NOISE IMPACT ASSESSMENT
FOR COBRA WASTE SOLUTIONS PTY LTD
30 LOFTUS ROAD, YENNORA NSW

Prepared for: Cobra Waste Solutions Pty Ltd

Prepared by: Victoria Hale, Senior Environmental Scientist
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Benbow ENVIRONMENTAL

Engineering a Sustainable Future for Our Environment

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EXECUTIVE SUMMARY

Benbow Environmental has been engaged by Cobra Waste Solutions Pty Ltd to undertake a noise impact assessment for the proposed resource recovery to be located at Warehouse B 30 Loftus Road, Yennora. The facility would receive, handle and process Construction and Demolition (C&D) and Commercial and Industrial (C&I) waste. The amount of waste to be received and processed is estimated to be up to 150,000 tonnes per year.

The site is located within the industrial area of Yennora. The nearest residential receptors are located approximately 520 metres south-east of the site.

Noise emissions from the site were predicted by using noise modelling software, SoundPlan (V7.3).

This noise impact assessment has been prepared in accordance with the following guidelines and documents:

- NSW Environmental Protection Authority, Noise Policy for Industry 2017; and
- Department of Environment, Climate Change and Water NSW, Road Noise Policy (DECCW, 2011).

The primary noise sources include:
- Crusher;
- Shredder;
- Screens/separators;
- Front end loaders;
- Excavators; and
- Trucks.

External vehicle truck movements are proposed to occur from 6am-6pm. Therefore the rear roller shutter doors were modelled open 100% of the time during the daytime scenario and closed 100% of the time during evening and nighttime scenarios.

During the day, evening and night periods the operational noise levels are predicted to comply with the Noise Policy for Industry at all residential receivers for all considered weather conditions. Sleep disturbance is not expected to occur at any residential receiver.

During daytime operations noise levels are predicted to exceed the industrial amenity noise criteria at the neighbouring industrial site (R14: 30 A Loftus Road, Yennora) in the carpark by 9 dB(A). The noise levels would comply with the noise criteria of 68 dB(A) within the building located at R14 where workers would work the majority of the time. The dominant source is noise from the open roller shutter doors. Therefore it is recommended fast acting automatic roller shutter doors be installed to minimise noise impacts on neighbouring industrial premises.

The following noise control measures are recommended:

- Restrict external vehicle movements to: 6am-6pm;
- Roller shutter doors to be closed 6pm-6am; and
- Fast acting roller shutter doors to be installed and programmed to be closed when not in use.

With the above controls in place the site is expected to comply with the NSW EPA Noise Policy for Industry at all receivers for all operational scenarios.

Compliance with the guidelines set out in the NSW Road Noise Policy was predicted at all considered receptors.

No construction will take place therefore construction noise and vibration impacts are not expected.

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Attachment 4: Noise Logger Charts

1. INTRODUCTION

Benbow Environmental has been engaged by Cobra Waste Solutions Pty Ltd to undertake a noise impact assessment for the proposed resource recovery to be located at Warehouse B 30 Loftus Road, Yennora. The facility would receive, handle and process Construction and Demolition (C&D) and Commercial and Industrial (C&I) waste. The amount of waste to be received and processed is estimated to be up to 150,000 tonnes per year.

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Noise emissions from the site were predicted by using noise modelling software, SoundPlan (V7.3).

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1.1 SCOPE OF WORKS

This noise impact assessment has been limited to the following scope of works:

- Site inspection and review of the proposed site operations;
- Long term unattended noise monitoring and short term attended noise monitoring in accordance with relevant guidelines;
- Establish project specific noise levels;
- Determine all potential noise sources associated with the existing and proposed development;
- Collect required noise sources data;
- Predict potential noise impacts at the nearest potentially affected receptors to the site;
- Assess potential noise impacts against relevant legislation and guidelines;
- Recommend general ameliorative measures/control solutions (where required); and
- Compile this report with concise statements of potential noise impact.

To aid in the review of this report, supporting documentation has been referenced within this report. A glossary of terminology is included in Attachment 1.

2. PROPOSED DEVELOPMENT

2.1 SITE LOCATION

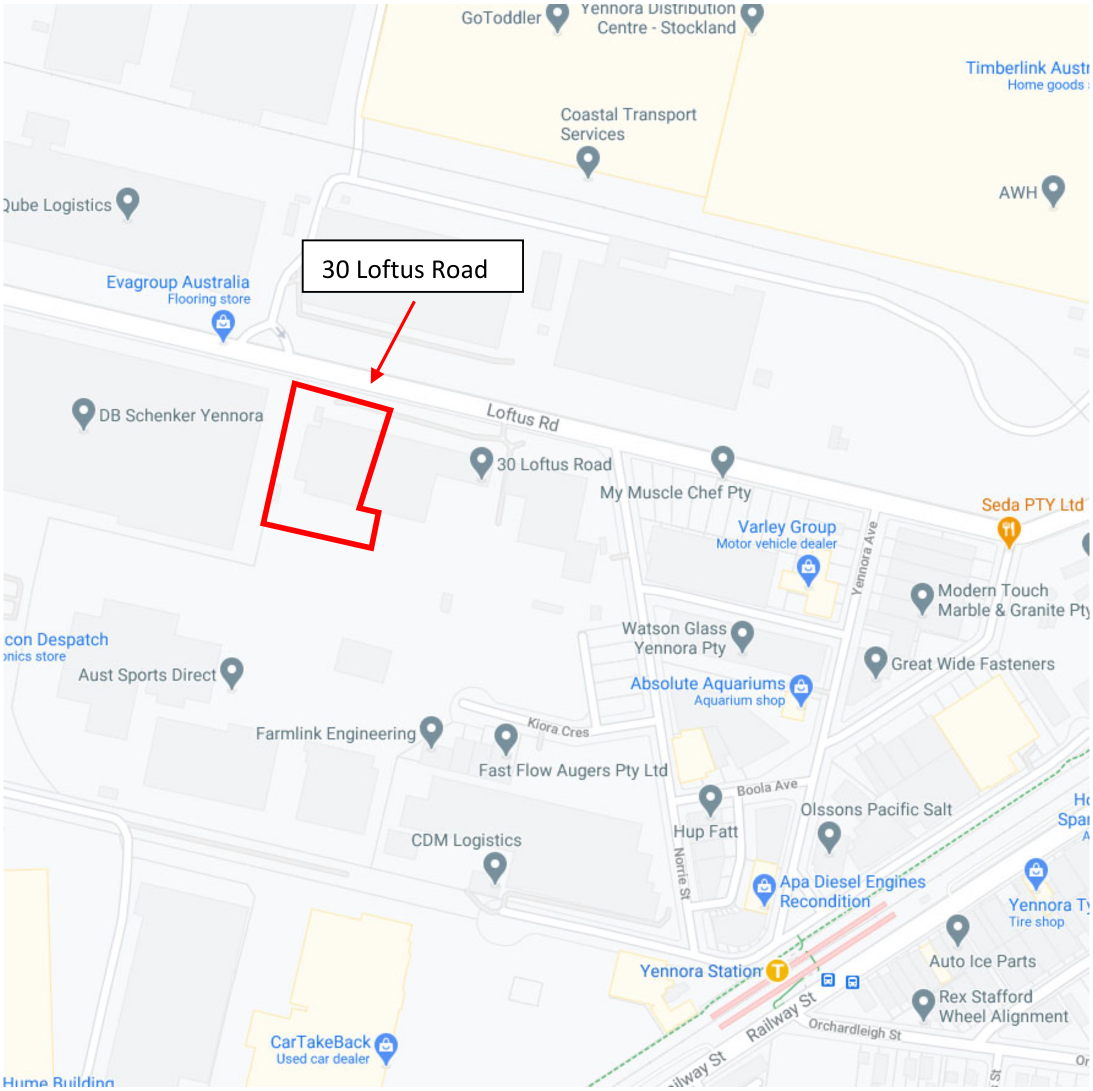
The site is located at Warehouse B, 30 Loftus Road, Yennora, Lot 8 DP 1233715 and is located in the middle of an industrial area.

The land is situated within the Local Government area of Cumberland Council.

The site location is shown in Figure 2-1 and the site aerial is presented in Figure 2-2.

The proposed site layout is shown in Figure 2-3.

Figure 2-1: Site Location



Source: Google Maps 2020

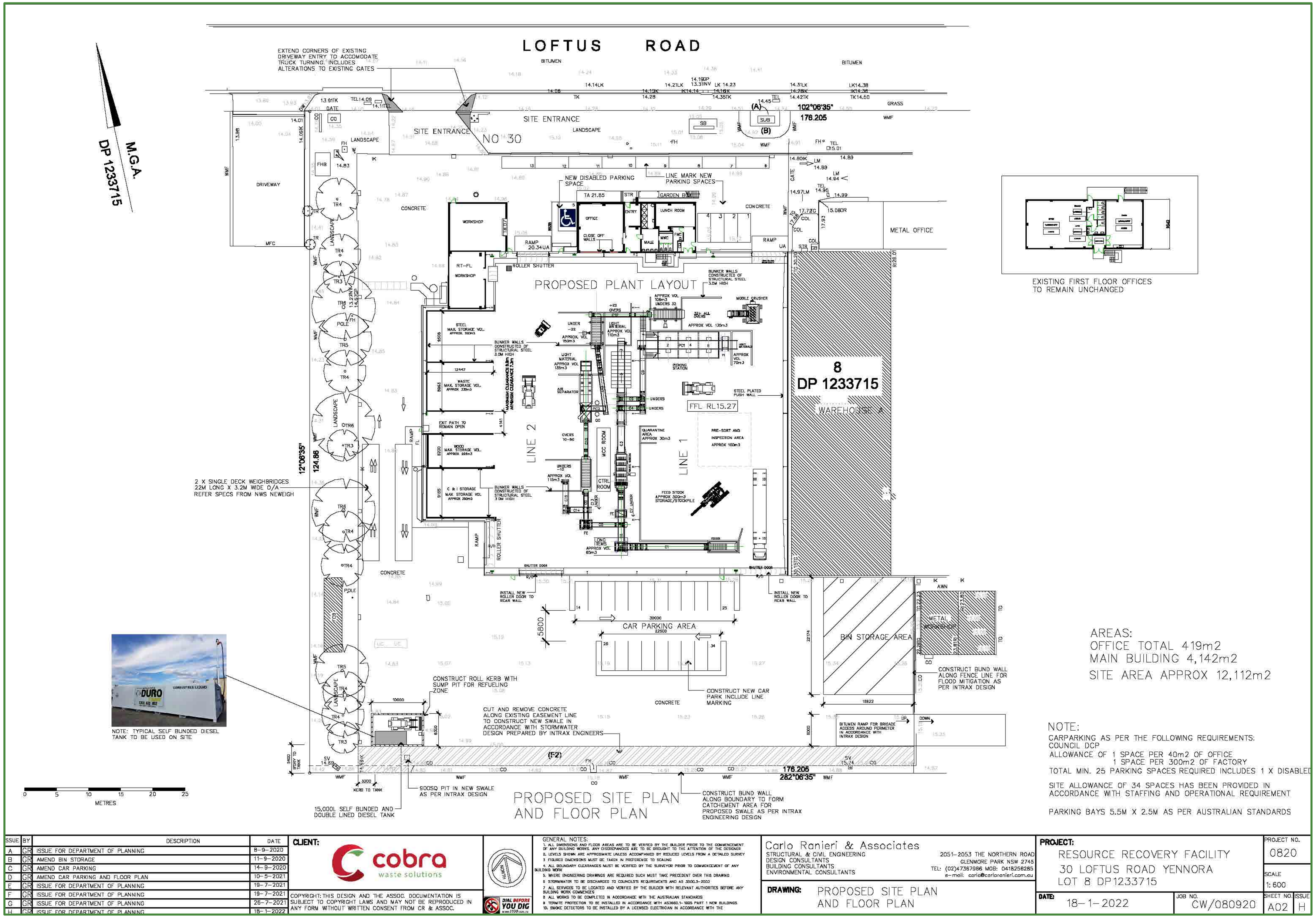
↑N Not to scale	LEGEND: Site ☐	Benbow Environment 25-27 Sherwood Street Northmead NSW 2152

Figure 2-2: Site Aerial

Source: Six Maps 2020

↑N Not to scale	LEGEND: Site	Benbow Environment 25-27 Sherwood Street Northmead NSW 2152

Figure 2-3: Proposed site layout



2.2 Process Description

The proposed development is for the establishment and operation of a resource recovery facility that would accept, process and store construction and demolition (C&D) and commercial and industrial (C&I) waste. All resource recovery activities and storage of waste would be undertaken within an existing building.

A technologically advanced resource recovery system has been developed specifically for this facility with components to be pre-fabricated off site for installation. A designated pre-sorting and materials inspection area would be located at the start point of the system. The system would consist of a feeder (feed hopper), a waste screen, a series of waste/flip flow screens (3) for sorting heavy and light material, conveyors, air separators, an enclosed picking station and three (3) magnets to enable efficient recovery and separation of material. Separated material would be captured in bays or bins at various points on the line and then transferred to storage bunkers within the building. A small crusher would be located at the end of the system for crushing of any larger materials.

Storage bunkers for waste would be established inside the building and would be constructed of structural steel walls. There would be storage bunkers and bins located along the processing line to capture recovered material at various points. These storage bunkers and bins are expected to store a maximum of 2,600 $m^3$of waste wholly within the building at any one time. The layout of the system would facilitate a regular turnover of waste through the system therefore requiring limited storage space.

The site contains existing infrastructure that would be utilised for the proposed development. This includes extensive fire protection equipment and a sprinkler system that has recently been installed within the building by the owner of the property under a separate modification application. On-site car parking would be established in the rear and front hardstand area with consideration given to ease of on-site vehicle movements. Two weighbridges would also be installed on the eastern driveway of the site.

The following process steps would be undertaken:

1. All trucks arriving at the site would enter via the existing driveway access on Loftus Road and be directed over the weighbridge along the western driveway. This would be the first inspection point where the contents of the truck would be inspected and paperwork regarding the waste load would be reviewed. Trucks with conforming loads would be weighed on the weighbridge then directed inside the building. Non-conforming loads would be turned away. Records of all truck loads entering the facility would be maintained at the weighbridge.

2. Loads of waste material would be unloaded in the pre-sort inspection area inside the building for initial separation. This would be the second inspection point in the process. Any non-conforming material would be reloaded onto the truck and removed in accordance with a waste inspection procedure. Conforming loads would be moved to the feedstock area for processing or to the C&I bunker for storage depending on the shift. At this point, large items can be manually removed and stored in the appropriate storage bunker. A quarantine area (reject bunker) on site would be established to deal with non-conforming wastes that inadvertently are not picked up at the inspection points.

3. A front end loader would transfer the pre-sorted material to the feedstock area and load it into the infeed hopper/shredder at the start of the process.

4. The material would be fed into the system and conveyed to long items separator for removal of any over-size material. Long items fall into the bunker and be manually sorted into appropriate storage bunkers.

5. A magnet would remove ferrous material which would fall into a separate storage bin and the remaining material would be sent through a waste screen.

6. At this point lighter material (Under -70) is directed down a separate line where an electrical magnet would remove ferrous material which would fall into a storage bin.

7. This lighter material line would pass through a flip flow screen where (-10mm soil) would fall into a bunker. The remaining material would send through an NIHOT DDS air separator where light material would be removed then two further flip flow screens for separation of under -22mm material and (9) for separation of under -32mm material that would fall into separate bunkers.

