NOISE IMPACT ASSESSMENT

UNITING EDINGLASSIE VILLAGE

EMU PLAINS

ACOUSTICS SERVICES

JHA

CONSULTING ENGINEERS

DOCUMENT CONTROL SHEET

Project Number	180053
Project Name	Uniting Edinglassie Village, Emu Plains
Description	Noise Impact Assessment
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Revision History

Issued To	Revision and Date								
Emmanuel Ghali,	REV	Rev A							
Midson	DATE	15/03/2018							
	REV								
	DATE								
	REV								
	DATE								

CONTENTS

1 INTRODUCTION

JHA have been engaged by The Uniting Church in Australia Property Trust to prepare an acoustic report for the Development Application for the proposed redevelopment of Uniting Edinglassie Village.

This report forms part of the development application submission to the Penrith City Council for the proposed redevelopment and construction of new Residential Aged Care (RAC) facilities and Independent Living Units (ILU) at 5-7 Emerald St, Emu Plains, NSW, 2750.

This report provides:

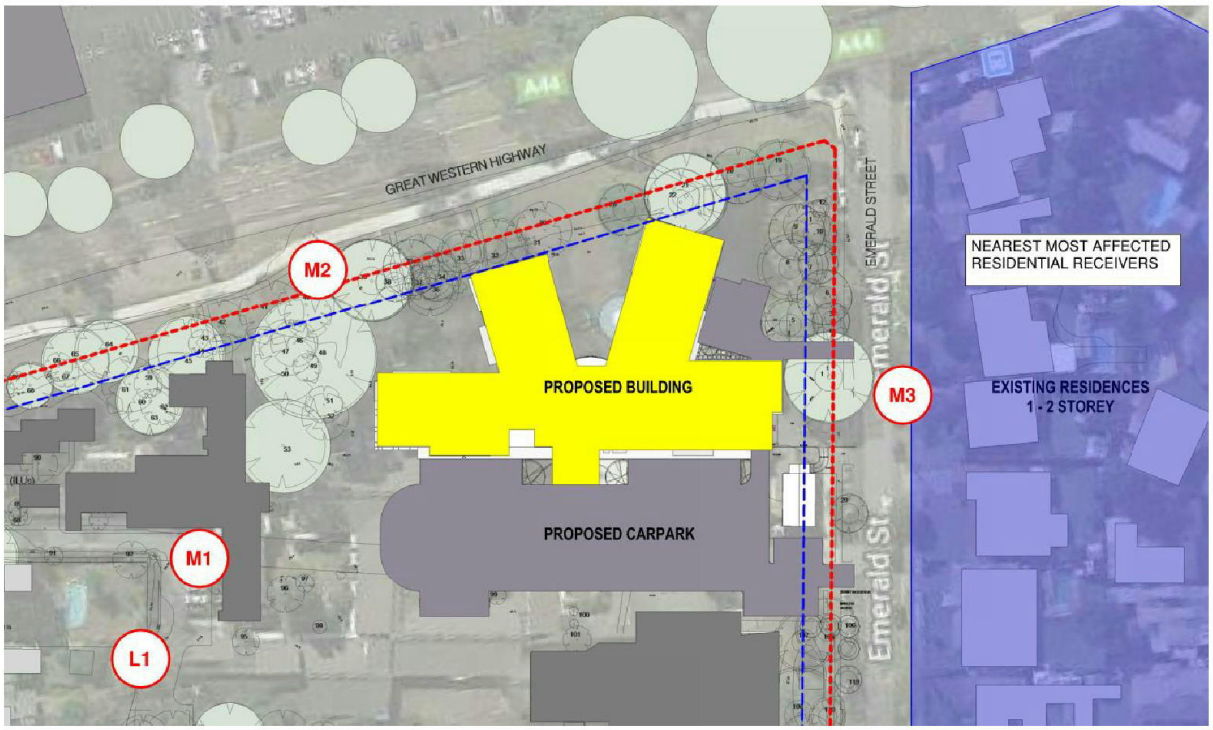
- A statement of compliance with the relevant statutory criteria for the proposed development within the vicinity of the nearest potentially affected receivers.
- Recommendations for noise mitigation measures for the proposed development in order to meet the relevant criteria when compliance is not achieved.

