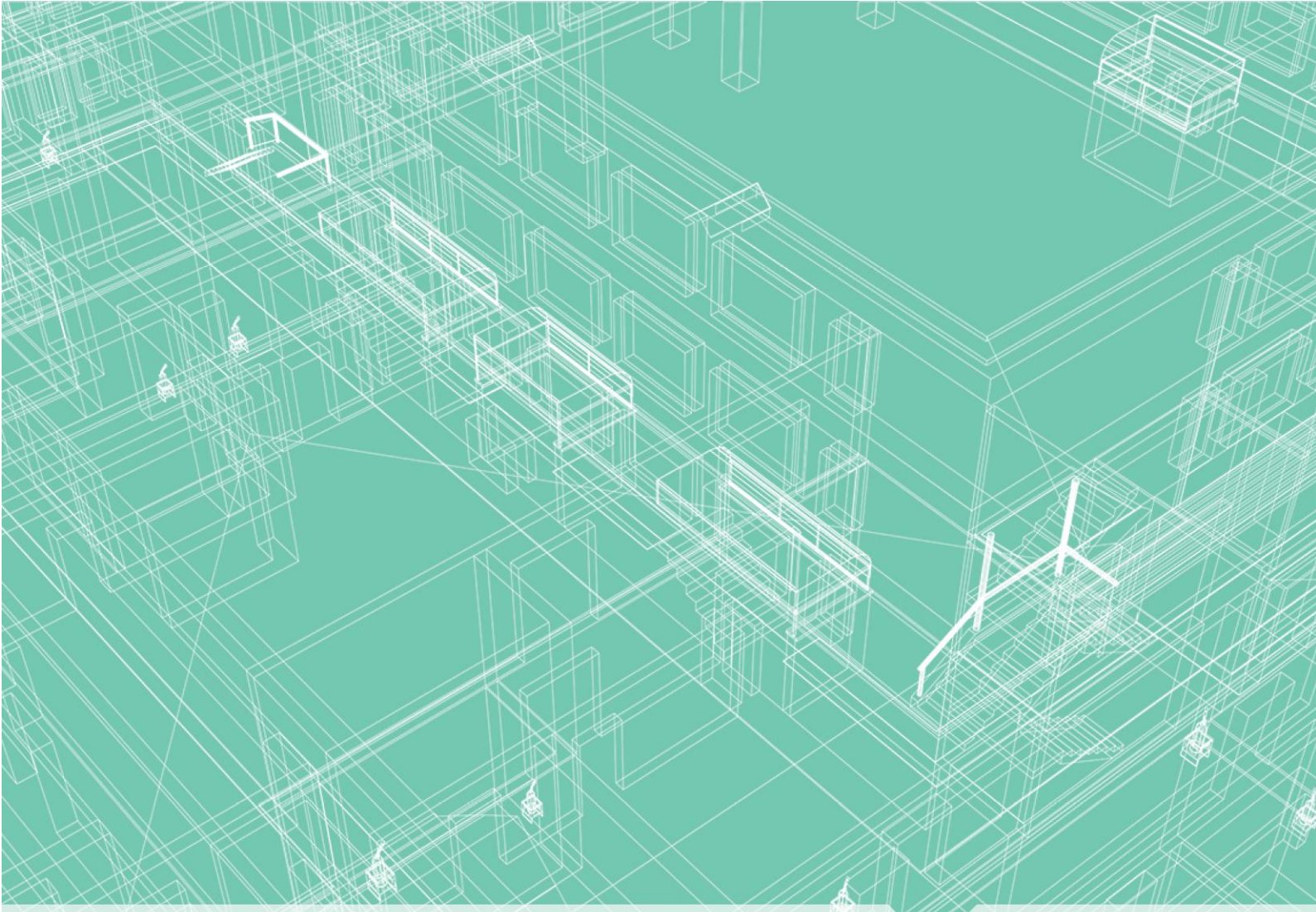

NOISE & VIBRATION IMPACT ASSESSMENT FOR SSDA (SSD 8865)

ST ANTHONY OF PADUA CATHOLIC SCHOOL, AUSTRAL

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DOCUMENT CONTROL SHEET

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CONTENTS

1 INTRODUCTION

JHA Consulting Engineers has been engaged by Munns Sly Moore Architects to provide a noise and vibration impact assessment for the State Significant Development (SSD 8865) Application for the proposed St Anthony of Padua Catholic School Development in Austral, NSW. The site is located at 125-165 Tenth Avenue and 140-170 Eleventh Avenue, Austral.

Secretary's Environmental Assessment Requirements (SEARs) have been issued, requiring the preparation of an Environmental Impact Statement (EIS) for the proposed development. This report addresses the requirements established by the Department of Planning and Environment (DoPaE) as part of the SSD process and has been prepares considering the following documentation:

- SEARs issued by the DoPaE.
- NSW EPA Noise Policy for Industry 2017.
- Association of Australasian Acoustic Consultants (AAAC) 'Guideline for Child Care Centre Acoustic Assessment' 2013.
- NSW EPA Road Noise Policy 2011.
- NSW DoP Development Near Rail Corridors and Busy Roads – Interim Guideline 2008.
- NSW DECCW Interim Construction Noise Guideline 2009.
- NSW DECC Assessing Vibration: a technical guideline 2006.

This acoustic report demonstrates compliance with the aforementioned SEARs and has been prepared to accompany a SSD Application to the NSW DoPaE. This report shall be read in conjunction with the Architectural design drawings and other consultant design reports submitted as part of the application.

The objectives of this acoustic assessment are:

- Identify noise sensitive receivers that will potentially be affected by the operation and construction of the proposed development.
- Carry out noise surveys to determine existing ambient and background noise levels on site.
- Establish the appropriate noise level and vibration criteria in accordance with the relevant standards, guidelines and legislation for the following noise emissions:
  - Mechanical plant from the development to the surrounding receivers.
  - Public address, school bell and tower bell.
  - Out-of-school-hours for activities within the performing arts theatre and the indoor recreational centre.
  - Outdoor playgrounds.
  - Child care centre.
- Determine whether the relevant criteria can be achieved based on the proposed operations and construction methods. Where applicable, provide recommendations for any necessary acoustic control measures that will need to be incorporated into the development or use in order to ensure with the assessment criteria.
- Provide recommendations for Construction Noise and Vibration Planning.

This report provides:

- A statement of compliance with the relevant statutory criteria for the proposed use development within the vicinity of the nearest potentially affected receivers.
- Recommendations for noise mitigation measures for the proposed development in order to meet the relevant criteria when compliance is not achieved.
- Recommendations for noise and vibration level criteria during construction phase.

The following documentation has been used for the preparation of this report:

- Site drawings of the proposed development.
- Traffic Impact Assessment report of the proposed development.
- Noise data collected on site through the use of noise loggers and a hand held spectrum analyser.

This document and related work has been prepared following JHA Consulting Engineers Quality and Environmental Management Systems, which are based on AS/NZS ISO 9001 and ISO 14001.

2 DESCRIPTION OF THE PROPOSAL

2.1 PROPOSED DEVELOPMENT

Austral is a suburb of Sydney in the local government area of the City of Liverpool. According to the 2016 Census of Population, there were 3,024 residents in Austral.

The proposed site is bounded by Fourth Avenue (to the West), Tenth Avenue (to the South) and Eleventh Avenue (to the North) and is located within a rural environment characterised by light levels of activity during the day. Figure 1 shows the site location and nearest noise sensitive receivers.

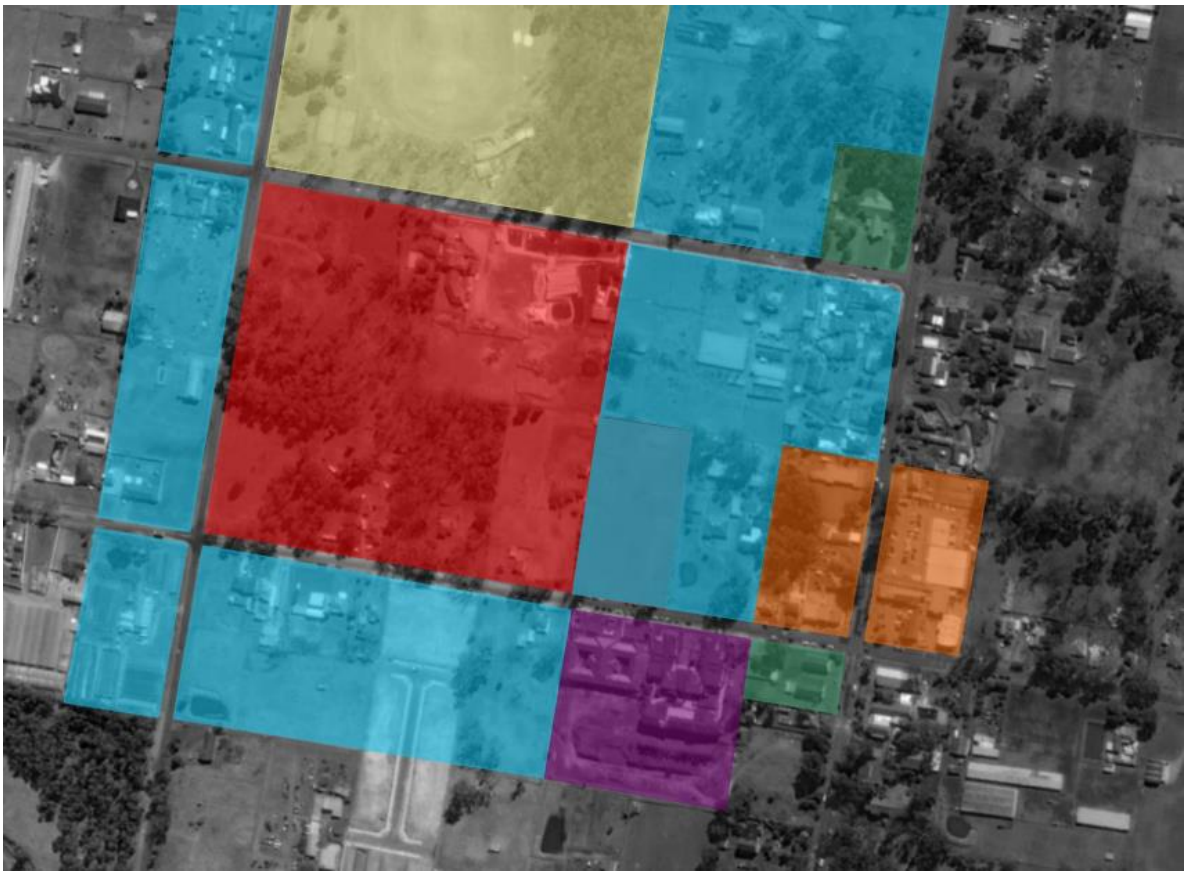


Figure 1: Aerial view of site showing the location of the proposed development (red shadow), residential receivers (blue shadow), commercial receivers (orange shadow), place of worship receivers (green shadow), aged care receivers (purple shadow) and active recreation receiver (yellow shadow).

The St Anthony of Padua Catholic School Masterplan identifies the staged development of the School comprising educational buildings and associated facilities including a church, trade training centre, multi-purpose hall, childcare centre, indoor and outdoor sports facilities. The School is proposed to accommodate up to 2480 students plus 200 staff members.

Notwithstanding that adjacent lots are not fully developed, noise impacts have considered future developments and noise level predictions have been obtained at their future location. A setback of 4.5 meters from the boundary and the dwellings has been used for the noise level predictions as per Liverpool Growth Centres Precincts DCP.

Figure 2 shows the proposed development layout plus distances to the nearest noise sensitive receivers as per the latest architectural drawings. The future dwellings and their respective distances outlined in Table 1 have been measured considering the setbacks as per the relevant DCP.

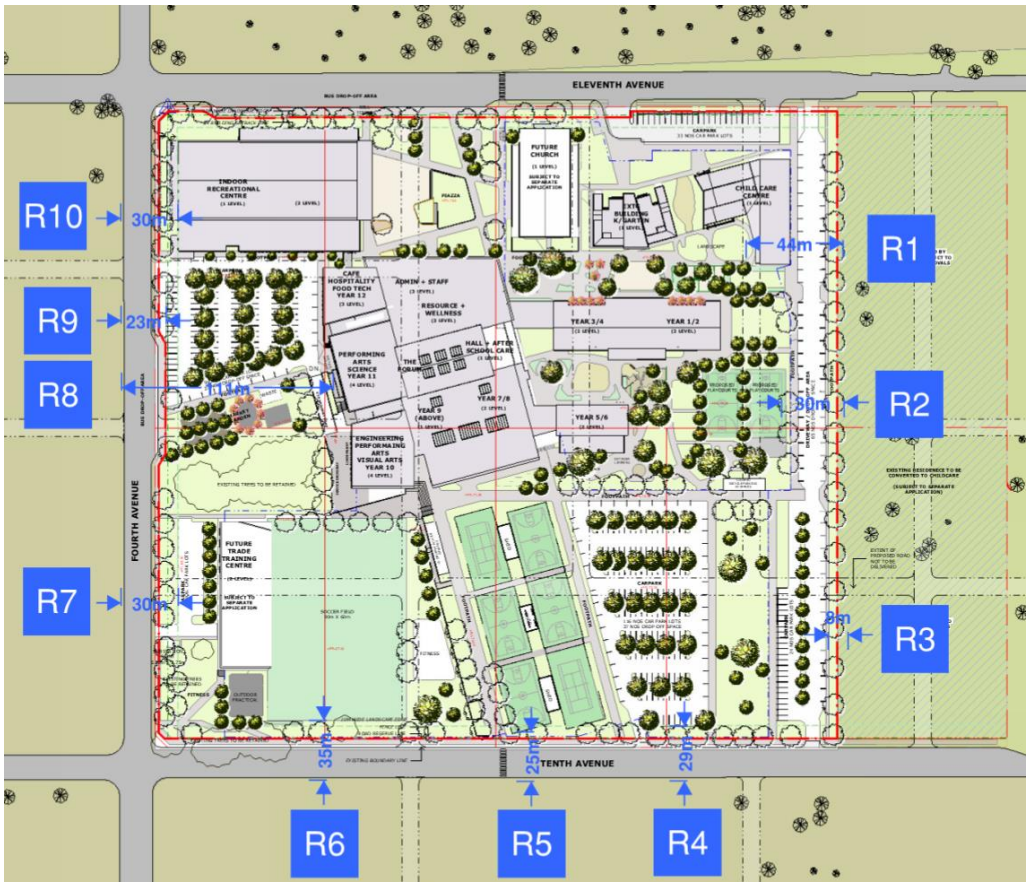


Figure 2: Site layout of the proposed development and distances to nearest noise sensitive receivers.

