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REPORT 150263R1

Revision 3

North Shore RCF

25, 25A and 27 Bushlands Avenue, Gordon

Mechanical Services Noise Assessment

PREPARED FOR:
Australian Nursing Home Foundation

4 July 2017

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North Shore RCF

25, 25A and 27 Bushlands Avenue, Gordon

Mechanical Services Noise Assessment

PREPARED BY:

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150263R1	Revision 1	20 September 2015	Rodney Stevens	Desmond Raymond	Rodney Stevens
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INTRODUCTION

Rodney Stevens Acoustics Pty Ltd (RSA) was commissioned by ANHF to conduct an assessment of the operational noise emissions associated with the proposed residential aged care facility pursuant to SEPP (housing for Seniors or People with a Disability) located at 25, 25A and 27 Bushlands Avenue, Gordon. It is noted that 25 Bushlands has been the subject of an interim Heritage Order and will not be removed.

This acoustical assessment has been based upon DA issue drawings supplied by Project Architects Boffa Robertson Group. Specific acoustic terminology is used in this report. An explanation of common acoustic terms is provided in Appendix A

PROPOSED DEVELOPMENT

The 25, 25A and 27 Bushlands Avenue development is a Residential Care Facility to accommodate seniors. The development is located in a residential street in Gordon.

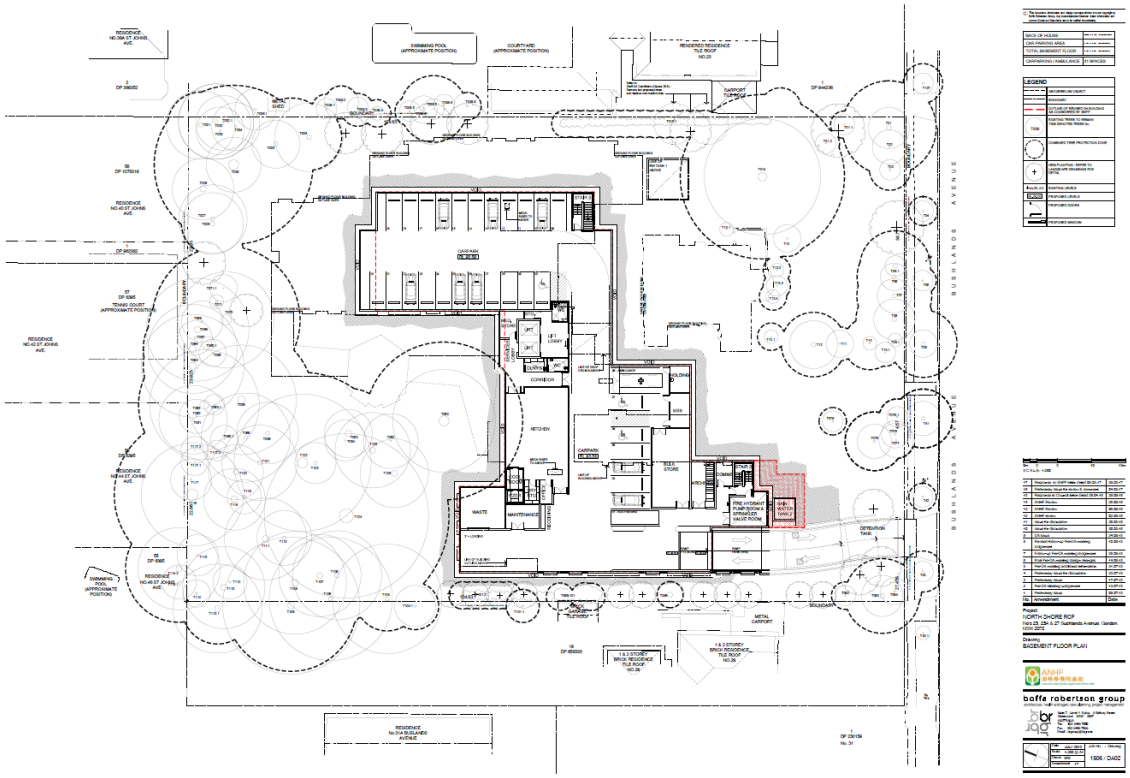
The facility is situated adjacent to surrounding residences with the closest residences being 23 and 29 Bushlands Avenue and 40, 42, 44 and 46 St Johns Avenue, Gordon.

The project location and site plans are shown below.

