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Transportation Noise Assessment

The Avenue Stage 8B
Rowley Road, Hilbert

Reference: 20115972-02

Prepared for

Peet Limited

Report: 20115972-02

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1 INTRODUCTION

This report has been prepared to assess the traffic noise impacts to "The Avenue" residential development Stage 8B. The development is within an area of land located east of Tonkin Highway and south of Rowley Road, referred to as Precinct J within the Wungong Urban Water Master Plan in the suburb of Hilbert.

The results of the assessment are compared against the *State Planning Policy No. 5.4 Road and Rail Noise* and recommendations are provided on noise mitigation requirements under this policy.

For a general locality map, refer to *Figure 1-1* and the subdivision layout is shown in *Figure 1-2*.

Appendix A contains a description of some of the terminology used throughout this report.

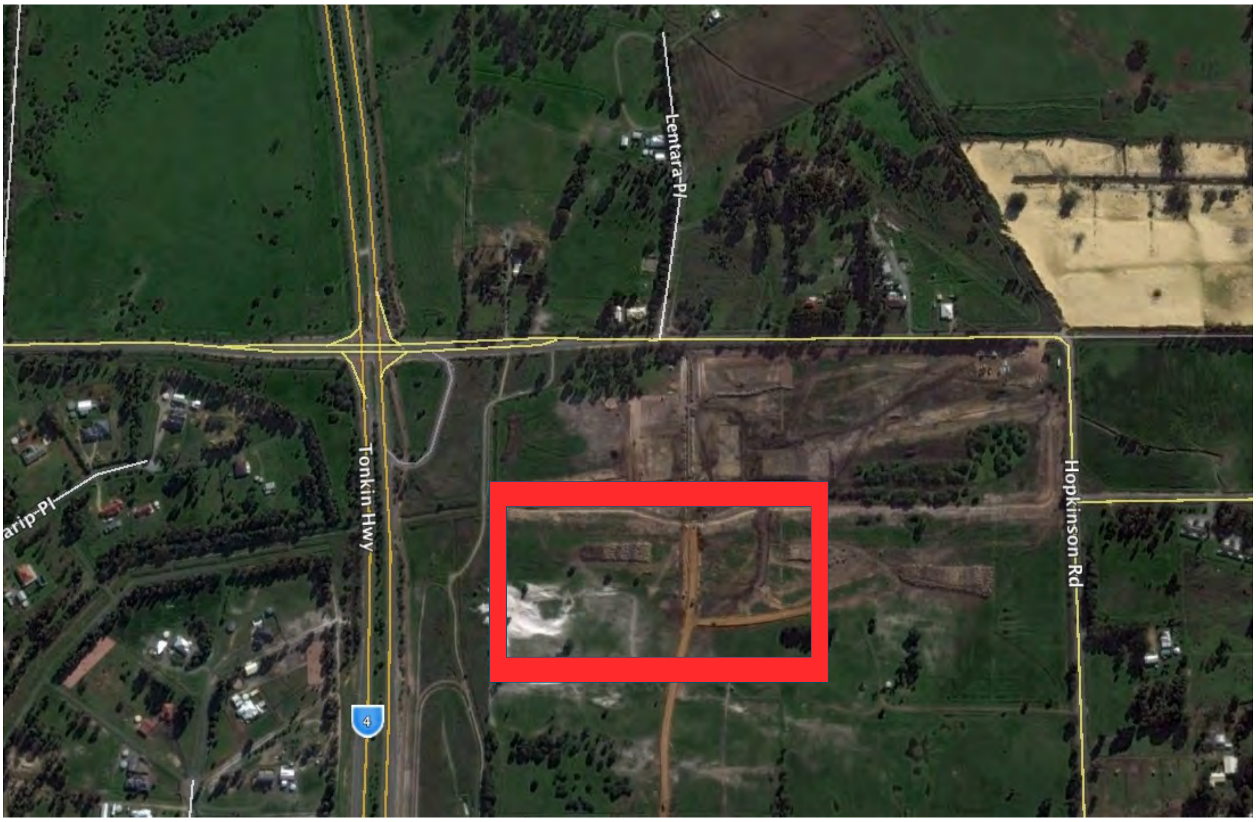


Figure 1-1 Road Project Locality

Figure 1-2 Subdivision Layout

2 CRITERIA

The criteria relevant to this assessment is provided in *State Planning Policy No. 5.4 Road and Rail Noise* (hereafter referred to as SPP 5.4) produced by the Western Australian Planning Commission (WAPC). The objectives of SPP 5.4 are to:

