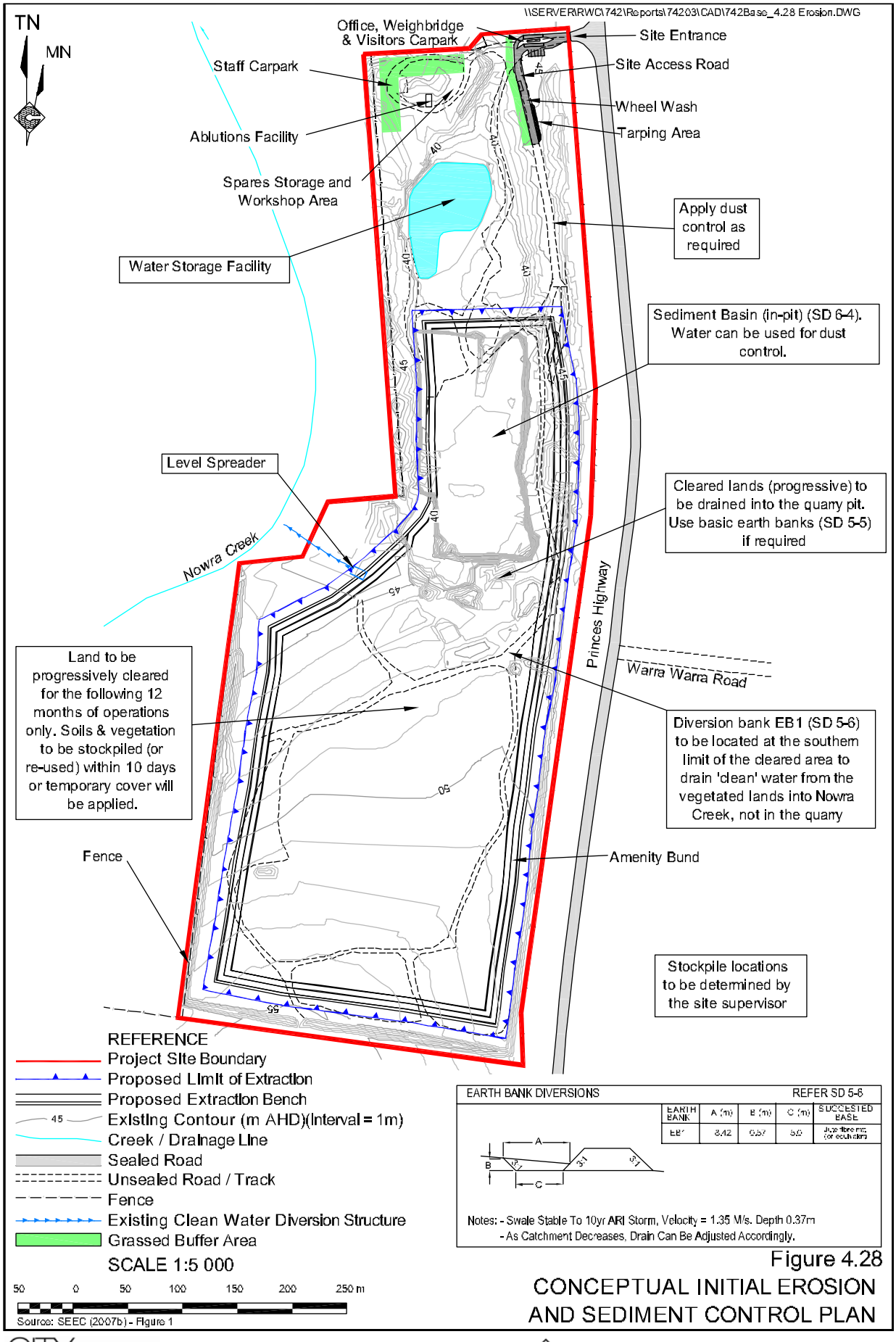
- ensure water discharged from the Project Site to Nowra Creek contains less than 50mg/L of suspended sediment;
- quantify the minimum size and construction standards of all surface water management structures; and
- identify the erosion and sediment control procedures that would be employed throughout the life of the Project.

In summary, the various components of the Conceptual Erosion and Sediment Control Plan are as follows. The indicative locations of the various components of the Conceptual Plan during Stage 1 of the Project are indicated on **Figure 4.28**.

- An earth bank to the south of the extraction area to divert all 'clean' surface water flows from undisturbed sections of the Project Site to a basic sediment retention structure and level spreader.
- Where practicable, all surface water flows from disturbed areas outside the extraction area would be directed to the water storage facility. All other potentially sediment-laden surface water flows would be directed to a sump within the extraction area.
- Construction of a sump within the extraction area.

In addition to the soil management procedures described in Section 2.3.5, the following procedures would be implemented throughout the life of the Project to ensure that the objectives of the Erosion and Sediment Control Plan are achieved.

- Water within the extraction area sump would preferentially be utilised for extraction-related activities such as dust suppression and watering of roads and other areas. Water within the water storage facility would preferentially be used for rehabilitation-related activities or within the irrigation area. When required, water within the extraction area sump would be pumped to the water storage facility. With the exception of periods following rainfall events, it is anticipated that water within the extraction area sump would primarily be sourced from groundwater inflows to the extraction area. As described in Section 4.2.3.6, groundwater in the vicinity of the Project Site is moderately to highly saline. Preferential use of this water for dust suppression activities would minimise the amount of salt that would be discharged to Nowra Creek.



Source: SEEC (2007b) - Figure 1

Figure 4.28
CONCEPTUAL INITIAL EROSION AND SEDIMENT CONTROL PLAN

- The site water balance (see Section 4.2.5.6) indicates that at the maximum level of disturbance, namely Stage 5 of the Project, there would be no requirement to discharge water to Nowra Creek from the water storage facility. The bio-infiltration facility would be constructed prior to any such water being discharged.
- Two "grassed buffer areas" as described in Section 4.2.4 would be constructed to ensure that suspended sediment concentrations of surface water flows from impervious sections of the Project Site flowing to Nowra Creek are acceptable.
- Sediment fencing would be installed along the downslope toe of all soil stockpiles or other disturbed areas.
- Temporary diversion structures would be constructed to divert surface water flows from soil stockpiles or other disturbed areas.
- Disturbed areas, including sections of the extraction area and access road, would be sprayed with water as required to limit dust lift-off.
- Sediment control structures would be inspected regularly and the adequacy of sediment control measures determined. Where required, the structures or procedures would be upgraded.

4.10 VISIBILITY

An important component of the existing operation of the Nowra Brickworks Quarry has been focused on limiting the impact of the Proponent's activities on the visual amenity of residents and other land users in the vicinity of the Project Site, including motorists using the Princes Highway and other local roads. The Proponent would continue to operate the proposed continued and expanded Nowra Brickworks Quarry with the aim of limiting impacts to the visual amenity of surrounding residents, land users and motorists.

The Proponent would implement the following mitigation measures and management procedures throughout the life of the Project.

- The existing perimeter bund along the eastern, southern and western boundaries of the Project Site would be retained and enhanced with the existing vegetated buffer within the Nowra Creek riparian zone would also be retained and enhanced to limit views of the Project Site from the proposed South Coast Correctional Facility.
- The existing line of mature trees adjacent to the eastern Project Site boundary would be retained and enhanced, where appropriate.
- The Proponent would adopt a high standard of housekeeping to achieve a visually attractive site. As part of this approach, the visual character of the various activities on the site would also be considered through the following.

- All buildings/structures would be clad with appropriate materials so as to reduce their visual impact.
- Selective landscaping would be positioned around the buildings where appropriate and where they could potentially be seen from areas outside the Project Site.
- The Project Site would be kept clean and tidy at all times.

Plates 4.1 and **4.2** present existing views of the Project Site from sections of the Princes Highway. The Proponent contends that its current operations have a negligible impact upon the visual amenity in the vicinity of the Project Site, and that the proposed activities would continue to be fully screened and would not be visible from outside the Project Site.

4.11 BUSHFIRE

4.11.1 Introduction

The Project Site is identified as bushfire prone land on the *Bushfire Prone Lands Map* published by the NSW Rural Fire Service. As a result, a bushfire assessment is required. This bushfire assessment has been undertaken by R.W. Corkery & Co. Pty Limited in accordance with Clause 46 of *Rural Fires Regulation 2002* and the document *Planning for Bushfire Protection* published by the NSW Rural Fire Service (Rural Fire Service, 2006). This sub-section also includes a summary of the bushfire mitigation measures and management controls that would be implemented by the Proponent throughout the life of the Project.

4.11.2 Bushfire Impact Assessment

Clause 46 of *Rural Fires Regulation 2002* provides a number of matters that are required to be assessed when determining an application related to bush fire prone land. Each of these matters is addressed separately below.

(a) a description (including the address) of the property on which the development the subject of the application is to be carried out

Plate 4.1: View of the Project Site looking to the west from the Princes Highway. (Source: C. Outtersides, City plan Services)

Plate 4.2: View of the Project Site looking to the southeast from the Princes Highway. (Source: C. Outtersides, City plan Services)

The Project Site is located within part of Lot 464, DP1058778, Princes Highway, South Nowra. A detailed description of the Project Site is provided in Section 2.1.2 of this document.

(b) a classification of the vegetation on and surrounding the property (out to a distance of 140 metres from the boundaries of the property) in accordance with the system for classification of vegetation contained in Planning for Bush Fire Protection.

Figure 4.29 provides a classification of the vegetation within and surrounding the Project Site to a distance of at least 140m from the boundary of the Project Site. Vegetation has been classified in accordance with the classification provided in Table A2.1 of Rural Fire Service (2006). Classifications were determined based on:

- vegetation descriptions provided in Gaia Research (2008);
- site inspections; and
- interpretation of aerial photographs.

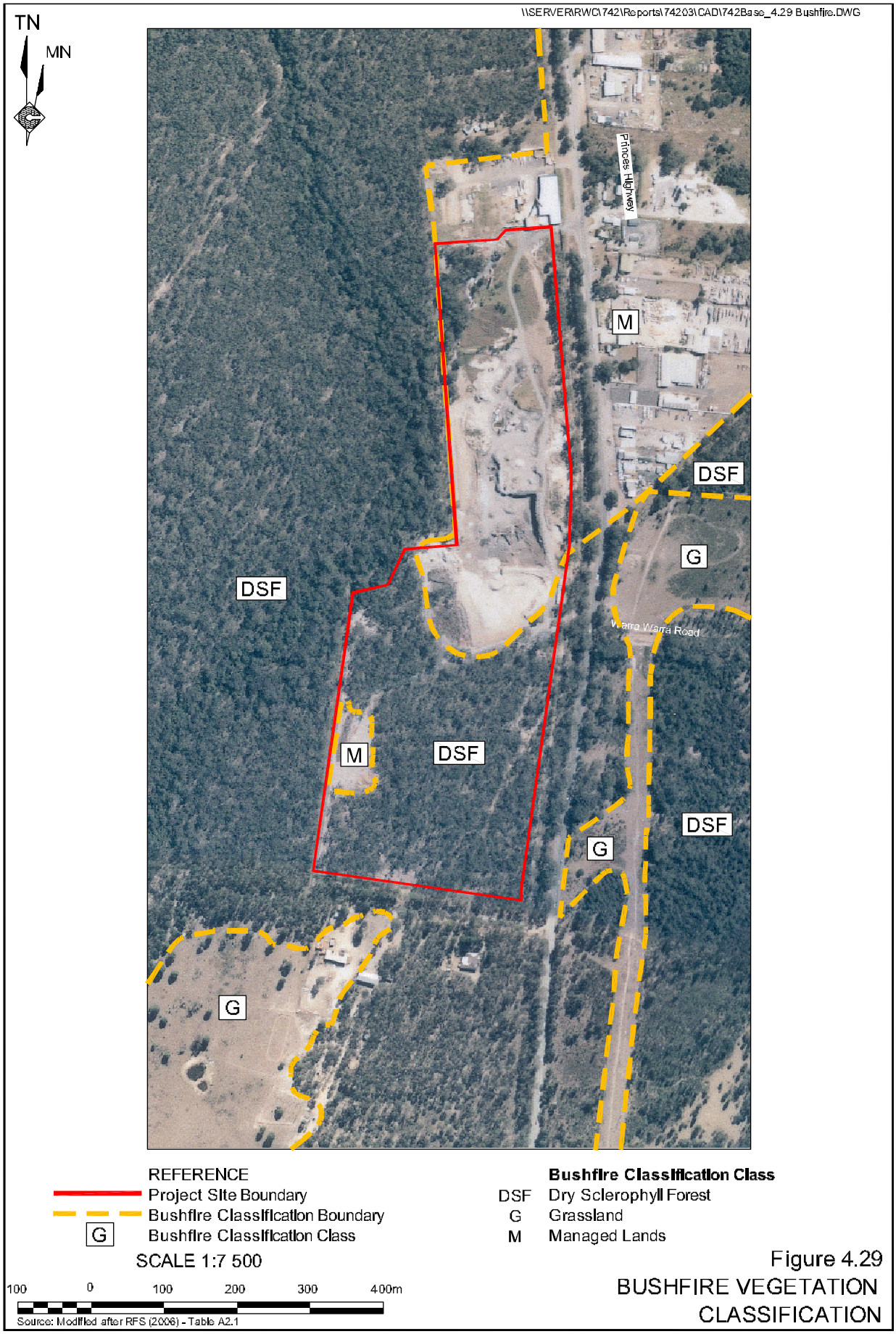


Figure 4.29
BUSHFIRE VEGETATION CLASSIFICATION

In summary, vegetation surrounding the Project Site may be classified as follows.

- Dry Sclerophyll Forest (Open Forest) – this vegetation type dominates the southern portion of the Project Site and the areas to the west, south and southeast of the Project Site. Gaia Research (2008) describes the vegetation within the Project Site as Spotted Gum forest with the most common species of tree being Spotted Gum, with smaller numbers of Grey Ironbark, Woollybutt, White Stringybark. Red Bloodwood, and Grey Gum. The canopy is approximately 25m to 30m high, with crowns commonly touching. Mid canopy and shrub layers are generally sparse.
- Grasslands – to the southwest and east of the Project Site.
- Managed lands – cleared and managed lands dominate the northern portion of the Project Site and the area to the east and northeast of the Project Site.

For the purposes of the bushfire assessment, the vegetation classification for the Project Site and surrounding land is assumed to be Dry Sclerophyll Forest.

(c) an assessment of the slope of the land on and surrounding the property (out to a distance of 100 metres from the boundaries of the property).

As identified in Section 4.1.2, the slope of the land within undisturbed sections of the Project Site and within the area surrounding the Project Site varies between vary between 1:20 (V:H) and 1:60 (V:H), or 0° to 5°.

(d) identification of any significant environmental features on the property.

No threatened species or endangered populations or ecological communities were identified within the Project Site. The threatened species that were identified as having the potential to use the Project Site are highly mobile, namely the Grey-headed Flying Fox, Square-tailed Kite and Glossy Black Cockatoo. As a result, there are no significant environmental features of the Project Site that would be adversely impacted by bushfire.

(e) the details of any threatened species, population or ecological community identified under the Threatened Species Conservation Act 1995 that is known to the applicant to exist on the property.

No threatened species or endangered populations or ecological communities were identified within the Project Site.

(f) the details and location of any Aboriginal relic (being a relic within the meaning of the National Parks and Wildlife Act 1974) or Aboriginal place (within the meaning of that Act) that is known to the applicant to be situated on the property.

No Aboriginal relic or place was identified within the Project Site.

(g) a bush fire assessment for the proposed development (including the methodology used in the assessment) that addresses the following matters:

(i) the extent to which the development is to provide for setbacks, including asset protection zones,

The Project Site is located within the Shoalhaven Local Government Area. Table A2.3 of Rural Fire Service (2006) identifies the Fire Danger Index for the Shoalhaven Local Government Area as 100. **Table 4.51** identifies the Asset Protection Zones based on a vegetation classification of Dry Sclerophyll Forest from Rural Fire Service (2006)

Table 4.51
Asset Protection Zones

Direction	Slope	Asset Protection Zone (m)		
		Inner	Outer	Total
North	0° to 5° downslope	50	20	70
East	0° to 5° downslope	50	20	70
West	0° to 5° downslope	50	20	70
South	upslope	40	20	60
Source: Rural Fire Service (2006) – Appendices 2 and 3				

As the all fixed Project-related infrastructure, namely the weighbridge and office, would be constructed more than 70m from the boundary of vegetation that may be classified as Dry Sclerophyll Forest, suitable asset protection zones would be maintained. In addition, all other equipment used within the Project Site would be mobile and would be able to be moved to a location that would be more than 70m from of vegetation that may be classified as Dry Sclerophyll Forest.

(ii) the siting and adequacy of water supplies for fire fighting,

The Proponent intends to maintain the water storage facility throughout the life of the Project and would, if requested in the event of a bushfire event, permit the use of the water storage facility and associated pumping infrastructure for fire fighting purposes. In addition, the Proponent would, throughout the life of the Project, maintain vehicular access to the water storage facility. As a result, water supplies are considered to be adequate.

(iii) the capacity of public roads in the vicinity to handle increased volumes of traffic in the event of a bush fire emergency,

The Project Site is located adjacent to the Princes Highway. This road is considered capable of handling increased volumes of traffic from the Project Site in the event of a bush fire emergency.

(iv) whether or not public roads in the vicinity that link with the fire trail network have two-way access,

The Princes Highway, site access road and site entrance have two-way access.

(v) the adequacy of arrangements for access to and egress from the development site for the purposes of an emergency response,

The Project Site would continue to be serviced by a site entrance and sealed site access road in the northeastern section of the Project Site. These facilities occur at a minimum distance of approximately 120m from the closest vegetation that may be classified as Dry Sclerophyll Forest. This entrance and site access road would provide suitable access to and egress from the Project Site in the event of an emergency.

(vi) the adequacy of bush fire maintenance plans and fire emergency procedures for the development site,

A Bushfire Management Plan would be developed and incorporated within the Mining Operations Plan for the Project.

