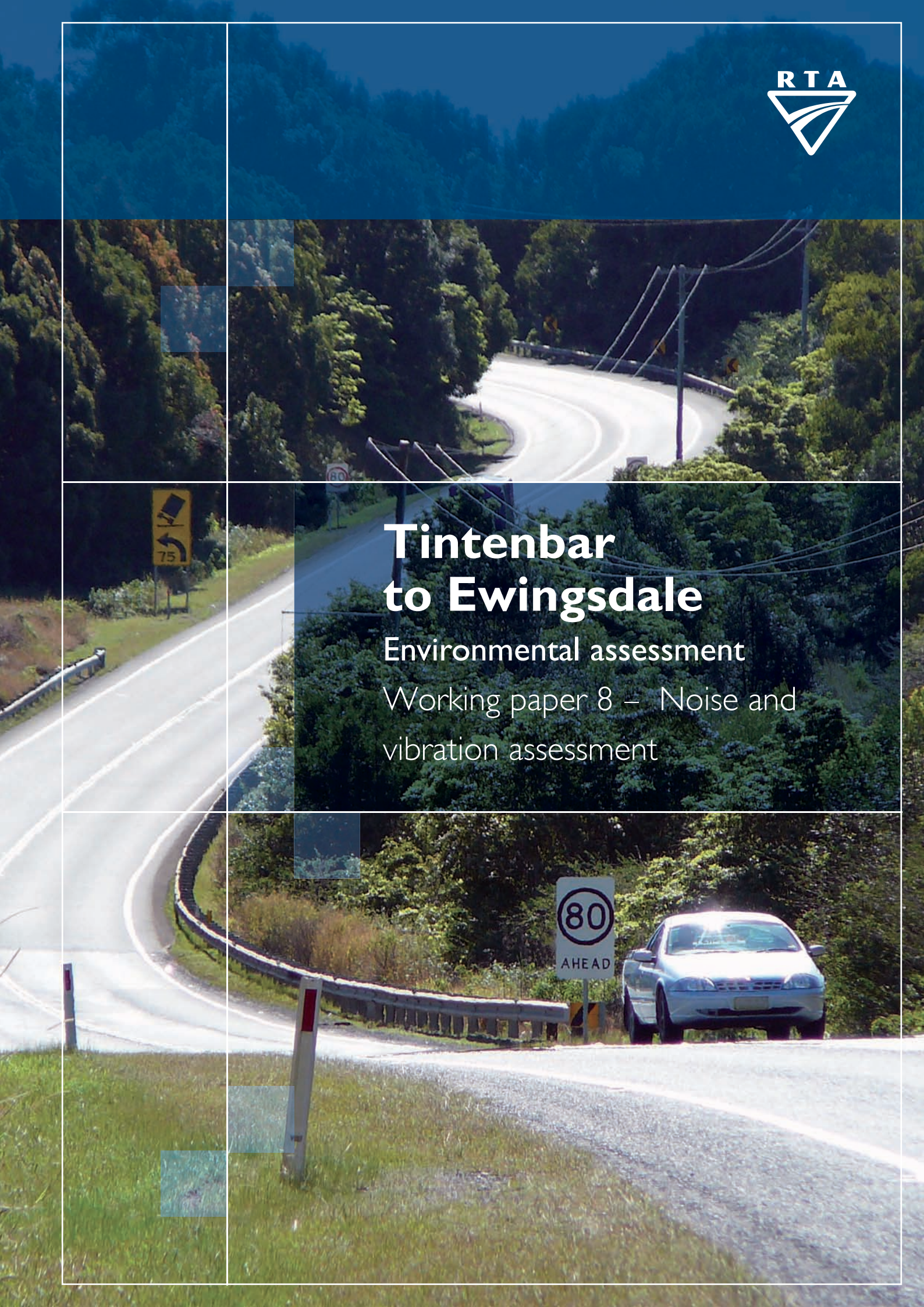

Tintenbar to Ewingsdale

Environmental assessment

Working paper 8 – Noise and vibration assessment

Roads and Traffic Authority

Upgrading the Pacific Highway

Tintenbar to Ewingsdale

Working Paper 8 - Noise and Vibration Assessment

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1 Introduction

As a part of the RTA's Pacific Highway Upgrading Program it is proposed to upgrade a section of the Pacific Highway between Tintenbar and Ewingsdale on the NSW North coast. Arup Acoustics has been commissioned to predict and assess the potential road traffic operational noise, and the construction and vibration impact for the proposed upgrade of this section.

This document is the Noise and Vibration Assessment[1] of the proposed upgrade alignment. It contains:

- The results of attended and unattended measurements undertaken in November 2004, May 2005 and February 2007 at several locations along the existing highway and in other parts the study area. This was done in order to assess the existing noise environment.
- The description and the results of a computer model made to predict the noise environment in the *future existing* and the *proposed upgrade* situations. The computer models were constructed in SOUNDPLAN noise modelling and prediction software. The computer model was calibrated using the results of the noise measurements taken on site. The results of the modelling are used to assess the noise impact of the proposed upgrade.
- A traffic noise assessment undertaken in Accordance with the NSW Environment Protection Authority's (EPA's) *Environmental Criteria for Road Traffic Noise* (ECRTN, May 1999) and the Road Traffic Authority's (RTA's) *Environmental Noise Management Manual* (ENMM, December 2001).
- A construction noise and vibration assessment undertaken in accordance with the Environmental Noise Control Manual (ENCM, December 1985).

1.1 General Noise and Vibration Impacts from Highways

Noise is generated during both the construction and operation of a major highway. Noise and vibration assessment criteria apply to both the construction and operational phases of the highway development, and applicable codes and standards are discussed in Chapter 2. The following paragraphs describe the key issues and effects.

During construction works, airborne noise is generated by construction equipment such as bulldozers, rock-breakers, compactors and generators. In the operational phase, road traffic generates airborne noise, due to both the rolling noise of vehicle wheels on the road surface, and engine / exhaust noise of vehicles (especially heavy vehicles such as articulated truck/trailer units).

Airborne noise spreads concentrically from the source, with sound levels reducing progressively with distance. For a source of significant length, such as a many vehicles travelling along the same stretch of road, the attenuation of sound with distance is less than for a "point" source such as a stationary vehicle or an item of construction plant.

Some noise sources have particular directivity characteristics, ie the noise is radiated more intensely in certain directions. For example, exhausts from earth moving machinery are often noisier in the direction that their exhaust is pointing. The height of the source above ground levels can also be relevant. Elevated sources such as the exhaust of a heavy diesel truck or the hammer of a percussive piling rig may 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 block the sound propagation path, such as ridge lines or man-made objects such as buildings or noise barriers, result in the attenuation of noise relative to an

[1] Alternatively called the *Noise and Vibration Assessment Report for the Preferred Route* in the RTA Environmental Noise Management Manual.

uninterrupted path. Care must be taken as large sound reflecting surfaces, such as buildings, can also result in the reflection of additional sound that can adversely impact on noise sensitive receivers.

Airborne noise is generally assessed in terms of the external noise level at a receiver position. Resulting noise levels within buildings will be lower as a result of the sound attenuation provided by the building envelope. The extent of this noise reduction depends on the building construction; with windows open, internal noise levels are typically approximately 10 dB(A) lower than external levels. With windows closed, external levels may be attenuated by 20 dB(A) or more.

Noise and vibration impacts on the community may be categorised as follows, in order of increasing severity:

- community/resident annoyance,
- disturbance to community/resident activities (eg sleep disturbance) and
- adverse effects on human health (eg increased blood pressure, heart rate or impaired performance due to lack of sleep).

Airborne noise has been known to have other adverse effects, such as sleep disturbance for humans, and effects on wildlife, but less research has concentrated on these impacts, and the evidence demonstrating the extent of the impacts is not clear.

1.2 Site Description

The proposed upgrade of the Pacific Highway runs between Tintenbar and Ewingsdale. The upgraded highway will be broadly adjacent to the route of the existing highway between Tintenbar and Bangalow. For this section, the existing highway will be used as a service road for the proposed upgrade. The proposed upgrade diverts from the existing highway at Bangalow, where the alignment is to the east of the existing highway. A tunnel is proposed under St. Helena Hill.

The proposed upgrade alignment has the following features in relation to the operational, and construction noise and vibration assessment:

- The existing highway has high traffic volumes and is one of the main truck routes in this area. Therefore, residences adjacent to the current route are currently exposed to high traffic noise levels.
- The route goes through predominantly rural areas, with many residences distributed along the whole corridor. The route passes several small communities such as Bangalow, Newrybar and Ewingsdale.
- Both the existing highway and the proposed upgrade closely pass Newrybar Primary School. The school is currently subject to reasonably high traffic noise exposure.
- The proposed upgrade passes Bangalow adjacent to the recent Clover Hill development. This area is currently subject to high traffic noise levels.
- The upgraded section ends at the Ewingsdale interchange which will also be subject to reconstruction. A 4.5 m high absorptive noise barrier is currently provided adjacent to Ewingsdale and shields the residences from traffic noise generated from the existing highway. It is proposed to retain as much as possible of this existing noise barrier.
- A section of the proposed upgrade will run through a tunnel under St. Helena Hill. Noise coming from tunnel portals may result in slightly higher traffic noise levels at nearby residences.
- Traffic flows may change on roads connected to the proposed upgrade, such as Ross Lane, Ivy Lane and Broken Head Road, several ramps and interchanges.

2 Noise Criteria

2.1 Objectives, Criteria & Principles

Criteria for the assessment of these types of impact are generally related to the following noise and vibration characteristics brought about by a scheme;

- Change in the level or character of ambient noise or vibration,
- The average level of noise and vibration exposure,
- The maximum level of the noise or vibration (eg during transient events), and
- The duration and time of day at which noise or vibration occurs.

2.2 Road Traffic Noise Criteria

The basic noise criteria are given in Table 1 of the EPA (now DECC) Environmental Criteria for Road Traffic Noise (ECRTN)[2]. The noise criteria are measured at the façade of the building at a height of 1.5 m and are listed in Table 1.

In addition, the ECRTN provides specific criteria for cases with 'extra noise sensitivities', as shown in Table 2.

It should be noted that the road traffic noise criteria are provided as guidelines and are 'non-mandatory'. They provide target noise levels that it is desired to meet where it is *feasible and reasonable* to do so. The policy document states that in some instances this may be achievable only through "long-term strategies such as improved planning; design and construction of adjoining land use developments; reduced vehicle emission levels through new vehicle standards and regulation of in-service vehicles; greater use of public transport; and alternative methods of freight haulage".

In particular, Practice Note IV of the *RTA Environmental Noise Management Manual* (ENMM)[3] provides detailed guidance on "selecting and designing 'feasible and reasonable' treatment options for road traffic noise". This practice note also suggests that noise mitigation should be considered if noise levels are *acute*, ie greater than or equal to 65 $dBL_{Aeq,15hr}$ (daytime) and 60 $dBL_{Aeq,9hr}$ (night-time).

2 *Environmental Criteria for Road Traffic Noise,* NSW EPA (now Department of Environment and Climate Change), May 1999. Available at http://www.epa.nsw.gov.au/resources/roadnoise1.pdf.

3 *Environmental Noise Management Manual,* Roads and Traffic Authority, December 2001, available at http://www.rta.nsw.gov.au/environment/downloads/noiseindex_dl1.html

Table 1 Basic noise level criteria for proposed road (Source: Table 1 EPA ECRTN)

Type of Development	Criteria		
	Day (7am - 10pm) dB(A)	Night (10pm - 7am) dB(A)	Where criteria are already exceeded.
1. New freeway or arterial road	55 $dBL_{Aeq,15hr}$	50 $dBL_{Aeq,9hr}$	The new road should be designed so as not to increase existing noise levels by more than 0.5 dB. Where feasible and reasonable, noise levels from existing roads should be reduced to meet the noise criteria. In some instances this may be achievable only through long-term strategies such as improved planning, design and construction of adjoining land use developments; reduced vehicle emission levels through new vehicle standards and regulation of in-service vehicles; greater use of public transport; and alternative methods of freight haulage.
3[4]. Redevelopment of existing freeway/arterial road	60 $dBL_{Aeq,15hr}$	55 $dBL_{Aeq,9hr}$	In all cases, the redevelopment should be designed so as not to increase existing noise levels by more than 2 dB. Where feasible and reasonable, noise levels from existing roads should be reduced to meet the noise criteria. In many instances this may be achievable only through long-term strategies such as improved planning, design and construction of adjoining land use developments; reduced vehicle emission levels through new vehicle standards and regulation of in-service vehicles; greater use of public transport; and alternative methods of freight haulage.

Table 2 Basic noise level criteria for sensitive land uses (Source: Table 2 EPA ECRTN and Technical Notes)

Sensitive Land Use	Criteria		
	Day (7am - 10pm) dB(A)	Night (10pm - 7am) dB(A)	Noise Mitigation Measures
1. Proposed school classrooms	40 $L_{Aeq,1hr}$	-	To achieve internal noise criteria in the short term, the most practicable mitigation measures are often related to building or façade treatments. In the medium to longer term, strategies such as regulation of exhaust noise from in-service vehicles, limitations on exhaust brake use, and restricting access for sensitive areas or during sensitive times to low noise vehicles can be applied to mitigate noise impacts across the road system. Other measures include improved planning, design and construction of sensitive land use developments; reduced new vehicle emission standards; greater use of public transport; and alternative methods of freight haulage. These medium- to long-term strategies apply equally to mitigating internal and external noise levels. Where existing levels of traffic noise exceed the criteria, all feasible and reasonable noise control measures should be evaluated and applied. Where this has been done and the internal or external criteria (as appropriate) cannot be achieved, the proposed road or land use development should be designed so as not to increase existing road traffic noise levels by more than 0.5 dB(A) for new roads and 2 dB(A) for redeveloped roads or land use development with potential to create additional traffic.
2. Hospital wards	35 $L_{Aeq,1hr}$ (internal)	35 $L_{Aeq,1hr}$ (internal)	
3. Places of worship	40 $L_{Aeq,1hr}$ (internal)	40 $L_{Aeq,1hr}$ (internal)	
4. Active recreation areas	60 $dBL_{Aeq,15hr}$	-	
5. Passive recreation and school playgrounds	55 $dBL_{Aeq,15hr}$	-	
X[5]. Existing school classrooms	45 $dBL_{Aeq,1hr}$ (internal)	-	

[4] Row numbering is based on the selected rows of Table 1, EPA ECRTN.
[5] Technical Note X to Table 2, EPA ECRTN.

2.3 Sleep Disturbance Criteria

The relationship between event maximum noise levels from road traffic and sleep disturbance is not currently well defined. The ECRTN discuss sleep disturbance in relation to the number of noise events causing awakenings during the night-time period. As the relationship between noise and sleep disturbance is not fully understood, the ECRTN acknowledges sleep disturbance from road traffic and states that the continuation of research into its assessment is important.

The ECRTN identifies that:

- Maximum internal noise levels below 50 – 55 dB(A) are unlikely to cause awakening reactions, and
- One or two noise events per night, with maximum internal noise levels of 65 – 70 dB(A) are not likely to affect health and wellbeing significantly.

The RTA ENMM provides a protocol for assessing maximum noise levels in Practice Note III (PN-III). PN-III suggests that:

- At locations where road traffic is continuous rather than intermittent, the $L_{eq,9hr}$ (night-time) target noise levels should sufficiently account for sleep disturbance impacts.
- However, where the emergence of maximum levels (L_{max}) over the ambient (L_{eq}) is greater than 15 dB(A), the $L_{Aeq,9hr}$ criteria may not sufficiently account for sleep disturbance impacts.

Therefore, an assessment of the impact of sleep disturbance on residents is made in terms of likely maximum noise levels from road traffic, the extent to which these maximum noise levels exceed the ambient level, and the expected number of noise events from road traffic during the night.

2.4 Other Reference Documents

Other reference documents also provide helpful guidance for the Noise Impact assessment.

The RTA's *Noise Wall Design Guide*[6] and *Pacific Highway urban design framework, Urban design guidelines for the SH10 from Hexam to Tweed Heads* documents provide guidance on the provision and use of noise barriers for noise mitigation.

The Northern Pacific Highway Noise Taskforce Report[7] provides a review of the issues related to traffic noise from the Pacific Highway, including, for example, noise from heavy vehicles, driver behaviour and the influence of pavement types. It provides recommendations and strategies for controlling road traffic noise from the highway.

2.5 Construction Noise and Vibration Criteria

2.5.1 Criteria for Airborne Construction Noise

Chapter 171 of the EPA's Environmental Noise Control Manual (ENCM)[8] sets out noise criteria for construction projects. The L_{A10} noise parameter is used as the descriptor to assess construction site noise (ie the noise level that is exceeded for 10% of the time, indicative of the *average maximum* level). The relevant criterion depends on the pre-existing L_{A90} noise level (being the noise level that is exceeded for 90% of the time, representative of the *background* noise level) and the duration of the construction activity.

6 *Noise wall design guideline, Design guidelines to improve the appearance of noise walls in NSW*, JPW, RTA Major Infrastructure Directorate, November 2006.

7 *Northern Pacific Highway Noise Taskforce Report*, Northern Pacific Highway Noise Taskforce, 11 August 2003.

8 *Environmental Noise Control Manual*, NSW EPA (now DECC), 1994.

The relevant criteria are as follows;

- for construction periods of four weeks or less, the L_{A10} noise level from construction activity should not exceed the existing L_{A90} background noise level by more than 20 dB.
- for construction periods of between four and 26 weeks, the L_{A10} noise level from construction activity should not exceed the existing L_{A90} background noise level by more than 10 dB.
- for construction periods greater than 26 weeks, the L_{A10} noise level from construction activity should not exceed the existing L_{A90} background noise level by more than 5 dB.
- for construction noise that is tonal or impulsive in nature, a 5 dB penalty is applied.

A summary of these criteria is given in the table below;

Table 3 Summary of construction noise criteria.

Construction Period	Criteria
4 weeks or less	LA10 ≤ LA90 + 20 dB
4 weeks to 26 weeks	LA10 ≤ LA90 + 10 dB
greater than 26 weeks	LA10 ≤ LA90 + 5 dB
tonal or impulsive noise	+5 dB penalty

While the total construction period for the entire project is likely to be greater than 26 weeks, many construction activities will progress along the route during the construction period, and a less stringent limit may be appropriate for certain activities.

For large construction projects such as this it is considered appropriate to treat noisy stages of work (such as the earthworks associated with a bridge replacement, for example) as discrete construction periods and assess them against the short and medium term guidelines, provided the cumulative affect of longer-term works is carefully managed.

Where construction noise is audible at residential premises, the EPA guideline recommends that construction should be limited to the following times;

- Monday to Friday, 7:00am to 6:00pm, with a maximum of nine hours per day.
- Saturday 7:00am to 1:00pm if inaudible on premises, otherwise 8:00am to 1:00pm
- No construction work to occur on Sundays or public holidays.

Due to the nature of highway projects, some construction work may be required to take place outside of those preferred hours, for example, works that are of an emergency or site safety nature, or for the delivery of oversize equipment. These activities will require very careful noise management, including close liaison with the local community, and the implementation of best practical measures to limit disturbance to the surrounding community.

Experience also shows that certain noisy processes, such as sheet piling, are likely to exceed the EPA guidelines at nearby locations even if carried out during the preferred hours. Practical alternatives are not always available and, in these cases, it will be necessary to ensure that the quietest suitable equipment is selected, that temporary noise screening is implemented where practical, and that the timing of the works is subject to prior discussion with the community.

In addition to the major construction activities and processes, some construction plant may be required to operate continuously (24 hours a day). These items of equipment should be treated as “semi-permanent” and the lowest criterion is appropriate (ie L_{A10} noise level should

not exceed the existing L_{A90} background noise level by more than 5 dB). This is broadly similar to the criterion that would be imposed under the EPA Industrial Noise Policy (INP) for permanent industrial noise sources.

Noise generated by haulage trucks and other construction related traffic is dealt with in two ways. Firstly, while trucks are operating on the construction site (eg during deliveries or spoil removal, including reversing beepers), noise must be assessed in the context of the contribution to the overall site activity noise. Secondly, when trucks leave the site to join the surrounding roads, the noise impact of the construction traffic must be assessed in terms of the change in overall traffic noise level. The criteria given in the EPA's ECRTN will then be adopted.

For land use developments with potential to create additional traffic on existing roads, the traffic arising from the development should not lead to an increase in existing noise of more than 2 dB.

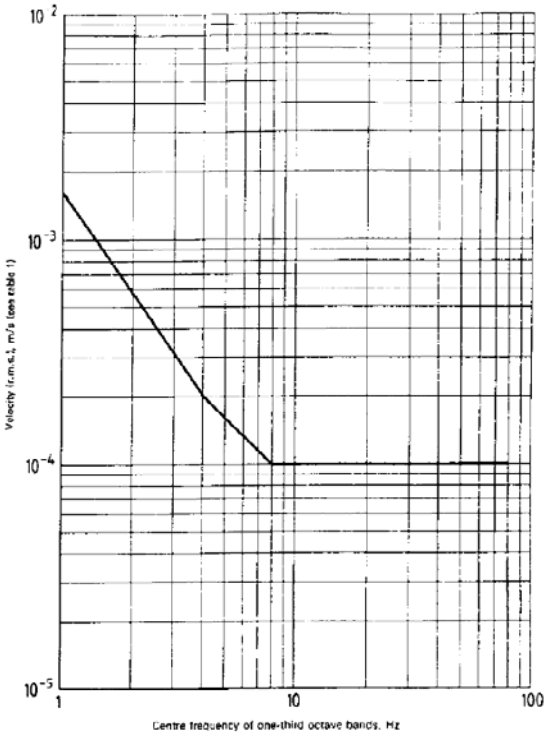
2.5.2 Criteria for Groundborne Construction Vibration

Criteria for construction vibration must address both;

- the potential for disturbance and annoyance to building occupants, and
- the potential for damage to buildings and other structures.

With regard to disturbance and annoyance, Australian standard AS 2670.2-1990 defines limits for both continuous and transient vibration events. These limits are given in the form of multiplying factors to be applied to base curves representing the threshold of human perception. Table 4 below shows the applicable multiplying factors. For example, the base curve (representing the threshold of human perception) for vertical vibration is a velocity of 0.1 mm/s (rms) and is shown in Figure 2b of AS 2670. Applying a multiplying factor of 4 would result in an applicable vibration limit of 0.4 mm/s (rms).

Figure 1 Building vibration z-axis base curve for velocity (Figure 2b of AS2670)



When these noise levels are applied to the base curve they show the continuous / intermittent and transient vibration levels below which the probability of adverse comment is low.

Table 4 Multiplying factors to be applied to base curves see Fig 2b AS2670.

Type of Building Occupancy	Time	Continuous or intermittent vibration	Transient vibration
Critical working areas eg. precision laboratories	Day	1	1
	Night	-	-
Residential	Day	2 to 4	30 to 90
	Night	1.4	1.4 to 20
Office	Day	4	60 to 128
	Night	-	-
Workshop	Day	8	90 to 128
	Night	-	-

Intermittent vibration can be assessed by using Vibration Dose Values (VDV's) calculated according to BS 6472.1992[9]. The Vibration dose value takes into account the length of the exposure as well as the maximum levels. Table 5 shows acceptable vibration dose values for intermittent vibration. There is a low probability of adverse comment or disturbance to building occupants at vibration values below the preferred values.

Table 5 Acceptable vibration dose values for intermittent vibration ($m/s^{1.75}$)

Location	Daytime (0700 – 2200 hrs)		Night-time (2200 – 0700 hrs)	
	Preferred value	Maximum value	Preferred value	Maximum value
Critical areas	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

More recently, the NSW DECC has published a technical guideline[10] for assessing vibration, which is based on BS6472 and Chapter 174 of the EPA ENCM[8]. For *intermittent* vibration, this also adopts the Vibration Dose Value approach.

With regard to the potential for ground vibration to cause damage to structures, it should be noted that vibration levels may reach much higher values than those applicable to human perception and comfort before the onset of any significant building damage risk. There are no directly applicable Australian Standards or guidelines, but a number of overseas standards provide useful guidance. It is recommended that the guidelines and limits in the British Standard BS 7385[11]are adopted as damage criteria for this project, together with a more conservative limit of 5 mm/s in the first instance.

The standard states in Annex A that 'the age and existing condition of a building are factors to consider in assessing the tolerance to vibration. If a building is in a very unstable state, then it will tend to be more vulnerable to the possibility of damage arising from vibration of any other ground borne disturbance'. It is recommended that buildings of importance are considered on a case-by-case basis with detailed engineering analysis being carried out if appropriate.

2.5.3 Blasting and Vibration Exposure

Ground vibration and airblast (also called blast overpressure) are two environmental impacts from blasting. The airblast is generally more noticeable than the ground vibration. High levels of vibration transmitted through the ground and the airblast could annoy residents, or in the extreme, cause damage to buildings or structures.

Appendix J of AS2187.2[12] provides general guidance on appropriate limits for ground vibration and airblast overpressure from blasting.

Recommended limits for the vibration level and blast overpressure from blasting are also found in guidelines from the Australian and New Zealand Environment Conservation Council

9 BS 6472 *Guide to evaluation of human exposure to vibration in buildings*, British Standards Institution.

10 *Assessing Vibration: a technical guideline*, Department of Environment and Conservation NSW, February 2006.

11 BS 7385: Part 2: 1993 *Evaluation and measurement for vibration in buildings, Guide to damage levels from groundborne vibration*, British Standards Institution.

12 AS 2187.2-2006 *Explosives - Storage, transport and use, Part 2 Use of explosives*, Standards Australia, 2006.

(ANZECC)[13]. These limit blast overpressure to 115 dB (lin, peak) at any residence, and ground vibration to 5 mm/s peak particle velocity (PPV). The guidelines also restrict blasting to between 9 am and 5 pm on weekdays and Saturday, and recommend only one detonation per day. Blasting at night should be avoided unless it is absolutely necessary. (These criteria are generally slightly more stringent than those documented in AS2187.2-2006).

Building damage is unlikely to be caused below these vibration levels, while building damage and human discomfort will be minimal below the overpressure limits. 'Conventional' blasting at 'normal' distances is unlikely to create ground vibration levels of sufficient magnitude to cause building damage. Cracks in buildings are far more likely to be caused by local ground and foundation movements caused by the settlement and swell of the ground due to prolonged wet or dry weather.

The EPA (now DECC) acknowledges that there could be some exceedance of the overpressure limit of 115 dB and the ground vibration limit of 5 mm/s on infrequent occasions. This should be limited to not more than 5% of total blasts. During this time the overpressure level should not exceed 120 dB at any time and the ground vibration limit should not exceed 10 mm/s at any time.

The Maximum Instantaneous Charge (MIC) will typically be limited to prevent unacceptable levels of air overpressure and noise.

2.5.4 Operational Vibration

Criteria for operational vibration can be found in AS2670.1 and AS2670.2[14], see Section 2.5.2 above. However, since vehicles are well isolated from the ground by their pneumatic tyres and suspension, vibration caused by operational road traffic is likely to be well below these criteria at all residences.

[13] *Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration*, Australia and New Zealand Environment Council, September 1990.

[14] AS2670.1-1990 *Evaluation of human exposure to whole-body vibration Part 1: General Requirements* AS2670.2-1990 *Evaluation of human exposure to whole-body vibration Part 2: Continuous and shock induced vibration in buildings (1 to 80 Hz)*, Standards Australia.

3 Existing Noise Environment

3.1 Noise Survey Methodology

Ambient noise measurements were conducted on site at locations along the proposed route corridor over approximately a two week period in November 2004, and a further two week period in May 2005. The measurements were undertaken at locations along the existing highway and at other locations within the study area. Unattended noise loggers were used to continuously measure noise at seven different locations. Attended noise measurements were also conducted at a further thirty-two locations within the study area. A description of the monitoring locations is given below.

A further detailed noise study was undertaken for the Newrybar Primary School situated near the intersection of the Pacific Highway and Broken Head Road in February 2007. A detailed description of the noise measurements and the outcome of the assessment can be found in Appendix D.

Noise loggers and the sound level meter were mounted on tripods 1.5 m 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 structures) with a sample period of 15 minutes.

Weather conditions were noted throughout the measurement periods and noise measurements were discarded where weather conditions were not suitable for noise monitoring (ie rain, wind speed > 5m/s).

Noise measurements were generally performed in accordance with Australian Standards1055[15] and 2702[16].

Simultaneous traffic counts were also undertaken at two locations on the existing Pacific Highway during the November 2004 noise measurements.

3.2 Equipment

The equipment used to measure the baseline noise levels is described in Table 6. The equipment was checked for calibration before and after each set of measurements.

Table 6 Summary of noise measurement equipment

Equipment manufacturer & type	Description of equipment	Serial No.
Brüel & Kjær 2236	Type 1 sound level meter	1778333
Brüel & Kjær 2236	Type 1 sound level meter	1942902
Brüel & Kjær 2260	Type 1 sound level meter	2124638
Brüel & Kjær 4231	Sound level calibrator	1790603
RTA[17] Technology 01	Sound logging meter	RTA-01 #082
RTA Technology 01	Sound logging meter	RTA-01 #083
RTA Technology 02	Sound logging meter	RTA-02 #009
RTA Technology 02	Sound logging meter	RTA-02 #016
RTA Technology 02	Sound logging meter	RTA-02 #029
RTA Technology 02	Sound logging meter	RTA-02 #031
RTA Technology 02	Sound logging meter	RTA-02 #035

15 AS 1055 – 1997 *Acoustics – Description and measurement of environmental noise*, Standards Australia.
16 AS 2702-1984 *Acoustics – Methods for the measurement of Road Traffic Noise*, Standards Australia.
17 Sound logging meters produced by Renzo Tonin & Associates Pty Ltd.

3.3 Measurement Locations

3.3.1 Attended Noise Measurements

The locations of the noise measurements taken in 2004 and 2005 are shown in Figure 2, and are described in Table 2.

The locations of the noise measurements taken at the Newrybar Primary School can be found in Appendix D.

Figure 2 Ambient noise measurement locations

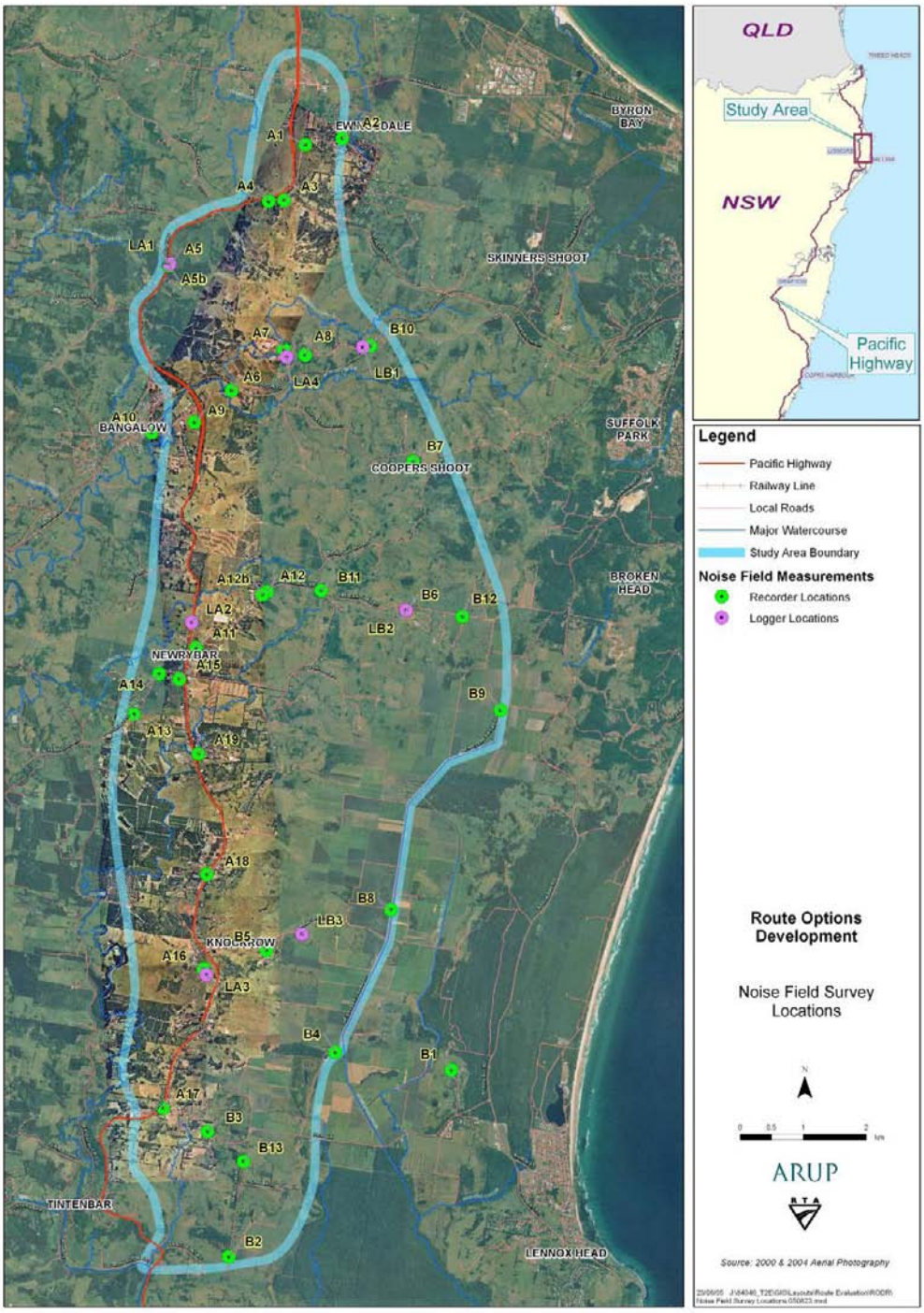


Table 7 Summary of attended noise measurement positions.

Site Number	Site Name	Comments
A1	69 Plantation Place, Ewingsdale	Pacific Highway audible
A2	Corner Plantation/Parkway, Ewingsdale	Insect noise dominated
A3	38 St Helena Road	Pacific Highway dominated
A4	Corner of Pacific Highway/St Helena Road	Pacific Highway dominated
A5	Lot 5, Pacific Highway	Pacific Highway dominated
A6	Bangalow Road (100m east of rail crossing)	Insect noise dominated
A7	Tinderbox Road (on boundary of original study area)	Insect noise dominated
A8	Corner of Bangalow Road/Talofa	Insect noise dominated
A9	Middle of new housing development on Bangalow Road	Pacific Highway & traffic along Bangalow Rd dominated
A10	Bangalow Public School	Local traffic dominated
A11	School, Broken Head Road	Pacific Highway dominated
A12	Broken Head Road	Pacific Highway audible, local traffic dominated
A13	Brooklet Road (on boundary of original study area)	Pacific Highway audible
A14	36 Brooklet Road	Pacific Highway & local traffic dominated
A15	Newrybar Community Hall	Pacific Highway & local traffic dominated
A16	44 Martins Lane West	Pacific Highway dominated
A17	Corner of Ross Lane/Pacific Highway	Pacific Highway dominated
A18	The Macadamia Castle	Pacific Highway dominated
A19	Hambley Lane	Pacific Highway dominated
B1	End of Fig Tree Hill Lane	Byron Bay Road dominated
B2	Sandy Flat Road	Pacific Highway audible
B3	Corner of Ross Lane/McLeish Lane	Birds, insects, local traffic
B4	Aquatic Centre, Newrybar Swamp Road	Birds, insects, local traffic
B5	Corner of Martins Lane East/Edward Place	Pacific Highway, birds, local traffic
B6	Broolco, 136 Midgen Flat Road	Birds, insects dominated
B7	Lot 2, 405 Coopers Shoot Road	Birds, insects dominated
B8	Newrybar Swamp Road	Byron Bay Rd, Pacific Highway just audible
B9	End of Newrybar Swamp Road	Byron Bay Rd, insects
B10	594 Byron/Bangalow Road	Insects, local traffic
B11	349 Old Byron Bay Road	Local traffic, birds, insects
B12	Midgen Flat Road	Local traffic, birds, insects
B13	Dufficys Lane	Pacific Highway, birds

3.3.2 Unattended Noise Measurements

Unattended ambient noise measurements were undertaken at 7 locations within the study area in 2004 and 2005. The locations of these unattended measurement locations are shown in Figure 2, and are described in Table 8.

Some unattended noise measurement locations are a large distance (eg over 500 m) from the existing highway and were selected to assess ambient noise conditions with little or no contribution from highway traffic noise.

Table 8 Summary of unattended noise measurement positions.

Site Number	Site Name
LA1	Lot 5 Pacific Highway
LA2	Kassa Bird's, Pacific Highway
LA3	44 Martins Lane West
LA4	Tinderbox Road, Bangalow
LB1	594 Bangalow Road
LB2	136 Midgen Flat Road
LB3	172 Martins Lane East

3.4 Results

The 15-minute attended ambient noise measurement results are presented in Table A1 in Appendix A. Unattended noise level measurement results are shown in Appendix B.

The results of the noise measurements taken at Newrybar Primary School can be found in Appendix D.

Due to large numbers of vehicles using the existing highway, traffic noise levels are generally high at locations close to the highway. Traffic noise levels during the night-time are dominated by truck movements, and some engine braking events were audible.

The measurements indicate that the 'acute' noise levels of 60 $dBL_{Aeq,9hr}$ and 65 $dBL_{Aeq,15hr}$ are currently exceeded at several locations. Further away from the existing highway traffic noise levels are generally low and below the target levels of 50 $dBL_{Aeq,9hr}$ and 55 $dBL_{Aeq,15hr}$. Therefore there is no current traffic noise exposure at these locations. Measurement locations along Broken Head Road are an exception as the noise levels measured along this road generally do exceed these target noise levels.

The attended noise measurements at the school show that sound levels at the west of the school are caused by traffic on both the Pacific Highway and Broken Head Road.

The criterion $L_{Aeq,15hr} \leq 55$ dB(A) for school playgrounds is likely to be exceeded at the measurement locations at the west of the school and at the locations close to Broken Head Road. The highest sound level measured at a location that is a part of the school playground is 60 dB(A) which is 5 dB higher than the criterion. The sound levels measured at the east, north and south of the school meet the criterion. The indoor measurements show that indoor sound levels in the rooms situated at the west exceed the criteria by between 2 and 4 dB. The indoor criteria are met in the other classrooms, situated at the east, south and north side of the school.

4 Noise Modelling for Road Traffic Noise Assessment

4.1 Situations

The noise level predictions were made both for daytime (7am - 10pm, 15hr) and night-time (10pm - 7am, 9hr) for three base cases;

- 'Future-Existing', ie predicted Year 2012 (proposed opening date) traffic flows on the *existing* road alignment,
- '2012', ie predicted Year 2012 traffic flows on the proposed dual carriageway alignment, and
- '2022', ie predicted Year 2022 traffic flows (10 years after opening) on the proposed dual carriageway alignment.

Noise levels have been predicted using the CoRTN[18] road traffic noise prediction methodology, as implemented in SoundPLAN v6.4 environmental noise prediction software[19]. As the CoRTN methodology predicts 18hr or 1hr L_{A10} noise levels (10 percentile, or average maximum), corrections have been derived to convert the basic L_{A10} results to the $L_{Aeq,15hr}$ and $L_{Aeq,9hr}$, $L_{Aeq,1hr}$ noise levels used by the EPA (see Section 4.3.1).

To evaluate potential sleep disturbance impacts noise level predictions have also been made for:

- The hourly minimum '2012', ie predicted Year 2012 traffic flows on the proposed dual carriageway alignment, and
- The maximum noise caused by trucks on the proposed dual carriageway alignment.

The corrections are based on actual traffic flows and noise levels measured adjacent to the existing Pacific Highway corridor between Tintenbar and Ewingsdale in 2004.

A SoundPLAN model of the existing road with measured traffic flows was compared to measured noise levels at 12 reference locations to calculate an overall site specific calibration factor for the noise model.

Noise levels have been predicted at over 600 individual residences and other receiver locations along the proposed route.

4.2 Model Assumptions

The noise prediction model takes account of the overall traffic volume and number of heavy goods vehicles, the vehicle speed, road gradient and type of road surface. 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 they are provided.

In accordance with EPA criteria, noise levels have been predicted at 1.0 m from the receiver façade, and a +2.5 dB façade correction has been applied to the noise predictions to take account of reflections of sound from the façade.

The grid noise maps were calculated 1.5 above the ground surface, the +2.5 dB façade correction has been incorporated in these contours.

The road source was modelled using source heights of 0.5 m, 1.5 m and 3.6 m above ground level. The source height of 0.5 m corresponds to the noise sources from light vehicles. The heavy vehicle noise source is split into 1.5 m and 3.6 m source heights. The 3.6 m source, which represents heavy vehicle exhaust noise sources, is 8 dB(A) below the 1.5 m source. The total of the 1.5 m and 3.6 m sources is equal to the total heavy vehicle source level as

18 *Calculation of Road Traffic Noise*, Department of Transport, Welsh Office, 1998.
19 Braunstein + Berndt GmbH

defined in CoRTN. To achieve these requirements using 0% HGV inputs in SoundPLAN, the corrections shown in Table 9 were applied. These corrections are derived from the above guidelines applied to the CoRTN *Correction for Mean Traffic Speed and Percentage Heavy Vehicles* (Chart 4).

Table 9 Split Height Source Corrections.

Source height	1.5 m	3.6 m
100km/h	+7.1 dB(A)	-0.9 dB(A)
110km/h	+6.8 dB(A)	-1.2 dB(A)

The surrounding landscape was modelled as 60% absorbent ground cover, except for areas of water which are 0% absorbent. Elevation lines of terrain features and noise mounds were included in the calculation situation. Buildings were modelled with a standardised height of 4.0 m and with no reflection loss.

The maximum design traffic speed of the proposed road has been assumed to be 110 km/h.

For the *base case* (ie with no noise mitigation), the new alignment (including tunnel) was modelled with a concrete road pavement, except for the bridges, which were modelled with a low noise asphalt surface. A correction of +3.0 dB was applied for the concrete pavement, and -2.0 dB for the low noise asphalt pavement[20].

The existing roads were modelled with dense graded asphalt road pavement. A correction of +0.0 dB was applied for this surface, with the exception of the Ewingsdale interchange, which was modelled with concrete road pavement (correction +3.0 dB).

The following roads are included in the model for the *future existing* scenario:

- Existing highway
- Ross Lane
- Broken Head road

The following roads and ramps are included in the model for the upgraded highway:

- The upgraded highway
- Existing highway (mainly used as a service road)
- Ross Lane
- Broken Head road
- Highway SB off-ramp into Ross Lane (MC40)
- Highway NB on-ramp from Ross Lane (MC20)
- Ivy Lane Interchange - NB on-ramp (MCA MC90)
- Ivy Lane Interchange - SB off-ramp (MCB)
- Ivy Lane (MC8)
- Bangalow Interchange - NB off-ramp (MCW)
- Bangalow Interchange - SB on-ramp (MCV)

[20] See Table 3.1 *Road surface noise corrections, relative to dense graded asphaltic concrete*, RTA Environmental Noise Management Manual.

- Ewingsdale Interchange - NB off-ramp (MC61)
- Ewingsdale Interchange - SB on-ramp (MCE1)
- Ewingsdale Interchange - NB on-ramp (MC81)
- Ewingsdale Pacific Highway Overpass (MCB1)
- Upgraded Highway Ewingsdale between NB off-ramp and NB on-ramp
- Upgraded Highway Ewingsdale between SB on-ramp and SB off-ramp

Other roads and ramps are expected to have low traffic flows and have no significant contribution to the traffic noise levels.

The existing noise barrier at Ewingsdale is included in the models for both the *future existing* situation and the proposed upgrade, where it is possible to be retained. Figure 2 in Appendix F shows the proposed barriers arrangement adjacent to Ewingsdale, including the redesign of the existing barrier.

The noise models for both the *base* case and *mitigated* case incorporate the proposed earth bunds adjacent to Newrybar School and Ewingsdale. These are provided to assist in distributing excess fill material generated by the project and balance the earthworks quantities, but they have been positioned such that they provide helpful visual screening and traffic noise attenuation.

Studies show that noise coming from tunnel portals can potentially cause higher traffic noise levels at noise sensitive receivers close to the tunnel portals. The traffic noise coming from the tunnel portal was modelled and taken into account in the noise assessment. The source level coming from the tunnel portals was calculated using an approach derived by Olafsen[21]. The tunnel noise level was distributed over horizontal source lines distributed over the tunnel portal areas.

4.3 Model Calibration

A SoundPLAN model of the existing road with measured traffic flows was compared to measured noise levels at 12 reference locations close to the road to calculate an overall calibration factor for the noise model.

A comparison between the daytime measured and predicted noise levels is shown in Figure 3 below. A comparison of night-time noise levels is shown in Figure 4.

Overall daytime and night-time calibration factors were calculated by minimising the least-squared difference between the measured and predicted levels at each of the locations. This analysis resulted in the following site-specific calibration factors

- +0.73 dB, daytime
- +2.18 dB, night-time.

This means that, on average, the measured levels were 0.7 dB above the predicted levels during the day time, and measured levels were nearly 2.2 dB higher than predicted during the night. The latter is expected to be a consequence of the large number of night-time truck movements. These calibration factors were taken into account in the subsequent noise modelling.

[21] *Noise from Tunnel Opening - An Engineering Approach,* S. Olafsen, Proc. Internoise 1996.

Figure 3 Day-time noise level verification

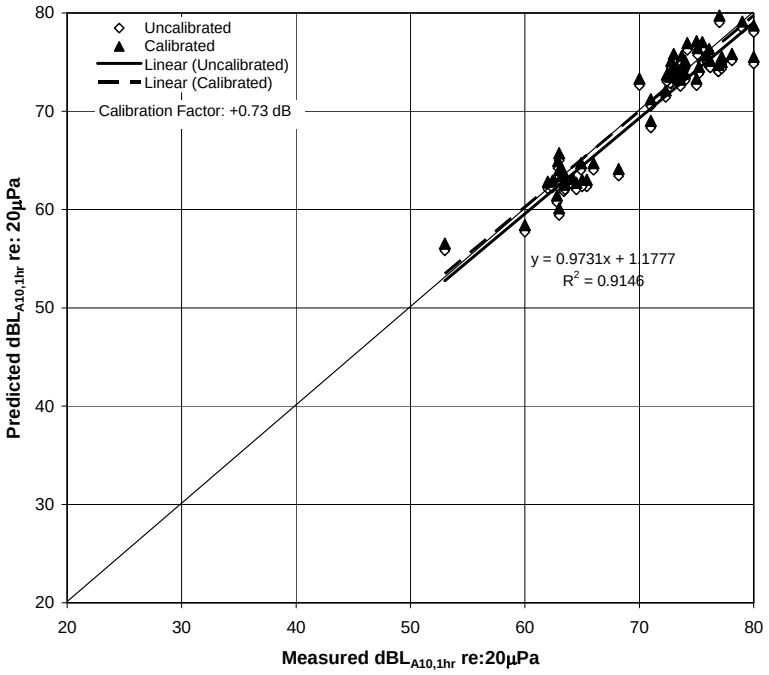
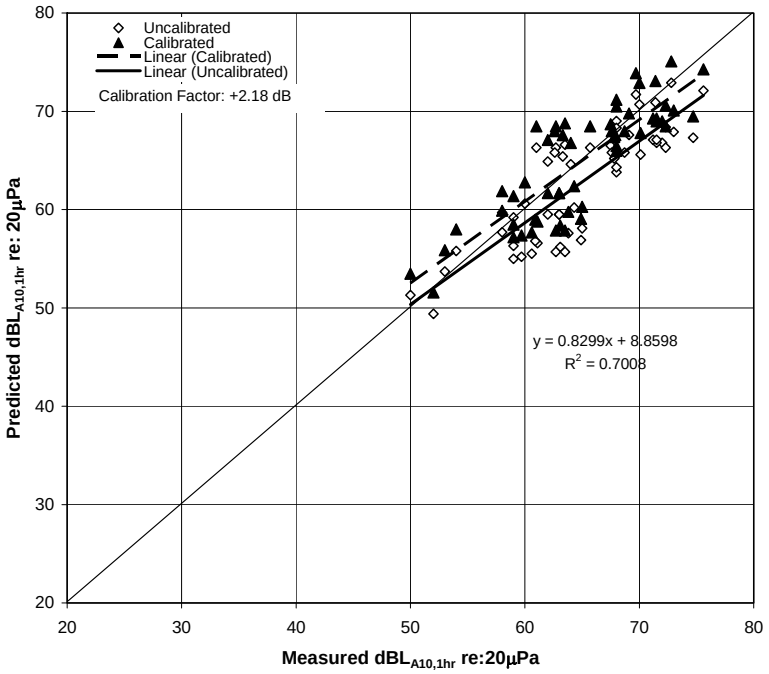


Figure 4 Night-time noise level verification.



4.3.1 L_{10} to L_{eq} Correction

As the CoRTN methodology predicts 18hr or 1hr L_{A10} noise levels, corrections have also been derived to convert the basic L_{A10} results to 15hr and 9hr L_{Aeq} noise levels used by the EPA. Based on actual site noise measurements of L_{A10} and L_{Aeq}, a correction of -3.5 dB (daytime) and -2.8 dB (night-time) have been applied. This is close to the nominal correction of -3.0 dB.

4.3.2 L_{max} sound level

The sound level used to calculate the maximum sound level, L_{max}, is based on the noise measurements taken from trucks on the Pacific Highway. Measurements were taken on different road gradients varying from 3% to 6% and where a significant number of vehicles were using engine braking. Approximately 40 individual measurements were taken. The 95th percentile source noise level was 92 dB(A), and has been used as a representative 'typical maximum' event noise level. This means that only 5%, or 1 in 20 truck engine braking events would be expected to exceed this noise level. The noise source was modelled as a moving point source along the roads and is considered as a representative typical maximum for an engine braking truck.

4.4 Traffic Flow and Composition Summary

The noise validations and predictions have been based on traffic flow and composition data provided by the RTA. The projected hourly traffic flow data for the year of project opening (2012) and 10 years after opening (2022) is provided in Table 10.

Modelling has been undertaken even for traffic flow rates that are sometimes significantly lower than recommended for use with the noise prediction methodology (ie CoRTN). Since the predictions are being made as equivalent average (ie L_{Aeq}) noise levels, rather than L_{10} noise levels, low flow-rates do not result in a loss of accuracy in the predictions.

Table 10a Projected hourly traffic flow data, *future existing* situation (2012)

	day 15hr (hourly average)		night 9hr (hourly average)	
	Total number of vehicles	% heavy goods vehicles	Total number of vehicles	% heavy goods vehicles
Existing highway north of Bangalow	1246	11.5%	295	31.9%
Existing highway south of Bangalow	886	12.8%	194	40.9%
Ross lane	294	3.9%	43	5.1%
Broken head road	74	4.5%	10	0.0%

Table 10b Projected hourly traffic flow data, proposed upgrade (2012, 2022)

	Day of opening 2012				10 years after day of opening 2022			
	day 15hr (hourly average)		night 9hr (hourly average)		day 15hr (hourly average)		night 9hr (hourly average)	
	Total number of vehicles	% heavy goods vehicles	Total number of vehicles	% heavy goods vehicles	Total number of vehicles	% heavy goods vehicles	Total number of vehicles	% heavy goods vehicles
Existing highway north of Bangalow	593	7%	73	19%	743	7%	92	19%
Existing highway south of Bangalow	78	6%	10	17%	98	6%	12	17%
Existing highway south of Ivy Lane	117	6%	14	17%	146	6%	18	18%
Existing highway from Ramp Ross Lane to Ross Lane	193	5%	26	10%	239	6%	31	10%
New alignment north of Bangalow	772	14%	170	44%	968	13%	212	42%
New alignment south of Bangalow	890	13%	194	40%	996	14%	246	40%
New alignment south of Ivy Lane	854	13%	186	41%	1068	13%	234	40%
Ross lane	315	4%	47	5%	383	4%	56	4%
Broken head road	52	4%	7	0%	63	4%	9	0%
Highway SB off-ramp into Ross Lane MC40	77	4%	11	0%	93	4%	13	0%
Highway NB on-ramp from Ross Lane MC20	113	4%	17	7%	137	4%	19	0%
Ivy Lane Interchange - NB on-ramp MCA MC90	19	7%	2	0%	24	8%	3	0%
Ivy Lane Interchange - SB off-ramp MCB	19	7%	2	0%	24	8%	3	0%
Ivy Lane MC8	39	9%	6	0%	49	8%	7	0%
Bangalow Interchange - NB off-ramp MCW	57	8%	9	13%	72	7%	11	10%
Bangalow Interchange - SB on-ramp MCV	57	8%	9	13%	72	7%	11	10%
Ewingsdale Interchange - NB off-ramp MC61	100	8%	21	11%	121	8%	26	9%
Ewingsdale Interchange - SB on-ramp MCE1	101	8%	21	11%	123	8%	26	9%
Ewingsdale Interchange - NB on-ramp MC81	488	8%	100	8%	601	8%	124	8%
Ewingsdale Pacific Highway Overpass MCB1	816	8%	168	8%	999	8%	206	8%
Upgraded Highway Ewingsdale between NB off ramp and NB on ramp	570	16%	126	54%	728	15%	162	53%
Upgraded Highway Ewingsdale between SB off ramp and SB on ramp	1058	12%	226	34%	1328	12%	286	34%

Table 11a Projected maximum hourly traffic flow data, *future existing* situation (2012).

	Total number of vehicles	% heavy goods vehicles
Existing highway south of Bangalow	1189	11%
Broken Head Road	95	4%

Table 11b Projected maximum traffic flow data, proposed upgrade (2012, 2022).

	Day of opening 2012		10 years after day of opening 2022	
	Total number of vehicles	% heavy goods vehicles	Total number of vehicles	% heavy goods vehicles
Existing highway south of Bangalow	99	6%	124	6%
New alignment south of Bangalow	1201	10%	1496	10%
Broken Head Road	66	4%	81	4%

Table 12 Projected minimum hourly traffic flow data, proposed upgrade (2012).

	Total number of vehicles	% heavy goods vehicles
Existing highway north of Bangalow	24	46%
Along Bangalow	6	32%
Existing highway south of Bangalow	3	32%
Existing highway south of Ivy Lane	5	42%
New alignment north of Bangalow	66	64%
New alignment south of Bangalow	76	59%
New alignment south of Ivy Lane	73	60%
Ewingsdale Interchange - NB on-ramp MC81 2012	22	50%
Pacific Highway Overpass MCB1 2012	68	50%
Upgraded Highway Ewingsdale between NB off ramp and NB on ramp	49	65%
Upgraded Highway Ewingsdale between SB off ramp and SB on ramp	71	61%

5 Road Traffic Noise Assessment

As the proposed upgrade generally follows the existing highway route and traffic flows are not expected to increase more than 30% over a 10 year period, the noise exposure of most residences is expected to change only marginally. Between Bangalow and Ewingsdale the noise exposure for residences close to the proposed route will increase. The noise exposure of residences along the existing highway between Bangalow and Ewingsdale (ie near to the Bangalow Bypass and Pacific Highway on St. Helena Hill) is expected to decrease.

Noise levels have been predicted at over 600 individual residences and other receiver locations along the proposed route. The noise level predictions were made both for daytime (7am - 10pm, 15hr) and night-time (10pm - 7am, 9hr) for three *base case* scenarios;

- 'Future-Existing', ie predicted Year 2012 (proposed opening date) traffic flows on the *existing* road alignment,
- '2012', ie predicted Year 2012 traffic flows on the proposed dual carriageway alignment, and
- '2022', ie predicted Year 2022 traffic flows (10 years after opening) on the proposed dual carriageway alignment.

The *base case* assumes a concrete wearing surface with a pavement noise level correction of +3 dB.

In addition, modelling has also been undertaken for two additional cases with low-noise asphalt (assumed to be Stone Mastic Asphalt (SMA)) in some key sections of the alignment. For this pavement type a correction of -2 dB was used. These *mitigated* scenarios are;

- Mitigated situation, '2012', ie predicted Year 2012 traffic flows on the proposed dual carriageway alignment, and
- Mitigated situation '2022', ie predicted Year 2022 traffic flows (10 years after opening) on the proposed dual carriageway alignment.

Noise contour plots for these prediction scenarios are shown in noise contour maps in Appendix E.

Table 13 Noise level contour plots, shown in Appendix E.

Ref.	Day/Night	Year	Description
A	Day	2012	Base Case (Concrete Pavement)
B	Night	2012	Base Case (Concrete Pavement)
C	Day	2022	Base Case (Concrete Pavement)
D	Night	2022	Base Case (Concrete Pavement)
E	Day	2012	Mitigated Case (Low Noise Pavement)
F	Night	2012	Mitigated Case (Low Noise Pavement)
G	Day	2022	Mitigated Case (Low Noise Pavement)
H	Night	2022	Mitigated Case (Low Noise Pavement)

The results for individual receivers are shown in Appendix C. The applicable noise criteria have been determined for each property individually based on the requirements of Practice Note I of the RTA ENMM.

Generally, noise mitigation is required if either;

- the predicted '2022' noise level *exceeds* the relevant criterion *and* the noise level increase is greater than 2 dB (Redevelopment) or 0.5 dB (New),

OR

- the noise level is *Acute* (ie > 65 $dBL_{Aeq,15hr}$ daytime, > 60 $dBL_{Aeq,9hr}$ night-time).

5.1 Analysis of 'Feasible and Reasonable' Noise Mitigation

Practice Note IV (PN-IV) of the RTA ENMM provides a detailed procedure for *'selecting and designing "feasible and reasonable" treatment options for road traffic noise'* that is aimed at providing a consistent approach to the evaluation, selection and design of appropriate noise control options. In particular, PN-IV Part (a) provides a detailed cost/benefit analysis of noise barrier options, including the level of noise reduction achieved, the number of residences protected and the typical installed cost of noise barriers.

This section of the report provides the analysis of noise mitigation options for the preferred route, in strict accordance with PN-IV. Base-case noise levels have been predicted based on a concrete pavement type.

For the base case (concrete pavement), 95 residences have predicted noise levels that are above the *acute* noise level criterion of 60 $dBL_{Aeq,9hr}$ and 65 $dBL_{Aeq,15hr}$ and therefore require consideration of noise mitigation. 219 residences are predicted to be exposed to traffic noise levels higher than the applicable base criteria and those noise levels are expected to go up by more than 0.5 dB or 2 dB (new freeway or redevelopment of existing, respectively) in the next 10 years. In total 314 residences require consideration of noise mitigation.

5.1.1 Road Traffic Noise Catchment Area and Identification of Noise Sensitive Receivers

Houses with a similar noise exposure are grouped into traffic noise catchment areas. The noise catchment areas are based on areas likely to have similar noise exposures based on the local topography, road design, setback and receiver type. Catchment areas typically extend to 300 m from the road alignment only, in accordance with the PN-IV procedure. However, RTA advice has been to include noise sensitive receivers that are further than 300 m from the road alignment where they are predicted to exceed the ECRTN target noise levels.

Traffic noise catchment areas are made in order to assess the feasibility of noise mitigation using a noise barrier. When residences are isolated, a noise wall or barrier is generally not considered as feasible or reasonable. Therefore noise catchment areas are only formed for 'clusters' of residences. Most noise sensitive receivers adjacent to the proposed upgrade are a relatively widely separated[22]'. Only one traffic noise catchment area was formed; this was for the noise sensitive receivers at Clover Hill in Bangalow. At this location the ECRTN target noise levels are exceeded for more than 3 sensitive receivers which are in relatively close proximity to one another. The noise catchment area is shown in the noise contour plots in Appendix E.

Predicted sound levels for other groups of noise sensitive receivers along the proposed upgrade do not exceed the ECRTN target noise levels for more than 3 noise sensitive receivers in each cluster of houses (this includes the noise sensitive receivers at Ewingsdale).

5.1.2 Analysis of Low-Noise Road Surface

Low-noise road surface (eg Stone Mastic Asphalt (SMA)) has also been examined as a potential noise mitigation option at key sections of the alignment.

Low-noise road surfacing has been examined for the following sections:

[22] Based on previous experience, properties are assumed to be 'clustered' if three or more affected properties are within 50 m distance of each other.

- Bridge over Minor Creek
- Bridge over Emigrant Creek
- From north of Emigrant Ck to bridge over Skinners Ck
- From Bangalow bypass to Tinderbox Creek
- From the tunnel under St. Helena Hill up to Ewingsdale interchange

The locations of the noise mitigation, including the proposed low-noise pavement is shown in the Figures in Appendix G.

Noise predictions were also made for this proposed mitigated situation with a low-noise road surface on these sections of the alignment. In this situation 63 residences are exposed to acute noise levels. 54 residences are predicted to be exposed to traffic noise levels higher than the applicable criteria and those noise levels are expected to go up by more than 0.5 dB or 2 dB (new freeway or redevelopment of existing, respectively) in the next 10 years. Therefore, in total 117 residences require consideration of noise mitigation if low-noise pavement is used for the proposed sections of the alignment.

In accordance with PN-IV, noise barriers are not considered feasible and reasonable where affected residences are grouped in numbers of three or less. This is the situation for the majority of the properties on this route. It is stated in PN-IV that architectural treatment should be considered for affected residences in these catchments.

For the affected receivers at Clover Hill in Bangalow the provision of noise barriers has been further evaluated. As the upgraded highway will be build outside the existing corridor, the upgrade at this location is considered to be a ‘new road’. The target noise levels are therefore 50 $BL_{Aeq,9hr}$ and 55 $dBL_{Aeq,15hr.}$ The results of this assessment can be found in Sections 5.2 and 5.3.

The noise assessment carried out for the school shows that there is an existing noise exposure. The future existing model forecast noise levels of up to 60 $dBL_{Aeq,1hr}$ which generally will result in a sound level of 50 $dBL_{Aeq, 1hr}$ internally with windows open.

In the model the proposed earth mound situated on the eastern side of the school was included. This earth bund provides shielding from the new highway. Traffic on the existing highway and the traffic noise levels on the western side of the school will decrease. The predicted noise levels for the proposed upgrade in 2022 meet the target level of 45 $dBL_{Aeq,1hr}$ internally (assuming a 10 dB reduction by the façade with windows open) and the criterion of 55 $dBL_{Aeq,1hr}$ on the school playgrounds close to the school.

