REVERB ACOUSTICS

Noise and Vibration Consultants

Noise Impact Assessment
Woolworths Kurri Kurri
Cnr. Hampden Street &
Barton Street
Kurri Kurri NSW

December 2022

Prepared for JNA Advisory Pty Ltd
Report No. 22-2810-R1

Building Acoustics-Council/EPA Submissions-Modelling-Compliance-Certification

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SECTION 1
Introduction

1.1 INTRODUCTION

Reverb Acoustics has been commissioned to conduct a noise impact assessment for a new retail development at the corner of Hampden Street and Barton Street, Kurri Kurri. The proposal will include demolition of existing structures and site works; part road closure, relocation and extension of existing laneway road; construction of two new commercial buildings with two specialty shops, together with a new Woolworths supermarket store and associated car parking, "Direct to Boot" bays, signage, loading facilities and landscaping.

This assessment considers noise impacts from mechanical plant (refrigeration, air conditioning, exhaust), loading dock activities (including unloading, truck movements, etc), and customer vehicles entering and leaving the premises and manoeuvring on the site. Other noise sources include garbage collection, trolley return and general site noise.

The assessment was requested by JNA Advisory Pty Ltd in support of and to accompany a Development Application to Cessnock City Council (CCC) and to ensure any noise control measures required for the site are incorporated during the design stages.

1.2 TECHNICAL REFERENCE / DOCUMENTS

NSW Environment Protection Authority (2017). *Noise Policy for Industry*

NSW Environment Protection Authority (1999). *Environmental Criteria for Road Traffic Noise*

NSW Roads and Traffic Authority (2001). *Environmental Noise Management Manual*

Office of Environment and Heritage (2011). *NSW Road Noise Policy.*

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

Department of Environment and Climate Change NSW (2010). *Noise Guide for Local Government.*

Plans supplied by our client, dated 12 December 2022. Note that variations from the design supplied to us may affect the acoustic recommendations.

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

SECTION 2
Existing Acoustic Environment Assessment Criteria

2.1 EXISTING ACOUSTIC ENVIRONMENT

A background noise level survey was conducted using a Class 1, Svan 977 environmental noise logging monitor, installed in a weatherproof security cage on the north side of Barton Street (see Figure 1). The selected location is representative of the acoustic environment in the receiver area and is considered an acceptable location for determination of the background noise in accordance with Appendix B of the NSW Environment Protection Authority's (EPA's) – Noise Policy for Industry (NPfI).

Noise levels were continuously monitored from 24 November to 1 December 2022, to determine the existing background and ambient noise levels for the area. The instrument was programmed to accumulate environmental noise data continuously and store results in internal memory. The data were then analysed to determine 15 minute Leq and statistical noise levels using dedicated software supplied with the instrument. The instrument was calibrated with a Brüel and Kjaer 4230 sound level calibrator producing 94dB at 1kHz before and after the monitoring period, as part of the instrument's programming and downloading procedure, and showed an error less than 0.5dB.

Table 1 shows a summary of our noise survey, including the Assessment Background Levels (ABL's), for the day, evening and night periods. From these ABL's the Rating Background Level (RBL) has been calculated, according to the procedures described in the EPA's NPfI and by following the procedures and guidelines detailed in Australian Standard AS1055-1997, "Acoustics - Description and Measurement of Environmental Noise, Part 1 General Procedures". A complete set of logger results is not shown, but available on request. Measured traffic noise levels at the site appears in Table 2.

Table 1: Summary of Noise Logger Results, dB(A)

Time Period	Background L90			Ambient Leq		
	Day 7am-6pm	Evening 6pm-10pm	Night 10pm-7am	Day 7am-6pm	Evening 6pm-10pm	Night 10pm-7am
24-25 Nov	43.0	42.7	37.2	57.5	56.6	49.5
25-26 Nov	43.7	44.8	36.3	58.8	56.4	49.4
26-27 Nov	41.7	44.3	34.7	57.7	55.4	52.6
27-28 Nov	39.2	43.2	36.4	56.6	54.7	57.5
28-29 Nov	43.2	42.0	38.9	58.4	55.6	54.3
29-30 Nov	42.5	42.8	36.2	58.5	56.5	49.2
30N-1D	43.8	43.3	36.0	58.4	58.4	50.6
RBL	**43**	**43**	**36**	**--**	**--**	**--**
LAeq	**--**	**--**	**--**	**58**	**56**	**53**

Site, weather and measuring conditions were all satisfactory during our noise surveys. We therefore see no serious reason to modify the results because of influencing factors related to the site, weather or our measuring techniques. The most critical time period when the development will be operating, i.e. when background noise levels are lowest, is in the late evening. Therefore, Reverb Acoustics conducted attended noise level monitoring during the most sensitive time period from 11.30pm-12.00am on 27 November 2022. Shown below are results of our attended noise survey.

