PROJECT CHINA STONE

Noise and Vibration 16

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16 NOISE AND VIBRATION

16.1 INTRODUCTION

This section provides a summary of the key findings of the Environmental Impact Statement (EIS) noise and vibration assessment undertaken for Project China Stone (the project) by Bridges Acoustics. The detailed assessment is provided in the *Noise Report* (Appendix M).

16.2 PROJECT SITE AND SENSITIVE RECEPTORS

The terrain in the region is generally flat at around 200 - 300 m Australian Height Datum (AHD) with the exception of Darkies Range which runs north – south along the western edge of the project site. Darkies Range reaches a height of approximately 500 m AHD. Lake Buchanan is located approximately 18 km north-west of the project site.

The main existing land uses in the region are cattle grazing and coal exploration. The region is sparsely populated, with a few isolated homesteads, but no towns or cities are located nearby.

The sensitive receptors considered in this assessment are presented in Table 16-1 and are also shown in Figure 16-1. With the exception of the Dooyne Outstation, the receptors are individual homesteads with the closest (Moonoomoo Homestead) located approximately 7 km from the project site. The Dooyne Outstation is not permanently occupied and is only used intermittently.

In addition to the sensitive receptors listed in Table 16-1, the project also includes an on-site accommodation village. On-site accommodation villages do not meet the definition of a sensitive receptor in accordance with the Department of Environment and Heritage Protection (EHP) Model Mining Conditions. However, the health and wellbeing of workers accommodated at the village has been considered and is discussed in Section 22 – Hazard and Risk.

Table 16-1 Sensitive Receptors

RECEPTOR ID	RECEPTOR NAME	DISTANCE FROM PROJECT SITE	LOCATION (UTM Z55S)	
			Easting (m)	Northing (m)
R1	Moonoomoo Homestead	7.2 km west	402,365	7,584,444
R2	Dooyne Outstation	9.9 km east	432,541	7,588,505
R3	Carmichael Homestead	11.8 km south-west	406,412	7,571,007

16.3 DESCRIPTION OF EXISTING NOISE ENVIRONMENT

The existing acoustic environment is influenced by natural sounds from grazing stock/farm animals, birds and insects, with no industrial noise and minimal traffic noise currently audible at all receptors. The existing noise environment was characterised using data from environmental noise monitoring undertaken for the project (using a combination of long-term monitors and short-term attended measurements) at the monitoring locations shown on Figure 16-1. Measured background noise levels adopted for the project (which form the basis of the noise criteria) are lower than the minimum background of 30 $LA_{90,15min}$ recommended in the *Model Mining Conditions* (EHP 2013) at all times.

16.4 REGULATORY REQUIREMENTS

The EHP has a number of policies and recommended procedures to assess environmental noise levels from various noise source categories. The following policy documents are relevant to this assessment:

- *Environmental Protection Policy (Noise) 1997* and *2008* (EPP Noise);
- Queensland Environmental Protection Agency (EPA) (2004). *Planning for Noise Control Guidelines* (PNCG);
- EPA (2004). *Draft Ecoaccess Guideline for the Assessment of Low Frequency Noise*;
- EHP (2013). *Model Mining Conditions*;
- EPA (2006). *Noise and Vibration from Blasting Guideline* (NVGB);
- EHP (2013). *Noise Measurement Manual, Version 4;* and
- EHP (2014). *Application Requirements for Activities with Noise Impacts*.

16.4.1 Mine Noise

Noise criteria for this assessment have been developed using procedures described in the *Model Mining Conditions*, as shown in Table 16-2.

Table 16-2 Model Mining Conditions EHP (2013) Noise Criteria for All Sensitive Receptors

TIME PERIOD		$LA_{EQ,ADJ,15MIN}$	$LA_{1,ADJ,15MIN}$
Day	7 am to 6 pm	35	40
Evening	6 pm to 10 pm	35	40
Night	10 pm to 7 am	30	35

16.4.2 Sleep Disturbance

Sleep disturbance potentially occurs when short, sharp sounds that intrude above the ambient level can be heard within a bedroom during the night.