This report is based on our understanding of the proposed project, application of the relevant state guidelines and professional experience within the acoustic field.

2 SITE INFORMATION

The proposed site is located in a medium density residential area, facing the Great Western Highway to the North and bounded by Troy Street to the West and Emerald Street to the East. Emu Plains Primary School is located to the South of the site. Nearest affected residential receivers are located to the East of the Site Figure 1 below.

Figure 1: Site Map and Measurement Locations



1.1 INSTRUMENTATION

The following equipment was used for the noise surveys:

- NTI XL2 Class 1 Sound Level Metre
- Rion NL-52 Class 1 noise logging sound level meter
- Bruel and Kjaer Class 1 Calibrator

All equipment was calibrated before and after the measurements and no significant drift was found. All equipment carries current traceable calibration certificates that can be provided upon request.

2.1 ATTENDED NOISE SURVEY RESULTS

Attended noise measurements of 15-minute duration were conducted on Monday 31/10/2016 between 14.00 and 15.00 at locations M1, M2 and M3 in order to characterise the acoustic environment around the site. A summary of the attended noise measurements taken at site are shown in Table 1. Refer to Figure 1 for measurement locations.

Table 1: Attended noise measurements

Measurement Location	Measurement Time	$L_{Aeq, 15mins}$ dB(A)	$L_{A10, 15mins}$ dB(A)	$L_{A90\ 15mins}$ dB(A)	Comments
M1	11.53am	49	52	42	Nature and Traffic Noise
M2	12.11pm	62	65	49	Traffic noise from highway
M3	12.29pm	51	54	45	Traffic noise
M4	12.45pm	54	57	43	Traffic and School operations noise

2.2 UNATTENDED NOISE MEASUREMENTS

Long term noise monitoring with a Rion NL-52 noise logging sound level meter were conducted between 28th October 2016 and 7th November 2016 at location shown in Figure 1. The noise logger was checked before and after the measurements using a Bruel & Kjaer Acoustic Calibrator. No calibration deviations were recorded. Note that any rain affected data during the period of logging has been excluded from the calculations.

Table 2: Unattended noise measurements

Location	Equivalent Continuous Noise Level $L_{Aeq,period}$ - dB(A)			Background Noise Level RBL - dB(A)		
	Day	Evening	Night	Day	Evening	Night
L1	52	47	41	42	42	35

The local ambient noise environment is typically that of an urban environment, with no dominant sources of noise.

3 NOISE CRITERIA

3.1 NSW INDUSTRIAL NOISE POLICY

The NSW Office of Environment and Heritage (OEH) Industrial Noise Policy (INP) sets out noise criteria to control the noise emission from industrial noise sources. Mechanical and operational noise from the development shall be addressed following the guideline in the NSW INP.

The calculation is based on the results of the ambient and background noise unattended monitoring, addressing two components:

- Controlling intrusive noise into nearby residences (Intrusiveness Criteria)
- Maintaining noise level amenity for particular land uses (Amenity Criteria)

Once both criteria are established the most stringent for each considered assessment period (day, evening, night) is adopted as the project-specific noise level (PSNL).

3.1.1 INTRUSIVENESS CRITERIA

The NSW OEH INP states the following:

> *"The intrusiveness of an industrial noise source may generally be considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented by the Laeq descriptor), measured over a 15-minute period, does not exceed the background noise level measured in the absence of the source by more than 5 dB(A)."*

The intrusiveness criterion can be summarised as L_{Aeq}, 15 minute ≤ RBL background noise level plus 5 dB(A).

