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Acoustic and Vibration Consultants

Supplementary Noise Assessment
China First Project
Mine and Rail Assessment

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Prepared for:

Waratah Coal

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Contents

1.0 Introduction

Savery & Associates Pty Ltd was commissioned by Waratah Coal Pty Ltd (Waratah Coal) to prepare a response to queries raised by various parties interested in specific details of the assessment of the integrated proposal consisting of a new coal mine near Alpha in central Queensland and a new heavy haul standard gauge rail system linking the mine to the Port of Abbot Point and the Abbot Point State Development Area (APSDA).

This report contains specific information relevant to the responses to specific queries provided by interested parties including:

- information recommended to be included in the environmental management plan;
- details on the analysis of the monitoring data in order to determine the planning noise levels;
- Updated details regarding adjustments for tonal and/or impulsive characteristics; and
- Additional assessment of rail vibration.

2.0 Noise environmental management plan

Acoustical elements for inclusion in the environmental management plan are shown in Table 1 and Table 2 for construction and operation respectively.

Table 1: Noise management plan - construction

<table>
<tr><td>Environmental protection objectives</td><td>To construct the mine, rail corridor and associated infrastructure in a manner that has minimal impact to the qualities of the acoustic environment that are conducive to the following:
The health and biodiversity of ecosystems
Human health and wellbeing, including by ensuring a suitable acoustic environment for individuals to sleep, study or learn, be involved in recreation, relax and converse
The amenity of the community.
In relation to vibration, the structural and cosmetic integrity of Indigenous and non-Indigenous cultural heritage sites and dwellings is to be protected.</td></tr>
<tr><td>Standards and measurable indicators</td><td>Noise from construction activities will not cause an environmental nuisance at any sensitive or commercial place.
Noise management plan should include noise limits proscribed by EA conditions, when provided.
Accommodation facilities
Temporary accommodation facilities will be designed to achieve the following noise levels to protect workers’ health and well-being:
<table>
<tr><th>Time</th><th colspan="3">Noise objectives for indoors, measured at the receptor in dB(A)</th></tr>
<tr><th></th><th>$L_{Aeq, adj, 1hr}$</th><th>$L_{A10, adj, 1hr}$</th><th>$L_{A1, adj, 1hr}$</th></tr>
<tr><td>Day and evening</td><td>35</td><td>40</td><td>45</td></tr>
<tr><td>Night</td><td>35</td><td>40</td><td>45</td></tr>
</table>
Blasting
Airblast overpressure level (when measured at, or extrapolated to, any noise sensitive or commercial place), will not exceed 115 dB (linear peak) for 9 out of any 10 consecutive blasts and 120 dB (linear peak) at any time.
Ground-borne vibration peak particle velocity caused by blasting operations, when measured at, or extrapolated to, any noise sensitive or commercial place, must not exceed more than 5 mm per second for 9 out of any 10 consecutive blasts initiated, nor 10 mm per second at any time.</td></tr>
</table>

Control strategies	**Out of hours general construction noise** General construction activities will occur between 6:00am and 6:00pm 7 days a week. On occasion general construction activities may be required outside these hours. Out of hours (6pm- 6am) activities may include but are not limited to: oversized delivery of plant or equipment, concrete pours, pneumatic testing and material delivery. Noise management measures will be developed and implemented for all out-of-hours construction activities (6.00pm- 6.00am). These will include consultation with potentially affected residents and prior notification of unavoidable construction activities. **Traffic and transport** Truck deliveries to laydown areas and construction sites will be restricted between 6:30pm and 6:30am. Suitable routes and times of travel will be identified prior to rail and plant construction to reduce disturbances to residents and traffic conditions. A traffic management plan will be developed and will include management of noise associated with traffic during the construction phase of the Project. This may include speed restrictions, and management of night-time traffic along roads adjacent to residential or other sensitive land uses. **Blasting** Blasting will be designed to meet the EP Act criteria. Pre- and post-construction inspections of sensitive structures will be conducted and monitoring will be undertaken during construction if predicted levels of ground vibration exceed 20% of statutory limits. Construction blasting will not be conducted within 100m from all identified cultural heritage sites.
Corrective action	**Complaints response** Noise complaints received from external stakeholders will be investigated and communication with the complainant undertaken within 24 hours. A record of the complaints and any actions taken will be recorded in the complaints database For complaints received from the administering authority, the results of any investigation (including an analysis and interpretation of any monitoring results) and abatement measures implemented will be provided to the administering authority within 14 days of completion of the investigation, or receipt of the monitoring results, whichever is the latter.

	Construction noise Corrective actions might include: • Re-scheduling noisy construction activities • Enhancing noise attenuation measures on plant and equipment • Compensation for noise affected residents.

Table 2: Noise management plan - operation

Environmental protection objectives	To operate the mine and rail line in a manner that has minimal impact to the qualities of the acoustic environment that are conducive to the following: • The health and biodiversity of ecosystems • Human health and wellbeing, including by ensuring a suitable acoustic environment for individuals to sleep, study or learn, be involved in recreation, relax and converse • The amenity of the community.
Standard and measurable indicators	Noise from petroleum activities will not cause an environmental nuisance at any sensitive or commercial place. **Fixed plant (including conveyors, wash plant and crushers)** The design criteria for fixed plant should achieve the PNLs determined for the project, measured at a sensitive receptor. **Accommodation facilities** Workers' accommodation facilities will be designed to achieve the following noise levels to protect workers' health and well-being:

Time	**Noise objectives for indoors, measured at the receptor in dB(A)**		
	$L_{Aeq, adj, 1hr}$	**$L_{A10, adj, 1hr}$**	**$L_{A1, adj, 1hr}$**
Day and evening	35	40	45
Night	35	40	45

Control strategies	Facilities will be designed and operated to meet the acoustic quality objectives of the EPP Noise. Lower noise technology will be incorporated into plant design where possible (e.g. low-noise rollers, electric drive engines). **Location of infrastructure** The rail line will generally be located more than 200m from sensitive receptors.