The PNCG recommends the maximum indoor sound level should not exceed 45 LA_{max} for more than 10-15 times per night which, according to Table 7 in the PNCG, equates to an outdoor sound level of:

- 47 LA_{max} for windows wide open;
- 52 LA_{max} assuming windows partly closed; and
- 62 LA_{max} with windows fully closed.

The noise criteria assume a 10% probability of awakening and apply at a point 4 m from the façade of a potentially affected residence.

16.4.3 Low Frequency Noise

The *Draft Ecoaccess Guideline for the Assessment of Low Frequency Noise* (EPA 2004) provides a low frequency criterion of 50 dBL for frequencies up to 200 Hz to minimise the potential for impacts on sensitive receptors. The criterion applies inside a dwelling with the windows and doors closed and would be approximately equivalent to a criterion of 60 dBL outside a dwelling.

16.4.4 Cumulative Noise

The *Model Mining Conditions* do not specifically address cumulative noise levels, however it is reasonable to adopt the Critical Values recommended in the *Model Mining Conditions*, as appropriate cumulative noise criteria as shown below:

- 45 $LA_{eq,15min}$ during the day;
- 40 $LA_{eq,15min}$ during the evening; and
- 35 $LA_{eq,15min}$ during the night.

16.4.5 Road Traffic Noise

Noise criteria applying to transportation sources are sourced from Schedule 1 of the EPP Noise (1997), in the absence of equivalent guidance in the later EPP Noise (2008). The EPP Noise (1997) recommends a daytime traffic noise criterion of 63 $LA_{10,18hr}$ for the time period 6am to midnight from a public road (e.g. Moray-Carmichael Road), while state-controlled roads (e.g. the Gregory Developmental Road) have a higher noise criterion of 68 $LA_{10,18hr}$.

All road noise criteria are assessed 1 m in front of the most exposed part of a dwelling or other noise sensitive place.

16.4.6 Blasting – Ground Vibration and Overpressure

Blasting criteria are sourced from the NVBG, which contains the following criteria:

- Ground vibration limits of 5 mm/s Peak Particle Velocity (PPV) for 9 out 10 consecutive blasts, with an absolute limit of 10 mm/s PPV; and
- Noise limit (overpressure) of 115 dBL peak for 9 out of any 10 consecutive blasts, with an absolute limit of 120 dBL peak for all blasts.

Criteria recommended by the NVBG are intended to minimise disturbance to residents and do not specifically consider the potential for building damage. British Standard 7385-2:1993 recommends criteria in the range 15 mm/s to 50 mm/s for light residential and industrial buildings to protect them from minor cosmetic damage, with higher vibration levels required to cause significant structural damage. The recommended disturbance criterion of 5 mm/s therefore provides adequate protection for all rural, residential or industrial structures.

16.5 PREDICTION METHODOLOGY

Environmental noise levels expected to be produced by the project have been calculated using RTA Technology's Environmental Noise Model (ENM) software. ENM is a general purpose noise modelling package that combines terrain and noise source information with other input parameters such as weather conditions to predict noise levels at specific receptor locations or as contours over a specified receptor area. Noise contour figures are presented in the *Noise Report* (Appendix M).

16.5.1 Prevailing Weather Conditions

Weather conditions relevant to the project site were analysed and the weather parameters shown in Table 16-3 were considered in the noise assessment.

