Environmental Noise Level Impact Assessment for Holy Annunciation Orthodox Church, 163 Park Road, Woolloongabba

conducted for

Holy Annunciation Orthodox Church

Report No: R22002.docx/D3622/Rev.0/25.01.22

Description	Name	Date
Ambient noise assessment	Josh Finlayson	14.12.2021
Source noise Assessment	Josh Finlayson	19.12.2021
Calculations	David Moore/Josh Finlayson	10.01.2022
Draft Report	David Moore	11.01.2022
Final Report	David Moore	25.01.2022

Report prepared for:	Holy Annunciation Orthodox Church 163 Park Road WOOLLOONGABBA QLD 4102
Authorised by:	Mr Andrew Katavic Church Warden Holy Annunciation Orthodox Church Mobile: 0416 201 454 Phone: -
Dates of assessment:	Tuesday 14 to Tuesday 21 December 2021
Consultants:	David Moore & Associates Pty Ltd (PO Box 38) 7 Eleanor Drive SILVAN VIC 3795 Telephone: 07 3170 3222 Mobile: 0417 717 506

.....

David Moore, B App Sc, MAAS

Our reference:	R22002.docx/D3622/Rev.0/25.01.2022

Table of Contents

Page No.

INTRODUCTION

The subject site is located at 163 Park Road, Woolloongabba (Lot 63 on RP158123) and the existing building is currently being used for Holy Annunciation Orthodox Church services. It is proposed that this use will continue, but it is proposed to raise the current building, move is slightly, and modify and extend the building. Potential noise impacts from the subject site are:

- church services, including singing (choir only);
- carpark activity;
- plant and equipment – air-conditioning units.

The current hours of operation of the site are within the period 0700 to 2200 hours (daytime and evening) and this will not change with the modifications and extensions.

To assess current ambient noise levels a 7-day assessment was conducted from monitoring location A, on the subject site adjacent to the southern boundary (adjacent to the south-west corner of the property) with the microphone elevated approximately 1.6 metres. At this monitoring location the dominant noise source was local and distant traffic, as well as the natural sounds of birds, wind in the vegetation and insects.

In accordance with the Brisbane City Council City Plan 2014 the following should be noted:

1. the subject site is zoned Character Residential (CR2);
2. the closest residential (adjoining to the south, east and west) are also zoned Character Residential;
3. the residential on the opposite (northern side) of Park Road are also Character Residential.

In accordance with PO2 of the Community Facilities Code:

PO2

Development ensures that noise generated does not exceed the noise (planning) criteria in Table 9.3.5.3.B and night-time noise criteria in Table 9.3.5.3.C at a sensitive zone or sensitive use.

This report details the results of the ambient noise level assessment, current ambient noise levels and rating background levels, noise limits, state of compliance with noise limits and any required noise control measures. As church services can vary significantly with respect to generated noise an assessment was also conducted of a church service at the Holy Annunciation Orthodox Church on Sunday 19 December 2021, from inside the church building. During this church service, which is representative of a normal Holy Annunciation Orthodox Church service, the following was noted:

1. no amplification of voice and no amplified music;
2. no musical instruments;
3. congregation of approximately 25 to 30;
4. apart from one door which was opened and closed during the service, the service is conducted wholly within an air-conditioned building with windows closed;
5. the dominant sounds during the service were:
    a. 6 person choir singing;
    b. priest speaking and ‘chanting’.

Refer Figure 1 for locality plan and monitoring location A, Figure 2 for the existing site plan, Figure 3 for the proposed site plan, Figure 4 for proposed ground floor plan and Figure 5 for proposed first floor plan. The referenced plans were prepared by Studio1 Building, Job number 21154 and dated 17 November 2021.