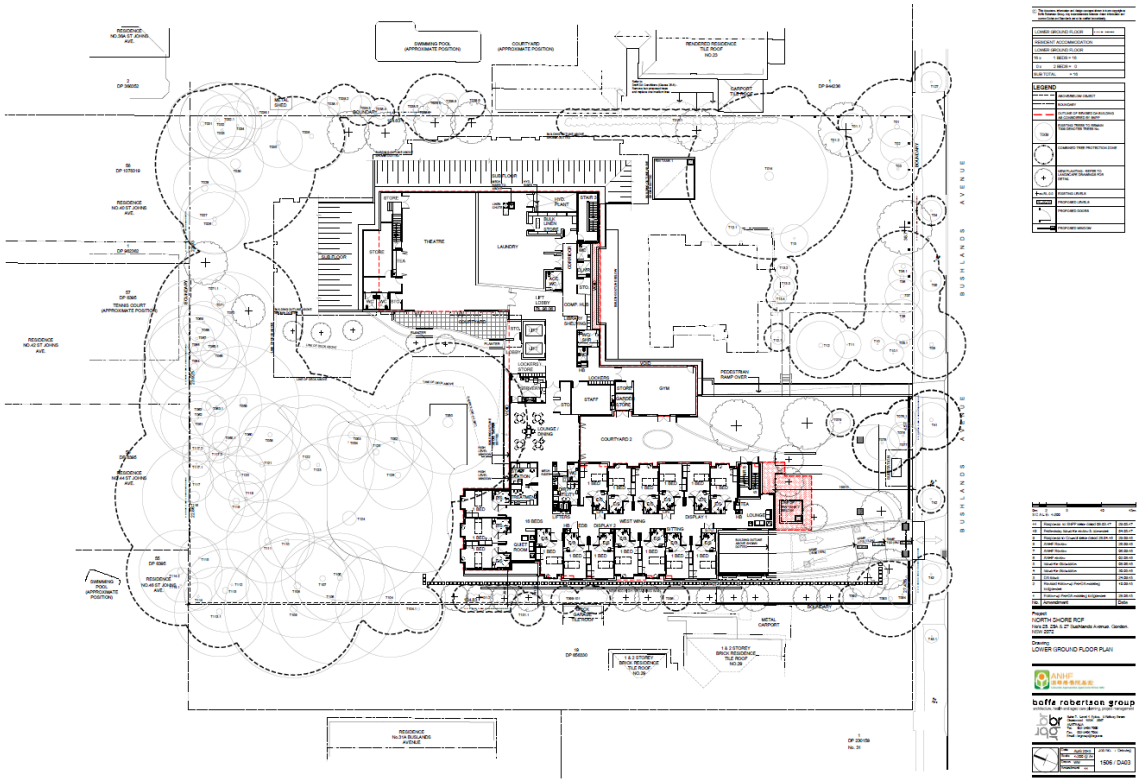
Project Location

Site Plans

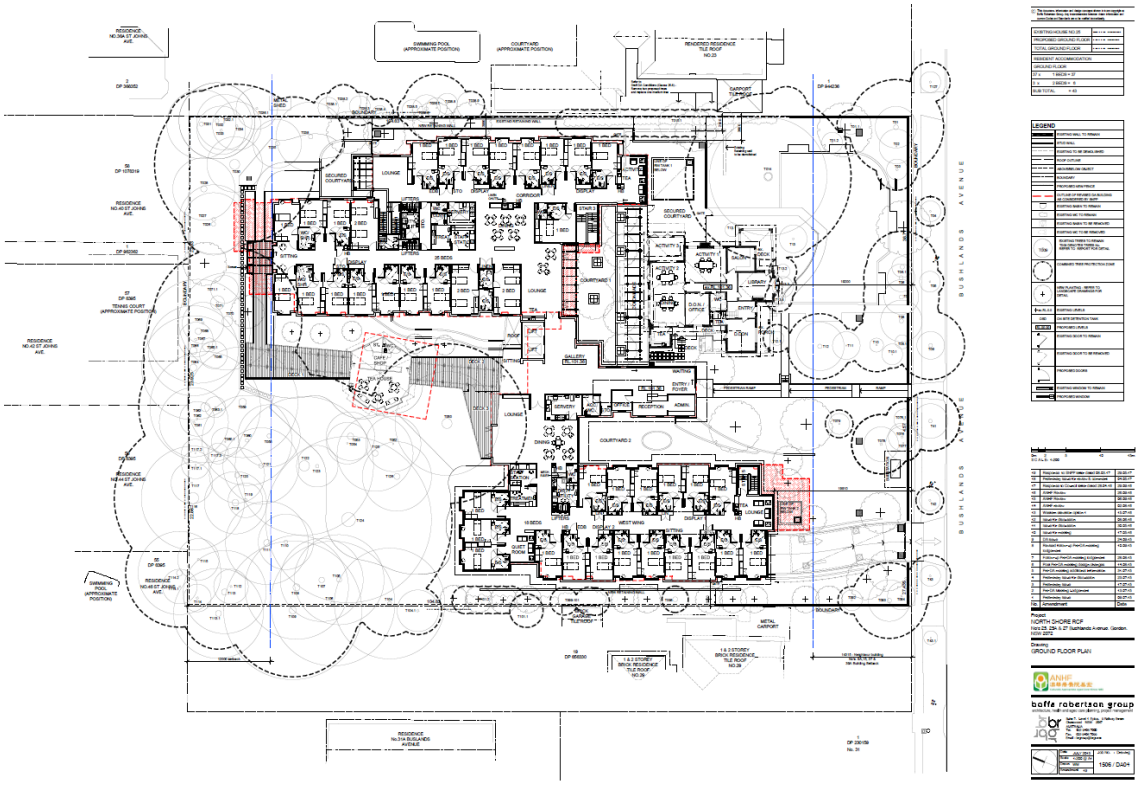
Basement



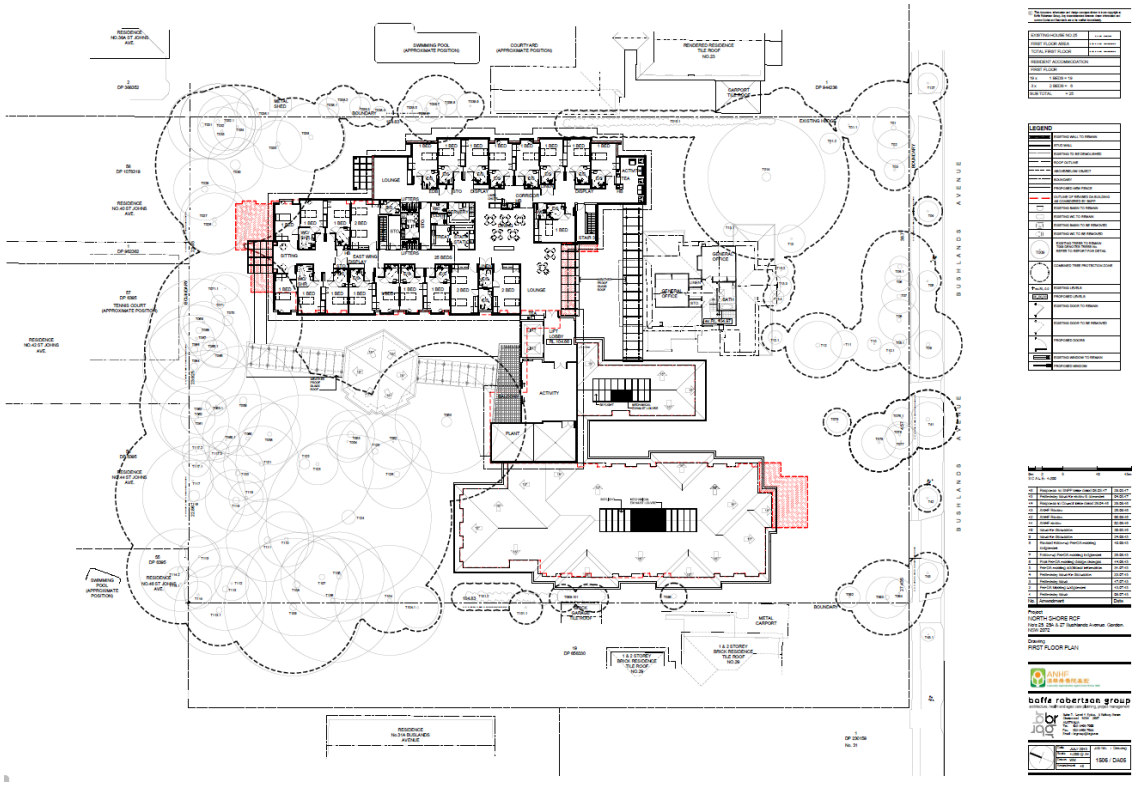
Lower Ground Floor



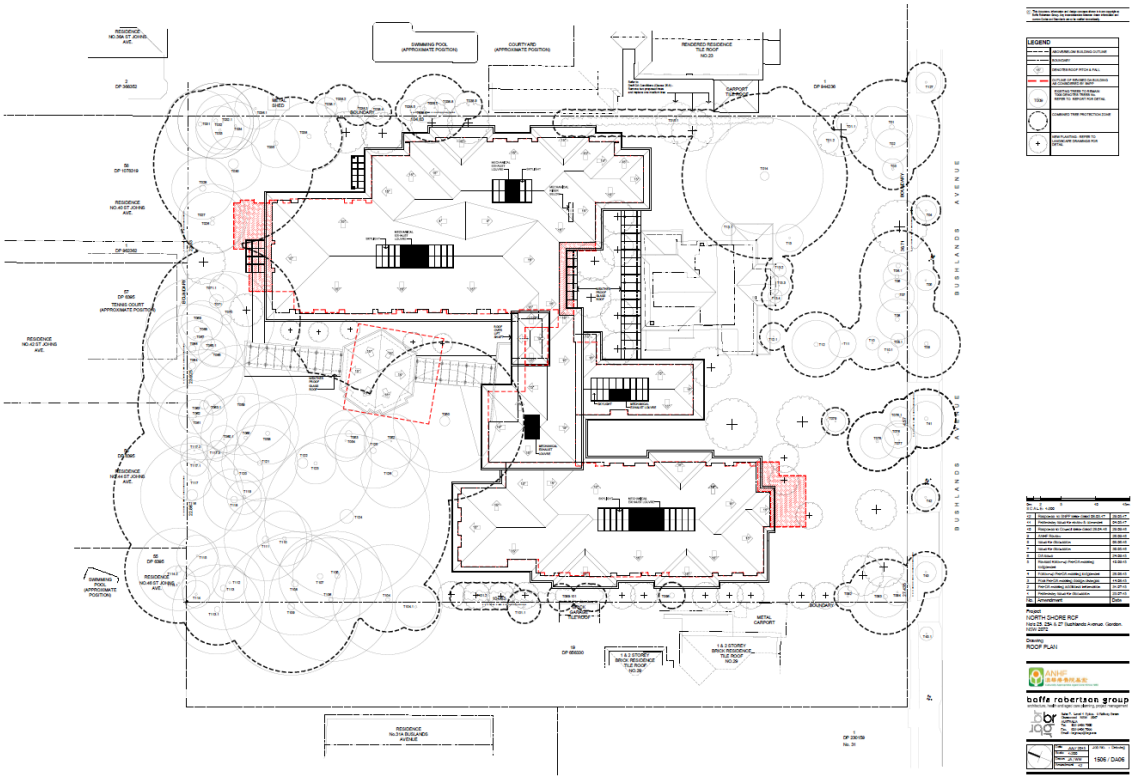
Ground Floor



First Floor



Roof



Drawing courtesy of Boffa Roberston Group

COUNCIL REQUIREMENTS

In pre DA notes from Ku-ring-gai Council the Environmental Health Section has stated:-

“Noise- The main potential sources of noise impact from the proposed development would include any mechanical exhaust/ventilation systems, air conditioning systems, noise from traffic generation, lift motors and the like. A full noise assessment from a suitably qualified acoustic consultant should be submitted and address the background noise levels and assessment against legislative noise criteria and recommendations/construction requirements, eg enclosures/barriers/building design”.

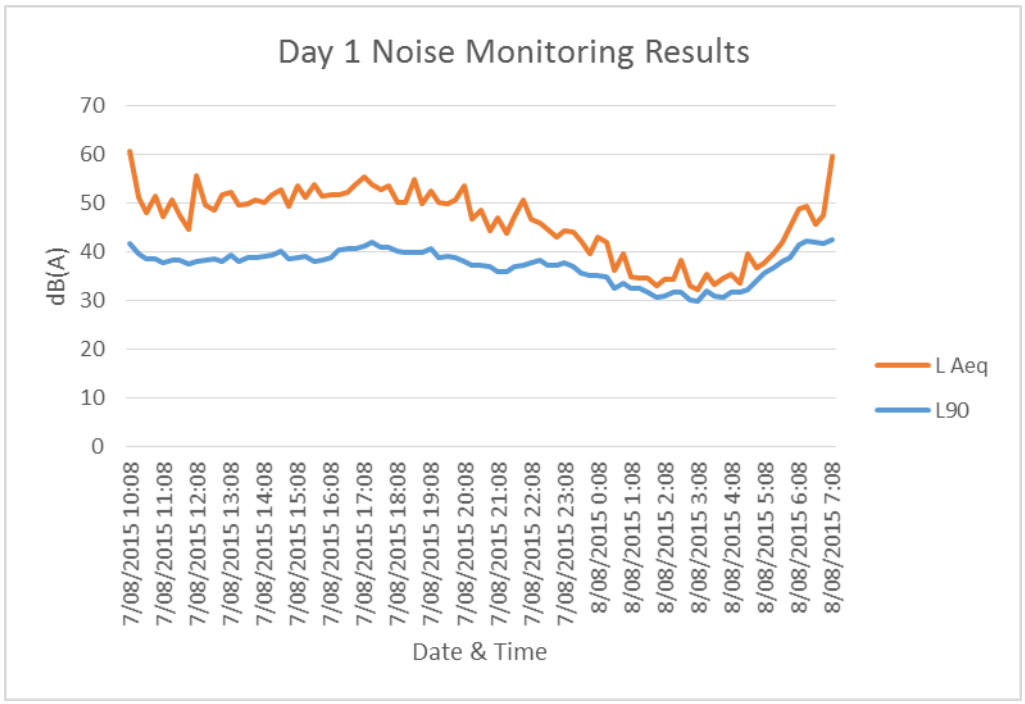
The mechanical ventilation plant associated with the project is the only source of significance in terms of operational noise emissions and includes exhaust and outside air fans and air conditioning condenser units and heat pumps.

