REVERB ACOUSTICS

Noise and Vibration Consultants

Noise Impact Assessment
Proposed Service Station & Convenience Store
79 Barrenjoey Road
Mona Vale NSW

April 2019

Prepared for RCI Group Pty Ltd
Report No. 19-2310-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 proposal to construct a service station and convenience store at 79 Barrenjoey Road, Mona Vale. This assessment considers noise sources such as mechanical plant (refrigeration, air conditioning, exhaust, compressor), deliveries (including unloading, truck movements, etc), and customer vehicles entering and leaving the premises and manoeuvring on the site. Other noise sources include garbage collection and general site noise.

The assessment was requested by RCI Group Pty Ltd to form part of and in support of a Development Application to Northern Beaches Council (NBC) and to ensure any noise control measures required for the development are incorporated during the design stages.

1.2 TECHNICAL REFERENCE / DOCUMENTS

Beranek, L.L and Istvan, L.V. (1992). *Noise and Vibration Control Engineering.* John Wiley and Sons, Inc.

Bies, D.A. and Hansen, C.H. (1996). *Engineering Noise Control: Theory and Practice*. London, E & F.N. Spon.

Gréhant B. (1996). *Acoustics in Buildings.* Thomas Telford Publishing.

Templeton, D. (1997). *Acoustics in the Built Environment.* Reed Education and Professional Publishing Ltd.

AS 2107-2000 *"Acoustics-Recommended Design Sound Levels and Reverberation Times for Building Interiors"*.

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

NSW Environment Protection Authority (2000). *Industrial Noise Policy*

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

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

Office of Environment and Heritage (2010). *NSW Road Noise Policy*

NSW Roads and Maritime Services (2001). *Environmental Noise Management Manual*

Intersect Traffic Pty Ltd (April 2019). *Traffic & Parking Assessment. Service Station and Convenience Store. Lot A DP.405025. 79 Barrenjoey Road, Mona Vale.*

Plans supplied by Brown Commercial Building Pty Ltd, rev. 7, dated 17 April 2019. 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
Project Description
Existing Acoustic Environment
Assessment Criteria

2.1 PROJECT DESCRIPTION

RCI Group Pty Ltd seeks approval for a service station and convenience store at 79 Barrenjoey Road, Mona Vale. The development will include a convenience store, refuelling area and parking for customers. This assessment is based on typical mechanical design layouts. Expected trading hours are 24 hours. Fuel tanker and general store deliveries may occur at any time from 5am to 12am. Nearest receivers identified during our site visit are as follows (also see Figure 1):

R1. Single-storey Residence E
R2. Double-storey Residence E
R3. Single-storey Residence E
R4. Global Self Storage S
R5. Light Industrial development W
R6. Mercedes Benz Dealership N

This assessment will focus on the noise impact at nearest receivers and it should be acknowledged that compliance with criteria at these locations will ensure satisfactory results at more remote locations. Plans supplied by Brown Commercial Building Pty Ltd show the layout of the site and the location of nearby land uses. Potential noise sources which may impact nearby residents include mechanical plant, loading/unloading activities, and customers' vehicles entering and leaving the premises and manoeuvring on the site. Other noise sources include general site noise such as garbage collection.

Figure 1: Site Plan

2.2 EXISTING ACOUSTIC ENVIRONMENT

A background noise level survey was conducted using a Class 1, Svan 977 environmental noise logging monitor, installed at the south east corner of the site, approximately 8 metres from the near lane of traffic on Barrenjoey Road. 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 (NPI).

