MARSHALL DAY Acoustics

PRECINCT 15

Environmental noise assessment

Rp 001 R01 2015051ML

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Project: **PRECINCT 15**
Environmental noise assessment

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1.0 INTRODUCTION

Marshall Day Acoustics Pty Ltd (MDA) has been commissioned to assess noise impacts associated with the proposed re-zoning of Precinct 15, Blackshaws Road, Altona North. This report updates MDA report 001 R01 2012234 entitled *Precinct 15, Blackshaws Road, Altona – Environmental Noise Assessment – Updated Phase 1 Report* dated 11 July 2012 following receipt of feedback from Hobsons Bay City Council dated December 2014.

A glossary of acoustic terms and symbols is provided in Appendix A.

1.1 Purpose of this assessment

The purpose of noise assessments undertaken at strategic level is to establish if the site is affected by environmental noise, and if it is, to establish whether the relevant criteria can be complied with. The final form of any noise mitigation should be determined at detailed design stage, as it is only at this stage that details relevant to the selection and design of mitigation measures are available. Accordingly, the primary purpose of this noise assessment is to establish the viability of the proposed uses at the site, rather than specific form and design detail of the proposed uses.

This assessment includes consideration of noise sources which may affect the amenity of proposed future uses on the site, in addition to existing commercial and industrial noise sources which may be encroached upon as a result o the introduction of new sensitive receivers at the site.

In the case of Precinct 15, the sources of environmental noise have been investigated sufficiently to determine that where excessive noise occurs, mitigation options are available that will adequately reduce the noise. The potential mitigation strategies that have been identified as adequate to achieve compliance with the relevant criteria include use of built form, noise barriers and acoustic treatment of dwellings.

The level of detail required at this stage can depend on the level of noise exposure. For example, we are informed that in the case of Amendment C82, the site was affected by significant levels of noise from an adjacent railyards. In that case, the level of investigation required is likely to be more substantial than Precinct 15, but the purpose of the investigation would still have been to establish that the relevant criteria can be complied with, and not necessarily to prepare specific recommendations.

This report establishes that where there is the potential for excessive noise, mitigation measures can be implemented to reduce the noise to acceptable levels. In most cases, however, further noise measurements and calculations will be required to determine the details of the mitigation measures implemented. Importantly, the appropriate mitigation measures would need to be determined on the basis of the design form and orientation of any buildings included as part of a subsequent planning permit application for the site, accounting for any changes in noise levels with time and any influences that the proposed built forms may have on the distribution of noise levels around the site.

2.0 SITE DESCRIPTION

2.1 Location and zoning

A map showing the subject site location and proposed rezoning is provided in Appendix B. The subject site is located in the northeast corner of Altona North and is currently zoned Industrial 1 (IN1Z) with a strip of Industrial 3 (IN3Z) along the eastern boundary. The site is bounded by:

- The SP Ausnet Brooklyn Terminal Station (zoned IN1Z) and the Westgate Freeway (RDZ1) to the north, with industrial uses north of the freeway
- The Newport to Sunshine railway line (PUZ4) at the northeast corner
- Residential (R1Z) land to the south, west and east
- The Department of Sustainability and Environment Fire Management and Equipment Development Centre on land zoned PUZ7 west of Kyle Road.

A small parcel of land zoned IN3Z west of Kyle Road is also part of the subject site.

Appendix C shows the current local zoning.

2.2 Sources of environmental noise

The subject site is affected by noise from:

- Traffic on the Westgate Freeway. This a major urban freeway, carrying over 160,000 vehicles per day
- Local commercial and industrial premises, including:
  - The electrical substation
  - The Fire Management and Equipment Development Centre
- The Italian Social Club
- Commercial and industrial premises on the subject site that may still be operating when development of the site for noise-sensitive uses commences
- Traffic on Blackshaws Road
- The railway line. This line carries only freight, but trains use the line at all times of the day and night, can be very long and are hauled by diesel locomotives.

Figure 1 indicates the location of these sources of noise.

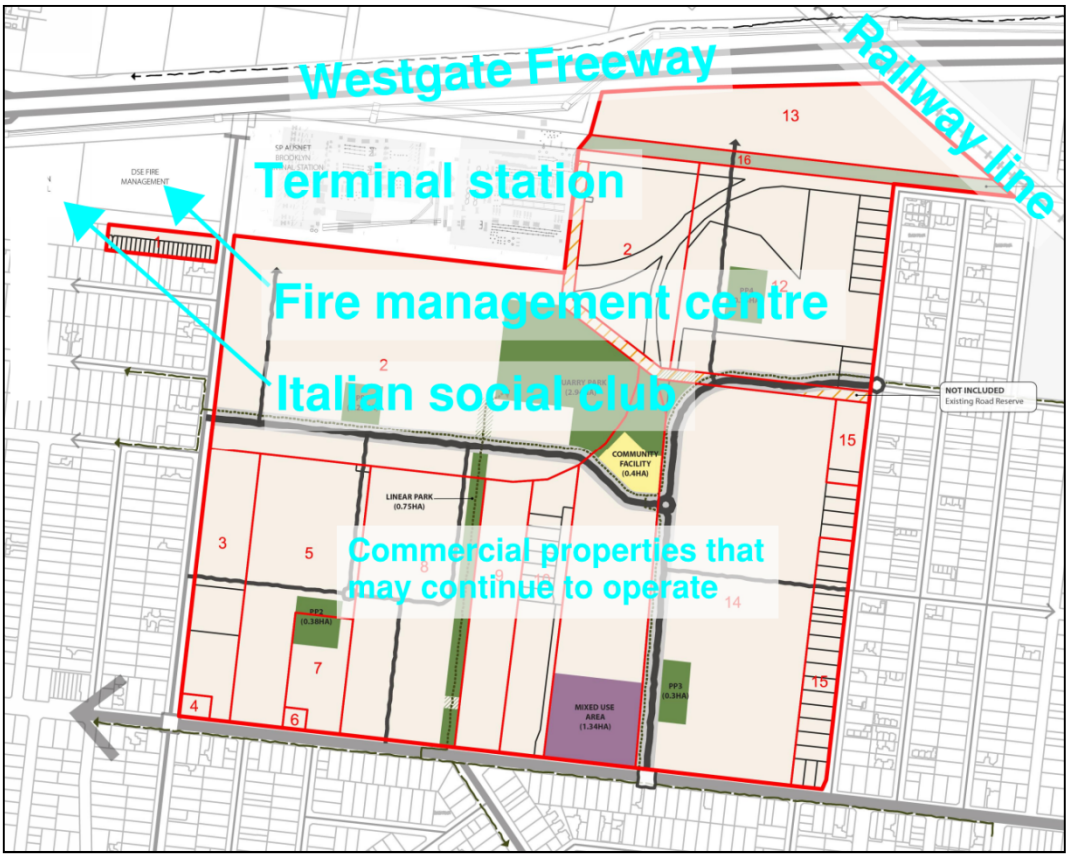


Figure 1: Sources of environmental noise

3.0 CRITERIA

3.1 Traffic noise

VicRoads has an internal policy which is used to determine entitlement to noise barriers in situations where VicRoads takes responsibility for noise mitigation. Since October 1997, this policy has been known as the *Traffic Noise Reduction Policy*. The Policy recommends noise level objectives for traffic noise throughout Victoria.

Where new developments are planned close to existing major traffic routes, the developer must take responsibility for noise mitigation. VicRoads is a referral authority, and so has the right to seek to impose requirements on residential developers seeking planning approvals for land adjacent to VicRoads-controlled roads. Guidance on VicRoads' usual requirements is provided in the VicRoads guideline *Requirements of Developers*. Guidance on interpretation and implementation of VicRoads' requirements is provided in Road Design Note RDN 6-1 *Interpretation and application of VicRoads Traffic Noise Reduction Policy 2005*.

A discussion of VicRoads' policy and guidelines is provided in Appendix D. In summary, VicRoads generally require that, in order to control traffic noise levels, the developer shall agree to undertake some combination of the following:

- Erect traffic noise barriers of sufficient height and suitable construction in order to reduce external noise levels to 63dB $L_{10(18h)}$ or less at the 'lowest habitable level' of affected buildings
- Provide sound insulation treatment to residential dwellings sufficient to achieve compliance with the recommended internal noise levels specified in Australian Standard

> 2107-2000 *Acoustics - Recommended design sound levels and reverberation times for building interiors*.

VicRoads has had an internal noise policy since 1979, and they have been responsible for noise barriers on new road projects (freeways, rural highways and major urban arterial roads) since that time. Since 1985, VicRoads' policy has also addressed retrofitting of noise barriers on freeways built prior to 1979. Thus, the policy only considers certain classes of roads.

Blackshaws Road is not a freeway and was constructed prior to 1979. Thus, VicRoads is unlikely to impose conditions regarding noise from traffic on Blackshaws Road. However, it is recommended by MDA that the VicRoads criteria be considered for residences or other noise-sensitive uses adjacent to Blackshaws Road.

3.2 Train noise

The *Victorian Passenger Rail Infrastructure Noise Policy* was released in April 2014. Section 5 of the policy sets out the conditions under which transport and planning bodies must apply the policy. Although the title of the policy suggests it only related to passenger rail noise, the policy states that:

> *Noise from both passenger rail and freight rail activity should be considered where the corridor is or is likely to also be used for freight rail operations.*

The policy sets 'investigation thresholds' for the assessment of noise. These are noise levels, which if exceeded, indicate that noise mitigation should be considered. It states that:

> *In considering changing land use near an existing passenger rail corridor, transport bodies and planning authorities should consider the receivers set out in Table B in Attachment 2. Transport bodies and planning authorities should consider whether the noise level produced at these receivers will exceed the investigation thresholds for the periods specified in Table B in Attachment 2.* [Table B of Attachment 2 is reproduced below as Table 1 in this report.]
>
> *If an assessment shows the investigation thresholds are not exceeded, noise impacts should be considered a secondary matter. This means no further action need be considered under this policy.*

The investigation thresholds are defined in terms of:

- $L_{Aeq,16h}$ – equivalent continuous daytime (0600-2200) noise level measured externally
- $L_{Aeq,8h}$ – equivalent continuous night-time (2200-0600) noise level measured externally
- L_{Amax} – maximum noise level measured externally.

