



Nangamay Public School

External Noise Compliance Survey Post Occupation

Richard Crookes Constructions
Level 3, 4 Broadcast Way
Artarmon NSW 2064

Report number: 210390_MRPS_External Noise Compliance Survey_Post Occupation_2.0.docx
Date: 27 April 2023
Version: For Submission



DOCUMENT CONTROL

Project Name	Nangamay Public School
Project Number	210390
Report Reference	210390_MRPS_External Noise Compliance Survey_Post Occupation
Client:	Richard Crookes Constructions Level 3, 4 Broadcast Way Artarmon NSW 2064

Revision	Description	Reference	Date	Prepared	Checked	Authorised
1.0	For Submission	210390_MRPS_External Noise Compliance Survey_Post Occupation	21 March 2023	Renzo Arango	Ben White	Ben White
2.0	For Submission	210390_MRPS_External Noise Compliance Survey_Post Occupation	27 April 2023	Renzo Arango	Ben White	Ben White

PREPARED BY:

Pulse White Noise Acoustics Pty Ltd
ABN 95 642 886 306
Level 5, 73 Miller Street, North Sydney, 2060
1800 4 PULSE

This report has been prepared by Pulse White Noise Acoustics Pty Ltd with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with the Client. Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of Richard Crookes Constructions Level 3, 4 Broadcast Way Artarmon NSW 2064

No warranties or guarantees are expressed or should be inferred by any third parties.

This report may not be relied upon by other parties without written consent from Pulse White Noise Acoustics.

This report remains the property of Pulse White Noise Acoustics Pty Ltd until paid for in full by the client, Richard Crookes Constructions Level 3, 4 Broadcast Way Artarmon NSW 2064.

Pulse White Noise Acoustics disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.



TABLE OF CONTENTS

1	INTRODUCTION	4
1.1	Project Description	4
1.2	Site Layout	5
2	ASSESSMENT CRITERIA	7
2.1	Consent Conditions.....	7
2.2	NSW Noise Policy for Industry	7
3	SURVEY RESULTS & ASSESSMENT	10
3.1	Survey Methodology	10
3.2	Survey Results & Assessment	10
4	CONCLUSIONS	12
	APPENDIX A: ACOUSTIC TERMINOLOGY	13

TABLES

Table 1	Measured ambient noise levels in accordance with the NSW NPI	8
Table 2	External noise level criteria in accordance with the NSW NPI	9
Table 3	Summary of external noise measurements – typical plant items	10
Table 4	Summary of external noise levels at nearest affected receivers	10

FIGURES

Figure 1	Site locality	5
Figure 2	Site layout.....	6
Figure 3	Site locality showing survey locations	8
Figure 4	Measurement locations, Buildings A & B2.....	11
Figure 5	Measurement location, Building B3	11

1 INTRODUCTION

Pulse White Noise Acoustics (PWNA) has been engaged to undertake an external noise survey of mechanical plant serving the new primary school in Mulgoa Rise, namely the Nangamay Public School (NPS). This survey is conducted after completion of construction works, as part of the post occupation assessment.

This survey is aimed at confirming compliance with the acoustic requirements stated in the relevant consent conditions. These conditions, and the derived external noise level criteria, are discussed in Section 2.

A glossary of terminology used in this report is provided in Appendix A.

1.1 Project Description

The new school development is located at 1-23 Forestwood Drive, Glenmore Park, NSW.

The proposed development includes a Core 21 school with 18 Home bases and 2 support classes, with the selected core facilities at Core 35, for the Hall, Library, Staff facilities and Admin. These facilities are distributed as follows (refer to Figure 2):

- Building A: Administrative offices, open office areas, interview rooms, library spaces, amenities.
- Buildings B2 and B3: Homebases, shared practical activity areas, amenities.
- Building C: Communal Hall, offices, storage spaces, canteen, amenities.
- Outdoor areas: Assembly space, games court, play space, covered outdoor learning areas (COLAs).
- Carpark comprising 17 car spaces for proposed stage.
- Waste collection area situated near the north-eastern corner of the project site.

