ACOUSTICS AND AIR

95 GREAT SOUTHERN ROAD

LAND RE-ZONING NOISE ASSESSMENT

REPORT NO. 15186
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MAY 2017

PREPARED FOR

TODOROSKI AIR SCIENCES
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GLOSSARY OF ACOUSTIC TERMS

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph below, are here defined.

Maximum Noise Level (L_{Amax}) – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

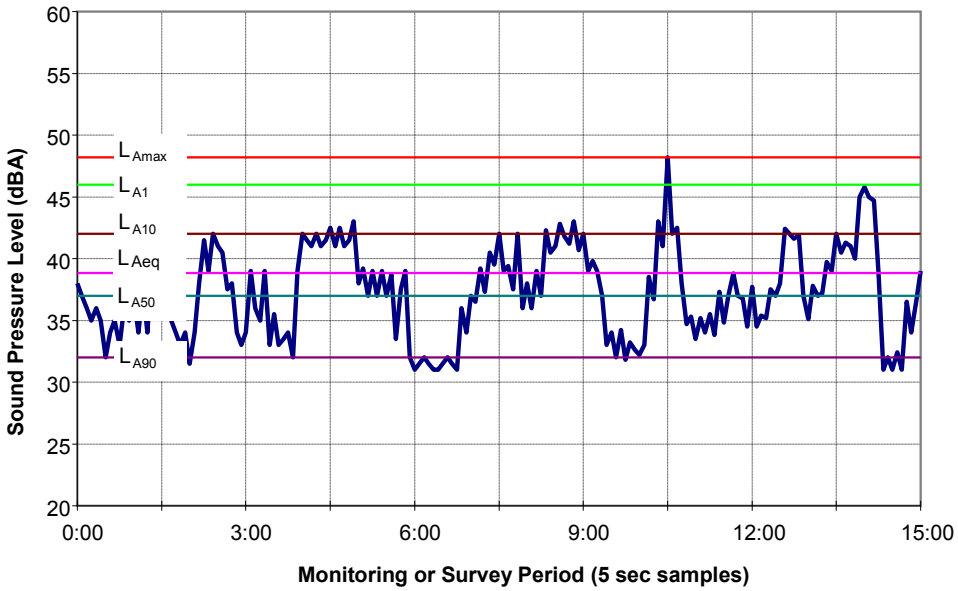
L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

ABL – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day. It is determined by calculating the 10th percentile (lowest 10th percent) background level (L_{A90}) for each period.

RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night time.

Typical Graph of Sound Pressure Level vs Time



1 INTRODUCTION

A parcel of land at 95 Great Southern Road, Bargo is proposed to be rezoned for residential use. This report has been prepared by Wilkinson Murray to provide an assessment of potential noise impacts on future residents within the rezoned land from nearby sources of transportation and industrial noise.

This assessment investigates potential noise sources within approximately 2.5 kilometres of the subject land (the Project).

1.1 Study Objectives

The key objectives of the study are:

- To determine whether any existing or approved nearby land uses would adversely impact, or would have the potential to adversely impact, the acoustic amenity of sensitive receivers within the Project site; and,
- To determine whether the use of the site for residential developments would adversely impact, or have the potential to adversely impact, the effective functioning of existing or approved nearby land uses, in relation to noise.

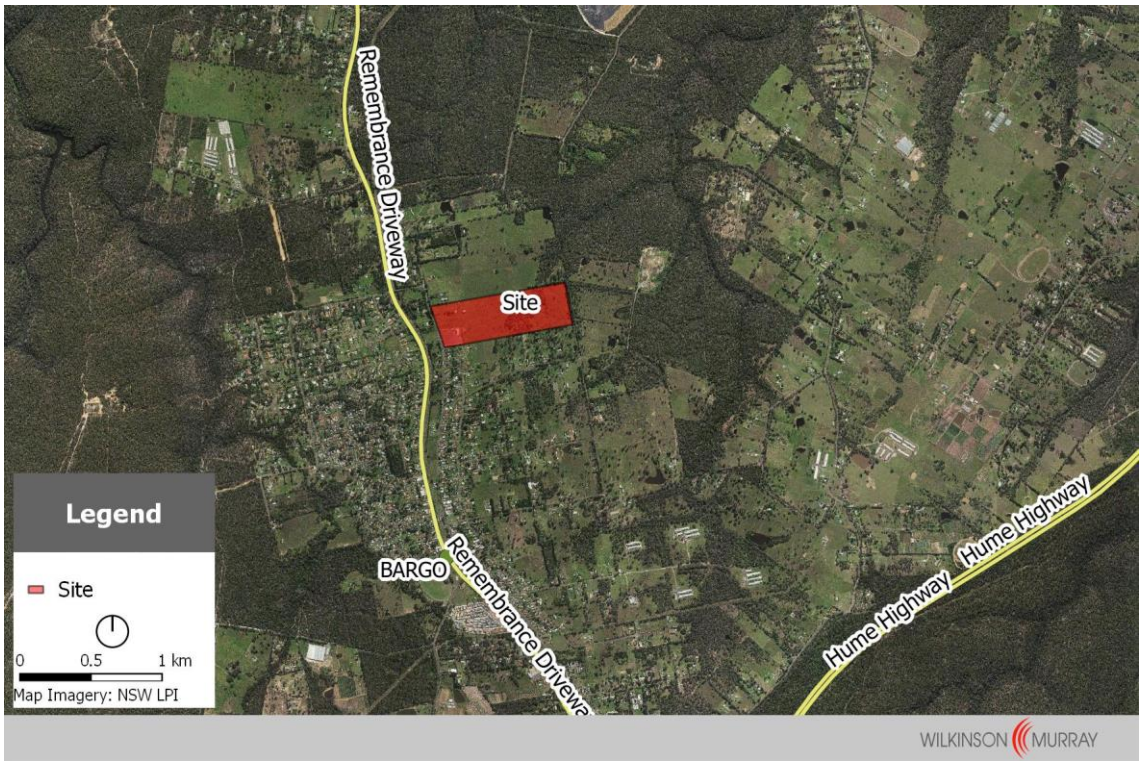
2 THE PROJECT

The Project site is located approximately 1.2 kilometres north-northeast of Bargo, NSW. The Project site covers an area of approximately 28 hectares and is currently vacant, except for a depot located in the southeast corner.

The site is bounded by Great Southern Road to the west, Government Road to the east, and rural residential lots to the north and south. The surrounding land use is predominantly low density rural residential lots. To the west and southwest of the site, separated by the Main South Railway Line, is higher density residential land use.

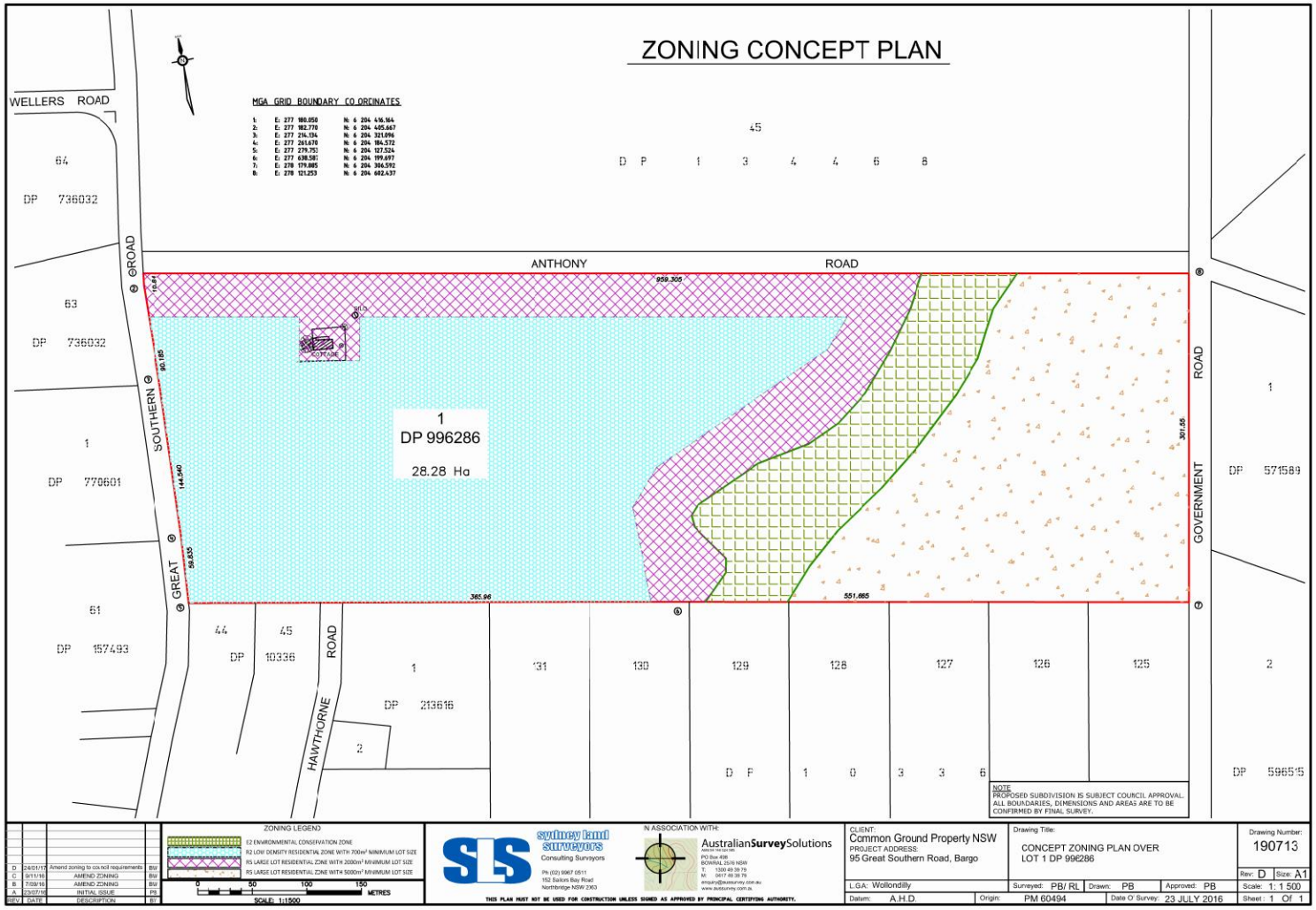
The site location is presented in Figure 2-1.

Figure 2-1 Site Location



The proposed re-zoning of the site is shown in Figure 2-2.