(vii) the construction standards to be used for building elements in the development,

All buildings within the Project Site would be temporary buildings.

(viii) the adequacy of sprinkler systems and other fire protection measures to be incorporated into the development,

The Proponent does not propose to install sprinkler systems for fire protection. Not withstanding this, however, the Proponent would maintain pumps and water lines for processing purposes. These pumps and water lines would be available for fire fighting purposes should they be required. In addition, the Proponent would maintain a water cart with hoses suitable for fire fighting to enable rapid response to small fires within the Project Site.

(h) an assessment of the extent to which the proposed development conforms with or deviates from the standards, specific objectives and performance criteria set out in Chapter 4 (Performance Based Controls) of Planning for Bush Fire Protection.

Section 4.2.6 of Rural Fire Service (2006) states that developments that do not fall under the identified categories of Special Fire Protection Purpose development, such as the Project, should be assessed against the objectives of Section 4.2.3 of that document. Section 4.2.3 of Rural Fire Service (2006) states that the objectives of Special Fire Protection Purpose development are as follows.

- Provide for the special characteristics and needs of occupants.
- Provide for safe emergency evacuation procedures.

The occupants of the Project Site would primarily be employees and visitors to the site who are unlikely to have special characteristics or needs that would require specific attention. Safe evacuation of the Project Site would be possible at all times as the site entrance is located in the northeastern section of the Project Site, away from areas of vegetation, and the Princes Highway would be capable of handling additional traffic in the event of an emergency

As a result, the Project is considered to be compliant with the requirements of Rural Fire Service (2006).

4.12 EUROPEAN HERITAGE

The European heritage assessment has been undertaken by R.W. Corkery & Co. Pty Limited.

A search of the following National, State and local heritage lists and databases was conducted on 4 December 2007 to identify any items of European heritage significance that occur on, or in the vicinity of, the Project Site.

- Australian Heritage Database.
- NSW State Heritage Database.
- Schedule 7 of the *Shoalhaven Local Environmental Plan 1985*.

The Australian and NSW heritage lists were searched for all heritage items within the Shoalhaven Local Government Area (LGA).

The Australian Heritage Database revealed 105 sites of heritage significance within the Shoalhaven LGA. Of these, 10 were listed as occurring in Nowra, with an additional heritage site recorded at Falls Creek. From the information available, there are no heritage sites registered on the Australian Heritage Database within 5km of the Project Site.

The NSW State Heritage Database listed nine sites of heritage significance listed on the *Heritage Act 1977*, with a further 143 sites of heritage significance listed by Local Government and State agencies within the Shoalhaven Local Government Area. Of the *Heritage Act 1977* listed sites, the closest sites occurred at West Street and Pleasant Way, Nowra, between 4km and 5km from the Project Site. Of the sites listed by Local Government and State agencies, the sites closest to the Project Site are a number of sites are located within the Nowra CBD, approximately 5km from the Project Site.

Schedule 7 of the *Shoalhaven Local Environmental Plan 1985* lists sites of heritage significance within the Shoalhaven LGA. From the information available, the closest sites to the Project Site are three sites at Worrigee, approximately 4km to the northeast of the Project Site. These sites comprise a rubblestone school house, a residence and two colonial wells.

In summary, the closest registered heritage site is, from the information available, approximately 4km from the Project Site. The environmental impact assessment presented in the preceding subsections indicates that, with the exception of Residences A, there would be no significant Project-related blasting, noise, air quality or visibility-related impacts on residences or commercial facilities within the vicinity of the Project Site. As a result, the Project would be unlikely to have a significant impact on registered items of heritage significance surrounding the Project Site.

4.13 SOCIO-ECONOMIC

4.13.1 Introduction

The socio-economic assessment has been undertaken by R.W. Corkery & Co. Pty Limited. A detailed description of the Project-related employment and economic contributions are presented in Sections 2.14.2 and 2.14.3 and a description of the community within the Shoalhaven Local Government Area is provided in Section 4.1.6. This sub-section provides a description of the measures that the Proponent would implement to maximise the positive socio-economic benefits and minimise adverse socio-economic impacts, if any, associated with the Project.

4.13.2 Mitigation Measures and Management Procedures

In addition to the mitigation measures and management procedures described previously in this Section, the Proponent would implement the following measures and procedures to ensure that Project-related benefits for the community surrounding the Project Site are maximised and adverse impacts are minimised.

- Where ever practicable, preference would be given to suppliers of equipment, services or consumables located within the Shoalhaven Local Government Area or Illawarra Region.
- Where ever practicable, when engaging new employees, the Proponent would hire candidates who live within the Shoalhaven Local Government Area over candidates with equivalent experience and qualifications based elsewhere.
- The Proponent would continue to support local junior sporting clubs through sponsorship or in kind support. In addition, the Proponent would review any request by a community organisation for support or assistance throughout the life of the Project.
- The Proponent would consult with the residents and community surrounding the Project Site, as required.
- The Proponent would advertise and maintain a community complaints telephone line. This telephone line would be likely to be the main telephone line for the Nowra Brickworks Quarry.
- The Proponent would develop and maintain a Complaints Management Plan to ensure prompt response to issues identified by the public. This plan would be prepared and included within the initial and subsequent Mining Operations Plans prepared for the Project.

4.13.3 Impact Assessment

The continuation and expansion of extractive operations at the Nowra Brickworks Quarry would result in a range of socio-economic benefits to the community within the vicinity of the Project Site. These benefits would include the following.

- Direct and indirect fulltime employment for approximately 20 and 7 personnel respectively at an annual production rate of 300 000t. At an annual production rate of 500 000t, the Project would provide direct and indirect employment for approximately 25 and 12 personnel respectively. As indicated in Section 4.1.6.3, these positions would be created in an area that, in 2006, had an unemployment rate of approximately 9%, compared with an unemployment rate of approximately 6% for NSW as a whole.
- Injection of approximately $11.3 million per year into the local and regional economy, with an additional approximately $4.1 million into the State and national economy at an annual production rate of 500 000t. This expenditure is likely to generate additional economic activity and flow on effects, providing further employment opportunities.
- Provision of a range of competitively priced, high quality specialist and general quarry products for construction, road maintenance and other purposes that would result in improvements to public safety and reduced construction and road maintenance costs in an area that, as described in Section 4.1.6.2, is growing significantly faster (approximately 1.5% per year) than NSW as a whole (approximately 0.95% per year).
- Provision of a competitively priced service to accept and recycle construction material, concrete and waste bitumen, preserving resources and reducing the amount of this material that would be placed into landfill or within other unlicensed locations.
- Provision of a well managed facility to receive, process and place VENM at competitive prices, resulting in reduced construction costs, reduced demand for landfill and creation of a final landform within the Project Site that will, in the long-term, provide significant biodiversity values and ecological services.
- Ongoing availability of easily accessible water supplies, including pumps for rapidly filling tankers, for use during emergencies.
- Continued support for local junior sporting and other organisations.

It is acknowledged that the Project would also have some minor adverse impacts, including the following.

- A minor increase in the salt load of Nowra Creek.
- The short to medium-term loss of an area of Spotted Gum forest.
- More frequent blasting operations.
- A slight increase in the number of heavy vehicles using the Princes Highway.

The Proponent contends that any adverse socio-economic or environmental impacts, both actual and perceived, would be more than adequately countered by the positive effect that the Project would have on employment in the vicinity of the Project Site and contribution of the Project to the local and regional economy and community.

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PREAMBLE

Section 5

Draft Statement of Commitments

This section tabulates and summarises the mitigation measures, management procedures and monitoring commitments made by the Proponent with respect to the proposed continuation and expansion of the Nowra Brickworks Quarry.

The commitments are presented in ***Table 5.1*** *in terms of their desired outcome(s), action(s) and timing.*

In order to assist readers when reviewing the commitments throughout this section, ***Figure 5.1*** *presents an aerial photograph of the Project Site and surrounds, together with the boundaries of the main Project components and all monitoring locations.*

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Table 5.1
Draft Statement of Commitments for the Nowra Brickworks Quarry

Desired Outcome	Action	Timing
1. Environmental Management		
Compliance with all conditional requirements in all approvals, licences and leases.	1.1 Comply with all commitments recorded in **Table 5.1**. 1.2 Comply with all conditional requirements included in the: • Project Approval; • Environment Protection Licence; • Mining Leases; and • any other approvals.	Continuous and as required.
All operations conducted in accordance with all relevant documentation.	1.3 Undertake all activities in accordance with the accepted Mining Operations Plan, environmental procedures, safety management plan and/or site-specific documentation.	Continuous and as required.
2. Area of Activities		
All approved activities are undertaken generally in the location(s) nominated on the figures shown in Sections 2 and 4.	2.1 Mark, and where appropriate, survey the boundaries of the areas of proposed disturbance.	Prior to the commencement of the relevant activity.
3. Hours of Operation		
All operations are undertaken within the approved operating hours.	3.1 Extraction, processing and VENM backfilling-related activities. • 7:00am to 6:00pm, Monday to Friday. • 7:00am to 4:00pm, Saturday 3.2 Product despatch. • 7:00am to 6:00pm, Monday to Saturday. • Up to three unladen trucks would arrive at the Project Site between 6:00am and 7:00am, Monday to Saturday and may return to the Project Site between 6:00pm and 8:00pm, Monday to Friday and between 4:00pm and 6:00pm Saturday. 3.3 Maintenance-related activities • 7:00am to 6:00pm, Monday to Saturday.	Continuous

Table 5.1 (Cont'd)
Draft Statement of Commitments for the Nowra Brickworks Quarry

Desired Outcome	Action		Timing
4. Hydrology (Surface Water and Groundwater)			
All surface water and ground water managed such that water to be discharged from the Project Site complies with all assessment criteria	4.1	Maintain and progressively relocate the existing surface water diversion and sediment containment structures.	As required
	4.2	Construct, maintain and relocate, as required, surface water diversion structures to ensure that all surface water flows within disturbed sections of the Project Site are directed to the extraction area or the water storage facility. The maximum catchment area would be required to be less than 5.9ha. To achieve this, the Proponent would ensure that progressive rehabilitation is undertaken as soon as practicable on sections of the Project Site no longer required for extraction-related operations.	
	4.3	Construct temporary surface water diversion structures on the upslope side of all soil stockpiles or other disturbed areas to limit erosion.	
	4.4	Install sediment fencing adjacent to the down-slope toe of all soil stockpiles or other disturbed areas.	
	4.5	Regularly inspect all surface water and sediment control structures for adequacy and repair or upgrade, where required.	Six monthly and following significant rainfall events
	4.6	Install and maintain a suitably sized sump within the active extraction area to collect all surface water runoff and groundwater inflows to the extraction area.	Following receipt of project approval
	4.7	Preferentially use water within the extraction area sump for dust suppression-related activities. Surplus water within the extraction area sump would be pumped to the water storage facility.	As required
	4.8	Preferentially use water within the water storage facility for rehabilitation-related activities or for irrigation within the irrigation area.	
	4.9	Construct 'grassed buffer areas' adjacent to the site access road and other sealed sections of the Project Site.	Within 6 months of receipt of project approval

Table 5.1 (Cont'd)
Draft Statement of Commitments for the Nowra Brickworks Quarry

Desired Outcome	Action		Timing
5. Ecology			
Minimise Project-related impacts on flora and fauna within and surrounding the Project Site.	5.1	Stage extraction activities such that they preferentially progress from disturbed sections of the Project Site to undisturbed sections.	Continuous
	5.2	Remove native vegetation only from those areas required for operational purposes during the subsequent 12 months.	
	5.3	Mark hollow-bearing trees to ensure they are readily identifiable.	
	5.4	Mark the boundaries of areas of native vegetation to be cleared.	Prior to clearing operations
	5.5	Erect cage traps in the vicinity of hollow-bearing trees for three consecutive nights.	
	5.6	Keep any trapped animal in captivity by animal for the period of clearing of native vegetation.	During clearing operations
	5.7	Clear non-hollow-bearing trees before clearing other vegetation.	During clearing operations
	5.8	Ensure a qualified fauna consultant is present during clearing of hollow-bearing trees.	
	5.9	Release any trapped animal adjacent to the Project Site.	Following clearing operations
	5.10	Break or cut cleared vegetation into manageable sections to be placed on areas undergoing rehabilitation or within other areas of native vegetation surrounding the Project Site.	Following clearing operations
	5.11	Undertake weed control programs within the Project Site.	Annually
	5.12	Strip, stockpile and spread topsoil and subsoil in accordance with Section 2.3.5.	During soil stripping programs
	5.13	Progressively rehabilitate all areas of disturbance no longer required for extraction or placement activities.	Following completion of extraction operations
	5.14	Implement the proposed biodiversity offset strategy	Within 6 months of receipt of project approval

Table 5.1 (Cont'd)
Draft Statement of Commitments for the Nowra Brickworks Quarry

Desired Outcome	Action	Timing
6. Traffic and Transportation		
Limit the impact of Project-related traffic	6.1. Adhere to the approved hours of operation.	Continuous
	6.2. Adhere to all speed limits.	
Allow concerned residents or motorists to report any traffic-related incidents, unsafe operation or general concerns.	6.3. Establish a complaints register, advertised in the local telephone directory.	On receipt of project approval
	6.4. Investigate all complaints and act decisively on substantiated incidents.	
Ensure all weight restrictions are adhered to	6.5. Weigh all entering and exiting laden trucks.	Continuous
Limit the tracking of material onto the Princes Highway to minimise dust, particulate matter and debris emissions.	6.6. Seal a 150m section of the site access road from the entrance gate and construct a wheel wash facility.	Prior to the amount of quarry products despatched from the Project Site exceeding 250 000t per year
	6.7. Ensure all loads are covered.	Continuous
	6.8. Provide a safe area for covering loads.	
Ensure all drivers adhere to the Projects Code of Conduct	6.9. Require all truck drivers to sign a Driver's Code of Conduct.	Prior to each driver leaving site for the first time
7. Air Quality		
Site activities are undertaken without exceeding DECC air quality criteria or goals.	7.1. Utilise water sprays and water trucks in all areas of potential dust lift-off to minimise potential dust emissions.	Continuous
	7.2. Utilise a chemical dust lift-off suppression system along unsealed roads, tracks and working areas, as well as with the mobile processing plant(s).	
	7.3. Utilise efficient mist sprays and wind sheltering equipment on processing equipment.	
	7.4. Maintain a maximum speed limit within the Project Site of 10km/h.	
	7.5. Stabilise the unsealed shoulders of the site assess road.	Prior to the amount of quarry products despatched from the Project Site exceeding 250 000t per year
	7.6. Install a wheel wash on the site access road to limit tracking of material onto the Princes Highway	
	7.7. Disturb only the minimum area required for operation of the quarry during the subsequent 12 months.	Continuous
	7.8. Stabilise soil stockpiles to be in place for more than 10 days through the application of cleared vegetation, hydroseeding, hydromulching or equivalent.	Following soil stripping activities

Table 5.1 (Cont'd)
Draft Statement of Commitments for the Nowra Brickworks Quarry

Desired Outcome	Action	Timing
7. Air Quality (Cont'd)		
Site activities are undertaken without exceeding DECC air quality criteria or goals. (Cont'd)	7.9. Minimise the creation of minor roads and access tracks.	Continuous
	7.10. Utilise dust aprons, dust extraction systems and/or water injection or sprays during drilling operations.	During drilling operations
	7.11. Adequately stem all blast holes with aggregates.	During blasting operations
	7.12. Commence rehabilitation as soon as practicable.	Once an area is no longer required for extraction or placement-related operations
8. Noise		
Project-related noise impacts on surrounding residences minimised.	8.1. Adhere to the approved hours of operation.	Continuous
	8.2. Use noise-mitigated mobile and processing equipment.	
	8.3. Undertake all processing operations within the deepest section of the quarry.	
	8.4. Maintain all mobile and processing equipment in accordance with the manufacturer's specifications.	
	8.5. Preferential selection of equipment with lower sound power levels over equipment with higher sound power levels.	As equipment renewal is required
	8.6. Progressively install frequency modulated reversing alarms on mobile equipment.	
9. Blasting		
Project-related blasting impacts within assessment guidelines.	9.1. Design and implement blasts by a suitably qualified blasting engineer and experienced shot-firer.	Each blast
	9.2. Design blasts to ensure the assessment criteria described in Section 4.7.4.5 are complied with at all residential and commercial receivers.	
	9.3. Modify blast designs, mitigation measures and operating procedures on the basis of monitoring results.	As required
	9.4. Limit blasting operations to between the hours of 9:00am and 4:00pm, Monday to Saturday.	Each blast
	9.5. Negotiate an appropriate arrangement with the owner of Residence A.	Prior to completion of Stage 1 of the Project

Table 5.1 (Cont'd)
Draft Statement of Commitments for the Nowra Brickworks Quarry

Desired Outcome	Action	Timing
9. Blasting (Cont'd)		
Project-related blasting impacts within assessment guidelines. (Cont'd)	9.6. Notify the following organisations verbally of each blast. • Shoalhaven City Council. • NSW Police. • NSW Roads and Traffic Authority. • The owner of Residence A. • Environment Protection Authority. • The South Coast Correctional Facility (when constructed).	On the working day prior to the blast being initiated
	9.7. Maintain the existing main telephone number (02 4421 7766) for the quarry as an environmental complaints line.	Continuous
	9.8. Maintain a register of complaints.	
	9.9. Respond promptly to any issue of concern.	
10. Aboriginal Cultural Heritage		
Unidentified Aboriginal sites are not disturbed by the Proponent's activities.	10.1. Ensure representatives of the Aboriginal community are present during activities that would disturb the upper 10cm of soil in the area marked on **Figure 5.1.**	During soil stripping operations in the area indicated
	10.2. Cease all work in the event that an item of suspected Aboriginal cultural heritage is discovered, establish a 20m x 20m buffer around the item and consult with the Department of Environment and Climate Change.	As required
	10.3. Cease all work in the event that suspected human remains are discovered, establish a 50m x 50m buffer around the item(s) and consult with NSW Police and the Department of Environment and Climate Change.	As required
11. Soils		
The Proponent's activities do not result in soil degradation or loss.	11.1. Strip soils only when they are moist.	During soil stripping operations
	11.2. Strip topsoils using a scraper, excavator or bulldozer to a depth of between 180mm and 250mm below the surface.	
	11.3. Strip subsoils to a depth of between 175mm and 500mm below the base of the topsoil.	
	11.4. Place soils directly on areas undergoing progressive rehabilitation, where practicable.	During rehabilitation operations

Table 5.1 (Cont'd)
Draft Statement of Commitments for the Nowra Brickworks Quarry

Desired Outcome	Action	Timing
11. Soils (Cont'd)		
The Proponent's activities do not result in soil degradation or loss. (Cont'd)	11.5. Place Virgin Excavated Natural Material (VENM) in the manner described in Section 2.9.5.	During VENM placement operations
	11.6. Place subsoil over the VENM to a thickness of approximately 250mm.	During soil placement operations
	11.7. Place topsoil to a thickness of approximately 200mm.	
	11.8. Apply biosolids to the topsoil at a rate of less than 20 dry tonnes per hectare.	
	11.9. Spread between 20mm to 40mm of mulched native vegetation, broken tree debris or bitumen sprayed straw mulch over the topsoil.	
	11.10. Locate soil stockpiles, where required, at least 2m from existing vegetation, areas of concentrated surface water flows, roads or other hazardous areas.	During soil stockpiling operations
	11.11. Construct soil stockpiles as low (less than 2m high), flat, elongated mounds with side slopes no greater than 1:3(V:H). Where practicable, topsoil stockpiles would be less than 1m high.	
	11.12. Stabilise stockpiles to be in place for more than 10 days through the application of mulched or broken vegetation, hydroseeding, hydromulching or equivalent.	During soil stockpiling operations
	11.13. Erect a sediment fence approximately 1m from the toe on the downslope side of soil stockpiles.	
	11.14. Use stockpiled soil material for rehabilitation-related operations within 6 months of being stockpiled.	
Ensure sediment-laden surface water is not permitted to flow off site.	11.15. Maintain and relocate an earth bank to divert all 'clean' surface water to a sediment retention structure and level spreader.	Continuous
	11.16. Divert all surface water flows from disturbed areas to the water storage facility where practicable.	
	11.17. Divert all other potentially sediment-laden surface water flows to a sump within the extraction area.	