8. The overs (32+ mm) material would be put through a crusher. Crushed aggregates would be stored in a bunker.

9. The heavier material waste stream would be conveyed from the waste screen to an ABP air separator where light material would be removed and fall into a bunker. The heavier material would then pass through an enclosed manual picking station where it is separated into paper/cardboard, wood, plastic and other recyclable material. This material would be stored in bins below the picking station.

10. Recovered waste would be transferred to designated storage bunkers within the building as required then loaded into trucks for transport to various facilities for reuse or further processing. General non-recyclable waste would be transferred to a designated storage bunker for removal to landfill.

2.3 HOURS OF OPERATIONS

The proposed facility is requesting approval to operate 24 hours per day, 7 days per week. Two eight (8) hour shifts – day and afternoon shifts would operate on Monday to Saturdays with the remaining hours and Sundays being for general maintenance. Vehicle deliveries will be restricted to 6am-6pm. This will allow for roller shutter doors to remain closed during evening and night.

A typical daily schedule of activities and their hours of operation is provided below.

Table 2-1: Proposed Hours of Operation

Activity	Day	Time
Waste Processing	Monday to Saturday	7:00am to 11:00pm
	Sundays & Public Holidays	Nil
Cleaning and Maintenance (as required)*	Monday to Sunday	24 hours
	Public Holidays	Nil
Incoming and outgoing truck loads	Monday to Saturday	6:00am to 6:00pm
	Sundays & Public Holidays	Nil

*Staff to work as required – maintenance staff from day or afternoon shift as overtime).

3. NEAREST SENSITIVE RECEPTORS

Table 3-1 identifies the nearest sensitive receivers that have the potential to be affected by the proposal. The aerial photographs of the sensitive receivers are shown in Figure 3-1. These receivers were selected based on their proximity and directional bearing from the subject site.

Table 3-1: Nearest Sensitive Receivers

Receiver ID	Street Address	Lot & DP	Distance from Site (m)	Direction from Site	Type of Receiver
R1	2A Ellis Parade, Yennora	1 DP 553522	520	SE	Residential
R2	45 Railway Street, Yennora	3 DP 574732	775	E	Residential
R3	66 Byron Road, Guildford	2 DP 975284	875	NE	Residential
R4	58 Tamplin Road, Guildford	7 DP 31391	775	NNE	Residential
R5	45 Dennistoun Avenue, Guildford West	118 DP 10981	76	NNW	Residential
R6	89 Dennistoun Avenue, Guildford West	50 DP 39199	940	NW	Residential
R7	28 Ace Avenue, Fairfield	30 DP 539236	850	WSW	Residential
R8	17 Pine Road, Fairfield	39 DP 13605	800	SW	Residential
R9	104 Railway Street, Yennora	5 DP 812983	630	S	Residential
R10	1-9 Orchardleigh Street, Yennora	1 DP 447926	505	SW	School
R11	16 Junction Street, Old Guildford	1 DP 509537	1,005	E	Childcare Centre
R12	405 The Horsley Drive, Fairfield	1 DP 1063605	750	WSW	School
R13	198 Fairfield Rd, Yennora NSW 2161 (Fairfield Road Park)	23 DP 610787	880	W	Active Recreation
R14	30 A Loftus Road, Yennora	8 DP 1233715	Adjacent	E	Industrial
R15	38 Pine Road, Yennora	200 DP 105758	Adjacent	W	Industrial
R16	14-54 Dennistoun Avenue, Yennora	21 DP 1171076	Adjacent	N	Industrial
R17	7 Kiora Crescent Yennora	7 DP1233715	Adjacent	S	Industrial

Figure 3-1: Nearest Sensitive Receivers

Source: Google Earth, 2021

↑N Not to scale	LEGEND: Site Boundary Sensitive Receiver	Benbow Environmental 25-27 Sherwood Street, Northmead NSW 2152

4. 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.

Unattended long-term noise monitoring was undertaken from 24th September 2019 to 7th October 2019 at a representative residential location.

4.1 NOISE MONITORING EQUIPMENT AND METHODOLOGY

The background noise level measurements were carried out using a Svantek SVAN 957 Precision Sound Level Meter (attended noise monitoring), and one (1) Acoustic Research Laboratories statistical Environmental Noise Logger, type EL-215 (unattended noise monitoring). The instrument sets complied with AS IEC 61672.1–2004 and was calibrated by a NATA accredited laboratory within two years of the measurement period. Calibration certificates have been included in Attachment 2.

Measurements of background and ambient noise levels were carried out in accordance with the Australian Standard AS 1055–1997 *Acoustics – Description and measurements of environmental noise* – Part 1 and Part 2 and the NSW EPA Noise Policy for Industry 2017.

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 instruments were 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 and 1.5 meters above ground level.

Details of the instrumentation and setting utilised are provided in Table 4-1.

Table 4-1: Instrumentation and Setup Details

Type of Monitoring	Equipment	Serial Number	Setup Details
Long-term Unattended	ARL-215	194702	A-weighted Fast Response 15 minute integration period
Short-term Attended	Svantek SVAN957 Type 1 Integrating Sound and Vibration analyser	15335	Three channels: A-weighted Fast Response C-weighted Fast Response A-weighted Impulse Response 15 minute integration period 1/3 octave band recorded every 100 ms Logger file Recorded at steps of 100 ms

4.2 Measurement Locations

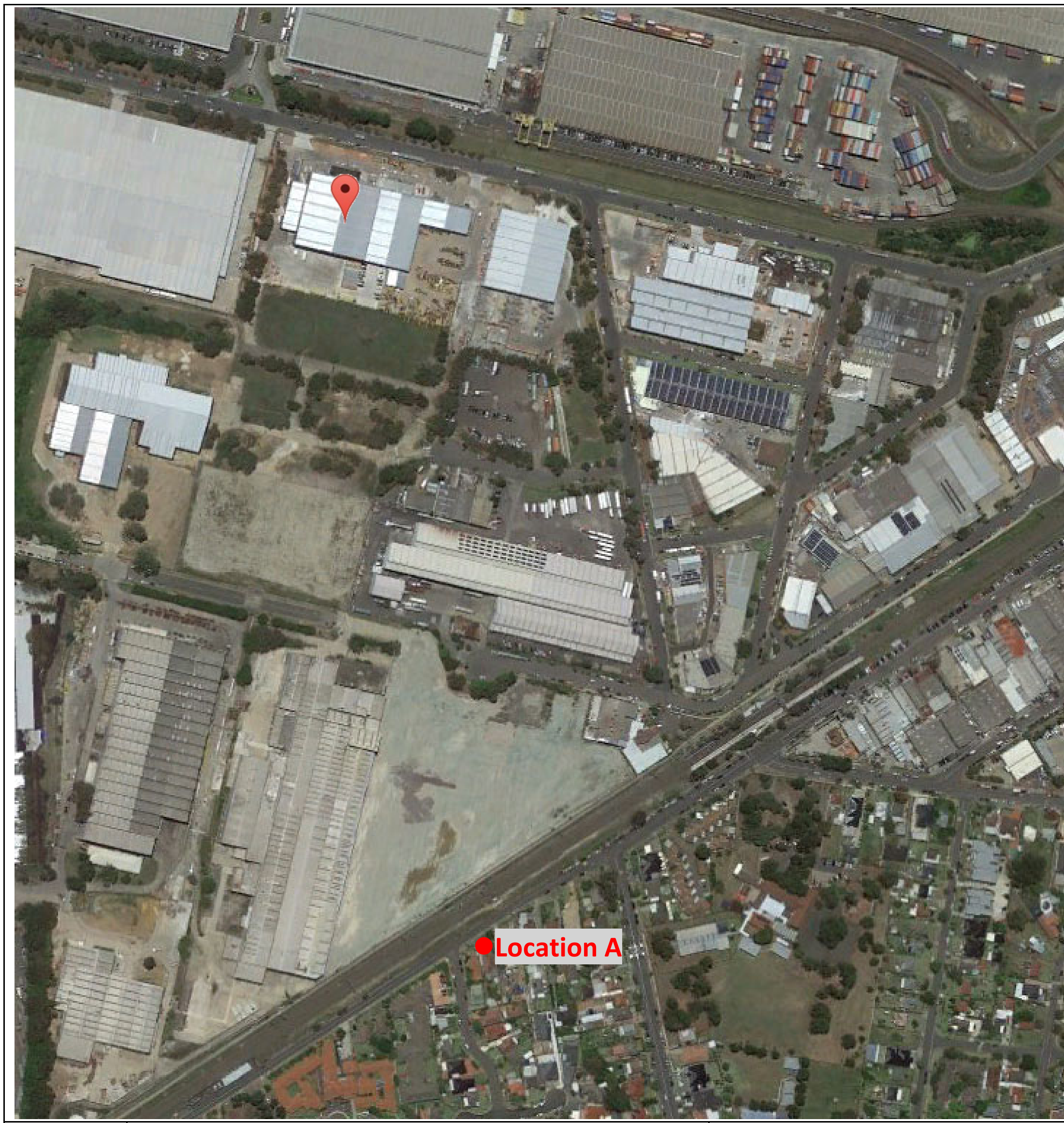
The environmental noise logger was utilised to measure the existing ambient and background noise levels. Unattended long-term noise monitoring was undertaken from 24th September 2019 to 7th October 2019 at one (1) residential location. An attended noise measurement was conducted on 24th September 2019 at one (1) residential location at 95 Railway Street, Yennora.

The noise logger location is shown in Figure 4-1 and listed in Table 4-2. Noise logger charts are presented in Attachment 4.

Table 4-2: Noise Monitoring Location

Monitoring Location	Methodology	Address
A	Attended monitoring and unattended monitoring	95 Railway Street, Yennora

Figure 4-1: Logger Location



↑N	LEGEND: Site Logger Location ●	Benbow Environmental 25 Sherwood Street, Northmead NSW 2152

4.3 Measured Noise Levels

4.3.1 Short Term Operator Attended Noise Monitoring Results

Attended noise monitoring was conducted on Monday the 24th September 2019 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 industrial sources. The results of the short-term attended noise monitoring are displayed in Table 4-3.

The attended measurements showed that the background noise levels were dominated by road traffic and noise from trains passing by.

Table 4-3: Operator Attended Noise Measurements, dB(A)

Location & Date/Time	L_{Aeq}	L_{A90}	L_{A10}	L_{A1}	Comments
Location A Tuesday 24/09/2019 11:50am Daytime Period	63	42	67	74	Truck Passing <79 dB(A) Car Passing <75 dB(A) Train <74 dB(A) Plane <58 dB(A) Residential Noise <57 dB(A) Birds <56 dB(A) Nearby work site <56 dB(A)

4.3.2 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. That is, 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 4-4. Daily noise logger graphs have been included in Attachment 3.

Only 5 full day time periods were obtained during the long term unattended measurements due to inclement weather conditions. From the logger graphs provided in Attachment 3 the 5 days are representative of the daily noise patterns throughout the period of monitoring, furthermore the development will operate during the night which will provide a more stringent criterion. Therefore additional monitoring is not required.

Table 4-4: Unattended Noise Monitoring Results at 95 Railway Street, Yennora 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
24/09/2019	73	73	71	67	67	64	41	43	41	63	62	60
25/09/2019	-	74	72	-	67	60	-	42	40	-	63	60
26/09/2019	-	72	72	-	67	59	-	42	38	-	62	62
27/09/2019	72	73	71	67	67	60	42	46	38	63	63	60
28/09/2019	-	72	-	-	67	-	-	43	-	-	61	-
29/09/2019	-	71	71	-	66	57	-	42	36	-	61	58
30/09/2019	-	73	72	-	67	58	-	40	36	-	62	60
1/10/2019	-	73	71	-	67	58	-	44	37	-	62	60
2/10/2019	-	-	-	-	-	-	-	-	-	-	-	-
3/10/2019	-	-	-	-	-	-	-	-	-	-	-	-
4/10/2019	-	-	-	-	-	-	-	-	-	-	-	-
5/10/2019	72	71	-	68	66	-	43	41	-	63	62	-
6/10/2019	71	71	71	66	65	60	42	43	38	61	61	59
7/10/2019	70	-	70	64	-	56	39	-	38	59	-	58
Average	**72**	**72**	**71**	**67**	**67**	**59**	*	*	*	*	*	*
Median (RBL)	*	*	*	*	*	*	**42**	**42**	**38**	*	*	*
Logarithmic Average	*	*	*	*	*	*	*	*	*	**62**	**62**	**60**

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.
A) Value removed as an outlier in total logarithmic average

5. 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 Bankstown Airport Automatic Weather Station (AWS ID 066137). In this Section, an analysis of the 2019 weather data has been conducted to establish whether significant winds are characteristic of the area.

5.1 WIND EFFECTS

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

5.1.1 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.

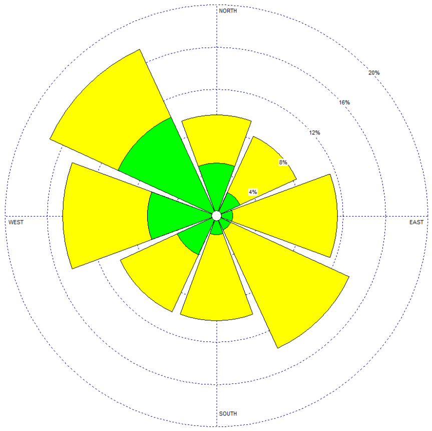
The concentric circles in each wind rose are the axis, which denote frequencies. In comparing the plots it should be noted that the axis varies between wind roses, although all wind roses are similar in size. The frequencies denoted on the axes are indicated beneath each wind rose.

5.1.2 Local Wind Trends

Seasonal wind rose plots for this site utilising the Bankstown Airport AWS data have been included in Figure 5-1 to Figure 5-3.

