

# **Technical paper 3**

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Noise and vibration

# NUNDAH BANK THIRD TRACK

## NOISE AND VIBRATION ASSESSMENT

ACOUSTICS AND AIR

REPORT NO. 10073  
VERSION H

WILKINSON  MURRAY

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**REPORT NO. 10073**  
**VERSION H**

**FEBRUARY 2011**

**PREPARED FOR**

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ACOUSTICS AND AIR

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## EXECUTIVE SUMMARY

An assessment of noise and vibration impacts associated with the proposed Nundah Bank Rail Project has been undertaken by Wilkinson Murray. Noise and vibration impacts that have been considered in the assessment include:

- operational noise and vibration;
- construction noise and vibration; and
- road traffic noise.

Assessment has been undertaken in accordance with the following NSW Government guidelines:

- *Interim Guidelines for the Assessment of Noise from Rail Infrastructure Projects* (IGANRIP)
- *Interim Construction Noise Guidelines* (ICNG)
- *Assessing Vibration: A Technical Guideline*
- *Environmental Criteria for Road Traffic Noise* (ECRTN)

### **Operational Noise and Vibration**

Operational rail noise has been assessed in general accordance with IGANRIP.

The nearest receivers are approximately 770m from the proposal. Attended and unattended noise monitoring demonstrated that existing rail noise levels at the nearest receiver were comparable with ambient noise levels. Therefore determination of existing rail noise levels required calculation of rail noise to supplement the limited measured data.

A computer noise model, using the NORDIC prediction algorithms and train source levels determined from RailCorp's Rail Noise Database (2003) was used in the prediction of rail noise levels. This model was calibrated with the measured data from the nearest receiver (Location B) and also a second measurement location nearer to the rail line (Location A), where rail noise greatly exceeded ambient noise levels and thus good resolution of rail noise was available. Nearly 300 trains were extracted from noise logger data at Location A, thus providing a sufficiently large dataset to account for the variability between train passby noise levels.

Existing rail noise  $L_{Aeq,15hr}$  day and  $L_{Aeq,9hr}$  night noise levels of under 45 dBA were calculated. Future noise levels, with the inclusion of the proposal, of under 49 dBA were calculated. This is within the applicable IGANRIP trigger levels for both day and night time periods and as such no further assessment is warranted.

Operational vibration levels at over 700mn will be negligible and so quantitative assessment of this was not undertaken.

### **Construction Impacts**

Construction noise has been assessed in general accordance with the ICNG.

The assessment of construction noise and vibration allows the area of risk to be identified, so that appropriately responsive measures can be adopted to mitigate or minimise any potential noise and vibration issues.

In general construction noise is predicted to comply with the relevant criteria during standard construction hours. A negligible 1 dB exceedance of criteria is predicted at the nearest receiver during bulk earthworks in the most exposed areas of the project.

Moderate exceedances of up to 6 dB are predicted during out-of-hours construction in the most exposed areas of the project. The majority of the works that are expected to occur outside standard construction hours are located at the northern end of the project. This area is well shielded from any surrounding receivers and as such noise levels are predicted to comply with criteria during these works.

Though impacts are considered to be minimised due to the large distance between the works and receivers, the following management and mitigation measures are recommended to further reduce noise impact at receivers.

- All mechanical plant should be silenced by best practical means using current technology. Noise suppression devices should be maintained to the manufacturer's specifications. Internal combustion engines are to be fitted with a suitable muffler in good working order.
- The constructor (as appropriate) should establish contact with the local residents and communicate, particularly when work outside standard construction hours is planned.
- All engine covers should be kept closed while equipment is operating.
- As far as possible, materials dropped from heights into or out of trucks should be minimised.
- Managing material stockpiles within the primary compound such that they provide a barrier between the plant and the nearest receivers is advisable.
- Broadband reversing alarms should be strongly considered for use on the site as they are a common cause of complaint. The sensitivity of receivers to tonal alarms at night is particularly heightened and this should be considered in preparing for works outside standard working hours (night time track possession works).

Vibration associated with the construction of the project will be negligible.

### **Traffic Noise Impacts**

Traffic noise generated on the local road network during construction of the proposal has been considered against criteria outlined in the *ECRTN* and is considered to be acceptable. There exists potential for minor exceedances of criteria during rail possessions that require significant vehicle movements in the night time period and we therefore recommend that drivers be briefed on the sensitivities of neighbouring receivers and encouraged to approach and leave the site in a considerate manner.

## 1 INTRODUCTION

Wilkinson Murray has been engaged by the Australian Rail Track Corporation (ARTC) to conduct an assessment of noise and vibration associated with the proposed Nundah Bank Rail Project for inclusion in the Project's Environmental Assessment (EA).

This assessment considers noise and vibration associated with both the construction and operation of the proposed project.

## 2 ASSESSMENT METHODOLOGY

### 2.1 Director-General's Requirements

The Director-General's Requirements (DGRs) state that the EA must contain an assessment of noise and vibration impacts.

The DGRs and the supporting DECCW letter dated 23 July 2010 state that assessment of noise and vibration should be done in accordance with the following NSW Department of Environment, Climate Change and Water (DECCW) publications:

- *Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects* [IGANRIP] (2007).
- *Interim Construction Noise Guideline* [ICNG] (2009).
- *Environmental Noise Management – Assessing Vibration: a technical guideline*.

### 2.2 Assessment Methodology

Assessment has been made in accordance with the guidance contained in the DGRs and the supporting DECCW letter.

Operational noise has been assessed in accordance with *IGANRIP*. A computer model was constructed and verified with measured data from the existing rail lines.

Construction noise has been modelled for assessment against the *ICNG*. Construction noise source levels have been based on measurements of similar construction activities.

The DGRs do not explicitly require assessment of road traffic noise generated by the proposal. As the construction of the proposal has the potential to generate road traffic for an extended period of time this has been assessed against the NSW DECCW's *Environmental Criteria for Road Traffic Noise* [ECRTN] (1999).

As the nearest residential receiver is approximately 770m from the proposal, vibration impacts will be negligible and well within the relevant criteria contained within the DECCW's *Assessing Vibration: a technical guideline* or relevant building damage criteria detailed in international standards. Similarly vibration levels produced by construction will also be negligible and within relevant guidelines and standards. For reference, the most stringent goal level specified in *Assessing Vibration: a technical guideline* is 0.2mm/s PPV for the assessment of continuous vibration occurring at night with regard to human comfort. A 30t rockhammer would produce

less than 0.1mm/s PPV<sup>(1)</sup> at the distance to the nearest receiver. As stated this magnitude of vibration is unperceivable and thus does not warrant further investigation or assessment.

### 3 SITE DESCRIPTION

The proposal is located in a rural area north of Singleton. The site location is shown in The proposed site layout is shown in Figure 3-2.

Figure 3-1.

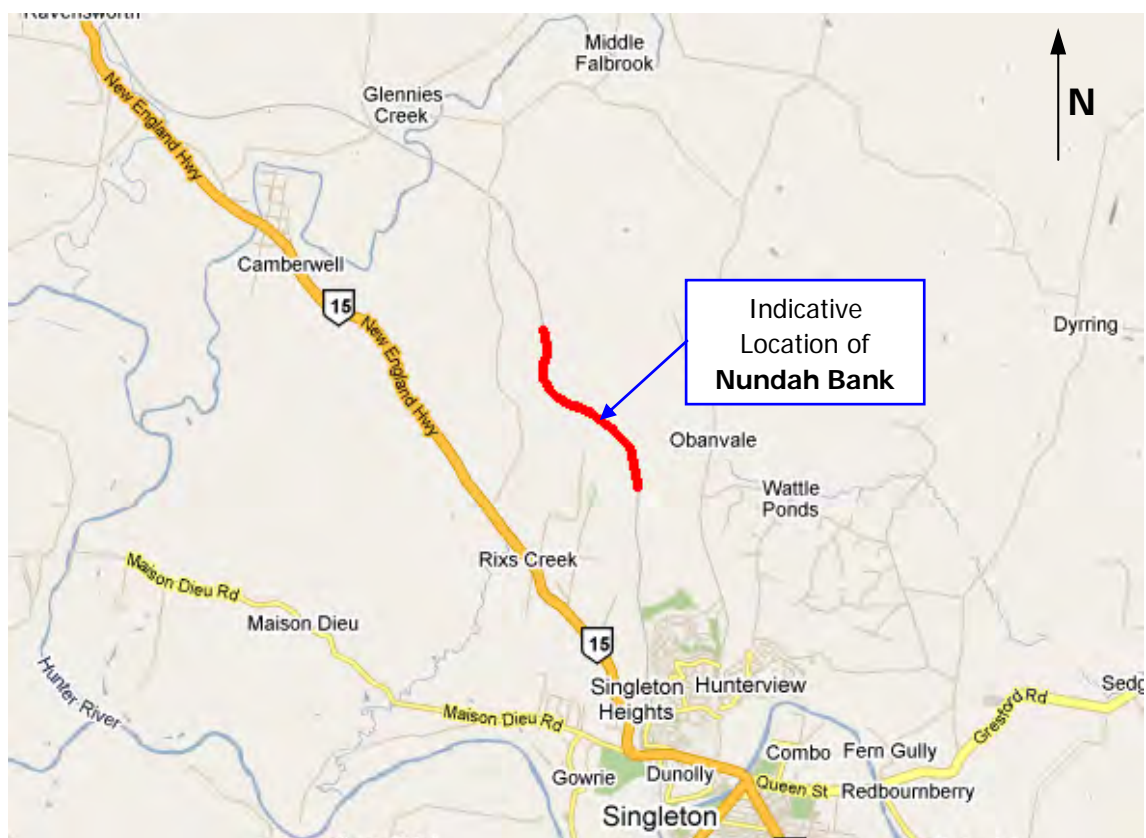
The site surrounds are generally rural in nature with few residential receivers surrounding the rail corridor. The nearest three receivers have been considered in this assessment. These are:

- R1 – 427 Bridgman Road; Approximately 770m from the rail line.
- R2 – 411 Bridgman Road; Approximately 920m from the rail line.
- R3 – 447 Bridgman Road; Approximately 950m from the rail line.

The area surrounding the proposal also includes the Rixs Creek Coal Mine to the west, and its associated infrastructure. Integra Coal is located to the east of the project at the northern end.