Table 5.1 (Cont'd)
Draft Statement of Commitments for the Nowra Brickworks Quarry

Desired Outcome	Action	Timing
11. Soils (Cont'd)		
Ensure sediment-laden surface water is not permitted to flow off site. (Cont'd)	11.18. Preferentially use water from the extraction area sump for dust suppression and watering of roads and other areas.	
	11.19. Construct a bio-infiltration facility in accordance with the specifications in Section 4.9.3.	Prior to discharge of surface water to Nowra Creek
	11.20. Preferentially use water within the water storage facility for rehabilitation-related activities.	Continuous
	11.21. Pump excess water from the extraction are sump to the water storage facility.	As required
	11.22. Pump water from the water storage facility to a bio-infiltration facility when the concentration of total suspended solids within the water storage facility is less than 50mg/L.	
	11.23. Pump water from the bio-infiltration facility to Nowra Creek.	
12. Visibility		
Limit impacts to the visual amenity of the area surrounding the Project Site.	12.1. Maintain the existing perimeter bunds.	Continuous
	12.2. Maintain the existing mature trees on the eastern boundary of the Project Site.	
	12.3. Adopt a high standard of house keeping.	
13. Socio-Economic		
Ensure Project-related adverse impacts are minimised and benefits are maximised.	13.1. Give preference to suppliers of equipment, services or consumables located within the Shoalhaven Local Government Area or Illawarra Region, where ever practicable.	Continuous
	13.2. Give preference, where reasonable to do so, when engaging new employees to candidates who live within the Shoalhaven Local Government Area.	
	13.3. Continue to support local junior sporting clubs through sponsorship or in kind support.	
	13.4. Review any request by a community organisation for support or assistance during the life of the Project.	As required

Table 5.1 (Cont'd)
Draft Statement of Commitments for the Nowra Brickworks Quarry

Desired Outcome	Action		Timing
13. Socio-Economic (Cont'd)			
Ensure Project-related adverse impacts are minimised and benefits are maximised. (Cont'd)	13.5.	Consult with the residents and community surrounding the Project Site.	Continuous
	13.6.	Advertise and maintain a community complaints telephone line.	
	13.7.	Develop and maintain a Complaints Management Plan to ensure prompt response to issues identified by the public.	
14. Environmental Monitoring			
Ongoing monitoring of surface and groundwater-related impacts.	14.1.	Monitor groundwater levels within Piezometers P1 to P8 (**Figure 5.1**).	Monthly.
	14.2.	Monitor and record groundwater quality within piezometers P2, P3, P5, P6 and P7 (**Figure 5.1**).	Quarterly
	14.3.	Monitor and record groundwater seepage on rock faces. To be undertaken by a geotechnical engineer.	Six monthly
	14.4.	Monitor and record surface water quality within the extraction area sump, the water storage facility, the sediment containment structure and within Nowra Creek upstream and downstream of the Project-site discharge point.	Monthly
	14.5.	Determine and record the quality of water pumped from the water storage facility to the bio-infiltration facility.	During each pumping campaign
	14.6.	Determine and record the quality of water discharged from the bio-infiltration facility to Nowra Creek.	
	14.7.	Determine and record the quality of water flowing from the sediment containment structure to Nowra Creek.	During or immediately following significant rainfall events
	14.8.	Determine, using in-line meters, and record the volumes of water pumped: • from the extraction area sump to the water storage facility; • from the water storage facility to the bio-infiltration facility; and • from the bio-infiltration facility to Nowra Creek.	During pumping programs

Table 5.1 (Cont'd)
Draft Statement of Commitments for the Nowra Brickworks Quarry

Desired Outcome	Action		Timing
14. Environmental Monitoring (Cont'd)			
Ongoing monitoring of surface and groundwater-related impacts. (Cont'd)	14.9.	Determine and record the volume of water used for extraction, processing, placement and rehabilitation-related operations.	Daily
Ongoing monitoring of ecology-related impacts.	14.10.	Undertake regular monitoring of areas undergoing rehabilitation to determine the success or otherwise of the management, mitigation and ameliorative measures and the rehabilitation programs.	Six monthly
	14.11.	Take photographs from fixed points to document activities within the Project Site, including rehabilitation progress.	Six monthly
	14.12.	Undertake weed inspection programs.	Annually
Ongoing monitoring of air quality-related impacts.	14.13.	Maintain the existing network of deposited dust monitoring gauges and determine and record dust deposition rates.	Monthly
	14.14.	Establish a meteorological station capable of measuring temperature at the surface and at a height of 10m, wind direction and speed and rainfall.	Within 3 months of receipt of project approval
Ongoing monitoring of blasting-related impacts.	14.15.	Monitor all blasts at the blast monitoring locations indicated on **Figure 5.1**.	Each blast
15. Environmental Documentation			
A systematic set of documents are in place to guide the planning and implementation of all environmental management strategies.	15.1	Incorporate the environmental procedures in an on-site management system.	Prior to relevant activity.
	15.2	Update the Mining Operations Plan.	As required.
	15.3	Incorporate relevant environmental data / information in Annual Environmental Management Reports.	Annually.
	15.4	Prepare the following environmental plans for the Project. – Air Quality Monitoring Program. – Noise Monitoring Program. – Blast Monitoring Program. – Flora and Fauna Management Plan. – Site Water Management Plan. – Groundwater Management Plan. – Rehabilitation and Landscape Management Plan	Variously.
	15.5	Incorporate the environmental procedures in an on-site management system.	Prior to relevant activity.

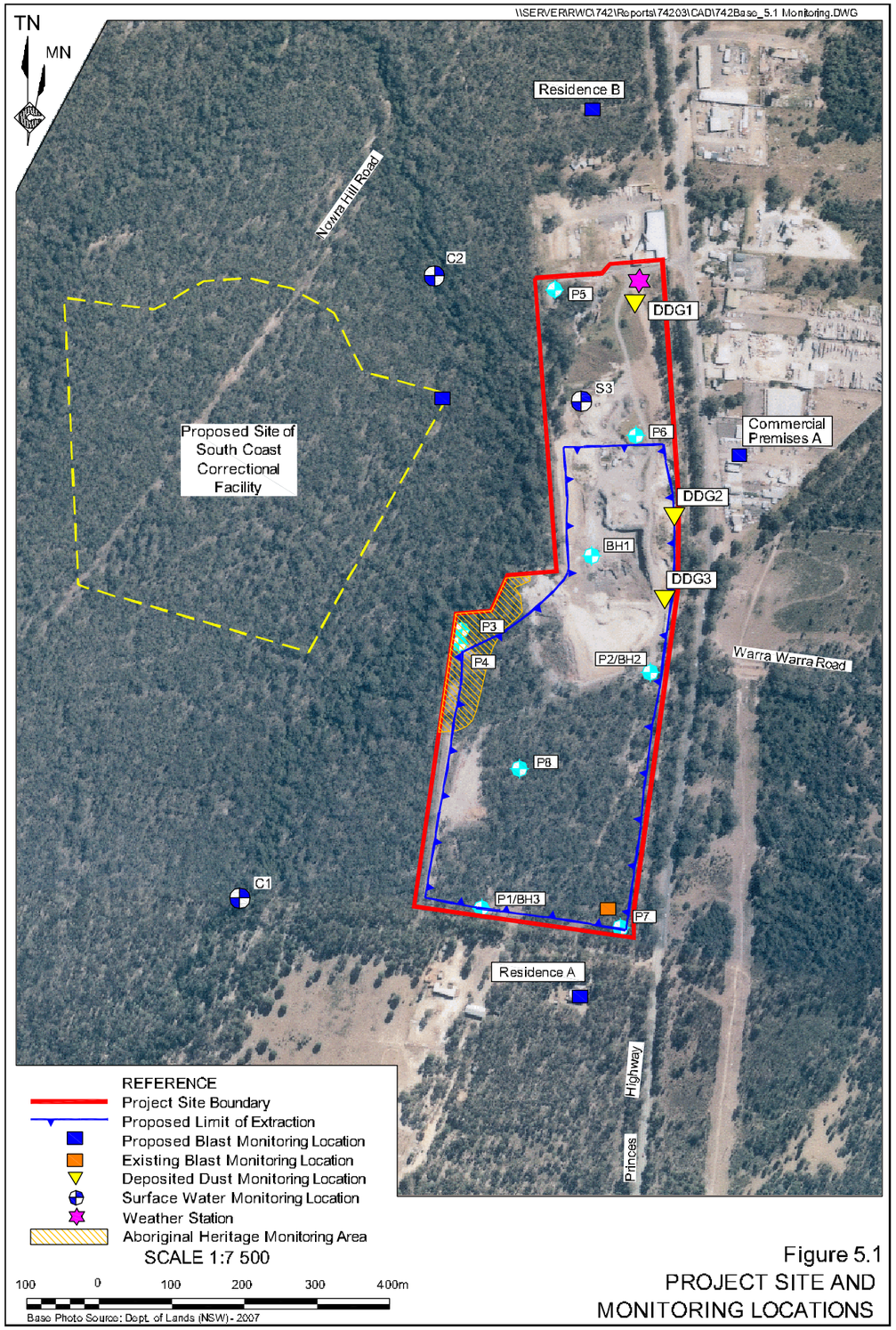

Figure 5.1
PROJECT SITE AND MONITORING LOCATIONS

R.W. CORKERY & CO. PTY. LIMITED

CITY PLAN SERVICES

PREAMBLE

Section 6

Project Evaluation and Conclusions

This section of the Environmental Assessment concludes the document with an evaluation of the proposed continuation and expansion of extractive operations at the Nowra Brickworks Quarry. Alternative development options are considered and the residual environmental risks assessed. This section also includes an assessment of the Project against the principles of Ecologically Sustainable Development and concludes with a justification of the Project.

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6.1 DEVELOPMENT ALTERNATIVES

6.1.1 Introduction

The Director-General's Requirements issued on 20 September 2007 require that the *Environmental Assessment* include a detailed description of the development alternatives considered.

The considerations of feasible alternatives to the proposed activities are discussed in this section and relate principally to:

- reduced depth of extraction;
- no expansion of extraction area;
- fixed processing plant;
- no VENM placement; and
- two extraction areas.

The alternative of not developing Nowra Brickworks Quarry is also considered in this section.

6.1.2 Reduced Depth of Extraction

The Project, as proposed, would result in the base of the extraction area with an elevation of approximately 19m AHD. Consideration was given to limiting the elevation of the base of the proposed extraction area to the elevation of the current base of the extraction area, namely approximately 29m AHD.

As indicated in Martens (2009), the estimated piezometric surface within the proposed extraction area occurs at an elevation of between approximately 30m AHD and 39m AHD. Limiting the base of the elevation of the base of the extraction area to approximately 29m AHD would have the effect of reducing the groundwater inflows into the extraction area. However, this approach was rejected for the following reasons.

- Limiting the elevation of the extraction area to approximately 29m AHD would, following placement of VENM into the extraction area, result in sterilisation of approximately 1.7 million m3, or 4 million tonnes, of shale resource.
- The sterilisation of approximately 4 million tonnes of material would result in a shorter Project life, necessitating the requirement to locate and develop an alternative source of quarry products and an alternative location to place VENM soon than would otherwise be the case.

- Limiting the elevation of the extraction area to approximately 29m AHD would result in less material being extracted and less volume for placement of VENM for the same level of surface disturbance, including removal of native vegetation, when compared with the proposed development. As a result, the same biodiversity impacts would be incurred for less material recovered.
- Limiting the level of extraction operations to 29m AHD would reduce the amount of groundwater that would flow into the extraction area. However, the anticipated groundwater inflows would not result in significant environmental impacts because, with the construction of the irrigation area and the grassed buffer areas, discharge of groundwater would not be required.
- Water that would be permitted to flow from the Project Site to Nowra Creek would have a concentration of dissolved solids of approximately 220mg/L, or approximately the same concentration as the concentration of Nowra Creek.

As a result, limiting the depth of extraction would not result in any significant benefit to the environment and would sterilise a significant shale resource.

6.1.3 No Expansion of Extraction Area

The Project, as proposed, would result in disturbance of approximately 7.4ha of native vegetation. The Proponent considered limiting development of the Nowra Brickworks Quarry to those areas already disturbed, namely limiting development to Stage 1 of the Project. This would have the advantage of not disturbing additional native vegetation. However, this approach was rejected for the following reasons.

- Limiting extraction to the areas of current disturbance would significantly reduce the amount of quarry products that would be extracted. This would result in alternative sources of quarry products having to be developed much sooner than would otherwise be the case.
- Section 2.11.5 indicates that the Proponent anticipates that during Stages 2 to 5, the vast majority of material that would be imported to the Project Site, including VENM, would be imported as backloads, providing significant environmental and economic benefits. Limiting extraction operations to Stage 1 of the proposed development would result in VENM placement operations occurring after the completion of the extraction operations, removing the opportunity to using backloads to transport VENM to the Project Site and the chance to realise the environmental and economic benefits that would flow from such a synergy.

As a result, on balance, the Proponent contends that the additional environmental impacts associated with the proposal, namely removal of approximately 7.4ha of native vegetation, are justified based on the additional material that would be recovered and environmental and economic benefits that would flow from transporting VENM to the Project Site using backloads.

6.1.4 Fixed Processing Plant

The Project, as proposed, would utilise mobile crushing and screening equipment. The Proponent considered incorporating a fixed processing plant into the Project. This would have the advantage of allowing fixed dust and noise-mitigation equipment to be installed. However, this approach was rejected for the following reasons.

- A fixed processing plant would need to be constructed at the natural surface. This would result in additional dust, noise and visual impacts. The dust and noise impacts of a fixed plant at the natural surface would be likely to be greater that the dust and noise impacts of a mobile plant in the base of the quarry, even if dust and noise-mitigation equipment were fitted to the fixed plant.
- The resource beneath the fixed plant would be sterilised.
- A fixed plant at surface would require stockpile areas surrounding the plant, further increasing the amount of the shale resource that would be sterilised and potentially increasing dust impacts of the Project.
- A fixed plant would not be as flexible as a mobile plant which can be combined in varying combinations depending on the quarry products required.
- A fixed plant would require two processing trains to enable the processing of recycling materials. Alternatively, if a single processing train were installed, processing of quarry products would have to cease to allow processing of recycling materials, significantly impacting on the ability of the quarry to provide a constant supply of quarry products.
- A fixed plant would require the installation of an electrical supply sufficient to operate the plant. This would impose a significant up-front economic cost on the Project.

As a result, on balance, the Proponent contends that the additional environmental impacts associated with the proposal, namely an inability to fit fixed dust and noise-mitigation equipment to the crushing and screening equipment, are outweighed by the environmental and economic costs of doing so.

6.1.5 No VENM Placement

The Project, as proposed, would include the placement of VENM within the extraction area to recreate the pre-extraction landform. The Proponent considered not importing such material. This would have the advantage of removing the small risk of importing inappropriate or contaminated material to the Project Site. However, this approach was rejected for the following reasons.

- No importation of VENM would result in the loss of the opportunity to backfill the extraction area and to create a landform that mimics the pre-extraction landform. This would pose ongoing safety and environmental risks that were considered by the Proponent to be unacceptable.
- If VENM were not imported and placed within the Project Site, a portion of this material may be placed in unlicensed facilities elsewhere, dumped illegally or placed into landfill.
- No importation of VENM would result in a lost opportunity to process and recycle a portion of the imported material for to form quarry products. This would be inconsistent with the principles of ecologically sustainable development and would not maximise the efficiency of resource utilisation.
- The Proponent would implement management measures that would minimise the risk of inappropriate material being imported to or placed within the Project Site.

