



CLIENTS | PEOPLE | PERFORMANCE

Hillview Heights Estates

Report on Qualitative Traffic Noise Intrusion Assessment

Moonee Waters Concept Plan

November 2007



Contents

Glossary – Acoustics	i
Executive Summary	ii
1. Introduction	1
1.1 Site Description	1
1.2 Objectives	3
1.3 Scope of Works	3
1.4 Assessment Methodology	3
1.5 Limitations	3
2. Existing Environment	5
2.1 Monitoring Locations	5
2.2 Noise Monitoring Results	7
3. Noise Criteria	8
3.1 Operational Industrial Noise Criteria	8
3.2 Road Traffic Noise Criteria	8
3.3 Development Affected by Road Traffic Noise	8
3.4 Land Use Development with Potential to Create Additional Traffic	9
3.5 Internal Noise Levels	10
3.6 Sleep Disturbance	11
4. Recommended Mitigation Measures	13
4.1 Noise Mitigation Measures	13
5. Conclusion	15
6. References	16
6.1 Acoustics	16

Table Index

Table 2-1 – Continuous Noise Logger Details	6
Table 2-2 Noise Monitoring Results – Background RBL L _{A90} Noise Levels	7



Table 2-3 – Noise Monitoring Results – Traffic Noise	
Descriptors	7
Table 3-1 Criteria for New Residential Development Affected by Freeway / Arterial Traffic Noise	9
Table 3-2 Criteria for New Residential Development with Potential to Affect Existing Freeways/Arterials	9
Table 3-3 Internal criteria for New Residential Development Affected by Freeway / Arterial Traffic Noise	10
Table 3-4 Extract of ‘Table 1 – Recommended Design Sound Levels for different areas of occupancy in buildings,’ AS/NZS 2107-2000	11
Table 3-5 Sleep Disturbance Criteria – Intermittent and Continuous Night Time Road Traffic, dB(A)	12

Figure Index

Figure 1-1 – Moonee Waters Concept Plan proposed site layout [Source: Annard Alcock Urban Design]	2
Figure 2-1 – Aerial figure of existing site location and previous long-term unattended monitoring locations [Source: NSW Department of Lands, Spatial information Exchange, http://imagery.maps.nsw.gov.au].	6



Glossary – Acoustics

dB	Decibel, which is 10 times the logarithm (base 10) of the ratio of a given sound pressure to a reference pressure; used as a unit of sound.
dB(A)	Unit used to measure 'A-weighted' sound pressure levels.
L_{A10} (Time)	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{A10} (1 hour)	The L_{10} level measured over a 1-hour period.
L_{A10} (18 hour)	The arithmetic average of the L_{10} levels for the 18-hour period between 0600 and 2400 hours on a normal working day. It is a common traffic noise descriptor.
L_{Aeq} (Time)	Equivalent sound pressure level: the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring.
L_{Aeq} (15 hr)	The L_{Aeq} noise level for the period 7 am to 10 pm.
L_{Aeq} (9 hr)	The L_{Aeq} noise level for the period 10 pm to 7 am.
L_{Aeq} (1 hr)	The L_{Aeq} noise level for a one-hour period. In the context of the NSW EPA Environmental Criteria for Road Traffic Noise, it represents the highest tenth percentile hourly A-weighted L_{eq} during the period 7 am to 10 pm, or 10 pm to 7 am, (whichever is relevant). If this cannot be defined accurately, use the highest A-weighted L_{eq} noise level.
L_{A90} (Time)	The A-weighted sound pressure level that is exceeded for 90% of the time over which a given sound is measured. This is considered to represent the background noise e.g. L_{A90} (15 min)
L_{A10} (Time)	The A-weighted sound pressure level that is exceeded for 10% of the time over which a given sound is measured.
Rating Background Level (RBL)	<p>The overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period (as opposed to over each 24 hour period used for the assessment background level). This is the level used for assessment purposes. It is defined as the median value of:</p> <p>All the day assessment background levels over the monitoring period for the day;</p> <p>All the evening assessment background levels over the monitoring period for the evening; or</p> <p>All the night assessment background levels over the monitoring period for the night.</p>
Tonality	Noise containing prominent a prominent frequency or frequencies characterised by definite pitch.



Executive Summary

GHD was commissioned by Hillview Heights Estates Pty Ltd to undertake a qualitative desktop assessment of potential road traffic noise intrusion from the Pacific Highway on the proposed Residential Subdivision land situated at Lot 66 DP 551005 Pacific Highway, Moonee Beach, NSW. The qualitative assessment of the Lot 66 land area was undertaken as part of the process of lodging part 3A Submission for Moonee Waters.

