# 12 Noise and Vibration

## 12.1 Introduction

The operation of the Daunia Coal Mine Project (the Project) has the potential to cause noise and vibration impacts on nearby sensitive receivers. This section of the Environmental Impact Statement (EIS) examines potential impacts by:

- assessing the existing noise and vibration environment;
- examining existing legislation and guidelines relevant to noise and vibration from Project operations;
- establishing appropriate criteria for noise and vibration that would protect the existing amenity;
- modelling and discussion of potential noise and vibration impacts from Project operations, including the cumulative impacts from the neighbouring Poitrel Mine; and
- discussing mitigation measures.

## 12.2 Existing Noise Environment

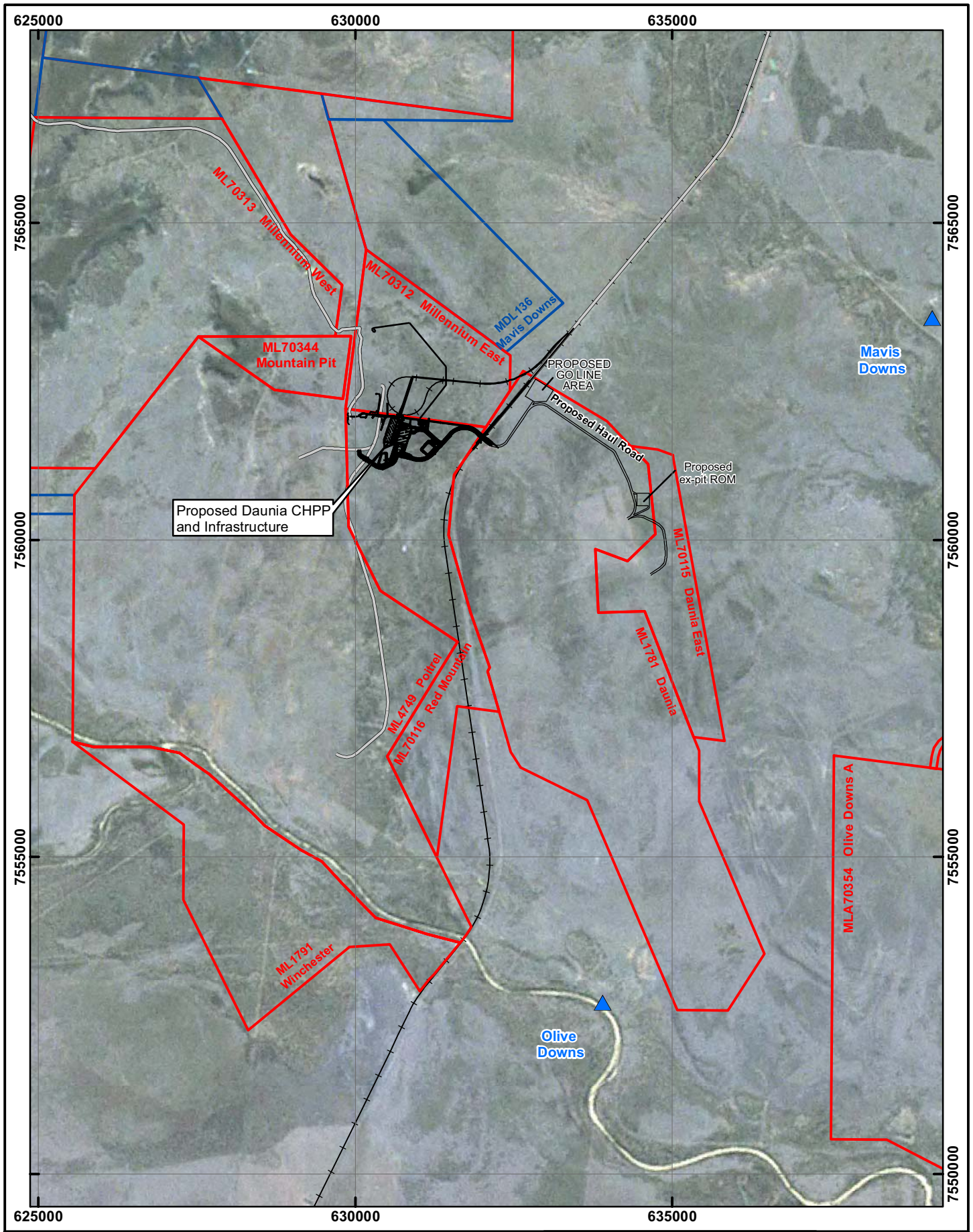
### 12.2.1 Description of Sensitive Receivers

An assessment of the existing noise environment was carried out at a number of sensitive receivers deemed most likely to be affected by noise nuisances from the Project.

Three sensitive receivers are identified in this assessment:

- Olive Downs Homestead
- Daunia Station
- Mavis Downs Homestead

The location of these receivers in relation to the Project Site is shown in **Figure 12-1**. Olive Downs Homestead, Daunia Station, and Mavis Downs Homestead are situated at about 1.3 km, 3.8 km, and 4.6 km respectively from the Project lease boundary. Surrounding mining operations include the Poitrel Mine and Millennium Mine to the west, and the Moorvale Mine to the northeast of Mavis Downs. Attended and unattended noise measurements were gathered at the three sensitive receiver locations for subjective and objective assessments of the existing noise environment.




**LEGEND**

- Sensitive Receiver
- Proposed Mine Infrastructure
- Road
- Existing Railway
- Mining Lease
- Mineral Development Licence

**FIGURE 12-1**

**DAUNIA COAL MINE EIS**

LOCATION OF NOISE SENSITIVE RECEIVERS

0 0.8 1.6 2.4 3.2

Kilometres

Scale 1:80,000 on A4

Projection: Australian Map Grid - Zone 55 (AGD84)

BMA

BHP Billiton Mitsubishi Alliance

I:\QENV\Projects\QE065201\800 Spatial\Arc_MXD\Figures\Fig_12-1_Location_of_Noise_Receivers_v3.mxd Produced: 8/10/2008 This figure should be read in conjunction with the data disclaimer at the front of this report.

### 12.2.2 Background Noise Monitoring

Noise monitors were set to apply A-weighting, fast response, and 15 minute time intervals in recording various noise descriptors including $L_{eq}$, $L_{90}$, $L_{10}$ and $L_{Max}$. The $L_{eq}$ noise level is the 'equivalent continuous sound level' that would have the same total sound energy over a period as a noise source that has fluctuating sound levels over the same period. The $L_{90}$ and $L_{10}$ are noise levels exceeded for 90 per cent and 10 per cent of the measurement period, respectively. $L_{90}$ is often representative of the background noise level, while $L_{10}$ is representative of the average maximum noise level.

Monitoring results showed the existing noise environment at the three locations is typical of a rural area, with noise sources consisting mainly of environmental influences such as the rustling of leaves, insects, birds and livestock, as well as localised vehicle and machinery noise. Observations made during the survey period determined that noise from the surrounding mine operations were not audible and therefore were not measured during attended monitoring. Anecdotal evidence from the residents at the Mavis Downs property suggested that noise from the existing Moorvale Mine was audible on occasion. Similar anecdotal evidence was made by Olive Downs residents regarding noise from rail and the Poitrel Mine.

The results from attended and unattended noise monitoring from the Olive Downs Homestead, Daunia Station, and Mavis Downs Homestead are presented in the following sections. Details on equipment, monitoring locations and monitoring periods have also been included in the sections below.

Background monitoring was conducted at residences at Olive Downs, Daunia Station and Mavis Downs between 31 March and 9 May 2008. Both attended and unattended monitoring was carried out in accordance with the standards set out in Australian Standard, AS1055.1 and AS1055.2 (1997).

#### Olive Downs

Details and results from background noise monitoring at the Olive Downs Homestead are summarised in **Table 12-1**. Equipment details are also provided. Continuous noise traces are provided in **Appendix M**.

**Table 12-1 Olive Downs Homestead Monitoring Details and Results**

| **Results from Attended Monitoring on 31 March 2008** | | | | |
|---|---|---|---|---|
| **Period** | **Leq dB(A)** | **L10 dB(A)** | **L90 dB(A)** | |
| Day 5:00pm | 45 | 48 | 41 | |
| **Comments** | Noise from birds, crickets, and cicadas. Calm conditions. | | | |
| **Results from Unattended Monitoring from 31 March to 10 April 2008** | | | | |
| **Period** | **Leq dB(A)** | **Lmax dB(A)** | **L10 dB(A)** | **L90 dB(A)** |
| Day 7am-6pm | 42.5 | 58.7 | 44.3 | 36.7 |
| Evening 6pm-10pm | 43.3 | 53.9 | 45.7 | 34.2 |
| Night 10pm-7am | 29.2 | 44.4 | 31.2 | 22.9 |
| **Equipment Details** | | | | |
| **Model** | Rion NL21 274 Type 2 Sound Level Meter | | | |
| **Noise Floor** | 22 dB(A) or less | | | |
| **Pre Calibration** | 93.6 dB at 1kHz | | | |
| **Post Calibration** | 93.6 dB at 1kHz | | | |

Monitoring results show that the existing noise level at Olive Downs remains steady during the day and evening periods, before lowering over the night time period.

1/3rd octave attended monitoring was conducted and significant noise sources were limited to birds, crickets and cicadas. Attended day, evening, and night time monitoring conducted in September 2007 by HLA Envirosciences Pty Ltd also found that significant noise sources were limited to insects and birds.

### Daunia Station

Details and results from noise monitoring at Daunia Station are summarised in **Table 12-2**, including details of the equipment used. Continuous noise traces are provided in **Appendix M**.

**Table 12-2 Daunia Station Homestead Monitoring Details and Results**

| **Results from Attended Monitoring on 31 March 2008** | | | | |
|---|---|---|---|---|
| **Period** | **Leq dB(A)** | **L10 dB(A)** | **L90 dB(A)** | |
| Evening 6:55pm | 53 | 56 | 50 | |
| **Comments** | Noise from insects and frogs significant. | | | |
| **Results from Unattended Monitoring from 31 March to 10 April 2008** | | | | |
| **Period** | **Leq dB(A)** | **Lmax dB(A)** | **L10 dB(A)** | **L90 dB(A)** |
| Day 7am-6pm | 51.7 | 75.4 | 51.2 | 37.3 |
| Evening 6pm-10pm | 43.9 | 56.7 | 44.6 | 37.9 |
| Night 10pm-7am | 34.2 | 48.5 | 34.7 | 29.9 |
| **Equipment Details** | | | | |
| **Model** | ARL315 Type 2 Sound Level Meter | | | |
| **Noise Floor** | 24 dB(A) as at the last calibration date of 3 April 2007 | | | |
| **Pre Calibration** | 93.7 dB at 1kHz | | | |
| **Post Calibration** | 93.8 dB at 1kHz | | | |

Existing noise levels at Daunia Station appear relatively high when compared to Olive Downs and Mavis Downs. However, existing noise levels at Daunia Station are likely to be lower than shown in the data. Examining the data and the continuous noise trace, the noise floor (electronic noise of the instrument) of the monitor was around 28 dB(A) which is higher than the 24 dB(A) stated at the last calibration date. The difference between the L10 and L90 levels over the night period also shows an average difference of less than 3 dB(A), with 66 per cent of differences under 3 dB. The monitor was placed well away from the influence of mechanical noise sources, and it is likely that monitoring results (especially night time results) have been affected by the noise floor of the monitor. There was a significant insect noise influence at this location, which could also account for the results. The background noise levels gathered from monitoring are not likely to be representative of the background noise levels for the whole year.

