

St Paul's Anglican Church Carlingford

Ministry Centre Building, St Paul's Anglican
Church Carlingford

Acoustic Assessment

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1 Introduction

The following report has been prepared by Acouras Consultancy on behalf of St Paul's Anglican Church Carlingford to assess the potential for noise impact associated with the use of new Ministry Centre Building that will replace the existing administration building located at St Paul's Anglican Church Carlingford. The new Ministry Centre building will include:

- Private offices, open plan office, meeting room, board room, kitchen, three (3) classroom/activity rooms and amenities on level 1.
- Outdoor courtyard between the Ministry Centre and the existing church building.
- Seven (7) classroom/activity rooms, breakout space and amenities on level 2.

The church is surrounded by existing residential dwellings located to the west and opposite Trigg Ave. To the east of the church site is Harold West Reserve. The site location is shown in Figure 1.

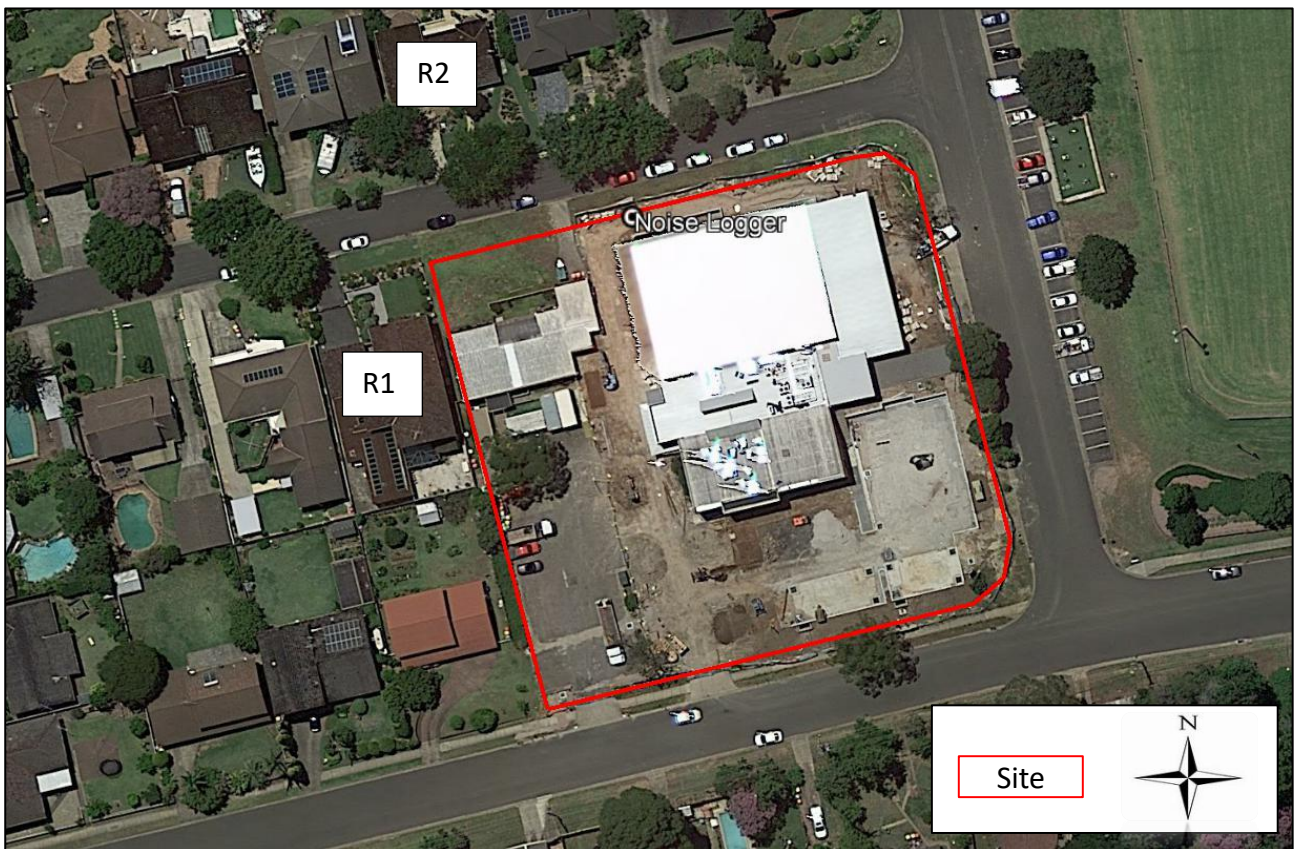


Figure 1 – Site Location, Nearest Residents and Noise Logger Position

The nearest potentially affected receivers are:

- R1 – Residential dwelling at No.7 Trigg Ave to the west.
- R2 – Residential dwelling at No.10 to 14 Trigg Ave to the north.