Residences to the north in St Johns Avenue and residents to the east and west in Bushlands Avenue are the main concern with regard to noise.

EXISTING NOISE ENVIRONMENT

25 Bushland Ave, Gordon – Front Yard Data

Location	Measurement Descriptor	Measured Noise Level – dB(A) re 20 µPa		
		Daytime	Evening	Night-time
		7.00 am - 6.00 pm	6.00 pm - 10.00 pm	10.00 pm - 7.00 am
On Site	L_{Aeq}	60	48	45
	RBL	51	39	38
Location	Period	Laeq	L90	
Logger Location	Day Time 7:00 am - 10:00 pm	60	39	
	Night Time 10:00 pm - 7:00 am	45	38	


Day 1 Noise Monitoring Results
70
60
50
40
30
20
10
0
dB(A)
7/08/2015 10:08
7/08/2015 11:08
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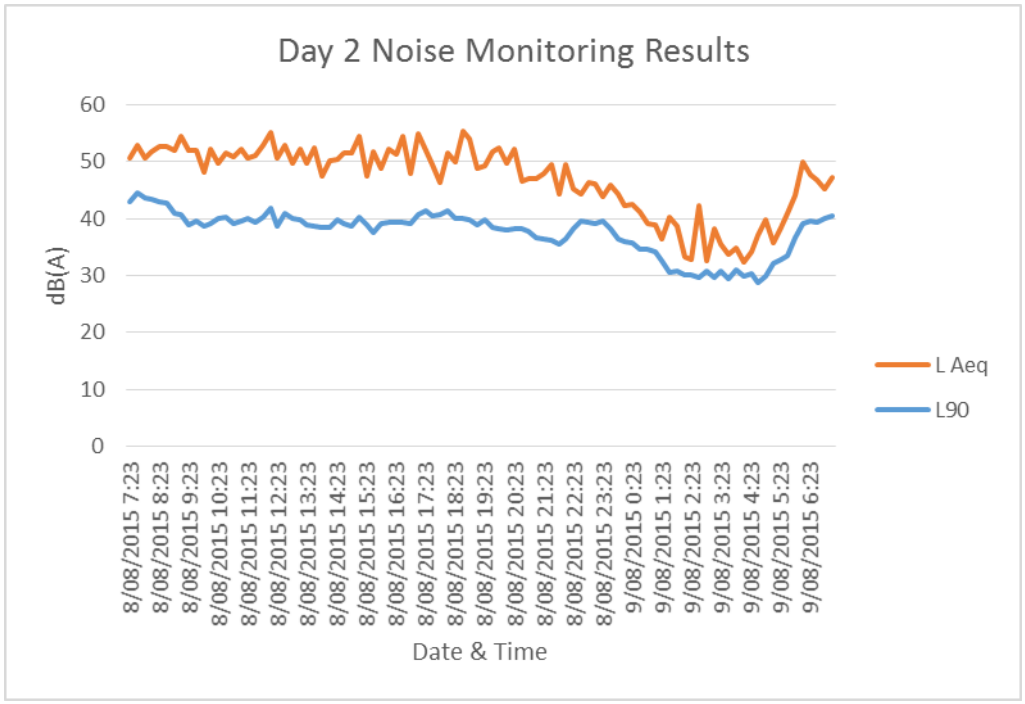
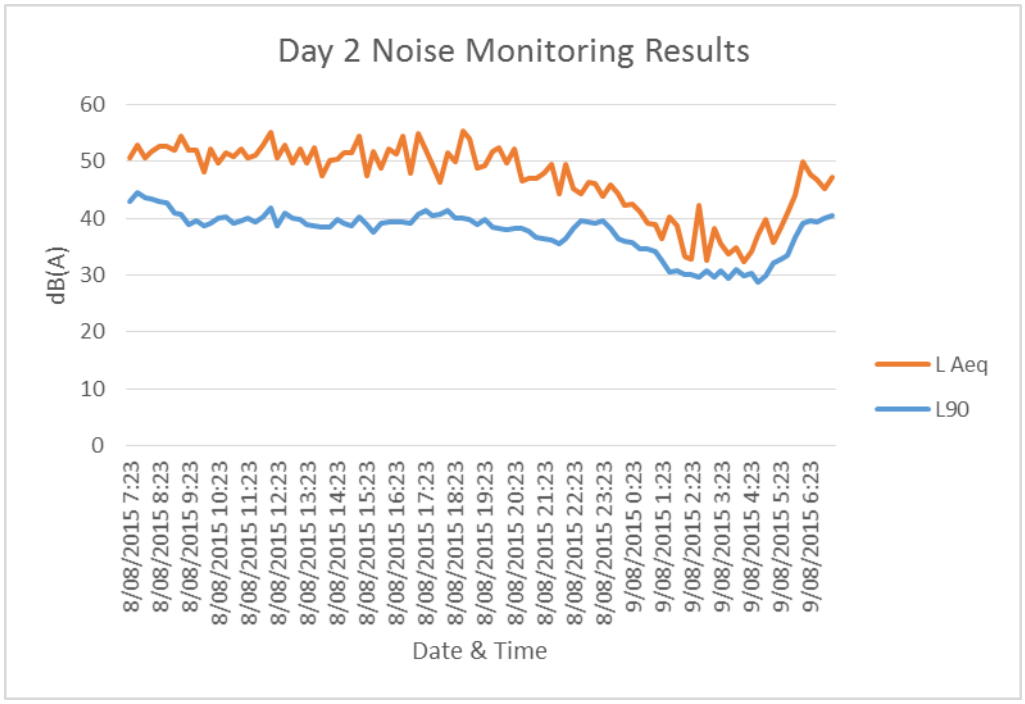
7/08/2015 13:08
7/08/2015 14:08
7/08/2015 15:08
7/08/2015 16:08
7/08/2015 17:08
7/08/2015 18:08
7/08/2015 19:08
7/08/2015 20:08
7/08/2015 21:08
7/08/2015 22:08
7/08/2015 23:08
8/08/2015 0:08
8/08/2015 1:08
8/08/2015 2:08
8/08/2015 3:08
8/08/2015 4:08
8/08/2015 5:08
8/08/2015 6:08
8/08/2015 7:08
Date & Time
L Aeq
L90


Day 2 Noise Monitoring Results
60
50
40
30
20
10
0
dB(A)
8/08/2015 7:23
8/08/2015 8:23
8/08/2015 9:23
8/08/2015 10:23
8/08/2015 11:23
8/08/2015 12:23
8/08/2015 13:23
8/08/2015 14:23
8/08/2015 15:23
8/08/2015 16:23
8/08/2015 17:23
8/08/2015 18:23
8/08/2015 19:23
8/08/2015 20:23
8/08/2015 21:23
8/08/2015 22:23
8/08/2015 23:23
9/08/2015 0:23
9/08/2015 1:23
9/08/2015 2:23
9/08/2015 3:23
9/08/2015 4:23
9/08/2015 5:23
9/08/2015 6:23
Date & Time
L Aeq
L90


Day 2 Noise Monitoring Results
60
50
40
30
20
10
0
dB(A)
L Aeq
L90
8/08/2015 7:23
8/08/2015 8:23
8/08/2015 9:23
8/08/2015 10:23
8/08/2015 11:23
8/08/2015 12:23
8/08/2015 13:23
8/08/2015 14:23
8/08/2015 15:23
8/08/2015 16:23
8/08/2015 17:23
8/08/2015 18:23
8/08/2015 19:23
8/08/2015 20:23
8/08/2015 21:23
8/08/2015 22:23
8/08/2015 23:23
9/08/2015 0:23
9/08/2015 1:23
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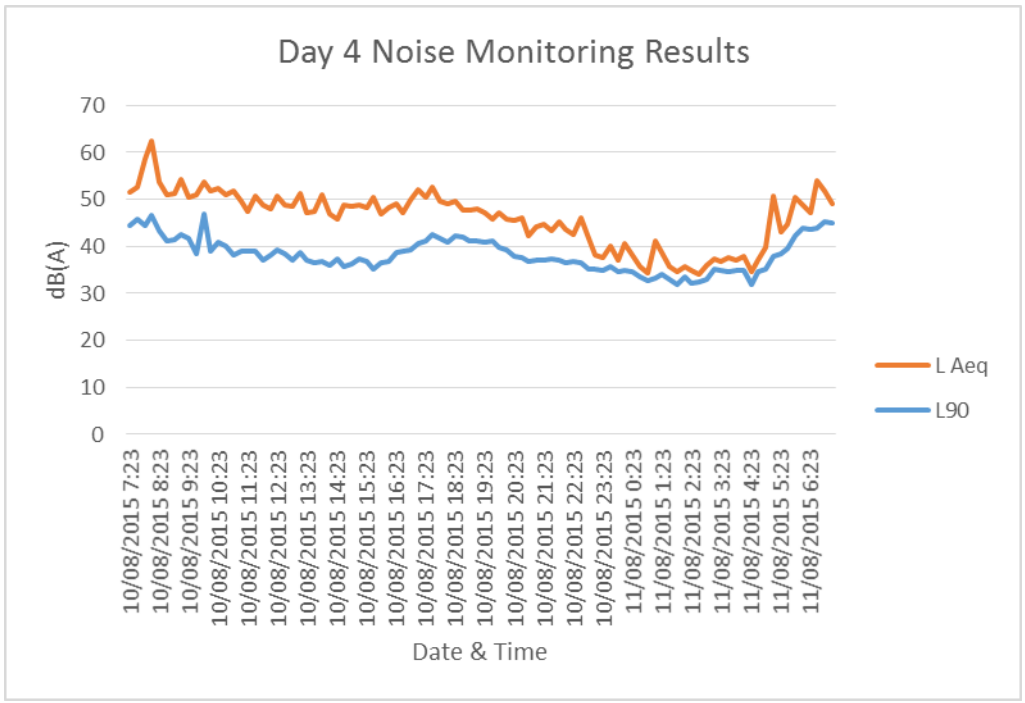
9/08/2015 4:23
9/08/2015 5:23
9/08/2015 6:23
Date & Time


