Jellinbah Group

# LAKE VERMONT RESOURCES ENVIRONMENTAL IMPACT STATEMENT

# CHAPTER 14 NOISE AND VIBRATION

aarc ENVIRONMENTAL SOLUTIONS

# Table of Contents



# List of Figures



# List of Tables

# 14 Noise and Vibration

## 14.1 Environmental objective and outcomes

This chapter has been prepared to assist the DES in carrying out the environmental objective assessment in respect of the following environmental objective stated in the Project ToR:

> *The Project will be operated in a way that protects the environmental values of the acoustic environment.*

The chapter also demonstrates that the Project meets one of the two possible performance outcomes as required by the Schedule 8 of the EP Regulation, these outcomes are:

> *Sounds from the activity is not audible at a sensitive receptor; and/or*
>
> *The release of sound to the environment from the activity is managed so that adverse effects on environmental values, including health and wellbeing and sensitive ecosystems, are prevented or minimised.*

A Noise and Vibration Assessment has been conducted for the Project by Trinity Consultants Australia Pty Ltd and is presented as Appendix M, Noise and Vibration Assessment. The Noise and Vibration Assessment has been prepared in consideration of Queensland's Environmental Protection (Noise) Policy 2019 EPP (Noise); the 'EIS Guideline–noise and vibration' (DES 2020k); the guideline 'Noise and Vibration from Blasting' (DES 2020j); and the 'Application requirements for activities with noise impacts' (DES 2021g).

### 14.1.1 Noise assessment terminology

The EPP (Noise) provides a dictionary of terms relating to acoustics. An overview of terms essential to the technical interpretation of noise in this chapter is provided below, including the indicators used to measure, model and assess the impacts of noise:

dB(A) means A-weighted decibels, a logarithmic scale simulating the response of the human ear, which is more sensitive to mid- to high-frequency sounds and relatively less sensitive to low-frequency sounds. This is the measurement unit in which noise levels are typically expressed.

dB(Z) means the noise level with no weighting applied, the same as the dB level.

$L_{eq,adj}$ means an A-weighted sound pressure level of a continuous, steady sound adjusted for tonal character. The ambient noise levels used in this chapter are the average monitored $L_{Aeq}$ noise levels for each period, which account for all noise sources within the local environment. Specifications of this indicator include the following two terms.

$L_{eq,adj,1hr}$ means an A-weighted sound pressure level of a continuous, steady sound adjusted for tonal character that, within a one-hour period, has the same mean square sound pressure of a sound that varies with time.

dB(L) the maximum reading in decibels (dB) obtained using the 'P' time weighting characteristic as specified in the Australian Standards (AS) 1259.1–1990, with all frequency-weighted networks inoperative.

Daytime means the period after 7 am on a day to 6 pm on the same day.

Evening means the period after 6 pm on a day to 10 pm on the same day.

Night-time means the period after 10 pm on a day to 7 am on the next day.

## 14.1.2 Acoustic quality objectives

In Queensland, environmental noise is regulated in accordance with the EPP (Noise), which is subordinate legislation under the EP Act. This policy identifies environmental values to be enhanced or protected, states acoustic quality objectives and provides a framework for making decisions about the acoustic environment.

#### 14.1.2.1 EPP (Noise)

The EPP (Noise) contains a range of acoustic quality objectives for various receptors. The objectives are in the form of noise levels, are defined for different times of the day, and use a number of acoustic parameters.

Schedule 1 of the EPP (Noise) includes the following acoustic quality objectives to be met at residential dwellings (Table 14.1).

*Table 14.1: Acoustic quality objectives as per Schedule 1 of the EPP (Noise)*

| **Residence (for outdoors)** | | |
|---|---|---|
| **Acoustic quality objectives at receptor dB(A) measured as:** | **Daytime and evening (7 am–10 pm)** | |
| $L_{Aeq, adj, 1hr}$ | 50 | |
| $L_{A10, adj, 1hr}$ | 55 | |
| $L_{A1, adj, 1hr}$ | 65 | |
| **Residence (for indoors)** | | |
| **Acoustic quality objectives at receptor dB(A) measured as:** | **Daytime and evening (7 am–10 pm)** | **Night-time (10 pm–7 am)** |
| $L_{Aeq, adj, 1hr}$ | 35 | 30 |
| $L_{A10, adj, 1hr}$ | 40 | 35 |
| $L_{A1, adj, 1hr}$ | 45 | 40 |

#### 14.1.2.2 Existing Environmental Authority conditions

The EA (EPML00659513) for the existing Lake Vermont Mine provides limits for noise and vibration emissions. Noise limits are provided in Table 14.2, and blasting limits are provided in Table 14.3.

*Table 14.2: Noise limits and associated notes for the existing Lake Vermont Mine*

| **Sensitive place** | | | | | | |
|---|---|---|---|---|---|---|
| **Noise level dB(A) measured as:** | **Monday to Saturday** | | | **Sunday and public holidays** | | |
| | **7 am–6 pm** | **6 pm–10 pm** | **10 pm–7 am** | **9 am–6 pm** | **6 pm–10 pm** | **10 pm–9 am** |
| $L_{Aeq, adj, 15 mins}$ | 40 | 40 | 35 | 40 | 40 | 35 |
| $L_{A1, adj, 15 mins}$ | 45 | 45 | 40 | 45 | 45 | 40 |
| **Commercial place** | | | | | | |
| **Noise level dB(A) measured as:** | **Monday to Saturday** | | | **Sunday and public holidays** | | |
| | **7 am–6 pm** | **6p m–10 pm** | **10 pm–7 am** | **9 am–6 pm** | **6 pm–10 pm** | **10 pm–9 am** |
| $L_{Aeq, adj, 15 mins}$ | 45 | 45 | 40 | 45 | 45 | 40 |

Notes: If measured bg (LA90, adj, 15 mins) is less than 30 dB(A), then 30 dB(A) can be substituted for the measured background level.
bg = background noise level (LA90, adj, 15 mins) measured over 3–5 days at the nearest sensitive receptor.
If the Project cannot meet the noise limits as calculated above, alternative limits may be calculated using the processes outlined in the 'Planning for Noise Control Guideline'.

*Table 14.3: Blasting noise limits for the existing Lake Vermont Mine*

| **Blasting noise limits** | **Sensitive or commercial blasting noise limits** | |
|---|---|---|
| | **7 am–6 pm** | **6 pm–7 am** |
| Airblast overpressure | 115dB (Linear) Peak for nine (9) out of ten (10) consecutive blasts initiated and not greater than 120dB (Linear) Peak at any time | No blasting to occur |
| Ground vibration peak particle velocity (PPV) | 5mm/second PPV of nine (9) out of ten (10) consecutive blasts and not greater than 10mm/second PPV at any time | No blasting to occur |

#### 14.1.2.3 Background creep

The current version of the EPP (Noise) does not contain criteria for background creep but states that background creep should be prevented or minimised to the extent that it is reasonable to do so. In accordance with the 'Noise measurement manual' (DES 2020l), background creep resultant of the Project has been considered in relation to cumulative impacts.

