

Clarence Valley Conservatorium of Music

Acoustic Report

Prepared for: DRA Architects

Project No: BNE0908
Date: 28 November 2024
Revision: [02]



Project: Clarence Valley Conservatorium of Music

Location: 8 Villiers St
Grafton NSW 2460

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Project No: BNE0908

Revision: [02]

Date: 28 November 2024

Rev	Date	Comment	Author	Technical Review	Authorisation & QA
01	20/10/2023	Final	DZ	WG	WG
02	28/11/2024	Final – minor amend	DZ	WG	WG

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1. Introduction

ADP consultants was commissioned by DRA Architects to provide a noise impact assessment for the proposed Clarence Valley Conservatorium of Music upgrade.

Figure 1 provides a site plan of the proposed development and its surrounds, including the location of noise measurements.

Figure 1 Site plan and noise measurement locations



1.1 Study area description

Based on our site survey and investigations we have identified the following sensitive receivers as being the nearest noise sensitive premises to the proposed development:

- > Residential receivers:
 - R1 - Grafton Quality Inn - two-storey inn across Villiers St to the east.
 - R2 – 28 Victoria St – single storey detached dwelling across Villiers St to the west.
 - R3 - Grafton Central Motel – 35 Fitzroy St to the east.
 - R4 – 16 Victoria St – raised two-storey detached dwelling to the south-east.
- > Commercial receivers:

- C1 -Cetnaj Lighting, Electrical, Data - Shop A/41 - 47 Fitzroy St, to the north of the existing conservatorium.
- C2 - Gurehlgam Corp Ltd. - 18-26 Victoria St to the south of the proposed conservatorium
- > The development itself that includes:
 - Multiple music practise rooms

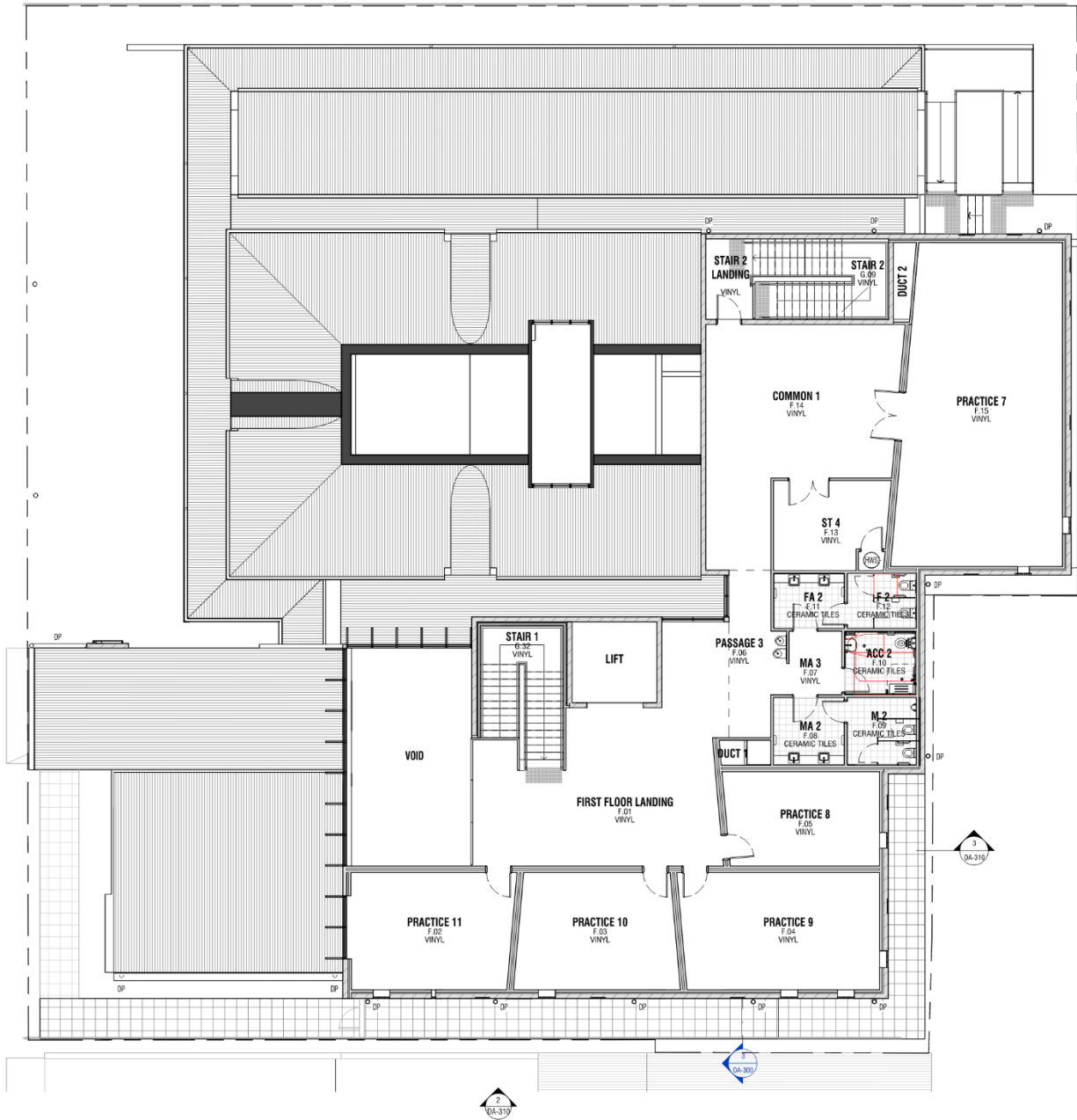
The buildings in the immediate site surrounds are predominantly residential and commercial use, and there were no significant noise sources (e.g. commercial plant, condenser units, air handling units, fans etc.) identified from other surrounding or nearby buildings which would impact on the amenity of the proposed development.