Figure 2-2 Proposed Re-Zoning

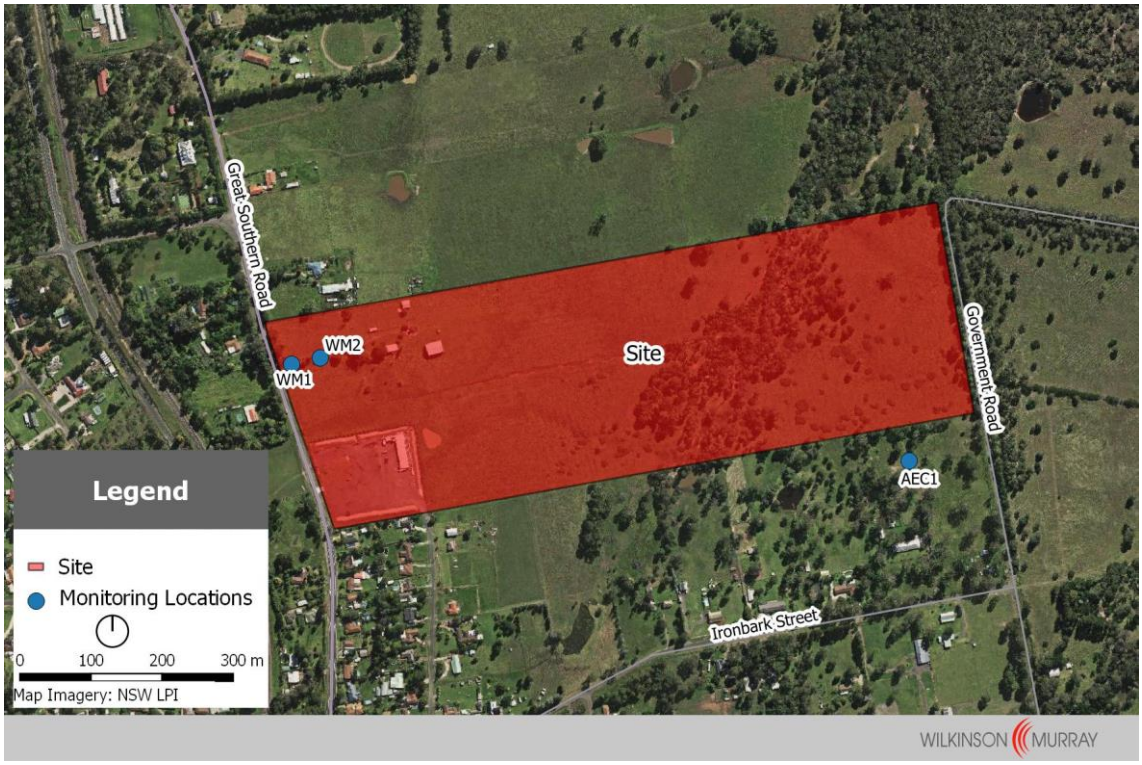


3 EXISTING NOISE ENVIRONMENT

To establish existing ambient noise levels within the Project site, unattended noise monitoring was conducted between 4 and 11 June 2015. Two monitoring locations (WM1 and WM2) were selected, with varying setback distances from Great Southern Road, to provide an indication of traffic noise levels in addition to background noise levels. The noise monitoring locations are presented in Figure 3-1.

In a recent noise impact assessment conducted by AECOM (AECOM 2013), for the Bargo Resources Recovery Facility & Transfer Station (RRF&TS), unattended background noise monitoring was carried out at a location near the Project site. This location (AEC1) is also shown in Figure 3-1.

Figure 3-1 Noise Monitoring Locations



The noise monitoring equipment used for the measurements conducted by Wilkinson Murray consisted of an environmental noise logger set to A-weighted, fast response. This equipment is capable of remotely monitoring and storing noise level descriptors for later detailed analysis. The equipment calibration was checked before and after the survey and no significant drift was noted. From the background noise levels (L_{A90}) the Rating Background Levels (RBLs) were determined using the methodology recommended in the NSW *Industrial Noise Policy* (INP) (EPA 2000).

The measurement equipment and data processing methodology used by AECOM are also understood to be in accordance with the INP.

Results of the unattended noise monitoring conducted by Wilkinson Murray and AECOM are presented in Table 3-1.

Table 3-1 Existing Ambient Noise Levels

Monitoring Location	RBL (dBA)			L_{Aeq} (dBA)		
	Day	Evening	Night	Day	Evening	Night
WM1	43	40	29*	57	54	53
WM2	41	39	28*	55	51	50
AEC1	36	36	36	54	49	46

* The INP recommends that if the calculated RBL is less than 30 dBA, then it is set to 30 dBA.

Daily plots of the noise logger data from the Wilkinson Murray survey are presented in Appendix A.

The dominant noise sources in the existing acoustic environment were noted to be birds, and traffic. These observations are consistent with those reported by AECOM.

Review of Table 3-1 indicates that the daytime and evening RBLs measured at WM1 and WM2 are significantly higher that the RBLs for the respective time periods measured at AEC1. This is a result of regular traffic flows along Great Southern Road. These flows are appreciable during the daytime and evening and become sporadic during the night. Accordingly, the night time RBLs measured at WM1 and WM2 are not affected by traffic noise. The night time RBL measured by Wilkinson Murray is significantly lower than that measured by AECOM. The specific reasons for the discrepancy are unknown, however a night time RBL of 30 dBA is considered reasonable for the Project site as there are no significant nearby sources of transportation or industrial noise during the night time.

4 POTENTIAL NOISE SOURCES

Potential sources of significant noise emissions in the vicinity of the Project site comprise traffic on nearby roads, and operational noise from the Bargo RRF&TS. The Tahmoor Underground Coal Mine is located approximately 2 kilometres north of the Project site, however is not considered contribute significantly to the acoustic environment of the Project site.

4.1 Traffic Noise Sources

Two roads in the vicinity of the Project site are identified as having the potential to generate significant levels of traffic noise, and warrant investigation.

Great Southern Road runs along the western boundary of the Project site, and has an average daily traffic volume of approximately 1,800 vehicles (AECOM 2013). Great Southern Road is classified as an 'Arterial Road' by the *NSW Road Noise Policy* (RNP) (DECCW 2011).

The development of the Bargo RRF&TS includes the extension of Anthony Street, from the intersection with Government Road to Great Southern Road, along the northern boundary of the Project site. The Anthony Street extension would serve as the primary access to the RRF&TS, and would facilitate a daily traffic volume of up to 350 vehicles (AECOM 2013).

Great Southern Road and the Anthony Street extension are illustrated in Figure 4-1.

4.2 Operational Noise Sources

The existing Bargo Waste Management Centre (Bargo WMC) is located approximately metres to the north east of the Project site, as shown in Figure 4-1. According to the Wollondilly Shire Council website[1], the Bargo WMC operates during daytime hours only. Wilkinson Murray was unable to locate a detailed noise assessment of the Bargo WMC, however, the facility is anticipated to operate a number of earthmoving plant, including excavators and front end loaders, and is also anticipated to include some on-site truck movement.

It is noted that during site visits in proximity to the Bargo WMC, conducted by Wilkinson Murray and AECOM, did not identify significant levels of operational noise associated with the site.

The Bargo RRF&TS is proposed to be located on a parcel of land approximately 150 metres to the north east of the Project site, adjacent to the existing Bargo WMC, as shown in Figure 4-1. The sources of operational noise emissions from the RRF&TS are well documented in AECOM 2013.

[1] http://www.wollondilly.nsw.gov.au/resident-services/waste/waste-management-centres/bargo-waste-management-centre/

Figure 4-1 Potential Noise Sources

5 NOISE CRITERIA

With a view to investigating the potential for noise impacts being experienced by future residents within the Project site, this section presents operational and traffic noise criteria that would be applicable to these receivers.

It should be noted that the noise criteria presented herein are for the purpose of investigating the suitability of the Project site for residential land use. Any implication of noise impacts caused by other activities or developments is not intended.

5.1 Operational Noise Criteria

The NSW *Industrial Noise Policy* (INP) (EPA 200) provides the framework for establishing noise criteria and assessing impacts from sources of industrial noise. This policy seeks to promote environmental well-being through preventing and minimising noise. On-site noise emissions from the RRF&TS are assessable under the INP.

There are two noise criteria which should be satisfied under the INP. The first being the "intrusiveness" criterion which assesses the likelihood of noise being intrusive above the ambient noise level. The intrusiveness criterion applies for residential receivers only.

The second noise criterion, known as the "amenity" criterion, ensures the total industrial noise from all sources in the area does not rise above a maximum acceptable level.

The INP stipulates that intrusiveness and amenity criteria are determined for the daytime (7.00am 6.00pm), evening (6.00pm 10.00pm) and night time (10.00pm 7.00am) periods, as relevant. The determined criteria apply at the most affected point on or within the receiver property boundary.

5.1.1 INP Intrusiveness Criteria

The intrusiveness criterion requires that the L_{Aeq} noise level from the source being assessed, when measured over 15 minutes, should not exceed the Rating Background Noise Level (RBL) by more than 5 dBA.

Table 5-1 summarises the intrusiveness noise criteria which would apply to residential receivers within the Project site. With a view to providing a conservative assessment, the criteria in Table 5-1 are based on the lowest established background noise levels for each time period, as identified in Section 3.

Table 5-1 Project specific intrusiveness criteria

Receiver	$L_{Aeq,15min}$ Intrusiveness Criterion (dBA)		
	Day*	Evening*	Night*
All residences within Project site	36+5 = 41	36+5 = 41	30+5 = 35

* Day = 7.00am – 6.00pm, Evening = 6.00pm – 10.00pm, Night = 10.00pm – 7.00am

5.1.2 INP Amenity Criteria

The amenity criteria set limits on the total noise level from all industrial noise sources affecting a receiver. Different amenity criteria apply for different types of receivers (e.g. residential, commercial, industrial – or for areas specifically reserved for passive recreation) and different areas (e.g. urban, suburban, rural).

The INP would classify the receivers within the Project site as "suburban". Accordingly, the applicable INP amenity criteria are presented in Table 5-2.

Table 5-2 Project specific amenity criteria

Receiver	$L_{Aeq,period}$ Amenity Criterion (dBA)		
	Day*	Evening*	Night*
All residences within Project site	55	45	40

* Day = 7.00am – 6.00pm, Evening = 6.00pm – 10.00pm, Night = 10.00pm – 7.00am

The noise level to be compared with the amenity criterion is the L_{Aeq} noise level, measured over the relevant day, evening or night time period, due to all industrial noise sources, but excluding non-industrial sources such as off-site transportation, i.e. on public roads.