Day 4 Noise Monitoring Results
70
60
50
40
30
20
10
0
dB(A)
L Aeq
L90
10/08/2015 7:23
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10/08/2015 9:23
10/08/2015 10:23
10/08/2015 11:23
10/08/2015 12:23
10/08/2015 13:23
10/08/2015 14:23
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10/08/2015 18:23
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11/08/2015 1:23
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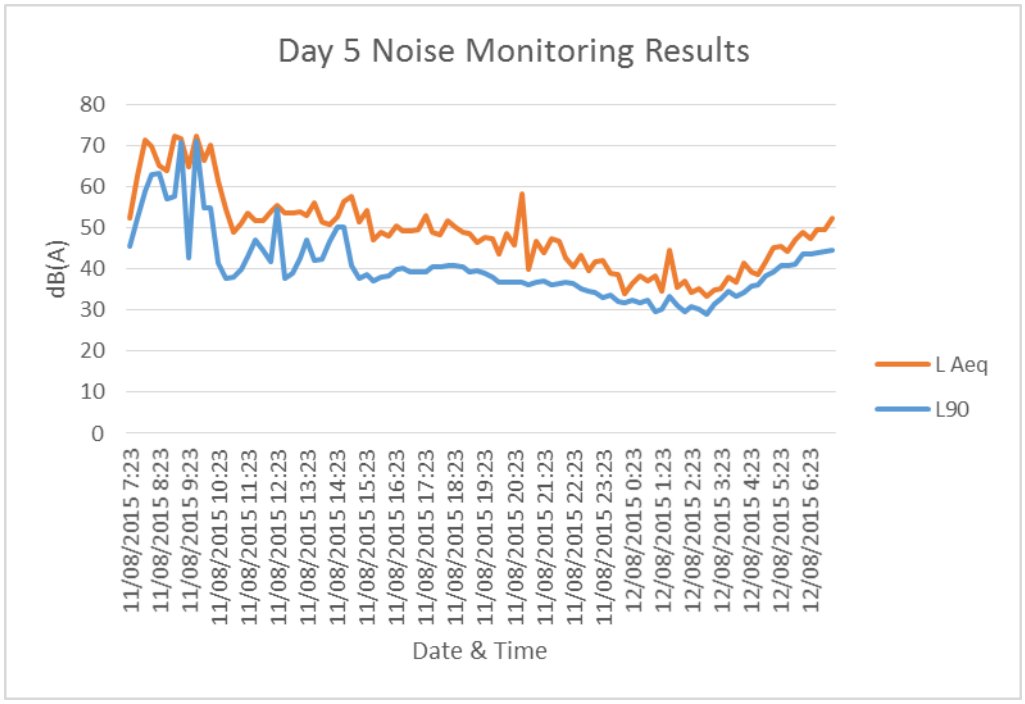
11/08/2015 3:23
11/08/2015 4:23
11/08/2015 5:23
11/08/2015 6:23
Date & Time


Day 5 Noise Monitoring Results
dB(A)
80
70
60
50
40
30
20
10
0
11/08/2015 7:23
11/08/2015 8:23
11/08/2015 9:23
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11/08/2015 11:23
11/08/2015 12:23
11/08/2015 13:23
11/08/2015 14:23
11/08/2015 15:23
11/08/2015 16:23
11/08/2015 17:23
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11/08/2015 22:23
11/08/2015 23:23
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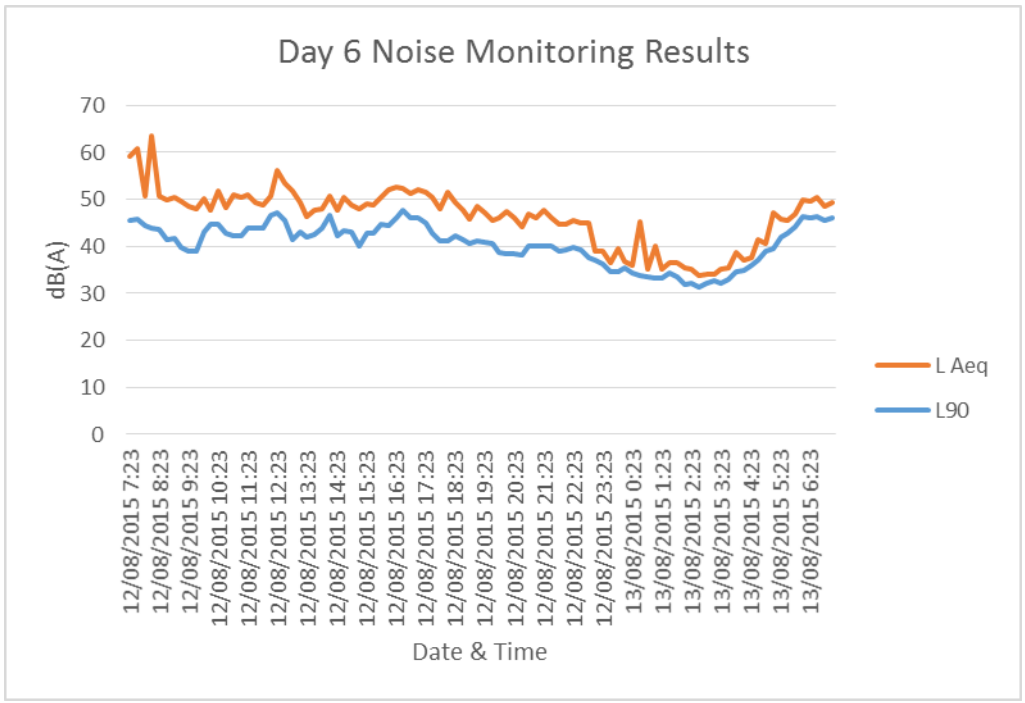
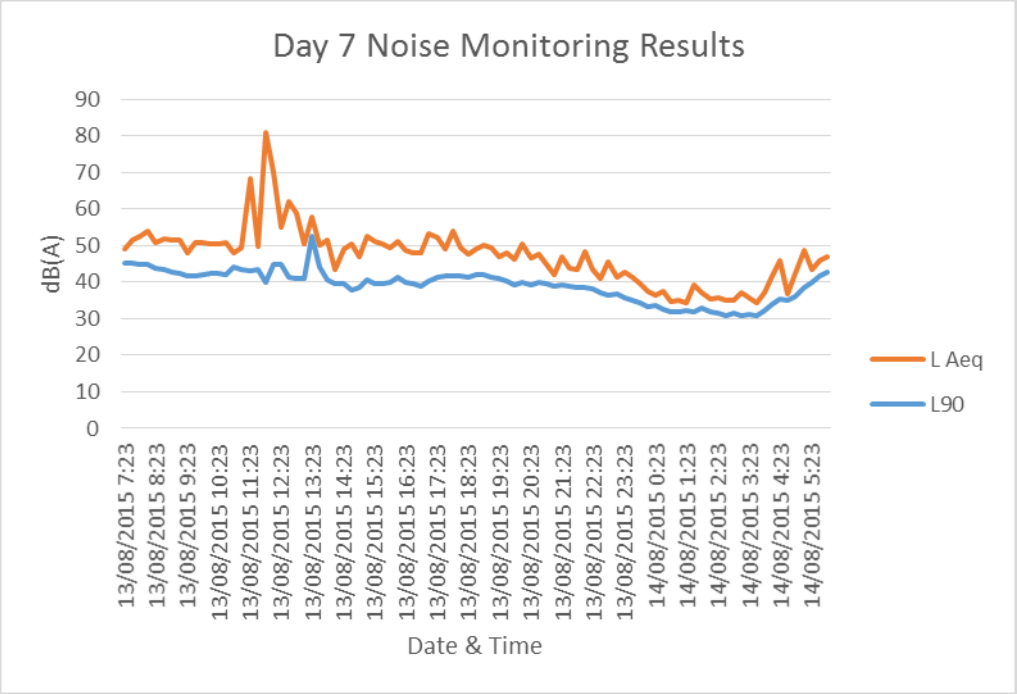
12/08/2015 1:23
12/08/2015 2:23
12/08/2015 3:23
12/08/2015 4:23
12/08/2015 5:23
12/08/2015 6:23
Date & Time
L Aeq
L90