5.2 Analysis of Road Treatment Options and Barrier Heights for the Clover Hill Catchment using *Base Case* Pavement

The predicted effectiveness of noise barriers of varying heights, in conjunction with the *base case* concrete road surface, for the catchment at Clover Hill is given in Table 14. For the purpose of this analysis, the catchment has been further divided into *segments* each having receivers with noise levels within a 5 dB(A) range[23].

Table 14 Effectiveness of noise barrier with varying heights.

Barrier Height, m	Representative barrier insertion loss dB(A)		
	Segment 1	Segment 2	Segment 3
0.0			
0.5	1		
1.0	2		
1.5	3		
2.0	4		
2.5	5	1	
3.0	6	1	
3.5	6	1	
4.0	7	1	
4.5	8	1	
5.0	8	1	
5.5	9	2	
6.0	9	2	
6.5	10	2	
7.0	10	2	
7.5	10	2	
8.0	11	2	

The *target*[24] *barrier* option has been calculated in accordance with Practice Note IV(a) *Noise barrier heights*. The target noise level of 50 dB(A) cannot be met with a barrier less than or equal to 8 m high. According to the RTA ENMM it is therefore not feasible or reasonable to provide a noise barrier.

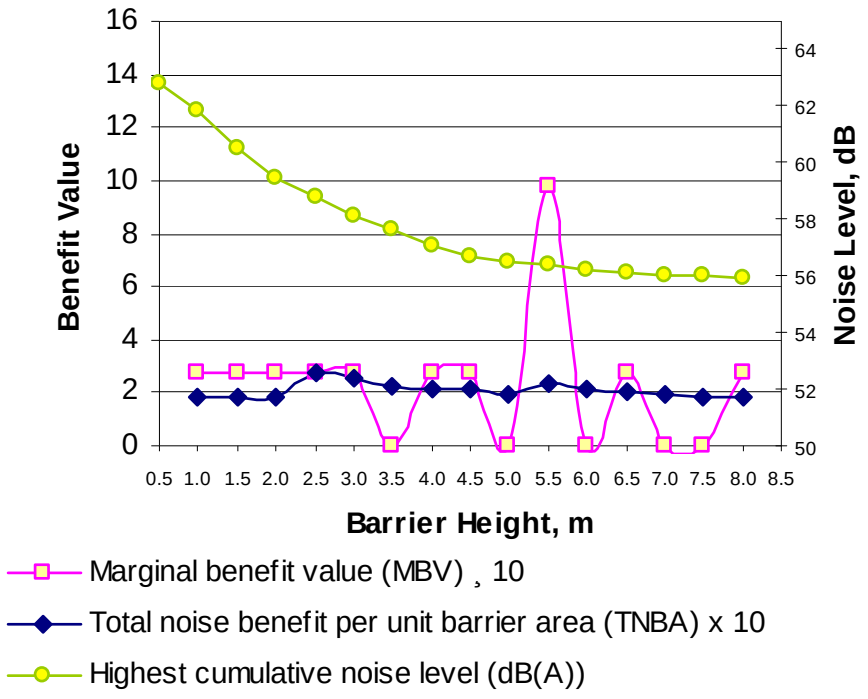
However, as a noise reduction of up to 11 dB can be achieved with a 150 m long barrier for the most affected property the *assessed barrier*[25] could still be considered. As shown in Figure 5 the assessed barrier in this situation is approximately 5.5 m high. With this barrier the highest Marginal Benefit Value can be achieved and the Total Noise Benefit per Unit Area is relatively high. The noise reduction with this barrier will be 9 dB at the most affected property. For the location of this barrier see Appendix F.

23 In accordance with Practice Noise IV (c).

24 The target barrier is the noise barrier having the height required to meet the ECRTN target noise levels.

25 The assessed barrier is the noise barrier having the height that provides the greatest marginal noise reduction benefit and the greatest benefit per unit of barrier area.

Figure 5 Barrier height effectiveness for potential noise barrier at Clover Hill



5.3 Analysis of Road Treatment properties and Barrier Heights for the Clover Hill Catchment using 'Low Noise' Pavement

The predicted effectiveness of noise barriers of varying heights, in conjunction with a low-noise road surface, for the catchment at Clover Hill was calculated. However, the target noise level of 50 dB(A) cannot be met with a barrier less than or equal to 8 m high even when low noise pavement is used. According to the RTA ENMM it is therefore not feasible or reasonable to provide a noise barrier.

As shown in Section 5.2.1. a noise reduction of up to approximately 11 dB can be achieved with a barrier 150 m long barrier for the most affected property. Therefore, the *assessed* barrier could still be considered. The *assessed* barrier in this situation with low noise pavement is also 5.5 m high. For the location of the barrier see Appendix F. The noise reduction with this barrier will be 9 dB at the most affected property.

5.4 Summary of Noise Mitigation Requirements

A detailed cost effectiveness analysis of noise mitigation options has been carried out in accordance with PN-IV of the RTA ENMM. The analysis demonstrates that it is necessary to provide noise mitigation in the form of architectural treatment to buildings or quieter road surfaces in conjunction with both architectural treatment and noise barriers.

Overall the PN-IV analysis results in the following potential noise mitigation measures;

- Low-noise road surfacing (such as open-graded asphalt or stone mastic asphalt) is recommended for the following sections:
  - From about 300 m south of Newrybar (Ch 141750) to Skinners Creek (Ch 143650).
  - From south of Bangalow (Ch 145200) to 750 m north of the proposed railway crossing at Bangalow (Ch 147800).
  - From the northern portal of the tunnel (Ch 150400) through to the Ewingsdale interchange (Ch 152100).

  - Bridge over Minor Creek
  - Bridge over Emigrant Creek

- In conjunction with the low-noise road surface treatment, Architectural treatment is recommended for 117 residences.
- Low noise pavement in conjunction with a 5.5 m high barrier is recommended adjacent to the residences at Clover Hill (this may reduce the number of houses that need architectural treatment).
- The already architecturally treated properties between Bangalow and Knockrow do not require additional noise treatment (these properties are referred to as 387-HO1, 393-HO1, 401-HO1, 406-HO1, 409-HO1 in Appendix C).
- The proposed earth works adjacent to Ewingsdale generally provide sufficient noise attenuation for the residences at Ewingsdale.
- The earth bund on the eastern side of the Newrybar Primary School will provide some shielding from noise coming from the upgraded highway. Further architectural treatment may also be considered.

5.5 Noise Mitigation Options

Architectural treatment will be required at approximately 117 residences (see Appendix C and G for locations). The form of the architectural treatment is to be agreed with the individual residents, and will be undertaken in accordance with the RTA ENMM and may include one or a combination of the following; upgraded glazing, doors and window seals and provision of fresh air ventilation/air-conditioning. The reduction in noise level that will be achieved by these treatments will depend on the structure type and condition of the existing building, but could be an improvement of 10-15 dB(A) indoors.

A noise barrier was also considered for the residences at Clover Hill. However, the target noise levels cannot be met even with a barrier 8 m high, and as such, the barrier was not considered feasible in strict accordance with Practice Note IV (for a barrier greater than 5 m high to be considered reasonable and feasible, it must provide at least 10 dB(A) of attenuation). Nevertheless, the *assessed* barrier was calculated to be 5.5 m high and does provide some level of noise reduction. A noise mound or bund could be considered, since it is anticipated that the earthworks for the project as a whole will result in excess material, which could be effectively reused here to minimise waste. This barrier or mound would be approximately 150 m long and at the location is shown in Appendix F.

Generally, the existing noise wall adjacent to Ewingsdale will remain, except where earthworks make this impractical.

The proposed earth mound (and 2 m high noise wall) along Ewingsdale provides sufficient shielding for the houses in and around the centre of Ewingsdale.

The earth bund will provide sufficient shielding to the school to meet the internal and external noise levels for the school.

5.6 Maximum Noise Levels

Maximum noise levels were assessed in accordance with Practice Note III of the RTA Environmental Noise Management Manual.

Maximum internal noise levels below 50-55 dB(A) and therefore external noise levels of 65 dB(A) or less are unlikely to cause awakening reactions. Maximum external noise levels above 65 dB(A) were compared with the lowest hourly L_{eq} level occurring at night time. Differences between these levels of 15 dB or more are likely to cause awakening reactions.

Existing maximum noise levels adjacent to the highway are typically due to engine braking events from individual trucks, particularly during the night-time period when there are a high

proportion of truck movements relative to other vehicles. Traffic predictions indicate future (2022) truck movements will average approximately 100 truck movements per hour during the night-time. Measurements adjacent to the route suggest that around 30% of trucks use engine braking at various locations along the existing route, which would equate to 30 maximum noise events per hour.

The alignment has been designed to minimised gradients and there are no traffic signals along the route. As a consequence, the use of noisy engine braking is likely to be significantly reduced compared to the existing highway.

5.7 Noise Monitoring Programme

The RTA ENMM recommends that post-construction noise monitoring should be included as a part of the operation of the upgraded highway to monitor and review the effectiveness of the noise mitigation in relation to the design noise level targets.

It is recommended that a noise and traffic flow monitoring programme is conducted after the road opening. This should include:

- measurement of traffic noise levels with normal operational traffic flows
- comparisons of the measured results with predicted noise levels
- verification that road traffic noise levels are in accordance with the project design noise levels.

6 Construction Noise and Vibration Assessment

The construction of a dual carriageway road occurs in three stages: earthworks, laying of the road-base and final laying of pavement. Noise generating activities would include construction of bridges, underpasses, and culverts; earthworks including tunnelling and cutting; paving; and drainage works. These activities would require the occasional use of rock breakers, jackhammers and concrete saws. Bridge and embankment construction could include piling activities. Blasting is likely to be required for the construction of the St. Helena Hill tunnel (see separate discussion below), and possibly some of the large cuttings.

Batching plants

Asphalt and concrete batching plants would be required at several locations along the construction route for a period of up to 2 years. The number of batching plants and final locations would be chosen by the construction contractor and would be dependent on specific contractor requirements and sequencing. Three preliminary general locations have been identified as potentially suitable for either concrete or asphalt batching plants:

- On the eastern side of the Ewingsdale interchange
- On the Bangalow Rd on the eastern side of the proposed upgrade
- On the north-west side of the proposed Ross Lane interchange
- Noise associated with batching plants would primarily be generated from associated vehicle movements and use of plant and equipment.

Site compound

A site compound would be required to be established for offices, facilities and storage of materials, plant and equipment. A preliminary location has been identified on the eastern side of the proposed upgrade on Bangalow Rd, adjacent to the preliminary batching plant location. Depending on the specific needs of the construction contractor and the sequencing of construction, there may potentially be more than one construction compound. Noise associated with a construction compound would primarily be generated from associated vehicle movements.

Crushing plant

A crushing plant may be required near the St Helena tunnel due to the generation of significant amounts of rock spoil. A preliminary location along the southern side of the proposed tunnel works has been identified. The final location of any crushing plant would be determined by the specific needs of the contractor as well as amenity issues. The crushing plant may need to be relocated several times during construction depending on the volumes of rock spoil generated at particular locations. Noise would be generated by the operation of the crushing plant.

Construction traffic

Construction traffic will generate noise over a relatively wide area and beyond the construction site itself. Routes for construction traffic would be determined during detailed design and construction stages. It would be expected however that traffic noise would be greatest where there is a concentration of vehicle movements, such as at construction compounds, batching plant locations and where construction is occurring at a given time.

6.1 Construction Noise and Vibration Impacts

The equipment likely to be used during the construction of the proposed road and the typical sound power levels associated with each type of equipment are listed in Table 15 below.

Table 15 Typical sound power levels of Construction Equipment, dB(A) re 10^{-12} W.

Construction Phase	Plant	Sound Power Level, dB(A) re 10^{-12} W
Earthworks	Bulldozer	115
	Scraper	115
	Grader	115
	Roller	105
	Water cart	105
Laying of pavement	Trucks	110
	Paving Machine	115
Bridge Construction	Percussive piling machine	120
	Trucks	110
Batching Plants	Batching Plant	106
	Trucks	100
	Bulldozer	115

The actual level of construction noise impact will depend on the type of equipment, construction methodology chosen by the construction contractor and final location of the work sites and batching plants.

Based on a typical average-maximum construction site sound power level of around 113 - 115 dBL_{A10} (re 1pW), and allowing for distance losses and typical atmospheric and environmental noise attenuation, typical construction noise levels are predicted to be around 70 – 75 dB_{LA10} at a distance of 50 m from construction sites, and 45 – 55 dBL_{A10} at a distance of 150 m. This would apply equally to earthworks and paving stages for construction.

There is the potential for construction noise criteria to be exceeded at times during the construction process where sensitive receivers are in close proximity to construction works. The three locations identified above are the most likely to be impacted by any exceedance of noise criteria. Newrybar Primary School is located 100 m from road acquisition boundary, and at both Clover Hill and Ewingsdale there are a number of sensitive receivers within 100 m of the road boundary.

Noise levels would be expected to be generally consistent along the proposed route. Sensitive receivers at a given location are likely to be exposed to noise for up to six months during the earthworks stage and up to six months during the paving stages. In the case of Newrybar Public School, the bridgeworks associated with the Broken Head Road overpass would generate noise for a period of up to nine months, which would occur after earthworks are complete, but may overlap with the paving stage.

Noise impacts from batching plants

Noise from batching or crushing plants also has the potential to impact sensitive receivers within the vicinity of the plant location. Noise emissions from batching plants arise from the use of plant and equipment and from associated vehicle movements. The preliminary plant

locations have been identified in part to minimise the number of sensitive receivers. An indicative radius of 200 m has been identified as an area where construction noise criteria may be exceeded at times. Sensitive receivers within 200 m of the preliminary locations would include:

- A maximum of two residences at Ewingsdale
- A maximum of one residence at Bangalow Road
- A maximum of two residences at Ross Lane.
- Noise would potentially be generated at these locations at least 18 months.

Noise impacts from construction compounds

An indicative radius of 200 m from construction compounds has been identified as an area where construction noise criteria may be exceeded at times. There would be one residence within 200 m of the preliminary construction compound location. Noise from a construction compound would be likely to be generated for the entire construction period.

Noise from crushing plant

A crushing plant would be likely to generate slightly higher noise levels than other construction activities. For this reason, a 300 m radius from the plant location has been identified as an indicative area which may be subject to exceedances of construction noise criteria. There are seven residences (on St Helena Road) within 300 m of the preliminary crushing plant location on the south side of the proposed tunnel. The location of the plant however would be at the base of the portal cuttings, which would provide some level of noise attenuation.

If a crushing plant is needed at other locations, it would generally be located at the base of a cutting, which would limit its potential noise impacts.

Noise from construction traffic

Noise from construction traffic within the road corridor is taken into account in generally qualitative terms in the relevant discussions above. There would be some noise impacts associated with construction vehicle movements outside the corridor, particularly in terms of any off-site disposal of excess fill. There would be a focus during detailed design, of optimising the cut/fill balance and minimising the volume of material disposed of off-site. The number and location of truck movements may be accurately determined at the completion of detailed design.

6.2 Construction Noise and Vibration Mitigation

In general, practices to reduce construction noise impacts will be required, and may include;

- adherence to the operating time limits and conditions where possible
- agreeing work outside standard operating limits in advance with the community and the DEC (possible works outside standard operating times could include emergency works, safety works, delivery of materials or equipment (eg oversize equipment))
- the location of stationary plant (air-compressors, generators, etc.) as far away as possible from residential areas
- using natural screening by topography wherever possible to reduce noise impacts
- using site sheds and other temporary structures or screens to limit noise exposure where possible
- installing operational noise barriers as early as possible to provide ongoing screening from construction activities, where possible
- the appropriate choice of low-noise construction equipment and/or methods

- modifications to construction equipment or the construction methodology or programme. This may entail programming activities to occur concurrently where a noisy activity will mask a less noisy activity, or, at different times where more than one noisy activity will significantly increase the noise. The programming should also consider the location of the activities due to occur concurrently.
- management and public consultation including, but not limited to; advance notification of planned activities and expected disruption/effects through letter drops, public meetings and effective monitoring of noise levels in and around potentially affected dwellings.

This represents the best practical means of control. Whilst the contractor will be able to achieve moderate reductions in noise and vibration, some impact is expected. A Construction Noise and Vibration Management Plan would be adopted for construction stages incorporating a programme of noise monitoring at sensitive receivers, a community information programme and a complaints hotline.

Similarly, the levels of vibration generated from various construction activities will be site specific, and will be dependant on the ground type, the particular equipment used, and the proximity of the construction activity to the receiver location.

Construction activities associated with general road construction are not generally expected to generate perceptible levels of vibration at nearby residences due to the considerable propagation distances. In some cases, where construction is required near to properties, some vibration may be perceptible, but the works are not predicted to generate levels of vibration that would cause damage.

6.3 Piling Noise and Vibration

To reduce the effect on residents of piling noise, nearby residents should be consulted regarding the intended activities associated with the piling process. Sub-contractors carrying out piling activities should be required to undertake pre-construction structural integrity surveys of all properties likely to be affected by piling operations within 300 m of piling.

Mitigation measures to reduce the impact of percussive piling activities include:

- using a resilient pad (dolly) between pile and hammer head
- enclosing the hammer head in a temporary acoustic shroud.

Alternatively, rotary bored or vibro-piling may be used where consistent with the type of pile used and restrictions on soil disturbance.

6.4 Noise and Vibration from Blasting

Blasting is likely to be required for the construction of the tunnel at St. Helena Hill and possibly for some of the large cuttings. It is possible that, due to the size of the project, more than one detonation may be required per day to reasonably progress the construction works. This would not be in accordance with the ANZECC[13] recommendations, but is likely to be acceptable if blasting times are limited and coordinated with the potentially affected receivers.

Many site factors will influence the transmission of vibration through the ground, such as the lithography and topography between the blast site and the receiver locations.

AS2187.2[12] provides a methodology for estimating ground vibration levels, and should be used for sizing of blasts to meet the criteria. In addition, AS2187.2 provides recommendations for reducing the effects of ground vibration and overpressure levels including the following;

- reduce the maximum instantaneous charge (MIC) or charge mass per delay by the use of delays of sufficient length, reduced hole diameter or deck loading

- Ensure that broken rock and excessive humps or toe are removed prior to the firing of the main blastholes
- Optimise blast delay (change burden and spacing) by altering drilling patterns or delay layout or alter hole inclination from the vertical
- Exercise strict control over the location, spacing and orientation of all blast drill holes and use the minimum practicable sub-drilling which gives satisfactory toe conditions.
- Establish times of blasting to suit the situation.

It is recommended that blasting management is addressed in the Construction Noise and Vibration Management plan. This plan will include measures to mitigate community disturbance caused by blasting required to construct the route. These measures should include guidelines for shot-firers such as minimising the required Maximum Instantaneous Charge (MIC), minimising face heights, optimising drilling patterns and the times of blasting. The community should be consulted and notified regarding proposed blasting timetables and contacts, particularly where multiple blasts per day may be required.

At this stage, given the proximity of residences above and adjacent to the tunnel alignment, it is anticipated that the typical allowable MIC will be around 4 kg to ensure that the ANZECC overpressure and vibration guidelines are met at the nearest sensitive receivers located on the St Helena ridgeline.

All blast vibration and overpressure levels should be measured at representative locations and kept on permanent record, along with any personal responses from the shot-firer and any affected neighbours. Any actions resulting from complaints will also be recorded. A pre-construction survey of potentially affected buildings (including houses) and structures should be carried out prior to commencement of blasting.

7 Conclusions and Recommendations

The noise levels have been predicted at over 600 individual residences and other receiver locations along the proposed route.

Due to large numbers of vehicles using the existing highway, existing noise levels are relatively high for residences close to the highway. As the proposed upgrade generally follows the existing highway route and traffic flows are not expected to change significantly, the noise exposure of most residences will only change marginally.

For 95 residences along the proposed upgrade, the acute noise level criterion of 60 $dBL_{Aeq,9hr}$ at night time and 65 $dBL_{Aeq,15hr}$ during day time is expected to be exceeded. For these houses noise mitigation is recommended. 219 residences exceed the base traffic noise criteria. Therefore, in total 314 residences require consideration of noise mitigation.

Low-noise pavement surfacing is proposed for some sections of the alignment. Noise predictions are also made for this proposed mitigated situation with low-noise pavement on some sections of the alignment. In this situation 63 residences are exposed to acute noise levels. A further 54 residences exceed the base traffic noise criteria. Therefore, in total 117 residences require consideration of noise mitigation when low-noise pavement is applied to these sections of the alignment.

For the residences at Clover Hill in Bangalow the feasibility of a noise wall was investigated. As the night time target level of 50 dB(A) cannot be met with a noise wall only, it should be considered as not feasible strictly in accordance with the Environmental Noise Management Manual. However, an assessed barrier of approximately 5.5 m could still be considered as this will decrease noise levels at the most affected resident by approximately 9 dB(A) and provide noise attenuation for a large number of residences. This barrier would reduce the number of houses that need architectural treatment.

For other affected residences, noise walls and low noise pavement were found not to be feasible and architectural treatment should be applied.

The earth bund designed along Ewingsdale will provide sufficient noise attenuation for most residences at Ewingsdale.

The proposed earth mound situated on the eastern side of the school provides shielding from the proposed upgrade. Traffic on the existing highway will decrease dramatically. The predicted internal noise level for the upgrade is significantly lower than for the future existing situation and meets the target noise levels.

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Appendix A

Attended Short-Term Measurement Results

Position	Date	Start Time	Noise Level, dB(A)				
			L_{min}	L_{90}	L_{eq}	L_{10}	L_{max}
A1[26]	15-Nov-04	14:02	42	46	50	52	69
A1	16-Nov-04	1:30	28	30	43	47	54
A1	17-Nov-04	15:45	42	44	48	50	66
A1	24-Nov-04	9:27	46	49	54	57	71
A1	25-Nov-04	1:29	33	41	52	54	65
A2	15-Nov-04	14:29	42	44	50	51	68
A2	16-Nov-04	1:49	33	36	40	42	63
A2	17-Nov-04	16:20	43	45	49	51	69
A2	25-Nov-04	1:53	37	39	45	49	63
A2	11-May-05	15:32	40	42	54	55	75
A2	25-May-05	17:05	38	41	52	55	69
A3	15-Nov-04	15:02	48	53	59	60	78
A3	16-Nov-04	0:45	37	40	49	52	60
A3	24-Nov-04	9:50	45	48	56	53	77
A3	25-Nov-04	2:15	39	42	58	56	85
A4	15-Nov-04	15:15	52	58	66	69	77
A4	16-Nov-04	1:07	37	42	60	63	78
A4	24-Nov-04	9:57	50	56	62	66	74
A4	25-Nov-04	2:20	38	45	61	65	76
A4	10-May-05	5:30	41	49	64	68	76
A5	15-Nov-04	15:43	56	63	77	80	89
A5	16-Nov-04	2:12	30	34	69	68	89
A5	24-Nov-04	10:17	48	60	76	80	88
A5	25-Nov-04	2:43	37	42	71	73	88
A5b	16-Nov-04	15:15	44	54	73	77	88
A5b	17-Nov-04	16:47	57	64	76	79	87
A6	15-Nov-04	16:11	46	50	64	67	81
A6	16-Nov-04	4:42	31	35	51	49	80
A6	24-Nov-04	11:08	46	49	65	67	84
A6	25-Nov-04	3:10	36	39	47	50	58
A7	15-Nov-04	16:20	46	50	55	58	74
A7	16-Nov-04	5:05	38	42	53	56	66
A7	24-Nov-04	11:16	39	41	47	49	65

[26] Blue colour indicates day time measurements, red indicates night time measurements

Position	Date	Start Time	Noise Level, dB(A)				
			L_{min}	L_{90}	L_{eq}	L_{10}	L_{max}
A7	25-Nov-04	3:33	40	47	52	55	58
A8	15-Nov-04	16:34	38	42	65	69	81
A8	16-Nov-04	5:27	34	40	58	50	84
A8	24-Nov-04	11:45	43	46	64	66	85
A8	25-Nov-04	3:58	38	41	45	48	58
A9	15-Nov-04	17:04	48	53	60	63	71
A9	16-Nov-04	2:51	44	50	54	56	61
A9	17-Nov-04	18:55	46	50	57	60	72
A9	18-Nov-04	2:28	41	47	52	54	60
A9	24-Nov-04	10:38	44	48	52	54	66
A9	11-May-05	15:02	47	51	54	57	60
A10	15-Nov-04	17:01	49	54	65	69	85
A10	16-Nov-04	2:33	34	37	60	45	86
A10	17-Nov-04	18:52	45	50	61	66	74
A10	18-Nov-04	2:47	37	41	44	44	60
A10	24-Nov-04	10:47	43	48	63	66	81
A10	10-May-05	5:01	35	38	57	51	81
A10	11-May-05	16:29	46	52	63	67	79
A11	15-Nov-04	17:37	46	53	61	65	78
A11	16-Nov-04	4:18	39	41	56	58	73
A11	17-Nov-04	18:23	45	50	60	63	75
A11	18-Nov-04	2:08	39	45	57	61	74
A12	15-Nov-04	17:38	46	50	64	63	84
A12	17-Nov-04	18:31	43	46	63	59	83
A12	18-Nov-04	1:48	46	49	53	51	80
A12b	16-Nov-04	3:58	42	50	55	54	79
A12b	11-May-05	16:48	39	42	63	62	85
A13	15-Nov-04	18:16	41	44	60	55	80
A13	16-Nov-04	3:33	30	33	38	40	46
A13	17-Nov-04	17:58	40	43	61	53	83
A13	18-Nov-04	1:27	46	49	57	53	80
A14	15-Nov-04	18:22	43	45	58	58	76
A15	15-Nov-04	18:46	44	48	55	58	71
A15	16-Nov-04	3:13	30	33	48	53	62

Position	Date	Start Time	Noise Level, dB(A)				
			L_{min}	L_{90}	L_{eq}	L_{10}	L_{max}
A15	17-Nov-04	17:28	46	50	58	60	74
A15	18-Nov-04	1:08	34	35	46	50	61
A15	10-May-05	3:49	33	35	50	55	65
A15	10-May-05	15:19	39	47	57	60	81
A16	16-Nov-04	17:30	42	49	59	62	73
A16	17-Nov-04	14:57	49	56	61	63	76
A16	18-Nov-04	0:11	38	41	56	59	74
A16	25-Nov-04	5:26	45	49	59	63	68
A17	17-Nov-04	14:34	46	52	67	71	85
A17	17-Nov-04	23:49	40	43	67	68	85
A17	24-Nov-04	12:27	47	53	68	71	84
A17	25-Nov-04	5:47	44	50	71	76	82
A17	11-May-05	14:04	53	60	70	74	83
A18	17-Nov-04	15:21	49	55	65	69	79
A18	18-Nov-04	0:30	43	49	61	61	83
A18	24-Nov-04	12:50	50	56	67	70	81
A18	25-Nov-04	5:05	40	45	67	70	82
A18	11-May-05	14:24	49	56	66	70	79
A19	17-Nov-04	17:17	47	52	58	61	72
A19	18-Nov-04	0:50	51	52	58	57	79
A19	24-Nov-04	13:12	45	51	60	63	74
A19	25-Nov-04	4:40	41	43	57	59	75
B1	9-May-05	15:17	33	35	45	44	69
B1	11-May-05	10:52	31	34	39	41	57
B1	25-May-05	16:10	31	34	43	44	69
B1	25-May-05	23:26	27	29	32	33	53
B1	27-May-05	14:11	32	35	40	43	64
B2	10-May-05	2:00	32	34	38	40	50
B2	11-May-05	12:03	33	37	53	47	78
B2	25-May-05	15:45	29	33	39	40	61
B2	25-May-05	22:48	33	36	43	44	75
B2	27-May-05	14:47	34	37	52	42	81
B3	10-May-05	2:23	32	34	56	42	83
B3	11-May-05	13:49	45	47	58	60	76

Position	Date	Start Time	Noise Level, dB(A)				
			L_{min}	L_{90}	L_{eq}	L_{10}	L_{max}
B3	25-May-05	15:22	36	40	58	62	76
B3	25-May-05	23:08	37	39	50	51	71
B3	27-May-05	14:28	36	39	54	56	72
B4	10-May-05	2:48	31	33	34	36	47
B4	25-May-05	12:45	30	32	46	42	77
B4	25-May-05	23:45	30	32	35	37	48
B4a	11-May-05	11:12	33	36	65	57	88
B5	10-May-05	3:29	34	36	38	39	58
B5	11-May-05	11:41	33	36	44	45	61
B5	25-May-05	10:50	30	35	50	49	69
B5	26-May-05	0:54	39	41	44	46	55
B6	10-May-05	4:17	33	35	37	37	61
B7	10-May-05	4:38	29	31	45	33	70
B7	11-May-05	9:45	30	32	56	48	80
B7	26-May-05	1:52	37	38	40	41	59
B7	26-May-05	15:38	32	35	54	51	75
B7	27-May-05	13:14	32	35	49	48	71
B8	10-May-05	21:35	32	34	36	37	57
B8	11-May-05	11:26	31	33	40	42	62
B8	25-May-05	11:25	35	38	50	54	65
B8	26-May-05	0:00	35	38	40	42	60
B9	10-May-05	21:58	29	31	32	33	49
B9	25-May-05	12:10	34	36	41	43	52
B9	26-May-05	0:16	24	26	29	30	46
B10	10-May-05	22:35	30	32	42	42	65
B10	11-May-05	9:20	33	37	53	58	67
B11	11-May-05	10:07	33	36	51	48	75
B11	25-May-05	9:50	40	41	60	49	80
B11	26-May-05	1:14	41	44	52	56	58
B11	27-May-05	13:30	31	36	56	58	75
B12	11-May-05	10:29	35	38	60	60	77
B12	25-May-05	10:15	33	38	62	53	84
B12	26-May-05	1:31	35	38	40	42	56
B12	27-May-05	13:48	31	34	60	52	80

Position	Date	Start Time	Noise Level, dB(A)				
			L_{min}	L_{90}	L_{eq}	L_{10}	L_{max}
B13	11-May-05	13:32	37	40	47	49	70
LA2	16-Nov-04	16:21	46	54	71	74	83
LA4	16-Nov-04	18:59	30	33	46	48	66[27]

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Appendix B

Unattended Long-Term Noise Measurement Results

Figure B1 Noise statistics from Location LA1, Lot 5, Pacific Highway, Wednesday 17 to Tues 23, November 2004

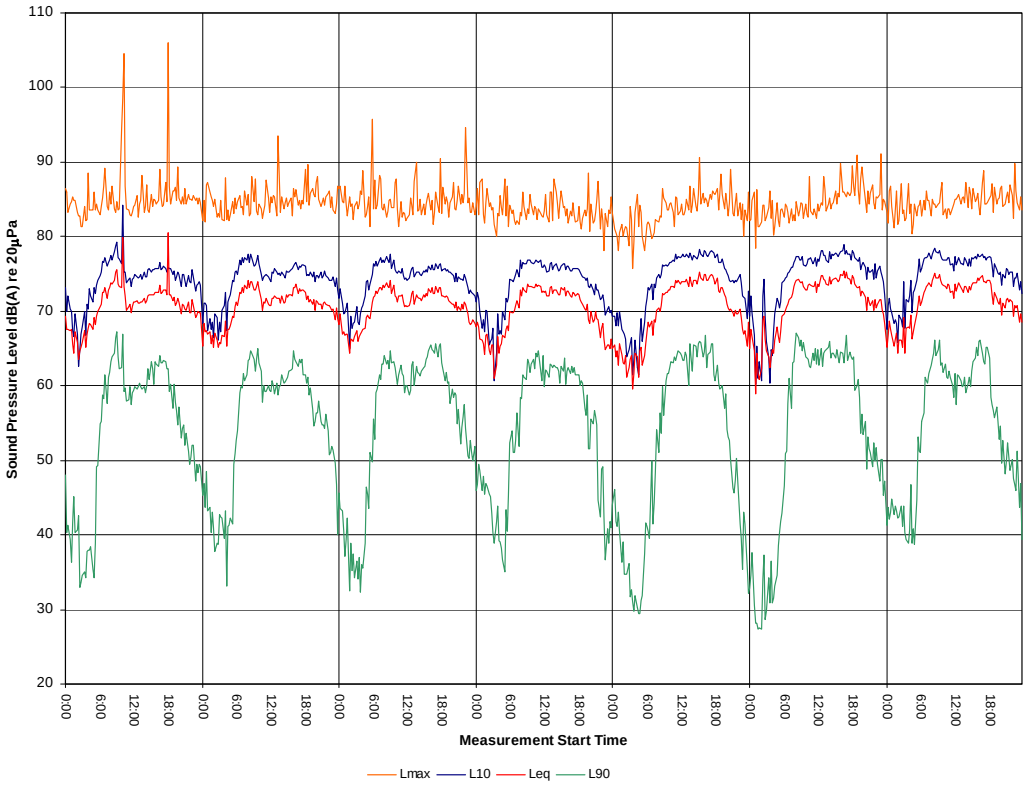


Figure B2 Noise statistics from Location LA1, Lot 5, Pacific Highway, Monday 9 to Sunday 15 May 2005

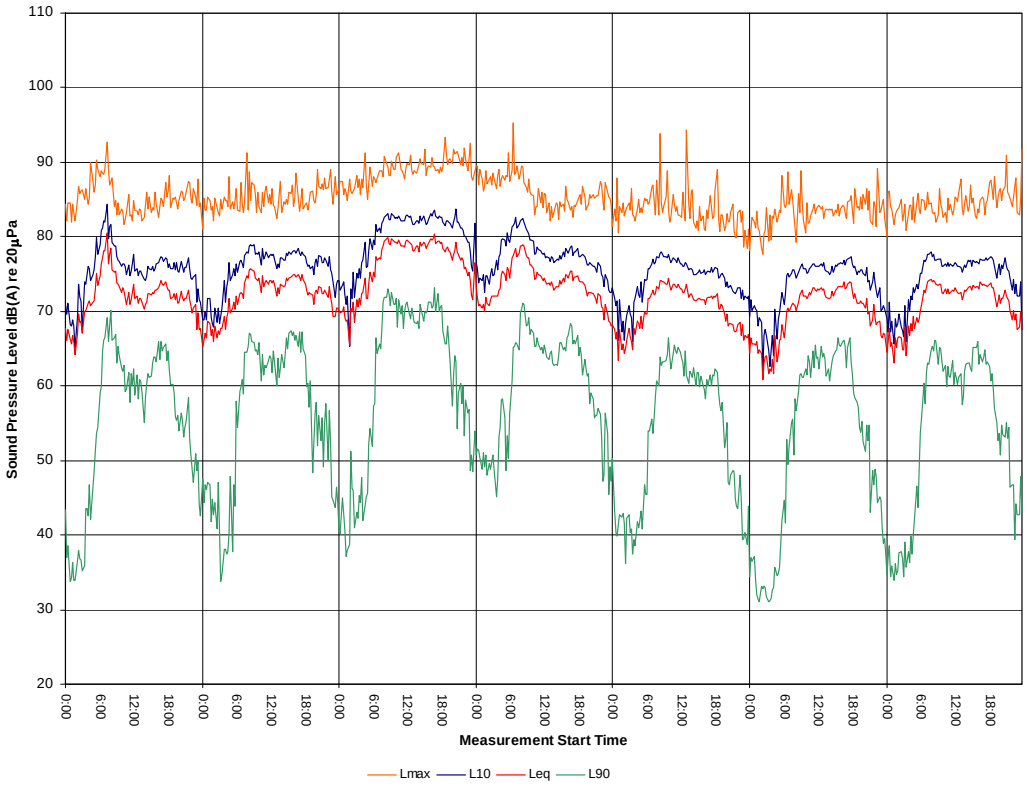


Figure B3 Noise statistics from Location LA1, Lot 5, Pacific Highway, Tuesday 17 to Monday 23 May 2005

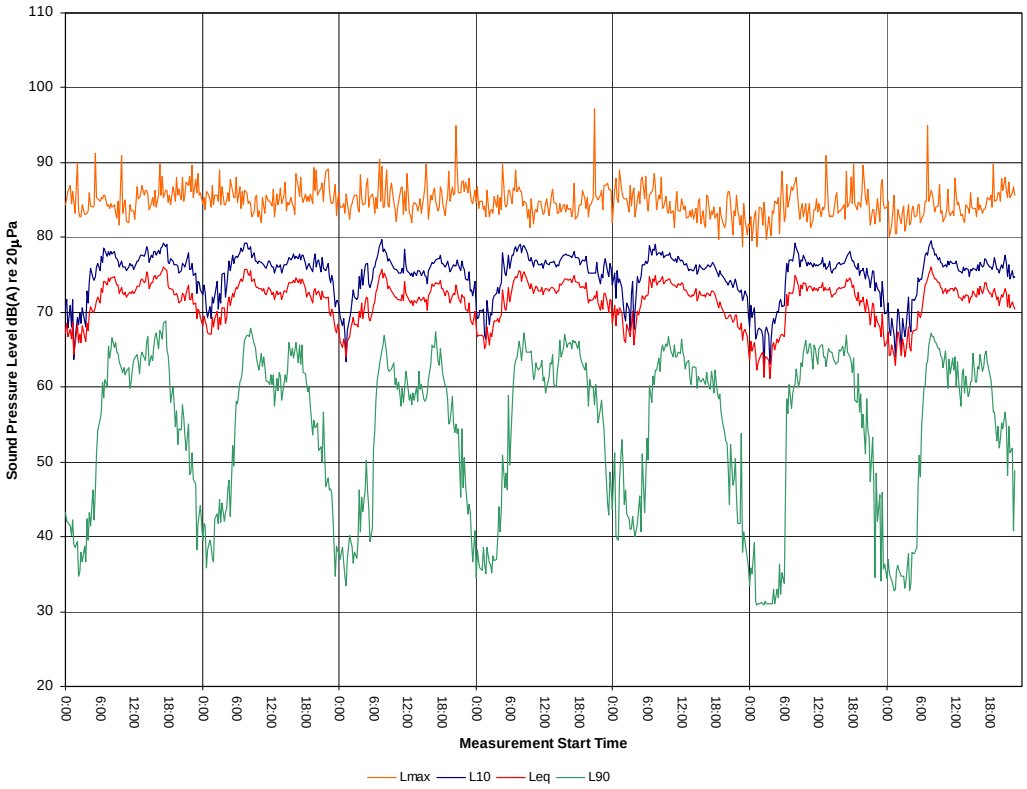


Figure B4 Noise statistics from Location LA2, Kassa Bird's, Pacific Highway, Wednesday 17 to Tues 23, November 2004

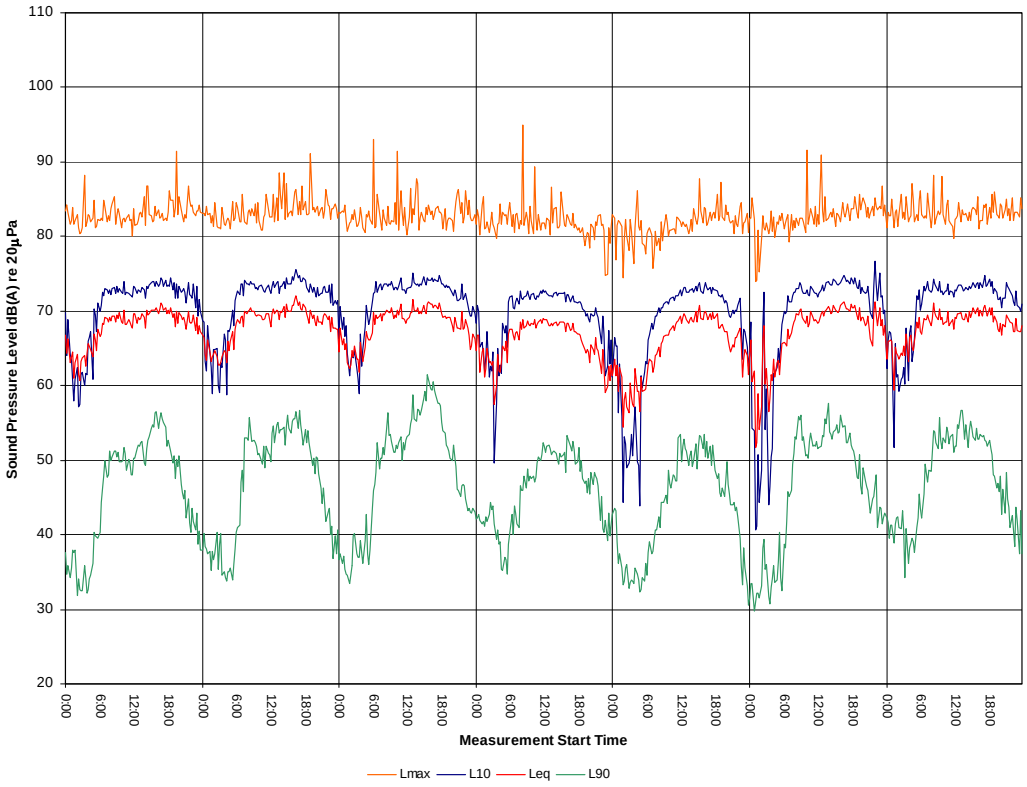


Figure B5 Noise statistics from Location LA3, 44 Martins Lane West, Wednesday 17 to Tues 23, November 2004

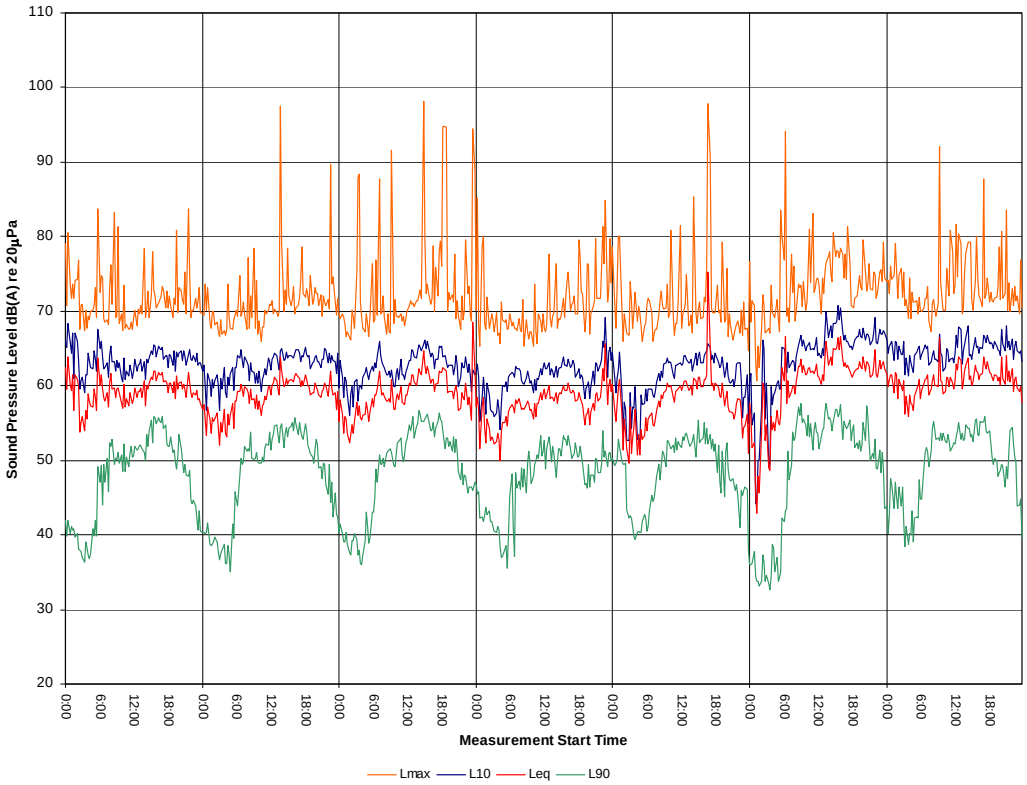


Figure B6 Noise statistics from Location LA3, 44 Martins Lane West, Tuesday 10 to Monday 16 May 2005

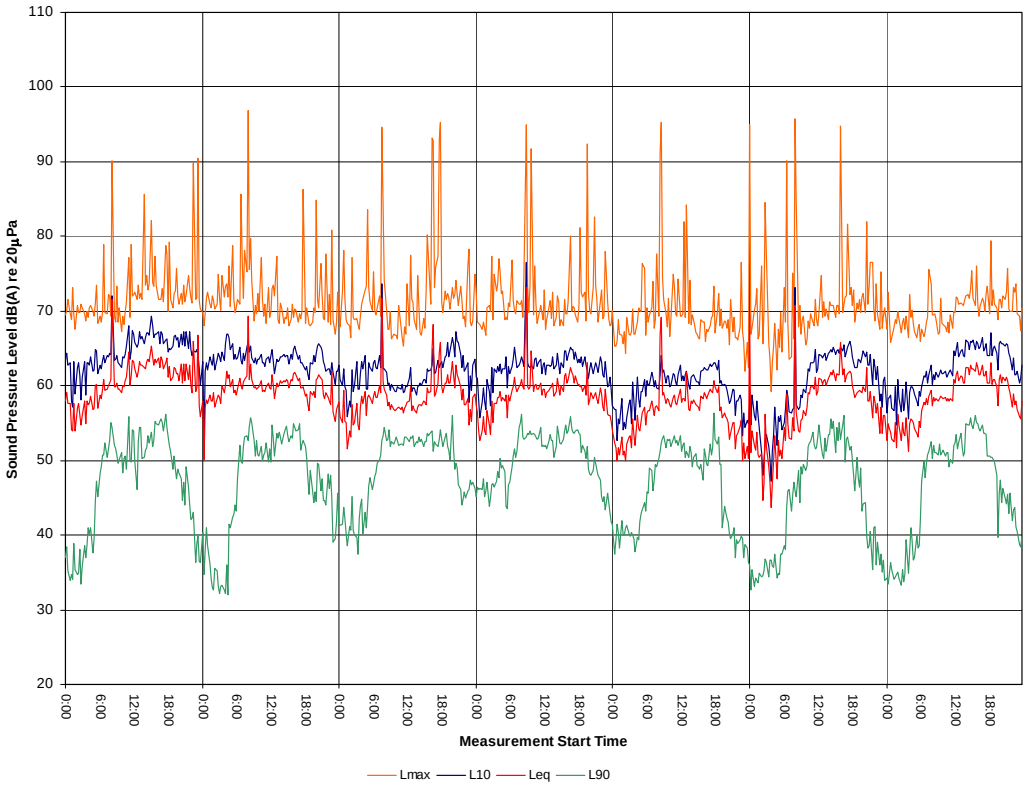


Figure B7 Noise statistics from Location LA3, 44 Martins Lane West, Tuesday 17 to Sunday 22 May 2005

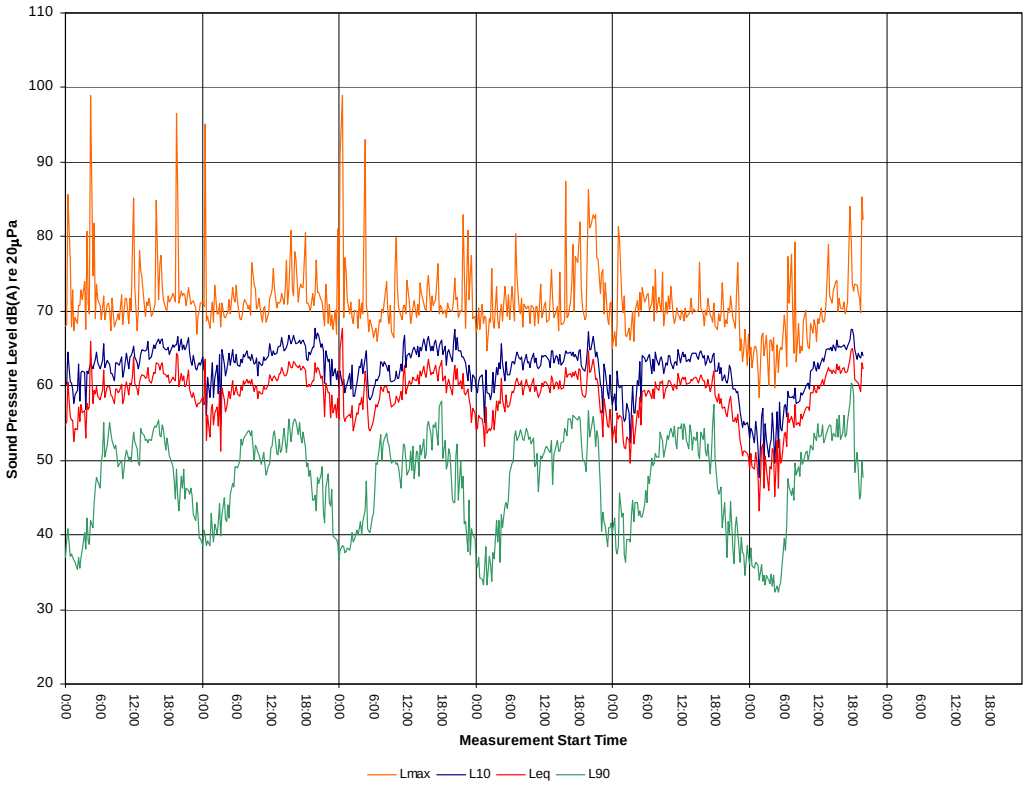


Figure B8 Noise statistics from Location LA4, Tinderbox Road, Bangalow, Wednesday 17 to Tues 23, November 2004

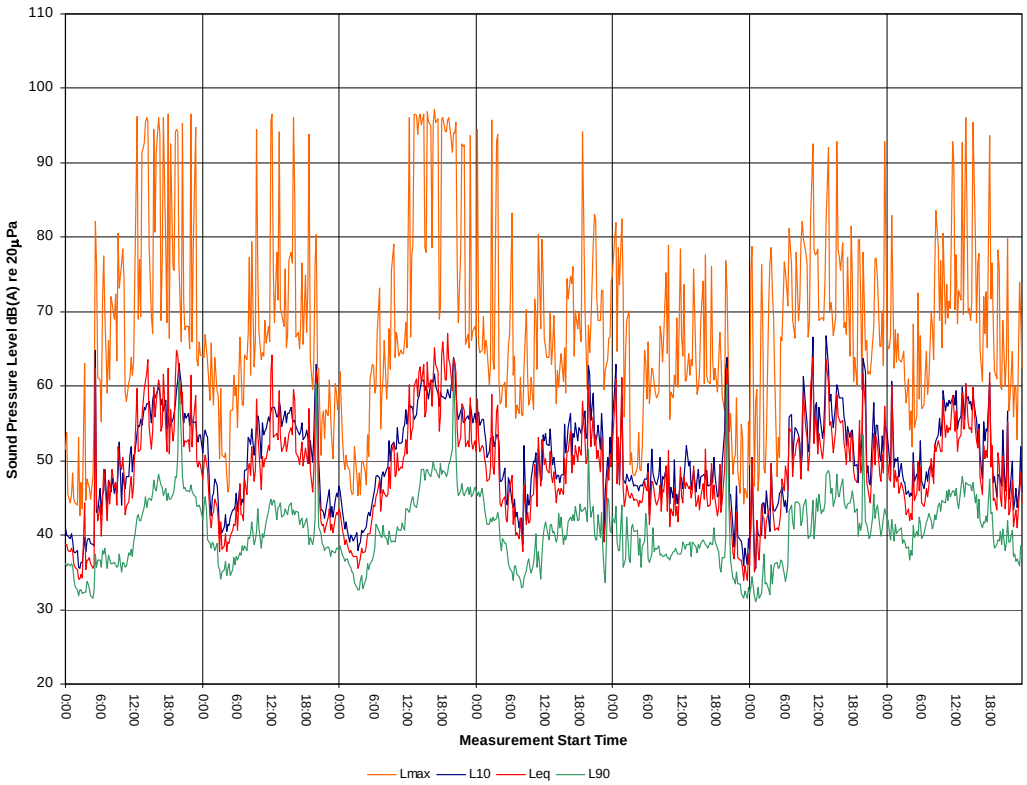


Figure B9 Noise statistics from Location LA2, Kassa Bird's, Pacific Highway, Wednesday 17 to Tues 23, November 2004

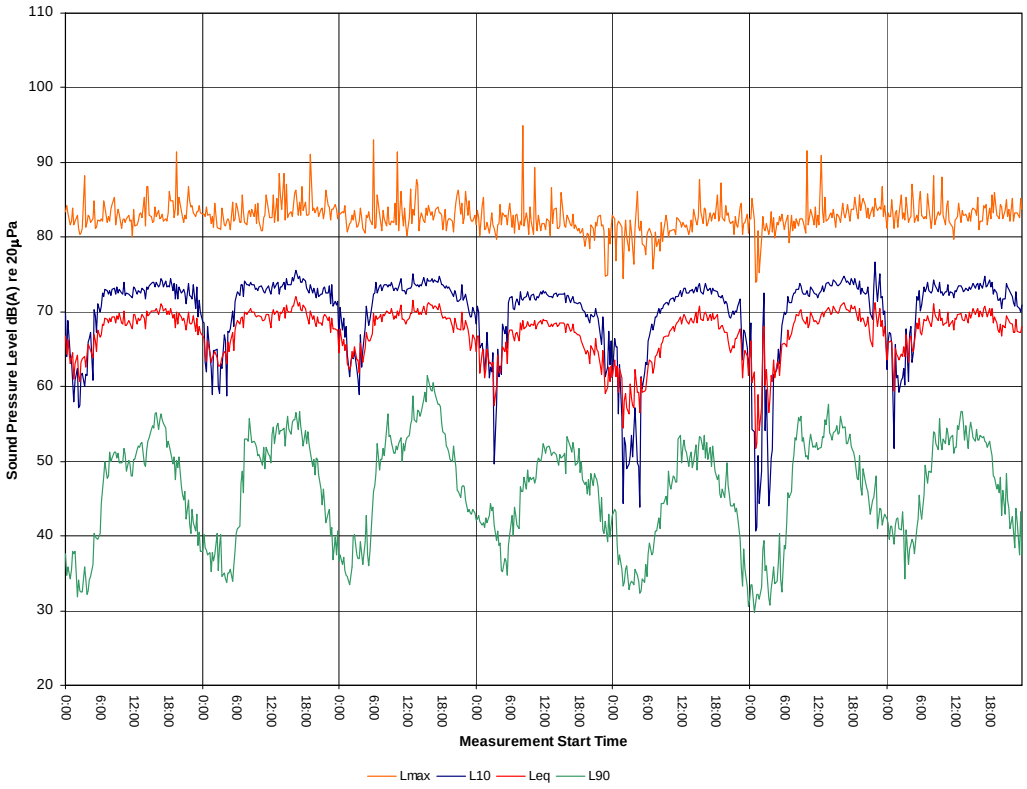


Figure B10 Noise statistics from Location LB1, 594 Bangalow Road, Tuesday 10 May to Mon 16 May 2005

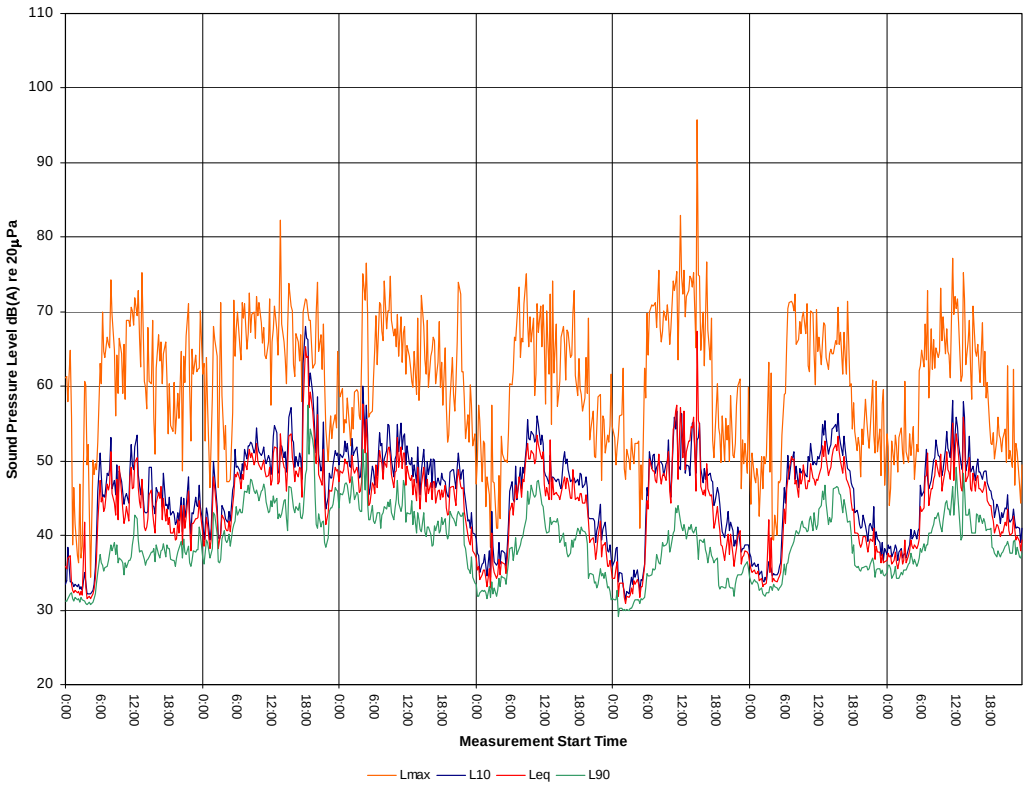


Figure B11 Noise statistics from Location LB1, 594 Bangalow Road, Tuesday 17 May to Thursday 19 May 2005

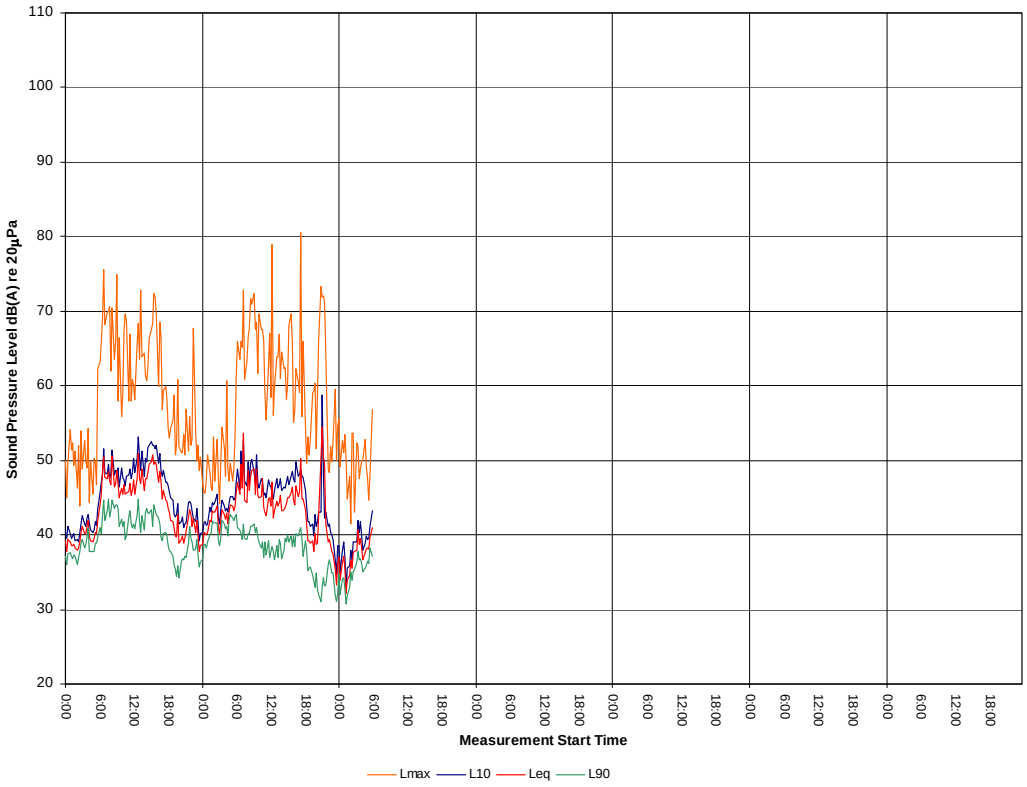


Figure B12 Noise statistics from Location LB2, 136 Midgen Flat Road, Tuesday 10 May to Mon 16 May 2005

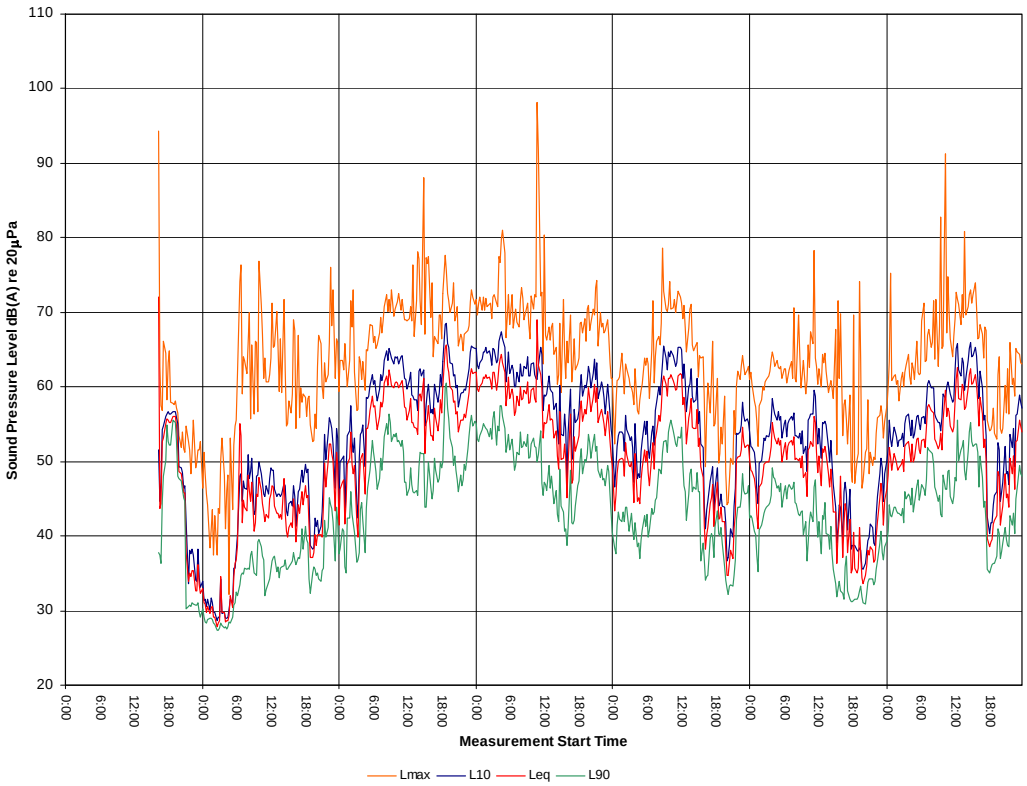


Figure B13 Noise statistics from Location LB2, 136 Midgen Flat Road, Tuesday 17 May to Sun 22 May 2005