2 Noise Criteria

The following standards and guidelines are applicable to this project:

- Parramatta City Council Pre-Lodgement Application (PL/4/2021).
- NSW EPA “Noise Policy for Industry” (NPfI) and “Noise Guide for Local Government” (NGLG).
- NSW EPA “Interim Construction Noise Guideline” (ICNG).
- Australian Standard 2436:2010: “Guide to noise and vibration control on construction, demolition and maintenance sites”.
- Australian standard AS/NZS 2107-2016: Acoustics – Recommended design sound levels and reverberation times for building interiors.
- Australian standard AS 1055.1-1997: Acoustics – Description and measurement of environmental noise - General procedures.

2.1 Internal Noise Levels

According to the Parramatta City Council Pre-Lodgement Application (PL/4/2021):

An Acoustic assessment required covering both demolition/construction impacts and operational impacts (internal & external) and in accordance with Clause 87 of the ISEPP.

Clause 87 only applies to developments that are adjacent to a rail corridor, which is not relevant to this development.

The Australian Standard AS 3671-1989 ‘Acoustics - Road traffic noise intrusion -building siting and construction’ provides guidance on the design but is limited as it refers to the Australian Standard AS 2107. Australian Standard AS 2107 – 2016 ‘Acoustic – Recommended Design Sound Levels and Reverberation Times for Building Interiors’ to provide the recommended design sound levels for different areas of occupancy in buildings.

Table 1— Recommended Internal Design Noise Levels (AS/NZS 2107)

Type of occupancy/activity	Recommended design sound level, (L _{Aeq})	Recommended Reverberation Time (T), s
Board and conference rooms	30 to 40	0.6 to 0.8
Meeting room (small)	40 to 45	< 0.6
Executive office	35 to 40	0.4 to 0.6
Open plan office	40 to 45	0.4 (see Note 1)
Teaching spaces/single classroom	35 to 45	Note 2
Break-out spaces	40 to 45	0.4 to 0.6
Toilets	45 to 55	-

Note 1: Reverberation time should be minimised as far as practicable for noise control.

Note 2: Certain teaching spaces, including those intended for students with learning difficulties and students with English as a second language, should have reverberation times at the lower end of the range.

2.2 Noise Survey and Project Specific Limits

An unattended noise survey was carried out at the site to measure the background and ambient noise levels. Noise monitoring was conducted between Wednesday 13th to Wednesday 20th October 2021. The unattended noise monitor was positioned, as shown in Figure 1 on the ground level.

Measurements were conducted using the following equipment:

- SVAN 977 Type 1 Real time Analyser/Noise Logger. Serial No. 34892.
- SVAN SV30A Type 1 Sound Level Calibrator. Serial No. 31830.

Noise monitoring was conducted in general accordance with Australian standard AS 1055.1-1997: Acoustics-Description and measurement of environmental noise-General procedures.

The noise analyser was calibrated immediately before and after measurements were taken with no discernible differences between these two recorded levels. The sound analyser is Type 1 and complies with Australian standard AS1259.2: 1990.

During the monitoring period any adverse weather conditions have been excluded. The noise logger results are presented in Appendix C.

Table 2 presents a summary of the measured background noise level and the allowable intrusive noise limit for this project in accordance with the EPA "Noise Policy for Industry" (NPfI). The amenity criteria are based on a suburban receiver.

Table 2—EPA NPfI Noise Limits, dBA

Time Period	Existing Noise Levels		NSW EPA NPfI			Project Noise Trigger Level Leq(15min)
	Leq (period)	RBL	Recommended ANL	Project ANL ¹ Leq(15min)	Intrusiveness Criteria, Leq(15min)	
Day	52	38	55	53	43	43
Evening	50	38	45	43	43	43
Night	43	33	40	38	38	38

During detailed design stage, the design and selection of the mechanical equipment required to service the proposed development will be required to achieve the EPA noise limits as presented in Table 2.

¹ 2. Project ANL is recommended ANL minus 5 dB(A) and plus 3 dB(A), to convert from a period level to a 15-minute level.

2.3 Construction Noise Criteria

The NSW EPA “Interim Construction Noise Guideline” (ICNG) provides guidance on noise limits from construction sites. Table 3 is an extract from the EPA guideline. When assessing short-term construction works, best management practices should be implemented to reduce any impact as far as practically possible.

Table 3 – Noise at Residences Using Quantitative Assessment

Time of Day	Management Level $L_{Aeq(15min)}$ *	How to Apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	<p>The noise affected level represents the point above which there may be some community reaction to noise.</p> <p>Where the predicted or measured $L_{Aeq(15min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level.</p> <p>The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.</p>
	Highly noise affected 75 dB(A)	<p>The highly noise affected level represents the point above which there may be strong community reaction to noise.</p> <p>Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account:</p> <ol style="list-style-type: none"> 1. times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences) 2. if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

* Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5m above ground level. If the property boundary is more than 30m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

Table 4 presents a summary of the measured background noise level and the noise management level for this project in based on the noise survey.