Table 2: Attended Noise Survey

Time	Date	Lmax	L90	Leq
23:30	27/11/22	76.5	40.0	55.0
Noise Source Contributions: Passing cars 65-76. Mech Plant across road 40				

Figure 1 – Locality Plan

Source: Google Earth

2.2 CRITERIA

2.2.1 Road Traffic Noise

The Roads and Maritime Services (RMS) base their assessment criteria on those outlined by EPA. Reference to Page 160 of the Environmental Noise Management Manual released in December 2001, indicates that noise reduction measures for new and existing developments should endeavour to meet the noise level targets set out in the EPA's Environmental Criteria for Road Traffic Noise (ECRTN). The ECRTN has been superceded by the NSW Road Noise Policy (RNP) which contains a number of criteria applied to a variety of road categories (freeway, arterial, sub-arterial and local roads) and situations (new, upgraded roads and new developments affected by road traffic). Table 3 shows the relevant categories, taken from Table 3 of the RNP:

Table 3: - Extract from Table 3 of RNP Showing Relevant Criteria.

Road Category	Day	Night
Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments.	60 LAeq,15hr (external)	55 LAeq,9hr (external
Existing residences affected by additional traffic on existing local roads generated by land use developments.	55 LAeq,1hr (external)	50 LAeq,1hr (external)

Road categories are defined in the RNP are as follows:

Freeway/arterial	Support major regional and inter-regional traffic movement. Freeways and motorways usually feature strict access control via grade separated interchanges.
Sub-arterial	Provide connection between arterial roads and local roads. May provide a support role to arterial roads during peak periods. May have been designed as local streets but can serve major traffic generators or non-local traffic functions. Previously designated as "collector" roads in ECRTN.
Local Road	Provide vehicular access to abutting property and surrounding streets. Provide a network for the movement of pedestrians and cyclists, and enable social interaction in a neighbourhood. Should connect, where practicable, only to sub-arterial roads.

Based on the above definitions, adjoining roads are classified as sub-arterial roads.

2.2.2 Site Activities / Mechanical Plant

Noise from industrial noise sources scheduled under the Protection of Environment Operations Act is assessed using the EPA's NPfI. However, local Councils and Government Departments may also apply the criteria for land use planning, compliance and complaints management. The NPfI specifies two separate criteria designed to ensure existing and future developments meet environmental noise objectives. The first limits intrusive noise to 5dB(A) above the background noise level and the other is based on the total industrial noise in an area in relation to the noise levels from the development to be assessed. Project Noise Trigger Levels are established for new developments by applying both criteria to the situation and adopting the more stringent of the two.

The existing L(A)eq for the receiver areas is dominated by traffic on nearby roads, and commercial/light industrial activity during the day, evening and night. Reference to Table 2.2 of the NPfI shows that all receiver areas are classified as urban. The Project Amenity Level is derived by subtracting 5dB(A) from the recommended amenity level shown in Table 2.2. A further +3dB(A) adjustment is required to standardise the time periods to LAeq,15 minute. The adjustments are carried out as follows:

Recommended Amenity Noise Level (Table 2.2) – 5dB(A) +3dB(A)

In high traffic areas where the existing traffic noise levels are 10dB or more above the recommended amenity level, the Amenity Level is derived by subtracting 15dB(A) from the existing traffic noise level.

Table 4 below specifies the applicable project intrusiveness and amenity noise trigger levels for the proposed redevelopment.

Table 4: - Base Noise Level Objectives

Period	Intrusiveness Criteria	Amenity Criteria
Day	48 (43+5)	58 (60-5+3)
Evening	48 (43+5)	48 (50-5+3)
Night	41 (36+5)	43 (45-5+3)
Shoulder (5am-7am)	43 (38+5)[1]	43 (45-5+3)
Shoulder (10pm-12am)	45 (40+5)[1]	43 (45-5+3)
Receiver Type: Urban (See EPA's NPfI - Table 2.2)		

1. Shoulder Period: the lowest 10th percentile of LAF90,15min dB measurements for the equivalent of one week's worth of valid data taken over the shoulder period (that is, all days included in a single data set of shoulder periods (see Section A3 of the EPA's NPfI).

Project specific noise levels, determined as the more stringent of the intrusiveness criteria and the amenity / high traffic criteria, are as follows:

Day	**48dB LAeq,15 Minute**	7am to 6pm Mon to Sat or 8am to 6pm Sun and Pub Hol.
Evening	**48dB LAeq,15 Minute**	6pm to 10pm
Night	**41dB LAeq,15 Minute**	10pm to 7am Mon to Sat or 10pm to 8am Sun and Pub Hol.
Shoulder	**43dB LAeq,15 Minute**	6am to 7am.
Shoulder	**43dB LAeq,15 Minute**	10pm to 12am.