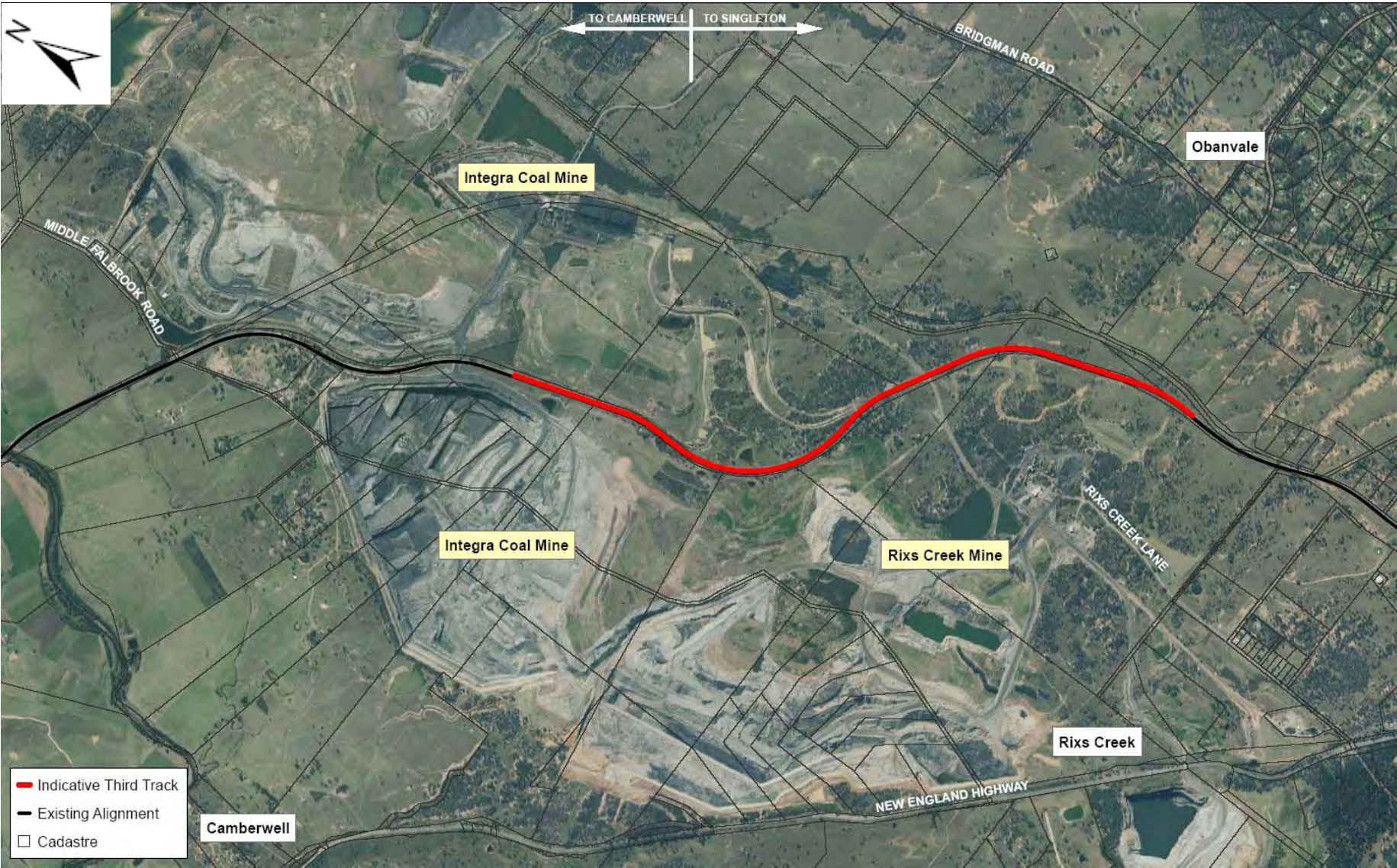
The proposed site layout is shown in Figure 3-2.

**Figure 3-1 Site Location**



<sup>1</sup> Vibration predictions are rarely done at such great distances with the exception of blast analysis. The predicted levels do not adequately account for the full extent of damping in the propagation path and consequently the actual receiver levels will likely be lower.

Figure 3-2 Site Layout



### 3.1 Rail Traffic

Table 3-1 shows current and estimated future numbers of train operations on the line. These figures have been provided by ARTC. 2018 represents the limit of train forecast modelling and so this has been adopted as the future scenario for this assessment.

**Table 3-1 Current and Future Train Numbers**

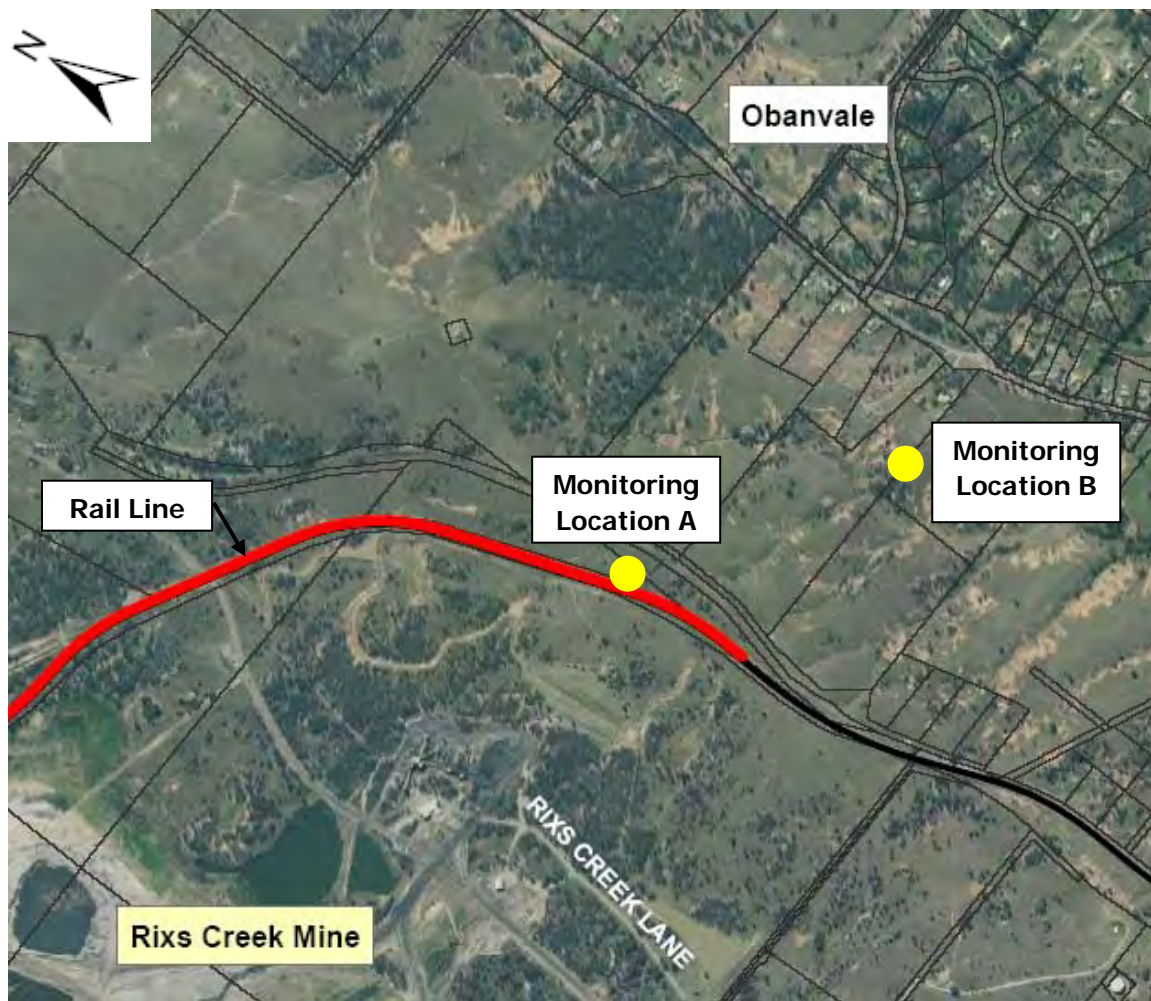
Train Type	Train pass-bys per 24 hours					
	2010			2018		
	Day	Night	Total	Day	Night	Total
	7am-10pm	10pm-7am	24-hour	7am-10pm	10pm-7am	24-hour
Freight (Coal and non-coal)	54	32	86	128	76	204
Passenger	4	2	6	4	2	6
<b>Total</b>	<b>58</b>	<b>34</b>	<b>92</b>	<b>132</b>	<b>78</b>	<b>210</b>

## 4 EXISTING ACOUSTIC ENVIRONMENT

In order to determine the existing acoustic environment, unattended noise monitoring was conducted between Monday, 26 and Friday, 30 July, 2010. Monitoring was conducted at the two locations detailed below. These locations are shown in Figure 4-1.

- **Location A** – 140m from rail line. This location was selected to calibrate the model in the event that train noise at the receiver was not able to be clearly identified above ambient noise.
- **Location B** – 427 Bridgman Road. This is the nearest residential receiver to the proposal.

Figure 4-1 Noise Monitoring Locations



Monitoring was conducted in free-field locations. Therefore, a 2.5dB façade correction has been applied to the measured rail noise levels for comparison with *IGANRIP* criteria. No façade correction has been applied to the reported RBL or  $L_{Aeq,period}$  noise levels.

The noise monitoring equipment used for these measurements consisted of an environmental noise logger set to A-weighted, fast response, continuously monitoring over 15-minute sampling periods. This equipment is capable of remotely monitoring and storing noise level descriptors

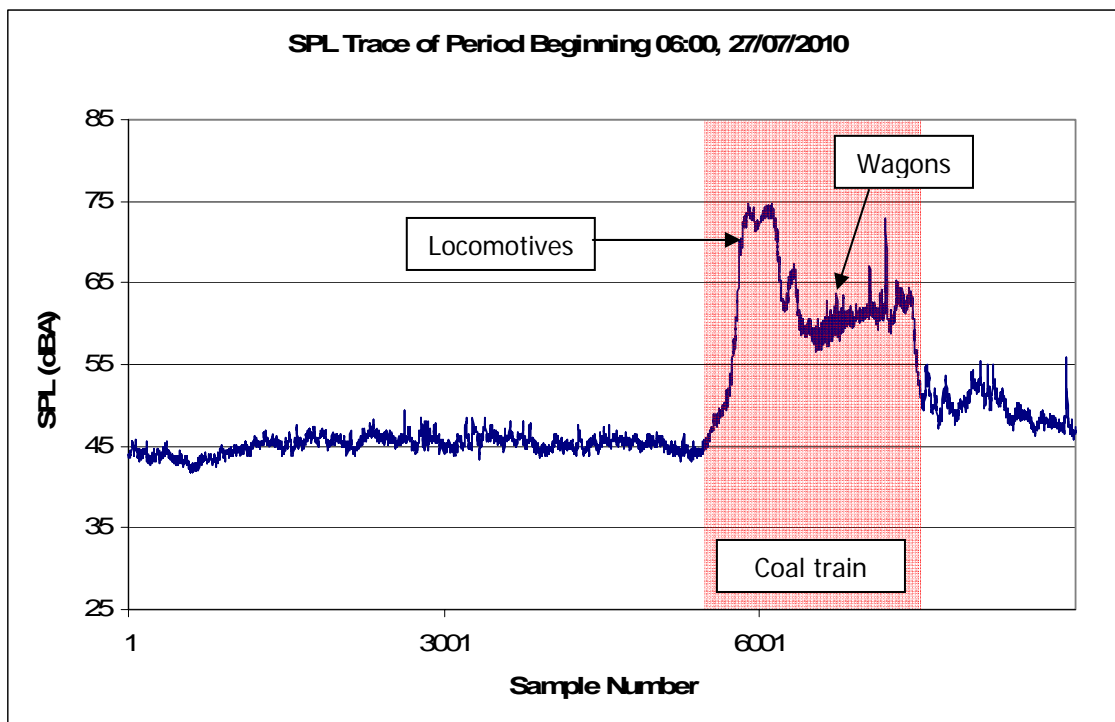
for later detailed analysis. The equipment calibration was checked before and after the survey and no significant drift occurred.

