

12 Noise and Vibration

12.1 Introduction

A noise and vibration assessment was undertaken of the project and a detailed technical report (Appendix M) prepared. This section outlines the existing background noise of the project site and surrounds and identifies the potential construction and operational noise and vibration (including blasting and transport noise) impacts associated with the proposed development on the greater Moranbah community.

12.2 Local Setting and Project Overview

12.2.1 Existing Receptor Locations

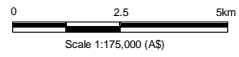
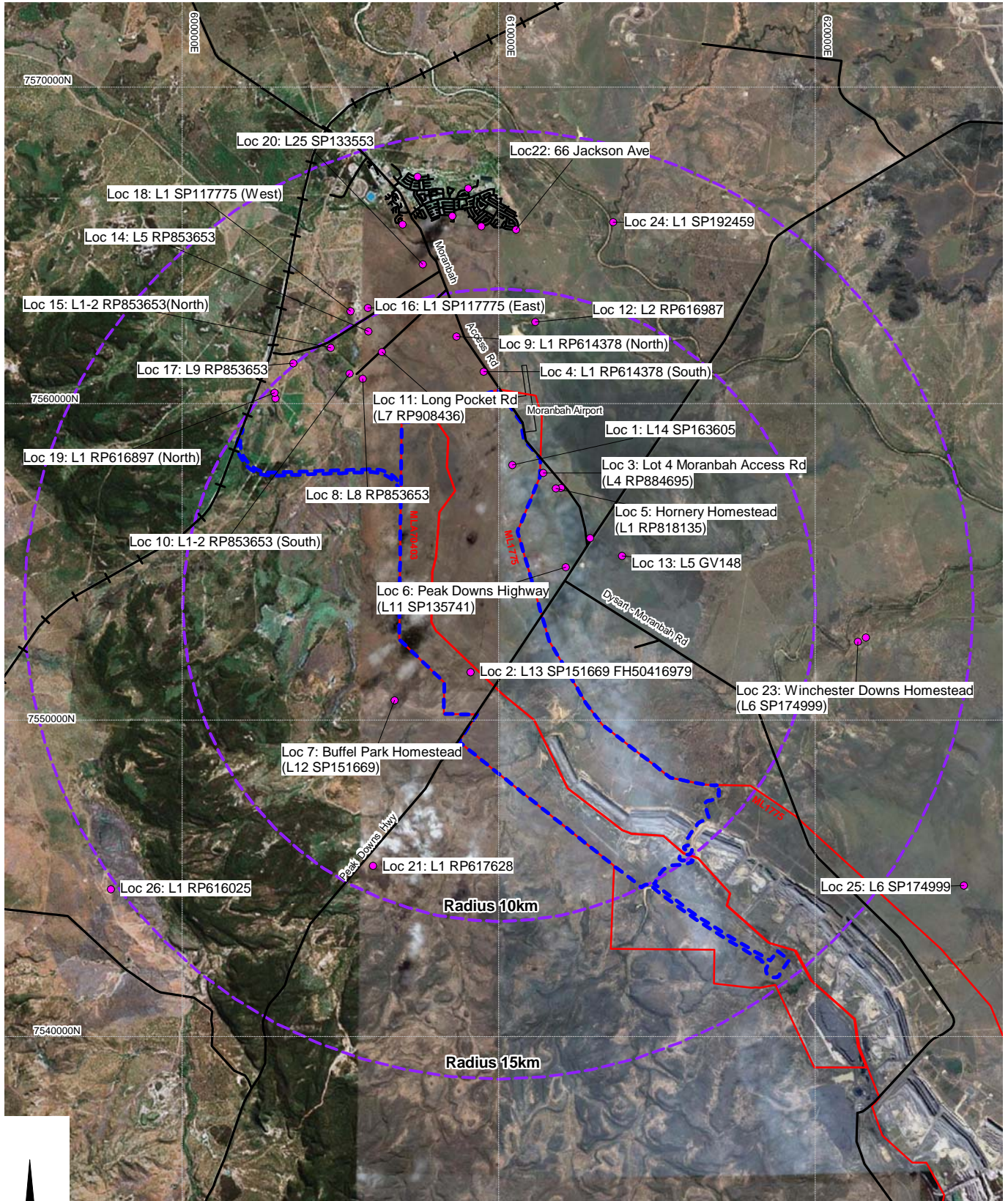
The closest sensitive receptors to the site are 23 residences located within a distance of approximately 5 km of the project site boundary. These residences comprise:

- Twelve residences located within a distance of approximately 3 km of the project site boundary.
- Eleven residences located within a distance of approximately 3 to 5 km of the project site boundary.

Moranbah, at its closest point, is located approximately 5 km to the north of the project site boundary and includes the monitoring location 66 Jackson Avenue as a representative location.



There are three other noise sensitive receptors located between 5 and 12 km of the site boundary that are remote from Moranbah.

Locations of sensitive receptors in relation to the project site are shown in Figure 12.1.



- Noise Sensitive Receiver
- Project Site
- Mining Lease

Source: BMA Supplied Data (November 2007)
 Note: Prepared by URS on behalf of Heggies Pty Ltd

Client  	Project CAVAL RIDGE PROJECT ENVIRONMENTAL IMPACT STATEMENT		Title LOCATION OF NOISE SENSITIVE RECEPTORS IN RELATION TO THE PROJECT AREA	
	Drawn: VH	Approved: RS	Date: 08-05-2009	
Job No: 4262 6158		File No: 42626158-g-577b.wor		Figure: 12.1
				Rev: B A4

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12.2.2 Proposed Development

Open cut mining at Caval Ridge Mine will have two main components: Overburden removal and coal mining. Strip mining technique will be utilised.

Overburden removal will occur during the pre-strip process and will utilise a truck and shovel fleet, as well as draglines in both Heyford and Horse Pits.

The exposed coal will be loaded by excavators and front end loaders into trucks for hauling either to the field coal stockpiles or to the ROM stockpiles for screening, crushing and processing.

The mine will operate on a 24 hour schedule, seven days a week during construction and operational phases with blasting limited to the daytime period only (between 7.00 am and 6.00 pm) each day. A detailed description of the mining process is provided in Section 3.4.

12.3 Existing Acoustical Environment

In order to determine noise limits in accordance with the EPA's Ecoaccess Guideline Planning for Noise Control, and in accordance with the ToR, ambient noise monitoring was conducted as part of this assessment. This section of the report outlines the methodology and results of this baseline noise and vibration monitoring.

12.3.1 Unattended Background Noise Surveys

The monitoring locations are shown in Figure 12.2. All noise loggers were programmed to continuously record A-weighted fast response noise levels over 15 minute sampling intervals. The calibration of all instruments was checked before and after monitoring and the difference in calibration noise level was within 0.3 dBA in all instances.

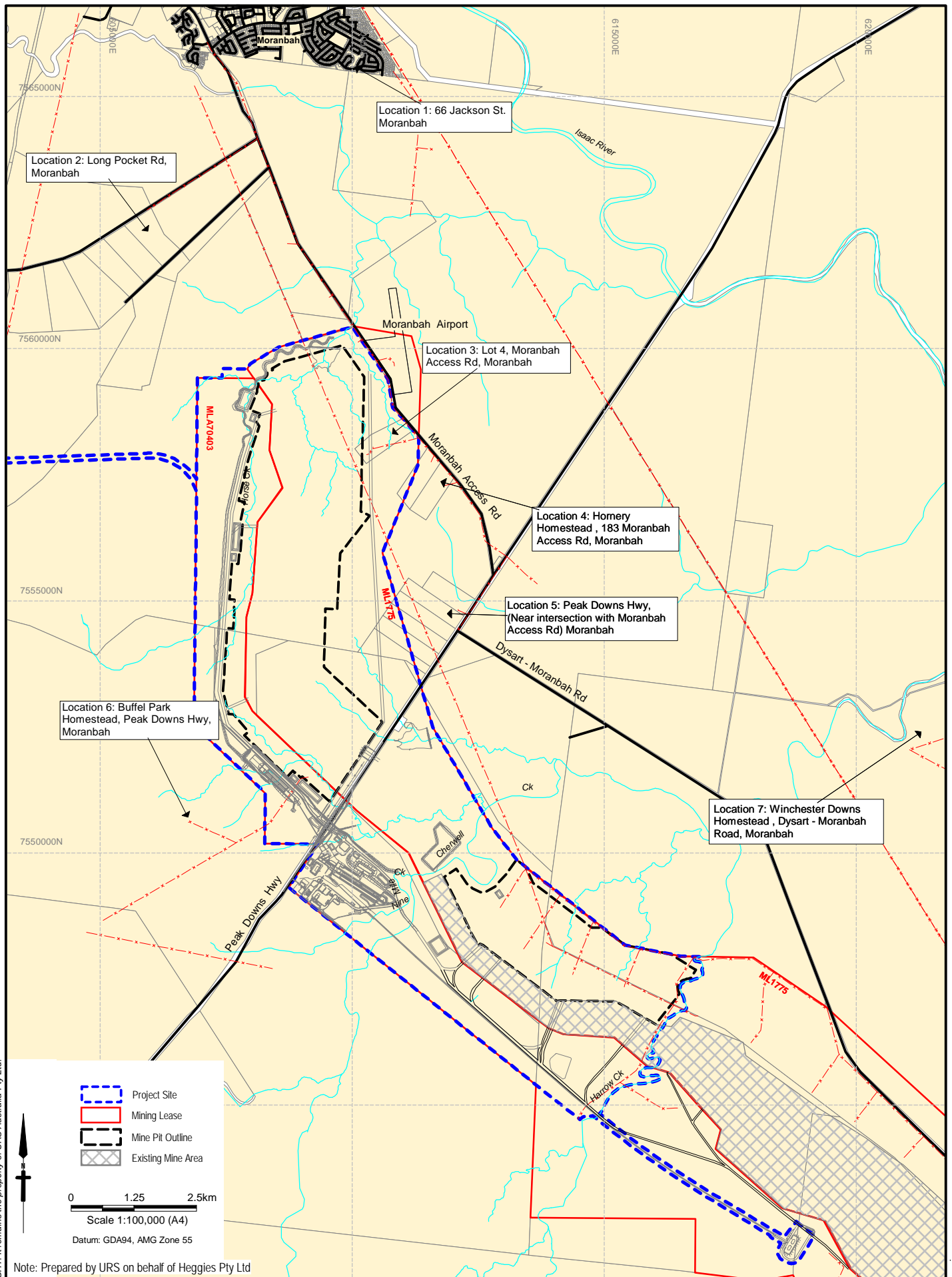
Noise logging took place at locations 1 to 5 from 28 November to 6 December, 2007, and at locations 6 and 7 from 10 March to 17 March, 2008.

Noise logging was also undertaken at locations 6 and 7 from 7 February to 21 February 2008.


The unattended ambient noise measurements collected at each monitoring location were used to determine the Rating Background Level (RBL) for daytime (7.00 am to 6.00 pm), evening (6.00 pm to 10.00 pm) and night-time (10.00 pm to 7.00 am) periods at each location.

Table 12.1 contains the determined RBL for each measurement location. These values are used to determine the Ecoaccess criteria in Section 12.5.