The qualitative assessment was conducted based on the findings of the previously undertaken noise monitoring adjacent to the Pacific Highway between the 11th and 18th November 2004. Monitoring was undertaken at two properties along the Pacific Highway approximately 700m and 1.2km to the south of the proposed development site southern boundary. Based on these indicative results, it was found that:

- ▶ Traffic noise is likely to be a feature of the ambient environment in the area; and
- ▶ Current traffic noise levels may potentially exceed the Environmental Criteria for Road Traffic Noise (ECRTN) criteria at the nearest proposed building footprint for a new residential development affected by freeway / arterial road traffic noise.

There will likely be increased noise effects resulting from assumed future traffic growth along the Pacific Highway and future building footprints are proposed to be situated nearer to the roadway than the location of previous monitoring. It may therefore be expected that both the ECRTN external and internal residential criteria may potentially be exceeded.

As the ECRTN goals are expected to be exceeded in this case, for new residential development with dwellings situated adjacent to the Pacific Highway, GHD suggest that to meet the criteria, all feasible and reasonable noise control options should be investigated.

GHD recommend that a detailed acoustic model be created for the site to establish which buildings are likely to exceed the noise goals and to determine appropriate noise control design measures. Taking into consideration the detailed design stage of the project, design measures would include:

- ▶ Potential noise barrier configurations; and
- ▶ Architectural design treatments for buildings within areas of equal noise impact zones.

As part of the detailed design stage of the proposed development GHD recommend:

- ▶ Detailed monitoring of the night time traffic flow characteristics and maximum noise level in line with the Environmental Noise Management Manual (ENMM) requirements to attain accurate data to be able to model the potential for sleep arousal at future residential premises; and
- ▶ A detailed investigation be conducted during the site detailed design phase as to whether acoustic barriers are potentially required along the proposed on-site roadways to protect the amenity of proposed dwellings.

Due to the close proximity of adjacent approved developments and existing residential receivers, GHD recommend that a site specific Construction Noise and Vibration Management Plan be undertaken prior to construction activities commencing.



1. Introduction

GHD was commissioned by Hillview Heights Estates Pty Ltd to undertake a qualitative desktop assessment of potential road traffic noise intrusion from the Pacific Highway on the proposed Residential Subdivision land situated at Lot 66 DP 551005 Pacific Highway, Moonee Beach, NSW.

This report utilises previous traffic noise monitoring data undertaken between the 11th and 18th November 2004. Monitoring was undertaken at two properties along the Pacific Highway approximately 700m and 1.2km to the south of the proposed development site southern boundary.

The location of the previous investigations subject sites and the proposed development site is approximately 9 km north of Coffs Harbour and is situated adjacent to Moonee and Sapphire Beaches east of the Pacific Highway, Coffs Harbour, NSW.

This report was prepared with consideration to the following documents:

- NSW Department of Environment & Climate Change (DECC) Environmental Criteria for Road Traffic Noise (ECRTN);
- NSW DECC Industrial Noise Policy (INP);
- NSW DECC Environmental Noise Control Manual (ENCM); and
- Road & Transport Authority (RTA) Environmental Noise Management Manual.

1.1 Site Description

GHD understand that the Concept Plan proposes two small villages of diverse residential development on higher lands where the biodiversity values are lowest.

GHD understand that the Concept Plan proposes in the order of 300 dwellings in two small villages (identified as Lots 2 and 3), occupying approximately 25% of the site [and about 32% of the Residential 2(E) zoned area]. The remaining of the site is proposed as primarily “Conservation Area” to be managed under “Community Title”. The proposed layout of the site is provided in Figure 1-1, below.

GHD understand that the predicted nearest building footprint of Lot 3 is approximately offset a distance of 40m to the Pacific Highway. Lot 2 is located east of the adjacent Sapphire Beach development, which generally forms a buffer between Lot 2 and Pacific Highway.

2



1.2 Objectives

The objectives of this qualitative noise assessment were to:

- Provide a qualitative assessment on potential background noise and road traffic issues in the nearby vicinity of the site; and
- Outline in principle noise mitigation measures if the results suggest a noise exceedance against relevant guidelines may occur.

1.3 Scope of Works

The scope of works for the qualitative desktop review noise impact assessment from the adjacent Pacific Highway onto the site comprised:

- Utilise previous traffic noise monitoring data undertaken between the 11th November and the 18th November 2004 at two properties along the Pacific Highway south of the proposed development site, Pacific Highway, Coffs Harbour, NSW, to establish the indicative ambient and traffic noise levels in the vicinity of the development;
- Establishing day, evening and night time noise levels in the vicinity of the development with consideration to the noise criteria in the INP and ECRTN; and
- Preparation of a report discussing the results.

