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ALPHA ACOUSTICS

ALTERATIONS AND ADDITIONS TO RELIGIOUS ESTABLISHMENT

NOISE IMPACT ASSESSMENT

12-14 Zouch Road, Denham Court, NSW 2565

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0	04/02/2020	Noise Impact Assessment Report	MF	MF
1	06/02/2020	Include explanation of people noise	MF	MF
2	14/02/2020	Clarify operations	MF	MF
3	14/02/2020	Finalising recommendations	MF	MF

CLIENT

Report Issued	Attention	Phone	Email
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Recommendations made in this report are intended to resolve acoustical problems only. We make no claim of expertise in other areas and draw your attention to the possibility that our recommendations may not meet the structural, fire, thermal, or other aspects of building construction

We encourage clients to check with us before using materials or equipment that are alternative to those specified in our Acoustical Report.

The integrity of acoustic structures is very dependent on installation techniques. For example, a small crack between the top of a wall and a ceiling can reduce the effective sound transmission loss of a wall from R_w 50 to R_w 40. Therefore, the use of contractors that are experienced in acoustic construction is encouraged. Furthermore, two insulation products may have the same thermal R rating but the sound absorption of one may be entirely deficient, therefore the use of materials and equipment that are supported by acoustic laboratory test data is encouraged.

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1 INTRODUCTION AND SITE DESCRIPTION

Alpha Acoustics Pty Ltd has been engaged by the International Bible Students Association to provide a noise impact assessment of the proposed alterations and additions to the existing religious establishment, located at 12-14 Zouch Road, Denham Court, NSW 2565.

Potential noise impacts are assessed in accordance with:

- The NSW Noise Policy for Industry (EPA, 2017).
- The NSW EPA Noise Guide for Local Government.
- The NSW Road Noise Policy, DEC, Environment and Water, 2011.

Scope of Work

- Inspect the site and environs
- Measure the background noise levels at a representative location on site
- Establish acceptable noise level criterion
- Quantify noise emissions from premises at the nominated residences
- Prepare a Noise Impact Report

2 PROJECT DESCRIPTION

The main noise sources at the site include:

- People talking,
- Vehicle movements onsite including forklifts, cars and light trucks,
- Mechanical plant noise from a low noise generator,
- Car park noise.

The nearest and most affected residential receivers surrounding the site are listed in Table 2.1 below and shown in Figure 2.1 below.

Figures 2.2 to 2.5 show the proposed site alterations and additions, zoning and photographs of the site and surrounds.

Table 2.1 Nearest and Most Affected residential receivers

Receiver	Address
R1	5 Denham Court Road, Denham Court
R2	15 Denham Court Road, Denham Court
R3	33 Church Road, Denham Court
R4	36 Church Road, Denham Court
R5	38 Church Road, Denham Court
R6	45 Church Road, Denham Court
R7	85 Denham Court Road, Denham Court
R8	95 Denham Court Road, Denham Court
R9	120 Huntingdale Drive, Denham Court
R10	141 Zouch Road, Bardia

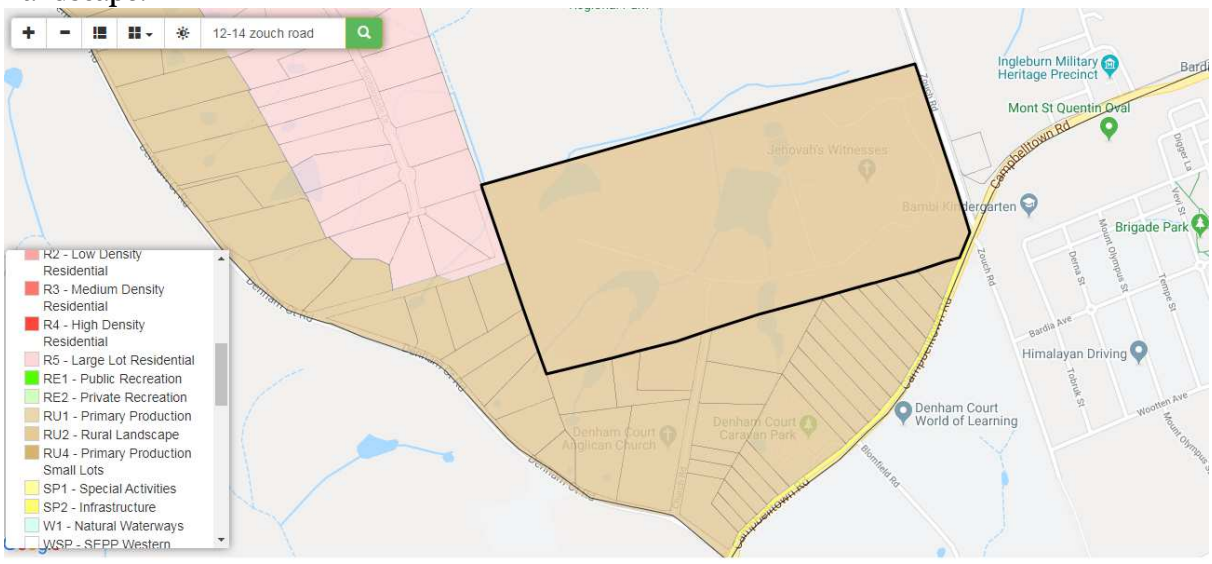
Figure 2.1 – Most Affected Residential Receivers

Figure 2.2 Site Plan of proposed Alterations and Additions

Figure 2.3 Photograph 1 of surrounds from noise measurement location ML1 (view West)

Figure 2.4 Photograph 2 of surrounds from noise measurement location ML1 (view south)

Figure 2.5 Zoning surrounding the project is R5 Large Lot Residential and Ru2 Rural Landscape.



3 NOISE SURVEY AND INSTRUMENTATION

All instrument systems had been laboratory calibrated using instrumentation traceable to Australian National Standards and certified within the last two years thus conforming to Australian Standards. The measurement system was also calibrated prior to and after the noise survey. Calibration drift was found to be less than 0.3 dB during attended measurements. No adjustments for instrument drift during the measurement period were warranted.

Table 3.1 Noise Instrumentation

Description	Model No.	Serial No.
Modular Precision Sound Analyser	B&K 2260	245 9227
Condenser Microphone 0.5" diameter	B&K 4189	245 8107
Acoustical Calibrator	B&K 4231	267 1553
Microphone Windscreen	Acoustically transparent foam	
Rion Noise Logger	NL-22	01273559
Condenser Microphone 0.5" diameter	UC-52	117012
Acoustical Calibrator	B&K 4231	267 1553
Microphone Windscreen	Acoustically transparent foam	

The Bruel & Kjaer 2260 Sound Analyser is a real-time precision integrating sound level meter with octave and third octave filters that samples noise at a rate of 10 samples per second. Measurements are stored as L_{eq}, L_1, L_{10}, L_{50} and L_{90} statistical data at 15-minute intervals (longer or shorter intervals optional) over the desired monitoring period.

In order to assess the severity of a possible environmental noise problem it is necessary to measure the ambient background noise level at the times and locations of worst possible annoyance. The lower the background noise level, the more perceptible the intrusive noise becomes and the more potentially annoying. The NSW Industrial Noise Policy sets out a method to determine the ambient L_{90} background noise level.

The ambient L_{90} background noise level is a statistical measure of the sound pressure level that is exceeded for 90% of the measuring period (typically 15 minutes). The NSW Noise Policy for Industry sets minimum rating background noise levels; 35 dB(A) in the daytime and 30 dB(A) in the evening period.

The Rating background noise level RBL as calculated in accordance with the NSW Noise Policy for Industry and shown in Table 3.1 below. Noise levels were measured continuously at ML1 between Wednesday 6th November 2019 and Wednesday 13th November 2019.