#### 14.1.2.4 Low-frequency noise

The Project will also generate low-frequency noise. The 'Ecoaccess Guideline for the Assessment of Low-Frequency noise' (EPA 2004) details methods and procedures applicable to low-frequency noise in mining operations. Limits associated with low-frequency noise account for occurrences of low-frequency noise in quiet environments when high frequencies of noise are absent (masking low-frequency noise), with the occurrence of an unbalanced frequency spectrum.

Low-frequency noise levels were not assessed directly because for noise impacts from a coal mining operation, compliance with the proposed "A-weighted"85 noise limits will result in compliance with any low-frequency

noise limits that could potentially be imposed (Appendix M, Noise and Vibration Assessment, Section 6.5). The existing Lake Vermont Mine is not subject to low frequency noise limits.

## 14.2 Proposed noise criteria for the Project

Mobile equipment and fixed plant used to support the construction, operation and closure of the Project will generate noise emissions. The external noise limits that have been adopted for the Project are based on the EPP (Noise), the 'Guideline for Noise and Vibration from Blasting' (DEHP 2020b) and the existing Lake Vermont Mine EA noise and vibration limits.

It is proposed to maintain the $L_{Aeq}$ noise criteria from the Lake Vermont Mine EA, with a proposed increase in the $L_{A1}$ noise criteria by 5 dB to bring them in line with the EPP (Noise) acoustic quality objectives as proposed within the Noise and Vibration Assessment (Appendix M, Section 4.8). It is noted that the objectives include a 10 dBA difference between the $L_{A1}$ and $L_{Aeq}$ objectives, with this proposed to be reflected in the Project noise limits. $L_{A1}$ noise limits are typically higher than the $L_{eq}$ noise limits as they are harder to measure and can be impacted by extraneous noise which can be readily removed from $L_{eq}$ measurements. It is also noted that the resulting change in limit is unlikely to impact environmental values as the predicted noise levels are below the EA limits. The proposed noise limits for the Project are presented in Table 14.4.

Meeting the proposed noise criteria enables the minimisation of adverse effects on environmental values from the release of sound to the environment, therefore achieving the environmental outcome for the Project ToR and the performance outcome for the environmental objective for noise under Schedule 8 of the EP Regulation.

*Table 14.4: Noise limits proposed for the Project*

| **Sensitive place** | | | | | | |
|---|---|---|---|---|---|---|
| **Noise level dB(A) measured as:** | **Monday to Saturday** | | | **Sunday and public holidays** | | |
| | **7 am–6 pm** | **6 pm–10 pm** | **10 pm–7 am** | **9 am–6 pm** | **6 pm–10 pm** | **10 pm–9 am** |
| $L_{Aeq, adj, 15 mins}$ | 40 | 40 | 35 | 40 | 40 | 35 |
| $L_{A1, adj, 15 mins}$ | 50 | 50 | 45 | 50 | 50 | 45 |
| **Commercial place** | | | | | | |
| $L_{Aeq, adj, 15 mins}$ | 45 | 45 | 40 | 45 | 45 | 40 |

Note: For receivers subject to mining noise from other mine operations and/or ambient noise levels in excess of the nominated noise limits, alternative noise limits may be proposed with due consideration for cumulative noise impacts.

#### 14.2.1.1 Blasting

There are two types of acoustic impacts associated with blasting:

1) airblast overpressure; and

2) ground vibration.

Airblast overpressure is the measurable effect of a blast of air pressure, including the energy generated below the level of human hearing. It is reported in linear decibels (dB(L)).

Ground vibration is the measurable movement of the ground surface caused by a blast. It is measured in mm/s.

The guideline 'Noise and Vibration from Blasting' (DES 2020b) provides acoustic criteria relating to noise and blasting from mining operations, with the existing Lake Vermont Mine EA replicating these acoustic criteria. It

is, therefore, proposed to maintain the blasting and ground vibration conditions from the existing Lake Vermont Mine EA, with these conditions also extended upon to include underground blasting limits consistent with the 'Noise and Vibration from Blasting' guideline (DES 2020j). Proposed blasting conditions are provided in Table 14.5.

*Table 14.5: Airblast overpressure and ground vibration limits proposed for the Project*

| **Blasting noise limits** | **Sensitive or commercial blasting noise limits** | |
|---|---|---|
| | **7 am–6 pm** | **6 pm–7 am** |
| Airblast overpressure | 115dB (Linear) Peak for nine (9) out of ten (10) consecutive blasts initiated and not greater than 120dB (Linear) Peak at any time | No blasting to occur |
| Ground vibration PPV | 5mm/second PPV of nine (9) out of ten (10) consecutive blasts and not greater than 10mm/second PPV at any time | No blasting to occur |

## 14.3 Description of existing values

The existing values with potential to be impacted by Project noise are detailed in section 14.3.1. The health and biodiversity of ecosystem's environmental values that have the potential to be impacted by Project noise are detailed in Chapter 10, Terrestrial Ecology, and the potential impact assessment in accordance with Schedule 1 of the EPP (Noise) is detailed in Section 10.5.2.6. No significant impacts to terrestrial fauna values are expected to occur as a result of the Project.

### 14.3.1 Operational noise

#### 14.3.1.1 Sensitive receptors

A sensitive receptor (SR) is defined in Schedule 1 of the EPP (Noise) as

> *an area or place where noise is measured.*

SRs with respect to the Project comprise of rural dwellings and a commercial (mining) operation, which are listed in Table 14.6:, with locations mapped in Figure 14.1:.

*Table 14.6: Identified sensitive receptors for the Project*

| SR ID | Receptor type | Name | Easting (m) | Northing (m) | Distance and direction from the Project[1] |
|---|---|---|---|---|---|
| R1 | Residential | Pownalls | 653025.00 | 7512686.00 | 18.11km NW |
| R2 | Residential | Seloh Nolem 1 | 652696.00 | 7532404.00 | 15.2km SW |
| R3 | Residential | Old Kyewong | 646743.00 | 7509949.00 | 16.49km NW |
| R4 | Residential | Mockingbird Downs | 652135.00 | 7513934.00 | 16.62km W |
| R5 | Residential | Meadowbrook Homestead[2] | 638086.00 | 7520400.00 | 4.62km NE |
| R6 | Residential | Lake Vermont Homestead[2] | 640116.00 | 7516958.00 | 7.85km NE |
| R7 | Residential | Willunga | 666958.00 | 7529954.00 | 27.89km W |
| R8 | Residential | Leichardt | 656328.00 | 7515670.00 | 19.09km W |
| R9 | Residential | Seloh Nolem 2 | 652770.00 | 7533482.00 | 15.83km SW |
| R10 | Residential | Old Bombandy | 657506.00 | 7516682.00 | 29.11km W |
| R11 | Residential | Vermont Park | 647231.00 | 7537824.00 | 15.14km S |
| R12 | Residential | Saraji Homestead 1 | 629573.71 | 7519126.55 | 11.47km E |
| R13 | Residential | Saraji Homestead 3 | 630689.29 | 7522987.44 | 9.04km E |
| R14 | Commercial | BMA Saraji | 631499.99 | 7520239.06 | 9.25km E |
| R15 | Residential | Iffley | 647326.04 | 7539855.65 | 16.96km S |
| R16 | Residential | Tay Glen | 635321.52 | 7509100.99 | 16.25km NE |
| R17 | Residential | Semple Residence | 649876.37 | 7506696.69 | 20.83km NW |
| R18 | Residential | Saraji Homestead 2 | 630424.00 | 7523432.00 | 9.23km E |

Notes: Distance and directions provided are from the centre point of the Project MIA.
Meadowbrook and Lake Vermont homesteads are owned by BHP Billiton Mitsubishi Alliance (BMA), with Meadowbrook unoccupied.