The logger determines  $L_{A1}$ ,  $L_{A10}$ ,  $L_{A90}$  and  $L_{Aeq}$  levels of the ambient noise. The  $L_{A1}$ ,  $L_{A10}$  and  $L_{A90}$  levels are the levels exceeded for 1%, 10% and 90% of the sample time respectively. The  $L_{A1}$  is indicative of maximum noise levels due to individual noise events such as the occasional passby of a train. The  $L_{A90}$  level is used to derive the Rating Background Level (RBL) which is defined in the *I/NP*. The  $L_{Aeq}$  level is the Equivalent Continuous Sound Level and has the same sound energy over the sampling period as the actual noise environment with its fluctuating sound levels. The  $L_{Aeq}$  is used for the assessment of operational rail noise and construction traffic noise.

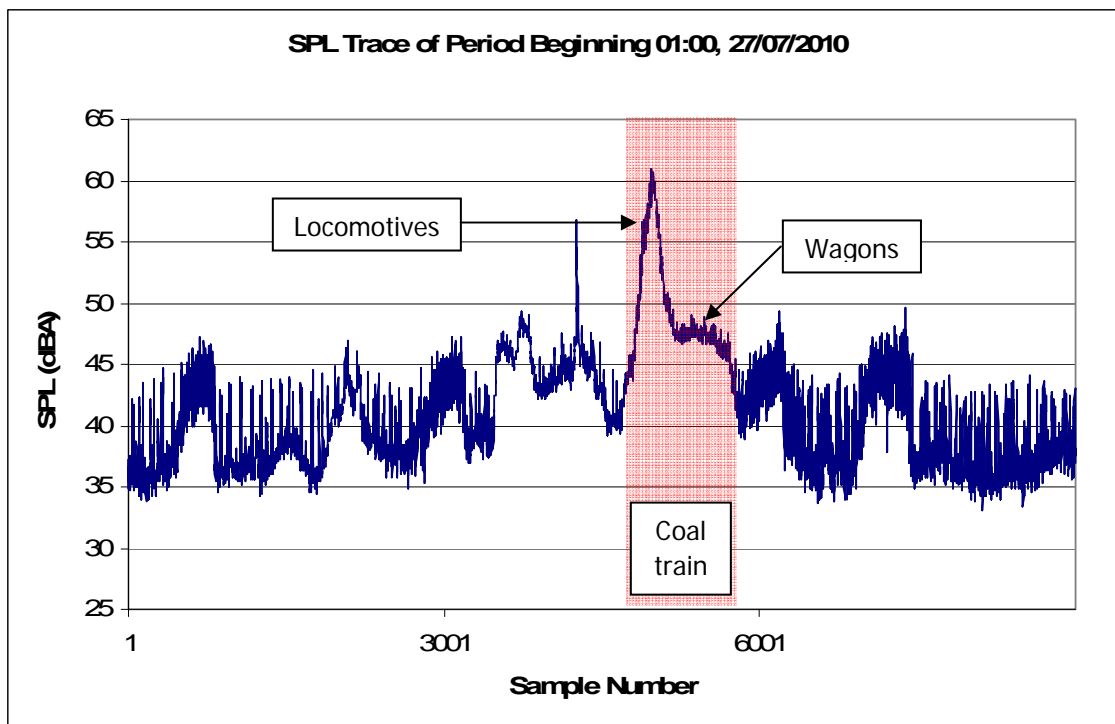
In addition, the noise logger was set to record a time-history of the noise level every one-tenth of a second. This time-history enables the identification of train events. Figure 4-2 and Figure 4-3 show examples of a 15-minute time-history containing a coal/ore train passby at monitoring locations A and B respectively.

Additionally the noise logger was set to record real-time audio to wav files.

**Figure 4-2 Example of a 15-minute Time-History Stored by the Noise Logger at Location A**



**Figure 4-3 Example of a 15-minute Time-History Stored by the Noise Logger at Location B (427 Bridgman Road)**



During the logger installation, attended monitoring of a train passby was conducted at each location. The noise levels from a coal train travelling in the Down direction (North) were only slightly audible at the residential receiver (Location B), and were not measureable, with the exception of the  $L_{Amax}$  noise level from the locomotive. An examination of the unattended monitoring results at this location confirms that train noise seldom exceeded ambient noise levels during the survey. The 15-minute time-history shown in Figure 4-3 is of a "noisier" train at the receiver. In this example locomotive noise is clearly identifiable, whilst wagon noise only slightly exceeds the ambient noise levels.

Additionally, the noise logger at Location B stopped unexpectedly after approximately 24 hours. For these reasons the noise logger at Location A has been primarily used to calibrate the noise model.

The measured noise levels at Location A for the period when the Location B logger was operational have been presented separately for comparison between the two monitoring locations.

Table 4-1 presents a summary of the measured noise levels over the monitoring period (all noise sources).

Table 4-2 and Table 4-3 present a summary of the measured rail events during the monitoring period at Location A. Note that rail noise levels at Location B could not be readily separated from ambient noise levels.

**Table 4-1 Summary of Existing Noise Levels**

Location	Day	L <sub>Aeq</sub> (dBA)		RBL (dBA)		
		Day <sup>1</sup>	Night <sup>1</sup>	Day <sup>2</sup>	Evening <sup>2</sup>	Night <sup>2</sup>
Location A	All	56	57	38	37	38
	26 <sup>th</sup> Night, 27 <sup>th</sup> Day	56	58	38	38	40
Location B	26 <sup>th</sup> Night, 27 <sup>th</sup> Day	44	45	37	40	39

Note: 1. Standard DECCW Day (7.00am–10.00pm) and Night (10.00pm–7.00am) rail time periods.  
2. Standard DECCW Day (7.00am–6.00pm), Evening (6.00pm–10.00pm) and Night (10.00pm–7.00am).

A review of the measured noise levels on the 26<sup>th</sup>/27<sup>th</sup> July 2010, when both noise loggers were operational shows that this day was typical of other days during the monitoring period. Therefore, the measured RBL values at Location B have been adopted for the derivation of relevant criteria at this location (construction only).

Note that the application notes for *Industrial Noise Policy (INP)* state that where evening or night time noise levels exceed the daytime noise levels, without justification for the increased noise, the daytime noise level should be adopted for these periods. Hence in this case an RBL of 37 dBA is adopted for all time periods.

**Table 4-2 Summary of Measured Train Levels at Location A - dBA**

Train Type	L <sub>Amax</sub>			Log Average SEL <sup>1</sup>
	Range	50 <sup>th</sup> Percentile	95 <sup>th</sup> Percentile	
Coal/Ore/Freight	59-97	76	84	89.3

Notes: 1. SEL – Sound Exposure Level – is the measure of sound energy in an event.  
2. All noise levels are façade corrected.

**Table 4-3 Summary of Measured Train Events – Location A**

Date	Number of Trains			Rail L <sub>Aeq,period</sub> (dBA)		
	Coal/Ore					
	24hr	Day <sup>1</sup>	Night <sup>1</sup>	24hr	Day <sup>1</sup>	Night <sup>1</sup>
Monday 26/7/2010 <sup>2</sup>	26 <sup>2</sup>	19 <sup>2</sup>	32	53 <sup>2</sup>	52 <sup>2</sup>	54
Tuesday 27/7/2010	79	48	31	58	56	56
Wednesday 28/7/2010	75	42	28	59	57	55
Thursday 29/7/2010	71	42	37	59	57	55
Friday 30/7/2010 <sup>2</sup>	41 <sup>2</sup>	14 <sup>2</sup>		56 <sup>2</sup>	51 <sup>2</sup>	
<b>All</b>	<b>292</b>	<b>292</b>		<b>55</b>	<b>53</b>	<b>53</b>

Notes: 1. Standard DECCW Day (7.00am–10.00pm) and Night (10.00pm–7.00am) rail time periods.  
2. Partial days: the logger was installed Monday afternoon and collected the following Monday lunchtime.  
3. All noise levels are façade corrected.

It should be noted that the train numbers measured during our survey are slightly lower than the estimates provided by ARTC for the existing operations, though they are similar. This is because the number of trains is variable and depends on a number of factors. The existing (2010) train numbers provided in Table 3-1 represent a busy day. ARTC have confirmed that the numbers in Table 4-3 are regularly achieved and thus they have been used for our assessment.

All modelling was based on the SEL of the measured train passbys, which is independent of the number of measured trains.

## 5 NOISE CRITERIA

### 5.1 Operational Noise Criteria

The DECCW's *Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects (IGANRIP)* (2007) provides guidance for assessment rail infrastructure. *IGANRIP* specifies 'trigger levels', which are "non mandatory targets that can be used to initiate an assessment of noise impacts and consideration of feasible and reasonable mitigation measures".

For residential receivers the noise trigger levels for absolute levels of rail noise have two components,  $L_{Aeq}$  and  $L_{Amax}$ . The  $L_{Aeq}$  contribution level of rail noise is assessed over both day and night periods. The application of the  $L_{Amax}$  descriptor for residential land uses recognises that rail events are not adequately described solely by the  $L_{Aeq}$  descriptor in terms of their effect on residential amenity and wellbeing.

**Table 5-1 Airborne Rail Traffic Noise Trigger Levels for Residential Land Uses [Source: Extract of Table 1 of the DECCW's IGANRIP]**

Type of Development	Day (7am – 10pm)	Night (10pm – 7am)	Comment
New rail line development	Development increases existing rail noise levels <b>and</b> resulting rail noise levels exceed:		These numbers represent external levels of noise that trigger the need for an assessment of the potential noise impacts from a rail infrastructure project.
	60 $L_{Aeq(15hr)}$ 80 $L_{Amax}$	55 $L_{Aeq(9hr)}$ 80 $L_{Amax}$	
Redevelopment of existing rail line	Development increases existing rail noise levels <b>and</b> resulting rail noise levels exceed:		An 'increase' in existing rail noise levels is taken to be an increase of 2dBA or more in $L_{Aeq}$ in any hour or an increase of 3dBA or more in $L_{Amax}$ .
	65 $L_{Aeq(15hr)}$ 85 $L_{Amax}$	60 $L_{Aeq(9hr)}$ 85 $L_{Amax}$	

In determining whether a rail line is considered a new or redeveloped rail line, *IGANRIP* states:

*"Redevelopment of an existing rail line applies where residential or noise-sensitive receivers are subject to existing rail noise at or above the noise trigger levels in (Table 5-1) for a new rail line development."*

Therefore, for the purpose of this assessment the rail line is considered a 'new rail line development' because the existing rail noise levels at the nearest receiver are below *IGANRIP* base trigger levels for a 'new line rail line development'.