1/3rd octave attended monitoring was conducted and significant noise sources were limited to insects and frogs.

### Mavis Downs Homestead

Details and results from noise monitoring at the Mavis Down Homestead are summarised in **Table 12-3**. Continuous noise traces are provided in **Appendix M**.

**Table 12-3 Mavis Downs Homestead Monitoring Details and Results**

| **Results from Attended Monitoring on 31 March 2008** | | | | |
|---|---|---|---|---|
| **Period** | **Leq dB(A)** | **L10 dB(A)** | **L90 dB(A)** | |
| Day | 44 | 49 | 42 | |
| **Comments** | Noise from crows and crickets. No other noise sources audible. | | | |
| **Results from Attended Monitoring on 9 May 2008** | | | | |
| Day | 40 | 43 | 34 | |
| **Comments** | Noise from rustling leaves, crows and occasional insects. Calm with a light easterly breeze. | | | |
| **Results from Unattended Monitoring from 2 May to 9 May 2008** | | | | |
| **Period** | **Leq dB(A)** | **Lmax dB(A)** | **L10 dB(A)** | **L90 dB(A)** |
| Day 7am-6pm | 40 | 61 | 41 | 29 |
| Evening 6pm-10pm | 44 | 53 | 48 | 35 |
| Night 10pm-7am | 32 | 47 | 34 | 24 |
| **Equipment Details** | | | | |
| **Model** | Rion NL21 Type 2 Sound Level Meter | | | |
| **Noise Floor** | 22 dB(A) or less | | | |
| **Pre Calibration** | 94.0 dB at 1kHz | | | |
| **Post Calibration** | 93.9 dB at 1kHz | | | |

Monitoring results show that the existing noise level at Mavis Downs rises in the evening period, before lowering over the night time period.

1/3rd octave attended monitoring was conducted on 31 March and 9 May 2008 and significant noise sources were limited to birds, crickets and crows.

### Previous Noise Surveys

Noise monitoring studies in areas surrounding the Poitrel site and the Daunia Project Site were previously undertaken in June 1996, May 2004 and September 2007. Monitoring in June 1996 and May 2004 assessed ambient levels prior to bulk sampling and mining activities in the area, while the September 2007 monitoring assessed the noise environment with the nearby Poitrel Mine in operation.

During each monitoring campaign, day, evening and night time data was gathered over a minimum of seven days in accordance with AS1055.1 (1997). **Table 12-4** summarises these earlier results from noise surveys in the area, and presents the average levels from monitoring over this period. For comparison, **Table 12-5** presents a summary of noise monitoring conducted in the Project area between April and May 2008.

**Table 12-4 Summary of Background Monitoring between 1996 and 2007**

| Monitoring Details | | Average Noise Levels dB(A) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Day (7am to 6pm) | | | Evening (6pm to 10pm) | | | Night (10pm - 7am) | | |
| Location | Date | $L_{eq}$ | $L_{10}$ | $L_{90}$ | $L_{eq}$ | $L_{10}$ | $L_{90}$ | $L_{eq}$ | $L_{10}$ | $L_{90}$ |
| Olive Downs | Sep 07 | 40 | 42 | 30 | 45 | 47 | 40 | 32 | 34 | 26 |
| Olive Downs | June 96 | 51 | 53 | 41 | <30* | <30* | <30* | 30 | 30 | <30* |
| Daunia Rural | June 96 | 44 | 41 | 35 | <30* | <30* | <30* | <30* | <30* | <30* |
| Daunia Home | June 96 | 49 | 44 | 37 | 32 | <30* | <30* | 34 | 32 | <30* |
| Poitrel Homestead | May 04 | 39 | 40 | 30 | 36 | 37 | 32 | 30 | 31 | 27 |
| Average | | 45 | 44 | 35 | 38 | 42 | 36 | 32 | 32 | 27 |

*The noise floor of the noise monitor used was 30 dB(A) and measured noise levels were below 30. These figures were not used in calculating averages.

**Table 12-5 Summary of Background Monitoring 2008**

| Monitoring Details | | Average Noise Levels dB(A) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Day (7am to 6pm) | | | Evening (6pm to 10pm) | | | Night (10pm - 7am) | | |
| Location | Date | $L_{eq}$ | $L_{10}$ | $L_{90}$ | $L_{eq}$ | $L_{10}$ | $L_{90}$ | $L_{eq}$ | $L_{10}$ | $L_{90}$ |
| Olive Downs | April 08 | 43 | 44 | 37 | 43 | 46 | 34 | 30 | 31 | 23 |
| Daunia Station | April 08 | 52 | 51 | 37 | 44 | 45 | 38 | 34 | 35 | 30 |
| Mavis Downs | May 08 | 40 | 41 | 29 | 44 | 47 | 35 | 32 | 34 | 24 |
| Average | | 45 | 45 | 34 | 44 | 46 | 36 | 32 | 33 | 26 |

The average data for the different monitoring periods show close correlation across different noise descriptors.

## 12.3 Meteorological Influences

The level of noise received by a receiver is affected by the meteorological factors such as wind and atmospheric temperature inversion. Such factors may result in a receiver experiencing an increase in noise where, under different meteorological conditions, they would not be impacted.

According to *Planning for Noise Control* (EPA 2004a) the prevailing and worst case meteorological conditions must be determined. The guideline recommends assessing for adverse wind and temperature inversion if:

- Wind speeds below 3 m/s blow from the noise source in the direction of the receiver for 30 per cent of any day, evening or night assessment period, at any time throughout the year; or
- Temperature inversion conditions occur for 30 per cent of the time during winter night time (between 6 pm to 7 am). This equates to approximately 2 nights per week during winter months.

### 12.3.1 Meteorological Conditions During Noise Monitoring

The Bureau of Meteorology weather station at Moranbah recorded no rainfall during the noise monitoring period. Wind speeds taken at 9 am and 3 pm during monitoring at Olive Downs and Daunia Station averaged 1.3 m/s and 2.1 m/s respectively, and wind direction ranged from easterlies to south easterlies.

Temperatures during this period ranged from a minimum of 10.4 degrees Celsius (°C) to maximum of 28.9 °C.

Wind speeds taken at 9 am and 3 pm during monitoring at Mavis Downs averaged less than 1 m/s and 1.4 m/s respectively, and consisted of easterlies and south easterlies. Temperatures during this period ranged from a minimum of 13 °C to maximum of 30.6 °C.

### 12.3.2 Annual Meteorological Trends

Wind directions vary from all directions but are predominantly from the east and northeast as shown in the all hours windrose in **Figure 12-2**. Winds at night are generally less than 5 m/s from the northeast. A detailed breakdown of wind speed and direction can be seen in the Air Quality chapter in **Section 10**. Average maximum daytime temperature at Moranbah is around 34 °C falling to 24 °C during the winter months, and minimum temperatures overnight are an average of 11 °C in July, rising to more than 21 °C between December and February.

As discussed above in **Section 12.3**, temperature inversion may increase noise levels at sensitive receivers locations, and requires assessment if temperature inversion conditions occur in the area for 30 per cent of winter night times. **Figure 12-3** has been produced using hourly data for 6 pm to 7 am in June, July and August as produced by TAPM (a meteorological and air pollution model) for Moranbah in 2004, and shows the likely percentage of temperature inversion on winter nights.

Meteorological conditions in which temperature inversion occurs is classed as stability class F, which is characterised by cloudless nights when the ground becomes cooler than the surrounding air. Typical are light winds less than 3 m/s and temperature inversion of 3 °C /100 m. It assists the propagation of noise, and can increase the noise impacts in areas surrounding the site. **Figure 12-3** shows that stability class F is likely to occur for approximately 58 per cent of the winter night period and hence is addressed in the impact assessment.

