NOISE IMPACT ASSESSMENT
PREPARED FOR
73 BULWER STREET, MAITLAND NSW 2320

Prepared for: Hoover Group Pty Ltd

Prepared by: Bethany Carlyon, Environmental Scientist
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Benbow
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1. INTRODUCTION

Benbow Environmental (BE) has been commissioned by Hoover Group Pty Ltd to provide a Noise Impact Assessment (NIA) for the proposed change of use from a class 1a dwelling to a class 9b disability day care centre to be located at 73 Bulwer Street, Maitland, NSW, 2320.

The proposed development includes the:

- Demolition of the existing external deck, door and roofing as well as one window;
- Demolition of internal walls in existing store room;
- Widening of door fronting Bulwer Street;
- Construction of ramp;
- Widening/replacement of doorways less than 850 mm (minimum width);
- Demolition of existing laundry/bathroom and fitout of two ambulant toilets and 1 disabled bathroom; and
- Operation of a disability day care facility.

The development has provision for 4 parking spaces.

This Noise Impact Assessment has been carried out in accordance with the following guidelines and documents:

- NSW Noise Policy for Industry (EPA 2017); and
- NSW Interim Construction Noise Guideline (DECC, 2009).

The assessment has been undertaken to ensure that the proposed activities would not generate adverse noise impacts on the nearest sensitive receivers including people in neighbouring residential houses. Additionally, the impact from the proposed development's construction noise has been assessed.

Long term unattended noise monitoring data was collected at the site from 23rd October to 30th October 2024 to derive the project specific noise levels (noise criteria) for all the considered nearest sensitive receivers.

Noise predictions were undertaken considering several receivers and utilising the noise modelling software Sound Plan v7.3. The sources of noise that present the primary potential for off-site impacts are the dedicated outside rest areas, and the proposed car park.

This report details the results of ambient noise measurements, the establishment of the noise criteria and the assessment of potential noise emissions from the proposed facility.

1.1 Scope of Works

The scope of works of this noise impact assessment is as follows:

- Provide a brief description of the proposed development;
- Measure existing ambient noise levels at proposed site location;
- Determine all potential noise sources associated with the proposed operations;
- Predict potential noise impacts from the development at the nearest affected existing receivers;
- Assess potential noise impacts against relevant legislation and guidelines;
- Recommend noise mitigation measures, where required; and
- The compilation of this report containing concise statements of potential noise impact.

2. PROJECT INFORMATION

A brief description of the subject site and lands surrounding the study area has been outlined within this section of the report.

2.1 SITE LOCALITY AND SURROUNDING LAND USE

The proposal is for change of use from a class 1a dwelling to a class 9b disability day care centre to be located at 73 Bulwer Street, Maitland, NSW, 2320 (legally designated as Lot 1/DP1038953). Site identification information and land use is summarised below in Table 2 1. An aerial photograph displaying the site location is provided in Figure 2-1.

Land zoning for the site and the surrounding area is displayed in Figure 2-2. As per the Maitland LEP 2011, the proposed development is zoned R1 – General Residential, at the edge of the residential zone.

The LEP states that an objective of the R1-zoned land is:
- To provide for the housing needs of the community.
- To provide for a variety of housing types and densities.
- To enable other land uses that provide facilities or services to meet the day to day needs of residents.

Thus, disability day care facilities are permitted with consent within R1 zoned land.

The surrounding land use zones include the R1 surrounding to the east, MU1 – Mixed Use which includes several businesses and schools to the north, east and west, E2 – Centre to the north, RE1 – Public Recreation to the northeast and SP2 – Railway (Maitland Railway Station) to the south.

Table 2-1: Site Identification

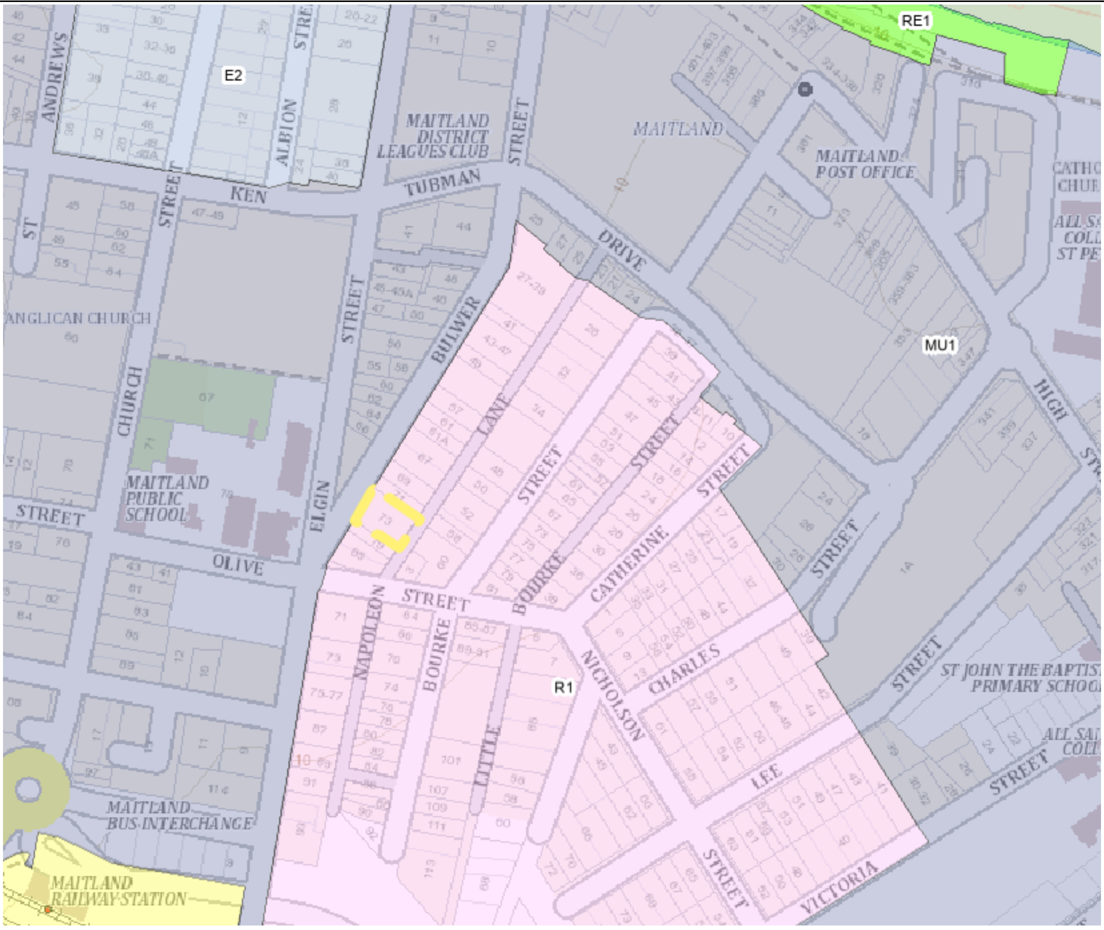
Lot and DP Number	Lot 1/DP1038953
Approximate Site Area (m^2)	800
Local Government Area	Maitland City Council
Current Land Zoning	R1 – General Residential

Figure 2-1: Site Location Aerial Photograph

Source: Google Earth 2024

↑N Not to scale	**LEGEND:** Site Boundary	Benbow Environmental 27 Sherwood Street, Northmead NSW 2152

Figure 2-2: Land Use Zoning Map



Source: NSW ePlanning Spatial Viewer 2024

↑N	**LEGEND:**	
	E2 - Commercial Centre E3 - Productivity Support MU - Mixed Use MU1 - Mixed Use R1 - General Residential RE1 - Public Recreation SP1 - Special Activities SP2 - Infrastructure	Benbow Environmental 27 Sherwood Street, Northmead NSW 2152

2.2 HOURS OF OPERATION

Hours of operation are as follows:

Monday: 8:30am – 5:30pm
Tuesday: 8:30am – 7:30pm
Wednesday: 8:30am – 6:30pm
Thursday: 8:30am – 7pm
Friday: 8:30am – 7:30pm
Saturday: 9:30am – 10:30am
Sunday: not operating

Hours of operation may fluctuate depending on the type of activities planned. Saturday operation is not every week, and will only occur as necessary. Opening hours will be restricted to the daytime and evening periods, and would not operate during the nighttime period. As further elaborated on in section 3 below, the three time periods are as follows:

- **Day** is defined as 7.00am to 6.00pm, Monday to Saturday and 8.00am to 6.00pm Sundays and Public Holidays;
- **Evening** is defined as 6.00pm to 10.00pm, Monday to Sunday and Public Holidays; and
- **Night** is defined as 10.00pm to 7.00am, Monday to Saturday and 10.00pm to 8.00am Sundays and Public Holidays.

2.3 NEAREST SENSITIVE RECEIVERS

Table 2-2 lists the location of representative potentially affected receivers that are considered in this assessment. These receptors were selected based on their proximity and directional bearing from the subject site. The aerial photograph of the locations of the sensitive receivers are shown in

Figure 2-3.

Table 2-2: Nearest Sensitive Receptors

Receiver ID	Address	Lot & DP	Distance and Direction from Site Boundary (m)	Type of Receiver
R1	71 Bulwer Street, Maitland	1/-/DP986182	Adjacent N	Residential
R2	58 Bourke Street, Maitland	1/-/DP996918	5 m E	Residential
R3	60 Bourke Street, Maitland	2/-/DP150343	10 m E	Residential
R4	3 Olive Street, Maitland	3/-/DP150343	10 m E	Residential
R5	79 Bulwer Street, Maitland	66/-/DP1038312	Adjacent S	Residential
R6	68-70 Bulwer Street, Maitland	1/-/SP89537	15 m NW	Residential
R7	70 Elgin Street, Maitland	100/-/DP811794	30 m W	School

Figure 2-3: Nearest Sensitive Receivers (Aerial Photograph)

↑N	**LEGEND:** Site Location	Benbow Environmental 27 Sherwood Road Northmead NSW 2152

2.4 PROPOSED DEVELOPMENT

The proposed operations of the subject development are detailed as follows.

The proposed development includes the:

- Demolition of the existing external deck, door and roofing as well as one window;
- Demolition of internal walls in existing store room;
- Widening of door fronting Bulwer Street;
- Construction of ramp;
- Widening/replacement of doorways less than 850 mm (minimum width); and
- Demolition of existing laundry/bathroom and fitout of two ambulant toilets and 1 disabled bathroom.

The rooms within the proposed development are as follows:

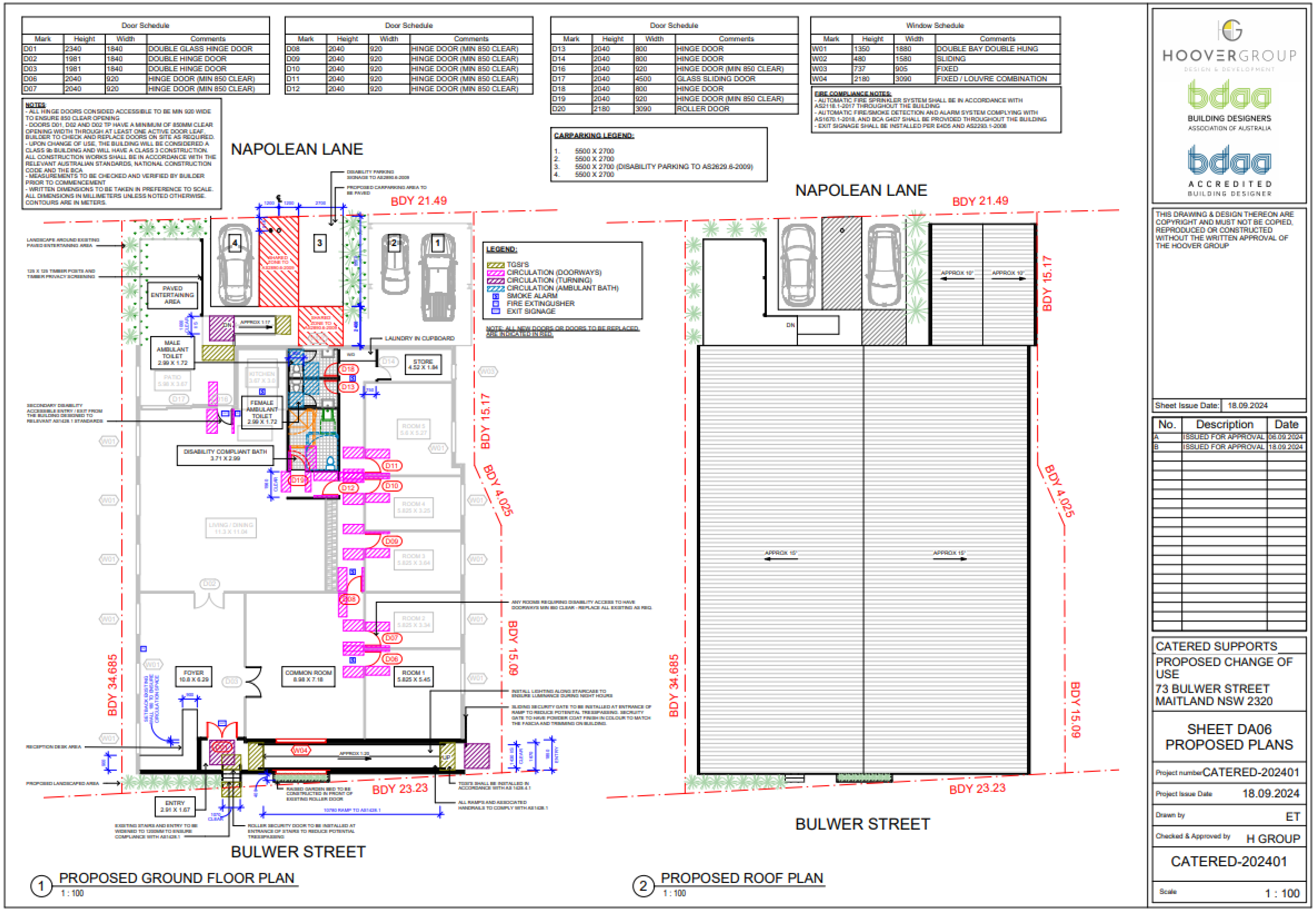
- Foyer – reception/entryway
- Rooms 1-5 – consultation offices and meeting rooms
- Living/dining – main occupying room for activities
- Kitchen
- Store
- Toilets and bath

No overnight stays will occur. All activities will occur during the day and evening hours.

The development has provision for 4 parking spaces.

The site plan for the proposed facility is displayed in Figure 2-4.

Figure 2-4: Site Plan



3. EXISTING ACOUSTIC ENVIRONMENT

The level of background and ambient noise is assessed separately for the daytime, evening, and night-time assessment periods. The NSW Noise Policy for Industry (EPA, 2017) defines these periods as follows:

- **Day** is defined as 7.00am to 6.00pm, Monday to Saturday and 8.00am to 6.00pm Sundays and Public Holidays;
- **Evening** is defined as 6.00pm to 10.00pm, Monday to Sunday and Public Holidays; and
- **Night** is defined as 10.00pm to 7.00am, Monday to Saturday and 10.00pm to 8.00am Sundays and Public Holidays.

3.1 Noise Monitoring Equipment and Methodology

Background noise level measurements were carried out using a Svantek SVAN 957 Precision Sound Level Meter (attended noise monitoring) and Acoustic Research Laboratories statistical Environmental Noise Loggers, type Ngara (unattended noise monitoring). The instrument sets were calibrated by a NATA accredited laboratory within two years of the measurement period. Calibration certificates have been included in Attachment 2.

To ensure accuracy and reliability in the results, field reference checks were applied both before and after the measurement period with an acoustic calibrator. There were no excessive variances observed in the reference signal between the pre-measurement and post-measurement calibration. The instrument was set on A-weighted Fast response and noise levels were measured over 15-minute statistical intervals. QA/QC procedures applied for the measurement and analysis of noise levels have been presented in Attachment 3. The microphones were fitted with windsocks and were positioned between 1.2 metres and 1.5 metres above ground level.

3.2 Noise Monitoring Locations

One (1) unattended environmental noise logger was placed within the front and rear of the site to measure the existing ambient and background noise levels. Unattended long-term noise monitoring was undertaken from 23rd October to 1st November 2024 at 73 Bulwer Street, Maitland. The noise logger location is shown in Figure 3-1 and listed in Table 3-1.