The definition of an "increase" in existing rail levels in Table 5-1 is not completely clear, particularly in the case where the number of movements is likely to increase due to developments not associated with the proposal. The definition determined by Wilkinson Murray in consultation with ARTC, which is adopted in this assessment, is as follows.

- The "increase in existing rail levels" refers to the difference between the current  $L_{Aeq}$  in any

hour and the level 10 years after opening of the project, in the absence of other developments that could increase traffic volumes. This should be evaluated in the hour for which the increase is greatest (not the hour for which the level is highest).

- The  $L_{Aeq(15hr)}$  and  $L_{Aeq(9hr)}$  levels to be compared with the “base” criteria refer to predicted levels 10 years after opening of the project, including any increase in traffic volumes due to other anticipated developments.

As the development is primarily aimed at removing a current bottleneck, the future increase in rail traffic is considered to be attributable to this proposal. Therefore future train numbers from 2018, i.e. the limit of available forecasts, have been adopted both for comparison with the “base” criteria and for adjudicating the “increase”.

## 5.2 Construction Noise Criteria

The NSW DECCW's *Interim Construction Noise Guidelines (ICNG)* recommends the following objectives:

### Recommended standard hours of work

- Monday to Friday 7am to 6pm
- Saturday 8am to 1pm
- No work on Sundays or Public Holiday

### Management Noise Goals

Noise goals are detailed in Table 5-2.

**Table 5-2 Noise at Residences using Quantitative Assessment**

Time of Day	Management Level	How to Apply
	$L_{Aeq,15min}$	
<b>Recommended standard hours:</b> Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or public holidays	Noise affected RBL + 10dB	The noise affected level represents the point above which there may be some community reaction to noise. <ul style="list-style-type: none"> <li>Where the predicted or measured <math>L_{Aeq,15 min}</math> is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level.</li> <li>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.</li> </ul>
	Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. <ul style="list-style-type: none"> <li>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:                             <ol style="list-style-type: none"> <li>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)</li> <li>if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.</li> </ol> </li> </ul>
<b>Outside recommended standard hours</b>	Noise affected RBL + 5dB	<ul style="list-style-type: none"> <li>A strong justification would typically be required for works outside the recommended standard hours.</li> <li>The proponent should apply all feasible and reasonable work practices to meet the noise affected level.</li> <li>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.</li> </ul>

The majority of the construction is expected to occur during the standard construction hours, however some works will be required to occur outside these hours, such as those required to be conducted during a railway possession.

Table 5-3 shows relevant construction noise goals.

**Table 5-3 Construction Noise Goals**

Acceptable $L_{Aeq}$ Noise Level		
Standard Construction Hours RBL + 10 (dBA)	Outside Standard Construction Hours RBL + 5 (dBA)	
	Evening	Night
47	42 <sup>1</sup>	42 <sup>1</sup>

Note: 1. Daytime RBL of 37 dBA has been adopted for evening and night in accordance with *INP*.

At night there is a requirement to meet sleep disturbance criteria outlined in the *ICNG* for intermittent/impulsive noise. The *ICNG* requires quantitative assessment of the potential for sleep disturbance if works will occur for more than two consecutive nights. It refers to the *Environmental Criteria for Road Traffic Noise (ECRTN)* for guidance on applicable sleep disturbance criteria. A commonly used “screening” criterion for assessment of sleep disturbance, which is specified in the DECCW’s *Noise Guide for Local Government (NGLG)*, is that  $L_{A1,1min}$  should not exceed the background noise level by more than 15dBA. This applies to the level of construction noise external to any residence or other noise-sensitive receiver for the night period (10.00pm–7.00am).

**Table 5-4 Sleep Disturbance Construction Noise Goals**

RBL – All Receivers (dBA)	Acceptable $L_{A1,1min}$ Noise Level
	Night (dBA)
37	52

There is evidence in the appendices to the *ECRTN* to suggest that external noise levels of this magnitude are insufficient to cause awakening reactions. Therefore this criterion is considered conservative.

## 6 OPERATIONAL NOISE ASSESSMENT

The operational noise has been assessed in accordance with *IGANRIP*. The first stage of this assessment is to determine if the trigger levels outlined in Table 5-1 are exceeded. If these levels are exceeded it is then necessary to conduct a full assessment of reasonable and feasible mitigation measures.

In order to conduct this assessment, it is necessary to determine current and future  $L_{Aeq,period}$  and  $L_{Amax}$  noise levels from rail events.

### 6.1 Rail Noise Modelling Methodology

Rail noise was calculated using the CadnaA computer noise modelling software. NORDIC prediction algorithms were implemented and train source noise levels determined from RailCorp's Rail Noise Database (2003).

The following assumptions were made regarding the operation of the proposal.

- Coal/Freight train numbers will increase up to 204 events per day (see Section 3.1 for details).
- The trains will be controlled so that no wheel or brake squeal occurs. Wheel squeal is unlikely as the proposal does not include any small radius curves, however a similar high-frequency tonal squeal can be induced by the brake shoe contacting the wheel during braking. If this is found to occur, it may be necessary to trial specific mitigation measures such as altering the brake shoe compound used.
- The distribution of trains throughout the day for the existing and future scenarios will be as provided by ARTC.
- The proportional increase in train numbers in the future will be the same in all 1 hour periods, and is the same as the proportional increase in the total daily train numbers.
- Train speeds will be 60km/h in both directions for the portion of track impacting the nearest receivers. Different speeds exist in other portions of the proposal, however these are well shielded from the receivers and have little impact on receiver noise levels. Train speeds were determined from data provided by ARTC and modelled noise levels at these speeds give good agreement with measured noise levels.

### 6.2 Rail Noise Model Verification

The modelled noise levels for an individual train passby are presented in Table 6-1 for comparison with the measured noise levels.

**Table 6-1 Individual Train Passby Levels - dBA**

Location	Type	$L_{Amax} - \text{Loco}$	$L_{Aeq,wagons}$	Energy Average SEL <sup>1</sup>
Location A	Modelled	73-75	65	89.3
	Measured	59 – 97, (76) <sup>3</sup>	55 – 65	89.3
Location B	Modelled	57-59	53	77.4
	Measured	40 – 63	40 – 50	N/A

Notes: 1. This represents the weighted (# of trains) energy average of all train types.

2. All levels are façade corrected.

3. The 50<sup>th</sup> percentile  $L_{Amax}$  is presented in brackets. Typically the NORDIC rail prediction method predicts the 50<sup>th</sup> percentile  $L_{Amax}$ .

The modelled results show good agreement with the measured noise levels.

The measured noise levels for Location B are based on a single attended measurement and a manual review of noise logger data at this location. No numerical calibration was done based on the measured levels at this location. Instead the modelled levels have been reviewed against these levels merely to confirm realistic outputs of the model at Location B.

Based on the measured range of  $L_{Amax}$  noise levels, an 8 dBA adjustment needs to be applied to modelled  $L_{Amax}$  levels to adjust from the 50<sup>th</sup> percentile noise level to the 95<sup>th</sup> percentile, which is used for assessment purposes.

### 6.3 Rail Noise Modelling Results

Table 6-2 presents the worst case increase in  $L_{Aeq,1hr}$  with the introduction of the development. Note that as the distribution of trains is expected to be unchanged in the future, the increase in noise level is merely a function of the increase in train numbers and will be uniform for all 1 hour periods. Therefore an indicative 1 hour period has been selected for assessment.

In order for IGANRIP trigger levels to be exceeded, both the "Difference (>2dB for *IGANRIP*)" column (Table 6-2) and the "Future" column (Table 6-3 or Table 6-4) must exceed the appropriate *IGANRIP* Trigger Level.

**Table 6-2 Existing and "Existing + Proposal / Future"  $L_{Aeq, 1hr}$  Rail Noise Levels**

Rec. ID	<i>IGANRIP</i> Trigger Level	Predicted Level (dBA)		Difference (>2dB for <i>IGANRIP</i> )	<i>IGANRIP</i> "Difference" Trigger
		Existing (2010)	Future (2018)		
1	Increase of greater than 2dBA	44.7	48.9	4.2	<b>YES</b>
2		44.2	48.3	4.1	<b>YES</b>
3		43.6	47.8	4.2	<b>YES</b>

Note: 1. Levels are shown to 1 decimal place only. The difference was calculated with more significant figures and thus may not equal exactly the difference between the levels shown.

A review of the results in Table 6-2 shows that the change in  $L_{Aeq, 1hr}$  noise levels is sufficient to constitute an 'increase' as defined by *IGANRIP*. This is a function of the additional number of trains predicted in the future.

Table 6-3 and Table 6-4 summarize the noise modelling results for existing and future operational noise levels  $L_{Aeq, period}$  day and night time noise levels, including projected increases in train movements as shown in Table 3-1.

**Table 6-3 Existing and Future  $L_{Aeq, 15hr}$  Day Rail Noise Levels**

Rec. ID	<i>IGANRIP</i> Trigger Level	Predicted Level (dBA)		<i>IGANRIP</i> "Base Level" Trigger
		Existing (2010)	Future (2018)	
1	60dBA	44.7	48.9	<b>NO</b>
2		44.2	48.3	<b>NO</b>
3		43.6	47.8	<b>NO</b>

**Table 6-4 Existing and Future  $L_{Aeq, 9hr}$  Night Rail Noise Levels**

Rec. ID	<i>IGANRIP</i> Trigger Level	Predicted Level (dBA)		<i>IGANRIP</i> "Base Level" Trigger
		Existing (2010)	Future (2018)	
1	55dBA	44.7	48.8	<b>NO</b>
2		44.2	48.2	<b>NO</b>
3		43.6	47.7	<b>NO</b>

The modelling results show that noise levels at each of the identified sensitive receivers are predicted to be within relevant *IGANRIP* trigger levels.

Table 6-5 presents the existing and future  $L_{Amax}$  noise levels. Again in order for *IGANRIP* trigger levels to be exceeded both the "Future" column and the "Difference" column need to exceed the appropriate trigger level.

**Table 6-5 Existing and Future 95<sup>th</sup> Percentile L<sub>Amax</sub> Rail Noise Levels**

Rec. ID	IGANRIP Trigger Level	Predicted Level (dBA)		Difference (> 3dB for IGANRIP)	IGANRIP "Difference" Trigger
		Existing (2010)	Future (2018)		
1	80dBA and greater than 3dB 'increase'	67.0	67.0	0	<b>NO</b>
2		66.5	66.5	0	<b>NO</b>
3		65.9	65.9	0	<b>NO</b>

L<sub>Amax</sub> noise levels are predicted to be well within appropriate criteria. There is not expected to be any increase in L<sub>Amax</sub> noise levels as a result of the development.

Table 6-6 presents an evaluation of the IGANRIP Trigger Levels for each receiver.

