Noise Impact Assessment - Airtrunk Data Centre Review of Air Cooled Chiller Option 2 Sirius Road, Lane Cove West

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1 INTRODUCTION

Pulse Acoustics Consultancy has been engaged to undertake a Noise Impact Assessment (NIA) of the proposal for the Airtrunk Syd 2 Datacentre, to be located at 1 Sirius Road, Lane Cove West. This NIA specifically analyses the modified scheme which includes the low voltage generators, changes in external plant platforms, relocation of carparking and lifts. The document also considers additional non-residential receivers, includes 3D noise modelling and incorporates the latest selections of chillers, generators and transformers.

This report assesses the potential operational noise and vibration impacts at the surrounding receptors. The results of background noise monitoring at the nearest receptors is presented. Project criteria have been derived with respect to the NSW Noise Policy for Industry (EPA, 2017), NSW Interim Construction Noise Guideline (DECC, 2009), Assessing Vibration: A Technical Guideline (DEC, 2006), British Standard 7385-2: 1993 and British Standard 6472: 1992. The predicted operational noise scenarios have been modelled in the iNoise 2019.1 software.

This report assesses the predicted operational impacts of the proposed Datacentre against the derived noise criteria. This report provides recommended noise mitigation measures to address potential noise and vibration impacts where relevant.

1.1 Site Description

The Airtrunk Syd 2 Datacentre is proposed to be located at 1 Sirius Road, Lane Cove West, formally known as Lot 15 DP 1179953. The site is zoned IN2 Light Industrial and is located in the Lane Cove local government area. Commercial receivers are located to the east of the site off Apollo Place and Sirius Road, while the Lane Cove Bushwalk is located to the west of the site. The closest residential receptors are located to the north of the site within the Arise by Meriton complex, to the northwest off Magdala Road and to the west off Jeanette Street. The subject site and surrounding area is shown in Figure 1 below.

Figure 1 Site location

1.2 Site Description & Operational Conditions

The subject site is proposed to house the Airtrunk Syd 2 Datacentre. The site will feature a multi-storey building, with externally housed generators, chillers and transformers. The development proposes to include air cooled chiller units that do not require cooling towers. The modified scheme also includes low voltage generators and changes in external plant platforms, relocation of carparking and lifts.

The development is understood to include:

- 106 chillers located on the building roof
- Each chiller consists of 1 x TMA 3B1280B ES EC-34 K (1,500kW) unit (or equivalent)
- 116 generators located on the external platforms
- 116 transformers located on the external platforms

Figure 2 presents a 3D figure of the proposed site and Figure 3 shows the site layout from the rooftop level.

Figure 2 3D figure of proposed site

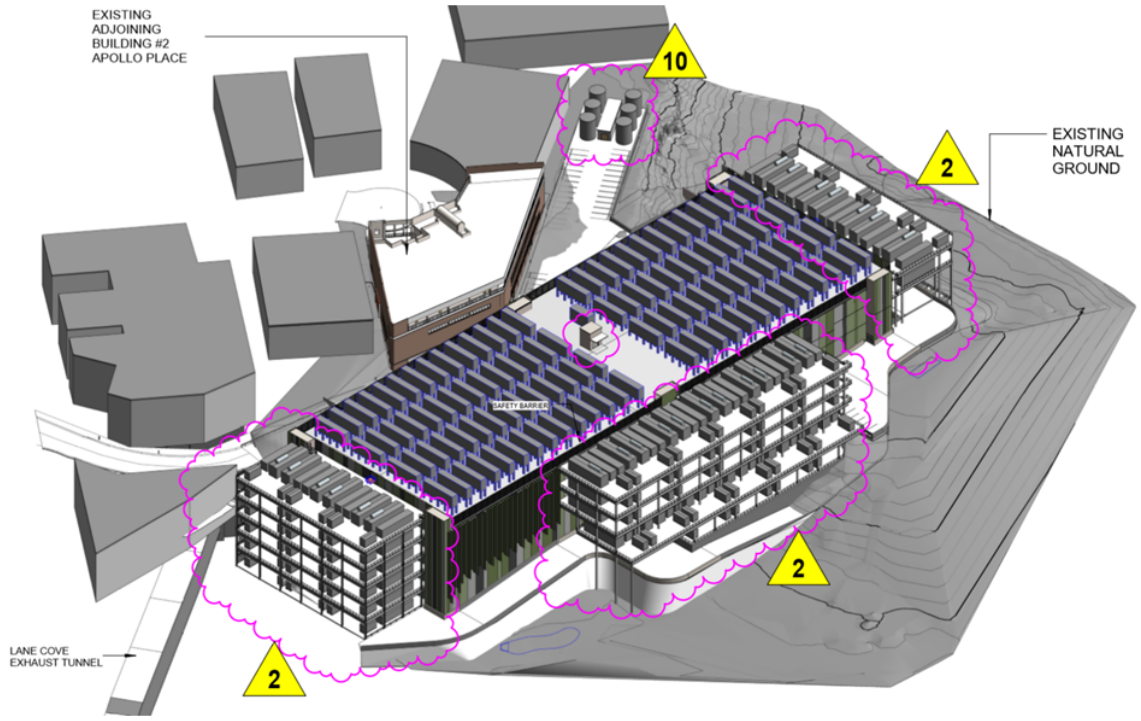
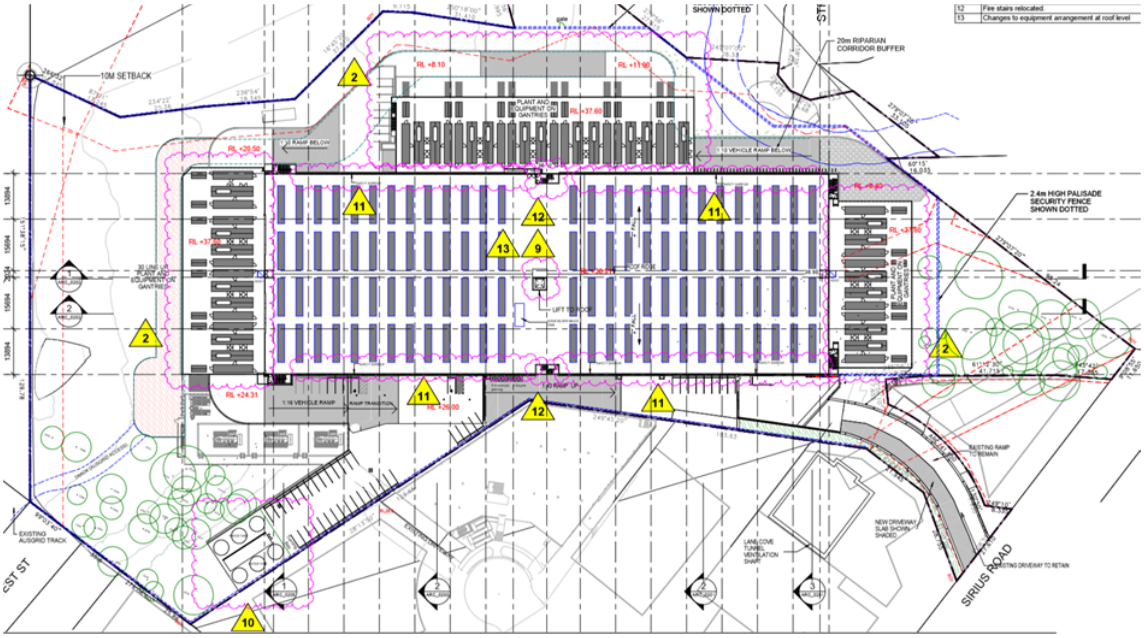
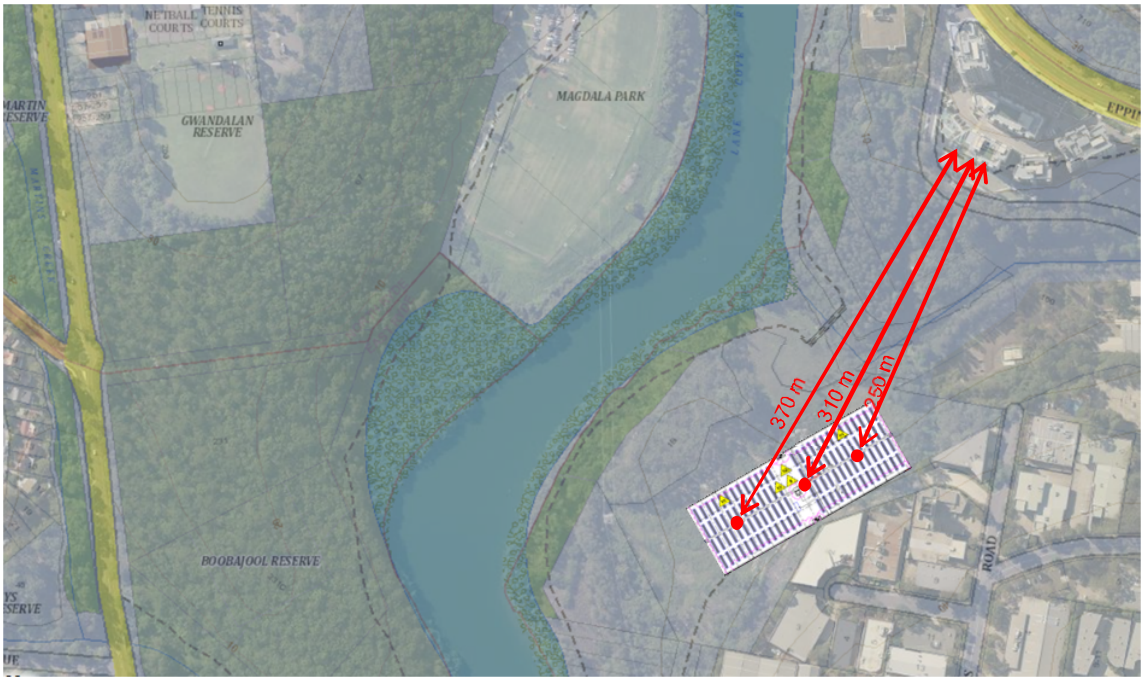


