REVERB ACOUSTICS

Noise and Vibration Consultants

Noise Impact Assessment
Online Distribution Outlet
114 Old Pittwater Road
Brookvale NSW

July 2017

Prepared for Woolworths Limited
Report No. 17-2092-R1

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

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1 INTRODUCTION

Reverb Acoustics has been commissioned to conduct a noise impact assessment for a proposed Online Distribution Outlet at 114 Old Pittwater Road, Brookvale. The proposal will include a warehouse, up to 12 smaller docks for outgoing produce, a larger dock for incoming produce, and parking for staff and contractors. This assessment considers mechanical plant (refrigeration, air conditioning), loading dock activities (including unloading, truck movements, etc), and staff vehicles entering and leaving the premises and manoeuvring on the site.

The assessment was requested by Woolworths Limited in support of and to accompany a Development Application (DA) to Northern Beaches Council (NBC) and to ensure any noise control measures required for the site are incorporated during the design stages.

2 TECHNICAL REFERENCE / DOCUMENTS

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

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. Note that variations from the design supplied to us may affect the acoustic recommendations.

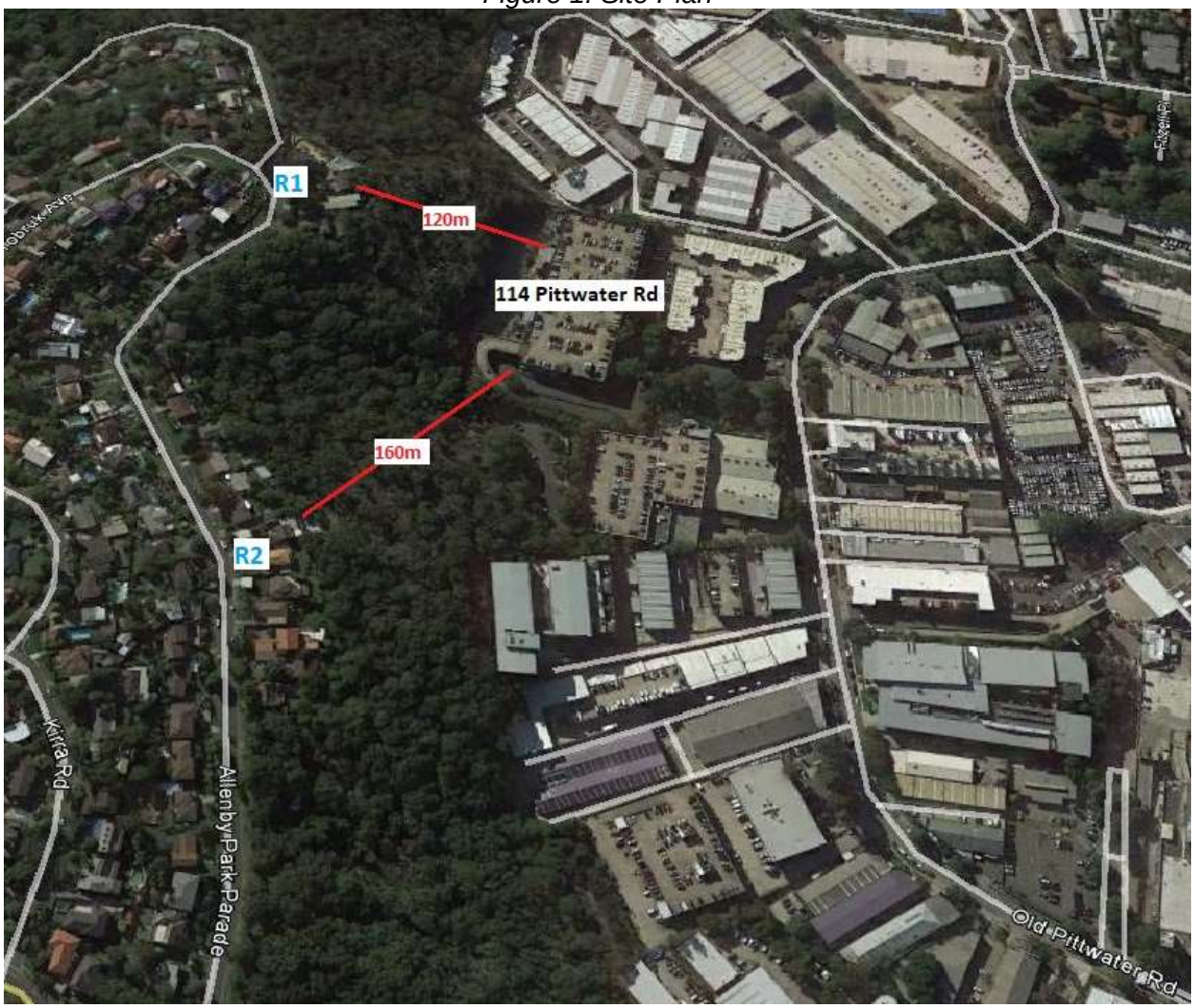
A Glossary of commonly used acoustical terms is presented in Appendix A to aid the reader in understanding the Report.