Where a new noise source is proposed in an area with negligible existing industrial noise, the amenity criterion for that source may be taken as being equal to the overall amenity criterion. However, where noise levels from existing industrial sources are already close to or above the acceptable amenity criterion, the INP requires that the acceptable amenity criterion for any further proposed industrial noise source is commensurately lowered, in the interest of preserving noise amenity. This provision is aimed at the prevention against cumulative noise increases over time due to industrialisation.

The land use surrounding the development and nearest receivers does not feature any significant sources of industrial noise. On this basis no adjustment to the INP amenity criteria has been applied.

Table 5-3 summarises the INP noise criteria with the most stringent criteria in each time period shown in bold font.

Table 5-3 Summary of INP Criteria

Receiver	Intrusiveness Criterion ($L_{Aeq,15min}$ dBA)			Amenity Criterion ($L_{Aeq,Period}$ dBA)		
	Day*	Evening*	Night*	Day*	Evening*	Night*
All residences within Project site	**41**	**41**	**30**	55	45	40

* Day = 7.00am – 6.00pm, Evening = 6.00pm – 10.00pm, Night = 10.00pm – 7.00am

Review of Table 5-3 indicates that the intrusiveness criteria are the most stringent at all times of day.

5.2 Traffic Noise Criteria

The *NSW Road Noise Policy* (RNP) (DECCW 2011) provides guidance on assessing road traffic noise impacts from traffic generating developments. The RNP road traffic noise assessment criteria for residential land uses are presented in Table 5-4.

In addition to the criteria in Table 5-4, the RNP advises that in cases where existing levels of road traffic noise exceed the applicable criteria, and that a development has the potential to increase road traffic noise levels; an increase of up to 2 dBA represents a minor impact that is considered barely perceptible to the average person.

Table 5-4 Road traffic noise criteria for residential land uses

Road Category	Type of project/land use	Assessment Criteria - dBA	
		Day (7am – 10pm)	Night (10pm – 7am)
Freeway/ arterial/ sub-arterial roads	Existing residences affected by noise from **new** freeway/arterial/sub-arterial road corridors	$L_{Aeq,\ 15\ hour}$ 55 (external)	$L_{Aeq,\ 9\ hour}$ 50 (external)
	Existing residences affected by noise from **redevelopment** of existing freeway/arterial/sub-arterial roads	$L_{Aeq,\ 15\ hour}$ 60 (external)	$L_{Aeq,\ 9\ hour}$ 55 (external)
	Existing residences affected by **additional traffic** on existing freeway/arterial/sub-arterial roads generated by land use developments		
Local roads	Existing residences affected by noise from **new** local road corridors	$L_{Aeq,\ 1\ hour}$ 55 (external)	$L_{Aeq,\ 1\ hour}$ 50 (external)
	Existing residences affected by noise from **redevelopment** of existing local roads		
	Existing residences affected by **additional traffic** on existing local roads generated by land use developments		

Note: Land use developers must meet internal noise goals in the Infrastructure SEPP (Department of Planning NSW 2007) for sensitive developments near busy roads.

Great Southern Road and the Anthony Street extension have been identified in this study as the most significant sources of traffic noise for the Project site. Great Southern Road and Anthony Street are classified by the RNP as 'arterial' and 'local' roads, respectively.

6 ASSESSMENT OF POTENTIAL IMPACTS

The following section investigates potential noise impacts, on future residential receivers within the Project site, from the noise sources previously identified. The investigation is applicable to single storey residential developments only. Any multiple storey developments should be assessed independently.

6.1 Potential Operational Noise Impacts

6.1.1 Potential Intrusiveness Noise Impacts from Bargo RRF&TS

As discussed in Section 4.2, the Bargo RRF&TS is the dominant source of operational noise in the vicinity of the Project site. Predicted noise level contours during the daytime and night time, as presented in AECOM 2013, are shown in Figure 6-1 and Figure 6-2, respectively. The night time noise level contours, presented in Figure 6-2, represent the predicted noise levels during adverse weather conditions.

Figure 6-1 RRF&TS Operational $L_{Aeq, 15min}$ Noise Levels - Daytime

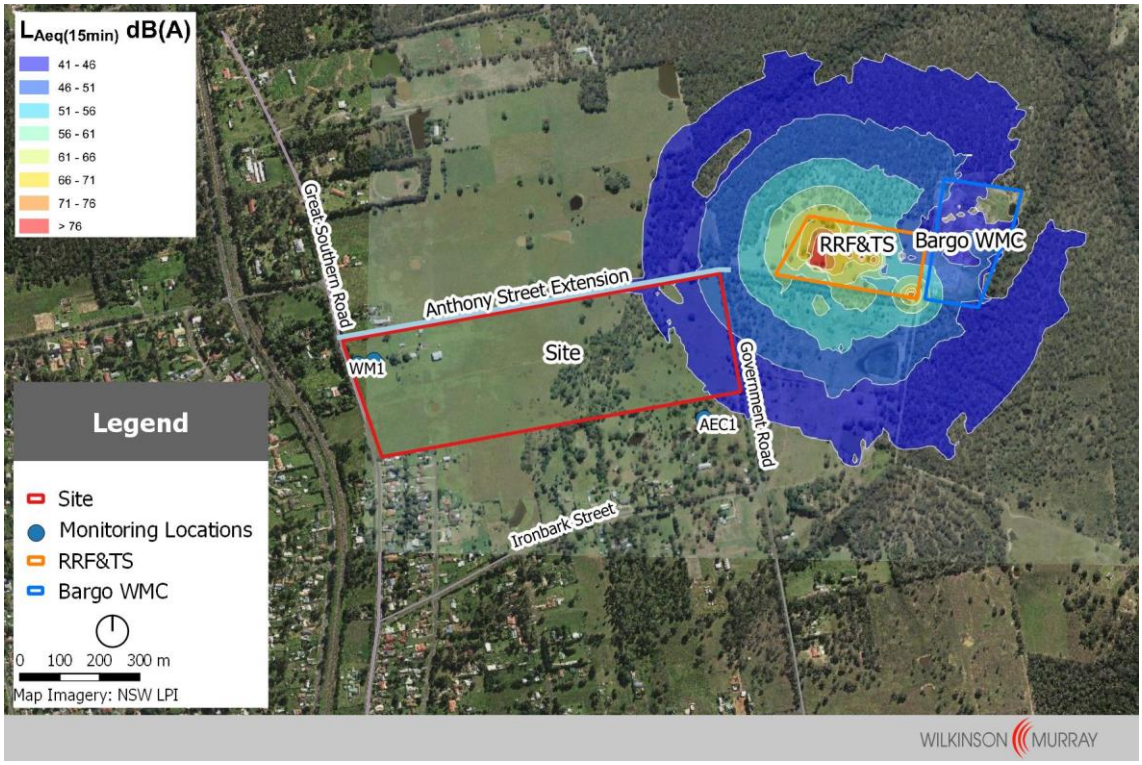
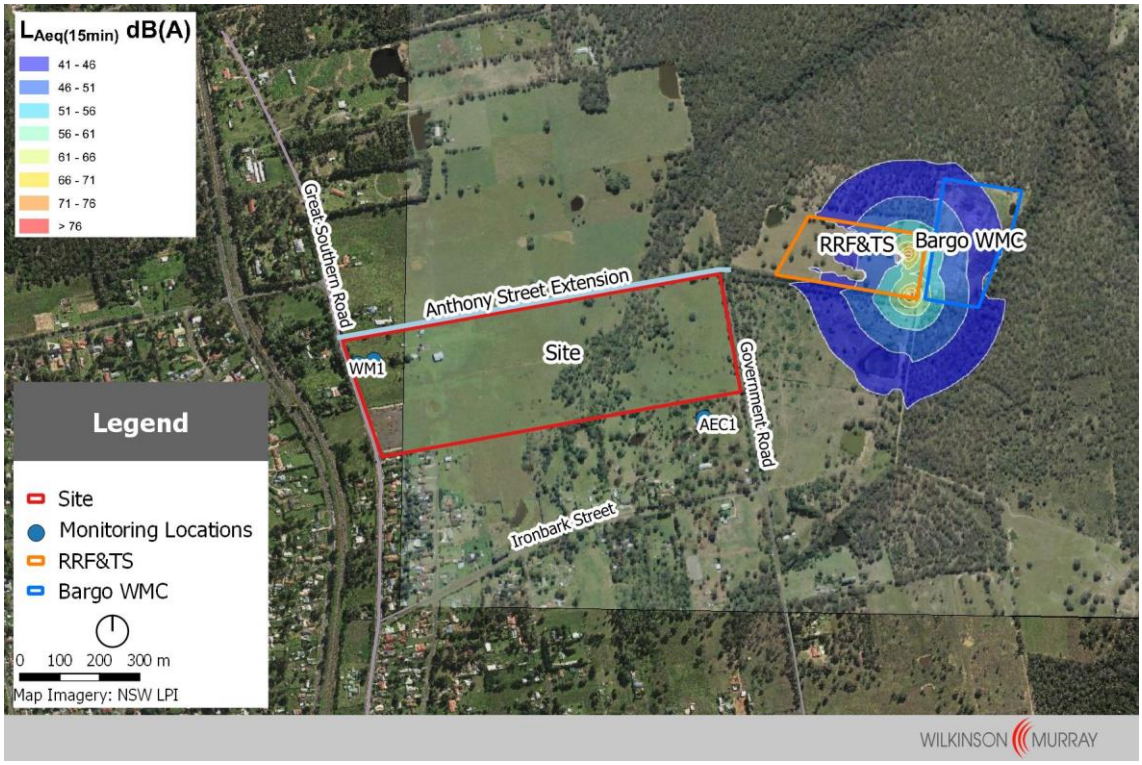


Figure 6-1 indicates that $L_{Aeq, 15min}$ noise levels are predicted to exceed the daytime operational noise goal of 41 dBA in the easternmost region of the Project site. The region of exceedance extends approximately 200 metres from the eastern Project site boundary. Daytime $L_{Aeq, 15min}$ noise levels within the majority of this region are predicted to be in the range of 41 to 46 dBA. In a small region at the north eastern corner of the Project site, within approximately 55 metres of the site boundary, daytime operational noise levels are predicted to be in the range of 46 to 49 dBA.