**Table 6-6 Evaluation of IGANRIP Trigger Levels**

Rec. ID	Day L <sub>Aeq,15hr</sub>			Night L <sub>Aeq,9hr</sub>			L <sub>Amax</sub>		
	Level	Increase	Overall	Level	Increase	Overall	Level	Increase	Overall
1	NO	YES	<b>NO</b>	NO	YES	<b>NO</b>	NO	NO	<b>NO</b>
2	NO	YES	<b>NO</b>	NO	YES	<b>NO</b>	NO	NO	<b>NO</b>
3	NO	YES	<b>NO</b>	NO	YES	<b>NO</b>	NO	NO	<b>NO</b>

The modelling results show that none of the receivers are predicted to experience noise levels exceeding relevant IGANRIP trigger levels and thus the development does not trigger the need for a full assessment of reasonable and feasible mitigation.

## **7 CONSTRUCTION NOISE ASSESSMENT**

### **7.1 Proposed Construction Activities**

Table 7-1 provides an indication of the likely sequence of construction activities for the Proposal.

The construction period for the proposal would be approximately 18 months.

### **7.2 Construction Compounds and Access Roads**

The proposal will require two construction compounds. The primary compound will be located adjacent to the Middle Falbrook Road level crossing. The secondary compound will be located at the end of Rix's Creek Lane.

The secondary compound is located adjacent to the proposal. The location of this compound and also the types of activities that will occur in this compound mean that any noise generated will have less impact on residences than the actual earthworks and rail construction assessed elsewhere. As such quantitative assessment of noise generated from this compound is not warranted.

The primary compound is located quite a distance from the main work areas. As such a lengthy vehicular access road is proposed alongside the existing rail line. A residential receiver, that is quite distant from the actual third track, is located approximately 550m from the primary compound. It is necessary to consider the noise impacts associated with the primary compound and the access road on this isolated receiver.

### **7.3 Construction Hours**

Standard construction hours would be limited to 7.00am to 6.00pm Monday to Friday and 8.00am to 1.00pm on Saturdays.

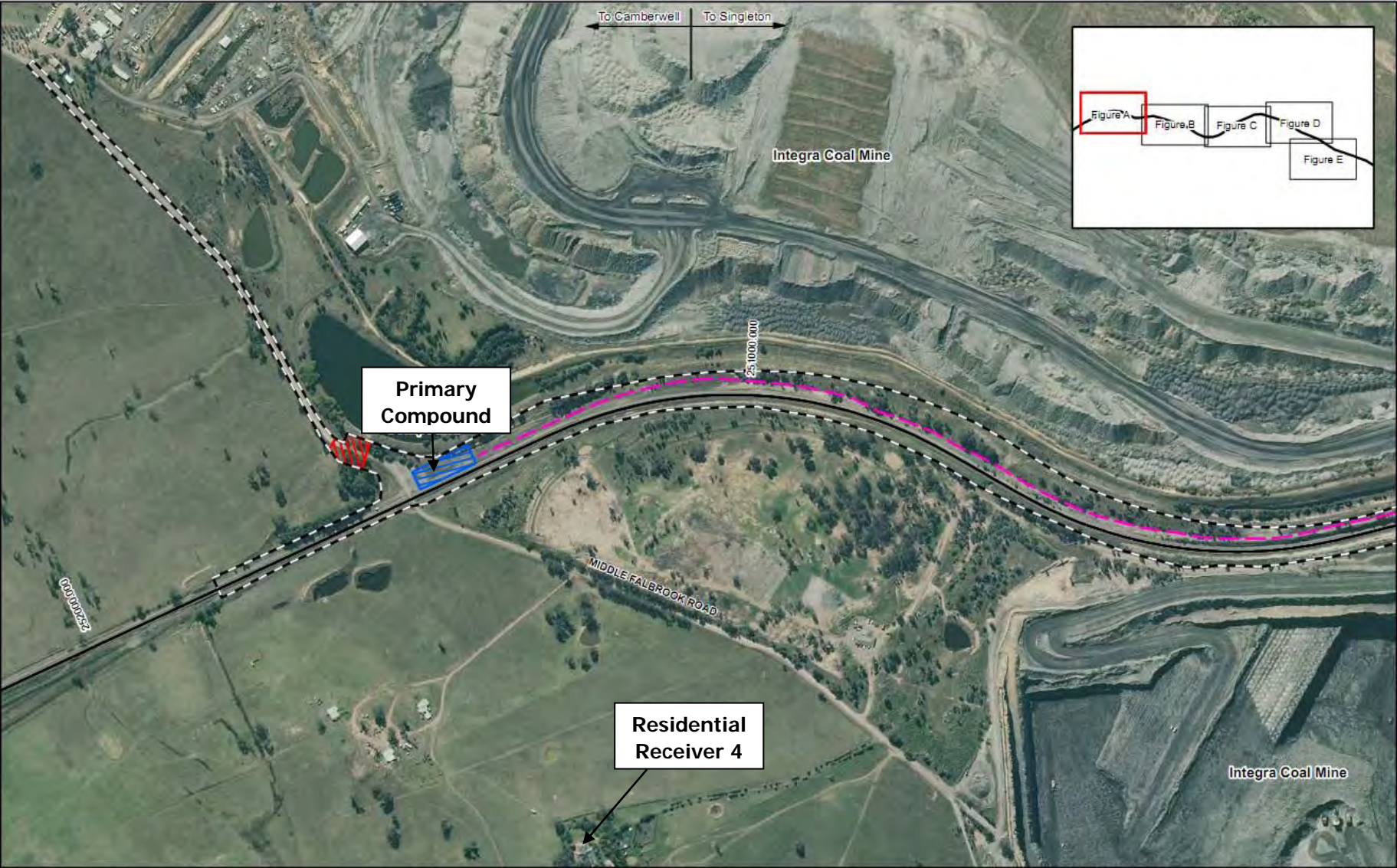
Work required to be conducted outside these hours includes:

- Track possessions
- Works required by utility service providers
- Oversize deliveries/unloading

**Table 7-1 Indicative Construction Activities**

Stage	Activity	Indicative Timing
Site establishment	<ul style="list-style-type: none"> <li>• Implement land acquisition and install site fence boundaries</li> <li>• Install environmental controls</li> <li>• Establish main and satellite compounds</li> <li>• Construction of extension to Rixs Creek Lane to rail corridor</li> <li>• Clear vegetation where haul roads and third track are to be constructed</li> <li>• Install traffic signage for site ingress/egress</li> <li>• Isolate areas from live rail corridor (Vortec fencing)</li> <li>• Survey stake out the works</li> <li>• Complete geotechnical site investigations</li> <li>• Install strengthening on existing wooden bridge on Middle Falbrook Road</li> </ul>	Pre-construction – July 2011 to November 2011
Construction	<ul style="list-style-type: none"> <li>• Stripping and stockpiling of topsoil</li> <li>• Extend existing culvert structures for new third rail track</li> <li>• Bulk earthworks (cut to fill)</li> <li>• Cutting back rock batters to widen existing cutting</li> <li>• Installation of rock anchors to support existing bridge abutments at Rixs Creek Mine bridge</li> <li>• Importation, placement and compaction of structural fill, capping material and ballast for construction of rail track formation</li> <li>• Construction of cess drains/open channels</li> <li>• Installation of new turnouts and crossovers during track possessions</li> <li>• Installation of sleepers and railway track for new third track</li> </ul>	During Construction – November 2011 to November 2012
Testing and commissioning	<ul style="list-style-type: none"> <li>• Testing and commission of railway systems</li> <li>• Hand over new third track to ARTC</li> </ul>	November 2012
Demobilisation	<ul style="list-style-type: none"> <li>• Removal of site compounds</li> <li>• Landscaping and rehabilitation of affected areas</li> <li>• Removal of environmental controls</li> <li>• Removal of site related traffic signage</li> </ul>	December 2012

Figure 7-1 Primary Construction Compound



#### 7.4 Proposed Construction Plant

The typical  $L_{Aeq}$  Sound Power Level (SWL) of all the plant likely to be used at various stages of works is identified in Table 7-2. These Sound Power Levels have been recently measured at other similar construction sites.

**Table 7-2 Typical  $L_{Aeq}$  Construction Plant Sound Power Levels (SWL)**

Plant	$L_{Aeq}$ SWL (dBA)	$L_{Aeq}$ SWL with Corrections for Impulsiveness and Tonality (dBA)	$L_{A1,1min}$ SWL (dBA)
Concrete Saw	112	117	118
Rail Saw	112	117	118
Rock Saw	115	120	121
Concrete Truck	107	107	114
Concrete Pump	103	103	110
Concrete Adgi/Vibro	105	105	112
Excavators	100-110	100-110	116
Hydraulic Hammer – Excavator Mounted	115-118	120-123	123
Air Drill Rig	116	116	120
Backhoe	105	105	112
Generators	90	90	92
Pumps	90-100	90-100	100
Front End Loader	111	111	116
Grader	107	107	114
Vibratory Roller	101	106	110
Cranes	105-111	105-111	118
Truck	105	105	114
Dump Truck	105	105	114
Rail Tamping Machine	113	118	120
Ballast Regulator	111	116	118
Welding Torch	90	90	95
Rail Grinder	109	114	120
Dozer	115	115	120

Using the information in Table 7-2, the cumulative sound power level for each scenario has been calculated. In any scenario, all pieces of equipment are not necessarily operating at their loudest simultaneously. Hence, for each scenario, a correction is applied to the total SWL from all equipment, to represent the maximum likely SWL emitted at any one time. The correction is assigned as described for each scenario.

Note that the correction for impulsiveness or tonality is shown above for reference only. The

application of such a penalty for these characteristics needs to be assessed at the residence, i.e. the character of the sound that the resident is exposed to. Wherever such a penalty is considered applicable it will be discussed and applied in the following sections.

Construction activities have been divided into stages to facilitate assessment.

#### 7.4.1 Site Establishment and Clearing

The works will require the following equipment:

- Excavators;
- Backhoe;
- Dozer;
- Front End Loader;
- Generators;
- Pumps;
- Dump Trucks; and
- Trucks.

Noise modelling has assumed that for the typical worst mobile plant operations, the cumulative  $L_{Aeq}$  sound power level will be dominated by the dozer, and hence a sound power level of 115dBA is assigned for this scenario. The  $L_{A1,1min}$  sound power level is assumed to be 120dBA.

#### 7.4.2 Bulk Earthworks

The works will require the following equipment:

- Excavators;
- Hydraulic Hammers;
- Backhoe;
- Dozer;
- Dump Trucks;
- Trucks;
- Vibratory Roller;
- Generators;
- Pumps;
- Grader; and
- Front End Loader.

Once again, the worst-case sound emission levels will be dominated by the dozer and hydraulic hammers. A sound power level of 118dBA has been assumed for modelling. Where receiver noise levels are predicted to be clearly audible a 5 dB correction for impulsiveness is warranted due to the use of the hydraulic hammer. The  $L_{A1,1min}$  sound power level is assumed to be 123dBA.