1.4 Assessment Methodology

The following steps for the qualitative noise assessment were undertaken:

- Compliance criteria for the proposed development were determined with consideration of previously undertaken unattended noise monitoring measurements;
- Ambient noise sources at the time of previously conducted unattended monitoring and potential future ambient noise sources identified and classified;
- Assessment of compliance;
- Comment on typical in-principle noise control options; and
- If the assessment results suggest a potential noise exceedance against relevant guidelines, outline in-principle acoustic design advice pertaining to possible in-principle site layout and architectural treatments.

1.5 Limitations

This report has been prepared for Hillview Heights Estates Pty Ltd. The purpose of the report was to provide an independent qualitative review of the potential road traffic noise intrusion at Lot 66 DP 551005 Pacific Highway, as part of the Part 3A Submission of the proposed Moonee Waters development, Moonee Beach, NSW.

It is not the intention of the assessment to cover every element of the acoustic environment, but rather to conduct the assessment with consideration to the prescribed work scope. The assessment did not include any in-situ testing, sampling or analysis.

The findings of the qualitative noise assessment represent the findings apparent at the date and time of the previously conducted traffic noise monitoring and the conditions of the existing noise assessment



undertaken. It is the nature of environmental assessments that all variations in environmental conditions cannot be accessed and all uncertainty concerning the conditions of the ambient noise, vibration environment cannot be eliminated. Professional judgement must be exercised in the investigation and interpretation of observations.

In conducting this assessment and preparing the report, current guidelines for noise were referred to. This work has been conducted in good faith with GHD's understanding of the client's brief and the generally accepted consulting practice.

No other warranty, expressed or implied, is made as to the information and professional advice included in this report. It is not intended for other parties or other uses.



2. Existing Environment

2.1 Monitoring Locations

Two *Acoustic Research Laboratories (ARL) Pty Ltd* Type 1 continuous environmental noise loggers, within current calibration, were used to monitor the noise environment at the locations detailed in Table 2-1 and shown graphically in Figure 2-1.

GHD understand that the previous monitoring locations, Location 1 and Location 2 were situated approximately 700m and 1.2km south, respectively, along the Pacific Highway from the southern boundary of the proposed development site.

GHD understand that the topographical conditions are similar in nature and that the Highway speed limit of 100 km/hr is the same past both the previous monitoring locations and the proposed development site. No correlation of received traffic noise levels between the sites has been undertaken for this qualitative assessment.

