REVERB ACOUSTICS

Noise and Vibration Consultants

Noise Impact Assessment
Proposed Hotel/Bar
The Esplanade Project
Shortland Esplanade
Newcastle NSW

September 2012

Prepared for Stronach Property Pty Ltd
Report No. 12-1663-R1

Building Acoustics – Council/OEH Submissions - Modelling - Compliance - Certification

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TABLE OF CONTENTS

1 INTRODUCTION

Reverb Acoustics has been commissioned to conduct a noise impact assessment for a hotel/bar at The Esplanade Project, Shortland Esplanade, Newcastle. The assessment considers likely sources of noise associated with the hotel/bar that may impact upon nearby existing and future residential receivers (i.e. amplified entertainment, patron activity, and mechanical plant). The purpose of this report is to recommend appropriate acoustic measures that must be implemented to ensure compliance with the requirements of the Office of Environment and Heritage (OEH), NSW Office of Liquor Gaming & Racing (OLGR) and Newcastle City Council (NCC).

The assessment was requested by Stronach Property Pty Ltd in support of and to accompany a Development Application to NCC and to ensure any noise control measures required are incorporated during the design stages.

2 TECHNICAL REFERENCE / DOCUMENTS

AS 1276.1-1999 *"Acoustics – Rating of sound insulation in buildings and of building elements. Part 1: Airborne sound insulation"*.

NSW Environment Protection Authority (1999). *Industrial Noise Policy*

NSW Environment Protection Authority (1994). *Environmental Noise Control Manual*

Department of Environment and Climate Change NSW (2007). *Noise Guide for Local Government.*

Liquor Administration Board *"Noise Control Guidelines"*

Plans supplied by Suters Architects. Note that variations from the design supplied to us, may affect the acoustic recommendations.

Newcastle City Council (2006). *Interim Technical Guideline for the Assessment and Control of Low Frequency Noise from the Development of Musical Entertainment Venues.*

Renzo Tonin & Associates (2007). *The Royal Newcastle PA Noise Assessment.*

Van den Berg G.P. and Passchier-Vermeer W. (1999). *Assessment of low frequency noise complaints, Proc, Internoise 99.*

W.J. Davies, P. Hepworth, A. Moorhouse, R. Oldfield (2005). *Noise from Pubs and Clubs, Phase 1.*

A. Moorhouse, D. Waddington, M. Adams (2005). *Proposed criteria for the assessment of low frequency noise disturbance.*

A Glossary of commonly used acoustical terms is presented in Appendix A to aid the reader in understanding the Report.

