# APPENDIX I

## Noise and vibration assessment for out of hours construction

# Cobbora Coal Mine

Noise and vibration assessment for out of hours construction

Prepared for Cobbora Holding Company | 7 February 2013

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# Cobbora Coal Mine

Final

Report J11030RP18 | Prepared for Cobbora Holding Company | 7 February 2013

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| Date | 7 February 2013 | Date | 7 February 2013 |



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## Appendices



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## Figures

# 1 Introduction

EMGA Mitchell McLennan Pty Limited (EMM) has been commissioned by Cobbora Holding Company Pty Limited (CHC) to undertake a construction noise and vibration assessment for the proposed Cobbora Coal Project (the Project).

This report reviews the proposed out of hours (OOH) activities for the Project and provides a qualitative assessment of noise and vibration impacts. The findings of this assessment will form part of a comprehensive Construction Noise and Vibration Management Plan (CNVMP) which is currently being completed for the Project.

## 1.1 Purpose and scope

The purpose of this review is to quantify noise levels generated by essential OOH construction activities required for the Project and provide reasonable and feasible mitigation measures where required.

A comprehensive CNVMP is to be completed identifying all construction activities for the Project and reasonable and feasible mitigation to reduce potential noise emissions.

## 1.2 Proposed OOH activities

It is noted that the Environmental Assessment (EA) specified proposed construction hours of six days per week for up to 12 hours per day, with some activities such as concrete pours being carried out on a 24 hour per day basis. However this has been revised and proposed OOH for this project is the subject of further detailed assessment in this report.

The revised program requires construction to be conducted seven days per week and up to 12 hours per day allowing for works to be expedited and will reduce the construction noise duration, which is considered a positive for the community. Therefore, this assessment has considered Sundays and public holidays: 7.00 am to 6.00 pm as standard assessment hours, while proposed night works are considered out of hours.

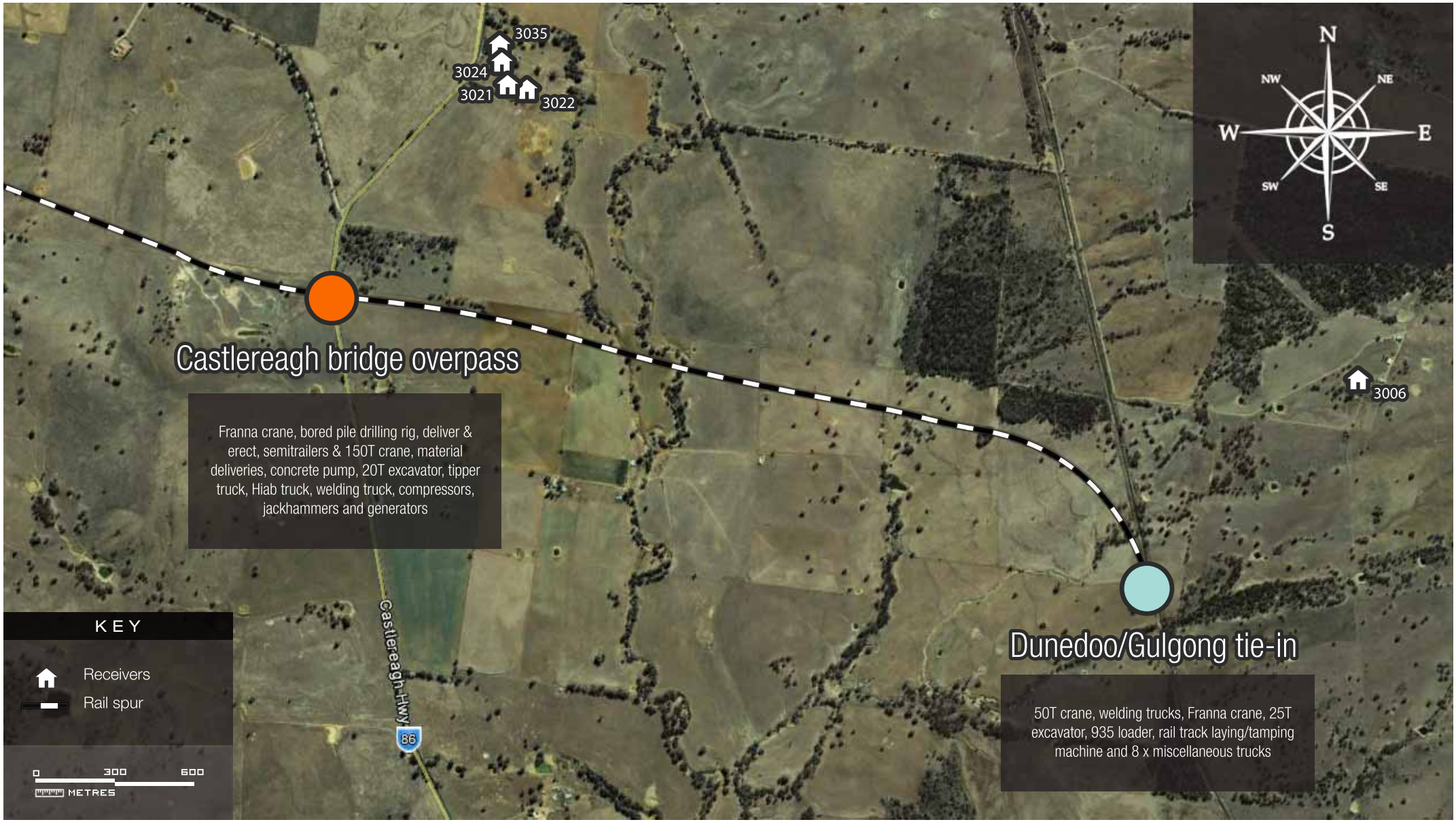
Construction works outside of these hours (ie night works) are expected to be divided into several activities. The activity, plant and duration/occurrence are presented in Table 1.1, it is noted that the duration is the proposed maximum for each task. Activities are likely to occur concurrently, however are mostly transient in nature, minimising the duration of noisy events at given receivers. Furthermore, distances between concurrent activities can mean that combined cumulative impacts are unlikely.

## Table 1.1 Construction activities

| Activity | Plant | Duration/occurrence |
|---|---|---|
| **1. Rail track tie-in to Dunedoo/Gulgong mainline** | | |
| | 50t crane, welding trucks, Franna crane, 25t excavator, 936 loader, rail track laying/tamping machine and 8 x miscellaneous trucks | Once off (Max four weeks) |
| **2. Drilling for blasting of rock** | | |
| a. Fleet J | Airtrack drills, compressors, light trucks for explosive delivery trucks(Ch14300 to Ch14900), 40t excavator, 3 x articulated dump truck, D11 dozer, grader and compactor. | 18 weeks |
| b. Fleet L | Airtrack drills, compressors, light trucks for explosive delivery (Ch22300), 2 x 40t excavators, 8 x articulated dump trucks, 2 x D11 dozer, grader, water cart, vibrating roller and 2 x D10 dozers. | 28 weeks |
| **3. Rock crushing and screening operation within the rail corridor at three locations** | | |
| a. Ch11600 to Ch12000 | Robo screen, impact crusher, excavator, D6 dozer, water truck, 980 loader, 4 x articulated dump truck, grader, compactors and vibrating roller. | 16 weeks |
| b. Ch13500 to Ch14600 | | 23 weeks |
| c. Ch20300 to Ch22500 | | 16 weeks |
| **4. Operation of concrete batch plant** | | |
| | Aggregate weigh bin (transfer conveyor enclosed), Concrete mixing bowl (motor and gearbox enclosed) and loading agitator from mixing bowl. | Continuous |
| **5. Coal Handling Preparation Plant (CHPP) construction** | | |
| a. Strip topsoil (clearing not required) | 3 x 631 scrapers, D9 dozer | 6 weeks |
| b. Cut/stockpile to fill by scraper fleet | 3 x 631 scrapers, D10 dozer, D8 dozer, compactor 825, grader 14H, water truck | 16 weeks |
| c. Pavement | 4 x articulated dump trucks 39t, grader 14H, water truck, vibrating roller, 4 x 20t excavators, 2 x backhoes, Franna crane, 936 loader, 3 x truck 8m$^3$ tipper, Hiab truck, 2 x light dual cab, flat top trucks, compressors, generators and wackers | 17 weeks |
| d. Structural works | 150t crane, franna crane, compressor, generator, light truck | 17 weeks |
| **6. Mine Infrastructure Area (MIA) civil works and construction** | | |
| a. Strip topsoil (clearing not required) | 3 x 631 scrapers, D9 dozer | 3 weeks |
| b. Cut/stockpile to fill by scraper fleet | 3 x 631 scrapers, D10 dozer, D8 dozer, compactor 825, grader 14H, water truck | 10 weeks |
| c. Pavement | 4 x articulated dump truck 39t, grader 14H, water truck, vibrating roller, 4 x 20t excavators, 2 x backhoes, Franna crane, 936 loader, 3 x truck 8m$^3$ tipper, Hiab truck, 2 x light dual cab, flat top trucks, compressors, generators and wackers | 15 weeks |
| d. Structural works | 150t crane, franna crane, compressor, generator, light truck | 15 weeks |
| **7. Castlereagh Highway overpass bridge over rail** | | |
| | Franna crane, bored pile drilling rig, deliver & erect - semitrailers & 150t crane, material deliveries, concrete pump, 20t excavator, tipper truck, Hiab truck, welding truck, compressors, jackhammers and generators | 39 weeks |