Figure 5-1: Wind Rose Plots – BOM Bankstown Airport AWS ID 066137 – 2019 – Day time

All Seasons

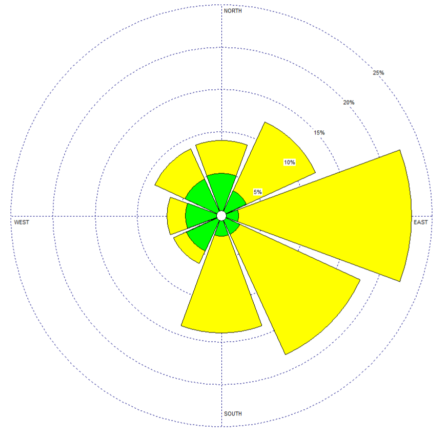


Average Wind Speed: 4.00 m/s

Calms Frequencies: 4.47%

Axis Frequencies: 4%, 8%, 12%, 16%, 20%

Summer Season (December – February)

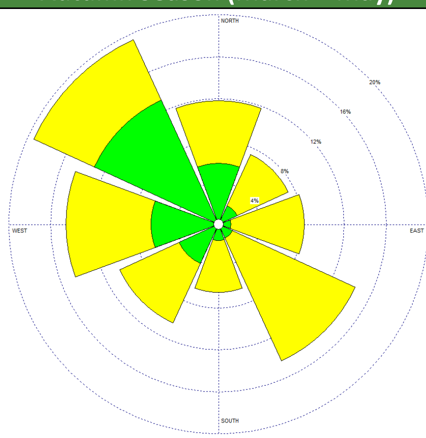


Average Wind Speed: 4.37 m/s

Calms Frequencies: 2.81%

Axis Frequencies: 5%, 10%, 15%, 20%, 25%

Autumn Season (March – May)

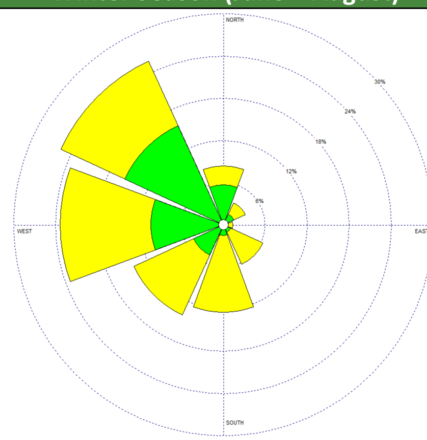


Average Wind Speed: 3.51 m/s

Calms Frequencies: 7.61%

Axis Frequencies: 4%, 8%, 12%, 16%, 20%

Winter Season (June – August)

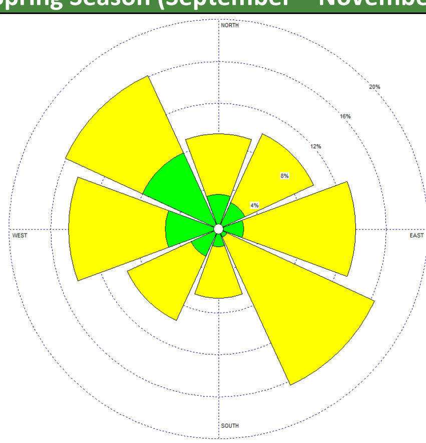


Average Wind Speed: 3.70 m/s

Calms Frequencies: 5.04%

Axis Frequencies: 6%, 12%, 18%, 24%, 30%

Spring Season (September – November)



Average Wind Speed: 4.43 m/s

Calms Frequencies: 2.50%

Axis Frequencies: 4%, 8%, 12%, 16%, 20%

Legend

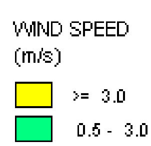


Figure 5-2: Wind Rose Plots – BOM Bankstown Airport AWS ID 066137 – 2019 – Evening time

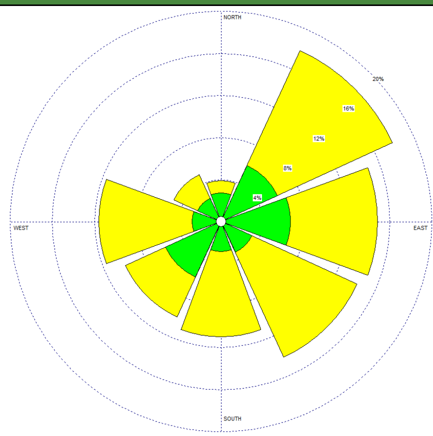
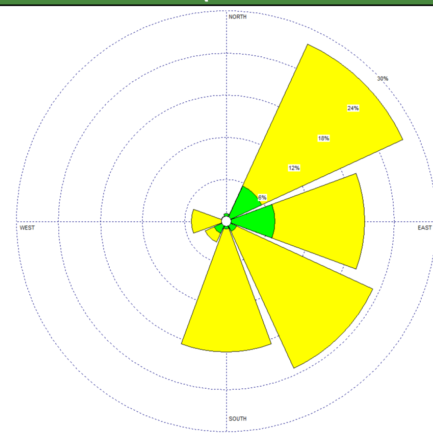
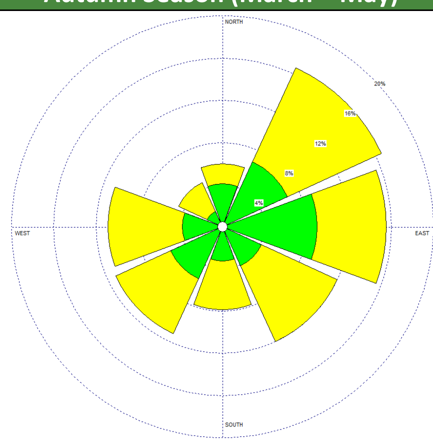
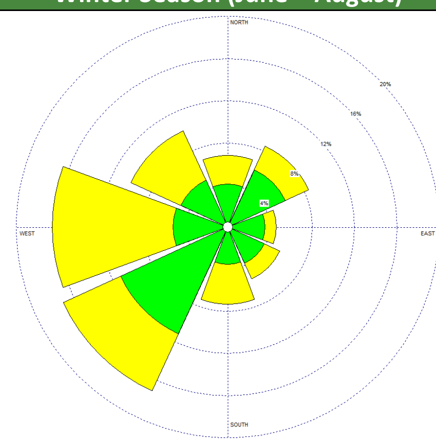
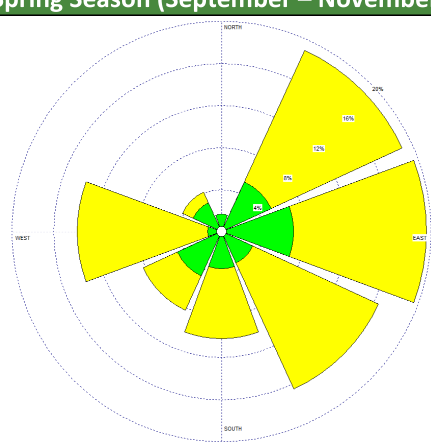
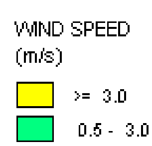
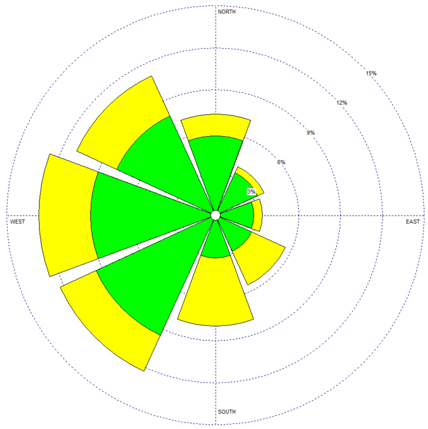
All Seasons	Summer Season (December – February)
 Average Wind Speed: 3.39 m/s Calms Frequencies: 11.51% Axis Frequencies: 4%, 8%, 12%, 16%, 20%	 Average Wind Speed: 4.47 m/s Calms Frequencies: 0.56% Axis Frequencies: 7%, 14%, 21%, 28%, 35%
Autumn Season (March – May)	**Winter Season (June – August)**
 Average Wind Speed: 2.84 m/s Calms Frequencies: 15.49% Axis Frequencies: 4%, 8%, 12%, 16%, 20%	 Average Wind Speed: 2.43 m/s Calms Frequencies: 23.64% Axis Frequencies: 4%, 8%, 12%, 16%, 20%
Spring Season (September – November)	**Legend**
 Average Wind Speed: 3.86 m/s Calms Frequencies: 6.04% Axis Frequencies: 5%, 10%, 15%, 20%, 25%	

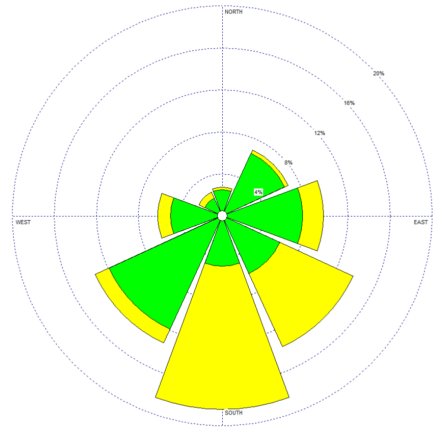
Figure 5-3: Wind Rose Plots – BOM Bankstown Airport AWS ID 066137 – 2019 – Night time

All Seasons



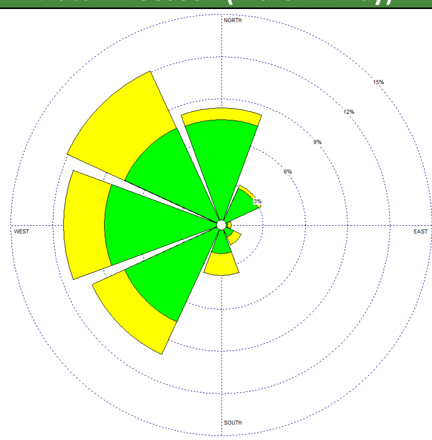
Average Wind Speed: 1.60 m/s
Calms Frequencies: 35.86%
Axis Frequencies: 3%, 6%, 9%, 12%, 15%

Summer Season (December – February)



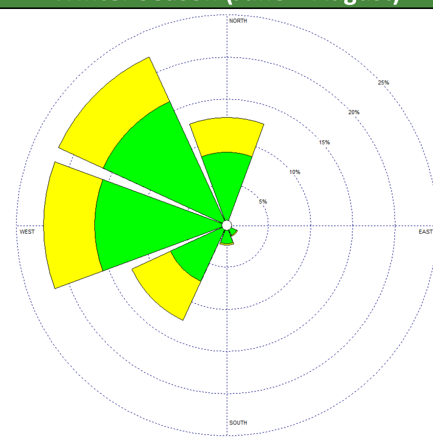
Average Wind Speed: 2.00 m/s
Calms Frequencies: 26.67%
Axis Frequencies: 4%, 8%, 12%, 16%, 20%

Autumn Season (March – May)



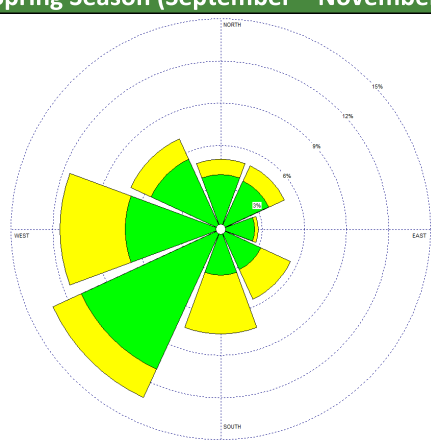
Average Wind Speed: 1.12 m/s
Calms Frequencies: 49.15%
Axis Frequencies: 3%, 6%, 9%, 12%, 15%

Winter Season (June – August)



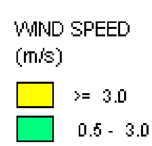
Average Wind Speed: 1.81 m/s
Calms Frequencies: 26.21%
Axis Frequencies: 5%, 10%, 15%, 20%, 25%

Spring Season (September – November)



Average Wind Speed: 1.48 m/s
Calms Frequencies: 41.27%
Axis Frequencies: 3%, 6%, 9%, 12%, 15%

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 5-1 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 5-1 that there are two 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. Therefore, worst case 3 m/s source-to-receiver winds have been included in the assessment.

Table 5-1: Noise Wind Component Analysis 2019 Bankstown

Receiver	Day				Evening				Night			
	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring
R1	11.4	20.7	21.5	13.7	1.3	6.5	12.5	6.9	4.6	16	28.3	10.1
R2	9.8	17.9	27.3	14.2	1	8.4	16.3	6.3	10.8	19.3	33	17
R3	9.2	11	16.4	8.5	3.6	11.1	20.9	8	18	16.4	23.3	18.7
R4	7.8	8.8	12.6	6.7	4.7	11.7	19.3	10.2	20.3	15	18.2	18.3
R5	5.5	5.4	5.9	4.4	3.4	9.8	12.2	9.1	15.4	5.1	5.2	8.9
R6	5.6	4.1	3.3	2.9	4.4	7.1	3.8	7.4	11	1.8	2.1	4.3
R7	8.3	7.2	4.2	6	15.9	15.2	4.9	15.1	14.7	2.8	1	6.7
R8	9.8	10.9	7.4	6.8	10.7	12	9	11.5	9.9	9.8	8.3	8.2
R9	10.9	17.1	15.3	11	2.6	9.5	11.7	6.3	5.2	15	22.6	8.6
R10	11.5	21.1	22	14.4	1	6.8	12.2	6.6	4.6	15.9	30	10.5
R11	10.9	16.7	24.1	13.6	1.8	9	16.3	7.7	12.7	18.7	30.7	18.2
R12	8.7	6.9	4.2	6.3	13.8	14.4	6.5	14	12.4	3.6	1.4	5.9
R13	7.6	6.2	4.2	4.7	13.5	14.1	4.6	16.5	14.4	1.9	1.9	6.6
R14	9.8	20.3	26.8	16	1	7.3	15.8	6	8.3	19.4	32.6	15.9
R15	7.5	5.7	4.5	4.8	18.2	16.8	4.6	16.8	15.6	2.1	1.6	7
R16	7.8	7.9	9.4	6	4.7	11.1	16.8	10.4	20.4	10.3	11.8	14.7
R17	10.1	14	9.7	9.5	10.2	11.4	11.7	10.4	7	12.4	15.5	8.3

Noise enhancing meteorological conditions occur for 30% or more of the period and season

5.2 Temperature Inversions

Temperature inversion is considered a feature where this occurs 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 analysis conducted on the 2019 weather data highlighted that during winter 36.05% of the nights presented temperature inversion conditions, therefore these effects have been included in the noise impact assessment.

5.2.1 Weather Conditions Considered in the Assessment

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

- Neutral Weather Conditions.
- Temperature Inversion
- Wind Conditions

Details of the considered meteorological conditions have been displayed in Table 5-2.

Table 5-2: 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
Inversion	10 °C	70%	2 m/s	Source to receiver	3°C/100 m	All	Night period
Wind	10 °C	70%	3 m/s	From W	No	All	Night period

6. CURRENT LEGISLATION AND GUIDELINES

6.1 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.

6.1.1 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.

6.1.2 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 6-1. The Urban amenity residential receiver category was selected based on the RBLs presented in Table 2-3 of NSW Noise Policy for Industry 2017.

Table 6-1: Amenity noise levels.

Receiver	Noise Amenity Area	Time of Day	L_{Aeq} dB(A) Recommended amenity noise level
Residential	Urban	Day	60
		Evening	50
		Night	45
Active Recreation	All	When in use	55
School Classroom	All	Noisiest 1-hour period when in use	Internal: 40[1]
			External: 50[2]
Industrial Premises	All	When in use	70

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.

6.1.3 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 considered to be both awakenings and disturbance to sleep stages.

Where the subject development/premises night-time noise levels at a residential location exceed:

- **$L_{Aeq, 15 minute}$ 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.

6.1.4 Assessment Periods and Shoulder Periods

As stated in the NSW EPA Noise Policy for Industry the daytime period is defined as 7.00am to 6.00pm, Monday to Saturday and 8.00am to 6.00pm Sundays and Public Holidays.

Also the aforementioned guideline includes the follows:

> Fact Sheet A: A3 - *"There will be situations that call for different assessment periods. For example, where early morning (5 am to 7 am) operations are proposed, it may be unreasonable to expect such operations to be assessed against the night-time project noise trigger levels—especially if existing background noise levels are steadily rising in these early morning hours. In these situations, and where operations outside of daytime hours can be justified, appropriate noise level targets may be negotiated with the regulatory/consent authority on a case-by-case basis. As a rule of thumb and for the purposes of deriving the intrusiveness noise level only, it may be appropriate to assign a shoulder period rating background noise level."*

The proposed facility will receive deliveries from 6.00am to 6.00pm, therefore the site will receive deliveries within the morning shoulder period (6.00am-7.00am).

The results of the long-term unattended noise monitoring undertaken by Benbow Environmental highlights that during the shoulder periods the background noise level is consistent with the day-time background noise level. This can be seen from the noise logger charts presented in Attachment 4.

Benbow Environmental believes that the day-time background noise level is representative of the shoulder periods as well; therefore, this has been considered in this noise impact assessment.

6.1.5 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 6-2 below presents the rating background level, 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 $L_{Aeq\ 15\ minute}$, 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. In order to ensure compliance under all circumstances, a 15 minute period assessment has been considered for all receptors.

