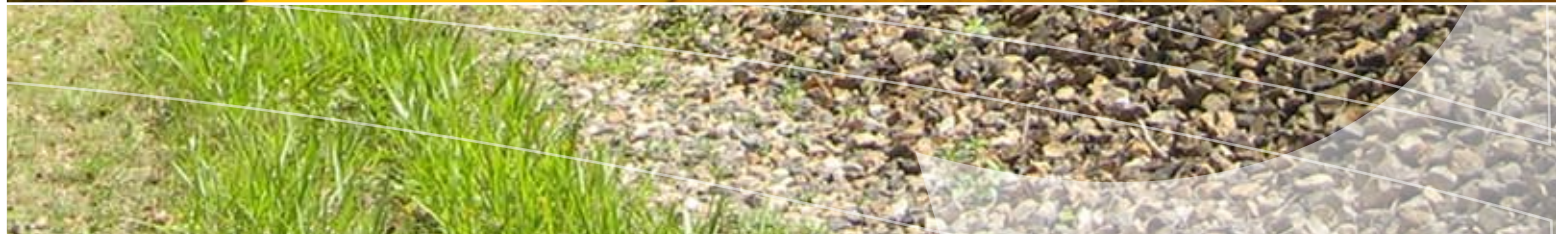


15 Noise and Vibration



15.1 Introduction

This chapter reviews the noise and vibration issues associated with the project.

Noise and vibration arise during construction and operation of a railway. Operating railways generate airborne noise due to the rolling associated with the railway car wheels on the track, engine and exhaust noise of locomotives. Braking, bearings, couplings, traction motors, air conditioning, fans and horns are also sources of operational noise. Gaps, joints and turnouts in the track can also contribute to noise. Tracks that have steeper gradients and tight curves generate additional rolling-stock noise resulting from the need to accelerate and brake, to negotiate these changes in track conditions. Airborne noise may also be generated by fixed railway equipment such as substations, tunnel ventilation plant and station public announcement systems. Track maintenance also generates noise from rail grinding, tamping and operation of machinery (engines and warning signals).

This chapter addresses section 3.6 of the terms of reference on noise and vibration and, in particular:

- investigate existing noise and vibration levels in the vicinity of the project
- identify noise sensitive receptors
- set the noise and vibration criteria at noise sensitive receptors for stages of the project taking into account relevant and legislation and guidelines
- investigate expected generation of noise and vibration from the proposed project activities at noise sensitive receptors. This includes noise levels during operation and construction of the project.
- recommend appropriate mitigation measures, where necessary, to achieve compliance with the relevant criteria.

15.2 Relevant legislation and policy

The following legislation and guidelines have been used to determine applicable criteria for the development:

Legislation:

1. *Environmental Protection Act, 1994* (reprint No.9). Where the local government for the local government area is not the administering authority or there is no provision of a local law in force for the relevant section, the noise standard as defined in Division 3 applies.
2. *Environmental Protection (Noise) Policy, 2008 (EPP)*, is a policy which subsists beneath the *Environmental Protection Act* and the purpose of the policy is to achieve the object of the Act in relation to the acoustic environment.
3. *Environmental Protection Regulation, 2008*, subsists beneath the *Environmental Protection Act* and sets the standards to which noise measurements must conform

Guidelines:

4. Queensland Rail Code of Practice, Railway Noise Management, November 2007
5. Department of Transport and Main Roads Interest in Planning Schemes 3 – Planning for Rail Noise
6. Ecoaccess Noise and Vibration from Blasting Guideline, 2006
7. Ecoaccess Assessment of Low Frequency Noise Guideline, Draft.

15.2.1 Acoustic quality objectives

Airborne noise levels in the environment are controlled through the Queensland Environmental Protection (Noise) Policy 2008 (EPP).

Schedule 1 of the EPP sets the acoustic quality objectives for noise sensitive receptors, and is prescribed for enhancing or protecting environmental values.

The policy prescribes an outdoor ambient level of 50 dBL_{Aeq,adj,1hour} or less for most of Queensland's population living in residential areas during the daytime and evening periods. Internal acoustic quality objectives have also been set for other noise sensitive receptors and range from 30 to 45 dBL_{Aeq,adj,1hour}.

These objectives are not applicable to the operational noise of railway, as it is an activity that is an exception under the *Environmental Protection Act 1994*, Schedule 1, Part 1.

15.2.2 Railway operating criteria

Noise limits for the operation of railway are currently not set by any Queensland Legislation.

Noise limits adopted by QR Limited in their Code of Practice, Railway Noise Management, November 2007, have been sourced from the superseded EPP (1997), which specified planning levels for railway to be assessed 1 m in front of the most exposed portion of an affected noise sensitive receptor in terms of a 24-hour L_{Aeq} noise level and a maximum pass-by level, L_{Amax}. The following planning levels apply:

- 65 dB(A), assessed as the 24 hour average equivalent continuous A-weighted sound pressure level
- 87 dB(A), assessed as a single event maximum sound pressure level.

QR Limited specifies that major upgrades and new corridors are to achieve as far as reasonably possible the planning levels.

Where compliance with the planning levels cannot be achieved, the Queensland Rail code of practice for railway noise management has nominated the following interim levels for the short term to be used while working towards meeting the planning levels in the long term:

- 70 dB(A), assessed as the 24 hour average equivalent continuous A weighted sound pressure level
- 95 dB(A), assessed as a single event maximum sound pressure level.

15 Noise and Vibration

A summary of the operating criteria is included in Table 15.2.2.

Table 15.2.2: QR Limited operating criteria

Criteria		
Guideline	LAeq,24hr dB(A)	L _{Amax} dB(A)
Planning Limit	65	87
Interim Limit	70	95

15.2.3 Construction criteria

Queensland legislation currently does not set noise limits for construction noise, other than blasting.

The *Environmental Protection Act 1994*, Section 440R, sets time constraints on noise from building works where audible noise is only allowable during the following period:

- business day or Saturday, 0630 – 1830 hours.

Section 440S of the Act sets time constraints on the use of regulated devices where a person may only operate a regulated device in a way that makes an audible noise during the following periods:

- business day or Saturday, 0700 – 1900 hours
- on any other day, 0800 – 1900 hours.

Where a regulated device includes:

- a compressor
- a ducted vacuuming system
- a generator
- a grass cutter
- an impacting tool
- a leaf blower
- a mulcher
- an oxyacetylene burner
- an electrical, mechanical or pneumatic power tool.

QR Limited have adopted more stringent time constraints for construction activities where:

Construction activities generating noise that affects neighbouring noise-sensitive places should, wherever possible and practicable, be confined to 'standard day-time working hours'

'Standard day-time working hours' are:

- Monday – Friday, 0700 – 1800 hours
- Saturday, 0700 – 1300 hours.

Construction noise during these hours does not have noise limits. It is recommended that any unavoidable construction outside of these hours complies with the general noise limits provided below to minimise the risk of causing a noise nuisance and the potential for noise abatement action (refer to Table 15.2.3).

Table 15.2.3: Recommended construction noise limits

Time Period	Noise Limit
Monday – Friday	
0700 – 1800 hours	No limit
1800 – 2200 hours	Background + 10 dBL _{Amax}
2200 – 0700 hours	40 dBL _{A1,adj,1hr} internal*
Saturday	
0700 – 1300 hours	No limit
1300 – 2200 hours	Background + 10 dBL _{Amax}
2200 – 0700 hours	40 dBL _{A1,adj,1hr} internal*
Sunday (and public holidays)	
All day	40 dBL _{A1,adj,1hr} internal*

**This is the EPP (2008) recommended night-time internal acoustic quality objective in relation to health and well being and the ability to sleep.*

QR Limited also recommends measures that should be considered during construction to assist in the reduction of noise.

These measures include:

- locating mobile plant (compressors, generators, etc) as far as practicable away from neighbouring noise-sensitive places
- directing principal noise sources (e.g. exhausts) away from noise-sensitive places as far as possible
- utilising the quietest available equipment within stock currently owned by QR Limited
- fitting of equipment with effective and properly maintained noise suppression equipment consistent with the requirements of the activity, where possible
- ensuring equipment utilised is maintained and operated as per the manufacturers specifications
- co-ordinating the loading/unloading of material activities to be within standard day-time working hours wherever practicably possible
- encouraging construction operators to have equipment that includes noise performance as a selection criterion at the time of purchase.

15.2.4 Blasting criteria

The *Environmental Protection Act 1994*, Section 440ZB, specifies maximum noise and vibration levels for blasting activities measured at an affected building. The Act recommends that a person must not conduct blasting if, at an affected building:

- the airblast overpressure is more than 115 dB (linear) peak for 4 out of any 5 consecutive blasts
- the airblast overpressure is more than 120 dB (linear) peak for any blast
- the ground vibration is, for vibrations of more than 35 Hz, more than 25 mm a second ground vibration, peak particle velocity

- the ground vibration is, for vibrations of no more than 35 Hz, more than 10 mm a second ground vibration, peak particle velocity.

The Ecoaccess Noise and Vibration from Blasting Guideline recommends that blasting should only be permitted:

- Monday to Friday 0900 – 1500 hours
- Saturday 0900 – 1300 hours.

15.2.5 Low frequency noise

The Ecoaccess Assessment of Low Frequency Noise Draft Guideline sets criteria to assess annoyance and discomfort to people at noise sensitive receptors caused by low frequency noise with a frequency range from 10 Hz to 200 Hz. Table 15.2.5a outlines the recommended limits for non-tonal low frequency noise ($L_{pA,LF}$, the A-weighted noise level in the frequency range 10 Hz to 160 Hz, one-third octave band spectra, measured indoors).

Table 15.2.5a: Recommended limits for non-tonal low frequency noise

Type of space	$L_{pA,LF}$
Dwelling, evening and night	20
Dwelling, day	25
Classroom, office etc	30
Rooms within commercial enterprises	35

The guideline also sets procedures for audibility assessments, to determine whether noise contains dominant low frequency components. The guideline has not yet been released as a public document and is not a legislative requirement but a guide on how people may be affected by low frequency noise and how this can be mitigated.

The guideline recommends that for cases where an individual complains of low frequency noise, an initial screening should be conducted, followed by an audibility assessment. Details of these are summarised in Table 15.2.5b.

Table 15.2.5b: Assessment framework

Assessment	Details
Initial Screening	To avoid complaints of low frequency noise annoyance, overall sound pressure level inside residences should not exceed 50 dB(Linear). If the dB(Linear) measurement exceeds the dB(A) measurement by more than 15 dB, a one-third octave band measurement in the frequency range 10 to 200 Hz should be carried out.
Audibility Assessment	To establish whether noise contains dominant low-frequency components, the following checks should be conducted: <ul style="list-style-type: none"> identify disturbances by listening to the recordings associated with complaint events and analysing time histories run concurrently of the Linear and A-weighted levels of recorded sound determine broadband L_{Aeq} and L_{LINeq} inside affected rooms

Table 15.2.5b: continued

Assessment	Details
Audibility Assessment	<ul style="list-style-type: none"> determine if the dB(Linear) measurement exceeds the dB(A) measurement by more than 15 dB if the dB(Linear) measurement exceeds the dB(A) measurement by more than 15 dB, the linear one-third octave band levels to be measured from 10 Hz to 200 Hz. these levels to be compared to the L_{HS}^* values for the best 10% of the older population to determine the degree of low frequency noise audibility. check for the existence of an amplitude-modulating component, where the noise level changes cyclically at a particular one-third octave band frequency (the added perception of loudness caused by this attribute is then accounted for by subtracting a 5 dB penalty from the L_{HS} value).

**The L_{HS} levels are the median values of the binaural hearing threshold levels of otologically selected subjects aged 55 to 60 years not exposed to high levels of occupational and recreational noise (minimum audible field). Given in decibels, relative to 20 micropascals in the frequency range from 8 Hz to 200 Hz inclusive.*

Potential noise reduction design measures at the source suggested by the guideline generally apply to permanent project works, measures that can be applied to construction activities include:

- use of exhaust silencers
- installation of enclosures.

Measures that can be implemented at the noise sensitive receptor include:

- re-positioning a bed to a location not affected by standing waves
- masking of the annoying low frequency noise by using an artificially created sound within a certain frequency range around the low frequency noise.

15.2.6 Sleep disturbance

The relationship between maximum noise levels and sleep disturbance is not well defined. There are many factors that contribute to awakenings such as sleep quality, sleep state and subject age. The maximum noise level, extent the noise exceeds the ambient noise level and the number of events during the night time contribute to sleep disturbance. However, even when noise is not a factor, awakenings may still occur.

The EPP (2008) recommends that for the health and well being of residents, in relation to the ability to sleep, the following acoustic quality objectives apply, when measured indoors:

- 30 dBL_{Aeq,adj,1hour}
- 35 dBL_{A10,adj,1hour}
- 40 dBL_{A1,adj,1hour}

Where noise levels are measured over a 1 hour period and are adjusted for tonal character or impulsiveness.

15 Noise and Vibration

15.2.7 Assessment time periods

Time periods used to assess the daily variation of existing noise levels are outlined in Table 15.2.7. These time periods are as defined in the EPP (2008).

Table 15.2.7: EPP (2008) time periods

Period	Time period
Day	0700-1800hrs
Evening	1800-2200hrs
Night	2200-0700hrs

15.2.8 Future development

The Department of Transport and Main Roads Interest in Planning Schemes 3 – Planning for Rail Noise (Department of Transport and Main Roads IPS) advises local governments on how planning schemes can manage new development close to existing or proposed rail corridors.

The Department of Transport and Main Roads IPS discourages noise sensitive development in areas affected by rail noise and advises that land use planning can reduce the problem of rail noise impacting on surrounding areas.

15.2.9 Local council

Maroochy Shire and Caloundra City Councils amalgamated with Noosa Shire in March 2008 to form the Sunshine Coast Regional Council (SCRC). Local city legislation that still applies is outlined below.

Caloundra City Council Plan 2004, Nuisance Code:

- Noise sensitive development within 100 metres of an existing or planned railway corridor is sited and designed to ensure that development is not subject to railway noise in excess of recognised acceptable limits, where external noise limits are as defined in the QR Code of Practice.

Maroochy Plan 2000, Desired Environmental Outcome No. 2 – Social Equity and Livability:

- Majority of approved noise sensitive developments are setback or buffered from major sources of noise generation.

15.3 Methodology

15.3.1 Baseline monitoring

Ambient noise measurements were conducted over 27 days in August/September 2008 to establish the current noise levels at noise sensitive receptors. The measurements were undertaken at 16 locations along the existing and proposed alignment.

Noise loggers were mounted with microphones at window height where possible, or 1.5 metres above ground level and set to fast time response for all measurements.

The L_{Aeq} , L_{Amax} , L_{A10} and L_{A90} noise indices were measured in free-field conditions (i.e. away from noise reflecting surfaces) with a sample period of one hour.

Weather conditions were noted throughout the measurement periods and noise measurements were discarded where weather conditions adversely affected the measured noise levels.

Noise measurements were performed in general accordance with Australian Standard 1055¹.

15.3.2 Equipment

The equipment used to measure the noise levels includes a sound level meter, sound logging meters and calibrator. The equipment was checked for calibration before and after each set of measurements, with no significant drift occurring.