Based on the proposed layout and the nearest noise sensitive receiver locations, Table 3 shows a summary of the most affected noise receivers plus assumed distances to nearest noise sources.

Sensitive Receiver	*Receiver*	*Noise Source*	*Approx. Distance, m*
R1	120 Eleventh Av - Future	Play area of Childcare Centre	44
R2	120 Eleventh Av - Future	Play Court A	30
R3	125 Tenth Av - Future	South-Eastern Carpark	8
R4	144 Tenth Av- Existing	Southern Carpark	29
R5	150 Tenth Av - Existing	Play Court B	25
R6	152-156 Tenth Av - Existing	Soccer Fields	35
R7	175 Tenth Av - Future	South-Western Carpark	30
R8	180 Eleventh Av – Future	Performance Centre	111
R9	180 Eleventh Av – Future	Western Carpark	23
R10	180 Eleventh Av – Future	Indoor Recreational Centre	30

Table 1: Nearest sensitive receivers surrounding the site

2.2 RESPONSE TO SEARS

The acoustic report is required by the Secretary's Environmental Assessment Requirements (SEARs) for SSD 8865. This table identifies the relevant SEAR's requirement/s and corresponding reference/s within this report.

SEARs Item	*Report Reference*
4. Environmental Amenity • *Assess amenity impacts on the surrounding locality, including solar access, visual privacy, overshadowing and acoustic impacts.* • *Identify any proposed use of the school outside of school hours (including weekends) and assess any resultant amenity impacts on the intermediate locality and proposed mitigation measures.*	Section 5 & 6
10. Noise and Vibration *Identify and provide a quantitative assessment of the main noise and vibration generating sources during demolition, site preparation, bulk excavation, construction and operation, including consideration of any public address system, school bell, mechanical services (e.g. air conditioning plant), use of any school hall for concerts etc. (both during and outside school hours) and any out of hours community use of the school facilities, and outline measures to minimise and mitigate the potential noise impacts on surrounding occupiers of land.*	Section 5, 6 & 7
Relevant Policies and Guidelines: • *NSW EPA Noise Policy for Industry (2017)* • *Interim Construction Noise Guideline (DECC)* • *Assessing Vibration: A Technical Guideline 2006* • *Development Near Rail Corridors and Busy Roads – Interim Guideline (Department of Planning 2008).*	Section 4

Table 2: Summary of relevant SEAR's requirements

3 SITE MEASUREMENTS

3.1 GENERAL

Attended and unattended noise surveys around the proposed site were conducted in order to establish the ambient and background noise levels of the site and surrounds.

Long-term noise monitoring was carried out from Thursday 5th to Thursday 12th April 2018 with a Rion NL-52 noise logger (Serial Number 1054192). The noise logger recorded L_{A1}, L_{A10}, L_{Aeq} and L_{A90} noise parameters at 15-minute intervals during the measurement period. The calibration of the noise logger was checked before and after use and no deviations were recorded.

The noise logger microphone was mounted 1.5 meters above the ground and windshield was used to protect the microphone. Weather conditions were generally calm and dry during the unattended noise monitoring.

On Thursday 5th April 2018, short-term noise measurements were carried out during day-time. Short-term noise measurements were carried out with a NTI XL-2 hand-held Sound Level Meter (Serial Number: A2A-13742-E0). The calibration of the SLM was checked before and after each use and no deviations were recorded.

JHA Consulting Engineers carried out the surveys, in accordance with the method described in the AS/NZS 1055:1997 'Acoustics – Description and measurement of environmental noise, parts 1 and 2'.

The SLM microphone was mounted 1.5 meters above the ground and a windshield was used to protect the microphone. Measurements were undertaken in the free field – i.e. more than 3 meters away from any building façade or vertical reflective surface. Weather conditions were calm and dry during the each attended noise monitoring.

The long-term and short-term noise monitoring locations are shown in Figure 3.

Figure 3: Long-term monitoring location (L1) and short-term monitoring location (M1).

3.2 SHORT-TERM NOISE MONITORING

Short-term noise monitoring was carried out to obtain representative third-octave band noise levels of the site plus close to the nearest noise sensitive receivers. One short-term noise monitoring location was chosen as representative as follows:

- Location M1: Eleventh Avenue at the proposed site boundary.

From observations during the site visit, it is noted that at location M1 ambient and background noise levels are dominated by low background noise levels and intermittent traffic noise.

A summary of the results of the short-term noise monitoring are shown in Table 3.

Location	*Date and Time*	*Parameter*	*Sound Pressure Level, dB re 20μPa*									
			Overall dB(A)	*Octave Band Centre Frequency, Hz*								
				31.5	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
M1	05/04/2018 14.10 – 14.25	$L_{90,15min}$	**39**	51	49	45	38	34	35	31	26	20
		$L_{eq,15min}$	**53**	63	60	54	48	46	47	44	44	46
		$L_{10,15min}$	**51**	66	63	56	49	45	47	43	38	34
	05/04/2018 14.30 – 14.45	$L_{90,15min}$	**39**	49	49	45	38	34	34	30	24	18
		$L_{eq,15min}$	**54**	59	64	56	52	50	51	45	41	34
		$L_{10,15min}$	**51**	62	63	58	49	46	47	43	39	30

Table 3: Short-term noise levels measured on site.

3.3 LONG-TERM NOISE MONITORING

The noise logger was located on the boundary of the proposed development site. This location was secured and considered to be representative of the typical ambient and background noise levels. The long-term noise monitoring location was chosen as follows:

- Location L1: Eleventh Avenue at the proposed site boundary.

The detailed results of the long-term noise monitoring are presented graphically in Appendix A. As stated in the NSW NPI, any data likely to be affected by rain, wind or other extraneous noise has been excluded from the calculations (shadowed in the Appendix A graphs).

The background noise levels have been established in general accordance with the methodology described in the NSW NPI, i.e. the 10th percentile background noise level for each period of each day of the ambient noise survey. The median of these levels is then presented as the background noise level for each assessment period.

The background and ambient noise levels measured for each period are shown in Table 4.

Location	*Rating Background Noise Levels, dB(A)*			*L_{Aeq} Ambient Noise Levels, dB(A)*		
	Day 7am-6pm	*Evening 6pm-10pm*	*Night 10pm-7am*	*Day 7am-6pm*	*Evening 6pm-10pm*	*Night 10pm-7am*
L1	37	38	33	54	51	47

Table 4: Long-term background and ambient noise levels measured on site.

3.4 EXISTING TRAFFIC NOISE

The traffic noise levels from the Eleventh Avenue have been processed following the NSW Road Noise Policy methodology. These values are based on the long-term noise monitoring at location L1 and are summarised in Table 5.

Location	*Traffic Noise Levels, dB(A)*			
	Day (7am-10pm) $L_{Aeq,15hour}$	*Night (10pm-7am)* $L_{Aeq,9hour}$	*Noisiest Hour Day (7am-10pm)* $L_{Aeq,1h}$	*Noisiest Hour Night (10pm-7am)* $L_{Aeq,1hour}$
L1	54	47	56	50

Table 5: Traffic noise levels as per NSW Road Noise Policy metrics.

4 RELEVANT NOISE STANDARDS AND GUIDELINES

4.1 STANDARDS AND GUIDELINES

The following standards and guidelines are considered relevant to the project and have been referenced in developing the project noise level criteria.

- Noise Emissions and Intrusive Noise
  - Environmental Planning and Assessment (EP&A) Act 1979.
  - Protection of the Environmental Operations (POEO) Act 1997.
  - Protection of the Environmental Operations. Noise Regulation Controls (NRC) 2008.
  - NSW Department of Environment Climate Change and Water (DECCW) Noise Guide for Local Government (NGLG) 2013.
  - Liverpool City Council Legislation.
  - NSW Environment Protection Authority (EPA) Noise Policy for Industry (NPI) 2017.
  - Association of Australasian Acoustical Consultants (AAAC) 'Guideline for Child Care Centre Acoustic Assessment'.
- Traffic Noise
  - NSW Department of Planning (DoP) 'Development Near Rail Corridors or Busy Roads – Interim Guideline' 2008.
  - NSW EPA Road Noise Policy (RNP) 2011.
- Construction Noise and Vibration
  - NSW DECCW Interim Construction Noise Guideline (ICNG) 2009.
  - NSW DECC Assessing Vibration: A Technical Guideline 2006.
  - NSW Road Maritime Service (RMS) Construction Noise and Vibration Guideline 2016.
  - Australian Standard AS 2436:2010 'Acoustics – Guide to Noise Control on Construction, Maintenance & Demolition Sites'.

4.2 REGULATORY FRAMEWORK

The Environmental Planning and Assessment Act 1979 (EP&A Act) provides the regulation framework for the protection of the environment in NSW. The Act is relevantly about planning matters and ensuring that "environmental impact" associated with the proposed development is properly considered and reasonable before granting development consent to develop.

The assessment of "environmental impact" relies upon the use of acceptable noise criteria which either maybe defined in a Development Control Plan, or derived from principles using guidelines like NSW EPA Noise Policy for Industry (NPI 2017) or Noise Guide for Local Government (NGLG 2013).

The Protection of the Environment Operations (POEO) Act 1997 has the objective of protect, restore and enhance the quality of NSW environment. Abatement of noise pollution is underpinned by the definition of "offensive noise" as follows:

"...

(a) that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:

(i) is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or

(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or

(b) that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances, prescribed by the regulations.

..."

Noise Guide for Local Government (NGLG), 2013 provides a consideration checklist to determine an "offensive noise".

4.3 NSW NOISE GUIDE FOR LOCAL GOVERNMENT

NGLG 2013 is a guideline that is at aimed at councils and planners to provide guidance in the management of local noise problems and in the interpretation of existing policy and legislation.

Table 1.3 of NGLG 2013 contains the management for common neighbourhood noise issues and describes Council as the Appropriate Regulatory Authority (ARA) for private educational facilities and general road traffic noise on local roads.

The offensive noise test aids in making a systematic judgment about the offensive nature of noise emissions. The NGLG 2013 offensive noise test considers that noise may be offensive in three ways, according to:

- Audibility.
- Duration.
- Inherently offensive characteristics.

4.4 NOISE EMISSIONS AND INTRUSIVE NOISE

4.4.1 LIVERPOOL CITY COUNCIL LEGISLATION

Relevant Planning Documents of Liverpool City Council Legislation have been reviewed for any noise requirement or criteria.

The Liverpool City Council Local Environmental Plan (L-LEP 2008) sets the Land Zoning as shown in Figure 4 as per information extracted from ePlanning portal of the Liverpool City Council. The site is categorized as Low Density Residential (R2) and surroundings are categorized as Low Density Residential, Medium Density Residential (R3), Public Recreation (RE1) and Environmental Living (E4)[1].

[1] Information retrieved on 6th February 2019.

Section 4.7 of the Liverpool Growth Centre Precincts Development Control Plan contains relevant requirements for non-residential developments in residential zones. These are as follows:

"...

4.3.4 Visual and acoustic privacy

...

No electrical, mechanical or hydraulic equipment or plant shall generate a noise level greater than 5dB(A) above background noise level measured at the property boundary during the hours 7.00am to 10.00pm and noise is not to exceed background levels during the hours 10.00pm to 7.00am/

...

4.7.4. Educational Establishments and Places of Worship

...

d) To mitigate the impact of noise, privacy, increased traffic and nuisance on surrounding residential development.

...

8. Development must be designed to minimise the possibility of noise impacts to the occupants of adjoining or neighbouring dwellings.

9. Where it is likely that a development may cause an adverse noise impact on nearby residential areas, an acoustic report will be required to be submitted to council with the Development Application.

10. Development must comply with Office of Environment and Heritage noise guidelines in clause 4.3.4.

11. Where appropriate, buffers should be put in place to limit noise impacts on the surrounding area. Extensive noise walls along most or all of a property boundary are not appropriate and other measures should be used to mitigate noise.

12. Sources of noise such as garbage collection, machinery, parking areas and air conditioning plants are sited away from adjoining properties and screened / insulated by walls or other acoustic treatment. Noise levels are not to exceed specified limits at the most affected point of the property boundary.

13. The general hours of operation for places of public worship and educational establishments are between 7am and 9pm.

14. Variation to the approved hours of operation may be approved by Council subject to other requirements or a merit assessment.

Note: Legislation covering noise impacts and hours of operation is the Protection of the Environment Operations Act 1997 and the Protection of the Environment (Noise Control) Regulation 2000 (Noise Control Regulation. Applicants should also refer to the Office of Environment and Heritage website for more information regarding noise control.

..."