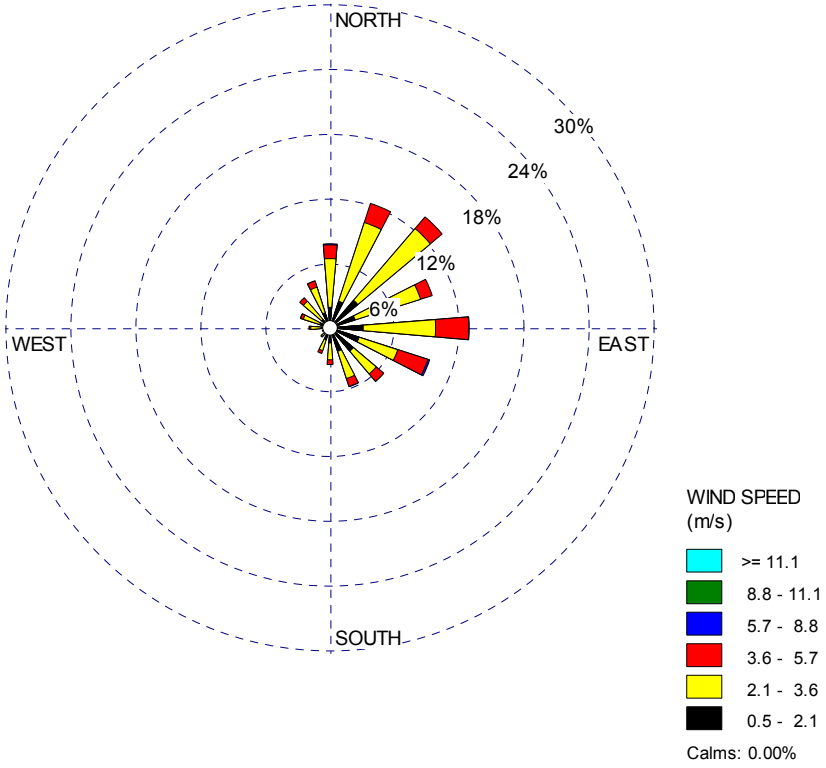



**Figure 12-2 All Hours Windrose for Daunia (TAPM)**

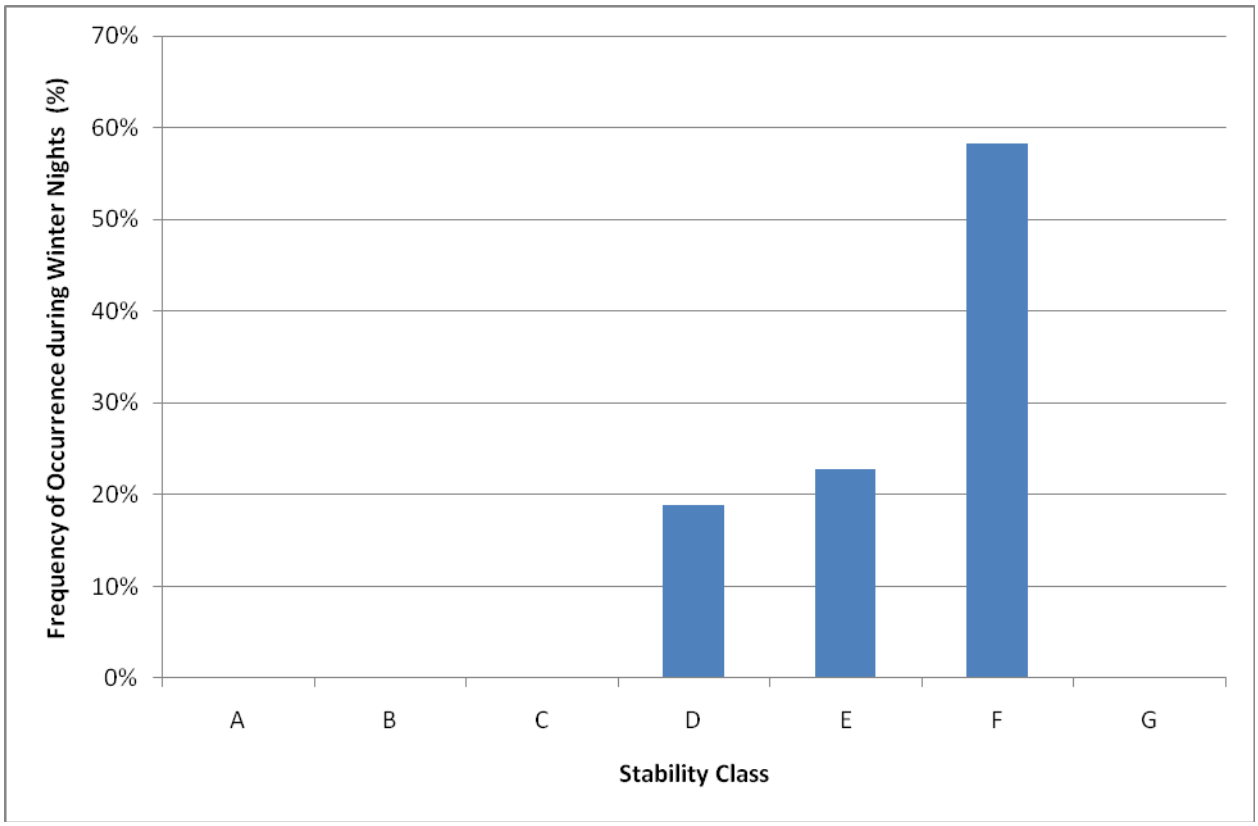



**Figure 12-3 Frequency of Different Stability Classes during Winter Nights (6pm to 7am)**

## 12.4 Legislation and Project Guidelines

### 12.4.1 Overview

The acoustic environment in Queensland is protected under the *Environmental Protection Act 1994 (Qld)* (EP Act) which states the objective of the Act is to 'protect Queensland's environment while allowing for development that improves the total quality of life'.

In conformance with the EP Act, the Queensland *Environmental Protection (Noise) Policy 1997* (EPP (Noise)) states in Section 10 that 'The environmental values to be enhanced or protected under this policy are the qualities of the acoustic environment that are conducive to:

a) the wellbeing of the community or a part of the community, including its social and economic amenity; or

b) the wellbeing of an individual, including the individual's opportunity to have sleep, relaxation and conversation without unreasonable interference from intrusive noise.

The EPP (Noise) gives an acoustic quality objective of an ambient level of 55 dB(A) or less, for most of Queensland's population living in residential areas. However, it '…is not intended that, in achieving the acoustic quality objective, any part of the acoustic environment be allowed to significantly deteriorate'. The 55 dB(A) objective is not applicable for all locations and for some projects other noise criteria are more relevant.

After a review of current noise policy and discussions with the Queensland Environmental Protection Agency (EPA), the following noise guidelines were identified as relevant to the Project:

- the Queensland EPA Ecoaccess Guideline "Planning for noise control", dated July 2004;
- the World Health Organization "Guidelines for Community Noise", dated April 1999;
- the Australia/New Zealand Standard AS/NZS 2107-2000, "Recommended Design Sound Levels and Reverberation Times for Building Interiors", dated 2000; and
- the EPA Ecoaccess guideline, "Noise and Vibration from Blasting", dated 2006.

### Queensland EPA Guideline "Planning For Noise Control" 2004

The Planning for Noise Control guideline contains methods and procedures that are applicable for setting conditions relating to noise emitted from mining operations, and are intended for noise planning purposes. The guideline is aimed at addressing the control and prevention of three aspects:

- prevention of background noise creep, that is, noise levels creeping higher and higher over time;
- containment and minimisation of variable noise; and
- avoidance of sleep disturbance.

The guideline uses two different methods of determining limits to be imposed on how much noise is emitted from the Project, and adopts the lesser of the two results as noise goals. The noise goals are levels that would be measured at 4 m from the façade of a building.

One method aims to prevent background noise creep and compares overall existing background noise to recommended background noise planning levels suitable to the area shown in **Table 12-6**. The process of comparison involves deducting from or adding to the recommended noise planning levels, with the amount adjusted dependent on how close existing noise levels are to the recommended planning levels. The resulting background noise planning level is converted to an hourly equivalent noise level and further deducted for tonal and impulsive characteristics.

**Table 12-6 Recommended Outdoor Background Noise Planning Levels**

| Receiver Land Use | Receiver Area Dominant Land Use* (Description for Neighbourhood) | Background noise level, minL90,1hour dB(A) | | |
|---|---|---|---|---|
| | | Day | Evening | Night |
| Purely residential | Very rural | 35 | 30 | 25 |

*Dominant land use is defined as a radius of 200 m from the receiver location under consideration.

The second method aims to protect noise impacts such as speech interference, community annoyance and to some extent sleep disturbance. It compares the noise contribution from existing similar operations to a maximum hourly equivalent noise planning level suitable to the area as shown in **Table 12-7**. The process of comparison involves deducting from, retaining, or adding to the recommended noise planning levels, with the amount adjusted dependent on how close existing noise levels are to recommended planning levels.

**Table 12-7 Maximum Values of Planning Noise Levels for Proposed Noise Sources**

| Receiver Land Use | Description of Neighbourhood* | Maximum Hourly Sound Pressure Level, Leq,1hour dB(A) | | |
|---|---|---|---|---|
| | | Day | Evening | Night |
| Purely residential | Very rural. Less than 40 vehicles an hour | 40 | 35 | 30 |

The guidelines also discuss sleep disturbance criteria, where an instantaneous maximum indoor sound level of 45 dB(A) should not be exceeded more than 10 to 15 times per night. The corresponding maximum external noise in the free field would be 52 dB(A) assuming partially closed windows.

### World Health Organization "Guidelines for Community Noise" 1999

The World Health Organization (WHO) discusses the effects of environmental noise in non-industrial environments. It examines aspects such as sleep disturbance, annoyance, and speech intelligibility and provides guidance for protecting people from adverse effects induced by too much noise. It is also referred to in the "Planning for Noise Control" guideline's section on sleep disturbance criteria.

Sleep disturbance is addressed as a major effect of environmental noise. The guideline recommends night time noise levels in bedrooms of 30 dB(A) $L_{eq}$ for continuous noise and 45 dB(A) $L_{max}$ for single sound events. When the noise consists largely of low frequency sounds, lower guideline values are recommended as low frequency noise can disturb sleep at lower sound pressure levels.

Most people are likely to be highly annoyed should daytime sound pressure levels at outdoor living areas exceed 55 dB(A) $L_{eq}$ for a steady, continuous noise. Moderate annoyance may be felt should daytime outdoor sound pressure level exceed 50 dB(A) $L_{eq}$. Sound pressure levels during the evening and night should be 5 to 10 dB lower than the level during the day. The recommendation of lower noise levels for low frequency noise also applies for outdoor living areas. For intermittent noise, it is necessary to take into account the maximum sound pressure level as well as the number of noise events.

Interference to speech intelligibility may be prevented by maintaining background noise to levels of about 35 dB(A) to 45 dB(A).

While the WHO guidelines provide noise level goals for sleep disturbance, external amenity and speech intelligibility, these goals would be in conflict with state based planning requirements recommended by the EPA. Therefore the project specific noise levels nominated in this report will be based on the most stringent of the criteria identified in the relevant noise guidelines.

### AS/NZS 2107 - Recommended Design Sound Levels and Reverberation Times for Building Interiors (2000)

This Standard recommends design criteria for steady ambient sound levels and reverberations times for different building interiors, taking into account the intended function of the area. The Standard recommends internal levels in sleeping areas for houses with negligible transport be limited to a maximum $L_{eq}$ of 30 dB(A) and an acceptable $L_{eq}$ level of 25 dB(A).

While identified in the Terms of Reference for the Project, the AS2107 Standard is more specifically intended for use by designers of buildings and residential developments and therefore is not appropriate for use in establishing project specific noise criteria for activities such as mining.

### Queensland EPA Ecoaccess Guideline – Noise and Vibration from Blasting (2006)

The Ecoaccess guideline, Noise and Vibration from Blasting (EPA 2006) provides assessment criteria for blasting noise and vibration as follows.

#### *Noise*

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:

a) Must be not more than 115 dB(linear) peak for nine out of any ten consecutive blasts initiated, regardless of the interval between blasts; and
b) Must not exceed 120 dB(linear) peak for any blast.

#### *Vibration*

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:

a) Must not exceed a peak particle velocity (PPV) of 5 mm/s for nine out of any ten consecutive blasts initiated, regardless of the interval between blasts; and
b) Must not exceed a PPV of 10 mm/s for any blast.

#### *Blasting Times*

Blasting should generally only be permitted during the hours of 9 am to 3 pm, Monday to Friday, and from 9 am to 1 pm on Saturdays. Blasting should not generally take place on Sundays or public holidays.

Blasting outside these recommended times should be approved only where:

a) 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
b) There is no likelihood of persons in a noise-sensitive place being affected because of the remote location of the blast site.

These levels would be applicable to any blasting undertaken as part of the Project operations.

### Project Specific Noise and Vibration Goals

The noise guidelines were used in conjunction with EPA consultation in determining noise goals that would protect the amenity of the sensitive receivers in the area whilst allowing the development of the coal resource.