Table 3: OEH INP intrusiveness criteria

Period	Noise Descriptor – dB(A)	Noise Criteria – dB(A)
Daytime 7am – 6pm	$L_{Aeq,15min}$ ≤ RBL + 5	47
Evening 6pm – 10pm	$L_{Aeq,15min}$ ≤ RBL + 5	47
Night 10pm – 7am	$L_{Aeq,15min}$ ≤ RBL + 5	40

3.1.1.1 'Modifying Factor' Adjustments

The NSW INP also states:

> *"Where a noise source contains certain characteristics, such as tonality, impulsiveness, intermittency, irregularity or dominant low-frequency content, there is evidence to suggest that it can cause greater annoyance than other noise at the same noise level."*

In order to take into account the potential annoying character of the noise an adjustment of 5 dB(A) for each annoying character aspect and cumulative of up to a total of 10 dB(A), is to be added to the measured value to penalise the noise for its potentially greater annoyance aspect.

Table 4.1 of Chapter 4 of the NSW DECCW INP provides procedures for determining whether an adjustment should be applied for greater annoyance aspect.

Table 4: Table 4.1 NSW DECCW INP – Modifying factor corrections

Factor	Assessment / Measurement	When to Apply	Correction[1]	Comments
Tonal Noise	One-third octave or narrow band analysis	Level of one-third octave band exceeds the level of the adjacent bands on both sides by: - 5 dB or more if the centre frequency of the band containing the tone is above 400 Hz - 8 dB or more if the centre frequency band containing the tone is 160 to 400 Hz inclusive - 15 dB or more if the centre frequency of the band containing the tone is below 160 Hz	5 dB[2]	Narrow-band frequency analysis may be required to precisely detect occurrence.
Low Frequency Noise	Measurement of C-weighted and A-weighted level	Measure / assesses C- and A-weighted levels over same time period. Correction to be applied if the difference between the two levels is 15 dB or more	5 dB[2]	C-weighting is designed to be more responsive to low-frequency noise, especially at higher overall levels
Impulsive Noise	A-weighted fast response and impulsive response	If difference in A-weighted maximum noise levels between fast response and impulse response is greater than 2 dB	Apply difference in measured levels as the correction, up to a maximum of 5 dB.	Characterised by a short rise time of 35 milliseconds (ms) and decay time of 1.5 s.
Intermittent Noise	Subjectively assessed	Level varies by more than 5 dB	5 dB	Adjustment to be applied for night-time only.
Duration	Single-event noise duration may range from 1.5 min to 2.5 h	On event in any 24-hour period	0 to – 20 dB(A)	The acceptable noise level may be increased by an adjustment depending on duration of noise.
Maximum Adjustment	Refer to individual modifying factors	Where two or more modifying factors are indicated	Maximum correction of 10dB(A)[2] (excluding duration correction)	

Notes:

1. Corrections to be added to the measured or predicted levels.
2. Where a source emits tonal and low-frequency noise, only one 5 dB correction should be applied if the tone is in the low-frequency range.

3.1.2 PROJECT SPECIFIC NOISE LEVELS (PSNL)

The following criteria is applicable for the external noise emissions from the development, as detailed below in Table 5. These project specific noise levels are in accordance with the requirements of the NSW INP, and shall be assessed to the most affected point on or within the residential boundary.

Table 5: Project specific noise levels

Period	Descriptor	PSNL dB(A)
Residential receivers		
Day (7:00am to 6:00pm)	$L_{Aeq,15min}$	47
Evening (6:00pm to 10:00pm)	$L_{Aeq,15min}$	47
Night (10:00pm to 7:00am)	$L_{Aeq,15min}$	40

3.2 INTERNAL NOISE LEVELS

Table 6 below shows the recommended Australian Standard AS/NZS 2107 Interior Sound Levels as required by the State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004 Section 34 "Visual and acoustic privacy".

Table 6: Recommended Internal Noise Levels

Type of Occupancy for Apartments near Major Roads	Recommended Design Sound Level, LAeq, dB(A)	
	Satisfactory	Maximum
Living Areas	35	45
Sleeping Areas	30	40
Work Areas	35	45
Common areas (e.g. foyer, corridors and lobbies)	45	55

The noise levels from plant, equipment and external sources shall not exceed the maximum levels shown in Table 6 above.