It is proposed that the school will operate as follows:

- School hours: 8:00 am to 4:00 pm.
- Out of hours: 7:00 am to 8:00 am; 4:00 pm to 6:00 pm.
- Vacation care hours: 7:00 am to 6:00 pm, Monday to Friday, during school holidays

Additionally, it is intended that the Communal Hall in Building C, and library in Building A; operate between 6:30 pm and 10:00 pm as part of the out of hours operation.

In the event of additional demand, the school can be expanded to a Core 35 primary school, facilitating future expansion of up to 26 additional home bases and 2 additional support classes. However, this will be the subject of a separate and future planning approval.

Based on the report titled "Transport and Traffic Assessment" (issued by PTC, dated 9 August 2021, referred herein as the *TTA Report*), it is understood the NPS has a maximum capacity of 414 students. Additionally, it is advised that waste collection will be conducted weekly; with the waste collection area being accessible from Deerubbin Drive.

1.2 Site Layout

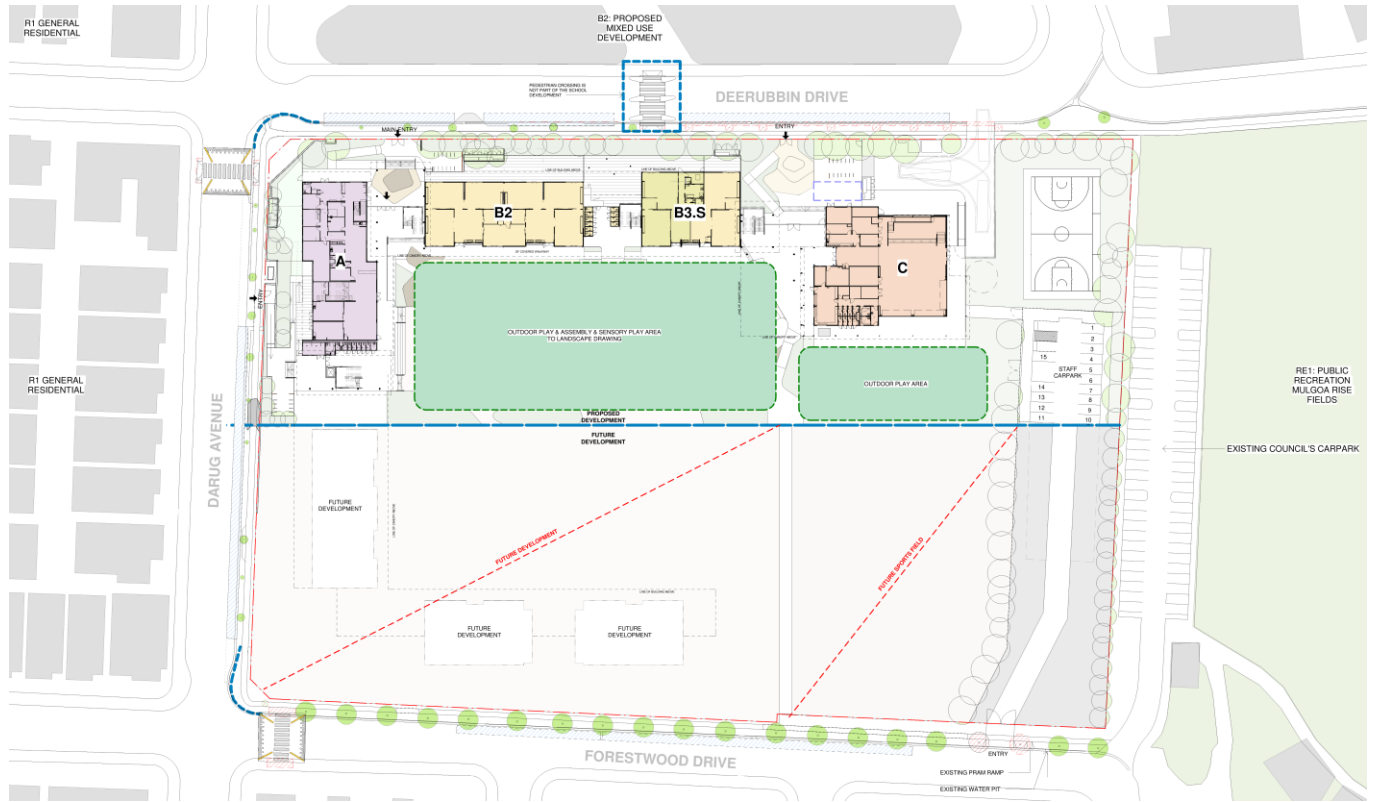
The NPS is surrounded by the following premises which are also considered the nearest noise affected receivers (refer to Figure 1):

