MOONEY MOONEY / PEAT ISLAND PLANNING PROPOSAL

Environmental Noise Assessment

5 September 2016

Government Property NSW

TH909-01F02 Report (r3).docx

Document details

Detail	Reference
Doc reference:	TH909-01F02 Report (r3).docx
Prepared for:	Government Property NSW
Address:	Level 5, 4-6 Bligh St Sydney NSW 2000
Attention:	Mr Daniel Brook

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Authorised
16.08.2016	Generate report	0	1	WC	MCH	MCH
05.09.2016	Final		2-3	WC	MCH	MCH

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1 Introduction

Renzo Tonin & Associates was engaged to conduct an environmental noise assessment of the proposed rezoning of surplus government owned land at Mooney Mooney and Peat Island (the site). This report quantifies the noise impacts from road traffic noise from nearby roads affecting the concept plan of potential future land uses. Specifically, this report identifies the compliance capability of the proposal with the NSW Environment Protection Authority's (EPA) 'Road Noise Policy' (RNP); the NSW 'State Environmental Planning Policy (Infrastructure)' 2007 (ISEPP), with regard to road traffic noise impact from the M1 Pacific Motorway.

In-principle design measures and noise controls are provided to show that future development envisaged as a result of the concept plan is capable of complying with nominated traffic noise goals.

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001. Appendix A contains a glossary of acoustic terms used in this report.

2 Project Description

The site is located on the eastern and western sides of the M1 Pacific Motorway at Mooney Mooney. A Concept Plan has been developed to facilitate future development for a range of land uses which would include:

- residential properties;
- hotel / tourism uses;
- car-based service centre; and
- minor retail developments.

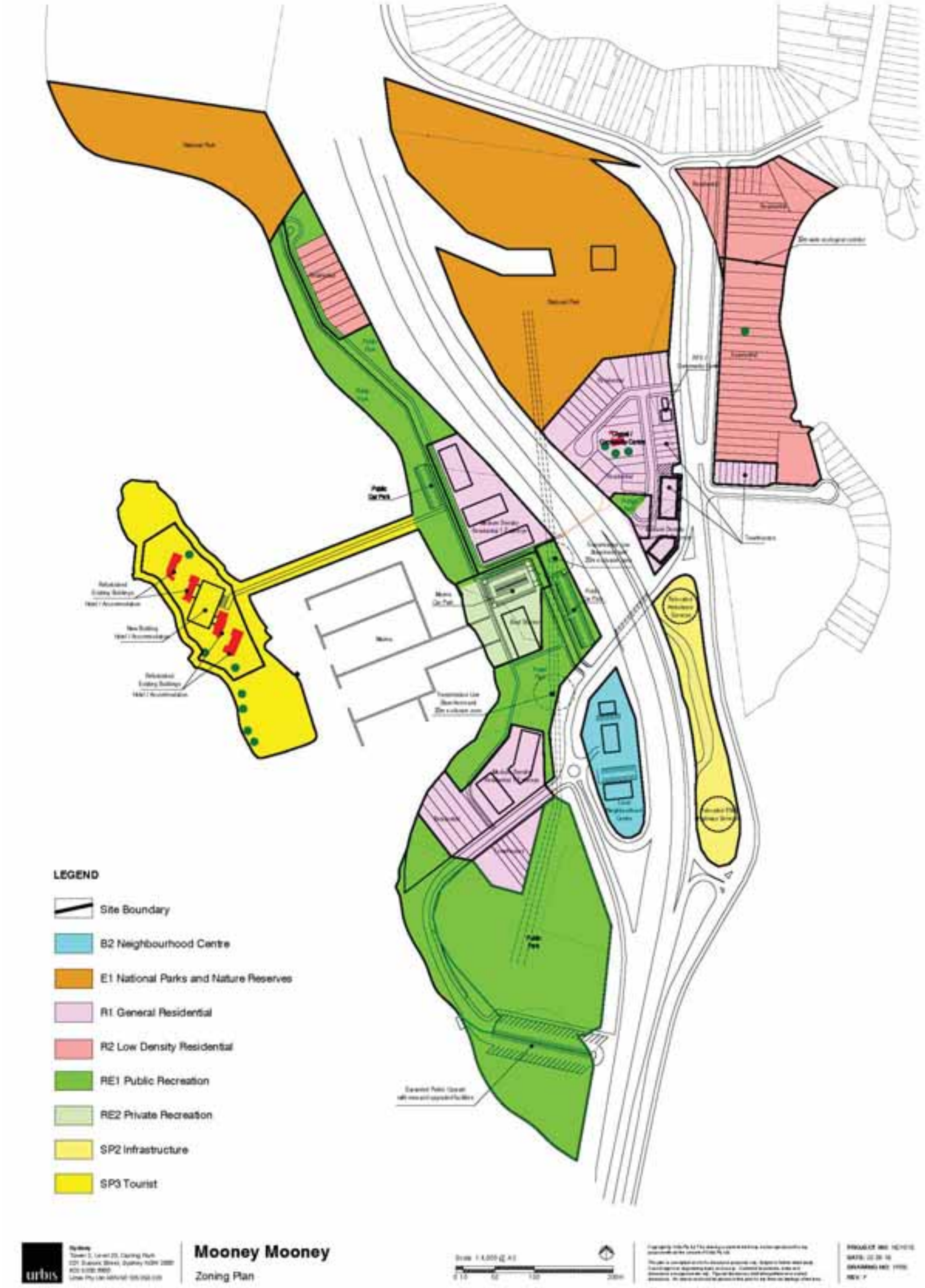
A study on the potential noise impacts upon the likely future land uses has been undertaken. Traffic noise has been determined to be the main contributor to noise impacts and is assessed in accordance with the requirements of the RNP and ISEPP for road traffic noise.