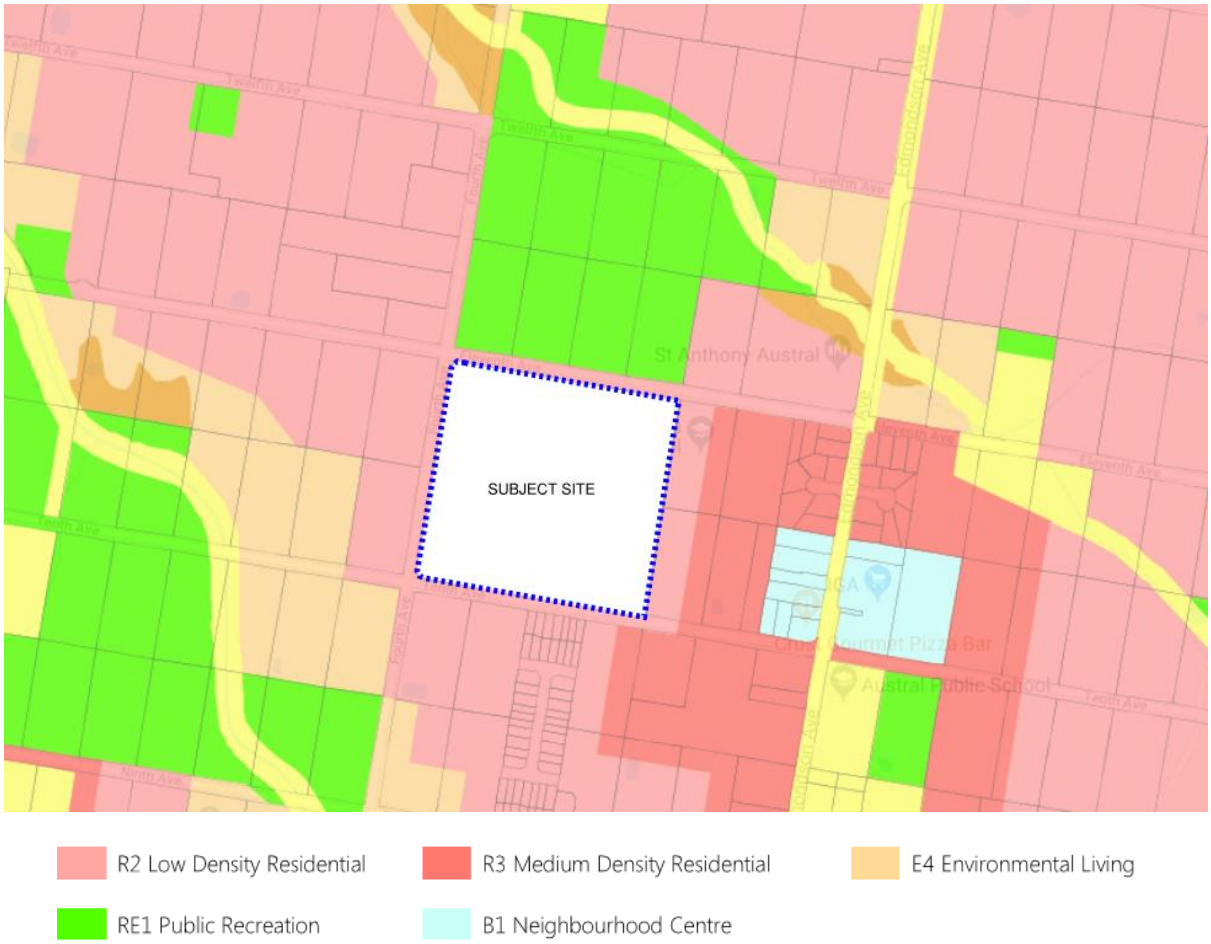


Figure 4: Land Zoning of the site (red shadow) and surroundings.

4.4.2 NSW EPA NOISE POLICY FOR INDUSTRY

The NSW EPA Noise Policy for Industry 2017 assesses noise from industrial noise sources - scheduled under the POEO. Mechanical noise from the development shall be addressed following the recommendations in the NSW NPI.

The assessment is carried out based on the existing ambient and background noise levels addressing the following:

- Intrusiveness Criteria, to control intrusive noise into nearby sensitive receivers.
- Amenity Criteria, to maintain the noise level amenity for particular land uses.

These criteria are established for each assessment period (day, evening and night) and the more stringent of the two criteria sets the Project Noise Trigger Level (PNTL's).

However, given land use in the area is undergoing a significant land zoning change – from rural to residential – Section 2.4.3 of the NSW NPI states the following: "*When land uses in an area are undergoing significant change, for example, residential subdivisions with associated development of local and regional roads, the background noise levels would be expected to change. The impact of noise from an existing industry on a proposed new residential area should be made using the recommended amenity noise level for the residential land use, not the project intrusiveness noise level.*"

The NSW NPI states the following to define the amenity criteria:

"To limit continuing increases in noise levels from application of the intrusiveness level alone, the ambient noise level within an area from all industrial noise sources combined should remain below the recommended amenity noise levels specified in Table 2.2 where feasible and reasonable. The recommended amenity noise levels will protect against noise impacts such as speech interference, community annoyance and some sleep disturbance."

Based on the amenity criteria definition and the land zoning, Table 6 shows the amenity criteria and PNTLs for the noise sensitive receivers.

Indicative Noise Amenity Area	*Period*	*Recommended Amenity Noise Level (L_{Aeq}), dB(A)*	*Amenity Criterion, dB(A)*
	Day	55	53 $L_{Aeq,15min}$ (55-5+3)
Residential (R2, R3)	Evening	45	43 $L_{Aeq,15min}$ (45-5+3)
	Night	40	38 $L_{Aeq,15min}$ (40-5+3)
Active Recreation	When in use	55	53 $L_{Aeq,15min}$ (55-5+3)

Table 6: Determination of the amenity criterion and PNTLs for noise sensitive receivers.

4.4.3 AAAC GUIDELINE FOR CHILD CARE CENTRE

There are no prescribed regulations or legislation that apply to noise from child care centres. Therefore, there is no prescribed noise criteria that can be used. Furthermore, we understand that common approach of "offensive noise" criteria is not appropriate for a planning situation such as this proposal.

Our noise assessment approach is based on:

- NSW tribunal decisions when assessing noise from the use of child care centres.
- 'Guideline for Childcare Centre Acoustic Assessment' prepared by the Association of Australasian Acoustical Consultants (AAAC).

The AAAC guideline is addressed for assessment of childcare centres and its noise level criterion for outdoor spaces have been considered as adequate by NSW tribunal decisions. As children do not play outdoors continuously for long periods of time, and as the duration of time for children playing outside is reduced, the overall noise annoyance reduces. Therefore, it is reasonable to allow a higher level of noise impact for a shorter duration.

Whilst the AAAC guideline does not apply for schools, there are similarities in noise emissions from uses of outdoor playground areas for schools and child care centres. Therefore, we recommend that the following noise criteria shall be applied to the school's outdoor playgrounds noise impacts.

Table 7 shows the noise level criteria proposed by the AAAC guideline for assessing noise from outdoor spaces. These are the noise levels which it is considered that complaints are unlikely.

Use of outdoor area	*Noise Level Criteria*	*Criteria*
Up to 2 hours (total) per day	$L_{Aeq,15min}$ noise level from outdoor area not to exceed the existing background noise level ($L_{A90,15min}$) plus 10 dB $L_{Aeq,15min} < L_{A90,15min} + 10$ dB(A)	$L_{Aeq,15min} \leq 47$ dB(A)
More than 2 hours (total) per day	$L_{Aeq,15min}$ noise level from outdoor area not to exceed the existing background noise level ($L_{A90,15min}$) plus 5 dB $L_{Aeq,15min} < L_{A90,15min} + 5$ dB(A)	$L_{Aeq,15min} \leq 42$ dB(A)

Table 7: Noise level criteria for the playground areas as per AAAC guideline.

4.4.4 SUMMARY OF OPERATIONAL NOISE LEVELS

Based on the criteria from the relevant noise standards and guidelines detailed above, Table 8 summarises the noise level criteria. For noise assessment purposes, the corresponding criteria based on background noise level measured, the lowest value has been used.

Noise Emission	*Standard / Guideline*	*Time Period*	*Noise Level Criteria*
External Mechanical Plant	NSW EPA NPI	Day Time (7am-6pm)	53
		Evening Time (6pm-10pm)	43
		Night Time (10pm-7am)	38
Public Address	L-DCP	Day Time (7am-10pm)	42
		Night Time (10pm-7am)	N/A
Performing Arts	L-DCP	Day Time (7am-10pm)	42
		Night Time (10pm-7am)	N/A
Indoor Recreational	L-DCP	Day Time (7am-10pm)	42
		Night Time (10pm-7am)	38
Outdoor Playgrounds	AAAC Guideline	Up to 2 hours	47
		More than 2 hours	42
Child Care Centre	AAAC Guideline	Up to 2 hours	47
		More than 2 hours	42

Table 8: Summary of the noise level criteria at the nearest noise sensitive receivers based on the noise emission.

4.5 TRAFFIC NOISE

4.5.1 DEVELOPMENT NEAR RAIL CORRIDORS OR BUSY ROADS – INTERIM GUIDELINE

The guideline details the application of clauses 85, 86, 87, 102 and 103 of the Infrastructure State Environmental Planning Policy (SEPP) which is required to be used when a development is adjacent to a rail corridor, a freeway, a toll-way, a transit-way or a road with an annual average daily traffic volume (AADT) of more than 40,000 vehicles.

At this stage, there are no rail corridors neither busy roads adjacent to the proposed development site or planning to develop. Therefore, we understand that this guideline does not apply for this project.

4.5.2 NSW ROAD NOISE POLICY

The NSW Road Noise Policy (RNP) establishes criteria for traffic noise from:

- Existing roads,
- New road projects,
- Road development projects,
- New traffic generated by developments.

For existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level should be limited up to 2.0dB (i.e. less than 2.1dB)[2] above the existing noise levels. An increase of up to 2.0dB represents a minor impact that is considered barely perceptible to the average person.

In cases where existing traffic noise levels are above the noise assessment criteria, the primary objective is to reduce these through feasible and reasonable measures to meet the assessment criteria.

Table 9 below provides the NSW RNP criteria for traffic noise levels due to additional traffic generated on local roads from land use development in relation to the applicable receiver types surrounding the site.

Receiver	*Noise Assessment Criteria*	
	7am-10pm	*10pm – 7am*
Residential – Collector Road Fourth and Eleventh Avenues	$L_{Aeq,15h}$ = 60dB(A)	$L_{Aeq,9h}$ = 55dB(A)
Residential – Local Road Tenth Avenue	$L_{Aeq,15h}$ = 55dB(A)	$L_{Aeq,9h}$ = 50dB(A)

Table 9: NSW RNP assessment criteria for additonal traffic on roads.

[2] NSW Roads and Maritime Services. Noise Criteria Guideline 2015. Page 10

4.6 CONSTRUCTION NOISE AND VIBRATION

4.6.1 NOISE CRITERIA

The noise criteria in this section are for guidance only and do not form part of any legal obligation on the part of the project proponent. However, compliance with these criteria is considered best practice.

As per the SEARs requirements for the proposed construction activities, noise criteria are established in accordance with the NSW DECCW Interim Construction Noise Guideline (ICNG) 2009.

The recommended hours for normal construction works are as follows:

- Monday to Friday: 7.00 to 18.00
- Saturday: 8.00 to 13.00
- No work on Sundays or public holidays

The ICNG suggest construction noise management levels that may minimise the likelihood of annoyance being caused to noise sensitive residential receivers depending on the duration of works. The management levels for long-term duration works are as follows:

- Within recommended standard hours.

  The $L_{Aeq,15min}$ level measured at the most exposed boundary of any affected residential receiver when the construction site is in operation must not exceed the background noise level by more than 10dB(A). This noise level represents the point above which there may be some community reaction to noise.

  However, in the case of a highly noise affected area, the construction noise level ($L_{Aeq,15min}$) at the most exposed boundary of any affected residential receiver when the construction site is in operation should not exceed 75dB(A). This level represents the point above which there may be strong community reaction to noise.

- Outside recommended standard hours.

  The $L_{Aeq,15min}$ level measured at the most exposed boundary of any affected residential receiver when the construction site is in operation must not exceed the background level by more than 5dB(A). It is noted that a strong justification is required for works outside the recommended standard hours.

ICNG suggests construction noise management levels for other sensitive land uses surrounding construction sites. They are as follows:

- Active recreation areas: $L_{Aeq,15min}$ 65dB(A) – external.

In order to establish the airborne construction noise criteria, noise levels from the unattended noise monitoring have been used for the noise sensitive receivers – refer to Section 3.3. Table 10 below summarises the airborne construction noise criteria for most affected noise sensitive receivers surrounding the development site.

Sensitive Receiver		*Airborne Construction Noise Criteria, L_{Aeq} dB(A)*	
		Within Standard Hours	*Outside Standard Hours*
Residential receivers	Noise affected / External	52	38
	Highly noise affected / External	75	N/A
Active Recreation	External	65	65

Table 10: ICNG construction airborne noise criteria for sensitive receivers surrounding the site.

The ICNG recommends internal ground-borne noise maximum levels at residences affected by nearby construction activities. Ground-borne noise is noise generated by vibration transmitted through the ground into a structure and can be more noticeable than airborne noise for some sensitive receivers.

The ground-borne noise levels presented below from the ICNG are for residential receivers during evening and night-time periods only, as the objective is to protect the amenity and sleep of people when they are at home.

- Evening: $L_{Aeq,15min}$ 40dB(A) - internal
- Night: $L_{Aeq,15min}$ 35dB(A) - internal

The internal noise levels are assessed at the centre of the most affected habitable room.

4.6.2 VIBRATION CRITERIA

4.6.2.1 Human Comfort

The Department of Environment and Climate Change (DECC) developed the document 'Assessing Vibration: A Technical Guideline' in February 2006 to assist in preventing people from exposure to excessive vibration levels within buildings. It is based on the guidelines contained in BS 6472.1:2008 'Guide to evaluation of human exposure to vibration in buildings – Vibration sources other than blasting'.

The guideline does not address vibration induced damage to structures or structure-borne noise effects. Vibration and its associated effects are usually classified as continuous (with magnitudes varying or remaining constant with time), impulsive (such as shocks) or intermittent (with the magnitude of each event being either constant or varying with time).

Vibration criteria for continuous and impulsive vibration are presented in Table 11 below, in terms of vibration velocity levels.

Place	*Time*	*r.m.s. velocity, mm/s [dB ref 10^{-9}mm/s]*			
		Continuous Vibration		*Impulsive Vibration*	
		Preferred	*Maximum*	*Preferred*	*Maximum*
Residences	Day-time	0.20 [106 dB]	0.40 [112 dB]	6.00 [136 dB]	12.00 [142 dB]
	Night-time	0.14 [103 dB]	0.28 [109 dB]	2.00 [126 dB]	4.00 [132 dB]
Offices, schools, educational and worship	When in use	0.40 [112 dB]	0.80 [118 dB]	13.00 [142 dB]	26.00 [148 dB]

Table 11: Continuous and impulsive vibration criteria applicable to the site. *Note: Day-time is 07am to 10pm and night-time is 10pm to 07am.*

When assessing intermittent vibration comprising a number of events, the Vibration Dose Value (VDV) it is recommended to be used. Table 12 shows the acceptable VDV values for intermittent vibration.

