

MOAMA BOWLING CLUB - ALTERATIONS AND ADDITIONS

DA Acoustic Assessment

16 November 2022

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TN006-01F01 DA Acoustic Report (r0)

Document details

Detail	Reference
Doc reference:	TN006-01F01 DA Acoustic Report (r0)
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Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Authorised
16/11/22	Final		0	S. Khan	T. Taylor	Y. Kalkunte

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Supplementary professional advice should be sought in respect of these issues.

Contents

1	Introduction	1
2	Acoustic Assessment Methodology	2
3	Project Description	3
3.1	Site Description	3
3.2	Surrounding Sensitive Receivers	4
4	Existing Noise Environment	6
5	Noise Emission Criteria and Project Noise Goals	7
5.1	Murray River Council	7
5.2	Liquor & Gaming NSW	7
5.2.1	Activity noise emission goals (residential receivers)	8
5.3	Noise Policy for Industry	9
5.3.1	Project intrusiveness noise levels	9
5.3.2	Project amenity noise levels	9
5.3.3	NPfI project noise trigger levels (activity noise to motel premises and operational noise emissions from building services plant and equipment)	10
6	Noise Emission Assessment	12
6.1	Assumptions	12
6.2	Prediction Methodology	13
6.3	Noise Emission Predictions	13
6.3.1	Predicted noise levels at residential receivers	14
6.3.2	Predicted noise levels at motel receiver	15
7	Recommendations	16
7.1	Activity Noise	16
7.1.1	Summer House	16
7.1.2	Alfresco sports bar	17
7.1.3	Alfresco gaming	17
7.2	Building Services Plant and Equipment	18
8	Conclusion	19
APPENDIX A	Glossary of terminology	20

List of tables

Table 1:	Assessment locations	5
Table 2:	Average background noise levels (AS 1055-1997 – Part 3)	6
Table 3:	Octave band centre frequency background noise levels	8
Table 4:	Operational noise goals for residential premises (activity noise)	8
Table 5:	Project intrusiveness noise trigger levels	9

Table 6:	Project amenity noise trigger levels	10
Table 7:	NPfI project noise trigger levels (activity noise to motel premises and noise emissions from building services plant and equipment)	11
Table 8:	Assumed source noise levels	12
Table 9:	Building envelope acoustic performance	12
Table 10:	Predicted cumulative activity noise emissions for Scenario 1 (up until 10pm)	14
Table 11:	Predicted cumulative activity noise emissions for Scenario 2 (10pm to 12:00am midnight)	14
Table 12:	Predicted cumulative activity noise emissions for Scenario 3 (12:00am midnight to 02:00am)	15
Table 13:	Predicted cumulative activity noise emissions at Moama Motel (H1)	15
Table 14:	Minimum insertion loss of acoustic louvre to exiting gaming areas	17

List of figures

Figure 1:	Proposed bowling club modifications	3
Figure 2:	Alfresco gaming extension and solid wall	3
Figure 3:	Proposed roof retractable awning above alfresco sports bar	4
Figure 4:	Site and receiver locations	5

1 Introduction

Renzo Tonin & Associates was engaged to undertake an operational noise assessment to support the Development Application (DA) for the proposed modifications and additions at Moama Bowling Club, 6 Shaw St, Moama.

The proposed alterations are in following areas:

- New club entry
- New Summer House multi-purpose space with outdoor area
- New alfresco sports bar (extension of the existing enclosed sports bar)
- Extension to the existing alfresco gaming area

The main aspects with respect to noise emissions will be:

- Activity noise (patron and music) from Summer House and associated outdoor area
- Activity noise (gaming machines, music and patrons) from alfresco gaming extension
- Activity noise (patron, TV audio and music) from new alfresco sports bar

This report quantifies noise emission associated with these activities and assesses operational noise impacts to nearby sensitive receivers, in accordance with the noise requirements of the Murray River Council and the standard noise condition under the Liquor & Gaming NSW (L&GNSW). Where necessary, building and/or noise management recommendations will be provided to ensure compliance with noise requirements.

2 Acoustic Assessment Methodology

In order to assess the potential noise impacts from subject proposal the following methodology was used:

- Identify surrounding sensitive land uses and potentially nearest affected receiver locations
- Establish existing background noise levels at the identified nearest affected receiver locations
- Use background noise levels to establish noise goals in accordance with relevant noise provisions
- Using predictive noise modelling to determine the extent of operational noise impacts associated with the subject proposal
- Identify if cumulative noise emissions exceed the relevant criteria, and
- Where noise emissions are predicted to exceed the project criteria, provide recommendations and management controls to achieve compliance.

