NOISE IMPACT ASSESSMENT
FOR AMJ DEMOLITION AND EXCAVATION
55 MARTIN ROAD, BADGERYS CREEK

Prepared for: AMJ Demolition and Excavation Pty Ltd
Claron Consulting

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EXECUTIVE SUMMARY

This document presents a noise impact assessment conducted by Benbow Environmental for the proposed resource recovery facility located at 55 Martin Road, Badgerys Creek. The amount of waste to be processed is estimated to be approximately 95,000 tonnes per year.

The nearest receivers and the noise generating activities have been identified. Noise criteria for the project have been formed, with assessment of the proposed site activities conducted against the NSW Noise Policy for Industry (EPA, 2017), NSW Interim Construction Noise Guideline (DECC, 2009) and the NSW Road Noise Policy (DECCW, 2011). Modelling of the activities was conducted using the noise modelling software SoundPlan 7.3.

This noise impact assessment finds that predicted noise levels will be below the criteria set out in accordance with the NSW Noise Policy for Industry, at all receivers and time periods. Recommendations for noise controls are given in section 7.3, including sound power levels for the front end loader, fencing, equipment and automated roller doors usage.

The generation of additional road traffic associated with the site's activities has been assessed and it was predicted to comply with the guidelines set out in the NSW Road Noise Policy.

Construction activities are recommended to be limited to standard hours in accordance with the Interim Construction Noise Guideline.

The site is located near the Western Sydney Airport in a zone where the ANEF is between 30 and 35. The proposed development is not a noise sensitive development and would be best classed as "other industrial" under AS2021; acceptable in all ANEF zones. Furthermore the proposed development meets the objectives of clause 7.18 of the Liverpool LEP.

This report concludes that following the carrying out of the recommendations in this report, the proposed site activities will have an acceptable noise impact on the surrounding receivers.

Contents Page

Tables Page

Figures

Page

Attachments

1. INTRODUCTION

Benbow Environmental has been engaged to undertake a noise impact assessment for the proposed resource recovery facility at 55 Martin Road, Badgerys Creek.

The site is located within a RU1 Primary Production Zoning in Badgerys Creek, within Liverpool City Council. The nearest residential receptors are located approximately adjacent to the northern boundary of the site.

Operations at the site would consist of trucks unloading Construction and Demolition (C&D) waste, including soil (VENM/ENM) and green waste (only garden waste). The amount of waste to be processed is estimated to be approximately 95,000 tonnes per year.

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 Environment Protection Authority (EPA), Noise Policy for Industry 2017;
- Department of Environment, Climate Change and Water (DECCW) NSW, Road Noise Policy (RNP) 2011; and
- Department of Environment and Climate Change (DECC) NSW, Interim Construction Noise Guideline (ICNG) 2009.

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 OVERVIEW OF OPERATIONS

The proponent is seeking to establish a resource recovery facility at 55 Martin Road, Lot 4 DP 611519. The following is to be constructed on the site:

- Unloading and processing shed;
- Material storage bays;
- Weighbridge and wheel wash; and
- Car park and landscaped area.

Trucks will enter the site from Martin Road, and unload materials in the unloading and processing shed. Materials are handled and sorted, concrete will be crushed and green waste will be shredded inside the shed. Sorted concrete, bricks, untreated timber and shredded green garden waste are stockpiled on site.

Recovered materials would be stored in the external storage bays for re-selling, either directly from site to trade clients or to a landscape supply outlet offsite. Any processed waste that is not suitable for resource recovery will be collected by a licensed waste contractor for final disposal to landfill.

The majority of stationary noise sources, including the screen and crusher are located inside the building. Mobile equipment such as trucks, excavators and loaders may be located outside the building. Truck movements per day include 10 x 15 tonne truck trips and 6 x 32 tonne truck trips, or a maximum of 2 truck trips per hour.

2.2 HOURS OF OPERATIONS

The resource recovery facility is proposed to operate from Monday to Friday 7am to 6pm and Saturday from 7am to 5pm. The site is not proposed to operate on Sundays or Public Holidays.

2.3 DESCRIPTION OF THE PROPOSAL

2.3.1 Site Description

The proposal site is located at 55 Martin Road, Badgerys Creek. The block is rectangular shaped and 25,400 m^2 in size. A brick building is located on the eastern end of the property. The land and surrounds is zoned RU1 Primary Production in the Liverpool Council Local Environment Plan 2008.

An unloading and processing shed is proposed to be located on the northern boundary of the property. Trucks are proposed to enter and exit the site from Martin Road. A weighbridge is to be located on the northern edge of the property off Martin Road, and a wheel wash is located further up the driveway, in alignment with truck turning parameters.

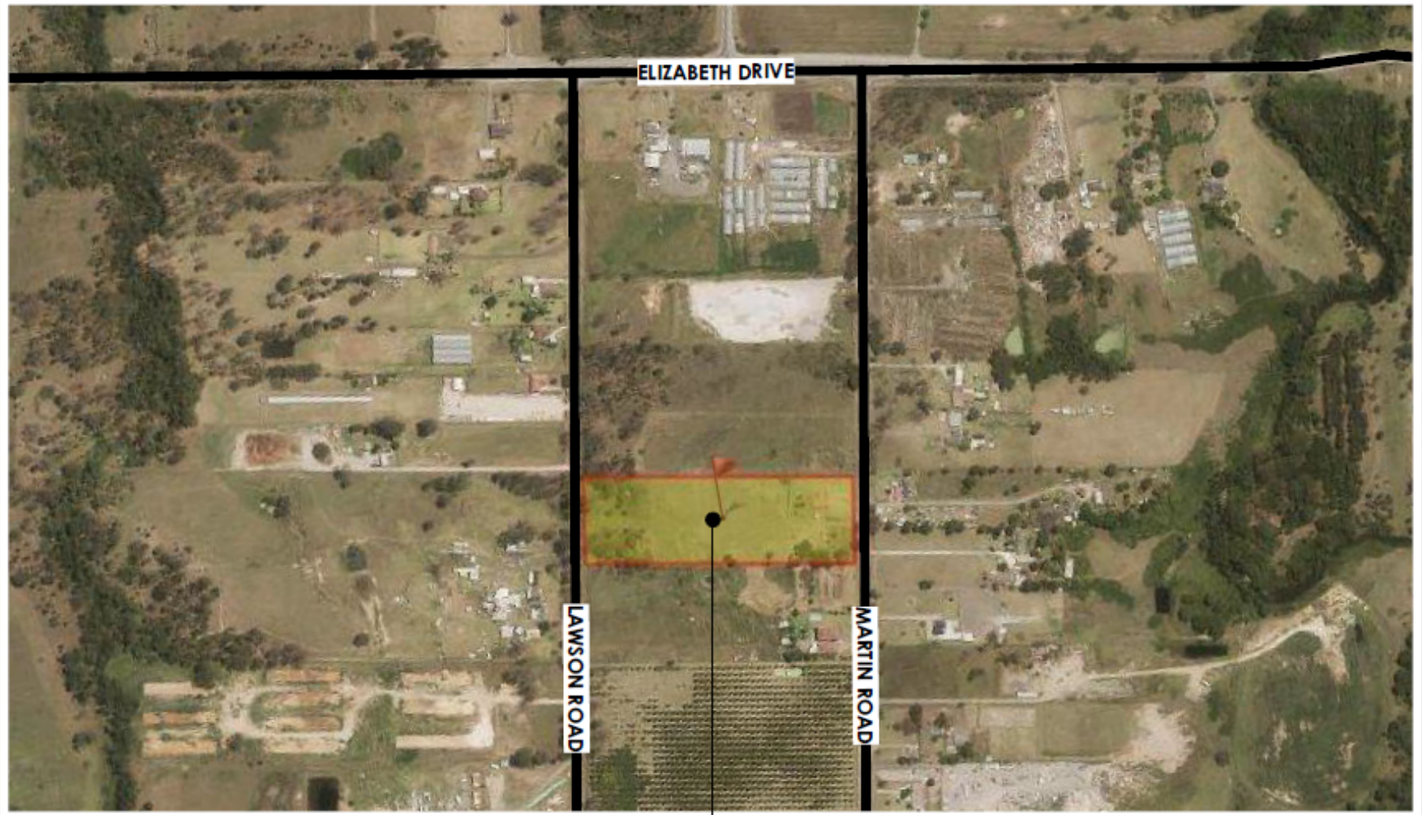
Cars are also proposed to enter and exit the site from Martin Road, driving into a new carpark between the existing brick building and Martin Road.

A site layout plan of the 55 Martin Road property is shown in Figure 2-1.

Figure 2-1: Site Layout

DRAWING SCHEDULE:

Drawing No.	Layout Name
00	COVER SHEET
01	LOCATION PLAN
02	SITE ANALYSIS PLAN (NOT ISSUED NOT CHANGED (FROM APPROVED DA)
03	SITE PLAN (WITH APPROVED DA FOOTPRINT OVERLAYED)
04	DETAILED SHED & TRUCK TURNING PLAN
05	DETAILED SITE PLAN (PART A) - LAWSON RD WEST
06	DETAILED SITE PLAN (PART B) - MARTIN RD EAST
07	SHED AMENITIES FLOOR PLANS
08	PROCESSING SHED ELEVATIONS
09	SECTION THRU PROCESSING SHED
10	SECTION THRU STOCKPILE BUNKER
11	NEW OFFICE BUILDING GROUND FLOOR PLAN
12	NEW OFFICE BUILDING ELEVATIONS EAST & WEST
13	NEW OFFICE BUILDING ELEVATIONS NORTH & SOUTH
14	VISUAL IMPACT ASSESSMENT
15	VISUAL IMPACT ASSESSMENT
16	VISUAL IMPACT ASSESSMENT
17	VISUAL IMPACT ASSESSMENT
18	VISUAL IMPACT ASSESSMENT
19	VISUAL IMPACT ASSESSMENT
20	VISUAL IMPACT ASSESSMENT
21	VISUAL IMPACT ASSESSMENT



1 LOCATION PLAN

ARCHITECTURE Tourism + Residential

Main Office: Level 2, 68 Sophia Street, Surry Hills NSW 2010
Parramatta Office: Suite 4703, 11 Hassall Street, Parramatta NSW 2150
+61 2 9283 0860 | www.ptiarchitecture.com.au
Nominated Registered Architect: Peter Israel (reg no 5064)
ABN 80 050 071 022

BY	DESCRIPTION	BY	DATE
A	ISSUE FOR INFORMATION	VW	05.11.2018
B	ISSUE FOR PRE DA	DD	23.07.2019
C	LIST REVISED ISSUED FOR INFORMATION	DD	23.07.2019

CLIENT: AMJ DEMOLITION & EXCAVATION

PROJECT TITLE: PROPOSED AMENDMENTS TO APPROVED DA-263/2018 WASTE RESOURCE RECOVERY FACILITY

DRAWING TITLE: LOCATION PLAN

NORTH POINT

DRAWN BY: VW / DD
CHECKED BY: PI
SCALE: N.T.S.
PROJECT No: P513

DA 01 C
stage dwg no. revision

2.3.2 Process Description

The processes involved in the sorting operations are as follows:

- Trucks drive to the site with waste materials from construction and demolition sites, entering the property from western access point off Martin Road.
- Trucks arrive on site at a rate of sixteen per day (sixteen truck movements entering the site and sixteen truck movements exiting the site).
- Trucks drive into the unloading and processing shed and unload materials in the holding area.
- Green waste, concrete and timber are separated from the waste stream.
- Concrete is crushed and screened.
- Sorted materials are loaded to the materials stockpile area by excavator. Materials are sorted into bricks, concrete, timber, glass, metal, as well as garden waste and soil (VENM/ENM).
- Products are either exported from site by truck or sold on location.

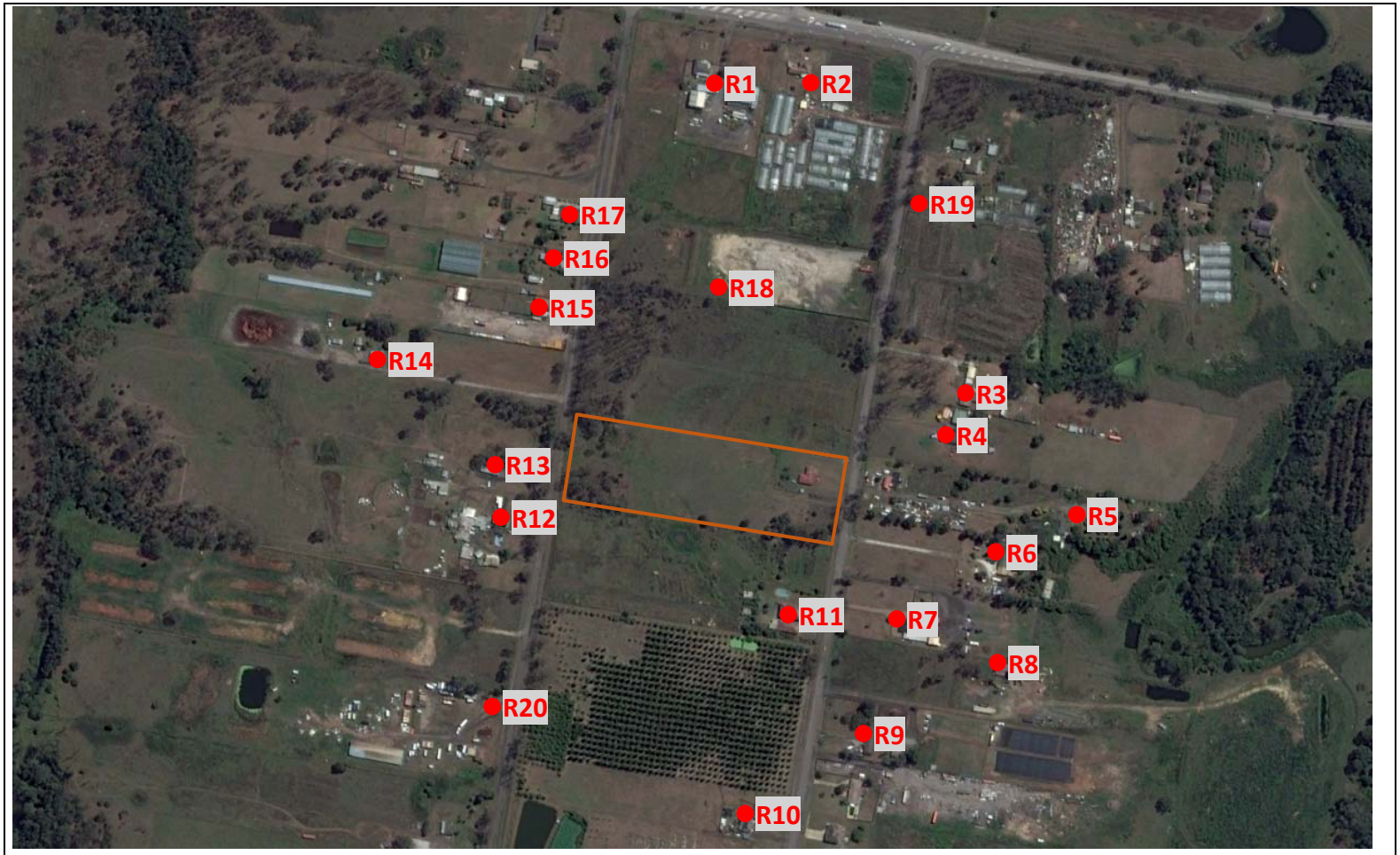
3. NEAREST SENSITIVE RECEPTORS

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

Table 3-1: Residential and Non-Residential Receivers

Receptor ID	Address	Lot & DP	Approx. Distance from Proposed Development	Type of Receptor
R1	1990 Elizabeth Drive, Badgerys Creek	Lot 10 DP 860338	370 m N	Residential
R2	1970 Elizabeth Drive, Badgerys Creek	Lot 11 DP 860338	370 m N	Residential
R3	30 Martin Road, Badgerys Creek	Lot 8 DP 226448	150 m NE	Residential
R4	40 Martin Road, Badgerys Creek	Lot 7 DP 226448	110 m NE	Residential
R5	50 Martin Road, Badgerys Creek	Lot 6 DP 226448	50 m E	Residential
R6	60 Martin Road, Badgerys Creek	Lot 5 DP 226448	170 m E	Residential
R7	70 Martin Road, Badgerys Creek	Lot 4 DP 226448	130 m SE	Residential
R8	80 Martin Road, Badgerys Creek	Lot 2 DP 530595	220 m SE	Residential
R9	90 Martin Road, Badgerys Creek	Lot 2 DP 226448	210 m SE	Residential
R10	75 Martin Road, Badgerys Creek	Lot 34 DP 3050	290 m S	Residential
R11	65 Martin Road, Badgerys Creek	Lot 36 DP 3050	Adjacent S	Residential
R12	83-87 Lawson Road, Badgerys Creek	Lot 6 DP 3050	70 m SW	Residential
R13	75 Lawson Road, Badgerys Creek	Lot 5 DP 3050	70 m W	Residential
R14	65 Lawson Road, Badgerys Creek	Lot 1 DP 104049	200 m W	Residential
R15	55 Lawson Road, Badgerys Creek	Lot 1 DP 1084967	110 m NW	Residential
R16	45 Lawson Road, Badgerys Creek	Lot 14 DP 531743	170 m NW	Residential
R17	35 Lawson Road, Badgerys Creek	Lot 13 DP 531743	200 m NW	Residential
R18	25 Martin Road, Badgerys Creek	Lot 1 DP 611519	150 m N	Industrial
R19	10 Martin Road, Badgerys Creek	Lot 10 DP 226448	270 m NE	Industrial
R20	105 Lawson Road, Badgerys Creek	Lot 8 DP 3050	220 m SW	Industrial

Figure 3-1: Residential and Non-Residential Receptors



N

LEGEND:

Site

Receptor

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 EPA Noise Policy for Industry 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 29th September 2017 to 10th October 2017 at two (2) residential locations.

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 two (2) Acoustic Research Laboratories statistical Environmental Noise Loggers, type EL-215 (unattended noise monitoring). The instrument sets complied with AS IEC 61672.1–2004 and were 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 Noise Policy for Industry (EPA, 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 metres above ground level.

In assessing the background noise levels, any data affected by adverse weather conditions has been discarded according to the requirements of the Noise Policy for Industry. The weather data was sourced from the Bureau of Meteorology Automatic Weather Station (AWS) located at Badgerys Creek (ID 067108).

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	194441	A-weighted Fast Response 15 minute integration period
Long-term Unattended	ARL-215	194552	A-weighted Fast Response 15 minute integration period
Short-term Attended	Svantek SVAN957 Type 1 Integrating Sound and Vibration analyser	15336	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 loggers were utilised to measure the existing ambient and background noise levels. Unattended long-term noise monitoring was undertaken from 29th September 2017 to 10th October 2017 at two (2) residential locations. The monitoring locations were selected, to represent the closest receivers off Martin Road.

Attended noise monitoring was undertaken on 29th September 2017.

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

Table 4-2: Noise Monitoring Locations

Monitoring Location	Methodology	Address
A	Attended monitoring and unattended monitoring	55 Martin Road, Badgerys Creek
B	Attended monitoring and unattended monitoring	83-87 Lawson Road, Badgerys Creek

Figure 4-1: Logger Locations

Table 4-3 identifies the receptor locations that have been associated with the two (2) noise logger locations and will therefore utilise the noise criteria derived from the measurement data obtained from the respective noise logger.

Table 4-3: Associated Residential Receptors

Logger	Associated Residential Receptor Locations
A	R1-R11
B	R12-R17

4.3 MEASURED NOISE LEVELS

4.3.1 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 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.

Existing road noise levels are presented in Table 4-5.

Table 4-4: Unattended Noise Monitoring Results, dB(A)

Monitoring Location and associated receptors	Assessment Background Level ABL (L_{90})			Equivalent Ambient Noise Level L_{eq}		
	Day	Evening	Night	Day	Evening	Night
Logger A	37	33	29	50	46	47
Logger B	37	35	30	51	49	48

Table 4-5: Road Traffic Noise Data at Locations A and B

Date	Existing Road Traffic Noise – dB(A)			
	Daytime (7am to 10pm)		Night-time (10pm to 7am)	
	$L_{eq\ (15\ hour)}$	$L_{eq\ (1\ hour)}$	$L_{eq\ (9\ hour)}$	$L_{eq\ (1\ hour)}$
Logger A	51	52	45	48
Logger B	51	52	45	49

4.3.2 Short Term Operator Attended Noise Monitoring Results

Given that the results of the unattended noise monitoring are affected by all ambient noise sources such as local fauna, road traffic and industrial sources, it is not possible to determine with precision the contribution of each component based on unattended monitoring alone. Therefore, the attended noise monitoring allows for a more detailed understanding of the existing ambient noise characteristics and a more meaningful final analysis to be undertaken. The results of the short-term attended noise monitoring are displayed in Table 4-6.