The maximum LAeq (1hour) for each daytime, evening and night-time period is also shown in Table 12.1. The median maximum LAeq (1hour) noise levels measured at each location has been used for this assessment.



Note: Prepared by URS on behalf of Heggies Pty Ltd

Client  BHP Billiton Mitsubishi Alliance	Project CAVAL RIDGE PROJECT ENVIRONMENTAL IMPACT STATEMENT		Title NOISE AND VIBRATION MONITORING LOCATIONS	
	Drawn: VH Job No: 4262 6158	Approved: RS File No: 42626158-g-578b.wor	Date: 08-05-2009	Figure: 12.2

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Table 12.1 Summary of (Unattended) Noise Logging Results

Locations	Description	Background Noise Levels minLA90 (dBA) ¹			Maximum Hourly SPL LAeq (1hour) (PNL)		
		Day 7am-6pm	Evening 6pm-10pm	Night 10pm-7am	Day 7am-6pm	Evening 6pm-10pm	Night 10pm-7am
1. 66 Jackson Ave, Moranbah	Back yard of detached two storey dwelling backing onto vacant land at south end of Moranbah	35	38 ²	36 ²	57	57 ²	53 ²
2. Long Pocket Road, Moranbah	Side yard of detached two storey dwelling bordering northern side of project boundary	33	37 ²	34 ²	59	55 ²	53 ²
3. Lot 4, Moranbah Access Road, Moranbah	Back yard of detached single story dwelling facing Moranbah Access Rd	40	41	27 ²	64	63	57 ²
4. Hornery Homestead – 183 Goonyella Road, Moranbah	Back yard of detached single storey homestead bordering eastern side of project boundary	32	36 ²	28 ²	55	42 ²	39 ²
5. Peak Downs Highway (near intersection with Moranbah Access Road), Moranbah	Representative location north of single storey dwelling bordering southern side of project boundary	31	33 ²	26 ²	48	47 ²	47 ²
6. Buffle Park Homestead, Peak Downs Highway, Moranbah	Representative location north of single storey dwelling bordering southern side of project boundary	33	34 ²	24 ²	69	61 ²	48 ²
7. Winchester Downs Homestead, Dysart-Moranbah Road, Moranbah	Representative location west of double storey dwelling bordering eastern side of project boundary	40	42 ²	20 ²	56	54	44 ²

Note 1: The LA90 represents the level exceeded for 90% of the interval period and is referred to as the background noise level. The LAeq is the equivalent continuous noise level defined as the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

Note 2: Values have been adjusted downward to remove the (tonal) influence of insects as it is expected that insect noise would not be present during winter months.

Review of the data presented in Table 12.1 indicates that the RBLs at the various monitoring locations ranged from 31 dBA to 40 dBA during the daytime, 33 dBA to 42 dBA during the evening and were 20 dBA

to 36 dBA during the night time. The measured background noise levels are typical of those of a rural environment with natural noise sources and some transportation noise contributions associated with Peak Downs Highway, Moranbah Access Road and Dysart-Moranbah Road.

12.3.2 Operator-Attended Noise Surveys

Operator attended noise surveys of 15 minutes duration were conducted at the noise logging locations during on-site visits between 28 November 2007 and 11 March 2008.

The operator-attended noise measurements were conducted using a precision integrating sound level meter (SVAN 948 – Serial No. 8895) in order to qualify the results obtained with the unattended noise loggers. During the attended noise surveys, the operator identified the character and duration of acoustically significant ambient noise sources.

The operator-attended noise measurement results validate the results obtained from the unattended noise loggers and support the use of the logged noise levels as being representative of the background noise environment at all residences.

12.3.3 Vibration

Vibration measurements were carried out at three locations (Locations 3, 4 and 5) from 28 November to 6 December, 2007, and at 2 additional locations (Locations 6 and 7) from 10 March to 17 March 2008 to determine existing baseline vibration levels, particularly from blasting.

The summarised results of the vibration measurements are documented in Table 12.2, which represents the highest recorded peak component particle velocity measured at each location.

Table 12.2 Summarised Vibration Measurements

Location	Date-Time	Highest Peak Component Particle Velocity (mm/s)
3 Lot 7, Moranbah Access Rd, Moranbah	28/11/07 9:55	0.23
4 Hornery Homestead- 183 Goonyella Rd (Moranbah Access Rd)	29/11/07 7:21	1.47
5 Peak Downs Hwy (Near intersection with Moranbah Access Rd)	5/12/07 12:29	1.21
6 Buffle Park Homestead - Peak Downs Highway	11/3/08 16:08	1.86
7. Winchester Downs Homestead- Peak Downs Mine Road	11/03/08 08:55	0.79

None of the above recorded vibration events correlate, on a time basis, with blasts from Peak Downs Mine. This finding concurs with the Peak Downs Mine Neighbourhood Vibration Monitoring Project.

12.4 Construction Noise Criteria

For construction work occurring during normal daytime hours, provided all mechanical powered plant is fitted with appropriate mufflers, specific noise limits are generally not warranted. In this regard, it may be

noted that the Queensland Environmental Protection (Noise) Policy 2008 [EPP (Noise)] does not include construction noise limits (other than those which apply to blasting).

Noise impacts are usually minimised by limiting the hours of operation and, in particular circumstances, scheduling the noisiest activities to occur at times when they would generate least disruption.

In accordance with the EP Act, where construction noise may affect adjacent residential premises or other residential accommodation (including hotels, motels, serviced units or backpacker accommodation), it is recommended to limit the hours of operation to:

- Monday to Saturday - 6.30 am to 6.30 pm

For construction works extending outside normal working hours, particular noise limits should be applied.

The most important amenity issue for surrounding residents during the evenings/night-time period is sleep preservation. The World Health Organisation (WHO) recommends for quality sleep, maximum noise levels should not exceed 45 dBA. This guideline is recommended for construction work outside the recommended hours listed above.

- Based on a conservative building façade noise reduction of 5 dBA through an open window, the external criterion of L_{Amax} (external) - 50 dBA is recommended for sleep disturbance, assessable at 4 m from the building façade.

12.5 Operational Noise Criteria

Operational noise levels emitted by the Caval Ridge Mine are assessable in accordance with three EPA guidelines:

- Ecoaccess Planning for Noise Control
- Ecoaccess Noise and Vibration from Blasting
- Ecoaccess Assessment of Low Frequency Noise.

12.5.1 Ecoaccess Planning for Noise Control

This Ecoaccess assessment process takes into account four factors:

- Control and prevention of background creep
- Determination of planning noise levels
- Containment of variable and short term noise emissions by setting specific (intrusive) noise levels
- Sleep disturbance.

The guideline recommends that the lower of the 2 levels derived from bullet points 2 and 3 be used for assessment purposes (as they are both based on the Leq parameter).

The guideline provides recommended Rated Background Levels (RBLs) in order to prevent background noise levels from progressively increasing over time with the establishment of new developments. The resultant background creep criterion at each monitoring location is presented in Table 12.3.

Table 12.3 Background Creep Criteria

Location	Criteria minLA90, 1hour (dBA)		
	Day	Evening	Night
1 66 Jackson Ave, Moranbah	38	28	26
2 Long Pocket Road, Moranbah	30	27	25
3 Lot 4, Moranbah Access Road, Moranbah	30	31	25
4 Hornery Homestead – 183 Goonyella Road, Moranbah	32	26	25
5 Peak Downs Highway (near intersection with Moranbah Access Road), Moranbah	33	25	25
6 Buffle Park Homestead, Peak Downs Highway, Moranbah	30	25	25
7 Winchester Downs Homestead, Dysart-Moranbah Road, Moranbah	30	32	25

The Specific Noise Level is determined from the existing RBL (from ambient attended and unattended noise monitoring) and is shown in Table 12.4.

Table 12.4 Specific (Intrusive) Noise Level Criteria

Location	Criteria LAeq, (1hour) (SNL)		
	Day	Evening	Night
1. 66 Jackson Ave, Moranbah	38	41	39
2. Long Pocket Road, Moranbah	36	40	37
3. Lot 4, Moranbah Access Road, Moranbah	43	44	30
4. Hornery Homestead – 183 Goonyella Road, Moranbah	35	39	31
5. Peak Downs Highway (near intersection with Moranbah Access Road), Moranbah	34	36	29
6. Buffle Park Homestead, Peak Downs Highway, Moranbah	36	37	28
7. Winchester Downs Homestead, Dysart-Moranbah Road, Moranbah	43	45	28

Note: The guideline sets a floor on Specific Noise Levels of 28 dBA (e.g. background creep floor of 25 dBA plus 3 dBA).



The specific noise levels will form the basis of the limiting LAeq criteria for the Caval Ridge Mine as they were found to be more stringent than the Planning Noise Level criteria.

To manage the LAeq criteria effectively for every noise sensitive receiver, not just the seven noise monitoring locations, three different criteria zones have been identified based on the results in Table 12.4. These zones are illustrated in Figure 12.3.

Zone 1 (37 dBA) Moranbah and northern properties (measurement locations at 66 Jackson Avenue, Moranbah, and Long Pocket Road, Moranbah)

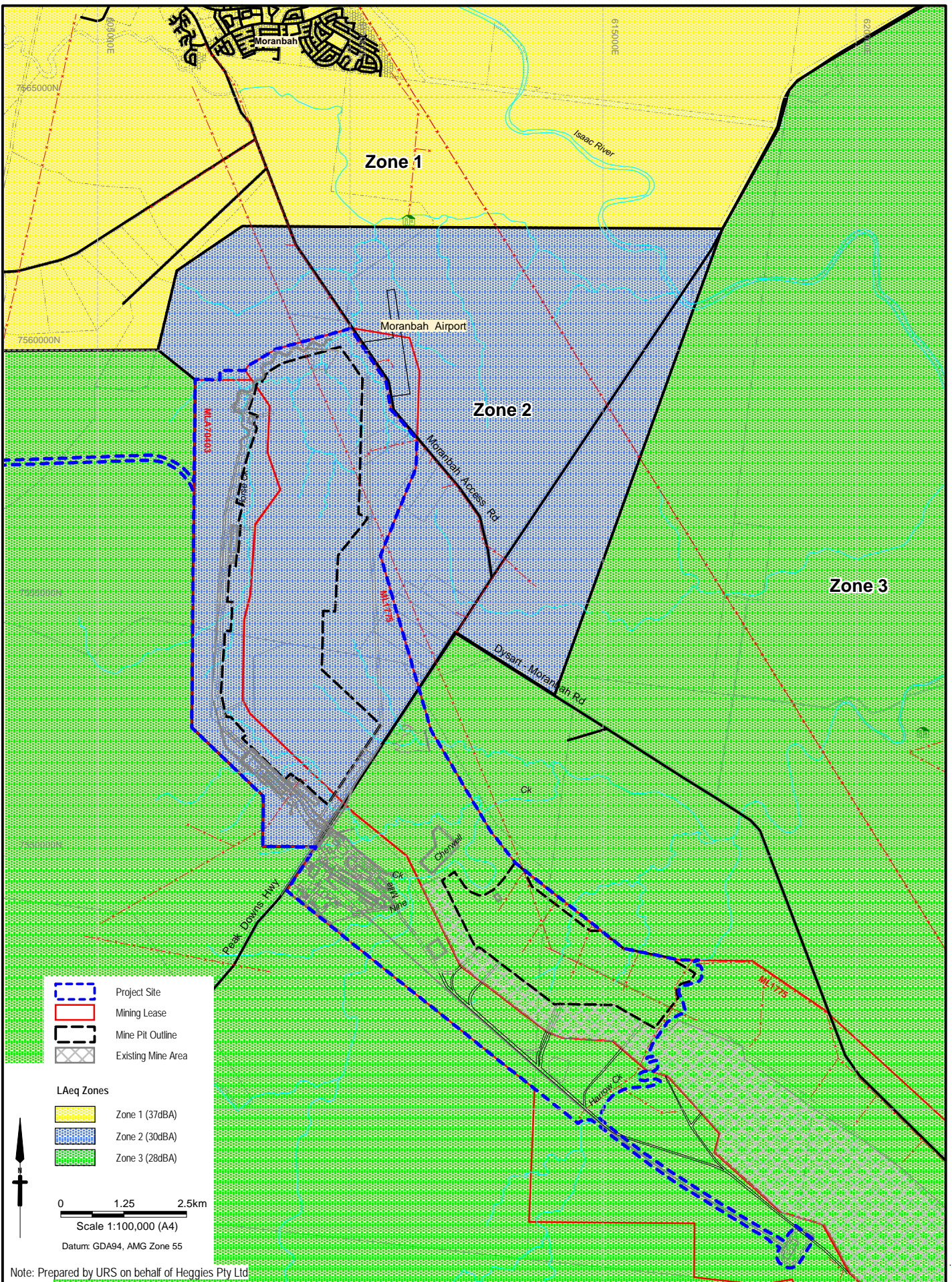
Zone 2 (30 dBA) Moranbah Access Road and surrounding properties (measurement locations at Lot 4, Moranbah Access Road, Moranbah and Hornery Homestead – 183 Goonyella Road, Moranbah)