#### 7.4.3 Rail Construction

The works will require the following equipment:

- Excavators;
- Front End Loader;
- Dump Trucks;

- Trucks;
- Generators;
- Pumps;
- Rail Tamping Machine;
- Ballast Regulator;
- Welding Torch
- Concrete Saw;
- Rail Saw;
- Concrete Truck;
- Concrete Pump;
- Concrete Adgi/Vibro;
- Cranes (up to 200t);
- Rail Grinder; and
- Front End Loader.

Noise modelling has assumed that for the typical worst mobile plant operations, the cumulative adjusted  $L_{Aeq}$  sound power level of this plant would be up to 113dBA resulting from the rail tamping machine. This level might also be subject to a 5dB penalty for low frequency / tonal noise depending on the noise level at the receiver relative to the ambient noise environment. Other activities such as rail or concrete cutting are expected to produce similar levels. The  $L_{A1,1min}$  sound power level is assumed to be 120dBA.

#### 7.4.4 Bridge Works

The Rix's Creek Mine overbridge will require upgrading works to facilitate the third track. The works will require the following equipment:

- Excavators;
- Hydraulic Hammers (4);
- Air Drill Rig (rock bolting);
- Rock Saw;
- Trucks;
- Generators; and
- Pumps.

The worst-case sound emission levels will result from the concurrent use of hydraulic hammers, the air drill rig and/or the rock saw. A sound power level of 118dBA has been assumed for modelling. Where receiver noise levels are predicted to be clearly audible a 5 dB correction for impulsiveness is warranted due to the use of the hydraulic hammer. The  $L_{A1,1min}$  sound power level is assumed to be 123dBA.

We note that the location of these works is shielded from the nearest receivers by topography.

#### 7.4.5 Demobilisation and Rehabilitation

The works will require the following equipment:

- Excavators;
- Backhoe;
- Generators;
- Pumps;
- Dump Trucks; and

- Trucks.

Noise modelling has assumed that for the typical worst mobile plant operations, the cumulative  $L_{Aeq}$  sound power level of this plant would be up to 107dBA from several plant items operating simultaneously. The  $L_{A1,1min}$  sound power level is assumed to be 116dBA.

#### 7.4.6 Primary Compound and Access Road

Typically the following equipment would be used in the site compound:

- Front End Loader;
- Trucks; and
- Light Vehicles.

The access road would typically be used for material delivery and light vehicle movements. The traffic report suggests that eight heavy vehicle movements (four each way) would be expected in a typical hour.

Noise modelling has assumed that the cumulative  $L_{Aeq}$  sound power level from the primary compound would be 111dBA, primarily from the use of the front end loader. Noise modelling has assumed eight truck movements per hour on the access road.

The  $L_{A1,1min}$  sound power level is assumed to be 116dBA and would be expected from infrequent high level noise events in the compound during loading or unloading.

### 7.5 Predicted Receiver Noise Levels

Typical worst case receiver noise levels have been predicted for each stage of works using the CadnaA computer noise modelling software.

The predicted receiver  $L_{Aeq}$  noise levels during each stage of the works are presented for comparison with *ICNG* criteria in Table 7-3.

**Table 7-3 Predicted  $L_{Aeq,15min}$  Construction Noise Levels**

Rec #	Criteria (dBA)		Predicted Receiver Noise Level (dBA)					
	Stand Constr Hrs (dBA)	Outside Stand Constr Hrs (dBA)		Construction Scenario				
		Evening	Night	7.4.1	7.4.2	7.4.3	7.4.4	7.4.5
1				41	48	44	35	33
2	47	42	42	40	47	43	35	32
3				38	45	41	35	30

**Table 7-4 Predicted  $L_{Aeq,15min}$  Compound & Access Road Noise Levels**

Rec #	Criteria (dBA)			Predicted Receiver Noise Level (dBA)	
	Standard Construction Hours	Outside Stand Constr Hrs		7.4.6	
		Evening	Night	Compound	Access Road
4	47	42	42	42	33

The noise levels predicted for Scenarios 7.4.2 and 7.4.3 are generally above the assumed ambient noise levels for the area (in the absence of trains) and therefore the impulsive and low frequency / tonal character of the hydraulic hammer and the tamping machine are likely to be evident at all receivers. Therefore, the noise levels presented for Scenario 7.3.3 include a 5dB penalty for this character.

The noise levels generated by typical worst case scenarios for each stage of construction are predicted to be within *ICNG* goal levels at the nearest sensitive receivers during standard construction hours, except for a negligible 1 dB exceedance whilst the hydraulic hammer is used in the most exposed location.

It is necessary to consider the context and potential impacts relating to the predicted exceedance. It is generally considered that an average person cannot distinguish a 1 dB difference in sound pressure levels. Furthermore the predicted receiver noise levels represent a worst-case noise level, with the noisiest equipment operating in the most exposed location; a scenario that may not eventuate. Therefore, for the most part of construction, mitigation would not be warranted. Instead we consider that the predicted noise level exceedance would be best managed through community consultation, monitoring and having the ability to modify work practices slightly if a complaint is generated. If a specific, confined work area is found to generate complaints, then it might be possible to erect a limited section of temporary hoarding adjacent to the works in this location.

The noise levels associated with the primary compound and access road are predicted to comply with the relevant criteria.

The *ICNG* permits work outside standard construction hours only if strong justification for the works occurring during these times is demonstrated. Justification is typically considered to be limited to works in the public interest, engineering reasons, access to public infrastructure etc. The criteria presented assume that justification for the works is shown.

If justification for the works occurring outside standard construction hours is not provided, then it is reasonable to assume that lower noise criteria should be met before works are permitted. The "out of hours" criteria presented in Table 7-3 are for works outside standard construction hours with justification, i.e. compliance with these criteria does not demonstrate that works outside standard construction hours are acceptable. The predicted noise levels indicate that the construction is likely to be audible at the nearest receivers and therefore we consider that works should be limited to standard construction hours wherever possible.

Some occasional night time works are expected to be required. The predicted  $L_{A1,1min}$  noise levels associated with these activities are presented in Table 7-5.

**Table 7-5 Predicted  $L_{A1,1min}$  Construction Noise Levels**

Rec #	Criteria (dBA)	Predicted Receiver Noise Level (dBA)				
		Construction Scenario				
		7.4.1	7.4.2	7.4.3	7.4.5	7.4.6
1	52	46	49	46	42	N/A
2		45	48	45	41	N/A
3		43	46	43	39	N/A
4		N/A	N/A	N/A	N/A	48

The predicted  $L_{A1,1min}$  noise levels indicate that awakening reactions from impulsive maxima are unlikely to occur.

It should be noted that these predictions have been made assuming still, isothermal conditions. At these distances meteorological conditions can have a significant impact on noise levels, particularly at night when temperature inversions can occur. Night works will be limited, and will typically occur over 1-4 consecutive nights. It is recommended that nearby receivers be notified of planned night works, however impacts are predicted to be limited.

It is noted that most of the scheduled track possession works are located near the junction with Camberwell Rail Loop. This location is shielded from the nearest receivers by topography and as such lower noise levels can be expected.

## 8 CONSTRUCTION NOISE MITIGATION MEASURES

The noise predictions indicate that the works are expected to be generally within relevant construction noise goals at the nearest receivers. However, the noise from construction is likely to be audible at residences and therefore it is recommended that the following mitigation strategies be implemented to minimise potential noise impacts:

- a. All mechanical plant should be silenced by best practical means using current technology. Noise suppression devices should be maintained to the manufacturer's specifications. Internal combustion engines are to be fitted with a suitable muffler in good working order.
- b. All vehicular movements to and from the site should comply with the appropriate regulatory authority requirements for such activities (e.g. road rules and speed limits).
- c. The constructor (as appropriate) should establish contact with the local residents and communicate, particularly when work outside standard construction hours is planned.
- d. All plant on site should be operated in accordance with the manufacturer's instructions and, where necessary, have current Roads & Traffic Authority (RTA) registration licences.
- e. All engine covers should be kept closed while equipment is operating.
- f. As far as possible, materials dropped from heights into or out of trucks should be minimised.
- g. Managing material stockpiles within the primary compound such that they provide a barrier between the plant and the nearest receivers is advisable.
- h. Broadband reversing alarms should be strongly considered for use on the site as they are a common cause of complaint. The sensitivity of receivers to tonal alarms at night is particularly heightened and this should be considered in preparing for works outside standard working hours (night time track possession works).

## 9 TRAFFIC NOISE ON THE LOCAL ROAD NETWORK

The construction phase of the project will generate additional traffic on the local road network.

The majority of construction traffic will access the site via Middle Falbrook Road at the northern end of the site. This traffic will use Middle Falbrook Road and Bridgman Road to access the New England Highway.

Some traffic will access the site via an extension of Rixs Creek Lane, at the southern end of the proposal, in order to gain access to the Down side of the existing rail lines. This traffic will then access the New England Highway directly from Rixs Creek Lane.

### 9.1 Traffic Noise Criteria

Applicable noise criteria for proposals which have the potential to increase traffic on roads are presented in the DECCW's *Environmental Criteria for Road Traffic Noise (ECRTN)*.

For the purposes of noise assessment Bridgman Road and Middle Falbrook Road would be considered "collector" and "local" roads respectively. The applicable noise criteria are as follows.

The base criteria for *land use developments with the potential to create additional traffic* are:

#### Collector roads

- $L_{Aeq,1hour}$  60dBA during daytime (7.00am – 10.00pm)
- $L_{Aeq,1hour}$  55dBA during night time (10.00pm – 7.00am).

#### Local roads

- $L_{Aeq,1hour}$  55dBA during daytime (7.00am – 10.00pm)
- $L_{Aeq,1hour}$  50dBA during night time (10.00pm – 7.00am).

Where these criteria are already exceeded by existing traffic noise levels the *ECRTN* recommends the following:

*In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2dB."*

### 9.2 Construction Traffic Generation

Construction will typically generate traffic due to staff movements and material importation.

The traffic assessment prepared for the project indicates that a total of 70 staff vehicle movements are expected in the hour before and after construction hours, i.e. 6-7am and 6-7pm. Of these 50 vehicles will enter/leave via the Middle Falbrook Road access and the remaining 20 will access the site via Rixs Creek Lane.

Delivery of quarry products will require up to 30 trucks per day to access the site via Middle

Falbrook Road during typical construction. Assuming an even distribution throughout the day this equates to 3 arrivals and 3 departures per hour. Truck deliveries via Rixs Creek Lane would be up to 10 per day, or approximately 1 arrival and 1 departure per hour. Truck movements will occur between 7am and 6pm and so will not coincide with the peak arrival and departure of staff vehicles.

Additional traffic will be generated during rail possessions when an increased workforce will be on site. Five possessions are scheduled for the project's construction, each lasting up to four days. Due to the infrequent nature of this peak traffic generation quantitative assessment has been done on the typical traffic generation only. We do note that slightly elevated noise levels will exist for short periods during rail possessions but given the infrequent occurrence and limited duration this is considered acceptable.