1.2 Proposed development

ADP Consulting understands that the development encompasses the following components and characteristics, for which there are corresponding acoustic design objectives:

- > Demolition of the southern building
- > Extension of the existing conservatorium to the south over two-storey's which includes:
 - Reception
 - Directors office
 - 6 additional music practise rooms
 - Foyer
 - Elevator and two additional sets of stairs
 - Meeting room
 - Staff room, common room and amenities

Figure 3 First Floor Plan (DRA Architects)



2. Acoustic measurements

2.1 Overview

Acoustic measurements consisted of an attended noise measurement and noise logging. The noise measurement locations are shown in Figure 1 and are described as follows:

- > Location A was the northern corner of the existing conservatorium.
- > Location B was on the berm overlooking the river between the McCarthy Centre, Lavery Pathology and Clarence River Sailing Club.

The noise monitoring was undertaken in general accordance with Australian Standard AS1055 Acoustics – Description and measurement of environmental noise and the EHP Noise Measurement Manual.

2.2 Attended measurements

Attended noise measurements were undertaken at Location A and B on Monday 25 September 2023 using a field and laboratory calibrated Nti XL2 sound level meter. The microphone height was approximately 1.3m above natural ground level and was located in the free field.

Table 1 presents the noise levels of the attended traffic and ambient noise measurements at the locations shown in Figure 1.

Table 1 Attended noise measurements, dBA

Date and time	Location	Noise level, dBA			Comments
		L _{eq}	L ₁₀	L ₉₀	
Monday 25 September 2023 12:00pm to 12:25pm	A (Conservatorium)	55	58	48	Cars passing: 53 to 59 dBA Bus on round-a-bout: 49 dBA Truck: 67 dBA
Monday 25 September 2023 1:15pm to 1:30pm	B (River)	46	49	43	Birds: 47 dBA Ute: 48 dBA Minimum: 40 dBA

2.3 Unattended measurements

Unattended noise measurements were conducted for a period of 8 days between Monday 25 September 2023 and Tuesday 03 October 2023 at Location A and B as shown in Figure 1.

It was observed that the background noise levels of the site and surrounds were predominantly influenced by nearby traffic noise on Fitzroy St, with some contribution from other local traffic from Villiers St and activities.

Noise levels at Location A are summarised in Table 2 and Location B in Table 3.

Table 2 Unattended background noise measurements at Location A, dBA

Period	Assessment Background levels (ABL) L ₉₀ dBA	Rating Background Level (RBL) L ₉₀ dBA	Repeatable – L _{eq} dBA
Note: Weekends are underlined			
Daytime (07:00-18:00)	51, 51, 53, 52, <u>51</u> , <u>48</u> , 49	50	59
Evening (18:00-22:00)	49, 51, 50, 51, <u>50</u> , <u>47</u> , 48	40	52
Night-time (22:00-07:00)	38, 39, 38, 38, <u>37</u> , <u>38</u> , 38	37	51

Table 3 Unattended background noise measurements at Location B, dBA

Period	Assessment Background levels (ABL) L ₉₀ dBA	Rating Background Level (RBL) L ₉₀ dBA	Repeatable – L _{eq} dBA
Note: Weekends are underlined			
Daytime (07:00-18:00)	46, 45, 49, 46, <u>45</u> , <u>44</u> , 46	44	55
Evening (18:00-22:00)	47, 49, 48, 51, <u>50</u> , <u>49</u> , 53	40	52
Night-time (22:00-07:00)	35, 37, 43, 36, <u>35</u> , <u>35</u> , 35	32	50

The long-term monitoring device was configured to report noise level descriptors every 15 minutes and periods with inclement weather (i.e. rainfall present or wind speeds greater than 5m/s) were excluded from the reported results and assessment.

