Boral Peppertree Quarry
Section 75w Modification

Final

for Boral Resources (NSW) Pty Ltd

June 2011

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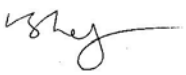
Boral Peppertree Quarry

Section 75w Modification Report

Boral Resources (NSW) Pty Ltd

June 2011

Approved by:	*Karl Rosen*
Position:	Project Manager
Signed:	
Date:	*10 June, 2011*
Approved by:	*Mike Shelly*
Position:	Partner
Signed:	
Date:	*10 June, 2011*

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FINAL REPORT

Boral Resources (NSW) Pty Ltd

Boral Peppertree Quarry
Section 75w Modification Report

June 2011

Reference: 0118026RP10

Environmental Resources Management Australia
Building C, 33 Saunders Street
Pyrmont, NSW 2009
Telephone +61 2 8584 8888
Facsimile +61 2 8584 8800
www.erm.com

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1.1 BACKGROUND

Boral Resources (NSW) Pty Ltd (Boral) proposes to establish and operate the Peppertree Quarry (formerly known as Marulan South Quarry) at Marulan South to supply the Sydney metropolitan market with high quality concrete and road sealing aggregates.

Environmental Resources Management Australia Pty Ltd (ERM) was engaged by Boral to prepare an Environmental Assessment to accompany a Section 75W modification application to be lodged with the Department of Planning (DoP). Boral propose to modify Project Approval (PA) 06_0074 in the following ways:

- construction of an earthen embankment to support a new rail loop adjacent to the dam wall on Tangarang Creek;
- relocation of the processing and rail-loading system based around the new rail loop;
- a new western overburden emplacement to be located at the site of the former processing plant;
- modification of Condition s 4 and 5 of PA 06_0074 to include an additional residential receptor at 'Pace', and minor modification of noise impact criteria based upon realistically achievable targets from the reconfigured detailed design;
- a reduction in the size and capacity of Dam 1 to 112 ML; and
- the reconfiguration of the proposed habitat management area to accommodate the revised dam capacity and the new rail loop.

This Environmental Assessment describes the proposed modifications, examines the statutory context of the proposal, and assesses its potential environmental impacts. The assessment has been based around a number of baseline studies and investigations undertaken for the Environmental Assessment undertaken for the original Project Application in 2006, which is referred to as the Project EA throughout this assessment.

1.2 *THE APPLICANT*

Boral is Australia's leading quarry operator with over 100 quarries producing sand, concrete aggregates, crushed rock, asphalt aggregates and road base products. In managing its quarry businesses, Boral regularly reviews the most sustainable and cost efficient ways to continue to meet market demands for construction materials.

Boral is currently in the planning and development stage for the Peppertree quarry and construction is expected to commence in mid 2011.

1.3 *THE SITE*

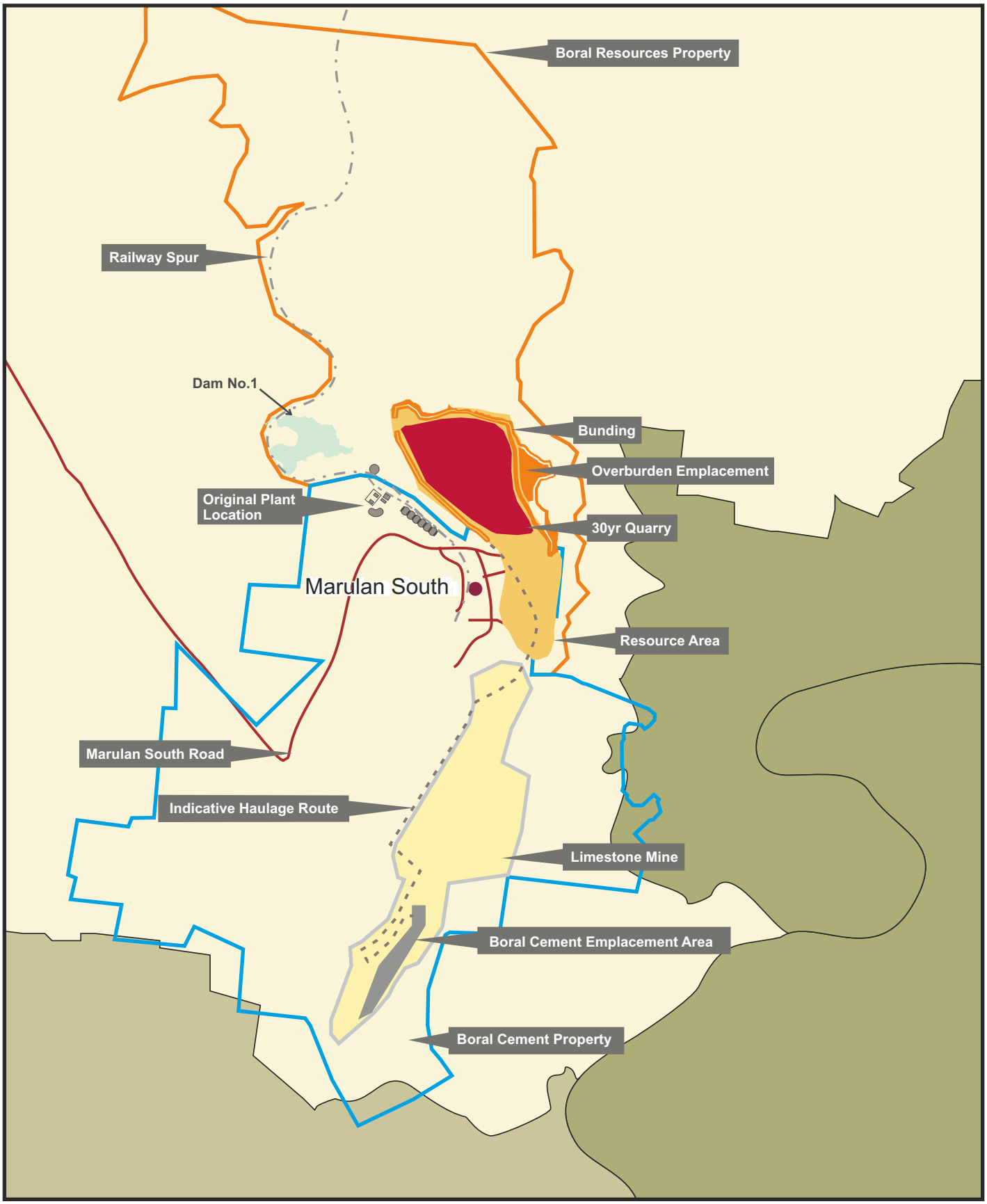
The Peppertree Quarry proposal remains predominantly as described in the original Project Application for the Marulan South Quarry. The site is located approximately 10km south east of Marulan in the Southern Tablelands. Production at the quarry will initially be relatively low, commencing at 1-2 million tonnes per annum (mtpa) and growing to 3.5 mtpa as proposed in the Project Application.

Road access to the quarry will continue via Marulan South Road, which extends from an intersection with the Hume Highway. Marulan South Road also services the existing Boral Cement limestone mine, a number of rural properties including poultry farms, a limestone processing factory and a fireworks factory.

Rail access to the site is available via an existing rail line which currently services the adjacent Boral Cement limestone mine. The rail line connects with the Main Southern Railway Line at Medway Junction approximately five kilometres north of Marulan South. Products from Peppertree Quarry will continue to be transported by rail for the duration of quarry operations.

The identified resource area covers approximately 104 ha on the eastern edge of a 600m Australian Height Datum (AHD) plateau adjacent to the former village of Marulan South. The Peppertree Quarry approval incorporates a 30 year operations area of approximately 70 ha commencing in the northern portion of total resource area.

A tertiary processing plant, rail loader and a water supply dam will be constructed to the north-west of the proposed quarry pit. The original plan for the quarry incorporating a conceptual 30 year quarry area, tertiary processing plant, rail loading facility and dam are shown on *Figure 1.1.*



Legend

- Morton National Park
- Bungonia State Conservation Area

Figure 1.1

Peppertree Quarry Site

Client:	Boral	
Project:	Peppertree Quarry	
Drawing No:	0118026s_Sect75W_C001_R2.cdr	
Date:	10/06/2011	Drawing size: A4
Drawn by:	SQW	Reviewed by: KR
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Building C, 33 Saunders St, Pyrmont, NSW 2009
Telephone +61 2 8584 8888

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A number of investigations have been undertaken during the detailed design of the Peppertree Quarry to improve the efficiency of operations and achieve improved environmental outcomes. The proposed modifications involve the construction an earthen embankment adjacent to the water supply dam embankment to support a rail loop and associated relocation of the tertiary processing plant and rail loading infrastructure to accommodate the revised rail alignment.

The modifications will effectively move the tertiary processing and loading operations away from the worst affected residential receptors, located south west of the site and allow for a more direct and efficient rail operation for both the Peppertree Quarry and the adjoining Boral Cement limestone mine. Other modifications include a new overburden emplacement to be located west of the pit in the area previously proposed for the tertiary processing plant and a reduction in the required size of the water supply dam with associated modification to the proposed habitat management area.

1.4 PROJECT APPROVAL

On 28th of February, 2007, the Minister for Planning approved the Marulan South Quarry Project (06_0074) under Part 3A of the *Environmental Planning and Assessment Act* 1979.

PA 06_0074 included all quarrying activities and supporting infrastructure, including a rail siding and loading facility, tertiary processing plant and water supply dams.

Boral's intention to submit this s75W application was outlined in a meeting held between Boral and the DoP on 20 July 2010. Boral's Community Consultative Committee was given a detailed explanation of the proposal at meetings on 24 June and 19 August 2010.

1.5 LAND OWNERSHIP AND NEARBY RESIDENCES

Boral Resources (NSW) Pty Ltd owns 650 ha of land abutting the Boral Cement limestone mine. The acquired property includes the Peppertree Quarry site, an identified resource area and surrounding buffer land.

Land use in the immediate surrounds of the plateau is predominately mining and grazing. The site of the former village of Marulan South is located between the proposed quarry site and the existing limestone mine on land owned by Boral Cement. Marulan South village was established principally to service the limestone mine and has been essentially closed down since the late 1990's. The majority of town infrastructure has been demolished over the years with little remaining apart from a disused hall and former bowling club.

A small number of rural properties are located to the north and west of the site including poultry farms, limestone processing industries and a fireworks factory. A new residential receptor has been constructed in the immediate vicinity of the Peppertree Quarry following the Project Approval. The property was identified as Property No. 16 in the Project EA and consisted of a poultry farm with no known planned or approved residence. The rural properties are accessed via Marulan South Road and the Boral Cement railway line separates them from the proposed quarry.

Rural residential properties are also located to the east of the site along Long Point Road. The properties are separated from the proposed quarry site by the deep Barbers Creek gorge.

The western face of Barbers Creek gorge to the east of the site is Crown Land, with Morton National Park adjoining to the east of Barbers Creek. Gorges forming Bungonia Creek and the Shoalhaven River border the plateau to the south and southeast respectively. Bungonia State Conservation Area is located on the southern side of Bungonia Creek, 5km to the south of the site.

The village of Marulan is on the Hume Highway approximately ten kilometres to the northwest of the site.

2 PROJECT PROPOSAL

2.1 PROPOSED DEVELOPMENT

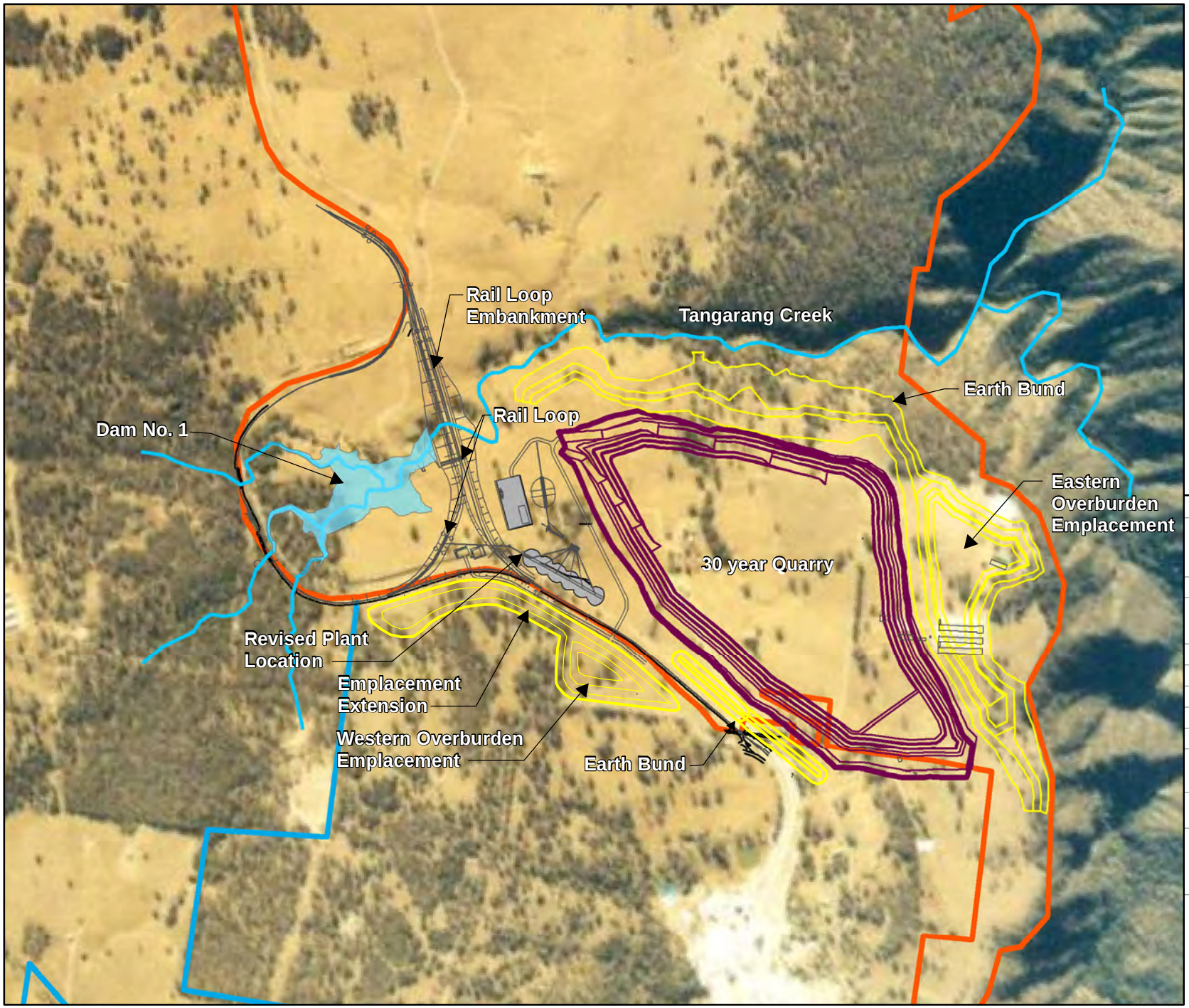
2.1.1 Summary

Boral wishes to modify PA 06_0074 in the following ways:

- construction of a new rail loop off the existing privately owned Boral Cement rail line. The new rail loop embankment will adjoin the water storage dam embankment to the east;
- relocation of loading facilities, tertiary processing plant, stockpiling and associated services; to be sited adjacent and to the east of the new rail loop;
- a new overburden emplacement to be located between Marulan South Road and the existing rail line;
- modification of Conditions 4 and 5 to include an additional residential noise receptor at Property 16 and modification of Project Specific Noise limits based upon detailed design and noise monitoring data; and
- reduction in size and capacity of the proposed water storage dam on Tangarang Creek.

All proposed facilities and activities would be located within the previously approved Project area. The proposed site layout is indicated in *Figure 2.1*.

Further details of all the proposed changes are provided in the subsequent sub-sections, with construction and operational impacts associated with the modifications assessed in the remainder of the EA .



Legend

- Proposed Dam Location
- Tangarang Creek
- Quarry Location
- Boral Cement Property Boundary
- Boral Peppertree Property Boundary

Figure 2.1

Peppertree Quarry - Proposed Site Layout

Client:	Boral		
Project:	Peppertree Quarry		
Drawing No:	0118026s_Sect75W_G001_R2.mxd		
Date:	5/05/2011	Drawing Size:	A4
Drawn By:	SW	Reviewed By:	RS
Projection:	GDA 1994		
Scale:	Refer to scale bar		

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0 100 200 300m

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2.1.2 Rail Loop

The new rail loop embankment is proposed to be constructed alongside the water storage dam wall. The embankment will be constructed on the eastern (down stream) side to allow enough width for two rail lines and a roadway at the crest.

Boral Cement currently operates trains along the existing rail line for transport of product from the limestone mine north to Sydney. The Peppertree Quarry will result in an additional 3 or 4 rail trains per day at full production. The line has the capacity to service the cumulative total of rail movements for both operations and the number of movements will remain in accordance with the original Project Application.

The construction of the new rail loop will allow for the separation of rail movements for the two operations and provide flexibility in the event of disruptions to planned scheduling.

The new rail embankment will facilitate a more direct approach to the existing Boral Cement limestone mine. The proposed rail embankment adjacent to the dam wall will halve the number of movements along the existing section of rail line which curves around the headwaters of Tangarang Creek and provide loaded trains from both operations with a more direct access to the Main Southern Line. This will provide a greater separation distance from residential receptors and minimise the use of the existing curved rail line with loaded trains.

2.1.3 Rail Loading and Tertiary Processing Plant

The rail loading facilities will be incorporated as part of the new rail loop, with the tertiary processing plant, stockpiling and associated services being moved adjacent and to the east of the new rail loop.

The relocation of the rail loading and tertiary processing plant to the eastern side of the proposed new rail line are functional requirements to facilitate efficient operations and to provide separation of rail movements from the quarry and the adjoining limestone mine.

The plant and rail loading facilities will also be located approximately 250m further away from the most affected residential receptor. This will result in an improvement to local amenity associated with noise and dust emissions for receptors located to the south-west of the quarry and minor alterations to the anticipated impacts to other near-bye receptors. All reasonable and feasible mitigation including the construction of an earthen acoustic barrier has been incorporated into the detailed design to minimise noise impacts to surrounding properties as discussed in Section 5.

2.1.4 Overburden Emplacement

A construction compound will initially be established at the former tertiary plant location, located between Marulan South Road and the Boral Cement railway line.

Following the commencement of site operations, the construction compound will be replaced by a new overburden emplacement area. The western overburden emplacement will be approximately 30m high and a capacity of approximately 1 million cubic metres.

The western overburden emplacement will incorporate an extension to form a bund to the north-west along the periphery of the existing rail line. The new emplacement and bund will be located predominantly within areas previously proposed to be developed in the original Project Application for the construction of former tertiary plant and rail siding.

The bund forming the extension to the western emplacement will be constructed during the initial stages of overburden stripping to a height of between 20 and 30m to assist with shielding surrounding receptors from emissions from the quarry.

Overburden from the site will initially be used to construct the earth bund around the perimeter of the quarry operations. A 30m overburden emplacement area forming an extension to the eastern earth bund was included in the original Project Application. The eastern emplacement area or "overburden dump" will require approximately 3.5 million cubic metres of material which is anticipated to allow for approximately 5 years worth of quarry operations.

Overburden will continue to be removed as quarrying proceeds over the 30 year quarry footprint. The new western overburden emplacement will provide for additional on site overburden storage, reducing the volume of overburden required to be transported to the southern pit of the adjacent Boral Cement Limestone Mine.

The western emplacement area also provides operational flexibility for the control noise emissions during adverse wind conditions as required. The new emplacement will provide operation flexibility to allow the overburden stripping fleet to be directed to either side of the quarry during adverse winds minimising potential impacts upon near-bye receptors.

The western emplacement will also reduce dust emissions associated with haulage of overburden to the adjoining Limestone Mine.

2.1.5 Inclusion Of An Additional Residential Receptor

Following the granting of PA 06_0074, a new residential receptor has been constructed on Marulan South Road within the noise footprint of Peppertree Quarry. The property was identified as Property No. 16 in the Project EA and consisted of a Turkey farm without a known planned or approved residence.

The new residential receptor does not have a noise performance condition assigned under Conditions 4 and 5 of Schedule 3 of the Project Approval and therefore can be interpreted as "any other noise sensitive location". Achieving the noise assessment criteria for "any other noise sensitive location" is not considered reasonable or feasible given the close proximity of residence in relation to the proposed quarry operations. It is proposed that Receptor 16 be incorporated into the Project approval with a realistically achievable noise impact assessment criteria calculated in accordance with the Industrial Noise Policy (INP) (2000).

2.1.6 Project Specific Noise Limit

This application seeks to vary the existing Project Approval criterion and develop new noise level criterion based on the methodology set out in DECCW's Industrial Noise Policy (INP) (2000). Noise modelling was used to assist with the conceptual planning for the quarry operations and various scenarios were trialled to identify the likelihood of the quarry complying with the consent criterion in PA_0074, which were based on the predicted (achievable) noise levels.

An updated noise impact assessment has been undertaken to assess the potential noise impacts from the Project at potentially affected receptors using the revised processing, rail loading and overburden operations and topographical data for the region in order to simulate the Project. The results of the impact assessment are detailed in *Chapter 5*.

2.1.7 Water Storage Dam

A key driver in the development of the Peppertree Quarry was a sustainable water management system, which aims for the proposed operations to be 100% self sufficient in water. During the EA preparation a sustainable water management system was developed based upon capturing stormwater run-off for use in the quarry processes, dust suppression and environmental controls. The system was based around obtaining the site's water supply from a freshwater dam located on Tangarang Creek. The Project EA proposed the construction of a water storage dam in this location of capacity 245ML, to meet an estimated yearly raw water demand of 255ML/year.

Demand management investigations undertaken during detailed design, have indicated that site water demand can be reduced from 255 ML/yr to 145 ML/year equating to a 43% reduction in water use per year.

Water balance investigations have indicated that a dam with 112ML capacity will be sufficient to meet the predicted water requirements whilst providing for future flexibility within the quarry operations, for the timing and control of environmental releases and provide additional storage capacity during drought periods.

The size of the main water storage dam is therefore proposed to be 112ML. The reduced dam capacity will limit the extent of impacts to the endangered Box-Gum Woodland and Aboriginal Heritage items in the upper reaches of the proposed reservoir.

2.1.8 Habitat Management Area

The change in the size and location of the dam footprint means a reduction in the amount of vegetation that is required to be cleared for its construction. In the approved Project the construction of Dam 1 would have resulted in the loss of approximately 2.6 ha (41 %) of the Box-Gum Woodland extant within the Project area. The changed size and capacity of Dam 1 has beneficial impacts in that it will only require removal of 1.8 ha of the Box-Gum Woodland representing a 30% reduction to the extent of impact associated with the proposal.

The proposed rail loop embankment and the reduction in capacity of Dam 1, will result in a slight reconfiguration of the Habitat Management Area (HMA), as proposed in the Landscape and Rehabilitation Plan prepared for the project.

The overall area of the HMA will remain as proposed at 12.5 ha, located around the periphery of the dam reservoir and the establishment of a 20 metre buffer on either side of Tangarang Creek. The creek buffer will be established downstream from the rail embankment and a section of rip rap incorporated into the design at the outlet from the spillway to provide scour protection for high flow releases from the reservoir.

3 STATUTORY PLANNING CONTEXT

3.1 APPLICABLE LEGISLATION, POLICIES AND PLANS

There are a number of statutory planning provisions that relate to the proposed modification, including:

- *Environment Protection and Biodiversity Conservation Act, 1999;*
- *Environmental Planning and Assessment Act, 1979* and Regulations, 2000;
- *Protection of the Environment Operations Act, 1997;*
- *Water Act, 1912;*
- *Water Management Act, 2000;*
- State Environmental Planning Policy (Major Projects), 2005;
- State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries), 2007;
- State Environmental Planning Policy No. 33 – Hazardous and Offensive Development; and
- Goulburn Mulwaree Local Environmental Plan 2009-Amendment No. 1 (LEP 2009).

The proposed modification is compliant with the various statutory requirements, with the relevant provisions outlined below.

3.2 COMMONWEALTH LEGISLATION

3.2.1 *Environment Protection And Biodiversity Conservation Act, 1999*

The *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) requires the approval of the Commonwealth Minister for the Environment for actions that may have a significant impact on matters of national environmental significance. The EPBC Act also requires Commonwealth approval for certain actions on Commonwealth land.

Matters of national environmental significance under the Act comprise:

- World Heritage areas;
- National Heritage Places;
- Ramsar wetlands of international importance;
- threatened species or ecological communities listed in the EPBC Act;
- migratory species listed in the EPBC Act;
- Commonwealth marine environments; and
- nuclear actions.

There are no World Heritage areas, National Heritage places, Ramsar wetlands or Commonwealth marine areas on or near the Peppertree Quarry site and the proposal does not involve a nuclear action.

Previous investigations undertaken within the Peppertree Quarry site identified the critically endangered ecological community, White Box Yellow Box Blakely's Red Gum Woodland (Box-Gum Woodland) in the vicinity of the water storage dam area.

In the original Project application, the construction of Dam 1 would have resulted in the loss of approximately 2.6 ha (41 %) of the Box-Gum Woodland extant within the Project area. The changed size and capacity of Dam 1 has beneficial impacts in that it will only require removal of 1.8 ha (29%) of the Box-Gum Woodland. The proposed modifications will therefore have a beneficial impact and a referral under the EPBC Act is therefore not considered warranted.

3.3 NSW LEGISLATION

3.3.1 Environmental Planning And Assessment Act, 1979 And Regulations, 2000

The proposed modification must be assessed in accordance with the *Environmental Planning and Assessment Act, 1979* (EP&A Act) and the Environmental Planning and Assessment Regulation 2000 (EP&A Regulation).

Section 75W (2) of the EP&A Act states that "*the proponent may request the Minister to modify the Minister's approval for a project*". The proposed application is seeking to modify Part 3A Major Project approval PA 06_0074.

Section 75W (3) states that "*the request for the Minister's approval is to be lodged with the Director-General. The Director-General may notify the proponent of environmental assessment requirements with respect to the proposed modification that the proponent must comply with before the matter will be considered by the Minister*".

The DoP advised that the Director Generals Requirements (DGRs) were not required for the proposal.

3.3.2 Protection Of The Environment Operations Act, 1997

The *Protection of the Environment Operations Act 1997* (PoEO Act) provides for an integrated system of licensing and contains a core list of activities requiring Environmental Protection Licenses (EPL) from the Department of Environment and Climate Change and Water (DECCW). These activities are called 'scheduled activities' and are listed in Schedule 1 of the Act.

On 23 July 2009, the DECCW issued EPL No. 13088 for the Peppertree Quarry exploratory test pit. An application to vary the EPL was lodged in February 2011 along with relevant management plans to include the full operation of the quarry. The proposed modification to the development will be subject to the conditions of this EPL.

3.3.3 Water Act, 1912

The Water Act, 1912 addresses issues relating to water rights, water and drainage, drainage promotion, and artesian wells. In those water sources (rivers, lakes and groundwater aquifers) in NSW where water sharing plans have not commenced, the *Water Act 1912* still governs the issue of new water licences and the trade of water licences and allocations. A water sharing plan has not commenced in the Shoalhaven catchment.

Boral has recently negotiated the purchase of existing allocations from other licence holders within the catchment and on 30 July 2010 lodged an application with the New South Wales Office of Water (NOW) for a surface water licence under Part 2 of the *Water Act 1912*.

3.3.4 Water Management Act, 2000

The *Water Management Act 2000* (WM Act) incorporates the provisions of various acts relating to the management of surface and groundwater in NSW, and provides a single statute for the regulation of water use and works that affect surface and groundwater, both marine and fresh. The WM Act is administered by the NOW.

Section 75U(h) of the EP&A Act excludes projects approved under Part 3A from requiring *"a water use approval under section 89, a water management work approval under section 90 or an activity approval under section 91 of the Water Management Act 2000.* The proposal also does not require the extraction of water from any Regulated River Water Source and no water sharing plans apply to the Project Area. Accordingly, there is no approval required.

3.3.5 Threatened Species Conservation Act, 1995

Projects determined by a statutory authority of the NSW State Government, are required to be assessed in accordance with the EP&A Act, as amended by the *Threatened Species Conservation Act 1995* (TSC Act). The TSC Act lists threatened species, populations and ecological communities under Schedules 1 and 2 of the Act, that are priorities for conservation within NSW.

One species listed as Vulnerable on Schedule 2 of the TSC Act; the Eastern Bentwing-bat *(Miniopterus schreibersii oceanensis* was found to have the potential to occur on the site. One ecological community listed as an Endangered on Schedule 1 of the TSC Act; White Box Yellow Box Blakely's Red Gum Woodland (Box-Gum Woodland) was found on the site.

The potential impacts on threatened species were considered in accordance with the requirements of the TSC Act and the EP&A Act and this impact assessment was reported in EA 2006.

This assessment concluded that the proposal was unlikely to have a significant impact on this species or this ecological community. The proposed modification will result in the removal of less Box Gum woodland, and potential foraging habitat for the Eastern Bent-wing Bat. Consequently, impacts to this ecological community and this species are not considered to be significant, rather, provides a net benefit to the endangered ecological community. It will have no additional impacts upon listed threatened species, populations or ecological communities, or their habitats, therefore an updated Assessment of Significance is not required.

3.3.6 Native Vegetation Act 2003

Clause 12 of the *Native Vegetation Act 2003* is administered by the DECCW and requires consent from the Minister for the clearing of 'native vegetation'. Section 75U of the EP&A Act excludes projects approved under Part 3A from requiring "*an authorisation referred to in section 12 of this (or under any Act to be repealed by that Act) to clear native vegetation*".

3.4 STATE ENVIRONMENTAL PLANNING POLICIES

3.4.1 State Environmental Planning Policy (Major Projects) 2005

State Environmental Planning Policy (Major Projects) 2005 identifies development to which the assessment and approval process under Part 3A of the EP&A Act applies.

The provisions of SEPP (Major Projects) apply to the proposed modification as the proposal involves a modification to a consent issued under Part 3A of the EP&A Act. Accordingly, the Minister for Planning is the consent authority for this section 75W modification.

3.4.2 State Environmental Planning Policy (Mining, Petroleum Production And Extractive Industries) 2007

This policy, which was gazetted on February 16, 2007, aims:

a) to provide for the proper management and development of mineral, petroleum and extractive material resources for the purpose of promoting the social and economic welfare of the State;

b) to facilitate the orderly and economic use and development of land containing mineral, petroleum and extractive material resource; and

c) to establish appropriate planning controls to encourage ecologically sustainable development through the environmental assessment, and sustainable management, of development of mineral, petroleum and extractive material resources.

Part 3 of the policy identifies matters for consideration by the consent authority in determining an application for consent for development for the purposes of mining, petroleum production or extractive industries. Whilst the current proposal is for a modification to an existing consent, the matters for consideration and the consistency of the proposed modification to these matters are the same, and are detailed below.

- Compatibility of proposed mine, petroleum production or extractive industry with other land uses.

The Site is located within Marulan South and surrounding land uses include rural properties including poultry farms, an adjacent limestone processing mine and other industry. The use of the site as a quarry is considered compatible with adjacent land uses and the proposed modification will not change this use. The proposed modification to construct and operate a rail loop will ensure that both Peppertree quarry and the adjacent Boral Cement limestone mine are able to operate efficiently.

The proposed modification will involve the construction and operation of a rail loop. Impacts associated with the proposed modification are detailed in *Sections 4* to *11*. Mitigation measures included within this assessment and the original Project EA will be implemented to ensure the potential impacts are minimised.

- Compatibility of proposed development with mining, petroleum production or extractive industry.

The proposed modification, in particular the construction and operation of the new rail loop, will support future quarrying operations on the site and assist in the recovery of the resource.

- Natural resource management and environmental management.

The proposed modification will result in minor environmental impacts which are able to be appropriately mitigated and managed (refer *Sections 4 to 11).*

- Resource recovery.