3.3 TRAFFIC NOISE GENERATION CRITERIA

The L_{Aeq} noise level or the "equivalent continuous noise level" correlates best with the human perception of annoyance associated with traffic noise. Road traffic noise impact is assessed in accordance with the NSW Road Noise Policy (Office of Environment and Heritage July 2011) which supersedes the *NSW Environmental Criteria for Road Traffic Noise* (ECRTN, Department of Environment Climate Change and Water 1999). The criterion (Table 3 – Road Traffic Noise Assessment Criteria for Residential Land Uses) divides land use developments into different categories and lists the respective criteria for each case. The category that is relevant to the proposed use of the site is shown below in Table 7.

Table 7: NSW Road Noise Policy – Traffic noise assessment criteria

Road Category	Type of project/land use	Assessment Criteria – dB(A)	
		Day (7am – 10pm)	Night (10pm – 7am)
Local Roads	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq,1\ hour}$ 55 (external)	$L_{Aeq,1\ hour}$ 50 (external)

In the event that the traffic noise at the site is already in excess of the criteria noted above, the NSW RNP states that the primary objective is to reduce the existing level through feasible and reasonable measures to meet the criteria above.

If this is not achievable, Section 3.4.1 Process for applying the criteria – Step 4 states that for existing residences affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise should be limited to 2 dB above that of the corresponding 'no build option'.

3.4 CONSTRUCTION VIBRATION CRITERIA

The Office of Environment and Heritage (OEH) developed a document, "Assessing vibration: A technical Guideline" in February 2006 to assist in preventing people from exposure to excessive vibration levels within buildings. The guideline does not however address vibration induced damage to structures or structure-borne noise effects. Vibration and its associated effects are usually classified as continuous, impulsive or intermittent.

3.4.1 HUMAN COMFORT – CONTINUOUS AND IMPULSIVE VIBRATION CRITERIA

Structural vibration in buildings can be detected by occupants and can affect them in many ways including reducing their quality of life and also their working efficiency. Complaint levels from occupants of buildings subject to vibration depend upon their use of the building and the time of the day.

Maximum allowable magnitudes of building vibration with respect to human response are shown in Table 8. It should be noted that the human comfort for vibration are more stringent than the building damage criteria.

Table 8: Preferred and maximum weighted RMS values for continuous and impulsive vibration

Location	Assessment period[1]	Preferred values		Maximum values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Continuous vibration					
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and place of worship	Day or night time	0.020	0.014	0.040	0.028
Impulsive vibration					
Residences	Daytime	0.30	0.21	0.60	0.42
	Night time	0.10	0.071	0.20	0.14
Offices, schools, educational institutions and place of worship	Day or night time	0.64	0.46	1.28	0.92

3.4.2 HUMAN COMFORT – INTERMITTENT VIBRATION CRITERIA

Disturbance caused by vibration will depend on its duration and its magnitude. This methodology of assessing intermittent vibration levels involves the calculation of a parameter called the Vibration Dose Value (VDV) which is used to evaluate the cumulative effects of intermittent vibration. Various studies support the fact that VDV assessment methods are far more accurate in assessing the level of disturbance than methods which is only based on the vibration magnitude. Refer to Table 9 for the acceptable VDV levels.

Table 9: Acceptable Vibration Dose Values for intermittent vibration (m/s1.75)

Location	Daytime (7:00am to 10:00pm)		Night-time (10:00pm to 7:00am)	
	Preferred value	Maximum value	Preferred value	Maximum value
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and place of worship	0.40	0.80	0.40	0.80

3.4.3 STRUCTURAL DAMAGE – VIBRATION CRITERIA

Ground vibration criteria are defined in terms of levels of vibration emission from construction activities which will avoid the risk of damaging surrounding buildings or structures. It should be noted that human comfort criteria are normally expressed in terms of acceleration whereas structural damage criteria are normally expressed in terms of velocity.

