MOOLARBEN COAL PROJECT

Response to Submissions

APPENDIX A11

Noise and Blasting Response

Project No: 04098

Noise and Vibration Impact Assessment
Proposed Moolarben Coal Mine – Preferred Project
Ulan, NSW

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APPENDIX A Noise Level Contours

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EXECUTIVE SUMMARY

A Preferred Project Noise and Vibration Impact Assessment (NVIA) has been prepareded for the proposed Moolarben Coal Mine near Ulan, NSW, following feedback from various parties during the IHAP process. This report aims to address all of the issues raised and particularly those raised by the IHAP expert. One omission from this report, due to time constraints, is the compilation of noise contour Figures for all modelled scenarios. The Tables have been updated, however, to include all newly identified receivers within the study area.

The assessment is based on or refers to the following Standards, policies, guidelines and documents:

- DEC *NSW Industrial Noise Policy* (2000).
- DEC *Environmental Criteria for Road Traffic Noise* (1999).
- ANZECC *Technical basis for guidelines to minimise annoyance due to blast overpressure and ground vibration* (2000).
- DEC publication *Assessing Vibration: a technical guideline* (2006).
- Australian Rail Track Corporation (ARTC) Environmental pollution license EPL 3142.
- Wilpinjong Noise and Blasting Impact Assessment, Richard Heggie Associates (RTA, 2005).
- Traffic Impact Assessment (TIA) for the Moolarben Coal project, Sinclair Knight Merz (SKM, 2006).
- US EPA document No. 550/9-74-004 "Information on Levels of Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, March 1974".
- AS 2187.2-1993 *"Explosives – Storage, Transport and Use. Part 2: Use of Explosives"*

A brief summary of essential data, results and recommendations arising from this assessment is presented below.

Ambient Noise Levels

Ambient noise monitoring was conducted at six residential receivers surrounding the project site during the period 12 July 2005 to 27 July 2005 (refer to Figure 1 on p2 for noise monitoring locations). Existing L_{Aeq} and L_{A90} (Rating Background levels, RBL) levels are summarised in **Table S1**.

Location	L_{Aeq}, period			L_{A90}, period		
	Day	Evening	Night	Day	Evening	Night
P. Renshaw *N6*	49	48	46	30	31	30
G. Tuck-Lee *N4*	55	44	44	33	36	34
D. Rayner *N1*	43	37	42	30	30	30
M. Powers (Ulan) *N5*	55	53	51	42	41	40
T. Roberts *N3*	49	45	39	34	33	32
B. Reid *N2*	47	40	37	30	30	30

TABLE S1
Measured ambient noise levels (July 2005).
(L_{90} values below 30 dB(A) have been set to 30dB(A) per DEC guidelines.)

Ulan Coal Mines Limited (UCML) noise dominated the acoustic environment in Ulan village. UCML noise levels measured during three attended monitoring campaigns under various operational and atmospheric conditions are summarised as follows:

Observed

Date	dB(A),L_{Aeq}	dB(A),L_{90}	weather	UCML operations
Nov 05	46-49	44-47	neutral	trucks, crushers, hum
Aug 06	48-50	45-48	adverse	trucks, crushers, hum
Nov 06	40-42 (est.)	38-40	noise-reducing	CHPP hum

Operational Noise Criteria

Recommended noise criteria for locations potentially affected by Pit 1 operations are shown in **Tables S2-S4**. Increased noise criteria have been recommended at some locations for the first six months of the project to allow the formation of an acoustic bund along the western edge of the Pit 1 out-of-pit emplacement area (OOP1). Bund formation and other construction activities on site would only occur during the day and not into the evening or night. When 24 hour mining commences the pre-established bund is predicted to reduce noise emissions by up to 7 dB at residences in and around the village of Ulan.

TABLE S2
Recommended daytime noise criteria for locations impacted by Pit 1.

Receiver	Description	Proposed noise criteria dB(A),$L_{eq(15min)}$	
		0-6 mths	6-12 mths
8	CN & HL Davies	35	35
46D	UCML (Mitchell)	35	35
16	DJ Little & AK Salter	35	35
15	L. Green	35	35
7	Wallis	35	35
13 *(N6)*	PF Renshaw	35	35
12	M & J Transport	35	35
148	EM Loughrey	46	46
160A	Ulan Primary School[1]	36	36
168	Ulan Anglican Church[1]	36	36
167	F Boyd	46	46
160B	Minister of Education	46	46
161	S Palmer	46	46
159	NA Power	46	46
41C	P Libertis	46	46
165	RJ Andrew	46	46
157 *(N5)*	MJ & JM Power	46	46
154	JM Cashel	45	45
155	JA Tortely	45	45
156	JA Knox	45	45
153	PE Newton	45	45
151	Ulan Catholic Church[1]	35	35
150	W & K Meredith	45	45
158	KE & RA Carlisle	45	45
46A	Flannery Centre	46	46
26	GF Robinson	43	38
49	"Olive Lea"	43	38
169	"Primo Park"	41	37
173	H Richter "Willow Park"	41	37
25 *(N4)*	GG Tuck-Lee	Pit 1 Noise Acquisition Zone	
24	LK Hoare	Pit 1 Noise Acquisition Zone	
5	M & P Swords	37	35
20	AJ & NN Williamson	39	35
6	Thompson	39	35

Table S2 (cont'd)

Receiver	Description	Proposed noise criteria dB(A),$L_{eq(15min)}$	
		0-6 mths	6-12 mths
22	A Aiton	38	38
23	A & E Woodhead	38	38
41A	P Libertis	38	38
63	BF & B Whitaker	38	38
64	JW Goninan & TL Boland	38	38
172	T Kimber	38	38
170 *(N3)*	T Roberts	38	38
58	ML & JL Bevege	35	35
37	J Szymkarczuk[2]	35	35
All other receivers		35	35

TABLE S3

Recommended evening and night-time noise criteria for locations in Ulan village.

Receivers	Weather condition	Intrusive criteria dB(A),$L_{eq(15min)}$		Amenity criteria dB(A),$L_{eq(period)}$	
		Evening	Night	Evening	Night
R148 Loughrey	W wind	47	47	39	34
	Neutral	49	49	37	36
	Adverse[1]	50	50	38	38
R167 Boyd	W wind	47	47	39	34
	Neutral	49	49	37	36
	Adverse[1]	50	50	38	38
R160B Minister of Educ.	W wind	47	47	39	34
	Neutral	49	49	37	36
	Adverse[1]	50	50	38	38
R161 Palmer	W wind	47	47	39	34
	Neutral	49	49	37	36
	Adverse[1]	50	50	38	38
R159 Power	W wind	47	47	39	34
	Neutral	49	49	37	36
	Adverse[1]	50	50	38	38
R41C Libertis	W wind	47	47	39	34
	Neutral	49	49	37	36
	Adverse[1]	50	50	38	38
R165 Andrew	W wind	47	47	39	34
	Neutral	49	49	37	36
	Adverse[1]	50	50	38	38
R157 (N5) Power	W wind	47	47	39	34
	Neutral	49	49	37	36
	Adverse[1]	50	50	38	38
R154 Cashel	W wind	46	46	41	33
	Neutral	48	48	37	35
	Adverse[1]	49	49	37	37
R155 Tortely	W wind	46	46	41	33
	Neutral	48	48	37	35
	Adverse[1]	49	49	37	37
R156 Knox	W wind	46	46	41	33
	Neutral	48	48	37	35
	Adverse[1]	49	49	37	37
R153 Newton	W wind	46	46	41	33
	Neutral	48	48	37	35
	Adverse[1]	49	49	37	37
Table S3 (cont'd)					

Receivers	Weather condition	Intrusive criteria dB(A),$L_{eq(15min)}$		Amenity criteria dB(A),$L_{eq(period)}$	
		Evening	Night	Evening	Night
R150 Meredith	W wind	46	46	41	33
	Neutral	48	48	37	35
	Adverse[1]	49	49	37	37
R158 Carlisle	W wind	46	46	41	33
	Neutral	48	48	37	35
	Adverse[1]	49	49	37	37
R46A Flannery Centre	W wind	46	46	41	33
	Neutral	48	48	37	35
	Adverse[1]	49	49	37	37

[1] Adverse conditions are prevailing winds from the general-east and inversions.

Receiver	Intrusive criteria dB(A),$L_{eq(15min)}$	
	Evening	Night
R8 Davies	35	35
R46D UCML (Mitchell)	35	35
R16 Little & Salter	35	35
R15 Green	35	35
R7 Wallis	35	35
R13 (N6) Renshaw	35	35
R12 M & J Transport	35	35
R26 Robinson	38	38
R49 “Olive Lea”	38	38
R169 “Primo Park”	37	37
R173 Richter	37	37
R5 Swords	35	35
R20 Williamson	35	35
R6 Thompson	35	35
R22 Aiton	38	37
R23 Woodhead	38	37
R41A Libertis	38	37
R63 Whitaker	38	37
R64 Goninan & Boland	38	37
R172 Kimber	38	37
R170 (N3) Roberts	38	37
R58 Bevege	35	35
R37 Szymkarczuk[1]	35	35
All other receivers	35	35

TABLE S4
Recommended evening and night-time noise criteria for locations outside Ulan village.

Summary of affected receivers

Two locations (*R25* Tuck-Lee and *R24* Hoare) have predicted noise levels more than 5 dB above the noise criterion after establishment of the acoustic bund at OOP1 and are in a noise “affectation zone”, where “affectation zone” is used in this report to identify receivers where predicted noise levels are 5 dB or more above the noise criteria. Receiver *R25* (Tuck-Lee) is also in the blasting affectation zone for Pit 1. The Swords residence (*R5*) is in the noise affectation zones for Pits 2 and 3 and the blasting affectation zone for Pit 2. Also included in the Pit 2 affectation zone are the Williamson (*R20*) residence and the vacant Thompson property (*R6*). The Rayner residence (*R36*) is in the blast affectation zone for Pit 3. Locations *R29A* (Mayberry) and *R29B* (Mayberry) are both in the noise and blasting affectation zones for Pit 3.

Two other locations, *R13* (Renshaw) and *R12* (M&J Transport), are in a noise affectation zone near the proposed rail loop.

Locations *R169* ("Primo Park"), *R173* (Richter) ,*R49* ("Olive Lea") and *R26* (Robinson) have predicted noise levels that may exceed the noise criteria by 1-3 dB under adverse conditions after 24 hour mining commences in Pit 1. These locations will be included in a noise monitoring / management program and provision would be made in the project approval for Moolarben Coal Mines Pty Ltd (MCMPL) to negotiate agreements with landowners should noise criterion exceedances be experienced.

This recommendation has been made because of the relative difficulty in achieving the noise criteria at these three locations. The acoustic bund at OOP1 is predicted to provide up to 7 dB attenuation of mining noise. Achieving the night time criteria in Table S2 at these locations would require all mobile plant (excavators, haul trucks, dozers) to be attenuated by a further 3 dB. Given the small number of receivers involved, the minor to moderate level of predicted exceedances and the high cost of noise attenuation (in terms of both purchase cost and ongoing maintenance) it is not considered feasible or reasonable to recommend attenuation at this stage.

Many of the minor exceedances could be mitigated by avoiding certain operations at times of adverse weather conditions. A Noise Management Plan will be developed for the project and noise monitoring will be conducted from commencement of activities on site. If the need arises to attenuate specific plant items, then the best practice approach will be adopted.

Train Noise Predictions

The assessment found that some of the proposed MCP trains were included in the cumulative train noise impact assessment for Wilpinjong Mine (Richard Heggie Associates, 2005). Specifically, two 650m trains per day were included for Ulan Phase 2 Underground (now part of the MCP lease area) as part of the currently approved train traffic on the Gulgong – Sandy Hollow Rail Line. Taking this into account, the calculated cumulative daytime train noise levels east of the site increased by 1 dB from those presented in the Wilpinjong EIS (which included existing trains from Ulan Coal Mine) as a result of introducing additional trains from MCP. No measurable increase in L_{Aeq} levels was calculated for additional night time train movements.

It is understood that train noise on the Gulgong – Sandy Hollow Rail Line is the responsibility of the Australian Rail Track Corporation (ARTC) with noise goals and Pollution Reduction Program guidelines contained in their Environmental Pollution License (EPL 3124). The set-back distance for achieving the ARTC noise goals at locations between the project site and Muswellbrook remains at 70 m (as established in the Wilpinjong EIS) and is governed by predicted night time L_{Aeq} levels.

Twenty-two residences were identified as being within 70 m of the rail line between the site and Muswellbrook during a helicopter survey of the rail line in April 2006. Most of these residences are in the town of Denman with the remaining residences being in rural areas. The rail line was in deep cut near several of the identified residences and two residences appeared to have acoustic bunds between the rail line and residence. Any future assessment of rail noise impacts would therefore need to be specific for each receiver and not reliant upon the predictions in this report.

Trains from MCP may also travel west to Lithgow. The set-back distance is 30 m, based on a noise objective of 85 dB(A),L_{max} in the ARTC EPL. Since this is an L_{Amax} set-back, it is not influenced by the number of trains.

Sixteen residences were identified as being within 30 m of the rail line between the site and Lithgow. These mainly include older residences in Mudgee, Kandos, Portland, Wallerawang and Rylstone. Two rural residences were identified as being within the 30 m set-back distance. The rail line is in cut near many of the residences in towns and some of the rural residences, so received maximum noise levels may be considerably lower than 85 dB(A) at these locations. Approximately 175 residences are within the set-back distance of 70 m that would be required to achieve the more stringent DEC train noise criteria. Again, these residences are mostly in Mudgee, Kandos, Portland, Wallerawang and Rylstone.

Road traffic noise

A Traffic Impact Assessment (TIA) for the project has been prepared by Sinclair Knight Merz (SKM). Results from that assessment have been used to estimate the potential for road traffic noise impacts.

The TIA assumed that all mine workers will live in Mudgee (75%) and Gulgong (25%). The increased light vehicle movements through Ulan village around shift changes are considered to represent the greatest potential for traffic noise impacts. Additional delivery vehicles on Ulan Road will not significantly increase the current road traffic volume and any increase in noise levels will be negligible.

Based on the assumption that the entire day shift will arrive between 6:30 am and 7 am and the night shift will all leave between 7 am and 7:30 am, an estimated maximum of 48 employee vehicles may travel on Cope Road, (MR 598) which links the site with Gulgong and passes through Ulan village. It is acknowledged in the TIA that the total shift change traffic is likely to occur over a period closer to two hours so the above assumption is worst case.

Based on this assessment, the traffic noise level in Ulan village at shift change may increase from an existing maximum of 58.3 dB(A),$L_{eq(1\ hr)}$ to 59.2 dB(A)),$L_{eq(1\ hr)}$. This 0.9 dB increase is less than the 2 dB increase allowed in the ECRTN.

Sleep Disturbance

An assessment of potential sleep disturbance under a worst case operating scenario has predicted levels that are not likely to disturb the sleep of any receiver. With the acoustic bund in place, the noise will be a general mine 'hum' with approximately ± 5dB fluctuation and sources typically identified with sleep disturbance (bucket impacts, dozer tracks, overburden dumping) will be shielded by the OOP1 acoustic bund at times when these sources may be a problem. This will be specifically addressed in the Noise Management Plan.

Mobile plant items will be fitted with broadband reverse alarms which have proven very effective in mitigating the noise impact from reverse beepers. Examples previously tested by Spectrum Acoustics are 10 dB quieter (perceived as half as loud) in the tonal frequency bands of standard alarms. The total noise is spread over many frequency bands so the sound is not tonal, it is more of a "static hiss" that dissipates rapidly with distance.

Blasting

Excessive vibration levels from blasting have been predicted at some receivers close to proposed Pits 2 and 3. Negotiated agreements will need to be reached between these receivers and MCMPL. No blasting criteria exceedances (ground vibration or airblast overpressure) have been predicted in Ulan village. In terms of both noise and blasting, residents in Ulan village will benefit from the fact that the MCP will commence at approximately the nearest point to the village and advance towards the northeast, thereby reducing both noise and vibration levels in the village over a relatively short period of time. Also, the resource is closest to the surface at the western edge of Pit 1 (closest to Ulan village) so the assessed large blasts are unlikely to be required there.

Blasting will occur within 700m of the Moolarben Dam wall. Predicted ground vibration levels at the dam wall from blasting in Pit 1 will be approximately 6.2 mm/s. Since dam walls are constructed to withstand earthquakes, which are far more intense than blasting vibration magnitudes, there is no risk to the dam from MCP blasting activities.

Two rock shelter sites (referred to in the archaeological report as S1MC55 and S1MC56) in the escarpment near Pit 2 will receive vibration levels from blasting in Pit 2 which are well below the 80mm/s limit cited in the Wilpinjong EIS.

In summary, it has been found that through a combination of negotiated agreements with a small number of significantly impacted receivers, an initial period of allowable elevated noise emissions to form an acoustic bund west of Pit 1 during daytime hours, a comprehensive Noise Management Plan incorporating the best practice engineering noise control process, noise monitoring and the opportunity for future negotiations to be conducted, the Moolarben Coal Mine can operate within the applicable noise and vibration guidelines.

1.0 INTRODUCTION

1.1 The Proposal

Moolarben Coal Mines Pty Limited (MCMPL) is seeking to establish a coal mine in the Western Coalfields of NSW, 40 km northeast of Mudgee and 25 km east of Gulgong. The proposal is State Significant Development and therefore the Minister for Planning is the consent authority. Accordingly, a Noise and Vibration Impact Assessment (NVIS) has been conducted for inclusion in the Environmental Assessment (EA) in accordance with the Department of Planning (DoP) Guidelines for the Preparation of an Environmental Impact Statement (EIS) – *Coal Mines and Associated Infrastructure*.

1.2 Study Area

The proposed Moolarben Coal Mine site lies south and east of the existing Ulan Mine and immediately west of the approved Wilpinjong Mine. The project area is characterised by substantial topographic relief, with land elevation ranging from about 400m RL in valleys to over 600m RL on adjacent ridges. The proposed open-cut pits lie adjacent to the western escarpments of the Munghorn Gap Nature Reserve.

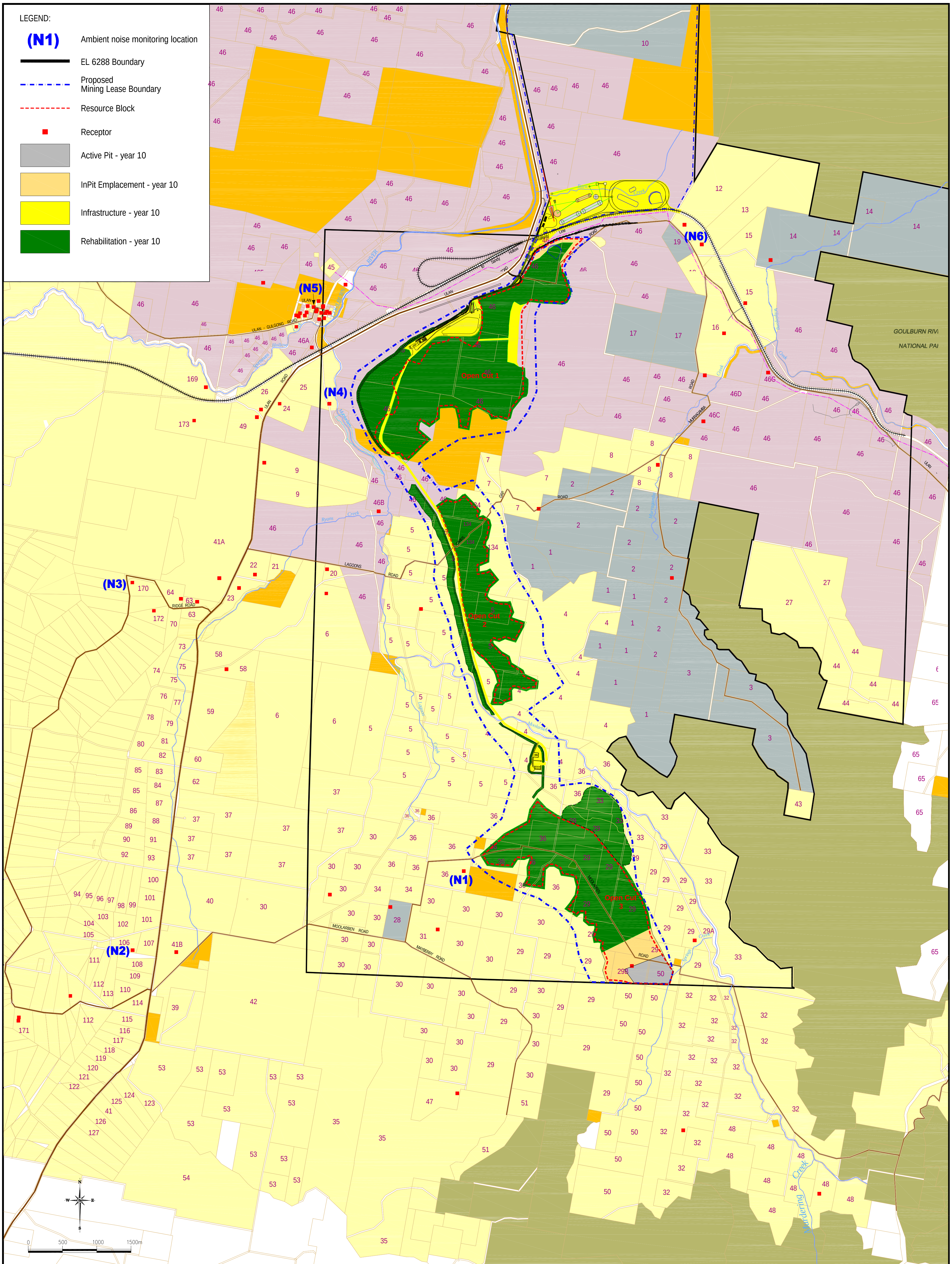
Ambient noise monitoring locations and land ownership as defined in the body of the EA are shown in **Figure 1**. Residential receivers (non-project related) considered in this NVIS are shown in **Table 1**. A more complete description of the project site and surrounds (that is, general aspects unrelated to noise) is given elsewhere in the EA.

1.3 Proposed Operations

The development is to be known as the Moolarben Coal Project (MCP), which comprises an underground mine and three open-cut areas with coal processing facilities and an on-site rail loop.

Infrastructure will be located on both sides of the Gulgong – Sandy Hollow Railway Line. This will comprise coal stockpiling, washing plant and rail loading facilities. A balloon rail loop will enable coal to be transported by rail to either Lithgow or Newcastle.

The underground and open-cut mines would operate concurrently with all coals washed on site in a two-stage Dense Medium Cyclone (DMC) plant yielding up to approximately 10 Mtpa of product coal.



Moolarben Coal Project

Noise Monitoring Locations and Assessed Receivers

SPECTRUM ACOUSTICS

Pegasus Technical

Figure 1

CAD FILE: Figure 1 NPA

TABLE 1

Assessed receivers (per Figure 1).