3 PROJECT DESCRIPTION

Woolworths Limited is seeking Development Consent to amend its Development Consent for an Online Distribution Outlet at 114 Old Pittwater Road, Brookvale. The proposal will include a warehouse, up to 12 smaller docks for outgoing produce, a larger dock for incoming produce, and parking for staff and contractors. The outlet will operate 24 hour/day 7 days/week. Nearest receivers are shown on Figure 1.

This assessment will focus on the noise impact at nearest residential 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. Potential noise sources which may impact nearby residents include mechanical plant, deliveries, and customers entering, leaving and manoeuvring on the site.

Figure 1: Site Plan



LEGEND:
R1. Residences approximately 120m west of the site.
R2. Residences approximately 160m south west of the site.

4 EXISTING ACOUSTIC ENVIRONMENT

In the absence of any reliable long-term background noise level measurements, acceptable average background noise levels were sourced from Australian Standard 1055.3-1997, Appendix A, which describes average background noise levels (L90) for residential areas within Australia for various types of receivers. Extracts from the Standard are reproduced in Table 1:

Table 1: Estimated Average Background A-Weighted Sound Pressure Levels (LA90,T) For Different Areas Containing Residences in Australia - AS 1055.3-1997 (Extract)

	Average Background Sound Level, L90 – dB(A)		
Receiver Category and Description of Neighbourhood	**0700 – 1800 (Day)**	**1800 – 2200 (Evening)**	**2200 – 0700 (Night)**
R1. Areas with negligible transportation	40	35	30
R2. Low density transportation	45	40	35
R3. Medium density transportation or some commerce or industry.	50	45	40
R4. Dense transportation or some commerce or industry.	55	50	45

Based on the above descriptions, residences to the west of the site are in a suburban area near industrial development, implying acceptable background noise levels for an R2 or R3 category receiver, as shown in Table 1. To provide a measure of conservatism, background noise levels for an R2 category receiver have been adopted for assessment purposes, as shown below:

Day **45dB(A),L90** (7am-6pm)
Evening **40dB(A),L90** (6pm-10pm)
Night **35dB(A),L90** (10pm-7am)

5 CRITERIA

5.1 Site Activities

The existing L(A)eq for the receiver area is dominated by traffic on nearby roads and neighbourhood activities and some industrial activity. Reference to Table 2.1 of the NSW Environment Protection Authority's (EPA's) Industrial Noise Policy (INP) shows that the area is classified as suburban. Industrial noise contributions are more than 6dB(A) below the recommended Leq, so the recommended Acceptable Noise Level (ANL) applies in this case, i.e. no ANL reduction required for industrial noise contributions. Table 4 below specifies the applicable base objectives for the proposed development. In high traffic areas where the existing traffic noise levels are at least 10dB above the Acceptable Noise Level, the high traffic amenity criterion applies.