Figure 1
Locality Plan (Top of the Page is North) and Monitoring Location A

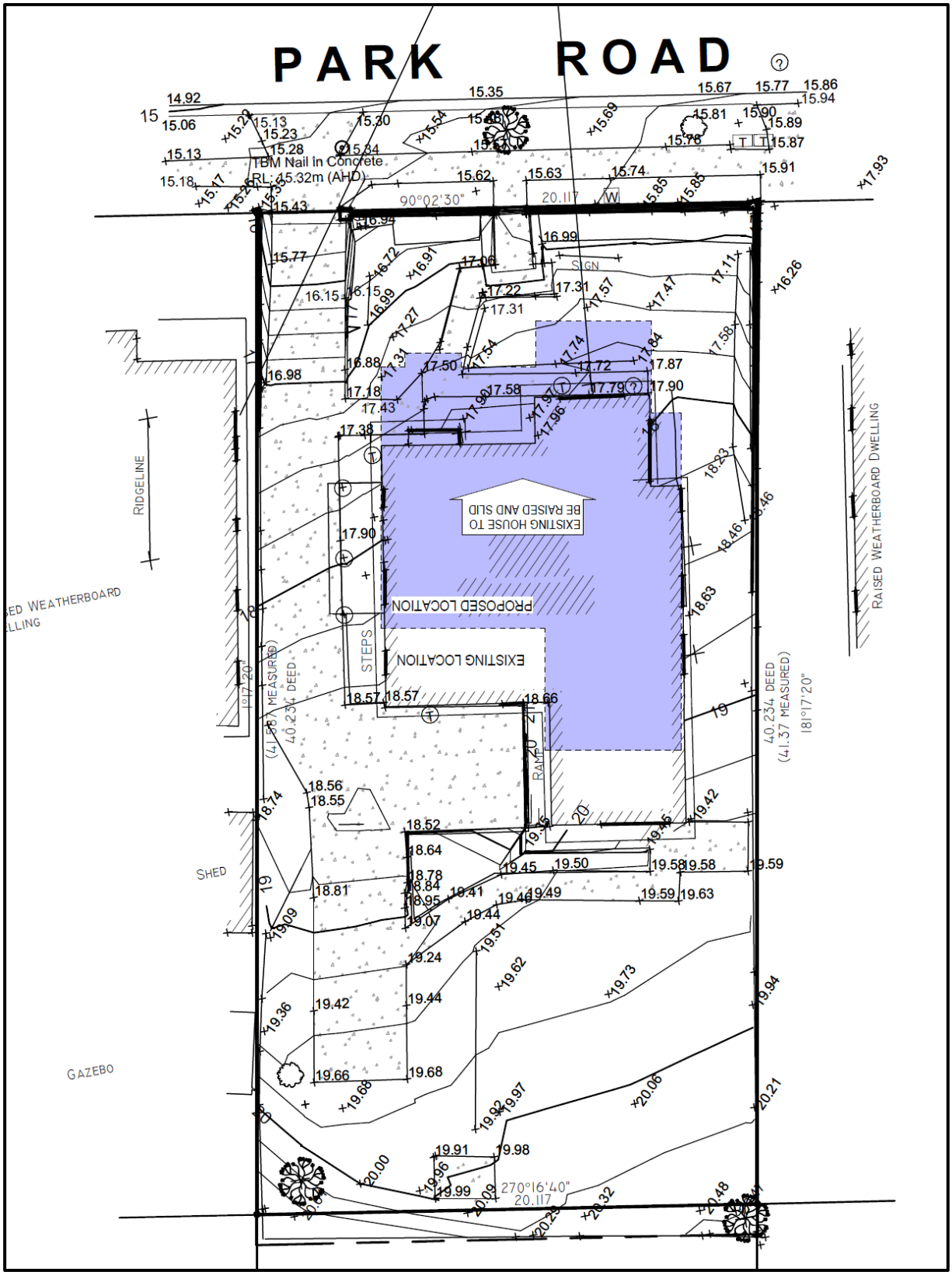


Figure 2
Existing Site Plan

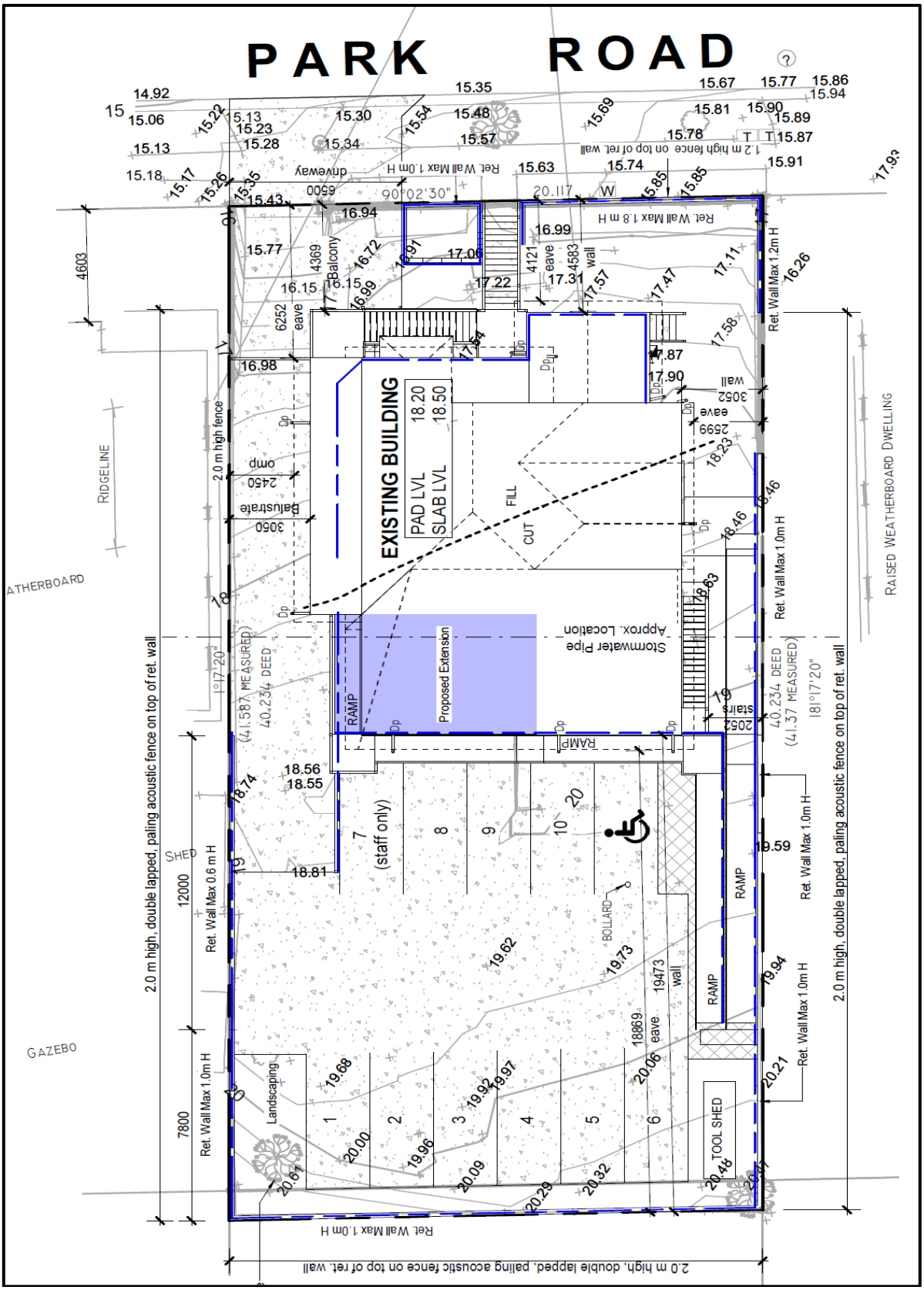


Figure 3
Proposed Site Plan

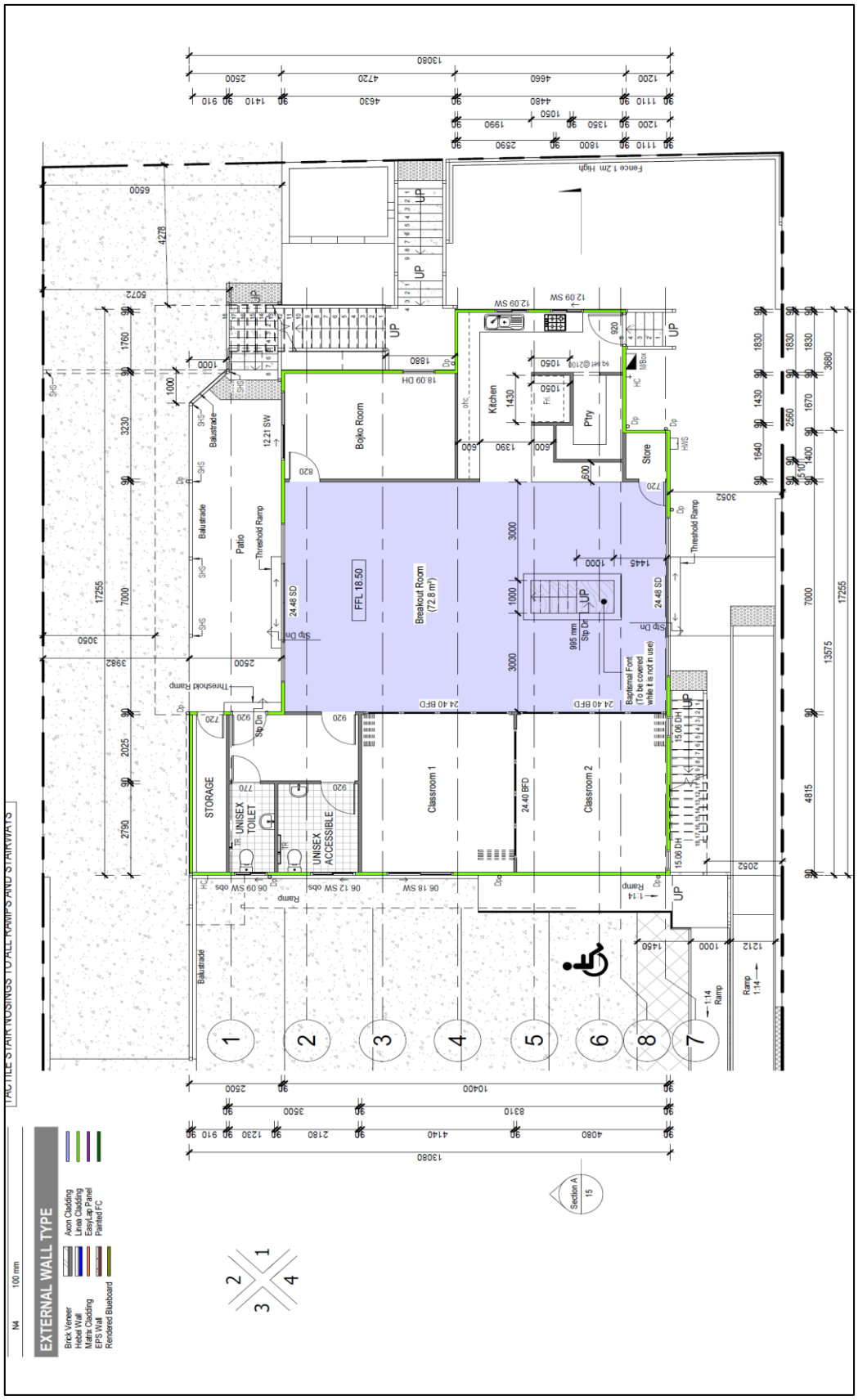


Figure 4
Proposed Ground Floor Plan

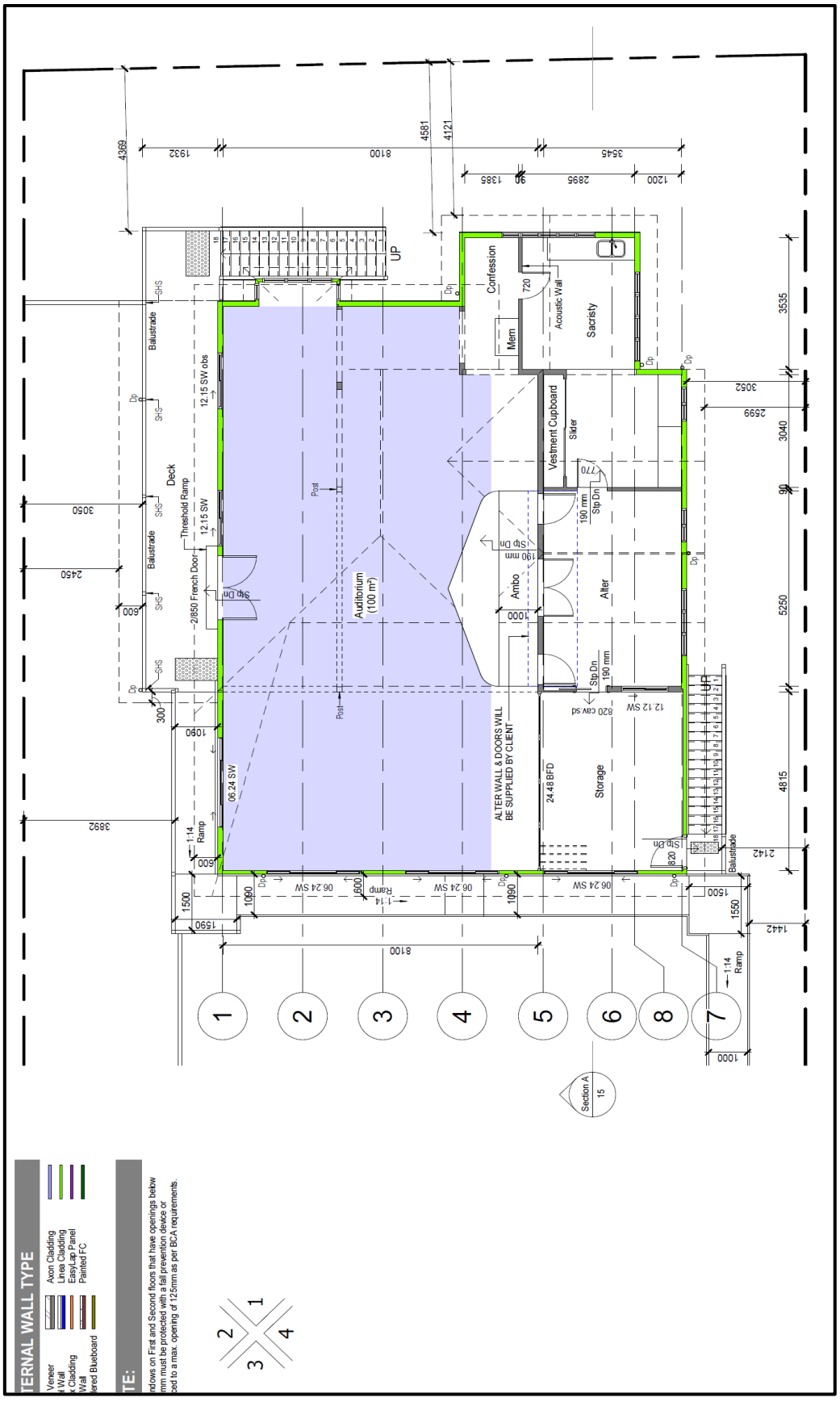


Figure 5
Proposed First Floor Plan

CRITERIA

Measurements and Calculations

All noise level measurements were conducted generally in accordance with the following:

- general requirements of the Queensland environmental protection legislation;
- Environmental Protection (Noise) Policy 2019;
- *Noise Measurement Manual*, Queensland Department of Environment and Heritage Protection, Version 4.01, 10 March 2021;
- Australian Standard AS 1055 - 2018, *Acoustics – Description and measurement of environmental noise*; and
- Brisbane City Council *City Plan 2014*.