Place	*Time*	*Vibration Dose Values, m/s$^{1.75}$*	
		Preferred	*Maximum*
Residences	Day-time	0.20	0.40
	Night-time	0.13	0.26
Offices, schools, educational and worship	When in use	0.40	0.80

Table 12: Intermittent vibration criteria applicable to the site.

4.6.2.2 Structural Building Damage

Ground vibration from construction activities can damage surrounding buildings or structures. For occupied buildings, the vibration criteria given in previous section for Human Comfort shall generally form the limiting vibration criteria for the Project.

For unoccupied buildings, or during periods where the buildings are unoccupied, the vibration criteria for building damage suggested by German Standard DIN 4150.3:1993 'Structural Vibration – Effects of Vibration on Structures' and British Standard BS 7385.2:1993 'Evaluation and Measurement for Vibration in Buildings' are to be adopted. Guideline values from DIN 4150.3:1993 and BS 7385.2:1993 are presented in Table 13 and Table 14 respectively.

Structural type	*r.m.s. velocity, mm/s*			
	Foundation			*Plane of floor uppermost full storey*
	Less than 10Hz	*10 to 50Hz*	*50 to 100Hz*	*Frequency mixture*
Dwellings or similar	5	5 to 15	15 to 20	15
Particularly sensitive	3	3 to 8	8 to 10	8

Table 13: DIN 4150.3:1993 Guideline values of vibration velocity for evaluating the effects of short-term vibration.

Structural type	*Peak particle velocity, mm/s*	
	4 to 15Hz	*15Hz and above*
Unreinforced or light framed structures Residential or light commercial type buildings	15mm/s @ 4Hz increasing to 20mm/s @ 15Hz	20mm/s @ 15Hz increasing to 50mm/s @ 40Hz and above

Table 14: BS 7385.2:1993 Guideline values of vibration velocity for evaluating cosmetic damage.

5 OPERATIONAL NOISE EMISSIONS ASSESSMENT

Noise break-out from the proposed development has the potential to impact on existing noise sensitive receivers. For the purpose of this noise impact assessment, the noise sources are assumed as follows:

- Noise emissions from mechanical plant from the development to the surrounding receivers.
- Noise emissions from recess and lunch bells, public address systems.
- Noise emissions from indoor activities – i.e. use of halls for music, sports, etc – from out-of-school-hours events.
- Noise emissions from outdoor playgrounds – Soccer fields and play courts.
- Noise emissions from child care centre.

Each of these noise sources has been considered in the noise impact assessment. The noise impact assessments have considered the following:

- Noise levels have been considered as continuous over assessment time period to provide the worst-case scenario.
- Distance attenuation, building shielding and directivity.
- Lowest measure background noise levels at the nearest noise sensitive receiver have been used to provide a worst-case scenario.

5.1 EXTERNAL MECHANICAL PLANT

Noise from proposed development mechanical plant rooms should be controlled to ensure external noise emissions are not intrusive and do not impact on the amenity of the sensitive receivers.

Mechanical plant will operate continuously during all day periods. At this stage, mechanical plant selections have not been made; therefore, it is not possible to undertake a detailed assessment of the mechanical plant noise emissions.

Noise controls will need to be incorporated with the design of the mechanical plant rooms to ensure that the cumulative noise levels from plant to the nearest sensitive receivers meets the NSW NPI noise level criteria – refer to Table 6.

Usual design noise controls that may need to be implemented will typically include, but are not limited to:

- Strategic location and selection of plant to ensure the cumulative noise levels at the receiver boundaries is met.
- Selection of appropriate quiet plant.
- Acoustic noise control measures to be put in place to minimise noise impacts such as:
  - In-duct attenuation
  - Noise enclosures as required
  - Sound absorptive panels
  - Acoustic louvres as required
  - Noise barriers as required

Acoustic assessment of all mechanical plant shall continue during the detailed design phase of the project in order to confirm any noise control measures to achieve the relevant noise criteria at the nearest noise sensitive receivers.

5.2 PUBLIC ADDRESS, SCHOOL BELL SYSTEMS AND TOWER BELL

Noise from proposed development public address, school bell systems and tower bell should be controlled to ensure external noise emissions are not intrusive and do not impact on the amenity of noise sensitive receivers.

At this stage, public address, school bell systems and tower bell selections have been not made; therefore, it is not possible to undertake a detailed assessment of the public address, school bell and tower bell noise emissions.

The EPA notes numerous reports of community concern arising from inadequate design and installation as well as inappropriate use of school public address and bell systems. EPA considers that appropriate design, installation and use of those systems can both:

- Meet the proponent's objectives of proper administration of the school and ensuring safety of students, staff and visitors, and
- Avoid interfering unreasonably with the comfort and repose of occupants of nearby residences.

The public address, school bell systems and tower bell shall be designed, installed and operated such that the systems does not interfere unreasonably with the comfort and repose of occupants of nearby residences. It is anticipated that the noise impact to the nearest sensitive receivers will be negligible if following measures are implemented:

- Low-powered horn-type speakers shall be located and orientated to provide a good coverage of the school areas whilst being directly away from residences. System coverage shall be reviewed during the detailed design phase.
- Speakers shall be mounted with a downward angle and as close to the ground level as possible.
- The noise level of the systems shall be adjusted on site so they will be clearly audible on the school site without being excessive. The systems shall initially be set sot that the noise at nearby residences do not exceed noise level criteria.
- Once the appropriate noise level has been determined on site, the systems shall be limited to these noise levels so that staff cannot increase the noise levels. Only nominated staff, trained in the appropriate use of the system, shall be permitted to operate the systems.
- The systems shall be set so that it only occurs on school days.

5.3 PERFORMING ARTS THEATRE

The Performing Arts Theatre is anticipated to host events that include amplified music and public address system internally. The expected noise impacts from the Performing Arts Theatre has been assessed at the nearest sensitive receivers, using the methodology and assumptions given below.

The assessment was made considering the proposed layout as shown on the architectural drawings. The following assumptions have been made for the assessment:

- Events occurring during evening time hours (most stringent noise criteria)
- Doors and windows shut during events
- Typical sound power levels for concerts and events

The noise levels inside the Performing Arts Theatre during a concert, and form the basis of the expected worst-case noise emission from the proposed use, is expected to be 100dB(A) when a live band will be playing.

The shortest distance between the Performing Arts Theatre façade and the nearest residential receiver (R8) in 180 Eleventh Avenue is 111 metres.

The building envelope of the Performing Arts Theatre will need to provide the following minimum sound insulation performance in order to meet the noise level criteria the nearest residential receiver during evening-time – allowable opening time is from 7am to 9pm (refer to Section 4.4.1).

Calculation	*Noise Level dB(A)*
$L_{Aeq,15min}$ of Live Band at 1 m	100
Increase in reverberant field, dB	3
Distance attenuation (111 m) plus surface correction, dB	-27
Noise Level Criteria during Day-time, $L_{Aeq,15min}$	42
Minimum sound insulation rating R_W, dB	**37**

Table 15: Noise assessment for Live Band noise break-out to the nearest sensitive receiver to the West.

5.4 INDOOR RECREATIONAL CENTRE

Sport activities within the Indoor Recreational Centre will be held regularly plus assemblies and occasional out-of-school-hours event such as "speech night". The out-of-school-hours events will occur occasionally during night-time, therefore, the night-time period has been considered for the noise impact assessment.

A noise assessment of the Indoor Recreational Centre has been conducted at the nearest residential receiver (R10). The noise assessment has considered the types of sporting activities expected to use the facility as and assessed against noise levels measured from previous similar projects.

The noise levels used within the assessment considers the following types of noise sources:

- Noise from bouncing balls,
- Noise from small sized crowds/spectators,
- Referee whistle noise,
- Intermittent shouting from players/participants,
- General noise from sporting activities (futsal and basketball),
- Amplified speech.

The noise levels inside the Indoor Recreational Centre are expected to be 86dB(A). The shortest distance between the Indoor Recreational Centre façade and the nearest residential receiver (R10) in 180 Eleventh Avenue is 30 metres. The following assumptions have been made for the assessment:

- Events occurring during night time hours (most stringent noise criteria)
- Doors and windows shut during events

The western façade of the Indoor Recreational Centre will need to provide the following minimum sound insulation performance in order to meet the noise level criteria in the nearest residential receiver during night-time.

Calculation	*Noise Level dB(A)*
$L_{Aeq,15min}$ within Indoor Recreational Centre	86
Increase in reverberant field, dB	3
Distance attenuation (30 m) plus surface correction, dB	-15
Noise Level Criteria during Night-time, $L_{Aeq,15min}$	38
Minimum sound insulation rating R_W, dB	**35**

Table 16: Noise assessment for sports within the Indoor Recreational Centre noise break-out to the nearest sensitive receiver to the West.

5.5 OUTDOOR PLAYGROUNDS

Noise emissions from the outdoor playgrounds has the potential to impact on the nearest noise sensitive receivers. The main noise sources is expected to be students using the outdoor play areas during school as well as before and after school for sport activities. Given that the proposed outdoor areas are not proposed to have external lighting, the assessments have considered the use throughout the day and evening time periods (07:00 – 22:00).

5.5.1 SOCCER FIELDS

It should be noted that outdoor areas are spread around school precinct and all students will not gather in the same area – except for undercover areas during rain events. A 3D acoustic modelling for the noise impact to the nearest noise sensitive receivers has been conducted using the simulation software SoundPlan (version 8). The acoustic modelling was undertaken considering the following:

- Students talking 'normal' speech to provide worst-case scenario. This equals to a sound pressure level of 60dB(A) at 1 metre per student.
- For every two students only one will be speaking at any given time with a 'normal' voice.
- A maximum number of 2,480 students will be at the same time during recess and lunch times.
- Soccer fields used for >2 hours per day
- Evening time criteria as worst-case scenario (6pm-10pm)
- Soccer fields have been modelled as an area noise source – i.e. all students are grouped that it is a worst-case scenario and unlikely to occur.

Based on the analysis, the predicted noise levels at the nearest noise sensitive receivers are shown in Table 17. Graphical representations of the results are shown in Appendix B.

Receiver	*Predicted Noise Level* $L_{Aeq,15min}$	*Evening Time Noise Criteria* $L_{Aeq,15min}$	*Compliance*
R4 – 144 Tenth Avenue	43	43	Yes
R5 – 150 Tenth Avenue	48	43	No
R6 – 152/156 Tenth Avenue	45	43	Yes
R7 – 175 Tenth Avenue	43	43	Yes

Table 17: Noise assessment at nearest residential sensitive receiver for the outdoor playgrounds.

Based on the noise level criteria for more than 2 hours of use throughout the day and evening, some exceedances are expected at the nearest noise sensitive receivers.

However, the assessment has considered the worst-case and unlikely scenario for number of students playing.. Further to the above, the noted exceedances would not be discernible by the average listener and therefore would not warrant receiver-based treatments or controls.

Based on the above, it can be stated that noise levels from the soccer field during a match or training on the field will meet the noise level criteria during day-time period at the nearest noise sensitive receivers.

5.5.2 PLAY COURTS

Sport activities within the Play Courts A and B will be held regularly plus occasional out-of-school-hours use. The out-of-school-hours events will not occur during night-time, therefore, day/evening-time period has been considered for the noise impact assessment.

A noise assessment of the Play Court A has been conducted at the nearest residential receiver (R2). Likewise for Play Court B and the nearest residential receiver (R5). The noise assessments have considered the types of sporting activities expected to use the facility as and assessed against noise levels measured from previous similar projects.

The noise levels used within the assessment considers the following types of noise sources:

- Noise from bouncing balls,
- Noise from small sized crowds,
- Intermittent shouting from players/participants,
- General noise from sporting activities (futsal and basketball),

The noise levels from the Play Court A are expected to be 72dB(A). The noise levels from the Play Court B are expected to be 77dB(A). The following tables show the results of the predicted noise levels at the nearest noise sensitive receivers.

Calculation	*Noise Level dB(A)*
$L_{Aeq,15min}$ of a game at 1m	72
Barrier attenuation	-7
Distance (30m) attenuation	-29
Resulting level at residential receiver (R2) $L_{Aeq,15min}$	36
Noise Level Criterion (more than 2 hours) / Complies?	43 / Yes

Table 18: Noise assessment for Play Court A at nearest noise sensitive receiver (R2).

Calculation	*Noise Level dB(A)*
$L_{Aeq,15min}$ of a game at 1m	77
Barrier attenuation	-7
Distance (25m) attenuation	-28
Resulting level at residential receiver (R5) $L_{Aeq,15min}$	42
Noise Level Criterion (more than 2 hours) / Complies?	42 / Yes

Table 19: Noise assessment for Play Court B at nearest noise sensitive receiver (R5).

5.6 CHILD CARE CENTRE

Noise break-out from the child care centre has the potential to impact on the nearest noise sensitive receivers. The key noise source it will be children playing in the outdoor area.

The child care centre will operate only during day-time. Therefore, the noise assessment has been carried out only for day-time period. It is assumed that the child care centre will have different activities areas. If so, it can be stated that children will be spread around these activities areas instead of being gathered.

A 3D acoustic modelling for the noise impact to the nearest noise sensitive receivers has been conducted using the simulation software SoundPlan (version 8). The acoustic modelling was undertaken considering the following:

- Noise level emissions as per Table 20, being the highest value of the noise level ranges from the AAAC guideline.
- Outdoor playground area with 125 children.
- Number of children upon their age is unknown. Therefore, the noise impact assessment has been carried out assuming the worst-case scenario – all children are aged 3 to 6 years.
- Background noise levels at the nearest noise sensitive receiver have been used to provide worst-case scenario.

The L_{weq} Sound Power Levels of 1 child with different ages are shown below in Table 20.