Table 6-2: Project Noise Trigger Levels (PNTL) for Operational Activities, dB(A)

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 $L_{Aeq\ 15\ minute}$[1]	PNTL $L_{Aeq\ 15\ minute}$	Sleep Disturbance L_{Amax}
R1-R9	Residential - Suburban	Day	42	**47**	60	58	**47**	**-**
		Evening	42	**47**	50	48	**47**	**-**
		Night	38	**43**	45	**43**	**43**	**53**
R10-R12	School Classroom (Childcare Centre)	Noisiest 1-hour period when in use	-	**-**	$L_{Aeq\ 1hr}$ = 50 (external)	50[2]	**50**	**-**
R13	Active Recreation	When in use	-	**-**	55	53	**53**	**-**
R14-R17	Industrial	When in use	-	**-**	70	68	**68**	**-**

Notes:

1) 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).
2) This value has been conservatively assumed that $L_{Aeq\ 15\ minute}$ is equivalent to $L_{Aeq\ 1hr}$.

6.2 NSW EPA ROAD NOISE POLICY

The NSW Road Noise Policy (RNP) has been adopted to establish the noise criteria for the potential noise impact associated with additional traffic generated by the proposal. The RNP was developed by the NSW EPA primarily to identify the strategies that address the issue of road traffic noise from:

- Existing roads;
- New road projects;
- Road redevelopment projects; and
- New traffic-generating developments.

6.2.1 Road Category

Vehicles are proposed to access the site from Loftus Road. There are no residents located along Loftus Road. The closest residents on potential truck routes are located adjacent to Military Road a 'sub-arterial road' and Pine Road, Fairfield Road and Polding Street North, 'local roads'.

6.2.2 Noise Assessment Criteria

Section 2.3 of the RNP outlines the criteria for assessing road traffic noise. The relevant Section of Table 3 of the RNP is shown in Table 6-3.

Table 6-3: Road Traffic Noise Assessment Criteria For Residential Land Uses, dB(A)

Road Category	Type of Project/Land Use	Assessment Criteria, dB(A)*	
		Day (7am-10pm)	Night (10pm-7am)
Sub-arterial roads	3. Existing residences affected by additional traffic on existing arterial roads generated by land use developments	$L_{Aeq\ (15\ hour)}$ 60 dB (external)	$L_{Aeq\ (9\ hour)}$ 55 dB (external)
Local roads	6. Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq\ (1\ hour)}$ 55 dB (external)	$L_{Aeq\ (1\ hour)}$ 50 dB (external)

* measured at 1 m from a building façade.

6.2.3 Relative Increase Criteria

In addition to the assessment criteria outlined above, any increase in the total traffic noise level at a location due to a proposed project or traffic-generating development, must be considered. Residences experiencing increases in total traffic noise levels above the relative criteria should also be considered for mitigation as described in Section 3.4 of the RNP. For road projects where the main subject road is a local road, the relative increase criterion does not apply.

Table 6 of the RNP outlines the relative increase criteria for residential land uses, with the details applicable to this project shown in Table 6-4.

Table 6-4: Relative Increase Criteria For Residential Land Uses, dB(A)

Road Category	Type of Project/Land Use	Total Traffic Noise Level Increase, dB(A)	
		Day (7am-10pm)	Night (10pm-7am)
Sub-arterial roads	Land use development with potential to generate additional traffic on existing road	Existing traffic $L_{Aeq\ (15\ hour)}$ + 12 dB (external)	Existing traffic $L_{Aeq\ (9\ hour)}$ + 12 dB (external)

The assessment criteria provided in Table 6-3 and the relative increase criteria provided in Table 6-4 should both be considered when designing project specific noise levels. When existing traffic levels are below the criteria in Table 6-3, the lower of the relative increase criteria and the assessment criteria in Table 6-4 should be adopted. For example, if the assessment criteria is 60 dB(A) and the relative increase criteria is 42 dB(A), then a project specific noise level of 42 dB(A) should be adopted. Similarly, if the assessment criteria is 60 dB(A) and the relative increase criteria is 65 dB(A), a project specific noise level of 60 dB(A) should be adopted.

6.2.4 Exceedance of Criteria

If the criteria shown in both Table 6-3 and Table 6-4 cannot be achieved, justification should be provided that all feasible and reasonable mitigation measures have been applied.

For existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'no build option'.

6.2.5 Assessment Locations for Existing Land Uses

Table 6-5: Assessment Locations for Existing Land Uses

Assessment Type	Assessment Location
External noise levels at residences	The noise level should be assessed at 1 metre from the façade and at a height of 1.5 metres from the floor. Separate noise criteria should be set and assessment carried out for each façade of a residence, except in straightforward situations where the residential façade most affected by road traffic noise can be readily identified. The residential noise level criterion includes an allowance for noise reflected from the façade ('façade correction'). Therefore, when taking a measurement in the free field where reflection during measurement is unlikely (as, for instance, when measuring open land before a residence is built), an appropriate correction – generally 2.5 dB – should be added to the measured value. The 'façade correction' should not be added to measurements taken 1 metre from the façade of an existing building. Free measurements should be taken at least 15 metres from any wall, building or other reflecting pavement surface on the opposite side of the roadway, and at least 3.5 metres from any wall, building or other pavement surface, behind or at the sides of the measurement point which would reflect the sound.
Noise levels at multi-level residential buildings	The external points of reference for measurement are the two floors of the building that are most exposed to traffic noise. On other floors, the internal noise level should be at least 10 dB less than the relevant external noise level on the basis of openable windows being opened sufficiently to provide adequate ventilation. (Refer to the Building Code of Australia (Australian Building Codes Board 2010) for additional information.)
Internal noise levels	Internal noise levels refer to the noise level at the centre of the habitable room that is most exposed to the traffic noise with openable windows being opened sufficiently to provide adequate ventilation. (Refer to the Building Code of Australia (Australian Building Codes Board 2010) for additional information.)
Open space – passive or active use	The noise level is to be assessed at the time(s) and location(s) regularly attended by people using the space. In this regard, 'regular' attendance at a location means at least once a week.

6.2.6 Road Traffic Project Specific Noise Levels

The selected project specific noise levels associated with road traffic noise are presented in Table 6-6.

Table 6-6: Project Specific Noise Levels Associated with Road Traffic, dB(A)

Receptor along	Period	Assessment Criteria
Military Road (Sub-arterial Road)	Day	60 $L_{Aeq,\ 15\ hour}$
	Night	55 $L_{Aeq,\ 9\ hour}$
Pine Road/ Fairfield Road/ Polding Street North (Local Roads)	Day	55 $L_{Aeq,\ 1\ hour}$
	Night	50 $L_{Aeq,\ 1\ hour}$

7. OPERATIONAL NOISE IMPACT ASSESSMENT

7.1 MODELLING METHODOLOGY

7.1.1 Noise Model

Noise propagation modelling was carried out using the Concawe algorithm within SoundPLAN v7.3. 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 and receiver locations.

The modelling stages have been carried out using both $L_{Aeq,\ 15\ minutes}$ and L_{Amax} descriptors. Using these descriptors, noise emission levels were predicted at the nearest potentially affected sensitive receptors to determine the noise impact against the relevant noise criteria in accordance with the NSW EPA Noise Policy for Industry.

7.1.2 Assumptions Made for Noise Modelling

It should be noted that the relevant assessment period for operational noise emissions has been considered to be 15 minutes. Therefore noise source durations detailed in the following assumptions 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:

- Topographical information was obtained from Google Earth.
- Heights of the on-site buildings have been taken from site plans and elevations.
- Off-site structures such as warehouses and buildings surrounding the project site have been included in the model.
- The site building at 30 Loftus Road has been modelled as an industrial building with internal sources.
- The walls and roof of the site building at 30 Loftus Road have been modelled as Trimdek 0.48 (R_w = 22 dB) with the north western corner of the building perforated brick 115 mm thick (R_w = 48 dB).
- Rear roller shutter doors have been modelled open 100% of the time during the daytime scenario and closed 100% of the time during evening and nighttime scenarios.
- All receptors were modelled at 1.5 m above ground level.
- All ground areas have been modelled considering different ground factors ranging from 0 to 1 (Hard to Soft ground). The subject site and immediate surrounding industrial area have been modelled with a ground absorption factor of 0. The residential areas have been modelled with a ground absorption factor of 0.6. Green areas, Parks and bushland areas have been modelled with a ground absorption coefficient of 1.

- During the daytime scenario trucks have been modelled considering two moving point sources at heights of 1.5 m and 3 m above ground level in order to account for the engine (1.5 m) and the exhaust outlet (3 m). An on-site speed of 10 km/hr has been considered.

- During the daytime scenario four (4) trucks have been modelled entering and leaving over a 15 minute period.

- Internal noise sources associated with the site activities have been modelled as operational for 100% of the operational hours of the site.

- The forklifts have been assumed to operate for 100% of the 15 minute period.

An outline of the noise sources and operational noise modelling stages has been provided below.

7.1.3 Noise Sources

The sound power levels for the identified noise sources associated with the operational activities are shown in Table 7-1 below. The sound power levels have been calculated from Benbow Environmental's extensive noise source database.

Table 7-1: A-Weighted 1/3 Octave Sound Power Levels dB(A)

Noise 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
Truck Engine	103	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	-	-	-
Truck Exhaust	101	42	46	55	63	68	71	76	76	78	80
		81	83	92	96	92	94	87	86	80	85
		83	82	80	81	81	80	76	-	-	-
Trommel screen	104	42	44	59	64	75	76	75	81	82	83
		83	84	90	93	90	92	94	95	95	95
		94	93	91	89	86	82	77	73	67	59
Air Separator	102	40	42	57	62	73	74	73	79	80	81
		81	82	88	91	88	90	92	93	93	93
		92	91	89	87	84	80	75	71	65	57
Forklift	92	36	59	61	51	65	66	77	68	60	62
		66	69	74	81	78	78	81	85	84	84
		81	75	71	71	65	63	56	51	45	42
Flip Flow screen	104	42	44	59	64	75	76	75	81	82	83
		83	84	90	93	90	92	94	95	95	95
		94	93	91	89	86	82	77	73	67	59
Front End Loader	102	44	51	59	65	64	77	77	78	80	85
		89	85	85	88	88	90	93	94	93	92
		91	90	88	87	84	81	77	73	66	60
Conveyor	80	29	31	29	35	38	49	45	49	53	57
		57	65	68	70	68	71	70	72	71	70
		63	63	59	56	52	49	44	42	36	29

Noise 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
Excavator	**101**	38	46	51	60	75	69	71	77	76	80
		81	81	86	87	87	89	91	92	92	92
		92	90	89	87	85	81	76	71	64	57
Aggregate Dumping	**98**	-	17	-	-	38	-	-	53	-	-
		68	-	-	80	-	-	87	-	-	91
		-	-	93	-	-	93	-	-	81	-
Shredder	**112**	46	55	62	62	67	76	86	84	83	88
		90	93	94	97	99	100	101	103	105	103
		102	102	100	96	92	88	82	77	71	63
Crusher	**107**	40	42	45	51	54	64	71	77	84	87
		88	90	94	97	97	99	96	98	96	96
		94	93	93	92	88	84	79	74	68	60

7.1.4 Noise Modelling Scenarios

Two operational scenarios were considered in the noise model. The first scenario is representative of daytime operations (6am-6pm) with external vehicle movements and rear open roller shutter doors. Scenario 2 considers evening time and night time under neutral and adverse weather conditions, with no external vehicle movements and roller shutter doors closed.

The equipment list for the operational scenarios is detailed in Table 7-2, with an equipment location diagram in Figure 7-1.

Table 7-2: Modelled Scenarios for Proposed Operations

Stage	Time of the day	Noise Sources for Worst 15-minute Period
Scenario 1. Neutral Weather Conditions	Daytime: 6am-6pm	Roller Shutter Doors Open • External Truck Movements • Forklift x2 • Aggregate dumping x5 • Crusher x1 • Shredder x1 • Air Separator x2 • Flip flow screen x3 • Trommel screen x1 • Front End Loader x2 • Excavator x2
Scenario 2. Neutral Weather Source to Receiver Winds Temperature Inversions	Evening & Night: 6pm-6am	Roller Shutter Doors Closed • Forklift x2 • Aggregate dumping x5 • Crusher x1 • Shredder x1 • Air Separator x2 • Flip Flow screen x3 • Trommel screen x1 • Front end loader x2 • Excavator x2