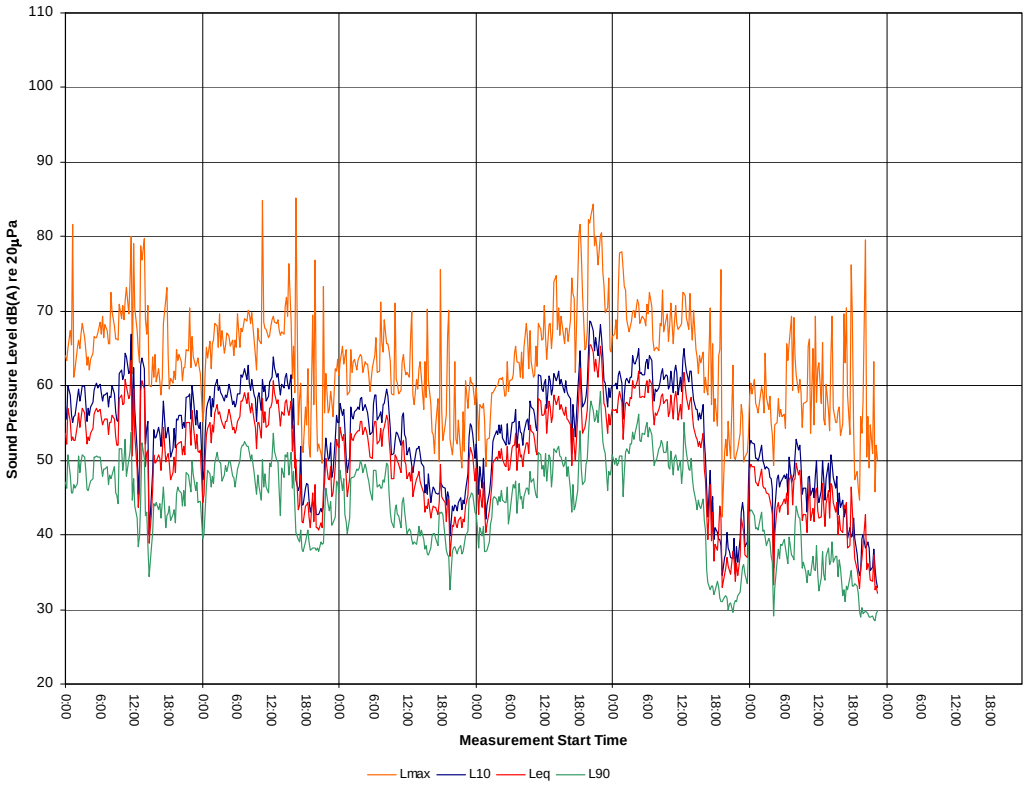


Figure B14 Noise statistics from Location LB3, 172 Martins Lane East, Tuesday 10 May to Mon 16 May 2005

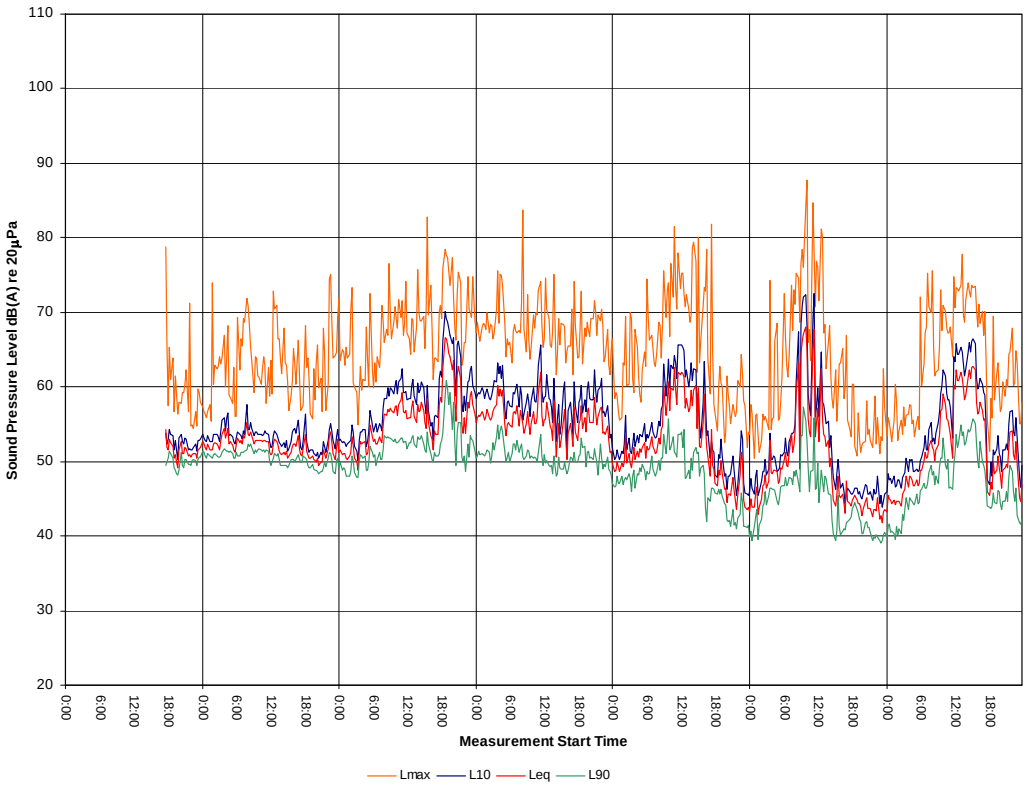
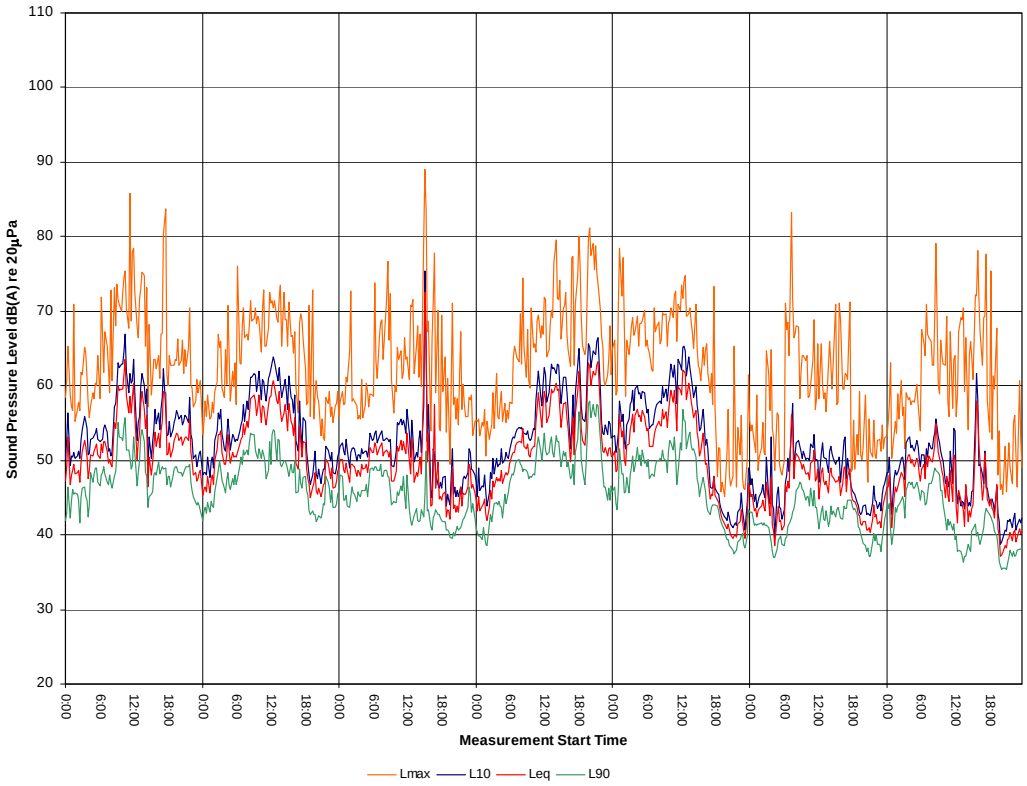


Figure B15 Noise statistics from Location LB3, 172 Martins Lane East, Tuesday 17 May to Mon 23 May 2005



Arup**Acoustics**

Appendix C

Single Point Receiver Noise Level Predictions

Receiver No.	Future Existing (2012) Noise Level, dB(A)		Type of development	Criteria, dB(A)		Base Case						Mitigated Case						Maximum Noise Level [illegible] level development 2012 dB(A)		Maximum noise level – Minimum noise level
						Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required	Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required			
	Day	Night		Day	Night	Day	Night	Day	Night	Day	Night		Day	Night	Day	Night	Day	Night				
59-HO1	51.0	47.5	new road	55.0	50.0	49.5	46.0	50.5	46.5	-0.5	-1.0		49.5	46.0	50.5	46.5	-0.5	-1.0		68	42	26
65-HO1	47.0	44.0	new road	55.0	50.0	45.5	42.5	46.5	43.0	-0.5	-1.0		45.5	42.5	46.5	43.0	-0.5	-1.0		63	39	Lmax < 65
72-HO1	61.0	55.5	new road	61.5	56.0	58.5	52.5	59.0	53.0	-2.0	-2.5		58.5	52.5	59.0	53.0	-2.0	-2.5		86	45	42
73-HO1	52.0	48.0	new road	55.0	50.0	50.0	46.0	51.0	47.0	-1.0	-1.0		50.0	46.0	51.0	47.0	-1.0	-1.0		72	42	29
79-HO1	53.5	49.0	new road	55.0	50.0	52.0	47.5	53.0	48.0	-0.5	-1.0		52.0	47.5	53.0	48.0	-0.5	-1.0		79	43	36
80-HO1	63.0	57.0	new road	63.5	57.5	60.5	54.5	61.5	55.5	-1.5	-1.5		60.5	54.5	61.5	55.5	-1.5	-1.5		88	47	41
81-HO1	70.5	69.0	new road	71.0	69.5	60.5	54.5	61.5	56.0	-9.0	-13.0		60.5	54.5	61.5	56.0	-9.0	-13.0		91	53	38
82-HO1	63.5	57.5	new road	64.0	58.0	61.5	55.5	62.0	56.0	-1.5	-1.5		61.5	55.5	62.0	56.0	-1.5	-1.5		90	47	43
85-HO1	60.0	58.0	new road	60.5	58.5	55.0	52.5	56.0	53.5	-4.0	-4.5		55.0	52.5	56.0	53.5	-4.0	-4.5		75	50	25
86-HO1	50.5	45.0	new road	55.0	50.0	48.5	43.5	49.5	44.5	-1.0	-0.5		48.5	43.5	49.5	44.5	-1.0	-0.5		72	38	34
87-HO1	61.5	55.5	new road	62.0	56.0	59.5	53.5	60.0	54.0	-1.5	-1.5		59.5	53.5	60.0	54.0	-1.5	-1.5		87	45	42
88-HO1	54.5	51.5	new road	55.0	52.0	53.5	50.5	54.5	51.0	0.0	-0.5		53.5	50.5	54.5	51.0	0.0	-0.5		72	47	25
93-HO1	57.5	52.0	new road	58.0	52.5	55.5	50.5	56.5	51.0	-1.0	-1.0		55.5	50.5	56.5	51.0	-1.0	-1.0		81	44	37
94-HO1	68.0	66.0	new road	68.5	66.5	60.5	57.5	61.5	58.5	-6.5	-7.5		60.5	57.5	61.5	58.5	-6.5	-7.5		87	55	32
98-HO1	51.0	45.0	new road	55.0	50.0	48.0	43.0	49.0	43.5	-2.0	-1.5		48.0	43.0	49.0	43.5	-2.0	-1.5		73	38	35
98-HO2	52.0	48.0	new road	55.0	50.0	50.0	47.0	51.0	48.0	-1.0	0.0		50.0	47.0	51.0	48.0	-1.0	0.0		70	44	26
99-HO1	67.0	60.5	new road	67.5	61.0	64.5	58.0	**65.5**	59.0	-1.5	-1.5	acute	64.5	58.0	**65.5**	59.0	-1.5	-1.5	acute	92	50	42
102-HO1	68.5	61.5	new road	69.0	62.0	**66.0**	59.0	**67.0**	59.5	-1.5	-2.0	acute	**66.0**	59.0	**67.0**	59.5	-1.5	-2.0	acute	94	51	44
106-HO1	64.5	59.5	new road	65.0	60.0	62.5	57.5	63.0	58.0	-1.5	-1.5		62.5	57.5	63.0	58.0	-1.5	-1.5		89	52	37
109-HO1	60.0	55.0	new road	60.5	55.5	58.0	53.5	59.0	54.5	-1.0	-0.5		58.0	53.5	59.0	54.5	-1.0	-0.5		82	49	33
110-HO1	67.0	65.5	new road	67.5	66.0	59.5	55.5	60.5	56.5	-6.5	-9.0		59.5	55.5	60.5	56.5	-6.5	-9.0		85	53	32
113-HO1	73.5	65.0	new road	74.0	65.5	**69.5**	**61.5**	**70.5**	**62.5**	-3.0	-2.5	acute	**69.5**	**61.5**	**70.5**	**62.5**	-3.0	-2.5	acute	97	55	43
121-HO1	67.0	65.5	new road	67.5	66.0	**65.0**	**62.0**	**65.5**	**63.0**	-1.5	-2.5	acute	**65.0**	**62.0**	**65.5**	**63.0**	-1.5	-2.5	acute	86	59	26
121-HO2	68.5	66.5	new road	69.0	67.0	**65.0**	**62.5**	**66.0**	**63.5**	-2.5	-3.0	acute	**65.0**	**62.5**	**66.0**	**63.5**	-2.5	-3.0	acute	87	59	28
122-HO1	54.5	52.0	new road	55.0	52.5	54.0	51.0	54.5	52.0	0.0	0.0		54.0	51.0	54.5	52.0	0.0	0.0		70	48	22

Receiver No.	Future Existing (2012) Noise Level, dB(A)		Type of development	Criteria, dB(A)		Base Case						Mitigated Case						Maximum Noise Level [illegible] level development 2012 dB(A)		Maximum noise level – Minimum noise level
						Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required	Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required			
	Day	Night		Day	Night	Day	Night	Day	Night	Day	Night		Day	Night	Day	Night	Day	Night				
125-HO1	64.0	62.5	new road	64.5	63.0	62.5	**60.0**	63.5	**61.0**	-0.5	-1.5	acute	62.5	**60.0**	63.5	**61.0**	-0.5	-1.5	acute	83	57	26
127-HO1	51.5	49.5	new road	55.0	50.0	52.0	49.5	52.5	50.5	1.0	1.0	new road, >0.5 dB increase	52.0	49.5	52.5	50.5	1.0	1.0	new road, >0.5 dB increase	67	47	20
128-HO1	51.0	49.0	new road	55.0	50.0	49.5	47.0	50.5	48.0	-0.5	-1.0		49.5	47.0	50.5	48.0	-0.5	-1.0		63	44	Lmax < 65
128-HO2	45.5	43.0	new road	55.0	50.0	45.5	43.0	46.0	43.5	0.5	0.5		45.5	43.0	46.0	43.5	0.5	0.5		61	40	Lmax < 65
129-HO1	63.5	61.5	new road	64.0	62.0	**69.0**	**67.0**	**70.0**	**67.5**	6.5	6.0	acute	**69.0**	**67.0**	**70.0**	**67.5**	6.5	6.0	acute	85	64	21
132-HO1	67.0	65.0	new road	67.5	65.5	**66.0**	**63.5**	**66.5**	**64.5**	-0.5	-0.5	acute	**66.0**	**63.5**	**66.5**	**64.5**	-0.5	-0.5	acute	84	61	24
137-HO1	64.0	62.5	new road	64.5	63.0	61.5	59.0	62.5	**60.0**	-1.5	-2.5	acute	61.5	59.0	62.5	**60.0**	-1.5	-2.5	acute	82	56	26
141-HO1	57.5	56.0	new road	58.0	56.5	62.0	**60.5**	62.5	**61.5**	5.0	5.5	acute	62.0	**60.5**	62.5	**61.5**	5.0	5.5	acute	77	58	19
142-HO1	56.0	54.0	new road	56.5	54.5	53.5	51.0	54.5	52.0	-1.5	-2.0		53.5	51.0	54.5	52.0	-1.5	-2.0		71	48	23
146-HO1	68.0	66.0	new road	68.5	66.5	62.5	59.0	63.5	**60.0**	-4.5	-6.0	acute	62.5	59.0	63.5	**60.0**	-4.5	-6.0	acute	87	56	31
149-HO1	70.5	69.0	new road	71.0	69.5	**65.5**	**62.5**	**66.5**	**63.5**	-4.0	-5.5	acute	**65.5**	**62.5**	**66.5**	**63.5**	-4.0	-5.5	acute	90	60	30
154-HO1	50.5	48.5	new road	55.0	50.0	51.5	49.5	52.5	50.5	2.0	2.0	new road, >0.5 dB increase	51.5	49.5	52.5	50.5	2.0	2.0	new road, >0.5 dB increase	62	47	Lmax < 65
155-HO1	60.0	58.5	new road	60.5	59.0	**69.5**	**68.0**	**70.5**	**69.0**	10.5	10.5	acute	**69.5**	**68.0**	**70.5**	**69.0**	10.5	10.5	acute	87	65	22
157-HO1	57.0	55.0	new road	57.5	55.5	54.0	51.5	55.0	52.5	-2.0	-2.5		54.0	51.5	55.0	52.5	-2.0	-2.5		72	49	23
158-HO1	65.5	64.0	new road	66.0	64.5	61.5	59.0	62.5	**60.0**	-3.0	-4.0	acute	61.5	59.0	62.5	**60.0**	-3.0	-4.0	acute	82	56	26
161-HO1	49.5	47.5	new road	55.0	50.0	51.5	49.5	52.5	50.5	3.0	3.0	new road, >0.5 dB increase	51.5	49.5	52.5	50.5	3.0	3.0	new road, >0.5 dB increase	62	47	Lmax < 65
161-HO2	50.5	49.0	new road	55.0	50.0	53.0	51.0	54.0	52.0	3.5	3.0	new road, >0.5 dB increase	53.0	51.0	54.0	52.0	3.5	3.0	new road, >0.5 dB increase	64	48	Lmax < 65
163-HO1	48.0	46.5	new road	55.0	50.0	44.5	42.0	45.5	43.0	-2.5	-3.5		44.5	42.0	45.5	43.0	-2.5	-3.5		65	39	Lmax < 65
165-HO1	59.0	57.5	new road	59.5	58.0	55.5	53.0	56.5	54.0	-2.5	-3.5		55.5	53.0	56.5	54.0	-2.5	-3.5		76	50	25
166-HO1	56.0	54.5	new road	56.5	55.0	52.0	49.0	53.0	50.0	-3.0	-4.5		52.0	49.0	53.0	50.0	-3.0	-4.5		71	46	25
167-HO1	66.5	64.5	new road	67.0	65.0	60.0	57.0	61.0	58.0	-5.5	-6.5		60.0	57.0	61.0	58.0	-5.5	-6.5		83	54	28
168-HO1	44.5	43.0	new road	55.0	50.0	47.5	45.0	48.0	46.0	3.5	3.0		47.5	45.0	48.0	46.0	3.5	3.0		57	42	Lmax < 65
170-HO1	60.0	58.5	new road	60.5	59.0	55.5	53.0	56.5	54.0	-3.5	-4.5		55.5	53.0	56.5	54.0	-3.5	-4.5		78	50	28
175-HO1	60.5	58.5	new road	61.0	59.0	**69.0**	**67.5**	**70.0**	**68.5**	9.5	10.0	acute	**69.0**	**67.5**	**70.0**	**68.5**	9.5	10.0	acute	87	65	22

Receiver No.	Future Existing (2012) Noise Level, dB(A)		Type of development	Criteria, dB(A)		Base Case						Mitigated Case						Maximum Noise Level minimum noise level development 2012 dB(A)		Maximum noise level – Minimum noise level
						Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required	Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required			
	Day	Night		Day	Night	Day	Night	Day	Night	Day	Night		Day	Night	Day	Night	Day	Night				
175-HO2	54.0	52.0	new road	55.0	52.5	59.0	57.0	60.0	58.0	6.0	6.0	new road, >0.5 dB increase	59.0	57.0	60.0	58.0	6.0	6.0	new road, >0.5 dB increase	70	54	16
178-HO1	59.0	57.5	new road	59.5	58.0	54.0	51.0	55.0	52.0	-4.0	-5.5		54.0	51.0	55.0	52.0	-4.0	-5.5		78	49	30
183-HO1	72.5	70.5	new road	73.0	71.0	**65.0**	**61.0**	**66.0**	**62.5**	-6.5	-8.0	acute	**65.0**	**61.0**	**66.0**	**62.5**	-6.5	-8.0	acute	91	59	33
184-HO1	69.5	68.0	new road	70.0	68.5	62.0	58.5	63.0	**60.0**	-6.5	-8.0	acute	62.0	58.5	63.0	**60.0**	-6.5	-8.0	acute	90	56	33
184-HO2	70.5	69.0	new road	71.0	69.5	62.5	58.5	63.5	59.5	-7.0	-9.5		62.5	58.5	63.5	59.5	-7.0	-9.5		89	56	33
185-HO1	67.5	66.0	new road	68.0	66.5	**67.0**	**65.0**	**68.0**	**66.0**	0.5	0.0	acute	**67.0**	**65.0**	**68.0**	**66.0**	0.5	0.0	acute	86	62	24
186-HO1	73.0	71.0	new road	73.5	71.5	**66.0**	**64.0**	**67.0**	**65.0**	-6.0	-6.0	acute	**66.0**	**64.0**	**67.0**	**65.0**	-6.0	-6.0	acute	92	61	31
188-HO1	73.0	71.0	new road	73.5	71.5	**65.0**	**61.0**	**66.0**	**62.0**	-7.0	-9.0	acute	**65.0**	**61.0**	**66.0**	**62.0**	-7.0	-9.0	acute	92	59	33
190-HO1	63.5	62.0	new road	64.0	62.5	**70.0**	**68.5**	**71.0**	**69.5**	7.5	7.5	acute	**70.0**	**68.5**	**71.0**	**69.5**	7.5	7.5	acute	87	66	21
192-HO1	57.5	55.5	new road	58.0	56.0	61.5	59.5	62.5	**60.5**	5.0	5.0	acute	61.5	59.5	62.5	**60.5**	5.0	5.0	acute	72	57	15
194-HO1	74.0	72.0	new road	74.5	72.5	64.0	**61.0**	**65.0**	**62.0**	-9.0	-10.0	acute	64.0	**61.0**	**65.0**	**62.0**	-9.0	-10.0	acute	94	58	36
196-HO1	70.0	68.5	new road	70.5	69.0	61.5	58.0	62.5	59.0	-7.5	-9.5		61.5	58.0	62.5	59.0	-7.5	-9.5		89	56	33
196-HO2	41.5	40.0	new road	55.0	50.0	40.0	37.5	41.0	38.5	-0.5	-1.5		40.0	37.5	41.0	38.5	-0.5	-1.5		56	35	Lmax < 65
199-HO1	42.5	41.0	new road	55.0	50.0	40.5	38.0	41.5	39.0	-1.0	-2.0		40.5	38.0	41.5	39.0	-1.0	-2.0		61	35	Lmax < 65
204-HO1	60.0	58.5	new road	60.5	59.0	**65.0**	**63.0**	**66.0**	**64.0**	6.0	5.5	acute	**65.0**	**63.0**	**66.0**	**64.0**	6.0	5.5	acute	78	60	18
204-HO2	61.0	59.0	new road	61.5	59.5	**65.0**	**63.5**	**66.0**	**64.5**	5.0	5.5	acute	**65.0**	**63.5**	**66.0**	**64.5**	5.0	5.5	acute	84	61	23
206-HO1	47.0	45.0	new road	55.0	50.0	45.5	43.0	46.5	44.0	-0.5	-1.0		45.5	43.0	46.5	44.0	-0.5	-1.0		54	40	Lmax < 65
209-HO1	70.0	68.0	new road	70.5	68.5	61.5	57.5	62.5	59.0	-7.5	-9.0		61.5	57.5	62.5	59.0	-7.5	-9.0		89	55	33
211-HO1	50.0	48.0	new road	55.0	50.0	44.5	41.5	45.5	42.5	-4.5	-5.5		44.5	41.5	45.5	42.5	-4.5	-5.5		62	39	Lmax < 65
214-HO1	48.5	47.0	new road	55.0	50.0	42.5	39.5	43.5	40.5	-5.0	-6.5		42.5	39.5	43.5	40.5	-5.0	-6.5		61	37	Lmax < 65
221-HO1	49.5	47.5	new road	55.0	50.0	43.0	39.5	44.0	41.0	-5.5	-6.5		43.0	39.5	44.0	41.0	-5.5	-6.5		61	37	Lmax < 65
224-HO1	48.5	47.0	new road	55.0	50.0	49.0	47.0	49.5	48.0	1.0	1.0		49.0	47.0	49.5	48.0	1.0	1.0		65	44	Lmax < 65
227-HO1	61.0	59.5	new road	61.5	60.0	57.0	54.5	58.0	55.5	-3.0	-4.0		57.0	54.5	58.0	55.5	-3.0	-4.0		77	52	26
230-HO1	69.0	67.5	new road	69.5	68.0	61.5	58.0	62.5	59.0	-6.5	-8.5		61.5	58.0	62.5	59.0	-6.5	-8.5		88	56	32
231-HO1	61.5	59.5	new road	62.0	60.0	64.5	**63.0**	**65.5**	**64.0**	4.0	4.5	acute	64.5	**63.0**	**65.5**	**64.0**	4.0	4.5	acute	83	60	23
233-HO1	53.0	52.0	new road	55.0	52.5	46.0	43.0	47.0	44.0	-6.0	-8.0		46.0	43.0	47.0	44.0	-6.0	-8.0		70	41	30

Receiver No.	Future Existing (2012) Noise Level, dB(A)		Type of development	Criteria, dB(A)		Base Case						Mitigated Case						Maximum Noise Level [illegible] level development 2012 dB(A)		Maximum noise level – Minimum noise level
						Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required	Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required			
	Day	Night		Day	Night	Day	Night	Day	Night	Day	Night		Day	Night	Day	Night	Day	Night				
237-HO1	62.0	61.0	new road	62.5	61.5	54.0	50.5	55.0	51.5	-7.0	-9.5		54.0	50.5	55.0	51.5	-7.0	-9.5		81	48	33
238-HO1	68.0	67.0	new road	68.5	67.5	**68.0**	**66.5**	**69.0**	**67.0**	1.0	0.0	acute	**68.0**	**66.5**	**69.0**	**67.0**	1.0	0.0	acute	89	63	25
238-HO2	75.5	73.0	new road	76.0	73.5	**67.0**	**65.0**	**68.0**	**66.0**	-7.5	-7.0	acute	**67.0**	**65.0**	**68.0**	**66.0**	-7.5	-7.0	acute	95	62	33
241-HO1	51.0	49.0	new road	55.0	50.0	53.0	51.0	54.0	52.0	3.0	3.0	new road, >0.5 dB increase	53.0	51.0	54.0	52.0	3.0	3.0	new road, >0.5 dB increase	64	48	Lmax < 65
242-HO1	61.5	60.0	new road	62.0	60.5	55.0	51.5	56.0	52.5	-5.5	-7.5		55.0	51.5	56.0	52.5	-5.5	-7.5		80	49	31
248-HO1	68.0	66.5	new road	68.5	67.0	60.0	56.0	61.0	57.5	-7.0	-9.0		60.0	56.0	61.0	57.5	-7.0	-9.0		89	54	35
249-HO1	55.5	53.5	new road	56.0	54.0	58.5	56.5	59.5	57.5	4.0	4.0	new road, >0.5 dB increase	58.5	56.5	59.5	57.5	4.0	4.0	new road, >0.5 dB increase	69	54	15
252-HO1	63.5	62.0	new road	64.0	62.5	58.0	55.5	59.0	56.5	-4.5	-5.5		58.0	55.5	59.0	56.5	-4.5	-5.5		81	53	28
253-HO1	64.0	62.0	new road	64.5	62.5	62.0	**60.5**	63.0	**61.0**	-1.0	-1.0	acute	62.0	**60.5**	63.0	**61.0**	-1.0	-1.0	acute	79	58	22
254-HO1	70.5	69.0	new road	71.0	69.5	62.5	58.5	63.5	59.5	-7.0	-9.5		62.5	58.5	63.5	59.5	-7.0	-9.5		89	56	33
255-HO1	58.0	56.0	new road	58.5	56.5	56.0	53.5	57.0	54.5	-1.0	-1.5		56.0	53.5	57.0	54.5	-1.0	-1.5		73	51	22
256-HO1	63.5	62.0	new road	64.0	62.5	58.5	56.0	59.5	57.0	-4.0	-5.0		58.5	56.0	59.5	57.0	-4.0	-5.0		79	53	26
257-HO1	61.0	59.0	new road	61.5	59.5	57.0	54.5	58.0	55.5	-3.0	-3.5		57.0	54.5	58.0	55.5	-3.0	-3.5		75	52	23
259-HO1	52.5	51.0	new road	55.0	51.5	51.5	49.0	52.5	50.0	0.0	-1.0		51.5	49.0	52.5	50.0	0.0	-1.0		63	46	Lmax < 65
260-HO1	60.5	58.5	new road	61.0	59.0	64.5	**62.5**	**65.0**	**63.5**	4.5	5.0	acute	64.5	**62.5**	**65.0**	**63.5**	4.5	5.0	acute	79	60	20
264-HO1	58.0	56.0	new road	58.5	56.5	**69.0**	**67.5**	**70.0**	**68.5**	12.0	12.5	acute	**69.0**	**67.5**	**70.0**	**68.5**	12.0	12.5	acute	87	65	22
266-HO1	62.0	60.5	new road	62.5	61.0	61.5	**60.0**	62.5	**60.5**	0.5	0.0	acute	61.5	**60.0**	62.5	**60.5**	0.5	0.0	acute	85	57	28
268-HO1	41.5	39.5	new road	55.0	50.0	42.0	39.5	42.5	40.5	1.0	1.0		42.0	39.5	42.5	40.5	1.0	1.0		50	37	Lmax < 65
269-HO1	59.5	57.5	new road	60.0	58.0	**66.0**	**64.5**	**67.0**	**65.5**	7.5	8.0	acute	**66.0**	**64.5**	**67.0**	**65.5**	7.5	8.0	acute	81	62	19
270-HO1	72.0	70.0	new road	72.5	70.5	63.0	58.5	64.5	59.5	-7.5	-10.5		63.0	58.5	64.5	59.5	-7.5	-10.5		91	56	35
272-HO1	60.0	58.0	new road	60.5	58.5	56.0	53.0	57.0	54.0	-3.0	-4.0		56.0	53.0	57.0	54.0	-3.0	-4.0		74	50	24
273-HO1	61.5	60.0	new road	62.0	60.5	56.5	53.5	57.5	54.5	-4.0	-5.5		56.5	53.5	57.5	54.5	-4.0	-5.5		76	51	26
275-HO1	63.5	62.0	new road	64.0	62.5	57.5	55.0	59.0	56.0	-4.5	-6.0		57.5	55.0	59.0	56.0	-4.5	-6.0		79	52	27
276-HO1	57.5	55.5	new road	58.0	56.0	54.5	52.0	55.5	53.0	-2.0	-2.5		54.5	52.0	55.5	53.0	-2.0	-2.5		71	49	22
277-HO1	71.5	70.0	new road	72.0	70.5	62.5	58.5	63.5	59.5	-8.0	-10.5		62.5	58.5	63.5	59.5	-8.0	-10.5		89	56	34

Receiver No.	Future Existing (2012) Noise Level, dB(A)		Type of development	Criteria, dB(A)		Base Case						Mitigated Case						Maximum Noise Level [illegible] level development 2012 dB(A)		Maximum noise level – Minimum noise level
						Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required	Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required			
	Day	Night		Day	Night	Day	Night	Day	Night	Day	Night		Day	Night	Day	Night	Day	Night				
280-HO1	54.0	52.5	new road	55.0	53.0	52.5	50.5	53.5	51.5	-0.5	-1.0		52.5	50.5	53.5	51.5	-0.5	-1.0		67	47	20
283-HO1	57.0	55.0	new road	57.5	55.5	55.5	53.0	56.5	54.0	-0.5	-1.0		55.5	53.0	56.5	54.0	-0.5	-1.0		68	50	18
286-HO1	54.5	52.5	new road	55.0	53.0	54.0	52.0	55.0	53.0	0.5	0.5		54.0	52.0	55.0	53.0	0.5	0.5		66	49	17
291-HO1	64.0	62.5	new road	64.5	63.0	61.0	59.0	62.0	**60.0**	-2.0	-2.5	acute	61.0	59.0	62.0	**60.0**	-2.0	-2.5	acute	83	56	26
292-HO1	48.5	47.0	new road	55.0	50.0	49.0	47.0	50.0	48.0	1.5	1.0		49.0	47.0	50.0	48.0	1.5	1.0		62	44	Lmax < 65
296-HO1	62.5	61.0	new road	63.0	61.5	58.5	56.5	59.5	57.5	-3.0	-3.5		58.5	56.5	59.5	57.5	-3.0	-3.5		75	53	22
296-HO2	61.0	59.0	new road	61.5	59.5	54.5	52.0	55.5	53.0	-5.5	-6.0		54.5	52.0	55.5	53.0	-5.5	-6.0		77	49	28
299-HO1	48.0	46.0	new road	55.0	50.0	47.5	45.5	48.5	46.5	0.5	0.5		47.5	45.5	48.5	46.5	0.5	0.5		62	43	Lmax < 65
304-HO1	51.5	49.5	new road	55.0	50.0	49.5	47.5	50.5	48.5	-1.0	-1.0		49.5	47.5	50.5	48.5	-1.0	-1.0		65	45	21
307-HO1	61.0	59.0	new road	61.5	59.5	57.5	55.5	58.5	56.0	-2.5	-3.0		57.5	55.5	58.0	56.0	-3.0	-3.0		74	52	21
308-HO1	50.0	48.5	new road	55.0	50.0	48.0	46.0	49.0	47.0	-1.0	-1.5		48.0	46.0	49.0	47.0	-1.0	-1.5		64	43	Lmax < 65
310-HO1	49.5	47.5	new road	55.0	50.0	47.0	45.0	48.0	46.0	-1.5	-1.5		47.0	45.0	48.0	46.0	-1.5	-1.5		64	42	Lmax < 65
312-HO1	48.5	46.5	new road	55.0	50.0	46.0	44.0	47.0	45.0	-1.5	-1.5		46.0	44.0	47.0	45.0	-1.5	-1.5		63	41	Lmax < 65
313-HO1	69.5	68.0	new road	70.0	68.5	63.5	**62.0**	64.5	**63.0**	-5.0	-5.0	acute	63.5	**62.0**	64.5	**63.0**	-5.0	-5.0	acute	88	59	28
314-HO1	55.0	53.0	new road	55.5	53.5	57.0	55.5	58.0	56.5	3.0	3.5	new road, >0.5 dB increase	57.0	55.5	58.0	56.5	3.0	3.5	new road, >0.5 dB increase	76	53	23
322-HO1	53.0	51.0	new road	55.0	51.5	55.0	53.5	56.0	54.5	3.0	3.5	new road, >0.5 dB increase	54.5	53.0	55.5	54.0	2.5	3.0	new road, >0.5 dB increase	65	50	15
322-HO2	58.0	56.5	new road	58.5	57.0	58.5	57.0	59.5	57.5	1.5	1.0	new road, >0.5 dB increase	58.0	56.0	59.0	57.0	1.0	0.5	new road, >0.5 dB increase	72	53	19
323-HO1	68.0	66.5	new road	68.5	67.0	64.0	**62.5**	**65.0**	**63.0**	-3.0	-3.5	acute	64.0	**62.5**	**65.0**	**63.0**	-3.0	-3.5	acute	86	59	27
331-HO1	55.0	53.0	new road	55.5	53.5	59.5	58.0	60.5	59.0	5.5	6.0	new road, >0.5 dB increase	59.5	58.0	60.5	59.0	5.5	6.0	new road, >0.5 dB increase	75	55	20
335-HO1	56.0	54.0	new road	56.5	54.5	57.0	55.0	58.0	56.0	2.0	2.0	new road, >0.5 dB increase	56.0	54.0	57.0	55.0	1.0	1.0	new road, >0.5 dB increase	70	51	18
337-HO1	61.0	59.0	new road	61.5	59.5	60.0	58.0	61.0	59.0	0.0	0.0		59.5	57.5	60.5	58.5	-0.5	-0.5		76	55	21
344-HO1	61.5	60.0	new road	62.0	60.5	61.0	59.5	62.0	**60.5**	0.5	0.5	acute	60.5	59.0	61.5	**60.0**	0.0	0.0	acute	75	56	19
347-HO1	71.0	69.0	new road	71.5	69.5	61.0	**60.0**	62.0	**61.0**	-9.0	-8.0	acute	61.0	59.5	62.0	**60.5**	-9.0	-8.5	acute	84	57	27

Receiver No.	Future Existing (2012) Noise Level, dB(A)		Type of development	Criteria, dB(A)		Base Case						Mitigated Case						Maximum Noise Level minimum noise level development 2012 dB(A)		Maximum noise level – Minimum noise level
						Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required	Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required			
	Day	Night		Day	Night	Day	Night	Day	Night	Day	Night		Day	Night	Day	Night	Day	Night				
354-HO2	50.0	48.0	new road	55.0	50.0	52.0	50.0	52.5	51.0	2.5	3.0	new road, >0.5 dB increase	50.5	48.5	51.5	49.5	1.5	1.5		63	46	Lmax < 65
355-HO1	48.0	46.0	new road	55.0	50.0	50.5	48.5	51.0	49.5	3.0	3.5		49.0	47.0	50.0	48.0	2.0	2.0		61	44	Lmax < 65
358-HO1	64.0	62.5	new road	64.5	63.0	**66.0**	**64.0**	**67.0**	**65.0**	3.0	2.5	acute	**66.0**	**64.0**	**67.0**	**65.0**	3.0	2.5	acute	83	61	22
361-HO1	48.0	46.5	new road	55.0	50.0	50.0	48.5	51.0	49.0	3.0	2.5		48.5	47.0	49.5	48.0	1.5	1.5		61	44	Lmax < 65
363-HO1	47.5	45.5	new road	55.0	50.0	49.5	47.5	50.5	48.5	3.0	3.0		48.0	46.0	49.0	47.0	1.5	1.5		60	43	Lmax < 65
365-HO1	50.0	48.0	new road	55.0	50.0	53.5	51.5	54.5	52.5	4.5	4.5	new road, >0.5 dB increase	51.0	49.5	52.0	50.0	2.0	2.0		62	46	Lmax < 65
369-HO1	49.0	47.0	new road	55.0	50.0	45.5	43.5	46.5	44.5	-2.5	-2.5		44.5	42.5	45.5	43.5	-3.5	-3.5		64	40	Lmax < 65
369-HO2	47.5	46.0	new road	55.0	50.0	45.5	43.5	46.5	44.5	-1.0	-1.5		45.0	43.0	46.0	44.0	-1.5	-2.0		63	40	Lmax < 65
378-HO1	49.0	47.5	new road	55.0	50.0	53.5	51.5	54.0	52.5	5.0	5.0	new road, >0.5 dB increase	50.5	48.5	51.5	49.5	2.5	2.0		62	45	Lmax < 65
379-HO1	46.5	44.5	new road	55.0	50.0	44.5	42.5	45.5	43.5	-1.0	-1.0		43.0	41.0	44.0	42.0	-2.5	-2.5		59	38	Lmax < 65
385-HO1	48.5	46.5	new road	55.0	50.0	46.0	44.5	47.0	45.5	-1.5	-1.0		44.5	43.0	45.5	43.5	-3.0	-3.0		63	40	Lmax < 65
387-HO1	69.0	67.5	new road	69.5	68.0	59.0	56.0	60.0	56.5	-9.0	-11.0		58.5	54.5	59.5	55.5	-9.5	-12.0		87	51	36
388-HO1	50.5	48.5	new road	55.0	50.0	47.0	45.0	48.0	46.0	-2.5	-2.5		45.5	43.5	46.5	44.5	-4.0	-4.0		65	41	Lmax < 65
393-HO1	68.0	66.5	new road	68.5	67.0	60.0	58.5	61.0	59.5	-7.0	-7.0		58.0	55.5	59.0	56.5	-9.0	-10.0		89	53	36
394-HO1	54.0	52.0	new road	55.0	52.5	49.0	46.5	50.0	47.5	-4.0	-4.5		47.0	44.5	48.0	45.5	-6.0	-6.5		69	42	28
401-HO1	73.0	71.0	new road	73.5	71.5	62.5	**60.5**	63.0	**61.5**	-10.0	-9.5	acute	60.5	56.0	62.0	56.5	-11.0	-14.5		93	53	40
405-HO1	53.5	51.5	new road	55.0	52.0	49.0	46.5	50.0	47.5	-3.5	-4.0		46.5	44.0	47.5	45.0	-6.0	-6.5		69	41	28
406-HO1	71.5	70.0	new road	72.0	70.5	62.5	**60.5**	63.5	**61.5**	-8.0	-8.5	acute	59.5	55.5	60.5	56.5	-11.0	-13.5		92	53	39
407-HO1	66.0	64.5	new road	66.5	65.0	57.5	54.5	58.5	55.0	-7.5	-9.5		56.0	52.0	56.5	52.5	-9.5	-12.0		86	49	37
409-HO1	71.0	69.0	new road	71.5	69.5	63.0	**61.0**	63.5	**62.0**	-7.5	-7.0	acute	59.0	56.0	60.0	57.0	-11.0	-12.0		90	53	37
413-HO1	73.5	71.5	new road	74.0	72.0	63.5	**60.0**	64.5	**61.0**	-9.0	-10.5	acute	62.0	58.0	63.0	58.5	-10.5	-13.0		92	54	38
415-HO1	53.5	51.5	new road	55.0	52.0	49.0	47.0	50.0	48.0	-3.5	-3.5		46.5	44.0	47.5	45.0	-6.0	-6.5		69	41	28
416-HO1	70.0	68.0	new road	70.5	68.5	61.5	58.5	62.5	59.5	-7.5	-8.5		59.5	56.0	60.5	56.5	-9.5	-11.5		88	52	35
419-HO1	68.0	66.5	new road	68.5	67.0	60.5	58.0	61.5	58.5	-6.5	-8.0		58.5	54.5	59.0	55.5	-9.0	-11.0		86	51	34
420-HO1	45.5	43.5	new road	55.0	50.0	45.5	43.5	46.5	44.5	1.0	1.0		42.0	40.0	43.0	41.0	-2.5	-2.5		54	37	Lmax < 65

Receiver No.	Future Existing (2012) Noise Level, dB(A)		Type of development	Criteria, dB(A)		Base Case						Mitigated Case						Maximum Noise Level [illegible] level development 2012 dB(A)		Maximum noise level – Minimum noise level
						Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required	Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required			
	Day	Night		Day	Night	Day	Night	Day	Night	Day	Night		Day	Night	Day	Night	Day	Night				
423-HO1	65.5	63.5	new road	66.0	64.0	59.0	56.5	60.0	57.5	-5.5	-6.0		56.5	53.0	57.5	54.0	-8.0	-9.5		84	50	34
424-HO1	67.0	65.0	new road	67.5	65.5	60.0	57.5	61.0	58.5	-6.0	-6.5		57.5	54.0	58.5	55.0	-8.5	-10.0		85	51	34
426-HO1	60.5	59.0	new road	61.0	59.5	57.0	55.0	58.0	56.0	-2.5	-3.0		53.5	51.0	54.5	52.0	-6.0	-7.0		80	48	32
429-HO1	53.5	51.5	new road	55.0	52.0	49.0	46.5	50.0	47.5	-3.5	-4.0		46.0	43.0	47.0	44.0	-6.5	-7.5		69	40	29
431-HO1	67.5	65.5	new road	68.0	66.0	60.5	57.5	61.0	58.5	-6.5	-7.0		58.0	54.5	59.0	55.0	-8.5	-10.5		85	51	34
433-HO1	45.0	43.0	new road	55.0	50.0	44.5	42.5	45.5	43.5	0.5	0.5		41.0	38.5	42.0	39.5	-3.0	-3.5		59	36	Lmax < 65
434-HO1	61.0	59.5	new road	61.5	60.0	56.5	54.5	57.5	55.5	-3.5	-4.0		53.5	50.5	54.5	51.5	-6.5	-8.0		79	48	31
436-HO1	68.0	66.5	new road	68.5	67.0	60.5	58.0	61.5	58.5	-6.5	-8.0		58.5	55.0	59.5	55.5	-8.5	-11.0		86	51	35
438-HO1	49.0	47.5	new road	55.0	50.0	47.5	45.5	48.5	46.5	-0.5	-1.0		44.5	42.0	45.5	43.0	-3.5	-4.5		62	39	Lmax < 65
441-HO1	59.0	57.5	new road	59.5	58.0	**67.0**	**65.5**	**68.0**	**66.5**	9.0	9.0	acute	62.0	**60.5**	63.0	**61.5**	4.0	4.0	acute	84	58	26
444-HO1	70.5	69.0	new road	71.0	69.5	62.0	59.0	63.0	59.5	-7.5	-9.5		60.5	56.5	61.0	57.0	-9.5	-12.0		89	53	36
445-HO1	59.0	57.5	new road	59.5	58.0	54.5	52.5	55.5	53.0	-3.5	-4.5		51.5	48.5	52.5	49.5	-6.5	-8.0		76	46	30
446-HO1	58.5	57.0	new road	59.0	57.5	54.0	52.0	55.0	53.0	-3.5	-4.0		51.0	48.5	52.0	49.5	-6.5	-7.5		74	45	29
449-HO1	56.5	54.5	new road	57.0	55.0	52.0	50.0	53.0	51.0	-3.5	-3.5		49.0	46.5	50.0	47.5	-6.5	-7.0		68	43	25
451-HO1	58.5	56.5	new road	59.0	57.0	53.5	51.0	54.5	52.0	-4.0	-4.5		50.5	47.5	51.5	48.5	-7.0	-8.0		71	45	26
452-HO1	56.5	55.0	new road	57.0	55.5	52.0	49.5	53.0	50.5	-3.5	-4.5		49.0	46.5	50.0	47.0	-6.5	-8.0		69	43	26
454-HO1	57.5	56.0	new road	58.0	56.5	53.0	51.0	54.0	52.0	-3.5	-4.0		50.5	47.5	51.5	48.5	-6.0	-7.5		71	45	27
455-HO1	61.0	59.0	new road	61.5	59.5	56.0	54.0	57.0	54.5	-4.0	-4.5		53.0	50.0	54.0	51.0	-7.0	-8.0		77	47	30
461-HO1	52.0	50.0	new road	55.0	50.5	58.0	56.0	59.0	57.0	7.0	7.0	new road, >0.5 dB increase	54.0	52.0	55.0	53.0	3.0	3.0	new road, >0.5 dB increase	68	49	19
462-HO1	48.5	46.5	new road	55.0	50.0	53.5	52.0	54.5	52.5	6.0	6.0	new road, >0.5 dB increase	50.0	48.0	51.0	49.0	2.5	2.5		64	45	Lmax < 65
463-HO1	63.0	61.5	new road	63.5	62.0	56.0	53.5	57.0	54.5	-6.0	-7.0		54.0	50.5	55.0	51.5	-8.0	-10.0		81	47	34
464-HO1	67.5	66.0	new road	68.0	66.5	60.5	59.0	61.5	**60.0**	-6.0	-6.0	acute	57.0	54.0	57.5	55.0	-10.0	-11.0		84	51	32
470-HO1	54.5	53.0	new road	55.0	53.5	51.0	49.0	52.0	50.0	-2.5	-3.0		48.0	45.5	49.0	46.5	-5.5	-6.5		68	43	25
485-HO1	65.5	64.0	new road	66.0	64.5	57.5	55.0	58.0	56.0	-7.5	-8.0		55.5	52.0	56.5	52.5	-9.0	-11.5		89	49	41
489-HO1	53.5	49.0	new road	55.0	50.0	56.0	53.5	57.0	54.5	3.5	5.5	new road, >0.5 dB increase	52.5	49.0	53.5	50.0	0.0	1.0		88	46	42

Receiver No.	Future Existing (2012) Noise Level, dB(A)		Type of development	Criteria, dB(A)		Base Case						Mitigated Case						Maximum Noise Level [illegible] level development 2012 dB(A)		Maximum noise level – Minimum noise level
						Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required	Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required			
	Day	Night		Day	Night	Day	Night	Day	Night	Day	Night		Day	Night	Day	Night	Day	Night				
490-HO1	56.5	54.0	new road	57.0	54.5	64.5	**62.5**	**65.5**	**63.5**	9.0	9.5	acute	60.0	58.0	61.0	59.0	4.5	5.0	new road, >0.5 dB increase	87	55	32
493-HO1	56.0	54.0	new road	56.5	54.5	62.5	**60.5**	63.5	**61.5**	7.5	7.5	acute	58.0	56.0	59.0	57.0	3.0	3.0	new road, >0.5 dB increase	87	53	34
501-HO1	72.5	71.0	new road	73.0	71.5	61.0	57.0	62.5	57.5	-10.0	-13.5		61.0	56.0	62.0	56.5	-10.5	-14.5		92	52	40
501-HO2	67.0	65.5	new road	67.5	66.0	57.0	53.5	58.0	54.0	-9.0	-11.5		56.5	52.0	57.5	52.5	-9.5	-13.0		85	48	37
505-HO1	51.0	45.0	new road	55.0	50.0	46.0	44.0	47.0	45.0	-4.0	0.0		44.0	42.0	45.0	43.0	-6.0	-2.0		57	39	Lmax < 65
506-HO1	57.5	53.5	new road	58.0	54.0	59.5	57.0	60.5	58.0	3.0	4.5	new road, >0.5 dB increase	56.5	53.5	58.0	54.5	0.5	1.0	new road, >0.5 dB increase	93	50	43
508-HO1	54.0	47.0	new road	55.0	50.0	49.0	46.0	50.0	47.0	-4.0	0.0		46.0	42.5	47.0	43.5	-7.0	-3.5		83	39	44
509-HO1	52.5	46.0	new road	55.0	50.0	46.5	44.5	47.5	45.5	-5.0	-0.5		44.0	41.5	45.0	42.5	-7.5	-3.5		73	39	34
510-HO1	53.5	46.5	new road	55.0	50.0	46.5	44.5	47.5	45.5	-6.0	-1.0		44.0	41.5	45.0	42.5	-8.5	-4.0		76	38	37
512-HO1	67.0	65.5	new road	67.5	66.0	61.0	58.5	62.0	59.5	-5.0	-6.0		58.5	55.5	59.0	56.0	-8.0	-9.5		85	52	33
515-HO1	57.0	49.5	new road	57.5	50.0	48.5	46.5	49.5	47.5	-7.5	-2.0		47.0	45.0	48.0	46.0	-9.0	-3.5		71	42	29
518-HO1	52.5	46.0	new road	55.0	50.0	46.5	44.5	47.5	45.5	-5.0	-0.5		44.5	42.5	45.5	43.5	-7.0	-2.5		62	40	Lmax < 65
519-HO1	57.0	49.5	new road	57.5	50.0	52.0	50.0	53.0	51.0	-4.0	1.5	new road, >0.5 dB increase	51.5	49.5	52.0	50.0	-5.0	0.5		76	46	29
520-HO1	55.0	48.0	new road	55.5	50.0	47.0	45.0	48.0	46.0	-7.0	-2.0		45.0	43.0	46.0	44.0	-9.0	-4.0		62	40	Lmax < 65
523-HO1	64.0	62.0	new road	64.5	62.5	**66.5**	**64.5**	**67.0**	**65.5**	3.0	3.5	acute	62.0	**60.0**	62.5	**61.0**	-1.5	-1.0	acute	81	57	24
528-HO1	54.0	52.0	new road	55.0	52.5	55.0	53.0	56.0	54.0	2.0	2.0	new road, >0.5 dB increase	54.0	52.0	54.5	53.0	0.5	1.0	new road, >0.5 dB increase	78	49	29
528-HO2	54.0	52.0	new road	55.0	52.5	55.5	53.0	56.5	53.5	2.5	1.5	new road, >0.5 dB increase	52.5	50.0	53.5	51.0	-0.5	-1.0		89	47	42
534-HO1	48.5	43.5	new road	55.0	50.0	45.5	43.5	46.0	44.5	-2.5	1.0		43.5	41.5	44.5	42.5	-4.0	-1.0		63	38	Lmax < 65
536-HO1	51.5	50.0	new road	55.0	50.5	50.0	48.0	51.0	49.0	-0.5	-1.0		47.0	45.0	48.0	46.0	-3.5	-4.0		63	42	Lmax < 65
537-HO1	54.5	49.5	new road	55.0	50.0	51.5	50.0	52.5	50.5	-2.0	1.0	new road, >0.5 dB increase	51.0	49.0	51.5	50.0	-3.0	0.5		67	46	22
538-HO1	53.5	49.0	new road	55.0	50.0	51.0	49.0	51.5	50.0	-2.0	1.0		50.0	48.0	51.0	49.0	-2.5	0.0		65	45	Lmax < 65
542-HO1	53.5	48.5	new road	55.0	50.0	47.0	45.0	48.0	46.0	-5.5	-2.5		46.0	44.0	46.5	44.5	-7.0	-4.0		63	41	Lmax < 65
543-HO1	54.5	49.0	new road	55.0	50.0	51.0	49.0	52.0	50.0	-2.5	1.0		50.0	48.0	51.0	49.0	-3.5	0.0		68	45	23

Receiver No.	Future Existing (2012) Noise Level, dB(A)		Type of development	Criteria, dB(A)		Base Case						Mitigated Case						Maximum Noise Level [illegible] level development 2012 dB(A)		Maximum noise level – Minimum noise level
						Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required	Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required			
	Day	Night		Day	Night	Day	Night	Day	Night	Day	Night		Day	Night	Day	Night	Day	Night				
547-HO1	53.5	49.5	new road	55.0	50.0	50.5	48.5	51.5	49.5	-2.0	0.0		49.5	48.0	50.5	48.5	-3.0	-1.0		66	45	21
553-HO1	52.5	49.0	new road	55.0	50.0	50.5	48.5	51.0	49.5	-1.5	0.5		49.5	47.5	50.5	48.5	-2.0	-0.5		66	45	22
558-HO1	54.5	49.0	new road	55.0	50.0	51.5	49.5	52.5	50.5	-2.0	1.5	new road, >0.5 dB increase	51.0	49.0	51.5	49.5	-3.0	0.5		68	46	22
566-HO1	52.5	49.0	new road	55.0	50.0	49.5	47.5	50.5	48.5	-2.0	-0.5		48.5	46.5	49.5	47.5	-3.0	-1.5		64	44	Lmax < 65
574-HO1	49.5	47.5	new road	55.0	50.0	48.0	46.5	49.0	47.5	-0.5	0.0		47.0	45.0	48.0	46.0	-1.5	-1.5		64	42	Lmax < 65
579-HO1	47.5	45.5	new road	55.0	50.0	46.0	44.0	46.5	45.0	-1.0	-0.5		45.0	43.0	46.0	44.0	-1.5	-1.5		61	40	Lmax < 65
583-HO1	61.5	60.0	new road	62.0	60.5	57.0	55.0	58.0	55.5	-3.5	-4.5		56.0	53.5	57.0	54.5	-4.5	-5.5		79	51	28
584-HO1	49.5	47.5	new road	55.0	50.0	48.5	46.5	49.5	47.5	0.0	0.0		45.5	43.5	46.5	44.5	-3.0	-3.0		62	41	Lmax < 65
588-HO1	56.5	55.0	new road	57.0	55.5	53.0	51.0	54.0	52.0	-2.5	-3.0		52.5	50.0	53.5	51.0	-3.0	-4.0		74	47	27
592-HO1	58.0	56.0	new road	58.5	56.5	60.0	58.5	61.0	59.5	3.0	3.5	new road, >0.5 dB increase	60.0	58.5	61.0	59.0	3.0	3.0	new road, >0.5 dB increase	72	55	17
596-HO1	53.5	46.5	new road	55.0	50.0	47.0	45.5	48.0	46.0	-5.5	-0.5		46.0	44.0	46.5	45.0	-7.0	-1.5		63	41	Lmax < 65
598-HO1	49.0	47.0	new road	55.0	50.0	48.0	46.5	49.0	47.0	0.0	0.0		46.5	45.0	47.5	46.0	-1.5	-1.0		64	42	Lmax < 65
601-HO1	55.5	54.0	new road	56.0	54.5	49.5	47.0	50.5	48.0	-5.0	-6.0		49.0	46.5	50.0	47.5	-5.5	-6.5		69	43	26
601-HO2	55.5	54.0	new road	56.0	54.5	50.0	48.0	51.0	49.0	-4.5	-5.0		50.0	47.5	50.5	48.5	-5.0	-5.5		69	44	25
607-HO1	65.5	63.5	new road	66.0	64.0	58.5	56.0	59.5	57.0	-6.0	-6.5		58.5	56.0	59.5	56.5	-6.0	-7.0		83	53	30
611-HO1	52.5	51.0	new road	55.0	51.5	48.0	46.0	49.0	46.5	-3.5	-4.5		46.5	44.5	47.5	45.0	-5.0	-6.0		64	41	Lmax < 65
616-HO1	68.5	67.0	new road	69.0	67.5	59.0	56.0	60.0	56.5	-8.5	-10.5		59.0	56.0	60.0	56.5	-8.5	-10.5		89	53	36
631-HO1	69.0	67.5	new road	69.5	68.0	61.0	58.5	62.0	59.5	-7.0	-8.0		61.0	58.5	62.0	59.5	-7.0	-8.0		87	55	32
632-HO1	57.5	56.0	new road	58.0	56.5	49.0	46.0	50.0	47.0	-7.5	-9.0		48.5	46.0	49.5	46.5	-8.0	-9.5		73	43	31
637-HO1	59.0	57.0	new road	59.5	57.5	59.5	58.0	60.5	58.5	1.5	1.5	new road, >0.5 dB increase	59.5	58.0	60.5	58.5	1.5	1.5	new road, >0.5 dB increase	74	55	19
643-HO1	40.0	36.5	new road	55.0	50.0	40.5	38.5	41.5	39.5	1.5	3.0		40.5	38.5	41.5	39.0	1.5	2.5		57	35	Lmax < 65
646-HO1	54.5	53.0	new road	55.0	53.5	49.5	47.5	50.5	48.5	-4.0	-4.5		49.5	47.5	50.5	48.0	-4.0	-5.0		69	44	24
647-HO1	47.5	45.5	new road	55.0	50.0	49.0	47.0	50.0	48.0	2.5	2.5		48.5	46.5	49.0	47.5	1.5	2.0		61	43	Lmax < 65
653-HO1	59.0	57.5	new road	59.5	58.0	50.5	47.5	51.5	48.5	-7.5	-9.0		50.5	47.0	51.0	48.0	-8.0	-9.5		76	44	32

Receiver No.	Future Existing (2012) Noise Level, dB(A)		Type of development	Criteria, dB(A)		Base Case						Mitigated Case						Maximum Noise Level minus Noise level development 2012 dB(A)	Maximum noise level – Minimum noise level
						Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required	Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required		
	Day	Night		Day	Night	Day	Night	Day	Night	Day	Night		Day	Night	Day	Night	Day	Night			
658-HO2	52.0	50.0	new road	55.0	50.5	53.5	51.5	54.5	52.5	2.5	2.5	new road, >0.5 dB increase	52.5	51.0	53.5	51.5	1.5	1.5	new road, >0.5 dB increase	65	48	17
660-HO1	69.0	67.5	new road	69.5	68.0	60.0	57.5	61.0	58.0	-8.0	-9.5		60.0	57.0	61.0	57.5	-8.0	-10.0		88	54	34
676-HO1	55.5	53.5	new road	56.0	54.0	53.0	51.0	54.0	52.0	-1.5	-1.5		51.5	49.5	52.5	50.5	-3.0	-3.0		69	47	23
683-HO1	63.5	62.0	redevelopment	65.5	64.0	**68.0**	**66.0**	**69.0**	**67.0**	5.5	5.0	acute	64.0	**62.0**	**65.0**	**63.0**	1.5	1.0	acute	80	59	21
695-HO1	60.5	58.5	redevelopment	62.5	60.5	63.0	**61.0**	63.5	**62.0**	3.0	3.5	acute	58.5	56.0	59.5	57.0	-1.0	-1.5		76	53	23
701-HO1	63.5	61.5	redevelopment	65.5	63.5	**67.0**	**65.5**	**68.0**	**66.0**	4.5	4.5	acute	63.0	**61.0**	64.0	**62.0**	0.5	0.5	acute	80	58	22
710-HO1	62.5	60.5	redevelopment	64.5	62.5	64.5	**63.0**	**65.5**	**63.5**	3.0	3.0	acute	60.0	58.0	61.0	59.0	-1.5	-1.5		77	55	22
712-HO1	57.0	55.0	redevelopment	60.0	57.0	59.0	57.5	60.0	58.5	3.0	3.5	redevelopment, >2 dB increase			52.5	55.5	53.5	-1.5	-1.5		73	50	23
713-HO1	55.5	54.0	redevelopment	60.0	56.0	58.0	56.0	58.5	57.0	3.0	3.0	redevelopment, >2 dB increase			51.0	54.0	52.0	-1.5	-2.0		70	48	22
714-HO1	60.5	59.0	redevelopment	62.5	61.0	63.0	**61.0**	64.0	**62.0**	3.5	3.0	acute	58.5	56.5	59.5	57.0	-1.0	-2.0		76	53	22
715-HO1	52.5	50.5	new road	55.0	51.0	53.0	51.0	54.0	52.0	1.5	1.5	new road, >0.5 dB increase	49.5	47.0	50.5	48.0	-2.0	-2.5		63	44	Lmax < 65
717-HO1	52.0	50.5	new road	55.0	51.0	53.0	51.0	54.0	52.0	2.0	1.5	new road, >0.5 dB increase	49.5	47.5	50.5	48.0	-1.5	-2.5		63	44	Lmax < 65
719-HO1	59.5	58.0	redevelopment	61.5	60.0	62.0	**60.0**	63.0	**61.0**	3.5	3.0	acute	57.5	55.5	58.5	56.5	-1.0	-1.5		75	52	23
722-HO1	60.0	58.5	redevelopment	62.0	60.5	62.5	**60.5**	63.5	**61.5**	3.5	3.0	acute	58.0	56.0	59.0	56.5	-1.0	-2.0		75	53	22
725-HO1	55.0	53.5	redevelopment	60.0	55.5	57.0	55.0	58.0	56.0	3.0	2.5	redevelopment, >2 dB increase			50.5	53.5	51.5	-1.5	-2.0		70	48	23
731-HO1	59.5	57.5	redevelopment	61.5	59.5	62.0	**60.0**	62.5	**61.0**	3.0	3.5	acute	57.0	55.0	58.0	56.0	-1.5	-1.5		74	52	22