Noise levels were continuously monitored from 17 March to 24 March 2019, 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 NPI 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 road traffic noise levels at the site are shown 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
28-29 Mar	58.5	53.6	32.7	69.4	69.0	62.8
29-30 Mar	59.5	53.5	41.6	69.7	68.7	64.1
30-31 Mar	59.8	52.9	37.8	70.2	67.3	62.1
31M-1A	54.3	51.1	41.6	68.8	67.0	62.1
1-2 Apr	59.7	53.9	45.2	70.3	69.4	62.8
2-3 Apr	59.9	55.8	30.5	70.6	70.8	63.7
RBL	**59.6**	**53.6**	**37.9**	**--**	**--**	**--**
LAeq	**--**	**--**	**--**	**69.9**	**68.9**	**63.0**

A summary of the measured noise environment at the site appears in Table 2, taken from our logger results. The measured noise levels are typical for residential areas near a busy road and commercial district.

Table 2: Existing Source Noise levels

Time Period	Leq		Lmax		L10		L90	
	Range	Average	Range	Average	Range	Average	Range	Average
Day	64-74	70	74-101	81	67-78	73	51-66	61
Evening	65-74	68	74-89	80	69-78	72	50-63	57
Night	50-71	61	68-94	77	47-74	64	29-64	45

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.

2.3 CRITERIA

2.3.1 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 4 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, Barrenjoey Road is classified as an arterial road.

In addition to the assessment criteria detailed above, the increase in total traffic noise must also be considered. Reproduced below in Table 4 are the relative increase criteria that trigger consideration of mitigation measures:

Table 4: - Reproduced Table 6 of RNP
Relative Increase Criteria for Residential Land Uses

Road Category	Type of Project/Development	Total Traffic Noise Level Increase–dB(A)	
		Day (7am-10pm)	Night (10pm-7am)
Freeway/arterial/sub-arterial roads & transitways	New road corridor / redevelopment of existing road/land use development with the potential to generate additional traffic on existing road	Existing traffic LAeq,(15hr)+12dB	Existing traffic LAeq,(9hr)+12dB

2.3.2 Site Activities/Mechanical Plant Noise

Noise from industrial noise sources scheduled under the Protection of Environment Operations Act is assessed using the EPA's NPI. However, local Councils and Government Departments may also apply the criteria for land use planning, compliance and complaints management. The NPI 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 NPI 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)

Table 5 below specifies the applicable project intrusiveness and amenity noise trigger levels for the proposed redevelopment.

Table 5: - Intrusiveness and Amenity Noise levels

Period	Intrusiveness Criteria	Amenity Criteria
Day	65 (60+5)	58 (60-5+3)
Evening	59 (54+5)	48 (50-5+3)
Night	43 (38+5)	43 (45-5+3)
Shoulder (5am-7am)	48 (43+5)[1]	43 (45-5+3)
Shoulder (10pm-12am)	48 (43+5)[1]	43 (45-5+3)
Receiver Type: Urban (See EPA's NPI - Table 2.1)		

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 NPI).

Project Noise Trigger Levels, determined as the more stringent of the intrusiveness criteria and the amenity / high traffic criteria, are as follows:

Day	**58dB 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	**43dB LAeq,15 Minute**	10pm to 7am Mon to Sat or 10pm to 8am Sun and Pub Hol.
Shoulder	**43dB LAeq,15 Minute**	10pm to 12am.
Shoulder	**43dB LAeq,15 Minute**	5am to 7am.

Commercial:
65dB(A),Leq,15 minute when in use

NOTE: Section 2.6 of the NPI 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.

2.3.3 Maximum Noise Level Event Assessment - Sleep Arousal

Section 2.5 of EPA's NPI 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 period.

SECTION 3
Noise Impact Assessment

3.1 METHODOLOGY

3.1.1 Road Traffic Noise

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 2.2. 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.

3.1.2 Site Equipment/Activities

Future noise sources on the site cannot be measured at this time, consequently noise levels produced by customer's vehicles, delivery trucks, mechanical plant and site activities 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 predictions of future environmental noise at each receiver and recommendations concerning noise control measures most likely to be required on this site.