Figure 3 Site Layout



The orientation of the proposed data centre with respect to the closest residential receiver is shown in Figure 4 below.

Figure 4 Chiller scheme with respect to residences at 150 Epping Road



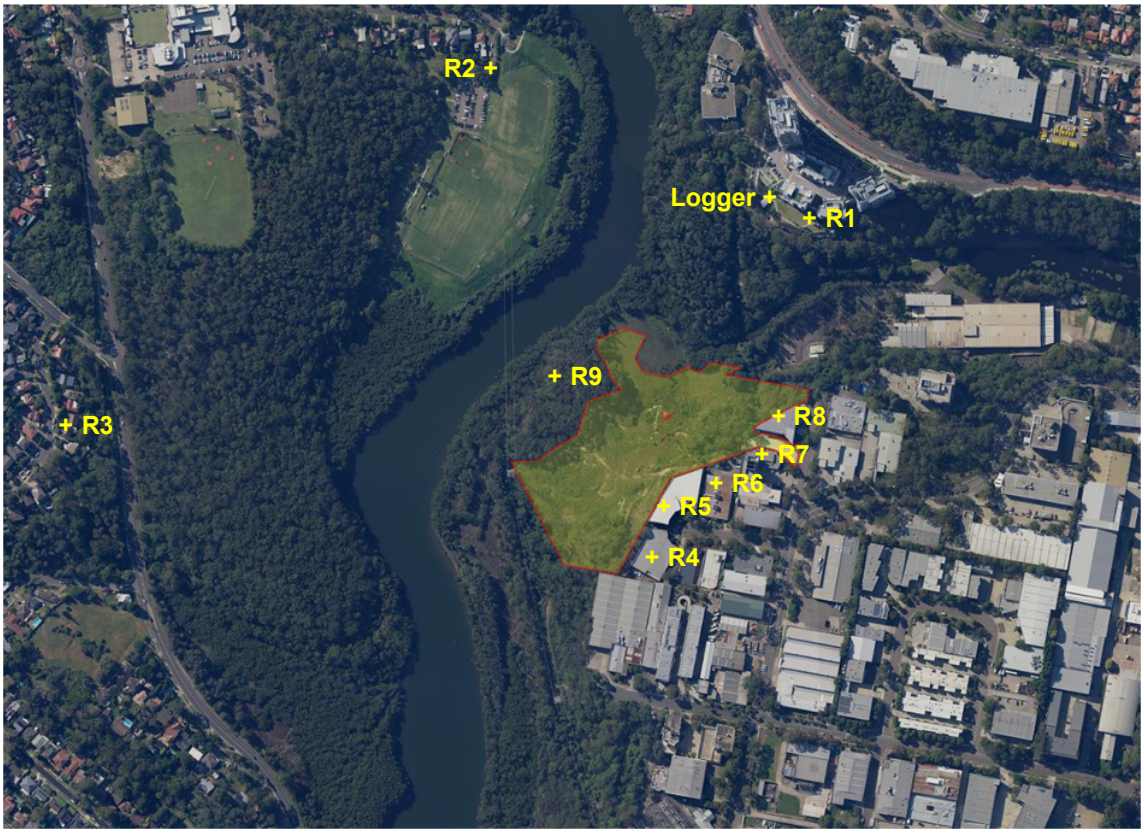
2 NEAREST SENSITIVE RECEPTORS

Several potentially impacted noise receivers are located in the vicinity of the subject site. The receptors in this report are considered representative of the closest off-site receivers for the proposed excavation phase activities. The considered receivers are listed in Table 1 and presented in Figure 5.

Table 1 Nearest potentially affected receivers

Receptor ID	Address	Lot and DP	Type of Receiver
R1	150 Epping Road, Lane Cove	Lot 1 DP 1219702	Residential
R2	65 Magdala Road, North Ryde	Lot 1 DP 416781	Residential
R3	14 Jeanette Street, East Ryde	Lot 20 DP 26556	Residential
R4	3 Apollo Place, Lane Cove West	Lot 8 DP 241877	Commercial
R5	2 Apollo Place, Lane Cove West	Lot 8 DP 241877	Commercial
R6	1 Apollo Place, Lane Cove West	SP 80721	Commercial
R7	5 Sirius Road, Lane Cove West	Lot 5 DP 241786	Commercial
R8	1A Sirius Road, Lane Cove West	Lot 16 DP 1179953	Commercial
R9	Sirius Road, Lane Cove West	Lot 7025 DP 93903	Passive Recreation

Figure 5 Location of nearest potentially affected receivers



3 ACOUSTIC SURVEY

3.1 Noise Descriptors and Terminology

Environmental noise constantly varies in level with time. Therefore, it is necessary to measure noise in terms of quantifiable time periods with statistical descriptors. Typically environmental noise is measured over 15 minute periods and relevant statistical descriptors of the fluctuating noise are determined to quantify the measured level.