15.3.3 Noise monitoring locations

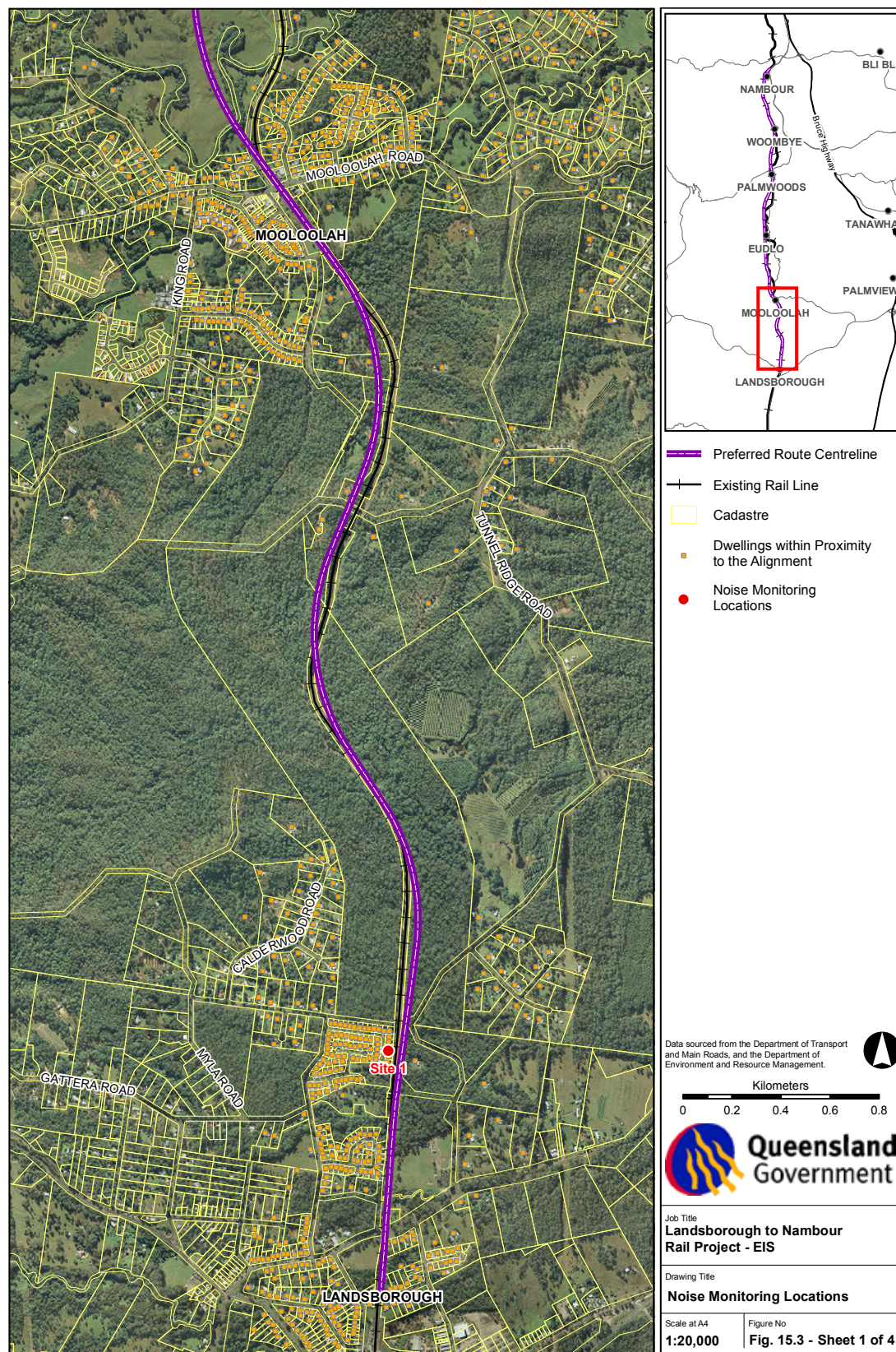
Noise monitoring was conducted at the locations listed in Table 15.3.3 and illustrated in Figure 15.3 on Noise monitoring locations.

Table 15.3.3: Noise monitoring locations

	Receptor Location
1	33 Tiverton Place, Landsborough
2	123 Neill Road, Mooloolah Valley
3	19 Logwoods Road, Eudlo
4	12 Beech Lane, Eudlo
5	9 Ash Lane, Eudlo
6	1 Eudlo School Road, Eudlo
7	63 Eudlo School Road, Eudlo
8	51 Main Street, Palmwoods
9	23 Jubilee Drive, Palmwoods
10	234 Paskins Road, Palmwoods
11	1-9 Nicklin Street, Palmwoods
12	Sundale Garden Village, 61 Jubilee Drive, Palmwoods
13	19 New Street, Woombye
14	66 Countryview Street, Woombye
15	Colless Lane, Nambour
16	16 Murray Crescent, Nambour

¹ AS1055-1977 Acoustics – Description and measurement of Environmental Noise, Standards Australia

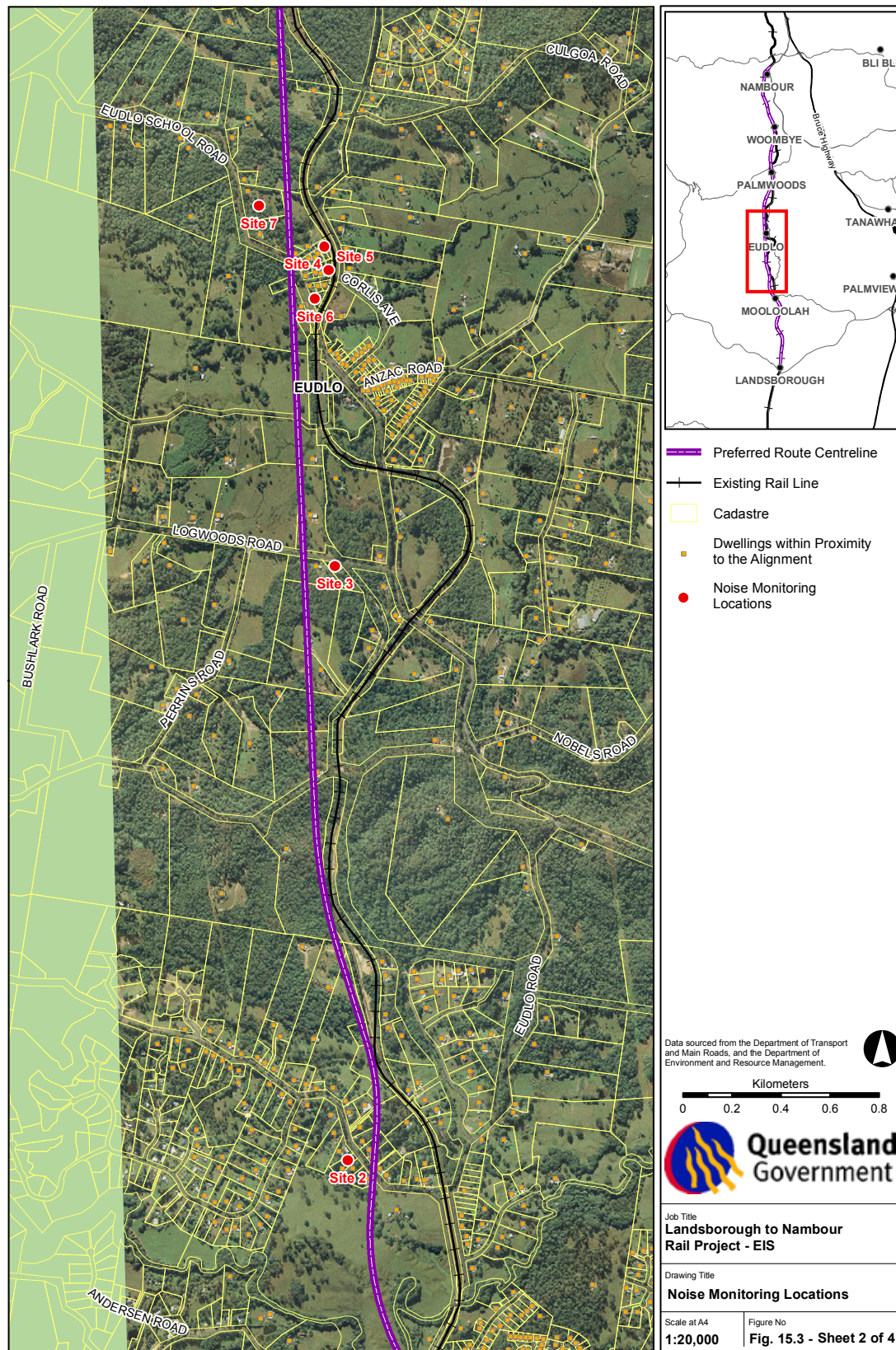
Figure 15.3: Noise monitoring locations



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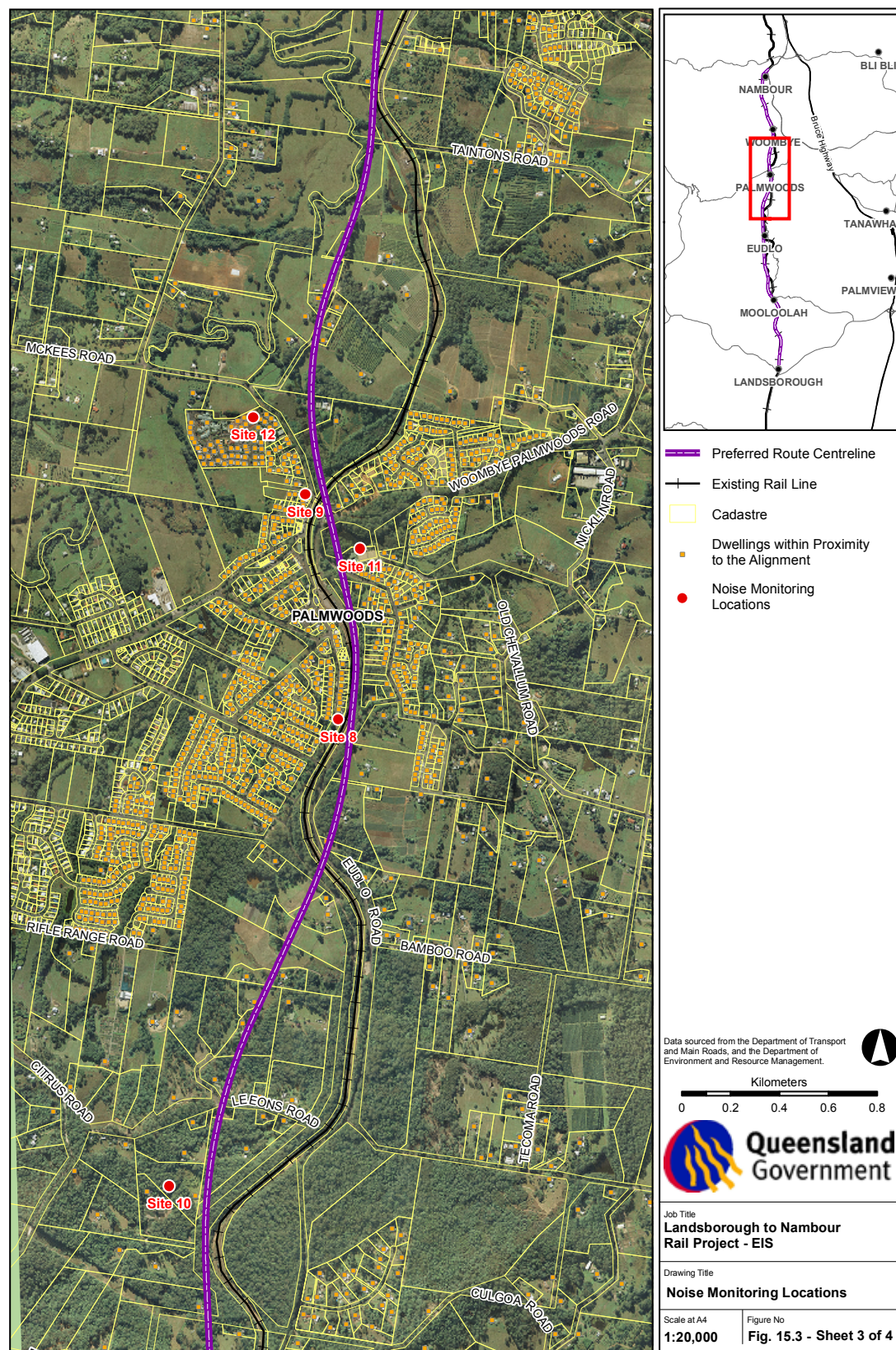
15 Noise and Vibration

Figure 15.3: Noise monitoring locations



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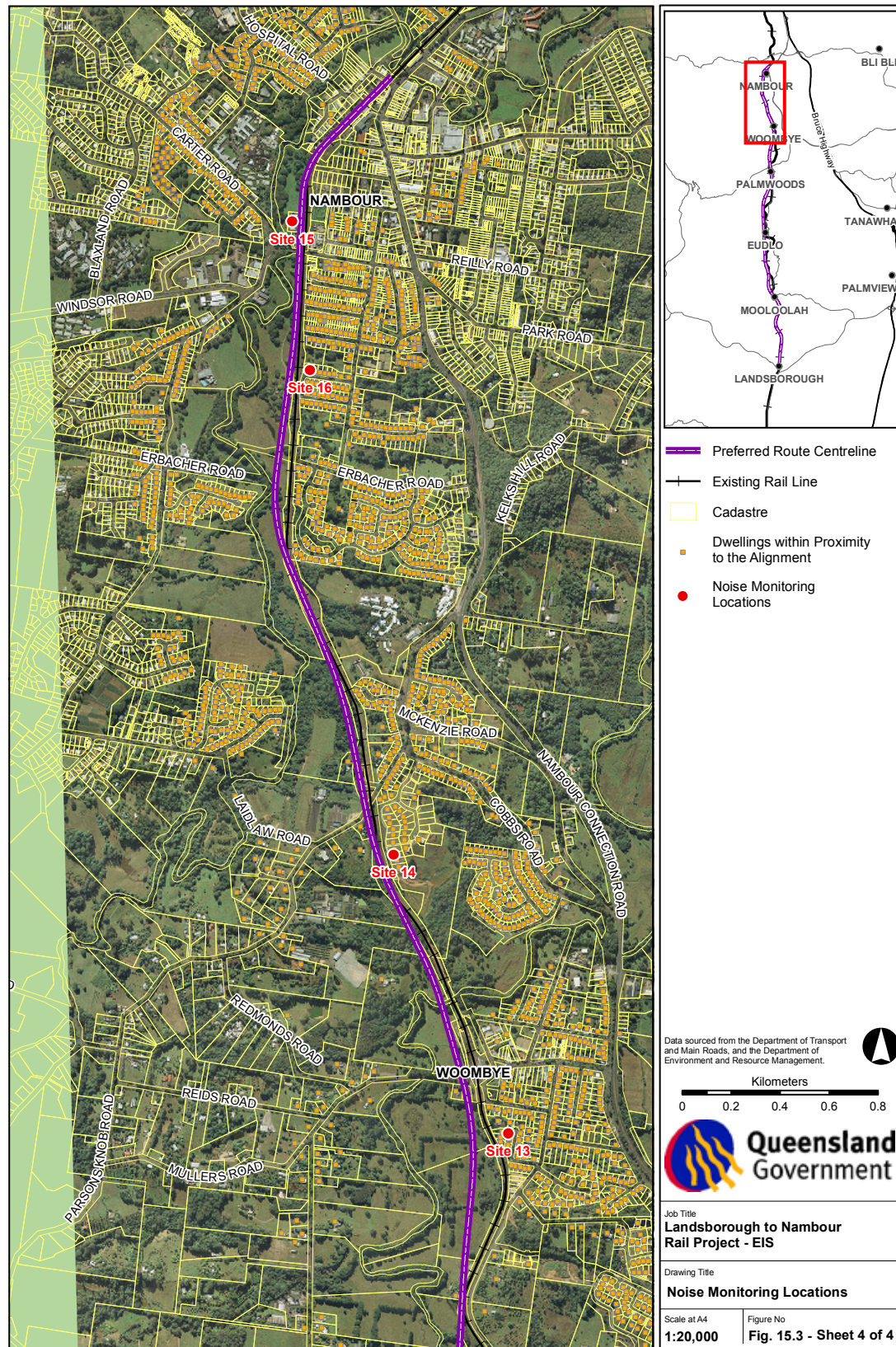
Figure 15.3: Noise monitoring locations



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15 Noise and Vibration

Figure 15.3: Noise monitoring locations



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15.4 Noise modelling

Noise modelling has been conducted using SoundPLAN Version 6.5 environmental noise prediction software² to predict the noise environment for the alignment of the Landsborough to Nambour railway line. Noise levels can be predicted at particular locations or noise contours can be calculated over whole areas.

Noise levels have been predicted using the Nordic Rail Prediction Method³ (Kilde Report 130), as implemented in SoundPLAN. Kilde has been used in this assessment as it is the only available model to predict both L_{Aeq} and L_{Amax} rail noise levels and QR Limited standard emission tables correspond with Kilde methodology.

When predicting noise levels, Kilde divides the source into elements in the direction along the track. The sound power generated by the source within each element length is replaced by a single point source at the element centre. The contribution from each track element is then added together to give the noise level for a given receptor position.

The existing and proposed alignments include two tunnel sections. The power radiated from the tunnel openings has been calculated using Olafsen's⁴ decay function, which takes into account the sound power generated on an equal stretch of open railway, tunnel absorption, diameter and length of the tunnel. The sound power level has then been applied to line sources equally distributed over the tunnel portals (1 m apart) in the SoundPLAN industrial model, as implemented in SoundPLAN for road traffic noise.

15.4.1 Model assumptions

The noise prediction model covers airborne noise only and can be used for all types of rail bound vehicles.

The propagation model takes account of losses due to geometrical spreading from the noise source, absorption from the ground and shielding from the ground topography and physical noise barriers where provided.

Noise levels have been predicted at 1.0 m from the most exposed façade and a +2.5 dB(A) façade correction has been applied to the noise predictions to take account of reflections from the façade.

Elevation lines of the terrain were included in the calculation situation. Buildings were modelled with individual heights from GIS data and with no reflection loss.

Where possible, the proposed alignment earth works have been incorporated within the traffic noise model for the proposed realignment.

² Braunstein + Berndt GmbH

³ Nordic Council of Ministers (1996) *Railway Traffic Noise – The Nordic Prediction Method*, TemaNord 1996:524

⁴ Olafson (1996) *Noise from Road Tunnel Openings – An Engineering Approach*, Internoise

Sections of the railway on elevated structures have been modelled as concrete bridges with ballast. The Nordic Rail Prediction Method recommends that a correction of +3 dB(A) is applied to account for the increase of noise from ballasted bridge structures.

Source railway noise levels have been derived from QR Limited's standard emission table. This provides source values to account for the rail vehicle type, speed and length. Emission from passenger vehicles on the existing line has been modelled as six car SMU/IMU vehicles on continuous welded rail and four car ICE vehicles. Existing freight, tilt and travel trains have been modelled as 'current generation' rolling stock with 625 metres consist. Year 2026 freight, tilt and travel trains have been modelled as 'new generation' locomotives with 625 metres consist (rolling stock, exclusive of the locomotive, making up a train).

A summary of the design parameters is included in Table 15.4.1.

Table 15.4.1: Input parameters to SoundPLAN model

Input	Detail
Train speed	65 km/hr (Existing)
	Future as designed
Methodology	Kilde Nordic Prediction Method
Façade correction	+2.5 dB(A)
Bridge correction	Concrete structures, +3 dB(A)
Cadastre and terrain data	Arup
Receptor height	4.5 m above ground level
Noise contours	Grid size: 50 m
	Field size: 9 x 9
	Height: 4.5 m above ground level
Source railway noise levels	QR Limited Standard Emission Table
Number of movements	QR Limited (Existing)
	Arup (Predicted)
Bridge parapets	1.1 m above bridge surface

15.4.2 Model calibration

A SoundPLAN model of the existing rail with current train schedules was compared to measured noise levels at nine of the 16 measurement locations along the existing alignment to calculate an overall calibration factor for the noise model. Presented in Table 15.4.2 are the measured unattended noise levels and the SoundPLAN predicted existing noise levels at monitoring locations. Receptors for calibration are at surveyed heights.

Noise monitoring was conducted in all townships along the rail alignment. A full description of baseline monitoring is included in Table 15.5.1. Not all monitoring positions have been used to calibrate the model as some locations were affected by existing noise sources, such as road traffic noise. Receptor locations within 100 metres of the existing alignment with no trafficable roads between the receptor and the railway have been used to calibrate the prediction model.

15 Noise and Vibration

Table 15.4.2: Comparison of measured and predicted 2008 noise levels, dB re 20 µPa

Receptor location	Average measured dBLAeq,24hr	Un-calibrated predicted dBLAeq,24hr
33 Tiverton Place, Landsborough	54	59
12 Beech Lane, Eudlo	60	64
9 Ash Lane, Eudlo	59	61
1 Eudlo School Road, Eudlo	59	60
51 Main Street, Palmwoods	62	63
19 New Street, Woombye	53	55
66 Countryview Street, Woombye	54	58
Colless Lane, Nambour	59	61
16 Murray Crescent, Nambour	55	59

A calibration factor of -3 dB has been applied to the model.

15.4.3 Situation

There are several factors that would cause future railway noise levels to differ from current noise levels. These are:

- change in traffic volume
- change in traffic composition
- change in locomotive design
- altering the rail alignment and height of rail line relative to receptors
- elevating the rail alignment onto bridge structures.

15.4.4 Traffic flow and composition

Existing traffic flow

The following rail schedule in Table 15.4.4a has been used to calibrate the SoundPLAN model and is representative of weekday movements:

Table 15.4.4a: Existing weekday rail movements

Type	Number of rail movements	
	Up (South)	Down (North)
SMU/IMU	6	7
ICE	5	6
Freight/Tilt/Travel Trains	18	16

Future traffic flow

Rail movements for year 2026 have been estimated (based on the operational analysis discussed in Chapter 7, Transport) and the following numbers in Table 15.4.4b have been used in the acoustic model to predict future noise levels from the proposed alignment:

Table 15.4.4b: Predicted rail movements

Type	Number of Rail Movements	
	Up (South)	Down (North)
SMU/IMU	46	47
ICE	0	0
Freight/Tilt/Travel Trains	28	28

15.4.5 Limitations of study

Operational ground-borne noise and vibration

Operating railways generate ground vibration, due to the rolling contact of steel wheels on the railway tracks. Ground-borne vibration propagates in the ground and may be transmitted into buildings via the foundations. Within buildings, it may be manifested as either:

- vibration that is directly perceptible to occupants
- noise that is radiated by the vibrating surfaces of the building referred to as *ground-borne noise*⁵.

There are no existing standards defining limits for ground-borne noise from operating railways. For at-grade track, airborne noise impacts would be expected to dominate over any ground-borne noise effects. Therefore, ground-borne noise has not been assessed further in this study. Similarly, ground-borne vibration impacts would not be expected to be significant compared to airborne noise impacts.

Construction noise and vibration

Many of the construction activities associated with a railway project usually only occur in a particular location for a matter of days or weeks as work progresses along the length of the railway line. In addition to these works, some construction activities such as rock breaking, concrete batching plants and vehicle / equipment movement and storage would take place at designated work-sites outside the railway corridor.

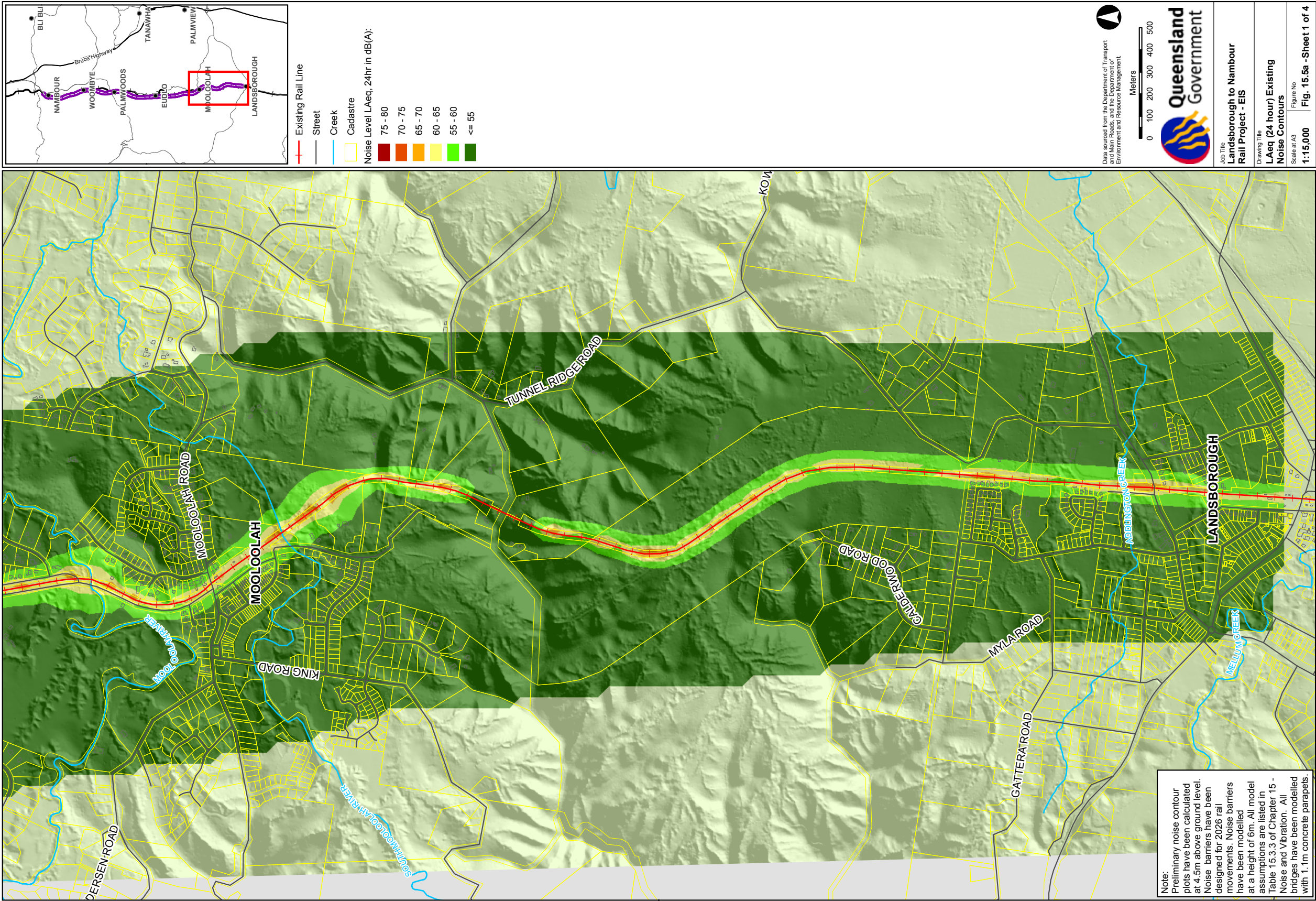
At this stage of the study, no detailed information is known about proposed construction methodologies or potential work-sites. A desk-top assessment of construction noise has been conducted, based on typical construction activities likely to occur during the construction of the proposed alignment. Equipment sound power levels have been taken from AS 2346⁶ and BS 5228⁷.

15.4.6 Assessment of impacts

Potential noise and vibration impacts have been assessed using significance criteria as discussed in Chapter 1, Section 1.8.

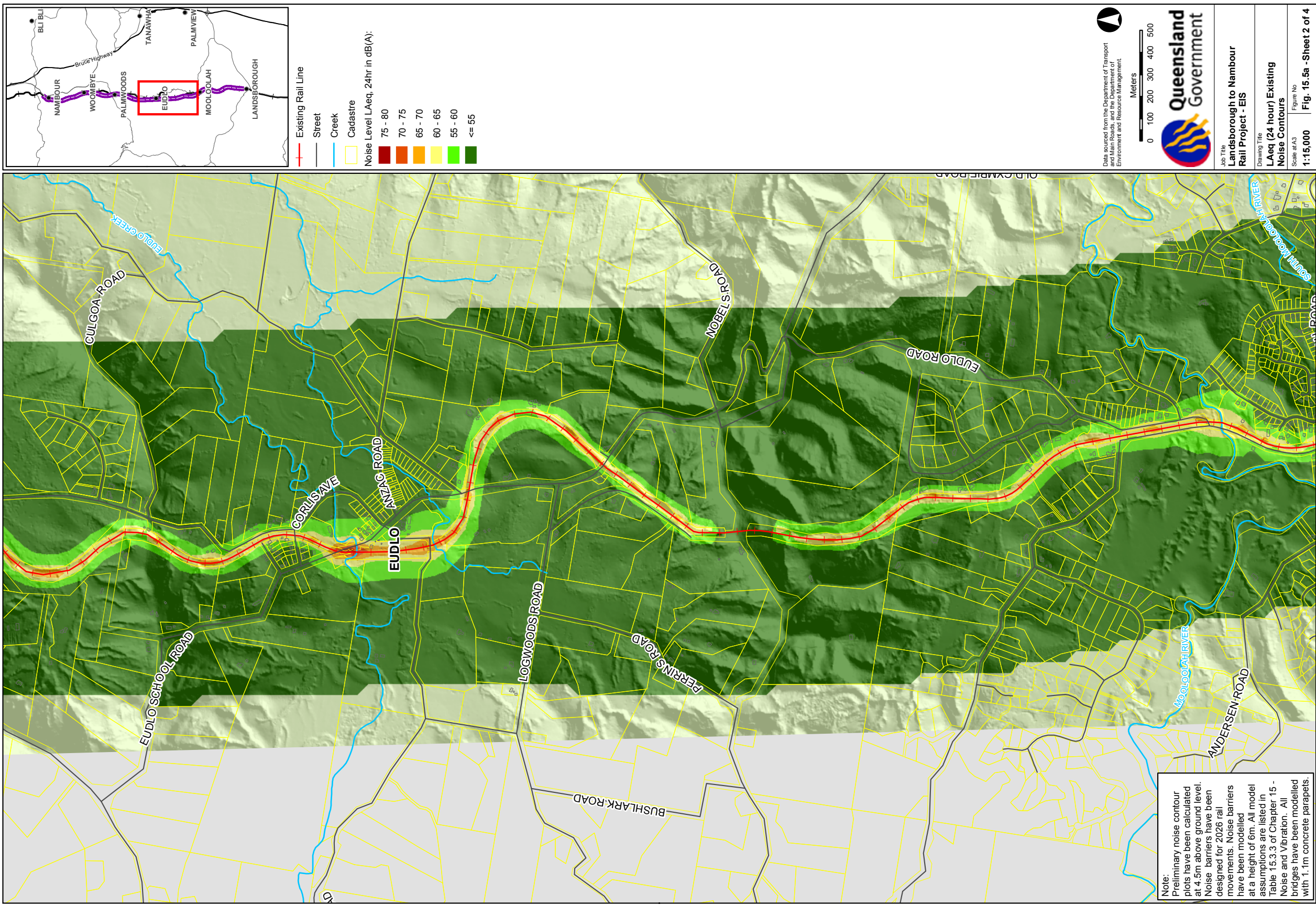
- ⁵ Also sometimes referred to as *re-radiated noise, structure-borne noise or regenerated noise*
- ⁶ AS 2346 – 1981, *Guide to noise control on construction, maintenance and demolition sites*
- ⁷ BS 5228: Part 1: 1997, *Noise and vibration control on construction and open sites*

Figure 15.5a: LAeq (24 hour) Existing Noise Contours



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Figure 15.5a: LAeq (24 hour) Existing Noise Contours



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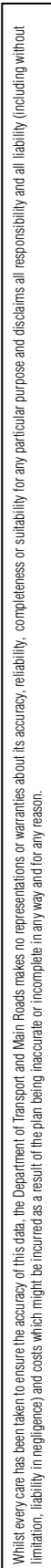


Figure 15.5a: LAeq (24 hour) Existing Noise Contours

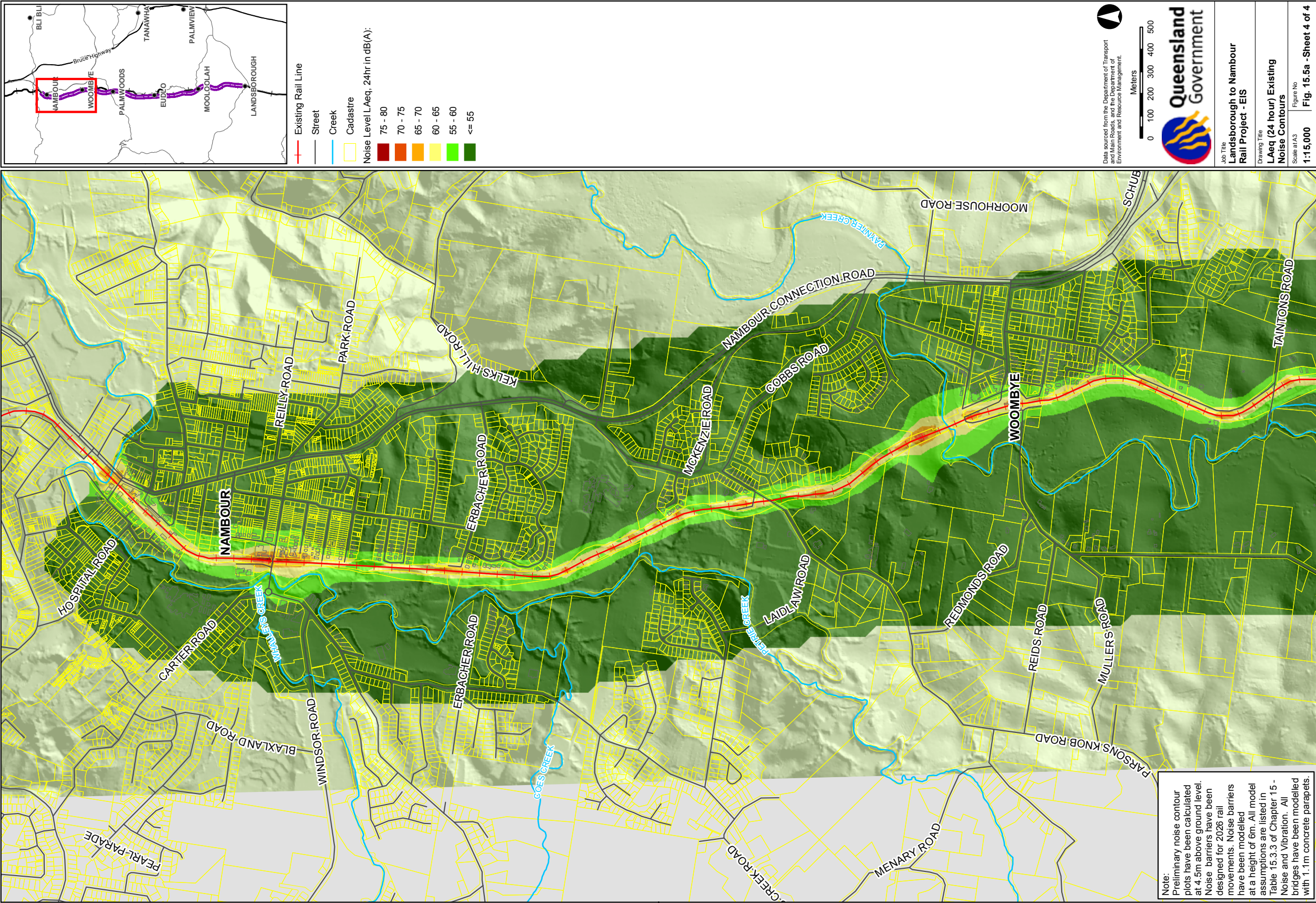
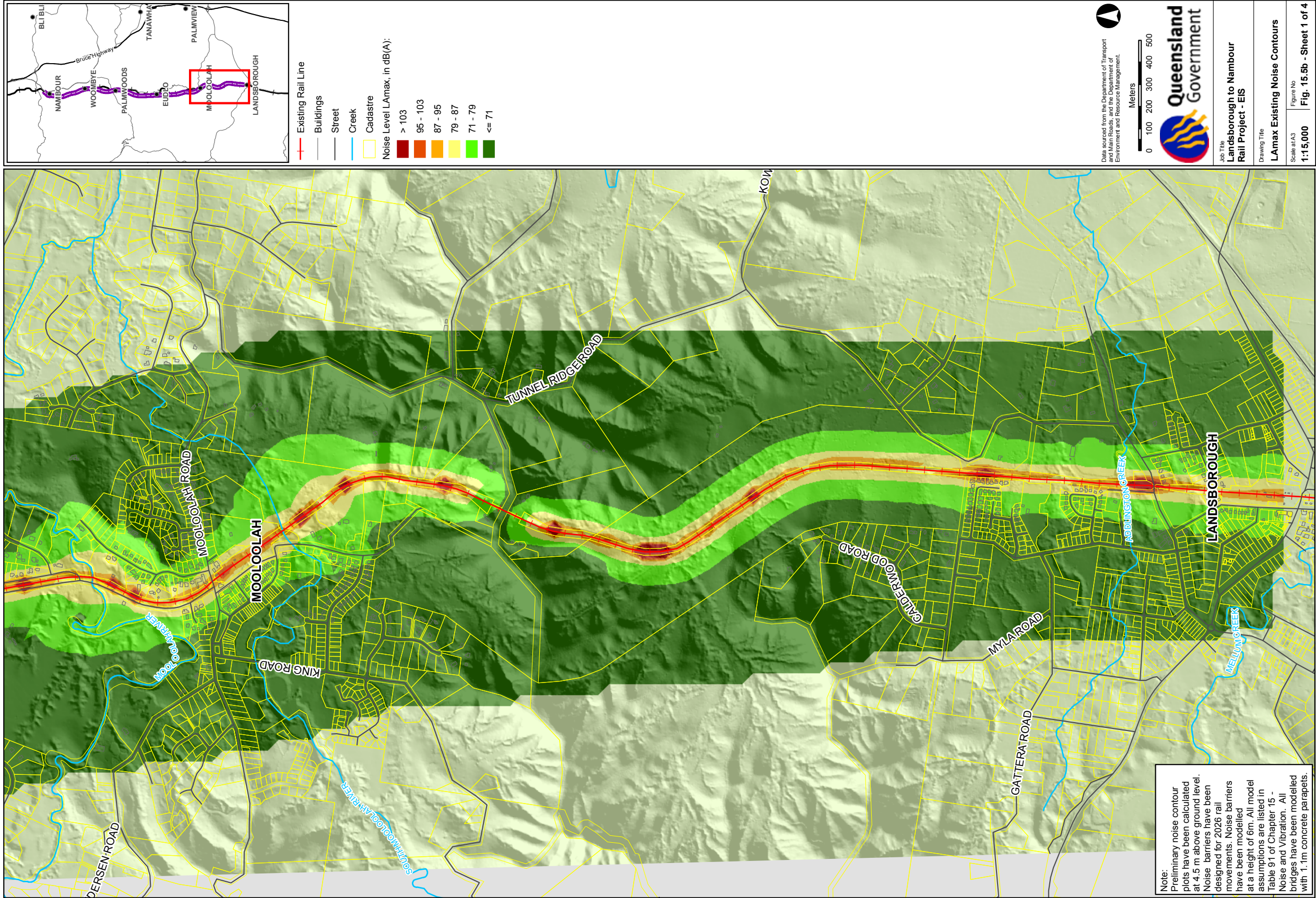
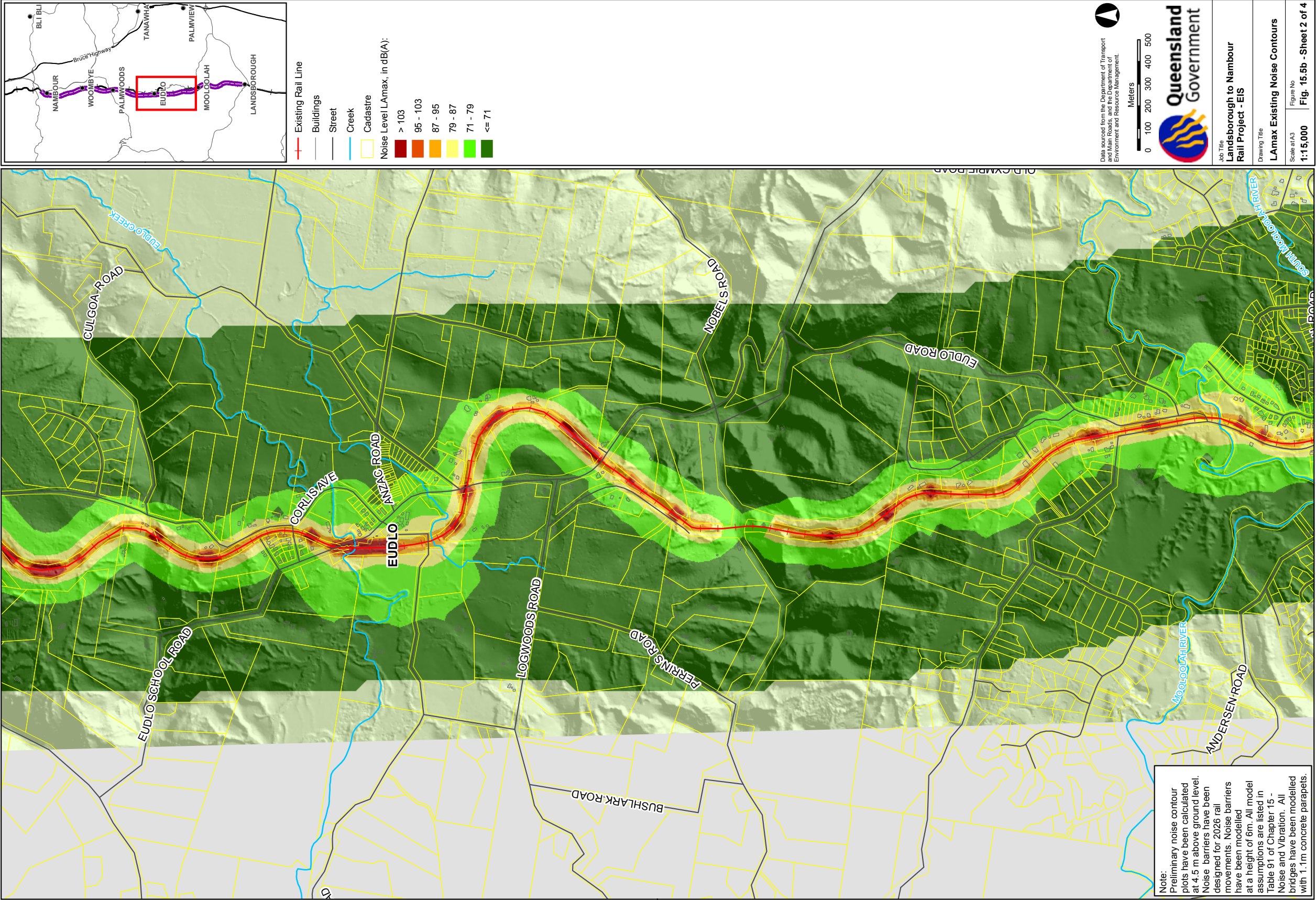


Figure 15.5b: LAmaz Existing Noise Contours



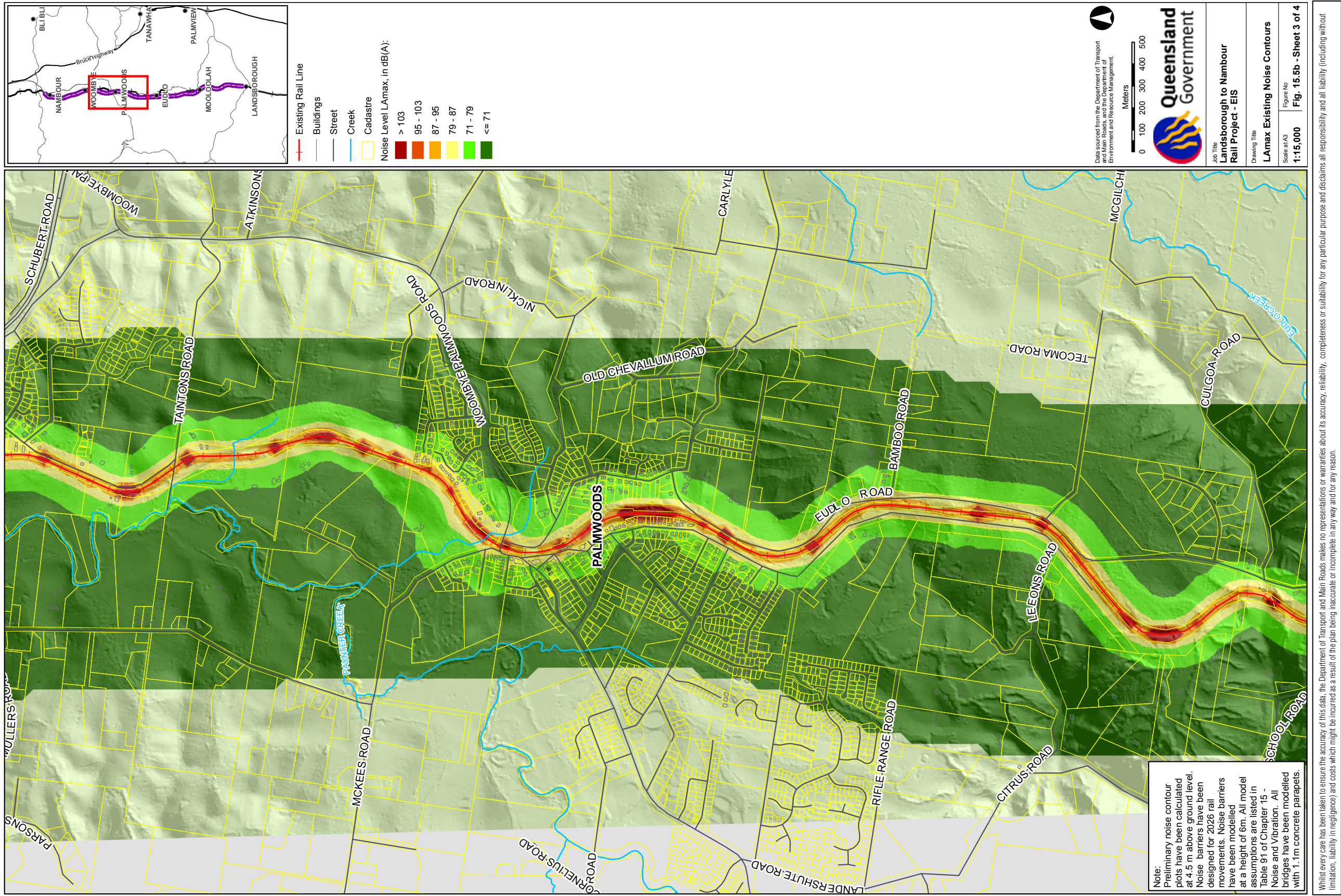
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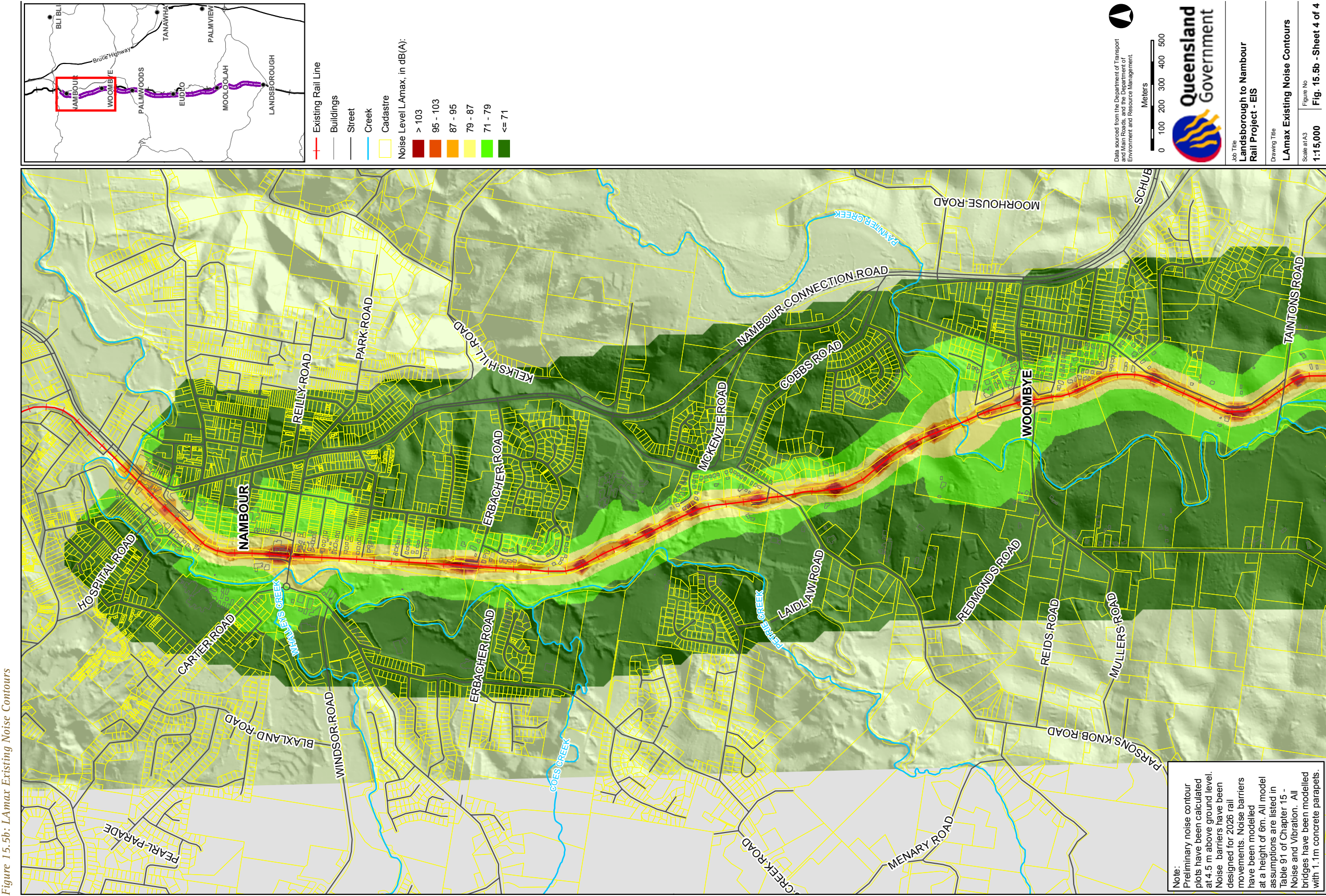
Figure 15.5b: LAmaz Existing Noise Contours



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Figure 15.5b: LAmaz Existing Noise Contours





These criteria allow for a standard assessment process across all topics covered in the EIS and provide a context for describing the significance of the impact. Significance criteria used for this chapter are described in Table 15.4.6.

Table 15.4.6: Significance criteria – noise

Significance	Description
High Adverse	Noise levels during operation are predicted to regularly exceed established planning noise guidelines (65 dBLAeq,24hr or 87 dBLAmax) by more than 10 dB(A) at noise sensitive receptors.
Moderate Adverse	Noise levels during operation are predicted to exceed planning noise guidelines by between 5 to 10 dB(A) or occasionally by more than 10 dB(A) at noise sensitive receptors.
Low Adverse	Noise levels during construction or operation are predicted to exceed established planning noise guidelines by up to 5 dB(A) or rarely by more than 10 dB(A) at noise sensitive receptors. Construction or operational noise levels are not predicted to exceed interim noise guidelines.

Negligible	Construction or operational noise levels are not predicted to exceed established noise guidelines.
Beneficial	Construction or operation contributes to the reduction of noise. For example, construction or operation shuts down an existing source of noise such as a road and the resulting noise impact is less than the previous noise impact.

Potential impacts have been identified and described based on the absence of mitigation or management (**potential impacts**). Suitable mitigation or management measures have then been noted (**proposed design / mitigation / management measures**) and the **residual impacts** have been described and assessed based on the significance criteria approach noted above.

15.5 Description of environmental conditions

15.5.1 Baseline monitoring

Noise monitoring was conducted at 16 locations as shown in Section 15.3.3. A summary of the results is included below in Table 15.5.1. The noise contours of the existing alignment show existing noise levels from the railway (Figures 15.5a).

Table 15.5.1: Baseline monitoring summary, dB re 20 µPa

Receptor location	Distance from existing alignment	Distance from future alignment	Identified land use	Measured Daytime dBL _{Aeq,1hr}	Measured rating background level, dB(A)		
					Day	Evening	Night
33 Tiverton Place, Landsborough	30 m	54 m	Residential	58	38	37	36
123 Neill Road, Mooloolah Valley	400 m	130 m	Rural Residential	54	33	36	32
19 Logwoods Road, Eudlo	360 m	137 m	Rural	46	34	34	34
12 Beech Lane, Eudlo	16 m	160 m	Residential	60	40	37	33
9 Ash Lane, Eudlo	20 m	160 m	Residential	59	36	38	28
1 Eudlo School Road, Eudlo	43 m	100 m	Residential	58	39	34	29
63 Eudlo School Road, Eudlo	200 m	125 m	Rural	54	36	40	27
51 Main Street, Palmwoods	20 m	45 m	Residential/ Commercial	64	40	38	33
23 Jubilee Drive, Palmwoods	64 m	84 m	Residential	62	43	36	34
234 Paskins Road, Palmwoods	135 m	35 m	Rural	48	33	35	32
1-9 Nicklin Street, Palmwoods	165 m	50 m	Recreational	54	44	38	29
Sundale Garden Village, 61 Jubilee Drive, Palmwoods	335 m	155 m	Residential	56	40	36	29
19 New Street, Woombye	62 m	140 m	Residential	54	40	34	30
66 Countryview Street, Woombye	50 m	50 m	Residential	55	37	32	27
Colless Lane, Nambour	30 m	N/A	Commercial	59	41	43	39
16 Murray Crescent, Nambour	47 m	80 m	Residential	56	39	35	29

15 Noise and Vibration

Receptors located in higher density urban areas in the vicinity of main townships have higher $L_{Aeq,24hr}$ noise levels, while the night time background levels were higher in areas closer to the railway line. This indicates that factors affecting the existing ambient environment are the noise sensitive receptor's proximity to major roads and the existing rail line. Generally, ambient noise levels are currently higher than the prescribed daytime acoustic objective of 50 dBL_{Aeq,adj,1hr} for residential properties, as set out in the EPP (2008).

15.5.2 Existing ambient environment

The majority of the project area is an open rural environment. Main towns along the railway have more densely populated residential areas, generally localised to small catchments around the train stations. As well as noise from the existing rail alignment, road traffic is a significant noise source in the area. The Bruce Highway is approximately 5 km to the east and provides access to main towns within the project area. A sub-arterial road, Eudlo Road, Mooloolah Valley to Nambour Connection Road, Nambour, follows the length of the existing rail alignment.

15.5.3 Noise sensitive receptors

As QR Limited guidelines have been based on the superseded EPP (1997), the definition of a noise sensitive receptor to be assessed against the operating criteria has been sourced from the updated 2008 document.

The EPP (2008) defines a noise sensitive receptor as any of the following:

- dwelling
- library and educational institution (including a school, college and university)
- childcare centre or kindergarten
- school or playground
- a hospital, surgery or other medical institution
- commercial and retail activity
- a protected area, or an area identified under a conservation plan as a critical habitat or an area of major interest, under the *Nature Conservation Act 1992*
- a park or garden that is open to the public (whether or not on payment of money) for use other than for sport or organised entertainment.

Noise sensitive receptors within 200 metres of the proposed realignment are described in Table 15.5.3. These include residences, schools, nursing homes and recreational parks.

Table 15.5.3: Noise sensitive receptors within 200 m of the project

Description	Location
Schools	Nambour Christian College, McKenzie Road, Woombye Eudlo State School, Highlands Road, Eudlo Maroochy Shire Council Child Care, 28 Mill Street, Nambour
Residences	A number of residential properties are within 200 m of the proposed realignment. These are located in the following townships: Nambour Burnside Palmwoods Woombye Coes Creek West Woombye Eudlo Mooloolah Valley Landsborough North Landsborough
Nursing Homes	Sundale Garden Village, 61 Jubilee Drive, Palmwoods
Places of Worship	Uniting Church Australia, 3 Florence Street, Nambour Baptist Union of Queensland, 27 Coes Creek Road, Burnside Nambour 7 th Day Adventist Church, 77 Coes Creek Road, Palmwoods Brisbane Congregation Jehovah's Witnesses, 45-55 Blackall Range Road, Woombye Evangelical Lutheran Trinity Congregation, 29 Back Woombye Road, Woombye The Corporation of the Synod of the Diocese of the Anglican Church, 9-13 Hill Street, Palmwoods
Commercial Properties	A number of commercial properties are within 200 m of the proposed realignment. These are located in the following townships: Nambour Burnside Palmwoods Woombye Coes Creek West Woombye Eudlo Mooloolah Valley Landsborough North Landsborough

Table 15.5.3: continued

Description	Location
Recreational Parks	Jubilee Park, 6 Hospital Road, Nambour
	Moss Day Park, Washington Street, Nambour
	Erbarcher Road Park, Nambour
	Carter Road Park, Nambour
	Park and Recreation Greenhaven, Palmwoods
	Huntingdale Drive Parks, Nambour
	Puch Street Reserve for Parks and Gardens, Coes Creek
	Palmway Close Park, Woombye
	Blackall Street Reserve for Park and Recreation, Woombye
	Woombye Recreation Ground, Back Woombye Road, Woombye
	Palm Grove Park Reserve for Park and Recreation, Palmwoods
	Reserve for Parks and Gardens, Merriman Court, Palmwoods
	Reserve for Park and Playground, 13 Main Street, Palmwoods
	Reserve for Park and Recreation, Tunnel Ridge Road, Landsborough
	Reserve for Park and Gardens, Coljohn Street, Landsborough
	Reserve for Park and Gardens, Rose Road, Landsborough
	Reserve for Park, Bray Road, Mooloolah Valley
	Reserve for Public Purposes, Sandy Road, Mooloolah Valley
	Reserve for Park and Recreation, Neill Road, Mooloolah Valley
	Reserve for Park and Gardens, Paget Street, Mooloolah Valley
	Reserve for Park, Myla Road, Landsborough
Bushland Recreational Parks	Eudlo Creek National Park, Paskins Road, Palmwoods
	Reserve for National Park, Tunnel Ridge Road, Landsborough

15.6 Information provided by the community

Throughout the project, there has been on-going community consultation. Details of activities and information releases are discussed in **Chapter 1, Section 1.9**. Issues raised to date and considered in both the route identification process and the assessment of the impact of the projects are discussed in **Table 15.6**.

Table 15.6: Community feedback, related to noise and vibration.

Issues Raised	Response	Section
Attention to the research and design of noise and vibration control measures (i.e., noise mounds and barriers). Train noise pollution is often a huge issue and with the implementation of three or four lines would most definitely add to the noise and vibration levels.	Noise monitoring and modelling has been undertaken for the project, taking into account the increased service frequency, and change to the alignment (from the existing).	This is documented in Chapter 15, Noise and vibration .
Existing vibration from the rail is extremely noticeable.	Whilst vibration has not been measured from the existing railway, it is anticipated that modern design standards applied for the project will aim to reduce these effects.	
How would tunnel works affect nearby properties - i.e. in terms of vibration.		
Concerns over traffic increases and noise pollution in Nambour.	Existing ambient noise levels are discussed in this chapter, based on the results of monitoring.	Section 15.5.2.
Noise is a concern as it is already quite noisy as trains squeal on the tracks approaching Palmwoods	A straighter alignment (i.e. no tight curves) provides better operational conditions, and less opportunity for wheel squeal to be generated. The increase in radii has been taken into account in the noise model.	
Concern about the increase in rail operation noise (Freight) since the introduction of additional operators on the line.	This issue is relevant to the Queensland Rail Code of Practice, Railway Noise Management, November 2007.	Section 1.2
Noise abatement is a high level of concern. Are there simple and cost effective mitigation and abatement measures that could be implemented?	Potential locations for noise mitigation measures have been identified. It is anticipated in future stages of detailed design appropriate treatments would be selected, in consultation with council and the community, where identified as required.	

15 Noise and Vibration

Table 15.6: continued

Issues Raised	Response	Section
If the freight line continued from Eumundi and followed the highway to Caboolture, the noise would be confined to an already existing noisy area.	This is not a consideration for this EIS as it does not address the objectives of the project.	
Concerns that the project would generate increased noise levels for those adjacent to the project area. Concerns that this would be a result of increased passenger and freight services, and increased speed of the alignment. Suggested noise barriers could be used in residential areas adjacent to the corridor.	The proposed rail corridor is likely to bring further reductions in noise levels through the improved alignment.	Refer Section 1.8.
Concern over noise generated from elevated structures.	This is an issue particularly for Palmwoods. Although noise generated by the existing railway already affects this township, the use of concrete structures, and further noise sensitive design treatments on the structure will be incorporated into the detailed design to reduce this effect.	Refer Section 1.8.

15.7 Assessment of potential impacts and mitigation measures

15.7.1 Construction noise

Potential impact – construction

Some construction activities, such as jack hammering and pile works, have the potential to adversely impact the surrounding environment. However, the impact of construction noise is temporary in nature, and once sections of the realignment have been completed, the ambient noise environment would return to an acceptable level.

At this stage of the development, the exact construction methodology is unknown. The project will involve the construction of:

- twelve new rail bridges
- tunnels (including cut and cover tunnel sections associated with the tunnels)

- five significant road realignment
- eight possible grade separation options.

Approximately 70% of the project occurs away from the existing rail corridor, which will allow construction in these areas to progress without the constraint of having to maintain an operational rail corridor nearby. **Chapter 2, Description of the project** provides more information on the construction of the project.

Construction noise impacts are most likely to occur from rock breaking and piling activities, although where earthworks occur close to properties there is also the potential for impacts to occur. Additionally, works within the rail corridor will need to be undertaken outside of the operational hours of the railway, as these are likely to generate noise impacts.

Preliminary equipment octave band noise levels have been sourced from *Update of Noise Database for Prediction of Noise on Construction and Open Sites* (DEFRA, 2005) based on typical construction activities likely to occur during the construction of the project and are presented in Table 15.7.1. Noise levels of equipment have been calculated at varying distances from the source, however, it should be noted that cumulative noise levels of multiple equipment operating at the same time will be higher than a single piece of equipment.

Table 15.7.1: Sound power levels of machinery, dB re 10⁻¹² W

Equipment	Sound Power Level, dB(A)	Sound Pressure Level, dB(A) at varying distances				
		10 m	25 m	50 m	100 m	200 m
Excavator	104	76	68	62	56	50
Diesel generator	93	65	57	51	45	39
Bored piling rig	114	86	78	72	66	60
Rock breaker	123	95	87	81	75	69
Dump truck	108	80	72	66	60	54

When the construction methodology has been determined during the detailed design phase of the project, construction noise will be reviewed to best practice standards to minimise the impact on the community, this should be reviewed against the recommended criterion set out in Table 15.2.3.

Proposed mitigation measures – construction

Although there are no construction noise limits defined by Queensland legislation, noise mitigation strategies should be implemented where practical to reduce the potential for adverse noise impacts and complaints.

Mitigation methods for construction noise can be separated into strategies for:

- construction noise monitoring
- source noise control and work practice strategies
- community liaison.

Construction noise monitoring

Using the suggested construction noise limits suggested in **Section 15.2.3**, immediately prior to construction when more specific details are known, background noise measurements should be conducted to determine the specific noise limits for localities that will be affected by construction noise.

The noise levels of the proposed construction activities will be modelled during the detailed design phase. Modelling will allow most unacceptable impacts on sensitive receptors (i.e. noise levels above the recommended criterion set out in **Table 15.2.3**) to be predicted prior to construction and to design appropriate mitigation measures, in consultation with affected receptors. The proposed mitigation strategy is detailed in **Chapter 22, Environmental Management Plans**.

The noise levels will be monitored during the construction of the project to ensure compliance with the objectives set above. In addition, a technical assessment of all noise complaints will ascertain whether the construction noise levels are within acceptable levels. The results of the technical assessment will be provided and, if necessary, action will be taken to reduce the noise impacts.

Where noise monitoring has shown that acceptable noise levels are exceeded, the mitigation strategy will be reviewed in this location, in consultation with the affected residents. **Chapter 1, Section 1.9 (Table 1.9.7)** provides more information about the complaint process

Source noise control and work practice strategies

QR Limited recommends mitigation measures for the construction of rail facilities. These measures are typical construction mitigation methods that include:

- use of the quietest equipment available i.e. using equipment with motor housing
- restricting work hours
- fitting construction equipment with effective and properly maintain noise attenuating equipment
- alternative processes
- silencing equipment where practicable
- placement and orientation of equipment to reduce impact at noise sensitive receptors
- screening equipment where practicable
- community notification program outlining the schedule, timeframe and nature of construction activities.

These measures will be implemented as a minimum for the construction of the project. However, further measures may be required and include:

- careful scheduling of work, managing construction activities to avoid audible noise nearest to the noise sensitive receptor during certain hours of the day

- keeping horns and reversing alarms to the minimum volume level possible, without compromising safety requirements
- using non-tonal/broadband type reversing alarms
- using stockpiled materials as noise barriers to shield sensitive receivers
- educating operators of equipment in potential noise issues, and in work techniques to minimise potential impacts
- treatment to building facades and temporary upgrade of room ventilation to reduce internal noise
- as a last resort, temporary relocation of affected residents.

Where the project is in proximity to sensitive receptors, construction will be generally limited to the following times:

- Monday – Friday, 0700 – 1800 hours
- Saturday, 0700 – 1300 hours

However, construction will occasionally take place outside of normal working hours, in particular where the project could interfere with the operation of the existing railway. When construction is required outside of the 'standard hours', consultation with the affected residents will ensure that suitable mitigation measures are in place to minimise the disturbance and that the affected residents are fully aware of the times, duration and nature of the planned construction activities.

Community liaison

In order to assist in controlling the expectations and the understanding of the communities, community liaison will occur during construction and a complaints procedure will be in place.

Where construction noise predictions indicate that activities will exceed the goals set out in **Table 15.2.3**, direct liaison with the residents of properties predicted to be affected will be undertaken.

As detailed in the strategies above, **Chapter 1, Section 1.9 (Table 1.9.7)** provides information about the complaint process.

In particular, consultation with the affected residents will:

- provide details of timing, duration and nature of the works
- review areas of concern
- inform residents about the mitigation strategies in place to control noise and protect their interests as far as practicable.

It is also important that feedback resulting from this liaison is duly processed and that:

- where complaints are received, or noise limits exceeded, it is followed up with an investigation
- if there are particularly critical construction stages (e.g. blasting, night-time works), monitoring must be conducted.

15 Noise and Vibration

Residual impact – construction

The residual impact significance of construction would need to be re-evaluated at a later stage when construction methodology is known. Given the mitigation measures outlined above and the temporary nature of construction activities, the residual impact is anticipated to be between negligible to moderate adverse.

15.7.2 Operational noise

Potential impacts – operation

Planning Levels

As mention in Section 15.2.2, QR planning limits, assessed at 1 m from the façade of a noise sensitive receptor, have been applied to the assessment of the new alignment. Where it is unfeasible for planning limits to be met, the interim limits apply, as outlined in Table 15.7.2:

Table 15.7.2: Planning limits

Guideline	Criteria	
	LAeq,24hr dB(A)	LAmx dB(A)
Planning Limit	65	87
Interim Limit	70	95

Where the planning limits have been exceeded, appropriate noise mitigation strategies have been implemented and the resulting mitigated noise levels have been predicted at noise sensitive receptors along the alignment.

Existing land use

A noise model has been used to predict noise levels at noise sensitive receptors within the project area. The proposed alignment has currently been designed to accommodate trains at 160 km/hr in straight sections, with 100 km/hr limits for 1000 metres radius curves. The bend leading into Nambour is restricted by existing constraints, providing a radius of 300 metres which allows a maximum speed of 60 km/hr.

Listed below are areas of existing noise receptors where noise levels are predicted to exceed QR Limited planning noise limits if no mitigation is applied:

- Landsborough
- Mooloolah
- Eudlo
- Palmwoods
- Woombye
- Nambour.

Elevation of alignment on structures

Noise level corrections for bridges have been applied in this assessment, which results in local increases in noise emissions. Bridges have been modelled as concrete bridges with ballast. Existing noise sensitive receptors directly affected by bridge structures in the proposed alignment are in the vicinity of Palmwoods.

To reduce the impact of elevated structures on existing noise sensitive receptors, the design must incorporate 1.1 metres high parapets on all bridges.

Planned future development

The townships along the rail alignment fall within the SCRC (an amalgamation of Maroochy Shire, Noosa Shire and Caloundra City in March 2008). The SEQ Regional Plan 2005-2026, produced by State government in June 2005, sets out:

- where urban growth can and cannot occur
- dwelling targets to be achieved by 2016 and 2026.

The plan requires all local governments in SEQ to prepare a Local Growth Management Strategy to manage growth within the area, with a long-term outlook to 2026.

The SCRC has developed a growth management position paper which incorporates the principles of Draft local growth management strategies from Caloundra, Maroochy and Noosa city councils. The residential strategy map indicated that the estimated dwelling capacity for year 2031 is expected to increase from 130,000 (year 2006) to 260,000.

15.7.3 Proposed mitigation measures – operation

Distance attenuation

Airborne noise spreads geometrically from the source, with sound levels reducing progressively with distance. For a source of significant length, such as a train, the attenuation of sound with distance is more gradual than for a “point” source such as a locomotive. Other factors that contribute to the attenuation of noise over a given distance include:

- ground absorption
- air absorption
- meteorological conditions
- natural barriers – e.g. other buildings, terrain elevation, dense foliage.

Some noise sources have particularly directivity characteristics, meaning that the noise is radiated more intensely in certain directions. The height of the source above ground levels is also relevant. Elevated sources such as the exhaust of a diesel locomotive result in a sound propagation path that is less obstructed by topographical features or noise barriers, resulting in higher noise levels at a given distance.

Features that interrupt the sound propagation path, such as landforms or man-made objects such as buildings or noise barriers, result in the attenuation relative to an uninterrupted path. Large sound reflecting surfaces, such as buildings, may also result in the reflection of additional sound to certain receivers.

In more open areas, where there is a clear line of sight to the railway, sound from the railway may be more noticeable than in a densely built up area. This is due to a range of factors including:

- Background noise levels in an urban environment will most likely be higher than a rural area. Where noise from a source may only just be audible above background noise levels in an urban environment, the same source in a rural area may be more audible due to the lack of masking background noise present.
- Urban areas are much more densely built up environment and are more likely to have other structures breaking up the line of sight to the noise source, creating a barrier effect.

Rail design

The proposed rail corridor is likely to bring further reductions in noise levels through the improved alignment. The proposed corridor for the project would be removing many tight radius curves which are often the source of flanging and wheel squeal noise, and also reducing the need for repeated accelerating and braking.

To reduce the impact of elevated structures, as well as implementing QR Limited measures identified in the Code of Practice, concrete bridges should be incorporated into the design. Compared to steel or composite structures, concrete bridges result in lower levels of re-radiated noise.

'New generation' locomotives

The predicted noise impact of the project for the year 2026 has been based on the 'new generation' locomotives. These locomotives have lower noise emission levels than current generation rolling stock. The selection of new locomotives would reduce the impact of freight train movements on the surrounding environment.

Noise barriers

Further attenuation of noise levels can be achieved through the use of noise barriers. Noise barriers placed between the source and receptor break up the direct line of sight to the noise source and results in attenuation relative to an uninterrupted path. For noise barriers to be effective they must be placed as close to the source or the receiver as possible.

It is possible to use noise barriers to reduce the impact of operational noise. However, when using noise barriers, the following limitations should be noted:

- Noise barriers are visually intrusive, and can potentially compromise employee safety around the rail line (e.g. for maintenance crews, by limiting sight lines and exit routes). QR Limited's Code of Practice acknowledges that the height of noise barriers needed to limit the noise levels to the planning levels may not be acceptable to all residents. QR Limited sets a maximum height limit of six metres for noise barriers.
- To maximise the effectiveness of the barriers, they should be positioned as close to the noise source as possible. This is difficult with railways due to track access requirements. The further the noise barrier is from the source of noise, the less effective it becomes at attenuating noise.

Recommended noise barriers are listed in Table 15.7.3a. All barriers have been modelled at 6 metres high. Barrier heights and placements should be investigated further in the detailed design phase of the project and assessed for individual residences. Initial investigation has shown that barriers would not need to be 6 m high, as the height of the barrier would be dependant on individual receptor height. At this stage of the assessment, all receptors have been assessed at 4.5 metres above ground level, assuming a typical house built above the ground. Areas where noise barriers are mitigating single residences should be investigated further, due to the length of the barrier required, barriers along the railway may not be the most effective method of mitigating noise. Indicative barrier locations have been identified in Figures 15.7a and 15.7b Noise Contours.

15 Noise and Vibration

Table 15.7.3a: Noise barriers required to meet QR Limited guideline

Barrier	Length of barrier	Position of barrier	Location of barrier to rail corridor	Criteria exceeded with no mitigation
Landsborough				
W1	95 m	Between Landsborough Station and Chainage 82000	West	Planning Levels
E1	70 m	Between Landsborough Station and Chainage 82000	East	Planning Levels
W2	295 m	Chainage 82400 to 82600	West	Planning Levels
E2	90 m	Chainage 82900	East	Planning Levels
W3	200 m	Chainage 82900 to 83100	West	Planning Levels
Mooloolah				
E3	330 m	Chainage 86700 to 86960	East	Planning Levels
Eudlo				
N/A				
Palmwoods				
W4	115 m	Chainage 92400	West	Planning Levels
W5	105 m	Chainage 93000	West	Planning Levels
W6	285 m	Chainage 95000 to 95200	West	Planning Levels
W7	65 m	Chainage 97500	West	Planning Levels
E5	260 m	Chainage 97500 to 97700	East	Interim and Planning Levels
Woombye				
W8	70 m	Chainage 98400	West	Planning Levels
W9	100 m	Chainage 99700	West	Planning Levels
Nambour				
E6	115 m	Chainage 100100 to 100200	East	Planning Levels
E7	110 m	Chainage 100700 to 100800	East	Planning Levels
E8	115m	Chainage 101100 to 101200	East	Planning Levels
E9	545 m	Chainage 101400 to 101900	East	Planning Levels

Based on earlier design, noise barriers were previously proposed at chainage 91600, in Eudlo. However, as the design has been refined to include a cut and cover tunnel at this location, there is no longer a need for the provision of noise barriers to mitigate noise impacts associated with the project.

Barrier E3 has been modelled as a 1.1m parapet on the bridge structure. Subject to detailed design, this barrier may need to be located adjacent to the residential properties.

Planned future development

The future rail project and its timing should be taken into consideration when planning and assessing future developments.

Section 9 of the QR Limited Code of Practice refers to the Department of Transport and Main Roads's Interest in Planning Schemes 3 – Planning for Rail Noise for assessment on new developments. The Department of Transport and Main Roads's Interest in Planning Schemes 3 – Planning for Rail Noise suggests the following examples of planning scheme measures to address noise impacts on new developments close to rail corridors:

- ensuring appropriate buffer distances between the noise source and the noise-sensitive receptor
- locating rooms most sensitive to noise furthest from the noise source
- adopting suitable building design techniques
- use of earth mounds and noise barriers between the noise source and the noise sensitive receptor.

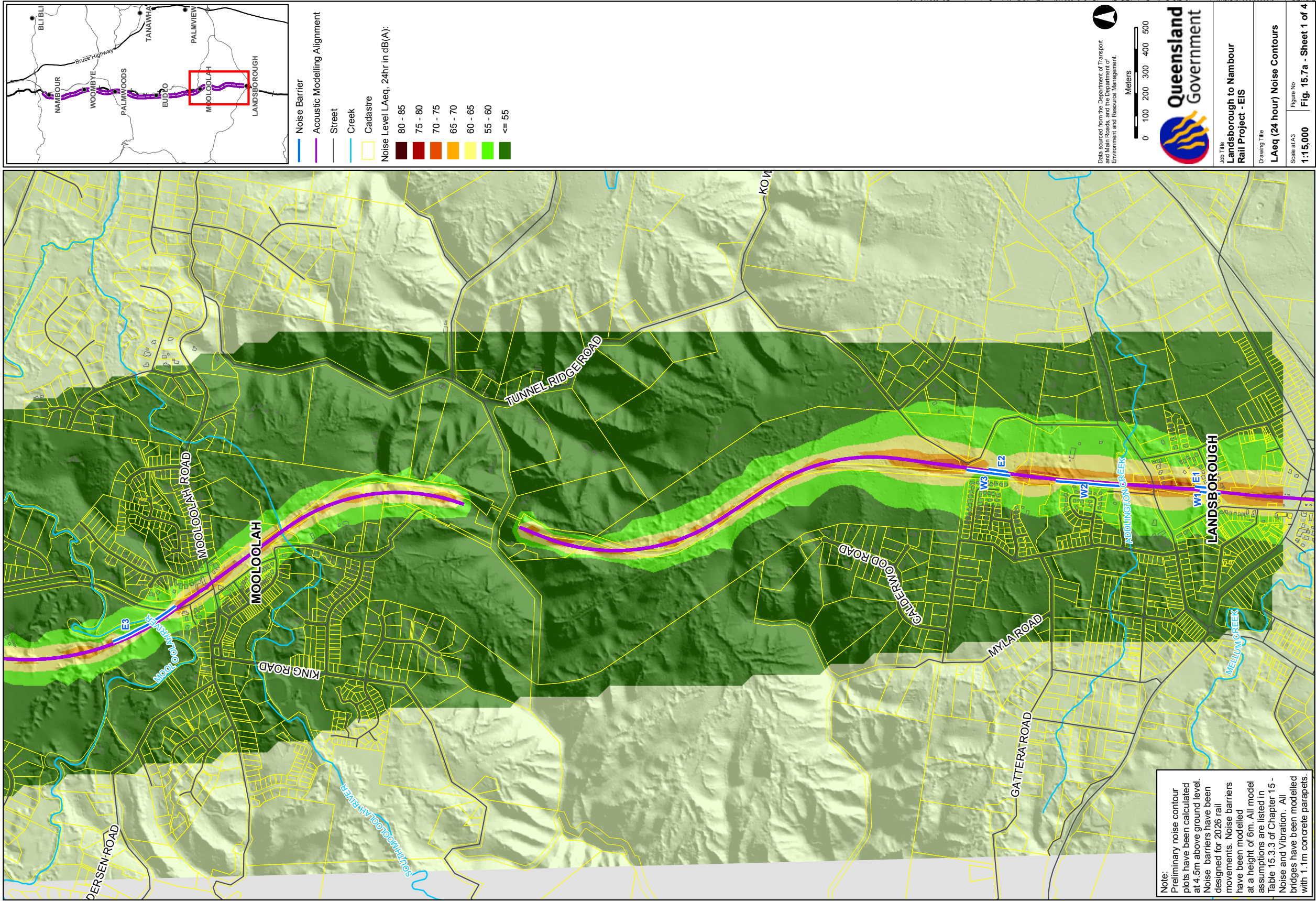
These measures are suggested with the aim of meeting EPP Planning Levels and maximum internal noise level (22:00 hrs to 06:00 hrs) not greater than 50 dB.

15.7.4 Residual impact – operation

With the use of mitigation measures as outlined above, it is expected that the residual impact of the project on existing properties would be low adverse.

Noise contours with noise barriers as listed in Section 15.8.2 are given in Figures 15.7a and 15.7b Noise contours.

Figure 15.7a: LAeq (24 hour) Noise Contours



Whilst every care has been taken to ensure the accuracy of this data, the Department of Transport and Main Roads makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) and costs which might be incurred as a result of the plan being inaccurate or incomplete in any way and for any reason.

Figure 15.7a: LAeq (24 hour) Noise Contours

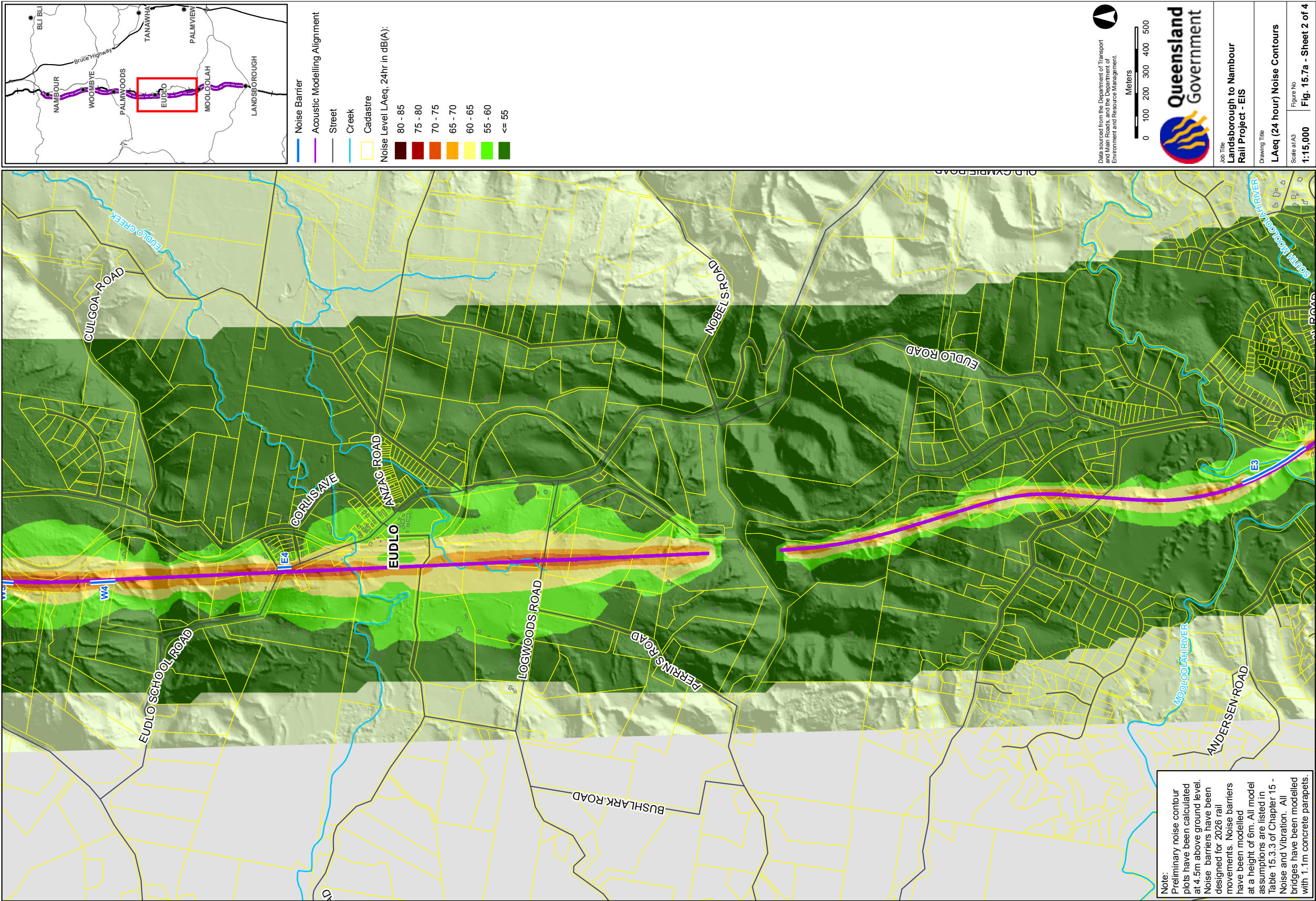
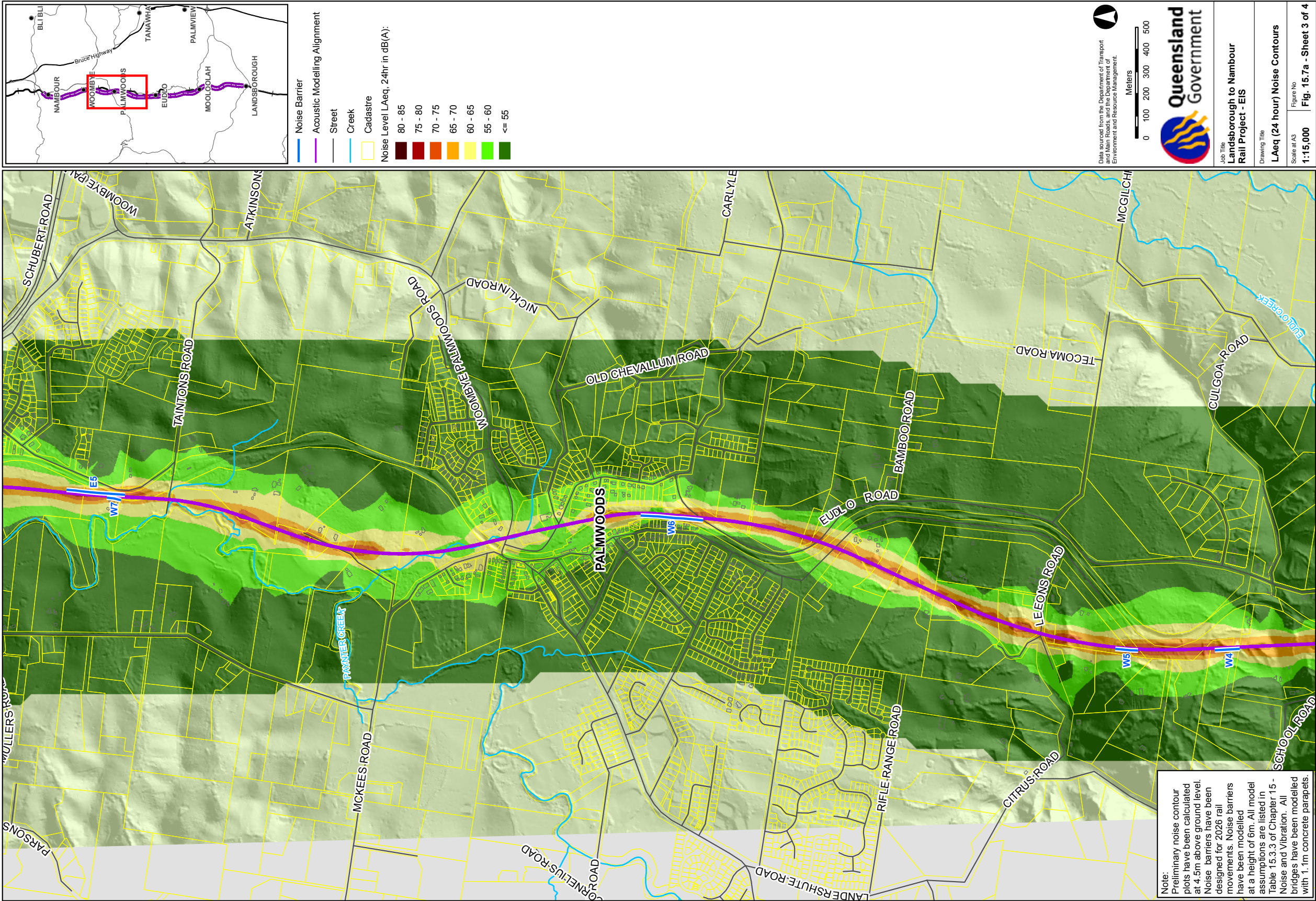


Figure 15.7a: LAeq (24 hour) Noise Contours



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Figure 15.7a: LAeq (24 hour) Noise Contours

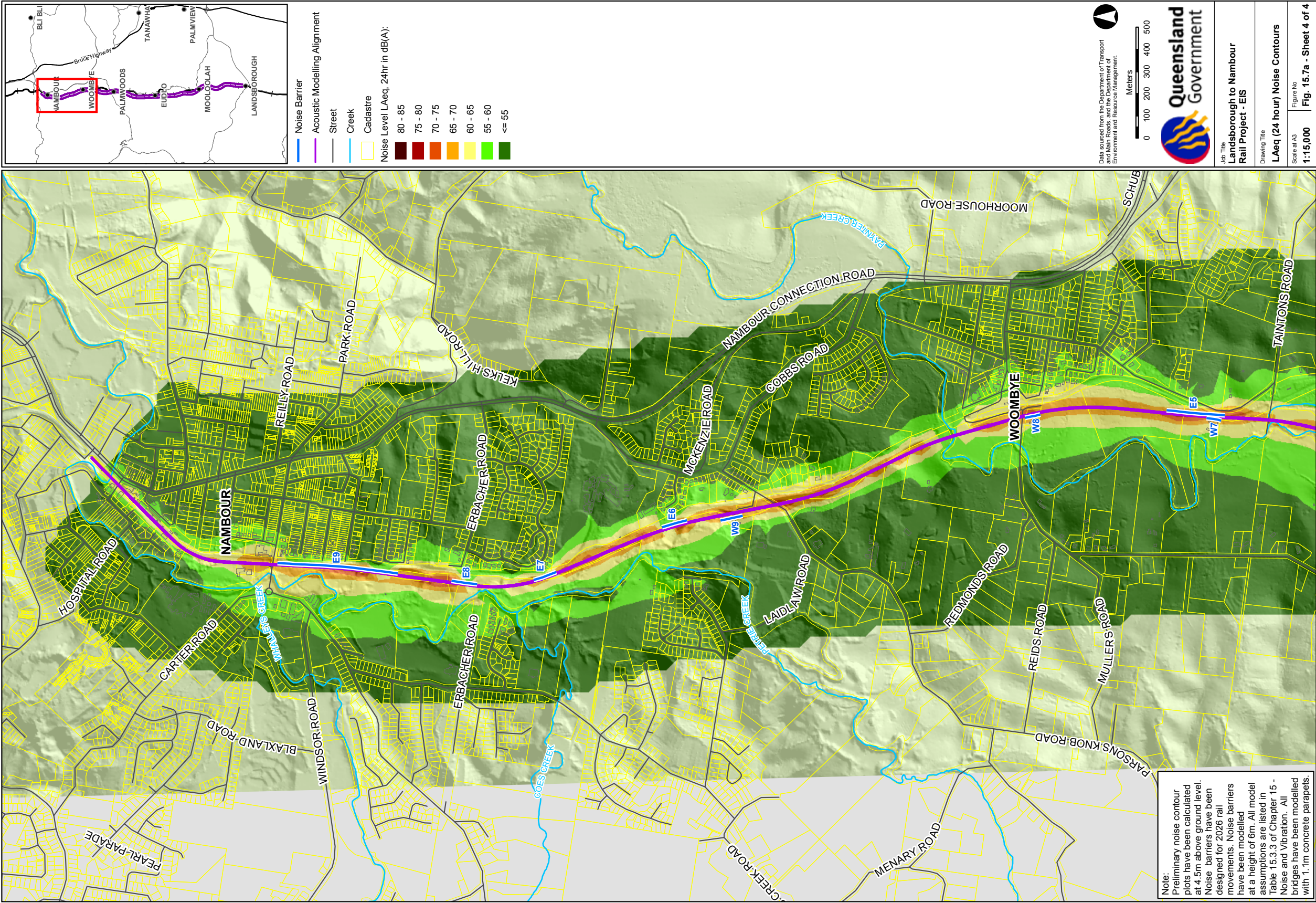
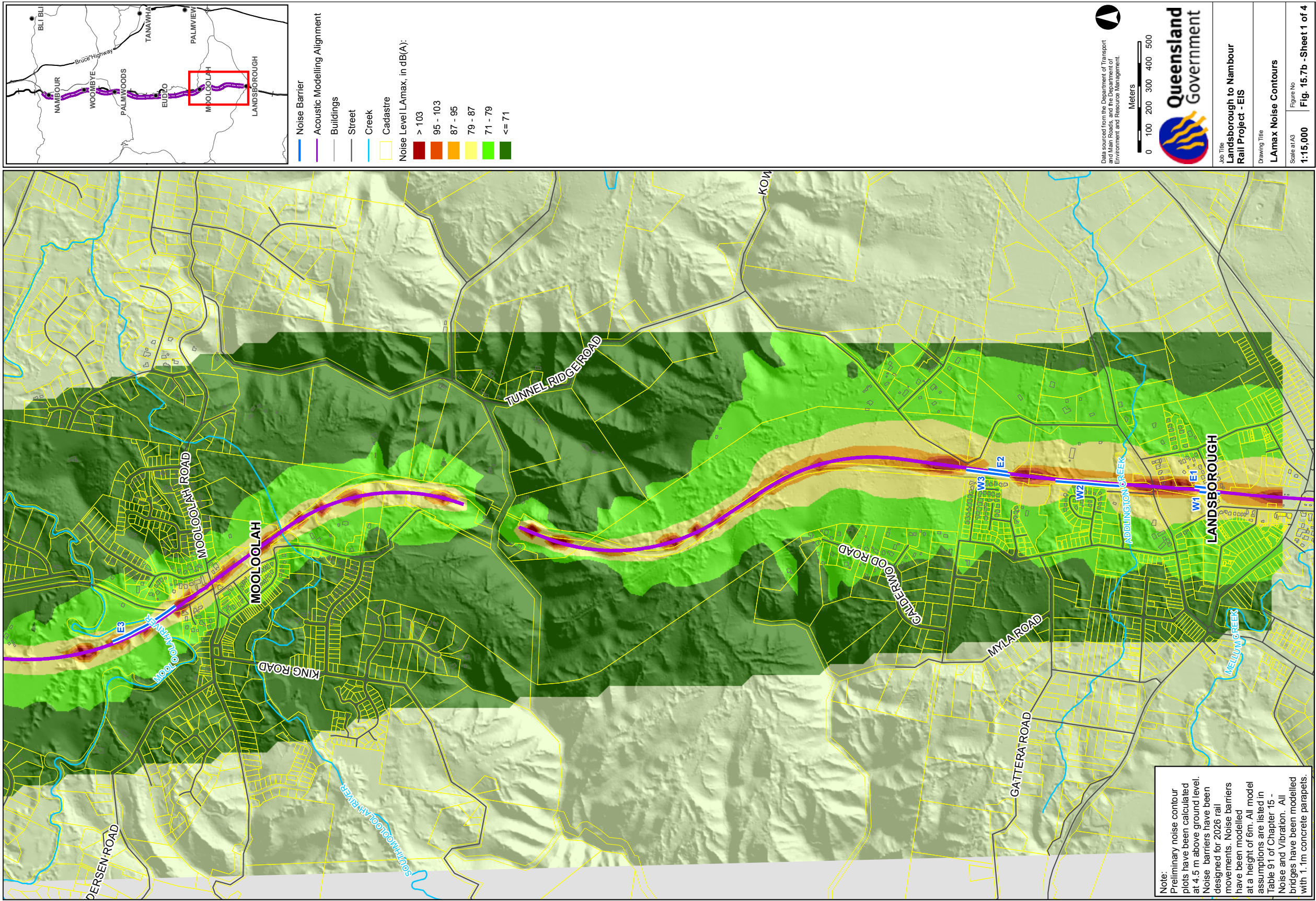


Figure 15.7b: LAmaz Noise Contours



Note:
Preliminary noise contour plots have been calculated at 4.5 m above ground level. Noise barriers have been designed for 2026 rail movements. Noise barriers have been modelled at a height of 6m. All model assumptions are listed in Table 91 of Chapter 15 - Noise and Vibration. All bridges have been modelled with 1.1m concrete parapets.

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Queensland Government

Job Title
Landsborough to Nambour Rail Project - EIS

Drawing Title
LAmaz Noise Contours

Scale at A3
1:15,000

Figure No
Fig. 15.7b - Sheet 1 of 4

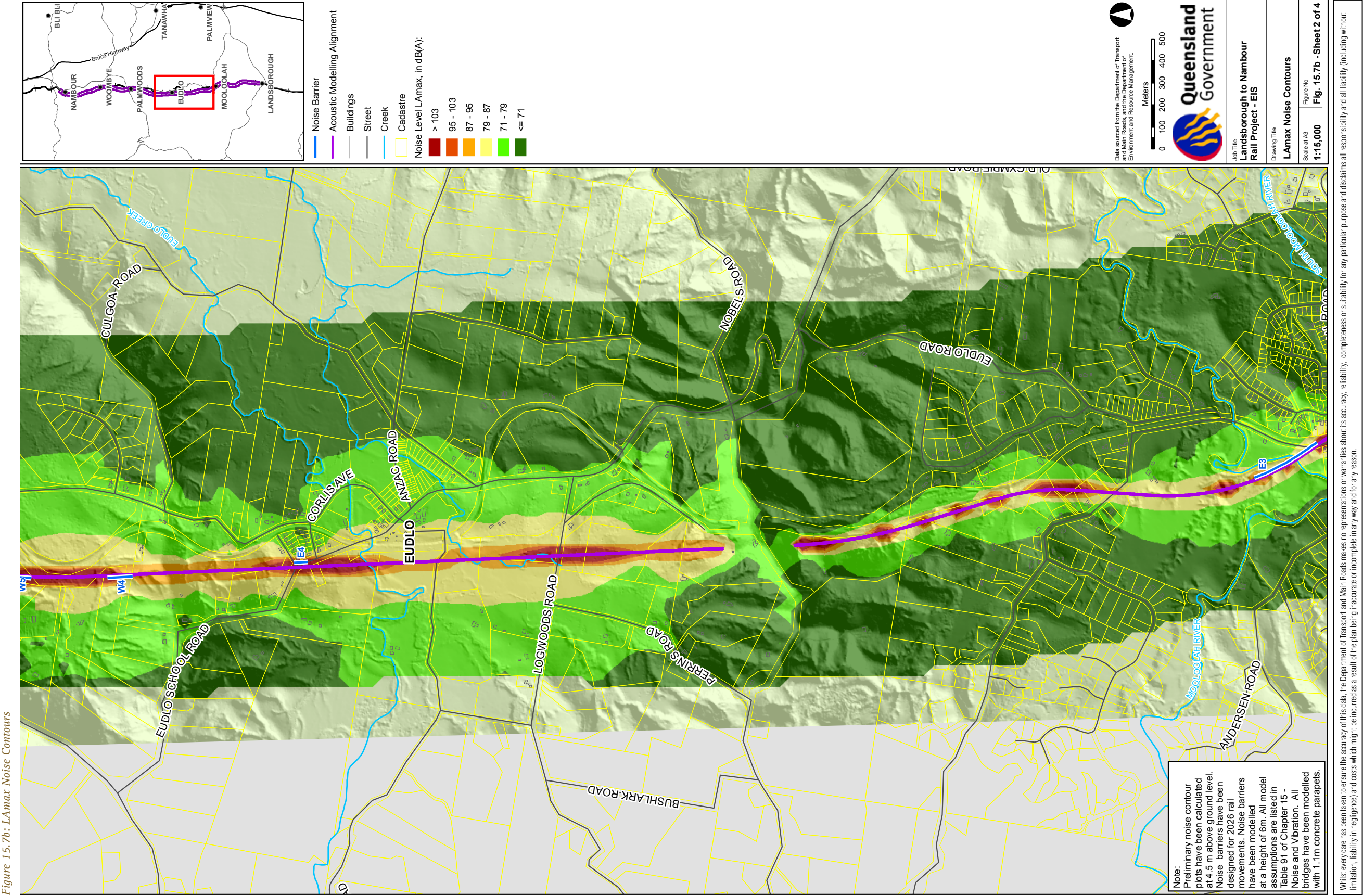
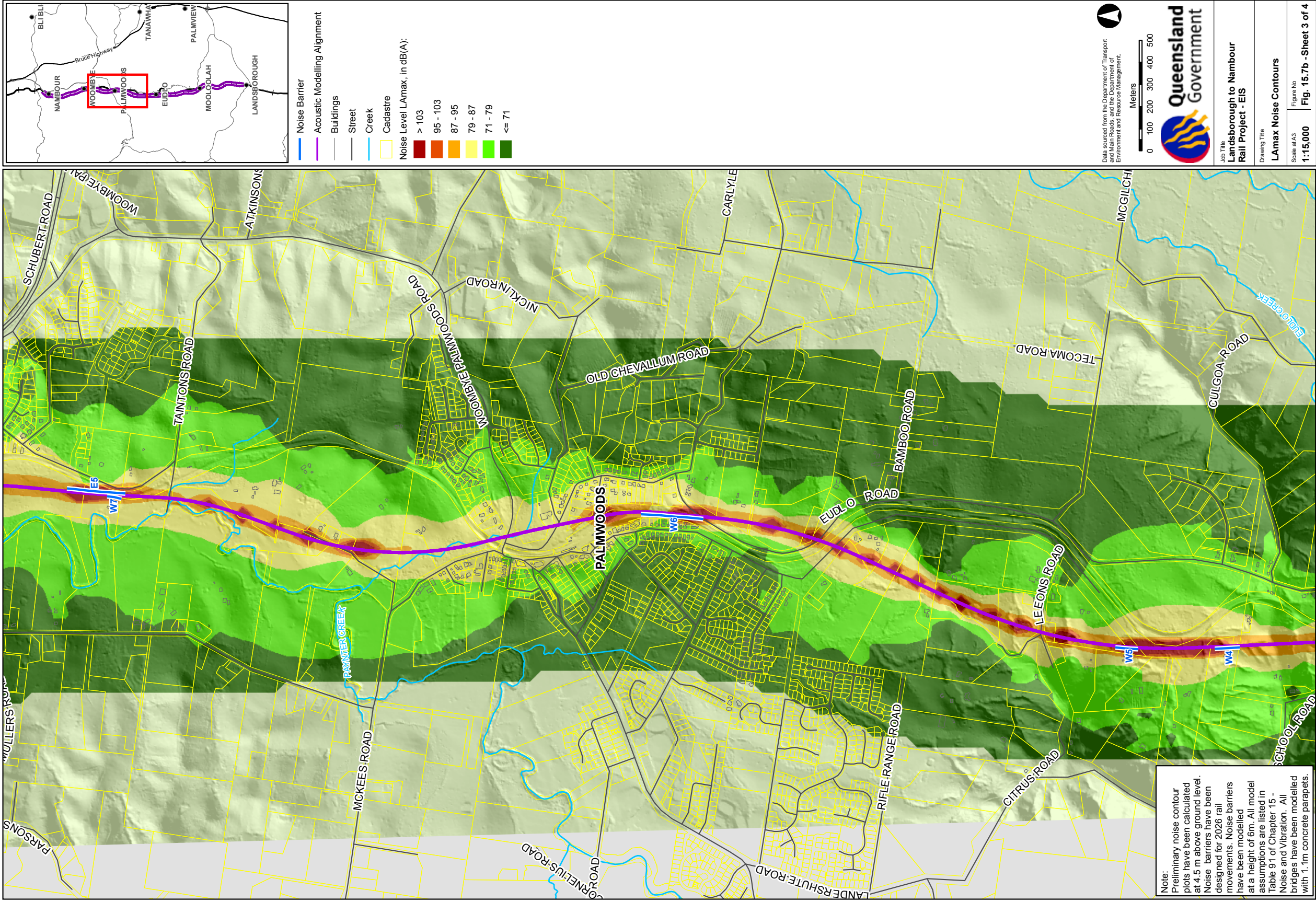


Figure 15.7b: LAmaz Noise Contours



Data sourced from the Department of Transport and Main Roads and the Department of Environment and Resource Management.

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Queensland Government

Job Title
Landsborough to Nambour Rail Project - EIS

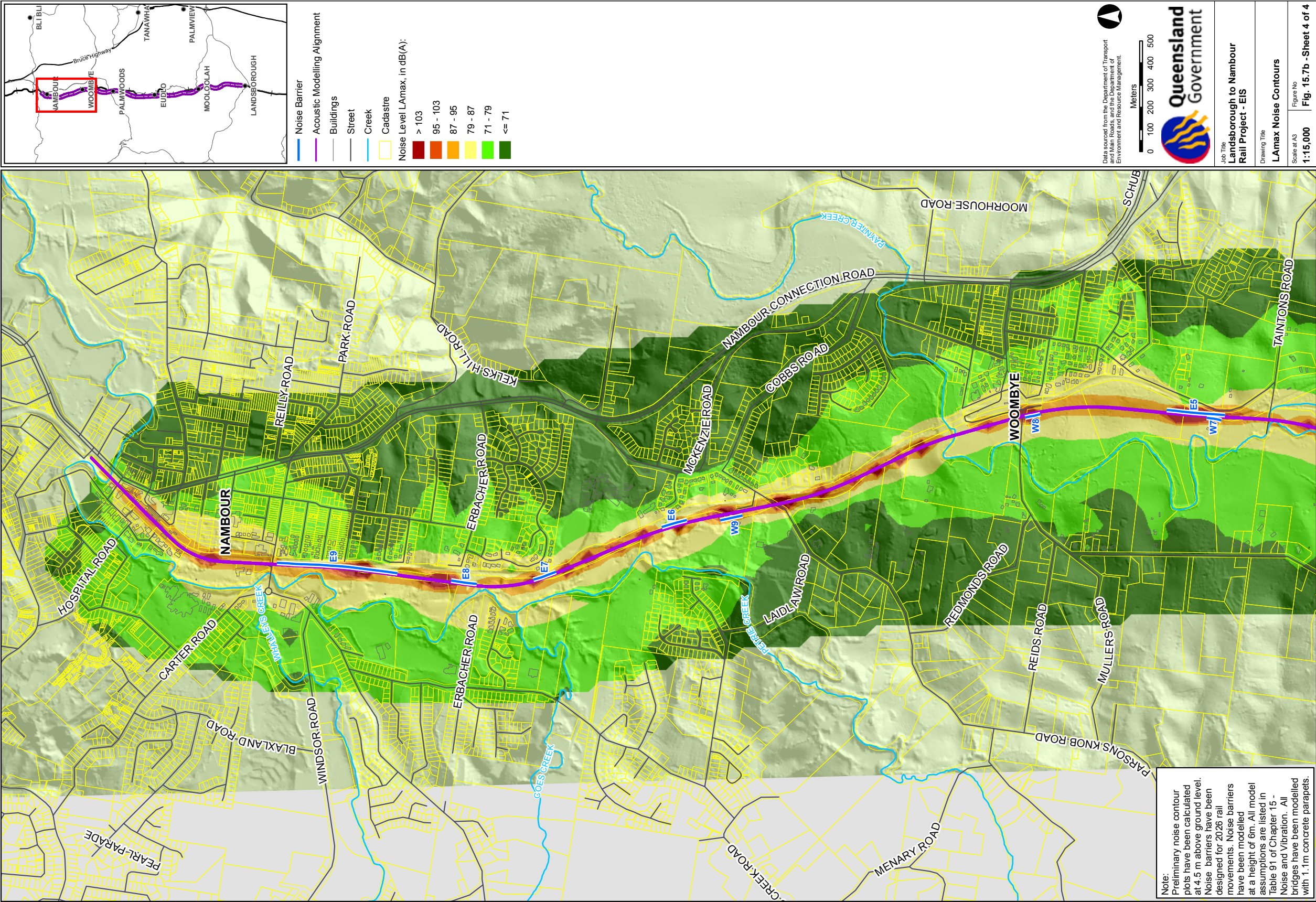
Drawing Title
LAmaz Noise Contours

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Figure No
Fig. 15.7b - Sheet 3 of 4

Whilst every care has been taken to ensure the accuracy of this data, the Department of Transport and Main Roads makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) and costs which might be incurred as a result of the plan being inaccurate or incomplete in any way and for any reason.

Figure 15.7b: LAmx Noise Contours



Existing land use

With noise barriers as listed in Section 15.7.3, areas to be considered for further mitigation are listed in Table 15.7.3b.

Table 15.7.3b: Further areas for consideration

Area	Mitigation assessed
Leach Avenue, Landsborough	Noise barrier – reference barrier E1, Table 15.7.3a
Karanne Drive, Mooloolah	Noise barrier – reference barrier E3, Table 15.7.3a
Taintons Road, Palmwoods	Noise barrier – reference barrier E5, Table 15.7.3a
Bridge Structures, Palmwoods	N/A ¹

The noise contours show the predicted noise levels at the areas surrounding the project site. The contours have been calculated to show where noise levels will exceed the QR Limited planning levels of 65dB_LAeq,24hr and 87dB_LAmax.

With the appropriate mitigation applied, it is expected noise levels may continue to exceed QR Limited planning limits. Further mitigation measures to be considered for individual properties include:

- increasing barrier height and length
- provide noise control to noise sensitive receptors.

Noise barriers are generally most effective when placed closest to the source of the noise, and therefore placed on the project boundary. However, in the case of the Karanne Drive area (reference barrier E3), the ultimate four track requirement is not likely to be realised for some time, and therefore it may not be appropriate to place the barriers on the corridor edge. Therefore investigation of placement on the existing property boundaries is recommended.

Planned future development

The concurrence powers of the Department of Transport and Main Roads under the *Integrated Planning Act 1997* and the identification of the project area provides with the scope to ensure future development along corridor is compatible.

It is also recommended that, in addition, an assessment should be made of the potential emission of low-frequency noise (noise with significant components below 200Hz) from major items of equipment and plant. If necessary, measures should be described for reducing the intensity of these components. Reference should be made to the draft guideline, 'Assessment of Low Frequency Noise' (former EPA now Department of Environment and Resource Management).

15.8 Summary and conclusions

The key matters from the assessment of noise and vibration are:

- Much of the project area is generally a low-level noise environment. Existing major noise sources are vehicular traffic on main roads, such as Eudlo Road and Woombye-Palmwoods Road, and rail noise from the existing alignment.
- There is a large number of existing noise sensitive receptors along the proposed alignment. Noise sensitive areas of concern are listed in Section 15.7.2.
- A preliminary assessment has indicated potential areas for mitigation. The length, height and placement of noise barriers should be investigated further and assessed for individual residences.
- Ground-borne vibration impacts would not be expected to be significant compared to the airborne noise impacts.
- Noise impacts can be effectively mitigated.

A summary of the impact significance, proposed mitigation, relevant management plans and residual impact post mitigation is detailed in Table 15.8.

15 Noise and Vibration

Table 15.8: Summary of impacts and mitigation

Potential impact	Main mitigation strategies	Management plans	Residual impact
Detailed design			
Meeting operational criteria limits	<ul style="list-style-type: none"> detailed design to consider length, height, materials of noise treatments in consultation with community seek opportunities to integrate noise treatment measures into future urban design in townships examine methods for noise mitigation on structures such as the Palmwoods bridge, and other areas identified for further consideration. 	QR Limited Code of Practice, Railway Noise Management	
Construction			
Excessive noise at nearby residences	<ul style="list-style-type: none"> use of the quietest equipment available restricting work hours⁸ fitting construction equipment with effective and properly maintain noise attenuating equipment alternative processes silencing equipment where practicable placement and orientation of equipment to reduce impact at noise sensitive receptors screening equipment where practicable community notification. 	QR Limited Code of Practice, Railway Noise Management	Negligible – Mod Adverse
Operation			
Existing land use	<ul style="list-style-type: none"> appropriate design and noise attenuation of the railway 1.1m parapets on all bridges. 	QR Limited Code of Practice, Railway Noise Management	Low Adverse
Future land use	<ul style="list-style-type: none"> By balancing the design of future developments with the design of the railway, an acceptable residual impact can be attained. The future rail alignment and its timing should be taken into consideration when planning and assessing future developments. 	Development assessment processes, Department of Transport and Main Roads Interest in Planning Schemes 3 – Planning for Rail Noise	Negligible

⁸ Where construction occurs close to the operational railway, it may not be possible to restrict hours of operation, due to the need to maintain services on the line