Day 6 Noise Monitoring Results
dB(A)
70
60
50
40
30
20
10
0
12/08/2015 7:23
12/08/2015 8:23
12/08/2015 9:23
12/08/2015 10:23
12/08/2015 11:23
12/08/2015 12:23
12/08/2015 13:23
12/08/2015 14:23
12/08/2015 15:23
12/08/2015 16:23
12/08/2015 17:23
12/08/2015 18:23
12/08/2015 19:23
12/08/2015 20:23
12/08/2015 21:23
12/08/2015 22:23
12/08/2015 23:23
13/08/2015 0:23
13/08/2015 1:23
13/08/2015 2:23
13/08/2015 3:23
13/08/2015 4:23
13/08/2015 5:23
13/08/2015 6:23
Date & Time
L Aeq
L90


Day 7 Noise Monitoring Results
dB(A)
90
80
70
60
50
40
30
20
10
0
13/08/2015 7:23
13/08/2015 8:23
13/08/2015 9:23
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13/08/2015 11:23
13/08/2015 12:23
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13/08/2015 14:23
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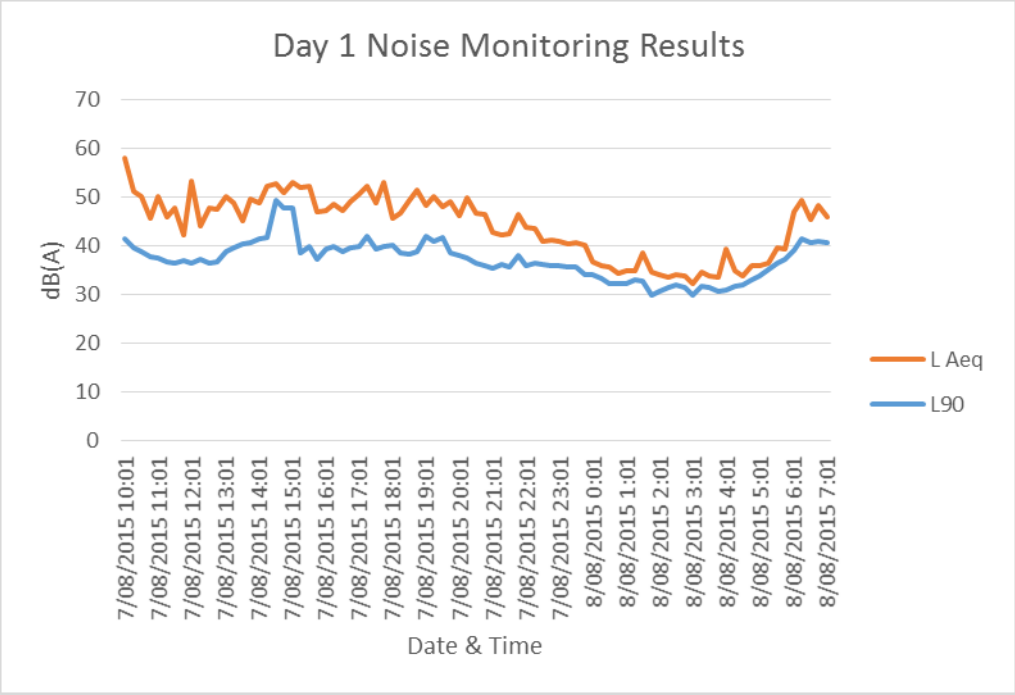
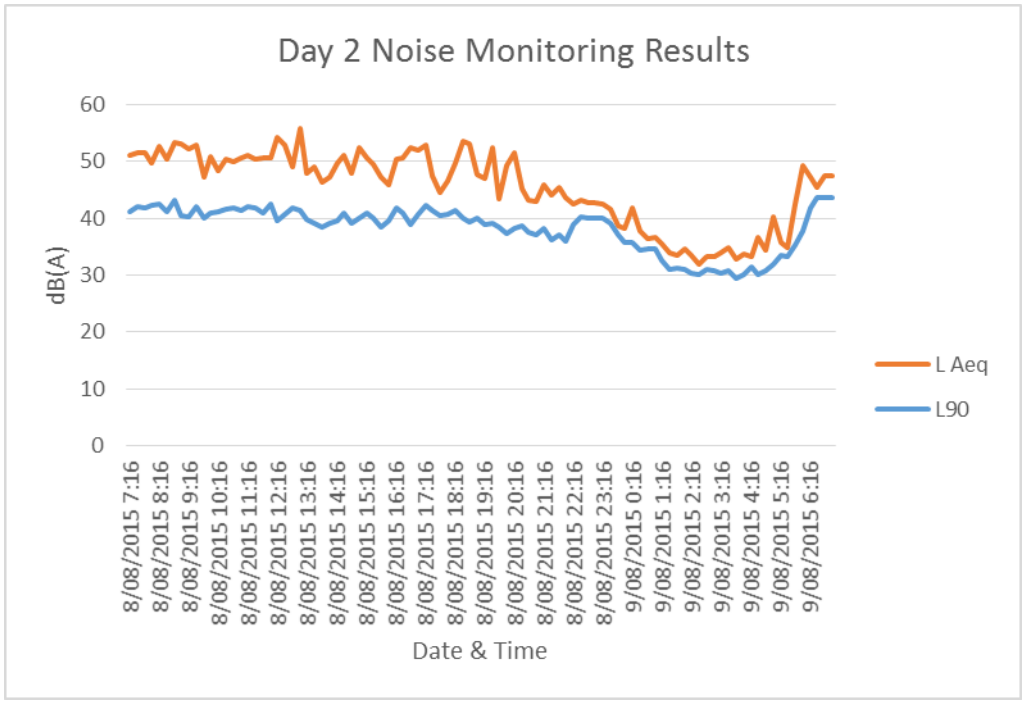
13/08/2015 18:23
13/08/2015 19:23
13/08/2015 20:23
13/08/2015 21:23
13/08/2015 22:23
13/08/2015 23:23
14/08/2015 0:23
14/08/2015 1:23
14/08/2015 2:23
14/08/2015 3:23
14/08/2015 4:23
14/08/2015 5:23
Date & Time
L Aeq
L90

25 Bushland Ave, Gordon – Back Yard Data

Location	Measurement Descriptor	Measured Noise Level – dB(A) re 20 µPa		
		Daytime	Evening	Night-time
		7.00 am - 6.00 pm	6.00 pm - 10.00 pm	10.00 pm - 7.00 am
On Site	L_{Aeq}	55	46	44
	RBL	43	41	41
Location	Period	Laeq	L90	
Logger Location	Day Time 7:00 am - 10:00 pm	55	41	
	Night Time 10:00 pm - 7:00 am	44	41	