The predicted daytime operational $L_{Aeq, 15min}$ noise levels from the RRF&TS are expected to exceed the intrusiveness noise goal by 5 – 8 dBA at the most sensitive locations within the Project site.

Figure 6-2 RRF&TS Operational $L_{Aeq, 15min}$ Noise Levels – Night time



The contours of predicted night time $L_{Aeq, 15min}$ noise levels presented in AECOM 2013 do not extend below 41 dBA – the night time criterion established in AECOM 2013. As presented in Section 3, background noise monitoring conducted by Wilkinson Murray indicates the potential for night time RBLs as low as 30 dBA. Accordingly, the location of the 35 dBA is to be extrapolated from the AECOM results.

Figure 6-2 shows contour lines which grow exponentially from the noise source; in this case, the RRF&TS. A 35 dBA contour line would be expected to enter the north eastern corner of the Project site, extending approximately 50 metres from the site boundary. The highest estimated night time $L_{Aeq, 15min}$ noise levels, during adverse weather conditions, within the Project site would be approximately 38 dBA. This indicates a potential 3 dBA exceedance of the night time intrusiveness noise goal.

6.1.2 Mitigation of Potential Intrusiveness Noise Impacts from Bargo RRF&TS

$L_{Aeq, 15min}$ operational noise levels from the RRF&TS are expected to exceed the daytime and night time noise goals within the Project site by up to 8 dBA and 3 dBA, respectively.

If residential lots are proposed to be established in the north eastern corner of the Project site, i.e. within the 41 dBA contour shown in Figure 6-1, a 1.8 metre solid fence, such as colorbond or lapped and capped timber, or a landscaped earth mound, extending along the entire eastern Project site boundary and along the northern Project site boundary from the north eastern corner to the watercourse would reduce operational noise levels within the Project site by 5 – 8 dBA and

would be expected to mitigate the predicted exceedances of the daytime and night time intrusiveness noise goals.

Figure 6-3 shows the recommended location of the fence or earth mount.

Figure 6-3 Operational Noise Mitigation

6.1.3 Potential Cumulative Noise Impacts from Bargo RRF&TS and Bargo WMC

The Bargo WMC operates during daytime hours, and therefore, there is the potential for cumulative noise levels from both the WMC and the RRF&TS to exceed those from either facility in isolation. Cumulative noise levels are assessed against the INP amenity criteria, presented in Table 5-2, and are based on the $L_{Aeq,\ period}$ noise descriptor.

$L_{Aeq,\ period}$ operational noise levels from developments such as the WMC and the RRF&TS are expected to be approximately 3-5 dBA below the worst-case $L_{Aeq,\ 15min}$ operational noise levels. Therefore, the mitigated daytime $L_{Aeq,\ period}$ noise levels within the Project site, due to the RRF&TS, would be expected to be less than 38 dBA.

A number of site observations have indicated that Bargo WMC is unlikely to contribute significant levels of operational noise within the Project site, however for the purposes of assessing potential cumulative noise impacts, it is conservatively assumed that the $L_{Aeq,\ period}$ noise levels within the Project site, due to the WMC, are equal to those from the RRF&TS – 38 dBA. Therefore, the daytime cumulative $L_{Aeq,\ period}$ noise levels at the most affected location within the project site is predicted to be less than 41 dBA. This is significantly below the applicable amenity criterion of 55 dBA.

Accordingly, cumulative noise impacts from the RRF&TS and the WMC are considered unlikely.

6.2 Potential Traffic Noise Impacts

As presented in Section 4.2, traffic movements along the Anthony Street extension and Great Southern Drive are the most likely sources of significant traffic noise at sensitive receiver locations within the Project site. Predicted traffic noise levels will be used to investigate the potential for noise impacts.

6.2.1 Traffic Noise from the Anthony Street Extension

Predicted noise level at sensitive receivers due to traffic movements along the Anthony Street extension are presented in AECOM 2013. The predicted peak hour $L_{Aeq,\ 1hr}$ traffic noise levels at the existing dwelling at 95 Great Southern Road are 53 dBA and 45 dBA during the daytime and night time, respectively. These levels are predicted for the year 2024, which is 10 years after the proposed opening of the WWR&TS.

According to cadastral data from NSW Land & Property Information (LPI), the façade of the existing dwelling at 95 Great Southern Road is approximately 70 metres from the edge of the Anthony Street extension, assuming a lane width of 3.5 metres. The attenuation of traffic noise levels due to distance is typically 3 dB per doubling of distance from the roadway. Therefore, a façade located approximately 45 metres from the edge of the Anthony Street extension would be subject to peak $L_{Aeq,\ 1hr}$ noise levels of 55 dBA and 47 dBA during the daytime and night time, respectively.

Residential facades established at least 45 metres from the edge of the Anthony Street extension are unlikely to be impacted by traffic noise.

6.2.2 Traffic Noise from Great Southern Road

The traffic noise assessment in AECOM 2013 does not present predicted noise levels from movements along Great Southern Road in the vicinity of the Project site. Therefore, traffic noise levels within the Project site due to Great Southern Road have been predicted based on available information.

Traffic noise levels from Great Southern Road have been predicted using the *Calculation of Road Traffic Noise (CoRTN)* algorithms, developed by the UK Department of Transport. The CoRTN algorithms take into account the following factors:

- Traffic volume, speed and percentage heavy vehicles;
- Road surface and gradient;
- Distance and angle of view of roadway from receivers;
- Shielding and ground absorption; and,
- Façade reflections.

The predicted façade traffic noise levels at a distance of 25 metres from the edge of Great Southern Road are 56 dBA ($L_{Aeq,\ 15hour}$) and 48 dBA ($L_{Aeq,\ 9hour}$) during the daytime and night time, respectively. The daytime prediction is consistent with the noise monitoring results gathered at WM1. The night time monitoring results from WM1 do not correlate well with the predicted traffic noise level, which is typical of unattended noise monitoring results near roads with low, intermittent night time traffic flows.

According to the CoRTN predictions, a residential façade located approximately 10 metres from the edge of Great Southern Road would experience traffic noise levels of 60 dBA and 53 dBA during the daytime and night time, respectively. It is considered unlikely that a residential façade would be established within 10 metres of Great Southern Road; and therefore, traffic movements along Great Southern Road are considered unlikely to result in an impact within the Project Site.

6.2.3 Mitigation of Potential Traffic Noise Impacts

A potential for traffic noise impacts has been identified for residential facades established within 45 metres of the nearside kerb of the Anthony Street extension. If north-facing residential facades are proposed within 45 metres of the kerb, it is recommended that:

- No facades are established within 15 metres of the kerb;
- A 1.8 metre high continuous fence, constructed of a solid material such as colorbond, lapped and capped timber, hebel or similar, is established along the northern boundary of the property; and,
- All north, east and west facing second storey facades are constructed with "Category 2 Noise Control Treatment" as defined in *Development Near Rail Corridors and Busy Roads – Interim Guideline* (see Appendix B).

In the event that a solid fence cannot be established along the northern boundary, all north, east and west facing facades should be constructed with Category 2 Noise Control Treatment.

For any situation not outlined above, an assessment should be carried out by a suitably qualified Acoustic Engineer to identify appropriate measures to mitigate road noise levels at affected facades.

7 CONCLUSION

This study conducts an investigation and noise assessment for the proposed re-zoning of land at 95 Great Southern Road, Bargo. The study identifies potential sources of significant industrial and transportation noise within the vicinity of the Project site, and assesses these sources for their potential to generate noise impacts at future sensitive receivers within the Project site.

This study identifies the Bargo RRF&TS as the most significant source of industrial noise in the vicinity of the Project site and identifies Great Southern Road and the Anthony Street extension as the most significant sources of transportation noise in the vicinity of the Project site. Potential industrial and traffic noise impacts have been assessed in general accordance with the following NSW Government guidelines:

- *NSW Industrial Noise Policy* (EPA, 2000); and,
- *NSW Road Noise Policy* (DECCW, 2011).

Predicted noise levels from the assessment of the RRF&TS (AECOM, 2013) indicate compliance with relevant noise goals over the majority of the Project site, with a small region of potential impact in the north east corner of the Project site.

Predicted traffic noise levels indicate general compliance with applicable road noise goals, subject to minimum setback distances between residential facades and roadside kerbs.

Overall, the study found that the Project site is generally suitable for residential land use, and provided recommendations to mitigate potential noise impacts.

8 REFERENCES

AECOM 2013, *Environmental Noise Impact Assessment, Bargo Resource Recovery Facility & Transfer Station*, AECOM Australia Pty Ltd, Sydney.

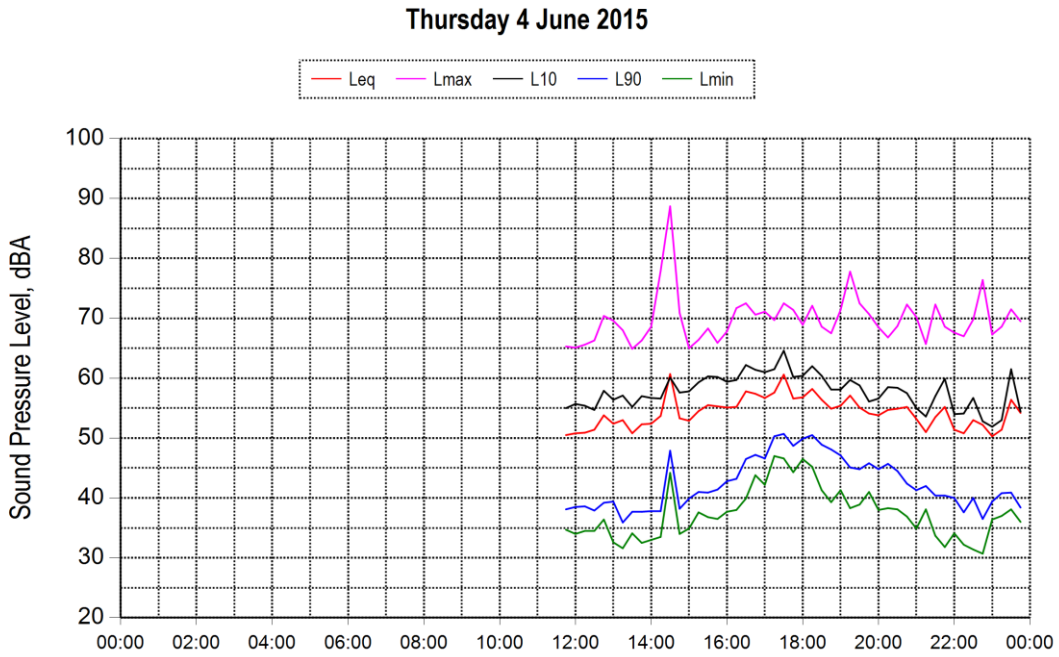
EPA 2000, *NSW Industrial Noise Policy*, Environmental Protection Authority, Sydney.

