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11.1 INTRODUCTION

This chapter identifies sensitive receptors, assesses the baseline ambient noise levels for the proposed railway project and quantifies the potential change in noise and vibration environments as a result of the construction and operation of the rail and associated infrastructure. The assessment for the rail has included potential impacts associated with the construction and operation of the project and associated infrastructure.

A detailed technical assessment of the potential impacts associated with noise and vibration emissions is provided in Volume 5, Appendix 20.

11.2 LEGISLATIVE FRAMEWORK

11.2.1 ENVIRONMENT PROTECTION (NOISE) POLICY

The EP Act provides the framework for the management of the noise environment in Queensland. The *Queensland Environmental Protection (Noise) Policy 2008* (EPP (Noise)) is subordinate legislation to the EP Act and it specifically identifies the acoustic environmental values to be enhanced or protected within the state of Queensland. These values are:

- the protection of the health and biodiversity of ecosystems;
- the protection of human health and wellbeing by ensuring a suitable acoustic environment for individuals to;
  - sleep;
  - study or learn;
  - be involved in recreation, including relaxation and conversation; and
- the protection of the amenity of the community.

11.2.2 ECOACCESS GUIDELINE PLANNING FOR NOISE CONTROL

For simple and common sources of noise disturbance in the community (e.g. noise from regulated devices, domestic or commercial air-conditioning systems) the acoustic values are protected by prescribed noise offences defined within EP Act. For new major industries or facilities the methodology for setting noise emission limits to protect the acoustic environmental values is determined in accordance with the Ecoaccess Guideline *Planning for Noise Control* (the Guideline).

The Guideline is intended to manage three aspects of the acoustic environment that may be affected by new development. These aspects are:

- the control and prevention of 'background noise creep' (the gradual cumulative increase in minimum noise levels generated by continuously operating machinery);
- the containment of variable noise levels and short term noise events to an 'acceptable level' above the background noise levels (e.g. noise associated with a short term but periodic noise such as the clanging of a tailgate); and
- the setting of noise limits for transient noise events in the night period to avoid 'sleep disturbance'.

11.2.3 QUANTITATIVE NOISE POLICY

The EPP (Noise) defines "Acoustic quality objectives" for the environment that are conducive to human health and wellbeing, including the ability for individuals to sleep, study, relax or converse. The acoustic quality objectives relevant to residential locations are reproduced below in Table 1 for reference. However the Explanatory Notes to the EPP (Noise) advises that these objectives relate to the all-encompassing noise environment, and should not be used to set emission limits for individual industries or noise sources.

Part 4 Section 10 of the EPP (Noise) defines the "management intent for an activity involving noise" as follows:

To the extent that it is reasonable to do so, noise from an activity must not be –

a) for noise that is continuous noise measured by $LA_{90,T}$ – more than nil dB(A) greater than the existing acoustic environment measured by $LA_{90,T}$; or

b) for noise that varies over time measured by $L_{Aeq,adj,T}$ – more than 5dB(A) greater than the existing acoustic environment measured by $LA_{90,T}$

Table 1. EPP (Noise) acoustic quality objectives for residential dwellings

SENSITIVE RECEPTOR	TIME OF DAY	ACOUSTIC QUALITY OBJECTIVES (MEASURED AT THE RECEPTOR) DB(A)			ENVIRONMENTAL VALUE
		$L_{Aeq,adj,1hr}$	$L_{A10,adj,1hr}$	$L_{A1,adj,1hr}$	
Dwelling (for outdoors)	daytime and evening	50	55	65	health and wellbeing
Dwelling (for indoors)	daytime and evening	35	40	45	health and wellbeing
	night-time	30	35	40	health and wellbeing in relation to the ability to sleep

Relevant criteria for various elements of noise and vibration management are outlined within legislation, the Guideline and various national and international documents and standards. The following section provides an outline of the relevant noise and vibration criteria that have been adopted for the assessment of potential impacts associated with this project and which are considered best practice.

11.2.4 RELEVANT NOISE AND VIBRATION CRITERIA

11.2.4.1 Noise Criteria

11.2.4.1.1 Construction

Construction noise and vibration is generally managed by local government under the EP Act. The EP Act controls construction noise by specifying building work that creates audible noise at a receptor location may only occur between 6.30 am and 6.30 pm on any day except Sundays and public holidays. There are no noise limits within or outside of these hours for building or other similar construction works. If construction work is required outside of normal daytime hours (6.30am to 6.30pm) then a construction noise EMP will be prepared which outlines the method by which audible noise at a receptor will be controlled during the out-of-hours work.

