Tarrawonga Coal Project

Environmental Assessment

APPENDIX C

NOISE AND BLASTING ASSESSMENT

Resource Strategies

Tarrawonga Coal Pty Ltd

ACOUSTICS AND AIR

TARRAWONGA COAL PROJECT
ENVIRONMENTAL ASSESSMENT
NOISE AND BLASTING IMPACT ASSESSMENT

REPORT NO. 09341-EA
VERSION C

WILKINSON MURRAY

TARRAWONGA COAL PROJECT
ENVIRONMENTAL ASSESSMENT
NOISE AND BLASTING IMPACT ASSESSMENT

REPORT NO. 09341-EA
VERSION C

NOVEMBER 2011

PREPARED FOR

TARRAWONGA COAL PTY LTD

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1 INTRODUCTION

This assessment has been prepared for Tarrawonga Coal Pty Ltd (TCPL) which is a joint venture between Whitehaven Coal Mining Pty Ltd (Whitehaven) (70% interest) and Boggabri Coal Pty Ltd (BCPL) (a wholly-owned subsidiary of Idemitsu Australia Resources Pty Ltd) (30% interest). TCPL owns and operates the existing mining operations at the Tarrawonga Coal Mine. The Tarrawonga Coal Mine is an open cut mining operation located approximately 15 kilometres (km) north-east of Boggabri and 42 km north-northwest of Gunnedah in New South Wales (NSW) (**Figure 1-1**). The Tarrawonga Coal Mine commenced operations in 2006 and currently produces up to approximately 2 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal.

This assessment addresses potential noise and blasting impacts associated with the proposed Tarrawonga Coal Project (the Project). The proposed life of the Project is 17 years, commencing 1 January 2013. The approximate extent of the existing and approved surface development (including open cut, mine waste rock emplacement, soil stockpiles and infrastructure areas) at the Tarrawonga Coal Mine are shown on **Figure 1-2**. The approximate extent of the Project surface development (incorporating the existing and approved development) is also shown on **Figure 1-2**.

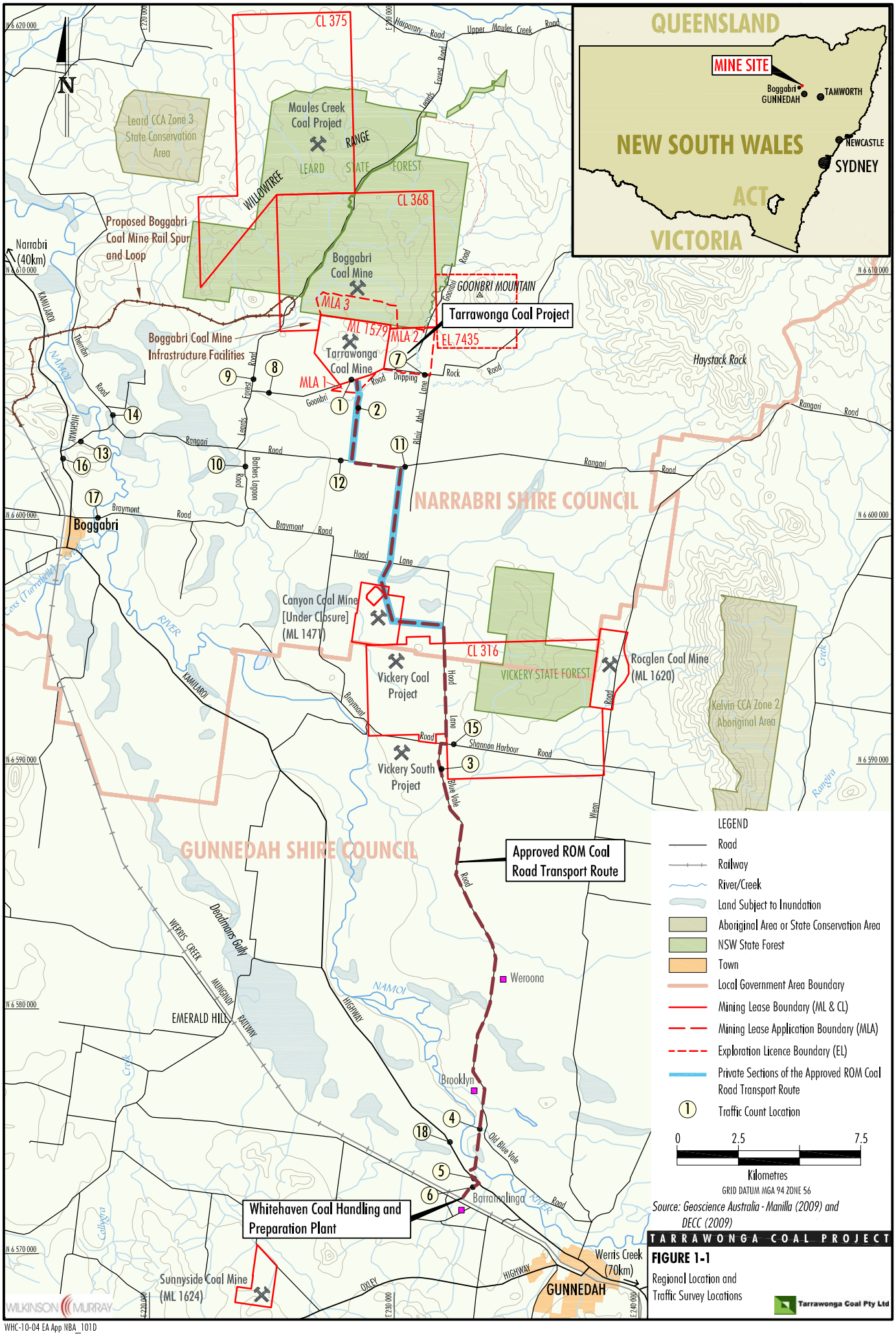
A glossary of terms and definitions is provided as **Attachment A** of this report.

1.1 Objectives of this Study

The primary objective of this study is to assess the potential noise and blasting impacts associated with the Project by addressing the Director-General's Environmental Assessment Requirements (EARs) issued by the NSW Department of Planning and Infrastructure (DP&I) on 7 July 2011, outlined as follows:

> ***Noise & Blasting*** *– including a quantitative assessment of potential:*
>
> *- construction, operational and transport noise impacts, both on and off-site; and*
>
> *- blasting impacts on people, livestock and property;*

The NSW Office of Environment and Heritage (OEH) have also outlined their agency comments for the noise assessment. These comments, and the section where they are addressed in this assessment, are outlined in **Table 1-1**.



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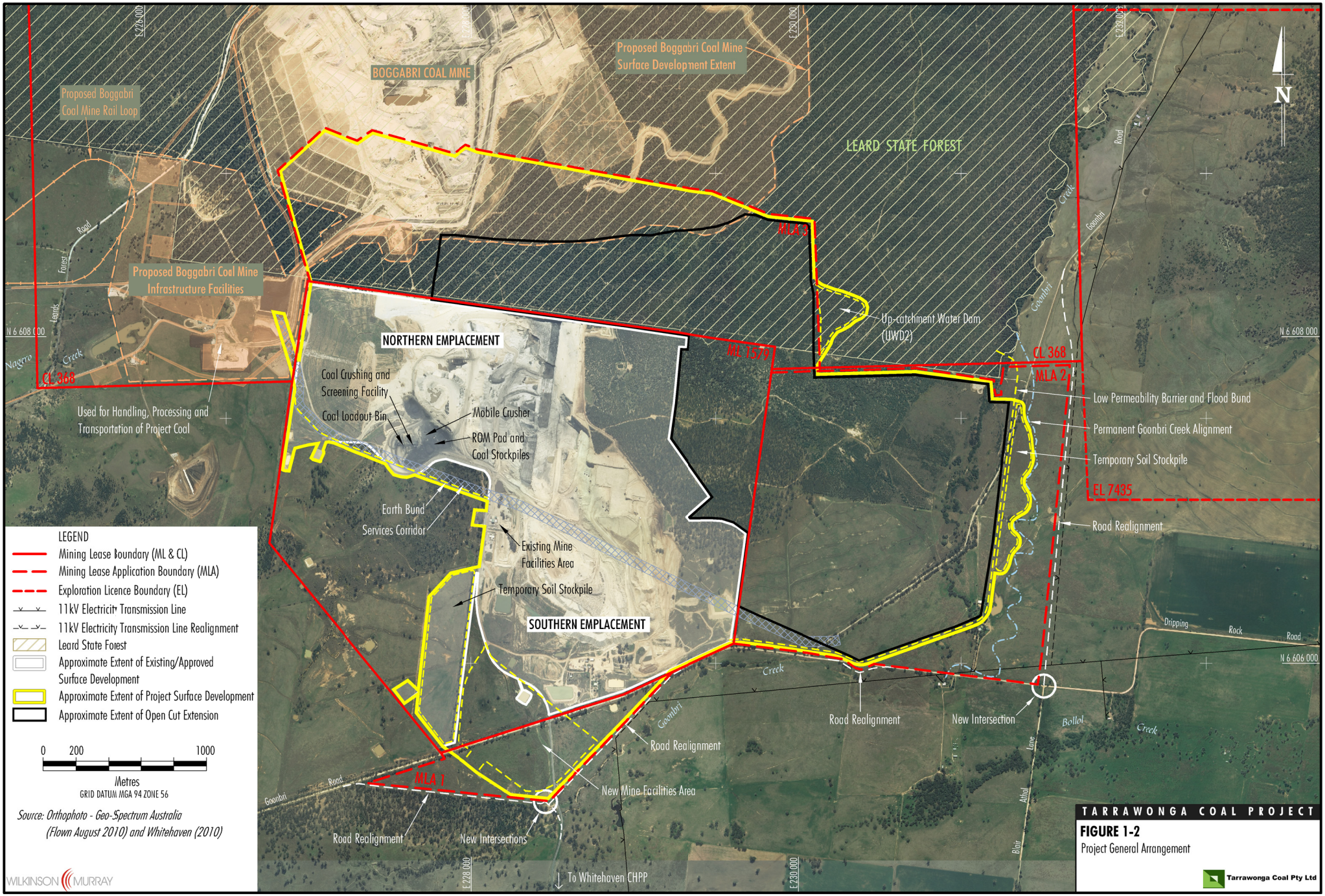

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Table 1-1
OEH Environmental Assessment Noise and Agency Comments

Comment	Section
General	
Construction noise associated with the proposed development should be assessed using the Interim Construction Noise Guideline (DECC, 2009).	6.9
Vibration from all activities (including construction and operation) to be undertaken on the premises should be assessed using the guidelines contained in Assessing Vibration: a technical guideline (DEC, 2006).	8
If blasting is required for any reasons during the construction or operational stage of the proposed development, blast impacts should be demonstrated to be capable of complying with the guidelines contained in Australian and New Zealand Environment Council – Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration (ANZEC, 1990).	8
Industry	
Operational noise from all industrial activities (including private haul roads and private railway lines) to be undertaken on the premises should be assessed using the guidelines contained in the NSW Industrial Noise Policy (EPA, 2000) and Industrial Noise Policy Application Notes.	6
Road	
Noise on public roads from increased road traffic generated by land use developments should be assessed using the guidelines contained in the Environmental Criteria for Road Traffic Noise (EPA, 1999).	7.1
Noise from new or upgraded public roads should be assessed using the Environmental Criteria for Road Traffic Noise (EPA, 1999).	7.1
Railway	
Noise from new or upgraded railways (other than railways on private premises) should be assessed using the Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects (DECC, 2007).	N/A
Noise from increased rail traffic on the NSW Rail Network resulting from rail traffic generating development (e.g. an extractive industry) should be assessed using the environmental assessment requirements for rail traffic–generating developments.	7.2

2 EXISTING TARRAWONGA COAL MINE

2.1 Overview of the Existing Tarrawonga Coal Mine

The Tarrawonga Coal Mine was approved under Development Consent DA 88-4-2005 by the NSW Minister for Planning in November 2005 under Part 4 of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act). The potential environmental impacts of the Tarrawonga Coal Mine were assessed in the *East Boggabri Joint Venture Environmental Impact Statement* (2005 EIS) (TCPL, 2005).

In 2010, TCPL sought approval under Section 75W of the EP&A Act for a modification to Development Consent DA 88-4-2005. The potential environmental impacts associated with the Modification were assessed in the Tarrawonga Coal Mine Modification Environmental Assessment (Whitehaven, 2010) (the Modification EA). DA 88-4-2005 MOD 1 was approved on 15 October 2010 by the NSW Minister for Planning.

The Tarrawonga Coal Mine involves construction and operation of an open cut coal mine using conventional open cut mining methods over an 8 to 10 year period to extract approximately 16.4 million tonnes (Mt) of ROM coal at a maximum rate of 2 Mtpa. Overburden generated from the open cut is placed in two adjoining out-of-pit emplacements, and as infill in the mine void.

The currently approved Tarrawonga Coal Mine consists of the following major elements:

- an open cut pit;
- Northern and Southern Emplacements;
- a coal processing area;
- soil stockpiling areas; and
- mine infrastructure and service facilities.

ROM coal from the Tarrawonga Coal Mine is crushed and screened on-site to a nominal 50 to 150 millimetres (mm), and then transported by road to Whitehaven's Coal Handling and Preparation Plant (CHPP) located approximately 35 km to the south on the outskirts of Gunnedah. The Whitehaven CHPP operates in accordance with a separate Development Consent (DA 0079.2002) issued by the Gunnedah Shire Council on 2 October 2002. At the CHPP the sized ROM coal is further crushed, screened, washed or bypassed before being loaded onto trains for dispatch and sale to customers as a low ash, thermal and/or semi-soft coking product coal.

Up to 450,000 tonnes (t) per annum of domestic specification (15 to 35 mm size) coal is approved to be crushed on-site in a mobile crusher for direct sale to customers (i.e. collection at the mine site).

2.2 Existing Noise Management Strategies at the Tarrawonga Coal Mine

2.2.1 Operational Noise Management

Noise management at the Tarrawonga Coal Mine is currently undertaken in accordance with the *Noise Management Plan* (TCPL, 2011a) which outlines:

- noise mitigation measures and controls;
- the noise monitoring and reporting regimes; and
- the management of exceedances and complaints.

The following noise management measures are implemented at the Tarrawonga Coal Mine, as detailed in the Noise Management Plan:

- *As per Condition 3(6) of DA 88-4-2005, mining operations will only be carried out on-site between 7am and midnight Monday to Friday, midnight to 3:30am Tuesday to Saturday and 7am to 6pm Saturday, excluding public holidays. Maintenance activities may be conducted at any time Monday to Sunday.*
- *Contractors, including all personnel and sub-contractors, will undergo environmental training on noise control and awareness via the generic induction process. Any contractor or subcontractor whose work is likely to create loud noise will be given more detailed guidance on the site's noise criteria and noise management requirements.*
- *The Sound Power Levels of mobile mining equipment will be periodically tested in accordance with International Standards Organisation (ISO) 6395:1988 "Acoustics – Measurement of exterior noise emitted by earth-moving machinery – Dynamic test conditions". Equipment will be required to have noise levels that do not exceed the Sound Power Levels listed in Table 6-1 of the Modification EA.*
- *Site equipment selection will include consideration of sound power levels and equipment will be maintained in good order.*
- *Personnel and contractors will be required to pay due attention to adverse weather conditions and make modifications to the work program where necessary.*
- *All complaints will be managed as outlined in Section 5.2* (of the Noise Management Plan).
- *Monitoring of emitted noise levels will be undertaken during mining operations to verify compliance with noise criteria and to assess the need, if any, for additional noise attenuation measures.*

In addition, the Noise Management Plan details the following reasonable and feasible noise mitigation measures implemented at the Tarrawonga Coal Mine, as identified in the Modification EA (Whitehaven, 2010):

- *Installation of a 6m high bund on the southern side of selected portions of the haul roads (where the haul roads run east-west);*
- *Where required by real-time noise monitoring, cessation of waste emplacement activities within the Southern Emplacement during evening and night time periods;*
- *Modified alignment of haul routes (in particular, relocating the haul route from the pit floor to the Northern Emplacement to its northern face, away from receivers to the south);*
- *ROM coal stockpiles orientated to screen the primary crusher; and*
- *Modification of the fleet during the evening and night time periods, including a reduction in the number of water carts, dozers and loaders, and cessation of scrapers.*

A mobile real-time noise monitor has recently been procured by TCPL. Consistent with the Noise Management Plan, the real-time monitor is located at selected nearby receivers in response to complaints. Currently (October 2011), the real time noise monitor is situated at the Sylvania residence (identified later in this report as "receiver 60b" – refer to **Table 4-1**).

2.2.2 Management of Noise from Off-site Road Transport of ROM Coal

Management of noise from off-site transport of ROM coal is undertaken in accordance with the *Road Noise Management Plan for the East Boggabri Coal Mine* (TCPL, 2006) and the *Road Noise Management Plan for the Rocglen Coal Mine* (Whitehaven, 2008a), which incorporates noise mitigation measures relating to road transport from both mining operations.

Mitigation measures taken from the Road Noise Management Plan (TCPL, 2006) are provided below:

- *Strict adherence to the approved hours of operation for coal despatch by road as stipulated in Development Consent Condition 4(43):*

  (a) 7.00am to 9.15 pm Monday to Friday;

  (b) 7.00am to 5.15 pm Saturday; and

  (c) at no time on public holidays.

- *Maintenance of the mine access road and internal road network to minimise noise generation from loaded and unloaded trucks.*

- *All product transportation trucks will be maintained in good condition to ensure both body and truck engine noises are within acceptable limits. Quiet technology trucks, e.g. trucks with air-bag suspensions and aluminium bodies which minimise the noise from unladen trucks in particular, will be used where available. Any new trucks purchased will incorporate high horse power engines which require fewer gear changes, lower operating revs and hence, less noise than older trucks.*

- *Driver education. Prior to the commencement of coal transportation, EBC* [East Boggabri Coal – now TCPL]*, in conjunction with the coal transport contractor, will undertake an education program for all drivers reinforcing:*

  - *the necessity to comply with all commitments in the Transport Code of Conduct, a copy of which will be supplied to all drivers;*
  - *the need for courteous and safe driving and compliance with EBC's commitments with respect to hours of operation and school buses; and*
  - *the locations of residences and the need for drivers to drive in a manner which minimises compression/exhaust braking and engine revving adjacent to residences, including driving in accordance with noise reduction signs.*

  All relief drivers will also be required to attend a competency-based induction prior to commencing to transport product coal from the mine site to ensure that they are fully aware of the noise limitations and expected driver behaviour.

- *Road noise monitoring as described in Section 5 [of the Road Noise Management Plan].*

- *All drivers will be encouraged to report any evidence of road pavement deterioration which could impact upon noise generation by trucks to their contracting mine (ie EBC or WCM management). EBC and WCM will then jointly assess the additional noise impacts from the road deterioration and, if necessary, undertake or arrange for any works required to achieve compliance with the road noise criteria. The required works will be undertaken by, or to the satisfaction of, the relevant local Council.*

It is relevant to note that TCPL has an existing noise agreement relating to haulage of product coal with the privately-owned receiver Kyalla, which is located south of the Tarrawonga Coal Mine. This receiver is identified as receiver 44a, later in this report – refer to **Table 4-1**.

No increase to the approved amount of coal transported to the Whitehaven CHPP is proposed as part of the Project, and after Year 1, or following the completion of the Boggabri Coal Mine Infrastructure Facilities, coal from the Tarrawonga Coal Mine would no longer be transported to the Whitehaven CHPP (refer to **Section 3** for further information).

2.2.3 Management of Blasting Effects

Management of blasting effects at the Tarrawonga Coal Mine is described in the *Blast Management Plan* (TCPL, 2011b). The Blast Management Plan describes the blast monitoring measures, which include ground vibration and airblast overpressure monitoring at two locations.

The Blast Management Plan provides the methodology for the blast monitoring regime, as well as a number of general blast management measures, including landowner notification of blast events, flyrock distribution monitoring, reporting and complaint management procedures.

2.2.4 Noise and Blasting Compliance Monitoring

Attended noise monitoring and vibration/air blast monitoring has been undertaken at the Tarrawonga Coal Mine since 2006. The noise monitoring results are summarised in **Table 2-1**.

Table 2-1
Noise and Blasting Monitoring Compliance Summary

Year	Blasting	Noise
2006/2007	Compliance with criteria.	Compliance with criteria.
2007/2008	Compliance with criteria. Some blasts were within the allowable 5% between 115 and 120 decibels [dB]).	• July 2007 – exceedances of criteria due to road haulage operations recorded at Pine Grove (now owned by Whitehaven) and Ambardo (now owned by Whitehaven). • September 2007 – exceedances of criteria due to road haulage operations recorded at Pine Grove and Ambardo. • January 2008 – exceedances of criteria due to road haulage operations recorded at Pine Grove and Ambardo.
2008/2009	Compliance with criteria.	• June 2008 – exceedances of criteria due to road haulage operations recorded at Pine Grove, Tarrawonga and Ambardo. • September 2008 – exceedances of criteria due to road haulage operations recorded at Ambardo. • March 2009 – exceedances of criteria due to road haulage operations recorded at Pine Grove and Ambardo.
2009/2010	Compliance with criteria.	• June 2009 – exceedances of criteria due to road haulage operations recorded at Pine Grove, Ambardo and Kyalla. • September 2009 – exceedances recorded at Pine Grove, Ambardo and Tarrawonga. At Pine Grove the exceedance was due to trucks travelling on the private section of the haul road. At Ambardo the total measured noise was a result of open cut operations and trucks travelling on the private section of the haul road. At Tarrawonga the exceedance was due to open cut operations. • September 2009 – exceedances of criteria due to open cut operations recorded at the former Blair Athol School House (now owned by Whitehaven). • December 2009 – exceedance of criteria due to road haulage operations recorded at Pine Grove. TCPL had an agreement in place with the owner of Pine Grove in respect to elevated noise levels from haul trucks and, therefore, under this agreement the measured noise level is not considered an exceedance of the noise criterion. • March 2010 – exceedance of criteria due to road haulage operations recorded at Pine Grove and Ambardo. TCPL had agreements in place with the owners of Pine Grove and Ambardo in respect to elevated noise levels from haul trucks and, therefore, under this agreement the measured noise level is not considered an exceedance of the noise criterion.
April 2010 to August 2011	Two marginal exceedances of airblast criterion (115.8 and 115.9 dB in April and July 2011), however these are within the allowable 5% between 115 and 120 dB.	• June 2010 – exceedance of criteria due to road haulage operations recorded at Pine Grove and Ambardo. TCPL had agreements in place with the owners of Pine Grove and Ambardo in respect to elevated noise levels from haul trucks and, therefore, under this agreement the measured noise level is not considered an exceedance of the noise criterion. Ambardo is now owned by Whitehaven.

Source: TCPL (2007; 2008, 2009; 2010)
June 2010, October 2010, December 2010 and April 2011 (Attended) Noise Monitoring Results; July 2010 and March 2011 Road Traffic Noise Monitoring.

2.2.5 Overview of Complaints Received to Date

A summary of complaints relating to on-site noise and blasting from Tarrawonga Coal Mine operations is provided in **Table 2-2** for the period April 2006 to August 2011.