Figure 7-1: Noise Source Locations – Scenario 1 – Daytime

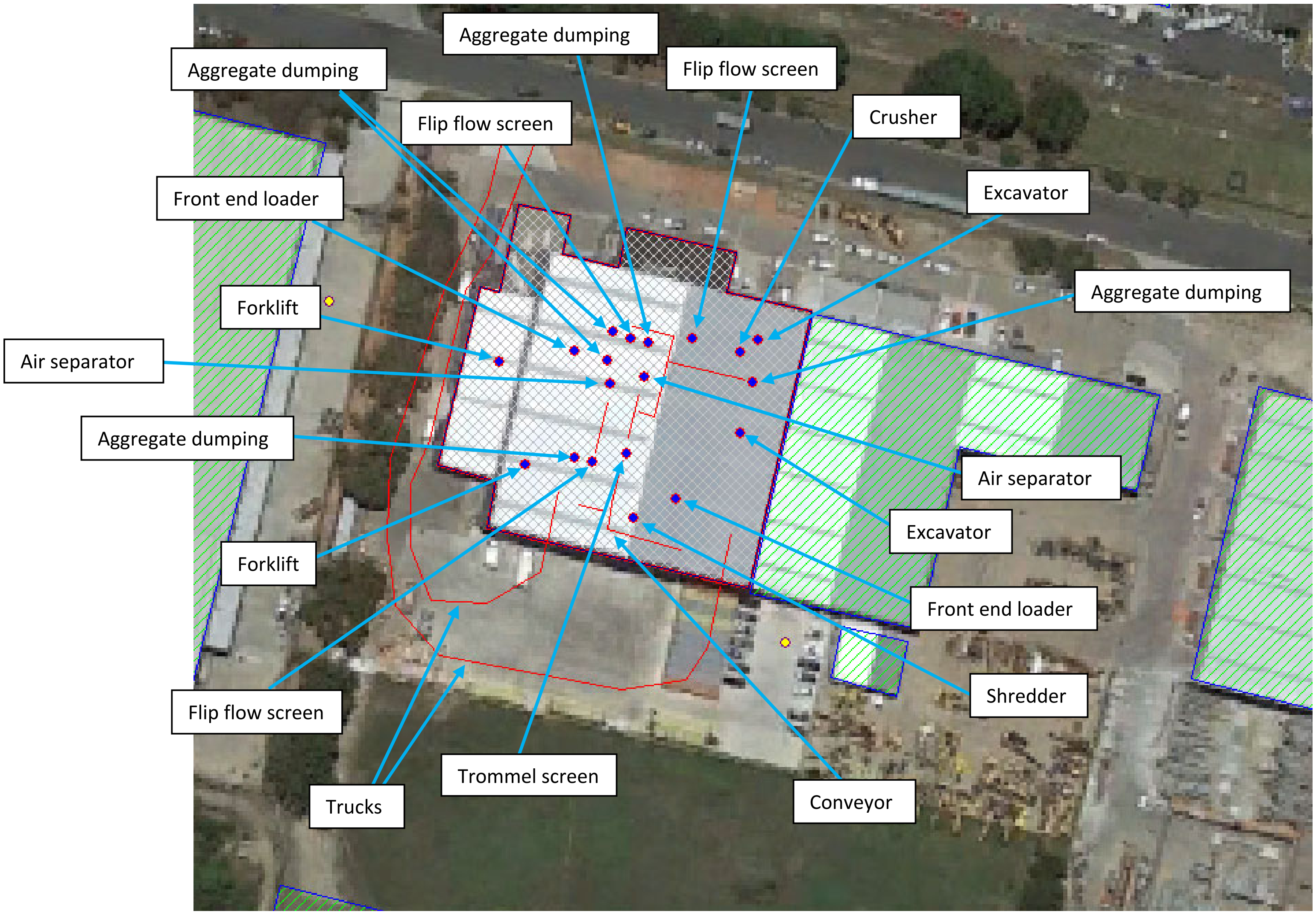
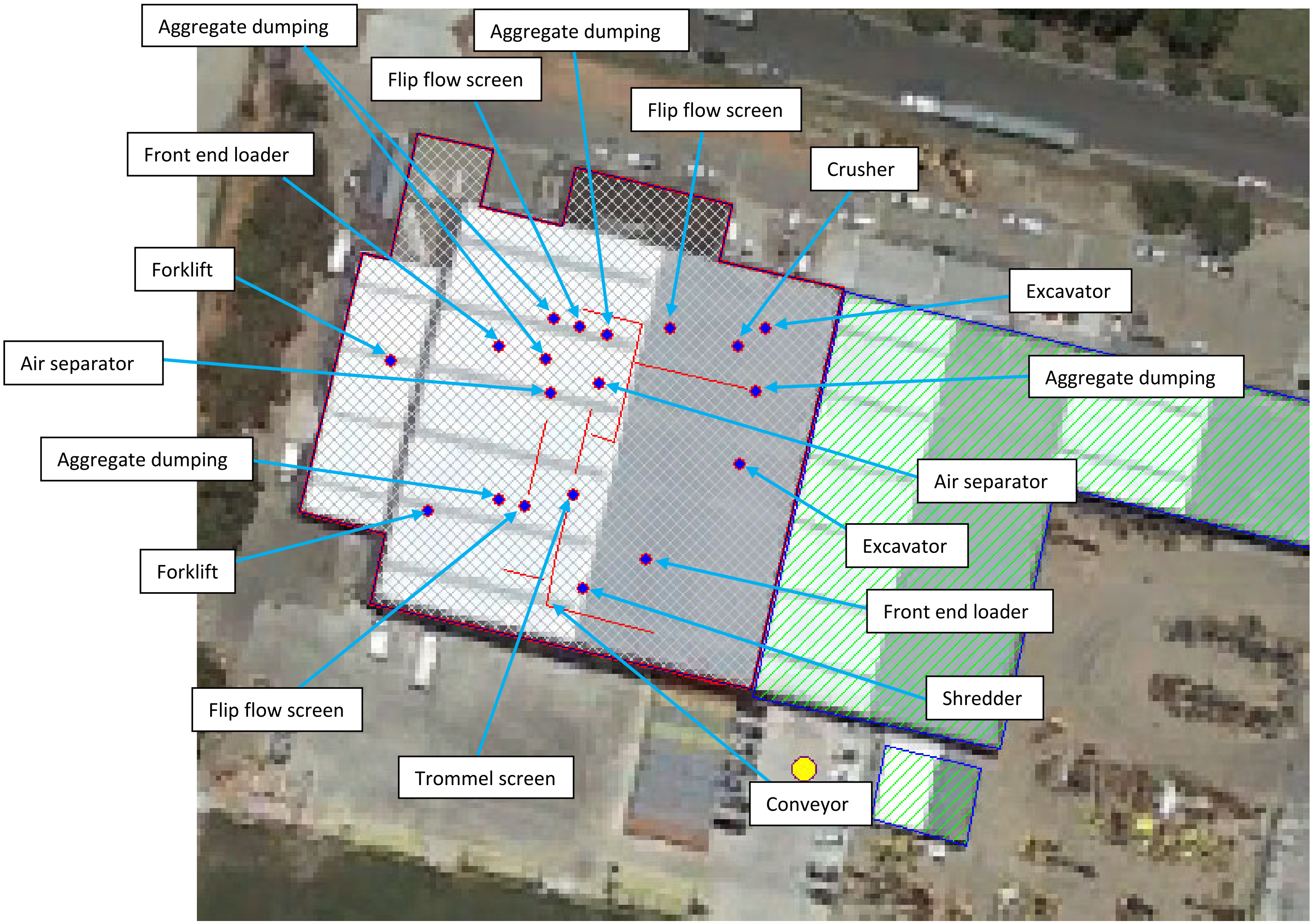


Figure 7-2: Noise Source Locations – Scenario 2 – Evening/Night



7.2 Operational Predicted Noise Levels

Results of the predictive noise modelling are shown in Table 7-3 and contour maps in Figure 7-3 to Figure 7-6 for the two scenarios.

During the day, evening and night periods the operational noise levels are predicted to comply with the Noise Policy for Industry at all residential receivers for all considered weather conditions. Sleep disturbance is not expected to occur at any residential receiver.

During daytime operations noise levels are predicted to exceed the industrial amenity noise criteria, outdoors at the neighbouring industrial sites:

- R14: 30A Loftus Road, Yennora in the carpark by 9 dB(A)
- R17: 7 Kiora Crescent Yennora outside the newly built warehouse by 2 dB(A).

The noise levels would comply with the noise criteria of 68 dB(A) within the building located on these sites where workers would work the majority of the time as the building façade would provide significant noise attenuation. The dominant source is noise from the open roller shutter doors. Therefore, it is recommended fast acting automatic roller shutter doors be installed to minimise noise impacts on neighbouring industrial premises by reducing the time the doors are left open. Other recommendations such as, no external vehicle movements and roller shutter doors closed during the evening and night period are effective and have been modelled. No further noise controls are considered warranted.

Table 7-3: Predicted Noise Levels – Operational Activities dB(A)

Receptor	Project Criteria $L_{eq(15\ minute)}$			Project Criteria L_{Amax}	Scenario 1 neutral		Scenario 2a) neutral		Scenario 2 b) wind conditions		Scenario 2c) temperature inversion	
	Day	Evening	Night		Predicted $L_{Aeq(15\ minute)}$	Predicted L_{Amax}	Predicted $L_{Aeq(15\ minute)}$	Predicted L_{Amax}	Predicted $L_{Aeq(15\ minute)}$	Predicted L_{Amax}	Predicted $L_{Aeq(15\ minute)}$	Predicted L_{Amax}
R1	47	47	43	53	35✓	40✓	29✓	34✓	34✓	39✓	34✓	39✓
R2	47	47	43	53	34✓	39✓	31✓	36✓	36✓	41✓	36✓	41✓
R3	47	47	43	53	34✓	39✓	31✓	36✓	36✓	41✓	36✓	41✓
R4	47	47	43	53	35✓	40✓	32✓	37✓	37✓	42✓	37✓	42✓
R5	47	47	43	53	32✓	37✓	29✓	34✓	34✓	39✓	34✓	39✓
R6	47	47	43	53	32✓	37✓	29✓	34✓	33✓	38✓	33✓	38✓
R7	47	47	43	53	42✓	47✓	32✓	37✓	36✓	41✓	36✓	41✓
R8	47	47	43	53	33✓	38✓	28✓	33✓	33✓	38✓	33✓	38✓
R9	47	47	43	53	31✓	36✓	27✓	32✓	32✓	37✓	32✓	37✓
R10	50			NA	40✓	-	33✓	-	38✓	-	38✓	-
R11	50			NA	31✓	-	28✓	-	33✓	-	33✓	-
R12	50			NA	42✓	-	33✓	-	37✓	-	37✓	-
R13	53			NA	31✓	-	28✓	-	33✓	-	33✓	-
R14	68			NA	77×	-	61✓	-	62✓	-	62✓	-
R15	68			NA	65✓	-	56✓	-	58✓	-	58✓	-
R16	68			NA	56✓	-	52✓	-	54✓	-	54✓	-
R17	68			NA	70×	-	55✓	-	57✓	-	57✓	-

✓Complies × Non-compliance

Figure 7-3: Scenario 1 Noise Contour Map

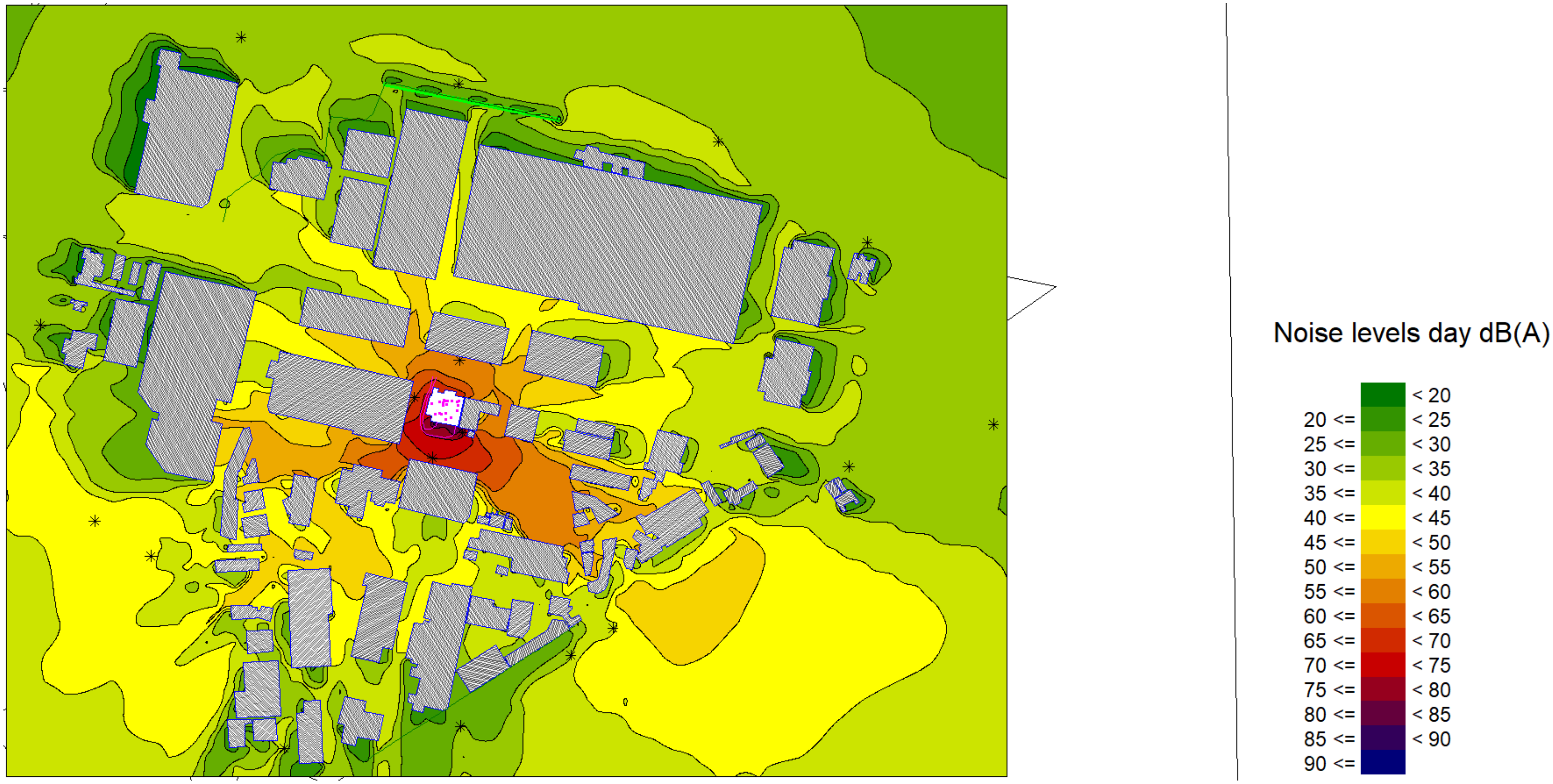


Figure 7-4: Scenario 2a Neutral Noise Contour Map

Figure 7-5: Scenario 2b Wind Conditions Noise Contour Map

Figure 7-6: Scenario 2c Temperature Inversion Conditions Noise Contour Map

7.3 RECOMMENDED OPERATIONAL MITIGATION MEASURES

The following noise control measures are recommended:

- Restrict external vehicle movements to: 6am-6pm;
- Roller shutter doors to be closed 6pm-6am; and
- Fast acting roller shutter doors to be installed and programmed to be closed when not in use.

With the above controls in place the site is expected to comply with the project noise trigger levels at all receivers for all operational scenarios. See Section 7.2 for justification.

8. ROAD TRAFFIC NOISE IMPACT ASSESSMENT

A description of the calculation methodology and the noise predictions associated with road traffic has been provided below.

The most likely routes for trucks that have receivers along them would involve travelling along Fairfield Road when heading north, Military Road when heading east, and along Pine Road when heading south and along Polding Street North when heading west as shown in Figure 8-1. The nearest residential receptors to the site along these routes are located along Pine Road, with the closest residential receiver identified as:

- 163 Military Road, Guildford;
- R8, 17 Pine Road, Fairfield;
- 134 Fairfield Road Guildford West; and
- 4 Polding Street North, Fairfield.

Calculation of road traffic noise contribution has been undertaken using SoundPLAN v7.3.

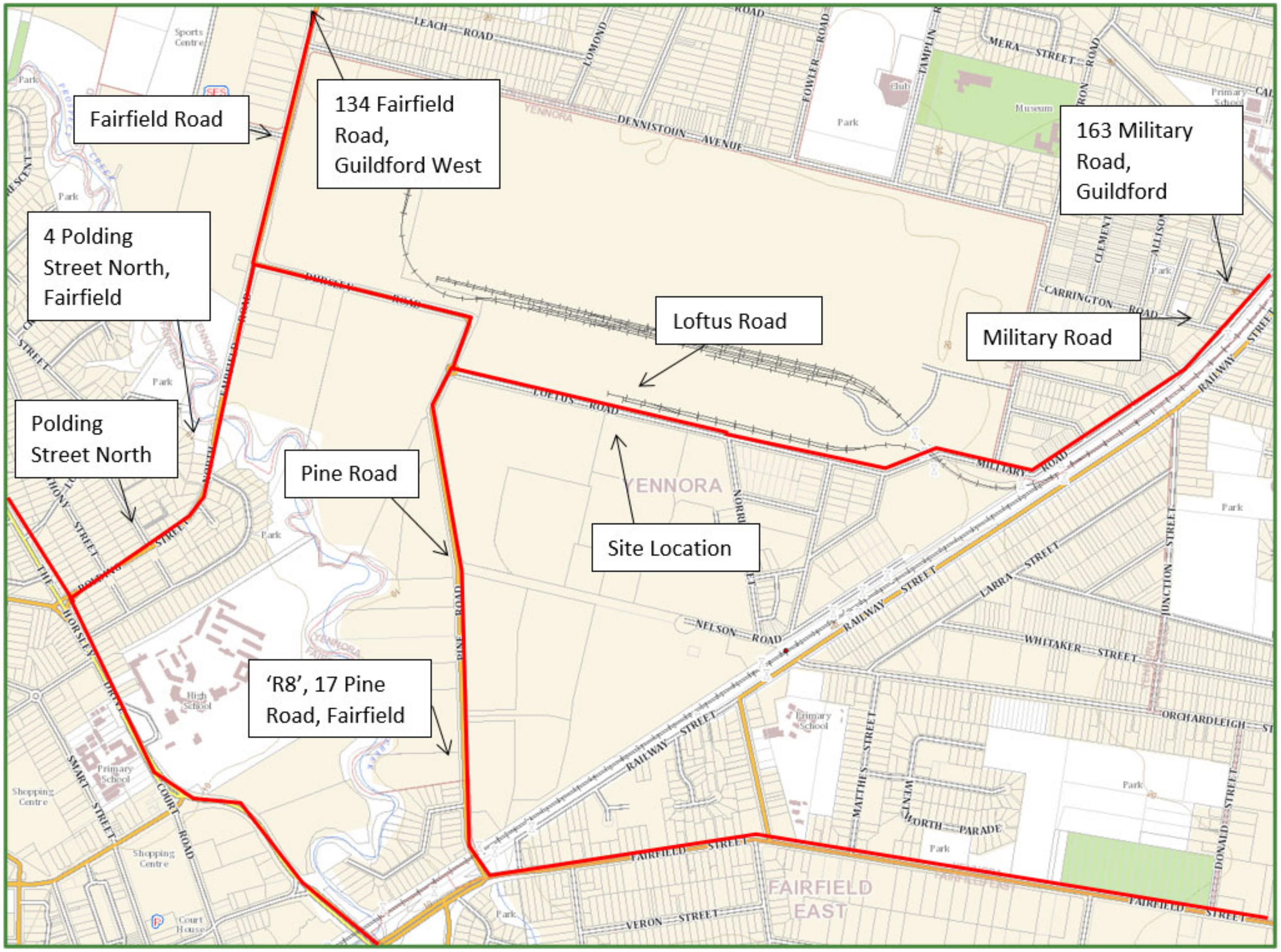
168 truck movements are expected per day. Four trucks have been considered to pass residences in a 15 minute period, therefore a worst case scenario of sixteen truck pass bys have been considered to occur in any one hour period in the day. The trucks are assumed to travel at the posted speed of 50 km/h along Pine Road and Military Road and 60 km/h along Fairfield Road and Polding Street North. Trucks have been modelled considering two moving point sources at heights of 1.5 m and 3 m above ground level in order to account for the engine (1.5 m) and the exhaust outlet (3 m).

