APPENDIX G
NOISE AND BLASTING IMPACT ASSESSMENT

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MT ARTHUR COAL - CONSOLIDATION PROJECT

NOISE AND BLASTING IMPACT ASSESSMENT

ACOUSTICS AND AIR

REPORT NO. 08172
VERSION G

WILKINSON MURRAY

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OCTOBER 2009

PREPARED FOR

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TABLE OF CONTENTS

1 INTRODUCTION

Hunter Valley Energy Coal Pty Ltd (HVEC), a wholly owned subsidiary of BHP Billiton, operates the Mt Arthur Coal Complex (Mt Arthur Coal) which includes combined operations of the Mt Arthur North Mine, the Bayswater No. 2 Mine, Bayswater No. 3 Mine, South Pit Extension and the Mt Arthur Underground (MAU) Project. The Mt Arthur Coal Complex is located south-west of Muswellbrook, off Thomas Mitchell Drive in the Muswellbrook Shire Council (MSC) Local Government Area (LGA) in the Upper Hunter Valley of NSW.

HVEC is applying for a new Project Approval under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to gain a single, contemporary planning approval for its open cut operations and the mining of additional areas within Mt Arthur Coal's current Mining Leases (ML).

This report addresses potential noise and vibration impacts associated with all aspects of the Project. Noise from mining and transport activities onsite has been assessed in accordance with the NSW Department of Environment & Climate Change's (DECC) *NSW Industrial Noise Policy* (INP). Noise impacts from road traffic are assessed under the *Environmental Criteria for Road Traffic Noise* (ECRTN). Noise impacts from additional rail movements on the Main Northern Railway have been assessed under the *Interim Guidelines for the Assessment of Noise from Rail Infrastructure Projects*.

2 ABBREVIATIONS AND DEFINITIONS

The following abbreviations and acronyms appear throughout the report.

Terminology	Description
	General Definitions
Antiene Rail Spur	Rail spur extending off the Main Northern Railway to Drayton Mine and the Mt Arthur Coal Complex. The rail spur was built under a Joint Venture between Mt Arthur Coal and Drayton Mine.
BarnOwl	BarnOwl ™ directional real-time noise monitoring system.
Bayswater No. 3	Mining area approved in 1994.
Bayswater Power Station	Power Station to south-east of the Mt Arthur Coal Complex. Mt Arthur Coal provides coal directly to Bayswater Power Station by a dedicated conveyor.
Bengalla Mine	Open cut mining operation 3-4 km north-west of the Mt Arthur Coal Complex, operated by Bengalla Mining Company.
CHPP	Coal Handling & Preparation Plant.
DECC	Department of Environment & Climate Change.
DoP	Department of Planning.
Drayton Mine	Open cut mining operation located immediately to the east of the Mt Arthur Coal Complex, operated by Anglo Coal (Drayton Management) Pty Limited.
DPI	Department of Primary Industries - Mineral Resources.
DWE	Department of Water and Energy.
EA	Environmental Assessment.
DGRs	Director General's Requirements.
ECRTN	*Environmental Criteria for Road Traffic Noise*
Edderton Road Realignment	Relocation of the northern section of Edderton Road to the west, as indicated on the mine plans.
EL	Exploration Lease.
EP&A Act	*Environmental Planning & Assessment Act 1979* (under which Project Approval for the Project is sought).
Exploration Adit	Mt Arthur Coal Exploration adit as approved under DA 06_0040.
HVEC	Hunter Valley Energy Coal Pty Ltd.
INP	*NSW Industrial Noise Policy*
Mt Arthur Coal Complex	Mt Arthur Coal operations. Mt Arthur Coal's existing operations consist of five mining areas: the Bayswater No. 2 mining area (extraction complete); the Bayswater No. 3 (operated since 1995); Mt Arthur North (operated since 2001); the South Pit Extension (approved in 2008); and the Mt Arthur Underground Project (approved 2008). An exploration adit was also approved in 2007.
Mt Arthur Coal Underground (MAU)	Mt Arthur Coal Underground Project which was approved under Project Approval 06_0091 in December 2008.

Terminology	Description
	General Definitions
MAN	Mt Arthur North (mining area operated since 2001).
MAN EIS	The Mt Arthur North Coal Project Environmental Impact Statement and associated approval (DA 144-05-2000).
Mtpa	Million tonnes per annum.
ML	Mining Lease.
MSC	Muswellbrook Shire Council; local government area within which the Project is located.
Out of Pit emplacement area (OoP)	Spoil placement to the west of the open cut operation, as indicated on mine plans.
Overburden Emplacement Area (OEA)	Placement of spoil to east and north of open cut activities.
Overpressure	Instantaneous increase in air pressure caused by blasting.
PPV	Peak Particle Velocity – the measure of ground vibration caused by blasting.
Project Approval	The approval sought for this Project under Part 3A of the EP&A Act.
Rail Loading Facility	Mt Arthur Coal rail loading facilities approved under DA 105-04-00 which join the Antiene Rail Spur.
RBL	Rating Background Level – a measure of background noise level defined in the INP.
Run-of-Mine (ROM)	The raw coal extracted in Mt Arthur Coal's operations.
South Pit	Extension area approved under Project Approval 06_0108 in January 2008.
Thomas Mitchell Drive	Primary industrial road bordering the Mt Arthur Coal Complex.
The Project Area	Mining area and extension area assessed as part of this EA.

Terms related to noise measurement units as used in this assessment are described in Appendix A.

3 EXISTING OPERATIONS

A site layout of the Mt Arthur Coal Complex is shown on Figure 3-1.

The currently approved Mt Arthur Coal Complex consists of the following mining areas:

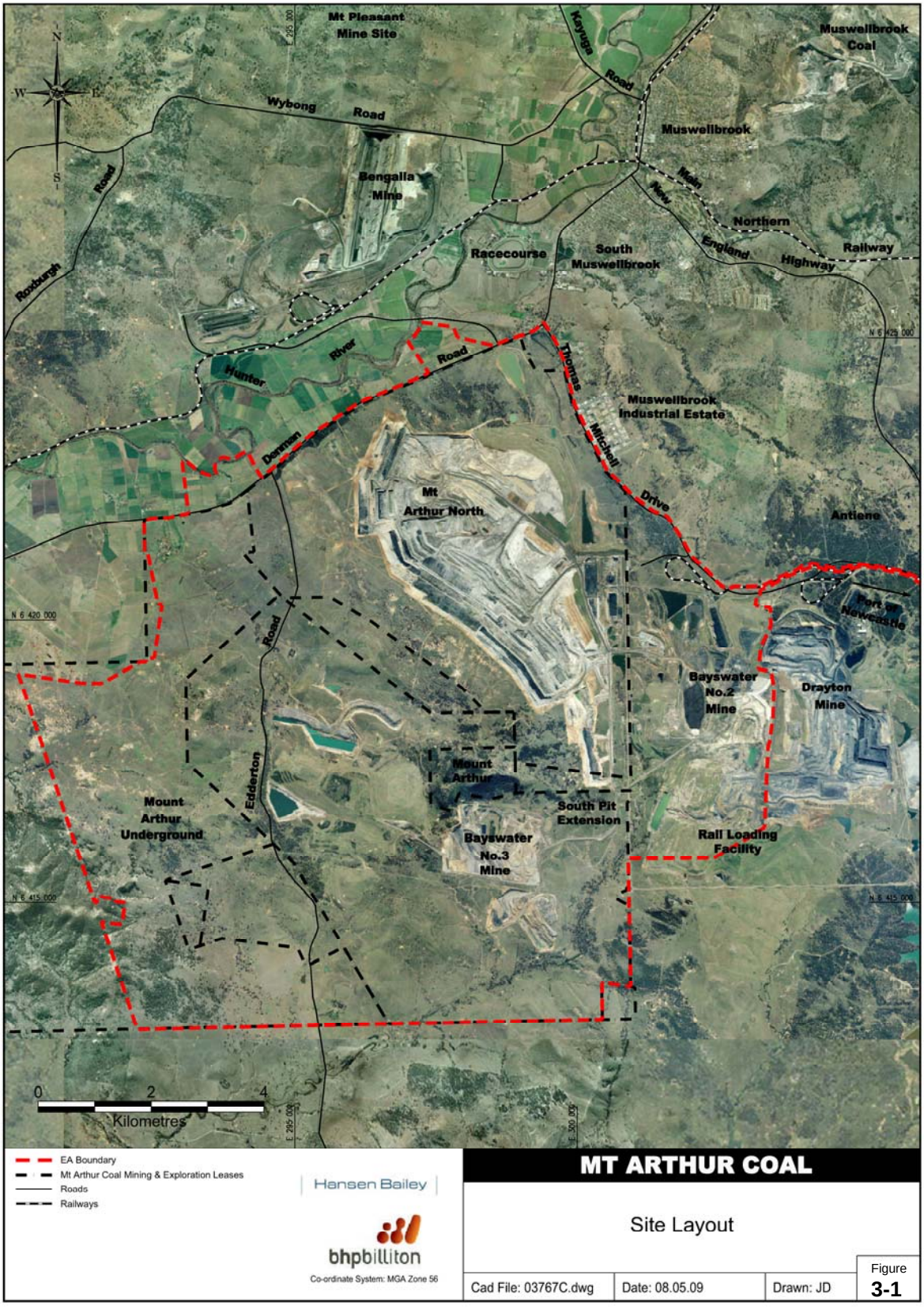
- Bayswater No. 2 open cut pit (extraction completed);
- Bayswater No. 3 open cut pit (operated since the 1995);
- Mt Arthur North (MAN) open cut pit (operated since 2001);
- South Pit extension open cut pit (approved in 2008 – extends the MAN South Pit 2.5 km south);
- Exploration Adit (commenced operations in 2007); and
- Mt Arthur Underground Project (MAU) (approved in December 2008).

Mt Arthur Coal currently has approval to produce up to 28 Million tonnes per annum (Mtpa) of run-of-mine (ROM) coal from the complex, of which 8 Mtpa is from underground mining methods.

Coal production from the MAN mining area has been the focus of Mt Arthur Coal's operations since 2002. Open cut coal mining is conducted via shovel and excavator. In 2008, coal was mined from the Glen Munro seam to the Ramrod Creek seam within the Wittingham coal measures. Open cut mining methods at the Mt Arthur Coal Complex allow the full recovery of all coal down to the Ramrod Creek seam.

Coal preparation, handling and loading is undertaken at the centralised Coal Handling & Preparation Plant (CHPP), which is strategically located in a valley to minimise environmental and social impacts. Export coal is loaded onto trains via the Rail Loading Facility whilst domestic coal is transported via conveyor directly to Macquarie Generation's Bayswater Power Station.

Figure 3-1 Site Layout



4 PROJECT DESCRIPTION

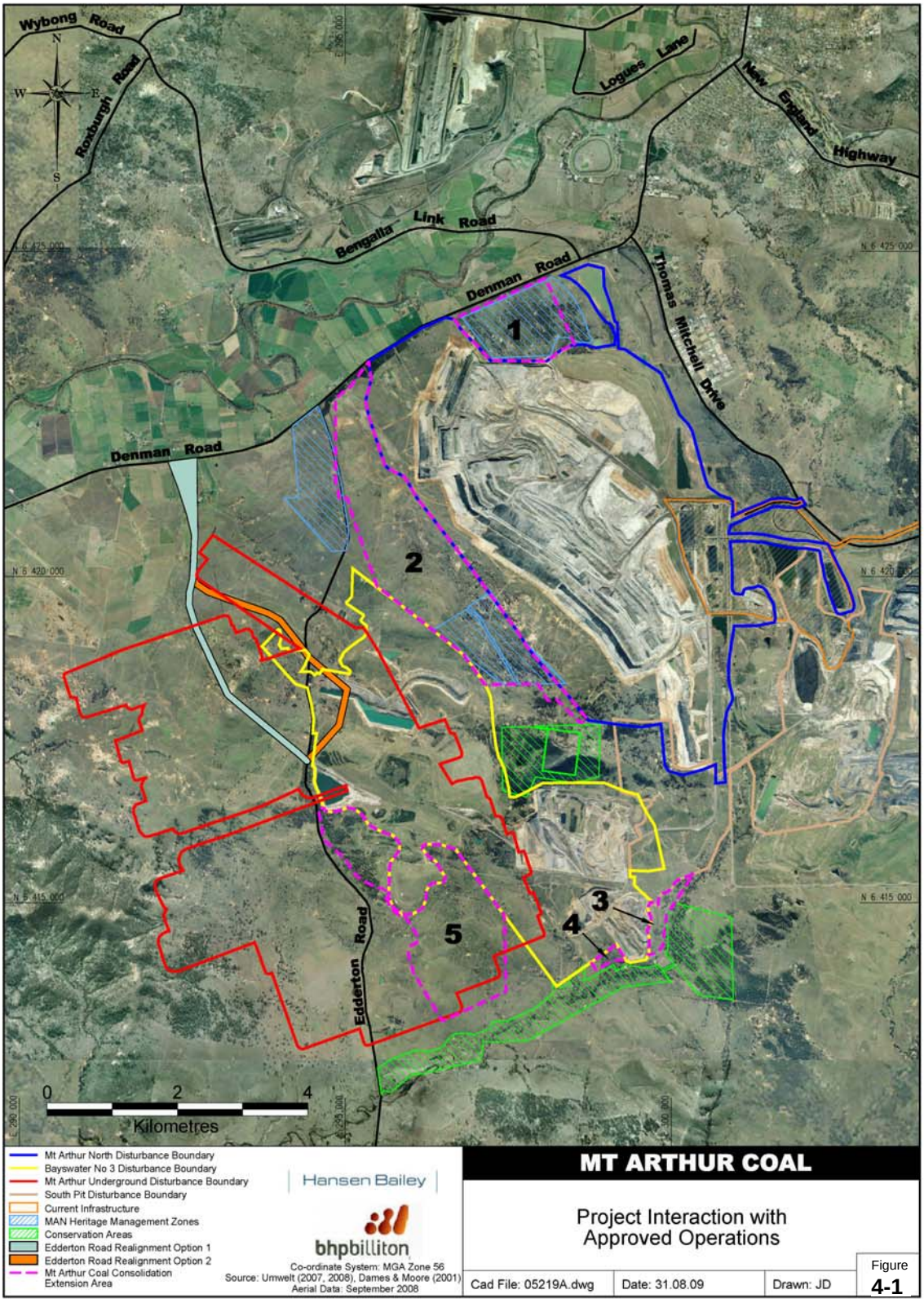
The Project continues all aspects of Mt Arthur Coals current activities and specifically, seeks approval for the following:

- Extending the mine footprint to uncover additional coal reserves within the current MLs;
- Increasing the Mt Arthur Coal Complex approved production levels by 8 Mtpa up to 36 Mtpa ROM coal. This will be achieved by;
  - Increasing open cut coal production by up to 8 Mtpa; and
  - Having the flexibility to increase either open cut or underground production by an additional 4 Mtpa if the maximum production from either underground or open cut methods is not being met (total to not exceed 36 Mtpa).
- Relocation of a section of Edderton Road in approximately 2019;
- Upgrading the existing Mt Arthur Coal CHPP to wash up to 36 Mtpa of ROM coal and allow the inclusion of an ultra-fine coal circuit to re-process fines and facilitate increased resource recovery and reduced water demand;
- Increasing the approved rail haulage capacity (in line with the increased ROM coal production) from 19 Mtpa to 27 Mtpa, with the construction of a second rail loading facility and associated conveyor system;
- Modifications to existing infrastructure (such as workshop and bath house), construction of additional ROM coal hoppers and the extension of ROM and product coal stockpiles; and
- A total workforce of approximately 2,600 at peak production, which represents an increase of approximately 1,610 from current staffing levels and an estimated additional 720 positions directly attributable to Project.

No changes to the mining method or hours of operation are proposed, although a gradual increase in the mobile equipment fleet will be required.

The additional open cut disturbance proposed is shown on Figure 4-1.

Figure 4-1 Mine Extension Area



5 BACKGROUND NOISE SURVEYS

5.1 Introduction to the Surveys

As discussed in Section 6, operational and construction noise criteria are related to the existing background noise. Wilkinson Murray began noise surveys as part of the Mt Arthur North Environmental Impact Statement (MAN EIS) in 1999, and the existing operational noise criteria for Mt Arthur Coal are based largely on the results of those surveys.

In the 10 years since those surveys, there has been considerable development in the area surrounding the Mt Arthur Coal Complex, and it was considered reasonable to reassess the background noise levels and the noise criteria as part of this assessment.

As the noise criteria also depend on the total industrial noise experienced by a receiver, the changes in industrial noise in the area were also considered.

Below is a summary of the procedure used to arrive at the background noise levels relied upon in this assessment:

- Assessment locations and receiver zones are established;
- Results of the noise surveys conducted for the MAN EIS are presented and discussed;
- Results of extra monitoring undertaken for the MAU project are discussed;
- Long-term noise monitoring, based on permanently installed BarnOwl noise monitors, is discussed, to show how the noise environment surrounding the Mt Arthur Coal Complex has changed;
- Monitoring conducted for this Project during the winter of 2008 is discussed; and
- The results of all monitoring are then combined to set new background noise levels where appropriate.

5.2 Assessment Locations

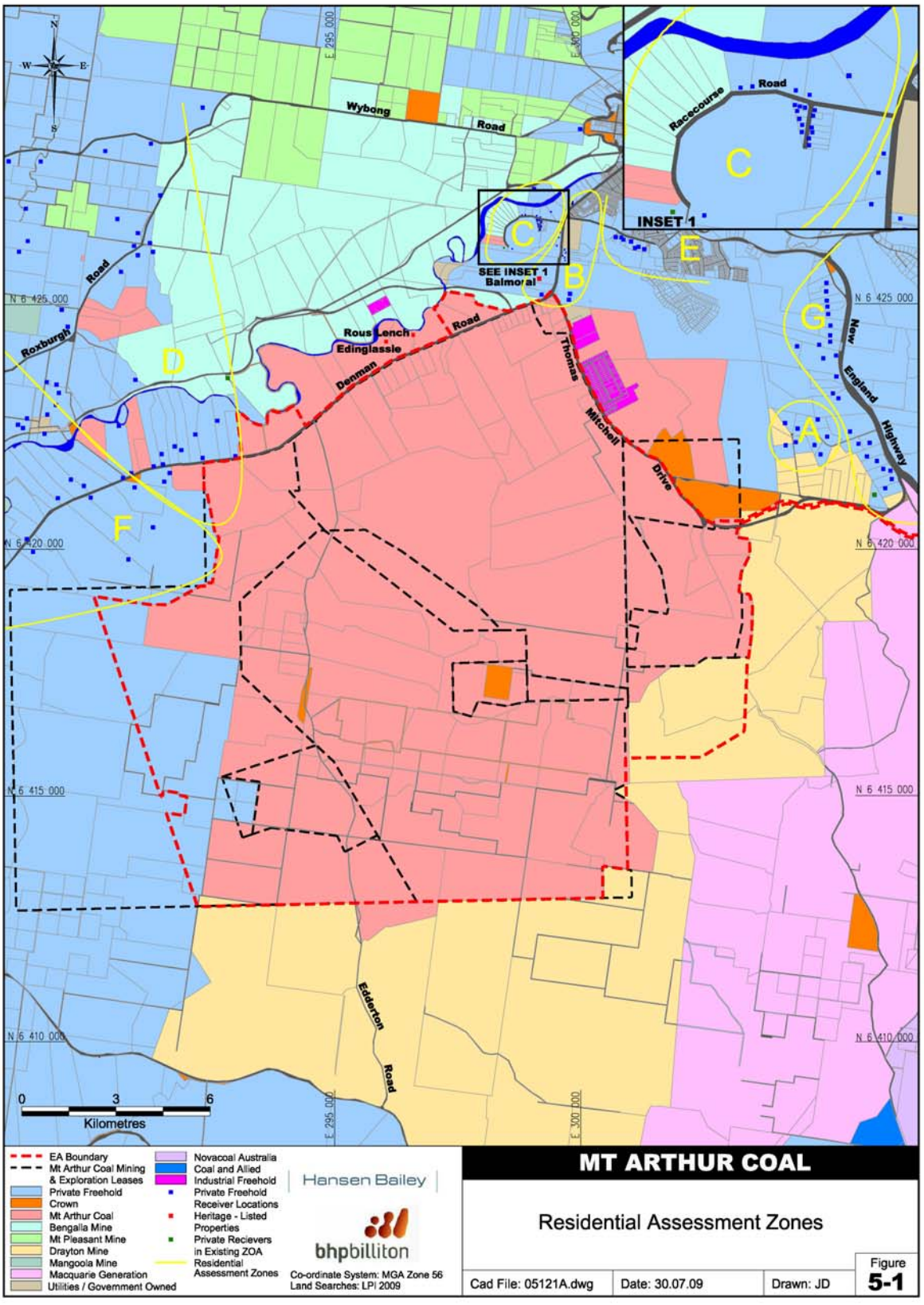
Noise has been assessed at 129 residential locations representative of all residences possibly impacted by noise from the Project. Each residential location has been assigned an individual number.

To set noise criteria the residences are grouped into zones where it is considered the Rating Background Level (RBL) and existing industrial noise are consistent across the zone. The zones are listed in Table 5-1 and shown on Figure 5-1.

Table 5-1 Residential Zones

Zone	Location
A	Antiene Estate
B	Skelletar Stock Route Thomas Mitchell Drive Denman Road
C	Racecourse Road
D	Denman Road (north-west) Roxburgh Vineyard (north-east) Roxburgh Road
E	South Muswellbrook (incl. the South Muswellbrook Development Area)
F	Denman Road West, Roxburgh Vineyard (west)
G	East of Antiene, New England Highway

Figure 5-1 Residential Assessment Zones shown on Land Ownership Map



5.3 Previous Background Noise Surveys

Wilkinson Murray Report 98102 (January 2000) was the acoustic assessment component of the MAN EIS. The background noise measurements undertaken for that project formed the basis for the noise criteria for Mt Arthur Coal.

Noise levels were monitored at ten locations for the MAN EIS. These are shown in Figure 5-2. The monitoring period(s) for each location are shown in Table 5-2, together with a description of the noise environment based on site visits.

The measured RBLs are shown in Table 5-3.

Table 5-2 Background Noise Monitoring Locations for MAN EIS

Location	Monitoring Period(s)	Noise Sources
A: Thomas Mitchell Drive near Drayton Mine (40m from road)	15/6/99-30/6/99	Heavy vehicles on Thomas Mitchell Drive; Drayton Mine
B: Balmoral Road, Antiene	10/8/99-15/8/99(1)	Heavy vehicles on Thomas Mitchell Drive; Drayton Mine
C: Barnett residence, Skelletar Stock Route	15/6/99-30/6/99; 10/8/99-26/8/99	Heavy vehicles from Bayswater No. 3 Mine; highway trucks
D: Webber residence, Thomas Mitchell Drive & Denman Road	15/6/99-30/6/99; 10/8/99-26/8/99	Animal noises; mine noise very faint
E: Yammanie residence, Thomas Mitchell Drive & Denman Road	15/6/99-30/6/99; 10/8/99-24/8/99	Heavy vehicles on Denman Road; occasional noise from Bengalla Mine
F: Boyle residence, Racecourse Road	15/6/99-30/6/99; 10/8/99-24/8/99(2)	Animal noises; Bengalla Mine dragline equipment
G: Rankin residence, Denman Road	15/6/99-29/6/99; 10/8/99-26/8/99	Equipment at Bengalla Mine
H: Oatley residence, Roxburgh vineyard	15/6/99-30/6/99; 10/8/99-26/8/99	Mining noise; heavy vehicles on Denman Road
I: Constable residence, Roxburgh Road	15/6/99-29/6/99; 10/8/99-24/8/99	Mining noise; insects
J: Roxburgh residence, South Muswellbrook	10/12/99-16/12/99	Mining Noise, Highway Trucks

(1) *Measurements truncated due to vandalism of logger*
(2) *Some data lost due to equipment failure*

Figure 5-2 Background Noise Monitoring Locations – MAN EIS

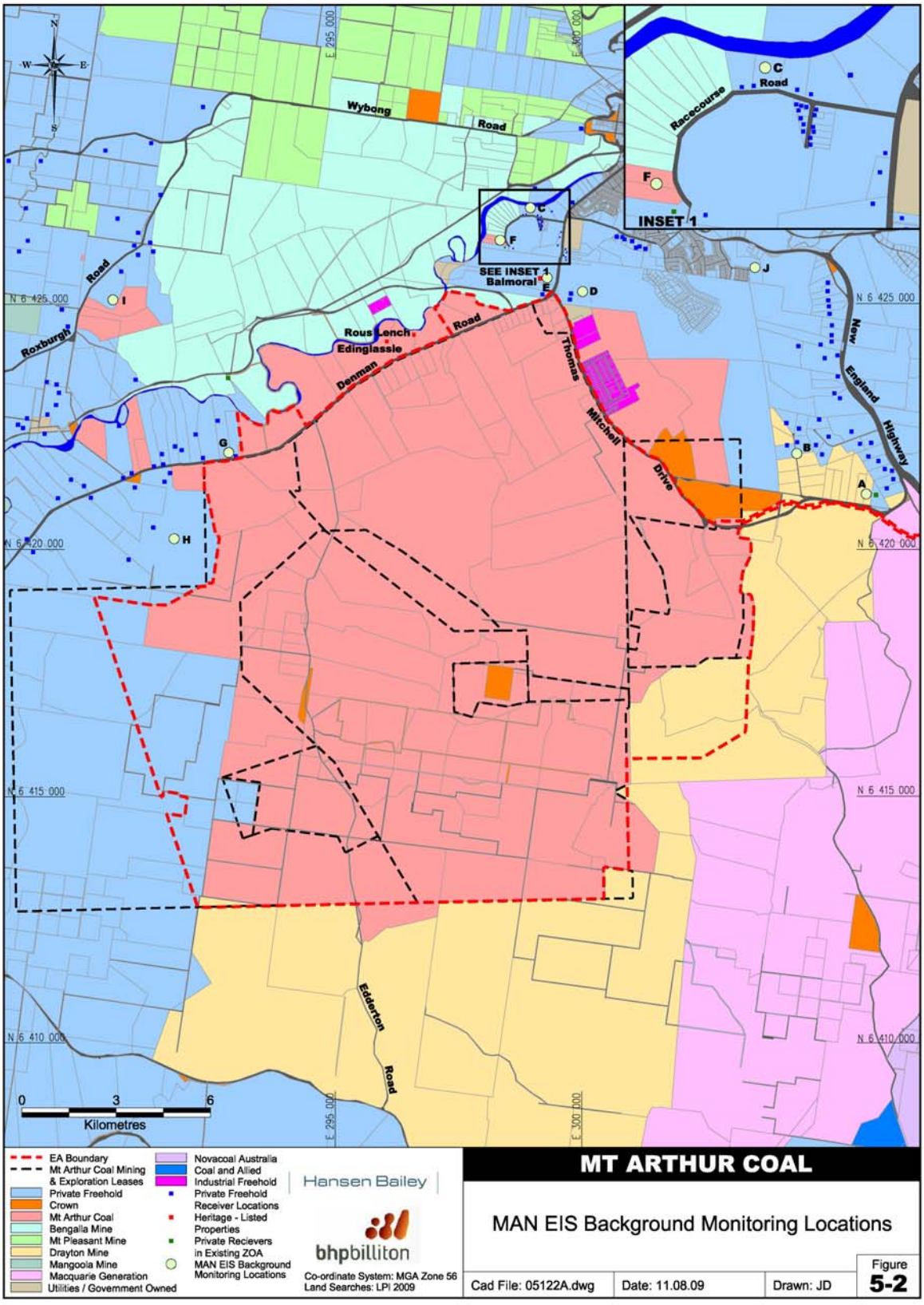


Table 5-3 Measured RBL – MAN EIS

Location	RBL (Day/Evening/Night)
A – Thomas Mitchell Drive	39/42/47
B – Antiene	33/36/33
C – Skelletar Stock Route	32/34/32
D – Thomas Mitchell Drive and Denman Rd	36/33/32
E – Thomas Mitchell Drive and Denman Rd	33/32/33
F – Racecourse Rd	32/33/30
G – Denman Rd	34/32/30
H – Roxburgh Vineyard	32/31/29
I – Roxburgh Rd	29/31/31
J – South Muswellbrook	30/33/31

The MAN EIS discussed the analysis of the background data to arrive at the proposed RBL for assessment. Subsequent to discussions with the DECC regarding the exclusion of data under INP rules, lower than measured background noise levels were adopted. The MAN EIS proposed RBLs, and those finally adopted for the setting of conditions of consent, are shown in Table 5-4.