Calculation	*Sound Power Level dB(A), re 1pW*
L_{weq} of 1 child aged 2 to 3 years	77
L_{weq} of 1 child aged 3 to 6 years	80

Table 20: Sound Power Level likely to be generated by a child as per AAAC Guideline.

The nearest residential receiver to be considered is R1 at 122 Eleventh Avenue (Lot 813), that it is approximately at 42 metres from the outdoor playground area.

In order to minimise noise impacts, a solid barrier has been included on the boundary between the child care centre and the residential receiver. The solid barrier shall be provided on the eastern boundary of the site. Minimum height shall be 1800mm. The barrier shall be solid and shall be constructed from a material with a total surface weight of not less than 12kg/m^2. It shall be continuous with no gaps and designed for external use. The barrier shall be provided with all bracing and structural support required to comply with loadings and building regulations.

Based on the analysis, the predicted noise levels at the nearest noise sensitive receiver is 40dB(A) which meets the noise level criteria established in Section 4.4.3 for more than two hours of playground use. Simulation grid noise mapping can be found in Appendix B.

Acoustic assessment of the barrier shall continue during the detailed design phase of the project in order to confirm final dimensions and composition.

5.7 OFFENSIVE NOISE

Based on the noise emissions assessments presented in the sections above, following comments regarding "offensive noise" shall be considered:

- The operational key noise sources from the proposed school will be mechanical plant, public address system, school bell system, tower bell system, out-of-school-hours events at the performing arts theatre and indoor recreational centre plus outdoor playgrounds use of the school and child care centre.
- Mechanical plant will be selected and noise control measures implemented to ensure that the noise levels at the nearest noise sensitive receiver do not exceed the NSW NPI noise criteria established in Section 4.3.2.
- Recommendations for the implementation and use of the public address, school bell and tower bell systems has been provided in Section 5.2 in order to meet the noise level criteria at the nearest noise sensitive receivers.
- Noise from out-of-school-hours events held within the indoor recreational centre will meet the noise level criteria at the nearest noise sensitive receivers assuming that a typical building envelope construction is selected and provided that doors remain closed during use.
- We state the following about the noise impact from the use of the outdoor playgrounds:
  - It cannot be considered as a loud noise in an absolute sense.
  - It is not irritating, it does not contains tonal components, neither is impulsive or the noise level fluctuates.
  - It would not occur during quiet time period – i.e. night-time.
- By controlling noise emissions (associated with the operation of the proposed development) in accordance with the relevant criteria, amenity of noise sensitive receivers will be maintained and noise emissions should not be intrusive, therefore it is not expected that people and noise sensitive receivers will be adversely affected by the development.

Based on the comments above, the development is able to satisfy the requirements of the POEO for "offensive noise" provided the relevant criteria outlined in Section 4.3 are achieved.

6 ROAD TRAFFIC NOISE

The student and staff member population following the construction of the development will increase the number of vehicles in the surrounding roads, with a potential increase in traffic noise exposure for the residential receivers located along these roads.

6.1 ON-ROAD TRAFFIC NOISE IMPACT

The traffic impact report for the proposed development prepared by Colston Budd Rogers & Kafes Pty Ltd (dated April 2018) provides an analysis of the additional traffic from the proposed development for the year 2036. This is summarised in the Table 21.

Road	*Location*	*Weekday Morning*		*Weekday Afternoon*	
		2036 base	*Plus development*	*2036 base*	*Plus development*
Edmondson Avenue	North of Eleventh Avenue	1,610	+350	1,920	+350
	North of Tenth Avenue	1,500	+240	1,480	+240
	South of Tenth Avenue	1,340	+520	1,660	+520
Fourth Avenue	North of Eleventh Avenue	770	+260	870	+260
	North of Tenth Avenue	670	+220	940	+220
	South of Tenth Avenue	610	+370	620	+370

Table 21: 2036 two-way peak hour traffic flows plus traffic generated by the proposed development.

As noted in Section 4.5.2, when considering land use redevelopment and the impact on sensitive land uses (residential / schools / hospitals / recreational) the NSW Road Noise Policy (RNP) states that an increase up to 2.0 dB in relation to existing noise levels is anticipated to be insignificant. As shown in Table 22, the increase of traffic noise levels in the year 2036 due to the proposed development, is less than the maximum allowable increase of 2.1 dB(A).

Road	*Location*	*Weekday Morning*	*Weekday Afternoon*
		Increase $L_{Aeq,1hour}$, dB(A)	
Edmondson Avenue	North of Eleventh Avenue	+0.9	+0.7
	North of Tenth Avenue	+0.6	+0.7
	South of Tenth Avenue	+1.4	+1.2
Fourth Avenue	North of Eleventh Avenue	+1.3	+1.1
	North of Tenth Avenue	+1.2	+0.9
	South of Tenth Avenue	+2.0	+2.0

Table 22: Predicted noise level increase due to traffic movements from the proposed development.

Therefore, the traffic increase due to the proposed development will not result in any noticeable change in traffic noise levels and is expected to meet the NSW Road Noise Policy recommendations.

6.2 CARPARK NOISE IMPACT

As per architectural drawings, the proposed car provision is 318 car parking spaces and 125 drop-off spaces which are spread as shown in Figure 5. The number of drop-off / pick-up car movements is 13 times the number of spaces, as per Traffic report.

Figure 5: Carpark and drop-off spaces proposed layout

The main source of noise will be from vehicles travelling in, around and out of the car parks. Morning and evening peak hours will be when highest traffic flow will occur. Vehicle access will be via Fourth Avenue, Tenth Avenue and Eleventh Avenue.

Eleventh Avenue is classified as a local road, Fourth Avenue and Tenth Avenue are classified as collector roads. All roads are two-way and it is assumed that maximum speed on peak hours will be 40km/h.

Noise assessments for each carpark have been undertaken for a peak hour scenario – worst-case assessment period and it is assumed that school is at full capacity.

The following have been assumed for the carpark noise impact:

- Average car movement duration is 1 minute.
- Correction to adjust assessment time to 1 hour.
- The total number of car movements for the period is the number of carparks divided by 4 plus 13 times the number of drop-off / pick-up spaces divided by 2.
- Assumed distance to nearest residential receiver is from the carpark access – i.e worst-case scenario.

6.2.1 CARPARK A

This carpark is located adjacent to the child care centre in Eleventh Avenue. It has a capacity of 33 carpark spaces and no drop-off / pick-up spaces. Nearest residential receiver is approximately at 44 metres.

Calculation	*Noise Level dB(A)*
$L_{Aeq,1h}$ of car movements at 1m	72
Distance correction (44m), dB	-33
Resulting level at residential receiver (R1), $L_{Aeq,1h}$	39
Noise Level Criterion Day-time / Complies?	55 / Yes

Table 23: Noise assessment of car movements at carpark A.

6.2.2 CARPARK B

This carpark is located adjacent to the child care centre in Eleventh Avenue and extends along a driveway until Tenth Avenue. It has a capacity of 65 drop-off / pick-up spaces and the distance to the nearest residential receiver is approximately at 30 metres.

Calculation	*Noise Level dB(A)*
$L_{Aeq,1h}$ of car movements at 1m	89
Distance correction (30m), dB	-30
Resulting level at residential receiver (R2), $L_{Aeq,1h}$	59
Noise Level Criterion Day-time / Complies?	60 / Yes

Table 24: Noise assessment of car movements at carpark B.

6.2.3 CARPARK C

This carpark is located adjacent to the outdoor learning area and sports court. Its access is via Tenth Avenue. It has a capacity of 39 car-park spaces and no drop-off / pick-up spaces, and the distance to the nearest residential receiver is approximately 8 metres.

Calculation	*Noise Level dB(A)*
$L_{Aeq,1h}$ of car movements at 10m	73
Distance correction (8m), dB	-18
Resulting level at residential receiver (R3), $L_{Aeq,1h}$	55
Noise Level Criterion Day-time / Complies?	60 / Yes

Table 25: Noise assessment of car movements at carpark C.

6.2.4 CARPARK D

This carpark is located adjacent to the outdoor learning area and sports court. Its access is via Tenth Avenue. It has a capacity of 116 car-park spaces and 37 drop-off / pick-up spaces, ant the distance to the nearest residential receiver is approximately 29 metres.

Calculation	*Noise Level dB(A)*
$L_{Aeq,1h}$ of car movements at 1m	87
Distance correction (29m), dB	-29
Resulting level at residential receiver (R4), $L_{Aeq,1h}$	58
Noise Level Criterion Day-time / Complies?	60 / Yes

Table 26: Noise assessment of car movements at carpark D.

6.2.5 CARPARK E

This carpark is located adjacent to the soccer field. Its access is via Fourth Avenue. It has a capacity of 32 car-park spaces and no drop-off / pick-up spaces, being 30 metres the approximate distance to the nearest residential receiver.

Calculation	*Noise Level dB(A)*
$L_{Aeq,1h}$ of car movement at 10m	72
Distance correction (30m), dB	-29
Resulting level at residential receiver (R7), $L_{Aeq,1h}$	43
Noise Level Criterion Day-time / Complies?	60 / Yes

Table 27: Noise assessment of car movements at carpark E.

6.2.6 CARPARK F

This carpark is located adjacent to the indoor recreational centre in Fourth Avenue. It has a capacity of 98 carpark spaces and 23 drop-off / pick-up spaces. Nearest residential receiver is approximately at 23 metres.

Calculation	Noise Level dB(A)
$L_{Aeq,1h}$ of car movements at 1m	85
Distance correction (23m), dB	-28
Resulting level at residential receiver, $L_{Aeq,1h}$	57
Noise Level Criterion Day-time / Complies?	60 / Yes

Table 28: Noise assessment of car movements at carpark F.

6.3 OUT OF HOURS CARPARK NOISE IMPACT

Out-of-hours events will be hosting occasionally in the Indoor Recreational Centre and will occur during evening-time. The available open carparks for out-of-hours events will be Carpark E and Carpark F.

The main source of noise will be from vehicles travelling in, around and out of the car parks. Vehicle access will be via Fourth Avenue.

The following have been assumed for the carpark noise impact:

- Noise assessment for an event scenario.
- Carpark at full capacity.
- Correction to adjust assessment time to 1 hour.
- Assumed distance to nearest residential receiver is from the carpark access – i.e worst-case scenario.

Carpark E is located adjacent to the soccer field and its access is via Fourth Avenue. It has a capacity of 32 car-park spaces and no drop-off / pick-up spaces, being 30 metres the approximate distance to the nearest residential receiver (R7).

Calculation	Noise Level dB(A)
$L_{Aeq,1h}$ of car movements at 1m	78
Distance correction (30m), dB	-29
Resulting level at residential receiver (R7), $L_{Aeq,15min}$	49
Noise Level Criterion Night-time / Complies?	55 / Yes

Table 29: Noise assessment of car movements at carpark E for out-of-hours events during night time.

Carpark F is located adjacent to the indoor recreational centre in Fourth Avenue. It has a capacity of 98 carpark spaces. Nearest residential receiver is approximately at 23 metres.

Calculation	Noise Level dB(A)
$L_{Aeq,1min}$ of car movement at 10m	83
Distance correction (23m), dB	-28
Resulting level at residential receiver (R9), $L_{Aeq,15min}$	55
Noise Level Criterion Night-time / Complies?	55 / Yes

Table 30: Noise assessment of car movements at carpark F for out-of-hours events during night time.

7 CONSTRUCTION NOISE AND VIBRATION PLANNING

Currently the project is at an early design stage and a detailed construction program is not yet full defined. This section of the Construction Noise and Vibration Planning provides general recommendations only and provides applicable criteria together with best noise and vibration control practices to be observed during the construction of the proposed development.

This preliminary advice in relation to construction noise and vibration management shall form the basis for the Contractor's Construction Noise and Vibration Management Plan.

Any noise from demolition and construction activities to be carried out on site must not result in *'offensive noise'* to any noise sensitive receiver. To this end, the Contractor employed to undertake the demolition and/or construction works is responsible for ensuring that any site noise and, in particular, any complaints shall be monitored, investigated, managed and controlled.

7.1 RELEVANT CODES AND STANDARDS FOR CONSTRUCTION NOISE AND VIBRATION CRITERIA

Section 4.6 of this report contains the relevant legislation, codes and standards plus construction noise and vibration criteria for this project.

7.2 CONTROL ELEMENTS

In order to meet the noise and vibration requirements of the site, the Contractor will be required to engage a qualified acoustic consultant to assist in the compilation of a Construction Noise and Vibration Management Plan, and undertake noise and vibration monitoring for the duration of the project.

7.2.1 WORKING HOURS

Recommended standard hours of work in the ICNG are as follows:

- Monday to Friday: 7.00 to 18.00
- Saturday: 8.00 to 13.00
- Sundays and Public Holidays: No excavation or construction works

7.2.2 GENERAL CONTROL ELEMENTS

As a general rule, minimising noise and vibration should be applied as universal work practice at any time of day, but especially for any construction works to be undertaken at critical times outside normal daytime/weekday periods.

It is noted that the reduction of noise and vibration at the source and the control of the transmission path between the construction site and the receiver(s) are the preferred options for noise minimisation. Providing treatments at the affected receivers should only be considered as a last resort.

Construction noise and vibration shall be managed by implementing the strategies listed below:

- *Plant and equipment*. In terms of both cost and results, controlling noise and vibration at the sources is one of the most effective methods of minimising the impacts from any work site activities. Work practices that will reduce noise and vibration at the source include:
  - Employing quieter techniques for all high noise activities such as rock breaking, concrete sawing, and using power and pneumatic tools.