The weather conditions were clear with little wind and the temperature ranged between 6^0C and 36^0C. The background noise consisted of aircraft, birds and distant traffic noise. Noise data is presented in Appendix B.

The summary results of the noise monitoring are shown in Table 3.1 below.

Table 3.1 Rating Background Level (NSW INP)

Noise Measurement Location	Time Period	Ambient L_{Aeq} Noise levels	Rating Background Level
Location – ML1 12-14 Zouch Road, Denham Court	Day (7am to 6 pm)	**52 dB(A)**	**39 dB(A)**
	Evening (6 pm to 10 pm)	**48 dB(A)**	**39 dB(A)**
	Night (10 pm to 7 am)	**43 dB(A)**	**34 dB(A)**

4 NOISE CRITERIA

4.1 Council Noise Criteria

It is understood that Liverpool City Council does not have a specific noise policy for noise emissions from the development. Therefore guidance in setting the noise criteria for this noise impact assessment is based on the NSW Noise Policy for Industry and the NSW Road Traffic Noise Policy as detailed below.

4.2 NSW Noise Policy for Industry

The Environment Protection Authority published their NSW Noise Policy for Industry (EPA, 2017) in 2017. The Noise Policy is specifically aimed at assessing noise from industrial noise sources scheduled under the Protection of the Environment Operations Act 1997 (POEO, 1997).

The extensions and alterations proposed are not a 'scheduled premises' under the Protection of the Environment Operations Act 1997 and is not required to hold a licence under that Act for operations at the site.

The Noise Policy provides a useful framework to assess noise emission from non-scheduled premises, whether that premises produces offensive or non-offensive noise.

The Protection of the Environment Operations Act 1997 defines "Offensive Noise" as noise:

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

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

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

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

the NSW Noise Policy for Industry will be used as a guide in determining whether the level of noise is considered intrusive or not.

4.3 Residential Receptor Noise Intrusiveness Criteria

The DEC states in Section 2.1 of its NSW Noise Policy for Industry (2017) that the L_{eq} level of noise intrusion from broad-band industrial noise sources may be up to 5 dBA above the L_{90} background noise level at the receptor without being considered offensive (EPA, 2017, Section 2.1).

The Rating Background Level at ML1 [See Figure 2.1] (representing the acoustical environment of the surrounding residential receivers) was 39 dBA during the daytime, 39 dBA during the evening and 34 dBA at night. Therefore the acceptable L_{eq} noise intrusiveness criteria for **broadband noise** in this area is;

- (39 + 5 =) 44 dBA during the day;
- (39 + 5 =) 44 dBA in the evening and;
- (34 + 5 =) 39 dBA at night.

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. Correction factors would be applied to the noise emissions when comparing to the project specific criteria.

4.4 Residential Noise Amenity Criterion

Depending on the type of area in which the noise is being made, there is a certain reasonable expectancy for noise amenity. Table 2.2 of the NSW Noise Policy for Industry provides a schedule of recommended L_{eq} industrial noise levels that under normal circumstances should not be exceeded. If successive developments occur near a residential area, each one allowing a criterion of background noise level plus 5 dBA, the ambient noise level will gradually creep higher.

Compliance with the Noise Amenity levels in Table 2.2 will limit ambient noise creep. The amenity criteria are the amenity noise level (Table 2.2 of the policy) minus 5 dB(A).

In this case the Noise Amenity criterion for a predominantly Rural Residential area (from Table 2.2 of the policy) would be

- (50 – 5 =) 45 dBA during the daytime,
- (45 – 5 =) 40 dBA in the evening and
- (40 – 5 =) 35 dBA during the night.

4.5 Project Specific Noise Criteria

When all the above factors are considered, we find that the most stringent noise criterion is a combination of the Noise Intrusiveness Criterion and Noise Amenity of:

- **44 dBA for broadband noise sources, during the day,**
- **40 dBA for broadband noise sources, in the evening,**
- **35 dBA for broadband noise sources, at night.**

These criteria apply at the most-affected point on or within the residential property boundary – or, if that is more than 30 metres from the residence, at the most-affected point within 30 metres of the residence. For upper floors, the noise is assessed outside the nearest window.

Note: The L_{Aeq} is determined over a 15-minute period for the project intrusiveness noise level and over an assessment period (day, evening and night) for the project amenity noise level. To standardise the time periods, for the intrusiveness and amenity noise levels, the policy assumes that the $L_{Aeq,15min}$ will be taken to be equal to the $L_{Aeq, period}$ + 3 decibels (dB). For this reason all noise modelling is based on the worst case 15 minutes in a period and no "period" adjustment is made to modelling data in line with a conservative assessment.

4.6 Sleep Disturbance

The World Health Organisation (WHO) set out a Sleep disturbance noise criteria in the "WHO Guidelines for community noise". Table 1 of that guideline establishes that sleep disturbance can occur inside bedrooms when the maximum noise level is at **L_{Amax} 45 dB(A)** (10pm to 7am). In practice, with a bedroom window open, this internal noise level will be equivalent to an outside maximum noise level of L_{Amax} 50 to 55 dB(A) [depending on building construction].

4.7 Traffic Noise

The NSW Road Traffic Noise Policy sets out noise criteria for traffic noise emissions from various types of roads. The alterations and additions propose to use the Church Road Entrance between 8:00am and 6:00pm. The road traffic noise criteria for existing residences affected by additional traffic on existing local roads generated by land use developments is:

- **$L_{Aeq, 1hour}$ 55 dBA(external) during the daytime.**

5 NOISE EMISSIONS

5.1 Filming Sound Levels

The main sources of noise associated with the outdoor filming includes:

a. People noise

b. Driving small vehicles and vans on site

c. Operating forklifts, scissor lifts and light hand tools

d. Operating a small low noise generator.

e. Operating a hand-held volume controllable electronic voice amplifier.

Noise modelling of several operational scenarios has been carried out. It is noted that the Church Road entrance will not be used in the night-time period. The modelling scenarios are based on the "Filming Management Plan" provided to Alpha Acoustics Pty Ltd and summarised in the following modelling scenarios:

Scenario Type A – $L_{Aeq,\ 15\ minutes}$ (8am to 5pm)

a. 15 people with 5 talking normally,
b. Small power tools such as electric drills and electric circular saws,
c. Utility Vehicles, forklifts, several electric carts, telehandler, scissor lifts, van,
d. Movie set generator.

Scenario Type B – $L_{Aeq,\ 15\ minutes}$ (7am to 10pm)

a. up to 70 people with 30 talking normally and 5 talking loudly,
b. Utility Vehicles, forklifts, several electric carts, telehandler, scissor lifts, van,
c. Movie set generator,
d. Hand-held volume controllable electronic voice amplifier

Scenario Type C1 – $L_{Aeq,\ 15\ minutes}$ (7am to 10pm)

a. up to 135 people with 60 talking normally and 15 talking loudly,
b. Utility Vehicles, forklifts, several electric carts, telehandler, scissor lifts, van,
c. Movie set generator,
d. Hand-held volume controllable electronic voice amplifier

Scenario Type C2 – $L_{Aeq,\ 15\ minutes}$ (6am to 7am)

- up to 75 people say 30 talking normally, 5 talking loudly,
- Utility Vehicles, 1 boom lift (i.e. scissor lift) , several electric carts,
- Movie set generator.

Scenario Type C3 – $L_{AMax,\ 15\ minutes}$ (6am to 7am)

- up to 75 people say 30 talking normally, 5 talking loudly,
- Utility Vehicles, 1 boom lift (i.e. scissor lift) , several electric carts,
- Movie set generator,
- Car parking activities

The sound sources have been modelled in SoundPLAN. The noise emissions used for the various noise sources (taken from previous similar noise measurement noise data from Alpha Acoustics Pty Ltd and SoundPlan Sound Library) are presented below in each noise modelling scenario as sound power levels.