Table 2: - Base Noise Level Objectives

Period	Intrusiveness Criteria	Amenity Criteria
Day	50 (45+5)	55
Evening	45 (40+5)	45
Night	40 (35+5)	40
Receiver Type: Suburban (See EPA's INP - Table 2.1)		

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

Day	**50dB LAeq,15 Minute**	7am to 6pm Mon to Sat or 8am to 6pm Sun and Pub Hol.
Evening	**45dB LAeq,15 Minute**	6pm to 10pm
Night	**40dB LAeq,15 Minute**	10pm to 7am Mon to Sat or 10pm to 8am Sun and Pub Hol.

5.2 Short Term Events – Sleep Arousal

Section 2.4.5 of the EPA'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 vehicle movements at the site.

Based on an average minimum background noise level of 35dB(A),L90 for night the sleep arousal criterion is set at **50dB(A),L1(1min)** at the bedroom window of any affected residential receiver.

6 METHODOLOGY

6.1 Site Activities

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.

Sound measurements were generally made around all sides of each machine/activity, to enable the acoustic sound power (dB re 1pW) to be calculated. The sound power level of each item is then theoretically propagated to each receiver. Propagation calculations were carried out using the following equation. 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 1:

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

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)

6.2 Mechanical Plant

Mechanical plant will be located in the dedicated plant room adjacent to the Transport Office. As no information is available for the type of proposed mechanical plant, this assessment is based on typical air conditioning and refrigeration plant for similar developments.

The sound power of anticipated plant is propagated to nearest receivers taking into account sound intensity losses due to geometric spreading, acoustic barriers, intervening topography. 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.

7 ANALYSIS

7.1 Received Noise Levels – Site Activities

Shown below are data for anticipated typical vehicle movements for the site. Proposed numbers are based on information supplied by our client.

Table 3: - Site Vehicle Movements

Vehicle Type/Situation	Vehicle Movements (Daily)	Vehicle Movements (Peak Periods)
Inbound Delivery trucks (refrigerated)	6/day	2/hour
Inbound Delivery trucks (rigid)	4/day	2/hour
Outbound Vans (refrigerated)	120+/day	60/5am-8am 60/1pm-3.30pm 12/30 minutes
Staff customer cars	300/day	150 at change shift
Total trucks (15 minute period) #		**4**
Total vans (15 minute period) #		**6**
Total cars (15 minute period) #		**150**

Site noise is assessed over a worst-case 15 minute period, in accordance with the EPA's INP.

Truck noise varies from one machine to another, with more modern larger trucks consistently producing a sound power in the range 102 to 106dB(A) at full power. This assessment assumes a typical truck sound power of 98dB(A), as trucks will be under slight acceleration as they negotiate ramps.

Cars typically produce an average sound power of 86dB(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 Acoustic Power Levels (Lw) of plant and activities expected at the site which were input into our computer model, are shown in Table 4. The Table gives the A-weighted Lw's for each listed plant item, principally based on manufacturers' data and our library of technical data, which has been accumulated from measurements taken in many similar situations on other sites. Also shown is the number of items operating and/or events at each location on the site. Each operating scenario assumes a worst-case situation during the busiest 15 minute assessment period.

Table 4: Item/Activity

Item/Activity	Lw dB(A)	Ramp	Van Docks (Outbound)	Truck Docks (Inbound)	Plant Room	Carpark
DAY/EVENING/NIGHT						
Refrigerated Trucks[1]	98	2	-	2	-	-
Rigid Trucks[2]	96	2	-	2	-	-
Refrigerated Vans[3]	92	6	6	-	-	-
Cars[4]	86	150	-	-	-	150
Air con/Refrig Plant[5]	96	-	-	-	12	-

The EPA define Day as 7am-6pm, Evening as 6pm-10pm, and Night as 10pm-7am.