Table 5-4 Proposed and Adopted Criteria for Assessment Areas – MAN EIS

Location	Proposed RBL (Day/Evening/Night)	Adopted RBL (Day/Evening/Night)	Current Study Assessment Area
B - Antiene	36/36/36	32 / 35 / 33	A, G
C - Skelletar Stock Route, A - Thomas Mitchell Drive, G - Denman Road and G - Denman Road West	35/32/31	34 /33 / 32	B, D
F - Racecourse Road	33/32/31	32 / 31 / 30	C
I - Roxburgh Road and H - Roxburgh Vineyard	30/30/30	32 / 31 / 30	D, F
J - South Muswellbrook	30/30/30	30 / 30 / 30	E

5.4 Mt Arthur Coal Underground Project

The RBLs adopted for the MAN EIS were carried forward into the assessment of the MAU. In addition, five residences located toward the east of Antiene were identified as not having been assessed for previous projects at the Mt Arthur Coal Complex and were included in the MAU assessment. These are receiver locations 98, 99, 100, 101 and 102 (see Figure 5-3 and 5-4). As part of the MAU assessment a review of noise contours from the proposed Mt Arthur Coal South Pit Extension, (Wilkinson Murray Report 05038) was undertaken and it was concluded that these residences would not be impacted by operational mining noise. However, they may be impacted by noise from rail passbys and were assessed as such. Landownership for each receiver location is shown in Appendix B.

Figure 5-3 Receiver Numbers (North)

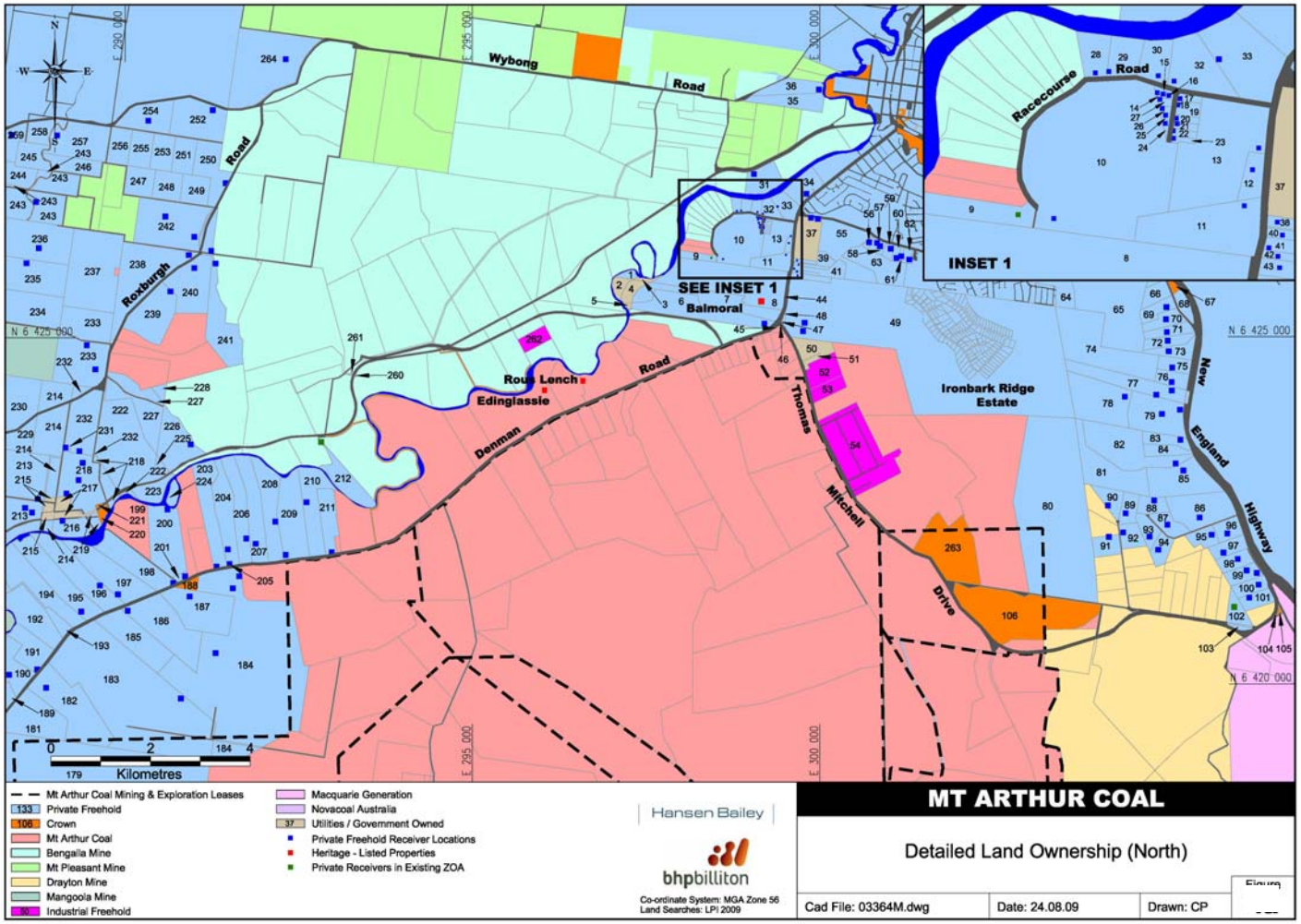
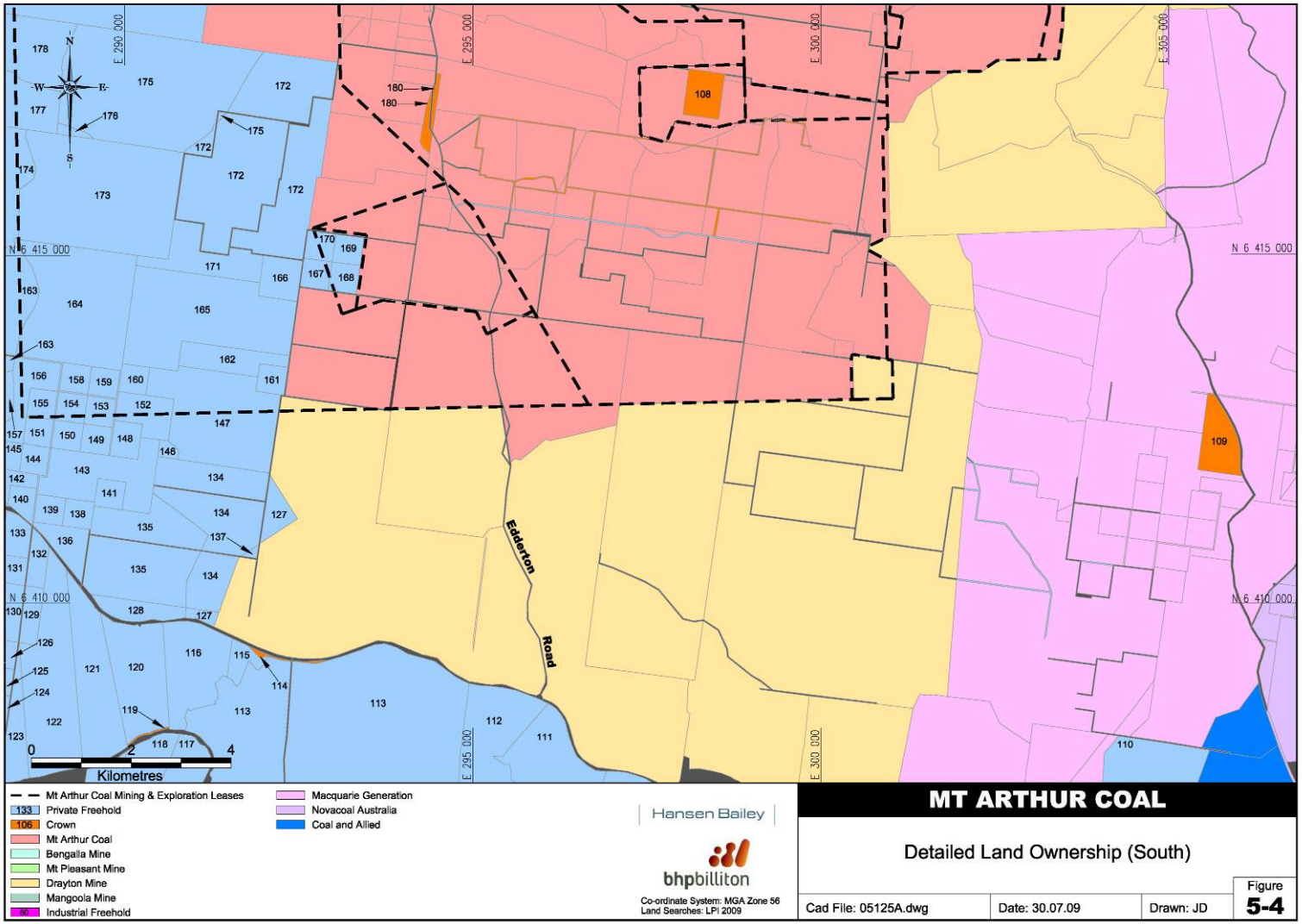


Figure 5-4 Receiver Numbers (South)



To assess the existing background noise an Environmental Noise Logger was installed at East Antiene (Location 101) from 13 to 26 April 2006. The RBLs were determined in accordance with the INP and are shown in Table 5-5. These RBLs are considered representative of the eastern portion of the Antiene rural residential estate which is located near to the New England Highway (Assessment Area G in the current assessment).

Table 5-5 Rating Background Levels at East Antiene Location 101

Parameter	Daytime (dBA)	Evening (dBA)	Night-time (dBA)
RBL	36	35	34

5.5 Long-Term and Recent Noise Monitoring

5.5.1 Measurement Locations

Noise levels around the Mt Arthur Coal Complex have been monitored since 1999. As well as noise logging for the environmental assessments for the MAN and MAU Projects, Wilkinson Murray has access to data from a network of four permanently installed directional real-time noise monitors (Denman Road West, South Muswellbrook, Racecourse Road and Yammanie) and meteorological stations located at and around the Mt Arthur Coal Complex. The first monitor commenced operation in 2001, and the others were introduced progressively over the period of 2001 to 2004. These monitors have been operated continuously since their installation and provide a significant amount of real-time background data.

In addition, monitoring was conducted at four supplementary locations during the winter of 2008. The additional four sites consisted of two sites where a mobile directional real-time monitoring unit was used and two sites where standard noise loggers were used.

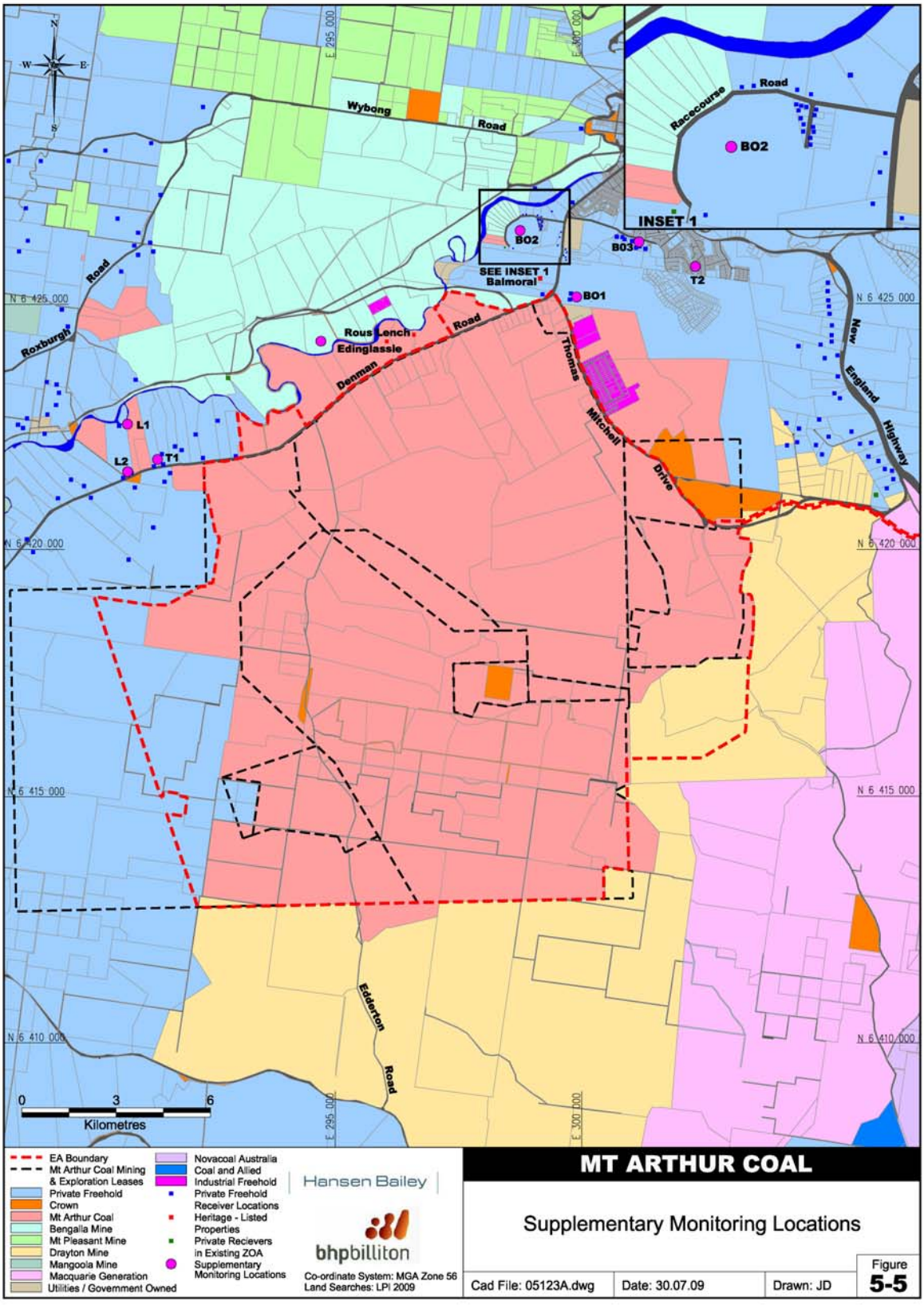
Data from three of the permanently installed real-time monitors (Racecourse Road, South Muswellbrook and Yammanie) were analysed for this assessment. The fourth real-time monitor, at Denman Road West, was not analysed as noise logging data from winter 2008 indicated the night-time RBL had not increased significantly at this location since the MAN EIS background monitoring.

In summary, the noise monitoring locations used for the review of the background noise levels in this assessment around the Mt Arthur Coal Complex included:

- BO1 – BarnOwl at Yammanie (nearest Receiver 49);
- BO2 – BarnOwl at Racecourse Road;
- BO3 – BarnOwl at Highbrook Park (South Muswellbrook);
- T1 – Temporary BarnOwl at Receiver 99;
- T2 – Temporary BarnOwl at 35 Mahogany Ave (South Muswellbrook);
- L1 – Logger at Mt Arthur Coal owned property; and
- L2 – Logger at Denton Property (Nearest Receiver 201).

The supplementary monitoring locations are shown on Figure 5-5.

Figure 5-5 Supplementary Monitoring Locations



5.5.2 Measurement Method

For both directional and non-directional noise monitoring, all monitoring equipment was set to A-weighted, fast response, continuous monitoring over 15-minute sampling periods. This equipment is capable of remotely monitoring and storing noise level descriptors, and in the case of directional monitors, audio files enable detailed analysis. For temporary monitors, equipment calibration was checked prior to and following the noise survey, with no significant variation observed. The permanent directional real-time noise monitors are subject to regular calibration.

Both directional and non-directional noise monitors calculate L_{A1}, L_{A10}, L_{A90} and L_{Aeq} levels of the ambient noise. L_{A1}, L_{A10} and L_{A90} are the noise levels exceeded for 1%, 10% and 90% of the sample time respectively (see Appendix A for definitions). The L_{A1} is indicative of maximum noise levels due to individual noise events such as the occasional pass-by of a heavy vehicle. The L_{A1} descriptor is generally used for the assessment of sleep disturbance. The L_{A90} level is used to determine the background noise level during the relevant assessment period. 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.

Results from the two non-directional noise monitors used for this Project are illustrated in Appendix C.

The BarnOwl noise monitors record the overall L_{A90} noise level, as well as the L_{Aeq} level of noise arriving from any specific direction. This is used to isolate noise arriving from the direction of the Mt Arthur Coal Complex and any other relevant industrial sources.

Meteorological data for all relevant periods was analysed to allow the exclusion of periods of rain and wind as required by the INP. At some permanent BarnOwl sites, exclusion of data was also required due to interference from a nearby high volume air sampler.

Results from all these forms of monitoring are discussed below in relation to each Residential Zone developed for this assessment.

5.6 Zone A – Antiene Estate

No recent logging was performed for this area. The RBLs used are unchanged from values used in MAU as presented in Table 5-4. They are:

- Daytime – 32 dBA;
- Evening – 35 dBA; and
- Night-time – 33 dBA.

The RBL for daytime at Antiene is 1 dBA lower than the night period. Based on current noise levels, this would be due to the influence of noise from Drayton Mine. As the noise from Drayton Mine would be increased by temperature inversions, the mine would have more influence during night-time than daytime. It is likely that this was also the case in 1999 when these RBLs were measured.

5.7 Zone B - Skelletar Stock Route, Thomas Mitchell Drive, Denman Road

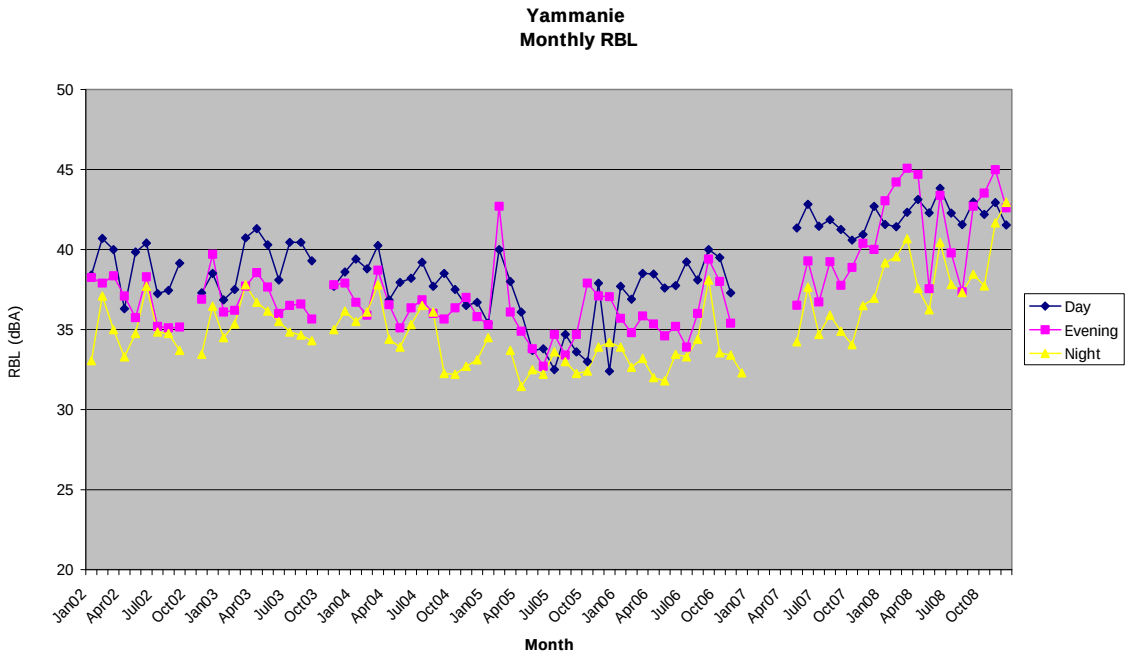
Figure 5-6 shows the monthly measured RBL for Yammanie (BO1) from 2002 to the end of 2008. The graph indicates a general increase in RBL over the period considered, particularly during the night-time, with most of the change occurring since 2006. In the period 2004 to 2006 the night-time RBL was similar to that used in the MAN EIS (32 dBA), but at other times it was considerably higher.

Analysis of directional data from the BarnOwl suggests that the noise from all directions has increased since 2006, with the largest increase being from the north, in the direction of Muswellbrook township. The increase cannot be accounted for simply by the larger industrial projects in the area. While a change in noise criteria is not recommended at this stage, it is noted that further analysis of this data during the next few years could show that the criteria at Yammanie are set conservatively low.

The RBLs used for setting criteria are unchanged (from the MAU EA) as part of this assessment and therefore are:

- Daytime – 34 dBA;
- Evening – 33 dBA; and
- Night-time – 32 dBA.

Figure 5-6 Monthly RBL at Yammanie



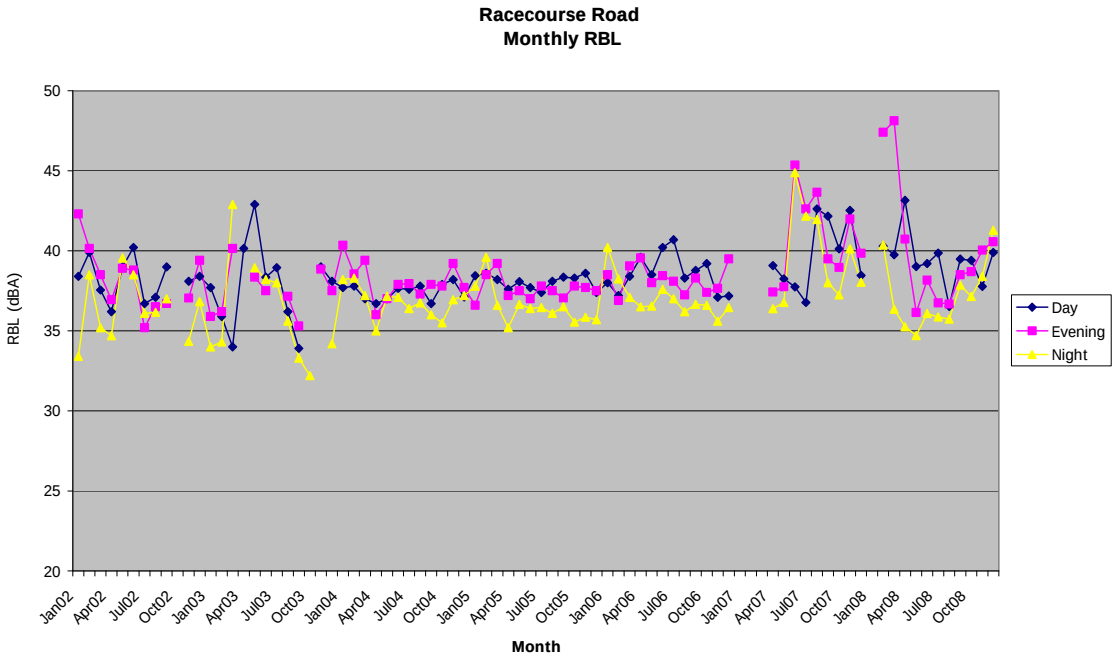
5.8 Zone C – Racecourse Road

5.8.1 Long-Term Noise Monitoring

Figure 5-7 shows the monthly RBL at Racecourse Road. Note that the BarnOwl was moved to Sheppard Avenue (on the opposite side of the racecourse) in 2002 but the BarnOwl location is still referred to as Racecourse Road. From the review of the monitoring data it is apparent that the night-time RBL of 30 dBA measured for the MAN EIS has not been repeated. There is no certain reason for this but may be explained by a combination of the following:

- The BarnOwl is at 4 m above the ground, whereas the noise logger was at 1.5 m, and therefore the BarnOwl microphone may be more exposed;
- The noise logger was close to a house in 1999, and may have been shielded from the predominant sources of background noise. In addition, the new real-time monitoring location (which is representative of the worst-case location for Mt Arthur Coal noise at a private residence in this area) may be more exposed than the original logger location, which is currently mine-owned; and
- A day by day analysis of background, rather than the monthly trend shown in Figure 5-7, shows that there is considerable variation in night-time ABLs (Assessed Background Level, referring only to one night-time period). The night-time ABL varies by more than 15 dBA, depending on when the measurements were done. It is possible then that the 1999 logger data was collected during a quiet period.