Noise (or sound) consists of minute fluctuations in atmospheric pressure capable of detection by human hearing. Noise levels are expressed in terms of decibels, abbreviated as dB or dBA, the "A" indicating that the noise levels have been frequency weighted to approximate the characteristics of normal human hearing. Because noise is measured using a logarithmic scale, 'normal' linear arithmetic does not apply, e.g. adding two sound sources of equal values result in an increase of 3dB (i.e. 60 dBA plus 60 dBA results in 63 dBA). A change of 1 dB or 2 dB in the sound level is difficult for most people to detect, whilst a 3 dB – 5 dB change corresponds to a small but noticeable change in loudness. A 10 dB change roughly corresponds to a doubling or halving in loudness.

The most relevant environmental noise descriptors are the L_{Aeq}, L_{A1}, L_{A10} and L_{A90} noise levels. The L_{Aeq} noise level represents the "equivalent energy average noise level". This parameter is derived by integrating the noise level measured over the measurement period. It represents the level that the fluctuating noise with the same acoustic energy would be if it were constant over the measured time period.

The L_{A1}, L_{A10} and L_{A90} levels are the levels exceeded for 1%, 10% and 90% of the sample period. These levels can be considered as the maximum noise level, the average repeatable maximum and average repeatable minimum noise levels, respectively.

Specific acoustic terminology is used in this assessment report. An explanation of common acoustic terms is included in Appendix A.

3.2 Arup Noise Survey

An acoustic survey of the existing ambient noise levels around the site were undertaken within the Arup Report (Acoustic Assessment_LCWDC-SSDA) in order to establish the noise emission criteria for the proposed development.

The Arup noise survey comprised of long term measurements over 4 days at Receiver 3 (14 Jeanette Street, East Ryde). The measured levels are given Table 3 of the Arup report, and copied below for ease of reference.

Table 2 Long term noise monitoring results, dBA

Location	Time Period[1]	Rating Background Level, dBA L_{A90}	Ambient dB L_{Aeq} noise levels
14 Jeanette Street	Day	42 dBA	57 dBA
	Evening	42 dBA	57 dBA
	Night	31 dBA	49 dBA

Note 1: For Monday to Saturday, Daytime 7:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 7:00 am. On Sundays and Public Holidays, Daytime 8:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 8:00 am

Note 2: As required by the NPI, the external ambient noise levels presented are free-field noise levels

Additional spot noise measurements were made at 2 other locations over single 15 min periods at each location (see below).

Table 3 Short term noise monitoring results, dBA

Location	Time Period	Rating Background Level, dBA L_{A90}	Ambient dB L_{Aeq} noise levels	Comments
150 Epping Road	14:55-15:10	47 dBA	49 dBA	Traffic noise, child crying, occasional aeroplane pass-by
65 Magdala Road	16:31-16:46	53 dBA	56 dBA	Traffic noise, car pass-by, children playing sports, birds and insects
14 Jeanette Street	17:09-17:25	46 dBA	50 dBA	Traffic noise, birds and insects, car pass-by

In reviewing the daytime background noise levels at around 3 pm at Location 1 (150 Epping Road – the closest residential at 250m) and location 3 (the long term noise monitoring location), it can be seen that that the closest residential location has a daytime noise level that is 5 dBA higher than the level given at the long term noise monitoring location.

On this basis it was hypothesised that the noise criteria used in the Arup report may be too conservative by approximately 5 dBA the nearest affected residences at 150 Epping Road. Additional unattended noise logging was therefore conducted by Pulse Acoustics, with the results presented in section 3.3 below.

3.3 Pulse Acoustic Noise Monitoring

3.3.1 Monitoring Details

To validate the estimated background noise levels at Location 1, long term unattended noise monitoring was conducted at the residences located at 150 Epping Road. Unattended noise levels were measured at ground level and are therefore likely to be lower than if the noise monitor was placed on a residential balcony, where traffic noise levels are expected to be higher. The noise logger was positioned in the garden area in front of the apartment buildings, with direct line of sight to the Lane Cove West Industrial Park.

The noise logger recorded noise levels that are thought to be typical of the lower level apartments that face the Industrial Park. The noise monitoring results at this location are therefore representative of the background noise levels currently experienced by the potential receivers of noise emissions from the development.

The location of the unattended noise logging survey is shown in Figure 6 below.

3.3.2 Monitoring Instrumentation

Instrumentation used for the noise survey comprised a Svantek 971 sound level meter / analysers (serial numbers 39165) fitted with a microphone windshield. Calibration of the logger was checked prior to and following the measurements. Drift in calibration did not exceed ±0.5 dBA. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates.

Charts presenting summaries of the measured daily noise data are attached in Appendix B. These charts, representing each 24 hour period, show the L_{A1}, L_{A10}, L_{Aeq} and L_{A90} noise levels measured over 15 minute time periods.

The measurement results have been filtered to remove data affected by adverse weather conditions, such as excessively windy or rainy time periods, as recorded by the Bureau of Meteorology weather station at Darling Harbour.

The noise monitoring location is shown in the image contained in Figure 6 below. Detailed noise logging results are shown in Appendix B.

Figure 6 Logging Location - front yard of 150 Epping Road development

3.4 Environmental Noise Monitoring Results

The measured background noise data of the logger was processed in accordance with the recommendations contained in the NSW Environment Protection Authority's (EPA) *Noise Policy for Industry* (NPI).

The Rating Background Noise Level (RBL) is the background noise level used for assessment purposes at the nearest potentially affected receiver. It is the 90th percentile of the daily background noise levels during each assessment period, being day, evening and night. The RBL $L_{A90\ (15minute)}$ and L_{Aeq} noise levels are presented in Table 4.

The results of the measurement survey provide ambient noise levels that are considered to be representative of the levels to be expected at the nearest and most affected residences to the proposed development (i.e. the apartments located at 150 Epping Road).

Table 4 Measured Ambient Noise Levels corresponding to the NPI's Assessment Time Periods

Measurement Location	Daytime[1] 7:00 am to 6:00 pm		Evening[1] 6:00 pm to 10:00 pm		Night-time[1] 10:00 pm to 7:00 am	
	RBL[2]	L_{Aeq}[3]	RBL[2]	L_{Aeq}[3]	RBL[2]	L_{Aeq}[3]
150 Epping Road	46 dBA	53 dBA	46 dBA	50 dBA	41 dBA	47 dBA

Note 1: For Monday to Saturday, Daytime 7:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 7:00 am. On Sundays and Public Holidays, Daytime 8:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 8:00 am

Note 2: The RBL noise level is representative of the "average minimum background sound level" (in the absence of the source under consideration), or simply the background level.

Note 3: The L_{Aeq} is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.

4 OPERATIONAL NOISE EMISSION CRITERIA

4.1 NSW Noise Policy for Industry

In NSW, the control of noise emissions is the responsibility of Local Governments and the NSW Environment Protection Authority (NSW EPA).