The construction will be undertaken in compliance with an EMP which will contain suitable construction noise and vibration management policies and procedures.

11.2.4.1.2 Operation

For new major development the methodology for setting noise emission limits to protect acoustic environmental values is determined in accordance with the Guideline.

The Guideline recommends a Planning Noise Level (PNL) for a new facility expressed as an unadjusted equivalent continuous measurement. The PNL is based on the ambient noise monitoring data, the town planning designation of each area and the observed proximity to significant road transport corridors. The analysis of PNLs identified two primary types of existing acoustic environment relevant to the project. The representative areas have been identified as:

- areas in proximity to Bruce Highway west of Bowen (near proposed coal terminal site); and,
- other remote rural environments (including along the majority of the rail corridor and around the mine site).

The Guideline recommends a PNL for a new facility expressed as an unadjusted equivalent continuous A-weighted sound pressure level ($L_{Aeq\ 1\ hour}$), with adjustment for assumed tonal and / or impulsive characteristics of a future noise source (or sources). The design PNLs are expressed as adjusted levels (LAeq 1 hour, adj). For this project the design PNLs for this project are summarised in Table 2.

Table 2. Design PNLs at residential receivers (outdoors)

RECEIVERS	DESIGN PLANNING NOISE LEVEL ($L_{Aeq,1hour,adj}$ – DBA)		
	DAY (7AM-6PM)	EVENING (6PM-10PM)	NIGHT (10PM-7AM)
Proximity to Bruce Highway west of Bowen (Salisbury Plains, Colinta, Merinda)	44	41	36
Other areas	39	28	28

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 3.

Table 3. Guideline adjustments to Design PNLs for audible characteristics

AUDIBLE CHARACTERISTIC	CRITERION	CORRECTION
Tonality	Subjectively just detectable	K1 = 2 - 3dB
	Subjectively prominent (clearly audible) and objectively measurable by one-third octave band analysis as per AS1055.1 Clause 6.6.3	K1 = 5 - 6 dB
Impulsivity	Subjectively detectable and objectively measureable as per AS1055.1 Clause .6.4	K2 = 2 dB

11.2.4.2 EPP (Noise) Review of Design Planning Levels

An evaluation of the derived Design PNLs has been conducted as recommended in the Explanatory Notes to the EPP (Noise). The Explanatory Notes require that the PNLs be compared with the Rating Background Level (RBL) which are the overall single-figure background noise levels representing each assessment period (day / evening / night) over the whole monitoring period. The RBL represents the background noise level that is present for ninety per cent of the standard day, evening or night periods and is the level used for assessment purposes. Background noise monitoring to determine the RBLs has been undertaken for the project and the results are outlined in Section 11.6.1.

Comparison of design planning levels in Table 2 with the general Acoustic Quality Objectives for the Queensland acoustic environment outlined in Table 1, indicates that the design PNLs for the areas near to the proposed rail corridor comply with the general Acoustic Quality Objectives for the Queensland acoustic environment. (To enable direct comparison of data for evening and night periods it is necessary to take into consideration a nominal 5-10dB indoor / outdoor transmission loss for a naturally ventilated dwelling). Table 4 presents a comparison of the measured RBL for the representative six locations along the rail corridor and the Design PNLs from Table 2.

Table 4. Comparison of RBLs with design PNLs

RECEIVER AREAS	DESIGN PLANNING NOISE LEVEL ($L_{Aeq,1hour,adj}$ – DBA)		
	DAY (7AM-6PM)	EVENING (6PM-10PM)	NIGHT (10PM-7AM)
Proximity to Bruce Highway west of Bowen	44 (36 RBL)	41 (35 RBL)	36 (30 RBL)
Other remote rural areas	37 (29 RBL)	28 (22 RBL)	28 (<15 RBL)

Table 5. Probability of sleep awakening (from the Guideline)

TYPICAL FACADE NOISE REDUCTION	FACADE DESCRIPTION	EXTERNAL MAXIMUM INSTANTANEOUS NOISE LEVEL (MAXLPA, DBA) CORRESPONDING TO AWAKENING PROBABILITY (%)			
		0%	5%	10%	20%
5	Windows wide open	37	42	47	52
10	Windows partially closed	42	47	52	57
20	Single glazed, closed	52	57	62	67
25	Double glazed, closed	57	62	67	72

The PNLs derived for the evening and night periods may permit background noise levels to exceed the "background creep" management intent as per Part 4 Section 10(2) of the EPP Noise (i.e. The PNL may be greater than the background noise level plus zero or 5 dB).. It is noted; however, that this possibility is inherent to the procedures of the Guideline and the EPP Noise and does not relate to the merits or acoustic impact of the Project.