DECCW 2011, *NSW Road Noise Policy*, Department of Environment, Climate Change and Water NSW, Sydney.

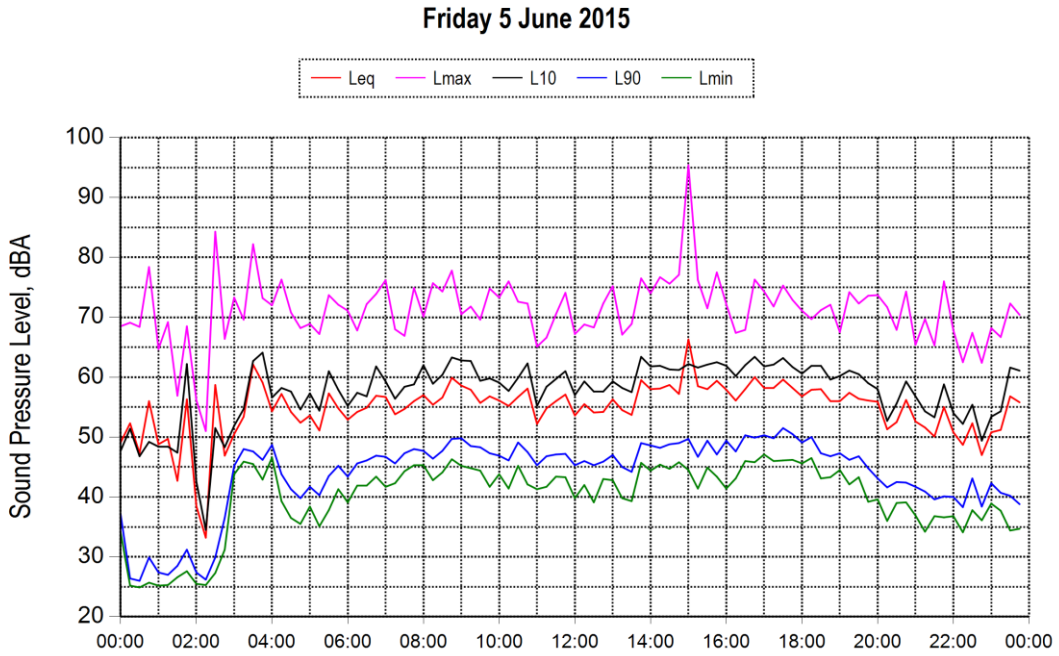
APPENDIX A

NOISE MEASUREMENT RESULTS

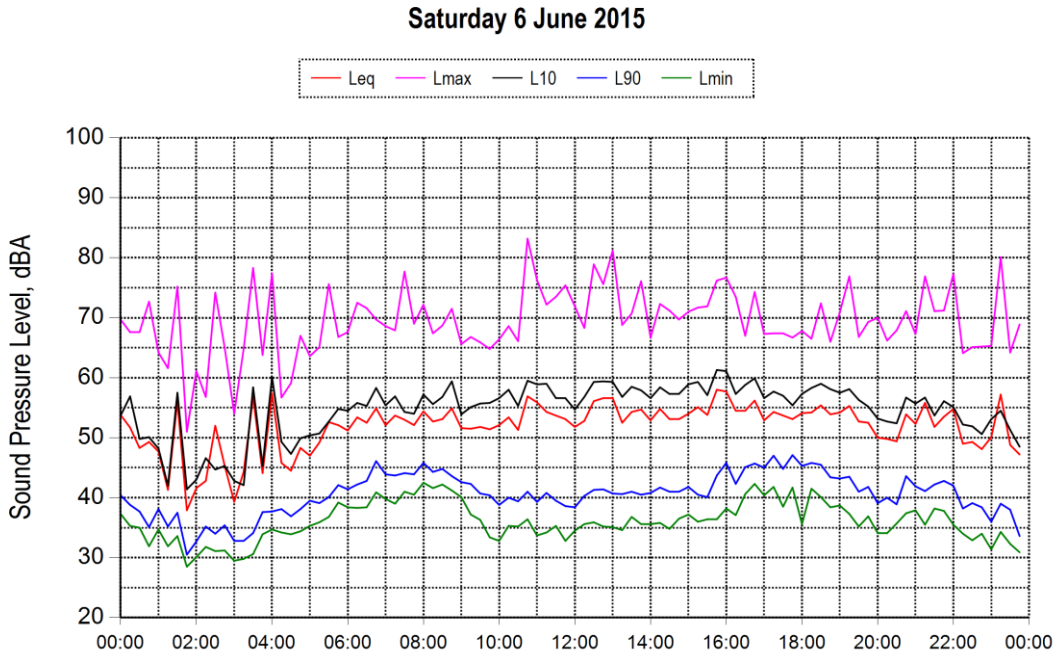
Project: 95 Great Southern Road
Location: WM1



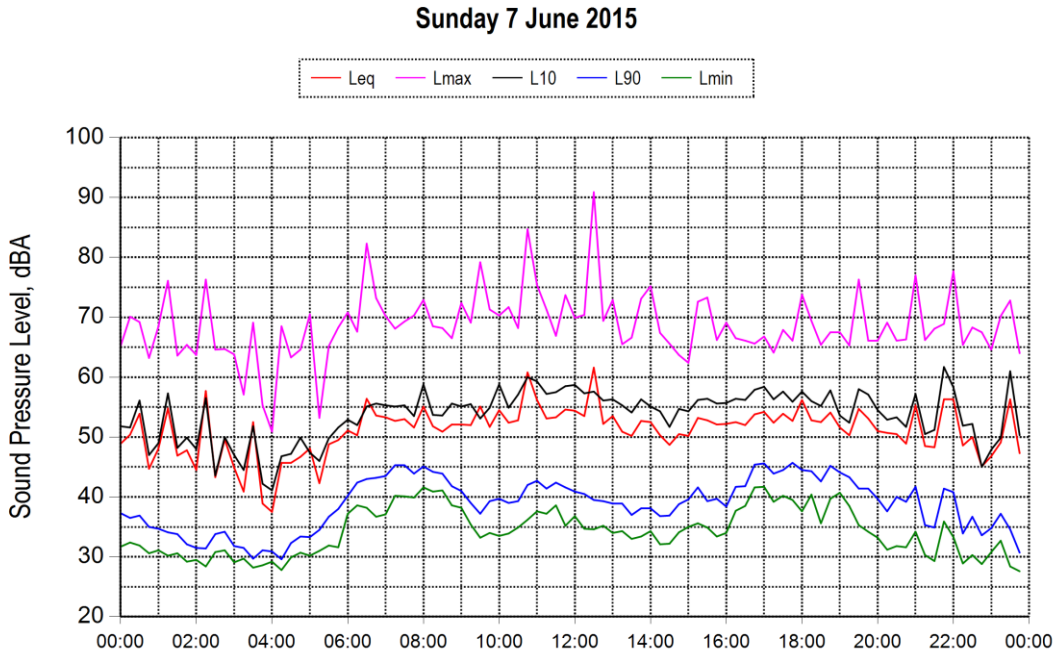
Project: 95 Great Southern Road
Location: WM1



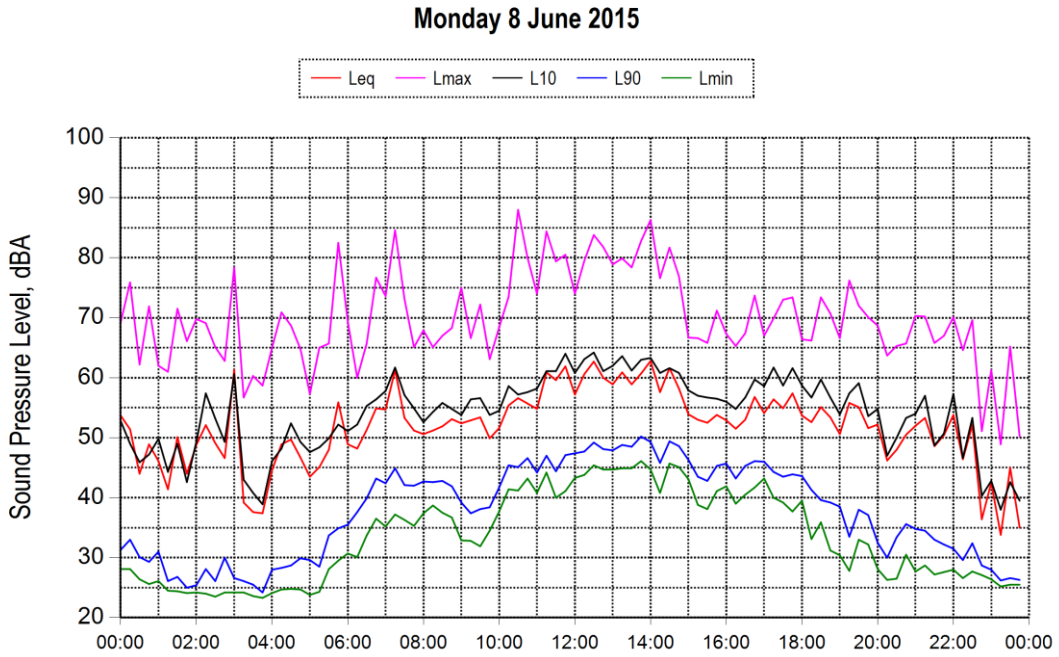
Project: 95 Great Southern Road
Location: WM1