	Accommodation facilities will be located at least 500m from sensitive receptors. **Traffic and transport** A traffic management plan will be developed and will include management of noise associated with traffic during the operational phase of the Project. This may include speed restrictions, and management of night-time traffic along roads adjacent to residential or other sensitive land uses. Truck deliveries will be restricted between 6:30pm and 6:30am. Suitable routes and times of travel will be identified prior to operations to reduce disturbances to residents and traffic conditions.
Corrective action	**Complaints response** Complaints received from external stakeholders will be investigated and communication with the complainant undertaken within 24 hours. A record of the complaints and any actions taken will be recorded in the complaints database For complaints received from the administering authority, the results of any investigation (including an analysis and interpretation of any monitoring results) and abatement measures implemented will be provided to the administering authority within 14 days of completion of the investigation, or receipt of the monitoring results, whichever is the latter. **Fixed plant noise** Corrective actions might include: • Installation of additional noise attenuation barriers • Use of lower noise technology • Modification of facilities' operational procedures • Modification of notification procedures for scheduled irregular noise events • Compensation for noise affected residents.

3.0 Determination of Rating Background Levels (RBLs)

Two sites (N1 and N6) were used for derivation of criteria for the proposed development in the original assessment, as it was determined that, based on the measured Rating Background Levels (RBLs), the sites could be simplified into two general groups: those near to a transport corridor, and those which were well isolated from any nearby transport corridors. Based on comments from DEHP[1], each of the receptors has been assessed separately in order to show the variation in the resultant design levels, particularly during the day and evening period.

A summary of the design planning levels for each receiver (proximity to highways and others) are shown in Table 3. The derivation for these calculations is shown in Appendix A. This derivation includes the updated receiver area land use described in issue reference 16003 along with the updated table for the adjustments for tonality and impulsivity from the DERM guideline Planning for Noise control described in issue reference 16001 and 16002.

In terms of the most critical period, the night-time period, the groups of receptors can be divided into two groups: the proximity to the Bruce Highway (near Abbot Point) and those well isolated from any nearby transport corridors. For more detailed criteria which would apply during the day and evening, the results are significantly more varied.

The design PNLs are summarised in Table 3. When using the PNLs to assess the received noise at a receptor from a specific source, the received level should be adjusted for tonal and/or impulsive characteristics as per the adjustments detailed in Table 4.

Table 3 - Design PNLs at Residential Receivers (outdoors)

Parameter	Site	Design Planning Level ($L_{Aeq,1hour,\ adj}$ - dBA)		
		Day (7am-6pm)	Evening (6pm-10pm)	Night (10pm-7am)
Proximity to Bruce Highway	N1	44	41	36
Proximity to Capricorn Highway	N5	37	28	28
Others	N2	41	38	28
	N3	34	28	28
	N4	29	31	28
	N6	37	30	28
	N7	28	28	28

[1] DEHP – Department of Environment and Heritage Protection, formerly known as Department of Environment and Resource Management. (DERM) (Queensland Government)

Parameter	Site	Design Planning Level ($L_{Aeq,1hour,\ adj}$ - dBA)		
		Day (7am-6pm)	Evening (6pm-10pm)	Night (10pm-7am)
	N8	32	28	28
	N9	36	30	28
	N10	33	31	28

Table 4: Guideline Corrections to PNL_{Bg} for Audible Characteristics

Audible Characteristic	Criterion	Correction
Tonality	Subjectively just detectable	K1 = 2 dB
	Subjectively prominent (clearly audible)[2]	K1 = 5 dB
Impulsivity	Subjectively detectable[3]	K2 = 2 dB
	Subjectively prominent (clearly audible)	K2 = 5 dB

[2] The objective test of tonality is as per AS1055.1 Clause 6.6.3
[3] The objective test of impulsive characteristics is as per AS1055.1 Clause 6.6.4

4.0 Rail Vibration – Additional analysis

4.1 Vibration Criteria

As described in the original assessment, the criteria relevant to the assessment of coal train pass-bys is the vibration levels to maintain human vibration comfort, applicable to the more long-term vibration.

4.1.1 Human Vibration Comfort Level

Reference is made to AS2670.2 1990 *Evaluation of Human Exposure to Whole-body Vibration – Continuous and Shock-induced Vibration in Buildings (1 to 80 Hz)*, which contains recommendations for vibration levels to maintain human comfort in the case of continuous vibrations (eg, train pass-bys). RMS values for weighted acceleration are the preferred assessment criteria, although in some cases assessment using RMS velocity may be applicable. Acceptable vibration levels in one-third octave bands for both RMS acceleration and velocity for both x-,y- axis and z- axis are shown in Table 5 and Table 6 respectively:

Table 5: RMS Acceleration criteria for human comfort as per AS2670.2 -1990

AS2670.2 1990 Comfort Criterion	Frequency Threshold	Acceleration (R.M.S)
X-axis & Y-axis	1 to 2Hz	$< 3.6 mms^{-2}$
	2 to 80Hz	$< 144 mms^{-2}$
Z-axis	1 to 4Hz	$< 10 mms^{-2}$
	4 to 8Hz	$< 5 mms^{-2}$
	8 to 80Hz	$< 50 mms^{-2}$

Table 6: RMS Velocity criteria for human comfort as per AS2670.2 -1990

AS2670.2 1990 Comfort Criterion	Frequency Threshold	Velocity (R.M.S)
X-axis & Y-axis	1 to 1.6Hz	$< 0.573 mms^{-1}$
	1.6 to 80Hz	$< 0.287 mms^{-1}$
Z-axis	1 to 4Hz	$< 1.59 mms^{-1}$
	4 to 8Hz	$< 0.199\ mms^{-1}$
	8 to 80Hz	$< 0.0995 mms^{-1}$

4.2 Additional assessment of rail vibration

Vibration levels associated with coal train pass-bys have been examined for residential locations located within 200m of the proposed rail corridor. The only receptor within 200m of the proposed rail corridor is R22 (Bakara).

In general, vibration emissions originating from the rail line will vary between two levels:

- from trains travelling slowly, between 20km/hr and 40km/hr, at the rail loop at both the mine site and the port facility; and
- from trains travelling on the straight sections of track at speeds of 80km/hr for a fully loaded train to 100km/hr for an empty train.