NOTE: Section 2.6 of the NPfI states that assessment should be to the most affected point on or within the residential property boundary, or if that is more than 30m from the residence, at the most affected point within 30m of the residence.

2.2.3 Maximum Noise Level Event Assessment - Sleep Arousal

Section 2.5 of EPA's NPfI requires a detailed maximum noise level event assessment to be undertaken where the subject development/premises night-time noise levels exceed the following:

- LAeq (15 minute) 40dB(A) or the prevailing RBL plus 5dB whichever is greater, and/or
- LAFmax 52dB(A) or the prevailing RBL plus 15dB, whichever is greater.

The detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the RBL, and the number of times this happens during the night.

SECTION 3
Noise Impact Assessment
Site Operation

3.1 PROJECT DESCRIPTION

JNA Advisory seeks Development Consent to construct a retail development at new retail development at the corner of Hampden Street and Barton Street, Kurri Kurri. The proposal will include the following:

- Demolition of all existing structures,
- Site preparation and bulk earthworks,
- Closure of unnamed laneway / road between Lot 136 DP.869710 to Barton Street with associated civil works,
- Extension of existing laneway / road (same overall width including carriageway and pedestrian footpath) within Lot 136 DP.869710 to the west and into Barton Street,
- Repositioning / re-line marking of 25 street car parking to Barton Street frontage,
- Construction of new commercial buildings with Building 1 fronting Lang Street and Building 2 fronting Baron Street,
    - Building 1 to allow for200 m² specialty shop / café,
    - Building 2 including:
        i) lower level from Barton Street car parking for 122 spaces (inclusive of disabled parking spaces), motorcycle spaces, bike rails, 100m² specialty shop, travelator, trolley bays, lift,6 x “Direct to Boot” bays and storage, trolley storage, substation, loading docks and associated facilities,
        ii) ground floor level from Lang Street / extended unnamed laneway including 32 car parking, motorcycle spaces, bike rails, trolley bays, access to lift Barton Street and travelator, 350 sqm specialty shop and 3,399 sqm metre Woolworths supermarket store with 409 sqm mezzanine and plant deck,
- signage, and
- landscaping.

This assessment considers mechanical plant (refrigeration, air conditioning, exhaust), loading dock activities (including unloading, truck movements, etc), and customer vehicles entering and leaving the premises and manoeuvring on the site. Other noise sources include garbage collection, trolley return and general site noise.

The following trading and operating hours are proposed:

Supermarket including	6am-12am	Monday to Sunday
Specialty Shops (General)	9am-6pm	Monday to Sunday
Loading Dock	5am-12am	Monday to Sunday

This assessment will focus on the noise impact at nearest existing and future receivers and it should be acknowledged that compliance with criteria at these locations will ensure satisfactory results at more remote locations. Plans supplied by our client show the layout of the site and the location of nearby land uses.

3.2 METHODOLOGY

3.2.1 Road Traffic

Due to the non-continuous nature of traffic flow to and from the site, noise generated by traffic associated with the development, on public roads, is assessed using the EPA approved US Environment Protection Agency's Intermittent Traffic Noise guidelines.

Equation 1 outlines the mathematical formula used in calculating the Leq,T noise level for intermittent traffic noise.

Equation 1:

$$L_{eq},T = L_b + 10\log\left[1+\frac{ND}{T}\left(\frac{10^{(L\max - Lb)/10}-1}{2.3}-\frac{\left(L_{\max}-L_b\right)}{10}\right)\right]$$

Where L_b background noise level (dB(A))
T is the time for each group of vehicles (min)
D is duration of noise of each vehicle (min)
L_{MAX} is vehicle noise (dB(A))
N is number of vehicle trips

Typical vehicle noise levels were sourced from our library of technical data, while background noise levels are those described in Section 2.1. The Lmax vehicle noise levels used in Equation 1 are the maximum predicted noise levels produced at the facade of the residence by vehicles entering and departing the site.

3.2.2 Mechanical Plant

Proposed mechanical plant details have been sourced from a supermarket Design Kit Specification, and based on typical layouts for similar sized developments, with the majority of plant located on dedicated roof-top plant deck or within the mezzanine plant room. As the exact type of mechanical plant has not been finalised at this stage, this assessment is based on sound levels sourced from our library of technical data.

The sound power of anticipated plant is propagated to nearest receivers taking into account sound intensity losses due to spherical spreading, acoustic barriers, etc. Additional minor losses such as molecular absorption, directivity and ground absorption have been 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.

3.2.3 Site Noise

Future noise sources on the site cannot be measured at this time, consequently typical noise levels from similar developments have been sourced from manufacturers' data and/or our library of technical data. This library has been accumulated from measurements taken in many similar situations on other sites, 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.