Figure 5-7 Monthly RBL at Racecourse Road



Analysis of the directional L_{Aeq} data from June to August 2008 indicates that the majority of noise at this location arrives from the north-east, rather than from the direction of either the Mt Arthur Coal Complex or Bengalla mines. The most significant source in the north-east direction is Muswellbrook itself, so this could be the result of increased urbanisation in the township. This is consistent with the previously mentioned directional analysis of the BarnOwl at Yammanie.

Based on the results in Figure 5-7, a conservatively low estimate of RBL values at this monitor would be 38 / 37 / 36 dBA for the day / evening / night periods respectively. However, it is accepted that the background noise at Racecourse Road could be influenced by noise from the Mt Arthur Coal Complex. Background noise is measured in terms of L_{A90}, and the industrial noise from the Mt Arthur Coal Complex is measured in terms of L_{Aeq}. The measured L_{A90} was corrected by subtracting the contribution of the Mt Arthur Coal Complex to the overall L_{Aeq}. Allowing for the uncertainties in these calculation methods, the conservative assumption was made that background levels at this location in the absence of noise from the Mt Arthur Coal Complex are:

- Daytime – 36 dBA;
- Evening – 35 dBA; and
- Night-time – 34 dBA.

In the INP, the amenity criterion depends on the level of other industrial noise at a location. Noise from the direction of Bengalla Mine (the only other likely source of industrial noise at this location) contributes approximately 35 dBA to the measured $L_{Aeq,night}$. From the INP, the acceptable level of noise at night is $L_{Aeq,9hr}$ 40 dBA (for either rural or suburban areas). This level needs to be modified to account for existing industrial noise. If the industrial noise other than from the Mt Arthur Coal Complex is 35 dBA, as appears to be the case, then the acceptable level is adjusted by minus 2 dBA. Hence the night-time amenity criterion for Racecourse Road would be 38 dBA.

5.9 Zone D - Denman Road North-west, Roxburgh Vineyard (north-east) and Roxburgh Road

RBLs in this zone were determined from noise logging at locations L1 and L2 for this Project (see Appendix C), and noise logging for the MAN EIS. The results of the logging at L1 and L2 are shown in Figure 5-8. The logger charts are shown in Appendix B.

Table 5-6 Rating Background Levels L1 and L2

Location	Daytime (dBA)	Evening (dBA)	Night-time (dBA)
L1	31	34	31
L2	35	30	30

As the loggers showed that there does not appear to have been a significant change in background noise levels at these locations, the RBLs from the MAU were used and are unchanged in this assessment. They are:

- Daytime – 32 dBA;
- Evening – 31 dBA; and
- Night-time – 30 dBA.

5.10 Zone E – South Muswellbrook

This location was not monitored for the MAN EIS; hence the most conservative RBLs possible under the INP were set in the MAN EIS – that is 30 dBA for daytime, evening and night.

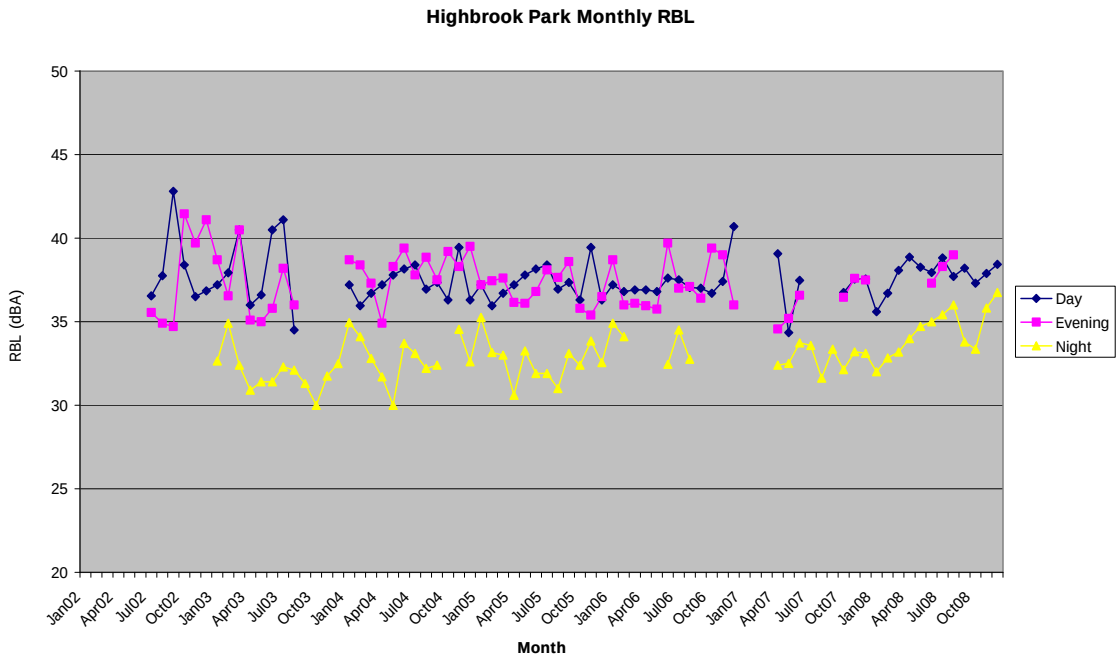
To establish more realistic criteria, monitoring was undertaken during October 2008, and the data from the nearest BarnOwl were analysed.

The BarnOwl data at location BO3, Highbrook Park, is in South Muswellbrook. However, as this location is not a residence, further logging was performed from 17 to 30 October 2008 at 35 Mahogany Ave approximately 900 m southwest of BO3 (shown as Location T2 on Figure 5-5). The analysis procedure was as follows:

- Analysis of BarnOwl directional data over Winter 2008 at location BO3 indicates that noise sources in the direction of mining operations at night have negligible contribution to overall LA90 noise levels, and hence the RBL at that location with or without the Mt Arthur Coal Complex in operation would be the same;
- The average RBL over the entire winter period at Highbrook Park was 35.5 dBA;
- The RBL was measured at a residential receiver (35 Mahogany Ave) over three weeks in October 2008, giving a value of 32.2 dBA;
- The simultaneous Highbrook Park measurement in October 2008 showed an RBL at that location of 33.7 dBA - a difference of 1.5 dBA between the two locations and a difference of 1.8 dBA between the October measurement and the entire winter period at Highbrook Park; and
- It is reasonable to apply the same difference to the RBL at 35 Mahogany Avenue to estimate the Winter RBL, giving an estimate of 34 dBA.

To further corroborate this analysis, an analysis of long term data from BO3 was undertaken. Figure 5-8 shows the monthly RBL for Highbrook Park. The graph shows a trend towards increasing noise levels over time. Note that the daytime and evening RBLs are consistently higher than the night-time RBLs. This is consistent with urban situations where the background noise is due to traffic. The increasing RBL over time is probably due to increasing activity and urbanisation in the area near monitor.

Figure 5-8 Monthly RBL at Highbrook Park



The RBLs at South Muswellbrook are therefore set conservatively as:

- Daytime – 34 dBA;
- Evening – 34 dBA; and
- Night-time – 34 dBA.

5.11 Zone F – Denman Road West and Roxburgh Vineyard (west)

Given the proximity to Zone D to Zone F, RBLs from the analysis for Zone D were adopted for this Zone.

The assumed RBLs for this assessment are:

- Daytime – 32 dBA;
- Evening – 31 dBA; and
- Night-time – 30 dBA.

5.12 Zone G - East Antiene, New England Highway

The levels were determined from noise logging for the MAU as described in Section 5.4.

The RBLs applied for this assessment are:

- Daytime – 36 dBA;
- Evening – 35 dBA; and
- Night-time – 34 dBA.

6 OPERATIONAL NOISE CRITERIA

6.1 Procedures for Assessment of Noise Emissions

Operational noise is assessed according to criteria specified in the INP. Terms related to noise measurement units as used in this assessment are described in Appendix A.

Two criteria are specified in the INP - the intrusive criterion and the amenity criterion.

6.2 The Intrusive Criterion

In general, the **intrusive criterion** requires that the $L_{Aeq,15min}$ noise level from a specific industrial source should not exceed the RBL by more than 5 dBA.

6.3 The Amenity Criterion

The **amenity criterion** sets an upper limit to control the total L_{Aeq} noise level from all industrial sources over day, evening and night periods. In this case, the surrounding residences are 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. Where there is existing industrial noise in an area, the criterion for any new source must be reduced accordingly to ensure that the total noise level does not exceed these values.

With increasing urbanisation of South Muswellbrook, it could be expected that the area will eventually be classed as “suburban”. As the evening and night-time amenity criteria are the same for “rural” and “suburban”, and the night-time period is always the critical period for determination of compliance, the classification of “rural” makes no difference to the current assessment. This approach is consistent with the previous assessment for MAU.

As the amenity criterion applies to all industrial sources in the area, setting a criterion for the contribution of this project requires understanding the contribution of other sources. Based on the premise that no residence will be exposed to more than two major industrial operations (i.e. Mt Arthur Coal operations and Bengalla Mine, Drayton Mine, Mangoola Coal or Mount Pleasant, depending on the location), and that noise impacts will be shared equally amongst those industrial sources, the default amenity criterion for noise impacts from the Project will be 37 dBA at each residence. The Industrial Estate has been discounted as a major source of night-time noise.

This default amenity criterion does not apply to Zone C, Racecourse Road. This was discussed in Section 5.8, where detailed analysis of directional monitoring was undertaken. A night time amenity criterion (for the project alone) of $L_{Aeq,9hr}$ 38dBA was established for Zone C.

6.4 Project – Specific Noise Levels

The project-specific noise goals for the Project are then taken as the more stringent of the intrusive and amenity criteria.

Table 6-1 summarises the RBLs, intrusive criteria and amenity criteria for the Project. Night-time intrusive criteria are lower than those for daytime and evening periods, with the exception of Antiene where the daytime criterion is 1 dB lower. The background noise at Antiene is influenced by noise from Drayton Mine. As the noise from Drayton Mine would be increased by temperature inversions, this source will have more influence during night-time than daytime.

At other locations, background noise is more influenced by such things as local traffic which decreases during evening and night-time hours.

Calculations indicate that due to the effect of night-time temperature inversions, night-time noise levels from the same noise source will be higher than daytime levels, by more than 1 dBA. Hence, at all locations, consideration of intrusive requires only consideration of night-time noise levels, since if these are acceptable, then levels at other times will also be acceptable.

A discussed in Section 7.7, $L_{Aeq,9hr}$ is approximately 4dBA lower than $L_{Aeq,15min}$ for mining noise Hence, for a constant noise source which operates on a 24-hour basis, the night-time intrusive criterion will be the most stringent criterion. Noise from train movements is a special case which is considered separately in Section 12.

Table 6-1 Intrusive (the Project Alone) $L_{Aeq,15min}$ & Amenity $L_{Aeq,period}$ Noise Criteria

Receiver Zone	Location	Assessed RBL (Day/Evening/Night) dBA	Intrusive Criteria (Day/Evening/Night) $L_{Aeq,15min}$ dBA	Amenity Criteria (Night[1]) $L_{Aeq,period}$ dBA
A	Antiene Estate	32 / 35 / 33	37 / 40 / 38	40
B	Skelletar Stock Route Thomas Mitchell Drive Denman Road	34 / 33 / 32	39 / 38 / 37	40
C	Racecourse Road	36 / 35 / 34	41 / 40 / 39	40
D	Denman Road North-west Roxburgh Vineyard (north east) and Roxburgh Road	32 / 31 / 30	37 / 36 / 35	40
E	South Muswellbrook (incl. the South Muswellbrook Development Area)	34 / 34 / 34	39 / 39 / 39	40
F	Denman Road West and Roxburgh Vineyard (west)	32 / 31 / 30	37 / 36 / 35	40
G	East Antiene	36 / 35 / 34	41 / 40 / 39	40

Note 1: In all cases, daytime and evening assessment will be determined by the Intrusive Criteria

7 OPERATIONAL NOISE PREDICTION

7.1 Noise Modelling Methodology

Operational noise levels at residences have been calculated using the Environmental Noise Model (ENM) prediction model (a proprietary computer program from RTA Technology Pty Ltd). This model has been endorsed by the DECC for environmental noise assessment and, using appropriate meteorological conditions, its results have been directly validated for noise in this area. For this study, the additionally proposed open cut development is modelled and combined with other operations from the Mt Arthur Coal Complex to model the noise generated from the entire complex, including rail noise. Total predicted operational noise levels are then compared with the Project-specific noise levels described in Table 6-1. This methodology allows a full understanding of the potential noise impacts at residences from the Mt Arthur Coal Complex.

Calculations were undertaken for three progressive operational scenarios, namely worst case winter nights in Years 2011, 2016 and 2022. These years correspond with Years 10, 15 and 20 respectively of the MAN EIS. Because of the prevalence of night-time temperature inversions in winter, it has been demonstrated that if operational noise levels comply with criteria during winter nights, they are likely to comply at all other times.

All calculations were performed for adverse meteorological conditions using the methodology outlined in Section 7.2.

7.2 Meteorological Conditions

Predictive noise modelling before 2005 was based on data collected from weather stations and inversion data from a temperature inversion tower at Bengalla Mine. Calculated 10^{th} percentile noise levels were shown to exceed 10^{th} percentile levels measured at the four permanent BarnOwl sites by up to 10 dBA. During preparation of the South Pit Extension EA, a calibration exercise was undertaken. It was demonstrated that the best correlation with measured noise levels during the worst-case month was with a single meteorological condition of high temperature inversion strength at night (4° per 100 m). Using this methodology, predicted noise levels have generally been within 2 dBA of measured levels which is considered best-practice. Both the South Pit Extension EA and MAU EA used this methodology. Recent calibrations undertaken during the preliminary constraints analysis for the Project again showed excellent correlation between predicted and measured noise levels over the winter period. This methodology was therefore used for this Project.

7.3 Constraints Analysis

The modelled scenarios presented in this report are the result of several ongoing constraints analyses of mining operations. Where feasible, operations have been modified to reduce noise emissions from the mine. Modifications to the mine plan to reduce noise impacts included:

- Procurement of noise-attenuated vehicles for critical haul routes;
- Modified alignment of haul routes;
- Reduction of haul truck numbers on critical routes;
- Adjustments to the intensity of mining in different mining areas; and
- Variation to heights of strategic dumps to allow greater noise shielding.

A change to the mine plan was also made in February 2009 to remove a portion of Macleans Hill from the area of disturbance primarily to reduce the visual impact of the project. As a result, noise impacts to the north of the Project were decreased.

Following these mine plan changes it has been shown that 2011 will be the year with the greatest potential noise impact. As the pit deepens in successive years, noise will reduce as shielding provided by the edge of the pit becomes more effective.

7.4 Equipment Sound Power Levels

Table 7-1 presents the assumed sound power levels for the noise modelling. As a noise control measure it is anticipated that 10 low-noise haul trucks (113 dBA) will be made available for deployment on noise–sensitive routes.

Table 7-1 Indicative Equipment Sound Power Levels

Equipment	Indicative Sound Power Level, dBA	Source
Haul Truck - Future Attenuated	113 (Assume 10 available for Project)	Best Practice Mitigated
Haul Truck 793DXQ	115	Mt Arthur Coal (MAC) Measurements 2008*
Haul Truck T282	117	MAC Measurements 2008*
Haul Truck 789C	111	MAC Measurements 2008*
Drill	112	MAC Measurements 2008*
Excavator 996	115	MAC Measurements 2008*
Excavator 994	113	MAC Measurements 2008*
Wheeled Dozer 854	115	MAC Measurements 2008*
Shovel 4100	121	MAC Measurements 2008*
D11 Dozer	113 (Attenuated)	MAC Measurements 2008*
D10 Dozer	110 (Attenuated)	MAC Measurements 2008*
Water cart	116	MAC Measurements 2008*
Grader	108	MAC Measurements 2008*
Conveyors (Shielded)	82 per metre / 79 per metre	Wilkinson Murray (WM) Measurements
Conveyor Drive	102	Global Acoustics 2008
Coal Prep Plant Module	117 (Southern façade excluded)	Global Acoustics 2008
Crushers	115	Global Acoustics 2008
Transfer Station & Conveyor Drive	112	Global Acoustics 2008
Stacker & Conveyor Drive	103	Global Acoustics 2008
Reclaimer & Conveyor Drive	115	Global Acoustics 2008
Reject Bin	96	Global Acoustics 2008
2 x QR Locomotives (20 kph)	79.1 per metre	WM Measurements 2007
1280m Freight Wagons (20 kph)	76.6 per metre	WM Measurements 2007
Rail Load out Bin	106	WM Measurements 2005
Stockpile Tracked Dozer	113 (D11 Attenuated)	MAC Measurements 2008*
PC 2000	117	WM Measurements
PC 1800	116	WM Measurements
PC 1600	115	WM Measurements
CAT 785	117	WM Measurements
CAT 777	115	WM Measurements

*Notes: * Independent specialist monitoring commissioned by Mt Arthur Coal.*

7.5 Equipment Locations

7.5.1 Mobile Plant

Mine plan drawings (updated in February 2009) were supplied for mine years 2011, 2016 and 2022. This included indicative locations of all mobile plant.

7.5.2 Infrastructure

This was modelled as per infrastructure drawings provided in January 2009 as no changes to infrastructure were made in the February 2009 update. The most dominant source of noise is the CHPP. Modelling includes the planned plant upgrade to enable the processing of up to 36 Mtpa ROM coal from 2014. The conceptual upgrade includes screens upgrade and new CHPP modules. This may vary as technology develops and new processes are available. Noise specification data for the proposed screens is unavailable, however from previous experience there will be an increase in noise of up to 5 dBA with the upgraded screens. This will increase total noise levels in the CHPP by approximately 3 dBA, given there are other components of noise in the CHPP. This is consistent with previous detailed calculations for similar facilities. A pro-rata increase in noise was added to account for the number of CHPP modules conceptually increasing from three to five. Therefore the total increase in noise from the CHPP is approximately 5-6 dBA from existing levels in modelled years 2016 and 2022.

7.5.3 Rail

Rail noise is considered as a line source. The length of line assessed as part of the Project extended from the existing Rail Loading facility and the proposed second rail loading facility, along the Antiene Rail Spur to its junction with the Main Northern Railway.

It was assumed that there will be two locomotives with approximately 1280 m of wagons. The model incorporates two sections of existing noise walls. It is assumed that only one rail loading bin will be in operation at any one time.

7.5.4 Equipment Utilisation

Project-specific criteria are the night-time intrusive criteria. They are assessed over 15 minutes and it is assumed that the following plant is active for that period:

- All mobile plant;
- One rail movement; and
- Worst-case infrastructure scenario.

Mobile plant numbers were derived from information provided by Mt Arthur Coal in January 2009. The proposed fleet numbers and their use are summarised in Table 7-2 and Table 7-3.

Table 7-2 Total Fleet and Operating Fleet (indicative only)

Equipment	Total Mobile Equipment Fleet		
	2011	2016	2022
Electric Shovels	3	5	4
Excavators	13	18	16
Trucks	71	107	94
Graders	16	22	18
Bulldozers	38	56	48
Rubber Tyre Bulldozers	6	8	7
Watercarts	4	8	7
Drills	6	8	7
Contract Fleet			
PC 2000 (3230)	1	-	-
PC 1800 (3220)	1	-	-
PC 1600 (3200)	1	-	-
Cat 785 (785)	8	-	-
Cat 777 (C777)	4	-	-
Dozer (D10T)	3	-	-
Watercart (Cat 777)	1	-	-
Grader (Cat 16M)	1	-	-

Table 7-3 Fleet Availability

Equipment Type	Availability %	Utilisation Rate %
Haul Trucks		
T282/797(360T)	82.1%	71%
Cat793XQD(240T)	86.1%	74%
Cat789C	86.1%	71%
Dozers		
D11 Fleet	85.9%	49%
Cat D10	95.8%	50%
Ancillary Equipment		
Cat 854G	90.3%	57%
Tiger 690	93.3%	69%
Cat 24H	86.6%	60%
Cat 16H	90.4%	41%
Cat 789WC	87.5%	22%
Shovels and Excavators		
P&H4100	90.7%	82%
P&H4100XPC	91.5%	82%
R996	88.3%	82%

Equipment Type	Availability %	Utilisation Rate %
EX5500	90.0%	82%
R994	90.5%	70%
Drills		
Drill	85.0%	72%

Fleet availability is reflected in Table 7-3. It should be noted that Utilisation Rates are per fleet and were used as part of this assessment.

7.6 Predicted Noise Levels

The predicted $L_{Aeq,15min}$ operational noise levels at all locations are presented in Appendix B. The results are summarised for each zone below.

Noise contours for 2011, 2016 and 2022 are presented in Appendix D.

7.6.1 Zone A: Antiene

Exceedances of the Intrusive Criterion are predicted at:

- Halloran (87) – 1 dBA in all years;
- Osborn (93) – 1 dBA in 2011, 2 dBA in other years; and
- Skinner (94) – 3 dBA in 2011, 4 dBA in 2016 and 3 dBA in 2022.

No other residences are predicted to experience exceedances of the Intrusive Criteria in Zone A.

7.6.2 Zone B: Skelletar Stock Route, Thomas Mitchell Drive, Denman Road

Exceedances of the Intrusive Criterion are predicted at:

- Scriven (6) – 3 dBA in 2011;
- Drake (8) – 2 dBA in 2011;
- Muswellbrook Shire Council (37) – 1 dBA in 2016; and
- Webber (49 - 2 residences) – 4 dBA in 2011 and 2 dBA in other years.

No other residences are predicted to experience exceedances of the Intrusive Criteria in Zone B.

7.6.3 Zone C: Racecourse Road

No exceedances of the Intrusive Criteria are predicted in this zone.

No exceedances of the intrusive criteria ($L_{Aeq,15}$ 39dBA) are predicted. $L_{Aeq,9h}$ night time noise is predicted to at least 4dBA below the intrusive noise – or at most 35dBA. As the amenity criterion is 38dBA (from Mt Arthur Coal's contribution), there is no predicted exceedance of the amenity criterion.

7.6.4 Zone D: Denman Road (north-west), Roxburgh Road & Roxburgh Vineyard (north-east)

Exceedances of the Intrusive Criterion are predicted at:

- Fosters Wine, two residences (184) – 1 dBA in 2011, then up to 3 dBA in 2016 and 2022;
- Latham (204) – 1 dBA in 2011 and 2016 and up to 2 dBA in 2022;

- Wild (206) – 2 dBA in all years;
- Zahra (207) – 1 dBA in 2011, 2 dBA in 2016 and 2022;
- Zahra (208) – 2 dBA in 2011, 3 dBA in 2016 and 2022;
- Rankin (209) – 1 dBA in all years;
- Rankin (210) – 4 dBA in 2011, 5 dBA in 2016 and 2022;
- Rankin (211) – 3 dBA in 2011, 4 dBA in 2016 and 2022;
- Chudyk (212) – 4 dBA in 2011, 6 dBA in 2016 and 5 dBA in 2022; and
- Roots (226) – 3 dBA in 2016 and 2 dBA in 2022.

It should be noted that Chudyk (212) is subject to existing acquisition rights upon request by an adjacent mining operation.

At the other 24 residences assessed in this group there are no predicted exceedances of the Intrusive criteria.

The dominant noise source for this zone is a westerly proposed waste haul route. As mining operations will continue to move towards residents to the north-west over time, additional controls beyond those already proposed are not practical.

7.6.5 Zone E: South Muswellbrook

No exceedances of the Intrusive Criteria are predicted in this zone.

7.6.6 Zone F: Denman Road West and Roxburgh Vineyard (west)

Exceedances of the Intrusive Criterion are predicted at:

- Fosters Wine, one residence (184) – 2 dBA in 2016 and 3 dBA in 2022; and
- Duncan (187) – 1 dBA in 2016 and 2022.

At the other 15 residences assessed in this group there are no predicted exceedances of the Intrusive Criteria.

7.6.7 Zone G: East of Antiene, New England Highway

At the southern end of Zone G, residences are predominately affected by noise from train movements on the Antiene Rail Spur. The $L_{Aeq,15min}$ noise level at these residences will increase by at most 1 dBA as a result of the Project due to increased noise from the CHPP.