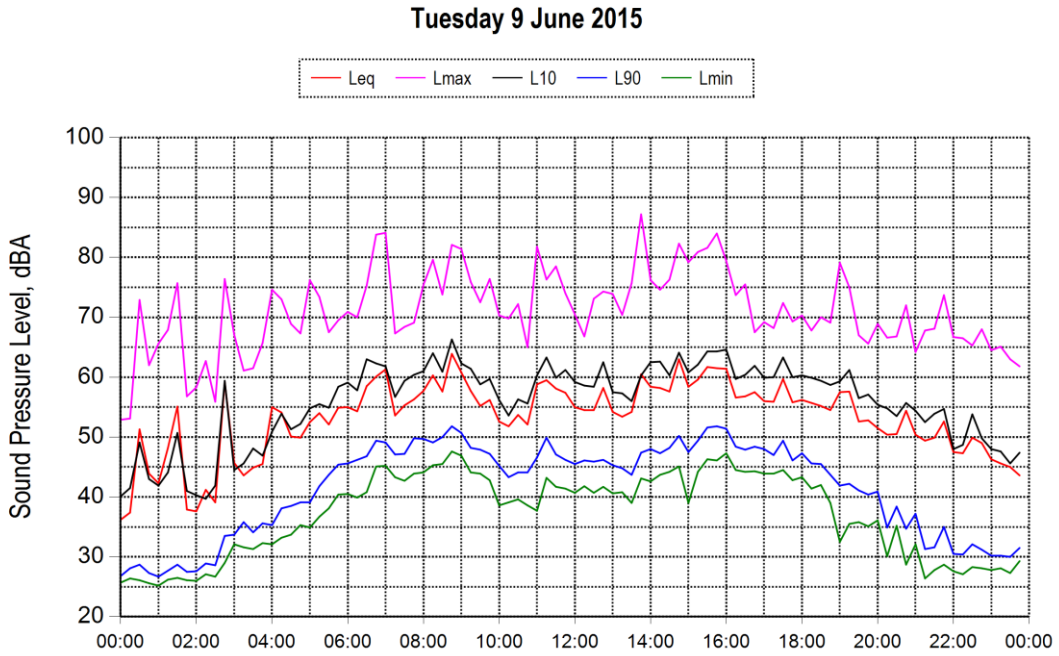
Project: 95 Great Southern Road
Location: WM1



Project: 95 Great Southern Road
Location: WM1



Project: 95 Great Southern Road
Location: WM1



Project: 95 Great Southern Road
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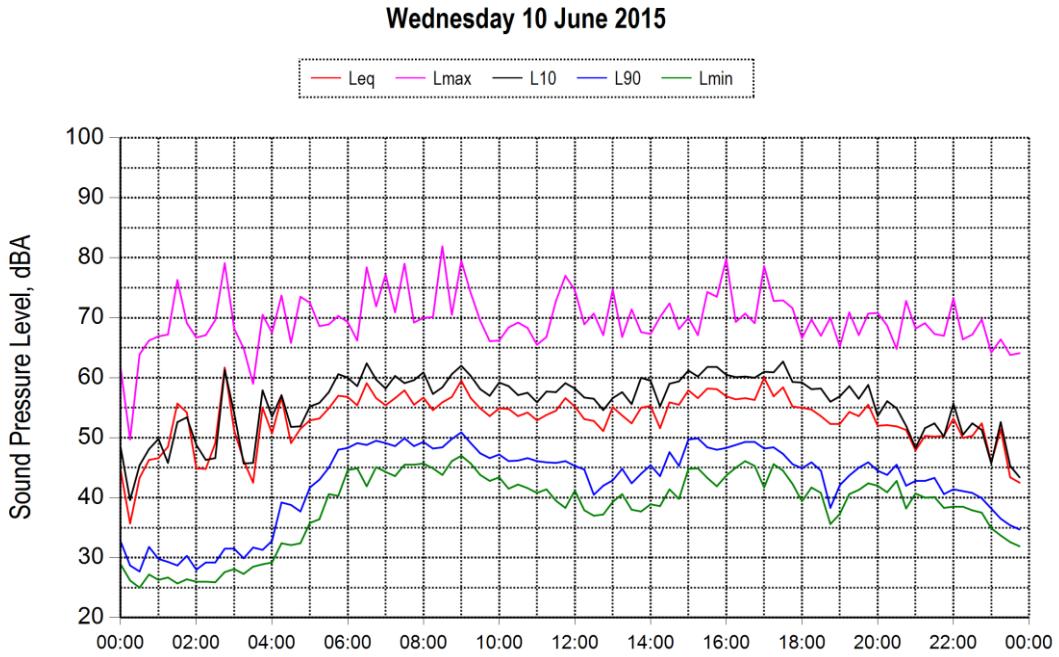

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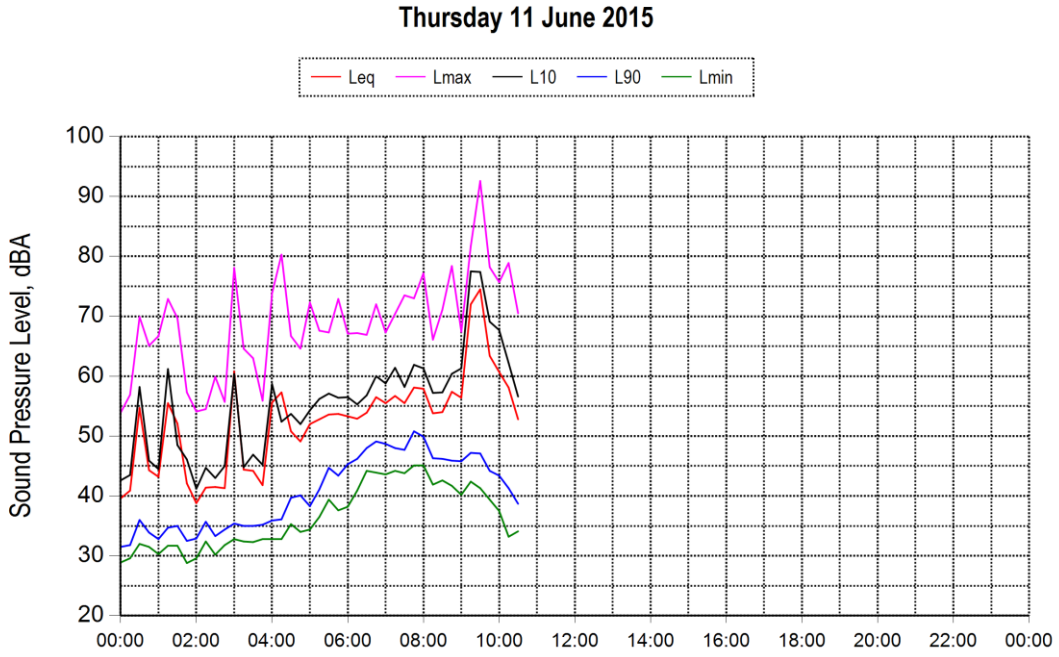

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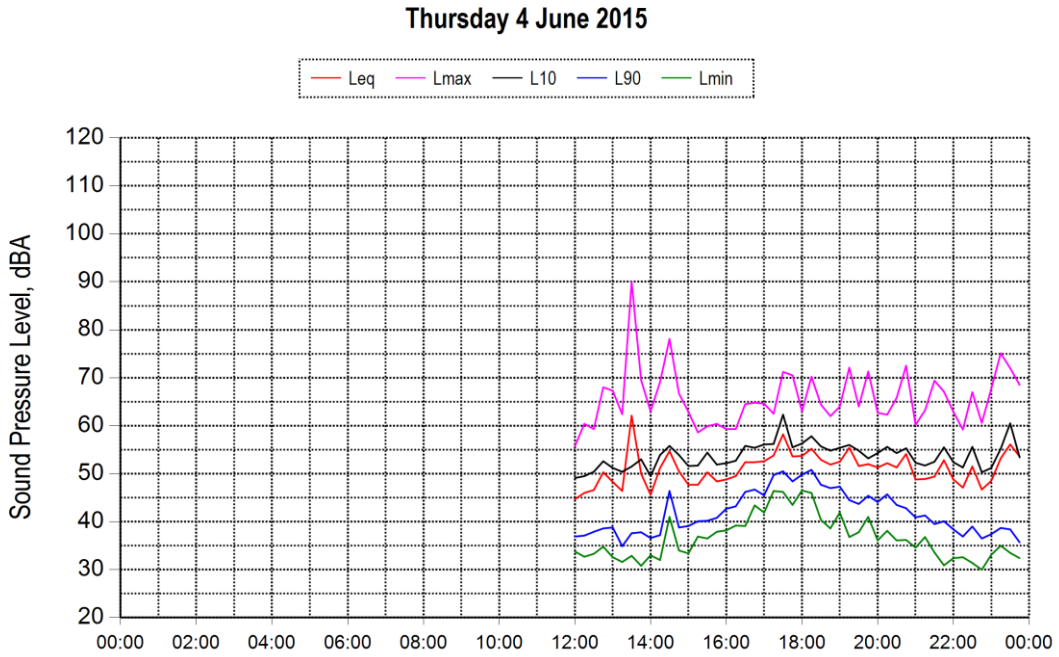
Location: WM2



Project: 95 Great Southern Road
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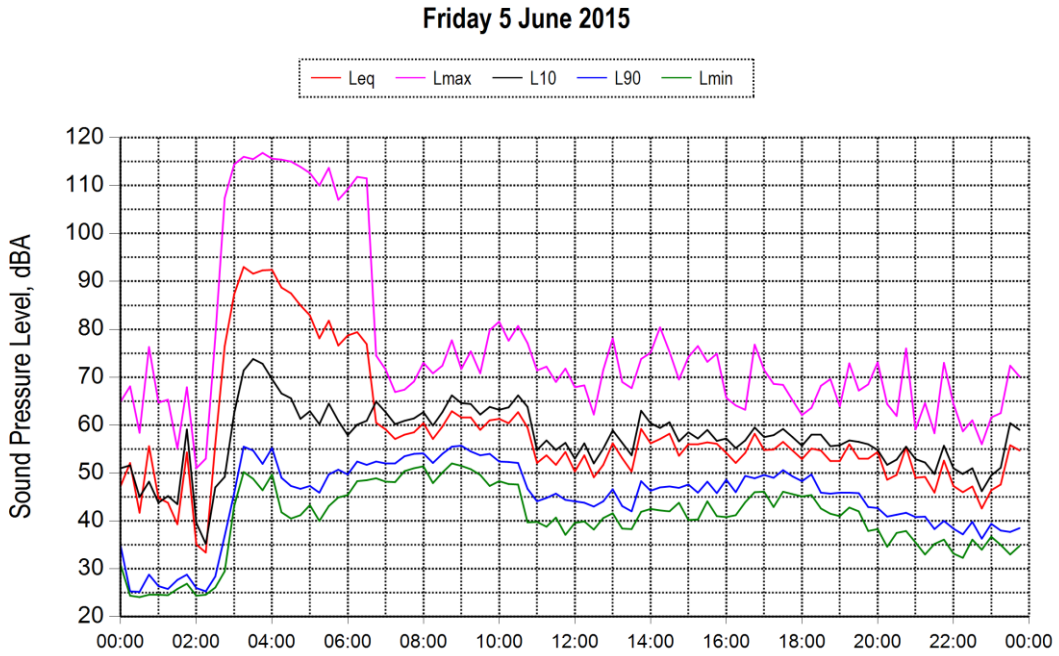