Receiver	Owner / Description
8	CN & HL Davies "East Lynne"
46C	Ulan Coal Mines Ltd (UCML) "Murragamba" (unoccupied)
46D	UCML (Mitchell)
16	DJ Little & AK Salter "Hillview"
15	L. Green
7	Wallis
13 *(N6)*	PF Renshaw
12	M & J Transport
148	EM Loughrey
160A	Ulan Primary School
168	Ulan Anglican Church
167	F Boyd
160B	Minister of Education
161	S Palmer
159	NA Power
41C	P Libertis
165	RJ Andrew
157 *(N5)*	MJ & JM Power (Project related secure location for noise logger)
154	JM Cashel
155	JA Tortely
156	JA Knox
153	PE Newton
151	Ulan Catholic Church
150	W & K Meredith
158	KE & RA Carlisle
46A	Flannery Centre (UCML)
26	GF Robinson
49	"Olive Lea"
169	"Primo Park"
173	H Richter "Willow Park"
25 *(N4)*	GG Tuck-Lee & S H Symons
24	LK Hoare
5	M & P Swords "The Lagoon"
20	AJ & NN Williamson
6	KC Thompson (vacant land with dwelling entitlement)
22	A Aiton
23	A & E Woodhead
41A	P Libertis "Lancley Downs"
63	BF & B Whitaker
64	JW Goninan & TL Boland
172	T Kimber
170 *(N3)*	T Roberts "Pine Haven"
58	ML & JL Bevege "Kozara"
37	J Szymkarczuk (vacant land with dwelling entitlement)
171	Ridge Rd Railway Museum
106 *(N2)*	TB & JH Reid
41B	P Libertis "Clear Springs"
30	R Cox "Moolarben"
28	D Chinner
31	M Cox "Barcoo"
36 *(N1)*	D & Y Rayner
29B	Mayberry
29A	Mayberry "Croydon"
47	Herbert
32	D & J Stokes "Coonaroo"
48	O'Sullivan

2.0 DESCRIPTION OF TERMS

This section of the report aims to convey an understanding of several commonly used acoustical terms. Various terms are explained in plain language and the effects of certain atmospheric phenomena on noise propagation are discussed. Noise level percentiles are explained with the aid of a diagram of a hypothetical noise signal.

The descriptions in this section are not formal definitions of the terms. Formal definitions may be found in AS1633-1985 "Acoustics – Glossary of terms and related symbols".

2.1 General Terms

Sound Power Level

The amount of acoustic energy (per second) emitted by a noise source. Usually written as "L_w" or "SWL", the Sound Power Level is expressed in decibels (dB) and cannot be directly measured. L_w is usually calculated from a measured sound pressure level.

Sound pressure Level

The "noise level", in decibels (dB), heard by our ears and/or measured with a sound level meter. Written as "SPL", the sound pressure level generally decreases with increasing distance from a source. Noise levels are often written as dB(A) rather than dB. The "A-weighting" is a correction applied to the measured noise signal to account for the ear's ability to hear sound differently at different frequencies. The A-weighted sound pressure level therefore represents the measured (or predicted) noise level as it would be heard by the typical human ear.

Temperature Inversion

An atmospheric state in which the air temperature increases with altitude. Sound travels faster in warmer air than in cold air, so that during an inversion the top of a "sound wave" will move faster than the bottom. This bends (refracts) sound back towards the ground. The result is a "trapping" of sound energy near the ground and an increase in noise levels. Similarly, daytime air temperatures typically reduce with altitude (approximately 1-2 ^{0}C/100m called the adiabatic lapse rate) and sound refracts upward slightly. The result is slightly reduced noise levels compared with a uniform or 'neutral' atmosphere.

Wind Shear

A moving air mass will experience a "friction drag" at the ground in much the same way as a lava flow will flow quickly on top and "roll over" the lava beneath which must drag along the ground. This increasing wind speed with altitude is called “wind shear”.

For a sound wave travelling down wind, the top of the wave moves faster than the bottom and the wave bends towards the ground. However, for a wave travelling into the wind the top of the wave is slowed down more than the bottom is and the wave bends upwards. **Figure 2** shows several examples of how atmospheric effects can bend sound waves.

FIGURE 2
Sound refraction under temperature inversions and wind gradients.

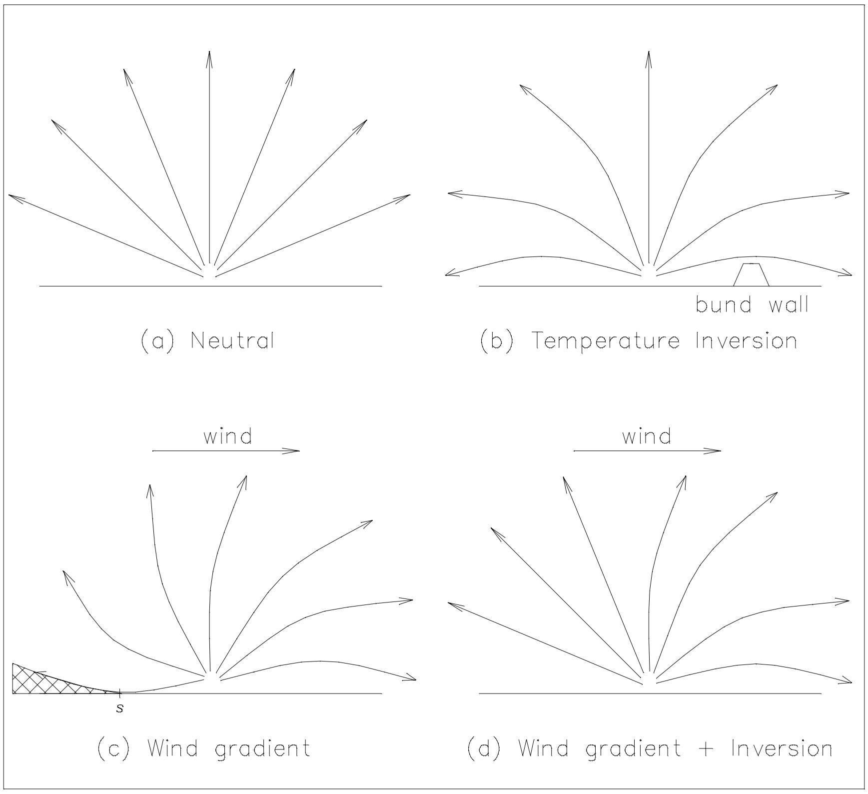


Figure 2 shows that sound rays can be refracted over a barrier (usually a bund wall or small hill) during a temperature inversion, increasing noise levels in the ‘shadow zone’.

Neutral Atmospheric Conditions

An atmosphere that is at a temperature of approximately 23^{0}C from ground level to an altitude of 200m or more. There are no fluctuations in density or humidity and no wind. Such conditions rarely occur, as temperature will usually vary with altitude and there is always movement in various directions in different layers of the atmosphere.

Prevailing Atmospheric Conditions

Atmospheric conditions (with regards to potential effects on noise propagation) which are characteristic of the study area. These will typically include seasonal wind directions and velocities. Temperature inversions will be included as prevailing if they occur, on average, for more than 2 nights per week in winter.

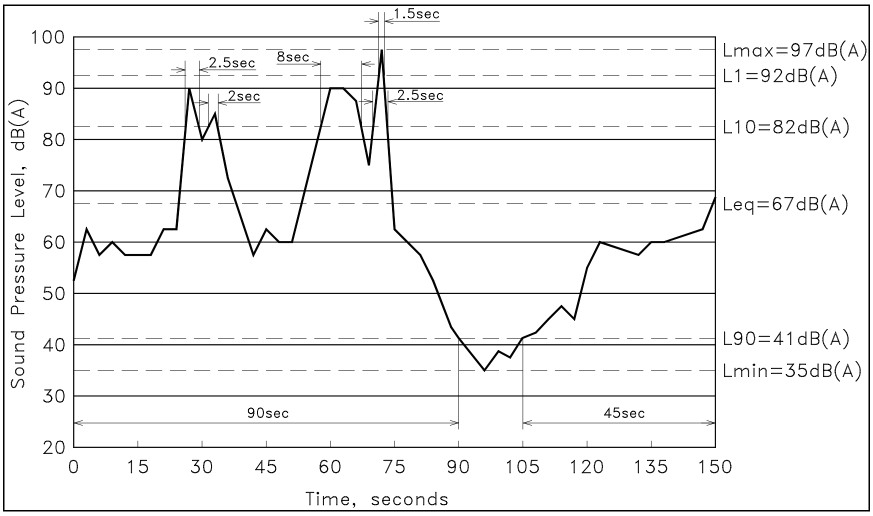
Adverse Atmospheric Conditions

Adverse conditions will include simultaneous winds and temperature inversions, even if the inversions occur for less than 2 nights per week in winter. This represents the worst case scenario for potential noise enhancement due to atmospheric effects.

2.2 Noise Level Percentiles

A noise level percentile (L_n) is the noise level (SPL) in decibels which is exceeded for "n" % of a given monitoring period. Several important L_n percentiles will be explained by considering the hypothetical time signal in **Figure 3**.

FIGURE 3
Hypothetical time-trace of 150-second sound signal.



The signal in Figure 3 has a duration of 2.5 minutes (ie 150 seconds) with noises occurring as follows:

- The person holding the instrument is standing beside a road and hears crickets in nearby grass at a level of around 60 dB (A);
- At about the 30 second mark a motorcycle passes on the road, followed by a car;
- At 60 seconds a truck passes;
- After the truck passes it sounds its air horn at the 73 second mark;
- The crickets are startled into silence as the truck fades into the distance;
- All is quiet until 105 seconds when the crickets slowly start to make noise, reaching full pitch by 120 seconds;
- The measurement stops at 150 seconds, just when an approaching car starts to become audible.

L_{A1} Noise Level

Near the top of Figure 3, there is a dashed line at 92 dB(A). A small spike of 1.5 sec duration extends above this line at around 73 seconds. Since 1.5 sec is 1% of the signal duration (150 seconds), the L_1 (or L_{A1} to signify A-weighting) noise level of this sample is 92 dB(A) and is from trhe truck's air horn. The L_1 percentile is often called the *average peak noise level* and is used by the NSW Department of Environment and Conservation (DEC) as a measure of potential disturbance to sleep.

L_{A10} Noise Level

The dashed line at 82 dB(A) is exceeded for four periods of duration 2.5 sec, 2 sec, 8 sec and 2.5 sec, respectively. The total of these is 15 sec, which is 10% of the total sample period. Therefore, the L_{A10} noise level of this sample is 82 dB(A). The L_{A10} percentile is called the *average maximum noise level* and has been widely used as an indicator of annoyance caused by noise.

L_{A90} Noise Level

In similar fashion to L_{A1} and L_{A10}, Figure 3 shows that the noise level of 41 dB(A) is exceeded for 135 seconds (90 + 45 =135). As this is 90% of the total sample period, the L_{A90} noise level of this sample is 41 dB(A). The L_{A90} percentile is called the *background noise level*.

L_{Aeq} Noise Level

Equivalent continuous noise level. As the name suggests, the L_{Aeq} of a fluctuating signal is the continuous noise level which, if occurring for the duration of the signal, would deliver equivalent acoustic energy to the actual signal. L_{Aeq} can be thought of as a kind of 'average' noise level. Recent research suggests that L_{Aeq} is the best indicator of annoyance caused by industrial noise and the DEC *NSW Industrial Noise Policy* (INP) takes this into consideration.

L_{Amax} and L_{Amin} Noise Levels

These are the maximum and minimum SPL values occurring during the sample. Reference to Figure 3 shows these values to be 97 dB(A) and 35 dB(A), respectively.

3.0 THE EXISTING ENVIRONMENT

The existing meteorological and acoustic environments have been studied as part of this EA. The acoustical climate has been quantified at six representative residential locations around the project site.

3.1 Meteorology

The atmospheric conditions most relevant to noise assessments are temperature inversions, gentle winds (indicative of possible wind shear) and relative humidity. Meteorological data for weather monitoring stations near the Rayner residence (*N1*) and in Ulan village (*N5*) have been analysed by Holmes Air Sciences (HAS) and results provided for this noise impact assessment. These data are discussed in greater detail in the EA document. The following data are the most significant with respect to noise propagation:

- Extremes of relative humidity (RH) are rarely experienced. For modelling purposes, a value of 70% RH was adopted;

- Mild temperature inversions (F class Pasquill stability) occur during more than 30% of nights in winter at both locations. An inversion strength of +3^{0}C/100m was adopted in the noise models (as per procedures in the INP, Appendix C). Meteorological data from the weather station in Ulan village suggest that winds are predominantly from the northeast under F class stability conditions. A 2m/s wind from the NE was therefore modelled with the temperature inversion for the Pit 1 assessment. At the Rayner weather station, winds coinciding with temperature inversions are predominantly from the southeast, so this drainage wind was modelled with the inversion for assessment of Pits 2 and 3.

- Gradient winds (vector component up to 3 m/s) are predominantly east-south easterly in summer/autumn and south westerly in winter/spring at both weather stations. A wind speed of 3m/s (at 10m above ground level) from each of these directions was modelled to determine the noise impact under each of these 'prevailing' wind conditions.

Typical calm daytime conditions of no wind, 70% RH and -1^{o}C/100m vertical temperature gradient (ie, dry adiabatic lapse rate, DALR) was also modelled to represent daytime noise levels under calm conditions.

3.2 Ambient Noise Levels

Ambient noise monitoring was conducted at six residential receivers surrounding the project site during the period 12 July 2005 to 27 July

2005 (refer to Figure 1 for noise monitoring locations *N1*-*N6*). Existing L_{Aeq} and L_{A90} (Rating Background levels, RBL) levels are summarised in **Table 2**. Noise data charts are shown in **Appendix B**.

TABLE 2
Measured ambient noise levels (July 2005).

Location	L_{Aeq}, period			L_{A90}, period		
	Day	Evening	Night	Day	Evening	Night
R13 Renshaw *N6*	49	48	46	29	31	29
R25 Tuck-Lee *N4*	55	44	44	33	36	34
R36 Rayner *N1*	43	37	42	28	26	24
R157 Power (Ulan) *N5*	55	53	51	42	41	40
R170 Roberts *N3*	49	45	39	34	33	32
R106 Reid *N2*	47	40	37	27	24	23

For the purposes of setting noise criteria relative to ambient noise levels, the INP considers a Rating Background Noise level (RBL) which is equal to:

- The measured background noise level if this is >=30 dB(A),L_{90}, or
- 30dB(A) if the measured level is <30 dB(A),L_{90}.

The contribution of existing industrial and transport noise sources to the measured ambient L_{Aeq} levels is estimated as follows:

Renshaw
No industrial noise sources observed nearby and no industrial noise audible during deployment or retrieval of noise logger. The nearby rail line may have contributed to L_{Aeq} levels, but this is generally not quantifiable in an unattended noise survey.

Tuck-Lee
Constant noise hum from nearby coal processing plant audible (and dominant) during deployment and retrieval of noise logger. Estimated industrial noise level (L_{Aeq}) is 35 dB(A), being 2 dB above the minimum background level of 33 dB(A).

Rayner
No industrial or transportation noise sources observed nearby and no industrial noise audible during deployment or retrieval of noise logger.

Power (Ulan village)
Constant noise hum from nearby coal processing plant audible (and dominant) during deployment and retrieval of noise logger. While the measured total night-time L_{Aeq} level was 51 dB(A), the industrial noise level (L_{Aeq}) is conservatively estimated at 42 dB(A), being 2 dB above the night time background level of 40 dB(A),L_{90}.

Roberts

The noise logger "flat-lines" at 32dB(A),L_{90} which is well above the instrument's noise floor, suggesting a constant noise source. Coal processing plant noise was faintly audible on deployment of the logger. Estimated L_{Aeq} level from industrial noise is 33 dB(A).

Reid

No industrial or transportation noise sources observed nearby and no industrial noise audible during deployment or retrieval of noise logger.

Based on these considerations, **Table 3** provides a summary of measured RBL's and estimated L_{Aeq} noise levels from industrial noise sources at the six monitored locations. Evening/night RBL's have been reduced to equal daytime RBL's where the logger data showed higher levels during the evening/night than during the day.

TABLE 3
Estimated industrial noise levels and Rating Background Levels (RBL).

Location	L_{Aeq} (industrial) , period			RBL (L_{A90}), period		
	Day	Evening	Night	Day	Evening	Night
R13 Renshaw *N6*	N/A	N/A	N/A	30	~~31~~ 30	30
R25 Tuck-Lee *N4*	35	35	35	33	~~35[1]~~ 33	~~34~~ 33
R36 Rayner *N1*	N/A	N/A	N/A	30	30	30
R157 Power (Ulan) *N5*	42	42	42	42	41	40
R46A Flannery Centre	41	41	41	41	40	39
R49 "Olive Lea"	35	35	35	33	~~35[1]~~ 33	~~34~~ 33
R26 Robinson	35	35	35	33	~~35[1]~~ 33	~~34~~ 33
R169 "Primo Park"	34	34	34	32	~~34~~ 32	~~33~~ 32
R170 Roberts *N3*	33	33	33	33	33	32
R106 Reid *N2*	N/A	N/A	N/A	30	30	30

3.3 Additional Noise Monitoring

Supplementary short-term attended noise monitoring conducted by Spectrum Acoustics on 15-16 August 2006 found that the contribution to the background noise level (L_{A90}) from Ulan Coal Mine at *R49* ("Olive Lea") was 42 dB(A). This was 6 dB lower than a background level of 48 dB(A) measured in Ulan village (at *R157*). The measurements also found that the difference between L_{Aeq} and L_{A90} levels was 1.2 dB in Ulan village and 2.2 dB at *R49* ("Olive Lea") illustrating the relatively constant nature of noise emissions from Ulan Coal Mine's surface facilities.

Based on these measurements, noise logger results at the Tuck-Lee residence have been adopted for *R49* ("Olive Lea") and *R26* (Robinson) as the 6 dB difference between background noise levels is reflected in the critical evening and night periods. Receiver *R169* ("Primo Park") is slightly further west of Ulan Coal Mine than *R49* ("Olive Lea") (refer to Figure 1) and estimated noise levels from Ulan Coal Mine at *R169*

("Primo Park") are shown in Table 3 as being 1 dB lower at 34 dB(A),L_{eq} and 32/34/33 dB(A),L_{90}.

The noise from UCML was measured to be approximately 1 dB lower at *R46A* (The Flannery centre) than in the centre of Ulan village. The adopted UCML noise levels for day/evening/night at this location are therefore 41 dB(A),L_{eq} and 41/40/39 dB(A),L_{90} in Table 3.

During the August 2006 attended survey, the temperature was -1^{0}C at 5:50 am and the air was clear and calm at ground level with clouds moving in from the east. These would have been adverse conditions with respect to noise emissions from UCML in Ulan village. While the $L_{Aeq(15 min)}$ from UCML was 48-49 dB(A), individual trucks backing up to the ROM hopper raised levels to 56-59 dB(A) for periods of 10-15 seconds every 2-3 minutes.

Measurements taken later in the morning at 8:30 am recorded the same noise levels. Applying a 'modifying correction factor' of +5 dB (see Figure 4 in the following section) for "intermittent noise" gives an assessable night time noise level of 53-54 dB(A),$L_{eq(15min)}$ from UCML in Ulan village.

Another attended survey conducted by Global Acoustics in November 2005 (commissioned by UCML in response to a complaint) recorded noise levels of 46-49 dB(A),$L_{eq(15 min)}$ as a general noise 'continuum' from UCML. Conditions at the time (between 9 and 10:30 pm) were reported as 6/8 overcast, 17^{0}C with no wind. These represent approximately neutral conditions with respect to noise emissions.

These attended results suggest that the estimate of 42 dB(A),L_{eq} from UCML in Ulan village in Table 3 above is a significant underestimation of UMCL noise levels that are known to occur under both adverse and neutral conditions.

Also, while a noise level of 42 dB(A),$L_{eq(15min)}$ was recorded at *R49* ("Olive Lea") during the August survey, the difference between C-weighted and A-weighted levels was 23 dB which attracts a +5dB "low frequency noise" correction factor. This suggests that the assessable noise level from UCML at this location was, and may often be, as high as 47 dB(A),$L_{eq(15min)}$ under adverse conditions.

Additional attended and unattended noise measurements were conducted by Spectrum Acoustics on 14-15 November 2006. A Svan 949 data logger was placed at the Power residence (*R157* in Ulan village) and simultaneous hand-held measurements were taken at several locations with a Bruel & Kjear 2260 Observer sound level meter.

At the time of the survey, winds were generally from the west gusting up to 5 m/s or more, thereby minimising the noise level from UCML to the NE and increasing environmental noise levels at the monitoring locations.

Table 4 shows a summary of valid noise measurements that were taken in Ulan village on the afternoon of 14 November and the morning of 15 November 2006 when the wind speed was less than 5 m/s. The results include a description of identified noise sources at the attended monitoring locations. Where UCML has been identified as a noise source, its contribution is shown in brackets.

TABLE 4
Measured noise levels in Ulan village on 14-15 November 2006. (Spectrum Acoustics)

Time/date	Location	$L_{Aeq(15min)}$	Source(s)	$L_{A90(15min)}$	Source(s)
12:20 14/11	*R157* Power	49.0	N/A	34.3	N/A
	R151 Catholic Church	43.1	Traffic, wind	32.6	Wind
12:48 14/11	*R157* Power	47.1	N/A	33.8	N/A
	R160A Ulan School	48.2	Birds, insects	37.3	Insects, wind
06:08 15/11	*R157* Power	49.0	N/A	45.7	N/A
	R172 Kimber	43.8	Birds	31.1	UCML (28)
06:36 15/11	*R157* Power	51.0	N/A	37.2	N/A
	R172 Kimber	39.2	Birds	30.1	UCML (29)
07:06 15/11	*R157* Power	48.6	N/A	38.8	N/A
	R160A Ulan School	47.0	Traffic, birds	39.9	UCML (39.9)
07:44 15/11	*R157* Power	43.3	N/A	41.7	N/A
	R153 Newton	48.2	Bus, wind	40.5	UCML (38)

During the survey, audible noise from UCML was a low hum with little variation. No coal trucks were running (visually observed) and no coal was on the processing line. The mine was therefore operating at a much lower noise output level than during the November 2005 and August 2006 attended surveys, when coal trucks and the crushing plant were major noise sources. These major sources were also not observed during deployment and retrieval of the noise loggers in July 2005.

This low level of activity at UCML combined with the favourable westerly wind resulted in lower measured noise levels at receivers west of UCML than have previously been measured under different operational activities and weather conditions.

In summary, UCML noise levels in Ulan village have been measured as follows:

Date	dB(A),L_{Aeq}	dB(A),L_{90}	weather	Observed UCML operations
July 2005	42 (estimate)	40-42	neutral	CHPP hum
Nov 05	46-49	44-47	neutral	trucks, crushers, hum
Aug 06	48-50	45-48	adverse	trucks, crushers, hum
Nov 06	40-42 (est.)	38-40	noise-reducing	CHPP hum

These results show that the July 2005 noise logging results presented above underestimate the background noise level from UCML in full operation under neutral conditions (Nov 05) by 4-5 dB. The L_{Aeq} level is underestimated by up to 7 dB.

Under noise-reducing conditions (wind from the west, Nov 06) L_{A90} and L_{Aeq} levels from UCML CHPP hum in Ulan village were 2dB lower than the July 2005 values. However, noise levels 2-3 dB higher than the July 2005 values are expected under noise-reducing conditions when UCML trucks and crushing plant are operating.

Short-term background noise levels in Ulan village were 5-7 dB higher than the July 2005 values under adverse conditions and when UCML was in full operation. Similarly, L_{Aeq} levels were 6-8 dB higher (ie up to 50 dB(A)) than the July 2005 estimated values under adverse conditions (not including the applicable +5dB correction for “intermittent noise” at night).