According to the RNP definitions and for the purpose of this assessment, the M1 Pacific Motorway is classified as an “arterial” road or “freeway”, as it carries predominantly through traffic between Sydney, the Central Coast and Newcastle.

The location of the subject site and the proposed Concept Plan and Zoning Plan layout are shown in Figure 1.

Figure 1 – Location of Subject Site and Proposed Concept Plan

Figure 2 – Location of Subject Site and Proposed Zoning Plan



3 Road Traffic Noise Criteria

3.1 NSW Road Noise Policy (RNP)

The NSW ‘Road Noise Policy’ (RNP) was introduced in July 2011 and replaced the NSW ‘Environmental Criteria for Road Traffic Noise’ (ECTRN). Table 3 of the RNP outlines criteria to be applied to particular types of road development and land use. The criteria apply when assessing noise impact and determining mitigation measures for existing developments that are potentially affected by road traffic noise, with the aim of preserving the amenity appropriate to the land use.

Unlike the ECTRN, the RNP no longer stipulates noise criteria for new land use developments potentially impacted by road traffic noise. Criteria for new residential developments affected by existing roads are now addressed through the ‘State Environmental Planning Policy (Infrastructure)’ 2007 ('ISEPP') and the associated NSW Department of Planning 'Development Near Rail Corridors and Busy Roads – Interim Guideline'.

3.2 State Environmental Planning Policy (Infrastructure) 2007 (ISEPP)

The NSW ‘State Environmental Planning Policy (Infrastructure)’ 2007 (known as 'ISEPP') is used to facilitate the effective delivery of infrastructure across the State. The aim of the policy includes identifying the environmental assessment category into which different types of infrastructure and services development fall and identifying matters to be considered in the assessment of development adjacent to particular types of infrastructure.

Pertinent to noise assessment, the ISEPP includes the following clauses:

“102 Impact of road noise or vibration on non-road development

1. *This clause applies to development for any of the following purposes that is on land in or adjacent to the road corridor for a freeway, a tollway or a transitway or any other road with an annual average daily traffic volume of more than 40,000 vehicles (based on the traffic volume data published on the website of the RTA) and that the consent authority considers is likely to be adversely affected by road noise or vibration:*
   - a. *a building for residential use,*
   - b. *a place of public worship,*
   - c. *a hospital,*
   - d. *an educational establishment or child care centre.*
2. *Before determining a development application for development to which this clause applies, the consent authority must take into consideration any guidelines that are issued by the Director-General for the purposes of this clause and published in the Gazette.*

3. *If the development is for the purposes of a building for residential use, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded:*

   e. *in any bedroom in the building - 35 dB(A) at any time between 10 pm and 7am,*

   f. *anywhere else in the building (other than a garage, kitchen, bathroom or hallway) - 40 dB(A) at any time.*

4. *In this clause, "freeway", "tollway" and "transitway" have the same meanings as they have in the Roads Act 1993"*

To support the ISEPP, the NSW Department of Planning released the 'Development Near Rail Corridors and Busy Roads – Interim Guideline' (December 2008). The Guideline assists in the planning, design and assessment of developments in, or adjacent to, major transport corridors in terms of noise, vibration and air quality. While the ISEPP applies only to roads with an AADT greater than 40,000 vehicles, the guideline is also recommended for other road traffic noise affected sites.