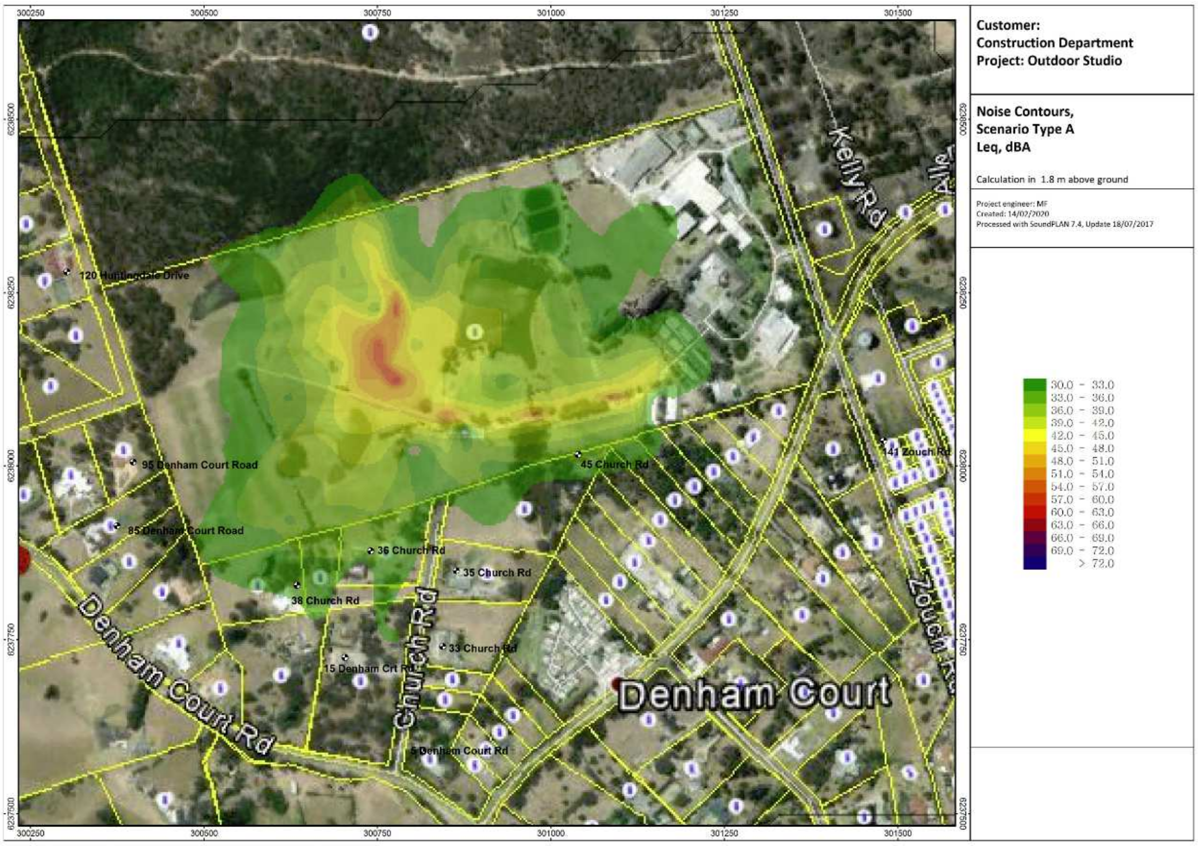
Knowing the source sound power level (see the modelling scenarios below), the sound pressure level can be calculated at a remote location using suitable formulae to account for distance losses, ground absorption, sound barriers, atmospheric effects, etc.

Noise modelling has been conducted using SoundPLAN v7.4 and the prediction methodology *ISO 9613-2: 1996* incorporating manufacturer published sound emission data. We would expect the order of uncertainty to be in the range of +/- 2 dB(A). The noise model presents all plant operating simultaneously, accordingly the predictions should be considered a worst-case scenario, assuming constant noise levels.

ISO 9613-2:1996 incorporates mild temperature inversions and light winds blowing from source to receiver to account for a worst case weather affected noise without the weather changing the rating background noise levels and hence noise criteria.

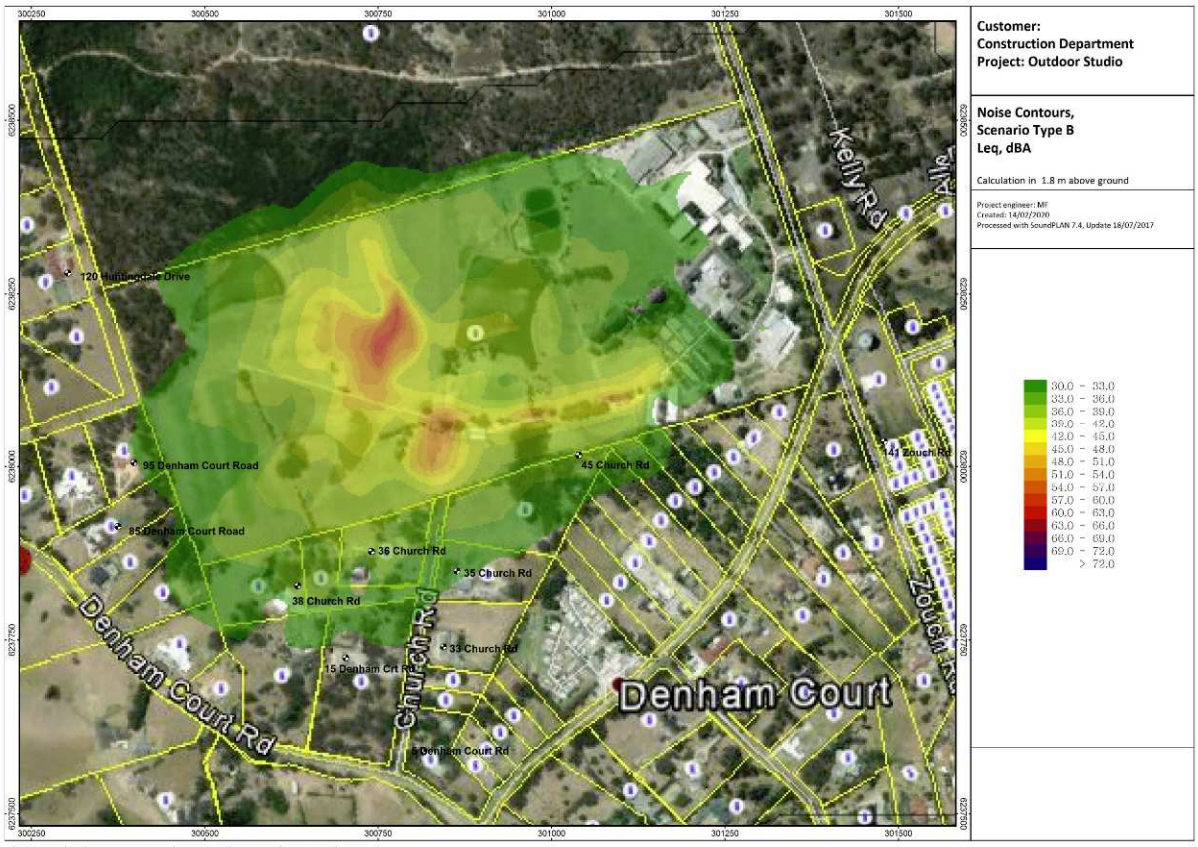
Noise modelling results are presented in Appendix C of this report. Additionally the $L_{Aeq,\ period}$ Noise emissions modelled in the day, evening and night-time period for the ground floor and first floor of nearby residential receivers have been incorporated as shown in the following figures:

Figure 5.1 - Scenario Type A – $L_{Aeq, 15\ minutes}$



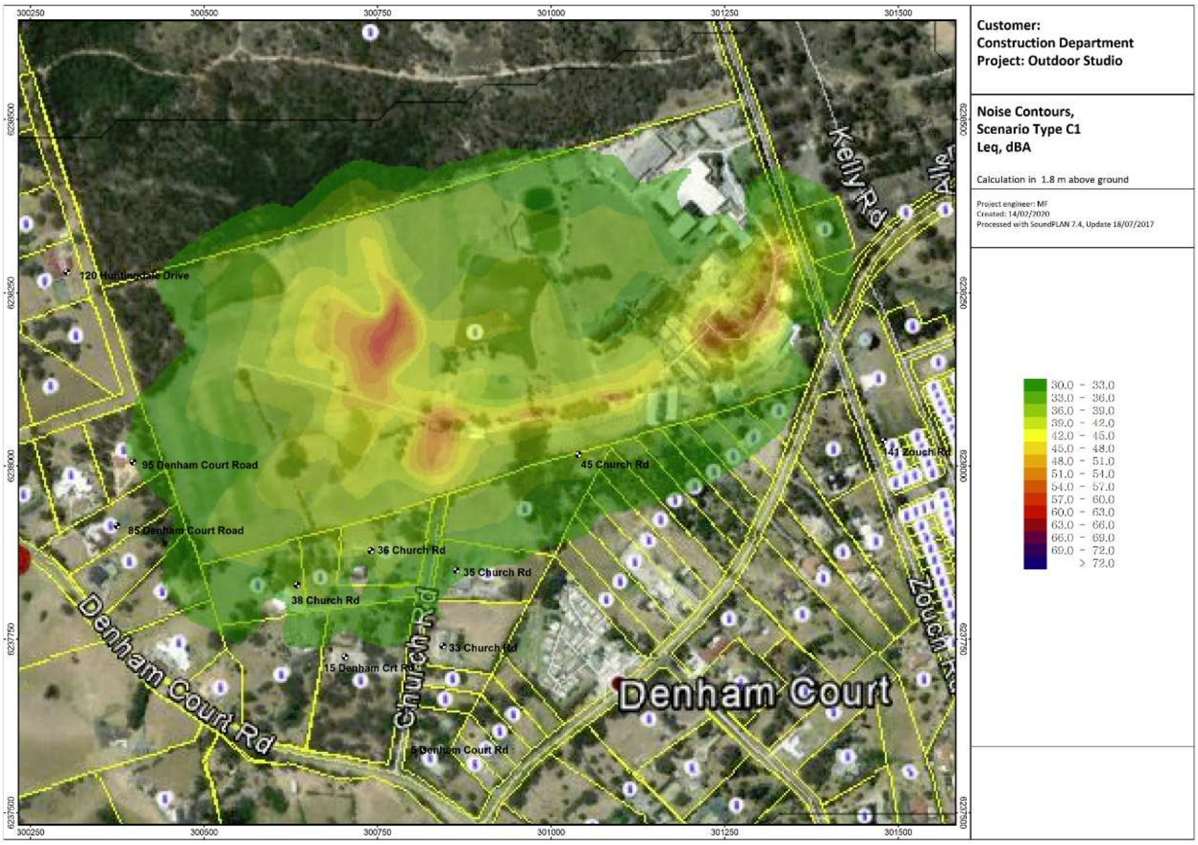
Scenario Type A - Sources	Source type	Lw dB(A)	63Hz dB(A)	125Hz dB(A)	250Hz dB(A)	500Hz dB(A)	1kHz dB(A)	2kHz dB(A)	4kHz dB(A)	8kHz dB(A)
hand tools (circ saw)	Point	85		53	65.7	71.3	74.5	81.3	81.2	69.2
hand tools (circ saw)	Point	85		53	65.7	71.3	74.5	81.3	81.2	69.2
scissor lift	Point	92	51.5	53.6	56.1	63.5	91.7	78.9	70.7	63.6
movie set generator	Point	89.9	58.8	75.9	81.4	84.8	84	83.2	74	66.9
talking normally	Point	65	21.9	42.8	54.8	62.2	57.5	56.3	53	39.8
talking normally	Point	65	21.9	42.8	54.8	62.2	57.5	56.3	53	39.8
talking normally	Point	65	21.9	42.8	54.8	62.2	57.5	56.3	53	39.8
talking normally	Point	65	21.9	42.8	54.8	62.2	57.5	56.3	53	39.8
talking normally	Point	65	21.9	42.8	54.8	62.2	57.5	56.3	53	39.8
telehandler	Point	93	72.3	73.4	79.8	88.2	86.5	87.7	81.4	74.4
van	Line	87	71.8	76.9	78.4	80.8	81	80.2	72	63.9

Figure 5.2 - Scenario Type B – $L_{Aeq,\ 15\ minutes}$



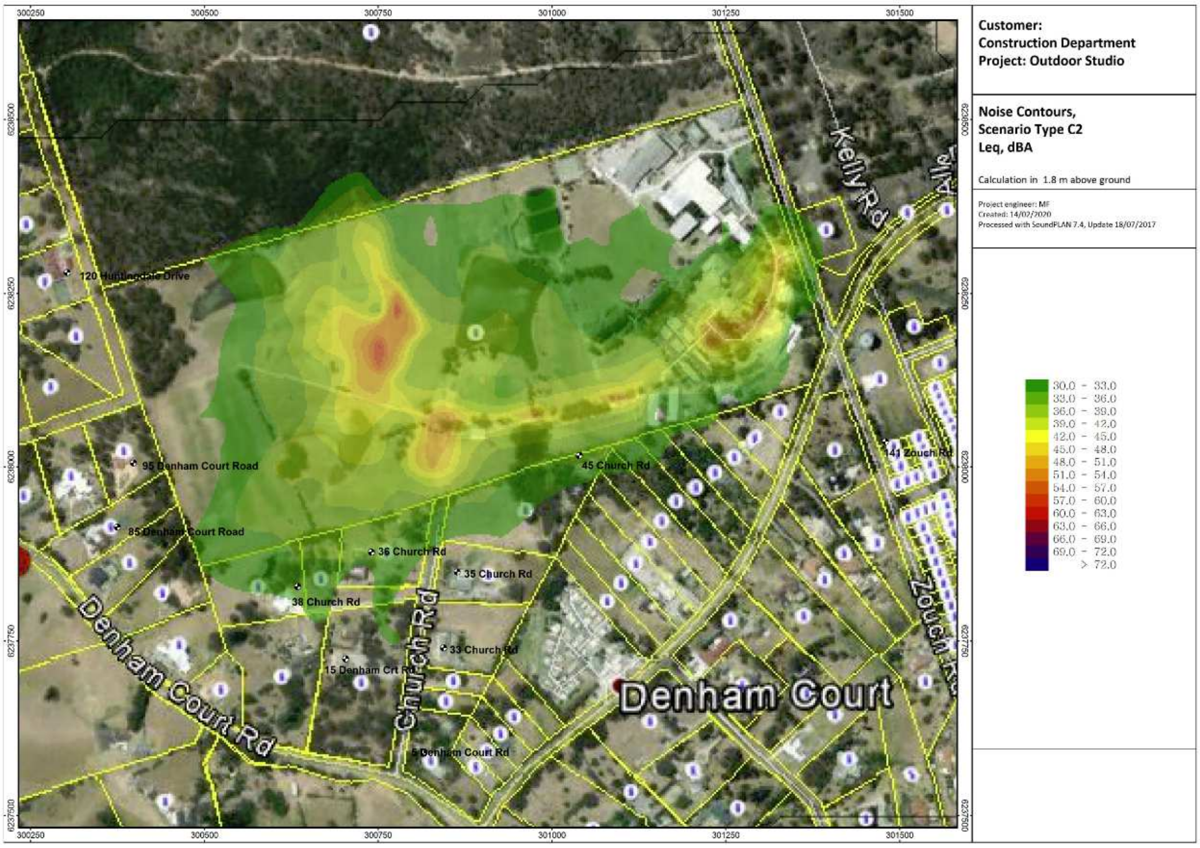
Scenario Type B - Sources	Source type	Lw dB(A)	63Hz dB(A)	125Hz dB(A)	250Hz dB(A)	500Hz dB(A)	1kHz dB(A)	2kHz dB(A)	4kHz dB(A)	8kHz dB(A)
5 people talk loudly	Point	73.4	30.3	51.2	63.2	70.6	65.9	64.7	61.4	48.2
5 people talk loudly	Point	73.4	30.3	51.2	63.2	70.6	65.9	64.7	61.4	48.2
5 people talk normally	Point	68.4	25.3	46.2	58.2	65.6	60.9	59.7	56.4	43.2
5 people talk normally	Point	68.4	25.3	46.2	58.2	65.6	60.9	59.7	56.4	43.2
5 people talk normally	Point	68.4	25.3	46.2	58.2	65.6	60.9	59.7	56.4	43.2
5 people talk normally	Point	68.4	25.3	46.2	58.2	65.6	60.9	59.7	56.4	43.2
5 People talk normally	Point	68.4	25.3	46.2	58.2	65.6	60.9	59.7	56.4	43.2
5 People talk normally	Point	68.4	25.3	46.2	58.2	65.6	60.9	59.7	56.4	43.2
10 cars in 15 minutes parking	Line	87.5	70.7	82.4	74.8	79.6	79.7	79.7	77.3	71.1
voice amplifier	Point	96.4	53.3	74.2	86.2	93.6	88.9	87.7	84.4	71.2
scissor lift	Point	92	51.5	53.6	56.1	63.5	91.7	78.9	70.7	63.6
movie set generator	Point	89.9	58.8	75.9	81.4	84.8	84	83.2	74	66.9
telehandler	Point	93	72.3	73.4	79.8	88.2	86.5	87.7	81.4	74.4
van	Line	87	71.8	76.9	78.4	80.8	81	80.2	72	63.9