The sound power level of each activity was determined according to the procedures described in AS IEC 61672-2004 as appropriate, and theoretically propagated to nearby receivers. Due to the non-continuous nature of activities, duration adjustments are determined using the following in-house mathematical formula. Where noise impacts above the criteria are identified, suitable noise control measures are implemented and reassessed to demonstrate satisfactory received noise levels in the residential area.

Equation 2:

$$L_{eq},T = Lw - 10\ log\ (2\ \pi\ r^2)\ + 10\ log\ \frac{(D\ x\ N)}{T}$$

Where Lw is sound power level of source (dB(A))
R distance to receiver (m)
D is duration of noise for each event (sec)
N is number of events
T is total assessment period (sec)

3.3 ANALYSIS AND DISCUSSION

3.3.1 Received Noise Levels - Road Traffic

Traffic due to the proposal travelling on nearby public roads is assessed separate to site noise and is subject to the criteria described in Section 2.2.1 of this Report. All delivery trucks will access the loading dock via the Barton Street entry/exit at the south east corner of the development and reverse into position at the dock. Once unloaded the trucks will drive out of the dock and exit the site. Customer's vehicles will access the carpark via the dedicated entry/exit off Barton Street at the south west corner of the development.

Delivery Trucks
The anticipated frequency of service deliveries and waste collection is summarised below, taken from counts for similar supermarket developments:

Supermarket

1 grocery/day	1 meat/day	1 frozen/day
1 dairy & milk/day	1 bread/day (van)	2 misc/day (van)
1 paper bails/week	1 refuse/week	1 fat & bone/week

Misc: 5/day (van/smaller trucks)
Anticipated total maximum 10 trucks/day (20 movements)

Specialty Retail
4-5 vans or trucks/day (8-10 movements)

Truck noise varies from one machine to another, with more modern larger trucks consistently producing a sound power in the range 100dB(A) to 106dB(A) at full power. This assessment assumes a typical large truck sound power of 104dB(A), as full engine power is not typically required to approach and depart the site at low speed.

Customers Vehicles

Previous studies for similar size developments indicate that the site will generate up to 250 vehicle movements/hr during peak day periods (7am-10pm). A 25% reduction would be typical during normal periods. Significantly less vehicle movements are expected during the morning shoulder period (6am-7am and 10pm-12am), with perhaps 100 vehicle movements/hr.

Vehicle Type	Traffic Generation	
	Day (7am-10pm)	Shoulder Periods
Trucks	30/day or 4/hour	2/hr
Cars	2900/day or 250/hr	100/hr

Cars typically produce an average sound power of 92dB(A), however wide variations are noted particularly with smaller modern cars and larger V8 or diesel powered vehicles. Our calculations present the worst case for the situation, as the noise produced by a typical car accelerating at full power is used to determine the received noise level. In reality, many people will not leave the site at full acceleration but will depart more sedately. The following Table shows calculations to determine received traffic noise levels at typical residential receivers along adjoining roads for peak day and night periods.

Table 5: Traffic Noise Calculations Barton Street - dB(A)Leq (T)

Traffic and Receiver	Peak Day		Peak Shoulder	
BARTON STREET				
Vehicle Type	Cars	Trucks	Cars	Trucks
Movements per hour	2900	30	200	4
Vehicle Sound Power	92	104	92	104
Received Noise Level, Lmax	61	73	59	73
Average Distance to Rec, m	15	15	15	15
Received Noise Level	51.5	45.4	48.6	45.4
Total Received	**52.4**		**50.3**	
Criteria	**60dB(A),Leq 15hr**		**55dB(A),Leq 9hr**	
Impact	**0**		**0**	

The above Table shows the noise impact from traffic movements associated with the development are predicted to compliant with the criteria during day and shoulder period (6am-7am) at all residential receivers and is considered acceptable.

3.3.2 Received Noise Levels - Loading Dock/Deliveries

As part of the proposal, a loading dock will be located at the south east corner of the development. Main sources of noise from loading docks are trucks entering the site and reversing into position, the truck refrigeration unit (supermarket trucks only), unloading of produce, and the compactor. Typical noise levels from loading dock activities, which were used in this assessment, have been measured at existing shopping centres in Sydney, Newcastle and the NSW South and North Coasts. A worst-case situation for loading dock activities has been assessed for a 15-minute period, as follows:

- A refrigerated truck enters off Barton Street and reverses into the supermarket dock.
- The truck engine is turned off, although the refrigeration unit remains running.
- Workers continuously unload the refrigerated truck parked at the supermarket dock.
- The refrigerated truck exits the dock.
- A second rigid truck enters off Barton Street and reverses into the dock.
- A compactor is operating in the dock area.