It does; however, highlight the possibility that received noise emission levels that just comply with PNLs may be audible at some receptor locations when background noise levels are very low.

Sleep disturbance

The relationship between the level of a noise event external to a dwelling and sleep awakenings is probabilistic, depending on individual sensitivity. The Guideline advises an approximate relationship between the maximum external noise event level ($maxL_{pA}$), the degree of dwelling envelope sound insulation and the resulting likelihood of sleep awakening as shown in Table 5.

The Guideline suggests achieving no higher than 10% probability of sleep awakenings. For the low background noise environments encountered in the study area, a 5% probability of sleep awakenings has been adopted for this project as a nominal goal.

It is possible that naturally ventilated receptor dwellings may be occupied with windows fully open at times. The sleep disturbance external noise limit for transient events from the rail corridor to prevent sleep awakenings at such a receptor is 42 dBA ($maxL_{pA}$).

For an air-conditioned receptor dwelling the indicative external noise limit for transient train passby events would be 57 dBA.

11.2.4.3 Rail Noise Criteria

Queensland Rail's (QR) *Code of Practice – Railway Noise Management*, provides operational railway noise criteria as follows:

- 65 dBA assessed as the 24-hour average equivalent continuous A-weighted sound pressure level, $L_{Aeq(24hour)}$; and
- 87 dBA assessed as a single event maximum sound pressure level, $L_{Amax.}$

Where appropriate, they are to be assessed 1 m in front of the building façade of an affected noise sensitive place.

As the proposed rail line is privately owned rather than state owned, the above criteria are used as a guideline only. The most stringent criteria for the proposed rail are that of sleep disturbance due to a train pass-by, as the rail corridor may be used during the night period. This results in a noise limit of 42 dBA L_{Amax}, assessed as a single event maximum sound pressure level.

The other parameter used for the assessment of rail noise is the $L_{Aeq,24hr}$ parameter, the 24-hour average equivalent continuous A-weighted sound pressure level. Although it is described as a continuous noise level, it is a calculation of this level based on the length and numbers of train pass-bys, so is based on a transient noise level. Based on experience, typically a difference of 4-5dB is found between the L_{Aeq} and L_{Amax} noise levels. Using the 42dBA L_{Amax} criterion as a reference would result in a comparative criterion of 37dBA $L_{Aeq, 24hr}$. Each of these criteria are well below the criteria used for rail assessments used by Queensland Rail.

11.2.5 VIBRATION CRITERIA

Vibration criteria are divided into four groups for assessment:-

- criteria to prevent building cosmetic damage, which is applicable to general construction vibration;
- criteria to prevent damage to buried pipe work and telecommunication cables during construction;
- regulated vibration criteria in the EP Act relating to blasting during construction; and
- criteria to maintain human vibration comfort, applicable to the more long-term vibration occurrences, such as that potentially created by coal train pass-bys.

11.2.5.1 General construction vibration

The maximum peak particle velocities recommended to prevent cosmetic damage to buildings are provided in Table 6 and are as recommended in AS 2187.2 2006 *Explosives - Storage and use - Use of explosives.*

Vibration due to construction and blasting activities has the potential to effect services such as buried pipe work, electrical and telecommunication cables. Short-term vibration limits for buried pipes are summarised in Table 7 and are the limits recommended by German Standard DIN 4150.3-1999 *Structural Vibration – Part 3: Effects of vibration on structures.*

Table 7. DIN 4150 Part 3 – Damage to buried pipes – guidelines for short-term vibration

PIPE MATERIAL	PEAK WALL VIBRATION VELOCITY (MM/S)
Steel (including welded pipes)	100
Clay, concrete, reinforced concrete, prestressed concrete, metal with or without flange (other than steel)	80
Masonry, Plastic	50

Recommended vibration limits for electrical cables and telecommunication services such as fibre optic cables are between 50 mm/s and 100 mm/s.