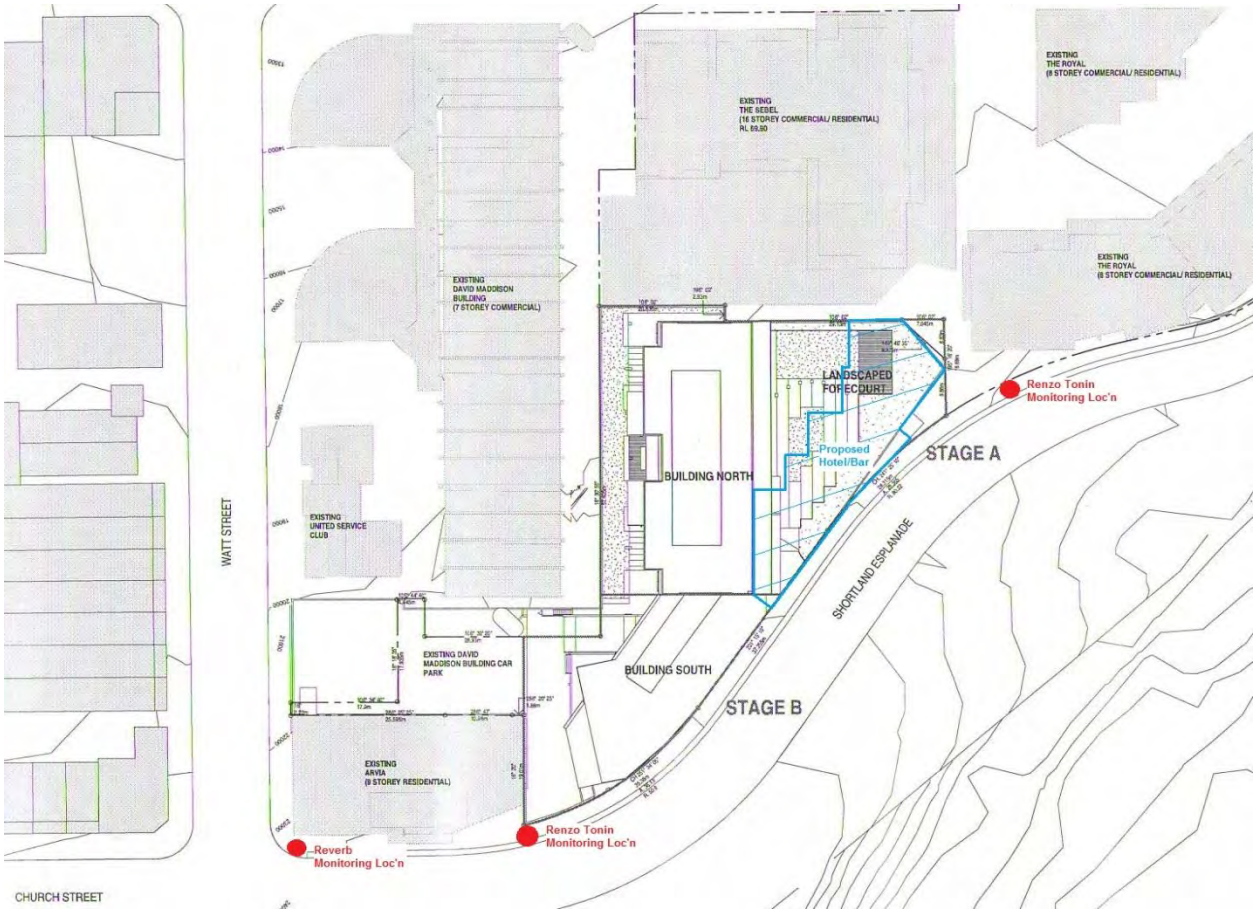
3 EXISTING ACOUSTIC ENVIRONMENT

Various acoustic assessments have been prepared in the vicinity of the proposal with all identifying elevated background noise levels, typical for developments affected by surf noise. The most recent background noise monitoring was conducted by Renzo Tonin & Associates in 2007[1]. The report lists background noise levels at various locations, with the lowest at night being 51dB(A),L90. Confirmation measurements conducted by Reverb Acoustics in August 2012 confirmed higher than average background noise levels at night with a minimum of 46dB(A),L90 after midnight. To provide a measure of conservatism we have adopted 46dB(A),L90 for the background noise level at all receivers for assessment purposes. As part of our monitoring at the site we obtained a frequency spectrum of the background noise. Table 1 below shows the adopted background noise level, adjusted to give a total level equivalent to the average background noise level between 6pm and midnight.

Table 1: Adopted Background Noise Level Spectrum, L(A)90 – 12am-7am

	Octave Band Centre Frequency, Hz								
dB(A)	**31.5**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
46	25	36	38	38	39	40	36	27	21

Figure 1 – Site Plan



[1] Renzo Tonin & Associates (2007). *The Royal Newcastle PA Noise Assessment.*

4 CRITERIA

4.1 Entertainment

Consultation with NCC's planning department confirms that their *Interim Technical Guideline for the Assessment and Control of Low Frequency Noise from the Development of Musical Entertainment Venues* must be applied for assessment of noise created by amplified entertainment associated with the hotel/bar. It should be noted that the intention of the guideline is to provide a means of guaranteeing inaudibility within neighbouring residences as part of the planning process and normal ongoing compliance is determined according to the LAB's Standard Noise Conditions. Reproduced in Table 2 are Council's criteria, which must be achieved within any habitable room of nearby residences. Included within the Table are the A weighted equivalent values to aid the reader in comparing various criteria sighted in this report.

Table 2: NCC Assessment Criteria

1/3 Octave Centre Frequency (Hz)	NCC Assessment Criteria for Audibility Predictions Lmax,(fast) or Adjusted Leq (30 sec) dB	NCC Assessment Criteria for Audibility Predictions Lmax,(fast) or Adjusted Leq (30 sec) dB(A)
31.5	50.0	10.6
40	42.8	8.2
50	36.2	6.0
63	30.6	4.4
80	25.6	3.1
100	21.3	2.2
125	17.2	1.1
160	13.1	-0.3
200	9.5	-1.4
250	6.5	-2.1

It should be noted that Council's Interim Guideline is much more stringent than the Lab's Standard Noise Conditions, therefore, providing noise from entertainment is compliant with the Guideline, the requirements of the LAB are guaranteed.