Assessment from the Planning for Noise Control Guideline:

- Recommended outdoor background planning noise levels in **Table 12-6** would be used to assess existing background noise; and

- Recommended maximum planning noise levels shown in **Table 12-7** would apply to the area surrounding sensitive receivers in assessing existing noise from mining operations.

Following the procedures outlined in the guideline, the recommended noise criteria for the Project are presented in **Table 12-8**.

**Table 12-8 Planning Noise Levels for the Daunia Coal Mine Project**

| **PNL – Specific Level Leq,1hour dB(A)** | | | |
|---|---|---|---|
| | **Day** | **Evening** | **Night** |
| **Olive Downs Homestead** | 40 | 35 | 30 |
| **Daunia Station** | 40 | 35 | 30 |
| **Mavis Downs Homestead** | 40 | 35 | 30 |
| **PNL – Lr,1hour dB(A)** | | | |
| | **Day** | **Evening** | **Night** |
| **Olive Downs Homestead** | 35 | 28 | 28 |
| **Daunia Station** | 28 | 28 | 28 |
| **Mavis Downs Homestead** | 35 | 28 | 28 |

Airblast overpressure and vibration levels (as shown in **Table 12-9**) would be applicable to any blasting undertaken as part of the Project operations. Blasting times of 9am to 5pm have been proposed given the nature of the mining operation and the remote location of the blast site.

**Table 12-9 Airblast overpressure and vibration limits in sensitive places (EPA, 2006)**

| **Blast noise and vibration parameter** | **Monday to Sunday 9am to 5pm** |
|---|---|
| Airblast overpressure level (dB linear peak) | 115 for 9 out of any 10 consecutive blasts regardless of interval between blasts.<br>Any single blast must not exceed 120. |
| Peak particle velocity (mm/s) | 5 mm/s for 9 out of any 10 consecutive blasts regardless of interval between blasts.<br>Any single blast must not exceed 10 mm/s. |

## 12.5 Noise Impact Assessment

The Project will be an open cut coal mining using a conventional excavator and truck fleet. The mining sequence will generally entail:

- progressive clearing of any vegetation occurring on areas to be mined using dozer and scrapers;
- stripping and hauling of topsoil from ahead of mining for storage and use in future rehabilitation of the site;
- drilling and blasting for fragmentation of overburden;
- removal of overburden, using a combination of dozers, excavators and trucks;
- coal removal using a combination of dozers, excavators, loaders and trucks; and

- rehabilitation of the site by re-shaping the waste rock dumps, topsoiling and revegetation using native vegetation.

A new 800 t/h Coal Handling and Preparation Plant (CHPP) will be built south of the existing Millennium CHPP to process coal mined from the Project Site. The new CHPP will be similar to the existing Millennium CHPP with coal quality from the Project Site being very similar to that currently being processed through that CHPP.

Due to the close proximity of the Project Site to the Poitrel Mine and Millennium CHPP, cumulative noise impacts have also been assessed through modelling.

A review of the Daunia and Poitrel mine plans show that operations will be closest to Daunia Station and Mavis Downs in years 1 and 5 of operations. This occurs when mine site noise sources will be situated at the northern end of the Project Site, approximately 4 km from the residences. Noise from the mining operations at the Olive Downs residence is expected to be greatest between years 15 and 20 where the majority of noise sources will be situated at the southern end of the Project Site, and where noise sources may be as close as 1.4 km from the residence.

### 12.5.1 Noise Modelling

Noise modelling involves incorporating acoustic information regarding the frequency content, the location and elevation of noise sources, the location of receivers, the intervening topography, and meteorological characteristics of the area. These aspects have been accounted for using SoundPlan, which is an acoustic modelling software package endorsed by the Queensland EPA. Within SoundPlan the CONCAWE industrial noise prediction method was adopted and the influence of wind and atmospheric stability was included.

The sound power levels of noise sources used in the modelling noise impacts are representative of $L_{Aeq}$ levels resulting from cyclic operations of the equipment. These noise levels were sourced using data from equipment manufacturers as well as field measurements and have been itemised in **Table 12-10**. Included in the table are equipment that is expected to be used by subcontractors, such as scrapers and dozers to be used for tree clearing and topsoil removal.

**Table 12-10 Sound Power Levels of Noise Sources**

| Noise Source | Leq dB(A) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 31.5 Hz | 63 Hz | 125 Hz | 250 Hz | 500 Hz | 1 kHz | 2 kHz | 4 kHz | 8 kHz | SWL |
| EX5500 | 77 | 93 | 105 | 114 | 119 | 115 | 113 | 108 | 98 | 122 |
| Liebherr R9250 | 77 | 92 | 104 | 112 | 117 | 113 | 111 | 105 | 96 | 120 |
| Liebherr R994 | 77 | 92 | 104 | 112 | 117 | 113 | 111 | 105 | 96 | 120 |
| Terex RH340 | 77 | 93 | 105 | 114 | 119 | 115 | 113 | 108 | 98 | 122 |
| Dragline | 61 | 72 | 86 | 97 | 103 | 108 | 107 | 105 | 96 | 113 |
| Cat 789 Haul Truck | 72 | 97 | 100 | 103 | 108 | 106 | 107 | 99 | 91 | 113 |
| Cat 793D Haul Truck | 72 | 97 | 100 | 103 | 108 | 106 | 107 | 99 | 91 | 113 |
| Komatsu HD785 | 67 | 75 | 85 | 98 | 97 | 103 | 106 | 112 | 103 | 114 |
| Cat D11 Dozer | 76 | 87 | 97 | 100 | 109 | 109 | 108 | 102 | 95 | 114 |
| Cat D10 Dozer | 76 | 87 | 97 | 100 | 109 | 109 | 108 | 102 | 95 | 114 |

| Noise Source | Leq dB(A) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 31.5 Hz | 63 Hz | 125 Hz | 250 Hz | 500 Hz | 1 kHz | 2 kHz | 4 kHz | 8 kHz | SWL |
| Cat 16H Grader | 64 | 78 | 94 | 100 | 106 | 110 | 106 | 103 | 98 | 113 |
| Cat 777 Water Truck | 67 | 75 | 85 | 98 | 97 | 103 | 106 | 112 | 103 | 114 |
| Cat 637 Scraper | 72 | 90 | 99 | 100 | 104 | 106 | 105 | 98 | 91 | 111 |
| Cat 988H FEL | 68 | 83 | 98 | 104 | 108 | 110 | 106 | 95 | 90 | 114 |
| Cat 992 FEL | 68 | 83 | 98 | 104 | 108 | 110 | 106 | 95 | 90 | 114 |
| Komatsu WA800 | 79 | 91 | 108 | 105 | 112 | 112 | 109 | 104 | 97 | 117 |
| Komatsu WA900 | 79 | 91 | 108 | 105 | 112 | 112 | 109 | 104 | 97 | 117 |
| Overburden Tamrock Drill | 76 | 86 | 103 | 102 | 106 | 108 | 109 | 104 | 97 | 114 |
| Crane | | | | | 105 | | | | | 105 |
| Concrete Mixer | | | | | 108 | | | | | 108 |
| Concrete Truck/Pump | | | | | 119 | | | | | 119 |
| Rock Breaker | | | | | 117 | | | | | 117 |
| Trommel (CHPP) | | | | | 102 | | | | | 102 |
| Cyclones (CHPP) | | | | | 96 | | | | | 96 |
| Fine Product Cake (CHPP) | | | | | 97 | | | | | 97 |

### 12.5.2 Noise Sources

#### Construction Noise Sources

The initial stage of mine establishment will involve clearing, levelling, and preparing the site for further works including the construction of the CHPP to the south of the Red Mountain rail loop. Other construction works include the construction of an overhead power line to the southern boundary of the Millennium lease, installation of process water pipeline and pump, construction of a rail overpass and construction of haul roads. Modelling has included an initial box cut.

The construction period is expected to be in the order of 16 months, with the majority of construction work occurring between March 2009 and June 2010. The CHPP construction work will be conducted in one 11 hour shift per day (10 days on and 4 days off), and other infrastructure and mine work being carried out in one 11 hour shift per day (10 days on and 4 days off). **Table 12-11** lists equipment that has been used in construction noise modelling.

**Table 12-11 Equipment List for Construction Works**

| Noise Source | No. |
|---|---|
| EX5500 | 2 |
| Cat 793D Haul Truck | 5 |
| Cat D10 Dozer | 2 |
| Cat 16H Grader | 2 |
| Cat 777 Water Truck | 1 |
| Cat 637 Scraper | 2 |
| Cat 988H FEL | 3 |

| Noise Source | No. |
|---|---|
| Crane | 2 |
| Concrete Mixer | 1 |
| Concrete Truck/Pump | 2 |
| Rock Breaker | 2 |

## Operations Noise Sources

Both Daunia and Poitrel mines will be in operation 24 hours per day for seven days a week. Operations noise sources will include mobile equipment such as excavators and haul trucks, as well as stationary sources such as the CHPP. Noise emissions will vary depending on the type of operation being performed, the operating style of the operator and level of maintenance. **Table 12-12** and **Table 12-13** list equipment that has been used to model Daunia and Poitrel mines, respectively.

**Table 12-12 Daunia Mine Equipment List**

| Noise Source | No. |
|---|---|
| Cat 789 Haul Truck | 5 |
| EX5500 | 3 |
| Liebherr R9250 | 1 |
| Cat 793 Haul Truck | 12 (15 for years 15+) |
| Cat D10 Dozer | 4 |
| Cat 16 Grader | 2 |
| Cat 777 Truck (include 2 water trucks) | 4 |
| Komatsu WA900 | 1 |
| Overburden Tamrock Drill | 1 |
| Cat 637 Scraper | 2 |
| Cat D11 Dozer | 2 |
| Cat 988 FEL | 1 |
| Trommel (CHPP) | 1 |
| Cyclones (CHPP) | 1 |
| Fine Product Cake (CHPP) | 1 |

**Table 12-13 Poitrel Mine Equipment List**

| Noise Source | No. |
|---|---|
| Cat 798 Haul Truck | 4 (5 for years 5+) |
| Komatsu HD785 | 2 |
| Cat 992 FEL | 1 |
| Dragline | 1 for years 5+ |
| Terex RH340 | 3 |
| Liebherr R994 | 1 |

| Noise Source | No. |
|---|---|
| Cat 793D Haul Truck | 10 (12 for years 5+) |
| Cat D10 Dozer | 3 |
| Cat 16 Grader | 2 |
| Cat 777 Water Truck | 1 |
| Komatsu WA800 | 1 |
| Overburden Tamrock Drill | 1 |
| Cat D11 Dozer | 1 (3 for years 5+) |
| Cat 988 FEL | 1 |
| Trommel (CHPP) | 1 |
| Cyclones (CHPP) | 1 |
| Fine Product Cake (CHPP) | 1 |

