

BHP BILLITON LIMITED

ENVIRONMENTAL NOISE ASSESSMENT YEELIRRIE PROJECT

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1. INTRODUCTION

BHP Billiton Limited commissioned Herring Storer Acoustics to carry out an acoustical assessment of noise emissions from the proposed Yeelirrie Project. The objectives of the study were to:

- Determine, by modelling, noise propagation from the mining operations.
- Assess the predicted noise levels received at the closest noise sensitive premises, for compliance with the *Environmental Protection (Noise) Regulations 1997*.
- If exceedances are predicted, investigate possible noise control options that will reduce noise emissions to achieve compliance with the regulations.

For information, an area plan is attached in Appendix A.

2. SUMMARY

As mining and the processing plant would operate 24 hours per day, under the *Environmental Protection (Noise) Regulations 1997* noise received at the neighbouring noise sensitive premises from the mining and the processing plant needs to comply with the assigned L_{A10} noise level of 35 dB(A) for the night period.

The closest noise sensitive premises would be the Yeelirrie homestead, located approximately 20km from the mine. At this distance, noise received at the closest neighbouring noise sensitive premises has been calculated to be 8 dB(A). Therefore, noise received at the neighbouring noise sensitive premises would be deemed to comply with the requirements of the *Environmental Protection (Noise) Regulations 1997*.

Although not required to comply with the requirements of the *Environmental Protection (Noise) Regulations 1997*, an assessment has also be undertaken of the noise that would be received at the accommodation camp located adjacent to the Yeelirrie Homestead. Noise received at the accommodation camp has been calculated at 8 dB(A).

A determination of noise that would be received at the Yeelirrie Homestead and accommodation camp has also been carried out. Modelling indicates that noise received at these locations would be 0 dB(A). Therefore, noise from reversing alarms would also be deemed to comply with regulatory requirements.

3. CRITERIA

The criteria used are in accordance with the *Environmental Protection (Noise) Regulations 1997*. These regulations stipulate maximum allowable external noise levels determined by the calculation of an influencing factor, which is then added to the base levels shown in Table 1. The influencing factor is calculated for the usage of land within the two circles, having radii of 100m and 450m from the premises of concern.

TABLE 1 - BASELINE ASSIGNED OUTDOOR NOISE LEVEL

Premises Receiving Noise	Time of Day	Assigned Level (dB)		
		L _{A10}	L _{A1}	L _{Amax}
Residential	0700 – 1900 hours Monday to Saturday	45 +IF	55 +IF	65 +IF
	0900 - 1900 hours Sunday and Public Holidays	40 +IF	50 +IF	65 +IF
	1900 – 2200 hours all days	40 +IF	50 +IF	65 +IF
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and Public Holidays	35 +IF	45 +IF	55 +IF

Notes: L_{A10} is the noise level exceeded for 10% of the time.
 L_{A1} is the noise level exceeded for 1% of the time.
 L_{Amax} is the maximum noise level.
 IF is the influencing factor.

It is a requirement that noise received at another premises, be free of annoying characteristics (tonality, modulation and impulsiveness), defined below as per Regulation 9 of the *Environmental Protection (Noise) Regulations 1997*.

“impulsiveness” means a variation in the emission of a noise where the difference between L_{Apeak} and L_{Amax Slow} is more than 15dB when determined for a single representative event;

“modulation” means a variation in the emission of noise that –

- (a) is more than 3dB L_{A Fast} or is more than 3dB L_{A Fast} in any one-third octave band;
- (b) is present for more at least 10% of the representative assessment period; and
- (c) is regular, cyclic and audible;

“tonality” means the presence in the noise emission of tonal characteristics where the difference between –

- (a) the A-weighted sound pressure level in any one-third octave band; and
- (b) the arithmetic average of the A-weighted sound pressure levels in the 2 adjacent one-third octave bands,

is greater than 3 dB when the sound pressure levels are determined as L_{Aeq,T} levels where the time period T is greater than 10% of the representative assessment period, or greater than 8 dB at any time when the sound pressure levels are determined as L_{A Slow} levels.

For information, examples of the above annoying characteristics are:

“impulsiveness” banging, thumping or other short term high noise levels, such as hammering.

“modulation” cyclic noise such as a siren.