4.2 Site Noise

Since this assessment relates to control of noise from licensed premises, together with determination of a Development Application to NCC, two relevant criteria may apply, namely the Liquor Administration Board's (LAB's) Standard Noise Conditions and the OEH's Industrial Noise Policy (INP). Patrons on city streets and mechanical plant associated with the development may be a source of offensive noise for neighbouring residents. Furthermore, overall dB(A) assessment underestimates the intrusive nature of intermittent noise sources. We have therefore applied the LAB's Standard Noise Conditions for the assessment purposes. The LAB's Standard Noise Conditions are as follows:

"The LA10 noise level emitted from the licensed premises shall not exceed the background noise level in any Octave Band Centre Frequency (31.5Hz - 8kHz inclusive) by more than 5dB between 07:00 am 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 any Octave Band Centre Frequency (31.5Hz - 8kHz inclusive) between 12:00 midnight and 07:00 am 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 07:00 am".

To ensure the requirements of the LAB are satisfied, we have adopted a planning level, in the adjacent residential area, before midnight of **48dB(A),L10** being 5dB(A) above the measured background noise level in the area between 6pm and midnight and **46dB(A),L10** after midnight being equal to the background noise level. This equates to planning noise level targets, as shown below.

Table 3: Noise Planning Level, L(A)10 – 6pm to Midnight

	Octave Band Centre Frequency, Hz								
dB(A)	**31.5**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
51	30	41	43	43	44	45	41	32	26

Table 4: Noise Planning Level, L(A)10 – Midnight to 7am

	Octave Band Centre Frequency, Hz								
dB(A)	**31.5**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
46	25	36	38	38	39	40	36	27	21

Alternate criteria that may apply are those contained in the OEH's INP, which consider noise from industrial noise sources scheduled under the Protection of Environment Operations Act. However, local Councils may also apply the criteria for land use planning, compliance and complaints management. Both the LAB and OEH criteria require noise from premises to be kept within 5dB(A) of the background noise level up to midnight. Since the hotel/bar is licensed and the LAB Conditions are more stringent, (i.e. L10 noise levels for quasi-steady state noise sources are generally 6-7dB(A) higher than Leq noise levels), we have adopted criteria shown in the above Tables.

4.3 Sleep Arousal

Section 2.4.5 of the OEH's Noise Guide for Local Government and Chapter 19-3 of their Environmental Noise Control Manual (ENCM) state *"the L1 level of any specific noise source should not exceed the background noise level (L90) by more than 15dB(A) when measured outside the bedroom window"*. This criterion is applied to residential situations between the hours of 10.00pm and 7.00am where a receptor's sleep may be interrupted by noise. It is applied in this case to residents likely to receive noise from patrons outside the hotel/bar (raised speech) between the hours of 10pm and 7am.

Based on an average minimum background noise level of 46dB(A),L90 for night (10pm-12am) the sleep arousal criterion is set at **61dB(A),L1$_{(1min)}$** at the bedroom window of any affected residential receiver.

5 METHODOLOGY

5.1 Entertainment

A theoretical assessment of live and recorded entertainment was carried out to predict the noise level at the nearest potentially affected residential boundaries. It is expected that only incidental music will be played within the hotel/bar, however, on occasion duos/trios with drum machine accompaniment are expected. Using noise data for the above scenarios and the known criteria at nearby existing and future residences enabled calculation of the required transmission loss of each building element. Inspection of the supplied plans and observations during our site visits has identified the following significant noise leakage paths:

Function Room*:*	East and west glazing entry doors

The Sound Power Levels, Lw dB(A), of expected types of entertainment are shown in the following Tables. The noise source was placed in the centre of the room, as the exact location of the "stage" was not known, then theoretically propagated to nearest residences taking into account reverberant field loss to internal surfaces and transmission loss through each building element.