The Location A RBLs have been used for the determination of noise emission criteria. These criteria have been presented in Section 3 of this report.

Further detail of the unattended noise monitoring is included in the noise logger graphs in Appendix B.

3. Criteria

3.1 Noise emissions

3.1.1 Overview

Noise emissions requirements from the proposed development under the Environmental Protection Act 1994 (EP Act), Environmental Protection Regulation 2019 (EP Regulation) and Environmental Protection (Noise) Policy 2019 (EPP Noise) are as follows:

3.1.2 Background Creep (EPP Noise)

The EPP Noise 2019 states that

- 2) *To the extent it is reasonable to do so, noise must be dealt with in a way that ensures—*
 - a) *The noise does not have any adverse effect, or potential adverse effect, on an environmental value under this policy; and*
 - b) *Background creep in an area or place is prevented or minimised.*
 - c) *Despite subsection (2)(b), if the acoustic quality objectives for an area or place are not being achieved or maintained, the noise experienced in the area or place must, to the extent it is reasonable to do so, be dealt with in a way that progressively improves the acoustic environment of the area or place.*

The EPP Noise 2019 policy document does not prescribe noise criteria for the prevention of minimisation of background creep.

In lieu, ADP Consulting have adopted the criteria from the earlier EPP Noise 2008 policy document, which states:

10 Controlling background creep

- (2) *To the extent that it is reasonable to do so, noise from an activity must not be—*
 - (a) *for noise that is continuous noise measured by $L_{A90,T}$ —more than nil dB(A) greater than the existing acoustic environment measured by $L_{A90,T}$; or*
 - (b) *for noise that varies over time measured by $L_{Aeq,adj,T}$ —more than 5dB(A) greater than the existing acoustic environment measured by $L_{A90,T}$.*

Part 3B of the EP Act prescribes default “noise standards” to specific activities and noise sources. The following default noise standards may be relevant to the proposed development:

440U Air-conditioning equipment

- (1) *This section applies to premises at or for which there is air-conditioning equipment.*
- (2) *An occupier of the premises must not use, or permit the use of, the equipment on any day—*
 - (a) *before 7a.m, if it makes a noise of more than 3dB(A) above the background level; or*
 - (b) *from 7a.m. to 10p.m, if it makes a noise of more than 5dB(A) above the background level;*
or
 - (c) *after 10p.m, if it makes a noise of more than 3dB(A) above the background level.*

3.2 Noise emissions summary

This section summarises site-specific noise emission requirements applicable to the proposed development per the EP Act / Regulations / Noise Policy and in calculated from the long-term site background noise measurements as presented in 2.3

Table 4 Noise emission criteria summary

Criteria item	Requirement per	Measurement descriptor	Criteria, dB(A)		
			Day (07:00-18:00)	Evening (18:00-22:00)	Night (22:00-07:00)
Background noise levels – Location A	N/A	$L_{A90,T}$	50	40	37
Background creep – Continuous noise (mechanical plant)	EPP Noise	$L_{Aeq,adj,T}$	50	40	37
Background creep – Varying noise	EPP Noise	$L_{Aeq,adj,T}$	55	45	42

It should be noted that the cumulative noise emission from the operations of the proposed development are to meet this noise criteria.

3.2.1 Music and entertainment noise

Noise emission restrictions apply to music and entertainment noise. Music must be planned, designed and installed to include suitable sound attenuation and other necessary acoustic treatments. This report provides an approach that needs to be incorporated in the proposed development to meet the noise emission requirements of the EPA Noise Protocol.

3.3 Internal acoustic environment

3.3.1 Internal noise levels and reverberation times

Indoor background design noise levels, which are deemed acceptable to the majority of reasonable occupants are published in AS/NZS 2107.

The following noise limits apply to continuous sources of outdoor noise (e.g. road traffic, rooftop plant) as well as sources internal to the proposed development such as plant and equipment. When selecting and designing the internal noise levels for mechanical plant and equipment, we recommend that the range of levels presented in Table 5 for each space be used.

Furthermore, AS/NZS 2107 refers to ideal reverberation times for various spaces. Low reverberation times are critical for speech intelligibility and perception of a space as having high acoustic quality. Table 5 schedules the recommended reverberation times for different relevant spaces.

Table 5 Internal design sound level and reverberation time criteria

Type of occupancy*	Design sound level, $L_{eq,T}$, dB(A)	Reverberation time, seconds
Meeting rooms	40 to 45	< 0.6
Executive offices	35 to 40	0.4 to 0.6
Music practise rooms	40 to 45	0.7 to 0.9
Reception areas	40 to 45	0.6 to 0.8
Corridors and lobbies	45 to 50	< 1.0
Toilets	45 to 55	–

3.3.2 Acoustic separation

Acoustic separation, or sound insulation, is important where there is a need control noise transmission between spaces such as between separate tenancies (e.g. for speech privacy) or between tenancies and common or plant areas (e.g. for noise level control).