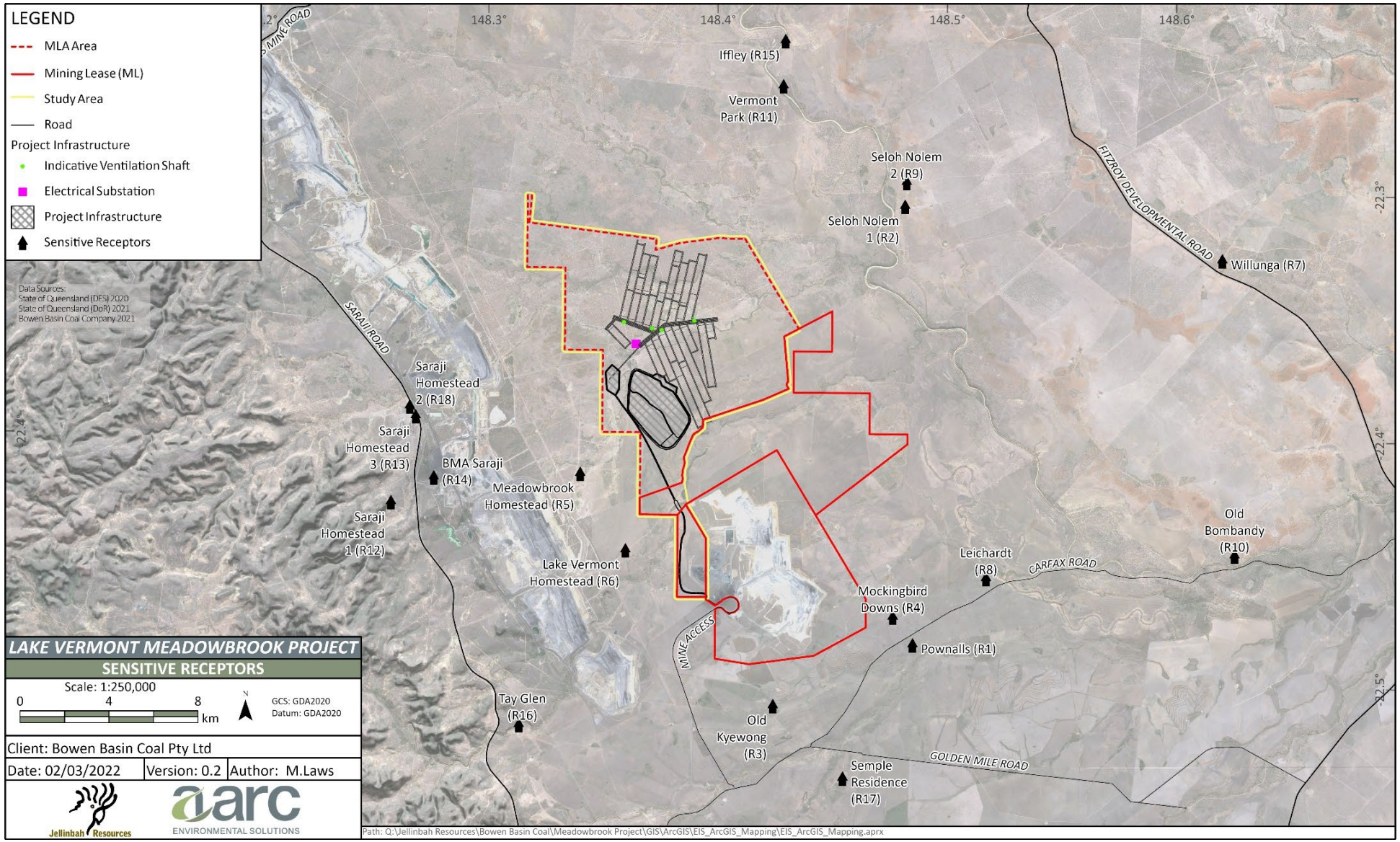


*Figure 14.1: Identified potential sensitive receptors near to the Project*

Of the SRs identified for the Project, a number of these were subsequently excluded from impact assessment. These SRs and the rationale for their exclusion are provided in Table 14.7.

*Table 14.7: SRs excluded from modelling and the rationale for exclusion*

| SR ID | Name | Rationale for exclusion |
|---|---|---|
| R5 | Meadowbrook Homestead | Refer to discussions following this Table. |
| R6 | Lake Vermont Homestead | |
| R7 | Willunga | These receptors are over 14 km from the Project operations and thus determined not to be impacted by noise emissions created by the Project. |
| R11 | Vermont Park | |
| R15 | Iffley | |
| R12 | Old Bombandy | These receivers are over 8 km from the Project operations and on the opposite (western) side of the Saraji Mine. |
| R13 | Saraji Homestead 1 | |
| R16 | Tay Glen | |
| R18 | Saraji Homestead 2 | |
| R17 | Semple Residence | This receiver is over 9 km from the Project operations and on the opposite (southern) side of Lake Vermont Mine. |

Meadowbrook Homestead (R5) and Lake Vermont Homestead (R6) are both homesteads owned by BMA. Meadowbrook Homestead is currently abandoned, and BMA has confirmed it will not be used as a residence in the future. The Lake Vermont homestead is currently occupied by a tenant of BMA, with appropriate agreements in place with the residents to acknowledge adjacent mining impacts. Hence, neither homestead was included as a sensitive receptor in the air quality assessment.

The potential Saraji East construction camp was also considered as a SR. This camp is proposed as a potential option for BMA to house construction workers, if required, for their Saraji East Project. In this regard, and also relevant to R5 and R6, BMA and Lake Vermont Resources Pty Ltd (LVR) have entered into an agreement that, amongst other things, provides:

- BMA and Bowen Basin Coal agree as to how the Saraji East Project and the Project may co-exist and how each party may assist, or at least not hinder, the development of the other party's project.
- That BMA acknowledges and agrees that the Saraji East Project is adjacent to the Project and Bowen Basin Coal will be engaging in mining operations and/or associated activities in relation to the Project.
- BMA further expressly acknowledges and agrees that BMA shall make no objection or claim for compensation in relation to any nuisance to BMA's Saraji East Project (including, without limiting the generality of the foregoing, any accommodation, villages, or camps for BMA's workers) caused by Bowen Basin Coal's mining operations and/or associated activities in relation to the Project (including, without limiting the generality of the foregoing, any noise, vibration, dust, or light).
- BMA and Bowen Basin Coal acknowledge and agree that they will each use their reasonable endeavours and negotiate in good faith to resolve any disputes which may arise between the parties in relation to the Saraji East Project and the Project.

As a result of the above, BMA has confirmed its position that no specific regulator assessment and/or conditioning is required in relation to the LVM Project Environmental Authority application and any LVM project interaction with the potential future Saraji East Project BMA village.

#### 14.3.1.2 Background noise levels

Background noise was observed and measured in conjunction with the monitoring of daily noise levels (refer Appendix M, Noise and Vibration Assessment. Attended noise measurements were undertaken on 9 and 10 February 2021 at three locations (SR3, SR5 and SR6).