## 1.3 Sensitive receiver review and OOH activities

A review of potential receivers has been undertaken adjacent to OOH construction areas and this remains consistent with those identified in Appendix N of the EA. Figure 1.1 to Figure 1.4 shows the nearest sensitive receptors and plant locations for each modelled OOH activity.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3024
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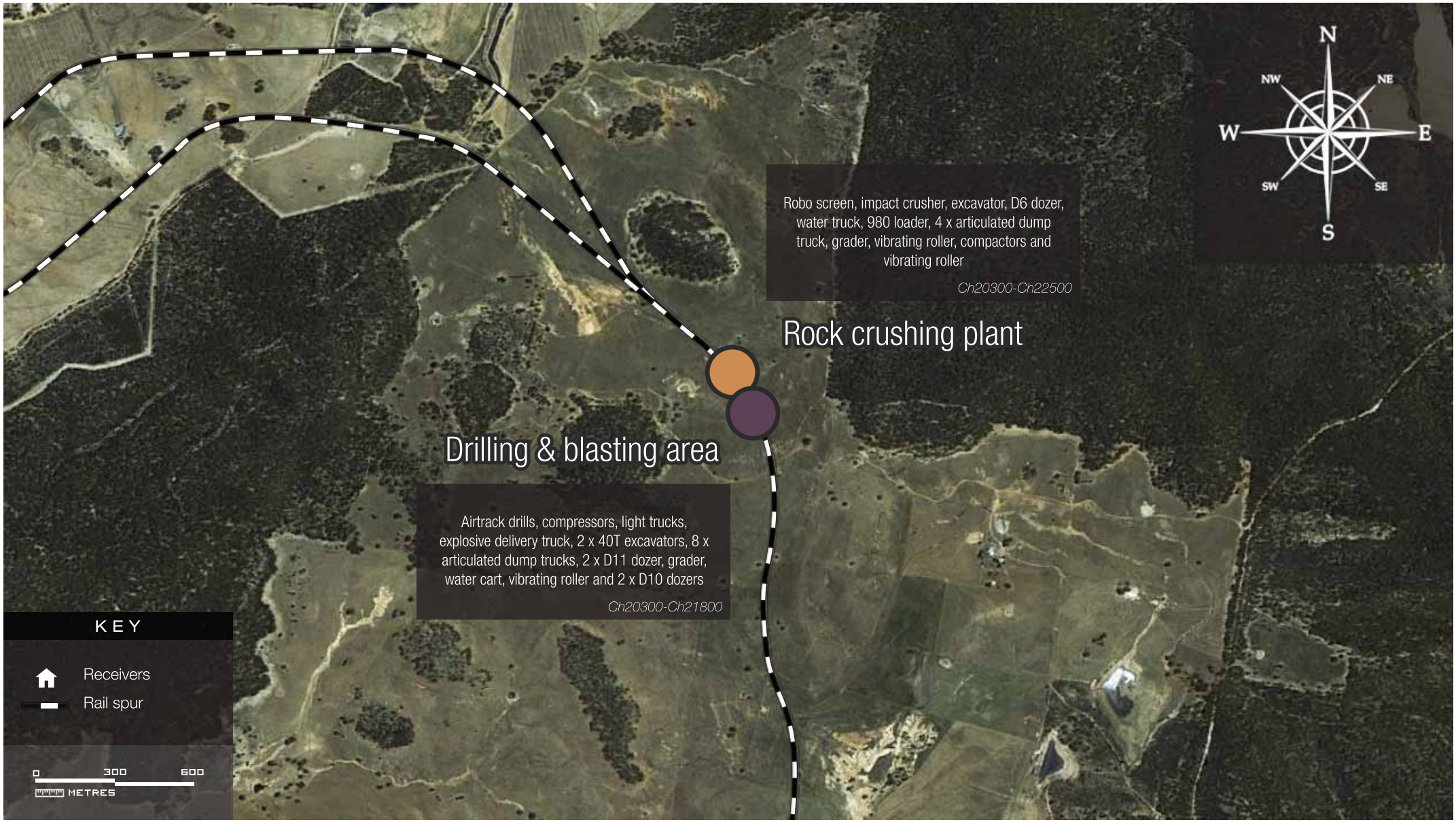
Castlereagh bridge overpass
Franna crane, bored pile drilling rig, deliver & erect, semitrailers & 150T crane, material deliveries, concrete pump, 20T excavator, tipper truck, Hiab truck, welding truck, compressors, jackhammers and generators
3006
Castlereagh Hwy
86
Dunedoo/Gulgong tie-in
50T crane, welding trucks, Franna crane, 25T excavator, 935 loader, rail track laying/tamping machine and 8 x miscellaneous trucks
KEY
Receivers
Rail spur
0
300
600
METRES


5001
Airtrack drills, compressors, light trucks, explosive delivery trucks, 40T excavator, 3 x articulated dump truck, D11 dozer, grader and compactor
Ch13500-Ch14600
Drilling & blasting area
Rock crushing plant
Robo screen, impact crusher, excavator, D6 dozer, water truck, 980 loader, 4 x articulated dump truck, grader, vibrating roller, compactors and vibrating roller
Ch13500-Ch14600
Airtrack drills, compressors, light trucks, explosive delivery trucks, 40T excavator, 3 x articulated dump truck, D11 dozer, grader and compactor
Ch11600-Ch12000
Drilling & blasting area
Rock crushing plant
Robo screen, impact crusher, excavator, D6 dozer, water truck, 980 loader, 4 x articulated dump truck, grader, vibrating roller, compactors and vibrating roller
Ch11600-Ch12000
N
NW
NE
W
E
SW
SE
S
KEY
Receivers
Rail spur
0
300
600
METRES


N
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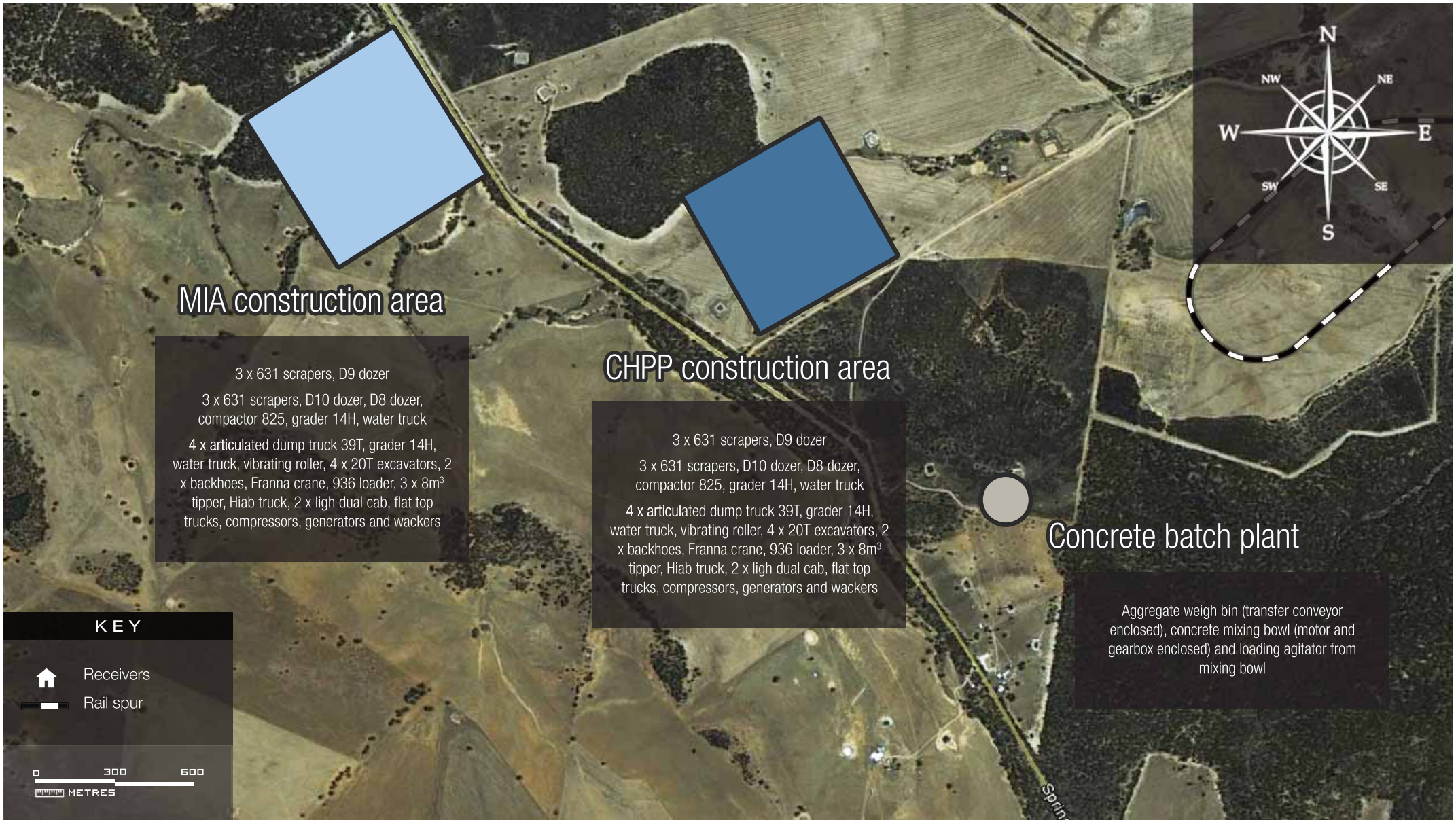
Robo screen, impact crusher, excavator, D6 dozer, water truck, 980 loader, 4 x articulated dump truck, grader, vibrating roller, compactors and vibrating roller
Ch20300-Ch22500
Rock crushing plant
Drilling & blasting area
Airtrack drills, compressors, light trucks, explosive delivery truck, 2 x 40T excavators, 8 x articulated dump trucks, 2 x D11 dozer, grader, water cart, vibrating roller and 2 x D10 dozers
Ch20300-Ch21800
KEY
Receivers
Rail spur
0
300
600
METRES


N
NW
NE
W
E
SW
SE
S
MIA construction area
3 x 631 scrapers, D9 dozer
3 x 631 scrapers, D10 dozer, D8 dozer, compactor 825, grader 14H, water truck
4 x articulated dump truck 39T, grader 14H, water truck, vibrating roller, 4 x 20T excavators, 2 x backhoes, Franna crane, 936 loader, 3 x 8m3 tipper, Hiab truck, 2 x ligh dual cab, flat top trucks, compressors, generators and wackers
CHPP construction area
3 x 631 scrapers, D9 dozer
3 x 631 scrapers, D10 dozer, D8 dozer, compactor 825, grader 14H, water truck
4 x articulated dump truck 39T, grader 14H, water truck, vibrating roller, 4 x 20T excavators, 2 x backhoes, Franna crane, 936 loader, 3 x 8m3 tipper, Hiab truck, 2 x ligh dual cab, flat top trucks, compressors, generators and wackers
Concrete batch plant
Aggregate weigh bin (transfer conveyor enclosed), concrete mixing bowl (motor and gearbox enclosed) and loading agitator from mixing bowl
KEY
Receivers
Rail spur
0
300
600
METRES

# 2 Construction noise and vibration goals

## 2.1 Determining construction noise and vibration goals

This assessment was developed and guided by the following published documents:

- *Department of Environment, Climate Change and Water NSW (DECCW) Interim Construction Noise Guideline (ICNG) (July 2009);*
- *DECCW - Industrial Noise Policy, January 2000 (INP);*
- *DECCW Assessing Vibration: A Technical Guideline (February 2006);*
- *German Standard DIN4150 (February 1999);*
- *British Standard BS7385: Part 2–1993; and*
- *Standards Australia – AS 1055.1-1997 Acoustics - Description and measurement of environmental noise - General procedures.*

### 2.1.1 Construction noise objectives

Construction noise objectives aim to minimise the noise impacts from the Project on surrounding sensitive receptors. This section provides a summary of noise objectives that are applicable to the Project.