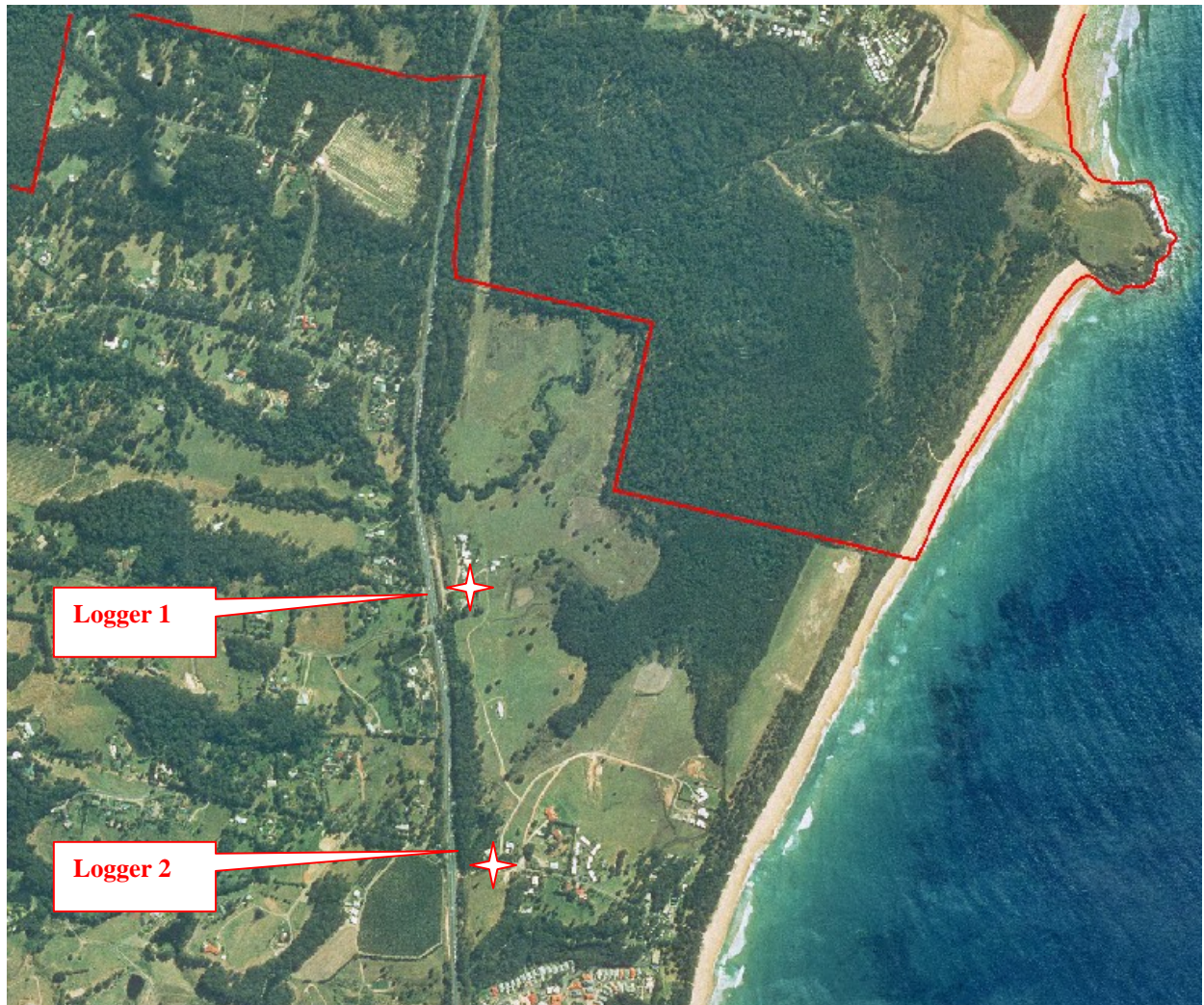


Figure 2-1 – Aerial figure of existing site location and previous long-term unattended monitoring locations [Source: *NSW Department of Lands, Spatial information Exchange*, <http://imagery.maps.nsw.gov.au>].

Table 2-1 – Continuous Noise Logger Details

Measurement Title	Logger 1	Logger 2
Monitoring Location	Cameron Property, representative of road traffic noise ingress into the site, approximately 130m separation distance between the logging location and the Pacific Highway to the west.	Brooks Property, approximately 75 metres east of the Pacific Highway.
Logger Serial No.	194603	194561
Measurement period started at	19:00 on 11 th November 2004	19:00 on 11 th November 2004



Measurement Title	Logger 1	Logger 2
Measurement period ceased at	10:00, 18 th November 2004	10:00, 18 th November 2004
Frequency Weighting	A	A
Time Response	Fast	Fast
Engineering Units	dB(A) SPL re:20µPa	dB(A) SPL re:20µPa

2.2 Noise Monitoring Results

Extraneous noise data where anomalous ‘peaks’ or ‘spikes’ were recorded which were not considered to be associated with the ambient background noise, were removed from the data sets.

As per the INP, data was also excluded from the analysis set where wind data in excess of 5m/s was recorded during the monitoring period.

A summary of calculated background $L_{A90(\text{period})}$ day, evening, and night for the monitoring period is provided in Table 2-2. A summary of calculated traffic noise descriptors $L_{Aeq(15hr)}$, $L_{Aeq(9hr)}$, and $L_{A10(18hr)}$ for the monitoring period is provided in Table 2-3¹.

Long term noise monitoring and attended field observations indicated that the noise environment at the logging locations was primarily described by traffic noise emanating from the Pacific Highway.

Table 2-2 Noise Monitoring Results – Background RBL L_{A90} Noise Levels

Monitoring	Day 7 am to 6 pm (RBL)	Evening 6 pm to 10 pm (RBL)	Night 10 pm to 7 am (RBL)
Logger 1	46	47	45
Logger 2	49	47	41

Table 2-3 – Noise Monitoring Results – Traffic Noise Descriptors

Monitoring location	$L_{Aeq(15hr)}$ 7:00 am to 10:00 pm [Average dB(A)]	$L_{Aeq(9hr)}$ 10:00 pm to 7:00 am [Average dB(A)]	$L_{A10(18hr)}$ 6:00 am to 12:00 pm [Average dB(A)]	Highest Hourly $L_{Aeq(1\text{ hour})}$ (10 pm to 7 am)
Logger 1	56	54	58	60
Logger 2	60	56	62	61

¹ Refer to Glossary page for definition of these parameters



3. Noise Criteria

3.1 Operational Industrial Noise Criteria

This section discusses noise criteria relating to the potential impact from future possible developments on residential adjacent land.