Table 3-1: Noise Monitoring Location

Monitoring Location	Methodology	Address
1	Unattended monitoring and attended monitoring	73 Bulwer Street, Maitland

Figure 3-1: Logger Location

↑N

LEGEND:
Site boundary
Location of logger

Benbow Environmental
27 Sherwood Street,
Northmead NSW 2152

3.3 LONG TERM UNATTENDED NOISE MONITORING RESULTS

The data was analysed to determine a single assessment background level (ABL) for each day, evening, and night time period, in accordance with the NSW EPA Noise Policy for Industry. The ABL is established by determining the lowest tenth-percentile level of the L_{A90} noise data over each period of interest. The background noise level or rating background level (RBL) representing the day, evening and night assessment periods is based on the median of individual ABL's determined over the entire monitoring period. The results of the long-term unattended noise monitoring are displayed in Table 3-2. Daily noise logger graphs have been included in Attachment 2.

Table 3-2: Unattended Noise Monitoring Results at Location 1 – 73 Bulwer Street Maitland, dB(A)

Date	Average L_1			Average L_{10}			ABL (L_{90})			L_{eq}		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
23/10/2024	59	54	43	49	48	38	36	34	29	49	57	36
24/10/2024	-	58	47	-	53	43	-	29	29	-	57	44
25/10/2024	-	-	-	-	-	-	-	-	-	-	-	-
26/10/2024	-	50	45	-	45	40	-	35	26	-	52	40
27/10/2024	55	52	47	43	47	43	32	33	28	46	49	42
28/10/2024	-	-	47	-	-	42	-	-	26	-	-	43
29/10/2024	59	-	48	50	-	43	36	-	28	51	-	44
30/10/2024	64	55	49	55	47	44	34	37	29	59	49	48
31/10/2024	58	56	49	48	49	45	36	39	31	49	50	44
Average	**59**	**54**	**47**	**49**	**48**	**42**	*	*	*	*	*	*
Median (RBL)	*	*	*	*	*	*	**36**	**34**	**28**	*	*	*
Logarithmic Average	*	*	*	*	*	*	*	*	*	**54**	**54**	**44**

Note: - indicates values that has not been considered due to adverse weather conditions.
* Indicates values that are not relevant to that noise descriptor.
Value in bold indicates relevant noise descriptor.

3.4 SHORT-TERM OPERATOR-ATTENDED NOISE MONITORING RESULTS

Attended noise monitoring was conducted on 23rd October 2024 in order to gain an understanding of the background noise sources of the area. Noise contributions were obtained from ambient noise sources such as local fauna, road traffic and surrounding resident noise. The results of the short-term attended noise monitoring are displayed in Table 3-3.

Table 3-3: Attended monitoring Results

Date/Time	L_{Aeq}	L_1	L_{A10}	L_{A90}	Comments
Location 1 Wednesday 23/10/2024 11:57 Daytime Period	46	57	48	40	Person talking nearby <54,65 dB(A) -intermittent Car passing <60 dB(A) Bird <56 dB(A) Door closing <55 dB(A) Distant revving <55 dB(A) Aeroplane <54 dB(A) Wind gust end of measurement <50 dB(A) Car <48 dB(A) Light breeze <43 dB(A) Music from distant residence <40 dB(A) Insects audible (minimal)

4. METEOROLOGICAL CONDITIONS

Wind and temperature inversions may affect the noise impact at the receptors. Therefore, noise enhancing weather conditions should be assessed when wind and temperature inversions are considered to be a feature of the area.

A site-representative meteorological data file was obtained from the Bureau of Meteorology (BOM) for the Paterson (Tocal) weather station (ID 061250). In this Section, an analysis of the 2023 weather data has been conducted to establish whether significant winds are characteristic of the area.

4.1 WIND EFFECTS

Wind is considered a feature where source-to-receiver wind speeds (at a 10 m height) of 3 m/s or below occur for 30% or more of the time in any assessment period in any season.

4.1.1 Wind Rose Plots

Wind rose plots show the direction that the wind is coming from, with triangles known as “petals”. The petals of the plots in the figures summarise wind direction data into 8 compass directions i.e. north, north-east, east, south-east, etc. The length of the triangles, or “petals”, indicates the frequency that the wind blows from that direction. Longer petals for a given direction indicate a higher frequency of wind from that direction. Each petal is divided into segments, with each segment representing one of the six wind speed classes.

Thus, the segments of a petal show what proportion of wind for a given direction falls into each class. The proportion of time for which wind speed is less than 0.5 m/s, when speed is negligible, is referred to as calm hours or “calms”. Calms are not shown on a wind rose as they have no direction, but the proportion of time consisting of the period under consideration is noted under each wind rose.

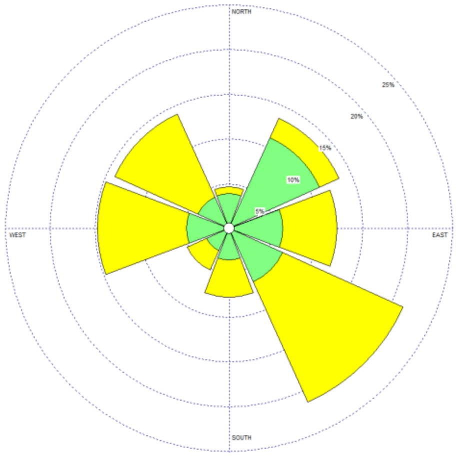
The concentric circles in each wind rose are the axis, which denote frequencies. When comparing the plots, it should be noted that the axis varies between wind roses, although all wind roses are similar in size. The frequencies denoted on the axes are indicated beneath each wind rose.

4.1.2 Local Wind Trends

Seasonal wind rose plots for this site utilising the Paterson (Tocal) data have been included in Figure 4-1 to Figure 4-3.

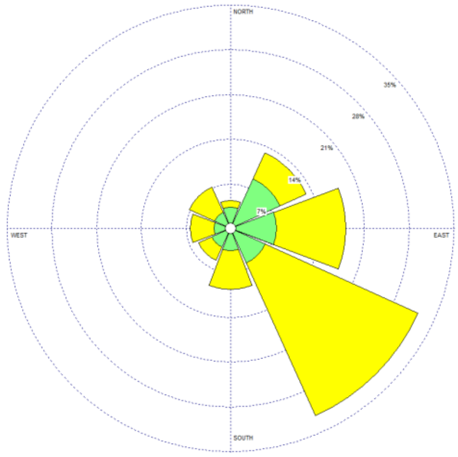
Figure 4-1: Wind Rose Plots – BOM Paterson (Tocal) ID 061250 – 2023 – Day time

All Seasons



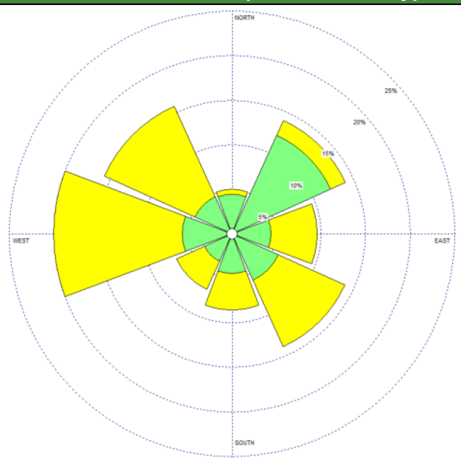
Average Wind Speed: 3.07 m/s
Calms Frequency: 5.91%
Axis Frequencies: 5%, 10%, 15%, 20%, 25%

Summer Season (December – February)



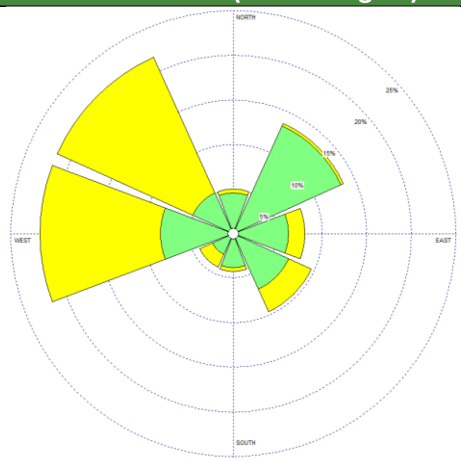
Average Wind Speed: 3.32 m/s
Calms Frequency: 2.52%
Axis Frequencies: 6%, 12%, 18%, 24%, 30%

Autumn Season (March – May)



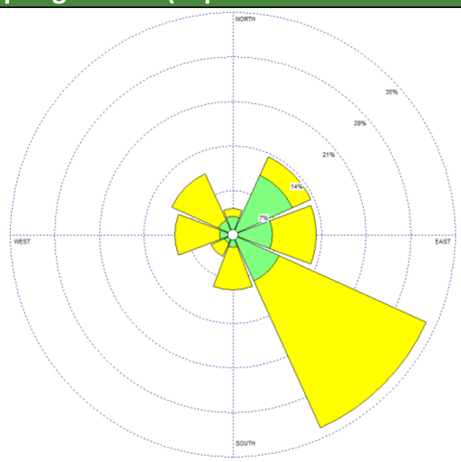
Average Wind Speed: 2.95 m/s
Calms Frequency: 4.18%
Axis Frequencies: 5%, 10%, 15%, 20%, 25%

Winter Season (June – August)



Average Wind Speed: 2.63 m/s
Calms Frequency: 7.63%
Axis Frequencies: 5%, 10%, 15%, 20%, 25%

Spring Season (September – November)



Average Wind Speed: 3.49 m/s
Calms Frequency: 3.49%
Axis Frequencies: 7%, 14%, 21%, 28%, 35%

Legend

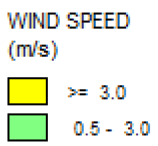
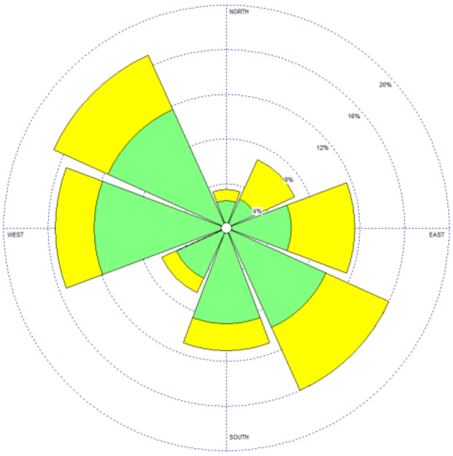


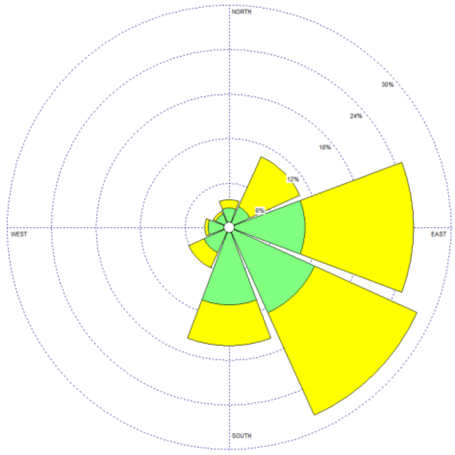
Figure 4-2: Wind Rose Plots – BOM Paterson (Tocal) ID 061250 – 2023 – Evening time

All Seasons



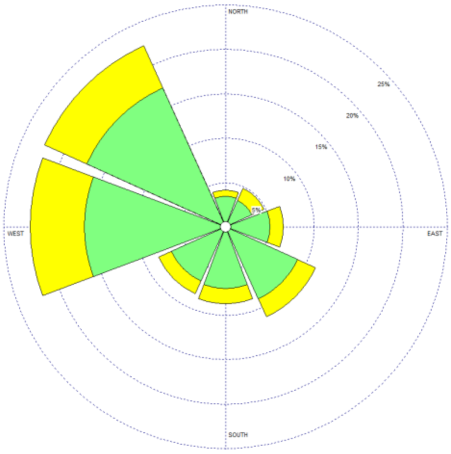
Average Wind Speed: 2.16 m/s
Calms Frequency: 9.26%
Axis Frequencies: 4%, 8%, 12%, 16%, 20%

Summer Season (December – February)



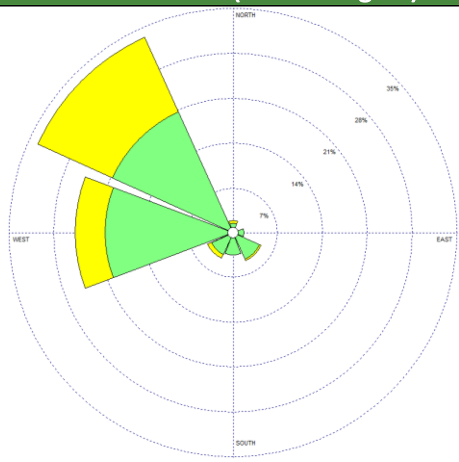
Average Wind Speed: 2.78 m/s
Calms Frequency: 2.23%
Axis Frequencies: 6%, 12%, 18%, 24%, 30%

Autumn Season (March – May)



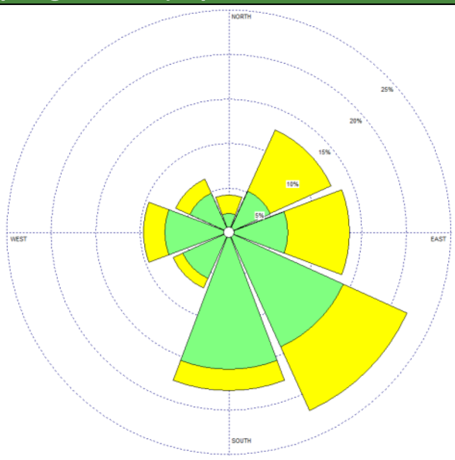
Average Wind Speed: 1.90 m/s
Calms Frequency: 5.17%
Axis Frequencies: 5%, 10%, 15%, 20%, 25%

Winter Season (June – August)



Average Wind Speed: 1.64 m/s
Calms Frequency: 10.47%
Axis Frequencies: 7%, 14%, 21%, 28%, 35%

Spring Season (September – November)



Average Wind Speed: 2.38 m/s
Calms Frequency: 2.30%
Axis Frequencies: 6%, 12%, 18%, 24%, 30%

Legend

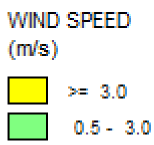
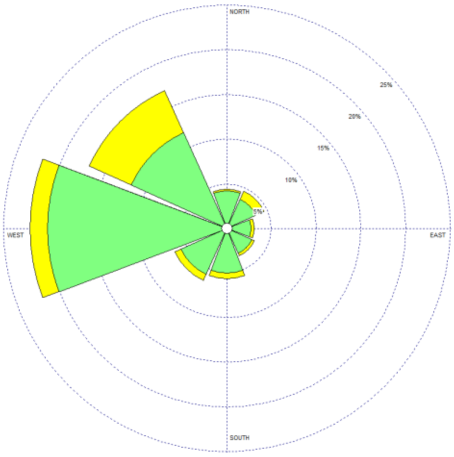


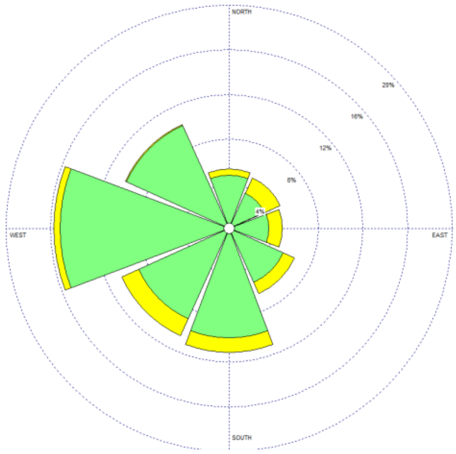
Figure 4-3: Wind Rose Plots – BOM Paterson (Tocal) ID 061250 – 2023 – Nighttime

All Seasons



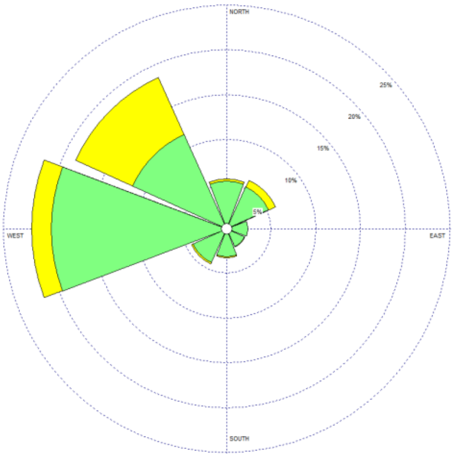
Average Wind Speed: 1.18 m/s
Calms Frequency: 28.43%
Axis Frequencies: 5%, 10%, 15%, 20%, 25%