The attended measurements showed that the background noise levels consisted of traffic from Elizabeth Drive, birds and trees rustling in the wind. Ambient noise levels were dominated by vehicles on Martin Road and Lawson Road, aeroplanes and surrounding industrial noise.

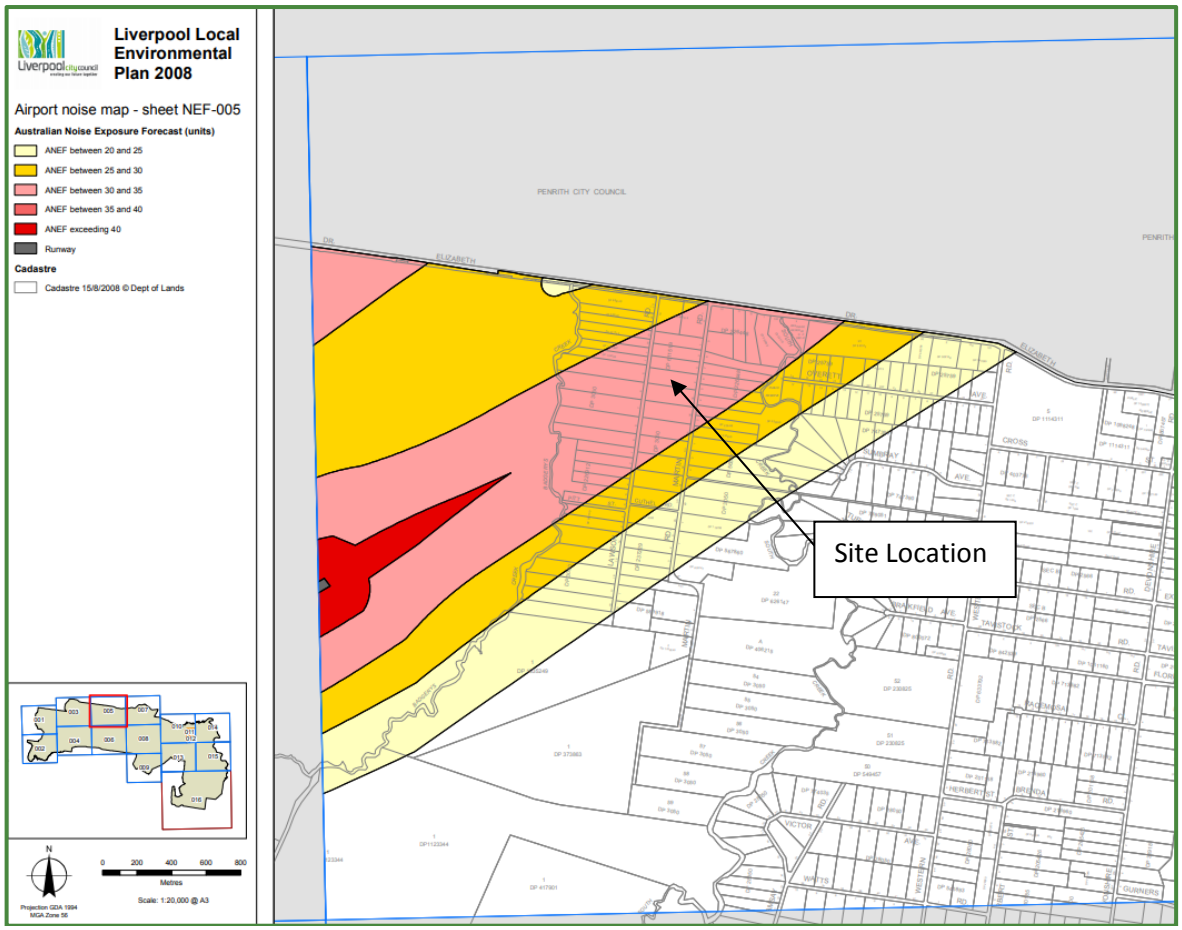
Table 4-6: Operator Attended Noise Measurements, dB(A)

Location & Date/Time	L_{Aeq}	L_{A90}	L_{A10}	L_{A1}	Comments
Location A Friday 29/09/2017 12:55 Daytime Period	61	38	59	81	Cars Martin Road < 74 dB(A) Trucks Martin Road < 83 dB(A) Background traffic Elizabeth Drive < 35 dB(A) **Distant fan < 30 dB(A)** Birds in trees < 45 dB(A) Wind in trees < 35 dB(A) Dog barking < 44 dB(A) Aeroplane < 58 dB(A) **Tractor < 40 dB(A), 90 seconds** **Distant excavator < 30 dB(A), 30 seconds** **Estimated L_{Aeq} noise level from industrial sources = 31 dB(A)**
Location B Friday 29/09/2017 12:28 Daytime Period	53	38	54	65	Cars Lawson Road < 68 dB(A) Trucks Lawson Road < 75 dB(A) Background traffic Elizabeth Drive < 32 dB(A) **Truck revving < 35 dB(A), 10 seconds** Birds < 55 dB(A) Light wind in trees < 40 dB(A) Aeroplane < 56 dB(A) **Industrial scraping/banging < 40 dB(A), 2 minutes** **Estimated L_{Aeq} noise level from industrial sources = 31 dB(A)**

4.4 WESTERN SYDNEY AIRPORT NOISE

The subject site lies under the flight path for the proposed Western Sydney Airport. The site location is shown on the Australian Noise Exposure Forecast (ANEF) map below.

Figure 4-2: Western Sydney Airport ANEF Map



As can be seen in the image above the ANEF for the site is between 30 and 35.

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 Badgerys Creek Automatic Weather Station (AWS ID 067108). At the time of preparing this report, the last full year of data available is 2016, and was therefore considered appropriate.

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.

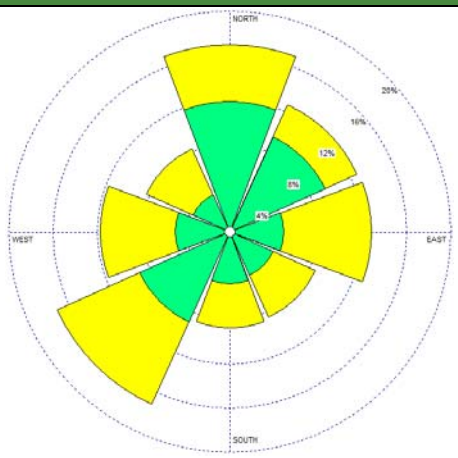
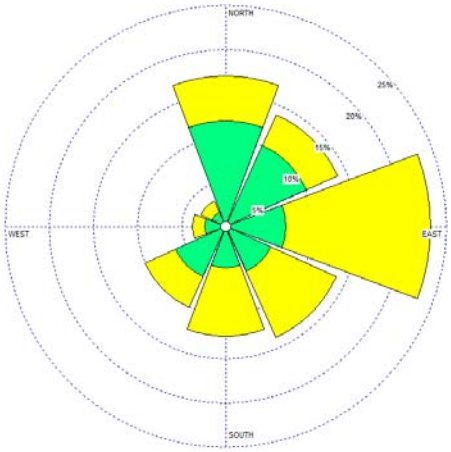
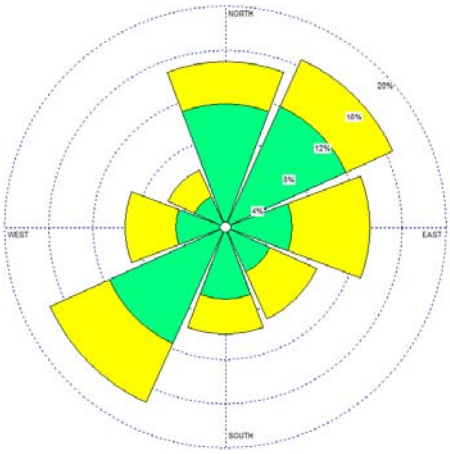
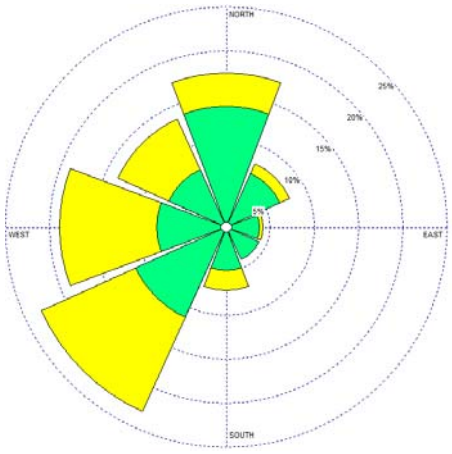
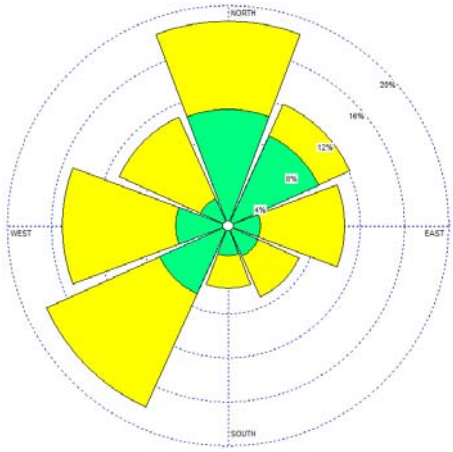
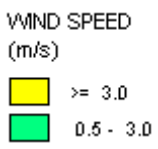
Thus, the segments of a petal show what proportion of wind for a given direction falls into each class. The proportion of time for which wind speed is less than 0.5 m/s, when speed is negligible, is referred to as calm hours or "calms". Calms are not shown on a wind rose as they have no direction, but 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 Badgerys Creek AWS data have been included in Figure 5-1.

Figure 5-1: Wind Rose Plots – BOM Badgerys Creek AWS ID 067108 2016 – Day time

All Seasons	Summer Season (December – February)
	
Average Wind Speed: 3.01 m/s Axis Frequencies: 4%, 8%, 12%, 16%, 20%	Average Wind Speed: 3.00 m/s Axis Frequencies: 5%, 10%, 15%, 20%, 25%
Autumn Season (March – May)	**Winter Season (June – August)**
	
Average Wind Speed: 2.58 m/s Axis Frequencies: 4%, 8%, 12%, 16%, 20%	Average Wind Speed: 2.84 m/s Axis Frequencies: 5%, 10%, 15%, 20%, 25%
Spring Season (September – November)	**Legend**
	
Average Wind Speed: 3.62m/s Axis Frequencies: 4%, 8%, 12%, 16%, 20%	

Based on the information presented from the weather data, source-to receiver wind speeds of 3 m/s or below are present for less than 30% of the time therefore wind effects have not been included in the assessment.

5.2 TEMPERATURE INVERSIONS

Operations are to take place during the day period, Monday to Friday 7am to 6pm and Saturday from 7am to 5pm. As the night period is not being utilised, temperature inversions are therefore not considered any further.

5.2.1 Weather Conditions Considered in the Assessment

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

- Condition A: Neutral Weather Conditions.

Details of the considered meteorological conditions have been displayed in Table 5-1.

Table 5-1: Meteorological Conditions Assessed in Noise Propagation Modelling

Condition	Classification	Ambient Temp.	Ambient Humidity	Wind Speed	Wind Direction (blowing from)	Temperature Inversion	Affected Receiver	Applicability
A	Neutral	10 °C	70%	-	-	No	All	All periods

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:

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

Table 6-1: Amenity noise levels.

Receiver	Noise Amenity Area	Time of Day	L_{Aeq} dB(A) Recommended amenity noise level
Residential	Rural	Day	50
		Evening	45
		Night	40
Industrial	All	When in use	70

Source: Table 2.2 NSW Noise Policy for Industry

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.

The development is not proposed to operate during the night period, and therefore a sleep disturbance assessment is not considered warranted.

6.1.4 Project Noise Trigger Levels

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

Table 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 $L_{Aeq\ 15\ minute}$ [2]	PNTL $L_{Aeq\ 15\ minute}$
R1-R11	Residential - Rural	Day	37	**42**	50	48	**42**
		Evening	33	**38**	45	43	**38**
		Night	30	**35**[1]	40	38	**35**
R12-R17	Residential - Rural	Day	37	**42**	50	48	**42**
		Evening	35	**40**	45	43	**40**
		Night	30	**35**	40	38	**35**
R18-R20	Industrial	When in use	-	-	70	68	**68**

Notes:
1) This value is based on the minimum assumed rating background level of 30 dB(A) for night time.
2) These levels have been converted to $L_{Aeq\ 15\ minute}$ using the following: $L_{Aeq\ 15\ minute} = L_{Aeq\ period} + 3$ dB (NSW Noise Policy for Industry Section 2.2).

6.2 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 Vehicle Route

Trucks and light vehicles are proposed to access the site from Martin Road. Martin Road is accessed from the sub-arterial road, Elizabeth Drive. The proposed transport routes are shown in Figure 6-1. The potentially most impacted residents to the proposed route are located along Martin Road, between Elizabeth Drive and the subject site.

Figure 6-1: Proposed Transport Route

6.2.2 Road Category

Based on the RNP road classification description, Martin Road would be classified as a 'local road'.

6.2.3 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)
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.

6.2.4 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.

As Martin Road is a local road, the relative increase criterion will not be further considered.

6.2.5 Assessment Locations for Existing Land Uses

Table 6-4: 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.)

Table 6-4: Assessment Locations for Existing Land Uses

Assessment Type	Assessment Location
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

Based on the traffic noise data obtained though the long term road traffic noise measurement, the current existing road traffic noise levels exceed the assessment criteria.

The selected project specific noise levels associated with road traffic noise are presented in Table 6-5.

Where existing traffic noise levels are above the noise assessment criteria, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'no build option'.

Table 6-5: Project Specific Noise Levels Associated with Road Traffic, dB(A)

Receptor along	Period	Existing Road Traffic Noise L_{eq}	Assessment Criteria L_{eq}	PSNL Cumulative Road Traffic Noise Level L_{eq}
R4, Martin Road (Local Road)	Day	48	55	**55**
	Night	44	50	**50**

6.3 CONSTRUCTION NOISE AND VIBRATION CRITERIA

Criteria for construction and demolition noise has been obtained from the NSW Interim Construction Noise Guideline (DECC, 2009). Guidance for construction vibration has been taken from British Standard BS7385-Part 2: 1993 '*Evaluation and measurement for vibration in buildings*' and other standards.

6.3.1 NSW Interim Construction Noise Guideline

Residential Criteria

Table 2 of the Interim Construction Noise Guideline (DECC, 2009), sets out construction noise management levels for noise at residences and how they are to be applied. The management noise levels are reproduced in Table 6-6 below. Restrictions to the hours of construction may apply to activities that generate noise at residences above the 'highly noise affected' noise management level.

Table 6-6: Management Levels at Residences Using Quantitative Assessment

Time of Day	Management Level $L_{Aeq(15\ minute)}$	How to Apply
Recommended standard hours: Monday to Friday 7am – 6pm Saturday 8am – 1pm No work on Sundays or Public Holidays	Noise Affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq(15\ minute)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practises to meet the noise affected level. • The proponent should also inform all potentially affected residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly Noise Affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. times identified by the community when they are less sensitive to noise (such as before and after school, or mid-morning or mid-afternoon for works near residents. 2. if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise Affected RBL + 5 dB	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. • For guidance on negotiating agreements see section 7.2.2 (RNP)

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

Other Land Uses

Table 6-7 sets out management levels for construction noise at other land uses applicable to the surrounding area.

Table 6-7: Management Levels at Other Land Uses

Land use	Management Level $L_{Aeq(15\ minute)}$ (applies when properties are being used)
Industrial Premises	External Noise Level 75 dB(A)

There are no other sensitive land uses in the area surrounding the proposed resource recovery facility.

The noise criterion for construction noise is presented in Table 6-8.

Table 6-8: Construction Noise Criterion dB(A)

Receiver	Land Use	Period	RBL L_{A90}	Management Level $L_{Aeq(15\ minute)}$
R1-R11	Residential	Standard Hours	37	47
R12-R17	Residential	Standard Hours	37	47
R18-R20	Industrial	Standard Hours	-	75

6.3.2 Vibration Criteria

A proposed list of operational equipment listed in Table 7-1 and construction equipment listed in Table 9-2 does not include significant sources of vibration, and is not expected to cause cosmetic damage to surrounding structures or cause human response to nearby receivers. Vibration impacts during the construction and operational activities have therefore not been further considered.

6.4 Western Sydney Airport Legislation

The Australian Noise Exposure Forecast (ANEF) describes the cumulative aircraft noise for an 'average annual day'. Below shows the acceptability for different uses in relation to the ANEF zone in accordance with AS2021.

Table 6-9: AS2021 – Building Site Acceptability base on ANEF zone

Building Type	ANEF zone of site		
	Acceptable	Conditionally Acceptable	Unacceptable
House, home unit, flat caravan park	Less than 20 ANEF	20 to 25 ANEF	Greater than 25 ANEF
Hotel, motel, hostel	Less than 25 ANEF	25 to 30 ANEF	Greater than 30 ANEF
School, university	Less than 20 ANEF	20 to 25 ANEF	Greater than 25 ANEF
Hospital, nursing home	Less than 20 ANEF	20 to 25 ANEF	Greater than 25 ANEF
Public building	Less than 20 ANEF	20 to 30 ANEF	Greater than 30 ANEF
Commercial building	Less than 25 ANEF	25 to 35 ANEF	Greater than 35 ANEF
Light industrial	Less than 30 ANEF	30 to 40 ANEF	Greater than 40 ANEF
Other industrial	Acceptable in all ANEF zones		

The proposed development would be best classed as "other industrial" Acceptable in all ANEF zones. The site is located in a zone where the ANEF is between 30 and 35.

6.4.1 LEP Clause 7.18

The Liverpool Local Environment Plan 2008 clause 7.18 states:

> *7.18 Development in areas subject to potential airport noise*
> *(1) The objectives of this clause are to ensure that development in the vicinity of Bankstown Airport and the proposed Badgery's Creek airport site—*
> *(a) has regard to the use or potential future use of each site as an airport, and*
> *(b) does not hinder or have any other adverse impact on the development or operation of the airports on those sites.*
> *(2) Development consent is required for the erection of a building on land where the ANEF exceeds 20 if it is erected for residential purposes or for any other purpose involving regular human occupation.*
> *(3) The following development is prohibited unless it meets the requirements of AS 2021–2000, Acoustics—Aircraft noise intrusion—Building siting and construction with respect to interior noise levels—*
> *(a) residential accommodation on land where the ANEF exceeds 20,*
> *(b) business premises, entertainment facilities, office premises, public administration buildings, retail premises and tourist and visitor accommodation on land where the ANEF exceeds 25.*
> *(4) The following development is prohibited—*
> *(a) educational establishments, hospitals and places of public worship on land where the ANEF exceeds 20,*
> *(b) dwellings on land where the ANEF exceeds 25 (other than development consisting of the alteration, extension or replacement of an existing dwelling house where the development is consistent with the objectives of this clause),*
> *(c) business premises, entertainment facilities, office premises, public administration buildings, retail premises and tourist and visitor accommodation on land where the ANEF exceeds 30.*

(5) In this clause—
ANEF means Australian Noise Exposure Forecast as shown on the Airport Noise Map.

The proposed development is considered to meet the objectives of the above clause. The development is a waste resource recovery facility and is not considered captured by the uses stated in the clauses above.

7. OPERATIONAL NOISE IMPACT ASSESSMENT

7.1 MODELLING METHODOLOGY

7.1.1 Noise Model

Noise propagation modelling was carried out using the ISO9613 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 and receiver locations.

The modelling scenarios have been carried out using the $L_{Aeq,\ 15\ minutes}$ descriptor. Using the descriptor, 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.