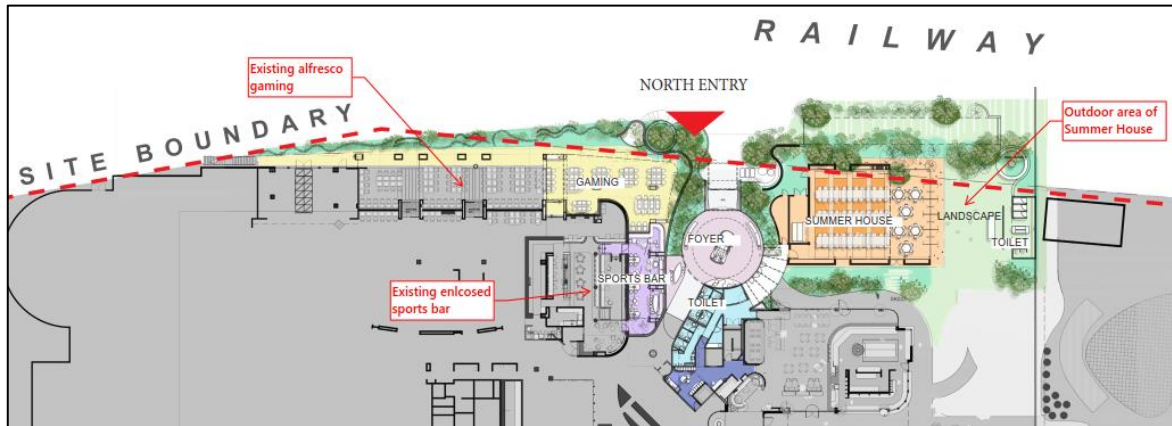
3 Project Description

3.1 Site Description

The site is called Moama Bowling Club and is located at 6 Shaw St, Moama.

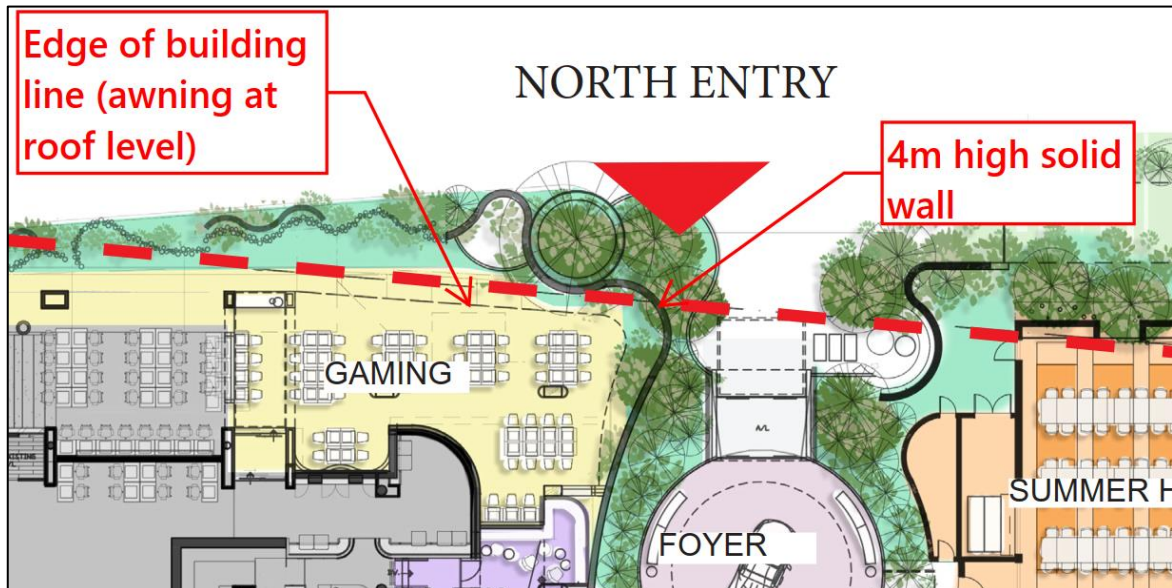
The proposed modifications to the existing bowling club are depicted below in Figure 1.