Table 4 — EPA ICNG Noise Limits, dBA

Receiver	Time Period	Existing Noise Levels		Management Level
		L _{eq} (period)	RBL	L _{Aeq} (15min)*
Residential	Mon-Fri: 07.00-18.00	52	38	48 dBA (75 dBA-Highly noise affected)
	Sat: 08.00-13.00	52	38	48 dBA (75 dBA-Highly noise affected)

3 Assessment and Recommendations

3.1 Façade Glazing Requirements

Acoustic glazing for the Ministry Centre is given in Table 5 are required to minimise noise impact to surrounding receivers from the activity inside the classrooms (Section 3.3.1) and noise levels within the building in accordance with the AS/NZS 2107:2016.

Table 5 – Schedule of Window and Glazing (R_w)

Level	Space	Glazing Thickness	Minimum R_w (Glazing+Frame)
1	Office, meeting rooms & kitchen	6.38mm laminated	30
	Classrooms: Year 9, 10 and Munchkins	6.38mm laminated	30
2	Classrooms: Year K-2, Year 8 & Year 7	10.38mm laminated	32
	Classrooms: Year 3-6	6.38mm laminated	30

All other non-habitable spaces, such as bathrooms and laundries require minimum 6mm monolithic glass (R_w 28).

All Windows/doors should be well sealed (air tight) when closed with good acoustic seals around the top and bottom sliders. Mohair seals are not considered to be acoustic seals.

3.2 Building Façade Construction

To provide sufficient acoustic attention of noise, the general external construction of the proposed building would need to be constructed as detailed in Table 6.

Table 6 – External Façade Construction (R_w)

Building Element	Proposed Construction	Minimum R_w
External Wall	External brick with internal plasterboard lining on studs. Insulation in the wall cavity as per thermal requirements.	45
Roof and ceiling	Colorbond metal roof with a plasterboard cavity ceiling. Insulation in the ceiling cavity as per thermal requirements.	45

3.3 Church Activity

The existing main church and the new church ministry building operating hours and key activities are as follows:

- Sunday church services - 7.45am, 9:15am, 11:15am, 4.00pm & 6.00pm.
- Sunday Children's and Youth ministries – Kids church comprises of several groups, Crèche (0-3 years), Munchkins (4-5 years), Beagles (K- Year 2), and Fireworks (Years 3-6), Youth (Years 7-10).
- Monday to Friday 9:00am-5:00pm, general church administration and ministry.
- Monday 9.30am Playcircle – under 5s with parents, grandparents and caregivers.
- Wednesday 9.30am – Women's bible study – A large group of women (including babies and toddlers) meet in both the main auditorium as a large group and also as many small study groups across all spaces in the church building and in the proposed Ministry Centre.
- Friday 6.00pm-7.00pm Ignite Kids Club – Years 3 to 6.
- Friday 7.00pm-9:30pm Salt Youth Group – Years 7 to 12.

For the church activities associated with the new Ministry Centre, the proposed operating conditions and assessment methodology have been applied:

- During church services on Sunday and Friday events, there may be a maximum of would be using the new church ministry building:
 - Years K-6 (Children): 45-90 children, including leaders.
 - Year 7-10 (Youth): 140 youth, including leaders.

3.3.1 Noise From Indoor Classrooms

- There is potential use of musical equipment inside the Ministry Centre on Sunday and Friday youth group meetings. The types of instruments that may typically be used include drums, acoustic guitar, electric guitar and electronic keyboard.
- From our previous experience on similar projects and noise measurements taken at the other music facilities, in Table 7 are typical noise levels of various musical instruments.
- During activities, the windows and doors are closed at all times.
- There is no music played (including pre-recorded or amplified) outside the buildings.

Table 7— Typical Noise Level of Various Musical Instruments

Instrument	Measured Sound Pressure Level SPL L_{eq} dBA @ 1m
Acoustic Drums	94-100 dBA
Electronic Keyboard (with amp)	66-75 dBA
Acoustic Piano (Upright/no amp)	75-80 dBA
Acoustic Steel String Guitar (no amp)	66-73 dBA
Acoustic Steel String Guitar (with amp)	78-86 dBA
Electric Guitar (with amp)	80-94 dBA

- The sound level of adult (male) normal speech noise levels are presented in Table 8 below. The sound pressure levels given in the table below are based on the Harris “Handbook of Acoustical Measurements and Noise Control”, and have been extrapolated for the proposed number of attendants.
- In the calculations, we have allowed for (as a worst case scenario):
 - up to 63 children (youth) in each room of level 1 with 25% of the people to be talking at any given time, as it is not expected that all people would talk simultaneously.
 - Music activities (drums) in each of the rooms on level 1.
- Calculations have been conducted based on ISO9613 using CadnaA (version 4.5.149).