Table 6. Transient maximum peak particle velocity to prevent cosmetic damage of buildings

TYPE OF BUILDING	PEAK COMPONENT PARTICLE VELOCITY IN FREQUENCY RANGE OF PREDOMINANT PULSE	
	4 HZ TO 15 HZ	15 HZ AND ABOVE
Reinforced or framed structures. Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
Unreinforced or light framed structure. Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

11.2.5.2 Human Vibration Comfort Level

AS2670.2 1990 *Evaluation of Human Exposure to Whole-body Vibration – Continuous and Shock-induced Vibration in Buildings (1 to 80 Hz)* recommends vibration levels to maintain human comfort. Vibration levels (in one-third octave bands) are considered to be acceptable to protect human comfort if they are less than the following:

- 0.48 mm/s at 1 Hz, reducing to
- 0.18 mm/s at 2 Hz, reducing to
- 0.1 mm/s at 8 Hz and above to 80 Hz.

11.2.6 BLASTING CRITERIA

Blasting causes airblast overpressure (noise) and ground vibration. The criteria for blast noise and vibration are contained in the EP Act and the Guideline. The act contains regulated vibration criteria, with the Guideline containing more stringent (in parts) advisory vibration

The following regulated criteria are specified in the EP Act:

"Noise from blasting is not unlawful environmental nuisance for an affected building if:

- the airblast overpressure is no more than 115 dB Z Peak for 4 out of 5 consecutive blasts; or
- the airblast overpressure is more than 120 dBA Z Peak for any blast; or

The ground vibration is:

- for vibrations of more than 35 Hz – no more than 25 mm/s ground vibration, peak particle velocity; or
- for vibrations of no more than 35 Hz – no more than 10 mm/s ground vibration, peak particle velocity."

The *Ecoaccess Guideline: Noise and Vibration from Blasting* advises that blasting activities should be carried out in such a manner that if blasting may affect a noise-sensitive place, then:

- the airblast overpressure must be not more than 115 dB(linear) peak for nine out of any 10 consecutive blasts initiated, regardless of the interval between blasts;
- the airblast overpressure must not exceed 120 dB(linear) peak for any blast;
- the ground-borne vibration must not exceed a peak particle velocity of 5 mm per second for nine out of any 10 consecutive blasts initiated, regardless of the interval between blasts;
- the ground-borne vibration must not exceed a peak particle velocity of 10mm per second for any blast; and
- blasting should generally only be permitted during the hours of 9 am to 3 pm, Monday to Friday, and from 9 am to 1 pm on Saturdays. Blasting should not generally take place on Sundays or public holidays.

Blasting outside these recommended times should be approved only where:

- blasting during the preferred times is clearly impracticable (in such situations blasts should be limited in number and stricter airblast overpressure and ground vibration limits may be applied), or
- there is no likelihood of persons in a noise-sensitive place being affected because of the remote location of the blast site.

11.3 ASSESSMENT METHOD

The following section describes the methodology utilised to survey the baseline noise environment and undertake the predictive modelling of additional noise and vibration sources into the environment.

11.3.1 Noise Modeling

Noise monitoring was conducted in accordance with the *Australian Standard AS1055.1-1997 Acoustics – Description and measurement of environmental noise, Part 1: General procedures, and the Queensland Noise Measurement Manual* (3rd Edition, 1 March 2000). Properties for monitoring were selected to represent potentially affected residences nearest to the proposed rail alignment. Baseline noise levels were monitored for a minimum period of seven days at seven sites. Figure 1 outlines the locations of the sensitive receptors and the noise monitoring sites.

Instrumentation was field-calibrated before and after measurements with all post-calibration results within 0.3 dBA of the pre-calibration level of 94 dBA. Simultaneous monitoring of wind speed, direction, and temperature, pressure and humidity conditions was conducted in the vicinity of baseline noise monitoring locations or based on information from local Bureau of Meteorology sites. Noise data that was affected by excessive wind speed or precipitation has been excluded from the aggregate noise level statistics.