Summer Season (December – February)



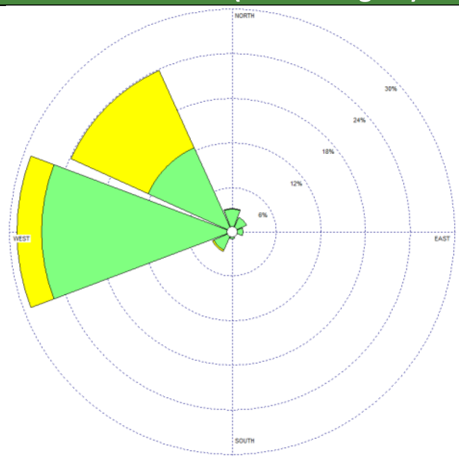
Average Wind Speed: 1.20 m/s
Calms Frequency: 18.24%
Axis Frequencies: 6%, 12%, 18%, 24%, 30%

Autumn Season (March – May)



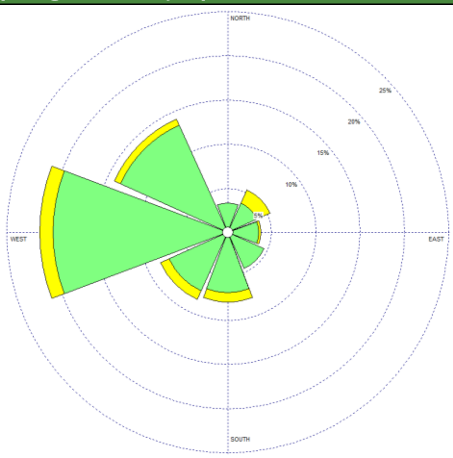
Average Wind Speed: 1.13 m/s
Calms Frequency: 21.28%
Axis Frequencies: 5%, 10%, 15%, 20%, 25%

Winter Season (June – August)



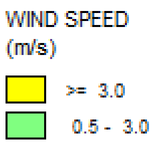
Average Wind Speed: 1.26 m/s
Calms Frequency: 21.30%
Axis Frequencies: 6%, 12%, 18%, 24%, 30%

Spring Season (September – November)



Average Wind Speed: 1.11 m/s
Calms Frequency: 16.20%
Axis Frequencies: 5%, 10%, 15%, 20%, 25%

Legend



Appendix D2, of the Noise Policy for Industry (EPA, 2017), refers to utilising the Noise Enhancing Wind Analysis (NEWA) program on the NSW EPA website, to determine the significance of source-to-receiver winds.

Table 4-1 below contains the noise wind component analysis from the NEWA software. Wind speeds are taken up to 3 m/s and wind direction is taken from source-to-receiver, plus and minus 45 degrees, as per appendix D2 of the Noise Policy for Industry.

It can be seen from Table 4-1 that there are twelve (12) instances, where more than 30% of wind speeds are less than 3 m/s in the plus and minus 45 degree arc from source to receiver. Only nine (9) instances occurred during the daytime and evening periods when the site will be operational. Therefore, worst case 3 m/s source-to-receiver winds have been considered in the assessment.

Table 4-1: Noise Wind Component Analysis 2023 Paterson (Tocal) Equestrian Centre BOM

Receiver	Day				Evening				Night			
	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring
1	6	11	12	3	8	30	32	13	26	26	32	21
2	6	11	13	3	7	35	41	12	27	27	35	23
3	5	10	13	3	5	36	43	10	24	29	35	23
4	5	10	10	3	4	28	38	8	17	23	24	17
5	6	10	10	3	4	23	26	7	15	16	16	12
6	16	14	14	14	33	11	4	20	11	4	2	5
7	21	15	18	15	32	12	2	15	7	6	3	5

(shaded) Noise enhancing meteorological conditions occur for 30% or more of the period and season.

4.2 TEMPERATURE INVERSIONS

Temperature inversion is considered a feature where this occurs on more than 30% of the nights in winter.

Temperature inversion conditions would be best associated with F-class stability conditions – generally associated with still/light winds and clear skies during the night-time or early morning period (these are referred to as stable atmospheric conditions). The site will not be operational in the nighttime periods, therefore temperature inversion conditions have not been assessed.

4.2.1 Weather Conditions Considered in the Assessment

The following conditions will be considered in this noise impact assessment considered:

- Neutral weather conditions; and
- Noise-enhancing wind conditions.

Details of the considered meteorological conditions have been displayed in Table 4-2.

Table 4-2: Meteorological Conditions Assessed in Noise Propagation Modelling

Classification	Ambient Temp.	Ambient Humidity	Wind Speed	Wind Direction (blowing from)	Temperature Inversion	Affected Receiver	Applicability
Neutral	10 °C	70%	0 m/s	-	No	All	All periods
Noise-Enhancing winds	10 °C	70%	3 m/s	Source to receiver	No	R1-R4 R6-R7	Day and evening

5. CURRENT LEGISLATION AND GUIDELINES

5.1 NSW EPA Noise Policy for Industry

The NSW Noise Policy for Industry was developed by the NSW EPA primarily for the assessment of noise emissions from industrial sites regulated by the NSW EPA.

The policy sets out two components that are used to assess potential site-related noise impacts. The intrusiveness noise level aims at controlling intrusive noise impacts in the short-term for residences. The amenity noise level aims at maintaining a suitable amenity for particular land uses including residences in the long-term. The more stringent of the intrusiveness or amenity level becomes the project noise trigger levels for the project.

5.1.1 Project Intrusiveness Noise Level

The project intrusiveness noise level is determined as follows:

$$L_{Aeq,\ 15\ minute} = \text{rating background noise level} + 5\ \text{dB}$$

Where the $L_{Aeq,(15minute)}$ is the predicted or measured L_{Aeq} from noise generated within the project site over a fifteen-minute interval at the receptor.

This is to be assessed at the most affected point on or within the residential property boundary or if that is more than 30 m from the residence, at the most affected point within 30 m of the residential dwelling.

5.1.2 Amenity Noise Level

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 Noise Policy for Industry 2017. The relevant recommended noise levels applicable are reproduced in Table 5-1 below.

Table 5-1: Amenity noise levels.

Receiver	Noise Amenity Area	Time of Day	L_{Aeq} dB(A) Recommended amenity noise level
Residential	Suburban	Day	55
		Evening	45
		Night	40
Active Recreation	All	When in use	55
School Classroom	All	Noisiest 1-hour period when in use	Internal: 40[1]
			External: 50[2]

Source: Table 2.2 and Section 2.6, NSW Noise Policy for Industry

Note:
1) In the case where existing schools are affected by noise from existing sources, the acceptable L_{Aeq} noise level may be increased to L_{Aeq} 1 hour.
2) Where internal amenity noise levels are specified, they refer to the noise level at the centre of the habitable room that is most exposed to the noise and apply with windows opened sufficiently to provide adequate ventilation, except where alternative means of ventilation complying with the Building Code of Australia are provided. In cases where gaining internal access for monitoring is difficult, then external noise levels 10 dB(A) above the internal levels apply.

> **The project amenity noise level for industrial developments = recommended amenity noise level minus 5 dB(A)**
>
> *The following exceptions to the above method to derive the project amenity noise levels apply:*
> 1. *In areas with high traffic noise levels*
> 2. *In proposed developments in major industrial clusters*
> 3. *Where the resultant project amenity noise level is 10 dB or more lower than the existing industrial noise level. In this case the project amenity noise levels can be set at 10 dB below existing industrial noise levels if it can be demonstrated that existing industrial noise levels are unlikely to reduce over time.*
> 4. *Where cumulative industrial noise is not a necessary consideration because no other industries are present in the area, or likely to be introduced into the area in the future. In such cases the relevant amenity noise level is assigned as the project amenity noise level for development.*

This development is not considered to be captured by the above exceptions.

5.1.3 Sleep Disturbance Criteria

In accordance with the NSW EPA Noise Policy for Industry, the potential for sleep disturbance from maximum noise level events from premises during the night-time period needs to be considered. Sleep disturbance is both awakenings and disturbance to sleep stages.
Where the subject development/premises night-time noise levels at a residential location exceed:

- **$L_{Aeq, 15\text{-}minute}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or**
- **L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater,**

A detailed maximum noise level assessment should be undertaken.

5.1.4 Project Noise Trigger Levels

The project noise trigger levels for the site have been established in accordance with the principles and methodologies of the NSW Noise Policy for Industry (EPA, 2017).

Table 5-2 below presents the minimum rating background levels, project intrusive noise level, recommended amenity noise level, and project amenity noise level. The project noise trigger level is the lowest value of intrusiveness or project amenity noise level after conversion to $L_{Aeq\ 15\text{-}minute}$, dB(A) equivalent level.

Different time periods apply for the noise criteria as the intrusive criterion considers a 15-minute assessment period while the amenity criterion requires assessment over the total length of time that a site is operational within each day, evening, or night period. To ensure compliance under all circumstances, a 15-minute period assessment has been considered for all receptors.

Table 5-2: Project Noise Trigger Levels NSW Noise Policy for Industry

Receiver	Type of Receptor	Time of day	Rating background noise level	Project intrusiveness noise level ($L_{eq(15\ minute)}$)	Recommended amenity noise level $L_{Aeq\ period}$	Project amenity noise level $L_{Aeq\ 15\ minute}$ [2]	PNTL $L_{Aeq\ 15\ minute}$	Sleep Disturbance L_{Amax}
R1-R6	Residential - Suburban	Day	36	**41**	55	53	**41**	**-**
		Evening	34	**39**	45	43	**39**	**-**
		Night	30[1]	**35**	40	38	**35**	**52**
R7	School classroom (external)	Day	-	-	50	48	**48**	**-**

Notes:
1) This level has been changed to be the minimum assumed RBL as per table 2.1 of the Noise Policy for Industry
2) These levels have been converted to **$L_{Aeq\ 15\ minute}$** using the following: **$L_{Aeq\ 15\ minute} = L_{Aeq\ period} + 3$ dB** (NSW Noise Policy for Industry Section 2.2).

6. NOISE IMPACT ASSESSMENT

An outline of the predictive noise modelling methodology and operating scenarios has been provided below.

6.1 MODELLING METHODOLOGY

Noise propagation modelling was carried out using the Concawe algorithm within SoundPLAN. This model has been extensively utilised by Benbow Environmental for assessing noise emissions for existing and proposed developments, and is recognised by regulatory authorities throughout Australia. The model allows for the prediction of noise from a site at the specified receptor, by calculating the contribution of each noise source. Other model inputs included the noise sources, topographical features of the subject area, surrounding buildings, noise walls and receiver locations.

The modelling scenario has been carried out using the L_{Aeq} and L_{Amax} descriptors. Using the model, noise levels were predicted at the potentially most affected receivers to determine the noise impact against the project specific noise levels and other relevant noise criteria in accordance with the NSW Noise Policy for Industry (EPA, 2017).

6.2 NOISE SOURCES

The overall sound power levels for the identified noise sources have been referenced either from Benbow Environmental's extensive database. The primary noise sources associated with the facility would include:

- Residents/staff/visitors occupying the outdoor seating area; and
- Car ignition and door slams.

The noise associated with traffic will be highest at peak AM and PM periods.

The noise data utilised do not present tonal, impulsive, intermittent or low frequency characteristics; therefore, the correction penalty for the presence of these characteristics has not been applied.

The octave band centre frequency sound power levels are presented in Table 6-1: A-weighted Sound Power Levels Associated with Operational Activities, dB(A)

Source	Overall LAeq	Third Octave Band Centre Frequency (Hz)									
		25	31	40	50	63	80	100	125	160	200
		250	315	400	500	630	800	1k	1.25k	1.6k	2k
		2.5k	3.15k	4k	5k	6.3k	8k	10k	12.5k	16k	20k
4 adults speaking	**80**	44	48	57	65	70	73	78	78	80	82
		83	85	94	98	94	96	89	88	82	87
		85	84	82	83	83	82	78	-	-	-
Car door closing	**95**	60	62	67	70	74	73	73	69	73	72
		73	79	82	86	85	83	86	88	86	79
		76	75	72	72	71	65	60	57	55	-
Car ignition	**78**	29	32	36	39	40	45	48	43	46	53
		54	49	52	60	65	63	64	67	70	71
		69	68	65	65	65	64	57	52	47	-

Table 6-2 The data have been used in the model to represent the noise emissions from the site at the nearest potentially affected sensitive residential receiver.

Table 6-1: A-weighted Sound Power Levels Associated with Operational Activities, dB(A)

Source	Overall LAeq	Third Octave Band Centre Frequency (Hz)									
		25	31	40	50	63	80	100	125	160	200
		250	315	400	500	630	800	1k	1.25k	1.6k	2k
		2.5k	3.15k	4k	5k	6.3k	8k	10k	12.5k	16k	20k
4 adults speaking	**80**	44	48	57	65	70	73	78	78	80	82
		83	85	94	98	94	96	89	88	82	87
		85	84	82	83	83	82	78	-	-	-
Car door closing	**95**	60	62	67	70	74	73	73	69	73	72
		73	79	82	86	85	83	86	88	86	79
		76	75	72	72	71	65	60	57	55	-
Car ignition	**78**	29	32	36	39	40	45	48	43	46	53
		54	49	52	60	65	63	64	67	70	71
		69	68	65	65	65	64	57	52	47	-

Table 6-2: Sources: A-weighted Sound Power Levels, dB(A)

Noise Source	LAmax	Total LAeq	Octave Band Centre Frequency (Hz)							
			63	125	250	500	1k	2k	4k	8k
Mechanical ventilation	69	65	64	57	52	47	47	43	38	34

6.3 Modelling Methodology

6.3.1 Noise Model

Noise emissions from the proposed operations were modelled using the Concawe algorithm within SoundPLAN V7.3. This model is recognised by the NSW EPA for modelling environmental noise emissions and has been used by BE on many projects achieving highly accurate and repeatable results.

The noise sources as well as the topographical features of the subject area and receivers, were all input into the noise model to determine the noise emissions of the proposed development at the nearest potentially affected residences. On-site structures were included in the model to account for shielding provided by the building walls.

The modelling scenario has been carried out using the $L_{Aeq(15\ minute)}$ descriptor. Using this descriptor, noise emission levels were predicted at the receivers to determine the noise impact against the relevant noise criteria in accordance with the NSW Noise Policy for Industry (EPA 2017). The summary of the relevant criteria is presented in Section 5.1.4.

6.3.2 Assumptions Made for Noise Modelling

When establishing configurations for a noise-modelling package, it is inherent that several reasonable assumptions be made. It should be noted that the relevant assessment period for on-site noise emissions is 15 minutes; therefore, noise source durations detailed throughout the following assumptions section should be considered per 15-minute period in view of potential noise impacts under worst-case scenarios. Each assessment-specific assumption has been detailed below:

- The proposed development has been modelled to be operating 24 hours, 7 days a week;
- Off-site topographical information was obtained from Google Earth;
- All one-storey receivers are modelled at 1.5 m above ground level;
- All ground areas at the site and surrounds have been modelled considering a ground absorption coefficient of 0.5. This represents hard ground such as asphalt and concrete resulting in 50% of the acoustic energy being reflected and 50% of the acoustic energy being absorbed;
- A ground-level mechanical plant has been assumed. This has been modelled as a single point source operating 100% of the time;
- The fences around the site and receivers were inputted;
- One car ignition (8 seconds per 15-minute for each) and one car door slam (5 seconds per 15-minute for each) have been modelled; and
- An estimate of 4 people talking outside have been modelled as a point source to resemble a worst-case scenario.

6.3.3 Scenario

The modelling scenario is detailed in Table 6-3.