In lieu of statutory or specific project related requirements, it is recommended that partitions within the proposed development are designed to meet the following acoustic performance recommendations to provide acoustic separation:

- > Walls between music rooms and/or other habitable spaces: $R_w + C_{tr} \geq 60$
- > Walls between differing uses: $R_w \geq 45$
- > Walls between private/confidential uses: $R_w \geq 50$
- > Floors between tenancies: $R_w \geq 50$ and $L_{n,w} \leq 65$
- > Walls between use and common areas (e.g. corridor, amenities): $R_w \geq 45$
- > Walls between uses containing a door: $R_w \geq 35$
- > Doors between common areas (e.g. corridor, lobby): $R_w \geq 30$
- > Walls between amenities/toilets and other areas (e.g. corridor): $R_w \geq 40$
- > Walls surrounding plant areas (e.g. plantrooms, lift shafts, waste stores): $R_w \geq 50$
- > Walls surrounding services risers: $R_w + C_{tr} \geq 40$
- > Between hydraulic services and occupied areas: $R_w + C_{tr} \geq 25$

The above acoustic performance recommendations are based on previous project experience and typical commercial expectations but the design will progress with future design stages.

3.3.3 Fire mode conditions

Some building systems only operate in fire mode and during periodic testing, so they do not add to background noise under typical conditions. According to AS/NZS 1668.1:2015, these systems are subject to noise limits relating not to occupant comfort but rather to occupant distress and the intelligibility of emergency commands.

Table 6 schedules the fire mode maximum internal noise levels according to AS/NZS 1668.

Table 6 Fire mode maximum sound pressure levels

Area type	Maximum noise level, L_{Aeq} dB(A)
Occupied Area	65
Fire-isolated exit (e.g. fire stair)	80

3.3.4 Vibration

Vibration is the oscillation of an object, structure, or surface at frequencies typically below 20Hz, which is inaudible but instead can be “felt”.

Structure-borne sound means oscillation at frequencies higher than 20Hz, resulting in audible noise, which is transmitted through rigid building elements and radiated by surfaces.

Human response to building vibration is a complex phenomenon. There is great variability in the vibration tolerance of humans, and as a result, human comfort criteria cannot robustly be defined and quantified. Acceptable values of human exposure to vibration depend on human activity and the character of the vibration, and they are further influenced by individual attitudes, expectations, and perceptibility.

Limits for vibration of the building structure potentially affecting human comfort have been derived from AVTG, which references and discusses practically AS 2670.2 and BS 6472. These standards propose maximum vibration levels in terms of baseline curves and multiplication factors. For the purpose of minimising the disturbing perceptibility of vibration within the occupied areas of this development; Table 5 specifies appropriate limits for floor vibration in a simplified form.

Table 7 Internal vibration limits – AVTG

Type of occupancy	Time	Vibration Limit – Preferred / Maximum		
		Continuous Vibration: r.m.s. Acceleration (m/s^2)	Impulsive Vibration: r.m.s. Acceleration (m/s^2)	Intermittent Vibration: Vibration Dose Value, VDV ($m/s^{1.75}$)
Offices, Retail, Circulation / other occupied ventilated space	Day or Night	0.020 / 0.040	0.640 / 1.280	0.40 / 0.80

Radiated structure-borne noise caused by vibration from building services and plant shall be limited to ensure the internal noise limits (refer to Section 3.3.1) are not exceeded.

4. Assessment & Recommendations

4.1 Noise emissions

4.1.1 Practise room

After reviewing the architectural documents and the aerial site map, the most sensitive receiver was noted to be – R3 - Grafton Central Motel on 35 Fitzroy St which will be approximately 10m from Practise Room 8. The average sound pressure level within the practice rooms is predicted below in Table 8.

Table 8 Practise Room internal noise level

Noise Source	Average room noise level, dBA, Hz								Overall
	63	125	250	500	1k	2k	4k	8k	
Music Practise Rooms	64	78	87	93	96	92	92	89	100

With a minimum R_w 45 or $R_w + C_{tr}$ of 37, the noise level ($L_{A,eq}$) at the façade of the Grafton Central Motel is predicted to be below the limit for the relevant noise criteria. It is expected that if the predicted noise level is compliant at this closest and most sensitive receiver that all other receivers will also be compliant.

The glazing requirements are discussed in Section 4.2.

4.1.2 Mechanical plant

At the time of writing, plant and equipment selection is yet to be finalised. It is anticipated that provision has been included in the current scheme to incorporate standard acoustic treatment, such as silencers, barriers, acoustically lined ductwork, acoustic louvres, vibration isolation etc. to meet the acoustic design criteria nominated in Section 3.3.1, particularly for noise emissions from the site in accordance with the EPA Noise criteria presented in Section 3.1.2.