## Modelling Methodology

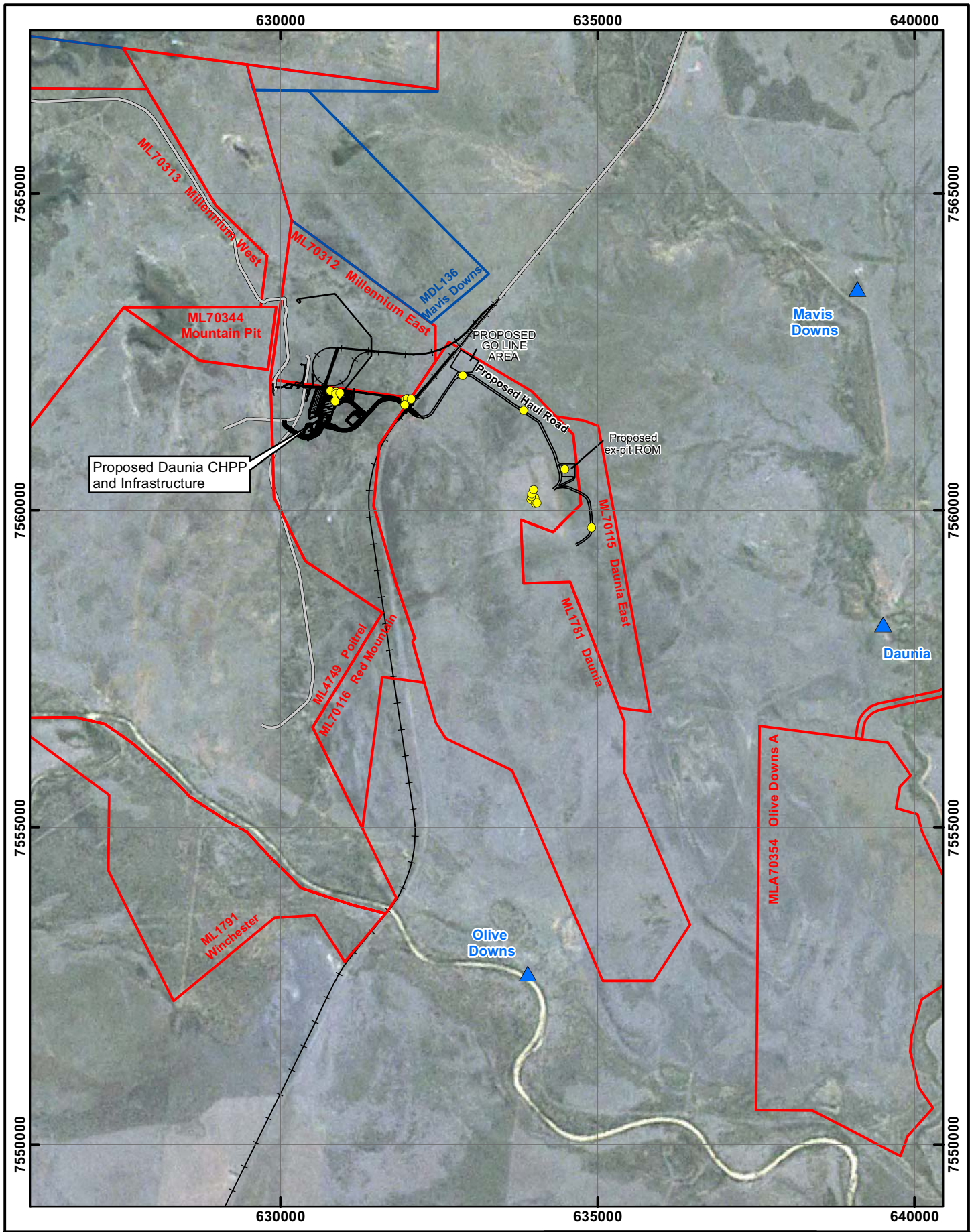
Excavators were modelled as point sources at 7 m above ground surface, and the CHPP components (Trommel, Cyclones and Fine Product Cake) were modelled at heights of 19 m, 19 m and 12 m, respectively. All other noise sources including haul trucks were modelled as point sources at 3 m above ground surface.

Modelling was conducted for different periods of the Project duration and includes both the construction and operational phases of the Project. Information regarding equipment noise, topography, and local meteorology that were used in the modelling are presented in the following sections. A summary of the different scenarios modelled is shown in **Table 12-14**. An image of the construction stage model presented in **Figure 12-4** shows the location of construction noise sources with regards to sensitive receiver locations. A 3D image of land contours used in the Year 20 model for cumulative impacts can be seen in **Figure 12-5**.

**Table 12-14 Summary of Different Scenarios Modelled**

| | **Description of Scenarios** | |
|---|---|---|
| | **Noise Impacts from Daunia Mine only** | **Cumulative Noise Impacts (from both Daunia and Poitrel Mines)** |
| Year 0 | ■ Establishment of project site including construction activities | |
| Year 1 | ■ Overburden removal and coal mining operations in pit | ■ Overburden removal and coal mining operations in pit |
| Year 5 | ■ Overburden removal and coal mining operations in pit | ■ Overburden removal and coal mining operations in pit |
| Year 15 | ■ Establishment of Spoil Dumps between the mine and the Olive Downs Homestead | ■ Establishment of Spoil Dumps between the mine and the Olive Downs Homestead |
| Year 20 | ■ Overburden removal and coal mining operations in pit | ■ Overburden removal and coal mining operations in pit |

A cumulative Year 0 scenario is not considered in this report due to the short duration of construction at Daunia. Year 10 is also not considered in this report as mine plans show Year 10 to be least likely to have noise impacts on receivers when compared to Years 1, 5, 15 and 20.




**LEGEND**

- Sensitive Receiver
- Construction Noise Sources
- Proposed Mine Infrastructure
- Road
- Existing Railway
- Mining Lease
- Mineral Development Licence

**FIGURE 12-4**
**DAUNIA COAL MINE EIS**
LOCATION OF CONSTRUCTION NOISE SOURCES AND SENSITIVE RECEIVERS

0 1 2 3
Kilometres
Scale 1:80,000 on A4
Projection: Australian Map Grid - Zone 55 (AGD84)

BMA
BHP Billiton Mitsubishi Alliance

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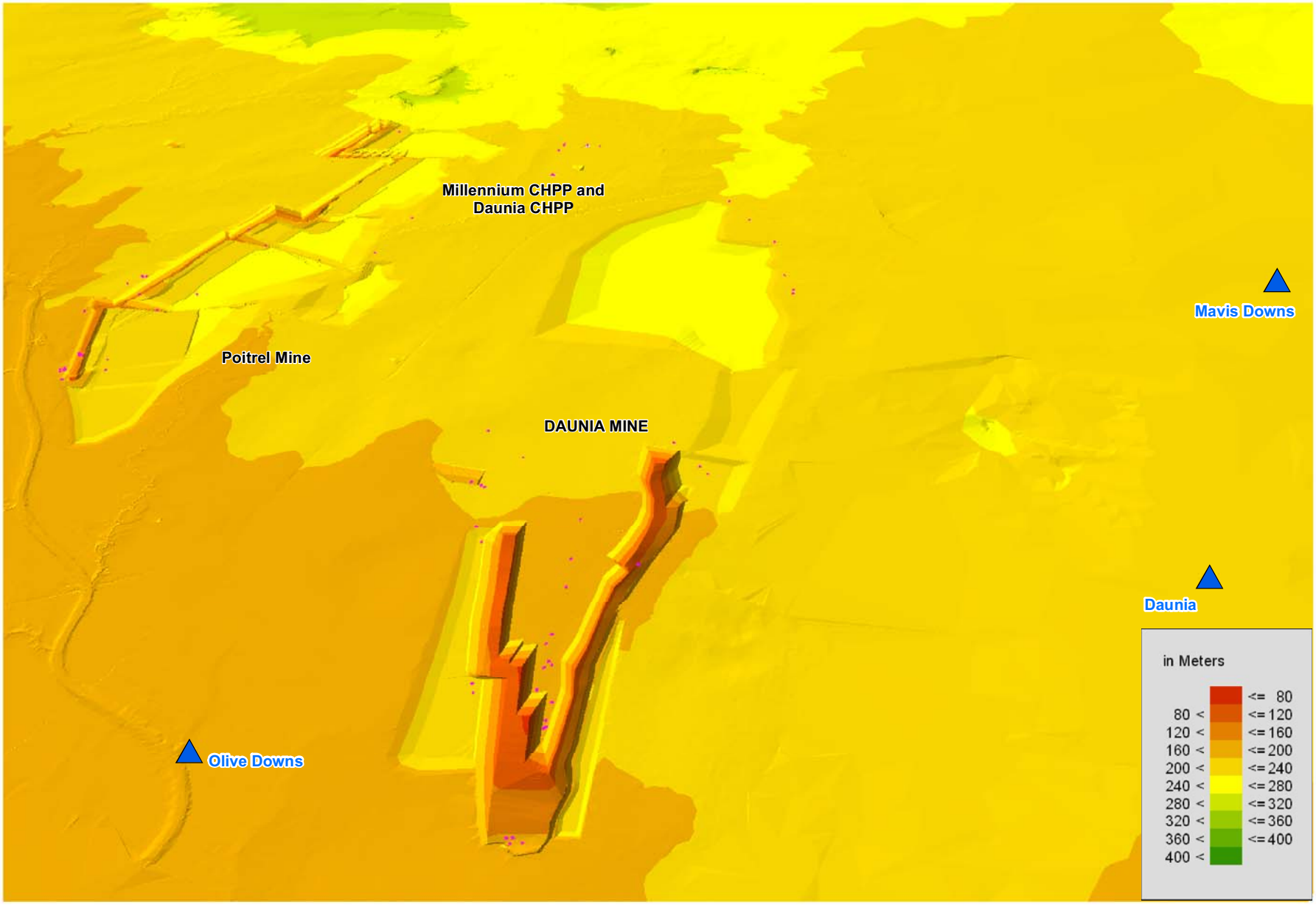


**LEGEND**

- Noise Sources
- Sensitive Receivers

**FIGURE 12-5**

**DAUNIA COAL MINE EIS**

3D IMAGE OF LAND CONTOURS USED FOR MODELLING OF CUMULATIVE IMPACTS IN YEAR 20

BMA
BHP Billiton Mitsubishi Alliance

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This figure should be read in conjunction with the data disclaimer at the front of this report.

A combination of 1 m and 5 m 3D contour data were used in modelling to represent both the surrounding terrain and mine plans for the different years of construction and operation. Terrain surface has been modelled as soft ground as this is representative of the Project Site and the surrounding area.