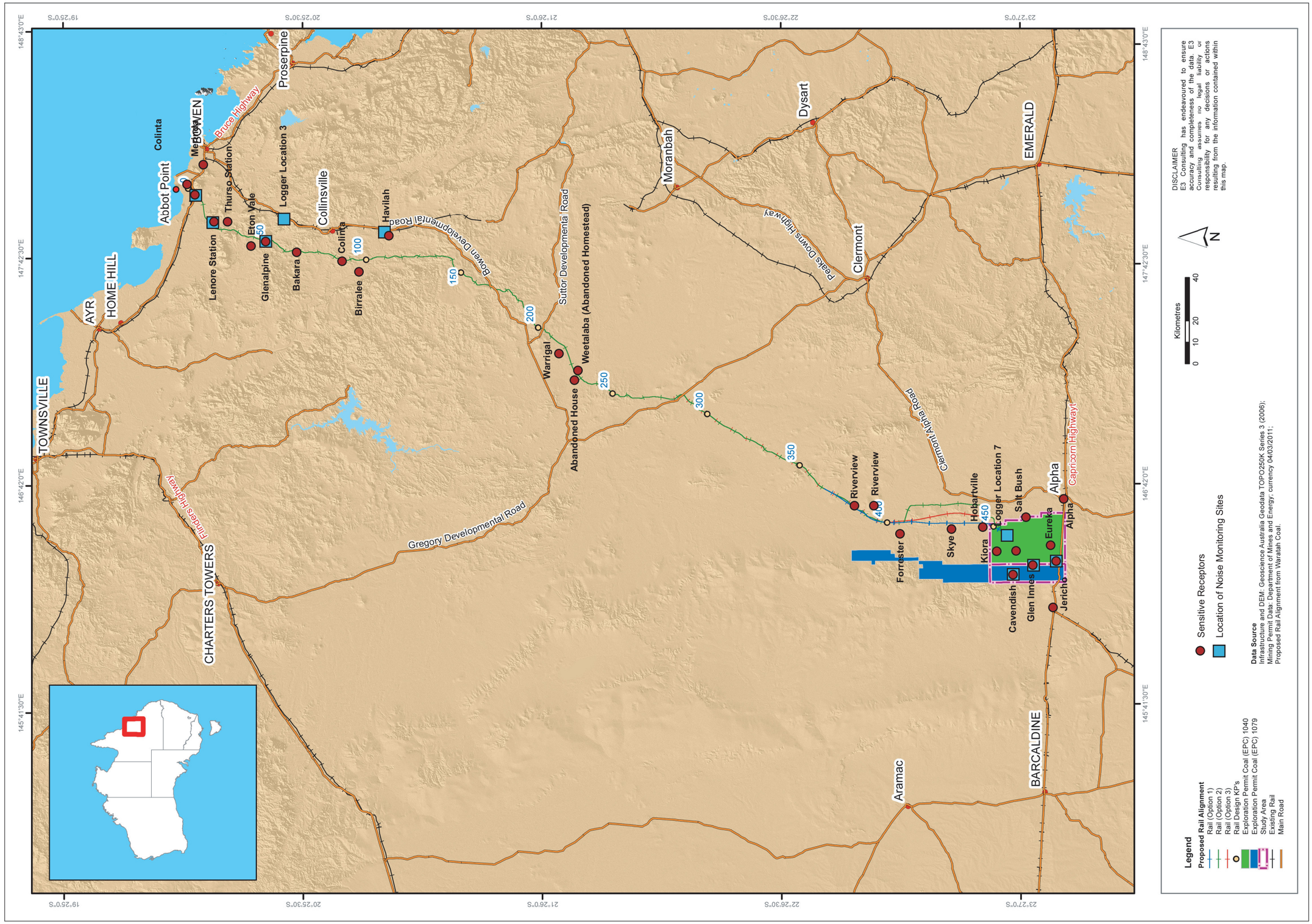
The Noise Control Manual also indicates that the influence of insect noise on baseline noise levels should be carefully considered. Some insect noise was evident on dusk and as a persistent feature throughout the night-time at a number of monitoring sites. The contribution of insects to the background noise levels was removed to ensure that the levels represented worst case seasonal levels.

A noise model of the rail corridor and surrounding area, including the noise sensitive receptor locations, was constructed using SoundPLAN software. The model predicts A-weighted sound pressure levels under meteorological conditions favourable to propagation (mild temperature inversion with slight downwind) from sources of known sound emission. The overall model accuracy is estimated as ±3 dBA.

The graphical noise contours generated by the model represent the envelope of results for noise propagation in all directions (i.e. summary of typical worst-case noise propagation in all directions relative to the noise source). Noise contours were interpolated from predicted grid noise levels that were calculated at a height of 1.6 m above local ground level. Point source receptors were also located at a height of 1.6 m above ground level, representing mid-window height. The model ground terrain was based on elevation data sourced from the Department of Natural Resources and was assigned to be 100% absorptive in the model which is consistent with predominant forested grass-land.

The source noise data used to model noise emissions during the typical operation of train movements were based on measured noise levels and library data files from relevant EIS documentation and manufacture specifications. Noise spectra were included in addition to the overall levels.