Receiver No.	Future Existing (2012) Noise Level, dB(A)		Type of development	Criteria, dB(A)		Base Case						Mitigated Case						Maximum Noise Level minimum noise level development 2012 dB(A)		Maximum noise level – Minimum noise level
						Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required	Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required			
	Day	Night		Day	Night	Day	Night	Day	Night	Day	Night		Day	Night	Day	Night	Day	Night				
735-HO1	54.5	53.0	new road	55.0	55.0	56.5	54.5	57.5	55.5	3.0	2.5	new road, >0.5 dB increase	52.0	50.0	53.0	51.0	-1.5	-2.0		71	47	24
736-HO1	57.0	55.5	redevelopment	60.0	57.5	59.5	57.5	60.5	58.5	3.5	3.0	redevelopment, >2 dB increase	52.5	56.0	53.5		-1.0	-2.0		73	50	23
751-HO1	54.5	53.0	new road	55.0	55.0	56.5	54.5	57.0	55.5	2.5	2.5	new road, >0.5 dB increase	52.0	49.5	53.0	50.5	-1.5	-2.5		70	47	24
759-HO1	51.5	49.5	new road	55.0	50.0	53.5	51.5	54.5	52.5	3.0	3.0	new road, >0.5 dB increase	49.5	47.0	50.0	48.0	-1.5	-1.5		66	44	22
768-HO1	53.0	51.0	new road	55.0	51.5	54.0	52.0	55.0	53.0	2.0	2.0	new road, >0.5 dB increase	50.0	47.5	50.5	48.5	-2.5	-2.5		66	45	22
769-HO1	60.5	59.0	new road	61.0	59.5	63.0	**61.5**	64.0	**62.0**	3.5	3.0	acute	59.5	57.0	60.0	58.0	-0.5	-1.0		75	54	21
776-HO1	50.0	48.0	new road	55.0	50.0	51.5	49.5	52.5	50.5	2.5	2.5	new road, >0.5 dB increase	47.5	45.5	48.5	46.0	-1.5	-2.0		63	42	Lmax < 65
777-HO1	51.0	49.0	new road	55.0	50.0	51.5	50.0	52.5	50.5	1.5	1.5	new road, >0.5 dB increase	47.5	45.5	48.5	46.5	-2.5	-2.5		63	42	Lmax < 65
780-HO1	49.5	47.5	new road	55.0	50.0	50.5	48.5	51.5	49.5	2.0	2.0		46.5	44.5	47.5	45.5	-2.0	-2.0		63	41	Lmax < 65
792-HO1	52.5	51.0	new road	55.0	51.5	54.0	52.0	55.0	53.0	2.5	2.0	new road, >0.5 dB increase	49.5	47.5	50.5	48.5	-2.0	-2.5		66	44	22
799-HO1	49.5	48.0	new road	55.0	50.0	51.0	49.0	52.0	50.0	2.5	2.0		47.0	45.0	48.0	46.0	-1.5	-2.0		63	42	Lmax < 65
800-HO1	55.0	53.0	new road	55.5	53.5	56.5	54.5	57.5	55.5	2.5	2.5	new road, >0.5 dB increase	52.0	50.0	53.0	51.0	-2.0	-2.0		69	47	22
801-HO1	48.0	46.0	new road	55.0	50.0	48.0	46.0	49.0	47.0	1.0	1.0		44.5	42.5	45.5	43.5	-2.5	-2.5		60	39	Lmax < 65
802-HO1	41.0	39.0	new road	55.0	50.0	50.0	48.0	50.5	49.0	9.5	10.0		46.5	44.5	47.5	45.5	6.5	6.5		61	42	Lmax < 65
803-HO1	49.5	47.5	new road	55.0	50.0	51.0	49.0	52.0	50.0	2.5	2.5		47.0	44.5	48.0	45.5	-1.5	-2.0		63	42	Lmax < 65
808-HO1	47.5	45.5	new road	55.0	50.0	47.0	45.0	48.0	46.0	0.5	0.5		44.0	41.5	44.5	42.5	-3.0	-3.0		60	38	Lmax < 65
810-HO1	54.0	52.5	new road	55.0	53.0	55.0	53.0	56.0	54.0	2.0	1.5	new road, >0.5 dB increase	50.5	48.5	51.5	49.5	-2.5	-3.0		67	45	22
811-HO1	50.0	48.0	new road	55.0	50.0	51.5	49.5	52.5	50.5	2.5	2.5	new road, >0.5 dB increase	47.5	45.0	48.0	46.0	-2.0	-2.0		64	42	Lmax < 65
811-HO2	50.0	48.0	new road	55.0	50.0	50.0	48.0	51.0	49.0	1.0	1.0		46.0	44.0	47.0	44.5	-3.0	-3.5		62	41	Lmax < 65

Receiver No.	Future Existing (2012) Noise Level, dB(A)		Type of development	Criteria, dB(A)		Base Case						Mitigated Case						Maximum Noise Level [illegible] level development 2012 dB(A)		Maximum noise level – Minimum noise level
						Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required	Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required			
	Day	Night		Day	Night	Day	Night	Day	Night	Day	Night		Day	Night	Day	Night	Day	Night				
815-HO1	50.0	48.5	new road	55.0	50.0	51.5	49.5	52.5	50.5	2.5	2.0	new road, >0.5 dB increase	47.5	45.5	48.5	46.0	-1.5	-2.5		64	42	Lmax < 65
818-HO1	50.0	48.5	new road	55.0	50.0	52.0	50.0	53.0	51.0	3.0	2.5	new road, >0.5 dB increase	47.5	45.5	48.5	46.5	-1.5	-2.0		64	43	Lmax < 65
819-HO1	50.5	48.5	new road	55.0	50.0	52.0	50.0	53.0	51.0	2.5	2.5	new road, >0.5 dB increase	48.0	45.5	49.0	46.5	-1.5	-2.0		64	43	Lmax < 65
820-HO1	50.5	48.5	new road	55.0	50.0	52.0	50.5	53.0	51.5	2.5	3.0	new road, >0.5 dB increase	48.0	46.0	49.0	47.0	-1.5	-1.5		64	43	Lmax < 65
821-HO1	54.0	52.0	new road	55.0	52.5	55.0	53.0	55.5	54.0	1.5	2.0	new road, >0.5 dB increase	50.5	48.5	51.5	49.0	-2.5	-3.0		67	45	22
822-HO1	50.5	48.5	new road	55.0	50.0	52.0	50.0	53.0	51.0	2.5	2.5	new road, >0.5 dB increase	48.0	45.5	49.0	46.5	-1.5	-2.0		65	43	Lmax < 65
823-HO1	55.5	53.5	new road	56.0	54.0	57.5	55.5	58.5	56.5	3.0	3.0	new road, >0.5 dB increase	53.0	50.5	54.0	51.5	-1.5	-2.0		70	48	23
826-HO1	50.5	49.0	new road	55.0	50.0	52.5	50.5	53.5	51.5	3.0	2.5	new road, >0.5 dB increase	48.0	46.0	49.0	47.0	-1.5	-2.0		65	43	22
827-HO1	50.5	49.0	new road	55.0	50.0	52.5	50.5	53.5	51.5	3.0	2.5	new road, >0.5 dB increase	48.5	46.0	49.0	47.0	-1.5	-2.0		65	43	22
830-HO1	50.5	49.0	new road	55.0	50.0	52.5	50.5	53.5	51.5	3.0	2.5	new road, >0.5 dB increase	48.0	46.0	49.0	47.0	-1.5	-2.0		65	43	22
831-HO1	51.0	49.0	new road	55.0	50.0	53.0	51.0	53.5	52.0	2.5	3.0	new road, >0.5 dB increase	48.5	46.5	49.5	47.0	-1.5	-2.0		65	43	22
832-HO1	50.5	49.0	new road	55.0	50.0	52.5	51.0	53.5	51.5	3.0	2.5	new road, >0.5 dB increase	48.5	46.5	49.5	47.0	-1.0	-2.0		65	43	Lmax < 65
834-HO1	51.0	49.0	new road	55.0	50.0	52.5	50.5	53.5	51.5	2.5	2.5	new road, >0.5 dB increase	48.5	46.0	49.0	47.0	-2.0	-2.0		64	43	Lmax < 65
835-HO1	51.5	49.5	new road	55.0	50.0	52.0	50.0	53.0	51.0	1.5	1.5	new road, >0.5 dB increase	48.0	46.0	49.0	46.5	-2.5	-3.0		62	43	Lmax < 65
837-HO1	52.5	51.0	new road	55.0	51.5	53.0	51.0	54.0	52.0	1.5	1.0	new road, >0.5 dB increase	49.0	47.0	50.0	47.5	-2.5	-3.5		65	44	22
839-HO1	54.0	52.0	new road	55.0	52.5	54.5	53.0	55.5	53.5	1.5	1.5	new road, >0.5 dB increase	50.5	48.5	51.5	49.0	-2.5	-3.0		67	45	22
846-HO1	51.0	49.0	new road	55.0	50.0	52.0	50.0	53.0	51.0	2.0	2.0	new road, >0.5 dB increase	48.0	45.5	49.0	46.5	-2.0	-2.5		63	43	Lmax < 65

Receiver No.	Future Existing (2012) Noise Level, dB(A)		Type of development	Criteria, dB(A)		Base Case						Mitigated Case						Maximum Noise Level [illegible] level development 2012 dB(A)		Maximum noise level – Minimum noise level
						Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required	Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required			
	Day	Night		Day	Night	Day	Night	Day	Night	Day	Night		Day	Night	Day	Night	Day	Night				
847-HO1	49.0	47.5	new road	55.0	50.0	50.0	48.0	51.0	49.0	2.0	1.5		46.0	44.0	47.0	45.0	-2.0	-2.5		63	41	Lmax < 65
848-HO1	48.5	46.5	new road	55.0	50.0	51.0	49.0	51.5	50.0	3.0	3.5		46.5	44.5	47.5	45.5	-1.0	-1.0		62	41	Lmax < 65
849-HO1	49.0	47.5	new road	55.0	50.0	51.0	49.0	52.0	50.0	3.0	2.5		47.0	44.5	47.5	45.5	-1.5	-2.0		62	41	Lmax < 65
853-HO1	49.5	47.5	new road	55.0	50.0	51.0	49.0	52.0	50.0	2.5	2.5		47.0	44.5	47.5	45.5	-2.0	-2.0		62	41	Lmax < 65
853-HO2	49.5	47.5	new road	55.0	50.0	51.0	49.0	52.0	50.0	2.5	2.5		47.0	45.0	48.0	45.5	-1.5	-2.0		61	42	Lmax < 65
855-HO1	49.0	47.0	new road	55.0	50.0	51.5	49.5	52.0	50.5	3.0	3.5	new road, >0.5 dB increase	47.0	45.0	48.0	46.0	-1.0	-1.0		63	42	Lmax < 65
857-HO1	51.0	49.5	new road	55.0	50.0	52.0	50.0	53.0	51.0	2.0	1.5	new road, >0.5 dB increase	48.0	45.5	49.0	46.5	-2.0	-3.0		62	43	Lmax < 65
859-HO1	49.5	48.0	new road	55.0	50.0	51.0	49.0	51.5	50.0	2.0	2.0		47.0	44.5	48.0	45.5	-1.5	-2.5		63	41	Lmax < 65
859-HO2	50.5	49.0	new road	55.0	50.0	51.5	49.5	52.5	50.5	2.0	1.5	new road, >0.5 dB increase	47.5	45.0	48.5	46.0	-2.0	-3.0		63	42	Lmax < 65
859-HO3	51.0	49.0	new road	55.0	50.0	51.0	49.0	52.0	50.0	1.0	1.0		47.0	45.0	48.0	45.5	-3.0	-3.5		64	42	Lmax < 65
859-HO4	49.0	47.0	new road	55.0	50.0	47.5	45.5	48.0	46.5	-1.0	-0.5		44.0	41.5	45.0	42.5	-4.0	-4.5		63	38	Lmax < 65
859-HO5	49.0	47.0	new road	55.0	50.0	47.5	46.0	48.5	46.5	-0.5	-0.5		44.0	42.0	45.0	43.0	-4.0	-4.0		63	39	Lmax < 65
860-HO1	52.0	50.0	new road	55.0	50.5	52.5	51.0	53.5	51.5	1.5	1.5	new road, >0.5 dB increase	48.5	46.5	49.5	47.5	-2.5	-2.5		65	43	22
860-HO2	53.0	51.0	new road	55.0	51.5	53.5	51.5	54.0	52.5	1.0	1.5	new road, >0.5 dB increase	49.5	47.0	50.0	48.0	-3.0	-3.0		65	44	Lmax < 65
860-HO3	53.0	51.5	new road	55.0	52.0	53.5	51.5	54.5	52.5	1.5	1.0	new road, >0.5 dB increase	49.5	47.5	50.5	48.0	-2.5	-3.5		65	44	Lmax < 65
861-HO1	50.0	48.0	new road	55.0	50.0	50.5	48.5	51.0	49.0	1.0	1.0		46.5	44.0	47.5	45.0	-2.5	-3.0		62	41	Lmax < 65
865-HO1	49.5	47.5	new road	55.0	50.0	49.0	47.0	49.5	48.0	0.0	0.5		45.0	42.5	46.0	43.5	-3.5	-4.0		64	39	Lmax < 65
866-HO1	50.5	48.5	new road	55.0	50.0	51.0	49.5	52.0	50.0	1.5	1.5		47.0	45.0	48.0	46.0	-2.5	-2.5		63	42	Lmax < 65
867-HO1	50.0	48.0	new road	55.0	50.0	49.5	47.5	50.5	48.5	0.5	0.5		46.0	43.5	46.5	44.5	-3.5	-3.5		64	41	Lmax < 65
869-HO1	50.5	48.5	new road	55.0	50.0	49.5	47.5	50.5	48.5	0.0	0.0		46.0	43.5	47.0	44.5	-3.5	-4.0		64	40	Lmax < 65
874-HO1	54.0	52.0	new road	55.0	52.5	54.5	52.5	55.5	53.5	1.5	1.5	new road, >0.5 dB increase	50.5	48.0	51.5	49.0	-2.5	-3.0		66	45	21
875-HO1	51.0	49.0	new road	55.0	50.0	52.0	50.0	53.0	51.0	2.0	2.0	new road, >0.5 dB increase	48.0	46.0	49.0	47.0	-2.0	-2.0		63	43	Lmax < 65

Receiver No.	Future Existing (2012) Noise Level, dB(A)		Type of development	Criteria, dB(A)		Base Case						Mitigated Case						Maximum Noise Level minus Noise level development 2012 dB(A)		Maximum noise level – Minimum noise level
						Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required	Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required			
	Day	Night		Day	Night	Day	Night	Day	Night	Day	Night		Day	Night	Day	Night	Day	Night				
876-HO1	51.0	49.0	new road	55.0	50.0	52.0	50.0	53.0	51.0	2.0	2.0	new road, >0.5 dB increase	48.0	46.0	49.0	47.0	-2.0	-2.0		63	43	Lmax < 65
877-HO1	51.5	49.5	new road	55.0	50.0	51.5	49.5	52.5	50.5	1.0	1.0	new road, >0.5 dB increase	47.5	45.0	48.5	46.0	-3.0	-3.5		64	42	Lmax < 65
878-HO1	59.0	57.0	new road	59.5	57.5	59.5	57.5	60.0	58.5	1.0	1.5	new road, >0.5 dB increase	55.5	53.0	56.5	54.0	-2.5	-3.0		74	50	24
880-HO1	51.0	49.5	new road	55.0	50.0	52.0	50.0	53.0	51.0	2.0	1.5	new road, >0.5 dB increase	48.0	46.0	49.0	47.0	-2.0	-2.5		63	43	Lmax < 65
884-HO1	48.0	46.5	new road	55.0	50.0	50.5	48.5	51.5	49.5	3.5	3.0		46.5	44.0	47.5	45.0	-0.5	-1.5		61	41	Lmax < 65
885-HO1	48.0	46.0	new road	55.0	50.0	50.5	48.5	51.5	49.5	3.5	3.5		46.5	44.0	47.0	45.0	-1.0	-1.0		60	41	Lmax < 65
888-HO1	49.0	47.0	new road	55.0	50.0	51.0	49.5	52.0	50.0	3.0	3.0		47.0	45.0	48.0	45.5	-1.0	-1.5		64	42	Lmax < 65
888-HO2	53.0	51.5	new road	55.0	52.0	53.5	51.5	54.5	52.5	1.5	1.0	new road, >0.5 dB increase	49.5	47.0	50.5	48.0	-2.5	-3.5		65	44	Lmax < 65
894-HO1	67.5	65.5	new road	68.0	66.0	**69.0**	**67.0**	**70.0**	**68.0**	2.5	2.5	acute	**65.0**	**62.5**	**66.0**	**63.5**	-1.5	-2.0	acute	73	60	13
894-HO2	59.5	58.0	new road	60.0	58.5	62.5	**60.5**	63.5	**61.5**	4.0	3.5	acute	58.5	56.5	59.5	57.5	0.0	-0.5		74	54	20
894-HO3	58.0	56.0	new road	58.5	56.5	61.0	59.0	62.0	**60.0**	4.0	4.0	acute	57.5	55.0	58.5	56.0	0.5	0.0		73	52	20
894-HO4	59.0	57.5	new road	59.5	58.0	58.0	56.5	59.0	57.0	0.0	-0.5		54.5	52.0	55.5	53.0	-3.5	-4.5		75	49	26
894-HO5	59.0	57.0	new road	59.5	57.5	57.0	55.5	58.0	56.0	-1.0	-1.0		53.5	51.0	54.5	52.0	-4.5	-5.0		74	48	27
894-HO6	56.0	54.0	new road	56.5	54.5	55.5	53.5	56.5	54.5	0.5	0.5		51.5	49.0	52.5	50.0	-3.5	-4.0		71	46	25
894-HO7	63.5	61.5	new road	64.0	62.0	58.5	56.0	59.5	57.0	-4.0	-4.5		55.5	52.5	56.5	53.0	-7.0	-8.5		80	49	31
894-8	65.5	64.0	new road	66.0	64.5	**68.0**	**66.0**	**69.0**	**67.0**	3.5	3.0	acute	64.0	**61.5**	**65.0**	**62.5**	-0.5	-1.5	acute	75	59	16
894-9	56.5	54.5	new road	57.0	55.0	59.0	57.0	59.5	57.5	3.0	3.0	new road, >0.5 dB increase	56.0	53.5	56.5	54.5	0.0	0.0		66	50	16
894-10	66.0	64.5	new road	66.5	65.0	**69.0**	**67.5**	**70.0**	**68.0**	4.0	3.5	acute	**65.0**	**62.5**	**66.0**	**63.5**	0.0	-1.0	acute	73	60	14
894-11	57.0	55.5	new road	57.5	56.0	59.5	57.5	60.5	58.5	3.5	3.0	new road, >0.5 dB increase	56.0	54.0	57.0	55.0	0.0	-0.5		70	51	19
894-12	56.5	55.0	new road	57.0	55.5	59.5	57.5	60.5	58.5	4.0	3.5	new road, >0.5 dB increase	56.0	53.5	56.5	54.5	0.0	-0.5		71	51	20
894-13	65.5	64.5	new road	66.0	65.0	**69.0**	**67.0**	**70.0**	**68.0**	4.5	3.5	acute	**65.0**	**62.5**	**65.5**	**63.5**	0.0	-1.0	acute	71	59	12
894-14	56.0	54.5	new road	56.5	55.0	59.0	57.0	60.0	58.0	4.0	3.5	new road, >0.5 dB increase	55.0	53.0	56.0	54.0	0.0	-0.5		70	50	20

Receiver No.	Future Existing (2012) Noise Level, dB(A)		Type of development	Criteria, dB(A)		Base Case						Mitigated Case						Maximum Noise Level [illegible] level development 2012 dB(A)		Maximum noise level – Minimum noise level
						Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required	Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required			
	Day	Night		Day	Night	Day	Night	Day	Night	Day	Night		Day	Night	Day	Night	Day	Night				
894-15	60.5	58.5	new road	61.0	59.0	62.5	**60.5**	63.5	**61.5**	3.0	3.0	acute	58.5	56.5	59.5	57.5	-1.0	-1.0		72	53	18
894-16	65.5	64.0	new road	66.0	64.5	**68.5**	**66.5**	**69.5**	**67.5**	4.0	3.5	acute	64.5	**62.0**	**65.0**	**63.0**	-0.5	-1.0	acute	70	59	11
894-17	58.5	57.0	new road	59.0	57.5	60.0	58.0	61.0	59.0	2.5	2.0	new road, >0.5 dB increase	57.0	54.5	57.5	55.5	-1.0	-1.5		72	51	20
894-18	56.5	54.5	new road	57.0	55.0	58.5	56.5	59.5	57.5	3.0	3.0	new road, >0.5 dB increase	54.5	52.5	55.5	53.5	-1.0	-1.0		70	49	20
894-19	58.0	56.0	new road	58.5	56.5	59.5	57.5	60.5	58.5	2.5	2.5	new road, >0.5 dB increase	55.5	53.0	56.5	54.0	-1.5	-2.0		71	50	21
894-20	60.5	59.0	new road	61.0	59.5	62.5	**61.0**	63.5	**61.5**	3.0	2.5	acute	59.0	56.5	60.0	57.5	-0.5	-1.5		73	54	19
894-21	56.0	54.5	new road	56.5	55.0	59.0	57.0	60.0	58.0	4.0	3.5	new road, >0.5 dB increase	55.0	52.5	56.0	53.5	0.0	-1.0		72	50	23
894-22	66.5	65.0	new road	67.0	65.5	**69.0**	**67.0**	**69.5**	**68.0**	3.0	3.0	acute	**65.0**	**62.5**	**65.5**	**63.5**	-1.0	-1.5	acute	72	59	12
894-23	61.0	59.5	new road	61.5	60.0	63.0	**61.0**	63.5	**61.5**	2.5	2.0	acute	59.0	56.5	60.0	57.5	-1.0	-2.0		74	54	21
894-24	59.0	57.0	new road	59.5	57.5	60.0	58.0	61.0	59.0	2.0	2.0	new road, >0.5 dB increase	56.5	54.0	57.5	55.0	-1.5	-2.0		73	51	21
894-25	67.5	66.0	new road	68.0	66.5	**69.0**	**67.0**	**70.0**	**67.5**	2.5	1.5	acute	**65.0**	**62.5**	**66.0**	**63.5**	-1.5	-2.5	acute	74	59	15
894-26	60.5	59.0	new road	61.0	59.5	62.0	**60.0**	63.0	**61.0**	2.5	2.0	acute	58.5	56.0	59.5	57.0	-1.0	-2.0		75	53	22
894-27	60.5	59.0	new road	61.0	59.5	62.0	**60.0**	62.5	**61.0**	2.0	2.0	acute	58.0	56.0	59.0	56.5	-1.5	-2.5		75	53	23
894-28	65.5	63.5	new road	66.0	64.0	**66.5**	**64.5**	**67.5**	**65.5**	2.0	2.0	acute	63.0	**60.5**	64.0	**61.0**	-1.5	-2.5	acute	76	57	19
894-29	60.5	59.0	new road	61.0	59.5	61.5	59.5	62.5	**60.5**	2.0	1.5	acute	58.0	55.5	59.0	56.5	-1.5	-2.5		76	52	23
894-30	57.0	55.5	new road	57.5	56.0	58.5	56.5	59.0	57.5	2.0	2.0	new road, >0.5 dB increase	54.5	52.0	55.5	53.0	-1.5	-2.5		71	49	21
894-31	58.0	56.5	new road	58.5	57.0	59.0	57.0	60.0	58.0	2.0	1.5	new road, >0.5 dB increase	55.5	53.5	56.5	54.0	-1.5	-2.5		73	50	23
894-32	56.5	55.0	new road	57.0	55.5	57.5	55.5	58.5	56.5	2.0	1.5	new road, >0.5 dB increase	53.5	51.0	54.5	52.0	-2.0	-3.0		70	48	22
894-33	60.5	59.0	new road	61.0	59.5	61.5	59.5	62.0	**60.0**	1.5	1.0	acute	57.5	55.5	58.5	56.0	-2.0	-3.0		76	52	23
894-34	64.5	62.5	new road	65.0	63.0	**65.0**	**63.0**	**66.0**	**64.0**	1.5	1.5	acute	61.5	59.0	62.5	**60.0**	-2.0	-2.5	acute	77	56	22
894-35	59.5	57.5	new road	60.0	58.0	60.0	58.5	61.0	59.0	1.5	1.5	new road, >0.5 dB increase	56.5	54.5	57.5	55.5	-2.0	-2.0		74	51	23

Receiver No.	Future Existing (2012) Noise Level, dB(A)		Type of development	Criteria, dB(A)		Base Case						Mitigated Case						Maximum Noise Level minus Noise level development 2012 dB(A)		Maximum noise level – Minimum noise level
						Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required	Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required			
	Day	Night		Day	Night	Day	Night	Day	Night	Day	Night		Day	Night	Day	Night	Day	Night				
894-36	60.0	58.5	new road	60.5	59.0	60.0	58.5	61.0	59.0	1.0	0.5	new road, >0.5 dB increase	56.5	54.0	57.5	55.0	-2.5	-3.5		76	51	25
894-37	63.0	61.5	new road	63.5	62.0	64.0	**62.0**	64.5	**62.5**	1.5	1.0	acute	60.0	57.5	61.0	58.5	-2.0	-3.0		78	54	24
894-38	67.5	66.0	new road	68.0	66.5	**68.0**	**65.5**	**68.5**	**66.5**	1.0	0.5	acute	64.0	**61.5**	**65.0**	**62.0**	-2.5	-4.0	acute	74	58	16
894-39	60.0	58.0	new road	60.5	58.5	59.5	57.5	60.5	58.5	0.5	0.5		56.0	53.5	57.0	54.5	-3.0	-3.5		75	50	25
894-40	64.0	62.0	new road	64.5	62.5	64.0	**62.0**	**65.0**	**63.0**	1.0	1.0	acute	60.5	58.0	61.5	59.0	-2.5	-3.0		79	55	24
894-41	65.0	63.5	new road	65.5	64.0	**65.0**	**63.0**	**66.0**	**64.0**	1.0	0.5	acute	61.5	58.5	62.5	59.5	-2.5	-4.0		79	55	24
894-42	52.0	50.5	new road	55.0	51.0	54.5	52.5	55.5	53.5	3.5	3.0	new road, >0.5 dB increase	51.5	49.0	52.0	50.0	0.0	-0.5		62	46	Lmax < 65
894-43	55.5	54.0	new road	56.0	54.5	56.0	54.0	57.0	55.0	1.5	1.0	new road, >0.5 dB increase	52.5	50.0	53.5	51.0	-2.0	-3.0		67	47	20
894-44	67.5	65.5	new road	68.0	66.0	**66.5**	**64.5**	**67.5**	**65.5**	0.0	0.0	acute	63.0	**60.5**	64.0	**61.0**	-3.5	-4.5	acute	75	57	18
894-45	61.5	60.0	new road	62.0	60.5	61.0	59.5	62.0	**60.0**	0.5	0.0	acute	57.5	55.0	58.5	56.0	-3.0	-4.0		78	52	26
894-46	56.0	54.5	new road	56.5	55.0	55.5	53.0	56.0	54.0	0.0	-0.5		51.5	49.0	52.5	50.0	-3.5	-4.5		70	46	24
894-47	61.5	59.5	new road	62.0	60.0	60.0	58.0	61.0	59.0	-0.5	-0.5		56.5	54.0	57.5	55.0	-4.0	-4.5		78	51	27
894-48	62.5	61.0	new road	63.0	61.5	61.5	59.5	62.5	**60.5**	0.0	-0.5	acute	58.0	55.5	59.0	56.5	-3.5	-4.5		79	52	27
894-49	63.5	62.0	new road	64.0	62.5	62.0	**60.0**	63.0	**61.0**	-0.5	-1.0	acute	58.5	56.0	59.5	57.0	-4.0	-5.0		81	53	29
894-50	61.5	59.5	new road	62.0	60.0	59.5	57.5	60.5	58.5	-1.0	-1.0		56.0	53.5	57.0	54.5	-4.5	-5.0		77	50	27
894-52	59.0	57.0	new road	59.5	57.5	57.0	55.5	58.0	56.0	-1.0	-1.0		53.5	51.0	54.5	52.0	-4.5	-5.0		74	48	26
894-53	65.0	63.5	new road	65.5	64.0	62.5	**60.5**	63.5	**61.5**	-1.5	-2.0	acute	59.5	56.5	60.5	57.5	-4.5	-6.0		83	53	30
894-54	62.0	60.5	new road	62.5	61.0	60.0	58.0	61.0	59.0	-1.0	-1.5		56.5	54.0	57.5	55.0	-4.5	-5.5		79	51	28
894-55	60.5	59.0	new road	61.0	59.5	59.0	57.0	59.5	57.5	-1.0	-1.5		55.5	52.5	56.0	53.5	-4.5	-5.5		76	49	27
894-56	63.0	61.5	new road	63.5	62.0	60.5	58.0	61.0	59.0	-2.0	-2.5		57.0	54.0	58.0	55.0	-5.0	-6.5		80	51	30
894-57	64.5	62.5	new road	65.0	63.0	60.5	58.0	61.5	59.0	-3.0	-3.5		57.5	54.5	58.5	55.0	-6.0	-7.5		82	51	31
894-58	60.5	59.0	new road	61.0	59.5	58.5	56.5	59.0	57.5	-1.5	-1.5		55.0	52.5	56.0	53.0	-4.5	-6.0		76	49	27
894-59	61.5	59.5	new road	62.0	60.0	59.0	57.0	60.0	58.0	-1.5	-1.5		55.5	53.0	56.5	53.5	-5.0	-6.0		77	49	28
894-60	62.0	60.0	new road	62.5	60.5	59.0	56.5	59.5	57.5	-2.5	-2.5		55.5	52.5	56.5	53.5	-5.5	-6.5		78	49	29
894-61	61.5	59.5	new road	62.0	60.0	58.5	56.0	59.5	57.0	-2.0	-2.5		55.0	52.0	56.0	53.0	-5.5	-6.5		79	49	30

Receiver No.	Future Existing (2012) Noise Level, dB(A)		Type of development	Criteria, dB(A)		Base Case							Mitigated Case							Maximum Noise Level [illegible] level development 2012 dB(A)		Maximum noise level – Minimum noise level
						Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required	Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required			
	Day	Night		Day	Night	Day	Night	Day	Night	Day	Night		Day	Night	Day	Night	Day	Night				
896-HO1	51.0	49.5	new road	55.0	50.0	52.0	50.5	53.0	51.0	2.0	1.5	new road, >0.5 dB increase	48.0	46.0	49.0	47.0	-2.0	-2.5		63	43	Lmax < 65
904-HO1	53.0	51.5	new road	55.0	52.0	55.0	53.0	56.0	54.0	3.0	2.5	new road, >0.5 dB increase	50.5	48.5	51.5	49.0	-1.5	-2.5		69	45	24
905-HO1	53.0	51.0	new road	55.0	51.5	55.0	53.0	56.0	54.0	3.0	3.0	new road, >0.5 dB increase	50.5	48.5	51.5	49.0	-1.5	-2.0		69	45	24
906-HO1	53.0	51.5	new road	55.0	52.0	55.0	53.0	56.0	54.0	3.0	2.5	new road, >0.5 dB increase	51.0	48.5	52.0	49.5	-1.0	-2.0		70	45	25
907-HO1	54.0	52.5	new road	55.0	53.0	55.5	53.5	56.5	54.5	2.5	2.0	new road, >0.5 dB increase	51.5	49.0	52.5	50.0	-1.5	-2.5		71	46	25
908-HO1	53.5	51.5	new road	55.0	52.0	53.5	51.5	54.5	52.5	1.0	1.0	new road, >0.5 dB increase	49.5	47.0	50.5	48.0	-3.0	-3.5		65	44	21
908-HO2	51.0	49.5	new road	55.0	50.0	52.0	50.0	53.0	51.0	2.0	1.5	new road, >0.5 dB increase	48.0	46.0	49.0	47.0	-2.0	-2.5		63	43	Lmax < 65
908-HO3	51.0	49.5	new road	55.0	50.0	52.0	50.5	53.0	51.0	2.0	1.5	new road, >0.5 dB increase	48.0	46.0	49.0	47.0	-2.0	-2.5		64	43	Lmax < 65
908-HO4	52.0	50.0	new road	55.0	50.5	52.5	50.5	53.5	51.5	1.5	1.5	new road, >0.5 dB increase	48.5	46.5	49.5	47.5	-2.5	-2.5		65	43	Lmax < 65
909-HO1	53.5	52.0	new road	55.0	52.5	54.5	53.0	55.5	54.0	2.0	2.0	new road, >0.5 dB increase	51.0	48.5	51.5	49.5	-2.0	-2.5		71	45	26
910-HO1	55.0	53.5	new road	55.5	54.0	56.0	54.0	57.0	55.0	2.0	1.5	new road, >0.5 dB increase	52.0	49.5	53.0	50.5	-2.0	-3.0		72	46	26
911-HO1	55.0	53.5	new road	55.5	54.0	56.0	54.0	57.0	55.0	2.0	1.5	new road, >0.5 dB increase	52.0	50.0	53.0	50.5	-2.0	-3.0		73	47	26
912-HO1	59.5	57.5	new road	60.0	58.0	56.5	54.5	57.5	55.5	-2.0	-2.0		53.0	50.5	54.0	51.5	-5.5	-6.0		73	47	26
914-HO1	51.5	49.5	new road	55.0	50.0	52.5	50.5	53.5	51.5	2.0	2.0	new road, >0.5 dB increase	48.5	46.5	49.5	47.0	-2.0	-2.5		64	43	Lmax < 65
917-HO1	51.5	49.5	new road	55.0	50.0	52.5	50.5	53.5	51.5	2.0	2.0	new road, >0.5 dB increase	48.5	46.5	49.5	47.5	-2.0	-2.0		65	43	Lmax < 65
918-HO1	51.5	49.5	new road	55.0	50.0	52.5	50.5	53.5	51.5	2.0	2.0	new road, >0.5 dB increase	48.5	46.5	49.5	47.5	-2.0	-2.0		65	43	Lmax < 65
922-HO1	51.5	50.0	new road	55.0	50.5	53.0	51.0	54.0	52.0	2.5	2.0	new road, >0.5 dB increase	48.5	46.5	49.5	47.5	-2.0	-2.5		65	43	22

Receiver No.	Future Existing (2012) Noise Level, dB(A)		Type of development	Criteria, dB(A)		Base Case						Mitigated Case						Maximum Noise Level [illegible] level development 2012 dB(A)		Maximum noise level – Minimum noise level
						Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required	Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required			
	Day	Night		Day	Night	Day	Night	Day	Night	Day	Night		Day	Night	Day	Night	Day	Night				
924-HO1	52.5	50.5	new road	55.0	51.0	53.0	51.0	54.0	52.0	1.5	1.5	new road, >0.5 dB increase	49.0	47.0	50.0	47.5	-2.5	-3.0		66	44	22
926-HO1	65.5	64.0	new road	66.0	64.5	58.5	56.0	59.0	56.5	-6.5	-7.5		56.0	52.5	57.0	53.0	-8.5	-11.0		84	49	35
929-HO1	52.5	50.5	new road	55.0	51.0	53.0	51.5	54.0	52.0	1.5	1.5	new road, >0.5 dB increase	49.0	47.0	50.0	48.0	-2.5	-2.5		66	44	22
930-HO1	52.5	50.5	new road	55.0	51.0	53.5	51.5	54.0	52.5	1.5	2.0	new road, >0.5 dB increase	49.5	47.0	50.0	48.0	-2.5	-2.5		66	44	22
932-HO1	52.0	50.0	new road	55.0	50.5	53.0	51.0	54.0	52.0	2.0	2.0	new road, >0.5 dB increase	48.5	46.5	49.5	47.5	-2.5	-2.5		66	43	22
932-HO2	49.0	47.0	new road	55.0	50.0	50.5	48.5	51.5	49.5	2.5	2.5		46.0	44.0	47.0	45.0	-2.0	-2.0		62	41	Lmax < 65
933-HO1	53.0	51.0	new road	55.0	51.5	53.5	51.5	54.5	52.5	1.5	1.5	new road, >0.5 dB increase	49.5	47.0	50.5	48.0	-2.5	-3.0		67	44	23
934-HO1	53.0	51.0	new road	55.0	51.5	53.5	51.5	54.5	52.5	1.5	1.5	new road, >0.5 dB increase	49.5	47.5	50.5	48.0	-2.5	-3.0		67	44	23
937-HO1	52.5	50.5	new road	55.0	51.0	53.0	51.5	54.0	52.0	1.5	1.5	new road, >0.5 dB increase	49.0	47.0	50.0	48.0	-2.5	-2.5		66	44	22
938-HO1	53.0	51.0	new road	55.0	51.5	53.5	51.5	54.5	52.5	1.5	1.5	new road, >0.5 dB increase	49.5	47.5	50.5	48.5	-2.5	-2.5		67	44	23
939-HO1	52.5	51.0	new road	55.0	51.5	53.5	51.5	54.0	52.0	1.5	1.0	new road, >0.5 dB increase	49.0	47.0	50.0	48.0	-2.5	-3.0		66	44	22
941-HO1	51.0	49.0	new road	55.0	50.0	52.5	50.5	53.5	51.5	2.5	2.5	new road, >0.5 dB increase	48.5	46.0	49.5	47.0	-1.5	-2.0		65	43	Lmax < 65
942-HO1	53.5	51.5	new road	55.0	52.0	54.0	52.0	54.5	53.0	1.0	1.5	new road, >0.5 dB increase	50.0	47.5	51.0	48.5	-2.5	-3.0		68	45	23
943-HO1	53.0	51.0	new road	55.0	51.5	53.5	51.5	54.5	52.5	1.5	1.5	new road, >0.5 dB increase	49.5	47.0	50.5	48.0	-2.5	-3.0		67	44	23
944-HO1	54.0	52.0	new road	55.0	52.5	54.0	52.0	55.0	53.0	1.0	1.0	new road, >0.5 dB increase	50.0	48.0	51.0	48.5	-3.0	-3.5		68	45	23
945-HO1	51.5	49.5	new road	55.0	50.0	53.0	51.0	54.0	52.0	2.5	2.5	new road, >0.5 dB increase	48.5	46.5	49.5	47.5	-2.0	-2.0		65	43	22
946-HO1	50.0	48.5	new road	55.0	50.0	55.5	53.5	56.0	54.5	6.0	6.0	new road, >0.5 dB increase	51.5	50.0	52.5	51.0	2.5	2.5	new road, >0.5 dB increase	67	47	20
947-HO1	44.5	42.5	new road	55.0	50.0	50.5	48.5	51.5	49.5	7.0	7.0		47.0	45.0	48.0	46.0	3.5	3.5		58	42	Lmax < 65

Receiver No.	Future Existing (2012) Noise Level, dB(A)		Type of development	Criteria, dB(A)		Base Case						Mitigated Case						Maximum Noise Level minimum noise level development 2012 dB(A)		Maximum noise level – Minimum noise level
						Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required	Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required			
	Day	Night		Day	Night	Day	Night	Day	Night	Day	Night		Day	Night	Day	Night	Day	Night				
948-HO1	53.0	51.0	new road	55.0	51.5	53.5	51.5	54.5	52.5	1.5	1.5	new road, >0.5 dB increase	49.5	47.0	50.5	48.0	-2.5	-3.0		67	44	23
949-HO1	53.5	51.5	new road	55.0	52.0	54.0	52.0	55.0	53.0	1.5	1.5	new road, >0.5 dB increase	50.0	47.5	51.0	48.5	-2.5	-3.0		68	45	23
950-HO1	52.0	50.0	new road	55.0	50.5	53.0	51.0	54.0	52.0	2.0	2.0	new road, >0.5 dB increase	49.0	46.5	50.0	47.5	-2.0	-2.5		66	43	23
951-HO1	52.0	50.0	new road	55.0	50.5	53.5	51.5	54.0	52.0	2.0	2.0	new road, >0.5 dB increase	49.0	47.0	50.0	47.5	-2.0	-2.5		66	44	22
952-HO1	48.0	46.0	new road	55.0	50.0	49.0	47.0	50.0	48.0	2.0	2.0		45.5	42.5	46.0	43.5	-2.0	-2.5		64	39	Lmax < 65
953-HO1	46.0	44.5	new road	55.0	50.0	51.5	50.0	52.5	50.5	6.5	6.0	new road, >0.5 dB increase	48.0	46.0	48.5	47.0	2.5	2.5		63	43	Lmax < 65
954-HO1	53.0	51.5	new road	55.0	52.0	53.5	51.5	54.5	52.5	1.5	1.0	new road, >0.5 dB increase	49.5	47.0	50.5	48.0	-2.5	-3.5		67	44	23
954-HO2	49.0	47.0	new road	55.0	50.0	50.5	48.5	51.5	49.5	2.5	2.5		46.0	44.0	47.0	44.5	-2.0	-2.5		62	41	Lmax < 65
955-HO1	55.0	53.5	new road	55.5	54.0	54.5	52.5	55.5	53.5	0.5	0.0		50.5	48.5	51.5	49.5	-3.5	-4.0		69	45	24
957-HO1	52.0	50.0	new road	55.0	50.5	52.5	50.5	53.5	51.5	1.5	1.5	new road, >0.5 dB increase	48.5	46.0	49.5	47.0	-2.5	-3.0		66	43	23
959-HO1	54.0	52.0	new road	55.0	52.5	54.0	52.0	55.0	53.0	1.0	1.0	new road, >0.5 dB increase	50.0	48.0	51.0	48.5	-3.0	-3.5		68	45	23
960-HO1	56.5	54.5	new road	57.0	55.0	55.0	53.0	55.5	53.5	-1.0	-1.0		51.0	48.5	52.0	49.5	-4.5	-5.0		70	45	25
961-HO1	54.5	52.5	new road	55.0	53.0	54.0	52.0	55.0	53.0	0.5	0.5		50.0	48.0	51.0	49.0	-3.5	-3.5		68	45	24
962-HO1	47.0	45.5	new road	55.0	50.0	46.5	44.5	47.5	45.5	0.5	0.0		42.5	40.5	43.5	41.5	-3.5	-4.0		65	37	28
963-HO1	51.0	49.0	new road	55.0	50.0	52.5	50.5	53.5	51.5	2.5	2.5	new road, >0.5 dB increase	48.5	46.0	49.0	47.0	-2.0	-2.0		65	43	23
964-HO1	55.0	53.0	new road	55.5	53.5	54.5	52.5	55.5	53.5	0.5	0.5		50.5	48.0	51.5	49.0	-3.5	-4.0		69	45	24
965-HO1	57.0	55.0	new road	57.5	55.5	54.5	52.5	55.5	53.5	-1.5	-1.5		51.0	48.5	52.0	49.5	-5.0	-5.5		71	45	26
968-HO1	50.5	48.5	new road	55.0	50.0	51.5	49.5	52.5	50.5	2.0	2.0	new road, >0.5 dB increase	47.5	45.0	48.5	46.0	-2.0	-2.5		65	42	24
969-HO1	53.5	51.5	new road	55.0	52.0	50.5	47.0	51.5	48.0	-2.0	-3.5		48.5	44.5	49.5	45.5	-4.0	-6.0		66	41	24
970-HO1	54.0	52.0	new road	55.0	52.5	54.0	52.0	55.0	53.0	1.0	1.0	new road, >0.5 dB increase	50.0	48.0	51.0	48.5	-3.0	-3.5		68	45	23
971-HO1	56.5	55.0	new road	57.0	55.5	55.0	53.0	56.0	54.0	-0.5	-1.0		51.5	49.0	52.0	49.5	-4.5	-5.5		71	46	25

Receiver No.	Future Existing (2012) Noise Level, dB(A)		Type of development	Criteria, dB(A)		Base Case						Mitigated Case						Maximum Noise Level [illegible] level development 2012 dB(A)		Maximum noise level – Minimum noise level
						Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required	Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required			
	Day	Night		Day	Night	Day	Night	Day	Night	Day	Night		Day	Night	Day	Night	Day	Night				
972-HO1	53.0	51.5	new road	55.0	52.0	54.0	52.0	54.5	52.5	1.5	1.0	new road, >0.5 dB increase	49.5	47.5	50.5	48.5	-2.5	-3.0		67	44	23
974-HO1	62.5	61.5	new road	63.0	62.0	64.5	**63.5**	**65.5**	**64.5**	3.0	3.0	acute	60.5	59.0	61.0	**60.0**	-1.5	-1.5	acute	82	56	26
975-HO1	58.5	56.5	new road	59.0	57.0	55.0	53.0	56.0	54.0	-2.5	-2.5		52.0	49.5	53.0	50.0	-5.5	-6.5		72	46	26
979-HO1	53.5	51.5	new road	55.0	52.0	54.0	52.0	55.0	52.5	1.5	1.0	new road, >0.5 dB increase	50.0	47.5	51.0	48.5	-2.5	-3.0		67	44	23
980-HO1	55.5	53.5	new road	56.0	54.0	54.5	52.0	55.0	53.0	-0.5	-0.5		50.5	48.0	51.5	49.0	-4.0	-4.5		71	45	26
982-HO1	52.5	51.0	new road	55.0	51.5	53.0	51.0	54.0	52.0	1.5	1.0	new road, >0.5 dB increase	49.0	47.0	50.0	47.5	-2.5	-3.5		66	44	22
983-HO1	57.5	55.5	new road	58.0	56.0	55.0	53.0	56.0	54.0	-1.5	-1.5		51.5	49.0	52.5	50.0	-5.0	-5.5		72	46	26
984-HO1	56.0	54.0	new road	56.5	54.5	55.0	53.0	56.0	53.5	0.0	-0.5		51.0	49.0	52.0	49.5	-4.0	-4.5		70	46	25
985-HO1	55.0	53.0	new road	55.5	53.5	54.5	52.5	55.5	53.5	0.5	0.5		50.5	48.5	51.5	49.0	-3.5	-4.0		68	45	23
986-HO1	54.0	52.5	new road	55.0	53.0	51.0	48.5	52.0	49.5	-2.0	-3.0		48.5	45.0	49.5	46.0	-4.5	-6.5		65	42	Lmax < 65
991-HO1	55.0	53.0	new road	55.5	53.5	53.0	50.5	53.5	51.5	-1.5	-1.5		49.5	47.0	50.5	48.0	-4.5	-5.0		69	44	26
994-HO1	58.0	56.5	new road	58.5	57.0	55.0	53.0	56.0	54.0	-2.0	-2.5		52.0	49.0	52.5	50.0	-5.5	-6.5		72	46	26
996-HO1	59.0	57.0	new road	59.5	57.5	55.5	53.0	56.5	54.0	-2.5	-3.0		52.0	49.5	53.0	50.5	-6.0	-6.5		73	46	27
997-HO1	60.5	58.5	new road	61.0	59.0	55.5	53.5	56.5	54.0	-4.0	-4.5		52.5	50.0	53.5	50.5	-7.0	-8.0		74	46	28
998-HO1	55.5	53.5	new road	56.0	54.0	54.5	52.0	55.0	53.0	-0.5	-0.5		50.5	48.0	51.5	49.0	-4.0	-4.5		69	45	24
999-HO1	49.0	47.5	new road	55.0	50.0	56.0	54.5	57.0	55.5	8.0	8.0	new road, >0.5 dB increase	52.5	51.0	53.5	52.0	4.5	4.5	new road, >0.5 dB increase	67	48	19
999-HO2	47.5	46.0	new road	55.0	50.0	55.0	53.5	56.0	54.0	8.5	8.0	new road, >0.5 dB increase	51.5	50.0	52.5	50.5	5.0	4.5	new road, >0.5 dB increase	66	47	19
1001-HO1	45.5	44.0	new road	55.0	50.0	50.5	49.0	51.5	50.0	6.0	6.0		47.0	45.0	48.0	46.0	2.5	2.0		63	42	Lmax < 65
1002-HO1	60.0	58.0	new road	60.5	58.5	55.5	53.0	56.5	54.0	-3.5	-4.0		52.5	49.5	53.5	50.5	-6.5	-7.5		74	46	28
1004-HO1	54.5	53.0	new road	55.0	53.5	46.0	43.0	47.0	43.5	-7.5	-9.5		44.5	41.0	46.0	42.0	-8.5	-11.0		73	36	36
1005-HO1	44.5	42.5	new road	55.0	50.0	48.5	46.5	49.0	47.5	4.5	5.0		44.5	42.5	45.5	43.0	1.0	0.5		61	39	Lmax < 65
1006-HO1	55.5	53.5	new road	56.0	54.0	46.0	42.0	47.0	43.0	-8.5	-10.5		44.5	40.5	46.0	41.0	-9.5	-12.5		73	35	38
1007-HO1	45.0	43.5	new road	55.0	50.0	50.0	48.0	50.5	49.0	5.5	5.5		46.5	44.5	47.0	45.5	2.0	2.0		62	41	Lmax < 65
1010-HO1	61.0	59.5	new road	61.5	60.0	55.5	53.5	56.5	54.0	-4.5	-5.5		53.0	50.0	54.0	50.5	-7.0	-9.0		75	46	29

Receiver No.	Future Existing (2012) Noise Level, dB(A)		Type of development	Criteria, dB(A)		Base Case						Mitigated Case						Maximum Noise Level [illegible] level development 2012 dB(A)		Maximum noise level – Minimum noise level
						Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required	Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required			
	Day	Night		Day	Night	Day	Night	Day	Night	Day	Night		Day	Night	Day	Night	Day	Night				
1010-HO2	61.5	59.5	new road	62.0	60.0	55.5	53.5	56.5	54.0	-5.0	-5.5		53.0	50.0	54.0	50.5	-7.5	-9.0		75	46	30
1011-HO2	51.5	49.5	new road	55.0	50.0	52.5	50.5	53.0	51.5	1.5	2.0	new road, >0.5 dB increase	48.0	46.0	49.0	47.0	-2.5	-2.5		64	43	Lmax < 65
1012-HO1	61.5	59.5	new road	62.0	60.0	55.5	53.0	56.5	54.0	-5.0	-5.5		53.0	50.0	54.0	50.5	-7.5	-9.0		76	46	30
1013-HO1	60.5	58.5	new road	61.0	59.0	55.0	52.5	56.0	53.5	-4.5	-5.0		52.0	49.0	53.0	50.0	-7.5	-8.5		75	45	29
1017-HO1	62.0	60.5	new road	62.5	61.0	55.5	53.0	56.5	54.0	-5.5	-6.5		53.0	50.0	54.0	50.5	-8.0	-10.0		77	46	31
1019-HO1	61.5	59.5	new road	62.0	60.0	53.5	51.0	54.5	51.5	-7.0	-8.0		52.0	48.5	53.0	49.0	-8.5	-10.5		76	43	33
1020-HO1	50.5	48.5	new road	55.0	50.0	58.5	57.0	59.5	58.0	9.0	9.5	new road, >0.5 dB increase	54.5	53.0	55.5	54.0	5.0	5.5	new road, >0.5 dB increase	72	50	22
1022-HO1	46.5	45.0	new road	55.0	50.0	53.5	52.0	54.5	53.0	8.0	8.0	new road, >0.5 dB increase	50.0	48.0	51.0	49.0	4.5	4.0		64	45	Lmax < 65
1024-HO1	47.5	45.5	new road	55.0	50.0	55.0	53.0	56.0	54.0	8.5	8.5	new road, >0.5 dB increase	51.5	49.5	52.0	50.5	4.5	5.0	new road, >0.5 dB increase	66	47	19
1026-HO1	56.0	54.0	new road	56.5	54.5	53.0	51.0	54.0	52.0	-2.0	-2.0		50.0	47.5	51.0	48.0	-5.0	-6.0		69	44	26
1030-HO1	59.5	57.5	new road	60.0	58.0	54.0	51.5	55.0	52.5	-4.5	-5.0		51.5	48.5	52.5	49.0	-7.0	-8.5		74	44	30
1033-HO1	53.0	51.5	new road	55.0	52.0	47.5	43.0	48.5	44.0	-4.5	-7.5		47.0	42.0	48.0	43.0	-5.0	-8.5		67	39	28
1033-HO2	55.0	53.5	new road	55.5	54.0	49.0	44.0	50.0	45.0	-5.0	-8.5		48.5	43.5	49.5	44.5	-5.5	-9.0		70	40	29
1034-HO1	40.0	35.0	new road	55.0	50.0	53.5	51.5	54.0	52.5	14.0	17.5	new road, >0.5 dB increase	52.0	50.5	53.0	51.5	13.0	16.5	new road, >0.5 dB increase	64	48	Lmax < 65
1035-HO1	48.5	47.0	new road	55.0	50.0	58.5	57.0	59.5	57.5	11.0	10.5	new road, >0.5 dB increase	55.0	53.5	56.0	54.5	7.5	7.5	new road, >0.5 dB increase	71	51	20
1035-HO2	47.5	46.0	new road	55.0	50.0	56.0	54.5	57.0	55.5	9.5	9.5	new road, >0.5 dB increase	52.0	50.5	53.0	51.5	5.5	5.5	new road, >0.5 dB increase	67	48	20
1039-HO1	40.0	35.0	new road	55.0	50.0	53.0	51.5	54.0	52.5	14.0	17.5	new road, >0.5 dB increase	52.0	50.5	53.0	51.0	13.0	16.0	new road, >0.5 dB increase	64	48	Lmax < 65
1042-HO1	40.0	35.0	new road	55.0	50.0	35.5	33.5	36.0	34.5	-4.0	-0.5		34.0	32.0	34.5	33.0	-5.5	-2.0		42	35	Lmax < 65
1045-HO1	45.5	44.0	new road	55.0	50.0	54.0	52.0	55.0	53.0	9.5	9.0	new road, >0.5 dB increase	51.5	50.0	52.5	50.5	7.0	6.5	new road, >0.5 dB increase	64	47	Lmax < 65
1046-HO1	40.0	35.0	new road	55.0	50.0	53.0	51.5	54.0	52.5	14.0	17.5	new road, >0.5 dB increase	52.0	50.0	53.0	51.0	13.0	16.0	new road, >0.5 dB increase	64	47	Lmax < 65
1048-HO1	57.0	55.5	new road	57.5	56.0	51.0	48.5	52.0	49.5	-5.0	-6.0		49.0	45.5	50.0	46.0	-7.0	-9.5		72	41	31

Receiver No.	Future Existing (2012) Noise Level, dB(A)		Type of development	Criteria, dB(A)		Base Case						Mitigated Case						Maximum Noise Level [illegible] level development 2012 dB(A)		Maximum noise level – Minimum noise level
						Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required	Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required			
	Day	Night		Day	Night	Day	Night	Day	Night	Day	Night		Day	Night	Day	Night	Day	Night				
1050-HO1	40.0	35.0	new road	55.0	50.0	55.0	53.0	56.0	54.0	16.0	19.0	new road, >0.5 dB increase	53.5	52.0	54.5	52.5	14.5	17.5	new road, >0.5 dB increase	66	49	18
1050-HO2	40.0	35.0	new road	55.0	50.0	52.5	51.0	53.5	52.0	13.5	17.0	new road, >0.5 dB increase	51.0	49.5	52.0	50.0	12.0	15.0		65	47	Lmax < 65
1051-HO1	40.0	35.0	new road	55.0	50.0	52.0	50.5	53.0	51.0	13.0	16.0	new road, >0.5 dB increase	50.5	49.0	51.5	50.0	11.5	15.0		63	46	Lmax < 65
1055-HO1	55.0	53.0	new road	55.5	53.5	49.5	46.5	50.5	47.5	-4.5	-5.5		47.0	43.5	48.0	44.0	-7.0	-9.0		67	39	28
1055-HO2	55.5	53.5	new road	56.0	54.0	49.0	46.0	50.0	47.0	-5.5	-6.5		46.5	43.0	47.5	44.0	-8.0	-9.5		69	39	30
1060-HO1	40.0	35.0	new road	55.0	50.0	55.5	53.5	56.5	54.5	16.5	19.5	new road, >0.5 dB increase	55.0	53.0	55.5	54.0	15.5	19.0	new road, >0.5 dB increase	65	50	15
1060-HO2	40.0	35.0	new road	55.0	50.0	55.0	53.5	56.0	54.5	16.0	19.5	new road, >0.5 dB increase	54.5	53.0	55.5	54.0	15.5	19.0	new road, >0.5 dB increase	65	50	15
1060-HO3	40.0	35.0	new road	55.0	50.0	48.0	46.0	49.0	47.0	9.0	12.0		47.5	46.0	48.5	47.0	8.5	12.0		57	43	Lmax < 65
1060-HO4	40.0	35.0	new road	55.0	50.0	42.0	40.0	43.0	41.0	3.0	6.0		41.5	40.0	42.5	41.0	2.5	6.0		49	37	Lmax < 65
1060-HO5	40.0	35.0	new road	55.0	50.0	53.5	52.0	54.5	52.5	14.5	17.5	new road, >0.5 dB increase	53.0	51.5	54.0	52.5	14.0	17.5	new road, >0.5 dB increase	64	49	Lmax < 65
1060-HO6	40.0	35.0	new road	55.0	50.0	55.0	53.0	56.0	54.0	16.0	19.0	new road, >0.5 dB increase	54.5	52.5	55.0	53.5	15.0	18.5	new road, >0.5 dB increase	65	50	15
1062-HO1	41.5	40.0	new road	55.0	50.0	61.0	59.5	62.0	**60.5**	20.5	20.5	acute	60.0	58.5	61.0	59.5	19.5	19.5	new road, >0.5 dB increase	76	56	21
1062-HO2	40.5	39.0	new road	55.0	50.0	58.0	56.5	59.0	57.5	18.5	18.5	new road, >0.5 dB increase	57.0	55.5	58.0	56.5	17.5	17.5	new road, >0.5 dB increase	73	53	21
1074-HO1	40.0	35.0	new road	55.0	50.0	53.5	52.0	54.0	52.5	14.0	17.5	new road, >0.5 dB increase	53.0	51.5	54.0	52.0	14.0	17.0	new road, >0.5 dB increase	68	49	20
1074-HO2	40.0	35.0	new road	55.0	50.0	55.0	53.5	56.0	54.5	16.0	19.5	new road, >0.5 dB increase	54.0	52.5	55.0	53.5	15.0	18.5	new road, >0.5 dB increase	67	50	17
1076-HO1	75.5	73.5	new road	76.0	74.0	**71.0**	**65.5**	**72.0**	**66.5**	-3.5	-7.0	acute	**71.0**	**65.5**	**72.0**	**66.5**	-3.5	-7.0	acute	92	63	29
1079-HO1	40.0	35.0	new road	55.0	50.0	60.5	59.0	61.5	59.5	21.5	24.5	new road, >0.5 dB increase	60.0	58.5	61.0	59.0	21.0	24.0	new road, >0.5 dB increase	73	55	17
1083-HO1	40.0	35.0	new road	55.0	50.0	49.5	48.0	50.5	49.0	10.5	14.0		49.5	48.0	50.5	49.0	10.5	14.0		63	45	Lmax < 65
1084-HO1	60.0	58.0	new road	60.5	58.5	56.0	50.5	57.0	51.5	-3.0	-6.5		56.0	50.5	57.0	51.5	-3.0	-6.5		71	48	23