- Protect the community from unreasonable levels of transport noise;
- Protect strategic and other significant freight transport corridors from incompatible urban encroachment;
- Ensure transport infrastructure and land-use can mutually exist within urban corridors;
- Ensure that noise impacts are addressed as early as possible in the planning process; and
- Encourage best practice noise mitigation design and construction standards

Table 2-1 sets out noise targets that are to be achieved by proposals under which SPP 5.4 applies. Where the targets are exceeded, an assessment is required to determine the likely level of transport noise and management/mitigation required.

Table 2-1 Noise Targets for Noise-Sensitive Land-Use

Outdoor Noise Target		Indoor Noise Target	
55 dB $L_{Aeq(Day)}$	50 dB $L_{Aeq(Night)}$	40 dB $L_{Aeq(Day)}$ (Living and Work Areas)	35 dB $L_{Aeq(Night)}$ (Bedrooms)

Notes:

- Day period is from 6am to 10pm and night period from 10pm to 6am.
- The outdoor noise target is to be measured at 1-metre from the most exposed, habitable[1] facade of the noise sensitive building.
- For all noise-sensitive land-use and/or development, indoor noise targets for other room usages may be reasonable drawn from Table 1 of Australian Standard/New Zealand Standard AS/NZS 2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors (as amended) for each relevant time period.
- Outdoor targets are to be met at all outdoor areas as far as is reasonable and practicable to do so using the various noise mitigation measures outlined in the Guidelines.

The application of SPP 5.4 is to consider anticipated traffic volumes for the next 20 years from when the noise assessment is undertaken.

In the application of the noise targets, the objective is to achieve:

- indoor noise levels specified in *Table 2-1* in noise-sensitive areas (e.g. bedrooms and living rooms of houses and school classrooms); and
- a reasonable degree of acoustic amenity for outdoor living areas on each residential lot. For non-residential noise-sensitive developments, for example schools and childcare centres, the design of outdoor areas should take into consideration the noise target.

[1] A habitable room is defined in State Planning Policy 3.1 as a room used for normal domestic activities that includes a bedroom, living room, lounge room, music room, sitting room, television room, kitchen, dining room, sewing room, study, playroom, sunroom, gymnasium, fully enclosed swimming pool or patio.

3 METHODOLOGY

Noise measurements and modelling have been undertaken in accordance with the requirements of the Policy as described below in *Sections 3.1 and 3.2*.

3.1 Site Measurements

Noise monitoring was undertaken along Tonkin Highway at one (1) location between the 13th and 19th December 2019, in order to:

- Quantify the existing noise levels;
- Determine the differences between different acoustic parameters ($L_{A10,18hour}$, $L_{Aeq(Day)}$ and $L_{Aeq(Night)}$); and
- Calibrate the noise model for existing conditions.

The instrumentation used was ARL Ngara noise data logger. The logger was positioned one-metre from a structure facade with the microphone 1.4 metres above ground level (refer *Figure 3-1*).

The logger was programmed to record hourly L_{A1}, L_{A10}, L_{A90}, and L_{Aeq} levels. These instruments comply with the instrumentation requirements of *Australian Standard 2702-1984 Acoustics – Methods for the Measurement of Road Traffic Noise*. The loggers were field calibrated before and after the measurement session and found to be accurate to within +/- 1 dB. Lloyd George Acoustics also holds current laboratory calibration certificate for the loggers.

The noise data collected was verified by inspection and professional judgement. Where hourly data was considered atypical, an estimated value was inserted and highlighted by bold italic lettering.

The weather conditions during the measurement period were obtained from the Bureau of Meteorology's Jandakot weather station. This data was compared against the Main Roads Western Australia (MRWA) specifications for measurement conditions.