Table 16-3 Modelled Weather Conditions

TIME PERIOD	SCENARIO	WEATHER PARAMETER				
		Temperature (°C)	Relative Humidity (%)	Wind Speed (m/s)	Wind Direction	Temperature Gradient (°C/100 m)
Day	Neutral	25	60	0	n/a	-2
	Prevailing Wind	25	60	3	NE	-2
		25	60	3	SE	-2
Evening/Night	Inversion	15	80	0	n/a	3
	Inversion + Wind	15	80	2	NW	3
	Prevailing Wind	15	80	3	N	0
		15	80	3	SE	0
		15	80	3	SSW	0

16.5.2 Operational Noise Sources

Noise levels that will be produced by equipment operating as part of the project have been determined from noise measurements taken at other operating mines. The sound power levels for each noise source together with the source locations are provided in the *Noise Report* (Appendix M). The sound power levels used in the assessment represent maximum noise levels produced by each machine or noise source operating continuously, with no correction for operating duration or duty cycle. The assumed situation is therefore likely to overstate average noise levels and to provide a measure of conservatism.

Project years 5, 10 and 20 have been modelled as these years include open cut mining at the eastern and western limits and at maximum intensity.

16.6 IMPACT ASSESSMENT

16.6.1 Mine Noise

A summary of noise level results at each of the sensitive receptors are shown in Table 16-4 along with the adopted noise criteria reproduced from Table 16-2. Table 16-4 shows predicted noise levels would meet relevant criteria at all sensitive receptors.

Table 16-4 Predicted Project Noise Levels and Noise Criteria LAeq, 15 min

RECEPTOR ID	ASSESSED YEAR	PREDICTED NOISE LEVEL			
		Neutral	Prevailing		
		Day	Day	Evening	Night
R1	5	<25	27	27	27
	15	<25	28	28	28
	20	<25	29	29	29
R2	5	<25	<25	27	27
	15	<25	<25	28	28
	20	<25	<25	29	29
R3	5	<25	<25	<25	<25
	15	<25	26	26	26
	20	<25	26	27	27
Noise Criteria		**35**	**35**	**35**	**30**

All other receptors located further from the project site would receive lower noise levels than the three closest receptors presented in Table 16-4.

16.6.2 Sleep Disturbance

Project related noise sources that have the potential to disturb sleep include vehicle reverse alarms, dozer tracks in reverse, material handling and shovel gate impacts, and train wagon bunching.

The project noise model was used to calculate the maximum noise levels at each sensitive receptor. The noise assessment demonstrated that the predicted noise levels would meet the sleep disturbance criteria described in Section 16.4.2 at all sensitive receptors. The assessment of sleep disturbance is described in detail in the *Noise Report* (Appendix M).

16.6.3 Low Frequency Noise

The main potential source of low frequency noise associated with the project will be coal processing equipment such as screens and sizers, however all project activities produce some low frequency noise.

Noise model results, with worst-case prevailing weather conditions at night, indicate that low frequency noise levels will be within the 60 dBL criterion at all sensitive receptors.

16.6.4 Cumulative Noise

The proposed Carmichael Coal Mine adjoins the project to the south-east and has the potential to affect cumulative noise levels at sensitive receptors. Figure 16-1 shows the location of the proposed Carmichael Mine Site in relation to the project site and the closest sensitive receptors. The Moray Power Project (MPP) involves the construction and operation of a thermal and diesel power station with a generating capacity of 150 Mega Watts. The MPP site is located immediately east of the proposed Carmichael Coal Mine site, approximately 23 km south-east of the project site and is proposed to supply power for the Carmichael Coal Mine. Due to the distance to the project site, there is no potential for cumulative noise impacts with the MPP. No other significant industrial developments exist or are proposed in the vicinity of the project.

Noise data from the published Carmichael Coal Mine and Rail Project (CCM&RP) Supplementary EIS was reviewed and predicted cumulative noise levels are presented in Table 16-5 for each of the sensitive receptors.