Table 8 — Typical Speech Noise Levels, dBA at 1m

Description	Octave Band, Hz Lin									Overall dBA
	31.5	63	125	250	500	1k	2k	4k	8k	
Typical Normal ² Speech at 1m	-	-	54	56	58	59	53	47	40	61
Typical Raised ² Speech at 1m	-	-	49	59	63	65	59	53	47	67

² Harris “Handbook of Acoustical Measurements and Noise Control”.

Table 9 presents the predicted noise from each of the cumulative noise from internal spaces to the nearest receivers.

Table 9 – Predicted Noise at Receivers

Noise Source	Receiver	Receiver Noise Level, L _{eq15min} dBA	NPfI	Complies (Y/N)
			Daytime/Evening Noise Limit L _{eq15min} dBA	
People talking	R1(Outside)	Less than 30 (inaudible)	43	Y
	R2 (Outside)	Less than 30 (inaudible)	43	Y
Music activities	R1(Outside)	39	43	Y
	R2 (Outside)	36	43	Y

Therefore, we would conclude that the potential noise from people seated in the outdoor area would also not exceed the EPA NPI noise limits.

3.3.2 Noise From Outdoor Courtyard

- During the daytime and evening periods when the courtyard will be used, including Sunday meetings and Friday youth meetings, there is a maximum of 20 people allowable in the courtyard area at one time.
- In the calculations, we have allowed of 50% of the people to be talking at a raised voice level (Table 8), as it is not expected that all people would talk simultaneously.
- The sound level of adult (male) normal speech noise levels are presented in Table 8 below. The sound pressure levels given in the table below are based on the Harris “Handbook of Acoustical Measurements and Noise Control”, and have been extrapolated for the proposed number of people.
- Calculations have been conducted based on ISO9613 using CadnaA (version 4.5.149).
- The underside of the building (level 2 above) and one (1) side of the wall is to be lined with sound absorption material (min. NRC 0.5), such as Acoufelt or CSR Martini.

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Table 10 and Figure 2 presents the predicted noise from each of the cumulative noise from the outdoor area at the nearest receivers (R1 and R2) along Trigg Ave with the no acoustic barriers.

Table 10 – Predicted Cumulative Noise at Receivers (People Talking)

Receiver	Number of People in Courtyard	Receiver Noise Level, $L_{eq15min}$ dBA	NPfI Noise Limit $L_{eq15min}$ dBA (Day/Evening)	Complies (Y/N)
R1 (Outside)	20	24	43	Y
R2 (Outside)	20	43	43	Y