Receiver No.	Future Existing (2012) Noise Level, dB(A)		Type of development	Criteria, dB(A)		Base Case						Mitigated Case						Maximum Noise Level [illegible] level development 2012 dB(A)		Maximum noise level – Minimum noise level
						Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required	Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required			
	Day	Night		Day	Night	Day	Night	Day	Night	Day	Night		Day	Night	Day	Night	Day	Night				
1097-HO1	49.0	47.0	new road	55.0	50.0	51.0	49.5	52.0	50.5	3.0	3.5	new road, >0.5 dB increase	50.0	48.5	51.0	49.5	2.0	2.5		67	46	22
1097-HO2	48.5	46.5	new road	55.0	50.0	53.5	52.0	54.5	53.0	6.0	6.5	new road, >0.5 dB increase	52.5	51.0	53.5	52.0	5.0	5.5	new road, >0.5 dB increase	69	48	21
1099-HO1	60.5	59.0	new road	61.0	59.5	57.0	51.5	58.0	52.5	-2.5	-6.5		57.0	51.5	58.0	52.5	-2.5	-6.5		78	49	29
1100-HO1	62.0	61.0	new road	62.5	61.5	58.0	53.5	59.0	54.5	-3.0	-6.5		58.0	53.5	59.0	54.5	-3.0	-6.5		79	51	28
1101-HO1	44.0	42.0	new road	55.0	50.0	63.0	**61.0**	64.0	**62.0**	20.0	20.0	acute	63.0	**61.0**	64.0	**62.0**	20.0	20.0	acute	73	58	15
1102-HO1	56.0	54.0	new road	56.5	54.5	52.0	47.0	53.0	48.0	-3.0	-6.0		52.0	47.0	53.0	48.0	-3.0	-6.0		71	45	27
1104-HO1	66.5	64.5	new road	67.0	65.0	62.0	57.0	63.0	58.0	-3.5	-6.5		62.0	57.0	63.0	58.0	-3.5	-6.5		84	55	30
1106-HO1	57.5	55.5	new road	58.0	56.0	53.5	48.5	54.5	49.0	-3.0	-6.5		53.5	48.5	54.5	49.0	-3.0	-6.5		72	46	26
1109-HO1	62.0	60.0	new road	62.5	60.5	57.5	52.5	58.5	53.5	-3.5	-6.5		57.5	52.5	58.5	53.5	-3.5	-6.5		77	50	27
1112-HO1	58.0	56.0	new road	58.5	56.5	54.0	48.5	55.0	49.5	-3.0	-6.5		54.0	48.5	55.0	49.5	-3.0	-6.5		70	46	24
1113-HO1	73.0	71.0	new road	73.5	71.5	**69.0**	**63.5**	**70.0**	**64.5**	-3.0	-6.5	acute	**69.0**	**63.5**	**70.0**	**64.5**	-3.0	-6.5	acute	91	61	30
1113-HO2	69.5	68.0	new road	70.0	68.5	**65.5**	**60.5**	**66.5**	**61.5**	-3.0	-6.5	acute	**65.5**	**60.5**	**66.5**	**61.5**	-3.0	-6.5	acute	88	58	30
1115-HO1	49.5	48.0	new road	55.0	50.0	50.5	48.5	51.5	49.0	2.0	1.0		50.5	48.5	51.5	49.0	2.0	1.0		67	45	21
1117-HO1	40.0	35.0	new road	55.0	50.0	48.5	46.5	49.0	47.5	9.0	12.5		48.5	46.5	49.0	47.5	9.0	12.5		59	44	Lmax < 65
1119-HO1	56.5	54.5	new road	57.0	55.0	56.5	54.5	57.5	55.5	1.0	1.0	new road, >0.5 dB increase	56.5	54.5	57.5	55.5	1.0	1.0	new road, >0.5 dB increase	69	51	17
1120-HO1	51.5	49.5	new road	55.0	50.0	62.5	**60.5**	63.5	**61.5**	12.0	12.0	acute	62.5	**60.5**	63.5	**61.5**	12.0	12.0	acute	76	58	18
1120-HO2	51.5	49.5	new road	55.0	50.0	57.0	55.0	58.0	56.0	6.5	6.5	new road, >0.5 dB increase	57.0	55.0	57.5	56.0	6.0	6.5	new road, >0.5 dB increase	73	52	21
1122-HO1	53.0	51.0	new road	55.0	51.5	55.0	53.0	56.0	54.0	3.0	3.0	new road, >0.5 dB increase	55.0	52.5	55.5	53.5	2.5	2.5	new road, >0.5 dB increase	65	49	16
1124-HO1	61.5	59.5	new road	62.0	60.0	57.5	52.0	58.5	53.0	-3.0	-6.5		57.5	52.0	58.5	53.0	-3.0	-6.5		73	50	24
1125-HO1	67.0	65.0	new road	67.5	65.5	63.0	58.0	64.0	58.5	-3.0	-6.5		63.0	58.0	64.0	58.5	-3.0	-6.5		82	55	27
1126-HO1	69.0	67.0	new road	69.5	67.5	**65.0**	59.5	**66.0**	**60.5**	-3.0	-6.5	acute	**65.0**	59.5	**66.0**	**60.5**	-3.0	-6.5	acute	86	57	29
1128-HO1	47.5	45.5	new road	55.0	50.0	49.5	47.0	50.0	48.0	2.5	2.5		48.5	46.0	49.5	47.0	2.0	1.5		61	43	Lmax < 65
1130-HO1	49.5	47.5	new road	55.0	50.0	52.0	49.5	53.0	50.5	3.5	3.0	new road, >0.5 dB increase	51.5	49.0	52.5	50.0	3.0	2.5		62	46	Lmax < 65

Receiver No.	Future Existing (2012) Noise Level, dB(A)		Type of development	Criteria, dB(A)		Base Case						Mitigated Case						Maximum Noise Level minimum noise level development 2012 dB(A)		Maximum noise level – Minimum noise level
						Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required	Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required			
	Day	Night		Day	Night	Day	Night	Day	Night	Day	Night		Day	Night	Day	Night	Day	Night				
1134-HO1	47.5	45.5	new road	55.0	50.0	50.5	48.5	51.0	49.0	3.5	3.5		47.5	45.5	48.5	46.5	1.0	1.0		62	43	Lmax < 65
1134-HO2	47.5	45.5	new road	55.0	50.0	49.0	47.0	50.0	48.0	2.5	2.5		45.5	43.0	46.0	44.0	-1.5	-1.5		62	40	Lmax < 65
1135-HO1	52.0	50.0	new road	55.0	50.5	57.5	55.5	58.5	56.5	6.5	6.5	new road, >0.5 dB increase	57.5	55.0	58.0	56.0	6.0	6.0	new road, >0.5 dB increase	67	52	15
1136-HO1	59.5	57.5	new road	60.0	58.0	55.5	50.0	56.5	51.0	-3.0	-6.5		55.5	50.0	56.5	51.0	-3.0	-6.5		72	48	25
1139-HO1	59.0	57.0	new road	59.5	57.5	56.5	52.0	57.5	53.0	-1.5	-4.0		56.0	52.0	57.0	53.0	-2.0	-4.0		71	49	22
1141-HO1	60.5	58.5	new road	61.0	59.0	56.5	52.0	57.5	53.0	-3.0	-5.5		56.5	52.0	57.5	52.5	-3.0	-6.0		77	49	28
1142-HO1	67.0	65.0	new road	67.5	65.5	63.0	57.5	64.0	58.5	-3.0	-6.5		63.0	57.5	64.0	58.5	-3.0	-6.5		85	55	30
1143-HO1	50.5	48.5	new road	55.0	50.0	52.0	50.0	53.0	51.0	2.5	2.5	new road, >0.5 dB increase	48.5	46.0	49.0	47.0	-1.5	-1.5		65	43	Lmax < 65
1144-HO1	62.0	60.0	new road	62.5	60.5	58.0	53.5	59.0	54.5	-3.0	-5.5		58.0	53.5	59.0	54.0	-3.0	-6.0		76	51	26
1145-HO1	52.0	50.5	new road	55.0	51.0	54.0	52.0	55.0	53.0	3.0	2.5	new road, >0.5 dB increase	50.5	48.0	51.5	49.0	-0.5	-1.5		66	45	21
1146-HO1	61.0	59.0	new road	61.5	59.5	58.5	55.5	59.5	56.0	-1.5	-3.0		58.5	55.5	59.5	56.0	-1.5	-3.0		74	52	21
1147-HO1	65.0	63.0	new road	65.5	63.5	61.0	56.0	62.0	57.0	-3.0	-6.0		61.0	56.0	62.0	57.0	-3.0	-6.0		80	53	27
1150-HO1	56.0	54.0	new road	56.5	54.5	52.0	46.5	53.0	47.5	-3.0	-6.5		52.0	46.5	53.0	47.5	-3.0	-6.5		68	44	24
1150-HO2	65.0	63.0	new road	65.5	63.5	61.0	56.0	62.0	57.0	-3.0	-6.0		61.0	56.0	62.0	57.0	-3.0	-6.0		81	53	28
1151-HO1	71.0	69.0	new road	71.5	69.5	**67.0**	**62.0**	**68.0**	**63.0**	-3.0	-6.0	acute	**67.0**	**62.0**	**68.0**	**63.0**	-3.0	-6.0	acute	88	59	28
1153-HO1	57.5	55.5	new road	58.0	56.0	56.5	54.5	57.5	55.5	0.0	0.0		56.5	54.5	57.5	55.5	0.0	0.0		71	51	19
1158-HO1	53.0	51.0	new road	55.0	51.5	58.5	56.5	59.5	57.5	6.5	6.5	new road, >0.5 dB increase	58.5	56.5	59.5	57.5	6.5	6.5	new road, >0.5 dB increase	68	53	15
1158-HO2	49.0	47.0	new road	55.0	50.0	51.5	49.0	52.0	50.0	3.0	3.0		48.5	45.5	49.5	46.5	0.5	-0.5		63	42	Lmax < 65
1159-HO1	75.0	73.0	new road	75.5	73.5	**71.0**	**65.0**	**72.0**	**66.0**	-3.0	-7.0	acute	**71.0**	**65.0**	**72.0**	**66.0**	-3.0	-7.0	acute	91	62	29
1162-HO1	59.5	57.5	new road	60.0	58.0	62.5	**60.5**	63.0	**61.0**	3.5	3.5	acute	58.5	56.0	59.5	57.0	0.0	-0.5		75	53	22
1165-HO1	46.5	44.5	new road	55.0	50.0	48.0	46.0	49.0	47.0	2.5	2.5		44.5	42.0	45.5	43.0	-1.0	-1.5		63	39	Lmax < 65
1166-HO1	49.5	47.5	new road	55.0	50.0	50.5	49.0	51.5	50.0	2.0	2.5		47.0	45.0	48.0	45.5	-1.5	-2.0		65	42	23
1169-HO1	44.5	42.5	new road	55.0	50.0	46.5	44.5	47.5	45.5	3.0	3.0		43.5	40.5	44.0	41.5	-0.5	-1.0		62	37	Lmax < 65
1170-HO1	61.5	59.5	new road	62.0	60.0	58.0	53.5	59.0	54.5	-2.5	-5.0		58.0	53.0	59.0	54.0	-2.5	-5.5		73	50	23

Receiver No.	Future Existing (2012) Noise Level, dB(A)		Type of development	Criteria, dB(A)		Base Case						Mitigated Case						Maximum Noise Level minimum noise level development 2012 dB(A)		Maximum noise level – Minimum noise level
						Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required	Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required			
	Day	Night		Day	Night	Day	Night	Day	Night	Day	Night		Day	Night	Day	Night	Day	Night				
1171-HO1	47.0	45.0	new road	55.0	50.0	48.5	47.0	49.5	48.0	2.5	3.0		45.5	43.0	46.5	44.0	-0.5	-1.0		64	40	Lmax < 65
1172-HO1	51.0	49.0	new road	55.0	50.0	52.0	50.5	53.0	51.5	2.0	2.5	new road, >0.5 dB increase	48.5	46.5	49.0	47.5	-2.0	-1.5		65	43	22
1173-HO1	60.5	59.0	new road	61.0	59.5	56.5	52.0	57.5	52.5	-3.0	-6.5		56.5	51.5	57.5	52.5	-3.0	-6.5		73	49	24
1178-HO1	50.0	48.0	new road	55.0	50.0	51.5	49.5	52.5	50.5	2.5	2.5	new road, >0.5 dB increase	48.5	46.0	49.0	47.0	-1.0	-1.0		64	43	Lmax < 65
1179-HO1	45.5	43.5	new road	55.0	50.0	47.5	45.0	48.5	46.0	3.0	2.5		44.5	41.5	45.5	42.5	0.0	-1.0		59	38	Lmax < 65
1180-HO1	48.5	46.5	new road	55.0	50.0	49.5	47.5	50.5	48.5	2.0	2.0		47.0	44.0	47.5	45.0	-1.0	-1.5		63	41	Lmax < 65
1181-HO1	52.0	50.0	new road	55.0	50.5	53.0	50.5	53.5	51.5	1.5	1.5	new road, >0.5 dB increase	50.0	47.5	51.0	48.5	-1.0	-1.5		65	44	Lmax < 65
1184-HO1	52.5	50.5	new road	55.0	51.0	53.0	51.0	54.0	52.0	1.5	1.5	new road, >0.5 dB increase	50.0	47.5	51.0	48.5	-1.5	-2.0		65	44	21
1185-HO1	48.0	46.0	new road	55.0	50.0	49.5	47.0	50.0	48.0	2.0	2.0		46.5	43.5	47.5	44.5	-0.5	-1.5		61	41	Lmax < 65
1186-HO1	55.0	53.5	new road	55.5	54.0	56.0	54.5	57.0	55.5	2.0	2.0	new road, >0.5 dB increase	52.5	51.0	53.5	52.0	-1.5	-1.5		70	47	23
1187-HO1	51.5	50.0	new road	55.0	50.5	52.0	50.0	53.0	51.0	1.5	1.0	new road, >0.5 dB increase	49.5	46.5	50.5	47.5	-1.0	-2.5		64	44	Lmax < 65
1188-HO1	53.0	51.5	new road	55.0	52.0	53.5	52.0	54.5	53.0	1.5	1.5	new road, >0.5 dB increase	50.5	48.5	51.5	49.5	-1.5	-2.0		67	45	22
1190-HO1	56.0	54.5	new road	56.5	55.0	56.5	55.0	57.5	56.0	1.5	1.5	new road, >0.5 dB increase	53.0	51.0	54.0	52.5	-2.0	-2.0		72	48	24
1192-HO1	57.5	56.0	new road	58.0	56.5	58.5	57.5	59.5	58.5	2.0	2.5	new road, >0.5 dB increase	55.0	53.5	55.5	54.5	-2.0	-1.5		75	50	25
1194-HO1	56.5	55.0	new road	57.0	55.5	57.5	56.0	58.0	57.0	1.5	2.0	new road, >0.5 dB increase	54.0	52.0	55.0	53.0	-1.5	-2.0		72	49	23
1195-HO1	53.5	52.0	new road	55.0	52.5	54.0	52.0	55.0	53.0	1.5	1.0	new road, >0.5 dB increase	51.0	48.5	52.0	49.5	-1.5	-2.5		67	45	21
1196-HO1	54.0	52.5	new road	55.0	53.0	54.5	52.5	55.0	53.5	1.0	1.0	new road, >0.5 dB increase	51.0	49.0	52.0	50.0	-2.0	-2.5		68	46	22
1196-HO2	54.5	52.5	new road	55.0	53.0	54.5	53.0	55.5	54.0	1.0	1.5	new road, >0.5 dB increase	52.0	49.5	52.5	50.5	-2.0	-2.0		68	46	22
1197-HO1	54.5	52.5	new road	55.0	53.0	55.0	53.5	56.0	54.5	1.5	2.0	new road, >0.5 dB increase	52.0	50.0	53.0	51.0	-1.5	-1.5		68	47	21

Receiver No.	Future Existing (2012) Noise Level, dB(A)		Type of development	Criteria, dB(A)		Base Case						Mitigated Case						Maximum Noise Level [illegible] level development 2012 dB(A)		Maximum noise level – Minimum noise level
						Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required	Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required			
	Day	Night		Day	Night	Day	Night	Day	Night	Day	Night		Day	Night	Day	Night	Day	Night				
1198-HO1	58.0	56.5	new road	58.5	57.0	59.0	58.0	60.0	59.0	2.0	2.5	new road, >0.5 dB increase	55.5	54.0	56.5	55.0	-1.5	-1.5		78	51	27
1199-HO1	56.0	54.0	new road	56.5	54.5	56.5	55.0	57.0	56.0	1.0	2.0	new road, >0.5 dB increase	53.0	51.0	54.0	52.0	-2.0	-2.0		70	48	23
1200-HO1	50.0	48.0	new road	55.0	50.0	51.0	49.0	52.0	50.0	2.0	2.0		49.0	46.0	50.0	47.0	0.0	-1.0		64	42	Lmax < 65
1202-HO1	47.5	45.5	new road	55.0	50.0	49.5	47.5	50.5	48.5	3.0	3.0		47.0	44.0	48.0	45.0	0.5	-0.5		60	41	Lmax < 65
1203-HO1	49.0	47.0	new road	55.0	50.0	50.0	48.0	51.0	49.0	2.0	2.0		47.0	44.5	48.0	45.5	-1.0	-1.5		63	41	Lmax < 65
1205-HO1	57.0	55.5	new road	57.5	56.0	58.0	56.5	59.0	57.5	2.0	2.0	new road, >0.5 dB increase	54.5	53.0	55.5	54.0	-1.5	-1.5		73	49	24
1205-HO2	57.0	55.0	new road	57.5	55.5	57.5	56.0	58.5	57.0	1.5	2.0	new road, >0.5 dB increase	54.5	52.0	55.0	53.5	-2.0	-1.5		72	49	23
1208-HO1	56.0	54.5	new road	56.5	55.0	56.0	54.0	57.0	55.0	1.0	0.5	new road, >0.5 dB increase	53.5	51.0	54.0	52.0	-2.0	-2.5		73	47	26
1209-HO1	55.5	54.0	new road	56.0	54.5	56.5	54.5	57.0	55.5	1.5	1.5	new road, >0.5 dB increase	53.5	51.0	54.0	52.0	-1.5	-2.0		70	48	22
1210-HO1	53.5	51.5	new road	55.0	52.0	54.5	52.5	55.5	53.5	2.0	2.0	new road, >0.5 dB increase	51.5	49.0	52.5	50.0	-1.0	-1.5		66	46	21
1211-HO1	55.5	54.0	new road	56.0	54.5	56.5	54.5	57.5	55.5	2.0	1.5	new road, >0.5 dB increase	54.0	51.5	54.5	52.5	-1.0	-1.5		71	48	23
1212-HO1	52.5	50.5	new road	55.0	51.0	53.5	51.5	54.0	52.0	1.5	1.5	new road, >0.5 dB increase	50.5	47.5	51.5	48.5	-1.0	-2.0		65	44	21
1213-HO1	54.5	52.5	new road	55.0	53.0	55.5	53.5	56.0	54.5	1.5	2.0	new road, >0.5 dB increase	52.5	50.0	53.5	51.0	-1.0	-1.5		67	46	21
1214-HO1	56.0	54.0	new road	56.5	54.5	56.0	54.0	56.5	55.0	0.5	1.0	new road, >0.5 dB increase	53.5	50.5	54.0	52.0	-2.0	-2.0		71	47	24
1215-HO1	56.5	55.0	new road	57.0	55.5	57.0	55.5	58.0	56.5	1.5	1.5	new road, >0.5 dB increase	54.0	51.5	55.0	53.0	-1.5	-2.0		71	48	23
1218-HO1	50.0	48.5	new road	55.0	50.0	51.5	49.5	52.5	50.5	2.5	2.0	new road, >0.5 dB increase	48.5	46.0	49.5	47.0	-0.5	-1.5		63	43	Lmax < 65
1221-HO1	53.0	51.0	new road	55.0	51.5	54.0	52.0	55.0	53.0	2.0	2.0	new road, >0.5 dB increase	51.5	48.5	52.0	49.5	-1.0	-1.5		65	45	Lmax < 65
1223-HO1	59.5	57.5	new road	60.0	58.0	58.5	55.5	59.5	56.5	0.0	-1.0		57.5	53.5	58.5	54.5	-1.0	-3.0		73	50	23

Receiver No.	Future Existing (2012) Noise Level, dB(A)		Type of development	Criteria, dB(A)		Base Case						Mitigated Case						Maximum Noise Level [illegible] level development 2012 dB(A)		Maximum noise level – Minimum noise level
						Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required	Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required			
	Day	Night		Day	Night	Day	Night	Day	Night	Day	Night		Day	Night	Day	Night	Day	Night				
1225-HO1	56.0	54.5	new road	56.5	55.0	57.5	55.5	58.0	56.5	2.0	2.0	new road, >0.5 dB increase	54.5	51.5	55.0	53.0	-1.0	-1.5		70	49	21
1226-HO1	50.5	48.5	new road	55.0	50.0	51.5	49.5	52.5	50.5	2.0	2.0	new road, >0.5 dB increase	49.0	46.0	49.5	47.0	-1.0	-1.5		63	43	Lmax < 65
1228-HO1	50.5	49.0	new road	55.0	50.0	51.5	49.5	52.5	50.5	2.0	1.5	new road, >0.5 dB increase	49.0	46.0	50.0	47.0	-0.5	-2.0		63	43	Lmax < 65
1229-HO1	52.0	50.0	new road	55.0	50.5	53.0	51.0	53.5	51.5	1.5	1.5	new road, >0.5 dB increase	50.0	47.5	51.0	48.5	-1.0	-1.5		63	44	Lmax < 65
1234-HO1	52.5	50.5	new road	55.0	51.0	53.5	51.5	54.5	52.5	2.0	2.0	new road, >0.5 dB increase	50.5	48.0	51.5	49.0	-1.0	-1.5		65	45	21
1235-HO1	53.0	51.0	new road	55.0	51.5	54.0	52.0	55.0	53.0	2.0	2.0	new road, >0.5 dB increase	51.0	48.5	51.5	49.5	-1.5	-1.5		66	45	21
1236-HO1	54.0	52.0	new road	55.0	52.5	55.0	53.0	56.0	53.5	2.0	1.5	new road, >0.5 dB increase	52.5	49.5	53.0	50.5	-1.0	-1.5		66	46	20
1237-HO1	50.5	48.5	new road	55.0	50.0	52.0	50.0	53.0	51.0	2.5	2.5	new road, >0.5 dB increase	49.5	46.5	50.5	47.5	0.0	-1.0		64	43	Lmax < 65
1239-HO1	54.5	52.5	new road	55.0	53.0	55.5	53.5	56.5	54.5	2.0	2.0	new road, >0.5 dB increase	53.0	50.0	54.0	51.0	-0.5	-1.5		67	47	20
1240-HO1	48.0	46.0	new road	55.0	50.0	49.5	47.5	50.5	48.0	2.5	2.0		47.0	44.0	48.0	45.0	0.0	-1.0		60	41	Lmax < 65
1241-HO1	50.0	48.0	new road	55.0	50.0	51.5	49.0	52.0	50.0	2.0	2.0		49.0	46.0	50.0	47.0	0.0	-1.0		63	43	Lmax < 65
1243-HO1	49.0	47.0	new road	55.0	50.0	51.0	48.5	52.0	49.5	3.0	2.5		48.5	45.5	49.5	46.5	0.5	-0.5		62	42	Lmax < 65
1244-HO1	48.0	46.0	new road	55.0	50.0	50.0	48.0	51.0	49.0	3.0	3.0		48.0	45.0	49.0	46.0	1.0	0.0		61	42	Lmax < 65
1245-HO1	48.0	46.0	new road	55.0	50.0	49.5	47.5	50.5	48.5	2.5	2.5		47.0	44.0	48.0	45.0	0.0	-1.0		61	41	Lmax < 65
1248-HO1	48.0	46.0	new road	55.0	50.0	50.0	47.5	51.0	48.5	3.0	2.5		48.0	45.0	48.5	46.0	0.5	0.0		61	41	Lmax < 65
1250-HO1	53.5	52.0	new road	55.0	52.5	55.0	52.5	56.0	53.5	2.5	1.5	new road, >0.5 dB increase	52.5	49.5	53.5	50.5	0.0	-1.5		65	46	19
1251-HO1	51.5	50.0	new road	55.0	50.5	53.5	51.0	54.0	52.0	2.5	2.0	new road, >0.5 dB increase	51.0	48.0	52.0	49.0	0.5	-1.0		63	45	Lmax < 65
1252-HO1	50.0	48.5	new road	55.0	50.0	51.5	49.0	52.5	50.0	2.5	1.5		49.0	46.0	50.0	47.0	0.0	-1.5		62	43	Lmax < 65
1256-HO1	54.0	52.0	new road	55.0	52.5	53.5	51.0	54.5	52.0	0.5	0.0		51.5	48.5	52.5	49.5	-1.5	-2.5		63	45	Lmax < 65
1256-HO2	54.5	53.0	new road	55.0	53.5	56.0	53.5	56.5	54.5	2.0	1.5	new road, >0.5 dB increase	53.5	50.5	54.0	51.5	-0.5	-1.5		66	47	19

Receiver No.	Future Existing (2012) Noise Level, dB(A)		Type of development	Criteria, dB(A)		Base Case						Mitigated Case						Maximum Noise Level [illegible] level development 2012 dB(A)		Maximum noise level – Minimum noise level
						Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required	Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required			
	Day	Night		Day	Night	Day	Night	Day	Night	Day	Night		Day	Night	Day	Night	Day	Night				
1257-HO1	48.0	46.5	new road	55.0	50.0	49.5	47.0	50.5	48.0	2.5	1.5		47.0	44.0	48.0	45.0	0.0	-1.5		62	41	Lmax < 65
1260-HO1	49.0	47.5	new road	55.0	50.0	50.5	48.5	51.5	49.5	2.5	2.0		48.5	45.5	49.0	46.5	0.0	-1.0		62	42	Lmax < 65
1261-HO1	48.0	46.0	new road	55.0	50.0	50.5	48.0	51.0	49.0	3.0	3.0		48.5	45.5	49.0	46.5	1.0	0.5		60	42	Lmax < 65
1262-HO1	52.0	50.5	new road	55.0	51.0	53.5	51.0	54.5	52.0	2.5	1.5	new road, >0.5 dB increase	51.5	48.5	52.5	49.5	0.5	-1.0		64	45	Lmax < 65
1265-HO1	48.5	47.0	new road	55.0	50.0	50.5	48.0	51.5	49.0	3.0	2.0		48.0	45.0	49.0	46.0	0.5	-1.0		61	42	Lmax < 65
1267-HO1	48.0	46.0	new road	55.0	50.0	50.5	48.0	51.5	49.0	3.5	3.0		48.5	45.5	49.5	46.5	1.5	0.5		57	42	Lmax < 65
1270-HO1	51.5	50.0	new road	55.0	50.5	53.0	50.5	54.0	51.5	2.5	1.5	new road, >0.5 dB increase	51.0	48.0	52.0	49.0	0.5	-1.0		63	44	Lmax < 65
1271-HO1	47.0	45.5	new road	55.0	50.0	49.5	47.5	50.5	48.5	3.5	3.0		47.5	45.0	48.5	46.0	1.5	0.5		57	41	Lmax < 65
1272-HO1	47.0	45.0	new road	55.0	50.0	49.5	47.0	50.5	48.0	3.5	3.0		47.5	44.0	48.5	45.0	1.5	0.0		57	41	Lmax < 65
1274-HO1	48.5	47.0	new road	55.0	50.0	50.5	48.5	51.5	49.5	3.0	2.5		48.5	45.5	49.0	46.5	0.5	-0.5		61	42	Lmax < 65
1277-HO1	47.0	45.0	new road	55.0	50.0	49.5	47.0	50.5	48.0	3.5	3.0		48.0	44.5	48.5	45.5	1.5	0.5		56	41	Lmax < 65
1280-HO1	48.0	46.0	new road	55.0	50.0	50.0	47.5	51.0	48.5	3.0	2.5		48.0	45.0	48.5	46.0	0.5	0.0		58	42	Lmax < 65
1281-HO1	47.5	46.0	new road	55.0	50.0	50.0	47.5	51.0	48.5	3.5	2.5		48.5	45.5	49.5	46.5	2.0	0.5		58	42	Lmax < 65
1282-HO1	47.0	45.5	new road	55.0	50.0	49.5	47.0	50.5	48.0	3.5	2.5		47.5	44.5	48.5	45.5	1.5	0.0		59	41	Lmax < 65
1283-HO1	48.5	46.5	new road	55.0	50.0	50.5	48.0	51.5	49.0	3.0	2.5		48.0	45.0	49.0	46.0	0.5	-0.5		61	42	Lmax < 65
1284-HO1	48.5	46.5	new road	55.0	50.0	50.0	48.0	51.0	49.0	2.5	2.5		47.5	45.0	48.5	45.5	0.0	-1.0		60	42	Lmax < 65
1285-HO1	47.5	46.0	new road	55.0	50.0	50.0	47.5	51.0	48.5	3.5	2.5		48.0	45.0	49.0	46.0	1.5	0.0		59	42	Lmax < 65
1287-HO1	47.5	46.0	new road	55.0	50.0	49.5	47.0	50.5	48.0	3.0	2.0		47.0	44.0	48.0	45.0	0.5	-1.0		60	41	Lmax < 65
1288-HO1	49.0	47.0	new road	55.0	50.0	50.5	48.0	51.5	49.0	2.5	2.0		48.5	45.5	49.5	46.5	0.5	-0.5		60	43	Lmax < 65
1289-HO1	48.0	46.5	new road	55.0	50.0	50.5	48.0	51.0	49.0	3.0	2.5		48.0	45.0	49.0	46.0	1.0	-0.5		60	42	Lmax < 65
1290-HO1	48.5	46.5	new road	55.0	50.0	50.5	48.0	51.5	49.0	3.0	2.5		48.0	45.0	49.0	46.0	0.5	-0.5		60	42	Lmax < 65
1291-HO1	59.0	57.5	new road	59.5	58.0	60.0	57.0	61.0	58.0	2.0	0.5	new road, >0.5 dB increase	59.0	55.5	59.5	56.0	0.5	-1.5		73	52	20
1295-HO1	57.5	55.5	new road	58.0	56.0	61.0	58.0	61.5	59.0	4.0	3.5	new road, >0.5 dB increase	60.0	56.5	60.5	57.5	3.0	2.0	new road, >0.5 dB increase	75	54	21
1303-HO1	53.0	51.0	new road	55.0	51.5	54.0	51.5	55.0	52.0	2.0	1.0	new road, >0.5 dB increase	53.0	50.0	54.0	50.5	1.0	-0.5		67	47	20

Receiver No.	Future Existing (2012) Noise Level, dB(A)		Type of development	Criteria, dB(A)		Base Case							Mitigated Case							Maximum Noise Level minimum noise level development 2012 dB(A)		Maximum noise level – Minimum noise level
						Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required	Noise Level Development, 2012, dB(A)		Noise Level Development, 2022, dB(A)		Future Existing 2012 – Development 2022		Reason for noise mitigation, if required			
	Day	Night		Day	Night	Day	Night	Day	Night	Day	Night		Day	Night	Day	Night	Day	Night				
1303-HO2	54.0	52.5	new road	55.0	53.0	57.0	53.5	57.5	54.5	3.5	2.0	new road, >0.5 dB increase	56.5	52.5	57.0	53.5	3.0	1.0	new road, >0.5 dB increase	68	49	19
1307-HO1	57.0	55.5	new road	57.5	56.0	59.5	56.5	60.5	57.5	3.5	2.0	new road, >0.5 dB increase	58.5	55.5	59.5	56.0	2.5	0.5	new road, >0.5 dB increase	74	52	21
1308-HO1	57.0	55.0	new road	57.5	55.5	59.0	56.0	60.0	57.0	3.0	2.0	new road, >0.5 dB increase	58.0	54.5	59.0	55.5	2.0	0.5	new road, >0.5 dB increase	73	51	21
1309-HO1	55.5	53.5	new road	56.0	54.0	57.0	54.0	58.0	55.0	2.5	1.5	new road, >0.5 dB increase	56.5	53.0	57.0	54.0	1.5	0.5	new road, >0.5 dB increase	70	50	20
1311-HO1	53.5	51.5	new road	55.0	52.0	57.5	54.5	58.0	55.5	4.5	4.0	new road, >0.5 dB increase	57.0	53.5	57.5	54.5	4.0	3.0	new road, >0.5 dB increase	70	50	20
1313-HO1	56.0	54.0	new road	56.5	54.5	58.0	55.5	59.0	56.5	3.0	2.5	new road, >0.5 dB increase	57.5	54.5	58.5	55.5	2.5	1.5	new road, >0.5 dB increase	71	52	19
BANG-20	50.5	48.5	new road	55.0	50.0	51.0	49.5	52.0	50.0	1.5	1.5		47.5	45.0	48.5	46.0	-2.0	-2.5		63	42	Lmax < 65
BANG-21	49.5	47.5	new road	55.0	50.0	50.5	48.5	51.5	49.5	2.0	2.0		47.0	44.5	47.5	45.5	-2.0	-2.0		62	42	Lmax < 65
BANG-62	51.5	49.5	new road	55.0	50.0	52.5	50.5	53.5	51.5	2.0	2.0	new road, >0.5 dB increase	48.5	46.0	49.5	47.0	-2.0	-2.5		65	43	22
BANG-71	45.0	43.0	new road	55.0	50.0	45.0	43.0	46.0	44.0	1.0	1.0		41.5	38.5	42.0	39.5	-3.0	-3.5		54	35	Lmax < 65

Arup**Acoustics**

Appendix D

Noise Assessment, Newrybar Primary School

D1 Introduction

This section reviews a noise study undertaken for the Newrybar Primary School (the site) situated next to the intersection of the Pacific Highway and Broken Head Road. The school's noise environment is likely to be affected by the upgrade of the Pacific Highway between Tintenbar and Ewingsdale. This study has been undertaken to asses the current noise environment of the school which is affected by traffic noise from the Pacific Highway and Broken Head Road. A site noise survey was undertaken between 14th and the 23rd of February 2007.

D2 Methodology

D2.1 Measurements

Attended noise measurements were conducted at several locations within the Newrybar Primary School property and at one location in Newrybar.

To gain understanding of the change on noise levels throughout the day and on different weekdays, unattended noise loggers were also used to continuously measure the sound levels. Two loggers were placed on the school property for a 10 day period from 14th until the 23rd of February 2007. One logger was placed at the west of the school close to the Pacific Highway and Broken Head Road. A second logger was placed immediately in the south west corner of the school oval side, on the east side of the school. These locations are shown in figure 1.

To estimate the variations in noise levels across the school grounds, attended noise measurements were conducted at 20 locations around the school.

In addition to the outdoor measurements described above, indoor noise levels were also measured. The indoor measurements were taken in three classrooms, the computer room, the staff room and in the library. Simultaneously, an outdoor measurement was taken in front of the most exposed façade of the room to enable further assessment of the relationship between outdoor and indoor noise levels. All measurements were taken with windows opened to simulate worse case scenario.

Measurements were taken also in front of the school on Broken Head Road and in front of the community hall on the old Pacific Highway in Newrybar. Noise measurements were taken at the same positions during a noise study conducted in 2004.

For more specific information about the locations of the measurements, see Section 2.3.

D2.2 Equipment

The equipment used to measure the noise levels is described in **Table D1**. The equipment was checked for calibration before and after each set of measurements.

Table D1 Summary of noise measurement equipment

Equipment manufacturer & type	Description of equipment	Serial No.
Brüel & Kjær 2236	Type 1 sound level meter	1778333
Brüel & Kjær 2260	Type 1 sound level meter	2124638
Brüel & Kjær 4231	Sound level calibrator	1790603
RTA Technology 02	Sound logging meter	RTA-02 #031
RTA Technology 02	Sound logging meter	RTA-02 #035

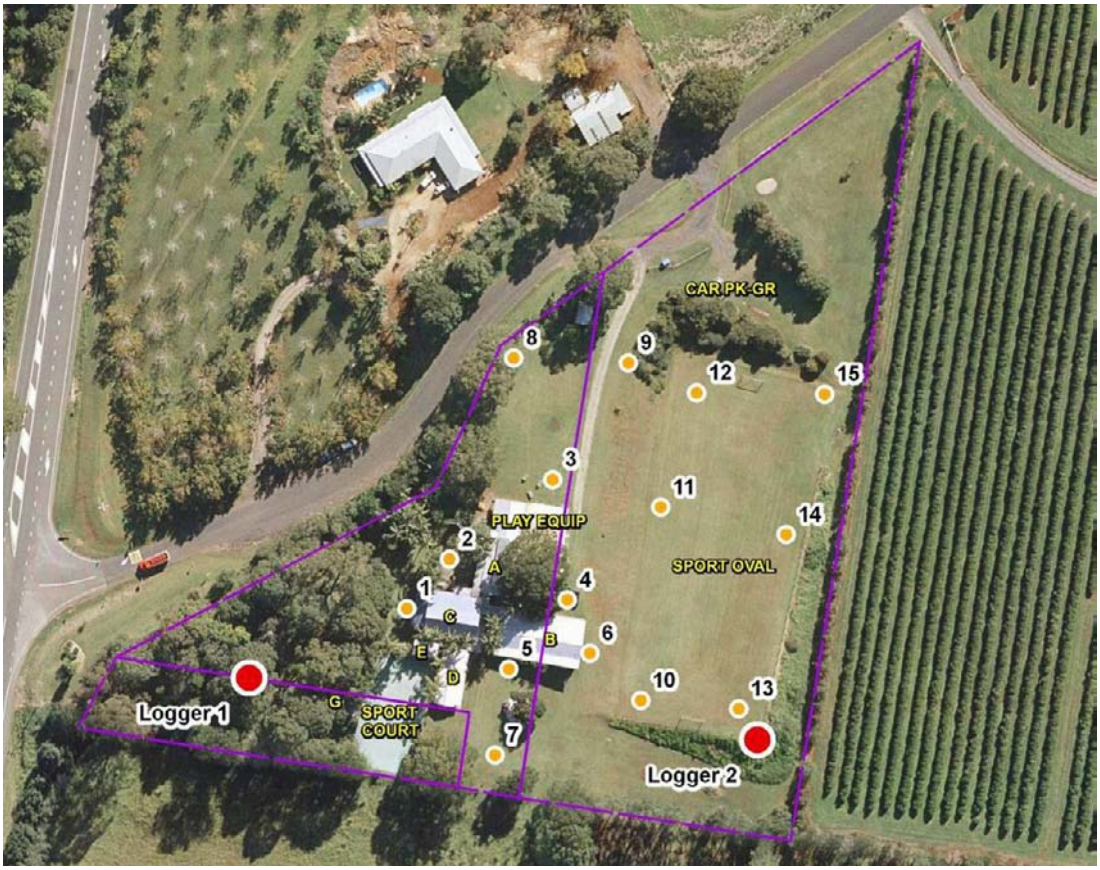
Both noise loggers and the sound level meters used for the attended measurements were mounted on tripods 1.5 m above ground level and set to *fast* time response. The L_{Aeq}, L_{Amax}, L_{Amin}, L_{A10} and L_{A90} noise indices were measured in free-field conditions (i.e. at least 2 m away from noise reflecting structures) with a sample period of 15 minutes.

Weather conditions were noted throughout the measurement periods and noise measurements were discarded where weather conditions were not suitable for noise monitoring. All noise measurements were performed in accordance with Australian Standard 1055[28].

D2.3 Locations

Attended noise measurements were undertaken at 20 locations on the school property. The measurements taken at locations that can be considered as a school playground are shown in **Figure D1**. **Figure D1** also shows the position of both sound loggers. The locations of the indoor noise measurements and the outdoor measurements taken simultaneously are shown in **Figure D2**. The attended measurement locations in front of the school and in Newrybar in front of the community hall are shown in **Figure D3**.

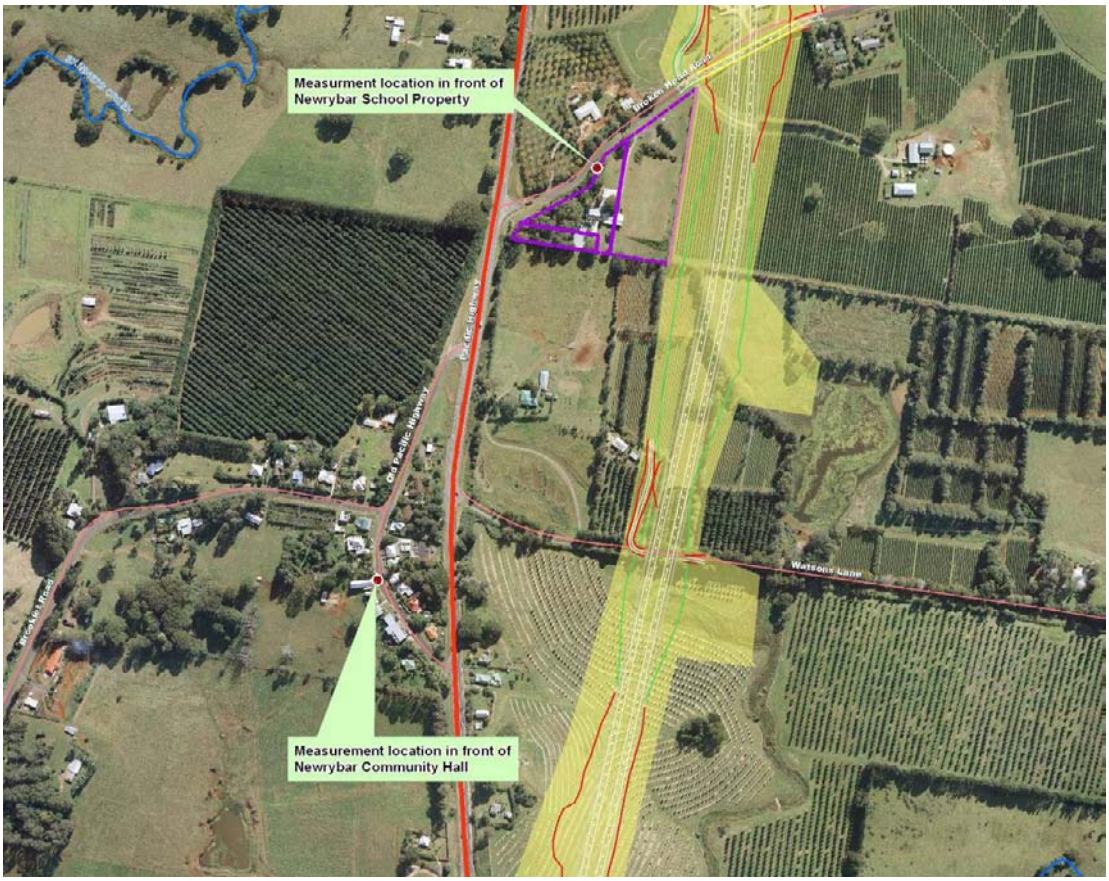
Figure D1 Noise monitoring positions at Newrybar Primary School Property



[28] AS 1055 – 1997 *Acoustics – Description and measurement of environmental noise,* Standards Australia

Figure D2 Noise monitoring locations in area around Newrybar Primary School

Figure D3 Noise monitoring locations for simultaneous measurments indoor and outdoors at Newrybar Primary School



D2.4 Policy References

The criteria to be adopted in later assessment stages of this study are based on the 'Environmental Criteria for Road Traffic Noise' written by the Environmental Protection Authority in 1999. The following documents and recognised standards have also been for this assessment:

- Department of Transport Welsh Office, HMSO, *Calculation of Road Traffic Noise* (CoRTN), (1988)
- Road and Traffic Authority of New South Wales, Environmental Noise Management Manual, 2001
- Australian Standard 2702-1984: *Acoustics - Methods for the Measurement of Road Traffic Noise*
- AS3671-1989, *Acoustics - Road traffic noise intrusion—Building siting and construction*
- AS2107-1987, *Acoustics - Recommended design sound levels and reverberation times for building interiors*. This report adopts the updated version of AS2107-1987 and AS2107-2000

A summary of final impact assessment criteria for schools and school playgrounds applicable for existing roads is presented in **Table D2**.

Table D2 Basic noise level criteria for existing classrooms and school playgrounds (after EPA ECRTN and Technical Notes).

Sensitive Land Use	Criteria		
	Day (7am - 10pm) dB(A)	Night (10pm - 7am) dB(A)	Noise Mitigation Measures
5. Passive recreation and school playgrounds	55 $dBL_{Aeq,15hr}$	-	To achieve internal noise criteria in the short term, the most practicable mitigation measures are often related to building or façade treatments. In the medium to longer term, strategies such as regulation of exhaust noise from in-service vehicles, limitations on exhaust brake use, and restricting access for sensitive areas or during sensitive times to low noise vehicles can be applied to mitigate noise impacts across the road system. Other measures include improved planning, design and construction of sensitive land use developments; reduced new vehicle emission standards; greater use of public transport; and alternative methods of freight haulage. These medium- to long-term strategies apply equally to mitigating internal and external noise levels. Where existing levels of traffic noise exceed the criteria, all feasible and reasonable noise control measures should be evaluated and applied. Where this has been done and the internal or external criteria (as appropriate) cannot be achieved, the proposed road or land use development should be designed so as not to increase existing road traffic noise levels by more than 0.5 dB(A) for new roads and 2 dB(A) for redeveloped roads or land use development with potential to create additional traffic.
X[29]. Existing school classrooms	45 $dBL_{Aeq,1hr}$ (internal)	-	

[29] Technical Note X from the EPA ECRTN.

D3 Results

D3.1 Attended noise measurements

This section shows the results of the three types of the attended measurements taken in and around the school and in Newrybar. Attended measurements are taken to identify the different noise sources and to estimate which sources contribute most to the sound level. The ambient noise measurements taken outdoors at the school property are described in Section D3.2. The indoor noise measurements taken inside the school building are described in Section D3.3. Section D3.4 discusses the results of the measurements taken in Newrybar and in front of the school property.

D3.2 Ambient noise measurements

Ambient noise measurements were taken at 20 locations. The measurements were taken at different times of the day. Each measurement is taken over a period of 15 minutes. **Table D3** shows the results of the measurements taken at locations that can be considered as a part of the school playground. For the results of all the measurements taken we refer to the Appendix.

Table D3 Results of 15-minute measurements taken at the school property, dB re 20µPa

Location	Date	Time	L_{90} dB(A)	L_{eq} dB(A)	L_{10} dB(A)	Audible noise sources
1	14 Feb.	16.10	53	59	63	Traffic, cicadas, birds
1	15 Feb.	08.01	50	60	63	Traffic, birds
1	15 Feb.	17.07	52	59	62	Traffic, birds, cicadas
1	16 Feb.	04.17	46	52	43	Traffic, crickets, rustling of leaves
1	16 Feb.	12.33	50	58	61	Traffic, cicadas cause highest noise levels, birds
2	14 Feb.	16.36	49	56	59	Traffic, wind
2	15 Feb.	07.41	49	57	61	Traffic, rain falling on tin roof, birds
2	15 Feb.	12.41	47	57	60	Traffic, cicadas
2	15 Feb.	17.07	51	57	60	Traffic, cicadas, rustling of leaves, birds
2	16 Feb.	03.52	45	54	56	Traffic, crickets, rustling of leaves
3	14 Feb.	17.23	45	50	53	Traffic, birds, cleaner
3	15 Feb.	08.01	44	52	55	Traffic, birds
3	16 Feb.	04.45	41	50	54	Traffic, crickets
4	14 Feb.	17.42	41	47	49	Traffic, birds, cleaner
5	14 Feb.	16.10	46	51	53	Traffic, cicadas, birds
5	15 Feb.	07.41	43	50	53	Traffic, water drops on tin roof
6	15 Feb.	08.20	42	48	49	Traffic, birds, children's voices, cars on school property
6	16 Feb.	04.45	38	41	43	Traffic, crickets
7	15 Feb.	16.47	48	53	55	Traffic, cicadas, rustling of leaves
8	15 Feb.	12.41	47	57	60	Traffic, cicadas
9	15 Feb.	15.19	45	54	55	Traffic, cicadas, birds
10	14 Feb.	16.36	40	45	47	Traffic, wind
10	15 Feb.	09.22	40	46	48	Traffic, children's voices, car on school property

Location	Date	Time	L_{90} dB(A)	L_{eq} dB(A)	L_{10} dB(A)	Audible noise sources
10	15 Feb.	14.42	41	49	49	Traffic, birds, cicadas, children's voices
11	15 Feb.	14.18	40	45	48	Traffic, birds, children's voices, cars on school property
12	15 Feb.	09.22	37	47	47	Traffic, birds, cicadas
12	15 Feb.	14.42	41	48	50	Traffic, cicadas, birds
12	15 Feb.	15.19	41	50	51	Traffic, cicadas cause highest noise levels, leaves, birds
12	15 Feb.	16.11	40	50	54	Traffic, buss accelerating caused highest noise level
13	14 Feb.	17.23	43	47	47	Traffic, birds
13	15 Feb.	09.03	40	48	48	Traffic, birds
13	15 Feb.	16.47	43	54	55	Traffic, cicadas
14	15 Feb.	14.18	40	44	47	Traffic, birds, cicadas, children's voices
14	15 Feb.	15.49	42	53	54	Traffic, cicadas cause highest noise levels, leaves, birds
14	16 Feb.	05.09	41	46	49	Traffic, crickets
14	16 Feb.	12.33	40	54	58	Traffic, cicadas cause highest noise levels
15	14 Feb.	17.42	38	43	46	Traffic, birds cause highest noise levels
15	15 Feb.	09.03	40	46	48	Traffic, birds
18	15 Feb.	09.44	54	72	75	Traffic, birds, cicadas

Comments

The overall average (L_{eq}) and average maximum (L_{10}) noise levels measured at the west of the school are caused by traffic on the Pacific Highway and on Broken Head Road. Most measurements taken at the east, north and south of the school are significantly influenced by other noise sources, such as cicadas, crickets and birds.

D3.3 Indoor measurements

Indoor measurements were taken in three classrooms, the computer room, the library and the teachers meeting room. The measurements were taken approximately 1.5 m from the façade most exposed to traffic noise. During the measurements, at least one of the windows in the façade was open. At location E and F a door was also open in this façade. An outdoor measurement in front of the same façade was taken simultaneously. The indoor measurements were taken over a 5-minute period. The results of these measurements are shown in **Table D4**.

Table D4 Results of 5 minute noise measurements taken indoors and in front of façade outdoors, dB re 20µPa.

Date	Time	Location	Indoor L_{eq} dB(A)	Outdoor L_{eq} dB(A)	Other sources
15 Feb. 2007	11.14	Classroom 1	38	49	children's voices, cicadas
15 Feb. 2007	11.26	Classroom 2	40	52	children's voices, cicadas
15 Feb. 2007	11.53	Classroom 3	42	58	children's voices
15 Feb. 2007	12.03	Computer room	47	61	cicadas are loud, birds
15 Feb. 2007	12.21	Library	49	58	children's voices, birds
15 Feb. 2007	12.30	Staff room	49	55	dripping tap, children's voices, birds

Comments

Typically the difference between the indoor and outdoor noise level is estimated to be 10 dB. For the classrooms and the computer room, the difference is 11 to 16 dB. For the library and the staff room the differences are 9 and 6 dB respectively. In both situations a door was open in the façade, which is probably the reason for the smaller difference.

D3.4 Comparison of measurements taken in 2004 and in 2007

During a noise study undertaken in November 2004 several sound level measurements were taken in front of the school on Broken Head Road and in front of the Newrybar Community Hall. The same types of measurements were taken at the same locations in February 2007. The results of both measurements are shown in the **Table D5** and **Table D6**.

Table D5 Results of measurements taken in front of the Newrybar primary school in 2004 and 2007, dB re 20µPa

Date	Day	Time	Measured sound level L_{eq} dB(A)
15 November 2004	Monday	17.37	61
16 November 2004	Tuesday	04.18	56
17 November 2004	Wednesday	18.23	60
18 November 2004	Thursday	02.08	57
15 February 2007	Thursday	21.30	62
16 February 2007	Friday	03.52	58

Table D6 Results of measurements taken in front of Newrybar Community Hall in 2004 and 2007, dB re 20µPa

Date	Day	Time	Measured sound level L_{eq} dB(A)
15 November 2004	Monday	18.46	55
16 November 2004	Tuesday	03.13	48
17 November 2004	Wednesday	17.28	58
18 November 2004	Thursday	01.08	46
15 February 2007	Thursday	21.50	52
16 February 2007	Friday	03.15	49
16 February 2007	Friday	05.35	52

Comments

The results show no significant difference between the measurements taken in 2004 and 2007. However, there are few measurements to be compared and many factors that influence these sound levels. Therefore no firm conclusions can be drawn.

D3.5 Unattended noise measurement results

To get a better understanding of the traffic noise throughout the day and at different times of the week two noise loggers were placed on the school property for a period of ten days (from 14 to 23 February 2007). The loggers continuously recorded various sound level parameters for every 15 minute period. One logger was placed between the school and the Pacific Highway (for location see logger 1 in **Figure D1**). The other logger was placed at the end of the school playground at the east of the school (for location see logger 2 in **Figure D1**). The results of these measurements are plotted in the graphs below.

Figure D4 Measured average sound level, logger 1 at west of school, dB re 20µPa

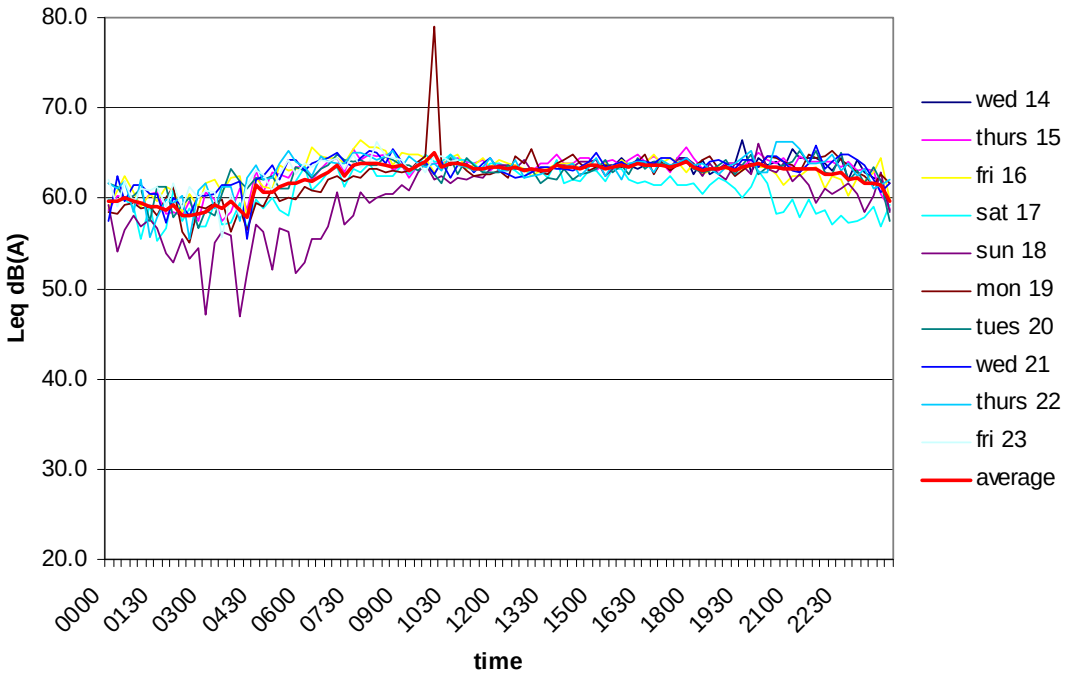


Figure D5 Measured background noise level, logger 1 at west of school, dB re 20µPa

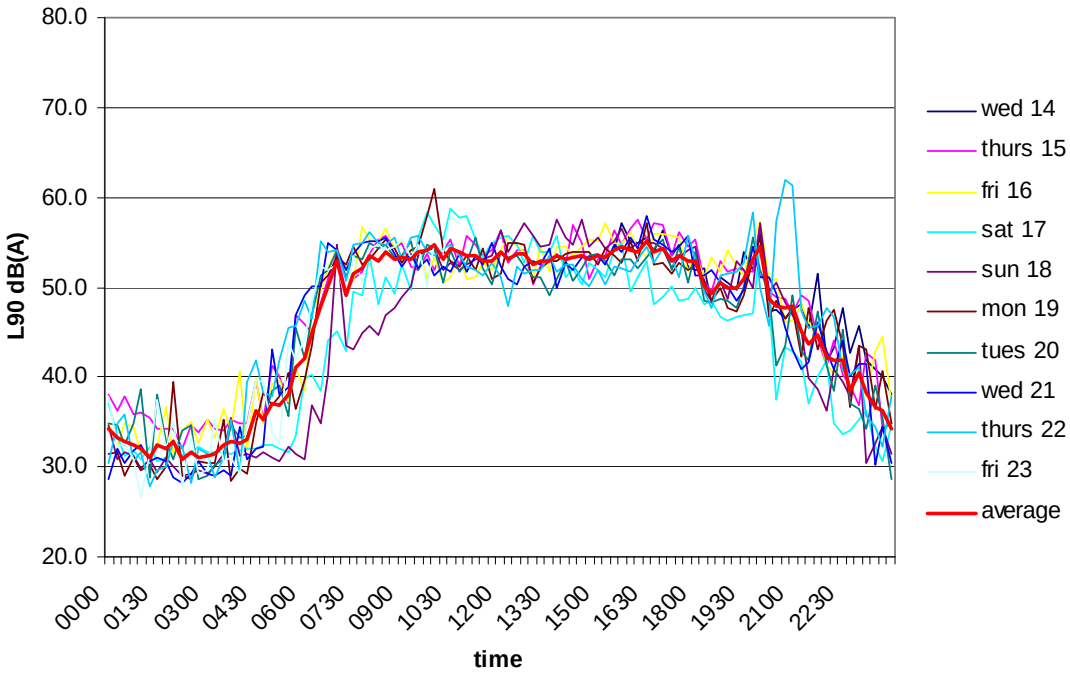


Figure D6 Measured average maximum sound level, logger 1 at west of school, dB re 20µPa

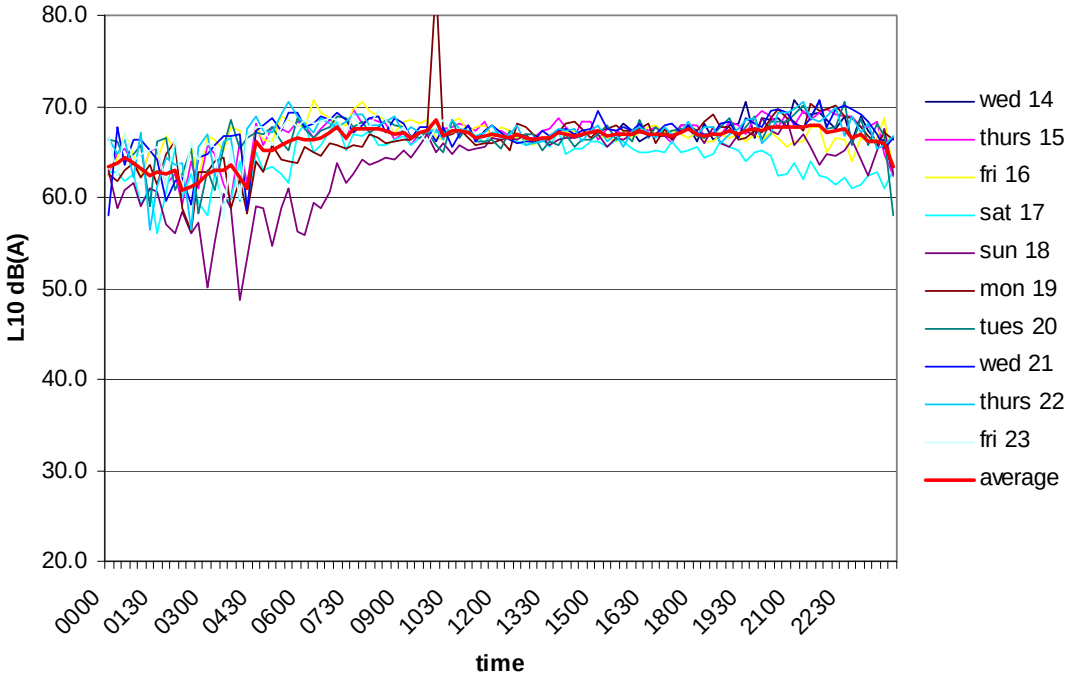


Figure D7 Measured average sound level, logger 2 on school playground, dB re 20µPa

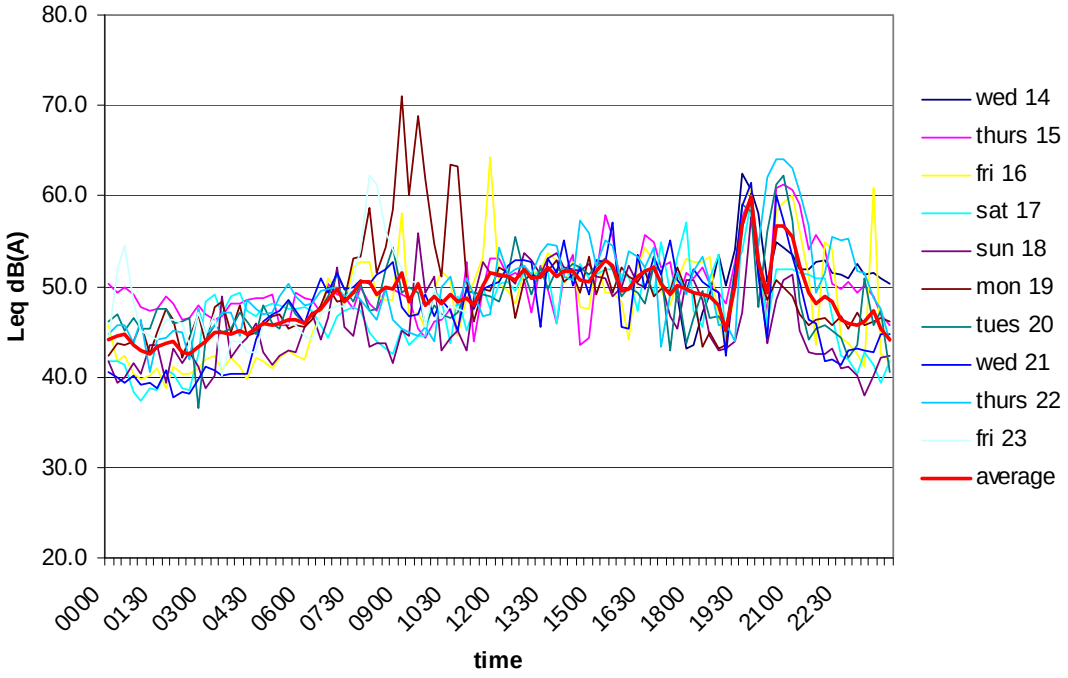


Figure D8 Measured background noise level, logger 2 on school playground, dB re 20µPa

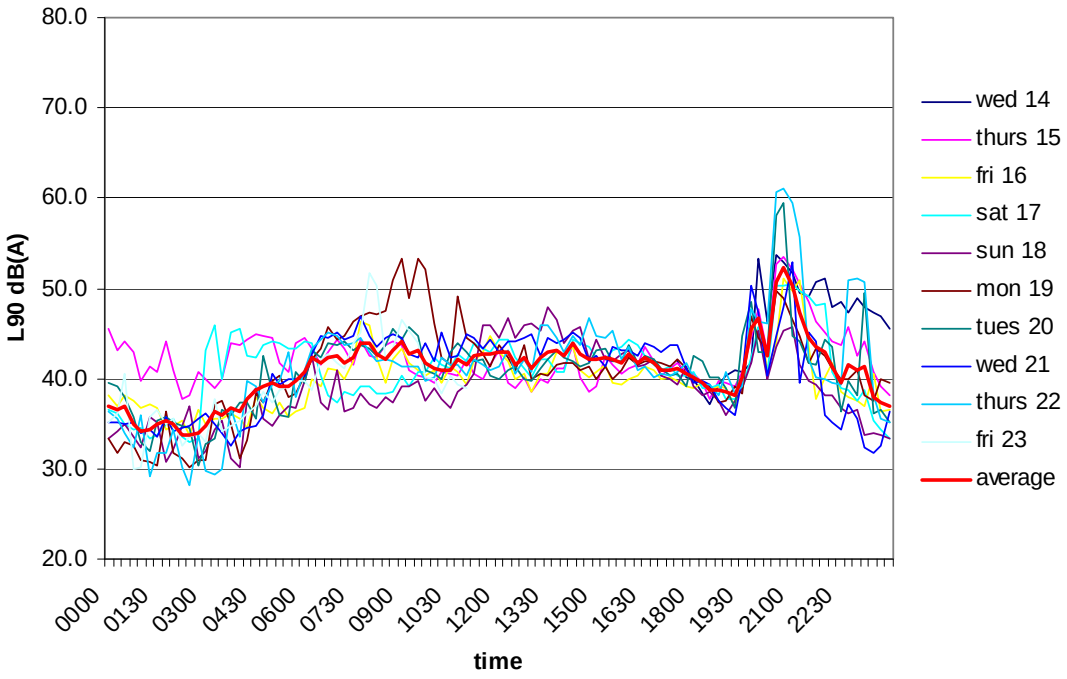
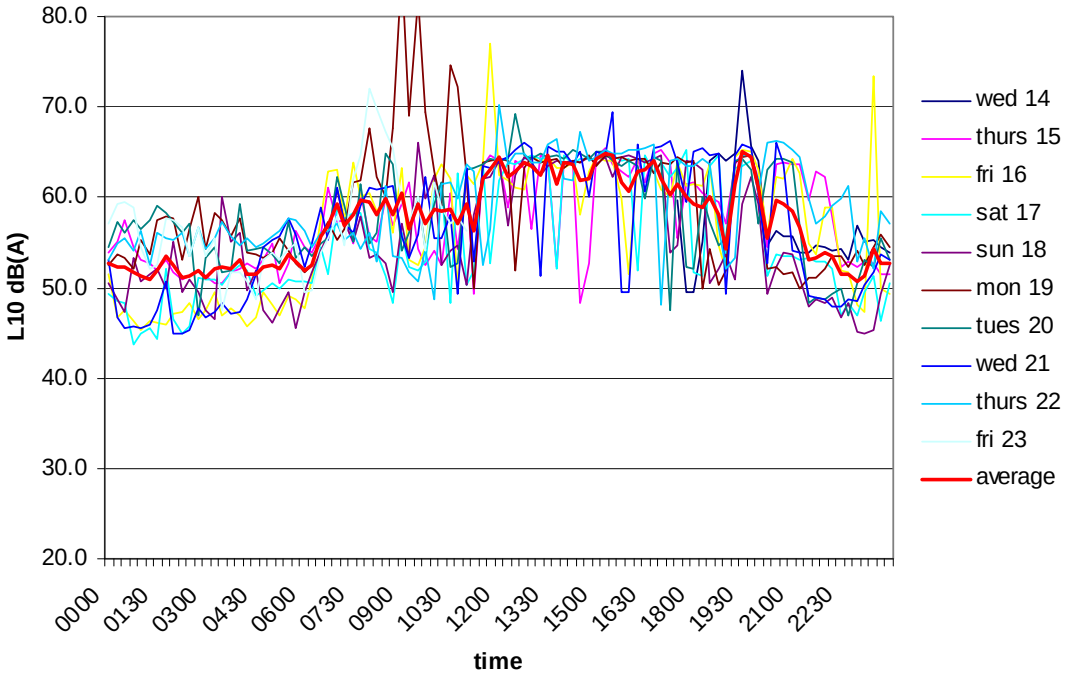


Figure D9 Measured average maximum sound level, logger 2 on school playground, dB re 20µPa



Comments

Figure D4 shows the average sound level west of the school. These noise levels are caused by traffic noise on the Pacific Highway and on Broken Head Road. The noise level is more or less constant between 07.00 and 23.00 with a slight increase in the morning and in the evening.