Table 6: Modelling Parameters:

Item	Lw, dB(A)	Acoustic Centre (m)	Comments
Refrigerated Truck (driving)	102-106	0.5, 1.5, 2.7, 2.7	Tyres, Engine, Exhaust
Refrigerated Truck (reversing)	102	0.5, 1.5, 2.7, 2.7	Tyres, Engine/Reverse Alarm, Exhaust
Truck Refrig Unit	86	2.7	Operates continuously
Rigid Truck (driving)	96-100	0.5, 1.5, 2.7	Tyres, Engine, Exhaust
Rigid Truck (reversing)	98	0.5, 1.5, 2.7, 2.7	Tyres, Engine/Reverse Alarm, Exhaust
Unload Dock	78	2.0	Gas Fork lift/pallet jack
Compactor	82	2.0	Located s'market dock

The following Table shows calculations to predict received noise levels from loading dock activities, propagated to nearest residential receivers south of the site (R3). All calculations are based on distances scaled from plans supplied by our client and through physical measurement during our site visits.

Table 7: Received Noise – Loading Dock Activities
Propagated South to Nearest Residential Bdry's (R3)

Item/Activity	Lw dB(A)	Ave Dist Rec (m)	Duration (sec)	No. of Events	Barrier Loss/Dir	Received dB(A)
Refrig truck enter	102	45	5	1	2	36
Refrig truck reverse	102	50	20	1	6	38
Refrig unit running	86	50	600	1	8	34
Unload refrig truck	78	55	900	1	14	21
Rigid truck enter	98	45	5	1	2	32
Rigid truck reverse	98	50	20	1	6	34
Compactor running	82	50	300	1	12	23
				Combined		**42**
				Crit (Shoulder)		**43**
				Impact		**-**

As can be seen by the results in the above Table, noise emissions from operation of the loading dock are predicted to be compliant with the criteria during proposed operating hours (i.e. 5am-12am) providing noise control modifications detailed in Section 4 are implemented.

3.3.3 Received Noise Levels – Vehicle Movements

Vehicles entering, leaving and manoeuvring on the site have the potential to cause disturbance to nearby residents. All cars will access the Lower Ground carpark via the Barton Street entry/exit. The greatest impact will occur during peak periods when the centre is open, and the carpark may be full. Based on typical peak traffic data up to 60 vehicle movements may occur during a 15 minute assessment period. Significantly less movements are expected during the early morning and evening shoulder periods with perhaps 25 vehicle movements during a 15-minute assessment period.

The following Table shows calculations of noise from site vehicles, propagated to the nearest residential boundaries south of the site (R3).

Table 8: Received Noise – Vehicle Movements (Peak Day)
Propagated South to Nearest Residential Boundaries (R3)

Item/Activity	Lw dB(A)	Ave Dist Rec (m)	Duration (sec)	No. of Events	Barrier Loss/Dir	Received dB(A)
Cars Enter/leave	82	30	5	60	2	38
Cars Drive Carpark	82	60	30	60	12	29
Cars Reverse Carpark	76	60	20	30	12	19
Cars Direct to Boot	82	70	10	5	14	11
Load Direct to Boot	76	70	30	5	14	9
				Combined		**38**
				Crit (D/E)		**48**
				Impact		**0/0**

Table 9 below shows results of calculations to predict the impact at each receiver, and accompanying notes detailing necessary modifications to achieve compliance.

Table 9: Calculated SPL, Site Vehicles - Propagated to Nearest Receivers

Receiver Loc'n	Received Noise (Day/Even/Shoulder)					Compliant YES/NO
	Period	dB(A),Leq	Crit	dB(A),Lm	Crit	
Retail S R1	Day	31	62	-	N/A	YES
	Evening	31	62	-	N/A	"
	Shoulder	28	62	-	N/A	"
Commercial S R2	Day	36	62	-	N/A	"
	Evening	36	62	-	N/A	"
	Shoulder	33	62	-	N/A	"
Residences S R3	Day	38	48	-	N/A	"
	Evening	38	48	-	N/A	"
	Shoulder	35	43	43	52	"
Retail S R4	Day	40	62	-	N/A	"
	Evening	40	62	-	N/A	"
	Shoulder	37	62	-	N/A	"
Hotel E R5	Day	41	48	-	N/A	"
	Evening	41	48	-	N/A	"
	Shoulder	38	43	49	52	"

The above results show that noise created by activities associated with the carparks (vehicles, customers) will be compliant with the criteria at all nearby receivers for normal and peak periods during the day, evening and shoulder periods. Compliance with the Sleep Arousal Criterion is also predicted at nearest residential receivers.