Table 6-3: Model Scenario

Scenario	Description
Scenario 1 Operations (Neutral Weather)	4 people talking
Scenario 2 Operations (Noise-Enhancing Winds)	Same as scenario 1, but considering wind effects
Scenario 3 Mechanical Plant (Neutral Weather)	1 air-conditioning fan, 1 car ignition and 1 car door slam (onsite car parking activity)
Scenario 4 Mechanical Plant (Noise-Enhancing Winds)	Same as scenario 3, but considering wind effects

Figure 6-1: Scenario 1 and 2 Operations Locations

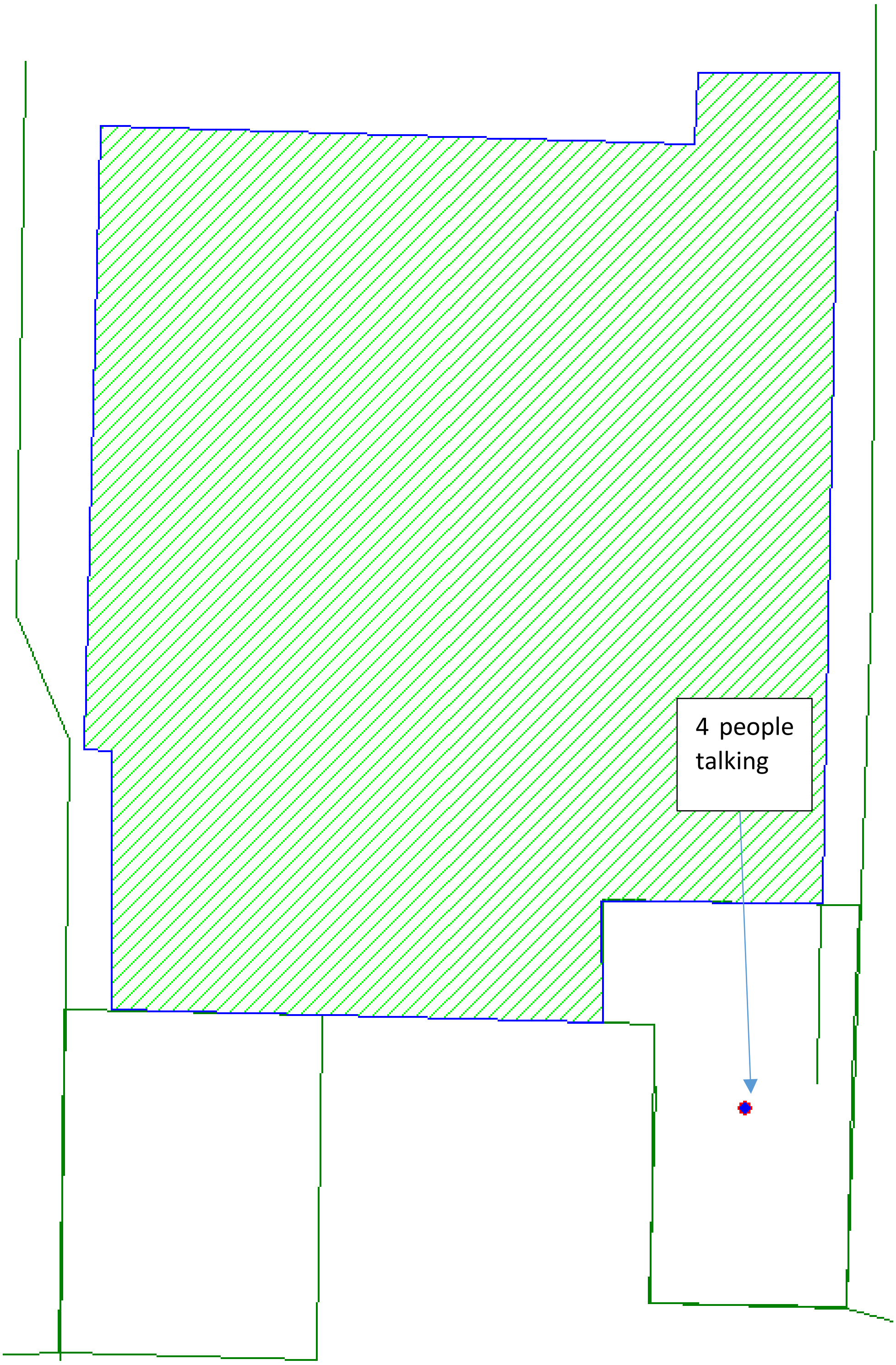
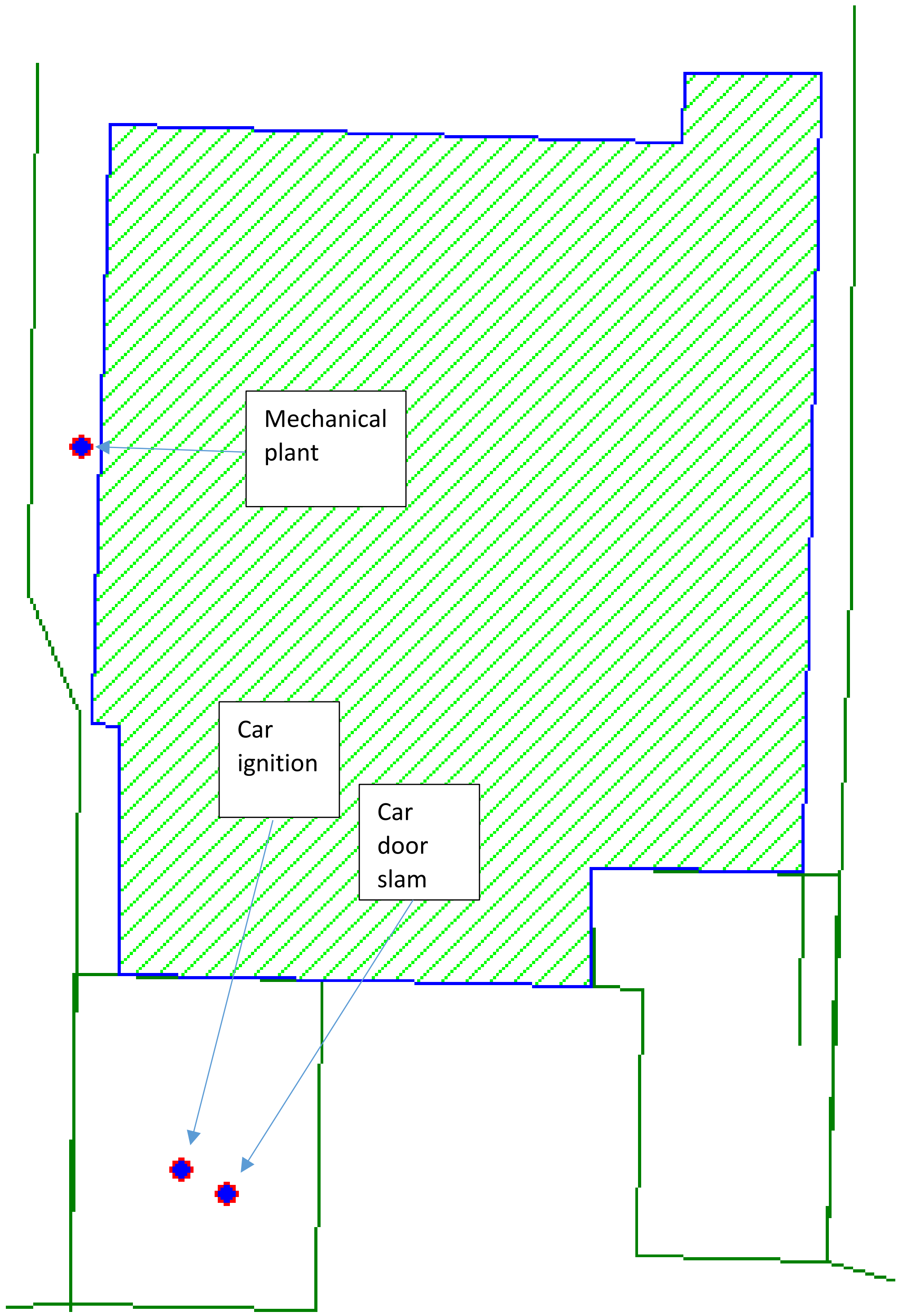


Figure 6-2: Scenario 3 and 4 Mechanical Plant Location



6.4 Predicted Noise Levels and Recommendations

Results of the predictive noise modelling are shown below.

Table 6-4 shows the predicted results for Scenarios 1-4 which includes the noise emissions from mechanical plants and carpark associated activities.

Table 6-4: Scenario 2 - Noise Modelling Results – Daytime/Evening Operations

Receiver	Noise Criteria L_{Aeq} (15 minute)		Predicted Noise Level L_{Aeq} (15 minute)		Predicted Noise Level L_{Aeq} (15 minute)	
	Day L_{Aeq} (15 minute)	Evening L_{Aeq} (15 minute)	Scenario 1 Operations Day/Evening Neutral Weather L_{Aeq} (15 minute)	Scenario 2 Operations Day/Evening Noise-Enhancing Winds L_{Aeq} (15 minute)	Scenario 3 Mechanical Plant Day/Evening Neutral Weather L_{Aeq} (15 minute)	Scenario 4 Mechanical Plant Day/Evening Noise-Enhancing Winds L_{Aeq} (15 minute)
R1	41	39	30✓	30✓	25✓	26✓
R2	41	39	30✓	30✓	30✓	31✓
R3	41	39	36✓	37✓	35✓	35✓
R4	41	39	26✓	27✓	35✓	35✓
R5	41	39	29✓	-	30✓	-
R6	41	39	18✓	19✓	20✓	21✓
R7	48	-	<10✓	<10✓	20✓	20✓

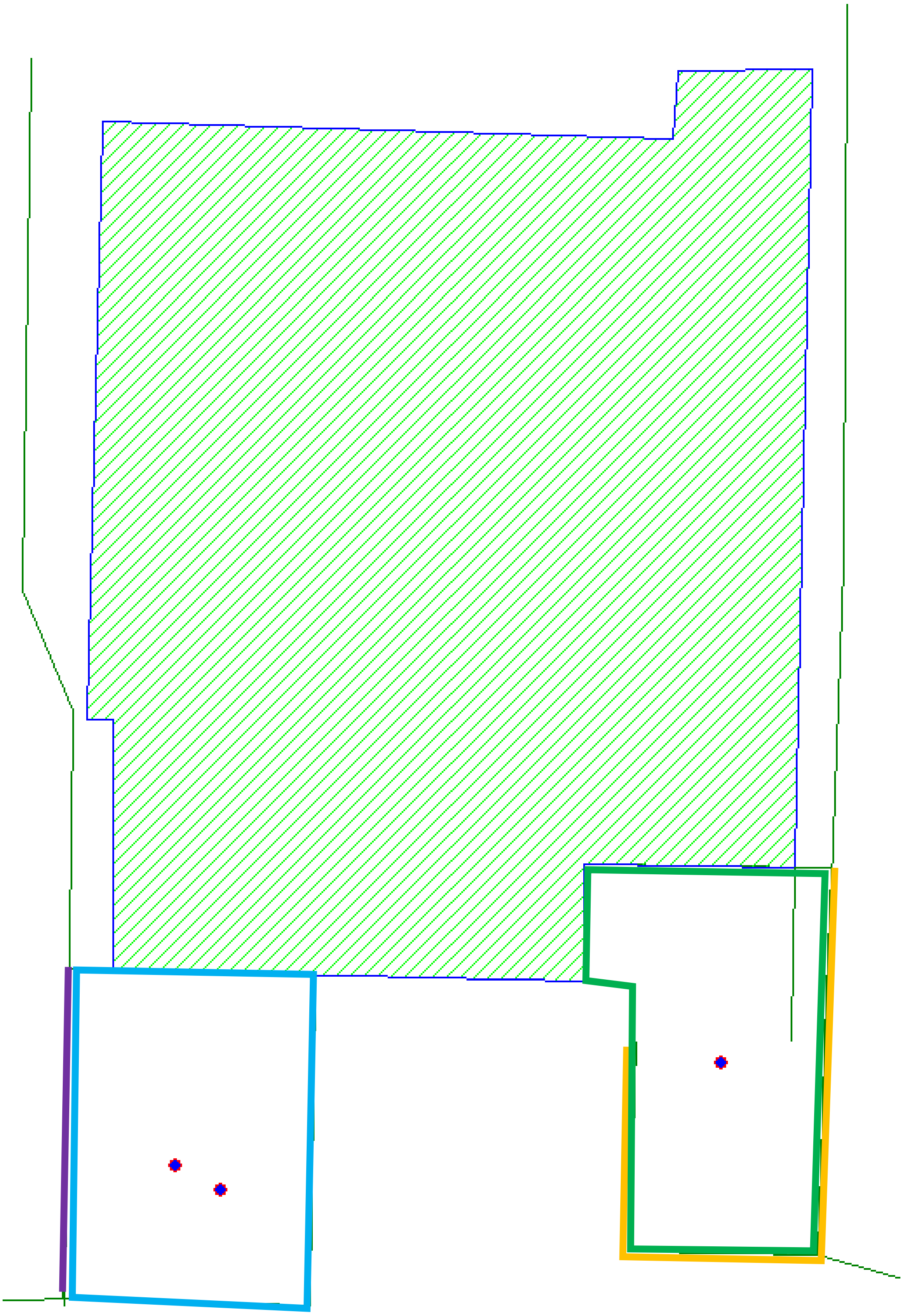
Note: ✓ indicates compliance with the relevant noise criteria ✗ indicates non-compliance with the relevant noise criteria.

The noise levels comply with the noise criteria for all time periods at all receivers. Therefore, the noise levels are acceptable for the proposed development.

6.4.1 Recommendations

There are several fences and awnings surrounding the southernmost point of the development (see figure below). These are to be installed to provide additional shielding from the proposed development and achieve compliance at the nearest sensitive receptors.

Figure 6-3: Noise Control Locations



Legend: Blue – 2.2 m awning. Purple – 2.2 m fence. Green – 2.1 m awning. Yellow – 2.1 m fence.

7. CONSTRUCTION AND DEMOLITION IMPACT ASSESSMENT

The proposed construction and demolition is as follows:

- Demolition of the existing external deck, door and roofing as well as one window;
- Demolition of internal walls in existing store room;
- Widening of door fronting Bulwer Street;
- Construction of ramp;
- Widening/replacement of doorways less than 850 mm (minimum width); and
- Demolition of existing laundry/bathroom and fitout of two ambulant toilets and 1 disabled bathroom.

These works are minimal and will occur relatively quickly. The noise impact in terms of duration and equipment needed are minor. Further assessment of construction and demolition noise is not warranted. Vibration Impact Assessment

The equipment proposed to be used are not known to produce significant levels of vibration. Therefore, a vibration assessment is not considered warranted.

8. STATEMENT OF POTENTIAL NOISE IMPACT

Benbow Environmental (BE) has been commissioned by Hoover Group Pty Ltd to provide a Noise Impact Assessment (NIA) for the proposed change of use from a class 1a dwelling to a class 9b disability day care centre to be located at 73 Bulwer Street, Maitland, NSW, 2320.

This assessment has been carried out in accordance with the guidelines established by the *NSW Environmental Protection Authority Noise Policy for Industry (2017).*

The nearest receivers and noise criteria were identified. The site operations were modelled using the predictive noise software, Sound Plan V7.3.

Operational scenario is predicted to comply with the Project Noise Trigger Levels as per the Noise Policy for Industry 2017 at all sensitive receptors during all time periods when controls of noise walls and awnings are implemented. Noise controls are presented in section 6.4.1.

This concludes the report.

Bethany Carlyon
Environmental Scientist

Richard Benbow
Principal Consultant

9. LIMITATIONS

Our services for this project are carried out in accordance with our current professional standards for site assessment investigations. No guarantees are either expressed or implied.

This report has been prepared solely for the use of Hoover Group Pty Ltd, as per our agreement for providing environmental services. Only Hoover Group Pty Ltd is entitled to rely upon the findings in the report within the scope of work described in this report. Otherwise, no responsibility is accepted for the use of any part of the report by another in any other context or for any other purpose.

Although all due care has been taken in the preparation of this study, no warranty is given, nor liability accepted (except that otherwise required by law) in relation to any of the information contained within this document. We accept no responsibility for the accuracy of any data or information provided to us by Hoover Group Pty Ltd for the purposes of preparing this report.

Any opinions and judgements expressed herein, which are based on our understanding and interpretation of current regulatory standards, should not be construed as legal advice.

ATTACHMENTS

Attachment 1: Noise Glossary

Glossary of Noise Terminology

‘A’ FREQUENCY WEIGHTING

The ‘A’ frequency weighting roughly approximates to the Fletcher-Munson 40 phon equal loudness contour. The human loudness perception at various frequencies and sound pressure levels is equated to the level of 40 dB at 1 kHz. The human ear is less sensitive to low frequency sound and very high frequency sound than midrange frequency sound (i.e. 500 Hz to 6 kHz). Humans are most sensitive to midrange frequency sounds, such as a child’s scream. Sound level meters have inbuilt frequency weighting networks that very roughly approximates the human loudness response at low sound levels. It should be noted that the human loudness response is not the same as the human annoyance response to sound. Here low frequency sounds can be more annoying than midrange frequency sounds even at very low loudness levels. The ‘A’ weighting is the most used frequency weighting for occupational and environmental noise assessments. However, for environmental noise assessments, adjustments for the character of the sound will often be required.