As a result, the Proponent contends that the minor to very minor additional risk or importation of inappropriate material to the Project Site is outweighed by the environmental and safety benefits of doing so.

6.1.6 Two Extraction Areas

The draft Nowra Bomaderry Structure Plan (the 'structure plan') identifies a conceptual road network in the vicinity of the Project Site (see Section 3.3.3.7). **Figure 6.1** presents a plan showing the proposed road network. The Plan identifies a conceptual local road extending west from the intersection of Warra Warra Road and the Princes Highway, through the Project Site, before turning to the northwest and intersecting the Nowra Hill Road reserve in the vicinity of the proposed South Coast Correctional Facility. The Proponent considered an extraction operation that resulted in two extraction areas, leaving a corridor for the future construction of the conceptual Warra Warra Road extension. However, this approach was rejected for the following reasons.

- To enable safe operation of both the conceptual road and the quarry, a corridor approximately 50m wide would be required**.** This would result in the potential sterilisation of approximately 1 million tonnes of shale resource.

- The location, width and timing of construction of the conceptual road have not been determined. As a result, the Proponent is unable to accurately determine the location and width of any potential 'road corridor' that would be required.
- ML 6322 was granted in 1971, while the structure plan was published in 2006. As a result, the Proponent's rights to the shale resources predate the publication of the draft structure plan.
- The proposed road network also passes across the proposed site of the South Coast Correctional Facility and would be likely to be incompatible with it (**Figure 6.1**). The Shoalhaven City Council has, in a Media Release dated 29 June 2005, indicated that it 'strongly supported' the proposed Correctional Facility. As a result of the incompatibility of the conceptual Warra Warra Road extension proposed local road and the proposed Correctional Facility, and in light of Council's strong support for the Correctional Facility, it is likely that any future development of this road would have an alignment that would be different from the alignment indicated within the structure plan.
- The separation of the proposed extraction area into two extraction areas would provide a number of significant logistical issues for the operation of the Project. These would include transporting equipment that would not be registered for use on public roads from one extraction area to the other and separation of the water management systems for the Project.
- The Project as proposed includes a proposal to backfill the extraction area with VENM to enable the formation of a final landform that would mimic the pre-extraction landform. As a result, extraction of shale resource within the area of the proposed local road would not permanently sterilise the area for development of the proposed road. As a result, the proposed road could be constructed following completion of VENM placement operations.

The Proponent contends that in light of the above, the provision of a 'road corridor' would impose an unreasonable burden on the Proponent.

6.1.7 Not Proceeding with the Development

The consequences of not proceeding with the Project include the following.

- The recoverable shale would not be mined by the Proponent. Such an outcome would be contrary to the objective of the Department of Primary Industries - Mineral Resources and the Proponent's obligations under the terms of its mining leases to maximise resource utilisation.
- The Proponent's customers would be required to source the quarry products currently supplied by the Proponent from other sources. This may increase the cost of such material and the distance it has to be transported, resulting in higher construction costs and additional heavy vehicle traffic and greenhouse gas emissions.

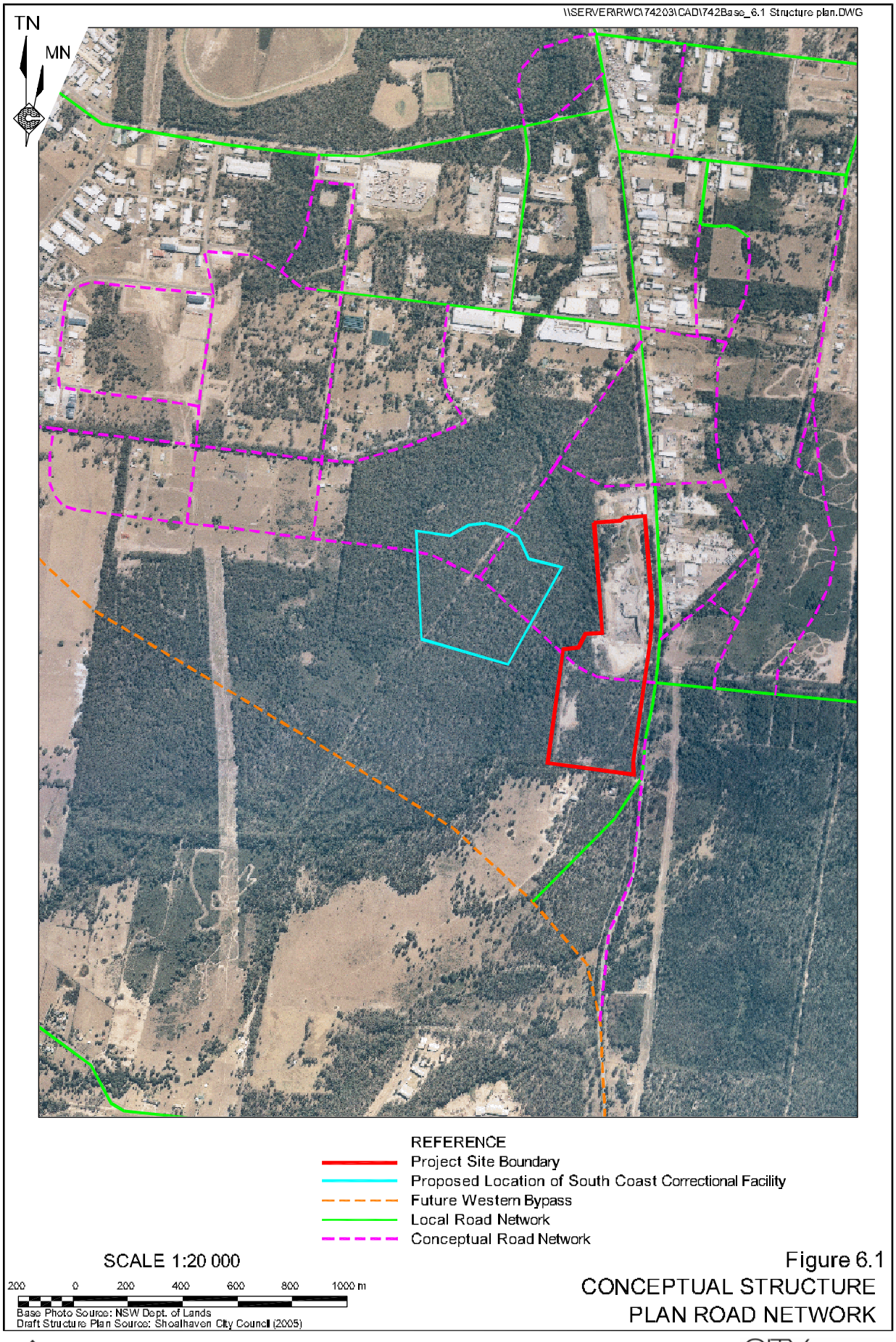

Figure 6.1
CONCEPTUAL STRUCTURE PLAN ROAD NETWORK

- The opportunity to create up to 37 full-time equivalent positions would be foregone.
- The disposable wages associated with the above positions would be foregone, a substantial portion of which would be spent within the Shoalhaven City Council Local Government Area
- The benefits flowing to the Shoalhaven City Council and the NSW and Commonwealth Governments through additional rates, royalties, taxes and contributions would be foregone.
- The opportunity to permanently preserve and protect the native vegetation within the proposed biodiversity offset area(s) and Project Site may be foregone.
- A number of relatively minor impacts on the biophysical environment would not eventuate.

It is considered therefore that the public interest of proceeding with the Project exceed the residual negative impacts associated with it.

6.2 EVALUATION OF THE BIOPHYSICAL, ECONOMIC AND SOCIAL ASPECTS

6.2.1 Introduction

This sub-section justifies the proposed continuation and expansion of extractive operations at the Nowra Brickworks Quarry by drawing together and reviewing the full range of positive and negative predicted residual impacts, including cumulative impacts previously discussed in Section 4 of this document. The residual impacts are those that remain after the proposed design and operational management, mitigation and offset measures have been taken considered. This part also presents and reviews the design and operational management, mitigation and offset measures proposed by the Proponent and recorded in the draft Statement of Conditions.

6.2.2 Biophysical Considerations

6.2.2.1 Introduction

Sections 4.2 to 4.13 discuss the range of anticipated residual impacts on the biophysical and socio-economic environment attributable to the Project, including cumulative impacts. Those impacts considered to be of greatest significance, and the proposed management of these, are summarised below.

6.2.2.2 Hydrology

Potential Project-related impacts include adverse impacts on the quality and quantity of water within Nowra Creek and aquifers within and in the vicinity of the Project Site.

The hydrology assessment concluded that the following.

- The concentration of dissolved solids in water that would be allowed to flow to Nowra Creek from undisturbed, rehabilitated and impervious sections of the Project Site would be approximately 220mg/L, or approximately the same as the concentration within Nowra Creek.
- The Project would have negligible impact on the flooding regime within Nowra Creek and the Project Site would not be impacted by flood events within the creek.
- The Project would result in a draw down of the piezometric surface in the vicinity of the Project Site of a maximum of 18m. The 1m drawdown contour is anticipated to occur approximately 1 425m from the boundary of the extraction area.
- Groundwater within the vicinity of the Project Site is moderately to highly saline, with an average conductivity of 8 729µS/cm.
- As the existing piezometric surface is 9m below the invert of Nowra Creek, the anticipated drawdown of the surface would be unlikely to have an impact of Nowra Creek.
- As the closest registered bore to the Project Site is 3.9km to the northeast, the anticipated drawdown of the piezometric surface would not impact on registered bores in the vicinity of the Project Site. In addition, the economic value of groundwater is likely to be low due to its saline nature.
- With the construction of an irrigation area of approximately 4ha, no discharge of water from within the extraction area or the water storage facility would be required.

As a result, the Project is not anticipated to be likely to have a significant adverse impact on the quality and quantity of water within Nowra Creek or the aquifer within and in the vicinity of the Project Site.

6.2.2.3 Ecology

Eleven species and three flora species listed on the schedules of the *Threatened Species Conservation Act 1995* (TSC Act) were recorded as occurring within 5km of the Project Site.

Approximately 7.4ha of the Project Site comprises previously logged Spotted Gum forest. The remainder of the Project Site comprises disturbed land. Eighty one species of plants were identified within the Project Site, including thirty species of exotic weeds. Approximately 48

hollow-bearing trees have been identified within the Project Site, of which approximately 37 would be disturbed by the Project. No Endangered Ecological Communities or species listed under the *Threatened Species Conservation Act 1995* were observed within the Project Site.

Sixty two species of fauna were observed within or surrounding the Project Site. One, the Square-tailed Kite, was observed adjacent to the Project Site.

The Ecology assessment concluded that no threatened species listed under the TSC Act or under the *Environment Protection and Biodiversity Conservation Act 1999* would be significantly impacted by the Project.

6.2.2.4 Traffic and Transportation

Potential Project-related impacts include increasing traffic levels on the Princes Highway and poor performance of the intersection between the site access road and highway.

The anticipated additional Project-related traffic would increase traffic levels on the Princes Highway by 0.1% or less. The operation of the existing site entrance would be good to satisfactory.

6.2.2.5 Air Quality

Potential air quality impacts primarily include the dispersion of particulate material in the atmosphere.

At a maximum rate of product dispatch of 500 000t per year, the anticipated rate of dust deposition from the Project alone would marginally exceed the assessment criteria of $2g/m^2$/month at two sites, namely at the Nowra Brickworks site adjacent to the northern boundary of the Project Site ($2.2g/m^2$/month) and at the conceptual roundabout at the intersection of Warra Warra Road and the Princes Highway ($2.7g/m^2$/month). In addition, the maximum cumulative daily $PM_{2.5}$ concentration would exceed the assessment criteria of $25\mu g/m^3$ at one receptor, namely Residence A to the south of the Project Site ($26.25\mu g/m^3$).

6.2.2.6 Noise

Existing noise levels in the vicinity of the Nowra Brickworks Quarry are influenced by a range of sources, including traffic on the Princes Highway, industrial noise from industrial and commercial operations to the east and north of the Project Site, noise from the Nowra Brickworks Quarry and naturally occurring noise, including noise from wind in trees, insects and birds. Project-specific noise assessment criteria were determined for four representative residences, namely Residences A to D.

Project-related noise emissions would be less than the Project-specific assessment criteria at all assessment locations, with the exception of Residence A during Stage 5 of the Project where the Project-specific assessment criteria (51dB(A)) would be exceeded by 5dB(A).

6.2.2.7 Blasting

Potential blasting impacts primarily include ground vibration and airblast overpressure.

The blasting assessment indicates that the existing blasting parameters would result in exceedances of the blasting assessment criteria at Residence A and B and Commercial Premises A. However, the blasting parameters would be modified based on the site blasting laws to ensure that blasting emissions at non-Project related residences would comply with the blasting assessment criteria. In addition, the Proponent would negotiate a suitable arrangement with the owners of Residence A prior to the completion of Stage 1 of the Project.

6.2.2.8 Aboriginal Cultural Heritage

No sites of Aboriginal heritage significance were identified within the Project Site. As a result, the Project would have no impact on matters of Aboriginal heritage significance.

6.2.2.9 Visual Amenity

The existing perimeter amenity bunds, vegetated buffer within the Nowra Creek riparian zone and line of mature trees adjacent to the eastern Project Site boundary would ensure that the Project would have no significant impact on the visual amenity of the area in the vicinity of the Project Site.

6.2.2.10 Bushfire

The Project Site is identified as bushfire prone land on the *Bushfire Prone Lands Map* published by the NSW Rural Fire Service. As a result, the Project is considered to be compliant with the requirements of Clause 46 of *Rural Fires Regulation 2002* and the document *Planning for Bushfire Protection* published by the NSW Rural Fire Service in 2006.

6.2.2.11 European Heritage

No items of European Heritage significance were identified within the Project Site or within 4.5km of the Project Site. As a result, the Project would have no impact on matters of European heritage significance.

6.2.3 Social and Economic Considerations

The Project is predicted to have the following social and economic benefits.

- Creation of 27 fulltime equivalent positions at an annual rate of product dispatch of 300 000t, increasing to 37 fulltime equivalent positions at an annual product dispatch rate of 500 000t.
- Injection of approximately $11.3 million per year into the local and regional economy, with an additional approximately $4.1 million into the State and national economy at an annual product dispatch rate of 500 000t. This expenditure is likely to generate additional economic activity and flow on effects, providing further employment opportunities.
- Provision of a range of competitively priced, high quality specialist and general quarry products.
- Provision of a competitively priced service to accept and recycle construction material.
- Provision of a well managed facility to receive, process and place VENM at competitive prices.
- Ongoing availability of easily accessible water supplies, including pumps, for rapidly filling tankers, for use during emergencies.

6.2.4 Conclusion

The Proponent contends that any adverse socio-economic or environmental impacts, both actual and perceived, would be more than adequately countered by the positive effect that the Project would have on employment in the vicinity of the Project Site and contribution of the Project to the local and regional economy and community.

6.3 EVALUATION OF ECOLOGICAL SUSTAINABILITY

6.3.1 Introduction

Sustainable practices by industry, all levels of Government and the community are recognised to be important for the future prosperity and well-being of the world. Schedule 2(6) of the *Environmental Planning and Assessment Regulation 2000*, requires an environmental impact assessment process to evaluate projects in terms of the principles of Ecologically Sustainable Development (ESD). The principles of ESD have been recognised for over a decade were based upon meeting the needs of the current generation while conserving our ecosystems for the benefit of future generations. In order to achieve sustainable development, recognition needs to be placed upon the integration of both short-term and long-term environmental, economic, social and equitable objectives.

Throughout the design of the Project, the Proponent has endeavoured to address each of the sustainable development principles. The following sub-sections draw together the features of the Project that reflect the four principles of sustainable development, namely:

- the precautionary principle;
- the principle of social equity;
- the principle of the conservation of biodiversity and ecological integrity; and
- the principle for the improved valuation and pricing of environmental resources.

6.3.2 The Precautionary Principle

The precautionary principle holds that where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental impacts. In the application of this principle, decisions should be guided by careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and an assessment of the risk-weighted consequences of various options should be made. Emphasis must be placed on anticipation and prevention of environmental damage, rather than remediation after the damage has occurred.

For the proposed continuation and expansion of extraction operations at the of the Nowra Brickworks Quarry, the Proponent has engaged six specialist consultancies to conduct detailed assessments of a number of environmental issues identified during the consultation and issue identification stage of the preparation of this document. These assessments ensure that there is a sufficient scientific understanding of the Project and the surrounding environment to enable the Minister to make a decision consistent with this principle.

Project Objectives

The principal objectives of the Project are the design and operation of the extraction and placement-related operations in a manner that avoids or minimises the impact(s) of these activities upon the environment within and surrounding the Project Site and upon residents in the vicinity of the Project Site and ensures compliance with relevant statutory requirements, environmental criteria and reasonable community expectations.

Design Safeguards

A number of design features of the Project were incorporated in recognition of the Precautionary Principle. These design features included the following.

- The floor of the extraction area was designed to an elevation of approximately 19m AHD. This compares with the elevation of the floor of the existing extraction area of approximately 29m AHD. This ensures that the area to be disturbed is minimised and that the recovery of the shale resources within the Project Site is maximised.

- The extraction area is designed to avoid high value vegetation within the riparian zone adjacent to Nowra Creek.
- The Project is to be staged such that extraction operations are to be completed within one section of the extraction area prior to commencing within the next section. In addition, backfilling operations are to be undertaken as soon as possible after completion of extraction-related operations in each section of the extraction area. This will ensure that the area disturbed at anyone time is minimised and that rehabilitation is undertaken progressively throughout the life of the Project.
- Processing and stockpiling operations are proposed to be undertaken within the deepest section of the extraction area. This will ensure that noise and dust-related impacts are minimised.
- The final landform would mimic the pre-extraction landform. In addition, the Proponent would, during creation of the final landform, re-establish the existing topsoil/subsoil/weathered substrate profile. This would assist the re-establishment of a vegetation community with a similar composition to the vegetation community that occurs within undisturbed sections of the Project Site at present.