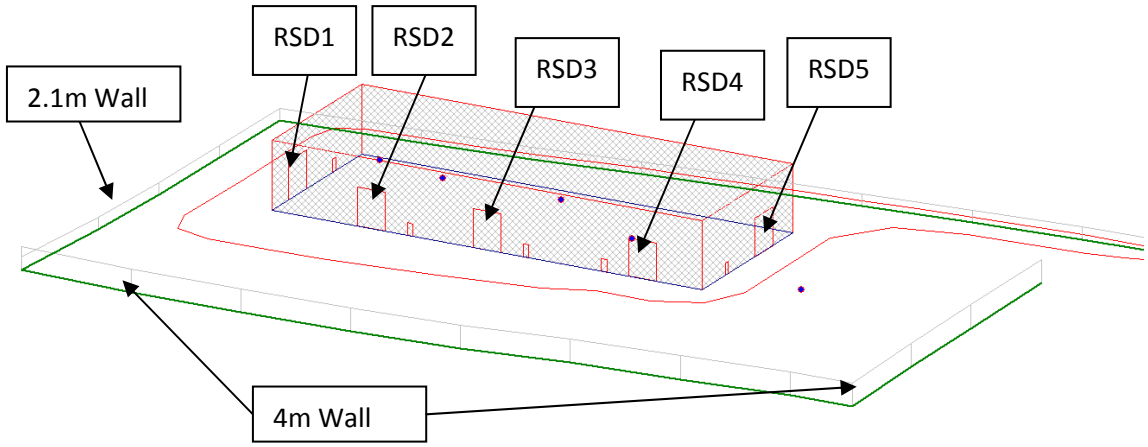
7.1.2 Assumptions Made for Noise Modelling

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:

- Off-site topographical information was obtained from Google Earth.
- On-site topography has been obtained from the site survey plans provided by the client.
- The unloading and processing shed has been modelled as an industrial building with internal point sources. The building dimensions are as shown on the survey plans. The majority of the industrial building walls and roof have been considered to be constructed of 1 mm colorbond sheet steel (R_w = 25 dB). The floor has been modelled as concrete.
- For scenario 1, the roller shutter doors have been modelled in the closed position for the entire 15 minute scenario. Pedestrian doors have been modelled open for 30 seconds per 15 minute scenario.
- For scenario 2, all roller shutter doors have been modelled in the closed position for the entire 15 minute scenario, except for door number 3 (the middle roller door). Roller door 3 has been modelled in the open position for 3 minutes, and closed for 12 minutes, simulating a truck or front end loader entering or exiting the shed. Pedestrian doors have been modelled open for 30 seconds per 15 minute scenario.
- For scenario 3, the roller shutter doors have been modelled in the open position for the entire 15 minute scenario. Pedestrian doors have been modelled open for 30 seconds per 15 minute scenario.

- A 2.1 m colorbond fence is modelled surrounding the hardstand area of the site. A 4m colorbond wall along the southern and eastern border of the hardstand area is modelled.
- 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 1.0 (soft).
- One (1) truck has been modelled entering the site as a worst case scenario over a 15 minute period. An on-site speed of 20 km/hr has been considered.
- Internal noise sources associated with the site activities (i.e. generator, excavator, triple deck screen, concrete crusher) have been modelled as point sources and will be operational for 100% of the operational hours of the site, when utilised in a scenario.
- Outdoor noise sources not associated with trucks (i.e. the truck manoeuvring and front end loader) has been modelled as point or line sources and will be operational for 100% of the operational hours of the site.
- The Front End Loader has been modelled with a sound power level of 97 dB(A), which is a relatively low level compared to other loaders on the market. The client intends to use a small compact loader which will meet this assumption.

Figure 7-1: 3D Model Perspective



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

7.1.3 Noise Sources

A-weighted octave band centre frequency sound power levels are presented in in Table 7-1 below. The sound power levels for the relevant noise sources have been calculated from measurements of sound pressure levels undertaken by an acoustic engineer from Benbow Environmental at similar sites and sourced from Benbow Environmental's extensive noise source database.

Table 7-1: A-weighted Sound Power Levels Associated with Operational Activities, dB(A)

Noise Source	Overall	Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
25T Excavator	**101**	80	83	89	95	94	93	90	83
Front End Loader	**97**	80	84	87	91	90	89	88	78
Triple Deck Screen	**100**	73	87	82	92	98	91	88	86
Concrete Crusher	**113**	80	90	97	103	106	107	107	105
Truck Maneuvering	**102**	73	81	86	101	92	90	85	85
Generator	**97**	64	74	81	87	90	91	91	89

7.1.4 Noise Modelling Scenarios

Three operational scenarios were considered in the noise model. The first noise generating scenario considered a situation where all noise sources on site were operating over the 15 minute assessment period, and the roller doors to the building were closed. The second scenario considered the roller doors to the building to be closed, except for the middle roller door which is open for 3 minutes of the 15 minute period. Scenario 2 enables a truck or front end loader to enter or exit the building. The third scenario considered the roller doors to the building to be open for transfer of materials to the stockpile area via front end loader, but with the crusher and excavator not running. It is understood from the client that the crusher and associated excavator will only operate for a little under half of the operational hours.

In all three scenarios, pedestrian doors are open for 30 seconds per 15 minute scenario, to allow occasional foot traffic in and out of the building. The equipment list is detailed in Table 7-2, with equipment location diagrams for scenarios 1-3 in Figure 7-2 to Figure 7-4.

Table 7-2: Modelled Noise Scenarios for Proposed Operations

Scenario	Time of the day	Noise Sources for Worst 15-minute Period
Scenario 1. All operations (all roller doors closed)	Monday – Friday 7am to 6pm Saturday 7am to 5pm	Indoor Noise Sources • Generator • Excavator • Triple decker screen • Concrete crusher Outdoor Noise sources • Truck manoeuvring • Front end loader
Scenario 2. Selected operations (all roller doors closed except for the middle roller door, open for 3 minutes out of a 15 minute period)	Monday – Friday 7am to 6pm Saturday 7am to 5pm	Indoor Noise Sources • Generator • Excavator • Triple decker screen • Concrete crusher Outdoor Noise sources • Truck manoeuvring • Front end loader
Scenario 3. Selected operations (all roller doors open)	Monday – Friday 7am to 6pm Saturday 7am to 5pm	Indoor Noise Sources • Generator • Triple decker screen Outdoor Noise sources • Truck manoeuvring • Front end loader

Figure 7-2: Scenario 1 – Roller Doors Closed – Operational noise sources

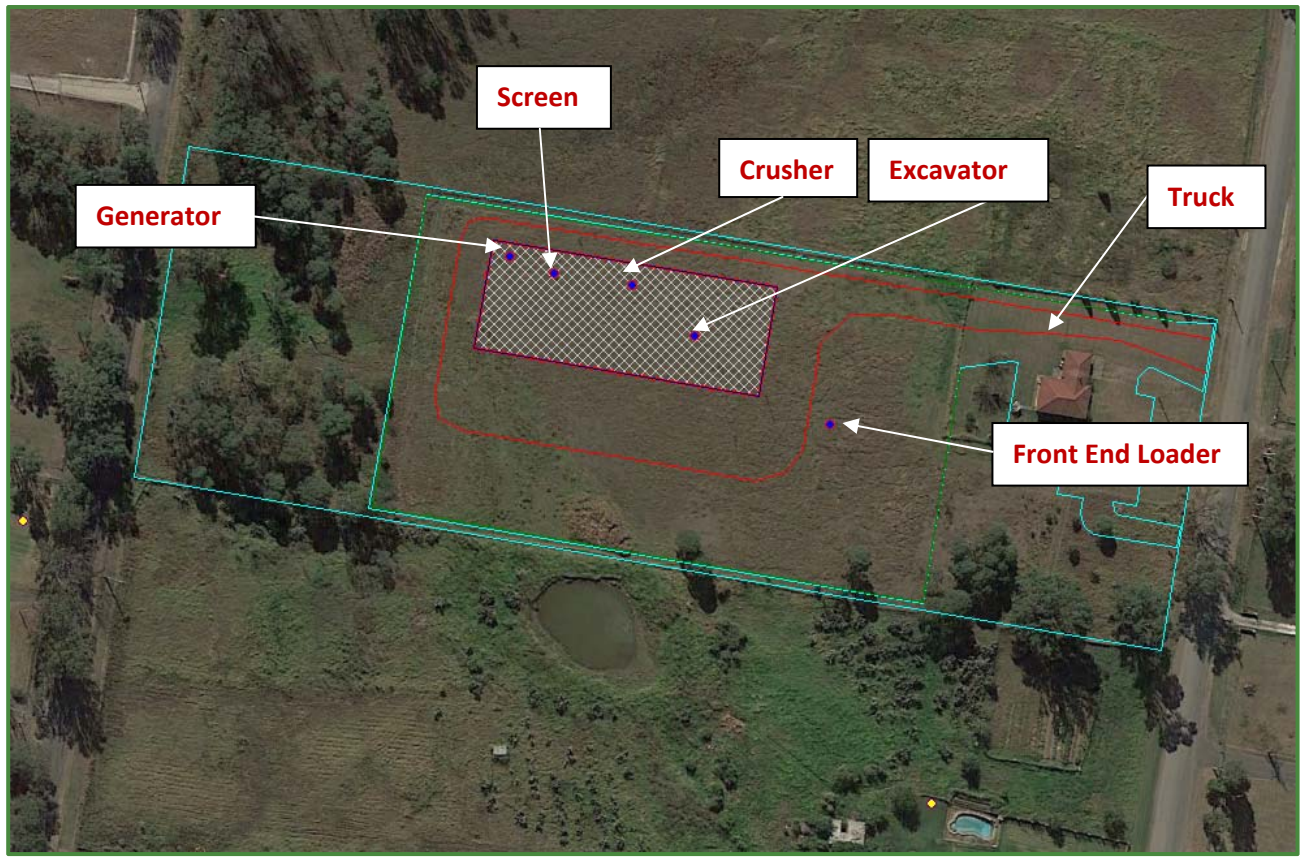


Figure 7-3: Scenario 2 – Roller Doors Mainly Closed – Operational noise sources

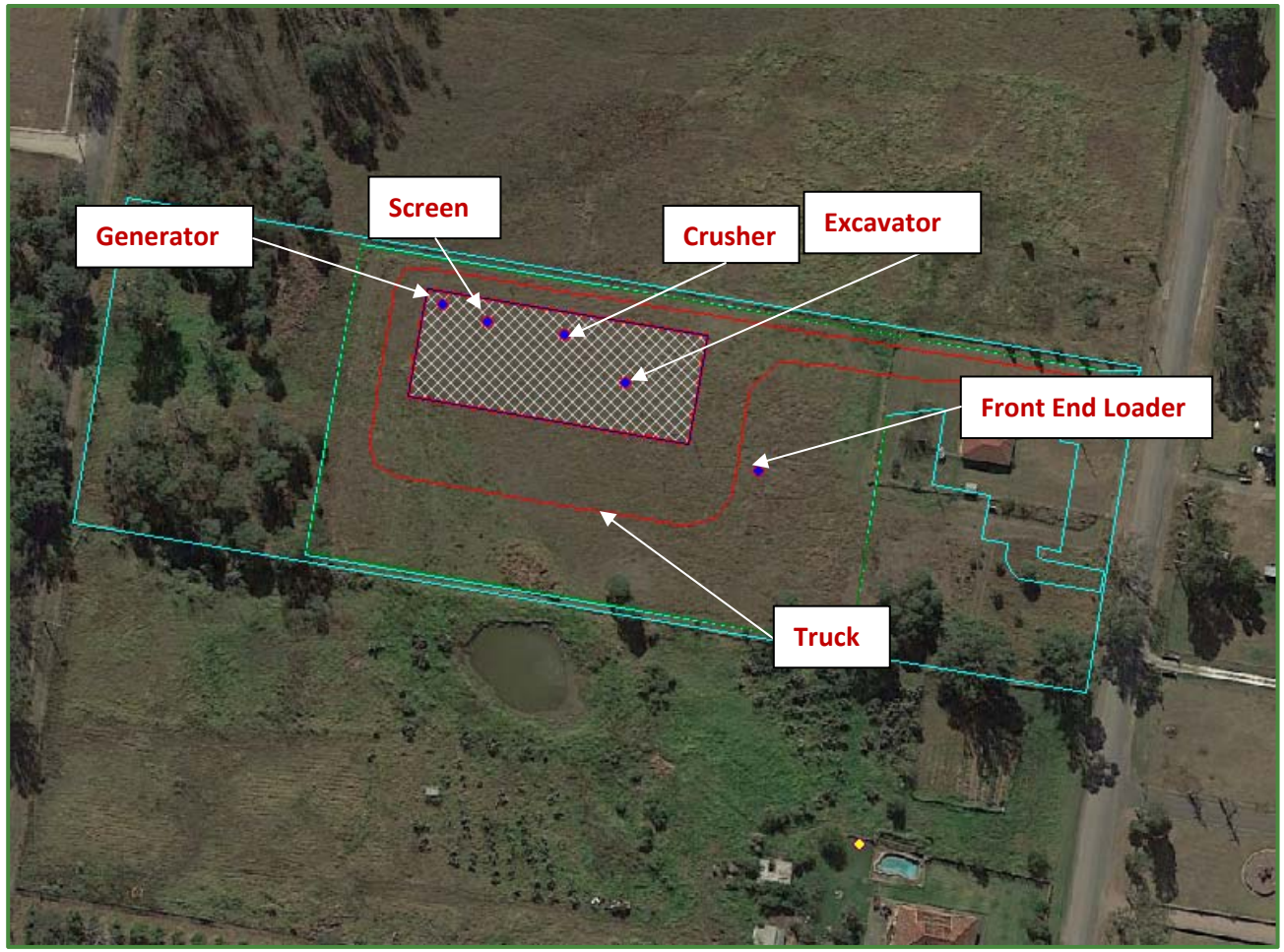
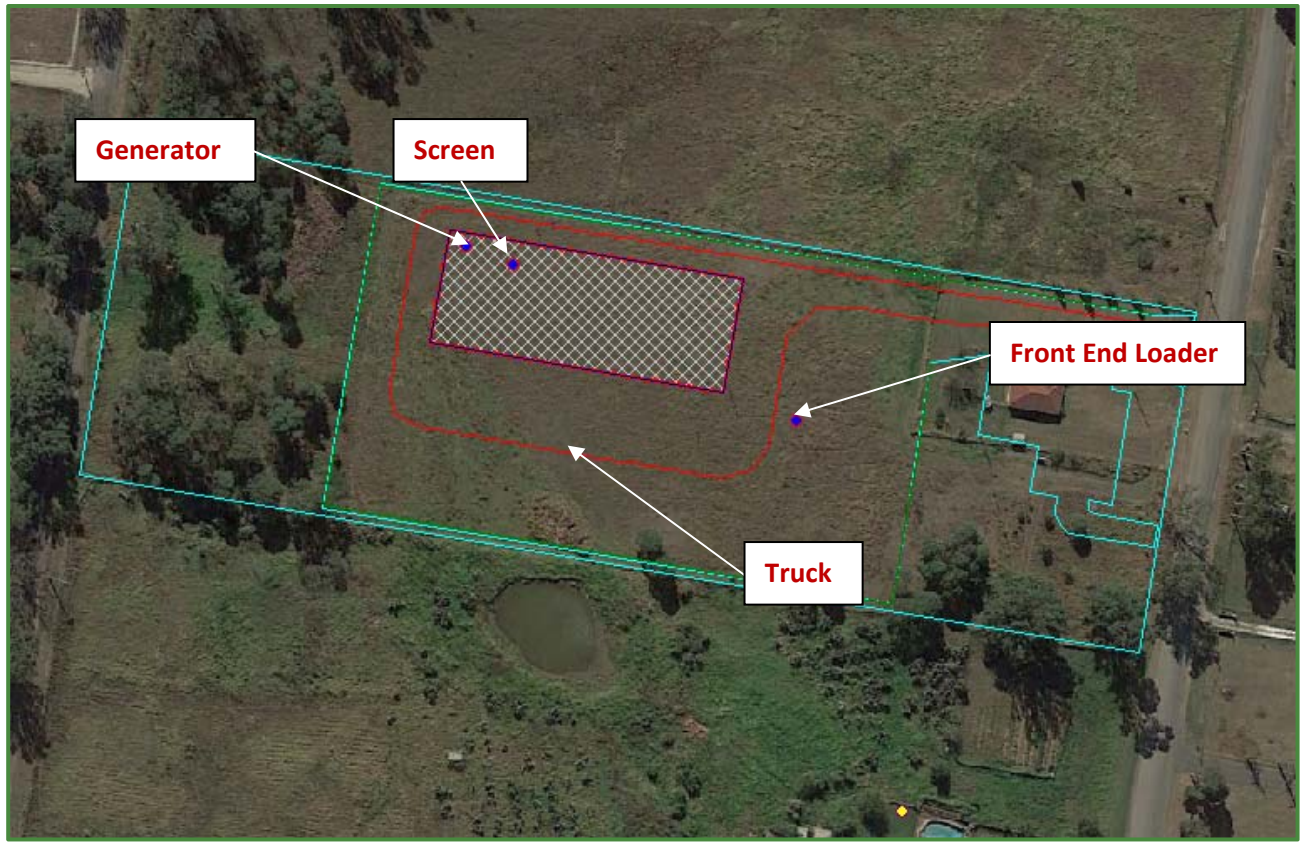


Figure 7-4: Scenario 3 – Roller Doors Open – Operational noise sources



7.2 OPERATIONAL PREDICTED NOISE LEVELS

Results of the predictive noise modelling of the operational activities are shown in Table 7-3.

During operations, noise levels are predicted to comply with the Noise Policy for Industry criteria at all receivers during all scenarios.

It is therefore concluded that the proposed site activities will not have a detrimental impact on the neighbouring receivers, if the noise control measures in section 7.3 are carried out.

Table 7-3: Noise Modelling Results Associated with Operational Activities, L_{eq}, dB(A)

Receiver	Criteria: PNTL ($L_{eq,15\ minute}$ dB(A)) – Day	Predicted: Scenario 1 (L_{eq}, dB(A))	Predicted: Scenario 2 (L_{eq}, dB(A))	Predicted: Scenario 3 (L_{eq}, dB(A))
R1	42	32 ✓	32 ✓	29 ✓
R2	42	32 ✓	32 ✓	30 ✓
R3	42	39 ✓	39 ✓	37 ✓
R4	42	39 ✓	39 ✓	38 ✓
R5	42	31 ✓	31 ✓	31 ✓
R6	42	34 ✓	35 ✓	34 ✓
R7	42	37 ✓	38 ✓	37 ✓
R8	42	33 ✓	34 ✓	34 ✓
R9	42	35 ✓	36 ✓	35 ✓
R10	42	33 ✓	34 ✓	33 ✓
R11	42	41 ✓	42 ✓	41 ✓
R12	42	40 ✓	42 ✓	41 ✓
R13	42	40 ✓	41 ✓	42 ✓
R14	42	33 ✓	33 ✓	31 ✓
R15	42	39 ✓	39 ✓	37 ✓
R16	42	37 ✓	37 ✓	35 ✓
R17	42	35 ✓	35 ✓	33 ✓
R18	68	40 ✓	40 ✓	36 ✓
R19	68	34 ✓	34 ✓	32 ✓
R20	68	34 ✓	35 ✓	35 ✓

7.3 NOISE CONTROL MEASURES

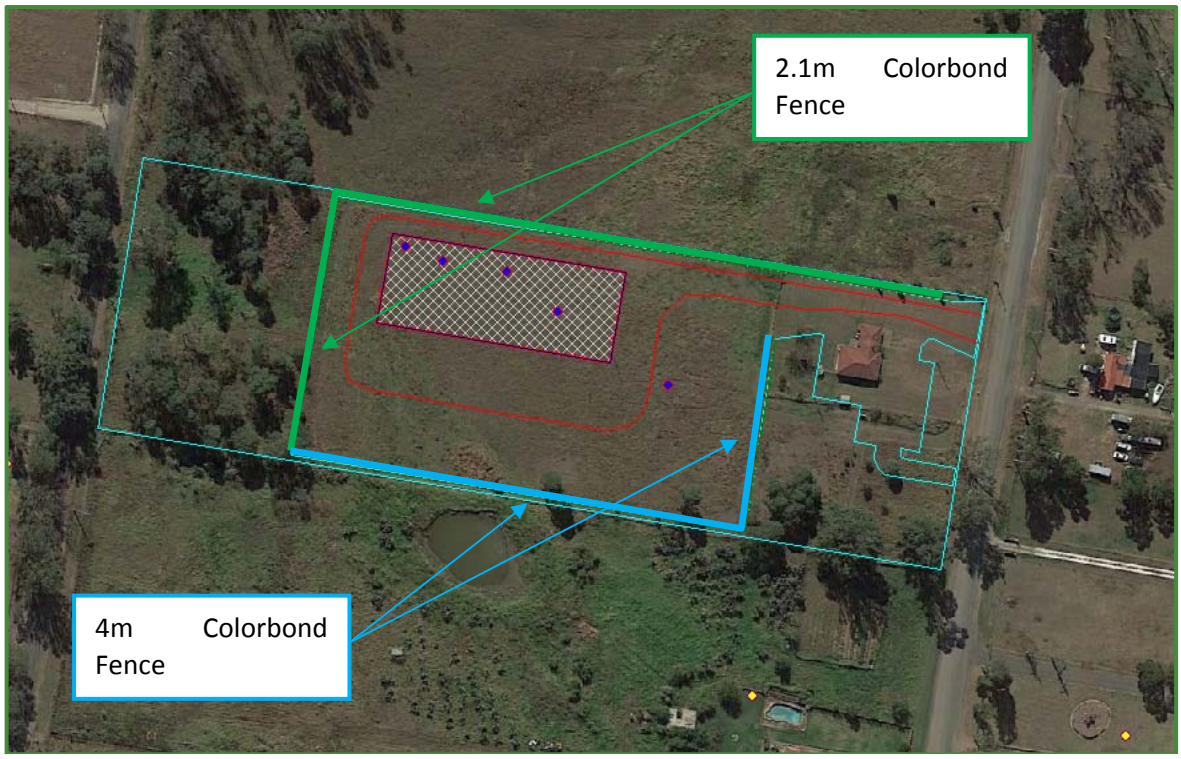
In order to achieve the predicted compliance levels at the nearest receptors, the following control measures are recommended to be implemented.