The $L_{Aeq,\ 15\ hour\ and}$ $L_{Aeq,\ 9\ hour}$ noise descriptors have been calculated at the most affected residential receptor located along the closest sub-arterial road and the $L_{Aeq,\ 1\ hour}$ noise descriptor has been used for the closest residential receptors along local roads. The predicted noise levels are displayed in Table 8-1.

Table 8-1: Predicted Levels for Road Traffic Noise

Receptor	Local Roads Noise Criteria	Site Contribution
	Day	Day
163 Military Road, Guildford	60 $L_{Aeq,\ 15\ hour}$	55 $L_{Aeq,\ 15\ hour}$ ✓
R8, 17 Pine Road, Fairfield	55 $L_{Aeq,\ 1\ hour}$	55 $L_{Aeq,\ 1\ hour}$ ✓
134 Fairfield Road, Guildford West	55 $L_{Aeq,\ 1\ hour}$	54 $L_{Aeq,\ 1\ hour}$ ✓
4 Polding Street North, Fairfield	55 $L_{Aeq,\ 1\ hour}$	53 $L_{Aeq,\ 1\ hour}$ ✓

Figure 8-1: Truck Routes



The road traffic noise impacts from vehicles travelling on Loftus Road are well shielded from the residential receivers, with industrial properties and significant distances located between the roads and the residential receivers. From Table 8-1, it can be seen that the predicted road traffic noise contributions will comply with the road noise criteria.

Therefore, the proposed vehicle movements are predicted to comply with the NSW Road Noise Policy, and no additional mitigation strategies are recommended.

9. STATEMENT OF POTENTIAL NOISE IMPACT

Benbow Environmental has been engaged by Cobra Waste Solutions Pty Ltd to undertake a noise impact assessment for the proposed resource recovery to be located at Warehouse B 30 Loftus Road, Yennora. The facility would receive, handle and process Construction and Demolition (C&D) and Commercial and Industrial (C&I) waste. The amount of waste to be received and processed is estimated to be up to 150,000 tonnes per year. Based on preliminary plans, the proposed maximum storage capacity for waste at the site at any one time is expected to be 1,500 tonnes.

The site is located within the industrial area of Yennora. The nearest residential receptors are located approximately 520 metres south-east of the site.

Noise emissions from the site were predicted by using noise modelling software, SoundPlan (V7.3).

This noise impact assessment has been prepared in accordance with the following guidelines and documents:

- NSW Environmental Protection Authority, Noise Policy for Industry 2017; and
- Department of Environment, Climate Change and Water NSW, Road Noise Policy (DECCW, 2011).

The following noise control measures are recommended:

- Restrict external vehicle movements to: 6am-6pm;
- Roller shutter doors to be closed 6pm-6am; and
- Fast acting roller shutter doors to be installed and programmed to be closed when not in use.

With the above controls in place the site is expected to comply with the NSW EPA Noise Policy for Industry at all receivers for all operational scenarios.

Compliance with the guidelines set out in the NSW Road Noise Policy was predicted at all considered receptors.

No construction will take place therefore construction noise and vibration impacts are not expected.

This concludes the report.

Victoria Hale
Senior Environmental Scientist

R T Benbow
Principal Consultant

10. 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 Cobra Waste Solutions Pty Ltd, as per our agreement for providing environmental services. Only Cobra Waste Solutions 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 Cobra Waste Solutions 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 commonly 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 (dB) 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, L_{Aeq}

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 L_{Aeq} 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.

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.

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.

MAXIMUM NOISE LEVEL, L_{AFmax}

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.

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."

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).

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 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 x 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. $L_w = L_p + 10 \log_{10}$ 'a' dB, re: 1pW, (10^{-12} watts) where 'a' is the measurement noise-emission area (m^2) in a free field.

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, R_w

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 ISO 717-1:2004). Internal partition wall R_w + 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 C_{tr} 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.

‘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—2004: ‘*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
AS 1259.1:1990 - AS 1259.2:1990
Calibration Certificate

Calibration Number C19409

Client Details Benbow Environmental
25-27 Sherwood Street
NORTHMEAD NSW 2152

Equipment Tested/ Model Number : ARL EL-215
Instrument Serial Number : 194702
Microphone Serial Number : N/A
Pre-amplifier Serial Number : N/A

Atmospheric Conditions
Ambient Temperature : 22.9°C
Relative Humidity : 37.2%
Barometric Pressure : 100.71kPa

Calibration Technician : Lucky Jaiswal
Calibration Date : 22 Jul 2019
Secondary Check: Sandra Minto
Report Issue Date : 25 Jul 2019

Approved Signatory : Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
10.2.2: Absolute sensitivity	*Pass*	10.3.4: Inherent system noise level	*Pass*
10.2.3: Frequency weighting	*Pass*	10.4.2: Time weighting characteristic F and S	*Pass*
10.3.2: Overload indications	*Pass*	10.4.3: Time weighting characteristic I	*Pass*
10.3.3: Accuracy of level range control	*Pass*	10.4.5: R.M.S performance	*Pass*
8.9: Detector-indicator linearity	*Pass*	9.3.2: Time averaging	*Pass*
8.10: Differential level linearity	*Pass*	9.3.5: Overload indication	*Pass*

Least Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
31.5 Hz to 8kHz	*±0.15dB*	*Temperature*	*±0.2°C*
12.5kHz	*±0.2dB*	*Relative Humidity*	*±2.4%*
16kHz	*±0.29dB*	*Barometric Pressure*	*±0.015kPa*
Electrical Tests			
31.5 Hz to 20 kHz	*±0.11dB*		

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

The sound level meter under test has been shown to conform to the type 2 requirements for periodic testing as described in AS 1259.1:1990 and AS 1259.2:1990 for the tests stated above.

NATA
WORLD RECOGNISED ACCREDITATION

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 Australian/National standards.

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: 25096

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: Rion
Type No: NC-73 **Serial No:** 10186522
Owner: Benbow Environmental
25-27 Sherwood Street
Northmead, NSW 2152

Tests Performed: Measured output pressure level was found to be:

Parameter	Pre-Adj	Adj Y/N	Output: (db re 20 µPa)	Frequency: (Hz)	THD&N (%)
Level 1:	NA	N	94.15	990.93	1.41
Level 2:	NA	N	NA	NA	NA
Uncertainty:			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITION OF TEST:
Ambient Pressure: 1020 hPa ±1.5 hPa **Relative Humidity:** 52% ±5%
Temperature: 24 °C ±2° C
Date of Calibration: 05/07/2019 **Issue Date:** 08/07/2019
Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017

CHECKED BY: ..JKB.. **AUTHORISED SIGNATURE:** ....
Jack Kielt

.Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.
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. 9262
Acoustic and Vibration Measurements

ACU-VIB ELECTRONICS
HEAD OFFICE
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
Web site: www.acu-vib.com.au

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: 24945

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: B & K
Type No: 4230 **Serial No:** 565912
Owner: Benbow Environmental
25-27 Sherwood Street
Northmead, NSW 2152

Tests Performed: Measured output pressure level was found to be:

Parameter	Pre-Adj	Adj Y/N	Output: (db re 20 μPa)	Frequency: (Hz)	THD&N (%)
Level 1:	NA	N	94.03	987.01	0.45
Level 2:	NA	N	NA	NA	NA
Uncertainty:			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITION OF TEST:
Ambient Pressure: 1001 hPa ±1.5 hPa **Relative Humidity:** 48% ±5%
Temperature: 23 °C ±2° C
Date of Calibration: 14/06/2019 **Issue Date:** 17/06/2019
Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017
CHECKED BY: ..JKB **AUTHORISED SIGNATURE:** ....
Jack Kielt

.Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.
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%.

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Acoustic and Vibration Measurements

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Mobile: 0413 809806
Web site: www.acu-vib.com.au

CERTIFICATE OF CALIBRATION

CERTIFICATE NO.: **SLM 24948 & FILT 5245**

Equipment Description: Sound & Vibration Analyser

Manufacturer: Svantek

Model No: Svan-957 **Serial No:** 15335

Microphone Type: 7052H **Serial No:** 40814

Preamplifier Type: SV12L **Serial No:** 18742

Filter Type: 1/3 Octave **Serial No:** 15335

Comments: All tests passed for class 1.
(See over for details)

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

Ambient Pressure: 1004 hPa ±1.5 hPa

Temperature: 23 °C ±2° C **Relative Humidity:** 39% ±5%

Date of Calibration: 14/06/2019 **Issue Date:** 17/06/2019

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

CHECKED BY: VKB **AUTHORISED SIGNATURE:** ....
Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

NATA
WORLD RECOGNISED ACCREDITATION

ACU-VIB
ELECTRONICS

HEAD OFFICE
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
web site: www.acu-vib.com.au

Accredited Lab. No. 9262
Acoustic and Vibration Measurements

Attachment 3: Noise 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 IEC 61672.1–2004 Electroacoustics – Sound level meters - Specifications.

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 2.

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 IEC 61672.1–2004 Electroacoustics – Sound level meters - Specifications.

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 logger type NGARA and EL-215 were used to conduct the long-term unattended noise monitoring. This equipment complies with Australian Standard AS IEC 61672.1–2004 *Electroacoustics – Sound level meters – Specifications* and are designated as a 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 2.

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.

Measurements affected by wind or rain over certain limits were excluded from the final analyses of the recorded data in accordance with the EPA's Industrial Noise Policy (INP). The wind data were modified to take into account the difference of height between the AWS (Automatic Weather Station) used by the Bureau of Meteorology (10m above ground level), and the microphone (1.5m above ground level). The correction factor applied to the data was calculated according to the Australian Standard AS 1170.2 2011 .

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}, L_{Aeq} and L_{Amax} levels were 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. The L_{Aeq} level is the equivalent continuous noise level or the level averaged on an equal energy basis which is used to describe the "Ambient Noise". The L_{Amax} noise levels are maximum sound pressure levels measured over the sampling period and this parameter is commonly used when assessing noise impact.

Measurement sample periods were fifteen minutes. The Noise -vs- Time daily noise logger charts representing measured noise levels at the noise monitoring locations are presented in Attachment 4.

ATTENDED NOISE MONITORING

NOISE MONITORING EQUIPMENT

The attended short-term noise monitoring was carried out using a SVANTEK SVAN957 Class 1 Precision Sound Level Meters. The instrument was calibrated by a NATA accredited laboratory within two years of the measurement period. The instrument sets comply with AS IEC 61672.1-2004 and was set on A-weighted, fast response.

The microphone was positioned at 1.2 to 1.5 metres above ground level and was fitted with windsocks. 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 2.

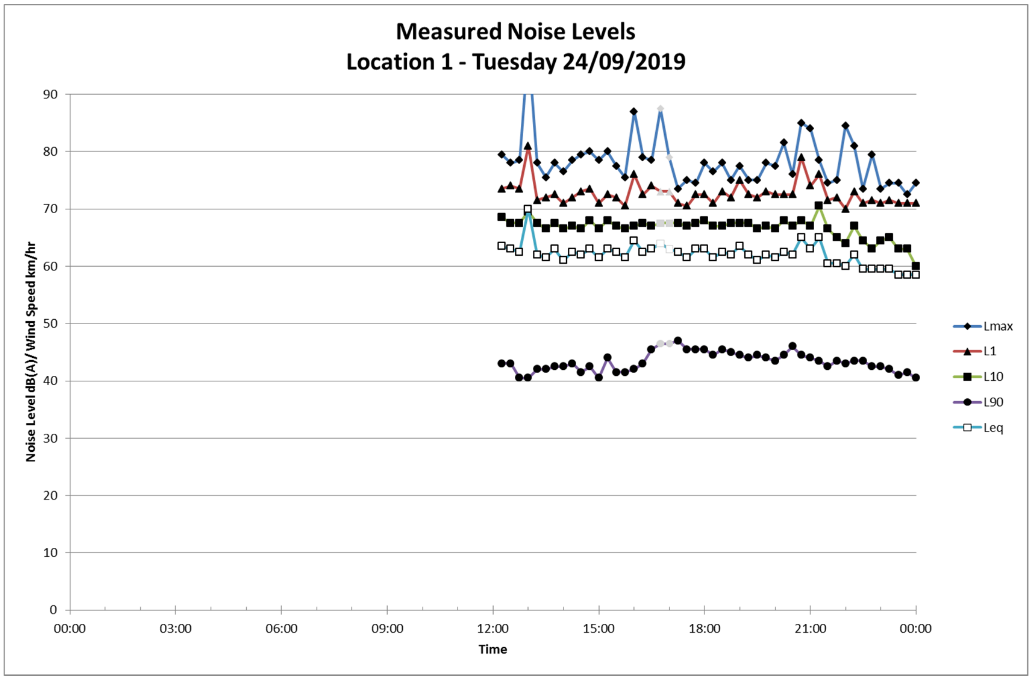
WEATHER CONDITIONS

It was clear, find without significant breeze.