Zone 3 (28 dBA) South, west and remote from project site properties (measurement locations at Buffle Park Homestead and Winchester Downs Homestead, Moranbah)



12.5.1.1 Sleep Disturbance

The guideline recommends that in order to achieve a good night's sleep, internal noise levels should not exceed LAmax 45 dBA more than 10 – 15 times per night. Based on a conservative attenuation of 5 dBA through a facade with open windows, the following external criterion is recommended, assessable 4 m from the façade and during the night-time period only:

- LAmax (external) - 50 dBA



Note: Prepared by URS on behalf of Heggies Pty Ltd

Client  BHP Billiton Mitsubishi Alliance	Project CAVAL RIDGE PROJECT ENVIRONMENTAL IMPACT STATEMENT		Title LAeq NOISE ASSESSMENT ZONES	
		Drawn: VH Job No: 4262 6158	Approved: RS File No: 42626158-g-579b.wor	Date: 08-05-2009 Figure: 12.3

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12.5.2 enHealth Council's Recommendations

The enHealth Council's The health effects of environmental noise – other than hearing loss document contains four recommendations:

- Recognise environmental noise as a potential health concern.
- Promote measures to reduce environmental noise and its health impacts.
- Address environmental noise in planning and development activities.
- Foster research on the non-auditory health impacts of noise.

Responses to these recommendations are presented below:

12.5.2.1 Recognise environmental noise as a potential health concern

The enHealth document contains one applicable recommendation to this project (amongst other noise related health impacts awareness initiatives) and that is the adoption of the World Health Organisations Guidelines for Community Noise 1999 below which no health effects are expected.

The guideline values relevant to this project are:

Residential -

- Bedrooms (internal) - 30 dBA Leq (steady noise)
- Bedrooms (internal) - 45 dBA Lmax (intermittent noise)
- Living Areas (internal) – 35 dBA Leq (steady noise)
- Living Areas (outdoor) – 50 dBA Leq (steady noise)

The most stringent enHealth guidelines are the two internal bedroom levels. The Ecoaccess criteria outlined in Section 12.5.1 adequately address these enHealth guidelines.

The above WHO 30 dBA Leq guideline equates to (conservatively) 35 dBA Leq external (given a 5 dBA façade) noise reduction. Given that the Ecoaccess criteria range from 28 dBA to 37 dBA and that 5 dBA is a conservative façade noise reduction (AS 3671 recommends the use of 10 dBA and indeed the WHO guideline recommends the use of 15 dBA as a façade noise reduction), it is considered acceptable that the use of the Ecoaccess criteria will also ensure compliance with the WHO guidelines.

12.5.2.2 Promote measures to reduce environmental noise and its health impacts

The enHealth document contains many high level actions in this recommendation in relation to education programs, mitigation and licensing controls, relevant standards and product labelling. This recommendation does not contain any relevant recommendations in relation to this project.

12.5.2.3 Address environmental noise in planning and development activities

The enHealth document contains many high level actions in this recommendation in relation to integrating noise into planning processes and national consistency for limits that are not relevant to this project. The one relevant recommendation is that baseline environmental noise levels should be undertaken (where appropriate) to inform planning actions. This has been completed for this project (Appendix M) – see Section 12.3.

12.5.2.4 Foster research on the non-auditory health impacts of noise

The enHealth document recommends that research be undertaken in many areas of noise to further understand the non-auditory health effects of noise. There is much and ongoing work still to be done in this area but the following information has been provided to assist in understanding the primary concerns in this area of acoustics.

Community noise or environmental noise is defined by the WHO as noise emitted from all sources (except noise at the industrial workplace) including road, rail, air traffic, construction, public works and the neighbourhood. The WHO's Guidelines for Community Noise lists the major health effects as:

- Noise-induced hearing impairment
- Interference with speech communication
- Disturbance of rest and sleep
- Psychophysiological, mental-health and performance effects
- Effects on residential behaviour and annoyance, and
- Interference with intended activities.

Until recently, noise has been largely viewed as an amenity issue and rarely focused on significant public health issues. Traditional environmental impact statements prepared for major infrastructure projects often include assessment of noise impacts as assessed against particular state or local planning guidelines. The following sections include a discussion on the issues of health effects relating specifically to annoyance and sleep disturbance.

Annoyance

The most common subjective response to noise is annoyance which may include mild anger and fear which stems from a belief that one is being avoidably harmed. The level of annoyance experienced by one person may differ considerably to another individual due to many factors including personal characteristics (e.g. people who are already stressed) and the ability to control the living environment.

As reported by the WHO, people may even report feeling anger, disappointment, dissatisfaction, withdrawal, helplessness, depression and anxiety due to noise. It is therefore imperative that noise be

minimised insofar as possible through best practice measures, the community be kept informed of works in advance and that any complaints are promptly addressed.

Sleep Disturbance

Potential for sleep disturbance due to the project have been identified. The consequences of sleep disturbance can be awakenings and alterations of sleep stages (categorised as 1, 2, 3, 4 and REM1), difficulty falling asleep, changes in respiration, cardiovascular effects and increased body movements. These changes can affect mood and performance during the following day.

As sleep is critical to restore biological processes, all practicable mitigation measures are required to minimise potential for sleep disturbance.

12.5.3 Noise and Vibration from Blasting

12.5.3.1 EP Act Criteria

The EP Act contains the following blast emissions (airblast and vibration) criteria:

“Section 61 - Noise from blasting is not unlawful environmental nuisance for an affected building if:

- The airblast overpressure is no more than 115 dB Z Peak for 4 out of 5 consecutive blasts; or
- The airblast overpressure is more than 120 dBA Z Peak for any blast; or

the ground vibration is:

- For vibrations of more than 35 Hz – no more than 25 m/s ground vibration, peak particle velocity; or
- For vibrations of no more than 35 Hz – no more than 10 mm/s ground vibration, peak particle velocity.”

The Act does not nominate times of blasting.

12.5.3.2 Ecoaccess Guidelines

The Queensland EPA’s document entitled Ecoaccess Guideline: Noise and Vibration from Blasting contains both different blast emissions criteria and times of blasting.

Noise Criteria

Blasting activities must be carried out in such a manner that if blasting noise should propagate to a noise-sensitive place, then

- The airblast overpressure must be not more than 115 dB (linear) peak for nine out of any 10 consecutive blasts initiated, regardless of the interval between blasts; and
- The airblast overpressure must not exceed 120 dB (linear) peak for any blast.

¹*Rapid Eye Movement: a recurring sleep state of rapidly shifting eye movements during which dreaming occurs.*
Caval Ridge Coal Mine Project – Environmental Impact Statement

Vibration Criteria

Blasting operations must be carried out in such a manner that if ground vibration should propagate to a noise-sensitive place:

- The ground-borne vibration must not exceed a peak particle velocity of 5 mm per second for 9 out of any 10 consecutive blasts initiated, regardless of the interval between blasts; and
- The ground-borne vibration must not exceed a peak particle velocity of 10 mm per second for any blast.

Times of Blasting

Blasting should generally only be permitted during the hours of 9.00 am to 3.00 pm, Monday to Friday, and from 9.00 am to 1.00 pm on Saturdays. Blasting should not generally take place on Sundays or public holidays.

Blasting outside these recommended times should be approved only where:

- Blasting during the preferred times is clearly impracticable (in such situations blasts should be limited in number and stricter airblast overpressure and ground vibration limits should apply); or
- There is no likelihood of persons in a noise-sensitive place being affected because of the remote location of the blast site.

12.5.3.3 Proposed Criteria

Taking both the regulation and the guideline into account, it is proposed that the following criteria be used for this assessment:

Noise Criteria

- The airblast overpressure is no more than 115 dB Linear Peak for 4 out of 5 consecutive blasts, and must not exceed 120 dB Linear Peak at any time.

Vibration Criteria

- For vibrations of more than 35 Hz – no more than 25 m/s ground vibration, peak particle velocity; or
- For vibrations of no more than 35 Hz – no more than 10 mm/s ground vibration, peak particle velocity.

Times of Blasting

Limiting blasting to between the hours recommended in the Ecoaccess guideline is impractical for the proposed mine. The principle of limiting the hours of blasting to the least sensitive times of the day, however, is a valid one. Therefore, the following times are recommended for blasting:

- Mandatory – 7.00 am to 6.00 pm each day (e.g. daytime as defined in the EPA guidelines)
- Preferred – 8.00 am to 5.00 pm each day

These recommended limits and times, in conjunction with the extensive community consultation and monitoring program proposed for the mine, are expected to result in acceptable blasting levels at all neighbouring properties.

12.5.4 Low Frequency Noise

The frequency range of infrasound is normally taken to be below 20 Hz and audible noise from 20 Hz to 20,000 Hz. Contrary to this interpretation, noise at frequencies below 20 Hz can be audible, however tonality is lost below 16 – 18 Hz thus losing a key element of perception. Low frequency noise spans the infrasonic and audible ranges and may be considered as the range from about 10 Hz to 200 Hz.

Guidance on the assessment of low frequency noise impacts can be sought from the Queensland DERM's Ecoaccess Guideline Assessment of Low Frequency Noise. The intent of these criteria is to accurately assess annoyance and discomfort to persons at noise sensitive places. The guideline assesses both infrasound – below 20 Hz (Part A) and low frequency noise – above 20 Hz (Part B).

For the purposes of this assessment, the low frequency criteria have been analysed to determine how they relate to the Leq (specific/intrusive) criterion developed using Planning for Noise Control.