Figure 1. Location of Sensitive Receptors and Monitoring Locations Adjacent to the Proposed Rail Alignment



11.4 EXISTING ENVIRONMENT

11.4.1 EXISTING NOISE LEVELS

Properties for monitoring were selected to represent potentially affected residences nearest to the proposed alignment of the railway. The location of the noise monitoring sites is outlined in Figure 1. Baseline sampling was conducted in autumn months between 13 and 21 April 2010, and in winter months between 2 and 9 July 2010. The Rating Background Level (RBL) is predominately composed of a variety of noise sources such as insects, birds and frogs, ongoing low intensity farming, vehicle noise and weather induced noise. In areas adjacent to the coal terminal, the noise environment is heavily influenced by the Bruce Highway and the North Coast Rail line.

Potential anomalies in noise levels as a result or irregular noise emissions, excessive insect noise or meteorological conditions were excluded from the RBLs through the use of the spectral noise logging carried out. The RBLs determined in accordance with the Ecoaccess Guideline are presented in Table 8.

A summary of the minimum $L_{Aeq,1hour}$ data for the day, evening and night periods for each monitoring location is presented in Table 9.

11.4.2 VIBRATION

No baseline ground vibration assessment was undertaken as ambient vibration levels are generally not significant in the areas adjacent to the proposed rail corridor. The exception is close to road corridors used by heavy vehicles that contain pot-holes or other significant surface irregularities. This situation may produce perceptible transient vibration levels during heavy vehicle pass-by in dwellings located at minimum road set-back distances. Well formed and sealed roads are not a significant source of ambient vibration at habitable distances from roadways.

Table 8. Rating background noise levels

MEASUREMENT LOCATION	RATING BACKGROUND NOISE LEVEL ($minL_{A90}$ – dBA)		
	DAY	EVENING	NIGHT
Salisbury Plains	36	35	30
Railway	33	30	20
Havilah	26	20	<15
Monklands	34	25	<15
Glenlea Downs	29	17	<15
Lenore Station	29	31	26
Glenapline	31	27	20
Fernie	25	25	23

Table 9. Minimum equivalent hourly noise levels

MEASUREMENT LOCATION	MINIMUM EQUIVALENT HOURLY NOISE LEVEL ($minL_{Aeq,1hour}$ – dBA)		
	DAY	EVENING	NIGHT
Salisbury Plains	38	40	38
Railway	52	55	46
Havilah	41	26	28
Monklands	44	39	32
Lenore Station	42	46	41
Glenalpine	46	45	43
Fernie	36	33	30

11.5 IMPACT ASSESSMENT

11.5.1 PREDICTED NOISE LEVELS

Each coal train is expected to haul approximately 20,000 tonnes of coal to the coal terminal. For the purposes of the daily average calculations, 14 movements per day have been assessed (seven up and seven down) initially for a 40 mtpa capacity, with 134 movements per day for the ultimate capacity of 400 mtpa. These movements would be at a time of choice for the mining operations and could be any time during the day or night. Table 10 outlines the proximity of noise sensitive receptors to the proposed railway corridor alignment.

Table 10. Distance from residential receives to proposed rail alignment

RESIDENTIAL RECEIVER	APPROXIMATE DISTANCE FROM PROPOSED RAIL (KM)
Monklands	2.4
Hobartville	1.4
Skye	2.6
Forrester	4.8
Riverview	6.0
Riverview	0.7
Weetalaba (Abandoned Homestead)	1.5
Abandoned House	0.7
Warrigal	3.3
Havilah	11.1
Birralee	5.3
Colinta Holdings	0.6
Collinsville	10.3
Bakara	0.1
Glenalpine	0.6
Eton Vale	3.6
Lenore	1.6
Salisbury Plains	2.3
Colinta Holdings	0.8
Merinda	12.0
Thursto	4.8

The predicted noise levels at residences nearest to the proposed rail alignment are outlined in Table 11.

Table 11. Predicted rail noise levels at residential locations

RESIDENTIAL RECEIVER	PREDICTED NOISE LEVELS AT RESIDENCES (DBA)		
	INITIAL CAPACITY (40MTPA) LAEQ, 24HR	ULTIMATE CAPACITY (400MTPA) LAEQ, 24HR	PASS-BY MAX LPA
Monklands	21	31	28
Hobartville	34	**43**	41
Skye	23	33	29
Forrester	23	33	29
Riverview	15	25	17
Riverview	32	41	42
Weetalaba (Abandoned Homestead)	26	36	34
Abandoned House	37	47	48
Warrigal	26	36	27
Havilah	<0	<0	<10
Birralee	15	25	19
Colinta Holdings	34	44	43
Collinsville	<0	<0	<10
Bakara	47	57	66
Glenalpine	33	43	44
Eton Vale	21	31	26
Lenore Station	29	38	38
Salisbury Plains	31	40	36
Colinta Holdings	30	40	40
Merinda	<0	<0	<10
Thursto	18	28	15

Note: Bold indicates potential predicted exceedences of night time sleep awakening nominal goal

Table 11 shows that the predicted noise emissions for the use of the rail corridor easily comply with the QR criteria but exceed the night-time noise criterion for sleep awakening (42 dBA max L_{pA}) at four residences (Abandoned house, Colinta Holdings, Bakara and Glenalpine). These residences are within 700m of the proposed rail corridor.