A summary of the anticipated traffic volumes is shown in Table 9-1.

**Table 9-1 Daily Construction Vehicle Movements (one way)**

Construction Traffic	Average		Peak	
	Light	Heavy	Light	Heavy
Entering the construction site via Middle Falbrook Road	50	30	80	40
Entering the construction site via Rixs Creek Lane	20	10	30	20

### 9.3 Existing Traffic Noise Levels and Volumes

Existing traffic numbers have been derived from the graphical representations in the project's traffic assessment report.

These are summarized in Table 9-2

**Table 9-2 Existing Hourly Vehicle Movements**

Road	6-7am		6-7pm		7am-6pm	
	Light	Heavy	Light	Heavy	Light	Heavy
Bridgman Road	800	32	900	9	800	30
Rixs Creek Lane	14	1	4	1	5	2

### 9.4 Construction Traffic Noise Levels

A detailed identification of sensitive receivers and setbacks has not been undertaken on these traffic routes. Aerial photography shows some buildings that could be residential dwellings. In general the traffic routes are sparsely populated, with the exception of Bridgman Road approaching the New England Highway.

Based on a typical setback of 50m some typical traffic noise levels have been calculated using the Calculation of Road Traffic Noise (*CoRTN*) algorithms. The results of this calculation are presented in Table 9-3.

**Table 9-3 Construction Traffic Noise Levels –  $L_{Aeq,1hr}$  (dBA)**

Construction Traffic Route	ECRTN Criteria		Predicted Levels					
			Existing			With Construction		
	Day	Night	Staff		Trucks	Staff		Trucks
			6-7am	6-7pm	7am-6pm	6-7am	6-7pm	7am-6pm
Middle Falbrook Road and Bridgman Road	60	55	62.5	63.2	62.5	62.9	63.6	62.7
Rixs Creek Lane	55	50	54.9	45.7	48.3	55.6	49.7	50.8

Construction traffic on Bridgman Road is predicted to increase existing noise levels by less than 1 dB in all scenarios. Traffic noise levels on Rixs Creek Lane are predicted either to be within the relevant criteria, or the increase is predicted to be less than 1 dB. Therefore traffic noise levels at the assumed setback are predicted to comply with the relevant criteria during typical days.

Some exceedances of criteria during rail possessions might be expected if a significant number of vehicles access the site during the night time period (10pm-7am). As the night time works will only occur for up to four nights at a time, some minor exceedances such as these are considered acceptable.

We recommend that all drivers accessing the site should be briefed on the locations of sensitive receivers and required to drive considerately when they are in the vicinity of these receivers, particularly during the night time period.

## 10 CONCLUSION

Wilkinson Murray has conducted an assessment of the noise and vibration impacts associated with the construction and operation of the proposed Nundah Bank Rail Project north of Singleton, NSW.

This assessment has been conducted in accordance with the following NSW Department of Environment, Climate Change and Water (DECCW) publications:

- *Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects (GANRIP) [2007]*.
- *Interim Construction Noise Guideline (ICNG) [2009]*.
- *Environmental Criteria for Road Traffic Noise (ECRTN) [1999]*.

Noise levels from the proposed rail development are predicted to be within the appropriate trigger levels outlined in *IGANRIP*.

Vibration emissions from the operation of the proposal are expected to be negligible at neighbouring receivers and have thus not been considered in this assessment.

Noise emissions during construction of the proposal are predicted to generally comply with goal levels contained in the *ICNG*. However, noise levels are predicted to be audible and therefore the mitigation measures outlined in Section 8 of this report are recommended to further minimize impacts during construction.

Traffic noise generated on the local road network during construction of the proposal has been considered against criteria outlined in the *ECRTN* and is considered to be acceptable. There exists potential for minor exceedances of criteria during rail possessions that require significant vehicle movements in the night time period and we therefore recommend that drivers be briefed on the sensitivities of neighbouring receivers and encouraged to approach and leave the site in a considerate manner.

**Note**

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**Quality Assurance**

We are committed to and have implemented AS/NZS ISO 9001:2008 "Quality Management Systems – Requirements". This management system has been externally certified and Licence No. QEC 13457 has been issued.

**AAAC**

This firm is a member firm of the Association of Australian Acoustical Consultants and the work here reported has been carried out in accordance with the terms of that membership.

<b>Version</b>	<b>Status</b>	<b>Date</b>	<b>Prepared by</b>	<b>Checked by</b>
A	PEA Draft	30 May 2010	Adam Bioletti	Rob Bullen
B	EA Draft	9 August 2010	Adam Bioletti	Rob Bullen
C	Final	21 October 2010	Adam Bioletti	
D	Revised Final	October 2010	Adam Bioletti	
E	Revised Final	6 December 2010	Adam Bioletti	
F	Revised Final	20 December 2010	Adam Bioletti	
G	Revised Final	11 February 2011	Adam Bioletti	
H	Revised Final	22 February 2011	Adam Bioletti	

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# APPENDIX A

## GLOSSARY OF TERMS



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## GLOSSARY

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph overleaf, are here defined.

**Maximum Noise Level ( $L_{Amax}$ )** – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

**$L_{A1}$**  – The  $L_{A1}$  level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the  $L_{A1}$  level for 99% of the time.

**$L_{A10}$**  – The  $L_{A10}$  level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the  $L_{A10}$  level for 90% of the time. The  $L_{A10}$  is a common noise descriptor for environmental noise and road traffic noise.

**$L_{Aeq}$**  – The equivalent continuous sound level ( $L_{Aeq}$ ) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

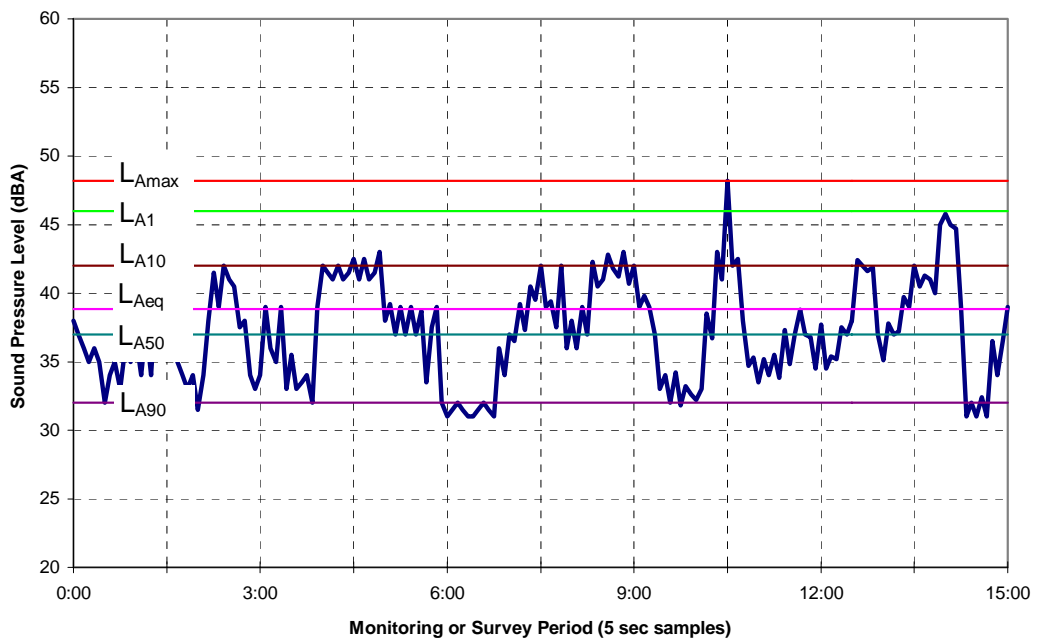
**$L_{A50}$**  – The  $L_{A50}$  level is the noise level which is exceeded for 50% of the sample period. During the sample period, the noise level is below the  $L_{A50}$  level for 50% of the time.

**$L_{A90}$**  – The  $L_{A90}$  level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the  $L_{A90}$  level for 10% of the time. This measure is commonly referred to as the background noise level.

**ABL** – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day. It is determined by calculating the 10<sup>th</sup> percentile (lowest 10<sup>th</sup> percent) background level ( $L_{A90}$ ) for each period.

**RBL** – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night time.

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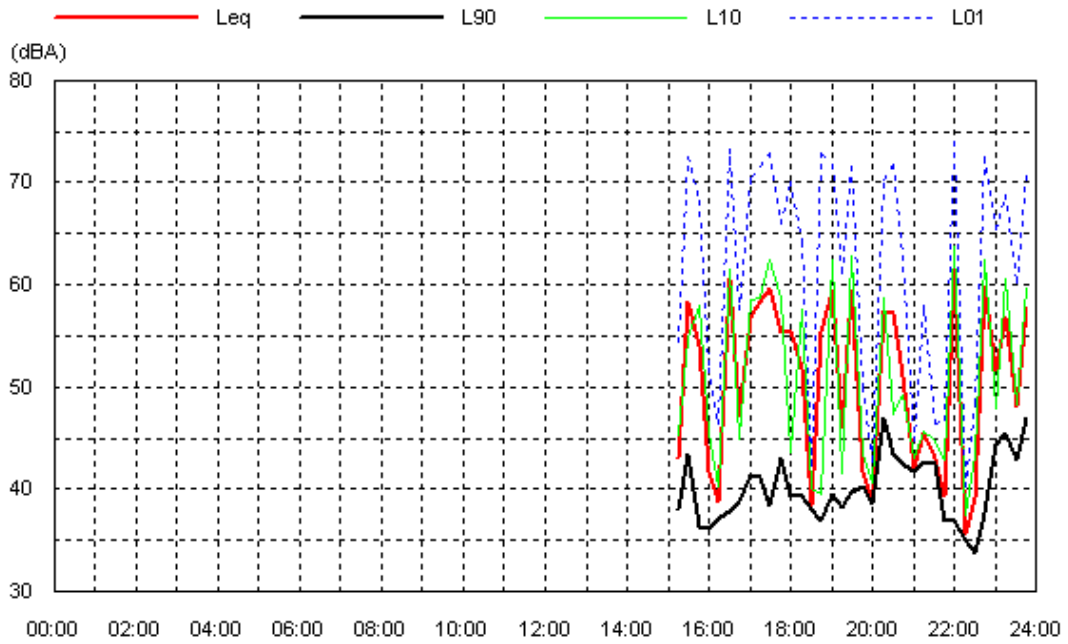
# APPENDIX B