The conclusions drawn from this analysis are:

- For Zones 2 and 3, the Planning for Noise Control Leq noise criterion is essentially equivalent (given usual environmental noise tolerances of +/- 2 dBA) to the low frequency noise criterion.
- For Zone 1, the low frequency noise criterion is 9 dBA more stringent.

12.6 Transportation Noise Assessment Criteria

Rail noise from the new section of track and train loadout loop has been assessed as part of the 11 operational mining scenarios and as such the criteria are derived from Ecoaccess Planning for Noise Control. This has resulted in more stringent criteria than those typically applied to rail noise in Queensland as stipulated in the EPP (Noise) and QR's *Code of Practice – Railway Noise Management*:

- 87 dBA LAmax
- 65 dBA LAeq(24hour).

The effect of construction and operational traffic on the noise emission from roadways affected by the project has been assessed. This assessment has been performed by calculating how traffic changes attributable to the project would alter the LA10 (18hour) level of noise emission from roadways using the CoRTN² prediction algorithms.

For assessment purposes it is common to set the threshold of significance in relation to changes to the emission level from roads at 2 dBA. This threshold is adopted in this project.

² Calculation of Road Traffic Noise - U.K. Department of Transport, Welsh Office.

12.7 Mine Noise Modelling Procedure

12.7.1 SoundPLAN

In order to calculate the noise emission levels at the various noise sensitive receiver locations, a SoundPLAN (Version 6.4) environmental computer model was developed. SoundPLAN is a software package which enables compilation of a sophisticated computer model comprising a digitised ground map (containing ground contours and buildings), the location and acoustic sound power levels of potentially critical noise sources on site and the location of receivers for assessment purposes.

The computer model can generate noise emission levels taking into account such factors as the source sound power levels and locations, distance attenuation, ground absorption, air absorption and shielding attenuation, as well as meteorological conditions, including wind effects.

Noise levels have been predicted at each of the identified 26 noise-sensitive locations.

12.7.2 CONCAWE

The CONCAWE prediction methodology was utilised within SoundPLAN. The CONCAWE prediction method is specially designed for large facilities and incorporates the influence of wind effects and the stability of the atmosphere.

The statistical accuracy of environmental noise predictions using CONCAWE was investigated by Marsh (Applied Acoustics 15 - 1982). Marsh concluded that CONCAWE was accurate to ± 2 dBA in any one octave band between 63 Hz and 4 kHz and ± 1 dBA overall.

Noise levels have been calculated for both neutral and worst case weather scenarios.

12.7.3 Construction and Operational Modelling Scenarios

One construction and 11 operational mining scenarios (covering the full life of the mine) have been modelled for this assessment.

Within the noise model, operations consisted of all plant items operating concurrently in order to simulate the overall maximum potential noise emission.

12.8 Transportation Noise Modelling Procedure

12.8.1 CoRTN Road Traffic Noise Prediction Method

Road traffic noise impacts have been estimated during the construction and operation of the Caval Ridge Mine.

Existing and future traffic patterns for Peak Downs Highway, Moranbah Access Road and Dysart-Moranbah Road are summarised in Table 12.5.



Table 12.5 Baseline Road Traffic Parameters

Road	Year 2007 Traffic Census		Year 2013 Projection		Year 2013 Projection With Project		Year 2023 Projection		Year 2023 Projection With Project	
	AADT ¹	% Heavy Vehicles	AADT ¹	% Heavy Vehicles	AADT ¹	% Heavy Vehicles	AADT ¹	% Heavy Vehicles	AADT ¹	% Heavy Vehicles
Moranbah Access Road	3114	18	7126	13	7423	12	16376	13	16673	13
Dysart-Moranbah Road	2053	16	3949	12	4004	12	9076	12	9131	12
Peak Downs Highway (Ch 88.180-100.900)	1876	16	3561	14	3864	13	8044	14	8346	14

1 - Annual Average Daily Traffic

12.8.2 Nordic Rail Traffic Noise Prediction Method

Rail noise levels from the new section of rail associated with the project have been predicted at each of the identified 26 noise-sensitive locations. The parameters used to calculate the future rail noise levels are summarised in Table 12.6.

Table 12.6 Train Movements for Caval Ridge Mine Project

Parameter	Value
Number of train movements per day (average)	2
Notch setting of train	Notch 1-2
Speed of train	2 - 20 km/h
Length of train	4,000 m
Number and type of locomotives	4 diesel (4000 class) from 2010 to 2012 and 3 diesel (3700 or 3800 class) from 2012 onwards

12.9 Noise Impact Assessment

12.9.1 Noise Impact Assessment - Construction

The predicted maximum (L_{max}) construction noise levels for neutral and weather conditions for properties located within 12 km of the project site boundary are shown in Table 12.7. Worst case weather predictions are also contained in only for those properties to the west and north-west of the project, based on the worst case weather parameters stipulated in the EPA's Planning for Noise Control guideline and annual weather data (eg frequency of temperature inversions and wind roses).

An accommodation village is proposed by BMA just south of Location 1 (adjacent but offset to the west of the Moranbah Access Road). The predicted noise levels shown in the technical report (Appendix M, Section 9) for Location 1 are considered representative of the noise levels experienced at the proposed accommodation village. No further assessment of the accommodation village has been undertaken as part of this assessment as it will be owned and operated by BMA.

However, it is recommended, where required that BMA undertake a further study to assess the likely noise levels at the proposed village and design the accommodation buildings appropriately to address any adverse impacts on their staff. It should be noted that very good noise reductions are achievable through well designed building facades thus providing an acceptable level of internal acoustic amenity.

Table 12.7 Predicted Construction Noise Levels – Neutral and Worst Case Weather Conditions

Location	Property Reference	Predicted Lmax Noise Level (dBA)	
		Neutral Weather Conditions	Worst Case Weather Conditions
1	L14 SP 163605	28	-
2	SP 151669 FH 50416979	50	-
3	Lot 4 Moranbah Access Road, Moranbah	28	-
4	L1 RP 614378 (South Property)	27	-
5	Hornery Homestead – 183 Moranbah Access Road, Moranbah	29	-
6	Peak Downs Highway (near intersection with Moranbah Access Road), Moranbah	36	-
7	Buffle Park Homestead, Peak Downs Highway, Moranbah	44	48
8	L8 RP 853653	23	27
9	L1 RP 614378 (North Property)	23	-
10	L1-2 RP 853653 (South Property)	25	29
11	Long Pocket Road, Moranbah	15	19
12	L2 RP 616987	25	-
13	GV 148	31	-
14	L5 RP853653	22	26
15	L1-2 RP 853653 (North Property)	22	26
16	L1 SP117775 (East Property)	22	26
17	L9 RP 853653	22	26
18	L1 SP 117775 (West Property)	24	28
19	L1 RP 616897 (North Property)	21	25
20	L25 RP 133553	21	-
21	L3 RP617628	35	-
22	66 Jackson Avenue, Moranbah	22	-
23	Winchester Downs Homestead – Dysart-Moranbah Road, Moranbah	26	-
24	L3 GV252	23	-
25	L6 SP174999	21	-
26	L1 RP616025	10	-

Note: Bold figures indicate an exceedence of the (evening/night) sleep disturbance limit of 50 dBA.



As documented in Table 12.7, there are no properties that exceed the recommended construction noise criterion.

12.9.2 Vibration Impact Assessment – Construction

There is only one activity – blasting – that is capable of producing measureable or feelable vibration levels at surrounding properties and this is discussed in Section 12.9.5.

12.9.3 Noise Impact Assessment – Operation

Based on the output from the SoundPLAN noise model and on the noise emissions criteria presented in Section 12.5, Table 12.8 and Table 12.9 present the predicted L90 noise level contributions from the proposed fixed plant operations for Neutral and Worst-Case (where applicable) weather conditions, respectively.

Table 12.8 Predicted LA90 Operational Noise Levels – Neutral Weather

Location Number	Property Reference	LA90 Criteria (dBA)	LA90 Predicted Noise Level (dBA)
1	L14 SP 163605	25	19
2	SP 151669 FH 50416979	25	47
3	Lot 4 Moranbah Access Road, Moranbah	25	18
4	L1 RP 614378 (South Property)	25	17
5	Hornery Homestead – 183 Moranbah Access Rd, Moranbah	25	20
6	Peak Downs Highway (near intersection with Moranbah Access Rd), Moranbah	25	27
7	Buffle Park Homestead, Peak Downs Highway, Moranbah	25	37
8	L8 RP 853653	25	14
9	L1 RP 614378 (North Property)	25	13
10	L1-2 RP 853653 (South Property)	25	16
11	Long Pocket Road, Moranbah	25	11
12	L2 RP 616987	25	15
13	GV 148	25	21
14	L5 RP853653	25	13
15	L1-2 RP 853653 (North Property)	25	13
16	L1 SP117775 (East Property)	25	12
17	L9 RP 853653	25	13
18	L1 SP 117775 (West Property)	25	14
19	L1 RP 616897 (North Property)	25	12
20	L25 RP 133553	25	11
21	L3 RP617628	25	25
22	66 Jackson Avenue, Moranbah	25	10
23	Winchester Downs Homestead – Dysart-Moranbah Road, Moranbah	25	18
24	L3 GV252	25	12
25	L6 SP174999	25	24
26	L1 RP616025	25	0

Note: Levels in bold indicate an exceedence of the 25 dBA LA90 noise criterion

Table 12.9 Predicted LA90 Operational Noise Levels – Worst Case Weather

Location Number	Property Reference	LA90 Criteria (dBA)	LA90 Predicted Noise Level (dBA)
7	Buffle Park Homestead, Peak Downs Highway, Moranbah	25	43
8	L8 RP 853653	25	18
10	L1-2 RP 853653 (South Property)	25	20
11	Long Pocket Road, Moranbah	25	15
14	L5 RP853653	25	17
15	L1-2 RP 853653 (North Property)	25	17
16	L1 SP117775 (East Property)	25	16
17	L9 RP 853653	25	16
18	L1 SP 117775 (West Property)	25	18
19	L1 RP 616897 (North Property)	25	16

Note: Levels in bold indicate an exceedence of the 25 dBA LA90 noise criterion

From the information contained in Table 12.8 and Table 12.9 it can be seen that the criteria are predicted to be exceeded under neutral weather conditions at three locations by up to 22 dBA. Under worst-case weather conditions, the criteria are predicted to be exceeded at one location (Location 7), where the predicted exceedence increases (about the neutral weather prediction) by 6 dBA.

Table 12.10 and Table 12.11 present the highest predicted LAeq noise level contributions from the proposed mine operations for Neutral and Worst-Case where applicable weather conditions, respectively. The overall noise level has been documented on top and the noise level excluding train movements is below in brackets.

In all except seven locations, the mobile mechanical plant dominates the Leq emissions from the proposed mine. At the other seven locations, both the steady state fixed plant and the mobile mechanical plant predictions have been logarithmically added to predict the overall level.