The proposed modification will ensure adequate rail transport capabilities are provided to the quarry operations, enabling resource recovery to occur in an efficient manner.

- Rehabilitation.

The proposed modification to install the new rail loop will result in some additional surface disturbance associated with the installation of the rail line. Following the construction activities, disturbed areas no longer required for operational purposes will be rehabilitated. Peppertree Quarry has approval for 30 years of quarrying on the site, with an identified resource of 250 million tonnes that could last 70 years. Future use of the site after the end of the quarry has not been determined, and decisions about appropriate rehabilitation will be made in accordance with the requirements of stakeholders at the time.

As the proposed activities will be compatible with other land uses; environmental impacts associated with the development will be mitigated through the implementation of appropriate control measures, and the operation will assist the planned recovery of the granodiorite resource, the proposed modifications are considered to be consistent with SEPP (Mining, Petroleum Production and Extractive Industries).

3.4.3 State Environmental Planning Policy No 33 – Hazardous And Offensive Development

State Environmental Planning Policy 33 – Hazardous and Offensive Development (SEPP 33) aims to "ensure that in considering any application to carry out potential hazardous or offensive development, the consent authority has sufficient information to assess whether the development is hazardous or offensive and to impose conditions to reduce or minimise any adverse impact". The policy aims to ensure that the merits of a proposal are properly addressed before being determined, particularly in regard to off-site risk. The proposed modification is not "potentially hazardous" as defined in SEPP 33 and consequently a preliminary hazard analysis is not required.

3.5 LOCAL PLANNING INSTRUMENTS

3.5.1 Goulburn Mulwaree Local Environment Plan 2009- Amendment 1

The Goulburn Mulwaree Local Environment Plan 2009 Amendment 1 (LEP 2009) is the environmental planning instrument which governs land use in the Project area.

Under LEP 2009 the majority of the site is zoned RU 1 Primary Production. Extractive industries are permissible in this zone with development consent. The relevant aims and objectives of the RU 1 zone include the following:

- To minimise the fragmentation and alienation of resource lands;
- To minimise conflict between land uses within the zone and with adjoining zones; and
- To allow the development of non-agricultural land uses which are compatible with the character of the zone;

The proposed modification is generally consistent with the objectives of the LEP and the objectives of the RU 1 Primary Production Zone.

4 AIR QUALITY IMPACT ASSESSMENT

4.1 BACKGROUND

Holmes Air Sciences undertook a quantitative air quality assessment for the initial Project EA. The assessment was based on a conventional approach following the procedures outlined in the NSW DEC guidelines "Approved Methods for the Modelling and Assessment of Air Pollutants in NSW" (DEC, 2005).

The assessment used a computer-based dispersion model to predict ground-level dust concentrations and deposition levels in the vicinity of the quarry under reasonable worst-case operational scenarios. The initial conceptual design for quarry operations was developed in conjunction with the environmental assessment process to ensure the acceptable emissions and best management practices were incorporated into the Project. A range of conservative assumptions for quarry operations were developed for the purposes of estimating dust emissions, with quarry operations designed to fall within the assumptions to ensure a conservative assessment.

The results of the original assessment indicated that the proposed quarry would fall within relevant DEC (now DECCW) criteria with the exception of a small number of anticipated exceedences to the 24 hour PM_{10} concentration criteria.

The proposed project modifications fall within the worst case operational scenarios adopted for the modelling undertaken for the Project EA. The tertiary processing and rail loading will be located approximately 250m further away from the most affected residential receptors and the new emplacement will substantially reduce the reliance for overburden haulage to the Boral Cement Limestone Mine south pit.

PAE Holmes (formerly Holmes Air Sciences) have undertaken additional quantitative modelling to predict the likely air quality impacts associated with the modified quarry operations. Revised emissions estimates and modelling have been based around maximum production rate of 3.5mtpa in order to represent worst case dust conditions for the operation of the quarry. This section presents a summary of the revised air quality assessment with the complete report included as Annex D.

4.2 AIR QUALITY ASSESSMENT CRITERIA

Air quality goals relate to the total dust burden in the air, including impacts from the project and background levels. Relevant assessment criteria are summarised in *Table 4.1* and *Table 4.2*.

Table 4.1 Assessment Criteria for Particulate Matter Concentrations

Pollutant	Averaging Period	Concentration (μg/m³)	Agency
TSP [I]	Annual mean (including cumulative sources)	90	National Health & Medical Research Council
PM_{10} [II]	24-hour maximum	50	DECCW
	Annual mean (including cumulative sources)	30	DECCW long-term reporting goal
	(24-hour average, 5 exceedances permitted per year)	50	National Environment Protection Council

Source: DEC

Notes: [I] TSP = total suspended particulate

[II] PM_{10} = particulate matter with aerodynamic diameters less than 10 μm

In addition to health impacts, airborne dust also has the potential to cause nuisance impacts by deposition on surfaces. The maximum acceptable increase in dust deposition over the existing dust levels, and the maximum acceptable total dust deposition due to the quarry and other sources are shown in *Table 11.2*. These criteria for dust fallout levels are set to protect against nuisance impacts (DEC, 2005).

Table 4.2 DECCW Criteria for Dust Fallout

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
Deposited dust (insoluble solids)	Annual	2 g/m²/month	4 g/m²/month

4.3 *EXISTING AIR QUALITY*

Background air quality monitoring was undertaken to measure the existing dust concentrations and deposition levels in the project area during the preparation of the Project EA. This included the measurement of both Total Suspended Particulates (TSP) and those dust particles with a diameter less than ten micrometres (PM_{10}) using high volume air samplers at two locations. This monitoring program was inclusive of dust emissions from the existing Boral Cement Limestone Mine activities and other background sources including traffic on unsealed roads, local building and construction activities, animal grazing activities and to a lesser extent traffic from the Hume Highway.

Twenty-four hour TSP and PM_{10} samples were recorded every three days for a 42 day period and then every six days for 66 day period from November 2005 to late February 2006 as part of the Project EA.

Average and maximum concentrations for PM_{10} and TSP are shown below in *Table 4.3*. The highest 24-hour average PM_{10} concentration since monitoring began was from Site 1 with 34 $\mu g/m^3$ on 27 December 2005. This is below the 50 $\mu g/m^3$ DEC 24-hour maximum goal. Average PM_{10} concentrations for the data period were below the DEC's annual average PM_{10} goal of 30 $\mu g/m^3$. Also, average TSP levels were below the 90 $\mu g/m^3$ goal.

Table 4.3 Dust concentration data for Peppertree Quarry

Date	Site 1 PM_{10}	Site 1 TSP	Site 2 PM_{10}	Site 2 TSP
Maximum ($\mu g/m^3$)	33.8	45.8	29.1	58.8
Average ($\mu g/m^3$)	16.4	25.2	13.9	24.9

Source: HAS 2006

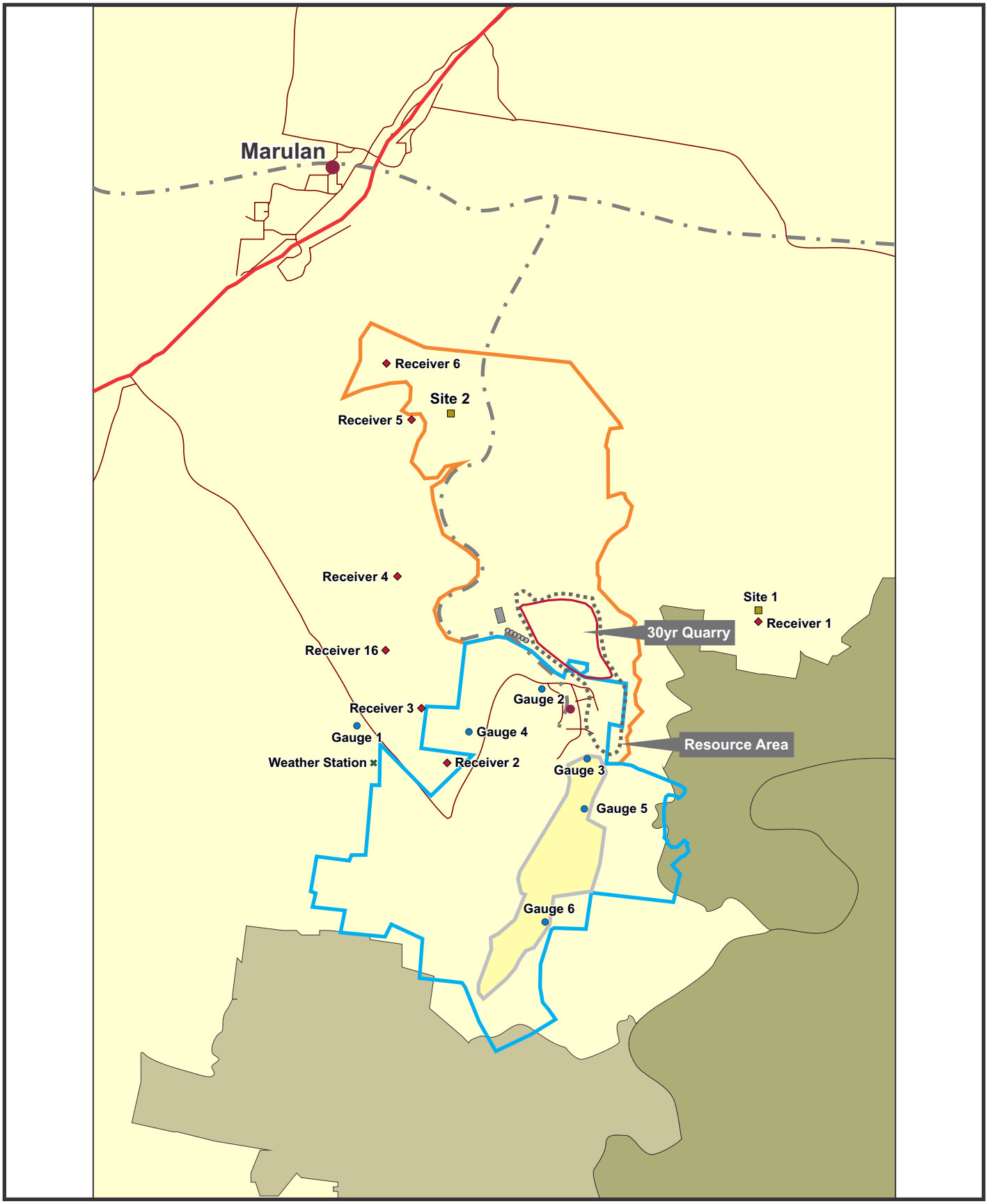
An estimate of 16 $\mu g/m^3$ has been taken to be the annual average PM_{10} background level to apply at the nearest residential receptors. The annual average for TSP has been taken to be 25 $\mu g/m^3$.

Additional modelling was undertaken by Holmes air Sciences during the determination phase of the Project. The additional assessment included an analysis of variance of the PM_{10} concentration data with contemporaneous meteorological data. This was used to reconstruct a time-series of 24-hour concentrations for each day for which meteorological data exists. This analysis was used to model a daily time series for 24 hour PM_{10} concentrations from the Peppertree Quarry and the adjacent limestone mine to determine potential exceedence of 24 hour criteria when added to background concentration data.

Dust deposition gauges have been operated by Boral Cement within an around the perimeter of the limestone mine since February 2001. A value of 3 g/m^2/month has taken to be the likely annual average dust deposition at each of the residential receptors surrounding the Peppertree Quarry. The location of residential receptors and Air Quality monitoring locations is presented on *Figure 4.1.*

The assumed background concentrations and deposition rates applicable at the nearest residential receptors are:

- annual average TSP of 25 $\mu g/m^3$;
- annual average PM_{10} of 16 $\mu g/m^3$; and
- annual average dust deposition of 3 g/m^2/month.



Legend

- Receiver Locations
- High Volume Air Samplers
- Dust Deposition Gauges
- Weather Station

Figure 4.1

Receiver Locations and Air Quality Monitoring Locations

Client:	Boral	
Project:	Peppertree Quarry	
Drawing No:	0118026s_Sect75W_C002_R1.cdr	
Date:	15/11/2010	Drawing size: A4
Drawn by:	GC	Reviewed by: RS
Scale:	Refer to Scale Bar	

N

0 1 2 3km

Environmental Resources Management Australia Pty Ltd
Building C, 33 Saunders St, Pyrmont, NSW 2009
Telephone +61 2 8584 8888

ERM

4.4 EMISSIONS FROM THE QUARRY

The assessment of total dust emissions in the EA considered two operational scenarios to capture the maximum extent of air quality impacts of the project on neighbouring residential properties. Operational scenarios modelled included:

- year 1 operations with overburden emplaced on the surrounding bund wall and the eastern emplacement area; and
- maximum production (3.5 mtpa) operations with overburden transported for emplacement to a stockpile in the Boral Cement limestone mine.

These two scenarios were considered to capture the worst-case in terms of air quality impacts of the Project on neighbouring residential properties. Truck sizes, haul road distances and routes, conveyors, facility layout, stockpile and pit areas, activity operating hours and other details that are necessary to estimate dust emissions were not fully developed for the initial Project EA, so worst case operational scenarios were used to estimate emissions. Material quantities for each scenario are presented in *Table 4.4*.

Table 4.4 Summary of estimate annual material quantities

Material	Year 1 / construction	Maximum production (3.5 Mtpa)
Overburden (bcm/y*)	537,400	500,000
Weathered material (t/y)	1,002,800	500,000
Product (t/y)	889,350	3,500,000

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2. Or simply delete these lines of text if not required

** Bank cubic metres per year (bcm/y).*

The most significant dust generating activities from the quarry operations were identified based upon the worst case project parameters and the dust emission estimates are presented below in *Table 4.5* together with emissions estimates from the modified layout. Emissions estimates for construction activities and the initial year of operation involving construction of the bund wall around the perimeter of the quarry will remain consistent with the EA so the assessment has focussed on the worst case scenario at maximum production. Details of the calculations are presented in Appendix B of the Air Quality Assessment presented in Annex H of the Project EA.

Table 4.5 ***Estimated Dust Emissions due to Marulan South Marulan South Quarry Operations***

ACTIVITY	Calculated TSP emission (kg/y)		
	Construction / year 1	Maximum production EA (3.5 Mtpa)	Maximum production Revised S75 (3.5 Mtpa)
Drilling rock	10227	10227	10,227
Blasting rock	1880	1880	1,880
Loading overburden to trucks	2036	1894	1,894
Hauling overburden to emplacement area	61801	402500	57,500
Dumping overburden to emplacement area	2036	1894	1,894
Dozer shaping overburden dump	17472	17472	17,472
Loading rock to trucks	3116	6588	6,588
Hauling rock to hopper/crusher	141911	300000	300,000
Dumping rock to hopper/crusher	3116	6588	6,588
Primary crushing and screening	2876	6080	6,080
Secondary crushing and screening	57786	122160	122,160
Tertiary crushing and screening	57786	122160	122,160
Loading to product stockpiles	2894	6119	6,119
Loading product to road trucks	80	170	170
Transport product off-site (sealed rd)	12614	26667	26,667
Loading product to trains by conveyor	297	1315	1,315
Wind erosion from exposed pit areas and bunds	160947	231828	240,439
Wind erosion from product stockpiles	9935	9935	9,935
Wind erosion from o/b emplacement area	86794	33118	44,637
Loading rejects (weathered material)	425	212	212
Hauling rejects to o/b emplacement area	350980	175000	25,000
Dumping rejects at emplacement area	425	212	212

ACTIVITY	Calculated TSP emission (kg/y)		
	Construction / year 1	Maximum production EA (3.5 Mtpa)	Maximum production Revised S75 (3.5 Mtpa)
Grading roads	1418	1418	1,418
Annual production (t)	**889,350**	**3,500,000**	**3,500,000**
TOTAL DUST (kg)	**988,854**	**1,485,436**	**1,010,567**

The proposed modifications are anticipated to significantly reduce the estimated dust emissions associated with the Project.

Emissions from tertiary crushing and screening plant will remain consistent with the original assessment with an estimated emission rate of 122160 kg/year at full production following the application of appropriate mitigation. The tertiary plant will however be relocated approximately a further 250m to the north-east away from the most affected receivers No. 2 and 3. The plant will also be located further away from the limestone mine, minimising the potential for cumulative impacts associated with the concurrent operations.

The major reduction in dust emissions will be associated with reducing the reliance on vehicles hauling overburden and weathered material on unsealed haul roads to the emplacement area in the limestone mine's south pit. The modelling conservatively assumed that at full production, all overburden and weathered material would be transported over a 14km return distance to the limestone mine using 50 tonne trucks. Haulage of overburden and rejects resulting in an estimated emission of up to 577,500 kg/year which was equivalent to around 38% of total emissions from the quarry operations. Restricting overburden haulage to a distance of approximately 2 km round trip to the proposed new western emplacement will reduce haulage dust emissions by 85% or a reduction of around 495,000 kg/year at full production.

The reduction in emissions associated with haulage will be partially offset by an increase in the potential for wind erosion from the new emplacement area. Conservatively assuming an additional 6 ha or exposed surface area will equate to emissions of up to around 44,637 kg/year.

The proposed modifications are therefore estimated to reduce total emissions from the quarry operations by more than 30% per year. The tertiary plant will be located further away from the most affected receptors and the haulage of overburden will no longer pass in close proximity to residential receptors located to the south west of the quarry operations.

4.4.1 Impact Identification

The revised air quality assessment included as Annex D, followed the same modelling methodology as was used for the Project EA in 2006. The model used was the US EPA ISCST3 model. A calibration factor of 1.6 has been applied to predictions of 24-hour PM_{10}. The rationale for this scaling factor is detailed in the EA.

In the Project EA, the maximum production year scenario produced, as expected, consistently higher predicted dust impacts than the modelling scenario for the first year of production. In order to ascertain the maximum likely dust impact on residences near the Peppertree Quarry, the maximum production year scenario has been modelled for the modified quarry layout.

The particle size distribution, as used in the AQIA, is as follows:

- $PM_{2.5}$ (FP) is 4.7% of the TSP;
- $PM_{2.5-10}$ (CM) is 34.4% of TSP; and
- PM_{10-30} (Rest) is 60.9% of TSP.

Dust concentrations and deposition rates have been predicted over an area 10 km by 12 km with the quarry site located approximately in the centre. Local terrain has been included in the modelling.

Model predictions have been made at 103 discrete receptors, including residential locations, located in the study area. The location of these receptors has been chosen to provide finer resolution closer to the dust sources and nearby receptors.

4.5 MODIFIED PEPPERTREE QUARRY

Dispersion model predictions for the maximum production year of quarry operations are summarised in Table 4.6 for the nearest residences. Predicted results are shown for both the layout as presented in the Project EA and the new proposed layout. Results have also been included for Receiver 16 which did not form part of the original assessment.

Some higher 24-hour PM_{10} concentrations are predicted to the west of the site. This differs from the 24-hour PM_{10} contours presented in the 2006 AQIA but is not unexpected given the presence of the western overburden emplacement area.

Annual average dust concentrations and deposition levels are, in general, similar to those in the AQIA and considerably below the respective air quality criteria. Some residences experience a slight increase in dust levels and others a slight decrease under the proposed modification. It should be noted, however, that predicted TSP and PM_{10} concentrations at Receptor 3, the worst affected receptor, are lower than for the AQIA.

Table 4.6 Predicted Impacts for the Peppertree Quarry Alone

ID	Easting (m)	Northing (m)		
			Approved layout	Modifiied layout
Maximum 24-hour average PM10 concentrations (µg/m3)				
1	230394	6149983	22.0	27.7
2	226824	6148362	25.6	30.4
3	226574	6148989	41.3	36.5
4	226253	6150502	16.8	20.6
5	226475	6152336	7.0	8.9
6	226127	6152946	5.3	7.1
16	226158	6149591	-	34.8
Annual average PM10 concentrations (µg/m3)				
1	230394	6149983	4.0	4.9
2	226824	6148362	4.4	6.6
3	226574	6148989	8.7	7.6
4	226253	6150502	2.2	2.1
5	226475	6152336	1.0	0.9
6	226127	6152946	0.7	0.7
16	226158	6149591	-	6.1
Annual average TSP concentrations (µg/m3)				
1	230394	6149983	4.3	5.3
2	226824	6148362	4.7	8.0
3	226574	6148989	9.1	8.0
4	226253	6150502	2.4	2.3
5	226475	6152336	1.1	1.0
6	226127	6152946	0.8	0.7
16	226158	6149591	-	6.4
Annual average dust deposition (µg/m2/month)				
1	230394	6149983	0.31	0.45
2	226824	6148362	0.10	0.28
3	226574	6148989	0.16	0.15
4	226253	6150502	0.08	0.08
5	226475	6152336	0.03	0.03
6	226127	6152946	0.02	0.02
16	226158	6149591	-	0.15

4.6 CUMULATIVE IMPACTS

4.6.1 Overview Of Approach

A conservative approach has been adopted for the assessment of cumulative impacts in the modelling, through the addition of background monitoring data as well as a modelled contribution from the adjacent Boral Cement limestone mine. This involves an element of double counting as the existing emissions from the limestone mine will already be included in the background monitoring data, but to an unknown extent. Additional modelling was carried out to include the estimated Boral Cement limestone Mine emissions, with the modified Peppertree emissions. Measured background levels were then added to these predictions to provide a conservative approach and the results are considered likely to overestimate actual levels.

For emissions estimation, to be consistent with the assumptions in the original AQIA, it was assumed that the Boral Cement operations produce 4 Mtpa of product per year and that the limestone mine dust emissions remain unchanged compared with those modelled in the AQIA. In the modelling, the limestone mine was represented by a number of volume sources with the same procedure has been adopted for this study as previously used in the AQIA..

4.6.2 Annual Average Predictions

Model results for annual average TSP and PM_{10} concentrations, as well as dust deposition levels, are presented in Table 4.7. These results show that annual average PM_{10} and TSP concentrations and annual average dust deposition would be below relevant air quality criteria at the nearest residences due to the combined effects of the Peppertree Quarry, the limestone mine and other local sources of dust. As mentioned previously, including both monitoring data and modelled emissions from the Boral Cement operations is a conservative approach.

Table 4.7 Predicted Cumulative Impacts at Residential Properties

ID	Easting (m)	Northing (m)	Approved layout	Modifiied layout
Annual average PM_{10} concentrations ($\mu g/m^3$)				
1	230394	6149983	22.1	23.1
2	226824	6148362	25.7	27.9
3	226574	6148989	27.6	26.7
4	226253	6150502	19.5	19.5
5	226475	6152336	17.7	17.7
6	226127	6152946	17.3	17.3
16	226158	6149591	-	24.1
Annual average TSP concentrations ($\mu g/m^3$)				
1	230394	6149983	31.5	32.7
2	226824	6148362	35.3	38.8
3	226574	6148989	37.1	36.3
4	226253	6150502	28.8	28.8
5	226475	6152336	26.8	26.8
6	226127	6152946	26.4	26.4
16	226158	6149591	-	33.5
Annual average dust deposition ($\mu g/m^2$/month)				
1	230394	6149983	3.4	3.5
2	226824	6148362	3.4	3.4
3	226574	6148989	3.3	3.2
4	226253	6150502	3.1	3.1
5	226475	6152336	3.1	3.0
6	226127	6152946	3.0	3.0
16	226158	6149591	-	3.2

4.6.3 24-Hour PM_{10} Predictions

It is important to note that it is not possible to accurately predict the cumulative 24-hour PM_{10} concentrations into the future using dispersion modelling, in particular due to the variability in ambient levels and spatial and temporal variation in any day to day anthropogenic activity, including any future quarrying activities.

Experience shows that the worst-case 24-hour PM_{10} concentrations are strongly influenced by other sources in the area, such as bushfires and dust storms, which are essentially unpredictable. These events often dominate the worst-case PM_{10} concentrations. However, this does not mean that no action should be taken to control project dust emissions.

There are currently no continuous measurements of PM_{10} available in the area which limits the options for predicting cumulative 24-hour PM_{10} levels at sensitive receptors. In light of this, the approach adopted in 2006 involved the development of a synthetic monitoring data set using contemporaneous meteorological data has been applied to this assessment.

The synthetic data for each 24-hour period was added to the model predictions for the modified quarrying operations (including Boral Cement) at these closest residences, in this case Residences 2, 3 and 16. The results are presented in Figure 4.2 and show that there are an isolated number of exceedances of the 50 µg/m^3 criterion at each of these residences over a year.

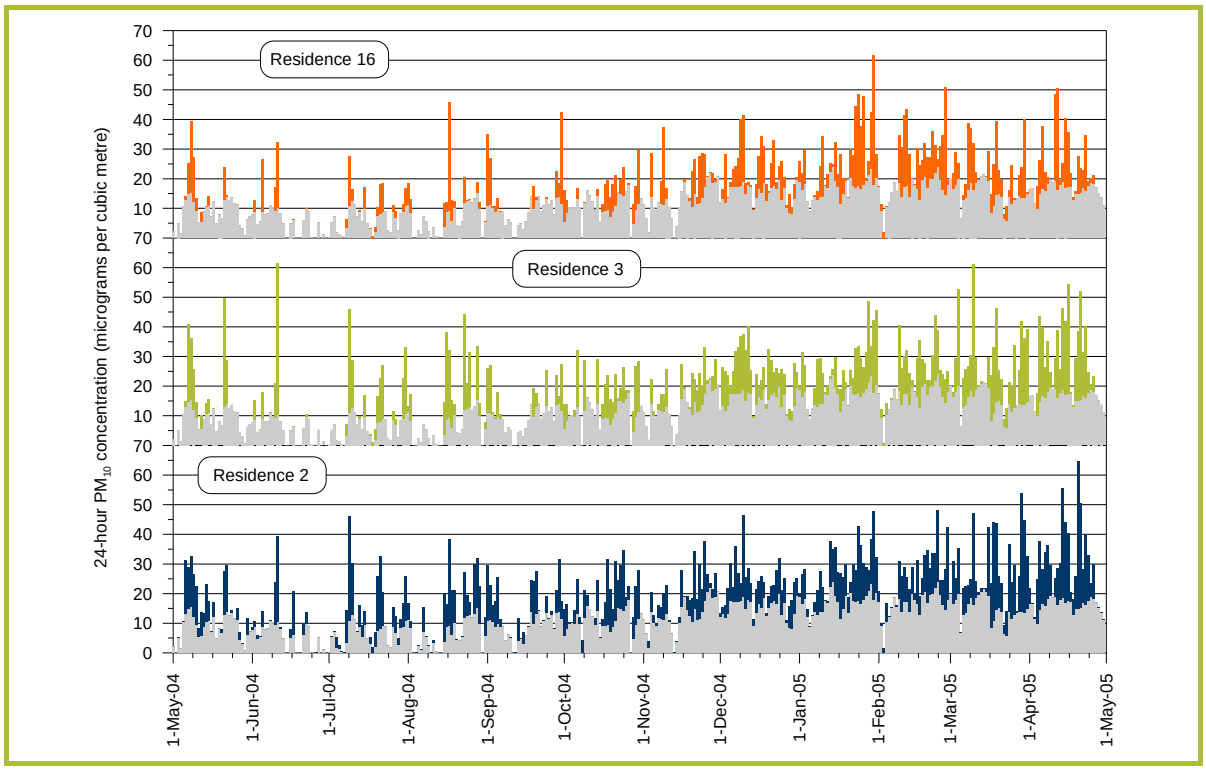


Figure 4.2 ***Time Series of Cumulative 24-hour PM_{10} Concentrations at Residences 2,3 and 16***

These results are tablulated in *Table 4.8* which presents the top ten background levels and associated modelling results, as well as the top ten modelling results and associated synthetic background level. The three exceedances at Residence 2, five at Residence 3 and one at Residence 16 are all captured in the table, and are highlight ted in red bold text.

The conservatively predicted levels in this scenario indicate any impact would be infrequent and at a low level if it occurs. It also represents a reduction in the estimated number of exceedances predicted for the most affected receiver from approximately 12 to 5 exceedances for Receiver 3.

Table 4.8 Summary of Model Results for Cumulative 24-hour average PM_{10} – Peppertree and BC

Date	Synthetic background PM_{10} ($\mu g/m^3$)	Increment from modelled sources	TOTAL cumulative impact	Date	Synthetic background PM_{10} ($\mu g/m^3$)	Increment from modelled sources	TOTAL cumulative impact
Residence 2							
24-Feb-05	24	24	48	20-Apr-05	15	50	**65**
14-Jan-05	24	11	35	29-Mar-05	14	40	**54**
29-Jan-05	23	15	38	14-Apr-05	19	37	**56**
13-Jan-05	22	15	38	21-Apr-05	15	35	50
27-Nov-04	22	2	24	09-Jul-04	11	35	46
23-Feb-05	22	12	34	18-Mar-05	11	33	44
14-Mar-05	21	0	22	30-Mar-05	14	31	45
28-Jan-05	21	7	28	10-Mar-05	16	31	47
30-Nov-04	21	0	21	30-Jan-05	18	30	48
19-Feb-05	21	12	33	17-Aug-04	9	29	39
Residence 3							
24-Feb-05	24	15	39	11-Jun-04	10	51	**61**
14-Jan-05	24	2	26	10-Mar-05	16	45	**61**
29-Jan-05	23	10	33	16-Apr-05	17	37	**54**
13-Jan-05	22	1	23	21-May-04	13	37	50
27-Nov-04	22	1	23	21-Apr-05	15	37	**52**
23-Feb-05	22	22	44	09-Jul-04	11	35	46
14-Mar-05	21	0	21	04-Mar-05	20	33	**53**
28-Jan-05	21	27	49	23-Aug-04	12	32	44
30-Nov-04	21	0	21	19-Mar-05	15	32	46
19-Feb-05	21	7	28	16-Aug-04	9	30	38
Residence 16							
24-Feb-05	24	3	27	30-Jan-05	18	44	**62**
14-Jan-05	24	1	25	17-Aug-04	9	36	46
29-Jan-05	23	19	42	27-Feb-05	14	36	50
13-Jan-05	22	3	25	12-Apr-05	16	34	50
27-Nov-04	22	0	22	24-Jan-05	18	31	49
23-Feb-05	22	9	31	30-Sep-04	12	31	43
14-Mar-05	21	0	21	26-Jan-05	18	30	48
28-Jan-05	21	5	26	11-Apr-05	19	29	48
30-Nov-04	21	0	21	23-Jan-05	17	28	45
19-Feb-05	21	11	32	30-Mar-05	14	26	40

As outlined previously, including both the Boral Cement emissions as well as monitoring data in the cumulative assessment is conservative, given that a proportion of the Boral Cement emissions will already be captured in the monitoring data. This leads to double counting of background levels and is likely to overestimate actual levels. To deal with this double counting, the same process as described above was redone to include the Peppertree operations only. Operations at the Boral Cement site were excluded from this modelling and assumed to be already accounted for in the monitoring data. The results are presented in Figure 4.3 and Table 4.9, and show no exceedances of the 50 $\mu g/m^3$ 24-hour average PM_{10} level.

In reality, the results are likely to lie somewhere between these two scenarios, indicating that the impact from the BC operations would be somewhere between nil and infrequent at a low level if impacts occur.