These noise objectives will be used to derive a consistent set of criteria which will be used to assess the Project impacts.

#### i Interim construction noise guideline

The NSW Department of Environment, Climate Change and Water (DECCW) provide the ICNG for the assessment and management of noise from construction works.

The ICNG provides two methodologies for the assessment of construction noise emissions:

- quantitative, which is suited to major construction projects with typical durations of more than 3 weeks; and

- qualitative, which is suited to short term infrastructure maintenance (<3weeks).

A quantitative assessment has been completed for this Project as construction will occur for more than 3 weeks.

#### ii Noise Management Level

Table 2.1 is an extract from the ICNG and provides noise management levels for residential receivers for day and out of hours periods.

## Table 2.1 ICNG Residential Criteria

| Time of Day | Management Level $L_{Aeq\ (15\ min)}$* | How to Apply |
|---|---|---|
| Recommended standard hours: Monday to Friday 7.00 am to 6.00 pm, Saturday 8.00 am to 1.00 pm, No work on Sundays or public holidays | Noise-affected RBL + 10 dB | The noise-affected level represents the point above which there may be some community reaction to noise.<br>• Where the predicted or measured $L_{eq(15\text{-}min)}$ is greater than the noise-affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level.<br>• The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details. |
| | Highly noise affected 75 dB(A) | The highly noise-affected level represents the point above which there may be strong community reaction to noise.<br>• Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account:<br>i) times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences);<br>ii) if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times. |
| Outside recommended standard hours | Noise-affected RBL + 5 dB | • A strong justification would typically be required for works outside the recommended standard hours.<br>• The proponent should apply all feasible and reasonable work practices to meet the noise affected level.<br>• Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise-affected level, the proponent should negotiate with the community.<br>• For guidance on negotiating agreements see Section 7.2.2 of the ICNG. |

### 2.1.2 Out of Hours Noise Criteria

As described earlier, it is expected activities presented in Table 1.1 will also be conducted during night periods.

The following criteria provided by DECCW in the ICNG will be adopted:

- Noise emissions not to exceed RBL plus 5dB(A).

OOH construction works must be accompanied by a strong justification and it is understood that several of the proposed OOH works for this Project are unavoidable due to work involved with public infrastructure (eg Castlereagh Highway or Dunedoo rail line).

It is an objective of this CNVMP to minimise the noise impacts of construction activities outside of nominal daytime hours. Therefore, all reasonable and feasible mitigation would be applied to sites that are situated in close proximity to receivers adopting best practice noise mitigation.

Based on the objective contained in *Section* 2.1.1, the noise criteria that will be adopted for residential receptors during out of hour's construction activities are provided in Table 2.2.

**Table 2.2 Residential Construction Noise Criteria – out of hours**

| Location | Out of hours $L_{Aeq,\ 15min}$ Noise Criterion (background +5dB), dB(A) |
|---|---|
| All private residences | 35 |

### 2.1.3 Sleep Disturbance

The DECCW's current policy (and previously referenced in the ENCM, 1994) recommends that $L_{1,1minute}$ (or $L_{max}$) noise from a source should not exceed the existing background noise by more than 15dB. Depending on the measured background noise, the sleep disturbance criteria for the quietest location could be as low as 45 dB(A)$L_{1,1\ minute}$.

The DECCW has acknowledged that the relationship between maximum noise levels and sleep disturbance is not currently well defined. If the background plus 15dB goal is achieved then impacts are not likely, but where it is not met, a more detailed analysis is required. A detailed analysis would include quantifying the noise level as well as the number of possible events above the ideal background plus 15dB goal.

The relevant sleep disturbance criterion for the residential receivers surrounding the site is presented in Table 2.3.

**Table 2.3 Sleep disturbance criteria**

| Location | Period | RBL, dB(A) | Sleep disturbance criteria dB(A), L1,1minute |
|---|---|---|---|
| All private residences | Night | 30 | 45 |

## 2.2 Vibration emission objectives and criteria

### 2.2.1 Construction vibration

Vibration emission objectives aim to reduce vibration impacts on the community. To minimise the impacts of vibration on receivers, vibration emissions are assessed in accordance with the *Environmental Noise Management – Assessing Vibration: A Technical Guideline* (DECCW, 2006). The Guideline is based on *British Standard (BS) 6472-1992: Evaluation of human exposure to vibration in buildings (1-80Hz)*.

### 2.2.2 Human comfort – Assessing vibration a technical guideline

*Assessing vibration: a technical guideline* was published in February of 2006 by the DECC and is based on guidelines contained in *BS 6472 – 1992, Evaluation of human exposure to vibration in buildings (1-80Hz).*

The guideline presents preferred and maximum vibration values for use in assessing human responses to vibration and provides recommendations for measurement and evaluation techniques. At vibration values below the preferred values, there is a low probability of adverse comment or disturbance to building occupants. Where all feasible and reasonable mitigation measures have been applied and vibration values are still beyond the maximum value, it is recommended the operator negotiate directly with the affected community.

The guideline defines three vibration types and provides direction for assessing and evaluating the applicable criteria. Table 2.1 of the guideline provides examples of the three vibration types and has been reproduced in Table 2.4.

**Table 2.4 Examples of types of vibration (from Table 2.1 of the guideline)**

| Continuous Vibration | Impulsive Vibration | Intermittent Vibration |
|---|---|---|
| Machinery, steady road traffic, continuous construction activity (such as tunnel boring machinery) | Infrequent: Activities that create up to 3 distinct vibration events in an assessment period, e.g. occasional dropping of heavy equipment, occasional loading and unloading. Blasting is assessed using ANZECC (1990) | Trains, intermittent nearby construction activity, passing heavy vehicles, forging machines, impact pile driving, jack hammers. Where the number of vibration events in an assessment period is three or fewer these would be assessed against impulsive vibration criteria |

#### i Continuous Vibration

*Appendix C* of the guideline outlines acceptable criteria for human exposure to continuous vibration (1-80Hz), the criteria are dependent on both the time of activity (usually daytime or night-time) and the occupied place being assessed. Table 2.5 reproduces the preferred and maximum criteria relating to measured peak velocity.

### Table 2.5 Criteria for exposure to continuous vibration

| Place | Time | Peak Velocity (mm/s) | |
|---|---|---|---|
| | | Preferred | Maximum |
| **Continuous vibration** | | | |
| Critical working Areas (e.g. hospital operating theatres, precision laboratories) | Day or Night-time | 0.14 | 0.28 |
| Residences | Daytime | 0.28 | 0.56 |
| | Night-time | 0.20 | 0.40 |
| Offices | Day or Night-time | 0.56 | 1.1 |
| Workshops | Day or Night-time | 1.1 | 2.2 |

*Notes:* *1. rms velocity (mm/s) and vibration velocity value (dB re $10^{-9}$ mm/s)*
*2. values given for most critical frequency >8Hz assuming sinusoidal motion.*

### ii Intermittent Vibration

Intermittent vibration (as defined in *Section 2.1* of the guideline) is assessed using the vibration dose concept which relates to vibration magnitude and exposure time.

Intermittent vibration is representative of activities such as impact hammering, rolling or general excavation work (such as an excavator tracking).

*Section 2.4* of the Guideline provides acceptable values for intermittent vibration in terms of vibration dose values (VDV) which requires the measurement of the overall weighted rms (root Mean square) acceleration levels over the frequency range 1 Hz to 80 Hz. To calculate VDV the following formula (refer *section 2.4.1* of the guideline) was used:

$$VDV = \left[ \int_0^T a^4(t)dt \right]^{0.25}$$

Where VDV is the vibration dose value in $m/s^{1.75}$, *a (t)* is the frequency-weighted rms of acceleration in $m/s^2$ and *T* is the total period of the day (in seconds) during which vibration may occur.

The acceptable Vibration Dose Values (VDV) for intermittent vibration is reproduced in Table 2.6.

**Table 2.6 Acceptable vibration dose values (VDV) for intermittent vibration (m/s $^{1.75}$)**

| Location | Daytime | | Night-time | |
|---|---|---|---|---|
| | Preferred Value, m/s$^{1.75}$ | Maximum Value, m/s$^{1.75}$ | Preferred Value, m/s$^{1.75}$ | Maximum Value, m/s$^{1.75}$ |
| Critical Areas | 0.10 | 0.20 | 0.10 | 0.20 |
| Residences | 0.20 | 0.4 | 0.13 | 0.26 |
| Offices, schools, educational institutions and placed of worship | 0.40 | 0.80 | 0.40 | 0.80 |
| Workshops | 0.80 | 1.60 | 0.80 | 1.60 |

*Notes: 1. Daytime is 7am to 10pm and Night-time is 10pm to 7am*
*2. These criterion are indicative only, and there may be a need to assess intermittent values against continuous or impulsive criteria for critical areas.*

There is a low probability of adverse comment or disturbance to building occupants at vibration values below the preferred values. Adverse comment or complaints may be expected if vibration values approach the maximum values. The Guideline states that activities should be designed to meet the preferred values where an area is not already exposed to vibration.

### 2.2.3 Structural damage criteria – DIN4150

For structural damage, vibration should be assessed at the foundation of a building structure. In the absence of a relevant Australian Standard, the German Standard DIN 4150 - Part 3: 1999 provides the strictest guideline levels of vibration velocity for evaluating the effects of vibration in structures. The limits presented in this standard are generally recognised to be conservative.

The DIN 4150 values (maximum levels measured in any direction at the foundation, or maximum levels measured in (x) or (y) horizontal directions, in the plane of the uppermost floor), are summarised in Table 2.7 and shown graphically in Figure 2.1.

For residential and commercial type structures, the standard recommends safe limits as low as 5mm/s and 20mm/s respectively. These limits increase with frequency values above 10Hz. The operational frequency of construction plant typically ranges between 10Hz to 30Hz, and hence according to DIN4150, the safe vibration criteria range for dwellings is 5 to 15 mm/s. For reinforced commercial type buildings the limit is as low as 20mm/s, while for heritage or sensitive structures the lower limit is 3mm/s.