- A 2.1 m colorbond fence is recommended to be constructed surrounding the hardstand area of the site. A 4 m colorbond fence is recommended to be constructed on the southern and eastern sides of the hardstand area. (See Figure 7-5).
- As per the assumptions listed in section 7.1.2 , the front end loader is recommended to have a sound power level of 97 dB(A) or lower. This is a comparatively low level compared to other loaders on the market, so it will be a relatively small FEL.
- It is recommended that the client purchase a front end loader which has a guarantee that it is below a sound power level of 97 dB(A), or alternatively post commissioning testing of the equipment be carried out by an acoustic consultant to ascertain the sound power level of the equipment.
- Pedestrian doors are to self-closing, so the doors automatically close once a pedestrian is no longer using the door.
- The following equipment is restricted to indoors only:
  - Crusher;
  - Generator;
  - Screen; and
  - Excavator.
- When either the crusher or excavator is operating indoors, one roller shutter door is recommended to be open for only 3 minutes out of a 15 minute scenario (scenario 2). To enable this to practically occur, for example, for the arrival of a truck, it is recommended that automated roller shutter doors be installed to assist in the opening and closing of doors as fast as possible.
- The roller shutter doors should be selected based on their acoustic performance with regards to minimising breakout noise and minimising noise generated from opening and closing operations.
- Should the roller doors need to be opened for extended periods to enable the transfer of materials to the stockpile area (scenario 3), the crusher and excavator are to be stopped and only the front end loader is recommended to be used.
- It is recommended mobile equipment regularly used onsite such as the excavator and front end loader be fitted with reversing lights or a white noise reversing alarm.

It is also recommended the following additional management practices be implemented:

- Prohibition of extended periods of on-site revving/idling;
- Minimisation of the use of truck exhaust brakes on site;
- Enforcement of low on-site speed limits;
- On-site vehicles to be maintained in accordance with a preventative maintenance program to ensure optimum performance and early detection of wearing or noisy components;
- Ensure condition of roadway surface is maintained (by responsible party) to ensure deterioration of internal access road surface does not lead to increased noise sources; and
- Vehicles awaiting loading, unloading or servicing shall be parked on site with their engines turned off.

Figure 7-5: Colorbond Fence Locations



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 proposed route for the heavy and light vehicles was presented in Figure 6-1. Trucks and light vehicles are proposed to access the site from Martin Road.

Calculation of road traffic noise contribution has been undertaken using the Calculation of Road Traffic Noise (CoRTN) algorithm within SoundPLAN v7.3. The CoRTN algorithm was utilised to predict the existing and proposed noise levels at the nearest residential receivers during the day and night time periods. The following correction factors have been used within the CoRTN algorithm:

- For Australian conditions (free field corrected), -0.7 dB;
- L_{10} to L_{eq}, -3.0 dB;
- For low traffic flow, -30 dB with the traffic volumes therefore multiplied by 1000;
- For Heavy Engines, -0.6 dB; and
- For Heavy Exhausts, -8.6 dB.

It is understood that a maximum of 16 truck movements are proposed per day between 7am and 5pm. 16 truck movements are assumed in each direction during the day period, with a maximum of three in any one hour period. A maximum of 10 light vehicle movements are expected in a one hour period. No truck movements are proposed during the night period. Vehicles are assumed to travel at the posted speed of 80 km/h.

The $L_{Aeq,\ 1\ hour}$ noise descriptor has been calculated at the most affected residential receptors located along Martin Road and Lawson Road. The predicted noise levels are displayed in Table 8-1. The highest noise levels would be predicted at these location, therefore they are the only results displayed.

Table 8-1: Predicted Levels for Road Traffic Noise

Receptor	Noise Criteria		Existing Traffic		Site Contribution		Cumulative Road Traffic Noise	
	Day $L_{Aeq,\ 1\ hour}$	Night $L_{Aeq,\ 1\ hour}$	Day $L_{Aeq,\ 1\ hour}$	Night $L_{Aeq,\ 1\ hour}$	Day $L_{Aeq,\ 1\ hour}$	Night $L_{Aeq,\ 1\ hour}$	Day $L_{Aeq,\ 1\ hour}$	Night $L_{Aeq,\ 1\ hour}$
R4, 40 Martin Road, Badgerys Creek	55	50	48	44	41 ✓	N/A ✓	50 ✓	44 ✓

For residential dwellings that front onto Martin Road, the predicted noise levels associated with the vehicle movements from the site would be below the daytime criteria of $L_{Aeq\ (1\ hour)}$ 55 dB for local roads. From Table 8-1, the predicted cumulative daytime $L_{Aeq,1\ hour}$ road traffic noise are below the noise criteria, as established from the NSW Road Noise Policy (RNP).

Step 3 of Section 3.4.1 of the RNP identifies possible reasonable and feasible control measures when exceedances of either the outlined criteria. As no exceedances are predicted, the proposed vehicle movements comply with the RNP, and no additional mitigation strategies are recommended.

9. CONSTRUCTION NOISE IMPACT ASSESSMENT

9.1 CONSTRUCTION ACTIVITIES

Construction activities are proposed to include the following:

- Site establishment;
- The building of the unloading and processing shed;
- The installation of a wheel wash and weighbridge;
- The setup of five storage bays; and
- Construction of the car park and landscaped area

The current residential dwelling is proposed to be kept, therefore no demolition works are proposed.

9.2 MODELLED NOISE GENERATING SCENARIOS

Considering the construction activities outlined in section 9.1, the three construction stages listed in Table 9-1 are modelled for civil works, concreting works and structure works. The noise generating stages consider a worst case scenario in which all equipment is running for 100% of the time over the 15 minute assessment period.

The equipment list for the stages is detailed in Table 9-1, with an equipment location diagrams in Figure 9-1 to Figure 9-3. Equipment is primarily located in the area of the proposed unloading and processing shed, as the majority of the construction works will take place at this location.

All works are proposed to be undertaken during standard construction hours, that is

- Monday to Friday, 7am to 6pm;
- Saturday 8am to 1pm ; and
- No work on Sundays or public holidays.

Table 9-1: Modelled Noise Stages for Proposed Construction Works

Scenario	Time of the day	Noise Sources for Worst 15-minute Period
Stage 1. Civil Works	Standard hours	• Dozer • Backhoe • Truck • Hand tools
Stage 2. Concreting construction works	Standard hours	• Concrete mixer truck • Concrete pump • Hand tools
Stage 3. Structure construction works	Standard hours	• Truck • Crane • Hand Tools

Figure 9-1: Construction Stage 1 – Civil Works

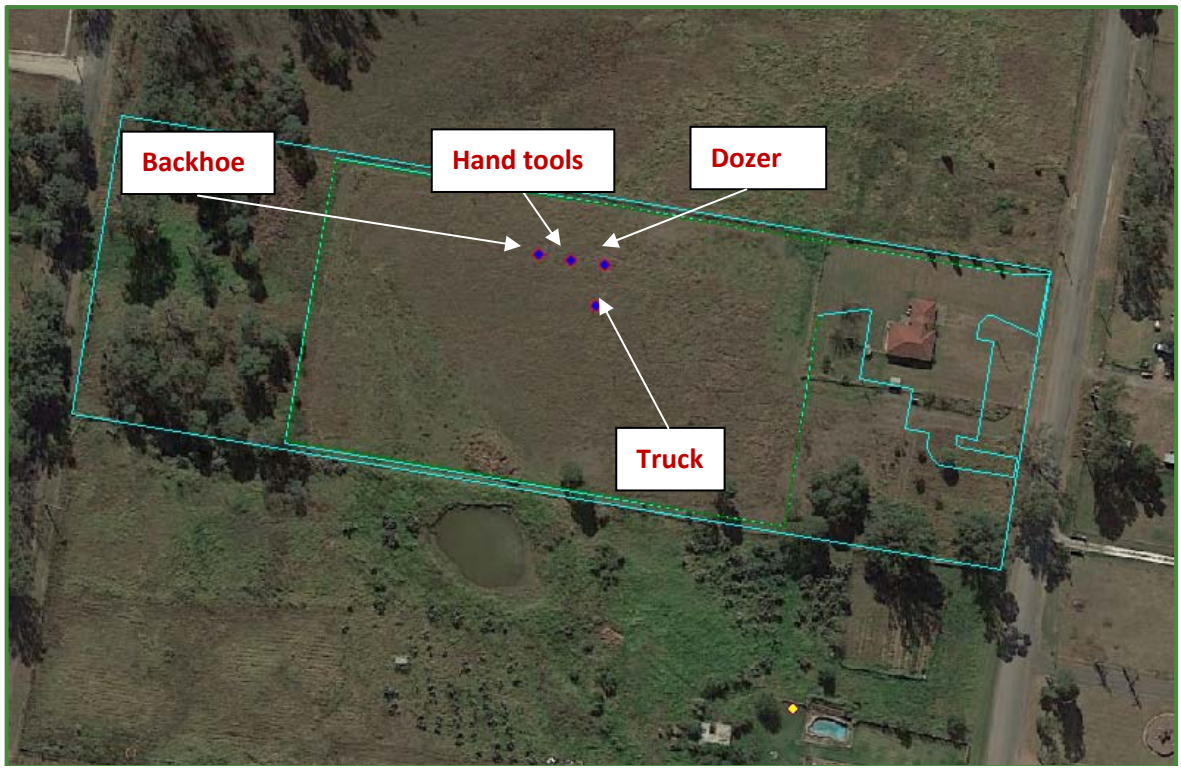


Figure 9-2: Construction Stage 2 – Concreting Construction Works

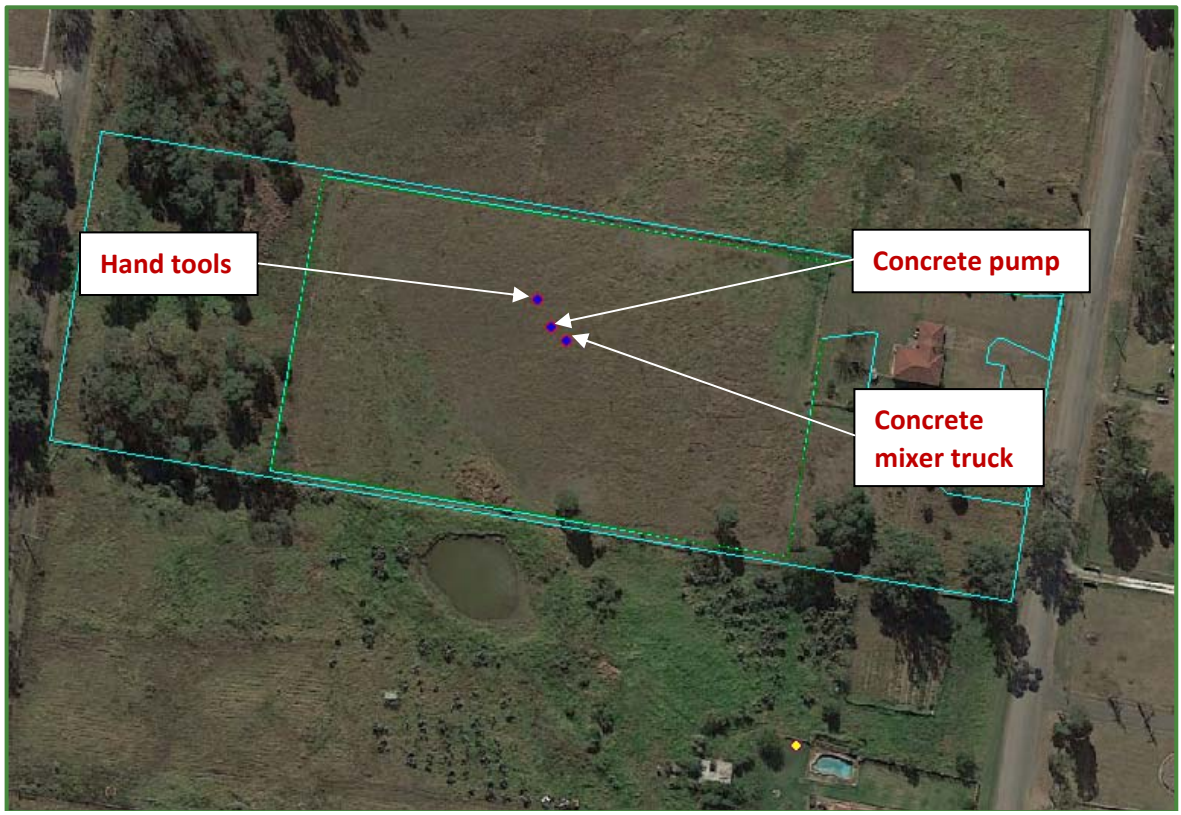
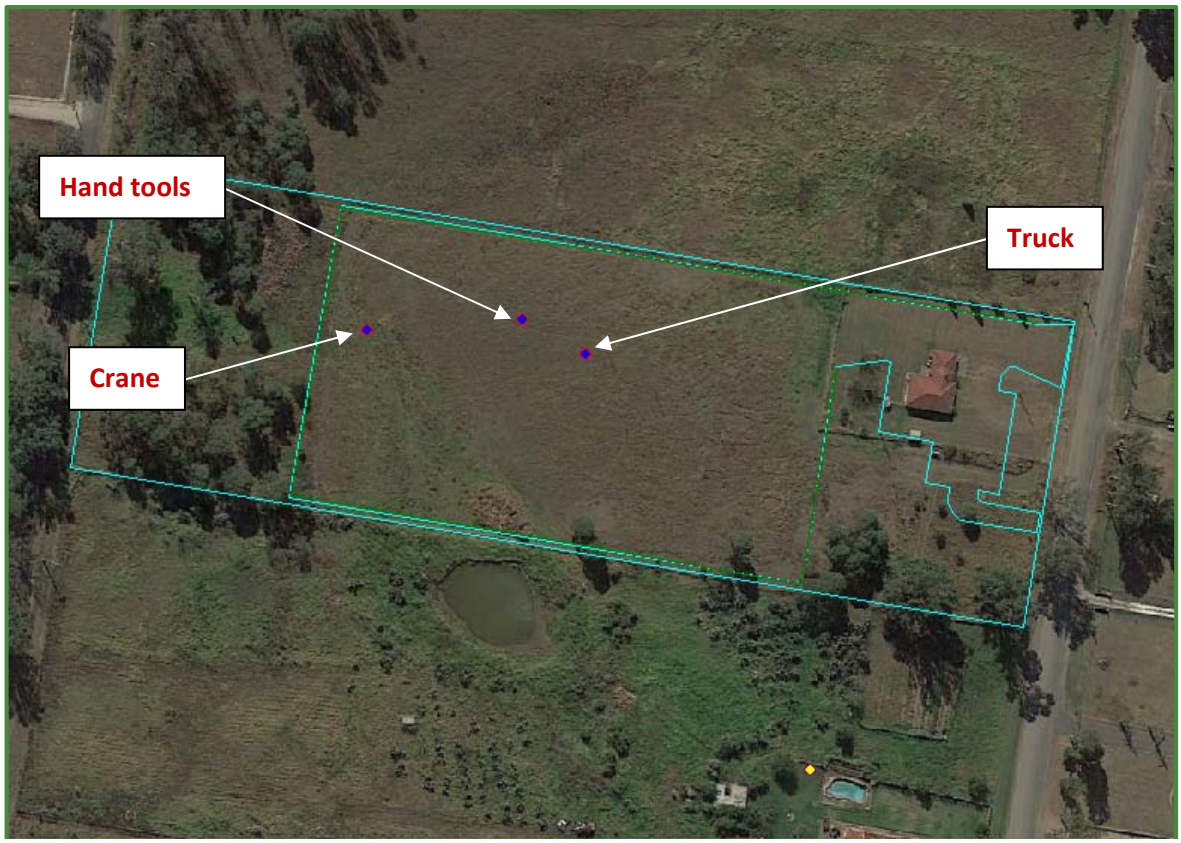


Figure 9-3: Construction Stage 3 – Structure Construction Works



9.3 MODELLING METHODOLOGY

9.3.1 Noise Model

Noise propagation modelling for the construction activities was carried out using the ISO 9613 algorithm within SoundPLAN v7.3. The construction stages were modelled using the $L_{Aeq,\ 15\ minutes}$ descriptor.

Assumptions made in the noise modelling of the construction noise stages are as follows:

- The relevant assessment period for operational noise emissions has been considered to be 15 minutes. Construction stages assume all equipment is running 100% of the time during the 15 minute assessment period, to provide a worst case scenario;
- Topographical information for off-site areas was obtained from Google Earth;
- Topographical information for on-site areas was obtained from the site survey;
- The model included the 2.1 m colorbond fence surrounding the hardstand area of the site and the 4m colorbond fence constructed on the southern and eastern sides of the hardstand area.
- All receptors were modelled at 1.5 m above ground level;

- The surrounding ground areas have been modelled with a ground absorption coefficient of 1.0 (soft); and

- All noise sources associated with the construction works have been modelled as point sources.

9.3.2 Noise Sources

A-weighted octave band centre frequency sound power levels are presented shown in Table 9-2 below. The sound power levels for the relevant noise sources have been calculated from measurements of sound pressure levels undertaken by an acoustic engineer from Benbow Environmental at similar sites and sourced from Benbow Environmental's noise source database, as well as taken from AS 2436-2010 and the UK Department for Environmental Food and Rural Affairs (DEFRA) database, *Update of noise database for prediction of noise on construction and open sites*.

Table 9-2: A-weighted Sound Power Levels Associated with Construction Activities, dB(A)

Noise Source	Overall	Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Truck	**102**	73	81	86	101	92	90	85	85
Dozer	**110**	101	105	103	103	100	97	91	83
Backhoe	**104**	102	94	92	92	91	88	87	78
Hand tools	**100**	71	81	91	96	94	90	87	81
Concrete truck	**108**	85	86	85	94	98	107	89	82
Concrete pump truck	**105**	77	92	97	99	100	95	95	89
Crane	**110**	94	99	103	104	104	102	94	84

9.4 CONSTRUCTION PREDICTED NOISE LEVELS

Results of the predictive noise modelling of the construction activities are shown in Table 9-3. For stage 1, compliance is predicted at all receivers except for a 1 dB exceedance predicted at R11. For stage 2, compliance is predicted to be achieved at all receivers except for R4, R11-R13 and R15. A maximum exceedance of a 3 dB is predicted at R12 and R13 in stage 2. For stage 3, compliance is predicted to be achieved at all receivers except R11-R13 and R15-R16. A maximum exceedance of 6 dB is predicted in stage 3.

Compliance with the construction noise criteria is therefore predicted to be achieved at the vast majority of receivers across the three stages during standard construction hours.

Construction activities are therefore proposed to take place during standard **construction** hours only as follows:

Monday to Friday:	7am to 5pm (with no hammering or saw-cutting to occur before 7.30am)
Saturday:	8am to 1pm (with no hammering or saw-cutting to occur before 8.30am)
Sunday and Public Holidays:	No works permitted

The predicted exceedances are minor in nature, and well below the 75 dB(A) "highly affected" noise criteria in the Interim Construction Noise Guideline. The following noise mitigation measures are therefore recommended:

- Construction works are recommended to take place during standard construction hours; and
- The colorbond fence is recommended to be installed on site prior to the remainder of the construction works taking place.

Table 9-3: Noise Modelling Results Associated with Construction Activities for L_{eq}, dB(A)

Receiver	Criteria: PSNL ($L_{eq,15\ minute}$ dB(A))	Predicted Levels: Stage (Standard Hours) (L_{eq}, dB(A))		
	Standard Hours	1	2	3
R1	47	39 ✓	43 ✓	43 ✓
R2	47	38 ✓	40 ✓	42 ✓
R3	47	44 ✓	46 ✓	47 ✓
R4	47	46 ✓	49 ✗	47 ✓
R5	47	40 ✓	41 ✓	42 ✓
R6	47	42 ✓	43 ✓	45 ✓
R7	47	44 ✓	46 ✓	47 ✓
R8	47	41 ✓	43 ✓	43 ✓
R9	47	42 ✓	44 ✓	45 ✓
R10	47	40 ✓	42 ✓	44 ✓
R11	47	48 ✗	49 ✗	52 ✗
R12	47	47 ✓	50 ✗	52 ✗
R13	47	47 ✓	50 ✗	53 ✗
R14	47	41 ✓	43 ✓	45 ✓
R15	47	46 ✓	49 ✗	50 ✗
R16	47	44 ✓	47 ✓	49 ✗
R17	47	43 ✓	45 ✓	47 ✓
R18	75	47 ✓	50 ✓	52 ✓
R19	75	40 ✓	42 ✓	46 ✓
R20	75	41 ✓	43 ✓	45 ✓

✓Complies ✗ Non-compliance

10. WESTERN SYDNEY AIRPORT ASSESSMENT

As shown in Figure 4-2, the site is located in a zone where the ANEF is between 30 and 35. The proposed development is not a noise sensitive development and would be best classed as “other industrial” under AS2021; acceptable in all ANEF zones. Furthermore the proposed development meets the objectives of clause 7.18 of the Liverpool LEP.