Noise Limits

In accordance with the requirements of City Plan 2014 the following should be noted:

Community Facilities Code

In accordance with the Community Facilities Code for the closest residential (Character Residential) the noise limits are:

- *Intrusive Noise Criteria:* $L_{Aeq,adj,T}$ is not greater than the rating background level by more than 3 dB(A), where T = 11 hours for the daytime, 4 hours for the evening and 9 hours for the night-time;

- *Acoustic Amenity Criteria:*
  - *Daytime: 50 dB(A)* $L_{Aeq,adj,11H}$;
  - *Evening: 45 dB(A)* $L_{Aeq,adj,4H}$;
  - *Night-time: 40 dB(A)* $L_{Aeq,adj,9H}$;

- *Night-time Noise Criteria (where the existing* $L_{Aeq,9Hnight}$ *is 45 to 60 dB(A)):*
  - *average of the 15-highest single* L_{Amax} *events is not greater than* $L_{Aeq,9Hnight}$ *+ 5 dB(A);*
  - *absolute maximum noise event is not greater than* $L_{Aeq,9Hnight}$ *+ 10 dB(A).*

AMBIENT NOISE LEVELS

Table 1 details the range and average ambient noise levels at Monitoring Location A, located on the subject site with the microphone elevated 1.6 metres above ground level. The results of this ambient noise assessment are dominated by local and distant traffic and, to a lesser extent, the natural sounds of birds, wind in the vegetation and insects. Refer Figure 1 for further detail of monitoring location A.

For details of measurement equipment, equipment settings, monitoring location and atmospheric conditions for the 7-day period, refer Appendix A, whilst Appendix B details all of the results of the ambient noise level measurements.

With respect to noise the following should be noted:

- daytime: 0700 to 1800 hours;
- evening: 1800 to 2200 hours;
- night-time: 2200 to 0700 hours;

- 'A' weighted: adjustment made by the sound level meter to the measured noise to correspond to the response of the human ear. This adjustment is standardised by international noise standards;
- $L_{Aeq,T}$: the equivalent continuous (or approximately the 'average') 'A' weighted sound pressure level for the measurement period 'T';
- $L_{A1,T}$: the 'A' weighted sound pressure level exceeded for 1% of the measurement period 'T';
- $L_{A10,T}$: the 'A' weighted sound pressure level exceeded for 10% of the measurement period 'T', which is an approximation of the 'average of the maximum noise levels';
- $L_{A90,T}$: the 'A' weighted sound pressure level exceeded for 90% of the measurement period 'T', which is an approximation of the 'average of the minimum noise levels', which is also known as the 'background' noise level;
- RBL: the Rating Background Level is the 10th percentile of the $L_{A90,T}$ background sound levels for the periods daytime, evening and night-time, and is a single figure for each of these time periods.

Table 1
Results of Ambient Noise Assessment, Monitoring Location A

Day	Date	Time	$L_{Aeq,T}$			$L_{A1,T}$			$L_{A10,T}$			$L_{A90,T}$			RBL
			Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum	Average	Average
Tuesday	14.12.21	Day	47.4	64.5	56.2	52.9	79.1	68.6	49.4	62.2	56.5	44.2	52.9	49.5	45.0
		Evening	49.1	61.8	55.5	53.5	70.8	63.9	50.4	63.2	56.8	46.6	59.5	51.6	47.3
		Night	38.0	54.0	48.7	43.5	68.1	59.4	39.8	56.8	50.3	35.6	47.8	43.5	36.7
Wednesday	15.12.21	Day	48.5	57.3	53.7	54.7	66.4	61.3	50.8	58.6	55.4	44.7	54.3	50.1	45.5
		Evening	52.0	69.5	61.1	56.5	71.9	64.9	53.4	71.1	63.2	48.6	67.0	58.2	48.8
		Night	38.1	51.8	48.0	43.1	60.6	54.4	40.0	53.4	49.8	34.2	49.0	44.6	36.3
Thursday	16.12.21	Day	47.8	59.2	54.4	53.2	73.8	62.0	49.9	59.1	56.0	43.8	54.9	51.2	45.5
		Evening	53.1	69.6	62.0	57.2	72.2	65.5	55.0	71.3	63.8	50.2	67.1	59.0	50.8
		Night	40.1	52.4	48.8	46.3	59.5	54.4	42.7	54.3	50.7	35.8	49.8	45.7	38.2
Friday	17.12.21	Day	51.2	61.8	56.5	57.2	68.7	63.5	52.7	67.5	60.2	46.7	54.4	51.3	48.2
		Evening	47.3	67.2	59.2	51.5	69.7	65.4	48.9	68.9	61.7	45.2	64.5	55.0	45.2
		Night	40.0	51.3	47.2	44.1	59.5	53.6	42.0	54.1	49.1	35.8	47.8	43.9	37.2
Saturday	18.12.21	Day	50.4	71.4	58.5	54.7	81.9	67.7	52.4	76.0	61.9	47.1	55.7	52.4	48.2
		Evening	54.8	66.9	59.3	57.9	67.5	64.1	56.5	68.5	61.6	52.3	64.6	56.4	52.6
		Night	40.3	55.0	49.5	45.3	62.3	55.8	42.5	56.7	51.1	36.6	52.8	46.1	37.4
Sunday	19.12.21	Day	44.8	60.6	55.9	51.5	74.0	62.9	47.3	60.5	57.6	39.3	56.3	52.8	46.3
		Evening	54.5	58.8	57.0	58.1	65.9	62.4	56.3	60.5	58.6	51.6	56.7	54.3	52.2
		Night	41.1	59.9	50.1	47.0	74.5	60.4	43.8	56.9	51.2	37.2	51.6	45.2	38.2
Monday	20.12.21	Day	45.7	57.7	53.8	51.8	67.3	60.8	47.5	59.4	55.6	42.3	55.7	50.6	42.9
		Evening	53.7	58.3	56.1	57.3	66.6	61.5	55.4	59.8	57.8	50.7	56.4	53.6	51.1
		Night	44.1	56.7	51.3	50.4	66.7	57.2	46.8	57.7	53.1	38.3	53.9	48.1	39.3
Tuesday	21.12.21	Day	48.0	59.6	55.4	54.5	71.5	62.8	49.7	63.8	57.4	43.9	55.5	52.1	44.6

Average Noise Level

$L_{Aeq,T}$	Daytime	55.6	$L_{A90,T}$	Daytime	51.3
	Evening	58.6		Evening	55.4
	Night-time	49.1		Night-time	45.3
$L_{A1,T}$	Daytime	63.7	RBL	Daytime	45.8
	Evening	64.0		Evening	49.7
	Night-time	56.5		Night-time	37.6
$L_{A10,T}$	Daytime	57.6			
	Evening	60.5			
	Night-time	50.8			

It should be noted that for the ambient noise assessment the only adverse weather conditions, in particular rainfall, was Saturday 18 December – 1.6mm. As this did not adversely impact the ambient noise data, no ambient noise data was excluded from the above averages.

Based on the above RBL levels the noise limits are:

- intrusive noise criteria:
  - daytime: 46 + 3 = 49 dB(A) $L_{Aeq,adj,11H}$;
  - evening: 50 + 3 = 53 dB(A) $L_{Aeq,adj,4H}$;
  - night-time: 38 + 3 = 41 dB(A) $L_{Aeq,adj,9H}$;

- acoustic amenity criteria:
  - daytime: 50 dB(A) $L_{Aeq,adj,11H}$;
  - evening: 45 dB(A) $L_{Aeq,adj,4H}$;
  - night-time: 40 dB(A) $L_{Aeq,adj,9H}$;

- night-time noise criteria:
  - L_{Amax} = 49.1 + 5 = 54 dB(A);
  - Single event maximum = 49.1 + 10 = 59 dB(A).

Based on the above intrusive noise and acoustic amenity criteria the adopted noise limits are:

- daytime: 49 dB(A) $L_{Aeq,adj,11H}$;
- evening: 45 dB(A) $L_{Aeq,adj,4H}$;
- night-time: 40 dB(A) $L_{Aeq,adj,9H}$.