4.0 OPERATIONAL NOISE (INITIAL DAYTIME OPERATIONS)

During the first six months of the project life, topsoil and overburden will be removed from the western end of Pit 1 (closest to Ulan village) and deposited to form a 15m high acoustic bund between Pit 1 and the village. This will occur during daytime hours only. During the first 12 months of the project life construction of surface facilities will take place, also during daytime hours only. Since this is longer than six months, “construction” noise criteria defined in the DEC *Environmental Noise Control Manual* (ENCM) would not apply and all activities on site would be subject to operational noise criteria established under the INP.

Noise impacts during the initial period of daytime operations are assessed below.

4.1 Operational Noise Criteria

The INP specifies two noise criteria for the determination of potential impacts: an *intrusive criterion* which limits L_{Aeq} noise levels from the industrial source to a value of ‘background plus 5dB’ and an *amenity criterion* which aims to protect against excessive noise levels where an area is becoming increasingly developed.

Both DEC and DoP have requested that Ulan village be assessed as a ‘rural’ noise amenity area. This assessment follows that recommendation, although the history of high mining noise levels in Ulan village and the close proximity to Ulan Coal Mine suggest a more urban acoustic environment. Table 2.1 of the INP recommends that

Acceptable Noise Levels (ANL) from industrial sources should not exceed the values shown in **Table 5** at rural residential receivers. ANL's for sensitive non-residential receivers within Ulan village (ie the school and churches) are also shown.

TABLE 5
Recommended acceptable industrial noise levels for various receiver types. (From Table 2.1, INP)

Noise Amenity Area	Time of day	Acceptable noise level from industrial sources, dB(A),$L_{eq(period)}$
Rural	Day	50
	Evening	45
	Night	40
School Classroom (internal)	Noisiest 1-hour period when in use	40
Church (internal)	When in use	40

The existing industrial noise levels in Table 3 are compared with the ANLs in Table 5 to determine the noise amenity criteria for a new noise source via rules given in INP Table 2.2, summarised below in **Table 6**.

For the non-residential receivers, it is generally accepted by DEC that the facade of a typical light framed building with the windows partly open to allow adequate air flow will attenuate approximately 10 dB(A). The cumulative industrial noise level outside the Ulan Public School and both churches must, therefore, not exceed an effective ANL (external) of 50 dB(A),L_{eq}.

TABLE 6
Reproduction of Table 2.2, INP.

Total existing L_{Aeq} noise level from Industrial sources, dB(A)	Maximum L_{Aeq} noise level for noise from new sources alone, dB(A)
Greater than or equal to ANL plus 2	If existing noise level is likely to decrease in future: ANL minus 10 If existing noise level is unlikely to decrease in future: existing level minus 10
ANL + 1	ANL - 8
ANL	ANL – 8
ANL – 1	ANL – 6
ANL – 2	ANL – 4
ANL – 3	ANL – 3
ANL – 4	ANL – 2
ANL – 5	ANL – 2
ANL – 6	ANL – 1
Less than ANL – 6	ANL

An example of an amenity criterion calculation is given below for the daytime period within Ulan Village.

Existing daytime industrial noise (Table 3):	42 dB(A),L_{eq}
ANL Daytime, 'rural' (Table 5):	50 dB(A),L_{eq}
Existing industrial noise equals:	ANL – 8
Amenity criterion (Table 6):	50 dB(A),L_{eq} (ie = ANL)

Intrusive (RBL + 5dB) and amenity criteria for assessed receivers are summarised in **Table 7**. The project-specific noise levels (PSNL) are defined in the INP as the lower of the intrusive and amenity criteria in each time period. Changes in the daytime noise criteria resulting from a review of the EA conducted by DEC are reflected in Table 7.

TABLE 7
Intrusive and amenity noise criteria and PSNL's for initial 12 month period of daytime operations.

Receiver/Location	Intrusive criterion, dB(A),$L_{eq(15\ min)}$	Amenity criterion, dB(A),$L_{eq(period)}$	Project Specific Noise Levels
R13 Renshaw *N6*	35	50	35 dB(A),$L_{eq(15\ min)}$
R25 Tuck-Lee *N4*	38	50	38 dB(A),$L_{eq(15\ min)}$
R36 Rayner *N1*	35	50	35 dB(A),$L_{eq(15\ min)}$
R157 Power (Ulan) *N5*	47	50	47 dB(A),$L_{eq(15\ min)}$
R160A Ulan School	N/A	50	50 dB(A),$L_{eq(1\ hr)}$
R168 Ulan Anglican Church	N/A	50	50 dB(A),L_{eq}
R151 Ulan Catholic Church	N/A	50	50 dB(A),L_{eq}
R46A Flannery Centre	46	50	46 dB(A),$L_{eq(15\ min)}$
R25 Tuck-Lee	38	50	38 dB(A),$L_{eq(15\ min)}$
R49 "Olive Lea"	38	50	38 dB(A),$L_{eq(15\ min)}$
R26 Robinson	38	50	38 dB(A),$L_{eq(15\ min)}$
R169 "Primo Park"	37	50	37 dB(A),$L_{eq(15\ min)}$
R170 Roberts *N3*	~~39~~ 38	50	38 dB(A),$L_{eq(15\ min)}$
R106 Reid *N2*	35	50	35 dB(A),$L_{eq(15\ min)}$
All other receivers	35	50	35 dB(A),$L_{eq(15\ min)}$

Chapter 4 of the INP also lists several "modifying factor" adjustments to be added to predicted (or measured) noise levels if the noise contains annoyance characteristics such as tones and low frequency content, or if the noise is tonal or intermittent in nature. A scanned copy of INP Table 4.1 describing these modifying factors is shown in **Figure 4** below.

FIGURE 4
Scanned copy of INP modifying factor corrections.

Table 4.1. Modifying factor corrections
(See definitions in *Section 4.2*)

Factor	Assessment/ measurement	When to apply	Correction[1]	Comments
Tonal noise	One-third octave or narrow band analysis	Level of one-third octave band exceeds the level of the adjacent bands on both sides by: —5 dB or more if the centre frequency of the band containing the tone is above 400 Hz —8 dB or more if the centre frequency of the band containing the tone is 160 to 400 Hz inclusive —15 dB or more if the centre frequency of the band containing the tone is below 160 Hz	5 dB[2]	Narrow-band frequency analysis may be required to precisely detect occurrence
Low frequency noise	Measurement of C-weighted and A-weighted level	Measure/assess C- and A-weighted levels over same time period. Correction to be applied if the difference between the two levels is 15 dB or more	5 dB[2]	C-weighting is designed to be more responsive to low-frequency noise
Impulsive noise	A-weighted fast response and impulse response	If difference in A-weighted maximum noise levels between fast response and impulse response is greater than 2 dB	Apply difference in measured levels as the correction, up to a maximum of 5 dB.	Characterised by a short rise time of 35 milliseconds (ms) and decay time of 1.5 s
Intermittent noise	Subjectively assessed	Level varies by more than 5 dB	5 dB	Adjustment to be applied for **night-time only.**
Duration	Single-event noise duration may range from 1.5 min to 2.5 h	One event in any 24-hour period	0 to –20 dB(A)	The acceptable noise level may be increased by an adjustment depending on duration of noise. (See *Table 4.2*)
Maximum adjustment	Refer to individual modifying factors	Where two or more modifying factors are indicated	Maximum correction of 10 dB(A)[2] (excluding duration correction)	

Notes:
1. Corrections to be added to the measured or predicted levels.
2. Where a source emits tonal and low-frequency noise, only one 5-dB correction should be applied if the tone is in the low-frequency range.

4.2 Noise Impact Assessment Procedure

The assessment of operational noise was conducted using RTA Technology's Environmental Noise Model (ENM) v3.06. All major noise producing items listed in Section 4.4.7, Table 4.4 of the EA were modelled at their known (for stationary sources such as the rail load-out and surface facilities) or most exposed (for mobile sources such as dump trucks) positions and noise contours and/or point calculations were generated for the surrounding area.

4.2.1 Noise Sources

Noise data for significant sources associated with the construction phase of the Project were obtained from Spectrum Acoustics' extensive database of measured coal mining plant items. All data used were for machinery identical to that proposed for MCP (CAT 793/789 haul trucks, Hitachi EX 5500/2500 excavators, CAT D10/D11 dozers, etc.)

Sound power levels and heights above ground level of construction noise sources used in the modelling are shown below in **Table 8**. Preliminary modelling has shown that construction of surface facilities (CHPP, rail loop etc) would be minimal or inaudible at all receivers in and around Ulan village. The loudest activity would be construction of the environmental bund west of Pit 1, so the construction noise assessment has focussed on this activity.

TABLE 8
Construction noise source sound power levels. These are calculated 15-minute L_{Aeq} levels as used in the noise model.

Construction noise source	Sound power level dB(A),$L_{eq(15\ min)}$	Source height above ground level, m
D11 dozer on dump	115	3
Overburden drill	114	2
Overburden excavator and trucks	116	5
Overburden dump (per pit)*	115	3
Overburden haul (on slope)*	115	3
Overburden haul (on flat)*	113	3
Small excavator (at rail loop)	110	3
Grader (at rail loop)	111	2

* All sources involving trucks assume 8-10 truck pass-bys per 15 minute period and were calculated from maximum pass-by levels and the total number of trucks in Table 4.4 of the EA. Haulage sources placed at approximately 500m intervals on haul routes.

4.2.2 Modelled Scenarios

As discussed in Section 3.1, modelling was conducted for the following atmospheric conditions:

- *Daytime 'neutral'* – Air temperature 20^{0}C, 70% relative humidity (RH), no wind, -1^{o}C/100m vertical temperature gradient (boundary layer adiabatic lapse);
- *Prevailing wind (spring/summer)* – Air temperature 20^{0}C, 70% R.H., 3m/s wind from ESE.
- *Prevailing wind (autumn/winter)* – Air temperature 20^{0}C, 70% R.H., 3m/s wind from SW.

Temperature inversions have not been modelled for the daytime construction activities in accordance with INP recommendations.

Point calculations and noise contours were generated for bund construction activities under each of the three atmospheric conditions discussed above. The scenarios included two overburden excavators and CAT 789 haul trucks at ground level at the southwestern end of Pit 1, overburden dumping (with dozer) along the western edge of the out of pit emplacement (OOP1) at the closest point to Ulan village. No coal haulage or processing is assessed in this construction scenario. Noise sources locations are shown in **Figure 5 in Appendix A**.

4.3 Predicted Daytime Noise Levels

As discussed above, bund formation (excavation, overburden removal and emplacement) would initially occur at natural ground level with the western edge of OOP1 being formed to a height of 15m.

Predicted noise levels when emplacing overburden on OOP1 at 15m above natural ground level (with haul road along the top of the bund) are summarised in **Table 9**. Exceedances of the INP derived PSNL's (Table 6) are in bold type. Noise contours for this scenario are shown in **Figures 9 to 12** in **Appendix A**.

Supplementary noise modelling (point calculations only) has shown that construction of surface facilities during the initial 18 months will produce noise levels less than 35 dB(A) at all receivers except *R12* (M & J Transport) and *R13* (Renshaw). Results for rail loop construction are included for these two locations in Table 9 but are not reflected in the noise contours of Figures 9 to 12.

TABLE 9
Predicted construction noise levels, dB(A),Leq(15-min). Dumping of overburden is at 15m above natural ground level on the western edge of OOP1.

Receiver	Description	Meteorological condition			PSNL
		Calm	ESE wind	SW wind	
8	CN & HL Davies	<25	<25	<25	35
46D	UCML (Mitchell)	<25	<25	<25	35
16	DJ Little & AK Salter	<25	<25	<25	35
15	L. Green	<25	<25	<25	35
7	Wallis	<25	<25	<25	35
13 *(N6)*	PF Renshaw	30	28	33	35
12	M & J Transport	32	31	35	35
148	EM Loughrey	41	46	41	47
160A	Ulan Primary School	41	46	41	50
168	Ulan Anglican Church	41	46	41	50
167	F Boyd	41	46	41	47
160B	Minister of Education	41	46	41	47
161	S Palmer	41	46	41	47
159	NA Power	41	46	41	47
41C	P Libertis	41	46	41	47
165	RJ Andrew	41	46	41	47
157 *(N5)*	MJ & JM Power	41	46	41	47
154	JM Cashel	40	45	40	46
155	JA Tortely	40	45	40	46
156	JA Knox	40	45	40	46
153	PE Newton	40	45	40	46
151	Ulan Catholic Church	40	45	40	50
150	W & K Meredith	40	45	40	46
158	KE & RA Carlisle	40	45	40	46

46A	Flannery Centre	45	46	42	46
26	GF Robinson	43	44	34	38
Table 9 (cont'd)					
Receiver	Description	Meteorological condition			PSNL
		Calm	ESE wind	SW wind	
49	"Olive Lea"	43	44	34	38
169	"Primo Park"	39	41	30	37
173	H Richter "Willow Park"	39	41	30	37
25 *(N4)*	GG Tuck-Lee	52	53	48	38
24	LK Hoare	46	47	40	38
5	M & P Swords	27	37	27	35
20	AJ & NN Williamson	30	39	28	35
6	Thomson[1]	30	39	28	35
22	A Aiton	29	36	<25	38
23	A & E Woodhead	27	35	<25	38
41A	P Libertis	<25	35	<25	38
63	BF & B Whitaker	<25	31	<25	38
64	JW Goninan & TL Boland	<25	31	<25	38
172	T Kimber	<25	28	<25	38
170 *(N3)*	T Roberts	<25	25	<25	38
58	ML & JL Bevege	<25	26	<25	35
37	J Szymkarczuk[1]	<25	<25	<25	35
All other receivers		<< 35			35

[1] Assessed to most likely dwelling location adjacent to *R20* Williamson.
[2] Noise level exceeded over 25% of vacant land.

4.4 Recommendations

The results shown in Table 8 show several exceedances of the PSNL's as summarised in **Table 10**.

TABLE 10
Predicted PSNL exceedances during construction of Pit 1 acoustic bund.

Predicted exceedances of construction noise criteria		
0 – 2 dB	Between 2 and 5 dB	5dB or greater
R5 Swords	*R169* "Primo Park" *R20* Williamson *R6* Thompson	*R49* "Olive Lea" *R26* Robinson *R25* Tuck-Lee *R24* LK Hoare

It will be shown in following sections that the environmental bund along the western edge of OOP1 would provide noise attenuation of up to 7 dB at the receivers in Table 10 for continued mining operations in Pit 1 under adverse meteorological conditions. As such, the bund would serve an essential noise reduction purpose and its establishment could be subject to noise criteria higher than the PSNL's for a period not exceeding six months.

It is recommended that predicted noise levels up to 5 dB above the PSNL be set as the noise criteria for the initial six month construction period for the bund. At locations where the predicted noise level is more than 5 dB above the PSNL, the noise criterion should be limited to the PSNL + 5 dB. These proposed construction noise criteria and PSNL's are summarised in **Table 11**.

TABLE 11
Proposed noise criteria during initial six month period of bund construction and PSNL's for continued daytime construction activities.

Receiver	Description	Proposed noise criteria dB(A),$L_{eq(15min)}$	
		0-6 mths	6-12 mths
8	CN & HL Davies	35	35
46D	UCML (Mitchell)	35	35
16	DJ Little & AK Salter	35	35
15	L. Green	35	35
7	Wallis	35	35
13 *(N6)*	PF Renshaw	35	35
12	M & J Transport	35	35
148	EM Loughrey	46	46
160A	Ulan Primary School[1]	36	36
168	Ulan Anglican Church[1]	36	36
167	F Boyd	46	46
160B	Minister of Education	46	46
161	S Palmer	46	46
159	NA Power	46	46
41C	P Libertis	46	46
165	RJ Andrew	46	46
157 *(N5)*	MJ & JM Power	46	46
154	JM Cashel	45	45
155	JA Tortely	45	45
156	JA Knox	45	45
153	PE Newton	45	45
151	Ulan Catholic Church[1]	35	35
150	W & K Meredith	45	45
158	KE & RA Carlisle	45	45
46A	Flannery Centre	46	46
26	GF Robinson	43	38
49	"Olive Lea"	43	38
169	"Primo Park"	41	37
173	H Richter "Willow Park"	41	37
25 *(N4)*	GG Tuck-Lee	Pit 1 Noise Acquisition Zone	
24	LK Hoare	Pit 1 Noise Acquisition Zone	
5	M & P Swords	37	35
20	AJ & NN Williamson	39	35
6	Thompson	39	35
22	A Aiton	38	38
23	A & E Woodhead	38	38
41A	P Libertis	38	38
63	BF & B Whitaker	38	38
64	JW Goninan & TL Boland	38	38
172	T Kimber	38	38
170 *(N3)*	T Roberts	38	38
58	ML & JL Bevege	35	35
37	J Szymkarczuk[2]	35	35
All other receivers		35	35

[1] Internal noise criterion equal to predicted external level minus 10 dB.
[2] Noise level exceeded over 25% of vacant land.

Noise levels greater than (PSNL + 5 dB) are predicted at *R25* (Tuck-Lee) and *R24* (Hoare) under most atmospheric conditions placing these receivers in a noise affectation zone.

It should be noted that while noise levels up to 46 dB(A) have been predicted in Ulan village and at *R46A* (The Flannery Centre) during the first six months of bund formation, the level would drop to 35 dB(A) or lower for the remainder of the 12 month period when surface facilities would be constructed.

Noise levels at *R169* ("Primo Park"), *R49* ("Olive Lea), *R26* (Robinson), *R6* Thompson and *R47* (Williamson) and all other receivers further to the SW will also be well below the noise criteria for most of the 6 month construction period between completion of the acoustic bund and commencement of 24-hour mining.

5.0 OPERATIONAL NOISE (24-HOUR OPERATIONS)

After the initial six month period of bund formation and total 12 month period of surface infrastructure construction it is proposed that 24-hour coal production, processing and transportation would commence. This section of the report establishes noise criteria for the day, evening and night-time operations and assesses the consequent noise impact of the extended operating hours.

5.1 Operational Noise Criteria

The daytime noise criteria established in Section 4.1 are based upon formal application of the INP under the current acoustic environment which is dominated by noise from the Ulan Coal Mining Limited (UCML) surface facilities adjacent to Ulan village.

The original version of this NVIS sought to derive night time criteria for MCP based on the assumption that UCML would reduce its noise level in Ulan village to 35 dB(A) under a Noise Reduction Plan (NRP). DEC responded to this approach by highlighting the error in assuming that the 35 dB(A) criterion applies to the entire UCML site. In their presentation to the IHAP in Mudgee on 9 November 2006, DEC indicated that MCP has no control over noise emissions from UCML and noise levels "may or may not decrease in the future".

A written submission from UCML in response to the MCP EA suggested that noise criteria in Ulan village had not been correctly set in the EA and that "proper application of the INP process" would result in a MCP noise criterion of 32 dB(A),$L_{eq(9hr)}$ at night.

This criterion proposed by UCML is 10 dB below the *existing* UCML noise levels of 42 dB(A) in Ulan village and, under "proper application of the INP process", has been derived using Tables 2.1 and 2.2 of the INP on the assumption that existing UCML noise levels in Ulan village are *unlikely* to decrease in the future.

In their presentation to IHAP on 9 November 2006, UCML's acoustic consultant informed the Panel that a Draft NRP had been produced with a proposed night-time noise goal for noise emissions from the entire UCML site of 37-39 dB(A),$L_{eq(9hr)}$ to be achieved in a period of 3-5 years. UCML's consultant also said that it would be "difficult to reduce noise substantially" from such a large operation with numerous noise sources.

This comment from UCML's acoustic consultant, the UCML proposed criterion of 32 dB(A) for MCP based on an assumption that UCML noise levels are *unlikely to decrease* in the future and the DEC comment that UCML noise levels "may or may not" decrease in the future do not strongly support the likelihood that noise emissions from UCML will decrease in the future. In the interests of 'reasonableness', there would need to be a high degree of certainty that UCML noise levels will substantially decrease in the future to justify imposing a 30 dB(A) noise criterion on MCP, which is up to 20 dB(A) below measured existing UCML levels.

Based on this recent information from both UCML and DEC, it is the author's belief that, in terms of potential effectiveness as opposed to "theoretical" noise goals in a NRP, it is unlikely that a 'reasonable and feasible' noise reduction program will be implemented and result in a substantial decrease in UCML's total noise emissions. Noise criteria for the evening and night time MCP operations will therefore be based on the assumption that existing noise levels from UCML, as measured during July 2005, are unlikely to decrease in the future.

In their written response to the MCP EA, UCML stated that "UCML intends to increase production [from approximately 4.7 Mtpa] to its approved production level [of 10 Mtpa] which leads to a significant underestimation of the potential maximum background dust levels in the area".

More than doubling the coal production levels at UCML will increase noise emissions from the site. This supports the assumption that UCML noise levels are unlikely to decrease in the future, even if the existing levels could be reduced by 3dB through a noise reduction program. This potential additional noise will not be taken into account when setting criteria for MCP.

Since the industrial noise environment in Ulan village varies with the meteorological conditions, this assessment will consider the measured variability of noise emissions from UCML under various meteorological conditions and will propose noise criteria for MCP relative to these noise levels.

Based on the measured UCML noise levels presented in Section 3.3 above, the noise contribution from UCML in Ulan village, when trucks are running and ROM coal is being processed, under the prevailing meteorological conditions are summarised below. Where a range of measured levels is shown in Section 3.3, the lower value in the range has been used.

Receivers in Ulan village closer to UCML than *R157* Power, (ie the noise logger location):

	$L_{Aeq(all\ periods)}$	$L_{A90(all\ periods)}$
Winds from west:	44 dB(A)	42 dB(A)
Neutral/calm:	46 dB(A)	44 dB(A)
Winds from east or inversions:	48 dB(A)	45 dB(A)

Receivers in Ulan village further from UCML than *R157* Power:

	$L_{Aeq(all\ periods)}$	$L_{A90(all\ periods)}$
Winds from west:	43 dB(A)	41 dB(A)
Neutral/calm:	45 dB(A)	43 dB(A)
Winds from east or inversions:	47 dB(A)	44 dB(A)

Assuming all residential receivers are 'rural' type and applying the procedure in section 4.1 above for setting evening and night-time amenity and intrusiveness criteria yields noise criteria for receivers in Ulan village as summarised in **Table 12**. Noise criteria at receivers outside Ulan village are equal to those proposed by DEC in their report to the IHAP and are shown in **Table 13**. The relevant Project-Specific Noise Levels (PSNL) are highlighted in bold type in both Tables.

TABLE 12
Intrusiveness and amenity noise criteria and PSNL's for MCP at residences in Ulan village.