3.3.4 Received Noise Levels - Substation Kiosk

As no information is available concerning the exact type of substation kiosk equipment (transformers, cooling operation, fans, etc), a limiting sound pressure level (SPL) has been specified at 3 metres from the surface of the kiosk, as shown in the following Table.

Table 10: Maximum Allowable SPL 3 metres from Kiosk – dB(A),Leq

Night Planning Level	41dB(A),Leq #
Maximum Plant Noise Level (SPL) at 3 metres	55

3dB(A) penalty applied to account for cumulative impact from all plant associated with the site.

3.3.5 Received Noise Levels - Mechanical Plant

The development will require air conditioning plant to ventilate habitable spaces and refrigeration plant for cool rooms/cold storage, while exhaust may be required for some specialty shops. This assessment is based on a typical supermarket Design Kit Specification. For assessment purposes we have assumed the majority of mechanical plant will be located on the dedicated roof-top plant deck, with some individual plant items located on the roof above specialty shops. The anticipated number and location of noise generating items associated with the development are shown below. Note that a detailed assessment of the noise impacts from all mechanical plant will be required once locations and selections have been finalised.

Location	*Plant Item*
Supermarket Deck/ Plant Room	Refrigeration condensers (x3) Air conditioning condensers(x3) Exhaust/Supply Air Fan (x2) Air conditioning condensers(x3) Temp racks (x3) Heat pump (x1)
Specialty Shops	Air conditioning condensers (x2) Exhaust (x1)

The following Table shows sample calculations to predict noise from anticipated mechanical plant on the roof-top plant, propagated south to nearest residential boundaries (R3).

Table 11: Calculated SPL, Roof-Top Plant
Propagated East to Nearest Residential Boundaries (R3)

		Octave Band Centre Frequency, Hz							
Item	**dB(A)**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Combined Lw plant	92	63	79	81	83	84	88	83	74
Barrier loss[1]		6	7	8	9	11	14	17	21
SPL at Receiver	**37**	14	28	29	30	29	30	22	9
Criteria (night)	**41**								
Impact	**-**								

1. Acoustic barrier at perimeter of plant deck.

As can be seen by the results in Table 11, noise emissions from roof-top plant are predicted to be compliant with the night criterion of 41dB(A),Leq at nearest residences, subject to construction details shown in Section 4. As previously stated, detailed assessment of the noise impacts from all mechanical plant associated with the development will be required once locations and selections have been finalised. In the interim, general acoustic recommendations and noise emission limits are detailed in Section 4.

3.3.6 Received Noise - Food & Drink Alfresco Areas

Food & Drink tenancies may be proposed for specialty shops. The following Table shows sample calculations of noise emissions from customers and incidental music in the alfresco areas, propagated to nearest residences south of the site (R3).

Table 12: SPL Activities in Alfresco Dining Areas, dB(A),Leq
Propagated South to Nearest Residences (R3)

		Octave Band Centre Frequency, Hz								
Item	**dB(A)**	**31.5**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
SPL at perimeter	76	24	45	60	67	72	71	64	57	46
Barrier loss[1]		3	3	2	2	1	1	1	0	0
Received	**38**	-	5	21	28	34	33	26	20	9
Crit 10pm-12am	**43**									
Impact	**-**									

1. Intervening structures.

Results in the above Table show that noise emissions from customers and incidental music in alfresco areas associated with Food & Drink tenancies is predicted to be compliant with the criteria at nearest residences south of the site (R3).

Table 15 below shows results of calculations to predict the impact from all food and drink alfresco areas at all nearby receivers.

Table 13: Calculated SPL, Alfresco Areas - Propagated to Nearest Receivers

Receiver	Rec Noise dB(A),Leq	Criteria 10pm-12am	Impact dB(A)	Rec Noise dB(A),Lmax	Criteria 10pm-12am	Impact dB(A)
R1	<30	62	0	-	N/A	0
R2	36	62	0	-	N/A	0
R3	38	43	0	48	52	0
R4	39	62	0	-	N/A	0
R5	41	43	0	51	52	0
R6	<30	62	0	-	N/A	0

The above results show that noise created by activities associated with Food & Drink Tenancies are predicted to be compliant with the criteria at all nearby receivers for normal and peak periods during the day and evening and shoulder period (10pm-12am).

3.3.7 Cumulative Noise Impact – Site Activities/Equipment

The cumulative noise impact from all activities associated with the site must be considered to confirm compliance. Peak periods during the day, evening, and shoulder periods are considered the time periods of most concern. The acoustic sum of all noise generating items expected to operate at the site, propagated to nearest residential receivers, is shown in the following Tables.