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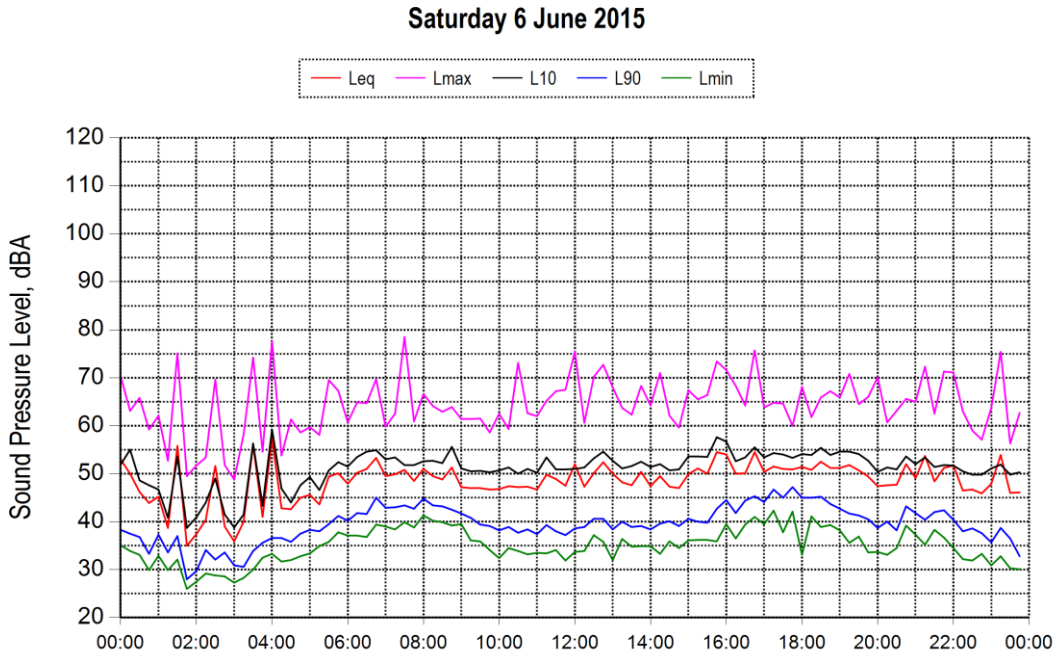
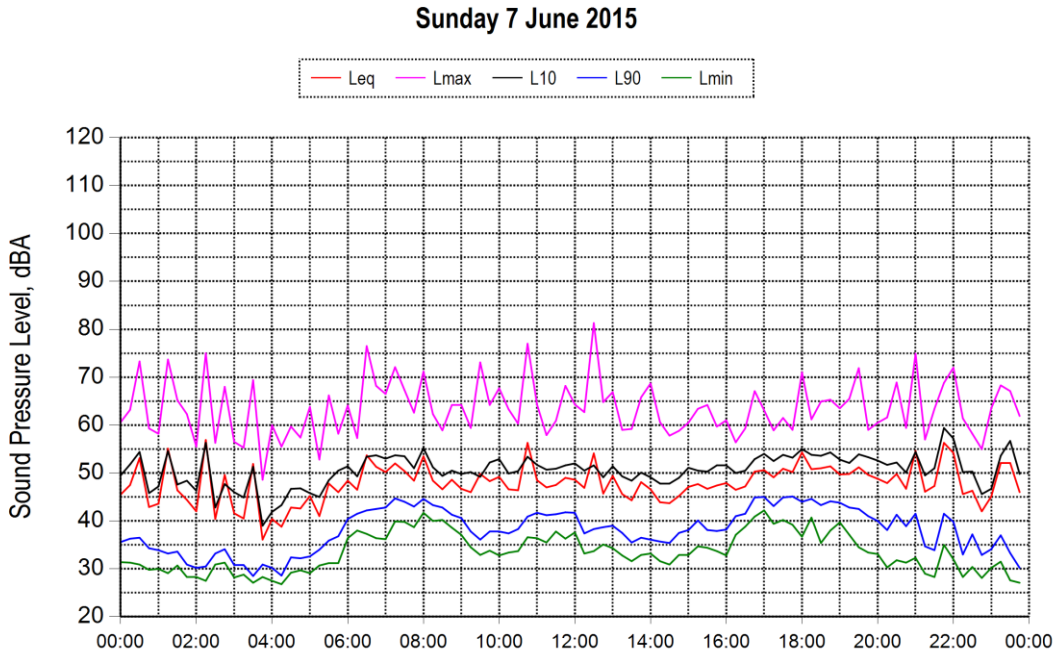
Location: WM2



Project: 95 Great Southern Road
Location: WM2



Project: 95 Great Southern Road
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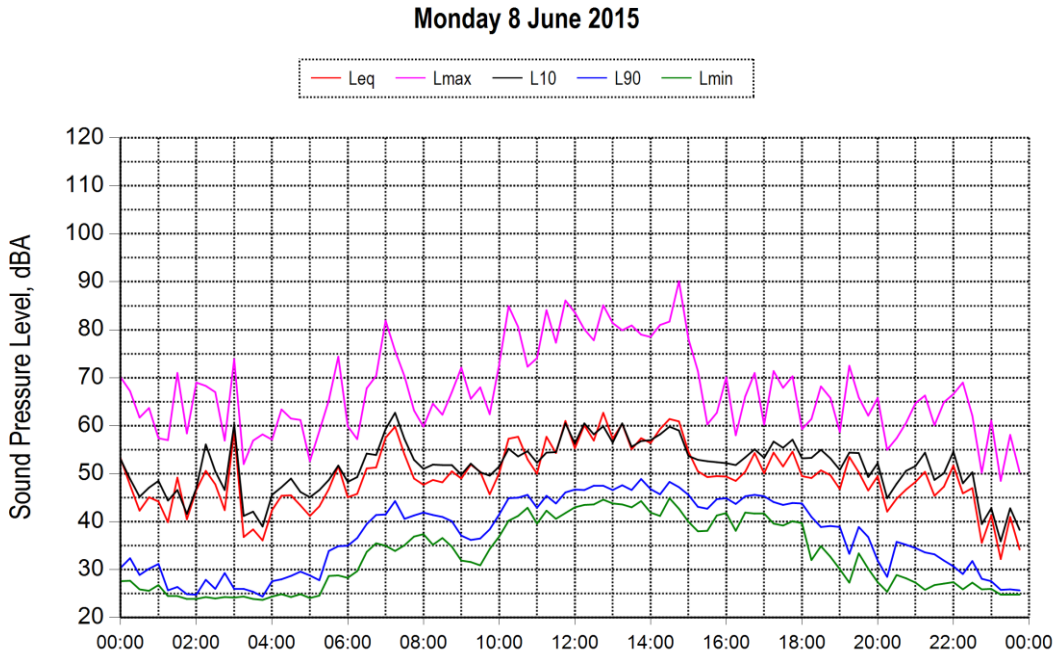