Exceedances of the Intrusive Criteria are predicted at:

- De Boer (95) – 1 dBA in all years;
- Bird (96) – 1 dBA in 2016;
- Clifton (97) – 2 dBA in 2011, 3 dBA in 2016 and 2 dBA in 2022;
- Jones (98) – 2 dBA in 2011, 3 dBA in 2016 and 2 dBA in 2022;
- Hunter (99 – 2 residences) – up to 3 dBA in all years;
- Sharman (100) – 3 dBA in all years;
- Horder (101) – 6 dBA in all years; and
- Robertson (102) – 9 dBA in all years.

It should be noted that Robertson (102) is subject to acquisition under the MAU Project Approval.

At the other 16 residences to the north of the zone, there are no predicted exceedances of the Intrusive Criteria.

7.7 Cumulative Noise Assessment

7.7.1 Zones B to F

A cumulative noise assessment has been undertaken for the worst-case night-time period.

Rather than model an entire nine hour scenario, the average difference between $L_{Aeq,15min}$ and $L_{Aeq,9hr}$ levels from BarnOwl measurements over an entire winter was determined. This correction was then applied to calculated $L_{Aeq,15min}$ noise levels. This approach is considered more accurate than attempting to model particular plant items over nine hours due to the complexity of modelling many items of moving plant, rather than just the worst case as is done for intrusive assessment.

On this basis, $L_{Aeq,9hr}$ noise levels will be approximately 4 dBA lower than $L_{Aeq,15min}$ levels, and no exceedance of the project-specific amenity criterion is predicted for any residence in these zones.

7.7.2 Zones A and G

Rail noise was separately calculated to the procedure outlined in Section 7.7.1 by determining the $L_{Aeq,Period}$ noise level from of a maximum of six movements in the nine hour night-time assessment period (2200-0700hrs). The result is then combined with the $L_{Aeq,period}$ from other sources.

Noise from rail movements was previously assessed for the MAU Project. Current projections for Mt Arthur Coal producing 36 Mtpa, which equates to 27 Mtpa product coal to be railed, are that the peak number of trains during the night-time period will be five. Hence the previous MAU assessment using six trains per night remains conservative.

Table 7-4 shows a summary of the findings of that assessment. It shows that predicted $L_{Aeq,9hr}$ night-time noise will exceed the amenity criterion at only one receiver – Robertson (102), which is subject to acquisition rights under the MAU Project Approval.

Table 7-4 Rail Noise in Zones A and G

Receiver No	Zone	Receiver Name	$L_{Aeq,9hr}$ Noise Levels (dBA)	Criteria (dBA)
94	A	Skinner	34	40
102	G	Robertson*	41	40
101	G	Horder	37	40
100	G	Sharman	34	40
99	G	Hunter	33	40
99 (2^{nd} residence)	G	Hunter	33	40

** Subject to acquisition under the MAU*

7.8 Potential for Sleep Disturbance

7.8.1 Criterion

Although the INP does not specifically address sleep disturbance, the DECC has published a *Noise Guide for Local Government* which states:

> *Where sleep disturbance is being assessed, $L_{A1,60\ seconds}$ or L_{Amax} noise level is most appropriate, and the measurement position might be outside the bedroom window. Sleep may be disturbed if the source noise level exceeds the background noise by more than 15dBA.*

This approach is consistent with that recommended in the DECC's *Environmental Noise Control Manual (1985).*

The potential for sleep disturbance is considered separately for mining operations and for rail infrastructure, as described below.

7.8.2 Noise from Mining Operations

The noise model described in Section 7.1 was used to analyse maximum noise levels. Three short-term noise sources that may have the potential to disturb sleep include:

- Bulldozer reversing alarm 115 dBA;
- Shovel bucket door banging 120 dBA; and
- Passage of haul trucks 115 dBA.

To predict the potential for noise disturbance, a source of sound power level 115 dBA was placed at many points along the haul routes, and a source of 120 dBA was placed at the location of other plant.

To illustrate the results, the predicted noise levels at the closest residences are shown in Table 7-5. The L_{AMax} noise levels at all of the closest residences is predicted to be below the sleep disturbance criterion. Similarly, all other residences surrounding the Mt Arthur Coal Complex will experience L_{AMax} noise levels below the sleep disturbance criterion.

Table 7-5 L_{AMax} levels from mine

Receiver No	Zone	Receiver Name	L_{AMax} Noise Levels (dBA)	Criteria (dBA)
6	B	Scriven	30	47
49	B	Webber	26	47
91	A	Doherty	27	48
102	G	Robertson	25	49
184	F	Fosters Wines	28	45
211	D	Rankin	28	45

7.8.3 Noise from Rail Infrastructure

The potential for sleep disturbance from rail infrastructure and movements at both Antiene (Zone A) and those residences east of Antiene (Zone G) was assessed. The predicted levels at the most affected residences are given in Table 7-6. Predictions were undertaken using the ENM noise model discussed in Section 7.1. Note that there are two residences on the property denoted Receiver 99.

The greatest potential for sleep disturbance will be due to a train passing at the closest point to each residence. The assumed sound power level of the locomotive is 116 dBA.

Table 7-6 Calculated External L_{Amax} Noise Level at Residences

Receiver No	Zone	Receiver Name	Goal (dBA)	Calculated External L_{Amax} (dBA)
94	A	Skinner	48	47
102	G	Robertson*	49	**61**
101	G	Horder	49	**53**
100	G	Sharman	49	49
99	G	Hunter	49	47
99 (2nd residence)	G	Hunter	49	46

** Subject to acquisition under the MAU.*

Calculated L_{Amax} levels from rail pass-by noise are within the criterion at all residences with the exception of East Antiene Locations 101 and 102. It should be noted that Robertson (102) is subject to acquisition upon request under the MAU Project Approval.

Further guidance on the potential for "awakenings" is given in Appendix B of the DECC's ECRTN in which it is concluded that:

- *"maximum internal [to the bedroom] noise levels below 50-55dBA are unlikely to cause awakening reactions", and*
- *"One or two noise events per night, with maximum internal noise level of 65-70dBA are not likely to affect health and wellbeing significantly".*

Although this document was written with respect to road traffic noise, the findings are based on a review of international sleep disturbance research and it is considered appropriate to apply the same findings to the potential for sleep disturbance from train pass-bys, given that the character of emergent noise over ambient background levels from trains will be similar to that of passing heavy vehicles. With that in mind, the predicted internal maximum noise level at the above residences, allowing bedroom windows to be open for ventilation, can be compared to the ECRTN "awaking reactions" goals and are shown in Table 7-7 below.

Table 7-7 Comparison with ECRTN Awakening Reactions Goals (Internal)

Location	Zone	Receiver name	Goal (dBA)	Calculated Internal L_{Amax} (dBA)
94	A	Skinner	50-55	37
102	G	Robertson	50-55	51
101	G	Horder	50-55	43
100	G	Sharman	50-55	39
99	G	Hunter	50-55	37
99 (2nd residence)	G	Hunter	50-55	36

All calculated internal maximum noise levels are within the range of levels that are unlikely to cause awakening reactions during the night-time period. Impacts on sleep disturbance during the day-time period will be less than those predicted for the worst-case night-time period as there will be no elevation of noise levels due to temperature inversions, and therefore rail pass-bys will be unlikely to cause awakening reactions should any shift workers reside in the Antiene area.

8 NOISE MITIGATION STRATEGIES

During development of this report many operational scenarios were modelled in order to evaluate noise mitigation strategies. In consultation with Hansen Bailey and Mt Arthur Coal, operations were modified to achieve reductions in noise emissions from the mine. The changes included:

- Placement of quiet vehicles on critical haul routes;
- Changed alignment of haul routes;
- Reduction of Haul truck numbers on critical routes; and
- Adjustments to intensity of mining in different mining areas;
- Variation of height of strategic dumps to allow greater noise shielding; and
- Use of white noise reversing alarms.

Further noise mitigation strategies could include:

- Further refinement of haul routes – for example, the western waste route. This may be able to be reduced by the introduction of a third waste route, diverting some trucks from that most sensitive route.

9 TRAFFIC NOISE ASSESSMENT

The Project has potential to generate additional traffic on public roads as a result of increased staff arrivals and departures, and also from heavy vehicle deliveries of supplies. Potential noise impacts at residences from two scenarios have been addressed in this assessment:

- Impacts during the infrastructure construction and upgrade period; and
- Impacts during the peak operational period of the Project.

Existing and proposed Project traffic volumes have been sourced from counts and projections provided in a traffic & transport study undertaken for the Project by Hansen Bailey. That report states that the Project will have a maximum impact on road traffic volumes in years 2011 and 2014.

9.1 Local Road Network

The principal road network that is adjacent to and/or provides access to the Mt Arthur Coal Complex includes:

- New England Highway;
- Denman Road;
- Thomas Mitchell Drive;
- Edderton Road; and
- Mt Arthur Coal Access Road and Contractor Facility Access Road.

Access to the site will be primarily via the existing Mt Arthur Coal Access Road from Thomas Mitchell Drive, both during construction and operational periods.

However, in terms of noise impacts there are no private residences with exposure to traffic on Edderton Road, Mt Arthur Coal Access Road or Contractor Facility Access Road and as such impacts have not been included in this assessment. This also applies to roads in the Muswellbrook Industrial Estate, off Thomas Mitchell Drive, north of the Mt Arthur Coal Access Road. These parts of the local road network have thus been excluded from any further analysis.

There are also relatively small numbers of proposed traffic movements generated by the Project in comparison to counts taken on the New England Highway. As a result there will be negligible effect on noise levels at those residences exposed to traffic noise from the New England Highway and no further assessment is warranted.

9.2 Road Traffic Noise Criteria

Criteria for the assessment of noise from traffic on public roads are set out in the DECC's ECRTN.

In terms of the ECRTN road classifications, Denman Road east of Thomas Mitchell Drive and Thomas Mitchell Drive itself are considered "collector" roads taking traffic from West Muswellbrook to the New England Highway. Denman Road west of Thomas Mitchell Drive is classified as a "local" road. The New England Highway is considered a "freeway or arterial road".

Table 9-1 ECRTN Criteria for Residences

Type of Development	Noise Level Criterion		Where Criteria are already Exceeded
	Day-time	Night-time	
Land use developments with potential to create additional traffic on collector roads	$L_{Aeq,1hr}$ 60 dBA	$L_{Aeq,1hr}$ 55 dBA	In all cases, the redevelopment should be designed so as not to increase existing noise levels by more than 2 dB. Where feasible & 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 local roads	$L_{Aeq,1hr}$ 55 dBA	$L_{Aeq,1hr}$ 50 dBA	
Land use developments with potential to create additional traffic on existing freeways/arterials	$L_{Aeq,15hr}$ 60 dBA	$L_{Aeq,9hr}$ 55 dBA	

Note: 1) Day-time is 7.00am – 10.00pm; Night-time is 10.00pm – 7.00am.

9.3 Existing and Future Background Traffic Flow

The existing traffic volumes collected in 2008 as provided in the traffic report are shown in Table 9-2. The tables show the 24 hour flow for both directions combined for each road under consideration. As the Project will have maximum impact on road traffic volumes in 2011 and 2014, the traffic report predicted background volumes for those years. The background volumes include traffic increase from annual growth factors, and extra traffic due to Mt Arthur Coal approved projects (such as the South Pit Extension and MAU) and other projects and operations including Drayton Mine, Bengalla Mine and Mangoola Coal. The background volumes for 2011 are given in Table 9-2, and for 2014 in Table 9-4.

Table 9-2 Current Traffic Volumes (2008)

Location	Existing Traffic	
	ALL	% Heavy Vehicles (HV)
Thomas Mitchell Drive, west of Access Road	4369	14
Thomas Mitchell Drive, east of Access Road	2545	21
Denman Road, north of Thomas Mitchell Drive	6756	11
Denman Road, south of Thomas Mitchell Drive	3944	17

Table 9-3 Predicted 24 hour 2011 Background Traffic Volumes

Location	Traffic Volumes	
	ALL	% HV
Thomas Mitchell Drive, west of Access Road	5590	13
Thomas Mitchell Drive, east of Access Road	3424	19
Denman Road, north of Thomas Mitchell Drive	8421	10
Denman Road, south of Thomas Mitchell Drive	4716	16

Table 9-4 Predicted 24 hour 2014 Background Traffic Volumes

Location	Traffic Volumes	
	ALL	% HV
Thomas Mitchell Drive, west of Access Road	5874	13
Thomas Mitchell Drive, east of Access Road	3590	19
Denman Road, north of Thomas Mitchell Drive	8860	10
Denman Road, south of Thomas Mitchell Drive	4984	16

9.4 Predicted Traffic Noise Impacts during Infrastructure Construction Phase

Construction is expected to occur mostly within the two years from 2010 to 2012. Construction is expected to employ up to 240 personnel. The construction period is predicted to generate a worst-case weekday traffic volume of 142 light and 10 heavy vehicles per day (each way).

Traffic volume count was undertaken by Hansen Bailey on Thomas Mitchell Drive, Denman Road, Mt Arthur Coal Access Road and Edderton Road from 31 October 2008 to 6 November 2008. Using the intersection counts in the appendices to the traffic report, traffic volumes during AM and PM peak hours were determined. As noise depends on the number of vehicles per hour, and the percentage of heavy vehicles, both are included in the following tables.

Table 9-5 and Table 9-6 show the existing traffic flows and additional construction traffic generated by the Project during the peak periods when construction workers would be using the local road network. Noise levels changes are calculated using CoRTN (Calculation of Road Traffic Noise UK DoE Traffic Noise Prediction Method 1988) prediction algorithms. The tables show that the construction traffic will increase traffic noise by a maximum of 0.6 dBA on Thomas Mitchell Drive east of the Mt Arthur Coal Access Road.

Table 9-5 Peak Construction Traffic AM peak

Location	Existing Traffic		Additional Traffic		Increase,
	ALL	% HV	ALL	% HV	L_{Aeq} dBA
Thomas Mitchell Drive, west of Access Road	626	7.3	654	7.6	0.5
Thomas Mitchell Drive, east of Access Road	699	10	720	10	0.1
Denman Road, north of Thomas Mitchell Drive	822	8.5	840	8.4	0
Denman Road, south of Thomas Mitchell Drive	399	8	402	8.1	0.1

Table 9-6 Peak Construction Traffic PM peak

Location	Existing Traffic		Additional Traffic		Increase,
	ALL	% HV	ALL	% HV	L_{Aeq} dBA
Thomas Mitchell Drive, west of Access Road	702	7.2	763	7.4	0.6
Thomas Mitchell Drive, east of Access Road	577	13.5	596	13.3	0
Denman Road, north of Thomas Mitchell Drive	835	23.6	817	24	0.1
Denman Road, south of Thomas Mitchell Drive	460	37.9	460	37.9	0

The increase in noise levels on all roads under assessment during the peak period of the construction phase is predicted to be within the ECRTN allowance of 2 dBA at all times.

9.5 Predicted Traffic Noise Impacts during Operational Phase

The Project is predicted to reach maximum operational capacity in 2014. The traffic noise level at any residence depends on the traffic volumes and the location of the residence with respect to the road. The ECRTN frames potential noise impact in terms of base noise goals, and minimisation of increase in noise where those goals cannot be reasonably and feasibly attained.

The Mt Arthur Coal Complex operates 24 hours per day, seven days per week. Management and administration make up approximately 25% of the workforce, typically working weekdays starting between 6.30 am and 8.00 am, and finishing between 3.30 pm and 6.00 pm. The remainder of the workforce is divided into two shifts commencing at 6.30 am and 6.30 pm. The MAU Project will introduce a third shift however, that workforce will operate independently of this Project.

Using flows in tables above, the maximum changes in noise levels on the subject roads during the proposed peak operational periods are calculated and presented in Table 9-7. Noise levels were calculated using CoRTN prediction algorithms for the hours during which the majority of workers will arrive and leave.

Table 9-7 2014 Operational Traffic AM peak

Location	Existing Traffic		Additional Traffic		Increase,
	ALL	% HV	ALL	% HV	L_{Aeq} dBA
Thomas Mitchell Drive, west of Access Road	613	14	667	13.2	0
Thomas Mitchell Drive, east of Access Road	705	10.2	767	9.9	0.1
Denman Road, north of Thomas Mitchell Drive	926	8.6	982	8.3	0
Denman Road, south of Thomas Mitchell Drive	509	8.6	515	8.9	0.3

Table 9-8 2014 Operational Traffic PM peak

Location	Existing Traffic		Additional Traffic		Increase,
	ALL	% HV	ALL	% HV	L_{Aeq} dBA
Thomas Mitchell Drive, west of Access Road	613	14	668	13.2	0
Thomas Mitchell Drive, east of Access Road	577	13.5	596	13.3	0
Denman Road, north of Thomas Mitchell Drive	817	24	875	25.5	0.8
Denman Road, south of Thomas Mitchell Drive	458	38.1	460	37.9	0

The increase in noise levels on all local roads is less than 1 dBA due to the Project. This is within the 2 dBA increase allowed by the ECRTN.

9.6 Cumulative Traffic Noise Impacts

As discussed in the traffic report there are several approved projects which have increased traffic volumes on the road network, including other approved Mt Arthur Coal projects. The background traffic volumes presented in Table 9-3 and Table 9-4 as used in the noise assessment include the predicted traffic for these projects.

The predicted cumulative increase in traffic noise levels is shown in Table 9-9. The increase is relative to the 2008 background traffic volume.

Table 9-9 Cumulative Traffic Noise Increase

Location	Cumulative Increase to 2011		Cumulative Increase to 2014	
	Without Project (dBA)	With Project (dBA)	Without Project (dBA)	With Project (dBA)
Thomas Mitchell Drive, west of Access Road	1	1.5	1.3	1.8
Thomas Mitchell Drive, east of Access Road	0.9	1	1.1	1.2
Denman Road, north of Thomas Mitchell Drive	0.8	0.8	1	0.9
Denman Road, south of Thomas Mitchell Drive	0.7	0.8	0.9	0.9

Table 9-9 shows the predicted increase in noise is less than 2 dBA at all residences, based on an increase from 2008 traffic counts.

The noise level at any residence will depend on its distance from the road. Table 9-10 shows the distance from the road at which the ECRTN criteria will be exceeded for residences with a typical angle of view to the road and where the road is not in a cutting. It is noted that the speed limit on Denman Road changes from 100 kph to 80 kph approximately 200 m east of Thomas Mitchell Drive and therefore two distances are shown.

Table 9-10 Distances at which ECRTN criteria would likely be exceeded – AM peak 2019

Location	ECRTN Criterion (dBA)	Distance (m)
Thomas Mitchell Drive, south of Denman Road (1)	60	90
Denman Rd, east of Thomas Mitchell Drive (2) (80 kph Speed Limit)	60	100
Denman Rd, east of Thomas Mitchell Drive (2) (100 kph Speed Limit)	60	150

Note: 1) Chipseal surface assumed
2) Dense Graded Asphaltic Concrete surface assumed

On Thomas Mitchell Drive the ECRTN criterion is predicted to be exceeded within 60 m of the road. Residence 49 (Webber) is the nearest and is nearly 200 m from Thomas Mitchell Drive, hence no traffic noise impact is predicted from this section of road.

There are no residences within 150 m of Denman Road in the section east of Thomas Mitchell Drive where the speed is 100 kph. In the section where the speed is 80 kph, and south of Skelletar Stock Route, there are seven residences within 100 m (Residence 11, 12, 13, 39, 40, 41, 42).

The nearest is Residence 41 (Ray) at approximately 35 m from the road. The noise level at this residence is predicted to be L_{Aeq} 65 dBA during the AM peak. At the other six receivers the predicted noise is 62 to 64 dBA. The increase in traffic noise due to the Project is therefore within the 2 dBA increase allowed by the ECRTN.

9.7 Summary of Traffic Noise Impacts

Traffic generation by the Project is predicted to increase traffic noise at residences near the road network by up to 0.6 dBA during the major construction phase of the Project, and 0.8 dBA during the operational phase of the Project.

Combined with other approved projects, the traffic noise is predicted to increase by 1-2 dBA up until 2019.

The lowest traffic noise increase is predicted at residences near Thomas Mitchell Drive east of the Mt Arthur Coal Access Road (Antiene residences). Traffic noise increases by the Project alone will be insignificant at these residences.

The highest traffic noise generation by the Project is on Denman Road east of Thomas Mitchell Drive. There are seven residences in the section of Denman Road between Thomas Mitchell Drive and Skelletar Stock Route where the base criteria of the ECRTN are predicted to be exceeded by both existing and future traffic. In this section of road, the increase in traffic noise due to this Project is within the 2 dBA increase allowed by the ECRTN.

10 CONSTRUCTION NOISE

10.1 Description of Construction Activities

The Project will include an upgrade of the existing Mt Arthur Coal CHPP to process up to 36 Mtpa of ROM coal from the open cut and underground mining operations and allow the inclusion of an ultra-fine coal circuit to re-process fines, facilitate increased resource recovery and reduced water demands and waste production. This will involve the installation of additional coal processing modules and extensions of the ROM and product coal stockpiles to handle the additional coal throughput. Additional ROM coal hoppers will also be constructed to feed coal to the CHPP. An additional conveyor system will be constructed to facilitate the development of a second rail loading facility.

The Project will also require the modification of the existing approved surface facilities at the Mt Arthur Coal Complex in addition to the establishment of some new surface facilities, such as extensions of existing car parking facilities, bathhouse, workshop and warehousing areas, administration buildings and heavy vehicle wash-down bays, drive-through service and repair bays.

The Project includes the relocation of the northern section of Edderton Road (see Figure 4-1). The construction works are anticipated to be completed during 2019, and last for approximately 32 weeks. Nominal equipment to be used during the construction works will include:

- Scrapers;
- Graders;
- Excavators;
- Backhoes;
- Crane;
- Smooth drum rollers;
- Pad foot rollers;
- Flat bed trucks;
- Fuel Truck;
- Water carts; and
- Dozers.

10.2 Construction Noise Criteria for Residences

Construction noise is assessed as part of operational noise.

10.3 Construction Plant Source Noise Levels

Sound power levels of typical construction plant are shown in Table 10-1.

Table 10-1 Typical Construction Plant Sound Power Levels

Plant	L_{Aeq} Sound Power Level (dBA)	L_{Aeq} Sound Power Level at 7m (dBA)
Front End Loader	111	86
Grader	107	82
Smooth Drum Roller	107	82
Spoil, Materials or Concrete Truck	109	84
Tower Crane or Mobile Crane	105	80

Plant	L_{Aeq} Sound Power Level (dBA)	L_{Aeq} Sound Power Level at 7m (dBA)
Excavator or Bobcat	107	82
Powered Hand Tools	109	84
30t Excavator operating with hydraulic hammer	122	97
Water Cart	110	85
Chainsaw	106	81
Forklift	106	81
Mulcher	106	81
Articulated Dump Truck	113	88
Handheld Jackhammer	113	88
Air Compressor (Power Tools)	98	73
Asphalt Paving Plant	114	89

Construction site source noise levels vary as different plant is used. In the case of road building the site also moves, so noise impact at any residence depends on the location of the building site. Table 10-2 shows estimated total sound power level of construction sites.

Table 10-2 Calculation of Total Sound Power Level

Activity	Typical Equipment Used	Total L_{Aeq} Sound Power Level used for calculations (dBA)
Site establishment	Excavators, Chainsaws, Mulching plant and Chipper, Cranes, Generators	110
Earthworks	Road Trucks, Compactor, Grader, Steel, multi tyred and Vibratory Rollers, Concrete pour, including Trucks and Concrete Vibrator, Asphalt paving plant, Backhoe, Sweeper, Compressors, Generators, (Excavator with hammer)	113
Structural Work	Trucks, cranes, hand tools	113
Paving	Compactor, Steel, multi tyred and vibratory Rollers, Asphalt paving plant, Sweeper, Compressors, Generators	112
Landscaping of exposed areas	Excavator/Bobcat, Powered Hand Tools, Air Compressor, Spoil, Material or Concrete truck, Jackhammer (for concrete embedded parts)	109

10.4 Impact of Construction at Edderton Road

The construction at Edderton Road will take place in daytime hours: that is 7.00am to 5.00pm Monday to Friday, and 7.00am to 1.00pm Saturdays.

The nearest residence to Edderton Road is Rankin (209), approximately 100 m to the north-west of the proposed realignment options, along Denman Road. The daytime noise criterion at Rankin (209) is L_{Aeq} 37dBA.

At Rankin (209) the predicted daytime noise level of mining activities for the 2016 scenario is 28dBA. This is 8dBA less than the predicted night time noise as the daytime noise is predicted without the influence of temperature inversions.

Table 10-2 illustrates that the noisiest activity at this construction site is predicted to be earthworks, with a site Sound Power Level of 113 dBA.

The predicted noise level at Rankin (209) is 38 dBA from earthworks. As the predicted mining noise is 10dBA less than this, the total noise emission from the mine and construction work is predicted to be 38dBA. This is 1dBA above the daytime criterion.

A 1dBA exceedance for temporary construction work is considered to have negligible noise impact. Construction noise from road works is a moving noise source, and the predicted exceedance would only occur when the site is at the northern end of Edderton Road.

No exceedance of the criterion is predicted at other residences.

10.5 Impact of Construction of Infrastructure

From Table 10-2 the noisiest activity at this construction site is predicted to be earthworks and structural work, both with a site Sound Power Level of 113 dBA. The earthworks will occur at the area where the car park is to be extended. Structural works will occur at various times at different locations on the site.

The nearest residences to the infrastructure site are Doherty (91) and Skinner (94). Both of these residences are approximately 5 km from the site of construction. Prediction of construction noise from this area has been undertaken using information from the operational noise model. The predicted construction noise level at these residences is 20-25 dBA. Variation will occur depending on the location of construction, and whether the equipment is shielded by buildings.