The NSW EPA has recently released a document titled *Noise Policy for Industry* (NSW NPI) which provides a framework and process for determining external noise criteria for the assessment of noise emission from industrial developments. The NSW NPI criteria for industrial noise sources have two components:

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

4.1.1 Intrusive Noise Impacts (Residential Receivers)

The NSW NPI states that the noise from any single source should not intrude greatly above the prevailing background noise level. Industrial noises are generally considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (L_{Aeq}), measured over a 15 minute period, does not exceed the background noise level measured in the absence of the source by more than 5 dB(A). This is often termed the Intrusiveness Criterion.

The 'Rating Background Level' (RBL) is the background noise level to be used for assessment purposes and is determined by the methods given in the NSW NPI. Using the rating background noise level approach results in the intrusiveness criterion being met for 90% of the time. Adjustments are to be applied to the level of noise produced by the source that is received at the assessment point where the noise source contains annoying characteristics such as tonality or impulsiveness.

4.1.2 Protecting Noise Amenity (All Receivers)

To limit continuing increases in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified in Table 2.2 of the NSW NPI. That is, the ambient L_{Aeq} noise level should not exceed the level appropriate for the particular locality and land use. This is often termed the 'Background Creep' or Amenity Criterion.

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

4.1.2.1 Area Classification

The NSW NPI characterises the "Urban Residential" noise environment as an area with an acoustical environment which shows the following:

- It is dominated by 'urban hum' or industrial source noise, where urban hum means the aggregate sound of many unidentifiable sources, consisting mostly of traffic and/or industrial related sounds
- Has through traffic with characteristically heavy and continuous traffic flows during peak periods

- is near commercial districts or industrial districts
- It has a combination of any of the above

In addition, the RBLs at 150 Epping Road are > 45 during the day, > 40 during the evening and > 35 during the night period, corresponding to the Urban receiver category. While it is noted that the Arup report had 150 Epping Road as a 'suburban receiver', from the noise logging conducted at this specific receiver as well as the characteristics mentioned above, the Urban receiver category is selected.

For other residences located to the west of the proposed development, these areas are classified as "Suburban" areas, as per the Arup report. The suburban category is an area that has local traffic with characteristic intermittent traffic flows or with some limited commerce or industry. The suburban area often has the following characteristic: evening ambient noise levels defined by the natural environment and human activity.

Therefore for residential receivers in either "Urban" or "Suburban" areas as well as non-residential receivers, the recommended amenity criteria are shown in Table 5 below.

Table 5 NSW NPI – Recommended L_{Aeq} Noise Levels from Industrial Noise Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day[1]	Recommended Amenity Noise Level ($L_{Aeq, period}$)[2]
Residence	Urban	Day	60
		Evening	50
		Night	45
	Suburban	Day	55
		Evening	45
		Night	40
Area reserved for passive recreation (e.g. national parks)	All	When in use	50
Commercial	All	When in use	65

Note 1: For Monday to Saturday, Daytime 7:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 7:00 am. On Sundays and Public Holidays, Daytime 8:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 8:00 am

Note 2: The L_{Aeq} is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.

When the existing noise level from industrial noise sources is close to the recommended "Amenity Noise Level" (ANL) given above, noise from the new source must be controlled to preserve the amenity of the area in line with the requirements of the NSW NPI.

4.1.3 Project Trigger Noise Levels

Generally speaking the noise criteria is determined by both the intrusiveness and amenity criteria. The intrusive and amenity criteria for industrial noise emissions, derived from the measured data, are presented in Table 6. The criteria are nominated for the purpose of determining the operational noise limits for mechanical plant associated with the development which can potentially affect noise sensitive receivers.

For each assessment period, the lower (i.e. the more stringent) of the amenity or intrusive criteria are adopted. These are shown in bold text in Table 6.

Table 6 External noise level criteria in accordance with the NSW NPI

Location	Time of Day	Project Amenity Noise Level, $L_{Aeq,\ period}$ [1] (dBA)	Measured $L_{A90,\ 15\ min}$ (RBL) [2] (dBA)	Measured $L_{Aeq,\ period}$ Noise Level (dBA)	Intrusive $L_{Aeq,\ 15\ min}$ Criterion [3] for New Sources (dBA)	Amenity $L_{Aeq,\ 15\ min}$ Criterion for New Sources (dBA) [4,5]	Noise Criterion (lower of the intrusiveness and amenity criteria [6])
150 Epping Road – Pulse data from Sat. 29-06-2019 and Tues. 02-07-2019 (R1)	Day	55	46	53	**51**	58	51
	Evening	45	46	50	51	**48**	48
	Night	40	41	47	46	**43**	43
150 Epping Road - Arup data at **2:55-3:10pm** (R1)	Day	50	47	49			
	Evening	40					
	Night	35					
65 Magdala Rd - Arup data at **4:30-4:45pm** (R2)	Day	50	53	56			
	Evening	40					
	Night	35					
14 Jeanette St East Ryde - Arup data (R3)	Day	50	42	57	**47**	50	47
	Evening	40	42	57	**47**	50	47
	Night	35	31	49	**36**	42	36
Commercial (R4-R8)	When in use	60	N/A	N/A	N/A	63	63
Passive recreation (R9)	When in use	45	N/A	N/A	N/A	48	48

Note 1: Project Amenity Noise Levels corresponding to "Suburban" areas, equivalent to the Recommended Amenity Noise Levels (from the NPI) minus 5 dBA

Note 2: L_{A90} Background Noise or Rating Background Level (RBL)

Note 3: Intrusive criterion is equal to the RBL + 5 dB

Note 4: Where the project amenity noise levels is 10 dB below the existing industrial LAeq noise level, the amenity criteria can be set at 10 dB below the existing LAeq noise level. Where the project amenity noise levels is 15 dB below the existing traffic noise level, the amenity criteria can be set at 15 dB below the existing L_{Aeq} noise level. This is based on the assumption that the existing noise levels are unlikely to decrease in the future.

Note 5: According to Section 2.2 of the NSW NPI, the $L_{Aeq,\ 15\ minutes}$ is equal to the $L_{Aeq,\ period}$ + 3 dB

Note 6: The lower of the amenity and the intrusiveness level is typically used as the applicable overall noise criterion for the day, evening and nighttime periods.

4.2 Criteria for Emergency Generators

Section 1.4 of the Noise Policy for Industry states that the Noise Policy for Industry applies to activities listed in Schedule 1 of the Protection of the Environment Operations (POEO) Act. In Schedule 1 of the POEO Act, Section 17 (1A), it states that

"this clause does not apply to the generation of electricity by means of electricity plant that is emergency stand-by plant operating for less than 200 hours per year".

It is understood that as part of this proposal, a number of generators are proposed to be located on external platforms. The generators are proposed to be used in the event of a power blackout. Additionally, the generators are proposed to be tested periodically, one at a time during the day period.

Testing of generators one by one will tally over 200 hours per year, while use of all generators in a power outage will not exceed 200 hours per year. Therefore, use of all generators at once is outside the Noise Policy for Industry. Testing of one generator at a time is within the framework of the Noise Policy for Industry and is analysed in this report.

4.3 Interim Construction Noise Guideline

The Interim Construction Noise Guideline (ICNG) sets out ways to deal with the potential impacts of construction noise on residences and other sensitive land uses. The ICNG presents assessment approaches that are tailored to the scale of construction projects.