Generally, the following allowances should be made for in the design:

- > Support points for major plant items should be structurally rigid. Mid-span areas of floor slab should be avoided where practical.
- > Plant and associated motor and drive assemblies should be mounted on steel chassis or concrete inertia bases (in accordance with ASHRAE)
- > For all major equipment such as chillers, diesel generators and cooling towers, local stiffening of plant room floors should be allowed
- > 200mm concrete slabs and precast/in-situ concrete walls surrounding plant rooms
- > Vibration isolators for equipment rotating plant and machinery located in plant rooms with >90% isolation efficiency
- > All penetrations to plant rooms should be properly dimensioned, packed and sealed
- > Main services ducts and pipes to have their own individual penetrations, with suitable spacing to allow good sealing

- > Allowance for acoustic attenuation treatments e.g. internal lining to air inlets and discharges to meet external noise emission criteria
- > For major equipment such as chillers and cooling towers, allow for local stiffening of the plant room floor
- > Speed controllers, if used, should be of good quality and compatible with the motor model. Poor quality controllers can result in significant increase in motor noise, as much as 10dB(A), with an offensive characteristic such as high frequency tone
- > Selection of low noise fans, allowance for smooth airflow conditions in ductwork, use of attenuators and lined duct work while minimising regenerated noise at bends, take-offs and transitions

4.2 External noise intrusion, glazing and external walls

The development is impacted by road traffic noise, primarily from Fitzroy Street to the north which carries 2 lanes of 40km/hr traffic in each direction, and secondarily from Villiers Street to the west which carries only 1 lane of traffic in each direction and serves more as a local access road.

Based on the $L_{A,eq}$ from the unattended noise logging, the indicative façade glazing requirements to achieve the internal noise level criteria presented in Section 3.3.1 and the noise emissions from the music practise rooms have been determined and are presented in Table 9.

Table 9 Minimum glazing performance recommendations

Glazing location	Indicative glazing construction	Minimum glazing octave band transmission loss – dB, Hz								
		63	125	250	500	1k	2k	4k	8k	R_w
Practise Room glazed facades	6/12/6mm double glazing, or; 12mm monolithic single glazing	23	23	22	32	34	32	36	40	34
All other glazed facades	6mm glazing	18	21	25	29	33	31	35	35	31

We understand that these glazing recommendations may be refined further during design development and the following considerations may need to be accounted for. These include:

- > On-site noise measurements e.g. of site road traffic noise levels
- > Thermal requirements
- > Structural and wind loading requirements of the glass (particularly at higher levels)
- > Detailed plans that finalize glazing sizes
- > Selected glazing suppliers and glazing system performances, including contribution through framing and seals (for operable glazing)

For external walls it is recommended that they achieve a minimum acoustic performance of R_w 45. We note that this is achieved by minimum 100mm thick concrete panel wall, either bare or with wall linings. Alternative external wall system such as those with studwork or brick may also be developed to achieve the recommended minimum acoustic performance of R_w 45 with minimum $R_w + C_{tr}$ of 37.

5. Summary

A noise impact assessment has been conducted for the proposed Clarence Valley Conservatorium of Music project at 8 Villiers St, Grafton NSW 2460.

The results and recommendations of the assessment are as follows:

- > Acoustic measurements have been undertaken and the results are shown in Section 2.
- > The acoustic criteria are outlined in Section 3.
- > A noise impact assessment of the:
 - music practise rooms have been undertaken and the results are shown in Section 4.1.1.
 - mechanical plant has been undertaken and the results are shown in Section 4.1.2.
- > Noise intrusion from traffic flow has been addressed in Section 4.2.
- > Building envelope upgrades to ameliorate both noise intrusion and noise emissions are as follows:
 - External walls: R_w 45 with minimum $R_w + C_{tr}$ of 37, which can be achieved with brickwork + 10mm internal plasterboard and minimum 45mm stud.
 - Practise room glazing: R_w 34 which can be achieved with 6/12/6mm double glazing, or; 12mm monolithic single glazing or equivalent.
 - All other glazing: R_w 31 which can be achieved with 6mm glazing or equivalent.

Implementation of the above recommendations is predicted to result in compliance with relevant noise criteria.

Appendix A

Glossary of acoustic terms

Air-borne sound

The sound emitted directly from a source into the surrounding air, such as speech, television or music.

Ambient sound

Of an environment: the all-encompassing sound associated with that environment, being a composite of sounds from many sources, near and far. This is normally taken to be the L_{Aeq} value.

Background noise level

The average of the lowest levels of the noise levels measured in an affected area in the absence of noise from occupants and from unwanted external ambient noise sources. Usually the L_{A90} value represents the background noise level.

dB(A)

Unit of acoustic measurement weighted to approximate the sensitivity of human hearing to sound frequency.