Figure 3-1 Typical Noise Data Logger

3.2 Noise Modelling

The computer programme *SoundPLAN 8.2* was utilised incorporating the *Calculation of Road Traffic Noise* (CoRTN) algorithms, modified to reflect Australian conditions. The modifications included the following:

- Vehicles were separated into heavy (Austroads Class 3 upwards) and non-heavy (Austroads Classes 1 & 2) with non-heavy vehicles having a source height of 0.5 metres above road level and heavy vehicles having two sources, at heights of 1.5 metres and 3.6 metres above road level, to represent the engine and exhaust respectively. By splitting the noise source into three, allows for less barrier attenuation for high level sources where barriers are to be considered.
- Note that a -8.0 dB correction is applied to the exhaust and -0.8 dB to the engine (based on Transportation Noise Reference Book, Paul Nelson, 1987), so as to provide consistent results with the CoRTN algorithms for the no barrier scenario;

Predictions are made at heights of 1.4 m above ground floor level for single storey houses and 4.4 m for double storey. The noise is predicted at 1.0 metre from an assumed building facade (resulting in a + 2.5 dB correction due to reflected noise).

Various input data are included in the modelling such as ground topography, road design, traffic volumes etc. These model inputs are discussed below.

3.2.1 Ground Topography, Road Design & Cadastral Data

Topographical data was based on that provided by Peet Limited, with the contours being in 0.5 metre intervals.

Buildings expected in future development stages between Tonkin Highway and this stage of the development have not been included in the calculations. As these future buildings can provide barrier attenuation when located between a source and receiver, in much the same way as a hill or wall provides noise shielding, the model is assumed to be very conservative. All single storey buildings are assumed to have a height of 4.0 metres. Where double storey buildings are assumed, these are assumed to have a height of 7.0 metres.

3.2.2 Ground Attenuation

The ground attenuation has been assumed to be 0.0 (0%) for the road, 0.5 (50%) throughout the subdivision, except for the public open space, which was set to 1.00 (100%). Note 0.0 represents hard reflective surfaces such as water and 1.00 represents absorptive surfaces such as grass.

3.2.3 Traffic Data

Traffic data includes:

- Road Surface – The noise relationship between different road surface types is shown below in *Table 3-1*.

Table 3-1 Noise Relationship Between Different Road Surfaces

Road Surfaces						
Chip Seal			Asphalt			
14mm	10mm	5mm	Dense Graded	Novachip	Stone Mastic	Open Graded
+3.5 dB	+2.5 dB	+1.5 dB	0.0 dB	-0.2 dB	-1.0 dB	-2.5 dB

The existing road surface Rowley Road is 14mm chip seal and the future road surface is assumed to be dense graded asphalt. For Tonkin Highway, the existing surface is chip seal and the future road surface is assumed to be open graded asphalt.

- Vehicle Speed – The existing and future posted speeds on Rowley Road are 80km/h and the existing and future posted speeds on Tonkin Highway are 100km/h.

- Traffic Volumes – Future (2041) AAWT traffic volumes used in the modelling have been determined from MRWA data and assume 6,000 vpd heading east along Rowley Road and 7400 vpd heading west. The percentage of heavy vehicles is assumed to be 8.7%. The future (2041) AAWT traffic volume along Tonkin Highway is assumed to be 72,000 vpd with the percentage of heavy vehicles is assumed to be 10%. The 18-hour traffic volumes, required for the CoRTN calculations, are assumed to be 94% of the AAWT volumes.

3.2.4 Parameter Conversion

The CoRTN algorithms used in the *SoundPlan* modelling package were originally developed to calculate the $L_{A10,18hour}$ noise level. The WAPC Policy however uses $L_{Aeq(Day)}$ and $L_{Aeq(Night)}$. The relationship between the parameters varies depending on the composition of traffic on the road (volumes in each period and percentage heavy vehicles). The SoundPLAN program utilises the parameters contained within the paper *Converting the UK Traffic Noise Index $L_{A10,18h}$ to EU Noise Indices for Noise Mapping*; TRL Limited to concert the parameters and these have been used for this assessment.

4 RESULTS

4.1 Noise Monitoring

The results of the noise monitoring are summarised below in *Table 4-1* and shown graphically in *Figure 4-1*.