Both **Figure D4** and **Figure D6** show a significant increase of the sound level on Monday 19 February around 10.30. This increase is unlikely to be caused by general traffic noise.

The noise measurements taken at the school playgrounds behind the school between 06.00 and 24.00 are influenced by other noise sources such as insects (cicadas and crickets), birds and the wind. The cicadas particularly, cause high noise levels which exceed the noise levels of traffic noise. The noise measurements taken between 24.00 and 06.00 are less likely to be influenced by other sources.

Figure D8 shows a significant increase of the background noise level east of the school between 19.00 and 22.00hrs. This increase is likely to be partly caused by the noise of insects during sunset.

D4 Conclusions

The attended noise measurements show that the average and the maximum sound levels at the west of the school are caused by traffic on both the Pacific Highway and Broken Head Road throughout the day. These noise levels caused by traffic are more or less constant from 07.00 until 22.00 hrs. This means that all attended measurements taken in this period can be considered as more or less representative for the $L_{eq(15hr)}$ and the $L_{eq(1hr)}$.

The criterion $L_{Aeq,15hr}$ of 55 dB or less for school playgrounds is likely to be exceeded at the measurement locations at the west of the school and at the locations close to Broken Head Road. The highest sound level measured at a location that is a part of the school playground is 60 dB(A) which is 5 dB higher than the criterion. This level was measured at location 2.

The sound levels measured at the east, north and south of the school meet the criterion. This is despite the higher sound levels caused by insects.

The indoor measurements show that indoor sound levels in the rooms situated at the west exceed the criteria by 2 to 4 dB. The indoor criteria are met in the other classrooms, situated at the east, south and north side of the school.

Appendix E

Predicted Noise Levels

Ref.	Day/Night	Year	Description
A	Day	2012	Base Case (Concrete Pavement)
B	Night	2012	Base Case (Concrete Pavement)
C	Day	2022	Base Case (Concrete Pavement)
D	Night	2022	Base Case (Concrete Pavement)
E	Day	2012	Mitigated Case (Low Noise Pavement)
F	Night	2012	Mitigated Case (Low Noise Pavement)
G	Day	2022	Mitigated Case (Low Noise Pavement)
H	Night	2022	Mitigated Case (Low Noise Pavement)

Figure E1-A1 Noise level contours proposed upgrade, 2012, Day-time, $dBL_{Aeq,15hr}$.

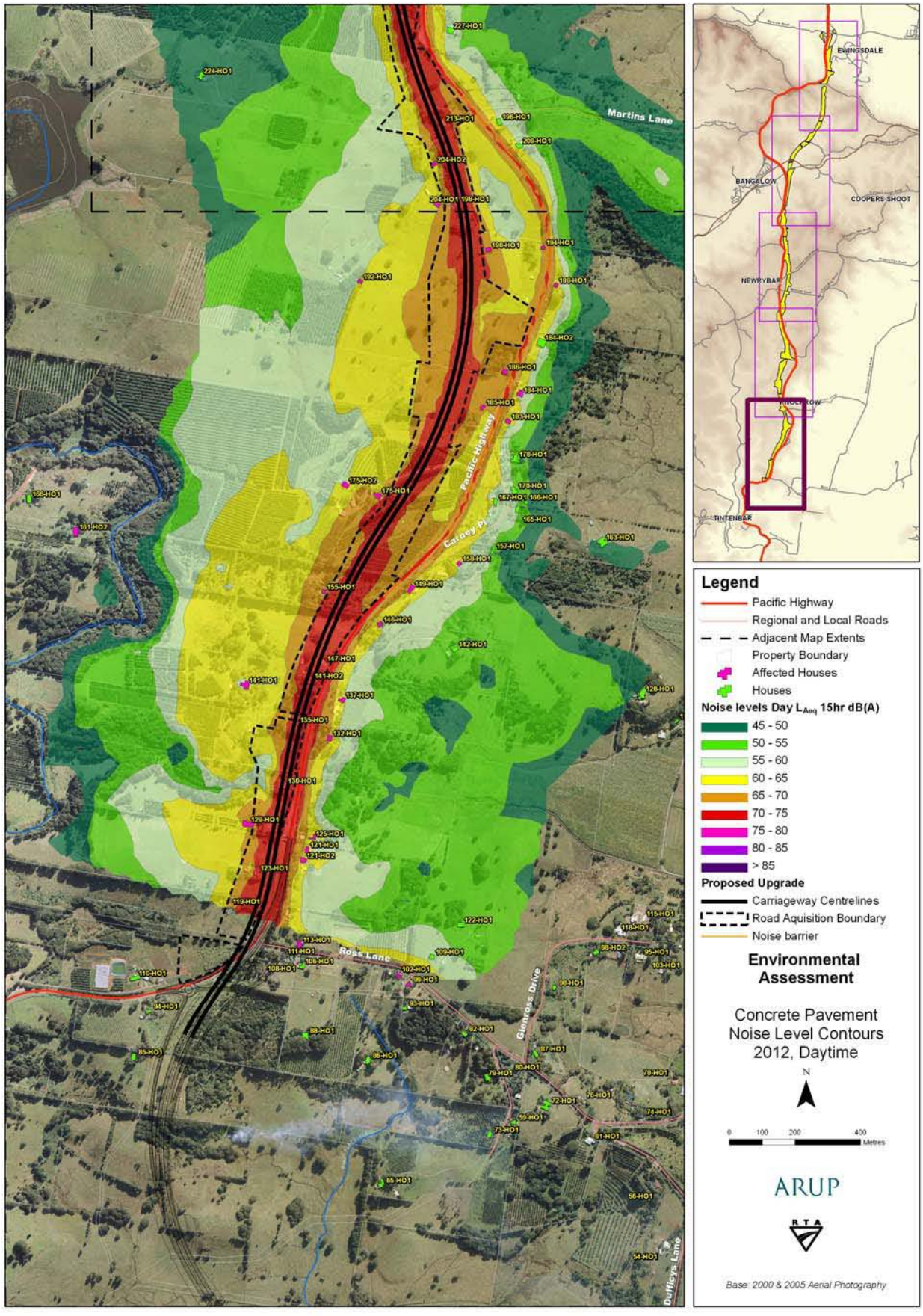

Martins Lane
Pacific Highway
Carney Dr
Ross Lane
Glenross Drive
Duffy's Lane
EWINGSDALE
BANGALOW
COOPERS SHOOT
NEWRYBAR
TINTENBAR
Legend
Pacific Highway
Regional and Local Roads
Adjacent Map Extents
Property Boundary
Affected Houses
Houses
Noise levels Day L_{Aeq} 15hr dB(A)
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
75 - 80
80 - 85
> 85
Proposed Upgrade
Carriageway Centrelines
Road Aquisition Boundary
Noise barrier
Environmental Assessment
Concrete Pavement
Noise Level Contours
2012, Daytime
N
0 100 200 400
Metres
ARUP
RTA
Base: 2000 & 2005 Aerial Photography

Figure E2-A2 Noise level contours proposed upgrade, 2012, Day-time, $dBL_{Aeq,15hr}$.

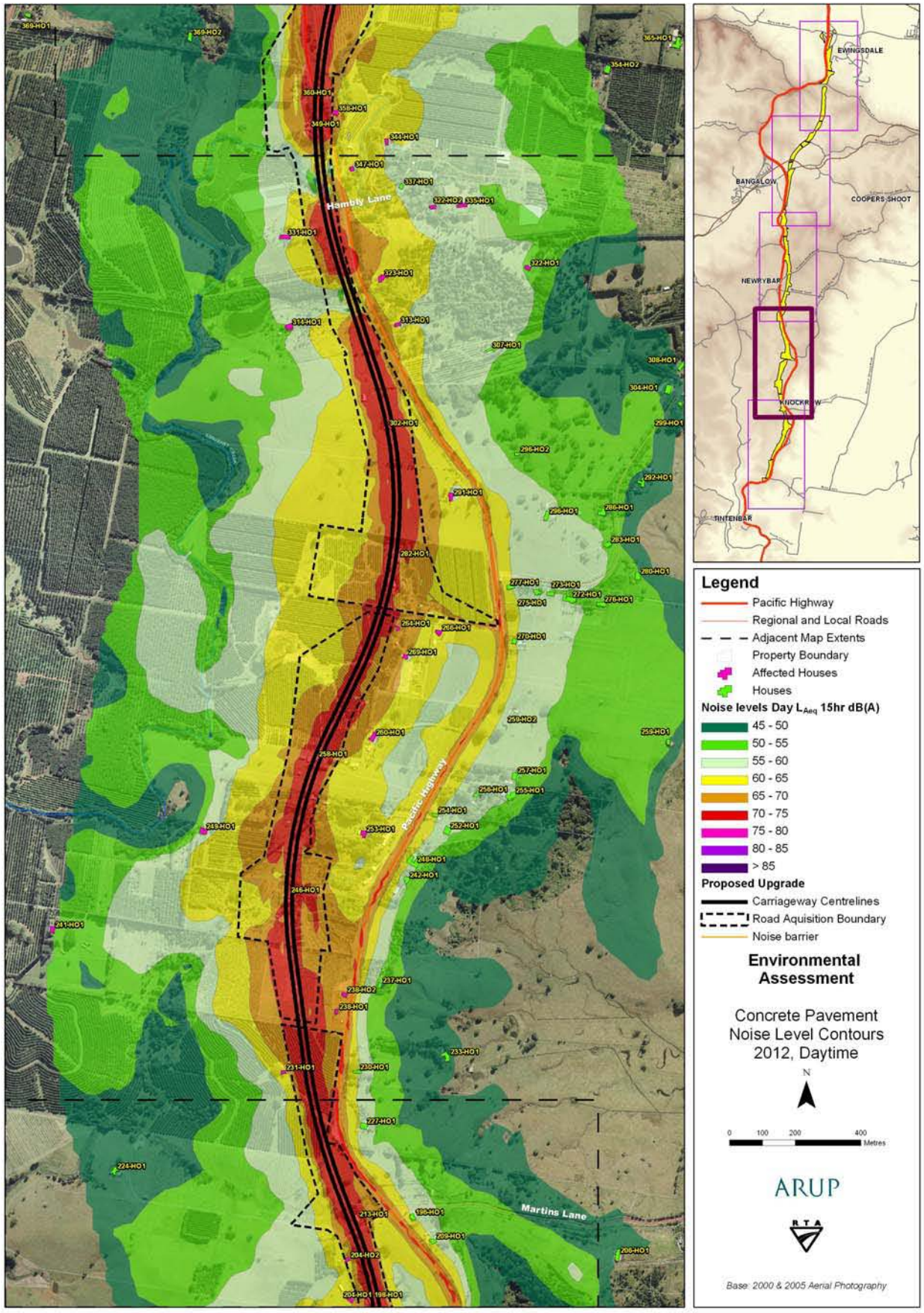


Figure E3-A3 Noise level contours proposed upgrade, 2012, Day-time, $dBL_{Aeq,15hr}$.

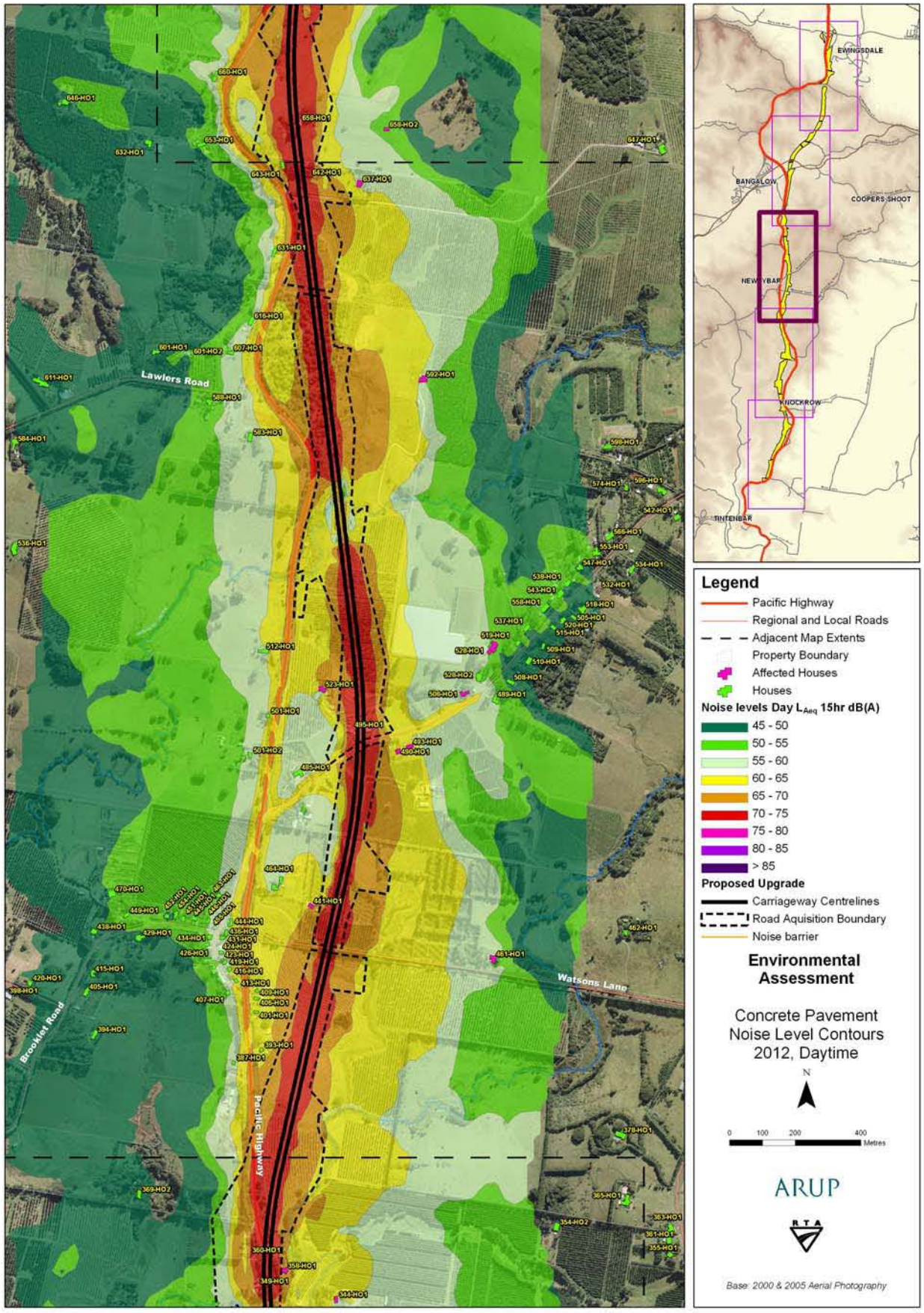


Figure E4-A4 Noise level contours proposed upgrade, 2012, Day-time, $dBL_{Aeq,15hr}$.

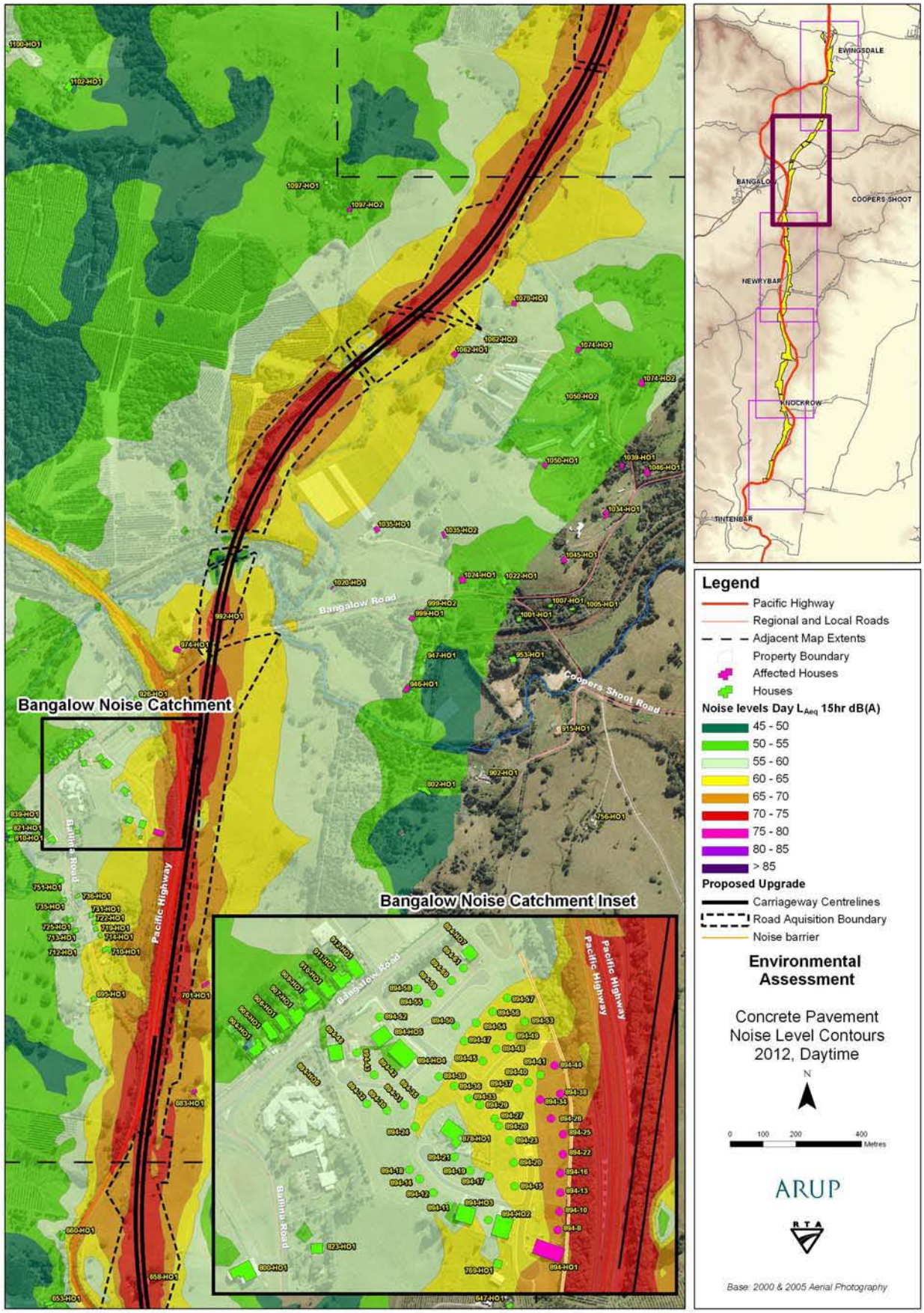


Figure E5-A5 Noise level contours proposed upgrade, 2012, Day-time, $dBL_{Aeq,15hr}$.

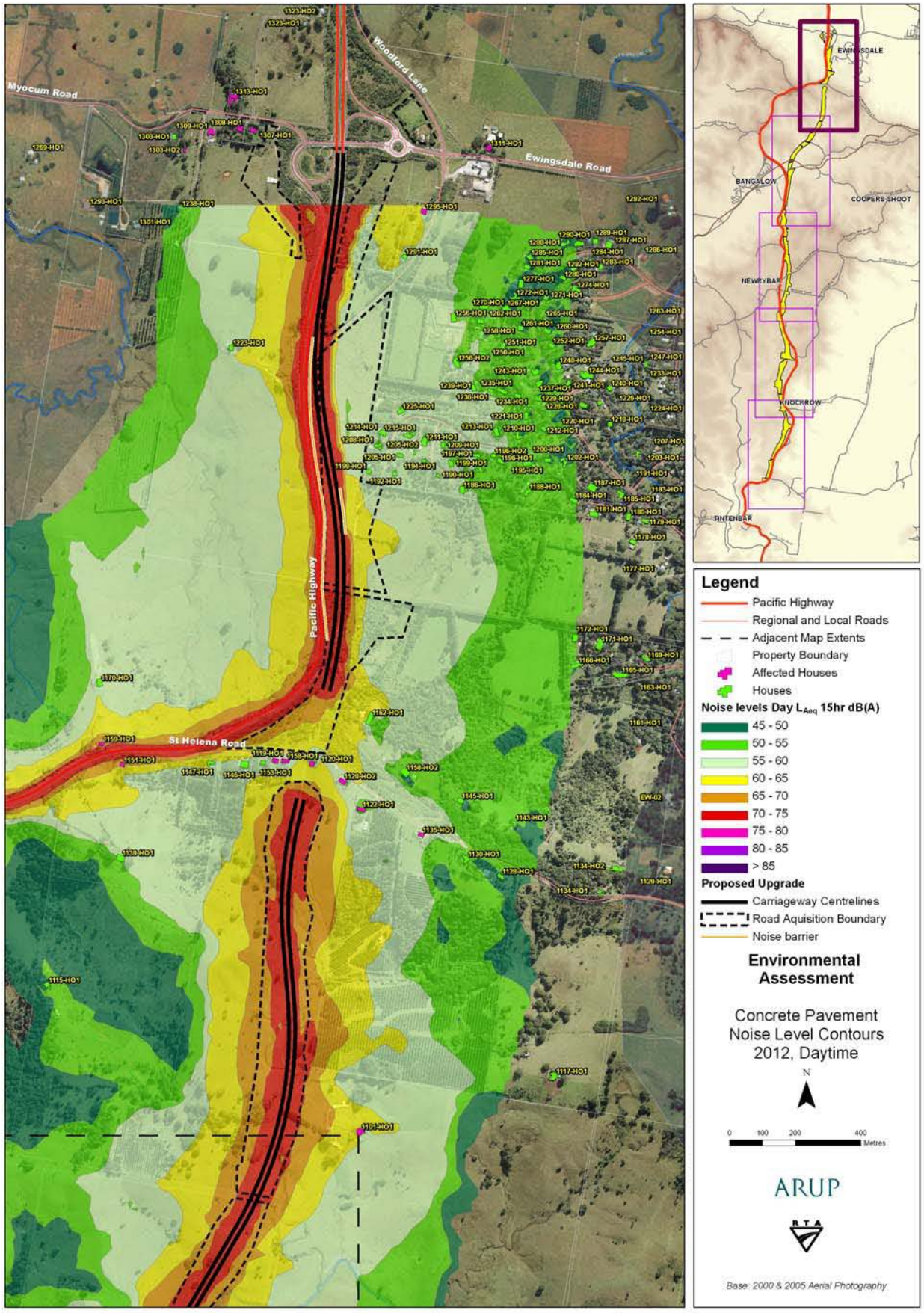


Figure E6-B1 Noise level contours, proposed upgrade 2012, Night-time, $dBL_{Aeq,9hr}$.

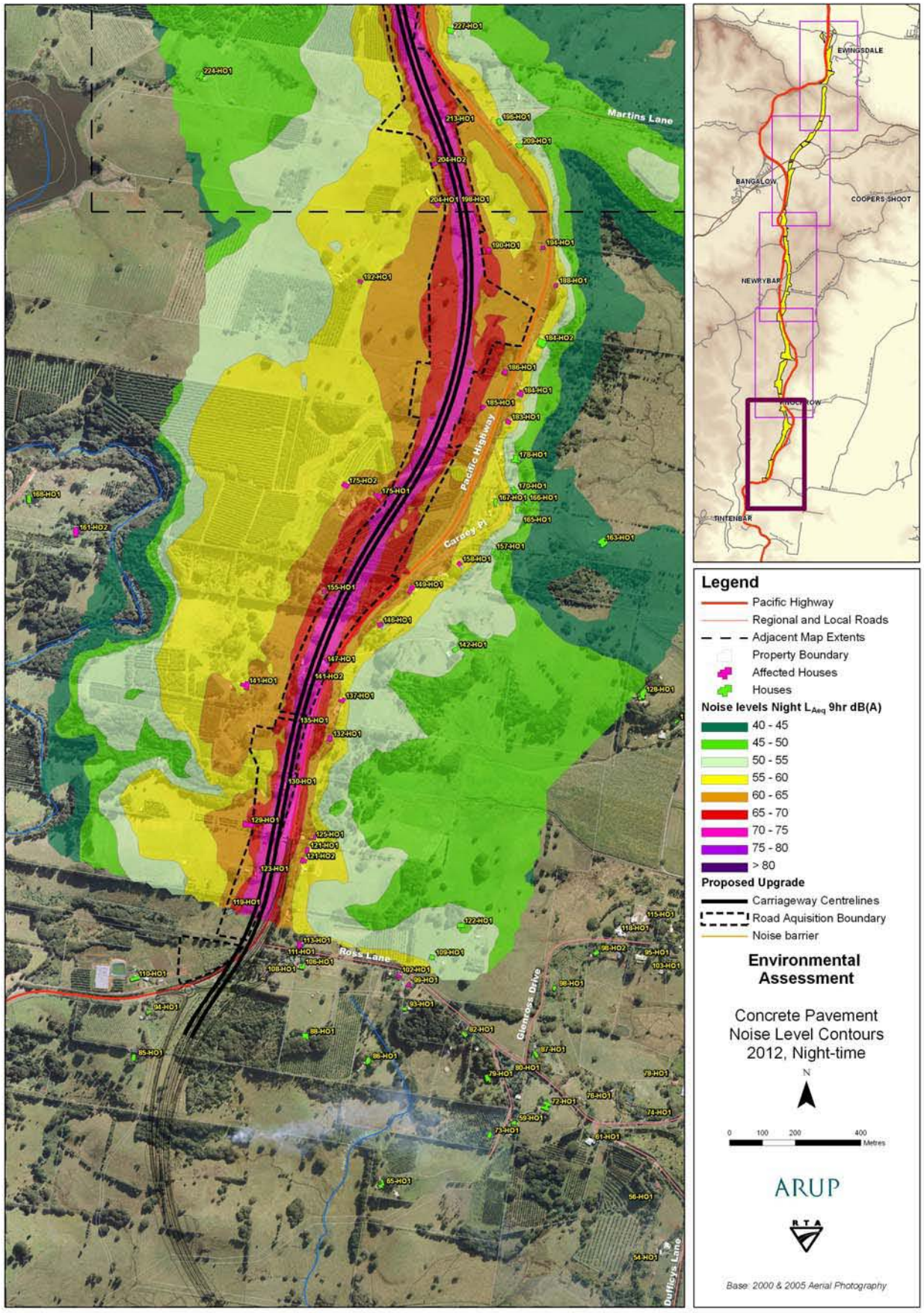


Figure E7-B2 Noise level contours, proposed upgrade 2012, Night-time, $dBL_{Aeq,9hr}$.

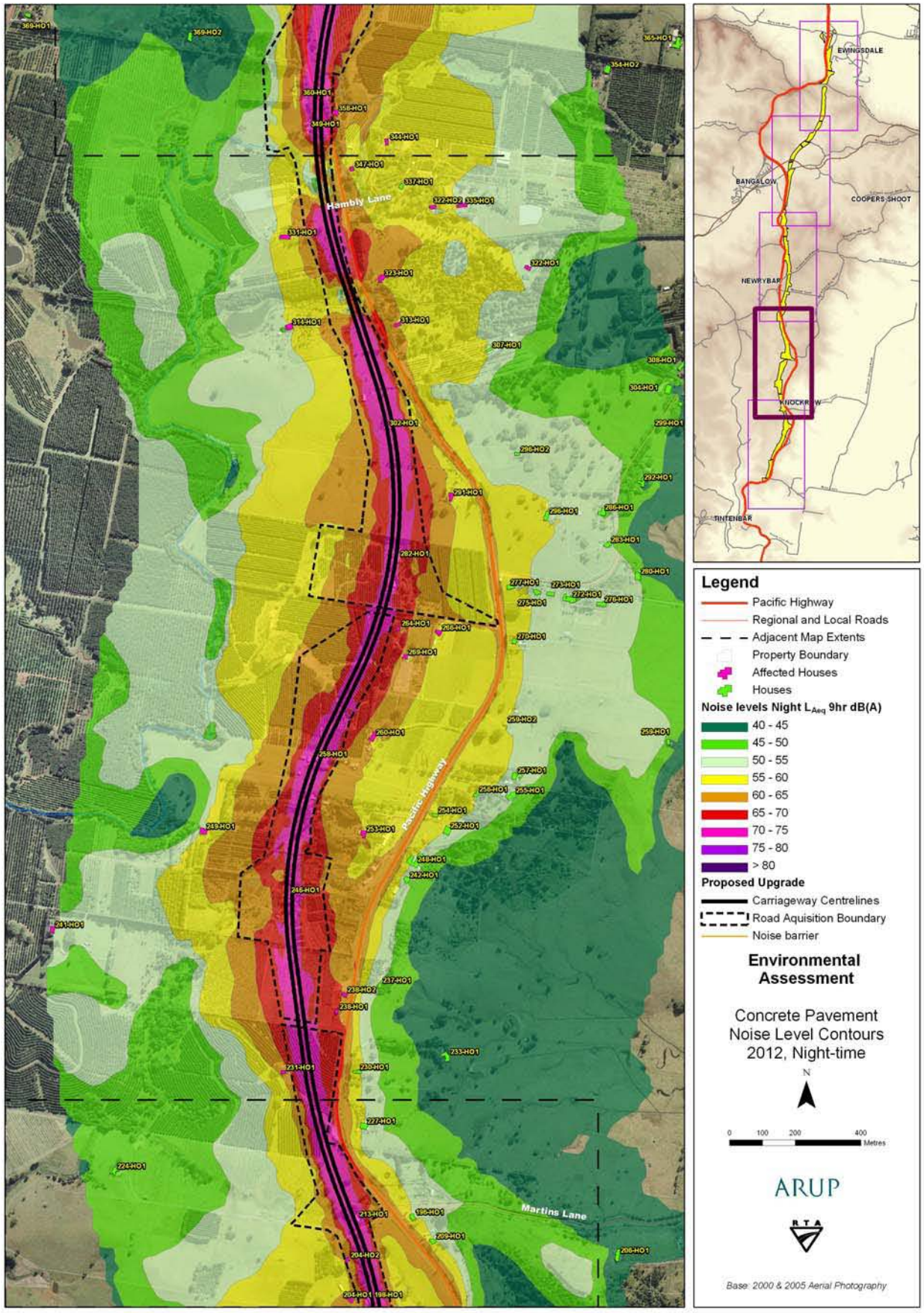


Figure E8-B3 Noise level contours, proposed upgrade 2012, Night-time, $dBL_{Aeq,9hr}$.

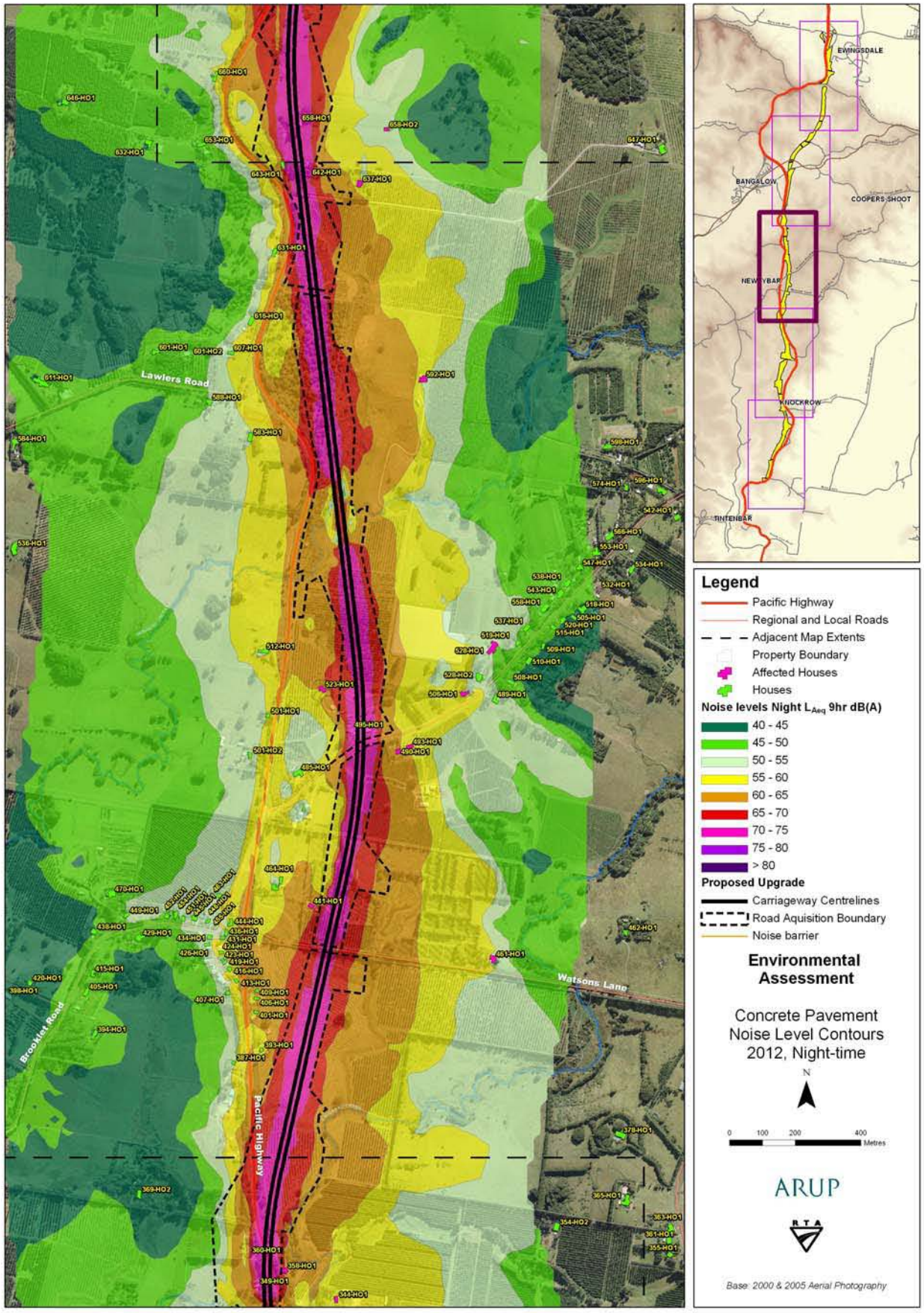


Figure E9-B4 Noise level contours, proposed upgrade 2012, Night-time, $dBL_{Aeq,9hr}$.

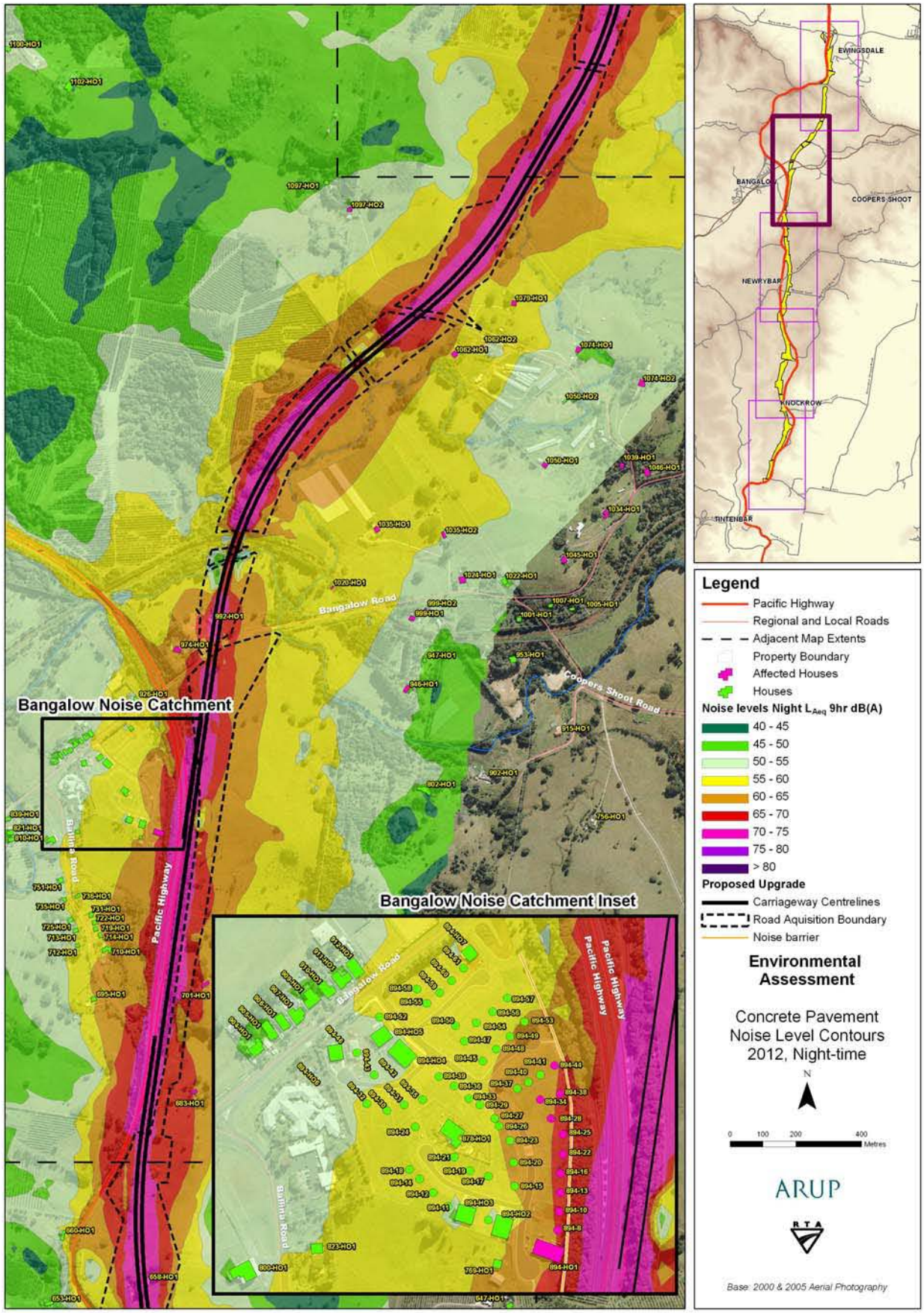


Figure E10-B5 Noise level contours, proposed upgrade 2012, Night-time, $dBL_{Aeq,9hr}$.

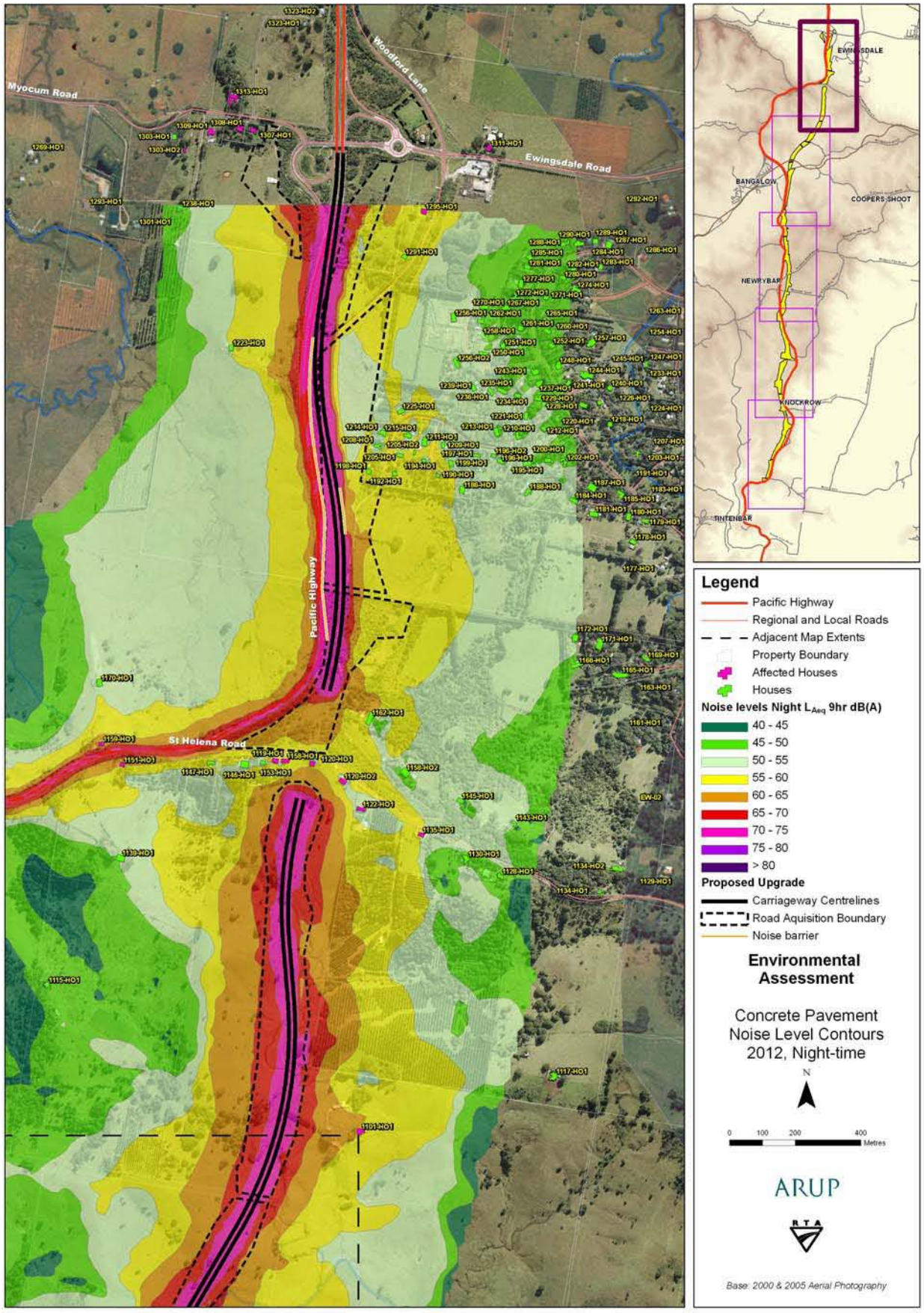


Figure E11-C1 Noise level contours, proposed upgrade 2022, Day-time, $dBL_{Aeq,15hr}$.

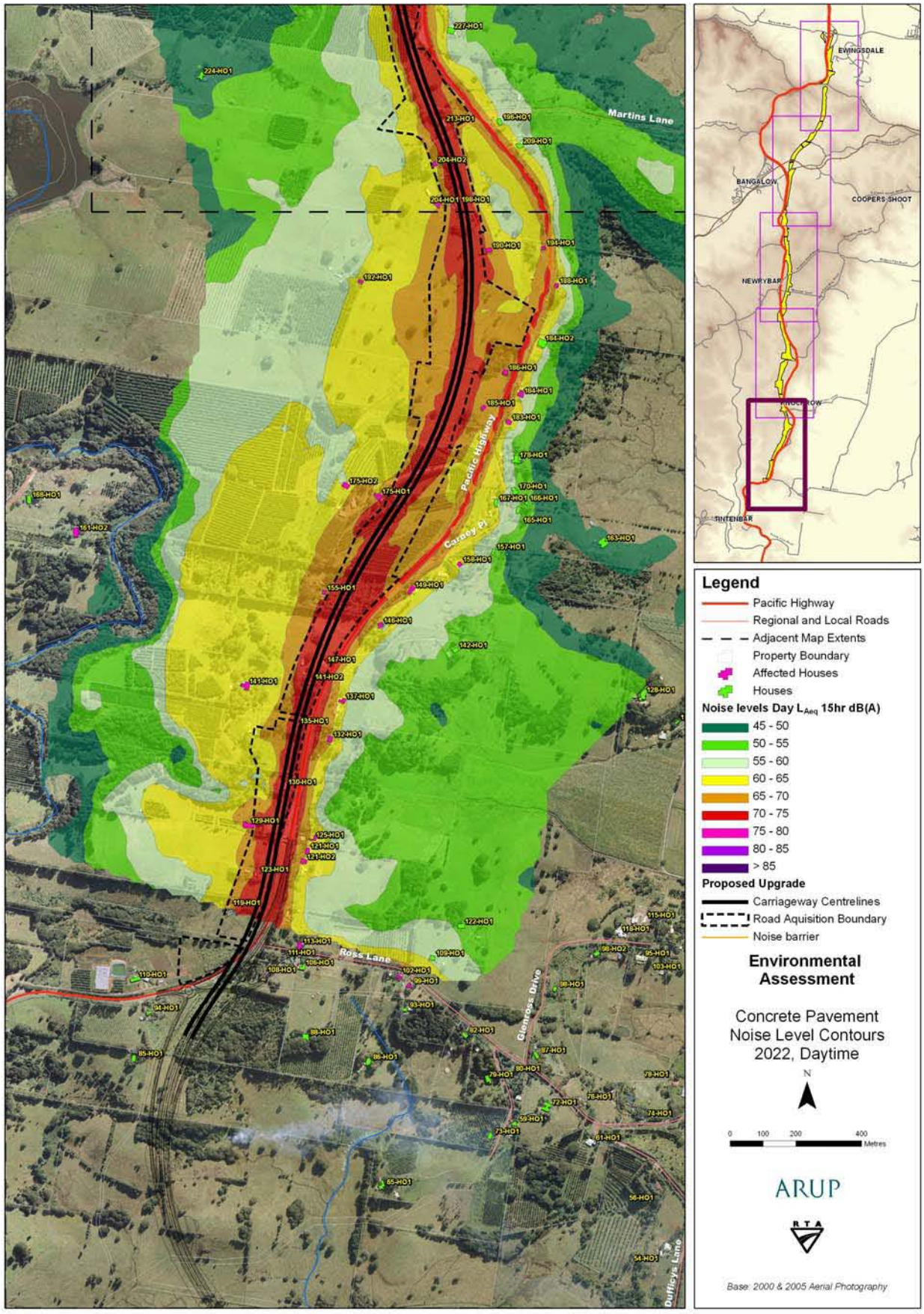


Figure E12-C2 Noise level contours, proposed upgrade 2022, Day-time, $dBL_{Aeq,15hr}$.

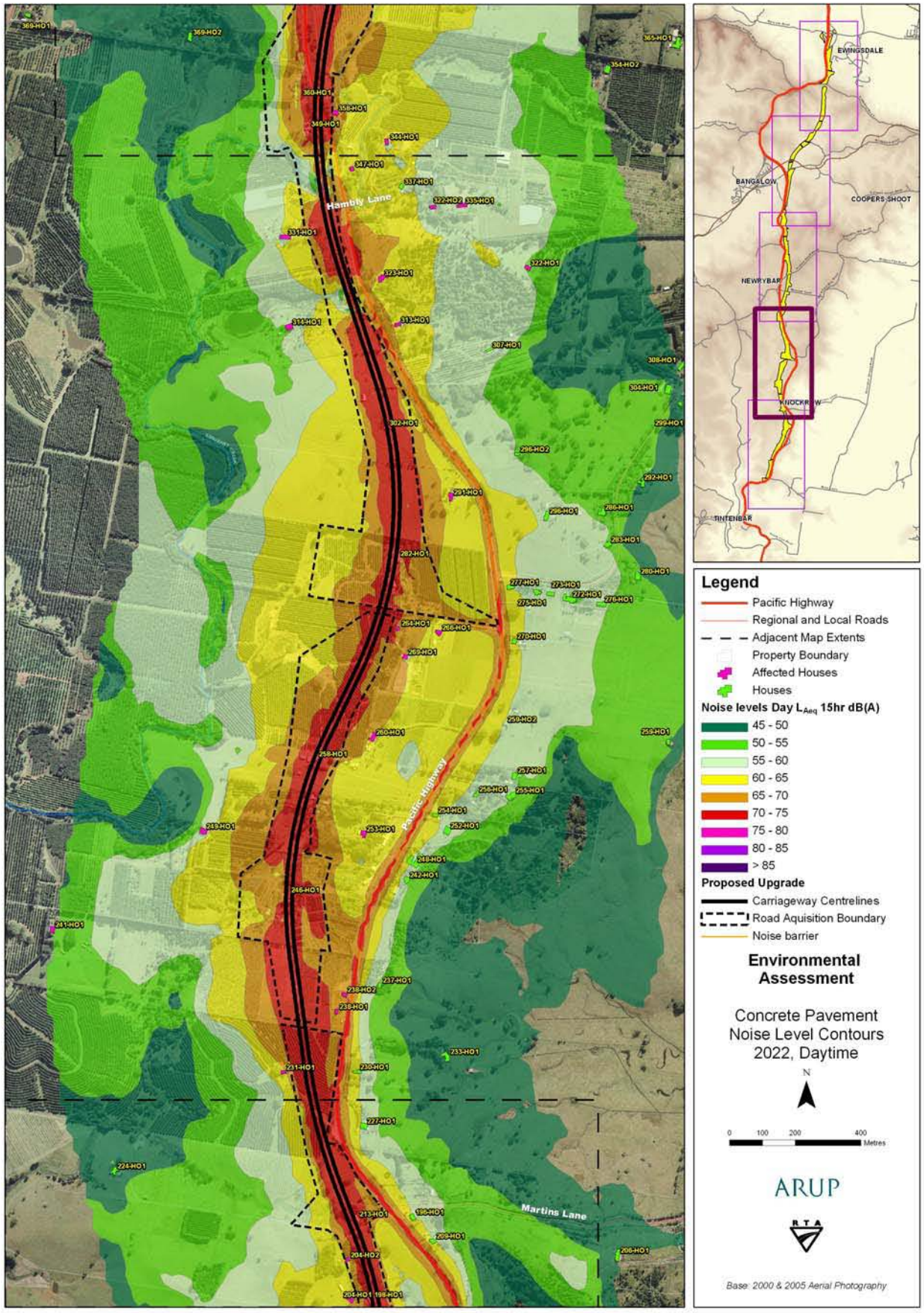


Figure E13-C3 Noise level contours, proposed upgrade 2022, Day-time, $dBL_{Aeq,15hr}$.

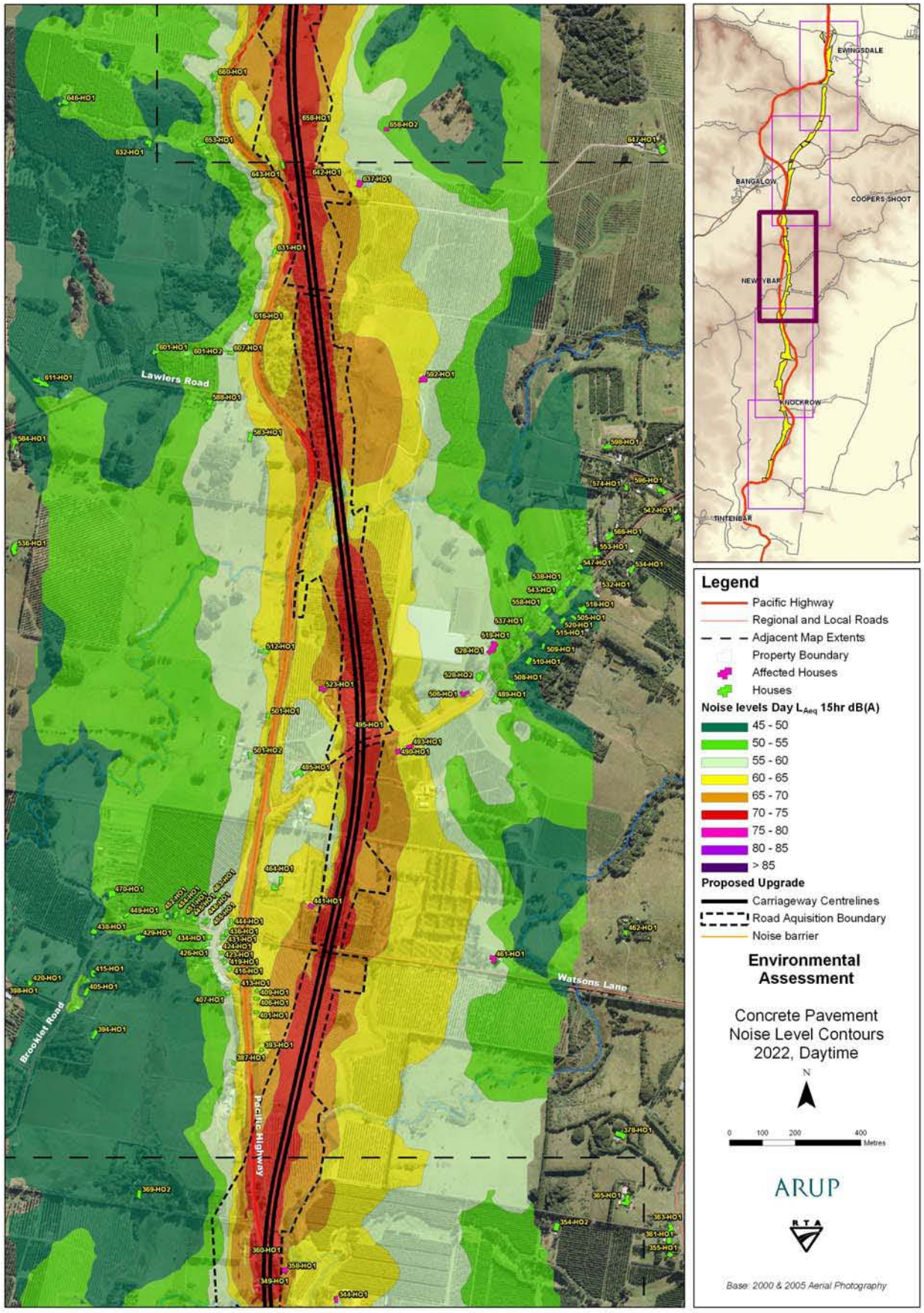


Figure E14-C4 Noise level contours, proposed upgrade 2022, Day-time, $dBL_{Aeq,15hr}$.

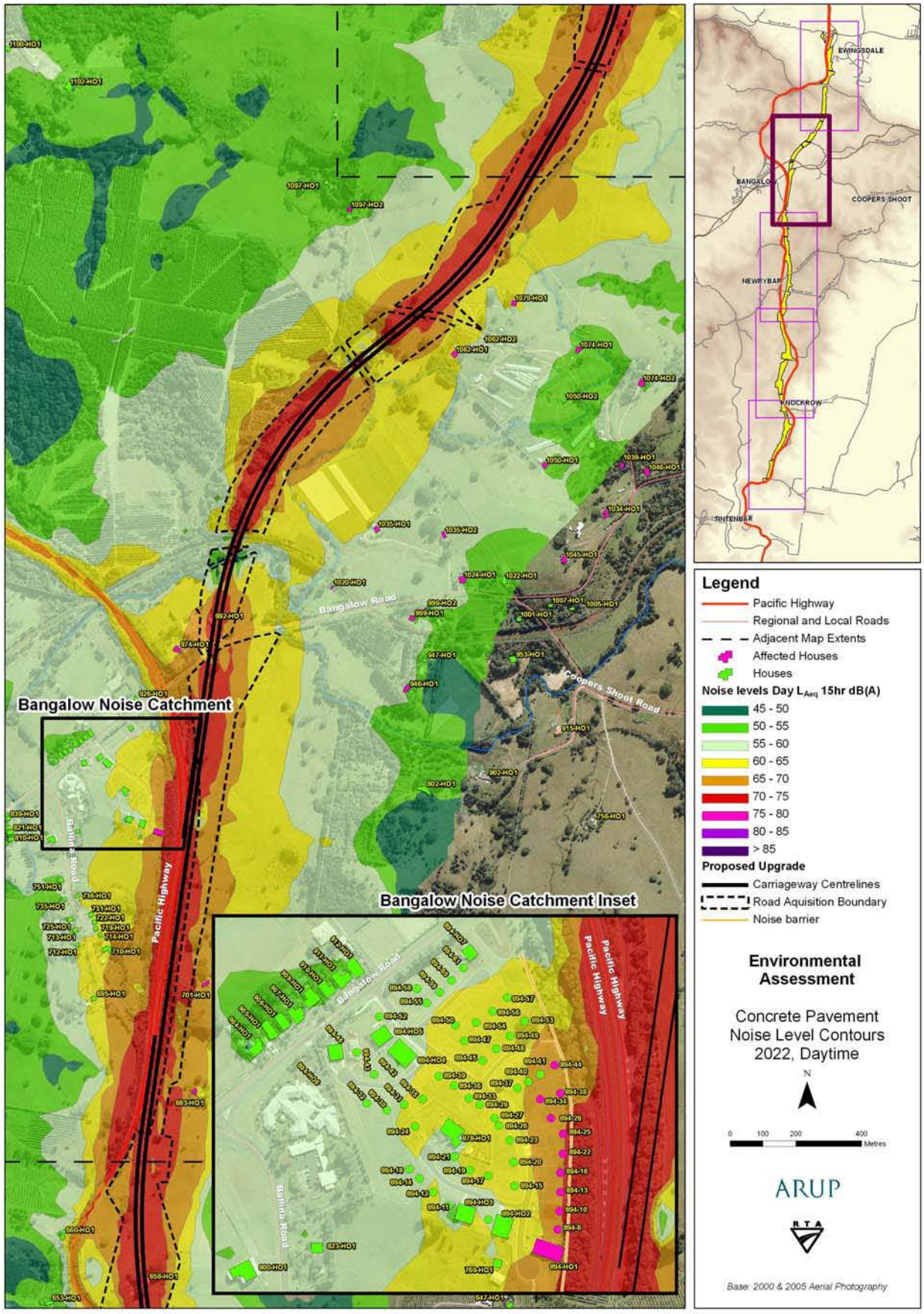


Figure E15-C5 Noise level contours, proposed upgrade 2022, Day-time, $dBL_{Aeq,15hr}$.