“tonality” source where most of the energy is confined to a small part of the audible spectrum, such as whining or a droning.

If the above characteristics exist and cannot be practicably removed, then any measured level is adjusted according to Table 2 below.

TABLE 2 - ADJUSTMENTS TO MEASURED LEVELS

Where tonality is present	Where modulation is present	Where impulsiveness is present
+5 dB(A)	+5 dB(A)	+10 dB(A)

Note: these adjustments are cumulative to a maximum of 15 dB.

The influencing factor (“IF”) has been assessed as 0 for the surrounding residential premises. The assigned outdoor noise levels for the proposed usage would be as for the base levels listed in Table 3.

TABLE 3 - BASELINE ASSIGNED OUTDOOR NOISE LEVEL

Premises Receiving Noise	Time of Day	Assigned Level (dB)		
		L _{A10}	L _{A1}	L _{Amax}
Residential	0700 – 1900 hours Monday to Saturday	45	55	65
	0900 - 1900 hours Sunday and Public Holidays	40	50	65
	1900 – 2200 hours all days	40	50	65
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and Public Holidays	35	45	55

Notes: L_{A10} is the noise level exceeded for 10% of the time.
 L_{A1} is the noise level exceeded for 1% of the time.
 L_{Amax} is the maximum noise level.

With regards to reversing alarms, it is noted that Regulation 3(c) states:

3 *Nothing in these regulations applies to -*

.....

(c) *noise emissions from safety warning devices fitted to motor vehicles, mining and earth moving machinery, vessels and buildings if -*

- (i) *it is a requirement under another written law that such a device be fitted; and*
- (ii) *it is not practicable to fit a safety warning device that complies with the written law under which it is required to be fitted and emits noise that complies with these regulations.*

4. MINING OPERATIONS

As mining and the processing would be a 24 hours per day operation, under the *Environmental Protection (Noise) Regulations 1997*, noise received at the neighbouring noise sensitive premises from the mining and processing plant needs to comply with the assigned L_{A10} noise level of 35 dB(A) for the night period.

Additionally, under the *Environmental Protection (Noise) Regulations 1997*, it is a requirement that noise received at a premises to be free of annoying characteristics (tonality, modulation and impulsiveness). However, if the annoying characteristic cannot be practically removed and noise received at the premises is deemed to contain an annoying characteristic then a penalty is added to the noise received at that premises. Noise emissions from mining equipment and processing plants are normally tonal in nature, however, in this case, given the distance to the neighbouring noise sensitive premises, it is likely that the tonal nature of the noise received at these premises would be masked by the natural background noise level and the +5 dB(A) penalty for a tonal component would not

be applied. However, to be conservative it has been assumed that noise received at the neighbouring noise sensitive premises would contain a tonal characteristic and the 5 dB(A) penalty would be applied to the noise received at a premises.

Even though we believe that reversing alarms would be exempt from the Regulations, an assessment of the noise that would be received at the neighbouring residential premises and accommodation camp from reversing alarms has been undertaken.

The closest noise sensitive premises to the mining would be the Yeelirrie Homestead, which is located approximately 20km to the east southeast of the mine. The second closest noise sensitive premises is located approximately 40km to the north west of the processing plant. The residential locations are shown on the attached locality plan attached in Appendix A.

It is also noted that the accommodation camp is to be located adjacent to the Yeelirrie Homestead.

5. METHODOLOGY / MODELLING

Noise received at the neighbouring residence was determined using the noise modelling computer program "SoundPlan". SoundPlan uses the theoretical sound power levels determined from measured sound pressure levels to calculate the noise level received at a specific location.

The calculations used the following input data:

- a) Ground contours.
- b) Standard DEC weather conditions as stipulated within the Environmental Protection Authority's "Draft Guidance for Noise Assessment of Environmental Factors No. 8 – Environmental Noise". The weather conditions are as listed in Table 4.
- c) Sound power levels used in the model were based on file data of similar operations. The sound power data is summarised in Table 5.

TABLE 4 - WEATHER CONDITIONS

Condition	Night Period
Temperature	15 °C
Relative Humidity	50%
Pasquill Stability Class	F
Wind Speed	3 m/s*

* From sources, towards receivers.