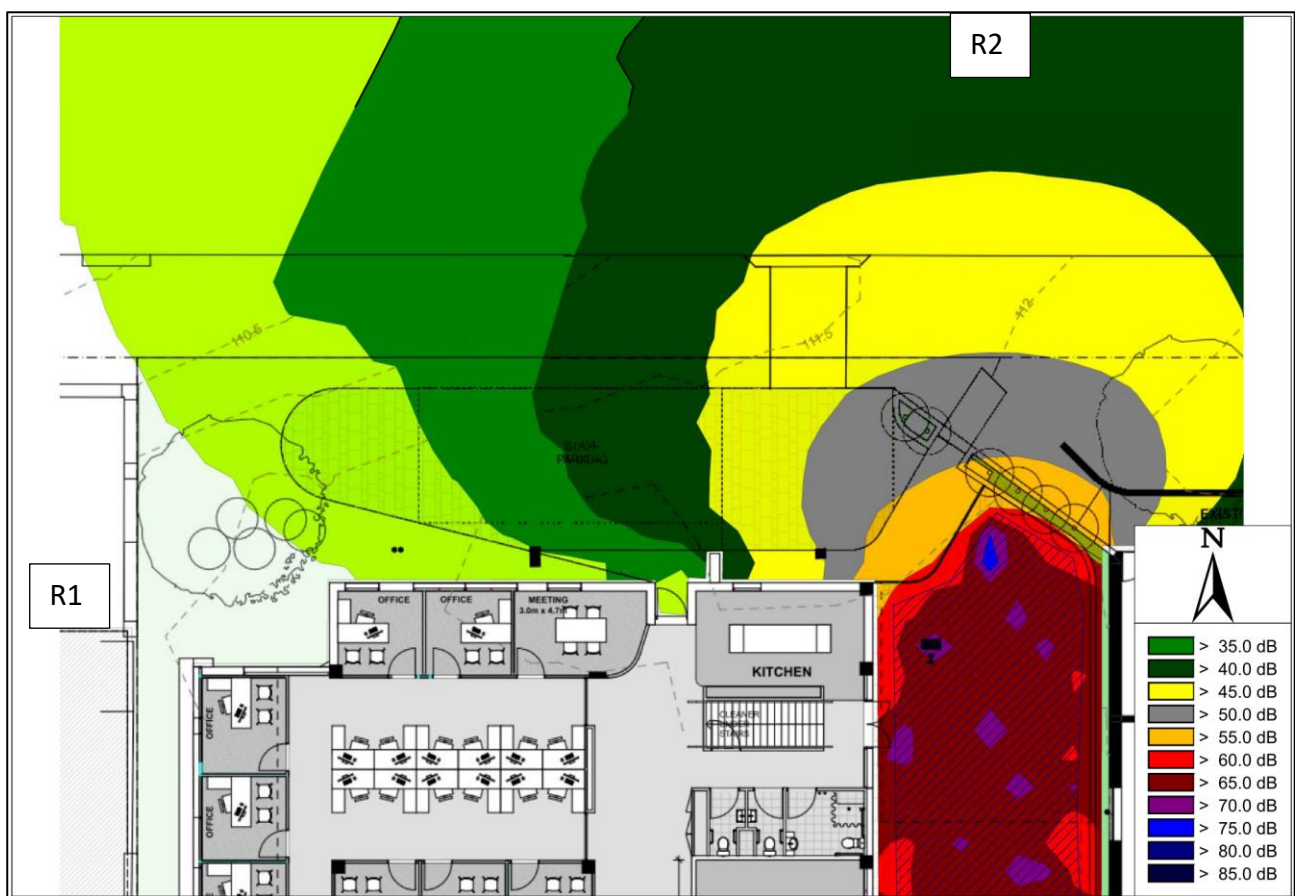


Figure 2 – Courtyard Noise Levels – Noise Model (Ground Level)

3.4 Mechanical Services

At the DA stage, the design and selection of mechanical equipment has not been finalised. Following the DA approval of the proposed development, during the Construction Certification Stage a detail assessment of all mechanical plant and equipment will be conducted to ensure compliance with the EPA and DCP noise criteria. Typical acoustic measures may include the construction of acoustic barriers, enclosures, attenuators and/or acoustic louvres.

3.5 Management of Construction Noise

At this stage, methodology and construction equipment have not been finalised and therefore a detailed construction noise impact assessment cannot be completed. As best practice techniques, the following work practices and procedures are to be considered:

- Adherence to the recommended preferred hours for construction and deliveries. Truck drivers are to be informed of site access routes, acceptable delivery hours and minimising extended periods of engine idling.
- When selecting equipment ensure where feasible and reasonable it has the most effective mufflers, enclosures and low-noise tool bits and blades. Always seek the manufacturer's advice before making modifications to plant to reduce noise.
- To provide respite to surrounding residents during the noisy construction activities, such as rockbreaking/jackhammering and piling, we recommended on site management by limiting these activities to the hours of 9 am to 12 pm and 2 pm to 5 pm Monday to Friday.
- Turn off plant that is not being used.
- Table 11 is an excerpt from Appendix E 'Noise Sources, remedies and their effectiveness' Australian Standard 2436:2010, presenting possible noise reductions from various control mechanisms.

Table 11 – Relative Effectiveness of Various forms of Noise Control³

Control by	Noise Reduction Possible in Practice, dB(A)
Distance	Approximately 6 for each doubling of distance
Screening	Normally 5 to 10, maximum 15
Enclosure	Normally 15 to 25, maximum 50
Silencing	Normally 5 to 10, maximum 20

Following the approval and prior to commencing construction, a detail assessment of construction activity and equipment will be conducted to ensure compliance with the Noise Management Level..

³ Table A1 in Australian Standard 2436:2010 and Department for Environment, Food and Rural Affairs (DEFRA UK).

4 Conclusion

An acoustic assessment of the proposed new Ministry Centre Building, St Paul's Anglican Church Carlingford has been carried out in accordance with the requirements of Parramatta City Council, EPA noise policies and Australian Standards.

An environmental noise survey of the site has been conducted and the noise limiting criteria for mechanical plant/equipment noise emission and church activities has been determined based on the EPA noise policies. The limits are presented in Table 2.

Construction for glazing, external walls and the roof/ceiling systems have been provided to achieve the internal noise criteria and are detailed in Section 3.1 and Section 3.2 .

Section 3.3 details our assessment of the potential noise impact from people noise in the indoor rooms and outdoor courtyard. Based on our predictions, the noise level at the receivers, as shown in Table 9 are expected to comply with EPA NPfl noise criteria provided the acoustic recommendations are implemented.

Providing the recommendations in this report are implemented, the noise from the proposed Ministry Centre is predicted to comply with acoustic requirements of the Parramatta City Council, EPA noise policies and Australian Standards.

Appendix A – Acoustic Terminology

Decibel, dB: A dimensionless unit which denotes the ratio between two quantities that are proportional to power, energy or intensity. One of these quantities is a designated reference by which all other quantities of identical units are divided. The sound pressure level in decibels is equal to 10 times the logarithm (to the base 10) of the ratio between the pressure squared divided by the reference pressure squared. The reference pressure used in acoustics is 20 micro Pascals.

A-WEIGHTING: A measure of sound pressure level designed to reflect the response of the human ear, which does not respond equally to all frequencies. To describe sound in a manner representative of the human ear's response it is necessary to reduce the effects of the low and high frequencies with respect to medium frequencies. The resultant sound level is said to be A-weighted, and the units are in decibels (dBA). The A-weighted sound level is also called the noise level.

Sound Pressure Level, L_p (dB), of a sound: 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. Sound pressure level is measured using a microphone and a sound level meter, and varies with distance from the source and the environment.

Ambient Noise/Sound: All noise level present in a given environment, usually being a composite of sounds from many sources far and near. Traffic, HVAC, masking sound or even low-level background music can contribute to ambient level of noise or sound.

Percentile Level - L_{90} , L_{10} , etc: A statistical measurement giving the sound pressure level which is exceeded for the given percentile of an observation period, e.g. L_{90} is the level which is exceeded for 90% of a measurement period. L_{90} is commonly referred to as the "background" sound level.

Background Noise (L_{90}): The sum total of all unwanted residual noise generated from all direct and reflected sound sources in a space that can represent an interface to, or interfere with good listening and speech intelligibility.

Rating Background Level – RBL: Method for determining the existing background noise level which involves calculating the tenth percentile from the L_{A90} measurements. This value gives the Assessment Background Noise Level (ABL). Rating Background Level is the median of the overall ABL.

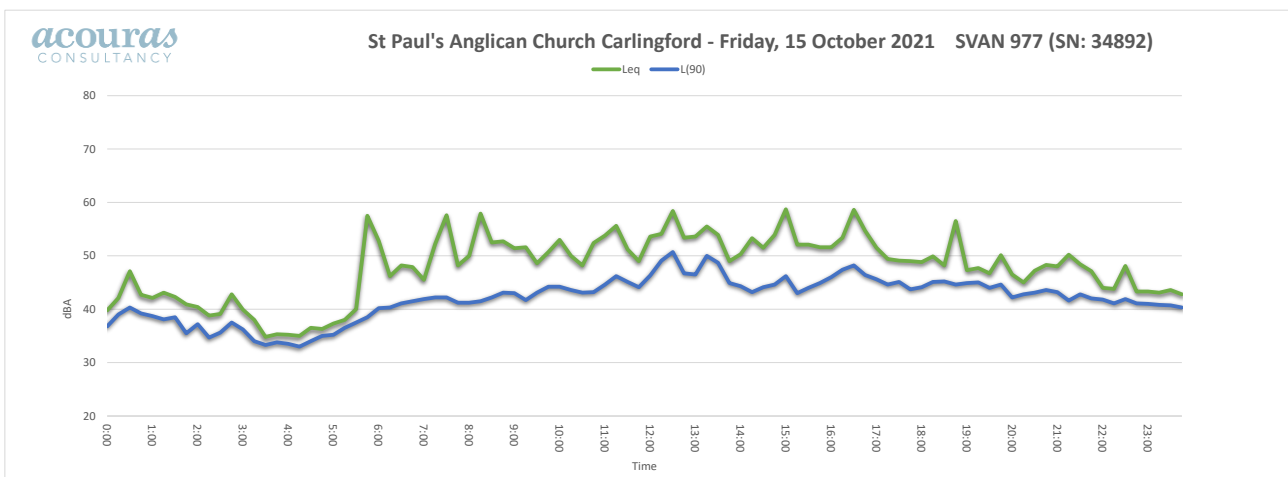
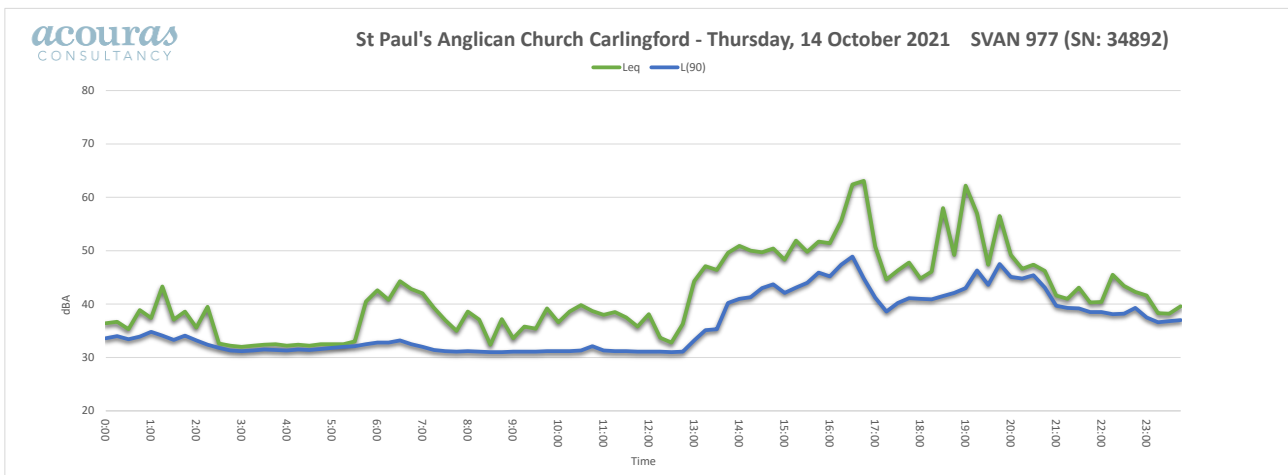
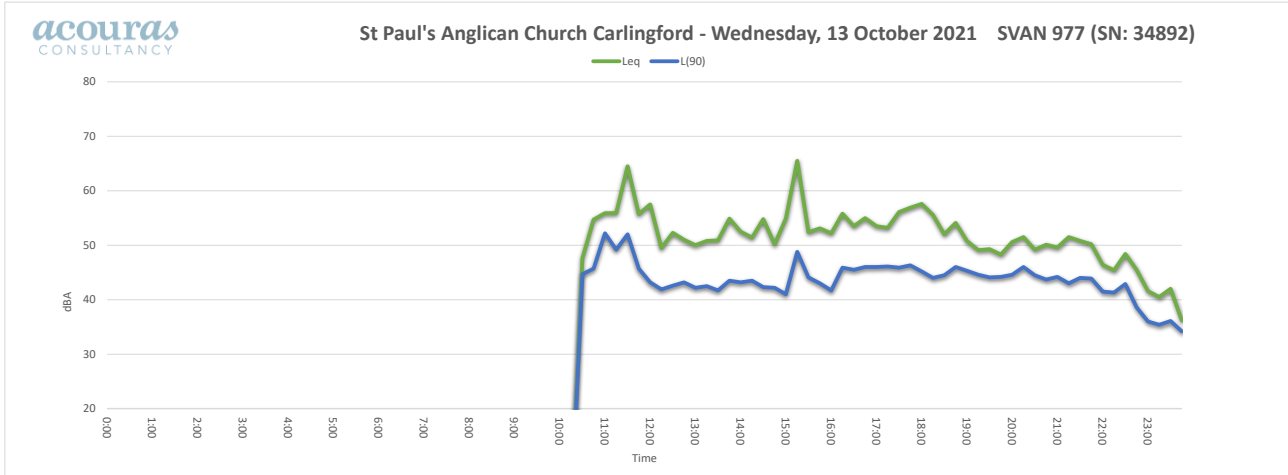
$L_{AEQ,T}$: Equivalent continuous A-weighted sound pressure level. The value of the A-weighted sound pressure level of a continuous steady sound that, within a measurement time interval T, has the same A-weighted sound energy as the actual time-varying sound.