Most commonly specified structural vibration levels are defined to minimize the risk of cosmetic surface cracks and are set below the levels that have the potential to cause damage to the main structure. Structural damage criteria are presented in German Standard DIN4150-Part 3 "Structural vibration in buildings – Effects on structures" and British Standard BS7385-Part 2: 1993 "Evaluation and Measurement for Vibration in Buildings". Table 10 indicates the vibration limits presented in DIN4150-Part 3 to ensure structural damage doesn't occur.

Table 10: Guideline value of vibration velocity, vi, for evaluating the effects of short-term vibration

Line	Type of Structure	Vibration velocity, vi, in mm/s			
		Foundation			Plane of floor of uppermost full storey
		At a frequency of			
		Less than 10Hz	10 to 50Hz	50 to 100*Hz	All Frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that, because of their particular sensitivity to vibration, do not correspond to those listed in lines 1 and 2 and are of great intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8
*For frequencies above 100Hz, at least the values specified in this column shall be applied					

Table 11 presents guide values for building vibration, based on the lowest vibration levels above which cosmetic damage has been demonstrated as per BS7385-Part 2:1993.

Table 11: Transient vibration guide values for cosmetic damage

Type of Building	Peak Particle Velocity in frequency range of predominant pulse (PPV)	
Residential or light commercial type buildings	4 Hz to 15 Hz	15 Hz and above
	15mm/s at 4Hz increasing to 20mm/s at 15Hz	20mm/s at 15Hz increasing to 50mm/s at 40Hz and above

3.4.4 CONSTRUCTION VIBRATION OBJECTIVES

Table 12 indicates the construction vibration criteria applicable to the residential and educational properties located adjacent to the development site.

Table 12: Construction vibration criteria summary

Location	Period	Human Comfort Vibration Objectives			Building damage Objectives – Velocity (mm/s)
		Continuous mm/s^2 (RMS)		Intermittent $mm/s^{1.75}$ (VDV)	
		z-axis	x- and y-axis		
Residential	Day time	10 - 20	7 - 14	0.20 - 0.40	5
	Night time	7 - 14	5 - 10	0.13 - 0.26	5
Educational	Day or night	20 - 40	14 - 28	0.40 - 0.80	5

4 NOISE ASSESSMENT

4.1 EXTERNAL GLAZING

The general limiting factor of the performance of a building façade in term of noise attenuation is the glazing. In the case of the proposed development, the noise from vehicles on Great Western Highway will place the greatest acoustic demand on the façades of the development.

In order to achieve the internal noise levels specified in the AS/NZS2107, the minimum recommended glazing selection for the façades of the proposed development is presented in Table 13.The ratings presented are based on the worst case scenario of external noise obtained from the attended and unattended noise measurements. The glazing thicknesses corresponding to the Rw ratings should be considered as the minimum thicknesses to achieve acoustical ratings. Greater glazing thicknesses may be required for structural loading, wind loading, thermal requirements etc.

The acoustic glazing mark-ups are presented in Appendix 1 and should be read in conjunction with Table 13.

Table 13: Recommended acoustic performance of glazing system

Glass System	Required Acoustic Rating of Glazing Assembly, R_W
6.38mm Laminated	32
8.38mm Laminated	34
10.38mm Laminated	35

NOTES:

The Required Acoustic Rating of Glazing Assembly, refers to the acoustic performance of the glazing once installed on site (including the frame). It is the responsibility of the builder to ensure that the required acoustic performance of the glazing system is achieved.

During the detailed design stage of the project the acoustic performance of the glazing facade should be reviewed as the combined noise from external sources and mechanical services could result in the internal noise level exceeding the recommended design sound level.

4.2 MECHANICAL PLANT NOISE EMISSIONS

This assessment has considered the noise emissions from the mechanical plant serving the residential and retail spaces. These noise sources have been used to predict the worst case scenario noise impact of the proposed use of the site to the nearby residential and commercial receivers.