Unattended monitoring was undertaken *via* noise loggers at the same SR locations during the period 9–23 February 2021. The location and timing of monitoring events and the results derived are provided Table 14.8. It is noted that significant insect noise was observed to be a seasonal influence at the time of monitoring, and data was filtered to remove insect noise. Representative background noise levels were calculated using the lowest tenth percentile method in accordance with the guideline on 'Planning for Noise Control' (DES 2019).

*Table 14.8: Summary of background noise levels*

| Receptor | Period | Background noise levels $L_{90}$, dba | | | Filtered background noise levels (excluding insects) $L_{90}$, dba | | |
|---|---|---|---|---|---|---|---|
| | | Day (7:00 am–6:00 pm) | Evening (6:00 pm–10:00 pm) | Night (10:00 pm–7:00 am) | Day (7:00 am–6:00 pm) | Evening (6:00 pm–10:00 pm) | Night (10:00pm–7:00 am) |
| Meadowbrook (SR5) | Wed. 10 Feb 2–Wed. 17 Feb 2021 | 35 | 39 | 37 | 26 | 27 | 23 |
| Lake Vermont (SR6) | Tue. 9 Feb–Tue. 16 Feb 2021 | 28 | 30 | 32 | 25 | 26 | 25 |
| Old Kyewong (SR3) | Tue. 9 Feb–Tue. 23 Feb 2021 | 33 | 36 | 31 | 24 | 26 | 24 |

The existing background noise environment surrounding the Project was found to be characterised by reasonably quiet ambient noise levels predominately influenced by mine-related noise from nearby mining operations, natural sources (e.g. frogs, insects, birds, wind in trees) and farm-related sources (e.g. farm machinery, livestock, dogs). Overall, the background noise level (less insect noise) was below 30 dBA $L_{90}$ at all three locations. If the background noise level were measured to be below 30 dBA $L_{90}$, it is generally advised that a minimum background noise level of 30 dBA $L_{90}$ is adopted (DES 2017). Additional noise monitoring during winter was not proposed due to the filtered noise levels (excluding insects) measuring below 30 dBA $L_{90}$.

## 14.4 Potential impacts

### 14.4.1 Upset conditions

Potential upset conditions and their impact on noise and vibration emissions have been considered in Appendix M, Noise and Vibration Assessment (Section 2.4). Upset conditions may arise due to equipment malfunctioning or severe weather conditions.

Malfunctioning equipment can result in a minor increase in the predicted noise level for that piece of equipment; however, the cumulative impact on the whole site is predicted to be minor. Through mitigation and management strategies, including regular maintenance and the removal of equipment from operation in the event of noise issues developing, adverse impacts are not predicted.

In severe weather conditions mine activity may reduce or stop and this reduction in activity would lower noise emissions. Strong winds blowing from the direction of the Project towards SRs may increase noise levels; however, the simultaneous increase in background noise levels created by wind noise (i.e. aeolian noise) will generally mask these increases.

By adopting proposed mitigation and management strategies, upset conditions are unlikely to alter noise impacts at SRs, and further assessment of such cases is not considered to be warranted.

## 14.4.2 Operational noise

#### 14.4.2.1 Noise modelling description

Noise modelling undertaken for the Project utilised the CONCAWE algorithm, which is widely used and accepted for noise modelling. The CONCAWE algorithm allows for modelling of several discrete meteorological scenarios.

The SoundPLAN V8.2 program was used to develop a three-dimensional digital terrain noise model of the Project area and the surrounding area, including the location of SRs. The model incorporates terrain data for the Project and the existing surrounding topography.

The propagation of noise in the outdoor environment can be influenced by local meteorological conditions (including air temperature, humidity, wind speed, wind direction and stability of the atmosphere) either in isolation or as a combined weather condition.

The SoundPLAN model predicts noise levels under five combinations of meteorological conditions, including:

1) Pasquill Stability Class;

2) temperature;

3) wind speed;

4) wind direction; and

5) relative humidity.

Four meteorological scenarios were modelled using the average daytime and night-time conditions when wind is either neutral or directed towards a receiver (adverse conditions) (refer Table 14.9). Wind speeds of 2 m/s were modelled as mining noise levels are usually highest under conditions of low wind speeds, and these modelling scenarios represent the conservative modelling of worst-case climatic scenarios. As wind speeds increase to 3 m/s, or greater, Project noise impacts are generally reduced due to extraneous background from higher wind speeds. Summer and winter meteorological conditions were modelled including neutral and adverse temperature inversion (scenarios N1 and N2).

*Table 14.9: Meteorological Scenarios*

| Parameters | Day meteorological scenario | | Night meteorological scenario | |
|---|---|---|---|---|
| | **Scenario D1** | **Scenario D2** | **Scenario N1** | **Scenario N2** |
| Pasquill Stability Class | D | D | F | F |
| Temperature (°C) | 25 | 25 | 10 | 10 |
| Wind Speed (m/s) | 0 | 2 | 0 | 2 |
| Wind direction | — | Towards receiver | — | Towards receiver |
| Relative Humidity (%) | 40 | 40 | 70 | 70 |

Potential noise impacts have been modelled for Project Year 7 and Project Year 22 of the Project. These scenarios have been selected to represent the years likely to produce the most severe noise impacts (worst-case scenarios). Specifically, Project Year 7 (indicatively 2032) represents a high production year for the proposed underground mine, while Project Year 22 (indicatively 2047) represents a period of overlap between the proposed underground mine and the proposed open-cut pit mining operations (refer Appendix M, Noise and Vibration Assessment, Section 6.2).

Modelling of the scenarios has included information regarding mine ground elevations, equipment numbers, equipment types, equipment locations and equipment emissions for each mining scenario. Noise source data (equipment emissions) included in the modelling was obtained from multiple sources, including:

- direct measurements from equipment manufacturers;
- Trinity Consultants Australia Pty Ltd's database of sound power levels; and
- relevant data from other similar mine projects.

Further detail on the methodology and information regarding noise emission sources (i.e. plant and equipment), assigned noise emission levels, noise metrics and rates of production used for this assessment are provided in Appendix M, Noise and Vibration Assessment (Section 2).

#### 14.4.2.2 Noise modelling results

The predicted noise levels at SRs for Project Year 7 and Project Year 22 of the Project are presented in Table 14.10. Noise levels are notably lower during Project Year 7, with mining activity occurring underground and surface activities limited to the handling and processing of mined ore and product coal.

Predicted noise levels in Project Year 22 are comparatively higher than Project Year 7, primarily resultant of the proposed open-cut mining activity (which commences during Project Year 20). However, no exceedances are predicted at any SRs assessed in the noise model. Indeed, predicted noise levels at SRs are at least 10 dB below the proposed Project noise limits, as shown in Table 14.10.

Predicted daytime and night-time noise levels for Project Year 7 and Project Year 22 are also shown graphically as noise contours in Figure 14.2 to Figure 14.5. As these figures illustrate, no exceedances of proposed noise limits are predicted to occur at SRs.