Table 4-1 Summary of Measurement Results

Measurement Location	Average Weekday Noise Level, dB			
	$L_{A10,18hour}$	$L_{Aeq,24hour}$	$L_{Aeq\ (Day)}$	$L_{Aeq\ (Night)}$
80 Bangap Place, Oakford	59	56	56	55

The results show that as the $L_{Aeq(day)}$ levels are less than 5 dB above the $L_{Aeq(night)}$ levels.. This confirms that the project criterion, which prescribes an allowable $L_{Aeq(night)}$ traffic noise level, represents the dominant time period in terms of compliance.

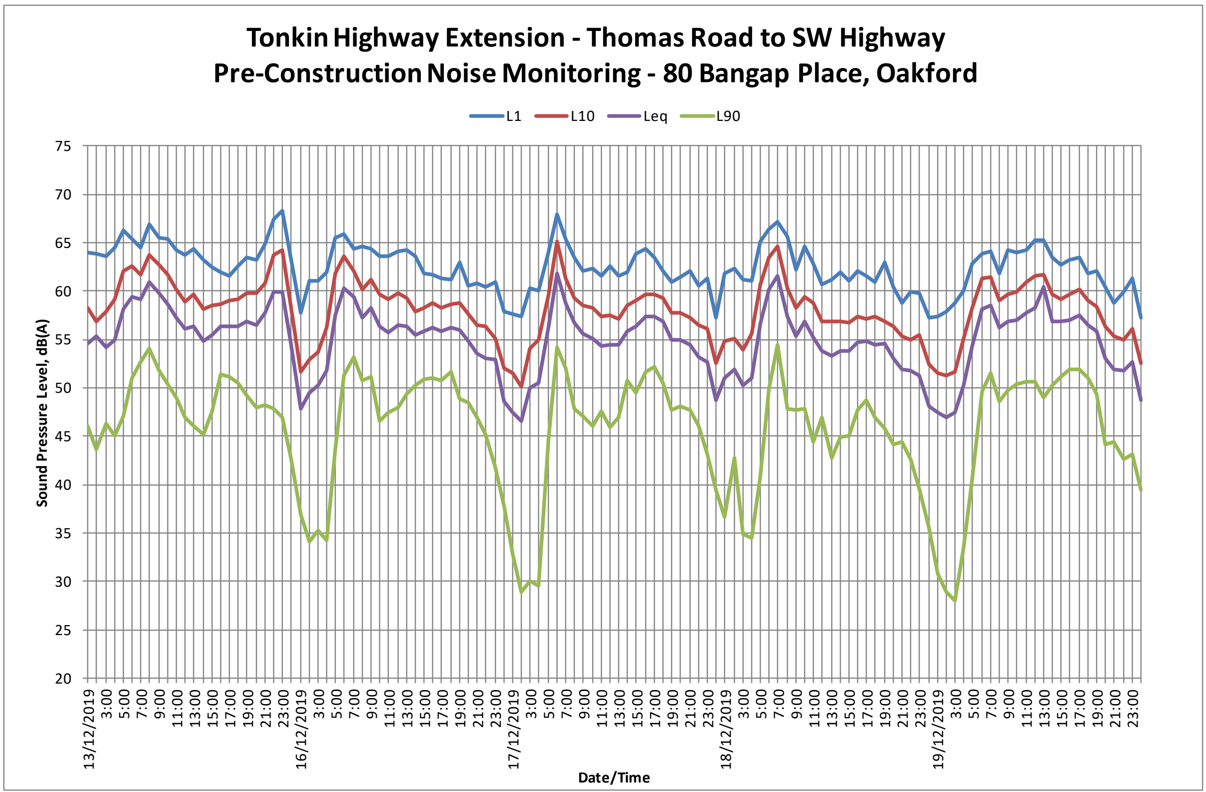


Figure 4-1 Noise Monitoring Results

4.2 Noise Model Calibration

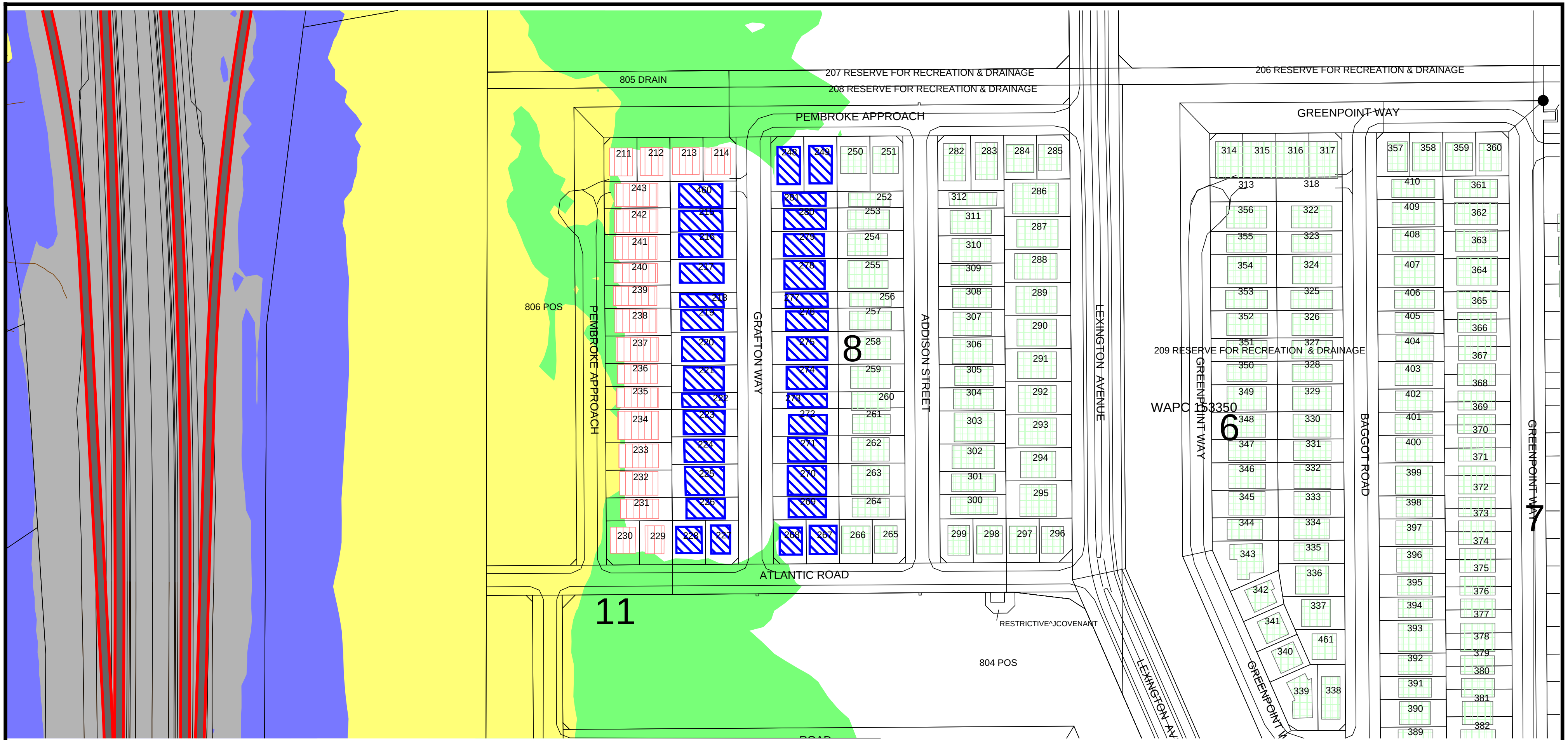
To calibrate the noise prediction model the noise at 80 Bangap Place, Oakford is predicted based on the current road design and traffic volumes. The results are then compared against the measured values and the model is adjusted accordingly. *Table 4-2* shows this comparison and comments on any differences between the two values.

Table 4-2 Comparison of Predicted and Measured Noise Levels

Receiver Location	Traffic Noise Level $L_{Aeq\ (night)}$ dB			
	Measured	Predicted	Variation	Comment
80 Bangap Place, Oakford	54.7	54.6	-0.1	Good Correlation

4.3 Noise Modelling

The results of the noise modelling are provided in *Figures 4-2 and 4-3* as an $L_{Aeq(Night)}$ noise level contour plot (ground and first floor) being for the future traffic conditions. It can be seen that predicted noise levels will be above the outdoor noise target for this stage of the subdivision for some lots.