11. STATEMENT OF POTENTIAL NOISE IMPACT

A noise impact assessment was undertaken to assess the potential noise emissions from the proposed resource recovery facility at 55 Martin Road, Badgerys Creek. The site is proposed to process up to 95,000 tonnes per annum.

The noise impact assessment was undertaken in accordance with the following guidelines:

- NSW Environment Protection Authority Noise Policy for Industry 2017;
- Department of Environment, Climate Change and Water NSW Road Noise Policy 2011; and
- Department of Environment, Climate Change and Water NSW Interim Construction Noise Guideline 2009.

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

The activities proposed by the proponent were found to be within the framework of the NSW Noise Policy for Industry. The noise generating scenarios are predicted to comply with the project specific noise levels at all receivers. Recommendations for noise controls are given in section 7.3, including sound power levels for the front end loader, fencing, equipment and automated roller doors usage.

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

Construction activities are recommended to be limited to standard hours in accordance with the Interim Construction Noise Guideline.

The site is located near the Western Sydney Airport in a zone where the ANEF is between 30 and 35. The proposed development is not a noise sensitive development and would be best classed as “other industrial” under AS2021; acceptable in all ANEF zones. Furthermore the proposed development meets the objectives of clause 7.18 of the Liverpool LEP.
This concludes the report.

R T Benbow
Principal Consultant

Emma Hansma
Senior Engineer

12. 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 AMJ Demolition and Excavation, as per our agreement for providing environmental services. Only AMJ Demolition and Excavation 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 AMJ Demolition and Excavation 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

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 (20×10^{-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 minimum 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*’.

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Sound Level Meter
AS 1259.1:1990 - AS 1259.2:1990
Calibration Certificate

Calibration Number C16368

Client Details Benbow Environmental
13 Daking Street
North Paramatta NSW 2151

Equipment Tested/ Model Number : ARL EL-215
Instrument Serial Number : 194441
Microphone Serial Number : N/A
Pre-amplifier Serial Number : N/A

Atmospheric Conditions
Ambient Temperature : 21.9°C
Relative Humidity : 34.2%
Barometric Pressure : 100kPa

Calibration Technician : Dennis Kim
Secondary Check: Riley Cooper
Calibration Date : 13/07/2016
Report Issue Date : 14/07/2016

Approved Signatory : Juan Aguero

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
31.5 Hz to 8kHz ±0.120dB
12.5kHz ±0.165dB
16kHz ±0.245dB
Electrical Tests
31.5 Hz to 20 kHz ±0.098dB

Environmental Conditions
Temperature ±0.3°C
Relative Humidity ±4.1%
Barometric Pressure ±0.1kPa

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.

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/National standards.

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Sound Level Meter
AS 1259.1:1990 - AS 1259.2:1990
Calibration Certificate

Calibration Number C17333

Client Details Benbow Environmental
13 Daking Street
North Parramatta NSW 2151

Equipment Tested/ Model Number : ARL EL-215
Instrument Serial Number : 194552
Microphone Serial Number :
Pre-amplifier Serial Number :

Atmospheric Conditions
Ambient Temperature : 22.8°C
Relative Humidity : 35.5%
Barometric Pressure : 101.15kPa

Calibration Technician : Lucky Jaiswal
Calibration Date : 12/07/2017
Secondary Check: Riley Cooper
Report Issue Date : 12/07/2017

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	*±0.16dB*	*Temperature*	*±0.05°C*
12.5kHz	*±0.2dB*	*Relative Humidity*	*±0.46%*
16kHz	*±0.29dB*	*Barometric Pressure*	*±0.017Pa*
Electrical Tests			
31.5 Hz to 20 kHz	*±0.12dB*		

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.

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.

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: 20949

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: Rion
Type No: NC-73 **Serial No:** 10186522
Owner: Benbow Environmental
13 Daking Street
North Parramatta NSW 2151

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	991.4	2.00
Level 2:	NA	N	NA	NA	NA
Uncertainty:			±0.11 dB	±0.05 Hz	±0.2 %
Uncertainty (at 95% c.l.) k=2					

CONDITION OF TEST:
Ambient Pressure: 996 hPa ±1.5 hPa **Relative Humidity:** 42% ±5%
Temperature: 22 °C ±2° C
Date of Calibration: 05/07/2017 **Issue Date:** 06/07/2017
Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2004
CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....
Jack Riolt

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

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.: SLM 21111 & FILT 4097

Equipment Description:	Sound & Vibration Analyser		
Manufacturer:	Svantek		
Model No:	Svan-957	**Serial No:**	15336
Microphone Type:	7052E	**Serial No:**	47869
Filter Type:	1/3 Octave	**Serial No:**	15336
Comments:	All tests passed for class 1. (See over for details)		
Owner:	Benbow Environmental 13 Daking Street North Parramatta 2151		
Ambient Pressure:	1004 hPa ±1.5 hPa		
Temperature:	21 °C ±2° C	**Relative Humidity:**	36% ±5%
Date of Calibration:	25/07/2017	**Issue Date:**	26/07/2017

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

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....
Jack Kidd

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

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Accredited Lab. No. 9262
Acoustic and Vibration Measurements

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ELECTRONICS

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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 Noise Policy for Industry. 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 (1.5 m 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, fine without significant breeze.

METHODOLOGY

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

Logger A – Unattended Noise Monitoring Results, dB(A)

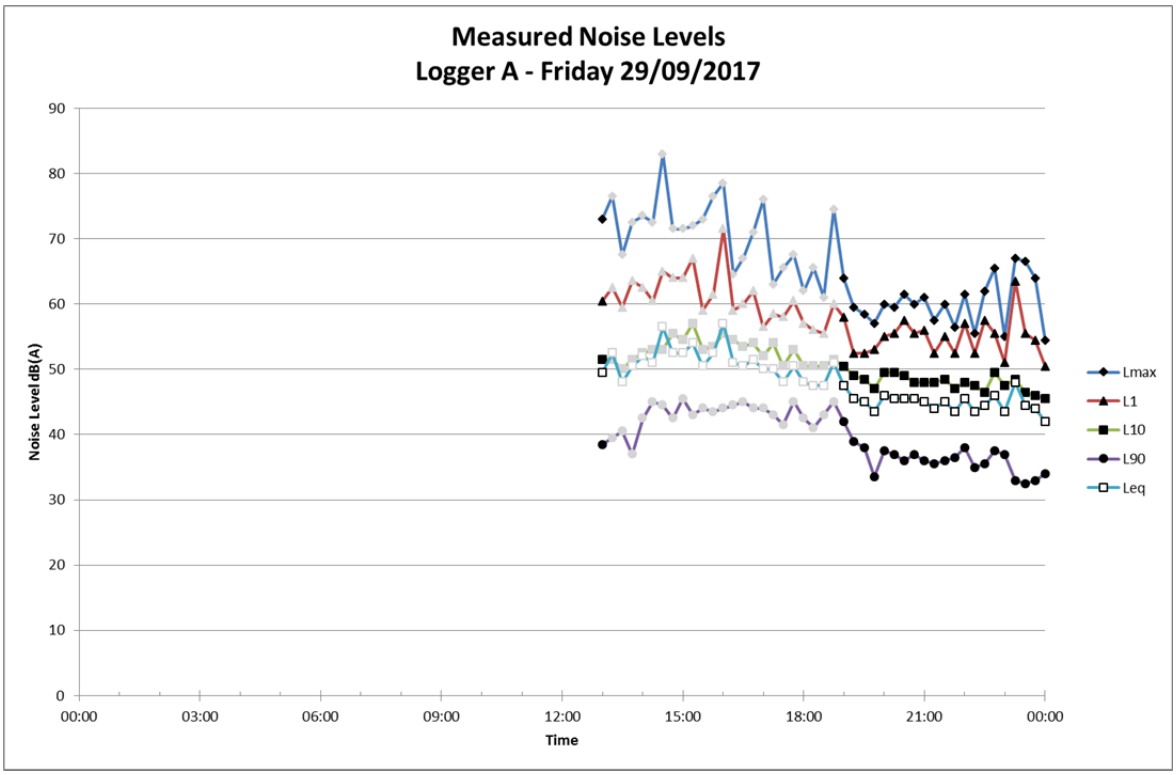
Location A						
Date	ABL (L_{90})			L_{eq}		
	Day	Evening	Night	Day	Evening	Night
29/09/2017	-	36	33	-	45	45
30/09/2017	-	33	-	-	46	-
1/10/2017	33	33	30	46	43	43
2/10/2017	-	35	29	-	47	42
3/10/2017	38	32	29	52	45	48
4/10/2017	38	34	30	52	46	49
5/10/2017	38	34	29	52	46	50
6/10/2017	-	33	29	-	48	47
7/10/2017	35	32	28	49	43	46
8/10/2017	36	32	28	47	44	42
9/10/2017	-	35	29	-	45	48
10/10/2017	-	-	-	-	-	-
Median (RBL)	**37**	**33**	**29**	*	*	*
Logarithmic Average	*	*	*	**50**	**46**	**47**

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

Road Traffic Noise Data at Location Logger A

Date	Existing Road Traffic Noise Location A – dB(A)			
	Daytime (7am to 10pm)		Night-time (10pm to 7am)	
	$L_{eq\ (15\ hour)}$	$L_{eq\ (1\ hour)}$	$L_{eq\ (9\ hour)}$	$L_{eq\ (1\ hour)}$
29/09/2017	-	-	-	-
30/09/2017	-	-	-	-
1/10/2017	46	47	41	43
2/10/2017	-	-	41	42
3/10/2017	53	53	45	49
4/10/2017	52	53	47	50
5/10/2017	53	54	47	51
6/10/2017	-	-	45	48
7/10/2017	50	51	44	47
8/10/2017	47	47	40	42
9/10/2017	-	-	45	48
10/10/2017	-	-	-	-
Logarithmic Average	51	52	45	48
Road Traffic Noise Levels at the Residence	47	48	41	44

– Data excluded because adverse weather conditions were present.


Measured Noise Levels
Logger A - Friday 29/09/2017
Noise Level dB(A)
90
80
70
60
50
40
30
20
10
0
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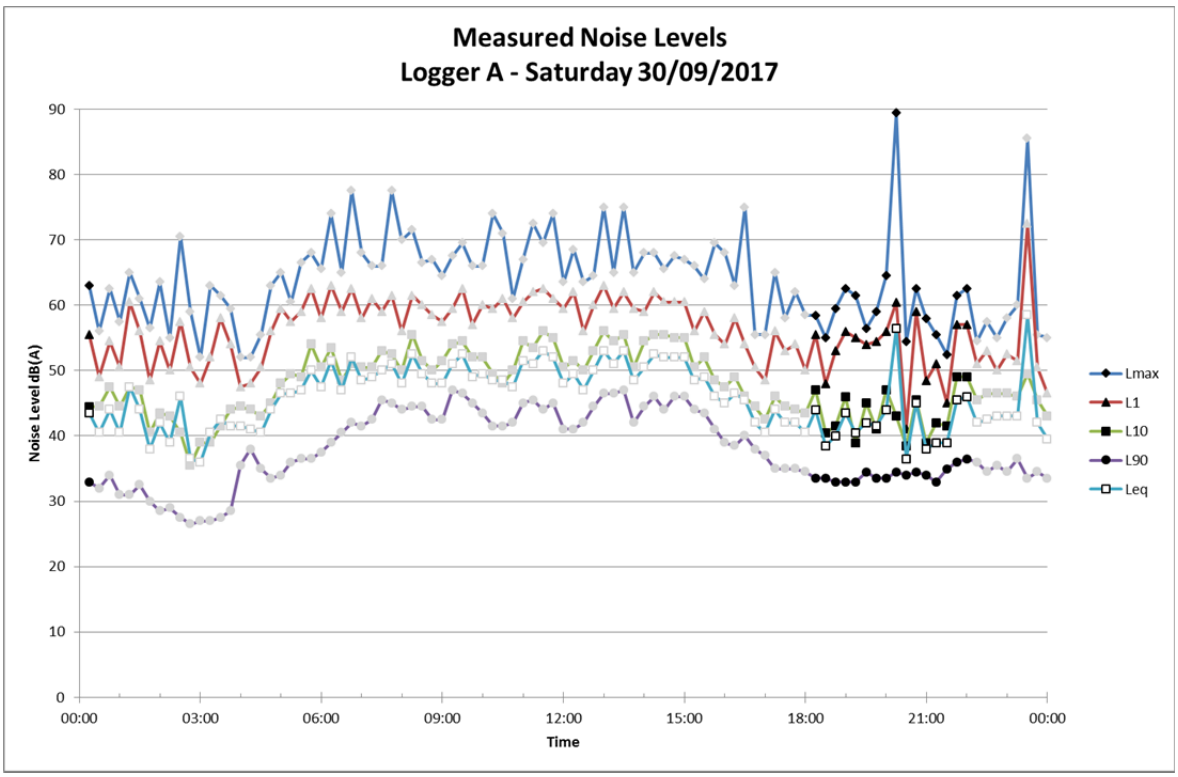
00:00
Time
Lmax
L1
L10
L90
Leq


Measured Noise Levels
Logger A - Saturday 30/09/2017
Noise Level dB(A)
90
80
70
60
50
40
30
20
10
0
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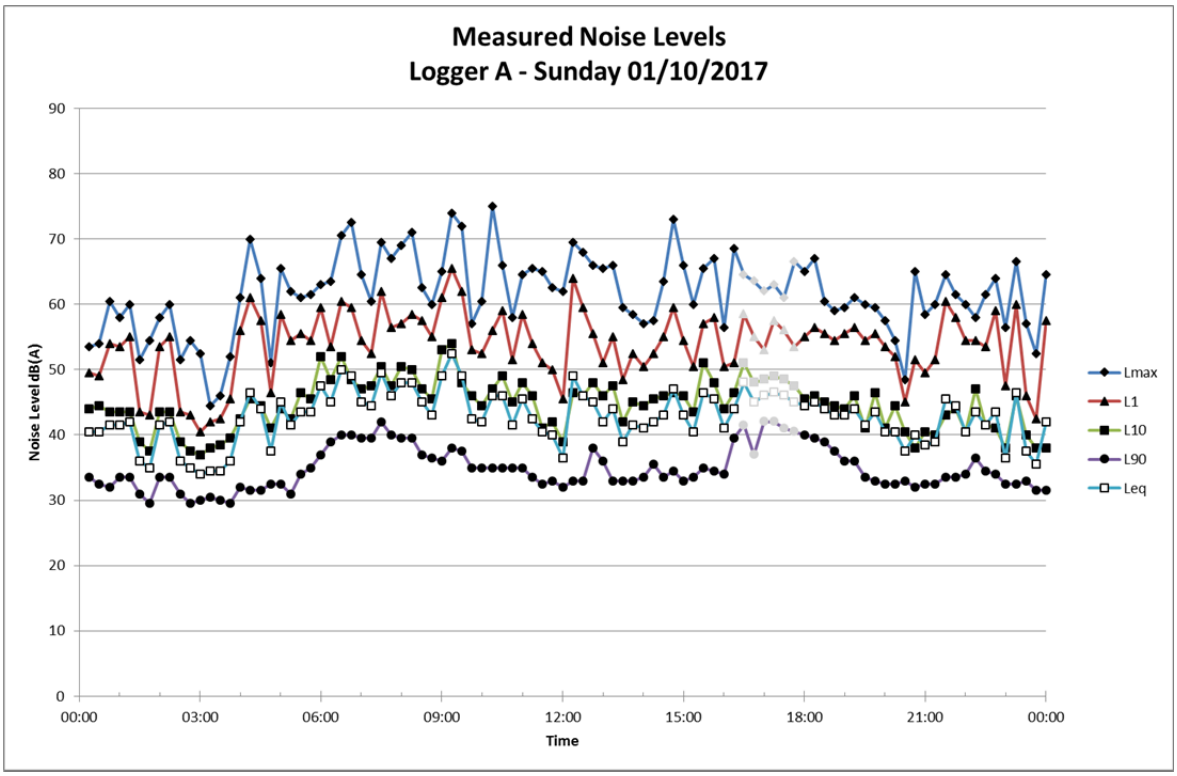
00:00
Time
Lmax
L1
L10
L90
Leq


Measured Noise Levels
Logger A - Sunday 01/10/2017
Noise Level dB(A)
90
80
70
60
50
40
30
20
10
0
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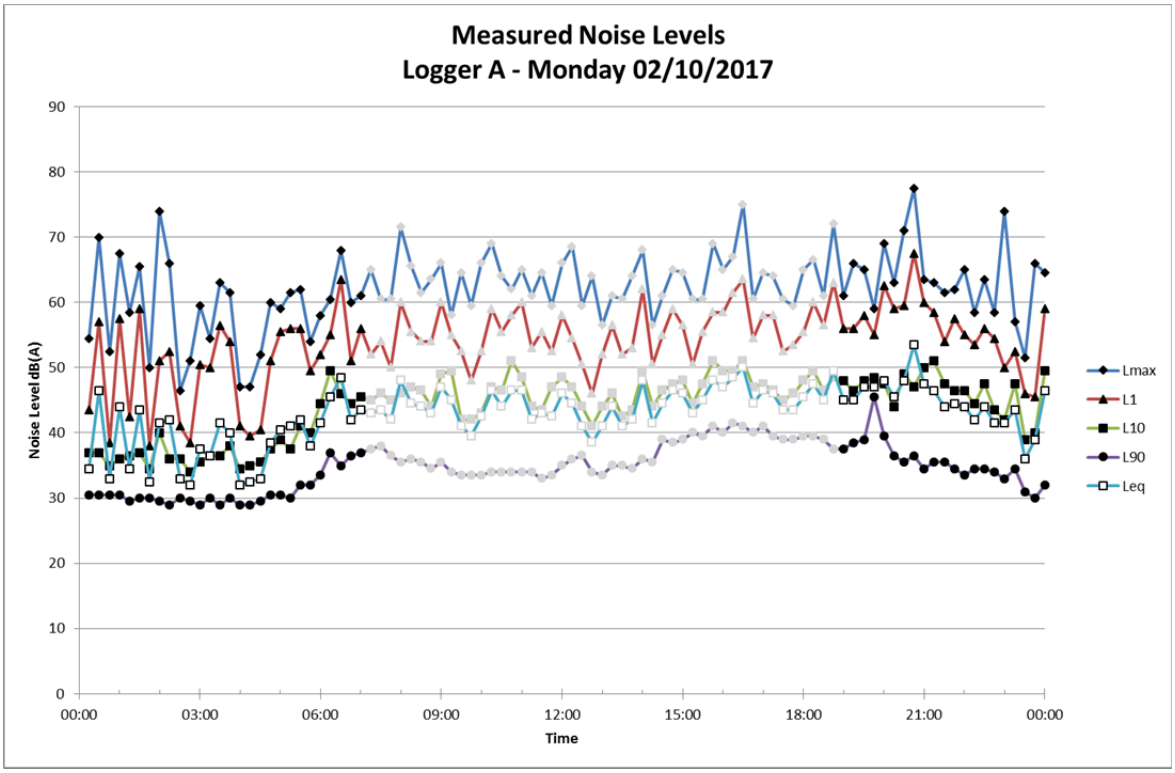
00:00
Time
Lmax
L1
L10
L90
Leq