Investigation thresholds for the redevelopment of land near existing rail infrastructure are presented in Table 1.

Table 1: Investigation thresholds for changing allowable land use near an existing rail corridor

Time	Type of receiver	Investigation thresholds		
Daytime (0600-2200)	Residential dwellings including aged person homes, hospitals, motels, caravan parks, and other buildings where people sleep. Noise sensitive community buildings including schools, kindergartens, libraries	65dB $L_{Aeq,16h}$	or	85dB L_{Amax}
Night-time (2200-0600)	Residential dwellings including aged person homes, hospitals, motels, caravan parks, and other buildings where people sleep.	60dB $L_{Aeq,8h}$	or	85dB L_{Amax}

The investigation thresholds are not design criteria. However, should the investigation thresholds be exceeded, then we recommend the following internal design criteria:

- Bedrooms: 55dB L_{Amax}
- Other living areas: 60dB L_{Amax}.

These limits are based on a precedent set in the Victorian Civil and Administrative Tribunal (VCAT) regarding acceptable internal noise levels for residences adjacent to railway lines (Reference No. P2470/2003). In this case, a decision to grant a permit was made on the basis that the noise level of trains was not to exceed 55dB L_{Amax} in bedrooms and 60dB L_{Amax} in living areas. These levels were based on the commonly-used criteria for sleep disturbance discussed in Section 3.2.1 below. In addition, the 55dB L_{Amax} criterion was specified by Public Transport Victoria (PTV) in 2012 in relation to a residential development adjacent to a mixed passenger/freight line in Braybrook.

3.2.1 Sleep disturbance

A document published in March 2011 by the New South Wales Government Office of Environment and Heritage (formerly the Office Environment Climate Change and Water) entitled *NSW Road Noise Policy* provides a review of research into the effect of environmental noise on sleep quality and has concluded the following:

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

3.3 Train vibration

Criteria for the response of humans to vibration are given in International Standard ISO 10137:2007 *Bases for design of structures - Serviceability of buildings and walkways against vibrations*.

This Standard specifies satisfactory magnitudes of building vibration with respect to human response using a number of frequency-dependent criteria, referred to as curves, applicable to different building uses. As some trains are expected to pass the site during the night, the applicable curve for this project is Curve 1.4 which sets criteria for the night for residential occupation. Also relevant is Curve 2, which is used for assessment during the day. Table 1

presents the vibration limits corresponding to curves 1.4 and 2 derived from the Standard and re-expressed as dB velocity.

Table 1: Vertical vibration criteria curves – ISO 10137:2007 Annex C Table C.1: dB re 10^{-6} mm/s rms

Criteria	Third octave band centre frequency								
	2	2.5	3.15	4	5	6.3	8	10-80	Hz
Curve 1.4 Night	118	115	112	109	107	105	103	103	dB
Curve 2 Day	121	118	115	112	110	108	106	106	dB

The maximum structural floor vibration due to routine train pass-bys should not exceed the limits in Table 1. Although not quoted in the standard, maximum train vibration is commonly assessed as the 95th percentile maximum of a representative sample of 15 -20 train pass-bys.

In addition to the magnitude of vibration, the human perception of vibration can also be affected by the exposure duration. ISO10137:2007 also provides a recognised criterion to assess vibration exposure over an 8-hour (night) or 16-hour (daytime) period. The Standard describes a parameter called the estimated Vibration Dose Value (VDV) which is a measure of the total energy experienced for a range of separate events, based on the vibration amplitude of each event, the number of events per period and the duration of each event. By assessing the VDV, the overall impact of all train events over a nominated period can be established. The VDV criteria reproduced from the Standard is presented in Table 2 below.

Table 2: VDV criteria from ISO 10137:2007 Annex C Table C.2: m/s$^{1.75}$

Residential buildings	Low probability of adverse comment	Adverse comment possible	Adverse comment probable
16hr Day	0.20 – 0.40	0.40 – 0.80	0.80 – 1.6
8hr Night	0.13	0.26	0.51

Thus, by utilising the criteria of Table 1 and Table 2, the structural vibration impacts of railway line proximity to the site can be assessed in magnitude and exposure. Although compliance with these criteria will reduce structural vibration to well below that which may lead to building structural damage and not be injurious to health, rail related vibration may still be perceptible at times.

3.4 Noise from industry

3.4.1 SEPP N-1

The relevant legislation governing noise from commerce and industry in metropolitan Melbourne is *State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade)* No. N-1 (SEPP N-1).

SEPP N-1 specifies a procedure to determine environmental noise limits at residences close to industry. According to this procedure, external noise limits at a noise-sensitive receiver

location (typically a residential property) are determined by consideration of the ambient background noise levels (L_{A90}) and the "zoning level" for that property. Noise limits are determined for each of the day, evening and night periods.

The zoning level is determined based on the land use in the area within a 200m radius of the receiver location. A high zoning level would apply in an industrial area and a low zoning level would apply in a residential area. Existing background noise levels are compared to the zoning level to determine any necessary adjustments. Where background noise levels are high or low compared to the zoning level, the noise limit is adjusted based on the background noise level. Where background noise levels are "neutral" (ie, not significantly different) compared to the zoning level, the noise limit is based on the zoning level only.

3.4.2 Future zoning

It is proposed to rezone the site as residential in all areas except for the proposed Mixed Use Zone on Blackshaws Road (see Appendix B). Table 2 identifies areas on the subject site that would be adjacent to commercial land uses and describes the zoning relevant to each location.

Table 2: Sites that would be adjacent to commercial land uses

	Subject site location and neighbouring land use	Zoning
1	Near the electrical substation	Residential, with Industrial (IN1Z) nearby
2	Near the Fire Management and Equipment Development Centre	Residential, with Public Use Zone (PUZ7) nearby
3	Near the proposed Mixed Use Zone	Residential, with Mixed Use Zone (MUZ) nearby
4	At the centre of the site, near the boundary between the first stages of residential development and the on-site industrial uses that will be in place during the transition to entirely residential use	Residential

These locations are identified in Figure 2.

Figure 2: Sites adjacent to commercial land uses
Blue text designates locations referred to in Table 2

Table 3 shows the SEPP N-1 zoning levels based on the future zoning at the locations identified in Table 2 and Figure 2.

Table 3: SEPP N-1 zoning levels

Period	Day of week	Start time	End time	Zoning level			
				Location 1	Location 2	Location 3	Location 4
Day	Mon-Fri	0700hrs	1800hrs	54	54	52	50
	Sat	0700hrs	1300hrs				
Evening	Mon-Fri	1800hrs	2200hrs	48	48	46	44
	Sat	1300hrs	2200hrs				
	Sun, Pub Hol	0700hrs	2200hrs				
Night	Mon-Sun	2200hrs	0700hrs	43	43	41	39

3.4.3 Noise limits

As discussed above, SEPP N-1 noise limits are dependent on zoning and on the ambient background noise levels. Based on the location of the site, the types of sources affecting noise levels at the site, and the indicative measured noise levels detailed in Section 4.2.2,

background noise levels at the site are not expected to be designated as low, and would either be classified as either neutral or high under SEPP N-1 depending on the specific location on the site. Thus, the SEPP N-1 noise limits will generally be equal to or higher than the zoning levels shown in Table 3, namely:

- Day: 50-54dB
- Evening: 44-48dB
- Night: 39-43dB.

3.5 Music noise

Music noise from entertainment venues such as the Italian Club is controlled in the State of Victoria by *State Environment Protection Policy (Control of Music Noise from Public Premises) No. N-2* (SEPP N-2). Compliance with SEPP N-2 is mandatory in the State of Victoria.

Where the level of music noise emissions exceeds limits set by SEPP N-2, it is the responsibility of the operator of the venue generating the music noise to take steps to reduce emissions. As the agent of change in this situation, Precinct 15 Landowners will need to ensure that the Italian Club does not come under new obligations as a result of new noise-sensitive uses coming into the area. However, the club is already close to existing residences, and compliance at existing residences is likely to ensure compliance at any new residences.

For indoor venues, SEPP N-2 sets noise limits as shown in Table 4.

Table 4: SEPP N-2 criteria

Time period		Noise limit
Day	0700-1800hrs	Music noise (L_{Aeq}) not permitted to exceed background noise (L_{A90}) plus 5dB.
Evening	1800-2200hrs	Music noise (L_{Aeq}) not permitted to exceed background noise (L_{A90}) plus 5dB.
Night	2200-0700hrs	Music noise (L_{OCT10}) is not permitted to exceed the background noise level (L_{OCT90}) by more than 8dB in any octave band (63Hz-4kHz) at a noise-sensitive area.

4.0 NOISE MEASUREMENTS

4.1 Purpose

As discussed in Section 1.1, the purpose of this report is to establish if the site is affected by environmental noise, and if it is, to establish whether the relevant criteria can be complied with. The measurements described herein are sufficient for this purpose, but in most cases, further noise measurements will be required to determine the details of the mitigation measures implemented. These details will be dependent on the particular form and arrangement of buildings proposed as part of any subsequent planning permit application for the site, and any influence these proposed buildings could have on noise levels across the site (in terms of both screening and reflection of noise).

4.2 Westgate Freeway

Measurement of noise from traffic on the Westgate Freeway was undertaken using an Acoustic Research Laboratories Environmental Logger Type EL-316, which was left in place during 9-11 February 2010, and manually using a Rion NA-27 Sound Level Meter on 17 February 2010 at approximately 12 midday. Accurate calibration of the instruments was confirmed before and after measurements. Details of the instrumentation are provided in Appendix E.

4.2.1 Noise monitoring

The noise monitor was placed on the site at a distance of approximately 160m from the boundary of the freeway reserve. Figure 3 shows the location of the noise monitor.