Table 12.10 Predicted Operational Noise Levels – Operation Scenarios 1-11 Neutral Weather Conditions

Location Number	Property Reference	LAeq Predicted Noise Level (dBA)											LAeq Criteria (dBA)	Maximum Criteria Exceedance (dBA)
		Scenario												
		1	2	3	4	5	6	7	8	9	10	11		
1	L14 SP 163605	29 (23)	40 (39)	30 (26)	42 (41)	43 (43)	33 (32)	43 (43)	48 (48)	31 (29)	50 (50)	55 (55)	30	+25
2	SP 151669 FH 504169791	67 (67)	47 (47)	57 (57)	51 (51)	51 (51)	51 (51)	50 (50)	47 (47)	51 (51)	53 (54)	51 (51)	30	+37
3	Lot 4 Moranbah Access Road, Moranbah	27 (23)	34 (34)	27 (25)	36 (36)	36 (36)	29 (27)	38 (38)	39 (39)	28 (26)	42 (42)	41 (41)	30	+12
4	L1 RP 614378 (South Property)	27 (21)	43 (43)	28 (25)	33 (32)	45 (45)	27 (23)	33 (33)	48 (48)	30 (29)	34 (34)	45 (45)	30	+18
5	Hornery Homestead – 183 Moranbah Access Road, Moranbah	28 (24)	33 (32)	29 (26)	36 (36)	35 (34)	29 (27)	38 (38)	37 (37)	30 (28)	42 (42)	39 (39)	30	+12
6	Peak Downs Highway (near1 intersection with Moranbah Access Road), Moranbah	34 (34)	31 (30)	36 (36)	35 (35)	33 (33)	37 (37)	37 (37)	33 (33)	37 (37)	37 (37)	34 (34)	30	+7
7	Buffle Park Homestead, Peak1 Downs Highway, Moranbah	40 (40)	38 (37)	40 (40)	40 (39)	39 (39)	40 (39)	39 (39)	39 (38)	39 (39)	39 (39)	39 (39)	28	+12
8	L8 RP 853653	28 (18)	37 (36)	29 (23)	32 (29)	35 (34)	28 (19)	30 (26)	32 (31)	29 (20)	30 (26)	30 (26)	37	NIL
9	L1 RP 614378 (North Property)	25 (17)	37 (37)	26 (21)	30 (29)	38 (38)	26 (19)	30 (28)	36 (36)	27 (23)	29 (28)	32 (31)	30	+8
10	L1-2 RP 853653 (South Property)	28 (20)	37 (36)	28 (22)	30 (28)	33 (32)	27 (19)	29 (25)	31 (29)	27 (19)	30 (27)	30 (27)	37	NIL
11	Long Pocket Road, Moranbah	22 (15)	35 (35)	23 (19)	29 (28)	34 (33)	22 (16)	26 (24)	31 (31)	23 (18)	26 (24)	27 (26)	37	NIL

Location Number	Property Reference	LAeq Predicted Noise Level (dBA)											LAeq Criteria (dBA)	Maximum Criteria Exceedance (dBA)
		Scenario												
		1	2	3	4	5	6	7	8	9	10	11		
12	L2 RP 616987	24 (19)	32 (32)	24 (20)	26 (24)	31 (30)	24 (20)	26 (24)	31 (31)	23 (18)	28 (27)	31 (30)	37	NIL
13	GV 1481	29 (28)	29 (28)	29 (29)	30 (29)	29 (28)	30 (29)	31 (31)	29 (28)	31 (31)	31 (30)	29 (29)	30	+1
14	L5 RP853653	26 (17)	33 (32)	27 (20)	29 (26)	32 (31)	26 (18)	28 (24)	30 (28)	26 (18)	28 (24)	28 (24)	37	NIL
15	L1-2 RP 853653 (North Property)	25 (12)	31 (30)	26 (20)	28 (25)	30 (28)	26 (18)	27 (23)	28 (26)	26 (18)	27 (23)	27 (23)	37	NIL
16	L1 SP117775 (East Property)	22 (16)	31 (30)	23 (19)	26 (25)	29 (29)	22 (17)	25 (23)	29 (28)	23 (20)	19 (18)	19 (18)	37	NIL
17	L9 RP 853653	24 (16)	29 (28)	25 (20)	26 (24)	28 (27)	24 (17)	26 (23)	26 (24)	24 (18)	25 (22)	25 (23)	37	NIL
18	L1 SP 117775 (West Property)	22 (18)	31 (31)	22 (19)	25 (24)	28 (27)	22 (17)	24 (22)	27 (26)	22 (17)	28 (21)	28 (21)	37	NIL
19	L1 RP 616897 (North Property)	26 (15)	29 (27)	26 (19)	27 (23)	28 (26)	25 (16)	27 (22)	27 (23)	25 (16)	25 (24)	26 (24)	37	NIL
20	L25 RP 133553	17 (15)	27 (27)	19 (17)	23 (22)	27 (27)	18 (16)	23 (23)	25 (25)	19 (18)	26 (20)	26 (20)	37	NIL
21	L3 RP6176281	28 (28)	27 (27)	28 (28)	28 (28)	28 (27)	28 (28)	28 (28)	27 (27)	28 (28)	27 (27)	27 (27)	28	NIL
22	66 Jackson Avenue, Moranbah	23 (15)	26 (24)	23 (17)	24 (20)	27 (25)	23 (15)	24 (21)	26 (25)	23 (18)	24 (24)	24 (23)	37	NIL
23	Winchester Downs Homestead – Dysart-Moranbah Road, Moranbah1	25 (24)	25 (24)	24 (24)	24 (23)	24 (23)	24 (24)	24 (24)	24 (231)	25 (24)	25 (22)	25 (23)	28	NIL
24	L3 GV252	21 (17)	24 (23)	20 (16)	21 (18)	23 (21)	20 (15)	22 (19)	23 (21)	20 (14)	23 (22)	22 (21)	37	NIL

Location Number	Property Reference	LAeq Predicted Noise Level (dBA)											LAeq Criteria (dBA)	Maximum Criteria Exceedance (dBA)
		Scenario												
		1	2	3	4	5	6	7	8	9	10	11		
25	L6 SP1749991	25 (25)	25 (25)	25 (25)	25 (25)	25 (25)	25 (25)	25 (25)	25 (25)	25 (25)	26 (25)	27 (26)	28	NIL
26	L1 RP616025	5 (3)	4 (1)	5 (4)	5 (3)	4 (2)	5 (3)	14 (13)	4 (2)	5 (3)	4 (2)	4 (2)	28	NIL
1 Predicted noise level is a combination of steady state fixed plant and mobile mechanical plant														

Table 12.11 Predicted Operational Noise Levels – Operation Scenarios 1-11 Worst-Case Weather Conditions

Location Number	Property Reference	LAeq Predicted Noise Level (dBA)											LAeq Criteria (dBA)	Maximum Criteria Exceedance (dBA)
		Scenario												
		1	2	3	4	5	6	7	8	9	10	11		
7	Buffle Park Homestead, Peak Downs Highway, Moranbah ¹	45 (45)	43 (43)	45 (45)	45 (45)	44 (44)	44 (45)	44 (44)	44 (44)	44 (44)	44 (44)	44 (44)	28	+17
8	L8 RP 853653	29 (22)	40 (40)	30 (27)	34 (33)	38 (37)	29 (24)	31 (29)	35 (34)	29 (24)	32 (30)	32 (30)	37	+3
10	L1-2 RP 853653 (South Property)	29 (24)	40 (40)	29 (26)	32 (31)	36 (36)	28 (23)	30 (28)	34 (33)	28 (23)	32 (21)	33 (31)	37	+3
11	Long Pocket Road, Moranbah	24 (20)	39 (39)	25 (23)	32 (31)	37 (37)	24 (20)	28 (27)	35 (35)	24 (22)	29 (28)	31 (30)	37	+2
	L5 RP853653	27 (21)	37 (37)	28 (24)	31 (30)	35 (34)	27 (22)	29 (27)	33 (32)	27 (23)	30 (28)	30 (29)	37	NIL
15	L1-2 RP 853653 (North Property)	27 (21)	35 (34)	28 (24)	31 (29)	33 (32)	27 (22)	29 (26)	31 (30)	27 (22)	29 (27)	29 (27)	37	NIL
16	L1 SP117775 (East Property)	24 (20)	34 (34)	25 (23)	29 (28)	33 (32)	24 (21)	27 (26)	32 (32)	26 (24)	22 (22)	22 (22)	37	NIL
17	L9 RP 853653	25 (21)	33 (32)	27 (24)	29 (28)	32 (31)	25 (22)	27 (26)	29 (28)	25 (22)	27 (25)	27 (25)	37	NIL
18	L1 SP 117775 (West Property)	25 (23)	35 (35)	25 (23)	28 (28)	31 (31)	23 (21)	26 (25)	30 (29)	24 (21)	29 (26)	29 (25)	37	NIL
19	L1 RP 616897 (North Property)	26 (19)	32 (31)	27 (23)	29 (27)	31 (30)	26 (20)	28 (25)	29 (27)	26 (20)	29 (28)	29 (28)	37	NIL
20	L25 RP 133553	20 (19)	31 (31)	22 (22)	26 (26)	30 (30)	21 (20)	26 (26)	29 (29)	23 (22)	25 (28)	27 (24)	37	NIL

¹ Predicted noise level is a combination of steady state fixed plant and mobile mechanical plant.

From the information contained in Table 12.12 and Table 12.13, it can be seen that the criteria are predicted to be exceeded under neutral weather conditions at nine locations by up to 37 dBA. Under worst-case weather conditions, the exceedance at one (Location 7) of these locations increase by 5 dBA and 3 additional properties (Location 8, 10, & 11) now have minor (up to 3 dBA) exceedances. The exceedances occur in scenarios when mobile operating plant is nearest to the receiver.

The results indicate that the LAeq operational noise levels from the project could increase by 2 to 3 dBA under worst case weather conditions, relative to neutral conditions, at the closest (e.g. worst case) distance to the properties.

It should also be noted that whilst the highest predicted noise level from rail operations (31 dBA LAeq) is above the levels recommended via Ecoaccess Planning for Noise Control, this predicted level is 34 dBA below the 65 dBA LAeq (24 hour) criteria contained in QR's Code of Practice – Railway Noise Management (which would be used to assess rail noise emissions elsewhere on the Queensland rail network).

The low frequency noise criterion is 9 dBA lower for the LAeq criterion for Zone 1 locations only, it should be noted that of the 13 locations that fall within the Zone 1 area, none were above the LAeq criterion based on Planning for Noise Control, for the neutral weather scenario. However, 10 locations will exceed the low frequency noise limit in the neutral weather scenario, by up to 9 dBA. It should be noted that of these 10 locations, 2 contain insignificant exceedances only (i.e. 1 or 2 dBA over the low frequency criteria).

Of the same 13 locations that fall within the Zone 1 area, there were 3 locations that exceeded the LAeq criterion based on the discussion above, for the worst-case weather scenario. A further eight locations are expected to exceed the low frequency noise limit in the worst-case weather scenario, by up to 12 dBA. It should be noted that of these eight locations, one contains insignificant exceedances only (i.e. 1 dBA over the low frequency criterion).

The noise emissions from mobile mining equipment (the dominant source from mining operations) is more appropriately assessed using the Planning for Noise Control Guideline given the broad band noise emissions from such plant. It is understood that the intent of the draft Low Frequency Noise Guideline was to address noise sources with inherent dominant infrasound or (very) low frequency noise characteristics. This is simply not the case for the noise sources under investigation in this assessment and therefore no further assessment, or discussion of mitigation measures, will be undertaken against the Low Frequency Noise Guideline.