Decibel scale

The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. Therefore, a 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. It is generally accepted that a 10 dB increase in the sound pressure level corresponds to a perceived doubling in loudness.

Examples of decibel levels of common sounds are as follows:

- > 0 dB(A) Threshold of human hearing
- > 30 dB(A) A quiet country park
- > 40 dB(A) Whisper in a library
- > 50 dB(A) Open office space
- > 70 dB(A) Inside a car on a freeway
- > 80 dB(A) Outboard motor
- > 90 dB(A) Heavy truck pass-by
- > 100 dB(A) Jackhammer / Subway train
- > 110 dB(A) Rock Concert
- > 115 dB(A) Limit of sound permitted in industry
- > 120 dB(A) 747 take off at 250 metres

Frequency

The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high-pitched sound and a low frequency to a low-pitched sound.

L_{90} , L_{10} , etc

A statistical measurement giving the sound pressure level which is exceeded for the given percentile of a measurement period (i.e. L_{90} is the level which is exceeded for 90 percent of a measurement period). L_{90} is commonly referred to as a basis for measuring the background sound level.

$L_{Aeq,T}$

The equivalent continuous A-weighted sound pressure level. The value of the A-weighted sound pressure level of a continuous steady sound that, within a measurement time interval T, has the same A-weighted sound energy as the actual time-varying sound.

L_{Amax}

The maximum sound pressure level measured over the measurement period.

L_{Amin}

The minimum sound pressure level measured over the measurement period.

Day

Referred to as the period between 7am and 6pm for Monday to Saturday and 8am to 6pm for Sundays and Public Holidays.

Evening

Referred to as the period between 6pm and 10pm for Monday to Sunday and Public Holidays.

Night

Referred to as the period between 10pm and 7am for Monday to Saturday and 10pm to 8am for Sundays and Public Holidays.

Assessment background level (ABL)

The overall background noise level on each day, evening and night periods for each day of the noise monitoring.

Rating background level (RBL)

The overall background level on each day, evening and night periods for the entire length of noise monitoring.

Reverberation

The persistence, after emission by the source has stopped, of a sound field in an enclosure.