Receivers	Weather condition	Intrusive criteria dB(A),$L_{eq(15min)}$		Amenity criteria dB(A),$L_{eq(period)}$	
		Evening	Night	Evening	Night
R148 Loughrey	W wind	47	47	39	34
	Neutral	49	49	37	36
	Adverse[1]	50	50	38	38
R167 Boyd	W wind	47	47	39	34
	Neutral	49	49	37	36
	Adverse[1]	50	50	38	38
R160B Minister of Educ.	W wind	47	47	39	34
	Neutral	49	49	37	36
	Adverse[1]	50	50	38	38
R161 Palmer	W wind	47	47	39	34
	Neutral	49	49	37	36
	Adverse[1]	50	50	38	38
R159 Power	W wind	47	47	39	34
	Neutral	49	49	37	36
	Adverse[1]	50	50	38	38

Table 12 (cont'd)					
Receivers	Weather condition	Intrusive criteria dB(A),$L_{eq(15min)}$		Amenity criteria dB(A),$L_{eq(period)}$	
		Evening	Night	Evening	Night
R41C Libertis	W wind	47	47	39	34
	Neutral	49	49	37	36
	Adverse[1]	50	50	38	38
R165 Andrew	W wind	47	47	39	34
	Neutral	49	49	37	36
	Adverse[1]	50	50	38	38
R157 (N5) Power	W wind	47	47	39	34
	Neutral	49	49	37	36
	Adverse[1]	50	50	38	38
R154 Cashel	W wind	46	46	41	33
	Neutral	48	48	37	35
	Adverse[1]	49	49	37	37
R155 Tortely	W wind	46	46	41	33
	Neutral	48	48	37	35
	Adverse[1]	49	49	37	37
R156 Knox	W wind	46	46	41	33
	Neutral	48	48	37	35
	Adverse[1]	49	49	37	37
R153 Newton	W wind	46	46	41	33
	Neutral	48	48	37	35
	Adverse[1]	49	49	37	37
R150 Meredith	W wind	46	46	41	33
	Neutral	48	48	37	35
	Adverse[1]	49	49	37	37
R158 Carlisle	W wind	46	46	41	33
	Neutral	48	48	37	35
	Adverse[1]	49	49	37	37
R46A Flannery Centre	W wind	46	46	41	33
	Neutral	48	48	37	35
	Adverse[1]	49	49	37	37

[1] Adverse conditions are prevailing winds from the general-east and inversions.

TABLE 13

Intrusiveness and amenity noise criteria and PSNL's for MCP at residences outside Ulan village.

Receiver	Intrusive criteria dB(A),$L_{eq(15min)}$		Amenity criteria dB(A),$L_{eq(period)}$	
	Evening	Night	Evening	Night
R8 Davies	35	35	45	40
R46D UCML (Mitchell)	35	35	45	40
R16 Little & Salter	35	35	45	40
R15 Green	35	35	45	40
R7 Wallis	35	35	45	40
R13 (N6) Renshaw	35	35	45	40
R12 M & J Transport	35	35	45	40
R25 (N4) Tuck-Lee	Pit 1 Noise Acquisition Zone			
R24 Hoare	Pit 1 Noise Acquisition Zone			
R26 Robinson	38	38	45	40
R49 "Olive Lea"	38	38	45	40
R169 "Primo Park"	37	37	45	40
R173 Richter	37	37	45	40
R5 Swords	35	35	45	40
R20 Williamson	35	35	45	40
R6 Thompson	35	35	45	40
R22 Aiton	38	37	45	40

Table 13 (cont'd)				
Receiver	Intrusive criteria dB(A),$L_{eq(15min)}$		Amenity criteria dB(A),$L_{eq(period)}$	
	Evening	Night	Evening	Night
R23 Woodhead	38	37	45	40
R41A Libertis	38	37	45	40
R63 Whitaker	38	37	45	40
R64 Goninan & Boland	38	37	45	40
R172 Kimber	38	37	45	40
R170 (N3) Roberts	38	37	45	40
R58 Bevege	35	35	45	40
R37 Szymkarczuk[1]	35	35	45	40
All other receivers	35	35	45	40

[1] Noise level exceeded over 25% of vacant land.

5.1.1 Justification for Noise Criteria

The noise criteria in Table 12 for Ulan village have been derived by assuming that noise levels from UCML are unlikely to reduce in the future, for the reasons given, and may actually increase in the short term when UCML doubles its production levels.

Since these criteria are different to those established by DEC, it would be appropriate to offer additional justification for the recommendation that they be approved by DoP should a consent for MCP be issued.

The first issue is whether the worst case predicted noise levels, which are equal to the proposed criteria, could have been achieved by fitting attenuator packages to mobile plant, rather than construction an acoustic bund as proposed. Noise modelling, and previous experience in similar circumstances, suggests that the bund will reduce the noise level from overburden/coal haul trucks and dumping by 5-7 dB.

Figures A and B below show sound power levels of attenuated (Unit 4005) and unattenuated (Unit 4008) Komatsu 630E haul trucks. These measurements were taken by the author in 2004 at a mine owned by the Proponent as part of ISO 6395 testing of all mobile plant.

The attenuated machine was fitted with half-chevron louvres in the radiator opening and grid box (retard braking cooling system) and a specially designed plenum chamber in the exhaust system intended to reduce characteristic exhaust tones.

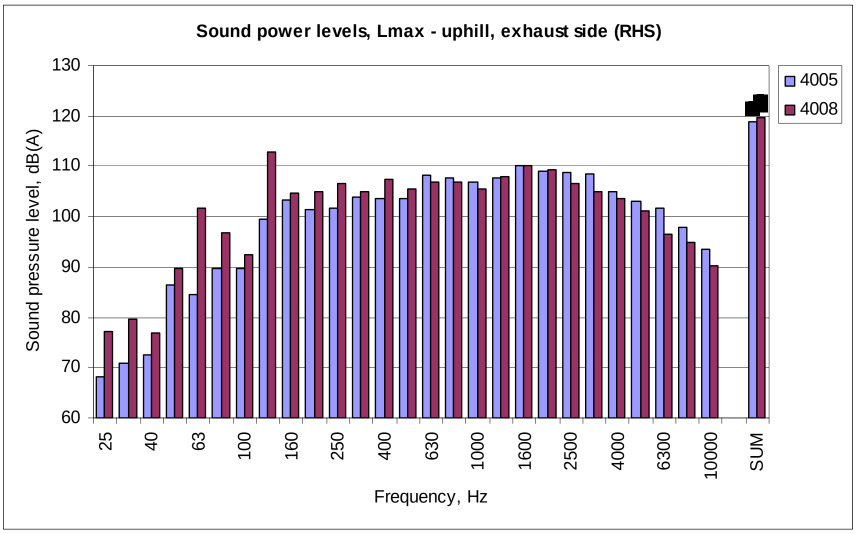


Figure A. Maximum pass-by sound power – uphill, exhaust side.

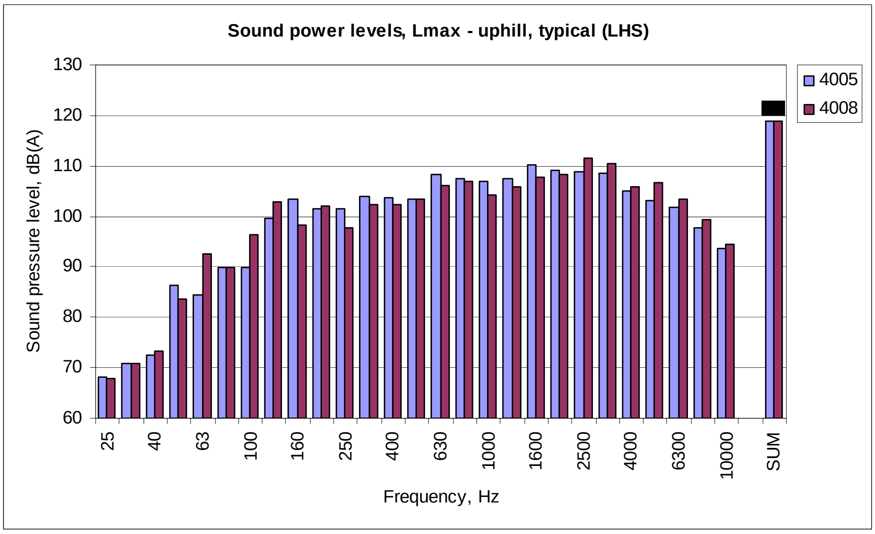


Figure B. Maximum pass-by sound power – uphill, non-exhaust side.

These figures show that the exhaust tones in the 63 Hz and 125 Hz bands have been effectively attenuated, but the overall L_w of pass-by under load,119 dB(A), is the same for the attenuated and unattenuated trucks.

The attenuator packages discussed were actually claimed to provide a 5-7 dB reduction in Lw, but this was for an ISO 6395 dynamic test where the uphill and down hill pass-by levels are averaged.

Figure C shows power levels of the two trucks when travelling downhill.

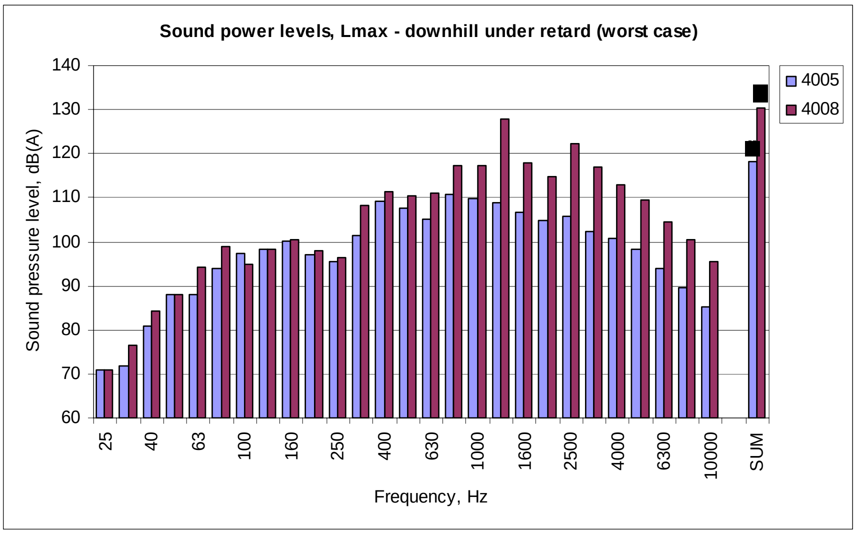


Figure C. Maximum pass-by sound power – downhill.

The acoustic attenuator did an excellent job of virtually eliminating grid box noise. In the case of MCP Pit 1, however, the trucks will be travelling along relatively flat ground, dumping overburden and returning to the Pit on the flat. The downhill section of the haul road will be shielded from Ulan village by the overburden dump or the pit itself. Since a reliable 7 dB reduction was sought, the option of a bund was pursued in preference to attenuator packages.

The above experience has been repeated at another Hunter valley mine. Similar attenuator packages fitted to all 14 proposed MCP dump trucks would have cost in excess of $3 million and achieved no significant reduction in the total noise output of the mine.

Further justification for the appropriateness of the proposed noise criteria in Ulan village is offered below where noise levels from UCML are compared with and added to the proposed night time MCP criteria under various operational and atmospheric conditions.

UCML	Weather	L_{Aeq}(UCML)	L_{Aeq}(MCP)	L_{Aeq}(Total)	Increase
Hum only	SW wind	40	34	41	+1 dB
All plant	SW wind	44	34	44	0 dB
Hum only	Neutral	42	36	43	+1 dB
All plant	Neutral	46	36	46	0 dB
Hum only	Adverse	44	38	45	+1 dB
All plant	Adverse	48	38	48	0 dB

Under all atmospheric conditions when UCML is only running ‘on idle’, the worst case noise increase from the addition of MCP noise is 1 dB. When UCML is at full operation, with trucks delivering coal to the ROM and the processing line operating, worst case MCP noise will be 10 dB below UCML levels and will contribute no measurable increase in noise levels in the village. Since the minimum perceivable noise level increase is commonly accepted to be 2 dB, there would be no time at which addition noise from MCP would increase the perceived noise levels in Ulan village.

5.2 Noise Impact Assessment Procedure

The assessment of operational noise was conducted using RTA Technology's Environmental Noise Model (ENM) v3.06. All major noise producing items listed in Section 4.4.7, Table 4.4 of the EA were modelled at their known (for stationary sources such as the rail load-out and surface facilities) or most exposed (for mobile sources such as dump trucks) positions and noise contours and/or point calculations were generated for the surrounding area.

5.2.1 Noise Sources

Noise data for significant sources associated with the MCP were obtained from Spectrum Acoustics' extensive database of measured coal mining plant items. All data used were for machinery identical to that proposed for MCP (CAT 793/789 haul trucks, Hitachi EX 5500/2500 excavators, CAT D10/D11 dozers, coal load-out facility, diesel locomotives, etc.)

Sound power levels of operational noise sources used in the modelling are shown below in **Table 14**.

TABLE 14
Operational noise source sound power levels. These are calculated 15-minute L_{Aeq} levels as used in the noise model and measured maximum levels.

Operational noise source	Sound power level, dB(A)		Source Height, m
	$L_{eq(15\ min)}$	L_{max}	
Loading empty coal wagons	101	116	3
3 x loco's idling on loop	105	111	3
Trucks at ROM hopper	115	125	3
Primary crusher	114	118	5
D11 dozer on dump	115	130	2
Overburden drill	114	116	1
O/B excavator (EX5500) and trucks	116	125	5
Coal excavator (EX 2500) and trucks	115	122	5
Overburden dump (per pit)*	115	125	3
Overburden haul (on slope)*	115	123	3
Overburden haul (on flat)*	113	121	3
Coal haul (from pit to processing area)*	111	120	3
Transfer station	115	118	5
Coal washery	116	118	10
Conveyors (per 100m)	76	N/A	2-10
Ventilation fan (enclosed)	102	102	5
Personnel carrier	115	115	1
Stacker/reclaimers (each)	105	N/A	10

* All sources involving trucks assume 8-10 truck pass-bys per 15 minute period so that all 14 haul trucks are included. Haulage sources placed at approximately 500m intervals on haul routes.

5.2.2 Modelled Scenarios

Noise modelling was conducted for the following atmospheric conditions:

- *Daytime calm* – Air temperature 20^{0}C, 70% relative humidity (RH), no wind, -1^{o}C/100m vertical temperature gradient (boundary layer dry adiabatic lapse);

- *Inversion* – Air temperature 5^{0}C, 70% R.H., +3^{o}C/100m vertical temperature gradient with 2m/s drainage flow[1];

- *Prevailing wind (summer/autumn)* – Air temperature 20^{0}C, 70% R.H., 3m/s wind from ESE; and

- *Prevailing wind (winter/spring)* – Air temperature 20^{0}C, 70% R.H., 3m/s wind from SW.

These are the same conditions as modelled in the assessment of construction noise levels, with the addition of inversion conditions during the night time in winter.

Noise models were generated for each of the following operational scenarios, for each of the four atmospheric conditions discussed above. These scenarios are considered to be the worst cases in terms of noise generation and potential impacts.

1) YEAR 1[2]: Pit 1 (with bund)**:** Same as the construction noise scenario except the western edge of OOP1 has been formed to a height of 15m above natural ground level as an environmental bund and overburden emplacement is occurring behind this bund. Excavators are modelled at 20m below natural ground surface level with an additional excavator working on coal extraction and CAT 789 trucks hauling coal to the ROM hopper. Coal transfer, processing and rail facility are in full operation. A 3.5m high acoustic barrier is included along the western side of the ROM hopper. Noise sources for this scenario are shown in **Figure 6 in Appendix A**.

2) YEAR 2: Pit 1 (continuing)**:** As (1) above except mining has advance further into Pit 1 and further overburden emplacement is occurring at 15m above natural ground level (ie, behind the acoustic bund but at the same height). Haul road to OOP1 is behind existing bund.

[1] NE drainage flow for Pit 1 Ulan village and SE drainage flow for Pits 2 and 3.
[2] First year of mining in Pit 1 after the initial 18 month construction period.

3) YEAR 6a: Pit 2 (start)**:** Commencement of mining at northern end of Pit 2 after completion of Pit 1. Pit 2 emplacement (OOP2) commences at natural ground level with no screening. Mining noise sources for this scenario are shown in **Figure 7 in Appendix A**. Coal transport and handling sources are as shown in Figure 7.

4) YEAR 6b: Pit 2 (continuing)**:** Same as above scenario (3) except OOP2 has been completed west of current mining area to a height of 15m during a 4-6 month period. Further overburden emplacement is occurring behind this bund.

5) YEAR 7: Pit 3 (north)**:** Commencement of mining at the northern end of Pit 3 nearest to the most exposed receivers. Pit 2 is nearing completion at its southern end. Coal haulage is behind the continuous acoustic bunds, OOP1 and OOP2 formed during operations in Pits 1 and 2. Noise sources for this scenario are shown in **Figure 8 in Appendix A**. Sources for the northern and of the coal haul route and surface infrastructure are as shown in Figures 6 and 6a.

6) YEAR 9: Pit 3 (south)**:** Mining at the southern end of Pit 3. Sources for the northern end of the coal haul route and surface infrastructure are as shown in Figure 6.

Tables 16-21 show predicted noise levels for the four assessed meteorological conditions. These predictions apply to times of day as summarised in **Table 15**.

TABLE 15
Applicable times for predicted noise levels.

Met Condition	Applicable time(s) for predicted noise levels
Lapse	Daytime, during calm conditions
ESE wind	Day, evening and night during spring-summer
SW wind	Day, evening and night during autumn-spring
Inversion	Night, winter only (per INP) with drainage-flow wind

5.3 Scenario 1: Year 1 (Pit 1, with bund)

After the initial 12 month period, coal extraction and further mining operations would continue at the south-western end of Pit 1. The western edge of the OOP1 would have been completed to 15m above natural ground level and the coal haulage (via CAT 789 trucks), transfer, processing and loading activities would be operational.

5.3.1 Predicted Operational Noise Levels

Predicted noise levels when dumping behind the 15m western edge of the OOP1 (with haul road also behind the bund) are summarised in **Table 16**. All exceedances of the most stringent (night time) criteria are shaded grey and major (5 dB or more) exceedances are shown in bold type. The corresponding criterion is also shaded/bolded. Noise contours for this scenario are shown in **Figures 13 to 16 in Appendix A**.

TABLE 16
Predicted Year 1 (Pit 1) noise levels, dB(A),$L_{eq(15min)}$. Dumping of overburden is behind the completed 15m western edge of OOP1.

Receiver	Meteorological condition				PSNL[1]					
	Calm	ESE wind	SW wind	Inv.	Evening			Night		
					nr	nt	ad	nr	nt	ad
R8 Davies	<25	<25	<25	<25	35	35	35	35	35	35
R46D UCML (Mitchell)	<25	<25	<25	<25	35	35	35	35	35	35
R16 Little & Salter	<25	<25	<25	<25	35	35	35	35	35	35
R15 Green	<25	21	<25	34	35	35	35	35	35	35
R7 Wallis	<25	28	<25	<25	35	35	35	35	35	35
R13 (N6) Renshaw	25	25	35	38	35	35	35	35	35	35
R12 M & J Transport	26	27	37	40	35	35	35	35	35	35
R148 Loughrey	28	37	29	38	39	37	38	34	36	38
R167 Boyd	28	37	29	38	39	37	38	34	36	38
R160B Minister of Ed.	28	37	29	38	39	37	38	34	36	38
R161 Palmer	28	37	29	38	39	37	38	34	36	38
R159 Power	28	37	29	38	39	37	38	34	36	38
R41C Libertis	28	37	29	38	39	37	38	34	36	38
R165 Andrew	28	37	29	38	39	37	38	34	36	38
R157 (N5) Power	28	37	29	38	39	37	38	34	36	38
R154 Cashel	27	36	28	37	41	37	37	33	35	37
R155 Tortely	27	36	28	37	41	37	37	33	35	37
R156 Knox	27	36	28	37	41	37	37	33	35	37
R153 Newton	27	36	28	37	41	37	37	33	35	37
R150 Meredith	27	36	28	37	41	37	37	33	35	37
R158 Carlisle	27	36	28	37	41	37	37	33	35	37
R46A Flannery Centre	28	38	29	39	41	37	37	33	35	37
R26 Robinson	25	38	<25	38	38	38	38	38	38	38
R49 "Olive Lea"	25	38	<25	38	38	38	38	38	38	38
R169 "Primo Park"	<25	35	<25	35	37	37	37	37	37	37
R173 Richter	<25	35	<25	35	37	37	37	37	37	37
R25 (N4) Tuck-Lee	Pit 1 Noise acquisition zone									
R24 Hoare	Pit 1 Noise acquisition zone									
R5 Swords	<25	35	<25	36	35	35	35	35	35	35
R20 Williamson	25	37	<25	38	35	35	35	35	35	35
R6 Thompson	25	37	<25	38	35	35	35	35	35	35
R22 Aiton	<25	35	<25	36	38	38	38	37	37	37
R23 Woodhead	<25	34	<25	35	38	38	38	37	37	37
R41A Libertis	<25	35	<25	35	38	38	38	37	37	37
R63 Whitaker	<25	32	<25	33	38	38	38	37	37	37
R64 Goninan & Boland	<25	31	<25	32	38	38	38	37	37	37
R172 Kimber	<25	29	<25	30	38	38	38	37	37	37
R170 (N3) Roberts	<25	35	<25	28	38	38	38	37	37	37
R58 Bevege	<25	32	<25	32	35	35	35	35	35	35
R37 Szymkarczuk[2]	<25	<25	<25	<25	35	35	35	35	35	35

[1] "nr" = noise-reducing (receiver-source wind), "nt" = neutral (calm), "ad" = adverse (general source-receiver wind and inversion).
[2] Noise level exceeded over 25% of vacant land.

5.3.2 Recommendations

The predicted noise level of 40 dB(A) at *R12* (M&J Transport) is mainly attributed to coal trains on the MCP site. It may not be economically feasible to construct a suitable acoustic barrier to mitigate this exceedance and this receiver would be in a noise affectation zone, along with *R25* (Tuck-Lee) which was identified as significantly impacted in the previous section.

Criterion exceedances of 1 – 3 dB have been predicted at *R46A* (The Flannery Centre), *R5* (Swords), *R6* (Thompson) and *R20* (Williamson) suggesting that noise emissions should be managed to minimise impacts at these locations. As with the bund construction scenario considered in the previous section, overburden dumping was modelled at a location approximately 1200m north of the Pit 1 extraction area. A more southerly dumping area (nearer to the Pit) could be utilised during ESE wind conditions and inversions to reduce noise levels at *R46A* (The Flannery Centre) by approximately 3 dB. The exact details of this management process would be assessed and documented in the Noise Management Plan (NMP).

It is recommended at this stage that the 1-3 dB exceedances in Table 16 could be mitigated by allowing for multiple dump sites and it is not proposed that the predicted levels should be adopted as the noise criteria in preference to the (lower) PSNL's. If noise management procedures are not successful for unforseen reasons, then a best practice approach of targeted investigation and engineered noise reduction of specific plant items would be initiated or MCMPL would enter into a negotiated agreement with the impacted receiver.

5.4 Scenario 2: Year 2 (Pit 1 continued)

This scenario is approximately the same as the construction noise scenario considered in the previous section, except that mining has progressed deeper into the pit and it would be necessary at times for dump trucks to operate at the height of the 15m acoustic bund when placing overburden behind it. This could be done with a haul road behind the bund and only a short spur rising to the top of the bund.

5.4.1 Predicted Noise Levels

Table 17 shows predicted noise levels and compares them with the PSNL's. All modelled exceedances during the critical night-time period are shaded grey, with major (5 dB or more) exceedances in bold type. Receivers west to southwest of Pit 1 have received noise levels under the ESE wind that are up to 3 dB lower than those predicted under the ENE wind.

For conservatism, the results presented in the EA for the ENE are reproduced below for the ESE wind. Predicted noise levels in Ulan village have increased by 2 dB as a result of the changed wind direction, but has reduced back to previously predicted levels under the ENE with the inclusion of the 3.5m acoustic barrier at the ROM hopper.