Table 14: Cumulative Noise Impact - Propagated to Nearest Receivers (Day/Evening)

Receiver/Item	Loading Dock	Site Vehicles	Mech Plant	Food & Drink	Sum
R1 – Retail S	45	31	37	<30	**47**
R2 – Commercial S	43	36	37	36	**45**
R3 – Residences S	42	38	37	38	**44**
R4 – Retail E	40	40	36	39	**44**
R5 – Hotel E	<30	41	38	41	**43**
R6 – Commercial NW	<30	<30	46	<30	**46**
R7 – Commercial NW	<30	<30	43	<30	**43**

Criteria: Day=48dB(A),Leq Evening=48dB(A),Leq Night=41dB(A),Leq 6am-7am=43dB(A),Leq, 10pm-12am=43dB(A),

Table 15: Cumulative Noise Impact - Propagated to Nearest Receivers (Shoulder)

Receiver/Item	Loading Dock	Site Vehicles	Mech Plant	Food & Drink	Sum
R1 – Retail S	45	28	37	<30	**46**
R2 – Commercial S	43	33	37	36	**45**
R3 – Residences S	42	35	37	38	**44**
R4 – Retail E	40	37	36	39	**44**
R5 – Hotel E	<30	38	38	41	**43**
R6 – Commercial NW	<30	<30	46	<30	**46**
R7 – Commercial NW	<30	<30	43	<30	**43**

Criteria: Day=48dB(A),Leq Evening=48dB(A),Leq Night=41dB(A),Leq 6am-7am=43dB(A),Leq, 10pm-12am=43dB(A),

As can be seen by the above results, the cumulative noise impact from activities associated with operation of the development are predicted to be compliant with the criteria at all nearby receivers during all assessed time periods. It is noted however, that a minor 1dB(A) exceedance may occur on rare occasions at Receiver R3 during the evening shoulder period (10pm-12am). It is highly unlikely that all activities will occur at the same time (i.e. maximum vehicle traffic, loading dock delivery, etc), therefore providing noise control modifications detailed in Section 4 are incorporated into the design, compliance is expected. Considering the relative constant traffic passing the site it is unlikely that activities associated with the development will cause any disturbance to residents.

Collectively, with up to 3 or 4 other sources operating simultaneously on occasion over various parts of the site, the acoustic sum could be as high as 75dB(A),Leq. This overall sum is at least 10dB below significant sources noted above, therefore they will not contribute or raise the sound level at nearby receivers.

SECTION 4
Summary of Recommended Noise Control

4 NOISE CONTROL RECOMMENDATIONS

4.1 Site Operations

4.1.1 The following trading hours are acceptable:

Supermarket including	6am-12am	Monday to Sunday
Specialty Shops (General)	9am-6pm	Monday to Sunday

4.1.2 We strongly recommend that waste collection be restricted to dock operating hours.

4.1.3 Given the variability of the proposed specialty shops it is not possible to specify exact acoustic controls on a case-to-case basis. For example, a café or butcher may require exhaust or refrigeration plant, while no significant noise is expected from a newsagent. In addition, the tenancy of retail outlets is usually dynamic dependent upon the success or otherwise of the occupant. For this reason, the onus is upon the tenant to ensure noise emission is kept to a minimum. Future tenants should be assessed on a case to case basis and required to submit their own Noise Impact Assessment to Council, if noise generating activities are anticipated.

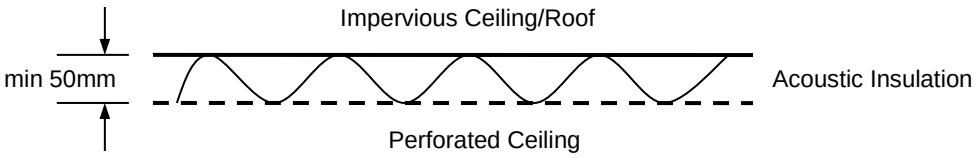
4.1.4 No amplified entertainment is permitted in any alfresco area associated with Food & Drink Tenancies. Background "incidental" music is permitted. A limiting SPL of **70dB(A),Lmax** is to be set at a distance of 3 metres from the speakers. Once this output limit is achieved, corresponding references should be assigned to the sound system controls and should only be accessed by responsible staff familiar with the system settings.

4.2 Loading Dock

4.2.1 The loading dock may operate from 5am-12am Monday to Sunday.

4.2.2 The entire loading dock area is to be treated to absorb reflected sound. We recommend the underside of the ceiling be treated to absorb reflected noise. See Figure 2 for detail. Available options include a perforated metal ceiling to the underside, i.e. Luxalon, Renhurst, or similar, minimum 10-15% open area, backed with R2 fibreglass or S2 polyester insulation. Alternatively, a perforated plasterboard or perforated FC sheet ceiling may be installed with cavity insulation. If the insulation is exposed to the weather, hosing, washing, etc, we recommend using a water resistant acrylic blanket (available through the supplier of the perforated metal ceiling).