During the analysis of operational noise at this residence, it was determined that the noise contribution from the Mt Arthur Coal infrastructure is 35-40 dBA at these residences. As the additional construction noise is predicted to be at least 10 dBA below this, the construction noise will not increase the overall noise significantly at these residences. Hence no noise impact is predicted from construction of infrastructure.

11 BLASTING

11.1 Background to the Study

Extensive experience in blasting at the Mt Arthur Coal Complex has been gained at Bayswater No. 2 & 3 (since 1960 and 1995, respectively) and at MAN (since 2001). Measurement of overpressure and vibration from blasting has been used in the prediction of blasts from the Project.

Initial studies indicated that typical blasts, conducted in accordance with existing practices, could cause exceedances of the vibration criterion at a number of properties. In addition, vibration impacts in particular are dependent on local geology, so that results from blasting in other mine areas only provide a guide to expected levels in the proposed new mining areas.

In this study, analysis has been undertaken for the "worst case" situation of existing blast procedures being continued in the proposed new areas.

Mt Arthur Coal is committed to achieving relevant blast criteria at all potentially-affected locations, utilising all available technology. Where models demonstrate that blasting will result in an exceedance, coal will not be won from the relevant mining areas. This study indicates the maximum extent of such sterilised areas, based on worst-case assumptions regarding mining procedures. It should be noted that additional mitigation will be used in order to win coal in areas where current practices are predicted to result in exceedances (as required) to ensure no coal is sterilised where it is economically feasible to mine and achieve compliance.

11.2 Blasting Noise and Vibration Criteria

11.2.1 Annoyance

Annoyance criteria are derived from the *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* prepared by the Australian and New Zealand Environment and Conservation Council (ANZECC). The fundamental criteria are that at any privately owned residence or other sensitive location:

- The 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
- The maximum peak particle ground velocity should not exceed 5 mm/sec for more than 5% of blasts in any year, and should not exceed 10 mm/sec for any blast.

11.2.2 Structural Damage

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

Australian Standard AS2187.2-2006 *Explosives - Storage and Use. Part 2 Use of explosives (Appendix J)* indicates *"From Australian and overseas research, damage (even of a cosmetic nature) has not been found to occur at airblast levels below 133dBL"*. A detailed analysis of vibration effects on two heritage properties (Edinglassie and Rous Lench) owned by Mt Arthur Coal (Bill Jordan & Associates: "Edinglassie Homestead & Rous Lench – Blast Vibration Vulnerability") recommends a slightly lower criterion of 133 dBL.

The structural damage criterion is relevant only for Mt Arthur Coal heritage properties (Edinglassie and Rous Lench homesteads) and unoccupied buildings owned by Mt Arthur Coal to ensure their integrity.

For assessment of damage due to ground vibration, *AS2187.2 2006 (Appendix J)* recommends frequency-dependent criteria for vibration damage, derived from British Standard 7385-2 and U.S. Bureau of Mines Standard RI 8507. These are in practice less stringent than the human comfort criterion of 5 mm/sec noted above, and hence need to be considered only in the case of buildings owned by Mt Arthur Coal, notably Edinglassie and Rous Lench and surrounding buildings. The report by Bill Jordan & Associates referenced above concludes that for these buildings, a vibration limit of 10 mm/sec peak component particle velocity is appropriate. The assessment concluded that blasting activities at this level could be undertaken safely, and further, that this criterion is considered conservative and these heritage structures should not suffer damage even at higher levels.

11.3 Prediction of Noise 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 maximum instantaneous charge of explosive, in kilograms (kg) Ammonium Nitrate Fuel Oil (ANFO) equivalent.

Predictive curves relating scaled distance to overpressure and ground vibration levels have been derived from measurements conducted at numerous sites. However, it is recognised that the exact relationship varies from site to site, and hence it is generally preferable to use data gathered close to the proposed blasting site in making predictions.

Wilkinson Murray has used data from over 7,600 records of blasts undertaken at the Mt Arthur Coal Complex 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. Data from the entire site has been used, rather than deriving separate predictive equations for different areas, because:

- Accurate prediction of 95th percentile levels requires a large data set, and predictions for individual areas would be subject to significant statistical error;
- Variability in predicted levels between different areas within the Mt Arthur Coal Complex is small relative to between-blasts variability; and
- The areas where the predictions are to be used are not necessarily comparable to any of the existing areas in terms of propagation of blast overpressure or vibration.

The raw data, and the derived prediction curves, are shown in Appendix E.

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.

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

Log(Peak Particle Velocity) = 3.015 - 1.4359 log(SD)

where SD is the vibration-scaled distance.

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

11.4 Blast Designs

Blast designs in the proposed mining area will depend on numerous factors including the depth of coal seams and design of benches. Three typical blast designs have been provided, with differing values of Maximum Instantaneous Charge (MIC) as follows:

- Deep Interburden / Overburden: MIC 1681 kg;
- Intermediate Interburden: MIC 812 kg; and
- Shallow Interburden: MIC 182 kg.

It is assumed that any of these three general blast types may be required at any location, and hence potential impacts should be assessed using the Deep Interburden / Overburden blast, representing the maximum impact. However, both Deep and Intermediate Interburden blasts are considered in order to indicate the range of impacts that may occur.

11.5 Predicted Residential Overpressure and Vibration Levels

Initial calculations indicated that if blasting were to proceed with MIC up to 1681 kg, as indicated above, over the entire proposed mining area, relevant criteria will be exceeded at a number of sensitive locations. The predictive equations above were used to define the areas within which blasting should be restricted in order to ensure that relevant criteria are met. These areas were defined on the basis of both 1681 kg and 812 kg blasts. In practice, overpressure criteria is the more critical at all locations except Edinglassie and Rous Lench. At these two locations, only criteria for structural damage are relevant, and the vibration-related criterion of 10 mm/sec peak component particle velocity is more stringent than the criterion of 133 dBL related to overpressure.

Areas where blasting will need to be managed in a different manner to current blasting methods onsite, to avoid potential exceedance of either the overpressure or the vibration criterion for at least one sensitive receiver, shown in Figure 11-1 for a 1681 kg blast and Figure 11-2 for a 812 kg blast.

Figure 11-1 Area within which Blasting should be Restricted to Achieve Relevant Overpressure and Vibration Criteria – 1681 kg Blast

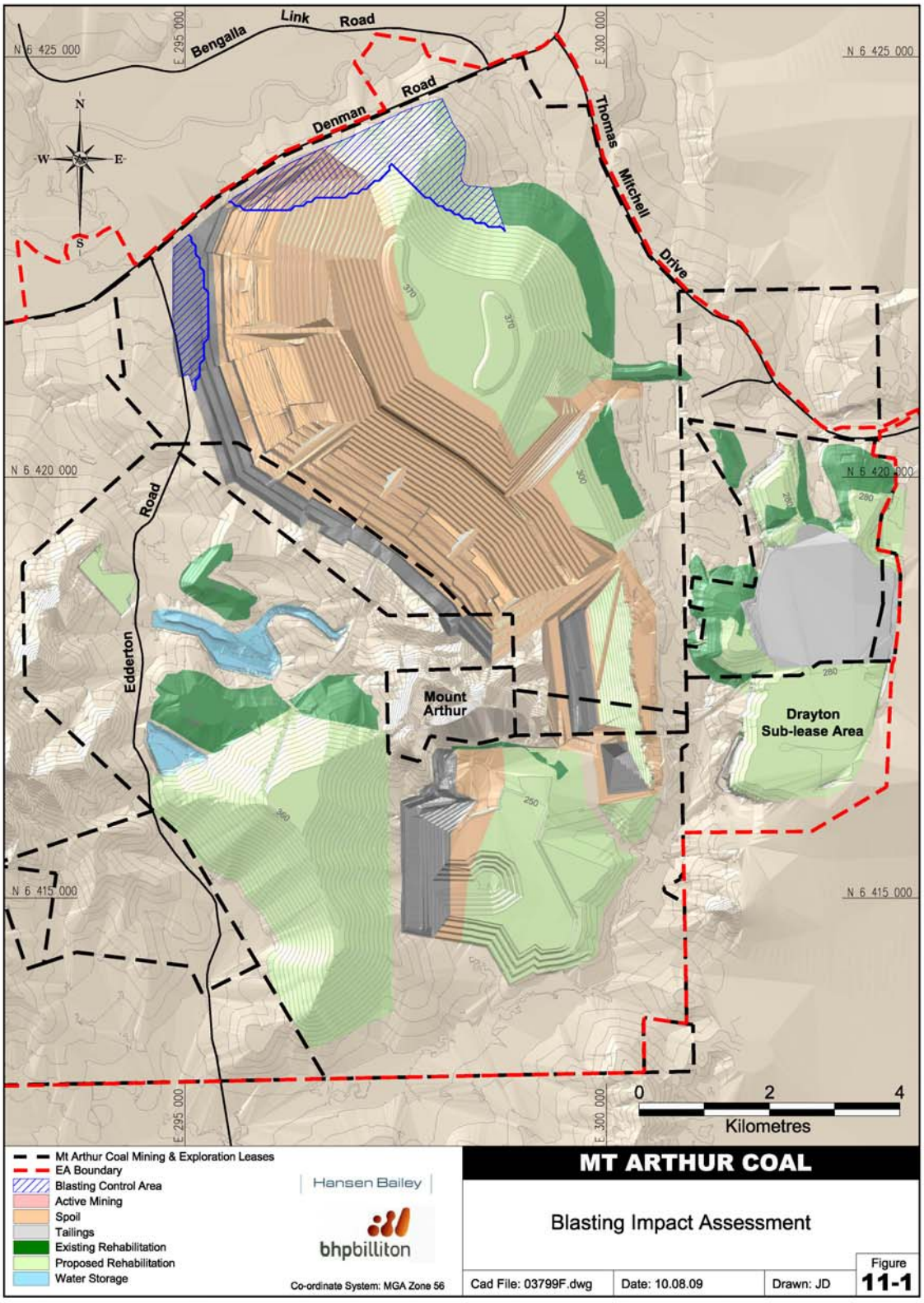
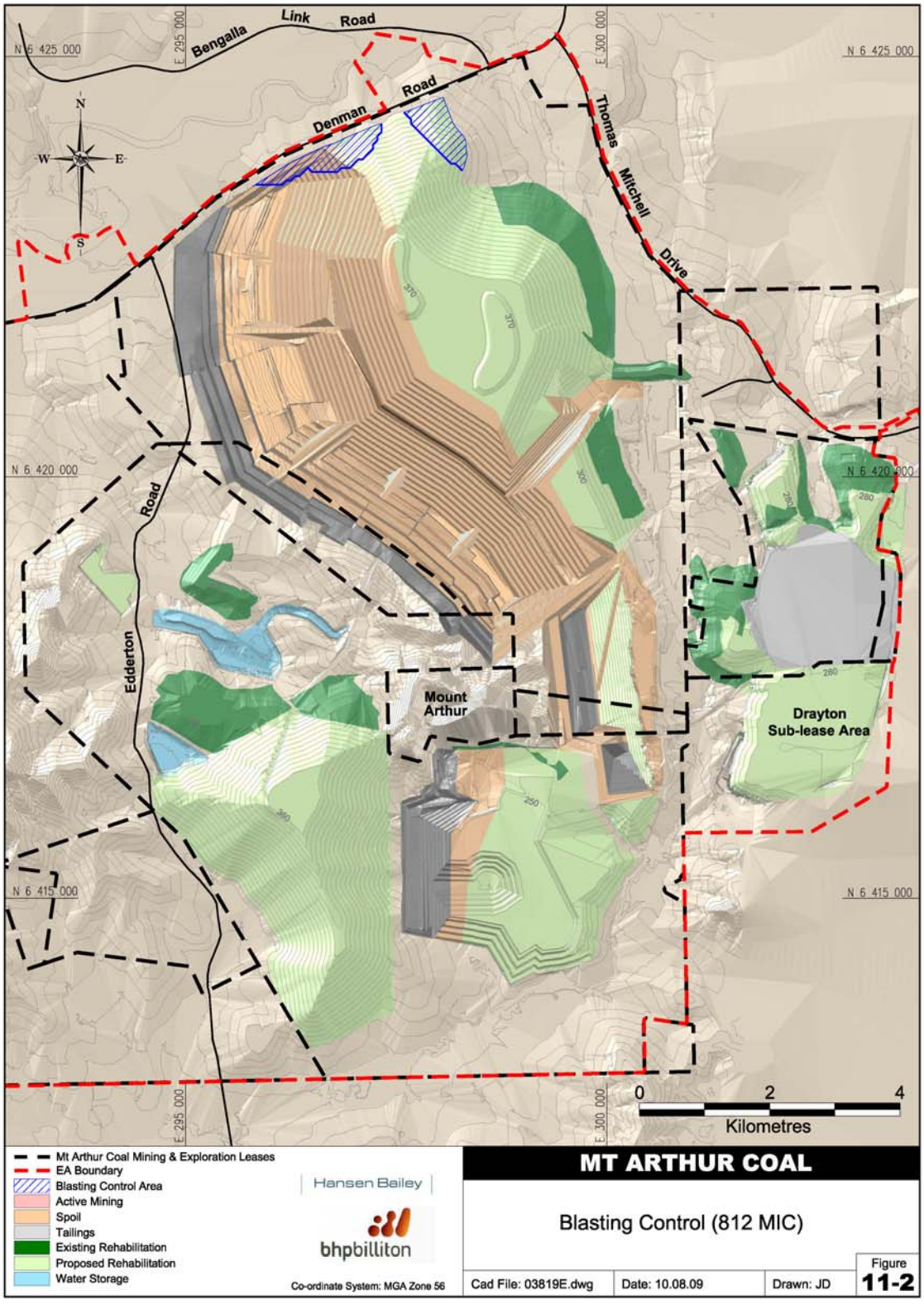


Figure 11-2 Area within which Blasting should be Restricted to Achieve Relevant Overpressure and Vibration Criteria – 812 kg Blast



11.6 Blast Noise and Vibration Mitigation

It should be noted that the areas shown in Figure 11-1 and Figure 11-2 assume a continuation of current blasting practices at the Mt Arthur Coal Complex. A number of options are available for reducing blast impacts, including reducing bench heights and the use of electronic detonators to provide accurate timing of charges. In addition, vibration impacts in particular are very dependent on local geology, so that results from blasting in other mine areas provide only a guide to expected levels in the proposed new mining areas.

Blasting options will be investigated as a part of mine operations and as new technology is proven, with a view to developing methods and practices to achieve relevant criteria at all surrounding residences and other buildings. These areas will be managed in a way that ensures all relevant criteria are satisfied during blasting.

Australian Standard AS2187.2-2006 makes reference to various limits including some for unoccupied buildings or structures made from reinforced concrete or steel. Establishing appropriate limits for each building potentially impacted could reduce the restrictions on blast design.

Sonic Detection and Ranting (SODAR) is currently applied at the Mt Arthur Coal Complex and will continue to be applied to determine appropriate meteorological conditions for blasting.

12 RAIL NOISE ASSESSMENT (MAIN LINE)

The Project will not generate additional rail movements on any one day on the Muswellbrook-Newcastle main line (part of the Main Northern Railway) to that already assessed and approved under existing planning approvals. This assessment of rail noise impacts due to train movements on the main line does not include rail movements on the Antiene rail spur which are addressed under operational noise impacts in Section 7.7.2 of this report.

12.1 Rail Noise Criteria

The DECC has published an *Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects.* Table 12-1 shows the trigger noise levels at which an assessment of rail noise impacts would be undertaken.

Table 12-1 Airborne Rail Traffic Noise Trigger Levels For Residential Land Uses

Type of development	Noise trigger levels dBA		Comment
	Daytime (7.00 am-6.00 pm)	Night-time (10.00 pm-7.00 am)	
New rail line development	Development increases existing rail noise levels *and* resulting rail noise levels exceed:		These numbers represent external levels of noise that trigger the need for an assessment of the potential noise impacts from a rail infrastructure Project.
	60 $L_{Aeq,15hr}$	55 $L_{Aeq,9hr}$	
	80 L_{Amax}	80 L_{Amax}	
Redevelopment of existing rail line	Development increases existing rail noise levels *and* resulting rail noise levels exceed:		An 'increase' in existing rail noise levels is taken to be an increase of 2 dBA or more in L_{Aeq} in any hour or an increase of 3 dBA or more in L_{Amax}.
	65 $L_{Aeq,15hr}$	60 $L_{Aeq,9hr}$	
	85 L_{Amax}	85 L_{Amax}	

Note: 1) Specified noise trigger levels refer to noise from rail transportation only and do not include ambient noise from other sources. However, they refer to noise from all rail traffic at the receiver location, not only noise due to the specific rail project under consideration.
2) The noise level values represent external levels except where otherwise stated.
3) 'Residential' typically means any residential premises located in a zone as defined in a planning instrument that permits new residential land use as a primary use. Where there is doubt as to the status of the residential land use, the relevant planning authority should be consulted.

An assessment of rail noise impacts is not required unless:

- The levels of rail noise in the table above are exceeded; and
- An increase in rail noise is predicted.

An increase in existing rail noise levels is defined as an increase of 2 dBA or more in L_{Aeq} or an increase of 3 dBA or more in L_{Amax}.

12.2 Existing Rail Movements

The total daily rail movements currently approved for the Mt Arthur Coal Complex are:

> *A maximum of 24 train movements per day on the Antiene rail spur from the Mt Arthur Coal Complex, except under an agreement with Drayton Mine to use some of its approved train movements, where this agreement has been approved by the Director-General of the NSW Department of Planning (Schedule 2, Condition 7 (b), DA06-0091).*

This Project requires a maximum of 24 rail movements per day. As no increase in rail movements is required from that already assessed and approved, noise from rail movements will not be increased.

Hence there will be no further noise impact from rail movements than that already assessed and approved and no further assessment is required.

13 CONCLUSION

13.1 Assessment Procedure

Noise and vibration from all aspects of the Project has been assessed. The assessment was conducted in accordance with relevant standards and guidelines, including the INP, ECRTN, *Interim Guidelines for the Assessment of Noise from Rail Infrastructure Projects* and ANZECC *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration*.

Background noise levels have in some cases been revised compared with previous studies, based on recent measurements using directional monitoring systems.

13.2 Operational Noise

Concerning houses affected by the Project but not affected by rail infrastructure (receivers in Zones A to F):

- Noise at all receivers is predicted to comply with the amenity criteria of the INP; and
- Noise at some receivers is predicted to exceed the intrusive criterion of the INP as shown Table 13-1.

Concerning houses near Antiene and affected by rail infrastructure (Zone G):

- Predicted noise at these locations is broadly the same as addressed in the MAU noise assessment. A minor increase (<1 dBA) is predicted at some residences due to increased noise contribution from the CHPP;
- Noise from operations other than rail transport of coal will comply with all relevant noise criteria;
- Noise from rail operations will exceed the intrusive criterion at some receivers as shown in Table 13-1; and
- Noise from rail operations will exceed the amenity criteria at one receiver – Robertson (102) (which is already subject to acquisition rights by Mt Arthur Coal).

Table 13-1 Exceedances at Residences & Modelled Predictions, $L_{Aeq,15min}$

Zone	Receiver	Maximum Exceedance of Intrusive Criterion (dBA)	Criterion $L_{Aeq,15min}$ (Night)	2011	2016	2022
A	Halloran (87)	1	38	39	39	39
	Osborn (93)	2	38	39	40	40
	Skinner (94)	4	38	41	42	41
B	Scriven (6)	3	37	40	36	36
	Drake (8)	2	37	39	36	36
	Muswellbrook Council (37)	1	37	37	38	37
	Webber (49)	4	37	41	39	39
C	No exceedances					
	Fosters Wines (184)**	3	35	36	38	38
D	Chudyk (212)*	6	35	39	41	40
	Wild (206)	2	35	37	37	37

Zone	Receiver	Maximum Exceedance of Intrusive Criterion (dBA)	Criterion $L_{Aeq,15min}$ (Night)	2011	2016	2022
	Zahra (207)	2	35	36	37	37
	Zahra (208)	3	35	37	38	38
	Rankin (209)	1	35	36	36	36
	Rankin (210)	5	35	39	40	40
	Rankin (211)	4	35	38	39	39
	Roots (226)	3	35	35	38	37
E	No exceedances					
F	Fosters Wines (184)	3	35	36	38	38
	Duncan (187)	1	35	35	36	36
	Latham (204)	2	35	36	36	37
G	De Boer (95)	1	39	40	40	40
	Bird (96)	1	39	39	40	39
	Clifton (97)	3	39	41	42	41
	Jones (98)	3	39	41	42	41
	Hunter (99)**	3	39	42	42	42
	Sharman (100)	3	39	42	42	42
	Horder (101)	6	39	45	45	45
	Robertson (102)^	9	39	48	48	48

** Subject to acquisition by an adjacent mining operation.*
^ Subject to acquisition by Mt Arthur Coal under the MAU.
*** Two residences.*
**** Three residences.*

13.3 Transport Noise

Noise from road transport is largely due to employees and deliveries to the site. Noise from road transport is predicted to comply with relevant criteria.

Noise from rail transport of coal is predicted to comply with relevant criteria. As there will be no increase in the already approved daily train numbers on the rail network, there will be no increase in noise levels compared with those previously defined and approved.

13.4 Blasting

Under current procedures, blasts of certain sizes would be excluded from particular areas to the north of the proposed mining area, as shown in Figure 11-1 and Figure 11-2. However, a number of improvements to current procedures are possible, and it is believed that these will allow blasting to be conducted over the entire proposed mine plan without exceeding blasting limits.

Trial blasts will be conducted to demonstrate compliance with relevant criteria before full-scale blasting was conducted in these areas.

Note

All materials specified by Wilkinson Murray Pty Limited have been selected solely on the basis of acoustic performance. Any other properties of these materials, such as fire rating, chemical properties etc. should be checked with the suppliers or other specialised bodies for fitness for a given purpose.

Quality Assurance

We are committed to and have implemented AS/NZS ISO 9001:2000 "Quality Management Systems – Requirements". This management system has been externally certified and Licence No. QEC 13457 has been issued.

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	3 March 2009	T Dean & G Jenner	Rob Bullen
B	Draft	24 March 2009	George Jenner	Rob Bullen
C	Draft	28 May 2009	George Jenner	Rob Bullen
D	Draft	8 June 2009	George Jenner	Rob Bullen
E	Final	12 August 2009	George Jenner	Rob Bullen
F	Final	28 August 2009	George Jenner	Rob Bullen
G	Final	11 October 2009	George Jenner	Rob Bullen

APPENDIX A

GLOSSARY OF TERMS

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.

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.

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.

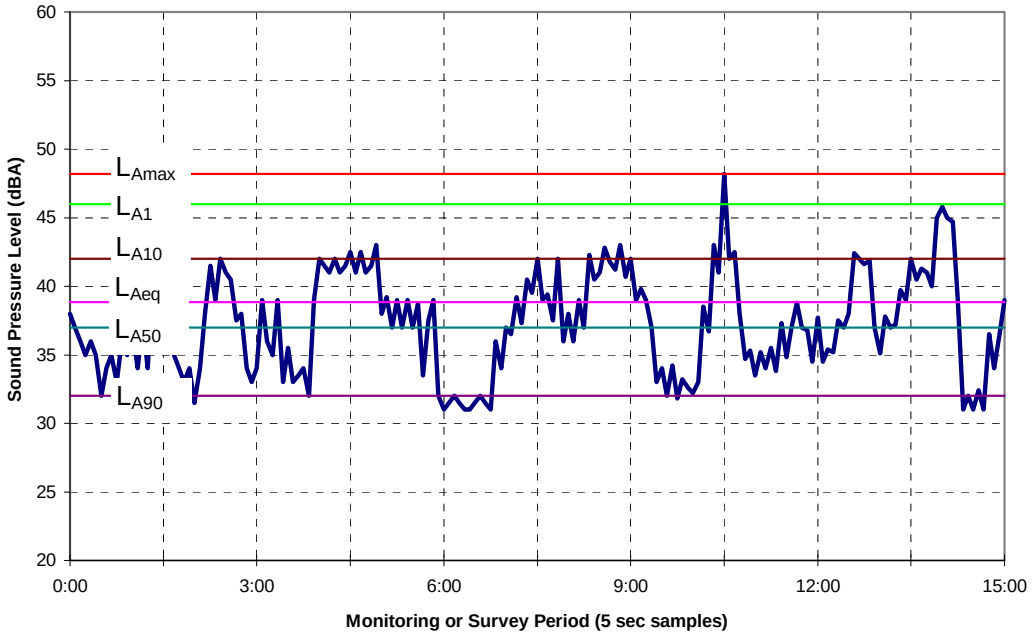
L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise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

L_{A50} – The L_{A50} level is the noise level which is exceeded for 50% of the sample period. During the sample period, the noise level is below the L_{A50} level for 50% of the time.

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.

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.

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.