This assessment has considered the following mechanical equipment:

- External roof mounted condenser units
- External roof mounted exhaust fans

In order to assess the worst case scenario, it was assumed that all the plant is running at any time throughout a 24hr period. Therefore the night time criteria will be used to determine the maximum sound power levels for the mechanical equipment.

This assessment has considered the project specific noise levels in accordance with the INP as detailed in Section 3.1

4.2.1 PROPOSED NOISE LEVELS

Refer to Table 14 for the maximum allowable sound power levels. These noise limits will results in compliance with the INP project specific noise levels.

Table 14: External Mechanical Plant Sound Power Levels

	SWL re 1pW (dB)								
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	Overall dB(A)
External condenser units	78	83	77	69	68	66	64	59	75
Kitchen Exhaust Fans	77	74	75	76	75	74	70	63	80

Provided the sound power levels do not exceed the values as shown in Table 14, the noise level at the surrounding receivers is predicted to comply with the relevant criteria. Note that acoustic mitigation measures such as 50mm internal duct lining and attenuators may be required.

Note that this is a preliminary assessment and it is recommended that an updated acoustic report is conducted at a later juncture when more information becomes available about the specific units to be used.

4.3 TRAFFIC NOISE GENERATION

The traffic noise associated with the expected peak hour traffic generation has been assessed in accordance with the NSW RNP for local roads. The assessment has been conducted at the nearby residential receivers located on Emerald St, with an anticipated AM and PM peak hour rate of 40 vehicles as indicated by TTW. The predicted noise levels associated with the traffic generation is shown below in Table 15.

Table 15: Predicted Traffic Noise Generation

Location	Existing Noise Levels	Predicted Noise Levels	Proposed maximum Noise Levels	Complies
	$L_{Aeq-1hour}$, dB(A)	$L_{Aeq-1hour}$, dB(A)	$L_{Aeq-1hour}$, dB(A)	
Emerald St	51	51.5	55	Yes

As shown in Table 15, the worst case scenario predicted increase in traffic noise level post-development at the nearest residential receiver along Emerald is less than 1dB and considered to be negligible. Based on this assessment, the proposed development is expected comply with the requirements of the NSW RNP.

5 CONCLUSION

An acoustic assessment for the modification of the proposed development at 5-7 Emerald St, Emu Plains has been conducted. This document forms part of the documentation package to be submitted to local authorities as part of the Development Application.

This report has provided criteria, in-principle treatment and design requirements which aim to achieve the statutory criteria discussed in Section 3.

Glazing for the buildings residential areas have been designed to achieve internal noise levels in accordance with the requirements of the relevant SEPP and Australian Standards. The glazing is presented in Appendix 1.

Maximum sound power levels for the mechanical services have been provided such that compliance is achieved for the day, evening and night criteria in accordance with the INP.

A road traffic noise assessment was conducted for traffic generated noise along Emerald St. Based on the information provided by TTW the traffic generated noise is negligible and predicted to comply with the requirements of the RNP.

Even though no assessment can be considered as being thorough enough to preclude all potential environmental impacts, having given regard to the above listed conclusions, it is the finding of this assessment that the development application should not be refused on the grounds of excessive noise generation.

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 air-conditioning units, layout of equipment, modifications to the building and introduction of any additional noise sources.

APPENDIX 1 – ACOUSTIC GLAZING MARK-UPS


LEGEND
Rw 32
Rw 34
Rw 35
21903
10007
BBQ PERGOLA
LAWN


LEGEND
R_w 32
R_w 34
R_w 35
21903
10007
BBQ PERGOLA
RL 27
LAWN
RL 27.50
LAWN
BALCONY
DINING
KITCHEN
LIVING
LAUNDRY
SITTING
BED
ENS
CIRC
LIFTER
STAIR
SHARED
CLEAN LINEN
DIRTY UTILITY
BULK STORE
EQUIP STORE
CLINICAL
COMMS
R4000