Management and Operational Safeguards

The framework for ongoing environmental management, operational performance and rehabilitation of the Project Site would be provided through the project approval and would be managed in accordance with the DPI-MR Mining, Rehabilitation and Environmental Management Process, and would involve the input from relevant State and local government agencies. The Mining Operations Plan would contain a range of site specific environmental procedures to achieve consistency with planned outcomes and to control identified risks. The Annual Environmental Management Report would report on the progress of the operation and provide an opportunity to review the effectiveness of the environmental management strategies adopted. In addition, the following management and operational safeguards would be implemented.

- Air quality, blasting impacts and surface water quality would be routinely monitored to ensure compliance with the goals outlined in the relevant sub-sections of Section 4. In addition, noise monitoring would be undertaken when requested by surrounding residents or business operators.
- The proposed mitigation measures and management procedures would be regularly reviewed and modified where necessary in light of environmental monitoring results and feedback received from government agencies, surrounding residents, employees and other interested parties.
- Regular monitoring of the status of rehabilitation, regeneration and enhancement programs within the Project Site and the biodiversity offset areas, when identified, with particular attention paid to threatened and vulnerable species. Remediation actions would be undertaken when identified as necessary following monitoring.

- Topsoil and subsoil would be stripped, stockpiled and re-spread in accordance with the procedures outlined in Section 2.3.5. A record would be maintained of the location, volume and date of creation of all soil stockpiles.

Rehabilitation and Subsequent Land Use

Long term adverse impacts on the environment would be avoided through:

- creation of a stable, free-draining final landform which mimics the pre-extraction landform and blends with the surrounding landforms;
- progressive rehabilitation of the recreated landform and other disturbed areas within the Project Site, including shaping of the final landform, spreading of subsoil and topsoil and reseeding or replanting with endemic, locally sourced species as described in Sections 2.3.5, 2.9.5 and 2.16.5;
- creation and management of the biodiversity offset area(s) for native vegetation conservation; and
- a final land use of native conservation for the rehabilitated extraction area which would, in the longer term, provide significant habitat with enhanced biodiversity values.

Conclusion

The precautionary principle has been considered during all stages of the design and assessment of the Project. The approach adopted, including initial design, risk analysis, consultation, specialist environmental assessment, design modification and safeguard design, provides a high degree of certainty that the Project would not result in any major unforeseen impacts.

6.3.3 Social Equity

Social equity includes both intra- and inter-generational equity. Intra-generational equity requires that the economic and social benefits of the Project be shared equitably among all members of the community, ie. both groups and individuals. Inter-generational equity requires that the present generation pass onto the next generation an environment that does not limit the ability of future generations to attain a quality of life at least equal to that of current generation.

Both elements of social equity are addressed through the design of the Project, the implementation of operational safeguards to mitigate any short-term or long-term environmental impacts, and the proposed rehabilitation of the areas directly disturbed. Examples of matters relating to social equity that are relevant to the various stages of the Project are listed below.

Project Objectives

The objectives of the Project are to ensure continued long-term, economically viable access to shale resources within the Project Site for the production of a range of competitively priced, high quality general and specialised products for construction, road maintenance and agricultural purposes while minimising the Project-related impacts on the environment within and surrounding the Project Site. This would provide a benefit to the entire community through reduced construction and road maintained costs. In addition, the Proponent intends to maintain an open and honest relationship with the members of the surrounding community through ongoing consultation, and address issues of concern as they arise.

The Proponent intends to ensure inter-generational equity by developing a final landform and vegetation community that mimics the pre-extraction landform and would be managed for native vegetation conservation purposes. In addition, the Proponent would secure a biodiversity offset area for the term of the anticipated impacts for the purposes of biodiversity conservation. These activities would ensure that habitat is available for threatened and venerable species for the term of the anticipated impacts. Furthermore, the Project would continue, and increase, the opportunities for economic activity in the local area both directly and indirectly.

Design Safeguards

The Project has been designed to maintain inter-generational equity by ensuring components of the existing biological, social and economic environment available to the present generation would also be available to future generations. Examples include the following.

- Creation of a final landform and vegetation community that would mimic the pre-extraction landform and the vegetation community in undisturbed sections of the Project Site. In addition, this would prevent excessively saline water accumulating within the final void.
- The extraction area has been designed to avoid disturbance to riparian vegetation adjacent to Nowra Creek and to ensure the least possible area of disturbance to native vegetation and sensitive fauna habitats.

Management and Operational Safeguards

The Proponent has, and would continue to ensure, inter- and intra-generational equity through the following management and operational safeguards.

- Management of the extraction, processing, placement and rehabilitation operations within the Project Site to ensure that Project-related impacts on residents and other members of the public in the vicinity of the Project Site are minimised.

- Consultation with local community stakeholders to ensure the Project does not have a significant negative impact on the facilities, services and amenity of the area surrounding the Project Site.
- Manage the Biodiversity Offset Areas for the purposes of biodiversity conservation for the term of anticipated impacts.

Rehabilitation and Subsequent Land Use

The final landform would be constructed to mimic the pre-extraction landform. In addition, the construction of the final landform, as described in Sections 2.9.5 and 2.16.5, would ensure that the soil/substrate profile is similar to the existing profile, and that re-establishment of the a vegetation community similar to the existing community in the undisturbed sections of the Project Site would not be compromised by an incompatible soil/substrate profile. In addition, the proposed final land use would be native vegetation conservation. Finally, the Proponent would identify, secure and manage a biodiversity offset area for the purposes of biodiversity conservation prior to the commencement of the Stage 2 of the Project. These actions would preserve and enhance the biodiversity values in the vicinity of the Project Site and the biodiversity offset area for future generations.

Conclusion

The principle of social equity has been and would be addressed throughout the design, operation and rehabilitation of the Project. The Project would contribute to the economic activity in the vicinity of the Project Site, provide competitively priced quarry products for public and private use and would result in the long-term preservation of the native vegetation in the vicinity of the Project Site. As a result, the benefits of the Project would be distributed throughout the local community. The Proponent would adopt a pro-active approach to identifying and addressing any concerns identified by the local community or its members.

The Project was also designed such that elements of the existing environment available to this generation, including land for native vegetation conservation purposes, would continue to be available to future generations.

6.3.4 Conservation of Biological Diversity and Ecological Integrity

The protection of biodiversity and maintenance of ecological integrity are central goals of sustainability. Biodiversity is usually considered at three levels: genetic diversity, species diversity and ecosystem diversity. It is important that developments do not threaten the integrity of the ecological system as a whole or the conservation of threatened species in the short- or long-term. Details of how the Project has been designed to achieve compliance with these principles are set out below.

Project Objectives

The Proponent is committed to undertake all activities in an environmentally responsible manner, and recognises the need to ensure that changes to natural components of the environment do not adversely affect biological diversity or ecological integrity. As such, the Project has been designed with an objective of minimising impacts on the flora and fauna within and in the vicinity of the Project Site, whilst allowing the extraction of an economically viable and needed resource.

Design Safeguards

The following design features were incorporated into the Project to ensure that the impact of the Proponent's activities on the biodiversity and ecological integrity of the Project Site and surrounding areas are minimised.

- The extraction area was designed to avoid vegetation within the riparian corridor adjacent to Nowra Creek.
- Extraction and placement operations have been staged to ensure that only the smallest area possible is disturbed at any particular time.

Management and Operational Safeguards

The following management and operational safeguards would be incorporated by the Proponent to ensure that the impact of its activities on the biodiversity and ecological integrity of the Project Site and surrounding areas is minimised.

- Clearing of native vegetation would preferentially occur in late spring to early autumn to avoid nesting or roosting fauna. In addition, trees with hollows would be inspected prior to any clearing commencing, and any threatened nesting or roosting animals would be relocated appropriately.
- Suitable cleared vegetation would be retained and used during rehabilitation of disturbed areas or relocated to the biodiversity offset areas.
- Weed eradication programs would continue to be implemented, as required.

Biodiversity Offset Strategy

The Biodiversity Offset Strategy would comprise protection and enhancement of two areas, namely the Northern and Southern Biodiversity Offset Areas, for a period of between 80 and 120 years. It is likely that the strategy would result in protection of a greater range and area of vegetation communities and habitat areas than would be disturbed by the proposed activities. As a result, the Project would preserve or enhance ecosystem diversity and would not threaten the integrity of the ecological systems in the short or long-term

Rehabilitation and Subsequent Land Use

Post-mining rehabilitation of the final landform would include natural regeneration or reseeding or planting of species consistent with the Spotted Gum forest in undisturbed sections of the Project Site.

The final land use would be used for native vegetation conservation, which would, in the medium to long term, increase the area and value of available habitat.

Conclusion

It is anticipated that the Project would have little impact on local or regional biodiversity. Notwithstanding this, disturbance to areas of native vegetation would be minimised, wherever possible. The post-mining use of the final landform for nature conservation purposes would increase the biodiversity value of the Project Site and surrounds in the medium to long term.

6.3.5 Improved Valuation, Pricing and Incentive Mechanisms

This principle is premised on the assumption that all resources should be appropriately valued and priced based upon the full life cycle of those resources, with appropriate and cost-effective environmental stewardship encouraged. A reflection on these issues with regards to the Project is set out below.

Project Objectives

The principal objectives of the Project are to operate the proposed open cut in a safe, environmentally responsible and cost-effective manner. This places environmental considerations at the forefront of the Proponent's decision-making process and demonstrates that an appropriate value has been placed on elements of the existing environment.

In addition, the Proponent proposes to import up to 50 000t per year of construction, concrete and bitumen waste to be recycled into high quality quarry products. In addition, the proponent proposes to import up to 200 000t of VENM per year for recycling and placement within the extraction area. The Proponent would charge an appropriate amount to accept this recycling material and VENM to ensure that it is financially attractive for the Proponent's customers to do so. This would result in reduced consumption of the finite shale resource, reduced requirement for landfill and would enable the Proponent to construct a useable final landform that would result in medium to long-term improvements in biodiversity values.

Design, Management and Operational Safeguards

The extent of research, planning and design of environmental safeguards and mitigation measures, as well as the Proponent's willingness to ensure that the Project Site and biodiversity offset area (when identified) are used for native vegetation conservation following the completion of extraction activities, is evidence of the value placed by the Proponent on the ecological resources within and in the vicinity of the Project Site.

Rehabilitation and Subsequent Land Use

The extent and anticipated cost of the proposed rehabilitation and weed control programs the Proponent intends to implement illustrates the value placed by the Proponent on the ecological resources within the Project Site and biodiversity offset areas.

Conclusion

The value placed by the Proponent on ecological resources is evident from the extent of site-specific investigations, planning and environmental safeguards and measures that have been undertaken and which would be implemented to prevent significant damage to the environment within, and in the vicinity of, the Project Site. It is anticipated that the income received from the sale of the quarry products would be sufficient to enable the Proponent to achieve an acceptable profit level whilst completing all environment-related tasks, commitments and conditions attached to all approvals, leases and licences.

6.3.6 Compatibility with the Principles of ESD

The approach taken in planning the Project has been multi-disciplinary, involving consultation with stakeholders and various government agencies, with emphasis placed on the application of design and operational management and mitigation measures to minimise potential environmental, social and economic impacts. The design of the Project has addressed each of the ESD principles and, on balance, it is concluded that the Project achieves a sustainable outcome for the local and wider environment.

6.4 CONCLUSIONS

The proposed continuation and expansion of extraction operations at the Nowra Brickworks Quarry has, to the extent feasible, been designed to address all environmental and other reasonable issues of concern to the community and all levels of government. This document, together with the range of specialist consultant studies undertaken, has identified that the Project should proceed for the following reasons.

- The Project would contribute towards satisfying demand for high quality, appropriately priced, specialist quarry products for construction, road maintenance and other purposes within the Shoalhaven City Council Local Government Area (LGA) and wider South Coast and southern Sydney area.
- The Project would allow for the recycling of up to 50 000t per year of construction, concrete and bitumen waste and up to 200 000t of VENM that would otherwise be likely to be placed within regional landfills.
- The Project would produce significant employment and economic benefits for the Shoalhaven LGA.
- The Project would satisfy sustainable development principles.

- The Project would result in construction of a final landform that would mimic the pre-extraction landform and would allow for a final land use that would result in medium to long-term improvement in the biodiversity value of the Project Site.
- The biodiversity offset strategy would result in an outcome that would maintain or improve biodiversity values.
- The Project would have a minimal and manageable impact on the biophysical environment.
- The Project would address impacts on the surrounding residents.
- The Project would reduce risk levels associated with possible incidents and impacts on the environment to an acceptable level.

Section 7

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Section 8

Glossary of Terms, Acronyms and Symbols

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GLOSSARY

A-weighted – an electronic filter having the frequency response corresponding approximately to that of human hearing.

A horizon – topsoil layer located at the upper surface of a soil profile.

Aboriginal heritage site – discrete area or concentration of artefactual material, place of past Aboriginal activity, or place of significance to Aboriginal people.

air contaminant – a substance in ambient atmosphere, resulting from the activity of man or from natural processes, causing adverse effects to man and the environment (also called "air pollution").

ambient – relating to conditions outside the active project site.

ambient air quality – the quality of the ambient air near ground level, expressed as concentrations or deposition rates of air pollutants – also expressed as existing air quality.

anecdotal evidence – informal, oral or written evidence of an event.

aquifer – rock or sediment capable of holding and transmitting groundwater.

aquifer recharge – re-entry of groundwater into an aquifer from which water has been removed.

archaeology – the scientific study of human history, particularly the relics and cultural remains of the distant past.

attenuation – reduction in sound pressure levels between two locations.

average annual rainfall – the average amount of rain to fall at a specific location over the period of 1 year (measured in millimetres).

Average Recurrence Interval (ARI) – statistical period in years for a design storm event.

B horizon – subsoil material located below the A horizon material and above the parent rock.

background level – the concentration (deposition) level of a pollutant which must be added to the concentration (deposition) level of the modelled sources in order to obtain a total.

background noise levels – the level of the ambient sound indicated on a sound level meter in the absence of the sound under investigation (eg sound from a particular noise source; or sound generated for test purposes).

baseline data – a body of information collected over time to define specific characteristics of an area (e.g. species occurrence or noise levels) prior to the commencement of an activity; baseline data allows any impacts arising from the activity to be identified by comparison with previously existing conditions.

baseline monitoring – monitoring performed prior to site development.

best management practice – the most effective actions which minimise human impact on the environment.

biological diversity/biodiversity – a concept encompassing the diversity of indigenous species and communities occurring in a given region; biological diversity includes genetic diversity, which is the diversity of genes and genotypes within each species; species diversity, which is the variety of living species; and ecosystem diversity which is the diversity of the different types of communities formed by living organisms and the relations between them.

biophysical – relating to the biological and physical attributes of the environment.

blending materials – quarry products imported to the Project Site from other quarries for the purposes of blending with extracted and recycling materials to produce specialised and general quarry products.

bore – a cylindrical drill hole, sunk into the ground and from which water is pumped for use or monitoring purposes.

buffer – a physical barrier / structure or width of land that encloses, partially encloses, or defines a particular environment. A buffer serves to minimise the impacts of non-desirable external influences on the adjoining environment.

bulldozer – an item of tracked mobile earth moving equipment fitted with a front blade and with rear rippers used for pushing and ripping soil and rock.

catchment area – the area determined by topographic features within which rainfall will contribute to runoff at a particular point.

compaction – the process of close packing of individual grains in a soil or sediment in response to pressure.

conservation – the management of resources in a way that will benefit both present and future generations.

contaminant – Any physical, chemical, biological or radiological substance or matter in water or soil that is not of natural origin.

contamination – The degradation of natural water quality as a result of man's activities. There is no implication of any specific limits, since the degree of permissible contamination depends upon the intended end use, or uses, of the water.

coarse sand – sand predominantly >0.6mm.

concentration – the amount of a substance, expressed as mass or volume, in a unit volume of air.

consolidation – the process whereby loose or soft sedimentary material (e.g. an alluvial deposit) becomes a compacted, harder sedimentary material (e.g. a sandstone).

contractor – specialist brought in to perform a specific task, such as the construction of infrastructure or the sand removal.

culvert – large pipe or channel carrying water underneath a structure (e.g. a road or railway track) or underneath the ground.

deceleration lane – a lane used for decreasing speed of motor vehicles before leaving the road.

dewatering – part removal of water from an aquifer system in excess of natural recharge so that the potentiometric surface declines appreciably in the area of extraction.

diversion bank – water management structure used to direct water away from particular areas (eg operational or ecologically sensitive areas).

drainage line – a passage along which water concentrates and flows towards a stream, drainage plain or swamp intermittently during or following rain.

drawdown – the difference between the water level observed during pumping and the non-pumping water level (static water level or static head).

dry screen – material separated into various sizes without water.

dust – particles of mostly mineral origin generated by erosion of surfaces and the removal and handling of materials.

dust gauge – instrument set up to record the rate of deposition of dust.

ecology – the relationship between living things and their environment.