### Table 2.7 Structural damage guideline values of vibration velocity – DIN4150

| Line* | Type of Structure | Vibration Velocity in mm/s | | | |
|---|---|---|---|---|---|
| | | At Foundation at a Frequency of | | | Plane of Floor of Uppermost Storey |
| | | 1Hz to 10Hz | 10Hz to 50 Hz | 50Hz to 100Hz | All Frequencies |
| 1 | Buildings used for commercial purposes, industrial buildings and buildings of similar design | 20 | 20 to 40 | 40 to 50 | 40 |
| 2 | Dwellings and buildings of similar design and/or use | 5 | 5 to 15 | 5 to 20 | 15 |
| 3 | Structures that because of their particular sensitivity to vibration do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g. buildings that are under a preservation order) | 3 | 3 to 8 | 8 to 10 | 8 |

*Notes:* *1. "Line*" refers to curves in Figure 1 of DIN4150.*

*2. For frequencies above 100Hz the higher values in the 50Hz to 100Hz column should be used.*

These levels are "safe limits", for which damage due to vibration effects is unlikely to occur. "Damage" is defined in DIN 4150 to include even minor non-structural effects such as superficial cracking in cement render, the enlargement of cracks already present, and the separation of partitions or intermediate walls from load bearing walls.

Should such damage be observed without vibration levels exceeding the "safe limits" then it is likely to be attributable to other causes. DIN 4150 also states that when vibration levels higher than the "safe limits" are present, it does not necessarily follow that damage will occur.

As indicated by the criteria from DIN 4150 in Table 2.7, high frequency vibration has less potential to cause damage than lower frequencies. This holds true for most soil types. Furthermore, the "point source" nature of vibration from plant causes the vibratory disturbances to arrive at different parts of nearby large structures in an out-of-phase manner, thereby reducing its potential to excite in-phase motion of the low order modes of vibration in such structures.

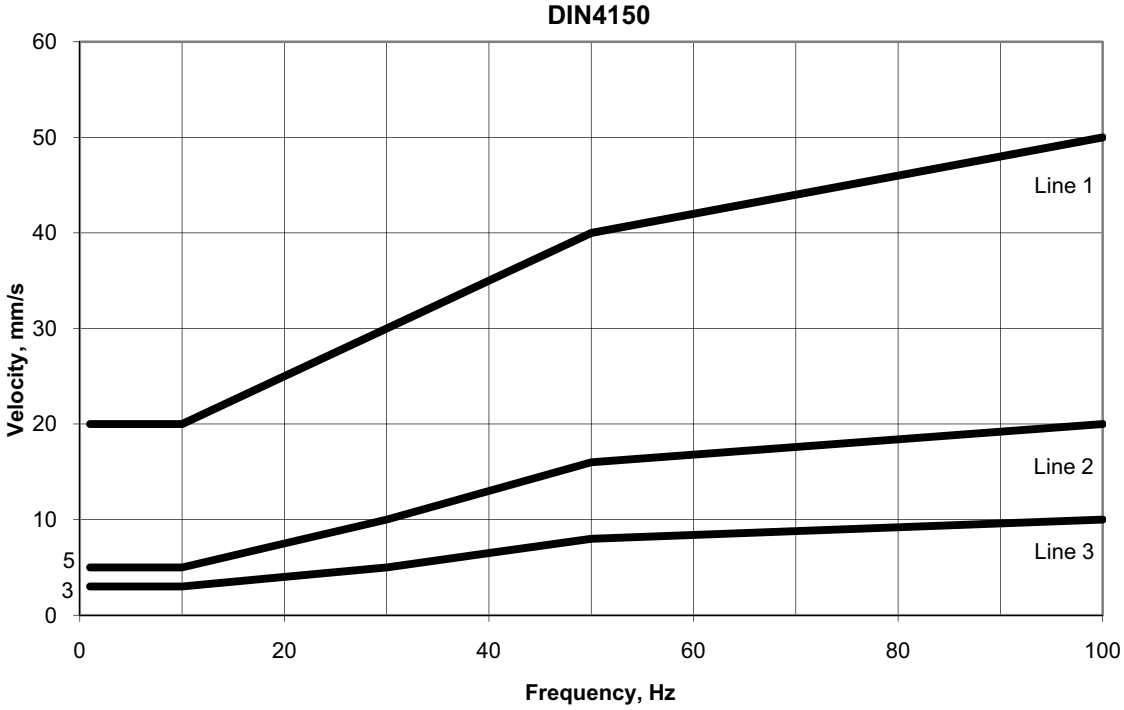



**Figure 2.1 DIN4150 structural vibration safe limits for buildings**

## 2.3 Road noise criteria

### 2.3.1 Assessment criteria

The principle guidance to assess the impact of road traffic noise on noise sensitive receptors is in the NSW EPA's *Road Noise Policy* (RNP, 2011).

The freeway/arterial/sub-arterial road type has been adopted for the Golden Highway, while Suzanne Road has considered a local road. Table 2.8 presents the road noise assessment criteria reproduced from Table 3 of the RNP.

**Table 2.8 Road traffic noise assessment criteria for residential land uses**

| Road category | Type of project/development | Assessment criteria, dB(A) | |
|---|---|---|---|
| | | Day (07.00 am to 10.00 pm) | Night (10.00 pm to 07.00 am) |
| Freeway/arterial/sub-arterial roads | Existing residences affected by additional traffic on existing freeway/arterial/sub-arterial roads generated by land use developments. | $L_{eq(15\text{-}hr)}$ 60 (external) | $L_{eq(9\text{-}hr)}$ 55 (external) |
| Local roads | New road corridor/redevelopment of existing road/land use development with the potential to generate additional traffic on existing road. | $L_{eq(1\text{-}hr)}$ 55 (external) | $L_{eq(1\text{-}hr)}$ 50 (external) |

Additionally, the RNP states where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to 2 dB.

### 2.3.2 Relative increase criteria

In addition to meeting the assessment criteria, any increase in total traffic noise at receivers must be considered. Receivers experiencing increases in total traffic noise levels above those presented in Table 2.9 should be considered for mitigation. For projects where the main subject road is a local road, the relative increase criteria do not apply.

**Table 2.9 Relative increase criteria for residential land uses**

| Road Category | Type of project/development | Total traffic noise level increase – dB(A) | |
|---|---|---|---|
| | | Day (07:00-22:00) | Night (22:00 – 07:00) |
| Freeway/arterial/sub-arterial roads and transitways | New road corridor/redevelopment of existing road/land use development with the potential to generate additional traffic on existing road. | Existing traffic $L_{eq(15\text{-}hr)}$+12 dB (external) | Existing traffic $L_{eq(9\text{-}hr)}$+ 12 dB (external) |

# 3 Assessment of Impacts

## 3.1 Quantitative assessment methodology

Noise modelling was based on three-dimensional digitised ground contours of the surrounding land, mine pits and overburden emplacement areas for five stages of the Project. The mine plans represent snapshots, with equipment placed at various locations and heights, representing realistic operating scenarios for each stage of construction. All plant has been modelled as operating simultaneously at full capacity, therefore, the results of the assessment should be considered as conservative.

Noise predictions were carried out using the Brüel and Kjær Predictor Version 8.11 noise prediction software. 'Predictor' calculates total noise levels at receptors from the concurrent operation of multiple noise sources. The model considers factors such as:

- the lateral and vertical location of plant;
- source-to-receptor distances;
- ground effects;
- atmospheric absorption;
- topography of the site and surrounding area; and
- applicable meteorological conditions.

The noise model calculates the $L_{eq}$ noise levels based on $L_{eq}$ sound power inputs for each assessed scenario, described below. Where relevant, modifying factors in accordance with Section 4 of the DECCW INP have been applied. The modelling assessment has adopted calm meteorological conditions (eg winds <0.5m/s) and 3 degree/100m inversions. Calm is representative of day, evening and night (excluding winter) periods, including Sundays. The inversion meteorological condition is representative of out of hours/night works that may occur from 10pm to 7am for winter months.

## 3.2 Results

### 3.2.1 Construction noise

The construction noise modelling results have been completed for proposed activities adjacent to nearest sensitive receivers. The aim of the model was to identify areas where feasible and reasonable mitigation measures are required. Activities 2 and 3 are transient and therefore results represent maximum noise events as each activity passes receivers, rather than continuous noise levels of the event for the duration of the project. It is anticipated several activities may occur concurrently, the model has assessed each task individually, although concurrent activities are not expected to significantly contribute to received noise levels given the likely separation distances between work areas. Receivers not assessed are considered to be outside the noise catchment, where levels are expected to be negligible and inaudible. The following activities were modelled in this assessment and are reproduced in Table A.1:

1. Rail track tie-in to Dunedoo/Gulgong mainline
2. Drilling for blasting of rock

a) Ch11600 to Ch12000 (Fleet J) ;

b) Ch13500 to Ch14600 (Fleet J); and

c) Ch20300 to Ch22500 (Fleet L).

3. Rock crushing and screening operation within the rail corridor at three locations

a) Ch11600 to Ch12000;

b) Ch13500 to Ch14600; and

c) Ch20300 to Ch22500.

4. Operation of concrete batch plant

5. Coal Handling Preparation Plant (CHPP) construction

a) Stripping;

b) Cut and fill;

c) Pavement; and

d) Structural works (buildings).

6. Mine Infrastructure Area (MIA) civil works and construction

a) Stripping;

b) Cut and fill;

c) Pavement; and

d) Structural works (buildings).

7. Castlereagh Highway overpass bridge over rail.

The construction noise impact assessment has adopted the items of equipment presented in Table 3.1 and associated noise emission data, as obtained from the EMM noise database.

**Table 3.1 Construction plant**

| Plant and equipment | Sound power level dB(A), $L_{eq.}$ (re $10^{-12}$ Watts) |
|---|---|
| crane (150t) | 112 |
| excavator (20t) | 104 |
| crane (50t) | 112 |
| scraper (631) | 120[1] |
| loader (936) | 120[1] |
| loader (980) | 116[1] |
| aggregate weigh bin | 108 |

## Table 3.1 Construction plant

| Plant and equipment | Sound power level dB(A), $L_{eq.}$ (re $10^{-12}$ Watts) |
|---|---|
| airtrack drills | 115 |
| articulated dump truck | 108 |
| backhoes | 103 |
| bored pile drilling rig | 115 |
| compactor | 116 |
| compressor | 108 |
| concrete mixing bowl | 99 |
| concrete pump | 113 |
| crusher | 114 |
| dozer (D10) | 122[1] |
| dozer (D11) | 125[1] |
| dozer (D6) | 112[1] |
| dozer (D8) | 119[1] |
| dozer (D9) | 117[1] |
| excavator (25t) | 99 |
| excavator (40t) | 107 |
| flat top truck | 96 |
| Franna crane | 106 |
| generator | 98 |
| grader | 104 |
| Hiab truck | 96 |
| jackhammer | 108[1] |
| light truck | 96 |
| loading agitator | 110 |
| rail track laying/tamping | 117 |
| screen | 114 |
| tipper truck | 102 |
| truck (39t) | 108 |
| vibrating roller | 116 |
| wacker packer | 108 |
| water truck | 96 |
| welding truck | 96 |

*Note: includes + 5 dB modification factor correction.*

Modelled noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence.