Figure 1: Proposed bowling club modifications



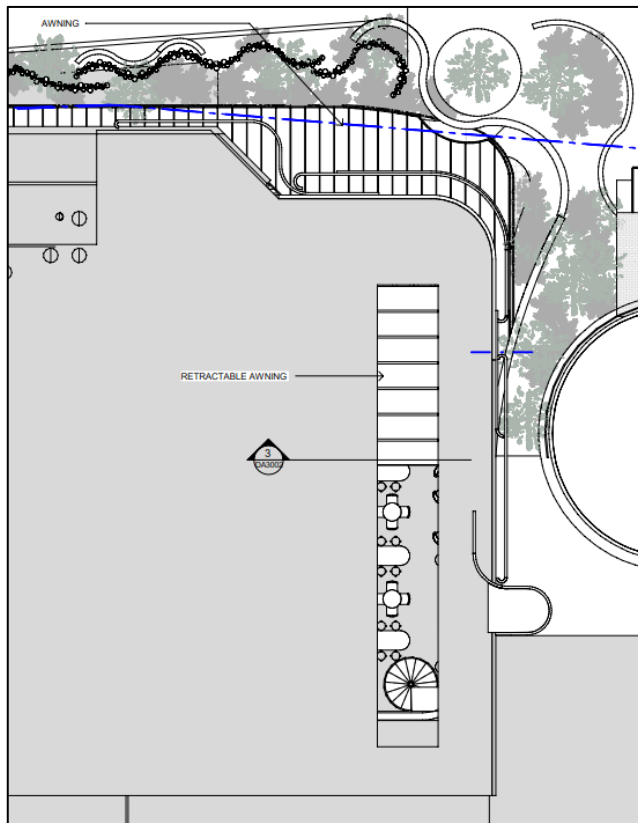
- The proposed gaming area extension is open along the railway frontage and to the north-east. A solid 4m high wall envelopes the north-east section of the extension and is illustrated below.

Figure 2: Alfresco gaming extension and solid wall



The new alfresco sports bar extension is completely enclosed, except for a new retractable awning proposed on the roof. This awning also extends into the new alfresco gaming area as illustrated in Figure 3.

Figure 3: Proposed roof retractable awning above alfresco sports bar



The proposed patron capacities for the additions and extensions are as follows:

- Summer House – 104 patrons
- Alfresco sports bar – 60 patrons
- Alfresco gaming extension – 41 patrons

No change is proposed to the current hours of operations, which are as follows:

- Sunday to Thursday – 10am to 1am
- Fridays and Saturdays – 10am to 2am

3.2 Surrounding Sensitive Receivers

The site is surrounded by a mix of residential and commercial premises. The potentially nearest affected noise sensitive receivers include the single storey residence at 25 Blair St, Moama (to the north-east) and the double storey residence at 2 Simms St, Moama (to the south-east).

A summary of surrounding sensitive receivers considered in this assessment are outlined in Table 1 and illustrated in Figure 4.

Table 1: Assessment locations

ID	Address	Description
R1	25 Blair St, Moama	Single storey residence located approx. 120m to the north-east of the project scope
R2	2 Simms St, Moama	Double storey residence located approx. 100m to the south-east of the project scope
R3	40 Blair St, Moama	Double storey residence located approx. 140m to the north-east of the project scope
H1	Moama Motel, 13-15 Meninya St, Moama	Double-storey motel located approx. 55m to the north-west of the project scope

Figure 4: Site and receiver locations

4 Existing Noise Environment

As the noise environment of an area almost always varies over time, background and ambient noise levels need to be determined for the operational times of the proposed development. For example, in a suburban or urban area, the noise environment is typically at its minimum at 3:00am in the morning and at its maximum during the morning and afternoon traffic peak hours.

The NSW Environmental Protection Authority's (EPA) *Noise Policy for Industry* (NPf) outlines the following standard time periods over which the background and ambient noise levels are to be determined:

- Day: 07:00-18:00 Monday to Saturday and 08:00-18:00 Sundays & Public Holidays
- Evening: 18:00-22:00 Monday to Sunday & Public Holidays
- Night: 22:00-07:00 Monday to Saturday and 22:00-08:00 Sundays & Public Holidays

The measurement of existing background levels was not possible due to ongoing floods and evacuations due to floods in Moama. Therefore, background noise levels utilised for this assessment are based on the estimated average background A-weighted noise levels depicted in Appendix A of the AS 1055.3-1997 '*Acoustics – Description and measurement of environmental noise – Part 3: Acquisition of data pertinent to land use*'.

This standard provides a guideline of typical average background noise levels for different areas containing residences in Australia, with noise area category 2 relevant to the subject site and presented in Table 2 below. By adopting these minimum levels, a conservative assessment is provided.