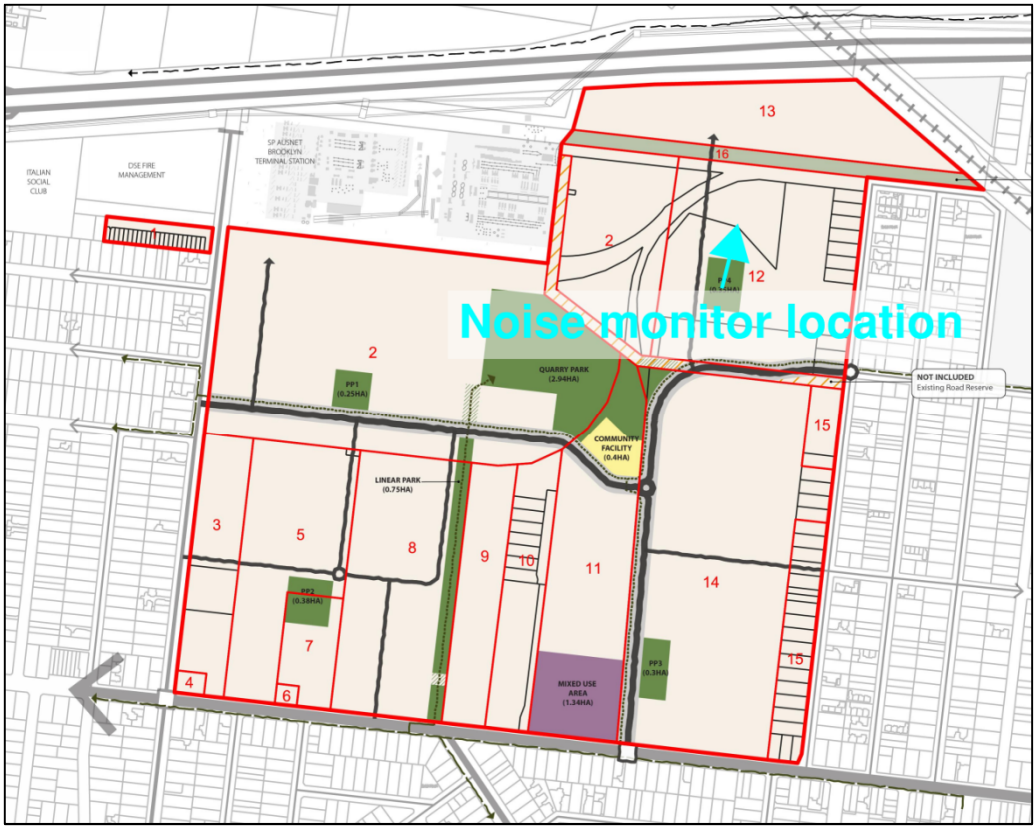


Figure 3: Noise monitor location

Table 5 shows the measured $L_{A10(18h)}$ on each day, with comments about the acceptability of the weather conditions.

Table 5: Measured noise levels, dB $L_{A10(18h)}$

Date	$L_{A10(18h)}$	Weather conditions (Laverton weather station)
9 February	55	7-20km/hr generally from the south
10 February	60	6-20km/hr mostly from the north, with occasional calm periods
11 February	56*	18mm rain between 3pm and 8pm

* Measured level was 59dB but appeared affected by extraneous noise. The anomalous values were removed from the data to determine the value shown

The noise levels appear to be affected by the wind speed and direction. None of the weather conditions were acceptable for road traffic noise measurement, but it is likely that the 60dB figure obtained on 10 February is the most reliable, and may be somewhat conservative (high).

Details of the measured noise levels are provided in Appendix F.

4.2.2 Manual measurement

Noise from the Westgate Freeway was measured on the freeway reserve boundary at the north end of Kyle Road for a period of 8 minutes. The L_{A10} noise level was 84dB. Figure 4 shows the measurement position. Details of the measurement time and duration are provided in Appendix G.

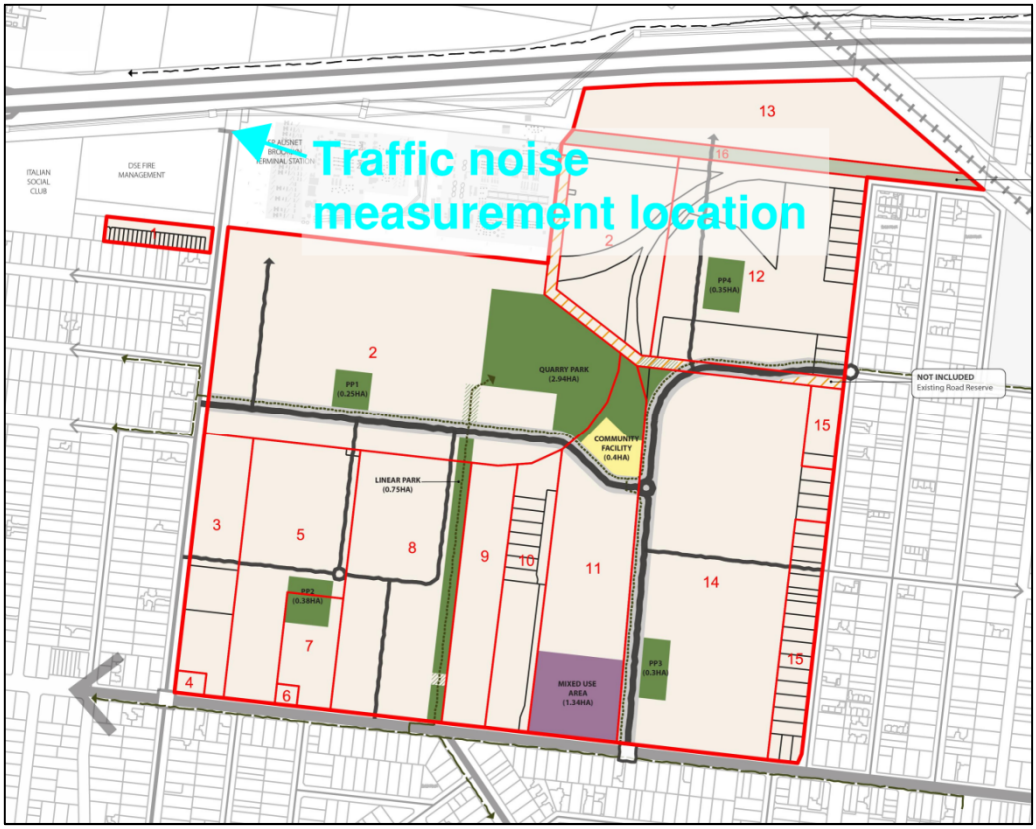


Figure 4: Manual traffic noise measurement position

4.3 Noise survey

Noise levels were measured at a number of locations on the site and in nearby streets during the day, evening and night on 21-22 January 2010 and 8 February 2010. The measurement locations are shown in Figure 5.

Figure 5: Noise survey measurement locations

The measured noise levels are shown in Table 6. Details of the measurement times and durations are provided in Appendix G.

Table 6: Noise levels on and near the site, dB

Location	Period	Background level (L_{A90})	Average level (L_{Aeq})	Average maximum level (L_{A10})
1	Day	53	57	59
	Evening	59	61	63
	Night	53	60	63
2	Day	41	45	47
	Evening	56	58	60
	Night	52	55	57
3	Day	48	53	55
	Evening	53	57	59
	Night	49	54	58
4	Day	38	59	54
	Evening	45	53	53
	Night	43	46	48

Location	Period	Background level (L_{A90})	Average level (L_{Aeq})	Average maximum level (L_{A10})
5	Day	54	68	72
	Evening	48	61	67
	Night	46	59	59

The measured noise levels shown in the table represent a snapshot of conditions at the time of the measurements and do not represent the lowest potential ambient noise levels. For example, in some cases, night and evening noise levels were higher than day noise levels. This could be due to variations in wind conditions, or some of the measurements could be affected by insect noise present on the warm summer evenings and nights at that time of year.

The highest average noise levels and average maximum noise levels were in Blackshaws Road, Location 5, as the measurement location was only 5m from the kerb.

At the other sites, the highest daytime average maximum noise levels were at locations 1 and 3, near the freeway. This pattern is also evident in the daytime average noise levels, except for the measurement at Location 4, which was affected by a bus pass-by. Note that this brief, noisy event caused the daytime average noise level to be higher than the average maximum noise level. This is because the event was too brief to significantly affect the average maximum (L_{A10}), which is a statistical measure, but added a significant quantity of sound energy to the average noise level, which is an equivalent-energy average.

At Location 1, traffic on the freeway was the dominant noise source, although noise from the electrical substation was also audible. As indicated in Appendix G and discussed above, there were a number sources of noise contributing to the measured levels. The intent of the measurements was not to single out particular noise sources and measure those to the exclusion of others, but to provide a measure of levels due to all contributing sources.

4.4 Railway noise

Noise from trains on this line was measured by MDA on 8 May 2006 and 9 July 2009, approximately 20m from the railway line. The measured noise levels are presented in Table 7.

Table 7: Train noise measurements

Description	Noise level, dB L_{Amax}
Freight train 40+ cars	84
Freight train 20+ cars	85

5.0 ASSESSMENT

5.1 Traffic noise – Westgate Freeway

As discussed in Section 4.2, the measured noise level was 60dB $L_{A10(18h)}$ at 160m from the Westgate Freeway boundary and the short-term noise level was 84dB L_{A10} at the boundary. As the measurement was at about 12pm, it would be approximately equal to the $L_{A10(18h)}$. Table 8 shows how these values can be adjusted to determine the approximate $L_{A10(18h)}$ at future residences. Note that the figure at 160m assumes open space between the residence and the freeway.

Table 8: Future traffic noise level at residences near the Westgate Freeway, dB $L_{A10(18h)}$

	At the boundary	At 160m
Measured value	84	60
Traffic growth	+1	+1
Facade effect*	+3	+3
Future noise level	88	64

* Due to reflections of sound from the facade of the building

The estimated future noise levels are 25dB higher than the VicRoads noise objective of 63dB $L_{A10(18h)}$ at the boundary and 1dB higher at 160m.

At the boundary, noise levels are extremely high. This should not prohibit residential use, but it is clear that careful design attention will be required to ensure acceptable amenity inside dwellings adjacent to the freeway and in associated outdoor living areas. It is likely that a combination of noise barriers and built form combined with acoustic treatment of the dwellings themselves will be required. Options for management of road traffic noise are discussed in Section 6.0.

5.2 Traffic noise – Blackshaws Road

As shown in Table 6, the measured noise level was 72dB L_{A10} on the footpath. As the measurement was at about 1:30pm, it would be approximately equal to the $L_{A10(18h)}$. Table 9 shows how this value can be adjusted to determine the approximate $L_{A10(18h)}$ at future residences.