Discussion with an Environmental Noise Compliance Officer of Coffs Harbour City Council confirmed that Council refers to current DECC guidelines such as the INP.

The INP provides guidance on the assessment of operational noise impacts. The guidelines include both Intrusive and Amenity criteria that are designed to protect receivers from noise significantly louder than the background level and to limit the total noise level from all sources near a receiver.

Intrusive noise limits set by the INP control the relative audibility of operational noise compared to the background level. Amenity criteria limit the total level of extraneous noise. Both sets of criteria are calculated and the lowest of the two in each time period normally apply.

Attended observations noted that existing levels of industrial noise in the area are not a significant contributor to the existing ambient noise level in the vicinity of the development therefore no Table 2.2 adjustments are necessary for the amenity noise criteria.

GHD understand that existing levels of industrial noise in the area are not a significant contributor to the existing ambient noise level in the vicinity of the development. Future proposed adjoining developments may result, however, in industrial noise elements such as mechanical plant items.

Due to the proximity of the Pacific Highway, criteria requiring application of the high traffic noise criterion in areas exposed to dominant traffic noise may be met at the nearest proposed building façades nearest the Pacific Highway and would need addressing in the derivation of site criteria.

Industrial noise intrusion for potentially affected areas should be assessed at later date if required, in order to maintain the acoustic amenity in the vicinity of the site.

3.2 Road Traffic Noise Criteria

All changes in traffic flows on public roads must be assessed with consideration to the Environmental Criteria for Road Traffic Noise (ECRTN).

3.3 Development Affected by Road Traffic Noise

The ECRTN contains "base" target criteria for different types of development at sensitive receptors. For a new residential development affected by traffic noise, the ECRTN sets noise criteria based on the functional category of the road. The framework embodies a non-mandatory performance-based approach where the criteria are applied as targets.

For the purposes of this assessment the Pacific Highway is considered to be a freeway / arterial road² as it handles through traffic with characteristically heavy and continuous traffic flows during peak periods.

The "base" target road traffic noise criteria for a new residential development affected by sub-arterial traffic noise is shown in Table 3-1, as per Category 2 of Table 1 of the ECRTN.

² As per the ECRTN classification of Freeway/Arterial roadways, that '...carry predominantly through-traffic from one region to another, forming principal avenues of communication for urban traffic movements.'



Table 3-1 Criteria for New Residential Development Affected by Freeway / Arterial Traffic Noise

Type of Development	Criteria		
	Day (7am–10pm)	Night (10pm–7am)	Where Criteria are Already Exceeded
New residential developments affected by sub-arterial traffic noise	L _{Aeq} (15hr) 55 dB(A)	L _{Aeq} (9hr) 50 dB(A)	Where feasible and reasonable, existing noise levels should be reduced to meet the noise criteria via judicious design and construction of the development. Locations, internal layouts, building materials and construction should be chosen so as to minimise noise impacts.

3.4 Land Use Development with Potential to Create Additional Traffic

The proposed residential development additionally has the potential to increase traffic on the Pacific Highway. The specific project falls under the ECRTN development type of:

“Land use development with the potential to create additional traffic on existing freeways and/or arterials.”

Table 3-2 lists the “base” target road traffic noise criteria for the Pacific Highway, as per Category 7 of Table 1. of the ECRTN.

Table 3-2 Criteria for New Residential Development with Potential to Affect Existing Freeways/Arterials

Type of Development	Criteria		
	Day (7am–10pm)	Night (10pm–7am)	Where Criteria are Already Exceeded
Land use developments with potential to create additional traffic on existing freeways / arterials	L _{Aeq} (15hr) 60 dB(A)	L _{Aeq} (9hr) 55 dB(A)	Where feasible and reasonable, existing noise levels should be reduced to meet the noise criteria. Possible applicable strategies include appropriate location of private access roads; regulating times of use; using clustering; using ‘quiet’ vehicles; and using barriers and acoustic treatments.

Additionally where the existing criteria has already been exceeded the ECRTN recommends that, *“...In all cases, traffic arising from the development should not lead to an increase in existing noise levels by more than 2 dB.”*

Furthermore, *“...where strategic and project-specific mitigation measures have been shown not to be feasible and reasonable, then a 0.5 dB (for new roads) or a 2 dB (for redeveloped roads and land use developments with potential to create additional traffic) increase in existing noise levels is allowed.”³*

³ Section 3.3 *Individual road projects* of the NSW DECC's Environmental Criteria for Road Traffic Noise (ECRTN).