The Guideline clarifies the time period of measurement and assessment. Section 3.4 '*What Noise and Vibration Concepts are Relevant*' and Table 3.1 of Section 3.6.1 confirms that noise assessment is based over the following time periods:

- Daytime 7:00am - 10:00pm $L_{Aeq(15hr)}$
- Night-time 10:00pm - 7:00am $L_{Aeq(9hr)}$

The noise criteria nominated in the ISEPP apply to internal noise levels with windows and doors closed. However, as this preliminary noise assessment is based on predictions at external locations, equivalent external noise criteria have been established. The equivalent external noise criterion is used to determine which areas of the development may require acoustic treatment in order to meet the internal noise requirements of the ISEPP. The equivalent external goals have been determined on the following basis:

- The ISEPP states:

  "*If internal noise levels with windows or doors open exceed the criteria by more than 10dBA, the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also to meet the ventilation requirements of the Building Code of Australia*."

- The internal criteria with windows open is therefore 10dB(A) above the criteria explicitly outlined in the ISEPP.
- The generally accepted noise reduction through an open window from a free-field external position is 10dB(A). Windows/doors are assumed to be open no more than 5% of room floor area, in accordance with the Building Code of Australia (BCA) ventilation requirements.

Based on the above, Table 3.1 presents the ISEPP internal noise criteria along with the equivalent external noise criteria for residential premises.

Table 3.1 – ISEPP Noise Criteria for New Residential Developments

Room	Location	$L_{Aeq,\,15hr}$ Day 7am – 10pm	$L_{Aeq\ 9hr}$ Night 10pm – 7am
Living rooms	Internal, windows closed	40	40
	Internal, windows open	50	50
	External free-field (allowing windows to remain open)[1]	60	60
Bedrooms	Internal, windows closed	40	35
	Internal, windows open	50	45
	External free-field (allowing windows to remain open)[1]	60	55

Notes: 1. ISEPP Guideline states that where internal noise criteria are exceeded by more than 10dB(A) with windows open mechanical ventilation is required. External goals have been calculated on the basis of nominal 10dB(A) reduction through an open window to a free-field position. Windows open to 5% of floor area in accordance with the BCA 2011 requirements.

Based on the above table, the most stringent criteria for the day and night time periods will be used for the assessment of road traffic noise impacting the proposal. That is, for the day period the external free-field noise criterion will be $L_{Aeq,15hr}$ 60dB(A) and for the night period the external free-field noise criterion will be $L_{Aeq,9hr}$ 55dB(A).

4 Road Traffic Noise Sources

An environmental noise assessment for the previous concept plan and proposal for the site was previously prepared by Renzo Tonin & Associates (ref. TE522-01F02 (rev 2), dated 29th April 2010). As part of the assessment, a traffic classification survey was undertaken along the M1 Pacific Motorway in Mooney Mooney. The 15hr and 9hr volumes from the survey as presented in the previous assessment are reproduced in the table below.

Table 4.1 – Existing 2009 Traffic Volumes along M1 Pacific Motorway, Mooney Mooney

Year	Road	Daytime (7am to 10pm)			Night time (10pm to 7am)		
		Total Volumes	%Heavy Vehicles	Vehicle Speeds[1]	Total Volumes	%Heavy Vehicles	Vehicle Speeds[1]
2009	M1 Pacific Motorway	60,105	12.3	107	8,416	23.2	106

Notes: 1. Based on 85th percentile vehicle speeds from 2009 traffic survey

Since development is anticipated to occur from 2018 for the site; in accordance with the RNP and ISEPP, traffic volumes for 10 years after the development occurs (ie. 2028) is to be used for the traffic noise impact assessment. However, modelled traffic volume data for the year 2028 for the M1 Pacific Motorway was not readily available at the time of this assessment. Instead, traffic data for the years from 2009 to 2014 were obtained from a permanent traffic counting station on the M1 Pacific Motorway located near the site. A 1.5% annual increase in traffic volume from 2009 to 2014, typically due to natural growth, was determined from the traffic data obtained and was used to calculate the expected traffic volumes for 2028. However, heavy vehicle percentages are based on the traffic classification survey conducted during the noise monitoring and presented in Table 4.1 above.