A portion of the main objectives from Section 1.3 of the ICNG are presented below:

- Promote a clear understanding of ways to identify and minimise noise from construction works
- Focus on applying all “feasible” and “reasonable” work practices to minimise construction noise impacts
- Encourage construction to be undertaken only during the recommended standard hours unless approval is given for works that cannot be undertaken during these hours
- Streamline the assessment and approval stages and reduce time spent dealing with complaints at the project implementation stage
- Provide flexibility in selecting site-specific feasible and reasonable work practices in order to minimise noise impacts

The ICNG contains a quantitative assessment method which is applicable to this project. Guidance levels are given for airborne noise at residences and other sensitive land uses, including commercial and industrial premises.

The quantitative assessment method involves predicting noise levels at sensitive receivers and comparing them with the Noise Management Levels (NMLs). The NML affectation categories for residential receivers have been reproduced from the guideline and are listed in Table 7 below.

Specific non-residential receivers in the vicinity of the proposed construction site, and their recommended ‘management levels’, are presented in Table 8.

Based on the measured background noise levels summarised in Section Table 4, the NMLs to be used in this assessment are listed in Table 9.

Table 7 NMLs for quantitative assessment at residences

Time of Day	Noise Management Level $L_{Aeq(15minute)}$ [1,2]	How to Apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq(15minute)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences. 2. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5 dB	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB above the noise affected level, the proponent should negotiate with the community.

Note 1 Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

Note 2 The RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours). The term RBL is described in detail in the NSW Industrial Noise Policy (EPA 2000).

Table 8 NMLs for quantitative assessment at non-residential receivers

Land Use	$L_{Aeq(15minute)}$ Construction NML
Commercial (R4-R8)	70
Passive Recreation (R9)	60

Table 9 NMLs as basis for the acoustic assessment

Receiver Types	NML, dB $L_{Aeq(15minute)}$	
	Standard Construction Hours: Monday to Friday: 7 am to 6 pm and Saturday: 8 am to 1 pm	OOHW Period 1 Construction Hours: Saturday 7am to 8am and Saturday: 1 pm to 4 pm
Residence (R1)	57	52
Residence (R2)	63	58
Residence (R3)	52	47
Commercial (R4-R8)	70	70
Passive Recreation (R9)	65	65

5 OPERATIONAL NOISE ASSESSMENT

5.1 Predictive Noise Modelling Equipment

Predictive noise modelling in this report carried out using the ISO 9613 algorithm within iNoise 2020.0. The iNoise software package was specifically used, as the 3D computational model of the site and surrounding area allows the terrain undulations, building heights and locations and noise source positions to be specifically modelled. In addition to terrain, buildings and noise sources, the iNoise model also includes ground absorption, receiver locations and solid fences where relevant.

Compared to the hand calculations used in the previous acoustic report (2019-07-02 Airtrunk - Acoustic Review of Air Cooled Chiller Option Final - Rev6), the 3D computational model enables a more accurate prediction of noise at the surrounding commercial and residential receptors given the significant differences in terrain and building heights that occur in the locality.

5.2 Equipment Sound Power Levels

In order to ensure compliance with the Project Trigger Noise Levels summarised in 4.1.3, the proposed chiller and transformer plant have been assessed at the nearest residences, located at 150 Epping Road as follows:

- The assessment for the proposed equipment is based on the sound levels listed for the chillers in Table 10, and the transformers and generators in Table 11 below.
- The chiller sound power levels for the day, evening and night-time periods have been based on the data provided by Geoclima for the proposed TMA 3B1280B ES EC-34 K (1,500kWr) Circlemiser models.
- **The chiller sound power levels for the day, evening and night-time periods are to be confirmed by Geoclima.**
- The sound power levels for the Transformers and Generators are based on the sound power levels within the Arup Memorandum dated 17 January 2020 and the Arup noise report LWCDC – SSDA Acoustic Assessment.
- As mentioned in section 4.2, testing of one generator at a time is within the framework of the Noise Policy for Industry. The use of all generators at once for emergency situations is not within the framework of section 1.4 of the Noise Policy for Industry as per Schedule 1 of the POEO Act, Section 17 (1A). Therefore a single generator in the worst case location is included in the day situation only.

Table 10 Sound power level for Chiller and correction levels without any attenuators

Condition	Temp	Unit	SWL (dB) in Octave Band Centre Frequencies (Hz)								
			63	125	250	500	1000	2000	4000	8000	dBA
Max	44 (100% load)	Circlemiser TMA 3B 1280B ES EC-34 K (1,500kWr)	75.6	82.5	83.8	89.8	93.7	92.7	86.1	79.6	**97.7**
Day	35 (35% fans)	Circlemiser TMA 3B 1280B ES EC-34 K (1,500kWr)	68.3	78.3	76.8	82.8	86.6	85.4	79	73.2	**90.5**
Evening	30 (35% fans)	Circlemiser TMA 3B 1280B ES EC-34 K (1,500kWr)	66.2	77.9	74.9	81	84.6	83.2	77	71.8	**88.5**
Night	25 (34% fans)	Circlemiser TMA 3B 1280B ES EC-34 K (1,500kWr)	63.5	77.6	72.7	79	82.3	80.6	74.7	70.3	**86.1**

Table 11 Sound power level for transformers and diesel generators

Equipment	No of units	SWL (dB) in Octave Band Centre Frequencies (Hz)								
		63	125	250	500	1000	2000	4000	8000	dBA
Transformers	106	71	73	68	68	62	57	52	45	**68**
Generators	1	118	114	99	96	98	99	91	87	**105**

5.3 Modelled Scenarios

Three noise generating scenarios are modelled in this report, for the day, evening and night periods, as follows

- Daytime: 106 chillers operating in the day condition, 116 transformers and 1 generator
- Evening: 106 chillers operating in the evening condition and 116 transformers
- Night: 106 chillers operating in the night condition and 116 transformers

5.4 Predicted Noise Levels

The predicted L_{Aeq} results of the modelled operational scenarios are presented below in Table 12.

Table 12 Predicted Noise Levels, Operational Scenarios, $L_{Aeq\ (15\ minute)}$

Receiver	Criteria			Predicted Noise Levels		
	Day	Evening	Night	Day Scenario	Evening Scenario	Night Scenario
R1	51	48	43	50	45	43
R2	47	47	36	43	39	36
R3	47	47	36	37	34	32
R4	63	63	63	54	52	50
R5	63	63	63	52	49	47
R6	63	63	63	54	51	48
R7	63	63	63	61	53	51
R8	63	63	63	63	48	47
R9	48	48	48	48	43	41

Noise contours of the modelled operational scenarios are shown below in Figure 7 to Figure 9. Note that the contour maps are set to receiver level heights of 1.5m, while the noise sources are at rooftop height.