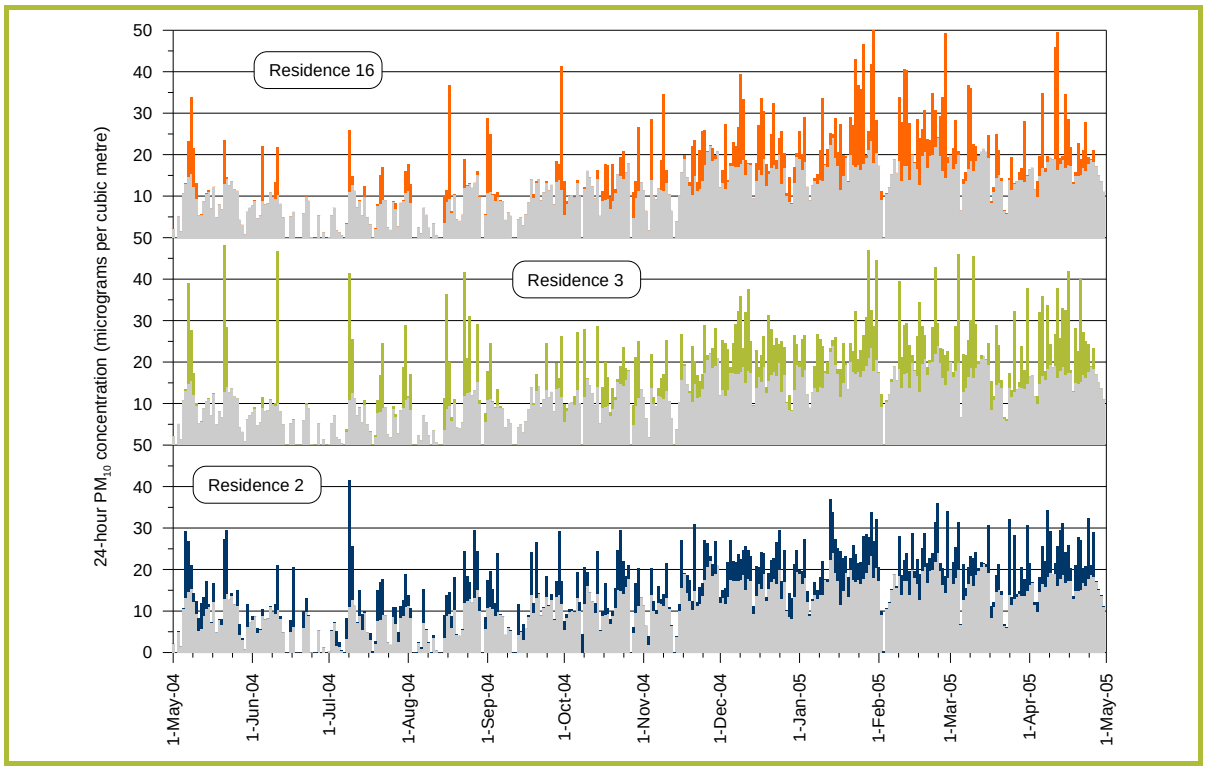


Figure 4.3 Time Series of Cumulative 24-hour PM10 Concentrations at Residences 2, 3 and 16

Table 4.9 Summary of Model Results for Cumulative 24-hour average PM10 – Peppertree Only

Date	Synthetic background PM_{10} (µg/m³)	Increment from modelled sources	TOTAL cumulative impact	Date	Synthetic background PM_{10} (µg/m³)	Increment from modelled sources	TOTAL cumulative impact
Residence 2							
24-Feb-05	24	12	36	09-Jul-04	11	30	41
14-Jan-05	24	10	34	24-Mar-05	14	18	32
29-Jan-05	23	11	34	27-Aug-04	13	16	30
13-Jan-05	22	15	37	06-May-04	13	16	29
27-Nov-04	22	1	23	08-Apr-05	18	16	34
23-Feb-05	22	10	32	28-Feb-05	18	16	34
14-Mar-05	21	0	22	21-Nov-04	15	16	31
28-Jan-05	21	7	28	31-Mar-05	15	16	31
30-Nov-04	21	0	21	22-May-04	14	15	29
19-Feb-05	21	8	29	29-Sep-04	14	15	29
Residence 3							
24-Feb-05	24	5	29	11-Jun-04	10	37	47
14-Jan-05	24	1	25	21-May-04	13	35	48
29-Jan-05	23	9	32	09-Jul-04	11	31	42
13-Jan-05	22	1	23	23-Aug-04	12	30	42
27-Nov-04	22	0	22	10-Mar-05	16	29	45
23-Feb-05	22	21	43	16-Aug-04	9	28	36
14-Mar-05	21	0	21	04-Mar-05	20	26	46
28-Jan-05	21	26	47	28-Jan-05	21	26	47
30-Nov-04	21	0	21	21-Apr-05	15	25	40
19-Feb-05	21	6	26	16-Apr-05	17	24	42
Residence 16							
24-Feb-05	24	0	24	27-Feb-05	14	35	49
14-Jan-05	24	1	25	12-Apr-05	16	33	49
29-Jan-05	23	18	42	30-Jan-05	18	32	50
13-Jan-05	22	3	25	30-Sep-04	12	30	41
27-Nov-04	22	0	22	26-Jan-05	18	29	47
23-Feb-05	22	9	31	17-Aug-04	9	27	37
14-Mar-05	21	0	21	11-Apr-05	19	27	46
28-Jan-05	21	5	26	23-Jan-05	17	26	43
30-Nov-04	21	0	21	09-Nov-04	11	23	35
19-Feb-05	21	10	31	11-Feb-05	17	23	41

4.6.4 Overview of Results

The model results show that annual average PM_{10} and TSP concentrations and annual average dust deposition would be well below relevant air quality criteria at the nearest residences due to the combined effects of the quarry, the Boral Cement limestone mine and other local sources of dust.

- Predicted maximum 24-hour average PM_{10} concentrations due to the Project only are below 50 $\mu g/m^3$ at all sensitive receptor locations.

- Predicted maximum 24-hour average PM_{10} concentrations due to the Project with background monitoring data are below 50 $\mu g/m^3$ at all sensitive receptor locations; and

- Applying DECCW's methodology for the assessment of cumulative 24-hour average PM_{10} there could be instances where the increment of the Project causes exceedances of the 50 $\mu g/m^3$ level when added to background levels. These instances are predicted for Residence 2 (approximately 3 days per year) and Residence 3 (approximately 5 days per year) and Residence 16 (approximately 1 day per year) for modelled Project and Boral Cement emissions;

The new overburden emplacement will reduce the need for haulage to the limestone mine south pit reducing overall dust emissions by 30%. The tertiary crushing plant will also be located an additional 250 m further away from the most effected residential properties at Receptor 2 and 3, creating additional source to receptor buffer distance and reducing the potential for short term exceedance of 24-hour average PM_{10} criteria. The flexibility to direct overburden haulage to either the eastern or the western emplacement areas during adverse meteorological conditions will further minimise the potential for a short term exceedance at nearby residences.

Overall the proposed modification are anticipated to have a positive outcome in terms of the potential for dust impacts to surrounding residential receptors

An air quality monitoring program has been prepared for the operation of the quarry including the operation of two high volume air samplers set up side-by-side in close proximity to the most affected receptors. One of the high volume samplers (HV1) will measure TSP and the other (HV2) will be fitted with a PM_{10} size selective inlet (SSI), to measure PM_{10}. Ongoing monitoring will be undertaken and additional limitations can be imposed upon quarry operations if the 50 $\mu g/m^3$ (24-hour) PM_{10} assessment criteria was found to be exceeded under adverse winds.

Potential air quality impacts arising from the construction of the elements included in the proposed modification include:

- dust generated from general ground disturbance to facilitate hardstand construction, including removal of groundcover;
- dust from traffic movements to and from the Site; and
- exhaust emissions from plant and machinery.

The proposed modifications are not anticipated to significantly alter the potential emissions associated with construction activities outlined in the original Project Application and will be managed through the implementation of appropriate construction site management measures as outlined below.

4.7 MITIGATION MEASURES

Dust emissions will be controlled during construction activities by:

- soil stripping when moist either naturally or through the application of water; and
- watering stockpiles of fine material;
- confining traffic to dedicated access roads and lay-down areas.
- use of water carts when required
- keeping exposed areas to a minimum;
- cleaning of areas which could become sources of wind erosion dust due to build-up of settled fine material;

During operations the following mitigation measures are proposed to mitigate air emission impacts:

Engineering Controls

- covering of conveyors;
- enclosing of crushing and screening plant with dust extraction system fitted;
- fitting of scrapers for cleaning conveyor belts;
- dust suppression sprays on the primary crusher;
- fitting drills with either water sprays or dry dust collection devices; and
- controlling stockpiles of fine material with water sprays etc.

Operational controls

Operational controls are used to vary operations when adverse meteorological conditions occur. These include:

- traffic confined to identified haul road routes;
- removal and rehabilitation of unnecessary roads;
- exposed areas kept to a minimum;
- watering of haul roads;
- cleaning of areas which could become sources of wind erosion dust due to build-up of settled fine material;
- reviewing meteorological conditions prior to blasting to minimise the exposure of residences to dust emissions; and
- daily assessment of meteorological conditions to identify wind conditions that may be conducive to excessive dust generation – for example, very high winds.

An automatic weather station operated by Boral Cement to the southwest of the site provides hourly measurements of temperature, wind speed, wind direction and sigma-theta (used to calculate stability). This weather station has been upgraded to service the needs of the Boral Cement Limestone Mine, as well as Peppertree Quarry.

During operations air quality monitoring will determine changes to air quality beyond the boundary of the site.

This will determine whether mitigation measures are effective in ensuring that annual average dust concentrations and dust deposition levels, and short-term (24-hour average) air quality impacts remain below relevant air quality criteria at the nearest residences.

5 NOISE ASSESSMENT

5.1 BACKGROUND

The proposed modification to the tertiary processing, rail loading and overburden emplacements during detailed design has resulted in a modification to the anticipated noise emissions at surrounding representative receptors. An additional residential property has been constructed in close proximity to the quarry following project approval and therefore was not previously considered in the noise assessment.

To address potential noise impacts at sensitive receptors arising from the proposed modifications to the site layout, a noise assessment was undertaken in accordance with the INP. The assessment involved a review of background noise monitoring data and meteorological data to review INP derived project specific noise levels and prevailing weather conditions. A noise model was developed using topographical data for the region, proposed rail loop and changes to the processing and loading facilities to calculate the potential noise emissions from the Project.

5.2 NOISE SENSITIVE RECEPTORS AND PROJECT APPROVAL

Noise sensitive receptors identified in the EA and identification numbers are presented in *Figure 5.1* and *Table 5.1* along with the noise conditions from the Schedule 3 of current project approval (PA 06_0074).

Table 5.1 Project Approval Operational Noise Limits

ID	Description	Approval Noise Limits, dB(A)			Acquisition Noise Criteria, dB(A)	
		Day	Night		Day	Night
		LAeq, 15min	LAeq, 15min	LA1, 1min	LAeq, 15min	LA1, 1min
1	Montgomery	35	35	45	41	40
2	Ordasi	39	35	45	44	44
3	Brown	44	35	46	44	44
4	Armitt	37	35	46	41	41
5	Cooper	35	35	45	40	40
6	Bartolo	35	35	45	40	40
Any other noise sensitive location		35	35	45	n/a	n/a
Notes: Daytime is 7:00am to 7:00pm; Night time is 7:00pm to 7:00am						

The project approval requires these noise limits to be achieved under the following conditions:

- *Noise from the site is to be measured at the most affected point within the residential boundary, or at the most affected point within 30 metres of the dwelling where the dwelling is more than 30 metres from the boundary, to determine compliance with the identified noise limits, except where otherwise specified below.*

- *Noise from the project is to be measured at 1 metre from the dwelling facade to determine compliance with the LA1 (1 minute) noise level.*

- *Where it can be demonstrated that direct measurement of noise from the project is impractical, alternative means of determining compliance may be acceptable (see Chapter 11 of the NSW Industrial Noise Policy).*

- *The modification factors presented in Section 4 of the NSW Industrial Noise Policy shall also be applied to the measured noise level where applicable.*

- *The identified noise emission limits apply under meteorological conditions of wind speed up to 3m/s at 10 metres above ground level, and temperature inversion conditions.*

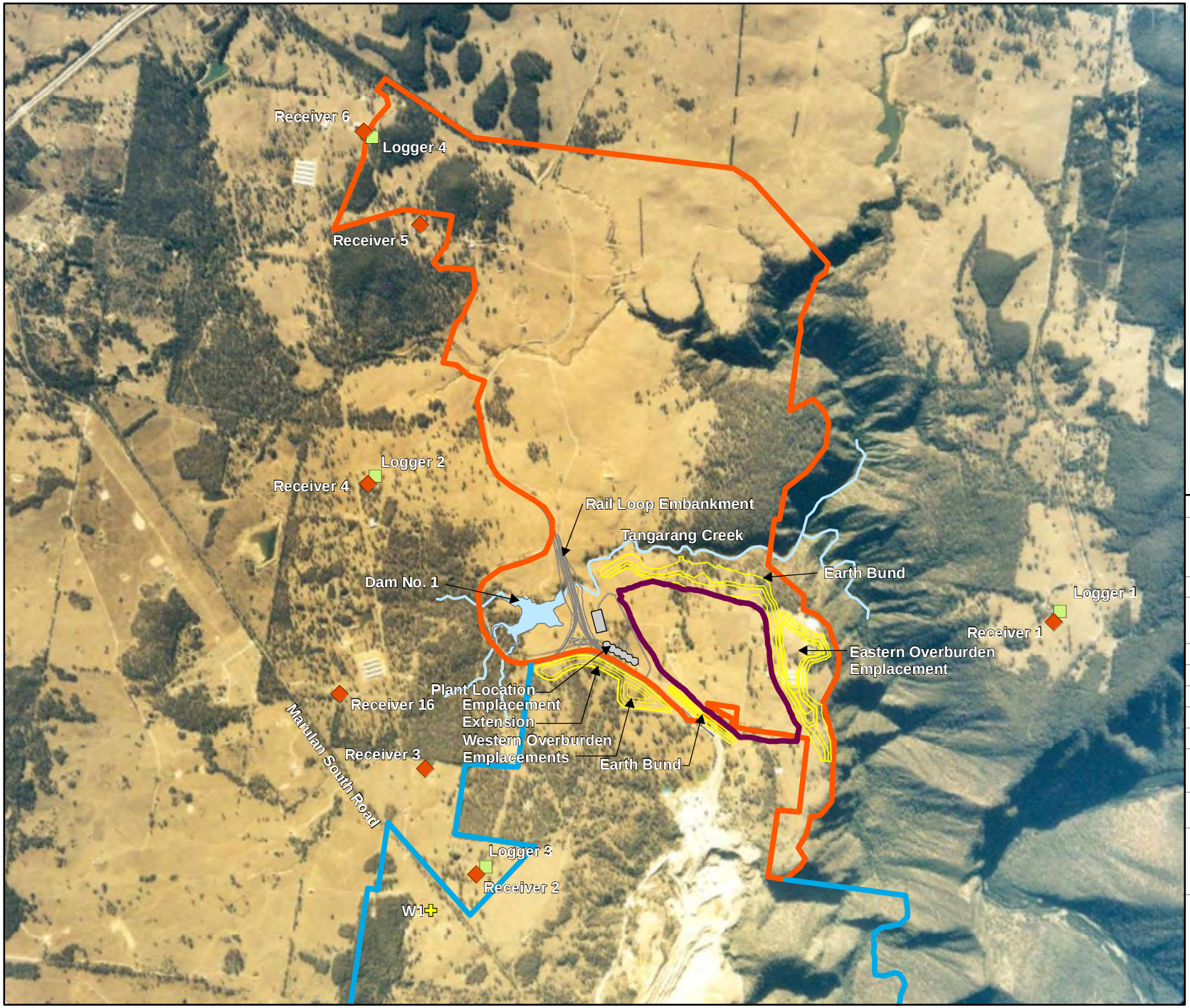
5.2.1 Additional Receptor Location

As described in *Section 2.1.5* a new residential dwelling has been constructed on Marulan South Road in close proximity to the Peppertree Quarry. The property was originally identified as Property No. 16 in the environmental assessment and Project Application and consisted of a poultry farm without an approved residence.

The new receptor, Receptor 16 (Pace) does not have a noise performance condition assigned under Conditions 4 and 5 of Schedule 3 of the Project Approval would be interpreted as *"any other noise sensitive location"*. Hence, this additional Receptor 16 (Pace) would have a noise performance condition of 35 dB(A) $L_{Aeq, 15min}$.

Noise modelling of the revised plant layout indicates that achieving the noise assessment criteria is not considered reasonable or feasible given the close proximity of the new residence in relation to the proposed quarry operations.

It is proposed that Receptor 16 (Pace) be incorporated into the Project approval with a practicable and achievable Project Specific Noise Limit derived in accordance with the DECCW's Industrial Noise Policy (INP) (2000) methodology which is reflective of the ambient noise environment. The derivation and justification of the proposed RBL and PSNL for this additional receptor is outlined in Section 5.5.



Legend

- Receiver Locations
- Noise Logger Locations
- Weather Station
- Quarry Location
- Boral Cement Property Boundary
- Boral Peppertree Property Boundary
- Proposed Dam Location
- Proposed Plant Location
- Tangarang Creek

Figure 5.1

Location of Noise Receivers

Client:	Boral	
Project:	Peppertree Quarry	
Drawing No:	0118026s_Sect75W_G009_R2.mxd	
Date:	5/05/2011	Drawing Size: A4
Drawn By:	SW	Reviewed By: RS
Projection:	GDA 1994	
Scale:	Refer to scale bar	

N

0 250 500 750m

Environmental Resources Management Australia Pty Ltd

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ERM

5.3 EXISTING ENVIRONMENT

5.3.1 Background Noise

Noise monitoring has been undertaken on a number of occasions during the Project development. An initial round of noise monitoring was undertaken for the EA in 2006 and additional monitoring was undertaken in 2008 and a comparison of the derived Rating Background Level (RBL) from each round of monitoring is presented in *Table 5.2* incorporating the additional requirements from the INP application notes.

Table 5.2 Comparison of Rating Background Levels 2006 - 2008

ID	Description	Period	RBL dB(A) LA90,15min		
			EA 2006	ERM 2008	Overall
1	Montgomery	Day	31	31	31
		Night	30	32	31
2	Ordasi	Day	34	30	32
		Night	37	34	36
3	Brown	Day	-	34	34
		Night	-	34	34
4	Armitt	Day	31	31	31
		Night	32	30	31
6	Bartolo	Day	30	-	30
		Night	30	-	30

5.3.2 Meteorological Data

Wind

Wind has the potential to increase noise impacts at a receptor when it is light and stable and blows from the direction of the noise source. As the strength of the wind increases the noise produced by the wind usually obscures noise from most industrial and transport sources.

Section 5 of the INP requires that noise impacts be assessed under weather conditions that would be expected to occur at a particular site for a significant period of time. When wind blows from the source to the receptor at speeds up to 3 m/s for more than 30 per cent of the time during any season, then wind is considered to be a feature of the area and noise level predictions must be made under these conditions.

Data from the Boral Cement (BC) meteorological station, approximately 2 km from the Peppertree quarry site for the period from January 2008 to May 2010 was analysed to determine the occurrence of prevailing winds from a larger data set. A detailed analysis of each data set for 2008, 2009 and 2010 to date are contained in *Annex A.* with a summary of the results presented *in Table 5.3.*

Table 5.3 INP Prevailing Wind Assessment – BC January 2008 – May 2010

Season	Wind Direction	Frequency of Occurrence (%)		
		0.5 m/s to 2 m/s	2 m/s to 3 m/s	0.5 m/s to 3 m/s
Daytime				
Summer	ENE±45	13.5%	20.2%	33.7%
Autumn	E±45	16.3%	12.8%	29.1%
Winter	WSW±45	6.7%	9.5%	16.2%
Spring	ENE±45	9.5%	11.9%	21.4%
Evening				
Summer	ENE±45	28.6%	22.8%	51.4%
Autumn	E±45	18.4%	7.1%	25.5%
Winter	W±45	13.9%	9.4%	23.3%
Spring	ENE±45	18.7%	6.7%	25.3%
Night Time				
Summer	E±45	20.3%	5.4%	25.7%
Autumn	WNW±45	10.3%	4.4%	14.7%
Winter	WSW±45	14.2%	9.0%	23.2%
Spring	NNW±45	12.8%	6.2%	19.0%

The wind analysis presented in *Table 5.3* indicates that prevailing north-east and easterly winds and therefore impacts from north-east and easterly winds have been considered in this assessment.

Temperature Inversions

Temperature inversions, when they occur, have the ability to increase noise levels by focusing sound waves. Temperature inversions occur predominantly at night during the winter months. For a temperature inversion to be a significant characteristic of the area it needs to occur for approximately 30 per cent of the total night-time (i.e. the evening and night time periods) during winter, or about two nights per week. Temperature inversions are generally determined based on the occurrence of atmospheric stability classes, with moderate and strong inversions corresponding to Pasquil- Gifford atmospheric stability categories F and G respectively.

Meteorological data was assessed in accordance with INP methodology to determine the occurrence of temperature inversions and are presented in *Table 5.4.*

Table 5.4 Occurrence of Pasquill-Gifford Stability Class (INP Assessment)

PASQUILL-GIFFORD STABILITY CLASS	FREQUENCY OF STABILITY CLASS
A	0.0%
B	0.0%
C	0.0%
D	33.6%
E	14.9%
F & G	**51.5%**

This assessment found that the occurrence of F and G atmospheric stability categories is greater than 30 per cent of the winter evening and night time periods. Therefore, the effects of temperature inversions have been considered in this assessment.

5.4 ASSESSMENT METHODOLOGY

Responsibility for the control of noise emissions in NSW is vested in Local Government and the DECCW. The Industrial Noise Policy (INP) provides a framework and methodology for deriving limit conditions for consent and licence conditions. Using this policy the DECCW regulates premises that are scheduled under the *Protection of the Environment Operations Act, 1997* (POEO Act).

The application of the INP involves the following processes:

- determining the project-specific noise levels (PSNL) from intrusiveness and amenity based criteria derived from measurement of the existing background and ambient noise levels;
- predicting or measuring the noise levels produced by the development; and
- comparing the predicted noise levels with the project-specific noise levels and assessing impacts.

Where the project-specific noise levels are predicted to be exceeded the INP provides guidelines on the assessment of feasible and reasonable noise mitigation strategies, including:

- 'weighing up' the benefit of the development against the social and environmental costs resulting from the noise impacts;
- establishment of achievable and agreed noise limits for the development in consultation with the consent authority; and
- undertaking performance monitoring of environmental noise levels to determine compliance with the consent and licence conditions.

A detailed summary of the INP assessment methodology and the 2006 application notes is provided in *Annex B*.

5.5 IMPACT ASSESSMENT CRITERIA - ADDITIONAL RECEPTOR 16

5.5.1 Additional Receptor 16

There are two criteria to consider when establishing PSNL for the assessment of industrial noise sources. These criteria are:

- the intrusive noise criterion, which is based on the RBL plus 5 dB. ; and
- the amenity noise criterion, which is based on the recommended noise levels in the INP for prescribed land use.

The PSNL are the lesser value of the amenity and intrusiveness criteria. The intrusiveness goals were found to be the limiting goals in all instances and were nominated as the PSNL for the original EA and project application.

The additional Receptor 16 (Pace) is located in close proximity to Receptor 3 (Brown) and is a similar distance from Marulan South Road, which is considered the primary non-industrial contributor to the existing background noise at these locations. Therefore the RBL determined for Receptor 3 (Brown) would be considered to be representative of Receptor 16 (Pace) and the resulting PSNLs are therefore presented in *Table 5.5*.

Table 5.5 Receptor 16 PSNL

ID & Description	RBL dB(A) LA90,15min		Intrusive Criteria, dB(A) LAeq, 15min		Amenity Criteria dB(A), LAeq, Period			PSNL dB(A) LAeq, 15min	
	Day	Night	Day	Night	Day	Eve	Night	Day	Night
3 Brown	34	34	39	39	50	45	40	39	39
16 Pace	**34**	**34**	**39**	**39**	**50**	**45**	**40**	**39**	**39**

5.5.2 *Comparison of INP Derived PSNL and Project Approval Noise Conditions*

Noise modelling undertaken for the original EA demonstrated that under worst case INP derived weather conditions, noise at most receptors was below the PSNL with the exception of Receptor 3 (Brown) and to a lesser extent Receptor 4 (Armitt). Predicted daytime noise levels for Receptor 3 (Brown) resulted in an exceedance of up to 5 dB(A) following the application of all reasonable and feasible mitigation measures.

This is exhibited in *Table 5.6* which compares the consented noise limits in PA 06_0074 and the intrusive criteria derived from the monitored RBLs.

Table 5.6 EA 2006 RBL and Consent Criteria

Receptor	Period	RBL dB(A) LA90,15min (EA 2006)	EA 2006 INP Intrusive Criteria, dB(A) LAeq, 15min	PA 06_0074 Noise Limits dB(A) LAeq, 15min
1- Montgomery	Day	31	36	35
	Night	30	35	35
16 - Pace	Day	34[1]	-	35
	Night	34[1]	-	35
2- Ordasi	Day	34	39	39
	Night	37	39[3] (42)	35
3- Brown	Day	34[2]	39	44
	Night	34[2]	39	35
4- Armitt	Day	31	36	37
	Night	32	37	35
5 – Cooper	Day	30	35	35
	Night	30	35	35
6 -Bartolo	Day	30	35	35
	Night	30	35	35

Note 1: RBL from Brown applied to Pace;

Note 2: 2008 monitoring;

Note 3: RBL + 5 in brackets, Intrusive criteria adjusted so it is no greater than daytime criteria.

Conditions 4 and 5 of PA 06_0074 specify the noise impact assessment criteria for the operation of the quarry. These noise limits were reached through application of the INP intrusiveness criteria and levels which could realistically be achieved based upon the proposed quarry operations. The noise assessment criteria was therefore adjusted to 5 dB(A) above the intrusive criteria for Receptor 3 (Brown) and 1 dB(A) for Receptor 4 (Armitt), to reflect achievable noise levels and based upon the commitment of ongoing consultation and negotiation with the affected receptors.

Similarly, the noise impact assessment criteria for other receptors have adopted limits lower than the INP derived PSNL where the noise modelling indicated that these levels could be achieved. The criteria for night shift activities has been set at 35 dB(A) $L_{Aeq, 15min}$ for all receptors based upon the predications of the model and is up to 4dB(A) less than the respective INP derived PSNL for a number of receptors.

5.6 NOISE IMPACT ASSESSMENT

5.6.1 Introduction

Noise modelling of site operations has been undertaken to quantify the potential for site noise contributions at the nearest receptors.

Noise modelling of site operations has been undertaken using Version 7.02 of Bruel & Kjaer's Predictor 7810 computer noise modelling software package utilising the ISO9613.1 and 9613.2 Industry (International method for general purpose, 1/3-Octaves) noise propagation algorithms and included CONCAWE meteorological factors.

5.6.2 Operational Scenarios

Detailed overburden, extraction and processing alternatives were investigated; resulting in a final operational scenario for which detailed modelling was conducted for daytime and night time operations.

The noise model was used to predict noise levels for the operational conditions shown in *Table 5.7.*

Table 5.7 Operational Scenarios

Operation	Daytime 7:00am to 7:00pm	Night-time 7:00pm to 7:00am
In pit extractive operations	✓	×
Overburden operations (east and west)	✓	×
In pit primary processing	✓	×
Secondary and tertiary processing	✓	✓
Rail loading and product transportation	✓	✓

5.6.3 Overburden Operations

Typical overburden operations involve the even distribution of the overburden fleet hauling to and dumping at both the eastern and western dumps. Where overburden operations are re-directed (mainly due to prevailing winds), the whole overburden fleet is modelled hauling to and dumping at either the eastern or western dump.

5.6.4 Meteorological Conditions

The meteorological conditions adopted for the modelling in accordance with the meteorological analysis is presented in *Table 5.8.*

The noise model was used to predict noise levels for the operational scenarios detailed in *Table 5.7* and the atmospheric conditions presented in *Table 5.8* resulting from the analysis of prevailing winds presented in *Section 5.3.2.*

Table 5.8 Meteorological Conditions for Noise Modelling

Scenario	Temperature (°C)	Relative Humidity (%)	Wind Speed (m/s)	Wind Direction (deg from North)	Atmospheric Stability Class (Pasquill-Gifford)
Calm Conditions					
Daytime	20	65	-	-	-
Night	10	90	-	-	-
INP Prevailing Conditions					
Daytime - NE	20	65	3	45 (NE)	-
Daytime - E	20	65	3	90 (E)	-
Night - NE	10	90	3	45 (NE)	-
Night –E	10	90	3	90 (E)	-
Night - Inv	10	90	-	-	F Class

5.6.5 Applied Mitigation

Processing Plant

The minimum noise mitigation measures incorporated into the plant design and input into the noise model are;:

- partial enclosure of the in-pit primary;
- enclosure of the secondary, tertiary processing plant;
- enclosure of the rail loading to rail wagons;
- enclosure of overhead bins for rail loading; and
- partial enclosure for haul trucks tipping raw material to jaw crusher.

Due to the proximity of the plant to receptors, the acoustic performance of the processing plant and train loading enclosures is required to be better than that of standard metal cladding. The enclosures will be required to be achieving a transmission loss of approximately 20 dB.

Mobile Equipment

Similarly, the standard or minimum noise mitigation applied to all mobile equipment are:

- haul truck noise suppression (-5 dB) to a resultant Lw of 116 dB(A);
- dozer track mitigation (-7dB) resulting in a reverse Lw of 112 dB(A); and
- overburden haul truck noise suppression (-2dB) to a resultant Lw of 111 dB(A).

Bunding and Barriers

A 10 metre high earth bund will be constructed around the perimeter of the quarry pit and supplemented by the additional shielding provided by the emplacement areas, the emplacement extension along the rail line and the new rail embankment as shown on *Figure 5.1*.

5.6.6 Equipment Sound Power Levels

A review of sound power levels (Lw) used in the EA was conducted in conjunction with the proposed quarry design modification and application of all reasonable and feasible mitigation. Sound power levels for fixed processing plant and typical mobile equipment used for overburden stripping and extractive operations following application of mitigation are shown in *Table* 5.9.

Table 5.9 Design Sound Power Levels

Description	Design SWL dB(A), re 10^{-12} Watts[1]
Primary screening plant (enclosed)	106
Secondary crushing and screening plant (enclosed)	106
Tertiary crushing and screening plant (enclosed)	106
Conveyors (Pit to 40KT Stockpile)	80 dB(A) per metre
Conveyors (Secondary & Tertiary)	75 dB(A) per metre
Mobile Crusher (Metso LT 160)	123
Komatsu 850 Excavator	106
Rail bins storage and loading (enclosed)	94
Komatsu WA800 FEL	114
CAT 988 FEL	111
Cat 777 Haul Truck (in pit)	116
Train - 81 class (2 locos)	117
Drill	120
Overburden Haul Truck (CAT 773 or similar)	111
D10/11 Dozer Push/ Reverse	109/ 112

Notes: 1 Design Lw used in noise modelling calculations are inclusive of applied noise mitigation as detailed in Section5.6.5.

5.6.7 Predicted Noise Levels

Calculated noise levels for the identified operational scenario, incorporating the proposed modifications to the site layout; equipment sound power levels and noise mitigation measures have been calculated. These levels have been compared to the noise limits in Project Approval and INP derived PSNL for Receptor 16 (Pace) and are presented in *Table 5.10, Table 5.11* and *Table 5.12*. Noise Contours for each scenario are presented in *Annex C*.