Compliance with the above noise limits will result in compliance with both the intrusive noise and acoustic amenity criteria.

SOURCE NOISE LEVELS

The potential noise sources associated with the Holy Annunciation Orthodox Church are:

- church services, including singing (choir only);
- carpark activity;
- plant and equipment – air-conditioning units.

From the noise assessment conducted of a Holy Annunciation Orthodox Church service within the existing building on Sunday 19 December 2021 (assessment duration was approximately 100 minutes) the following highest noise levels should be noted, at an average distance from the noise source of approximately 3 metres:

- 67 dB(A) $L_{Aeq,adj,T}$;
- 83 dB(A) maximum;
- 77 dB(A) $L_{Amax,T}$.

Noise from the carpark, for up to approximately 30 people and including the noise of vehicles driving in the carpark, doors closing, engines starting and some people laughing and talking, at an average distance of approximately 10 metres (from the centre of the carpark), are as follows:

- 50 dB(A) $L_{Aeq,adj,T}$;
- 60 dB(A) maximum;
- 56 dB(A) $L_{Amax,T}$.

The only plant and equipment associated with the proposed alterations and extensions to the church building are air-conditioning units, with an expected sound power level of 65 dB(A) L_{WAeq} each, for a total of approximately four units.

With all windows of the church closed and just one door opening and closing (predominantly closed) during the church service, the noise reduction provided by the building would be approximately 20 dB(A).

The above source noise levels have been calculated to the closest residential, namely:

- opposite side of Park Road – 164 and 166 Park Road, front boundary;
- adjoining to the west – 159 Park Road, eastern side boundary;
- adjoining to the east – 165 Park Road, western side boundary;
- adjoining to the south – 27 Albert Street, rear boundary.

In accordance with the Community Facility Code (and as indicated on the proposed site plan) a 2.0 metre high acoustic barrier is required for the complete length of the western, southern and eastern boundaries of the subject site. This acoustic barrier is proposed to be an overlapping timber paling fence, 2m high and, for a ground level receptor, providing a noise reduction to the adjoining residential properties of approximately 8 dB(A).

164 and 166 Park Road

At the closest boundary of 164 and 166 Park Road Table 2 details the calculated source noise levels, with due consideration of separation distance and, as appropriate, intervening barriers/buildings.

Table 2
Determination of Noise Impact at Closest Residential Boundary to the North, 164 and 166 Park Road

Noise Source	Time Period	Source Level, dB(A)	Distance, m	Attenuation, dB(A)		Source Level at Receiver, dB(A)	Complies With Limit, Y/N
				Distance	Barrier/inside to outside		
Steady State Noise Sources							
Air-conditioning units (4 of)	Day	54 $L_{Aeq,adj,11H}$ @ 3m	50	34	-	20	Y
	Evening	54 $L_{Aeq,adj,4H}$ @ 3m	50	34	-	20	Y
Combined	Day	$L_{Aeq,adj,11H}$	-	-	-	**20**	**Y**
	Evening	$L_{Aeq,adj,4H}$	-	-	-	**20**	**Y**
Time Varying Noise Sources							
Church service	Day	67 $L_{Aeq,adj,11H}$ @ 3m	35	21	20	36	Y
	Evening	67 $L_{Aeq,adj,4H}$ @ 3m	35	21	20	36	Y
Carpark activity	Day	50 $L_{Aeq,adj,11H}$ @ 10m	50	14	5	31	Y
	Evening	50 $L_{Aeq,adj,4H}$ @ 10m	50	14	5	31	Y
Combined	Day	$L_{Aeq,adj,11H}$	-	-	-	**37**	**Y**
	Evening	$L_{Aeq,adj,4H}$	-	-	-	**37**	**Y**

Based on the source noise levels and calculations detailed in Table 2 the combined noise level of all potential sources associated with the Holy Annunciation Orthodox Church comply with the daytime and evening noise limits at the closest residential boundary to the north – opposite side of Park Road. This compliance is achieved with no additional noise control measures required.

159 Park Road

At the closest (side) boundary of 159 Park Road Table 3 details the calculated source noise levels, with due consideration of separation distance and, as appropriate, intervening barriers/buildings.

Table 3
Determination of Noise Impact at Closest Residential Boundary to the West, 159 Park Road

Noise Source	Time Period	Source Level, dB(A)	Distance, m	Attenuation, dB(A)		Source Level at Receiver, dB(A)	Complies With Limit, Y/N
				Distance	Barrier/inside to outside		
Steady State Noise Sources							
Air-conditioning units (4 of)	Day	54 $L_{Aeq,adj,11H}$ @ 3m	10	11	8	35	Y
	Evening	54 $L_{Aeq,adj,4H}$ @ 3m	10	11	8	35	Y
Combined	Day	$L_{Aeq,adj,11H}$	-	-	-	**35**	**Y**
	Evening	$L_{Aeq,adj,4H}$	-	-	-	**35**	**Y**
Time Varying Noise Sources							
Church service	Day	67 $L_{Aeq,adj,11H}$ @ 3m	10	11	20	36	Y
	Evening	67 $L_{Aeq,adj,4H}$ @ 3m	10	11	20	36	Y
Carpark activity	Day	50 $L_{Aeq,adj,11H}$ @ 10m	10	0	8	42	Y
	Evening	50 $L_{Aeq,adj,4H}$ @ 10m	10	0	8	42	Y
Combined	Day	$L_{Aeq,adj,11H}$	-	-	-	**43**	**Y**
	Evening	$L_{Aeq,adj,4H}$	-	-	-	**43**	**Y**

Based on the source noise levels and calculations detailed in Table 3 the combined time varying noise levels comply with the noise limits for the daytime and evening time periods, at the closest residential boundary to the west. This compliance is achieved with no additional noise control measures required.

165 Park Road

At the closest (side) boundary of 165 Park Road Table 4 details the calculated source noise levels, with due consideration of separation distance and, as appropriate, intervening barriers/buildings.

Table 4
Determination of Noise Impact at Closest Residential Boundary to the East, 165 Park Road

Noise Source	Time Period	Source Level, dB(A)	Distance, m	Attenuation, dB(A)		Source Level at Receiver, dB(A)	Complies With Limit, Y/N
				Distance	Barrier/inside to outside		
Steady State Noise Sources							
Air-conditioning units (4 of)	Day	54 $L_{Aeq,adj,11H}$ @ 3m	10	11	8	35	Y
	Evening	54 $L_{Aeq,adj,4H}$ @ 3m	10	11	8	35	Y
Combined	Day	$L_{Aeq,adj,11H}$	-	-	-	**35**	**Y**
	Evening	$L_{Aeq,adj,4H}$	-	-	-	**35**	**Y**
Time Varying Noise Sources							
Church service	Day	67 $L_{Aeq,adj,11H}$ @ 3m	10	11	20	36	Y
	Evening	67 $L_{Aeq,adj,4H}$ @ 3m	10	11	20	36	Y
Carpark activity	Day	50 $L_{Aeq,adj,11H}$ @ 10m	10	0	8	42	Y
	Evening	50 $L_{Aeq,adj,4H}$ @ 10m	10	0	8	42	Y
Combined	Day	$L_{Aeq,adj,11H}$	-	-	-	**43**	**Y**
	Evening	$L_{Aeq,adj,4H}$	-	-	-	**43**	**Y**

Based on the source noise levels and calculations detailed in Table 4 the combined time varying noise levels comply with the noise limits for the daytime and evening time periods, at the closest residential boundary to the east. This compliance is achieved with no additional noise control measures required.

27 Albert Street

At the closest (northern) boundary of 27 Albert Street Table 5 details the calculated source noise levels, with due consideration of separation distance and, as appropriate, intervening barriers/buildings.

Table 4
Determination of Noise Impact at Closest Residential Boundary to the East, 165 Park Road

Noise Source	Time Period	Source Level, dB(A)	Distance, m	Attenuation, dB(A)		Source Level at Receiver, dB(A)	Complies With Limit, Y/N
				Distance	Barrier/inside to outside		
Steady State Noise Sources							
Air-conditioning units (4 of)	Day	54 $L_{Aeq,adj,11H}$ @ 3m	18	16	8	30	Y
	Evening	54 $L_{Aeq,adj,4H}$ @ 3m	18	16	8	30	Y
Combined	Day	$L_{Aeq,adj,11H}$	-	-	-	**30**	**Y**
	Evening	$L_{Aeq,adj,4H}$	-	-	-	**30**	**Y**
Time Varying Noise Sources							
Church service	Day	67 $L_{Aeq,adj,11H}$ @ 3m	10	11	20	36	Y
	Evening	67 $L_{Aeq,adj,4H}$ @ 3m	10	11	20	36	Y
Carpark activity	Day	50 $L_{Aeq,adj,11H}$ @ 10m	10	0	8	42	Y
	Evening	50 $L_{Aeq,adj,4H}$ @ 10m	10	0	8	42	Y
Combined	Day	$L_{Aeq,adj,11H}$	-	-	-	**43**	**Y**
	Evening	$L_{Aeq,adj,4H}$	-	-	-	**43**	**Y**

Based on the source noise levels and calculations detailed in Table 5 the combined time varying noise levels comply with the noise limits for the daytime, evening and night-time time periods, at the closest residential boundary to the south.