Therefore, traffic volumes for the assessment year 2028 are presented in Table 4.2 below.

Table 4.2 – Predicted 2028 Traffic Volumes Used for Traffic Noise Assessment

Road	Period	Descriptor	Traffic Volumes	
			Total	Heavy Vehicle %
M1 Pacific Motorway	Daytime (7am to 10pm)	15 hour	81,815	12.3
	Night time (10pm to 7am)	9 hour	11,464	23.2

In addition to traffic volumes and compositions, traffic speeds are also required for noise predictions. For the predictions of traffic noise, the posted speed limit of 110km/h has been used.

5 Road Traffic Noise Assessment

5.1 Noise Modelling Methodology

The noise prediction model used to predict traffic noise levels for the proposal are contained within the calculation algorithms of the noise model developed by the United Kingdom Department of Environment entitled "Calculation of Road Traffic Noise (1988)" known as the CoRTN88 method. This method has been adapted to Australian conditions and extensively tested by the Australian Road Research Board.

The model predicts noise levels for free flowing traffic and a modified method has been developed which enables an accurate prediction of noise from high truck exhausts to be taken into account. The method predicts the $L_{10(1hour)}$ noise levels within the daytime 15 hour (7am to 10pm) and night-time 9 hour (10pm to 7am) periods and a correction of -3dB(A) is applied to obtain the $L_{eq(1hour)}$ noise levels for each period. The $L_{eq(1hour)}$ noise level for the time period 7am to 10pm is then equated to the daily $L_{eq(15hour)}$ noise level. Similarly, the $L_{eq(1hour)}$ noise level for the time period 10pm to 7am is then equated to the night time $L_{eq(9hour)}$ noise level.

The noise prediction model takes into account the following modelling inputs.

Table 5.1 – Summary of Noise Modelling Inputs

Input Parameters	Data Acquired From
Traffic volumes and mix	As described in Section 4
Vehicle speed	Existing – Based on traffic survey undertaken in previous study Future – 110km/h posted speed limit for the M1 Pacific Motorway
Ground topography at receiver and road	From 3D data provided by Chase Burke and Harvey, the NSW Department of Lands SIX Viewer and Urbis
Road Geometry	From 3D data provided by Chase Burke and Harvey, the NSW Department of Lands SIX Viewer and Urbis
Vehicle source height	The differing source heights of cars and trucks (3-source heights used) were used and detailed within the noise model as follows: • 0.5m for car exhaust • 1.5m for car and truck engines • 3.6m for truck exhaust
Receiver Heights	• 1.5m above ground level for ground floor level of proposed dwellings • 4.5m above ground level for first floor levels of proposed dwellings
Angles of view from receiver	Determined during site inspections and aerial photos
Air and ground absorption	Detailed within CORTN, ground absorption varied along route. Numeric values varied between 0 (hard surface) to 1 (100% absorptive).
Correction for Australian conditions	-0.7 dB(A) for 'free field' conditions
Acoustic properties of road surfaces	Assumed dense graded asphaltic (DGA) on M1 Pacific Motorway

5.2 Predicted Traffic Noise Levels

Road traffic noise levels are predicted across the site using noise contour maps. The predicted noise contour levels have been overlayed on the proposed land use locations to identify areas of exceedances.

Figure 3 and Figure 4 presents the day time noise contours representing road traffic noise generated by the M1 Pacific Motorway for the year 2018 for development on site at ground level and first floor level, respectively. Figure 5 and Figure 6 presents the day time noise contours representing road traffic noise generated by the M1 Pacific Motorway for the Design Year 2028 of the site at ground level and first floor level, respectively.

Figure 7 and Figure 8 presents the night time noise contours representing road traffic noise generated by the surrounding road network for the year 2018 of the site at ground level and first floor level, respectively. Figure 9 and Figure 10 presents the night time noise contours representing road traffic noise generated by the surrounding road network for the Design Year 2028 of the site at ground level and first floor level, respectively.