Day 2 Noise Monitoring Results
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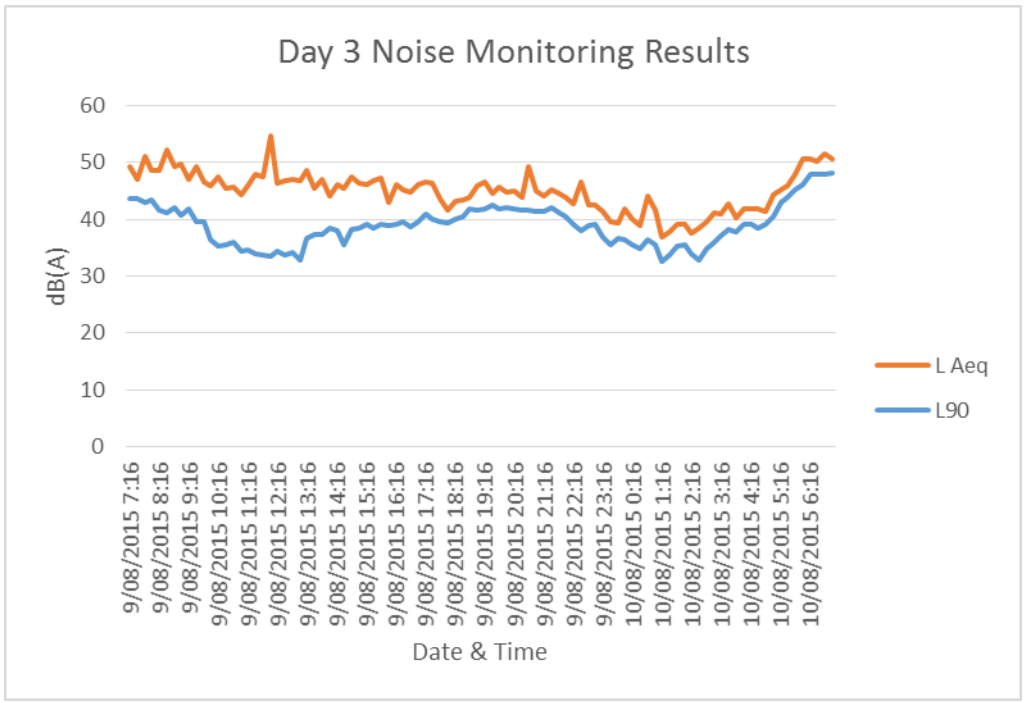
50
40
30
20
10
0
dB(A)
8/08/2015 7:16
8/08/2015 8:16
8/08/2015 9:16
8/08/2015 10:16
8/08/2015 11:16
8/08/2015 12:16
8/08/2015 13:16
8/08/2015 14:16
8/08/2015 15:16
8/08/2015 16:16
8/08/2015 17:16
8/08/2015 18:16
8/08/2015 19:16
8/08/2015 20:16
8/08/2015 21:16
8/08/2015 22:16
8/08/2015 23:16
9/08/2015 0:16
9/08/2015 1:16
9/08/2015 2:16
9/08/2015 3:16
9/08/2015 4:16
9/08/2015 5:16
9/08/2015 6:16
Date & Time
L Aeq
L90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50
40
30
20
10
0
dB(A)
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9/08/2015 8:16
9/08/2015 9:16
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9/08/2015 13:16
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9/08/2015 16:16
9/08/2015 17:16
9/08/2015 18:16
9/08/2015 19:16
9/08/2015 20:16
9/08/2015 21:16
9/08/2015 22:16
9/08/2015 23:16
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10/08/2015 1:16
10/08/2015 2:16
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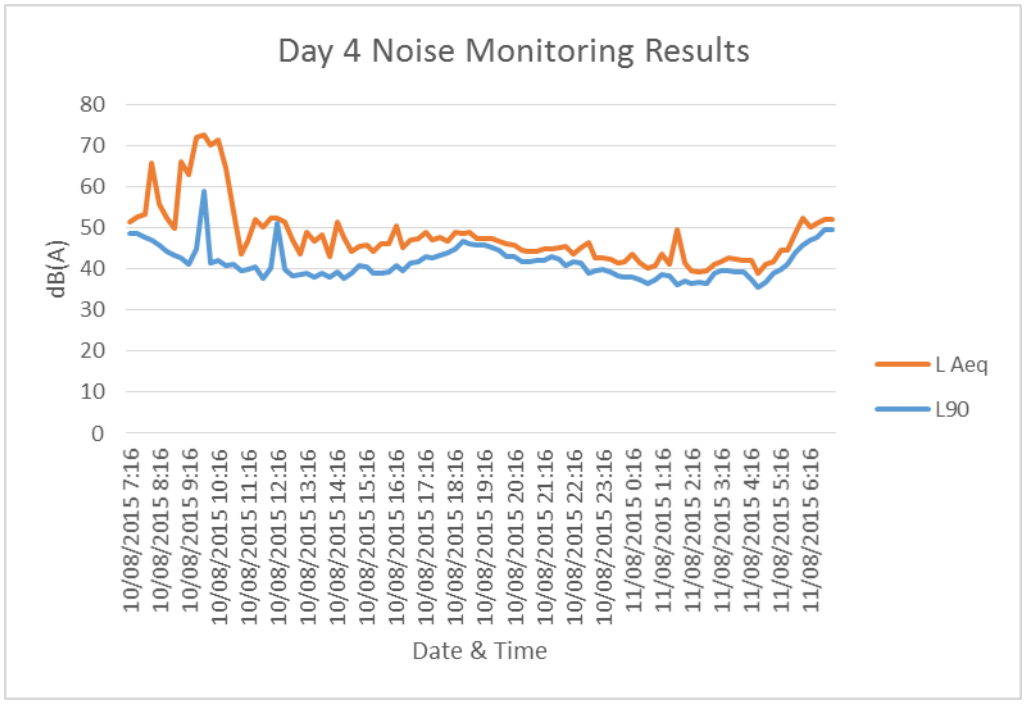
10/08/2015 4:16
10/08/2015 5:16
10/08/2015 6:16
Date & Time
L Aeq
L90


Day 4 Noise Monitoring Results
dB(A)
80
70
60
50
40
30
20
10
0
10/08/2015 7:16
10/08/2015 8:16
10/08/2015 9:16
10/08/2015 10:16
10/08/2015 11:16
10/08/2015 12:16
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10/08/2015 17:16
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10/08/2015 22:16
10/08/2015 23:16
11/08/2015 0:16
11/08/2015 1:16
11/08/2015 2:16
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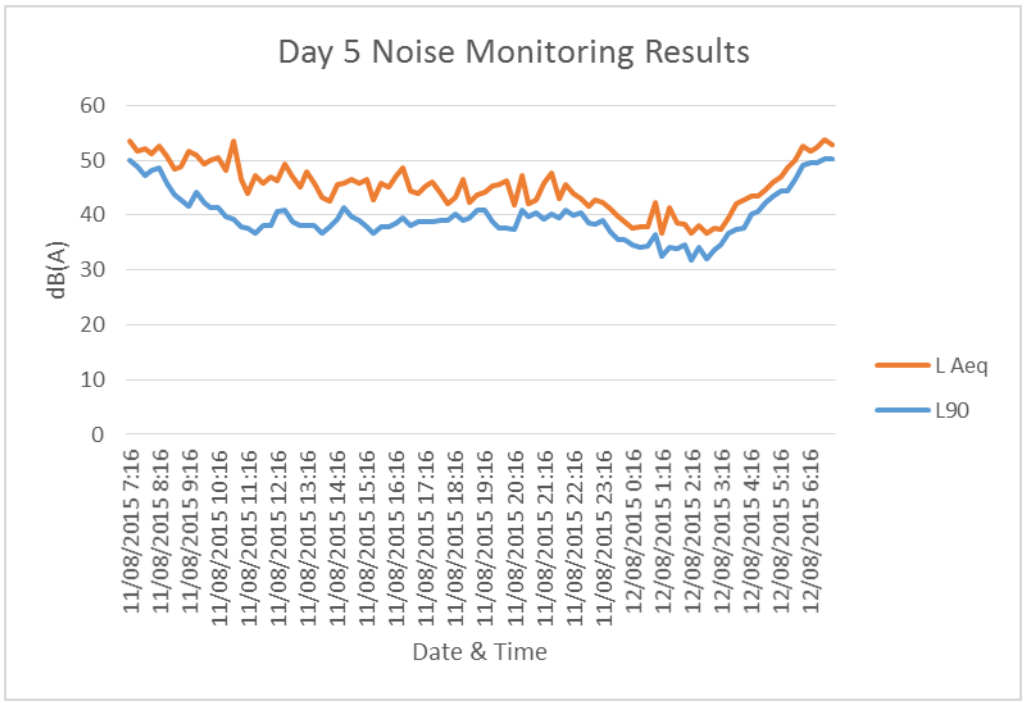
11/08/2015 4:16
11/08/2015 5:16
11/08/2015 6:16
Date & Time
L Aeq
L90


Day 5 Noise Monitoring Results
dB(A)
60
50
40
30
20
10
0
11/08/2015 7:16
11/08/2015 8:16
11/08/2015 9:16
11/08/2015 10:16
11/08/2015 11:16
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12/08/2015 2:16
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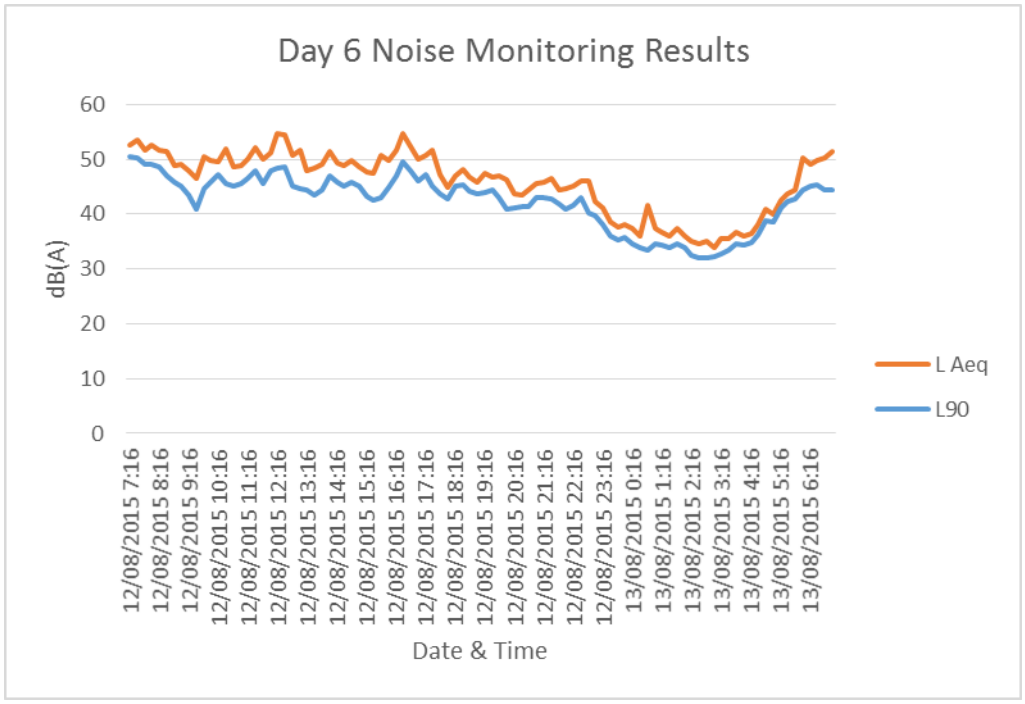
12/08/2015 4:16
12/08/2015 5:16
12/08/2015 6:16
Date & Time
L Aeq
L90