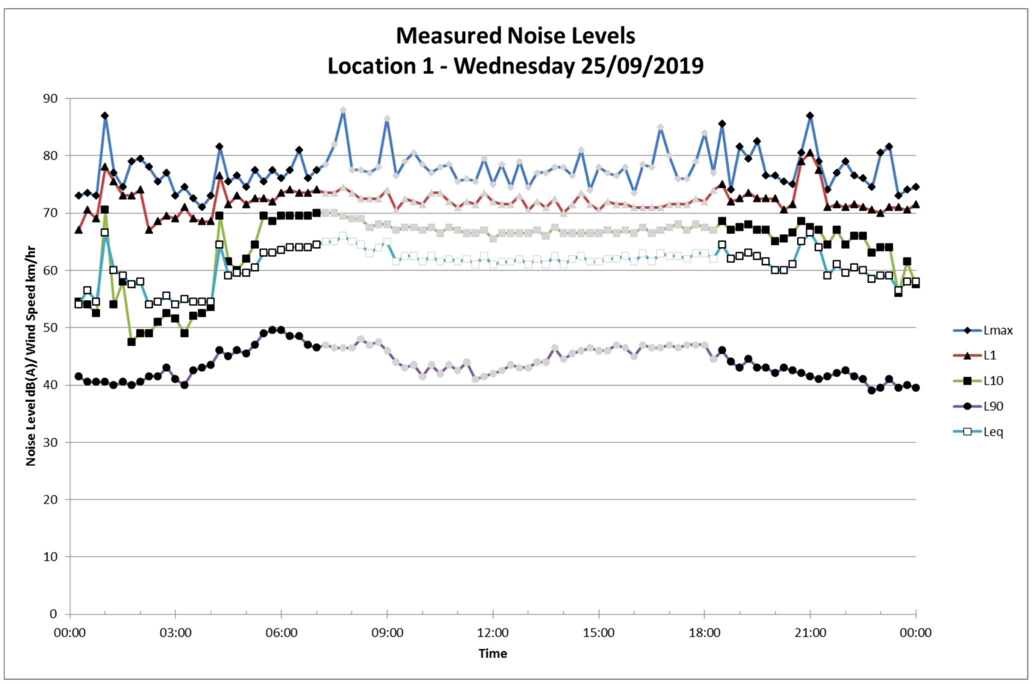
METHODOLOGY

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

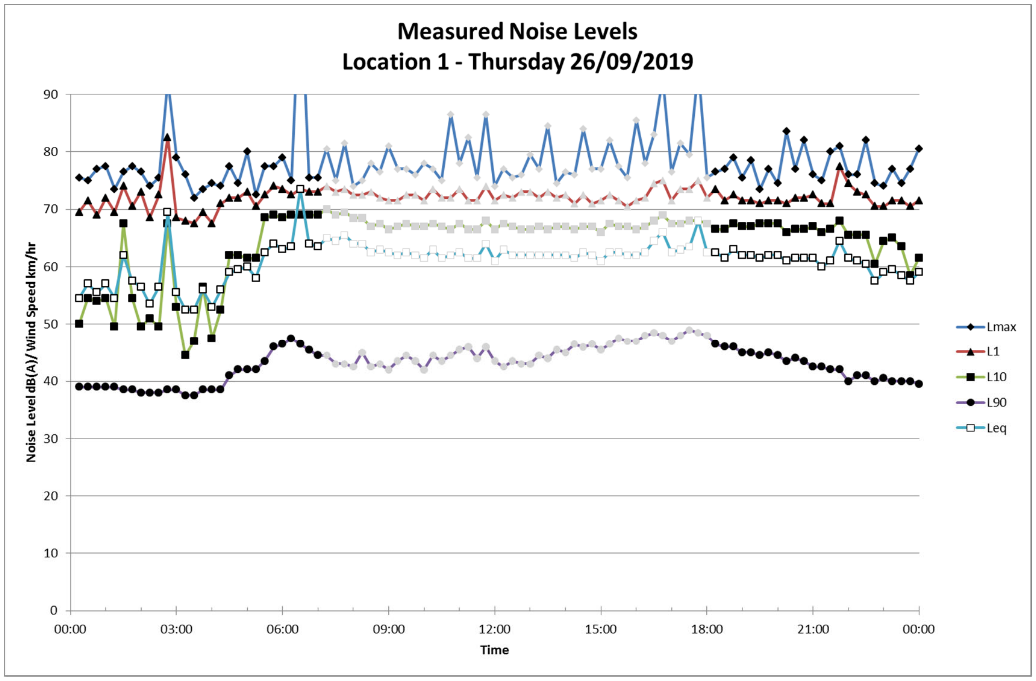
Attachment 4: Noise Logger Charts

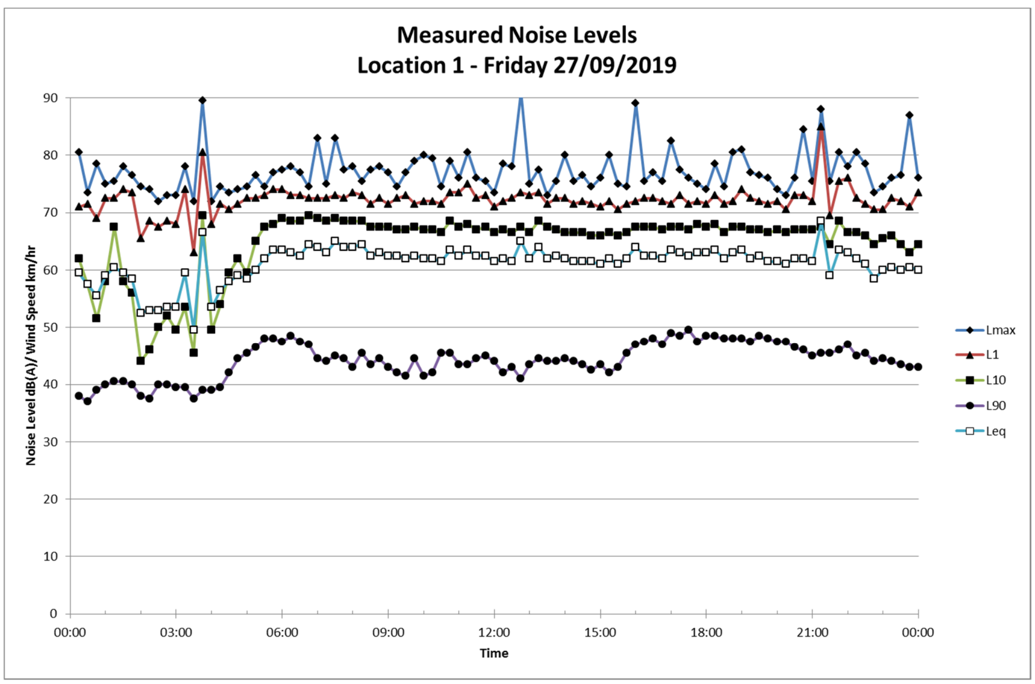


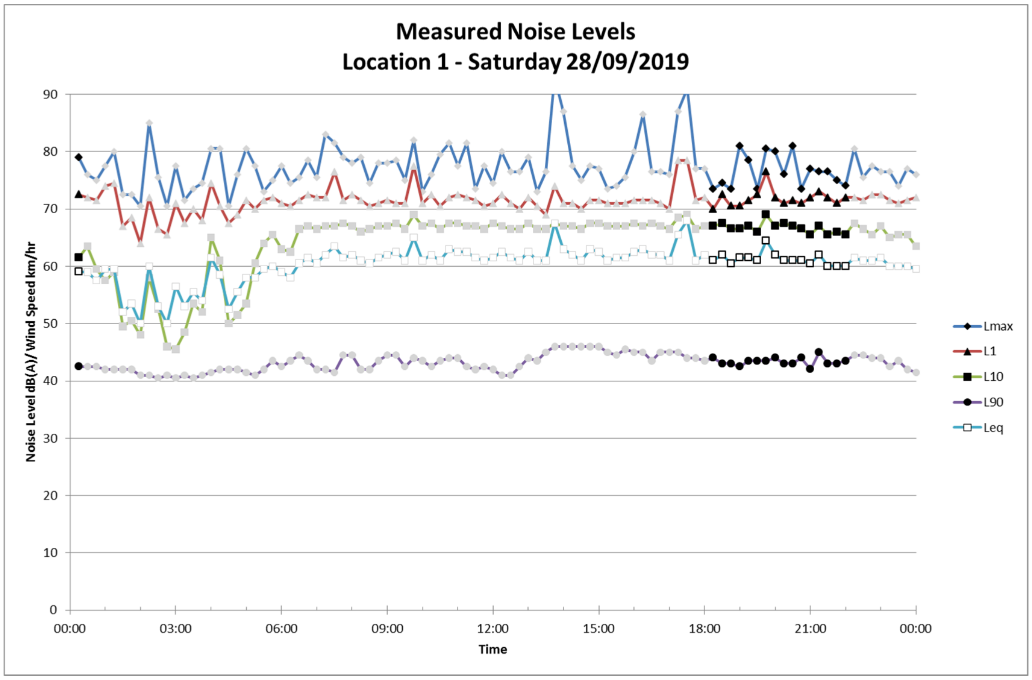
Measured Noise Levels
Location 1 - Tuesday 24/09/2019
Noise Level dB(A)/ Wind Speed km/hr
0
10
20
30
40
50
60
70
80
90
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Time
Lmax
L1
L10
L90
Leq



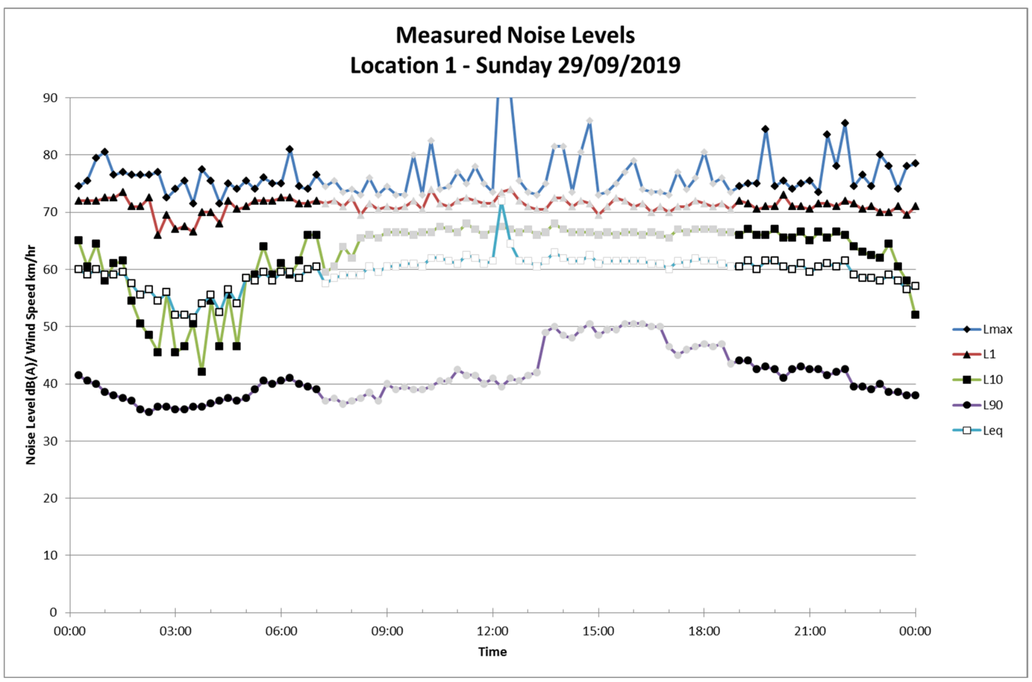
Measured Noise Levels
Location 1 - Wednesday 25/09/2019
Noise Level dB(A)/ Wind Speed km/hr
0
10
20
30
40
50
60
70
80
90
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Time
Lmax
L1
L10
L90
Leq


Measured Noise Levels
Location 1 - Thursday 26/09/2019
Noise Level dB(A)/ Wind Speed km/hr
0
10
20
30
40
50
60
70
80
90
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Time
Lmax
L1
L10
L90
Leq

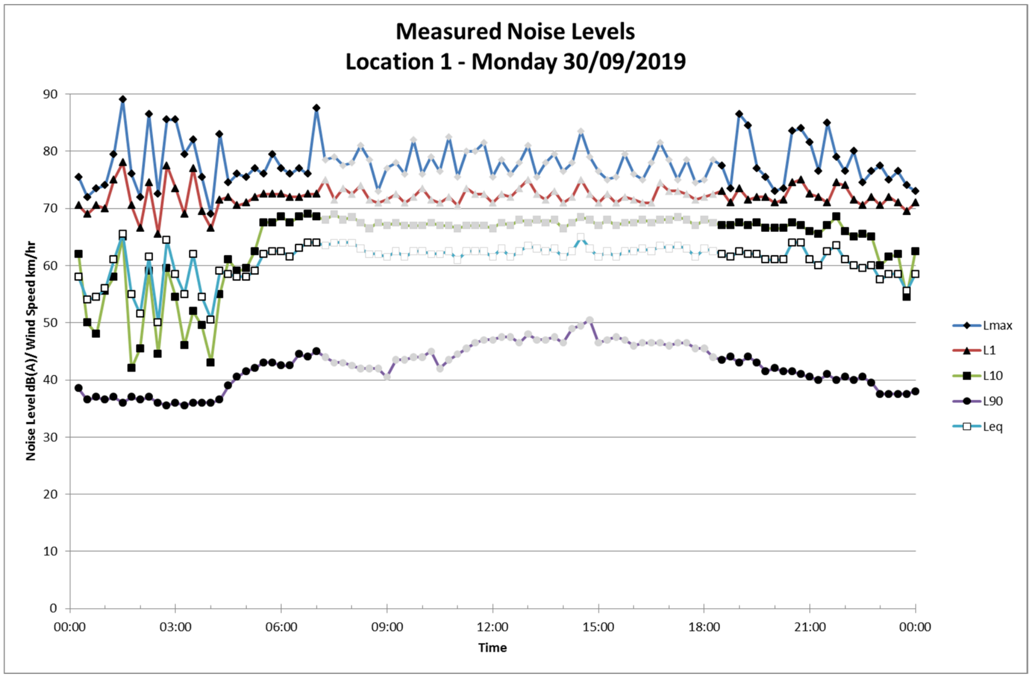

Measured Noise Levels
Location 1 - Friday 27/09/2019
Noise Level dB(A)/ Wind Speed km/hr
0
10
20
30
40
50
60
70
80
90
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Time
Lmax
L1
L10
L90
Leq

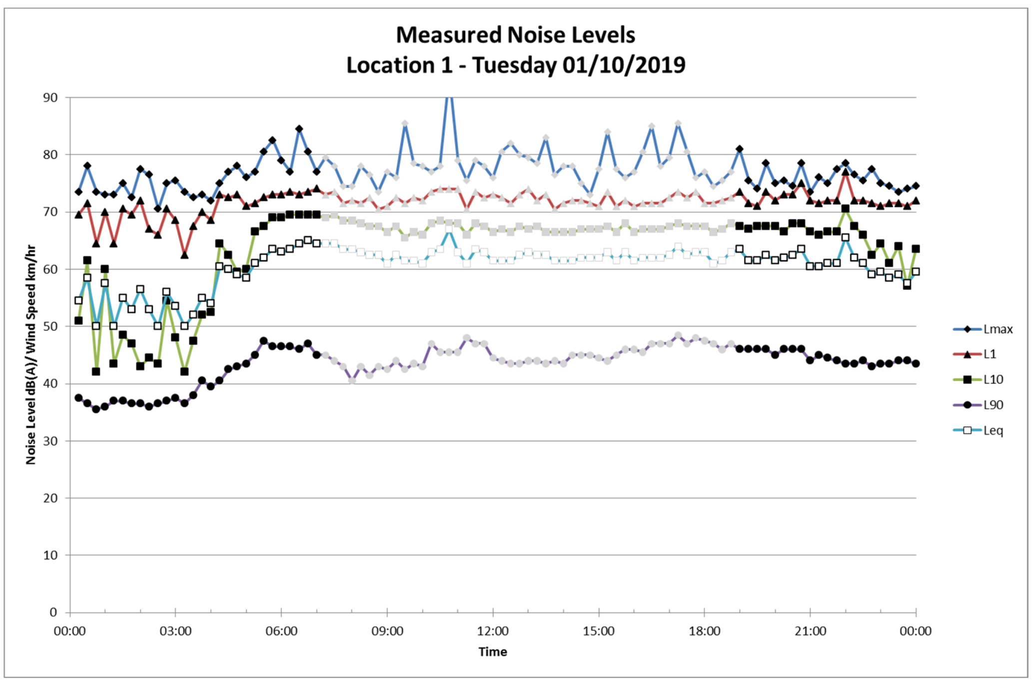


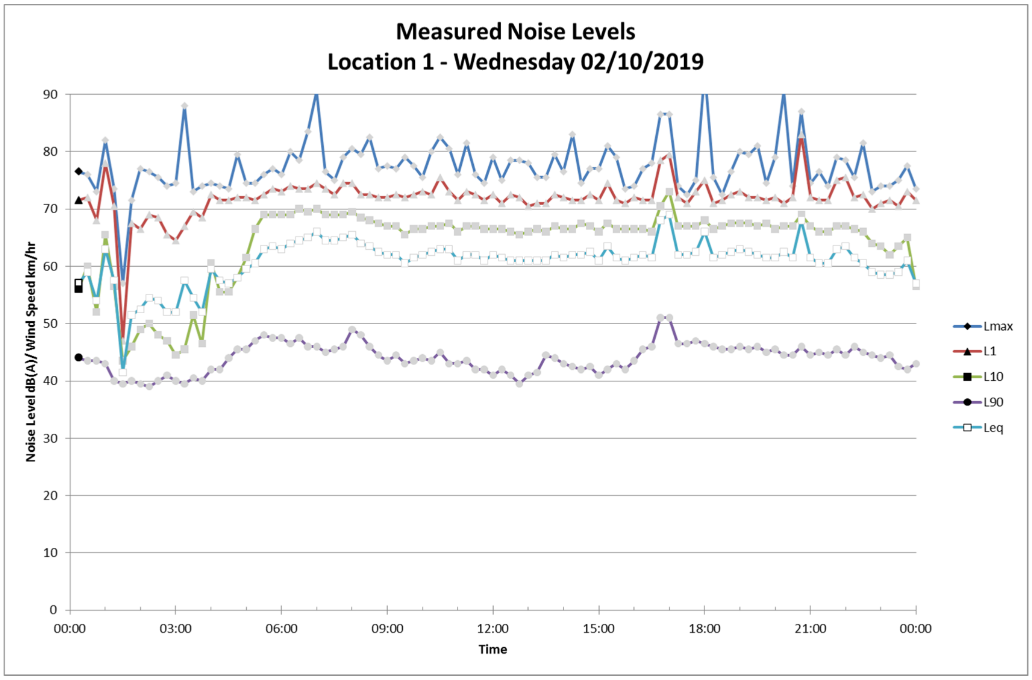
Measured Noise Levels
Location 1 - Saturday 28/09/2019
Noise Level dB(A)/ Wind Speed km/hr
90
80
70
60
50
40
30
20
10
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Time
Lmax
L1
L10
L90
Leq