*Table 14.10: Predicted A-weighted noise levels ($L_{eq}$ dBA)*

| Sensitive Receptor | Predicted noise emissions levels $L_{eq}$ dBA | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Year 7 | | | | Year 22 | | | |
| | D1 | D2 | N1 | N2 | D1 | D2 | N1 | N2 |
| **Noise Criteria $L_{eq}$** | 40 | 40 | 35 | 35 | 40 | 40 | 35 | 35 |
| R1 – Downfalls | 8 | 13 | 17 | 14 | 11 | 17 | 21 | 18 |
| R2 – Seloh Nolem 1 | 6 | 12 | 17 | 13 | 12 | 18 | 23 | 19 |
| R3 – Old Kyewong | 14 | 20 | 24 | 22 | 16 | 22 | 25 | 23 |
| R4 – Mockingbird Downs | 10 | 16 | 20 | 17 | 14 | 20 | 24 | 20 |
| R8 – Leichardt | 5 | 10 | 15 | 11 | 10 | 16 | 21 | 17 |
| R9 – Seloh Nolem 2 | 5 | 11 | 16 | 12 | 12 | 18 | 22 | 18 |
| R10 – Old Bombandy | 4 | 9 | 14 | 10 | 10 | 15 | 20 | 16 |

#### 14.4.2.3 Low-frequency noise modelling and results

Low-frequency (i.e. Z-weighted) noise levels have not been assessed for the Project, as low-frequency noise impacts have not been reported as an issue for the current Lake Vermont Mine. In this regard, it is noted that the Lake Vermont Mine EA does not include low-frequency noise limits. Further to this, it is considered very unlikely that coal mine noise that complies with A-weighted noise limits, as shown in Table 14.1, would result in low-frequency (Z-weighted) noise exceedances. As such, low-frequency noise impacts are not considered an issue for the Project (refer Appendix M, Noise and Vibration Assessment, Section 6.5).

### 14.4.3 Blasting

#### 14.4.3.1 Blasting modelling

Ground vibration and airblast overpressure levels caused by blasting activities have been predicted based on the formulas and methodology of Australian Standard 2187.2 'Explosives–Storage Transport and Use–Use of Explosive', which predicts the peak particle velocity (PPV) in mm/s and the airblast overpressure (peak pressure) in dB. Existing vibration levels are considered negligible, except at locations close to roads or items of fixed plant. The blasting assessment model incorporates predicted overpressure and vibration levels at SRs using a 1600 kg maximum instantaneous charge based on a site exponent (attenuation rate) of 1.6 and a site constant range of 800–1600. These values were estimated based on experience with similar projects (refer Appendix M, Noise and Vibration Assessment, Section 7).

Further detail regarding blasting model inputs, including formulas and criteria, are outlined in Appendix M, Noise and Vibration Assessment (Section 7).