Measured Noise Levels
Logger A - Monday 02/10/2017
Noise Level dB(A)
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80
70
60
50
40
30
20
10
0
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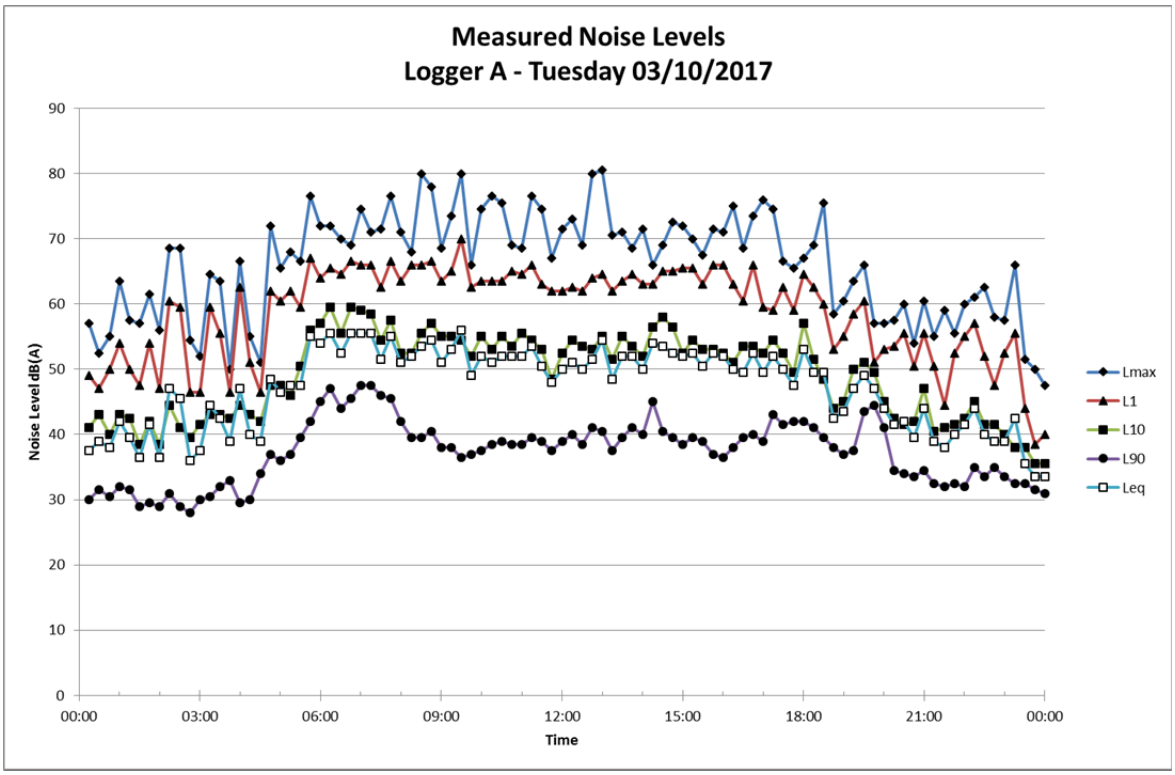
00:00
Time
Lmax
L1
L10
L90
Leq


Measured Noise Levels
Logger A - Tuesday 03/10/2017
Noise Level dB(A)
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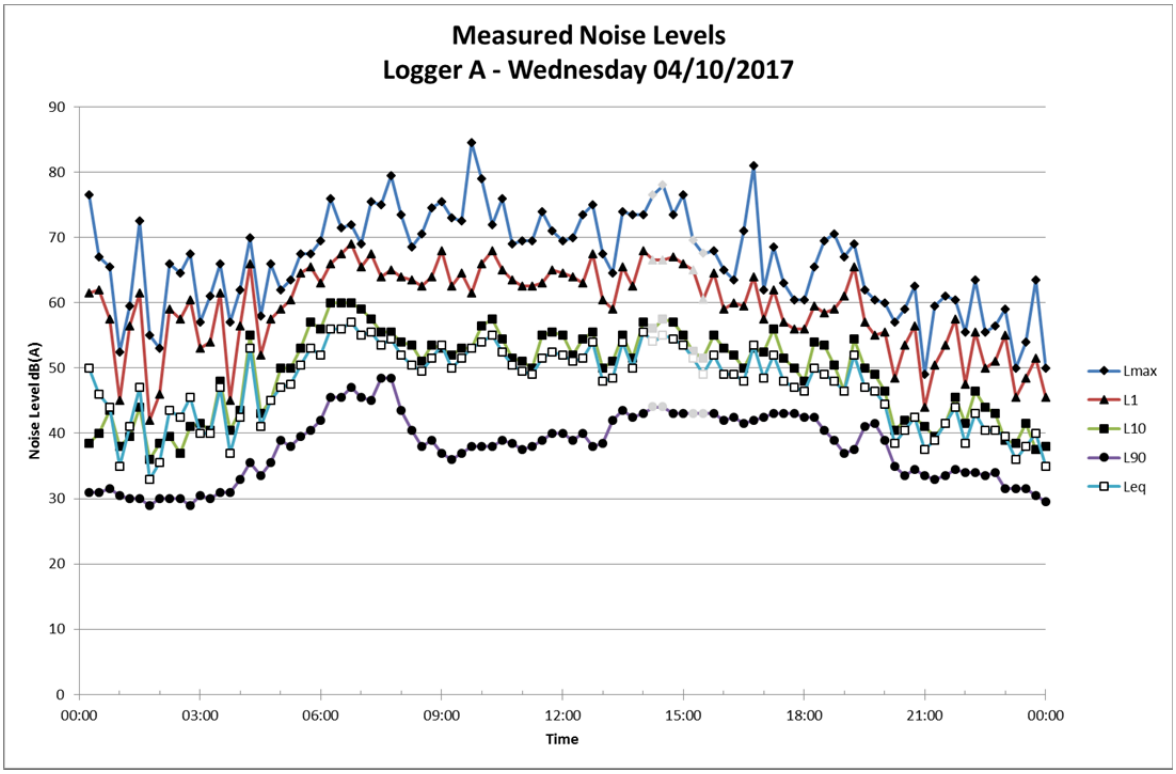
80
70
60
50
40
30
20
10
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Time
Lmax
L1
L10
L90
Leq


Measured Noise Levels
Logger A - Wednesday 04/10/2017
Noise Level dB(A)
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80
70
60
50
40
30
20
10
0
00:00
03:00
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12:00
15:00
18:00
21:00
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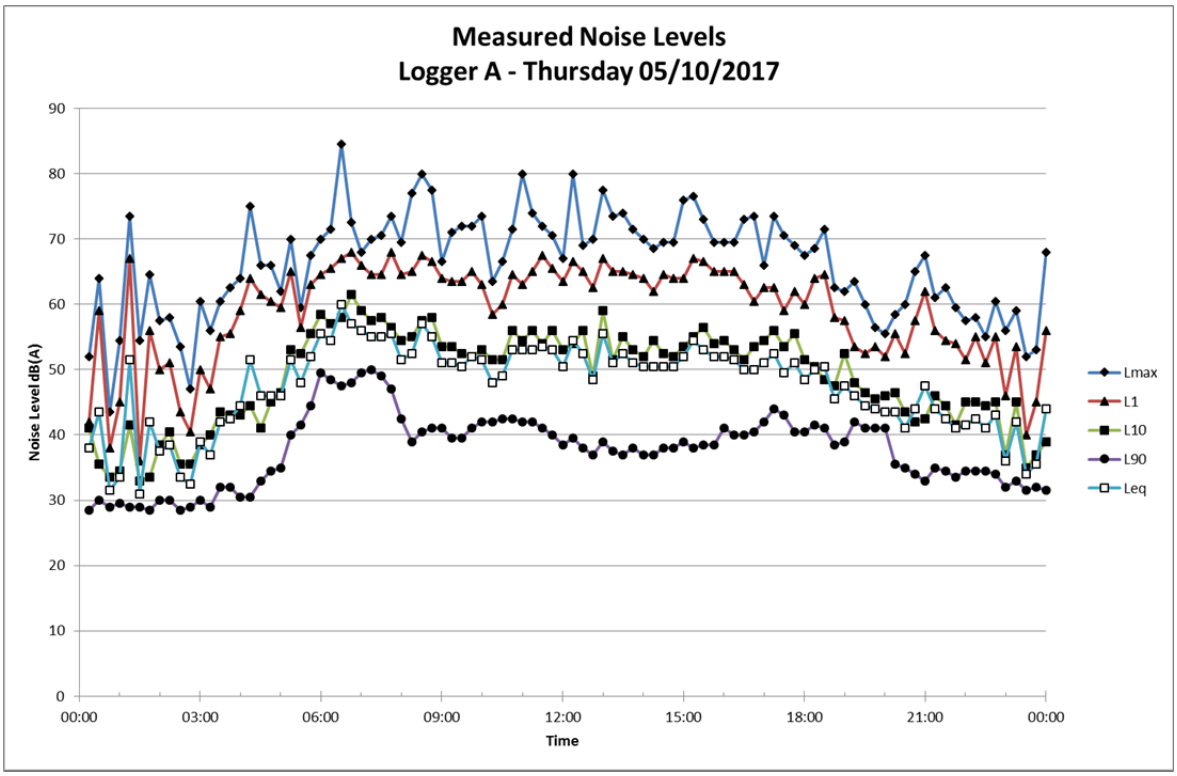
Time
Lmax
L1
L10
L90
Leq


Measured Noise Levels
Logger A - Thursday 05/10/2017
Noise Level dB(A)
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70
60
50
40
30
20
10
0
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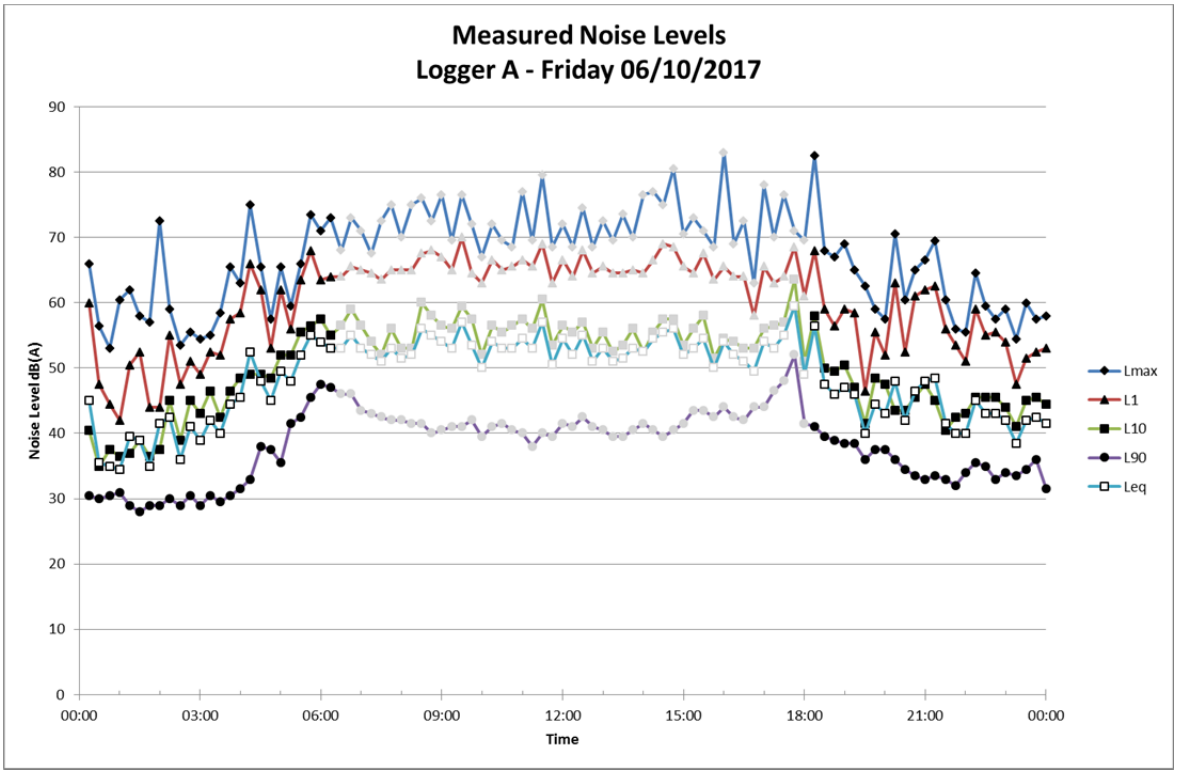
00:00
Time
Lmax
L1
L10
L90
Leq


Measured Noise Levels
Logger A - Friday 06/10/2017
Noise Level dB(A)
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70
60
50
40
30
20
10
0
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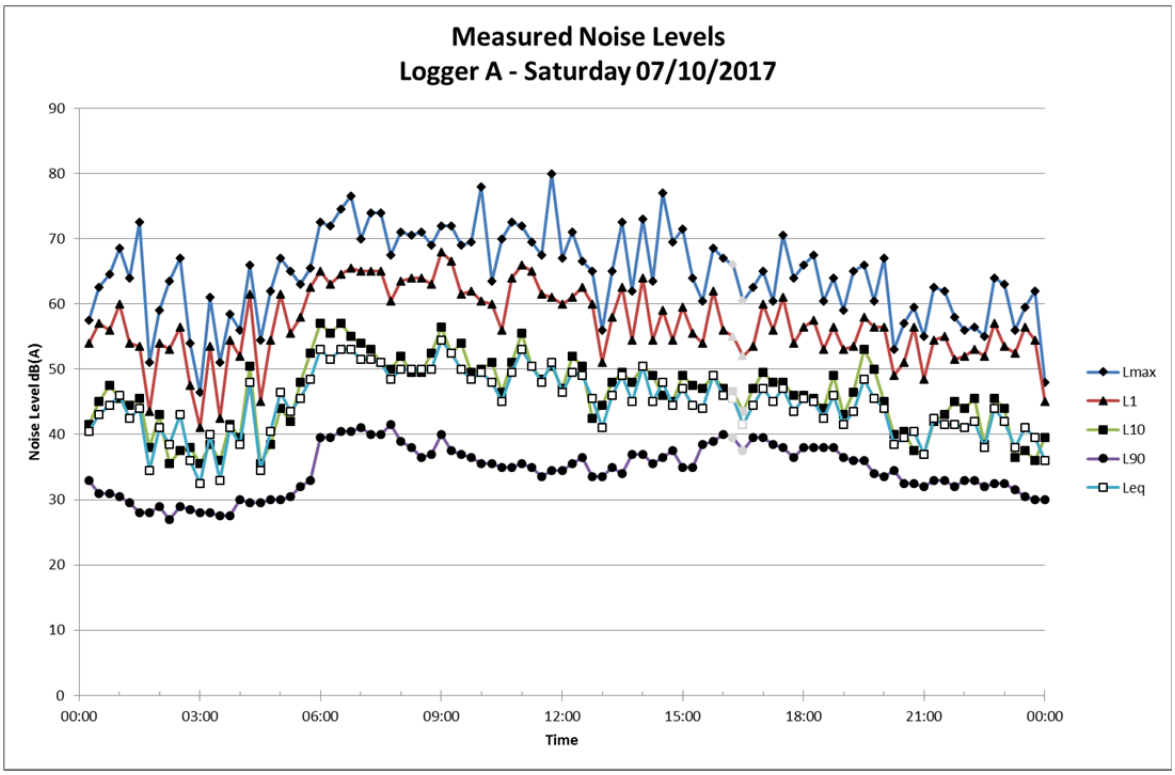
00:00
Time
Lmax
L1
L10
L90
Leq


Measured Noise Levels
Logger A - Saturday 07/10/2017
Noise Level dB(A)
90
80
70
60
50
40
30
20
10
0
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03:00
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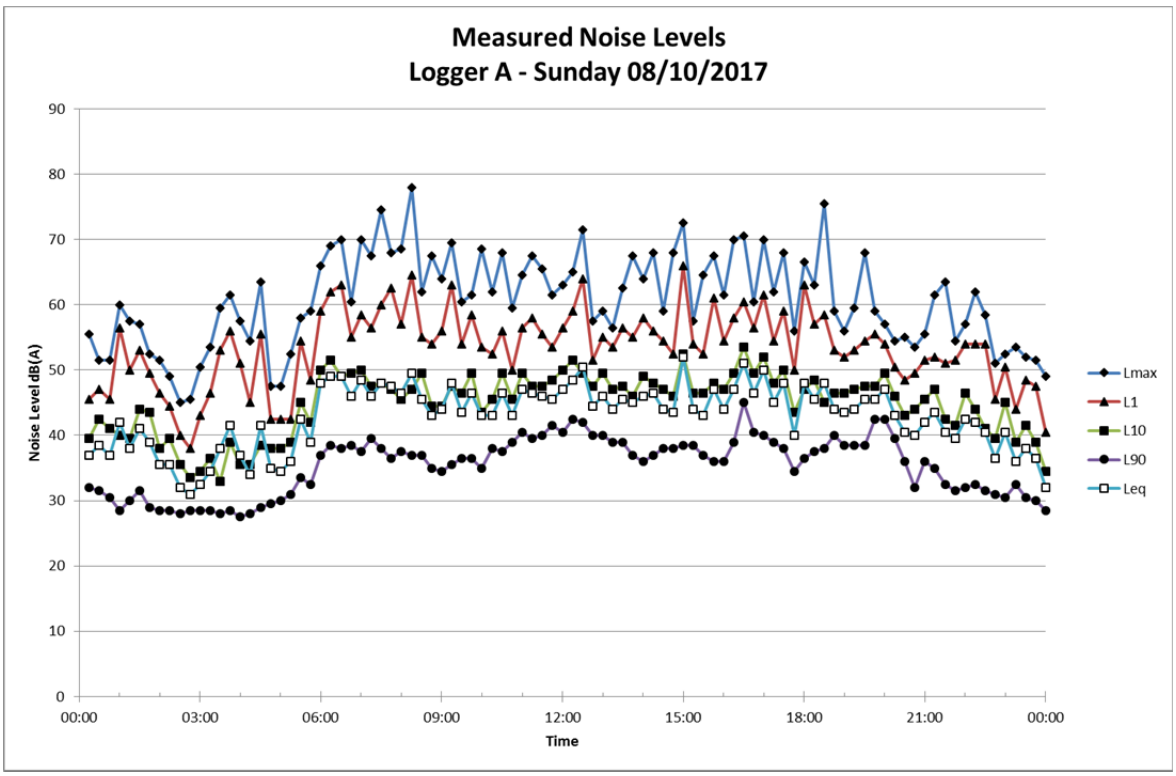
00:00
Time
Lmax
L1
L10
L90
Leq


Measured Noise Levels
Logger A - Sunday 08/10/2017
Noise Level dB(A)
90
80
70
60
50
40
30
20
10
0
00:00
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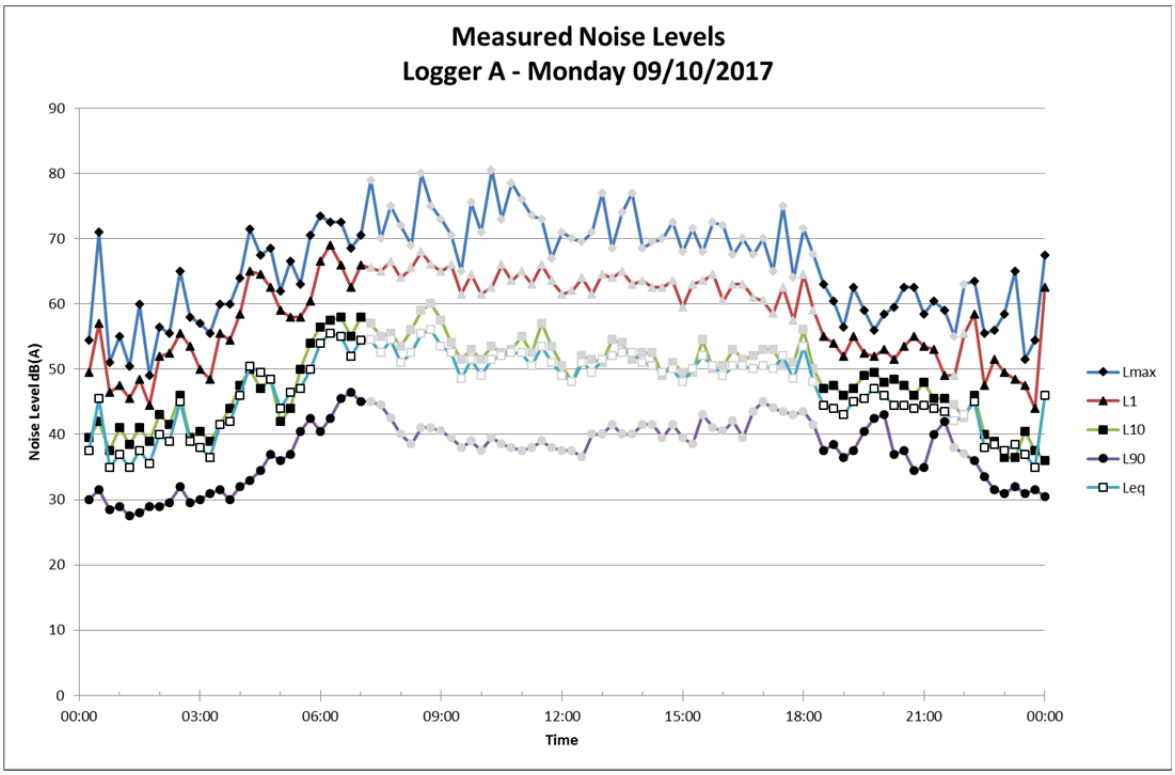
00:00
Time
Lmax
L1
L10
L90
Leq