NOISE CONTROL

To comply with the noise limits at all of the closest residential to the Holy Annunciation Orthodox Church at 163 Park Road, Woolloongabba, no additional noise control measures are required.

In accordance with the Community Facility Code a 2 metre high acoustic barrier is required for the western, southern and eastern boundaries of the subject site and this is adequate to control all potential noise sources to the noise limits.

The above noise control measures are based on the assumed number and location of the air-conditioning units. Once the actual location for the air-conditioning units, together with their associated noise levels, are known, the acoustic consultant should re-calculate noise impact. If any of the noise limits are exceeded then the acoustic consultant should nominate suitable additional noise control measures.

CONCLUSIONS

The subject site is located at 163 Park Road, Woolloongabba and the existing building is currently being used for Holy Annunciation Orthodox Church services, between 0700 and 2200 hours. It is proposed that this use will continue (and the daytime and evening usage will be maintained), but it is proposed to raise the current building, move is slightly, and modify and extend the building. Potential noise impacts from the subject site are:

- church services, including singing (choir only);
- carpark activity;
- plant and equipment – air-conditioning units.

To assess current ambient noise levels a 7-day assessment was conducted from monitoring location A, on the subject site adjacent to the southern boundary with the microphone elevated approximately 1.6 metres. At this monitoring location the dominant noise source was local and distant traffic, as well as the natural sounds of birds, wind in the vegetation and insects.

From the results of the ambient noise assessment the Rating Background Level was calculated and in accordance with the Community Facility Code the noise limits determined relative to all of the closest residential, namely:

- opposite side of Park Road – 164 and 166 Park Road, front boundary;
- adjoining to the west – 159 Park Road, eastern side boundary;
- adjoining to the east – 165 Park Road, western side boundary;
- adjoining to the south – 27 Albert Street, rear boundary.

Source noise levels for a church service were based on an actual assessment of a service at the subject site on Sunday 19 December 2021, with the duration of this assessment being 100 minutes, to include the whole service. With respect to the service the following should be noted:

- no amplification of voice and no amplified music;
- no musical instruments;
- congregation of approximately 25 to 30;
- apart from one door which was opened and closed during the service, the service is conducted wholly within an air-conditioned building with windows closed;
- the dominant sounds during the service were:
    - 6 person choir singing;
    - priest speaking and ‘chanting’.

Carpark and air-conditioning source noise levels were based on data already held by the consultant.

Source noise levels were calculated to the closest boundary of the closest residences, with the results of these calculations and the combined steady state and time varying noise levels compared to the noise limits in Tables 2 to 5 inclusive for the closest residences at 159, 164, 165 and 166 Park Road and 27 Albert Street respectively.

All daytime and evening noise limits are complied at the closest boundary of all of the closest residential to the subject site, with no additional noise control measures required. It should be noted that in accordance with the Community Facility Code a 2 metre high acoustic barrier is required for the western, southern and eastern boundaries of the subject site and this is as shown on the site plan and is adequate to control all potential noise sources to the noise limits.

The noise impact assessment is based on the assumed number and location of the air-conditioning units. Once the actual location for the air-conditioning units, together with their associated noise levels, are known, the acoustic consultant should re-calculate noise impact. If any of the noise limits are exceeded then the acoustic consultant should nominate suitable additional noise control measures.

RECOMMENDATION

It is recommended that, from an environmental noise perspective, the proposed alterations and extensions to the Holy Annunciation Orthodox Church at 163 Park Road, Woolloongabba be approved, provided that the noise control measures detailed in this report are incorporated into this development.

APPENDIX A: NOISE LEVEL MEASUREMENT EQUIPMENT

Measurement Equipment

The following equipment was used to conduct the ambient noise level study at Monitoring Location A:

- Bruel and Kjaer Type 2260 Observer Hand Held Sound Analyzer – Serial No. 2487423, with Type BZ 7131, BZ 7132 and BZ 7133 Software and Prepolarised free-field ½" microphone, Type 4189, Serial No. 2469624;
- Bruel and Kjaer Type 3592 outdoor microphone kit, including Type UA1404 outdoor microphone;
- Bruel and Kjaer Type AO 0442 ten metre microphone extension cable; and
- Bruel and Kjaer Type 4231 Sound Level Calibrator, Serial No. 2292736.

All of the above equipment is Type 1 in accordance with the requirements of Australian Standard AS 1259-1990, *Acoustics – Sound Level Meters*, as required by Australian Standard AS 1055-2018.

Measurement Equipment Settings

The above equipment was used with the following settings:

- Detector: RMS
- Time Weighting: FAST
- Frequency Weighting: A
- Sound Incidence: FRONTAL
- Microphone sensitivity: -28.0 dB

Calibration

The sound level meter was calibrated to the required value of 93.8 dB at 1000 Hz immediately before and after the noise level measurements were conducted. At no time was an adjustment of more than ±0.5 dB required. This complies with the requirements of the Australian Standard.

Monitoring Location

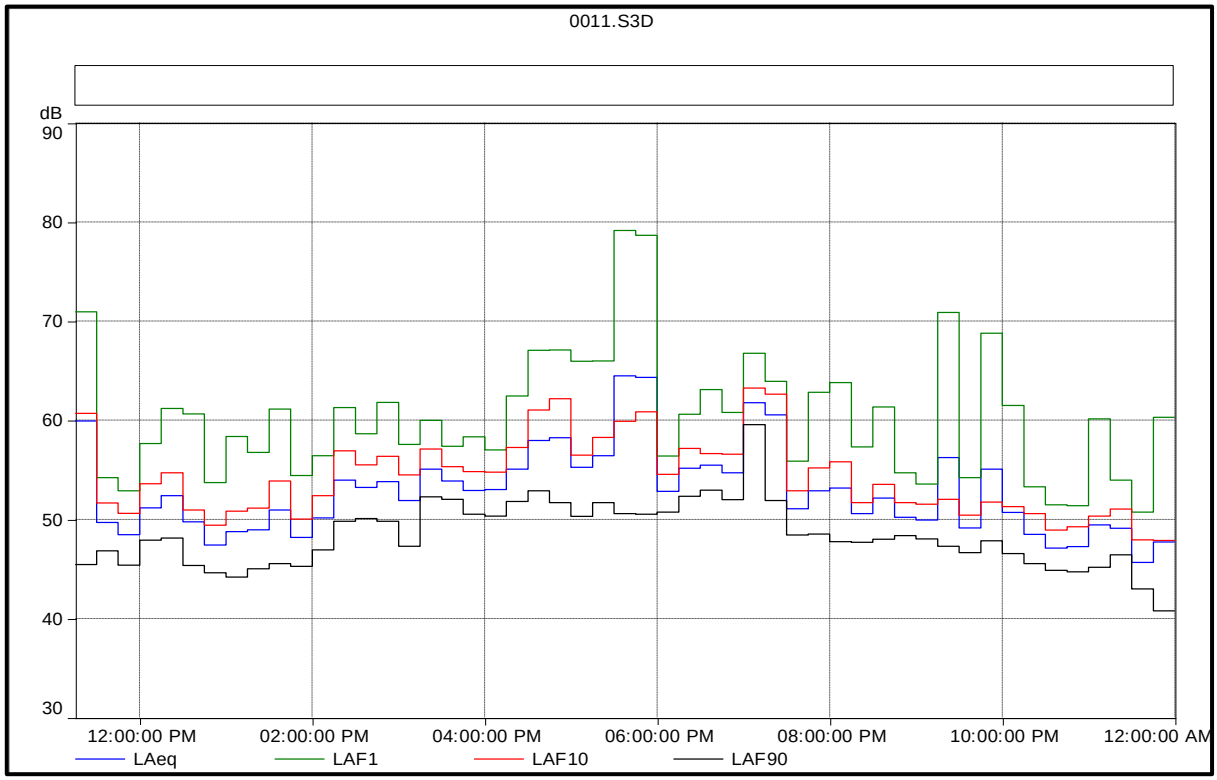
Monitoring Location A was on the subject site adjacent to the southern boundary and adjacent to the south-west corner of the property, with the microphone elevated 1.6 metres above ground level. Refer Figure 1 for further detail.