Figure 3 – 2018 Daytime $L_{Aeq\ (15hr)}$ Contour (Ground Floor)

Figure 4 – 2018 Day-time $L_{Aeq\ (15hr)}$ Contour (First Floor)

Figure 5 – 2028 Daytime $L_{Aeq\ (15hr)}$ Contour (Ground Floor)

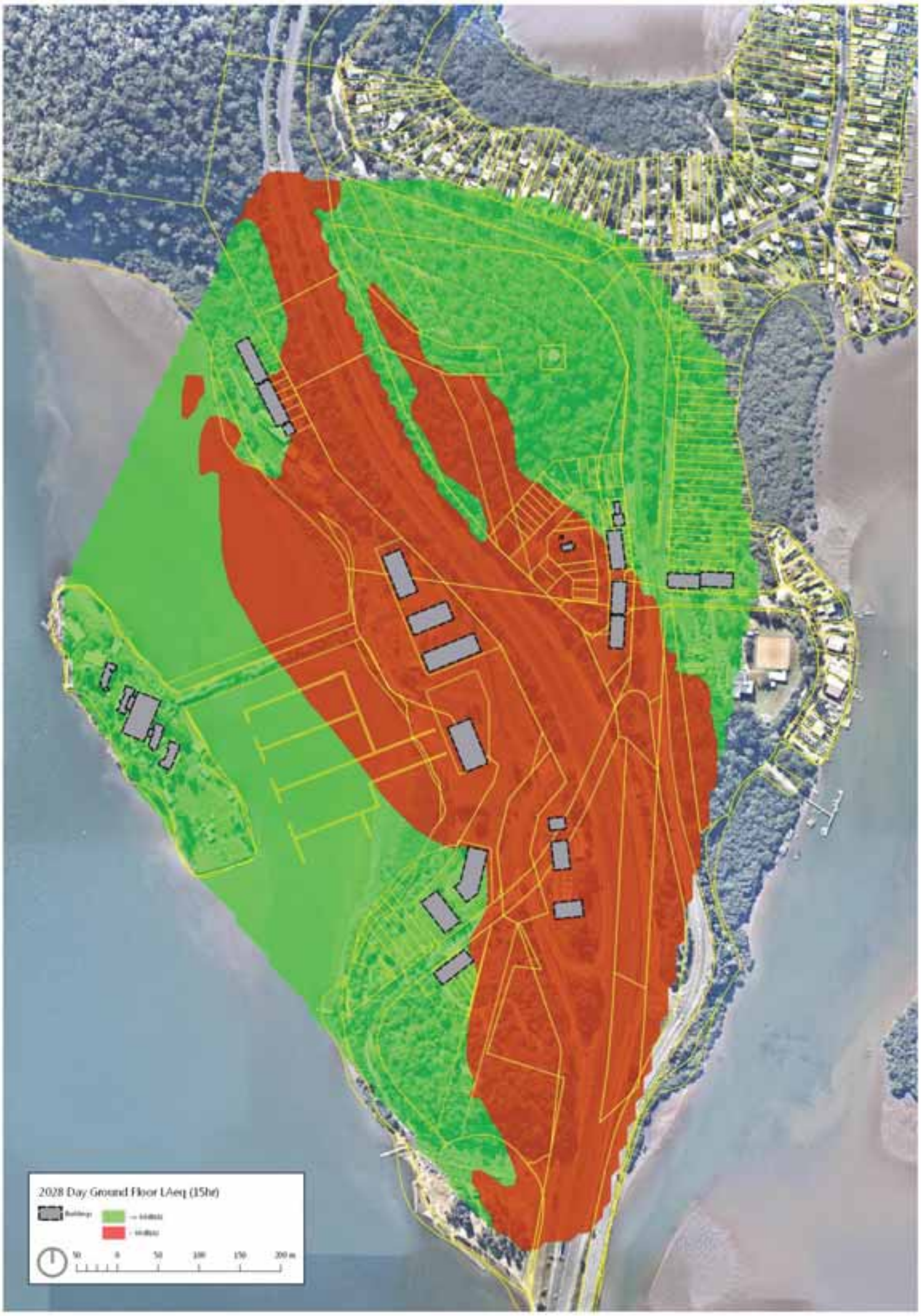


Figure 6 – 2028 Day-time $L_{Aeq\ (15hr)}$ Contour (First Floor)