Two meteorological conditions have been assessed including calm, representing day/evening and night for all seasons excluding winter, while inversion conditions represent night periods in winter.

### i Rail track tie-in to Dunedoo/Gulgong mainline

Predicted noise level results for the rail track tie in works are presented in Table 3.2.

**Table 3.2 1. Rail track tie-in to Dunedoo/Gulgong mainline**

| Receiver | Predicted Received $L_{eq}$ Noise Level, dB(A) | | ICNG $L_{eq, 15min}$ Criteria, dB(A) |
|---|---|---|---|
| | Calm | Inversion | Out of hours |
| 3006,3008,1004 | 45-<57 | 50-<58 | 35 |
| 3029,1001, 3020-3022,3024, 1031, 3035 | 42-<48 | 45-<50 | |
| 3018,3236 | 40-<42 | 40-<45 | |
| 1002 | 36 | >35-<40 | |

### ii Drilling for blasting of rock

Predicted noise level results for blast hole drilling for Ch11600 to Ch12000 are presented in Table 3.3.

**Table 3.3 2a. Drilling for blasting of rock, Ch11600 to Ch12000**

| Receiver | Predicted Received $L_{eq}$ Noise Level, dB(A) | | ICNG $L_{eq, 15min}$ Criteria, dB(A) |
|---|---|---|---|
| | Calm | Inversion | Out of hours |
| 3063, 5001, 3062 | 40-<43 | 50-<58 | 35 |
| 3065, 3067, 3235, 3066, 3050, 3108, | >35-<40 | 45-<50 | |
| 1046, 5003, 3052, 3051, 1122, 1037, 1072 | <35 | 40-<45 | |
| 1076, 1075, 3021, 3029, 1014, 3024, 3035, 3022, 1058, 1246, 5016, 1031, 1078, 1179, 2097, 3020, 3018, 1094, 1158, 3236, 1242, 1155, 3086, 1039, 1250, 1011, 1013, 1059, 1157, 1156, 1241, 1244, 3177, 1239 | <30 | >35-<40 | |

Predicted noise level results for blast hole drilling for Ch13500 to Ch14600 are presented in Table 3.4.

### Table 3.4 2b. Drilling for blasting of rock, Ch13500 to Ch14600

| Receiver | Predicted Received $L_{eq}$ Noise Level, dB(A) | | ICNG $L_{eq, 15min}$ Criteria, dB(A) |
|---|---|---|---|
| | Calm | Inversion | Out of hours |
| 5001, 3108 | 49-<57 | 50-<58 | 35 |
| 1094, 3062 | <38 | 45-<50 | |
| 1122, 3235, 3067, 5003, 3050, 1075, 3066, 3063, 1046, 1072 | 30-<37 | 40-<45 | |
| 1058, 3065, 1059, 1158, 3177, 1179, 1180, 1155, 1157, 1246, 1156, 1251, 1037, 1199, 3086, 3052, 1178, 3051, 1242, 1014, 1200, 1241, 3035, 3021, 3024, 1011, 3022, 3236, 3018, 3029, 2097, 3020, 1013, 1031, 1198 | <30-<35 | >35-<40 | |

Predicted noise level results for blast hole drilling for Ch20300 to Ch22500 are presented in Table 3.5.

### Table 3.5 2c. Drilling for blasting of rock, Ch20300 to Ch22500

| Receiver | Predicted Received $L_{eq}$ Noise Level, dB(A) | | ICNG $L_{eq, 15min}$ Criteria, dB(A) |
|---|---|---|---|
| | Calm | Inversion | Out of hours |
| 3086, 3108, 5001 | <46 | 45-<50 | 35 |
| 1246, 1072, 1252, 1242, 3063, 3066, 3067, 3065, 3235, 3062, 3177, 1243, 1239, 1251 | 30-<36 | 40-<45 | |
| 1046, 3050, 3051, 1122, 1180, 3052, 1037, 1198, 1199, 5003, 1250, 1238, 1253, 1089, 1244, 1088, 1094, 1241, 3035, 5006 | <30-<35 | >35-<40 | |

## iii Rock crushing

Predicted noise level results for rock crushing are presented in Table 3.6 for three areas of the rail spur alignment.

### Table 3.6 3. Rock crushing

| Receiver | Predicted Received $L_{eq}$ Noise Level, dB(A) | | ICNG $L_{eq, 15min}$ Criteria, dB(A) |
|---|---|---|---|
| | Calm | Inversion | Out of hours |
| **3a. Rock crushing Ch11600 to Ch12000** | | | |
| 5001 | 28 | 36 | 35 |
| 5003 | 20 | 36 | |

### Table 3.6 3. Rock crushing

| Receiver | Predicted Received $L_{eq}$ Noise Level, dB(A) | | ICNG $L_{eq, 15min}$ Criteria, dB(A) |
|---|---|---|---|
| | Calm | Inversion | Out of hours |
| **3b. Rock crushing Ch13500 to Ch14600** | | | |
| 5001 | 45 | 48 | 35 |
| 5003 | 31 | 39 | |
| 3108 | 36 | 38 | |
| **3c. Rock crushing Ch20300 to Ch22500** | | | |
| All | <30 | <30 | 35 |

## iv Operation of concrete batch plant

Results of batch plant operation are presented in Table 3.7.

### Table 3.7 4. Concrete batch plant operation

| Receiver | Predicted Received $L_{eq}$ Noise Level, dB(A) | | ICNG $L_{eq, 15min}$ Criteria, dB(A) |
|---|---|---|---|
| | Calm | Inversion | Out of hours |
| All | <20 | <30 | 35 |

## v Coal Handling Preparation Plant (CHPP) construction

Predicted noise level results for the construction of the CHPP for three tasks including, stripping, cut and fill and paving operations are presented in Table 3.8.

### Table 3.8 5. CHPP construction

| Receiver | Predicted Received $L_{eq}$ Noise Level, dB(A) | | ICNG $L_{eq, 15min}$ Criteria, dB(A) |
|---|---|---|---|
| | Calm | Inversion | Out of hours |
| **5a. Stripping** | | | |
| 3177, 1180,1213,1198 | <30 | >35-<40 | 35 |
| **Cut and fill** | | | |
| 3177, | 31 | 41 | 35 |
| 1180,1213,1198,1199,3218, 3108 | <30 | >35-<40 | |
| **5b. Pavement** | | | |
| 3177 | 31 | 41 | 35 |
| 1180,1213,1198,1199,3218, | <30 | >35-<40 | |
| **5c. Structural (buildings)** | | | |
| All | <20 | <25 | 35 |

### vi Mine Infrastructure Area (MIA) civil works and construction

Predicted noise level results for the construction and civil works associated with the MIA are presented in Table 3.9.

**Table 3.9 6. MIA Civil works and construction**

| Receiver | Predicted Received $L_{eq}$ Noise Level, dB(A) | | ICNG $L_{eq, 15min}$ Criteria, dB(A) |
|---|---|---|---|
| | Calm | Inversion | Out of hours |
| **6a. Stripping** | | | |
| 3177,1180,1199,1198,1213, 3218,1178 | <30 | >35-<40 | 35 |
| **6b. Cut and fill** | | | |
| 3177 | <30 | 40 | 35 |
| 1180,1199,1198,1213,3218 1178,3224,1215,1223,1222, | <30 | >35-<40 | |
| **6c. Pavement** | | | |
| 3177, 1180,1198,1199,1213 | <35 | 40-<45 | 35 |
| 3218,1178,1215,3224,1200, 1223,1222, 3108 | <30 | >35-<40 | |
| **6d. Structural (buildings)** | | | |
| All | <20 | <25 | 35 |

### vii Castlereagh Highway overpass (bridge over rail)

Predicted noise level results for the construction of the Castlereagh Highway overpass are presented in Table 3.10.

**Table 3.10 7. Castlereagh Highway overpass construction**

| Receiver | Predicted Received $L_{eq}$ Noise Level, dB(A) | | ICNG $L_{eq, 15min}$ Criteria, dB(A) |
|---|---|---|---|
| | Calm | Inversion | Out of hours |
| 3021,3022,3024,3035 | 40-<43 | 40-<45 | 35 |
| 3020 | 38 | 39 | |

## 3.2.2 Summary

Table 3.11 summarises each event per assessment period and identifies where reasonable and feasible mitigation would be required. It is noted that all activities with the exception of 3c, 4, 5d and 6d require reasonable and feasible mitigation to reduce noise impact, particularly if carried out at night under inversion meteorological conditions.

### Table 3.11 Summary of required reasonable and feasible mitigation

| | Activity | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Period** | **1** | **2a** | **2b** | **2c** | **3a** | **3b** | **3c** | **4** | **5a** | **5b** | **5c** | **5d** | **6a** | **6b** | **6c** | **6d** | **7** |
| Day | * | * | * | * | √ | * | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | * |
| Evening | * | * | * | * | √ | * | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | * |
| Night | * | * | * | * | √ | * | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | * |
| Night (Winter) | * | * | * | * | * | * | √ | √ | * | * | * | √ | * | * | * | √ | * |

*Note : * denotes reasonable and feasible mitigation to be considered for activity during this assessment period, . √ identifies compliance achieved without reasonable and feasible mitigation.*

## 3.3 Sleep disturbance

People asleep in their homes may be disturbed by intermittent construction noises, such as bulldozer track plates and reversing alarms. Typical noise levels from the loudest of these events are presented in Table 3.12 which has been obtained from measurements undertaken on similar projects.

### Table 3.12 Maximum noise from intermittent sources

| **Noise source** | **Measured $L_{max}$ noise level, dB(A)** |
|---|---|
| Dump truck | 125 |
| Reverse alarm | 105–115 (with maximum modifying factor adjustment) |
| Bulldozer with reversing alarm | 115 |

Table 3.12 indicates the highest maximum noise levels expected at homes would likely result from haul trucks or rail pass-by noise. The maximum (at source) sound power level of unmitigated dump trucks has previously been measured to be typically 125 dB(A)$L_{max}$. Maximum noise levels at each residence were calculated under adverse meteorological conditions.

Predicted $L_{max}$ noise levels from trucks at receptors were based on the typical equipment positions used for proposed OOH construction. Predictions were based on a single event for each activity, rather than the simultaneous operation of a number of plant items, because of the low probability of more than one maximum noise event occurring concurrently. The criterion used to assess sleep disturbance is based on the EPA's 'background noise level plus 15 dB' criteria for maximum ($L_{max}$) noise sources.