NOTES:

1. Trucks under slight acceleration, reverse into position, unload.
2. Trucks under slight acceleration, reverse into position, unload.
3. Vans enter/leave, reverse into position, loading.
4. Cars under slight acceleration, reverse/drive into position.
5. Located in plant room.

Table 5 shows calculations to predict the cumulative noise impact during peak periods at nearest residential boundaries west of the site (R1). Preliminary calculations reveal that acoustic louvres will be required for any ventilation openings in the plant room.

Table 5: Received Noise - Site Activities dB(A),Leq (Peak)
Propagated West to nearest Residential Boundaries (R1)

Item/Activity	Lw dB(A)	Dist to Rec (m)	Duration (sec)	No. of Events	Barrier Loss/Dir	Received dB(A)
Refrig truck on ramp	98	140	10	2	6	25
Refrig truck reverse	100	120	15	2	10	26
Refrigeration unit	92	130	900	2	14	31
Unload refrig truck	82	140	900	2	16	18
Rigid truck on ramp	96	140	10	2	6	23
Rigid truck reverse	98	120	15	2	10	24
Unload rigid truck	82	140	900	2	16	18
Refrig van on ramp	92	140	5	6	6	20
Refrig van reverse	88	120	10	6	10	17
Load refrig van	76	140	600	6	16	15
Cars on ramp	86	140	5	150	8	26
Cars reverse	76	100	10	80	10	18
Plant in plant room	96	120	900	1	16	30
				Combined		**36**
				Criteria (Night)		**40**
				Impact		**0**

As can be seen by the results in Table 5, the cumulative noise impact from all site activities and equipment is predicted to be compliant with the criteria, providing acoustic modifications noted above are incorporated into the design of the site.

Table 6 shows a summary of predicted noise impacts during all time periods at nearest residential receivers with noise control in place.

Table 6: Summary Received Noise – All Nearby Residential Receivers

Receiver Loc'n	Received Noise (Day/Evening/Night)						
	Period	dB(A),Leq	Crit	Impact	dB(A),L1	Crit	Impact
Residences West R1	Day	36	50	0	-	N/A	-
	Evening	36	45	0	-	N/A	-
	Night	36	40	0	41	50	0
Residences South West R2	Day	34	50	0	-	N/A	-
	Evening	34	45	0	-	N/A	-
	Night	34	40	0	40	50	0

As can be seen by results in the above Table, noise associated with site activities and equipment will generally be compliant with the criteria during all time periods at all nearby receivers, providing acoustic treatment detailed in Section 8 is implemented.

8 SUMMARY OF RECOMMENDED NOISE CONTROL

This section summarises recommended noise control measures for mechanical plant, the loading dock and the overall site.

8.1 Proposed operating hours 24 hours/day 7 days/week are acceptable.

8.2 The loading/unloading docks may operate 24 hours/day 7 days/week.

8.3 No acoustic treatment is required for roof-top exhaust plant providing noise emissions are below an SPL in excess of 78dB(A) at a distance of 1 metre. If noise emissions exceed the nominated limit, acoustic barriers must fully enclose the exhaust discharge on 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 and must be 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 an absorbent foam, faced with perforated metal (minimum 15% open area) to reduce reverberant sound (fibrous infills are not recommended as they will deteriorate if wet). 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.

8.4 Any ventilation openings in the plant room must be 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

8.5 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.

8.6 Once the plant layout has been finalised, details should be forwarded to the acoustic consultant for approval.

9 CONCLUSION

A noise impact assessment for a proposed Online Distribution Outlet at 114 Old Pittwater Road, Brookvale, has been completed, resulting in noise control recommendations summarised in Section 8 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 activity associated with nearby commercial developments, noise generated by the site may 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.

In conclusion, operation of the facility will not cause any long term excessive environmental noise at any residential properties. We therefore see no acoustic reason why approval for 24 hour operation, 7 days a week should be denied.

REVERB ACOUSTICS

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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).