Day 6 Noise Monitoring Results
60
50
40
30
20
10
0
dB(A)
12/08/2015 7:16
12/08/2015 8:16
12/08/2015 9:16
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12/08/2015 11:16
12/08/2015 12:16
12/08/2015 13:16
12/08/2015 14:16
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12/08/2015 17:16
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12/08/2015 19:16
12/08/2015 20:16
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13/08/2015 2:16
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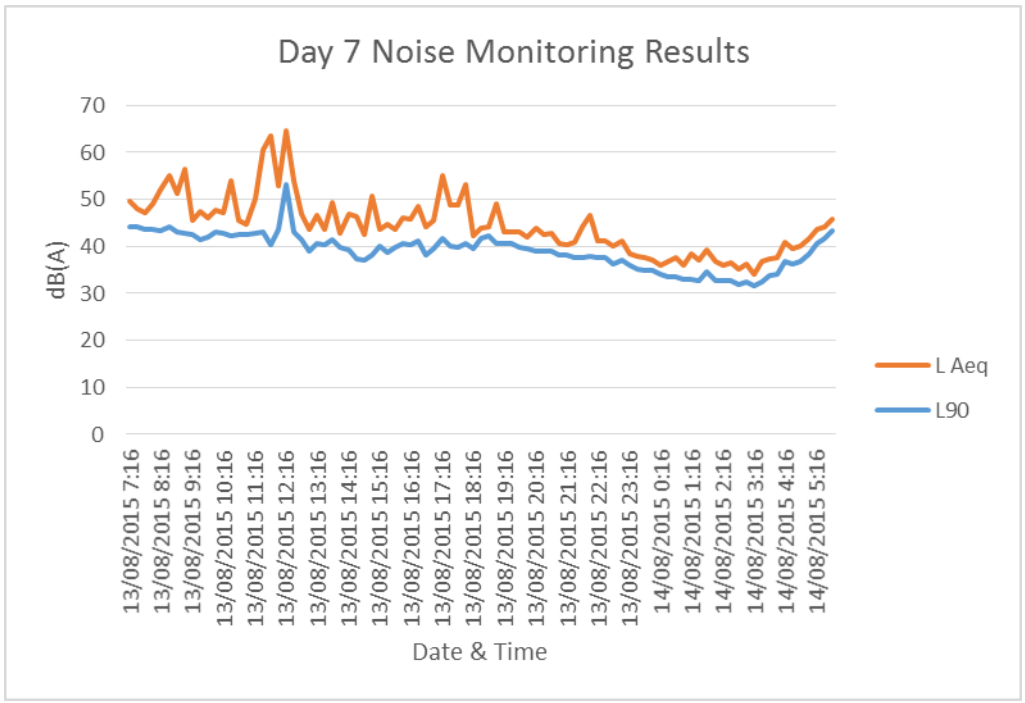
13/08/2015 6:16
Date & Time
L Aeq
L90


Day 7 Noise Monitoring Results
70
60
50
40
30
20
10
0
dB(A)
13/08/2015 7:16
13/08/2015 8:16
13/08/2015 9:16
13/08/2015 10:16
13/08/2015 11:16
13/08/2015 12:16
13/08/2015 13:16
13/08/2015 14:16
13/08/2015 15:16
13/08/2015 16:16
13/08/2015 17:16
13/08/2015 18:16
13/08/2015 19:16
13/08/2015 20:16
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13/08/2015 22:16
13/08/2015 23:16
14/08/2015 0:16
14/08/2015 1:16
14/08/2015 2:16
14/08/2015 3:16
14/08/2015 4:16
14/08/2015 5:16
Date & Time
L Aeq
L90

ASSESSMENT CRITERIA

The main potential sources of noise impact from the proposed development would include any mechanical exhaust/ventilation systems, air conditioning systems, noise from traffic generation and the like.

The NSW *Industrial Noise Policy* (EPA 2000) provides a framework and process for deriving noise criteria. The INP criteria for industrial noise sources (eg continuous operational noise from mechanical plant), has two components:

- Controlling the *intrusive* noise impacts for residents and other sensitive receivers in the short term; and
- Maintaining noise level *amenity* for particular land uses for residents and sensitive receivers in other land uses.

Assessing Intrusiveness (Residential Receivers)

For assessing intrusiveness, the background noise level of the area needs to be established. The intrusiveness criterion essentially requires the equivalent continuous noise level (L_{Aeq}) of a noise source to not exceed the measured Rated Background Level (RBL) by more than 5 dBA, over any 15 minute period.

Assessing Amenity (All Receivers)

The amenity assessment is based on noise criteria specific to land use and corresponding sensitivity to noise. The cumulative effect of noise from industrial sources needs to be considered in assessing the impact. The criteria relate only to continuous industrial noise sources and do not apply to road, rail or community noise. If the existing (measured) industrial-type noise level approaches the criterion value, then the Policy sets maximum noise emission levels from new sources with the objective of ensuring that the cumulative levels do not significantly exceed the criterion.

Assessment criteria for (continuous) operational noise emissions from mechanical plant for each of the defined day, evening and night-time periods have been derived from the minimum RBLs adopted for residential receivers in accordance with the INP.

Project Specific Noise Levels for the various assessment periods at the surrounding receiver locations are given (in bold)**.** In this case the area surrounding the site does not contain industrial noise sources so the amenity criterion becomes equal to the Recommended Amenity Criteria for Residences (ANL or Acceptable Noise Level)**.**

Project Specific Noise Criteria for Continuous Operational Noise Emissions

Receiver	Period [1]	ANL [2] LAeq (Period)	RBL[3] LA90(15min)	Intrusive LAeq(15min)	Amenity LAeq(Period)
Residence Front & Rear	Daytime	50	43/51	**48**	50
	Evening	45	39/41	**44**	45
	Night	40	30/41	**35**	40

Note 1: EPA Governing Periods are Day: 7:00 am to 6:00 pm, Evening: 6:00 pm to 10:00 pm, Night: 10.00 pm to 7.00 am.

Note 2: Recommended Amenity Criteria for Residences in a Rural Area - ANL Acceptable Noise Level.

Note 3: RBL Rating Background Level based on AS 1055.2-1997 Appendix A.

In summary, the project specific noise level for the assessment of (continuous $L_{Aeq(15minute)}$) operational noise emissions between 6:00 am and 10:00 pm, based upon the procedures documented within the NSW INP, is **44 dBA** at residential receivers. For any plant operating at night-time, between 10:00 pm and 6:00 am, the project specific noise limit is **35 dBA** at residential receivers

ASSESSMENT of ENVIRONMENTAL NOISE EMISSIONS

The noise emission of any new mechanical plant associated with the development should be controlled so that the operation of such plant does not adversely impact upon neighbouring residential properties and also on potentially sensitive spaces within the Aged Care Facility itself. At this stage of the selection of mechanical plant has not been made.

It is understood that the external mechanical plant selected for the proposed residential development are the car park exhaust & supply fans, outside air supply fans, roller shutter doors, garbage chute exhaust fans and garbage room fans. There are no other significant noise emitting from the mechanical services proposed for this development. The recommended fan models and manufacturer's Sound Power Level (SWL) have been derived from typical size equipment at similar sites and are presented in Table 1 below.

Table 1 Sound Power Level of Proposed Mechanical Plant

Name	l/s	Sound Power SWL, dB at Octave Band Centre Frequency (Hz) (Each Item)							
		63	125	250	500	1k	2k	4k	8k
Car Park Exhaust Fan (Lower Basement)	60	-	48	56	57	54	53	45	38
Car Park Supply Fan (Lower Basement)	13,160	74	80	79	77	74	68	63	68
Outside Air Supply Fan (Roof)	440	-	62	69	73	75	74	68	59
Outside Air Supply Fan (Roof)	600	-	62	69	73	75	74	68	59
Garbage Exhaust Fan (Roof)	400	78	77	68	65	60	58	56	52
Kitchen Exhaust Fan (Roof)	400	78	77	68	65	60	58	56	52
Roller Shutters	-	83	77	69	66	58	58	56	50

The assessment of potential noise impact from the operation of the proposed mechanical plant has been based on the prediction of noise propagation over increasing separation distance from the each plant location. Equation 4-1 has been applied with the SWLs to predict noise impacts at nearest receivers. The equation does not account for noise attenuation from the local terrain.

Equation 4-1 Calculation for the prediction of operational noise

$$SPL_{received} = SWL_{source} - 20\log(r) - 8$$

The equation includes a - 8 dB(A) correction to account for the loss of acoustic energy from hemi-spherical radiation.

The predicted noise impact of the proposed mechanical plant at nearest surrounding residential boundaries, has been calculated and is presented in Table 2 below. To account for a worst case scenario, the predicted noise impact is of all plant operating simultaneously. The assessment has been conducted on the understanding that the exhaust fans will be located on the lower basement.

Table 2 Predicted New Mechanical Plant Noise at Neighbouring Residences

Receiver Location	Predicted Worst Case Mechanical Plant Operational L_{Aeq} Noise Level – dB(A)	Noise Criterion at Receiver Location – dB(A)	Compliance (Yes/No)
40-46 St Johns Avenue	32	35 dBA	Yes
23 Bushlands Avenue	36		Yes
31 Bushlands Avenue	36		Yes
28 Bushlands Avenue	36		Yes
29 Bushlands Avenue	36		Yes

The predicted noise levels at the nearby residential sensitive receivers shows compliance to the established noise criteria. No further acoustic treatment is required for the mechanical plants.

CAR PARK ENTRANCE

There is a potential for the noise generated by activity with vehicles entering and leaving the basement carpark, community bus being used during the daytime, waste collection during the daytime and delivery during the daytime impacting upon nearby residences, and in particular the residences 30 and 32 Bushlands Avenue and 29 Bushlands Avenue.

The noise emissions from operation of vehicles and the community bus operation during the night time period have been calculated to 30 and 32 Bushlands Avenue and 29 Bushlands Avenue. As this is during the time night, the predicted noise levels have been assessed to the more stringent sleep disturbance criteria and presented in the table below.