4.2.1 Vibration levels from slowly moving trains (rail loops)

In order to quantify vibrations from slowly moving coal trains, vibration levels have been sampled near Queensland Rail coal freight operations in South-East Queensland.

A loaded coal train pass-by was measured at a distance of 20m from the rail track. The location of measurement was close to a rail crossing, and as such, train speeds were low. The ground around the area at the time of measurement was softened due to recent rain. A summary of results is shown in Table 7.

Table 7: Max RMS velocity during loaded coal train pass-by at 20 metres.

Axis	Frequency Threshold	Max RMS Velocity (mms^{-1})
X-axis & Y-axis	1 to 1.6Hz	0.051
	1.6 to 80Hz	0.040
Z-axis	1 to 4Hz	0.003
	4 to 8Hz	0.003
	8 to 80Hz	0.023

These vibration levels are within the human comfort criteria outlined in AS2670.2, as summarised in Table 6 in Section 4.1.1. It can be concluded that vibration from slowly moving coal trains on rail loops near the mine and port area will not be a significant issue at distances beyond 20m from the rail line.

4.2.2 Vibration levels from coal trains at typical maximum traveling speed (straight track)

For vibration levels from the coal trains travelling at their maximum speed on the straight sections of track, reference has been made to the United States Federal Transit Administration's [US FTA's], "*Transit Noise and Vibration Impact Assessment, May 2006"*. This document is also referred to by other Australian state authorities, such as the Department of Environment and Conservation NSW (Department of Environment and Conservation (2006) *Assessing Vibration: A Technical Guideline*). In normal operation, the coal train is expected to pass by receiver R22 (Bakara) at speeds of between 80 to 100km/h.

Using the method outlined in the US FTA publication, the prediction for maximum RMS velocity from a freight train is shown in Table 8.

Table 8: Predicted freight train maximum RMS velocity using the "*Transit Noise and Vibration Impact Assessment, May 2006*"

Axis	Distance from track (m)	Max RMS Velocity (mms^{-1})
Sum	20	0.384
	80	0.086

The results of Table 8 are based on the following assumptions for nominal rail operation:

- Good rail and track conditions (eg, no rail corrugations or wheel flats)
- Normal groundbourne vibration propagation
- Speed correction to 60mp/h (~97km/h)

The overall maximum RMS vibration velocity at a distance of 80m from the track (ie. the distance from the proposed train to receiver R22) is estimated to comply with criterion for all axes of vibration propagation as outlined in Table 8. It is concluded that the noise criteria for noise emissions from rail movements is comparatively much more stringent than the vibration criteria for human comfort.

Appendix A - Derivation of Planning Levels

A.1 Control of Background Noise Creep

To prevent the background noise levels (for day, evening and night periods) from gradually increasing with the establishment of new developments in an area, the Guideline describes a methodology for determining the design imission[4] limits for each new development (or industry) based upon *Recommended* and *Rating* (existing) outdoor background noise levels (min $L_{A90,\,1hour}$[2]). The *Recommended* background noise levels depend upon the nature of the surrounding land use, being lower for green-field areas, and higher for recognised industrial areas as detailed in Table 9.

Table 9: Qld EPA Guideline - *Recommended* Background Levels

Receiver Land Use	Receiver Area Dominant Land Use	Recommended Background Noise level $minL_{A90,1hour}$ (dBA)[5]		
		Day (7am to 6pm)	Evening (6pm to 10pm)	Night (10pm to 7am)
Purely residential	Very Rural	35	30	25
	Rural residential, church, hospital	40	35	30
	Shop or commercial office	45	40	35
	Light industry	50	45	40
Residential area on a busy road, or near an industrial or commercial area	Rural residential, church, hospital	45	40	35
	Shop or commercial office	50	45	40
	Light industry	55	50	45
Industrial area	Rural residential, church, hospital	50	45	40
	Shop or commercial office	55	50	45
	Factory office or factory	60	60	60
Passive recreation area	Picnic grounds, public beaches, bush walks, public gardens, et	35	35	35

[4] *Imission* refers to noise received at a sensitive location, such as a residence

[5] $minL_{A90,1hour}$ is defined as the Rating Background Level in accordance with the methodology defined in the *Planning for Noise Control* guideline

To control and prevent cumulative increase of the *Rating* (actual) background level above the *Recommended* background levels in Table 9, the *Planning* background levels ($min_{LA90,\ 1hour}$) applicable for a new development are determined from the *Recommended* background levels (from Table 9) and the *Rating* (existing) Background Levels in accordance with Table 10.

Table 10: Qld EPA Guideline- *Planning* Background Levels

Classification of Rating Background Level at Receptor	Planning Background Level ($minL_{A90,\ 1\ hour}$)
A. above the Recommended level in Table 9	At least 10 dBA below Table 9 Recommended level
B. at Recommended level	10 dBA below Table 9 Recommended level
C. below Recommended level by:	Set Planning background Level:
1 dB	9 dB below Recommended level
2 dB	5 dB below Recommended level
3 dB	3 dB below Recommended level
4 dB	2 dB below Recommended level
5 dB	2 dB below Recommended level
6 dB or more	5 dB above Existing Background Level

The *Planning* equivalent noise level for a new development that is based on consideration of background creep ($PNL_{Bg,}$) is determined using the *Planning* background level ($minL_{A90,\ 1\ hour}$) from Table 10 in the following equation:

$PNL_{Bg,}$ = Planning $min.L_{A90,1\ hour}$ + 3 dB – K1 – K2

The adjustments K1 and K2 are required by the Guideline to account for tonal and impulsive noise characteristics of a development. If present, these characteristics increase the subjective audibility of sound, and the resulting PNL_{Bg}, is lowered accordingly. The required adjustments to the PNL_{Bg}, to adjust for tonal and impulsive characteristics are summarised in Table 11.