Figure 5.3 - Scenario Type C1 – $L_{Aeq, 15\ minutes}$



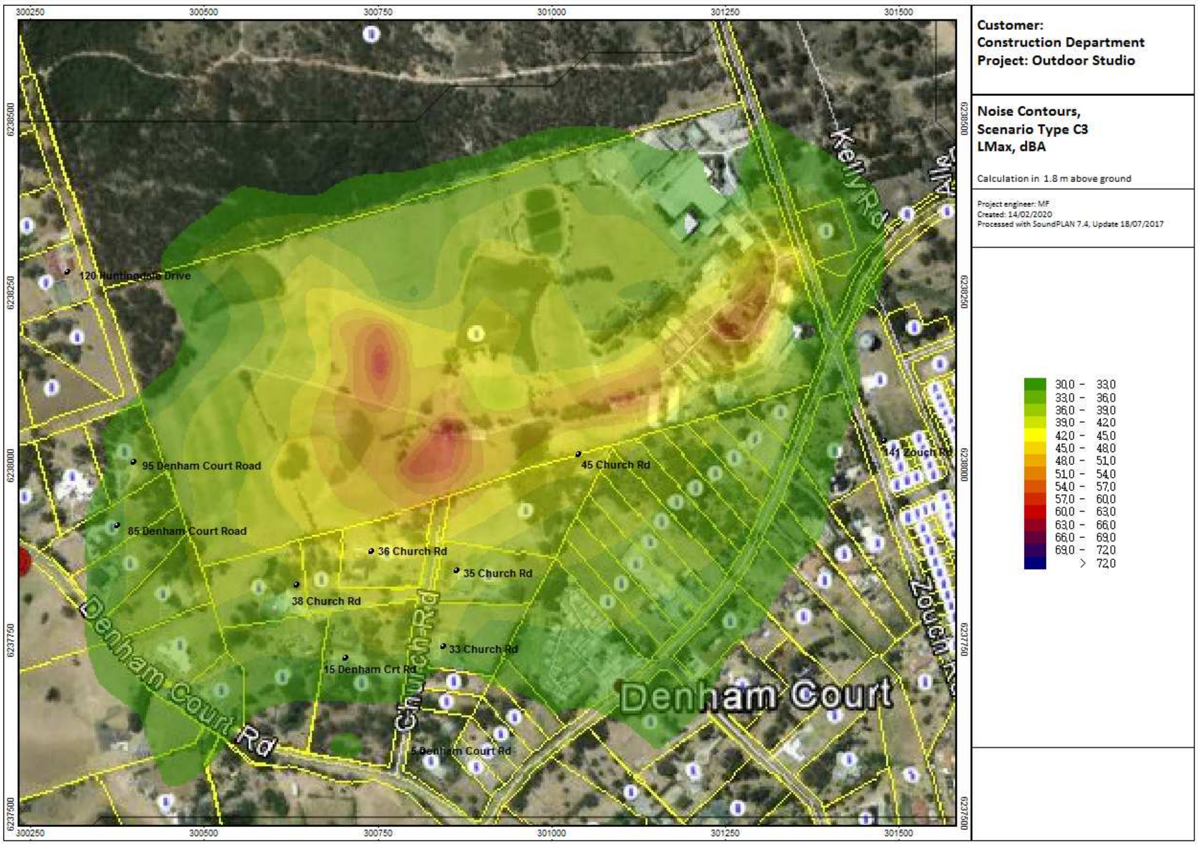
Scenario Type C1 - Sources	Source type	Lw dB(A)	63Hz dB(A)	125Hz dB(A)	250Hz dB(A)	500Hz dB(A)	1kHz dB(A)	2kHz dB(A)	4kHz dB(A)	8kHz dB(A)
5 people talk loudly	Point	73.4	30.3	51.2	63.2	70.6	65.9	64.7	61.4	48.2
5 people talk loudly	Point	73.4	30.3	51.2	63.2	70.6	65.9	64.7	61.4	48.2
5 people talk loudly	Point	73.4	30.3	51.2	63.2	70.6	65.9	64.7	61.4	48.2
5 people talk normally	Point	68.4	25.3	46.2	58.2	65.6	60.9	59.7	56.4	43.2
5 people talk normally	Point	68.4	25.3	46.2	58.2	65.6	60.9	59.7	56.4	43.2
5 people talk normally	Point	68.4	25.3	46.2	58.2	65.6	60.9	59.7	56.4	43.2
5 people talk normally	Point	68.4	25.3	46.2	58.2	65.6	60.9	59.7	56.4	43.2
5 people talk normally	Point	68.4	25.3	46.2	58.2	65.6	60.9	59.7	56.4	43.2
5 people talk normally	Point	68.4	25.3	46.2	58.2	65.6	60.9	59.7	56.4	43.2
5 people talk normally	Point	68.4	25.3	46.2	58.2	65.6	60.9	59.7	56.4	43.2
5 people talk normally	Point	68.4	25.3	46.2	58.2	65.6	60.9	59.7	56.4	43.2
5 people talk normally	Point	68.4	25.3	46.2	58.2	65.6	60.9	59.7	56.4	43.2
5 people talk normally	Point	68.4	25.3	46.2	58.2	65.6	60.9	59.7	56.4	43.2
5 People talk normally	Point	68.4	25.3	46.2	58.2	65.6	60.9	59.7	56.4	43.2
5 people talking normally	Point	68.4	25.3	46.2	58.2	65.6	60.9	59.7	56.4	43.2
10 cars in 15 minutes parking	Line	87.5	70.7	82.4	74.8	79.6	79.7	79.7	77.3	71.1
30 cars in 15 minutes	Line	92	75.2	86.9	79.3	84.1	84.2	84.2	81.8	75.6
voice amplifier	Point	96.4	53.3	74.2	86.2	93.6	88.9	87.7	84.4	71.2
scissor lift	Point	92	51.5	53.6	56.1	63.5	91.7	78.9	70.7	63.6
movie set generator	Point	89.9	58.8	75.9	81.4	84.8	84	83.2	74	66.9
telehandler	Point	93	72.3	73.4	79.8	88.2	86.5	87.7	81.4	74.4
van	Line	87	71.8	76.9	78.4	80.8	81	80.2	72	63.9