Table 5: Lw, Typical Trio & Drum Machine dB(lin),max

	1/3 Octave Band Frequency, Hz L(A)10									
Item	**31.5**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**
Lw Disco	102	103	105	106	107	106	105	104	102	102

Table 6: Lw, Typical Trio & Drum Machine dB(A),L10

Octave Band Centre Frequency, Hz									
dB(A)	**31.5**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
100	56	68	79	90	94	95	90	91	76

5.2 Mechanical Plant

Selection and location of mechanical plant has not been finalised at this stage. For assessment purposes we have therefore sourced manufacturers' noise emission data for similar sized developments. We have further assumed one (1) kitchen exhaust fan will be required, typically V53 vertical fans with the outlet located 1 metre above roof level over the kitchen. Refrigeration and air conditioning plant will also more than likely be required, and we have assumed a worst-case situation with plant located on the roof or along the facade closest to residences. Plant may therefore be as close as 30 metres from nearest residences.

The combined Sound Power Level, Lw dB(A), of anticipated mechanical plant is shown in the following Tables. The sound power of the proposed plant is propagated to residential locations taking into account sound intensity losses due to spherical spreading, with additional minor losses such as molecular absorption, directivity and ground absorption ignored in the calculations. As a result, predicted received noise levels are expected to slightly overstate actual received levels and thus provide a measure of conservatism. Comparison of the predicted noise levels produced by the plant and the allowable level are then compared to give the noise impact at the receiver.

Table 7: Combined Lw of typical Kitchen Exhaust

		Octave Band Centre Frequency, Hz							
Item	**dB(A)**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Plant	**76**	39	44	70	73	68	61	51	31

Table 8: Combined Lw of air conditioning plant

		Octave Band Centre Frequency, Hz							
Item	**dB(A)**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Plant	**82**	56	65	69	74	76	77	72	62

Table 9: Combined Lw of refrigeration plant

		Octave Band Centre Frequency, Hz							
Item	**dB(A)**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Plant	**86**	47	53	78	81	76	69	59	39

6 ANALYSIS AND DISCUSSION

6.1 Received Noise Levels – Entertainment

NCC Guideline

The following Table shows a summary of calculations to predict the noise impact from entertainment in the hotel/bar, propagated through each building element and the resulting impact, within nearest future and existing residential receivers.

Table 10: Combined Noise Impact from Entertainment Propagated Within Nearest Future/Existing Residences

	1/3 Octave Band Frequency, Hz L(lin)max									
Noise Path	**31.5**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**
Glazing	29.2	26.2	24.2	21.2	20.2	18.2	15.2	12.2	5.2	5.2
Doors (closed)	26.1	23.1	20.1	17.1	15.1	14.1	10.1	6.1	-0.9	-0..9
Combined	**30.9**	**27.9**	**25.6**	**22.6**	**21.4**	**19.6**	**16.4**	**13.2**	**6.2**	**6.2**
NCC Criteria	**50.0**	**42.8**	**36.2**	**30.6**	**25.6**	**21.3**	**17.2**	**13.1**	**9.5**	**6.5**
Impact	**-19.1**	**-14.9**	**-10.6**	**-8.0**	**-4.2**	**-1.7**	**-0.8**	**0.1**	**-3.3**	**-0.3**

Note. Trio & drum machine playing at designated location and includes reverberant field loss, barrier attenuation and directivity to inside surface. Based on Radius of Reverberation = 0.94, Room Constant = 44.8

Theoretical results in the above Tables show that noise emissions from live and recorded entertainment propagated through building components of the hotel/bar are predicted to be compliant with the criteria, based on anticipated types of amplified entertainment. Higher received noise levels will occur if bands or Discos play, although this is unlikely given the nature of the business.

LAB Standard Noise Conditions

The following Table shows a summary of calculations to predict the noise impact from entertainment in the hotel/bar, propagated through each building element and the resulting impact, within nearest future and existing residential receivers.

Table 11: Entertainment Propagated to Nearest Residential Receivers

		Octave Band Centre Frequency, Hz								
Noise Path	**dB(A)**	**31.5**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Glazing	31	6	12	20	27	27	21	18	9	-
Doors #	24	8	8	15	20	19	13	12	6	-
Combined	**32**	**10**	**13**	**21**	**28**	**27**	**21**	**19**	**11**	**-**
Criteria	**46**	**25**	**36**	**38**	**38**	**39**	**40**	**36**	**27**	**21**
Impact	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Doors closed.

Theoretical results in the above Tables show that noise emissions from entertainment in the hotel/bar will be compliant with the overall LAB dB(A) criteria at all existing and future residential receivers. See Section 7 for required construction details and strategies.