For the ultimate capacity (400mtpa) scenario, an exceedance of the 37dBA $L_{Aeq, 24hr}$ criterion is shown for Hobartville, Riverview, Lenore Station, Salisbury Plains and Colinta Holdings.

It is concluded that to achieve the night-time criterion for 24 hour use of the rail corridor, the residences at Colinta Holdings, Bakara and Glenalpine would require either:

- upgrading of the residential buildings to ensure that the internal sleep disturbance criterion is achieved. This may include upgrade of the bedroom facades (particularly the windows) along with the installation of some form of mechanical ventilation to ensure that the ventilation requirements of the Building Code of Australia (BCA) could be achieved with external windows and doors closed;
- relocation of the residence or some other form of change of use for the residences so they would no longer be noise-sensitive locations; or

- attenuation of the rail noise through the use of noise barriers adjacent to the rail line. Heights and their locations would be determined during the detailed design of the rail line

No mitigation measures have been proposed for the Abandoned house.

It is concluded that to achieve the 24 hour criterion for the rail corridor for the 400mtpa scenario, the residences at Hobartville, Riverview, Lenore Station, Salisbury Plains and Colinta Holdings would require either:

- relocation of the residence or some other form of change of use for the residences so they would no longer be noise-sensitive locations; or
- attenuation of the rail noise through the use of noise barriers adjacent to the rail line. Heights and their locations would be determined during the detailed design of the rail line

11.5.2 PREDICTED VIBRATION LEVELS

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 rail corridor is Bakara. Vibration levels have been predicted based on levels sampled near Queensland Rail coal freight operations in South-East Queensland.

Predicted levels at Bakara are presented in Table 12 based on measured ground vibration levels at a position 20 m from the nearest rail line during the passby of a loaded diesel-hauled coal train.

The predicted levels comply with the vibration levels recommended to achieve human comfort. It is concluded that no adverse human comfort vibration impacts would result at Bakara during coal train pass-bys.

Table 12. Predicted ground vibration levels at residential locations

RESIDENTIAL RECEIVER	DISTANCE TO RAIL LINE	GROUND VIBRATION	
		PEAK PARTICLE VELOCITY (MM/S)	DOMINANT FREQUENCY
Coal train vibration samples	20 m	0.2 (wagons) 0.3 (locomotives)	5-20 Hz
Bakara	80 m	<0.1	
AS2670.2 1990 Comfort Criterion		0.18 0.1	2 Hz ≥8 Hz

11.6 MITIGATION AND MANAGEMENT

Noise and vibration will be managed by the incorporation of noise mitigation measures into the project EMP for construction and operation of the proposed rail corridor and associated infrastructure. The following specific mitigation will be considered and if appropriate, implemented, during the railway project:

11.6.1 CONSTRUCTION NOISE CONTROL

A Noise Management Plan (NMP) will be prepared and implemented for all construction activities so that potential noise impacts during construction (including commissioning), particularly if required outside of standard daytime working hours, are minimised at noise sensitive locations.

The NMP will include at least the following requirements:

- normal hours for noise emitting construction activities to the period 0630 – 1830 on business days and Saturdays;
- the Construction Manager will ensure construction is undertaken in accordance with an EMP which will include a Noise Control Plan for any significant out-of-hours works;
- the Construction Manager will be responsible for establishing processes with relevant contractors to ensure that regular "tool-box" meetings with workers are held throughout the construction period, where best practice methods to minimise noise impact of construction activities will be reviewed and discussed with the workers;
- the noise control plan should be in general accordance with *AS 2436* regarding selection of equipment and processes to be used on site, maintenance of equipment, use of temporary screens and enclosures etc, as appropriate;
- an effective community consultation program with occupants of the nearest noise sensitive locations shall be implemented and maintained throughout the construction period; and
- a Complaints Register shall be established and maintained throughout the construction period. Upon receipt of a complaint, a process to investigate the complaint and undertake suitable remedial action or monitoring shall be initiated with the complaints and results recorded.