Figure 7 Operational Scenario 1 – Day Activities

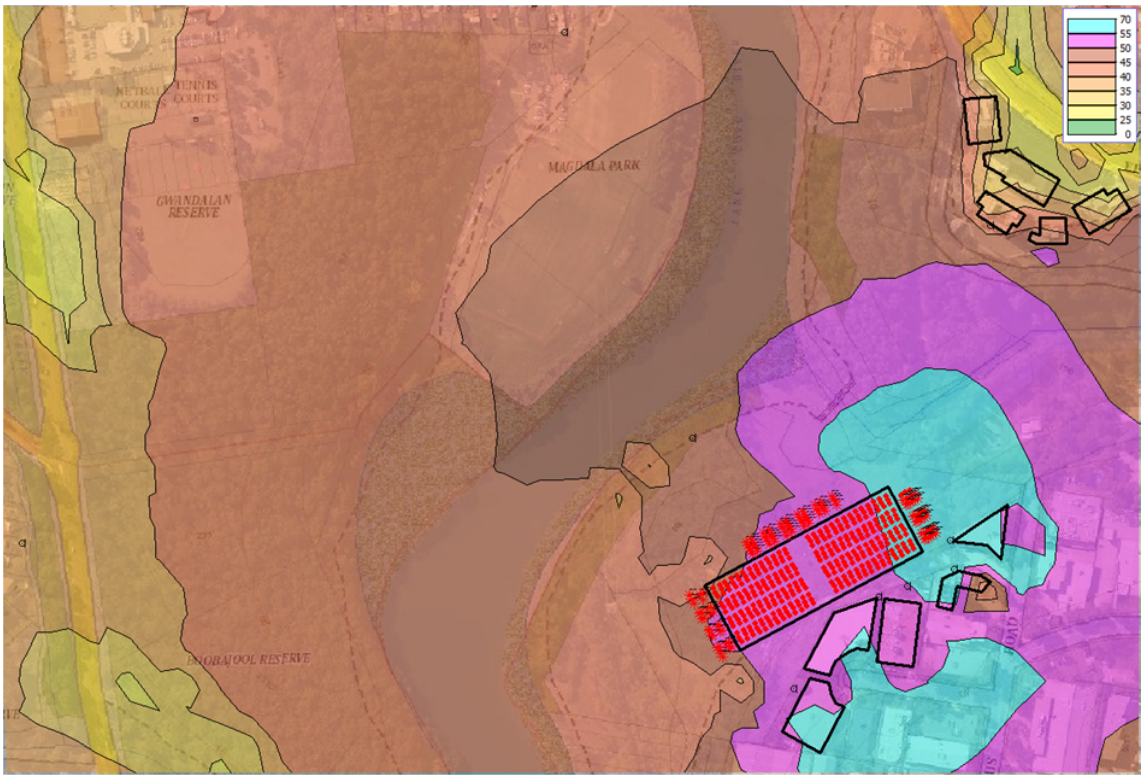


Figure 8 Operational Scenario 2 – Evening Activities

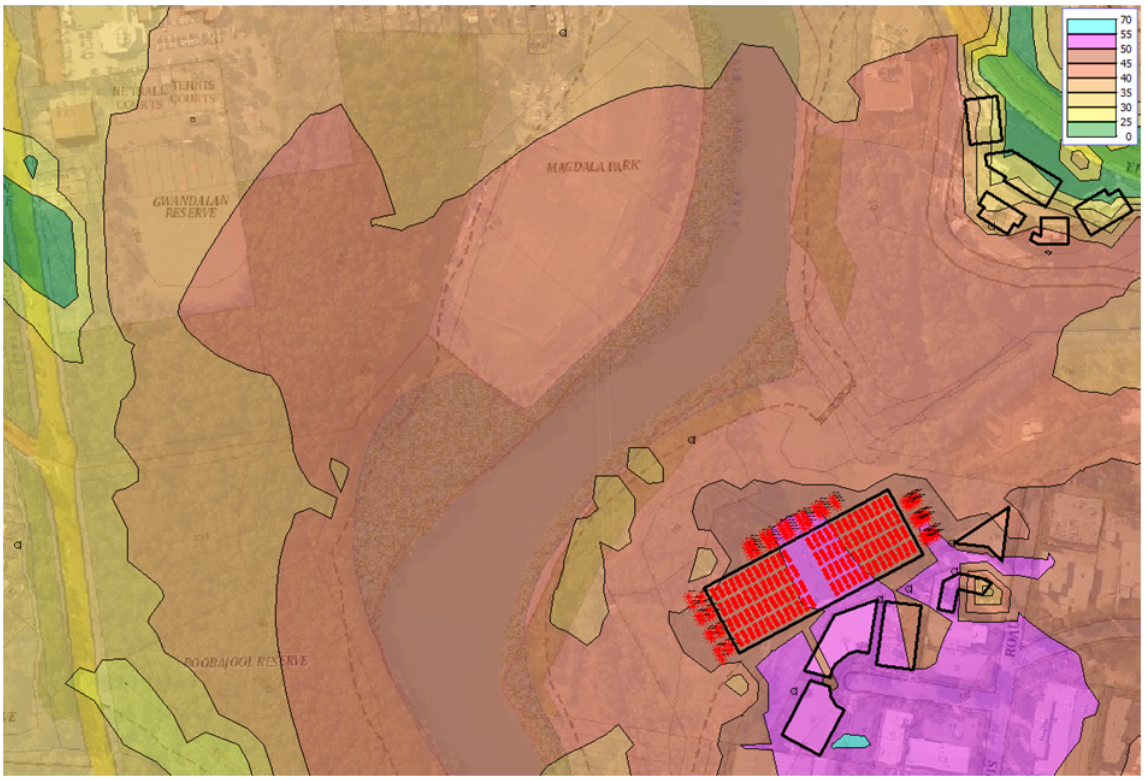
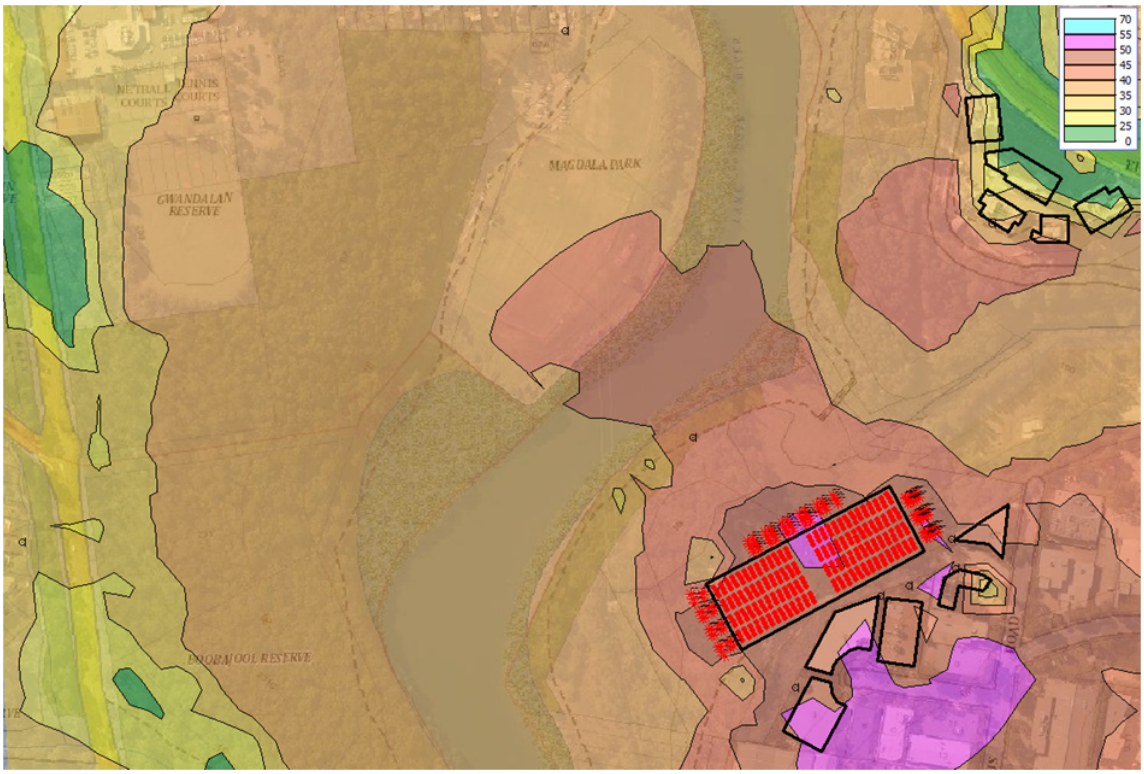


Figure 9 Operational Scenario 3 – Night Activities



The results from Table 12 and the figures above show that the L_{Aeq} noise levels are predicted to comply with the noise criteria at all surrounding residential and non-residential receptors during all time periods. No further mitigation measures are recommended beyond the assumptions already included within this report.