Table 11: Guideline Corrections to PNL_{Bg} for Audible Characteristics

Audible Characteristic	Criterion	Correction
Tonality	Subjectively just detectable	K1 = 2 dB
	Subjectively prominent (clearly audible)[6]	K1 = 5 dB
Impulsivity	Subjectively detectable[7]	K2 = 2 dB
	Subjectively prominent (clearly audible)	K2 = 5 dB

[6] The objective test of tonality is as per AS1055.1 Clause 6.6.3
[7] The objective test of impulsive characteristics is as per AS1055.1 Clause 6.6.4

Planning equivalent levels ($PNL_{Bg,}$) have been determined in accordance with the methods of the Guideline for the several areas nearby to the site based on the ambient noise monitoring data at the monitoring locations, their town planning designation and current land use. The Recommended Background ($minL_{A90,1\ hour}$) for each area based on the descriptions and levels in Table 9 are shown below in Table 12.

Table 12: Recommended Background Levels for Surrounding Area

Area	Receiver Land Use by Zoning	Receiver Area Dominant Land Use	Recommended Background ($minL_{A90,1\ hour}$) from Table 9		
			Day	Evening	Night
Proximity to Bruce Highway – N1	Residential area on a busy road, or near an industrial or commercial area	Residential	45	40	35
Proximity to Capricorn Highway – N5	Residential area on a busy road, or near an industrial or commercial area	Residential	45	40	35
Other – N2	Residential area on a busy road, or near an industrial or commercial area	Rural residential	45	40	35
Other – N3	Purely residential	Very Rural	35	30	25
Other – N4	Purely residential	Very Rural	35	30	25
Other – N6	Purely residential	Very Rural	35	30	25
Other – N7	Purely residential	Very Rural	35	30	25
Other – N8	Purely residential	Very Rural	35	30	25
Other – N9	Purely residential	Very Rural	35	30	25
Other – N10	Purely residential	Very Rural	35	30	25

As discussed in the noise and vibration technical report (ref. Waratah Coal EIS Volume 5, Appendix 20), rather than apply an overall adjustment to the criteria without regard to the actual expected tonality subjectively determined at the receiver, it is recommended that all PNL's be expressed as adjusted levels, to ensure that tonal/impulsive characteristics are properly accounted for.

Table 13: Planning Level Derivation (Background Methodology) – Proximity to Bruce Highway west of Bowen – Salisbury Plains

Parameter	Source	Sound Pressure Level, dBA		
		Day	Evening	Night
Recommended Background ($minL_{A90,1\ hour}$)	Table 12	45	40	35
Rating Background ($minL_{A90,1\ hour}$)	Site N1	36	35	30
Planning Background ($minL_{A90,1\ hour}$)	Table 10	41 (Rating +5)	38 (Rec - 2)	33 (Rec - 2)
Planning Noise Level ($PNL_{Bg,}$) ($L_{Aeq,1hour,\ adj}$)	Planning BG + 3	44	41	36

Table 14: Planning Level Derivation (Background Methodology) – Others – Pepper (Railway)

Parameter	Source	Sound Pressure Level, dBA		
		Day	Evening	Night
Recommended Background ($minL_{A90,1\ hour}$)	Table 12	45	40	35
Rating Background ($minL_{A90,1\ hour}$)	Site N2	33	30	20
Planning Background ($minL_{A90,1\ hour}$)	Table 10	38 Rating +5)	35 Rating +5)	25 Rating +5)
Planning Noise Level ($PNL_{Bg,}$) ($L_{Aeq,1hour,\ adj}$)	Planning BG + 3	41	38	28

Table 15: Planning Level Derivation (Background Methodology) – Others –Havilah

Parameter	Source	Sound Pressure Level, dBA		
		Day	Evening	Night
Recommended Background ($minL_{A90,1\ hour}$)	Table 12	35	30	25
Rating Background ($minL_{A90,1\ hour}$)	Site N3	26	20	<15
Planning Background ($minL_{A90,1\ hour}$)	Table 10	31 (Rating+5)	25 (Rating+5)	25 (set at threshold[8])
Planning Noise Level ($PNL_{Bg,}$) ($L_{Aeq,1hour,\ adj}$)	Planning BG + 3	34	28	28

[8] Threshold set as per Appendix C Example C4 of the Guideline.

Table 16: Planning Level Derivation (Background Methodology) – Others –Monklands

Parameter	Source	Sound Pressure Level, dBA		
		Day	Evening	Night
Recommended Background ($minL_{A90,1\ hour}$)	Table 12	35	30	25
Rating Background ($minL_{A90,1\ hour}$)	Site N4	34	25	<15
Planning Background ($minL_{A90,1\ hour}$)	Table 10	26 (Rec -9)	28 (Rec -2)	25 (set at threshold[10])
Planning Noise Level ($PNL_{Bg,}$) ($L_{Aeq,1hour,\ adj}$)	Planning BG + 3	29	31	28

Table 17: Planning Level Derivation (Background Methodology) – Proximity to Capricorn Highway –Glenlea Downs

Parameter	Source	Sound Pressure Level, dBA		
		Day	Evening	Night
Recommended Background ($minL_{A90,1\ hour}$)	Table 12	45	40	35
Rating Background ($minL_{A90,1\ hour}$)	Site N5	29	17	<15
Planning Background ($minL_{A90,1\ hour}$)	Table 10	34 (Rating +5)	25 (set at threshold[10])	25 (set at threshold[10])
Planning Noise Level ($PNL_{Bg,}$) ($L_{Aeq,1hour,\ adj}$)	Planning BG + 3	37	28	28

Table 18: Planning Level Derivation (Background Methodology) – Others – Lambton Meadows

Parameter	Source	Sound Pressure Level, dBA		
		Day	Evening	Night
Recommended Background ($minL_{A90,1\ hour}$)	Table 12	35	30	25
Rating Background ($minL_{A90,1\ hour}$)	Site N6	29	22	<15
Planning Background ($minL_{A90,1\ hour}$)	Table 10	34 (Rating+5)	27 (Rating+5)	25 (set at threshold[10])
Planning Noise Level ($PNL_{Bg,}$) ($L_{Aeq,1hour,\ adj}$)	Planning BG + 3	37	30	28