TABLE 17

Predicted Year 2 (Pit 1) noise levels, dB(A),$L_{eq(15min)}$. Dumping of overburden is behind, but at the same height as, the western edge of OOP1.

Receiver	Meteorological condition				PSNL[1]					
	Calm	ESE wind	SW wind	Inv.	Evening nr	Evening nt	Evening ad	Night nr	Night nt	Night ad
R8 Davies	<25	<25	<25	25	35	35	35	35	35	35
R46D UCML (Mitchell)	<25	<25	<25	26	35	35	35	35	35	35
R16 Little & Salter	<25	<25	25	29	35	35	35	35	35	35
R15 Green	<25	23	32	<25	35	35	35	35	35	35
R7 Wallis	<25	30	<25	31	35	35	35	35	35	35
R13 (N6) Renshaw	25	25	35	35	35	35	35	35	35	35
R12 M & J Transport	Noise affectation zone – rail loop									
R148 Loughrey	35	39	35	44	39	37	38	34	36	38
R167 Boyd	35	39	35	44	39	37	38	34	36	38
R160B Minister of Ed.	35	39	35	44	39	37	38	34	36	38
R161 Palmer	35	39	35	44	39	37	38	34	36	38
R159 Power	35	39	35	44	39	37	38	34	36	38
R41C Libertis	35	39	35	44	39	37	38	34	36	38
R165 Andrew	35	39	35	44	39	37	38	34	36	38
R157 (N5) Power	35	39	35	44	39	37	38	34	36	38
R154 Cashel	34	38	34	43	41	37	37	33	35	37
R155 Tortely	34	38	34	43	41	37	37	33	35	37
R156 Knox	34	38	34	43	41	37	37	33	35	37
R153 Newton	34	38	34	43	41	37	37	33	35	37
R150 Meredith	34	38	34	43	41	37	37	33	35	37
R158 Carlisle	34	38	34	43	41	37	37	33	35	37
R46A Flannery Centre	35	40	34	45	41	37	37	33	35	37
R26 Robinson	30	36	28	43	38	38	38	38	38	38
R49 "Olive Lea"	30	36	28	43	38	38	38	38	38	38
R169 "Primo Park"	25	33	25	40	37	37	37	37	37	37
R173 Richter	25	33	25	40	37	37	37	37	37	37
R25 (N4) Tuck-Lee	Pit 1 Noise acquisition zone									
R24 Hoare	Pit 1 Noise acquisition zone									
R5 Swords	<25	33	<25	40	35	35	35	35	35	35
R20 Williamson	25	36	<25	40	35	35	35	35	35	35
R6 Thompson	25	36	<25	40	35	35	35	35	35	35
R22 Aiton	<25	31	<25	38	38	38	38	37	37	37
R23 Woodhead	<25	30	<25	37	38	38	38	37	37	37
R41A Libertis	<25	32	<25	37	38	38	38	37	37	37
R63 Whitaker	<25	31	<25	36	38	38	38	37	37	37
R64 Goninan & Boland	<25	31	<25	36	38	38	38	37	37	37
R172 Kimber	<25	30	<25	35	38	38	38	37	37	37
R170 (N3) Roberts	<25	<25	<25	30	38	38	38	37	37	37
R58 Bevege	<25	29	<25	35	35	35	35	35	35	35
R37 Szymkarczuk[2]	<25	<25	<25	<25	35	35	35	35	35	35

[1] "nr" = noise-reducing (general receiver-source wind), "nt" = neutral (calm), "ad" = adverse (general source-receiver wind and inversion).
[2] Noise level exceeded over 25% of vacant land.

5.4.2 Recommendations

Under all modelled conditions *except inversions*, Table 17 suggests that high level overburden emplacement may occur on OOP1 without creating more than a 1 dB noise criterion exceedance at *R49* ("Olive Lea"), *R26*

(Robinson), *R6* (Thompson) and *R20* (Williamson) and in Ulan village, and a 3 dB exceedance at *R46A* (The Flannery Centre) during the critical night time period. Again, these predicted levels are for a dumping location nearest to the receivers.

The NMP will formally require both low level and high level dumping locations, with the high level areas only to be utilised when there is no temperature inversion present or ESE wind. In this way, OOP1 could be completed without producing exceedances of the PSNL's. After Year 2, Pit 1 will have advanced further to the east, in-pit dumping will occur and noise emissions at the most impacted receivers will reduce.

5.4.3 Sleep Disturbance

The ENCM (Ch. 19) advises that sleep may be disturbed if maximum noise levels (taken as an $L_{A1(1\ min)}$ but conservatively assessed as L_{max}) exceed the night time background noise level by 15 dB or more.

Sleep disturbance criteria based on the July 2005 logger results presented in the EA are as follows:

Ulan village (east of *R157* Power):	55 dB(A),$L_{A1(1\ min)}$
Ulan village (west of *R157* Power):	54 dB(A),$L_{A1(1\ min)}$
R46A Flannery Centre:	54 dB(A),$L_{A1(1\ min)}$
R49 "Olive Lea", *R26* Robinson:	48 dB(A),$L_{A1(1\ min)}$
R169 "Primo Park", *R173* Richter, *R22* Aiton: *R23* Woodhead, *R41A* Libertis, *R63* Whitaker *R64* Goninan, *R172* Kimber, *R170* Roberts	47 dB(A),$L_{A1(1\ min)}$
All other residential receivers:	45 dB(A),$L_{A1(1\ min)}$

Typical mining sources (and maximum sound power levels) that may potentially disturb sleep include dozer tracks (130 dB(A)), coal trucks under full load (123 dB(A)), rock impacts from shovels loading trucks (125 dB(A)), impacts within rotary breaker (118 dB(A)) and reverse alarms (115 dB(A)). Since reverse alarms are tonal and a well known offensive noise source within the mining industry, all mobile plant will be fitted with suitable broad-band alarms.

The assessment in the previous sections has established that night-time operations would be required under the NMP to occur behind the pre-established acoustic bund under inversion (worst case) conditions. With dumping on OOP1 occurring behind (but at the same height as) the bund the highest predicted noise levels in Table 17 are 40 dB(A),$L_{eq(15\ min)}$ at

R1 (The Flannery Centre) and 39 dB(A),$L_{eq(15\ min)}$ at residences in Ulan village under an ENE wind.

Taking Ulan village as an example, the contributions from significant sources to the predicted level of 39 dB(A) are summarised below.

Source	dB(A),L_{eq}
Dump	33.7
Shovel 1 and trucks	32.4
Drill	32.0
Overburden haul on flat (behind bund)	30.2
Dozer on dump	29.0
Coal haulage	28.8
Shovel 2 and trucks	26.2
TOTAL	39.3

Maximum noise levels in Ulan village are conservatively estimated by adding the difference between source L_{Aeq} and L_{max} sound power levels in Table 14 to the predicted contributions shown above as follows:

Source	dB(A),L_{max}
Dump	43.7
Shovel 1 and trucks	41.4
Drill	34.0
Overburden haul on flat (behind bund)	38.2
Dozer on dump	44.0
Coal haulage	38.8
Shovel 2 and trucks	35.2

Since short term impacts rarely occur simultaneously, the predicted worst case impact noise level within Ulan village is 44 dB(A),L_{max} from dozer tracks which is 5 dB higher than the worse case predicted total L_{Aeq} level of 39 dB(A) and significantly less than the criterion of 55 dB(A),$L_{1(1\ min)}$. **Table 18** shows approximate sleep disturbance levels for Pit 1 based on an estimate that the maximum noise level from an individual source may be up to 7dB greater than the total L_{Aeq} noise emission from the mining operation.

TABLE 18
Predicted Year 1 (Pit 1) sleep disturbance levels, dB(A),L_{Amax}. Dumping of overburden is behind the completed 15m western edge of OOP1.

Receiver	Meteorological condition				Criterion dB(A),Lmax
	Calm	ESE wind	SW wind	Inv.	
R8 Davies	<32	<32	<32	32	45
R46D UCML (Mitchell)	<32	<32	<32	<32	45
R16 Little & Salter	<32	<32	<32	<32	45
R15 Green	<32	28	<32	41	45
R7 Wallis	<32	28	<32	<32	45
R13 (N6) Renshaw	32	32	42	45	45
R148 Loughrey	35	42	36	45	55
R167 Boyd	35	42	36	45	55

Table 18 (cont'd)					
Receiver	Meteorological condition				Criterion dB(A),Lmax
	Calm	ESE wind	SW wind	Inv.	
R160B Minister of Ed.	35	42	36	45	55
R161 Palmer	35	42	36	45	55
R159 Power	35	42	36	45	55
R41C Libertis	35	42	36	45	55
R165 Andrew	35	42	36	45	55
R157 (N5) Power	35	42	36	45	55
R154 Cashel	34	41	35	44	54
R155 Tortely	34	41	35	44	54
R156 Knox	34	41	35	44	54
R153 Newton	34	41	35	44	54
R150 Meredith	34	41	35	44	54
R158 Carlisle	34	41	35	44	54
R46A Flannery Centre	35	45	36	46	54
R26 Robinson	32	45	<32	45	48
R49 "Olive Lea"	32	45	<32	45	48
R169 "Primo Park"	32	45	<32	45	47
R173 Richter	32	45	<32	45	47
R5 Swords	<32	42	<32	41	45
R20 Williamson	32	44	<32	45	45
R6 Thompson	32	44	<32	45	45
R22 Aiton	<32	42	<32	43	47
R23 Woodhead	<32	41	<32	42	47
R41A Libertis	<32	42	<32	42	47
R63 Whitaker	<32	39	<32	40	47
R64 Goninan & Boland	<32	38	<32	39	47
R172 Kimber	<32	36	<32	37	47
R170 (N3) Roberts	<32	42	<32	35	47
R58 Bevege	<32	39	<32	39	45
R37 Szymkarczuk[2]	<32	<32	<32	<32	

[1] "nr" = noise-reducing (receiver-source wind), "nt" = neutral (calm), "ad" = adverse (general source-receiver wind and inversion).

[2] Noise level exceeded over 25% of vacant land.

The above results suggest that sleep disturbance criteria will not be exceeded at any receiver near Pit 1.

The NMP will address potential sleep disturbance issues by limiting the operation of dozers at high level locations under adverse conditions when 24 hour operations commence.

5.5 Scenarios 3 & 4: Year 6 (Start Pit 2)

At the start of Year 6 mining will commence at the northern end of Pit 2. In this scenario, overburden would initially be placed in an exposed location along the western edge of OOP2. Locations identified in the previous section as significantly noise impacted have not been included in the Pit 2 scenarios.

5.5.1 Predicted Noise Levels

Predicted noise levels at potentially affected receivers are summarised in **Table 19**. All PSNL exceedances are shaded grey, with major (5 dB or more) exceedances in bold type. Noise contours for ENE wind conditions are shown in **Figure 17 in Appendix A**. Received Pit 2 noise levels are 1dB higher in Ulan village and 2dB higher at other receivers W-NW of Pit 2 under the ESE wind than for the ENE wind, as reflected in Table 19.

TABLE 19

Predicted Year 6 (Start Pit 2) noise levels, dB(A),$L_{eq(15min)}$. Dumping of overburden is at ground level at the western edge of OOP2.

Receiver	Meteorological condition				PSNL[1]					
					Evening			Night		
	Calm	ESE wind	SW wind	Inv.	nr	nt	ad	nr	nt	ad
R8 Davies	<20	<20	35	23	35	35	35	35	35	35
R46D UCML (Mitchell)	<20	<20	25	25	35	35	35	35	35	35
R16 Little & Salter	<20	<20	30	24	35	35	35	35	35	35
R15 Green	<20	<20	29	23	35	35	35	35	35	35
R7 Wallis	27	28	34	30	35	35	35	35	35	35
R13 (N6) Renshaw	25	24	41	32	35	35	35	35	35	35
R12 M & J Transport	Noise affectation zone – rail loop									
R148 Loughrey	28	36	28	40	39	37	38	34	36	38
R167 Boyd	28	36	28	40	39	37	38	34	36	38
R160B Minister of Ed.	28	36	28	40	39	37	38	34	36	38
R161 Palmer	28	36	28	40	39	37	38	34	36	38
R159 Power	28	36	28	40	39	37	38	34	36	38
R41C Libertis	28	36	28	40	39	37	38	34	36	38
R165 Andrew	28	36	28	40	39	37	38	34	36	38
R157 (N5) Power	28	36	28	40	39	37	38	34	36	38
R154 Cashel	27	35	27	39	41	37	37	33	35	37
R155 Tortely	27	35	27	39	41	37	37	33	35	37
R156 Knox	27	35	27	39	41	37	37	33	35	37
R153 Newton	27	35	27	39	41	37	37	33	35	37
R150 Meredith	27	35	27	39	41	37	37	33	35	37
R158 Carlisle	27	35	27	39	41	37	37	33	35	37
R46A Flannery Centre	28	37	28	40	41	37	37	33	35	37
R26 Robinson	29	38	27	39	38	38	38	38	38	38
R49 "Olive Lea"	29	38	27	39	38	38	38	38	38	38
R169 "Primo Park"	25	37	25	36	37	37	37	37	37	37
R173 Richter	25	37	25	36	37	37	37	37	37	37
R25 (N4) Tuck-Lee	Pit 1 Noise acquisition zone									
R24 Hoare	Pit 1 Noise acquisition zone									
R5 Swords	35	42	35	40	35	35	35	35	35	35
R20 Williamson	35	43	35	43	35	35	35	35	35	35
R6 Thompson	35	43	35	43	35	35	35	35	35	35
R22 Aiton	31	37	29	37	38	38	38	37	37	37
R23 Woodhead	30	36	28	36	38	38	38	37	37	37
R41A Libertis	30	36	28	36	38	38	38	37	37	37
R63 Whitaker	28	35	25	35	38	38	38	37	37	37
R64 Goninan & Boland	28	35	24	35	38	38	38	37	37	37
R172 Kimber	27	32	24	33	38	38	38	37	37	37
R170 (N3) Roberts	20	30	<20	30	38	38	38	37	37	37
R58 Bevege	28	35	25	35	35	35	35	35	35	35
R37 Szymkarczuk[2]	<25	30	<25	32	35	35	35	35	35	35
R30 Cox "Moolarben"	<30	<30	<30	<30	35	35	35	35	35	35
R28 Chinner	<30	<30	<30	<30	35	35	35	35	35	35

R31 Cox "Barcoo"	<30	<30	<30	<30	35	35	35	35	35	35

Table 19 (cont'd)

Receiver	Meteorological condition				PSNL[1]					
					Evening			Night		
	Calm	ESE wind	SW wind	Inv.	nr	nt	ad	nr	nt	ad
R36 Rayner	<30	<30	<30	<30	35	35	35	35	35	35
R29B Mayberry	<30	<30	<30	<30	35	35	35	35	35	35
R29A Mayberry	<30	<30	<30	<30	35	35	35	35	35	35
R10 Herbert	<30	<30	<30	<30	35	35	35	35	35	35
R47 Herbert	<30	<30	<30	<30	35	35	35	35	35	35
R32 Stokes	<30	<30	<30	<30	35	35	35	35	35	35
R48 O'Sullivan	<30	<30	<30	<30	35	35	35	35	35	35

[1] "nr" = noise-reducing (general receiver-source wind), "nt" = neutral (calm), "ad" = adverse (general source-receiver wind and inversion).

[2] Noise level exceeded over 25% of vacant land.

Table 20 shows predicted sleep disturbance levels from Pit 2 mining, assuming L_{Amax} levels from individual sources up to 7dB above L_{Aeq} levels from the entire mining operation.

TABLE 20

Predicted Year 6 (Pit 2) sleep disturbance levels, dB(A),L_{Amax}. Dumping of overburden is in the open at ground level.

Receiver	Meteorological condition				Criterion dB(A),Lmax
	Calm	ESE wind	SW wind	Inv.	
R8 Davies	<27	<27	42	30	45
R46D UCML (Mitchell)	<27	<27	32	32	45
R16 Little & Salter	<27	<27	37	31	45
R15 Green	<27	<27	36	30	45
R7 Wallis	34	35	41	37	45
R13 (N6) Renshaw	32	31	48	39	45
R148 Loughrey	35	43	35	47	55
R167 Boyd	35	43	35	47	55
R160B Minister of Ed.	35	43	35	47	55
R161 Palmer	35	43	35	47	55
R159 Power	35	43	35	47	55
R41C Libertis	35	43	35	47	55
R165 Andrew	35	43	35	47	55
R157 (N5) Power	35	43	35	47	55
R154 Cashel	34	42	34	46	54
R155 Tortely	34	42	34	46	54
R156 Knox	34	42	34	46	54
R153 Newton	34	42	34	46	54
R150 Meredith	34	42	34	46	54
R158 Carlisle	34	42	34	46	54
R46A Flannery Centre	35	43	35	47	54
R26 Robinson	36	45	34	46	48
R49 "Olive Lea"	36	45	34	46	48
R169 "Primo Park"	32	44	32	43	47
R173 Richter	32	44	32	43	47
R5 Swords	42	49	42	47	45
R20 Williamson	42	50	42	50	45
R6 Thompson	42	50	42	50	45
R22 Aiton	38	44	36	44	47
R23 Woodhead	37	43	35	43	47
R41A Libertis	37	43	35	43	47
R63 Whitaker	35	42	32	42	47

R64 Goninan & Boland	35	42	31	42	47
Table 20 (cont'd)					
Receiver	Meteorological condition				Criterion dB(A),Lmax
	Calm	ESE wind	SW wind	Inv.	
R172 Kimber	34	39	31	40	47
R170 (N3) Roberts	27	37	<27	37	47
R58 Bevege	35	42	32	42	45
R37 Szymkarczuk[2]	<32	37	<32	39	45
R30 Cox "Moolarben"	<37	<37	<37	<37	45
R28 Chinner	<37	<37	<37	<37	45
R31 Cox "Barcoo"	<37	<37	<37	<37	45
R36 Rayner	<37	<37	<37	<37	45
R29B Mayberry	<37	<37	<37	<37	45
R29A Mayberry	<37	<37	<37	<37	45
R10 Herbert	<37	<37	<37	<37	45
R47 Herbert	<37	<37	<37	<37	45
R32 Stokes	<37	<37	<37	<37	45
R48 O'Sullivan	<37	<37	<37	<37	45

Another Pit 2 scenario was run in which overburden emplacement was located behind a 10m emplacement (ie western edge of OOP2) formed during the first few months of mining in Pit 2. This scenario was generated to determine the effectiveness of OOP2 as an acoustic bund at locations that showed major exceedances of the PSNL's in Table 18.

Predicted noise levels under this additional scenario are summarised in **Table 21**. Noise contours for this additional scenario under ENE wind conditions are shown in **Figure 18** in Appendix A. All criterion exceedances are shaded grey, with major (5 dB or more) exceedances in bold type.

TABLE 21

Predicted Year 6 (Pit 2) noise levels, dB(A),$L_{eq(15min)}$. Dumping of overburden is behind the 10m high OOP2 formed in the first months of mining in Pit 2.

Receiver	Meteorological condition				PSNL[1]					
					Evening			Night		
	Calm	ESE wind	SW wind	Inv.	nr	nt	ad	nr	nt	ad
R8 Davies	<20	<20	35	23	35	35	35	35	35	35
R46D UCML (Mitchell)	<20	<20	25	25	35	35	35	35	35	35
R16 Little & Salter	<20	<20	30	24	35	35	35	35	35	35
R15 Green	<20	<20	29	23	35	35	35	35	35	35
R7 Wallis	27	28	34	30	35	35	35	35	35	35
R13 (N6) Renshaw	25	24	41	32	35	35	35	35	35	35
R12 M & J Transport	Noise affectation zone – rail loop									
R148 Loughrey	28	35	28	38	39	37	38	34	36	38
R167 Boyd	28	35	28	38	39	37	38	34	36	38
R160B Minister of Ed.	28	35	28	38	39	37	38	34	36	38
R161 Palmer	28	35	28	38	39	37	38	34	36	38
R159 Power	28	35	28	38	39	37	38	34	36	38
R41C Libertis	28	35	28	38	39	37	38	34	36	38
R165 Andrew	28	35	28	38	39	37	38	34	36	38
R157 (N5) Power	28	35	28	38	39	37	38	34	36	38
R154 Cashel	27	34	27	37	41	37	37	33	35	37
R155 Tortely	27	34	27	37	41	37	37	33	35	37
R156 Knox	27	34	27	37	41	37	37	33	35	37

Table 21 (cont'd)

Receiver	Meteorological condition				PSNL[1]					
		ESE	SW		Evening			Night		
	Calm	wind	wind	Inv.	nr	nt	ad	nr	nt	ad
R153 Newton	27	34	27	37	41	37	37	33	35	37
R150 Meredith	27	34	27	37	41	37	37	33	35	37
R158 Carlisle	27	34	27	37	41	37	37	33	35	37
R46A Flannery Centre	28	36	28	37	41	37	37	33	35	37
R26 Robinson	26	35	25	36	38	38	38	38	38	38
R49 "Olive Lea"	26	35	25	36	38	38	38	38	38	38
R169 "Primo Park"	24	32	23	35	37	37	37	37	37	37
R173 Richter	24	32	23	35	37	37	37	37	37	37
R25 (N4) Tuck-Lee	Pit 1 Noise acquisition zone									
R24 Hoare	Pit 1 Noise acquisition zone									
R5 Swords	28	39	29	30	35	35	35	35	35	35
R20 Williamson	26	37	25	34	35	35	35	35	35	35
R6 Thompson	26	37	25	34	35	35	35	35	35	35
R22 Aiton	31	37	29	37	38	38	38	37	37	37
R23 Woodhead	30	36	28	36	38	38	38	37	37	37
R64 Goninan & Boland	<25	32	<25	28	38	38	38	37	37	37
R172 Kimber	<25	29	<25	26	38	38	38	37	37	37
R41A Libertis	22	35	21	33	38	38	38	37	37	37
R63 Whitaker	<25	32	<25	29	38	38	38	37	37	37
R170 (N3) Roberts	<20	27	<20	24	38	38	38	37	37	37
R58 Bevege	<25	29	<25	30	35	35	35	35	35	35
R37 Szymkarczuk[2]	<30	29	<30	27	35	35	35	35	35	35
R30 Cox "Moolarben"	<30	<30	<30	<30	35	35	35	35	35	35
R28 Chinner	<30	<30	<30	<30	35	35	35	35	35	35
R31 Cox "Barcoo"	<30	<30	<30	<30	35	35	35	35	35	35
R36 Rayner	<30	<30	<30	<30	35	35	35	35	35	35
R29B Mayberry	<30	<30	<30	<30	35	35	35	35	35	35
R29A Mayberry	<30	<30	<30	<30	35	35	35	35	35	35
R10 Herbert	<30	<30	<30	<30	35	35	35	35	35	35
R47 Herbert	<30	<30	<30	<30	35	35	35	35	35	35
R32 Stokes	<30	<30	<30	<30	35	35	35	35	35	35
R48 O'Sullivan	<30	<30	<30	<30	35	35	35	35	35	35

[1] "nr" = noise-reducing (general receiver-source wind), "nt" = neutral (calm), "ad" = adverse (general source-receiver wind and inversion).

[2] Noise level exceeded over 25% of vacant land.