Appendix B – Architectural Drawings

This assessment was based on the following architectural drawings provided by Stanton Dahl Architects

Drawing	Issue	Date	Description
SK01	P02		Cover Sheet
SK02	P02	29/10/2021	Site Plan
SK03	P02	29/10/2021	Proposal Level 1
SK04	P02	29/10/2021	Proposal Level 2
SK05	P02	29/10/2021	Section
SK06	P02	29/10/2021	External Perspectives
SK07	P02	29/10/2021	External Perspectives

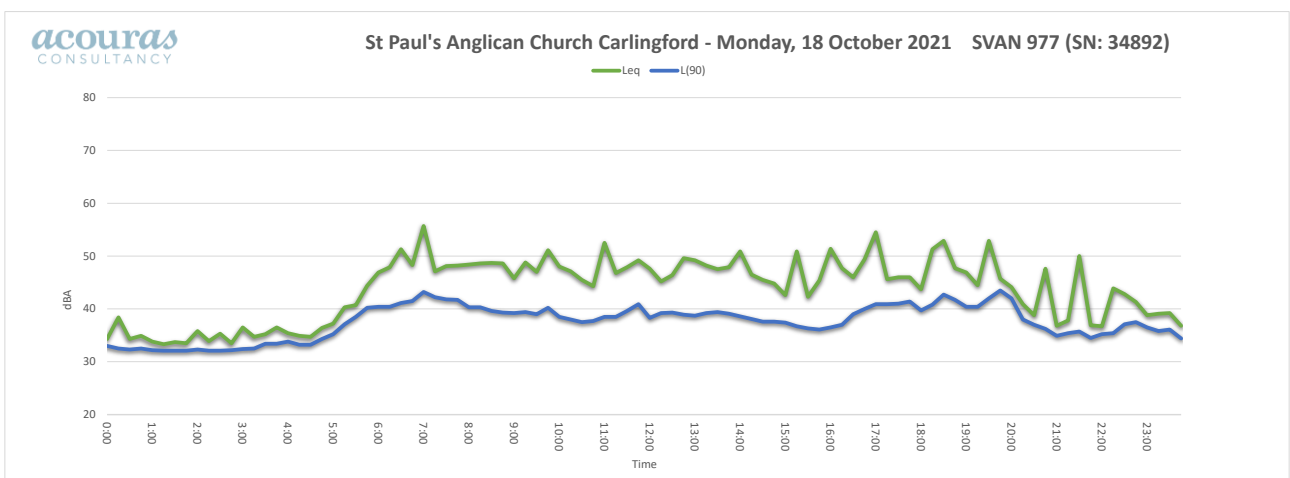
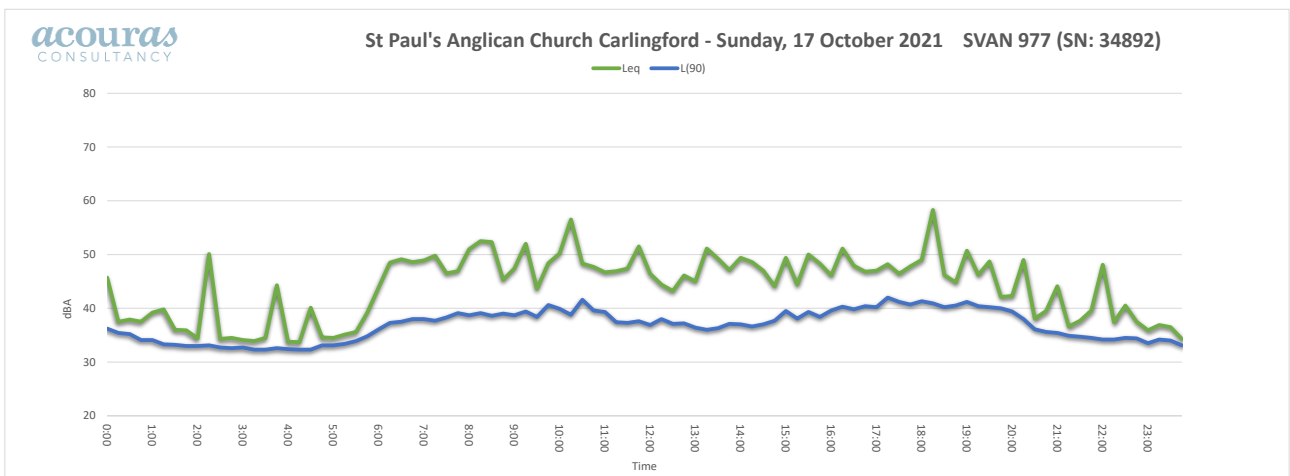
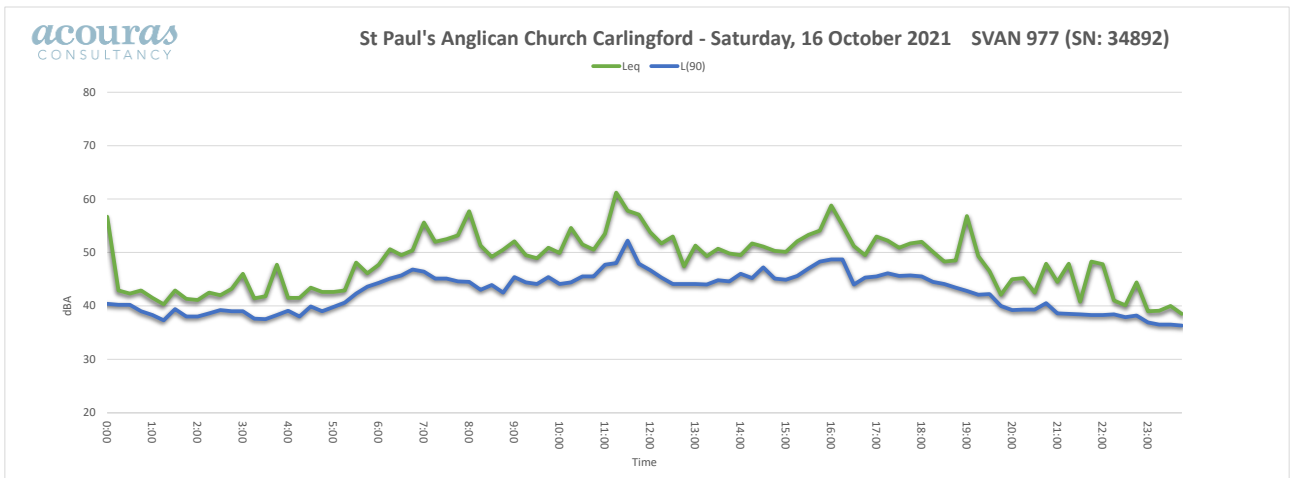
Appendix C – Noise Logger Results



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