Table 2-2
Complaints Summary April 2006 to August 2011

Date Received	Details	TCPL Response
28/07/2006	Blasting vibration and potential for damage to house.	• TCPL discussed with complainant and conducted ongoing monitoring for future blasts. • Complaint later withdrawn following further blasts and no impact on the house was noted.
5/07/2007	Blast event resulted in windows rattling at house.	• TCPL advised the complainant that blast controls were tightened to exclude blasting where wind speed >6 metres per second (m/s) from the north-west. Blasting to take place around midday, where relevant, to avoid inversion conditions.
9/07/2007	General complaint received in relation to noise and blasting.	• TCPL advised the complainant that monitoring indicates compliance with the relevant criteria.
20/08/2007	General complaint received in relation to noise and blasting.	• TCPL advised the complainant that monitoring indicates compliance with the relevant criteria.
23/04/2008	Blast event resulted in windows shaking at house.	• TCPL advised the complainant that monitoring indicates compliance with the relevant criteria.
7/09/2009	Blast event resulted in windows and house shaking.	• TCPL advised that conditions at the time of the blast were not ideal due to low cloud cover and moisture in the air, but that the blast went ahead to avoid safety issues associated with wet blast area and a need to disconnect charges if the blast didn't proceed. No monitoring was available at the residence at the time of the blast. TCPL offered to set up blast monitoring at the residence, however this offer was not taken up.
8/10/2009	General complaint received in relation to noise.	• TCPL reviewed the meteorological data, which indicated the prevailing wind on that day was away from the receiver. Suspected source of the noise was the Boggabri Coal Mine, which is closer to the receiver than Tarrawonga Coal Mine.
2/03/2011	Complainant advised that he was not being informed of blasting times for Tarrawonga.	• TCPL was informing the complainant of blast times via his landline. TCPL to advise of future blasting times via the complainant's mobile phone.
13/05/2011	Tarrawonga Coal Mine audible on occasions.	• TCPL to obtain noise data once the real-time noise monitor is installed (which occurred at the end of May 2011).
25/7/2011	Concern was raised relating to blast event rattling windows and resulting in a discernable plume.	• Letter response issued on 29 July 2011 identifying blast within compliance limits. TCPL also reviewed video footage of blast event with blasting contractor.
25/7/2011	Concern was raised relating to blast event rattling windows and resulting in a discernable plume. (Second complaint regarding same blast event.)	• Letter response issued on 29 July 2011 identifying blast within compliance limits. TCPL also reviewed video footage of blast event with blasting contractor.

Source: TCPL (2007; 2008, 2009; 2010; 2011c).

Table 2-2 shows that in the five years since April 2006, only 11 complaints were received in relation to on-site noise and blasting; only four of these complaints specifically referred to noise.

TCPL has also received other complaints during this period in relation to road haulage and haulage operating times (e.g. concerns that haulage was undertaken outside of approved hours). Following each complaint, TCPL verified whether haulage was being undertaken within approved timeframes, advised the road haulage contractors of the complaints and undertook appropriate steps to address those issues in consultation with the complainants.

3 PROJECT OVERVIEW

3.1 General Description

The general arrangement of the Project utilises the existing infrastructure and service facilities at the Tarrawonga Coal Mine and integrates with the neighbouring Boggabri Coal Mine.

The main activities associated with the development of the Project would include:

- continued development of mining operations in the Maules Creek Formation to facilitate a Project ROM coal production rate of up to 3 Mtpa, including open cut extensions:
  - to the east within Mining Lease (ML) 1579 and Mining Lease Application (MLA) 2; and
  - to the north within Coal Lease (CL) 368 (MLA 3) which adjoins ML 1579;
- ongoing exploration activities;
- construction and use of a services corridor (including haul road link) directly from the Project open cut mining operation to the upgraded Boggabri Coal Mine Infrastructure Facilities[1];
- use of upgraded Boggabri Coal Mine Infrastructure Facilities for the handling and processing of Project coal and the loading of Project product coal to trains for transport on the Boggabri Coal Mine private rail spur to the Werris Creek Mungindi Railway[1];
- construction and use of a new mine facilities area including relocation of existing mine facilities infrastructure and service facilities;
- use of an existing on-site mobile crusher for coal crushing and screening of up to 150,000 t of domestic specification coal per annum for direct collection by customers at the mine site;
- use an existing on-site mobile crusher to produce up to approximately 90,000 cubic metres (m^3) of gravel materials per annum for direct collection by customers at the mine site;
- progressive backfilling of the mine void behind the advancing open cut mining operation with waste rock and minor quantities of coarse reject material;
- continued and expanded placement of waste rock in the Northern Emplacement (including integration with the Boggabri Coal Mine emplacement) and Southern Emplacement, as mining develops;
- progressive development of new haul roads and internal roads, as mining develops;
- realignment of sections of Goonbri Road and construction of new intersections;
- construction of an engineered low permeability barrier to the east and south-east of the open cut to reduce the potential for local drainage of alluvial groundwater into the open cut;
- removal of a section of Goonbri Creek within the Project open cut and the establishment of a permanent Goonbri Creek alignment and associated flood bund to the east and south-east of the open cut;
- progressive development of sediment basins and storage dams, pumps, pipelines and other water management equipment and structures;
- continued development of soil stockpiles, laydown areas and gravel/borrow areas;
- ongoing monitoring and rehabilitation; and

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[1] Subject to approvals and upgrades being in place for the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities.

- other associated minor infrastructure, plant, equipment and activities.

The proposed life of the Project is 17 years, commencing 1 January 2013.

In Project Year 1 only, or until approvals and upgrades are in place for the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities, the Project would make continued use of the existing on-site ROM coal handling areas, coal crushing, screening and loadout facilities. Road transport of sized ROM coal to the Whitehaven CHPP would also continue in this initial period (with no increase in the currently approved maximum off-site coal trucking rate).

The Project general arrangement is shown on **Figure 1-2**. A description of the Project is provided in Section 2 in the Main Report of the EA.

In addition, a 6 metre (m) high noise control earth bund would be constructed along exposed sections of the services corridor (i.e. the internal haulage route connecting the Project to the Boggabri Coal Mine) to mitigate noise from moving haul trucks.

A detailed description of the Project is provided in Section 2 in the Main Report of the Environmental Assessment (EA). The subsections below provide an overview of the Project, with a focus on those elements that are material from a noise and blasting assessment perspective.

3.2 Project Construction/Development Activities

The Project would continue to utilise the existing infrastructure and services at the Tarrawonga Coal Mine, where possible. Additional infrastructure and the relocation of existing infrastructure would be required to support the Project, including:

- relocation of the mine facilities area;
- construction of a services corridor to the upgraded Boggabri Coal Mine Infrastructure Facilities;
- realignment of sections of Goonbri Road and construction of new intersections; and
- construction of the low permeability barrier, permanent Goonbri Creek alignment and associated flood bund.

3.3 Mining Operations

Project mining operations would be conducted 24 hours per day, seven days per week.

The Project includes extension of the existing approved open cut in coal seams to the east in ML 1579 and MLA 2 and to the north within CL 368 (MLA 3). The Southern Emplacement and new mine facilities area would also extend into MLA 1.

Progressive vegetation clearing and soil stripping would be undertaken ahead of the advancing open cut mining operation, and would typically be conducted using a fleet of dozers, scrapers and a water cart.

Drill and blast techniques are used for the removal of competent overburden (and interburden) material at the Tarrawonga Coal Mine and would continue for the Project. A mixture of ammonium nitrate and fuel oil (ANFO) (dry holes) and emulsion blend (wet holes) explosives would continue to be used.

Following blasting, overburden and interburden would continue to be removed by excavator and dump truck, with supporting dozers. The overburden/interburden would be placed in out-of-pit mine waste rock emplacements, or as infill in the mine void, behind the advancing open cut mining operations. The waste rock emplacements would be progressively shaped by dozers for rehabilitation activities (i.e. final re-contouring, topsoiling and revegetation).

Coal mining would continue to involve excavators loading ROM coal into haul trucks for haulage to either the Project or the Boggabri Coal Mine ROM coal handling areas.

During Project Year 1, or until approvals and upgrades are in place for the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities, ROM coal would continue to be hauled to the existing ROM pad via internal haul roads, with no increase in the existing approved rate of 2 Mtpa ROM coal. Processing and transport of this ROM coal would be as per the existing operations, and would continue to be loaded into haulage contractor trucks and transported via the Approved ROM Coal Road Transport Route to the Whitehaven CHPP.

At the Whitehaven CHPP, the sized ROM coal would continue to be either directly loaded onto trains (i.e. bypass) or crushed, screened and washed before being loaded onto trains for rail transport to the Port of Newcastle and export markets. No change to existing Whitehaven CHPP rail movements would be required for the Project.

Once approvals and upgrades are in place for the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities, ROM coal would be transported via the services corridor haul road directly from the Project open cut.

The Continuation of Boggabri Coal Mine (the Boggabri Coal Continuation Project) includes upgrades to the existing ROM pad, construction of a CHPP, upgrades to product handling and a 17 km private rail spur, rail loop and rail loadout facility. Once approvals and upgrades are in place for the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities, subsequent handling, processing and train loading of up to approximately 2.8 Mtpa of Project product coal would be undertaken on a campaign basis at Boggabri.

Up to 150,000 t ROM coal per annum would be selectively hauled to the Project on-site mobile crusher for crushing and screening to produce domestic specification (15 to 35 mm) coal. In addition, up to 90,000 m^3 per annum of gravel material would be produced by crushing and screening of select overburden material (excavated from within the open cut extent) in the Project on-site mobile crusher. The mobile crusher would be operated during daytime hours only (i.e. 7.00 am to 6.00 pm).

3.4 Indicative Mine Schedule and Noise Scenarios

The indicative mine schedule for the Project is shown in **Table 3-1**.

Table 3-1
Indicative Mine Schedule

Project Year	Waste Rock (Mbcm)	ROM Coal (Mtpa)
1*	25.0	2.5
2	29.5	3.0
3	27.5	3.0
4	28.0	3.0
5	29.0	3.0
6	33.0	3.0
7	32.0	3.0
8	32.0	3.0
9	27.0	3.0
10	29.0	3.0
11	30.0	3.0
12	28.0	3.0
13	31.0	3.0
14	31.0	3.0
15	31.0	3.0
16	31.0	3.0
17	23.0	3.0
Total	497.0	50.5

* Assumed Project commencement date is 1 January 2013.

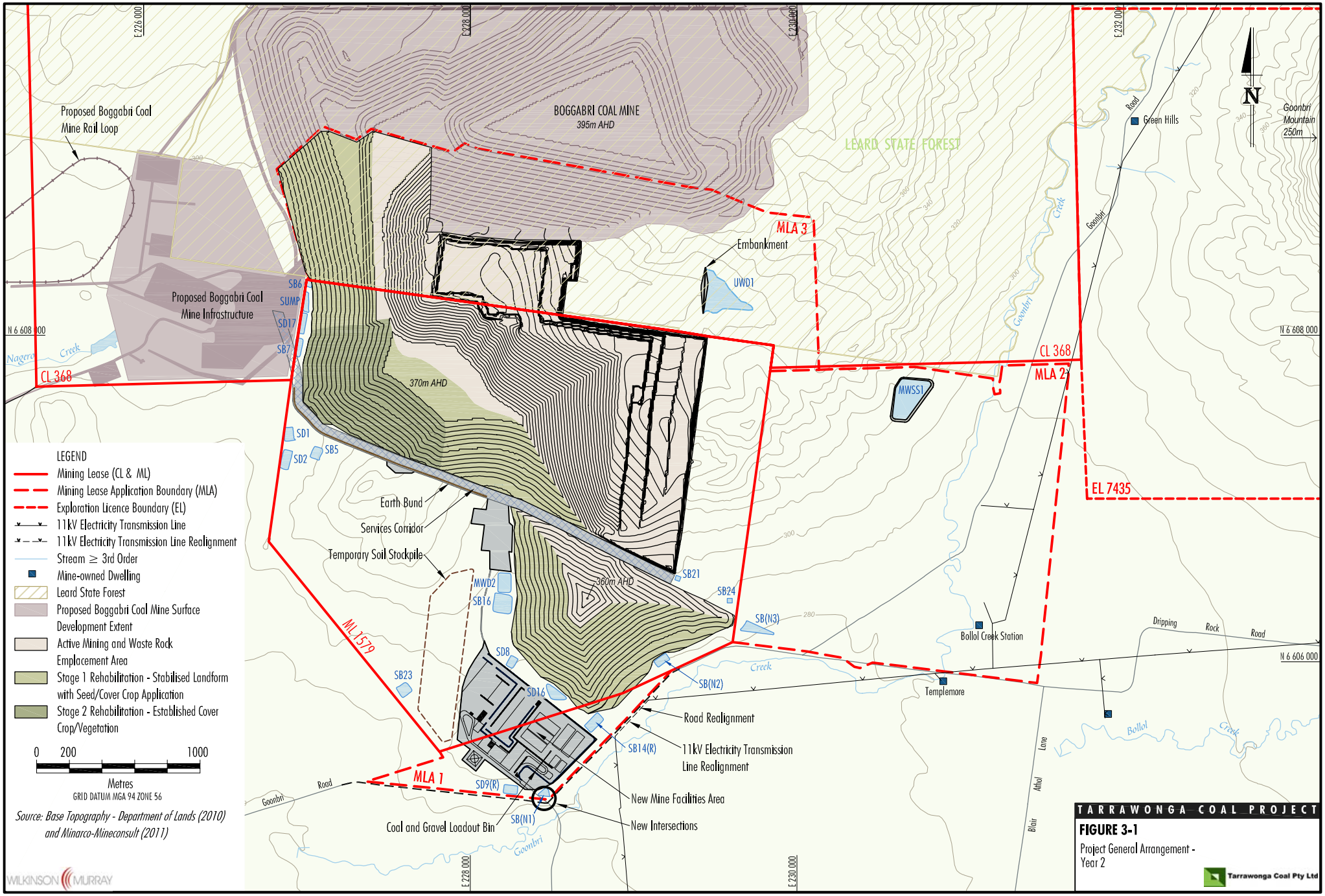
This assessment has considered the noise impacts from mining operations during Project Years 2, 4 and 16 of the Project, for the following reasons:

- Project Year 2 (**Figure 3-1**) considers mining operations in the western portion of the Project area, represents the first year that the Project reaches full ROM coal production and considers waste rock emplacement at the Southern Emplacement.
- Project Year 4 (**Figure 3-2**) is equivalent to the maximum year of production at the Boggabri Coal Continuation Project (BCPL, 2010), and has been included in consideration of cumulative noise impacts.
- Project Year 16 (**Figure 3-3**) considers mining operations in the eastern portion of the Project area.

3.5 Road Traffic

The key road traffic generating activities associated with the Project would include:

- Continued transportation of up to 2 Mtpa ROM coal from the Tarrawonga Coal Mine to the Whitehaven CHPP, prior to approvals and upgrades being in place for the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities, between 7.00 am and 9.15 pm Monday to Friday, and between 7.00 am and 5.15 pm on Saturdays (excluding public holidays).
- Collection of up to 150,000 t crushed coal and up to 90,000 m³ crushed gravel per annum from the Tarrawonga Coal Mine by customers utilising the haul route from Gunnedah or from Boggabri and surrounding areas via Kamilaroi Highway, Rangari Road and the haul route between 7.00 am and 9.15 pm Monday to Friday, and between 7.00 am and 5.15 pm on Saturdays (excluding public holidays).
- Until approvals and upgrades are in place for the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities, the maximum extraction of ROM coal at the Project would be capped at the existing approved rate of 2 Mtpa. This would limit total off-site road haulage movements of coal materials (i.e. both sized ROM coal and domestic coal) to current maximum levels.



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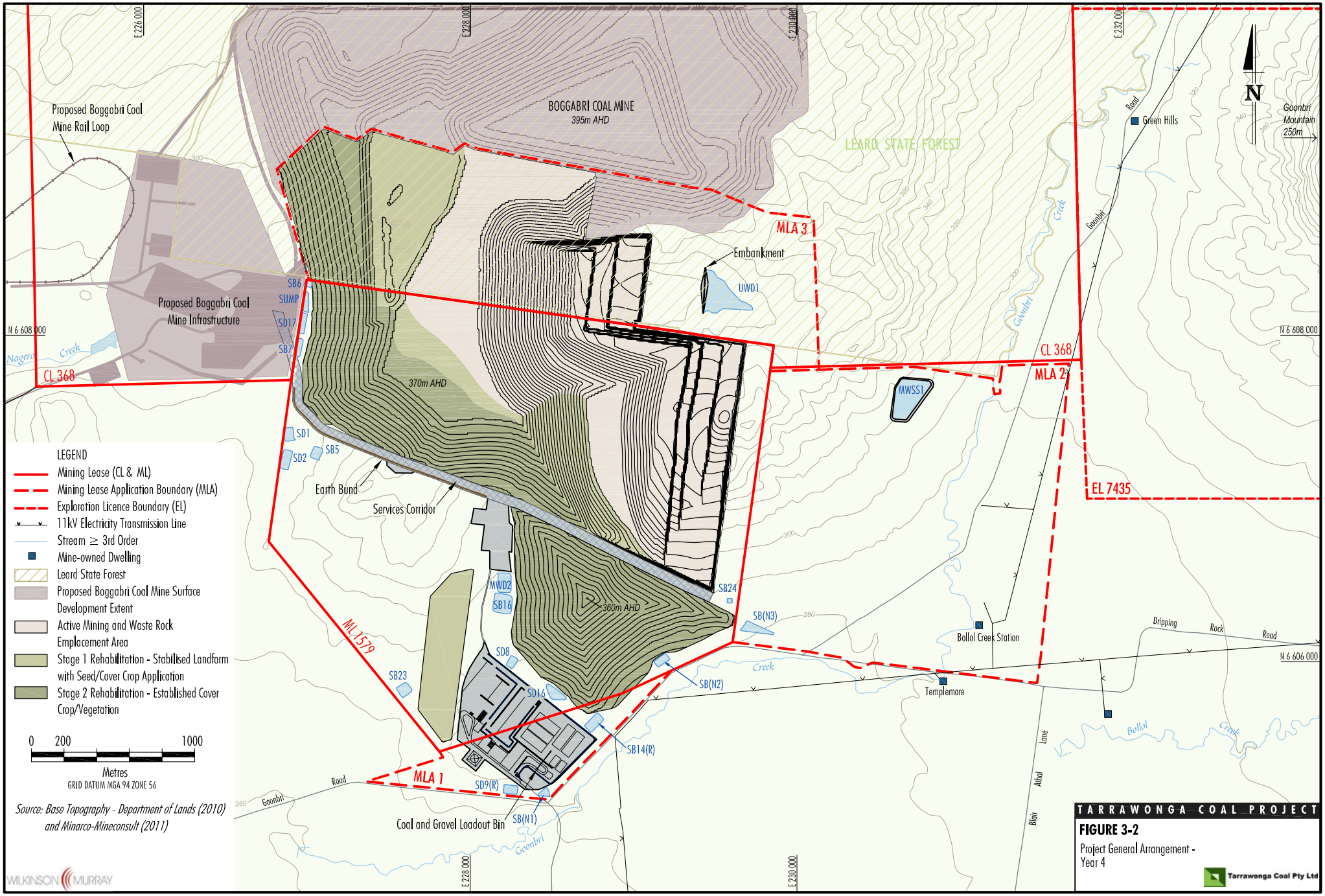

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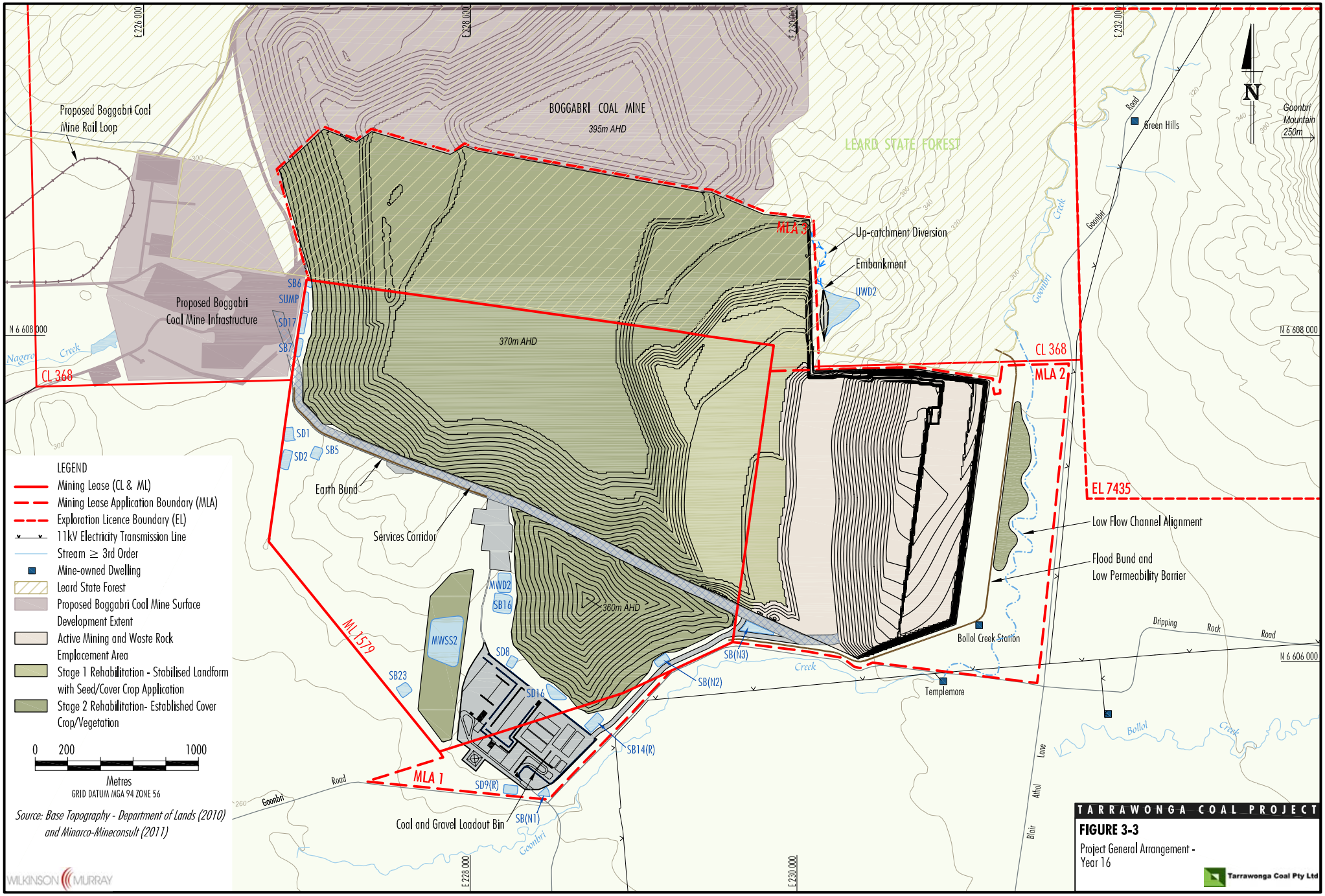

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- An increase in light vehicle traffic generation as a direct result of the increase in employees from 86 to 120 full time on-site personnel, and modifications to shift arrangements to accommodate 24 hour operations, with nominal shift start and finish times at full development as follows:
  - Administration personnel – 7.00 am to 5.00 pm weekdays.
  - Mining Operations Day Personnel – 6.30 am to 7.00 pm.
  - Mining Operations Night Personnel – 6.30 pm to 7.00 am.
- An increase in light vehicle traffic generation by construction workforce, which would comprise 20 additional personnel.
- An increase in deliveries of materials and consumables associated with construction activity.
- An increase in deliveries of consumables directly resulting from increased ROM coal production and on-site activity.
- No change to deliveries and visitor hours (i.e. generally between 6.00 am and 6.00 pm daily).

3.6 Rail Movements

Until approvals and upgrades are in place for the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities, sized ROM coal would continue to be loaded into haulage contractor trucks and transported via the Approved ROM Coal Road Transport Route to the Whitehaven CHPP, where the coal would continue to be either directly loaded onto trains (i.e. bypass) or crushed, screened and washed before being loaded onto trains for rail transport to Newcastle and export markets. No change to existing Whitehaven CHPP rail movements would be required for the Project.

Once approvals and upgrades are in place for the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities, up to ten Project coal trains would be dispatched per week on the Boggabri Coal Mine private rail spur and Werris Creek Mungindi Railway to the Port of Newcastle. This equates to an average of approximately 1.5 trains per day (with a typical coal train capacity of 5,400 t to 6,000 t), with a maximum of two trains per day (or four train movements).

3.7 Blasting

The removal of competent overburden (and interburden) material at the Tarrawonga Coal Mine is presently undertaken by drill and blast techniques. This would continue for the duration of the Project.

A mixture of ANFO (dry holes) and emulsion blends (wet holes) explosives would continue to be used at the Tarrawonga Coal Mine.

Blast sizes would typically include:

- intermediate interburden blasts with a maximum instantaneous charge (MIC) of approximately 1,365 kilograms (kg); and
- deep overburden/interburden blasts with an MIC of approximately 2,275 kg.

Blast designs and sizes would vary over the life of the Project and would depend on numerous factors including the depth of coal seams and the design of benches.

In accordance with DA 88-4-2005 MOD 1, blasting at the Tarrawonga Coal Mine would only occur between the hours of 9.00 am and 5.00 pm Monday to Saturday (excluding public holidays).

DA 88-4-2005 MOD 1 also limits blasting at the Tarrawonga Coal Mine to no more than one blast per day on site, unless an additional blast is required following a misfire. However, for the Project up to two blasts per day would be required (to account for the two advancing mine faces at the Project open cut).

As the open cut mining operations advance to the south-east later in the Project life, some sections of Goonbri Road would be temporarily closed during blast events within 500 m of the public road.

4 NOISE RECEIVERS AND SURROUNDING LAND USES

Land use in the local area is dominated by agricultural operations and open cut coal mining.

Tarrawonga Coal Mine is bounded to the north by the Leard State Forest and the Boggabri Coal Mine. To the west, south and east of the Tarrawonga Coal Mine there are a range of mine-owned and private rural receivers, all of which have been considered in this assessment. These receivers are listed in **Table 4-1** and shown on **Figure 4-1**. The land ownership relating to these receivers are listed in **Figure 4-2**. Receivers with numbering starting with either a 1 or 2 prefix (e.g. 1b) are mine-owned residences.

Of the receivers in **Table 4-1**, receiver 45 is in the current Tarrawonga Coal Mine Affectation Zone (DA 88-4-2005 MOD1). In addition, TCPL has an existing noise agreement relating to haulage of ROM coal with the privately-owned receiver 44a, which is located south of the Tarrawonga Coal Mine.

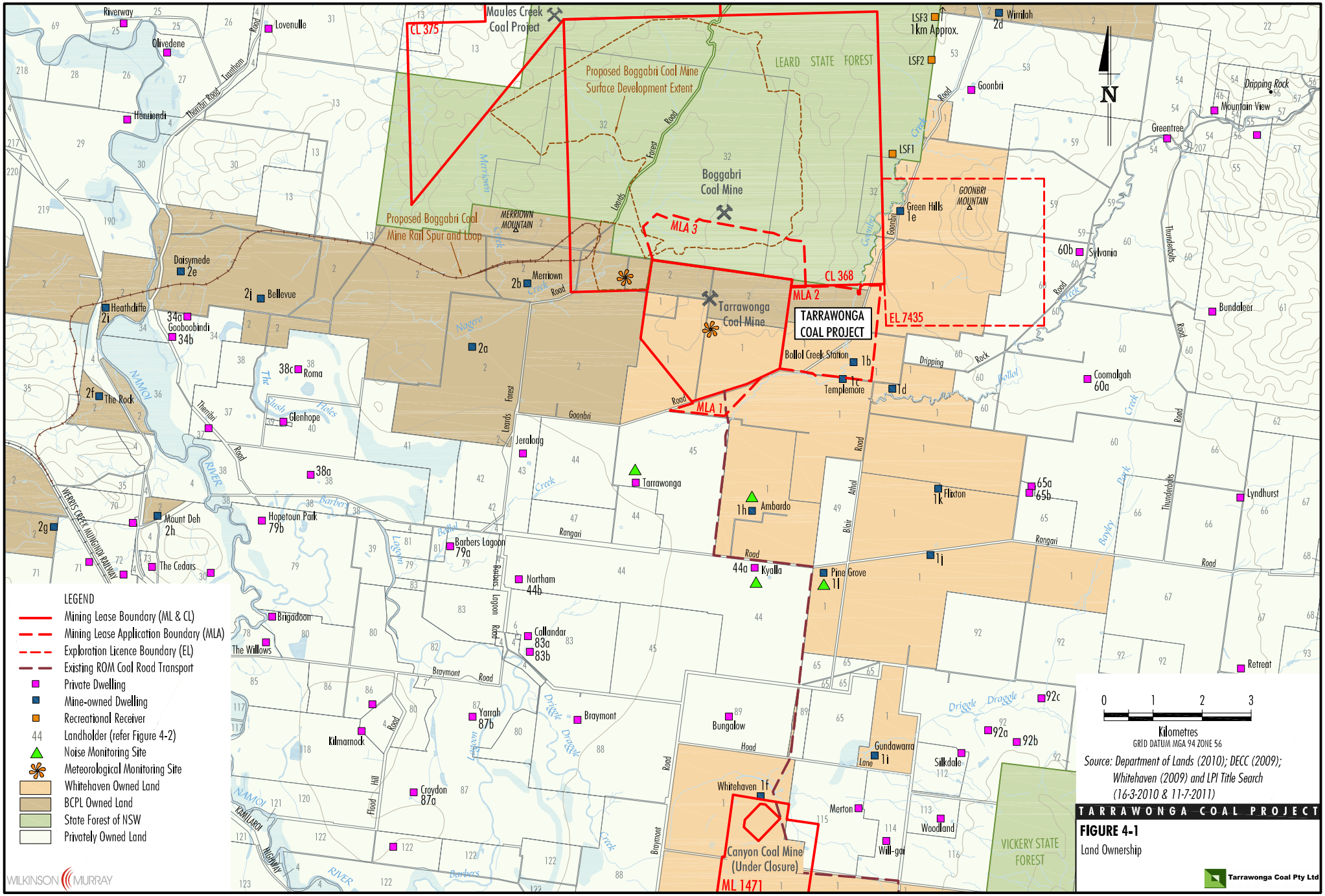
In addition to the receivers listed in **Table 4-1**, three indicative receiver locations in Leard State Forest have been selected for assessment against the Industrial Noise Policy's (INP) amenity criteria. The location of these receivers have been selected for their proximity to access tracks within the forest.

Table 4-1
Receivers Considered in this Assessment

Receiver ID	Dwelling Name	Ownership	Easting	Northing
25	Riverway	Riverway Boggabri Pty Ltd	216220	6613128
27	Olivedene	J.A. Bastardo	217106	6612530
29	Henriendi	P.J. Watson and G. Parkin	216293	6611163
30	-	M.F., S.T. and S.L. Hart and P.F. Rice	217911	6601948
31	Lovenulle	Estate: Perpetual Lease M.J. and M.L. Nott	219178	6613017
34a	Gooboobindi	R.W., A. and R.W. Grover	217462	6607175
34b	-		217214	6606728
37	-	R.J. and E.J. Browning	217952	6604864
38a	-	R.J. Heiler	220038	6603915
38c	Roma		219775	6606045
39	Glenhope	D.V. Gillham	219481	6604997
43	Jeralong	G., L.S. and J.A. Suey	224370	6604351
44a	Kyalla	R.R. and P.L. Crosby	229097	6602016
44b	Northam		224284	6601781
45	Tarrawonga	R.P. and R.D. McGregor	226672	6603754
46	Mountain View	H.J. Lynch	238480	6611350
53	Goonbri	V.P. and S.M. McAuliffe	233520	6611771
54	Greentree	P.A. Devine	237514	6610781
55	-	P.J. Brien and D.M. Austin	239346	6610849
60a	Coomalgah	J.E. and R.J. Picton	235889	6605870
60b	Sylvania		235727	6608460
61	Bundaleer	P.W.J. Pritchard and M.E. McDonald-Pritchard	238437	6607246
65a	-	T.R. Hall and A.I. Myers Johnson	234752	6603700
65b	-		234707	6603594
66	Lyndhurst	M.G. and F.J. Farquhar	239009	6603449
67	Retreat	R.L. and K.A. Penrose	239020	6599961

Table 4-1 (Continued)
Receivers Considered in this Assessment

Receiver ID	Dwelling Name	Ownership	Easting	Northing
70	-	D.W. and A.M. Keys	216265	6602920
71	-	R.A. and C.M. Collyer	215595	6602145
72	-	R.W. and E.J. Kemp	216153	6602004
73	The Cedars	L.W. and M.D. Hunt	216800	6602036
78	The Willows	J.M. and N.M. McKechnie	219126	6600495
79a	Barbers Lagoon	K.D. Gillham	222883	6602455
79b	Hopetoun Park		219041	6602977
80	Brigadoon	A.D. Watson Holdings Pty Ltd	219253	6601019
83a	Callandar	R.P. McGregor	224469	6600621
83b	-		224507	6600300
86	-	Peter J Watson Holdings Pty Ltd	221297	6599230
87a	Croydon	D.S. Riley	222139	6597432
87b	Yarrah		223342	6598974
88	Braymont	M.J. and J.H. Maunder	225481	6598912
89	Bungalow	K.A. and C. Blanch	228572	6598981
92a	-	I. Macleod Hall	233861	6598699
92b	-		234447	6598461
92c	-		234948	6599352
112	Silkdale	N.P. and S.A. Jackson	233318	6598234
113	Woodland	J.R. and K.L. Fletcher	232895	6596896
114	Will-gai	L.P. and T.G. Mainey	231784	6596439
115	Merton	R.D. Mitchell and C.T. Palmer	231216	6597110
118	Kilmarnock	A.D. Watson	221075	6598682
122	-	Nandewar Pty Limited	221722	6596321
1b	Bollol Creek Station	Whitehaven Coal Mining Pty Limited	231114	6606207
1c	Templemore		230899	6605874
1d	-		231907	6605661
1e	Green Hills		232069	6609299
1f	Whitehaven		229210	6597384
1h	Ambardo		229044	6603178
1i	Gundawarra		231547	6598184
1j	-		232693	6602344
1k	Flixton		232841	6603631
1l	Pine Grove		230504	6601914
2a	-	Boggabri Coal Pty Limited	223331	6606527
2b	Merriown		224464	6607819
2d	Wirrilah		234081	6613345
2e	Daisymede		217335	6608075
2f	The Rock		215770	6605490
2g	-		214795	6602850
2h	Mount Deh		216920	6603080
2i	Heathcliffe		215815	6607410
2j	Bellvue		219019	6607512
LSF1	N/A	Leard State Forest	231911	6610467
LSF2	N/A		232705	6612382
LSF3	N/A		232947	6614338



TARRAWONGA COAL PROJECT

FIGURE 4-1

Land Ownership

Tarrawonga Coal Pty Ltd

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REFERENCE No.	LANDHOLDER	REFERENCE No.	LANDHOLDER
1	Whitehaven Coal Mining Pty Limited	65	T.R. Hall and A.I. Myers Johnson
2	Boggabri Coal Pty Limited	66	M.G. and F.J. Farquhar
4	The State of New South Wales	67	R.L. and K.A. Penrose
6	Narrabri Shire Council	68	P.G. and I.L. Capel
7	The Council of the Shire of Namoi	69	B.G. and K.M. Bomford
13	Aston Coal 2 Pty Ltd	70	D.W. and A.M. Keys
22	C.D. and C.A. Baldwin	71	R.A. and C.M. Collyer
25	Riverway Boggabri Pty Ltd	72	R.W. and E.J. Kemp
26	Bresrow Pty Ltd	73	L.W. and M.D. Hunt
27	J.A. Bastardo	78	J.M. and N.M. McKechnie
28	D.B. Hudson	79	K.D. Gillham
29	P.J. Watson and G. Parkin	80	A.D. Watson Holdings Pty Ltd
30	M.F., S.T. and S.L. Hart and P.F. Rice	81	K.L. Grover
31	Estate: Perpetual Lease M.J. and M.L. Nott	82	E.C. and J.E. Clarke
32	State Forests of NSW	83	R.P. McGregor
34	R.W., A. and R.W. Grover	85	Kilmarnock (Boggabri) Pty Ltd
35	Aston Coal 2 Pty Ltd and Boggabri Coal Pty Ltd	86	Peter J Watson Holdings Pty Ltd
36	G.P., L.F. and W.P. Clarke	87	D.S. Riley
37	R.J. and E.J. Browning	88	M.J. and J.H. Maunder
38	R.J. Heiler	89	K.A. and C. Blanch
39	D.V. Gillham	92	I. Macleod Hall
40	D.V. and R.J. Gillham	93	G.A. and M.E. Geddes
41	L.E. James and K.E. Woodward	112	N.P. and S.A. Jackson
42	K.R. and K.A. Pryor	113	J.R. and K.L. Fletcher
43	G., L.S. and J.A. Suey	114	L.P. and T.G. Mainey
44	R.R. and P.L. Crosby	115	R.D. Mitchell and C.T. Palmer
45	R.P. and R.D. McGregor	116	C.R. and C.P. Stewart Investments Pty Limited
46	H.J. Lynch	117	J.L. and K. Davis
47	B.J. Crosby	118	A.D. Watson
49	P. and A.C. Laird	120	Nambarloo Pty Limited
53	V.P. and S.M. McAuliffe	121	D.M. and C.A. Kirkbride
54	P.A. Devine	122	Nandewar Pty Limited
55	P.J. Brien and D.M. Austin	123	Primeag Australia Limited
56	F. Agsten	190	L.E. Christie-Rockliff
57	P.N. Bet	207	J. and T. Milosevski
59	P.M. and M.I. Mainey	217	F.J. Maunder
60	J.E. and R.J. Picton	218	P.A. Maunder
61	P.W.J. Pritchard and M.E. McDonald Pritchard	219	P.J. Watson
62	I. and B. Doshen	220	Glek Pty Ltd

Source: LPI (2010 & 2011)

TARRAWONGA COAL PROJECT

FIGURE 4-2

Relevant Land Ownership List

WILKINSON MURRAY

Tarrawonga Coal Pty Ltd

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5 OPERATIONAL NOISE ASSESSMENT CRITERIA

5.1 Intrusiveness and Amenity Criteria

The INP specifies two noise criteria:

- an intrusiveness criterion which requires that the equivalent continuous noise level ($L_{Aeq,15\ minute}$) from a specific industrial source should not exceed the background noise level by more than 5 A-weighted decibels (dBA); and
- an amenity criterion which aims to maintain noise amenity over the whole daytime, evening or night-time period where it is subjected to cumulative noise from a number of industrial sources.

The INP stipulates that *the background noise levels to be measured are those that are present at the time of the noise assessment and without the subject development operating. Hence, for the assessment of modifications to an existing development, the noise from the existing development should be excluded from background noise measurements*.

Construction of the Tarrawonga Coal Mine commenced in 2006 and it is therefore considered appropriate to refer to the baseline noise levels established by Spectrum Acoustics for the 2005 Environmental Impact Statement (EIS), which is the relevant original assessment document for the Tarrawonga Coal Mine. Background noise levels are defined in this document as follows:

> *A noise study was conducted in 1982 by Louis Challis & Associates for the Boggabri Coal Project (LCA, 1982). Noise measurements were taken at several residences on farms in the area around the Boggabri Coal Project area.*
>
> *The results of LCA (1982) were typical of rural areas away from major roads and industries with daytime background LA_{90} noise levels of around 30dB(A),L_{90} and night time L_{90} levels as low as 23dB(A). Given that there has been no appreciable change in the acoustic environment in the intervening years, these background levels would remain appropriate and have been adopted for the present assessment.*
>
> *It is a standard DEC requirement that noise levels below 30dB(A) shall be taken as 30dB(A) for the purposes of assessing industrial noise, so that the 30dB(A),L_{90} background level would be adopted for all residential receivers during the day, evening and night.*

In addition to the above, background noise surveys were also conducted for the original Maules Creek EIS in February 1986, including at The Rock (receiver 2f in this assessment) (Bridges Acoustics, 2011). This survey also showed that daytime noise levels are around 30 dBA, whilst night-time noise was dominated by extraneous insect noise (Bridges Acoustics, 2011).

Based on the existing Rating Background Noise Level (RBL) for day, evening and night periods being assumed to be 30 dBA, the intrusiveness criterion is 35 dBA $L_{Aeq,15\ minute}$ for all privately-owned receivers. This is consistent with Schedule 3, Condition 2 of the existing Tarrawonga Coal Mine Development Consent (DA 88-4-2005 MOD1).

The amenity criteria are relevant in the context of controlling cumulative noise impacts resulting from the concurrent operation of the Project and the other potential sources of industrial noise (for example, the Boggabri Coal Continuation Project and the Maules Creek Coal Project, located immediately north and north-north-west of the Tarrawonga Coal Mine, respectively [**Figure 1-1**]). The amenity criteria set upper limits to control the total $L_{Aeq,Period}$ noise levels at a given receiver from all industrial sources over day, evening and night periods. In this case, the surrounding receivers are situated in an area which would be classified as “Rural” under the INP, and the relevant recommended “acceptable” amenity criteria for $L_{Aeq,Period}$ are 50, 45 and 40 dBA for daytime, evening and night-time periods, respectively.

In addition, the INP also stipulates a recommended "maximum" amenity level of 5 dBA above the "acceptable" levels.

The INP describes the 'Project-specific criteria' as being the lower (i.e. more stringent) of the intrusiveness and amenity criteria. Consistent with this approach, this assessment uses the intrusiveness criterion to assess noise from the Project, and the amenity criteria to assess cumulative noise.

In addition to the above, three receiver locations have been chosen within Leard State Forest (LSF1-3) in order to review the potential for noise impacts under the amenity criteria for areas specifically reserved for passive recreation. The recommended "acceptable" and "maximum" noise levels for passive recreation areas are 50 and 55 dBA $L_{Aeq,Period}$, respectively.

In view of the above, **Table 5-1** summarises the criteria used in this assessment.

Table 5-1
Project Criteria Summary

Criteria Type	Receiver Number	Receiver Description	Day	Evening	Night-time
INP Intrusive	All except for LSF1-3	Residential receivers	35 $L_{Aeq,15\ minute}$ (dBA)	35 $L_{Aeq,15\ minute}$ (dBA)	35 $L_{Aeq,15\ minute}$ (dBA)
INP Amenity	All except for LSF1-3	Residential receivers	50 $L_{Aeq,Period}$ (dBA) recommended acceptable	45 $L_{Aeq,Period}$ (dBA) recommended acceptable	40 $L_{Aeq,Period}$ (dBA) recommended acceptable
			55 $L_{Aeq,Period}$ (dBA) recommended maximum	50 $L_{Aeq,Period}$ (dBA) recommended maximum	45 $L_{Aeq,Period}$ (dBA) recommended maximum
INP Amenity	LSF1-3	Leard State Forest recreation areas	Recommended acceptable and recommended maximum noise levels for passive recreation areas are 50 and 55 $L_{Aeq,Period}$ (dBA), respectively when in use.		

Notes:

Day: the period from 7:00 am to 6:00 pm Monday to Saturday; or 8:00 am to 6:00 pm on Sundays and public holidays

Evening: the period from 6:00 pm to 10:00 pm

Night: the remaining periods.

Assessment Methodology

The INP states that intrusiveness and amenity criteria have been developed to protect at least 90% of the population living in the vicinity of the industrial noise sources from the adverse effects of noise for at least 90% of the time (Environment Protection Authority [EPA], 2000). Provided the criteria in the INP are achieved, it is unlikely that most people would consider the resultant noise levels excessive.

In those cases where the criteria are not achieved, it does not automatically follow that all people exposed to the noise would find the noise unacceptable. In subjective terms, exceedances of the Project-specific noise assessment criteria can generally be described as follows:

- Negligible noise level increase <1 dBA (not noticeable by all people).
- Marginal noise level increase 1 to 2 dBA (not noticeable by most people).
- Moderate noise level increase 3 to 5 dBA (not noticeable by some people but may be noticeable by others).
- Appreciable noise level increase >5 dBA (noticeable by most people).

In view of the above, **Table 5-2** presents the methodology for assessing noise levels which may exceed the INP project specific noise assessment criteria.

Table 5-2
Project Noise Impact Assessment Methodology

Assessment Criteria	Noise Criteria	Noise Management Zone		Noise Affectation Zone
		Marginal	Moderate	
Intrusiveness $L_{Aeq,15\ minute}$	Refer Table 5-1	1 to 2 dBA above Project-specific criteria	3 to 5 dBA above Project-specific criteria	> 5 dBA above Project-specific criteria
Amenity $L_{Aeq,Period}$	Refer Table 5-1			

5.2 Sleep Disturbance Criterion

To help protect against people waking from their sleep, the OEH recommends that 1-minute L_{A1} noise levels (effectively, the $L_{A,max}$ maximum noise level) should not exceed the background noise level (assessed by the RBL) by more than 15 dBA when measured or computed at the location of a building façade. The "sleep disturbance" criterion is only applicable to night-time (10.00 pm to 7.00 am) operations.

On the basis that the RBL in the area can be assumed to be 30 dBA, the sleep disturbance criterion when assessed external to the residence is 45 dBA $L_{A1,1\ minute}$. This is consistent with Schedule 3, Condition 2 of the existing Tarrawonga Coal Mine Development Consent (DA 88-4-2005 MOD 1).

6 OPERATIONAL NOISE ASSESSMENT

6.1 Noise Modelling Methodology

Operational noise levels at nearby receivers have been calculated using the Environmental Noise Model (ENM) prediction model (a proprietary computer program from RTA Technology Pty Ltd). This modelling software has been previously accepted by the OEH for use in environmental noise assessments. The assessment models the total noise at each receiver from the operation of the Project. Total predicted operational noise levels are then compared with the operational noise criteria presented in **Table 5-1**.

6.1.1 Noise Assessment Scenarios

Noise modelling was undertaken for the day, evening and night operating scenarios for mining Years 2, 4 and 16. **Section 3.4** provides the rationale behind the selection of these scenarios.

Assessment of the Project's potential noise impacts conservatively includes the contributions from some coal handling and processing equipment at the Boggabri Coal Mine which would be undertaken in accordance with a separate approval. This is plant identified by TCPL as being required for the handling, processing and rail loading of Tarrawonga Coal Mine coal at the Boggabri Coal Mine once the proposed services corridor has been commissioned. Further details are provided in **Section 6.3**.

6.1.2 Meteorological Environment for Noise Assessment Purposes

The INP generally directs the use of a single set of adverse meteorological data in the assessment of noise impacts (EPA, 2000). However, for noise modelling in this and other projects (including the noise assessment for the Modification EA [Wilkinson Murray, 2010]), Wilkinson Murray has adopted the more rigorous approach of predicting noise levels at nearby receivers for a range of meteorological conditions based on meteorological data obtained from the locality. The noise modelling presented in this assessment is based on data provided by PAEHolmes (2011) from their CALMET model at a location indicative of the Tarrawonga Coal Mine meteorological station for the 2010 calendar year. CALMET data have been used as it includes a contiguous dataset of wind speed, direction and temperature inversion (based on sigma theta data) which is not available from the local weather station. Statistical occurrences of meteorological conditions are used to calculate a 10^{th} percentile exceedance noise level (i.e. the level that is exceeded 10% of the time), which is then compared with relevant criteria.

This alternative assessment procedure involves significantly greater computational complexity than the use of a single set of meteorological conditions. However, we believe it provides a more rigorous method of assessing noise exposure, and one that is more easily understood by the community. The approach of using the 10^{th} percentile calculated noise level as a measure of noise impacts has been considered acceptable by the OEH for previous similar mining project assessments.

The data for wind direction and wind speed are classified into eight directional intervals and five speed intervals (between 0.5 m/s and 3 m/s - with all other instances of wind speed ascribed as "calm") in accordance with the INP.

Stability class data provided by PAEHolmes (2011) were resolved into Pasquil-Gifford stability classes using the CALPUFF modelling package. However, the CALPUFF-generated data are only available in a six class system (i.e. A-F), where the F class also includes occurrences of G category stability class. Wilkinson Murray resolved G class data from the CALPUFF data generally in accordance with Table E6 of Appendix E of the INP by identifying recorded instances of F class during night periods for which the wind speed was less than 2 m/s.

Based on this analysis, temperature inversions with a strength of up to 4 degrees Celsius (°C)/100 m combined with winds of up to 1.75 m/s were included within the meteorological conditions modelled for the Project.

The above procedure considers all meteorological conditions at all receivers, and the conditions which determine the 10th percentile noise level would differ between receivers. For receivers to the south of the Project, 10th percentile night-time meteorological conditions include temperature inversions of 4°C/100 m combined with winds from the north of a strength of 1.75 m/s.

In accordance with the OEH's (2011) *Application Notes – NSW Industrial Noise Policy*, noise levels at sensitive receivers were also predicted for calm meteorological conditions.

6.2 Investigation of Feasible and Reasonable Noise Mitigation Measures

The Modification EA (Whitehaven, 2010) included a number of specific mitigation measures designed to reduce noise levels associated with the modification. These measures, along with a status of their implementation, are provided in **Table 6-1**.

Table 6-1
Implementation Status of Specific Mitigation Measures described in the Modification EA

Specific Mitigation Measures	TCPL Implementation Status
Installation of a 6 m high bund on the southern side of selected portions of the haul roads (where the haul roads run east-west).	Bund constructed on main truck haul road from the open cut to the ROM pad.
Where required by real-time noise monitoring, cessation of waste emplacement activities within the Southern Emplacement during evening and night-time periods.	Real-time noise monitor installed at Receiver 60b Sylvania since the end of May 2011. TCPL has advised that monitoring results have confirmed compliance with noise levels with no requirement for alteration to mining activities to date (to September 2011).
Modified alignment of haul routes (in particular, relocating the haul route from the pit floor to the northern face of the Northern Emplacement, away from receivers to the south).	Waste preferentially hauled to the Northern Emplacement via northern haul road. Access is occasionally required from the south to allow appropriate dump development/shaping.
ROM coal stockpiles orientated to screen the primary crusher.	ROM stockpile positioned on the southern side of the crusher to minimise potential for noise propagation to private receivers to the south and south-east.
Modification of the fleet during evening and night-time periods; including a reduction in the number of water carts, dozers and loaders, and cessation of scrapers.	A number of fleet items are (e.g. some water carts, dozers, loaders and scrapers) are not used at night-time.

6.2.1 Noise Mitigation Measures to be Adopted for the Project

The modelled scenarios presented in this report represent the culmination of several iterative noise modelling investigations designed to determine feasible and reasonable noise mitigation measures. The scenarios also drew upon the knowledge gained during modelling conducted as part of the Modification EA (Wilkinson Murray, 2010). For example, the specific mitigation measures described in **Table 6-1** were considered during the development of the Project noise assessment and incorporated where applicable.

Where feasible and reasonable, operations have been modified to reduce potential noise emissions from the Project. The iterative steps undertaken are described below:

1. Preliminary noise modelling of scenarios representative of the maximum noise emissions from the Project to identify the potential for noise exceedances.
2. Evaluation of various combinations of noise management and mitigation measures to assess their relative effectiveness.
3. Review of the effectiveness of these measures and assessment of their feasibility by TCPL.
4. Adoption by TCPL of management and mitigation measures to appreciably reduce noise emissions associated with the Project, including:
   - installation of a 6 m high bund[2] on the southern side of exposed sections of the services corridor (i.e. ROM coal haul road to the Boggabri Coal Mine Infrastructure Facilities).
   - modified alignment of haul routes to reduce exposure relative to nearby receivers; and
   - modification of the fleet during the evening and night-time periods.

6.3 Fleet List and Sound Power Levels

Table 6-2 presents the schedule of equipment, plant sound power levels and the period of operation of plant (i.e. day/evening/night) used in the noise modelling. The sound power levels given in **Table 6-2** are conservative in that they are based on plant operating at maximum capacity for an entire 15 minutes.

The assessment of noise from the Project includes the contributions from some coal handling and processing equipment at the Boggabri Coal Mine which would be undertaken in accordance with a separate approval. This is because the Project ROM coal would be processed, handled and transported using this infrastructure following approvals and upgrades for the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities being in-place. These plant items are identified separately in **Table 6-2**.

As shown on **Figure 1-1**, the Approved ROM Coal Road Transport Route includes private sections and public sections (e.g. Rangari Road and Blue Vale Road).

As described above, Project ROM coal would be transported directly to the Boggabri Coal Mine Infrastructure Facilities for handling and processing, and coal products would then transported by rail via the Boggabri Coal Mine rail loop and spur along the Werris Creek Mungindi Railway (once approvals and upgrades are in place). This would result in the cessation of transportation of ROM coal to the Whitehaven CHPP and a material reduction in overall road transport movements along the Approved ROM Coal Road Transport Route.

The operational noise scenarios have therefore focused on Project mine-site noise, and do not include the re-assessment of any private sections of the Approved ROM Coal Road Transport Route. Public road noise is assessed in **Section 7**.

[2] It should be noted that noise modelling conservatively included a 5 m high bund, however, TCPL commits to building a 6 m high bund.

Table 6-2
Indicative Equipment Sound Power Levels

	Fleet Item	Model	Location / Function	Number of Equipment	Period	Sound Power Level L_{Aeq} (dBA)	Reference
Equipment at Tarrawonga Coal Mine	Excavators	RH170	Waste rock removal	3	Day, evening, night	115	Spectrum Acoustics (2005)
		RH340	Coal mining	1		115	
		EX1900	Coal mining	1		114	Spectrum Acoustics (2005)
	Haul Trucks	3300	Haul roads (waste rock)	7	Day, evening, night	116 (on grade) / 119 (on incline)	Spectrum Acoustics (2010a)
		785C	Haul roads (coal)	12		118/121	Spectrum Acoustics (2010a)
		793/830	Haul roads (waste rock)	4		118/121	Wilkinson Murray Database
	Dozers	D11R	Topsoil removal	4	Day	116	Wilkinson Murray (2010)
		D11R	Waste rock removal		Day, evening, night		
		D11R	Waste rock emplacement		Day, evening, night		
		D11R	Waste rock emplacement		Day		
		D10R	Coal mining	1	Day, evening, night	116	Wilkinson Murray Database
	Loaders	988H	Mobile crusher	1	Day	117	Spectrum Acoustics (2010a)
	Scrapers	637-2	Topsoil removal	4	Day	115	Spectrum Acoustics (2005)
	Graders	16M	Haul roads	2	Day, evening, night	108	Wilkinson Murray (2010)
	Drill	SKF	Waste rock blasting	1	Day	117	Spectrum Acoustics (2010a)
		Cubex	Waste rock blasting	1	Day	117	Spectrum Acoustics (2010a)
		DML60	Waste rock blasting	1	Day	117	Spectrum Acoustics (2010a)
	Water Cart	Road	Haul roads	4	Day, evening, night	107/110	Wilkinson Murray (2010)
	Water Truck	773	Topsoil removal	1	Day	108/111	Wilkinson Murray Database
	Mobile Crusher	-	New Mine Facilities Area	1	Day	113	Wilkinson Murray (2010)

Table 6-2 (Continued)
Indicative Equipment Sound Power Levels

	Fleet Item	Model	Location / Function	Number of Equipment	Period	Sound Power Level L_{Aeq} (dBA)	Reference
Equipment at Boggabri Coal Mine	Loaders	IT38G	Boggabri Coal Mine ROM Pad	1	Day, evening, night	117	Spectrum Acoustics (2010a)
	Dozers	D10R	Boggabri Coal Mine Product Coal Stockpile	1	Day, evening, night	116	Wilkinson Murray (2010)
	Primary Crusher	-	Boggabri Coal Mine ROM Pad	1	Day, evening, night	113	Spectrum Acoustics (2010a)
	Locomotive (idling)	-	Boggabri Coal Mine Rail Loop	3	Day, evening, night	97	Bridges Acoustics (2010)

6.4 Predicted Operational Noise Levels from the Project

The predicted 10th percentile $L_{Aeq,15\ minute}$ operational noise levels at each receiver are presented in **Table 6-3**. Results are presented for each of Years 2, 4 and 16 for both calm and adverse meteorological conditions (**Section 6.1.2**). Indicative noise contours for night-time operations under adverse meteorological conditions for Years 2, 4 and 16 are presented in **Figures 6-1**, **6-2** and **6-3**, respectively.

Within **Table 6-3**, predicted operational noise levels at privately-owned receivers in excess of the 35 dBA $L_{Aeq,15\ minute}$ noise criterion are shown in **bold**. The mine-owned receivers are included in **Table 6-3** for the purpose of information only.

The results in **Table 6-3** may be summarised as follows:

Daytime

- During the day, operational noise from the Project would comply with the 35 dBA $L_{Aeq,15\ minute}$ criterion at all privately-owned receivers.

Calm Meteorological Conditions (Night)

- During periods of calm meteorological conditions at night, operational noise from the Project would comply with the 35 dBA $L_{Aeq,15\ minute}$ criterion at all privately-owned receivers.

Tenth Percentile Meteorological Conditions (day, evening and night)

- In most instances, operational noise from the Project at nearby receivers would be highest during evening and night-time periods due mainly to the prevalence of temperature inversions.
- Noise exceedances of the 35 dBA $L_{Aeq,15\ minute}$ criterion of greater than 5 dBA are predicted for receivers 43 and 45 during evening and night-time periods.
- Noise exceedances of the 35 dBA $L_{Aeq,15\ minute}$ criterion of between 3-5 dBA are predicted for privately-owned receiver 44a during the evening and night-time periods.

A summary of those receivers predicted to exceed criteria under adverse meteorological conditions is provided in **Table 6-4**. The receivers are segregated according to the DP&I "Noise Management Zone" (receivers exposed to noise exceedances of between 1 to 5 dBA) and "Noise Affectation Zone" (receivers exposed to noise >5 dBA above the noise criterion) classifications.

Table 6-3
Predicted $L_{Aeq,15\ minute}$ 10th Percentile Operational Noise from Project (including Calm Meteorological Conditions)

Receiver ID	$L_{Aeq,15\ minute}$ Noise Level (dBA)[1, 2]												
	Year 2				Year 4				Year 16				Noise
	Night (Calm)	Day (Mets)	Evening (Mets)	Night (Mets)	Night (Calm)	Day (Mets)	Evening (Mets)	Night (Mets)	Night (Calm)	Day (Mets)	Evening (Mets)	Night (Mets)	Criterion (dBA)
30	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	35
31	<20	25	25	26	<20	25	26	26	<20	25	25	26	35
34a	<20	25	26	27	<20	25	26	27	<20	24	25	26	35
34b	<20	25	26	27	<20	25	26	27	<20	22	24	25	35
37	<20	23	25	26	<20	23	26	27	<20	22	25	26	35
38a	<20	26	29	30	<20	27	29	30	<20	26	28	30	35
38c	<20	23	27	28	<20	23	27	28	<20	22	26	27	35
39	<20	24	27	28	<20	24	28	29	<20	23	26	27	35
43	27	32	**40**	**41**	28	33	**40**	**42**	26	32	**40**	**41**	35
44a	26	28	**38**	**39**	28	28	**39**	**39**	27	29	**39**	**39**	35
44b	21	22	34	35	22	22	34	35	20	23	33	34	35
45	30	30	**44**	**46**	31	30	**45**	**46**	30	31	**44**	**46**	35
46	<20	23	24	24	<20	24	24	25	<20	25	24	25	35
53	<20	30	30	31	<20	32	31	32	20	31	29	30	35
54	<20	23	24	24	<20	24	24	25	<20	26	25	26	35
55	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	35
60a	22	29	30	31	22	30	31	32	23	30	31	32	35
60b	<20	27	27	28	<20	28	28	29	<20	30	29	30	35
61	<20	25	25	26	<20	25	26	26	<20	26	26	26	35
65a	22	27	31	32	23	29	32	33	23	27	30	32	35
65b	22	27	31	32	22	28	32	33	22	27	30	32	35
66	<20	23	24	25	<20	24	25	26	<20	22	24	24	35

Table 6-3 (Continued)
Predicted $L_{Aeq,15\ minute}$ 10th Percentile Operational Noise from Project (including Calm Meteorological Conditions)

Receiver ID	$L_{Aeq,15\ minute}$ Noise Level (dBA)[1, 2]												
	Year 2				Year 4				Year 16				Noise
	Night (Calm)	Day (Mets)	Evening (Mets)	Night (Mets)	Night (Calm)	Day (Mets)	Evening (Mets)	Night (Mets)	Night (Calm)	Day (Mets)	Evening (Mets)	Night (Mets)	Criterion (dBA)
67	<20	20	23	23	<20	21	23	24	<20	<20	22	22	35
70	<20	22	23	25	<20	23	24	25	<20	22	24	25	35
71	<20	<20	21	22	<20	<20	22	23	<20	<20	21	21	35
72	<20	<20	21	21	<20	<20	22	22	<20	<20	<20	<20	35
73	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	35
78	<20	21	26	27	<20	22	26	26	<20	20	24	25	35
79a	21	25	33	34	22	25	33	34	20	25	32	34	35
79b	<20	25	27	28	<20	25	27	28	<20	24	26	27	35
80	<20	22	26	27	<20	23	26	27	<20	21	24	25	35
83a	<20	20	32	33	20	20	32	33	<20	<20	30	31	35
83b	<20	<20	31	32	20	20	31	32	<20	<20	29	31	35
86	<20	<20	27	27	<20	<20	26	27	<20	<20	24	25	35
87a	<20	<20	26	26	<20	<20	25	26	<20	<20	22	23	35
87b	<20	<20	28	29	<20	<20	28	29	<20	<20	25	27	35
88	<20	<20	29	30	<20	20	30	30	<20	<20	27	28	35
89	<20	22	30	31	21	22	31	31	<20	<20	29	30	35
92a	<20	20	27	28	<20	20	28	28	<20	<20	28	28	35
92b	<20	<20	27	27	<20	<20	27	28	<20	<20	27	28	35
92c	<20	<20	27	27	<20	<20	27	27	<20	<20	26	26	35
112	<20	<20	28	28	<20	<20	28	29	<20	<20	29	29	35
113	<20	<20	26	26	<20	<20	26	26	<20	<20	24	25	35
114	<20	<20	26	26	<20	<20	26	26	<20	<20	24	24	35
115	<20	<20	26	27	<20	<20	26	27	<20	<20	25	26	35
118	<20	<20	20	21	<20	<20	21	21	<20	<20	<20	<20	35
122	<20	<20	24	25	<20	<20	24	25	<20	<20	20	21	35

Table 6-3 (Continued)
Predicted $L_{Aeq,15\ minute}$ 10th Percentile Operational Noise from Project (including Calm Meteorological Conditions)

Receiver ID	$L_{Aeq,15\ minute}$ Noise Level (dBA)[1, 2]												
	Year 2				Year 4				Year 16				Noise
	Night (Calm)	Day (Mets)	Evening (Mets)	Night (Mets)	Night (Calm)	Day (Mets)	Evening (Mets)	Night (Mets)	Night (Calm)	Day (Mets)	Evening (Mets)	Night (Mets)	Criterion (dBA)
1b[3]	41	43	47	48	40	43	48	49	N/A[3]	N/A[3]	N/A[3]	N/A[3]	35
1c[3]	43	44	48	49	42	44	49	50	N/A[3]	N/A[3]	N/A[3]	N/A[3]	35
1d	35	37	42	43	35	38	43	44	40	45	49	50	35
1e	22	35	36	37	24	38	38	39	29	39	38	39	35
1f	<20	<20	28	29	<20	20	28	29	<20	<20	27	28	35
1h	30	32	43	43	32	32	43	43	32	34	44	45	35
1i	<20	<20	28	28	<20	20	28	28	<20	<20	27	27	35
1j	23	24	34	34	24	25	34	35	24	23	35	36	35
1k	27	30	36	37	27	30	36	38	29	30	39	40	35
1l	25	27	36	37	26	27	37	37	27	26	38	39	35
2a	26	33	38	39	26	33	38	39	25	32	37	38	35
2b	34	38	43	44	34	38	43	44	34	38	42	44	35
2d	<20	30	29	29	<20	30	29	30	<20	29	28	29	35
2e	<20	20	22	23	<20	<20	21	22	<20	<20	20	21	35
2f	<20	22	24	24	<20	22	24	25	<20	20	23	24	35
2g	<20	21	22	23	<20	21	23	24	<20	22	23	24	35
2h	<20	23	25	25	<20	23	25	25	<20	23	24	25	35
2i	<20	21	23	23	<20	21	23	24	<20	21	23	24	35
2j	<20	27	28	29	<20	26	28	29	<20	26	27	28	35

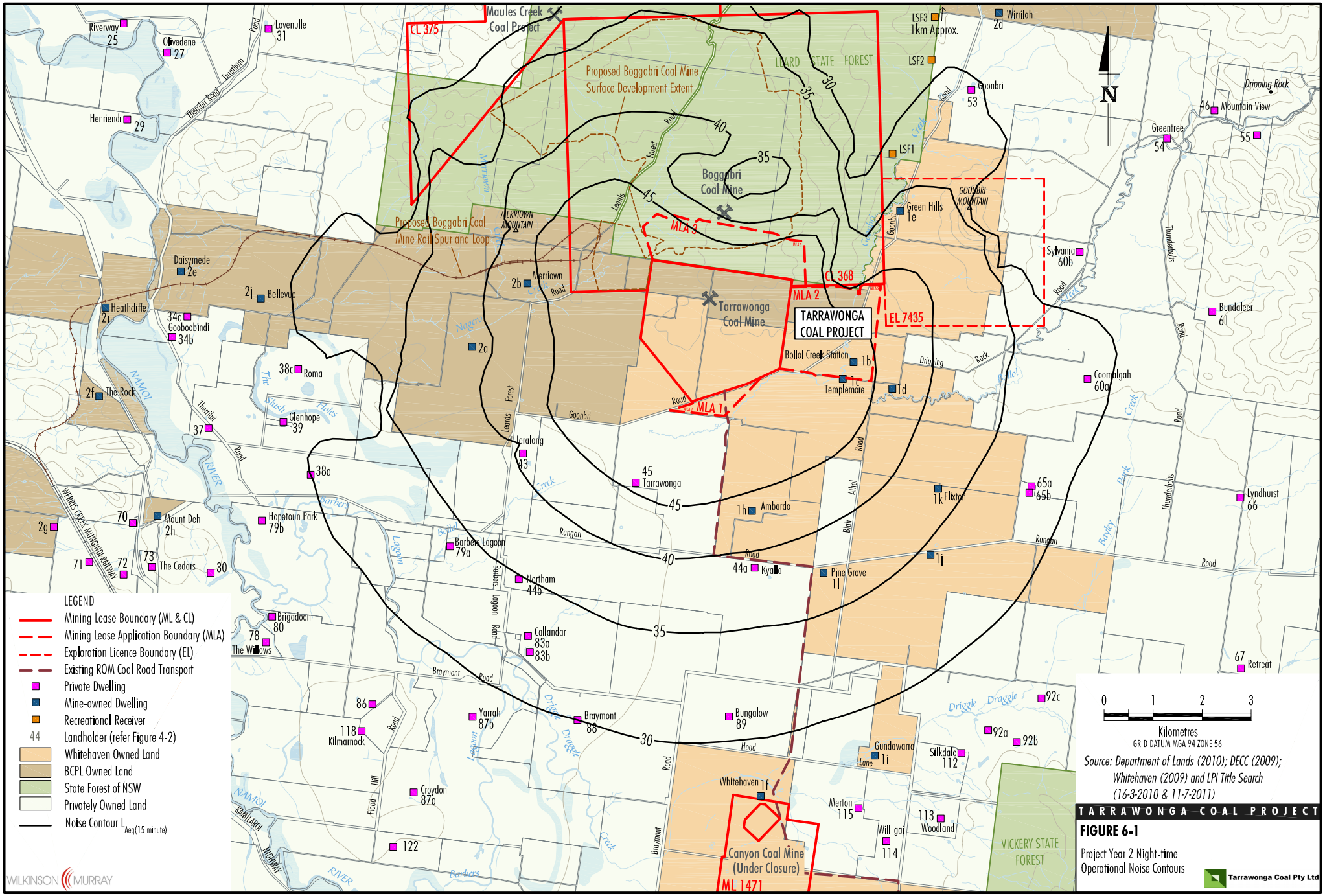
Notes:

1 Noise levels predicted to result under 10th percentile meteorological conditions as described in Section 6.1.2 (indicated by 'Mets').

2 **Bold** indicates exceedances of 35dBA $L_{Aeq,15\ minute}$ noise criterion for privately-owned receivers.

3 Receivers 1b and 1c would not be occupied during Year 16.

4 Receivers 1b-1l and 2a-2j are mine-owned



Source: Department of Lands (2010); DECC (2009); Whitehaven (2009) and LPI Title Search (16-3-2010 & 11-7-2011)

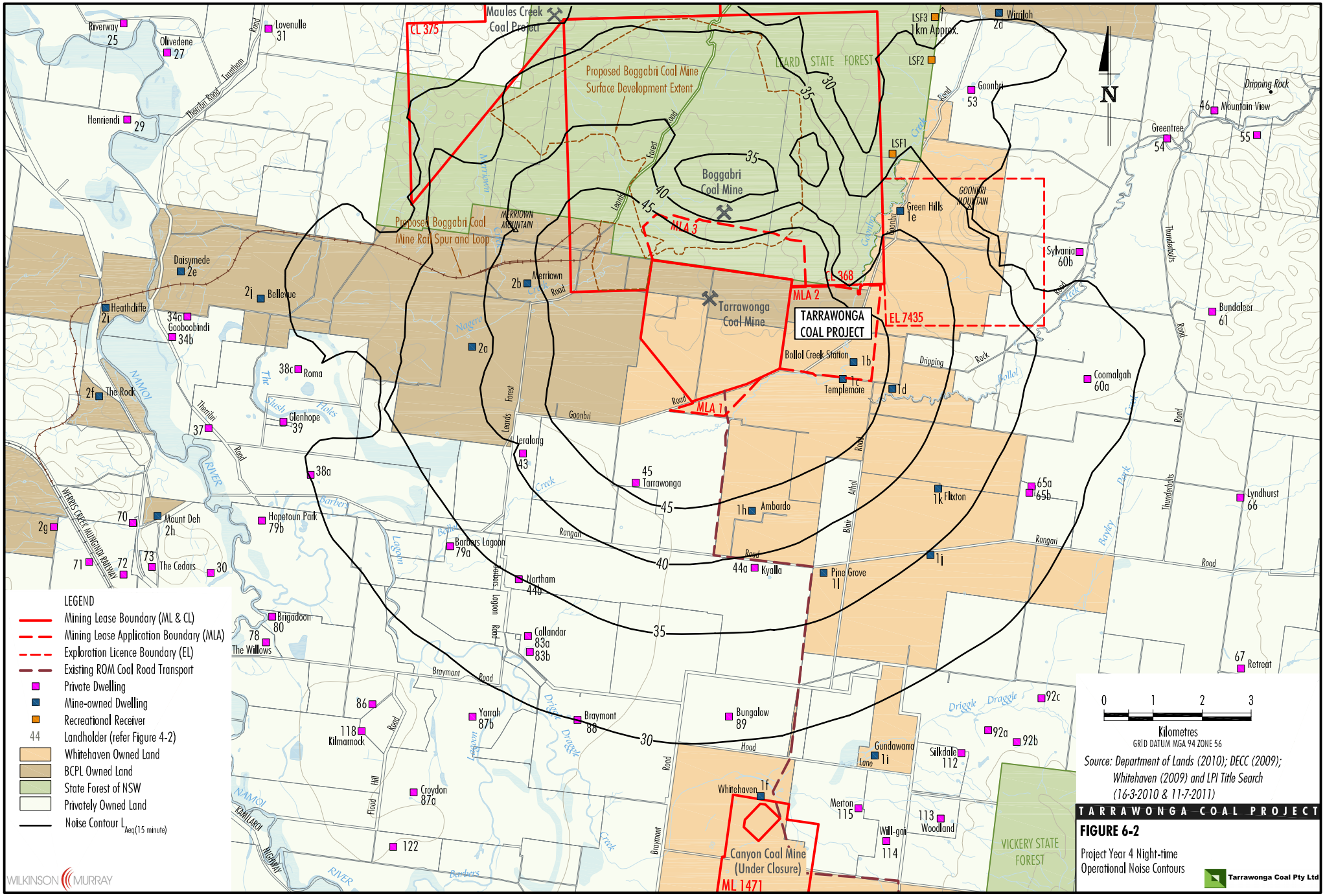
TARRAWONGA COAL PROJECT

FIGURE 6-1

Project Year 2 Night-time Operational Noise Contours

Tarrawonga Coal Pty Ltd

WHC-10-04 EA App NBA_107E



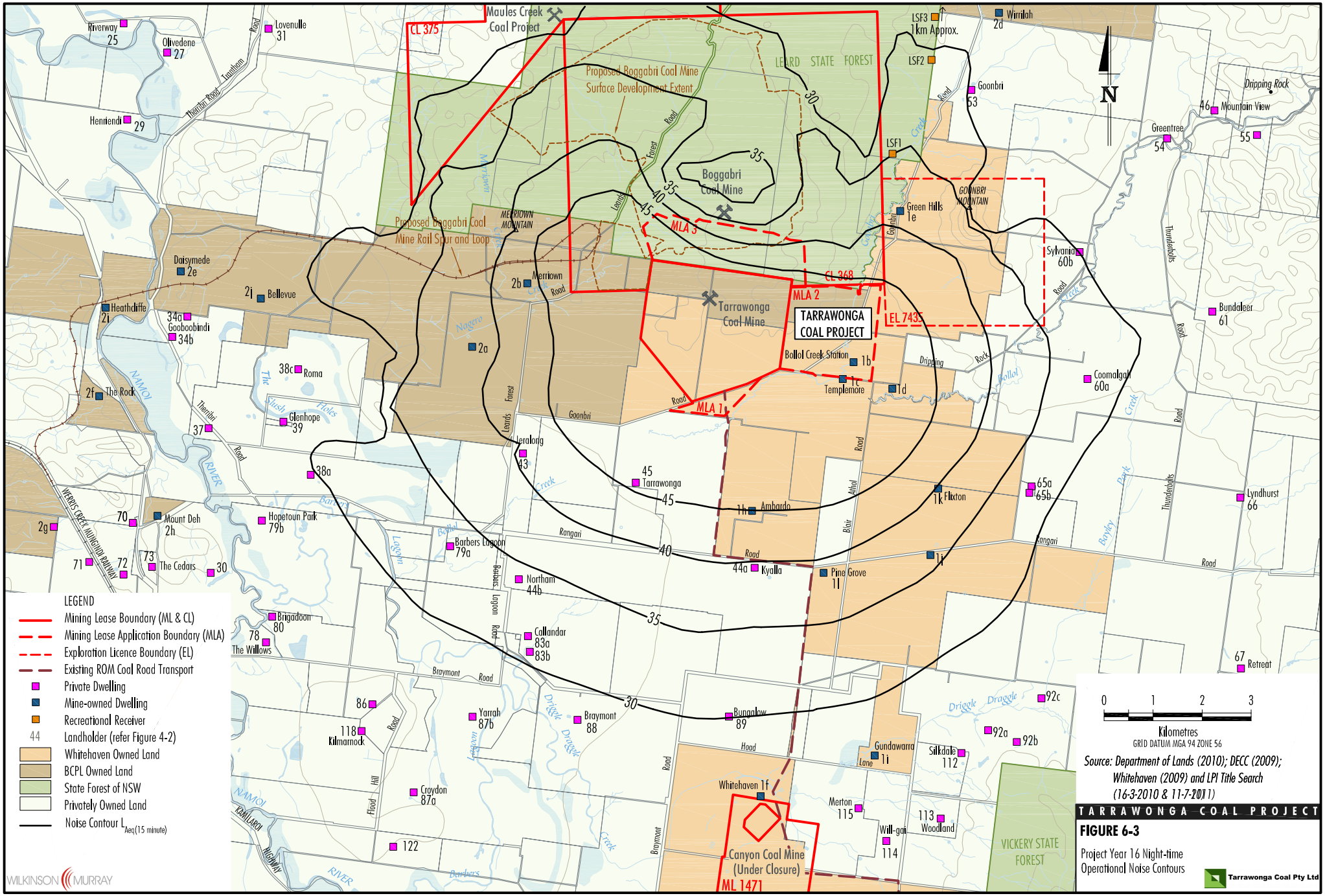
TARRAWONGA COAL PROJECT

FIGURE 6-2

Project Year 4 Night-time Operational Noise Contours

Tarrawonga Coal Pty Ltd

WHC-10-04 EA App NBA_108E



TARRAWONGA COAL PROJECT

FIGURE 6-3

Project Year 16 Night-time Operational Noise Contours

Tarrawonga Coal Pty Ltd

WHC-10-04 EA App NBA_109E

Table 6-4
Summary of Potential Exceedances under Adverse Meteorological Conditions

Noise Management Zone		Noise Affectation Zone
1 to 2 dBA exceedance	3 to 5 dBA exceedance	> 5 dBA exceedance
Nil	receiver 44a	receivers 43 and 45

Section 6.10 provides a description of TCPL's obligations with respect to these zones of management and affectation.

In practice, two of these receivers (44a and 45) would experience some improvement in their daytime and evening noise environments due to the material reduction in ROM coal road haulage to Gunnedah once approvals and upgrades are in place for the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities.

The owner of receiver 43 purchased this property in 2011. The potential for elevated noise levels at this receiver was noted prior to this purchase (e.g. in the 2010 Modification [Wilkinson Murray, 2010]).

6.5 Predicted Operational Noise Levels without Boggabri Coal Mine Contributions

As described in **Section 6.3**, Project noise levels provided in **Table 6-2** include the noise contributions from some handling and processing equipment at the Boggabri Coal Mine. This is because the Project ROM coal would be processed, handled and transported using this infrastructure once approvals and upgrades are in place for the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities.

Attachment B presents the night-time operational noise levels in the absence of any contributions from these Boggabri Coal Mine noise sources.

These results indicate that operational noise levels are similar to those Project levels presented in **Table 6-3**, and no material changes to the Project noise results are apparent (i.e. the number and extent of exceedances remain the same).

6.6 Vacant Land Noise Assessment

The existing Tarrawonga Coal Mine Development Consent (DA 88-4-2005 MOD 1) includes noise criteria that apply to "more than 25% of any privately-owned land" (Schedule 3, Condition 2).

Wilkinson Murray has reviewed noise contours for the Project (**Figures 6-1** to **6-3**) and has concluded that greater than 25% of property 49 (Laird) is predicted to be affected by Project noise greater than 40 dBA $L_{Aeq,15\ minute}$. In addition, it is predicted that more than 25% of each of properties 41 (Jones and Woodward) and 42 (Pryor) would receive operational noise levels of less than 40 dBA $L_{Aeq,15\ minute}$ but more than 35 dBA $L_{Aeq,15\ minute}$.

6.7 Cumulative Noise Assessment

If all three Projects are approved, the Project would operate concurrently with both the Boggabri Coal Continuation Project and the Maules Creek Coal Project. In this event, receivers may potentially be exposed to noise from all three industrial sources simultaneously. This assessment of the potential for cumulative noise impacts has been undertaken conservatively by assuming that all three projects will be approved as currently proposed.

The Rocglen Coal Extension Project (Project Application 10_0015) is an open cut coal mine located approximately 13 km south-west of the Project. One receiver (Project receiver 67) is coincident between receivers assessed as part of the Rocglen Noise and Vibration Impact Assessment (Spectrum Acoustics, 2010b) and the receivers assessed for the Project. The highest noise level predicted for this receiver resulting from the Rocglen Coal Extension Project was 34 dBA $L_{Aeq(15\ min)}$, whilst the highest Project noise level is predicted to be 24 dBA $L_{Aeq(15\ min)}$ (**Table 6-3**). This indicates that cumulative noise from the Rocglen Coal Extension Project and the Project is unlikely to exceed the amenity criterion, and thus, the Rocglen Coal Extension Project is not discussed further.

The assessment of cumulative impacts considers the total and relative noise contributions from the Project, and the adjacent Boggabri Coal Continuation and Maules Creek Coal Projects. The contribution of noise from the Boggabri Coal Continuation and Maules Creek Coal Projects has been taken from predictions of noise emissions included in the following documents:

- *Acoustic Impact Assessment Continuation of Boggabri Coal Mine Environmental Assessment* prepared by Bridges Acoustics (2010); and
- *Acoustic Impact Assessment Maules Creek Coal Project Environmental Assessment* prepared by Bridges Acoustics (2011).

The methodology used for assessment of cumulative impacts was to logarithmically sum the predicted 10th percentile night-time noise levels for the Project, Boggabri Coal Continuation Project and Maules Creek Coal Project for key receivers. The overall cumulative noise levels are then reported against the night-time amenity criterion (**Table 5-1**).

Consistent with **Section 6.3**, the Project contributions also includes the contributions from some coal handling and processing equipment at the Boggabri Coal Mine which would be undertaken in accordance with a separate approval.

The assessment of cumulative noise impacts is undertaken in consideration of the average L_{Aeq} noise level over the entire night period (10.00 pm to 7.00 am, a period of 9 hours), and not just the 10th percentile $L_{Aeq,15\ minute}$ noise level within that period as is required for the assessment of operational intrusiveness noise impacts (**Section 6.3**). Correspondingly, the $L_{Aeq,9\ hour}$ noise descriptor is used to assess cumulative impacts.

Both the Boggabri Coal Continuation and Maules Creek Coal Projects are scheduled to commence operations on 1 January 2012, while the anticipated start date for the Project is 1 January 2013. For the purposes of cumulative assessment, the closest available noise prediction year for the three projects were selected. Given the noise predictions available for the Boggabri Coal Continuation and Maules Creek Coal Projects, predicted noise levels from Years 2, 4 and 16 of the Tarrawonga Coal Project were separately summed with Years 1, 5 and 10 of the Boggabri Coal Continuation Project and Years 1, 5 and 15 of the Maules Creek Coal Project noise impact assessments, respectively.

The summation of the various noise predictions used for cumulative assessment is summarised below:

- Cumulative Year 2 = Year 2 Project + Year 1 Boggabri Coal Continuation Project + Year 1 Maules Creek Coal Project.
- Cumulative Year 4 = Year 4 Project + Year 5 Boggabri Coal Continuation Project + Year 5 Maules Creek Coal Project.
- Cumulative Year 16 = Year 16 Project + Year 10 Boggabri Coal Continuation Project + Year 15 Maules Creek Coal Project.

The assessment of cumulative impacts was undertaken for all receivers for which there was predicted noise level data for the Project and at least one of the Boggabri Coal Continuation or Maules Creek Coal Projects. The predicted cumulative noise levels for this selection of receivers is presented in **Table 6-5**.

These predicted Project noise levels relate to the $L_{Aeq,9\ hour}$ noise level averaged over all recorded meteorological conditions over all night periods within the worst case season (e.g. autumn, winter, spring, summer). The night-time period was selected as it is the worst-case period in terms of the predicted Project noise levels, therefore there is more potential for the Project to contribute to cumulative noise issues in this period.

The exception to the above are the three Leard State Forest receivers (LSF 1–3), for which cumulative daytime noise levels have been estimated (given that recreational use of the forest will likely be contained to daytime hours). The cumulative noise level predictions for these receivers conservatively assume that the contribution from the Maules Creek Project is 30 dBA $L_{Aeq,9\ hour}$.

Table 6-5 indicates that night-time cumulative noise levels would comply with the night-time recommended maximum ameninty criterion of 45 dBA $L_{Aeq,9\ hour}$.

Table 6-5 indicates that night-time cumulative noise levels would comply with the night-time recommended acceptable amenity criterion (40 dBA $L_{Aeq,9\ hour}$) for all but two privately-owned receivers. Exceedance of the amenity criterion would likely arise at receiver 43 (a marginal 1 dBA exceedance) and receiver 45 (5 dBA exceedance).

As indicated in **Table 6-4**, receivers 43 and 45 have been identified as falling within the Project's Noise Affectation Zone. Receiver 45 is currently in the Tarrawonga Coal Mine affectation zone. Accordingly, it is recommended that the dialogue which TCPL would enter into with these receivers in respect of operational noise impacts should also consider management of cumulative noise effects.

Table 6-5
Predicted Night-Time Cumulative $L_{Aeq,9\ hour}$ Operational Noise from the Project, Boggabri Coal Continuation Project and Maules Creek Coal Project

Tarrawonga Receiver ID	Night-Time $L_{Aeq,9\ hour}$ Noise Level (dBA)												Recommended Acceptable Criterion $L_{Aeq,9\ hour}$ (dBA)	Recommended Maximum Criterion $L_{Aeq,9\ hour}$ (dBA)
	Project			Boggabri Coal Continuation Project (incl Rail Spur)			Maules Creek Coal Project (incl Rail Spur)			Cumulative Noise $L_{Aeq,9\ hour}$ (dBA)				
	Year 2 (2014)	Year 4 (2016)	Year 16 (2028)	Year 1 (2012)	Year 5 (2016)	Year 10 (2021)	Year 1 (2012)	Year 5 (2016)	Year 15 (2026)	Year 2 (2014)	Year 4 (2016)	Year 16 (2028)		
31	24	25	24	-	-	-	39	40	40	40	40	40	40	45
34	25	25	24	35	36	36	37	37	37	39	40	40	40	45
34b	25	25	23	34	36	36	36	36	36	38	39	39	40	45
37	24	25	24	29	31	31	-	-	-	30	32	32	40	45
38a	28	29	28	27	31	30	-	-	-	31	33	32	40	45
38c	25	25	24	29	32	32	31	32	31	34	35	35	40	45
39	26	26	25	28	32	31	-	-	-	30	33	32	40	45
43	38	39	38	34	38	36	-	-	-	40	**41**	40	40	45
44a	38	38	38	33	35	33	-	-	-	39	40	39	40	45
44b	33	33	32	30	33	32	-	-	-	35	36	35	40	45
45	43	44	43	37	39	37	-	-	-	**44**	**45**	**44**	40	45
53	28	29	28	33	37	36	-	-	-	34	37	36	40	45
79a	32	32	32	30	33	31	-	-	-	34	36	35	40	45
LSF1*	29	26	34	30	30	30	<30	<30	<30	35	34	37	50	N/A
LSF2*	27	24	29	30	30	30	<30	<30	<30	34	34	35	50	N/A
LSF3*	18	15	19	32	32	32	<30	<30	<30	34	34	34	50	N/A

Notes:

(1) $L_{Aeq,9\ hour}$ refers to the Leq noise level measured over the entire night period (10.00 pm-7.00 am)

(2) Project noise levels predicted to result under 10th percentile meteorological conditions as described in Section 6.1.2

(3) **Bold** indicates exceedances of night-time 40 dBA $L_{Aeq,Period}$ cumulative noise criterion

* Denotes Project noise level from daytime noise predictions, Boggabri noise level estimated from Bridges Acoustics (2010) daytime operations from noise contours and Maules Creek noise level estimated from Bridges Acoustics (2011) daytime operations from noise contours (all noise levels adjusted from $L_{Aeq,15\ minute)}$ to $L_{Aeq,Period}$).

6.8 Potential for Sleep Disturbance

The noise model described in **Section 6.1** was also used to analyse maximum (L_{Amax}) noise levels likely to arise from the Project's night-time operations. The instantaneous noise sources and their typical L_{Amax} sound power levels that may have the potential to disturb sleep include:

- Plant reversing alarms 115 dBA L_{Amax};
- Loaders dumping 118 dBA L_{Amax};
- Primary crusher dumping 119 dBA L_{Amax};
- Shovel bucket scrapers 120 dBA L_{Amax};
- Dozer Track noise 120 dBA L_{Amax};
- Engine noise as trucks pass at-grade 118 dBA L_{Amax};
- Engine noise as trucks ascend inclines 121 dBA L_{Amax}; and
- Locomotive and wagon shunting and wheel squeal 121 dBA L_{Amax}.

The predicted night-time L_{Amax} noise levels at receivers surrounding the Tarrawonga Coal Mine are indicated in **Table 6-6**. L_{Amax} noise levels are conservatively compared with the $L_{A1,1\ minute}$ criterion of 45 dBA for this assessment. Mine-owned receivers are included for the purpose of information only.

These maximum (L_{Amax}) noise level predictions were modelled using the same plant locations used for the modelling of operational noise impacts. The predictions are based on 10^{th} percentile meteorological conditions as described in **Section 6.1.2**. L_{Amax} noise levels to receivers would be lower than reported during periods of "calm" weather conditions.

Table 6-6 indicates that the predicted L_{Amax} noise levels at all privately-owned receivers from night operations from the Project are predicted to be below the sleep disturbance criterion, with the exception of receiver 45. This receiver is also predicted to exceed the $L_{Aeq,15\ minute}$ criterion for operational noise as described in **Table 6-3**.

Table 6-6
L_{Amax} Levels from Night-Time Operations at the Tarrawonga Coal Mine

Receiver ID	Year 2[1]	Year 4[1]	Year 16[1]	Criterion ($L_{A1,1\ minute}$ dBA)
30	27	26	25	45
31	32	31	30	45
34a	31	31	29	45
34b	31	30	28	45
37	30	30	28	45
38a	34	34	32	45
38c	33	32	31	45
39	34	34	33	45
43	44	44	41	45
44a	42	42	40	45
44b	38	38	35	45
45	**48**	**48**	45	45
46	28	28	27	45
53	35	35	32	45
54	28	28	27	45
55	< 20	< 20	< 20	45
60a	35	35	32	45
60b	32	33	32	45
61	30	30	28	45
65a	36	36	33	45
65b	36	36	33	45
66	29	29	27	45
67	28	27	26	45
70	30	29	28	45
71	28	28	26	45
72	28	28	26	45
73	25	25	23	45
78	30	29	26	45
79a	38	37	35	45
79b	32	31	30	45
80	30	30	27	45
83a	36	36	32	45
83b	35	35	32	45
86	31	30	26	45
87a	30	29	25	45
87b	32	32	28	45
88	33	33	29	45
89	34	33	31	45
92a	31	31	30	45
92b	31	31	30	45
92c	31	30	29	45

Table 6-6 (Continued)
L_{Amax} Levels from Night-Time Operations at the Tarrawonga Coal Mine

Receiver ID	Year 2[1]	Year 4[1]	Year 16[1]	Criterion ($L_{A1,1\ minute}$ dBA)
112	32	31	31	45
113	29	28	27	45
114	29	28	26	45
115	30	29	27	45
118	26	25	23	45
122	28	28	23	45
1b[2]	51	52	N/A[2]	45
1c[2]	53	54	N/A[2]	45
1d	46	47	50	45
1e	41	42	41	45
1f	32	31	29	45
1h	46	46	45	45
1i	32	31	29	45
1j	38	37	38	45
1k	40	40	42	45
1l	40	40	40	45
2a	43	42	41	45
2b	48	47	46	45
2d	34	33	31	45
2e	29	29	28	45
2f	28	28	25	45
2g	28	28	27	45
2h	30	30	29	45
2i	30	29	29	45
2j	34	33	32	45

Notes:

[1] Noise levels predicted to result under 10th percentile meteorological conditions as described in Section 6.1.2

[2] Receivers 1b and 1c would not be occupied during Year 16.

6.9 Construction Noise

As perceived from receivers in the vicinity of the Project, noise from Project surface construction activities would largely be indistinguishable from operational activities given that similar plant would be deployed and that construction activities would occur in areas adjacent to operational activities. Construction/development activities would generally be undertaken during daytime hours.

Additional mobile equipment would be required for short periods during the Project construction/development activities including mobile cranes, excavators, loaders and delivery trucks. The number and type of equipment would vary depending on the activity being undertaken. Construction activity associated with the low permeability barrier, permanent Goonbri Creek alignment and associated flood bund would have the highest potential for off-site noise impacts.

These construction activities are summarised below:

- **Low Permeability Barrier** - a low permeability barrier would be constructed in the alluvium to the east and south east of the open cut extent. Construction of the low permeability barrier would be completed before the open cut intersects the alluvium (approximately Year 12). Construction would generally involve excavation of a trench followed by backfilling of the trench with a bentonite blend. It is anticipated that construction of the Low Permeability Barrier would take approximately 9 months.
- **Permanent Flood Bund** - a permanent flood bund would be constructed to prevent inundation of the open cut during operations and post mining from surface water flows during flood events, and would confine surface water flow on the western side of the permanent Goonbri Creek alignment. Its alignment would generally coincide with the alignment of the low permeability barrier. It is anticipated that construction of the Permanent Flood Bund would take approximately 3 months.
- **Permanent Goonbri Creek Alignment** - In approximately Year 15, open cut mining would remove a section of Goonbri Creek. Prior to the open cut advancing into this section of the creek, the permanent Goonbri Creek alignment would be established to the east of the open cut, low permeability barrier and permanent flood bund. Stages of construction would include:
  - excavation to form the low flow channel in the upper (i.e. northern) portion of the permanent Goonbri Creek alignment;
  - use of spoil from this excavation to form swales in the lower portion of the permanent Goonbri Creek alignment;
  - placement of rock fill armouring and topsoil on the eastern embankment of the permanent flood bund;
  - rock fill and woody debris placement to create a pool-riffle system within the low flow channel alignment; and
  - revegetation of the low flow channel and banks and the eastern embankment of the permanent flood bund.

  Construction of the Permanent Goonbri Creek Alignment would take approximately three months.

The above activities are further described in Appendix R of the EA.

An indicative construction fleet for the permanent Goonbri Creek alignment and associated flood bund and low permeability barrier comprises:

- one 85 t excavator (sound power level 115 dBA);
- two 30 t excavators (each having a sound power level 109 dBA);
- one long armed excavator (sound power level 115 dBA);
- ten dump trucks (40 t) (each having a sound power level 109 dBA);
- one scraper (40 t) (sound power level 107 dBA);
- one grader (sound power level 115 dBA);
- one compactor CAT825 (sound power level 110 dBA); and
- two track dozers (D7) (each having a sound power level 116 dBA).

The estimated total sound power level from the concurrent operation of all construction plant is 125 dBA. It is noted, however, that the entire construction fleet would operate concurrently only during certain stages of the construction of the permanent Goonbri Creek alignment and associated flood bund and low permeability barrier.

The *Interim Construction Noise Guideline* (NSW Department of Environment and Climate Change [DECC], 2009) provides recommended noise management levels as described in **Table 6-7**.

Table 6-7
Construction Noise Guidelines within Recommended Standard Hours

Time of Day	Management Level $L_{Aeq,15\ minute}$	How to Apply
Recommended Standard Hours: Monday to Friday 7.00 am to 6.00 pm Saturday 8.00 am to 1.00 pm	Noise affected RBL + 10 dBA	The noise affected level represents the point above which there may be some community reaction to noise: • Where the predicted or measured $L_{Aeq.\ 15\ minute}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
No work on Sundays or public holidays	Highly noise affected 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise: • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences. 2. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

Source: DECC (2009)

Noise from the construction of the permanent Goonbri Creek alignment was predicted using the ENM. Noise modelling assumed the entire construction fleet to be operating concurrently, and sited within the permanent Goonbri Creek alignment construction zone between the realigned creek and the low permeability barrier.

Table 6-8 below provides the predicted construction noise levels for key receivers in the vicinity of the Project.

Table 6-8
Construction Noise Modelling Results

Receiver ID	$L_{Aeq,15\ minute}$ Noise Level (dBA)			
	Construction Only		Combined Year 16 and Construction	
	Calm	Mets	Calm	Mets
34	< 20	< 20	< 20	25
34b	< 20	< 20	< 20	23
37	< 20	< 20	< 20	22
38a	< 20	< 20	< 20	26
38c	< 20	< 20	< 20	22
39	< 20	< 20	< 20	24
43	< 20	< 20	26	33
44a	< 20	< 20	27	29
44b	< 20	< 20	20	23
45	< 20	< 20	30	31
53	< 20	24	21	32
60a	< 20	21	24	30
60b	< 20	27	< 20	32
65a	< 20	22	23	28
65b	< 20	22	23	28
79a	< 20	< 20	20	25

Note: Noise levels predicted to result under 10th percentile meteorological conditions as described in Section 6.1.2 (indicated by 'Mets').