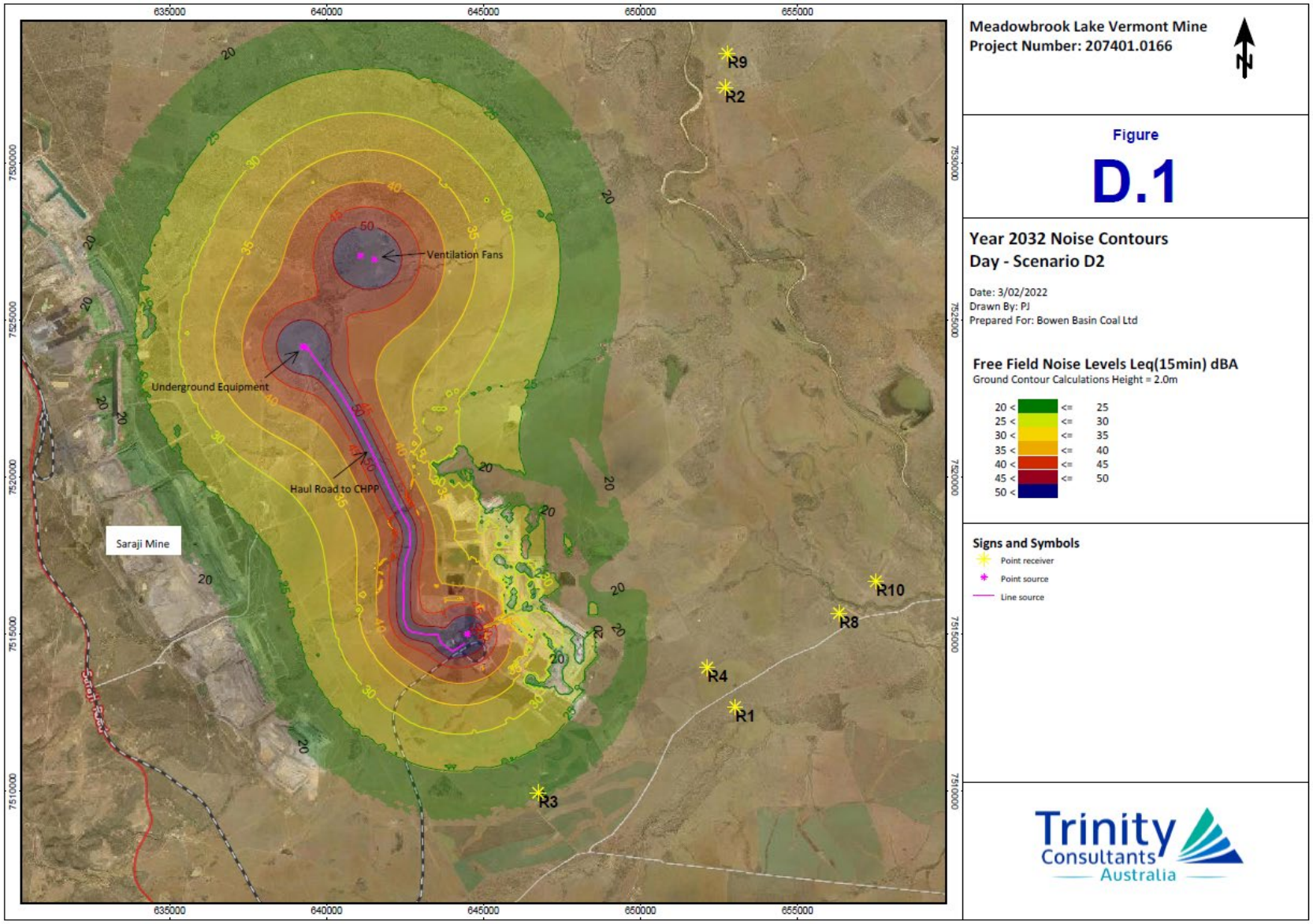


*Figure 14.2: Noise contours for Project Year 7, daytime scenario (D2)*

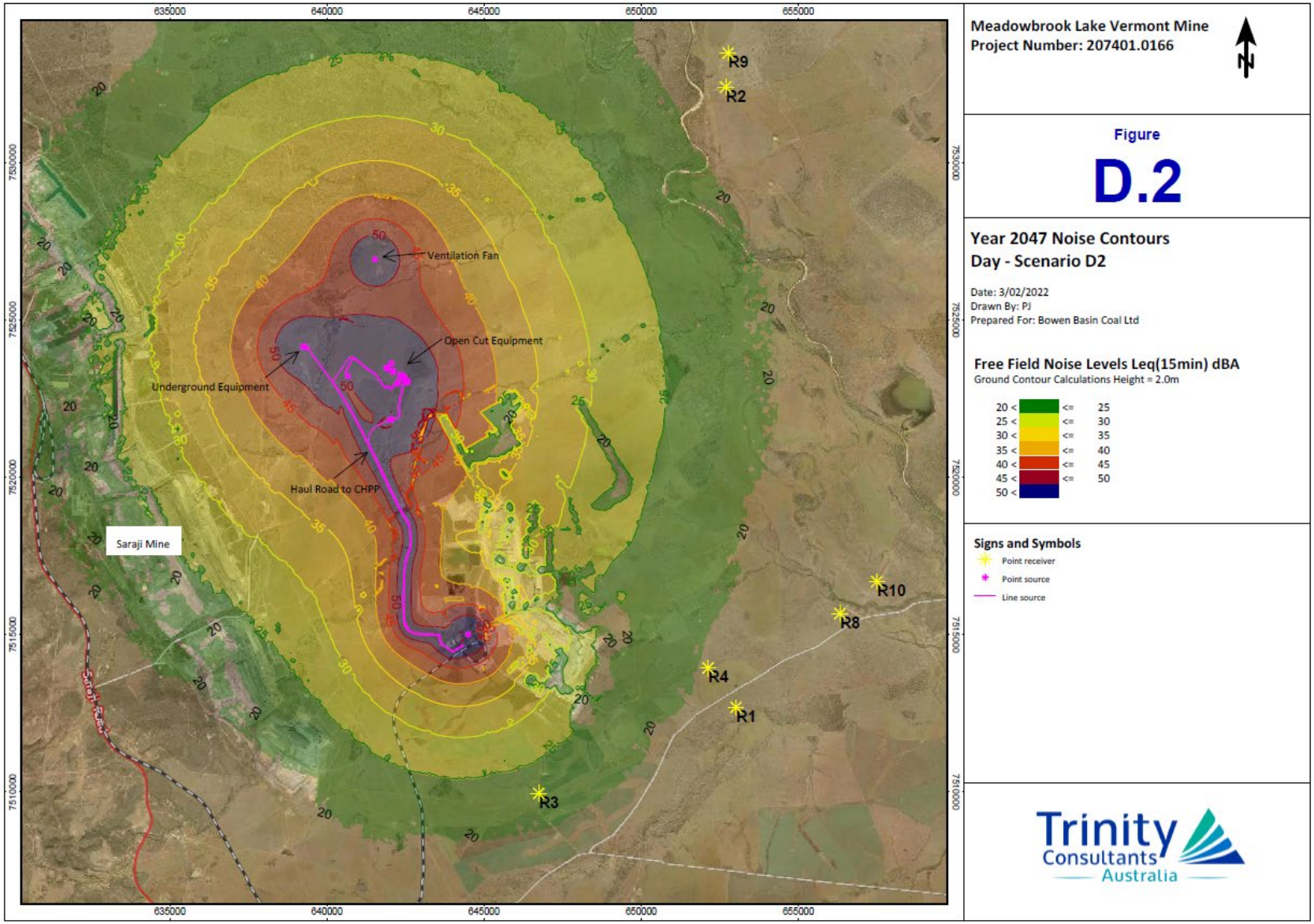


*Figure 14.3: Noise contours for Project Year 22, daytime scenario (D2)*

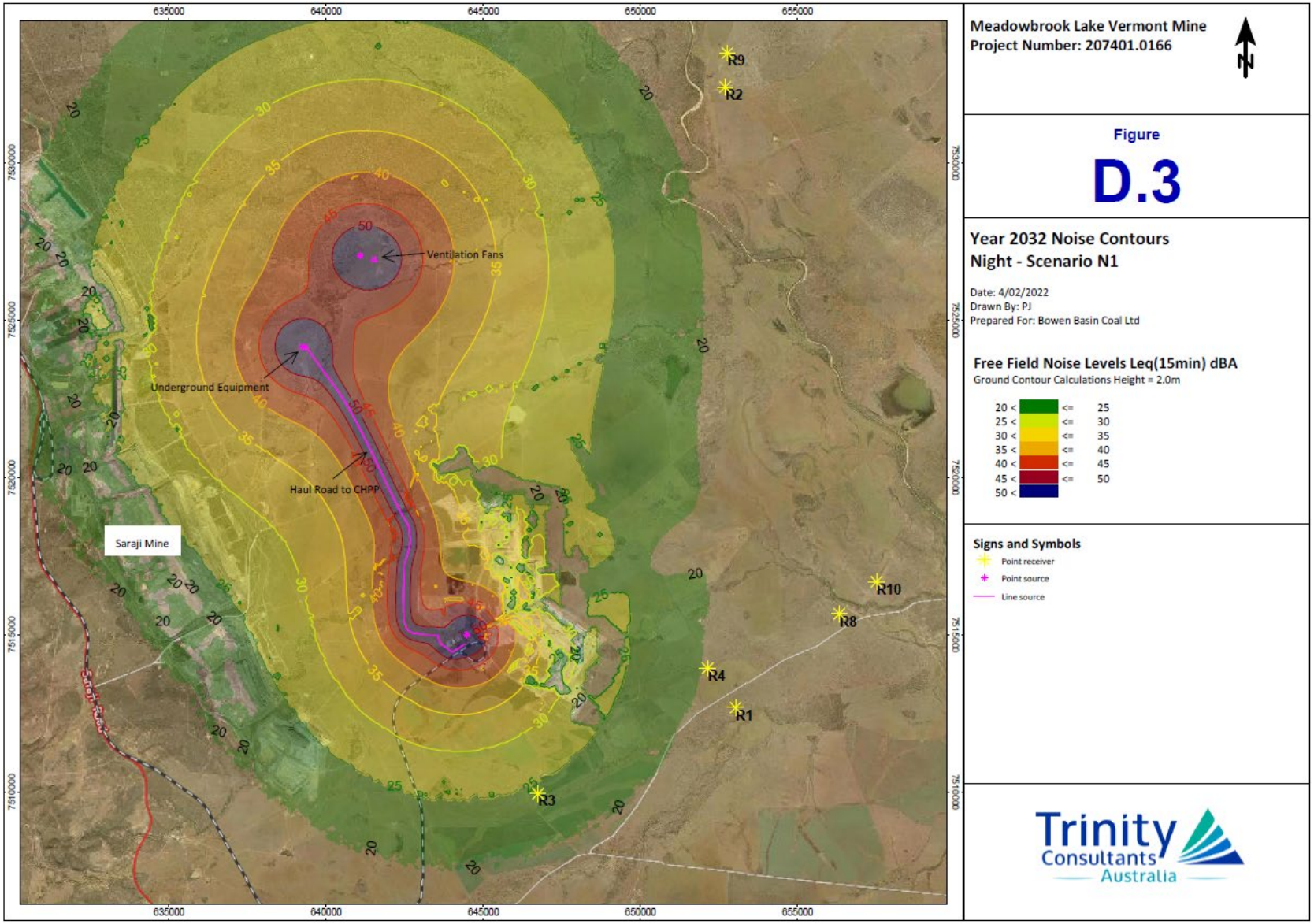


*Figure 14.4: Noise contours for Project Year 7, night-time scenario (N1)*

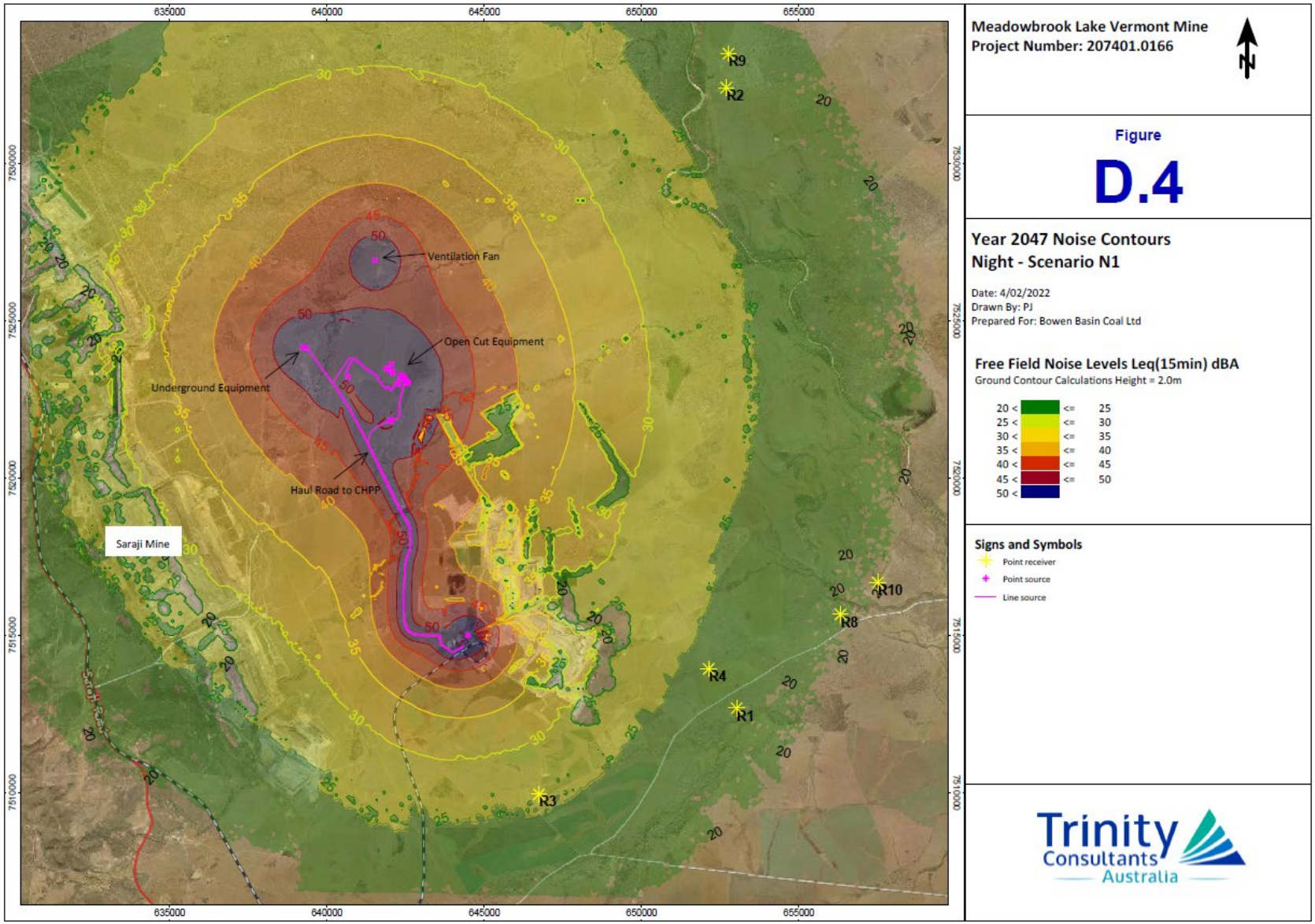


*Figure 14.5: Noise contours for Project Year 22, night-time scenario (N1)*

#### 14.4.3.2 Blasting results

The Project blasting assessment predicts that ground vibration will not exceed the objective of 5 mm/s at distances greater than 1.5 km. The airblast overpressure assessment predicts that airblast levels will meet the Project objective of 115 dB(Z) at distances greater than 1.03 km, with airblast levels of 120 dB(Z) predicted at 700 m. Given all applicable SRs are greater than 10 km away from the Project's proposed open-cut pit, blasting limits are anticipated to be complied with throughout all Project phases.

A 'Blast Monitoring Program' (in accordance with the existing Lake Vermont Mine EA, Condition F4) is in operation for the existing Lake Vermont Mine, which will be extended to include the Project site.

Airblast ground pressure and overpressure due to blasting are, therefore, predicted to be compliant with the Project objectives at all SRs.

### 14.4.4 Cumulative noise

The Project is close to several existing and proposed mining projects, as shown in Figure 14.6. These existing and proposed operations have the potential to contribute to noise levels experienced at SRs; therefore, cumulative noise impacts have been assessed in Section 6.6 of Appendix M, Noise and Vibration Assessment.

It should be noted that existing background noise levels (used within the determination of modelled Project noise) do include the noise emissions from the existing Lake Vermont Mine and the existing Saraji Mine (BHP Mitsubishi Alliance). These are the only existing, significant contributors to the Project's potential cumulative noise impacts. As such, it is important to recognise that these noise emissions have already been