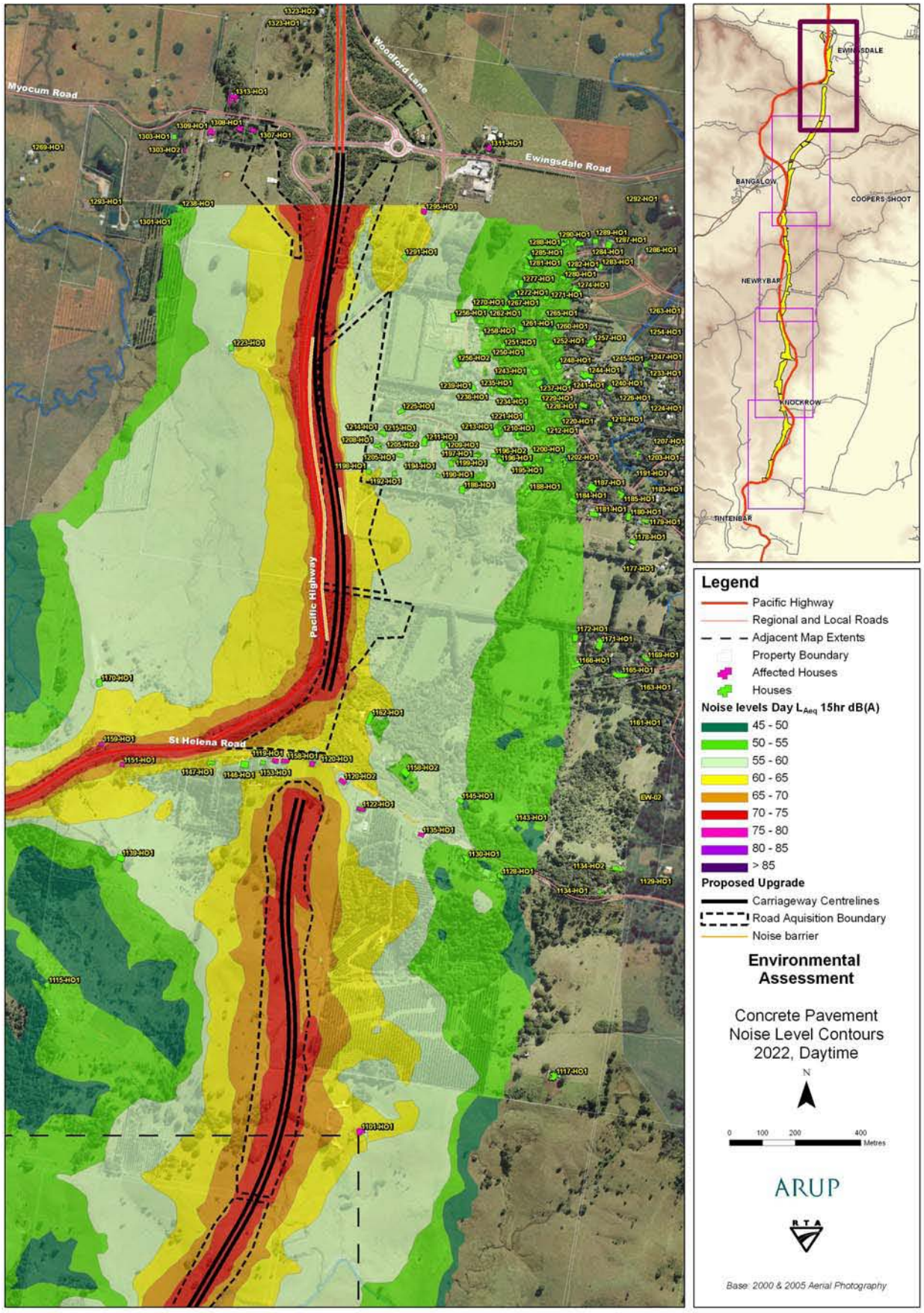


Figure E16-D1 Noise level contours, proposed upgrade 2022, Night-time, $dBL_{Aeq,9hr}$.

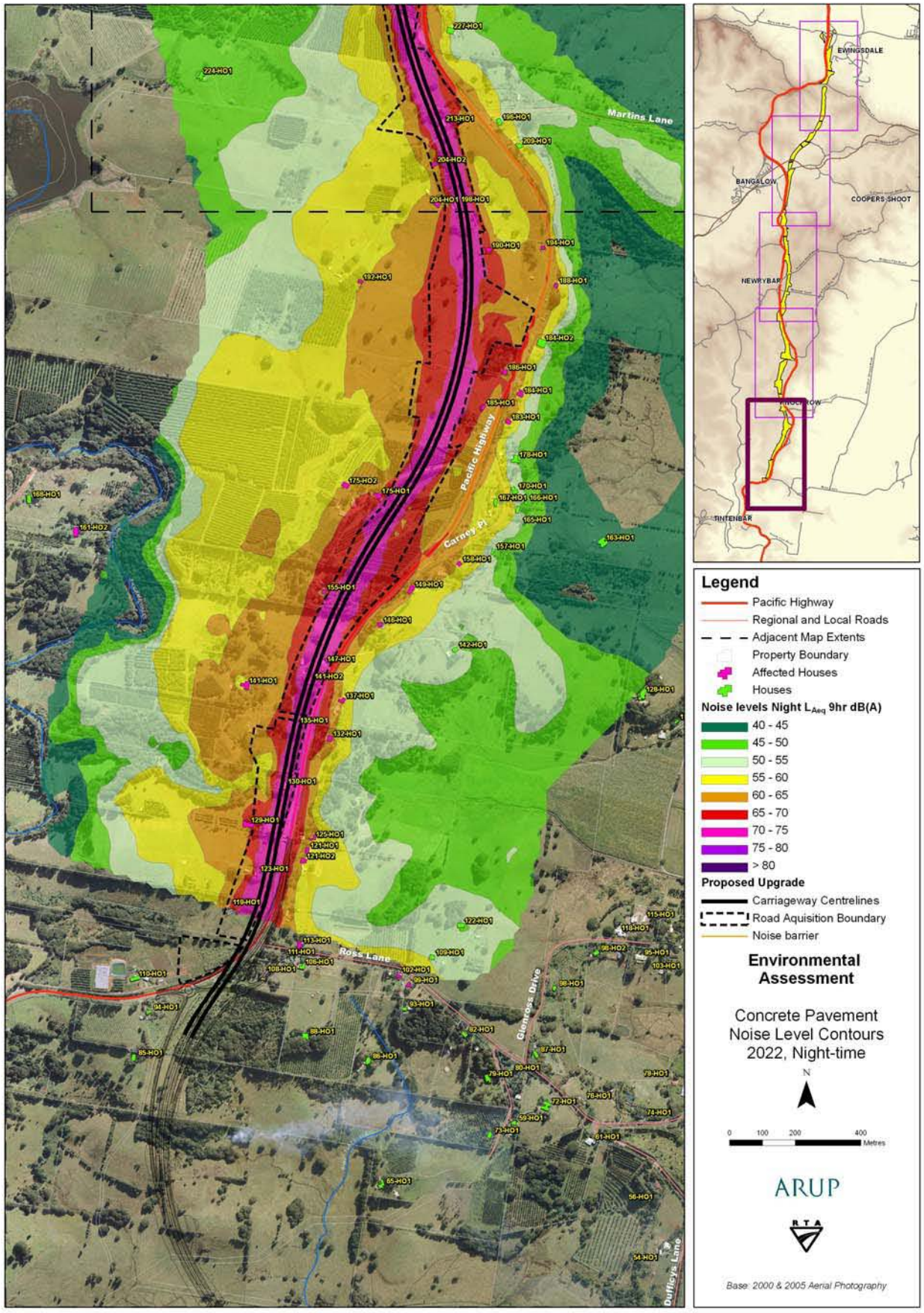


Figure E17-D2 Noise level contours, proposed upgrade 2022, Night-time, $dBL_{Aeq,9hr}$.

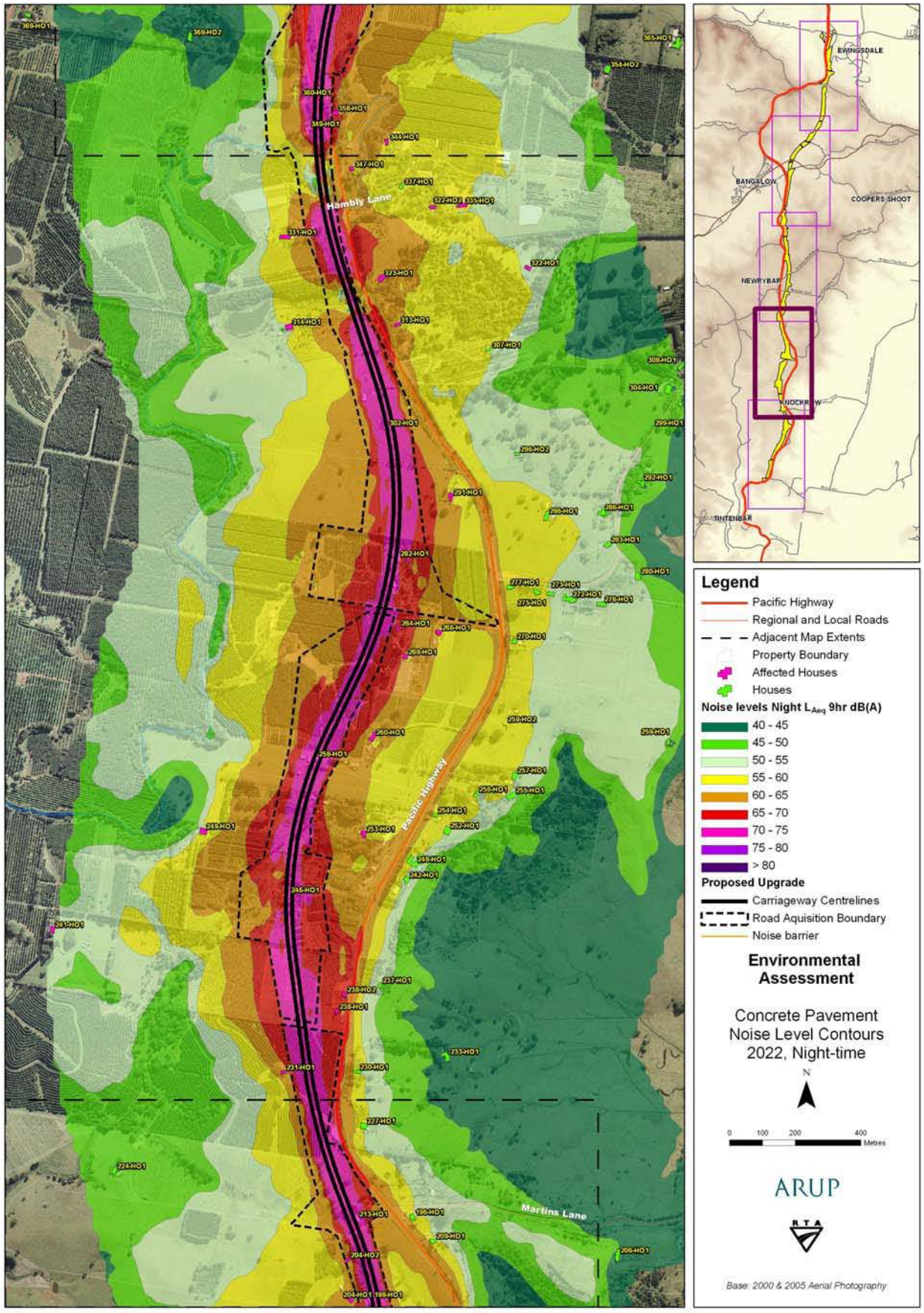


Figure E18-D3 Noise level contours, proposed upgrade 2022, Night-time, $dBL_{Aeq,9hr}$.

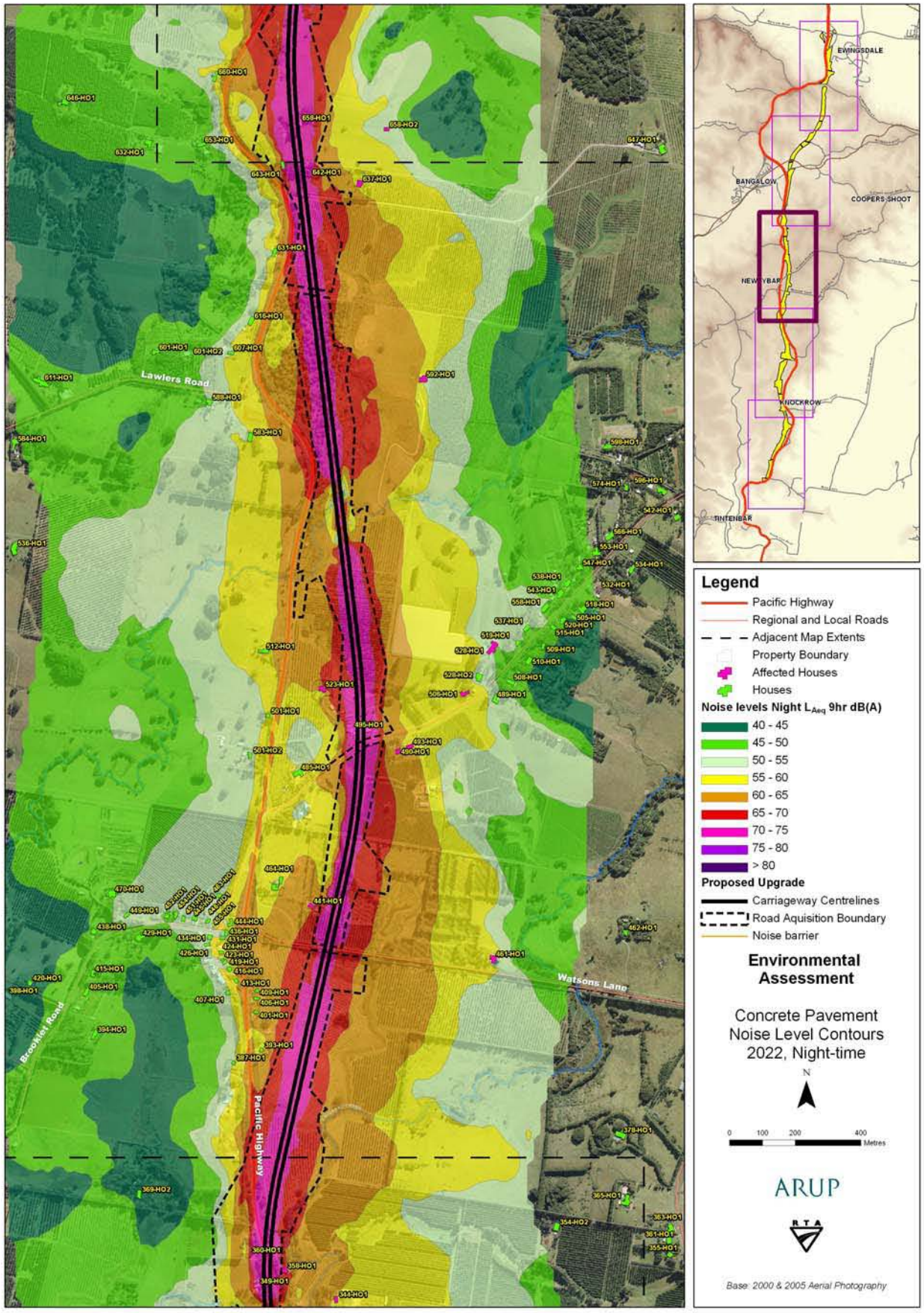


Figure E19-D4 Noise level contours, proposed upgrade 2022, Night-time, $dBL_{Aeq,9hr}$.

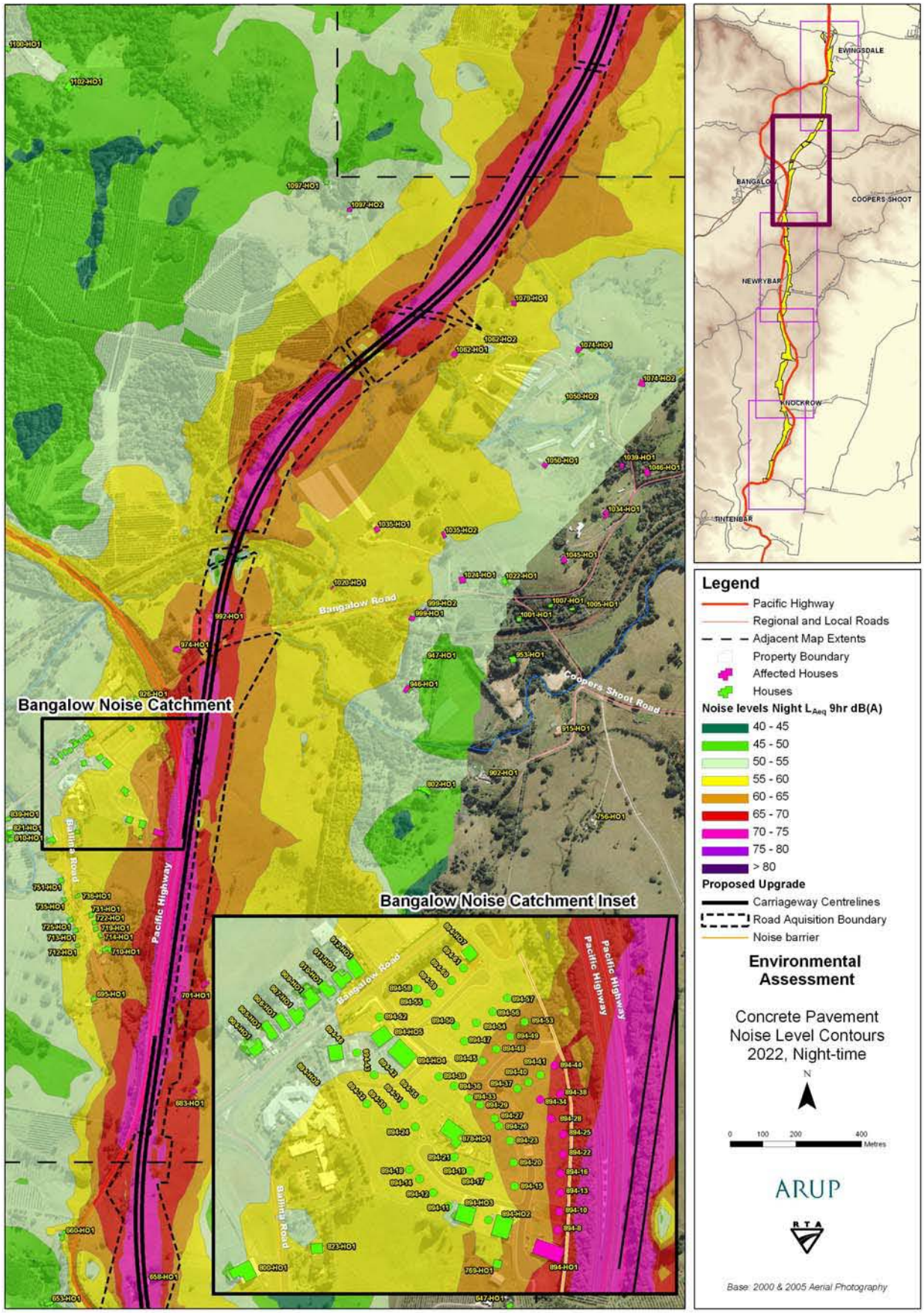


Figure E20-D5 Noise level contours, proposed upgrade 2022, Night-time, $dBL_{Aeq,9hr}$.

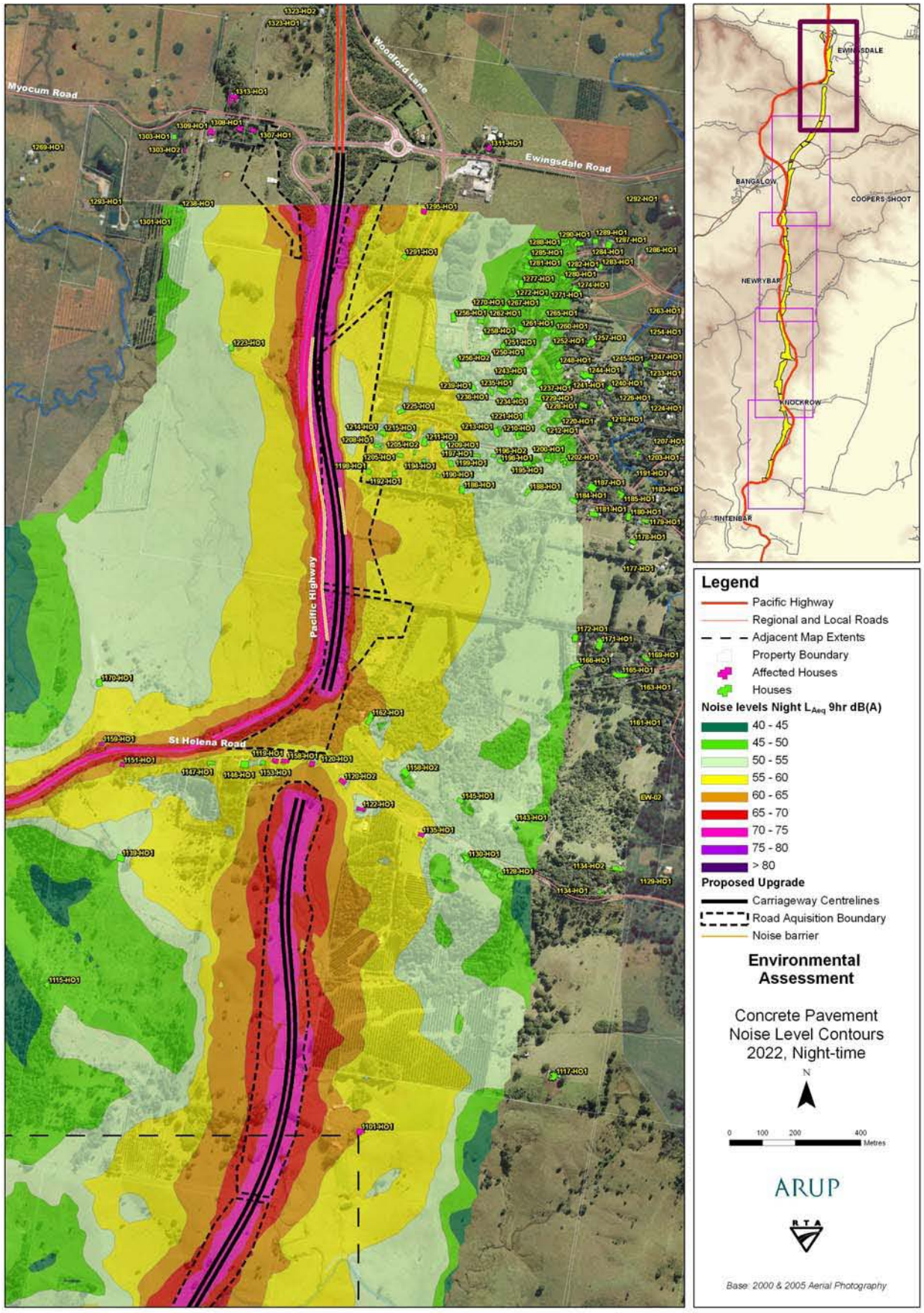


Figure E21-E1 Noise level contours proposed upgrade mitigated with SMA, 2012, Day-time, $dBL_{Aeq,15hr}$.

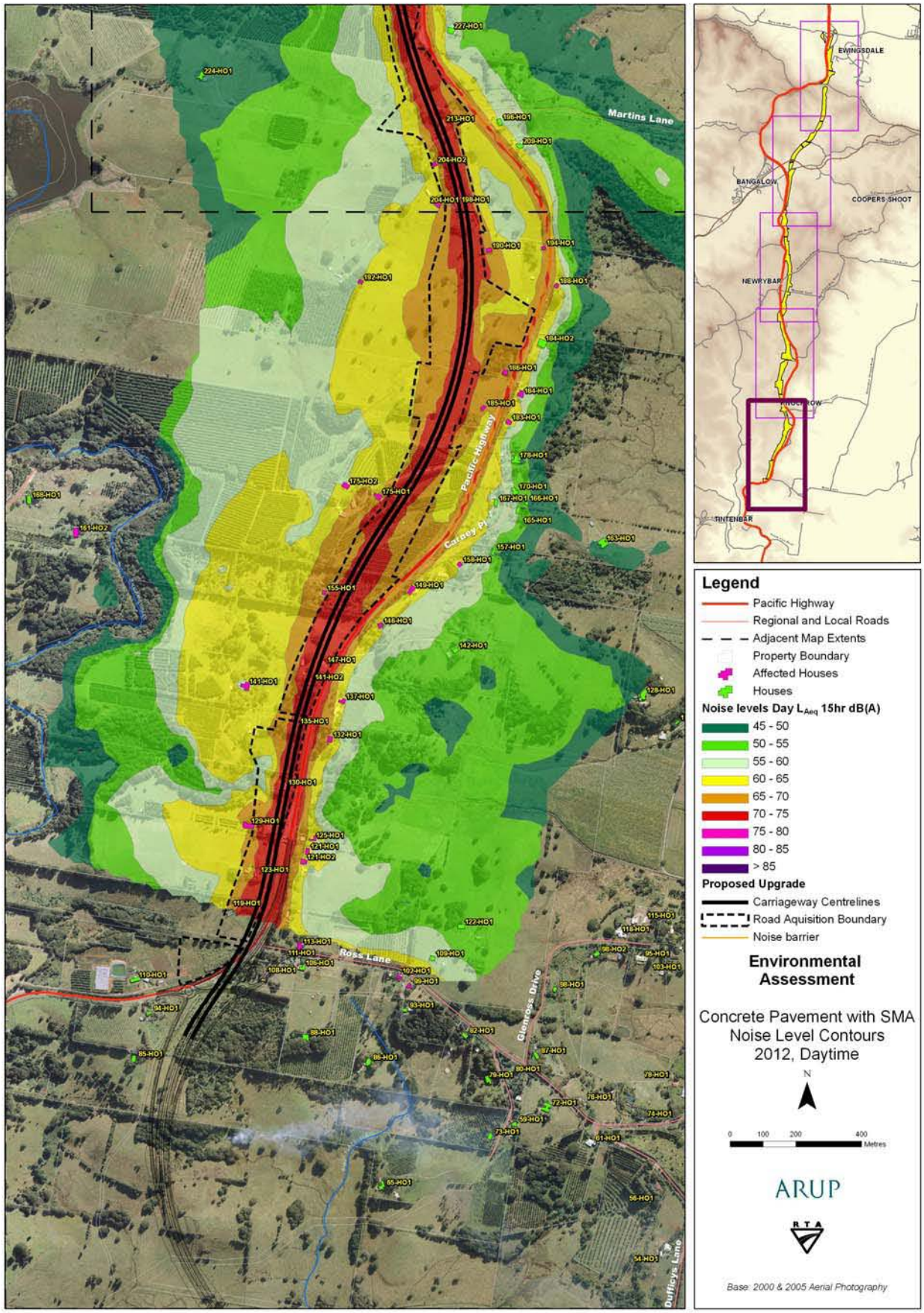


Figure E22-E2 Noise level contours proposed upgrade mitigated with SMA, 2012, Day-time, $dBL_{Aeq,15hr}$.

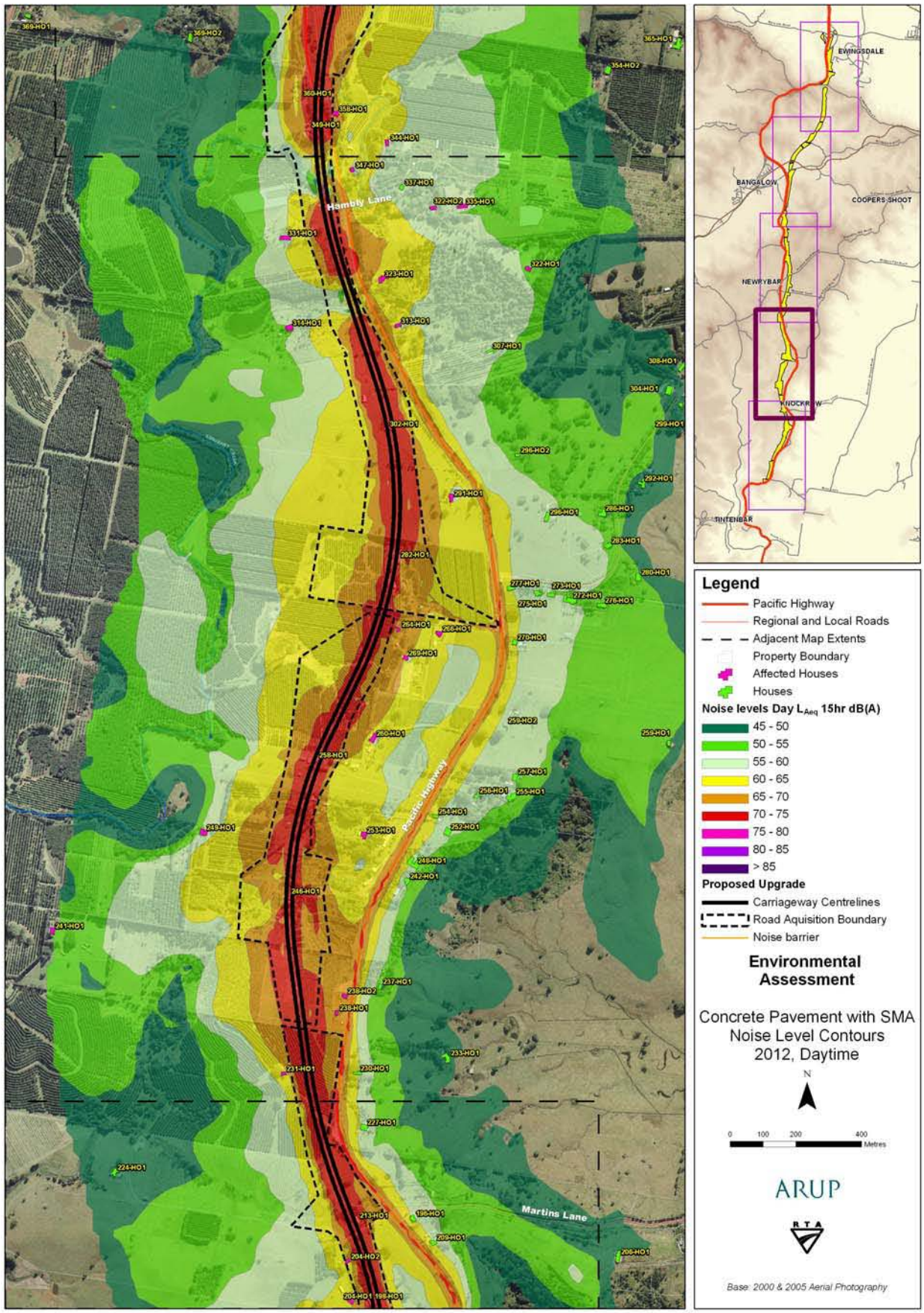


Figure E23-E3 Noise level contours proposed upgrade mitigated with SMA, 2012, Day-time, $dBL_{Aeq,15hr}$.

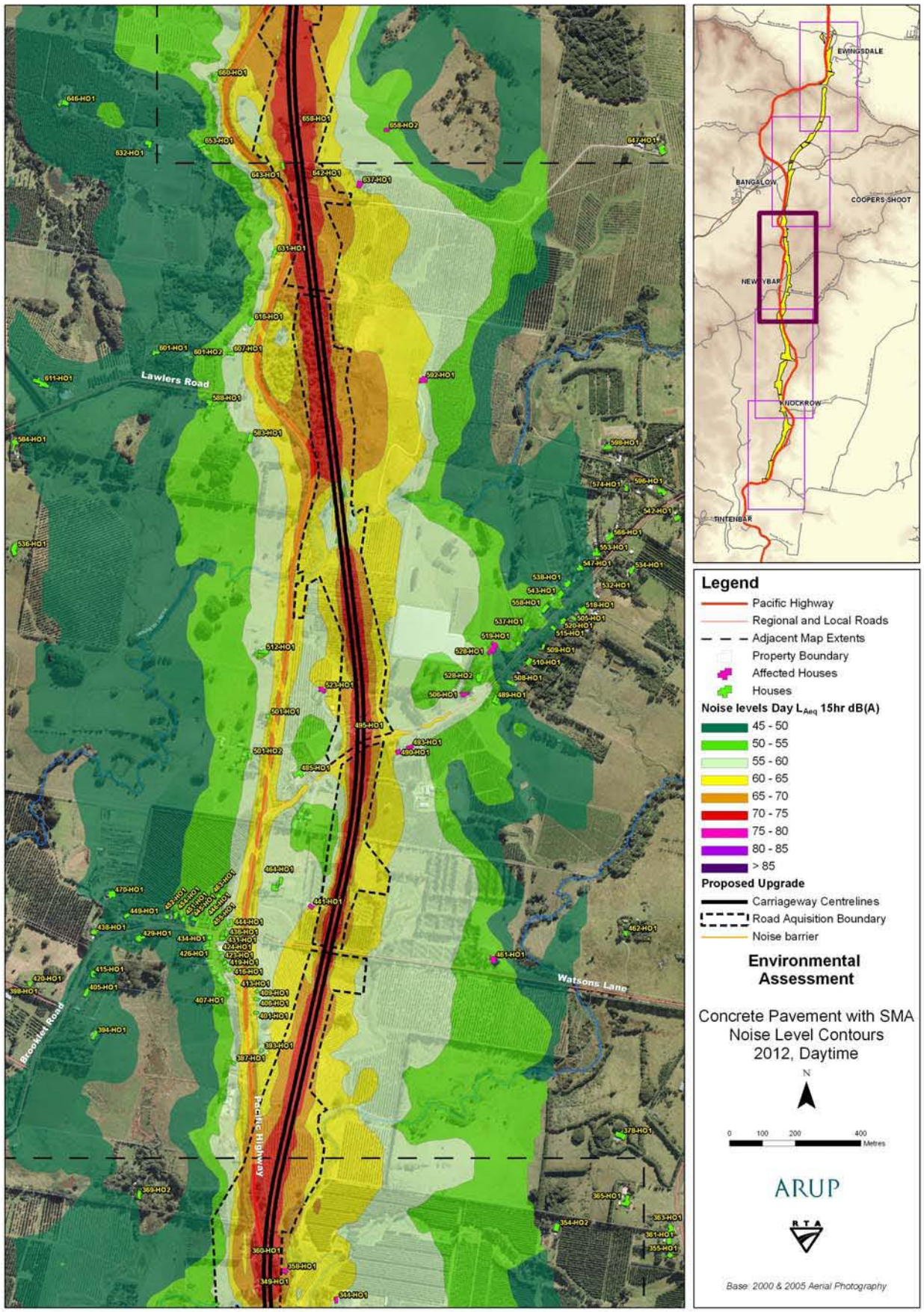


Figure E24-E4 Noise level contours proposed upgrade mitigated with SMA, 2012, Day-time, $dBL_{Aeq,15hr}$.

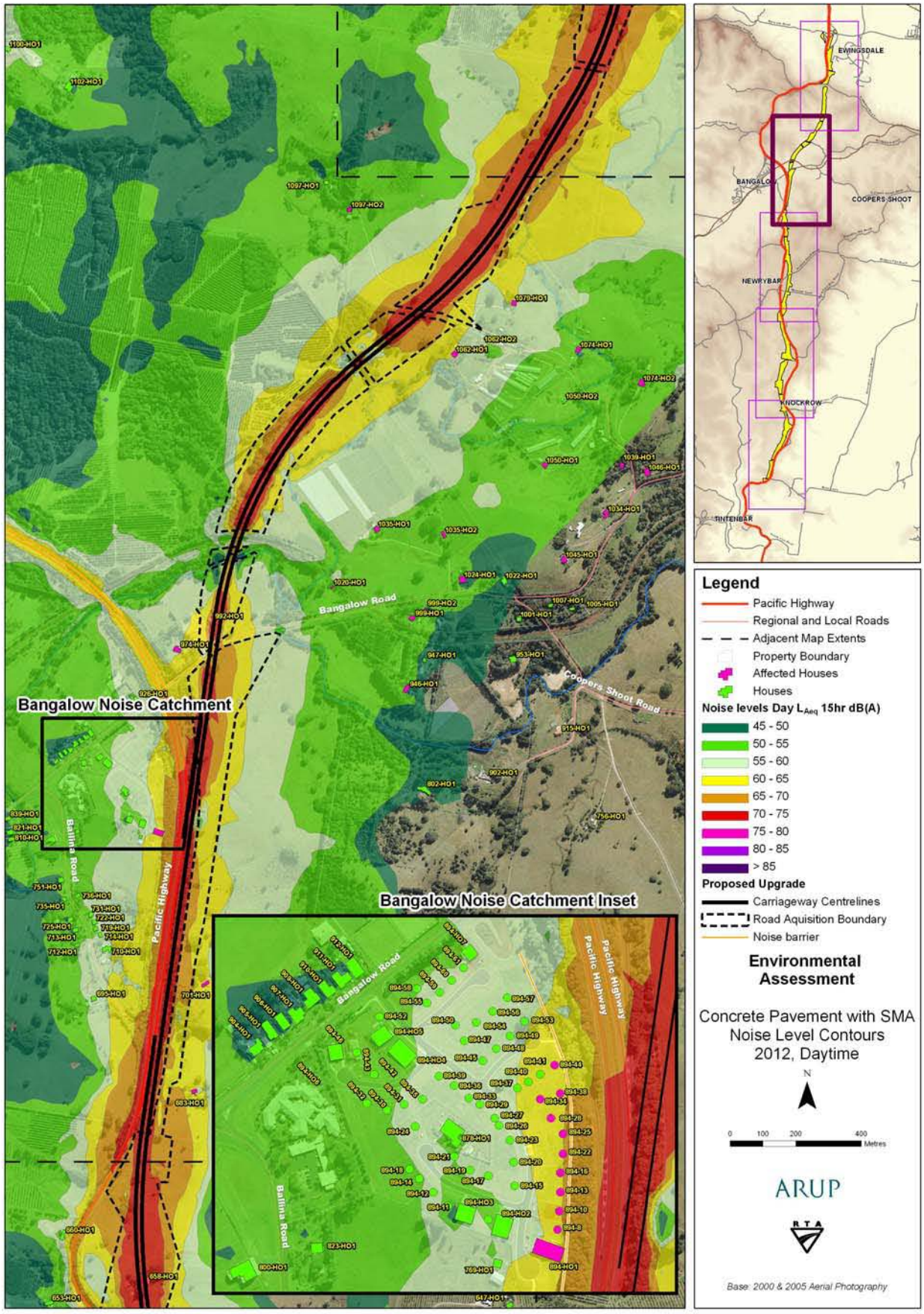


Figure E25-E5 Noise level contours proposed upgrade mitigated with SMA, 2012, Day-time,dBL$_{Aeq,15hr}$.

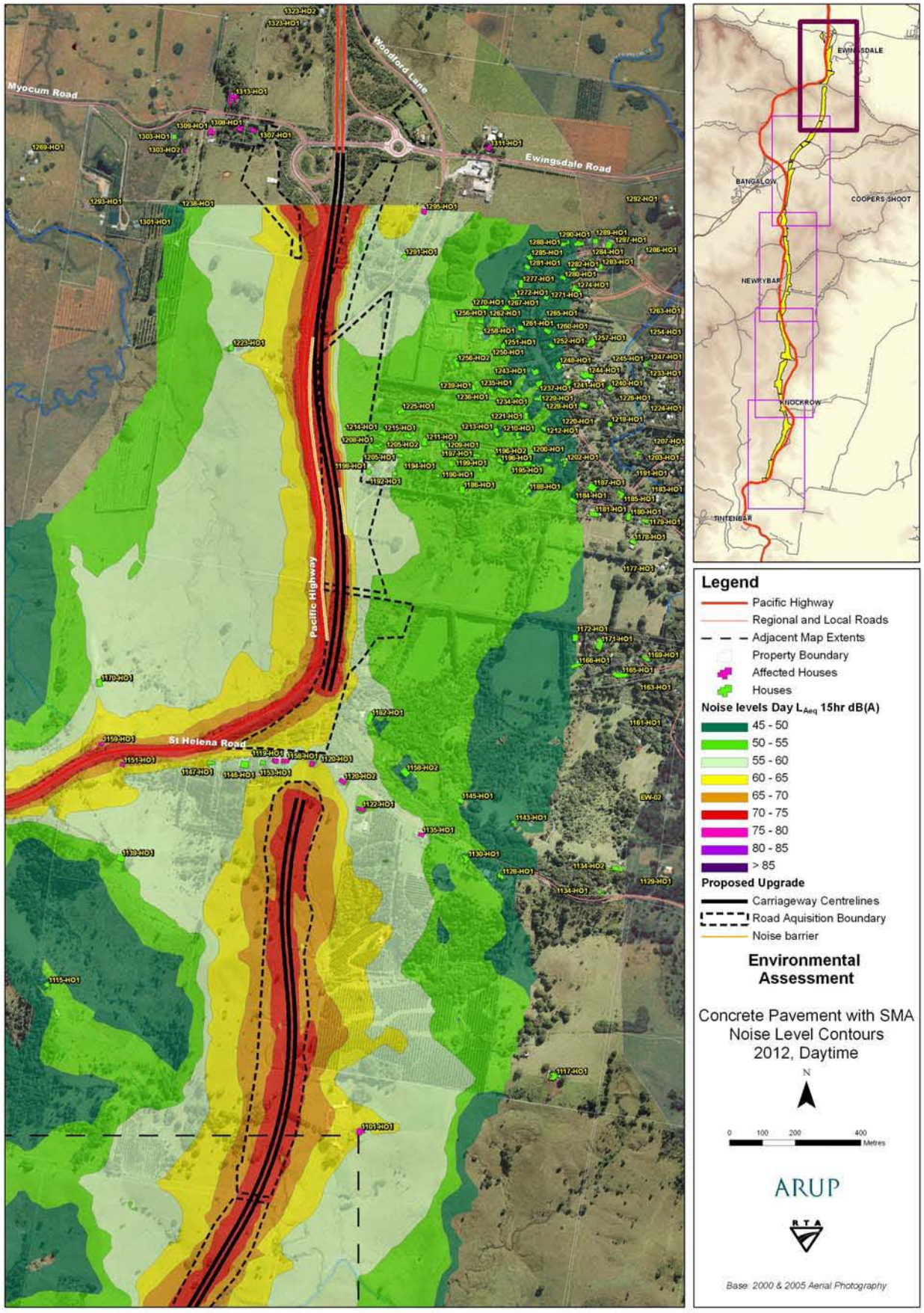


Figure E26-F1 Noise level contours, proposed upgrade 2012 mitigated with SMA, Night-time,dB$L_{Aeq,9hr}$.

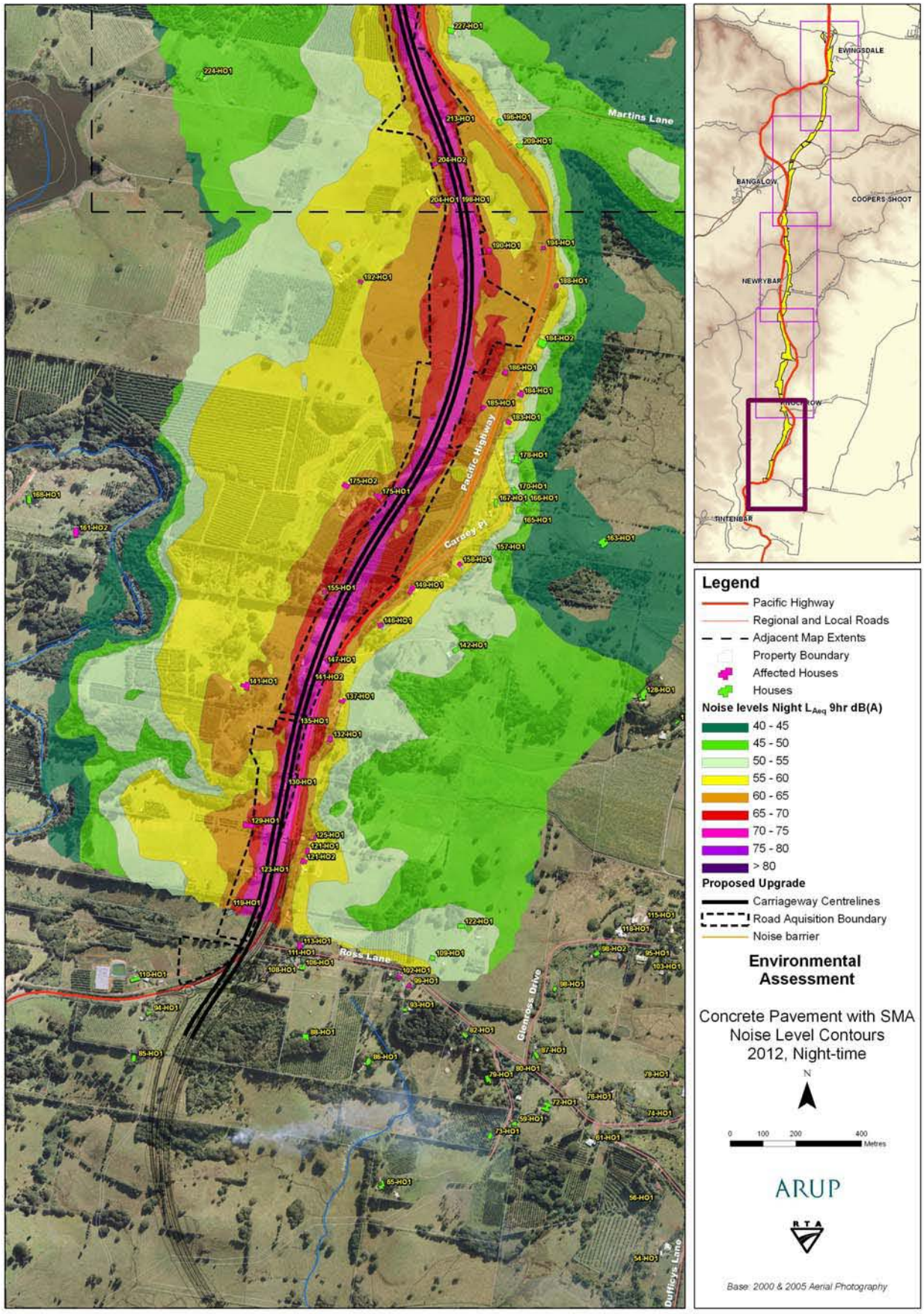


Figure E27-F2 Noise level contours, proposed upgrade 2012 mitigated with SMA, Night-time,dB$L_{Aeq,9hr}$.

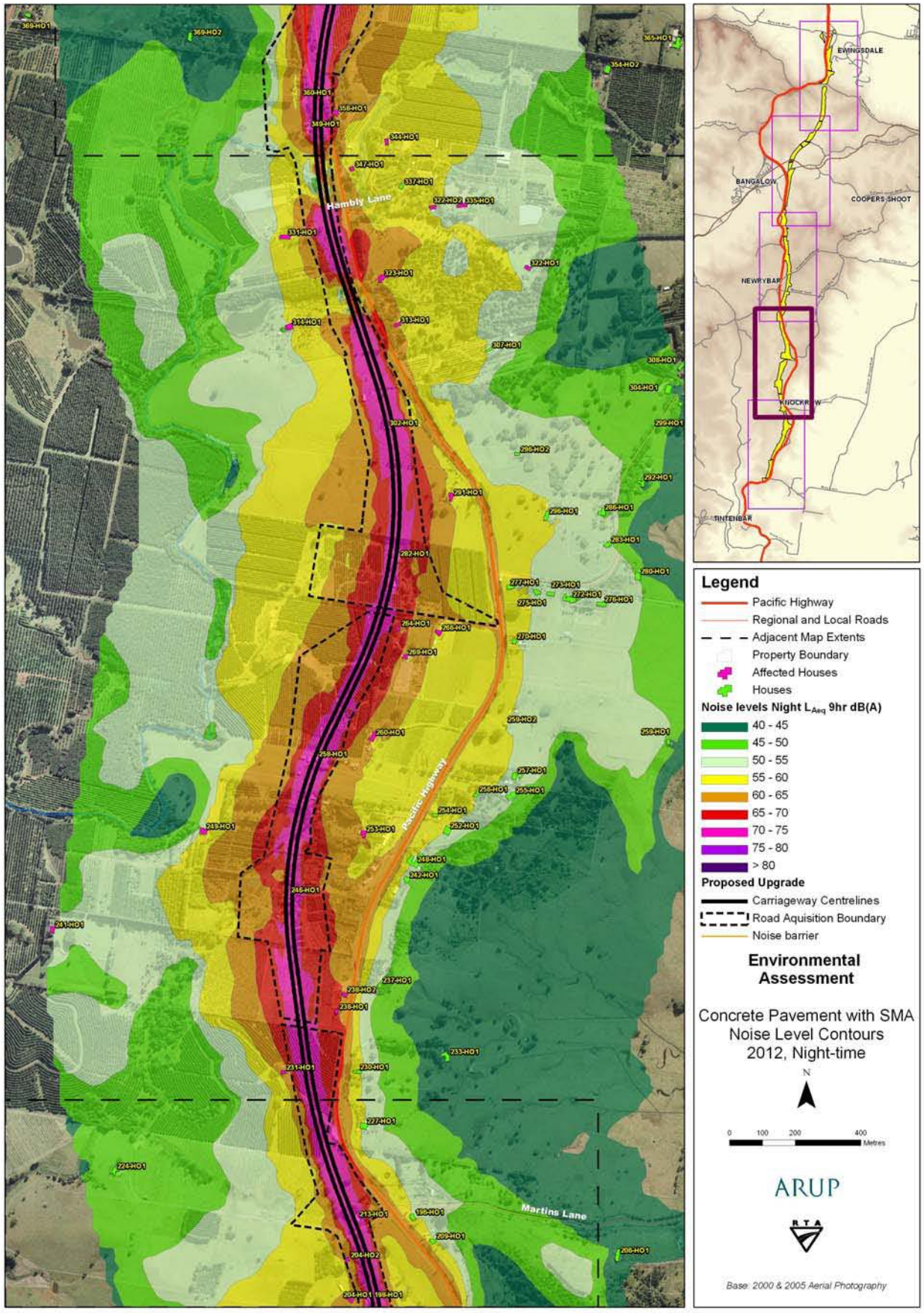


Figure E28-F3 Noise level contours, proposed upgrade 2012 mitigated with SMA, Night-time,dB$L_{Aeq,9hr}$

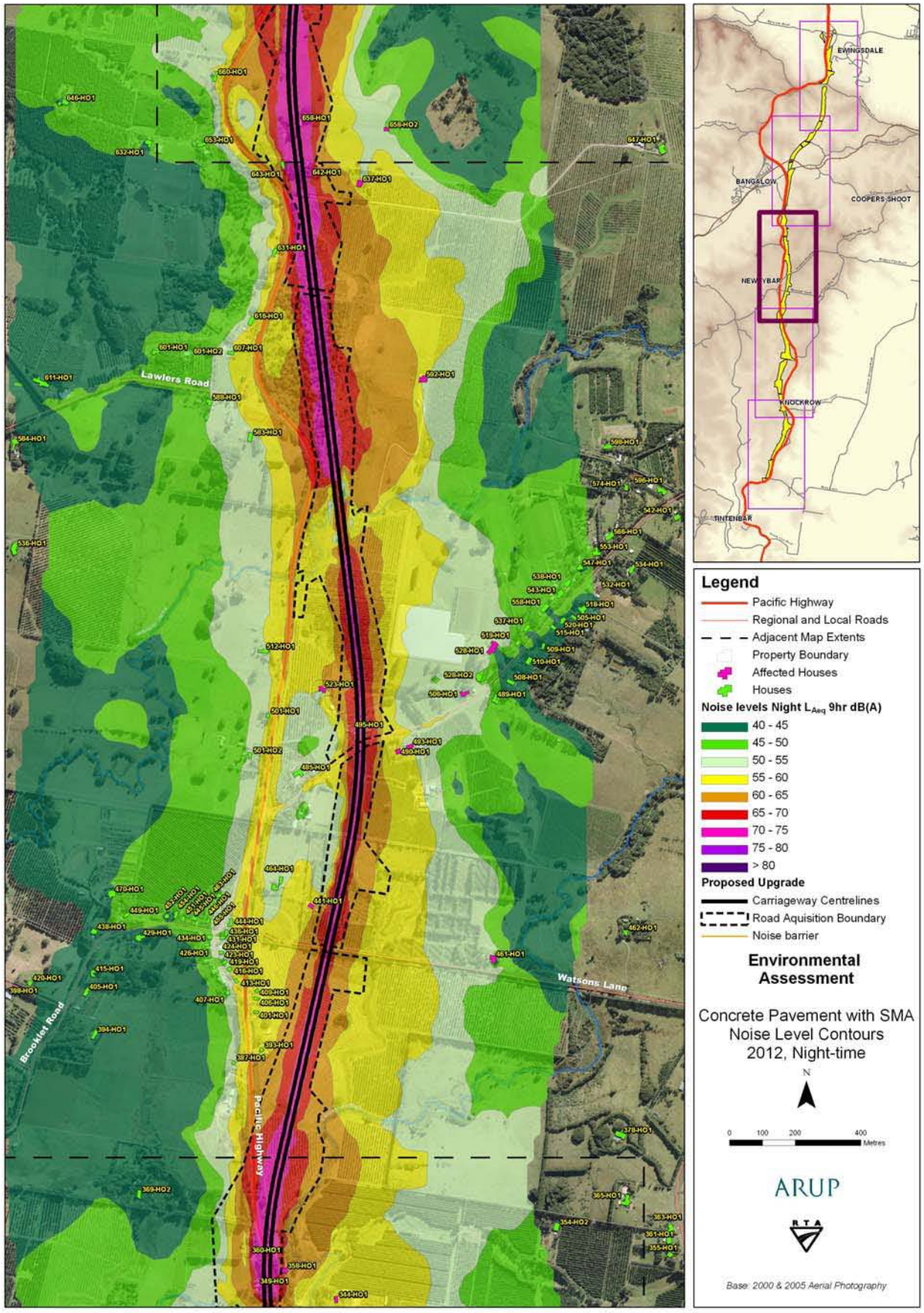


Figure E29-F4 Noise level contours, proposed upgrade 2012 mitigated with SMA, Night-time,dBL$_{Aeq,9hr}$.

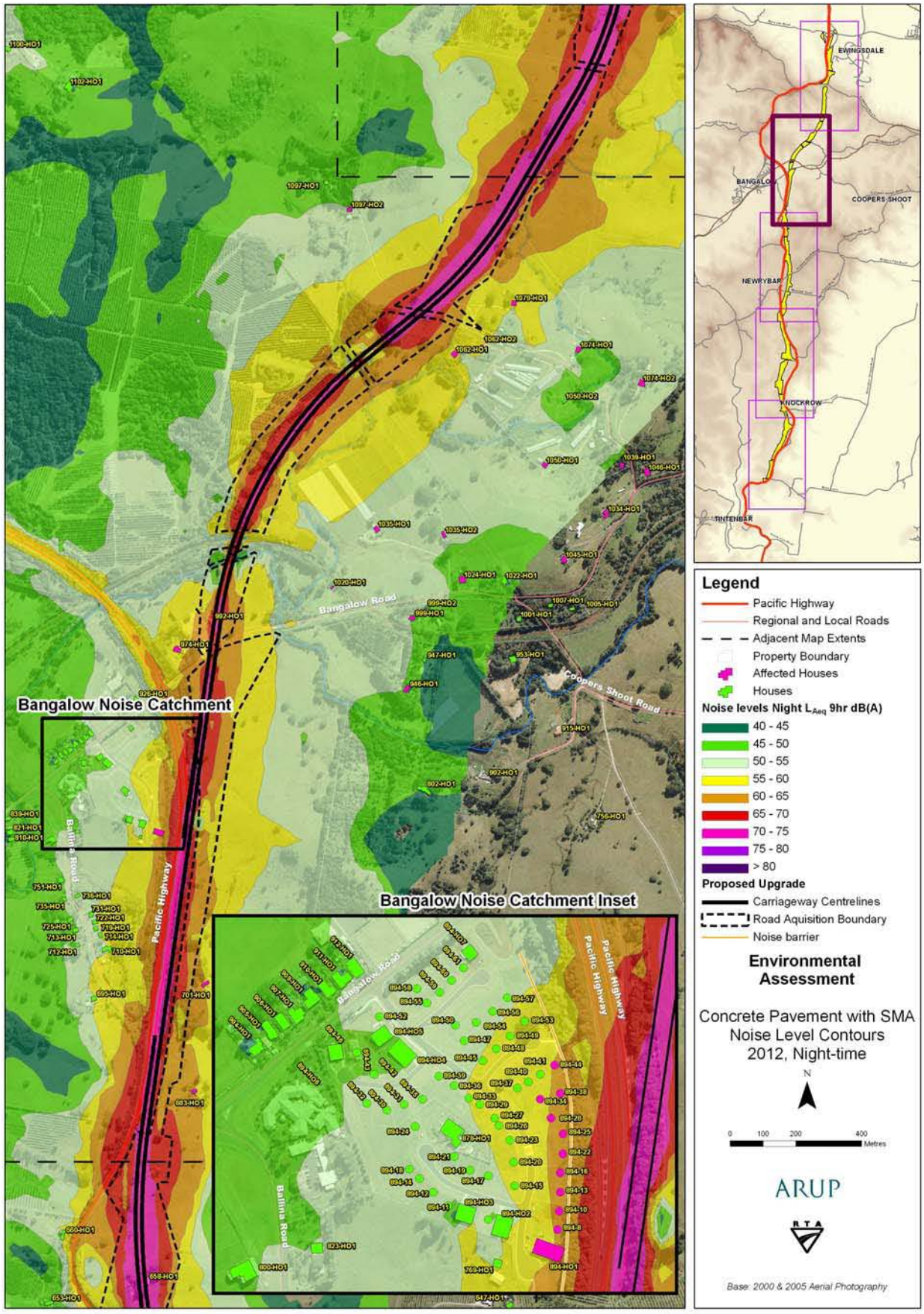


Figure E30-F5 Noise level contours, proposed upgrade 2012 mitigated with SMA, Night-time,dB$L_{Aeq,9hr}$.

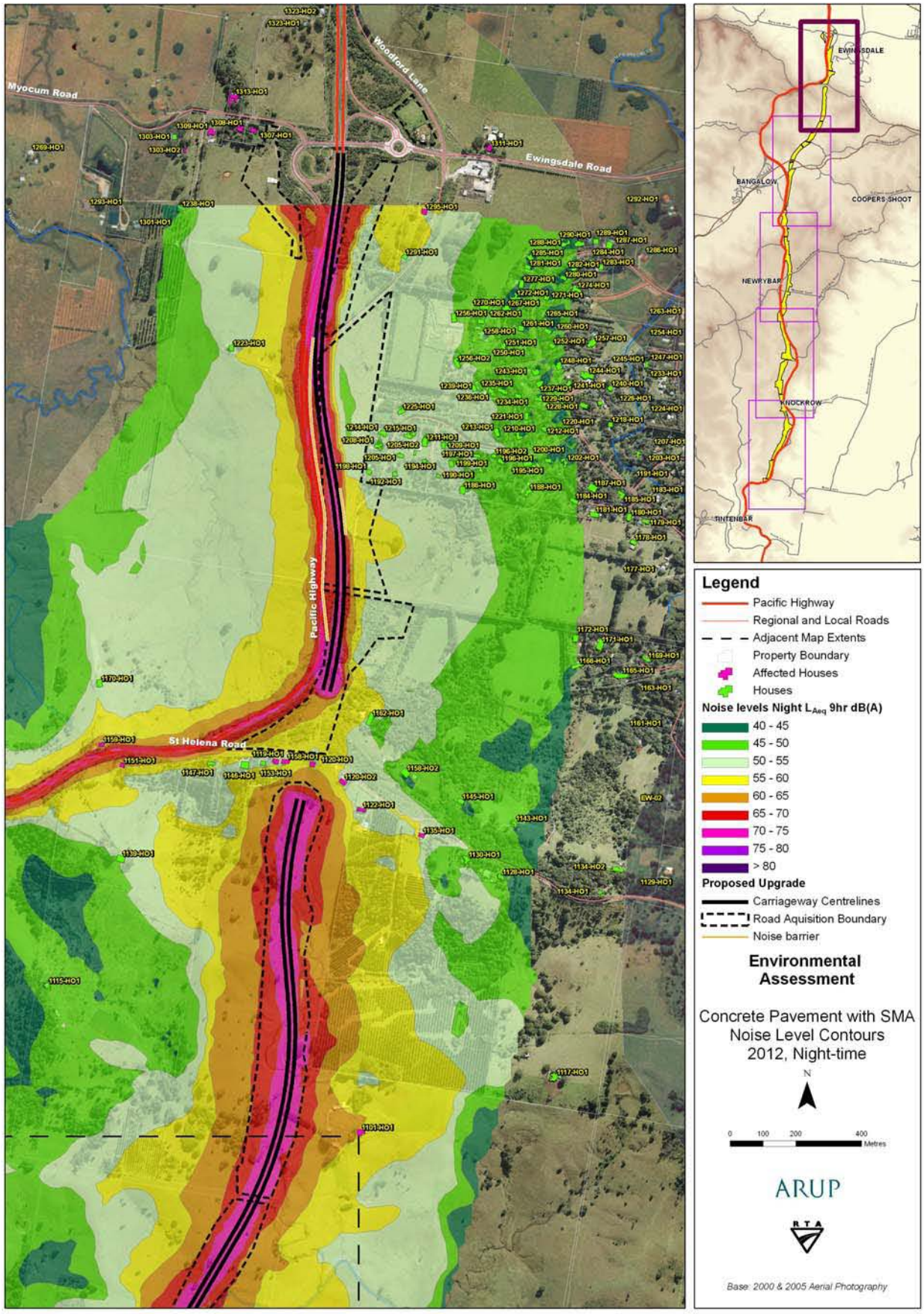


Figure E31-G1 Noise level contours, proposed upgrade 2022 mitigated with SMA, Day-time,dB$L_{Aeq,15hr}$.