60
55
50
45
40
35
30
25
20
Sound Pressure Level (dBA)
LAmax
LA1
LA10
LAeq
LA50
LA90
0:00
3:00
6:00
9:00
12:00
15:00
Monitoring or Survey Period (5 sec samples)

APPENDIX B

PREDICTED NOISE RESULTS

Project 08172 Appendix C for Version G- 27 October 2009				Predicted Noise Level LAeq,15min dBA			Exceedance		
EA Receiver Number	Description and EA Number	Receiver Zone	Criterion (Night)	2011	2016	2022	2011	2016	2022
6	Scriven_6	B	37	40	36	36	**3**	0	0
8	Drake_8	B	37	39	36	36	**2**	0	0
9	Englebrecht_9	C	39	39	39	39	0	0	0
10	Muswellbrook Race Club Ltd_10	C	39	39	39	39	0	0	0
11	JP Drake_11	B	37	37	36	36	0	0	0
12	DR & CJ Tubb_12	B	37	37	36	36	0	0	0
13	Upper Hunter Developers Pty Ltd & Turner_13	B	37	37	36	36	0	0	0
14	Robinson_14	C	39	37	38	37	0	0	0
15	Dobie_15	C	39	37	38	37	0	0	0
16	Sweeney_16	C	39	37	38	37	0	0	0
17	Gleeson & Cranfield_17	C	39	37	37	37	0	0	0
18	SM Bredden_18	C	39	37	37	37	0	0	0
20	Good_20	C	39	37	37	37	0	0	0
21	Cridland_21	C	39	37	37	37	0	0	0
22	Englebrecht Racing Stables Pty Ltd_22	C	39	37	37	37	0	0	0
23	Englebrecht_23	C	39	37	37	37	0	0	0
24	RJ & TT Reid_24	C	39	37	38	37	0	0	0
25	Andrews_25	C	39	37	38	37	0	0	0
26	Byrnes & Moller_26	C	39	37	38	37	0	0	0
27	TD Barron_27	C	39	37	38	37	0	0	0
28	McGoldrick_28	C	39	38	38	38	0	0	0
29	Berrnett_29	C	39	38	38	38	0	0	0
30	Englebrech_30	C	39	38	38	38	0	0	0
31	Jabetin PT_31	C	39	37	37	37	0	0	0
32	Almond & Hume_32	C	39	37	37	37	0	0	0
33	Barkley_33	C	39	37	37	37	0	0	0
34	Hardes_34	B	37	35	35	35	0	0	0
36	Horne_36	B	37	34	34	34	0	0	0
37	The Council of the Municipality of Muswe_37	B	37	37	38	37	0	**1**	0
37	The Council of the Municipailty of Muswe_37	B	37	36	36	36	0	0	0
39	JR & JA Buckley_39	B	37	37	36	35	0	0	0
40	JR & JA Buckley_40	B	37	37	36	35	0	0	0
41	Ray_41	B	37	37	36	35	0	0	0
42	Hallett & Campbell_42	B	37	37	36	35	0	0	0
43	Hallett & Campbell_43	B	37	37	36	35	0	0	0
49	Webber_49	B	37	39	36	36	**2**	0	0
49	Webber_49	B	37	41	39	39	**4**	**2**	**2**
56	Bancroft_56	E	39	37	38	37	0	0	0
57	Mayer_57	E	39	37	38	37	0	0	0
58	Masters_58	E	39	37	38	37	0	0	0
59	Osborn_59	E	39	37	38	37	0	0	0
60	Osborn_60	E	39	37	38	37	0	0	0
61	Burton_61	E	39	37	38	37	0	0	0
62	Burke & Talbot_62	E	39	37	38	37	0	0	0
69	Wells_69	G	39	31	32	32	0	0	0
70	Folpp_70	G	39	32	33	32	0	0	0
71	Hunt_71	G	39	31	32	31	0	0	0
72	Budden_72	G	39	30	32	31	0	0	0
73	Hogan_73	G	39	30	31	30	0	0	0
75	Harris_75	G	39	30	31	30	0	0	0
76	Merlaust Pty Ltd_76	G	39	30	30	29	0	0	0
77	Perram_77	G	39	30	30	28	0	0	0
77	Perram_77	G	39	30	30	29	0	0	0
78	Yarramolong Stud Pty Ltd_78	G	39	37	38	38	0	0	0
79	Jackson_79	G	39	30	31	30	0	0	0
79	Jackson_79	G	39	30	30	29	0	0	0
82	Newton_82	G	39	36	37	37	0	0	0
83	K Newton_83	G	39	33	33	32	0	0	0
85	Collins_85	G	39	36	37	37	0	0	0
86	Baxter_86	G	39	38	39	39	0	0	0
87	Halloran_87	A	38	39	39	39	**1**	**1**	**1**
88	Reynolds_88	A	38	36	37	36	0	0	0
89	Page_89	A	38	36	36	36	0	0	0

Project 08172 Appendix C for Version G- 27 October 2009				Predicted Noise Level LAeq,15min dBA			Exceedance		
EA Receiver Number	Description and EA Number	Receiver Zone	Criterion (Night)	2011	2016	2022	2011	2016	2022
90	Page_90	A	38	34	34	34	0	0	0
91	Doherty_91	A	38	38	38	38	0	0	0
92	Duck_92	A	38	37	38	37	0	0	0
93	Osborn_93	A	38	39	40	40	**1**	**2**	**2**
94	Skinner_94	A	38	41	42	41	**3**	**4**	**3**
95	De Boer_95	G	39	40	40	40	**1**	**1**	**1**
96	Bird_96	G	39	39	40	39	0	**1**	0
97	Clifton_97	G	39	41	42	41	**2**	**3**	**2**
98	Jones_98	G	39	41	42	41	**2**	**3**	**2**
99	Hunter_99	G	39	41	41	41	**2**	**2**	**2**
99	Hunter_99	G	39	42	42	42	**3**	**3**	**3**
100	Sharman_100	G	39	42	42	42	**3**	**3**	**3**
101	Horder_101	G	39	45	45	45	**6**	**6**	**6**
102	Robertson_102	G	39	48	48	48	**9**	**9**	**9**
182	Paulsen_182	F	35	31	31	31	0	0	0
183	Beringer Blass Wine_183	F	35	33	34	34	0	0	0
184	Fosters Wine_184	F	35	36	38	38	**1**	**3**	**3**
184	Fosters Wine_184	F	35	36	37	38	**1**	**2**	**3**
184	Fosters Wine_184	F	35	35	37	38	0	**2**	**3**
186	Turner_186	F	35	33	33	33	0	0	0
187	Duncan_187	F	35	35	36	36	0	**1**	**1**
190	Phillips_190	F	35	31	32	32	0	0	0
191	Wilks_191	F	35	30	30	31	0	0	0
195	MacPherson_195	F	35	32	32	33	0	0	0
196	Eglington, Fuller & Goodchild_196	F	35	33	33	34	0	0	0
197	Eglington, Fuller & Goodchild_197	F	35	33	33	34	0	0	0
198	Duncan_198	F	35	32	32	32	0	0	0
199	Boyle_199	F	35	34	34	35	0	0	0
200	Walsh_200	D	35	35	35	35	0	0	0
201	Denton_201	F	35	32	32	31	0	0	0
202	Fosters Wine_202	D	35	35	36	36	0	**1**	**1**
203	Latham_203	F	35	34	34	35	0	0	0
204	Latham_204	F	35	36	36	37	**1**	**1**	**2**
205	Lambkin_205	F	35	35	35	35	0	0	0
206	Wild_206	D	35	37	37	37	**2**	**2**	**2**
207	Zahra_207	D	35	36	37	37	**1**	**2**	**2**
208	Zahra_208	D	35	37	38	38	**2**	**3**	**3**
209	Rankin_209	D	35	36	36	36	**1**	**1**	**1**
210	Rankin_210	D	35	39	40	40	**4**	**5**	**5**
211	Rankin_211	D	35	38	39	39	**3**	**4**	**4**
212	Chudyk_212	D	35	39	41	40	**4**	**6**	**5**
213	Lawson_213	F	35	32	33	33	0	0	0
213	Lawson_213	F	35	32	33	33	0	0	0
213	Lawson_213	F	35	30	30	30	0	0	0
216	Meyer_216	F	35	33	33	34	0	0	0
218	Markham_218	F	35	33	35	34	0	0	0
218	Markham_218	F	35	33	35	34	0	0	0
218	Markham_218	F	35	33	34	34	0	0	0
226	T Roots_226	D	35	35	38	37	0	**3**	**2**
231	Brown_231	D	35	33	34	34	0	0	0
232	Brown_232	D	35	33	34	34	0	0	0
233	Merrick_233	D	35	29	29	27	0	0	0
233	Merrick_233	D	35	30	29	28	0	0	0
235	Thompson_235	D	35	27	27	26	0	0	0
236	Thompson_236	D	35	27	27	26	0	0	0
238	M Peel_238	D	35	32	33	33	0	0	0
239	P Ellis_239	D	35	33	35	34	0	0	0
240	Murray_240	D	35	31	31	32	0	0	0
241	P & C Lane_241	D	35	31	32	32	0	0	0
242	Ellis_242	D	35	32	33	33	0	0	0
242	Ellis_242	D	35	29	28	28	0	0	0
242	Ellis_242	D	35	32	33	32	0	0	0
243	McNeill_243	D	35	26	26	25	0	0	0
250	Hamilton_250	D	35	33	35	34	0	0	0
252	B & T Strachan_252	D	35	28	29	29	0	0	0
254	Hughes_254	D	35	27	27	26	0	0	0

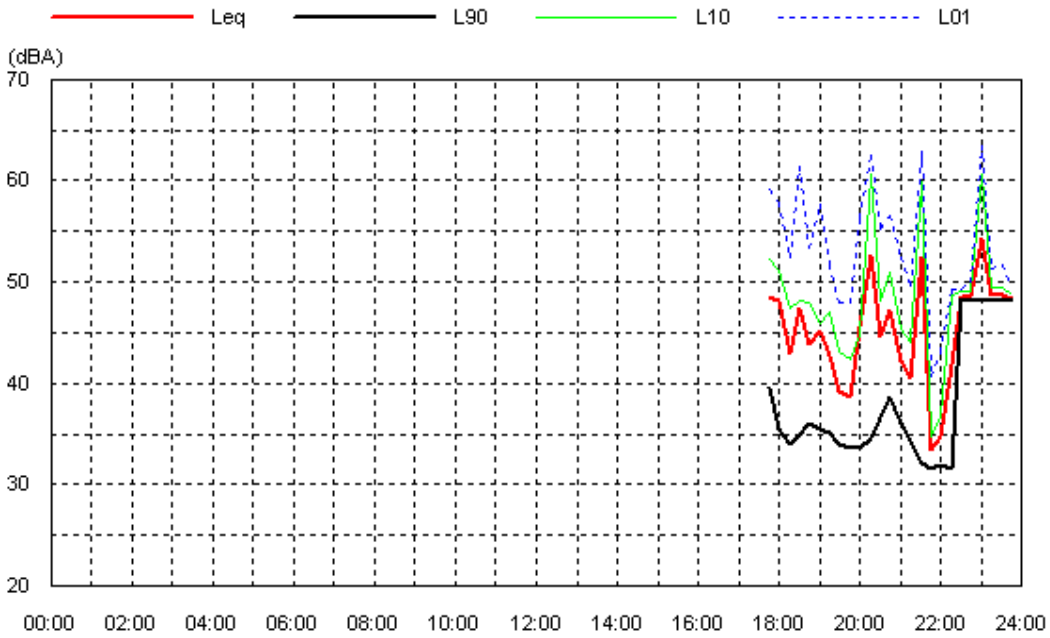
Project 08172 Appendix C for Version G- 27 October 2009				Predicted Noise Level LAeq,15min dBA			Exceedance		
EA Receiver Number	Description and EA Number	Receiver Zone	Criterion (Night)	2011	2016	2022	2011	2016	2022
257	Parkinson_257	D	35	27	27	27	0	0	0
259	Googe_259	D	35	27	27	27	0	0	0
264	J Moore	D	35	29	29	29	0	0	0

APPENDIX C

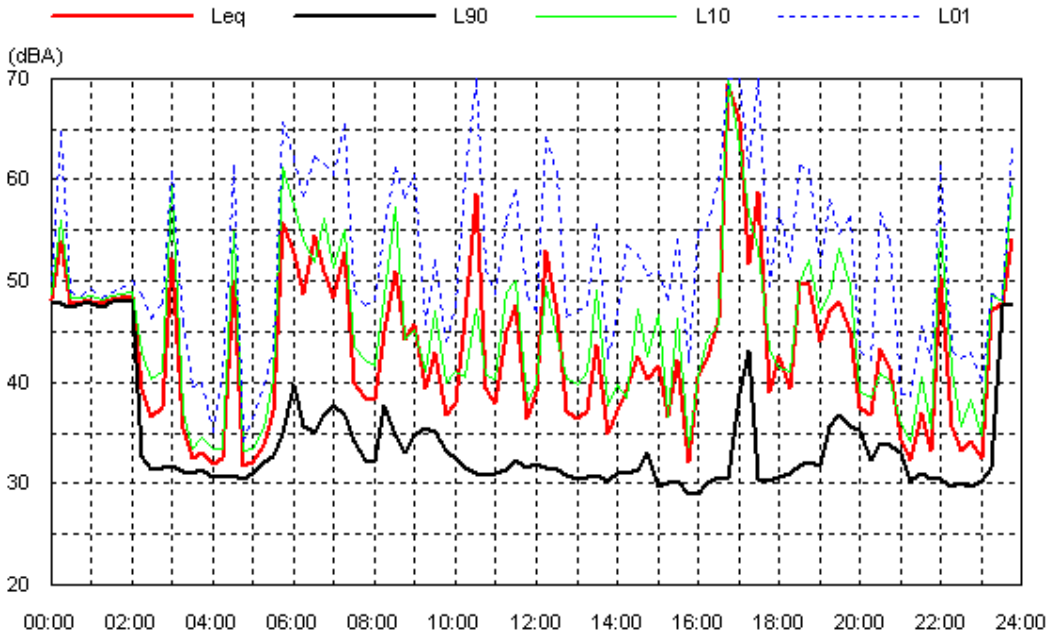
NOISE MEASUREMENT RESULTS

Logger L1 Results
Location: Mt Arthur Coal owned Property (formerly Roxburgh Flat), Muswellbrook

Tue 07 Oct 08

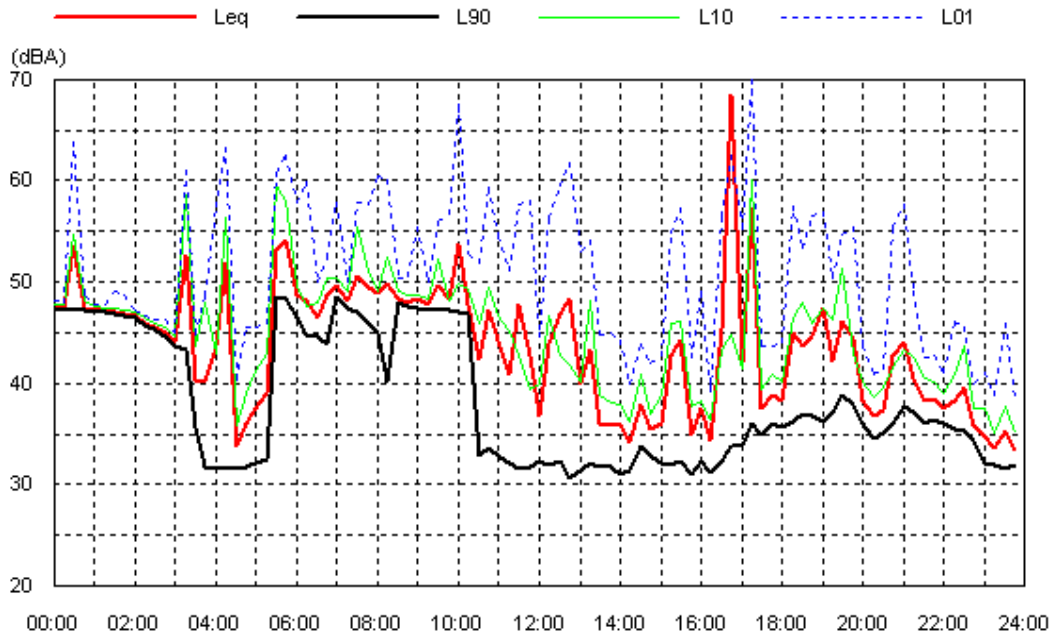


Wed 08 Oct 08

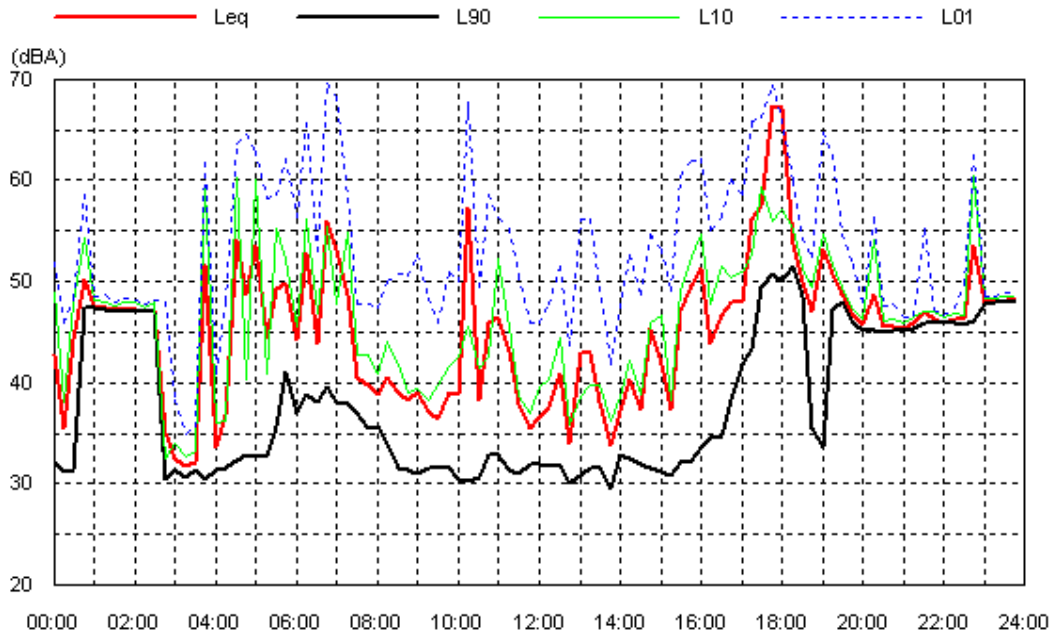


Logger L1 Results
Location: Mt Arthur Coal owned Property (formerly Roxburgh Flat), Muswellbrook

Thu 09 Oct 08

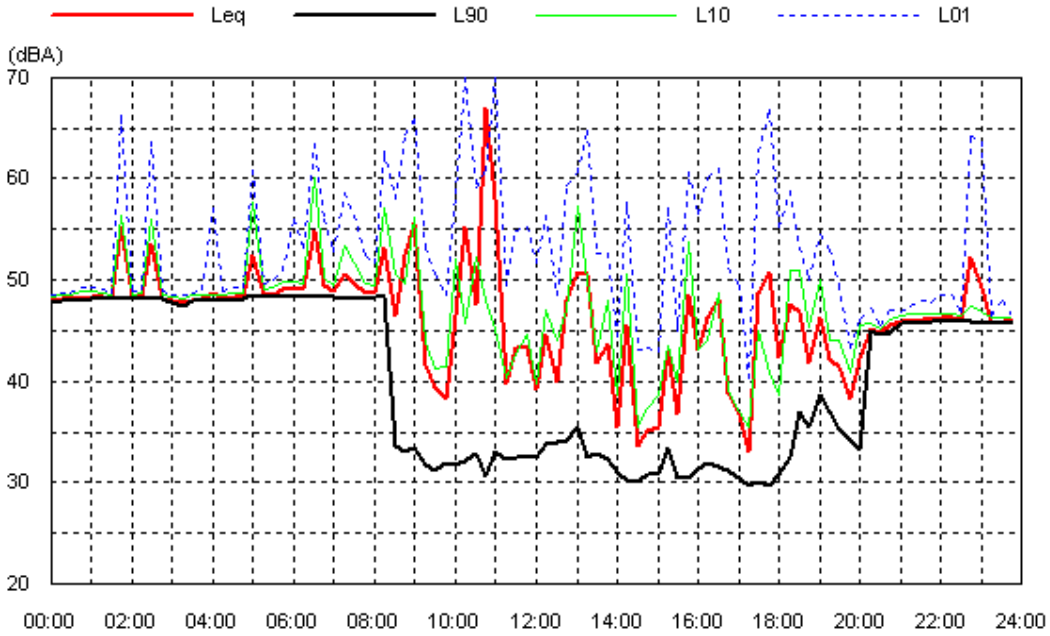


Fri 10 Oct 08

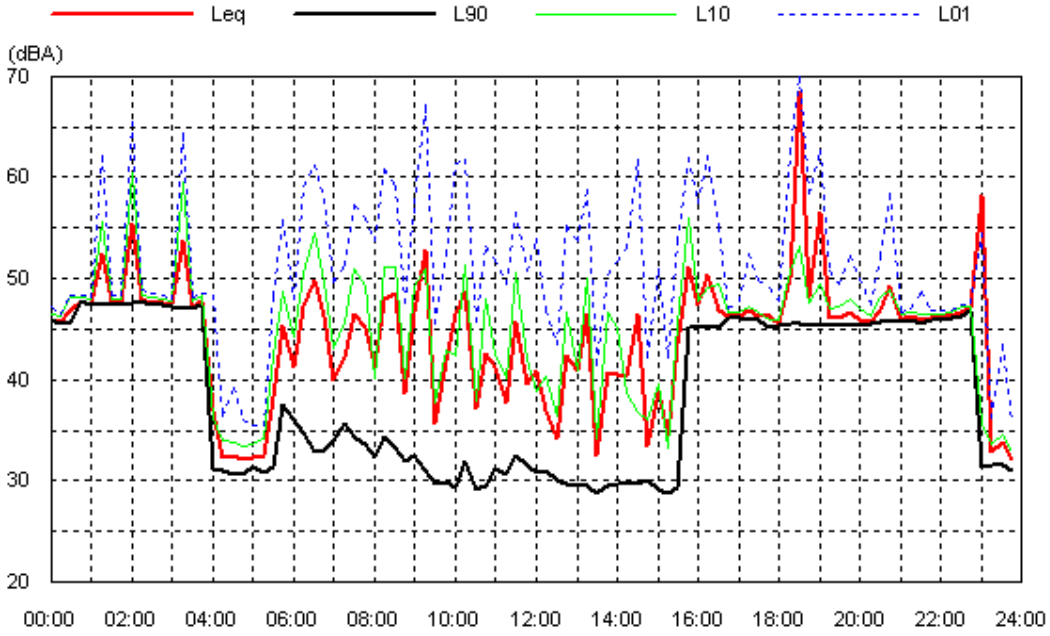


Logger L1 Results
Location: Mt Arthur Coal owned Property (formerly Roxburgh Flat), Muswellbrook

Sat 11 Oct 08

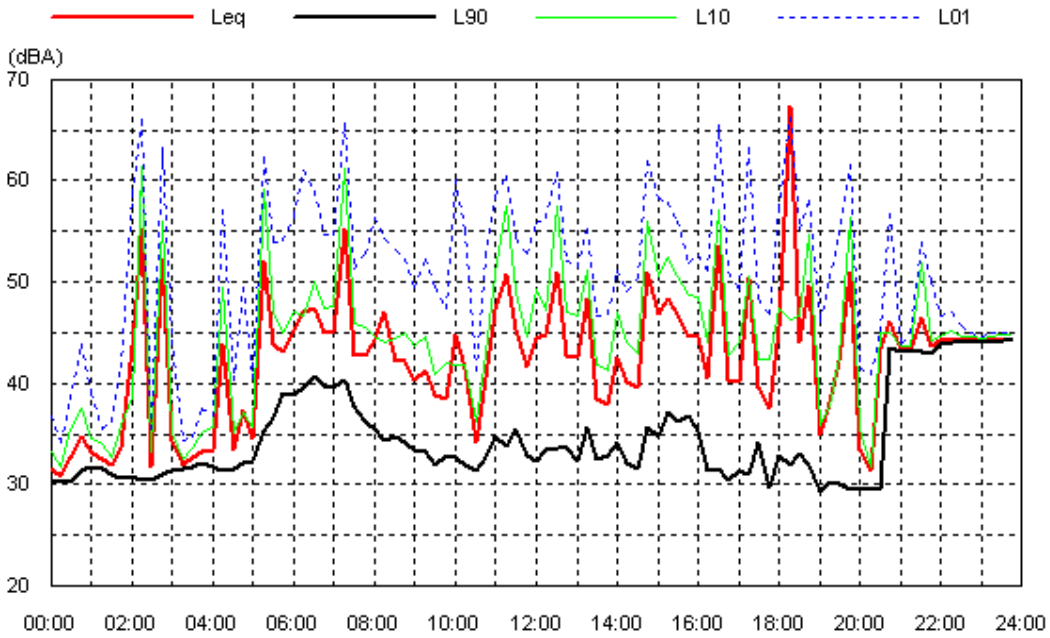


Sun 12 Oct 08

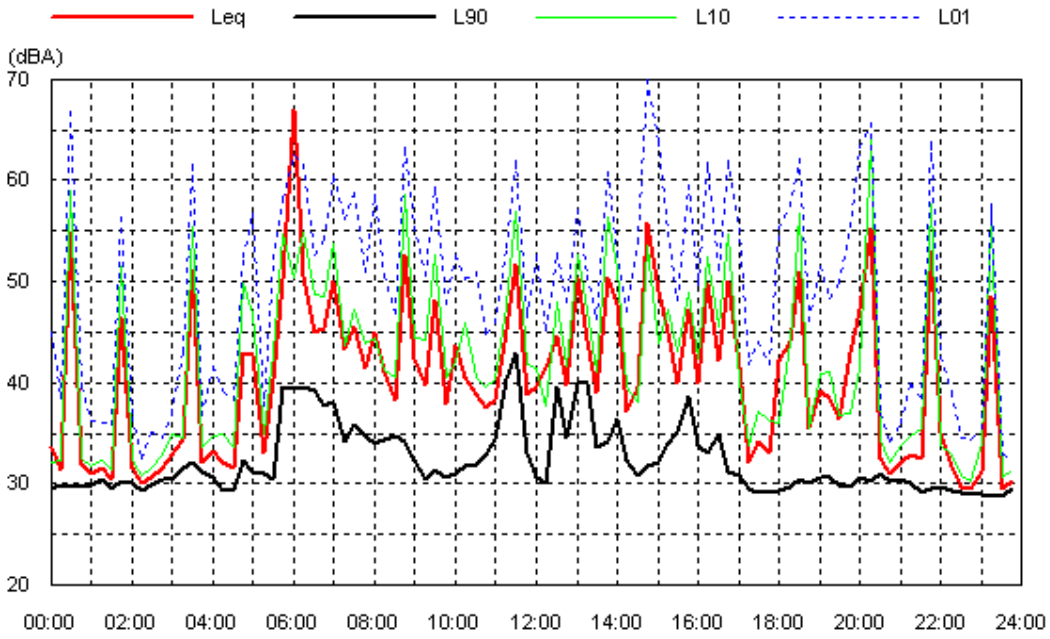


Logger L1 Results
Location: Mt Arthur Coal owned Property (formerly Roxburgh Flat), Muswellbrook