- Residences which are located along the western and southern property boundaries. Residences along the western property boundary are situated across Darug Avenue; and those along the southern property boundary are located across Forestwood Drive.
- A future mixed-use development which will be located across Deerubbin Drive (i.e. 90-98 Glenmore Ridge Drive), along the northern property boundary.
- Residences which are also situated along Deerubbin Drive, to the north-east and north-west from the site.
- A childcare centre located at Ground Level, 71 Deerubbin Drive, Glenmore Park. This only operates from Mondays to Fridays, 6:30 am to 6:00pm.
- Along the eastern property boundary: Active recreation areas (i.e. Mulgoa Rise Fields), and areas dedicated to environmental conservation.

Figure 1 Site locality



Figure 2 Site layout



2 ASSESSMENT CRITERIA

2.1 Consent Conditions

The consent conditions relevant to the new school development are discussed in application number SSD 11070211. Hence, the following consent conditions are to be achieved at post occupation:

Part E – Post Occupation, Operational Noise Limits

- E8. *The Applicant must ensure that noise generated by operation of the development does not exceed the noise limits in the updated New Primary School in Mulgoa Rise, Review of Environmental Factors – Noise & Vibration Assessment Report prepared by Pulse White Noise Acoustics dated 2 November 2021.*
- E9. *The Applicant must undertake short term noise monitoring in accordance with the Noise Policy for Industry where valid data is collected following the commencement of use of each stage of the development. The monitoring program must be carried out by an appropriately qualified person and a monitoring report must be submitted to the Planning Secretary within two months of commencement use of each stage of the development or other timeframe agreed to by the Planning Secretary to verify that operational noise levels do not exceed the recommended noise levels for mechanical plant identified in updated New Primary School in Mulgoa Rise, Review of Environmental Factors – Noise & Vibration Assessment Report prepared by Pulse White Noise Acoustics dated 2 November 2021. Should the noise monitoring program identify any exceedance of the recommended noise levels referred to above, the Applicant is required to implement appropriate noise attenuation measures as soon as practicable so that operational noise levels do not exceed the recommended noise levels or provide attenuation measures at the affected noise sensitive receivers.*

The report mentioned in condition E8 (referred herein as the REF N&VA Report) discusses the external noise level criteria used for our assessment. The criteria are reiterated in Section 2.2 of this report. Compliance with these operational trigger levels will automatically demonstrate that acoustic recommendations have been correctly implemented.

2.2 NSW Noise Policy for Industry

Section 2 of the REF N&VA Report discusses the methodology and measurement results of unattended noise survey undertaken on site. This survey was conducted to determine the existing ambient noise levels which are required to derive the external noise level criteria.