Atmospheric Conditions

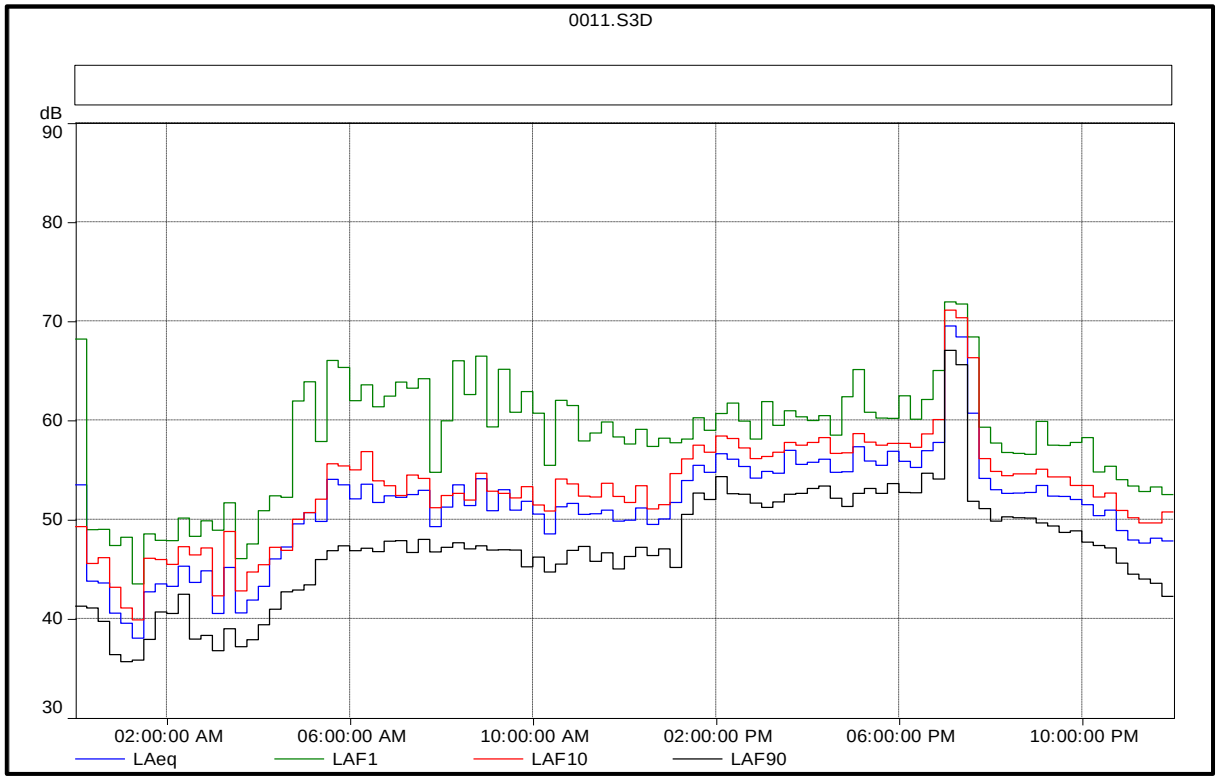
Throughout the ambient noise assessment atmospheric conditions generally complied with the requirements of the Australian Standard. Refer Appendix C for further details.

APPENDIX B: DETAILED RESULTS OF NOISE LEVEL MEASUREMENTS

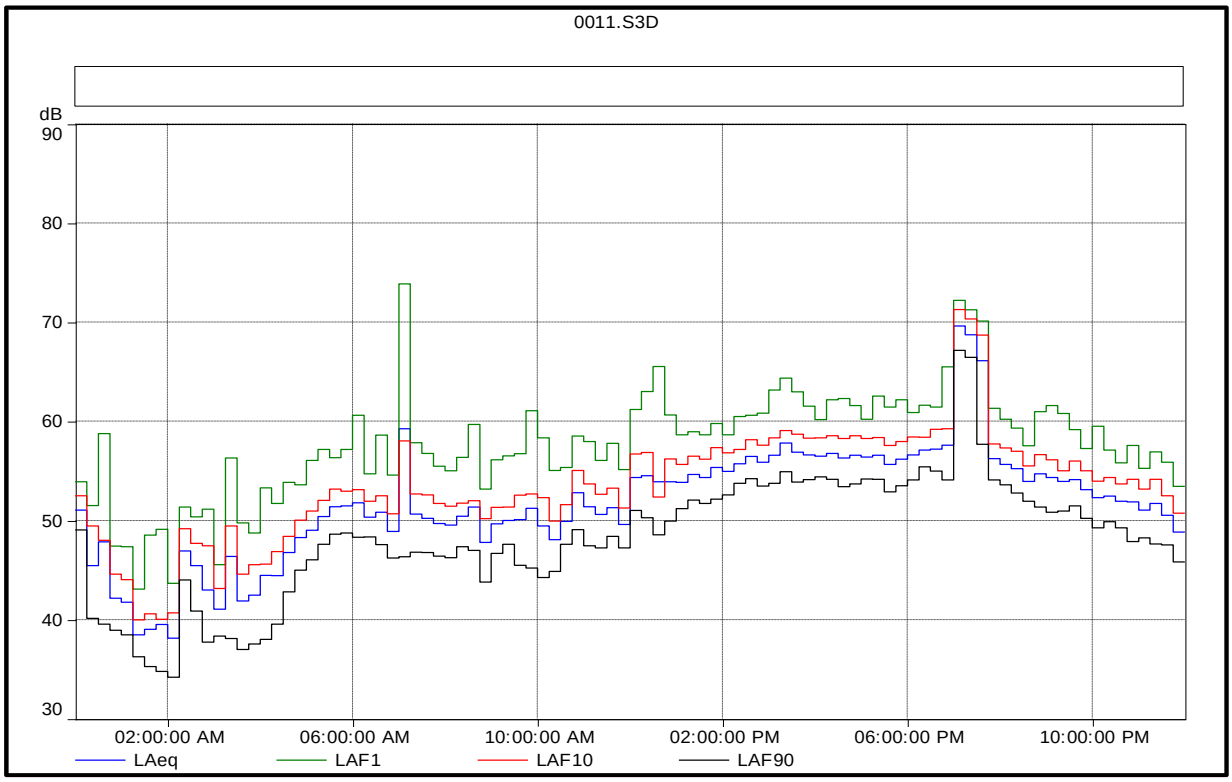
Instrument:		2260
Application:		BZ7219 version 1.2
Start Time:		14/12/2021 11:15:08 AM
End Time:		22/12/2021 10:59:12 AM
Elapsed Time:		191:44:04
Bandwidth:		1/3 Octave
Peaks Over:		140.0 dB
Range:		32.0-112.0 dB
	Time	Frequency
Broad-band measurements:	S F I	A C
Broad-band statistics:	F	A
Octave measurements:	F	L
	Logging	
Log Rate:	0:15:00	
Broadband Parameters:	All	
Spectrum Parameters:	All	
Instrument Serial Number:		2487423
Microphone Serial Number:		
Input:		Microphone
Windscreen Correction:		None
S. I. Correction:		Frontal
Calibration Time:		14/12/2021 11:02:27 AM
Calibration Level:		94.0 dB
Sensitivity:		-28.0 dB
ZF0023:		Not used



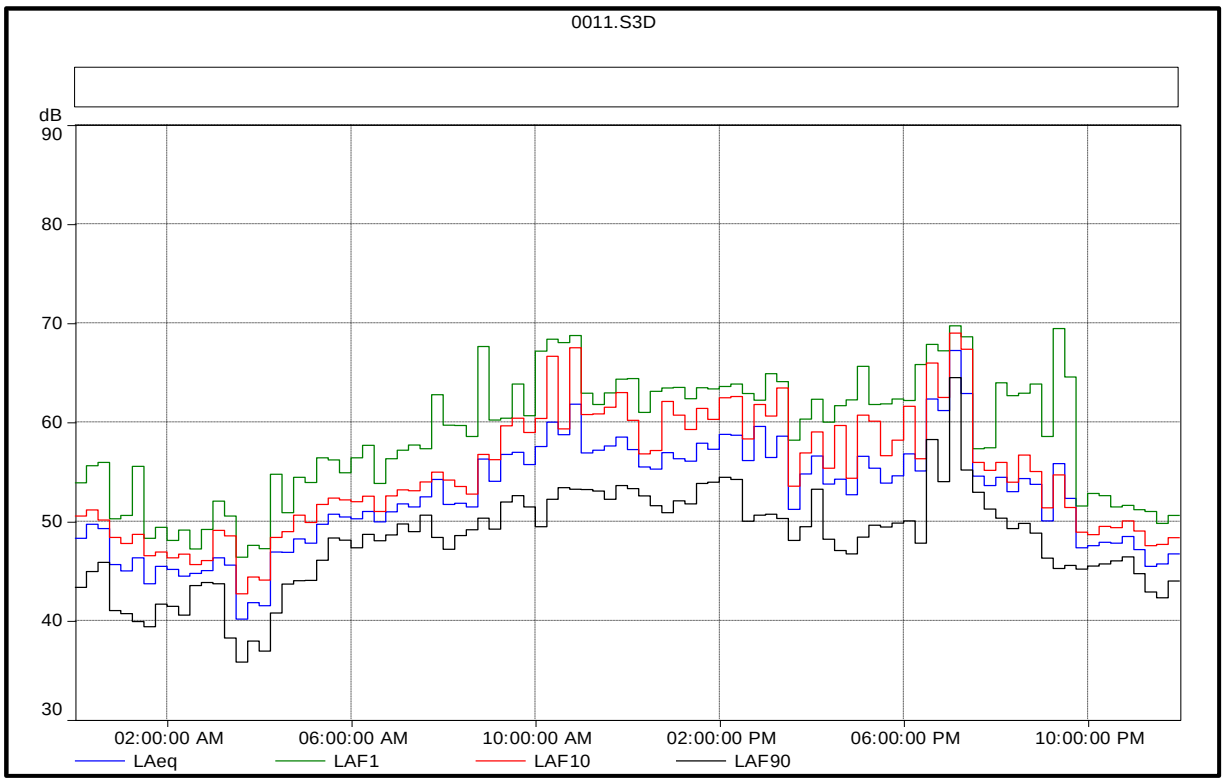
Day 1
Tuesday 14 December 2021 from 1115 hours