All noise level measurements were taken with a Svan 912AE Sound and Vibration Analyser. This instrument is Class 1 accuracy, in accordance with the requirements of IEC 61672, and has the capability to measure steady, fluctuating, intermittent and/or impulsive sound, and to compute and display percentile noise levels for the measuring period. A calibration signal was used to align the instrument train prior to measuring and checked at the conclusion. Difference in the two measurements was less than 0.5dB. Each measurement was taken over a representative time period to include all aspects of machine/process operation, including additional start-up noise where applicable. Items of equipment, which produced a brief burst of noise, were measured for a similarly brief time period to ensure the results were not influenced by long periods of inactivity between operations. Sound measurements were generally made around all sides of each machine, 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 with allowances made for spherical spreading, directivity, molecular absorption, intervening topography or barriers and ground effects giving the received noise level at the receiver from that particular plant item.

Addition of the received Sound Pressure Level (SPL) for each of the individual operating sources gives the total SPL at each receiver, which is then compared to the relevant criterion. Where noise impacts above the criterion are identified, suitable noise control measures are implemented and reassessed to demonstrate satisfactory received noise levels.

The theoretical assessment is based on a worst-case scenario, where all fixed plant items are operating simultaneously and vehicles entering and leaving in a location most exposed to the surrounding residences. In reality, many items will not always be operating in the most exposed areas, so actual received noise levels are expected to be less than the predictions shown in this report, or at worst equal to the predicted noise levels for only part of the time.

Due to the non-continuous nature of some site activities (i.e. car/truck movements, etc), adjustments for duration have been made using the following in-house mathematical formula. Note that fixed plant items such as air conditioning/exhaust plant will be continuous over the entire assessment period and no duration adjustment is necessary.

Equation 2:

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

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)

3.2 ANALYSIS

3.2.1 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 5.1 of this Report. Trucks and customer vehicles will enter the site via Ackroyd Street and Ocean Drive.

Delivery/Customers' Trucks
This assessment assumes only 1 fuel delivery will occur in a single day, with perhaps 1-2 smaller trucks to deliver fresh foods, dry goods, drinks, etc, which may occur at any time from 5am to 12am. Based on the above assumptions, 2-3 trucks may enter and leave the site each day (4-6 movements).

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 102dB(A), as full engine power is not typically required to approach and depart the site at low speed.

Customers' Vehicles
The Intersect Traffic Report[1] indicates that the development will generate 112 vehicle movements/hr during peak periods. For assessment purposes we have assumed 5% of vehicles will be trucks/vans. It is reasonable to assume that say 80 vehicle movements/hr would be typical during other times. This equates to approximately 1100 movements during the day (7am-10pm). Significantly less vehicle movements are expected at night, with perhaps 20 vehicle movements/hr or 540 vehicle movements during the night (10pm-7am).

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.

[1] Intersect Traffic Pty Ltd (April 2019). *Traffic & Parking Assessment. Service Station and Convenience Store. Lot A DP.405025. 79 Barrenjoey Road, Mona Vale.*

The following Tables show calculations to determine received traffic noise levels at typical residential receivers along Ackroyd Street and Ocean Drive for peak day and night periods.

Table 6: Traffic Noise Calculations Mona Vale Road - dB(A)Leq (T)

Traffic and Receiver	Peak Day		Peak Night	
Vehicle Type	Cars	Trucks	Cars	Trucks
Movements per day/night	1100	65	540	28
Vehicle Sound Power	92	102	92	102
Average Distance to Rec, m	15	15	15	15
Rec Noise Level dB(A),Leq	48.1	46.8	47.2	45.3
Total Received	**50.5**		**49.4**	
Criteria	**60dB(A),Leq 15hr**		**55dB(A),Leq 9hr**	
Impact	**0**		**0**	
Existing Noise Level	**58**		**50**	
Existing + Proposed	**58.7**		**52.7**	
Relative Noise Increase	**0.7**		**2.7**	

The above Tables show the noise impact from traffic movements on public roads, associated with the development are predicted to compliant with the criteria during the peak day and night periods at all residential receivers and is considered acceptable.