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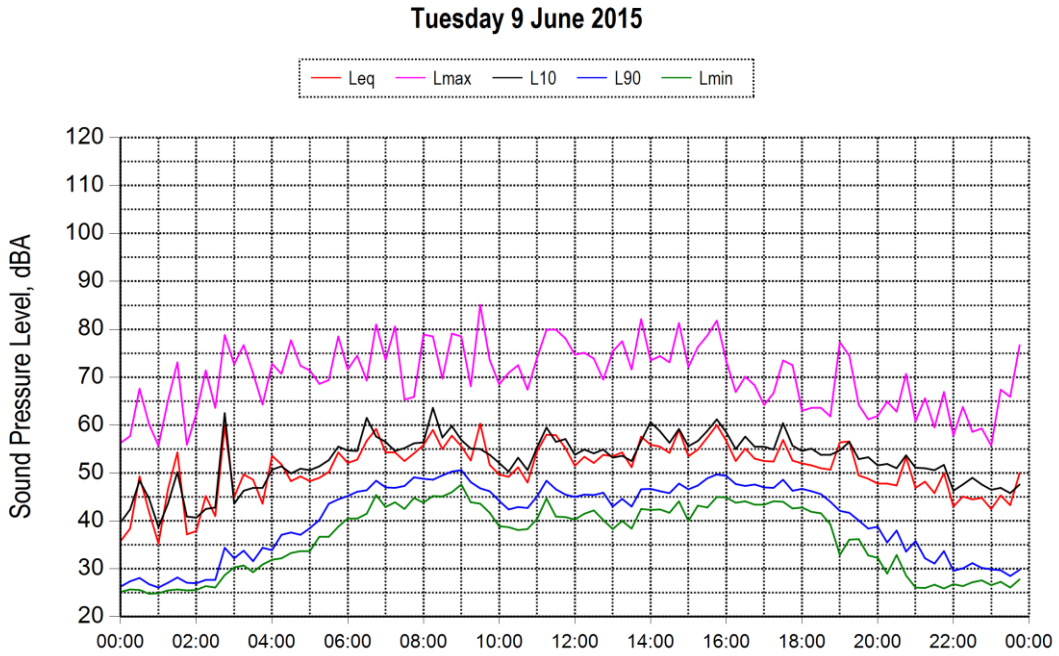
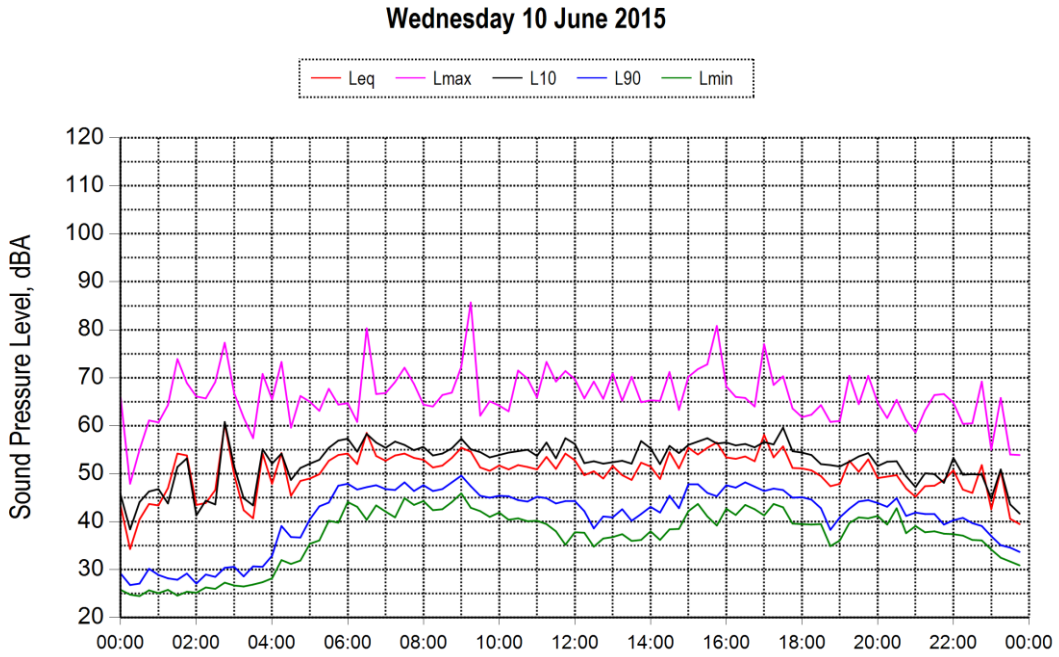
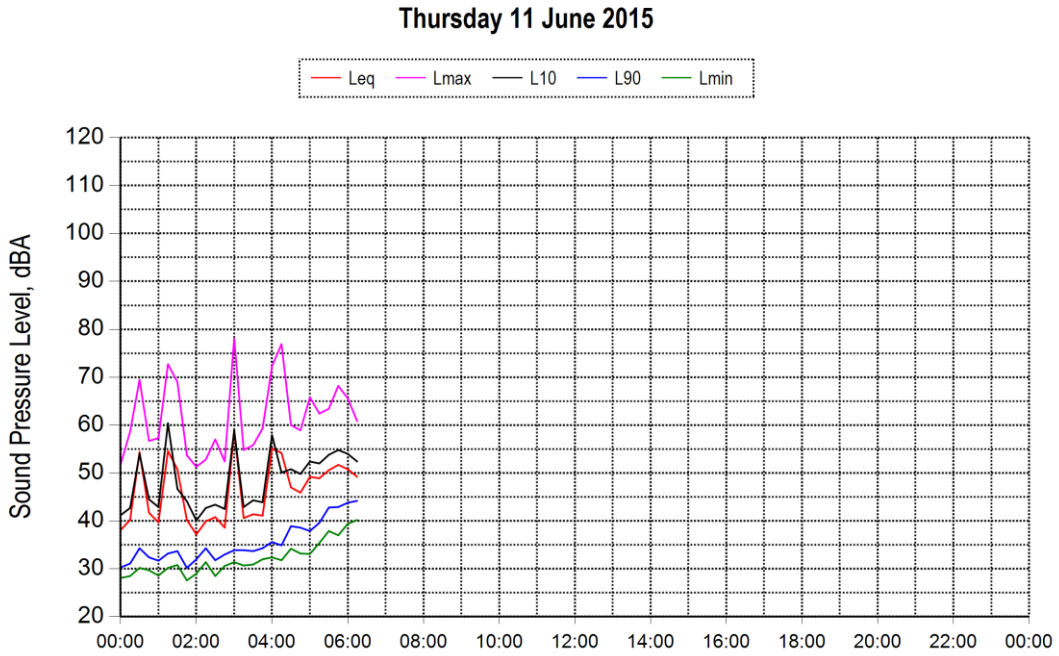


Project: 95 Great Southern Road
Location: WM2



Project: 95 Great Southern Road
Location: WM2



APPENDIX B

NOISE CONTROL TREATMENT

Appendix C – Acoustic Treatment of Residences

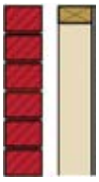
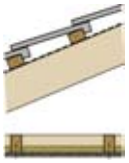
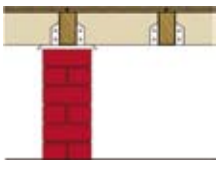
The following table sets out standard (or deemed-to-satisfy) constructions for each category of noise control treatment for the sleeping areas and other habitable areas of single / dual occupancy residential developments only. The assumptions made in the noise modelling are as follows:

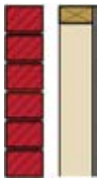
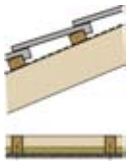
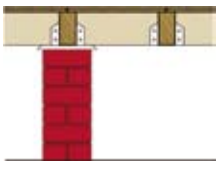
- Typical layout of a modern dwelling taken from a recent large residential development in an outer Sydney suburb
- Bedrooms and other habitable rooms are exposed to road noise

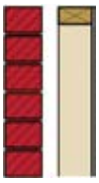
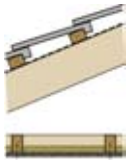
ACOUSTIC PERFORMANCE OF BUILDING ELEMENTS

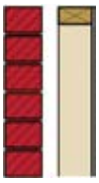
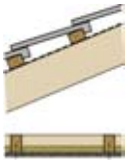
The acoustic performances assumed of each building element in deriving the Standard Constructions for each category of noise control treatment presented in the preceding Table, are presented below in terms of Weighted Sound Reduction Index (Rw) values, which can be used to find alternatives to the standard constructions presented in this Appendix:

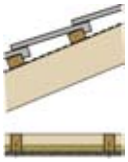
Category of Noise Control Treatment	R_w of Building Elements (minimum assumed)				
	Windows/Sliding Doors	Frontage Facade	Roof	Entry Door	Floor
Category 1	24	38	40	28	29
Category 2	27	45	43	30	29
Category 3	32	52	48	33	50
Category 4	35	55	52	33	50
Category 5	43	55	55	40	50

Category No.	Building Element	Standard Constructions	sample
1	**Windows/Sliding Doors**	Openable with minimum 4mm monolithic glass and standard weather seals	
	Frontage Facade	**Timber Frame or Cladding:** 6mm fibre cement sheeting or weatherboards or plank cladding externally, 90mm deep timber stud or 92mm metal stud, 13mm standard plasterboard internally	
		Brick Veneer: 110mm brick, 90mm timber stud or 92mm metal stud, minimum 50mm clearance between masonry and stud frame, 10mm standard plasterboard internally	
		Double Brick Cavity: 2 leaves of 110mm brickwork separated by 50mm gap	
	Roof	Pitched concrete or terracotta tile or metal sheet roof with sarking, 10mm plasterboard ceiling fixed to ceiling joists, R1.5 insulation batts in roof cavity.	
	Entry Door	35mm solid core timber door fitted with full perimeter acoustic seals	
	Floor	1 layer of 19mm structural floor boards, timber joist on piers	
		Concrete slab floor on ground	

Category No.	Building Element	Standard Constructions	sample
2	**Windows/Sliding Doors**	Openable with minimum 6mm monolithic glass and full perimeter acoustic seals	
	Frontage Facade	**Timber Frame or Cladding Construction:** 6mm fibre cement sheeting or weatherboards or plank cladding externally, 90mm deep timber stud or 92mm metal stud, 13mm standard plasterboard internally with R2 insulation in wall cavity.	
		Brick Veneer Construction: 110mm brick, 90mm timber stud frame or 92mm metal stud, minimum 50mm clearance between masonry and stud frame, 10mm standard plasterboard internally.	
		Double Brick Cavity Construction: 2 leaves of 110mm brickwork separated by 50mm gap	
	Roof	Pitched concrete or terracotta tile or metal sheet roof with sarking, 10mm plasterboard ceiling fixed to ceiling joists, R2 insulation batts in roof cavity.	
	Entry Door	40mm solid core timber door fitted with full perimeter acoustic seals	
	Floor	1 layer of 19mm structural floor boards, timber joist on piers	
		Concrete slab floor on ground	

Category No.	Building Element	Standard Constructions	sample
3	**Windows/Sliding Doors**	Openable with minimum 6.38mm laminated glass and full perimeter acoustic seals	
	Frontage Facade	**Brick Veneer Construction:** 110mm brick, 90mm timber stud or 92mm metal stud, minimum 50mm clearance between masonry and stud frame, 10mm standard plasterboard internally.	
		Double Brick Cavity Construction: 2 leaves of 110mm brickwork separated by 50mm gap	
	Roof	Pitched concrete or terracotta tile or sheet metal roof with sarking, 1 layer of 13mm sound-rated plasterboard fixed to ceiling joists, R2 insulation batts in roof cavity.	
	Entry Door	45mm solid core timber door fitted with full perimeter acoustic seals	
	Floor	Concrete slab floor on ground	

Category No.	Building Element	Standard Constructions	sample
4	**Windows/Sliding Doors**	Openable with minimum 10.38mm laminated glass and full perimeter acoustic seals	
	Frontage Facade	**Brick Veneer Construction:** 110mm brick, 90mm timber stud or 92mm metal stud, minimum 50mm clearance between masonry and stud frame, R2 insulation batts in wall cavity, 10mm standard plasterboard internally.	
		Double Brick Cavity Construction: 2 leaves of 110mm brickwork separated by 50mm gap	
	Roof	Pitched concrete or terracotta tile or sheet metal roof with sarking, 2 layers of 10mm sound-rated plasterboard fixed to ceiling joists, R2 insulation batts in roof cavity.	
	Entry Door	45mm solid core timber door fitted with full perimeter acoustic seals	
	Floor	Concrete slab floor on ground	

Category No.	Building Element	Standard Constructions	sample
5	**Windows/Sliding Doors**	Openable Double Glazing with separate panes: 5mm monolithic glass, 100mm air gap, 5mm monolithic glass with full perimeter acoustic seals.	
	Frontage Facade	**Double Brick Cavity Construction:** 2 leaves of 110mm brickwork separated by 50mm gap with cement render to the external face of the wall and cement render or 13mm plasterboard direct fixed to internal faces of the wall.	
	Roof	Pitched concrete or terracotta tile or sheet metal roof with sarking, 2 layers of 10mm sound-rated plasterboard fixed to ceiling joist using resilient mounts, R2 insulation batts in roof cavity	
	Entry Door	Special high performance acoustic door required - Consult an Acoustic Engineer	*Door to acoustic consultant's specifications*
	Floor	Concrete slab floor on ground	
6	**All**	Consult an Acoustic Engineer	