Table 16-5 Predicted Cumulative Noise Levels, Night Prevailing Weather Conditions, LA_{eq}

RECEPTOR ID	PREDICTED NOISE LEVEL, LA_{eq}			Cumulative Criteria, Night, LA_{eq}
	Project	CCM&RP	Cumulative noise level	
R1	29	<10	29	35
R2	29	20	30	35
R3	27	13	27	35

Table 16-5 shows that predicted worst case cumulative noise levels are below the relevant criteria at all receptors. No adverse cumulative noise impacts are therefore predicted at any sensitive receptors.

All other receptors located further from the project would receive insignificant noise from the project. Therefore no adverse cumulative noise impacts will occur at any other receptors.

16.6.5 Construction Noise

Construction activities to be undertaken as part of the project include the establishment of the mine infrastructure including the coal handling and preparation plants, conveyors, rail loop and train loading facilities, workshops, dams, mine waste storage facilities, the on-site power station, workforce accommodation village and the private airstrip.

The earthmoving phase for each construction activity typically produces the highest sound power level and has been considered in this assessment.

The *Noise Report* (Appendix M) details the equipment fleet expected to be required for construction of the mine facilities. Assuming all machines operate continuously at full power, a total construction sound power level of 132 dBA is predicted. This is 10 dBA lower than the total operational sound power level for the project and consequently construction noise levels at receptors will be approximately 10 dBA lower than operations (Section 16.6.1). Predicted construction noise levels are therefore acceptable at all receptors.

16.6.6 Road Traffic Noise

Worst case construction traffic noise levels on local roads would be generated by up to 40 truck and 40 car movements per day on Elgin-Moray Road and Moray-Carmichael Road east of the project. Worst case operational traffic noise levels would be generated by up to 57 truck and 57 car movements per day.

Calculations based on the Calculation of Road Traffic Noise method indicate the following received noise level contributions at a nominal distance of 100 m from Elgin-Moray Road and Moray-Carmichael Road east of the project entrance compared to the 63 $LA_{10,18hr}$ criterion:

- Baseline and construction traffic: 52 $LA_{10,18hr}$; and
- Baseline and operational traffic: 50 $LA_{10,18hr.}$

Calculated traffic noise levels from combined baseline and project related traffic are more than 10 dBA below relevant traffic noise criteria at a nominal distance of 100 m from local roads and are therefore predicted to be below the criteria at all residential receptors.

16.6.7 Aircraft Noise

Workforce transport to and from the project site would primarily occur by plane upon completion of the airstrip. The preliminary aircraft schedule indicates aircraft destinations are likely to include major population centres such as Cairns, Townsville, Bundaberg and Brisbane, using aircraft with capacities up to 200 seats depending on the number of employees at each destination.

A theoretical worst case situation, assuming a large jet aircraft such as a Boeing 737 or Airbus A-320 travelling from the project airstrip directly over the closest receptor (R2), would result in a maximum noise level of 69 LA_{max}. Maximum noise levels from aircraft serving the project would therefore be within the maximum noise level criterion of 80 LA_{max} at all receptors.

Aircraft movements would be scheduled during the day and early evening where possible, while aircraft flight-paths would be selected to minimise noise impact to receptors.