Ecologically Sustainable Development (ESD) – using, conserving and enhancing the community's resources so that the ecological processes on which life depends, are maintained, and the total quality of life now and in the future, can be increased (Commonwealth of Australia 1992).

ecosystem – a functional unit of energy transfer and nutrient cycling in a given place. It includes all the relationships within the biotic community and between the biotic components of the system.

electrical conductivity – an estimate of the total dissolved salts within a solution (eg. soil solution or water body).

emission – a discharge of a substance (e.g. dust) into the environment.

environment – a general term for all the conditions (physical, chemical, biological and social) in which an organism or group of organisms (including human beings) exists.

environmental policy – statement by the organisation of its intentions and principles, in relation to the overall environmental performance, which provides a framework for action and for the setting of its environmental objectives and targets (AS ISO 14050).

erosion – the wearing away of the land surface (whether natural or artificial) by the action of water, wind and ice.

excavate – to dig into natural material or fill using an excavator or other machinery.

excavator – item of earth-moving equipment fitted with a bucket on an articulated boom used for digging material from a face in front of, or below the machine.

excavated material – unweathered shale material extracted from within the extraction area by drill and blast methods for crushing and blending with blending and recycling materials to produce specialised and general quarry products.

extant vegetation – remaining or existing vegetation.

extraction – the removal of extractive materials by excavation, drilling/blasting or dredging.

fauna – a general term for animals such as birds, reptiles, marsupials, fish etc.

flora – a general term for plants.

fractures – Any breakage of a rock mass along a direction or directions not associated with cleavage or fissility.

friable – easily crumbled as in poorly cemented rocks.

front-end loader – machine used to lift and place soil, earth, rocks, etc or to load products into trucks.

gravel – particles with a maximum diameter exceeding 2mm.

gradient – rate of change of a given variable (such as temperature or elevation) with distance.

groundwater – water contained in voids such as fractures and cavities in rocks and inter-particle spaces in sediments e.g. sand.

groundwater depression – localised lowering of the regional water table.

habitat – the place where an organism normally lives; habitats can be described by their floristic and physical characteristics.

hydraulic conductivity (k) – the rate of flow of water in an aquifer through a cross section of unit area under a unit hydraulic gradient, at the prevailing temperature. Usually expressed in units of metres per second or metres per day.

hydraulic gradient – the direction of groundwater flow.

hydrocarbon – any organic compound, gaseous, liquid, or solid, consisting solely of carbon and hydrogen. Crude oil is essentially a complex mixture of hydrocarbons.

hydrology – the study of surface water and groundwater.

hydrogeology – the study of groundwater.

impact – the effect of human induced action on the environment (modified from Westman, 1985).

infrastructure – the supporting installations and services that supply the needs of a project e.g. roads.

inter-generational equity – the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

intra-generational equity – the present generation should ensure that improved well-being and welfare are accessible to all sectors of society within Australia and that improved welfare within Australia does not result in decreased welfare in other nations.

in-situ – a term sued to distinguish material (e.g. rocks, minerals, fossils, etc.) found in its original position of formation, deposition, or growth, as opposed to transported material.

landform – a specific feature of a landscape (such as a hill) or the general shape of the land.

matrix – fine grained constituent of some sedimentary rocks containing coarser grains and fragments.

massive – of homogeneous structure, lacking bedding, stratification, etc.

migratory – passing, usually predictably (based on aquatic species), from one region or climate to another, for purposes of feeding, breeding, or other biological purposes.

mitigation measures – measures implemented to reduce (mitigate) an impact (such as the construction of a perimeter bund to reduce noise emissions).

monitoring – the regular measurement of components of the environment to understand a feature of the environment and/or establish that environmental standards are being met.

mottling – multi-coloured effect in soils - grey and yellow-brown is common.

native – said of an organism or group of organisms that is restricted to a particular region or environment. A local inhabitant of a place.

offsets – to offset an activity means to compensate for the negative impacts of that activity, by taking a separate action with positive impacts.

oxidation – the process of combining with oxygen.

particle size distribution – the relative proportions of particles (e.g. in a sediment) that fall within specific size categories.

particulate matter – small solid or liquid particles suspended in or falling through the atmosphere - sometimes expressed by the term particulates.

perennial – refers to stream which has flow throughout the year.

permeable – able to transmit fluids e.g. groundwater.

permeability – a material property of a porous rock relating to the ability of the material to transmit water.

pH – a measure of the degree of acidity or alkalinity of a solution; expressed numerically (logarithmically) on a scale of 1 to 14, on which 1 is most acid, 7 is neutral acid, and 14 is most basic (alkaline).

precautionary principle – where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

processing plant – a group of equipment used to clean and separate sands into various sizes.

production bore – A small diameter hole from which groundwater is extracted. It usually relates to a cased and screened, adequately developed and efficient bore used for groundwater removal.

progressive rehabilitation – rehabilitation of a disturbed area as soon as practicable after the final landform is achieved.

quartz – crystalline silica, an important rock-forming mineral SiO_2.

Ramsar listed wetlands – wetlands recognised to have considerable ecological value in accordance with the Ramsar convention.

recycling materials – waste concrete, bitumen, brick and other construction material that is imported to the Project Site for the purposes of recycling the materials by crushing and blending with extracted and blending materials to produce specialised and general quarry products.

rehabilitation – the preparation of a final landform after disturbance and its stabilisation with grasses, trees and/or shrubs.

resource – an estimate of potentially usable material in a defined area based on preliminary geological information.

revegetation – replacement of vegetation, principally grasses and legumes on areas disturbed by quarrying activities.

rip shale – weathered shale material extracted by excavator within the extraction area for direct sale to the Proponent's customers.

runoff – that part of precipitation flowing to surface streams or dams.

salinity – the total content of dissolved solids in groundwater, commonly expressed as parts of dissolved solids per million parts of water (ppm), or milligrams of dissolved solids per litre of solution (mg/L); the significance of salinity depends on the nature as well as the amount of the dissolved solids.

sand – sediment comprising particles in 0.063mm to 2mm size range.

sandstone - general term for sedimentary rock with grain size from 0.063mm to 2mm - grains may be minerals or rock fragments.

scarify – to stir the soil without altering its form, or disturbing its sequence of layers.

silt – sediment comprising most particles between 0.004 mm and 0.063 mm in diameter.

silt-stop fencing – fine mesh fencing normally installed downslope of a sediment source, designed to trap silt and sediment and allow the water to pass through.

slake – breakdown of soil particles in water due to the swelling of clays and air expulsion.

social equity – embraces value concepts of justice and fairness so that the basic needs of all the sectors of society are met and there is a fairer distribution of costs and benefits to improve the well-being and welfare of the community, population or society.

species – a taxonomic grouping of organisms that are able to interbreed with each other but not with members of other species.

species diversity – a measure of the number of different species in a given area.

stockpile – a pile or mound used to store material, typically products.

storage capacity – the maximum volume of liquid able to be retained in a structure.

stormwater – surface water runoff reaching stream channels immediately after rainfall.

subsoil – surface material comprising the B and C Horizons of soil with distinct profiles; often having brighter colours and higher clay contrasts.

surface waters – all water flowing over, or contained on, a landscape (e.g. runoff, channels, ponds etc).

suspended solids – solids held in suspension by the turbulent flow of a fluid.

sustainable development – development that meets the needs of the present without compromising the ability of future generations to meet their needs (World Commission on Environment and Development 1990).

terrestrial – of or relating to the land, as distinct from air or water.

topography – the physical relief and contour of an area.

topsoil – the surface layer of a soil profile containing the main percentage of organic material and viable life forms and seeds.

total suspended solids – a common measure used to determine suspended solids concentrations in a waterbody and expressed in terms of mass per unit of volume (e.g. milligrams per litre).

transect – a fixed line along which observations are made of flora and fauna.

tributary – a stream or river that flows into a larger river or lake.

unconsolidated – loose or soft, not compacted (particularly soil or sediment).

Virgin Excavated Natural Material – material excavated during construction or other earth disturbing activities that is not contaminated with a non-natural material such as bricks, concrete, building materials, wood or chemicals.

visual amenity – attractiveness to the eye.

wash plant – a plant designed to wash unwanted sized materials from product.

water quality – degree or the lack of contamination of water.

water table – the upper limit of the saturated zone within a rock or sediment mass, generally at atmospheric pressure. It is characteristic of unconfined aquifers.

weed – any plant (in particular an herbaceous one) that survives in an area where it is harmful or troublesome to the desired land use.

wildlife corridor – a strip of vegetation that has a design purpose of allowing animals to pass from one area to another and acting as an undisturbed area for wildlife preservation.

wildlife – non-domesticated fauna.

wind rose – diagrammatic representation of wind direction, strength, and frequency of occurrence over a specified period.

woodland – plant communities dominated by trees whose crowns shade less than 30% of the ground.

worst-case scenario – a sequence of events likely to result in the worst-case effects on the environment.

yield – Yield of a water bore can refer either to the capacity of the bore or to the amount of water actually withdrawn.

SYMBOLS

~ – approximately.

bcm – bank cubic metres

°C – degrees Celsius.

µg/L – micrograms per litre.

µg/m^3 – micrograms per cubic metre.

µm – micron, one millionth of a metre (one thousandth of a millimetre).

µS/cm – microsiemens per centimetre; a measure of electrical conductivity.

% – percentage.

< – less than.

≤ – less than or equal to.

> – greater than.

≥ – greater than or equal to.

cm – centimetre (unit of measure).

dB(A) – the unit of measurement of sound pressure level heard by the human ear, expressed in “A” scale.

dS/cm – decisiemens per centimetre; a measure of electrical conductivity.

dS/m – decisiemens per metre; a measure of electrical conductivity.

g – gram (= 0.001 kilogram).

g/m^2/month – grams per square metre per month unit for deposited dust.

ha – hectare (100 m x 100 m).

kg – kilogram (weight measure).

kL – kilolitre (thousand litres).

km – kilometre (= 1 000 metres).

km^2 – square kilometres.

km/hr – kilometres per hour.

L – litre.

L/day – litres per day.

L/s – litres per second.

L/t – litres per tonne.

lcm – loose cubic metres.

L_{A10} – sound level exceeded 10 per cent of the sampling time.

L_{A90} – sound level exceeded 90 per cent of the sampling time.

L_{Aeq} – the L_{Aeq} is the "equal energy" average noise levels, and is used in some instances for the assessment of traffic noise effects or the risk of hearing impairment due to noise exposures.

$L_{Aeq(1\ hour)}$ – the "equal energy" average noise level over 60 minutes – used for assessing impacts of motor vehicles.

$L_{Aeq(T)}$ – Sound level of continuous noise which emits the same energy as the fluctuation sound over a given time period (T).

L_{Amax} – the absolute maximum noise level measured in a given time interval.

L_{AN} – the A-weighted sound pressure level exceeded by N% of a given measured period.

m – metre.

m AHD – metres Australian Height Datum.

m^2 – square metre.

m^3 – cubic metre.

mg – milligram (weight unit).

mg/L – milligrams per litre (parts per million).

ML – megalitre.

mm – millimetre (= 0.001 metres).

Mm^3 – million cubic metres.

Mt – million tonnes (metric tonne = 1 000 kg).

$PM_{2.5}$ – particulate matter <2.5μm in diameter.

PM_{10} – particulate matter <10μm in diameter.

ppm – parts per million.

swl – standing water level.

t – tonnes.

TDS – total dissolved solids expressed in mg/L

t/m^3 – tonnes per cubic metre.

tpa – tonnes per annum.

tpd – tonnes per day

tph – tonnes per hour.

V – volt.

ACRONYMS

AADT Annual Average Daily Traffic.

ABS Australian Bureau of Statistics

AEMR Annual Environmental Management Report

AMMAAT Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW

AHD Australian Height Datum; generally equivalent to mean sea level.

ANZECC Australian and New Zealand Environment and Conservation Council

ARI Average Recurrence Interval

AS Australian Standard

AWS Automatic Weather Station

BoM Bureau of Meteorology

CAMBA China/Australia Migratory Bird Agreement

DECC Department of Environment and Climate Change

DoP Department of Planning

DPI Department of Primary Industries

DWE Department of Water and Energy

EA Environmental Assessment

EMP Environmental Management Plan

ENM Environmental Noise Model

EP&A Act Environmental Planning and Assessment Act 1979 (NSW)

EPA Environment Protection Authority (NSW)

EPBC Act Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)

ESD Ecologically Sustainable Development

HVAS High Volume Air Sampler

INP Industrial Noise Policy

JAMBA Japan/Australia Migratory Bird Agreement

LALC Local Aboriginal Land Council

LEP Local Environmental Plan

MOP Mining Operations Plan

NEPC National Environment Protection Council

NEPM National Environment Protection Manual

NHMRC National Health and Medical Research Council

NP&W Act National Parks and Wildlife Act 1974 (NSW)

NPWS National Parks and Wildlife Service (NSW)

RBL Rating background level

REP Regional Environmental Plan

RTA Roads and Traffic Authority

SEPP State Environmental Planning Policy

TAPM The Air Pollution Model

TSC Act Threatened Species Conservation Act 1995 (NSW)

TSP Total Suspended Particulate matter

V:H vertical is to horizontal

VENM Virgin Excavated Natural Material

APPENDICES

Appendices

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APPENDIX 1

Appendix 1

Major Projects Application for Project Approval

Application No: 07_0123

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Major Project application

NSW GOVERNMENT
Department of Planning

Date received: 12/9/07 Project Application No. 07-0123

1. Before you lodge

This form is required to apply for the approval of the Minister to carry out a project to which Part 3A of the *Environmental Planning and Assessment Act 1979* (the Act) applies.

Before lodging this application, it is recommended that you first consult with the Department of Planning (the Department) concerning your project.

A Planning Focus Meeting (PFM) may need to be held for this project involving the Department, relevant agencies, council or other groups identified by the Department. If a PFM is held, the Department will issue the Director-General's requirements for the Environmental Assessment following the meeting.

All applications must be lodged with the Director-General, by courier or mail. An electronic copy should also be emailed to the assessment contact officer assigned to the project.

NSW Department of Planning
Ground floor, 23-33 Bridge Street, Sydney NSW 2000
GPO Box 39 Sydney NSW 2001
DX 10181 Sydney Stock Exchange
Phone 1300 305 695

2. Details of the proponent

Company/organisation/agency: SOUTH COAST CONCRETE CRUSHING AND RECYCLING PTY LTD
ABN: 76095243584

☑ Mr ☐ Ms ☐ Mrs ☐ Dr ☐ Other

First name: JOHN
Family name: GREEN

Position: MINE MANAGER

STREET ADDRESS

Unit/street no.:
Street name:

Suburb or town:
State:
Postcode:

POSTAL ADDRESS (or mark 'as above')

PO Box 192

Suburb or town: OAKFLATS
State: NSW
Postcode: 2529

Daytime telephone: 02-44217766
Fax: 02-44217988
Mobile: 0418276376

Email:

3. Identify the land you propose to develop

STREET ADDRESS (where relevant)

Unit/street no.: /

Street or property name: NOWRA BRICKWORKS QUARRY

Suburb, town or locality: SOUTH NOWRA

Postcode: 2541

Local government area(s): SHOALHAVEN

State electorate(s):

REAL PROPERTY DESCRIPTION

LOT 4, DEPOSITED PLAN 1058778

Note: The real property description is found on a map of the land or on the title documents for the land. If you are unsure of the real property description, you should contact the Department of Lands.

Please ensure that you place a slash (/) to distinguish between the lot, section, DP and strata numbers. If the project applies to more than one piece of land, please use a comma to distinguish between each real property description.

OR detailed description of land attached. ☐

MAP: A map of the site and locality should also be submitted with this application.

4. Major Project description and other requirements

Provide a brief title for your project.

CONTINUATION AND EXPANSION OF EXTRACTIVE OPERATIONS

PROJECT APPROVAL

If you are applying for approval of a project, include in the project title, all significant components for which approval is being sought. If the application relates to part only of a project, the project title should reflect this.

Is the application for approval of a project? ☑ Yes ☐ No

Is the application related to part only of a project? ☐ Yes ☑ No

CONCEPT PLAN APPROVAL

If you are applying for approval of a concept plan, include in the project title, all components for which approval 'in concept' is being sought. If the application also relates to approval of a project, a description of this should also be included in the project title.

Is the application for approval of a Concept Plan? ☐ Yes ☑ No

Is a project application being made concurrently for all or part of the project? ☐ Yes ☑ No

You are also required to provide a Project Description and address any matters required by the Director-General in accordance with section 75E or section 75M of the Act. Failure to do so may lead to your application being rejected.

Is a Project Description attached? ☑ Yes ☐ No

Does the Project Description include any additional matters required by the Director-General under section 75E or section 75M of the Act? ☐ Yes ☑ No

Note: An electronic copy of the project description is also required as all applications must be provided on the Department's website. You should contact the Department on the correct electronic format.

ESTIMATED CAPITAL INVESTMENT VALUE

Please indicate the estimated capital investment value (CIV) of the project. The CIV includes all costs necessary to establish and operate the project, including the design and construction of buildings, structures, associated infrastructure and fixed or mobile plant and equipment (but excluding GST and land costs).

$ 2.8M

EQUIVALENT FULL-TIME JOBS

Please indicate the number of jobs created by the project. This should be expressed as a proportion of full time jobs over a full year.

Construction jobs (full-time equivalent)	
Operational jobs (full-time equivalent)	10

5. Approvals from State agencies

Does the project require any of the following: (tick all that are appropriate)

- ☐ an aquaculture permit under section 144 of the *Fisheries Management Act 1994*
- ☐ an approval under section 15 of the *Mine Subsidence Compensation Act 1961*
- ☑ a mining lease under the *Mining Act 1992*
- ☐ a production lease under the *Petroleum (Onshore) Act 1991*
- ☑ an environment protection licence under Chapter 3 of the *Protection of the Environment Operations Act 1997* (for any of the purposes referred to in section 43 of that Act) Extractive Industry - Mines
- ☑ a consent under section 138 of the *Roads Act 1993*
- ☐ a licence under the *Pipelines Act 1967*

6. Landowner's consent or notification

As the owner(s) of the above property, I/we consent to this application being made on our behalf by the proponent:

Land: Lot 464 DP 1058778	Land:
Signature: [signature]	Signature:
Name: Grant Merrick Allocation Manager Land Management	Name:
Date: 5 September 2007	Date:

Note: Under clause 8F of the *Environmental Planning and Assessment Regulation 2000* (the Regulation), certain applications for approval under Part 3A of the Act do not require the consent of the landowner, however, the proponent is required to give notice of the application:

- in the case of linear infrastructure projects, by notice in a newspaper circulating in the locality prior to the commencement of the public consultation period,
- in the case of mining or petroleum production projects, by notice in a newspaper circulating in the locality within 14 days of this application being made,
- in the case of critical infrastructure projects, to the owner of the land within 14 days of this application being made, and
- in other cases, to the owner of the land at any time before the application is made.