Results of the sleep disturbance assessment for all OOH activities are presented in Table 3.13 and identifies that there is an exceedance of the sleep disturbance criteria during rail track tie in works and during the Castlereagh Highway overpass bridge construction. It is recommended that receivers in close proximity to these activities be considered for reasonable and feasible management strategies and/or temporary accommodation. Also, a marginal 2dB exceedance is predicted for drilling and crushing works at CH13500 to Ch14600.

**Table 3.13 Sleep disturbance results**

| Receiver | Predicted received $L_{max}$ noise level, dB(A), inversion | $L_{max}$ Criteria, dB(A) |
|---|---|---|
| **Rail track tie-in** | | |
| 3006 | **49** | 45 |
| **Drilling and crushing at Ch11600 to Ch12000** | | |
| All receivers | <40 | 45 |
| **Drilling and crushing at Ch13500 to Ch14600** | | |
| 5001 | **47** | 45 |
| **Drilling and crushing at Ch20300 to Ch22500** | | |
| All receivers | <40 | 45 |
| **Concrete batching plant** | | |
| All receivers | <40 | 45 |
| **Coal Handling Preparation Plant (CHPP) construction** | | |
| All receivers | <40 | 45 |
| **Concrete batching plant** | | |
| All receivers | <40 | 45 |
| **Mine infrastructure area (MIA) construction** | | |
| All receivers | <40 | 45 |
| **Castlereagh Highway overpass bridge over rail** | | |
| 3021 | **51** | 45 |
| 3022 | **51** | |
| 3024 | **50** | |
| 3035 | **50** | |
| 3020 | **46** | |

## 3.4 Road traffic noise

### 3.4.1 Construction road traffic noise

During construction, the Project will generate vehicle traffic movements from both the workforce and site visitors. These are expected to occur mainly during daytime hours and utilise the Spring Ridge Road entrance to site. A breakdown of vehicles associated with construction activities is as follows:

- 101 light trips each way will be associated with workers commuting from other regional centres each day;
- 38 each way trips will be associated with site visitors from other regional centres each day;
- 100 truck deliveries to the worksites will be required each day;
- 40 trips per day each way associated with service (eg food, drink, laundry, cleaning) staff car traffic movements;

- 18 truck deliveries a day will be associated with water supply and waste water removal;
- one bus trip each way a day for the fly-in-fly-out workforce; and
- 40 light trips each way a day for the drive-in-drive-out workforce.

For the calculation of road traffic noise, vehicles accessing the south eastern construction areas have been assessed assuming access via Suzanne Road. For a worst case assessment all construction vehicles have been included to travel to site via this route in a one hour period. This is highly conservative as the majority of vehicles will access the site via Spring Ridge Road and be spread out over several hours throughout a day or night period.

The results of the construction traffic noise assessment have assumed vehicles travelling to south east construction zones of the Project via Suzanne Road, which has been classed as a local road, nearest to receiver 3062. This route will allow for access to several construction sites, such as bridge works, rail spur, power easements and intersection alignments. It is noted that an assessment for construction traffic to the north of the site via Spring Ridge road has not been completed, as receivers are situated at distances of greater than 2km to Spring Ridge and as a results road traffic noise is anticipated to be negligible. Results for Suzanne Road are presented in Table 3.14.

**Table 3.14 Construction road traffic noise levels at Suzanne Road receptors**

| Distance to nearest privately owned receptor (m) | Assessment criterion | Calculated construction traffic noise |
|---|---|---|
| | **Day $L_{eq(1\text{-}hour)}$, dB(A)** | |
| 425 (3062) | 55 | 49.6 |
| | **Night $L_{eq(1\text{-}hour)}$, dB(A)** | |
| 425 (3062) | 50 | 49.6 |

*Note: existing traffic flows along Suzanne Road are expected to be negligible <10/hr.*

## 3.5 Construction vibration levels

### 3.5.1 Human vibration exposure

Generally, there is a low probability of adverse comment or disturbance to building occupants for impact hammering for distances of up to 50 metres allowing for regular respite periods. Historic data from similar projects identifies that vibration levels at this distance are likely to be 0.2 $m/s^{1.75}$ VDV, equivalent to the daytime criterion value.

The human exposure criteria for vibration is not expected to be exceeded at the nearest receiver to construction since they are over 100m from works, where levels are extrapolated to be below $0.1m/s^{1.75}$, and therefore below even the night time criterion.

### 3.5.2 Structural vibration

Compaction associated with non-vibratory rollers, whackers, jackhammers and steel plate installation will be localised and attenuate rapidly with distance, and typically are not significant enough to generate vibration levels that would attribute to structural vibration. Note vibratory rollers have not been considered in this assessment although historically vibratory compaction remains below sensitive receiver criteria (3mm/s) when buffer distances of 30 metres or more are adopted.

# 4 Noise management strategy

## 4.1 Overall approach

The primary objective of the noise and vibration management strategy is to minimise noise impacts on the surrounding community. The Project will adopt the following hierarchical strategy to achieve this objective:

- ensure that construction activities meet construction noise goals within the allowable hours of operation as far as practicable;
- where noise levels are above relevant goals, implement reasonable and feasible best practice noise controls to minimise noise emissions and/or exposure duration at affected receivers; and
- where the use of best practice noise controls do not adequately address exceedance of noise goals, adopt alternative measures to minimise impacts on the community.

## 4.2 Construction hours

### 4.2.1 Out of hours construction

Any request to vary the hours of construction activities as identified above shall be:

- considered on a case by case basis or activity-specific basis;
- accompanied by details of the nature and need for activities to be undertaken during the varied construction hours; and
- accompanied by written evidence that activities undertaken during the varied construction hours are strongly justified; appropriate consultation with potentially affected receivers and notification of the relevant regulatory authorities has occurred; and all practicable and reasonable mitigation measures will be put in place.

## 4.3 Construction noise management and mitigation

Australian Standard AS 2436-1981 "*Guide to Noise Control on Construction, Maintenance and Demolition Sites*" sets out numerous practical recommendations to assist in mitigating construction noise emissions. Recommendations provided in this standard include operational strategies, source noise control strategies, noise barrier controls, and community consultation.

It is estimated that adopting strategies contained in this standard may result in the following noise attenuation:

- up to 10 dB(A) where space requirements place limitations on the attenuation options available; and
- up to 20 dB(A) in situations where noise source noise mitigation measures (silencers, mufflers, etc) can be combined with noise barriers and other management techniques.

Should compliance noise monitoring indicate exceedances of the noise criteria, a combination of comprehensive noise mitigation treatments (i.e. noise barriers, equipment enclosures, silencers, regular equipment maintenance, etc) and consultation with the local communities will be considered to manage exceedances. Further descriptions of management measures and mitigation options are provided for specific construction activities and work areas in the following sections. General noise mitigation and management measures are included in Table 4.1.

### 4.3.1 Rail track tie-in to Dunedoo/Gulgong mainline

Special consideration is needed for several activities where night works are unavoidable. During these periods, the following strategies will be considered:

During rail track tie-in works, the following mitigation strategies to manage noise include:

- where possible, tamping of tracks is to be undertaken during day or evening hours;
- the position of cranes will be oriented away from nearby receivers; and
- all equipment will have efficient muffler design and be well-maintained.

### 4.3.2 Drilling of rock

During onsite drilling operations, the following mitigation strategies to manage noise include:

- all plant are to utilise the broadband reverse alarm in lieu of the traditional 'beeper' type reverse alarm;
- drilling is to be orientated away from sensitive receivers and use localised barriers around rig's where possible; and
- delivery of material is recommended to be restricted to day time hours.

### 4.3.3 Rock crushing

During crushing, the following mitigation strategies to manage noise include:

- all crushing and screening plant are to be positioned within stockpiles so that their line of site is blocked to nearby sensitive receivers; and
- all plant are to utilise the broadband reverse alarm in lieu of the traditional 'beeper' type reverse alarm.

### 4.3.4 Concrete batching plant

The concrete batching plant is identified to achieve the OOH criteria, notwithstanding, aggregate and cement deliveries should be undertaken during daytime periods to minimise impacts on surrounding receivers.

### 4.3.5 CHPP and MIA construction

During construction works associated with the CHPP, the following mitigation strategies to manage noise include:

- all equipment will have efficient muffler design and be well-maintained;
- all deliveries of construction material to occur during daytime hours; and
- all plant are to utilise the broadband reverse alarm in lieu of the traditional 'beeper' type reverse alarm.

### 4.3.6 Additional management and monitoring

- consultation with immediately adjacent residences to proposed works will include letter box drops and verbal communication at least 1 week prior to works;
- representative noise monitoring during all works between the hours of 10pm to 7am; and
- provision for alternate accommodation for people with special needs or health issues where nights work is scheduled to occur within close proximity to receivers, in particular for receivers identified to be above the sleep disturbance criteria (Table 3.13).

## Table 4.1 Noise and vibration management and mitigation measures

| Management measures | Responsibility | Timing |
|---|---|---|
| **Out of hours works** | | |
| Where audible construction is proposed to be undertaken out of the approved hours (as above), an out of hours application will be completed, following the "out of hours" procedures. | Project Manager / Contractor | As required |
| Notification of "out of hours" works is to be provided to potentially affected stakeholders at the earliest possible time (at least one week) prior to works commencing, unless works are required in the event of a direction from police or other relevant authority for safety reasons or where required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm. | Project Manager | As required |
| Attended noise monitoring is to be undertaken for a representative sample (plant type, activity and time of night) of all out of hours work | Acoustic Specialist or Suitably Qualified and trained Environment Officer | As required |
| **Community and stakeholder liaison** | | |
| Communities and stakeholders who are likely to be directly impacted by construction will be provided with detailed information on the nature and timing of the proposed works. | Project Manager | At least 1 week prior to construction |
| **General construction operations** | | |
| Where possible, machinery will be located / orientated to direct noise away from any sensitive receivers. | Contractor / Subcontractor | As required |
| Undertake regular maintenance of machinery to minimise noise emissions. Maintenance will be confined to standard daytime construction hours and where possible, away from noise sensitive receivers. | Contractor / Subcontractor | At all times/ Where possible |
| The quietest suitable machinery reasonably available will be selected for each work activity. | Contractor / Subcontractor | As required |
| All machinery will have efficient muffler design and be well-maintained | Contractor / Subcontractor | At all times |
| The offset distance between noisy items of plant/machinery and nearby sensitive receivers will be maximised. | Contractor / Subcontractor | At all times |
| Where practicable, ensure that noisy plant/machinery are not working together simultaneously in close proximity to sensitive receivers. | Contractor / Subcontractor | At all times |

## Table 4.1 Noise and vibration management and mitigation measures

| Management measures | Responsibility | Timing |
|---|---|---|
| **Trucking operations** | | |
| Trucks will adhere to the designated speed limits in and around the Project. | Contractor / Subcontractor | At all times |
| Trucks will refrain from using compression breaking where possible. | Contractor / Subcontractor | At all times |
| Alternatives to traditional 'beeper' type reverse alarm will be utilised. | Contractor / Subcontractor | As required |
| **Monitoring and reporting** | | |
| Construction noise levels will be monitored within representative sensitive areas to determine compliance with relevant noise criteria, taking into account any adjustments for impulsive or tonal noise characteristics. Should monitoring indicate exceedances reasonable and feasible best available additional mitigation measures would be considered and implemented. | Acoustic Specialist or Suitably Qualified and trained Environment Officer | Early in construction period, as required |
| Ongoing spot checks of noise-intensive plant and equipment will be undertaken. | Acoustic Specialist or Suitably Qualified and trained Environment Officer | As required / Ongoing |
| **Training** | | |
| All contractors and staff will undergo noise awareness training as part of the Project induction | Project Manager / Foremen | Pre-Construction |

# 5 Noise monitoring

To ensure that management strategies provided to minimise noise emissions are carried out, a noise monitoring program has been developed to guide, manage, quantify and control noise emissions from construction activities. Where monitoring indicates exceedances, additional mitigation measures and controls may be considered to minimise impacts to nearby sensitive receptors.