Measured Noise Levels
Logger A - Monday 09/10/2017
Noise Level dB(A)
90
80
70
60
50
40
30
20
10
0
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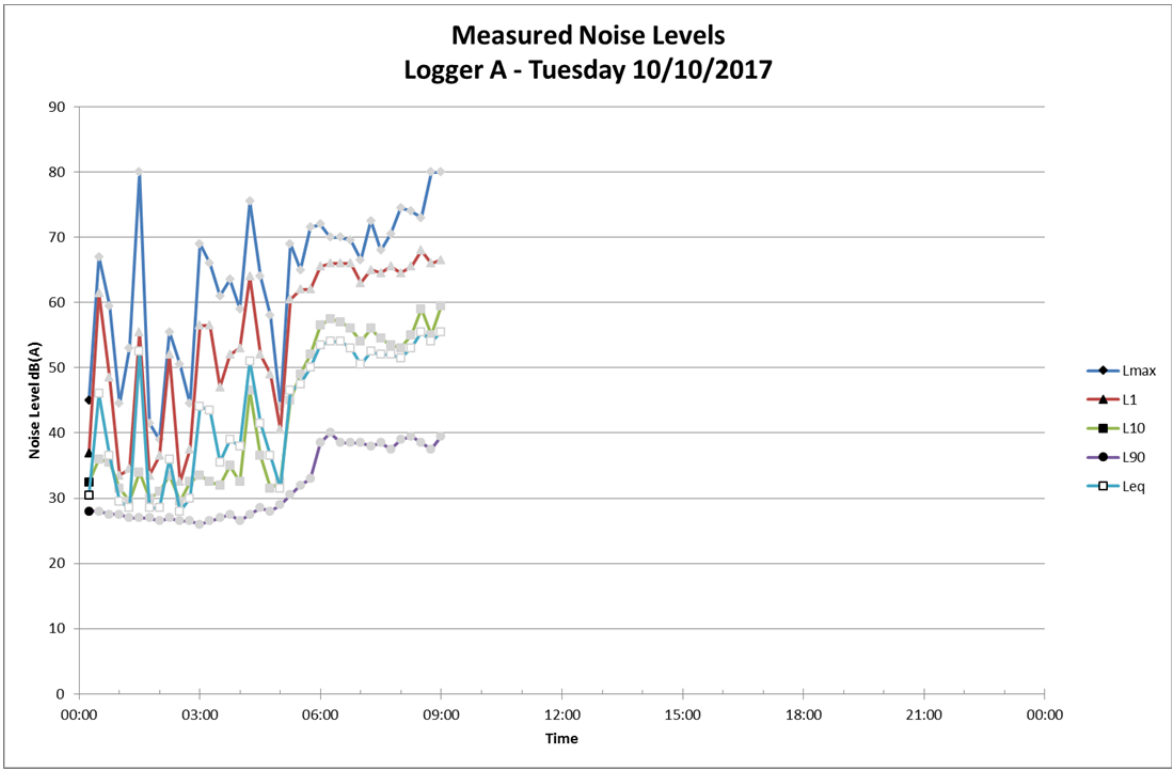
00:00
Time
Lmax
L1
L10
L90
Leq


Measured Noise Levels
Logger A - Tuesday 10/10/2017
Noise Level dB(A)
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

Logger B – Unattended Noise Monitoring Results, dB(A)

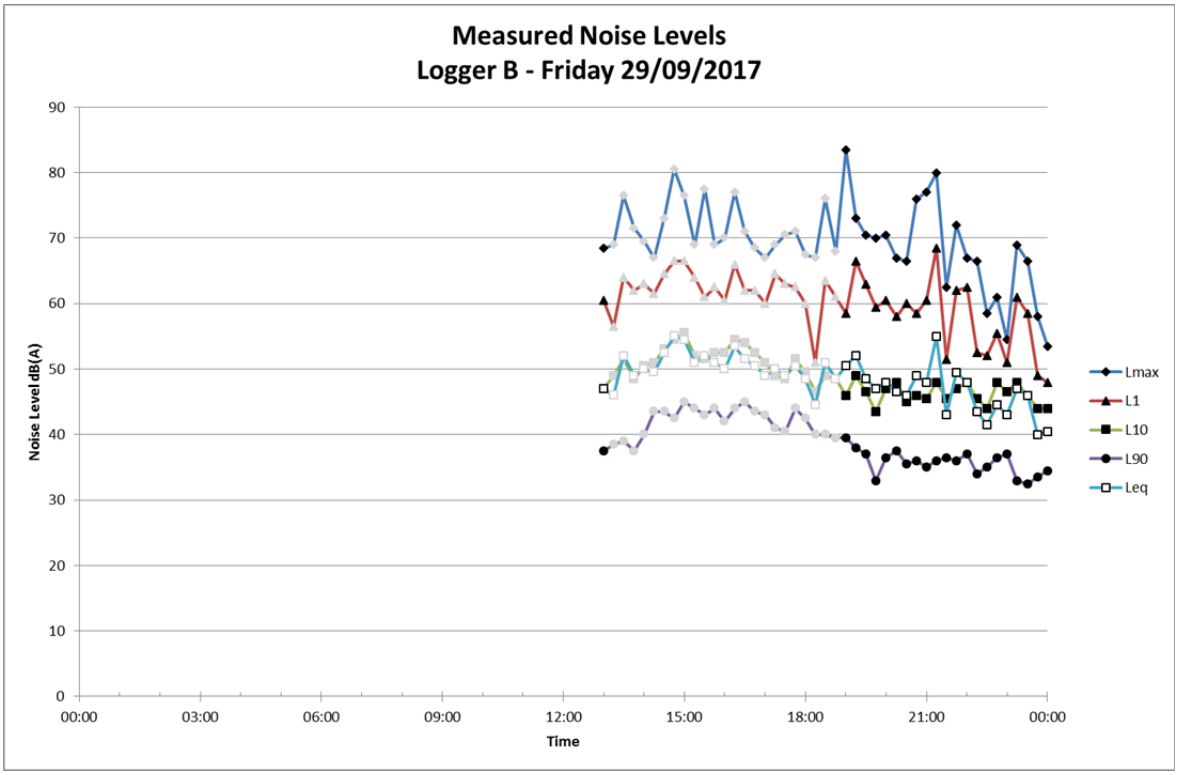
Location B						
Date	ABL (L_{90})			L_{eq}		
	Day	Evening	Night	Day	Evening	Night
29/09/2017	-	35	33	-	50	44
30/09/2017	-	33	-	-	45	-
1/10/2017	34	33	32	48	48	43
2/10/2017	-	37	30	-	52	51
3/10/2017	37	36	31	51	49	49
4/10/2017	38	35	31	51	50	53
5/10/2017	38	36	30	52	49	47
6/10/2017	-	35	30	-	48	44
7/10/2017	35	32	29	51	49	45
8/10/2017	36	33	30	50	48	43
9/10/2017	-	37	30	-	47	45
10/10/2017	-	-	-	-	-	-
Median (RBL)	**37**	**35**	**30**	*	*	*
Logarithmic Average	*	*	*	**51**	**49**	**48**

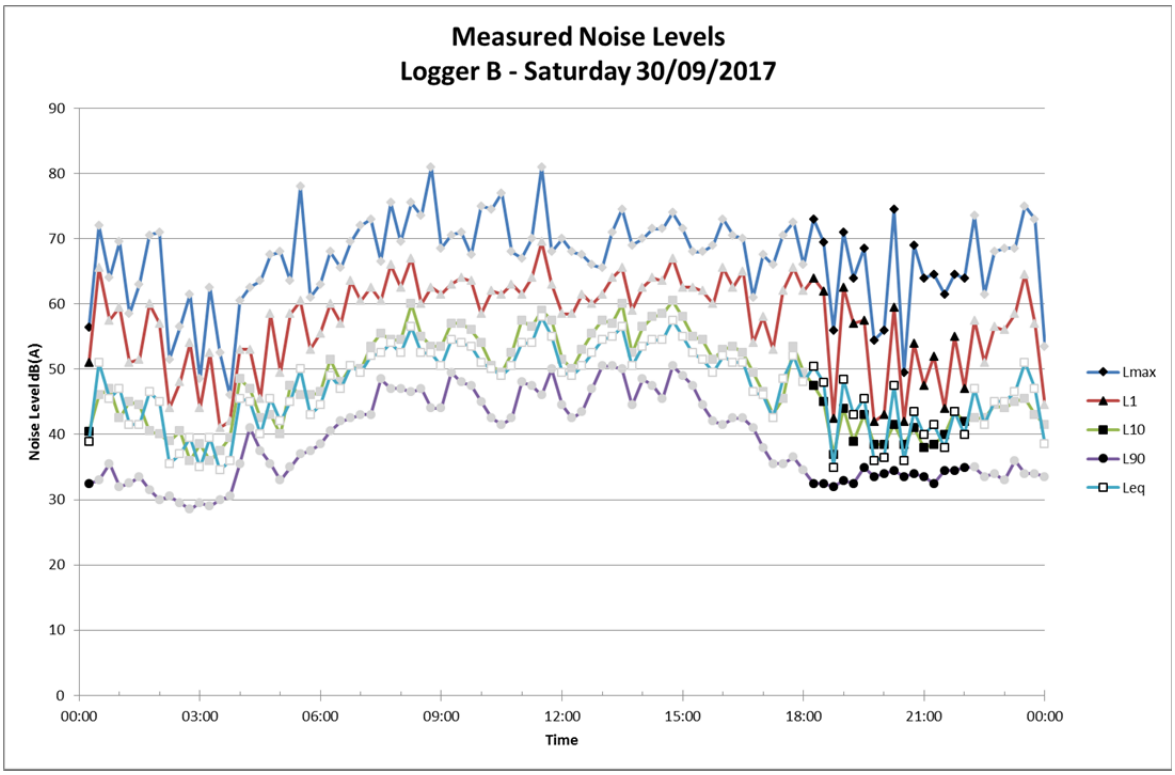
Note: - indicates values that has not been considered due to adverse weather conditions
* Indicates values that are not relevant to that noise descriptor

Road Traffic Noise Data at Location Logger B

Date	Existing Road Traffic Noise Location B – dB(A)			
	Daytime (7am to 10pm)		Night-time (10pm to 7am)	
	$L_{eq\ (15\ hour)}$	$L_{eq\ (1\ hour)}$	$L_{eq\ (9\ hour)}$	$L_{eq\ (1\ hour)}$
29/09/2017	-	-	-	-
30/09/2017	-	-	-	-
1/10/2017	49	49	43	44
2/10/2017	-	-	46	51
3/10/2017	51	52	46	50
4/10/2017	52	52	48	53
5/10/2017	53	54	44	48
6/10/2017	-	-	42	45
7/10/2017	52	53	44	45
8/10/2017	50	50	39	43
9/10/2017	-	-	42	45
10/10/2017	-	-	-	-
Logarithmic Average	51	52	45	49
Road Traffic Noise Levels at the Residence	47	48	41	45

– Data excluded because adverse weather conditions were present.


Measured Noise Levels
Logger B - Friday 29/09/2017
Noise Level dB(A)
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
Logger B - Saturday 30/09/2017
Noise Level dB(A)
90
80
70
60
50
40
30
20
10
0
00:00
03:00
06:00
09:00
12:00
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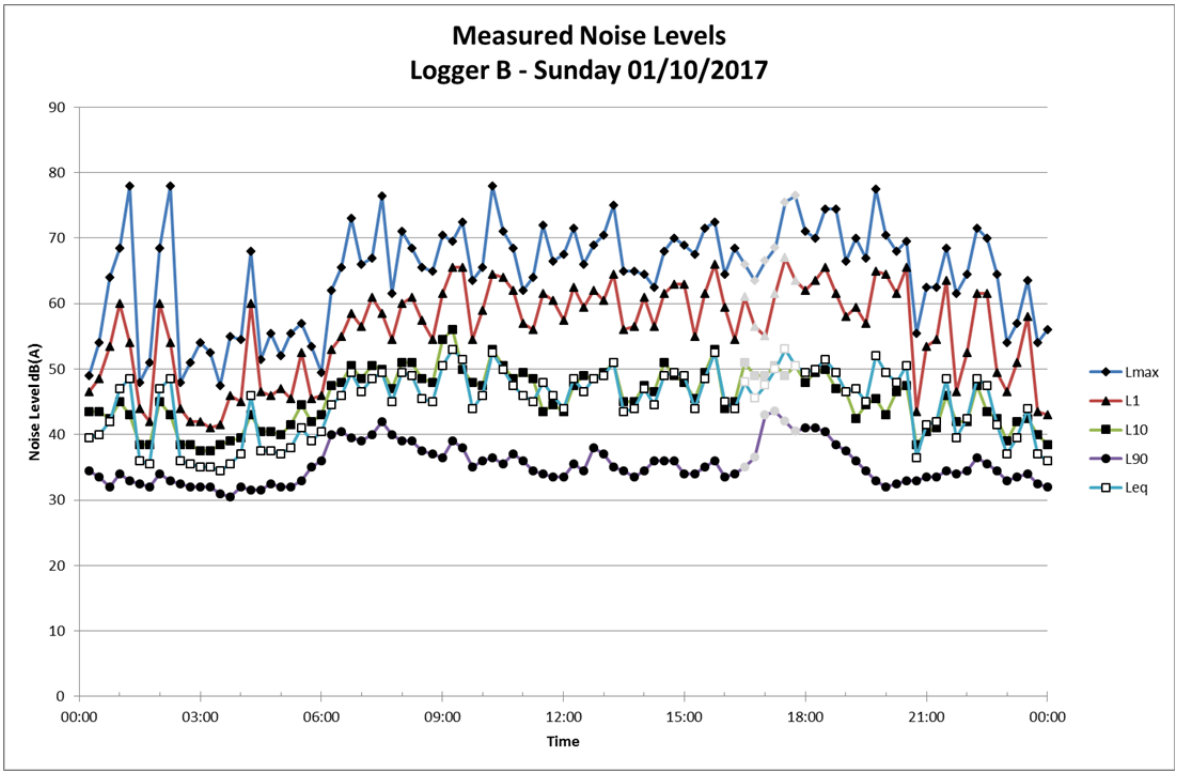
18:00
21:00
00:00
Time
Lmax
L1
L10
L90
Leq


Measured Noise Levels
Logger B - Sunday 01/10/2017
Noise Level dB(A)
90
80
70
60
50
40
30
20
10
0
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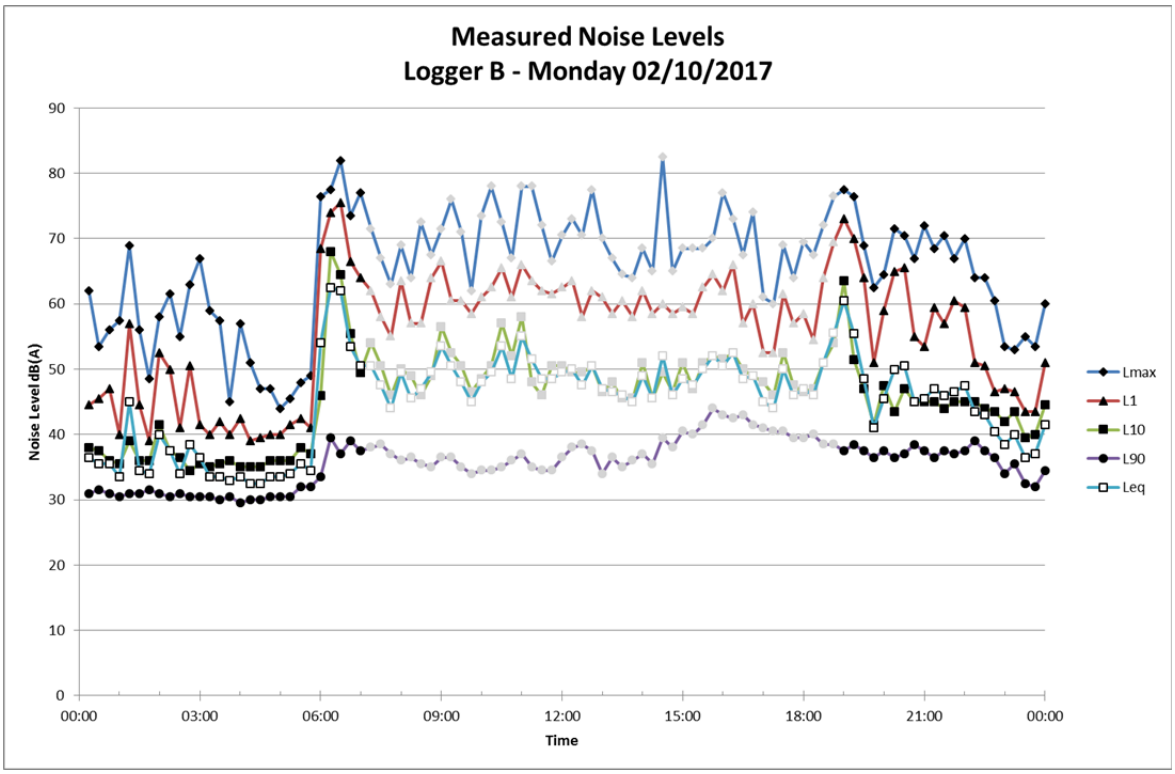
Time
Lmax
L1
L10
L90
Leq


Measured Noise Levels
Logger B - Monday 02/10/2017
Noise Level dB(A)
90
80
70
60
50
40
30
20
10
0
00:00
03:00
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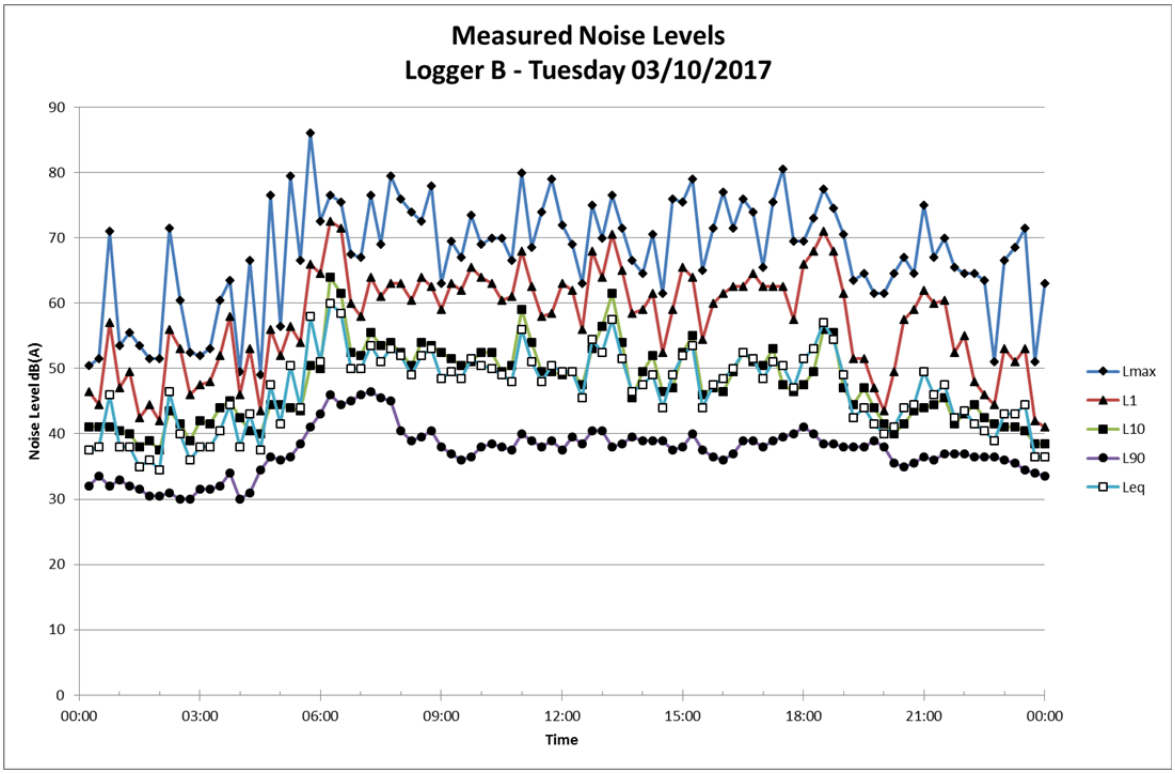
Time
Lmax
L1
L10
L90
Leq