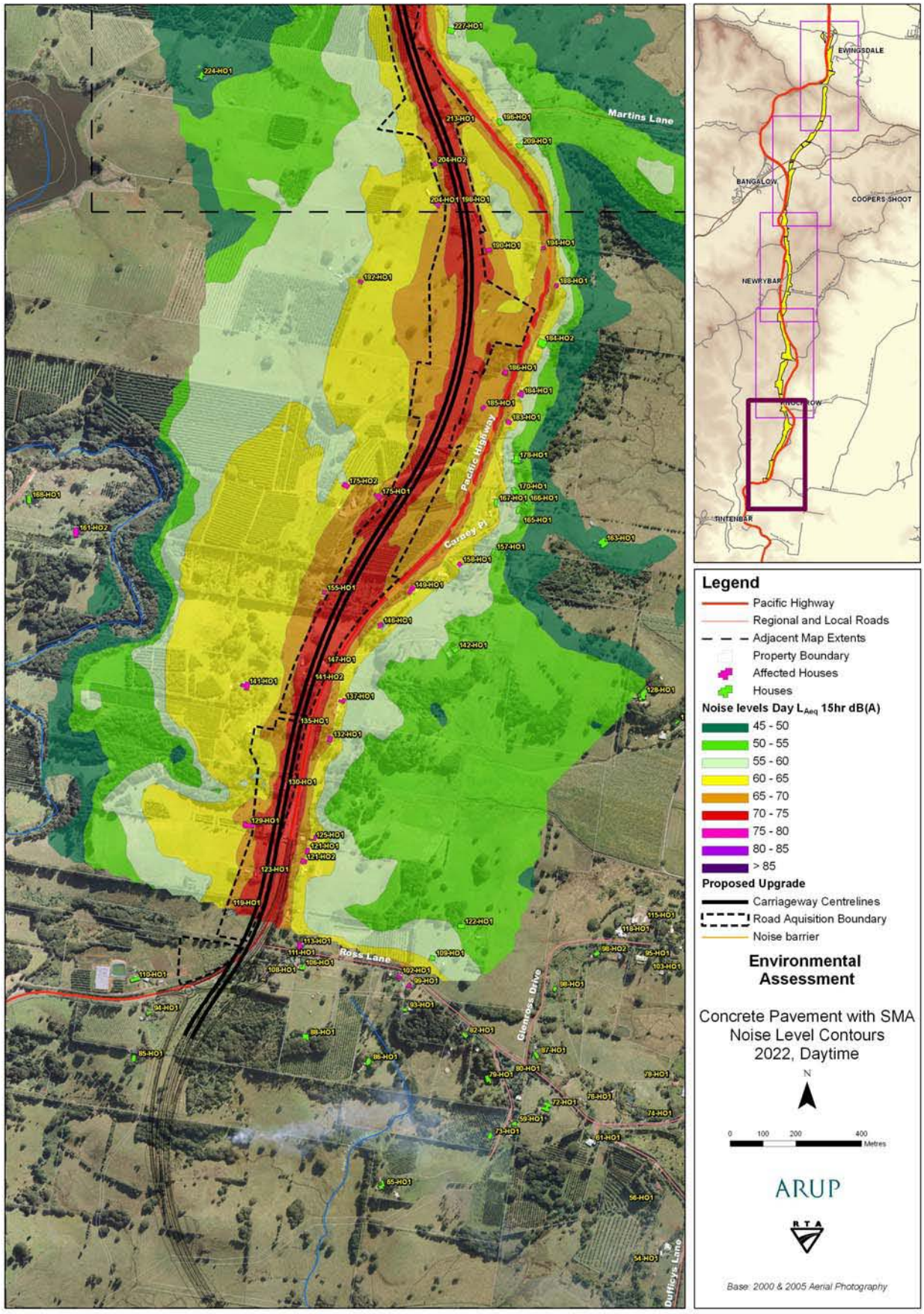


Figure E32-G2 Noise level contours, proposed upgrade 2022 mitigated with SMA, Day-time, $dBL_{Aeq,15hr}$.

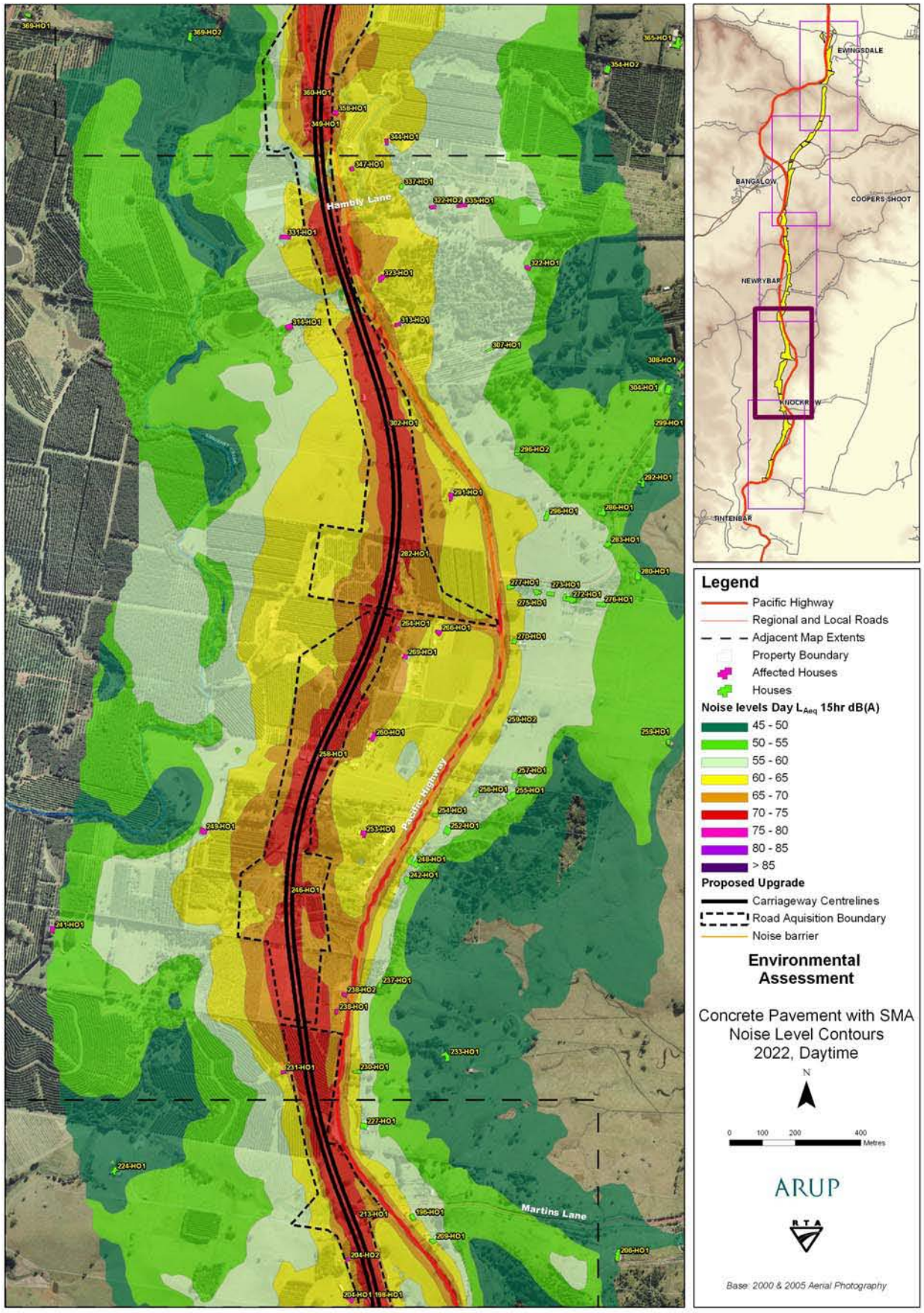


Figure E33-G3 Noise level contours, proposed upgrade 2022 mitigated with SMA, Day-time,dB$L_{Aeq,15hr}$.

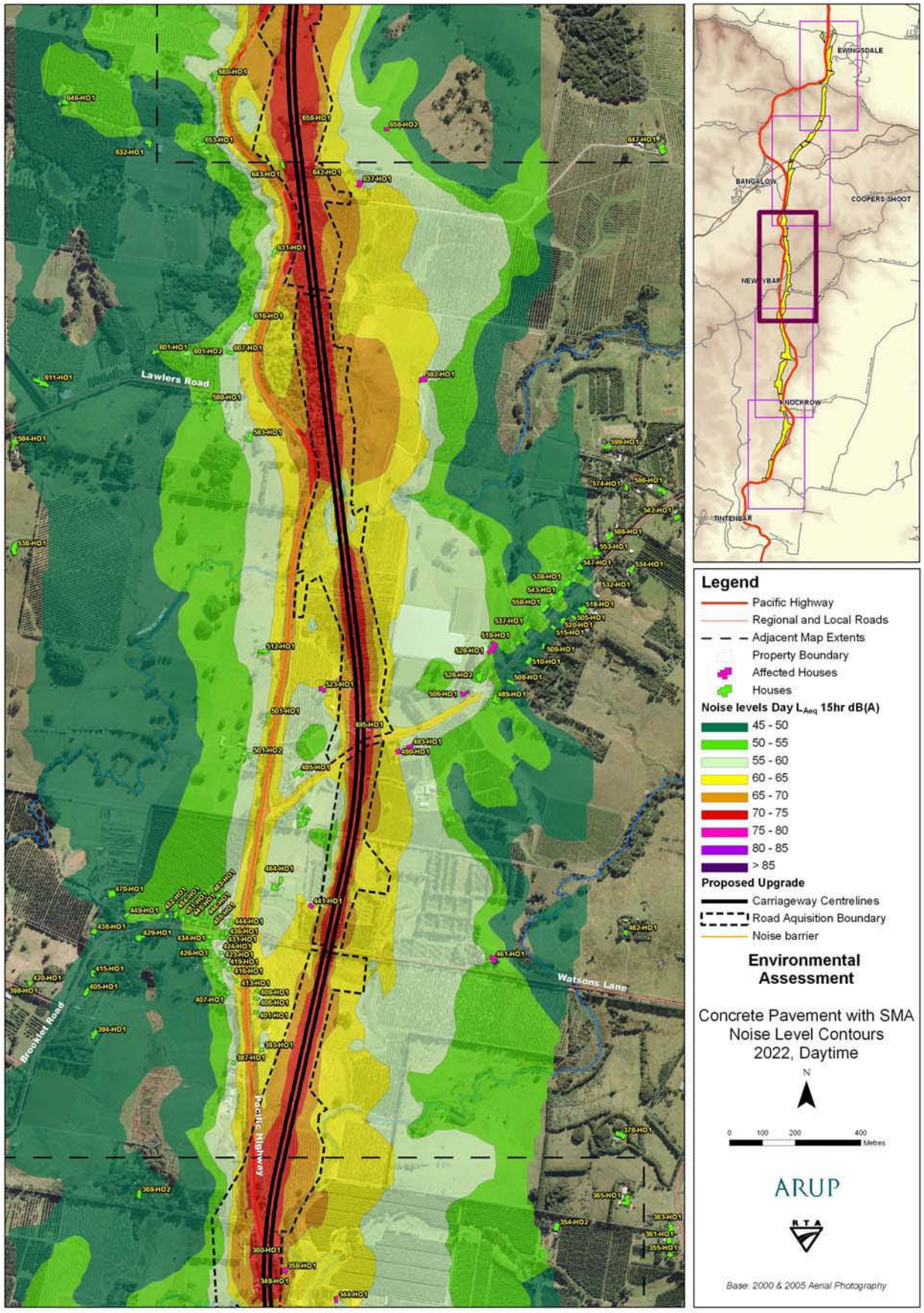


Figure E34-G4 Noise level contours, proposed upgrade 2022 mitigated with SMA, Day-time,dB$L_{Aeq,15hr}$.

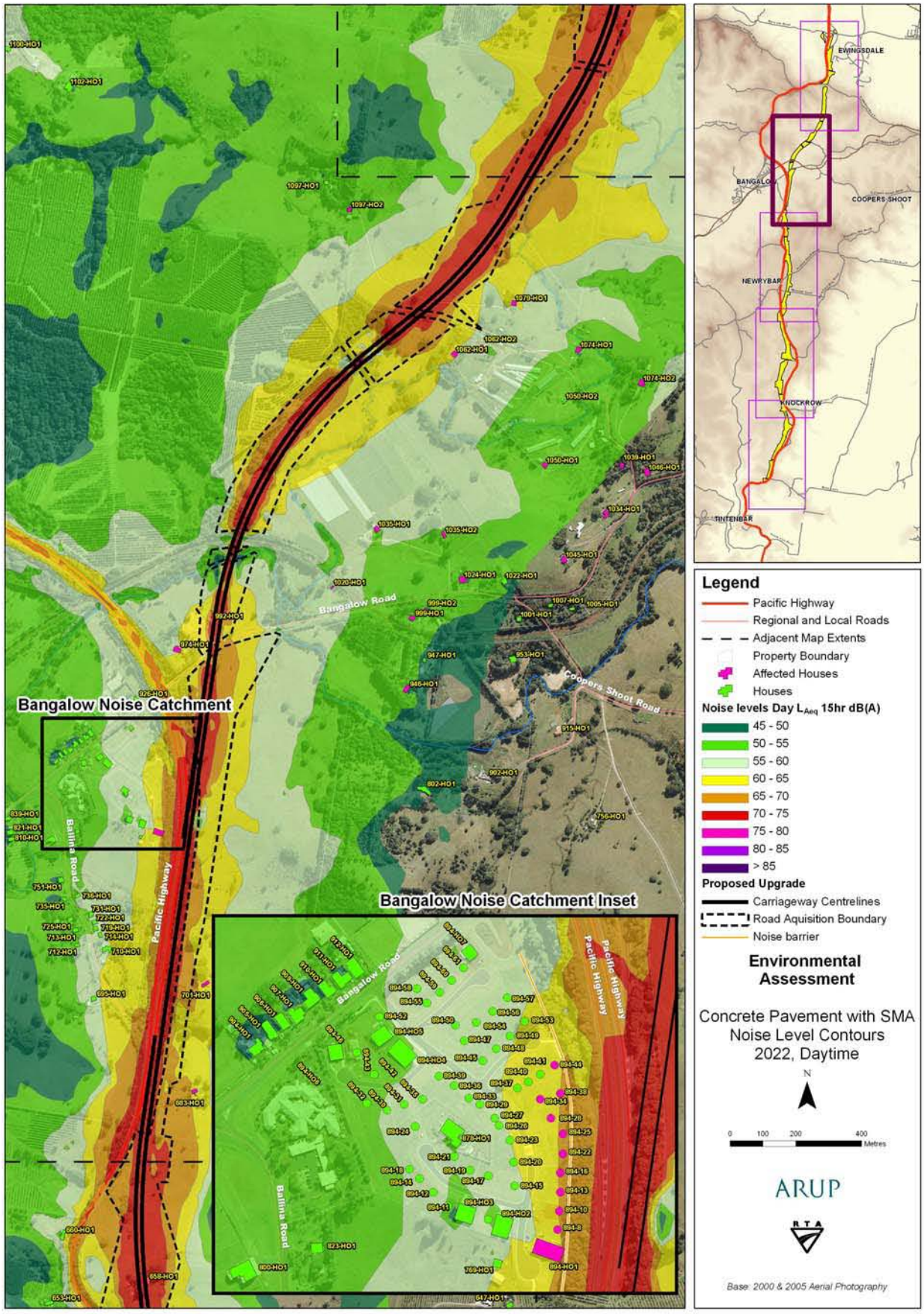


Figure E35-G5 Noise level contours, proposed upgrade 2022 mitigated with SMA, Day-time,dB$L_{Aeq,15hr}$.

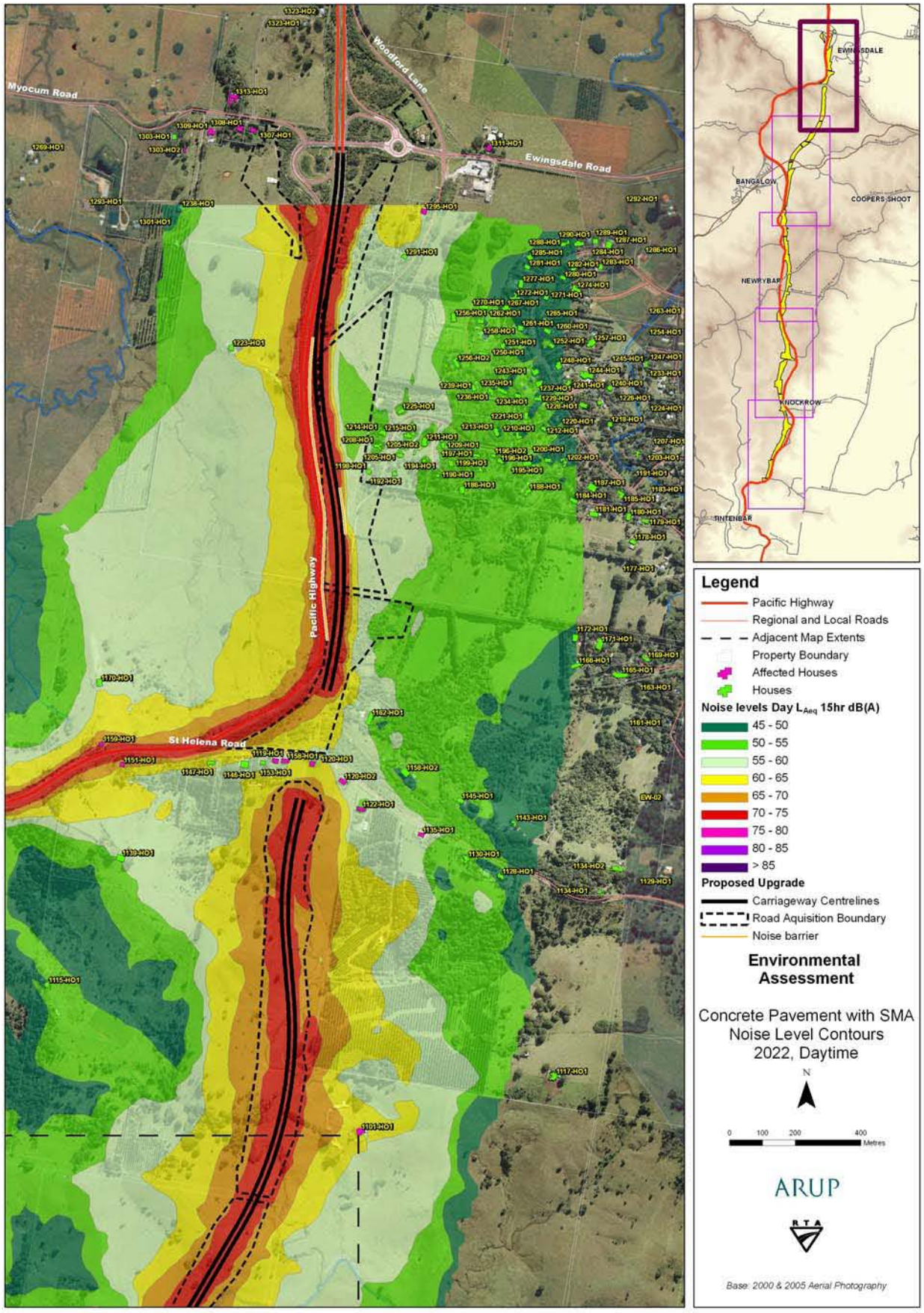


Figure E36-H1 Noise level contours, proposed upgrade 2022 mitigated with SMA, Night-time,dB$L_{Aeq,9hr}$.

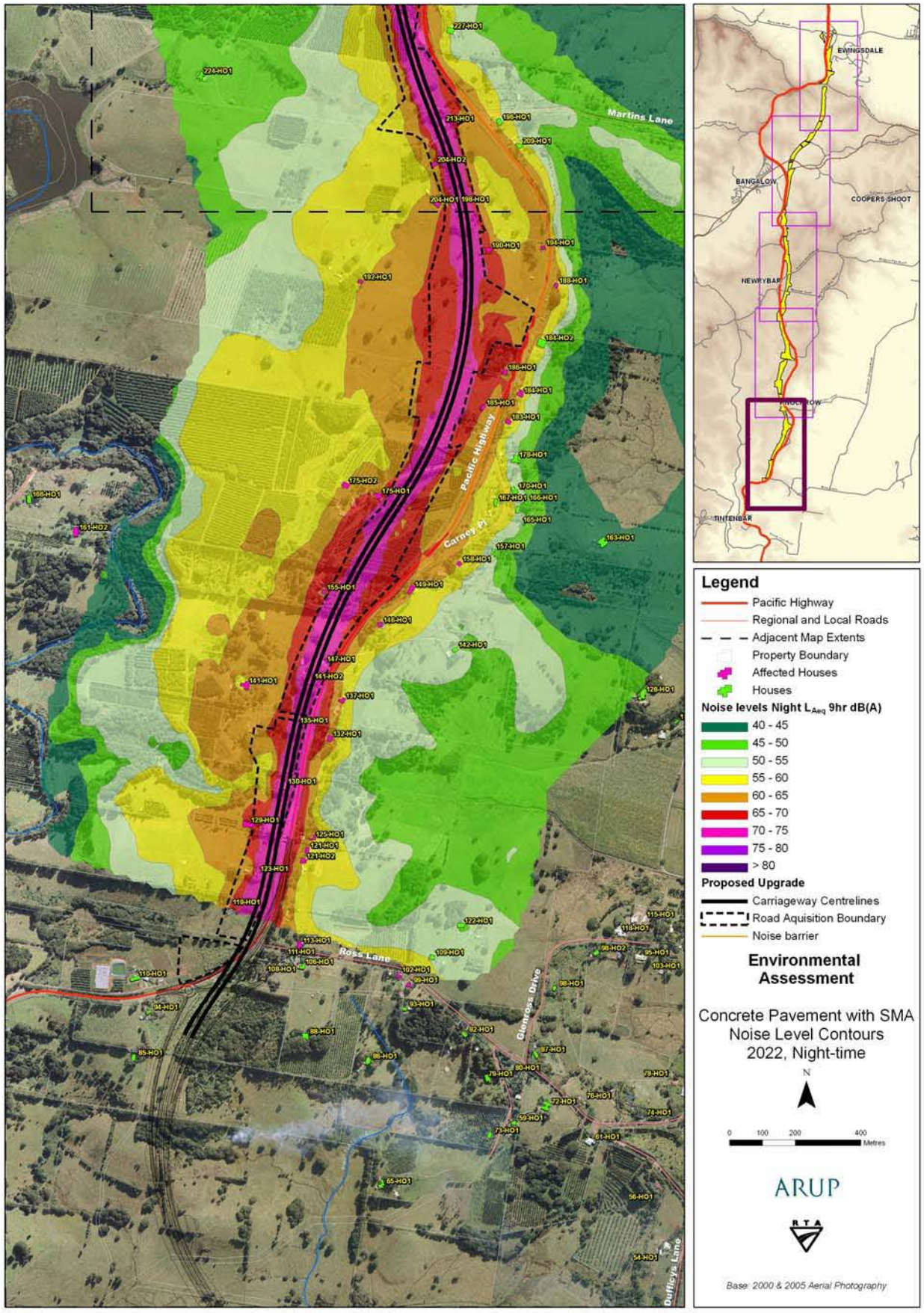


Figure E37-H2 Noise level contours, proposed upgrade 2022 mitigated with SMA, Night-time,dB$L_{Aeq,9hr}$.

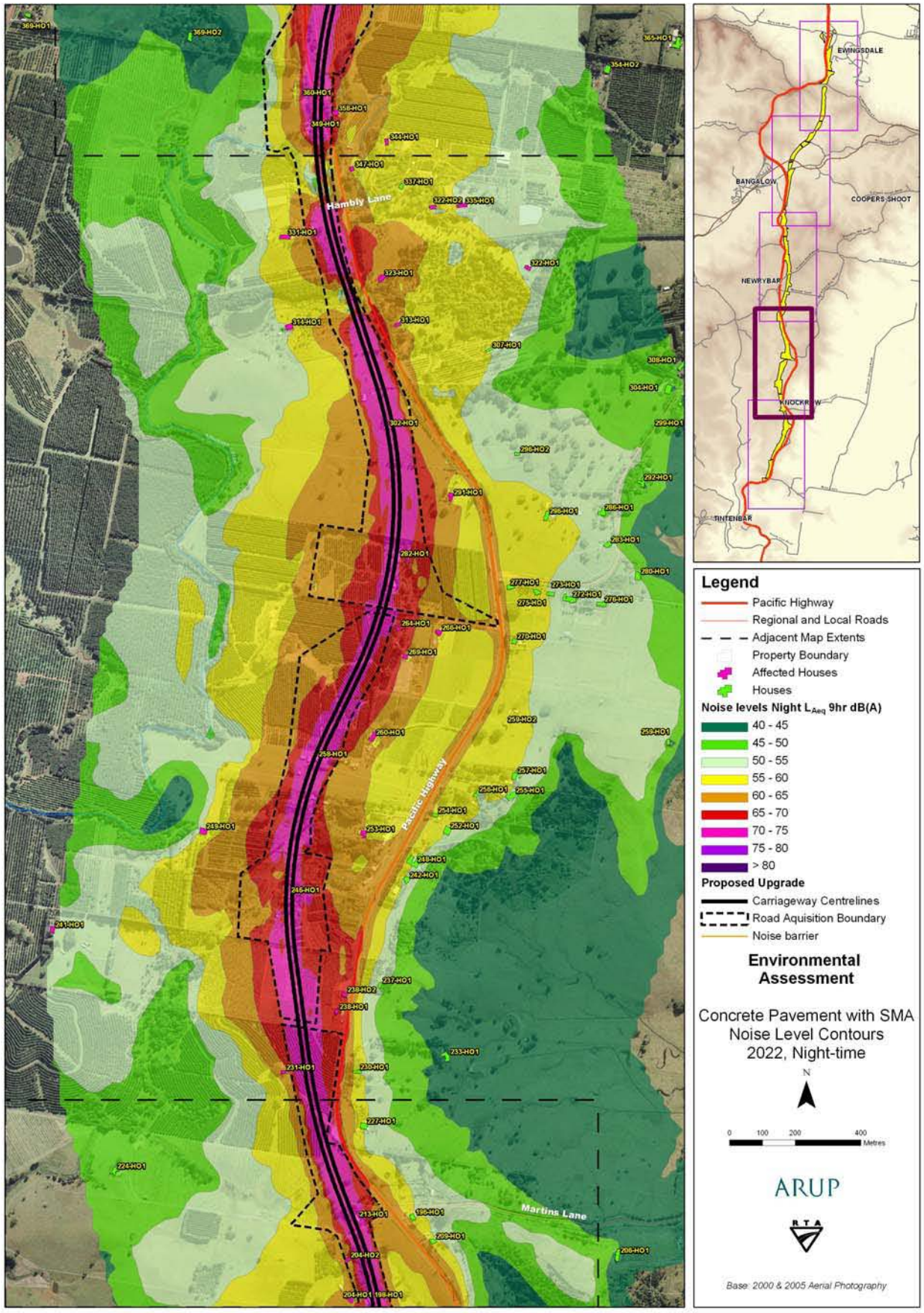


Figure E38-H3 Noise level contours, proposed upgrade 2022 mitigated with SMA, Night-time,dB$L_{Aeq,9hr}$.

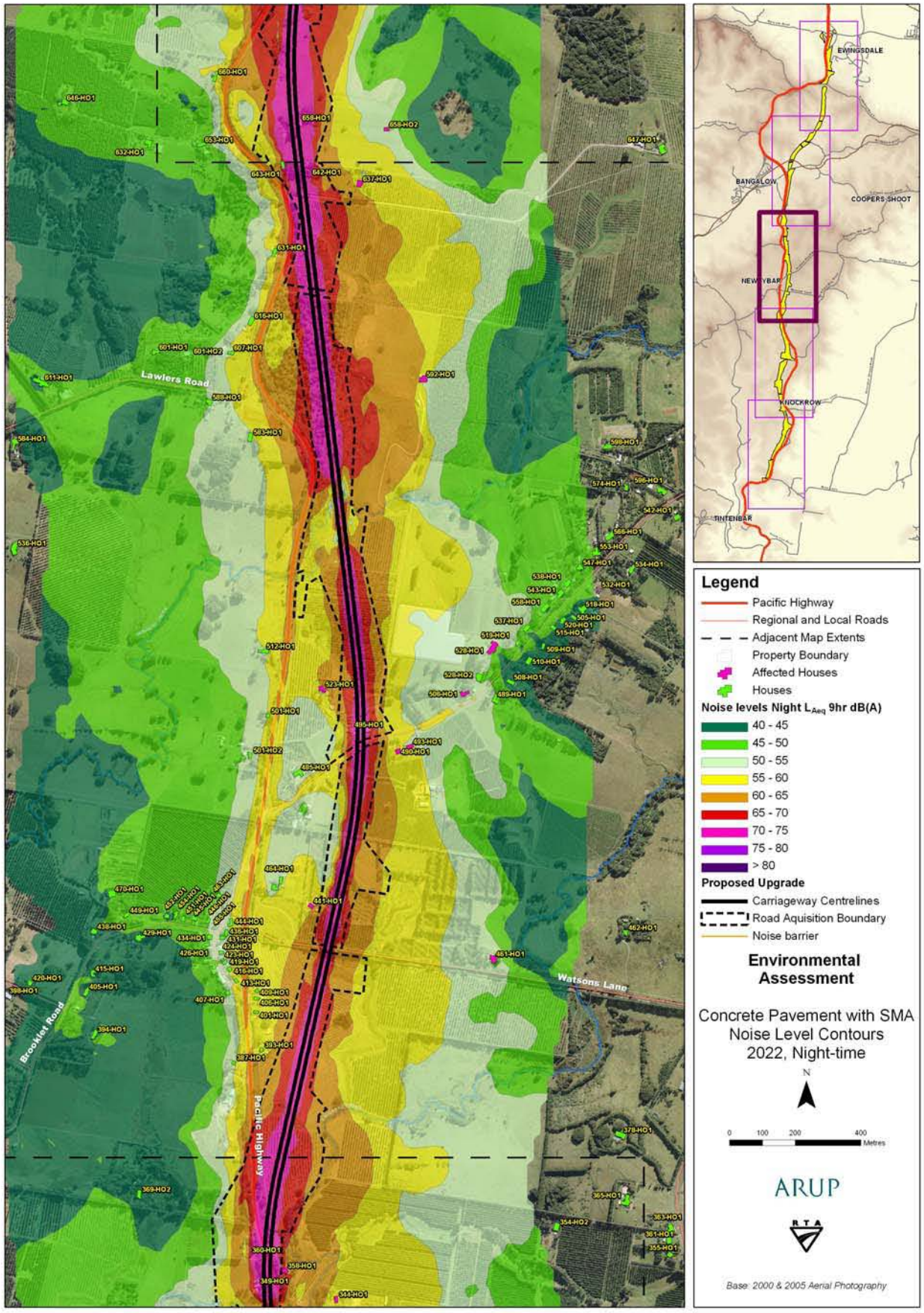


Figure E39-H4 Noise level contours, proposed upgrade 2022 mitigated with SMA, Night-time,dB$L_{Aeq,9hr}$.

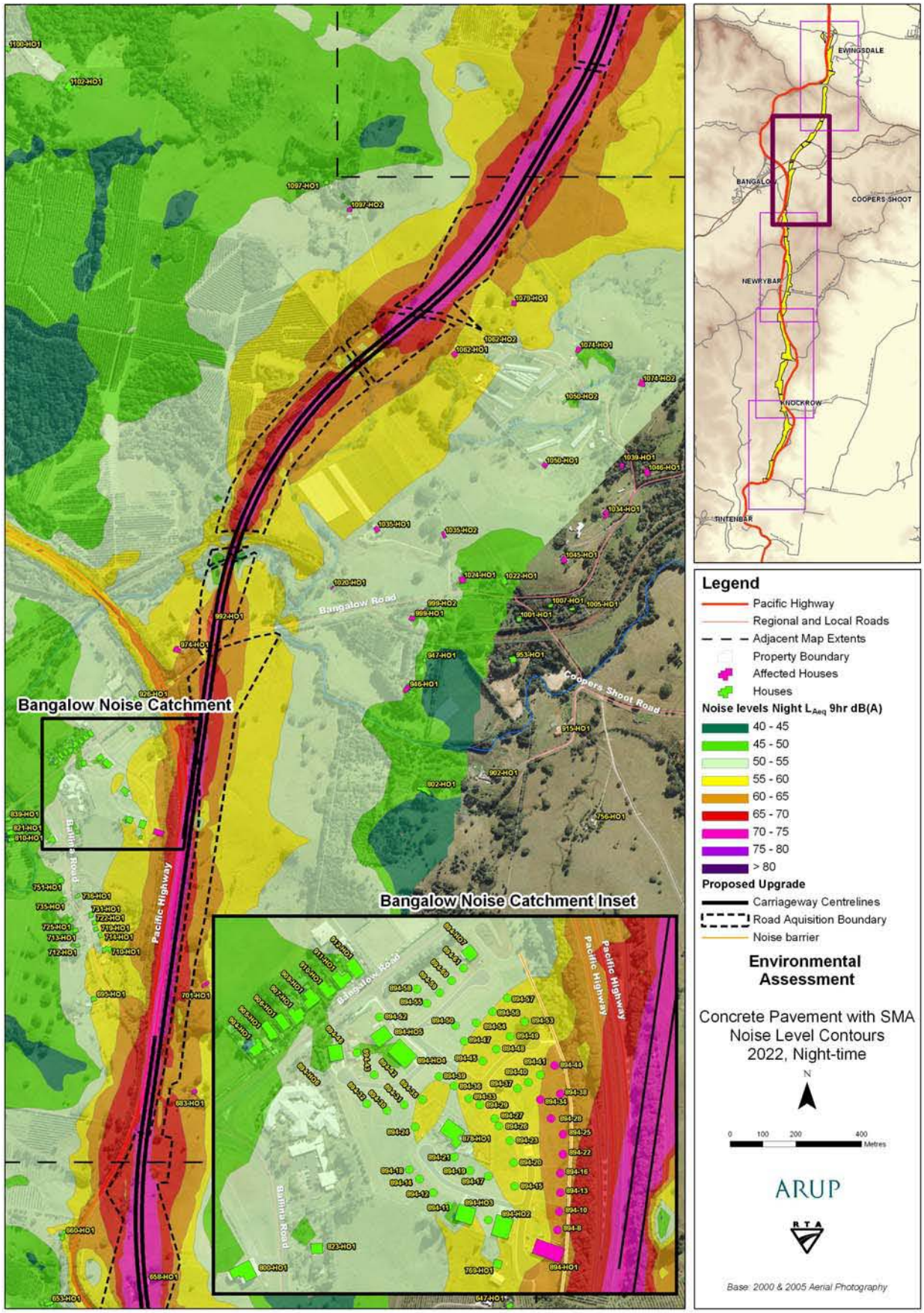
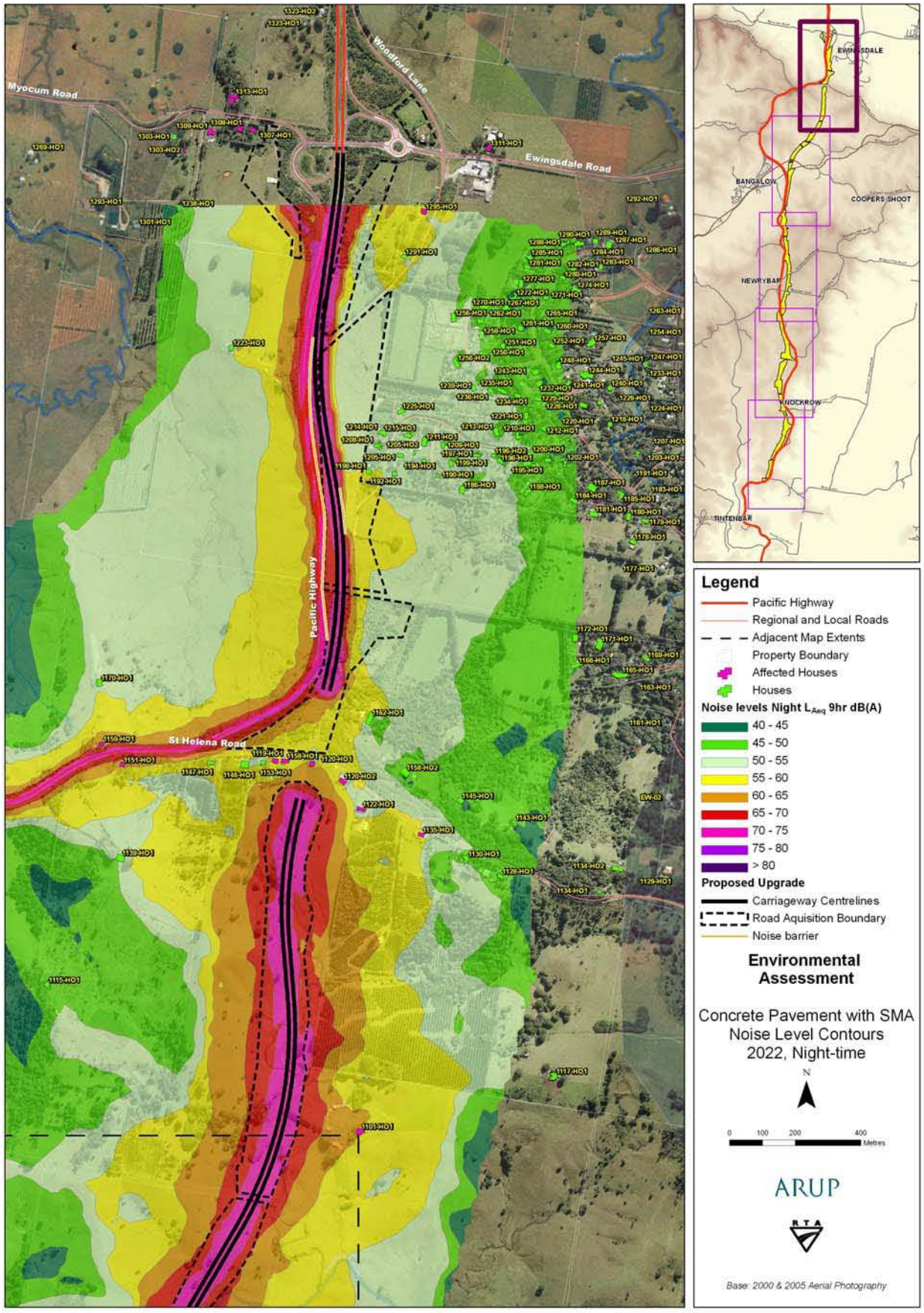


Figure E40-H5 Noise level contours, proposed upgrade 2022 mitigated with SMA, Night-time,dB$L_{Aeq,9hr}$.



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Appendix F

Barrier Designs

Figure F1 Possible noise barrier for Clover Hill Area.

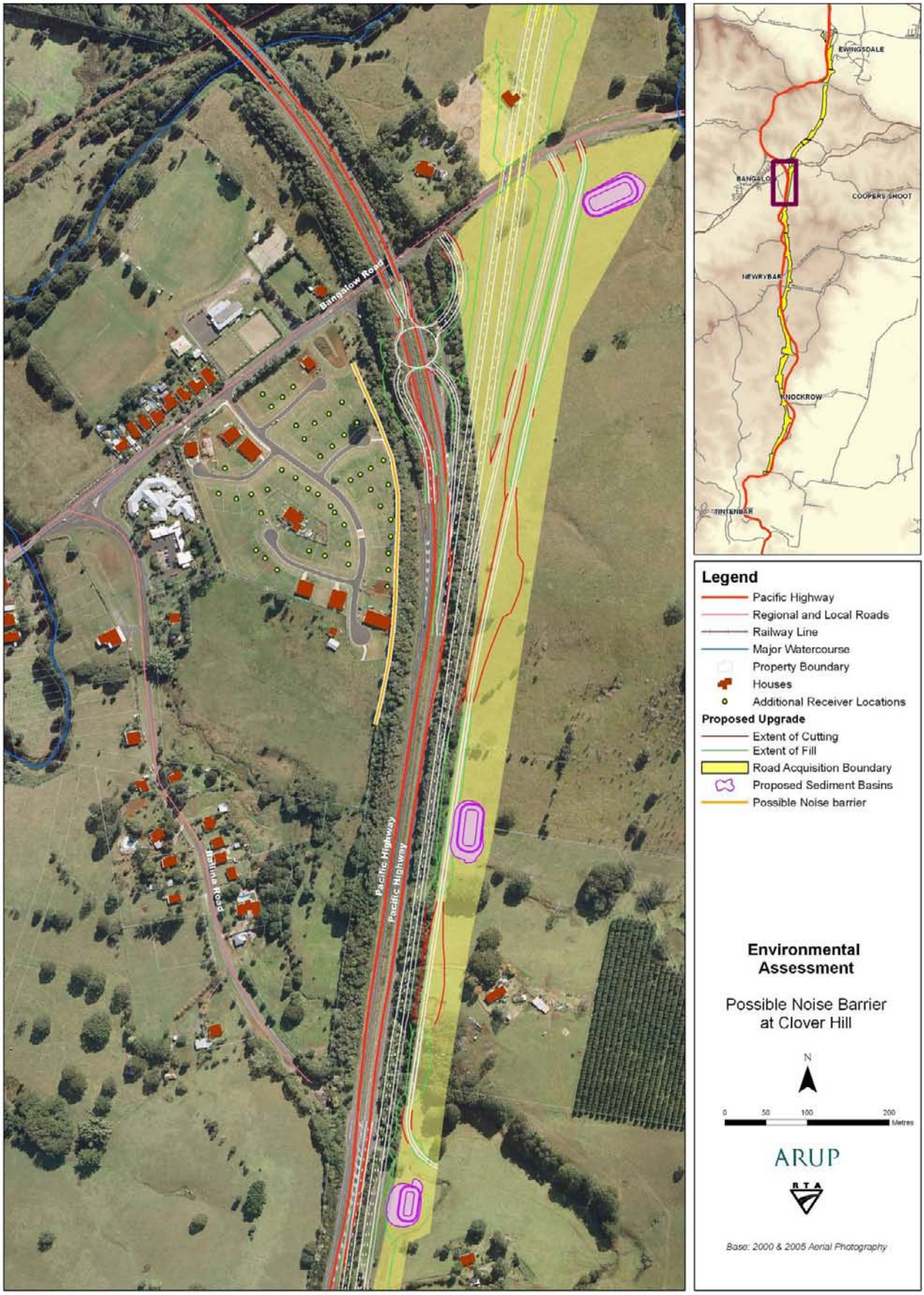
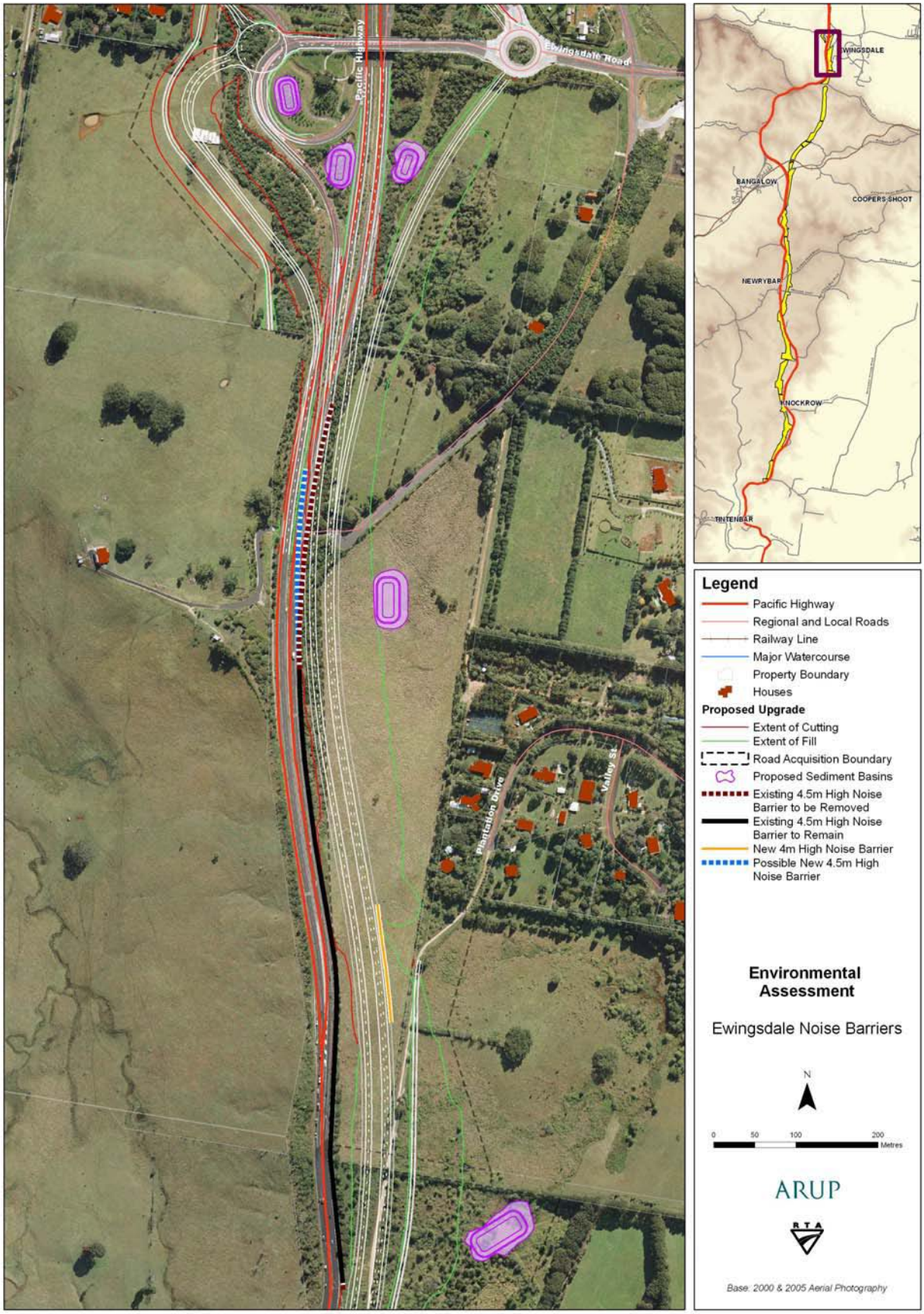


Figure F2 Noise barrier scenarios for Ewingsdale Area.



Arup**Acoustics**

Appendix G

Properties proposed for Architectural Treatment and Location of Low Noise Pavement

Figure G1 Properties proposed for architectural treatment (mitigated case) and location of low-noise pavement.

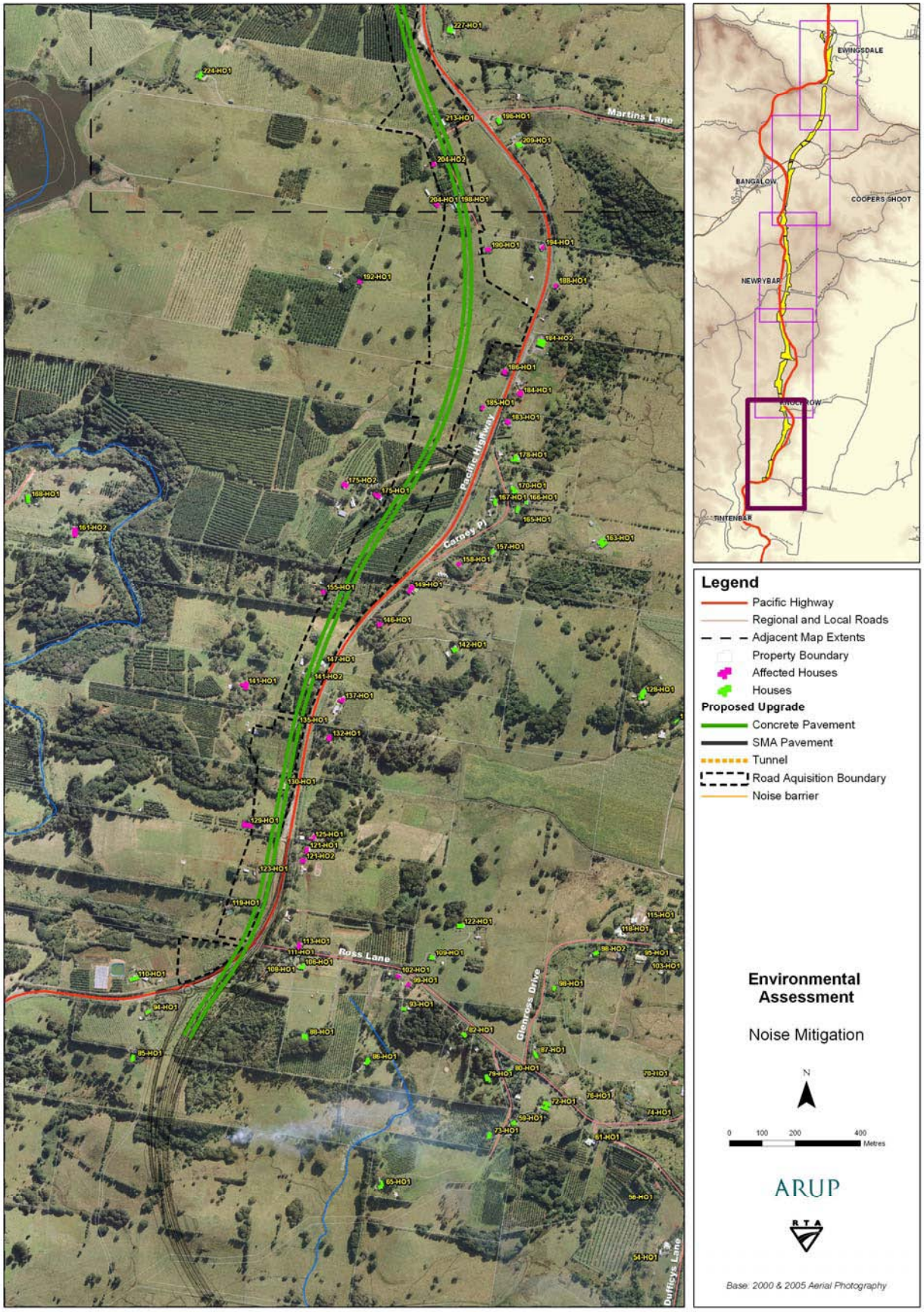


Figure G2 Properties proposed for architectural treatment (mitigated case) and location of low-noise pavement.

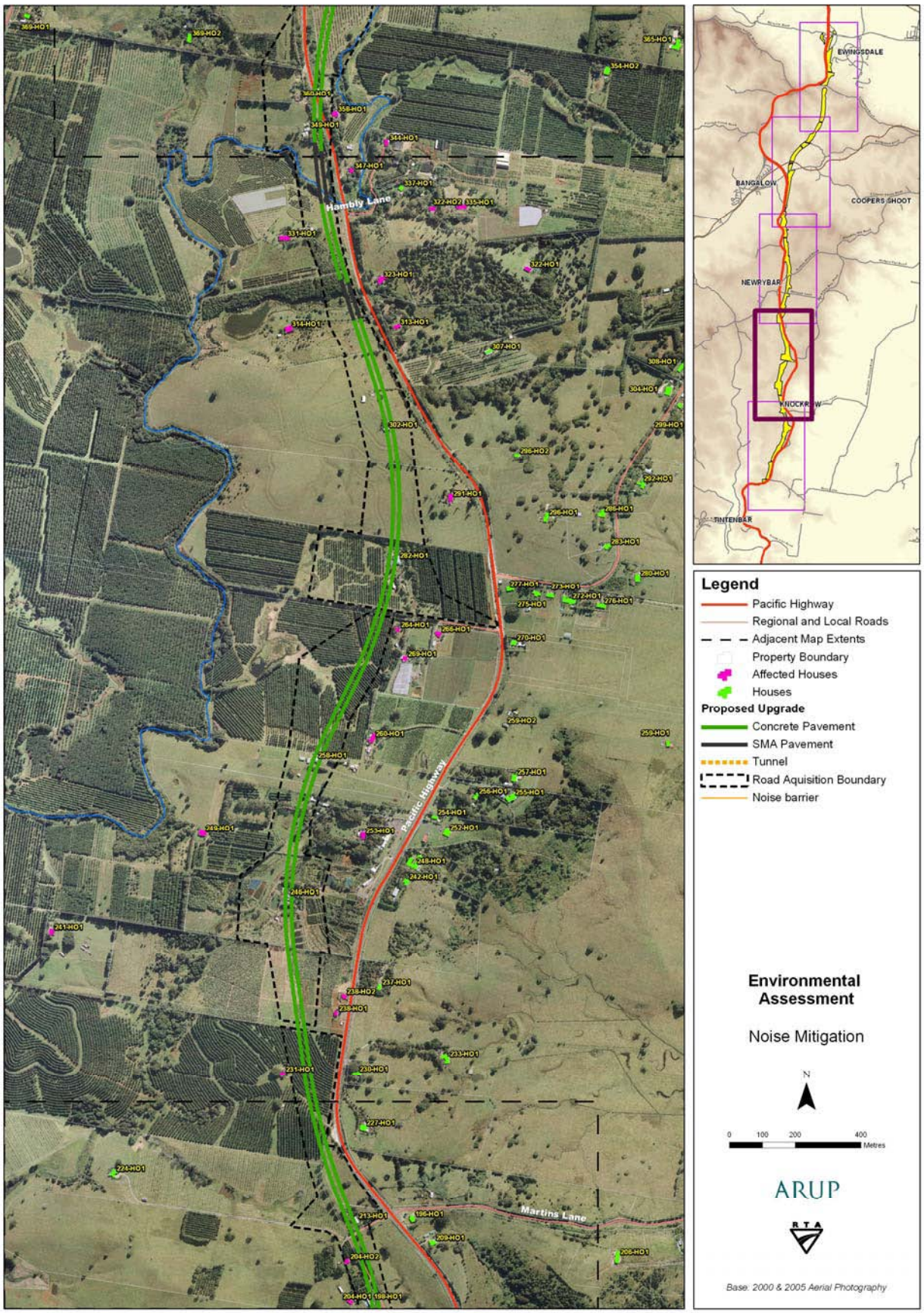


Figure G3 Properties proposed for architectural treatment (mitigated case) and location of low-noise pavement.

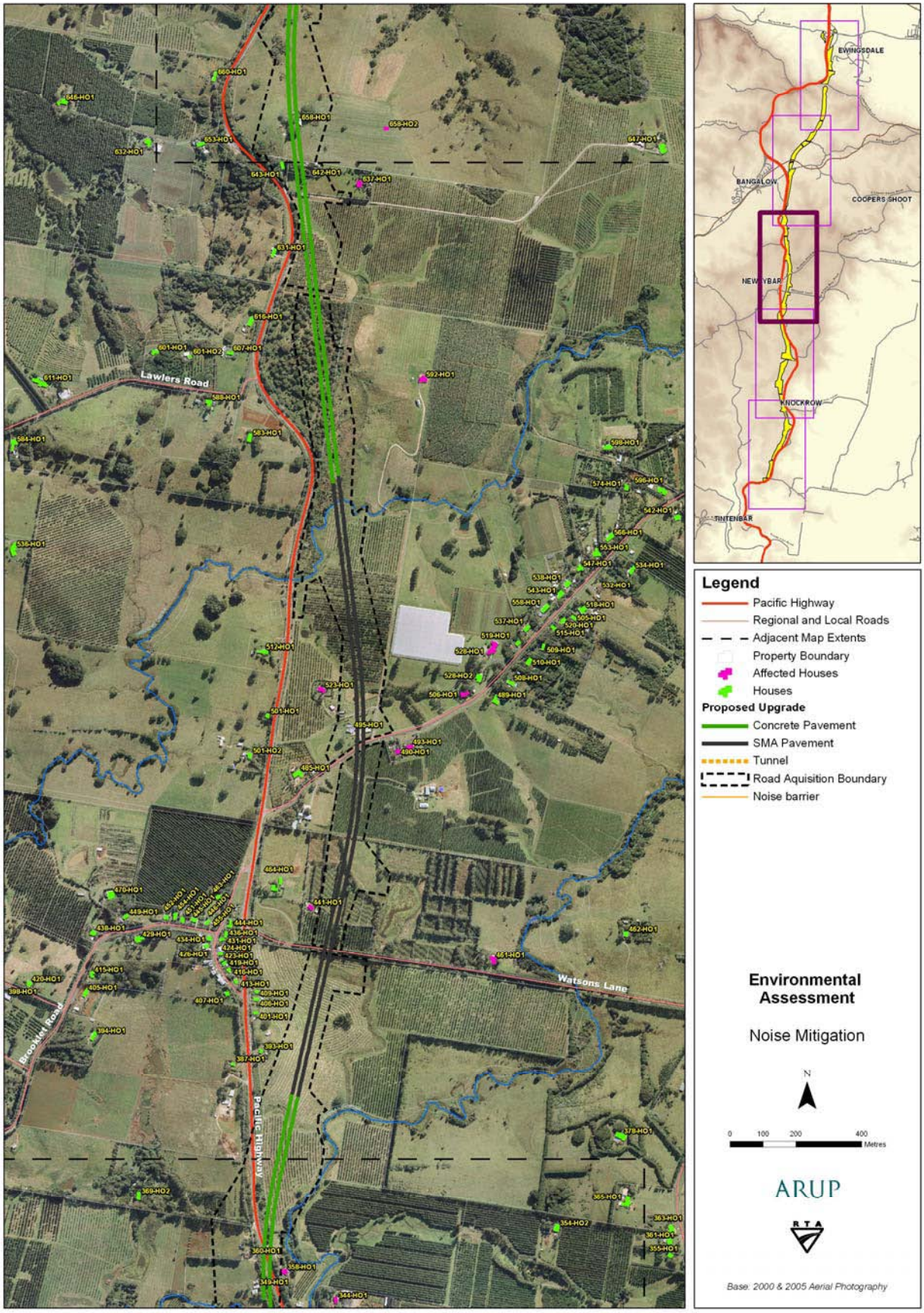


Figure G4 Properties proposed for architectural treatment (mitigated case) and location of low-noise pavement.

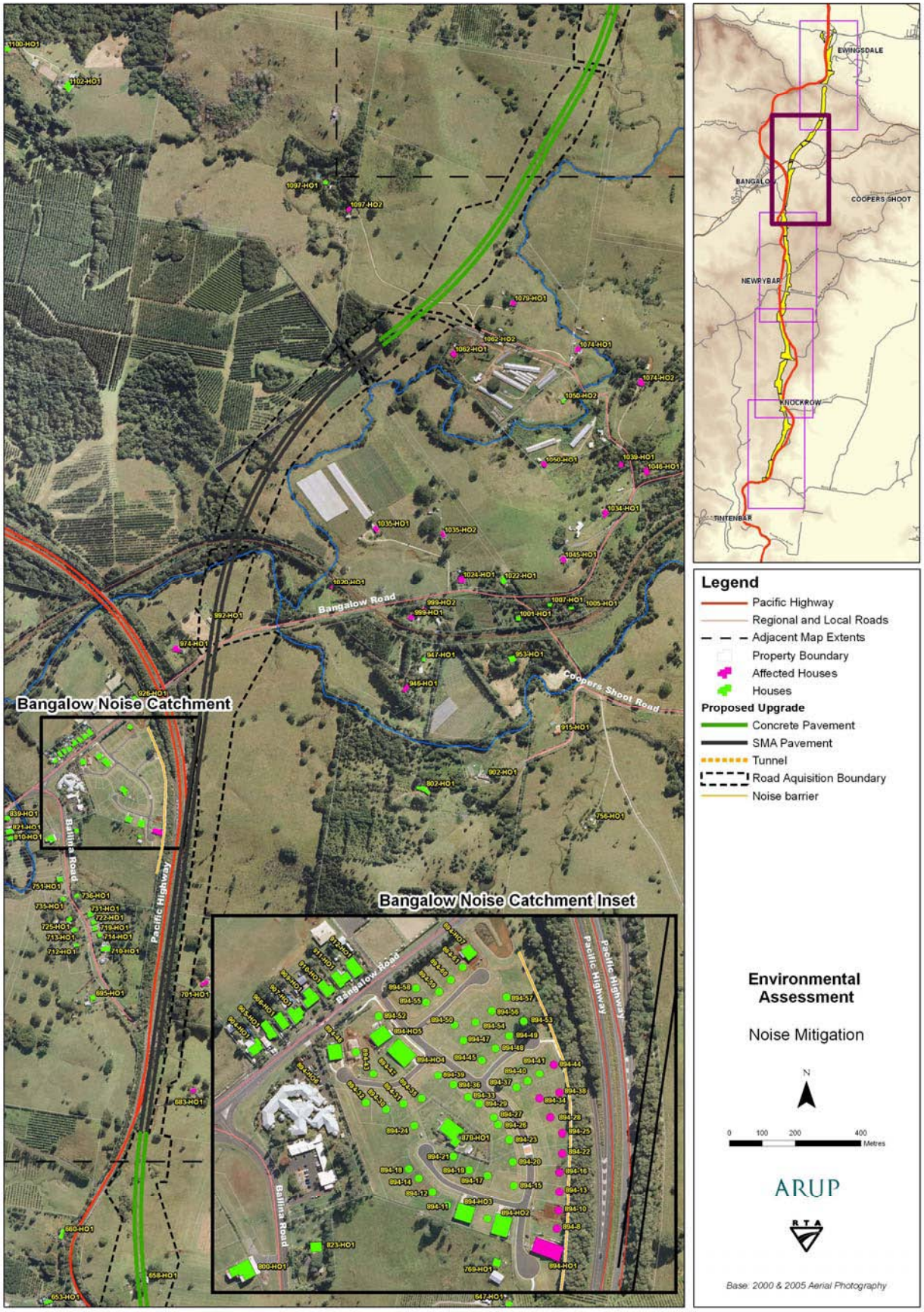


Figure G5 Properties proposed for architectural treatment (mitigated case) and location of low-noise pavement.