  - Use quieter plant and equipment based on the optimal power and size to most efficiently perform the required tasks.
  - Regularly inspecting and maintain plant and equipment to minimise noise and vibration level increases, to ensure that all noise and vibration reduction devices are operating effectively.
  - Where appropriate, obtain acoustic test certificates for equipment.
- *On site noise management.* Practices that will reduce noise from the site include:
  - Maximising the distance between noise activities and noise sensitive receivers. Strategically locate equipment and plant.
  - Undertaking noisy fabrication work off-site where possible.
  - Avoid the use of reversing beeping alarms or provide for alternative systems, such as broadband reversing alarms, particularly during night or out-of-hours works.
  - Maintaining any pre-existing barriers or walls on a demolition or excavation site as long as possible to provide optimum sound propagation control.
  - Using temporary site building and material stockpiles as noise barriers. These can often be created using site earthworks and may be included as a part of final landscape design.
  - Installing purpose built noise barriers, acoustic sheds and enclosures.
- *Work scheduling.* Scheduling work during periods when people are least affected is an important way of reducing adverse impacts. The following scheduling aspects may reduce impacts:
  - Provide respite periods, including restricting very noisy activities to daytime, restricting the number of nights that after-hours work is conducted near residences, or by determining any specific requirements, particularly those needed for noise sensitive receivers.
  - Scheduling activities to minimise impacts by undertaking all possible work during hours that will least adversely affect sensitive receivers and by avoiding conflicts with other scheduled events.
  - Scheduling work to coincide with non-sensitive periods.
  - Scheduling noisy activities to coincide with high levels of neighbourhood noise so that noise from the activities is partially masked and not as intrusive.
  - Planning deliveries and access to the site to occur quietly and efficiently and organising parking only within designated areas located away from sensitive receivers.
  - Optimising the number of deliveries to the site by amalgamating loads where possible and scheduling arrivals within designated hours.
  - Designating, designing and maintaining access routes to the site to minimise impacts.
  - Including contract conditions that include penalties for non-compliance with reasonable instructions by the principal to minimise noise or arrange suitable scheduling.
- *Consultation, notification and complaints handling.*
  - Provide information to neighbours before and during construction.
  - Maintain good communication between the community and Project staff.
  - Have a documented complaints process and keep register of any complaints.
  - Give complaints a fair hearing and provide for a quick response.
  - Implement all feasible and reasonable measures to address the source of complaint. Implementation of all reasonable and feasible mitigation measures for all works will ensure that any adverse noise impacts to surrounding receivers are minimised when noise goals cannot be met due to safety or space constraints.

7.2.3 ADDITIONAL NOISE AND VIBRATION CONTROL MEASURES

If, during construction, an item of equipment exceeds ether the noise criteria at any location or the equipment noise level limits, the following noise control measures, together with construction best practices, shall be considered to minimise the noise impacts on the neighbourhood.

- Schedule noisy activities to occur outside of the most sensitive times of the day for each nominated receiver.
- Consider implementing equipment-specific screening or other noise control measures recommended in Appendix C of AS 2436:2010.
- Limit the number of trucks on site at the commencement of site activities to the minimum required by the loading facilities on site.
- When loading trucks, adopt best practice noise management strategies to avoid materials being dropped from height into dump trucks.
- Avoid unnecessary idling of trucks and equipment.
- Ensure that any miscellaneous equipment (extraction fans, hand tools, etc) not specifically identified in this plan incorporates silencing/shielding equipment as required to meet the noise criteria.

Implementation of all reasonable and feasible mitigation measures for all internal and underground works will ensure that any adverse noise impacts to surrounding residential, commercial and recreational receivers are minimised when noise goals cannot be met due to safety or space constraints.

The NSW RMS 'Construction Noise and Vibration Guideline' provides safe working distances for vibration intensive plant and are quoted for both 'cosmetic' damage (in accordance with BS 7385.2:1993) and human comfort (in accordance with DECC's 'Assessing Vibration: A Technical Guideline'). The recommended safe working distances for typical construction plant are provided in Table 31.

Plant Item	*Description*	*Cosmetic Damage*	*Human Response*
Small Hydraulic Hammer	5-12 tonne	2m	7m
Medium Hydraulic Hammer	12-18 tonne	7m	23m
Large Hydraulic Hammer	18-34 tonne	22m	73m
Vibratory Pile Driver	Sheet piles	2-20m	20m
Pile Boring	<800mm	2m	N/A
Jackhammer	Hand held	1m	Avoid Contact with Structure

Table 31: Recommended minimum working distances for vibration intensive plant from sensitive receivers.

If Contractor has concerns for the disruptions at nearest sensitive receivers due to vibration intensive plant use, it is recommended that prior to the commencement of the works, to undertake a preliminary vibration survey on each key vibration generating activity / equipment.

The preliminary vibration survey and assessment will determine whether the vibration levels might exceed the relevant criteria then vibration mitigation and management measures will need to be put in place to ensure vibration impacts are minimised as far possible.

A vibration monitoring system may be considered to assess the risk of potential structural damage to nearby buildings of concern.

8 NOISE MANAGEMENT PLAN

One of the most effective measures that should be implemented in conjunction with the physical noise controls is a Noise Management Plan (NMP). The NMP should be incorporated within the Centre's overall management plan.

The following are examples of management measures that may be incorporated into a Noise Management Plan.

- Restrict the use of sports courts prior 8.00am.
- Minimise the use of the Public Address, School Bell and Bell Tower systems.
- Waste collection shall not operate before 8.00am or after 10.00pm.
- A contact phone number for the School's director should be made available to neighbours to facilitate communication and to resolve any neighbourhood issues that may arise due to operation of the School.
- Parents should be informed of the importance of noise minimisation when entering the site, dropping off or picking up children.

9 SUMMARY AND CONCLUSIONS

A noise assessment has been carried out for the proposed development of St Anthony of Padua Catholic School at Austral. This report forms part of the documentation package to be submitted to the Department of Planning as part of the State Significant Development Application.

This report establishes relevant noise level criteria, details the acoustic assessment and provides comments and recommendations for the proposed development. Ambient and background noise surveys have been undertaken at the existing site to establish the appropriate noise criteria in accordance with the relevant guidelines.

The noise assessment has adopted methodology from relevant guidelines, standards and legislation to assess noise impact. The noise impacts have been predicted at the nearest noise sensitive receiver boundaries.

At this stage, mechanical plant selections have not been made. Therefore, recommendations have been provided to minimise the impact of external noise emissions associated with the mechanical plant of the proposed development to the nearest sensitive receivers.

At this stage, public address, school bell systems and tower bell have not been selected. Therefore, recommendations have been provided to minimise the impact of external noise emissions associated with the public address, school bell systems and tower bell of the proposed development to the nearest sensitive receivers.

Minimum sound insulation performance values have been proposed for the façades of the Performing Arts Theatre and Indoor Recreational Centre in order to meet the noise criteria at the nearest receivers.

External noise emissions associated with the outdoor playgrounds have been assessed. Some exceedances to the noise criteria were predicted, however these exceedances were not considered as significant of intrusive.

Child care centre outdoor playground area noise impact has been assessed. Predictions show that noise level criteria will be met when the playground will be a full-capacity.

The traffic noise impact due to number of vehicles due to the proposed development – based on the information provided in the traffic report – is anticipated to be insignificant, as the noise levels will not increase more than 2dB at the sensitive noise receivers.

Noise impact of peak hour car movements in the carparks has been assessed and results show that noise level criteria will be met. Out-of-hours carpark use will be limited to Carpark E and Carpark F. The noise impact assessment shows that the noise level criteria will be met.

Potential construction noise and vibration impacts on the surroundings have been presented in this report and recommendations based on the relevant guidelines are provided. There will be times / situations when construction noise associated with demolition, earthworks, excavation and new-build works are likely to exceed the stated criteria, particularly when works occur in the areas closer to sensitive receivers or with direct view between the receivers and the works.

The information presented in this report shall be reviewed if any modifications to the features of the development specified in this report occur, including and not restricted to selection of mechanical plant, modifications to the buildings and introduction of any additional noise sources.

Based on the information presented in this report, relevant objectives will be satisfied and therefore approval is recommended to be granted.

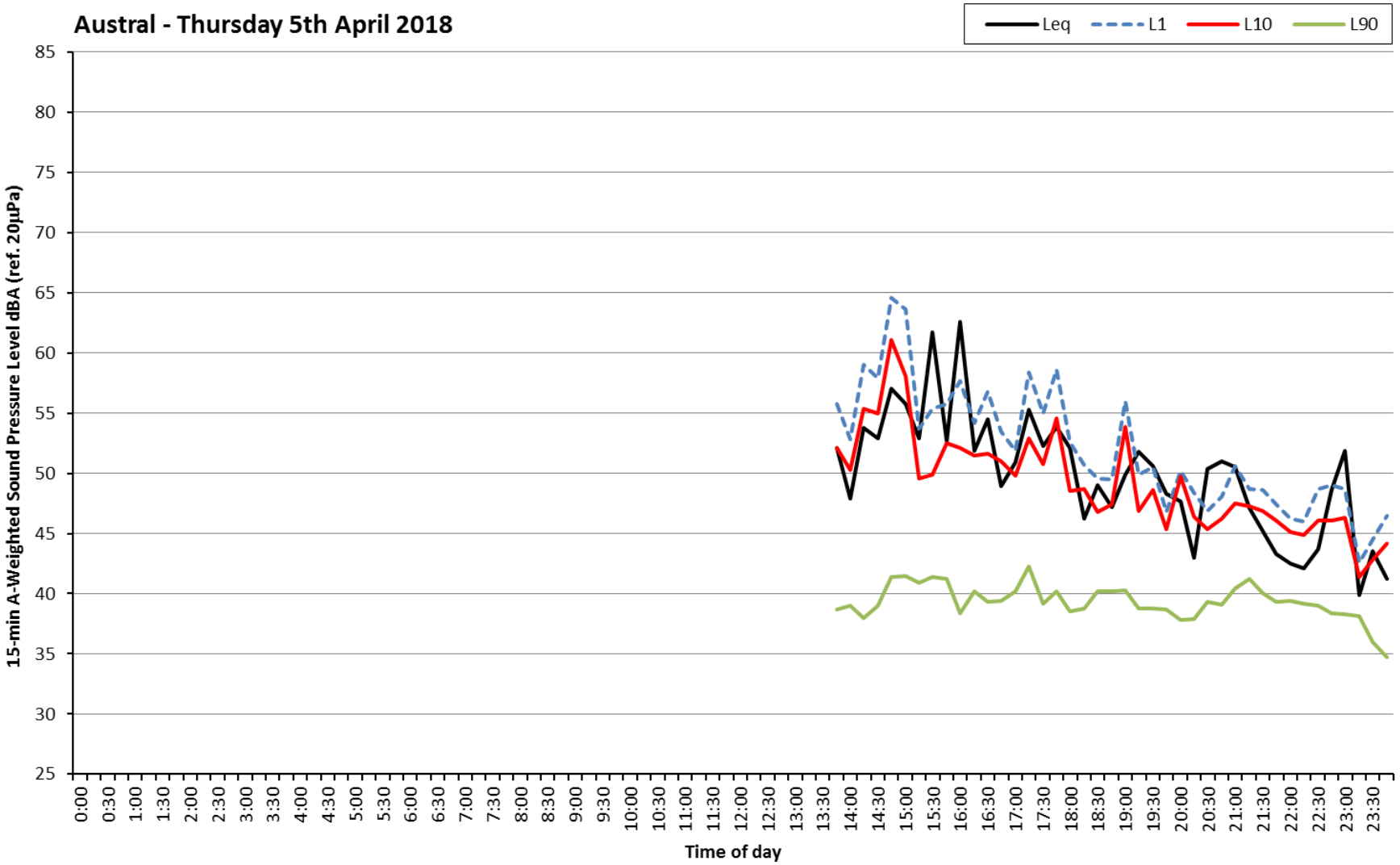
APPENDIX A: LONG-TERM NOISE MONITORING RESULTS