7. Proponent's signature

As the proponent(s) of the project and in signing below, I/we hereby:

- provide a description of the project and address all matters required by the Director-General pursuant to section 75E and/or section 75M of the Act, and
- apply, subject to satisfying clause 8D of the Environmental Planning and Assessment Regulation, for the Director-General's environmental assessment requirements pursuant to Part 3A of the Act, and
- declare that all information contained within this application is accurate at the time of signing.

Signature

Name
JOHN GREEN

Date
10/9/07

In what capacity are you signing if you are not the proponent

Name, if you are not the proponent

Department of Lands
Land Administration & Management
Property & Spatial Information

The Mine Manager
South Coast Concrete Crushing and Recycling
P O Box 192
Oak Flats NSW 2529

Contact: Helen Wheeler
Phone: (02) 4428 9133
Fax: (02) 4421 2172
email: Helen.wheeler@lands.nsw.gov.au

Attention: John Green

Our Ref: Trim 07/3416
Your Ref:

5 September 2007

Dear John

Re: Notification of Major Project Application – Lot 464 DP 1058778.

The Preliminary Environmental Assessment has been reviewed by this office and the Department has no objection to lodgement with the Department of Planning in accordance with the provisions of the Environment Planning and Assessment Act.

The Department has also forwarded its Key Issue requirements to the Department of Planning for use in the relevant Minister's requirements for the full Environmental Assessment report.

Please note that land previously referred to as Vacant Crown land has now been reserved across NSW; the relevant reference to lot 464 DP 1058778 is Part Parish Reserve 755952.

Yours sincerely

Helen Wheeler
Senior Environmental Officer
NSW Dept of Lands

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APPENDIX 2

Appendix 2

Director-General's Requirements for Environmental Assessment and Coverage of Requirements

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CONTENTS

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NSW GOVERNMENT
Department of Planning

Contact: Michael Young
Phone: 02 9228 6437
Fax: 02 9228 6466
Email: michael.young@planning.nsw.gov.au

Our ref: S07/00306

Mr John Green
Mine Manager
South Coast Concrete Crushing and Recycling Pty Ltd
PO Box 192
OAK FLATS NSW 2529

Dear Mr Green

Director-General's Requirements
Nowra Brickworks Quarry Project
Project Application No: 07_0123

The Department has received your project application for the Nowra Brickworks Quarry Project at South Nowra in the Shoalhaven local government area.

I have attached a copy of the Director-General's requirements for the project. These requirements have been prepared in consultation with relevant public authorities, and are based on the information that you have provided to date. I have also attached a copy of the public authorities' comments for your information.

Please note that under section 75F(3) of the *Environmental Planning and Assessment Act 1979*, the Director-General may alter these requirements at any time.

If your proposal is likely to have a significant impact on matters of National Environmental Significance, it will require an approval under the Commonwealth *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act). This approval is in addition to any approvals required under NSW legislation. It is your responsibility to contact the Department of the Environment and Water Resources in Canberra ((02) 6274 1111 or http://www.environment.gov.au) to determine if your proposal will require an approval under the EPBC Act. The Commonwealth Government has accredited the NSW environmental assessment process for assessing any impacts on matters of National Environmental Significance. As a result, if it is determined that an approval is required under the EPBC Act, please contact the Department immediately as supplementary Director-General's requirements may need to be issued.

I would appreciate it if you would contact the Department at least 2 weeks before you propose to submit your Environmental Assessment of the project to determine:

- the fees applicable (see Division 1A, Part 15 of the *Environmental Planning & Assessment Regulation 2000)*;
- whether the proposal requires an approval under the EPBC Act;
- the consultation and public exhibition arrangements that will apply; and
- the number of copies (hard-copy or CD-ROM) of the Environmental Assessment for exhibition purposes.

Department of Planning, 23-33 Bridge Street (GPO Box 39), Sydney, NSW 2001
Website www.planning.nsw.gov.au

As you may know, the Department will review the Environmental Assessment in consultation with the relevant authorities to determine if it adequately addresses the Director-General's requirements. If the Director-General considers the Environmental Assessment to be inadequate, you will be required to revise it prior to public exhibition.

The Director-General's requirements will be placed on the Department's website along with other relevant information which becomes available during the assessment of the project. As a result, the Department would appreciate it if all documents that are subsequently submitted to the Department are in a suitable format for the web, and if you would arrange for an electronic version of the Environmental Assessment for the project to be hosted on a suitable website with a link to the Department's website.

If you have any enquiries about these requirements, please contact Michael Young of the Department's Mining and Extractive Industries team, on (02) 9228 6437.

Yours sincerely

20.9.07

Chris Wilson
Executive Director
Major Project Assessments

As delegate of the Director-General

Director-General's Requirements

Section 75F of the *Environmental Planning and Assessment Act 1979*

Application Number	07_0123
Project	The continuation and expansion of extractive operations at the Nowra Brickworks Quarry, which includes: • continued operation of the quarry and its expansion to the south; • extracting up to 350,000 tonnes of shale material a year; • transporting up to 500,000 tonnes of product a year from the site by road; • importing construction waste and quarry products for recycling; • importing up to 200,000 tonnes of virgin excavated natural material (VENM) for reprocessing and rehabilitation; and • progressively rehabilitating the site.
Site	Lot 464 DP 1058778, Princes Highway, South Nowra
Proponent	South Coast Concrete Crushing and Recycling Pty Ltd
Date of Issue	20 September 2007
Date of Expiration	20 September 2009
General Requirements	The Environmental Assessment must include: • an executive summary; • a detailed description of all components of the project including the: – quantity and quality of the extractive resource, the likely use of the resource, and whether or not a Mining Lease is still required given that the Proponent holds a Mining Lease for the extraction of brick clay/shale; – need for the project; – alternatives considered; and – various components and stages of the project; • consideration of any relevant statutory provisions, including the objects of the *Environmental Planning and Assessment Act 1979*; • an overview of all the environmental impacts of the project, identifying the key issues for further assessment, and taking into consideration the issues raised during consultation; • a detailed assessment of the key issues specified below and any other significant issues identified in the general overview of environmental impacts of the project (see above), which includes: – a description of the existing environment; – an assessment of the potential impacts of the project (in particular, the proposed South Coast Correctional Centre), including any cumulative impacts; – a description of the measures that would be implemented to avoid, minimise, mitigate, offset, manage and/or monitor the impacts of the project; • a draft Statement of Commitments, outlining environmental management, mitigation and monitoring measures; • a conclusion justifying the project, taking into consideration the environmental impacts of the project, the suitability of the site, and the benefits of the project; and • a signed statement from the author of the Environmental Assessment certifying that the information contained in the report is neither false nor misleading.
Key Issues	• **Strategic** – assess the potential impacts of the project on any strategic land use planning initiative that the Council may have for the Nowra-Bomaderry area; • **Noise** – including construction and operational noise and off-site road noise impacts;

	• **Blasting and Vibration;** • **Air Quality**; • **Surface and Ground Water** - including details of surface and ground water impacts and a site water balance; details of the proposed water management system including any creek diversions and sediment/water supply dams and water transfers to adjoining land; and a contingency strategy setting out the measures that would be implemented to minimise impacts on the supply of water (quality and quantity) to the environment and surrounding landowners; • **Traffic and Transport** – details of traffic volumes generated by the project and an assessment of the likely impacts of this traffic on the capacity and safety of the surrounding road network, taking into account the proposed upgrade of the Princes Highway and the construction of the Warra Warra Road roundabout; • **Flora and Fauna** – including impacts on threatened species, populations or endangered ecological communities or their habitats; and details of vegetation offsets to ensure that there is no net loss to the flora and fauna values of the area; • **Visual**; • **Heritage** – including Aboriginal and non-Aboriginal heritage; and • **Rehabilitation and Final Land Form** - including a justification for the proposed final land form and use in relation to any strategic land use objectives for the area; a detailed description of how the site would be progressively rehabilitated and integrated into the surrounding landscape; the measures that would be put in place to ensure sufficient financial resources are available to implement the proposed rehabilitation measures, and the ongoing management of the site following the cessation of extraction activities.
References	The Environmental Assessment must take into account relevant State Government technical and policy guidelines. While not exhaustive, guidelines which may be relevant to the project are included in the attached list.
Consultation	During the preparation of the Environmental Assessment, you should consult with the relevant local, State or Commonwealth Government authorities, service providers, community groups and affected landowners. In particular you should consult with: • Department of Commerce; • Department of Environment and Climate Change; • Department of Lands; • Department of Primary Industries; • Department of Water and Energy; • Roads and Traffic Authority; and • Shoalhaven City Council. The consultation process and the issues raised must be described in the Environmental Assessment.
Deemed refusal period	60 days

Table A2-1
Director-General's Requirements from Relevant *Environmental Assessment* Sections
(Department of Planning – 20 September 2007)

Paraphrased Requirement	Relevant EA Section
GENERAL	
The *Environmental Assessment* must include:	
• an executive summary;	Executive Summary
• a detailed description of all components of the project including the:	
- quantity and quality of the extractive resource, the likely use of the resource, and whether or not a Mining Lease is still required given that the Proponent holds a Mining Lease for the extraction of brick clay / shale;	2.2.2
- need for the project;	6
- alternatives considered; and	6.2
- various components and stages of the project;	2.3 to 2.13
• consideration of any relevant statutory provisions, including the objects of the *Environmental Planning and Assessment Act 1979*;	3.3.2
• an overview of all the environmental impacts of the project, identifying the key issues for further assessment, and taking into consideration the issues raised during consultation;	3
• a detailed assessment of the key issues specified below and any other significant issues identified in the general overview of environmental impacts of the project (see above), which includes:	
- a description of the existing environment;	4.2
- an assessment of the potential impacts of the project (in particular, the proposed South Coast Correctional Centre), including any cumulative impacts;	4.7
- a description of the measures that would be implemented to avoid, minimise, mitigate, offset, manage, and/or monitor the impacts of the project;	5
• a draft Statement of Commitments, outlining environmental management, mitigation and monitoring measures;	5
• a conclusion justifying the project, taking into consideration the environmental impacts of the project, the suitability of the site, and the benefits of the project; and	6
• a signed statement from the author of the Environmental Assessment certifying that the information contained in the report is neither false nor misleading.	Covering Page
STRATEGIC	
Assess the potential impacts of the project on any strategic land use planning initiative that the Council may have for the Nowra-Bomaderry area.	3.3.3 and 6.1.6
NOISE	
Determine construction and operational noise and off-site road noise impacts.	4.6.6 & 4.6.7
BLASTING AND VIBRATION	
Assess blasting and vibration impacts.	4.7.6
AIR QUALITY	
Assess air quality impacts.	4.5.6
SURFACE WATER AND GROUNDWATER	
Include details of surface and groundwater impacts and a site water balance.	4.2.5
Include details of the proposed water management system including any creek diversions and sediment / water supply dams and water transfers to adjoining land.	4.2.4

Table A2-1 (Cont'd)
Director-General's Requirements from Relevant *Environmental Assessment* Sections
(Department of Planning – 20 September 2007)

Paraphrased Requirement	Relevant EA Section
SURFACE WATER AND GROUNDWATER (CONT'D)	
Include a contingency strategy setting out the measures that would be implemented to minimise impacts on the supply of water (quality and quantity) to the environment and surrounding landowners.	4.2.4
TRAFFIC AND TRANSPORT	
Include details of traffic volumes generated by the project and an assessment of the likely impacts of this traffic on the capacity and safety of the surrounding road network, taking into account the proposed upgrade of the Princes Highway and the construction of the Warra Warra roundabout.	4.3
FLORA AND FAUNA	
Determine impacts on threatened species, populations or endangered ecological communities or their habitats.	4.3.8
Include details of vegetation offsets to ensure that there is no net loss to the flora and fauna values of the area.	2.15.9
VISUAL	
Determine visual impacts.	4.10
HERITAGE	
Determine Aboriginal and non-Aboriginal heritage impacts.	4.8 and 4.12
REHABILITATION AND FINAL LAND FORM	
Include a justification for the proposed final land form and use in relation to any strategic land use objectives for the area.	2.15.3, 2.15.4 and 6.2.5
Include a detailed description of how the site would be progressively rehabilitated and integrated into the surrounding landscape.	2.15.5
Determine the measures that would be put in place to ensure sufficient financial resources are available to implement the proposed rehabilitation measures, and the ongoing management of the site following the cessation of extraction activities.	2.15.5
CONSULTATION	
During the preparation of the *Environmental Assessment*, you should consult with the relevant local, State or Commonwealth Government authorities, service providers, community groups and affected landowners. In particular you should consult with: • Department of Commerce; • Department of Environment and Climate Change; • Department of Lands; • Department of Primary Industries; • Department of Water and Energy; • Roads and Traffic Authority; and • Shoalhaven City Council. The consultation process and the issues raised must be described in the *Environmental Assessment*.	3.2

Table A2-2
Requirements from Other Government Agencies from Relevant *Environmental Assessment* Sections

Government Authority	Paraphrased Requirement	Relevant EA Section
GENERAL		
Department of Environment and Climate Change (7/9/07)	The DECC's key information requirements for the project are: • the environmental impacts of the project; • the impacts of the project on threatened species and their habitat; • the impacts of the project on Aboriginal cultural heritage values; and • the actions that will be taken to avoid or mitigate impacts or compensate to prevent unavoidable impacts identified above.	4 4.3.8 4.8.6 4.3.7 and 4.8.5
	Provide details on the location of the proposed development, including the affected environment, to place the proposal in its local and regional environmental context including surrounding land uses, planning zonings and potential sensitive receptors.	Sections 2 and 4.1
	Describe mitigation and management options. This should include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.	Various Section 4
Department of Primary Industries (13/9/07)	Provide detailed information on the products and uses of the materials to be extracted from the quarry.	2.2.3
	Demonstrate that the size and quality of the resource have been adequately assessed and provide details of methods used to assess the resource.	2.2.2
	The *Environmental Assessment* should address the relevant issues outlined in the Mineral Resources Division's standard guidelines for the preparation of *Environmental Assessments*.	Various
	Provide possible downstream impacts on aquatic habitat. The *Environmental Assessment* should address other relevant issues outlined in the Fisheries Division's standard guidelines for *Environmental Assessment* preparation.	4.2.5
	The *Environmental Assessment* should address relevant issues in the Agriculture Division's general guidelines for quarry proposals.	Various
Shoalhaven City Council (7/9/07)	Provide a detailed assessment against the relevant statutory controls should be undertaken. The following as a minimum should be considered. • State Environmental Planning Policy – Major Projects. • State Environmental Planning Policy No. 11 – Traffic Generating Developments (ie. Schedule 1 development). • State Environmental Planning Policy No. 33 – Hazardous and Offensive Development. • State Environmental Planning Policy – Mining, Petroleum Production and Extractive Industries. • Illawarra Regional Environmental Plan No. 1. • Nowra Bomaderry Structure Plan. • Shoalhaven Local Environmental Plan 1985 (as amended) – in particular Clauses 2, 9 (with specific reference to 1(b) and 1(f) zones), 23, 26 and 28. • Development Control Plan No 18 (Carparking Code). • Development Control Plan No. 78 (On Site Sewerage Management). • Development Control Plan No. 93 (Controls for Waste Minimisation and Management).	N/A

Table A2-2
Requirements from Other Government Agencies from Relevant *Environmental Assessment* Sections

Government Authority	Paraphrased Requirement	Relevant EA Section
GENERAL (CONT'D)		
Shoalhaven City Council (7/9/07)	Provide a description of the proposal is required that clearly identifies the works for which approval is sought including, but not limited to, the identification of: • maximum quantities of materials that will be extracted from the quarry annually; • maximum quantities of materials that will be brought into the quarry for blending with materials extracted from the site annually; • maximum quantities of VENM materials that will be brought into the site for rehabilitation purposes annually; and • details on the number and type of machinery to be used (ie. jaw crushers, cone crushers, screening plants etc) and other associated quarry infrastructure.	2.1.3
	The applicant should provide details on works that are included under maintenance related activities including associated measures that will be implemented to minimise any environmental impacts and detail what additional staffing facilities will be supplied and / or constructed on site and how these will be serviced.	2.8
	The application should consider and be consistent with the Nowra Bomaderry Structure Plan. This proposed development should not jeopardise the viability of the proposed road network as per the Structure Plan.	3.3.3.2 and 6.2.6
	The applicant should detail if the development will: • in relation to water supply, require water supply; and • in relation to sewerage services, will the development require sewerage services.	2.13.1
NOISE AND BLASTING		
Department of Environment and Climate Change (7/9/07)	The DECC notes the proposal is located on land adjoining the proposed South Coast Correctional facility. South Coast Concrete Crushing and Recycling (SCCCR) conduct regular blasting which may impact upon this proposal as it will be considered as the nearest sensitive receiver.	4.7.6
	The proposal must be designed, constructed, operated and maintained so that there are no adverse impacts from noise (including traffic noise).	4.6.7
Shoalhaven City Council (7/9/07)	A Noise Impact Assessment should be prepared by a suitably qualified practicing noise consultant. Sound levels should not exceed 5dB(A) above ambient background levels as measured from the property boundary of the nearest affected residence. Intrusive noise criteria to comply with DECC's Industrial Noise Policy. The assessment should detail measures to be put in place if it is determined that noise will be a problem.	4.6
	Vibration levels (especially during blasting operations) are to be addressed and monitoring carried out. Details of the monitoring proposed (including the location of monitoring stations) should be detailed including how blasting operations are undertaken and are in accordance with DECC requirements.	4.7.6

Table A2-2
Requirements from Other Government Agencies from Relevant *Environmental Assessment* Sections