Figure 5.4 - Scenario Type C2 – $L_{Aeq,\ 15\ minutes}$



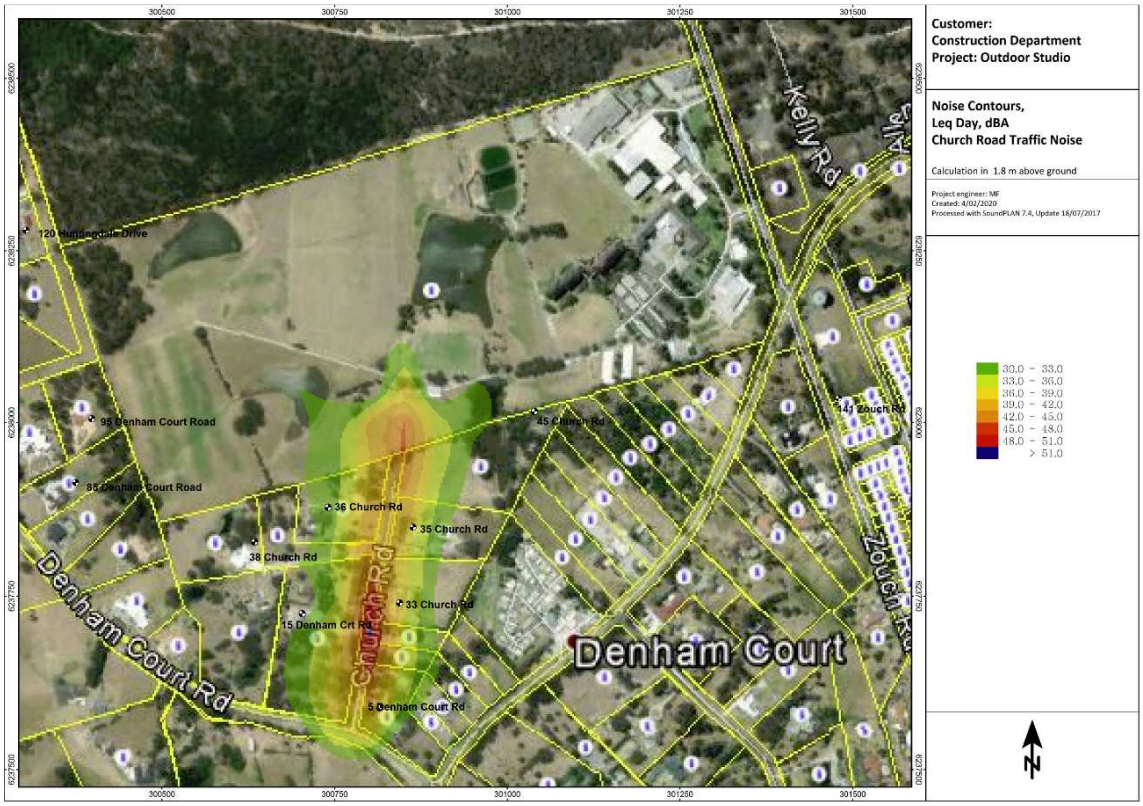
Scenario Type C2 - Sources	Source type	Lw dB(A)	63Hz dB(A)	125Hz dB(A)	250Hz dB(A)	500Hz dB(A)	1kHz dB(A)	2kHz dB(A)	4kHz dB(A)	8kHz dB(A)
5 people talk loudly	Point	73.4	30.3	51.2	63.2	70.6	65.9	64.7	61.4	48.2
5 people talk loudly	Point	73.4	30.3	51.2	63.2	70.6	65.9	64.7	61.4	48.2
5 people talk normally	Point	68.4	25.3	46.2	58.2	65.6	60.9	59.7	56.4	43.2
5 people talk normally	Point	68.4	25.3	46.2	58.2	65.6	60.9	59.7	56.4	43.2
5 people talk normally	Point	68.4	25.3	46.2	58.2	65.6	60.9	59.7	56.4	43.2
5 people talk normally	Point	68.4	25.3	46.2	58.2	65.6	60.9	59.7	56.4	43.2
5 people talk normally	Point	68.4	25.3	46.2	58.2	65.6	60.9	59.7	56.4	43.2
5 people talk normally	Point	68.4	25.3	46.2	58.2	65.6	60.9	59.7	56.4	43.2
5 people talk normally	Point	68.4	25.3	46.2	58.2	65.6	60.9	59.7	56.4	43.2
5 People talk normally	Point	68.4	25.3	46.2	58.2	65.6	60.9	59.7	56.4	43.2
10 cars in 15 minutes	Line	88	71.2	82.9	75.3	80.1	80.2	80.2	77.8	71.6
10 cars in 15 minutes parking	Line	85	68.2	79.9	72.3	77.1	77.2	77.2	74.8	68.6
scissor lift	Point	92	51.5	53.6	56.1	63.5	91.7	78.9	70.7	63.6
movie set generator	Point	89.9	58.8	75.9	81.4	84.8	84	83.2	74	66.9
telehandler	Point	93	72.3	73.4	79.8	88.2	86.5	87.7	81.4	74.4
van	Line	85	69.8	74.9	76.4	78.8	79	78.2	70	61.9

Figure 5.5 - Scenario Type C3 – $L_{AMax, 15\ minutes}$



Scenario Type C3 - Sources	Source type	Lw dB(A)	63Hz dB(A)	125Hz dB(A)	250Hz dB(A)	500Hz dB(A)	1kHz dB(A)	2kHz dB(A)	4kHz dB(A)	8kHz dB(A)
5 people talk loudly	Point	73.4	30.3	51.2	63.2	70.6	65.9	64.7	61.4	48.2
5 people talk normally	Point	68.4	25.3	46.2	58.2	65.6	60.9	59.7	56.4	43.2
5 people talk normally	Point	68.4	25.3	46.2	58.2	65.6	60.9	59.7	56.4	43.2
5 people talk normally	Point	68.4	25.3	46.2	58.2	65.6	60.9	59.7	56.4	43.2
5 people talk normally	Point	68.4	25.3	46.2	58.2	65.6	60.9	59.7	56.4	43.2
5 people talk normally	Point	68.4	25.3	46.2	58.2	65.6	60.9	59.7	56.4	43.2
5 people talk normally	Point	68.4	25.3	46.2	58.2	65.6	60.9	59.7	56.4	43.2
5 people talk normally	Point	68.4	25.3	46.2	58.2	65.6	60.9	59.7	56.4	43.2
5 People talk normally	Point	68.4	25.3	46.2	58.2	65.6	60.9	59.7	56.4	43.2
Lmax car take off	Line	94.1	77.3	89	81.4	86.2	86.3	86.3	83.9	77.7
Lmax car take off	Line	94.1	77.3	89	81.4	86.2	86.3	86.3	83.9	77.7
Lmax door close	Point	97.1	61.2	73.1	83.1	90.2	93	90.5	87.6	81.4
scissor lift Lmax	Point	97.3	56.8	58.9	61.4	68.8	97	84.2	76	68.9
movie set generator	Point	89.9	58.8	75.9	81.4	84.8	84	83.2	74	66.9
van Lmax	Line	92	76.8	81.9	83.4	85.8	86	85.2	77	68.9

Figure 5.6 - Scenario Daytime (8am to 6pm) Traffic along Church Road – $L_{Aeq,\ 1\ hour}$



Scenario Traffic Noise - Sources	Source type	Lw dB(A)	63Hz dB(A)	125Hz dB(A)	250Hz dB(A)	500Hz dB(A)	1kHz dB(A)	2kHz dB(A)	4kHz dB(A)	8kHz dB(A)
Church Road Cars	50 cars p.hr	90	73.2	84.9	77.3	82.1	82.2	82.2	79.8	73.6

5.2 Noise Management

The modelled noise emissions from the proposal are calculated as complying with the noise criteria in all noise model scenarios provided the following noise conditions are met:

- The movie set generator should have a sound power level of less than 90 dB(A).
- The hand-held volume controllable electronic voice amplifier should have a sound power level of no more than 100dB(A).
- Reversing safety beepers on all relevant plant equipment should be "broadband" style to reduce tonal noise annoyance.