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.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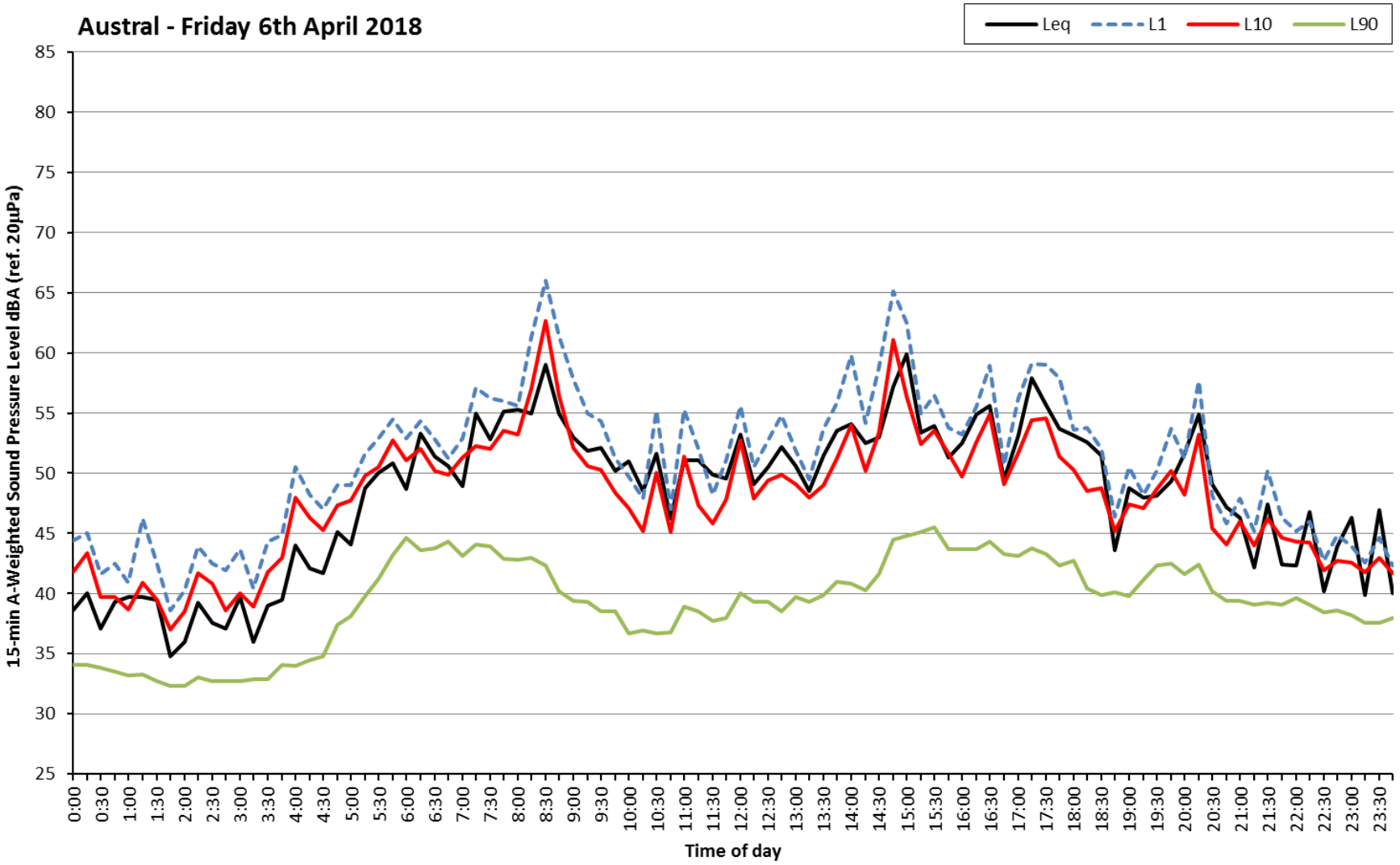
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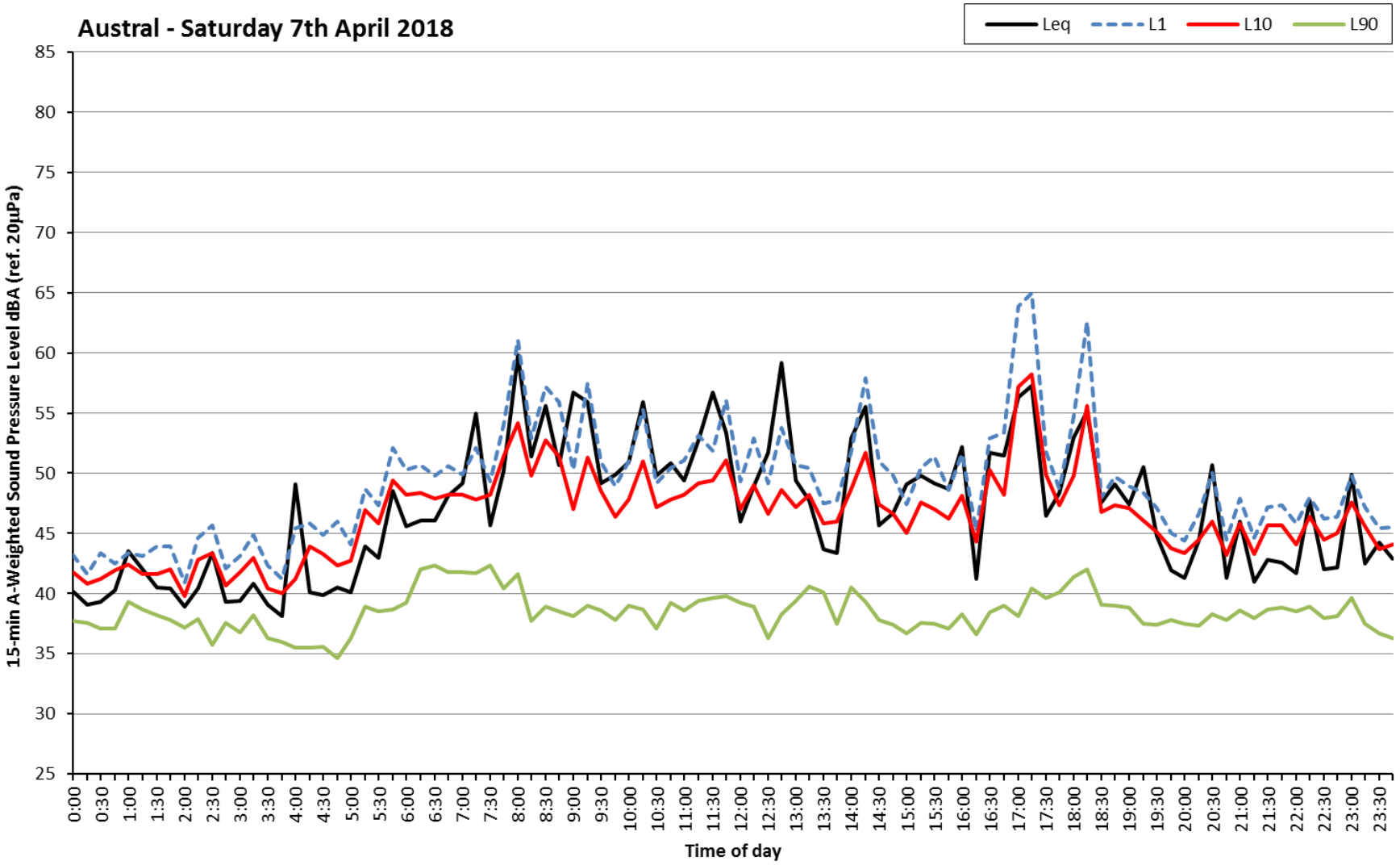
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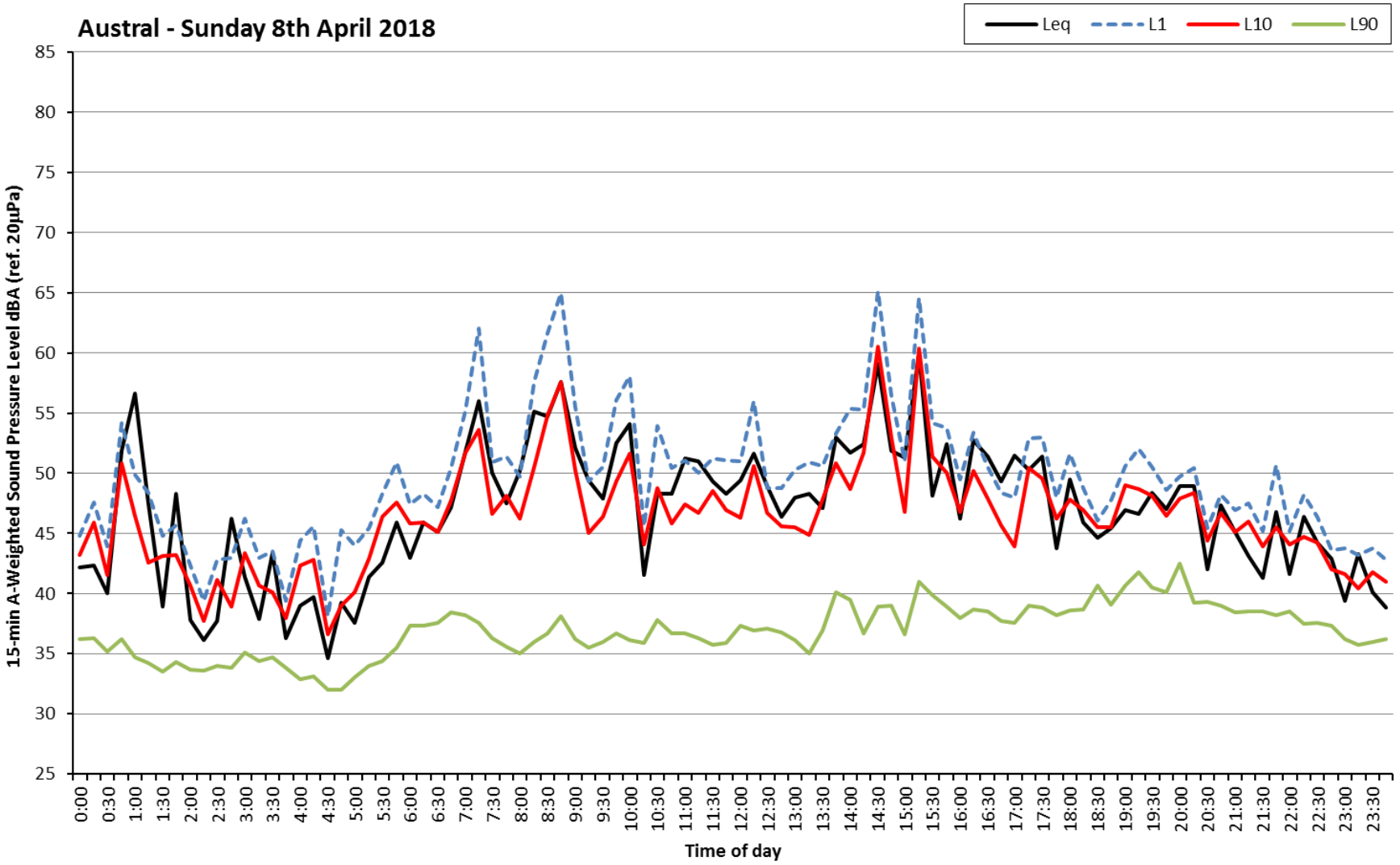
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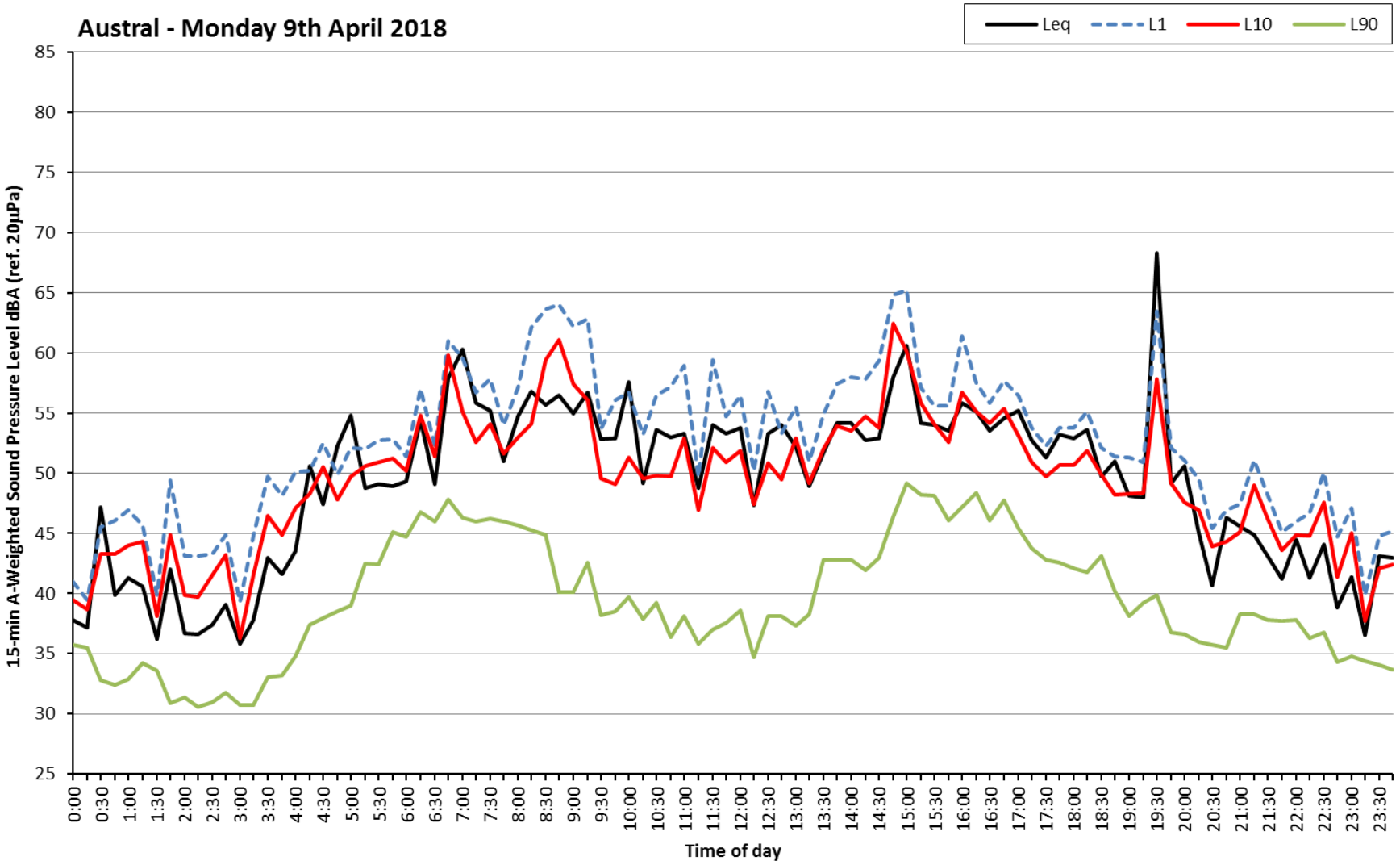
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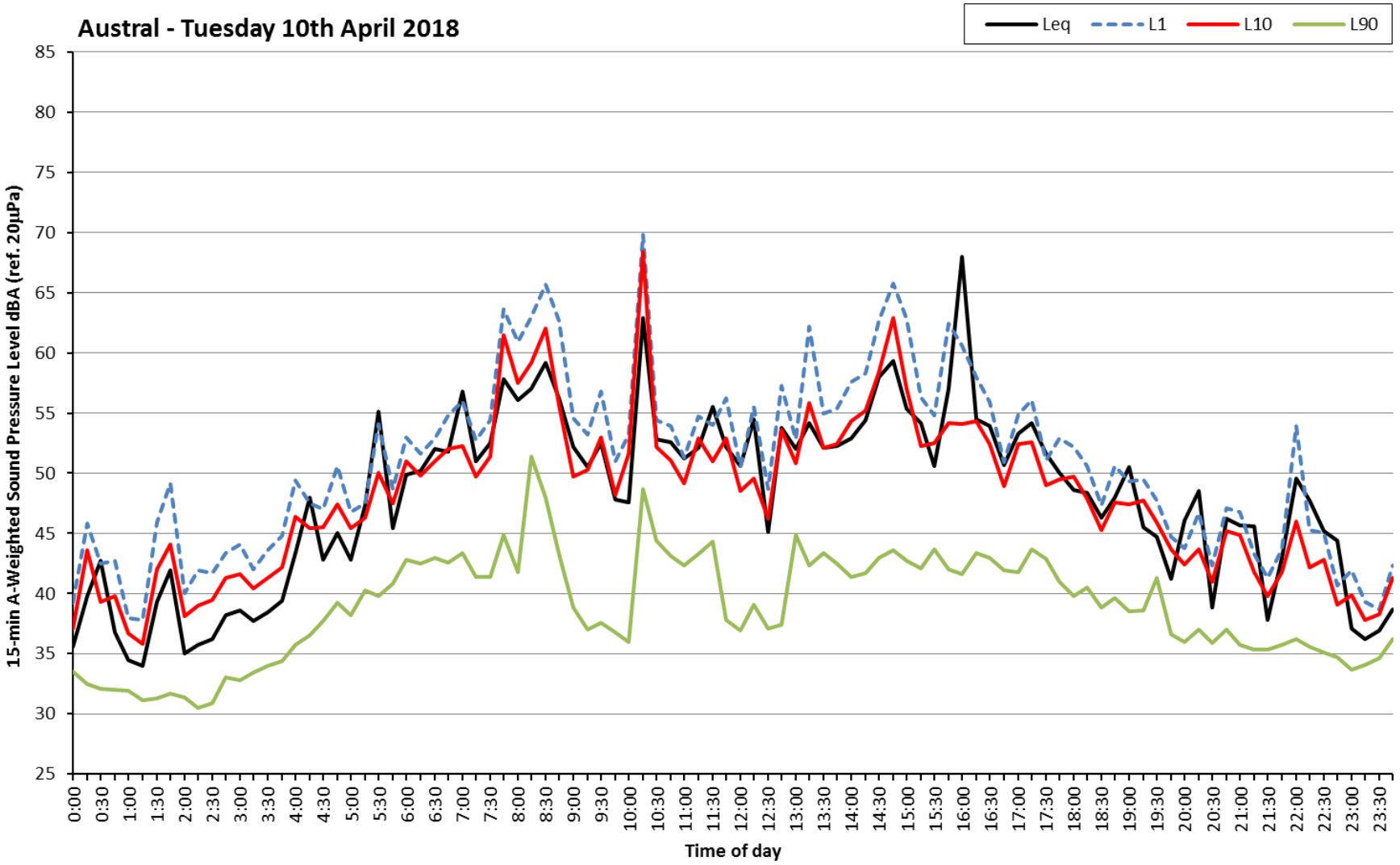
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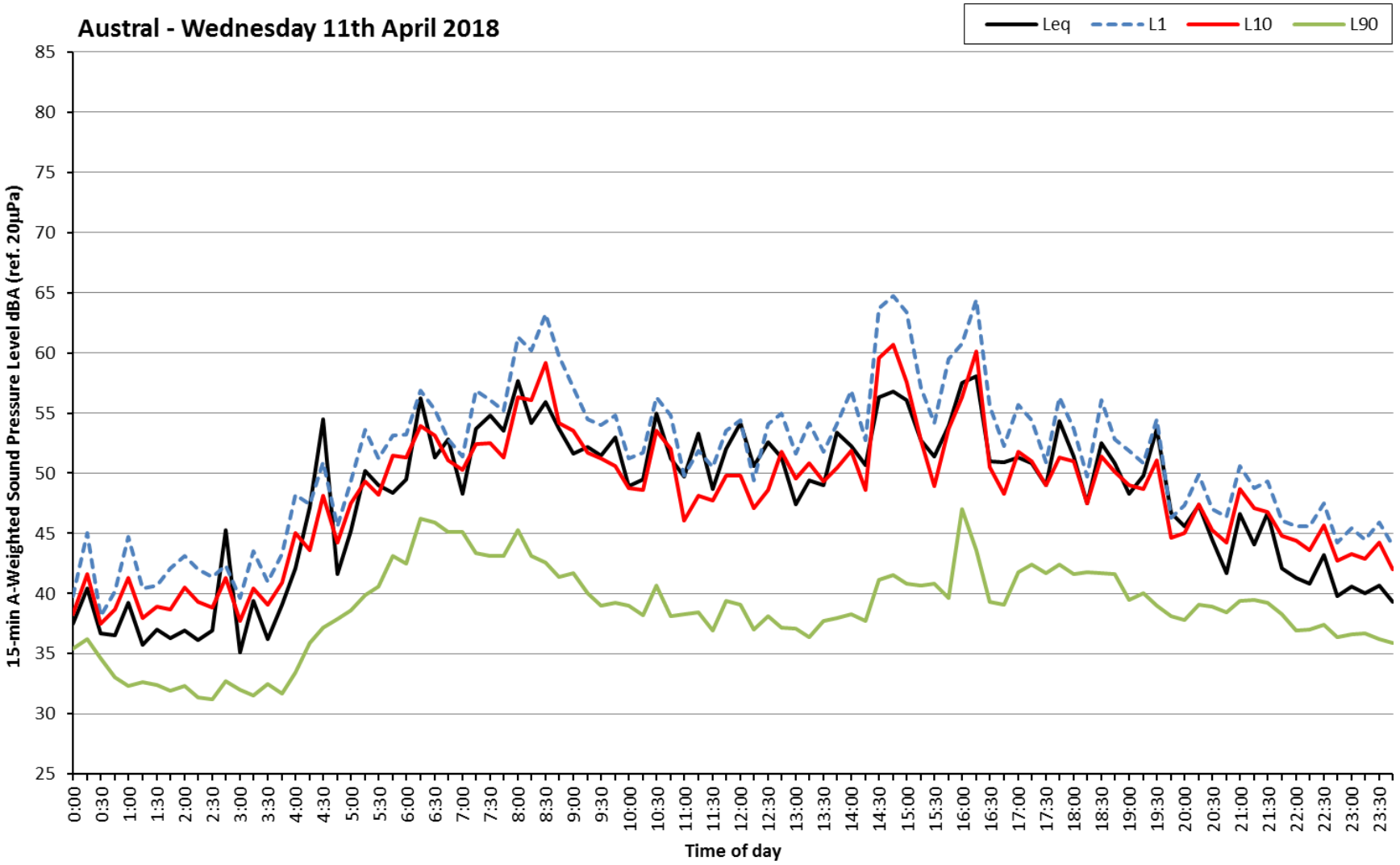