AMBIENT NOISE

The ambient noise level at a particular location is the overall environmental noise level caused by all noise sources in the area, both near and far, including all forms of traffic, industry, lawnmowers, wind in foliage, insects, animals, etc. Usually assessed as an energy average over a set time period ‘T’ (L_{Aeq},T).

AUDIBLE

Audible refers to a sound that can be heard. There are a range of audibility grades, varying from “barely audible”, “just audible” to “clearly audible” and “prominent”.

BACKGROUND NOISE LEVEL

Total silence does not exist in the natural or built environments, only varying degrees of noise. The Background Noise Level is the minimum repeatable level of noise measured in the absence of the noise under investigation and any other short-term noises such as those caused by all forms of traffic, industry, lawnmowers, wind in foliage, insects, animals, etc.. It is quantified by the noise level that is exceeded for 90 % of the measurement period ‘T’ (L_{A90}, T). Background Noise Levels are often determined for the day, evening, and night-time periods where relevant. This is done by statistically analysing the range of time period (typically 15 minute) measurements over multiple days (often 7 days). For a 15-minute measurement period the Background Noise Level is set at the quietest level that occurs at 1.5 minutes.

‘C’ FREQUENCY WEIGHTING

The ‘C’ frequency weighting approximates the 100 phon equal loudness contour. The human ear frequency response is more linear at high sound levels and the 100 phon equal loudness contour attempts to represent this at various frequencies at sound levels of approximately 100 dB.

DECIBEL

The decibel (h) is a logarithmic scale that allows a wide range of values to be compressed into a more comprehensible range, typically 0 dB to 120 dB. The decibel is ten times the logarithm of the ratio of any two quantities that relate to the flow of energy (i.e. power). When used in acoustics it is the ratio of square of the sound pressure level to a reference sound pressure level, the ratio of the sound power level to a reference sound power level, or the ratio of the sound intensity level to a reference sound intensity level. See also Sound Pressure Level and Sound Power Level. Noise levels in decibels cannot be added arithmetically since they are logarithmic numbers. If one machine is generating a noise level of 50 dB, and another similar machine is placed beside it, the level will increase to 53 dB (from $10 \log_{10} (10^{(50/10)} + 10^{(50/10)})$ and not 100 dB. In theory, ten similar machines placed side by side will increase the sound level by 10 dB, and one hundred machines increase the sound level by 20 dB. The human ear has a vast sound-sensitivity range of over a thousand billion to one, so the logarithmic decibel scale is useful for acoustical assessments.

dBA – See 'A' frequency weighting

dBC – See 'C' frequency weighting

EQUIVALENT CONTINUOUS SOUND LEVEL, LAeq

Many sounds, such as road traffic noise or construction noise, vary repeatedly in level over a period of time. More sophisticated sound level meters have an integrating/averaging electronic device inbuilt, which will display the energy time-average (equivalent continuous sound level - L_{Aeq}) of the 'A' frequency weighted sound pressure level. Because the decibel scale is a logarithmic ratio, the higher noise levels have far more sound energy, and therefore the LAeq level tends to indicate an average which is strongly influenced by short term, high level noise events. Many studies show that human reaction to level-varying sounds tends to relate closer to the L_{Aeq} noise level than any other descriptor.

'F' (FAST) TIME WEIGHTING

Sound level meter design-goal time constant which is 0.125 seconds.

FLETCHER–MUNSON EQUAL LOUDNESS CONTOUR CURVES

The Fletcher–Munson curves are one of many sets of equal loudness contours for the human ear, determined experimentally by Harvey Fletcher and Wilden A. Munson, and reported in a 1933 paper entitled "Loudness, its definition, measurement and calculation" in the Journal of the Acoustic Society of America.

FREE FIELD

In acoustics a free field is a measurement area not subject to significant reflection of acoustical energy. A free field measurement is typically not closer than 3.5 metres to any large flat object (other than the ground) such as a fence or wall or inside an anechoic chamber.

FREQUENCY

The number of oscillations or cycles of a wave motion per unit time, the SI unit is the hertz (Hz). 1 Hz is equivalent to one cycle per second. 1000 Hz is 1 kHz.

IMPACT ISOLATION CLASS (IIC)

The American Society for Testing and Materials (ASTM) has specified that the IIC of a floor/ceiling system shall be determined by operating an ISO 140 Standard Tapping Machine on the floor and measuring the noise generated in the room below. The IIC is a number found by fitting a reference curve to the measured octave band levels and then deducting the sound pressure level at 500 Hz from 110 decibels. Thus, the higher the IIC, the better the impact sound isolation. Not commonly used in Australia.

'I' (IMPULSE) TIME WEIGHTING

Sound level meter time constant now not in general use. The 'I' (impulse) time weighting is not suitable for rating impulsive sounds with respect to their loudness. It is also not suitable for assessing the risk of hearing impairment or for determining the 'impulsiveness' of a sound.

IMPACT SOUND INSULATION ($L_{nT,w}$)

Australian Standard AS ISO 717.2—2004 has specified that the Impact Sound Insulation of a floor/ceiling system be quantified by operating an ISO 140 Standard Tapping Machine on the floor and measuring the noise generated in the room below. The Weighted Standardised Impact Sound Pressure Level ($L_{nT,w}$) is the sound pressure level at 500 Hz for a reference curve fitted to the measured 1/3 octave band levels. Thus the lower $L_{nT,w}$ the better the impact sound insulation.

IMPULSE NOISE

An impulse noise is typified by a sudden rise time and a rapid sound decay, such as a hammer blow, rifle shot or balloon burst.

LOUDNESS

The volume to which a sound is audible to a listener is a subjective term referred to as loudness. Humans generally perceive an approximate doubling of loudness when the sound level increases by about 10 dB and an approximate halving of loudness when the sound level decreases by about 10 dB.

MAXIMUM NOISE LEVEL, LAFmax

The root-mean-square (rms) maximum sound pressure level measured with sound level meter using the 'A' frequency weighting and the 'F' (Fast) time weighting. Often used for noise assessments other than aircraft.

MAXIMUM NOISE LEVEL, LASmax

The root-mean-square (rms) maximum sound pressure level measured with sound level meter using the 'A' frequency weighting and the 'S' (Slow) time weighting. Often used for aircraft noise assessments.

NOISE RATING NUMBERS

A set of empirically developed equal loudness curves has been adopted as Australian Standard AS 1469—1983. These curves allow the loudness of a noise to be described with a single NR number. The Noise Rating number is that curve which touches the highest level on the measured spectrum of the subject noise. For broadband noise such as fans and engines, the NR number often equals the 'A' frequency weighted dB level minus five.

NOISE

Noise is unwanted, harmful, or inharmonious (discordant) sound. Sound is wave motion within matter, be it gaseous, liquid, or solid. Noise usually includes vibration as well as sound.

NOISE REDUCTION COEFFICIENT – See: "Sound Absorption Coefficient"

OFFENSIVE NOISE

Reference: Dictionary of the NSW Protection of the Environment Operations Act 1997).

"Offensive Noise means noise:
(a) that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:
(i) is harmful to (or likely to be harmful to) a person who is outside the premise from which it is emitted, or
(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or
(b) that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances prescribed by the regulations."

PINK NOISE

Pink noise is a broadband noise with an equal amount of energy in each octave or third octave band width. Because of this, Pink Noise has more energy at the lower frequencies than White Noise and is used widely for Sound Transmission Loss testing.

REVERBERATION TIME, T60

The time in seconds, after a sound signal has ceased, for the sound level inside a room to decay by 60 dB. The first 5 dB decay is often ignored, because of fluctuations that occur while reverberant sound conditions are being established in the room. The decay time for the next 30 dB is measured and the result doubled to determine the T_{60}. The Early Decay Time (EDT) is the slope of the decay curve in the first 10 dB normalised to 60 dB.

SOUND ABSORPTION COEFFICIENT, α

Sound is absorbed in porous materials by the viscous conversion of sound energy to a small amount of heat energy as the sound waves pass through it. Sound is similarly absorbed by the flexural bending of internally damped panels. The fraction of incident energy that is absorbed is termed the Sound Absorption Coefficient, α. An absorption coefficient of 0.9 indicates that 90 % of the incident sound energy is absorbed. The average α from 250 to 2 kHz is termed the Noise Reduction Coefficient (NRC).

'S' (SLOW) TIME WEIGHTING

Sound level meter design-goal time constant which is 1 second.

SOUND ATTENUATION

A reduction of sound due to distance, enclosure, or some other devise. If an enclosure is placed around a machine, or an attenuator (muffler or silencer) is fitted to a duct, the noise emission is reduced or attenuated. An enclosure that attenuates the noise level by 20 dB reduces the sound energy by one hundred times.

SOUND EXPOSURE LEVEL (LAE)

Integration (summation) rather than an average of the sound energy over a set time period. Use to assess single noise events such as truck or train pass by or aircraft flyovers. The sound exposure level is related to the energy average (L_{Aeq}, T) by the formula L_{Aeq}, T = L_{AE} – 10 $\log_{10}$ T. The abbreviation (SEL) is sometimes inconsistently used in place of the symbol (L_{AE}).

SOUND PRESSURE

The rms sound pressure measured in pascals (Pa). A pascal is a unit equivalent to a newton per square metre (N/m^2).

SOUND PRESSURE LEVEL, Lp

The level of sound measured on a sound level meter and expressed in decibels (dB). Where L_P = 10 $\log_{10}$ $(Pa/Po)^2$ dB (or 20 log10 (Pa/ Po) dB) where Pa is the rms sound pressure in Pascal and Po is a reference sound pressure conventionally chosen is 20 µPa (20×10^{-6} Pa) for airborne sound. L_p varies with distance from a noise source.

SOUND POWER

The rms sound power measured in watts (W). The watt is a unit defined as one joule per second. A measures the rate of energy flow, conversion or transfer.

SOUND POWER LEVEL, Lw

The sound power level of a noise source is the inherent noise of the device. Therefore sound power level does not vary with distance from the noise source or with a different acoustic environment. Lw = Lp + 10 $\log_{10}$ 'a' dB, re: 1pW, (10^{-12} watts) where 'a' is the measurement noise-emission area (m^2) in a free field.

SOUND TRANSMISSION CLASS (STC)

An internationally standardised method of rating the sound transmission loss of partition walls to indicate the sound reduction from one side of a partition to the other in the frequency range of 125 Hz to 4000 kHz. (Refer: Australian Standard AS 1276—1979). Now not in general use in Australia see: weighted sound reduction index.

SOUND TRANSMISSION LOSS

The amount in decibels by which a random sound is reduced as it passes through a sound barrier. A method for the measurement of airborne Sound Transmission Loss of a building partition is given in Australian Standard AS 1191—2002.

STATISTICAL NOISE LEVELS, Ln.

Noise which varies in level over a specific period of time 'T' (standard measurement times are 15 minute periods) may be quantified in terms of various statistical descriptors for example:-

- The noise level, in decibels, exceeded for 1 % of the measurement time period, when 'A' frequency weighted and 'F' time weighted is reference to as L_{AF1}, T. This may be used for describing short-term noise levels such as could cause sleep arousal during the night.
- The noise level, in decibels, exceeded for 10 % of the measurement time period, when 'A' frequency weighted and 'F' time weighted is reference to as L_{AF10}, T. In most countries the LAF10, T is measured over periods of 15 minutes, and is used to describe the average maximum noise level.
- The noise level, in decibels, exceeded for 90 % of the measurement time period, when 'A' frequency weighted and 'F' time weighted is reference to as L_{AF90}, T. In most countries the LAF90, T is measured over periods of 15 minutes, and is used to describe the average minim um or background noise level.

STEADY NOISE

Noise, which varies in level by 6 dB or less, over the period of interest with the time-weighting set to "Fast", is considered to be "steady". (Refer AS 1055.1—1997).

WEIGHTED SOUND REDUCTION INDEX, Rw

This is a single number rating of the airborne sound insulation of a wall, partition or ceiling. The sound reduction is normally measured over a frequency range of 100 Hz to 3.150 kHz and averaged in accordance with ISO standard weighting curves (Refer AS/NZS 1276.1:1999). Internal partition wall Rw + C ratings are frequency weighted to simulate insulation from human voice noise. The R_w + C is similar in value to the STC rating value. External walls, doors and windows may be $R_w + C_{tr}$ rated to simulate insulation from road traffic noise. The spectrum adaptation term Ctr adjustment factor takes account of low frequency noise. The weighted sound reduction index is normally similar or slightly lower number than the STC rating value.

WHITE NOISE

White noise is broadband random noise whose spectral density is constant across its entire frequency range. The sound power is the same for equal bandwidths from low to high frequencies. Because the higher frequency octave bands cover a wider spectrum, white noise has more energy at the higher frequencies and sounds like a hiss.

'Z' FREQUENCY WEIGHTING

The 'Z' (Zero) frequency weighting is 0 dB within the nominal 1/3 octave band frequency range centred on 10 Hz to 20 kHz. This is within the tolerance limits given in AS IEC 61672.1—2019: '*Electroacoustics – Sound level meters – Specifications*'.

Attachment 2: Calibration Certificates

Acoustic Research Labs Pty Ltd
Unit 36/14 Loyalty Rd
North Rocks NSW AUSTRALIA 2151
Ph: +61 2 9484 0800 A.B.N. 65 160 399 119
www.acousticresearch.com.au

Sound Level Meter
IEC 61672-3:2013
Calibration Certificate

Calibration Number C24053

Client Details	Benbow Environmental Pty Ltd 25-27 Sherwood Street Northmead NSW 2152
Equipment Tested/ Model Number :	NGARA
Instrument Serial Number :	8780AD
Microphone Serial Number :	317856
Pre-amplifier Serial Number :	27983
Firmware Version :	V12.6

Pre-Test Atmospheric Conditions		**Post-Test Atmospheric Conditions**	
Ambient Temperature :	25.1 °C	**Ambient Temperature :**	26 °C
Relative Humidity :	47 %	**Relative Humidity :**	47.5 %
Barometric Pressure :	99.88 kPa	**Barometric Pressure :**	99.81 kPa

Calibration Technician :	Shaheen Boaz	**Secondary Check:**	Dhanush Bonu
Calibration Date :	25 Jan 2024	**Report Issue Date :**	30 Jan 2024

Approved Signatory : Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
12: Acoustical Sig. tests of a frequency weighting	*Pass*	17: Level linearity incl. the level range control	*N/A*
13: Electrical Sig. tests of frequency weightings	*Pass*	18: Toneburst response	*Pass*
14: Frequency and time weightings at 1 kHz	*Pass*	19: C Weighted Peak Sound Level	*N/A*
15: Long Term Stability	*Pass*	20: Overload Indication	*Pass*
16: Level linearity on the reference level range	*Pass*	21: High Level Stability	*Pass*

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

However, no general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1:2013 because evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013 and because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in IEC 61672-1:2013.

Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
125Hz	*±0.13 dB*	*Temperature*	*±0.1 °C*
1kHz	*±0.13 dB*	*Relative Humidity*	*±1.9 %*
8kHz	*±0.14 dB*	*Barometric Pressure*	*±0.11 kPa*
Electrical Tests	*±0.13 dB*		

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

This calibration certificate is to be read in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
Accredited for compliance with ISO/IEC 17025 - Calibration.

The results of the tests, calibrations and/or measurements included in this document are traceable to SI units.

NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration and inspection reports.

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: SLM36595

EQUIPMENT TESTED: Sound & Vibration Analyser

Manufacturer:	Svantek		
Type No:	SVAN-957	**Serial No:**	15336
Mic. Type:	7052E	**Serial No:**	47869
Pre-Amp. Type:	SV12L	**Serial No:**	18743
Filter Type:	1/3 Octave	**Test No:**	F036598

Owner: Benbow Environmental
25-27 Sherwood Street
Northmead, NSW 2152

Tests Performed: IEC 61672-3:2013 & IEC 61260-3:2016

Comments: All Test passed for Class 1. (See overleaf for details)

CONDITIONS OF TEST:

Ambient Pressure	1003	hPa ±1 hPa	**Date of Receipt :**	27/06/2023
Temperature	24	°C ±1° C	**Date of Calibration :**	28/06/2023
Relative Humidity	36	% ±5%	**Date of Issue :**	03/07/2023

Acu-Vib Test Procedure: AVP10 (SLM) & AVP06 (Filters)

CHECKED BY: ...KB... **AUTHORISED SIGNATURE:** ....

Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.
This report applies only to the item identified in the report and may not be reproduced in part.
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

NATA
WORLD RECOGNISED ACCREDITATION
Accredited Lab No. 9262
Acoustic and Vibration Measurements

Acu-Vib Electronics
CALIBRATIONS SALES RENTALS REPAIRS

Head Office & Calibration Laboratory
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
(02) 9680 8133
www.acu-vib.com.au

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: C39738

EQUIPMENT TESTED : Acoustic Calibrator

Manufacturer: Rion
Type No: NC-73 **Serial No:** 10186522
Class: 1
Owner: Benbow Environmental
25-27 Sherwood Street
Northmead, NSW 2152
Tests Performed: Measured Output Pressure level, Frequency & Distortion
Comments: See Details and Class Tolerance overleaf.

CONDITION OF TEST:

Ambient Pressure	1005	hPa ±1 hPa	**Date of Receipt :**	06/05/2024
Temperature	24	°C ±1° C	**Date of Calibration :**	13/05/2024
Relative Humidity	59	% ±5%	**Date of Issue :**	27/05/2024

Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017

CHECKED BY: ....
AUTHORISED SIGNATURE: ....
Hein Soe

Accredited for compliance with ISO/IEC 17025 - Calibration
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

This report applies only to the item identified in the report and may not be reproduced in part.

The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

Acu-Vib Electronics
ACOUSTICS AND VIBRATIONS

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Unit 36/14 Loyalty Rd
North Rocks NSW AUSTRALIA 2151
Ph: +61 2 9484 0800 A.B.N. 65 160 399 119
www.acousticresearch.com.au

Sound Calibrator
IEC 60942:2017

Calibration Certificate

Calibration Number C24677

Client Details Benbow Environmental Pty Ltd
25-27 Sherwood Street
Northmead NSW, 2152

Equipment Tested/ Model Number : Pulsar Model 105
Instrument Serial Number : 101545

Atmospheric Conditions
Ambient Temperature : 22.6 °C
Relative Humidity : 37.4 %
Barometric Pressure : 100.81 kPa

Calibration Technician : Shaheen Boaz
Calibration Date : 05 Sep 2024
Secondary Check: Cooper Sallway
Report Issue Date : 6 Sep 2024

Approved Signatory : Juan Aguero

Characteristic Tested	Result
Generated Sound Pressure Level	*Pass*
Frequency Generated	*Pass*
Total Distortion	*Pass*

Nominal Level	Nominal Frequency	Measured Level	Measured Frequency
94	1000	93.88	1000.30

The sound calibrator has been shown to conform to the class 1 requirements for periodic testing, described in Annex B of IEC 60942:2017 for the sound pressure level(s) and frequency(ies) stated, for the environmental conditions under which the tests were performed..

Uncertainties of Measurement -

Specific Tests		Environmental Conditions	
Generated SPL	*±0.10 dB*	*Temperature*	*±0.1 °C*
Frequency	*±0.07 %*	*Relative Humidity*	*±1.9 %*
Distortion	*±0.20 %*	*Barometric Pressure*	*±0.11 kPa*

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

This calibration certificate is to be read in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
Accredited for compliance with ISO/IEC 17025 - Calibration.

The results of the tests, calibrations and/or measurements included in this document are traceable to SI units.

NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration and inspection reports.

Attachment 3: QA/QC Procedures

Calibration of Sound Level Meters

A sound level meter requires regular calibration to ensure its measurement performance remains within specification. Benbow Environmental sound level meters are calibrated by a National Association of Testing Authority (NATA) registered laboratory or a laboratory approved by the NSW Environment Protection Authority (EPA) every two years and after each major repair, in accordance with AS 1259–1990.

The calibration of the sound level meter was checked immediately before and after each series of measurements using an acoustic calibrator. The acoustic calibrator provides a known sound pressure level, which the meter indicates when the calibrator is activated while positioned on the meter microphone.

The sound level meters also incorporate an internal calibrator for use in setting up. This provides a check of the electrical calibration of the meter, but does not check the performance of the microphone. Acoustical calibration checks the entire instrument including the microphone. Calibration certificates for the instrument sets used have been included as Attachment 1.

Care and Maintenance of Sound Level Meters

Noise measuring equipment contains delicate components and therefore must be handled accordingly. The equipment is manufactured to comply with international and national standards and is checked periodically for compliance. The technical specifications for sound level meters used in Australia are defined in Australian Standard AS 1259–1990 "*Sound Level Meters"*.

The sound level meters and associated accessories are protected during storage, measurement and transportation against dirt, corrosion, rapid changes of temperature, humidity, rain, wind, vibration, electric and magnetic fields. Microphone cables and adaptors are always connected and disconnected with the power turned off. Batteries are removed (with the instrument turned off) if the instrument is not to be used for some time.

Investigation Procedures

All investigative procedures were conducted in accordance with AS 1055.1–1997 *Acoustics – Description and Measurement of Environmental Noise* Part 1: *General Procedures*.

The following information was recorded and kept for reference purposes:

- type of instrumentation used and measurement procedure conducted;
- description of the time aspect of the measurements, ie. measurement time intervals; and
- positions of measurements and the time and date were noted.

As per AS 1055.1–1997, all measurements were carried out at least 3.5 m from any reflecting structure other than the ground. The preferred measurement height of 1.2 m above the ground was utilised. A sketch of the area was made identifying positions of measurement and the approximate location of the noise source and distances in meters (approx.).

Unattended Noise Monitoring

NOISE MONITORING EQUIPMENT

ARL noise loggers type Ngara were used to conduct the long-term unattended noise monitoring. This equipment complies with Australian Standard 1259.2–1990 *Acoustics – Sound Level Meters* and is designated as a Type 1 and Type 2 instrument suitable for field use.

The measured data is processed statistically and stored in memory every 15 minutes. The equipment was calibrated prior and subsequent to the measurement period using a Rion NC-73 sound level calibrator. There were no significant variances observed in the reference signal between the pre-measurement and post-measurement calibrations. Instrument calibration certificates have also been included in Attachment 1.

METEOROLOGICAL CONSIDERATION DURING MONITORING

For the long-term attended monitoring, meteorological data for the relevant period were provided by the Bureau of Meteorology, which was considered representative of the site for throughout the monitoring period.

DESCRIPTORS & FILTERS USED FOR MONITORING

Noise levels are commonly measured using A-weighted filters and are usually described as dB(A). The "A-weighting" refers to standardised amplitude versus frequency curve used to "weight" sound measurements to represent the response of the human ear. The human ear is less sensitive to low frequency sound than it is to high frequency sound. Overall A-weighted measurements quantify sound with a single number to represent how people subjectively hear different frequencies at different levels.

Noise environments can be described using various descriptors depending on characteristics of noise or purpose of assessments. For this survey the L_{A90} was used to analyse the monitoring results. The statistical descriptors L_{A90} measures the noise level exceeded for 90% of the sample measurement time, and is used to describe the “Background noise”. Background noise is the underlying level of noise present in the ambient noise, excluding extraneous noise or the noise source under investigation.

Measurement sample periods were fifteen minutes. The Noise -vs- Time graphs representing measured noise levels at the noise monitoring location are presented in Attachment 3.

ATTENDED NOISE MONITORING

NOISE MONITORING EQUIPMENT

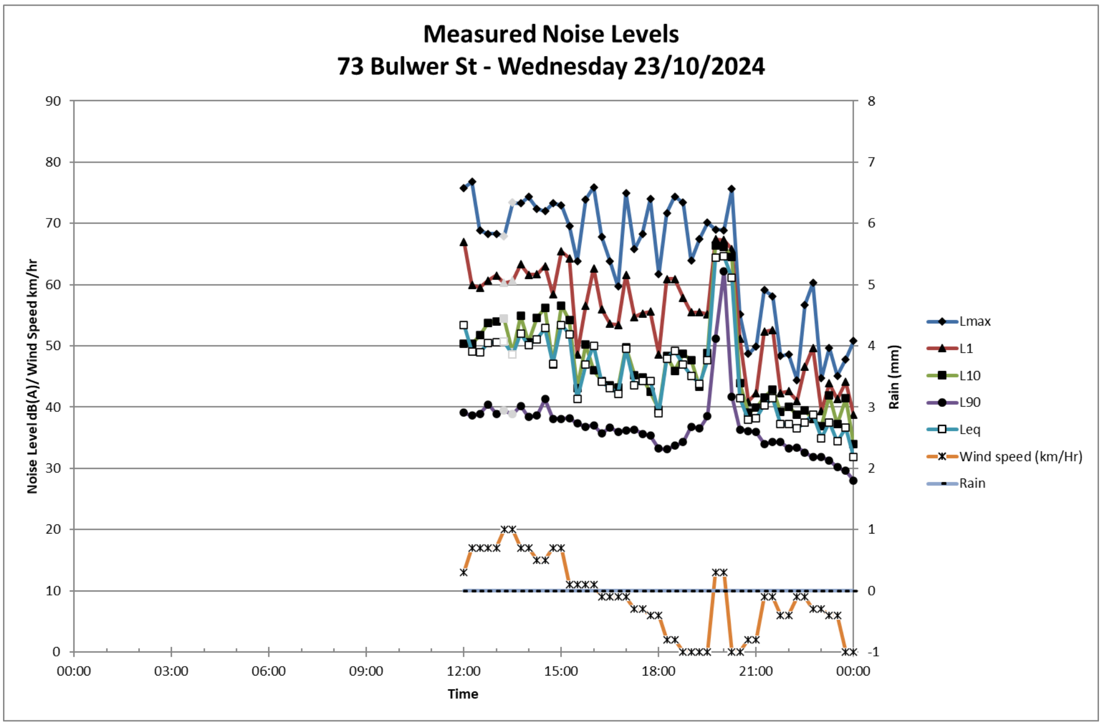
The attended short-term noise monitoring was carried out using a SVANTEK SVAN957 Class 1 Precision Sound Level Meter. The instrument was calibrated by a NATA accredited laboratory within two years of the measurement period. The instrument sets comply with AS 1259 and was set on A-weighted, fast response.

The microphone was positioned at 1.5 metres above ground level and was fitted with a windsock. The instrument was calibrated using a Rion NC-73 sound level calibrator prior and subsequent to the measurement period to ensure the reliability and accuracy of the instrument sets. There were no significant variances observed in the reference signal between the pre-measurement and post-measurement calibrations. Instrument calibration certificates have also been included in Attachment 1.

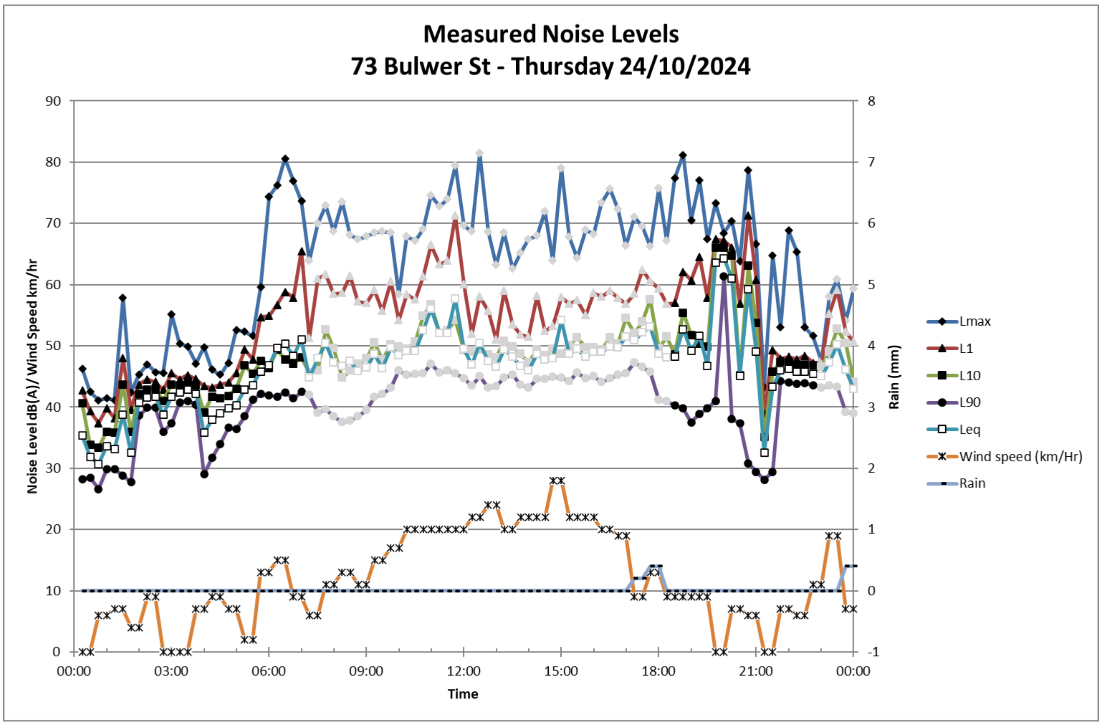
WEATHER CONDITIONS
It was clear, fine without significant breeze.

METHODOLOGY
The attended noise measurements were carried out generally in accordance with Australian Standard AS 1055-1997 "Acoustics – Description and Measurement of Environmental Noise".