Table 9: Future noise level at residences on Blackshaws Road, dB $L_{A10(18h)}$

Item	Noise level
Measured value	72
Assume dwelling facade is 5m from footpath	-3
Traffic growth	+1
Facade effect*	+3
Future $L_{A10(18h)}$	73

* Due to reflections of sound from the facade of the building

The estimated future noise level is 10dB higher than the VicRoads noise objective of 63dB. Some combination of noise barriers or acoustic treatment of the dwellings will be required. The future noise level estimate is based on one short-term measurement and will need to be confirmed by longer-term measurements as part of future planning permit applications.

Options for management of road traffic noise are discussed in Section 6.0.

5.3 Train noise

The distance from the centreline of the nearest railway track to the subject site boundary is approximately 20m. Thus maximum noise levels from train pass-bys are likely to be 84-85dB L_{Amax} as shown in Table 7.

This is approximately equal to the 85dB L_{Amax} threshold specified in Table 1 under the *Victorian Passenger Rail Infrastructure Noise Policy*. Only the maximum noise level is considered here, as this line carries very little traffic. The 65dB $L_{Aeq,16h}$ and 60dB $L_{Aeq,8h}$ thresholds are averages, and with so little train traffic, the average noise levels will be below these thresholds.

The measured noise levels are close to the 85dB L_{Amax} threshold under the current rail noise policy. It is likely that additional measurements undertaken as part of a detailed planning application would indicate a range of results, including values marginally higher than the 85dB L_{Amax} trigger.

If the threshold is exceeded, dwellings located near the railway are likely to require acoustic treatment to ensure compliance with the internal criteria, and these measures will require an account of the low frequency characteristics associated with diesel locomotive engine noise.

Even if the threshold is not exceeded, consideration should be given to compliance internally with the criteria for sleep disturbance cited in Section 3.2, namely:

- Bedrooms: 55dB L_{Amax}
- Other living areas: 60dB L_{Amax}.

5.4 Train vibration

Vibration levels due to freight train movements have been measured previously at other locations by Marshall Day Acoustics.

Vibration will be attenuated by:

- Distance of buildings from the railway line
- Coupling losses between the ground and the foundation of the buildings
- Losses as vibration progresses through the structure of the buildings.

Initial calculations based on previous measurements demonstrate that vibration levels are expected to be low and that residential development could be viably accommodated at the site and achieve the vibration criteria specified in Section 3.2.1 for both transient and average exposure vibration levels.

Depending on the positions and types of structures proposed as part of any future planning permit application, acceptable vibration levels may potentially be achieved without dedicated vibration management measures. This should however ultimately be confirmed

as part of detailed assessments in support of any future planning permit application, including details of any specific foundation or treatments proposed to maintain compliance with the criteria, for the properties adjacent to the railway reserve, namely properties 13 and 16.

For example, should the buildings at the site boundary be of timber construction, building resonances which could amplify vibration should be taken into account. If timber construction is envisaged, a detailed analysis should be undertaken before the development proceeds.

5.5 Commercial and industrial noise

As the agent of change in this situation, Precinct 15 landowners will need to ensure that local industry does not come under new obligations as a result of new noise-sensitive uses coming into the area.

The nearby industrial or commercial land use that is most definite to persist into the future is the electrical terminal station. The boundary of the terminal station is currently 70m from the nearest residences, but would be immediately adjacent to any new residences built next to it.

Because of the dominance of noise from traffic on the Westgate Freeway, noise from existing industry was not readily measurable and, generally, not audible. Discussions should take place with the owners and operators of adjoining commercial and industrial premises at the detailed design stage to allow noise measurements under typical worst-case operating conditions.

Any industry still operating on the site when noise-sensitive uses commence may also require detailed assessment. Such reverse amenity assessments will, of course, take into account any existing SEPP N-1 obligations currently constraining industry.

For the electrical terminal station and any industry remaining on the subject site, noise control solutions include:

- Noise barriers
- Use of built form in a manner similar to that described in Section 6.2.1
- At-source noise mitigation measures such as enclosures or attenuators installed with the cooperation of the owners and operators of the noise-generating premises.

5.6 Music noise

The Italian Club is the only source of music noise near the subject site. The distance from the club to existing residences is similar to the future distance to the subject site. It is likely that compliance with the regulations at the existing residences will ensure compliance at new dwellings on the subject site.

6.0 MITIGATION OF ROAD TRAFFIC NOISE

6.1 Noise barriers

6.1.1 Westgate Freeway

If noise barriers form part of the mitigation measures for road traffic noise , a noise barrier approximately 8m high next to the Westgate Freeway may be required to comply with VicRoads' traffic noise objective of 63dB $L_{A10(18h)}$ at ground level locations.

In many cases, the best location for noise barriers is generally on the road reserve, as the barrier then becomes a VicRoads asset, allowing VicRoads greater control over aesthetic and landscape design, and placing responsibility for maintenance clearly with VicRoads. An amount is paid to VicRoads to cover maintenance for an initial period, generally ten years.

If built form is used to mitigate noise, VicRoads may require that the buildings be built at least 3-5m in from the property boundary to allow access to the rear of the buildings for maintenance. This is in order to ensure that the buildings can be maintained by the owners or body corporate without needing to enter the road reserve.

The details of these options for noise mitigation have been discussed with VicRoads' noise expert. The solutions are considered feasible, and VicRoads have advised they would be prepared to examine the matter in more detail on referral as part of any future detailed planning application for the site.

6.1.2 Blackshaws Road

Noise barriers are not considered to be an appropriate design solution, as residences will front onto Blackshaws Road. Acoustic treatment of future residences is discussed in Section Section 6.2.2.

6.2 Use of built form to mitigate noise

6.2.1 Westgate Freeway

A solid row of townhouses or apartments can be constructed along the Westgate Freeway boundary to act as a noise barrier, shielding the remainder of the site from noise. Inside these dwellings, noise-tolerant areas such as toilets, bathrooms, laundries, kitchens and storage areas can be located on the side of the building nearest the road, with noise-sensitive areas such as bedrooms furthest away. The facade facing the freeway would potentially require a very high noise reduction rating to achieve the internal noise levels outlined in Australian Standard AS2107-2000 Acoustics - Recommended design sound levels and reverberation times for building interiors. A sufficiently high rating is considered viable, and could be achieved with common types of residential facade construction techniques, but will require careful consideration of all elements of the facade.

It is likely that the row of dwellings will need to be at least 8m high to provide sufficient shielding for the external living areas and the rest of the estate. The wall facing the freeway will need careful design and might typically consist of:

- 150mm thick concrete or brick panel
- 20mm airgap
- 50mm steel stud

- 2 layers 13mm thick high density plasterboard or equivalent
- 50mm thick sound absorptive material in the cavity.

Any windows facing the freeway would be limited in size and double glazed. The glazing might typically consist of:

- 6.38mm laminated glass
- 200mm air gap
- 10.38mm laminated glass.

These are indications of the type of noise mitigation solution that may be required, included here to demonstrate the high level of noise reduction required, and are not recommendations. The final solution will be determined at the detailed design stage.

Any external living areas would be located at the front of the dwellings, shielded from the noise. Very high noise reductions can be achieved using this approach. For example, at Herriot's Glen, adjacent to the Monash Freeway, noise levels in the front yards are 30dB quieter than at the rear of the dwellings.

If built form is used to mitigate noise, VicRoads may require that the buildings be built at least 3-5m in from the property boundary to allow access to the rear of the buildings for maintenance. This is in order to ensure that the buildings can be maintained by the owners or body corporate without needing to enter the road reserve.

6.2.2 Blackshaws Road

A similar principle can be used for the interface with Blackshaws Road, only in this case, the residences are likely to face Blackshaws Road, shielding the backyards from noise. Single- or multi-storey buildings would be suitable, but may require some controls on building envelopes to ensure that the gaps between buildings were minimised and the external living areas were located at the rear.

Acoustic treatment of dwellings

Dwellings fronting onto Blackshaws Road might typically require:

- Brick veneer or special-construction lightweight walls
- 6.76mm laminated glass windows with good seals
- Acoustic insulation in ceiling
- 2 layers of plasterboard on bedroom ceilings
- Solid core external doors with foam seals
- A means of ventilating the dwellings that will allow the windows to be kept closed if desired.

7.0 SUMMARY

7.1 Traffic noise

- The subject site is affected by noise from traffic on the Westgate Freeway and Blackshaws Road.
- Noise from traffic can be adequately mitigated using a variety of measures including noise barriers, built form, and acoustic treatment of dwellings.
- If noise barriers were used on the Westgate Freeway, the height of the barriers are likely to be approximately 8m.
- Acoustic treatment of dwellings would consist of roof/ceiling and facade upgrades, including heavy glazing and well-sealed solid doors.

7.2 Rail noise and vibration

- Preliminary noise measurements indicate that existing noise levels adjacent to the railway line are close to the investigation threshold specified in the *Victorian Passenger Rail Infrastructure Noise Policy*. Further noise measurements are recommended at the detailed design stage as part of any planning permit application relevant to the properties adjacent to the railway reserve, namely properties 13 and 16.
- If the threshold is exceeded, internal design criteria of 55dB L_{Amax} in bedrooms and 60dB L_{Amax} in other living areas are recommended.

7.3 Industrial and commercial noise

- Noise from the electrical terminal station and any industry still operating on the site when noise-sensitive uses commence will have to comply with SEPP N-1.
- As the agent of change in this situation, Precinct 15 landowners will need to ensure that local industry does not come under new obligations as a result of new noise-sensitive uses coming into the area.
- Noise barriers or use of built form could be used to attenuate noise, or at-source noise mitigation measures implemented with the cooperation of the owners and operators of the noise-generating premises.

7.4 Music noise

- The distance from the Italian Club to existing residences is similar to the future distance to the subject site. It is likely that compliance with the regulations at the existing residences will ensure compliance at new dwellings on the subject site.

7.5 Conclusion

Environmental noise can be effectively managed with appropriate design of mitigation measures implemented as part of any proposed future uses at the site. It is recommended that any rezoning planning controls include requirements that detailed acoustic reports must be prepared to support planning permit applications for sensitive uses at the site, including an account of amenity at the proposed development, and impacts to the ongoing operational viability of surrounding commercial and industrial operations. Such reports should include an account of existing transportation noise sources in the area in terms of both airborne noise and ground borne vibration.

APPENDIX A GLOSSARY OF TERMINOLOGY

dB	Unit of overall noise level, in decibels.
A-weighting	Filtering of measured sound to approximate the average human hearing response. An A-weighted noise level will have 'A' in the subscript or show the unit 'dBA'.
Ambient	The ambient noise level is the noise level measured in the absence of the intrusive noise or the noise requiring control. Ambient noise levels are frequently measured to determine the situation prior to the addition of a new noise source.
L_{A90}	The noise level exceeded for 90% of the measurement period. This is commonly referred to as the background noise level.
L_{Aeq}	Equivalent continuous noise level, which is the constant sound level over a stated time period which is equivalent in total sound energy to the time-varying sound level measured over the same time period. Often referred to as the 'average noise level' measured over a specific time period.
L_{eff}	The effective noise level of commercial or industrial noise determined in accordance with *State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) No. N-1* (SEPP N-1). This is the L_{Aeq} noise level over a half-hour period, adjusted for the character of the noise. Adjustments are made for tonality, intermittency and impulsiveness.
L_{A10}	Non-continuous noise levels are described in terms of the level exceeded for 10% of the measurement period (L_{10}). This is commonly referred to as the typical maximum level and is generally measured in dB.
$L_{A10(18h)}$	The arithmetic average of the 18 one-hour L_{A10} measurements (or predictions) between 0600-0000hrs.

APPENDIX B LAND USE PLAN

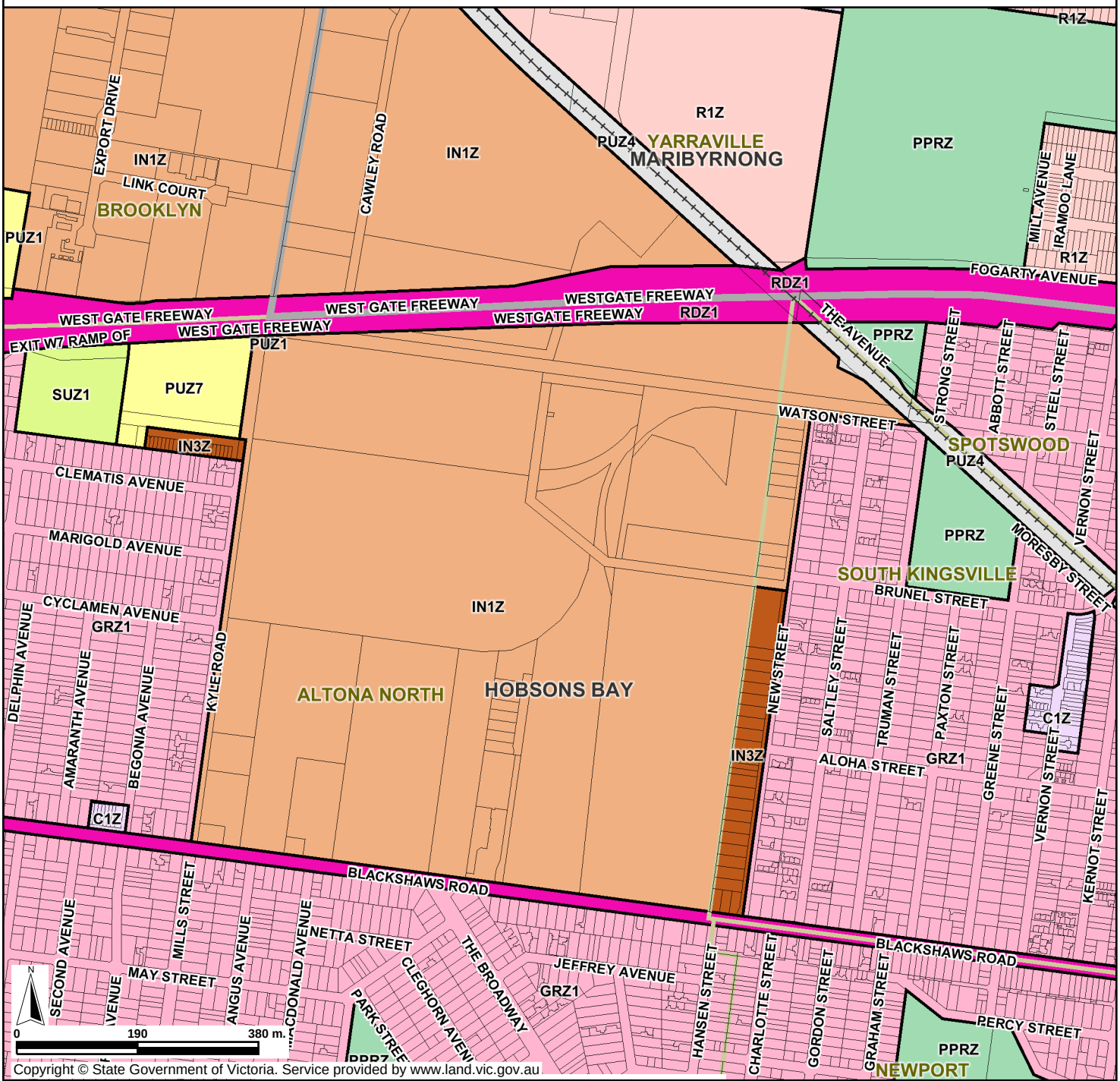

CAWLEY INDUSTRIAL PARK
MCIVOR RESERVE
SP AUSNET BROOKLYN TERMINAL STATION
ITALIAN SOCIAL CLUB
DSE FIRE MANAGEMENT
EDWARDS RESERVE
RJ COOPER RESERVE
NEWPORT LAKES PARK
NOT INCLUDED
Encumbered Open Space
Drainage Easement Land
NOT INCLUDED
Existing Road Reserve
PP1 (0.25HA)
PP2 (0.38HA)
PP3 (0.3HA)
PP4 (0.35HA)
QUARRY PARK (2.94HA)
COMMUNITY FACILITY (0.4HA)
LINEAR PARK (0.75HA)
MIXED USE AREA (1.34HA)
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16

APPENDIX C CURRENT ZONING

Planning Map

Local zoning - Precinct 15

Department of Transport, Planning and Local Infrastructure



Legend

WARRNAMBOOL Major Town
Major Road, Road
BOURKE STREET Road name
Railway, Tramway
Property/Parcel, Selected
25 2 1C Address, Lot, Crown allotment
River, Stream, Coastline
Waterbody
Locality
SEDDON Locality Name
Local Government Area
BRIMBANK Local Government Name
Urban Growth Boundary (UGB)
Area outside the UGB
Investigation Area
Land added to UGB since 2005
Boundary of Searched Suburb

ZONES

- ACZ - Activity Centre
- B1Z - Commercial 1
- B2Z - Commercial 1
- B3Z - Commercial 2
- B4Z - Commercial 2
- B5Z - Commercial 1
- C1Z - Commercial 1
- C2Z - Commercial 2
- CA - Commonwealth Land
- CCZ - Capital City
- CDZ - Comprehensive Development
- DZ - Dockland
- ERZ - Environmental Rural
- FZ - Farming
- GRZ - General Residential
- GWAZ - Green Wedge A
- GWZ - Green Wedge
- IN1Z - Industrial 1
- IN2Z - Industrial 2
- IN3Z - Industrial 3
- LDRZ - Low Density Residential
- MUZ - Mixed Use
- NRZ - Neighbourhood Residential
- PCRZ - Public Conservation & Resource
- PDZ - Priority Development
- PPRZ - Public Park & Recreation
- PUZ1 - Public Use - Service & Utility
- PUZ2 - Public Use - Education
- PUZ3 - Public Use - Health Community
- PUZ4 - Public Use - Transport
- PUZ5 - Public Use - Cemetery/Crematorium
- PUZ6 - Public Use - Local Government
- PUZ7 - Public Use - Other Public Use
- PZ - Port
- R1Z - General Residential
- R2Z - General Residential
- R3Z - General Residential
- RAZ - Rural Activity
- RCZ - Rural Conservation
- RDZ1 - Road - Category 1
- RDZ2 - Road - Category 2
- RGZ - Residential Growth
- RLZ - Rural Living
- RUZ - Rural
- SUZ - Special Use
- TZ - Township
- UFZ - Urban Floodway
- UGZ - Urban Growth

OVERLAYS

- AEO - Airport Environs
- BMO - Bushfire Management (also WMO)
- CLPO - City Link Project
- DCPO - Development Contributions Plan
- DDO - Design & Development
- DDOPT - Design & Development Part
- DPO - Development Plan
- EAO - Environmental Audit
- EMO - Erosion Management
- ESO - Environmental Significance
- FO - Floodway
- HO - Heritage
- IPO - Incorporated Plan
- LSIO - Land Subject to Inundation
- MAEO1 - Melbourne Airport Environs 1
- MAEO2 - Melbourne Airport Environs 2
- NCO - Neighbourhood Character
- PO - Parking
- PAO - Public Acquisition
- RO - Restructure
- RCO - Road Closure
- SBO - Special Building
- SLO - Significant Landscape
- SMO - Salinity Management
- SRO - State Resource
- VPO - Vegetation Protection

Map Centre - Melways 41 E12
Map Scale 1:9,022
February 3, 2015 2:53:40 PM

State Government Victoria

APPENDIX D ROAD TRAFFIC NOISE CRITERIA

VicRoads' *Requirements of Developers*

VicRoads generally require that, in order to control traffic noise levels, the developer shall agree to undertake one (or both) (or some combination) of the following:

- Erect traffic noise barriers of sufficient height and suitable construction in order to reduce external noise levels to 63dB $L_{A10(18h)}$ or less
- Provide sound insulation treatment to residential dwellings sufficient to achieve compliance with the recommended internal noise levels specified in Australian Standard 2107-2000 *Acoustics - Recommended design sound levels and reverberation times for building interiors*.

External noise levels

The VicRoads traffic noise objective is expressed as an $L_{A10(18h)}$ figure, in dB, which is the average of all of the individual hourly L_{A10} values between 6am and midnight on any day. VicRoads' objective is that traffic noise levels should not exceed 63dB $L_{A10(18h)}$ at 1m from the worst-affected facade of a residential dwelling, measured at the centre of the window on the lowest habitable level. Thus, VicRoads' external criterion applies at or close to ground level only.

VicRoads' preferred noise mitigation solution is generally the use of noise barriers of sufficient height to achieve compliance with the 63dB noise level objective. If, in consultation with VicRoads, it is agreed that strict compliance with the 63dB noise level objective has undesirable impacts (such as overshadowing, or impacts on visual amenity), lower noise barriers can be considered, provided that acoustic treatment is applied to any residence where 63dB may be exceeded.

Internal noise levels

Australian Standard 2107-2000 *Acoustics - Recommended design sound levels and reverberation times for building interiors* provides recommendations for acceptable internal noise levels. Table D1 shows the recommended internal noise levels stated in AS2107 for "houses and apartments near major roads."

Table D1

AS2107 recommended internal noise levels, Leq dB

Area	Recommended internal noise level	
	Satisfactory	Maximum
Living areas	35	45
Sleeping areas	30	40
Work/utility areas	35	45
Apartment common areas (eg; lobbies)	45	55

Compliance with the "satisfactory" level is preferred, but compliance with the "maximum" noise level is acceptable.

Measurement duration

AS2107 does not specify the measurement procedure to determine whether compliance has been achieved but does state the following:

> *In situations where traffic (or other) noise levels may vary widely over a 24-hour period, measurements to assess compliance with this Standard should be taken at the relevant time according to the area of occupancy or activity in the building.*

Given the above, it could be argued that compliance measurements for bedrooms should be made during the night period between 2200-0700hrs (commonly referred to as the night period), although this does not allow for those occupants who may be shift workers or such like that may have a requirement to sleep during the day. For living and dining rooms, the compliance measurement should be made during the day and evening time periods of 0700-2200hrs (commonly referred to as the day/evening period).

AS2107 does not specify the noise measurement duration. It is recommended that compliance generally be assessed based on the typical worst-case 15-minute Leq noise level throughout the relevant time period (eg, night-time for bedrooms).

APPENDIX E INSTRUMENT DETAILS

Instrument	Make	Model	Serial number
Noise monitor	Acoustic Research Laboratories	EL-316	16-707-024
Sound level meter	Rion	NA-27	00270190
Sound level calibrator	Brüel & Kjær	4230	1691204

APPENDIX F NOISE MONITORING RESULTS

Logger Measurements

Date:	Wednesday, 4 February 2015
File name:	\\mda-dc01\p\Proposal\2014\201405dy\04 Calculations\[20100209 Precinct 15 logger (file from old job cleaned up for appendices).xlsx]Logger_Summary
Job number:	2010016
Job name:	Precinct 15, Blackshaws Road, Altona North
Initials:	NP
Measurement Dates:	Tuesday, 09 February 2010 to Thursday, 11 February 2010
Weather during Measurement:	0 0
Notes:	22-46 New Street, South Kingsville 0 0 0

OVERVIEW SHEET - DAILY AVERAGES OVER ENTIRE MEASUREMENT PERIOD

Noise Level, dBA	Leq	L10	L90	Lmax	NOTES
24-hour	62	57	51	111	
18-hr (0600-0000)	63	57	52	111	
Day 15-hr (0700-2200)	64	57	52	111	
Night 9-hr (2200-0700)	55	51	44	103	
Lday (0700-1800)	64	57	52	111	
Levening (1800-2200)	62	56	52	77	
Lnight (2200-0700)	55	51	44	103	
LDN	64				
LDEN	66				
00:00 - 01:00	56	57	51	69	
01:00 - 02:00	53	56	48	73	
02:00 - 03:00	52	54	46	69	
03:00 - 04:00	51	54	46	66	
04:00 - 05:00	53	56	47	66	
05:00 - 06:00	55	59	50	70	
06:00 - 07:00	59	62	54	74	
07:00 - 08:00	61	62	58	71	
08:00 - 09:00	59	61	55	73	
09:00 - 10:00	58	59	54	72	
10:00 - 11:00	57	59	51	71	
11:00 - 12:00	56	56	49	91	
12:00 - 13:00	52	53	49	71	
13:00 - 14:00	52	53	48	78	
14:00 - 15:00	52	54	48	73	
15:00 - 16:00	58	56	51	81	
16:00 - 17:00	62	59	54	76	
17:00 - 18:00	74	59	55	72	
18:00 - 19:00	58	56	52	77	
19:00 - 20:00	59	57	53	74	
20:00 - 21:00	66	59	51	71	
21:00 - 22:00	59	56	51	74	
22:00 - 23:00	55	57	51	70	
23:00 - 24:00	56	57	52	67	

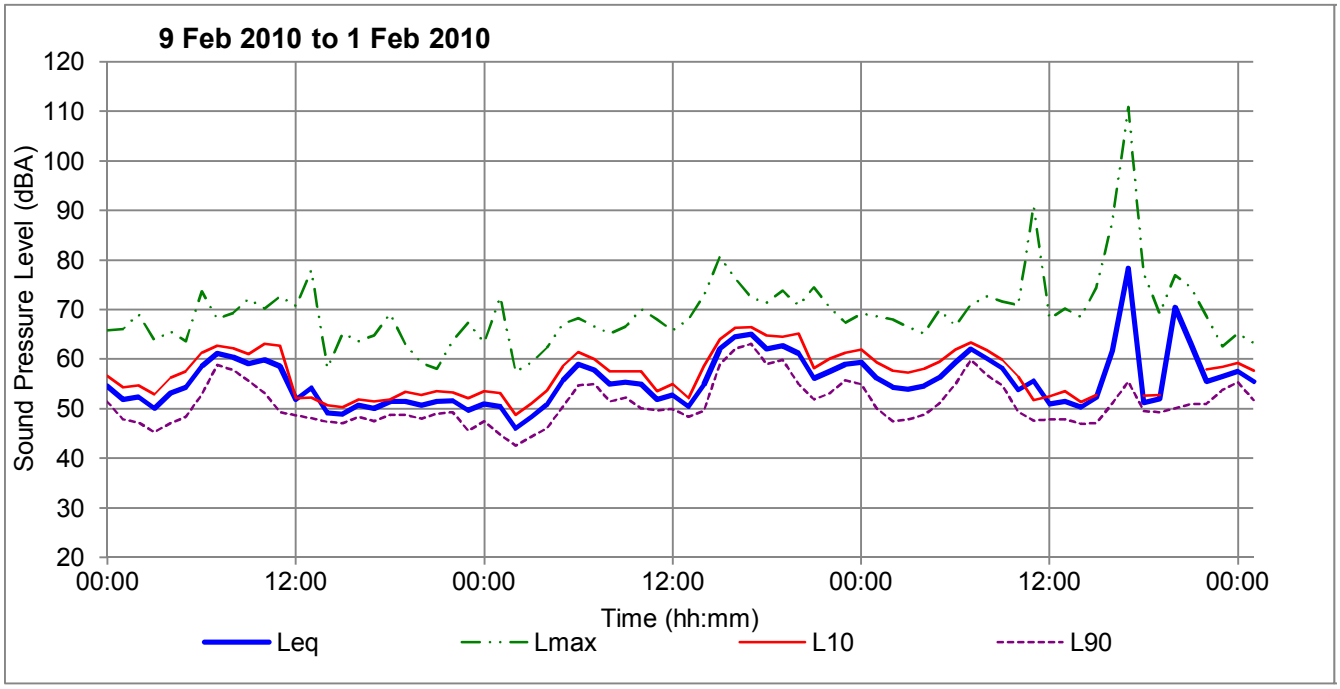
Logger Measurements

Date:	Wednesday, 4 February 2015
File name:	\\mda-dc01\p\Proposal\2014\201405dy\04 Calculations\[20100209 Precinct 15 logger (file from old job cleaned up for appendices).xlsx]Logger_Summary
Job number:	2010016
Job name:	Precinct 15, Blackshaws Road, Altona North
Initials:	NP
Measurement Dates:	Tuesday, 09 February 2010 to Thursday, 11 February 2010
Weather during Measurement:	0 0
Notes:	22-46 New Street, South Kingsville 0 0 0

OVERVIEW SUMMARY SHEET

Noise Level, dBA		Leq	L10	L90	Lmax
Day (0700-1800)	Lowest	49	50	47	58
	Average	64	57	52	72
	Highest	78	66	63	111
Evening (1800-2200)	Lowest	51	52	48	58
	Average	62	56	52	70
	Highest	70	65	60	77
Night (2200-0700)	Lowest	17	17	17	18
	Average	55	51	44	60
	Highest	61	62	56	103

$L_{eq\ 24\text{-}hr}$	62 dBA
$L_{eq\ 15\text{-}hr\ (0700\text{-}2200)}$	64 dBA
$L_{eq\ 9\text{-}hr\ (2200\text{-}0700)}$	55 dBA
$L_{10\ 18\text{-}hr\ (0600\text{-}0000)}$	57 dBA
L_{DN}	64 dBA
L_{DEN}	66 dBA



Logger Measurements

MARSHALL DAY Acoustics

Date: Wednesday, 4 February 2015
File name: \\mda-dc01\p\Proposal\2014\201405dy\04 Calculations\[20100209 Precinct 15 logger (file from old job cleaned up for appendices).xlsx]Logger_Summary
Job number: 2010016
Job name: Precinct 15, Blackshaws Road, Altona North
Initials: NP
Measurement Date: Tuesday, 09 February 2010
Weather during Measurement:
Notes:

MEASURED NOISE LEVELS SHEET

Noise Level, dBA	Leq	L10	L90	Lmax	NOTES
24-hour	55	55	50	78	
18-hr (0600-0000)	56	55	50	78	
Day 15-hr (0700-2200)	56	55	50	78	
Night 9-hr (2200-0700)	53	54	47	73	
Lday (0700-1800)	57	56	51	78	
Levening (1800-2200)	51	53	49	69	
Lnight (2200-0700)	53	54	47	73	
LDN	60				
LDEN	61				
00:00 - 01:00	55	57	52	66	
01:00 - 02:00	52	54	48	66	
02:00 - 03:00	52	55	47	69	
03:00 - 04:00	50	53	45	64	
04:00 - 05:00	53	56	47	66	
05:00 - 06:00	54	58	48	64	
06:00 - 07:00	59	61	53	74	
07:00 - 08:00	61	63	59	68	
08:00 - 09:00	60	62	58	69	
09:00 - 10:00	59	61	56	72	
10:00 - 11:00	60	63	53	70	
11:00 - 12:00	59	63	49	73	
12:00 - 13:00	52	52	49	71	
13:00 - 14:00	54	52	48	78	
14:00 - 15:00	49	51	47	58	
15:00 - 16:00	49	50	47	65	
16:00 - 17:00	51	52	48	64	
17:00 - 18:00	50	52	47	65	
18:00 - 19:00	51	52	49	69	
19:00 - 20:00	51	53	49	63	
20:00 - 21:00	51	53	48	59	
21:00 - 22:00	52	54	49	58	
22:00 - 23:00	52	53	49	64	
23:00 - 24:00	50	52	46	67	