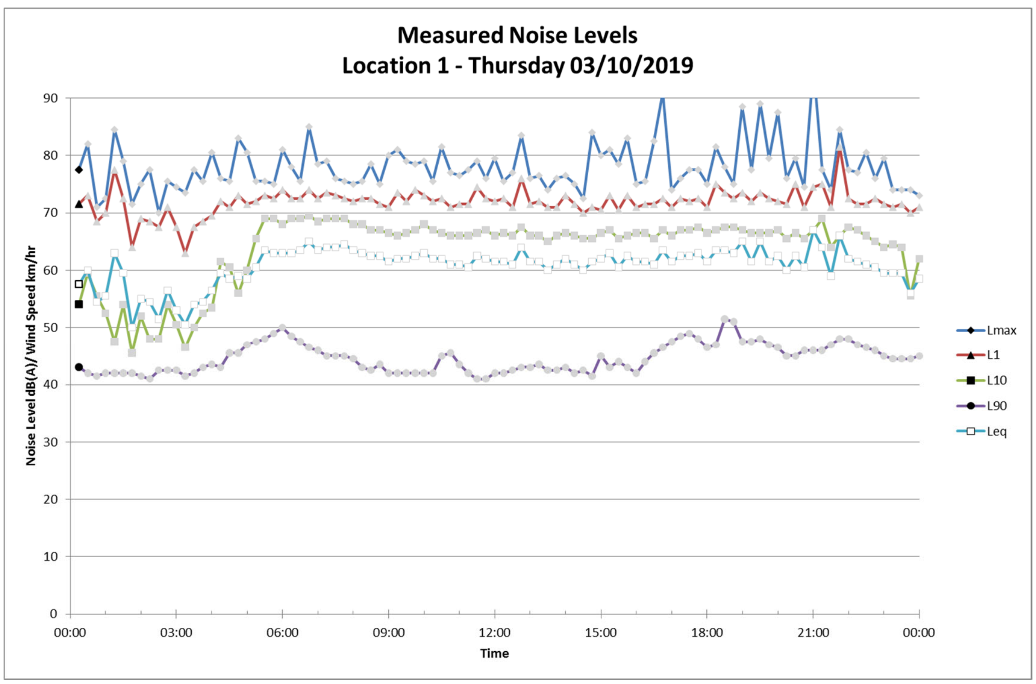


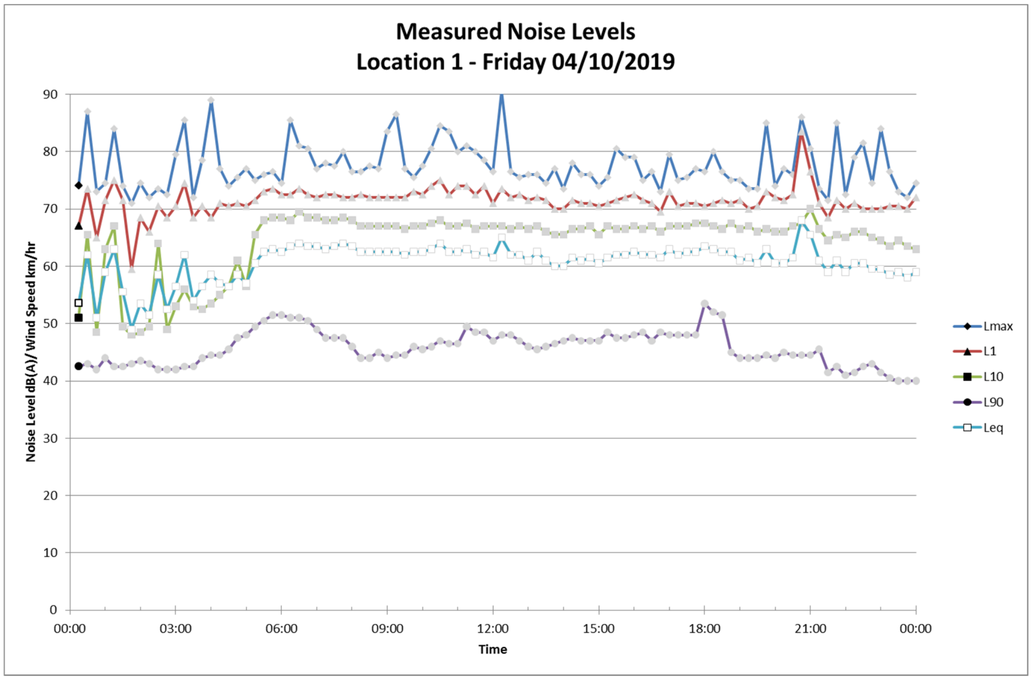
Measured Noise Levels
Location 1 - Sunday 29/09/2019
Noise Level dB(A)/ Wind Speed km/hr
90
80
70
60
50
40
30
20
10
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Time
Lmax
L1
L10
L90
Leq

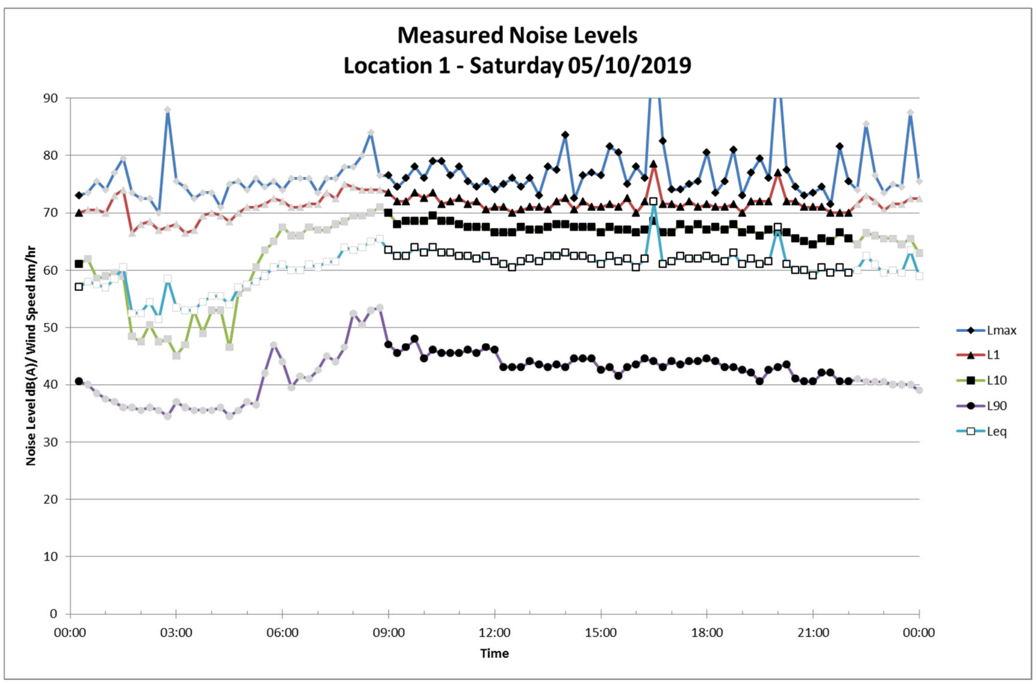

Measured Noise Levels
Location 1 - Monday 30/09/2019
Noise Level dB(A)/ Wind Speed km/hr
90
80
70
60
50
40
30
20
10
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Time
Lmax
L1
L10
L90
Leq

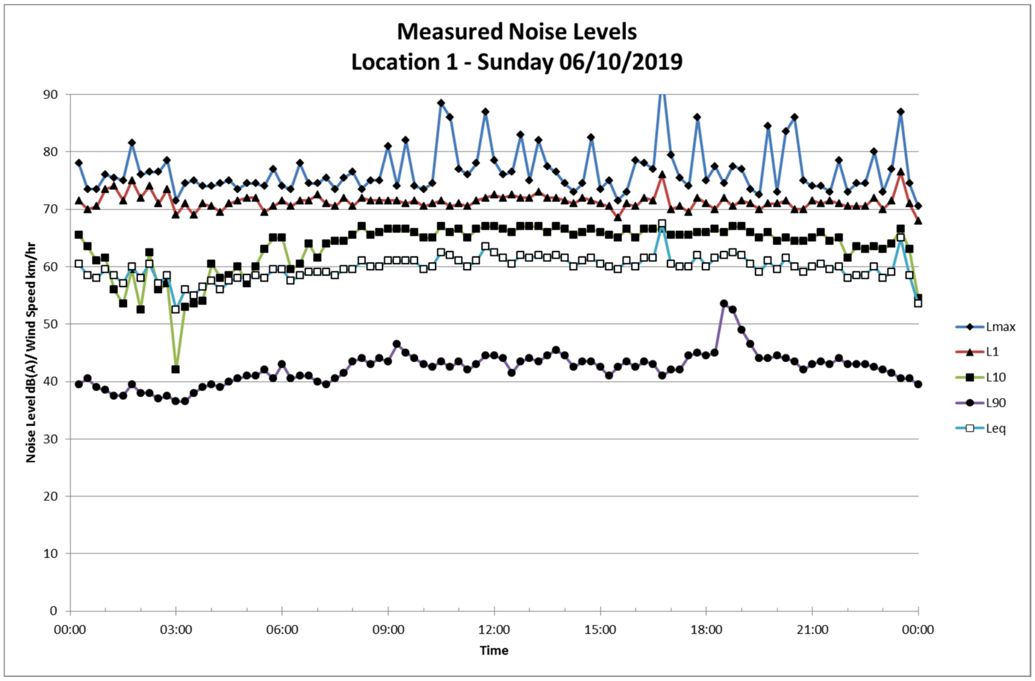

Measured Noise Levels
Location 1 - Tuesday 01/10/2019
Noise Level dB(A)/ Wind Speed km/hr
90
80
70
60
50
40
30
20
10
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Time
Lmax
L1
L10
L90
Leq

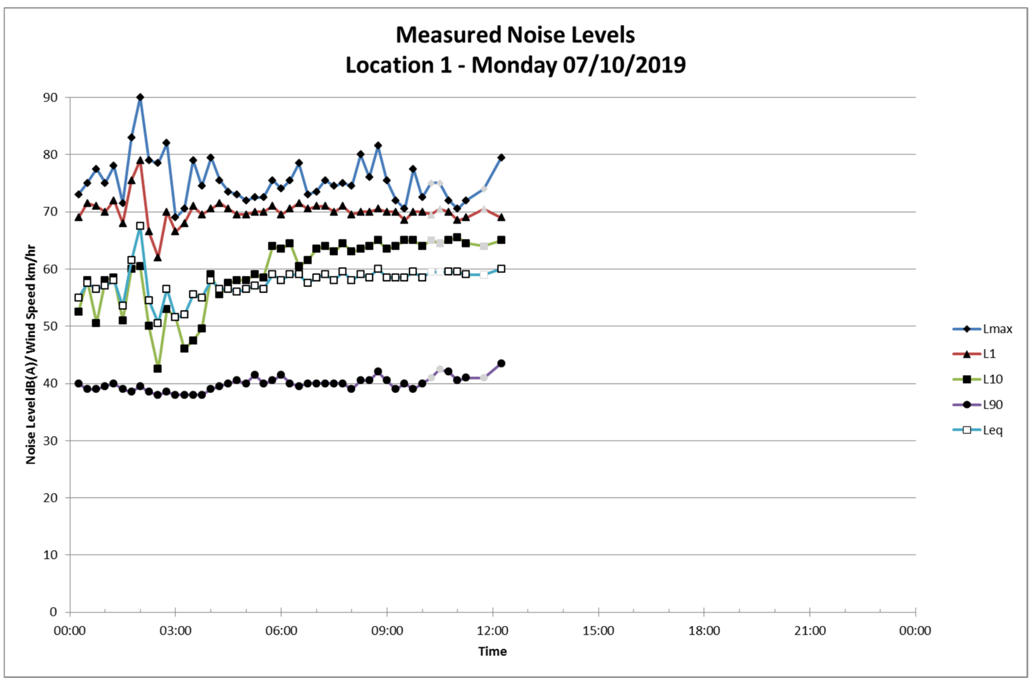

Measured Noise Levels
Location 1 - Wednesday 02/10/2019
Noise Level dB(A)/ Wind Speed km/hr
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
0
10
20
30
40
50
60
70
80
90
Lmax
L1
L10
L90
Leq


Measured Noise Levels
Location 1 - Thursday 03/10/2019
Noise Level dB(A)/ Wind Speed km/hr
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
Lmax
L1
L10
L90
Leq


Measured Noise Levels
Location 1 - Friday 04/10/2019
90
80
70
60
50
40
30
20
10
0
Noise Level dB(A)/ Wind Speed km/hr
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Time
Lmax
L1
L10
L90
Leq


Measured Noise Levels
Location 1 - Saturday 05/10/2019
90
80
70
60
50
40
30
20
10
0
Noise Level dB(A)/ Wind Speed km/hr
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Time
Lmax
L1
L10
L90
Leq


Measured Noise Levels
Location 1 - Sunday 06/10/2019
Noise Level dB(A)/ Wind Speed km/hr
0
10
20
30
40
50
60
70
80
90
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Time
Lmax
L1
L10
L90
Leq


Measured Noise Levels
Location 1 - Monday 07/10/2019
Noise Level dB(A)/ Wind Speed km/hr
0
10
20
30
40
50
60
70
80
90
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Time
Lmax
L1
L10
L90
Leq