The results of **Table 6-8** indicate that construction noise levels would not exceed the 'highly noise affected' or the 'noise affected' noise levels in the *Interim Construction Noise Guideline* (DECC, 2009) for a subset of the closest privately-owned receivers.

In addition, noise resulting from construction of the permanent Goonbri Creek alignment would be largely indistinguishable from operational noise. Consequently, an indicative comparison with operational noise criteria has also been made in **Table 6-8**. When conservatively adding daytime noise from Year 16 operations (**Section 6.4**) to the predicted construction noise levels, no exceedances of daytime criteria would occur.

Given the above and that construction activities would be constrained to daytime hours, these construction activities would not give rise to additional noise impacts. Notwithstanding, it is recommended that general noise management measures be applied to minimise the potential for noise emissions during construction (**Section 6.10**).

6.10 Noise Management Measures

This section outlines the approach by which TCPL would manage noise impacts from its proposed operations. Central to the approach is the classification of potentially impacted receivers into the Noise Affectation Zone and Noise Management Zone.

Noise Management Zone

Receivers expected to be exposed to operational noise levels of between 1 to 5 dBA above the Project-specific noise criterion (35 dBA $L_{Aeq,15\ minute}$) are said to fall within the Noise Management Zone. Depending on the extent of the exceedance of the Project-specific criteria, noise impacts at receivers within the Noise Management Zone could range from negligible to moderate (in terms of the perceived noise level). For noise sensitive receivers falling within the Noise Management Zone, it is recommended that management procedures be implemented including:

- noise monitoring on-site and within the community;
- prompt response to any community issues of concern or complaints;
- refinement of on-site noise mitigation measures and mine operating procedures, where practicable;
- discussions with relevant landowners to assess concerns; and
- implementation of feasible and reasonable acoustical mitigation at receivers.

Noise Affectation Zone

Receivers expected to be exposed to operational noise levels in excess of 5 dBA of the Project-specific noise criterion are said to fall within the Noise Affectation Zone. Exposure to noise levels corresponding to this zone may be considered unacceptable by some landowners, particularly at night-time. For noise receivers located within this zone, it is recommended that TCPL considers adopting the following management measures:

- discussions with relevant landowners to assess concerns and define responses;
- implementation of acoustical mitigation at receivers; and
- enter into negotiated agreements with landowners (including acquisition).

General Management Measures

Consistent with the Noise Management Plan (TCPL, 2011a), real-time noise monitors would be installed at relevant reference locations to assist with noise management and to facilitate the implementation of real-time noise controls. The existing Noise Management Program would be revised to mandate the use of the continuous noise monitors as part of the noise management regime. The revised Noise Management Program would include details of noise level 'triggers' that would result in operational noise controls being invoked.

In addition, a number of general noise management measures would continue to be undertaken in accordance with the Noise Management Plan (TCPL, 2011a), including:

- Contractors, including all personnel and sub-contractors, would undergo environmental training on noise control and awareness. This training would take place before the commencement of work by any contractor, or sub-contractor, whose work is likely to create loud noise.
- The Sound Power Levels of mobile mining equipment would be periodically tested in accordance with International Standards Organisation (ISO) 6395:1988 "Acoustics - Measurement of exterior noise emitted by earth-moving machinery - Dynamic test conditions".
- Site equipment selection would include consideration of sound power levels and equipment would be maintained in good order.

- The contractors would be required to pay due attention to adverse weather conditions and make modifications to the work program where necessary.
- All complaints would be registered and responded to in accordance with the complaints procedures in the Environmental Management System.
- Monitoring of emitted noise levels would be undertaken during mining operations to verify compliance with noise criteria and to assess the need, if any, for additional noise attenuation measures.

7 TRANSPORTATION NOISE

7.1 Road Traffic Noise

7.1.1 Introduction

In accordance with the existing Tarrawonga Coal Mine Development Consent (DA 88-4-2005 MOD 1), the regulation of off-site road noise along the Approved ROM Coal Road Transport Route is separated between private sections of the haul road and public sections of the haul road. The private sections are shown on **Figure 1-1**, with the remainder being public roads.

As the haulage of ROM coal from the Project along the Approved ROM Coal Road Transport Route is scheduled to cease once approvals and upgrades are in place for the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities, this assessment focuses on transportation noise generated on public roads only.

7.1.2 Road Traffic Noise Criteria

Criteria for assessment of noise from traffic on public roads are set out in the *Environmental Criteria for Road Traffic Noise* (ECRTN)[3]. The relevant criteria are set out in **Table 7-1**.

Table 7-1
Criteria for Traffic Noise – Residences

Type of Development	Noise Level Criterion		Where Criteria are already Exceeded
	Day (7.00 am-10.00 pm)	**Night (10.00 pm-7.00 am)**	
Land use developments with potential to create additional traffic on existing arterial roads (or sub-arterial roads)	$L_{Aeq,15\ hour}$ 60 dBA	$L_{Aeq,9\ hour}$ 55 dBA	In all cases, the redevelopment should be designed so as not to increase existing noise levels by more than 2dB. Where feasible and reasonable, noise levels from existing roads should be reduced to meet the noise criteria. In many instances this may be achievable only through long-term strategies.
Land use developments with potential to create additional traffic on existing local road	$L_{Aeq,1\ hour}$ 55 dBA	$L_{Aeq,1\ hour}$ 50 dBA	
Land use developments with potential to create additional traffic on existing collector road	$L_{Aeq,1\ hour}$ 60 dBA	$L_{Aeq,1\ hour}$ 55 dBA	

The existing approval for the Tarrawonga Coal Mine (DA 88-4-2005 MOD 1) states that the noise levels generated by Project traffic, including Project traffic on Blue Vale Road, must not exceed 60 dBA, $L_{Aeq,1\ hour}$ during the day and 55 dBA $L_{Aeq,1\ hour}$ during the night at any receiver. The ECRTN defines day time as 7.00 am to 10.00 pm and night-time as 10.00 pm to 7.00 am. These criteria are consistent with those specified in the ECRTN for "collector roads". Further, the Approved ROM Coal Road Transport Route has previously been identified as a 'principal haulage route' in accordance with the ECRTN (**Spectrum Acoustics, 2005**) which, for the purpose of noise assessment, confers to it the status of a "collector road".

[3] Despite the recent (July 2011) release of the NSW Road Noise Policy, the ECRTN is adopted as the assessment protocol as directed by the Director-General's Requirements for the Project and in accordance with advice published on the OEH website which directs that the ECRTN should be used for Part 3A projects.

As such, the public sections of the haulage route are considered under the collector road criteria.

7.1.3 Road Traffic Impacts

A traffic study for the Project (Appendix H of the EA) found that the Project would have only minor impacts on the operation of the surrounding road system. The Project would result in a material reduction in coal haulage trips on the surrounding road system due to the proposed movement of ROM coal internally to the Boggabri Coal Mine once approvals and upgrades are in place for the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities. Additional employees, deliveries and domestic coal traffic associated with the Project would be more than offset by the reduction in ROM coal truck trips to Gunnedah.

Table 7-2 presents the existing average weekday traffic volumes measured on public roads around the Project. **Table 7-3** summarises the composition of existing weekday traffic volumes. Figure 1-1 shows the relevant traffic count locations.

Table 7-2
Existing Average Weekday Traffic Volumes

Traffic Count Location	Road	Road Category Type	Existing Traffic 2010 All Traffic including Tarrawonga Coal Mine	
			Day (7.00 am-10.00 pm)	Night (10.00 pm-7.00 am)
2	Haul Route south of Goonbri Road	Collector road	52	42
3	Blue Vale Road south of Shannon Harbour Road	Collector road	43	43
4	Blue Vale Road north-east of Kamilaroi Highway	Collector road	114	47
5	Kamilaroi Highway between Blue Vale Road and CHPP*	Arterial road	2870	318
7	Dripping Rock Road east of Goonbri Road	Local road	3	1
8	Goonbri Road east of Leards Forest Road	Local road	8	7
10	Barbers Lagoon Road south of Rangari Road	Local road	5	2
11	Rangari Road east of Haul Route	Local road	7	8
12	Rangari Road west of Haul Route	Local road	60	47
13	Rangari Road east of Kamilaroi Highway	Local road	40	43
16	Kamilaroi Highway south of Rangari Road*	Arterial road	1770	258
17	Braymont Road at Namoi River Bridge	Local road	15	4

*Traffic volumes are provided for the full day (7.00 am to 10.00 pm) and night periods (10.00 pm to 7.00 am), rather than peak hours as the Kamilaroi Highway is an Arterial road.

The existing traffic volumes on Rangari Road between the private sections of the haul roads (**Figure 1-1**) would be similar to "Haul Road south of Dripping Rock Road" (Traffic Count Location 2); therefore, Traffic Count Location 2 has been used as a proxy for Haul Route on Rangari Road. The justification for this is that Traffic Count Location 2 has a high percentage of Project-related heavy vehicle traffic, so is likely to be a reasonable proxy for the Haul Route on Rangari Road.

Table 7-3
Traffic Composition

Site	Road and Location	Percent	
		Light	Heavy
2	Haul Route south of Goonbri Road	30.9	69.1
3	Blue Vale Road south of Shannon Harbour Road	43.3	56.7
4	Blue Vale Road north-east of Kamilaroi Highway	61.2	38.8
5	Kamilaroi Highway between Blue Vale Road and CHPP	68.1	31.9
7	Dripping Rock Road east of Goonbri Road	66.7	33.3
8	Goonbri Road east of Leards Forest Road	88.3	11.7
10	Barbers Lagoon Road south of Rangari Road	90.2	9.8
11	Rangari Road east of Haul Route	94.0	6.0
12	Rangari Road west of Haul Route	47.7	52.3
13	Rangari Road east of Kamilaroi Highway	89.9	10.1
16	Kamilaroi Highway south of Rangari Road	81.2	18.8
17	Braymont Road at Namoi River Bridge	93.6	6.4

Table 7-4 summarises how the traffic not associated with the Project, including projected traffic to and from the Boggabri Coal Continuation Project and Maules Creek Coal Project, can be expected to increase over time on the surrounding road network. The traffic generated by the Project including construction, employee vehicles and deliveries, and its distribution on the surrounding road network is summarised in **Table 7-5**.

As can be seen from the traffic volumes in **Tables 7-4** and **7-5**, the roads potentially impacted from the project are Rangari Road (between the private haul roads), Blue Vale Road and the Kamilaroi Highway. As such, the road traffic noise assessment will concentrate on these roads.

The realigned portions of Goonbri Road and Dripping Rock Road have not been quantitatively assessed, due to the low traffic volumes on these roads (e.g. Dripping Rock Road experiences current movements of 14 vehicles per day [**Table 7-4**]) and because the road are not proposed to be relocated materially closer to privately-owned receivers.

Table 7-4
Average Weekday Non-Project Traffic Volumes

Traffic Count Location	Road Name	Year 1 (2013)		Year 4 (2016)		Year 17 (2029)	
		Day (7.00 am-10.00 pm)	Night (10.00 pm-7.00 am)	Day (7.00 am-10.00 pm)	Night (10.00 pm-7.00 am)	Day (7.00 am-10.00 pm)	Night (10.00 pm-7.00 am)
2	Haul Road south of Goonbri Road	0	0	0	0	0	0
3	Blue Vale Road south of Shannon Harbour Road	2	9	0	1	0	1
4	Blue Vale Road northeast of Kamilaroi Highway	82	42	79	35	89	39
5	Kamilaroi Highway between Blue Vale Road and CHPP*	2,555	305	2,587	289	2,904	324
7	Dripping Rock Road east of Goonbri Road	10	4	14	5	11	4
8	Goonbri Road east of Leards Forest Road	12	11	17	14	14	11
10	Barbers Lagoon Road south of Rangari Road	21	20	6	3	6	3
11	Rangari Road east of Haul Route	12	15	21	24	18	19
12	Rangari Road west of Haul Route	64	51	73	57	76	59
13	Rangari Road east of Kamilaroi Highway	83	111	107	121	95	107
16	Kamilaroi Highway south of Rangari Road*	2,043	339	2,206	349	2,335	366
17	Braymont Road at Namoi River Bridge	14	4	15	4	16	5

*Traffic volumes are provided for the full day (7.00 am to 10.00 pm) and night periods (10.00 pm to 7.00 am), rather than peak hours as the Kamilaroi Highway is an Arterial road.

Table 7-5
Average Weekday Project-Related Traffic Volumes

Traffic Count Location	Road Name	Year 1 (2013)		Year 4 (2016)		Year 17 (2029)	
		Day (7.00 am-10.00 pm)	Night (10.00 pm-7.00 am)	Day (7.00 am-10.00 pm)	Day (7.00 am-10.00 pm)	Night (10.00 pm-7.00 am)	Day (7.00 am-10.00 pm)
2	Haul Road south of Goonbri Road	66	57	30	55	30	55
3	Blue Vale Road south of Shannon Harbour Road	56	54	25	52	25	52
4	Blue Vale Road northeast of Kamilaroi Highway	49	26	21	24	21	24
5	Kamilaroi Highway between Blue Vale Road and CHPP*	549	59	161	57	161	57
7	Dripping Rock Road east of Goonbri Road	0	0	0	0	0	0
8	Goonbri Road east of Leards Forest Road	4	3	3	4	3	4
10	Barbers Lagoon Road south of Rangari Road	1	0	1	0	1	0
11	Rangari Road east of Haul Route	3	2	2	3	2	3
12	Rangari Road west of Haul Route	7	8	8	7	8	7
13	Rangari Road east of Kamilaroi Highway	8	7	8	7	8	7
16	Kamilaroi Highway south of Rangari Road*	46	6	32	6	32	6
17	Braymont Road at Namoi River Bridge	2	0	1	0	1	0

*Traffic volumes are provided for the full day (7.00 am to 10.00 pm) and night periods (10.00 pm to 7.00 am), rather than peak hours as the Kamilaroi Highway is an Arterial road.

7.1.4 Rangari Road between the private sections of the haul roads

The closest residential receiver on Rangari Road between the private haul roads is the Kyalla residence approximately 180 m from Rangari Road (**Figure 4-1**).

Based on the estimated traffic scenarios presented in **Tables 7-3, 7-4** and **7-5** calculated traffic noise levels at the closest residential receiver (Kyalla) have been predicted and are presented in **Table 7-6**. If the predicted traffic noise levels at the Kyalla residence meets the proposed criteria then the criteria would be met at all other receivers along the road.

Table 7-6
Calculated Traffic Noise Levels at the Kyalla Residence on Rangari Road

	Existing 2010	**Year 1 (2013)**	**Year 4 (2016)**	**Year 17 (2029)**
	$L_{Aeq,1\ hour}$ (Day/Night) (dBA)	**$L_{Aeq,1\ hour}$ (Day/Night) (dBA)**	**$L_{Aeq,1\ hour}$ (Day/Night) (dBA)**	**$L_{Aeq,1\ hour}$ (Day/Night) (dBA)**
Non – Project Traffic Noise	48/47	0/0	0/0	0/0
Project Traffic Noise		49/48	46/48	46/48
Total	48/47	49/48	46/48	46/48
Criteria		(60/55)		
Complies	Yes	Yes	Yes	Yes

The traffic noise levels along Rangari Road between the private sections of the haul roads are dominated by the Project. The predicted traffic noise levels at the Kyalla residence are well within the road traffic noise criteria.

7.1.5 Blue Vale Road south of Shannon Harbour Road

There are a number of residences along Blue Vale Road south of Shannon Harbour Road. The closest residential receiver on Blue Vale Road south of Shannon Harbour Road is the Weroona residence approximately 280 m from Blue Vale Road (**Figure 1-1**).

Based on the traffic data presented in **Tables 7-3, 7-4** and **7-5** calculated traffic noise levels at the closest residential receiver (Weroona) have been predicted and are presented in **Table 7-7**. If the predicted traffic noise levels at the Weroona residence meets the proposed criteria then the criteria would be met at all other receivers along the road.

The traffic noise levels along Blue Vale Road south of Shannon Harbour Road are dominated by the Project. The predicted traffic noise levels at the Weroona residence are well within the road traffic noise criteria.

Table 7-7
Calculated Traffic Noise Levels at the Weroona Residence along Blue Vale Road south of Shannon Harbour Road

	Existing 2010	Year 1 (2013)	Year 4 (2016)	Year 17 (2029)
	$L_{Aeq,1\ hour}$ (Day/Night) (dBA)	$L_{Aeq,1\ hour}$ (Day/Night) (dBA)	$L_{Aeq,1\ hour}$ (Day/Night) (dBA)	$L_{Aeq,1\ hour}$ (Day/Night) (dBA)
Non – Project Traffic Noise	44/44	<30/37	0/<30	0/<30
Project Traffic Noise		45/45	42/45	42/45
Total	44/44	45/46	42/45	42/45
Criteria		(60/55)		
Complies	Yes	Yes	Yes	Yes

7.1.6 Blue Vale Road north-east of Kamilaroi Highway

There are a small number of residences along Blue Vale Road north-east of Kamilaroi Highway. The closest residential receiver on Blue Vale Road north-east of Kamilaroi Highway is the Brooklyn residence approximately 90 m from Blue Vale Road (**Figure 1-1**).

Based on the traffic data presented in **Tables 7-3, 7-4** and **7-5**, calculated traffic noise levels at the closest residential receiver (Brooklyn) have been predicted and are presented in **Table 7-8**. If the predicted traffic noise levels at the Brooklyn residence meets the proposed criteria then the criteria would be met at all other receivers along the road.

Table 7-8
Calculated Traffic Noise Levels at the Brooklyn Residence along Blue Vale Road north-east of Kamilaroi Highway

	Existing 2010	Year 1 (2013)	Year 4 (2016)	Year 17 (2029)
	$L_{Aeq,1\ hour}$ (Day/Night) (dBA)	$L_{Aeq,1\ hour}$ (Day/Night) (dBA)	$L_{Aeq,1\ hour}$ (Day/Night) (dBA)	$L_{Aeq,1\ hour}$ (Day/Night) (dBA)
Non – Project Traffic Noise	54/50	53/50	53/49	53/50
Project Traffic Noise		52/48	47/48	47/48
Total	54/50	56/53	54/52	54/53
Criteria		(60/55)		
Complies	Yes	Yes	Yes	Yes

The traffic noise level along Blue Vale Road north-east of Kamilaroi Highway is currently equally shared by non-Project and Project-related traffic noise. In the future, the Project-related traffic noise would reduce. The total predicted traffic noise levels at the Brooklyn residence would however typically stay the same as existing levels with a 1 dB increase in Year 1. The total traffic noise levels are within the road traffic noise criteria of 60 dBA, $L_{Aeq,1\ hour}$ during the day and 55 dBA $L_{Aeq,1\ hour}$ during the night now and in the future.

7.1.7 Kamilaroi Highway between Blue Vale Road and CHPP

There are residential receivers on the Kamilaroi Highway between Blue Vale Road and the CHPP. The closest residential receivers on Kamilaroi Highway would be the Longlands receiver ('Barramalinga') approximately 70 m from the road (**Figure 1-1**).

Based on the estimated traffic scenarios presented in **Tables 7-3, 7-4** and **7-5** traffic noise levels at the closest residential receiver (Longlands) have been calculated and are presented in **Table 7-9**. If the predicted traffic noise levels at the Longlands residence meets the proposed criteria then the criteria would be met at all other receivers along the road.

Table 7-9
Calculated Traffic Noise Levels at the Longlands Residence along Kamilaroi Highway

	Existing 2010	**Year 1 (2013)**	**Year 4 (2016)**	**Year 17 (2029)**
	$L_{Aeq,15\ hour}/L_{Aeq,9\ hour}$ (Day/Night) (dBA)	**$L_{Aeq,15\ hour}/L_{Aeq,9\ hour}$ (Day/Night) (dBA)**	**$L_{Aeq,15\ hour}/L_{Aeq,9\ hour}$ (Day/Night) (dBA)**	**$L_{Aeq,15\ hour}/L_{Aeq,9\ hour}$ (Day/Night) (dBA)**
Non – Project Traffic Noise	58/50	57/50	57/50	58/50
Project Traffic Noise		50/43	45/43	45/43
Total	58/50	58/51	57/51	58/51
Criteria		(60/55)		
Complies	Yes	Yes	Yes	Yes

The traffic noise levels along Kamilaroi Highway are dominated by the non-Project traffic. The predicted traffic noise levels at the Longlands residence are within the road traffic noise criteria.

7.1.8 Kamilaroi Highway south of Rangari Road

Kamilaroi Highway south of Rangari Road goes through the township of Boggabri. The closest residential receivers on Kamilaroi Highway south on Rangari Road would be in the township of Boggabri approximately 18 m from the road.

Based on the estimated traffic scenarios presented in **Tables 7-3, 7-4** and **7-5** traffic noise levels at the closest residential receivers in Boggabri have been calculated and are presented in **Table 7-10**.

The traffic noise levels along Kamilaroi Highway are dominated by non-Project traffic. The predicted total traffic noise levels in Boggabri are within the road traffic noise criteria. The traffic noise levels from the Project-related traffic do not contribute substantially to the overall traffic noise.

Table 7-10
Calculated Traffic Noise Levels at the closest receiver in Boggabri along Kamilaroi Highway

	Existing 2010	Year 1 (2013)	Year 4 (2016)	Year 17 (2029)
	$L_{Aeq,15\ hour}/L_{Aeq,9\ hour}$ (Day/Night) (dBA)	$L_{Aeq,15\ hour}/L_{Aeq,9\ hour}$ (Day/Night) (dBA)	$L_{Aeq,\ 15\ hour}/L_{Aeq,9\ hour}$ (Day/Night) (dBA)	$L_{Aeq,15\ hour}/L_{Aeq,9\ hour}$ (Day/Night) (dBA)
Non – Project Traffic Noise	59/52	59/54	60/54	60/54
Project Traffic Noise		44/40	43/40	43/40
Total	59/52	60/54	60/54	60/54
Criteria		(60/55)		
Complies	Yes	Yes	Yes	Yes

7.1.9 Conclusion

The traffic noise study has found that the Project would have minimal impact on traffic noise for public roads in the vicinity of the Project.

Generally, traffic noise levels along the existing ROM coal haulage route would reduce due to the material reduction in ROM coal road haulage to Gunnedah once approvals and upgrades are in place for the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities.

7.2 Rail Noise

7.2.1 Introduction

Project product coal would be transported via rail from the Boggabri Coal Mine rail loop once approvals and upgrades are in place for the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities (**Section 3.6**). Consequently, a rail noise assessment was undertaken for the Werris Creek Mungindi Railway.

7.2.2 Rail Noise Criteria

Australian Rail Track Corporation (ARTC) operates the Werris Creek Mungindi Railway. Noise emissions from railways operated by ARTC are regulated via ARTC's Environment Protection Licence (EPL) 3142. EPL Section L6 does not nominate specific environmental noise limits but notes that:

> *It is an objective of this Licence to progressively reduce noise levels to the goals of 65 dB(A)Leq, (day time from 7am – 10pm), 60 dB(A)Leq, (night time from 10pm – 7am) and 85dB(A) (24 hr) max pass-by noise, at one metre from the façade of affected residential properties through the implementation of the Pollution Reduction Programs.*

Based on the information presented above, the following noise criteria have been adopted for the Project:

- $L_{Aeq,9\ hour}$ = 60 dBA;
- $L_{Aeq,15\ hour}$ = 65 dBA; and
- L_{Amax} = 85 dBA.

In addition, the NSW OEH's rail noise requirements (http://www.environment.nsw.gov.au/noise/railnoise.htm) "Environment Assessment Requirements for Rail Traffic - Generating Developments" provides alternative rail noise assessment criteria. Rail noise assessment trigger levels are presented in **Table 7-11**.

Table 7-11
OEH Rail Noise Assessment Trigger Levels

Descriptor	Rail Traffic Noise Goal
$L_{Aeq,24\ hour}$	60 dBA
Maximum Pass-by L_{Amax} (95th percentile)	85 dBA

Note: 95th percentile equates to the 5% exceedance value.