Table 19: Planning Level Derivation (Background Methodology) – Others –Cavendish

Parameter	Source	Sound Pressure Level, dBA		
		Day	Evening	Night
Recommended Background ($minL_{A90,1\ hour}$)	Table 12	35	30	25
Rating Background ($minL_{A90,1\ hour}$)	Site N7	35	34	22
Planning Background ($minL_{A90,1\ hour}$)	Table 10	25 (Rec -10)	25 (Rec -9)	25 (set at threshold[10])
Planning Noise Level ($PNL_{Bg,}$) ($L_{Aeq,1hour,\ adj}$)	Planning BG + 3	28	28	28

Table 20: Planning Level Derivation (Background Methodology) – Others –Lenore

Parameter	Source	Sound Pressure Level, dBA		
		Day	Evening	Night
Recommended Background ($minL_{A90,1\ hour}$)	Table 12	35	30	25
Rating Background ($minL_{A90,1\ hour}$)	Site N8	29	31	26
Planning Background ($minL_{A90,1\ hour}$)	Table 10	34 (Rating +5)	25 (set at threshold[10])	25 (set at threshold[10])
Planning Noise Level ($PNL_{Bg,}$) ($L_{Aeq,1hour,\ adj}$)	Planning BG + 3	37	28	28

Table 21: Planning Level Derivation (Background Methodology) – Others –Glenalpine

Parameter	Source	Sound Pressure Level, dBA		
		Day	Evening	Night
Recommended Background ($minL_{A90,1\ hour}$)	Table 12	35	30	25
Rating Background ($minL_{A90,1\ hour}$)	Site N9	31	27	20
Planning Background ($minL_{A90,1\ hour}$)	Table 10	33 (Rec -2)	27 (Rec -3)	25 (set at threshold[10])
Planning Noise Level ($PNL_{Bg,}$) ($L_{Aeq,1hour,\ adj}$)	Planning BG + 3	36	30	28

Table 22: Planning Level Derivation (Background Methodology) – Others –Fernie

Parameter	Source	Sound Pressure Level, dBA		
		Day	Evening	Night
Recommended Background ($minL_{A90,1\ hour}$)	Table 12	35	30	25
Rating Background ($minL_{A90,1\ hour}$)	Site N10	25	25	23
Planning Background ($minL_{A90,1\ hour}$)	Table 10	30 (Rating +5)	28 (Rating -2)	25 (set at threshold[10])
Planning Noise Level ($PNL_{Bg,}$) ($L_{Aeq,1hour,\ adj}$)	Planning BG + 3	33	31	28

A.2 Management of Variable Noise

To ensure that the derived Planning Noise Level adequately contains levels of transient or variable noises from new developments (e.g. transportation noise or noise from cyclic industrial processes), the Guideline describes a methodology for determining an alternative Planning Noise Level (PNL_{Eq}) depending on the relationship between the Baseline minimum $L_{Aeq,1hour}$ values in each time period, and the Recommended Maximum Planning Noise Levels (Recommended PNLs) advised in the Guideline. The Guideline advises that the Recommended PNLs are intended to help protect against noise impacts such as "speech interference, community annoyance and, to some extent, sleep disturbance".

The Guideline Recommended PNLs depend upon the nature of the surrounding land use, being lower for green-field areas, and higher for recognised commercial/industrial areas and areas with more transportation noise sources, as defined in Table 23.

Table 23: Guideline Recommended Maximum Planning Noise Levels

Noise Area Category	Description of Neighbourhood[9]	Recommended Maximum PNL[10], ($L_{Aeq,1hour}$ - dBA)		
		Day	Evening	Night
Z1	Very rural, purely residential. Less than 40 vehicles/hour	40	35	30
Z2	Negligible transportation. Less than 80 vehicles/hour	50	45	40
Z3	Low-density transportation. Less than 200 vehicles/hour	55	50	45
Z4	Medium density transportation (less than 600 vehicles/hour) or some commerce or industry	60	55	50
Z5	Dense transportation (less than 1200 vehicles/hour) or some commerce or industry	65	60	55
Z6	Very dense transportation (less than 3000 vehicles/hour) or in commercial or bordering industrial districts	70	65	60
Z7	Extremely dense transportation (3000 or greater vehicles/hour) or within predominantly industrial districts	75	70	65

The procedure for determining the PNL_{Eq} considers both the 'Baseline' minimum $L_{Aeq,1hour}$ values and the maximum recommended PNLs as summarised in Table 24.

[9] Where transportation noise is present, the minimum of the hourly L_{Aeq} values for transportation noise in the appropriate time period is taken, or the corresponding guideline value from Table 23, whichever is the greater. Guidance in selecting the appropriate hourly L_{Aeq} values for premises adjoining roadways carrying more than 100 vehicles/hour is given in the Guideline.

[10] Recommended levels are estimated 4m from the facade of a building

Table 24: Guideline Determination of PNL_{Eq} to contain Variable Noise

Comparison of Baseline $L_{Aeq,1hour}$ at Receptor with Recommended PNL (Table 23)	PNL_{Eq} for New Sources ($L_{Aeq,\ 1\ hour}$ – dBA)
Baseline ≥ Recommended + 2 dB	If Baseline $L_{Aeq,1hour}$ is likely to decrease in future, 10 dB below Recommended If Baseline $L_{Aeq,1hour}$ is likely to increase in future, 10 dB below Baseline
Baseline = Recommended + 1 dB	Recommended – 9 dB
Baseline = Recommended	Recommended – 8 dB
Baseline = Recommended -1 dB	Recommended – 6 dB
Baseline = Recommended -2 dB	Recommended – 4 dB
Baseline = Recommended -3 dB	Recommended – 3 dB
Baseline = Recommended -4 dB	Recommended – 2 dB
Baseline = Recommended -5 dB	Recommended – 2 dB
Baseline = Recommended -6 dB	Recommended – 1 dB
Baseline < Recommended -6 dB	Recommended

A.3 Design Planning Noise Level (PNL_{Design})

After determining the PNL_{Eq} and PNL_{Bg} these values are compared, and the lower value used as the Design PNL (PNL_{Design}). Where values of PNL_{Eq} are determined to be lower than 25dBA, the threshold value of 25dBA has been used (as outlined in Appendix C Example C4 of the Guideline). This analysis is summarised in Table 25 to Table 34. The residences in proximity to Bruce Highway west of Bowen and the Capricorn Highway are subject to significant transportation noise in the form of rail and road traffic noise, while site N2 (Pepper) was chosen to monitor coal train passby noise and is therefore significantly affected by rail noise. All other receiver areas are subject to minimal road traffic and rail noise.