Government Authority	Paraphrased Requirement	Relevant EA Section
	ECOLOGY	
Department of Environment and Climate Change (7/9/07)	The proposal should be consistent with the principle pertaining to the potential biocertification of the Nowra / Bomaderry Structure Plan.	3.3.3.2
	Not all areas of the proposed site may be suitable for development and any development will need to avoid Endangered Ecological Communities and provide an appropriate buffer and asset protection zone.	
	Threatened species that could potentially occur onsite and should be considered include: • Bush Stone-curlew; • Gang-gang Cockatoo; • Large forest owls; • Glossy Black cockatoo; • Yellow-bellied Glider • All Microchripterean bats; • Square Tailed Kite; • Grey headed Flying Fox; • Green and Golden Bell Frog; • *Cryptostylis hunteriana*; • Illawarra Greenhood; and • *Genoplesium baurei*.	4.3.3
	All survey work for these species should be undertaken at the appropriate time of year for each species to maximise the survey results.	4.3.4
	All hollow bearing trees on site should be identified and marked on a map to be supplied within the *Environmental Assessment*. These hollow bearing trees should also be targeted for stag watches to indicate the presence or absence of hollow dependent fauna in particular micro bats, yellow bellied glider, squirrel gliders, Glossy black and Gang Gang cockatoos. All of these species will require an assessment of the use of the hollow bearing trees during the breeding period for each species.	4.3.4 and Figure 4.16
	The *Environmental Assessment* must describe what actions will be undertaken to avoid or mitigate impacts caused by the development on all threatened species described at the site.	4.3.7
Department of Lands (7/9/07)	The likely presence of threatened flora and fauna should be assessed for all threatened species, including the Bush Stone Curlew and Illawarra Greenhood Orchid.	4.3.3
	The survey should take account of the time of year when threatened species are likely to be present.	4.3.4
	Details of the methods used should be included in the *Environmental Assessment*.	4.3.4
	SEPP 44 – Koala Habitat should be addressed in the assessment.	4.3.8.5

Table A2-2
Requirements from Other Government Agencies from Relevant *Environmental Assessment* Sections

Government Authority	Paraphrased Requirement	Relevant EA Section
ECOLOGY (CONT'D)		
Department of Water and Energy (6/9/07)	Existing vegetation within a width of 40m either side of Nowra Creek should be retained and protected as a *core riparian zone* (CRZ). The CRZ is to remain or become fully vegetated with local provenance native vegetation (including aquatic groundcovers, shrubs and other species) to a minimum width from the banks of the river.	2.4.2
	A *vegetated buffer* (VB) of 10m either side of the CRZ should be provided.	2.4.2
	The identified Riparian Corridor Objective Setting objectives be applied to this site and that the Brickworks Quarry Project be therefore developed in a manner which is consistent with maintaining / achieving these objectives.	4.3.7
	The EAR should outline an appropriate management regime for the riparian areas to ensure that the riparian lands continue to meet the recommended objectives. In this regard the preparation of a Vegetation Management Plan (VMP) for the Nowra Creek Riparian Corridor continued within the subject site would be appropriate.	4.3.7
Shoalhaven City Council (7/9/07)	A detailed flora and fauna survey(s) of the site should be prepared in accordance with "Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities" Working Draft November 2004 by the NSW Department of Environment and Conservation, or any subsequent approved versions by the NSW Department of Environment and Climate Change (DECC).	4.3
	An ecological study of the receiving water is to be carried out in accordance with DECC requirements.	N/A
	It is noted that an Endangered Ecological Community (Swamp sclerophyll forest on coastal floodplains) is mapped as occurring on the site.	4.3.6
AIR QUALITY		
Department of Environment and Climate Change (7/9/07)	Details must be provided on proposed dust management strategies for all potential sources of dust.	4.5.3
	The *Environmental Assessment* must be conducted in accordance with the DECC publication "*Approved Methods for Modelling and Assessment of Pollutants in New South Wales*".	4.5.5
	The *Environmental Assessment* must assess PM_{10} (24-hour and annual average), total suspended particulates and deposited dust impacts.	4.5.6
	The *Environmental Assessment* must include a cumulative assessment that examines the impacts of the proposal combined with all existing and approved dust generating activities.	4.5.6
Shoalhaven City Council (7/9/07)	An Air Quality Assessment Report prepared by a suitably qualified practicing air quality consultant should be undertaken. This report needs to address the public health implications. Details of air emissions, including dust, should be assessed as per Department of Environment and Conservation guidelines. The assessment should detail measures to be put in place if it is determined that the proposed development will have a negative impact upon air quality. If dust is found to be a potential issue, then a dust minimisation / management plan should be prepared.	4.5

Table A2-2
Requirements from Other Government Agencies from Relevant *Environmental Assessment* Sections

Government Authority	Paraphrased Requirement	Relevant EA Section
SURFACE WATER AND GROUNDWATER		
Department of Environment and Climate Change (7/9/07)	The environmental outcomes for the project in relation to water should be: • there is no pollution of waters (including surface and groundwater) during construction or occupation of the site by the final users; • there is no inconsistency with any relevant Statement of Joint Intent established by the Healthy Rivers Commission; and • It is acceptable in terms of the achievement or protection of the River Flow Objectives and Water Quality Objectives.	4.2
	The *Environmental Assessment* must: • take into account and complement Shoalhaven City Council's Integrated Water Cycle Management Plan which is currently being developed; and • demonstrate that there is sufficient capacity to treat and manage the sewage that is generated by this development.	N/A
Department of Lands (7/9/07)	A detailed field assessment of groundwater flows needs to be conducted prior to excavation, including the quantity of groundwater expected to yield from the 10m to 13m aquifer with the piezometric surface of 0.038m/m.	4.2.5.5
	The impact and management of this water should be addressed for the period of operation of the quarry.	4.2
	The likely behaviour of the groundwater surface following rehabilitation should be addressed.	4.2.5.5
Department of Water and Energy (6/9/07)	The EA should clearly demonstrate that the proposed depths of quarry extraction will not impact upon and be able to maintain the integrity of Nowra Creek and adjoining riparian vegetation.	4.2.5
	The EA should identify all water sources, water usage and water management details of the proposal are required, including design, layout, pumping and storage capacities, volumes of water to be used, all associated earthworks and infrastructure works etc.	4.2.4
	The EA should demonstrate how the proposed water demand and usage will impact on the surrounding water users including the water-dependent environment most notably, Nowra Creek.	4.2.5
	The EA will need to demonstrate the proposal's sustainability and its environmental merit.	6.3 and 6.4
	The EA should consider the issues outlined in the Groundwater Assessment Guidelines – Major Projects: Developments Impacting on Groundwater.	4.2
	A license or licences under Part 5 of the *Water Act, 1912* is / are required for each piezometer(s).	2.1.4
	If the excavation is deepened to a level that intercepts the groundwater table, groundwater licensing action will be triggered.	2.1.4

Table A2-2
Requirements from Other Government Agencies from Relevant *Environmental Assessment* Sections

Government Authority	Paraphrased Requirement	Relevant EA Section
SURFACE WATER AND GROUNDWATER (CONT'D)		
Department of Water and Energy (6/9/07)	Any activities proposing the transfer of surface or groundwater from the quarry to adjoining lands / landuses will likely require licensing action. This matter should be clarified in the EAR and specific details of any proposed off-site water use to be provided.	N/A
Department of Natural Resources	The locations and conditions of any bores within 1 kilometre of the proposed development and the current and potential uses and users of groundwater in that area.	4.2.3.1
	A baseline assessment of the local and regional groundwater systems based on a reasonable period of monitoring at appropriate locations including: • the depth to the water table, hydraulic gradient, flow directions and rates, location of any recharge areas and discharge sites; • the geological characteristics in the area in relation to the vulnerability of the groundwater to pollution; • the ambient quality of groundwater in the area; and • the presence of environmentally sensitive areas in the vicinity of the proposal site, determination of the occurrence of any threatened or endangered species, and identification of the likely interaction of these ecosystems or communities with groundwater.	4.2.3
	The potential for acid-related issues due to the presence of acid sulphate soils, if present in the area, considering impacts from the alteration of groundwater levels together with mitigation measures (including minimisation of disturbance of the material or the water table and treatment of disturbed soils or acid water), and details of the proposed monitoring program and response strategies should deleterious effects be observed.	2.3.5.2
	The potential for contaminated soils to exist on the site, the potential direct or indirect effects on groundwater, the need for remediation (including the level of remediation, the proposed methods to be used and a monitoring program to assess the progress of the decontamination) and the results of any correspondence with the NSW Department of Environment and Climate Change.	2.3.5.2
	An assessment of the potential risk of contamination of groundwater by activities associated with the development, including: • effects on groundwater recharge areas or aquifer intake areas; • the potential source of pollution, the likely transference of any pollutants to groundwater and measures to avoid contamination during construction and operation; • proposals for remediation should contamination occur; • an assessment of the potential impacts on existing and future uses of groundwater in the area considering both successful and unsuccessful site management and contaminant containment; and • an assessment of the adequacy of proposed construction and operational measures to prevent contamination of groundwater.	4.2.5

Table A2-2
Requirements from Other Government Agencies from Relevant *Environmental Assessment* Sections

Government Authority	Paraphrased Requirement	Relevant EA Section
SURFACE WATER AND GROUNDWATER (CONT'D)		
Department of Natural Resources	Any constraints on the proposal due to soil characteristics, with regard to the potential for lateral or vertical movement of contaminants, considering the permeability of the subsoil structure or surface sealing characteristics, and an assessment of the likelihood of vertical or lateral seepage or flow to neighbouring properties, natural waterbodies or groundwater.	2.3.5.2
	Identification of the location and nature of any rising groundwater levels or salinisation problems, if present in the area, and an assessment of the potential for the proposal to contribute to the progression or expansion of these impacts.	N/A
	An assessment of the need to treat groundwater, stormwater, seepage water, tail water or process water prior to on-site use or discharge to meet beneficial use water quality objectives or other limits or guidelines, identification of the approvals required and details of the adequacy of protection provided by the proposal.	4.2.5.6
	Predictions of the effects of dewatering or depressurisation on the local and regional groundwater systems, identification of the approvals required and details of the adequacy of protection provided by the proposal.	4.2.5.5
	Definition of the potential impacts of any proposed water usage from a groundwater source (including on neighbouring users and environmental attributes), identification of the approvals required and details of the adequacy of protection provided by the proposal.	4.2.5.6
	Advice on the potential impacts on species, populations, or ecological communities or their habitats (including threatened or endangered species) either directly, or indirectly through changes to the groundwater regime (flow, pressure, level or quality), and details of the adequacy of protection provided by the proposal.	4.2.5.5
	Description of the proposed final use of the site and its compatibility with the surroundings, including: • the suitability of the site for the identified end use with regard to groundwater, permeability of soil and the type of material to be introduced to achieve any proposed final landform; • assessment of the potential groundwater impacts, long-term potential water quality problems and details of the proposed management if the final landform is proposed to include a recreation lake; • the general suitability of proposed soil material for rehabilitation purposes and the adequacy of measures to be adopted during the development of any final landform to prevent introduction of contaminated or unsuitable material; and • the adequacy of measures to ensure the groundwater will not become contaminated during and after the development of any final landform.	2.15.4 and 4.2.5

Table A2-2
Requirements from Other Government Agencies from Relevant *Environmental Assessment* Sections

Government Authority	Paraphrased Requirement	Relevant EA Section
SURFACE WATER AND GROUNDWATER (CONT'D)		
Department of Natural Resources	Details of a plan for the ongoing maintenance and monitoring of groundwater including: • the key information to be monitored, impact assessment criteria and the reasons for monitoring; • the monitoring locations, intervals and durations; • procedures to be undertaken if the monitoring indicates a non-compliance or abnormality; • internal reporting and links to management practices and action plans; • reporting procedures to relevant authorities; • the effectiveness of proposed management controls or mitigation measures; and • the means for verification of predicted impacts of the proposal.	4.2.6
	Outlines of strategies to feed information from the monitoring programs back into the management practices and action plans to improve the environmental performance and sustainability of all components of the proposal.	4.2.6
	Advice on the sustainability of the proposal described in terms of site-specific environmental performance requirements considering the vulnerability of the groundwater and the threats to other environmental factors.	4.2.5 and 6.4
	Assessments of the cumulative impacts of the proposal with regard to any other activities with similar impacts in the area interacting with the environment, and specifically groundwater.	N/A
Shoalhaven City Council (7/9/07)	A water balance model may be required and if so should be prepared by a suitable consultant and any impact on the nearest creek water quality assessed.	4.2.5.2
	An effluent disposal / wastewater report should be prepared, particularly addressing the needs of staff on site and ensuring compliance with Shoalhaven City Council Development Control Plan No. 78 – Effluent Disposal for Unsewered Areas.	N/A
	Measures for the control of stormwater should be outlined in a stormwater treatment plan which details the collection and mitigation of stormwater runoff and treatment of gross stormwater pollutants that will be generated during the operation of the proposed quarry.	4.2.4 and 4.2.5.2
CONTAMINATED LAND		
Department of Environment and Climate Change (7/9/07)	Document the assessment and management of any land contamination to ensure that the land is not allowed to be put to a use that is inappropriate because of the presence of contamination.	N/A
ABORIGINAL HERITAGE		
Department of Environment and Climate Change (7/9/07)	The *Environmental Assessment* should address and document the information requirements set out in the draft "Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation" involving surveys and consultation with the Aboriginal community.	4.8
	The *Environmental Assessment* must identify the nature and extent of impacts on Aboriginal cultural heritage values across the project area.	4.8.4

Table A2-2
Requirements from Other Government Agencies from Relevant *Environmental Assessment* Sections

Government Authority	Paraphrased Requirement	Relevant EA Section
ABORIGINAL HERITAGE (CONT'D)		
Department of Environment and Climate Change (7/9/07)	The *Environmental Assessment* must describe the actions that will be taken to avoid or mitigate impacts or compensate to prevent unavoidable impacts of the project on Aboriginal cultural heritage values. This should include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.	4.8.5
	The *Environmental Assessment* needs to clearly demonstrate that effective community consultation with Aboriginal communities has been undertaken in determining and assessing impacts, developing options and making final recommendations.	4.8.2.2
Department of Lands (7/9/07)	As the proposed use of the land involves excavation activities Native Titles may need to be addressed by the applicant.	N/A
Shoalhaven City Council (7/9/07)	An Indigenous and Non-Indigenous Cultural Heritage Assessment is to be prepared by a suitably qualified and practising consultant.	4.8 and 4.12
VENM IMPORTATION AND PLACEMENT		
Department of Lands (7/9/07)	The *Environmental Assessment* must address the type and quality of fill being brought onto the site for rehabilitation and the measures to assure no contaminants are imported into the site. The relevant guidelines, procedures and minimum requires for "certification, verification, placement and compaction" for this activity should be stated in the *Environmental Assessment*.	2.9
	The time between excavation and backfilling should be stated in the report.	2.4.5
Shoalhaven City Council (7/9/07)	Under no circumstances is any waste material to be introduced to the site for rehabilitation or any other purpose. All introduced fill is to be assessed prior to being brought onto the site in accordance with the DECC Guidelines for Assessing Solid Waste. Details of the process to be implemented to establish and document that all material being brought onto the site is "VENM" should be provided.	2.9
TRAFFIC		
Roads and Traffic Authority (6/9/07)	A traffic impact study (TIS) should be prepared in accordance with Table 2.1 of the *RTA Guide to Traffic Generating Developments*. This should include an assessment of peak hour traffic movements including staff movements and provide north / south trip distributions.	4.4
	The applicant should be aware that access to the Princes Highway is likely to be restricted to left in / left out in the future. The traffic assessment should consider the required access treatments for both scenarios (existing and future left in / left out).	4.4.5.4
	The applicant should confirm that blasting activities will not necessitate any closures of the Princes Highway.	2.4.4.2
Shoalhaven City Council (7/9/07)	Expanded access from the existing access driveway is not supported and Council's preference is for access to be at the proposed Warra Warra Road / Princes Highway roundabout. In addition, a Traffic Impact Study should be prepared in accordance with RTA guidelines.	2.11.3
VISUAL		
Shoalhaven City Council (7/9/07)	The visual impact of the proposed works needs to be clarified and assessed as part of the application and assessment process. The visual impact of the development needs to be quantified from relevant points (ie. adjoining lands, existing / proposed redevelopment areas, the Princes Highway etc).	4.10

Table A2-2
Requirements from Other Government Agencies from Relevant *Environmental Assessment* Sections

Government Authority	Paraphrased Requirement	Relevant EA Section
BUSHFIRE		
Shoalhaven City Council (7/9/07)	The subject site is identified on the Rural Fire Service 'bushfire prone lands map' as being bushfire affected. As such a bushfire assessment in accordance with the provisions of Planning for Bushfire Protection 2006 should be prepared. It is recommended that the bushfire assessment be prepared consistent with Clause 46 of the *Rural Fire Regulations 2002*.	4.11
SOCIO-ECONOMIC		
Shoalhaven City Council (7/9/07)	Details of economic implications during operation (jobs, expenditure locally etc.) needs to be assessed.	2.13.2, 2.13.3 and 4.13
SOILS		
Shoalhaven City Council (7/9/07)	An assessment of sediment and erosion control measures to be put in place (having regard where applicable for the requirements of the Landcom manual *"Soils and Construction, Managing Urban Stormwater, Vol 1 4th Edition, March 2004"* should be carried out. Issues such as, but not limited to, shake down areas and wheel wash for trucks are to be addressed to minimise soil movement off site.	2.3.5
	An assessment should be carried out by a suitable consultant to identify or discount the presence of acid sulphate soils on the site. If present on the site an Acid Sulfate Soil Management Plan will need to be prepared.	2.3.5 and 4.9
	Soil and topsoil handling and storage techniques used to minimise the storage time of individual stockpiles should also be stated.	4.3.5
REHABILITATION		
Shoalhaven City Council (7/9/07)	The site needs to be progressively rehabilitated as quarry activities progress towards the site's southern boundary. As such, a rehabilitation plan should be prepared by a suitably qualified consultant that provides details of the proposed final landform, a detailed description and timing of how / when the site will be progressively rehabilitated including planting / seeding densities and a maintenance regime etc.	2.15

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