The Avenue Subdivision - Stage 8B
Future Noise Level Contours

$L_{Aeq(Night)}$ Noise Level Contours Based on 2041 Traffic Volumes
Ground Floor Level

SoundPlan v8.2
CoRTN Algorithms

2 November 2021

Signs and symbols

- Development Housing
- Future Development Stage
- Existing Development Stage

Noise levels

$L_{Aeq,(Night)}$ dB

<= 50	
<= 51	Exposure A
<= 52	
<= 53	
<= 54	Exposure B
<= 55	
<= 56	
<= 57	
<= 58	Exposure C
<= 59	
<= 60	
<= 61	
> 61	Exposure D

SPP 5.4 (Sep 2019)

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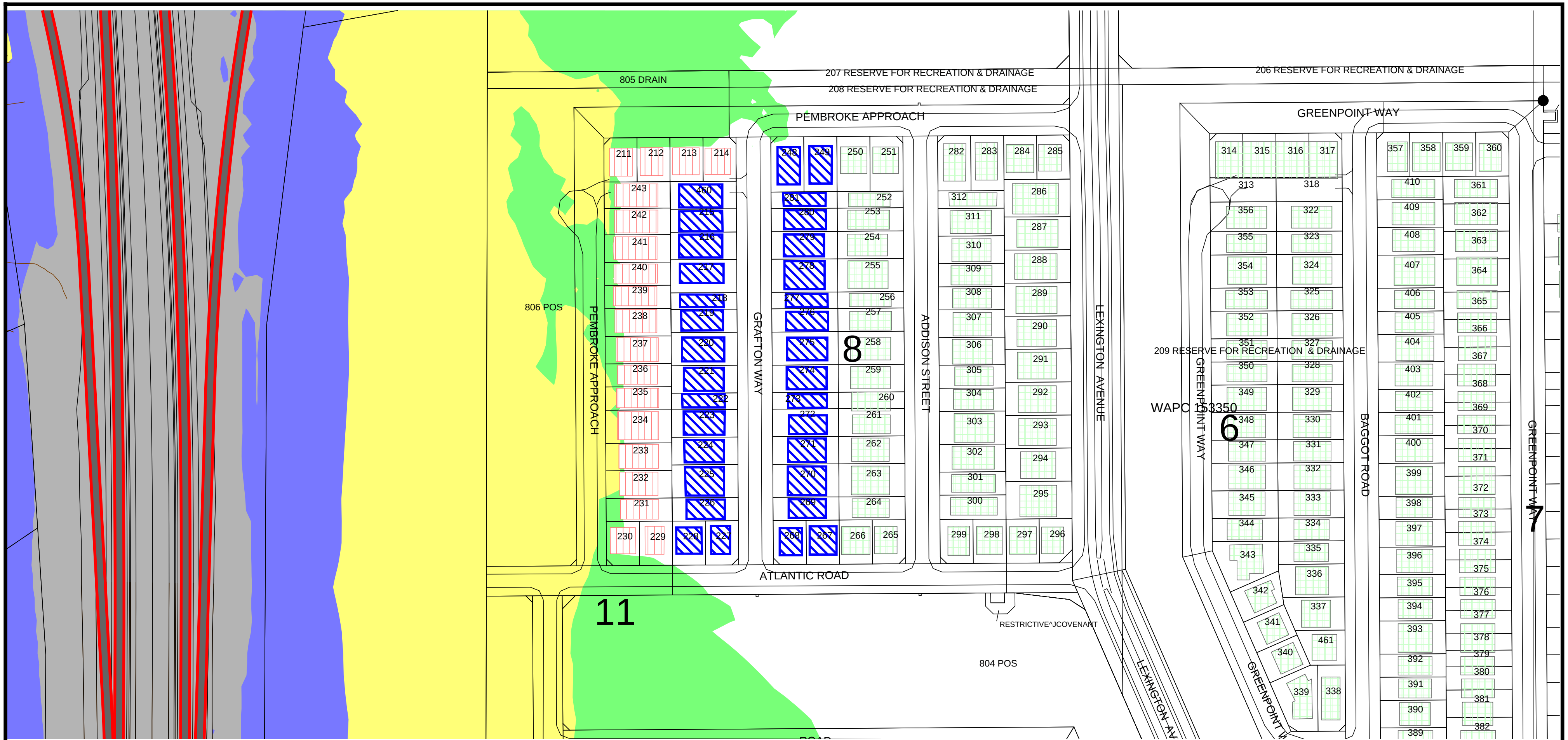
Length Scale

0 15 30 60 90 120 m

N

Figure 4-2



The Avenue Subdivision - Stage 8B
Future Noise Level Contours

$L_{Aeq(Night)}$ Noise Level Contours Based on 2041 Traffic Volumes
Upper Floor Level

SoundPlan v8.2
CoRTN Algorithms

2 November 2021

Signs and symbols

- Development Housing
- Future Development Stage
- Existing Development Stage

Noise levels

$L_{Aeq,(Night)}$ dB

<= 50	
<= 51	Exposure A
<= 52	
<= 53	
<= 54	Exposure B
<= 55	
<= 56	
<= 57	
<= 58	Exposure C
<= 59	
<= 60	
<= 61	
> 61	Exposure D

SPP 5.4 (Sep 2019)

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Length Scale

0 15 30 60 90 120 m

Figure 4-3

5 ASSESSMENT

The objectives of SPP 5.4 are to achieve:

- indoor noise levels specified in *Table 2-1* in noise-sensitive areas (e.g. bedrooms and living rooms of houses and school classrooms); and
- a reasonable degree of acoustic amenity for outdoor living areas on each residential lot.

Where the outdoor noise targets of *Table 2-1* are achieved, no further controls are necessary.

With reference to the predicted noise levels in *Figure 4-2 and 4-3*, it is evident the outdoor noise target will be exceeded at two lots on ground floor level. Where lots are above the outdoor noise target, the following Packages (refer *Appendix A*) are required:

  - Package A where noise levels are between 51 dB and 53 dB $L_{Aeq(Night)}$;
  - Package B where noise levels are between 54 dB and 57 dB $L_{Aeq(Night)}$;
  - Package C where noise levels are between 58 dB and 61 dB $L_{Aeq(Night)}$;

    Alternative constructions from the deemed to satisfy packages may be acceptable if supported by a report undertaken by a suitably qualified acoustical consultant (member firm of the Association of Australasian Acoustical Consultants (AAAC)), once the lots specific building plans are available.

- All affected lots are to have notifications on lot titles as per SPP 5.4 requirements – refer *Appendix A*.

The proposed facade protection for each lot is provided in *Figure 5-1*, being for the ground floor level (upper floor facade protection is not required).

The Avenue Subdivision - Stage 8B
Facade Treatments - Ground Floor Level

2 November 2021

Signs and symbols

- Treatment Not Required
- "Package A" Treatment
- Area

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Length Scale

0 10 20 40 60 80 m

Figure 5-1

6 CONCLUSION

The results of this assessment show that there are two lots predicted to receive a future road traffic noise level that will be above the outdoor noise target. Therefore under the requirements of the *State Planning Policy No. 5.4 Road and Rail Noise,* mitigation measures are required as detailed in *Section 5* of this assessment.

Appendix A

Quiet House Packages

Appendix B

Terminology

The following is an explanation of the terminology used throughout this report.

Decibel (dB)
The decibel is the unit that describes the sound pressure and sound power levels of a noise source. It is a logarithmic scale referenced to the threshold of hearing.

A-Weighting
An A-weighted noise level has been filtered in such a way as to represent the way in which the human ear perceives sound. This weighting reflects the fact that the human ear is not as sensitive to lower frequencies as it is to higher frequencies. An A-weighted sound level is described as L_A dB.

L_1
An L_1 level is the noise level which is exceeded for 1 per cent of the measurement period and is considered to represent the average of the maximum noise levels measured.

L_{10}
An L_{10} level is the noise level which is exceeded for 10 per cent of the measurement period and is considered to represent the "*intrusive*" noise level.

L_{90}
An L_{90} level is the noise level which is exceeded for 90 per cent of the measurement period and is considered to represent the "*background*" noise level.

L_{eq}
The L_{eq} level represents the average noise energy during a measurement period.

$L_{A10,18hour}$
The $L_{A10,18\ hour}$ level is the arithmetic average of the hourly L_{A10} levels between 6.00 am and midnight. The *CoRTN* algorithms were developed to calculate this parameter.

$L_{Aeq,24hour}$
The $L_{Aeq,24\ hour}$ level is the logarithmic average of the hourly L_{Aeq} levels for a full day (from midnight to midnight).