In this case, the expected volume of traffic from the site compared to Pacific Highway volumes, will likely have minimal affect upon the emitted Pacific Highway road traffic noise. The limiting road traffic noise criteria in this case is that shown in Table 3-1, where likely noise impacts should be reduced to meet the noise criteria via judicious design and construction of the development. Recommended mitigation measures are outlined in Section 4 of this report.

3.5 Internal Noise Levels

Guidance regarding internal noise levels are presented within Section 2 of the ECRTN. The DEC prefers internal noise level criteria to be set by the relevant planning or building authority, with levels depending on the type of development the planning authority wants to encourage within certain areas.

In the absence of specific local codes, the ECRTN recommends internal levels of 35–40 dB(A) at night for Sleeping areas, being the most sensitive area to noise impact.

Guidance for other living areas is that internal noise levels 10 dB below external levels are recommended on the basis of openable windows opened sufficiently to provide adequate ventilation, typically equating to a minimum of 20% of the window area being open.

For new residential developments affected by freeway / arterial traffic noise, the criteria is summarised in Table 3-3.

Table 3-3 Internal criteria for New Residential Development Affected by Freeway / Arterial Traffic Noise

Type of Development	Internal Criteria	
	Day (7am–10pm)	Night (10pm–7am)
New residential developments affected by freeway / arterial traffic noise	55 – 10 = 45dB(A)	Sleeping Areas
		Other Living areas
		35 to 40dB(A)
		50–10 = 40dB(A)

In addition to the above criteria GHD recommend that an approach be adopted for the detailed design phase of the proposed development, whereby for each specific building type/area, the recommended satisfactory indoor sound level be determined from *AS/NZS 2107:2000 Acoustics – Recommended design sound levels and reverberation times for building interiors*, with the required building component construction chosen with consideration to the traffic noise reduction of *AS 3671:1989 Acoustics – Road Traffic Noise Intrusion – Building Siting and Construction*.

An extract of AS2107 recommended design sound levels and reverberation times for residential buildings is shown in Table 3-4.



Table 3-4 Extract of 'Table 1 – Recommended Design Sound Levels for different areas of occupancy in buildings,' AS/NZS 2107-2000

Type of Occupancy/Activity	Recommended design sound level, L _{Aeq} , dB(A)		Recommended reverberation time (T), sec
	Satisfactory	Maximum	
7. Residential Buildings			
Dining Rooms	40	45	< 1.0
Enclosed carparks	55	65	-
Foyers and recreation areas	45	50	*
Kitchen, laundry and maintenance areas	45	55	-
Sleeping Areas –			
- Hotels and Motels near minor roads	30	35	-
- Hotels and Motels near major roads	35	40	-
Washrooms and toilets	45	55	-

Note: * Reverberation time should be minimized as far as practicable for noise control.

+ With reference to AS2107, Appendix A, Figure 1A mean reverberation times for selected spaces.

3.6 Sleep Disturbance

3.6.1 Sleep Disturbance Criteria - General

The NSW DECC publication ENCM⁴, Chapter 19 provides consideration for sleep arousal levels. It states that noise control should be applied with the general intent to protect people from sleep arousal. The DECC's *Noise Guide for Local Government* provides further clarification on sleep disturbance.

The purpose of sleep arousal guidelines is to address short high-level noise likely to cause awakening during night time period 10 pm to 7 am and 8 am on Sundays and Public Holidays. To achieve this, the L_{A1(60 seconds)} or L_{Amax} noise level of any specific noise source should not exceed the background noise level (L₉₀) by more than 15 dB(A) when measured 1 metre from outside a bedroom window.

3.6.2 Sleep Disturbance Criteria – Road Traffic Noise Related

Sleep arousal goals are not set within the ECRTN. To evaluate potential sleep disturbance where impacts may occur during the sensitive night period, the Environmental Noise Management Manual (ENMM) provides an assessment protocol based on the evaluation of the maximum noise level. Essentially, the number and degree of L_{max} noise events of individual vehicle pass-bys that exceed the L_{eq} for each hour of the night.

The maximum noise assessment is meant as a tool to help choose mitigation strategies and not as an ultimate criterion. As described in Section 3.5 of this report, the DECC prefers internal noise level criteria to be set by the relevant planning or building authority.

⁴ ENCM: The DEC's *Environmental Noise Control Manual* has been incorporated and superseded by other DEC policy documents, although still recognized as a useful source of information and planning reference document.