Mon 13 Oct 08

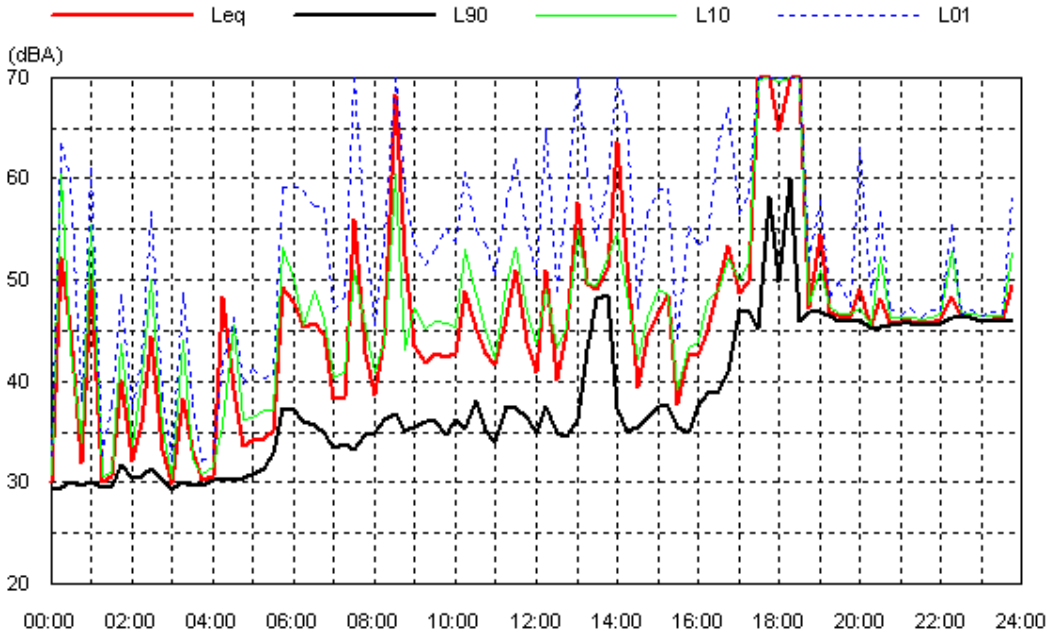


Tue 14 Oct 08

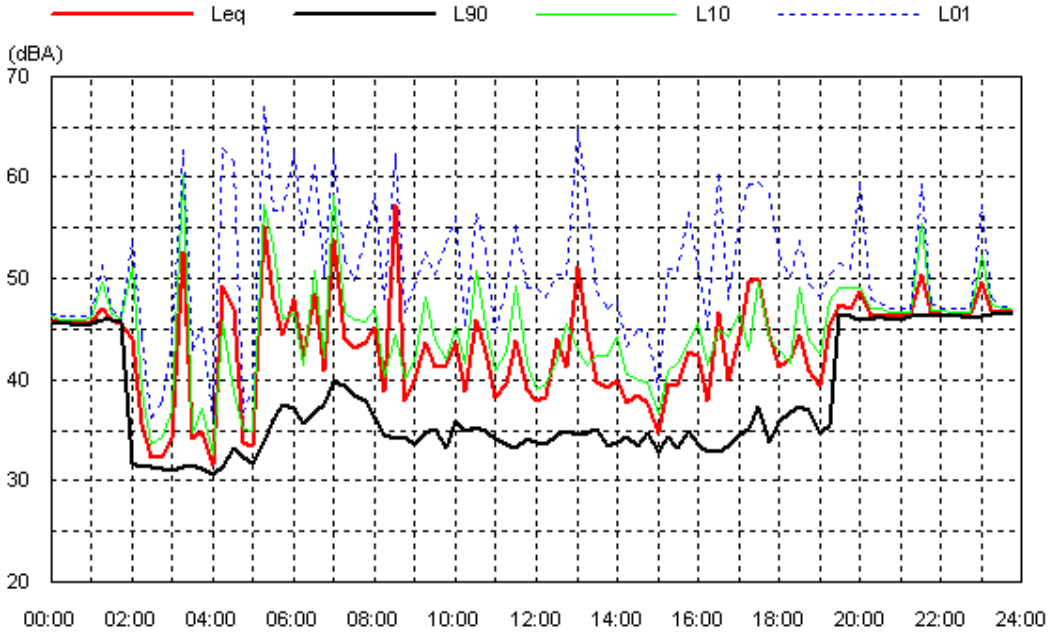


Logger L1 Results
Location: Mt Arthur Coal owned Property (formerly Roxburgh Flat), Muswellbrook

Wed 15 Oct 08

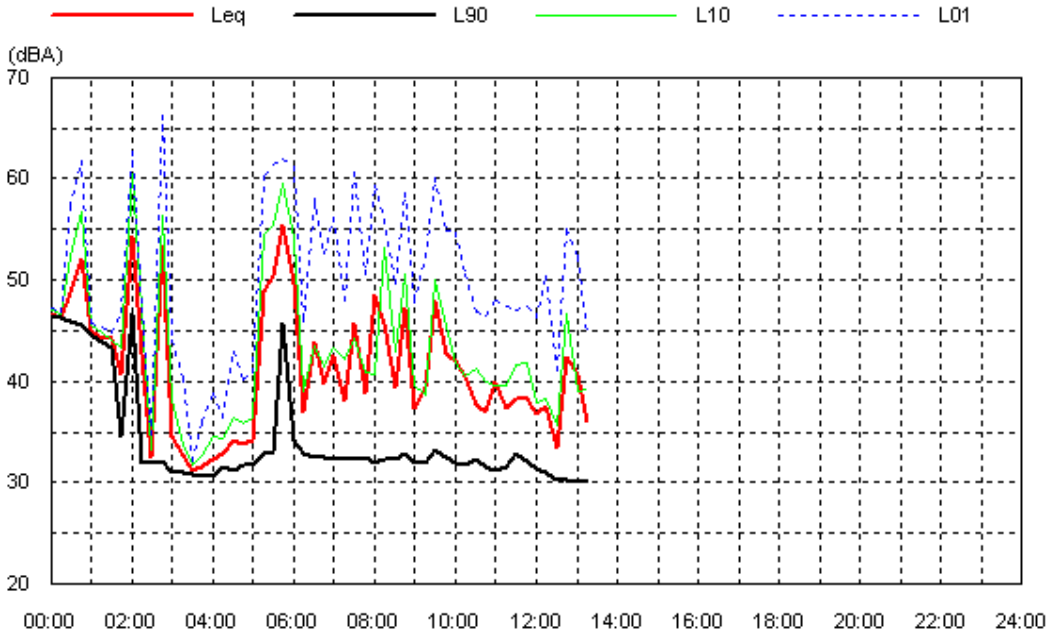


Thu 16 Oct 08



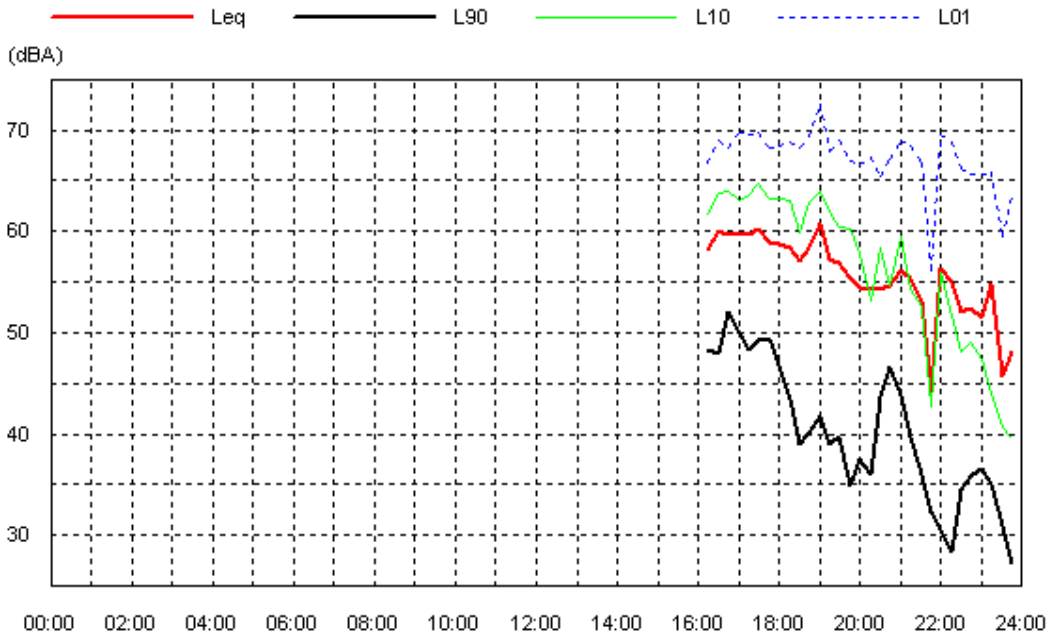
Logger L1 Results
Location: Mt Arthur Coal owned Property (formerly Roxburgh Flat), Muswellbrook

Fri 17 Oct 08

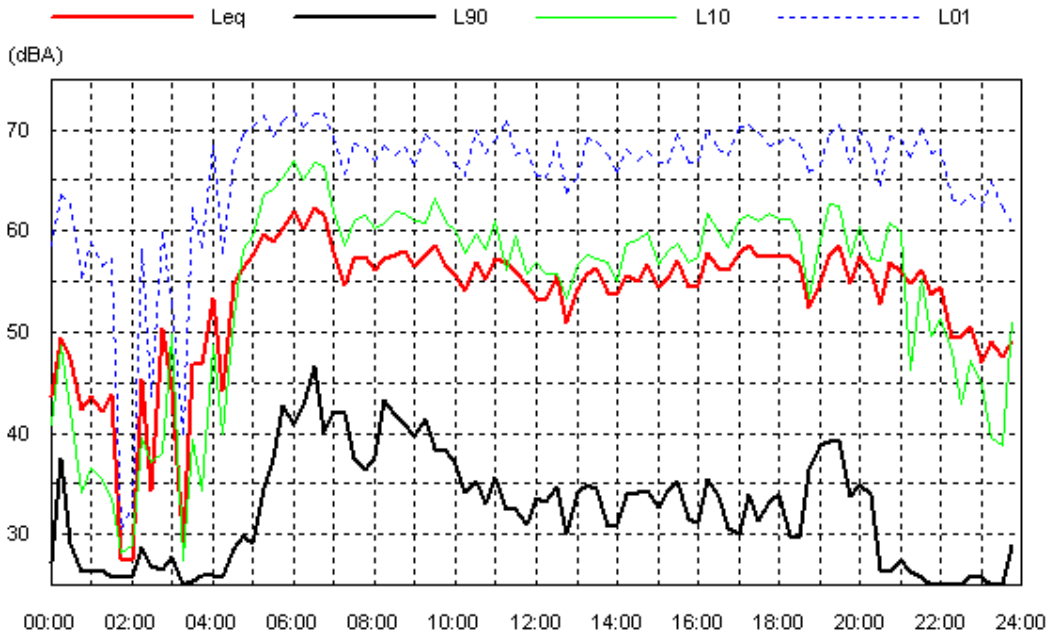


Logger L2 Results
Location: Denton Residence, Muswellbrook (Property ID 201)

Tue 07 Oct 08

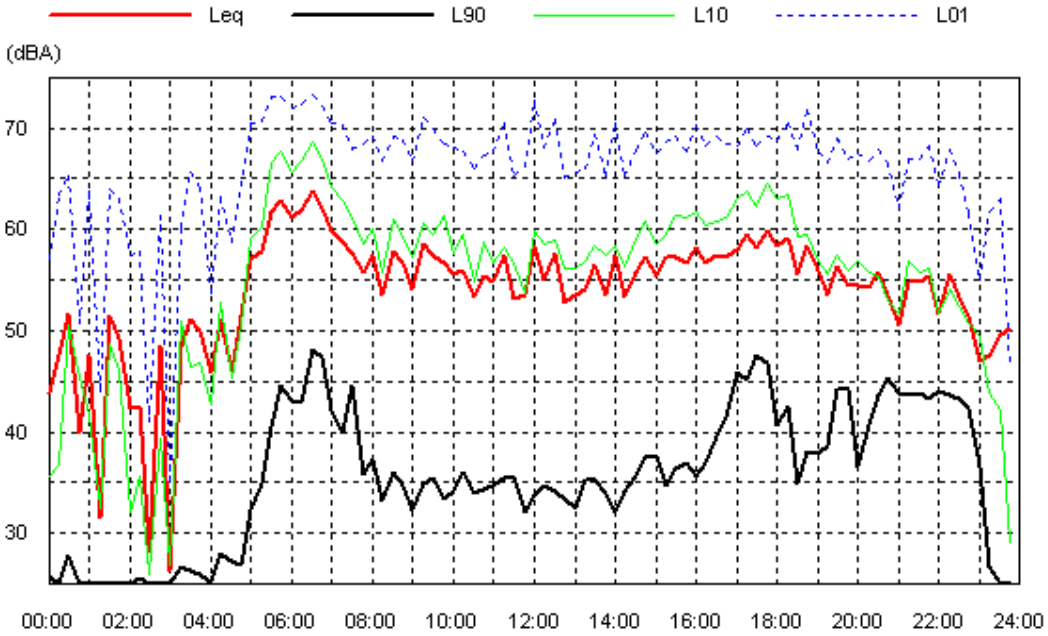


Wed 08 Oct 08

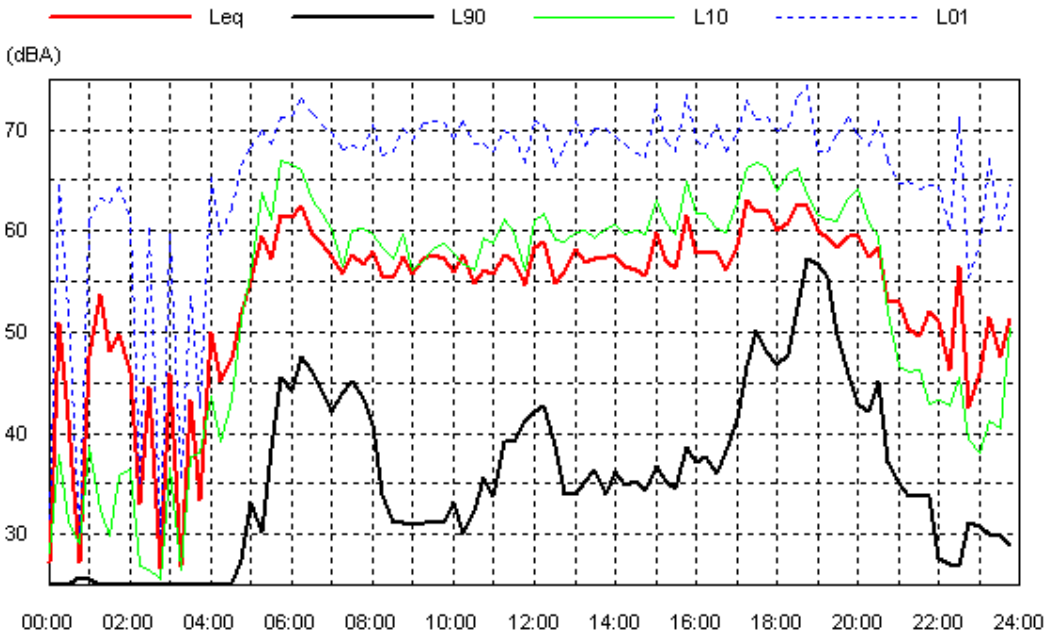


Logger L2 Results
Location: Denton Residence, Muswellbrook (Property ID 201)

Thu 09 Oct 08

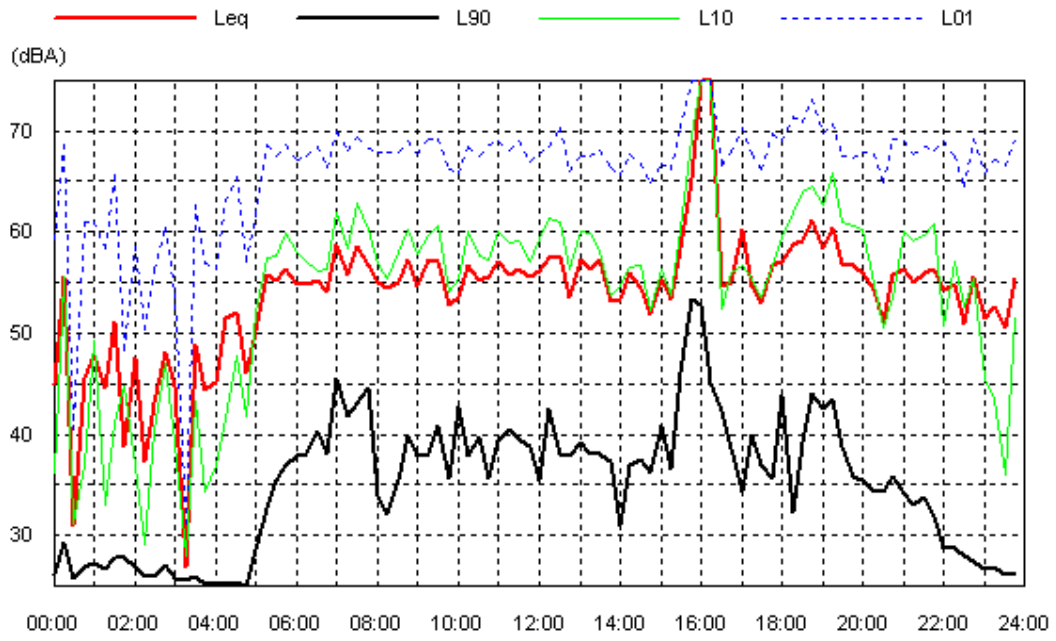


Fri 10 Oct 08

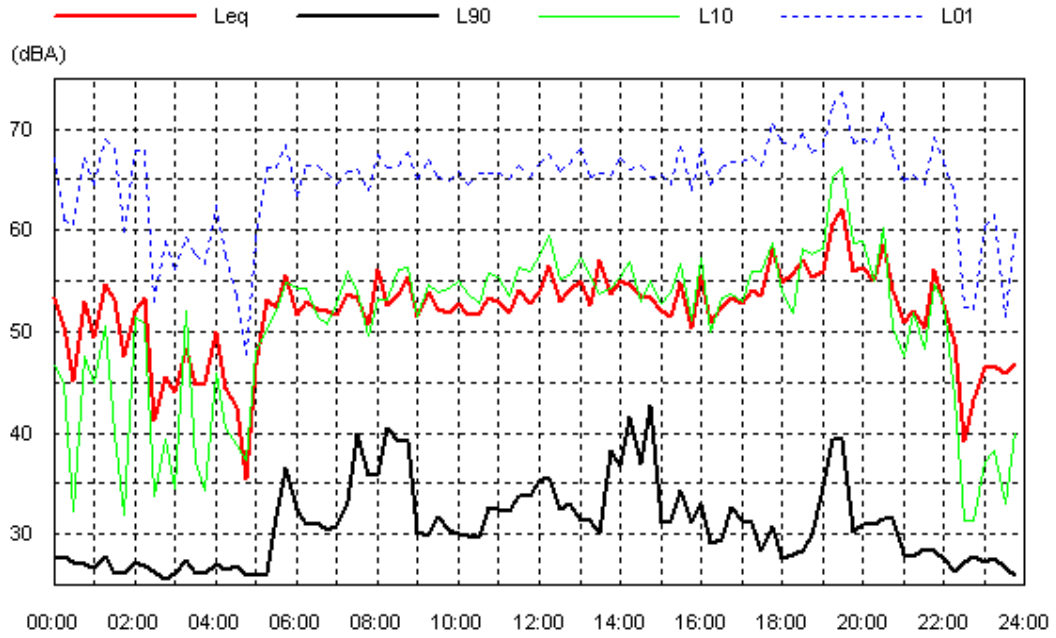


Logger L2 Results
Location: Denton Residence, Muswellbrook (Property ID 201)

Sat 11 Oct 08

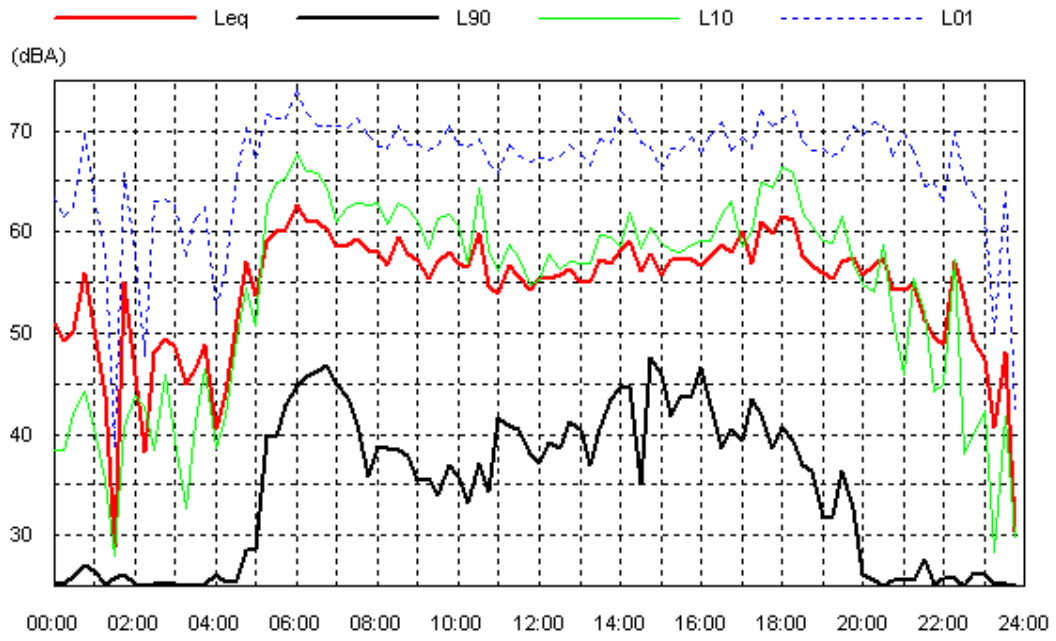


Sun 12 Oct 08

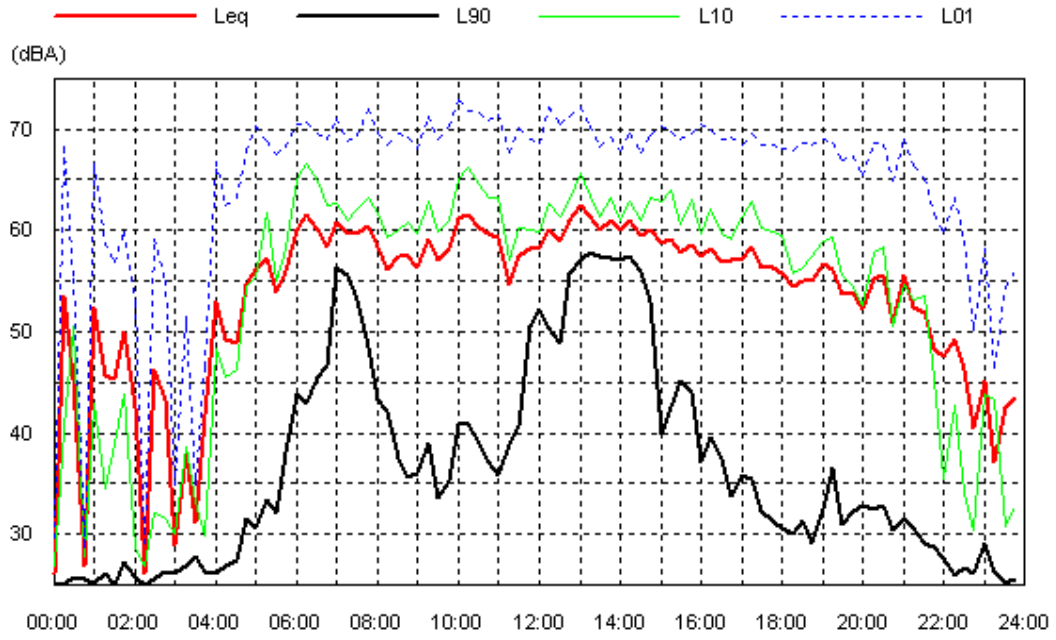


Logger L2 Results
Location: Denton Residence, Muswellbrook (Property ID 201)