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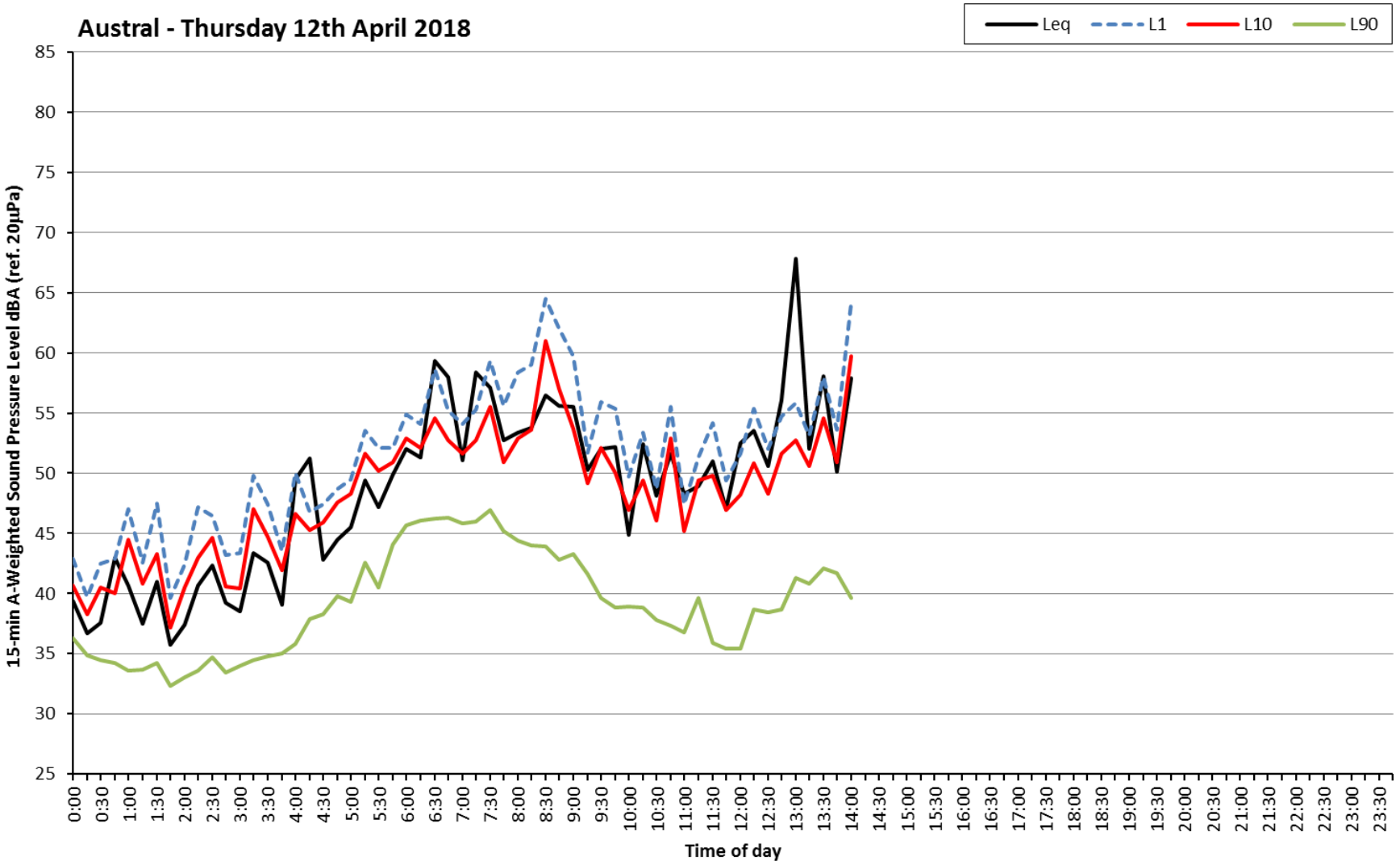
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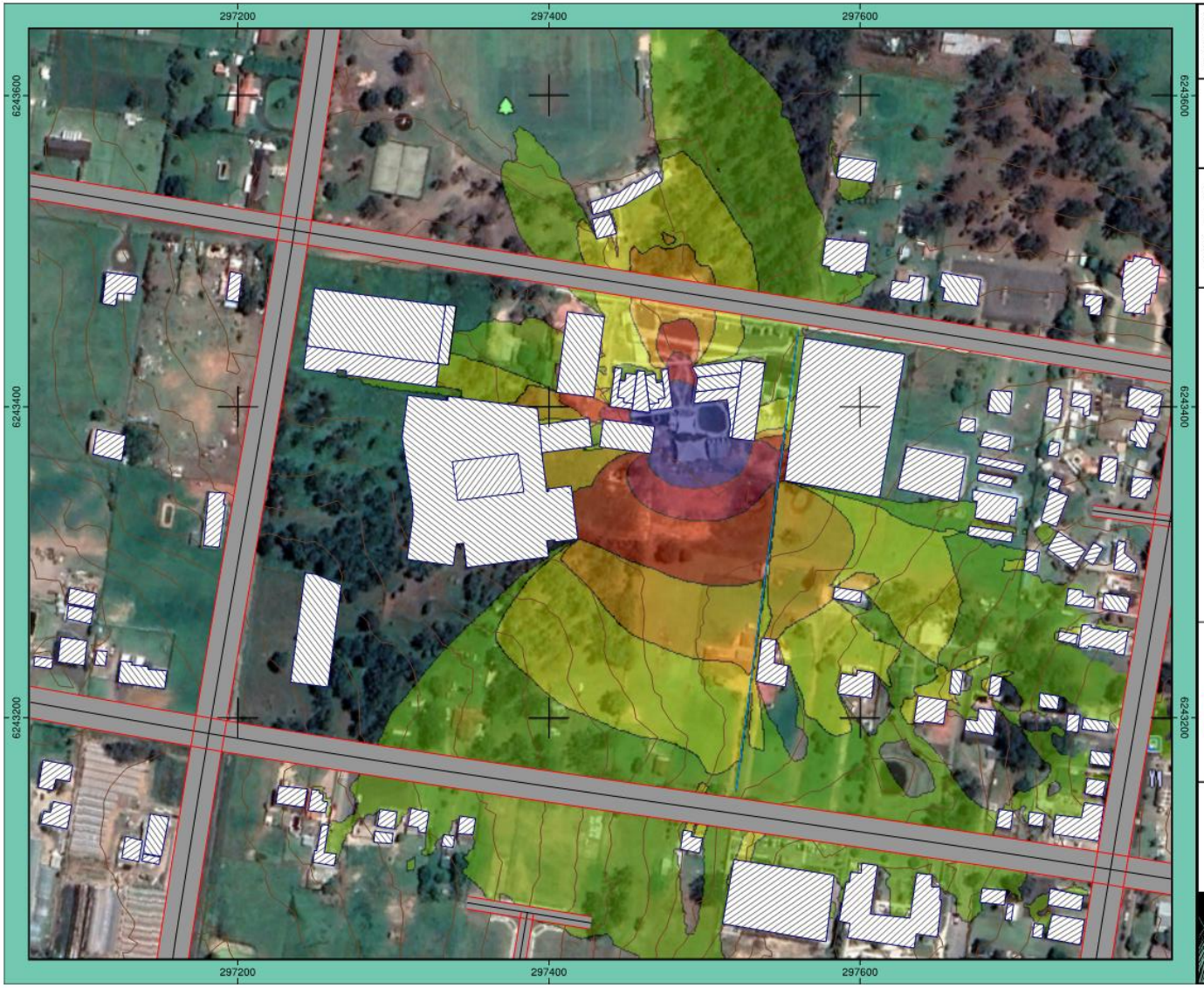
APPENDIX B: NOISE SIMULATION RESULTS



Client: Pepper
Project: St Anthony of Padua
Project-No. 180123

ctpg

Grid Noise Map

Playground Noise – 125 3-6 yr olds

Simulation engineer: Sven Vallely
Created: 23/08/2019

Noise Level
$L_{Aeq,15min}$ (dB)

- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- > 60

Signs and symbols

- Road
- Area source
- Main building

JHA Engineers Pty Ltd
L23 101 Miller Street,
North Sydney, NSW 2060
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w: www.jhaservices.com

JHA