5.5.2 Recommendations

A comparison of the results in Tables 19 and 20 shows that utilising the western edge of OOP2 as an acoustic bund, after its formation during the first few months of mining in Pit 2, would reduce the major exceedances at *R5* (Swords), *R6* (Thompson) and *R20* (Williamson) to minor/moderate exceedances under ESE wind conditions. The major exceedances at these locations would be reduced to compliant levels under the modelled temperature inversion conditions.

Since OOP2 would be formed in a narrow strip running from northwest to southeast as Pit 2 progresses to the southeast, there may be limited opportunity to establish two emplacement sites – one "protected" and one "exposed" from the point of view of *R5* (Swords), *R6* (Thompson) and

R20 (Williamson). This would mean that overburden emplacement in exposed locations would occur regularly on OOP2 and the noise levels shown in Table 16 at *R5* (Swords), *R6* (Thompson) and *R20* (Williamson) would be difficult to avoid. For this reason, it is considered that these three locations would be in the Pit 2 noise affectation zone. Noise from Pit 2 would add to rail loop noise at *R30* (Renshaw) placing this residence in the Rail loop/Pit2 noise affectation zone.

Only very minor (1 dB) exceedances would remain at *R49* ("Olive Lea") and *R26* (Robinson) under temperature inversion conditions, with OOP2 progressing to the southeast and thereby providing an acoustic barrier from the point of view of these receivers. Worst case mining noise levels at these two receivers would reduce as Pit 2 progresses to the south.

5.6 Scenarios 5 & 6: Years 8-10 (Pit 3)

Mining at the north western end of Pit 3 would commence approximately at the start of Year 8. Mining at the southern end of Pit 2 would be nearing completion at this time. The coal haul road from Pit 2 would be east of the completed OOP2 and a 7m bund would be constructed along the section of coal haul road between Pits 2 and 3.

5.6.1 Predicted Noise Levels

Predicted noise levels at potentially affected receivers in Year 8 (commencement of Pit 3) are summarised in **Table 22**. Noise contours for temperature inversion conditions are shown in **Figure 19**, Appendix A.

TABLE 22

Predicted Year 8 (Start Pit 3) noise levels, dB(A),$L_{eq(15min)}$.

Receiver	Meteorological condition				PSNL[1]					
					Evening			Night		
	Calm	ESE wind	SW wind	Inv.	nr	nt	ad	nr	nt	ad
R5 Swords	30	38	30	40	35	35	35	35	35	35
R20 Williamson	27	37	25	36	35	35	35	35	35	35
R6 Thompson	27	37	25	36	35	35	35	35	35	35
R22 Aiton	23	33	22	35	38	38	38	37	37	37
R23 Woodhead	23	33	22	35	38	38	38	37	37	37
R41A Libertis	23	33	22	35	38	38	38	37	37	37
R63 Whitaker	<25	32	<25	33	38	38	38	37	37	37
R64 Goninan & Boland	<25	32	<25	33	38	38	38	37	37	37
R172 Kimber	<25	31	<25	32	38	38	38	37	37	37
R170 (N3) Roberts	20	29	<20	30	38	38	38	37	37	37
R58 Bevege	22	32	<25	33	35	35	35	35	35	35
R37 Szymkarczuk[2]	28	37	29	38	35	35	35	35	35	35
R30 Cox "Moolarben"	23	34	20	37	35	35	35	35	35	35
R28 Chinner	23	34	20	35	35	35	35	35	35	35
R31 Cox "Barcoo"	20	29	<20	25	35	35	35	35	35	35
R36 Rayner	29	35	27	40	35	35	35	35	35	35
R29B Mayberry	25	25	25	26	35	35	35	35	35	35
R29A Mayberry	23	22	28	25	35	35	35	35	35	35
R47 Herbert	<20	28	<20	23	35	35	35	35	35	35
R32 Stokes	<20	<20	<20	20	35	35	35	35	35	35
R48 O'Sullivan	<20	<20	<20	<20	35	35	35	35	35	35

Noise level predictions for Year 10 (end of Pit 3) are summarised in **Table 23**. All modelled exceedances of the PSNL's are shaded grey, with major (5 dB or more) exceedances in bold type. Noise contours for temperature inversion conditions are shown in **Figure 20** in Appendix A.

TABLE 23

Predicted Year 10 (End Pit 3) noise levels, dB(A),$L_{eq(15min)}$.

Receiver	Meteorological condition				PSNL[1]					
					Evening			Night		
	Calm	ESE wind	SW wind	Inv.	nr	nt	ad	nr	nt	ad
R5 Swords	30	35	29	39	35	35	35	35	35	35
R20 Williamson	26	35	25	35	35	35	35	35	35	35
R6 Thompson	26	35	25	35	35	35	35	35	35	35
R22 Aiton	25	33	22	35	38	38	38	37	37	37
R23 Woodhead	25	33	23	35	38	38	38	37	37	37
R41A Libertis	22	31	21	34	38	38	38	37	37	37
R63 Whitaker	<20	32	<20	33	38	38	38	37	37	37
R64 Goninan & Boland	<20	31	<20	33	38	38	38	37	37	37
R172 Kimber	<20	28	<20	31	38	38	38	37	37	37
R170 (N3) Roberts	<20	26	<20	29	38	38	38	37	37	37
R58 Bevege	21	30	20	31	35	35	35	35	35	35
R37 Szymkarczuk[2]	<20	30	<20	34	35	35	35	35	35	35
R30 Cox "Moolarben"	<20	33	<20	35	35	35	35	35	35	35
R28 Chinner	<20	36	<20	35	35	35	35	35	35	35
R31 Cox "Barcoo"	<20	32	<20	35	35	35	35	35	35	35
R36 Rayner	25	32	24	30	35	35	35	35	35	35
R29B Mayberry	52	55	50	>55	35	35	35	35	35	35
R29A Mayberry	50	46	55	55	35	35	35	35	35	35
R47 Herbert	<20	30	<20	25	35	35	35	35	35	35
R32 Stokes	20	24	20	25	35	35	35	35	35	35
R48 O'Sullivan	<20	31	<20	30	35	35	35	35	35	35

[1] "nr" = noise-reducing (general receiver-source wind), "nt" = neutral (calm), "ad" = adverse (general source-receiver wind and inversion).

[2] Noise level exceeded over 25% of vacant land.

5.6.2 Recommendations

Receivers *R29A* (Mayberry) and *R29B* (Mayberry) are in the "affectation zone" for Pit 3 operations with noise levels expected to exceed the 35 dB(A) criterion by more than 5 dB at around Year 9. MCMPL woiuld be required to negotiate agreements with the landowner.

Receiver *R36* (Rayner) may receive noise levels up to 5 dB above the criterion at the commencement of Pit 3 under inversion conditions. No significant exceedances are predicted at this location under all other atmospheric conditions. Since Pit 3 would advance quickly to the southeast, increased distance and a natural hill would act to greatly reduce noise levels at this location. The predicted criterion exceedances would be of relatively short duration with compliant levels expected within a few months of commencing Pit 3. MCMPL would be required to negotiate with the landowner at *R36* (Rayner).

Worst case noise levels at *R20* (Williamson), *R6* (Thompson), *R30* (Cox) and *R28* (Chinner) are predicted to be only 1-2 dB above the criterion.

Again, noise levels at these locations would reduce to compliant levels over a short period of time as Pit 3 progresses to the south east. It is recommended that the 35 dB(A) criterion be applied at these locations, with an allowance for up to 2 dB exceedances under worst case meteorological conditions during the first 6 months of mining in Pit 3.

Noise levels at the commencement of mining in Pit 3 are predicted to be greater than 38 dB(A) over 25% of vacant land owned by *R37* (Szymkarczuk) under inversion conditions.

Receiver *R5* (Swords) would be in the Pit 3 noise "affectation zone". It has been found earlier in this report that this location would fall into the Pit 2 noise "affectation zone" well before commencement of mining in Pit 3. Receivers *R14* (Williamson) and *R6* (Thompson) was also identified as significantly impacted in the assessment of Pit 2.

5.7 Cumulative Mining Noise Impacts

Cumulative noise impacts with existing and possible future (reduced) noise emissions from Ulan Coal Mine have been addressed earlier in this report in the establishment of amenity criteria. Noise criteria for the initial six month period of environmental bund establishment and further 12 months of surface facilities construction were relative to the existing daytime noise emissions from Ulan Coal Mine. Noise criteria for 24-hour mining operations at MCP were based on the completion of a noise reduction program by Ulan Coal Mine.

Reference to the Wilpinjong EIS shows the only residences that could potentially be affected by mine noise from both Wilpinjong and MCP are east of the project site (locations *R22* (Hayes), *R23* (Davies), *R24* (Wallis), *R25* (Little & Salter), *R26* (UCML, unoccupied), *R30* (Renshaw) and *R62* (UCML, Mitchell)). It is noted that these locations are all west of the Wilpinjong Mine site and the worst case noise levels at these locations reported for any operational scenario in the Wilpinjong EIS were under easterly wind conditions. Under these conditions, the noise levels predicted in the current assessment are generally less than 20 dB(A) and up to 25 dB(A),$L_{eq\ (15\ min)}$ at *R30* (Renshaw) only. Noise levels from Ulan Coal Mine at these locations under an easterly wind would be even lower.

Similarly, the worst case noise predictions from MCP are under winds from the southwest with levels approaching (and equalling) the 35 dB(A) criterion at locations *R23* (Davies) and *R26* (UCML, unoccupied). These predicted maximum levels coincide with mining near the northern end of Pit 2 where a saddle in the topography provides a low point between these receivers and Pit 2. Under all operational scenarios presented in the Wilpinjong EIS noise levels were below 20 dB(A) at these receivers under the modelled WNW wind.

Under both worst case scenarios (winds generally from the east for Wilpinjong and from the west for MCP) there is little potential for cumulative mining noise impacts at any receivers.

Worst case predicted noise levels from MCP and Wilpinjong at the most impacted receivers east of MCP (those not included in the noise acquisition zone near the MCP rail loop), for similar years of operation, are summarised in **Table 24**.

Table 24. Cumulative mining noise levels east of MCP - dB(A),$L_{eq(15\ min)}$

Year	Receiver	MCP			Wilpinjong			TOTAL		
		Inv	SW	ESE	Inv	W	E	Inv	W*	E*
Y1 (2008)	*R2* Birt & Hayes	30	<25	<20	<20	<20	<25	30	<26	<26
Y2 (2009)	*R2* Birt & Hayes	31	<25	<20	<20	<20	<25	31	<26	<26
Y6 (2013)	*R16* Little & Salter	24	30	<20	<20	<20	<25	<25	30	<26

* Winds generally from the East and West.

6.0 OFF-SITE RAIL TRAFFIC

6.1 Train Noise and Vibration Criteria

6.1.1 Train Noise Criteria – MCP

The operation of MCP will result in additional train movements to the east on the Gulgong – Sandy Hollow Rail Line between the site and Muswellbrook and to the west between the site and Lithgow. There will be a corresponding increase in noise exposure at residences along the train line with the section between the site and Muswellbrook bearing the greater proportion of existing and proposed train movements.

Chapter 163 of the DEC *Environmental Noise Control Manual* (ENCM) specifies limits on train noise levels as follows:

Descriptor	Planning Levels	Maximum Levels
Leq, 24 hour	55dB(A)	60dB(A)
Lmax	80dB(A)	85dB(A)

These criteria will be assessed as the DEC preferred maximum levels from train noise generated by MCP.

6.1.2 Train Noise Criteria – Cumulative

The Australian Rail Track Corporation (ARTC) operates the Gulgong-Sandy Hollow and Main Northern railways. ARTC's EPL 3142 does not contain environmental noise limits but states the objective of progressive reduction of noise levels from rail lines through Pollution Reduction Programs (PRPs).

While the Gulgong-Sandy Hollow and Main Northern railways are not currently subject to a PRP, Section U1.1 of EPL 3142 provides the following goals to work towards in developing a PRP:

Descriptor	Design Goal
Leq, (15 hour), day	65dB(A)
Leq, (9 hour), night	60dB(A)
Lmax (24 hour)	85dB(A)

These criteria will be considered here in the assessment of cumulative train noise levels as a result of the MCP.

6.1.3 Train Vibration Levels

Various authorities have set maximum limits on allowable ground and building vibration in different situations. In this Report, vibration criteria were obtained from the DEC publication "Assessing Vibration: A Technical Guideline" (AVTG, 2006).

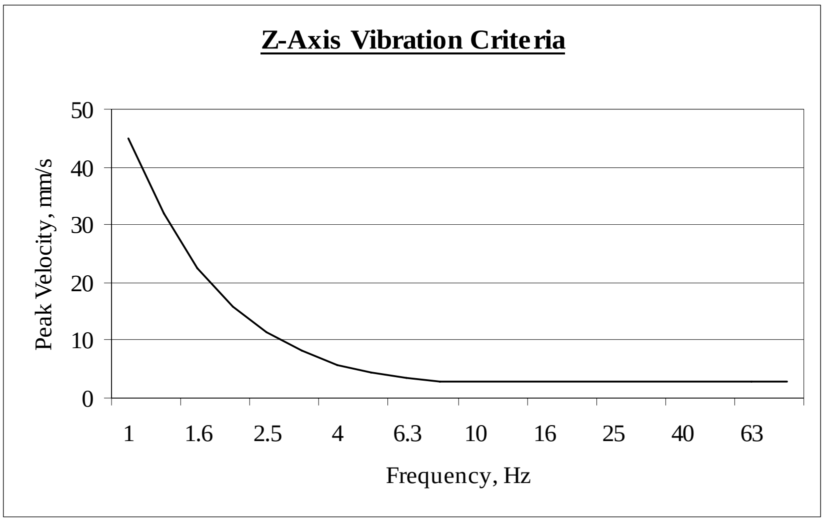
DEC limits are for vibration in buildings, and relate to personal comfort and not structural integrity of the building. **Table 25** shows the applicable multiplying factors, taken from Table B1.1 of the AVTG, which are applied to the base vibration velocity curves in Figures B1.3 and B1.4 of the guideline.

TABLE 25
DEC vertical axis vibration (acceleration) criteria - multiplying factors.

Area, Time	Continuous	Intermittent / Impulsive
Residential - Day	2 -4	60 - 90
Residential - Night	1.4	20

Figure 21 displays the Z-axis (vertical) vibration criteria (expressed in vibration velocity, mm/s) based on an intermittent vibration source in a residential area during night-time hours.

FIGURE 21
Night time criteria for vertical vibration velocity, due to passing coal trains.



As train-induced ground vibrations typically comprise frequencies greater than 10Hz, and the vertical vibration criteria are more stringent than the horizontal vibration criteria, a maximum allowable vertical vibration velocity of 2.82mm/s applies.

6.2 Train Noise Impact Assessment

The Wilpinjong EIS considered noise impacts from existing and consented freight trains (including coal trains from Ulan Coal mine) travelling east from the site as well as the cumulative levels including proposed trains from Wilpinjong. Results are summarised in Table 37 of the Wilpinjong Noise and Blasting Impact Assessment (WNBIS) conducted by Richard Heggie Associates (RHA, 2005).

Based on a rail haulage volume of 9.7 Mtpa, the WNBIS gives the projected numbers of trains from Wilpinjong as four 1542m trains per day on average and up to six per day during peak periods. Up to 3.85 trains per day (ie approximately four) would be required to haul MCP coal.

Subtracting the predicted day and night time existing / consented L_{Aeq} train noise levels from the predicted cumulative levels given in the WNBIS provides a good estimate of the predicted contribution from Wilpinjong trains alone. These values are summarised in **Table 26** below.

TABLE 26
Predicted noise levels from Wilpinjong coal trains (source RHA, 2005).

Distance to receiver	Daytime (Wilpinjong trains only)		
	Average $L_{Aeq(15\ hour)}$	Peak $L_{Aeq(15\ hour)}$	Passby L_{Amax}
30 m	58	58	85
60 m	55	55	81
90 m	53	54	78
Distance to receiver	Night time (Wilpinjong trains only)		
	Average $L_{Aeq(9\ hour)}$	Peak $L_{Aeq(9\ hour)}$	Passby L_{Amax}

30 m	57	58	85
60 m	54	55	81
90 m	52	53	78

Since the product coal tonnages and calculated train numbers (ie four 1542m trains per day) for Wilpinjong and MCP are almost identical, the calculated train noise levels for both mines will be equal. Based on the results in Table 26 the predicted noise levels from MCP trains (all considered to be travelling east from the site) are summarised in **Table 27**.

TABLE 27
Predicted noise levels from MCP based on 10 Mtpa product coal volume.

Distance to receiver	Daytime (Moolarben trains only)		
	Average $L_{Aeq(15\ hour)}$	Peak $L_{Aeq(15\ hour)}$	Passby L_{Amax}
30 m	58	58	85
60 m	55	55	81
90 m	53	54	78
Distance to receiver	Night time (Moolarben trains only)		
	Average $L_{Aeq(9\ hour)}$	Peak $L_{Aeq(9\ hour)}$	Passby L_{Amax}
30 m	57	58	85
60 m	54	55	81
90 m	52	53	78

Predicted cumulative train noise levels as presented in the WNBIS (Table 37) are reproduced below in **Table 28**.

TABLE 28
Predicted cumulative train noise levels in WNBIS (RHA, 2005).

Distance to receiver	Daytime (existing/consented trains + Wilpinjong trains)		
	Average $L_{Aeq(15\ hour)}$	Peak $L_{Aeq(15\ hour)}$	Passby L_{Amax}
30 m	65	65	85
60 m	62	62	81
90 m	60	61	78
Distance to receiver	Night time (existing/consented trains + Wilpinjong trains)		
	Average $L_{Aeq(9\ hour)}$	Peak $L_{Aeq(9\ hour)}$	Passby L_{Amax}
30 m	64	65	85
60 m	61	65	81
90 m	59	60	78

It is noted below Table 36 in the WNBIS that the cumulative train noise calculations included existing Ulan Mine trains and two consented trains (650m long) per day from “Ulan Stage 2”, referring to Underground Mine No 4, which was granted approval in 1985. This approved underground mine is now included as part of the MCP, so almost one-quarter of MCP’s projected number of train movements have already been included in the Wilpinjong cumulative train noise assessment.

Specifically, the WNBIS included one 650m train (two movements) during both the day and the night, whereas the total estimated average number of train movements from MCP for 10Mtpa product coal is approximately three 1500m trains (six movements) during the day and one train at night. The WNBIS, therefore, already includes train movements that are equal to 42% of the MCP trains at night (ie, (1x650m)/(1x1500m) = 0.42) and 14% of the MCP daytime trains (ie, (1X650m)/(3x1500m) = 0.14).

The total cumulative *daytime* train noise level may be calculated by subtracting 0.7 dB from daytime L_{Aeq} values in Table 27 (ie assuming 14% of MCP coal trains during the day have been accounted for in the WNBIS) and logarithmically adding these to the daytime values in Table 28.

Similarly, the total cumulative night time train noise level may be calculated by subtracting 2.4 dB from night time L_{Aeq} values in Table 27 (ie assuming 42% of MCP trains during the night have been accounted for in the WNBIS) and logarithmically adding these to the night time values in Table 28. These calculations are summarised in **Table 29** below.

TABLE 29
Predicted cumulative train noise levels including projected train numbers from MCP.

Distance to receiver	Daytime (existing/consented* trains + Moolarben trains)		
	Average $L_{Aeq(15\ hour)}$	Peak $L_{Aeq(15\ hour)}$	Passby L_{Amax}
30 m	66	66	85
60 m	63	63	81
90 m	61	62	78
Distance to receiver	**Night time (existing/consented* trains + Moolarben)**		
	Average $L_{Aeq(9\ hour)}$	Peak $L_{Aeq(9\ hour)}$	Passby L_{Amax}
30 m	64	65	85
60 m	61	65	81
90 m	59	60	78

* These now include Wilpinjong trains as the project has been approved.

6.3 Discussion of Train Noise Impacts

Comparison of Tables 28 and 29 shows that the introduction of four 1500m trains per day from MCP would increase the cumulative rail noise level presented in the WNBIS by 1dB during the day with no significant increase during the night.

The "set-back" distances at which the noise criteria are met for trains travelling on the Gulgong – Sandy Hollow Railway between the project site and Muswellbrook would not change from those presented in the

WNBIS, since the limiting factor was (and still would be) night time L_{Aeq} noise levels.

6.3.1 DEC Train Noise Criteria – East of site

As discussed in Section 5.1.1 the DEC train noise criteria (Planning Levels) applicable to trains from MCP alone are:

Descriptor	Planning Levels	Maximum Levels
$L_{eq\ (24\ hour)}$	55dB(A)	60dB(A)
L_{max}	80dB(A)	85dB(A)

Reference to Table 27 shows that the "set-back" distance to achieve these criteria would be 70m, governed by the maximum passby level and not the L_{Aeq} level. That is, the L_{Aeq} level would be achieved at approximately 60 m, whereas the L_{Amax} level of 80 dB(A) would be met at approximately 70 m.

6.3.2 ARTC Train Noise Goals – East of site

The ARTC train noise goals in EPL 3142 appear to be guided by the "Maximum" rather than the "Planning" levels recommended by DEC. These levels are reproduced below and will be assessed against the cumulative noise levels shown in Table 29.

Descriptor	Design Goal
Leq, (15 hour), day	65dB(A)
Leq, (9 hour), night	60dB(A)
Lmax (24 hour)	85dB(A)

In this case, the set-back distances would be determined by the L_{Aeq} levels rather than L_{Amax} levels. The L_{Amax} level of 85 dB(A) would be achieved at 30 m, whereas the day and night L_{Aeq} set-back distances would be 40 m and 70 m respectively.

In summary, the set-back distance for MCP trains travelling to Muswellbrook would be 70 m and is governed by L_{Amax} levels relative to the DEC criteria. The setback distance for cumulative train noise levels is also 70 m, governed by night time L_{Aeq} levels relative to the ARTC noise goals.

6.3.3 ARTC Train Noise Goals – West of site

As a worst case, it will be assumed that all coal trains from MCP may travel west to the Mount Piper and Wallerawang power stations near Lithgow. Under these conditions, the DEC set-back distance of 70 m remains. The set-back distance to achieve the ARTC noise goal reduces to 30 m. Both noise limit objectives are governed by L_{Amax} levels. It is considered that the ARTC noise goals would be the governing condition on this section of the rail line.

6.4 Potentially Affected Receivers

An aerial survey of the train line between Muswellbrook and Lithgow (approximately 350 km) was conducted via helicopter in April 2006. All residences within approximately 200 m of the rail line were located using a Global Positioning System (GPS) and later transposed to locations on 1:25000 scale topographic maps. Photographs and videos were also taken to identify these residences and verify distances from the rail line. Receivers have been defined as potentially affected based on the ARTC set-back distances.

6.4.1 Receivers East of site

Twenty-two residences were identified as being within 70 m of the rail line between the site and Muswellbrook. Most of these are in the town of Denman with the remaining residences being in rural areas.

6.4.2 Receivers West of site

Sixteen residences were identified as being within 30 m of the rail line between the site and Lithgow. These mainly include residences in Mudgee, Kandos, Portland, Wallerawang and Rylstone. Two rural residences were identified within the 30 m set-back distance.

The rail line is in cut near many of the residences in towns and some of the rural residences. As a result received maximum noise levels may be considerably lower than 85 dB(A) at 30 m. L_{Aeq} levels at these residences will also be lower than predicted in the above Tables.