6 CONCLUSIONS

Pulse Acoustics has prepared a Noise Impact Assessment for the proposed Airtrunk Syd 2 datacentre to be located at 1 Sirius Road, Lane Cove. The datacentre is proposed to consist of external noise generating equipment including chillers, generators and transformers.

This Noise Impact Assessment specifically analyses the modified scheme which includes the low voltage generators, changes in external plant platforms, relocation of carparking and lifts. The assessment also considers additional non-residential receivers, includes 3D noise modelling and incorporates the latest selections of chillers, generators and transformers.

The operational activities for the day, evening and night periods were modelled in iNoise V2020.0 modelling software. The 3D modelling software specifically allows the site and surrounding area allows the terrain undulations of the site and surrounds, the building heights and locations as well as the noise source positions to be specifically modelled. Additionally, noise modelling considers the nearest commercial and passive recreation receivers.

This report considers day, evening and night scenarios in which all chillers and transformers are operational, with an additional one generator considered to be testing during the day scenario. This approach is consistent with section 1.4 of the Noise Policy for Industry and Schedule 1 of the POEO Act, Section 17 (1A).

Operational noise controls in this report include the following

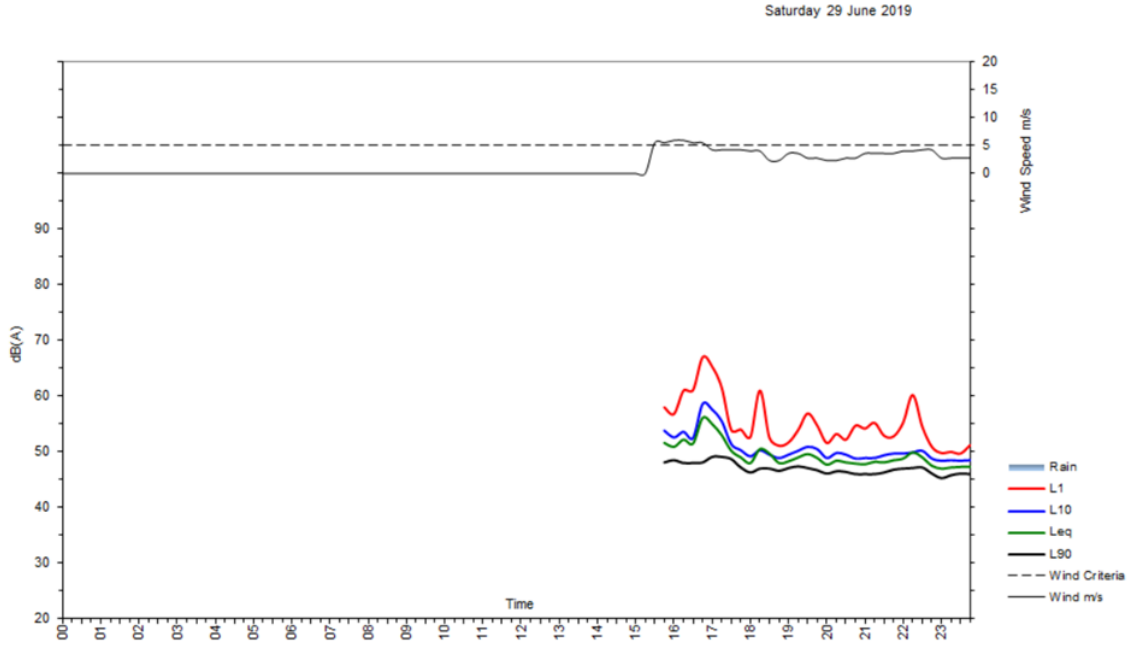
- The chiller sound power levels for the day, evening and night-time periods are to be no higher than the data provided by Geoclima for the proposed TMA 3B 1280B ES EC-34 K (1,500kW) Circlemiser models.
- Testing of generators takes place during the day period only with a single generator at a time;
- The sound power levels for the generators and transformers are no higher than the levels quoted in Table 11 of this report.

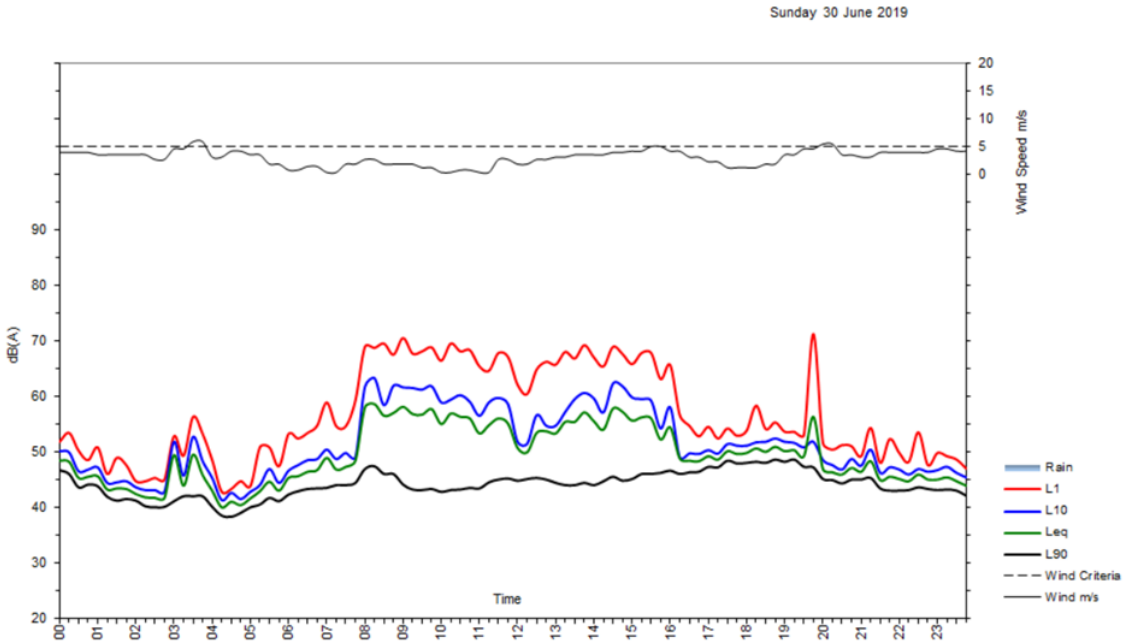
Following the adoption of the noise control measures and assumptions listed in this report, the operational noise generating scenarios are predicted to be compliant with the Noise Policy for Industry.