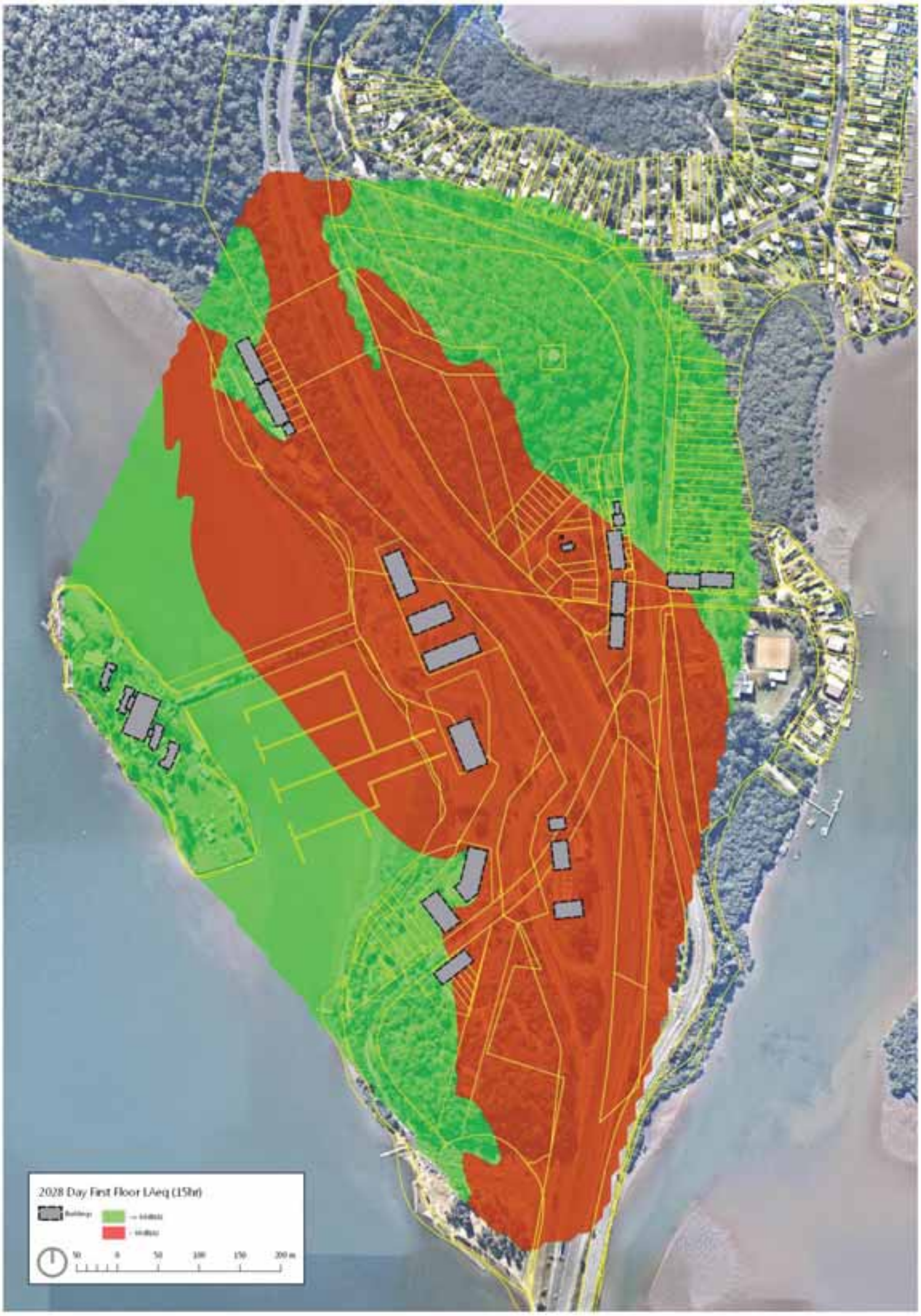


Figure 7 – 2018 Night Time $L_{Aeq\ (9hr)}$ Contour (Ground Floor)

Figure 8 – 2018 Night-time $L_{Aeq\ (9hr)}$ Contour (First Floor)

Figure 9 – 2028 Night Time $L_{Aeq\ (9hr)}$ Contour (Ground Floor)

Figure 10 – 2028 Night-time $L_{Aeq\ (9hr)}$ Contour (First Floor)

5.3 Assessment of Impacts

The red shaded contour areas shown in Figure 5 and Figure 6 for the day period indicate the locations within the noise contours where road traffic noise levels from the M1 Pacific Motorway, for the design year 2028, would exceed the ISEPP road traffic noise criteria for the day period [ie. > $L_{Aeq,15hr}$ 60dB(A)]. Therefore, it is recommended that for residential lots located within the red shaded areas, appropriate acoustic mitigation measures should be incorporated in the design of the residential lots (see Section 6 following).