Table 25: Design Planning Level Derivation – Proximity to Bruce Highway west of Bowen – Salisbury Plains

Parameter	Source	Sound Pressure Level ($L_{Aeq,1hour}$ – dBA)		
		Day	Evening	Night
Recommended Maximum PNL	Table 23 (z4)	60	55	50
Baseline minimum $L_{Aeq,1hour}$	Site N1	38	40	38
PNL_{Eq} ($L_{Aeq,1hour,\ adj}$)	Table 24	60 (Rec.)	55 (Rec.)	50 (Rec.)
PNL_{Bg} ($L_{Aeq,1hour,\ adj}$)	Table 13	44	41	36
PNL_{Design} ($L_{Aeq,1hour,\ adj}$)	lesser of PNL_{Eq} and PNL_{Bg}	44	41	36

Table 26: Design Planning Level Derivation – Others – Pepper (Railway)

Parameter	Source	Sound Pressure Level ($L_{Aeq,1hour}$ – dBA)		
		Day	Evening	Night
Recommended Maximum PNL	Table 23 (z4)	60	55	50
Baseline minimum $L_{Aeq,1hour}$	Site N2	52	55	46
PNL_{Eq} ($L_{Aeq,1hour,\ adj}$)	Table 24	60 (Rec.)	47 (Rec. -8)	48 (Rec. -2)
PNL_{Bg} ($L_{Aeq,1hour,\ adj}$)	Table 14	41	38	28
PNL_{Design} ($L_{Aeq,1hour,\ adj}$)	lesser of PNL_{Eq} and PNL_{Bg}	41	38	28

Table 27: Design Planning Level Derivation – Others – Havilah

Parameter	Source	Sound Pressure Level ($L_{Aeq,1hour}$ – dBA)		
		Day	Evening	Night
Recommended Maximum PNL	Table 23 (z2)	50	45	40
Baseline minimum $L_{Aeq,1hour}$	Site N3	41	26	28
PNL_{Eq} ($L_{Aeq,1hour,\ adj}$)	Table 24	50 (Rec.)	45 (Rec.)	40 (Rec.)
PNL_{Bg} ($L_{Aeq,1hour,\ adj}$)	Table 15	34	28	28
PNL_{Design} ($L_{Aeq,1hour,\ adj}$)	lesser of PNL_{Eq} and PNL_{Bg}	34	28	28

Table 28: Design Planning Level Derivation – Others – Monklands

Parameter	Source	Sound Pressure Level ($L_{Aeq,1hour}$ – dBA)		
		Day	Evening	Night
Recommended Maximum PNL	Table 23 (z2)	50	45	40
Baseline minimum $L_{Aeq,1hour}$	Site N4	44	39	32
PNL_{Eq} ($L_{Aeq,1hour,\ adj}$)	Table 16	49 (Rec. -1)	44 (Rec. -1)	40 (Rec.)
PNL_{Bg} ($L_{Aeq,1hour,\ adj}$)	Table 13	29	31	28
PNL_{Design} ($L_{Aeq,1hour,\ adj}$)	lesser of PNL_{Eq} and PNL_{Bg}	29	31	28

Table 29: Design Planning Level Derivation – Proximity to Capricorn Highway –Glenlea Downs

Parameter	Source	Sound Pressure Level ($L_{Aeq,1hour}$ – dBA)		
		Day	Evening	Night
Recommended Maximum PNL	Table 23 (z4)	60	55	50
Baseline minimum $L_{Aeq,1hour}$	Site N5	39	35	23
PNL_{Eq} ($L_{Aeq,1hour,\ adj}$)	Table 24	60 (Rec.)	55 (Rec.)	50 (Rec.)
PNL_{Bg} ($L_{Aeq,1hour,\ adj}$)	Table 17	37	28	28
PNL_{Design} ($L_{Aeq,1hour,\ adj}$)	lesser of PNL_{Eq} and PNL_{Bg}	37	28	28

Table 30: Design Planning Level Derivation – Others – Lambton Meadows

Parameter	Source	Sound Pressure Level ($L_{Aeq,1hour}$ – dBA)		
		Day	Evening	Night
Recommended Maximum PNL	Table 23 (z1)	40	35	30
Baseline minimum $L_{Aeq,1hour}$	Site N6	37	31	23
PNL_{Eq} ($L_{Aeq,1hour,\ adj}$)	Table 24	37 (Rec. -3)	33 (Rec. -2)	30 (Rec.)
PNL_{Bg} ($L_{Aeq,1hour,\ adj}$)	Table 18	37	30	28
PNL_{Design} ($L_{Aeq,1hour,\ adj}$)	lesser of PNL_{Eq} and PNL_{Bg}	37	30	28

Table 31: Design Planning Level Derivation – Others – Cavendish

Parameter	Source	Sound Pressure Level ($L_{Aeq,1hour}$ – dBA)		
		Day	Evening	Night
Recommended Maximum PNL	Table 23 (z2)	50	45	40
Baseline minimum $L_{Aeq,1hour}$	Site N7	43	47	36
PNL_{Eq} ($L_{Aeq,1hour,\ adj}$)	Table 24	50 (Rec.)	37 (Base. -10)	38 (Rec. - 2)
PNL_{Bg} ($L_{Aeq,1hour,\ adj}$)	Table 19	28	28	28
PNL_{Design} ($L_{Aeq,1hour,\ adj}$)	lesser of PNL_{Eq} and PNL_{Bg}	28	28	28