Figure 2: Absorbent Ceiling Detail to Entire Loading Dock Area



4.2.3 Trucks visiting the dock must not congregate outside the dock area or park on streets. Deliveries should be co-ordinated with management to ensure trucks are able to enter the dock immediately when arriving at the site.

4.3 Mechanical Plant

4.3.1 As part of Construction Certificate documentation a detailed assessment of the noise impacts from all mechanical plant associated with the development will be required once locations and selections have been finalised.

4.3.2 No noise control will need to be incorporated into the design of proposed mechanical plant if the following maximum allowable limits are not exceeded (also see Item 4.3.3):

Location	Plant Item	Maximum Allowable Noise level	
		SPL @ 3m	Lw
Supermarket Deck & Plant Room	Refrig condenser	N/A – See Item 4.3.3	
	Air con condenser	"	
	Exhaust/Supply Air Fan	"	
	Temp racks	"	
	Heat pump	"	
Specialty/Commercial Roof	Air con condensers	60	78
	Refrig condensers	60	78
	Exhaust discharge	58	76

4.3.3 Acoustic barriers will be required at the perimeter of the supermarket roof-top plant deck along the south, east and west sides. Barriers must be minimum 300mm above the top of the highest plant item. Absorbent panel options include the following:

- Acoustisorb Panels (available thru Modular Walls)
- CFG Acoustic+ Panels (available thru Con-Form Group)
- Alternate option approved by Reverb Acoustics

Final acoustic barrier heights and locations will be determined as part of the CC documentation, recommended in Item 4.3.1 above.

Acoustic barriers must continue at least 300mm below the top of the plant deck.

NOTE 1: All barrier heights are above top of plant, not height above plant deck

NOTE 2: Any supply/exhaust fans in plant room roof/walls must not produce an SLP >65dB(A) at 1 metre (includes combined noise from fans and plant equipment). Acoustically rated ducts/louvres must be installed at plant room side of fan for any roof opening.

NOTE 3: Should impervious acoustic barriers create ventilation problems for the plant deck, we recommend installing acoustic louvres. The louvres must have the following insertion loss values (typically Fantech SBL1, Nap Silentflo 300S Line or Robertson Type 7010):

Required Insertion Loss Values for Acoustic Barriers/Plant Room Louvres – dB

	Octave Band Centre Frequency, Hz							
	63	125	250	500	1k	2k	4k	8k
NR	10	12	15	19	20	18	18	14
STL	4	6	9	13	14	12	12	8

4.3.4 Noise emissions from the substation kiosk must not exceed a sound pressure level of 55dB(A),Leq at a distance of 3 metres. Where plant intended to be installed on the site produces noise in excess of specified levels, noise control will be required to ensure satisfactory noise emissions.

4.3.5 Acoustic louvres are required in the walls of the plant room above the loading dock, in preference to standard ventilation louvres. The louvres must have the following insertion loss values (typically Fantech SBL1, Nap Silentflo 300S Line or Robertson Type 7010):

Required Insertion Loss Values for Acoustic Barriers/Plant Room Louvres – dB

	Octave Band Centre Frequency, Hz							
	63	125	250	500	1k	2k	4k	8k
NR	10	12	15	19	20	18	18	14
STL	4	6	9	13	14	12	12	8

4.3.6 Any roof-top exhaust plant that is not located on the supermarket plant deck that produces an SPL above the limits specified in Item 4.3.2 must have acoustic barriers constructed at the fan discharge. 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 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 Acoustisorb panels or similar construction detailed previously for deck barriers. Barrier construction is based solely on acoustic issues. Visual, wind load issues must be considered and designed by appropriately qualified engineers.

4.3.7 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.

4.3.8 Once the plant layout has been finalised, details should be forwarded to the acoustic consultant for approval. Revision of the plant layout may result in modified acoustic requirements.

The above noise control recommendations are not necessarily the only options available, but are expected to be the most cost-effective and practical with the information currently to hand. Alternative options can be considered providing they result in the same or lower received noise levels at any nearby residence.

SECTION 5
Conclusion

5.1 CONCLUSION

A noise impact assessment for a new retail development at the corner of Hampden Street and Barton Street, Kurri Kurri, has been completed, resulting in noise control recommendations summarised in Section 4 of this Report. This assessment has shown that 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.

Considering the relatively constant traffic on nearby roads and increasing activity in the nearby area, noise generated by the site will be audible at times but not intrusive at any nearby residence. As the character and amplitude of activities associated with the site will be similar to those already impacting the area, it will be less intrusive than an unfamiliar introduced source and should be acceptable to residents, considering the economic and social benefit to the local community as a whole.

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

Steve Brady M.A.S.A. A.A.A.S.
Principal Consultant

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).