considered within the Project background noise conditions. There are two proposed projects for which noise impacts were not included in modelled background noise levels, the Saraji East Project and the Olive Downs Project. However the cumulative impacts of the Project and these proposed projects was assessed and the outcome presented below.

The Saraji East Project, being a proposed extension eastward of the existing Saraji Mine (refer Figure 14.6), has also been considered as a key source of potential cumulative noise emissions for the Project. However, the Saraji East Project noise emissions will predominantly impact areas to the west of the existing Saraji Mine (which will not be influenced by Lake Vermont Meadowbrook Project noise). The SRs closest to the Project (R1–R4 and R8–R10) are located at distances greater than 15 km away and at these distances, any cumulative noise impacts resultant of the Project and other existing or proposed projects are considered to be negligible.

The highest predicted noise level at SRs to the south-east (R1, R3, R4, R8 and R10) is 25 dBA $L_{Aeq,}$ which is at least 10 dB below the existing Lake Vermont Mine night-time noise limit of 35 dBA $L_{Aeq,15min}$. As such, mine noise contribution from the Project to the cumulative noise impacts at these SRs is expected to be relatively insignificant, noting that a noise level of 25 dBA is assessed as a negligible contribution to a mine noise limit of 35 dBA (refer Appendix M, Noise and Vibration Assessment, Section 6.6).

For receivers to the northeast of the Project (R2 and R9), the highest predicted noise level is 23 dBA $L_{Aeq}$. Given the highest predicted level is at least 12 dB below the nearby Olive Downs Mine night-time noise limit of 35 dBA $L_{Aeq,15min}$, the noise contribution from the Project to potential cumulative impacts is considered relatively insignificant. That is, a noise level of 23 dBA has negligible contribution to a mine noise limit of 35 dBA (refer Appendix M, Noise and Vibration Assessment, Section 6.6).

The Project is not expected to significantly contribute to cumulative noise impacts to SRs.