As discussed in **Section 12.3**, temperature inversion is characteristic of the Project area (stability class F). Wind speeds in the area are generally less than 5 m/s and mostly come from the east. Such winds would reduce noise impacts from the Project to residents at Daunia Station and Mavis Downs, but they would also potentially increase noise impacts at Olive Downs. As per "Planning for Noise Control", adverse wind conditions have been considered for all sensitive receivers and have been incorporated in the model using 3 m/s source to receiver winds.

The SoundPlan default values of 10 °C for temperature and 70 per cent relative humidity has been assumed.

### 12.5.3 Predicted Noise Impacts from Modelling Results

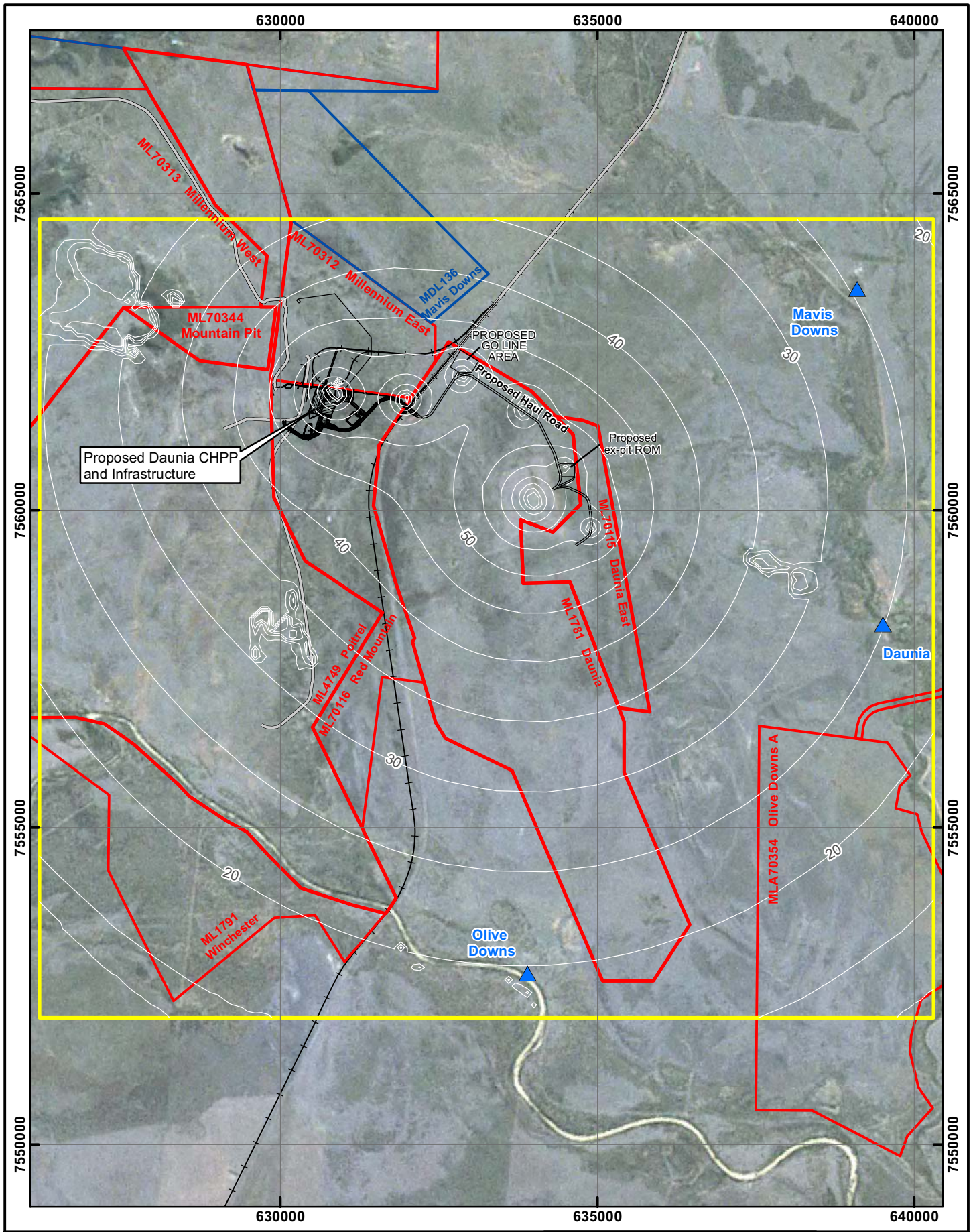
#### Construction Noise

The results from modelling with neutral meteorological conditions, temperature inversion and adverse wind conditions are summarised in **Table 12-15**.

**Table 12-15 Predicted Construction Noise levels**

| | | Leq dB(A) | |
|---|---|---|---|
| **Noise Impact from Daunia Mine Construction Only** | **Location** | **Neutral Condition** | **Temperature Inversion and Adverse Wind** |
| | Olive Downs | 15 | 20 |
| | Daunia Station | 19 | 25 |
| | Mavis Downs | 19 | 25 |

The CHPP construction will only occur during the day time. Modelling results show that noise levels at the three sensitive receivers are predicted to be less than the day time criteria of 28 dB(A) at Daunia Station and 32 dB(A) $L_{eq}$ at Olive Downs and Mavis Downs. A noise contour map of the predicted construction noise impacts at the three sensitive receivers is shown in **Figure 12-6**.




**LEGEND**

- Sensitive Receiver
- Proposed Mine Infrastructure
- Road
- Existing Railway
- Model_Extent
- Noise Contours (dB(A))
- Mining Lease
- Mineral Development Licence

**FIGURE 12-6**
**DAUNIA COAL MINE EIS**
CONSTRUCTION STAGE NOISE LEVELS FOR WORST CASE METEOROLOGICAL CONDITIONS

0 1 2 3
Kilometres

Scale 1:80,000 on A4
Projection: Australian Map Grid - Zone 55 (AGD84)

BMA
BHP Billiton Mitsubishi Alliance

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## Operational Noise

Predicted noise levels from modelling with neutral meteorological conditions are shown in **Table 12-16**. Predicted noise levels with temperature inversion and adverse wind conditions are summarised in **Table 12-17**. As the Project will be operating 24 hours a day, predicted noise levels exceeding the night time criteria of 28 dB(A) $L_{eq}$ has been shaded red.

**Table 12-16 Predicted Operational Noise levels with Neutral Meteorological Conditions**

| | Location | Leq Noise Levels (dB(A)) | | | |
|---|---|---|---|---|---|
| | | Year 1 | Year 5 | Year 15 | Year 20 |
| **Noise Impact from Daunia Mine Only** | Olive Downs | 15 | 17 | 36 | 35 |
| | Daunia Station | 22 | 18 | 23 | 23 |
| | Mavis Downs | 21 | 19 | 17 | 16 |
| **Cumulative Noise Impacts** | Olive Downs | 19 | 22 | 36 | 36 |
| | Daunia Station | 22 | 19 | 23 | 23 |
| | Mavis Downs | 22 | 19 | 17 | 17 |

**Table 12-17 Predicted Operational Noise levels with Adverse Wind Conditions and Temperature Inversion**

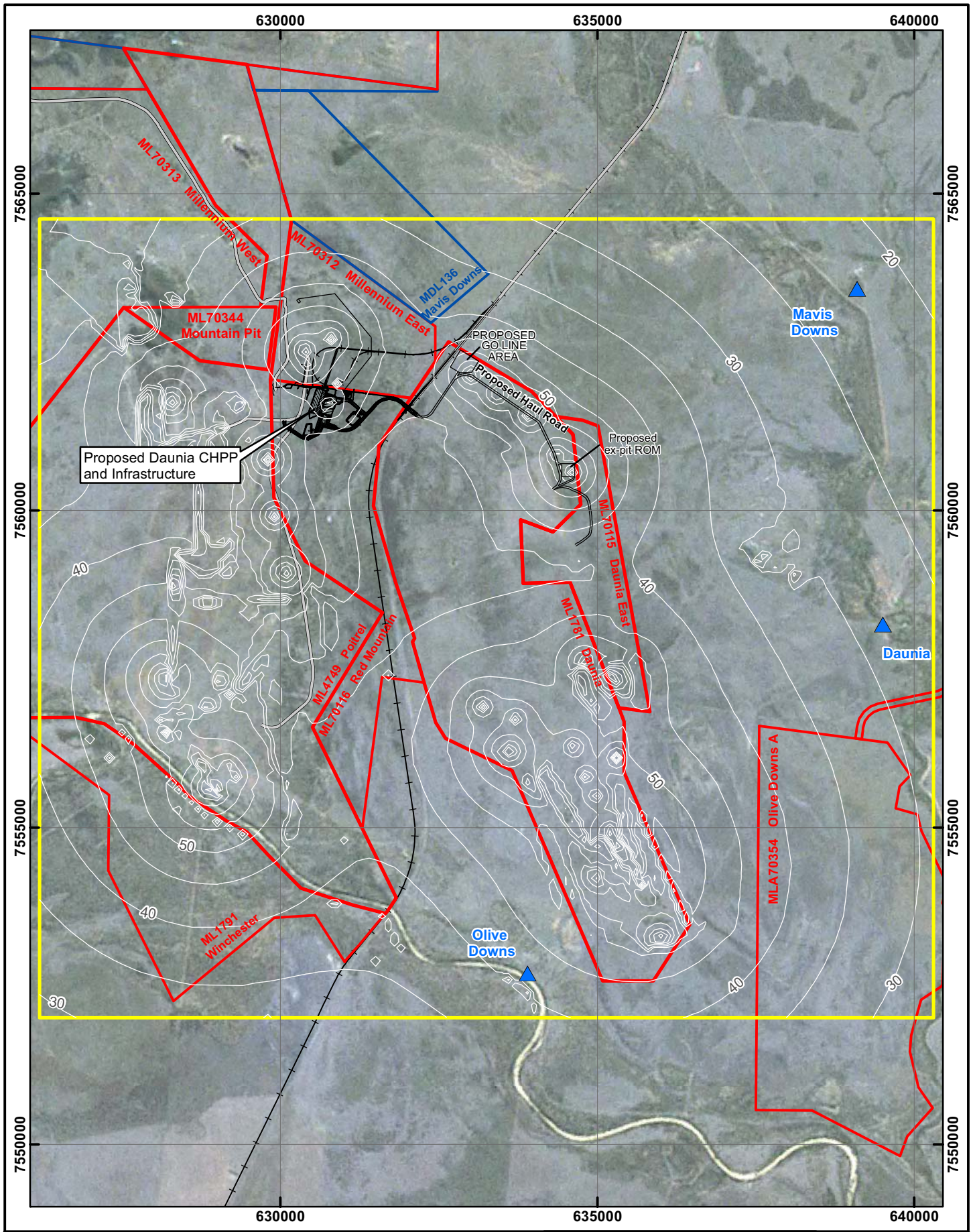
| | Location | Leq Noise Levels (dB(A)) | | | |
|---|---|---|---|---|---|
| | | Year 1 | Year 5 | Year 15 | Year 20 |
| **Noise Impact from Daunia Mine Only** | Olive Downs | 20 | 21 | 41 | 41 |
| | Daunia Station | 27 | 24 | 28 | 28 |
| | Mavis Downs | 27 | 24 | 22 | 21 |
| **Cumulative Noise Impacts** | Olive Downs | 24 | 27 | 41 | 41 |
| | Daunia Station | 27 | 24 | 28 | 28 |
| | Mavis Downs | 27 | 24 | 22 | 22 |

Modelling results indicate that noise levels at the three sensitive receivers are predicted to be within the 28 dB(A) $L_{eq}$ night time noise criteria for most of the modelled scenarios. Exceptions occur at Olive Downs when operational activities in years 15 to 20 are expected to be as close as 1.5 km from the residence. The predicted noise levels also indicate that the noise contribution from the Poitrel Mine may cause increased noise levels at Olive Downs during the operational scenarios for years 1 to 5.