Table 5.10 Predicted Noise Levels - East and West Overburden Operations

ID	Description	Predicted Noise Level, dB(A) LAeq, 15min							PSNLdB(A) LAeq, 15min	
		Calm		Prevailing Conditions						
		Day	Night	Day		Night			Day	Night
				NE	E	NE	E	Inv		
1	Montgomery	35	< 30	31	31	< 30	< 30	< 30	35	35
16	Pace	37	31	**40**	**40**	35	35	35	39	39
2	Ordasi	37	< 30	**40**	**40**	33	34	34	39	35
3	Brown	38	32	41	41	35	**36**	**36**	44	35
4	Armitt	37	30	**39**	**39**	34	34	34	37	35
5	Cooper	35	< 30	32	**38**	< 30	32	32	35	35
6	Bartolo	< 30	< 30	< 30	31	< 30	< 30	< 30	35	35

Table 5.11 Predicted Noise Levels - East Overburden Operations

ID	Description	Predicted Noise Level, dB(A) LAeq, 15min							PSNL dB(A) LAeq, 15min	
		Calm		Prevailing Conditions						
		Day	Night	Day		Night			Day	Night
				NE	E	NE	E	Inv		
1	Montgomery	**36**	< 30	33	33	< 30	< 30	< 30	35	35
16	Pace	36	33	39	39	35	35	35	39	39
2	Ordasi	36	31	38	38	33	34	34	39	35
3	Brown	37	33	40	40	**36**	**36**	**36**	44	35
4	Armitt	35	32	**38**	**38**	34	34	34	37	35
5	Cooper	35	30	32	**37**	< 30	32	32	35	35
6	Bartolo	< 30	< 30	< 30	30	< 30	< 30	< 30	35	35

Table 5.12 Predicted Noise Levels - West Overburden Operations

ID	Description	Predicted Noise Level, dB(A) LAeq, 15min							PSNLdB(A) LAeq, 15min	
		Calm		Prevailing Conditions						
		Day	Night	Day		Night			Day	Night
				NE	E	NE	E	Inv		
1	Montgomery	33	< 30	< 30	< 30	< 30	< 30	< 30	35	35
16	Pace	38	33	**40**	**41**	34	35	35	39	39
2	Ordasi	38	31	**41**	**41**	32	33	33	39	35
3	Brown	39	33	42	42	35	35	35	44	35
4	Armitt	37	32	**39**	**40**	33	34	34	37	35
5	Cooper	**36**	30	33	**38**	< 30	31	31	35	35
6	Bartolo	< 30	< 30	< 30	32	< 30	< 30	< 30	35	35

5.6.8 Noise Impacts

Daytime

Considerable exceedences of the noise impact assessment criteria are anticipated for the newly identified Receptor 16 (Pace) when assessed as "*any other noise sensitive location*" under Condition 4 of Schedule 3 of the Project Approval.

Application of the derived INP PSNL of 39 dB(A) $L_{Aeq,\ 15min}$ for Receptor 16 (Pace) from the review of background noise monitoring will result in exceedence of the up to 2 dB(A) of the daytime PSNL. This exceedence of the PSNL is primarily attributable to overburden operations on the western dump and would only be experienced when north-east wind speeds are approaching 3 m/s.

In calm conditions there are also minor exceedences of up to 1 dB(A) at the Receptor 1 (Montgomery), Pace and Receptor 6 (Cooper) receptors during specific overburden operations. Management of overburden operations such alternating between overburden dumps and/ or working in shielded locations can be utilised to reduce or eliminate these noise impact.

During prevailing winds, exceedences up to 3 dB(A) may be experienced at receptors to the both the west and east of the quarry depending on the prevailing conditions and overburden operations.

Night time

Noise levels comply with the noise impact assessment criteria at most locations for night time operations except for a minor exceedence of less than 1 dB(A) at Receptor 3 (Brown) during prevailing night time winds or temperature inversion.

These predicted noise levels are representative of worst case operational scenario inclusive of processing operation, rail loading and transport combined with noise enhancing winds and / or temperature inversion.

It is considered likely that the predicted noise levels present a maximum noise level during any assessment period as neither winds or temperature inversions provide a constant influence and actual noise levels are likely to fluctuate accordingly.

5.6.9 S75w Impact Assessment Criteria

As previously discussed in *Section 5.5.2*, the noise impact assessment criteria Conditions 4 and 5 of PA 06_0074 for the operation of the quarry were reached through application of the INP methodology and levels which could realistically be achieved based upon the proposed quarry operations.

Chapter 8 the INP states:

"Where, in the final analysis, the level of impact would still exceed the project-specific noise levels, the economic and social benefits flowing from the proposed development to the community should be evaluated against the undesirable noise impacts.

Where it can be demonstrated by the proponent that the development offers net benefits, a regulatory/ consent authority may consider these as grounds for applying the achievable noise levels, rather than the project-specific noise levels, as the statutory compliance limit.

8.2.1 Residual level of impact: checklist

It is important that, as far as possible, the noise assessment quantifies any remaining or residual impacts that exceed the project-specific noise levels, after applying feasible and reasonable mitigation strategies.

The acceptability of the residual noise impacts should be evaluated by taking into consideration factors such as:

1) *Characteristics of the area and receivers likely to be affected;*
2) *Characteristics of the proposal and its noise or vibrations, such as:*
    a. *the noise characteristics of the activity;*
    b. *the extent to which any remaining noise impact exceeds the project-specific noise levels;*
    c. *the circumstances and times when the project-specific noise levels are likely to be exceeded;*
    d. *the circumstances and times when the source noise levels are likely to be below the project-specific noise levels (for example,when wind blows source noise away from the receiver)*
3) *The feasibility of additional mitigation or management measures"* [1]

In consideration of *Chapter 8 – Negotiation Process,* the proposed modification and subsequent revised noise emissions it is recommended that the noise impact assessment criteria be adopted for the potentially noise sensitive receptors presented in *Table 5.13* be adopted for Peppertree Quarry.

[1] Section 8 NSW INP (2000)

Table 5.13 S75W Impact Assessment Criteria

Receptor	Period	Achievable Noise Level dB(A), LAeq, 15min	INP Derived PSNL dB(A) LAeq, 15min	PA 06_0074 Noise Limits dB(A) LAeq, 15min	Proposed S75W Noise Limits dB(A) LAeq, 15min
1- Montgomery	Day	36	36	35	**36**
	Night	35	35	35	35
16 - Pace	Day	41	-	35	**41**
	Night	35	-	35	35
2- Ordasi	Day	41	39	39	**41**
	Night	35	39	35	35
3- Brown	Day	42	39	44	**42**
	Night	36	39	35	**36**
4- Armitt	Day	40	36	37	**40**
	Night	36	37	35	**36**
5 - Cooper.	Day	38	35	35	**38**
	Night	35	35	35	35
6 -Bartolo	Day	35	35	35	35
	Night	35	35	35	35

1. Noise from the site is to be measured at the most affected point within the residential boundary, or at the most affected point within 30 metres of the dwelling where the dwelling is more than 30 metres from the boundary, to determine compliance with the identified noise limits, except where otherwise specified below.
2. Where it can be demonstrated that direct measurement of noise from the project is impractical, alternative means of determining compliance may be acceptable (see Chapter 11 of the NSW Industrial Noise Policy).
3. The modification factors presented in Section 4 of the NSW Industrial Noise Policy shall also be applied to the measured noise level where applicable.
4. The identified noise emission limits apply under the relevant meteorological conditions outlined in the assessment procedures in Chapter 5 of the NSW Industrial Noise Policy.
5. These limits do not apply if the Proponent has an agreement with the relevant owner/s of these residences to generate higher noise levels, and the Proponent has advised the Department in writing of the terms of this agreement

In summary, the proposed S75W noise limits are generally higher than the PA 06_0074 Noise Limits for the daytime period, however, night time limits are generally lower than INP derived PSNL to 35 dB(A) $L_{Aeq, 15min}$ with the exception of Receptor 3 (Brown) which is 36 dB(A) $L_{Aeq, 15min}$.

Compliance with the proposed S75W noise limits would be considered minor or negligible impacts because:

- noise levels are within 3 dB of the preferred INP derived PSNL;
- the impact would occur during the least sensitive daytime;
- night time noise emissions are in compliance with, or are lower than the more sensitive night time PSNL; and
- the noise source can be effectively managed to minimise the occurrence and magnitude of the impact.

Chapter 9 Consent/Licence Conditions of the INP states:

A consent agreement or licence condition arrived at through the process described in this policy will have taken the following issues into account:

- *the assessed noise impact, which includes the impact of the noise source and any additional impact caused by meteorological conditions*
- *mitigation measures required to achieve the project-specific noise levels*
- *identification of a practical limit on noise control*
- *consideration of trade-offs*
- *whether the final noise level proposed is acceptable.*

It is important to note that the agreed limits in the consent or licence apply under the meteorological conditions determined by the policy to be relevant to the assessment site.

Based on the aforementioned, it is recommended that the noise impact assessment criteria for the Project Approval be based on the proposed S75W noise limits and meteorological conditions presented in *Table 5.13.*

5.7 MANAGING NOISE IMPACTS

Noise modelling has shown that there is potential for noise emissions from the quarry operations to exceed the PSNL, with the exceedences occurring during the daytime period when the prevailing winds occur. The significant noise sources during this time are the overburden fleet.

Predicted noise levels do not exceed the PSNL by more than 5 dB, and hence the operation would be considered to be in the noise management zone. Noise impacts in this zone could range from negligible to moderate and it is recommended that management procedures be implemented including:

- prompt response to any issues of concern raised by community;
- noise monitoring on-site and within the community;
- refinement of on-site noise mitigation measures and plant operating procedures where practical;
- consideration of acoustical mitigation at receivers; and
- consideration of negotiated agreements with property holders.

5.7.1 Overburden Fleet Operations

The new western emplacement area will provide operation flexibility to allow the overburden stripping fleet to be directed to either side of the quarry during adverse winds minimising potential impacts upon nearby receptors.

Light westerly winds occur for less than 30% of the time and are not assessable in accordance with the INP. However, light westerly winds to have a potential to adversely affect Receptor 1 (Montgomery) when the overburden fleet is operating on the eastern emplacement area. Directing the overburden fleet to the western dump will provide additional source to receptor buffer distance to minimise the potential for adverse emissions. Similarly, the overburden fleet will be directed to the eastern dump during north easterly and easterly winds, when noise monitoring indicates potential impacts upon receptors located to the west of the pit.

Management of overburden operations such as reducing the fleet, using an alternative overburden dump or working in shielded locations will also be utilised to reduce or eliminate the noise impact where possible.

5.7.2 Operational Noise Management Plan

A Noise Monitoring Program (NMP) has been developed to address potential noise impacts associated with the proposed operations.

The NMP outlines:

- noise mitigation measures and operating procedures required to ensure compliance with noise goals;
- procedures to respond to any complaints or issues raised by the owner of the affected residences; and
- details of the on and off-site operational noise monitoring program.

5.8 CONCLUSION

The proposed modification to the quarry during detailed design has resulted in a modification to the anticipated noise emissions at surrounding representative receptors.

Since the project approval, an additional residential receptor in close proximity to the quarry has been considered and representative noise impact assessment criteria has been determined in accordance with the procedures set out in the INP.

A review of noise monitoring and meteorological data has been conducted to determine the PSNL and metrological conditions that operational noise emissions are expected to achieve at receptors.

Predicted operational noise levels from the revised quarry design generally meet the Project Approval noise limits with some minor exceedences of up to 1 dB during the daytime for calm conditions and up to 3 dB for prevailing (adverse) conditions. This is primarily due to the proximity of the overburden fleet and the prevailing winds and do not exceed the PSNL by more than 5 dB, and hence the impacts at receptors are considered minor and are manageable. Management of overburden operations such alternating between overburden dumps and/ or working in shielded locations will be utilised to reduce or eliminate these noise impacts where feasible.

The predicted instances of exceedance are less than 3 dB above the PSNL and it is recommended that the noise impact assessment criteria be amended to represent limits that can realistically be achieved for the property.

This position is justified as it is interpreted that the intent of the INP is *"to protect at least 90 per cent of the population living in the vicinity of industrial noise sources from the adverse effects of noise for at least 90 per cent of the time. Provided the criteria in this document are achieved, then it is unlikely that most people would consider the resultant noise levels excessive. In those cases when the project-specific noise levels are not, or cannot be, achieved, then it does not automatically follow that those people affected by the noise would find the noise unacceptable."*[2]

Although instances have been predicted of noise emissions exceeding the current Project Approval noise impact assessment criteria (PA_06_0074), this noise impact assessment of the proposed modification to the quarry design has demonstrated that any potential impacts are of minor to negligible significance, which is underpinned by:

- a comprehensive understanding of the potential for noise emissions from the plant through detailed predictive noise modelling;
- applying best available technology for noise source mitigation;
- best practicable design of quarry features such as emplacement areas, barriers and processing plant layout; and
- noise management procedures.

[2] Section 1.4 NSW INP (2000)

6 SURFACE WATER IMPACT ASSESSMENT

6.1 EXISTING

The overall resource area for the Peppertree Quarry site intersects three small catchments, two of which drain northwards to Tangarang Creek. Tangarang Creek is ephemeral and has a catchment area of approximately 753 hectares above the north-western corner of the site and flows along the northern edge of the proposed quarry footprint to join with Barbers Creek, approximately 500 m from the quarry site. Barbers Creek has a total catchment area of approximately 9000 ha, with the Tangarang Creek catchment comprising less than 10% of the overall catchment area.

Boral has also acquired a number of properties to the north of the quarry, with an overall property area of approximately 650 ha. Marulan Creek traverses the northern portion of Boral's land, flowing east and also entering Barbers Creek upstream from Tangarang Creek. Barbers Creek subsequently flows southward to meet the Shoalhaven River.

During the EA preparation a sustainable water management system was developed based upon capturing stormwater run-off for use in the quarry processes, dust suppression and environmental controls. The system was based around obtaining the site's water supply from a freshwater dam located on Tangarang Creek. The initial Project EA proposed the construction of a water storage dam in this location of capacity 245ML, to meet an estimated yearly raw water demand of 255ML/year.

However, Shoalhaven River and its tributaries were subject to an Order under Section 22B of the *Water Act 1912*, effectively placing an embargo on new applications for entitlement to water within the Shoalhaven catchment. The then Department of Water and Energy (DWE) advised that Boral should reconsider the quarry design and investigate all potential alternative options that were not affected by the embargo prior to any further discussions. Subsequently, Boral undertook further investigations to reduce water consumption and pursue alternative water supplies, as detailed below.

6.1.1 Site Water Demand

Boral re-assessed site water demand and was able to reduce the initial estimate of maximum yearly usage of 255 ML/yr to 145ML per year (ERM 2009). This equates to a 43% reduction in site water demand requirements from the original water demand of 255 ML/yr proposed in the Project application.

Boral has subsequently resolved licensing issues through the purchase and transfer of existing licensed surface water allocations, and has returned to the original concept associated with the construction of a main storage dam on Tangarang Creek.

6.1.2 Modified Dam Capacity

ERM has undertaken additional surface water modelling to assess dam capacity requirements with a revised water demand of the 145 ML/yr and using one dam on Tangarang Creek as the primary water supply source. The revised dam capacity proposed under this modification is 112 ML. This allows for the site to meet its required water use and results in water shortage days (50% usage days), for 0.11 % of the time during site operation. It also has potential to create nil usage days approximately 0.03% of the time.

Constructing a dam with a capacity of up to 112ML capacity provides for future flexibility within the quarry operations, for the timing and control of environmental releases and to provide additional storage capacity during drought periods. There may also be potential in the future to supplement the Boral Cement Limestone mine water supply to reduce reliance on extractions from Tallong Weir, upstream in the Barbers Creek catchment.

6.2 POTENTIAL IMPACTS

6.2.1 Erosion

The construction of the new rail loop will create an additional area of ground disturbance, however this is not considered significant when considered in relation to the remainder of the earth works required to develop the quarry site.

Erosion and sediment control measures will be implemented prior to the disturbance of any land. The general approach to managing site water will be to capture and treat the water in sediment dams that have been designed in accordance with the requirements of the Project Approval. Erosion and sediment controls will be installed in accordance with the Blue Book and exposed areas will be progressively rehabilitated throughout construction and where possible during operation of the quarry.

6.2.2 Water Supply

The water supply system has been specifically designed to be self sufficient and not place additional demand on existing water supplies to the locality.

Water balance modelling has indicated that construction of Dam 1 with a depth of 6.5m would have sufficient capacity to service the water demand for the proposed quarry operations with minimal potential for water shortages during dry weather, as discussed in Section *6.1.2*.

6.2.3 Alteration To Catchments And Yields

The dam catchment is approximately 753 ha, which flows to Barbers Creek which has a catchment of approximately 9000 ha. Modelling undertaken indicates that 81% of the flows in Tangarang Creek will be returned to the catchment, and it is likely that the overall reduction in the Barbers Creek flow will be around 1.6%.

Taking into account losses and use from the dam, the average yearly water losses from the catchment will approximate 189.8 ML/yr. This equates to less than 0.08 % of the total flow yearly flow within the Shoalhaven River. The transfer of existing water entitlements results in no net loss of potential yield in the catchment.

6.2.4 Environmental Flows

Condition 24 of PA 06_0074 stipulates that 10% of the daily flows into the dam are returned to Tangarang Creek. The modelling undertaken by ERM incorporated a daily return of 10% of dam flows to the catchment while allowing the required site water use to be obtained. Therefore, the water supply assessment indicates that the required environmental flows will be met.

Further to this, the dam will spill excess water directly back into the catchment. The combined releases of environmental flows and spills results in 81% of the inflows to the dam being returned to Tangarang Creek.

Flow regimes will be developed that mimic natural flows in terms of frequency and variation with a minimum number of releases each year equivalent to the number of rainfall events in the catchment and to suit the downstream ecosystem.

6.2.5 Mitigation Measures

Mitigation measures include:

- the diversion of clean water run-off to clean water-storages;
- retention and treatment of "dirty water" to prevent sediment laden or contaminated runoff leaving the site;
- recycling and treatment of all water used in quarrying activities to minimise demand for top-up water from the clean water dams and to minimise the flow of dirty water to the Pit storage;
- construction of a wetland or vegetated swale upstream of the primary water storage dam to improve the quality of run-off entering the dam and act as a filter for excess flows from the in-pit storages;
- retention of environmental flows, equivalent to a minimum of 10% of average daily flows to be released to mimic natural flow patterns;
- water quality and quantity monitoring to confirm the efficiency of the proposed water management system and ensure there are no detrimental impacts upon groundwater systems or surface receiving waters.

7.1.1 Existing Flora and Fauna

A flora and fauna impact assessment of the quarry site was undertaken for the original EA in 2006. The majority of the Peppertree quarry site has been previously cleared of native trees and has been used for grazing livestock for many decades. Vegetation on the site is predominantly pasture grasses with only small, isolated stands of trees scattered throughout.

Investigations carried out for Project EA identified the presence of a small area of Box-Gum Grassy Woodland at the proposed location of Dam 1, covering approximately 6.3 hectares. The area surrounding the dam is proposed to be conserved as a Habitat Management Area in accordance with the conditions of approval. This area is separated from a much larger area of woodland by the existing railway line to the limestone mine.

Figure 7.1 shows the location of threatened species and endangered ecological communities recorded previously within the site. The HMA surrounding the revised dam configuration is shown in Figure 7.2

Further ecological investigations were undertaken in May 2011 within the 75 W amendment area and the following vegetation communities were recorded:

- exotic Grassland with scattered trees;
- riparian trees over exotic understorey; and
- transition zone between exotic grassland and Box Gum Grassy Woodland.

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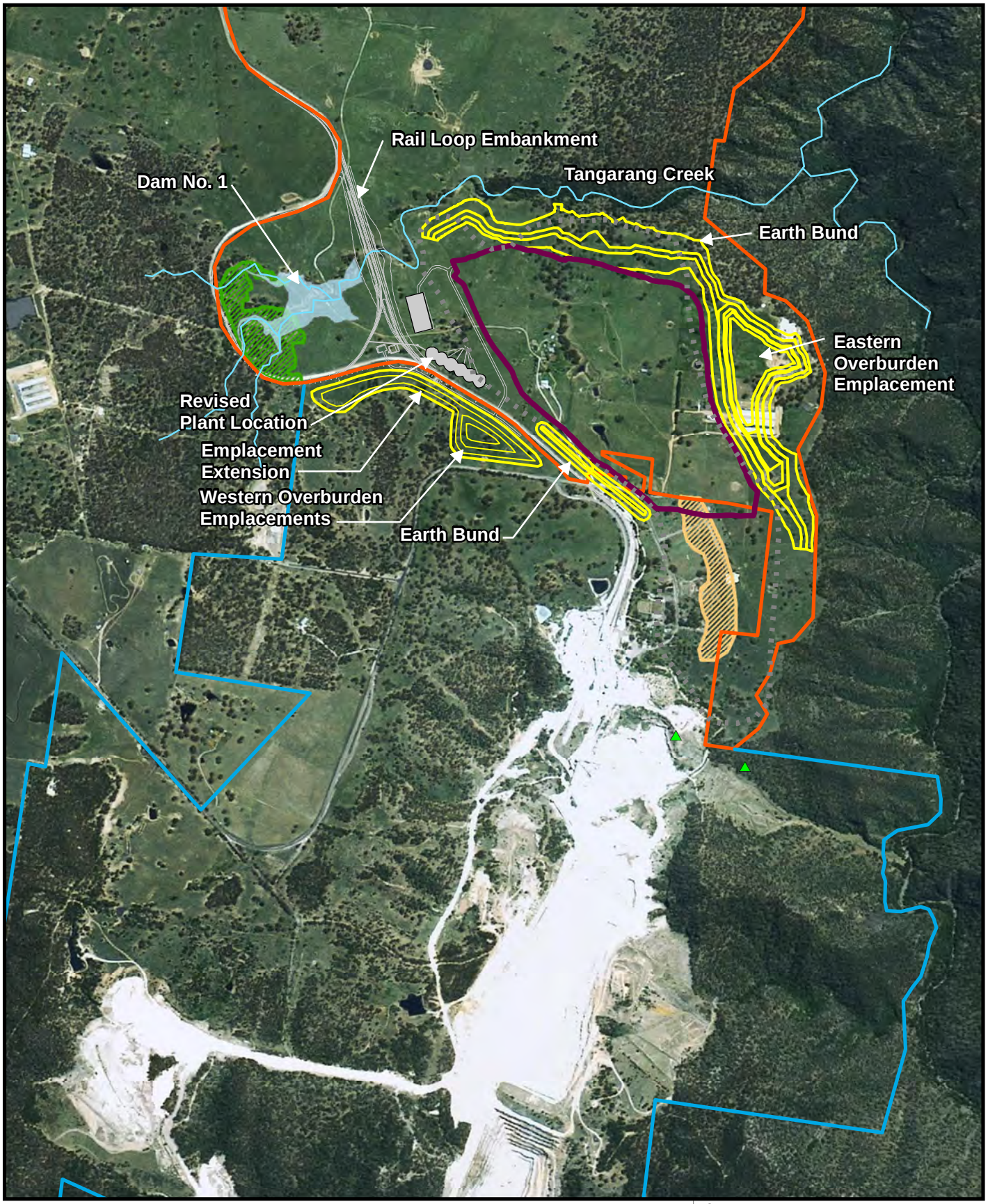

Legend

- *Solanum Celatum* Locations
- Tangarang Creek
- Resource Boundary
- Quarry Location
- Boral Cement Property Boundary
- Boral Peppertree Property Boundary
- Proposed Plant Location
- Proposed Dam Location
- Disturbed Woodland
- Box Gum Woodland

Client:	Boral
Project:	Peppertree Quarry
Drawing	0118026s_Sect75W_G010_R2.mxd
Date:	5/05/2011 Drawing Size: A4
Drawn By:	SW Reviewed By: RS
Projection:	UTM Zone 56, Southern Hemisphere
Scale:	Refer to scale bar

N

0 100 200 300m

Figure 7.1

Location of Threatened Species and Ecological Communities within the Site

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ERM

Figure 7.2

Revised Habitat Management Area

Client:	Boral	
Project:	Peppertree Quarry	
Drawing No:	0118026s_Sect75W_G002_R2.mxd	
Date:	5/05/2011	Drawing Size: A4
Drawn By:	SW	Reviewed By: RS
Projection:	UTM Zone	
Scale:	Refer to scale bar	

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0 50 100 150m

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Fauna And Fauna Habitat

Within the 75 W amendment area the following species were recorded:

- Water Dragon (*Physignathus lesueurii*) (Tangarang Creek 2006 survey);
- Eastern Rosella (*Platycercus eximius)*;
- Crimson Rosella (*Platycercus elegans)*;
- White-winged Chough (*Corcorax melanorhamphos)*;
- Australian Magpie (*Cracticus tibicen*);
- Noisy Miner (*Manorina melanocephala);* and
- Eastern Grey Kangaroo *(Macropus giganteus).*

Fauna habitat recorded within the 75 W amendment area included:

- riparian zone of Tangarang Creek;
- leaf litter and ground debris;
- exotic grassland and pasture; and
- scattered paddock trees.

7.1.2 Potential Impacts

The following elements of the 75 W amendment have the potential to impact native flora and fauna:

- realignment of the rail loop (crosses adjacent to the dam wall embankment);
- reconfiguration of the processing and rail loading system; and
- construction of the western overburden dump and bund extension;

The realignment of the rail loop will not create additional impacts to those previously assessed as part of the original EA, as the dam wall was previously assessed and the remaining sections of the rail loop cross cleared grazing land that was assessed in 2006. Reconfiguration of the processing and rail loading system and construction of the western overburden emplacement will occur within areas previously assessed within the 2006 EA. The sites consist predominantly of exotic grasses with isolated stands of trees which will be removed as part of the proposal. Some granivorous and insectivorous native bird species and reptiles may use these areas but the loss of this habitat type is not considered to be a significant impact to these species, given its occurrence within the site and the local area.

The bund forming the extension to the western overburden emplacement will be constructed predominantly within exotic grassland along the periphery of the existing rail line, and will result in the removal of some scattered trees. The trees will be removed from areas that mark the transition to Box-Gum Grassy Woodland (located west of the site) (see Figure 7.1 and Figure 7.2). Using the EPBC Act Policy Statement (Department of the Environment and Heritage 2006) the small transition area to be removed would not be considered to be Box-Gum Grassy Woodland as the understorey was predominantly exotic and Stringybarks formed one of the dominant canopy species. The bund will be designed to be restricted to areas dominated by exotic grasses and will not impact upon the adjacent areas of woodland.

The construction of the bund will have the positive impact of removing invasive weed species that are adjacent to the woodland, and will be rehabilitated with native Box-Gum Grassy Woodland species in accordance with the Landscape Management Plan for the site. As the bund will be battered and more than 30 m in width, shade is not expected to impact negatively on the adjacent woodland.

The approved water storage dam will be reduced in size and this will have a positive impact by reducing the area of impact to the Box-Gum Grassy Woodland. In the approved Project the construction of the water storage dam would have resulted in the loss of approximately 2.6 ha of the Box-Gum Woodland. The reduced size of the water storage dam will result in the removal of 1.8 ha of the Box-Gum Woodland. Offsets for the loss of woodland have been previously negotiated and approved and this loss is not part of this assessment.

Threatened Species

No threatened species are expected to be impacted as a result of the 75 W amendment.

7.1.3 Mitigation Measures

Mitigation measures to be implemented as part of this proposal for the protection of native flora and fauna include:

- rehabilitation of the bunds and emplacement areas with native Box-Gum Grassy Woodland species;
- rehabilitation within three months of completion of the bund;
- protection of the Box-Gum Grassy Woodland by installation of secure fencing prior to construction of the bund;
- assessment of trees to be removed to ensure no fauna species (such as birds or small arboreal mammals) will be impacted(pre-clearing survey and if hollows recorded then an animal handler on site while trees are removed);
- removal of trees in accordance with the previous recommendations (EA 2006); and
- ongoing management of rehabilitation to ensure no weeds of significance enter the Box-Gum grassy Woodland

7.2 CONCLUDING STATEMENT

Given the mitigation measures to be implemented as part of this 75W amendment, a net ecological benefit is expected as a result of:

- reduction in size of the water storage dam;
- increase in proportion of the HMA;
- removal of exotic grassland;
- progressive rehabilitation of bunds and emplacement areas with native Box-Gum Grassy Woodland species; and
- management of weeds to reduce potential for impacts to woodland areas.

8 ABORIGINAL AND CULTURAL HERITAGE

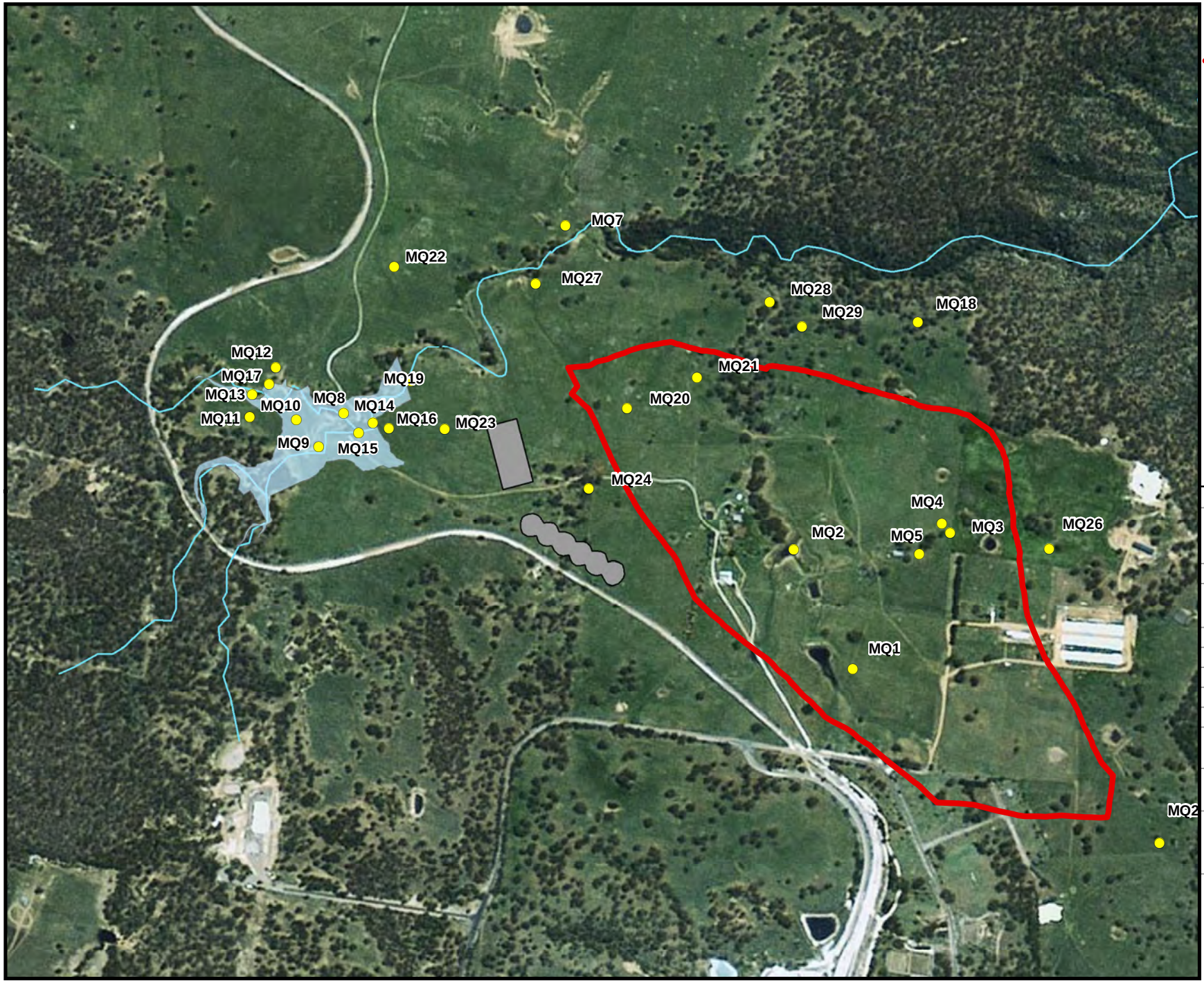
An Aboriginal heritage assessment of the quarry was undertaken for the Project EA in 2006. The outcomes of the survey (ERM 2006) were a series of 'open' sites comprising one or more Aboriginal flaked stone artefacts. In general the archaeological evidence suggested a low density of stone artefacts spread widely across the landscape. However, the areas immediately surrounding Tangarang Creek (located within the inundation area of a proposed water storage dam) were identified as having a higher density with a range of artefacts that warranted further investigation if they were to be impacted as shown on *Figure 8.1*.