Table 2: Average background noise levels (AS 1055-1997 – Part 3)

Description of neighbourhood	Time of Day	Average background noise level dB(A)
Areas with low density transportation	Day	45
	Evening	40
	Night	35

Notes: Day: 07:00-18:00 Monday to Saturday and 09:00-18:00 Sundays & Public Holidays
 Evening: 18:00-22:00 Monday to Sunday & Public Holidays
 Night: 22:00-07:00 Monday to Saturday and 22:00-09:00 Sundays & Public Holidays

5 Noise Emission Criteria and Project Noise Goals

5.1 Murray River Council

A review of the *Murray River Council Development Control Plan 2012* (DCP) did not reveal any specific noise requirements for the proposed development type (licensed venues or entertainment premises).

5.2 Liquor & Gaming NSW

Noise emissions from licensed premises in NSW, such as restaurants, bars, and clubs, should aim to comply with the standard noise criteria set by the L&GNSW. The L&GNSW, through the Liquor Act 2007, is the regulatory authority that deals with noise pollution issues pertaining to licensed premises. The L&GNSW criteria apply to noise emission associated with activities from the licensed area of the premises, including music and patron noise but excludes mechanical plant. Noise emissions are assessed in terms of the noise limits set out in the L&GNSW's 'Standard Noise Condition' which states as follows:

"The LA10 noise level emitted from the licensed premises shall not exceed the background noise level in an Octave Band Centre Frequency (31.5Hz – 8kHz inclusive) by more than 5dB between 7:00am and 12:00 midnight at the boundary of any affected residence.*

The LA10 noise level emitted from the licensed premises shall not exceed the background noise level in an Octave Band Centre Frequency (31.5Hz – 8kHz inclusive) between 12:00 midnight and 7:00am at the boundary of any affected residence.*

Notwithstanding compliance with the above, the noise from the licensed premises shall not be audible within any habitable room in any residential premises between the hours of 12:00 midnight and 7:00am.

Interior noise levels which still exceed safe hearing levels are in no way supported or condoned by the Liquor Administration Board.

This is a minimum standard. In some instances, the Board may specify a time earlier than midnight in respect of the above condition.

**For the purposes of this condition, the LA10 can be taken as the average maximum deflection of the noise emission from the licensed premises."*

As the L&GNSW criteria only applies to residential premises, operational noise impacts to non-residential receivers will be assessed against the provisions of the NPfI.

5.2.1 Activity noise emission goals (residential receivers)

As the L&GNSW criteria applies over an octave band centre frequency (31.5Hz – 8kHz inclusive), a historical background measurement carried out at Oran Park from Tuesday, 7 to Wednesday, 15 June 2022 is considered for obtaining the octave band centre frequency values for the average background noise levels mentioned in Table 2. The noise environment at this location is expected to be similar to that at Moama given the similarities in built form and low-density transportation.

Table 3: Octave band centre frequency background noise levels

Assessment period	Descriptor	Overall dB(A)	Octave band centre frequency – Hz, dB(Z)								
			31.5	63	125	250	500	1k	2k	4k	8k
R1, R2 and R3											
Day	L ₁₀	45	55	52	45	39	40	42	38	26	17
Evening	L ₁₀	40	50	47	40	34	35	37	33	24	17
Night	L ₁₀	35	50	45	37	32	32	31	27	19	18

Notes: Day: 07:00-18:00 Monday to Saturday and 09:00-18:00 Sundays & Public Holidays
 Evening: 18:00-22:00 Monday to Sunday & Public Holidays
 Night: 22:00-07:00 Monday to Saturday and 22:00-09:00 Sundays & Public Holidays

The resulting octave band noise goals are presented in Table 4.

Table 4: Operational noise goals for residential premises (activity noise)

Assessment period	Descriptor	Overall dB(A)	Octave band centre frequency – Hz, dB(Z)								
			31.5	63	125	250	500	1k	2k	4k	8k
R1, R2 and R3											
Day	L ₁₀	50	60	57	50	44	45	47	43	31	22
Evening	L ₁₀	45	55	52	45	39	40	42	38	29	22
22:00 - 00:00	L ₁₀	40	55	50	42	37	37	36	32	24	23
00:00 – 02:00 (inaudibility)^	L ₁₀	25	48*	35	27	22	22	21	17	9	8

Notes: Day: 07:00-18:00 Monday to Saturday and 09:00-18:00 Sundays & Public Holidays
 Evening: 18:00-22:00 Monday to Sunday & Public Holidays

^ For the determination of inaudibility, Renzo Tonin & Associates consider a design criterion of 10dB below the background noise level in each octave band for intermittent noise sources. It is assumed that if inaudibility goal is achieved externally, the internal inaudibility criterion will also be achieved.

* Threshold of hearing in accordance with AS3657.1. Lowest third octave level for the respective octave band.

5.3 Noise Policy for Industry

The NPfI is the most adopted noise emission guideline to control general operational noise from developments. As the provisions of L&GNSW only applies to residential premises, activity noise impacts to the H1 motel receiver (see Section 3.2) and operational noise emissions from building services plant and equipment, is assessed against the provisions of the NPfI.

The NPfI assessment procedure has two components:

- Controlling intrusive noise impacts in the short-term for residential properties, and
- Maintaining noise level amenity (long-term) for residences and other land uses.

In accordance with the NPfI, noise impact should be assessed against the project noise trigger level, which is the lower value of the project intrusiveness noise levels and project amenity noise levels.

5.3.1 Project intrusiveness noise levels

According to the NPfI, the intrusiveness of a noise source may generally be considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented by the $L_{Aeq,15min}$ descriptor) does not exceed the background noise level measured in the absence of the source by more than 5dB(A). The project intrusiveness noise level is only applicable to residential receivers and is determined as follows:

$$L_{Aeq,15minute} \text{ Intrusiveness noise level} = \text{RBL plus } 5\text{dB(A)}$$

The resulting project intrusiveness noise trigger levels for the nearest affected residential receivers are presented in Table 5 below.

Table 5: Project intrusiveness noise trigger levels

Receiver	Intrusiveness noise level, dB(A) $L_{Aeq(15min)}$		
	Day	Evening	Night
R1, R2 and R3	45 + 5 = 50	40 + 5 = 45	35 + 5 = 40

Note:

Day: 07:00-18:00 Monday to Saturday and 08:00-18:00 Sundays & Public Holidays

Evening: 18:00-22:00 Monday to Sunday & Public Holidays

Night: 22:00-07:00 Monday to Saturday and 22:00-08:00 Sundays & Public Holidays

5.3.2 Project amenity noise levels

The project amenity noise levels for different time periods of the day are determined in accordance with Section 2.4 of the NPfI. The NPfI recommends amenity noise levels ($L_{Aeq, period}$) for various receivers including residential, commercial, and industrial receivers and sensitive receivers such as schools, hotels, hospitals, churches, and parks. These "recommended amenity noise levels" represent the objective for total industrial noise experienced at a receiver location. However, when assessing a single industrial development and its impact on an area, "project amenity noise levels" apply.

To ensure that the total industrial noise level (existing plus new) remain within the recommended amenity noise levels for an area, the project amenity noise level that applies for each new industrial noise source is determined as follows:

$$L_{Aeq,period} \text{ Project amenity noise level} = L_{Aeq,period} \text{ Recommended amenity noise level} - 5dB(A)$$

Furthermore, given that the intrusiveness noise level is based on a 15-minute assessment period and the project amenity noise level is based on day, evening, and night assessment periods, the NPfI provides the following guidance on adjusting the $L_{Aeq,period}$ level to a representative $L_{Aeq,15minute}$ level to standardise the time periods.

$$L_{Aeq,15minute} = L_{Aeq,period} + 3dB(A)$$

NPfI recommended amenity noise levels and the resulting project amenity noise trigger levels are presented in Table 6 below.

Table 6: Project amenity noise trigger levels

Period	Recommended Amenity Noise Level	Project Amenity Noise Level	Final Project Amenity Noise level
	$dB(A)_{Leq(period)}$	$dB(A)_{Leq(period)}$	$dB(A)_{Leq(15mins)}$
R1, R2 and R3			
Day	50	$50 - 5 = 45$	$45 + 3 = 48$
Evening	45	$45 - 5 = 40$	$40 + 3 = 43$
Night	40	$40 - 5 = 35$	$35 + 3 = 38$
H1			
Day	55	$55 - 5 = 50$	$50 + 3 = 53$
Evening	50	$50 - 5 = 45$	$45 + 3 = 48$
Night	45	$45 - 5 = 40$	$40 + 3 = 43$

Notes:

1. Recommended amenity levels are based on Rural amenity area.
2. Time periods are as follows:
 - a. Day: 07:00-18:00 Monday to Saturday and 08:00-18:00 Sundays & Public Holidays
 - b. Evening: 18:00-22:00 Monday to Sunday & Public Holidays
 - c. Night: 22:00-07:00 Monday to Saturday and 22:00-08:00 Sundays & Public Holidays

5.3.3 NPfI project noise trigger levels (activity noise to motel premises and operational noise emissions from building services plant and equipment)

In accordance with the NPfI, the project noise trigger levels, which are the lower (i.e., more stringent) value of the project intrusiveness noise level and project amenity noise level, have been determined and shown in Table 7 below.

Table 7: NPfl project noise trigger levels (activity noise to motel premises and noise emissions from building services plant and equipment)

Receiver type	NPfl Project Noise Trigger Levels, $L_{Aeq, 15min}$		
	Day	Evening	Night
R1, R2 and R3	48	43	38
H1	53	48	43

Notes: Day: 07:00-18:00 Monday to Saturday and 08:00-18:00 Sundays & Public Holidays
 Evening: 18:00-22:00 Monday to Sunday & Public Holidays
 Night: 22:00-07:00 Monday to Saturday and 22:00-08:00 Sundays & Public Holidays

6 Noise Emission Assessment

6.1 Assumptions

Primary noise sources from the site will be as follows:

- Activity noise (patron and music) from Summer House and associated outdoor area
- Activity noise (gaming machines, music and patrons) from alfresco gaming extension
- Activity noise (patron, TV audio and music) from new alfresco sports bar

Assumed source noise levels are presented in Table 8.

Table 8: Assumed source noise levels

Area	Overall dB(A)	Octave band centre frequency – Hz, dB(Z) L ₁₀								
		31.5	63	125	250	500	1k	2k	4k	8k
Internal noise level (sound pressure level, SPL) in Summer House ¹	84	70	72	72	73	81	81	77	70	68
Sound power level (SWL) of raised voice per patron in outdoor area of Summer House ²	80	63	65	73	73	79	76	71	62	50
SPL in the alfresco sports bar ³	80	67	71	71	72	77	76	71	65	56
SPL in the alfresco gaming extension ⁴	73	61	61	64	68	73	67	63	58	56

Note:

1. Assumed noise level is representative of a crowded indoor licensed venue with moderate amplified music and acoustic absorptive treatment.
2. Source noise spectrum and overall level is representative of patrons speaking with raised speech in a crowded outdoor beer garden, with background music.
3. Assumed noise level is representative of a typical sports bar with occasional raised voice, background music, TV audio and acoustic absorptive treatment.
4. Assumed noise level is typical for an alfresco gaming area with gaming machine noise and background music.

The following assumptions regarding the acoustic performance of the building envelope design have been made for the acoustic assessment.

Table 9: Building envelope acoustic performance

Area	Construction Element	Assumed acoustic Performance, R _w	Indicative Construction
Summer House	Fixed façade glazing, bi-fold doors and hinged doors	31 ¹	6.38mm laminate glass in aluminium frame with full perimeter rubber acoustic seals
Alfresco Sports Bar	Retractable awning	28 ¹	Assumed glazed and performance equal to Breezeway Altair® with 6mm toughened glass
Existing alfresco gaming areas	Louvres (does not apply to proposed extension)	26	IAC Acoustics Slimshield™ Acoustic Louvres (600mm deep)

Note:

1. Acoustic performance of glazing assembly (i.e., glass, frame, and seals).

6.2 Prediction Methodology

The noise predictions were based upon the architectural drawings set out in Section 3, and carried out in accordance with ISO9613 as implemented by CadnaA computer modelling program. The software considers sound radiation patterns, acoustic shielding and potential reflections from intervening building elements, and noise attenuation due to distance.

6.3 Noise Emission Predictions

- **Scenario 1 (up until 10pm):**
 - Summer House operating at maximum capacity (i.e., 104 patrons with one in two talking at any given time) and bi-fold doors open. Hinged access doors generally closed and only open momentarily for ingress/egress. Up to 80 patrons assumed in the outdoor area at any given time.
 - Alfresco sports bar retractable awning open and space filled to overall capacity (i.e., 60 patrons, with one in two talking).
 - Alfresco gaming areas operating at capacity.
- **Scenario 2 (10pm to 12:00am midnight):**
 - Summer House operating at maximum capacity (i.e., 104 patrons with one in two talking at any given time) and all façade operable elements closed. Patron ingress/egress restricted to pair doors along southern façade or single door leading into the foyer.
 - Summer house outdoor area not in operation.
 - Alfresco sports bar retractable awning open and space filled to overall capacity (i.e., 60 patrons, with one in two talking).
 - Alfresco gaming areas operating at capacity.
- **Scenario 3 (12:00am midnight to 02:00am):**
 - Summer House operating at maximum capacity (i.e., 104 patrons with one in two talking at any given time) and all façade operable elements closed. Patron ingress/egress restricted to single door leading into the foyer.
 - Summer house outdoor area not in operation.
 - Alfresco sports bar retractable awning closed, and space filled to overall capacity (i.e., 60 patrons, with one in two talking).
 - Alfresco gaming areas operating at capacity.

6.3.1 Predicted noise levels at residential receivers

Table 10, Table 11 and Table 12 summarises the results of cumulative activity noise emissions to the surrounding potentially nearest affected residences.

All predictions are made on the assumption that the recommendations described in Section 7 are implemented.

Table 10: Predicted cumulative activity noise emissions for Scenario 1 (up until 10pm)

Assessment ID	Description		Overall dBA	Octave band centre frequency – Hz, dB(Z)								
				31.5	63	125	250	500	1k	2k	4k	8k
R1 - 25 Blair St, Moama	Predicted noise levels, L ₁₀		43	30	31	36	32	39	40	35	24	5
	Noise goals	Day	50	60	57	50	44	45	47	43	31	22
		Evening	45	55	52	45	39	40	42	38	29	22
	Complies?	up to 10pm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R2 - 2 Simms St, Moama	Predicted noise levels, L ₁₀		44	30	32	37	32	40	41	36	25	7
	Noise goals	Day	50	60	57	50	44	45	47	43	31	22
		Evening	45	55	52	45	39	40	42	38	29	22
	Complies?	up to 10pm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R3 - 40 Blair St, Moama	Predicted noise levels, L ₁₀		37	28	29	33	28	35	34	29	20	0
	Noise goals	Day	50	60	57	50	44	45	47	43	31	22
		Evening	45	55	52	45	39	40	42	38	29	22
	Complies?	up to 10pm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 11: Predicted cumulative activity noise emissions for Scenario 2 (10pm to 12:00am midnight)

Assessment ID	Description	Overall dBA	Octave band centre frequency – Hz, dB(Z)									
			31.5	63	125	250	500	1k	2k	4k	8k	
R1 - 25 Blair St, Moama	Predicted noise levels, L ₁₀	29	27	27	24	23	27	26	20	12	5	
	Noise goals	22:00-00:00	40	55	50	42	37	37	36	32	24	23
	Complies?	22:00-00:00	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R2 - 2 Simms St, Moama	Predicted noise levels, L ₁₀	37	28	30	27	25	33	35	30	22	13	
	Noise goals	22:00-00:00	40	55	50	42	37	37	36	32	24	23
	Complies?	22:00-00:00	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R3 - 40 Blair St, Moama	Predicted noise levels, L ₁₀	26	23	24	20	19	24	23	17	6	0	
	Noise goals	22:00-00:00	40	55	50	42	37	37	36	32	24	23
	Complies?	22:00-00:00	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 12: Predicted cumulative activity noise emissions for Scenario 3 (12:00am midnight to 02:00am)

Assessment ID	Description	Overall dBA	Octave band centre frequency - Hz (dBZ)								
			31.5	63	125	250	500	1k	2k	4k	8k
R1 - 25 Blair St, Moama	Predicted noise levels	22	26	24	20	19	22	16	11	0	5
	Noise goals 00:00-02:00	25	48	35	27	22	22	21	17	9	8
	Complies? 00:00-02:00	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R2 - 2 Simms St, Moama	Predicted noise levels	21	23	23	16	11	20	16	12	2	7
	Noise goals 00:00-02:00	25	48	35	27	22	22	21	17	9	8
	Complies? 00:00-02:00	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R3 - 28 Blair St, Moama	Predicted noise levels	22	24	20	14	12	14	20	16	8	0
	Noise goals 00:00-02:00	25	48	35	27	22	22	21	17	9	8
	Complies? 00:00-02:00	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Exceedance is marked in **Bold**.

6.3.2 Predicted noise levels at motel receiver

Table 13 summarises the results of cumulative activity noise emissions to Moama Motel (receiver H1).

Table 13: Predicted cumulative activity noise emissions at Moama Motel (H1)

Assessment ID	Scenario	Predicted noise levels, dB(A) _{Leq(15min)}	NPfl Project Noise Trigger Levels, dB(A) _{Leq(15min)}	Complies?
H1 – Moama Motel @ 13-15 Meninya St, Moama	1	38	48 ¹	Yes
	2	35	43	Yes
	3	33	43	Yes

Note:

1. Project noise trigger level during evening period (6pm – 10pm) is more stringent than daytime (7am – 6pm) and compliance during this period will also result in compliance during the day.

7 Recommendations

The following mitigation measures and management strategies must be implemented to ensure compliance with the project noise emission goals.

7.1 Activity Noise

7.1.1 Summer House

- The maximum capacity of must be limited to 104 patrons. Only 80 patrons are permitted the associated outdoor area, at any given time.
- All façade glazed elements (including bi-fold and hinged doors) shall achieve an acoustic performance of at least R_w 31 (6.38mm laminate glass or similar).
- Minimum 40mm thick solid core timber construction is recommended for any proposed timber doors. The doors shall be installed with full perimeter rubber acoustic seals and achieve an acoustic performance of at least R_w 30.
- The proposed bi-fold doors can remain open till 10pm. These doors should be closed after 10pm, with no ingress/egress permitted via these doors.
- All other doors shall be installed with self-closing mechanism and should generally remain closed, except for ingress/egress. The operation of these doors must be restricted as follows:
 - Up to 10pm: any door accessible for ingress/egress.
 - Between 10pm and 12am: patrons ingress/egress restricted to pair doors along southern façade or single door leading into the foyer.
 - After midnight: patrons ingress/egress restricted to single door leading into the foyer.
- The proposed metal deck roof shall be installed a solid ceiling system must also be installed in the Summer House, suspended at least 250mm below the metal deck roof. Minimum 2 x 13mm plasterboard or equivalent (minimum 8.4 kg/m²) is acceptable for the solid ceiling, with 75mm thick 11kg/m³ density acoustic insulation installed in the ceiling cavity, evenly spaced.
 - No openings are permitted in the solid ceiling directly open to the cavity.
- Absorptive acoustic lining is recommended to the underside of ceiling (100% ceiling area), achieving an NRC no less than 0.9.
- Music levels internally shall not exceed 80 dB(A)_{L10} SPL and 85 dB(A)_{L10} SPL (measured in the centre of the space) till 10pm and after 10pm respectively.

- Speakers proposed to be suspended from the roof must be installed at least 1m below the solid ceiling, angled downwards (45° angle to the floor) and mounted using Embleton NRD vibration isolators or equal. Speakers are not to be positioned within 2 metres of any door (including bi-fold doors)

7.1.2 Alfresco sports bar

- The maximum capacity must be limited to 60 patrons.
- The proposed retractable awning shall achieve an acoustic performance of at least R_w 28 (e.g., Breezeway Altair® glazed louvre system).
- The retractable awning must be closed after midnight.
- Background music shall not exceed 65dB(A) L_{10} SPL (measured in the centre of the space).
- Absorptive surface finishes and soft furnishings are generally recommended to this space. At a minimum this should include absorptive lining to the underside of at least 80% of soffit/ceiling (minimum NRC 0.8) and carpet flooring.

7.1.3 Alfresco gaming

- The façade louvres to the existing alfresco gaming (along railway frontage) must be replaced with acoustic louvres with the following minimum insertion loss:

Table 14: Minimum insertion loss of acoustic louvre to exiting gaming areas

Source	Insertion Loss, dB							
	63	125	250	500	1k	2k	4k	8k
IAC Acoustics Slimshield™ Acoustic Louvres (600mm deep)	7	9	12	24	31	33	29	30

- Background music shall not exceed 65dB(A) L_{10} SPL (measured in the centre of the space). Speakers in the new gaming extension shall be positioned at least 1m from the edge of building line above (see Figure 2).
- Absorptive surface finishes and soft furnishings are generally recommended to this space. At a minimum this should include absorptive lining to the underside of at least 80% of soffit/ceiling (minimum NRC 0.8).

7.2 Building Services Plant and Equipment

If any new building services plant or equipment is proposed as part of these works:

- Acoustic assessment of the proposed design and equipment specifications should be undertaken during subsequent stages of design, to ensure cumulative noise emissions (existing and new plant/equipment) does not exceed the project NPfI noise trigger levels (see Table 7). Consent conditions typically require detailed assessment of mechanical plant and equipment prior to issue of the Construction Certificate.
- Plant noise emission can be controlled by appropriate mechanical services design and implementation of common engineering methods, which may include:
 - procurement of 'quiet' plant
 - strategic positioning of plant away from sensitive receivers (maximise distance and any intervening acoustic shielding provided by existing structures on site)
 - commercially available acoustic attenuators for air discharge and air intakes of plant
 - acoustically lined and lagged ductwork
 - acoustic barriers between plant and sensitive neighbouring premises
 - partial or complete acoustic enclosures over plant

8 Conclusion

Renzo Tonin & Associates has completed an assessment of operational noise emissions to support the alterations and additions at the Moama Bowling Club.

The proposal has been assessed against the relevant noise requirements of Liquor and Gaming NSW and EPA *Noise Policy for Industry*.

Provided the recommended acoustic treatments and management measures detailed in Section 7 of this report are adopted, noise emissions will comply with acoustic requirements.

APPENDIX A Glossary of terminology

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

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment 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. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. 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 L90 noise level (see below).
Decibel [dB]	The units 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 CBD mall 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 A-weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in 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.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz) but is less effective outside these frequencies.
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 L90 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.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain L _{eq} sound levels over any period of time and can be used for predicting noise at various locations.
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.