The noise levels generated by carpark activities are variable. The calculated noise emissions to the nearest residential receivers at 29 Bushlands Avenue 30 and 32 Bushlands Avenue are based upon the sound power levels derived from studies conducted of vehicle noise levels in the context of low speed vehicle activities.

The calculations below have been conducted under the assumption that noise will be attenuated through proposed building façade including the provision of 6.38mm laminated glazing on the carpark entrance wall. Noise attenuation at 30&32 Bushlands Avenue is assumed to be through distance from the edge of the driveway to the building façade. Attenuation from the edge of the driveway to the building façade on 29 Bushlands Avenue has been assumed to be through distance and also the short duration of noise.

Car Park Entrance Noise Emissions

Noise Source	Typical Maximum Sound Power Level - dB(A)	Received Noise Level at nearest residences – dB(A)	Sleep Disturbance Criterion – dB(A) ($L_{A1(60second)}$)	INP Criteria – dBA ($L_{Aeq(15min)}$)	Compliance
30 and 32 Bushlands Avenue					
Car Accelerating	93	L_{Amax} 45 dBA	45		Yes
Car Moving	83	L_{Amax} 35 dBA	45		Yes
Community Bus Moving	90	$L_{Aeq(15min)}$ 42 dBA, L_{Amax} 44 dBA	45	48	Yes
Waste Collection vehicles	95	$L_{Aeq(15min)}$ 45 dBA	-	48	Yes
Delivery Vans	85	$L_{Aeq(15min)}$ 40 dBA	-	48	Yes
29 Bushlands Avenue					
Car Accelerating	93	L_{Amax} 45 dBA	45		Yes
Car Moving	83	L_{Amax} 35 dBA	45		Yes
Community Bus Moving	90	$L_{Aeq(15min)}$ 42 dBA, L_{Amax} 43 dBA	45	48	Yes
Waste Collection vehicles	95	$L_{Aeq(15min)}$ 45 dBA	-	48	Yes
Delivery Vans	85	$L_{Aeq(15min)}$ 40 dBA	-	48	Yes

Vehicle noise emissions associated with activity of entering and leaving the basement car parking area have been predicted to achieve sleep disturbance criterion during the night period and the cumulative use of the community bus, waste collection & delivery vehicles will comply with the daytime criterion. It is understood that the community bus will start operating from 6:45 am on an hourly basis up to 11:00 pm. With the operation outside of daytime hours, the noise level at the nearest resident, 29 Bushlands Avenue and 30 and 32 Bushlands Avenue to be $L_{Aeq(15min)}$ 30 dBA $L_{Aeq(15min)}$ 29 dBA respectively with a bus operating at every hour. This will comply with the 48 dBA criteria and 45 dB(A) for the Sleep Disturbance.

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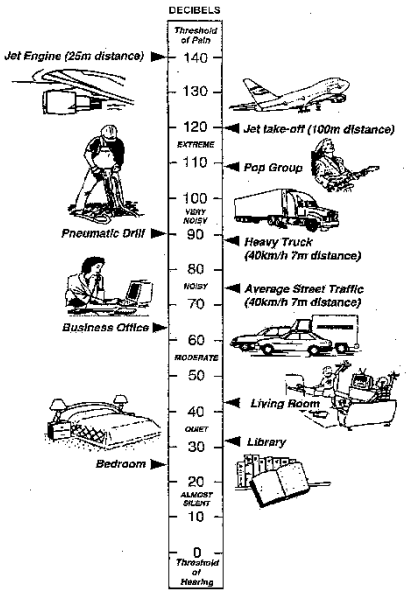
Appendix A – Acoustic Terminology

A-weighted sound pressure	The human ear is not equally sensitive to sound at different frequencies. People are more sensitive to sound in the range of 1 to 4 kHz (1000 – 4000 vibrations per second) and less sensitive to lower and higher frequency sound. During noise measurement an electronic '*A-weighting*' frequency filter is applied to the measured sound level *dB(A)* to account for these sensitivities. Other frequency weightings (B, C and D) are less commonly used. Sound measured without a filter is denoted as linear weighted dB(linear).
Ambient noise	The total noise in a given situation, inclusive of all noise source contributions in the near and far field.
Community annoyance	Includes noise annoyance due to: ▪ character of the noise (e.g. sound pressure level, tonality, impulsiveness, low-frequency content) ▪ character of the environment (e.g. very quiet suburban, suburban, urban, near industry) ▪ miscellaneous circumstances (e.g. noise avoidance possibilities, cognitive noise, unpleasant associations) ▪ human activity being interrupted (e.g. sleep, communicating, reading, working, listening to radio/TV, recreation).
Compliance	The process of checking that source noise levels meet with the noise limits in a statutory context.
Cumulative noise level	The total level of noise from all sources.
Extraneous noise	Noise resulting from activities that are not typical to the area. Atypical activities may include construction, and traffic generated by holiday periods and by special events such as concerts or sporting events. Normal daily traffic is not considered to be extraneous.
Feasible and reasonable measures	Feasibility relates to engineering considerations and what is practical to build; reasonableness relates to the application of judgement in arriving at a decision, taking into account the following factors: ▪ Noise mitigation benefits (amount of noise reduction provided, number of people protected). ▪ Cost of mitigation (cost of mitigation versus benefit provided). ▪ Community views (aesthetic impacts and community wishes). ▪ Noise levels for affected land uses (existing and future levels, and changes in noise levels).

Impulsiveness	Impulsive noise is noise with a high peak of short duration or a sequence of these peaks. Impulsive noise is also considered annoying.
Low frequency	Noise containing major components in the low-frequency range (20 to 250 Hz) of the frequency spectrum.
Noise criteria	The general set of non-mandatory noise levels for protecting against intrusive noise (for example, background noise plus 5 dB) and loss of amenity (e.g. noise levels for various land use).
Noise level (goal)	A noise level that should be adopted for planning purposes as the highest acceptable noise level for the specific area, land use and time of day.
Noise limits	Enforceable noise levels that appear in conditions on consents and licences. The noise limits are based on achievable noise levels, which the proponent has predicted can be met during the environmental assessment. Exceedance of the noise limits can result in the requirement for either the development of noise management plans or legal action.
Performance-based goals	Goals specified in terms of the outcomes/performance to be achieved, but not in terms of the means of achieving them.
Rating Background Level (RBL)	The rating background level is the overall single figure background level representing each day, evening and night time period. The rating background level is the 10th percentile min L_{A90} noise level measured over all day, evening and night time monitoring periods.
Receptor	The noise-sensitive land use at which noise from a development can be heard.
Sleep disturbance	Awakenings and disturbance of sleep stages.
Sound and decibels (dB)	Sound (or noise) is caused by minute changes in atmospheric pressure that are detected by the human ear. The ratio between the quietest noise audible and that which should cause permanent hearing damage is a million times the change in sound pressure. To simplify this range the sound pressures are logarithmically converted to decibels from a reference level of 2 x 10-5 Pa. The picture below indicates typical noise levels from common noise sources.



dB is the abbreviation for decibel – a unit of sound measurement. It is equivalent to 10 times the logarithm (to base 10) of the ratio of a given sound pressure to a reference pressure.

Sound power level (SWL)

The sound power level of a noise source is the sound energy emitted by the source. Notated as SWL, sound power levels are typically presented in *dB(A)*.

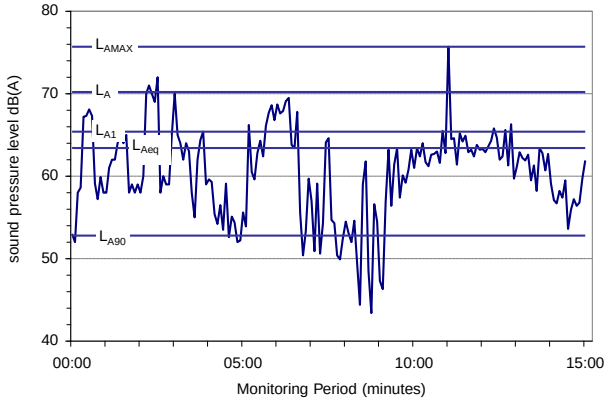
Sound pressure level (SPL)

The level of noise, usually expressed as SPL in *dB(A)*, as measured by a standard sound level meter with a pressure microphone. The sound pressure level in *dB(A)* gives a close indication of the subjective loudness of the noise.

Statistic noise levels

Noise levels varying over time (e.g. community noise, traffic noise, construction noise) are described in terms of the statistical exceedance level.

A hypothetical example of A weighted noise levels over a 15 minute measurement period is indicated in the following figure:



Key descriptors:

L_{Amax} Maximum recorded noise level.

	L_{A1} The noise level exceeded for 1% of the 15 minute interval.
	L_{A10} Noise level present for 10% of the 15 minute interval. Commonly referred to the average maximum noise level.
	L_{Aeq} Equivalent continuous (energy average) A-weighted sound pressure level. It is defined as the steady sound level that contains the same amount of acoustic energy as the corresponding time-varying sound.
	L_{A90} Noise level exceeded for 90% of time (background level). The average minimum background sound level (in the absence of the source under consideration).
Threshold	The lowest sound pressure level that produces a detectable response (in an instrument/person).
Tonality	Tonal noise contains one or more prominent tones (and characterised by a distinct frequency components) and is considered more annoying. A 2 to 5 dBA penalty is typically applied to noise sources with tonal characteristics.