Eight sites, located within the proposed quarry footprint, were assessed as being of low cultural significance, with scientific heritage value lying predominantly in the capacity of the Aboriginal sites to demonstrate pre-European Aboriginal land use. The eleven sites in the proposed Dam 1 reservoir area were assessed as having high potential to contain subsurface deposits and moderate scientific significance for the density and frequency of artefacts (including the raw materials and artefact types) across the different landforms, which have the potential to contribute to archaeological research in the region.

Geotechnical works undertaken in July 2010 were monitored by an archaeologist and Aboriginal representatives, resulted in the identification of ten new Aboriginal sites within the Project Application area. The new Aboriginal sites were located across a range of landforms, some of which will be impacted by the project.

An Aboriginal Heritage Management Plan has been prepared in accordance with Condition 32 of Project approval. This plan has been finalised in consultation with the local Aboriginal groups, DECCW and submitted to the DoP. The plan sets out the requirements for further archaeological management on the site based upon the significance assessment and Aboriginal community needs. As the additional sites to be lost are located within the area judged to have high potential for subsurface archaeological deposit they will be subject to archaeological testing and possible open area excavation.

ERM archaeologists working with representatives of the Aboriginal groups registered for the assessment have recently completed the sub-surface excavation and salvage with the artefacts awaiting analysis.



Legend

- Aboriginal Site Locations
- Peppertree Quarry Boundary
- Dam Location
- Proposed Plant Location
- Tangarang Creek

Figure 8.1

Aboriginal Sites Identified within the PAA

Client:	Boral	
Project:	Peppertree Quarry	
Drawing No:	0118026s_Sect75W_G003_R0.mxd	
Date:	05/10/2010	Drawing size: A4
Drawn by:	SW	Reviewed by: RS
Projection:	UTM Zone 56, Southern Hemisphere	
Scale:	Refer to Scale Bar	

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9 VISUAL IMPACT ASSESSMENT

9.1 EXISTING

The proposed Peppertree Quarry is predominantly shielded from view from all potential nearby receptors due to natural topography. A visual assessment of the proposed Peppertree Quarry was undertaken for original EA in 2006. The report included an assessment of the visibility of the proposed quarry from surrounding viewpoints using three-dimensional digital terrain modeling. The chosen assessment points were selected where views into the project site might occur from an access road, surrounding properties or the designated lookout in Morton National Park or Bungonia State Conservation Area.

The assessment found that landscape around the proposed development, generally had a high visual absorption capacity due to the existing terrain and scattered vegetation. The high visual absorption capacity corresponds directly with the generally low significance of visual impacts to views from the existing proposal.

Viewpoints were selected to represent the maximum extent of potential views of the proposed quarry as shown on *Figure 9.1*. The viewpoint from Marulan South Road represented the only location where prominent views of the quarry could be obtained.

9.2 POTENTIAL IMPACTS

For the purposes of this assessment the potential visual impacts of this modification on the previously selected viewpoints has been reconsidered. Due to the low sensitivity of the surrounds and the lack of previous visual impacts, 3D remodeling of the proposed modification has not been undertaken.

The key element of the modified proposal with potential for visual impacts is the new overburden emplacement to the south of the rail line. The emplacement will be highly visible as vehicles approach from the west along Marulan South Road in accordance with the view of the plant area from Viewpoint 6 in the Project EA. However, this section of Marulan South Road is used only to service the Boral Cement Limestone Mine and the proposed new quarry and is therefore representative of the surrounding landuse and does not represent a sensitive viewpoint. Progressive stabilisation and revegetation of the outer perimeter of the overburden dump will increase the visual absorption with surrounding grassed paddocks.

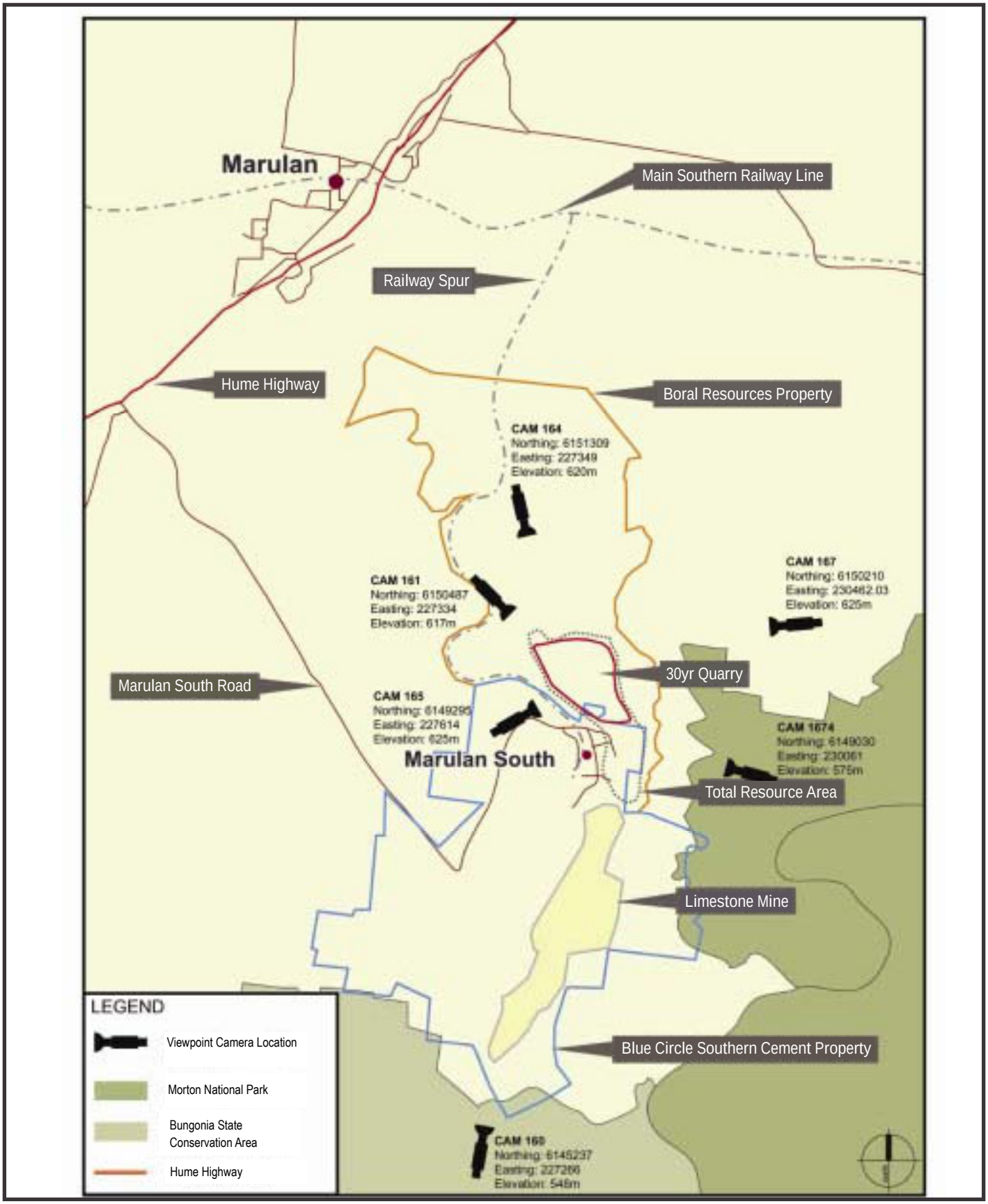

Figure 9.1

Proposed Quarry with View Assessment Point Locations

Client:	Boral	
Project:	Peppertree Quarry	
Drawing No:	0118026s_Sect75W_C003_R0.cdr	
Date:	17/03/2011	Drawing size: A4
Drawn by:	SQW	Reviewed by: RS
Scale:	Refer to Scale Bar	

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Building C, 33 Saunders St, Pyrmont, NSW 2009
Telephone +61 2 8584 8888

ERM

The overburden emplacement and processing area will also be visible from View Point 5 to north-west of the quarry along the edge of the existing rail line. This viewpoint is located within Boral property and the rail line is only used for transport of product from the quarry and adjoining Limestone Mine. The closest residential receptor is located approximately 1.3km further west of this viewpoint with dense woodland in between resulting in minimal potential visibility of the revised layout.

Similarly, to the north -west of the site the terrain drops away to the closest private properties, restricting any views of the site. Residential receptors in these locations will be predominantly shielded from view of the quarry by existing terrain and the proposed modified site layout will not alter these views.

The proposal will not be visible from Bungonia Lookdown and views of the quarry will remain extremely limited from residential properties to the east of the site on Long Point Road and the walking trail which extends along the adjoining spurline. The intervening terrain and the eastern bund and overburden emplacement will shield the new tertiary plant and the western overburden emplacement from views from the east.

10 TRAFFIC AND TRANSPORT IMPACT ASSESSMENT

10.1 EXISTING ENVIRONMENT

Road access to the Peppertree Quarry site is available via Marulan South Road, which extends from an intersection with the Hume Highway and services the existing limestone mine, a number of rural properties, poultry farms, lime processing plant and fireworks factory.

The Hume Highway at Marulan is a separated dual carriageway and forms the major north-south transport corridor between Sydney and subsequently Melbourne. Marulan South Road runs to the east from the Hume Highway for approximately 8.5 km to the former village of Marulan South and the existing Boral Cement Limestone mine.

The intersection of the Hume Highway and Marulan South Road is an at-grade junction with a protected "seagull like" junction design. The intersection provides acceleration and deceleration lanes of approximately 150 metres and provides excellent site distance in each direction. An intersection of Marulan South Road with Jerrara Road which extends towards Bungonia, is located immediately adjacent to the Hume Highway intersection.

Marulan South Road is an existing B-Double approved access route which currently operates at a high level of service. The road has been previously assessed by the RTA and Mulwaree Shire Council in 1998 which confirmed that the road was suitable to accommodate restricted access vehicles including B-Doubles.

Boral proposes to transport all quarry product by rail and road access will only be used during construction, and for employee and maintenance vehicles during quarry operations.

10.1.1 Impacts

Construction Phase

Marulan South Road will be used by the construction workforce of up to 20 staff over a period of approximately 12 months.

A transport analysis undertaken for the EA in 2006 included an analysis of the existing use and capacity of the road network and potential impacts associated with construction, operational, maintenance and delivery vehicles.

The assessment found that construction vehicles will have minimal impact upon the capacity of Marulan South Road or the existing Marulan South Road and Hume Highway intersection.

Construction of the proposed rail loop infrastructure would be undertaken concurrently with broader construction activities for the quarry. Although resulting in a temporary increase in vehicle movements along the local road network, the increase would be of limited magnitude and of short duration.

10.1.2 Operations

Products from Peppertree Quarry will be transported by rail. Trains will traverse the new rail loop and onto the Main Southern Railway for transportation to Boral's Sydney rail terminals at Enfield and St Peters and possible other terminals.

At peak production there will be up to four trains servicing Peppertree Quarry making a daily trip between the quarry and typically the Sydney market. Each train has capacity to transport up to around 1,000,000 tonnes per annum which at full production would equate to around 3 or 4 rail trains per day. Train loading and trips will be a 24 hour operation to enable trips to be scheduled away from peak commuter times on the Main Southern Railway.

Advice from the Australian Rail Track Corporation Ltd (ARTC) indicates that there is adequate capacity to accommodate the rail haulage forecasts of the Quarry.

Boral Cement currently operates up to five or six trains per day along the existing rail line for transport of product from the limestone mine north to Sydney. The Peppertree Quarry will result in an additional 3 or 4 rail trains per day at full production. The line has the capacity to service the cumulative total of rail movements for both operations and the number of movements will remain in accordance with the original Project Application.

The construction of the new rail loop will allow for the separation of rail movements for the two operations and provide flexibility in the event of disruptions to planned scheduling.

11 SOCIAL IMPACT ASSESSMENT

Peppertree Quarry will result in considerable social and economic benefits at both the local and state level. The main economic benefit of the proposal is related to the security of supply of construction materials for the Sydney construction market. Local economic benefits include employment opportunities during the construction and operation of the quarry and subsequent flow on effects to the local economy.

The proposed modifications to Peppertree Quarry, in particular the addition of the new rail loop will provide for the efficient transport of resource to the Sydney market. The construction of the rail loop will also result in slightly increased employment demand during the construction phase of the works.

The proposed changes will typically improve local amenity by moving the tertiary processing and rail loading facilities further away from the most affected receptors and minimise dust emissions by restricting the haulage distance for overburden placement. The potential socio-economic impacts arising from the modification are therefore considered positive.

12 CONCLUSION

A number of investigations have been undertaken during the detailed design of the Peppertree Quarry to improve the efficiency of operations and achieve improved environmental outcomes. The proposal remains predominantly the same as the original Project Application, with minor refinements to the tertiary processing, rail infrastructure and a new overburden emplacement area located to the west of the site.

The modifications involve the construction of a rail embankment adjacent to the water supply dam embankment to form a rail loop with associated relocation of the tertiary processing plant and rail loading facilities to accommodate the revised rail alignment. The new rail embankment will facilitate a more direct approach to the existing Boral Cement Limestone Mine, minimising wheel noise around the existing curved section of the line.

The construction of the new rail loop will allow for the separation of rail movements for the two operations and provide flexibility in the event of disruptions to planned scheduling.

The relocation of the tertiary plant will result in a reduction in potential noise impacts for the most affected receptor and minor alteration to anticipated noise levels at other near-bye residential receptors. A new residential receptor has also been constructed in close proximity to the quarry and will need a site specific noise impact assessment criteria incorporated into the approval to achieve compliance.

The new overburden emplacement will provide for additional on site storage, reducing the volume of overburden required for offsite haulage to the adjoining limestone mine or other potential locations. Eliminating overburden haulage to the adjoining limestone mine will minimise total dust emissions by approximately 30%. The new emplacement area will provide operation flexibility to allow the overburden stripping fleet to be directed to either side of the quarry during adverse winds minimising potential impacts upon near-bye receptors.

Demand management investigations have reduced the estimated water usage at the quarry by 43% from 255ML/yr estimated in the original Project application to 145ML/yr. The dam capacity required to meet the anticipated water demand requirements has been restricted to 112ML.

The reduction in dam size will subsequently reduce the extent of required clearance upon Box-Gum Woodland by 30% and providing a net benefit to ecological outcomes for the site. The eastern overburden emplacement will be located in cleared areas dominated by exotic grasses and the bund extending along the railway alignment will be designed to ensure minimal disturbance to the adjacent woodland areas.

This assessment of the potential environmental impacts arising from the proposed modifications to Peppertree Quarry has established that through the adoption and ongoing use of proposed mitigation measures will result in improvements to both operational efficiencies and environmental outcomes.

Annex A

Detailed Meteorological Analysis

Met station	BCSC Marulan						Met station	BCSC Marulan						Met station	BCSC Marulan					
		Job No	Year						Job No	Year						Job No	Year			
DAY		118026	2008				DAY		118206	2009				DAY		118206	2008-10			
Period	Calm	Wind Direction	0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/s		Period	Calm	Wind Direction	0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/s		Period	Calm	Wind Direction	0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/s	
Summer	7.7%	ENE±45	15.8%	19.6%	35.4%		Summer	1.1%	ENE±45	7.5%	23.2%	30.7%		Summer	5.8%	ENE±45	13.5%	20.2%	33.7%	
Autumn	11.1%	E±45	17.1%	15.2%	32.3%		Autumn	7.4%	E±45	15.4%	16.6%	32.0%		Autumn	15.1%	E±45	16.3%	12.8%	29.1%	
Winter	6.8%	SSE±45	8.1%	7.4%	15.4%		Winter	15.6%	W±45	8.7%	10.1%	18.9%		Winter	11.2%	WSW±45	6.7%	9.5%	16.2%	
Spring	0.6%	ENE±45	7.6%	12.3%	19.9%		Spring	6.7%	ENE±45	11.4%	11.4%	22.8%		Spring	3.6%	ENE±45	9.5%	11.9%	21.4%	
EVENING							EVENING							EVENING						
Period	Calm	Wind Direction	0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/s		Period	Calm	Wind Direction	0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/s		Period	Calm	Wind Direction	0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/s	
Summer	5.2%	ENE±45	31.0%	22.8%	53.8%		Summer	2.9%	ENE±45	21.5%	30.2%	51.7%		Summer	7.5%	ENE±45	28.6%	22.8%	51.4%	
Autumn	26.6%	E±45	21.7%	9.5%	31.3%		Autumn	21.5%	ENE±45	25.5%	8.2%	33.7%		Autumn	37.1%	E±45	18.4%	7.1%	25.5%	
Winter	27.7%	W±45	14.3%	8.3%	22.6%		Winter	41.0%	W±45	13.5%	10.6%	24.0%		Winter	34.4%	W±45	13.9%	9.4%	23.3%	
Spring	10.2%	NE±45	21.6%	9.8%	31.3%		Spring	36.3%	ENE±45	16.9%	2.9%	19.8%		Spring	23.2%	ENE±45	18.7%	6.7%	25.3%	
NIGHT							NIGHT							NIGHT						
Period	Calm	Wind Direction	0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/s		Period	Calm	Wind Direction	0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/s		Period	Calm	Wind Direction	0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/s	
Summer	32.5%	E±45	21.4%	3.8%	25.2%		Summer	24.1%	E±45	20.5%	7.4%	27.9%		Summer	33.9%	E±45	20.3%	5.4%	25.7%	
Autumn	41.4%	WNW±45	15.8%	5.0%	20.7%		Autumn	42.5%	E±45	12.1%	3.9%	15.9%		Autumn	52.4%	WNW±45	10.3%	4.4%	14.7%	
Winter	26.9%	WSW±45	15.3%	9.3%	24.6%		Winter	45.0%	WSW±45	13.1%	8.6%	21.7%		Winter	36.0%	WSW±45	14.2%	9.0%	23.2%	
Spring	19.5%	NNW±45	18.3%	7.4%	25.7%		Spring	51.6%	WNW±45	7.8%	5.9%	13.7%		Spring	35.6%	NNW±45	12.8%	6.2%	19.0%	

Annex B

INP Methodology

B.1 NSW INDUSTRIAL NOISE POLICY - NOISE IMPACT ASSESSMENT PROCEDURES

Responsibility for the control of noise emissions in NSW is vested in Local Government and the Department of Environment, Climate Change and Water (DECCW, and formerly the EPA – Environment Protection Authority).

The NSW *Industrial Noise Policy* (INP) first published by the EPA in January 2000, provides a framework and methodology for deriving limit conditions for consent and licence conditions. Using this policy the DECCW regulates premises that are scheduled under the *Protection of the Environment Operations Act, 1997* (POEO Act). The specific INP objectives are:

- to establish noise criteria that would protect the community from excessive intrusive noise and preserve amenity for specific land uses;
- to use the criteria as the basis for deriving PSNL;
- to promote uniform methods to estimate and measure noise impacts, including a procedure for evaluating meteorological effects;
- to outline a range of mitigation measures that could be used to minimise noise impacts;
- to provide a formal process to guide the determination of feasible and reasonable noise limits for consent or licence conditions that reconcile noise impacts with the economic, social and environmental considerations of industrial development; and
- to carry out functions relating to the prevention, minimisation and control of noise from premises scheduled under the POEO Act.

The INP is designed for large and complex industrial sources and outlines processes designed to strike a feasible and reasonable balance between the operations of industrial activities and the protection of the community from noise levels that are intrusive or unpleasant. The application of the INP involves the following processes:

- determining the Project-Specific Noise Levels (PSNL) from intrusiveness and amenity based measurement of the existing background and ambient noise levels;
- predicting or measuring the noise levels produced by the development; and
- comparing the predicted noise levels with the PSNL and assessing impacts.

Where the PSNL are predicted to be exceeded the INP provides guidelines on the assessment of feasible and reasonable noise mitigation strategies, including:

- 'weighing up' the benefit of the development against the social and environmental costs resulting from the noise impacts;
- establishment of achievable and agreed noise limits for the development in consultation with the consent authority; and
- undertaking performance monitoring of environmental noise levels to determine compliance with the consent and licence conditions.

B.1.1 NSW INP - Assessment Methodology

There are two criteria to consider when establishing PSNL for the assessment of industrial noise sources. These criteria are as follows:

- the 'Intrusive Noise' criterion, which is based on the background noise level plus 5 dB. The background noise level, or Rating Background Level (RBL), is determined in accordance with Section 3 of the INP and is based on the use of noise monitoring data to establish the assessable background noise levels; and
- the 'Amenity Noise' criterion, which is based on the recommended noise levels in the INP for prescribed land use. The recommended acceptable and maximum ambient noise levels are outlined in *Table 2.1* of the INP. *Table 2.2* of the INP outlines the requirements for developments where the existing noise level from industrial noise sources is close to the acceptable noise level.

The relevant tables in *Section 2* of the INP relating to the amenity criteria relevant to the project are presented in *Table B.1* and *Table B.2*.

Table B.1 Amenity Criteria - Recommended LAeq Noise Levels from Industrial Noise Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended LAeq Noise Level	
			Acceptable	Recommended Maximum
Residence	Rural	Day	50 dB(A)	55 dB(A)
		Evening	45 dB(A)	50 dB(A)
		Night	40 dB(A)	45 dB(A)
	Suburban	Day	55 dB(A)	60 dB(A)
		Evening	45 dB(A)	50 dB(A)
		Night	40 dB(A)	45 dB(A)
	Urban	Day	60 dB(A)	65 dB(A)
		Evening	50 dB(A)	55 dB(A)
		Night	45 dB(A)	50 dB(A)
	Urban/Industrial Interface - for existing situations only	Day	65 dB(A)	70 dB(A)
		Evening	55 dB(A)	60 dB(A)
		Night	50 dB(A)	55 dB(A)
Area specifically reserved for passive recreation	All	When in use	50 dB(A)	55 dB(A)
Active recreation area (School playground, golf course)			55 dB(A)	60 dB(A)
Commercial premises			65 dB(A)	70 dB(A)
Industrial premises			70 dB(A)	75 dB(A)

1. *In accordance with the INP the assessment periods are defined as follows: Daytime is the period from 7am to 6pm - Monday to Saturday; or 8am to 6pm on Sundays and Public Holidays, Evening is the period from 6pm to 10pm and Night time is all remaining periods; and*
2. *The LAeq index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.*

Table B.2 ***Modification to Acceptable Noise Level (ANL) to Account for Existing Levels of Industrial Noise***

Total Existing LAeq Noise Level from Industrial Noise Sources	Maximum LAeq Noise Level for Noise from New Sources Alone, dB
≥ Acceptable noise level plus 2 dB	If existing noise level is likely to decrease in future acceptable noise level minus 10 dB If existing noise level is unlikely to decrease in future existing noise level minus 10 dB
Acceptable noise level plus 1 dB	Acceptable noise level minus 8 dB
Acceptable noise level	Acceptable noise level minus 8 dB
Acceptable noise level minus 1 dB	Acceptable noise level minus 6 dB
Acceptable noise level minus 2 dB	Acceptable noise level minus 4 dB
Acceptable noise level minus 3 dB	Acceptable noise level minus 3 dB
Acceptable noise level minus 4 dB	Acceptable noise level minus 2 dB
Acceptable noise level minus 5 dB	Acceptable noise level minus 2 dB
Acceptable noise level minus 6 dB	Acceptable noise level minus 1 dB
< Acceptable noise level minus 6 dB	Acceptable noise level

1. *ANL = recommended acceptable LAeq noise level for the specific receiver.*

In assessing the noise impacts from industrial sources at residential receivers both criteria are considered. For each period (day, evening and night) the most stringent of either the intrusive or amenity criteria becomes the limiting criterion and forms the project-specific noise level for the industrial source.

If the existing ambient noise level is close to the acceptable noise level, a new source must be controlled to preserve the amenity of the surrounding area. If the overall noise level from the industrial source already exceeds the acceptable noise level for the affected area, the L_{Aeq} noise level from a new source should meet the conditions set out in *Table 2.2* of the INP.

B.1.2 INP - Project Specific Noise Levels

The INP states that the criteria outlined in *Table B.1* and *Table B.2* have been selected to protect at least 90 per cent of the population living in the vicinity of industrial noise sources from the adverse effects of noise for at least 90 per cent of the time. Provided the criteria in the INP are achieved, it is unlikely that most people would consider the resultant noise levels excessive.

Table B.3 presents the methodology for assessing noise levels which may exceed the INP PSNL.

Table B.3 Noise Impact Assessment Methodology

Assessment Criterion	Project Specific Noise Level	Noise Management Zone	Noise Affectation Zone
Intrusive	Rating background level plus 5 dB	≤ 5 dB above project-specific criteria	≥ 5 dB above project-specific criteria
Amenity	INP based on existing industrial level	≤ 5 dB above project-specific criteria	≥ 5 dB above project-specific criteria

For the purposes of assessing the potential noise impacts the project-specific, management and affectation criteria are further defined in the following sections.

Project Specific Noise Level

Most people in the broader community would generally consider exposure to noise levels that achieve the project-specific criteria acceptable.

Noise Management Zone

Depending on the degree of exceedence of the project-specific noise level (1 dB to 5 dB) noise impacts in this zone could range from negligible to moderate. It is recommended that management procedures be implemented including:

- prompt response to any issues of concern raised by community;
- noise monitoring on-site and within the community;
- refinement of on-site noise mitigation measures and plant operating procedures where practical;
- consideration of acoustical mitigation at receivers; and
- consideration of negotiated agreements with property holders.

Noise Affectation Zone

Exposure to noise levels corresponding to this zone (more than 5 dB above project-specific criteria) may be considered unacceptable by some property holders and implementation of the following measures may be required:

- discussions with relevant property holders to assess concerns and provide solutions;
- implementation of acoustical mitigation at receivers; and
- negotiated agreements with property holders.

B.1.3 Sleep Disturbance

Refer INP Application Note *B.2.21*

NSW Environmental Criteria for Road Traffic Noise - Guidance

Further guidance on potential sleep disturbance impacts is provided in the Department of Environment, Climate Change and Water (formerly the EPA – Environment Protection Authority) NSW *Environmental Criteria for Road Traffic Noise* (ECRTN), May 1999, which states that:

- sleep disturbance occurs through two mechanisms: changes in sleep state and awakenings;
- awakenings are better correlated to subjective assessments of sleep quality than are changes in sleep state;
- factors (other than noise) that contribute significantly to awakening reactions include sleep state and subject age; and
- the maximum noise level, the extent that noise exceeds the ambient noise level and the number of noise events that contribute to sleep disturbance.

The ECRTN recommends that the assessment should include a calculation of the maximum noise levels, the extent to which the maximum noise levels for individual vehicle pass-bys exceed the L_{eq} for each hour of the night, and the number of maximum noise events. A substantial portion of the ECRTN provides a review of international sleep disturbance research, indicating that:

- maximum internal noise levels below 50–55 dB(A) are unlikely to cause awakening reactions; and
- one or two noise events per night with maximum internal noise levels of 65–70 dB(A) are not likely to significantly affect health and wellbeing.

Internal to External Correction Factors

Modelled noise levels (for operational and sleep disturbance aspects of a project) are typically calculated at the property boundary or external building façade, however the ECRTN specifies and internal noise level criteria for assessing maximum noise level events, as such an internal noise level equivalent must be determined, or the criteria adapted to assess a calculated external noise level.

In determining an external criteria equivalent for maximum noise level assessment, ERM has conservatively applied a 20 dB noise level correction factor to the relevant internal criteria described in the ECRTN. This 20 dB correction factor is approximately equivalent to the acoustic performance of an outer building envelope with windows closed (light frame and single glazed window, refer ENMM). This is considered reasonable as the maximum noise level assessment only applies at night, when windows would typically remain closed.

B.2 INP - APPLICATION NOTES

These application notes are provided to assist industry and acoustical consultants develop noise impact assessments and apply the provisions of the INP with the aim of reducing processing time. The DECCW require noise impact assessments to apply the provisions of the INP; alternative approaches are not acceptable. The process for identifying PSNL in *Section 2* of the INP must be followed.

The level of mitigation that can be applied to a project is based on what is feasible and reasonable within the circumstances of that project. Valid factors include costs, aesthetics, community preferences, noise reduction achieved, etc. Noise level requirements in a licence are based on what the project can achieve using feasible and reasonable mitigation.

B.2.1 Identifying the Existing Level of Noise from Industry

(See INP *Section 2.2* and *Section 3.2*)

Table 2.1 of the INP (Amenity Criteria p.16) sets out recommended cumulative noise levels for industry. In assessment of the amenity effects of noise from a new development it is essential that the level of noise already present be determined.

Where the ambient noise levels are below the Acceptable Noise Level (ANL), then ideally the measurement of the existing level of noise should include only noise from industrial sources. In these situations, however, it may be acceptable to include noise from other sources (for example, roads or neighbourhood). The reasons for this are that:

- including noise from other sources typically results in assessing the worst case for impacts on amenity; and
- strictly excluding noise from sources other than industry can be difficult and costly and may not be necessary if the development meets the criteria.

However, where ambient noise levels are above the ANL then noise from other sources should be excluded in establishing existing levels of industrial noise. Where the level of road traffic noise is high enough to make noise from an industrial source inaudible for the majority of the time or difficult to measure directly, it may be necessary to consider applying the assessment for areas of high traffic noise. (Application Note: '*Amenity criteria in high traffic noise areas*', provides further guidance on this).

B.2.2 Assessing Noise at Industrial/Commercial Receivers

(See INP *Section 2.2*)

The INP does not require that intrusive noise be assessed at industrial or commercial premises. For industrial/commercial receivers, only the amenity criteria apply. Amenity noise levels should be assessed at the most affected point on or within the property boundary. This approach also applies to other non-residential receivers, such as educational facilities, hospitals and places of worship.

B.2.3 When to Apply the Urban/Industrial Interface Amenity Category

(See INP *Section 2.2.1*)

The urban/industrial interface category in the INP recognises that the availability of noise mitigation measures might be limited for existing premises where residences are close to existing industries.

The urban/industrial interface amenity category applies only for existing situations (that is, an existing receiver near an existing industry) and only for those receivers in the immediate area surrounding the existing industry, that is, the region that extends from the boundary of the existing industry to the point where the noise level of the existing industry (measured at its boundary) has fallen by 5 decibels.

Beyond the interface region (that is, beyond the point where noise has fallen by 5 decibels) the receiver category that most describes the area (rural, suburban or urban) would apply[1].

For new developments of a limited nature (such as an extension to existing process or plant or when replacing part of an existing process or plant with new technology) on existing sites (where the urban/industrial amenity category applies) then the urban/industrial amenity category is the appropriate amenity category for the new development. However, where a new development on an existing site is of a substantial nature (such as demolition of the existing plant and replacement with current technology or different type of plant) and where replacement of the existing plant has a realistic potential to significantly reduce receiver noise levels through using feasible and reasonable noise mitigation (i.e. where the existing plant is the dominant or a significant contributor to receiver noise levels) then the applicable noise criteria for the new development is the appropriate (rural, suburban or urban) amenity criteria for the location.

In most cases the situation will be apparent but in some cases careful judgement will be required to determine whether the new development is of sufficient magnitude to effectively replace the existing plant. In situations where no clear conclusion on the magnitude of change created by the new development is possible then the urban/industrial amenity category should apply.

[1] The wording on pages 18 and 67 of the INP does not fully clarify this and the word 'urban' should be deleted and replaced with the word 'applicable' on page 18 at line 6 of the 'Urban/industrial interface' category and on page 67 at line 9 of the first paragraph

B.2.4 Identifying the Appropriate Receiver Amenity Category

(See INP *Section 2.2.2*)

Amenity criteria in *Table 2.1* of the INP vary depending on the type of receiver. INP *Section 2.2.2* provides guidance on identifying the appropriate receiver type. Where there is doubt or debate over which receiver category is appropriate, the proponent needs to seek the views of the relevant land use manager (for example, Council or Department of Planning). Once the land use manager has identified the land use (e.g. zone, allowable density of development and land use patterns), the appropriate amenity criteria can be assigned.

B.2.5 Amenity Criteria in High Traffic Noise Areas

(See INP *Section 2.2.3*)

In areas where traffic flow is continuous and noise from industrial sources is inaudible or difficult to measure due to a high level of road traffic noise, and where the $L_{Aeq\ (period,\ traffic)}$ noise level is more than 10 dB above the ANL presented in *Table 2.1*, the ANL is replaced by $L_{Aeq\ (period,\ traffic)}$ minus 10 dB and this becomes the new ANL for the receiver area. Once the new ANL is determined, the project-specific amenity criterion can be determined by following the modification process given in *Table 2.2* of the INP[2].

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[2] **Example:** An industrial development is proposed adjacent to several existing industrial facilities. The measured ambient night-time LAeq noise level is 60 dB(A) at a receiver potentially affected by noise from the proposed industrial development. The residential receiving area of the assessment location has been identified as 'urban'. A nearby road dominates the night-time acoustic environment at the receiver and there are no other environmental or extraneous local noise sources. In these circumstances, the measured ambient LAeq noise level of 60 dB(A) can be taken to represent the LAeq (period, traffic). The night-time noise contribution from existing industry is estimated to be 46 dB(A). What is the project-specific amenity (night-time) noise criterion for the proposed industrial development?

Solution: The LAeq (period, traffic) minus 10 dB is greater than the night time ANL of 45 dB(A) as determined from Table 2.1 for urban areas not significantly affected by traffic noise. Therefore, the approach described in Section 2.2.3 of the INP can be applied and the new ANL becomes LAeq (period, traffic) minus 10 dB. As the LAeq (period, traffic) is 60 dB(A), then the new ANL becomes 50 dB(A). This is the amenity noise criterion for the total industry LAeq noise in the area. The project-specific amenity (night-time) noise criterion for the proposed industrial development is then determined by comparing the existing industry LAeq of 46 dB(A) to the new ANL of 50 dB(A) with respect to the modification process given in Table 2.2. This gives the project-specific amenity (night-time) noise criterion of 48 dB(A), that is, new ANL minus 2 dB(A).

B.2.6 Dealing With Cumulative Noise from Multiple Developments

(See INP *Section 2.2.4*)

The intrusive and amenity criteria outlined in *Section 2* of the INP were established primarily to deal with individual development applications for industrial sites in the vicinity of existing sensitive receivers with stable background noise levels. In *Section 2.2.4* the INP recognises that for multiple developments, such as a new industrial area, a strategic approach can be implemented to ensure the amenity objectives are not compromised and an equitable share of the remaining available allocation of amenity-related noise for each industrial development is achieved.

B.2.7 Identifying Which of the Amenity or Intrusive Criteria Apply

(See INP *Section 2.4*)

The INP notes that the PSNL is the more stringent of either the amenity or intrusive criteria. This is not necessarily just a matter of comparing the magnitude of the amenity criteria to the intrusive criteria because different time periods apply (intrusive criteria uses 15 minutes while the amenity criteria are over the day, evening or night period).

For example, where the same number applies to both of the amenity and intrusive criteria, the intrusive criteria would typically be more stringent because it is determined over a much shorter period.

Where the predicted amenity noise level is lower than the intrusive level for the proposed development, the proponent needs to ensure that both levels will be satisfied. In this situation, noise limits specified in the licence conditions will include both the intrusive and amenity noise levels predicted to be achieved by the proposal to ensure that the community is protected from intrusive noise impacts at all times.

B.2.8 Assessing Background Noise Levels

(See INP *Section 3.1*)

To determine the Rating Background Level (RBL) and existing industry-contributed L_{Aeq}, the measurement of ambient noise levels should be undertaken in the absence of noise from the development under consideration.

B.2.9 When the RBL for Evening or Night is Higher than the RBL for Daytime

(See INP *Section 3.1*)

The results of long term unattended background noise monitoring can sometimes determine that the calculated Rating Background Level (RBL) for the evening or night period is higher than the RBL for the daytime period. These situations can often arise due to increased noise from, for example, insects or frogs during the evening and night in the warmer months or due to temperature inversion conditions during winter. The objective of carrying out long-term background noise monitoring is to determine existing background noise levels at a location that are indicative of the entire year.

In determining PSNL from the RBL's, the community's expectations also need to be considered. The community generally expects greater control of noise during the more sensitive evening and night-time periods than the less sensitive daytime period. Therefore, in determining PSNL for a particular development, it is generally recommended that the intrusive noise level for evening be set at no greater than the intrusive noise level for daytime. The intrusive noise level for night-time should be no greater than the intrusive noise level for day or evening. Alternative approaches to these recommendations may be adopted if appropriately justified.

B.2.10 Maximum Noise Levels during Shoulder Periods

(See INP *Section 3.3*)

Noise levels in limit conditions for sleep disturbance would typically be set as a maximum noise level. The approach noted in the INP for developing intrusive criteria for the shoulder period is not appropriate for determining maximum noise levels for the shoulder period. That is, assigning a background noise level based on averaging daytime and night-time RBL's may be appropriate for determining intrusive criteria but it is not appropriate for assigning maximum noise levels. The reason for this is that the day or night RBL is based around the 90th percentile of LA90's, which is quite different to an RBL based on an average. (Additionally, setting maximum noise levels for the shoulder period based on the lowest LA90 during the period is not practical as it can result in the maximum noise limit being set lower than the intrusive noise limit).

In order to generate a statistically valid data set to derive the 90th percentile of LA90's for the shoulder period, a much larger sampling time (than the one week typically applied) would be required, with associated cost and practicality implications. Therefore, a statistical approach to calculating the RBL for shoulder periods is not required by the INP.

It is the intention of the INP that appropriate noise targets for the shoulder period be negotiated with the regulatory/consent authority on a case-by-case basis. The focus of the INP is on avoiding or minimising noise of a high level and/or with intrusive characteristics, during the shoulder period, through the use of best practice.

Options available to the proponent for managing maximum noise levels during the shoulder period are to:

- avoid noise events during the shoulder period (or at least during the first half and then to meet RBL (shoulder period) +15 dB(A) during the second half of the shoulder period);
- collect sufficient data to calculate a statistically robust 90th percentile-based RBL for the shoulder period and use this to determine RBL+15 dB(A) as the maximum noise level limit; and
- conduct a detailed analysis of the number and noise level of noise events, and the exceedence of the background noise level, then, present a case comparing the results of the analysis and the research results contained in Appendix B of the ECRTN.

B.2.11 Tonality - Sliding Scale Test

(See INP *Section 4.2*)

The sliding scale test for tonality outlined in *Section 4* of the INP uses a linear (z-weighted) spectrum (that is, no frequency weighting on each of the octave or third octave bands).

B.2.12 Duration Correction

(See INP *Section 4.2*)

Section 4 of the INP provides guidance on the use of modifying factors to account for certain characteristics of a noise source. The duration factors in *Table 4.2* are intended to increase the criterion that is acceptable, whereas the modifying factor corrections in *Table 4.1* are intended to increase the measured or predicted level.

B.2.13 Determining What Weather Conditions Should Be Used When Predicting Noise

Background

(See INP *Section 5*)

The INP intends that the noise levels used in assessing noise impacts at the consent stage include the effects of any weather conditions that are a feature of the area when the development operates. This means that the effects of weather conditions such as temperature inversions and wind on the noise level experienced at sensitive receivers should be adequately assessed at the consent stage.

Wind can enhance noise propagation compared with calm conditions (where there is no wind). When a wind blows, friction causes the air to move more slowly close to the ground than at higher altitudes. This phenomenon of wind speed increasing with height is termed 'wind shear'. The increase in noise occurs because sound waves from the source are bent through this 'wind shear' back towards the ground.

Unlike temperature inversions, wind can enhance propagation during any time of the day, evening or night. Wind does not increase noise in all directions and can also reduce noise. For example, wind blowing from the south to the north (termed a 'southerly' wind) increases noise to the north of an industrial premise and also reduces noise to the south of that premises.

In some instances, where one or more significant weather conditions have been identified as part of a noise assessment, noise levels from the industrial premises under only these significant weather conditions have been assessed, but noise levels under calm conditions have not.

The INP describes in *Section 5* when weather is "significant" (i.e. it occurs more than 30% of the relevant time period) and how to apply this in the noise assessment. This approach may result in noise levels at some receivers being underestimated, as in the southerly prevailing wind scenario described above.

Recommended Approach

This application note clarifies that in all cases at each receiver:

- noise levels from the premises under calm conditions as well as any significant weather conditions as defined in the INP should be predicted or measured; and
- the highest of the noise levels from Step 1 (above) is to be used in the assessment for that receiver.

The intent of the INP is not to require that these conditions should be applied exclusively where the significant weather conditions act to reduce noise at a sensitive receiver.

For example, where a significant prevailing wind of speed less than three metres per second increases noise levels at a receiver to the north of a development (compared with those predicted under calm conditions), the noise levels predicted under that prevailing wind should be used at that receiver. For receiver(s) to the south of the same development, if the noise levels predicted under calm wind conditions are higher than those predicted under the significant prevailing wind, the noise levels predicted under calm wind conditions should be used at the southern receiver(s).

The DECCW has previously accepted (and will accept) noise predictions based on modelling noise emissions using long term weather data, as it can present a higher level of analysis than that required under the INP.

B.2.14 How Calm Is Defined

(See INP *Section 5.1*)

In the assessment of wind effects, the INP requires the assessment of wind speeds of up to 3 metres per second where these speeds are a feature of the area (they occur for 30% of the time or more) but does not specify the minimum wind speed that needs to be assessed. The calm condition is typically represented by wind speeds less than or equal to 0.5 metres per second as this is likely to be the lower limit of measurement.

B.2.15 Presenting Predicted Noise Impacts

(See INP *Section 6.3*)

In carrying out noise impact predictions for a particular development, predicted noise levels for calm conditions as well as any significant adverse weather conditions should generally be provided. It is particularly useful to provide predicted noise impacts for calm weather conditions where predicted noise impacts under adverse weather conditions exceed the PSNL. This allows for a better understanding of potential noise impacts from the development.

B.2.16 Noise Impact Assessment for the Modification of Existing Industrial Premises

Background

(See INP *Section 10*)

Section 10 of the INP outlines the application of the policy to existing industrial premises. As well as being used to assess noise emissions from new industrial premises, the INP is also applied to situations where existing industrial premises are modified, expanded or upgraded.

Where a modification is proposed, the noise level targets for the premises (termed Project Specific Noise Levels) are to be determined firstly excluding any noise from the subject premises. The noise from the existing premises is then assessed against these targets to determine if there is a need to consider noise mitigation for existing operations. The predicted noise level from the proposed modification is then assessed, both in isolation and in combination with noise from the existing premises.

The total noise emissions from the modified premises should ideally not exceed the Project Specific Noise Levels. If the existing premises cannot achieve these targets, the allowable noise emissions from the proposed modification will be set so that the modification does not significantly increase the existing noise emissions.

Recommended Approach

This application note outlines these processes together with the degree of information required to support a proper assessment of modifications to an existing industrial premises. A noise impact assessment for the modification of existing industrial premises should include, as a minimum:

- existing noise criteria contained in consents, approvals or licences, that are applicable to the premises;
- Project Specific Noise Levels (PSNL) for the premise determined in accordance with the INP and relevant application notes[3];
- where application of the INP results in a PSNL more stringent than existing noise criteria, the PSNL should be adopted for noise assessment purposes[4];

[3] Care should be taken to exclude noise from the existing premises when quantifying background and existing industrial noise levels (further guidance is in the INP in *Section 11.1.2*

- measured or predicted noise levels from the existing premises at noise sensitive receiver locations;

- predicted noise contribution from the proposed modification, in isolation, at noise sensitive receiver locations; and

- cumulative noise levels from the entire premises (i.e. combined level from existing and proposed modification) compared to the PSNL.

B.2.17 Where Noise from the Existing Premises Exceeds the PSNL

Where it can be determined that noise from the existing premises alone is currently exceeding the PSNL, a preliminary analysis of potential noise mitigation measures, and conceptual noise reductions, needs to be undertaken for the existing premises[5]. Once the conceptual mitigated level of noise performance of the existing premises (i.e. what can be achieved) has been determined, the contribution noise level goal for the modification can be determined. The noise level goal for the modification should be set at least 10dB below the PSNL, or where it has been determined that the existing premises cannot achieve the PSNL, it should be set at least 10dB below the conceptual mitigated noise performance of the existing premises.

This approach is designed to ensure that noise from the modification does not become the limiting factor in noise from the entire premises potentially meeting the PSNL.

---

[4] The INP acknowledges that the PSNL is a goal sought to be achieved through the application of feasible and reasonable noise mitigation measures and is not necessarily applied as a statutory limit by default.

[5] This does not mean that in all circumstances noise mitigation to existing premises will be required as part of a modification. Decisions of this nature will be determined on a case-by-case basis, taking into account various factors, for example, feasible and reasonable mitigation options, the absolute level of noise and existing measures of community impact, including complaint

B.2.18 Prosecution Guidelines

(See INP *Section 11.1*)

The DECCW's approach to prosecuting offences is described in EPA prosecution guidelines, 2001, particularly *Sections 3.2* to *Section 3.6* under 'Discretion' which states that "*not every breach of the criminal law is automatically prosecuted*", "*The EPA has a discretion as to how to proceed in relation to environmental breaches*" and "*Each case will be assessed to determine whether prosecution is the appropriate strategic response*". *Sections 3.7* to *Section 3.8* under '*Factors to be considered*' in the Guidelines describe factors that are considered when determining whether prosecution is required, such as "*whether the breach is a continuing or second offence*", "*the availability and efficacy of any alternatives to prosecution"* and "*the prevalence of the alleged offence and the need for deterrence, both specific and general*".

B.2.19 Using Appendix D

Appendix D of the INP provides a rough guide for predicting the increase in noise due to inversion effects. The data provided is based on simple calculations performed using the Environmental Noise Model (ENM), assuming flat ground and no barriers.

The use of this Appendix may underestimate the effects of temperature inversions where a barrier or intervening topography is present. For detailed noise impact assessments, a more thorough analysis of noise impacts under temperature inversions is expected. Where a noise model such as SoundPlan or ENM is used to determine noise impacts from a development under calm conditions or during wind conditions, the model should also be used to determine potential noise impacts under inversion conditions, rather than using Appendix D of the INP.

B.2.20 How to Account For Operations That Only Occur For Part of the Day, Evening or Night

If a plant operates throughout the day and evening but only part of the night, the assessment and applicable criteria are based on the period that the plant operates. For example, if the night operation occurs between 10 pm and 3 am the assessment of background noise and existing noise from industry would cover only those 5 hours and the applicable criteria would be derived from this period. The same applies for part operation during the day or evening.

The basic inputs needed to establish the amenity criteria are the existing industrial noise and the ANL's for different types of receivers. The amenity criterion is then obtained by a process that seeks to limit continuing increases in noise levels from industrial sources. The amenity criterion is equally applicable to a development that operates only for a portion of the relevant assessment period.

During the impact prediction phase, determining whether an industrial activity meets the amenity criteria entails assessing the noise level emissions from the activity over the period it takes place. Typically this would correspond to the times during which the industrial operation has approval to operate as specified in a licence or consent.

For example, where an industrial operation commences at 5am, the period during which to assess night-time amenity would be from 5am to 7am. A noise impact assessment should not include the period during which the industrial operation does not operate (the night-time hours of 10pm to 5am).

The basic premise of assessing noise over the period that an activity occurs has and continues to be the standard approach.

The existing industrial noise should be used in conjunction with the appropriate ANL to establish the amenity criteria applicable. The criteria are applicable to the hours the development operates.

If there were a disparity between the approved operating hours and the actual period over which industrial activities take place then the appropriate period to apply to assessing amenity would need to be assigned with the aim of assessing noise over the time in which industrial activities take place. In practice, it is expected that this is unlikely to be a significant issue as most industrial operations conduct industrial activities during their approved operating hours.

In situations where high levels of ambient noise occur the INP provides a mechanism to adjust the applicable noise criteria so as not to impose overly stringent criteria. For example, if an industry operates from 5am to 7am and the receiver premises experience high levels of existing traffic noise at this time, the ANL used to derive the amenity criteria can be adjusted on the basis of the high existing traffic noise. If the existing industrial noise is low, then the traffic-modified ANL becomes the amenity criterion.

B.2.21 Sleep Disturbance

Peak noise level events, such as reversing beepers, noise from heavy items being dropped or other high noise level events, have the potential to cause sleep disturbance. The potential for high noise level events at night and effects on sleep should be addressed in noise assessments for both the construction and operational phases of a development. The INP does not specifically address sleep disturbance from high noise level events.

DECCW reviewed research on sleep disturbance in the ECRTN. This review concluded that the range of results is sufficiently diverse that it was not reasonable to issue new noise criteria for sleep disturbance.

From the research, DECCW recognised that current sleep disturbance criterion of an $L_{A1\ (1\ minute)}$ not exceeding the $L_{A90\ (15\ minute)}$ by more than 15 dB(A) is not ideal. Nevertheless, as there is insufficient evidence to determine what should replace it, DECCW will continue to use it as a guide to identify the likelihood of sleep disturbance. This means that where the criterion is met, sleep disturbance is not likely, but where it is not met, a more detailed analysis is required.

The detailed analysis should cover the maximum noise level or $L_{A1\ (1\ minute)}$ that is, the extent to which the maximum noise level exceeds the background level and the number of times this happens during the night-time period. Some guidance on possible impact is contained in the review of research results in the appendices to the ECRTN. Other factors that may be important in assessing the extent of impacts on sleep include:

- how often high noise events will occur;
- time of day (normally between 10pm and 7am); and
- whether there are times of day when there is a clear change in the noise environment (such as during early morning shoulder periods).

The $L_{A1\ (1\ minute)}$ descriptor is meant to represent a maximum noise level measured under 'fast' time response. DECCW will accept analysis based on either $L_{A1\ (1\ minute)}$ or L_{AMax}.

B.2.22 Addressing Privately Owned Haul Roads

Noise from privately owned haul roads is to be assessed as an industrial noise source according to the INP. The practice of treating access roads as part of the industrial premises with which they are associated is a long established part of noise management in NSW, which the INP has not changed. The basis for treating vehicles on private access roads as part of an industrial noise source lies in the relationship between the enterprise and the noise, and the community's response to noise from vehicles operating on private roads.

The character of the noise is different to general road traffic noise: Traffic on access roads is solely related to the operation of the site served by the access road and is usually composed almost entirely of heavy vehicles, producing noise of a different character to the typical public roadway where smaller vehicles typically predominate.

Factors that influence community response are different compared to public roads: The distribution of benefits from the operation of a private access road is typically perceived to be different than from a public road. Affected members of the public have been reported as questioning the equity of truck noise degrading their amenity for the benefit of others.

The degree of control possible for traffic on a private access road is typically perceived as greater than for a public road. The result is a higher level of expectations that more can and should be done to reduce noise from the private road (than from a public one).

B.2.23 Determining Noise Limits for Licence Conditions

Where the proponent predicts that noise levels from the industrial development would be below the PSNL, then the noise limits specified in the licence/consent conditions should reflect the noise levels that the proponent states would be achieved (that is, the predicted noise levels, however a minimum intrusive criterion of 35 dB(A) still applies). This is for a number of reasons:

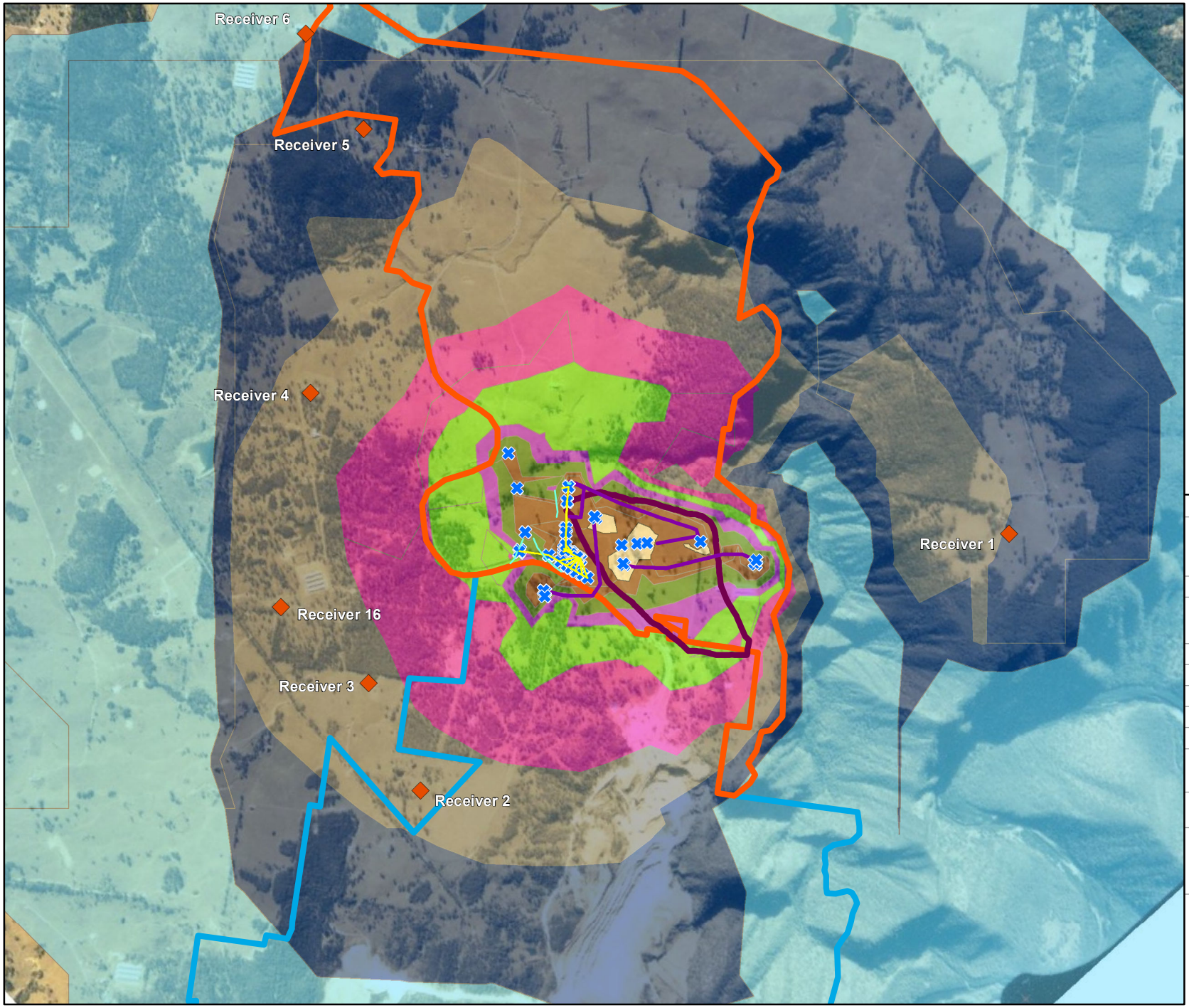
- to ensure that the best-management practices and best available technology described in the noise impact assessment report are actually adopted by the proponent;
- to ensure that the level of achievable performance presented by the proponent to the public, though public documentation such as Environmental Impact Statements, is achieved;
- to optimise the opportunity for further industrial development in the area without an unacceptable degradation of the acoustic amenity of the area; and
- to fulfil a general aim of the environmental assessment process to minimise environmental impacts.

It should be noted that noise limits would apply to the contributed noise levels from only the premises or site of concern. In setting noise limits, judgement needs to be made as to whether the predicted noise levels warrant noise limits on the licence/consent. Where the predicted noise levels from the premises of concern are well below the PSNL, there may be no need for noise limit conditions.

Any tolerances to the predicted noise levels should be addressed in the proponent's assessment of impacts so that the predicted noise levels can be applied in conditions.

Annex C

Noise Contours



Legend

- Point Sources
- Line Sources
- Moving Source
- Noise Barriers
- Noise Assessment Receiver Locations
- Proposed Quarry Location
- Boral Peppertree Property Boundary
- Boral Cement Property Boundary

Noise Contours

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- 30 - 35
- 35 - 40
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Annex C - Noise Contour Plots

Processing Operations, East and West Overburden Dumps - Day Time Calm

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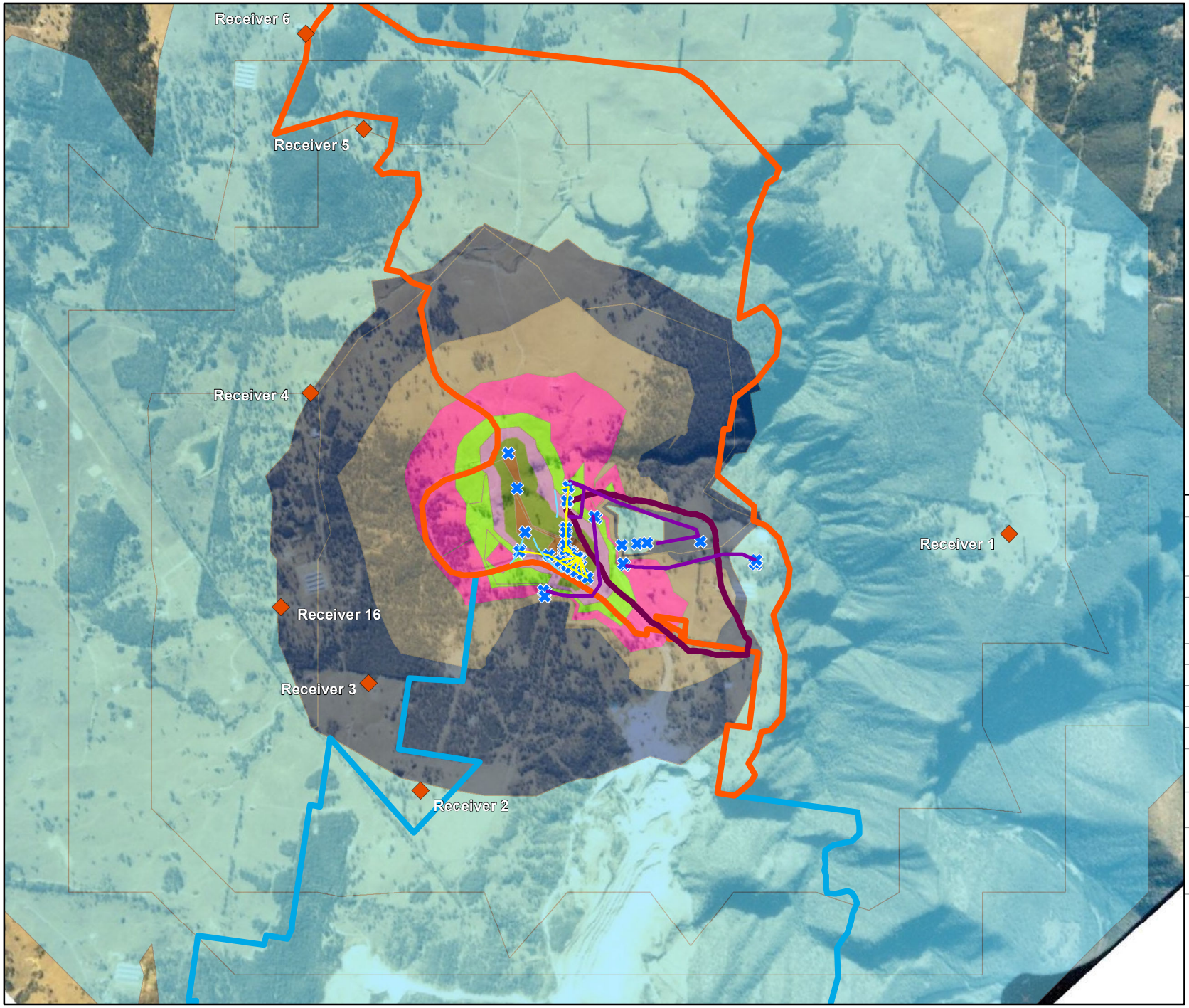

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Annex C - Noise Contour Plots

Processing Operations, East and West Overburden Dumps - Night Time Calm

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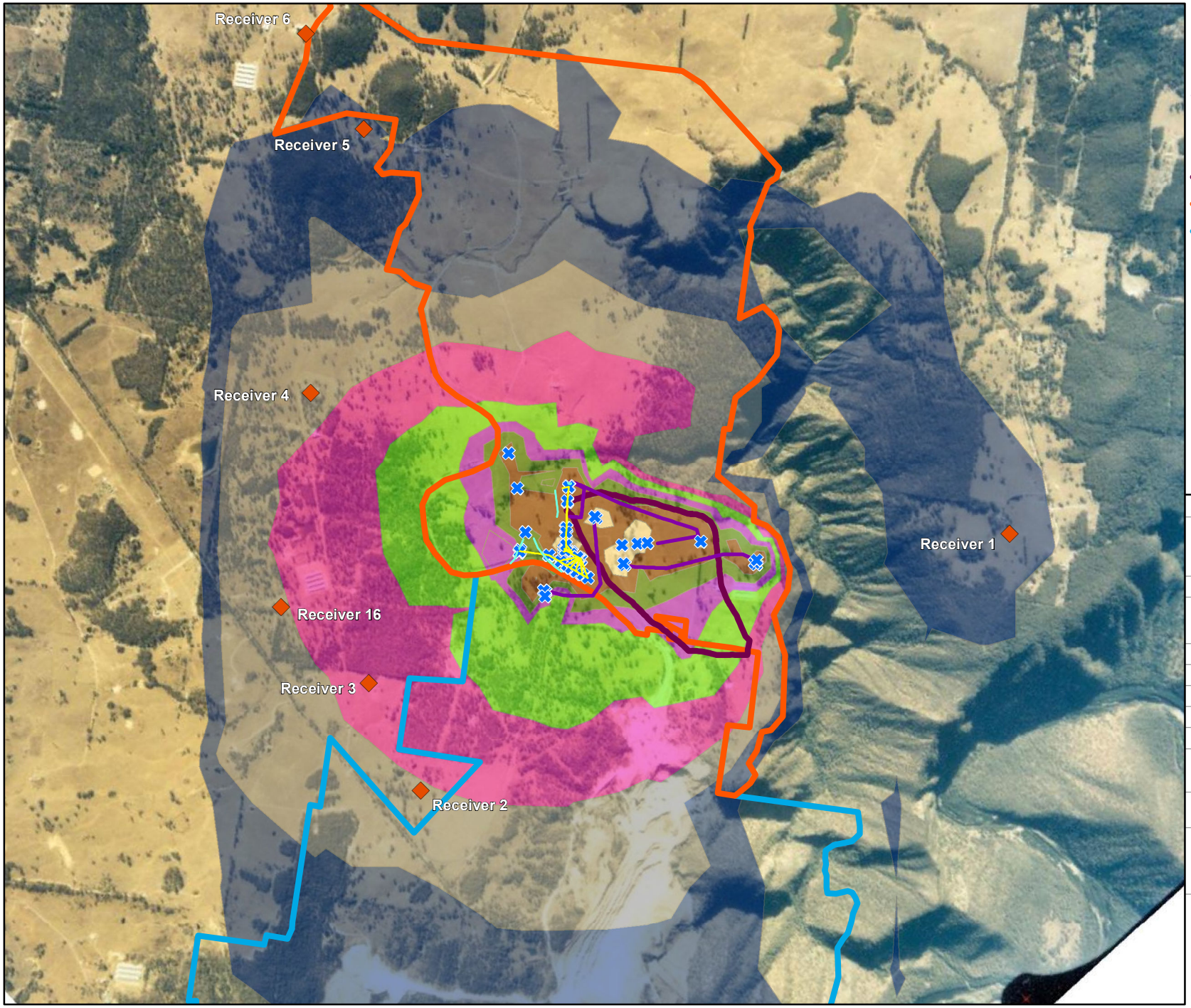

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Annex C - Noise Contour Plots

Processing Operations, East and West Overburden Dumps - North East Prevailing Wind

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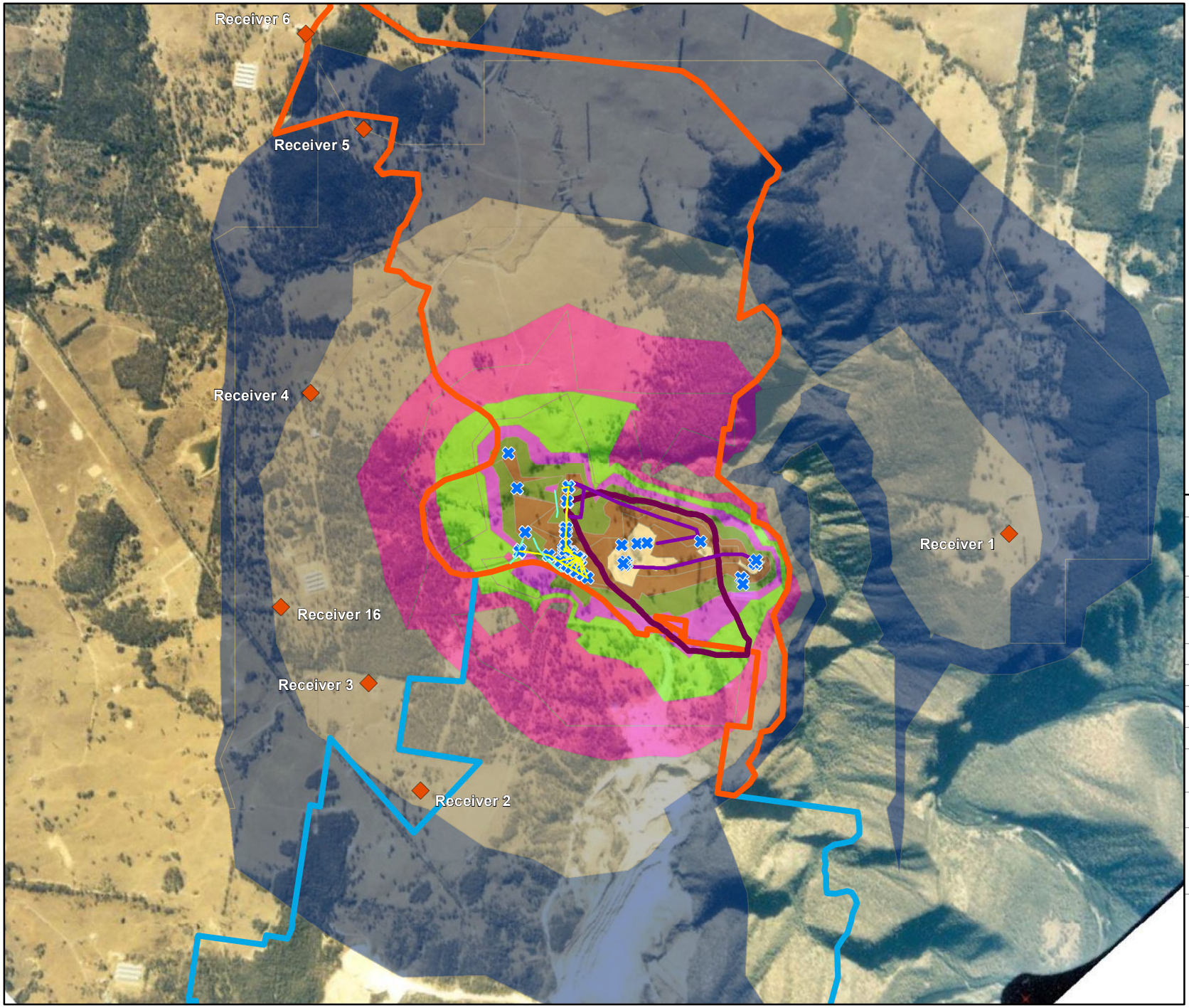

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Processing Operations, East Overburden Dump - Day Time Calm

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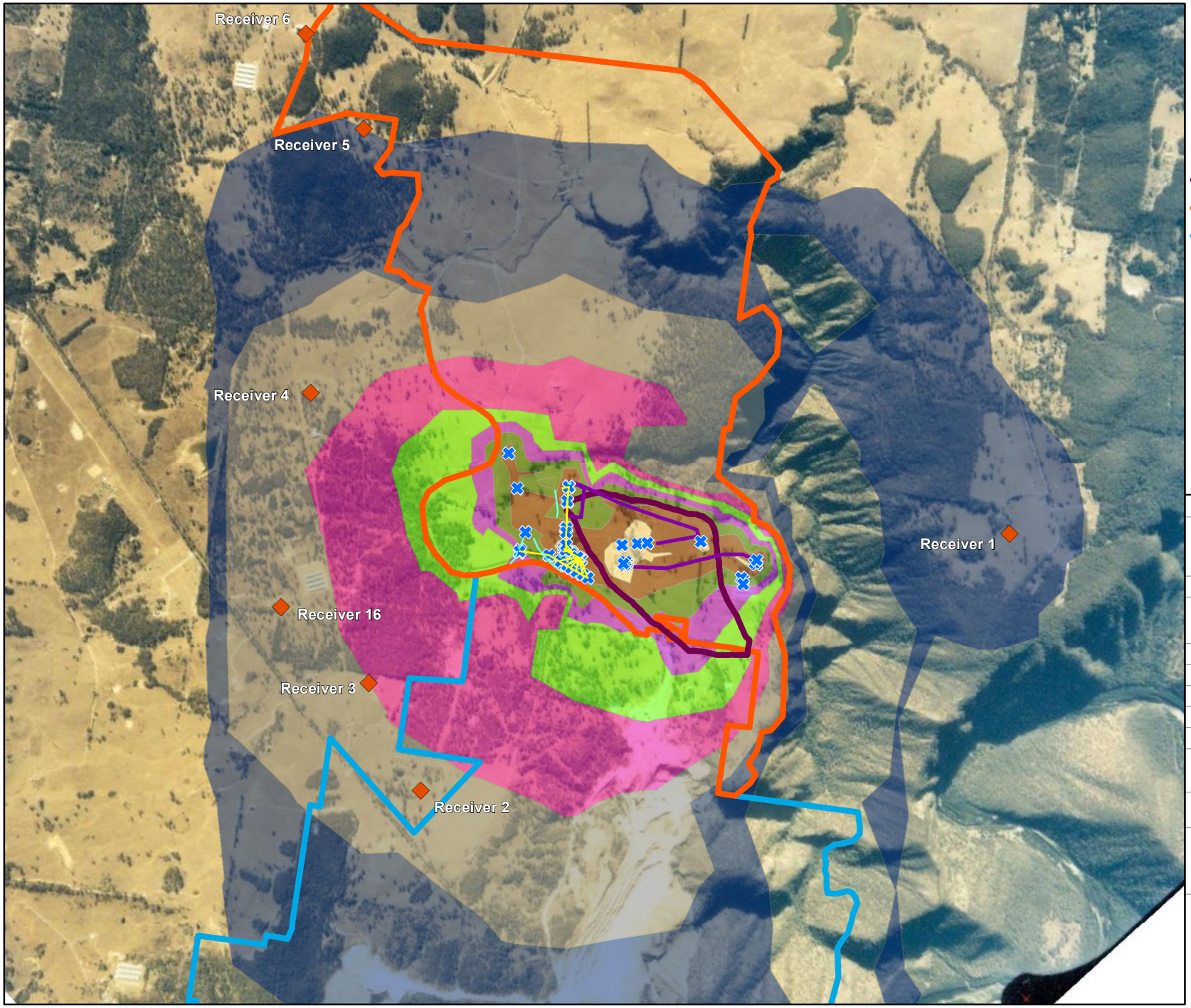

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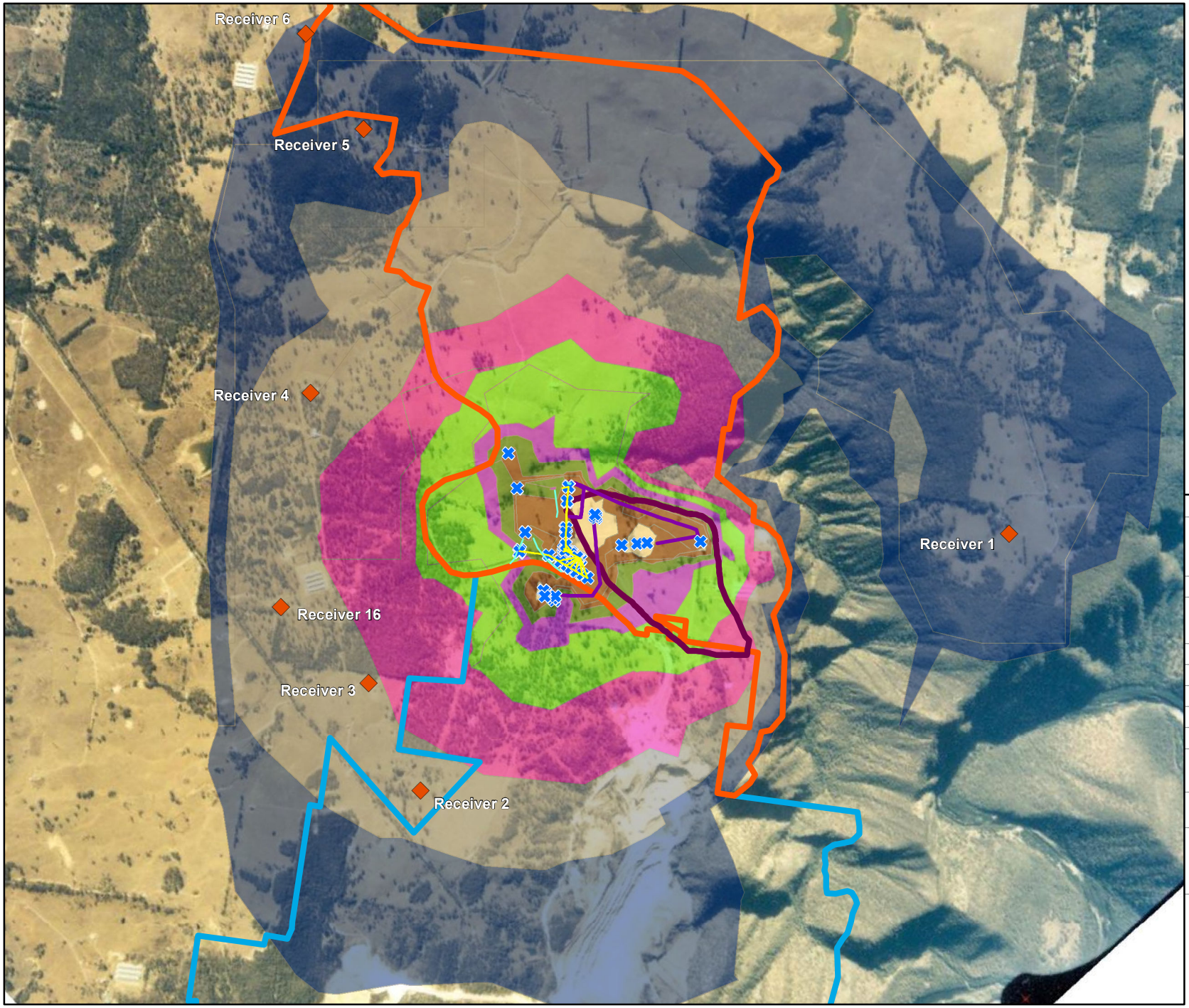

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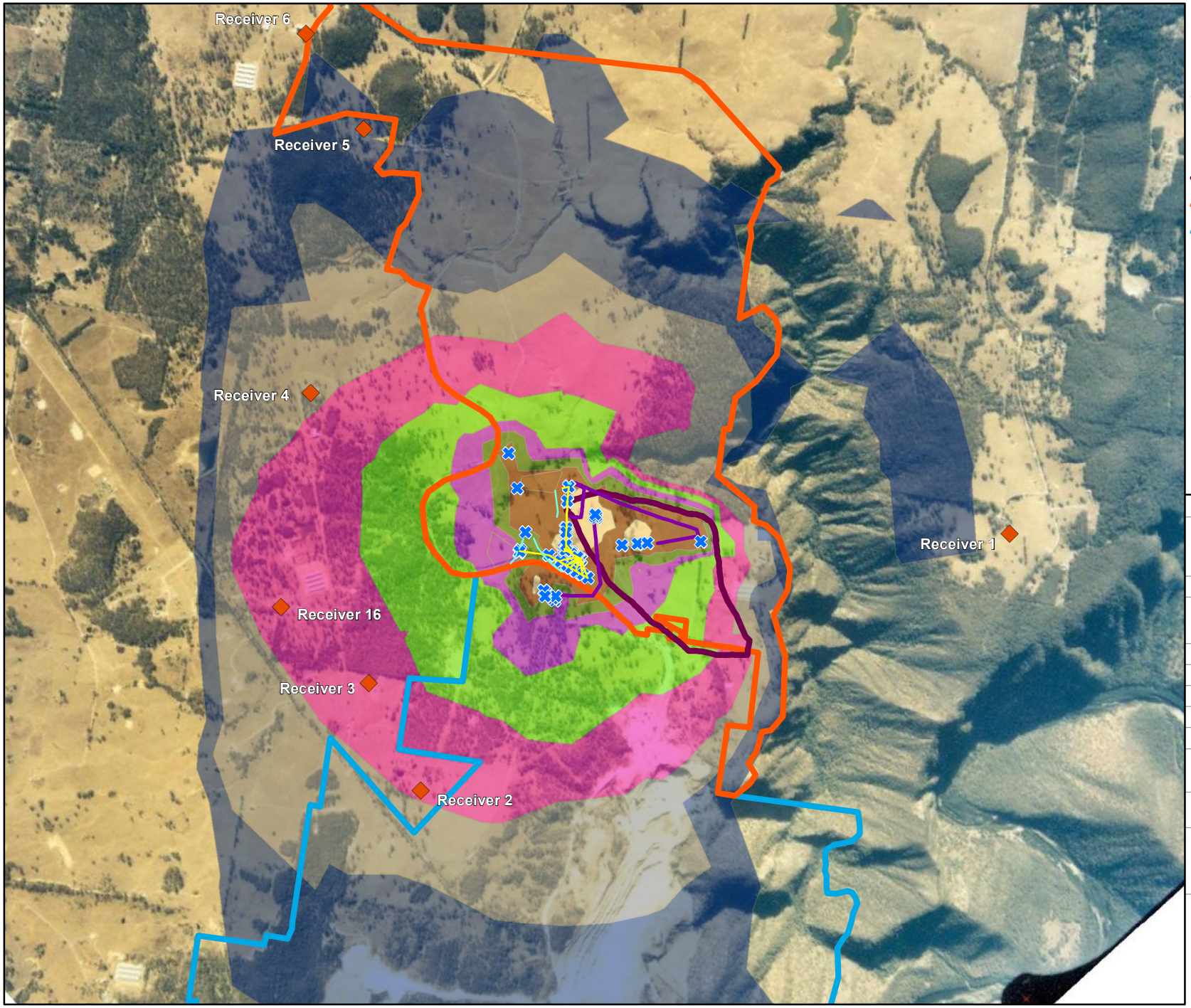

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Annex D

Air Quality Modelling Assessment

AIR QUALITY MODELLING

MODIFICATIONS TO PEPPERTREE QUARRY (FORMERLY MARULAN SOUTH QUARRY)

ERM Australia
on behalf of
Boral Resources (NSW) Pty Ltd

Job No: 5886

6 May 2011

PROJECT TITLE:	Modifications to Peppertree Quarry (formerly Marulan South Quarry)
JOB NUMBER:	5886
PREPARED FOR:	Karl Rosen – ERM Australia
WRITTEN BY:	C. Isley & J. Barnett
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PAEHolmes a Division of Queensland Environment Pty Ltd
ABN 86 127 101 642

SYDNEY:
Suite 203, Level 2, Building D, 240 Beecroft Road
EPPING NSW 2121
Ph: 02 9809 0900
Fax: 02 9809 0999

BRISBANE:
Level 1, La Melba, 59 Melbourne Street South Brisbane Qld 4101
PO Box 3306 South Brisbane Qld 4101
Ph: +61 7 3004 6400
Fax: +61 7 3844 5858

Email: info@paeholmes.com

Website: www.paeholmes.com

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1 INTRODUCTION

An air quality impact assessment (AQIA) was prepared in 2006 for the Marulan South Quarry Project (**HAS 2006a**). This project was approved in 2007. Boral Resources (NSW) Pty Ltd (Boral) has now proposed modifications to their previous design, now referred to as Peppertree Quarry.

This report provides additional air quality modelling for those modifications relevant to air quality, for inclusion with a Section 75W modification application to be lodged with the Department of Planning (DoP) by Environmental Resources Management Australia Pty Ltd (ERM). This report will provide a quantitative analysis of the modified project with regard to dust, comparing predicted dust impacts to those predicted in the AQIA.

The modifications pertaining to dust impacts are understood to include the following;

- Changed haulage routes reducing the overall hauling distances for overburden and rejects;
- The relocation of the processing and rail-loading system 250 m to the northeast; and
- A new western overburden emplacement area and bunding, to be located at the site of the former processing plant.

It is also noted that an additional residential receptor is now located in the study area at which dust impacts will also need to be considered. Production volumes and activities are otherwise unchanged with regard to their capacity for dust generation from those modelled in the original AQIA.

Hauling overburden to the emplacement area within the adjacent limestone mine (Boral Cement (BC), 14 km return distance) was the major emission source in the original AQIA. This emplacement area will initially be replaced by the new western overburden emplacement area. The western and eastern emplacement areas will be used initially and haulage will only commence to BC when the eastern and western emplacement areas reaches capacity. Haulage to the BC south pit has not been re-modelled in this study.

The modified layout of the Peppertree Quarry is shown in **Figure 1.1**. An additional residential receptor has been included to the west of the quarry, labelled as Residence 16.

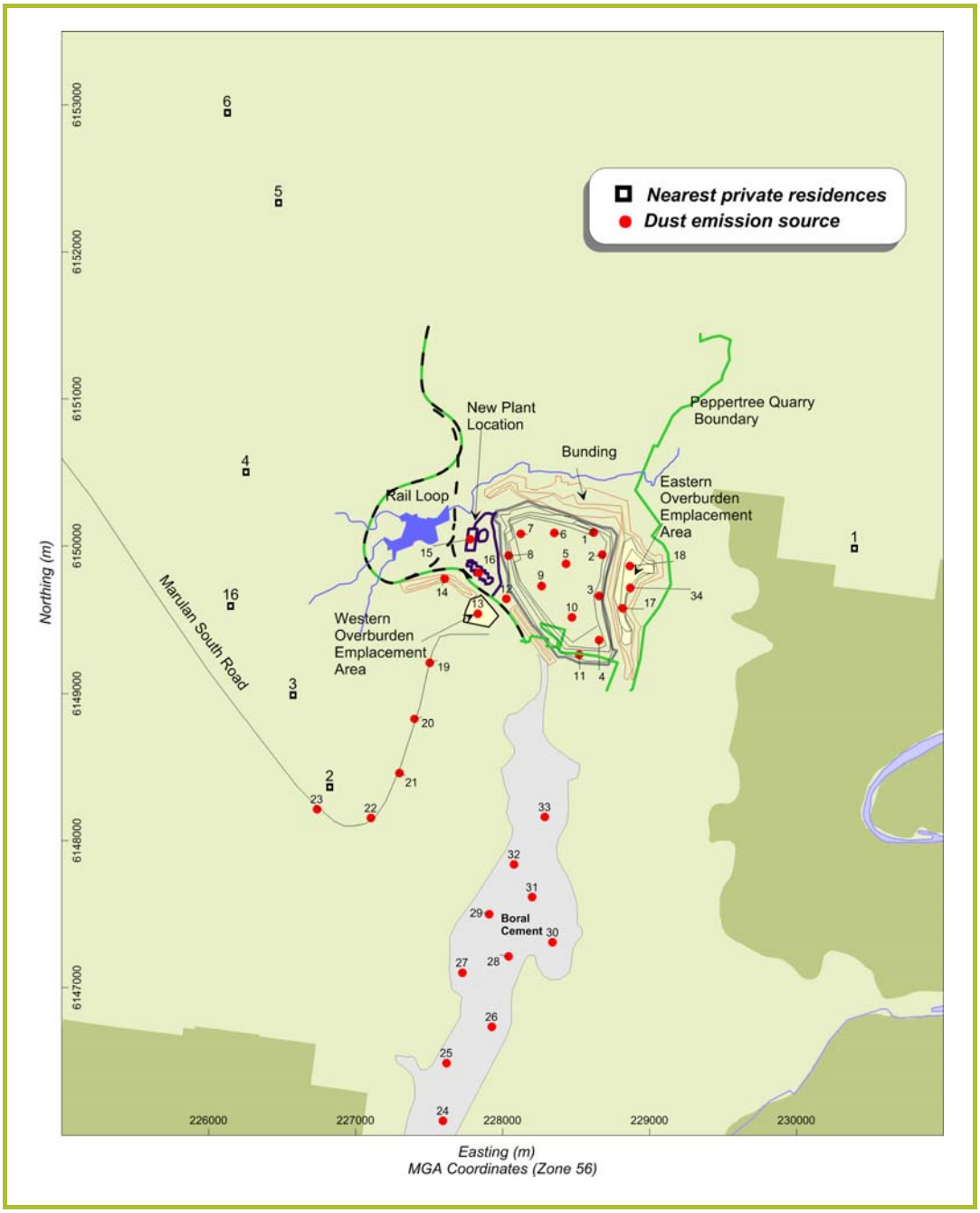

Figure 1.1: Layout of Peppertree Quarry

2 AIR QUALITY CRITERIA

This section provides information on the air quality criteria used to assess the impact of emissions. The assessment criteria provide benchmarks, which if met, are intended to protect the community against the adverse effects of air pollutants. These criteria are generally considered to reflect current Australian community standards for the protection of health and protection against nuisance effects. There have been some changes to air quality criteria from the time of the original AQIA work in 2006. The most up to date information is presented in the following sections.

2.1 Assessment Criteria

2.1.1 Particulate Matter

The Director-General's Requirements (DGR's) for the initial project application require an assessment of the potential impacts of the project, taking into consideration any relevant guidelines. The DGR's list the Approved Methods (**DEC, 2005**) as applicable guidelines. **Table 2.1** includes the particulate matter criteria from the Approved Methods (**DEC, 2005**) that are relevant to this study.

Table 2.1: Air quality criteria/standards for particulate matter concentrations

Pollutant	Criterion/ Standard	Averaging Period	Source
TSP[a]	90 µg/m^3	Annual mean	NHMRC
PM_{10}[b]	50 µg/m^3	24-hour average	**DEC** (**2005**) (impact assessment criteria) National Environmental Protection Measures (NEPM) (ambient air quality standard, allows five exceedances per year, e.g. for bushfires and dust storms)
	30 µg/m^3	Annual mean	**DEC** (**2005**) (impact assessment criteria)

2.1.2 Dust Deposition

In addition to health impacts, airborne dust also has the potential to cause nuisance effects by depositing on surfaces. **Table 2.2** shows the maximum acceptable increase in dust deposition over the existing dust levels from an amenity perspective. These DECCW criteria for dust fallout levels are set to protect against nuisance impacts (**DEC, 2005**).

Table 2.2: DECCW criteria for dust (insoluble solids) fallout

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
Deposited dust	Annual	2 g/m^2/month*	4 g/m^2/month

* grams per square metre per month

[a] TSP refers to all particles suspended in the air. In practice, the upper size range is typically 30 to 50 µm.

[b] PM_{10} refers to all particles with the equivalent aerodynamic diameters of less than 10µm, that is, all particles that behave aerodynamically in the same way as spherical particles with a unit density.

2.2 Recent Approval Conditions

Recent Department of Planning (DoP) Project Approval conditions are relevant to managing an operating project, and it is appropriate to consider these in the overall assessment of mitigation and management options for a proposed project. The Marulan South Quarry Project Approval include the cumulative criteria in **Table 2.3** and in **Table 2.4**.

Table 2.3: Recent DoP Project Approval air quality assessment criteria

Pollutant	Criterion	Averaging Period	Application
TSP	90 μg/m^3	Annual mean	Total impact
PM_{10}	50 μg/m^3	24-hour average	Total impact
	30 μg/m^3	Annual mean	Total impact
Deposited dust	2 g/m^2/month	Annual mean	Incremental impact
	4 g/m^2/month	Annual mean	Total impact

Table 2.4: Recent DoP Project Approval air quality acquisition criteria

Pollutant	Criterion	Averaging Period	Application
TSP	90 μg/m^3	Annual mean	Total impact
PM_{10}	150 μg/m^3	24-hour average	Total impact
	50 μg/m^3	24-hour average	Incremental impact
	30 μg/m^3	Annual mean	Total impact
Deposited dust	2 g/m^2/month	Annual mean	Incremental impact
	4 g/m^2/month	Annual mean	Total impact

The criteria for TSP and PM_{10} in recent DoP Project Approval conditions exclude all extraordinary events such as bushfires and dust storms. Total impact includes the impact of a project and all other sources, whilst incremental impact refers to the impact of the project considered in isolation.

3 EXISTING ENVIRONMENT

3.1 Meteorology

The original AQIA used meteorological data from an automatic weather station on the Boral property, collected for the period May 2004 to April 2005. To allow comparison of the modified Peppertree Quarry design with dust impacts reported in the AQIA, this same meteorological data set has been used.

3.2 Existing air quality

3.2.1 Annual Average Dust Concentration

The data available to describe the existing air quality for the project area remains the same as reported in the AQIA, that is, the four month period from November 2005 to February 2006. Two

high volume air samplers collected measurements for both TSP and PM_{10} over this period and the following values were taken to represent estimated annual average background levels:

- Annual average TSP of 25 $\mu g/m^3$
- Annual average PM_{10} of 16 $\mu g/m^3$

3.2.2 Annual Average Dust Deposition

Monthly deposition levels were collected by BC from February 2001 to August 2005 across a network of six gauges. These measurements would include effects from all existing sources in the area, including the BC operations. Results varied across the network, depending on their proximity to the existing quarry, but a value of 3 g/m^2/month was taken to be the likely annual average dust deposition background level. This will be conservative as it will include emissions from BC.

3.2.3 24-hour PM_{10} Concentration

In addition, the DECCW guidelines require an assessment against 24-hour PM_{10} concentrations. The Approved Methods procedure involves predicting the 24-hour concentration due to the project, determining the appropriate background concentration, adding the two together and comparing these with the assessment criteria, which in the case of 24-hour PM_{10} is 50 $\mu g/m^3$.

However, from time-to-time the 24-hour PM_{10} assessment criterion of 50 $\mu g/m^3$ is exceeded in most places across Australia. This occurs within metropolitan areas and in rural areas and may arise because of the presence of bushfire smoke, dust storms and the like. In any circumstance where the existing background ambient PM_{10} level concentration exceeds 50 $\mu g/m^3$, it is clearly not possible for a project to comply with the 50 $\mu g/m^3$ level.

The DECCW has developed a procedure for dealing with these circumstances. In Section 5.1.3 of the Approved Methods it states *"in some locations, existing ambient air pollutant concentrations may exceed the impact assessment criteria from time-to-time. In such circumstances, the licensee must demonstrate that no additional exceedances of the impact assessment criteria will occur as a result of the proposed activity and that best management practices will be implemented to minimise emissions of air pollutants as far as is practical…"*. The procedure presupposes that the proponent has access to a time-series of 24-hour PM_{10} concentrations for each day in a year and contemporaneous meteorological data for the same period so that the model can be run. For the current project, there is no contemporaneous time series of background PM_{10} concentrations available, but as will be seen in **Section 6.3.2**, an alternative approach was used in the 2006 AQIA and approved by the Department of Planning.

4 REVISED EMISSION ESTIMATES

As previously reported in the AQIA, production will initially be relatively low, commencing at 1-2 million tonnes per annum (mtpa), increasing to 3.5 mtpa. Emissions estimates are shown in **Table 4.1** have been based on the maximum production rate of 3.5 mtpa in order to reflect worst-case dust conditions.

The changes in dust emissions compared with the AQIA are as follows.

- Reject materials from the processing plant are proposed to be hauled a shorter distance to the western overburden emplacement area, conservatively

estimated as a 2 km round trip. This would replace the 14 km (return) haul to the BC south pit, resulting in a dust emission reduction of 150,000 kg/year;

- Hauling overburden to emplacement areas is now proposed to be from the Peppertree Quarry pit to either the eastern or western overburden emplacement area (estimated return trip of 3km in either case), rather than a 14 km return trip to the BC south pit. This would bring a dust emission reduction of 345,000 kg/year;
- The proposed western overburden emplacement area adds an additional exposed area of 3.5 ha[c]. This would result in dust emissions of approximately 11,519 kg/year.
- It is estimated that wind erosion arising from areas of additional bunding to be constructed around the pit will add approximately 8,611 kg/year to dust emissions from the project.

The net effect of these proposed changes on dust emissions from Peppertree Quarry operations is a reduction of 474,798 kg/year total dust emission. This is a reduction of more than 30% on dust emission levels estimated in the original AQIA.

In an effort to minimise dust impacts to surrounding receivers, haul trucks will be directed to either the western or eastern dumps depending on wind direction. That is, for example, using the western dump during westerly winds to maximise the source to receiver distance. The model used in this study was unable to reflect such haulage conditional on wind direction and hence will likely over predict dust levels at residences due to haulage.

Haulage to the BC south pit will still be required when the eastern and western overburden emplacement areas reach capacity. This has not been modelled in this assessment as it has already been modelled for the approved design, as presented in the original AQIA. It is assumed that by such time as the BC is required for dumping overburden, the eastern and western overburden areas would be rehabilitated, or undergoing rehabilitation and hence not contributing any dust emission additional to that modelled in the AQIA.

Further assumptions made for the purposes of estimating and calculating dust emissions are listed in the AQIA. Dust emissions as input into the ISCST3 model are listed in **Appendix A**.

[c] Exposed surface area as advised by ERM Australia.

Table 4.1: Dust emission estimates

ACTIVITY	Calculated TSP emission (kg/y)	
	Maximum production (3.5 Mtpa) Approved layout	Maximum production (3.5 Mtpa) Modified layout
Drilling rock	10,227	10,227
Blasting rock	1,880	1,880
Loading overburden to trucks	1,894	1,894
Hauling overburden to emplacement area	402,500	57,500
Dumping overburden to emplacement area	1,894	1,894
Dozer shaping overburden dump	17,472	17,472
Loading rock to trucks	6,588	6,588
Hauling rock to hopper/crusher	300,000	300,000
Dumping rock to hopper/crusher	6,588	6,588
Primary crushing and screening	6,080	6,080
Secondary crushing and screening	122,160	122,160
Tertiary crushing and screening	122,160	122,160
Loading to product stockpiles	6,119	6,119
Loading product to road trucks	170	170
Transport product off-site (sealed road)	26,667	26,667
Loading product to trains by conveyor	1,315	1,315
Wind erosion from exposed pit areas and bunds	231,828	240,439
Wind erosion from product stockpiles	9,935	9,935
Wind erosion from overburden emplacement area	33,118	44,637
Loading rejects (weathered material)	212	212
Hauling rejects to overburden emplacement	175,000	25,000
Dumping rejects at emplacement area	212	212
Grading roads	1,418	1,418
Annual production (t)	**3,500,000**	**3,500,000**
TOTAL DUST (kg)	**1,485,436**	**1,010,567**

5 APPROACH TO ASSESSMENT

This assessment has followed the same modelling methodology as was used in the 2006 AQIA. The model used was the US EPA ISCST3 model. A calibration factor of 1.6 has been applied to predictions of 24-hour PM_{10}. The rationale for this scaling factor is detailed in the AQIA.