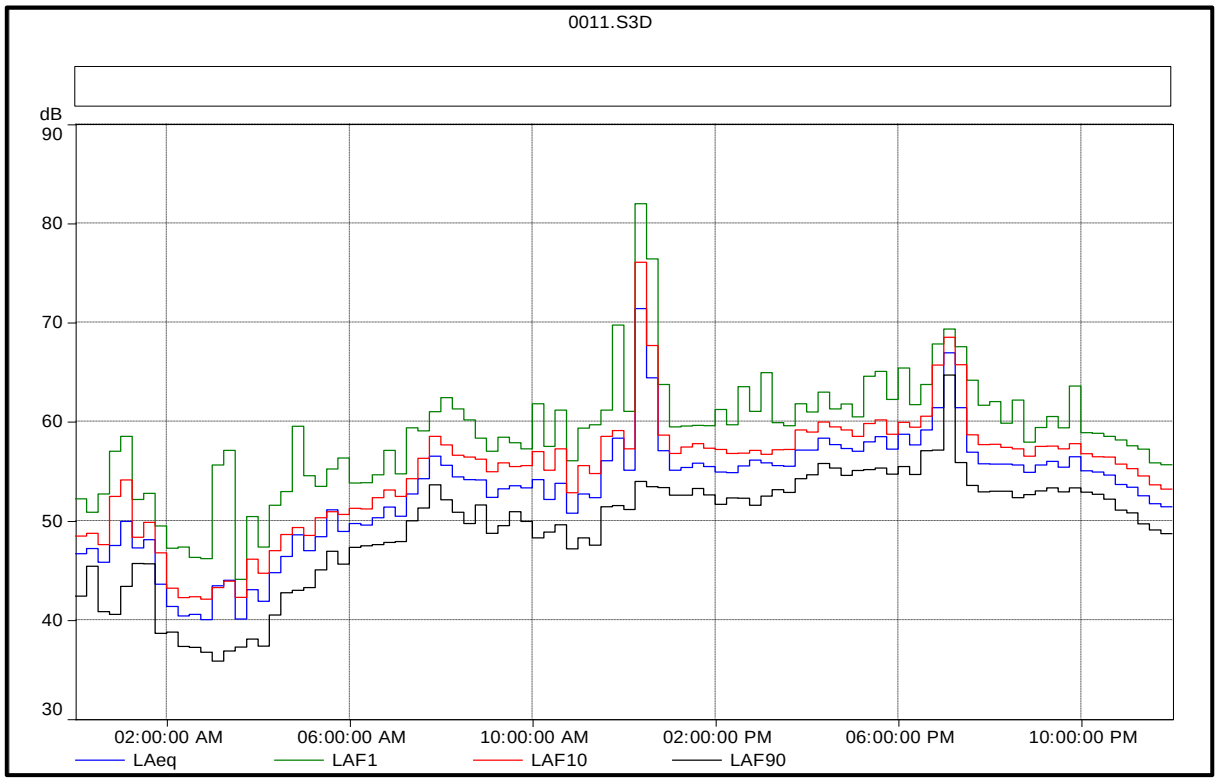
Day 2
Wednesday 15 December 2021



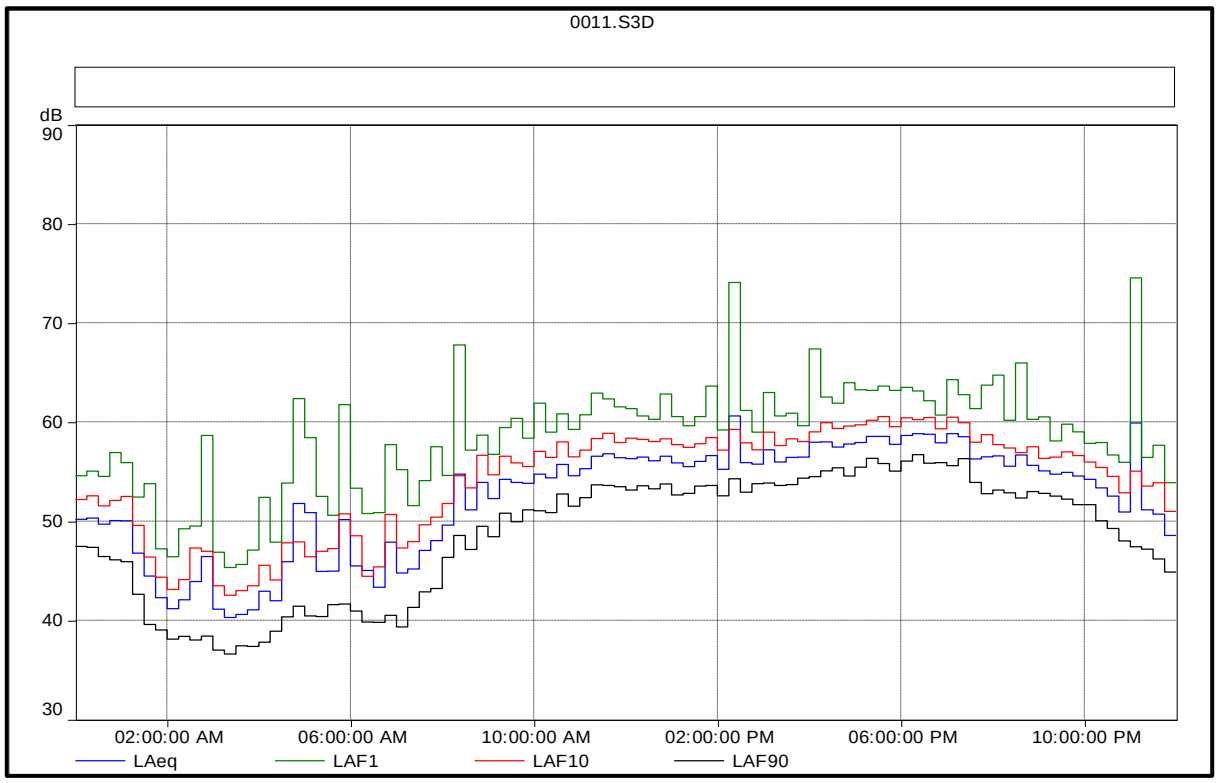
Day 3
Thursday 16 December 2021



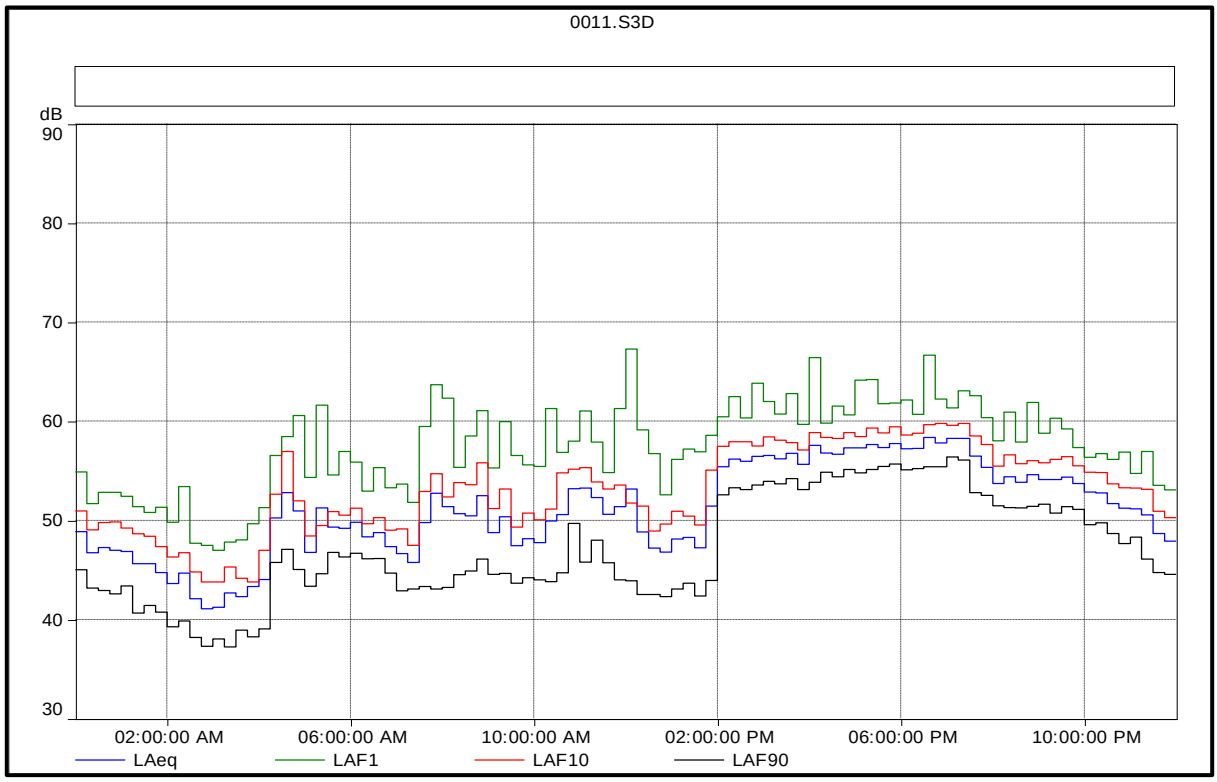
Day 4
Friday 17 December 2021



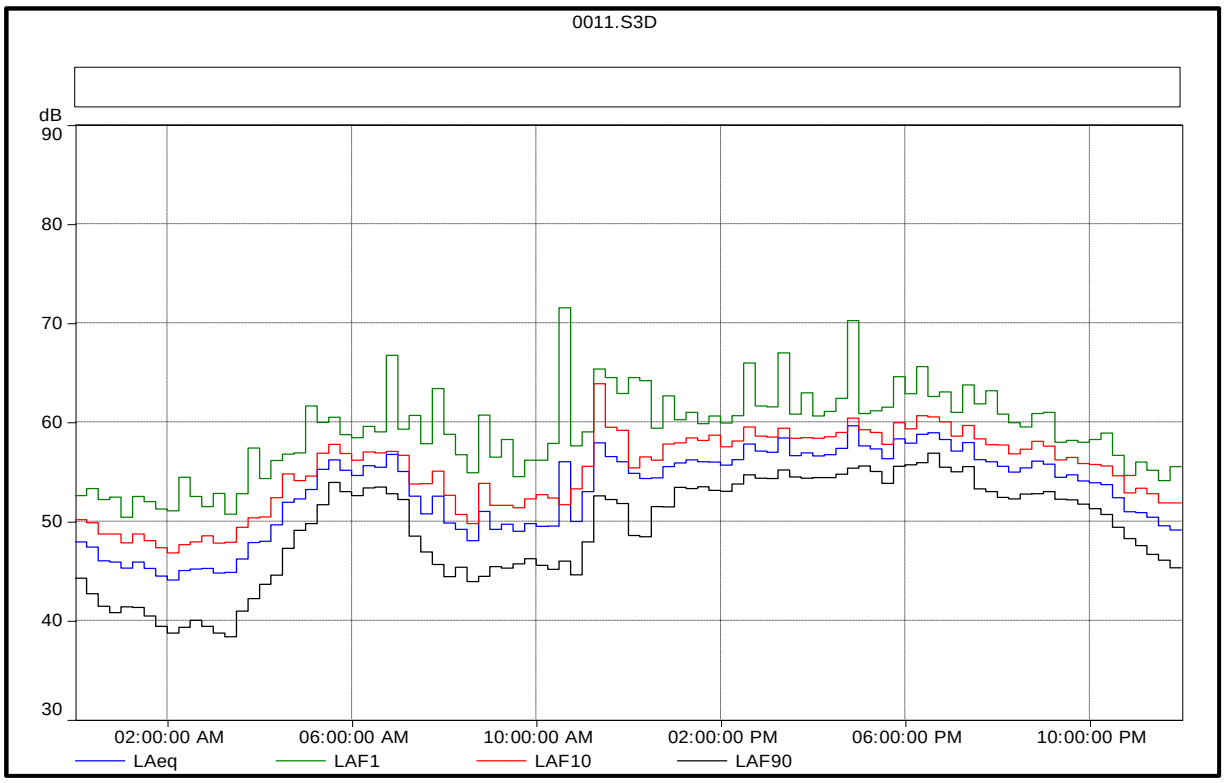
Day 5
Saturday 18 December 2021



Day 6
Sunday 19 December 2021



Day 7
Monday 20 December 2021



Day 8
Tuesday 21 December 2021

APPENDIX C: ATMOSPHERIC CONDITIONS FOR BRISBANE FOR DECEMBER 2021

Australian Government
Bureau of Meteorology

Brisbane, Queensland
December 2021 Daily Weather Observations

Most observations from Brisbane City, but some from Brisbane Airport.

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm						
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	We	20.8	26.7	75.4		1.0	E	17	17:51	22.3	91	8	SSW	4	1013.1	23.5	86	8		Calm	1011.0
2	Th	21.8	29.5	5.2		8.6	E	19	14:56	26.5	69	5	SSE	4	1013.2	27.5	66	6	E	9	1010.7
3	Fr	21.2	30.4			12.5	ESE	24	16:49	27.6	59	4	SE	7	1014.8	29.7	58	2	E	11	1012.2
4	Sa	20.4	30.1			10.7	S	46	19:30	27.6	59	2	NE	6	1013.2	29.5	53	1	NE	7	1008.8
5	Su	18.9	27.9			12.1	ESE	31	14:06	24.4	65	7	S	7	1014.6	26.9	53	3	ESE	11	1013.0
6	Mo	18.6	28.1			8.8	E	28	11:55	23.6	72	4	WSW	6	1016.3	26.1	61	6	ENE	15	1013.2
7	Tu	20.2	28.4			6.5	ENE	20	15:15	25.9	67	7	E	7	1014.0	26.9	63	5	ENE	11	1011.7
8	We	21.7	29.3			3.6	S	33	14:52	26.2	65	8	WNW	4	1013.2	23.4	66	8	S	17	1012.1
9	Th	19.6	32.0			11.2	WNW	33	18:48	26.3	55	1	WSW	6	1010.4	28.9	63	3	NNE	7	1005.8
10	Fr	20.0	31.5	17.8		11.5	W	28	13:45	26.6	65	3	WSW	6	1008.7	30.3	39	3	W	13	1005.6
11	Sa	17.7	30.1			13.2	E	28	13:00	26.4	38	0	SW	7	1011.5	26.9	51	3	E	15	1009.4
12	Su	20.4	28.1	0		12.5	E	28	13:18	25.7	60	4	ESE	6	1014.3	26.2	55	1	E	13	1011.6
13	Mo	19.9	27.9	0		11.6	E	28	15:17	26.3	56	3	SE	6	1013.2	26.4	58	1	E	15	1009.9
14	Tu	19.3	31.1	0		12.9	E	26	17:06	26.3	49	1	SSE	4	1012.6	29.1	41	1	E	11	1009.0
15	We	18.7	30.5	0			E	20	16:20	25.8	51	1	SW	6	1012.9	28.9	47	1	E	9	1009.9