The dominant noise sources in most scenarios for Daunia Station and Mavis Downs were the overburden excavators working on the surface, and a front end loader that was modelled as operating at the ROM pile near the eastern edge of the Project lease boundary for all scenarios. Other major sources for Daunia Station and Mavis Downs were spoil dump dozers and haul trucks.

Dominant noise sources for Olive Downs were similar to Daunia Station and Mavis Downs in years 1 to 5. With the mine progressing closer to Olive Downs beyond year 5, overburden excavators, spoil dump dozers and haul trucks were the main contributors of noise.

A noise contour map of the predicted noise impacts from the Project at the three sensitive receivers in Year 20 is shown in **Figure 12-7**.




**LEGEND**

- Sensitive Receiver
- Proposed Mine Infrastructure
- Road
- Existing Railway
- Model_Extent
- Noise Contours (dB(A))
- Mining Lease
- Mineral Development Licence

**FIGURE 12-7**
**DAUNIA COAL MINE EIS**
YEAR 20 CUMULATIVE NOISE LEVELS FOR WORST CASE METEOROLOGICAL CONDITIONS

0 1 2 3
Kilometres

Scale 1:80,000 on A4
Projection: Australian Map Grid - Zone 55 (AGD84)

BMA
BHP Billiton Mitsubishi Alliance

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## Low Frequency Noise Influences

Over large distances, low frequency noise becomes dominant as mid to high frequency noise is attenuated. Mining equipment is a noted source of low frequency noise and on this basis an assessment of the potential for low frequency noise impacts has been made.

The draft EPA Ecoaccess guideline 'Assessment of Low Frequency Noise' is aimed at assessing annoyance and discomfort caused by noise with a frequency range from 10 Hz to 200 Hz. It includes guidelines on assessing annoyance caused by infrasound, as well as tonal and non-tonal noise.

As predicted, noise levels from modelling are not available in 1/3 Octave bands, therefore tonality of the predicted noise at sensitive receivers cannot be determined. For this assessment, the sum total of A-weighted levels at 63 Hz, 125 Hz, and 250 Hz components of predicted noise levels were compared with the recommended limits for non-tonal low frequency noise as shown in **Table 12-18** (where $L_{p,LF}$ dB(A) is the sum of A-weighted noise levels in the frequency range 10 Hz to 160 Hz).

**Table 12-18 Recommended Indoor Limits for Non-tonal Low Frequency Noise for a Dwelling**

| Type of Space | Lp,LF dB(A) |
|---|---|
| Dwelling, evening and night (6pm to 7am) | 20 |
| Dwelling, day (7am to 6pm) | 25 |

**Table 12-19** shows predicted noise levels at 63 Hz, 125 Hz and 250 Hz at sensitive receivers for adverse wind and temperature inversion. As the Project will be operating 24 hours a day, cells exceeding the evening and night time recommended level of 20 dB(A) have been shaded red.

Predicted low frequency noise levels at Olive Downs are expected to exceed recommended levels in years 15 to 20 of the Project.

**Table 12-19 Summary of Predicted Low Frequency Noise Levels at Sensitive Receivers**

| | Year | Location | Sound Pressure Level dB(A) | | | |
|---|---|---|---|---|---|---|
| | | | 63 | 125 | 250 | Sum ($L_{p,LF}$) |
| **Daunia Mine Impact** | Year 1 | Olive Downs | 0 | 13 | 5 | 14 |
| | | Mavis Downs | 3 | 17 | 12 | 18 |
| | | Daunia | 4 | 17 | 12 | 18 |
| | Year 5 | Olive Downs | 0 | 14 | 7 | 15 |
| | | Mavis Downs | 1 | 16 | 9 | 18 |
| | | Daunia | 1 | 16 | 9 | 18 |
| | Year 15 | Olive Downs | 15 | 23 | 23 | 26 |
| | | Mavis Downs | 0 | 15 | 8 | 16 |
| | | Daunia | 4 | 17 | 12 | 18 |
| | Year 20 | Olive Downs | 15 | 24 | 22 | 26 |
| | | Mavis Downs | 0 | 15 | 8 | 16 |
| | | Daunia | 4 | 17 | 12 | 18 |
| **Cumulative Impact** | Year 1 | Olive Downs | 1 | 16 | 9 | 18 |
| | | Mavis Downs | 3 | 18 | 12 | 19 |
| | | Daunia | 4 | 18 | 12 | 19 |
| | Year 5 | Olive Downs | 2 | 17 | 12 | 18 |
| | | Mavis Downs | 1 | 17 | 10 | 18 |
| | | Daunia | 1 | 17 | 9 | 18 |
| | Year 15 | Olive Downs | 15 | 24 | 23 | 27 |
| | | Mavis Downs | 0 | 16 | 9 | 17 |
| | | Daunia | 4 | 18 | 13 | 19 |
| | Year 20 | Olive Downs | 15 | 24 | 23 | 27 |
| | | Mavis Downs | 0 | 16 | 8 | 17 |
| | | Daunia | 4 | 18 | 13 | 19 |

## 12.6 Airblast Overpressure and Vibration Impact Assessment

### 12.6.1 Existing Vibrations and Airblast Overpressure

Sensitive receivers identified for the Project are currently at least 4km away from potential vibration sources such as mines and main roads. Data gathered from vibration and airblast overpressure monitoring stations in the area show that existing levels are well under guideline levels set out in **Section 12.4**.

Vibration and airblast overpressure monitoring is conducted at a number of permanent monitoring stations in the area. A permanent monitoring station of interest is Winchester, which is about 10km from the current Poitrel Mine operations. This station also monitors for vibrations and airblast from the closer Peak Downs Mine and Saraji Mine which is south from Peak Downs.

Results up to July 2008 show the maximum airblast overpressure levels at Winchester from blasting activities were under the 115 dB(linear) criteria except in one instance where a level of 115.7 dB(linear) corresponding to a blast at the Poitrel Mine was recorded. It should be noted this reading, like the vast majority of airblast overpressure readings, were wind affected, and was well below 133 dB(linear), above

which damage may occur. The ground vibrations levels have been well under the lower guideline of 5 mm/s except in one instance where a level of 5.85 mm/s corresponding to a blast at Peak Downs Mine was recorded. This was well below levels required to cause damage.

Vibration data gathered since June 2006 have shown that only 13 per cent of the BMA blasts have been noticed by nearby sensitive receivers. Data from monitoring are constantly being examined to explore methods of blasting that will reduce and minimise impacts.

### 12.6.2 Assessment of Vibrations and Airblast Overpressure Impacts from the Project

#### Airblast Overpressure Impacts

Airblast overpressure levels are dependent on a number of factors including charge mass, stemming height, burden depth, distance from the blast to the receiver, topographical shielding, and meteorological conditions. A simple estimate of overpressure levels has been made using **Equation 1** adopted from AS2187.2 (2006).

$$P = K_a(R/Q^{1/3})^a$$

Equation 1

Where

- P = Pressure (kPa)
- Q = explosive charge mass per delay (kg)
- R = distance from charge (m)
- $K_a$ = site constant
- a = site exponent

The constants used in the above formula are site specific and require detailed knowledge of blasting methods. However, the upper and lower ranges can be closely predicted using typical constants provided in AS2187.2. A site exponent (a) of −1.45 provides a good estimate for unconfined surface charges under neutral meteorological conditions. A site constant ($K_a$) refers to the level of constraint of the charge, and is generally 10 to 100 for confined blasthole charges when using the site exponent of -1.45.

For the assessment of airblast impacts, **Equation 1** was used to estimate distances (R) at which an airblast level of 115 dB(linear) would be met for different levels of constraint and charge masses. The results are shown in **Figure 12-8**.

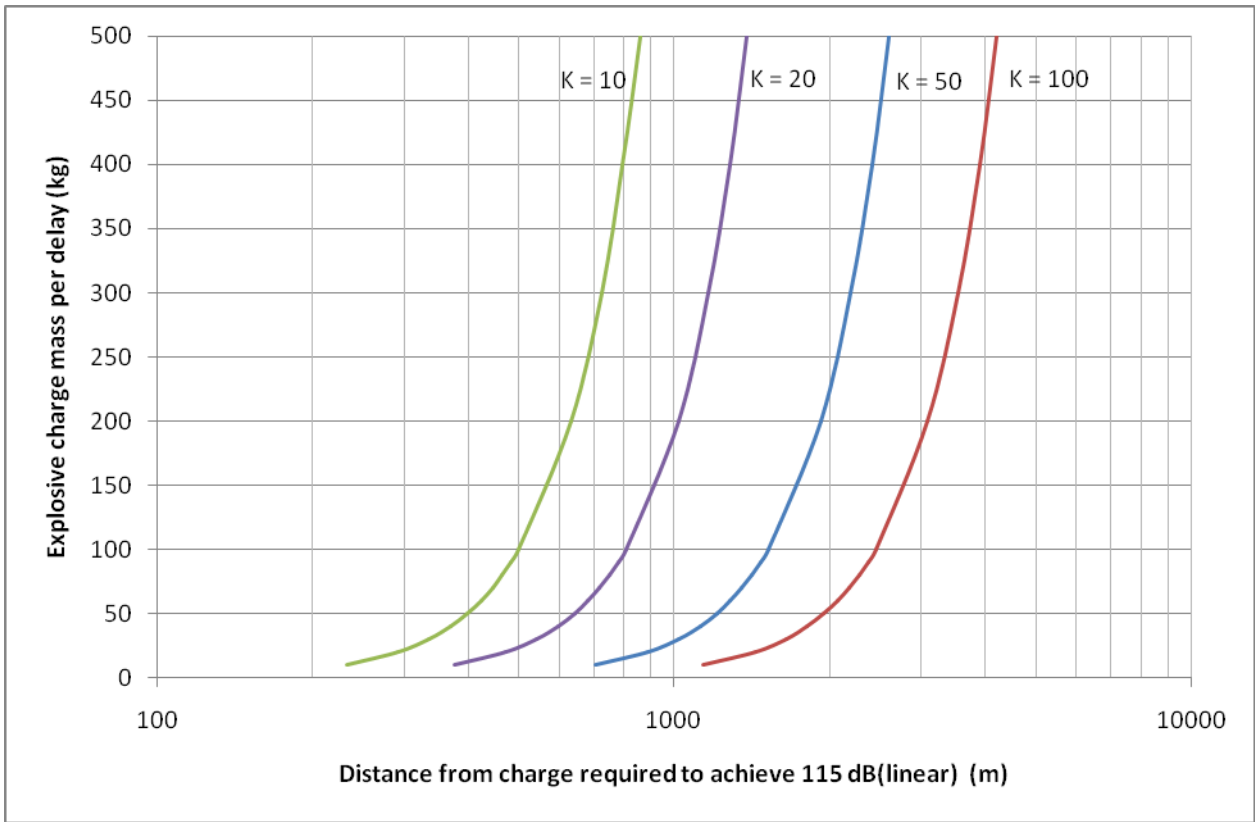


**Figure 12-8 Graph of Constraint Levels against Charge Masses**

Mavis Downs and Daunia Station are more than 3.8 km from the Project mining lease boundary. As shown in **Figure 12-8**, management of charge masses will help to achieve airblast levels of under 115 dB(linear) at the two sensitive receivers.