In the AQIA, the maximum production year scenario produced, as expected, consistently higher predicted dust impacts than the modelling scenario for the first year of production. In order to ascertain the maximum likely dust impact on residences near the Peppertree Quarry, the maximum production year scenario has been modelled in this report for the modified quarry layout.

The particle size distribution, as used in the AQIA, is as follows:

- $PM_{2.5}$ (FP) is 4.7% of the TSP;
- $PM_{2.5-10}$ (CM) is 34.4% of TSP; and
- PM_{10-30} (Rest) is 60.9% of TSP.

Dust concentrations and deposition rates have been predicted over an area 10 km by 12 km with the quarry site located approximately in the centre. Local terrain has been included in the modelling.

Model predictions have been made at 103 discrete receptors, including residential locations, located in the study area. The location of these receptors has been chosen to provide finer resolution closer to the dust sources and nearby receptors.

6 ASSESSMENT OF IMPACTS

6.1 Assessment Criteria

The air quality criteria used for identifying which properties are likely to experience air quality impacts are those specified in the Approved Methods (**DEC, 2005**) and were presented in **Section 2.1**.

The criteria are:

- 50 µg/m^3 for 24-hour average PM_{10} concentrations;
- 30 µg/m^3 for annual average PM_{10} concentrations;
- 90 µg/m^3 for annual average TSP concentrations;
- 2 g/m^2/month for annual average deposition (insoluble solids) due to the project considered alone; and
- 4 g/m^2/month for annual average predicted cumulative deposition (insoluble solids) due to the project and other sources.

A predicted level above any of these air quality criteria at a privately owned residence was taken to represent a potential air quality impact. **Section 6.2** presents a simple comparison of the

original modelling results with those for the modified project. This comparison is for the Peppertree Quarry alone. Cumulative impacts are presented in **Sections 6.3**.

6.2 Modified Peppertree Quarry

Dispersion model predictions for the maximum production year of quarry operations are summarised in **Table 6.1** for the nearest residences. Predicted results are shown for both the layout as presented in the AQIA and the new proposed layout. Results have also been included for an additional residence, labelled as Residence 16 (see **Figure 1.1**), which did not form part of the assessment in the AQIA.

Some higher 24-hour PM_{10} concentrations are predicted to the west of the site. This differs from the 24-hour PM_{10} contours presented in the 2006 AQIA but is not unexpected given the presence of the western overburden emplacement area.

In **Table 6.1**, it can be seen that annual average dust concentrations and deposition levels are, in general, similar to those in the AQIA. Some residences experience a slight increase in dust levels and others a slight decrease under the proposed modification. It should be noted, however, that predicted TSP and PM_{10} concentrations at Receptor 3, the worst affected receptor, are lower than for the AQIA.

Table 6.1: Predicted impacts for the Peppertree Quarry alone

ID	Easting (m)	Northing (m)	Approved layout	Modifiied layout
Maximum 24-hour average PM_{10} concentrations ($\mu g/m^3$)				
1	230394	6149983	22.0	27.7
2	226824	6148362	25.6	30.4
3	226574	6148989	41.3	36.5
4	226253	6150502	16.8	20.6
5	226475	6152336	7.0	8.9
6	226127	6152946	5.3	7.1
16	226158	6149591	-	34.8
Annual average PM_{10} concentrations ($\mu g/m^3$)				
1	230394	6149983	4.0	4.9
2	226824	6148362	4.4	6.6
3	226574	6148989	8.7	7.6
4	226253	6150502	2.2	2.1
5	226475	6152336	1.0	0.9
6	226127	6152946	0.7	0.7
16	226158	6149591	-	6.1
Annual average TSP concentrations ($\mu g/m^3$)				
1	230394	6149983	4.3	5.3
2	226824	6148362	4.7	8.0
3	226574	6148989	9.1	8.0
4	226253	6150502	2.4	2.3
5	226475	6152336	1.1	1.0
6	226127	6152946	0.8	0.7
16	226158	6149591	-	6.4
Annual average dust deposition ($\mu g/m^2/month$)				
1	230394	6149983	0.31	0.45
2	226824	6148362	0.10	0.28
3	226574	6148989	0.16	0.15
4	226253	6150502	0.08	0.08
5	226475	6152336	0.03	0.03
6	226127	6152946	0.02	0.02
16	226158	6149591	-	0.15

6.3 Cumulative Impacts

Cumulative impacts are represented by the addition of both background monitoring data as well as the contribution from BC operations. This will involve an element of double counting as existing BC emissions will be included in the background monitoring data, but to an unknown extent. Additional modelling was carried out to include the estimated BC emissions, with the modified Peppertree emissions. Measured background levels were then added to these predictions and the results are discussed in the following two sections. This is a conservative approach and the results are considered likely to overestimate actual levels.

For emissions estimation, to be consistent with the assumptions in the original AQIA, it was assumed that the BC operations produce 4 Mtpa of product per year and that the BC dust emissions remain unchanged compared with those modelled in the AQIA. In the modelling, the BC mine was represented by a number of volume sources. Details on how the BC was modelled are included in the AQIA and the same procedure has been followed in this assessment.

6.3.1 Annual Average Predictions

Model results for annual average TSP and PM_{10} concentrations, as well as dust deposition levels, are presented in **Table 6.2**. The background levels summarised in **Section 3.2** have been added to the modelling results. These results show that annual average PM_{10} and TSP concentrations and annual average dust deposition would be below relevant air quality criteria at the nearest residences due to the combined effects of the Peppertree Quarry, the BC mine and other local sources of dust. As mentioned previously, including both monitoring data and modelled emissions from the BC operations is a conservative approach.

Table 6.2: Predicted cumulaitve impacts at residential properties

ID	Easting (m)	Northing (m)	Approved layout	Modifiied layout
Annual average PM_{10} concentrations ($\mu g/m^3$)				
1	230394	6149983	22.1	23.1
2	226824	6148362	25.7	27.9
3	226574	6148989	27.6	26.7
4	226253	6150502	19.5	19.5
5	226475	6152336	17.7	17.7
6	226127	6152946	17.3	17.3
16	226158	6149591	-	24.1
Annual average TSP concentrations ($\mu g/m^3$)				
1	230394	6149983	31.5	32.7
2	226824	6148362	35.3	38.8
3	226574	6148989	37.1	36.3
4	226253	6150502	28.8	28.8
5	226475	6152336	26.8	26.8
6	226127	6152946	26.4	26.4
16	226158	6149591	-	33.5
Annual average dust deposition ($\mu g/m^2/month$)				
1	230394	6149983	3.4	3.5
2	226824	6148362	3.4	3.4
3	226574	6148989	3.3	3.2
4	226253	6150502	3.1	3.1
5	226475	6152336	3.1	3.0
6	226127	6152946	3.0	3.0
16	226158	6149591	-	3.2

6.3.2 24-Hour PM_{10} Predictions

It is important to note that it is not possible to accurately predict the cumulative 24-hour PM_{10} concentrations into the future using dispersion modelling, in particular due to the variability in ambient levels and spatial and temporal variation in any day to day anthropogenic activity, including any future quarrying activities.

Experience shows that the worst-case 24-hour PM_{10} concentrations are strongly influenced by other sources in the area, such as bushfires and dust storms, which are essentially unpredictable. These events often dominate the worst-case PM_{10} concentrations. However, this does not mean that no action should be taken to control project dust emissions.

There are currently no continuous measurements of PM_{10} available in the area which limits the options for predicting cumulative 24-hour PM_{10} levels at sensitive receptors. In light of this, the approach adopted in 2006 has been applied.

In 2006, in response to questions from the Department of Planning in relation to the cumulative 24-hour PM_{10} assessment for this project, PAEHolmes (then Holmes Air Sciences) developed an approach to make use of Section 5.1.3 of the Approved Methods in the absence of continuous

monitoring (**HAS, 2006b**). The approach is fully described in that document, but in summary, it involved developing a synthetic monitoring data set through an analysis of variance of the available PM_{10} data and contemporaneous meteorological data. The relationships between PM_{10} and wind speed and temperature were not strong; nevertheless, the synthetic background data set has the same statistical properties as the actual measured data.

This same synthetic data set has been applied in this case to assess the 24-hour PM_{10} cumulative impacts of the modified Peppertree Quarry. The synthetic data for each 24-hour period was added to the model predictions for the modified quarrying operations (including BC) at these closest residences, in this case Residences 2, 3 and 16. The results are presented in **Figure 6.1** and show that there are an isolated number of exceedances of the 50 µg/m^3 criterion at each of these residences over a year.

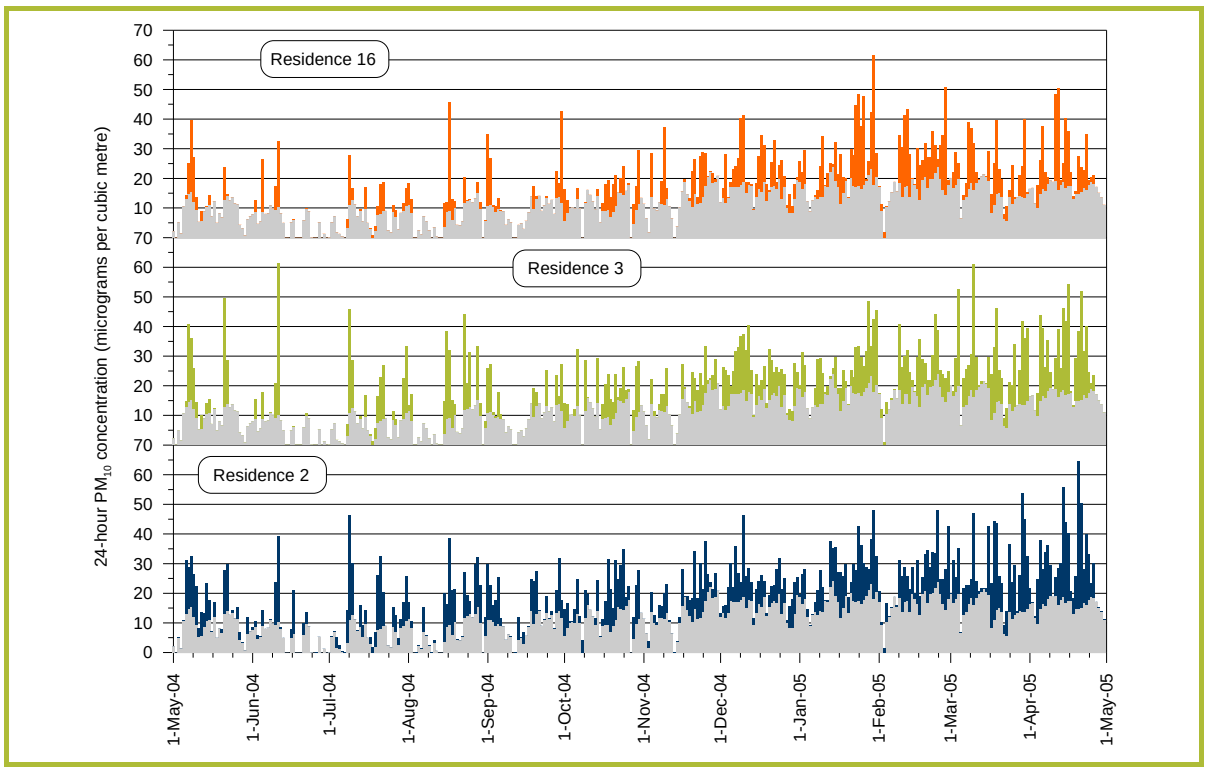

Figure 6.1: Time series of cumulative 24-hour PM_{10} concentrations at Residences 2, 3 and 16

These results are also tablulated in **Table 6.3**, which presents the top ten background levels and associated modelling results, as well as the top ten modelling results and associated synthetic background level. The three exceedances at Residence 2, five at Residence 3 and one at Residence 16 are all captured in the table, and are highlighted in red bold text.

The conservatively predicted levels in this scenario indicate any impact would be infrequent and at a low level if it occurs.

Table 6.3: Summary of model results for cumulative 24-hour average PM_{10} – Peppertree and BC

Date	Synthetic background PM_{10} ($\mu g/m^3$)	Increment from modelled sources	TOTAL cumulative impact	Date	Synthetic background PM_{10} ($\mu g/m^3$)	Increment from modelled sources	TOTAL cumulative impact
Residence 2							
24-Feb-05	24	24	48	20-Apr-05	15	50	**65**
14-Jan-05	24	11	35	29-Mar-05	14	40	**54**
29-Jan-05	23	15	38	14-Apr-05	19	37	**56**
13-Jan-05	22	15	38	21-Apr-05	15	35	50
27-Nov-04	22	2	24	09-Jul-04	11	35	46
23-Feb-05	22	12	34	18-Mar-05	11	33	44
14-Mar-05	21	0	22	30-Mar-05	14	31	45
28-Jan-05	21	7	28	10-Mar-05	16	31	47
30-Nov-04	21	0	21	30-Jan-05	18	30	48
19-Feb-05	21	12	33	17-Aug-04	9	29	39
Residence 3							
24-Feb-05	24	15	39	11-Jun-04	10	51	**61**
14-Jan-05	24	2	26	10-Mar-05	16	45	**61**
29-Jan-05	23	10	33	16-Apr-05	17	37	**54**
13-Jan-05	22	1	23	21-May-04	13	37	50
27-Nov-04	22	1	23	21-Apr-05	15	37	**52**
23-Feb-05	22	22	44	09-Jul-04	11	35	46
14-Mar-05	21	0	21	04-Mar-05	20	33	**53**
28-Jan-05	21	27	49	23-Aug-04	12	32	44
30-Nov-04	21	0	21	19-Mar-05	15	32	46
19-Feb-05	21	7	28	16-Aug-04	9	30	38
Residence 16							
24-Feb-05	24	3	27	30-Jan-05	18	44	**62**
14-Jan-05	24	1	25	17-Aug-04	9	36	46
29-Jan-05	23	19	42	27-Feb-05	14	36	50
13-Jan-05	22	3	25	12-Apr-05	16	34	50
27-Nov-04	22	0	22	24-Jan-05	18	31	49
23-Feb-05	22	9	31	30-Sep-04	12	31	43
14-Mar-05	21	0	21	26-Jan-05	18	30	48
28-Jan-05	21	5	26	11-Apr-05	19	29	48
30-Nov-04	21	0	21	23-Jan-05	17	28	45
19-Feb-05	21	11	32	30-Mar-05	14	26	40

As outlined previously, including both the BC emissions as well as monitoring data in the cumulative assessment is conservative, given that a proportion of the BC emissions will already be captured in the monitoring data, although the extent is unknown. This leads to double counting of background levels and is likely to overestimate actual levels. To deal with this double counting, the same process as described above was redone to include the Peppertree operations only. Operations at the BC site were excluded from this modelling and assumed to be already accounted for in the monitoring data. The results are presented in **Figure 6.2** and **Table 6.4**, and show no exceedances of the 50 µg/m^3 24-hour average PM_{10} level.

In reality, the results are likely to lie somewhere between these two scenarios, indicating that the impact from the BC operations would be somewhere between nil and infrequent at a low level if impacts occur.

As an aside, it is interesting to note that for this modelling scenario, the results for Residence 16 are slightly higher than for Residences 2 and 3. This is likely to be an indication that the BC operations are more significant for Residences 2 and 3 than at 16.

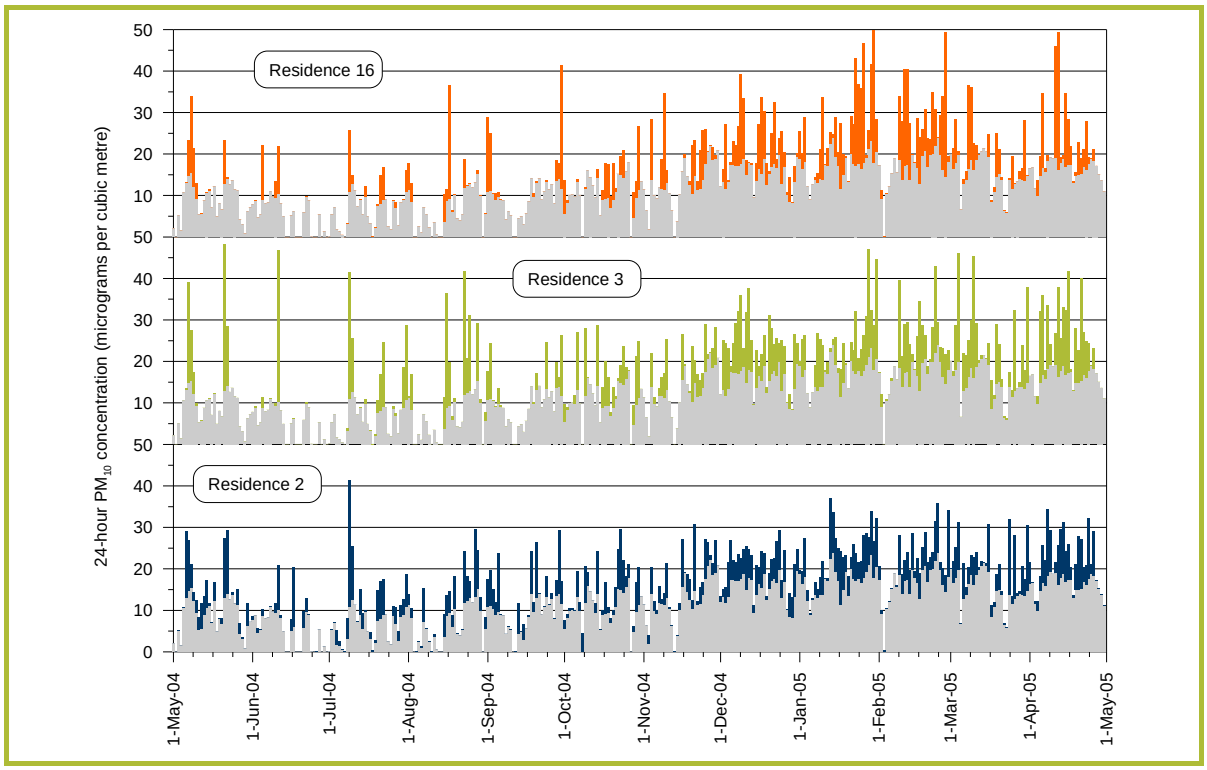

Figure 6.2: Time series of cumulative 24-hour PM_{10} concentrations at Residences 2, 3 and 16

Table 6.4: Summary of model results for cumulative 24-hour average PM_{10} – Peppertree only

Date	Synthetic background PM_{10} ($\mu g/m^3$)	Increment from modelled sources	TOTAL cumulative impact	Date	Synthetic background PM_{10} ($\mu g/m^3$)	Increment from modelled sources	TOTAL cumulative impact
Residence 2							
24-Feb-05	24	12	36	09-Jul-04	11	30	41
14-Jan-05	24	10	34	24-Mar-05	14	18	32
29-Jan-05	23	11	34	27-Aug-04	13	16	30
13-Jan-05	22	15	37	06-May-04	13	16	29
27-Nov-04	22	1	23	08-Apr-05	18	16	34
23-Feb-05	22	10	32	28-Feb-05	18	16	34
14-Mar-05	21	0	22	21-Nov-04	15	16	31
28-Jan-05	21	7	28	31-Mar-05	15	16	31
30-Nov-04	21	0	21	22-May-04	14	15	29
19-Feb-05	21	8	29	29-Sep-04	14	15	29
Residence 3							
24-Feb-05	24	5	29	11-Jun-04	10	37	47
14-Jan-05	24	1	25	21-May-04	13	35	48
29-Jan-05	23	9	32	09-Jul-04	11	31	42
13-Jan-05	22	1	23	23-Aug-04	12	30	42
27-Nov-04	22	0	22	10-Mar-05	16	29	45
23-Feb-05	22	21	43	16-Aug-04	9	28	36
14-Mar-05	21	0	21	04-Mar-05	20	26	46
28-Jan-05	21	26	47	28-Jan-05	21	26	47
30-Nov-04	21	0	21	21-Apr-05	15	25	40
19-Feb-05	21	6	26	16-Apr-05	17	24	42
Residence 16							
24-Feb-05	24	0	24	27-Feb-05	14	35	49
14-Jan-05	24	1	25	12-Apr-05	16	33	49
29-Jan-05	23	18	42	30-Jan-05	18	32	50
13-Jan-05	22	3	25	30-Sep-04	12	30	41
27-Nov-04	22	0	22	26-Jan-05	18	29	47
23-Feb-05	22	9	31	17-Aug-04	9	27	37
14-Mar-05	21	0	21	11-Apr-05	19	27	46
28-Jan-05	21	5	26	23-Jan-05	17	26	43
30-Nov-04	21	0	21	09-Nov-04	11	23	35
19-Feb-05	21	10	31	11-Feb-05	17	23	41

7 MINIMISING AIR QUALITY IMPACTS

The operational scenarios chosen for this assessment were selected to capture the maximum extent of air quality impacts due to the proposed operations. This was to allow some flexibility in quarry operations within the determined limits of the worst-case scenario. In order to ensure that air quality criteria are not exceeded at the nearest residences, mitigation measures should be implemented to reduce dust emissions.

The Section 75W Modification document for the Peppertree Quarry (**ERM 2011**) lists several dust controls measures to be implemented, and these are summarised below.

Dust emissions will be controlled during construction activities by:

- soil stripping when ground is moist (either through rain or the application of water);
- watering stockpiles of fine material;
- confining traffic to dedicated access roads and lay-down areas;
- use of water carts as required;
- keeping exposed surfaces to a minimum; and
- cleaning of areas which could become sources of wind erosion dust due to build-up of settled fine material.

During operations, the following mitigation measures are proposed to mitigate air emission impacts:

- covering of conveyors;
- enclosing of crushing and screening plant with a dust extraction system fitted;
- fitting of scrapers for cleaning conveyor belts;
- dust suppression sprays on the primary crusher;
- fitting drills with either water sprays or dry dust collection devices;
- confining stockpiles of fine material with water sprays or other appropriate measures;
- confining traffic to identified haul road routes;
- removal and rehabilitation of unnecessary roads;
- minimising exposed areas;
- watering haul roads;
- cleaning of areas which could become sources of wind erosion dust due to build-up of settled fine material;
- reviewing meteorological conditions prior to blasting to minimise exposure of residences to dust emissions; and

- reviewing meteorological conditions prior to selection of haul route (to eastern or western emplacement areas) to minimise exposure of residences to dust emissions.

Air quality monitoring will be conducted to determine changes in local air quality due to the Peppertree Quarry operations.

8 CONCLUSIONS

Model predictions for the operation of the Peppertree Quarry indicate that long-term average dust levels at nearby residences will be within the relevant air quality criteria. This remains the case when background dust levels are added to model predictions.

Modelled 24-hour PM_{10} cumulative levels include dust contributions from the BC Quarry, and results indicate that isolated exceedances of the 24-hour average PM_{10} criterion may occur at three of the closest residences. However, dust emission estimates and modelled scenarios in this report are conservative and therefore if the intended dust mitigation and control measures are carried out, dust levels at nearby residences are expected to remain within the relevant criteria.

9 REFERENCES

DEC (2005)

"Approved Methods for the Modelling and Assessment of Air Pollutants in NSW", August 2005.

ERM (2011)

"Boral Peppertree Quarry Section 75W Modification", March 2011.

HAS (2006a)

"Air Quality Impact Assessment:Proposed Marulan South Hard Rock Quarry", Australian Bureau of Statistics. Holmes Air Sciences. August 2006.

HAS (2006b)

Letter to Department of Planning from Nigel Holmes, dated 30th November 2006, including further analysis of monitoring data and cumulative impacts assessment of 24-hour average PM_{10} concentrations.

Appendix A: Modelled Dust Emissions

Scenario: Peppertree Quarry Maximum Year

```
------------------------------       04-May-2011
15:32
DUST EMISSION CALCULATIONS V2
 ------------------------------

 Output emissions file  : C:\ISC\emissRQ.dat
 Meteorological file    : C:\ISC\Bor0405.isc
 Number of dust sources : 24
 Number of activities    : 24 (note sources are
numbered 1-23, 34)
 No-blast conditions    : None
 Wind sensitive factor   : 1.292 (1.402 adjusted
for activity hours)
 Wind erosion factor    : 44.163

  -----ACTIVITY SUMMARY-----
 ACTIVITY NAME : Drilling rock
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 10227 kg/y
 FROM SOURCES  : 11
1 2 3 4 5 6 7 8 9 10 11
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0

 ACTIVITY NAME : Blasting rock
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 1880 kg/y
 FROM SOURCES  : 11
1 2 3 4 5 6 7 8 9 10 11
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0

 ACTIVITY NAME : Loading overburden to trucks
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 1894 kg/y
 FROM SOURCES  : 11
1 2 3 4 5 6 7 8 9 10 11
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0

 ACTIVITY   NAME   :   Hauling   overburden   to
emplacement area (BCC)
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 57500 kg/y
 FROM SOURCES  : 16
1 2 3 4 5 6 7 8 9 10 11 12 13 17 18 34
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0



 ACTIVITY   NAME   :   Dumping   overburden   to
emplacement area (BCC)
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 1894 kg/y
 FROM SOURCES  : 4
13 17 18 34
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0

 ACTIVITY  NAME  :  Dozer  shaping  overburden  dump
(BCC)
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 17472 kg/y
 FROM SOURCES  : 4
13 17 18 34
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0

 ACTIVITY NAME : Loading rock to trucks
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 6588 kg/y
 FROM SOURCES  : 6
1 2 5 6 7 9
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0

 ACTIVITY NAME : Hauling rock to hopper
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 300000 kg/y
 FROM SOURCES  : 10
1 2 3 4 5 6 7 8 9 10
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0

 ACTIVITY NAME : Dumping rock to hopper
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 6588 kg/y
 FROM SOURCES  : 5
1 2 7 8 9
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0

 ACTIVITY NAME : Primary crushing and screening
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 6080 kg/y
 FROM SOURCES  : 5
1 2 7 8 9
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Secondary crushing and screening
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 122160 kg/y
 FROM SOURCES  : 5
1 2 7 8 9
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Tertiary crushing and screening
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 122160 kg/y
 FROM SOURCES  : 2
15 16
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Loading to product stockpiles
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 6119 kg/y
 FROM SOURCES  : 1
15
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
```

```
 ACTIVITY NAME : Loading product to road trucks
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 170 kg/y
 FROM SOURCES  : 2
15 16
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Transport product off-site
(sealed rd)
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 26667 kg/y
 FROM SOURCES  : 5
19 20 21 22 23
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Loading product to trains by
conveyors
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 1315 kg/y
 FROM SOURCES  : 1
16
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from exposed pit
areas and bunds
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 231828 kg/y
 FROM SOURCES  : 11
1 2 3 4 5 6 7 8 9 10 11
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from product
stockpiles
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 9935 kg/y
 FROM SOURCES  : 1
15
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from EAST o/b
emplacement area
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 33118 kg/y
 FROM SOURCES  : 2
17 18
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Loading rejects (weathered
material)
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 212 kg/y
 FROM SOURCES  : 1
15
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Hauling rejects to o/b
emplacement area
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 10000 kg/y
 FROM SOURCES  : 5
12 13 14 15 16
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dumping rejects at emplacement
area (BCC)
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 212 kg/y
 FROM SOURCES  : 2
13 14
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Grading roads
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 1418 kg/y
 FROM SOURCES  : 23
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
20 21 22 23
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : wind erosion West OBEA
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 20202 kg/y
 FROM SOURCES  : 2
13 14
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
```

Scenario:Cumulative Peppertree Quarry Maximum Year Plus BC.

```
----------------------- 04-May-2011 15:14
  DUST EMISSION CALCULATIONS V2
 ------------------------------

 Output emissions file  : C:\ISC\emiss_R.dat
 Meteorological file    : C:\ISC\Bor0405.isc
 Number of dust sources : 34
 Number of activities   : 27
 No-blast conditions    : None
 Wind sensitive factor  : 1.292 (1.388 adjusted
for activity hours)
 Wind erosion factor    : 44.163

  -----ACTIVITY SUMMARY-----
 ACTIVITY NAME : Drilling rock
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 10227 kg/y
 FROM SOURCES  : 11
1 2 3 4 5 6 7 8 9 10 11
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0

 ACTIVITY NAME : Blasting rock
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 1880 kg/y
 FROM SOURCES  : 11
1 2 3 4 5 6 7 8 9 10 11
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0

 ACTIVITY NAME : Loading overburden to trucks
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 1894 kg/y
 FROM SOURCES  : 11
1 2 3 4 5 6 7 8 9 10 11
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0

 ACTIVITY   NAME   :   Hauling   overburden   to
emplacement area (BCC)
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 57500 kg/y
 FROM SOURCES  : 16
1 2 3 4 5 6 7 8 9 10 11 12 13 17 18 34
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0

 ACTIVITY   NAME   :   Dumping   overburden   to
emplacement area (BCC)
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 1894 kg/y
 FROM SOURCES  : 4
13 17 18 34
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0

 ACTIVITY  NAME  :  Dozer  shaping  overburden  dump
(BCC)
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 17472 kg/y
 FROM SOURCES  : 4
13 17 18 34
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0

 ACTIVITY NAME : Loading rock to trucks
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 6588 kg/y
 FROM SOURCES  : 6
1 2 5 6 7 9
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0

 ACTIVITY NAME : Hauling rock to hopper
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 300000 kg/y
 FROM SOURCES  : 10
1 2 3 4 5 6 7 8 9 10
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0

 ACTIVITY NAME : Dumping rock to hopper
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 6588 kg/y
 FROM SOURCES  : 5
1 2 7 8 9
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0

 ACTIVITY NAME : Primary crushing and screening
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 6080 kg/y
 FROM SOURCES  : 5
1 2 7 8 9
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Secondary crushing and screening
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 122160 kg/y
 FROM SOURCES  : 5
1 2 7 8 9
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Tertiary crushing and screening
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 122160 kg/y
 FROM SOURCES  : 2
15 16
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Loading to product stockpiles
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 6119 kg/y
 FROM SOURCES  : 1
15
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
```

```
 ACTIVITY NAME : Loading product to road trucks
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 170 kg/y
 FROM SOURCES  : 2
15 16
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Transport product off-site
(sealed rd)
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 26667 kg/y
 FROM SOURCES  : 5
19 20 21 22 23
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Loading product to trains by
conveyor
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 1315 kg/y
 FROM SOURCES  : 1
16
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from exposed pit
areas and bunds
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 231828 kg/y
 FROM SOURCES  : 11
1 2 3 4 5 6 7 8 9 10 11
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from product
stockpiles
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 9935 kg/y
 FROM SOURCES  : 1
15
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from EAST o/b
emplacement area
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 33118 kg/y
 FROM SOURCES  : 2
17 18
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Loading rejects (weathered
material)
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 212 kg/y
 FROM SOURCES  : 1
15
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Hauling rejects to o/b
emplacement area
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 25000 kg/y
 FROM SOURCES  : 5
12 13 14 15 16
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dumping rejects at emplacement
area (BCC)
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 212 kg/y
 FROM SOURCES  : 2
13 14
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Grading roads
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 1418 kg/y
 FROM SOURCES  : 23
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
20 21 22 23
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : BCSC Limestone mine - wind
insensitive
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 802510 kg/y
 FROM SOURCES  : 10
24 25 26 27 28 29 30 31 32 33
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : BCSC Limestone mine - wind
sensitive
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 121594 kg/y
 FROM SOURCES  : 10
24 25 26 27 28 29 30 31 32 33
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : BCSC Limestone mine - wind
erosion
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 314150 kg/y
 FROM SOURCES  : 10
24 25 26 27 28 29 30 31 32 33
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from WEST o/b
emplacement area
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 20202 kg/y
 FROM SOURCES  : 2
13 14
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
```

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Environmental Resources Management

Building C, 33 Saunders Street
Pyrmont NSW 2009
Locked Bag 24,
Broadway NSW 2007

T: 61 2 8584 8888
F: 61 2 8584 8800
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