Sound isolation

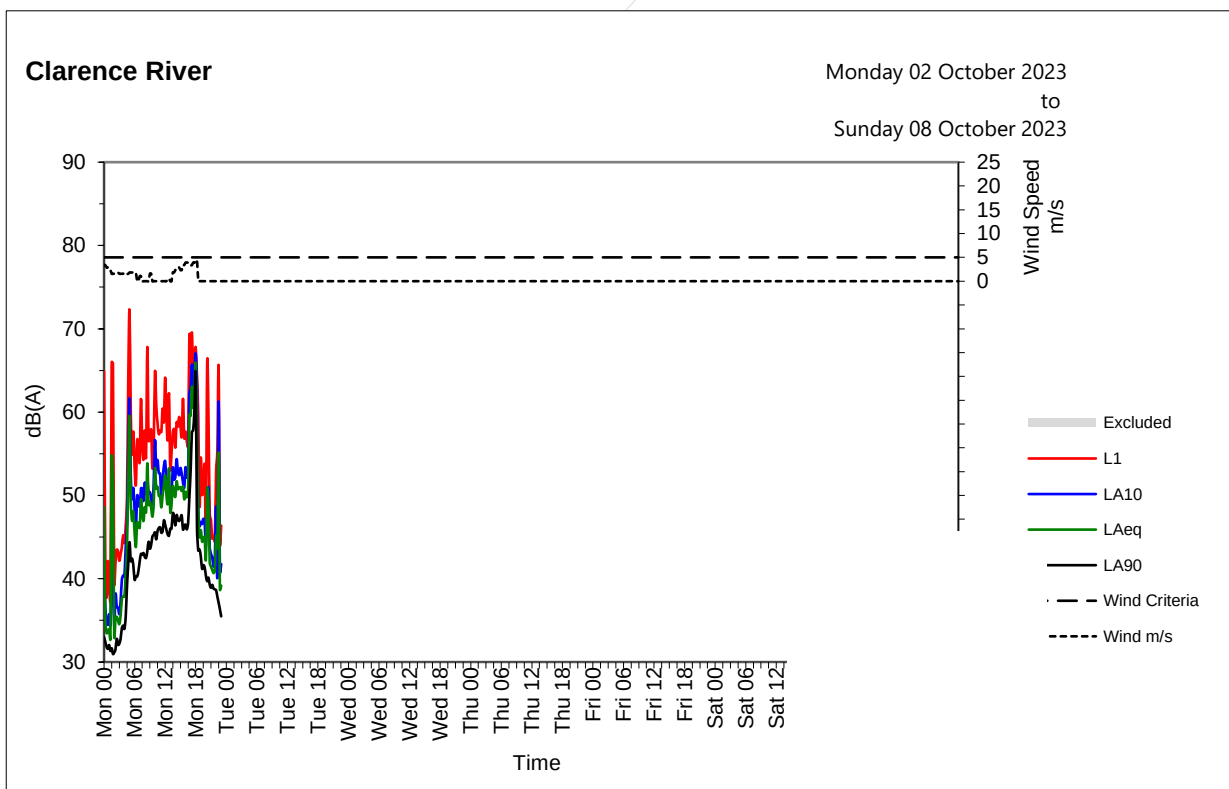
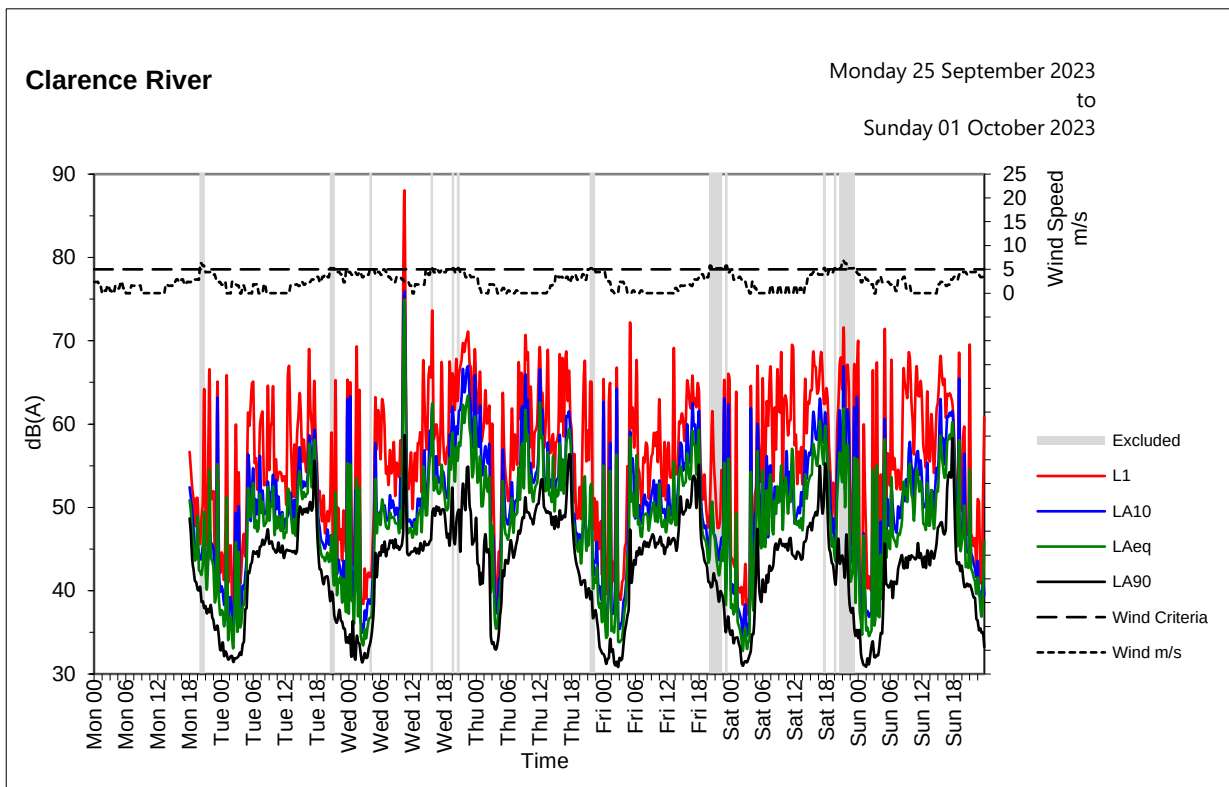
A reference to the degree of acoustical separation between two spaces. Sound isolation may refer to sound transmission loss of a partition or to noise reduction from any unwanted noise source. The term 'sound isolation' does not specify any grade or performance quality and requires the units to be specified for any contractual condition.

Sound pressure level, L_p, dB of a sound

A measurement obtained directly obtained using a microphone and sound level meter. Sound pressure level varies with distance from a source and with changes to the measuring environment. Sound pressure level equals 20 times the logarithm to the base 10 of the ratio of the R.M.S. sound pressure to the reference sound pressure of 20 micro Pascals.

Appendix B

Noise logger graphs

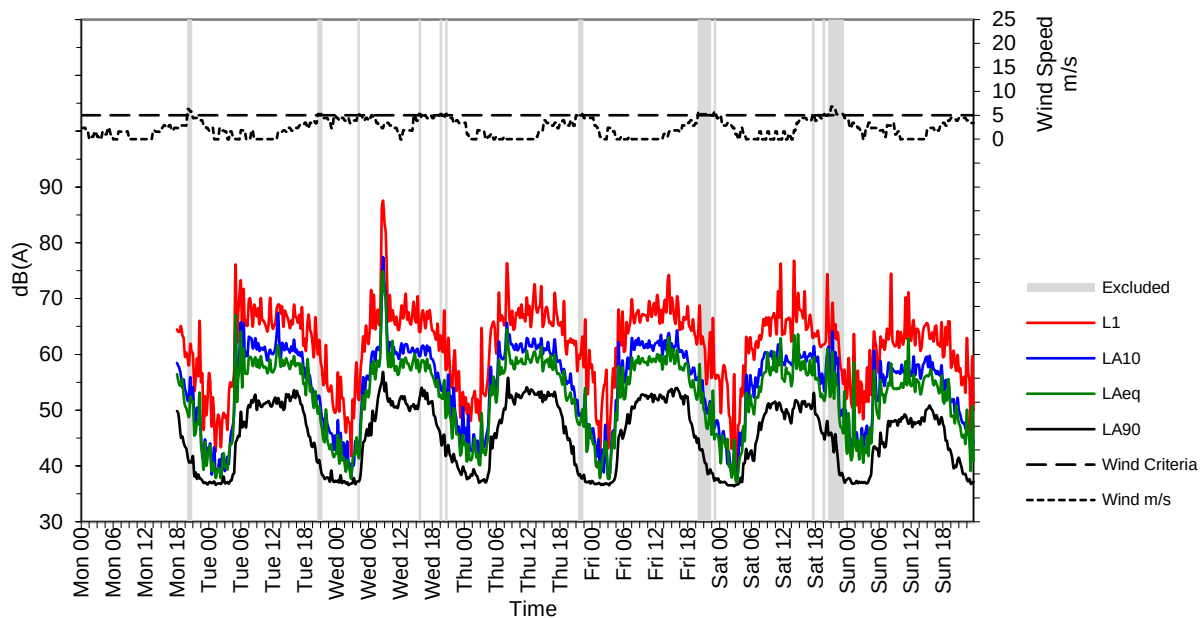


Conservatorium

Monday 25 September 2023

to

Sunday 01 October 2023

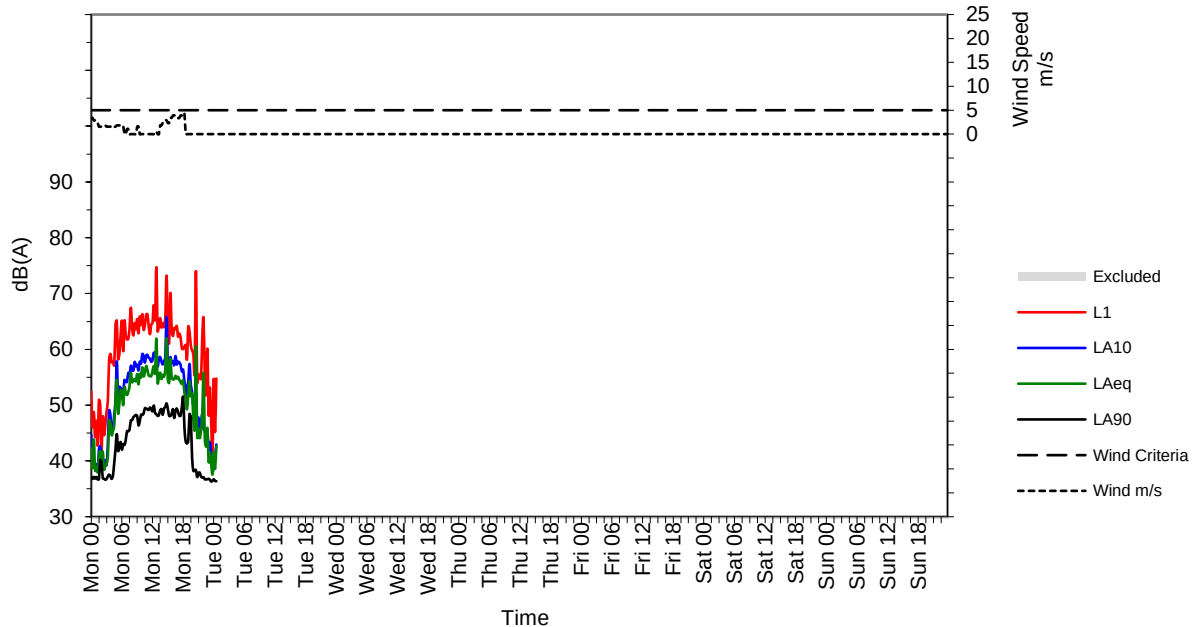


Conservatorium

Monday 02 October 2023

to

Sunday 08 October 2023



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