



Taylor Group c/- Six Degrees Architects
7 May 2026

Barwon Heads Hotel

Town Planning Acoustic Report

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Project Barwon Heads Hotel
Client Taylor Group
Document Number AC843MB-01E02 Town Planning Acoustic Report (r4)

Revision	Date	Comment	Author	Reviewer
0	18.08.2025	Draft - Issued to Client	CP	AL
1	05.12.2025	Draft Town Planning Issue - Issued to Client	CP	AL
2	16.12.2025	Town Planning Issue - Issued to Client	CP	AL
3	18.03.2026	Town Planning Issue - Council RFI update	CP	AL
4	07.05.2026	Town Planning Issue - Council RFI update	CP	AL

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1. Introduction

Octave Acoustics was engaged to provide a noise impact assessment for the proposed Barwon Heads Hotel redevelopment, located at 1 Bridge Road, Barwon Heads, Victoria 3227 (Subject Site / Subject Development / Venue), to support the planning permit application.

The update within this report revision (4) provides additional information with respect to the type of music noise limitation device to be used, per Council RFI letter PP: PP-1097-2025, PI: 226207, dated 6th of May 2026:

" ... in regard to the above planning application at 1 Bridge Road, Barwon Heads.

Thank you for the meeting held on 28 April 2026 to discuss Environmental Health's noise requirements associated with the application.

Following that meeting, Council's Environmental Health Unit has requested further information regarding the type of noise limiter proposed to be installed at the venue. Specifically, confirmation is required that the system will be a suppressor/compressor type that controls and limits sound levels within the venue, rather than a system that cuts power to the amplifiers. ..."

Response to the above RFI is provided in Section 5.3.1, on page 23.

The previous report revision (3) provided additional information with respect to patron noise and acoustic screening, per Council RFI letter PP-1097-2025, dated 20th January 2026. Council has requested clarification and update to this acoustic town planning report with respect to the following two items:

...

Environmental Health are mostly supportive of the findings of the report, however;

- a) *We have concerns with the use of sleep disturbance noise levels as a means to mitigate the +8dB relative difference in noise levels demonstrated in table 13. It is our concern that this difference is significant enough that 2B Bridge road would be adversely impacted and that the City would receive complaints from this property. The RNP quoted points to one of two noise events per night. Noise from this development is unlikely to fit within the one or two events given the significant changes to floor plans proposed. We would suggest the acoustic report needs to be updated to consider other (potentially physical) mitigation measures for 2B Bridge Road.*
- b) *The report findings are based on the inclusion of acoustic screens in outdoor areas and as such, the report includes a site plan at Appendix C with acoustic screens demonstrated (including 2 different screen heights as discussed in the report). The report does not include specifications for the design of these screens. Please update the report to show this information.*

Responses to the above RFIs are provided Section 4.2.5, Section 4.2.7 and Appendix C respectively.

1.1. Subject Site Redevelopment

The proposed redevelopment of the hotel will deliver the renovation and fit-out of the existing two storey building and surrounding hardstand and landscape areas, including:

- Completely refurbished ground level indoor trading spaces and bar, servicing approximately 140 seated patrons.
- Newly constructed ground level function room, servicing approximately 72 seated patrons.
- Newly constructed level 1 indoor trading space and bar, servicing approximately 87 seated patrons.
- Newly constructed ground level façades, primarily to the North and East of the building.
- Newly constructed ground level outdoor patron area to the North, abutting Bridge Road, servicing approximately 50 seated patrons.
- Refurbishment of existing outdoor patron area to the East of the building, abutting Ewing Blyth Drive, servicing approximately 200 seated patrons.
- The existing licence for the venue is for 700 patrons.

- The client seeks to revise the licence to a total of 1500 patrons, with a maximum of 600 patrons in the proposed outdoor areas.
- New roof to central area of the building.
- New commercial kitchen and amenities spaces on the ground level, situated centrally within the building.
- Associated new store rooms, cool/freezer room and waste management area.
- Extensive exterior landscaping.

The Subject Site is situated within two zones, "Commercial Zone 1" (C1Z) and "Neighbourhood Residential Zone 6" (NRZ6), located within the City of Greater Geelong planning area. It is abutted by:

- Bridge Road residential area to the North (zoned GRZ1);
- Golightly Street residential and commercial area to the West (zoned NRZ6, C1Z);
- Residential area to the South (zoned NRZ6);
- Public Park/Reserve to the West along Ewing Blyth Drive (zoned PCRZ).

1.2. Operating Hours

The hotel trading hours are understood to remain unchanged. These are as follows:

For Consumption off the licenced premises:

- Sunday, Good Friday & Anzac Day Between 10am and 11pm
- On any other day Between 7am and 11pm

For Consumption on the licenced premises:

In the Public Bar area:

- Sunday Between 10am and 1am the following morning
- Good Friday & Anzac Day Between 12noon and 1am the following morning
- Anzac Day (not being a Sunday) Between 10am and 1am the day following
- On any other day Between 7am and 1am the day following including until 1am on Anzac Day & Good Friday morning.

In the remainder of the premises:

- Sunday Between 10am and 1am the following morning
- Good Friday & Anzac Day Between 12noon and 3am the following morning
- Monday to Friday Between 7am and 1am the following morning
- Saturday Between 7am and 3am the following morning
- Until 3am on the morning of a Public Holiday including until 3am on Anzac Day & Good Friday morning.
- Until 3am on the Monday preceding Melbourne Cup Day.

As and from the 26th December each year up to and including the following 31st January between the following times:

- Sunday Between 10am and 3am the following morning
- On any other day Between 7am and 3am the following morning
- As and from Good Friday up to and including Easter Tuesday until 3am on each of those mornings.

2. Noise Measurements

2.1. Unattended Noise Monitoring

Octave Acoustics carried out unattended noise monitoring between Thursday the 24th of July and Thursday the 31st of July 2025. Measurements were carried out using an NTi XL2 sound level meter which was calibrated before and after all measurements using a Brüel & Kjær 4320 calibrator. No drift in calibration was detected. The NTi XL2 complies with the requirements of IEC 61672-1:2013 Sound Level Meters and is classified as a Class 1 instrument. The calibrator complies with the requirements of IEC 60942:2004 Sound Calibrators. Both the XL2 and calibrator carry current NATA certification or manufacturer's certification if less than two years old.

Noise monitoring was conducted at a height of 1.2m atop a Level 1 balcony located to the North-East of the Subject Site. The noise monitor microphone was installed in free field conditions and had direct line of sight to Bridge Road. The noise monitoring location is as shown in Figure 1 below. A summary of the results of these measurements is presented in Table 1, Table 2, Table 3 and Appendix B.

2.1.1. Results of Unattended Noise Measurements

A summary of key results relating to general ambient noise for derivation of EPA noise criteria are set out in the following tables.

Table 1 – Lowest Period Background Noise Level Measured (Commercial Plant)

Period	Metric	Lowest Background Noise Level Measured at the Subject Site, dB(A)
Day ₁		56
Evening ₂	LA90	47
Night ₃		38

Notes:

- Day period is:
 - 07:00 – 18:00 Monday – Saturday (except public holidays)
- Evening period is:
 - 18:00 – 22:00 Monday – Saturday
 - 07:00 – 22:00 Sunday and public holidays
- Night period is:
 - 22:00 – 07:00 Monday – Sunday

Table 2 – Lowest Hourly Background Noise Level, Day/Evening Period (Music)

Period	Date, Time	Minimum Ambient Background
Day/Evening ₁	27 th July, 21:00–22:00	38 dB LA90_1hr

Notes:

- Day / evening period is:
 - 07:00 – 23:00 Monday – Saturday (other than a public holiday)
 - 09:00 – 22:00 Sunday or a public holiday (other than if either is preceding a public holiday)
 - 09:00 – 23:00 Sunday or a public holiday (if either is preceding a public holiday)

Table 3 – Lowest Hourly Octave Band Background Noise Level, Night Period during Operating Hours (Music)

Metric	Octave Band Centre Frequency (Hz)						
	63	125	250	500	1000	2000	4000
Minimum Ambient Background, 27 th July 2025, 22:00–23:00; (L _{Oct 90}) ₁	39	40	36	32	30	24	17

- Notes:
- Night period is:
 - 23:00 – 07:00 Monday to Friday (other than a public holiday or a day preceding a public holiday)
 - 23:00 Saturday or any day preceding a public holiday – 09:00 Sunday
 - 22:00 Sunday or a public holiday (if neither is preceding a public holiday) – 07:00 Monday

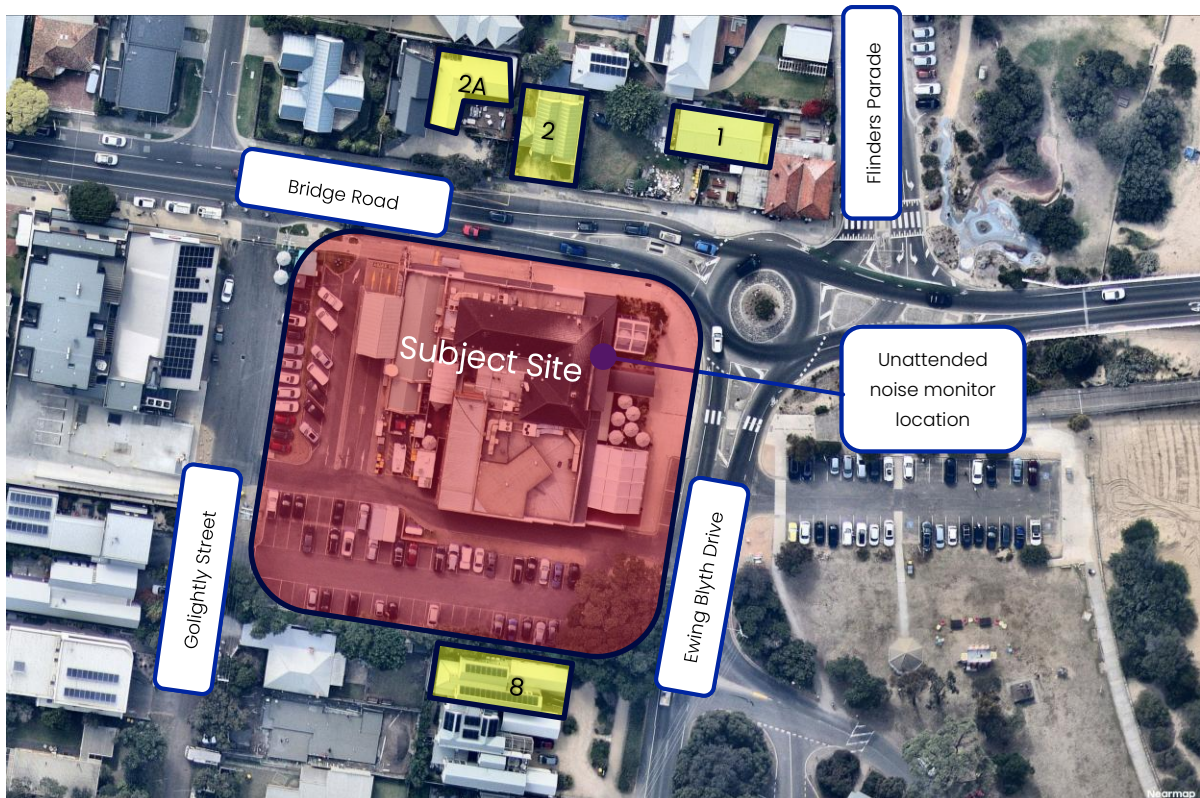


Figure 1 – Subject Site Context

3. Criteria

3.1. Environment Protection Regulations 2021

3.1.1. Music Noise Emissions from Indoor Entertainment Venues

Music noise emissions associated with the operation of indoor entertainment venues are required to comply with Part 5.3 of the Environment Protection Regulations 2021 (EPR 2021). EPA Victoria Noise Limit and Assessment Protocol for the Control of Noise from Commercial, Industrial and Trade Premises and Entertainment Venues Publication 1826.5 (Publication 1826.5) provides a protocol for determining the relevant EPR 2021 noise limits and carrying out subsequent assessment of noise impacts.

EPR 2021 is a regulation under the *Environment Protection Act 2017* (EP Act) and compliance is mandatory when noise levels are assessed at noise sensitive areas which includes residential properties. The applicable EPR 2021 noise limits for music noise affecting residential properties adjacent to the Subject Development have been calculated from existing background noise levels and are presented in Table 4 and Table 5 below.

Table 4 – EPR 2021 Day & Evening Period Criteria for Music Noise

Period	Minimum Ambient Background, dB L_{A90}	+ 5 dB	Applicable EPR 2021 Noise Limit dB L_{Aeq}
Day / Evening ₁	38	+5	43

Notes:

- Day / evening period is:
 - 07:00 – 23:00 Monday – Saturday (other than a public holiday)
 - 09:00 – 22:00 Sunday or a public holiday (other than if either is preceding a public holiday)
 - 09:00 – 23:00 Sunday or a public holiday (if either is preceding a public holiday)

Table 5 – EPR 2021 Night Period Criteria for Music Noise

Metric	Octave Band Centre Frequency (Hz)						
	63	125	250	500	1000	2000	4000
Minimum Ambient Background, dB $L_{Z90,1}$	39	40	36	32	30	24	17
+ 8 dB per octave band	+8	+8	+8	+8	+8	+8	+8
Applicable Music Noise Limit, dB L_{z10}	47	48	44	40	38	32	25
Applicable Music Noise Limit, dB $L_{Zeq,2}$	44	45	41	37	35	29	22

Notes:

- Night period is:
 - 23:00 – 07:00 Monday to Friday (other than a public holiday or a day preceding a public holiday)
 - 23:00 Saturday or any day preceding a public holiday – 09:00 Sunday
 - 22:00 Sunday or a public holiday (if neither is preceding a public holiday) – 07:00 Monday
- It is commonly accepted that L_{eq} is 3dB less than L_{10} .

3.1.2. Clause 53.06 Live Music & Entertainment Noise

Clause 53.06 defines a live music entertainment venue as:

- A food and drink premises, nightclub, function centre or residential hotel that includes live music entertainment.

- A rehearsal studio
- Any other venue used for the performance of music and specified in clause 2.0 of the schedule to this clause, subject to any specified condition or limitation.

The requirements to be met in order to satisfy Clause 53.06 are stated as:

A live music entertainment venue must be designed, constructed, and managed to minimise noise emissions from the premises and provide acoustic attenuation measures that would protect a noise sensitive residential use within 50 metres of the venue.

A noise sensitive residential use must be designed and constructed to include acoustic attenuation measures that will reduce noise levels from any.

- *Indoor live music entertainment venue to below the noise limits specified in Environment Protection Regulations 2021 Part 5.3 (EPR 2021).*
- *Outdoor live music entertainment venue to below 45dB(A), assessed as an Leq over 15 minutes.*

For the purpose of assessing whether the above noise standards are met, the noise measurement point may be located inside a habitable room of a noise sensitive residential use with windows and doors closed.

A permit may be granted to reduce or waive these requirements if the responsible authority is satisfied that an alternative measure meets the purpose of this clause.

Applications requirements under Clause 53.06 are as follows:

An application must be accompanied by the following information, as appropriate:

- *A site analysis, including plans detailing:*
 - *The existing and proposed layout of the use, buildings or works, including all external windows and doors.*
 - *The location of any doors, windows and open-source space areas of existing properties in close proximity to the site.*
- *If the application is associated with a noise sensitive residential use:*
 - *The location of any live music entertainment venues within 50 metres of the site.*
 - *The days and hours of operation of that venue.*
 - *The times during which live music will be performed.*
- *Details of existing and proposed acoustic attenuation measures.*

If in the opinion of the responsible authority an application requirement is not relevant to the evaluation of an application, the responsible authority may waive or reduce the requirement.

With respect to these requirements, it is appropriate that the performance of acoustic attenuation measures is assessed with respect to the degree to which compliance with EPR 2021 is achieved at the potentially most affected noise sensitive receivers (refer to Section 3.1.1).

3.1.3. Plant Noise Emissions

Noise associated with base building plant and services is required to comply with Part 5.3 of the Environment Protection Regulations 2021 (EPR 2021). EPA Victoria Noise Limit and Assessment Protocol for the Control of Noise from Commercial, Industrial and Trade Premises and Entertainment Venues Publication 1826.4 (Publication 1826.4) provides a protocol for determining EPR 2021 noise limits and carrying out subsequent assessment of noise impacts.

EPR 2021 is a regulation under the Environment Protection Act 2017 (EP Act) and compliance is mandatory when noise levels are assessed at noise sensitive areas which includes residential properties. The applicable EPR 2021 noise limits for plant and services noise emissions have been calculated and are provided in Table 6 below.

Table 6 – EPR 2021 Mechanical Plant Noise Limits

Period	Zoning Level, L _{Aeq}	Background noise level, dB L _{A90}	Background Classification	Applicable Noise Limit ⁴ , dB L _{Aeq}
Day ¹	54	56	High	62
Evening ²	47	47	High	50
Night ³	42	38	Neutral	42

- Notes:
- Day period is:
 - 07:00 – 18:00 Monday – Saturday (except public holidays)
 - Evening period is:
 - 18:00 – 22:00 Monday – Saturday
 - 07:00 – 22:00 Sunday and public holidays
 - Night period is:
 - 22:00 – 07:00 Monday – Sunday
 - Where the noise source under consideration is equipment used solely in relation to emergencies (such as fire pumps, standby generators, stair pressurisation and smoke spill fans), the relevant noise limit applying to the testing or maintenance of such equipment is increased by 10dB for the day period and 5dB for the evening and night periods.

3.1.4. General Environmental Duty

Under Part 3.2 of the EP Act, a person who is engaging in an activity that may give rise to risks of harm to human health or the environment from pollution or waste (including noise) must minimise those risks, so far as reasonably practicable.

With respect to noise, to determine what is (or was at a particular time) reasonably practicable in relation to the minimisation of risks of harm to human health and the environment, regard must be given to:

- The likelihood of those risks eventuating,
- The degree of harm that would result if those risks eventuated,
- What the concerned person knows, or ought reasonably to know, about the harm or risks of harm and any ways of eliminating or reducing those risks,
- The availability and suitability of ways to eliminate or reduce those risks,
- The cost of eliminating or reducing those risks.

It should be noted that the General Environmental Duty requirement applies irrespective of whether compliance with EPR 2021 noise limits is achieved. Compliance with EPR noise limits does not necessarily infer adequate conduct under General Environmental Duty.

3.2. Waste Collections and Deliveries

EPA Publication 1254.2 *Noise control guidelines* provides guidelines for noise generated by waste collection and deliveries, with the aim of assisting in the resolution of complaints and averting possible noise nuisances.

3.2.1. Waste Collections

The guidelines recommend that where a residential area will be impacted from noise from the collection of refuse, the collections should be restricted to the following times:

- For one collection per week: 6:30am – 8pm Monday to Saturday, and 9am – 8pm Sundays and public holidays.
- For multiple collections per week: 7am – 8pm Monday to Saturday, and 9am – 8pm Sundays and public holidays.

Additionally:

- Refuse bins should be located at sites that provide minimal annoyance to residential premises.
- Compaction should be carried out while the vehicle is moving.
- Bottles should not be broken up at the collection site.
- Routes which service predominantly residential areas should be altered regularly to reduce early morning disturbances.
- Noisy verbal communication between operators should be avoided where possible.

3.2.2. Deliveries

The guidelines recommend that where a residential area will be impacted by noise from deliveries, deliveries should be inaudible within any habitable room of any residential premises outside the following hours:

- 7am – 10pm Monday to Saturday.
- 9am – 10pm Sundays and public holidays.

3.3. Patron Noise

There are no mandatory regulatory criteria or formally endorsed guidelines in Victoria specifically governing the assessment of noise generated by patrons. While Victorian members of the Association of Australasian Acoustical Consultants (AAAC) have undertaken discussions aimed at developing an appropriate assessment framework, no agreed methodology has been established. Within this regulatory context, and recognising that the Barwon Heads Hotel is a long-established venue of local heritage significance, the proposed refurbishment works, which include a modest increase in overall outdoor patron capacity and the addition of new outdoor seating areas, are considered limited in scale.

Given these circumstances, the application of a relative-change assessment methodology is considered to be a reasonable approach. This approach involves comparing existing operating conditions, including current outdoor patron numbers and spatial layouts, with those proposed as part of the redevelopment. By quantifying the incremental change in both quasi-steady-state crowd noise (typically representing crowd “babble”) and short-duration transient vocal events (such as occasional loud laughter or shouting), the methodology provides a practical and contextually appropriate indication of potential changes to noise emissions and the resultant impacts on nearby residential amenity.

The client has advised that, under current operating conditions, up to approximately 500 patrons may occupy the eastern outdoor areas of the venue, comprising a mix of seated and standing occupants. Under the proposed operating scenario, the total outdoor patron capacity would increase to approximately 600 persons, again consisting of a combination of seated and standing patrons. Standing patrons would continue to be restricted to the eastern outdoor area, whereas the newly introduced northern outdoor area is intended to accommodate seated patrons only.

4. Assessment

4.1. 3D Computer Noise Model

A 3-D computer noise model of the Subject Site and surroundings was built in CadnaA software and calculations run implementing the ISO9613 algorithms. The ISO9613 algorithms calculate the propagation of noise between source and receiver taking into account propagation effects associated with:

- Source sound power
- Geometrical spreading
- Atmospheric conditions
- Air-absorption
- Ground absorption ($G=0$)
- Reflections
- Barrier effects associated with the built form of buildings on the Subject Site and adjacent buildings.

4.2. Patron Noise

4.2.1. Methodology

Sound power levels for patrons were determined using the methodology developed by Hayne in *"Prediction of Noise from Small to Medium Sized Crowds"* (2011). The calculated levels were then adjusted as follows:

- An additional 2 dB was applied to patron sound power levels to account for behavioural influences associated with alcohol consumption and food service within outdoor areas where patrons are seated; and
- An additional 5 dB was applied to patron sound power levels to represent the increased vocal activity typically associated with the vertical consumption of alcohol within outdoor areas where patrons are standing.

The methodology provides two sound power level spectra:

- An L_{Aeq} sound power level spectrum, representing quasi-steady-state patron noise (i.e., general conversational "voice babble"); and
- An L_{Amax} sound power level spectrum, representing occasional loud transient noise events such as loud laughter or shouting, both as discussed in Section 3.3.

4.2.2. Outdoor Patrons – Seated and Standing

To determine the appropriate sound power levels for the patron-noise assessment in accordance with the Hayne methodology outlined above, patron numbers were estimated for both seated and standing patrons under existing operating conditions and the proposed redevelopment.

Proposed seated patron capacities were sourced from Six Degrees Architects Drawing TP101, Rev. TP-1, dated 27.11.2025. The revised eastern seating layout is estimated to accommodate approximately 200 seated patrons, while the new northern seating area is expected to provide seating for approximately 50 patrons. For comparison, the existing eastern outdoor seating area is understood to accommodate approximately 170 seated patrons, as referenced in Six Degrees Architects Drawing SD011 Rev P3, "Existing/Demo Ground Floor," dated 13.06.2025.

As previously discussed, the client has further advised that, under current operating conditions, up to 500 patrons may occupy the existing eastern outdoor area, comprising a combination of seated and standing patrons. Under the proposed re-configuration, the outdoor areas are intended to accommodate a maximum of 600 patrons, also comprising a mix of seated and standing occupants. Estimated seated and standing patron numbers for both existing and proposed outdoor trading areas have therefore been derived and are summarised in Table 7 below.

Table 7 – Estimated Seated and Standing Patrons, Existing versus Proposed Outdoor Areas

Venue	Total outdoor Patron numbers	Seated Patrons	Standing Patrons
Existing outdoor area	≈ 500	≈ 170	≈ 330
Proposed outdoor area	≈ 600	≈ 250	≈ 350

It should be noted that for the purposes of the patron noise assessments, seated patron numbers as shown in Table 7, have been calculated based on the current design documentation, and are considered indicative at this stage of the development. These numbers are not intended to define a maximum seated patron capacity, as reasonable variations in seated patron numbers are expected to occur from time to time, in accordance with normal venue operations.

4.2.3. Quasi-Steady State Assessment; Seated Patrons only

The quasi-steady state seated patron sound power levels in the proposed outdoor trading areas that were utilised for the purposes of the assessment are presented in Table 8 below.

Table 8 – Proposed Outdoor Areas, Seated Patrons Average Sound Power Levels, dB re 10⁻¹² Watts

Number of Patrons, Outdoor Trading Area (OT_)	Octave Band Center Frequency (Hz)						
	63	125	250	500	1000	2000	4000
12 (in each OT4, 5, 6)	70	70	75	81	78	73	65
16 (OT7)	72	72	77	83	80	75	67
60 (OT3)	81	81	86	92	89	84	76
42 (Pavillion)	78	78	83	89	86	81	73
96 (OT1 + OT2)	84	84	89	95	92	87	79

Seated patron noise impacts at the potentially most affected residential receiver locations were calculated using the 3-D noise model. The resulting noise levels were compared between the existing venue layout and patron numbers, versus those associated with the proposed layout with increased seating capacity. For the purposes of the modelling, the following assumptions were adopted:

- All outdoor seating areas are at full capacity (existing condition: ≈ 170 seated patrons, proposed: ≈ 250 seated patrons), with patrons evenly distributed and modelled at a seated height of 1.2 metres.
- No standing patrons are present in the outdoor areas.
- 1.6 metre high boundary acoustic screens are installed adjacent to the various patron areas, with a 1.8 metre high screen located at the north-eastern corner, consistent with existing conditions (refer to Appendix C for the acoustic screen layout used for the assessment).

Table 9 below compares the calculated results for the existing and proposed outdoor areas, taking into account seated patrons only.

Table 9 – Quasi-Steady State Noise, Seated Patrons, Existing vs. Proposed Outdoor Patron Areas

Location	Proposed seated Patrons: Noise Level at residential receivers	Existing seated Patrons: Noise Level at residential receivers	Relative Difference in Calculated Noise Levels, Proposed vs. Existing	Resulting Impact Considered Acceptable?
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	(dB, LAeq)	(dB, LAeq)		
1 Flinders Parade	51	46	+5 dB	Yes
2 Bridge Road	49	44	+5 dB	Yes
2A Bridge Road	47	42	+5 dB	Yes
2B Bridge Road	46	40	+6 dB	Yes
8 Ewing Blyth Drive	48	47	+1 dB	Yes

The proposed outdoor seating layout, which increases the overall number of seated patrons, is calculated to increase the quasi-steady-state patron noise emissions by 5 dB to 6 dB at the nearest residential properties, when all outdoor seated areas are fully occupied, relative to current conditions. While a change of this magnitude is generally perceptible to the average listener, it is not expected to result in significant impact to residential amenity, as the predicted noise levels remain within the range of typical ambient background levels measured during day and evening periods (refer to Table 1). As such, this level of increase is considered to be acceptable.

In addition, it should also be noted that:

- The calculation is conservative as it assumes that both the northern and eastern outdoor areas are simultaneously operating at full seated capacity. When these outdoor areas are not fully occupied, the relative difference is anticipated to be lower.
- Due to this conservative methodology, typical patron noise levels are expected to be lower than calculated levels.

With the acoustic screens installed, as per the extent shown in Appendix C, the resulting noise impacts associated with use of the new northern outdoor trading area have been minimised as far as is practicable within the context of the site.

4.2.4. Quasi-Steady State Assessment; Seated and Standing Patrons

Further to the seated-only assessment of quasi-steady-state patron noise emissions, an additional assessment considered a mix of standing and seated patrons. Table 10 below presents the sound power levels for standing patrons in the proposed outdoor trading areas, which were utilised in addition to the seated patron sound power levels that are stated in Table 8.

Table 10 - Proposed Outdoor Areas, Standing Patrons Average Sound Power Levels, dB re 10⁻¹² Watts

Number of Patrons, Outdoor Trading Area (OT_)	Octave Band Center Frequency (Hz)						
	63	125	250	500	1000	2000	4000
90, OT3	86	86	91	97	94	89	81
260 total, Pavillion, OT1, OT2, OT3	93	93	98	104	101	96	88

Noise impacts from the combined seated and standing patrons at the potentially most affected residential receiver locations were calculated using the 3-D noise model. The resulting noise levels were compared between the existing venue layout and patron numbers, versus those associated with the proposed layout with increased patron capacity. For the purpose of the modelling, the following assumptions were adopted:

- All outdoor seating and standing areas are at full capacity (existing condition: ≈ 170 seated and ≈ 330 standing patrons; proposed: ≈ 250 seated and ≈ 350 standing patrons), with patrons evenly distributed and modelled:
 - at a seated height of 1.2 metres, and

- at a standing height of 1.7 metres.
- The proposed new northern outdoor area is assumed to accommodate seated patrons only, i.e., the standing patrons are all modelled within the proposed eastern outdoor area.
- 1.6 metre high boundary acoustic screens are installed adjacent to the various patron areas, with a 1.8 metre high screen located at the north-eastern corner, consistent with existing conditions (refer to Appendix C for the acoustic screen layout for the assessment).

Table 11 below compares the calculated results for the existing and proposed outdoor areas, taking into account a combination of standing and seated patrons.

Table 11 – Quasi-Steady State Noise, Seated & Standing Patrons, Existing vs. Proposed Outdoor Patron Areas

Location	Proposed seated & standing Patrons: Noise Level at residential receivers (dB, L _{Aeq})	Existing seated & standing Patrons: Noise Level at residential receivers (dB, L _{Aeq})	Relative Difference in Noise Level, Proposed vs. Existing	Resulting Impact Considered Acceptable?
1 Flinders Parade	58	58	0 dB	Yes
2 Bridge Road	56	56	0 dB	Yes
2A Bridge Road	51	51	0 dB	Yes
2B Bridge Road	49	49	0 dB	Yes
8 Ewing Blyth Drive	58	58	0 dB	Yes

Accounting for both seated and standing patrons, and noting that the total occupancy increases from 500 to 600 between the existing conditions and the proposed usage, the resulting change in noise levels is calculated to be negligible, and therefore is considered to be acceptable.

4.2.5. Transient Assessment; Seated Patrons only

For the transient noise assessment, the same seated patron numbers and layouts were used as for the steady state noise assessment, comparing the relative difference between the existing and the proposed outdoor seated areas (refer to Section 4.2.2). The transient seated patron sound power levels in the proposed outdoor trading areas that were used for the purposes of the assessment are presented in Table 12 below.

Table 12 – Proposed Seated Patrons, Transient Sound Power Levels, dB re 10⁻¹² Watts

Number of Patrons, Outdoor Trading Area (OT_)	Octave Band Center Frequency (Hz)						
	63	125	250	500	1000	2000	4000
12 (in each OT4, 5, 6)	83	83	88	94	91	86	78
16 (OT7)	84	84	89	95	92	87	79
60 (OT3)	90	90	95	101	98	93	85
42 (Pavillion)	89	89	94	100	97	92	84
96 (OT1 + OT2)	93	93	98	104	101	96	88

Seated patron noise impacts at the potentially most affected residential receiver locations were calculated using the 3-D noise model. The resulting transient noise levels were compared between the existing venue layout and patron numbers versus those associated with the proposed layout and increased seating capacity. As previously, for the purpose of the modelling, the following assumptions were adopted:

- All outdoor seating areas are at full capacity (existing condition: \approx 170 seated patrons, proposed: \approx 250 seated patrons), with patrons evenly distributed and modelled at a seated height of 1.2 metres.
- No standing patrons are present in any outdoor areas.
- 1.6 metre high boundary acoustic screens are installed adjacent to the various patron areas, with a 1.8 metre high screen located at the north-eastern corner, consistent with existing conditions (refer to Appendix C for the acoustic screen layout used for the assessment).

The calculated results were compared and are shown in Table 13 below.

Table 13 – Transient Noise, Seated Patrons, Existing vs. Proposed Outdoor Patron Areas

Location	Proposed seated Patrons: Noise Level at residential receivers (dB, L _{Amax})	Existing seated Patrons: Noise Level at residential receivers (dB, L _{Amax})	Relative Difference in Calculated Noise Levels, Proposed vs. Existing	Resulting Impact Considered Acceptable?
1 Flinders Parade	61	58	+3 dB	Yes
2 Bridge Road	60	55	+5 dB	Yes
2A Bridge Road	58	53	+5 dB	Yes
2B Bridge Road	59	51	+8 dB	No further consideration required
8 Ewing Blyth Drive	56	56	+0 dB	Yes

The proposed outdoor seating layout is calculated to result in an increased transient noise level by 8 dB at one residential receiver, situated at 2B Bridge Road. Given the magnitude of this increase, additional analysis was undertaken to assess its implications within the context of the venue's operations and the surrounding amenity.

Octave Acoustics therefore applied a sleep disturbance analysis to this assessment. Whilst there are currently no policies or guidelines in Victoria for the assessment of sleep disturbance, VCAT typically accepts levels defined in accordance with the NSW Road Noise Policy 2011 (RNP). The RNP concludes that:

- *Maximum internal noise levels below 50-55dB(A) are unlikely to awaken people from sleep; and*
- *One or two noise events per night, with maximum internal noise levels of 65-70dB(A) are not likely to affect health and wellbeing significantly.*

These levels are usually only applied between the hours 10pm to 7am, however, are reasonable to consider relevant here to provide further context. Where residential windows may be open for ventilation, it is generally accepted that the noise reduction via the open window is 10dB(A). Therefore, external noise levels need to exceed sleep disturbance levels by more than 10dB(A) to warrant further assessment. This is summarized in Table 14 below.

Table 14 – Sleep Disturbance Noise Levels

Bedroom Noise Level, dB L _{Amax}	Correction for Outdoor Level	Associated Sleep Disturbance Outdoor Noise Level, dB L _{Amax}
50-55	+10 dB	60-65

Comparison of the calculated proposed outdoor patron area transient noise from Table 13, with the sleep disturbance levels in Table 14 shows that, although an increase of 8 dB at one residential receiver was calculated, sleep amenity would not be expected to be significantly affected, as it is below the sleep disturbance trigger range of 60 dB to 65 dB, and therefore considered acceptable. This assessment is summarised in Table 15 below.

Table 15 – Transient Noise of the Proposed Seated Patrons compared to Sleep Disturbance Noise Levels

Location	Proposed Seated Patrons: Noise Level at residences (dB, L _{Amax})	Sleep Disturbance Outdoor Noise Level (dB, L _{Amax})	Further Consideration Required?	Resulting Impact Considered Acceptable?
1 Flinders Parade	61	60–65	No	Yes
2 Bridge Road	60	60–65	No	Yes
2A Bridge Road	58	60–65	No	Yes
2B Bridge Road	59	60–65	No	Yes
8 Ewing Blyth Drive	56	60–65	No	Yes

In regard to Council's RFI in relation to transient noise impacts which may affect the residential property at 2B Bridge Road, Octave Acoustics notes that the calculated outdoor noise level of 59 dB L_{Amax} at the property boundary of 2B Bridge Road complies with the relevant RNP sleep disturbance criterion when accounting for the typical 10dB(A) reduction that is expected to occur through an open window. This results in a calculated internal bedroom noise level of 49 dB L_{Amax}. This outcome is consistent with the RNP guidance, which states that *internal noise levels below 50–55 dB L_{Amax} are unlikely to awaken people from sleep*.

The second RNP criterion, which states that *one or two noise events per night with maximum internal noise levels of 65–70 dB(A) are not likely to affect health and wellbeing significantly*, is not considered relevant in this instance, as it is not expected to be approached or exceeded. The calculated external noise level of 59 dB L_{Amax} at the residential boundary of 2B Bridge Road already accounts for transient patron noise, such as occasional loud laughter or shouting, resulting in a calculated noise level of 49dB L_{Amax} within the bedroom, assuming that the bedroom window is open. This level is comfortably below the 65–70 dB L_{Amax} internal level referenced in the second RNP criterion.

4.2.6. Transient Assessment; Seated & Standing Patrons

In addition to transient sound power levels for the proposed seated outdoor patrons, standing patron transient sound power levels were calculated for the proposed outdoor trading areas, which are summarised in Table 16 below.

Table 16 – Proposed Outdoor Areas, Standing Patrons Transient Sound Power Levels, dB re 10⁻¹² Watts

Number of Patrons, Outdoor Trading Area (OT_)	Octave Band Center Frequency (Hz)						
	63	125	250	500	1000	2000	4000
90, OT3	95	95	100	106	103	98	90
260 total, Pavillion, OT1, OT2, OT3	101	101	106	112	109	104	96

For the purpose of the modelling, the following assumptions were adopted:

- All outdoor seating and standing areas are at full capacity (existing condition: \approx 170 seated and \approx 330 standing patrons; proposed: \approx 250 seated and \approx 350 standing patrons), with patrons evenly distributed and modelled:
 - at a seated height of 1.2 metres, and
 - at a standing height of 1.7 metres.
- The proposed new northern outdoor area is assumed to accommodate seated patrons only, i.e., the standing patrons are all assumed to be located within the eastern outdoor area.
- 1.6 metre high boundary acoustic screens are installed adjacent to the various patron areas, with a 1.8 metre high screen located at the north-eastern corner, consistent with existing conditions (refer to Appendix C for the acoustic screen layout for the assessment).

The results were compared and are shown in Table 17 below.

Table 17 – Transient Noise, Seated & Standing Patrons; Existing vs. Proposed Outdoor Patron Areas

Location	Proposed seated & standing Patrons: Noise Level at residential receivers (dB, L_{Amax})	Existing seated & standing Patrons: Noise Level at residential receivers (dB, L_{Amax})	Relative Difference in Calculated Noise Levels, Proposed vs. Existing	Resulting Impact Considered Acceptable?
1 Flinders Parade	67	66	+1 dB	Yes
2 Bridge Road	65	63	+2 dB	Yes
2A Bridge Road	61	60	+1 dB	Yes
2B Bridge Road	60	58	+2 dB	Yes
8 Ewing Blyth Drive	64	64	0 dB	Yes

The relative comparison of transient noise levels for combined seated and standing patrons, between the existing venue and the proposed outdoor areas, indicates a relatively minor increase of 1 dB to 2 dB at the nearest sensitive receivers. This change is considered immaterial, as it would not be perceptible to the average listener, and is therefore regarded as acceptable, in the context of the venue's proposed outdoor trading area changes, compared to existing conditions.

4.2.7. Acoustic Screen Specification

Acoustic screening required to mitigate patron noise, as referenced throughout Section 4.2, is to be constructed as follows:

- Acoustic screening to comprise solid glazing with heights of 1.6 metre and 1.8 metre above finished floor level, in accordance with the glazing markup shown in Appendix C.
- Any capping or glass edge protection is to be located above the respective 1.6 metre and 1.8 metre screen heights.
- The acoustic screens are to be fully continuous, with no gaps or openings, and all joints between panels are to be appropriately sealed.
- The acoustic screens must achieve a minimum surface density of 15 kg/m².
- The glazed component is to comprise a minimum of 8 mm thick clear acoustic/safety glass.

4.3. Music Noise

4.3.1. Music Noise Assessment

It is understood that music is proposed to be played within all indoor areas of the hotel:

- Newly constructed ground floor Function Room to the North-West,
- Public Bar and Indoor Trading 1, 2, 3, on the ground floor to the North and East, and
- Level 1 Indoor Trading 10.

It is understood that amplified music may be played at a volume that exceeds “background level” in certain settings, such as during functions, DJ performances, and similar events. Music noise emissions must be assessed in accordance with Clause 53.06. It is mandatory that music noise emissions comply with EPR 2021 noise limits (refer to Section 3.1.1). The previously developed 3-D computer model was used to calculate indoor music noise emissions impacting the nearest residential dwellings along Bridge Road.

4.3.1.1. AAAC Guideline Description of Internal Reverberant Noise Levels from Amplified Music

The Association of Australasian Acoustical Consultants (AAAC) *Licensed Premises Noise Assessment Technical Guideline Version 2.0* (AAAC Guideline) provides a subjective description of internal reverberant noise levels associated with various amplified music levels. The music noise levels and associated subjective descriptions in relation to “background music” and “foreground music” are referred to in the following sections of this document.

Table 18 – Internal Reverberant Noise Levels from Amplified Music

Type	Internal Level (L _{Aeq})	Comment
Background Music	67-74 dB(A)	Allows for conversation at normal vocal effort at 600 mm separation.
	70-77 dB(A)	Allows for conversation at raised vocal effort at 600 mm separation.
Foreground Music	85-90 dB(A)	Minimum level patrons expect amplified music to be played at when the music is meant to be the dominating soundscape (i.e. levels below this would be considered not loud enough.) Typical night club level at the start of the night
	90-96 dB(A) 101 to 106 dB(Z) 100 to 105 dB(C)	Typical level within a nightclub as patron numbers increase. Loud vocal effort required in close proximity to listener's ear. Potential nightclub level early in the night when patrons and operators may be suffering from a temporary threshold shift (TTS) ¹ in hearing (e.g. after approximately 1 hour of amplified music exposure.)
	97-105 dB(A) 107 to 115 dB(Z) 106 to 120 dB(C)	Typical level that may be considered “very” or “extremely” loud. Loud to shouting vocal effort required in close proximity to listener's ear. Potential nightclub level towards peak of the night and/or when patrons and operators may be suffering from an even greater temporary threshold shift (TTS) ¹ in hearing. The L _{zeq} sound level in the 63 Hz octave band can be as high as 120 dB. Note that the level of programme content in the 31.5 Hz band is increasing and may need to be considered.

4.3.1.2. Music Noise Modelling Assumptions

As the Venue's façades are primarily constructed from masonry, it is expected that music noise transmission to the nearest affected noise sensitive receivers will be dominated by breakout via lightweight roof/ceiling systems (Function Room roof, main building roof opening with fabric awning) and façade glazing. Music noise break out from the Venue was modelled using the following assumptions:

- Function Room (Ground Floor):

- Music noise transmission through external glazing was modelled using vertical area sources applied to the glazed façade.
- Music noise transmission through the light weight roof/ceiling was modelled using a horizontal area source applied to the roof.
- Ground Floor and Level 1 Spaces:
 - Music noise transmission through external glazing was modelled using vertical area sources applied to the glazed façade.
 - Level 1 roof opening was modelled as a horizontal area source with no transmission loss.
- Non-glazed façade walls are assumed to achieve an R_w rating which is at least 15 dB(A) higher than the glazed elements.
- All windows and doors are modelled as closed.
- The octave band transmission loss spectrums for the external glazing and the Function Room roof system used in the 3-D computer noise model are as stated in Table 19 below.
- The modelled internal music spectrum within the ground floor function space and public bar, as well as ground floor and level 1 indoor trading areas is as presented in the paper *Influence of Music Genre and Composition on Entertainment Noise Limits* by Hayne et al, 2005 (refer to Table 20).

Table 19 – Calculated Transmission Loss Data of Venue Building Elements used in 3-D Noise Model

Building Element	Assumed form of construction	R_w	Octave Band Center Frequency (Hz)						
			63	125	250	500	1000	2000	4000
Function Room roof system	Metal roof cladding atop timber joists; 90mm thick R2.5 insulation in roof cavity, 10mm plasterboard lining	36	18	22	24	32	41	42	50
All external glazing	Double glazing: 6mm glass pane / 12mm air gap / 6.38mm laminated glass	33	23	23	21	28	37	37	44

Table 20 – Spectral music noise data Rock music genre - Influence of music genre and composition on entertainment noise limits (2005) by Hayne, Mee and Rumble

Genre	dB(A)	Octave Band Centre Frequency (Hz)						
		63	125	250	500	1k	2k	4k
Rock	116	113	115	112	111	109	109	109 ₁

Notes: 1. Extrapolated from lower octave bands.

4.3.1.3. Day/Evening Period

Music noise octave band data was sourced from *Influence of Music Genre and Composition on Entertainment Noise Limits* by Hayne et al, 2005 (refer to Table 20) and incorporated into the 3-D computer noise model. This data was used to calculate the maximum overall A-weighted internal noise levels within various indoor spaces that would ensure compliance with music noise limits at potentially affected residential receivers during daytime, evening, and nighttime periods. Refer to Table 21 below for details. For modelling purposes, it was assumed that all indoor areas were playing music simultaneously, ground floor music is played at the same elevated volume, while Level 1 music is played at background level of 70dB L_{Aeq} .

The calculated internal music level within the Venue of 96 dB L_{Aeq} during the Day/Evening period falls within the AAAC Guideline 90–96 dB(A) grouping of “Foreground Music” which is described as “Typical level within a nightclub as patron numbers increase. Loud vocal effort required in close proximity to listener’s ear. Potential nightclub level early in the night.” In practice, it is reasonable to expect that the level of music played inside the Venue may be lower than the allowable Day/Evening period compliant music noise level, in particular locations where “Background Music” may be played, such as in the bar and dining areas. As such, it is expected that this calculated upper limit for music noise within the various spaces of Venue will provide ample margin for compliance during the day/evening period.

Table 21 – Compliant overall A-weighted music noise level within all ground floor indoor trading areas for Day/Evening period.

Address of Noise Sensitive Receiver	Compliant Internal Music Noise Level, dB L_{Aeq}	Calculated Music Noise Level at Noise Sensitive Receiver, dB L_{Aeq}	Applicable Music Noise Limit at Noise Sensitive Receiver, dB L_{Aeq}	Complies?
1 Flinders Parade	96	43	43	Yes
2 Bridge Road	96	43	43	Yes
2A Bridge Road	96	43	43	Yes

Notes: 1. Compliant music noise level scaled using the Rock genre spectrum, applicable to ground level areas only. Level 1 music may be played at background level of up to 70dB L_{Aeq} .

4.3.1.4. Night Period

The 3-D computer noise model was then run again to determine the maximum internal octave band music noise levels that are calculated to lead to compliance during the night period, at the worst-case residential receiver, located at 2 Bridge Road. Compliance at this location is expected to lead to compliance at all other assessable locations. For modelling purposes, it was assumed that all indoor areas were playing music simultaneously, ground floor music is played at the same elevated volume, while Level 1 music is played at a background level of 70dB L_{Aeq} .

The results show that for the night period, an indoor music noise level of 88 dB L_{Aeq} on the ground level trading areas is calculated to achieve compliance at the nearest sensitive receivers along Bridge Road, per details in Table 22. This noise level falls within the AAAC Guideline 85–90 dB(A) grouping of “Foreground Music” and under the guideline defined as “Minimum level patrons expect amplified music to be played at when the music is meant to be the dominating soundscape (i.e. levels below this would be considered not loud enough.) Typical night club level at the start of the night”. In practice, it is reasonable to expect that the level of music played inside the Venue may be lower than the allowable Night period compliant music noise level, in particular locations where “Background Music” may be played, such as in the bar and dining areas. However, sound levels of up to 88 dB L_{Aeq} may be anticipated during events that require elevated music volumes, such as functions or DJ performances.

Table 22 – Music Noise Level, all ground floor² indoor trading areas, to nearest sensitive Receiver; Night

Condition	dB(A)	Octave Band Center Frequency (Hz)						
		63	125	250	500	1000	2000	4000
Music Noise Level (L_{10})	91	88	90	87	86	84	84	84
Music Noise Level (L_{eq})₁	88	85	87	84	83	81	81	81
Music Level at most affected receiver (L_{10})	-	45	45	43	35	26	25	19
Applicable EPR 2021 criteria (L_{10})	-	47	48	44	40	38	32	25
Complies?	-	✓	✓	✓	✓	✓	✓	✓

Notes:

1. The L_{10} music level is commonly 3dB higher than the L_{eq} music level.
2. On Level 1: background music is permissible, at a level of 70dB L_{Aeq} .

5. Recommendations

5.1. Noise Emissions Associated with Mechanical Plant

It is important to note that, at this stage of the design, a quantitative assessment of any new mechanical plant and equipment cannot be undertaken as neither a detailed mechanical design or associated plant and equipment selections are available. However, it is expected that compliance can be achieved with EPR 2021 noise limits stated in Table 6 using standard acoustic treatments such as acoustically lined ductwork, duct attenuators and acoustic screening as required. It is expected that most key new plant items such as such as air-conditioning plant, kitchen exhaust fan and cool room fan would be located on the rooftop. It is expected that any new air-conditioning plant (such as large air-conditioning condensers or chillers) in particular, will require acoustic plant screening with the specific requirements to be determined during the detailed design phase of the development.

During the detailed design phase, noise from any new mechanical plant and equipment shall be assessed and specific noise treatments (such as plant screening and duct attenuators) documented to ensure that cumulative noise from all base building and commercial plant does not exceed EPR 2021 noise limits. In addition, all vibrating and rotating plant and equipment shall be installed on isolation mounts which are selected in accordance with Chapter 48 *Noise and Vibration Control* of the ASHRAE Handbook.

5.2. Patron Noise Emissions

In order to minimise patron noise emissions to adjacent residential receivers the following is recommended:

- 1.6 metre high boundary acoustic screens should be installed adjacent to the various patron areas, with a 1.8 metre high screen installed at the north-eastern corner, consistent with existing conditions (refer to Appendix C for the acoustic screen layout).
- To minimise patron noise impacts associated with the new northern outdoor trading area, it is recommended that this space be restricted to use by seated patrons only.

5.3. Music Noise Emissions

To ensure that the EPR 2021 music noise limits are not exceeded in accordance with Planning Scheme Clause 53.06, it is recommended that the following conditions be included in the planning permit and that the Venue operator ensures that these recommendations are implemented within any spaces where music is played.

- Any music noise emissions from indoor spaces shall comply with the requirements of the Environment Protection Regulations 2021 Part 5.3 Division 4 – Unreasonable and aggravated noise from entertainment venues and outdoor entertainment venues.
- Fixed speakers shall not be installed outdoors.
- Music shall not be played outdoors.
- The external windows and doors should be closed any time when music is played above “background level”.
- Amplified music played within any spaces at levels that exceed “background level” must be played via a music noise-limiting device.

5.3.1. Noise Limiter Requirements

Music noise limitation devices should be installed to the sound systems within any indoor spaces, where amplified music is expected to be played above background levels, for example the Function Room. The music noise limitation devices shall be of the suppression/compression type, such as the *Drawmer SL22 Sound Level Limiter*, or the *TSV Model CSM-2 Sound Monitor*, or equivalent, that control sound levels to within the specified limit (i.e. do not simply cut power to the sound system). The music noise limitation devices should be calibrated by a qualified acoustic engineer such that music noise emissions cumulatively do not exceed the EPA music noise limits (refer Section 3.1.1) at adjacent noise sensitive receivers. The music noise limitation device must be locked in a tamper-proof manner in such a way that it cannot be adjusted by operators other than a qualified acoustic engineer or technician nominated by the licensee and notified to the Responsible Authority. All

amplified music within the relevant spaces must be played through the in-house, noise limited system. If the in-house speaker system is altered, then adjustment of the noise limitation device may be required.

6. Conclusions

Octave Acoustics was engaged to provide an acoustic assessment for the proposed Barwon Heads Hotel re-development, located at 1 Bridge Road, Barwon Heads.

Measurements of background noise levels were carried out proximate to Bridge Road. A 3-D computer noise model of the Subject Development was developed in CadnaA and was run to compute patron and music noise impacts to the nearest residential receivers on Bridge Road and Ewing Blyth Drive.

While there are no mandatory criteria for assessing patron noise, Octave Acoustics' analysis indicates that quasi-steady state noise from the proposed outdoor seated areas may increase by approximately 6 dB at the nearest residential properties when all seated areas are fully occupied. While this increase would be noticeable, it is not expected to result in any significant impact on residential amenity, noting that the assessment is conservative and actual patron numbers will fluctuate. When both seated and standing patrons are considered in the outdoor trading areas, the predicted noise levels show only a negligible change compared with existing conditions. On this basis, overall patron noise associated with the proposed redevelopment is considered acceptable.

Planning Scheme Clause 53.06 requires that indoor live music venues be designed, constructed and maintained to comply with EPR 2021 music noise limits at noise sensitive residential receivers within 50 metres of the venue. It is proposed that live music may be played in the ground floor function room and public bar as well as the ground floor and first floor trading spaces within the Venue. EPR 2021 noise limits for music noise emissions have been determined.

In order to ensure compliance with EPR 2021 noise limits for it is recommended that all music that is played within the indoor spaces, at a level that exceeds a background level of 67-77 dB L_{Aeq} , is played through the in-house sound system which incorporates a music noise limitation device. The noise limitation device(s) should be calibrated by a suitably qualified acoustic engineer in order that compliance with EPR 2021 music noise limits is achieved at the closest affected residential receivers, in accordance with the requirements of Clause 53.06.

At this stage of the proposed development, any new mechanical plans and specifications are not available to inform a detailed assessment with respect to EPR 2021 compliance. It is expected that the majority of base building plant will be carried over and remain at its current location on the rooftop, and that typical acoustic treatment such as plant screening and duct attenuators will be sufficient to achieve compliance with EPR 2021 noise limits for any new mechanical plant, where relevant. At this stage, it is typically satisfactory to accept a condition on the permit which stipulates a requirement for compliance with EPR 2021.

Appendix A: Glossary of Terms

'A' Frequency Weighting

The 'A' frequency weighting roughly approximates to the Fletcher–Munson 40 phon equal loudness contour. The human loudness perception at various frequencies and sound pressure levels is equated to the level of 40 dB at 1 kHz. The human ear is less sensitive to low frequency sound and very high frequency sound than midrange frequency sound (i.e. 500 Hz to 6 kHz). Humans are most sensitive to midrange frequency sounds, such as a child's scream. Sound level meters have inbuilt frequency weighting networks that very roughly approximates the human loudness response at low sound levels. It should be noted that the human loudness response is not the same as the human annoyance response to sound. Here low frequency sounds can be more annoying than midrange frequency sounds even at very low loudness levels. The 'A' weighting is the most commonly used frequency weighting for occupational and environmental noise assessments. However, for environmental noise assessments, adjustments for the character of the sound will often be required.

AMBIENT NOISE

The ambient noise level at a particular location is the overall environmental noise level caused by all noise sources in the area, both near and far, including all forms of traffic, industry, lawnmowers, wind in foliage, insects, animals, etc. Usually assessed as an energy average over a set time period 'T' (LAeq,T).

AUDIBLE

Audible refers to a sound that can be heard. There are a range of audibility grades, varying from "barely audible", "just audible" to "clearly audible" and "prominent".

BACKGROUND NOISE LEVEL

Total silence does not exist in the natural or built environments, only varying degrees of noise. The Background Noise Level is the minimum repeatable level of noise measured in the absence of the noise under investigation and any other short-term noises such as those caused by all forms of traffic, industry, lawnmowers, wind in foliage, insects, animals, etc. It is quantified by the noise level that is exceeded for 90 % of the measurement period 'T' (LA90,T). Background Noise Levels are often determined for the day, evening and night time periods where relevant. This is done by statistically analysing the range of time period (typically 15

minute) measurements over multiple days (often 7 days). For a 15-minute measurement period the Background Noise Level is set at the quietest level that occurs at 1.5 minutes.

'C' FREQUENCY WEIGHTING

The 'C' frequency weighting approximates the 100 phon equal loudness contour. The human ear frequency response is more linear at high sound levels and the 100 phon equal loudness contour attempts to represent this at various frequencies at sound levels of approximately 100 dB.

DECIBEL

The decibel (dB) is a logarithmic scale that allows a wide range of values to be compressed into a more comprehensible range, typically 0 dB to 120 dB. The decibel is ten times the logarithm of the ratio of any two quantities that relate to the flow of energy (i.e. power). When used in acoustics it is the ratio of the square of the sound pressure level to a reference sound pressure level, the ratio of the sound power level to a reference sound power level, or the ratio of the sound intensity level to a reference sound intensity level. See also Sound Pressure Level and Sound Power Level. Noise levels in decibels cannot be added arithmetically since they are logarithmic numbers. If one machine is generating a noise level of 50 dB, and another similar machine is placed beside it, the level will increase to 53 dB (from $10 \log_{10}(10^{(50/10)} + 10^{(50/10)})$) and not 100 dB. In theory, ten similar machines placed side by side will increase the sound level by 10 dB, and one hundred machines increase the sound level by 20 dB. The human ear has a vast sound-sensitivity range of over a thousand billion to one, so the logarithmic decibel scale is useful for acoustical assessments.

dBA – See 'A' frequency weighting

dBC – See 'C' frequency weighting

EQUIVALENT CONTINUOUS SOUND LEVEL, LAeq

Many sounds, such as road traffic noise or construction noise, vary repeatedly in level over a period of time. More sophisticated sound level meters have an integrating/averaging electronic device inbuilt, which will display the energy time-average (equivalent continuous sound level - LAeq) of the 'A' frequency weighted sound pressure level. Because the decibel scale is a logarithmic ratio, the higher noise levels have far more sound energy, and therefore the LAeq level tends to indicate an average which is strongly influenced by short-term,

high level noise events. Many studies show that human reaction to level-varying sounds tends to relate closer to the LAeq noise level than any other descriptor.

'F' (FAST) TIME WEIGHTING

Sound level meter design-goal time constant which is 0.125 seconds.

FREE FIELD

In acoustics a free field is a measurement area not subject to significant reflection of acoustical energy. A free field measurement is typically not closer than 3.5 metres to any large flat object (other than the ground) such as a fence or wall or inside an anechoic chamber.

FREQUENCY

The number of oscillations or cycles of a wave motion per unit time, the SI unit is the hertz (Hz). 1 Hz is equivalent to one cycle per second. 1000 Hz is 1 kHz.

LOUDNESS

The volume to which a sound is audible to a listener is a subjective term referred to as loudness. Humans generally perceive an approximate doubling of loudness when the sound level increases by about 10 dB and an approximate halving of loudness when the sound level decreases by about 10 dB.

MAXIMUM NOISE LEVEL, LAFmax

The root-mean-square (rms) maximum sound pressure level measured with sound level meter using the 'A' frequency weighting and the 'F' (Fast) time weighting. Often used for noise assessments other than aircraft.

MAXIMUM NOISE LEVEL, LASmax

The root-mean-square (rms) maximum sound pressure level measured with sound level meter using the 'A' frequency weighting and the 'S' (Slow) time weighting. Often used for aircraft noise assessments.

NOISE

Noise is unwanted, harmful or inharmonious (discordant) sound. Sound is wave motion within matter, be it gaseous, liquid or solid. Noise usually includes vibration as well as sound.

OFFENSIVE NOISE

Reference: Dictionary of the NSW Protection of the Environment Operations Act 1997).

"Offensive Noise means 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 likely to be harmful to) a person who is outside the premise 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 regulations."

'S' (SLOW) TIME WEIGHTING

Sound level meter design-goal time constant which is 1 second.

SOUND ATTENUATION

A reduction of sound due to distance, enclosure or some other device. If an enclosure is placed around a machine, or an attenuator (muffler or silencer) is fitted to a duct, the noise emission is reduced or attenuated. An enclosure that attenuates the noise level by 20 dB reduces the sound energy by one hundred times.

SOUND EXPOSURE LEVEL (LAE)

Integration (summation) rather than an average of the sound energy over a set time period. Use to assess single noise events such as truck or train pass by or aircraft flyovers. The sound exposure level is related to the energy average (LAeq,T) by the formula $LA_{eq,T} = LAE - 10 \log_{10} T$. The abbreviation (SEL) is sometimes inconsistently used in place of the symbol (LAE).

SOUND PRESSURE

The rms sound pressure measured in pascals (Pa). A pascal is a unit equivalent to a newton per square metre (N/m²).

SOUND PRESSURE LEVEL, Lp

The level of sound measured on a sound level meter and expressed in decibels (dB). Where $L_p = 10 \log_{10} (P_a/P_o)^2$ dB (or $20 \log_{10} (P_a/P_o)$ dB) where P_a is the rms sound pressure in Pascal and P_o is a reference sound pressure conventionally chosen is 20 μ Pa (20×10^{-6} Pa) for airborne sound. L_p varies with distance from a noise source.

SOUND POWER

The rms sound power measured in watts (W). The watt is a unit defined as one joule per second. A

measures the rate of energy flow, conversion or transfer.

SOUND POWER LEVEL, L_w

The sound power level of a noise source is the inherent noise of the device. Therefore, sound power level does not vary with distance from the noise source or with a different acoustic environment. $L_w = L_p + 10 \log_{10} 'a'$ dB,

re: 1pW , (10^{-12} watts) where 'a' is the measurement noise-emission area (m^2) in a free field.

SOUND TRANSMISSION LOSS

The amount in decibels by which a random sound is reduced as it passes through a sound barrier. A method for the measurement of airborne Sound Transmission Loss of a building partition is given in Australian Standard AS1191 - 2002.

STATISTICAL NOISE LEVELS, L_n

Noise which varies in level over a specific period of time 'T' (standard measurement times are often 15-minute periods) may be quantified in terms of various statistical descriptors with some common examples:

The noise level, in decibels, exceeded for 1% of the measurement time period, when 'A' frequency weighted and 'F' time weighted is reference to as $L_{AF1,T}$. This may be used for describing short-term noise levels such as could cause sleep arousal during the night.

The noise level, in decibels, exceeded for 10% of the measurement time period, when 'A' frequency

weighted and 'F' time weighted is reference to as $L_{AF10,T}$. In most countries the $L_{AF10,T}$ is measured over periods of 15 minutes, and is used to describe the average maximum noise level.

The noise level, in decibels, exceeded for 90% of the measurement time period, when 'A' frequency weighted and 'F' time weighted is reference to as $L_{AF90,T}$. In most countries the $L_{AF90,T}$ is measured over periods of 15 minutes, and is used to describe the average minimum or background noise level.

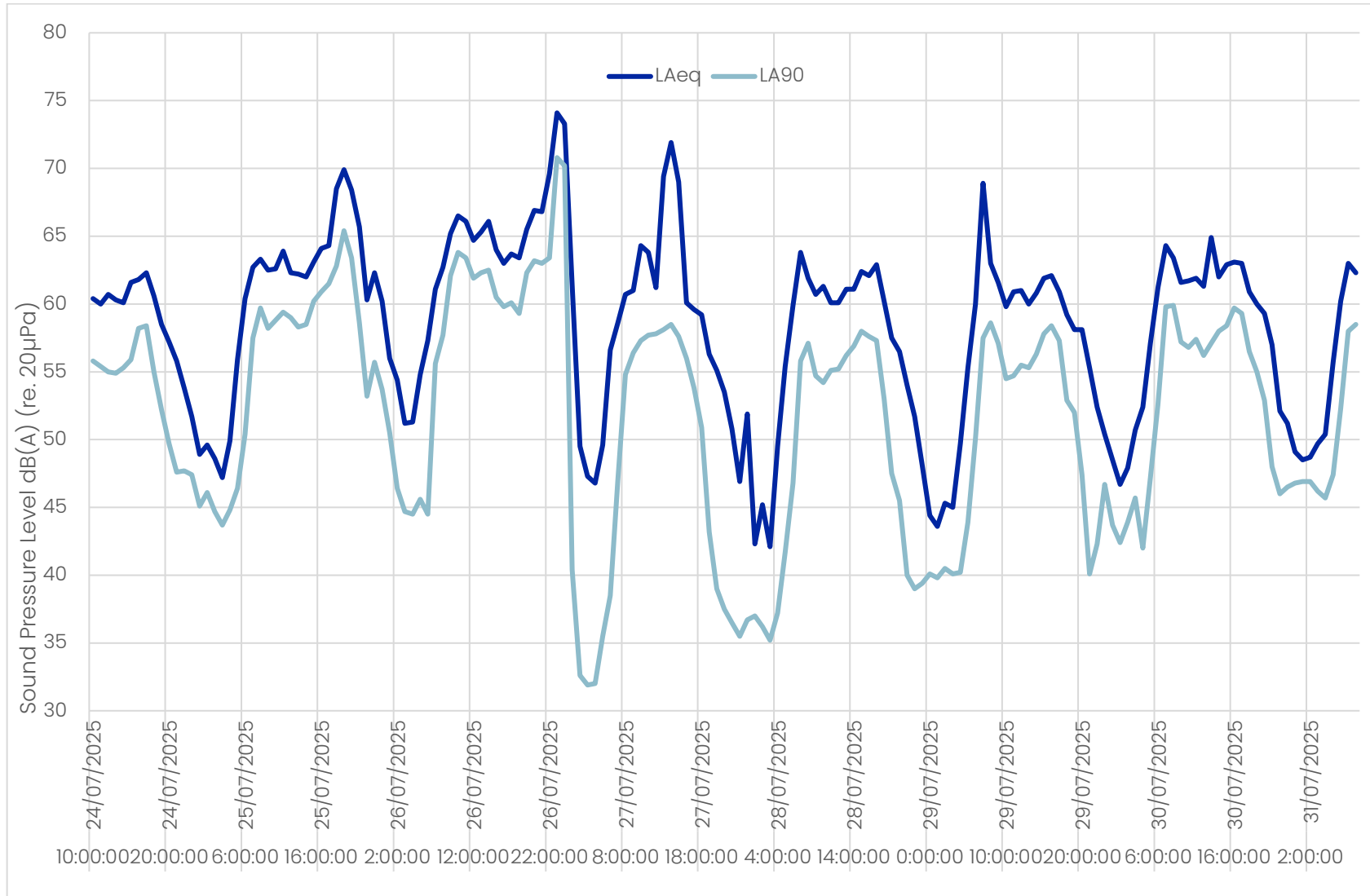
WEIGHTED SOUND REDUCTION INDEX, R_w

This is a single number rating of the airborne sound insulation of a wall, partition or ceiling. The sound reduction is normally measured over a frequency range of 100 Hz to 3.150 kHz and averaged in accordance with ISO standard weighting curves (Refer AS/NZS 1276.1:1999). Internal partition wall R_w+C ratings are frequency weighted to simulate insulation from human voice noise. The R_w+C is similar in value to the STC rating value. External walls, doors and windows may be R_w+C_{tr} rated to simulate insulation from road traffic noise. The spectrum adaptation term C_{tr} adjustment factor takes account of low frequency noise. The weighted sound reduction index is normally similar or slightly lower number than the STC rating value.

'Z' FREQUENCY WEIGHTING

The 'Z' (Zero) frequency weighting is 0 dB within the nominal 1/3 octave band frequency range centred on 10 Hz to 20 kHz. This is within the tolerance limits given in AS IEC 61672.1-2004: 'Electroacoustics - Sound level meters - Specifications'.

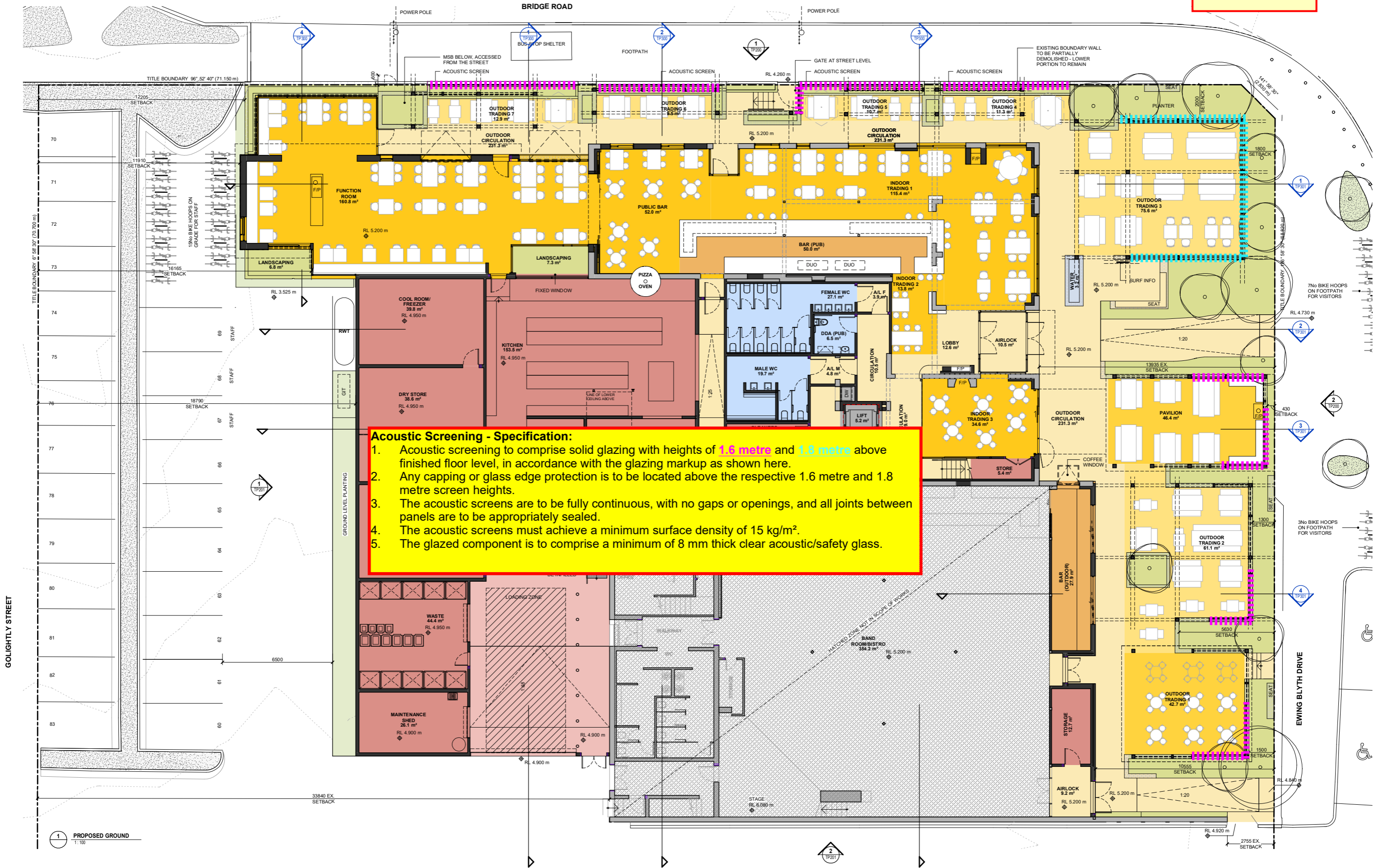
Appendix B: Noise Logging Summary



Appendix C: Markup, Acoustic Screens

Barwon Heads Hotel, Proposed Outdoor Patron Areas: Acoustic Screen Markup, for 3-D Noise Analysis

1.0m screen
1.8m screen



Acoustic Screening - Specification:

1. Acoustic screening to comprise solid glazing with heights of **1.6 metre** and **1.8 metre** above finished floor level, in accordance with the glazing markup as shown here.
2. Any capping or glass edge protection is to be located above the respective 1.6 metre and 1.8 metre screen heights.
3. The acoustic screens are to be fully continuous, with no gaps or openings, and all joints between panels are to be appropriately sealed.
4. The acoustic screens must achieve a minimum surface density of 15 kg/m².
5. The glazed component is to comprise a minimum of 8 mm thick clear acoustic/safety glass.