## NOISE MEASUREMENT RESULTS

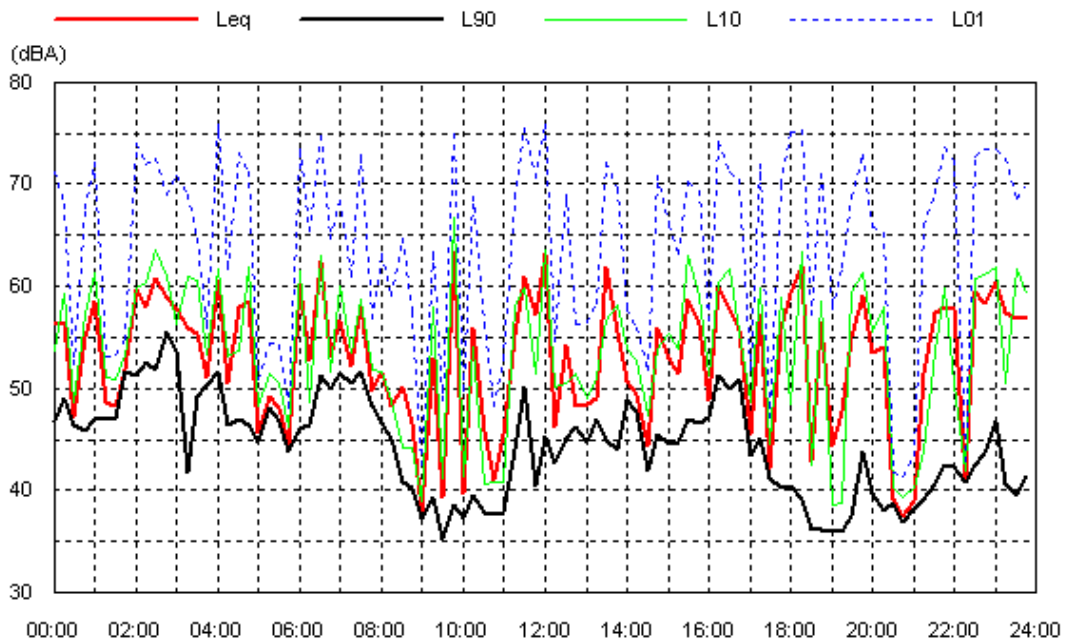


Location: A. 140m from rail line

Mon 26 Jul 10

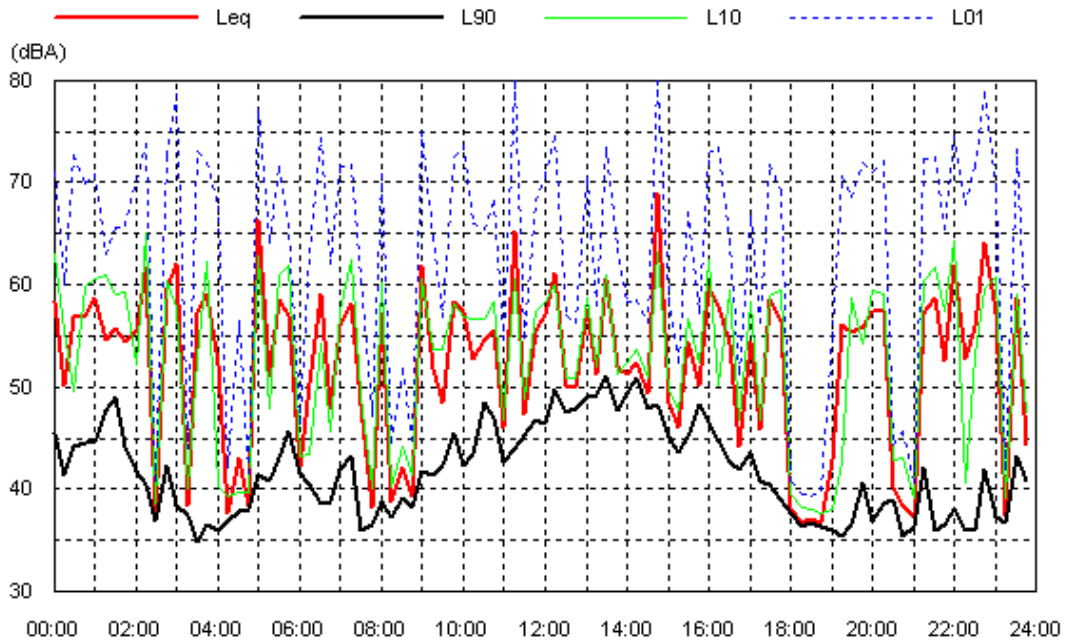


Tue 27 Jul 10

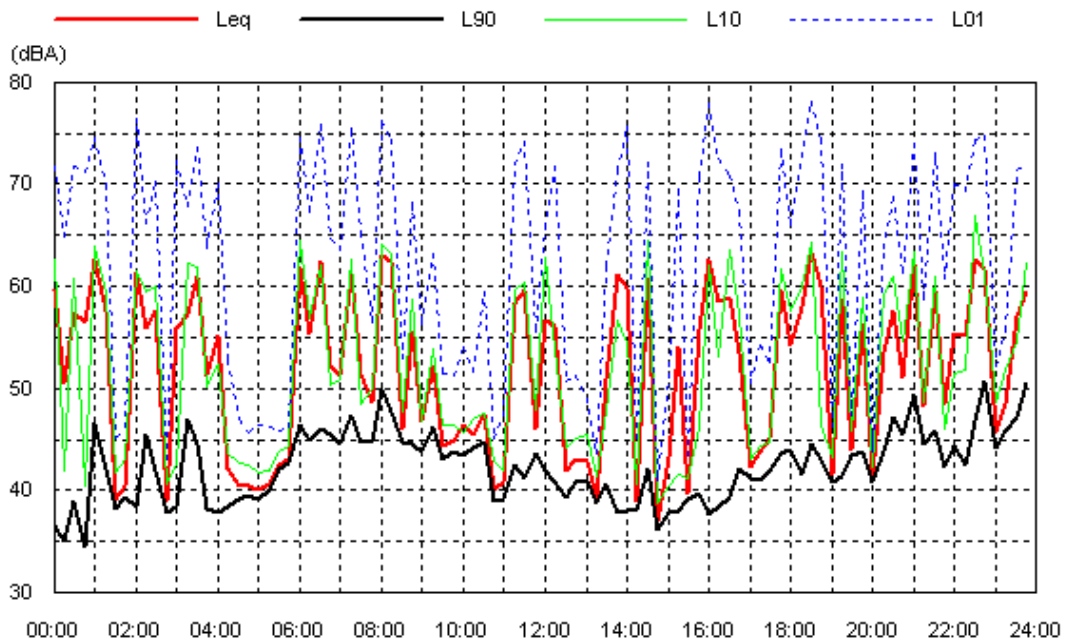


Location: A. 140m from rail line

Wed 28 Jul 10

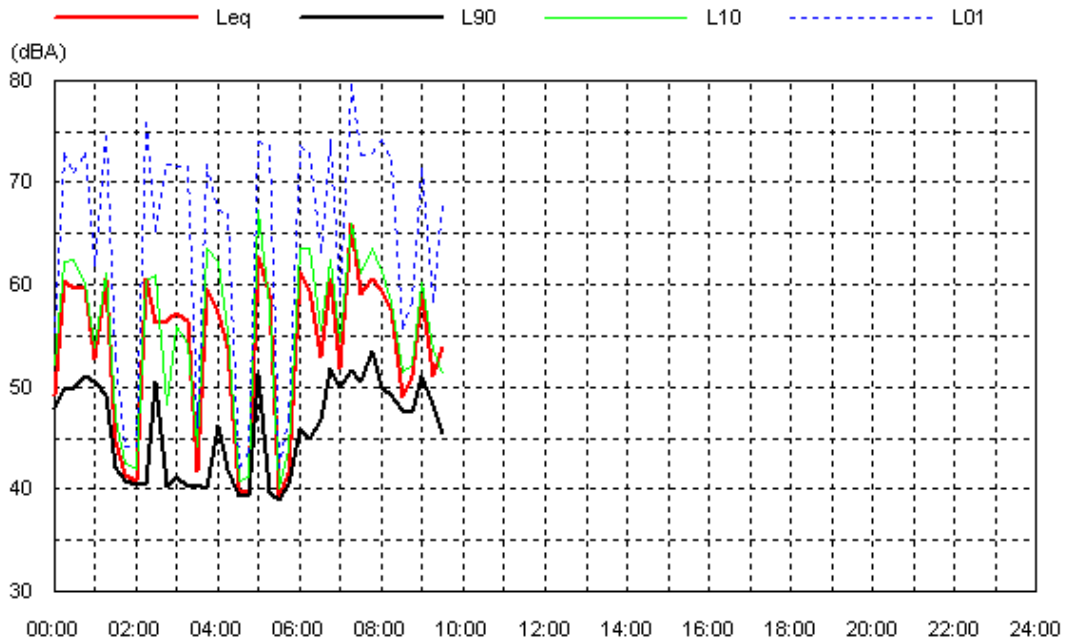


Thu 29 Jul 10



Location: A. 140m from rail line

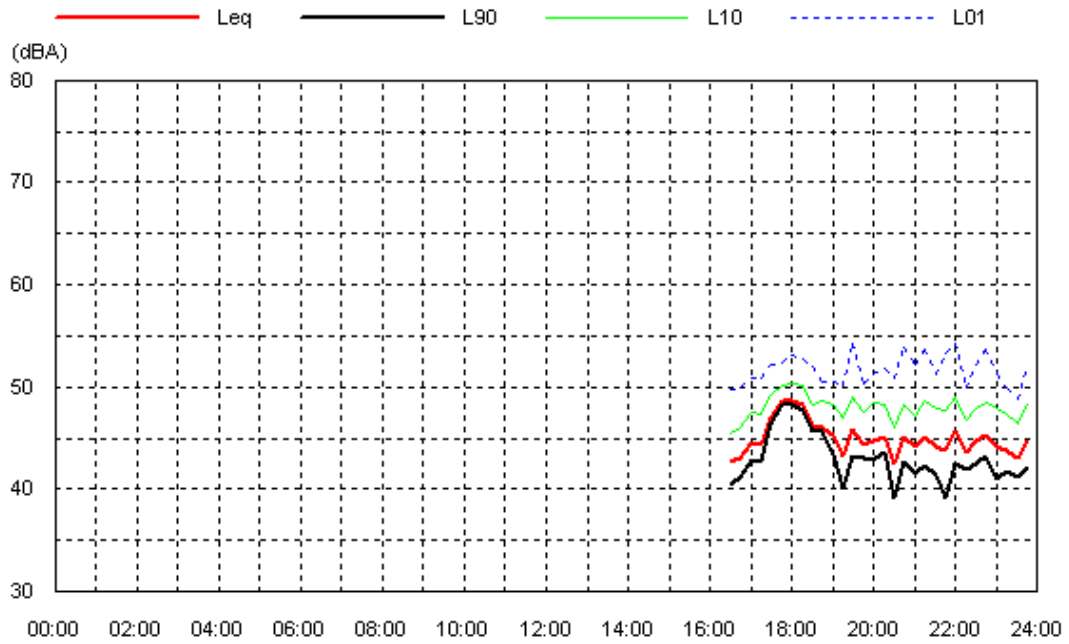
Fri 30 Jul 10



Location: B. 427 Bridgman Road, Obanvale

Data shaded: Extraneous

Mon 26 Jul 10



Tue 27 Jul 10