Table 12.12 and Table 12.13 present the highest predicted LAmax noise level contributions from the proposed mine operations for Neutral and Worst-Case (where appropriate) weather conditions, respectively.

Table 12.12 Predicted LAMax Operational Noise Levels – Operation Scenarios 1-11 Neutral Weather Conditions

Location Number	Property Reference	LAMax Predicted Noise Level (dBA)											LAMax Criteria (dBA)	Maximum Criteria Exceedance (dBA)
		Scenario												
		1	2	3	4	5	6	7	8	9	10	11		
1	L14 SP 163605	31 (31)	47 (47)	43 (34)	49 (49)	51 (51)	43 (40)	51 (51)	56 (56)	43 (37)	58 (58)	63 (63)	50	+13
2	SP 151669 FH 50416979	75 (75)	57 (41)	65 (65)	57 (57)	56 (56)	56 (56)	55 (55)	54 (42)	56 (56)	59 (59)	57 (57)	50	+25
3	Lot 4 Moranbah Access Road, Moranbah	44 (31)	44 (42)	40 (33)	44 (44)	44 (44)	40 (35)	46 (46)	47 (47)	40 (34)	50 (50)	49 (49)	50	NIL
4	L1 RP 614378 (South Property)	45 (29)	51 (51)	41 (33)	41 (40)	53 (53)	41 (31)	41 (41)	56 (56)	41 (37)	42 (42)	53 (53)	50	+6
5	Hornery Homestead – 183 Moranbah Access Road, Moranbah	44 (32)	44 (40)	40 (34)	44 (44)	42 (42)	40 (35)	46 (46)	45 (45)	40 (36)	50 (50)	47 (47)	50	NIL
6	Peak Downs Highway (near intersection with Moranbah Access Road), Moranbah	42 (41)	42 (37)	43 (43)	42 (42)	39 (39)	45 (45)	44 (44)	40 (40)	45 (45)	45 (45)	41 (41)	50	NIL
7	Buffle Park Homestead, Peak Downs Highway, Moranbah	50 (44)	50 (35)	46 (44)	46 (43)	46 (41)	46 (43)	46 (42)	46 (39)	46 (41)	46 (41)	46 (41)	50	NIL
8	L8 RP 853653	46 (26)	46 (44)	43 (31)	43 (37)	43 (42)	43 (27)	43 (34)	43 (39)	43 (28)	43 (34)	43 (34)	50	NIL
9	L1 RP 614378 (North Property)	42 (25)	45 (45)	39 (29)	39 (37)	46 (46)	39 (27)	39 (36)	44 (44)	39 (31)	36 (39)	39 (39)	50	NIL
10	L1-2 RP 853653 (South Property)	46 (28)	46 (44)	43 (30)	43 (36)	43 (40)	43 (27)	43 (33)	43 (37)	43 (27)	43 (35)	43 (35)	50	NIL

Location Number	Property Reference	LAMax Predicted Noise Level (dBA)											LAMax Criteria (dBA)	Maximum Criteria Exceedance (dBA)
		Scenario												
		1	2	3	4	5	6	7	8	9	10	11		
11	Long Pocket Road, Moranbah	40 (23)	43 (43)	37 (27)	37 (36)	41 (41)	37 (24)	37 (32)	39 (39)	37 (26)	37 (32)	38 (38)	50	NIL
12	L2 RP 616987	39 (27)	40 (40)	36 (28)	36 (32)	38 (38)	36 (28)	36 (32)	39 (39)	36 (26)	36 (35)	38 (38)	50	NIL
13	GV 148	39 (35)	39 (35)	36 (36)	36 (36)	35 (35)	36 (36)	38 (38)	35 (35)	37 (37)	38 (38)	36 (36)	50	NIL
14	L5 RP853653	42 (25)	42 (40)	39 (28)	39 (34)	39 (39)	39 (26)	39 (32)	39 (36)	39 (26)	39 (32)	39 (32)	50	NIL
15	L1-2 RP 853653 (North Property)	44 (25)	44 (38)	41 (28)	41 (33)	41 (36)	41 (26)	41 (31)	41 (34)	41 (26)	41 (31)	41 (31)	50	NIL
16	L1 SP117775 (East Property)	38 (24)	38 (38)	35 (27)	35 (33)	37 (37)	35 (25)	35 (31)	36 (36)	35 (28)	35 (30)	35 (31)	50	NIL
17	L9 RP 853653	44 (24)	44 (36)	40 (28)	40 (32)	40 (35)	40 (25)	40 (31)	40 (32)	40 (26)	40 (29)	40 (29)	50	NIL
18	L1 SP 117775 (West Property)	42 (26)	42 (39)	39 (27)	39 (32)	39 (35)	39 (25)	39 (30)	39 (34)	39 (25)	39 (32)	39 (32)	50	NIL
19	L1 RP 616897 (North Property)	49 (23)	49 (35)	46 (27)	46 (31)	46 (34)	46 (24)	46 (30)	46 (31)	46 (24)	46 (28)	46 (28)	50	NIL
20	L25 RP 133553	30 (23)	35 (35)	26 (25)	30 (30)	35 (35)	26 (24)	31 (31)	33 (33)	26 (26)	29 (29)	30 (30)	50	NIL
21	L3 RP617628	41 (32)	41 (29)	38 (33)	38 (32)	38 (31)	38 (33)	38 (32)	38 (31)	38 (32)	38 (32)	38 (31)	50	NIL
22	66 Jackson Avenue, Moranbah	38 (23)	38 (32)	35 (25)	35 (28)	35 (33)	35 (23)	35 (29)	35 (33)	35 (26)	35 (28)	35 (29)	50	NIL

Location Number	Property Reference	LAMax Predicted Noise Level (dBA)											LAMax Criteria (dBA)	Maximum Criteria Exceedance (dBA)
		Scenario												
		1	2	3	4	5	6	7	8	9	10	11		
23	Winchester Downs Homestead – Dysart-Moranbah Road, Moranbah	36 (31)	36 (31)	33 (30)	33 (29)	33 (29)	33 (30)	33 (30)	33 (29)	33 (31)	33 (30)	33 (29)	50	NIL
24	L3 GV252	35 (25)	35 (31)	32 (24)	32 (26)	32 (29)	32 (23)	32 (27)	32 (29)	32 (22)	32 (28)	32 (29)	50	NIL
25	L6 SP174999	27 (25)	27 (24)	27 (27)	26 (26)	25 (25)	27 (27)	26 (26)	26 (26)	27 (27)	26 (26)	26 (26)	50	NIL
26	L1 RP616025	15 (11)	15 (9)	12 (12)	11 (11)	11 (10)	11 (11)	21 (21)	11 (10)	11 (11)	11 (10)	11 (10)	50	NIL

Note: Levels in bold indicate an exceedance of the applicable criterion. Levels in brackets denote noise level excluding rail noise.

Table 12.13 Predicted LAMax Operational Noise Levels – Operation Scenarios 1-11 Worst-Case Weather Conditions

Location Number	Property Reference	LAMax Predicted Noise Level (dBA)											LAMax Criteria (dBA)	Max Criteria Exceedance (dBA)
		Scenario												
		1	2	3	4	5	6	7	8	9	10	11		
7	Buffle Park Homestead, Peak Downs Highway, Moranbah	50 (48)	50 (39)	48 (48)	47 (47)	46 (45)	47 (47)	46 (46)	46 (43)	46 (45)	46 (45)	46 (45)	50	NIL
8	L8 RP 853653	46 (30)	48 (48)	43 (35)	43 (41)	43 (45)	43 (32)	43 (37)	43 (42)	43 (32)	43 (38)	43 (38)	50	NIL
10	L1-2 RP 853653 (South Property)	46 (32)	48 (48)	43 (34)	43 (39)	44 (44)	43 (31)	43 (36)	43 (41)	43 (31)	43 (39)	43 (39)	50	NIL
11	Long Pocket Road, Moranbah	40 (28)	47 (47)	37 (31)	39 (39)	45 (45)	37 (28)	37 (35)	43 (43)	37 (30)	37 (36)	38 (38)	50	NIL
14	L5 RP853653	42 (29)	45 (45)	39 (32)	39 (38)	42 (42)	39 (30)	39 (35)	40 (40)	39 (31)	39 (36)	39 (37)	50	NIL
15	L1-2 RP 853653 (North Property)	44 (29)	44 (42)	41 (32)	41 (37)	41 (40)	41 (30)	41 (34)	41 (38)	41 (30)	41 (35)	41 (35)	50	NIL
16	L1 SP117775 (East Property)	38 (28)	42 (42)	35 (31)	36 (36)	40 (40)	35 (29)	35 (34)	40 (40)	35 (32)	35 (34)	35 (35)	50	NIL
17	L9 RP 853653	44 (29)	44 (40)	40 (32)	40 (36)	40 (39)	40 (30)	40 (34)	40 (36)	40 (30)	40 (33)	40 (33)	50	NIL
18	L1 SP 117775 (West Property)	42 (31)	43 (43)	39 (31)	39 (36)	39 (39)	39 (29)	39 (33)	39 (37)	39 (29)	39 (36)	39 (36)	50	NIL
19	L1 RP 616897 (North Property)	49 (27)	49 (39)	46 (31)	46 (35)	46 (38)	46 (28)	46 (33)	46 (35)	46 (28)	46 (32)	46 (32)	50	NIL
20	L25 RP 133553	30 (27)	39 (39)	30 (30)	34 (34)	38 (38)	28 (28)	34 (34)	37 (37)	30 (30)	33 (33)	34 (34)	50	NIL

Note: Levels in bold indicate an exceedance of the applicable criterion. Levels in brackets denote noise level excluding rail noise.

From the information contained in Table 12.12 and Table 12.13, it can be seen that the criteria are predicted to be exceeded under neutral weather conditions at three locations by up to 25 dBA. Under worst-case weather conditions, no additional properties are adversely affected.

It should also be noted that whilst the highest predicted LAmax noise level from rail operations (57 dBA LAmax) is above the levels recommended via Planning for Noise Control, it is 30 dBA below the 87 dBA LAmax criteria contained in EPP (Noise) and QR's Code of Practice – Railway Noise Management which would be used to assess rail noise emissions elsewhere on the Queensland rail network.

12.9.3.1 Mining Cumulative Noise Impacts

The cumulative noise impacts are inherently assessed through the background creep (L90) and specific/intrusive (Leq) criteria (see Section 12.5) contained in the EPA's Planning for Noise Control guideline. Both criteria take into account the existing ambient noise level in an area from all existing industry and other noise sources such as road and railway traffic.

The (EPA's Planning for Noise Control) assessment methodology is based on the existing ambient noise monitoring (undertaken at seven locations surrounding the proposed mine) and comparison to recommended ambient noise levels. The cumulative effect of the existing industry and other noise sources, together with the proposed mine, is assessed to not exceed the recommended ambient noise levels. If the existing noise level is already above the recommended noise levels, the associated noise levels of the proposed mine are set between 8 and 10 dBA below the existing ambient noise level so as the cumulative effects of existing and proposed industry should not increase above existing noise levels.