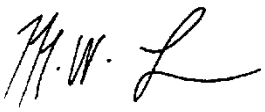
Additionally, the following noise management measures may be implemented to further reduce noise emissions from the proposal:

- Vehicle engines should be switched off during loading activities whenever possible.
- Small passenger vehicles should park in the designated carparks.
- The Church Road entrance should only be used between 8:00am and 6:00pm
- It is recommended that noise commissioning to validate the acoustic design will be undertaken as soon as the site is operational.

6 NOISE IMPACT STATEMENT

Alpha Acoustics Pty Ltd has been engaged by the International Bible Students Association to provide a noise impact assessment of the proposed alterations and additions to the existing religious establishment, located at 12-14 Zouch Road, Denham Court, NSW 2565.

Noise measurements and calculations show that noise emissions from the proposed alterations and additions to the existing religious establishment comply with The Environment Protection Authority (EPA) NSW Noise Policy for Industry (EPA, 2017), The NSW EPA Noise Guide for Local Government and The NSW Road Noise Policy, DEC, Environment and Water, 2011.



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Attachments:

- Appendix A - Glossary of Acoustic Terms
- Appendix B - Ambient Noise Survey
- Appendix C – Drawings
- Appendix D – Noise Model Outputs

APPENDIX A – ACOUSTIC TERMS

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Acoustic Barrier — Solid walls or partitions, solid fences, earth mounds, earth berms, buildings, etc used to reduce noise, without eliminating it.

Ambient Sound — The totally encompassing sound in a given situation at a given time, usually composed of sound from all sources near and far.

Assessment Period — The period in a day over which assessments are made.

Assessment Point — A point at which noise measurements are taken or estimated.

Background Noise — Background noise is the term used to describe the noise measured in the absence of the noise under investigation. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the $\mathbf{L_{90}}$ noise level (see below).

Decibel [dB] — The unit that sound is measured in. The following are examples of the decibel readings of everyday sounds.

0dB	the faintest sound we can hear
30dB	a quiet library or in a quiet location in the country
45dB	typical office space. Ambience in the city at night
60dB	Queens Square at lunch time
70dB	the sound of a car passing on the street
80dB	loud music played at home
90dB	the sound of a truck passing on the street
100dB	the sound of a rock band
115dB	limit of sound permitted in industry
120dB	deafening

dB(A): A-weighted decibels — The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.

Frequency — Frequency is synonymous to *pitch*. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.

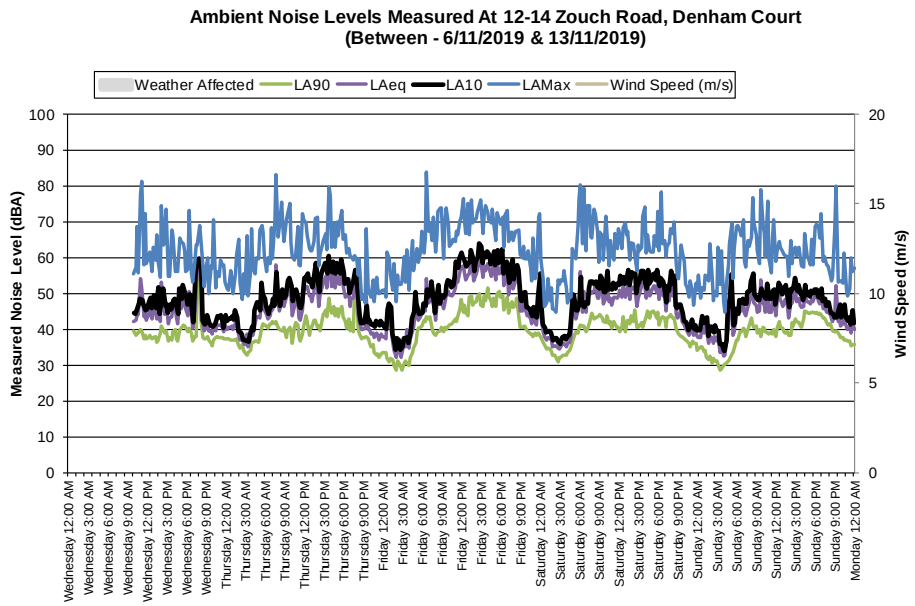
Impulsive noise — Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.

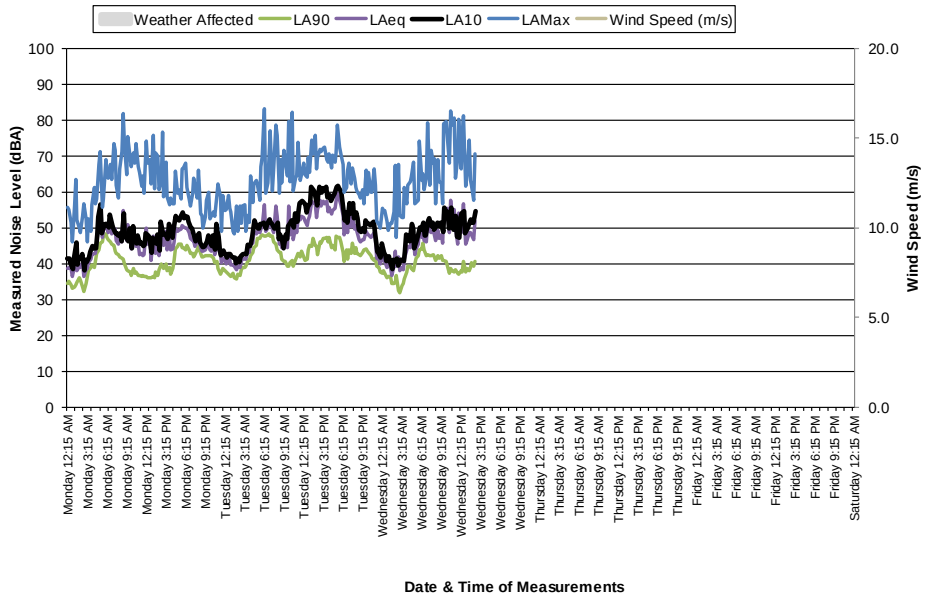
Intermittent noise — The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.

L_{max} — The maximum sound pressure level measured over a given period.

L_{min}	The minimum sound pressure level measured over a given period.
L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L_{90} noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound Absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound Level Meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound Pressure Level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound Power Level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

APPENDIX B –AMBIENT NOISE SURVEY





Summary of averaged noise levels, dB(A) from logging on site.