16.6.8 Blasting – Ground Vibration and Overpressure

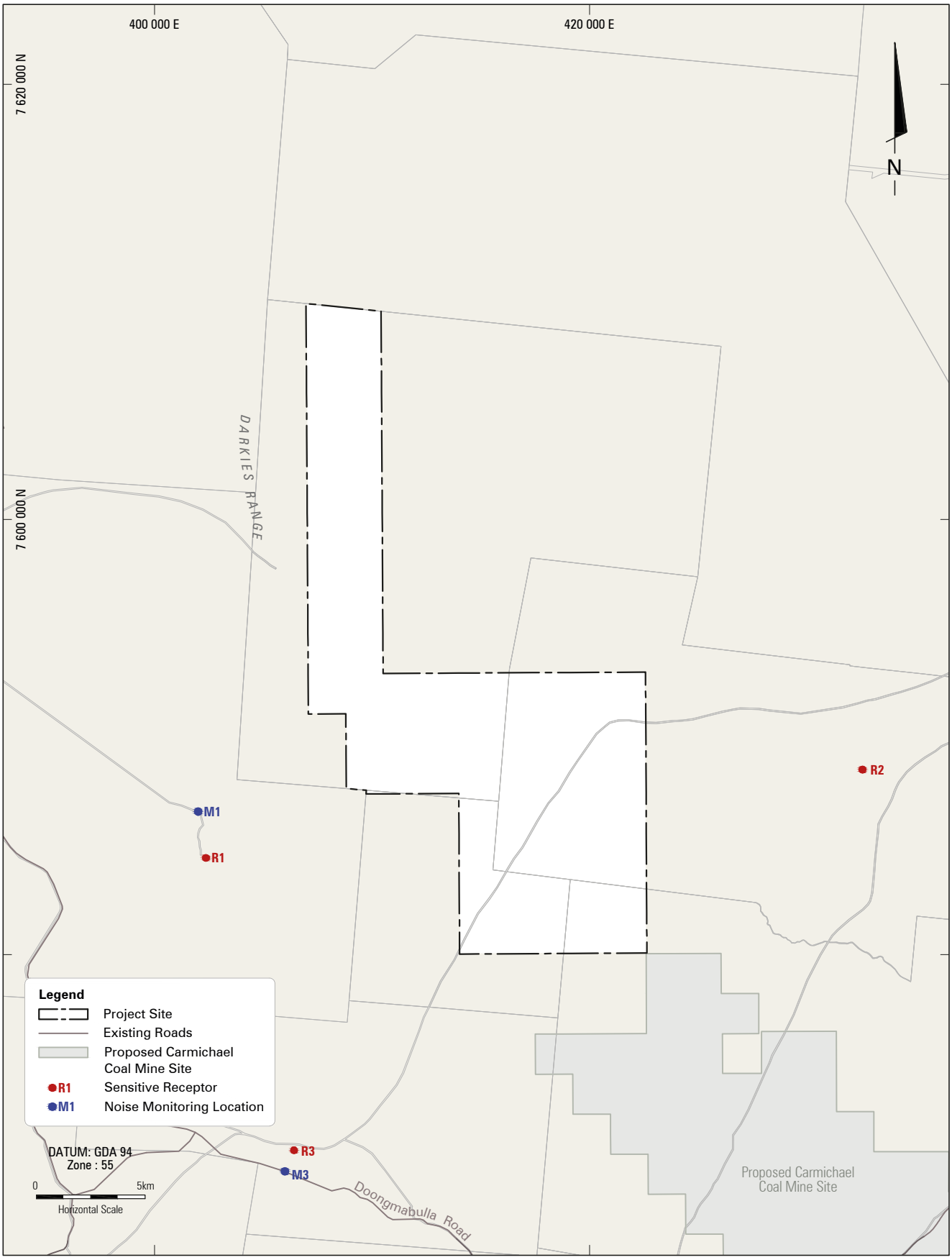
Blast effects have been calculated assuming a Maximum Instantaneous Charge (MIC) of up to 2,000 kg which is typical of large open cut coal mines. Predicted ground vibration and blast overpressure levels are well within the criteria at the closest receptor for this MIC. This is primarily due to the large buffer distances between the project site and the closest receptors. Blast impacts are therefore predicted to be within the relevant criteria at all sensitive receptors.

16.7 MITIGATION MEASURES

As discussed in Section 16.6, the noise assessment concludes that the proposed construction and operation of the project will produce noise levels that are within the relevant criteria at all noise sensitive receptors. Consequently, additional noise mitigation measures are not warranted.

A complaints handling procedure will be implemented for the project. The procedure will involve the investigation of any complaints in relation to noise and blast impacts. These investigations would include noise and blast impact monitoring, if necessary.

FIGURES



PROJECT CHINA STONE

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Sensitive Receptors

FIGURE 16-1