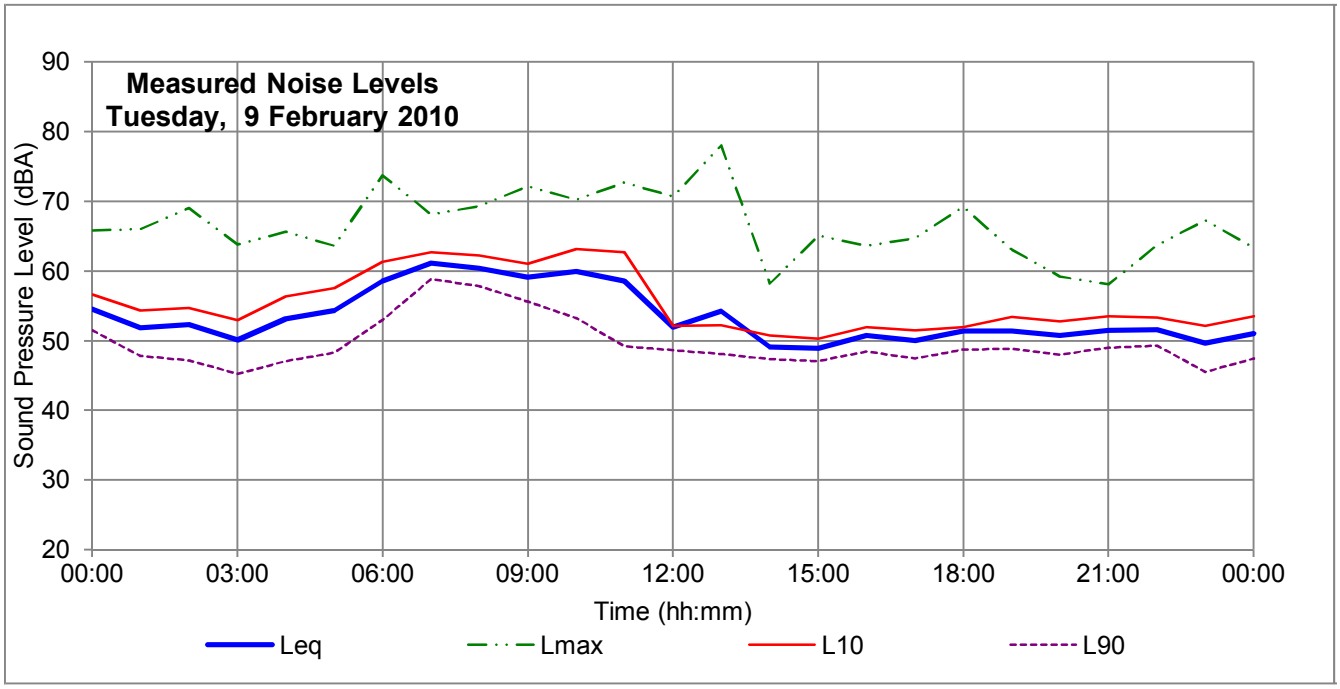
Logger Measurements

Date:	Wednesday, 4 February 2015
File name:	\\mda-dc01\p\Proposal\2014\201405dy\04 Calculations\[20100209 Precinct 15 logger (file from old job cleaned up for appendices).xlsx]Logger_Summary
Job number:	2010016
Job name:	Precinct 15, Blackshaws Road, Altona North
Initials:	NP
Measurement Date:	Tuesday, 09 February 2010
Weather during Measurement:	
Notes:	

SUMMARY SHEET

Noise Level, dBA		Leq	L10	L90	Lmax
Day	Lowest	49	50	47	58
(0700-1800)	Average	57	56	51	68
	Highest	61	63	59	78
Evening	Lowest	51	52	48	58
(1800-2200)	Average	51	53	49	62
	Highest	52	54	49	69
Night	Lowest	46	49	43	57
(2200-0700)	Average	53	54	47	65
	Highest	59	61	55	73

$L_{eq\ 24\text{-}hr}$	55 dBA
$L_{eq\ 15\text{-}hr\ (0700\text{-}2200)}$	56 dBA
$L_{eq\ 9\text{-}hr\ (2200\text{-}0700)}$	53 dBA
$L_{10\ 18\text{-}hr\ (0600\text{-}0000)}$	55 dBA
L_{DN}	60 dBA
L_{DEN}	61 dBA



Logger Measurements

MARSHALL DAY Acoustics

Date: Wednesday, 4 February 2015
File name: \\mda-dc01\p\Proposal\2014\201405dy\04 Calculations\[20100209 Precinct 15 logger (file from old job cleaned up for appendices).xlsx]Logger_Summary
Job number: 2010016
Job name: Precinct 15, Blackshaws Road, Altona North
Initials: NP
Measurement Date: Wednesday, 10 February 2010
Weather during Measurement:
Notes:

MEASURED NOISE LEVELS SHEET

Noise Level, dBA	Leq	L10	L90	Lmax	NOTES
24-hour	59	58	52	81	
18-hr (0600-0000)	60	60	54	81	
Day 15-hr (0700-2200)	60	60	54	81	
Night 9-hr (2200-0700)	57	60	52	70	
Lday (0700-1800)	60	59	54	81	
Levening (1800-2200)	61	63	56	74	
Lnight (2200-0700)	57	60	52	70	
LDN	64				
LDEN	65				
00:00 - 01:00	51	54	47	63	
01:00 - 02:00	50	53	45	73	
02:00 - 03:00	46	49	43	57	
03:00 - 04:00	48	51	44	59	
04:00 - 05:00	51	54	46	62	
05:00 - 06:00	56	59	50	67	
06:00 - 07:00	59	61	55	68	
07:00 - 08:00	58	60	55	67	
08:00 - 09:00	55	58	52	65	
09:00 - 10:00	55	58	52	67	
10:00 - 11:00	55	58	50	70	
11:00 - 12:00	52	54	50	68	
12:00 - 13:00	53	55	50	66	
13:00 - 14:00	50	52	48	68	
14:00 - 15:00	55	59	50	73	
15:00 - 16:00	62	64	59	81	
16:00 - 17:00	65	66	62	76	
17:00 - 18:00	65	66	63	72	
18:00 - 19:00	62	65	59	71	
19:00 - 20:00	63	65	60	74	
20:00 - 21:00	61	65	55	71	
21:00 - 22:00	56	58	52	74	
22:00 - 23:00	58	60	53	70	
23:00 - 24:00	59	61	56	67	

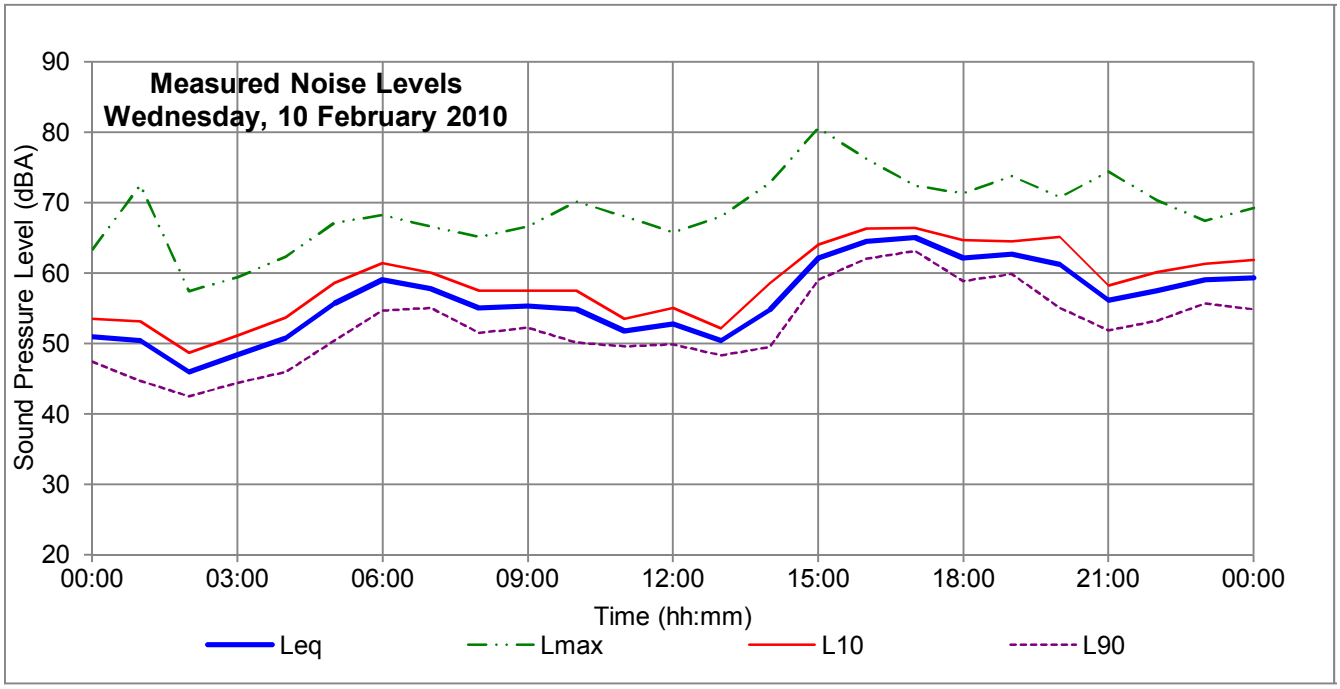
Logger Measurements

Date:	Wednesday, 4 February 2015
File name:	\\mda-dc01\p\Proposal\2014\201405dy\04 Calculations\[20100209 Precinct 15 logger (file from old job cleaned up for appendices).xlsx]Logger_Summary
Job number:	2010016
Job name:	Precinct 15, Blackshaws Road, Altona North
Initials:	NP
Measurement Date:	Wednesday, 10 February 2010
Weather during Measurement:	
Notes:	