Period	LA1	LA10	LAeq	LAmax	Rating Background Noise Level LA90, dB(A)
Day (7am to 6pm)	64	52	52	75	**39**
Evening (6pm to 10pm)	61	50	48	71	**39**
Night (10pm to 7am)	61	44	43	74	**34**

APPENDIX C – DRAWINGS

APPENDIX D – NOISE MODEL OUTPUTS

Scenario Type A – $L_{Aeq,\ 15\ minutes}$ (8am to 5pm)

Receiver	Floor	Day Criteria	LAeq dB(A)
5 Denham Court Rd	GF	44	22.7
5 Denham Court Rd	1.FL	44	21.9
15 Denham Court Rd	GF	44	19.8
15 Denham Court Rd	1.FL	44	25.9
33 Church Rd	GF	44	26.2
33 Church Rd	1.FL	44	25.6
35 Church Rd	GF	44	29.8
35 Church Rd	1.FL	44	28
36 Church Rd	GF	44	34
36 Church Rd	1.FL	44	33.9
38 Church Rd	GF	44	33.8
38 Church Rd	1.FL	44	32
45 Church Rd	GF	44	34.3
45 Church Rd	1.FL	44	34.3
85 Denham Court Road	GF	44	26.8
85 Denham Court Road	1.FL	44	25.7
95 Denham Court Road	GF	44	25.7
95 Denham Court Road	1.FL	44	26.6
120 Huntingdale Drive	GF	44	14.3
120 Huntingdale Drive	1.FL	44	19.2
141 Zouch Rd	GF	44	18.9
141 Zouch Rd	1.FL	44	20.5

Scenario Type B – $L_{Aeq,\ 15\ minutes}$ (7am to 10pm)

Receiver	Floor	Day Criteria	Evening Criteria	LAeq dB(A)
5 Denham Court Rd	GF	44	40	24.7
5 Denham Court Rd	1.FL	44	40	24.7
15 Denham Court Rd	GF	44	40	23.7
15 Denham Court Rd	1.FL	44	40	29.1
33 Church Rd	GF	44	40	28.5
33 Church Rd	1.FL	44	40	28.6
35 Church Rd	GF	44	40	33.1
35 Church Rd	1.FL	44	40	31.3
36 Church Rd	GF	44	40	35.8
36 Church Rd	1.FL	44	40	35.8
38 Church Rd	GF	44	40	35.2
38 Church Rd	1.FL	44	40	33.9
45 Church Rd	GF	44	40	35.6
45 Church Rd	1.FL	44	40	35.7
85 Denham Court Road	GF	44	40	29.2
85 Denham Court Road	1.FL	44	40	28.8
95 Denham Court Road	GF	44	40	29.6
95 Denham Court Road	1.FL	44	40	30.9
120 Huntingdale Drive	GF	44	40	19.7
120 Huntingdale Drive	1.FL	44	40	23.3
141 Zouch Rd	GF	44	40	20.3
141 Zouch Rd	1.FL	44	40	21.7

Scenario Type C1 – $L_{Aeq,\ 15\ minutes}$ (7am to 10pm)

Receiver	Floor	Day Criteria	Evening Criteria	LAeq dB(A)
5 Denham Court Rd	GF	44	40	25
5 Denham Court Rd	1.FL	44	40	25.1
15 Denham Court Rd	GF	44	40	24.3
15 Denham Court Rd	1.FL	44	40	29.3
33 Church Rd	GF	44	40	28.6
33 Church Rd	1.FL	44	40	28.9
35 Church Rd	GF	44	40	33.4
35 Church Rd	1.FL	44	40	31.6
36 Church Rd	GF	44	40	36
36 Church Rd	1.FL	44	40	35.9
38 Church Rd	GF	44	40	35.3
38 Church Rd	1.FL	44	40	34
45 Church Rd	GF	44	40	35.9
45 Church Rd	1.FL	44	40	36.1
85 Denham Court Road	GF	44	40	29.4
85 Denham Court Road	1.FL	44	40	29
95 Denham Court Road	GF	44	40	29.8
95 Denham Court Road	1.FL	44	40	31.1
120 Huntingdale Drive	GF	44	40	20.1
120 Huntingdale Drive	1.FL	44	40	23.5
141 Zouch Rd	GF	44	40	24
141 Zouch Rd	1.FL	44	40	25.1

Scenario Type C2 – $L_{Aeq,\ 15\ minutes}$ (6am to 7am)

Receiver	Floor	Night-time Criteria	LAeq dB(A)
5 Denham Court Rd	GF	35	23
5 Denham Court Rd	1.FL	35	22.4
15 Denham Court Rd	GF	35	21.6
15 Denham Court Rd	1.FL	35	26.3
33 Church Rd	GF	35	26.6
33 Church Rd	1.FL	35	26.1
35 Church Rd	GF	35	30.7
35 Church Rd	1.FL	35	28.8
36 Church Rd	GF	35	34
36 Church Rd	1.FL	35	33.8
38 Church Rd	GF	35	33.8
38 Church Rd	1.FL	35	32
45 Church Rd	GF	35	33.9
45 Church Rd	1.FL	35	33.9
85 Denham Court Road	GF	35	27.1
85 Denham Court Road	1.FL	35	26.2
95 Denham Court Road	GF	35	26.1
95 Denham Court Road	1.FL	35	27
120 Huntingdale Drive	GF	35	15
120 Huntingdale Drive	1.FL	35	19.6
141 Zouch Rd	GF	35	21.3
141 Zouch Rd	1.FL	35	22.4

Scenario Type C3 – $L_{AMax,\ 15\ minutes}$ (6am to 7am)

Receiver	Floor	Night-time Criteria	LAMax dB(A)
5 Denham Court Rd	GF	50	31.3
5 Denham Court Rd	1.FL	50	31.3
15 Denham Court Rd	GF	50	31.7
15 Denham Court Rd	1.FL	50	35.2
33 Church Rd	GF	50	35.4
33 Church Rd	1.FL	50	36.7
35 Church Rd	GF	50	41.4
35 Church Rd	1.FL	50	40.4
36 Church Rd	GF	50	42.2
36 Church Rd	1.FL	50	42.5
38 Church Rd	GF	50	41.6
38 Church Rd	1.FL	50	40
45 Church Rd	GF	50	42.8
45 Church Rd	1.FL	50	42.2
85 Denham Court Road	GF	50	34.3
85 Denham Court Road	1.FL	50	33.5
95 Denham Court Road	GF	50	33.1
95 Denham Court Road	1.FL	50	33.8
120 Huntingdale Drive	GF	50	20.3
120 Huntingdale Drive	1.FL	50	24.3
141 Zouch Rd	GF	50	27.9
141 Zouch Rd	1.FL	50	29

Scenario Traffic (8am to 6pm) Church Road – $L_{Aeq, 1\ hour}$

Receiver	Floor	Traffic Noise Criteria	LAeq, 1 Hour dB(A)
5 Denham Court Rd	GF	55	39.3
5 Denham Court Rd	1.FL	55	38.2
15 Denham Court Rd	GF	55	31.8
15 Denham Court Rd	1.FL	55	31.5
33 Church Rd	GF	55	36.9
33 Church Rd	1.FL	55	36.7
35 Church Rd	GF	55	37.7
35 Church Rd	1.FL	55	37.4
36 Church Rd	GF	55	35.3
36 Church Rd	1.FL	55	33.3
38 Church Rd	GF	55	26.5
38 Church Rd	1.FL	55	26.6
45 Church Rd	GF	55	28.5
45 Church Rd	1.FL	55	27.2
85 Denham Court Road	GF	55	20.3
85 Denham Court Road	1.FL	55	20.1
95 Denham Court Road	GF	55	20.1
95 Denham Court Road	1.FL	55	20.5
120 Huntingdale Drive	GF	55	10.9
120 Huntingdale Drive	1.FL	55	12.7
141 Zouch Rd	GF	55	13.1
141 Zouch Rd	1.FL	55	14

Note: 50 car movements per hour have been used in calculations