The survey locations for the unattended noise survey are the following (refer to Figure 3):

- For residences along southern property boundary (i.e. across Forestwood Drive), unattended noise measurements were conducted in the vicinity of these residences (i.e. *Logger Location 1*).
- For residences facing western property boundary, along Darug Avenue, unattended noise measurements were conducted at 21 Darug Avenue (i.e. *Logger Location 3*).
- For residences facing northern property boundary (i.e. along Deerubbin Drive), unattended noise measurements discussed in report titled "*Noise Impact Assessment Proposed Mixed-Use Development 90-98 Glenmore Ridge Drive Glenmore Park NSW*" (dated June 2020, issued by Reverb Acoustics Pty. Ltd.); are used. Location where these measurements were conducted is shown as *Logger Location 2* in Figure 2.

The measurements obtained from the unattended noise survey are summarised in Table 1.

Figure 3 Site locality showing survey locations



Table 1 Measured ambient noise levels in accordance with the NSW NPI

Measurement Location	Daytime 7:00 am to 6:00 pm		Evening 6:00 pm to 10:00 pm		Night Time 10:00 pm to 7:00 am	
	LA90	LAeq	LA90	LAeq	LA90	LAeq
Logger Location 1: No. 30 Forestwood Drive Glenmore Park	34 dBA	52 dBA	34 dBA	50 dBA	32 dBA	49 dBA
Logger Location 2 (by others): At southern property boundary of future mixed- use development at 90-98 Glenmore Ridge Drive	43 dBA	51 dBA	38 dBA	47 dBA	33 dBA	46 dBA
Logger Location 3: No. 21 Darug Avenue Glenmore Park	37 dBA	57 dBA	37 dBA	55 dBA	32 dBA	49 dBA

Notes:

1. For Monday to Saturday, Daytime 7:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 7:00 am. On Sundays and Public Holidays, Daytime 8:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 8:00 am
2. The LA90 noise level is representative of the "average minimum background sound level" (in the absence of the source under consideration), or simply the background level
3. The LAeq is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.

Based on the results from the unattended noise survey, operational noise trigger levels are determined in accordance with the procedures discussed on the NSW Noise Policy for Industry (NSW NPI). The operational noise trigger levels are discussed in detail in Section 3 of the REF N&VA Report. These trigger levels are summarised in Table 2 below.



Table 2 External noise level criteria in accordance with the NSW NPI

Location	Time of Day	Project Noise Emissions Requirements dB LAeq, 15 min
Residences along: Forestwood Drive	Day	40
	Evening	39
	Night	37
	Shoulder period: 6:30 am- 7:00 am	44
Residences along: Darug Avenue	Day	42
	Evening	42
	Night	37
	Shoulder period: 6:30 am- 7:00 am	46
Residences along: Deerubbin Drive	Day	48
	Evening	43
	Night	38
	Shoulder period: 6:30 am- 7:00 am	42
Commercial premises at future mixed use development along Deerubbin Drive	When in use	63
Active Recreation Areas: Mulgoa Rise Fields	When in use	53
Child Care Centre (external level)	When in use	55



3 SURVEY RESULTS & ASSESSMENT

3.1 Survey Methodology

The external noise survey was undertaken on 13 March 2023 at 3:30 pm, which is within school hours. Measurements were undertaken in the absence of construction works currently in progress at the mixed use development along Deerubbin Drive.

During the survey, the outdoor mechanical plant items functioned under typical operational loads. Weather conditions during the survey were found to be favourable (i.e. no rain and wind speeds less than 5 m/s).

The survey measurements were conducted using a Bruel & Kjaer Type 2250 sound level analyser (serial number 2709757). Calibration of both sound level meters was checked prior to and following the measurements, using a Brüel & Kjær Type 4230 sound calibrator (serial number 1275644). The calibrator emitted a calibration tone of 94 dB at 1 kHz. The drift in calibration did not exceed ± 0.5 dB. All equipment carries appropriate and current NATA (or manufacturer) calibration certificates.

3.2 Survey Results & Assessment

Table 3 below summarises the external noise measurements conducted in proximity to the outdoor plant items. These measurements were conducted when mechanical plant items were functioning under typical operating conditions. Measurement locations are shown in Figure 4 and Figure 5.