Mon 13 Oct 08

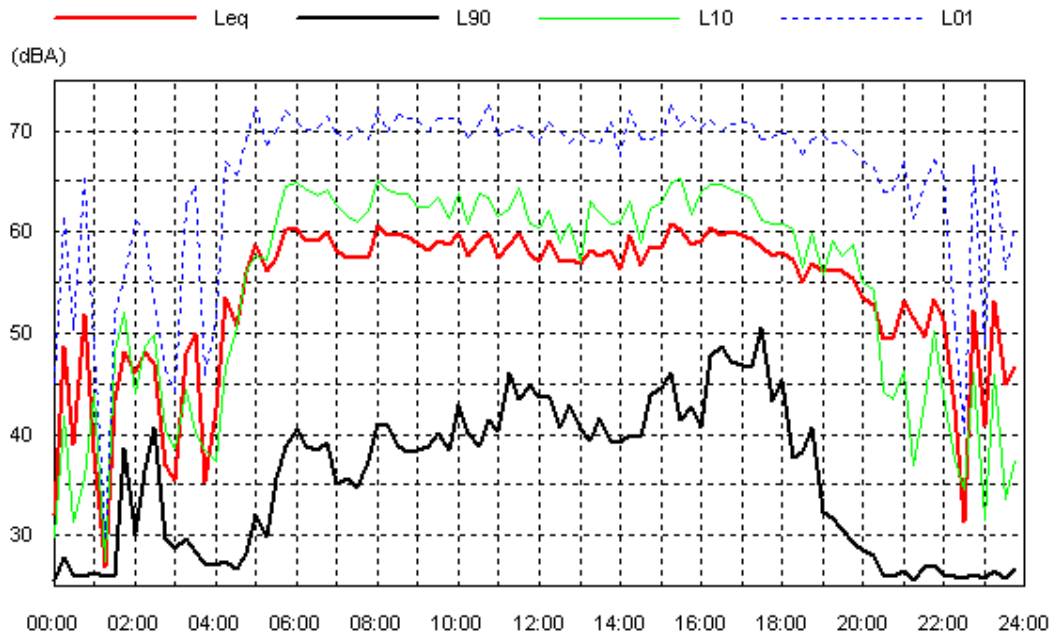


Tue 14 Oct 08

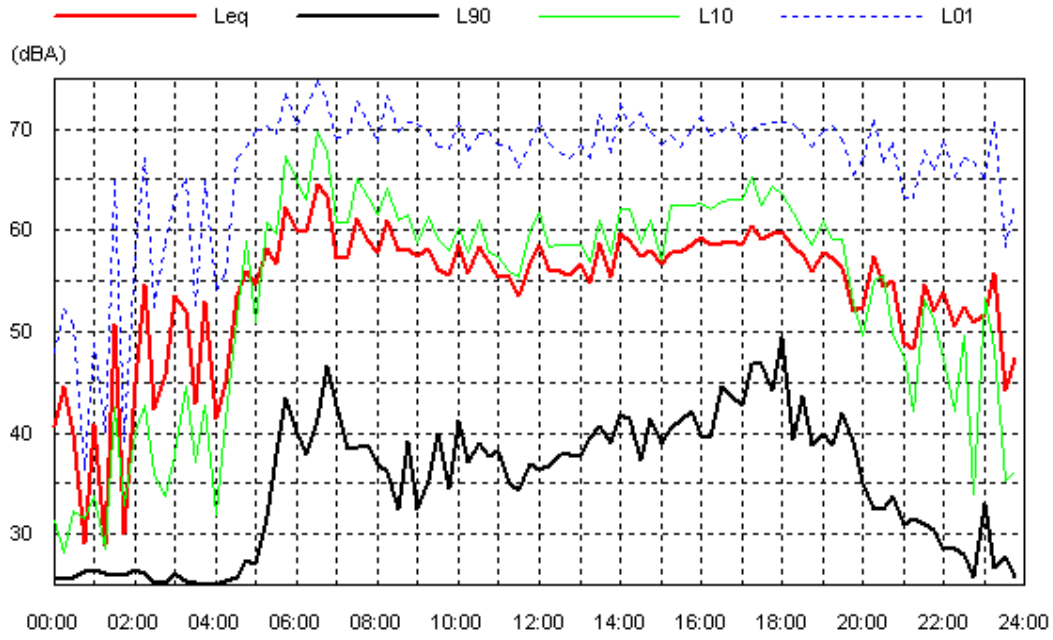


Logger L2 Results
Location: Denton Residence, Muswellbrook (Property ID 201)

Wed 15 Oct 08

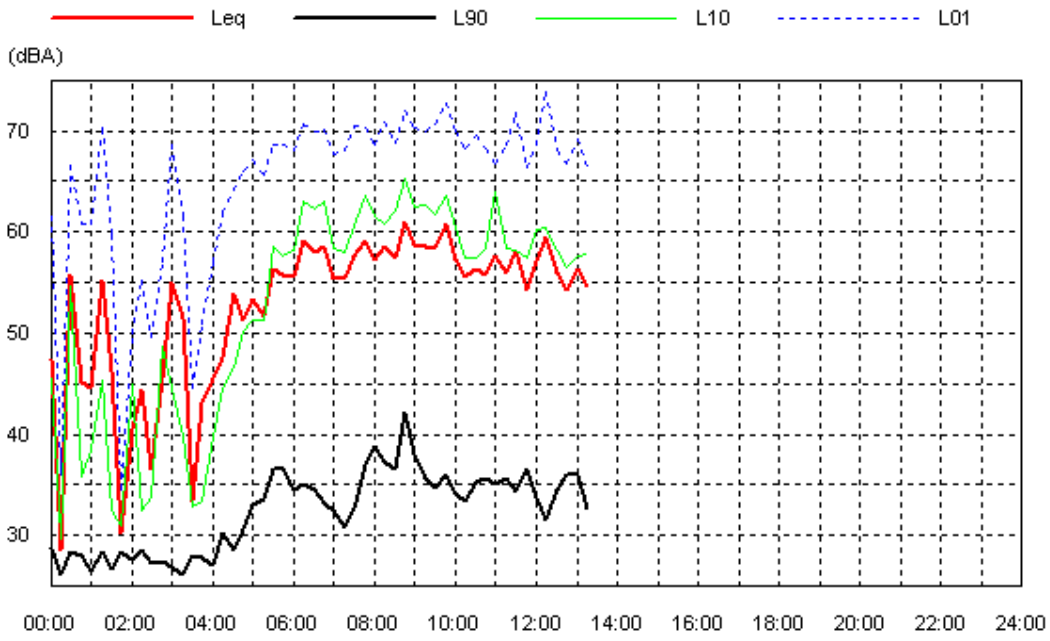


Thu 16 Oct 08



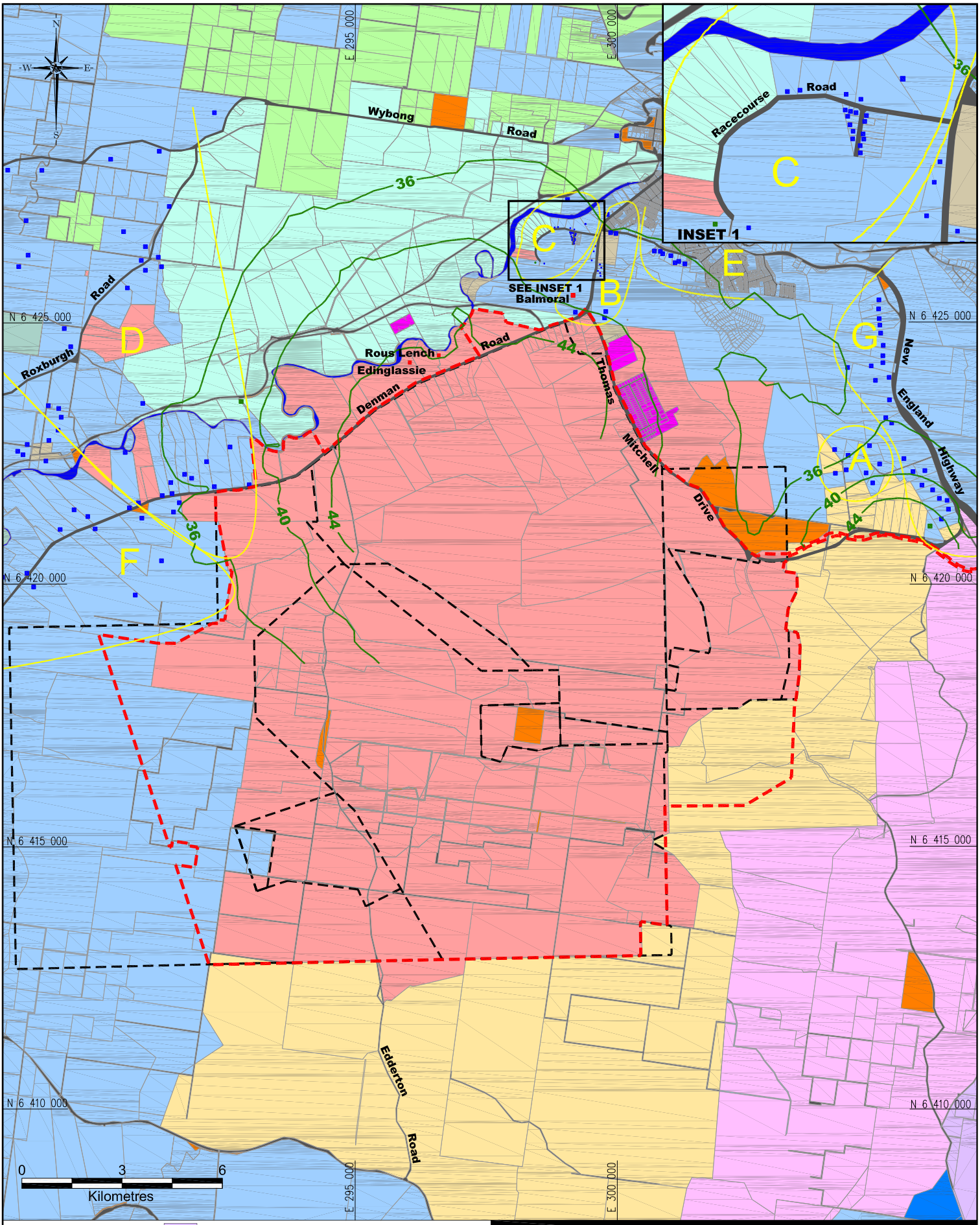
Logger L2 Results
Location: Denton Residence, Muswellbrook (Property ID 201)

Fri 17 Oct 08



APPENDIX D

NOISE CONTOURS



EA Boundary
Mt Arthur Coal Mining & Exploration Leases
Private Freehold
Crown
Mt Arthur Coal
Bengalla Mine
Mt Pleasant Mine
Drayton Mine
Mangoola Mine
Macquarie Generation
Utilities / Government Owned
Novacoal Australia
Coal and Allied
Industrial Freehold
Private Freehold Receiver Locations
Heritage - Listed Properties
Private Recievers in Existing ZOA
Residential Assessment Zones
Noise Contours LAeq (15 min)

Hansen Bailey

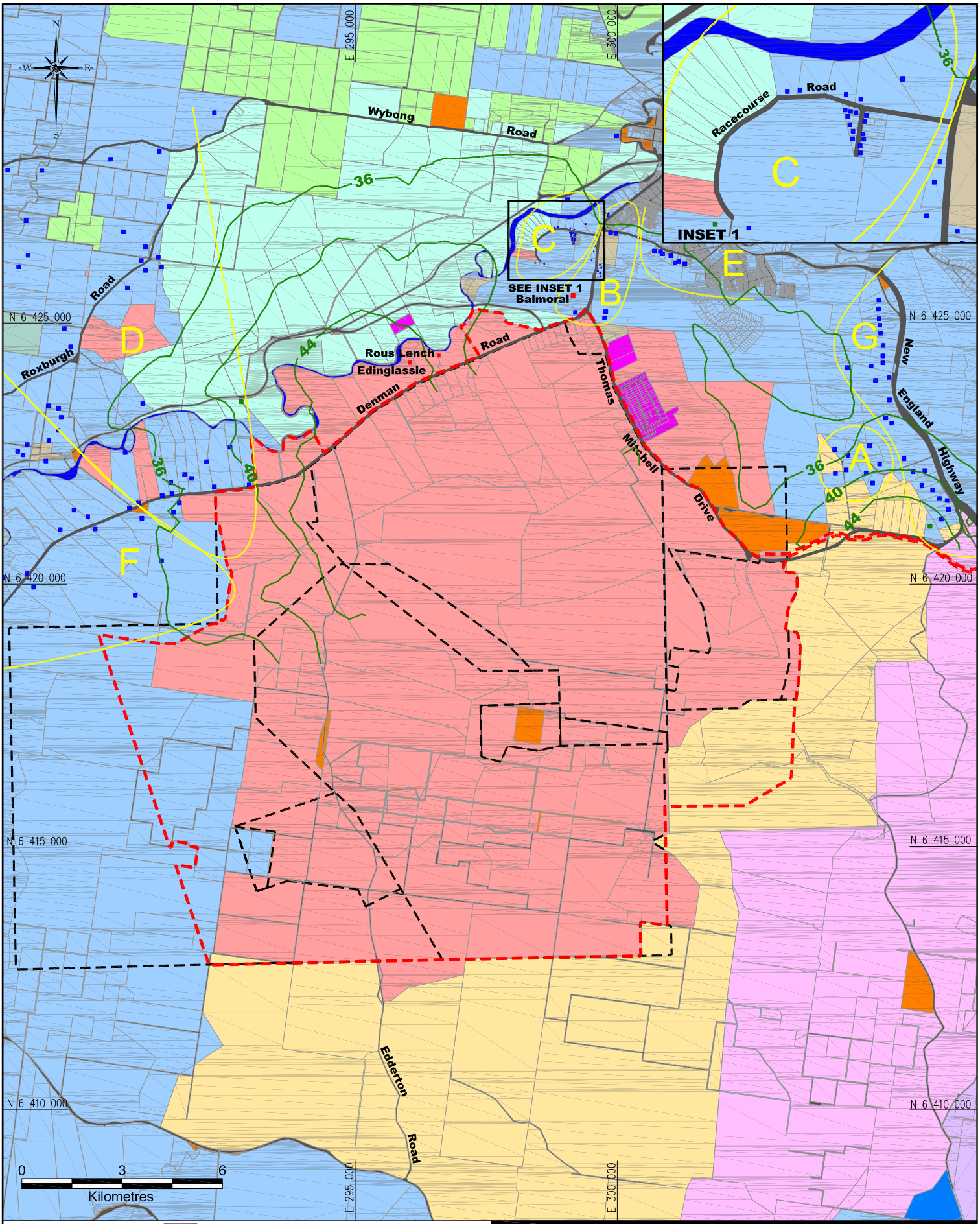
bhpbilliton

Co-ordinate System: MGA Zone 56
Land Searches: LPI 2009
Source: Wilkinson Murray (2009)

MT ARTHUR COAL

Indicative Noise Contours 2011

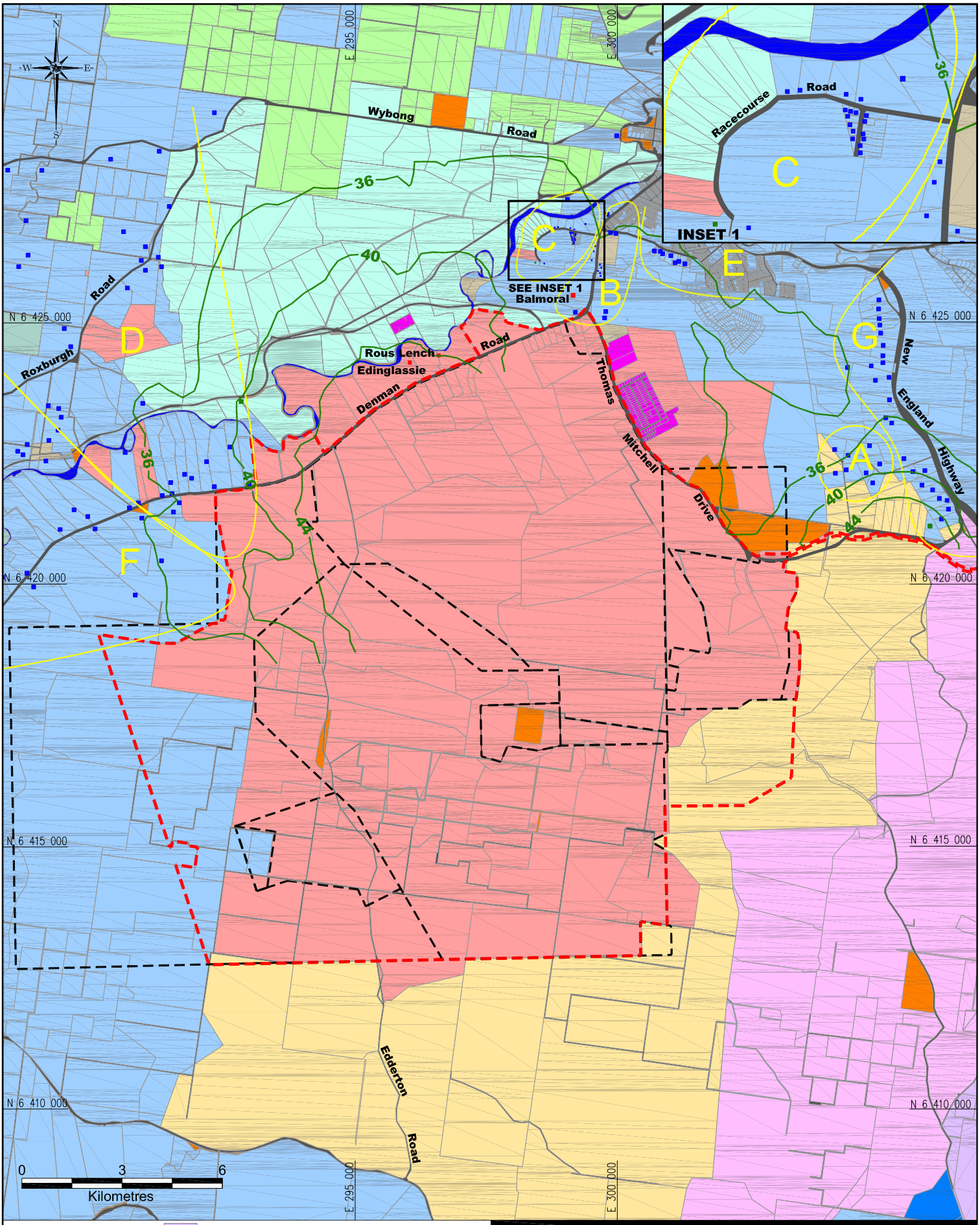
Cad File: 05156A.dwg	Date: 07.08.09	Drawn: JD	Figure 1



MT ARTHUR COAL

Indicative Noise Contours 2016

Cad File: 05157A.dwg	Date: 07.08.09	Drawn: JD	Figure 2



EA Boundary
Mt Arthur Coal Mining & Exploration Leases
Private Freehold
Crown
Mt Arthur Coal
Bengalla Mine
Mt Pleasant Mine
Drayton Mine
Mangoola Mine
Macquarie Generation
Utilities / Government Owned

Novacoal Australia
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Industrial Freehold
Private Freehold Receiver Locations
Heritage - Listed Properties
Private Recievers in Existing ZOA
Residential Assessment Zones
Noise Contours LAeq (15 min)

Hansen Bailey

bhpbilliton

Co-ordinate System: MGA Zone 56
Land Searches: LPI 2009
Source: Wilkinson Murray (2009)

MT ARTHUR COAL

Indicative Noise Contours 2022

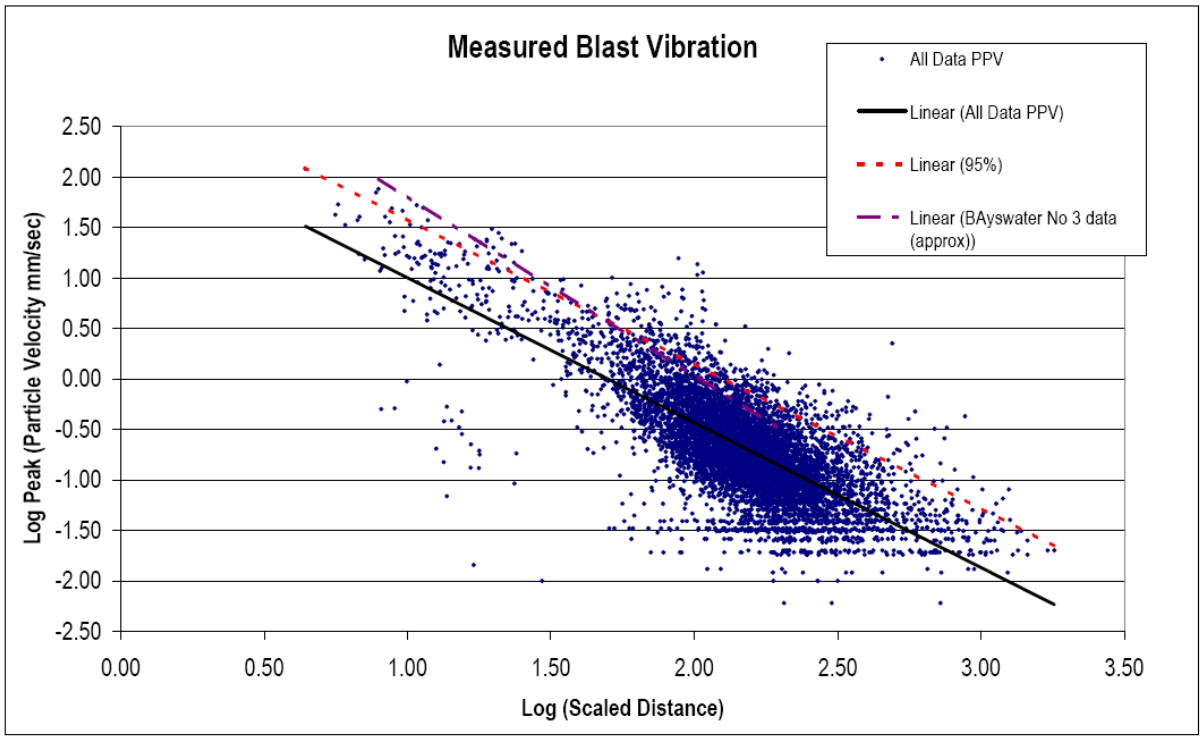
Cad File: 05158A.dwg	Date: 07.08.09	Drawn: JD	Figure 3

APPENDIX E

BLASTING ANALYSIS

For this study, Wilkinson Murray have derived new predictive equations for vibration and overpressure using measurement data from approximately 7,000 blasts provided by MAC. Figure E.1 illustrates the measured data and associated linear trend lines.

Figure E.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 - 0.3mm/sec.

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

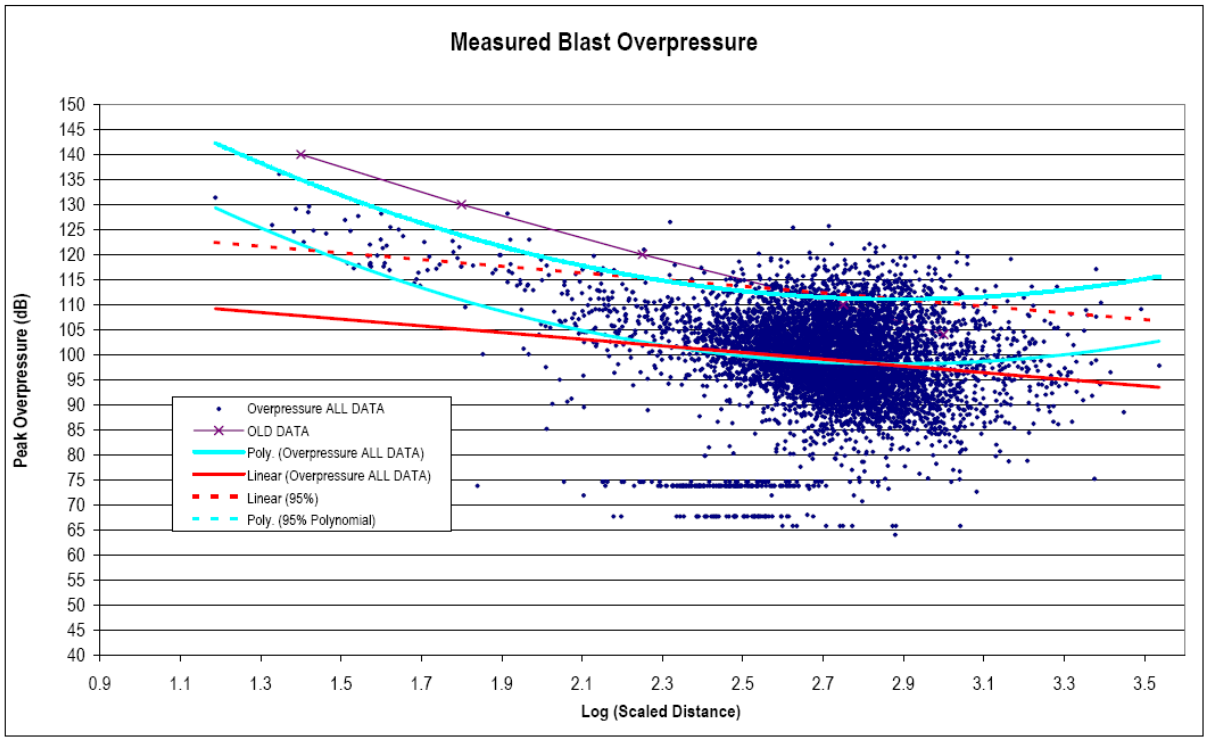


Figure E.2 shows data for overpressure. Analysis of this data showed that the relationship between measured peak overpressure and scaled distance is better defined with a polynomial equation (blue) at close range rather than a standard linear equation (red). At relatively low values of scaled distance,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