While we consider that the controls recommended to reduce entertainment noise to acceptable levels will be satisfactory, the wide variation in output from entertainment may cause higher than predicted noise in the residential area. Should this occur, we recommend the installation of an electronic TecSound noise monitor in the function room. These devices have been proven capable of controlling low frequency emissions and are a cost effective solution for minor noise exceedances. As an alternative a Panaray MB4 modular Bass Loudspeaker system may be installed. This system utilises highly directional speakers that can be oriented away from surface openings, significantly reducing noise emissions from the premises.

6.2 Received Noise Levels – Mechanical Plant

Mechanical plant will be required to ventilate habitable spaces. Therefore, for assessment purposes we have assumed that one (1) kitchen exhaust fan will be required, typically V53 vertical fans with the outlet located 1 metre above roof level over the kitchen. Air conditioning plant and refrigeration plant will also more than likely be required, and we have assumed a worst-case situation with plant located on the roof or along the facade closest to residences.

Table 12 shows a summary of calculations of noise from anticipated mechanical plant, propagated within nearest residences.

Table 12: Calculated SPL, Mechanical Plant – Propagated to Nearest Receivers

		Octave Band Centre Frequency, Hz								
Noise Path	**dB(A)**	**31.5**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Air con	29	-	3	12	16	21	23	24	19	9
Exhaust	17	-	-	-	11	14	9	2	-	-
Refrig	27	-	-	-	21	24	19	12	2	-
Combined	**31**	**-**	**4**	**13**	**23**	**26**	**25**	**25**	**20**	**9**
Criteria	**46**	**25**	**36**	**38**	**38**	**39**	**40**	**36**	**27**	**21**
Impact	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

As can be seen by the results in the above Table noise emissions from mechanical plant is predicted to be compliant with the criteria during all time periods, therefore no special acoustic modifications will be necessary. Our calculations are based on typical noise levels for anticipated mechanical plant and assumed locations. If plant produces noise higher than our adopted levels, exceedances of the criteria may occur. See Section 7 for acoustic details for all mechanical plant producing noise levels above those adopted by us.

6.3 People on City Streets

Noise levels produced by patrons congregating outside the development in the early hours of the morning have the potential to interrupt the sleep of occupants within Units. Typical noise produced by patrons congregating on the footpath and passing the site has been sourced from our library of technical data. This library has been accumulated from measurements taken in many similar situations in the CBD in the vicinity of Nite Clubs, and allows theoretical predictions of future noise impacts at each receiver and recommendations concerning noise control measures to be incorporated in the design of the site.

Our measurements were taken over a representative time period to include all aspects of the noise, including the cumulative impact of several people talking with a loud voice simultaneously. Sound measurements enable the acoustic sound power (dB re 1pW) to be calculated. The sound power level is then theoretically propagated to exposed facades and propagated through each building element to determine the internal noise level. Comparison of the predicted noise levels and the allowable level are then compared to give the noise impact.

An estimated worst-case situation was modelled with a group of 10-15 people gathered on the street near the development. The sources were placed at varying locations on the pavement ranging from 10-20 metres from nearest Units.

Based on the above scenario a peak noise level of 70-72dB(A) has been predicted at more exposed lower level Units, which at times may be up to 11dB(A) above the sleep arousal criterion of 61dB(A),L1. Windows are typically the acoustic weak spot and standard 3-4mm glass will only achieve 10-15dB attenuation if the window frames are fully sealed into the parent wall. However, the acoustic report prepared by Renzo Tonin & Associates has specified acoustic windows achieving Rw32-35 for east residential windows. Laminated glass typically attenuates 25dB or more at speech frequency (500Hz-1kHz), depending on the thickness and orientation of the glazing. So, based on an exterior noise level of 72dB, noise within the Units is not expected to exceed 49dB(A),L1 and is considered acceptable.

7 NOISE CONTROLRECOMMENDATIONS

a) Entertainment should be restricted to duos or trios with drum machine accompaniment. Live bands and Discos are not permitted unless noise emissions are closely monitored in the adjacent residential area.

b) Doors to the hotel/bar must remain closed when amplified entertainment is occurring.

c) No special acoustic management is required when low level incidental music is played in the premises.

d) In the event of complaint or if low frequency bass noise is identified in the residential area(s), all doors must be closed.

e) All glazing is to achieve a minimum Rw33 rating. This can be typically achieved with 6.38mm laminated glass or similar.

f) In the unlikely event that complaints arising from amplified music, we recommend installing an electronic TecSound noise monitor or Panaray MB4 modular Bass Loudspeaker system in the entertainment area. These devices have been proven capable of controlling low frequency emissions and are a cost effective solution for minor noise exceedances.

g) Usage:
Entertainment/PA
- Doors must be closed.