From these measurements, noise levels were predicted at the nearest affected residential locations. This approach was adopted since:

- These affected locations were inaccessible when the survey was conducted.
- Noise emissions from other plant items not related to the project site were noted at these locations.

Consequently, Table 4 lists the noise levels predicted at the nearest affected receivers.

Table 3 Summary of external noise measurements – typical plant items

Floor Level	Measured Plant Room	Measurement Location	Measurement, dB LAeq
Ground	Plant Enclosure Building A	5.5 m from source	45
Ground	Plant Enclosure Building B2	1 m from source	45
Ground	Plant Enclosure Building B3	1 m from source	45

Table 4 Summary of external noise levels at nearest affected receivers

Receiver	Receiver Type	Noise Level Contribution at Receiver, dB LAeq	External Noise Level Criterion (Day Period), dB LAeq, 15 minutes	Assessment Outcome
Forestwood Drive	Residential	< 35	40	Compliant
Darug Avenue	Residential	< 35	42	Compliant
Deerubbin Drive	Mixed Use	< 35	48	Compliant
Child Care Centre at 71 Deerubbin Drive	Child Care Centre	< 35	55	Compliant

Figure 4 Measurement locations, Buildings A & B2

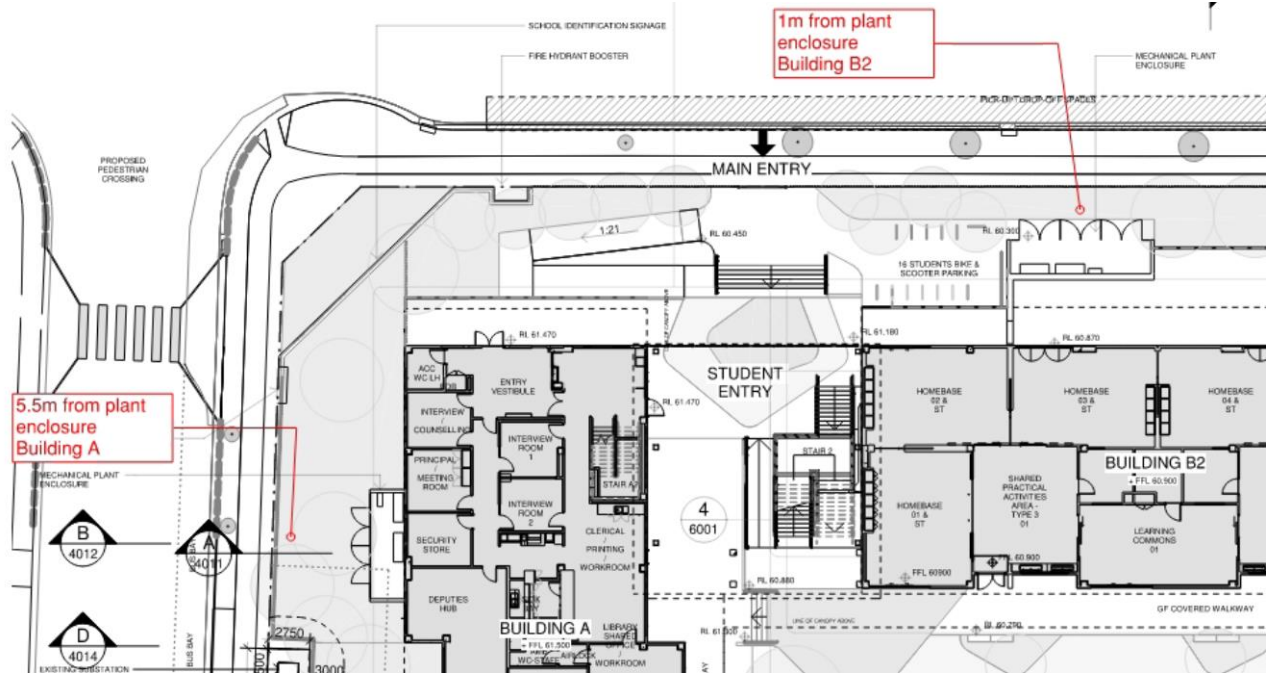
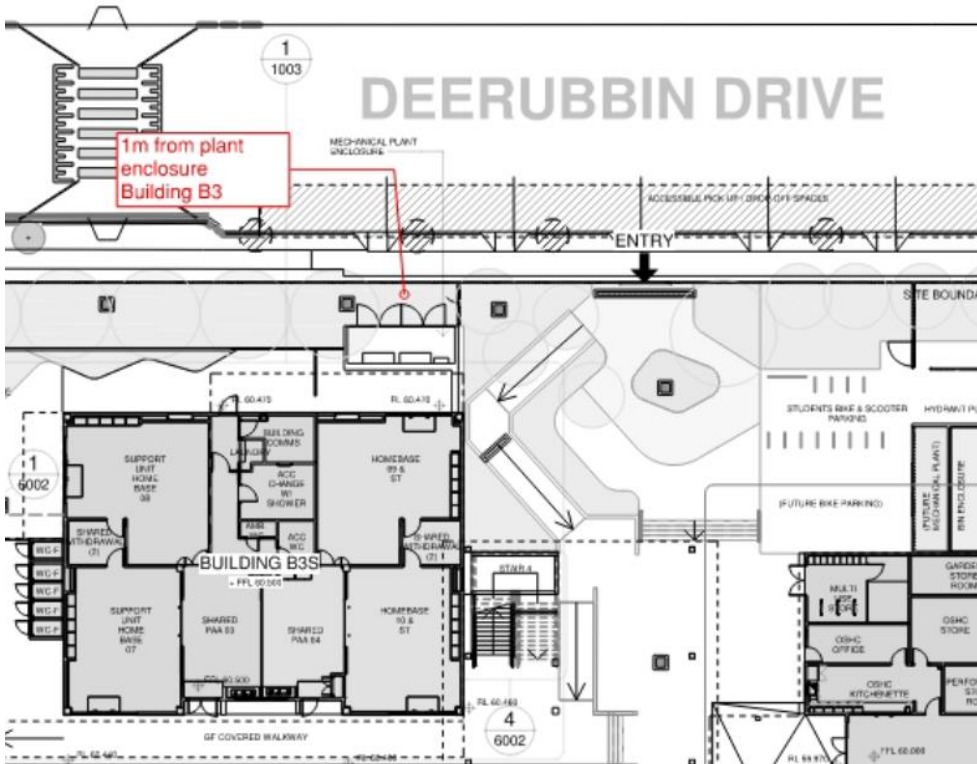