Measured Noise Levels
Logger B - Tuesday 03/10/2017
Noise Level dB(A)
90
80
70
60
50
40
30
20
10
0
00:00
03:00
06:00
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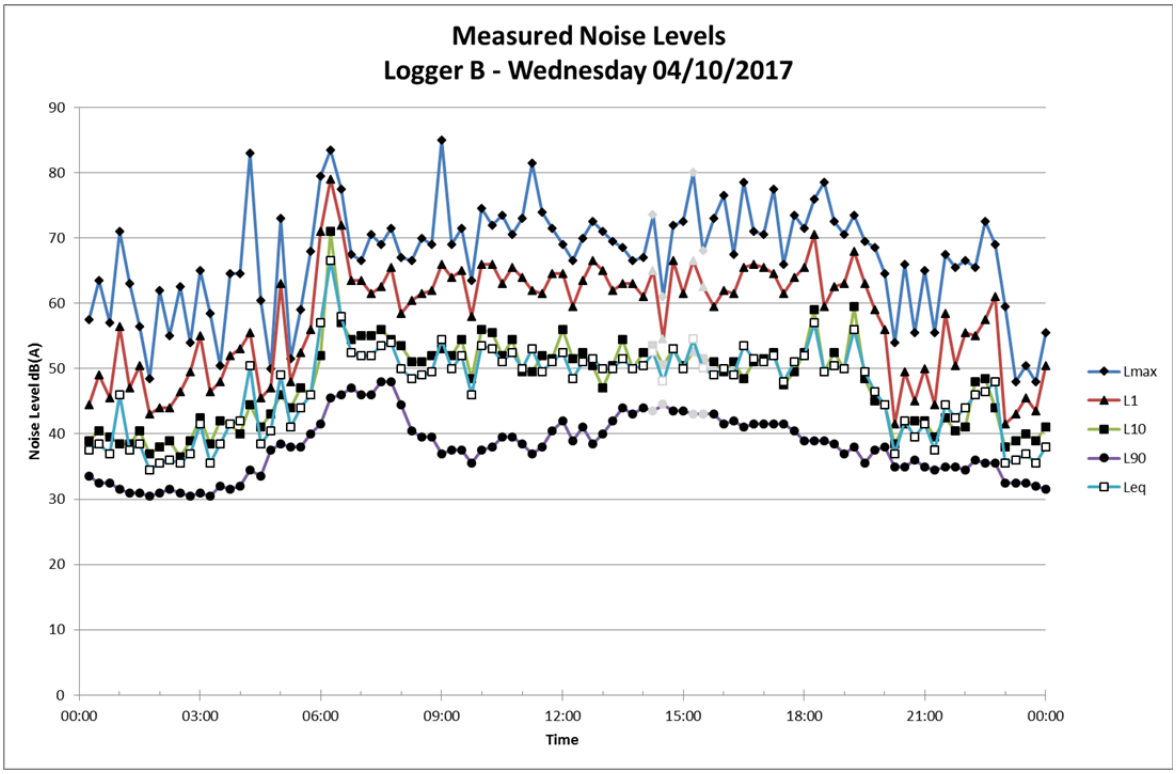
18:00
21:00
00:00
Time
Lmax
L1
L10
L90
Leq


Measured Noise Levels
Logger B - Wednesday 04/10/2017
Noise Level dB(A)
90
80
70
60
50
40
30
20
10
0
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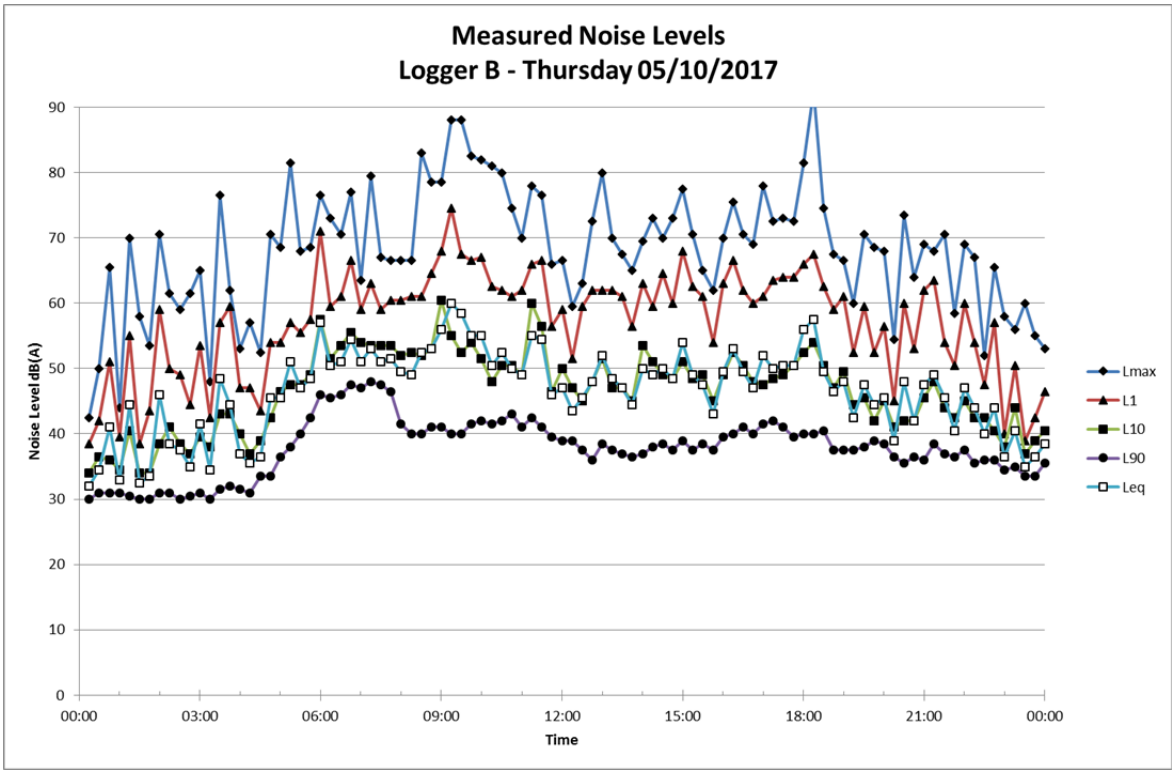
Time
Lmax
L1
L10
L90
Leq


Measured Noise Levels
Logger B - Thursday 05/10/2017
Noise Level dB(A)
90
80
70
60
50
40
30
20
10
0
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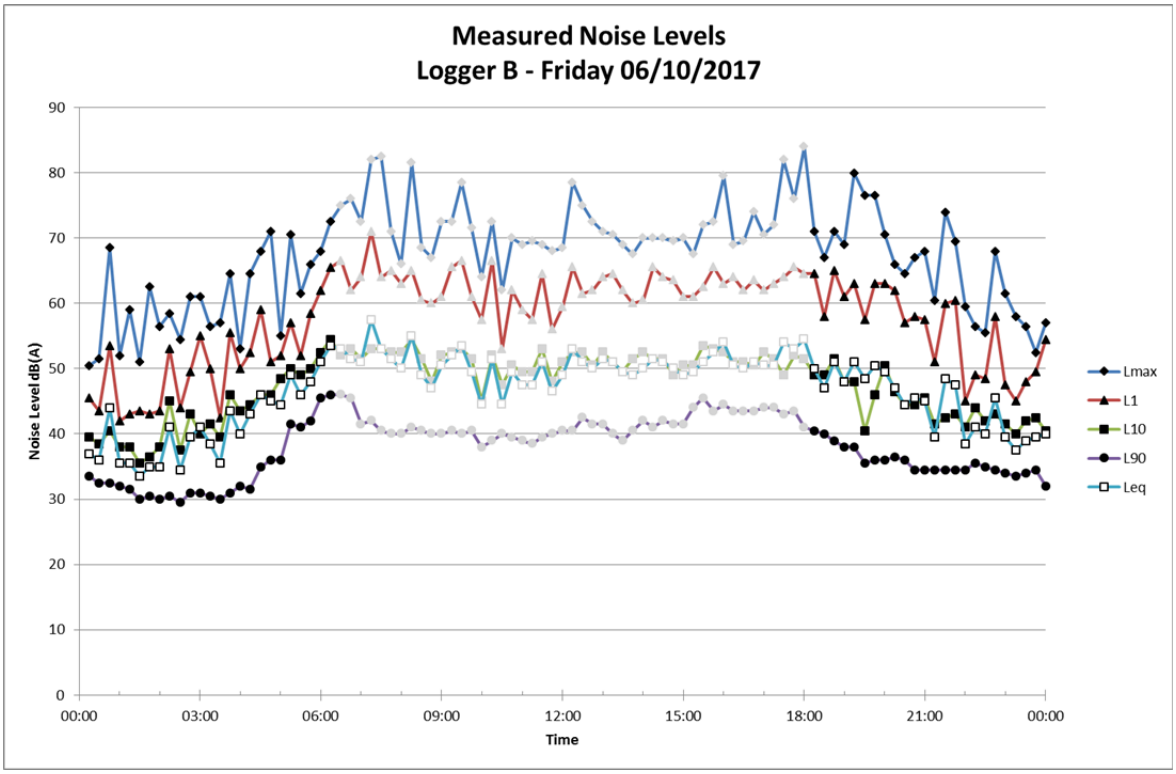
00:00
Time
Lmax
L1
L10
L90
Leq


Measured Noise Levels
Logger B - Friday 06/10/2017
Noise Level dB(A)
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80
70
60
50
40
30
20
10
0
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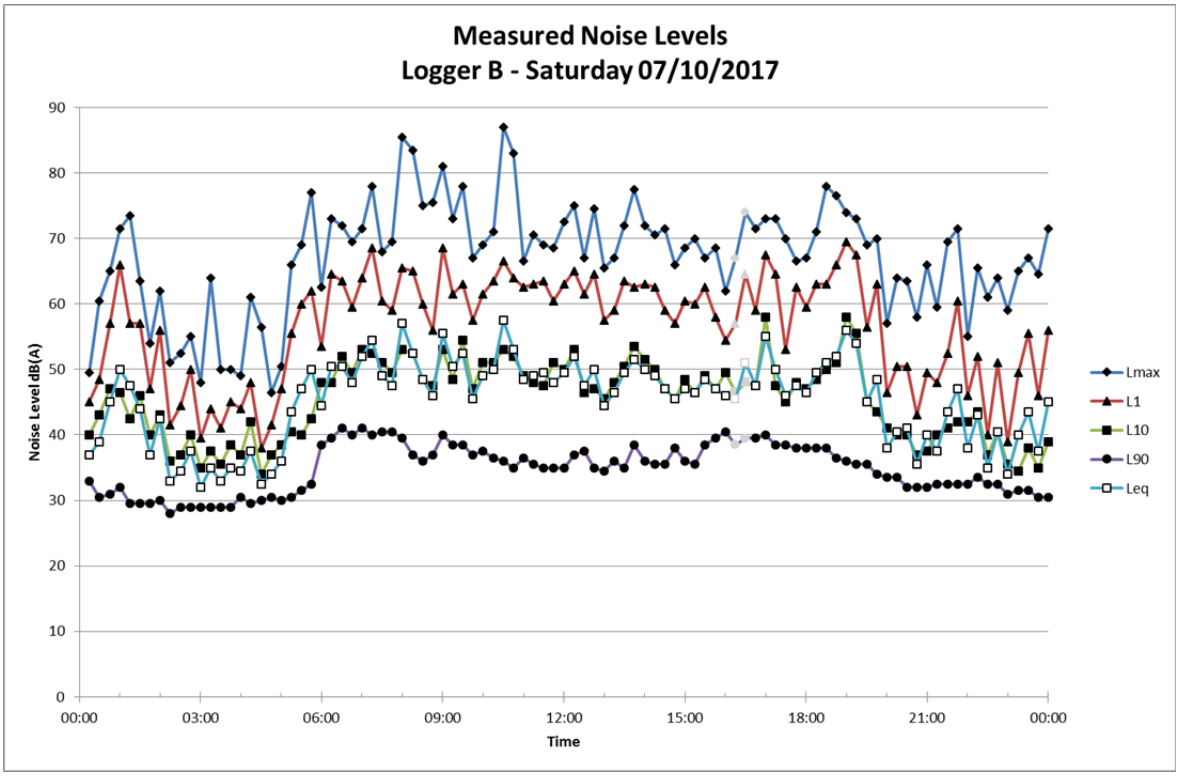
Time
Lmax
L1
L10
L90
Leq


Measured Noise Levels
Logger B - Saturday 07/10/2017
Noise Level dB(A)
90
80
70
60
50
40
30
20
10
0
00:00
03:00
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21:00
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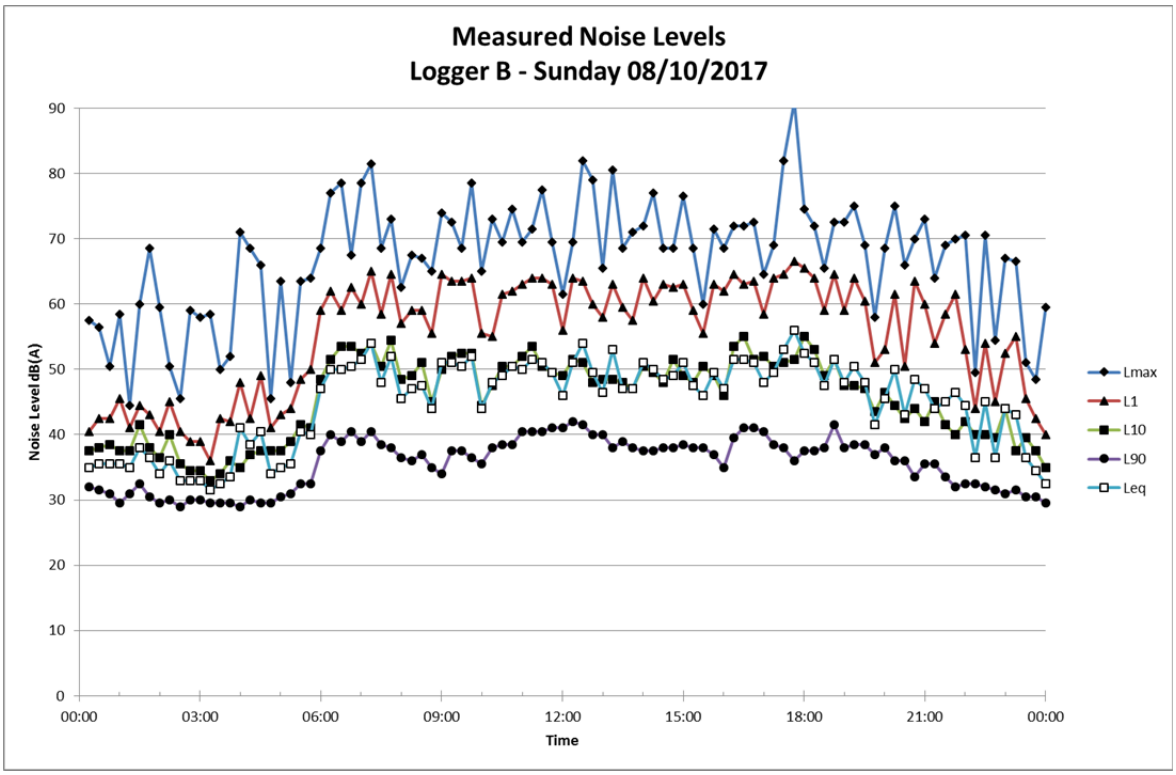
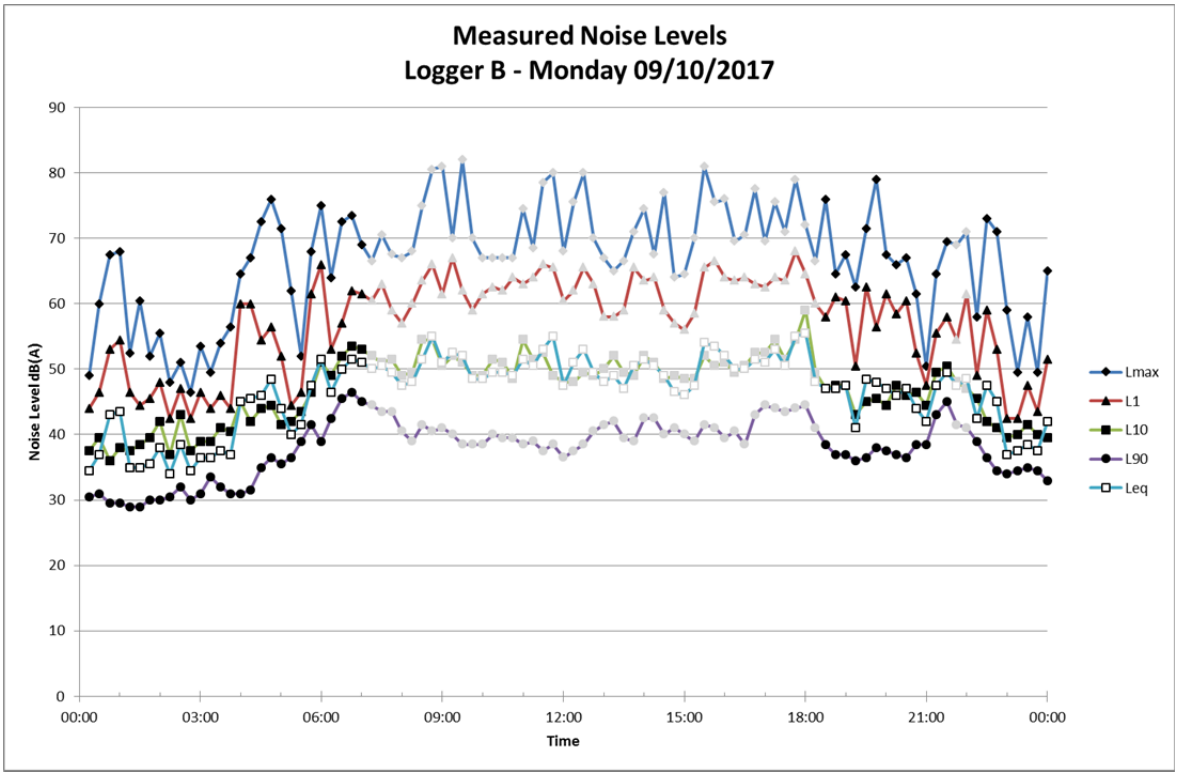
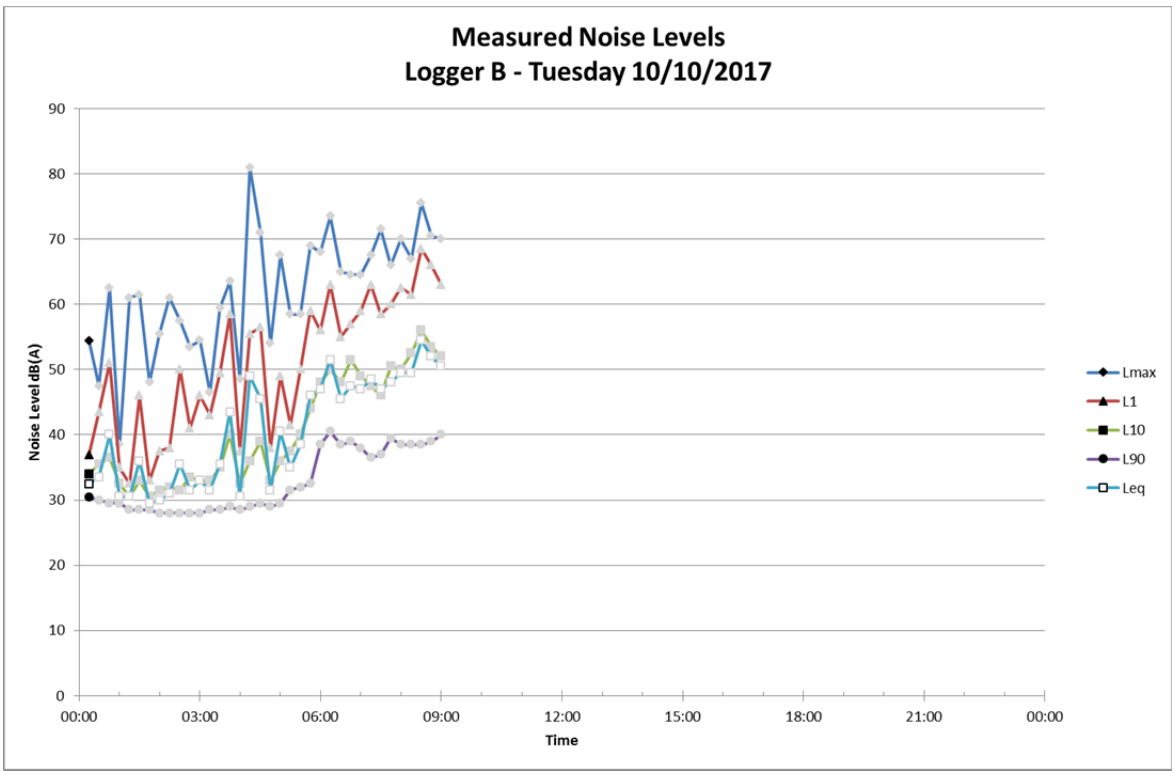
Time
Lmax
L1
L10
L90
Leq


Measured Noise Levels
Logger B - Sunday 08/10/2017
Noise Level dB(A)
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
Logger B - Monday 09/10/2017
Noise Level dB(A)
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
Logger B - Tuesday 10/10/2017
Noise Level dB(A)
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