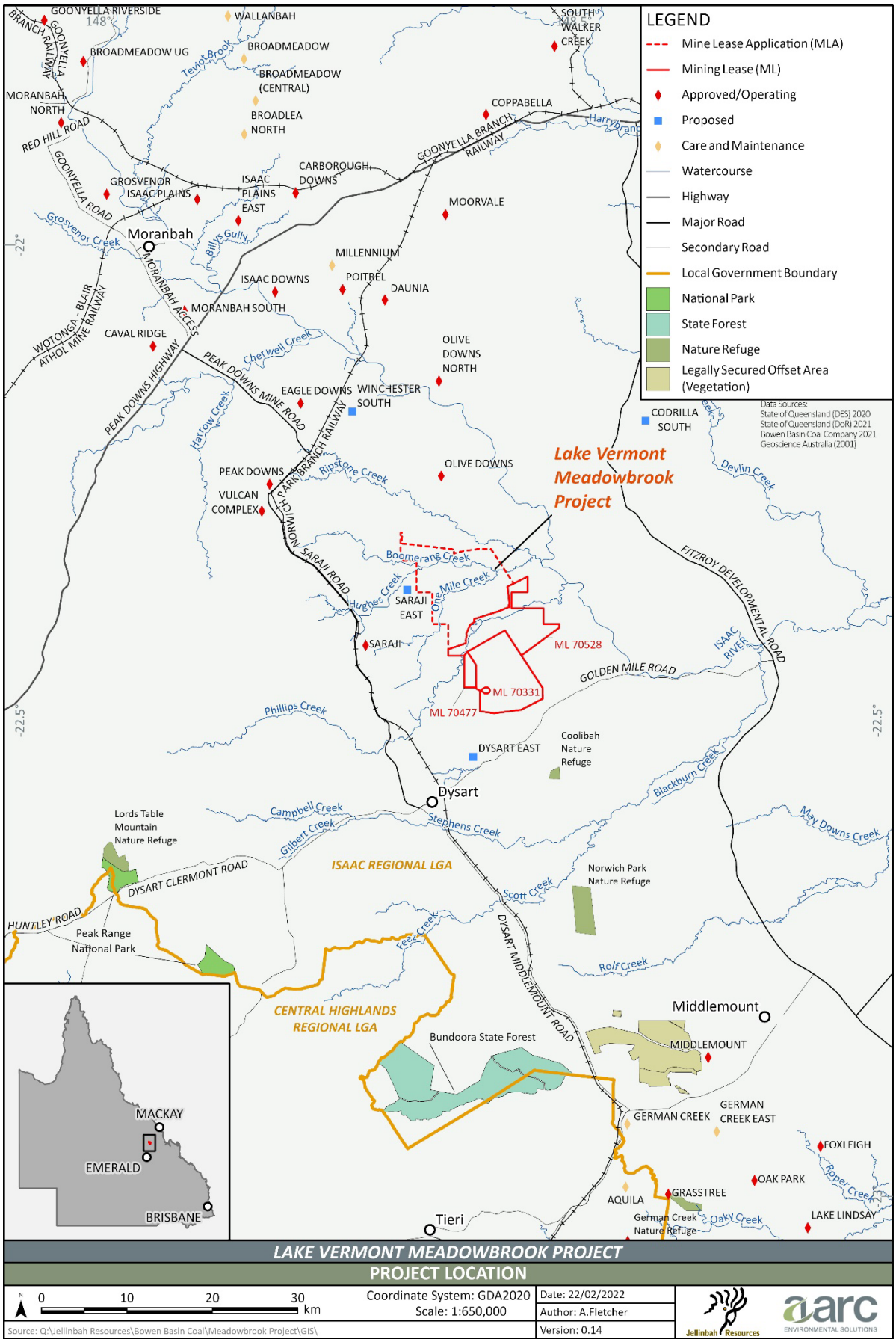


*Figure 14.6: Project location in respect of existing and proposed mining projects*

### 14.4.5 Impact assessment summary

The assessment of Project noise impacts determined that noise impacts will not exceed the proposed noise criteria, and thereby achieve the performance outcome for the environmental objective for noise under Schedule 8 of the EP Regulation. By demonstrating the Project can achieve the proposed noise criteria, the Project is compatible with current and future land uses which include mining and grazing.

## 14.5 Mitigation and management measures

The management hierarchy for noise as set out in the EPP (Noise) requires that for an activity involving noise that affects, or may affect, an environmental value to the extent that it is reasonable to do so, noise management must be dealt with in the following order of preference:

1) Avoid the noise (e.g. locate an industrial activity in an area that is not near an SR).
2) Minimise the noise in the following order:
    a) Orientate an activity to minimise the noise (e.g. face the part of an activity that makes noise away from an SR); then
    b) Use the best available technology to minimise the noise.
3) Manage the noise (e.g. use heavy machinery only during business hours).

Noise and vibration mitigation measures are not expected to be required for the Project to meet proposed compliance limits because of the relatively large distance to SRs and the low modelled noise and blasting outputs predicted. This is consistent with the operational experiences of the existing Lake Vermont Mine, which does not have a history of noise or vibration related complaints, or recorded exceedances of noise and vibration criteria. The demonstrated success of the existing Lake Vermont Mine in meeting the noise criteria indicates that existing mitigation and management measures implemented at the existing Lake Vermont Mine are effective in managing noise emissions. As such, noise and vibration exceedances and/or complaints are not reasonably expected as a result of the proposed Project.

Should the Project receive a noise or blasting-related complaint, the Project operator will:

- undertake an investigation to verify and understand the matter of concern, including undertaking monitoring from the relevant noise-sensitive place (consistent with the conditions of the existing Lake Vermont Mine EA and the 'Model Mining Conditions' [DES 2017c]); and
- prepare a report if an exceedance of a noise or blasting limit is identified that includes monitoring results obtained, assessment of any mitigating and/or aggravating factors and proposed suitable mitigation measures to return the Project to compliance.

### 14.5.1 Monitoring

Short-term monitoring period will be undertaken in the event of a noise or vibration complaint, including the following:

- noise monitoring at the affected receiver's location;
- the setup of a noise logger for a minimum of a 5-day period;
- audio recordings/snapshots and 1 second time period noise levels;
- 15-minute third octave band noise levels; and
- attended noise measurements conducted for a minimum of 1 hour to characterise the night-time noise environment.

Should continuous/ongoing complaints originating at the same sensitive residential or commercial place arise, longer-term noise monitoring would be implemented to ensure that an exceedance of noise limits could be identified immediately. A long-term monitoring system would provide recordings and parameters as specified in the short-term monitoring but will also alert mine operators in real time to allow for reactions to potential exceedances.

Where monitoring is undertaken, reporting of noise levels will comply with the latest edition of the Noise Measurement Manual or the most recent version of the Australian Standard 1055, Acoustics – Description and Measurement of Environmental Noise.

### 14.5.2 Response to a noise exceedance

Should future monitoring confirm that noise criteria are not being met with the current management actions, further corrective actions will be undertaken. A range of noise management strategies will be considered, and an approach designed to best mitigate the recorded exceedances will be applied. The range of measures that may be considered includes:

- reducing or stopping operations during times that are likely to result in exceedances;
- moving mine equipment further from SRs;
- reducing the amount of mine equipment in use at any one time;
- incorporating noise mitigation equipment;
- engineered noise reduction features; and
- providing acoustic or ventilation upgrades to SRs.