Similarly, the red shaded areas shown in Figure 9 and Figure 10 for the night period indicate the locations within the noise contours where road traffic noise levels from the M1 Pacific Motorway, for the design year 2028, would exceed the IESPP road traffic noise criteria for the night period [ie. > $L_{Aeq,9hr}$ 55dB(A)]. Therefore, it is recommended that for residential lots located within the red shaded area, appropriate acoustic mitigation measures should be incorporated in the design of the residential lots (see Section 6 following).

6 Recommendations

The following recommendations provide typical noise control solutions commonly used to reduce noise impacts to residential buildings within a subdivision. This information is presented for the purpose of planning proposal assessment only and shall not be used in more detailed design unless otherwise approved in writing by the acoustic consultant.

6.1 Noise Barriers

For residential properties constructed within the $L_{Aeq(15hr)}$ 60dB(A) and/or $L_{Aeq(9hr)}$ 55dB(A) contours (ie. red shaded areas shown in Figure 3 to Figure 10), the use of noise barriers should be considered to reduce traffic noise impacts. Noise barriers can usually reduce noise levels by at least 5dB(A) when they are high enough to break line-of-sight and 10-15dB(A) in the acoustic 'shadow zone' (region in which there is no line-of-sight), with a maximum total noise reduction of 20dB(A).

Noise barriers can be effective for mitigating traffic noise where residences are closely grouped and there are no breaks / gaps in the barrier. Where proposed dwellings are of double storey or multi-storey construction, high noise barriers (>5m) would be required to mitigate noise to the upper levels and may not be a feasible option given the structural requirements for high barriers.

Furthermore, noise barriers are only feasible where the barriers do not cause access difficulties to properties and where they are visually acceptable. Where driveway access is required for residential properties it is preferred not to use noise barriers as the overall noise reduction provided by the barrier is compromised by the need to install an access gate.

The effectiveness and location of any noise barriers will need to be investigated during the detailed design stage when final property layout and density distribution have been determined.

6.2 Building Treatment

Residential properties constructed within the $L_{Aeq(15hr)}$ 60dB(A) and/or $L_{Aeq(9hr)}$ 55dB(A) contour (ie. red shaded areas shown in Figure 3 to Figure 10) should be designed to satisfy the internal noise requirements of the ISEPP.

Examples of building treatment options that may be considered in order to achieve the ISEPP requirements may include, but not limited to, the following:

- Provide glazing with sufficient acoustic performance for windows facing the traffic noise source including the installation of acoustic seals for operable windows.
- Provide doors with sufficient acoustic performance for doors facing the traffic noise source including the installation of acoustic seals.
- Facades facing the traffic noise source be of masonry construction.

- If the ISEPP internal noise levels can only be achieved with windows and doors closed, then mechanical ventilation (eg. acoustic wall ventilators, air conditioners that provide fresh air circulation or the like) should be provided to ensure fresh airflow inside the dwellings so to meet the requirements of the Building Code of Australia (BCA).

Depending on the noise reductions required in order to achieve the internal noise requirement of the ISEPP, various types of building treatment options are available to mitigate noise. The associated cost implications will depend upon the required noise controls options shown below. It is noted that cost estimates are only provided as a guide and should not be used for cost planning.

- Option 1 Mechanical ventilation only

  1-10 dB(A) reduction

  Where external noise levels are less than 10dB(A) above the nominated external criteria, the internal noise goals may be achieved with windows closed. A light framed building with single glazed windows will provide a minimum noise reduction of up to 20dB(A) from outside to inside when windows are closed. If the ISEPP internal noise goals can only be achieved with windows closed, then mechanical ventilation must be provided to ensure fresh airflow inside the dwelling so to meet the requirements of the Building Code of Australia.

  It is important to ensure that mechanical ventilation does not provide a new noise leakage path into the dwelling and does not create a noise nuisance to neighbouring residential premises.