The objectives of the noise monitoring program are as follows:

- assess construction noise levels against derived construction noise criteria, with consideration given to non-site related ambient and background noise at the time of measurements;
- identify potential noise sources and their relative contribution to noise impacts from construction;
- specify appropriate intervals for noise monitoring to evaluate, assess and report the noise contribution due to construction;
- outline the methodologies to be adopted for monitoring construction noise, including justification for monitoring intervals or triggers, weather conditions, monitoring location selection and timing; and
- incorporate noise management and mitigation strategies outlined in this plan.

## 5.1 General noise measurement procedures

The noise measurement procedures adopted for the Project shall be in accordance with AS 1055-1997 "*Acoustics - Description and Measurement of Environmental Noise*" and the DECCW's *Environmental Noise Control Manual* (1994) and be guided by the ICNG.

### 5.1.1 Monitoring equipment

All acoustic instrumentation used in the monitoring of construction should comply with the requirements of AS IEC 61672.1-2004 and carries current NATA or manufacturer calibration certificates. All instrumentation shall be programmed to record statistical noise level indices in 15 minute or lower intervals which may include the $L_{Amax}$, $L_{A1}$, $L_{A10}$, $L_{A90}$, $L_{Amin}$ and the $L_{Aeq}$.

The statistical noise exceedance levels ($L_{An}$) are the levels exceeded for n% of the 15 minute or other interval. The $L_{A90}$ represents the level exceeded for 90% of the interval period and is referred to as the average minimum or background noise level. The $L_{A10}$ is the level exceeded for 10% of the time and is usually referred to as the average maximum noise level. The $L_{Aeq}$ is the equivalent continuous sound pressure level and represents the steady sound level which is equal in energy to the fluctuating level over the interval period. The $L_{Amax}$ is the maximum noise level recorded over the interval.

Instrument calibration shall be checked before and after each measurement survey, ensuring a valid variation in calibrated levels not exceeding ±0.5 dBA.

## 5.2 Noise monitoring approach

Noise monitoring will be undertaken by a suitably qualified acoustic specialist or suitably qualified and trained environment officer.

Noise monitoring will be carried out at the nearest sensitive receivers, but not limited to, those summarised in this report.

Where ambient noise is a significant feature of the noise environment at the monitoring location, and the relative construction noise contribution cannot be quantified, interim monitoring locations may be selected so that the construction noise is clearly audible above the background noise level. Using this methodology, $L_{Aeq,15min}$ noise levels can be estimated back to the receiver using distance attenuation calculations, and compared with construction criteria.

### 5.2.1 Operator attended noise surveys

Operator attended noise measurements will be conducted at the potentially most affected receiver locations or representative thereof, relevant to the construction activities at the time of monitoring. Attended noise measurements are conducted to quantify noise emissions and estimate the $L_{Aeq,15min}$ noise contribution from construction activities with respect to the overall level of ambient noise. Importantly, the background and ambient noise levels at that time and in the absence of site contribution will also be quantified. These measurements will be conducted by suitably qualified acoustic specialist.

Ongoing monitoring may be undertaken on a regular basis for the duration of construction at selected sites depending on noise sensitivity.

The operator shall quantify and characterise the maximum ($L_{Amax}$) and equivalent ($L_{Aeq}$) noise levels from both extraneous (non-site) and construction noise sources over a period of 15 minutes for representative potentially affected receivers.

A site layout, outlining the locations of construction equipment, is to be included in noise monitoring reports.

#### i Characteristics of construction noise

Where relevant the operator will identify and quantify relevant modifying factor corrections (including such corrections for tonality, low frequencies, impulsive and intermittent noise) associated with construction, the corrections factors are to be applied in accordance with Section 4 (and Table 4.1) of the DECCW's INP.

#### ii Monitoring in response to stakeholder feedback

Additional monitoring may be undertaken in the event of stakeholder feedback regarding noise levels, in the form of a noise complaint or consultation with a government authority.

The Environment Manager or member of the team would liaise with the Community and Stakeholder Manager and Site Superintendent to determine the likely cause of the complaint or background to concerns raised by other stakeholders. If deemed necessary, attended monitoring would be undertaken to assess the noise level for comparison to the construction noise goals, with consideration given to non-site related ambient and background noise at the time of measurements.

Where the measured (or otherwise determined) noise level contribution from site is above the specified noise goal, (with consideration given to non-site related ambient and background noise at the time of measurements) additional noise mitigation will be considered where reasonable and feasible.

## 5.3 Training

All personnel involved in monitoring noise and vibration levels will be adequately trained and up to date with relevant measurement standards, methodologies and product technology with respect to noise and vibration measurements.

## 5.4 Noise non compliance management

Where monitoring identifies exceedances of the relevant criteria at receivers, noise mitigation and management will be critical in minimising noise impacts and need to be identified during noise measurements. Identified exceedances must be reported to the Project Manager immediately.

The Project Manager will, where reasonable and feasible, apply best practice innovative noise mitigation measures to construction work sites where construction noise goals are consistently exceeded and complaints are received.

Australian Standard AS 2436-1981 "*Guide to Noise Control on Construction, Maintenance and Demolition Sites*" sets out numerous practical recommendations to assist in mitigating construction noise emissions. Recommendations provided in this standard include operational strategies, source noise control strategies, noise barrier controls and community consultation.

## 5.5 Monitoring, auditing and reporting program

Regular monitoring, auditing and reporting will be undertaken in accordance with specifications of the CNVMP. These are described further in the following sections.

### 5.5.1 Auditing

Regular internal audits for compliance against the construction noise criteria will be undertaken by the Project Manager every six months. These will include auditing:

- Monitoring reports;
- Environmental mitigative measures specified in this CNVMP are implemented and operated in accordance with relevant procedures;
- Daily, weekly and routine environmental checklists are kept and maintained and have been actioned as necessary;
- Environmental and site induction records are in order; and
- Reports such as Management Reports and Incident Reports are being recorded and acted on.

Audits of site environmental performance will also assess the appropriateness and effectiveness of specified controls and identify potential improvements.

### 5.5.2 Reporting

#### i Reporting of monitoring results

Reporting of monitoring will include the following:

- Monitoring location(s);
- List of operating plant and equipment;
- Measured noise and/or vibration levels from construction;
- Overall ambient noise levels;
- Comparison of results with relevant construction goals;
- Monitoring equipment details;
- Weather conditions; and
- Comments specific to each site.

Monitoring shall be reported to the Project Manager on a regular basis for compliance and corrective action if required. Monitoring reports will be kept within the Project filling system and a hard copy on site.

In the event of an exceedance of the relevant noise criteria the Project Manager shall be promptly informed of the location, the margin of exceedance and the source of exceedance.

Additional noise measurement methods such as near field monitoring may be utilised to investigate noise emissions in relation to noise complaints, or to determine compliance with the noise goals where potential non-compliances have been identified or are difficult to quantify from operator-attended noise measurements at the receiver.

All monitoring results will be documented and reported in regular intervals.

#### ii Compliance reporting

Compliance reports, reporting on compliance against the construction noise criteria, will be prepared and submitted to the Project Manager as required. Compliance reports will include a summary of the information listed in the preceding sections, specifically issues or non-compliances and the response or management of the issues and non-compliances.

## Table 5.1 Monitoring, inspections, auditing and reporting

| Activity | Location | Purpose | Resources | Responsibility | Timing / Frequency | Reported to |
|---|---|---|---|---|---|---|
| General observation of noisy plant/equipment | At plant/equipment | Ensure plant running correctly, identify noisy plant requiring maintenance | - | Contractor | Daily | Contractor |
| Attended noise surveys – early construction | Impacted representative sensitive receivers | Compliance with noise goals | Acoustic Measurement Survey Sheet | Acoustic Specialist / Environmental Officer | Early in construction phase for selected work sites | Project Manager |
| Attended noise surveys – out of hours work | Impacted representative sensitive receivers | Compliance with noise goals | Acoustic Measurement Survey Sheet | Acoustic Specialist / Environmental Officer | Representative sample of all night works | Project Manager |
| Internal Audits | Project office, site offices | Audit for compliance against the noise criteria and relevant statutory requirements | Audit Form | Acoustic Specialist / Environmental Officer | Six Monthly | Project Manager |

# 6 Conclusion

EMM has completed a Construction Noise and Vibration Management Plan (CNVMP) for the Cobbora Coal Project (the Project).

The results of the quantitative assessment indicate that noise emissions from OOH construction activities in some cases, have the potential to generate noise levels above OOH criteria. The noise management recommendations provided in this report should be adopted to minimise the noise impacts on residences especially during out of hours work.

Vibration emissions are not expected to generate structural damage for the assessed minimum offset distances.

Traffic generation associated with construction is expected to remain below the relevant RNP criteria for all receivers. Notwithstanding, delivery of materials should be restricted to daytime hours where possible.

# References


Australian Standards 2006, AS2187-2: Explosives – Storage and use Part 2: Use of explosives.

Australian Standard AS 2436-1981 "*Guide to Noise Control on Construction, Maintenance and Demolition Sites*".

German Standard DIN 4150 - Part 3: 1999.

NSW Department of Environment and Climate Change, 2009, *Interim Construction Noise Guideline.*

NSW Environment Protection Authority (EPA) 2000, *NSW Industrial Noise Policy*.

NSW Roads and Traffic Authority (NSW RTA) 2001, *Noise Management Manual*.

NSW Environmental Protection Authority (EPA) 2011, *Road Noise Policy*.