For *continuous* road traffic noise emission at residential receiver locations the ECRTN night period LAeq(9hr) noise criteria apply.

For *intermittent* nighttime traffic a “*maximum noise event*” resulting from vehicle pass-by applies, defined as:

$$L_{\max} - L_{\text{eq}}(1\text{hr}) \geq 15 \text{ dB(A)}$$

Based on long-term monitoring conducted at location Logger 1 indicative criteria are expressed in Table 3-5.

Table 3-5 Sleep Disturbance Criteria – Intermittent and Continuous Night Time Road Traffic, dB(A)

Receivers	Continuous Traffic	Intermittent traffic
	LAeq(9hr)	$L_{\max} \leq L_{\text{eq}}(1\text{hour}) + 15 \text{ dB(A)}$
Surrounding residential receivers	¹ 50	² 75

Note: 1. From Table 3-1, LAeq(9hr) level at existing approximately 46m Pacific Highway set-back.

2. From Table 2-3, 60 LAeq (1 hour) (10 pm to 7 am) + 15 = 75dB(A).



4. Recommended Mitigation Measures

4.1 Noise Mitigation Measures

As the ECRTN goals are expected to be exceeded at the proposed new residential development situated adjacent to the Pacific Highway, GHD suggest that all feasible⁵ and reasonable⁶ noise control options should be investigated.

4.1.1 External Noise Mitigation

Site layout and orientation of building structures can be effective in reducing noise levels. Items such as masonry walls, fences, mounds and vegetation (mainly benefiting aesthetics and visual intrusion) are effective at reducing noise at the receiver.

GHD generally recommends the avoidance of co-location of incompatible land uses by judicious land use and project planning leading to prevention of the occurrence of potential noise problems.

Measures can be applied such as the spatial separation between noisy activities and noise-sensitive areas, with intervening areas such as access roads, car parks, dams, nature reserves, commercial areas, maintenance areas, grounds supplies and nurseries between residences and the noise source.

Distance attenuation is also an effective mitigation measure. When road traffic noise is considered as a line source, every doubling of distance equates to a reduction in sound pressure level of 3 dB. Setbacks aid in reducing the extent of other noise mitigation required as well.

Site layout and orientation of the building structures can significantly mitigate intrusive noise levels and shield outdoor living areas such as courtyards and barbecue areas. Through appropriate site planning such as placing the proposed residential structures to utilise the structures themselves to act as noise barriers between the noise source and exterior living areas, potential outdoor noise impacts can be substantially reduced.

A Cadna-A 3D noise model created during a quantitative assessment can be utilised in the detailed design phase to optimise the site layout and noise control design options to mitigate emitted site noise. Assessing measures such as staged development, site layout, density of material, height and array of buildings, and potential shielding effects etc.

Noise barriers can be constructed from earth, concrete, masonry, wood, metal, and other materials. To effectively reduce sound transmission through the barrier, the material chosen must be rigid and sufficiently dense (at least 15 - 20 kilograms/square metre). All noise barrier types are generally equally effective acoustically provided they have this density.

Noise barriers do not completely block all noise, but they can reduce overall noise levels. To effectively reduce the noise coming around its ends, a barrier should extend past the last affected residence by approximately three times the distance from the residence to the source and by not less than 50 metres where space permits. A noise barrier should also be sealed and extend down to or below the ground level.

⁵ With reference to engineering practicality.

⁶ A weighted analysis of factors such as: Costs and benefits of mitigation; Community comment; Aesthetic impacts; Existing & future noise levels at affected sensitive receivers; and, the overall benefit of the development.



For land areas adjacent the Pacific Highway site boundary, to gain the greatest barrier effect, variations in topography should aim to maximise the relative heights between the top of any acoustic barriers and the ground height of the first row of any allotments.

The first stage to mitigating noise intrusion is appropriate site planning, building design, and the use of insulation and sound absorbing materials in building construction could be utilised as outlined below for any proposed residences potentially affected by road traffic noise ingress.

Due to the area of the site, its position in relation to the Pacific Highway, and the previously undertaken noise monitoring results, it is considered that architectural treatments would also be necessary to enable compliance with the internal noise criteria.

GHD recommend that unattended noise monitoring be undertaken representative of the nearest proposed building footprint in the proposed development to quantify site specific criteria. This would be undertaken as a separate item following the completion of this desktop noise assessment, with the cost to be determined following completion this qualitative assessment.