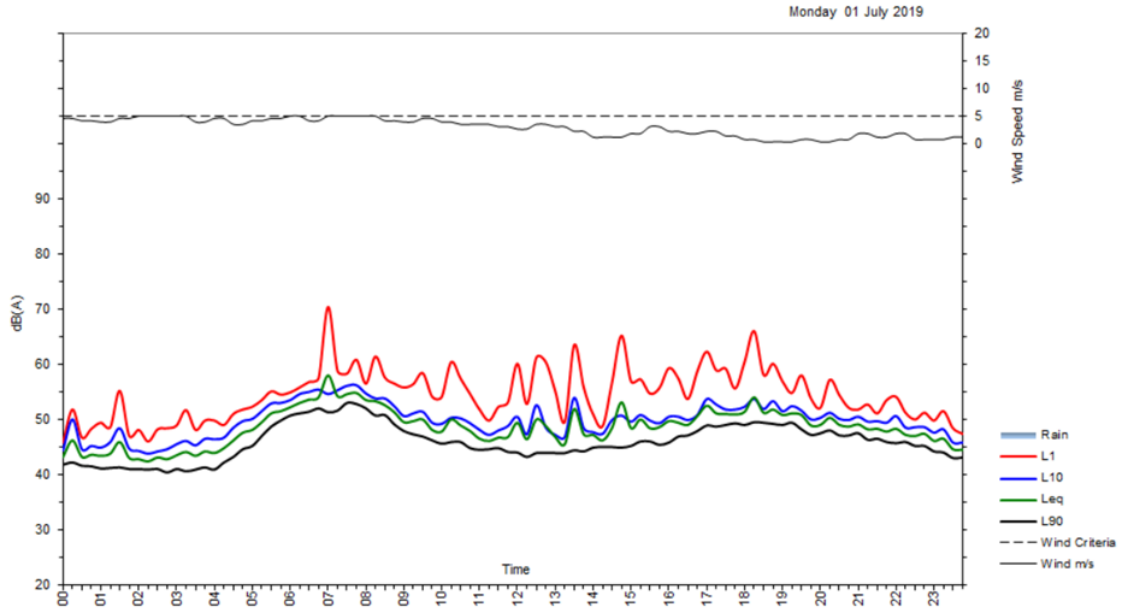
APPENDIX A: ACOUSTIC GLOSSARY

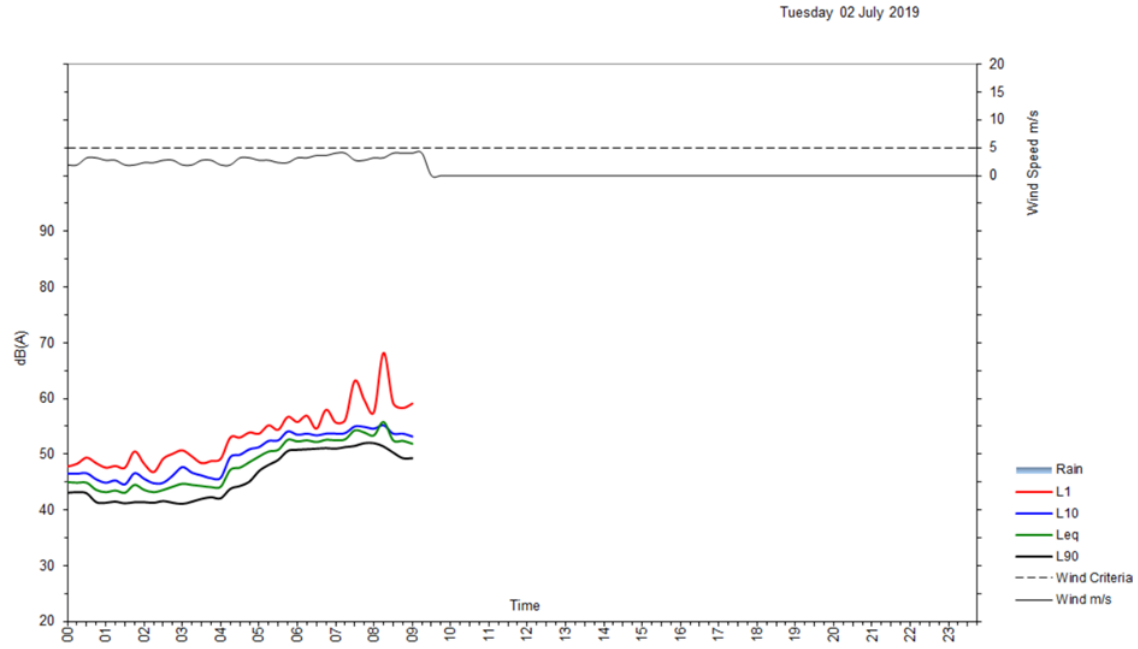
Ambient Sound	The totally encompassing sound in a given situation at a given time, usually composed of sound from all sources near and far.
Audible Range	The limits of frequency which are audible or heard as sound. The normal ear in young adults detects sound having frequencies in the region 20 Hz to 20 kHz, although it is possible for some people to detect frequencies outside these limits.
Character, acoustic	The total of the qualities making up the individuality of the noise. The pitch or shape of a sound's frequency content (spectrum) dictate a sound's character.
Decibel [dB]	The level of noise is measured objectively using a Sound Level Meter. The following are examples of the decibel readings of every day sounds; 0dBA the faintest sound we can hear 30dBA a quiet library or in a quiet location in the country 45dBA typical office space. Ambience in the city at night 60dBA Martin Place at lunch time 70dBA the sound of a car passing on the street 80dBA loud music played at home 90dBA the sound of a truck passing on the street 100dBA the sound of a rock band 115dBA limit of sound permitted in industry 120dBA deafening
dB(A)	*A-weighted decibels* The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter. The sound pressure level in dB(A) gives a close indication of the subjective loudness of the noise.
Frequency	Frequency is synonymous to *pitch*. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Loudness	A rise of 10 dB in sound level corresponds approximately to a doubling of subjective loudness. That is, a sound of 85 dB is twice as loud as a sound of 75 dB which is twice as loud as a sound of 65 dB and so on
LMax	The maximum sound pressure level measured over a given period.
LMin	The minimum sound pressure level measured over a given period.
L1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L10	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L90	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L_{90} noise level expressed in units of dB(A).
Leq	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Background Sound Level	The average of the lowest levels of the sound levels measured in an affected area in the absence of noise from occupants and from unwanted, external ambient noise sources. Usually taken to mean the LA90 value
Sound Isolation	A reference to the degree of acoustical separation between any two areas. Sound isolation may refer to sound transmission loss of a partition or to noise reduction from any unwanted noise source. The term "sound isolation" does not specify any grade or performance quality and requires the units to be specified for any contractual condition
Sound Pressure Level, LP dB	A measurement obtained directly using a microphone and sound level meter. Sound pressure level varies with distance from a source and with changes to the measuring environment. Sound pressure level equals 20 times the logarithm to the base 10 of the ratio of the rms sound pressure to the reference sound pressure of 20 micro Pascals.
Sound Power Level, Lw dB	Sound power level is a measure of the sound energy emitted by a source, does not change with distance, and cannot be directly measured. Sound power level of a machine may vary depending on the actual operating load and is calculated from sound pressure level measurements with appropriate corrections for distance and/or environmental conditions. Sound power levels is equal to 10 times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power of 1 picoWatt

APPENDIX B: NOISE MONITORING RESULTS






Monday 01 July 2019
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


Tuesday 02 July 2019
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s