NSW Environmental Protection Authority and Department of Planning and Infrastructure (EPA and DP&I) 2007, *The Interim Guideline for Assessment of Noise from Rail Infrastructure Projects.*

NSW Environmental Protection Authority (EPA) 2006, *Assessing Vibration: A Technical Guideline.*

NSW Environmental Protection Authority (EPA) 1999, *Environmental Criteria for Road Traffic Noise*.

# Appendix A

## Activity and plant inventory

The following activities were modelled in this assessment and are reproduced in Table A.1:

1. Rail track tie-in to Dunedoo/Gulgong mainline
2. Drilling for blasting of rock
    a) Ch11600 to Ch12000 (Fleet J) ;
    b) Ch13500 to Ch14600 (Fleet J); and
    c) Ch20300 to Ch22500 (Fleet L).
3. Rock crushing and screening operation within the rail corridor at three locations
    a) Ch11600 to Ch12000;
    b) Ch13500 to Ch14600; and
    c) Ch20300 to Ch22500.
4. Operation of concrete batch plant
5. Coal Handling Preparation Plant (CHPP) construction
    a) Stripping;
    b) Cut and fill;
    c) Pavement; and
    d) Structural works.
6. Mine Infrastructure Area (MIA) civil works and construction
    a) Stripping;
    b) Cut and fill;
    c) Pavement; and
    d) Structural works.
7. Castlereagh Highway overpass bridge over rail

## Table A.1 Modelled plant items per activity

| Activity/equipment | Leq Sound power level, dB(A). | Activity | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 Fleet J and L | 3 a | 3 b | 3 c | 4 | 5 a | 5 b | 5 c | 5 d | 6 a | 6 b | 6 c | 6 d | 7 |
| crane (150t) | 112 | | | | | | | | | | √ | | | | √ | √ |
| excavator (20t) | 104 | | | √ | √ | √ | | | | √ | | | | √ | | √ |
| crane (50t) | 112 | √ | | | | | | | | | | | | | | |
| scraper (631) | 120 | | | | | | | √ | √ | | | √ | √ | | | |
| loader (936) | 127 | √ | | | | | | | | √ | | | | √ | | |
| loader (980) | 116 | | | √ | √ | √ | | | | | | | | | | |
| aggregate weigh bin | 108 | | | | | | √ | | | | | | | | | |
| airtrack drills | 115 | | √ | | | | | | | | | | | | | |
| articulated dump truck | 108 | | √ | √ | √ | √ | | | | √ | | | | √ | | |
| backhoes | 103 | | | | | | | | | √ | | | | √ | | |
| bored pile drilling rig | 115 | | | | | | | | | | | | | | | √ |
| compactor | 116 | | √ | √ | √ | √ | | | √ | | | | √ | | | |
| compressor | 108 | | √ | | | | | | | √ | √ | | | √ | √ | √ |
| concrete mixing bowl | 99 | | | | | | √ | | | | | | | | | |
| concrete pump | 113 | | | | | | | | | | | | | | | √ |
| crusher | 114 | | | √ | √ | √ | | | | | | | | | | |
| dozer (D10) | 122[1] | | | | | | | | √ | | | | √ | | | |
| dozer (D11) | 125[1] | | √ | | | | | | | | | | | | | |
| dozer (D6) | 112[1] | | | √ | √ | √ | | | | | | | | | | |
| dozer (D8) | 119[1] | | | | | | | | √ | | | | √ | | | |
| dozer (D9) | 117[1] | | | | | | | √ | | | | √ | | | | |
| excavator (25t) | 99 | √ | | | | | | | | | | | | | | |
| excavator (40t) | 107 | | √ | | | | | | | | | | | | | |

## Table A.1 Modelled plant items per activity

| Activity/equipment | Leq Sound power level, dB(A). | Activity | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 Fleet J and L | 3 a | 3 b | 3 c | 4 | 5 a | 5 b | 5 c | 5 d | 6 a | 6 b | 6 c | 6 d | 7 |
| flat top truck | 96 | | | | | | | | | √ | | | | √ | | |
| Franna crane | 106 | √ | | | | | | | | √ | √ | | | √ | √ | √ |
| generator | 98 | | | | | | | | | √ | √ | | | √ | √ | √ |
| grader | 104 | | √ | √ | √ | √ | | | √ | √ | | | √ | √ | | |
| Hiab truck | 96 | | | | | | | | | √ | | | | √ | | √ |
| jackhammer | 108 | | | | | | | | | | | | | | | √ |
| light truck | 96 | √ | √ | | | | | | | √ | √ | | | √ | √ | |
| loading agitator | 110 | | | | | | √ | | | | | | | | | |
| rail track laying/tamping | 117 | √ | | | | | | | | | | | | | | |
| screen | 114 | | | √ | √ | √ | | | | | | | | | | |
| tipper truck | 102 | | | | | | | | | √ | | | | √ | | √ |
| truck (39t) | 108 | | | | | | | | | | | | | | | |
| vibrating roller | 116 | | | √ | √ | √ | | | | √ | | | | √ | | |
| wacker packer | 108 | | | | | | | | | √ | | | | √ | | |
| water truck | 96 | | | √ | √ | √ | | | √ | √ | | | √ | √ | | |
| welding truck | 96 | √ | | | | | | | | | | | | | | √ |

*Note: includes + 5 dB modification facto correction.*

# Appendix B

## Glossary and definitions

## B.1 Glossary and definitions

A number of technical terms are required for the discussion of noise. These are explained in Table B.1, along with other terms used in this report.

**Table B.1 Glossary of acoustic**

| Term | Description |
|---|---|
| ABL | The assessment background level (ABL) is defined in the INP as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L90 statistical noise levels. |
| Day period[1] | Monday–Saturday: 7.00 am to 6.00 pm, and on Sundays and public holidays: 8.00 am to 6.00 pm. |
| dB(A) | Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear. |
| ECRTN | *Environmental Criteria for Road Traffic Noise* |
| Evening period[1] | Monday–Saturday: 6.00 pm to 10.00 pm, and on Sundays and public holidays: 6.00 pm to 10.00 pm. |
| INP | Industrial Noise Policy (EPA 2000) |
| $L_1$ | The noise level exceeded for 1% of the time. |
| $L_{10}$ | The noise level which is exceeded 10% of the time. It is roughly equivalent to the average of maximum noise level. |
| $L_{90}$ | The noise level that is exceeded 90% of the time. Commonly referred to as the background noise level. |
| $L_{eq}$ | The energy average noise from a source. This is the equivalent continuous sound pressure level over a given period. The $L_{eq(15min)}$ descriptor refers to an $L_{eq}$ noise level measured over a 15-minute period. |
| $L_{max}$ | The maximum sound pressure level received during a measuring interval. |
| Night period[1] | Monday–Saturday: 10.00 pm to 7.00 am, and on Sundays and public holidays: 10.00 pm to 8.00 am. |
| PSNL | The project-specific noise levels (PSNL) are criteria for a particular industrial noise source or industry. The PSNL is the lower of either the intrusive criteria or amenity criteria. |
| RBL | The rating background level (RBL) is an overall single value background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the average background levels. |
| Sound power level (Lw) | A measure of the total power radiated by a source. The sound power of a source is a fundamental property of the source and is independent of the surrounding environment. |
| Temperature inversion | A meteorological condition where the atmospheric temperature increases with altitude. |

*Note: 1 excludes road traffic noise where Day: 07:00 am – 10:00 pm, Night: 10:00pm to 07:00am.*

To provide greater context to the noise levels discussed in this report, it is useful to have an appreciation of decibels (dB), the unit of noise measurement. Table B.2 provides some practical indication as to what an average person perceives about changes in noise levels.

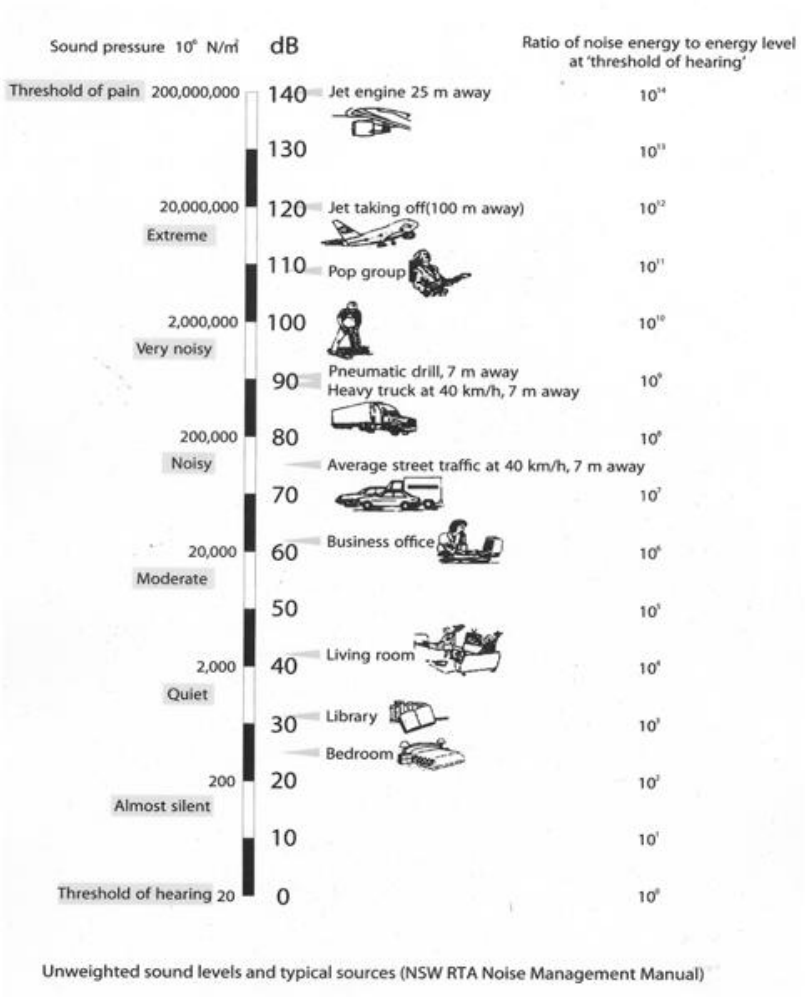
### Table B.2 Perceived change in noise

| Change in sound level (dB) | Perceived change in noise |
|---|---|
| 0-2 | imperceptible |
| 3 | just perceptible |
| 5 | noticeable difference |
| 10 | twice (or half) as loud |
| 15 | large change |
| 20 | four times as loud (or quarter) as loud |

## B.2 Common noise levels

Examples of common noise levels encountered on a daily basis are provided in B.1.

### Figure B.1 Common noise levels




*(Source: NSW RTA Noise Management Manual, 2001)*