Table 32: Design Planning Level Derivation – Others – Lenore

Parameter	Source	Sound Pressure Level ($L_{Aeq,1hour}$ – dBA)		
		Day	Evening	Night
Recommended Maximum PNL	Table 23 (z1)	40	35	30
Baseline minimum $L_{Aeq,1hour}$	Site N8	42	46	41
PNL_{Eq} ($L_{Aeq,1hour,\ adj}$)	Table 24	32 (Base. -10)	36 (Base. -10)	31 (Base. -10)
PNL_{Bg} ($L_{Aeq,1hour,\ adj}$)	Table 20	37	28	28
PNL_{Design} ($L_{Aeq,1hour,\ adj}$)	lesser of PNL_{Eq} and PNL_{Bg}	32	28	28

Table 33: Design Planning Level Derivation – Others – Glenalpine

Parameter	Source	Sound Pressure Level ($L_{Aeq,1hour}$ – dBA)		
		Day	Evening	Night
Recommended Maximum PNL	Table 23 (z1)	40	35	30
Baseline minimum $L_{Aeq,1hour}$	Site N9	46	45	43
PNL_{Eq} ($L_{Aeq,1hour,\ adj}$)	Table 24	36 (Base. -10)	35 (Base. -10)	33 (Base. -10)
PNL_{Bg} ($L_{Aeq,1hour,\ adj}$)	Table 21	36	30	28
PNL_{Design} ($L_{Aeq,1hour,\ adj}$)	lesser of PNL_{Eq} and PNL_{Bg}	36	30	28

Table 34: Design Planning Level Derivation – Others – Fernie

Parameter	Source	Sound Pressure Level ($L_{Aeq,1hour}$ – dBA)		
		Day	Evening	Night
Recommended Maximum PNL	Table 23 (z2)	50	45	40
Baseline minimum $L_{Aeq,1hour}$	Site N10	36	33	30
PNL_{Eq} ($L_{Aeq,1hour,\ adj}$)	Table 24	50 (Rec.)	45 (Rec.)	40 (Rec.)
PNL_{Bg} ($L_{Aeq,1hour,\ adj}$)	Table 22	33	31	28
PNL_{Design} ($L_{Aeq,1hour,\ adj}$)	lesser of PNL_{Eq} and PNL_{Bg}	33	31	28

Appendix B - Figures

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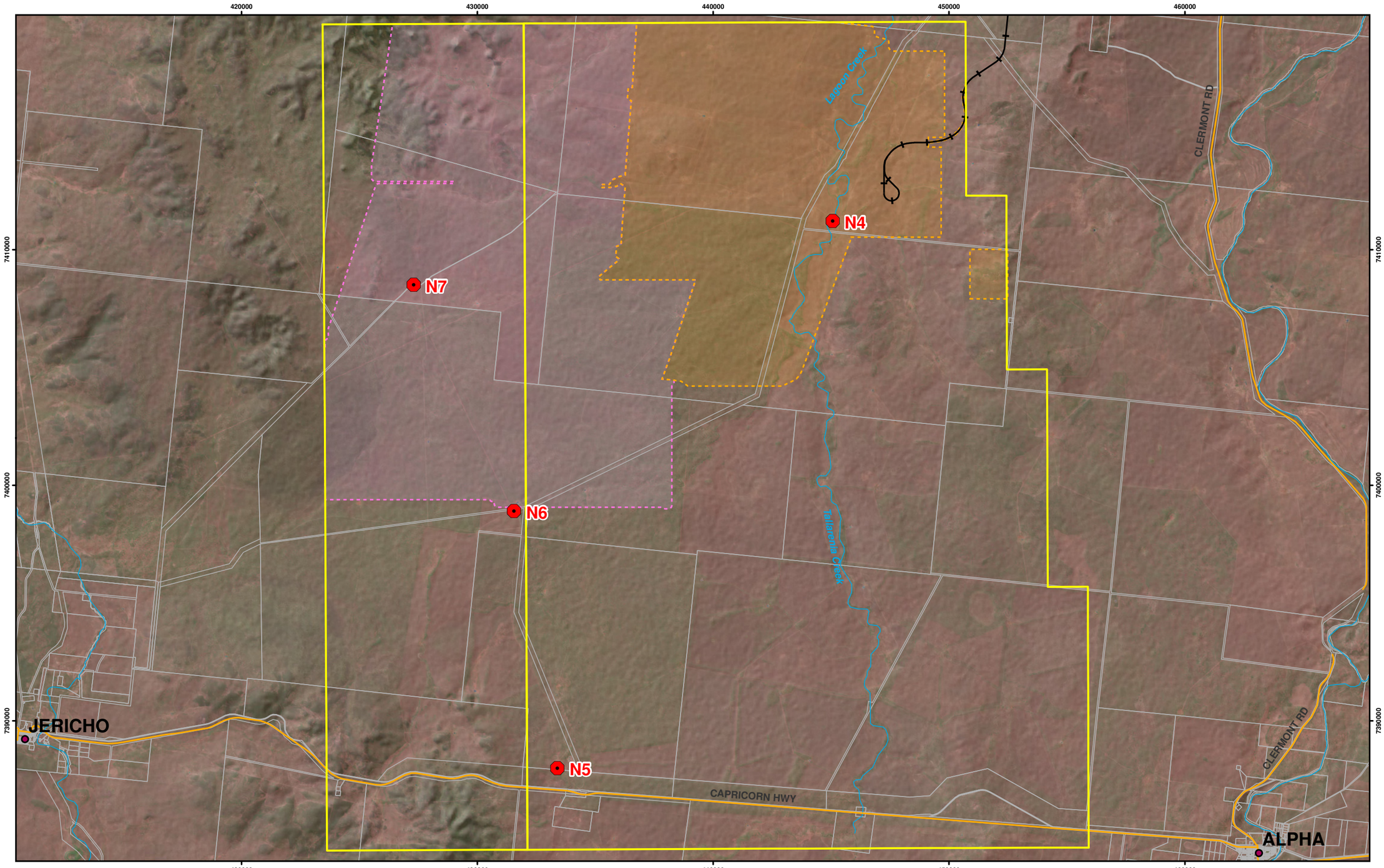


GALILEE COAL PROJECT (Northern Export Facility)