The OEH's rail noise assessment trigger levels are similar to the ARTC's EPL noise goals; however the OEH trigger levels have an averaging period of 24 hours, rather than daytime (15 hours) and night-time (9 hours) for the ARTC's goals. The OEH rail noise assessment requirements also provides:

> *Where the cumulative noise level exceeds the noise assessment trigger levels, and project-related noise increases are predicted, all feasible and reasonable noise mitigation measures should be implemented. As a general principle, where the reduction of existing noise levels can be achieved through feasible and reasonable measures, a reduction in noise levels to meet the noise assessment trigger levels is the primary objective. In all cases where the LAeq noise level increases are more than 2dB(A), strong justification should be provided as to why it is not feasible or reasonable to reduce the increase.*

In addition, the OEH's rail noise assessment requirements also provides guidance in relation to the geographical extent of rail noise assessment which should be undertaken for a rail traffic generating development (such as the Project):

> *Ideally, the geographical extent of the rail noise assessment should be to where project/related rail noise increases are less than 0.5dB. This roughly equates to where project/related rail traffic represents less than 10% of total line/corridor rail traffic.*

7.2.3 Rail Noise Impacts

The Werris Creek Mungindi Railway starts at the major rail centre of Werris Creek, and heads north to Moree enroute to the remote town of Mungindi, on the Queensland border. Along the line are the towns of Boggabri, Gunnedah and Curlewis.

The Project will generate a maximum additional four rail movements per day from the proposed Boggabri Coal Mine Rail Spur to Werris Creek and along the Main Northern rail line to the port of Newcastle.

Tables 7-12 and 7-13 display the existing/approved, proposed and Project rail passbys on the Werris Creek Mungindi Railway between Boggabri Coal Mine Rail Spur and the Whitehaven CHPP Gunnedah and Whitehaven CHPP Gunnedah to Werris Creek, respectively.

Table 7-12
Werris Creek Mungindi Railway, Train Movements between Boggabri Rail Spur and Whitehaven CHPP

Scenario	Train	Loco Configuration	Daily Train Numbers – Passbys		
			Day	Night	24 hour
Existing/Approved	Boggabri Coal Mine[1]	3 x 82 Class Locomotives	1.6	1	2.6
	Narrabri Coal Mine Stage 1[2]	3 x 82 Class Locomotives	4	0	4
	Cotton, Grain, General Freight[3]	2 x 82 Class Locomotives	5.6	3.4	9
	Narrabri Coal Mine Stage 2[4]	3 x 82 Class Locomotives	6	4	10
	Passenger[3]	XPT Passenger	2	0	2
	Total		**19.2**	**8.4**	**27.6**
Proposed	Boggabri Coal Continuation[4]	3 x 82 Class Locomotives	2	1	3
	Maules Creek Coal Project[4]	3 x 82 Class Locomotives	6	4	10
	Total		**8**	**5**	**13**
Project	Tarrawonga Coal Project	3 x 82 Class Locomotives	3	1	4

1 Hansen Bailey (2011) *Continuation of Boggabri Coal Mine Environmental Assessment*.

2 Narrabri Coal Pty Ltd (2007) *Narrabri Coal Mine Stage 1 Project Environmental Assessment*.

3 KMH Environmental (2011) *Burilda Passing Loop Review of Environmental Factors*.

4 Bridges Acoustics (2011) *Acoustic Impact Assessment Maules Creek Coal Project Environmental Assessment.*

Table 7-13
Werris Creek Mungindi Railway, Train Movements between Whitehaven CHPP and Werris Creek

Scenario	Train	Loco Configuration	Daily Train Numbers – Passbys		
			Day	Night	24 hour
Existing/Approved	Whitehaven CHPP Coal[1]	3 x 82 Class Locomotives	1	1	2
	Boggabri Coal Mine[2]	3 x 82 Class Locomotives	1.6	1	2.6
	Narrabri Coal Mine Stage 1[3]	3 x 82 Class Locomotives	4	0	4
	Cotton, Grain, General Freight[4]	2 x 82 Class Locomotives	5.6	3.4	9
	Narrabri Coal Mine Stage 2[5]	3 x 82 Class Locomotives	6	4	10
	Passenger[4]	XPT Passenger	2	0	2
	Total		**20.2**	**9.4**	**29.6**
Proposed	Boggabri Coal Continuation[5]	3 x 82 Class Locomotives	2	1	3
	Maules Creek Coal Project[5]	3 x 82 Class Locomotives	6	4	10
	Total		**8**	**5**	**13**
Project	Tarrawonga Coal Project	3 x 82 Class Locomotives	3	1	4

1 Whitehaven (2008b) *Whitehaven CHPP/Rail Loading Facility Statement of Environmental Effects.*

2 Hansen Bailey (2011) *Continuation of Boggabri Coal Mine Environmental Assessment*.

3 Narrabri Coal Pty Ltd (2007) *Narrabri Coal Mine Stage 1 Project Environmental Assessment*.

4 KMH Environmental (2011) *Burilda Passing loop Review of Environmental Factors*.

5 Bridges Acoustics (2011) *Acoustic Impact Assessment Maules Creek Coal Project Environmental Assessment.*

As can be seen from **Tables 7-12** and **7-13**, the Project contribution to 24 hour rail traffic on the Werris Creek Mungindi Railway (between Whitehaven CHPP and Werris Creek) would be approximately 14% of existing/approved rail movements and approximately 9% of existing/approved plus proposed rail movements. Considering that east of Werris Creek, train movements include rail traffic from the Cobar/Parkes and Armidale/Tamworth rail lines; extending the Project rail noise assessment to Werris Creek is considered to be generally consistent with the OEH requirements for geographic extent of rail noise assessments for rail traffic generating development (i.e. assessment extends to where Project rail traffic represents less than 10% of total line/corridor rail traffic).

Using the above data on train movements, it is possible to calculate the distance from the rail line at which ARTC criteria are exceeded using predicted energy average L_{Aeq} and Sound Exposure Level (SEL) noise levels from the RailCorp NSW standard rail noise database for passenger trains, locomotives and freight wagons. The database levels are adjusted for speed, number of locomotives, length of trains and audible wheel defects, with no allowance for shielding. A façade correction of 2 dBA is also applied.

Distances at which the ARTC and OEH criteria are exceeded for both existing and proposed movements for the Boggabri Rail Spur to the Whitehaven CHPP are illustrated in **Table 7-14**.

Table 7-14
Criteria Offset Distances: Train Movements between Boggabri Rail Spur to Whitehaven CHPP

Period	Criterion (dBA)	Existing/Approved Movements	Existing/Approved Plus Proposed Movements	Existing/Approved, Proposed plus Project
		Distance from Track (m)	Distance from Track (m)	Distance from Track (m)
L_{Aeq},Day (7.00 am-10.00 pm)	65	<13	<17	<18
L_{Aeq},Night (10.00 pm-7.00 am)	60	<23	<31	<33
L_{Aeq},24 hour (24 hour)	60	<26	<34	<36
L_{Amax},Passby Noise (24 hours)	85	<25	<25	<25

Table 7-14 shows that for the Werris Creek Mungindi Railway between the Boggabri Rail Spur and Whitehaven CHPP Gunnedah:

- The maximum increase in distance from the track to meet the ARTC criteria as a result of the Project rail movements, compared with the existing/approved plus proposed movements, is 1 m for daytime operations and 2 m for operations at night.
- The maximum increase in distance from the track to meet the OEH criteria as a result of the Project rail movements, compared with the existing/approved plus proposed movements, is 2 m for 24 hour operations.
- There is no change in the maximum passby noise.

Distances at which the ARTC and OEH criteria are exceeded for both existing and proposed movements for the Boggabri Rail Spur to the Whitehaven CHPP are illustrated in **Table 7-15**.

Table 7-15
Criteria Offset Distances: Train Movements between Whitehaven CHPP to Werris Creek

Period	Criterion (dBA)	Existing/Approved Movements	Existing/Approved Plus Proposed Movements	Existing/Approved, Proposed plus Project
		Distance from Track (m)	Distance from Track (m)	Distance from Track (m)
L_{Aeq},Day (7.00 am-10.00 pm)	65	<14	<17	<18
L_{Aeq},Night (10.00 pm-7.00 am)	60	<25	<33	<34
L_{Aeq},24 hour (24 hour)	60	<28	<35	<37
L_{Amax},Passby Noise (24 hours)	85	<25	<25	<25

Table 7-15 shows that for the Werris Creek Mungindi Railway between the Whitehaven CHPP Gunnedah and Werris Creek:

- The maximum increase in distance from the track to meet the ARTC criteria as a result of the Project rail movements, compared with the existing/approved plus proposed movements is 1 m for daytime operations and 1 m for operations at night.
- The maximum increase in distance from the track to meet the OEH criteria as a result of the Project only rail movements, compared with the existing/approved plus proposed movements is 2 m for 24 hour operations.
- There is no change in the maximum passby noise.

7.2.4 Conclusion

It is concluded from the rail noise assessment presented above that the Project rail movements would result in a negligible increase in noise along the Werris Creek Mungindi Railway between the Boggabri Rail Spur and Werris Creek, with any increase in rail noise being less than 2 dBA (which is the relevant threshold in the OEH rail noise assessment requirements).

The buffer distance from the rail line at which the relevant ARTC and OEH criteria would be met would extend away from the rail line by a negligible 2 m due to the Project. In addition L_{Amax} passby noise levels would not change due to the Project.

8 BLASTING ASSESSMENT

The removal of competent overburden (and interburden) material at the Tarrawonga Coal Mine is undertaken using a drill and blast program that would continue for duration of the Project.

A mixture of ANFO (dry holes) and emulsion blends (wet holes) explosives would continue to be used at the Project.

Blast sizes would typically be in the range of:

- intermediate interburden blasts with a MIC of approximately 1,365 kg; and
- deep overburden/interburden blasts with an MIC of approximately 2,275 kg.

Blast designs and sizes would vary over the life of the Project and would depend on numerous factors including the depth of coal seams and the design of open cut benches.

In accordance with DA 88-4-2005 MOD 1, blasting at the Tarrawonga Coal Mine would only occur between the hours of 9.00 am and 5.00 pm Monday to Saturday (excluding public holidays).

DA 88-4-2005 MOD 1 also limits blasting at the Tarrawonga Coal Mine to be undertaken no more than one blast per day on site, unless an additional blast is required following a misfire. However, for the Project up to two blasts per day would be required (to account for the two advancing mine faces of the Project).

As the open cut mining operations advance to the south-east later in the Project life, some sections of Goonbri Road would be temporarily closed during blast events within 500 m of the public road.

8.1 Airblast Overpressure Noise and Vibration Criteria

8.1.1 Criteria for the Minimisation of Human Annoyance from Blasting

The OEH guideline *Assessing Vibration: a technical guideline* (Department of Environment and Conservation [DEC], 2006) defers to the *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* prepared by the Australian and New Zealand Environment Council (1990). Human annoyance criteria for blasting for any privately-owned residence or other sensitive location are:

- maximum overpressure due to blasting should not exceed 115 dB for more than 5% of blasts in any year, and should not exceed 120 dB for any blast; and
- maximum peak particle ground velocity should not exceed 5 millimetres per second (mm/s) for more than 5% of blasts in any year, and should not exceed 10 mm/s for any blast.

8.1.2 Criteria for the Prevention of Structural Damage to Buildings

At sufficiently high levels, blast overpressure may in itself cause structural damage to some building elements such as windows.

Australian Standard (AS) AS 2187.2-2006 *Explosives - Storage and Use - Part 2 Use of explosives* indicates *From Australian and overseas research, damage (even of a cosmetic nature) has not been found to occur at airblast levels below 133dB*.

For assessment of damage due to ground vibration, *AS 2187.2-2006* recommends frequency-dependent criteria for vibration damage, derived from British Standard 7385-2 and United States Bureau of Mines Standard RI 8507. These are in practice less stringent than the human comfort criterion of 5 mm/s noted above, and hence need to be considered only in the case of mine-owned receivers. For the frequencies typical of blast vibration, a value of 10 mm/s peak particle velocity (PPV) represents a conservatively low estimate of the level above which structural damage may possibly occur.

8.2 Prediction of Airblast Overpressure and Vibration Levels

Airblast overpressure and ground vibration levels from blasting are related to the "scaled distance" from the blast, which is defined as:

- Scaled distance = D/W^(1/3) for airblast overpressure; and
- Scaled distance = D/W^(1/2) for ground vibration.

where D is the distance from the blast in metres and W is the MIC of explosive, in kg ANFO equivalent.

Predictive curves relating scaled distance to overpressure and ground vibration levels have been derived from measurements conducted at numerous sites.

For this assessment, Wilkinson Murray has used data from over 7,600 records of blasts undertaken in the Hunter Valley, NSW to derive relationships between scaled distance and overpressure or vibration. These relationships are designed to predict not the mean level of overpressure or vibration, as in a standard "site law", but the 95th percentile value, representing the level which would be exceeded by only 5% of blasts, given the use of current blast practice and the current level of variability in overpressure or vibration for the same scaled distance.

The raw data, and the derived prediction curves, are shown in **Attachment C**.

For overpressure, a curvilinear relationship with log(Scaled Distance) was required to adequately explain the data:

$$\text{Overpressure (dB)} = 201.1 - 62.313 \log(SD) + 10.79 (\log(SD))^2$$

where SD is the overpressure-scaled distance (as per formula given above).

For vibration, a linear relationship with log(Peak Particle Velocity) was derived:

$$\log(\text{Peak Particle Velocity}) = 3.015 - 1.4359 \log(SD)$$

where SD is the vibration-scaled distance (as per formula given above).

These formulae were used to predict vibration levels at all potentially-affected locations.

8.3 Predicted Overpressure and Vibration Levels at Receivers

Based on the predictive equations outlined in **Section 8.2**, **Table 8-1** indicates the range of 5% exceedance overpressure and ground vibration levels expected at the nearest mine-owned and privately-owned receivers resulting from the proposed typical and maximum blast MIC's of 1,365 kg and 2,275 kg, respectively. The 5% exceedance levels are the levels that should be compared to the 5% exceedance criteria of 115 dBLinear (dBL) for overpressure and 5mm/s for vibration. Peak or maximum blasting levels are not presented because these levels are typically caused by geological anomalies, which are unpredictable.

It is assumed that either of these general blast types may be required at any location, and hence potential impacts should be assessed on the basis of impacts expected from deep interburden/ overburden blasts, representing the potential maximum impact. However, both deep and intermediate interburden blasts are considered in order to indicate the range of impacts that may occur.

It is predicted that there would be no airblast or vibration impacts on any private receiver from blasting operations.

Marginal exceedances of the structural damage criteria are predicted to occur at one Whitehaven-owned receiver 1d.

In addition, a non-Aboriginal heritage site (i.e. a survey marker tree) is located near receiver 1d. This tree is predicted to be subjected to vibration levels marginally in excess of 10 mm/s, the structural damage criterion for buildings. It is noted however that, generally speaking, trees are less susceptible to blast vibration damage than buildings.

Table 8-1
Predicted Overpressure and Vibration Levels Resulting from Blasting within Tarrawonga Coal Mine Pits (5% Exceedance Levels)

Receiver ID	Year 2		Year 4		Year 16	
	Peak Overpressure, dBL	PPV Ground Vibration, mm/s	Peak Overpressure, dBL	PPV Ground Vibration, mm/s	Peak Overpressure, dBL	PPV Ground Vibration, mm/s
30	111.2 to 111.3	0.33 to 0.36	111.2 to 111.3	0.32 to 0.35	111.3 to 111.4	0.28 to 0.31
31	111.2 to 111.2	0.37 to 0.4	111.2 to 111.2	0.36 to 0.39	111.3 to 111.3	0.31 to 0.33
34a	111.2 to 111.2	0.37 to 0.38	111.2 to 111.2	0.36 to 0.37	111.3 to 111.3	0.31 to 0.31
34b	111.2 to 111.2	0.36 to 0.37	111.2 to 111.2	0.35 to 0.36	111.3 to 111.3	0.3 to 0.31
37	111.2 to 111.2	0.38 to 0.4	111.2 to 111.2	0.37 to 0.39	111.3 to 111.3	0.31 to 0.33
38a	111.1 to 111.1	0.47 to 0.51	111.1 to 111.1	0.45 to 0.5	111.2 to 111.2	0.38 to 0.41
38c	111.1 to 111.1	0.49 to 0.52	111.1 to 111.1	0.48 to 0.5	111.2 to 111.2	0.4 to 0.41
39	111.1 to 111.1	0.46 to 0.49	111.1 to 111.1	0.44 to 0.47	111.2 to 111.2	0.37 to 0.39
43	111.6 to 112	0.96 to 1.18	111.6 to 111.9	0.92 to 1.12	111.3 to 111.5	0.72 to 0.83
44a	111.7 to 112.4	1.02 to 1.47	111.7 to 112.5	1.02 to 1.51	111.7 to 112.4	1 to 1.45
44b	111.2 to 111.4	0.66 to 0.82	111.2 to 111.4	0.65 to 0.8	111.2 to 111.2	0.56 to 0.66
45	112.2 to 113.1	1.3 to 1.91	112.1 to 113	1.26 to 1.85	111.7 to 112.2	1.02 to 1.32
46	111.1 to 111.1	0.45 to 0.5	111.1 to 111.1	0.46 to 0.52	111.2 to 111.2	0.55 to 0.63
53	111.5 to 111.8	0.85 to 1.1	111.5 to 111.9	0.86 to 1.14	111.7 to 112.3	0.98 to 1.4
54	111.2 to 111.2	0.53 to 0.6	111.2 to 111.2	0.55 to 0.62	111.3 to 111.4	0.66 to 0.78
55	111.1 to 111.1	0.42 to 0.46	111.1 to 111.1	0.43 to 0.47	111.1 to 111.2	0.51 to 0.57
60a	111.5 to 111.5	0.83 to 0.85	111.5 to 111.6	0.88 to 0.9	112.1 to 112.2	1.26 to 1.3
60b	111.5 to 111.6	0.84 to 0.92	111.5 to 111.7	0.88 to 0.97	112 to 112.4	1.2 to 1.43
61	111.2 to 111.2	0.54 to 0.55	111.2 to 111.2	0.56 to 0.57	111.3 to 111.3	0.71 to 0.75
65a	111.5 to 111.6	0.83 to 0.94	111.5 to 111.7	0.87 to 1.01	112 to 112.4	1.17 to 1.45
65b	111.4 to 111.6	0.83 to 0.94	111.5 to 111.7	0.86 to 1	111.9 to 112.4	1.15 to 1.44
66	111.1 to 111.1	0.44 to 0.46	111.1 to 111.1	0.45 to 0.48	111.2 to 111.2	0.56 to 0.6
67	111.2 to 111.2	0.35 to 0.38	111.2 to 111.2	0.36 to 0.39	111.1 to 111.1	0.42 to 0.46
70	111.3 to 111.4	0.29 to 0.31	111.3 to 111.4	0.29 to 0.31	111.4 to 111.5	0.25 to 0.27
71	111.4 to 111.4	0.27 to 0.29	111.4 to 111.5	0.26 to 0.28	111.5 to 111.6	0.23 to 0.25
72	111.3 to 111.4	0.28 to 0.3	111.3 to 111.4	0.28 to 0.29	111.5 to 111.6	0.24 to 0.26
73	111.3 to 111.3	0.3 to 0.32	111.3 to 111.4	0.29 to 0.31	111.4 to 111.5	0.26 to 0.28
78	111.2 to 111.2	0.34 to 0.38	111.2 to 111.2	0.33 to 0.37	111.3 to 111.3	0.3 to 0.32

Table 8-1 (Continued)
Predicted Overpressure and Vibration Levels Resulting from Blasting within Tarrawonga Coal Mine pits (5% Exceedance Levels)

Receiver ID	Year 2		Year 4		Year 16	
	Peak Overpressure, dBL	PPV Ground Vibration, mm/s	Peak Overpressure, dBL	PPV Ground Vibration, mm/s	Peak Overpressure, dBL	PPV Ground Vibration, mm/s
79a	111.2 to 111.3	0.6 to 0.72	111.2 to 111.3	0.59 to 0.7	111.1 to 111.2	0.5 to 0.57
79b	111.1 to 111.2	0.39 to 0.43	111.1 to 111.2	0.38 to 0.42	111.2 to 111.3	0.33 to 0.36
80	111.2 to 111.2	0.36 to 0.4	111.2 to 111.2	0.35 to 0.39	111.2 to 111.3	0.31 to 0.34
83a	111.2 to 111.3	0.57 to 0.71	111.2 to 111.3	0.57 to 0.7	111.1 to 111.2	0.5 to 0.6
83b	111.2 to 111.3	0.55 to 0.68	111.2 to 111.3	0.54 to 0.67	111.1 to 111.2	0.49 to 0.58
86	111.1 to 111.2	0.37 to 0.43	111.1 to 111.2	0.37 to 0.42	111.2 to 111.3	0.33 to 0.37
87a	111.2 to 111.2	0.34 to 0.39	111.2 to 111.2	0.33 to 0.39	111.2 to 111.3	0.31 to 0.35
87b	111.1 to 111.1	0.43 to 0.51	111.1 to 111.1	0.42 to 0.5	111.1 to 111.2	0.39 to 0.45
88	111.1 to 111.2	0.49 to 0.6	111.1 to 111.2	0.49 to 0.6	111.1 to 111.2	0.45 to 0.55
89	111.2 to 111.3	0.56 to 0.71	111.2 to 111.3	0.56 to 0.72	111.2 to 111.3	0.55 to 0.7
92a	111.1 to 111.2	0.46 to 0.54	111.1 to 111.2	0.47 to 0.56	111.1 to 111.2	0.53 to 0.65
92b	111.1 to 111.1	0.43 to 0.5	111.1 to 111.1	0.44 to 0.52	111.1 to 111.2	0.49 to 0.6
92c	111.1 to 111.2	0.47 to 0.54	111.1 to 111.2	0.48 to 0.56	111.2 to 111.2	0.54 to 0.66
112	111.1 to 111.1	0.45 to 0.53	111.1 to 111.2	0.46 to 0.55	111.1 to 111.2	0.5 to 0.62
113	111.1 to 111.2	0.39 to 0.46	111.1 to 111.2	0.39 to 0.47	111.1 to 111.1	0.42 to 0.51
114	111.1 to 111.2	0.38 to 0.45	111.1 to 111.2	0.38 to 0.46	111.1 to 111.2	0.41 to 0.49
115	111.1 to 111.1	0.42 to 0.5	111.1 to 111.1	0.42 to 0.51	111.1 to 111.2	0.44 to 0.54
118	111.2 to 111.2	0.35 to 0.4	111.2 to 111.2	0.35 to 0.39	111.2 to 111.3	0.31 to 0.35
122	111.2 to 111.3	0.3 to 0.34	111.2 to 111.3	0.3 to 0.34	111.3 to 111.4	0.28 to 0.31
LSF1	112.3 to 113.4	1.42 to 2.12	112.4 to 113.5	1.44 to 2.24	112.6 to 114.3	1.61 to 2.83
LSF2	112.3 to 113.4	1.42 to 2.12	112.4 to 113.5	1.44 to 2.24	112.6 to 114.3	1.61 to 2.83
LSF3	112.3 to 113.4	1.42 to 2.12	112.4 to 113.5	1.44 to 2.24	112.6 to 114.3	1.61 to 2.83
1b[3]	115.3 to 116.7	3.65 to 5.09	115.7 to 117.7	4.07 to 6.26	N/A[3]	N/A[3]
1c[3]	115 to 117.1	3.41 to 5.52	115.4 to 118.3	3.73 to 6.91	N/A[3]	N/A[3]
1d	113.6 to 114.4	2.27 to 2.92	113.8 to 115	2.47 to 3.36	116 to 120.6	4.33 to **10.43**
1e	113 to 114.2	1.84 to 2.72	113.1 to 114.5	1.91 to 2.98	113.8 to 116.9	2.43 to 5.26
1f	111.1 to 111.2	0.44 to 0.54	111.1 to 111.2	0.45 to 0.55	111.1 to 111.2	0.45 to 0.55
1h	112.3 to 113.5	1.39 to 2.23	112.3 to 113.6	1.39 to 2.32	112.2 to 113.3	1.32 to 2.06
1i	111.1 to 111.2	0.48 to 0.58	111.1 to 111.2	0.49 to 0.6	111.1 to 111.2	0.52 to 0.65
1j	111.5 to 111.9	0.89 to 1.13	111.6 to 112	0.92 to 1.21	111.9 to 112.6	1.12 to 1.6
1k	111.9 to 112.4	1.13 to 1.43	112 to 112.5	1.18 to 1.55	112.6 to 113.7	1.56 to 2.38
1l	111.7 to 112.2	0.97 to 1.35	111.7 to 112.3	0.99 to 1.42	111.8 to 112.6	1.05 to 1.57
2a	111.6 to 111.7	0.95 to 1.03	111.6 to 111.7	0.9 to 0.97	111.3 to 111.3	0.68 to 0.71
2b	112.2 to 112.2	1.32 to 1.35	112.1 to 112.1	1.24 to 1.26	111.5 to 111.5	0.86 to 0.87
2d	111.2 to 111.4	0.63 to 0.78	111.2 to 111.4	0.63 to 0.8	111.3 to 111.6	0.69 to 0.91
2e	111.2 to 111.2	0.37 to 0.37	111.2 to 111.2	0.36 to 0.36	111.3 to 111.3	0.3 to 0.31
2f	111.3 to 111.3	0.3 to 0.31	111.3 to 111.4	0.29 to 0.3	111.5 to 111.5	0.26 to 0.26
2g	111.4 to 111.5	0.26 to 0.27	111.5 to 111.5	0.25 to 0.27	111.6 to 111.7	0.22 to 0.23
2h	111.2 to 111.3	0.32 to 0.34	111.3 to 111.3	0.31 to 0.33	111.4 to 111.4	0.27 to 0.29
2i	111.3 to 111.3	0.31 to 0.31	111.3 to 111.3	0.3 to 0.31	111.5 to 111.5	0.26 to 0.26
2j	111.1 to 111.1	0.45 to 0.46	111.1 to 111.1	0.44 to 0.45	111.2 to 111.2	0.37 to 0.37

Notes:

[1] Overpressure and ground vibration levels likely to result from typical and maximum MIC of 1,365 kg and 2,275 kg, respectively.