SUMMARY SHEET

Noise Level, dBA		Leq	L10	L90	Lmax
Day	Lowest	50	52	48	65
(0700-1800)	Average	60	59	54	70
	Highest	65	66	63	81
Evening	Lowest	56	58	52	71
(1800-2200)	Average	61	63	56	73
	Highest	63	65	60	74
Night	Lowest	54	57	47	65
(2200-0700)	Average	57	60	52	68
	Highest	59	62	56	70

$L_{eq\ 24\text{-}hr}$	59 dBA
$L_{eq\ 15\text{-}hr\ (0700\text{-}2200)}$	60 dBA
$L_{eq\ 9\text{-}hr\ (2200\text{-}0700)}$	57 dBA
$L_{10\ 18\text{-}hr\ (0600\text{-}0000)}$	60 dBA
L_{DN}	64 dBA
L_{DEN}	65 dBA



Logger Measurements

MARSHALL DAY Acoustics

Date: Wednesday, 4 February 2015
File name: \\mda-dc01\p\Proposal\2014\201405dy\04 Calculations\[20100209 Precinct 15 logger (file from old job cleaned up for appendices).xlsx]Logger_Summary
Job number: 2010016
Job name: Precinct 15, Blackshaws Road, Altona North
Initials: NP
Measurement Date: Thursday, 11 February 2010
Weather during Measurement:
Notes:

MEASURED NOISE LEVELS SHEET

Noise Level, dBA	Leq	L10	L90	Lmax	NOTES
24-hour	66	57	51	111	
18-hr (0600-0000)	67	56	51	111	
Day 15-hr (0700-2200)	68	55	51	111	
Night 9-hr (2200-0700)	55	40	33	103	
Lday (0700-1800)	68	56	51	111	
Levening (1800-2200)	65	53	50	77	
Lnight (2200-0700)	55	40	33	103	
LDN	67				
LDEN	68				
00:00 - 01:00	59	62	55	69	
01:00 - 02:00	56	59	50	69	
02:00 - 03:00	54	58	47	68	
03:00 - 04:00	54	57	48	66	
04:00 - 05:00	55	58	49	65	
05:00 - 06:00	56	60	51	70	
06:00 - 07:00	59	62	55	67	
07:00 - 08:00	62	63	60	71	
08:00 - 09:00	60	62	57	73	
09:00 - 10:00	58	60	55	72	
10:00 - 11:00	54	57	49	71	
11:00 - 12:00	56	52	48	91	
12:00 - 13:00	51	53	48	68	
13:00 - 14:00	51	54	48	70	
14:00 - 15:00	50	51	47	69	
15:00 - 16:00	52	53	47	74	
16:00 - 17:00	62		51		
17:00 - 18:00	78		55		
18:00 - 19:00	51	53	50	77	
19:00 - 20:00	52	53	49	69	
20:00 - 21:00	70		50		
21:00 - 22:00	63		51		
22:00 - 23:00	55	58	51	69	
23:00 - 24:00	57	58	54	63	

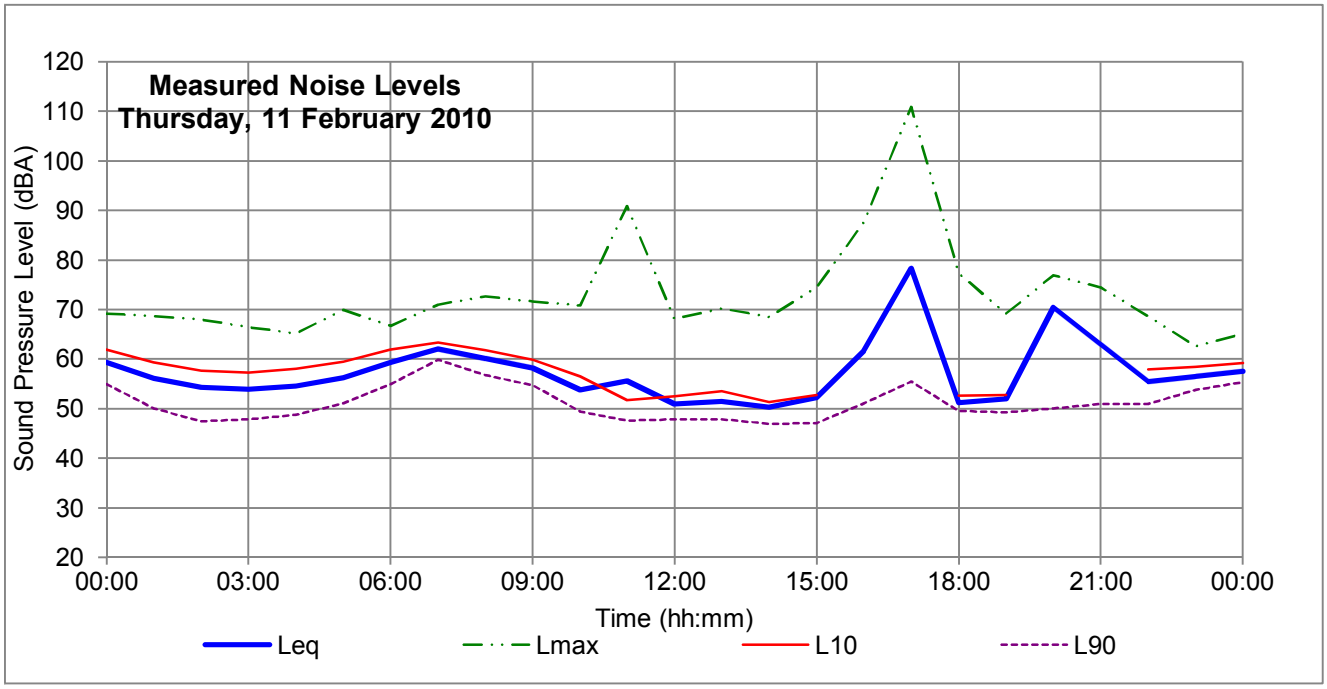
Logger Measurements

Date:	Wednesday, 4 February 2015
File name:	\\mda-dc01\p\Proposal\2014\201405dy\04 Calculations\[20100209 Precinct 15 logger (file from old job cleaned up for appendices).xlsx]Logger_Summary
Job number:	2010016
Job name:	Precinct 15, Blackshaws Road, Altona North
Initials:	NP
Measurement Date:	Thursday, 11 February 2010
Weather during Measurement:	
Notes:	

SUMMARY SHEET

Noise Level, dBA		Leq	L10	L90	Lmax
Day	Lowest	50	51	47	68
(0700-1800)	Average	68	56	51	78
	Highest	78	63	60	111
Evening	Lowest	51	53	49	69
(1800-2200)	Average	65	53	50	74
	Highest	70	53	51	77
Night	Lowest	17	17	17	18
(2200-0700)	Average	55	40	33	48
	Highest	61	59	55	103

$L_{eq\ 24\text{-}hr}$	66 dBA
$L_{eq\ 15\text{-}hr\ (0700\text{-}2200)}$	68 dBA
$L_{eq\ 9\text{-}hr\ (2200\text{-}0700)}$	55 dBA
$L_{10\ 18\text{-}hr\ (0600\text{-}0000)}$	56 dBA
L_{DN}	67 dBA
L_{DEN}	68 dBA



APPENDIX G NOISE MEASUREMENT DETAILS

Noise survey

Date	Time	Position	Time period	Duration	Weather	Noise sources
21/01/2010	9:10:24 PM	1	Evening	739 sec	Warm, calm, high cloud	Freeway, rumble (and some arcing noise) from terminal station, hum barely audible
21/01/2010	9:29:41 PM	2	Evening	755 sec	Warm, calm, high cloud	Freeway, cicadas
21/01/2010	9:48:56 PM	3	Evening	670 sec	Warm, calm, high cloud	Freeway, cicadas, commercial jet flyover
21/01/2010	10:12:42 PM	5	Evening	575 sec	Warm, calm, high cloud	Distant freeway, 9 cars on Blackshaws Road
21/01/2010	10:27:28 PM	4	Evening	478 sec	Warm, calm, high cloud	Distant freeway, 1 car on local street, 2 trucks on New Street, cicada, commercial jet flyover
22/01/2010	2:52:36 AM	5	Night	694 sec	Warm, calm, high cloud	Freeway, cicadas, car idling next door for ~2 minutes
22/01/2010	3:12:55 AM	1	Night	900 sec	Warm, calm, high cloud	Freeway, rumble from substation
22/01/2010	3:34:58 AM	2	Night	900 sec	Warm, light breeze generally from north	Freeway, cicadas
22/01/2010	4:21:26 AM	4	Night	788 sec	Warm, light breeze generally from north	Freeway, cicadas, 2 cars on local street
22/01/2010	4:39:06 AM	3	Night	607 sec	Warm, light breeze generally from north	Freeway, cicadas
8/02/2010	12:14:12 PM	3	Day	900 sec	Hot, no clouds, light wind generally SSW	Freeway, some noise from commercial site, 1-2 cars on local street
8/02/2010	12:31:46 PM	1	Day	696 sec	Hot, no clouds, light wind generally SSW	-

Date	Time	Position	Time period	Duration	Weather	Noise sources
8/02/2010	12:45:54 PM	2	Day	621 sec	Hot, no clouds, light wind generally from south, occasionally calm	Freeway seems quiet
8/02/2010	1:03:35 PM	4	Day	693 sec	Hot, no clouds, light wind generally from south, occasionally calm	Local traffic: 14 light vehicles, 1 bus on Aloha Street; 36 light vehicles on New Street
8/02/2010	1:24:42 PM	5	Day	702 sec	Hot, no clouds, light wind generally from south, occasionally calm	Traffic on Blackshaws Road (4 minute sample): 40 light vehicles, 2 trucks

Manual traffic noise measurement

Date	Time	Position	Time period	Duration	Weather	Noise sources
17/02/2009	11:55:50 AM	North end of Kyle Road	N/A	544 sec	-	Freeway