4.1.2 Internal Noise Mitigation

Appropriate site planning, building design, and the use of insulation and sound absorbing materials in building construction could be utilised as outlined below for any proposed residences fronting either the Pacific Highway. GHD recommend the following building processes and ways to design a house to mitigate road traffic related noise intrusion.

Layout of the rooms in the building structure is important. Putting less sensitive noise areas such as the bathroom, laundry, and the kitchen closer to the noise source shields the more sensitive areas such as the bedrooms, living rooms, and studies. Using building materials, which insulate or absorb sound in the floors, walls, ceilings and roofs is another way of keeping traffic noise out of the home. For example, adding thermal insulation to the ceiling can reduce noise levels by 7 to 8 decibels.

Identify and define noise affected zones where building design needs to incorporate grades of architectural noise mitigation, to ensure that internal noise levels are acceptable. It is far more cost effective to install appropriate noise insulation at the building stage.

GHD recommend that detailed noise modelling be undertaken to determine suitable noise mitigation measures. This would be undertaken as a separate item following the completion of this desktop noise assessment, with the cost to be determined following completion this qualitative assessment.



5. Conclusion

Establishment of indicative project specific noise goals was undertaken on behalf of Hillview Heights Estates Pty Ltd as part of the process of lodging the part 3A Submission for the proposed Residential Subdivision land situated at Lot 66 DP 551005 Pacific Highway, Moonee Beach, NSW.

Results of the qualitative assessment suggest traffic noise onto the site has the potential to adversely affect the development site.

The qualitative assessment was conducted based on the findings of the previously undertaken noise monitoring adjacent to the Pacific Highway between the 11th and 18th November 2004. Monitoring was undertaken at two properties along the Pacific Highway approximately 700m and 1.2km to the south of the proposed development site southern boundary. Based on these indicative results, it was found that:

- ▮ Traffic noise is likely to be a feature of the ambient environment in the area; and
- ▮ Current traffic noise levels may potentially exceed the Environmental Criteria for Road Traffic Noise (ECRTN) criteria at the nearest proposed building footprint for a new residential development affected by freeway / arterial road traffic noise.

There will likely be increased noise effects resulting from assumed future traffic growth along the Pacific Highway and future building footprints are proposed to be situated nearer to the roadway than the location of previous monitoring. It may therefore be expected that both the ECRTN external and internal residential criteria may potentially be exceeded.

GHD has outlined a range of possible mitigation measures that may achieve the ECRTN goals but to determine exactly what mitigation measures will be required, detailed traffic noise intrusion modelling is recommended.

Detailed noise modelling is required to determine exactly what mitigation measures will be required to achieve the ECRTN goals. GHD recommend that unattended noise monitoring be undertaken representative of the nearest potentially affected building footprint in the proposed development nearest to the Pacific Highway with levels used to establish site specific traffic noise intrusion criteria.

By using standard acoustic attenuation and vibration mitigation measures it can be reasonably expected that acceptable noise levels may be achieved for future proposed residences within the assessment site.

Due to the close proximity of adjacent approved developments and existing residential receivers, GHD recommend that a site specific Construction Noise and Vibration Management Plan be undertaken prior to construction activities commencing.



6. References

6.1 Acoustics

NSW DEC, *Environmental Criteria for Industrial Noise Policy (INP)*, January 2000.

NSW DEC *Application Notes to the NSW Industrial Noise Policy*, released 4th May 2006.

DEC NSW, *Environmental Criteria for Road Traffic Noise*, Roads and Traffic Authority, Environmental Protection Authority, Chatswood, 1999.

NSW DEC, *Environmental Noise Control Manual*, June 1994.

NSW Roads & Traffic Authority publication, RTA Environmental Noise Management Manual (ENMM), Version 1, Issued December 2001.

Australian Standards AS/NZS 2107:2000, *Acoustics – Recommended design sound levels and reverberation times for building interiors*.

Australian Standards AS 3671:1989, *Acoustics – Road traffic noise intrusion – Building siting and construction*.



GHD Pty Ltd ABN 39 008 488 373

352 King St Newcastle NSW 2300

PO Box 5403 Hunter Region Mail Centre NSW 2310

T: (02) 4979 9999 F: (02) 4979 9988 E: ntlmail@ghd.com.au

© **GHD Pty Ltd 2007**

This document is and shall remain the property of GHD Pty Ltd. The document may only be used for the purposes for which it was commissioned and in accordance with the Consultancy Agreement for the commission. Unauthorised use of this document in any form whatsoever is prohibited.

Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	S Kozakiewicz	V Chavand		G Collins		26/10/07
1	S Kozakiewicz	V Chavand		G Collins		22/11/07