TABLE 5 - SOUND POWER LEVELS dB(A)

Item	Sound Power Level dB(A)
CAT D10 Dozer	116
CAT 992 Front End Loader	117
CAT777 Ore Truck (6 off)	119
Drill Rig	124
Processing Plant	124
Water Cart (45kl)	113
CAT 14M Grader	113
CAT330 Excavator/Rockbreaker	119
Komatsu PC1250 Excavator	114
7MW Diesel Generator (2 off)	116

We understand that the maximum sound power level of a reversing alarm would be 132 dB(A).

Although there would be some diversity in noise emissions from the mining operations, to be conservative noise modelling was undertaken with all equipment operating.

Single point calculations were undertaken for both the mining operations and a reversing alarm. However, noise contour calculations were only undertaken for the mining operations. Noise contours show the overall noise level that would be received at a location due to the various activities carried out, where as single point calculations show the influence of individual items on the overall noise resulting at a specific location.

6. RESULTS

Single point calculations were carried out for the residences located around the proposed mine; and accommodation camp and the resultant noise levels are summarised in Table 6.

TABLE 6 - CALCULATED NOISE LEVELS FROM MINING

Location	Calculated Noise Level (dB(A))
Yeelirrie Homestead	8
Accommodation camp	8
Homestead 40km to North West	0

The noise contour plot is attached in Appendix B for information.

The noise received at the above premises from reversing alarms is summarised in Table 7.

TABLE 7 - CALCULATED NOISE LEVEL FROM REVERSING ALARMS

Location	Calculated Noise Level (dB(A))
Yeelirrie Homestead	0
Accommodation camp	0
Homestead 40km to North West	0

7. DISCUSSION

As mining and processing would occur 24 hours per day, under the *Environmental Protection (Noise) Regulations 1997* noise received at the neighbouring noise sensitive premises from the mining and processing plant needs to comply with the assigned L_{A10} noise level of 35 dB(A) for the night period. Additionally, if noise emissions from the mining and processing plant, when received at a noise sensitive premises, has been assumed to contain a tonal characteristic, then under the Regulations a +5 dB(A) penalty is applied to the noise received at a premises. The calculated noise levels and adjustments are listed in Table 8.

TABLE 8 – APPLICABLE ADJUSTMENTS AND ASSESSABLE LEVEL OF NOISE EMISSIONS

Location	Calculated Noise Level, dB(A)	Applicable Adjustments to Measured Noise Levels, dB(A)			Assessable Noise Level, dB(A)
		Where Noise Emission is NOT music			
		Tonality	Modulation	Impulsiveness	
Yeelirrie Homestead	8	+5	-	-	13
Accommodation camp	8	+5	-	-	13
Homestead 40km to North West	0	+5	-	-	5

Based on the above an assessment was undertaken for the worst case location and the assessment is summarised in Table 9.

TABLE 9 – ASSESSMENT OF NOISE LEVEL EMISSIONS

Scenario	Assessable Noise Level, dB(A)	Applicable Times of Day	Applicable L _{A10} Assigned Level (dB)	Exceedance to Assigned Noise Level (dB)
Yeelirrie Homestead	13	Day	45	Complies
		Sunday / Public Holiday Day Period	40	Complies
		Evening	40	Complies
		Night	35	Complies
Accommodation camp	13	Day	45	Complies
		Sunday / Public Holiday Day Period	40	Complies
		Evening	40	Complies
		Night	35	Complies
Homestead 40km to North West	5	Day	45	Complies
		Sunday / Public Holiday Day Period	40	Complies
		Evening	40	Complies
		Night	35	Complies

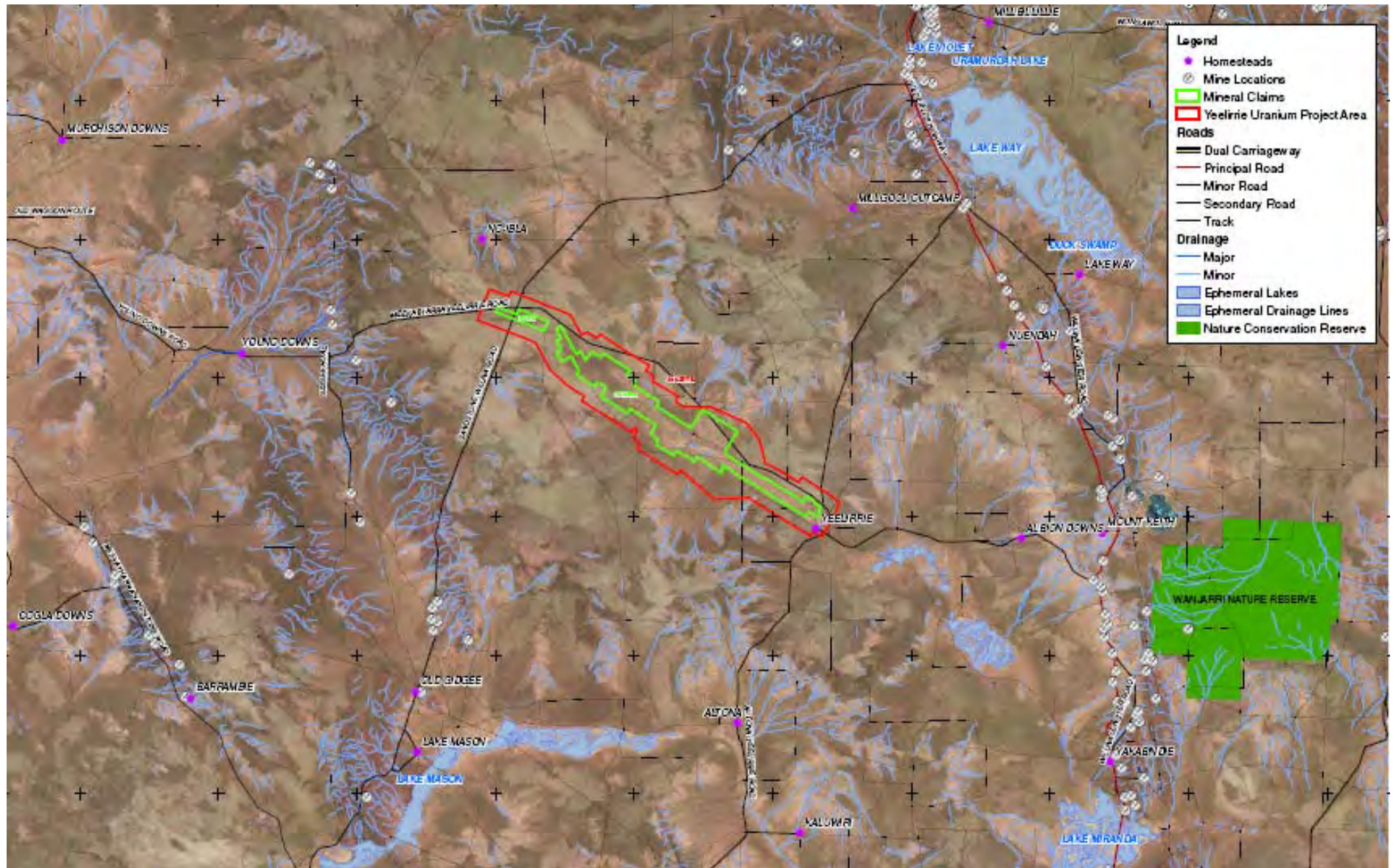
The closest noise sensitive premises to the mining would be the Yeelirrie Homestead, which is located approximately 20km to the east southeast of the mine. At this distance, noise received at the closest neighbouring noise sensitive premises has been calculated at 8 dB(A). Therefore, noise received at the neighbouring noise sensitive premises would be deemed to comply with the requirements of the *Environmental Protection (Noise) Regulations 1997* even if a +5 dB(A) penalty was applied for a tonal component.

Although not required to comply with the requirements of the *Environmental Protection (Noise) Regulations 1997*, an assessment has also been undertaken of the noise that would be received at the accommodation camp located adjacent to the Yeelirrie Homestead has also been determined to be 8 dB(A), which would also be deemed to comply with the requirements of the *Environmental Protection (Noise) Regulations 1997* even if a +5 dB(A) penalty was applied for a tonal component.

Noise received at the Yeelirrie Homestead from reversing alarms has been calculated at 0 dB(A). Therefore, noise emissions from reversing alarms would be deemed to comply with the requirements of the *Environmental Protection (Noise) Regulations 1997*.

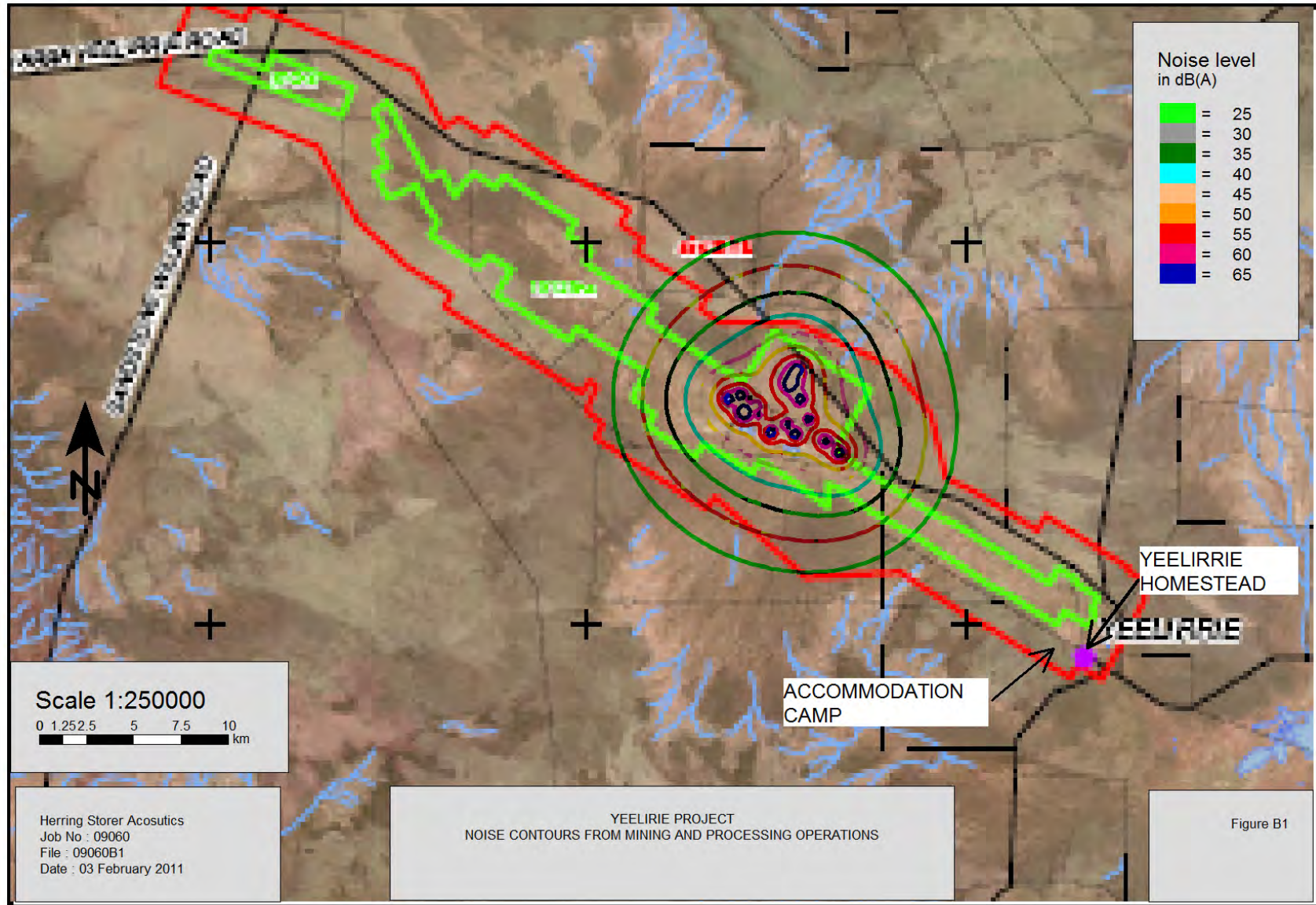
APPENDIX A

Locality Plan



APPENDIX B

Noise Contour Plot



APPENDIX C

References

References

1. *Environmental Protection (Noise) Regulations 1997*, as ammended in 2000.
2. *Draft Guidance for Noise Assessment of Environmental Factors No. 8 – Environmental Noise*. Environmental Protection Authority May 2007.