3.2.2 Received Noise – Site Operation (Activities/Equipment)

The Acoustic Power Levels (Lw's) of plant and machinery expected for the site which were input into our computer model, are shown in the following Table for peak day, evening and night periods. The Table gives the A-weighted sound power levels for each listed plant item, principally based on manufacturers' data and our library of technical data. Also shown is the number of items expected at the site during a 15 minute assessment period.

Table 7: Equipment/Activities (15 minute Assessment Period)

Item/Activity	Lw dB(A)	Fuel Canopy	Blg	Air/Water W C'Park	Blg Roof	Service Yard	Fill Point
DAY / EVENING / SHOULDER							
Cust car[1]	80	30	5	2			
Cust truck/van[2]		5	1	1			
Tanker E/L[3]	95						2
Tanker refuel[4]	76						1
Delivery truck[5]	86		1				
Unload truck[6]	76		1				
Air con plant[7]	69				2		
Refrig plant[8]	72				1		
Air/Water[9]	82			4		4	
NIGHT							
Cust car[1]	80	15	3	2			
Cust truck/van[2]		3	1	1			
Tanker E/L[3]	95						
Tanker refuel[4]	76						
Delivery truck[5]	86						
Unload truck[6]	76						
Air con plant[7]	69				2		
Refrig plant[8]	72				1		
Air/Water[9]	82			4		4	

NOTE: Fuel tankers and delivery trucks will only visit the site from 5am-12am.

NOTES:
1. Cars manoeuvring in carpark, at service station fill points.
2. Trucks/vans manoeuvring in carpark, at service station fill points.
3. Tanker enter and park at fill point then switch engine off.
4. Tanker at fill point. Fill tanks gravity fed.
5. Delivery truck enter and park adjacent to store.
6. Unload delivery truck.
7. Air con on building roof.
8. Refrig plant on building roof.
9. Cars at RFP Retail Forecourt Inflator with inbuilt compressor, or compressor in service yard.

Table 8 shows calculations to predict the cumulative noise impact during peak periods at the nearest residential boundaries east of the site across The Lakes Way (R2).

Table 8: Received Noise - Site Activities dB(A),Leq (Day/Evening/Shoulder)
Propagated E to Nearest Residential Boundary R1/R2

Item/Activity	Lw dB(A)	Ave Dist Rec (m)	Duration (sec)	No. of Events	Barrier Loss/Dir	Received dB(A)
Cars at car canopy	80	45	10	30	0	34
Cars Blg Carpark	80	45	10	5	0	26
Cars Air/Water	80	40	10	2	0	23
Vans Canopy	85	45	10	6	0	32
Vans Blg Carpark	85	45	10	5	0	31
Vans Air/Water	85	40	10	1	0	25
Tanker enter	96	40	15	1	0	38
Tanker at fill point	76	45	600	1	0	33
Tanker leave	9	40	10	1	0	36
Del truck enter	86	45	15	1	0	27
Unload del truck	76	60	300	1	0	27
Del truck leave	86	45	10	1	0	25
Air con service yard	69	60	900	2	18	10
Refrig service yard	74	60	900	1	18	12
Compressor serv yard	82	60	10	4	18	7
NOTE: Tankers will not visit site during the night. Deliveries will not occur at night.				**Combined**		**43**
				Crit (D/E/S)		**58/48/43**
				Impact		**0/0/0**

As can be seen by the results in Table 8, the cumulative noise impact from activities associated with the site are predicted to be compliant with the criteria during the day, evening and shoulder periods at nearest residential boundaries east of the site (R1/R2). Compliance is dependent on the following noise control strategies being implemented:

1. Limiting noise level for roof-top mechanical plant.
2. Restrictions on delivery times.

Table 9 shows a summary of predicted noise impacts during all time periods at nearest receivers with noise control in place.