Figure 5 Measurement location, Building B3



4 CONCLUSIONS

This report discusses the outcomes of the external noise assessment conducted at the new primary school in Mulgoa Rise, namely the Nangamay Public School. This school is located at 1-23 Forestwood Drive, Glenmore Park, NSW.

This survey was undertaken to address the acoustic requirements stated in consent conditions E8 and E9. These consent conditions state the requirements for external noise emissions from mechanical plant during post occupation (i.e. after completion of construction works).

Based on the outcomes of the external noise assessment, it is found that compliance is achieved with the external noise level criteria defined in Condition E8. Therefore, the requirements discussed in consent conditions E8 and E9, are satisfied.

For any additional information, please do not hesitate the undersigned.

Regards

Renzo Arango
Pulse White Noise Acoustics



APPENDIX A: ACOUSTIC TERMINOLOGY

The following is a brief description of the acoustic terminology used in this report.

<i>Sound power level</i>	The total sound emitted by a source																						
<i>Sound pressure level</i>	The amount of sound at a specified point																						
<i>Decibel [dB]</i>	The measurement unit of sound																						
<i>A Weighted decibels [dB(A)]</i>	The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).																						
<i>Decibel scale</i>	<p>The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. A 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB increase in the sound pressure level corresponds to a perceived doubling in volume. Examples of decibel levels of common sounds are as follows:</p> <table><tr><td>0 dB(A)</td><td>Threshold of human hearing</td></tr><tr><td>30 dB(A)</td><td>A quiet country park</td></tr><tr><td>40 dB(A)</td><td>Whisper in a library</td></tr><tr><td>50 dB(A)</td><td>Open office space</td></tr><tr><td>70 dB(A)</td><td>Inside a car on a freeway</td></tr><tr><td>80 dB(A)</td><td>Outboard motor</td></tr><tr><td>90 dB(A)</td><td>Heavy truck pass-by</td></tr><tr><td>100 dB(A)</td><td>Jackhammer/Subway train</td></tr><tr><td>110 dB(A)</td><td>Rock Concert</td></tr><tr><td>115 dB(A)</td><td>Limit of sound permitted in industry</td></tr><tr><td>120 dB(A)</td><td>747 take off at 250 metres</td></tr></table>	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
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																						
<i>Frequency [f]</i>	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.																						
<i>Ambient sound</i>	The all-encompassing sound at a point composed of sound from all sources near and far.																						
<i>Equivalent continuous sound level [L_{eq}]</i>	The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy.																						
<i>Reverberation</i>	The persistence of sound in a space after the source of that sound has been stopped (the reverberation time is the time taken for a reverberant sound field to decrease by 60 dB)																						
<i>Air-borne sound</i>	The sound emitted directly from a source into the surrounding air, such as speech, television or music																						
<i>Impact sound</i>	The sound emitted from force of one object hitting another such as footfalls and slamming cupboards.																						
<i>Air-borne sound isolation</i>	The reduction of airborne sound between two rooms.																						
<i>Sound Reduction Index [R] (Sound Transmission Loss)</i>	The ratio the sound incident on a partition to the sound transmitted by the partition.																						
<i>Weighted sound reduction index [R_w]</i>	A single figure representation of the air-borne sound insulation of a partition based upon the R values for each frequency measured in a laboratory environment.																						
<i>Level difference [D]</i>	The difference in sound pressure level between two rooms.																						



<i>Normalised level difference $[D_n]$</i>	The difference in sound pressure level between two rooms normalised for the absorption area of the receiving room.
<i>Standardised level difference $[D_{nT}]$</i>	The difference in sound pressure level between two rooms normalised for the reverberation time of the receiving room.
<i>Weighted standardised level difference $[D_{nT,w}]$</i>	A single figure representation of the air-borne sound insulation of a partition based upon the level difference. Generally used to present the performance of a partition when measured in situ on site.
C_{tr}	A value added to an R_w or $D_{nT,w}$ value to account for variations in the spectrum.
<i>Impact sound isolation</i>	The resistance of a floor or wall to transmit impact sound.
<i>Impact sound pressure level $[L_i]$</i>	The sound pressure level in the receiving room produced by impacts subjected to the adjacent floor or wall by a tapping machine.
<i>Normalised impact sound pressure level $[L_n]$</i>	The impact sound pressure level normalised for the absorption area of the receiving room.
<i>Weighted normalised impact sound pressure level $[L_{n,w}]$</i>	A single figure representation of the impact sound insulation of a floor or wall based upon the impact sound pressure level measured in a laboratory.
<i>Weighted standardised impact sound pressure level $[L'_{nT,w}]$</i>	A single figure representation of the impact sound insulation of a floor or wall based upon the impact sound pressure level measured in situ on site.
C_I	A value added to an L_{nW} or $L'_{nT,w}$ value to account for variations in the spectrum.
<i>Energy Equivalent Sound Pressure Level $[L_{A,eq,T}]$</i>	'A' weighted, energy averaged sound pressure level over the measurement period T.
<i>Percentile Sound Pressure Level $[L_{Ax,T}]$</i>	'A' weighted, sound pressure that is exceeded for percentile x of the measurement period T.

*Definitions of a number of terms have been adapted from Australian Standard AS1633:1985 "Acoustics – Glossary of terms and related symbols"