Meetings, low level incidental music, etc:
- No acoustic requirement.

Access
- Patrons must not be left congregating outside the building for prolonged periods of time, particularly in the late evening or night. Responsible staff should encourage visitors to leave the site.

h) Any exhaust plant that produces a sound pressure level (SPL) in excess of 65dB(A) at a distance of 3 metres must have acoustic barriers constructed at the fan discharge. The barriers must fully enclose at least three sides towards any residence. In our experience, a more efficient and structurally secure barrier is one that encloses all four sides.

The barrier must extend at least 600mm above and below the fan centre and/or the highest point of the discharge outlet. The barrier must be no closer than 500mm and no further than 1200mm from the edges of the exhaust. Barrier construction should consist of an outer layer of one sheet of 12mm fibre cement sheeting (Villaboard, Hardiflex), or 19mm marine plywood. The inside (plant side) is to be lined with absorbent material such as Woodtex. Note that variations to barrier construction or alternate materials are not permitted without approval from the acoustical consultant. Barrier construction is based solely on acoustic issues. Visual, wind load issues must be considered and designed by appropriately qualified engineers.

i) The contractor responsible for supplying and installing mechanical plant must provide evidence that installed plant meets this noise emission limit, or that noise control included with the plant is effective in reducing the sound level to the specified limit. Once the plant layout has been finalised, details should be forwarded to the acoustic consultant for approval.

j) Management should implement an initial noise management program, perhaps during the first month or two after opening. Regular patrols by appropriately trained staff should be undertaken in the nearby residential areas. A subjective audibility assessment of noise emissions should be undertaken to ensure the amenity of neighbours is maintained. If noise emissions are audible at any residence, then the staff member must immediately investigate the source of noise leakage and rectify the problem, i.e. instruct entertainment providers to reduce music output, etc.

The results and recommendations from all staff noise surveys must be recorded in a log book for future reference. The log book should contain the following:

- Time and date of survey
- Survey location.
- Description of noise sources audible during subjective assessment i.e. traffic, patrons, etc.
- In the event of unsatisfactory noise emissions, a description of noise control strategies.
- Signature.

8 CONCLUSION

A noise impact assessment a hotel/bar at The Esplanade Project, Shortland Esplanade, Newcastle, has been completed, resulting in noise control recommendations summarised in Section 7 of this Report. The site is suitable for the intended purpose providing recommendations outlined in this report are incorporated into the design. With these or equivalent measures in place, noise from the site will be either within the criteria or generally below the existing background noise level in the area for the majority of the time.

The existing average Leq noise levels already impacting the residential areas is equal to or above that predicted by the proposal and since the character and amplitude of activities associated with the extended site will be similar to those already impacting the area, it will be less intrusive than an unfamiliar introduced source.

Theoretical results show no exceedance of the LAB (and therefore Council) noise criteria, during allowable time periods, due to entertainment, patron activity or mechanical plant, however, in the unlikely event of complaints arising, appropriate noise management strategies are available and described in Section 7.

Providing the recommendations presented in this report are implemented, operation of the hotel/bar will not have any long term adverse noise impact upon the acoustic amenity of nearby residents. We therefore see no acoustic reason why the proposal should be denied.

APPENDIX A
Definition of Acoustic Terms

Definition of Acoustic Terms

Term	Definition
dB(A)	A unit of measurement in decibels (A), of sound pressure level which has its frequency characteristics modified by a filter ("A-weighted") so as to more closely approximate the frequency response of the human ear.
ABL	*Assessment Background Level* – A single figure representing each individual assessment period (day, evening, night). Determined as the L90 of the L90's for each separate period.
RBL	*Rating Background Level* – The overall single figure background level for each assessment period (day, evening, night) over the entire monitoring period.
Leq	Equivalent Continuous Noise Level - which, lasting for as long as a given noise event has the same amount of acoustic energy as the given event.
L90	The noise level which is equalled or exceeded for 90% of the measurement period. An indicator of the mean minimum noise level, and is used in Australia as the descriptor for background or ambient noise (usually in dBA).
L10	The noise level which is equalled or exceeded for 10% of the measurement period. L_{10} is an indicator of the mean maximum noise level, and was previously used in Australia as the descriptor for intrusive noise (usually in dBA).