- Option 2 Upgraded seals for windows and doors

  10-12dB(A) reduction

  Where external noise levels are only slightly greater than 10dB(A) above the nominated external criteria, then in addition to installing mechanical ventilation systems (Option 1), special acoustic grade seals should also be installed on windows and perimeter doors exposed to road traffic noise to enable the internal noise criteria to be achieved with windows and doors shut.

- Option 3 Upgraded windows, glazing and doors

  >12 dB(A) reduction

  Where the predicted external noise level exceeds the nominated external criteria by significantly more than 10dB(A), then upgraded windows and glazing and the provision of solid core doors will be required on the facades exposed to the road noise source, in addition to the mechanical ventilation described in Option 1 and the acoustic seals in Option 2. Note that these upgrades are only suitable for masonry buildings. It is unlikely that this degree of upgrade would provide significant benefits to light framed structures should there be no acoustic insulation in the walls.

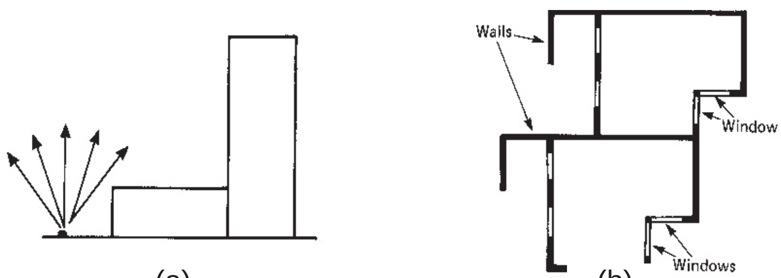
6.3 Building Design

Buildings to be constructed in areas affected by road traffic noise, as discussed above, should consider building layout design at the design stage to aid in achieving compliance with ISEPP requirements for internal noise levels.

Courtyards and open space areas can be located away from the road, using the building as a buffer to obtain a quiet outdoor environment. Within the building itself, locate less sensitive rooms closest to the road, so that these essentially form a barrier between the road and noise sensitive rooms such as bedrooms. Where possible, locate the building further away from the road, thereby reducing road traffic noise at the facade.

Figure 11 below provides examples of 'self-protecting' building design.

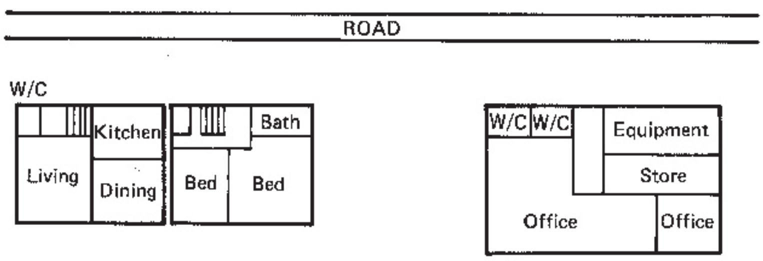
Figure 11 – Examples of 'Self-Protecting' Buildings



(a) (b)

(a) Podium provides shielding for most of the tower block

(b) Building shape provides shielding for the windows and the solid wing wall provides a quiet courtyard



(c)

(c) Arrangement of rooms to minimise traffic noise problems

(Nelson P 1987 p11/16)

7 Conclusion

Renzo Tonin & Associates has completed an assessment of road traffic noise impact on the proposed concept plan associated with the planning proposal for the site adjacent to the M1 Pacific Motorway. Specifically, the road traffic noise impacts have been quantified and compared to the noise guidelines set by the NSW EPA and ISEPP.

This assessment has addressed relevant matters of consideration for the planning proposal stage and the recommendations included in this report are identified as further investigation at a later detailed design stage following gateway determination for the proposal.

Any noise mitigation recommendations included in this report are in-principle only. The assistance of an acoustic consultant should be sought at the detailed design stage of the project to provide more accurate design advice when there is more detailed information about building type, lot arrangement and traffic flow information available.

APPENDIX A Glossary of Terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of every day sounds: 0dB The faintest sound we can hear 30dB A quiet library or in a quiet location in the country 45dB Typical office space. Ambience in the city at night 60dB CBD mall at lunch time 70dB The sound of a car passing on the street 80dB Loud music played at home 90dB The sound of a truck passing on the street 100dB The sound of a rock band 115dB Limit of sound permitted in industry 120dB Deafening
dB(A)	A-weighted decibels. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the “A” filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.

L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.