[2] **Bold** indicates exceedance of either of the Human Annoyance (private receivers only) or Building Damage blasting criteria (all receivers).

[3] Receivers 1b and 1c would not be occupied during Year 16.

[4] PPV = Peak Particle Velocity

8.4 Potential Flyrock Impacts

Flyrock is any material ejected from the blast site by the force of the blast.

Flyrock would be managed through appropriate blast design in order to minimise flyrock risk to the public using Goonbri Road, Dripping Rock Road and to nearby residential receivers and livestock.

Consistent with the advice of both the NSW Division of Resources and Energy (DRE) (within the NSW Department of Trade and Investment, Regional Infrastructure and Services [DTIRIS]) and the appropriate roads authority (Narrabri Shire Council), the section of Goonbri Road within 500 m of blasting activities would be closed and public access restricted during blasting events by use of road closure signs and sentries at either end of the roadway.

All land within 500 m of proposed open cut areas is owned by Whitehaven (other than Goonbri Road). Areas outside of mining leases (or MLAs) are generally grazed by cattle.

8.5 Airblast Overpressure and Vibration Mitigation

Blast and vibration management would continue to be conducted at the Tarrawonga Coal Mine in accordance with the *Blasting Management Plan* (TCPL, 2011b), which would be revised for the Project.

TCPL would ensure that the receiver 1d is unoccupied towards the end of the Project mine-life, when blast vibration in exceedance of the structural damage criteria is predicted to occur. The dwelling would not be re-occupied until a structural inspection indicates that the building is structurally sound and fit for re-occupation.

Consistent with advice previously received from the DRE and the appropriate roads authority (Narrabri Shire Council), the section of Goonbri Road within 500 m of blasting activities would be closed and public access restricted during blasting events by use of road closure signs and sentries at either end of the roadway.

The existing Blast Management Plan would be revised to include the above measures for the Project, and would also include procedures for the management of livestock in close proximity to blast events.

9 CONCLUSION

9.1 General

- The Tarrawonga Coal Mine is an open cut mining operation located approximately 15 km north-east of Boggabri and 42 km north-northwest of Gunnedah in NSW. The Tarrawonga Coal Mine commenced operations in 2006 and currently produces up to approximately 2 Mtpa ROM coal.
- ROM coal is currently transported to the Whitehaven CHPP via road-registered haul trucks on a combination of private and public roads. This occasionally results in noise impacts on receivers near to the haulage route. One of these privately-owned receivers has a private agreement with TCPL in relation to haulage noise.
- This assessment addresses potential noise and blasting impacts associated with the Project, which has a proposed life of 17 years.
- During Project Year 1, or until approvals and upgrades are in place for the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities, ROM coal would continue to be hauled to the existing ROM pad via internal haul roads, with no increase in the existing approved rate of 2 Mtpa ROM coal
- Once approvals and upgrades are in place for the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities, ROM coal would be transported via the services corridor haul road directly from the Project open cut.
- The assessment of operational noise from the Project includes the contributions from some coal handling and processing equipment at the Boggabri Coal Mine which would be undertaken in accordance with a separate approval.

9.2 Project Operational Noise

- Operational noise impacts were assessed for three years (Years 2, 4 and 16), for different periods of the day (daytime, evening and night-time) and with regard for noise-enhancing meteorological conditions including winds of speeds of up to 3 m/s and temperature inversions of up to 4^{o}C/100 m.
- The 10th percentile methodology was used, whereby noise levels were predicted for all meteorological conditions experienced at the site and the 10th percentile exceedance level reported.
- Initial modelling and previous experience with operational noise at the Tarrawonga Coal Mine resulted in TCPL committing to an acoustic bund on the southern side of the services corridor haul road to the Boggabri Coal Mine.
- During the daytime, operational noise from the Project would comply with the 35 dBA $L_{Aeq,15\ minute}$ operational noise criterion at all privately-owned residences.
- Operational noise from the Project would also comply with the 35 dBA $L_{Aeq,15\ minute}$ night-time operational noise criterion at all privately-owned residences during periods of calm meteorological conditions.

- At evening and night-time periods during adverse meteorological conditions, operational noise would exceed the relevant criterion at three privately-owned receivers (i.e. residences 43, 44a and 45). Of these, receiver 45 is in the existing Tarrawonga Coal Mine Affectation Zone and receiver 44a has a private agreement with TCPL in relation to road haulage noise.
- Receivers 43 and 45 would exceed the criteria by greater than 5 dBA and would be in the Project noise Affectation Zone, whilst receiver 44a would be in the moderate noise Management Zone (3 – 5 dBA above the criteria).
- In practice, two of these receivers (44a and 45) would experience some improvement in their daytime and evening noise environments due to the material reduction in ROM coal road haulage to Gunnedah once approvals and upgrades are in place for the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities.
- One parcel of vacant land (property 49) is predicted to exceed the criteria by greater than 5 dBA.
- Operational noise impacts to these receivers would be managed according to the DP&I's Noise Management Zone and Noise Affectation Zone protocols which provide strategies involving community engagement, real-time noise monitoring, investigations into acoustical mitigation measures, and if required, acquisition of property.

9.3 Cumulative Noise

- Cumulative noise impacts resulting from the concurrent operation of the Project, Boggabri Coal Continuation Project and the Maules Creek Coal Project were assessed against the INP recommended acceptable and recommended maximum amenity criteria. The Boggabri Coal Continuation Project and Maules Creek Coal Project are not yet approved projects, however they were conservatively assessed as currently proposed for cumulative impacts.
- The assessment indicates that cumulative noise levels resulting from the concurrent operation of the Project and the adjacent Boggabri Coal Continuation and Maules Creek Coal Projects would comply with the night-time recommended maximum amenity criterion (45 dBA) at all receivers and with the night-time recommended acceptable amenity criterion (40 dBA) for all but two privately-owned receivers. Exceedance of this criterion would likely occur at receiver 43 (1 dB exceedance) and receiver 45 (5 dB exceedance).
- Receivers 43 and 45 are identified as falling within the Project's Noise Affectation Zone and are also within the Boggabri Coal Continuation Project's Noise Affectation Zone.
- No noise impacts on representative receiver locations selected within Leard State Forest are predicted in the context of the INP's passive recreation criterion.

9.4 Sleep Disturbance

- Modelling of L_{Amax} noise levels at nearby receivers was undertaken for typical instantaneous mine-site noise sources, such as reversing alarms and shovel bucket scrapes. This analysis indicates that predicted noise levels would not exceed the 45 dBA $L_{A1,1\ minute}$ criterion at privately owned receivers, with the exception of receiver 45 (which is also predicted to exceed operational and cumulative amenity noise criteria as described above).

9.5 Project Construction Noise

- Assessment of the potential for noise impacts from construction associated with the permanent Goonbri Creek alignment (including the low permeability barrier and flood bund) indicates that no receiver would be either 'highly noise affected' or 'noise affected' as defined in the *Interim Construction Noise Guideline* (DECC, 2009).
- Noise resulting from construction of the permanent Goonbri Creek alignment would largely be indistinguishable from operational noise. To this end, no exceedances of the daytime operational noise criterion would occur even when predicted construction noise levels are added to predicted Year 16 daytime operational noise levels.

9.6 Blasting

- It is predicted that no airblast or vibration impacts would result at any privately-owned residences. Marginal exceedance of the structural damage criteria are predicted at mine-owned receiver 1d.
- TCPL would ensure that the receiver 1d is unoccupied towards the end of the Project mine-life, when exceedance of the structural damage criteria is predicted to occur. The dwelling would not be re-occupied until a structural inspection indicates that the building is structurally sound and fit for re-occupation.
- Goonbri Road would be temporarily closed during blast events within 500 m of the road.
- Measures would be put in place to avoid flyrock impacts on livestock.

9.7 Road Traffic Noise

- Road traffic noise along public roads has been assessed in accordance with the ECRTN.
- Generally, traffic noise levels along the existing ROM coal haulage route would reduce due to the material reduction in ROM coal road haulage to Gunnedah once approvals and upgrades are in place for the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities.
- Blue Vale Road, Kamilaroi Highway and a section of Rangari Road were selected for assessment.
- The assessment indicates that noise from Project traffic on public roads would comply with the ECRTN traffic noise criteria.

9.8 Rail Noise

- Rail noise assessment conducted in accordance with ARTC's EPL and OEH requirements for rail traffic-generating development.
- The rail noise assessment focuses on two sections of the Werris Creek Mungindi Railway; Boggabri rail spur to Whitehaven CHPP and Whitehaven CHPP to Werris Creek.
- Increases in rail noise due to the Project would be minor and always less than 2 dBA.
- The distance from the rail line at which the relevant ARTC and OEH criteria would be met, would increase by a negligible 2 m due to the Project.

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AAAC

This firm is a member firm of the Association of Australian Acoustical Consultants and the work here reported has been carried out in accordance with the terms of that membership.

Version	Status	Date	Prepared by	Checked by
A	Draft	8 Sept 2011	David Borella	Internal Draft
B	Draft	4 Oct 2011	David Borella	Neil Gross
C	FINAL - Draft	25 Oct 2011	David Borella	John Wasserman
C	FINAL	29 November 2011	David Borella	John Wasserman

ATTACHMENT A

GLOSSARY OF TERMS & DEFINITIONS

GLOSSARY

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph overleaf, are here defined.

ABL – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night-time) for each day. It is determined by calculating the 10^{th} percentile (lowest 10^{th} percent) background level (L_{A90}) for each period.

dB(A) – A-weighted decibels. The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.

Frequency – Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.

Impulsive Noise – Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.

Intermittent Noise – The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

Maximum Noise Level (L_{Amax}) – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period **–** daytime, evening and night-time.

Sound Absorption – The ability of a material to absorb sound energy through its conversion into thermal energy.

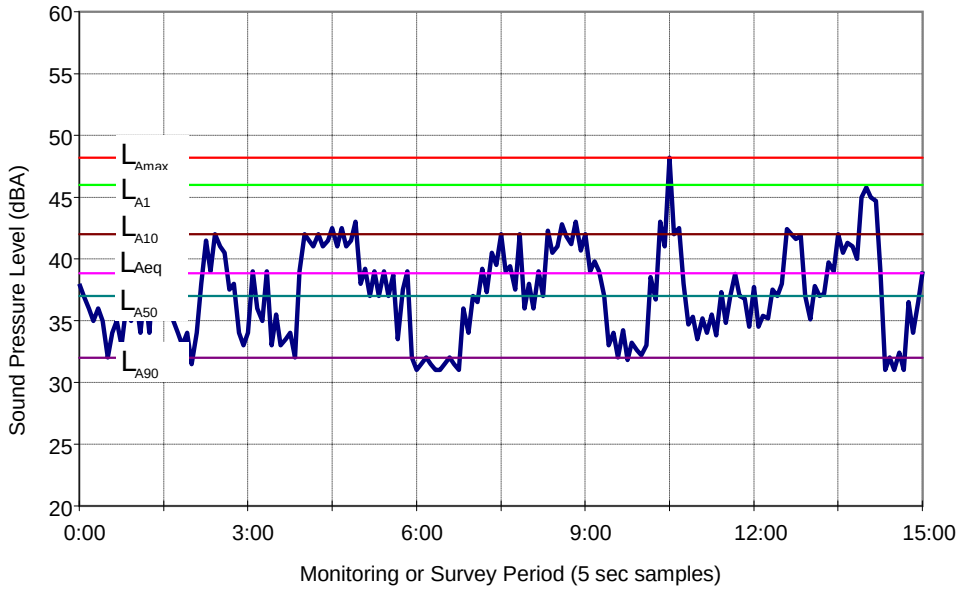
Sound Exposure Level (SEL) – The equivalent (or L_{eq}) noise level of an event normalised to one second. This metric is used to compare noise events having different time durations.

Sound Level Meter – An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure level.

Sound Pressure Level – The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.

Tonal Noise – Containing a prominent frequency and characterised by a definite pitch.

Typical Graph of Sound Pressure Level vs Time



ABBREVIATIONS & DEFINITIONS

The following abbreviations and acronyms appear throughout the report.

Terminology	Description
AEMR	Annual Environmental Management Report.
AHD	Australian Height Datum (used in relation to height of topography).
ANFO	Ammonium Nitrate Fuel Oil.
Boggabri Coal Mine	Open cut mining operation to the immediate north of Tarrawonga Coal Mine, operated by Boggabri Coal Pty Limited.
CHPP	Coal handling Preparation Plant.
DP&I	NSW Department of Planning and Infrastructure.
EA	Environmental Assessment.
ENM	Environmental Noise Model
EP&A Act	NSW *Environmental Planning and Assessment Act, 1979*.
INP	NSW Industrial Noise Policy.
OEH	NSW Office of Environment and Heritage
Overpressure	Instantaneous increase in air pressure caused by blasting.
Mbcm	Million bank cubic metres.
MIC	Maximum Instantaneous Charge.
Mtpa	Million tonnes per annum (rate of extraction).
PPV	Peak Particle Velocity – the measure of ground vibration caused by blasting.
RBL	Rating Background Level – a measure of background noise level defined in the INP.
ROM	Run-of-mine – raw coal produced at the Tarrawonga Coal Mine.
TCPL	Tarrawonga Coal Pty Limited.

ATTACHMENT B

PROJECT OPERATIONAL NOISE LEVELS WITHOUT ANY BOGGABRI COAL MINE CONTRIBUTIONS

Project Operational Noise Levels without any Boggabri Coal Mine Infrastructure $L_{Aeq,15\ minute}$ (dBA) (Mets)									
Receiver	**Year 2**			**Year 4**			**Year 16**		
	Day	**Evening**	**Night**	**Day**	**Evening**	**Night**	**Day**	**Evening**	**Night**
30	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
31	24	24	25	24	25	26	24	24	24
34a	25	26	27	25	26	27	24	25	26
34b	24	26	27	25	26	27	22	24	25
37	21	24	25	22	26	26	21	24	25
38a	26	29	30	26	29	30	26	28	29
38c	23	26	27	23	27	28	21	25	26
39	23	26	27	23	27	27	21	24	25
43	32	**40**	**41**	33	**40**	**41**	32	**40**	**41**
44a	28	**38**	**39**	28	**38**	**39**	29	**39**	**39**
44b	21	33	35	21	34	35	23	33	34
45	30	**44**	**46**	30	**45**	**46**	31	**44**	**46**
46	23	23	24	24	24	24	25	24	24
53	30	30	31	32	31	32	30	29	30
54	23	24	24	24	24	25	26	25	26
55	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
60a	29	30	31	30	31	32	29	31	32
60b	27	27	28	28	28	29	30	29	30
61	25	25	25	25	25	26	26	25	26
65a	27	31	32	28	31	33	27	30	32
65b	27	31	32	28	31	33	27	30	312
66	23	24	25	24	25	25	22	23	24
67	< 20	23	23	21	23	23	< 20	23	22
70	22	23	24	23	24	24	22	23	24
71	< 20	20	21	< 20	21	22	< 20	< 20	20
72	< 20	< 20	20	< 20	20	21	< 20	< 20	< 20
73	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
78	21	25	26	22	25	26	20	23	24
79a	25	32	34	25	32	34	25	32	33
79b	24	27	28	25	27	28	24	26	27
80	22	26	27	23	26	27	21	24	25
83a	20	31	33	20	32	33	18	30	31
83b	< 20	31	32	20	31	32	< 20	29	31
86	< 20	27	27	17	26	27	< 20	24	25
87a	< 20	26	26	< 20	25	26	< 20	22	26
87b	< 20	28	29	< 20	28	29	< 20	25	27
88	< 20	29	30	20	30	30	< 20	27	28
89	22	30	31	22	31	31	< 20	29	30
92a	< 20	27	28	20	28	28	< 20	28	28
92b	< 20	27	27	< 20	27	27	< 20	27	27
92c	< 20	26	27	< 20	27	27	< 20	25	26
112	< 20	28	28	< 20	28	28	< 20	29	29
113	< 20	26	26	< 20	25	26	< 20	24	25

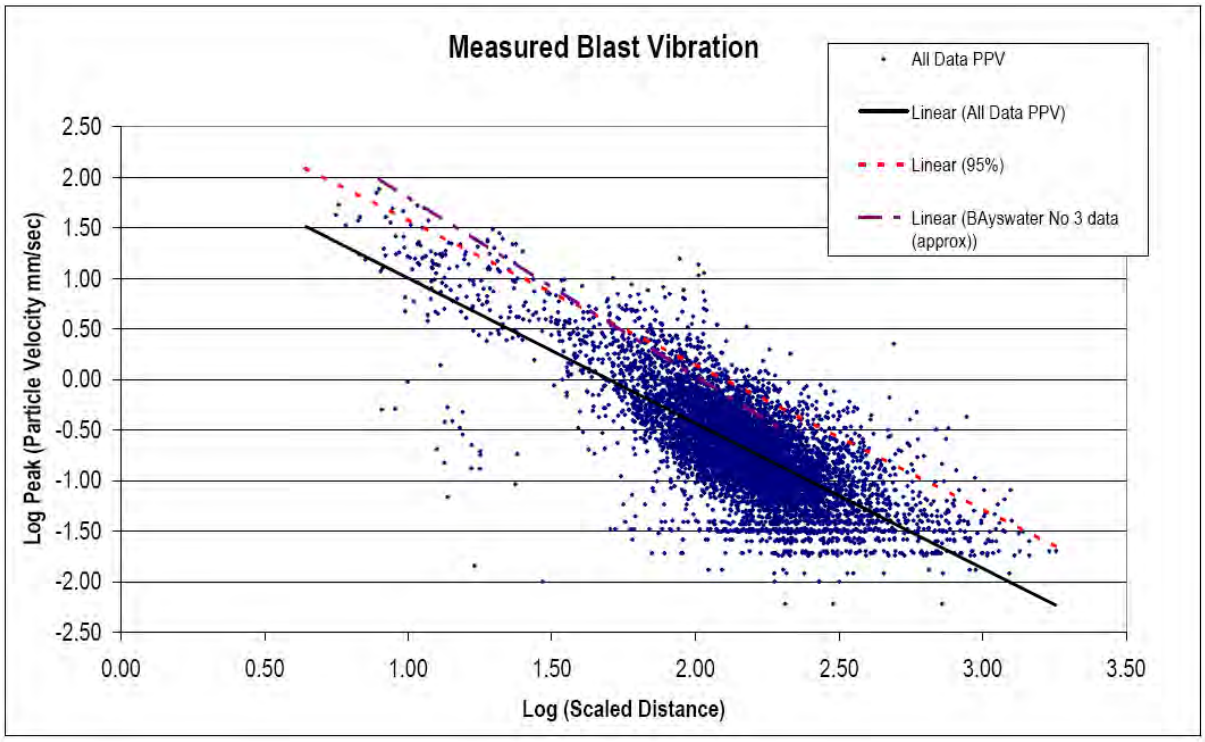
Operational Noise Levels WITHOUT Boggabri Coal Mine Infrastructure $L_{Aeq,15\ minute}$ (dBA) (Mets)									
Label	**Year 2**	**Year 2**	**Year 2**	**Year 4**	**Year 4**	**Year 4**	**Year 16**	**Year 16**	**Year 16**
	Day	**Evening**	**Night**	**Day**	**Evening**	**Night**	**Day**	**Evening**	**Night**
114	< 20	25	26	< 20	25	26	< 20	24	24
115	< 20	26	27	< 20	26	27	< 20	25	25
118	< 20	20	21	< 20	20	21	< 20	< 20	< 20
122	< 20	24	25	< 20	24	25	< 20	20	21
1b	43	47	48	43	48	49	53	54	56
1c	44	48	49	44	49	50	52	57	57
1d	37	42	43	38	43	44	45	49	50
1e	35	36	37	38	38	39	39	38	39
1f	< 20	28	29	< 20	28	29	< 20	27	28
1h	32	43	43	32	43	43	34	44	45
1i	< 20	28	28	20	28	28	< 20	26	27
1j	24	34	34	25	34	35	23	35	36
1k	30	36	37	29	36	37	30	38	40
1l	27	36	37	27	37	37	26	38	39
2a	31	37	38	32	37	38	31	36	38
2b	37	42	43	37	42	43	37	41	43
2d	29	29	29	30	29	30	29	28	28
2e	< 20	21	21	< 20	< 20	21	< 20	< 20	< 20
2f	22	24	24	22	24	25	20	23	24
2g	20	22	22	21	22	23	21	23	23
2h	23	24	25	23	24	25	22	24	25
2i	< 20	21	22	< 20	22	22	20	21	22
2j	26	28	29	26	28	29	25	27	28

ATTACHMENT C

BLASTING PREDICTION CURVES

For this study, Wilkinson Murray has derived predictive equations for vibration and overpressure using measurement data from approximately 7,000 blasts. Figure C.1 illustrates the measured data and associated linear trend lines for vibration.

Figure C.1 Measured Peak Particle Velocity from blasts at Mt Arthur North (logarithmic scale) and Comparison with Data from Bayswater No 3



The figure shows a revised best fit line, a 95 percentile line, and also the previously-adopted 95 percentile based on 1999 data from Bayswater No 3. The correlation with the old data is close, although the new 95 percentile shows slightly lower vibration levels at shorter scaled distance – in the order of 0.2 to 0.3millimetres per second (mm/s).

Figure C.2 shows data for overpressure. Analysis of these data showed that the relationship between measured peak overpressure and scaled distance is better defined with a polynomial equation (blue) at close range rather than a standard linear equation (red). At relatively low values of scaled distance, the new polynomial 95 percentile curve is approximately 5 decibels (dB) lower than the linear trend line derived from the previous Bayswater No 3 data.

Figure C.2 Measured Peak Overpressure from blasts at Mt Arthur North, and Comparison with Data from Bayswater No 3