11.6.2 OPERATIONAL NOISE CONTROL

Table 11 shows that the predicted noise emissions for the operation of the proposed rail corridor readily comply with the QR criteria but exceed the night-time noise criterion for sleep awakening (42dBA max LpA) at four residences (Abandoned house, Colinta, Bakara and Glenapline). These residences are within 700 m of the proposed rail corridor.

Achievement of the night-time criterion for 24 hour use of the rail corridor at the residences at Colinta, Bakara and Glenapline will require either:

upgrading of the residential buildings to ensure that the internal sleep disturbance criterion is achieved. This may include upgrade of the bedroom facades (particularly the windows) along with the installation of some form of mechanical ventilation to ensure that the ventilation requirements of the BCA could be achieved with external windows and doors closed;

relocation of the residence or some other form of change of use for the residences so they would no longer be noise-sensitive locations; or

attenuation of the rail noise through the use of noise barriers adjacent to the rail line. Heights and their locations would be determined during the detailed design of the rail line.

11.6.3 CONSTRUCTION VIBRATION CONTROL

Vibration management will be incorporated into the development of the project EMP. The EMP will consider vibration criteria to prevent building cosmetic damage, to prevent damage to buried pipe work and telecommunication cables and to regulate vibration from potential blasting activities. The following criteria will be used to manage potential vibration impacts during construction

11.6.3.1 General construction vibration

The maximum peak particle velocities with reference to cosmetic damage to buildings are provided in Table 6 and are as recommended in AS 2187.2 2006 *Explosives – Storage and use – Use of explosives*.

Vibration due to construction and blasting activities has the potential to effect services such as buried pipe work, electrical and telecommunication cables. Short-term vibration limits for buried pipe work, electrical and telecommunication cables are summarised in Table 7

and are taken from German Standard DIN 4150.3-1999 *Structural Vibration – Part 3: Effects of vibration on structures*.

Vibration criteria for electrical cables and telecommunication services such as fibre optic cables are between 50 mm/s and 100 mm/s.

11.6.3.2 Blasting

Should blasting be required during the construction of the railway project, a detailed Blast Management Plan will be prepared. All blasting activities will be undertaken in accordance with the requirements of the EP act and the *Ecoaccess Guideline: Noise and Vibration from Blasting*.

11.6.4 OPERATIONAL VIBRATION CONTROL

No adverse vibration impacts would result at any residential locations during coal train pass-bys along the rail corridor. No specific mitigation measures are required for operational vibration control. Nevertheless Waratah Coal will develop a vibration management plan for the operation of the railway project.

11.7 CONCLUSIONS

11.7.1 ASSESSMENT OUTCOMES

Baseline ambient noise levels were sampled at seven sites representing noise sensitive locations along the proposed rail corridor. From these measurements, design planning levels were determined for noise emissions from the project. Noise modelling was carried out for the coal trains in the rail corridor using the source noise data.

From the modelling conducted, noise and vibration were assessed and where necessary, recommendations for methods and options for amelioration were provided. The following conclusions can be drawn from the outcomes of the assessment:

Rail Corridor

With the recommended noise amelioration implemented, the noise impact of the proposed rail corridor will not be significant. Rail vibration is not significant from the assessment conducted.

Construction Noise

There is only limited potential for significant construction noise emissions at the nearest receptors due to the nature of the construction activities required for this project, the allowable time for construction per day and the large intervening distance between the sources and the receptors. Using the Construction Noise Management Plan recommended to be prepared and implemented, potential noise impacts during construction (including blasting, if required) will be minimised at noise sensitive locations.

11.8 COMMITMENTS

To manage potential impacts of noise and vibration during construction, Waratah Coal will implement mitigation and management requirements as outlined in Section 11.7.

With respect to the noise of train passbys during operations along the rail corridor, the following mitigation measures will be considered for implementation at Colinta Holdings (both), Bakara, Hobartville, Riverview, Lenore Station, Salisbury Plains and Glenapline stations:

- upgrading of the residential buildings to ensure that the internal sleep disturbance criterion is achieved. This may include upgrade of the bedroom facades (particularly the windows) along with the installation of some form of mechanical ventilation to ensure that the ventilation requirements of the BCA could be achieved with external windows and doors closed (not applicable for Hobartville, Riverview, Lenore Station, Salisbury Plains and one of Colinta Holdings);
- relocation of the residence or some other form of change of use for the residences so they would no longer be noise-sensitive locations; or
- attenuation of the rail noise through the use of noise barriers adjacent to the rail. Heights and their locations would be determined during the detailed design of the rail.