Approximately 175 residences were identified as being within the 70 m set-back distance to achieve the more stringent DEC recommended targets for train noise. It is acknowledged that the responsibility for managing noise from off-site train movements rests with ARTC and not MCP.

6.5 Train Vibration Levels

Vibration levels from laden and unladen coal trains have been widely studied in the Hunter Valley. A thorough assessment conducted in 1997 (*Noise and Vibration Assessment, Jerrys Plains Rail Spur, Wilkinson Murray Pty Limited*, WMPL) forms the basis of the rail vibration assessment in this study. The WMPL investigation of ground vibration levels induced by passing coal trains found worst-case peak particle velocities, at a central frequency of 40Hz, of approximately 0.11mm/s at a distance of 20m from the rail line. This is less than one-twentieth of the 2.82mm/s criterion and therefore exceedances of the rail vibration criterion are not expected at any receiver.

7.0 OFF-SITE ROAD TRAFFIC

A Traffic Impact Assessment (TIA) for the project has been prepared by Sinclair Knight Merz (SKM). Results from that assessment have been used to estimate the potential for road traffic noise impacts.

The TIA assumed that all mine workers will live in Mudgee and Gulgong. While most heavy vehicles delivering goods to the site are expected to use Ulan Road (MR 214), an estimated 25% of employee vehicles will travel on Cope Road (MR 598) which links the site with Gulgong and passes through Ulan village. The increased traffic numbers through Ulan village around shift changes is considered to represent the greatest potential for traffic noise impacts from the project.

Only a very minor proportional increase in daytime traffic on Ulan Road is expected due to site delivery vehicles and the additional noise from this minor increase has not been assessed.

7.1 Traffic Noise Criteria

Noise criteria for the generation of additional traffic on public roads were sourced from the DEC *Environmental Criteria for Road Traffic Noise* (ECRTN). Considering MR214 and MR 598 as collector roads, the ECRTN criteria are as follows:

Category	Day (7am-10pm)	Night (10pm-7am)
Land use development with potential to create additional traffic on collector roads	60dB(A),$L_{eq(1hr)}$	55dB(A),$L_{eq(1hr)}$

Since these are 1-hour criteria, they will be applied to shift changes as the worst case for maximum traffic noise impacts.

7.2 Assessment Methodology

Off-site vehicle movements would be of an intermittent rather than constant nature. There are many methods available for calculating the cumulative noise impact arising from intermittent signals of various shapes. The methodology employed in this assessment was sourced from the US Environmental Protection Agency document No. 550/9-74-004 “Information on Levels of Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, March 1974”.

The main parameters considered in the traffic noise assessment are

L_{max} = maximum vehicle noise at residence, dB(A)
T = assessment period (minutes)
τ = “10dB-down” duration per vehicle (minutes), and
n = number of vehicles during assessment period.

The facade of the nearest residence to MR 598 in Ulan village is assumed to be 20 m from the centre of the road, at which distance the maximum noise level (L_{max}) from a passing light vehicle is approximately 65 dB(A) at town speed (60 km/h). The TIA estimates the maximum hourly traffic load of up to 190 vehicles would occur around the morning shift change at 7 am. Of these approximately 25% (or 48 vehicles) may pass through Ulan village in a 1-hour period and, therefore, n = 48 and T = 60.

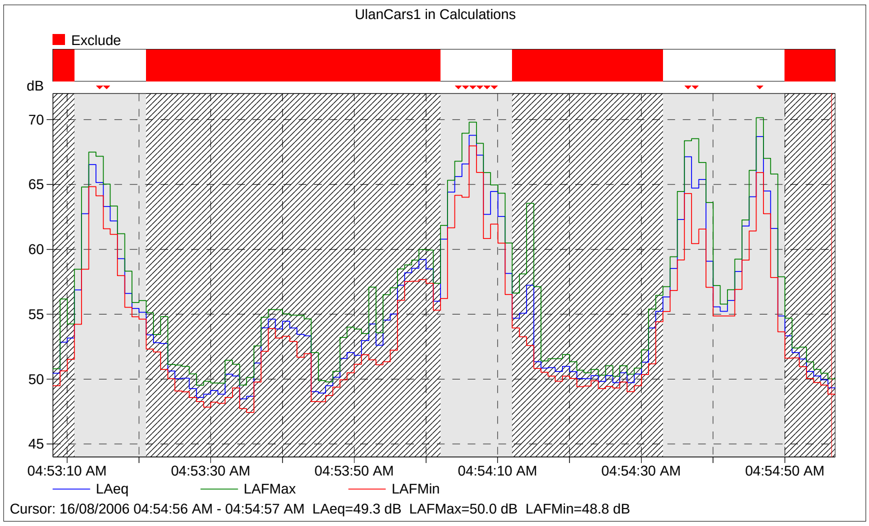
The duration per vehicle, τ, is calculated from the distance between source and receiver, D, and the vehicle speed, v, by $\tau = 0.1D/v$. Substituting values gives τ = 0.12 min (7 s). A value of 10 s was used in the calculation to allow for slower speeds at corners.

7.3 Predicted Traffic Noise Levels

Using the parameters discussed above, a traffic noise level of 51 dB(A),$L_{eq(1\ hr)}$ was calculated at 20 m from the centre of the road. It must be noted that this number may be high, since all workers were assumed to travel to work on MR 215 (from Mudgee) or MR 598 (from Gulgong), whereas some workers may come from other areas. It was also assumed that the entire day shift would arrive between 6:30 am and 7 am and the night shift would all leave between 7 am and 7:30 am. It is acknowledged in the TIA that the total shift change traffic is likely to occur over a period closer to two hours.

Based on this assessment, the traffic noise level in Ulan village at shift change will be below the night time noise criterion of 55 dB(A),$L_{eq(1\ hr)}$.

Noise measurements conducted by the author in Ulan village on 16 August 2006 included four light vehicles passing by on route to (presumably) Ulan or Wilpinjong mines, enabling an accurate calculation of traffic noise levels to be performed. A 1-second time-trace of these vehicles is shown below. (Note: the internal clock on the sound level meter was 1 hour slow).



The maximum pass-by noise levels at 12m from the centre-line of the lane ranged from 67-70 dB(A). Removing the data between car passages using Bruel & Kjear Evaluator software revealed that the four cars contributed 63.4 dB(A),$L_{eq(37\ sec)}$. A sound exposure level (SEL) is essentially a 1-second L_{eq} and is a useful measure for adding discrete noises together. The SEL for the four cars is

SEL (4 cars) = 63.4 + 10*Log(37) = 79.1 dB(A).

The assessment considered that 48 cars may pass through Ulan village during one hour at shift change as a worst case. Since this is 12 times the number of measured cars (ie 4) we have

SEL (48 cars) = 79.1 + 10*Log(12) = 89.9 dB(A).

The traffic noise criterion is over a 1-hour period, so the above SEL is 'averaged' over one hour as

$L_{Aeq(1hr)}$ = 89.9 – 10*log(3600) = 54.3 dB(A).

Finally, the measurement was at 12m from the source and the minimum distance to a residence was estimated at 20m in the acoustic assessment. Assuming that L_{Aeq} levels from a line source drop off as 1/r (ie cylindrical radiation) as opposed to the more rapid $1/r^2$ reduction for a point source (ie spherical radiation) the level at 20m from the road is estimated as

$L_{Aeq(1hr)}$ = 54.3 – 10*log(20/12) = 52.1 dB(A).

This is slightly higher than the 51 dB(A) predicted using the intermittent noise calculation, but is below the night time traffic noise criterion of 55 dB(A),$L_{eq(1\ hour)}$.

Informal information presented at the IHAP suggested that there may currently be up to 200 light vehicles passing through Ulan village in a one-hour period between approximately 5:30 and 6:30 am. The 1-hour L_{Aeq} from this number of vehicles is

$$L_{Aeq(1hr)} = 52.1 + 10*\log(200/48) = 58.3 \text{ dB(A)}.$$

This level is above the 55 dB(A) criterion recommended in the ECRTN. Adding the predicted 52.1 dB(A) from MCP to the maximum existing level of 58.3 dB(A) gives a total traffic noise level of 59.2 dB(A).

An increase of 0.9 dB over the existing traffic noise level is less than the maximum 2 dB increased allowed under the ECRTN in situations where the recommended criteria are currently exceeded.

A noise compliance monitoring location in Ulan village will be documented in the NMP to ensure that measurements are taken during the period of maximum traffic volume in the village. The measurement will record and report total traffic noise level and number of vehicles.

8.0 BLAST OVERPRESSURE AND VIBRATION

8.1 Blasting Criteria

8.1.1 Annoyance Criteria

Noise and vibration levels from blasting are assessable against criteria proposed by the Australian and New Zealand Environment and Conservation Council (ANZECC) in their publication *"Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration – September 1990"*. These criteria are summarised as follows:

- The recommended maximum overpressure level for blasting is 115 dB;

- The level of 115 dB may be exceeded for up to 5% of the total number of blasts over a 12-month period, but should not exceed 120 dB at any time;

- The recommended maximum vibration velocity for blasting is 5 mm/s Peak Vector Sum (PVS);

- The PVS level of 5 mm/s may be exceeded for up to 5% of the total number of blasts over a 12-month period, but should not exceed 10 mm/s at any time;

- Blasting should generally only be permitted during the hours of 9 am to 5 pm Monday to Saturday, and should not take place on Sundays and Public Holidays; and

- Blasting should generally take place no more than once per day.

8.1.2 Building Damage Criteria

Building damage assessment criteria are nominated in AS 2187.2-1993 *"Explosives – Storage, Transport and Use. Part 2: Use of Explosives"* and summarised in **Table 30.**

TABLE 30
Blasting criteria to limit damage to buildings (AS 2187).

Building Type	Vibration Level (mm/s)	Airblast Level (dB re 20 μPa)
Sensitive (and Heritage)	5	133
Residential	10	133
Commercial/Industrial	25	133

The annoyance (ANZECC) criteria are more stringent than the building damage criteria (Table 30) and will be taken as the governing criteria for the assessment of impacts from the MCP. Also, DEC typically indicates that blasting should achieve a long-term maximum ground vibration level of 2 mm/s PVS.

8.2 Blast Impact Assessment Procedure

The following sections provide standard equations for predicting blast overpressure and ground vibration levels, sourced from the United States Bureau of Mines.

8.2.1 Blast Overpressure

Unweighted airblast overpressure levels (OP) are predicted from **Equation 1** below.

$$OP = 165 - 24(\log_{10}(D) - 0.3\log_{10}(Q)), \quad dB \qquad (1)$$

where D is distance from the blast to the assessment point (m) and
Q is the weight of explosive per delay (kg).

Analysis of 12 months blast data for a coal mine in the Hunter Valley has shown Equation 1 to underestimate overpressure levels by up to 3 dB for small blasts (MIC 100-400kg) and overestimate by 1 dB for larger blasts (MIC > 400kg). Given the range of MIC values considered in this assessment (450-850 kg) no correction has been applied to Equation 1 to provide a small element of conservatism.

8.2.2 Blast Vibration

The basic equations for calculation of peak particle vibration (PPV) levels from blasting are as follows:

$$PPV = 1140\left(\frac{D}{Q^{0.5}}\right)^{-1.6}$$, mm/s (for average ground type) (2)

$$PPV = 500\left(\frac{D}{Q^{0.5}}\right)^{-1.6}$$, mm/s (for hard rock) (3)

where *D* and *Q* are defined as in Equation 1.

A coefficient value of 1000 has been used to approximate reasonably soft ground in the blast vibration calculations to provide a conservative assessment as no specific site law has been established through trial blasting.

8.3 Blast Impact Predictions

8.3.1 Residential Receivers

Predicted blast overpressure and ground vibration levels are shown in **Table 31** for receivers within 2000 m of proposed Pits 1 – 3. Calculations are based on a range of charge weights (Maximum Instantaneous Charge weight, MIC) up to the maximum value of 850 kg provided by the Mining Engineer.

Levels greater than the 5% exceedance limits (115 dB overpressure and 5 mm/s vibration) are shaded grey. Levels equal to or exceeding the absolute limits (120 dB overpressure and 10 mm/s vibration) are in bold type.

TABLE 31
Predicted blast overpressure and ground vibration levels.

Receiver	Distance (m)[a]	MIC = 450 kg		MIC = 650 kg		MIC = 850 kg	
		PPV[b]	OP[c]	PPV	OP	PPV	OP
R157 Power	1325	1.4	111	1.9	113	2.3	114
R160A School	1255	1.5	111	2.0	113	2.4	114
R25 Tuck-Lee	715	3.7	118	5.0	119	6.2	120
R24 Hoare	1145	1.8	112	2.3	114	2.9	115
R49 Olive-Lea	1630	1.0	109	1.3	110	1.6	111
R26 Robinson	1600	1.0	109	1.3	110	1.6	111

R5 Swords	510	6.4	121	8.6	122	10.6	123
R20 Williamson	1225	1.6	112	2.1	113	2.6	114
R36 Rayner	715	3.1	118	5.0	119	6.2	120
R28 Chinner	1630	1.0	109	1.3	110	1.6	111
R30 M Cox	1325	1.4	111	1.9	113	2.3	114
R29B Mayberry	<100m	83.7	138	112.3	139	139.2	140
R29A Mayberry	300m	14.4	127	19.4	128	20.0	129
R32 Stokes	1835	0.8	107	1.1	109	1.4	110

[a] Distance from receiver to closest point of nearest Pit.
[b] Peak vertical ground vibration, mm/s.
[c] Blast overpressure, dB.

8.3.2 Non-residential Locations

The closest sensitive road/rail infrastructure to blasting activities is the Ulan Road bridge over the Gulgong – Sandy Hollow rail line east of the UCML rail loop. Blasting in the north-eastern corner of Pit 1 may come within 300m of this bridge. At this distance, MIC values less than 650 kg must be used if the 20mm/s vibration limit for rail culverts is to be satisfied.

It should be noted that blasting will commence at large distances from any sensitive road/rail structures and ample site data will be available to enable appropriate blast design near these structures.

Blasting will occur within 700m of the Moolarben Dam wall. Moolarben Dam is a prescribed dam which is 12m high and of rockfill construction. Predicted ground vibration levels at the dam wall from blasting in Pit 1 will be approximately equally to the maximum 6.2 mm/s predicted at *R16* (Tuck-Lee).

The NSW Dams Safety Committee (DSC) 2004/05 Annual Report identifies no significant safety risks at Moolarben Dam, suggesting that it is structurally sound. Since dam walls must be constructed to withstand earthquakes, which are far more intense than blasting vibration magnitudes, there is no risk to the dam from MCP blasting activities.

Two rock shelter sites (referred to in the archaeological report as S1MC55 and S1MC56) in the escarpment near Pit 2 will receive vibration levels from blasting in Pit 2 which are well below the 80mm/s limit cited in the Wilpinjong EIS. Again, site specific data would be available to more accurately estimate vibration impacts well before blasting commences in Pit 2.

8.4 Discussion of Blast Impacts and Recommendations

Two locations, *R29A* (Mayberry) and *R29B* (Mayberry), will be extremely impacted by blasting in Pit 3 and the dwellings would not be able to withstand the predicted level of ground vibration. A negotiated agreement should be made between these landowners and MCMPL before commencement of mining in Pit 3.

The Swords residence (*R5*) would be significantly impacted by blast overpressure and ground vibration from mining in Pit 2. The amenity criteria (115 dB overpressure and 5 mm/s vibration) are likely to be exceeded for all blasts and the 10 mm/s criterion for potential building damage is likely to be exceeded for the larger blasts.

Small to moderately sized blasts are predicted to approach and slightly exceed the criteria at both *R25* (Tuck-Lee, Pit1) and *R36* (Rayner, Pit 3). In both of these cases, the relevant Pit will advance directly away from the residence so the maximum impact from blasting would be relatively brief at these locations. Also, smaller blasts would be required at the western edge of the resource and the larger blasts would only be required further east as the seams dip. Vibration levels well below the 10mm/s criterion for potential building damage are predicted at both locations even for the larger blasts.

Three of these four impacted locations, *R20* (Williamson), *R6* (Thompson) and *R5* (Swords), are within the noise affectation zones for the respective Pits and a negotiated agreement should be made between these landowners and MCMPL before commencement of mining in Pit 2.

It is recommended that a negotiated agreement be reached between MCMPL and the landowner at *R36* (Rayner) before commencement of mining in Pit 3. It should be noted that there would be several years of blast monitoring results available before the commencement of Pit 3 to gain a better understanding of the site-specific blast propagation law and therefore a more reliable estimate of blast impacts could be made.

The DEC long term goal of 2 mm/s vibration would be achieved at distances beyond 1430m for the larger blasts (MIC 850kg). Mining is expected to be this distance from Ulan village after the second year, with operations continuing to move further away. Again, it is unlikely that large blasts would be required at the western extent of Pit 1 (ie closest to Ulan village) since this is where the resource is closest to the surface.

In many cases, the relevant Pit will be between the blast site and residential receiver (ie Pits 2 and 3 advance away from the nearest receivers). While this is not allowed for in the calculations of blast impacts, it is expected that the pit void would provide a ground vibration "barrier" and lower levels of ground vibrations may be experienced.

9.0 SUMMARY OF IMPACTS AND RECOMMENDATIONS

9.1 Pit 1 Mining

Based on the results of noise modelling for the initial mining and Year 1 scenarios, it was found that a period of up to six months would be required to establish an acoustic bund between Pit 1 and the most affected residential receivers. The bund was found to attenuate Pit 1 mining noise levels by up to 7 dB within Ulan village and it was recommended that elevated noise criteria be approved for the first six months of the project.

Construction of surface facilities is expected to occur during the first 18 months of the project with 24-hour mining, coal processing and transportation to commence after this time.

The residences predicted to be significantly impacted by Pit 1 operations are *R12* (M&J Transport, impacted by rail noise), *R24* (Hoare, impacted by noise) and *R25* (Tuck-Lee, impacted by noise and blasting). An agreement should be negotiated between MCMPL and these receivers prior to commencement of activities in Pit 1.

Locations *R13* (Renshaw), *R46A* (The Flannery Centre), *R49* ("Olive Lea"), *R26* (Robinson), *R5* (Swords), *R6* (Thompson) and *R14* (Williamson) are predicted to have minor – moderate noise criterion exceedances. These locations would be placed in a noise "management zone" and should be included in a noise monitoring program (other noise monitoring locations may be nominated at the discretion of DEC). Provisions should be made in the project Consent for MCMPL to negotiate agreements with landowners should noise monitoring confirm criterion exceedences.

Noise monitoring for MCP during the construction period should also determine the noise contribution from Ulan Coal Mine operations with the results made available to DEC and DoP. This would assist the regulatory agencies in assessing the effectiveness of the Ulan Coal Mine noise reduction program.

9.2 Pit 2 Mining

The residences predicted to be significantly impacted by Pit 2 operations are *R13* (Renshaw, impacted by Pit 2 mining combined with rail noise), *R25* (Tuck-Lee, impacted by noise), *R5* (Swords, impacted by noise and blasting), *R6* (Thompson, impacted by noise) and *R20* (Williamson, impacted by noise). These locations may be omitted as noise monitoring locations for Pit 2, although other locations may be included by DEC.

MCMPL would be required to negotiate agreements with the impacted landowners.

9.3 Pit 3 Mining

The residences predicted to be significantly impacted by Pit 3 operations are *R29A* (Mayberry, impacted by End Pit 3 noise and blasting), *R29*B (Mayberry, impacted by End Pit 3 noise and blasting), *R5* (Swords, impacted by Start Pit 3 noise) and *R36* (Rayner, impacted by Start Pit 3 noise).

MCMPL would be required to negotiate agreements with the impacted landowners.

Minor (ie no greater than 2 dB) noise criterion exceedances were predicted at *R31* (Cox) and *R28* (Chinner) under worst case meteorological conditions at the commencement of Pit 3. These locations should be included in a noise monitoring program. Other locations may be nominated by DEC.

10.0 CONCLUSION

A noise and vibration impact assessment has been conducted for the proposed Moolarben Coal Project in the Western Coalfields of NSW, 40 km northeast of Mudgee and 25 km east of Gulgong.

The assessment has found several locations that would be adversely impacted by the project and recommendations have been made regarding negotiated agreements between the affected residents and Moolarben Coal Mines Pty Ltd (MCMPL).

It was also found that the leading (western) edge of the Pit 1 out of pit emplacement (OOP1) could be formed within a period of approximately six months and would significantly reduce noise levels of night-time operations by up to 7 dB in Ulan village and at some rural residences to the west of the project site.

A recommendation has been made to allow higher noise criteria for the period of bund formation. After completion of the bund, daytime noise limits would be in force until 24-hour mining commences. At this time, operation noise criteria would apply.

Some minor to moderate exceedances of the operational noise criteria were predicted. Since the possibility of further reducing noise levels (lower than the levels achieved with the acoustic bund) would be prohibitively costly, it has been recommended that the affected receivers be incorporated in a noise monitoring program. The results of noise measurements would be considered in any future negotiations between these residents and MCMPL. Since the proposed acoustic bund would be over 1500m long, there would be the possibility of planning multiple dumping locations to minimise noise impacts under adverse weather conditions. A comprehensive Noise Management Plan would be developed prior to construction activities commencing.

It has also been found that some of the residences impacted by noise would also be adversely impacted by blast overpressure and ground vibration. Two locations near the proposed rail loop were predicted to receive excessive noise from coal trains on the MCP rail loop. Negotiations between these landowners and MCMPL have commenced.

It was found that 22 receivers east of the site and 16 receivers west of the site may be close enough to the train line to receive noise levels from coal trains that would exceed the ARTC design goals in EPL 3124. Approximately 175 residences west of the site may receive noise levels higher than the more stringent DEC recommended train noise levels. The potential impacts east of the site (towards Muswellbrook) would depend on the total number of trains while impacts to the west (towards Lithgow) would depend on maximum levels from individual trains.

The exact impact of train noise generated by the project, when considered cumulatively with all other rail users, is difficult to determine based on the available information. For example, the proportion of trains that may travel east and west of the site is unknown.

It is acknowledged by DEC, DoP and the ARTC that management of noise from coal trains travelling on the RIC corridor is the responsibility of ARTC and would be addressed by them should the issue of noise arise when the number of trains increases.

An assessment of potential sleep disturbance under the worst case scenario has predicted levels that are not likely to disturb the sleep of any receiver. With the acoustic bund in place, the noise will be a general mine 'hum' with approximately ± 5dB fluctuation and sources typically identified with sleep disturbance (bucket impacts, dozer tracks, overburden dumping) will be shielded by the OOP1 acoustic bund at times when these sources may be a problem. Plant items will be fitted with broadband reverse alarms which have proven very effective in mitigating their noise impact.

Noise levels from light vehicles travelling to site at shift-change were predicted to be below the DEC criterion. No significant traffic noise impact will occur from heavy vehicle deliveries to the MCP site during the daytime.

Excessive vibration levels from blasting have been predicted at some receivers close to proposed Pits 2 and 3. Negotiated agreements will need to be reached between these receivers and MCMPL. No blasting criteria exceedances (ground vibration or airblast overpressure) have been predicted in Ulan village. In terms of both noise and blasting, residents in Ulan village will benefit from the fact that the MCP will commence at approximately the nearest point to the village and advance towards the northeast, thereby reducing both noise and vibration levels in the village over a relatively short period of time.