Table 9: Summary Received Noise – All Nearby Receivers

Receiver Loc'n	Received Noise (Day/Evening/Night)						
	Period	dB(A),Leq	Crit	Impact	dB(A),Lm	Crit	Impact
S.Storey	Day	43	58	0	-	N/A	-
Residence E	Evening	43	48	0	-	N/A	-
R1	Shoulder	43	43	0	53	52	1
	Night	35	43	0	45	52	0
D. Storey	Day	43	58	0	-	N/A	-
Residence E	Evening	43	48	0	-	N/A	-
R2	Shoulder	43	43	0	53	52	1
	Night	35	43	0	45	52	0
S.Storey	Day	42	58	0	-	N/A	-
Residence E	Evening	42	48	0	-	N/A	-
R3	Shoulder	42	43	0	52	52	0
	Night	34	43	0	44	52	-
Global	Day	49	58	0	-	N/A	-
Storage S	Evening	49	48	0	-	N/A	-
R4	Shoulder	49	43	0	-	N/A	0
	Night	41	43	0	-	N/A	-
Light	Day	51	58	0	-	N/A	-
Industrial W	Evening	51	48	0	-	N/A	-
R5	Shoulder	51	43	0	-	N/A	0
	Night	43	43	0	-	N/A	-
Mercedes	Day	52	58	0	-	N/A	-
Benz N	Evening	52	48	0	-	N/A	-
R6	Shoulder	52	43	0	-	N/A	0
	Night	43	43	0	-	N/A	-

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 4 is implemented. A minor 1dB(A) exceedance of the Sleep Arousal Criterion is noted during the Shoulder periods at residences R1 and R2, however given that existing average (Lmax) noise levels already impacting the area are more than 25dB(A) higher than predicted by the proposal, it is unlikely that residents will notice any major increase in noise due to occasional deliveries.

SECTION 4
Summary of Recommended Noise Control

4. NOISE CONTROL RECOMMENDATIONS

4.1 The service station and convenience store may trade over the full 24 hour period

4.2 Fuel tanker deliveries are to be restricted to 5am-12am.

4.3 General store deliveries are to be restricted to 5am-12am.

4.4 Preference should be given to installing a RFP Retail Forecourt Inflator with inbuilt compressor, in preference to a separate compressor. If a separate compressor is preferred it must be located in the service yard.

4.5 Perimeter walls to the Service Yard must be impervious from the ground to a height of 1800mm above FGL. Construction may consist of Colorbond or similar. A gap of 50-75mm may be left at ground level to aid in drainage, cleaning, etc.

4.6 No acoustic barriers are required adjacent to roof-top air mechanical plant unless noise emissions from individual items are above an SPL in excess of 75dB(A) at a distance of 1 metre in which case acoustic barriers must be constructed between the plant and residences to the east. Barriers must be 300mm above the top of the plant. Barrier construction should consist of *either* Acoustisorb panels (available through Modular Walls) *or* 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 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.

4.7 No acoustic modifications are required to plant that is located within the service yard.

4.8 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.

4.9 It is strongly recommended that waste collection be restricted to weekdays 7.00am to 6.00pm.

4.10 Construction Certificate documentation must be forwarded to Reverb Acoustics to ensure all recommendations within this report have been incorporated into the design of the site.

4.11 For both staff and customers, some form of education campaign is suggested to ensure satisfactory noise levels at nearby residences. For staff, the education can be part of in-service training, while for visitors reminders may be included in promotional material and reinforced with erection of appropriate signage.

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 proposal to construct a service station and convenience store at 79 Barrenjoey Road, Mona Vale, has been completed, resulting in noise control recommendations summarised in Section 4 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 criterion or generally below the existing noise levels in the area for the majority of the time.

With relatively constant traffic on nearby roads, and the abundance of nearby commercial development, noise generated by the proposed 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.

Providing the recommendations presented in this report are implemented noise emissions from operation of the site 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).