Approaching year 20 of the Project, mine plans show the nearest mining reserve blocks to be about 1.5 km from Olive Downs. A combination of reduced charge masses and increased constraint levels including ensuring appropriate stemming height, type and adequate burden may be needed to achieve airblast levels of 115 dB(linear) or less, at 1.5 km. Mitigation measures are further discussed in **Section 12.9.2**.

Meteorological conditions should be assessed at the time of blasting as temperature inversion and adverse wind conditions can increase airblast levels by up to 20 dB(linear) (AS2187.02 2006).

### Ground Vibration Impacts

Ground vibration levels from blasting depend on factors such as the charge mass of explosive per delay, distance from the blast, and ground transmission characteristics. As such, the most accurate method of prediction would involve actual measurements from blasting on site. Estimations, however, can be made using Figure J7.3.1 (adopted from AS2187.2) which predicts vibration levels at different distances for varying charge masses. Figure J7.3.1 has been reproduced in **Figure 12-9**.

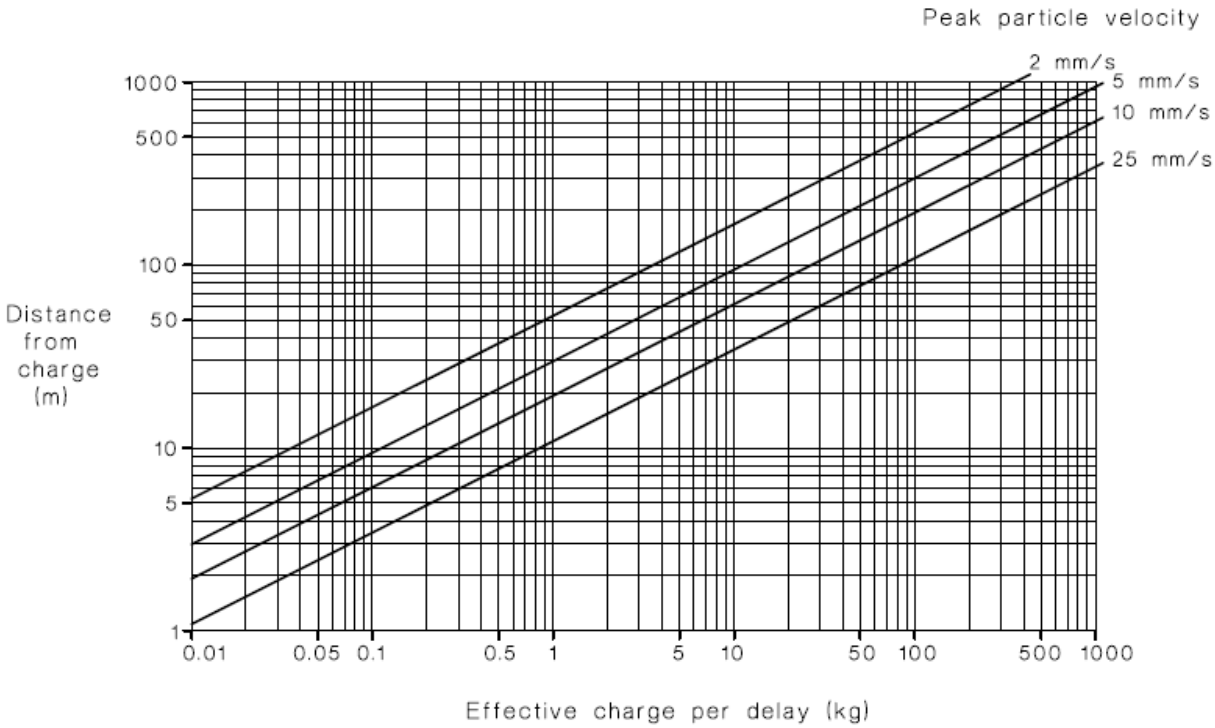


FIGURE J7.3.1 FREE-FACE—AVERAGE FIELD CONDITIONS

**Figure 12-9 Estimated Vibration Levels**

**Figure 12-9** shows that blasting of a charge mass of 1000 kg will be under 5.0 mm/s at 1 km from the point of blasting. With monitoring and management of charge masses, vibration levels at Daunia Station and Mavis Downs are likely to be well below 5.0 mm/s. Vibration levels at Olive Downs are also estimated to be below 5 mm/s, where the nearest mining reserve blocks are about 1.5 km from Olive Downs.

## 12.7 Road Noise

Access to the mine site will be via the Poitrel and Millennium coal mines' access road from the northwest, off the Peak Downs Highway. Daunia Road may at times, also be used to access the Project Site during construction. Coal will be transported by rail to the Hay Point coal terminal for distribution to the international market.

The Project is expected to result in minimal changes to existing traffic volume and composition in both the construction and operation stages, and the resulting noise differences at sensitive receivers will be negligible. For detailed information on transport impacts from the Project, refer to **Section 13**.

## 12.8 Noise Impacts on Terrestrial Animals and Avifauna

Much of the vegetation of the Project Site has been cleared and the resulting modified grassland lacks important habitat features for fauna and avifauna, including migratory species in the area.

The effect of noise on animals can be similar to the effect observed in humans (Environment Australia, 1998). Noise may adversely affect wildlife by interfering with communication, masking the sounds of predators and prey and causing 'stress' or avoidance reactions. Experiments have also shown that exposure to noise impulses throughout the sleep period can result in poorer daytime task performance.

Studies have shown the reaction to noise can vary from species to species, including those that are known to have adapted to human activity. Environment Australia (1998) suggest that unusual noise, in combination with close proximity visual stimulation, is enough to disturb any animal, including man, and cause panic and that any sudden and unexpected intrusion, whether acoustic or of another nature, may produce a startle or panic reaction. However, in the absence of stimulation of other sensory systems (for instance optical or smell), the animal learns quite quickly to ignore the noise source, particularly when it exists in the presence of man.

Previous extensive clearing of vegetation in the Project area for agricultural purposes has reduced the amount of available habitat, and as a result, has minimised the potential for impact by the Project's operational noise on local wildlife.

## 12.9 Recommended Mitigation Measures

This section discusses practical measures for minimising noise and vibration. Particular consideration is given to the discussion of impacts at Olive Downs where noise levels are predicted to exceed the criteria in years 15 to 20.

### 12.9.1 Mitigation of Noise Emissions

Noise levels at Daunia Station and Mavis Downs are predicted to be within the night time criteria of 28 dB(A) calculated using the 'Planning for Noise Control' guideline.

The following measures are proposed to reduce noise impacts at the above locations where required:

- Proper maintenance and operation procedures to minimise nuisance noise emissions from equipment, including servicing and maintenance of exhaust systems on mine equipment.
- Formal complaints to be investigated to determine the source of the nuisance noise and, where appropriate, noise monitoring to be conducted at the affected residence.
- The speed of heavy vehicle traffic on the haul road to be limited.
- Positioning noisy equipment away from sensitive receivers.
- Planning for containment within pits of noisy equipment such as haul trucks and excavators. This may involve haul road placement inside the pit.
- Application of noise mitigation technologies on individual equipment.
- The implementation of a noise monitoring program at the three sensitive receivers (this is discussed further below).

In addition to complaint based monitoring, noise monitoring will be undertaken at Daunia, Mavis Downs, and Olive Downs in years 1, 5 and 10. Monitoring will be undertaken at Olive Downs every two years, during years 10 to 20 due to the potential for increased noise levels over this period.

Noise levels at Olive Downs are predicted to exceed the criteria in years 15 to 20 as the mine progresses to the southern end of the Project Site. Continued consultation and negotiation with the Olive Downs property owners will occur during the development and operation of the mine to respond to noise and vibration issues. Additional 'at receiver' noise mitigation options may also need to be considered.

The noise contribution at Olive Downs from the Poitrel Mine in Years 15 to 20 is predicted to be about 26 dB(A), and will not affect overall noise levels significantly.

### 12.9.2 Mitigation of Vibration and Airblast Overpressure from Blasting

Blasting times should be limited to between 9 am and 5 pm. No blasting should take place at night.

The following are a number of mitigation measures that may be applied in conjunction with monitoring to minimise vibration and airblast impacts where required:

- 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, and
- restricting blasts to favourable weather conditions.

Airblast levels at Olive Downs in years 15 to 20 of the Project are expected to be below criteria limits with monitoring and management by the contractor.

## 12.10 Conclusion

This chapter of the EIS described the existing environmental values that may be affected by noise and vibration from Project activities and discussed the potential impacts of the activities and corresponding options for mitigation.

In describing existing acoustic values, the results from noise monitoring data were analysed using the Ecoaccess 'Planning for Noise Control' guideline to a prescribe noise criteria for the Project that would protect existing environment values. The criteria set out in the "Noise and Vibration from Blasting" guideline has been adopted for airblast overpressure and vibration from blasting.

The potential noise impacts from the Project have been predicted using the SoundPlan 6.5 noise modelling package. The potential vibration and overpressure impacts from blasting have been assessed using fundamentals, experience from similar mining operations, and examination of monitoring data gathered from mines and monitoring stations close to the Project Site.

Excluding the period between years 15 and 20 at Olive Downs, noise and vibration levels are predicted to be within the noise criteria and blasting criteria over the duration of the Project. Continued consultation and negotiation with the Olive Downs property owners will occur during the development and operation of the mine to respond to noise and vibration issues.