Blasting will occur within 700m of the Moolarben Dam wall. Predicted ground vibration levels at the dam wall from blasting in Pit 1 will be approximately 6.2 mm/s. Since dam walls must be constructed to withstand earthquakes, which are far more intense than blasting vibration magnitudes, there is no risk to the dam from MCP blasting activities.

Two rock shelter sites (referred to in the archaeological report as S1MC55 and S1MC56) in the escarpment near Pit 2 will receive vibration levels from blasting in Pit 2 which are well below the 80mm/s limit cited in the Wilpinjong EIS.

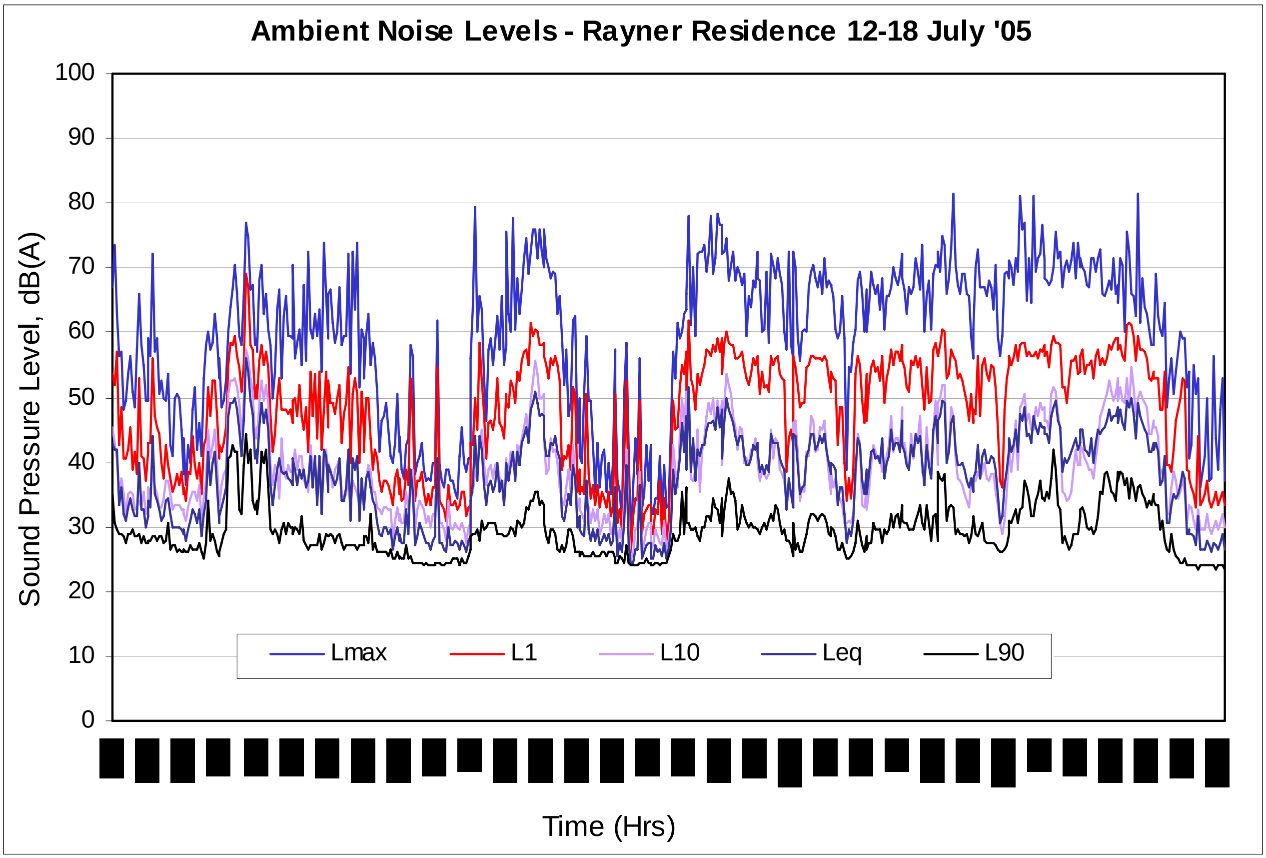
In summary, it has been found that through a combination of negotiated agreements, formation of an acoustic bund west of Pit 1, an initial period of allowable elevated noise emissions, noise monitoring and the opportunity for future negotiations to be conducted, the Moolarben Coal Mine could operate within the applicable noise and vibration guidelines.

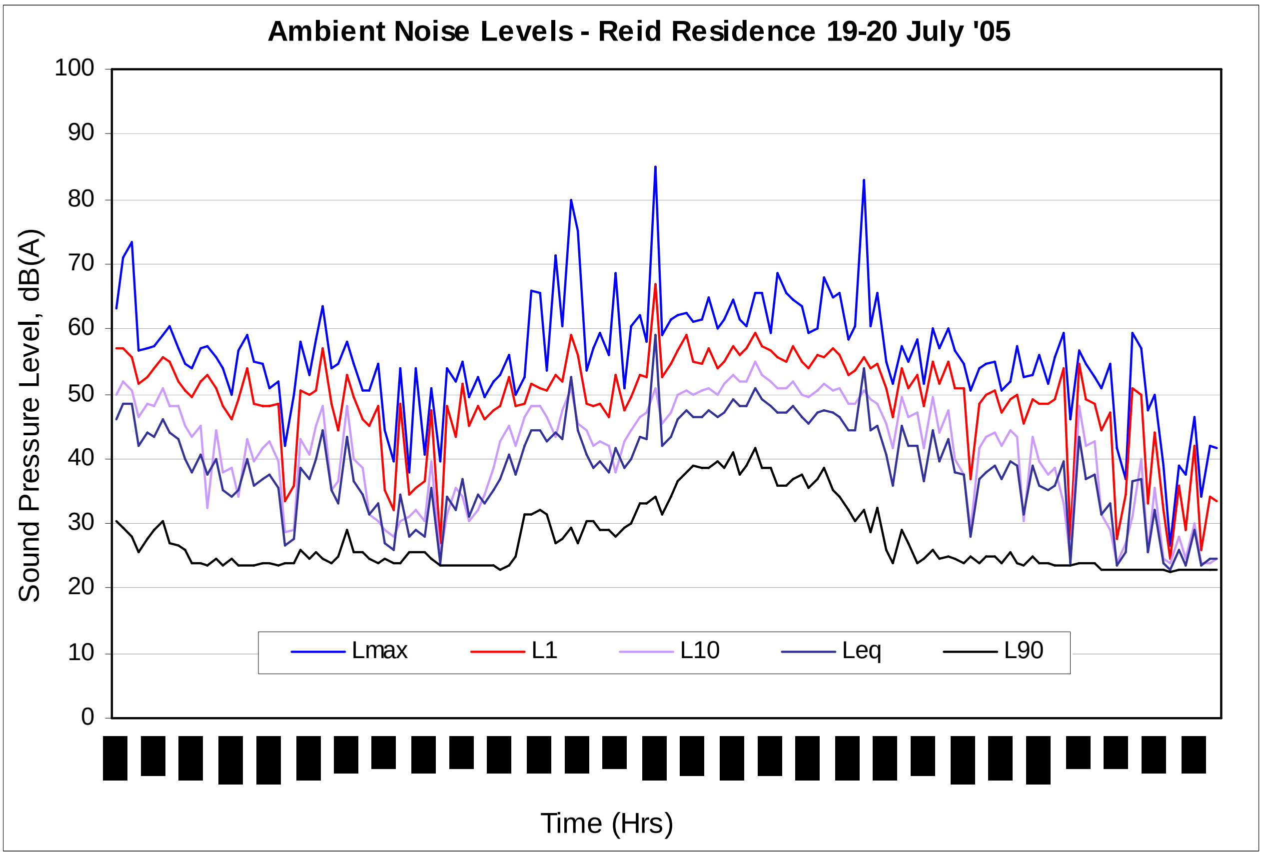
APPENDIX A

NOISE LEVEL CONTOURS

APPENDIX B

MEASURED AMBIENT NOISE DATA CHARTS


Ambient Noise Levels - Rayner Residence 12-18 July '05
Sound Pressure Level, dB(A)
100
90
80
70
60
50
40
30
20
10
0
Lmax
L1
L10
Leq
L90
Time (Hrs)


Ambient Noise Levels - Reid Residence 19-20 July '05
Sound Pressure Level, dB(A)
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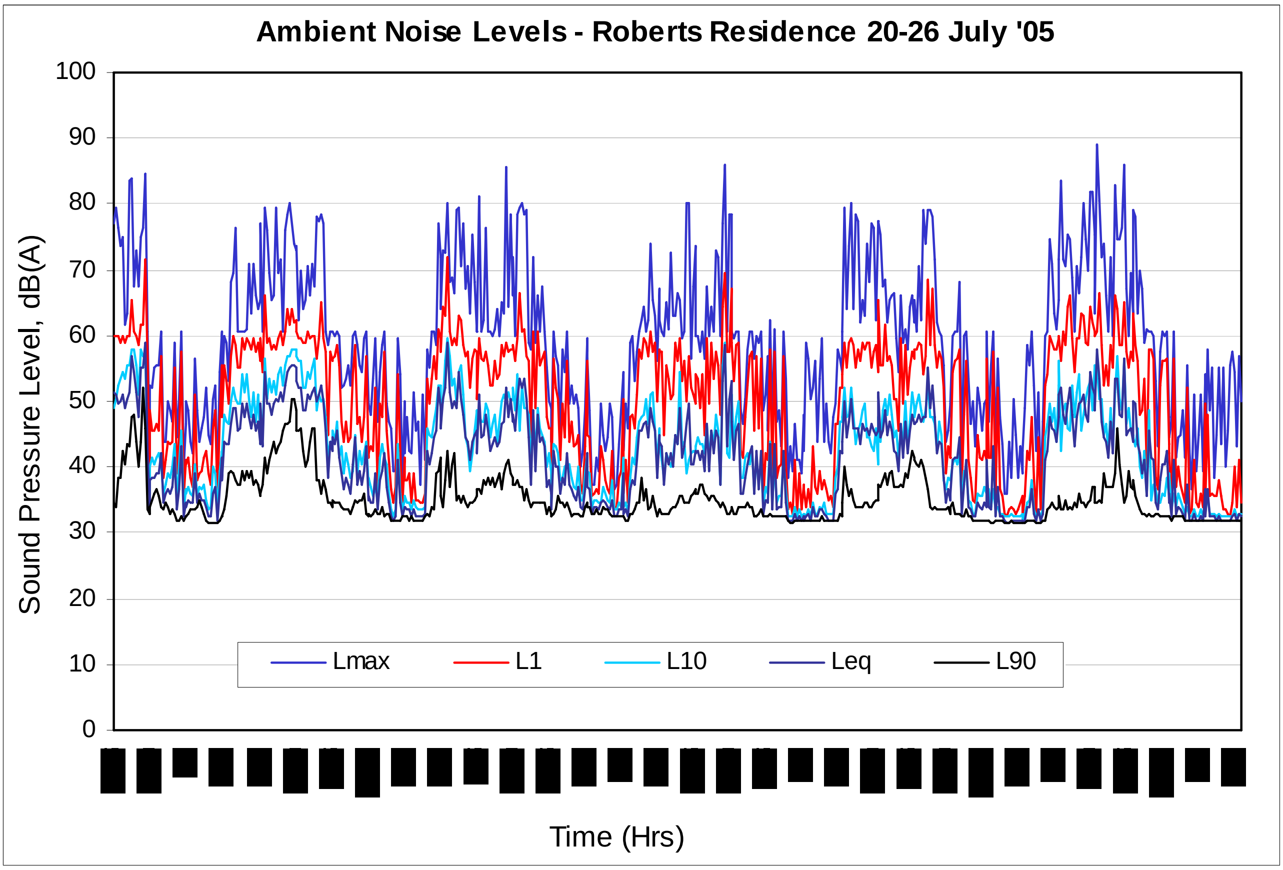
90
80
70
60
50
40
30
20
10
0
Lmax
L1
L10
Leq
L90
Time (Hrs)


Ambient Noise Levels - Roberts Residence 20-26 July '05
Sound Pressure Level, dB(A)
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80
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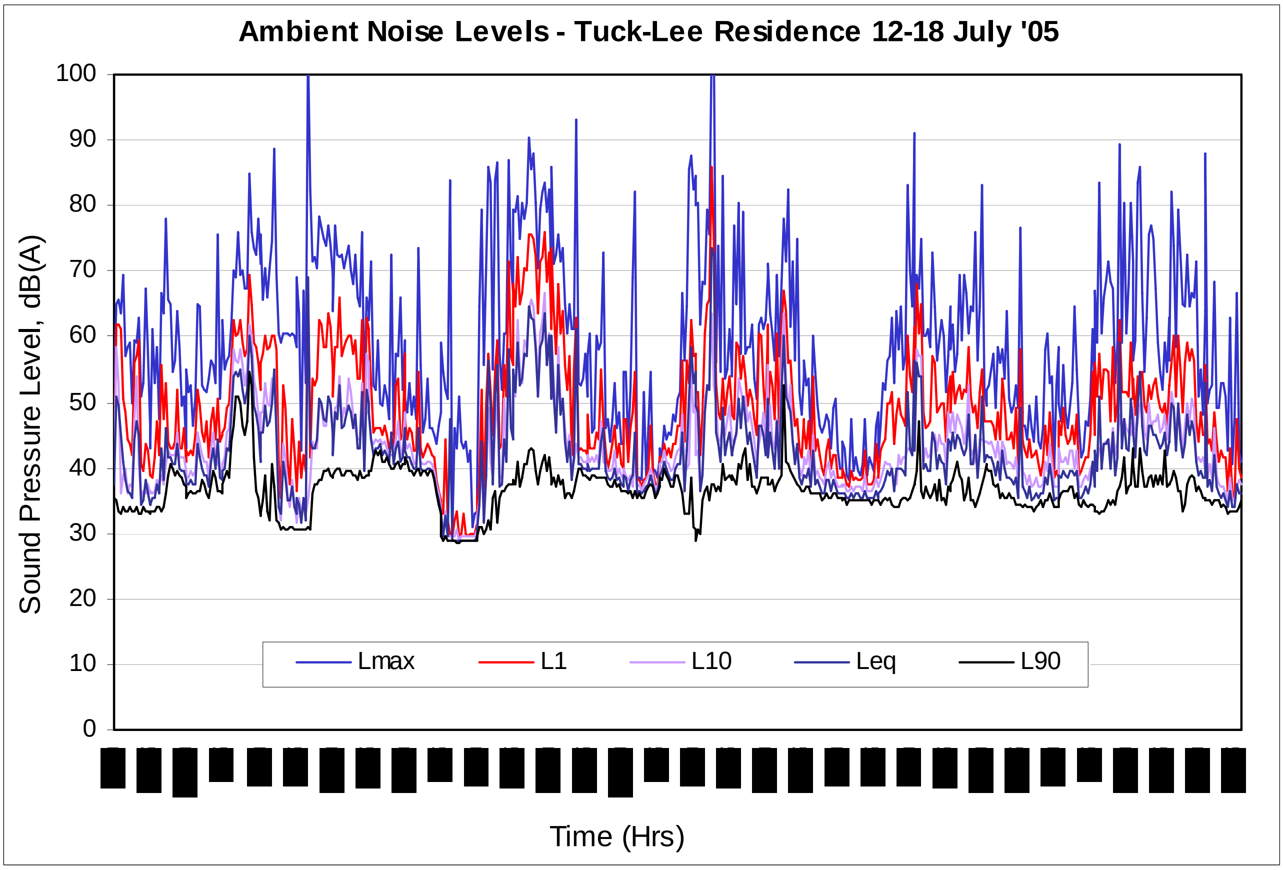
60
50
40
30
20
10
0
Lmax
L1
L10
Leq
L90
Time (Hrs)


Ambient Noise Levels - Tuck-Lee Residence 12-18 July '05
Sound Pressure Level, dB(A)
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40
30
20
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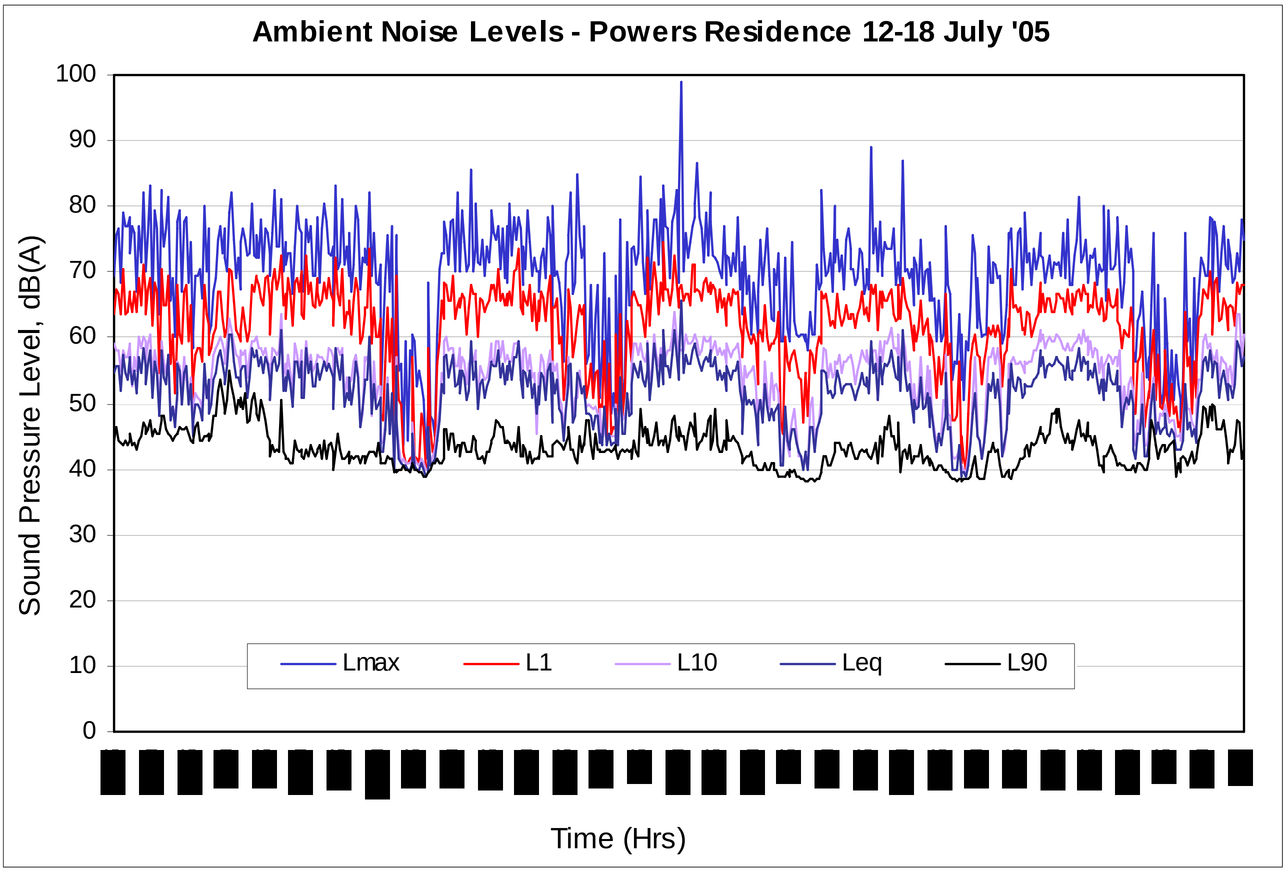
0
Lmax
L1
L10
Leq
L90
Time (Hrs)


Ambient Noise Levels - Powers Residence 12-18 July '05
Sound Pressure Level, dB(A)
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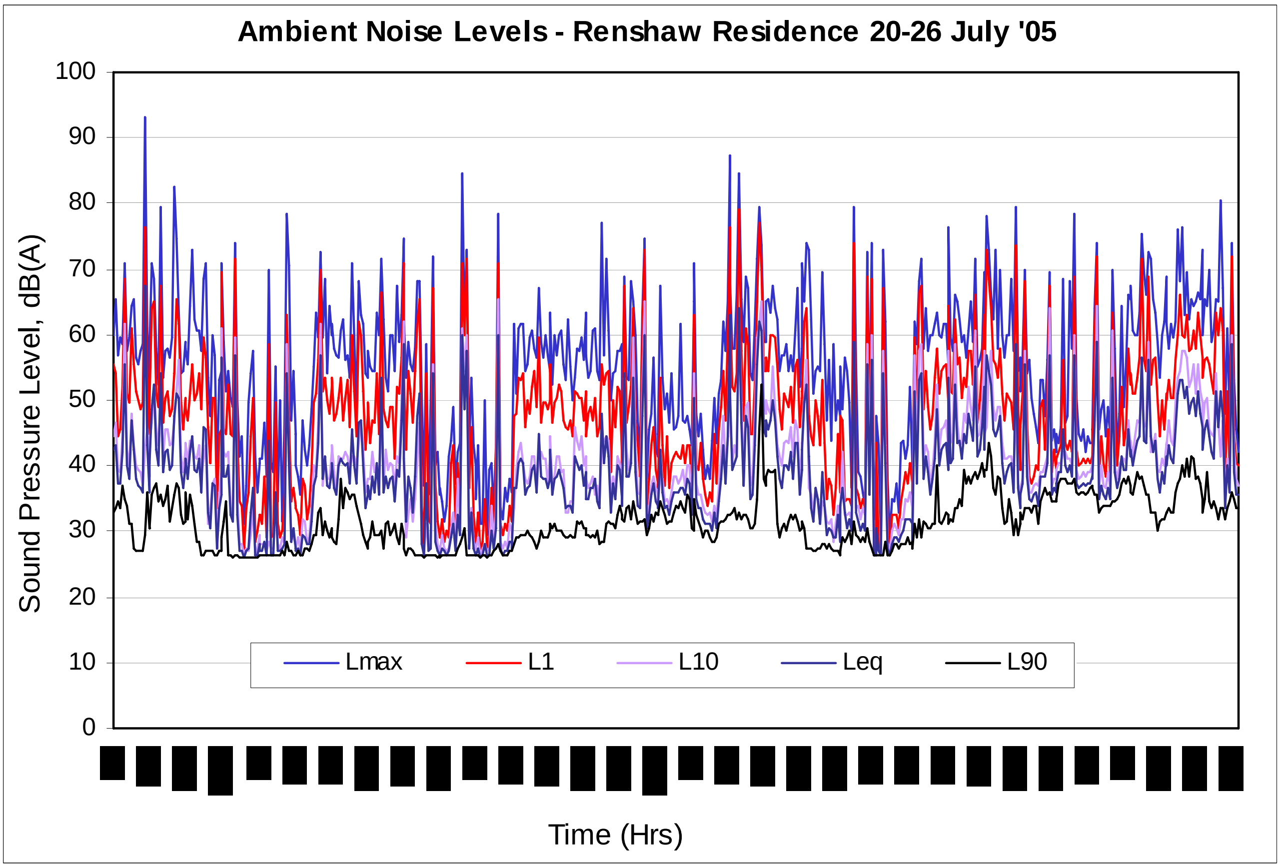
70
60
50
40
30
20
10
0
Lmax
L1
L10
Leq
L90
Time (Hrs)


Ambient Noise Levels - Renshaw Residence 20-26 July '05
Sound Pressure Level, dB(A)
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80
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60
50
40
30
20
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0
Lmax
L1
L10
Leq
L90
Time (Hrs)