16	Th	19.9	31.1	0			ENE	20	15:41	26.8	59	2	SSE	2	1012.3	29.7	39	6	ENE	9	1010.3
17	Fr	20.9	29.8	0		8.9	NE	22	10:30	27.7	57	4	E	9	1015.8	25.5	69	6	ESE	11	1013.9
18	Sa	20.4	29.7	1.6		12.9	ENE	22	17:33	27.2	59	3	ENE	6	1018.2	28.3	55	1	ENE	11	1015.2
19	Su	19.2	29.7	0			ENE	24	12:04	27.1	57	3	E	2	1017.4	29.2	45	1	N	9	1013.4
20	Mo	21.7	33.3	0			NNE	22	18:12	28.0	57	7	WSW	2	1015.2	30.9	54	7	NNE	9	1012.0
21	Tu	23.2	32.5	0			ENE	24	15:24	29.5	51	7	NW	2	1014.8	31.1	55	7	NNE	7	1011.2
22	We	22.2	31.5	0		12.1	NNE	26	15:50	28.3	55	2	WNW	4	1011.9	30.3	48	6	ENE	11	1008.0
23	Th	21.2	31.1	0		9.3	SSE	31	14:23	27.8	61	7	E	4	1011.1	23.8	90	7	N	6	1009.6
24	Fr	22.5	31.6	17.0			E	37	13:06	27.6	73	5	WSW	6	1012.0	25.2	73	7	ESE	9	1009.3
25	Sa	22.8	30.0	0			ENE	33	13:26	27.0	65	7	SSE	6	1012.4	24.4	83	8	NE	4	1010.5
26	Su	20.8	28.4	7.6		3.0	E	26	12:34	25.8	74	7	S	6	1012.3	27.1	62	7	ESE	7	1009.5
27	Mo	21.3	28.9	0		4.3	SE	24	16:44	27.8	59	7	SSE	7	1010.1	22.1	87	8	S	7	1008.0
28	Tu	19.6	25.7	14.6		1.7	SE	44	12:05	23.3	60	8	SSE	15	1012.9	24.7	50	8	SE	19	1012.0
29	We	19.1	26.9	0		2.7	SE	35	17:02	23.6	59	8	SE	9	1014.1	24.8	56	7	ESE	11	1011.9
30	Th	17.8	27.7	0		7.7	E	33	14:05	22.6	65	7	SSE	7	1014.6	25.4	55	5	ESE	13	1012.9
31	Fr	18.9	25.6	0		2.2	E	35	13:24	24.7	62	8	SE	11	1013.8	24.0	72	8	E	11	1011.7
Statistics for December 2021																					
Mean		20.3	29.5			8.4				26.2	61	4		5	1013.4	27.0	59	4		10	1010.8
Lowest		17.7	25.6			1.0				22.3	38	0	#	2	1008.7	22.1	39	1		Calm	1005.6
Highest		23.2	33.3	75.4		13.2	S	46		29.5	91	8	SSE	15	1018.2	31.1	90	8	SE	19	1015.2
Total				139.2		201.5															

Temperature, humidity, wind, pressure and rainfall observations are from Brisbane (station 040913). Cloud, evaporation and sunshine observations are from Brisbane Aero (station 040842)

Brisbane Airport is located about 12 kilometres north east of the Brisbane City site, and closer to the coast. The evaporation, sunshine and cloud values should be used as a guide only.

IDCJDW4019.202112 Prepared at 13:01 UTC on 7 Jan 2022