Savery & Associates Pty Ltd
Acoustic and Vibration Consultants

Source:	Cadastral Boundaries: DERM 2012 Mine Detail, Proposed Railway Line: Waratah Coal Pty. Ltd. 2012 Arterial Roads, Watercourses: Geoscience Australia 2012 Sensitive Receptors: Savery & Associates Pty Ltd 2012 Background Image: Satellite Image Geoscience Australia 2005, Shaded relief: ESRI Data & amp; Maps 2006
Disclaimer:	This plan is based on or contains data provided by others. Waratah Coal Pty. Ltd. gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suiability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to and use of the data. Data must not be used for direct marketing or be used in breach of privacy laws.
File:	WAR20-26-SEIS0023-FIG1a-ACOUSTIC-VIBRATION-RECEPTORS-MINE-120720

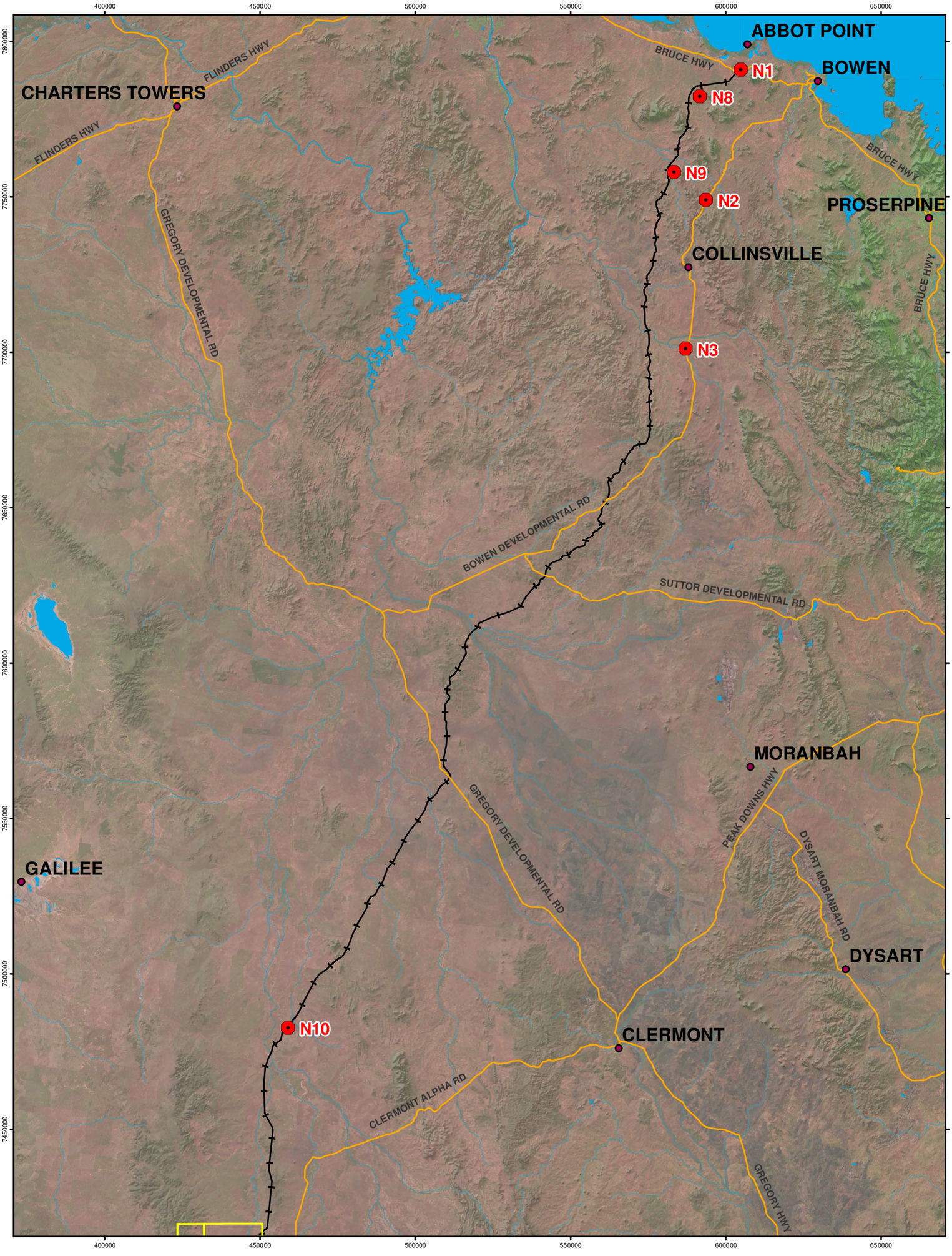
0 2,500 5,000 7,500 10,000
Metres

A4 Scale 1:200,000

Coordinate System: GDA 1994 MGA Zone 55 Projection: Transverse Mercator

- EPC1040 & Part of EPC1079
- Cadastral Boundary
- Identified sensitive receptor locations
- Probable Clearing Footprint
- Subsidence Footprint
- Proposed Railway Line
- Arterial Road

FIGURE 1:
MONITORING LOCATIONS NEARBY PROPOSED MINE SITE



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Source:	Cadastral Boundaries: DERM 2012 Mine Detail, Proposed Railway Line: Waratah Coal Pty. Ltd. 2012 Arterial Roads, Watercourses: Geoscience Australia 2012 Sensitive Receptors: Savery & Associates Pty Ltd 2012 Background Image: Satellite Image Geoscience Australia 2005, Shaded relief: ESRI Data & amp; Maps 2006
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File:	WAR20-26-SEIS0023-FIG2a ACOUSTIC-VIBRATION-RECEPTORS-RAIL-120720

0 25 50
Kilometers

A4 Scale 1:1,500,000

Coordinate System: GDA 1994 MGA Zone 55 Projection: Transverse Mercator

- Identified sensitive receptor locations
- EPC1040 & Part of EPC1079
- Arterial Road
- Proposed Railway Line
- Watercourse

FIGURE 2:
MONITORING LOCATIONS NEAR PROPOSED RAIL ALIGNMENT