12.9.4 Noise Impact Assessment – Transportation (Operation)

12.9.4.1 Road Traffic Noise

Table 12.14 shows the expected increase in road traffic noise levels associated with construction and operation activities for the project.

Table 12.14 Increase in Road Traffic Noise Levels due to Construction and Operational Vehicles

Road Segment	Predicted Increase in LA10(18hour) Noise Level (dBA)	
	Construction Phase	Operational Phase
Moranbah Access Road	+0.1	+0.1
Dysart-Moranbah Road	+0.1	+0.1
Peak Downs Highway	+0.3	+0.1

As changes in noise levels of less than 2 dBA are unnoticeable to the human ear, no adverse impact is anticipated.

12.9.5 Vibration Impact Assessment - Blast emissions (Operation)

Blasting site laws have been developed from a combination of the proposed blast design parameters and blast emission data obtained from BMA's nearby Peak Downs Mine (ground vibration only) and ICI's Handbook of Blasting Tables.

The predicted levels of Peak Vector Sum (PVS) ground vibration velocity and peak airblast at the nearest potentially affected properties to the mine blasting are presented in Table 12.15. Please note that the frequency of blast ground vibrations at distance from the mine are predicted to be below 35 Hz, therefore the applicable vibration criterion is 10 mm/s (not 25 mm/s).

Table 12.15 Predicted Levels of Blast Emissions for the Range of 500 kg 1000 kg MIC

Location	Distance from Blasting	PVS Ground Vibration	Peak Airblast ¹
1 - L14 SP 163605	0 km	391.5 - 681.6 mm/s	139 - 142 dB Linear
2 - SP 151669 FH 50416979	0 km	391.5 - 681.6 mm/s	139 - 142 dB Linear
3 - Lot 4 Moranbah Access Road, Moranbah	0.3 km	67.5 - 117.5 mm/s	128 - 130 dB Linear
4 - L1 RP 614378 (South Property)	0.6 km	22.3 - 38.8 mm/s	121 - 123 dB Linear
5 - Hornery Homestead - 183 Moranbah Access Road, Moranbah	0.7 km	17.4 - 30.3 mm/s	119 - 122 dB Linear
6 - Peak Downs Highway (near intersection with Moranbah Access Road), Moranbah	1.2 km	7.3 - 12.8 mm/s	114 - 116 dB Linear
7 - Buffle Park Homestead, Peak Downs Highway, Moranbah	1.5 km	5.1 - 8.9 mm/s	111 - 114 dB Linear
8 - L8 RP 853653	1.8 km	3.8 - 6.7 mm/s	109 - 112 dB Linear
9 - L1 RP 614378 (North Property)	2 km	3.2 - 5.6 mm/s	108 - 111 dB Linear
10 - L1-2 RP 853653 (South Property)	2.2 km	2.8 - 4.8 mm/s	107 - 110 dB Linear
11 - Long Pocket Road, Moranbah	2.3 km	2.6 - 4.5 mm/s	107 - 109 dB Linear
12 - L2 RP 616987	2.3 km	2.6 - 4.5 mm/s	107 - 109 dB Linear
13 - GV 148	3 km	1.7 - 3.0 mm/s	104 - 106 dB Linear
14 - L5 RP853653	3.1 km	0.6 - 2.8 mm/s	104 - 106 dB Linear
15 - L1-2 RP 853653 (North Property)	3.2 km	1.5 - 2.7 mm/s	103 - 106 dB Linear
16 - L1 SP117775 (East Property)	3.8 km	1.2 - 2.0 mm/s	101 - 104 dB Linear
17 - L9 RP 853653	3.9 km	1.1 - 1.9 mm/s	101 - 104 dB Linear
18 - L1 SP 117775 (West Property)	4 km	1.1 - 1.9 mm/s	101 - 103 dB Linear
19 - L1 RP 616897 (North Property)	4.1 km	1.0 - 1.8 mm/s	101 - 103 dB Linear
20 - L25 RP 133553	4.4 km	0.9 - 1.6 mm/s	100 - 102 dB Linear
21 - L3 RP617628	4.8 km	0.8 - 1.4 mm/s	99 - 101 dB Linear
22 - 66 Jackson Avenue, Moranbah	5 km	0.7 - 1.3 mm/s	99 - 101 dB Linear
23 - Winchester Downs Homestead - Dysart-Moranbah Road, Moranbah	6 km	0.6 - 1.0 mm/s	97 - 99 dB Linear
24 - L3 GV252	6 km	0.6 - 1.0 mm/s	97 - 99 dB Linear
25 - L6 SP174999	6 km	0.6 - 1.0 mm/s	97 - 99 dB Linear
26 - L1 RP616025	10.1 km	0.2 - 0.4 mm/s	91 - 94 dB Linear

1- Predictions for 20% exceedence therefore criterion is 115 dB Lin

The following information is derived from the predicted levels of blast emissions:

- The predicted levels of ground vibration at all but six nearby residences comply with the EPA's criteria.
- The predicted levels of peak airblast at all but six residences comply with the EPA's criteria.

Vibration Effects on Underground Pipelines

DIN 4150.3-1999 provides a guideline values to avoid damage to underground pipes as shown in Table 12.16.

Table 12.16 DIN 4150 Part 3 “Table 2 – Guideline values for vibration velocity to be used when evaluating the effects of short-term vibration on buried pipework”

Pipe Material	Guideline values for velocity measured on the pipe in mm/s	Offset distance to achieve guideline value in m
Steel (including welded pipes)	100	330
Clay, concrete, reinforced concrete, pre-stressed concrete, metal (with or without flange)	80	380
Masonry, plastic	50	510

There are no known underground pipelines within 510 m of the pit area (eg where blasting will occur) so no adverse effects are predicted as a result of this project.

12.10 Noise and Vibration impact assessment on fauna

12.10.1 Effects of Noise on Wildlife

As far as our research currently reveals, there are no government policies or other widely-accepted guidelines in respect to the noise levels which may be acceptable to wildlife. The levels or character of noise that may startle or otherwise affect the feeding or breeding pattern of birds or other wild animals are also not firmly established in the technical literature.

It is concluded that birds tend to accept and/or adapt to constant steady noise levels, even of a relatively high level in the order of 70 dBA. Poole found that continuous exposure to higher noise levels (from 70 dBA to 85 dBA and above) may cause some degree of behavioural changes in birds (non-specific to species).

Observations of behaviour patterns also indicate a higher tolerance to intermittent, moderate level noise events such as road traffic.

Sudden loud or impulsive or impact noises are capable of causing birds and other wild animals to become startled, which if repeated in the longer term, may affect feeding and possibly breeding habits in some bird species. On the other hand, there are instances where such noises have been used in an attempt to drive flocks of birds (and bats) away from particular sites (at airports, waste disposal sites, etc). Due possibly to the more domesticated nature of these bird species, the success of such trials have been of limited success.

12.10.2 Effects of Noise on Farm Animals

An analysis of data from 42 herds did not show any evidence that flyovers or proximity to the ends of the active runways had an effect on the milk production of the herds. Animal installations were selected for observations on animal behaviour under sonic boom conditions. Numbers of animals observed in this study were about 10,000 commercial feedlot beef cattle, 100 horses, 150 sheep and 320 lactating dairy cattle. Booms during the test period were scheduled at varying intervals during the morning hours Monday to Friday of each week.

Results of the study showed that the reactions of the sheep and horses to sonic booms were slight. Dairy cattle were little affected by sonic booms (125 dB to 136 dB). Only 19 of 104 booms produced even a mild reaction, as evidenced by a temporary cessation of eating, rising of heads, or slight startle effects in a few of those being milked. Milk production was not affected during the test period, as evidenced by total and individual milk yield.

12.10.3 Poultry

The most extensive relevant studies found on the effects of blast emissions were those of the effects of sonic booms from aircraft on poultry (sonic booms being similar in character to airblast from blasting). A study by Heinemann investigated the effects of sonic booms on eleven poultry farms all having two or more poultry barns housing over 10,000 birds in each.

Over 600 low-level missions were flown which produced sound pressure levels of 85 dB to 140 dB in the barns. During the overflights the bird community stopped their usual activities and exhibited what could be termed an alert reaction. They quietened down, attempted to locate the source of the noise, and then either maintained their position or moved away from the area from which the aircraft was approaching. When flock movement occurred it was never a panicky stampede but merely a shift of the flock away from the approach-side of the building.

12.10.4 Effects of Noise on Swine

To determine possible harmful effects of aircraft noise (some of which was similar in character to airblast from blasting), pigs, boars, and sows were exposed to reproduced aircraft and other loud sounds at various stages of the life cycle (Bond, James, et al 1963). The swine unit, animals, and diets used were typical of those found at most swine production operations.

The typical reaction of a nursing sow to the sounds was initial alarm during which she arose to her feet and appeared to search for the source of sound, followed by resumption of suckling by the baby pig and apparent indifference to the sound. When suckling pigs were exposed to the sound in the absence of the dam they appeared to be alarmed and crowded together.

Boars and sows were almost entirely indifferent to loud sounds during mating.

Measurements of heart rate before, during and after sound exposure were made of a large number of weaning pigs to supplement the prior production results. These studies showed that the heart rate was significantly increased during exposure but that it decelerated rapidly after the sound was discontinued while the pattern of the electrocardiogram appeared to be unchanged.

In conclusion, apart from the possibility of noise from blasting startling birds and therefore over time possibly changing where they nest, no adverse impacts on animals are predicted for this project. Given that there is no conclusive information available to confirm that should birds be startled they will change where they nest, noise impacts on animal life surrounding the project site is considered acceptable.

12.11 Noise Mitigation Measures

12.11.1 Construction

Based on the results of Table 12.6 no adverse construction noise levels are predicted except at Location 2 which is located within the ultimate pit design. Therefore, specific noise mitigation measures are not warranted.

It is good practice however to be aware of some general measures that can be adopted to limit noise emitted from the project site. They fall into three categories:

- Source Noise Control Strategies
- Work Practice Control Strategies
- Community Liaison Strategies.

12.11.2 Operational Mining

A number of mitigation measures have been investigated in order to achieve compliance with the criteria nominated in this report. The two measures (which are interrelated) that will dictate all other requirements are:

- Resumptions
- Ownership of properties by BMA itself.

The aspect of this project which clearly has the highest level of non-compliance, prior to the development of a noise mitigation strategy, is the average or Leq noise criterion contained in Planning for Noise Control.

The properties that exceed the Planning for Noise Control Leq criterion for either neutral or worst case weather conditions, and their current ownership, are:

- | | |
|---|-----------|
| ■ Location 1 – L14 SP 163605 | BMA owned |
| ■ Location 2 – SP 151669 FH 50416979 | BMA owned |
| ■ Location 3 – Lot 4 Moranbah Access Road | BMA owned |



- Location 4 – L1 RP 614378 Mining Company
- Location 5 – Hornery Homestead BMA owned
- Location 6 – Peak Downs Highway BMA owned
- Location 7 – Buffle Park Privately owned
- Location 8 – L8 RP 853653 Privately owned
- Location 9 – L1 RP 614378 Mining Company (and vacant)
- Location 10 - L1-2 RP 853653 Privately owned
- Location 11 – Long Pocket Rd Privately owned
- Location 13 – GV 148 Privately owned

No mitigation measures will be investigated for those properties owned by BMA, as BMA have the ability to control the occupancy of these properties to meet their operational/environmental requirements.

For the remaining properties, a suite of mitigation measures were investigated. These were:

- Low and Super Low noise idlers for the overland conveyor.
- Partial and full enclosure of the overland conveyor.
- Bund walls of 10 m and 20 m height.
- Upgraded silencing (eg high performance silencers) of mobile mine equipment.

A brief discussion of the predicted noise levels and associated scenarios, reasonable and feasible mitigation options and predicted compliance with noise criteria is discussed below for each of the remaining (non-BMA owned) properties.

Location 4 – L1 RP 614378

A combination of both noise bunds and upgraded silencing of equipment would not achieve compliance with the noise criterion at this property and therefore the possible resumption of this property, or entering into an agreement with Anglo, are options that will require further discussion.

Location 7 – Buffle Park

A combination of both super low noise idlers and a full enclosure of the overland conveyor would not achieve compliance with the L90 (steady state) noise criterion at this property. A combination of both bund wall and upgraded silencing of mobile plant would not achieve compliance with the Leq noise criterion at this property.

Therefore the possible resumption of this property will require further discussion.



Location 8 – L8 RP 853653

Compliance with the noise criterion is achievable with either option listed above (albeit the bund wall results in a negligible 1 dBA exceedence). However, it is recommended that a comprehensive noise monitoring program be implemented before undertaking any of these mitigation measures as the exceedence of 3 dBA (before mitigation is implemented) is commonly accepted in the acoustic industry as minor. Given the commonly accepted accuracy of environmental noise prediction of +/- 2 dBA, it is recommended that this (monitoring) validation of actual noise emissions be undertaken as the initial step.

Location 9 – L1 RP 614378

Compliance with the noise criterion is close to achievable with either option and certainly achievable with a combination of both measures. However, possible resumption of this property, or entering into an agreement with Anglo, may require further discussion.

Location 10 – L1-2 RP 853653

Compliance with the noise criterion is achievable with either option listed above (albeit the bund wall results in a negligible 1 dBA exceedence). However, it is recommended that a comprehensive noise monitoring program be implemented before undertaking any of these mitigation measures as the exceedence of 3 dBA (before mitigation is implemented) is commonly accepted in the acoustic industry as minor. Given the commonly accepted accuracy of environmental noise prediction of +/- 2 dBA, it is recommended that this (monitoring) validation of actual noise emissions be undertaken as the initial step.

Location 11 – Long Pocket Road

Compliance with the noise criterion is achievable with either option listed above. However, it is recommended that a comprehensive noise monitoring program be implemented before undertaking any of these mitigation measures as the exceedence of 2 dBA (before mitigation is implemented) is commonly accepted in the acoustic industry as negligible. Given the commonly accepted accuracy of environmental noise prediction of +/- 2 dBA, it is recommended that this (monitoring) validation of actual noise emissions be undertaken as the initial step.

Location 13 – GV 148

Compliance with the noise criterion is achievable with either option listed above. However, it is recommended that a comprehensive noise monitoring program be implemented before undertaking any of these mitigation measures as the exceedence of 1 dBA (before mitigation is implemented) is commonly accepted in the acoustic industry as negligible. Given the commonly accepted accuracy of environmental noise prediction of +/- 2 dBA, it is recommended that this (monitoring) validation of actual noise emissions be undertaken as the initial step.

As a project wide initiative, the use of self adjusting volume or broad-band buzzer type reversing alarms should be utilised to avoid additional annoyance to neighbours. Should only traditional “constant volume beeping” type reversing alarms be used, then the Leq noise predictions presented in this report for mobile mechanical plant would be penalised a further 2 dBA (e.g. the predicted noise levels and where applicable exceedences would be 2 dBA greater) for such added annoyance.

12.11.3 General Measures

The following general control strategies for noise will be implemented:

- Self adjusting volume or broad-band buzzer type reversing alarms will be utilised to avoid additional noise annoyance to sensitive receptors. Should only traditional constant volume beeping type reversing alarms be used, then the Leq noise measurements for mobile mechanical plant will be penalised a further 2 dBA for the added tonal annoyance.
- Implement maintenance and operation procedures to minimise nuisance noise emissions from equipment, including servicing and maintenance of exhaust systems on mine equipment.
- Investigate complaints to determine the source of the nuisance noise.
- Maintain a register that details noise complaints and corrective actions relating to the complaint.
- Limit the speed of heavy vehicle traffic on haul roads.
- Plan to design haul roads and manage noisy equipment within pits to minimise impacts on sensitive receivers.
- Consider noise control technologies on mining equipment and haul trucks during procurement.
- Apply noise mitigation technologies on individual equipment where necessary.
- Implement a noise monitoring program as discussed below.

The following control strategies for blasting will be implemented.

- Carry out blasting only during daylight hours, generally during the hours of 8.00 am to 5.00 pm, Monday to Sunday.
- Plan to blast during the middle of the day when background noise levels are higher than at other times of day.
- Where monitoring or complaints indicate airblast overpressure or ground vibration levels of impact consistently above the environmental protection objectives, the following mitigations measures will be considered:
 - Reducing the maximum instantaneous charge (MIC) by using delays, reduced hole diameter and/or deck loading.
 - Changing the burden and spacing by altering the drilling pattern and/or delay layout, or altering the hole inclination.
 - Ensuring stemming depth and type is adequate.

- Restricting blasts to favourable weather conditions.

12.11.4 Monitoring

12.11.4.1 Ongoing Monitoring Program

A combination of permanent and short term annual noise and vibration monitoring will be undertaken as outlined below at the locations identified in Table 12.17 and Table 12.18.

Table 12.17 Recommended Permanent Monitoring Locations

Location
Hornery Homestead- 183 Goonyella Rd (Moranbah Access Rd)
Long Pocket Rd, Moranbah
Winchester Downs Homestead- Peak Downs Mine Road
Buffle Park Homestead- Peak Downs Highway
'The Bucket' Park, Moranbah Access Rd ¹

Note ¹ - A permanent noise and vibration monitoring system may be installed at 'The Bucket' Park, though additional housing or security measures may be required to protect the monitoring equipment due to public accessibility.

It is also recommended that one of the permanent sites utilise a trailer mounted station. This would need to be located at a somewhat secure site (e.g. Buffle Park) for on-going security reasons. This approach allows the flexibility of temporarily relocating the permanent site to a complainant's property without the need for an acoustic professional to visit the site.

Table 12.18 Recommended Non-Permanent Monitoring Locations

Location
Lot 7, Moranbah Access Road
Peak Downs Highway (near intersection with Moranbah Access Road)
66 Jackson Street, Moranbah

A noise and vibration logger will be placed at the locations in Table 12.18 along with 15-minute operator-attended noise and vibration measurements (carried out during day, evening and night periods), over a 48 hour period each year. The combination of permanent and short-term annual noise monitoring will ensure that a comprehensive monitoring program for continuous noise and vibration is achieved.

12.11.4.2 Complaints Based Monitoring

In the event of a community member registering a complaint regarding excessive noise or vibration levels, a two-phase response regime will be implemented:

First complaint: Remote Response - Data from the nearest permanent monitoring site will be interrogated remotely to determine justification of the complaint. Should the trailer option be implemented, a variation on

this Remote Response would be to drive the trailer to the complainant's property and then interrogate the data remotely.

Second complaint: Site Response - An acoustic professional will visit the area where the complaint was registered for a 48-hour period to undertake continuous logging as well as short-term noise and/or vibration monitoring to determine impacts.

12.12 Conclusion

A comprehensive study of both construction and operational noise levels from the project has been undertaken.

Background noise levels were monitored at seven locations in the surrounding community and ambient vibration measurements were undertaken at five locations.

All appropriate legislation, regulations, guidelines and standards were reviewed, in accordance with the Terms of Reference, to establish (in conjunction with the noise and vibration monitoring) the recommended noise and vibration criteria for this project.

A 3-D SoundPLAN noise model was then developed, based on 3-D terrain data supplied by BMA, to model all steady state (L90), average (Leq) and maximum (Lmax) noise emissions from the new rail line, CHPP, overland conveyor and mobile mechanical mining plant. Both neutral and "worst case" weather conditions (where applicable) were modelled in accordance with the EPA's Planning for Noise Control guideline.

Predictions were then undertaken for all scenarios and these predictions compared to the criteria developed for this project. A summary of these findings is presented below:

- For the steady state (L90) noise emissions from the processing plant and overland conveyor, three locations (Locations 2, 6 and 7) exceeded the criterion for neutral weather and one of these three locations (Location 7) increased by a further 6 dBA under worst case weather conditions
- For average (Leq) noise emissions from processing plant and/or overland conveyors and/or train movements on the new section of track and/or mobile mechanical plant involved in mining, 9 locations (Locations 1, 2, 3, 4, 5, 6, 7, 9 and 13) exceeded the criterion for neutral weather. Under 'worst-case' weather conditions, the exceedence at one of these (9) locations (Location 7) increased by 5 dBA and three additional properties (Locations 8, 10 & 11) were identified to now have minor (up to 3 dBA) exceedences.
- For maximum (Lmax) noise emissions from train or mobile mechanical plant, three locations (Locations 1, 2 and 4) are predicted to exceed under neutral weather conditions and they remain the only three locations under worst case conditions also.

The results indicate that the LAeq operational noise levels from the Caval Ridge Mine could increase by 2 to 3 dBA under worst case weather conditions, relative to neutral conditions, at the closest (e.g. worst case)



distance to the properties. At greater distances, increases of 4 to 5 dBA are predicted due to worst case weather conditions.

No adverse noise impacts are predicted for road transportation into and out of the project site.

Blasting site laws (or prediction algorithms) were developed based on actual data collected by the current monitoring program for Peak Downs Mine (ground vibration only) and ICI's Handbook of Blasting Tables. Six locations (Locations 1 to 6) are predicted to exceed the blasting criteria. Only one of these six locations is not currently owned by BMA, however it is already owned by neighbouring miner.

A suite of mitigation measures were investigated for those properties that exceeded the criteria. These mitigation measures were:

- Low and Super Low noise idlers for the overland conveyor.
- Partial and full enclosure of the overland conveyor.
- Bund walls of 10 m and 20 m height.
- Upgraded silencing (eg high performance silencers) of mobile mine equipment.

Predictions indicate that only two of the properties identified as exceeding any of the criteria cannot achieve compliance by the use of one or more of the above mitigation measures. These are Location 4 (owned by neighbouring miner) and Location 7. At these locations, the possibility of resumption, or entering into an agreement with neighbour, will need to be discussed further.

For all other locations, it is recommended that a comprehensive noise monitoring program be put in place to validate the predictions undertaken for this study before implementing mitigation measures (which in themselves are subject to further detailed design).

In conclusion, based on the noise predictions undertaken for the EIS, engineering solutions (subject to further detailed design) can be implemented to achieve acceptable noise and vibration levels at all non-BMA owned properties with the exception of two properties - Location 4 (owned by neighbouring miner) and Location 7 (privately owned). At these locations, the possibility of resumption, or entering into an agreement with the property owner (e.g. to provide air conditioning and/or upgraded building façade treatments in order to ensure acceptable internal acoustic amenity), will be further assessed and negotiated.