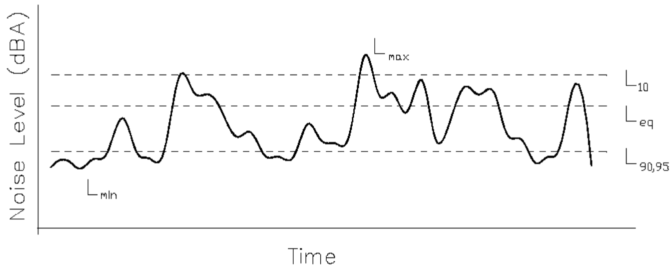
$L_{Aeq,8hour}$ / $L_{Aeq\ (Night)}$
The $L_{Aeq\ (Night)}$ level is the logarithmic average of the hourly L_{Aeq} levels from 10.00 pm to 6.00 am on the same day.

$L_{Aeq,16hour}$ / $L_{Aeq\ (Day)}$
The $L_{Aeq\ (Day)}$ level is the logarithmic average of the hourly L_{Aeq} levels from 6.00 am to 10.00 pm on the same day. This value is typically 1-3 dB less than the $L_{A10,18hour}$.

Satisfactory Design Sound Level
The level of noise that has been found to be acceptable by most people for the environment in question and also to be not intrusive.

Maximum Design Sound Level
The level of noise above which most people occupying the space start to become dissatisfied with the level of noise.

Chart of Noise Level Descriptors



Austroads Vehicle Class

AUSTROADS Vehicle Classification System

Level 1 Length (indicative) Type	Level 2 Axles and Axle Groups: Axles	Groups	Level 3 Vehicle Type: Typical Description	AUSTROADS Classification: Class	Parameters	Typical Configuration
			LIGHT VEHICLES			
Short up to 5.5m		1 or 2	**Short** Sedan, Wagon, 4WD, Utility, Light Van, Bicycle, Motorcycle, etc	1	d(1) ≤ 3.2m and axles = 2	
Medium 5.5m to 14.5m	3, 4 or 5	3	**Short - Towing** Trailer, Caravan, Boat, etc	2	groups = 3 d(1) ≥ 2.1m, d(1) ≤ 3.2m, d(2) ≥ 2.1m and axles = 3, 4 or 5	
			HEAVY VEHICLES			
	2	2	**Two Axle Truck or Bus**	3	d(1) > 3.2m and axles = 2	
	3	2	**Three Axle Truck or Bus**	4	axles = 3 and groups = 2	
	> 3	2	**Four Axle Truck**	5	axles > 3 and groups = 2	
Long 11.5m to 19.0m	3	3	**Three Axle Articulated** Three axle articulated vehicle, or Rigid vehicle and trailer	6	d(1) > 3.2m, axles = 3 and groups = 3	
	4	> 2	**Four Axle Articulated** Four axle articulated vehicle, or Rigid vehicle and trailer	7	d(2) < 2.1m or d(1) < 2.1m or d(1) > 3.2m axles = 4 and groups > 2	
	5	> 2	**Five Axle Articulated** Five axle articulated vehicle, or Rigid vehicle and trailer	8	d(2) < 2.1m or d(1) < 2.1m or d(1) > 3.2m axles = 5 and groups > 2	
	≥ 6	> 2	**Six Axle Articulated** Six axle articulated vehicle, or Rigid vehicle and trailer	9	axles = 6 and groups > 2 or axles > 6 and groups = 3	
Medium Combination 17.5m to 36.5m	> 6	4	**B Double** B Double, or Heavy truck and trailer	10	groups = 4 and axles > 6	
	> 6	5 or 6	**Double Road Train** Double road train, or Medium articulated vehicle and one dog trailer (M.A.D.)	11	groups = 5 or 6 and axles > 6	
Large Combination Over 33.0m	> 6	> 6	**Triple Road Train** Triple road train, or Heavy truck and three trailers	12	groups > 6 and axles > 6	

Definitions: Group: Axle group, where adjacent axles are less than 2.1m apart
Groups: Number of axle groups
Axles: Number of axles (maximum axle spacing of 10.0m)
d(1): Distance between first and second axle
d(2): Distance between second and third axle

Typical Noise Levels