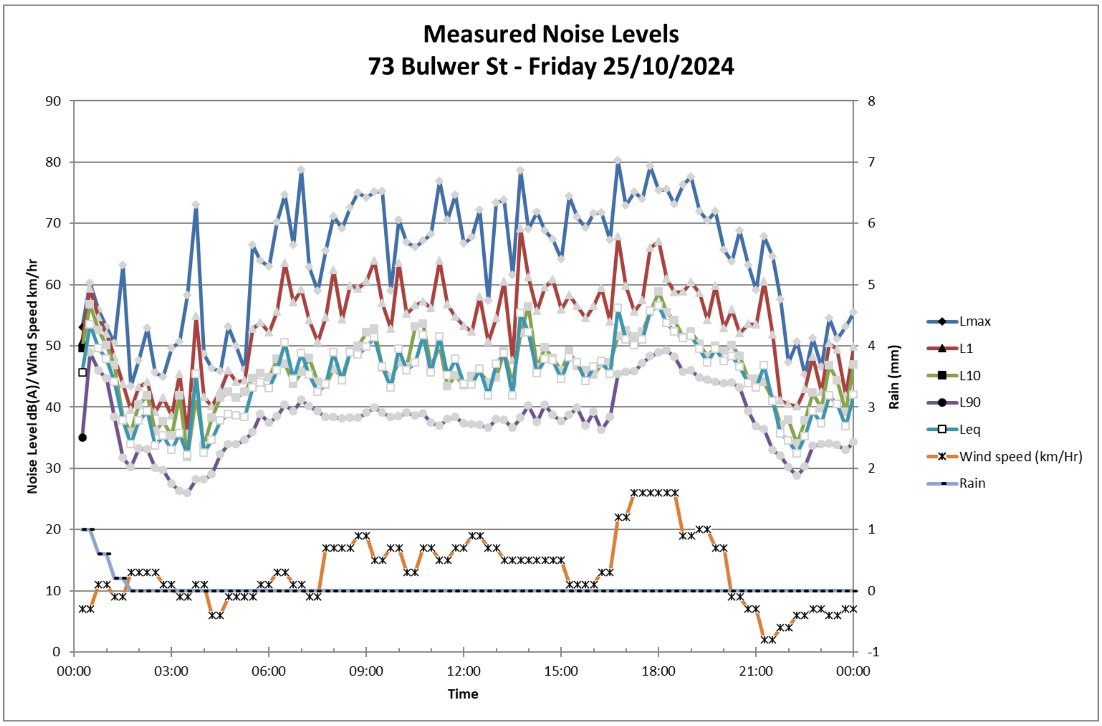
Attachment 4: Logger Graphs

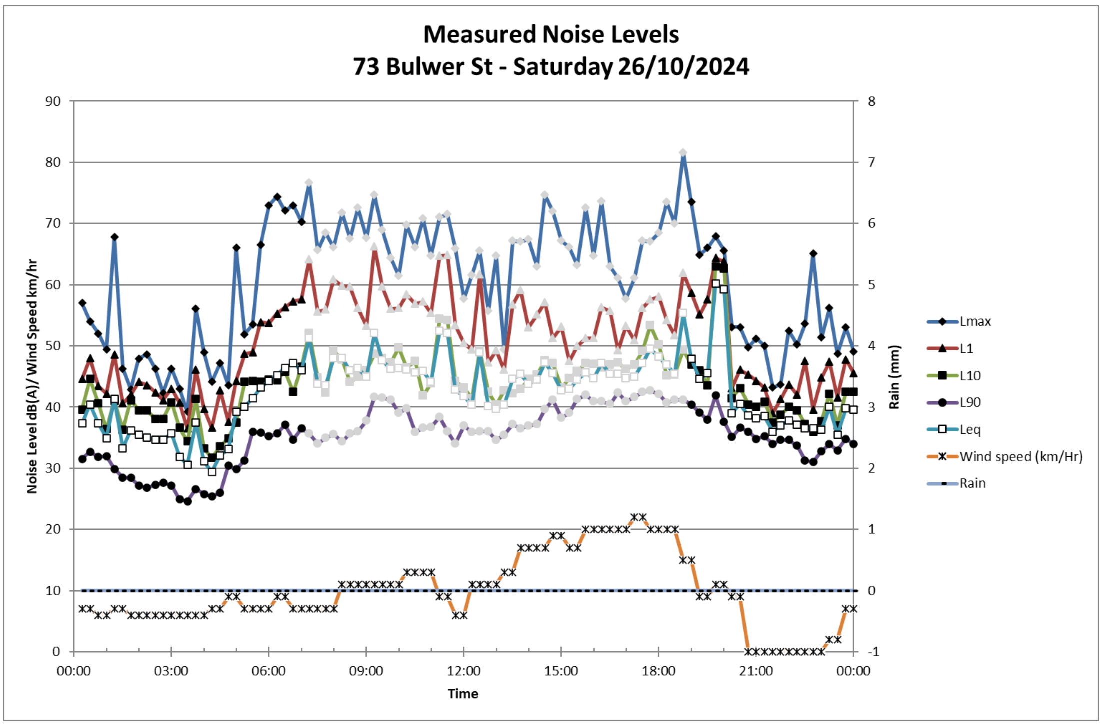


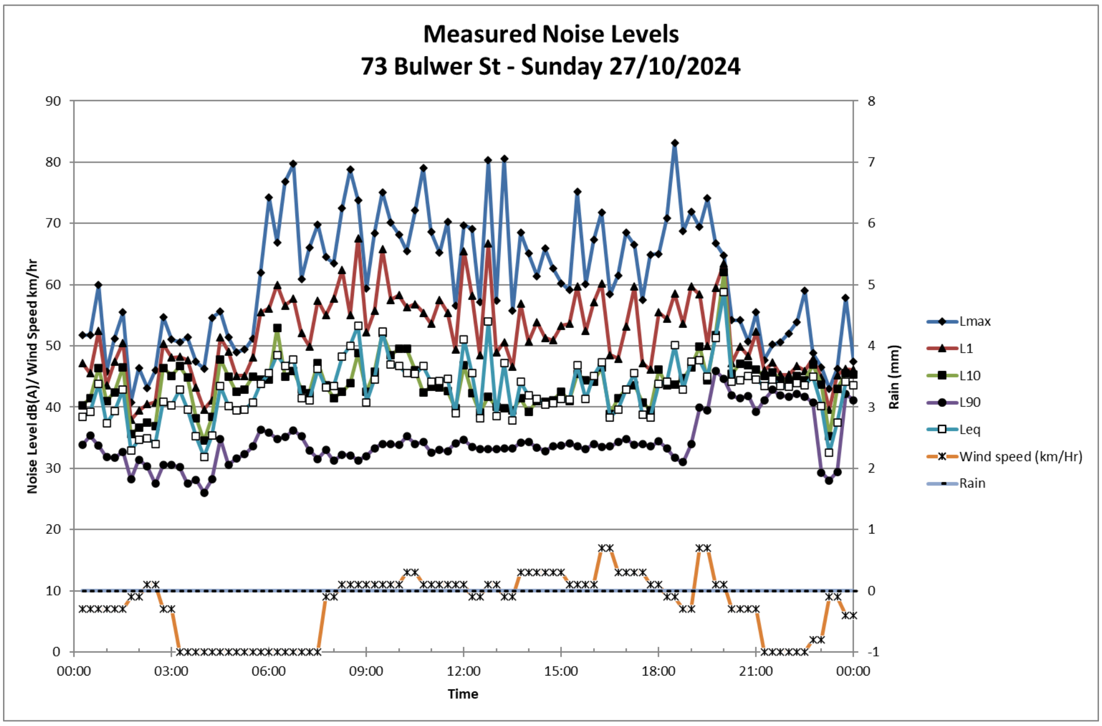
Measured Noise Levels
73 Bulwer St - Wednesday 23/10/2024
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain

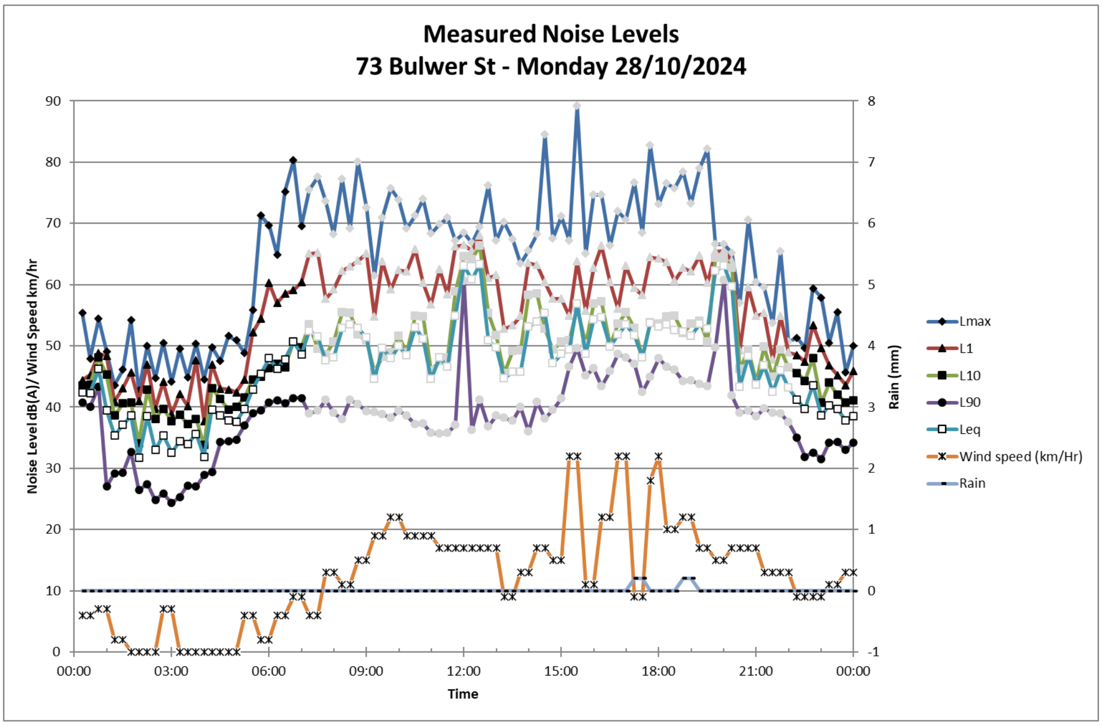


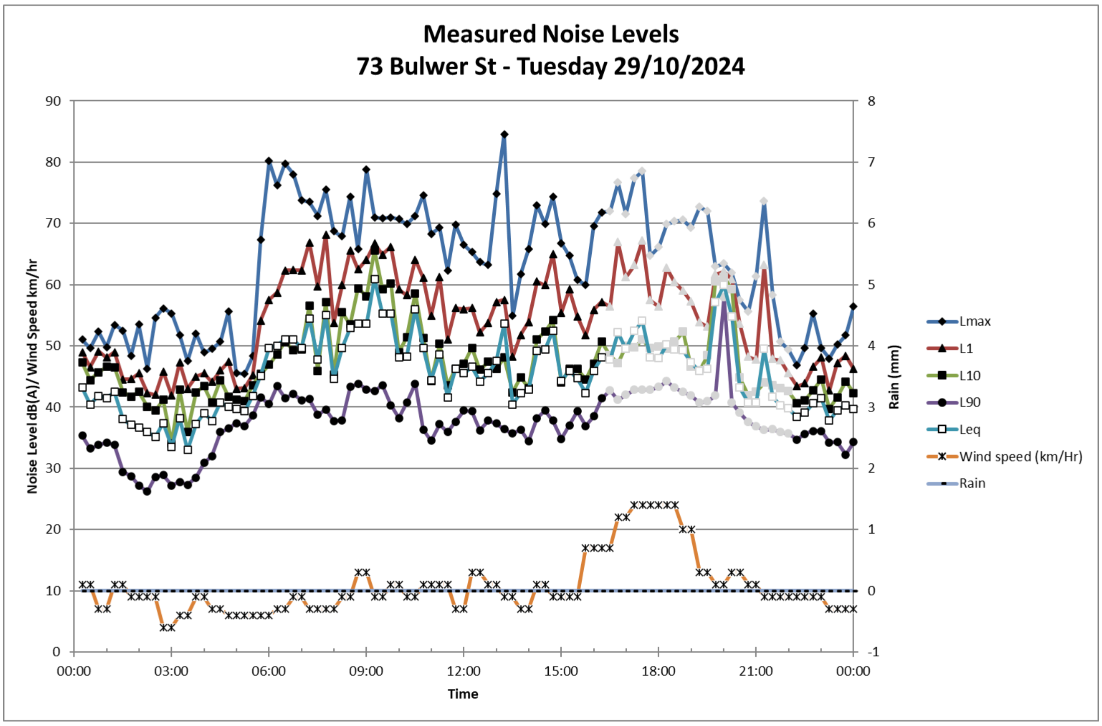
Measured Noise Levels
73 Bulwer St - Thursday 24/10/2024
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain


Measured Noise Levels
73 Bulwer St - Friday 25/10/2024
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain

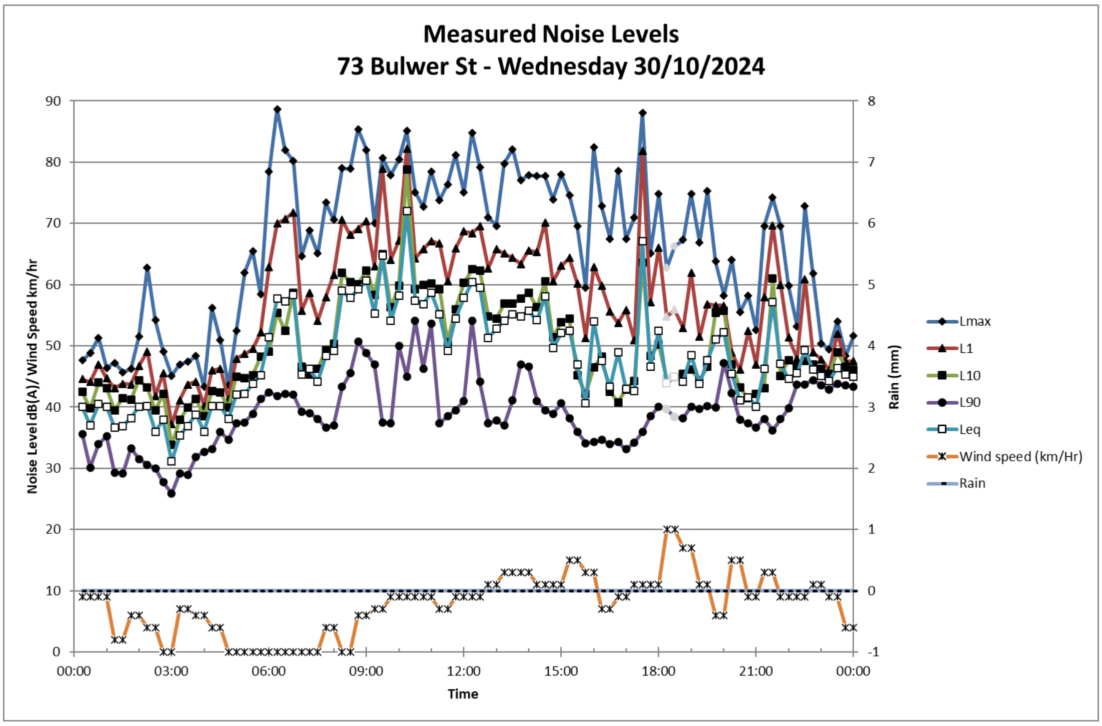

Measured Noise Levels
73 Bulwer St - Saturday 26/10/2024
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain


Measured Noise Levels
73 Bulwer St - Sunday 27/10/2024
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain

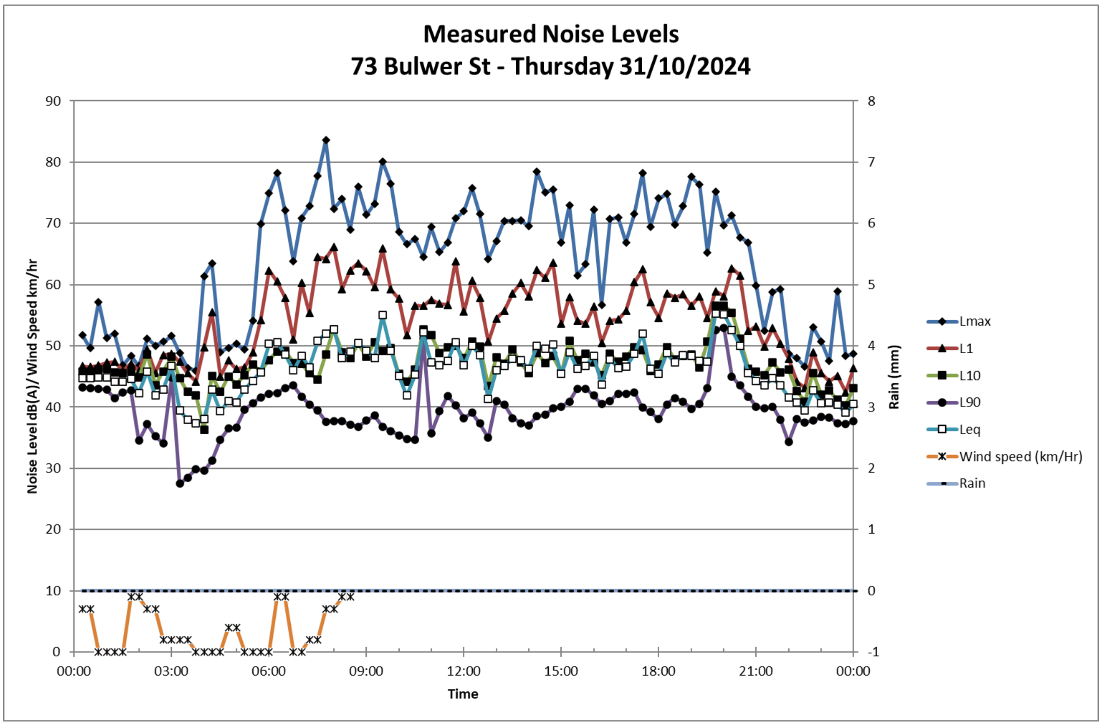

Measured Noise Levels
73 Bulwer St - Monday 28/10/2024
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain



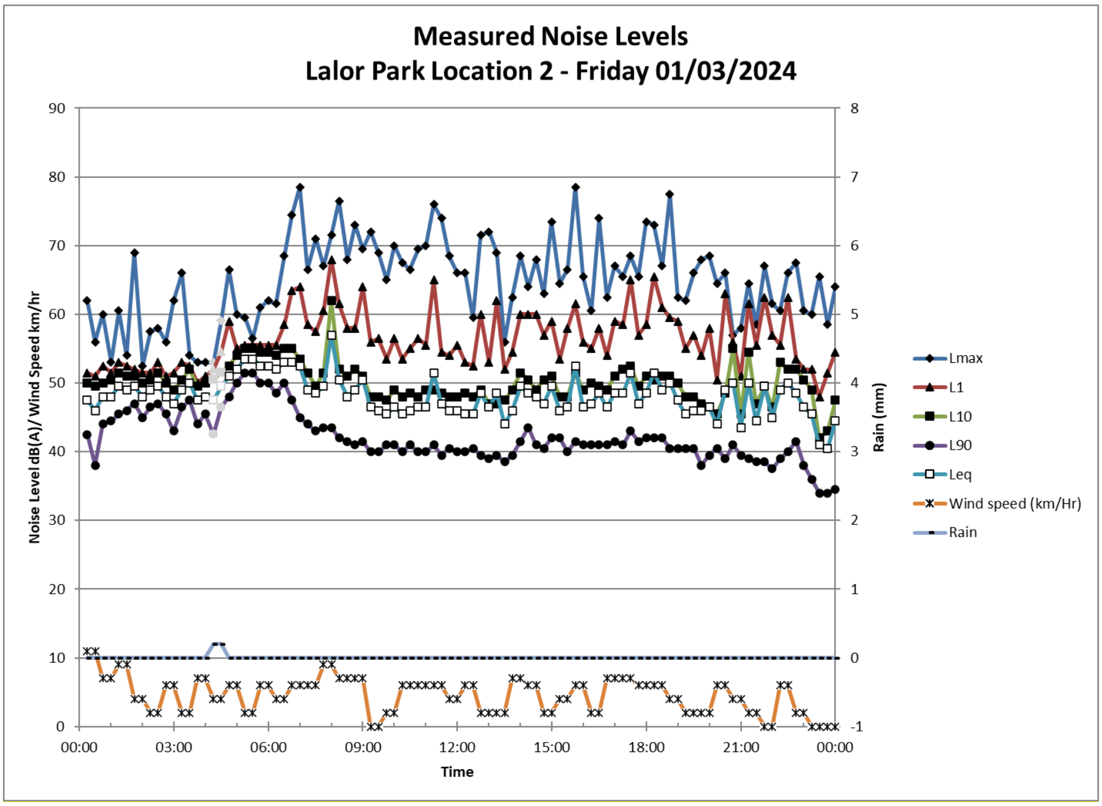
Measured Noise Levels
73 Bulwer St - Tuesday 29/10/2024
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain

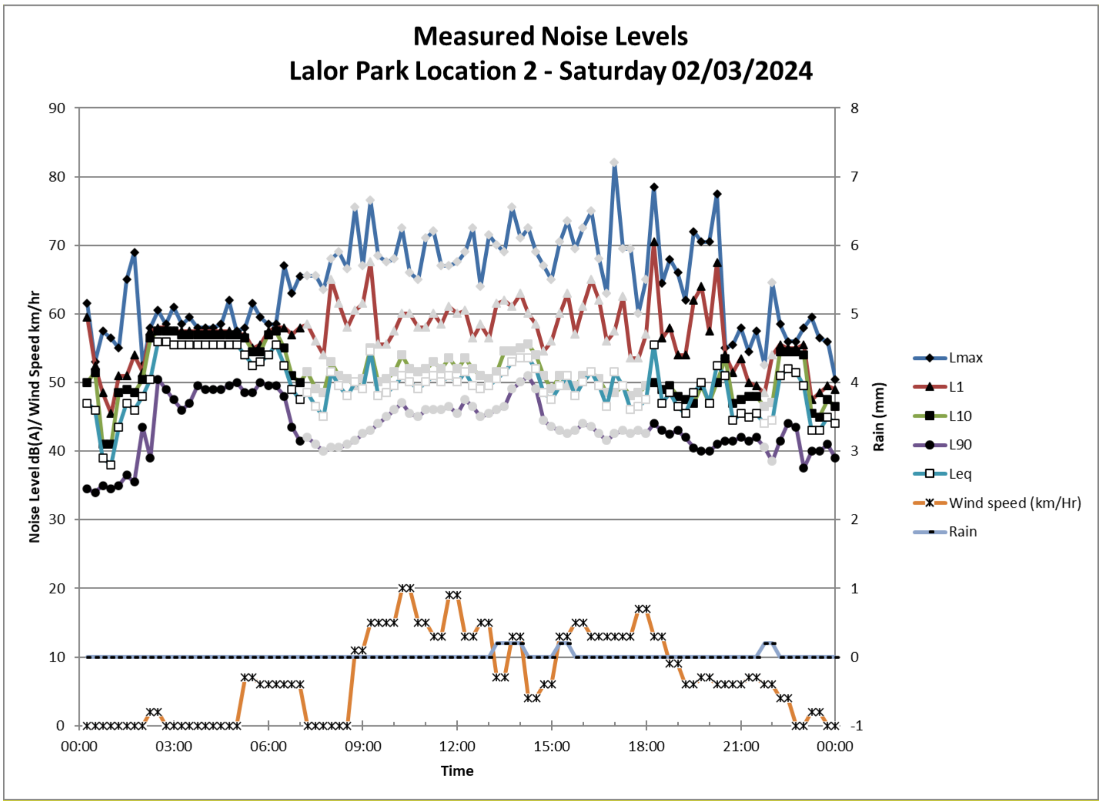


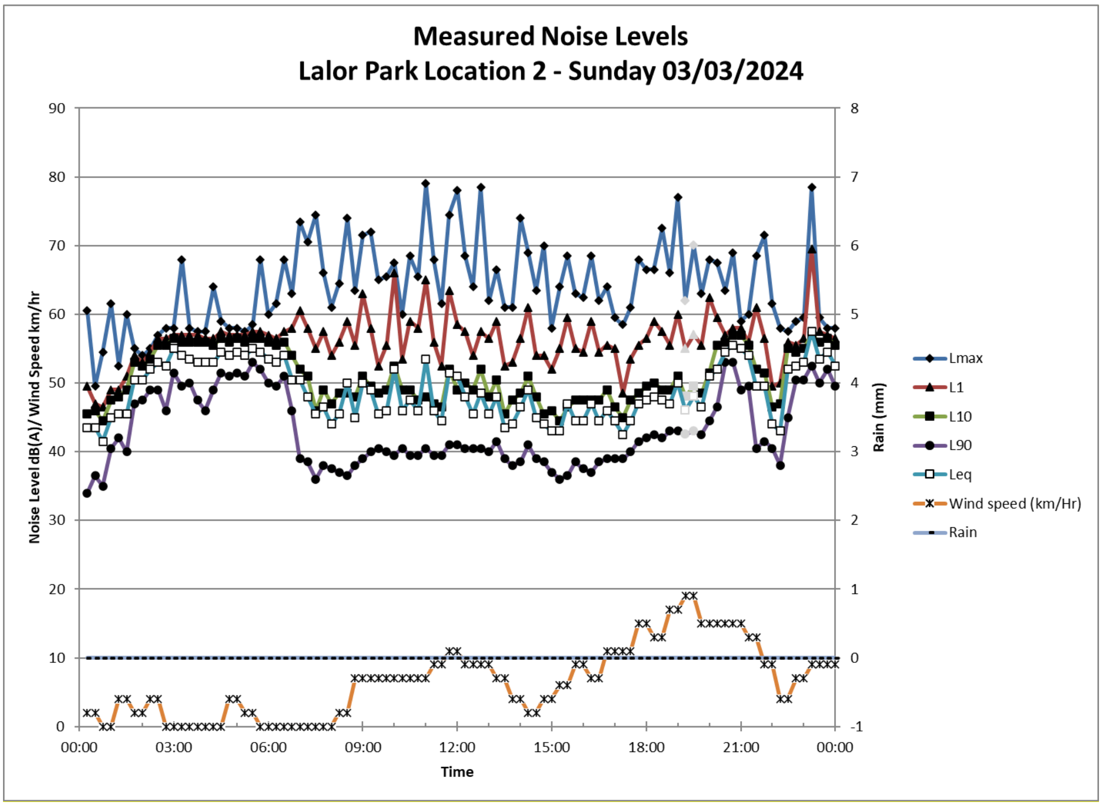
Measured Noise Levels
73 Bulwer St - Wednesday 30/10/2024
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain



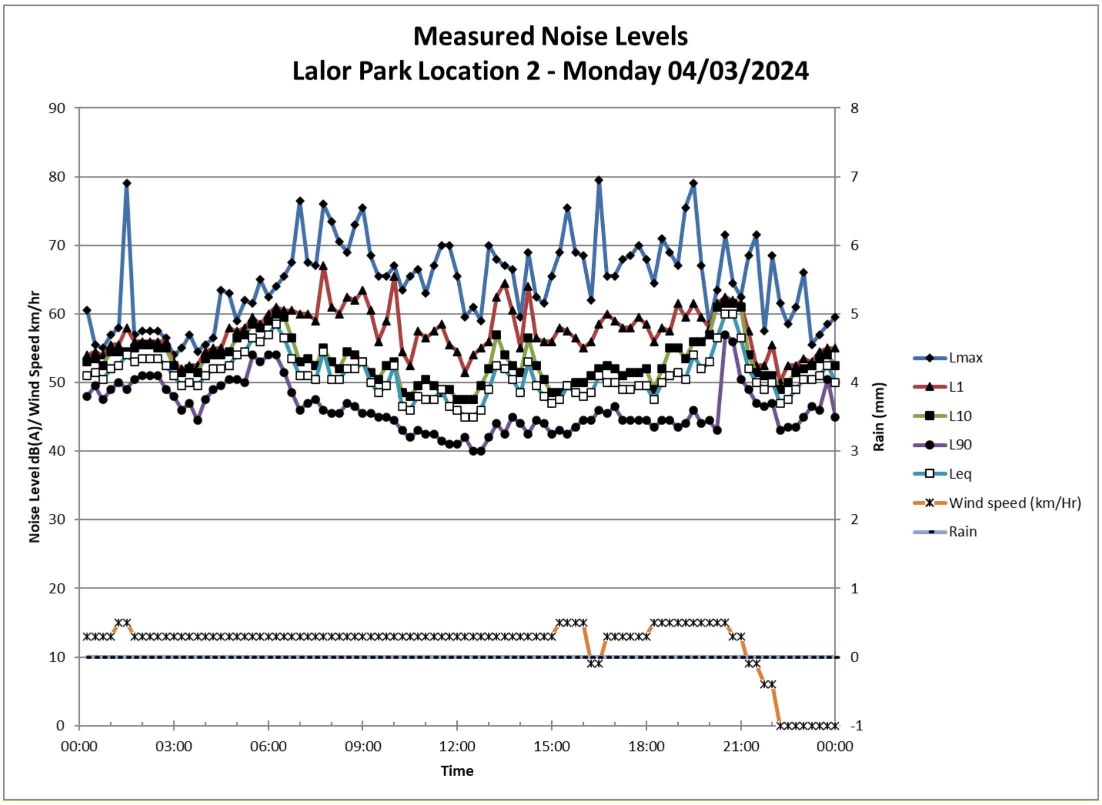
Measured Noise Levels
73 Bulwer St - Thursday 31/10/2024
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
0
10
20
30
40
50
60
70
80
90
-1
0
1
2
3
4
5
6
7
8
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain


Measured Noise Levels
Lalor Park Location 2 - Friday 01/03/2024
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain

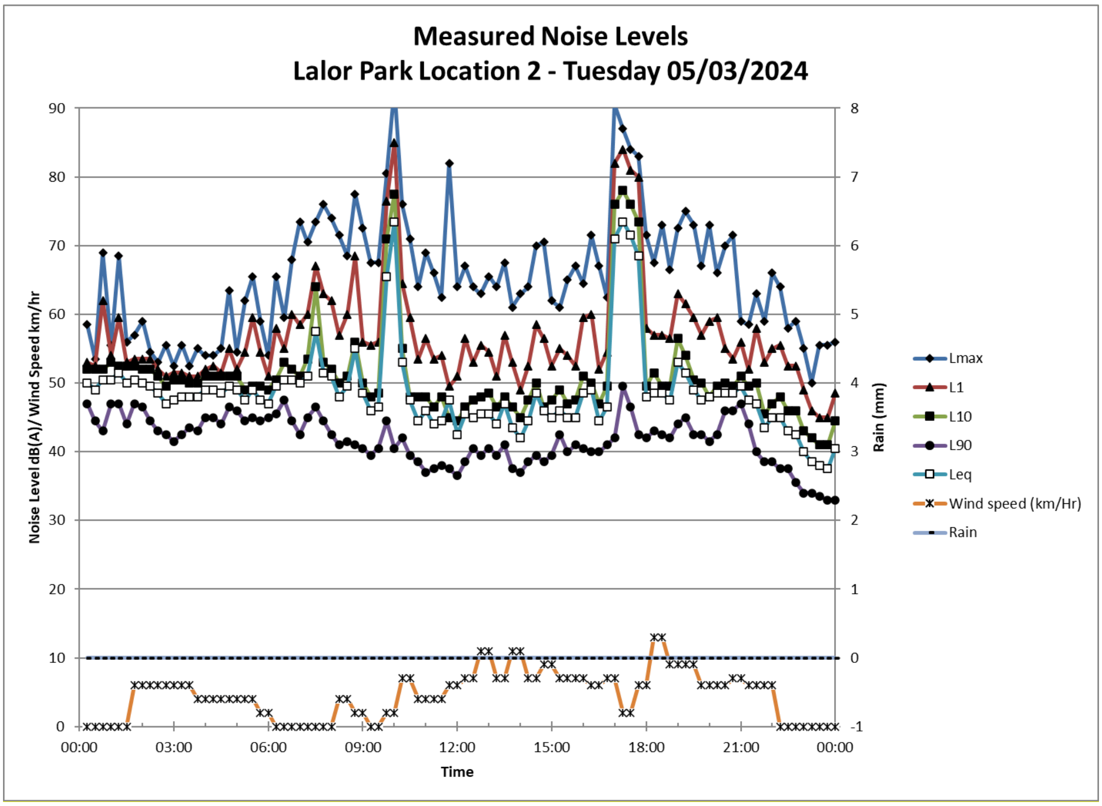

Measured Noise Levels
Lalor Park Location 2 - Saturday 02/03/2024
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain

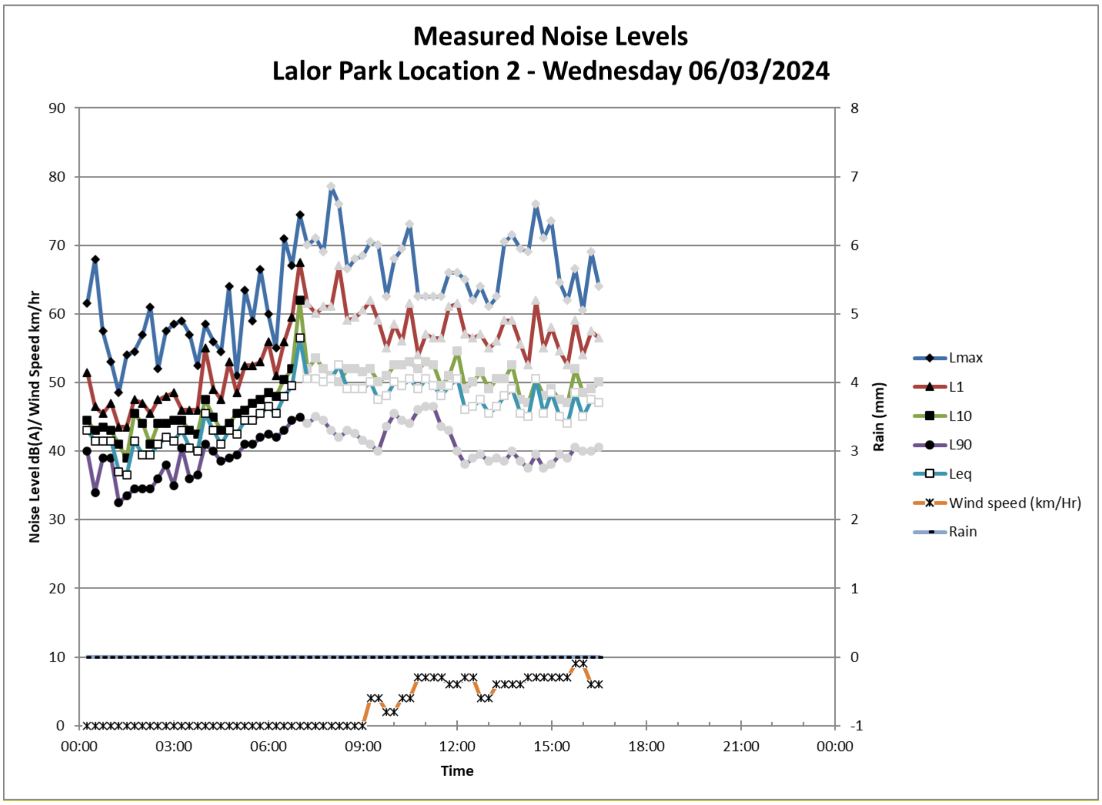


Measured Noise Levels
Lalor Park Location 2 - Sunday 03/03/2024
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain



Measured Noise Levels
Lalor Park Location 2 - Monday 04/03/2024
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain


Measured Noise Levels
Lalor Park Location 2 - Tuesday 05/03/2024
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain


Measured Noise Levels
Lalor Park Location 2 - Wednesday 06/03/2024
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain