35-47 Stennett Road, Ingleburn – Stage 3

Noise and Vibration Impact Assessment

Stockland

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1 INTRODUCTION

Pulse White Noise Acoustics has been engaged to undertake the Noise and Vibration Impact Assessment of the proposed warehouse development located at Stage 3, 35-47 Stennett Road, Ingleburn.

The project includes a industrial warehouse project which will include the following:

1. Three (3) warehouse buildings including building 5A, 5B, 5C, 6A, 6B, 6C, 7A and 7B.
2. Associated parking and truck loading areas.
3. Estate Roads.

This assessment includes the acoustic investigation into the potential for noise impacts from the operation of the completed project as well as potential noise impacts from traffic movements on surrounding streets.

Additionally, construction noise and vibration management strategies are included in this report.

1.1 Proposed Development

The proposed development seeks approval for the staged development of the site as an industrial estate. The proposed development comprises:

- Site Establishment:
    - Demolition and removal of existing structures on the site including ground finishes.
    - Remediation of the site; and
    - Required bulk earthworks.
- Staged construction of three warehouse buildings with ancillary handstand and office spaces as follows:
    - Warehouse 5 (5A, 5B and 5C) and associated offices.
    - Warehouse 6 (6A and 6B) and associated offices.
    - Warehouse 7 (7A and 7B) and associated offices.
- Use of the warehouses for warehouse and distribution purposes 24 hours per day 7 days per week.
- Ancillary development including:
    - business identification signage zones
    - A minimum of 201 vehicular car parking spaces
    - landscaping
    - retaining walls
    - utility infrastructure and services connection; and

2 PROJECT DETAILS

The industrial site is located at 35-47 Stennett Road, Ingleburn. The site is located in the Campbelltown City Council.

The surrounding area includes the following:

1. Existing commercial/industrial receivers to the north, east and west of the site.

2. Odyssey House is located to the south of the site and has been assessed as a residential receiver. Odyssey house is located over 200m to the south of the site.

The surrounding receivers to the site includes existing industrial uses to the north, east and west as well as Odyssey House which is located to the south of the site and has been assessed as a residential receiver.

Figure 2-1 Site location

Table 2-1 Nearest Potentially Affected Receivers

Receptor ID	Address	Orientation	Type of Receiver
R1	55 Stennett Road, Ingleburn	To the west of the site	Industrial
R2	54-56 Stennett Road, Ingleburn	To the northwest of the site	Industrial
R3	50 Stennett Road, Ingleburn	To the north of the site	Industrial
R4	Stennett Road, Ingleburn	To the west of the site	Industrial
R5	Odyssey House	To the south of the site	Residential

2.1 Site Description

The proposed industrial development is located at 35-47 Stennett Road, Ingleburn. The industrial precinct will consist of a number of warehouses with external hardstand areas and estate roads.

Noise generating sources are expected to be from truck movements, car movements, mechanical equipment and warehouse uses.

The industrial precinct is proposed to be used 24 hours a day, seven days a week. The proposed site plan is shown below in Figure 2-2.

Figure 2-2 Proposed Site Plan

3 EXISTING ACOUSTIC ENVIRONMENT

The site is located within proximity to Campbeltown Road and the Hume Highway which are to the west of the site, both of which carry high traffic volumes including public transport buses and heavy vehicles.

The site is located within an area which is classified as an *Urban* area as defined in EPA's Noise Policy for Industry and includes the following:

1. Has through-traffic with characteristically heavy and continuous traffic flows during peak periods.
2. Is near commercial districts or industrial districts

The exiting noise levels at the site are predominantly as a result from existing industrial facilities and traffic noise within the vicinity of the site including Campbeltown Road and Hume Highway to the west of the site.

3.1 Noise Descriptors and Terminology

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

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

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

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

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

3.2 Unattended Acoustic Monitoring

3.2.1 Monitoring Details

To determine the background noise levels at nearby receivers, long term unattended noise monitoring was conducted at the boundary of the subject site and the nearest receiver to the south of the site including Odyssey House. As per Table A1 of the Noise Policy for Industry, the noise logger was placed in the vicinity of the reasonably most or potentially most affected residence. The location of the noise is shown in Figure 2-1 above.

3.2.2 Monitoring Instrumentation

Instrumentation used for the noise survey comprised a Svan 971 sound level meter / analysers (serial number 103360 fitted with a microphone windshield. Calibration of the logger was checked prior to and following the measurements. Drift in calibration did not exceed ±0.5 dBA. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates.

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

Logging was conducted from Friday 12th to the 23rd of July 2021 continuously. The measurement results have been filtered to remove data affected by adverse weather conditions, such as excessively windy or rainy time periods, as recorded by the nearest Bureau of Meteorology. Detailed noise logging results are shown in Appendix B.

The figure below includes the noise logger location installed on the site.

Figure 3-1 Noise Logger Installed on the Site

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

The Rating Background Noise Level (RBL) is the background noise level used for assessment purposes at the nearest potentially affected receiver. It is the 90th percentile of the daily background noise levels during each assessment period, being day, evening and the night. The RBL $L_{A90\ (15minute)}$ and L_{Aeq} noise levels are presented in Table 3-1 for the unattended logging. The measured noise levels are considered to be representative of the levels to be expected at the nearest and most affected residence to the proposed development.

Table 3-1 Measured ambient noise levels in accordance with the NSW NPI

Measurement Location	Daytime[1] 7:00 am to 6:00 pm		Evening[1] 6:00 pm to 10:00 pm		Night-time[1] 10:00 pm to 7:00 am	
	L_{A90}[2]	L_{Aeq}[3]	L_{A90}[2]	L_{Aeq}[3]	L_{A90}[2]	L_{Aeq}[3]
Logger Location	46	52	47	51	46	52

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

Note 2: The L_{A90} noise level is representative of the "average minimum background sound level" (in the absence of the source under consideration), or simply the background level.

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

4 APPLICABLE GUIDELINES AND PROJECT CRITERIA

This section contains noise criteria on the operational criteria, construction criteria and vibration criteria.

The following criteria are relevant for the assessment of noise and vibration emissions from the proposed training centre:

- For the assessment of the predicted operational noise emissions by the training facility: The criteria have been derived in accordance with the *Noise Policy for Industry* (EPA, 2017). Refer to Section 4.1.
- The assessment of the noise impacts of the construction noise on the sensitive receivers: The criteria have been derived in accordance with the *Interim Construction Noise Guideline* (DECC, 2009). Refer to Section 7.2.
- For the assessment of vibration impacts from the development: The criteria have been derived in accordance with Assessing Vibration: A Technical Guideline (DEC, 2006), BS 7385-2: 1993 and BS 6472: 1992. Refer to Section 7.3.

4.1 NSW Noise Policy for Industry

In NSW, the control of noise emissions is the responsibility of Local Government and the NSW Environment Protection Authority (NSW EPA). In October 2017, the NSW EPA released the *Noise Policy for Industry* (NSW NPI). The purpose of the policy is to ensure that noise impacts associated with particular industrial developments are evaluated and managed in a consistent and transparent manner. The policy aims to ensure that noise is kept to acceptable levels in balance with the social and economic value of industry in NSW.

The NSW NPI criteria for industrial noise sources have two components:

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

The project noise trigger level is derived from the more stringent value out of the project intrusiveness noise level and the project amenity noise level.

4.1.1 Intrusive Noise Impacts (Residential Receivers)

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

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

4.1.2 Protecting Noise Amenity (All Receivers)

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

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

4.1.3 Area Classification

For the considered receptors in an *Urban* area, the recommended amenity noise level is shown in Table 4-1 below. When the existing noise level from industrial noise sources is close to the recommended "Amenity Noise Level" (ANL) given above, noise from the new source must be controlled to preserve the amenity of the area in line with the requirements of the NSW NPI.

Table 4-1 NSW NPI – Recommended L_{Aeq} Noise Levels from Industrial Noise Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day[1]	Recommended Amenity Noise Level ($L_{Aeq, period}$)[2]
Residence	Urban	Day	60
		Evening	50
		Night	45

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

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

4.1.4 Project Trigger Noise Levels

The intrusive and amenity criteria for industrial noise emissions derived from the measured data are presented in Table 4-2. The amenity and intrusive criterion are nominated for the purpose of determining the operational noise limits for noise sources associated with the development which can potentially affect noise sensitive receivers.

For each assessment period, the project trigger noise levels are the lower (i.e. the more stringent) of the amenity or intrusive criteria. The project trigger noise levels are shown in bold text in Table 4-2.

Table 4-2 External noise level criteria in accordance with the NSW NPI

Location	Time of Day	Project Amenity Noise Level, $L_{Aeq, period}$ [1] (dBA)	Measured $L_{A90, 15\ min}$ (RBL) [2] (dBA)	Measured $L_{Aeq, period}$ Noise Level (dBA)	Intrusive $L_{Aeq, 15\ min}$ Criterion for New Sources (dBA) [3]	Amenity $L_{Aeq, 15\ min}$ Criterion for New Sources (dBA) [3, 4]
Residence (Urban)	Day	55	46	52	**51**	58
	Evening	45	46[5]	51	51	**48**
	Night	40	46	52	51	**43**

Note 1: Project Amenity Noise Levels corresponding to "Urban" areas, equivalent to the Recommended Amenity Noise Levels minus 5 dBA

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

Note 3: Project Noise Trigger Levels are shown in bold

Note 4: According to Section 2.2 of the NSW NPI, the LAeq, 15 minutes is equal to the LAeq, period + 3 dB

Note 5: As per section Section 2.3 of the NPI, it is generally recommended that the project intrusiveness noise level for evening be set at no greater than the project intrusiveness noise level for daytime

4.1.5 Sleep Disturbance

An accurate representation of sleep disturbance impacts on a community from a noise source is particularly difficult to quantify mainly due to differing responses of individuals to sleep disturbance – this is found even within a single subject monitored at different stages of a single night's sleep or during different periods of sleep.

In addition the differing grades of sleep state make a definitive definition difficult, and even where sleep disturbance is not noted by the subject, factors such as heart rate, mood and performance can still be negatively affected.

An assessment of sleep disturbance should consider the maximum noise level or $L_{A1(1\ minute)}$, and the extent to which the maximum noise level exceeds the background level and the number of times this may happen during the night-time period. Factors that may be important in assessing the extent of impacts on sleep include:

- How often high noise events will occur;
- Time of day (normally between 10.00pm and 7.00am); and
- Whether there are times of day when there is a clear change in the existing noise environment (such as during night periods).

The most recent NSW guidance in relation to sleep disturbance is contained in the NSW EPA's online *Application notes – NSW industrial noise policy*. For the purposes of this assessment a night-time sleep disturbance 'screening criterion' noise goal of RBL +15 dB(A) is applied.

The term 'screening criterion' indicates a noise level that is intended as a guide to identify the likelihood of sleep disturbance. While it is not a firm criterion to be met, where the criterion is met, sleep disturbance is not likely. When the screening criterion is not met, a more detailed analysis is required.

With regard to reaction to potential sleep awakening events, the RNP gives the following guidance:

> *'From the research on sleep disturbance to date it can be concluded that:*
> - *maximum internal noise levels below 50–55 dBA are unlikely to awaken people from sleep*
> - *one or two noise events per night, with maximum internal noise levels of 65–70 dB(A), are not likely to affect health and wellbeing significantly*

The EPA's *Industrial Noise Policy for Industry* (NPfI) and the *NSW Road Noise Policy (RNP)* includes suitable criteria for the assessment of potential sleep awakening events, which have been used as the basis of this report.

The NPfI includes the following commentary regarding possible sleep awakening events:

> ***2.5 Maximum noise level event assessment***
>
> *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:*
> - *LAeq,15min 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or*
> - *LAFmax 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater,*
>
> *A detailed maximum noise level event assessment should be undertaken.*
>
> *The detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period. Some guidance on possible impact is contained in the review of research results in the NSW Road Noise Policy.*

The RNP includes the following comments regarding sleep disturbance:

> *From the research on sleep disturbance to date it can be concluded that:*
> - *maximum internal noise levels below 50–55 dB(A) are unlikely to awaken people from sleep*
> - *one or two noise events per night, with maximum internal noise levels of 65–70 dB(A), are not likely to affect health and wellbeing significantly.*

4.1.5.1 Sleep Disturbance Noise Assessment Levels

Based on the NSW *Noise Policy for Industry* and the *Road Noise Policy* is a suitable assessment of intermittent noise impacts to protect the health and wellbeing of residential receivers from intermittent noise levels generated on the site.

Based on the relevant standards detailed above, a summary of the sleep disturbance noise level criteria is detailed in the following table.

Table 4-3 Sleep Disturbance Criteria

Type of Receiver	Location	Policy	Description	Background Noise level Night	Resulting Maximum Noise Level
Residential Receiver	External Noise levels	Noise Policy for Industry	The potential for sleep disturbance from maximum noise level events	46 dB(A) L $L_{90,15min}$	$L_{Aeq,15min}$ 51 dB(A) Externally
					L_{AFmax} 61 dB(A) Externally
	Within the residential dwelling	Road Noise Policy	1 or 2 events unlikely to awaken people from sleep		65-70 dB(A) Lmax Internally
			Maximum internal noise unlikely to awaken people from sleep		50-55 dB(A) Lmax Internally

Based on the details included within the NPfI and the RNP, in the event a noise level of 61 dB(A) L_{max} or 51 $L_{Aeq\ 15\ min}$ does not occur externally at the residential receiver as a result of the use of the operation of the property (internally within the residential receiver) then noise levels are *unlikely to awaken people from sleep,* and compliance with the requirements of the NPfI and the RNP regarding sleep disturbance would be achieved.

5 OPERATIONAL ACOUSTIC ASSESSMENT

This section of the report details the assessment of noise generated on the site has been undertaken on this section of the report. The assessment of potential noise sources resulting from the future operation of the site are detailed in the following sections.

5.1 Mechanical Plant and Equipment

At this stage of the project the selections of plant and equipment items has not been undertaken. As a result the exact selections and resulting noise levels of the plant and equipment to be installed on the site have not been determined. As such a detailed assessment of noise associated from engineering services cannot be undertaken.

To ensure that future selections of plant items meet external noise levels at surrounding receivers a proof of concept approach has been undertaken in this assessment.

In our experience, for this type of development the following mechanical systems may be installed, and their associated sound power levels are outlined below.

- Ventilation fans – 80dB(A) (Lw)
- Toilet exhaust fans – 45dBA (Lw)
- Air Conditioning Condensers – 80dBA (Lw)
- Chiller equipment for specific warehouses, which is assessed in the following point.

For the proposed ventilation systems, it is anticipated that the physical fans would be installed on a plant area of the roof of the project with mechanical ductwork moving air from the warehouses areas to the roof as required. A dedicated plant deck area will be provided on the roof of each warehouse.

On the assumption of the Sound Power Level above and the ductwork that is installed is acoustically treated with 50mm internal lining or attenuators (depending on the exact location), compliance would be achieved.

Toilet exhaust fans for the units will individually discharge from the amenity areas of the future warehouses using in ceiling or roof top mounted fans. It is recommended that 1m of acoustic flexible ducting is used on the intake and discharge side of the fan or a section of internally lined ductwork, on this assumption compliance would be achieved.

Roof top plant areas for individual warehouse amenities (office areas) would be provided using condensers located on the roof or ground level. It is expected that each warehouse will include a number of administration areas which will require condenser equipment. Providing this equipment is located on ground level or on roof top of the office areas then the resulting noise emissions will comply with the relevant noise emission criteria.

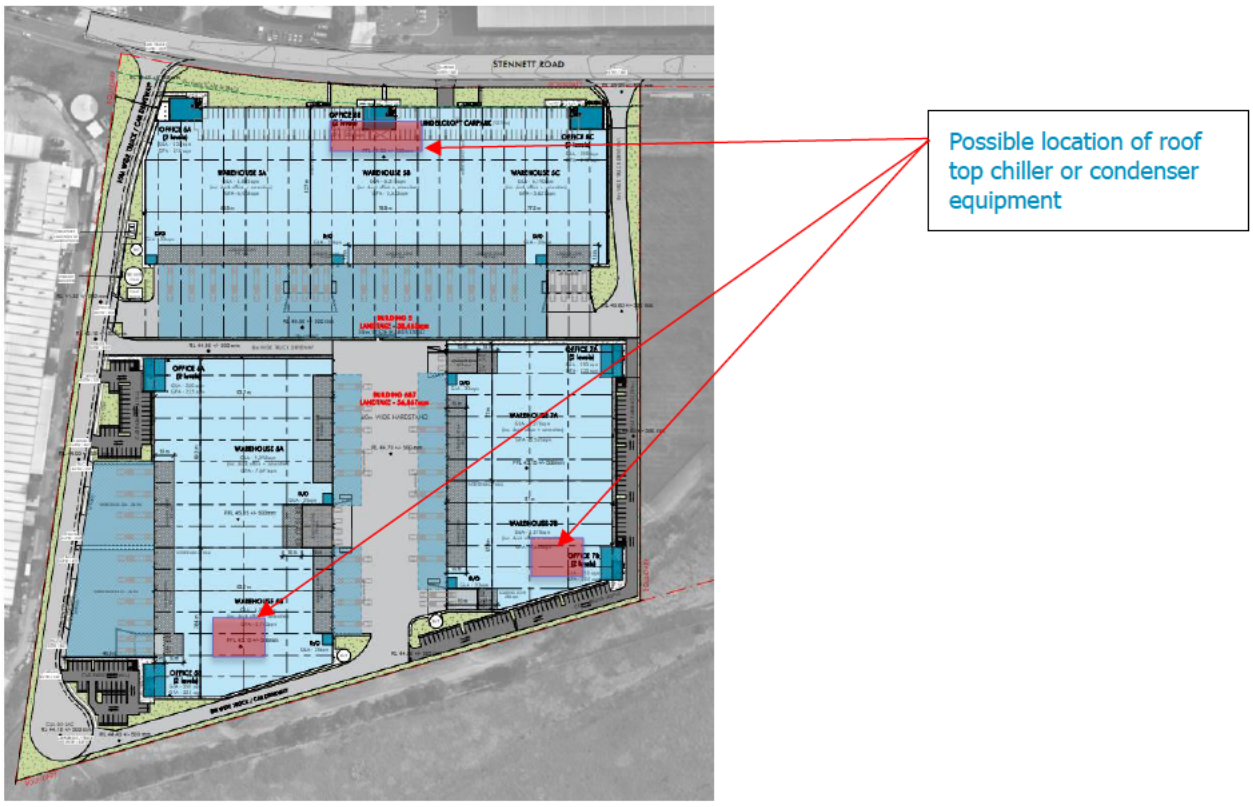
Details of the required mechanical services equipment and acoustic treatments to ensure the relevant noise level criteria is achieved will be provided as part of the CC submission of the project.

Experience with similar projects confirms that the acoustic treatment of mechanical services is both possible and practical to ensure noise emission criteria is achieved.

5.2 Condenser and Chiller Equipment

The proposed site may include the use of chiller or large condenser equipment. The location of the warehouses and assumed locations of the future external chiller/condenser locations are detailed in the figure below.

Figure 5-1 Proposed Chiller or Condenser Equipment



For the purpose of this assessment facility it has been assumed that the required external chiller/condenser equipment will include a bank of air-cooled chillers or the like. The expected noise levels of this equipment is up to 95 dB(A) Sound Power Level (SWL).

Based on the location of the surrounding receivers to the site which include the residence to the south of the site at Odyssey House, with a distance of over 200m from the future equipment.

Based in proposed equipment the following noise levels have been calculated:

a)	Source Noise of cooling equipment -	95 dB(A) SWL)
b)	Distance correction (200m)-	-54 dB
c)	Acoustic Screening -	-10 dB
d)	Calculated Noise Level -	**31 dB(A)**
	Night Time Noise Criteria	**43 dB(A)**

Based on the results of the acoustic assessment detailed above acoustic screening to the proposed chiller equipment may be required. The acoustic screen should consist of the following:

1. A solid screen including a construction which includes the following:
    a. Solid material including FC sheet, Sheet Metal, Masonry or the like with a minimum acoustic performance of Rw 15.
    b. Screen to be installed to a minimum height of the chiller/condenser equipment.
    c. Screen to be constructed such that a line of sight barrier exists between the equipment and the residential receivers located to the east of the site.

It is noted that the assessment above assumes that the required chiller equipment will be operating at 100% during night times periods. It is likely that the operational capacities of the equipment will not be required to operate at 100% during night-time periods and a further reduction in the predicted noise levels above would result.

Based on the assessment of the proposed warehouses which may include roof top cooling equipment the resulting noise levels from the proposed equipment to be included on the site will be acoustically acceptable and compliant with the relevant noise assessment criteria detailed in this report.

5.3 Use of the Warehouses

The proposed future use of the warehouses will include spaces with the potential for materials movement and storage. The future use of each warehouse will include the potential for the following equipment of the site, including expected noise levels:

- Material handling equipment (forklifts) for each warehouse, with a noise levels of up to 90 dB(A) (SWL) and a resulting internal noise level within warehouses of 80dB(A) sound pressure level (SPL).
- Heavy and light vehicle movements to each warehouse hardstand with a noise level of up to 110 dB(A).

For the purpose of this assessment, it has been assumed that the use of the equipment above could be undertaken internally within the future warehouses and externally of the warehouse areas within the hardstand areas as detailed in the figure below.

Figure 5-2 Proposed hard Stand Areas

5.4 Predicted Noise Emissions

This section of the report details the resulting predicted noise emissions from the operation of the proposed site to the surrounding residential receivers, including the sources detailed in the section above.

The assessment includes the potentially worst-case periods including the following:

1. All plant and equipment is operational simultaneously for all warehouses.
2. The hardstand areas for each warehouse is being used simultaneously including 1 forklift and 1 heavy vehicle moving in a 15min period for each warehouse.
3. All warehouses are being used for internal use simultaneously.

Predictions include the assessment to the receiver's locations as detailed in Figure 2 of this report.

Predictions have been undertaken for the operation of activities undertaken within the future warehouse areas as well as the external traffic movements on hardstands. Predictions have included the contributions of the cumulative noise impacts and are detailed in the following table.

Table 5-1 External Noise Emission Predictions – Internal Activities

Location	Time of Day	Predicted Noise Emissions LAeq, 15min (dBA)							Cumulative Predicted Noise Levels LAeq, 15min (dBA)	Project Noise Level Criteria LAeq, 15min (dBA)
		Warehouse Source								
		5A	5B	5C	6A	6B	7A	7B		
Residential Receiver – Odyssey house	Day	>14	>14	>14	>14	21	>14	21	26.4	51
	Evening	>14	>14	>14	>14	21	>14	21	26.4	48
	Night	>14	>14	>14	>14	21	>14	21	26.4	43
Calculated noise emissions from the use of internal areas of the warehouses with maximum expected noise levels within each warehouse of up to 80 dB(A) Leq 15min as a Sound Pressure Level within each warehouse.										

Predictions have been undertaken for the contribution of noise from the external activities for each warehouse, including vehicle movements on the hardstands. Predictions have included the contributions of the warehouses individually as well as cumulative and are detailed in the following table.

Table 5-2 External Noise Emission Predictions – External Activities and Vehicle Movements including Forklifts

Location	Time of Day	Predicted Noise Emissions LAeq, 15min (dBA)							Cumulative Predicted Noise Levels LAeq, 15min (dBA)	Project Noise Level Criteria LAeq, 15min (dBA)
		Warehouse Source								
		5A	5B	5C	6A	6B	7A	7B		
Residential Receiver – Odyssey house	Day	>20	>20	>20	>20	31	>20	29	35.7	51
	Evening	>20	>20	>20	>20	31	>20	29	35.7	48
	Night	>15	>15	>15	>15	26	>15	23	30.5	43
Predicted external noise levels from external operations including viceless movements and delivery truck entry and exit on the site										

Predictions have been undertaken for the contribution of noise from the expected mechanical equipment on the site. Predictions have included the contributions of the warehouses individually as well as cumulative and are detailed in the following table.

Table 5-3 External Noise Emission Predictions – Mechanical Equipment

Location	Time of Day	Predicted Noise Emissions $L_{Aeq, 15min}$ (dBA)							Cumulative Predicted Noise Levels $L_{Aeq, 15min}$ (dBA)	Project Noise Level Criteria $L_{Aeq, 15min}$ (dBA)
		Warehouse Source								
		5A	5B	5C	6A	6B	7A	7B		
Urban residences Northern Locations	Day	>20	>20	>20	>20	31	>20	31	34.9	51
	Evening	>20	>20	>20	>20	31	>20	31	34.9	48
	Night	>20	>20	>20	>20	31	>20	31	34.9	43
Predicted external noise levels from external operations including possible plant and equipment propose for the warehouses										

Based on the results of the predicted noise levels from the various noise sources on the site the cumulative noise impacts to the surrounding receivers are detailed in the table below.

Table 5-4 External Noise Emission Predictions – Cumulative Noise Impacts

Location	Time of Day	Predicted Noise Emissions $L_{Aeq, 15min}$ (dBA)			Cumulative Predicted Noise Levels $L_{Aeq, 15min}$ (dBA)	Project Noise Level Criteria $L_{Aeq, 15min}$ (dBA)
		Noise Source				
		Internal	External	Plant Noise		
Urban residences Northern Locations	Day	26.4	35.7	34.9	38.6	51
	Evening	26.4	35.7	34.9	38.6	48
	Night	26.4	30.5	34.9	36.7	43
Cumulative noise levels passed on the predictions for each noise source elements detailed in the tables above.						

Based on the results of the noise level predictions noise emissions from all elements of the site will comply with the relevant noise emission criteria.

It is noted that predictions have been based on the possible maximum operating conditions and in the event the site does not include possible maximum conditions a reduction in the predicted noise levels above will result.

5.4.1 Sleep Disturbance Assessment

Based on the proposed use of the site an assessment of potential for a sleep disturbance event has been undertaken. The assessment includes the potential for a maximum noise level from a heavy vehicle on the site within the closest proximity of the site to Odyssey house located to the south of the site.. The sample calculation for potential maximum sleep disturbance noise levels are included below.

Table 5-5 Sleep Disturbance Noise Calculation to Residential Receiver

	Noise Level
Noise Source – Truck on Hard Stands	110 dB(A) Lmax
Distance Correction (200m)	-54
Resulting External Noise Level	56 dB(A) Lmax
Maximum Noise Level Sleep Disturbance Level (external)	61 dB(A) Lmax
Noise Level Compliance	Yes

Based on the results of the assessment detailed above the resulting maximum noise level from the operation of the site, including the movement of trucks externally, will comply with the relevant criteria for sleep disturbance and will be acceptable.

The assessment includes the assumption that the is no line of sight barrier and the activity is being used at the closest location on the site. In the event there is an additional distance or a line of sight barrier from activities on the site then the resulting maximum noise levels will be less than that detailed in the table above.

5.5 Recommended Acoustic Mitigations

The recommended mitigations and management controls should be included in the design, construction and operation of the site (in addition to those included in the sections above) to ensure suitable on-going operation of the site include the following:

1. All external hardstand, driveways and the like should include flat services.
2. Any grates or metal drainage points should be securely fixed to prevent movement as vehicles pass over.
3. All surfaces being used for vehicles and forklifts should be brush finishes (ie not polished or painted).
4. Any expansion joints should include flush finishes including cover plates where vehicles pass over.
5. A site contact should be provided to residence for complaints.
6. Acoustic certification testing should be undertaken to confirm resulting noise emissions comply with the relevant criteria. Testing should be undertaken within 6 months of the facility being in operation. In the event noise levels are in excess of noise criteria additional acoustic mitigation and/or control to be specified and adopted to ensure noise emission criteria is achieved.

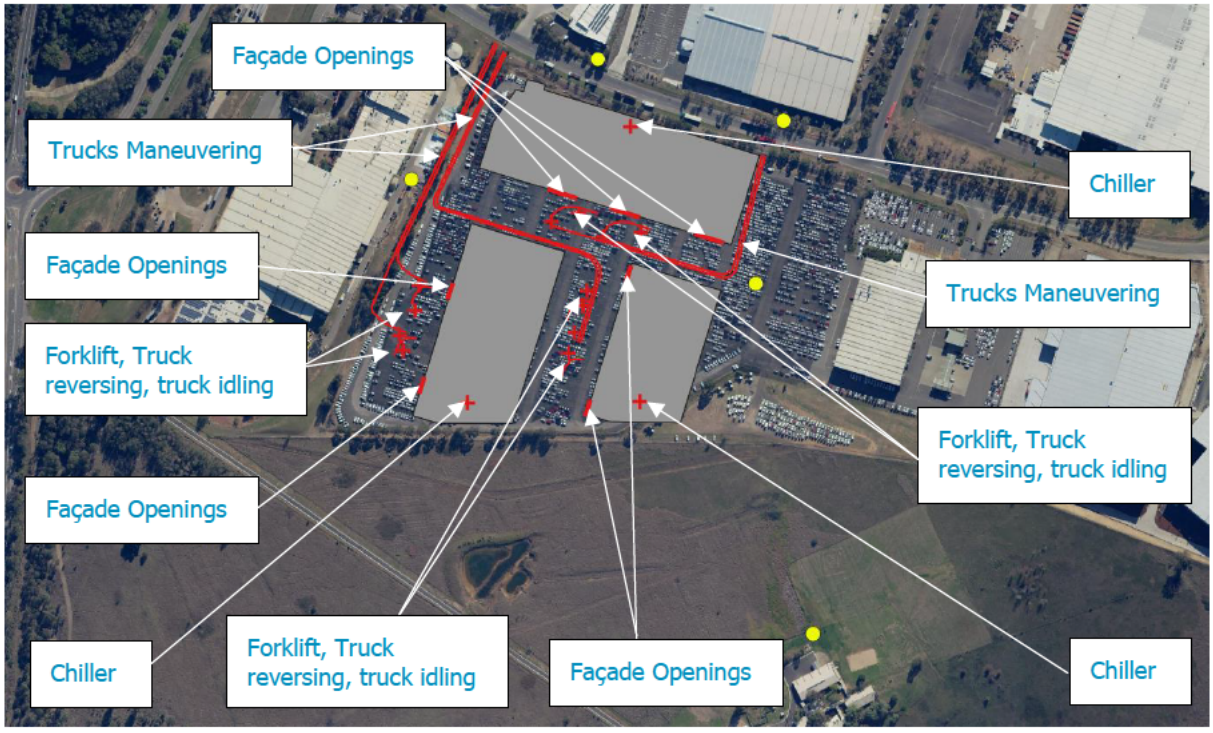
5.6 Results of Noise Modelling

As part of this assessment detailed noise modelling of the proposed site has been undertaken which is presented in this section of the report. Modelling has been undertaken using iNoise modelling. Details of the noise emission modelling are included in this section of the report and included in Appendix D.

The noise modelling was undertaken to include the operation of the site, including the assumptions detailed in the section above regarding source on the site and the figures detailed in the figures below.

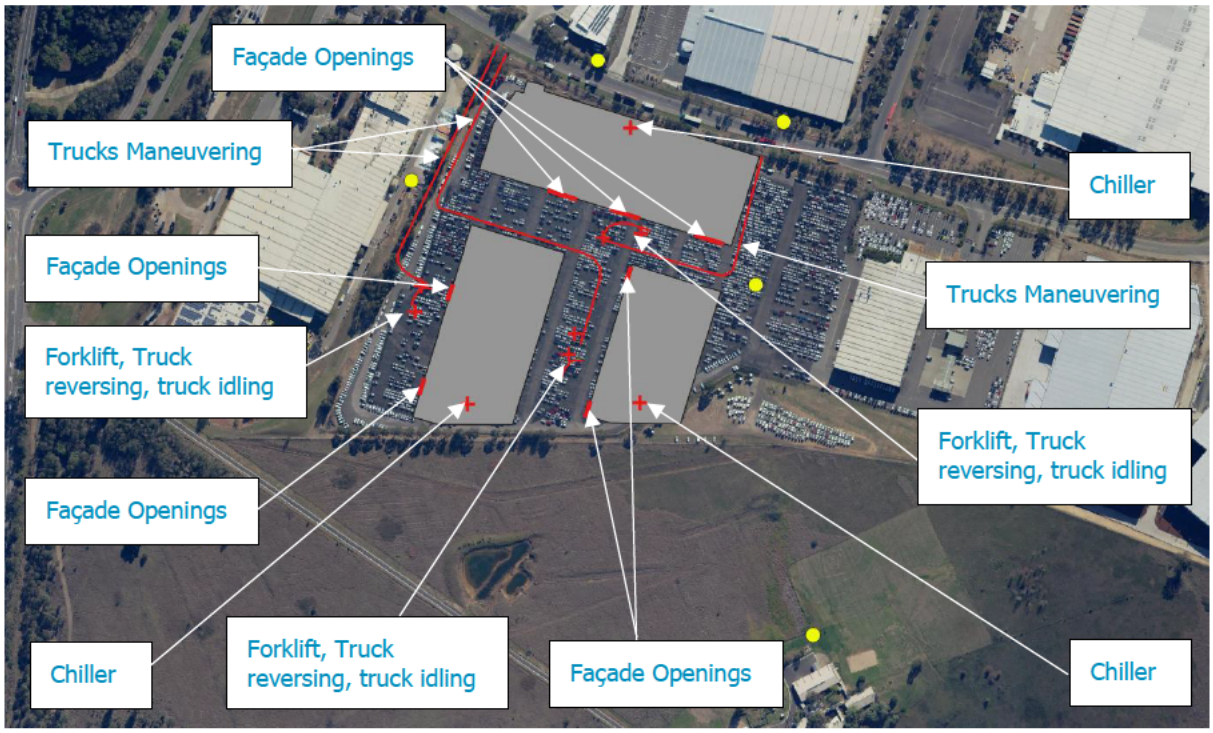
The location of the noise sources for the day scenario are shown in Figure 5-3 below.

Figure 5-3 Day Source Locations



The location of the noise sources for the night scenario are shown in Figure 5-4 below.

Figure 5-4 Night Source Locations



The modelling was undertaken based on the operation of the sources being conducted simultaneously at any time.

Noise modelling included noise contour mapping, which is included in Appendix C (which have been conducted in additional to the noise calculations included in the section above). Noise modelling has been undertaken for the following receiver locations:

1. R1 - 55 Stennett Road Ingleburn – Industrial receiver
2. R2 - 56 Stennett Road Ingleburn – Industrial receiver
3. R3 - 50 Stennett Road Ingleburn – Industrial receiver
4. R4 - 47 Stennett Road Ingleburn – Industrial receiver
5. R5 - 169 Campbelltown Road Ingleburn – Residential receiver, including Odyssey House

The results of the of the iNoise modelling are included in Appendix C and are summarised in the results table below.

Table 5-6 Summary of Noise Modelling Results

Receiver Location	Time of Day	Calculated External Noise level	Project Noise Emissions Criteria $L_{Aeq,\ 15\ min}$ (dBA)	Comments
1	Day	62	65	Results of the iNoise modelling indicate noise emissions which are compliant with the projects noise emission criteria providing recommended mitigations included in this report are included in the design and operation of the project
	Evening	59	65	
	Night	59	65	
2	Day	48	65	
	Evening	47	65	
	Night	47	65	
3	Day	51	65	
	Evening	48	65	
	Night	48	65	
4	Day	58	65	
	Evening	55	65	
	Night	55	65	
5	Day	40	51	
	Evening	39	48	
	Night	39	43	

The results of noise modelling are included in Appendix C.

The assessment of noise emissions from the site (including noise modelling results) have included an assessment of modifying factors including tonality and annoying characteristics. The noise modelling results include predictions of noise emissions in single octave levels; the resulting noise levels do not include noise levels which are defined as annoying or tonal using the definitions of the EPA's *Noise Policy for Industry.*

Based on the results of this assessment, including the iNoise modelling, the cumulative noise emissions from the proposed development will comply with the relevant noise emissions criteria providing the recommended acoustic treatments to the existing area, detailed in this report, are implemented.

6 ADDITIONAL TRAFFIC NOISE ON SURROUNDING ROADWAYS

This section of the report details the assessment of future traffic noise on surrounding streets as a result of vehicles using the site.

The suitable noise criteria for the assessment of road traffic noise generated by vehicles using the site are set out in the NSW Government's NSW Road Noise Policy (RNP). Table 3 of the RNP standard details the assessment criteria to be applied at residences potentially impacted by additional traffic volumes based on the road category and land use. The relevant noise criteria is detailed in the table below.

Table 3 Road traffic noise assessment criteria for residential land uses

Road category	Type of project/land use	Assessment criteria – dB(A)	
		Day (7 a.m.–10 p.m.)	Night (10 p.m.–7 a.m.)
Freeway/ arterial/ sub-arterial roads	1. Existing residences affected by noise from **new** freeway/arterial/sub-arterial road corridors	$L_{Aeq,\ (15\ hour)}$ 55 (external)	$L_{Aeq,\ (9\ hour)}$ 50 (external)
	2. Existing residences affected by noise from **redevelopment** of existing freeway/arterial/sub-arterial roads 3. Existing residences affected by **additional traffic** on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq,\ (15\ hour)}$ 60 (external)	$L_{Aeq,\ (9\ hour)}$ 55 (external)
Local roads	4. Existing residences affected by noise from **new** local road corridors 5. Existing residences affected by noise from **redevelopment** of existing local roads 6. Existing residences affected by **additional traffic** on existing local roads generated by land use developments	$L_{Aeq,\ (1\ hour)}$ 55 (external)	$L_{Aeq,\ (1\ hour)}$ 50 (external)

Note: Land use developers must meet internal noise goals in the Infrastructure SEPP (Department of Planning NSW 2007) for sensitive developments near busy roads (see **Appendix C10**).

In addition to the table above the RNP includes criteria for sites where existing noise levels exceed those levels detailed in the table above. Section 3.4.1 of the RNP *Process of applying the criteria* includes the following:

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

In order to generate an increase of 2 dB on local road traffic noise, existing traffic volumes should increase by approximately 60%. Based on the location of the site, which includes proximity to the site including Stennett Road and then using Campbeltown Road and the Hume Highway. It is noted that the traffic volume generated by the development will be significantly less than 60% of the existing traffic flows on these roadways and the movement of traffic from the site will not use roadways which include residential receivers.

Therefore, it is it is expected that the increase on existing traffic noise levels, due to the traffic generation, will be less than 2 dB on local roadways from traffic movements resulting from use of the site on residential receivers and will be acoustically acceptable.

7 CONSTRUCTION NOISE AND VIBRATION MANAGEMENT PLAN

This section of the report details the assessment of noise associated with the proposed demolition activities associated with the development. The assessment has been undertaken to assess the potential noise impacts from construction and demolition on surrounding receivers to the site.

The proposed construction and demolition activities to be undertaken on the site include the removal of the existing buildings and construction of the new development. The development will then be constructed using normal construction processes.

The EPA's Interim Construction Noise Guideline defines normal day time hours as the following:

2.2 Recommended standard hours

The recommended standard hours for construction work are shown in Table 1; however, they are not mandatory. There are some situations, as described below, where construction work may need to be undertaken outside of these hours. The likely noise impacts and the ability to undertake works during the recommended standard hours should be considered when scheduling work.

Table 1: Recommended standard hours for construction work

Work type	Recommended standard hours of work*
Normal construction	Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays
Blasting	Monday to Friday 9 am to 5 pm Saturday 9 am to 1 pm No blasting on Sundays or public holidays

* The relevant authority (consent, determining or regulatory) may impose more or less stringent construction hours.

7.1 Proposed Appliances

The proposed appliances which will be used as part of the construction required as part of the development are detailed in the table below.

Table 7-1 Noise Level from Expected Demotion Appliances

Tasks	Equipment	Sound Power Levels per task dB(A) L_{10}	Aggregate Sound Power Level per Task dB(A) L_{10}
Site Demolition and Earth works	Jack hammer mounted on skid steer	118	122
	Hand held jack hammer	111	
	Concrete saw	119	
	Skid steer	110	
	Power hand tools	109	
	Excavators	115	
	Trucks	110	
	Earth Rollers	112	
Construction Works	Piling	115	120
	Welder	101	
	Saw cutter	109	
	Dump truck	109	
	Concrete saw	119	
	Power hand tools	109	
	Cranes	110	

Notes: Noise levels of proposed equipment to be used on the site based on the Australian Standard AS2436-2010 and noise level measurements previously undertaken of similar equipment on construction sites.

7.2 Construction Noise Criteria

This section of the report details the relevant construction noise criteria which is applicable to the site.

7.2.1 Interim Construction Noise Guideline

Noise criteria for construction and demolition activities are discussed in the *Interim Construction Noise Guideline* (ICNG). The ICNG also recommends procedures to address potential impacts of construction noise on residences and other sensitive land uses. The main objectives of the ICNG are summarised as follows:

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

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

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

Table 7-2 Noise Management Levels from Construction – Quantitative Assessment

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

Receiver Type	Time of Day	Noise Management Level LAeq(15minute)1,2	How to Apply
Industrial Receivers	When is use	LAeq (15 min) 75 dB(A)	During construction, the proponent should regularly update the occupants of the commercial and industrial premises regarding noise levels and hours of work.

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

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

Based on the table above the suitable construction noise management levels for works undertaken on the site is detailed in the table below.

Table 7-3 Site Construction Noise Management Levels

Noise Source	Time Period	Receiver Type	Construction Noise Management Level	'High Noise Affected' Level
Construction Noise	Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Residential	56 dB(A) LAeq (15min)	75 dB(A) LAeq (15min)
	When in Use	Industrial Receivers	75 dB(A) Leq (15 min)	

Note 1: Construction noise management levels based on the Interim Construction Noise Guideline

7.3 Construction Vibration Criteria

Effects of ground borne vibration on buildings may be segregated into the following three categories:

- Human comfort – vibration in which the occupants or users of the building are inconvenienced or possibly disturbed. Refer to further discussion in Section 7.3.1.
- Effects on building contents – where vibration can cause damage to fixtures, fittings and other non-building related objects. Refer to further discussion in Section 7.3.2 and 7.3.3.
- Effects on building structures – where vibration can compromise the integrity of the building or structure itself. Refer to further discussion in Section 7.3.2 and 7.3.3.

7.3.1 Vibration Criteria – Human Comfort

Vibration effects relating specifically to the human comfort aspects of the project are taken from the guideline titled *"Assessing Vibration – A Technical Guideline"*. (AVTG) This type of impact can be further categorised and assessed using the appropriate criterion as follows:

- Continuous vibration – from uninterrupted sources (refer to Table 7-4).
- Impulsive vibration – up to three instances of sudden impact e.g. dropping heavy items, per monitoring period (refer to Table 7-5).
- Intermittent vibration – such as from drilling, compacting or activities that would result in continuous vibration if operated continuously (refer to Table 7-6).

Table 7-4 Continuous vibration acceleration criteria (m/s2) 1 Hz-80 Hz

Location	Assessment period	Preferred Values		Maximum Values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Day or night-time	0.020	0.014	0.040	0.028
		0.04	0.029	0.080	0.058
Workshops	Day or night-time	0.04	0.029	0.080	0.058

Table 7-5 Impulsive vibration acceleration criteria (m/s2) 1 Hz-80 Hz

Location	Assessment period	Preferred Values		Maximum Values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14
Offices, schools, educational institutions and places of worship	Day or night-time	0.64	0.46	1.28	0.92
Workshops	Day or night-time	0.64	0.46	1.28	0.92

Table 7-6 Intermittent vibration impacts criteria (m/s1.75) 1 Hz-80 Hz

Location	Daytime		Night-time	
	Preferred Values	Maximum Values	Preferred Values	Maximum Values
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

7.3.2 Vibration Criteria – Building Contents and Structure

The vibration effects on the building itself are assessed against international standards as follows:

- For transient vibration: British Standard BS 7385: Part 2-1993 "Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration" (BSI 1993); and
- For continuous or repetitive vibration: German DIN 4150: Part 3 – 1999 "Effects of Vibration on Structure" (DIN 1999).

7.3.3 Standard BS 7385 Part 2 - 1993

For transient vibration, as discussed in standard BS 7385 Part 2-1993, the criteria are based on peak particle velocity (mm/s) which is to be measured at the base of the building. These are summarised in Table 7-7 and illustrated in the Figure below.

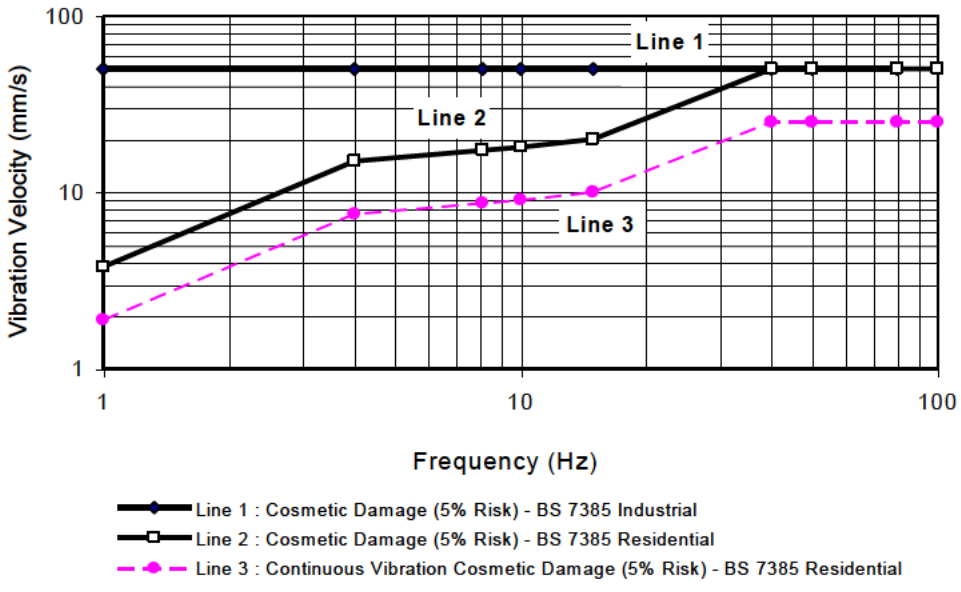
Table 7-7 Transient vibration criteria as per standard BS 7385 Part 2 - 1993

Line in Figure below	Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
		4 Hz to 15 Hz	15 Hz and Above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
2	Unreinforced or light framed structures Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Standard BS 7385 Part 2 – 1993 states that the values in Table 7-7 relate to transient vibration which does not cause resonant responses in buildings.

Where the dynamic loading caused by continuous vibration events is such as that results in dynamic magnification due to resonance (especially at the lower frequencies where lower guide values apply), then the values in Figure 7-1 may need to be reduced by up to 50% (refer to Line 3 in the Figure below).

Figure 7-1 Construction Vibration Limits



In the lower frequency region where strains associated with a given vibration velocity magnitude are higher, the recommended values corresponding to Line 2 are reduced. Below a frequency of 4 Hz where a high displacement is associated with the relatively low peak component particle velocity value, a maximum displacement of 0.6 mm (zero to peak) is recommended. This displacement is equivalent to a vibration velocity of 3.7 mm/s at 1 Hz.

The standard also states that minor damage is possible at vibration magnitudes which are greater than twice those given in the table above, and major damage to a building structure may occur at values greater than four times the tabulated values.

Fatigue considerations are also addressed in the standard and it is concluded that unless calculation indicates that the magnitude and number of load reversals is significant (in respect of the fatigue life of building materials) then the values in the table above should not be reduced for fatigue considerations.

7.3.3.1 Standard DIN 4150 Part 3 - 1999

For continuous or repetitive vibration, standard DIN 4150 Part 3-1999 provides criteria based on values for peak particle velocity (mm/s) measured at the foundation of the building; these are summarised in the table below. The criteria are frequency dependent and specific to particular categories of structures.

Table 7-8 Structural damage criteria as per standard DIN 4150 Part 3 - 1999

Type of Structure	Peak Component Particle Velocity, mm/s			
	Vibration at the foundation at a frequency of			Vibration of horizontal plane of highest floor at all frequencies
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz[1]	
Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
Structures that, because of their sensitivity to vibration, do not correspond to those listed in lines 1 and 2 and are of great intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8

Note 1: For frequencies above 100Hz, at least the values specified in this column shall be applied.

7.4 Construction Noise Management – Qualitative Assessment

Based on the assessment conducted of the expected construction noise levels generated from the construction of the project noise levels are generally expected to require the building contractor to engage in management of activities on the site.

The following management controls are recommended to mitigate construction noise levels on the site:

1. All plant and equipment are to be maintained such that they are in good working order.
2. A register of complaints is to be recorded in the event of complaints being received, including location, time of complaint, nature of the complaint and actions resulting from the complaint.
3. If required a noise level measurement of the offending plant item generating complaints is to be conducted and noise mitigations undertaken to reduce noise levels to within Noise Management levels in the event magnitude of noise levels is found to be above suitable levels.
4. The use of percussive and concrete sawing should be undertaken behind a closed façade when possible.
5. The use of high noise generating equipment including hydraulic hammers, rock cutters or the like should not be undertaken prior to 8am Monday to Friday or 8.30am Saturdays.
6. The loading of trucks should be conducted such that there is not a requirement to stack truck on the roadways adjacent to the residential receivers.

In addition to the recommended mitigations above details of the proposed construction (including demolition) works to be conducted on the site, including type of activities to be conducted as well as the expected duration of activities should be provided to the surrounding receivers.

A detailed construction noise and vibration management plan is to be provided by the building contractor as part of the construction certificate.

7.5 Construction Noise Assessment – Quantitative Assessment

A quantitative assessment of the construction noise levels resulting from the proposed works to has been undertaken.

The assessment has been based on the expected noise levels to be generated on the site including those detailed in the section above. Calculations of the resulting construction noise levels of the residential receivers within proximity to the site is detailed in the table below.

Table 7-9 Quantitative Assessment of Construction Noise to Neighboring Residence

Source Noise	Equipment	Sound Power Levels dB(A) L_{10}	Aggregate Sound Power Level dB(A) L_{10}	Calculated Construction Noise Levels
Site Demolition works	Jack hammer mounted on skid steer	118	122	Up to 65 dB(A) when items used externally
	Hand held jack hammer	111		
	Concrete saw	119		
	Skid steer	110		
	Power hand tools	109		
	Excavators	115		
	Trucks	110		
	Earth Rollers	112		
Construction Works	Piling	115	120	Up to 63 dB(A) when items used externally Up to 55 dB(A) when items used externally
	Welder	101		
	Saw cutter	109		
	Dump truck	109		
	Concrete saw	119		
	Power hand tools	109		
	Cranes	110		

Based on the qualitative assessment of construction noise suitable management controls and community notifications are required to be conducted.

The required management of construction noise impacts are included in this section of the report.

Subject to the implementation of these management measures, acoustic impacts during construction of the proposal will be acceptable.

7.6 Construction Vibration

Construction vibration may occur during the earthworks particularly if outcrops of dolerite are encountered. Safe working distances for building damage will be complied with at all times and vibration monitoring will be undertaken to ensure acceptable levels of vibration are satisfied.

Based on the location of the site there are significant separation of areas where construction activities will be conducted from surrounding building. Based on the location of works that will be conducted there will be safe working distances relating to continuous vibration from construction equipment. Most construction activities will have intermittent vibration emissions and therefore, higher vibration levels occurring over shorter periods are acceptable for intermittent events.

Construction vibration is not expected to generated magnitudes of vibration with the potential to exceed the criteria applicable for human comfort and therefore the nearest residential receivers are not likely to experience adverse vibration impacts.

8 CONCLUSIONS

This report details the Noise Impact Assessment of the proposed warehouse development at 35-47 Stennett Road, Ingleburn.

External noise emissions from the site have been assessed and detailed in accordance with the NSW Environmental Protection Authorities *Noise Policy for Industry*. The future design and treatment of all building services associated with the project can be acoustically treated to ensure all noise emissions from the site comply with the EPA NPfI criteria. Details of the equipment and associated acoustic treatments will be provided as part of the CC submission of the project.

An assessment of additional traffic noise generated by vehicles using the site has been undertaken and calculated noise levels comply with the requirements of the EPA's *Road Noise Policy.*

A construction noise and vibration assessment of the expected construction activities required to be used to complete the project has been undertaken and mitigation measures to be applied during the construction stage of the project. Subject to the undertaking these management measures, the project will have acceptable noise levels during the construction period.

For any additional information please do not hesitate to contact the person below.

Regards

[redacted]

Ben White
Director

Pulse White Noise Acoustics

9 APPENDIX A: ACOUSTIC TERMINOLOGY

The following is a brief description of the acoustic terminology used in this report.

Sound power level	The total sound emitted by a source
Sound pressure level	The amount of sound at a specified point
Decibel [dB]	The measurement unit of sound
A Weighted decibels [dB(A])	The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).
Decibel scale	The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. A 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB increase in the sound pressure level corresponds to a perceived doubling in volume. Examples of decibel levels of common sounds are as follows:

0dB(A)	Threshold of human hearing
30dB(A)	A quiet country park
40dB(A)	Whisper in a library
50dB(A)	Open office space
70dB(A)	Inside a car on a freeway
80dB(A)	Outboard motor
90dB(A)	Heavy truck pass-by
100dB(A)	Jackhammer/Subway train
110 dB(A)	Rock Concert
115dB(A)	Limit of sound permitted in industry
120dB(A)	747 take off at 250 metres

Frequency [f]	The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high pitched sound and a low frequency to a low pitched sound.
Ambient sound	The all-encompassing sound at a point composed of sound from all sources near and far.
Equivalent continuous sound level [L_{eq}]	The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy.
Reverberation	The persistence of sound in a space after the source of that sound has been stopped (the reverberation time is the time taken for a reverberant sound field to decrease by 60 dB)
Air-borne sound	The sound emitted directly from a source into the surrounding air, such as speech, television or music
Impact sound	The sound emitted from force of one object hitting another such as footfalls and slamming cupboards.
Air-borne sound isolation	The reduction of airborne sound between two rooms.
Sound Reduction Index [R] (Sound Transmission Loss)	The ratio the sound incident on a partition to the sound transmitted by the partition.
Weighted sound reduction index [R_w]	A single figure representation of the air-borne sound insulation of a partition based upon the R values for each frequency measured in a laboratory environment.
Level difference [D]	The difference in sound pressure level between two rooms.

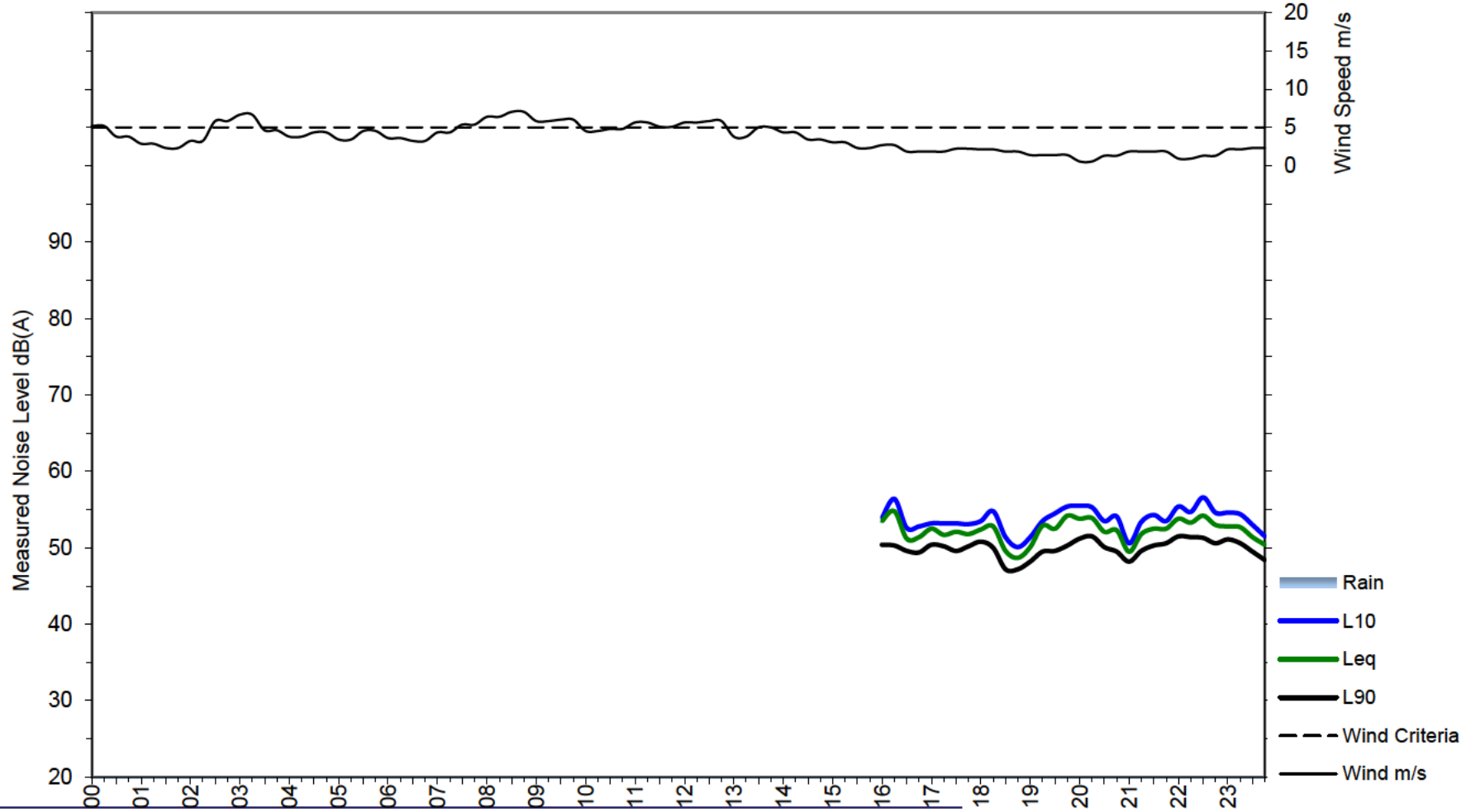
Normalised level difference [D_n]	The difference in sound pressure level between two rooms normalised for the absorption area of the receiving room.
Standardised level difference [D_{nT}]	The difference in sound pressure level between two rooms normalised for the reverberation time of the receiving room.
Weighted standardised level difference [$D_{nT,w}$]	A single figure representation of the air-borne sound insulation of a partition based upon the level difference. Generally used to present the performance of a partition when measured in situ on site.
C_{tr}	A value added to an R_w or $D_{nT,w}$ value to account for variations in the spectrum.
Impact sound isolation	The resistance of a floor or wall to transmit impact sound.
Impact sound pressure level [L_i]	The sound pressure level in the receiving room produced by impacts subjected to the adjacent floor or wall by a tapping machine.
Normalised impact sound pressure level [L_n]	The impact sound pressure level normalised for the absorption area of the receiving room.
Weighted normalised impact sound pressure level [$L_{n,w}$]	A single figure representation of the impact sound insulation of a floor or wall based upon the impact sound pressure level measured in a laboratory.
Weighted standardised impact sound pressure level [$L'_{nT,w}$]	A single figure representation of the impact sound insulation of a floor or wall based upon the impact sound pressure level measured in situ on site.
C_I	A value added to an L_{nW} or $L'_{nT,w}$ value to account for variations in the spectrum.
Energy Equivalent Sound Pressure Level [$L_{A,eq,T}$]	'A' weighted, energy averaged sound pressure level over the measurement period T.
Percentile Sound Pressure Level [$L_{Ax,T}$]	'A' weighted, sound pressure that is exceeded for percentile x of the measurement period T.

*Definitions of a number of terms have been adapted from Australian Standard AS1633:1985 *"Acoustics – Glossary of terms and related symbols"*

10 APPENDIX B: UNATTENDED NOISE LOGGING

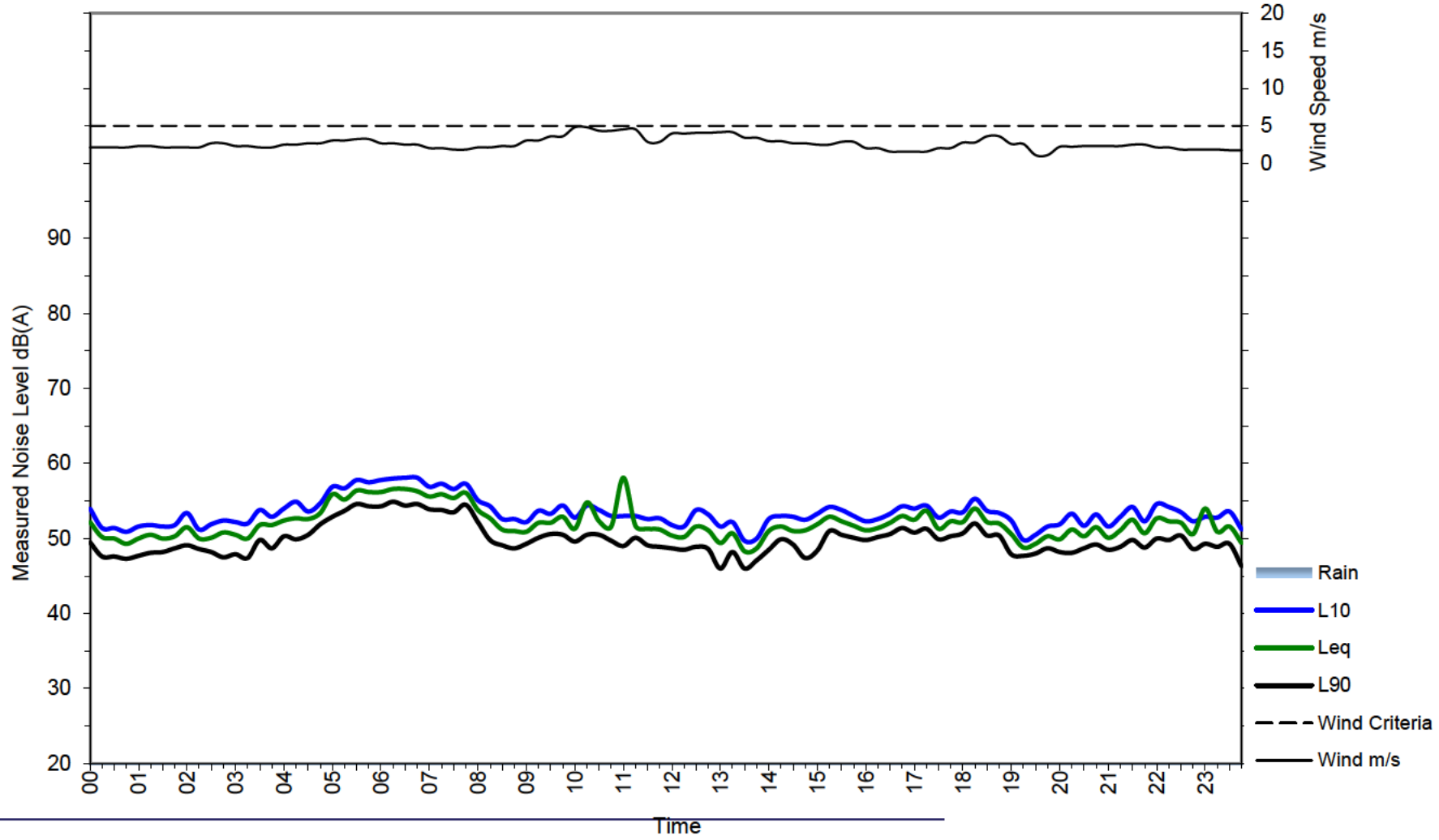
35-47 Stennett Road, Ingleburn

Thursday 12 August 2021



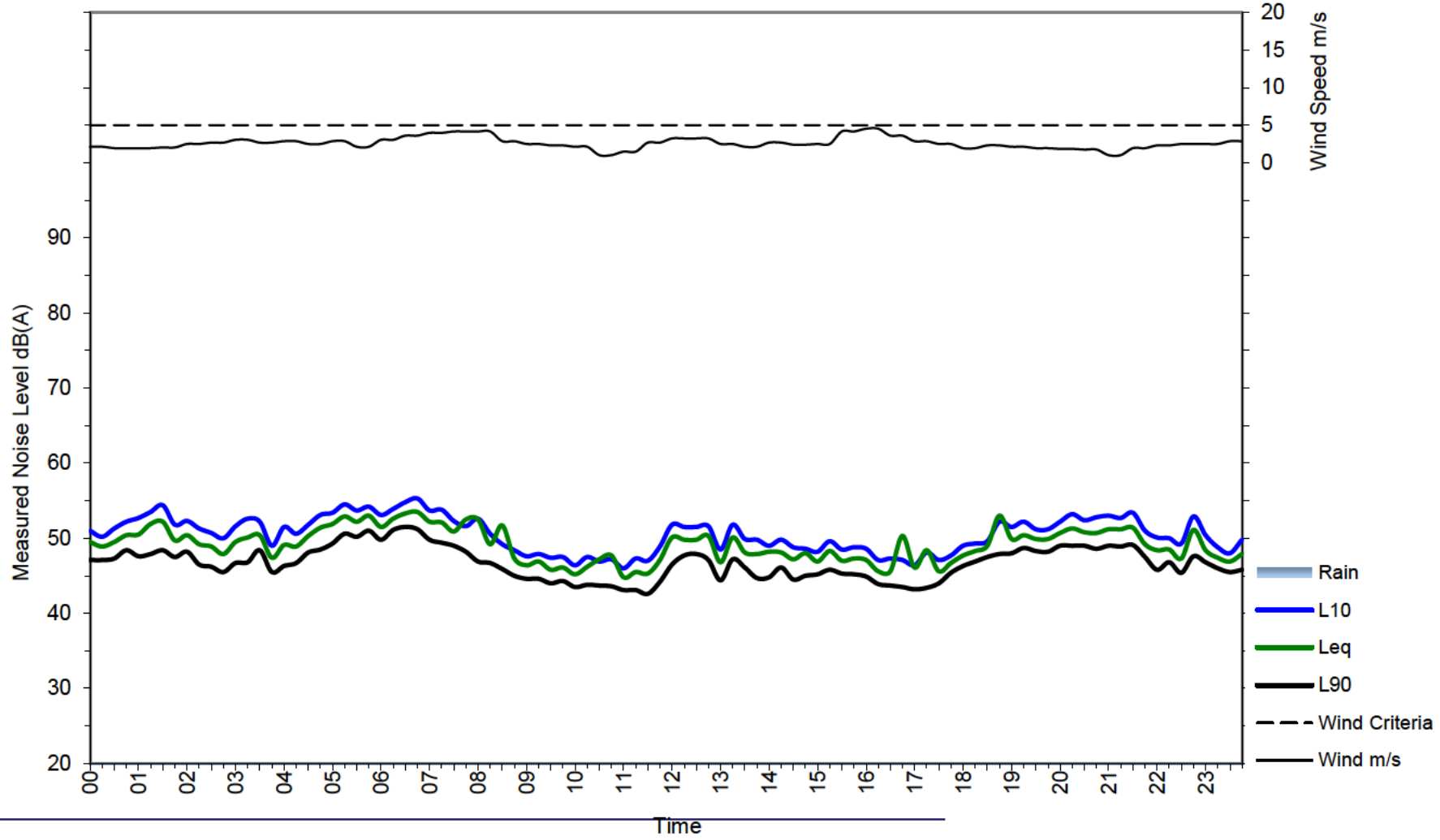
35-47 Stennett Road, Ingleburn

Friday 13 August 2021



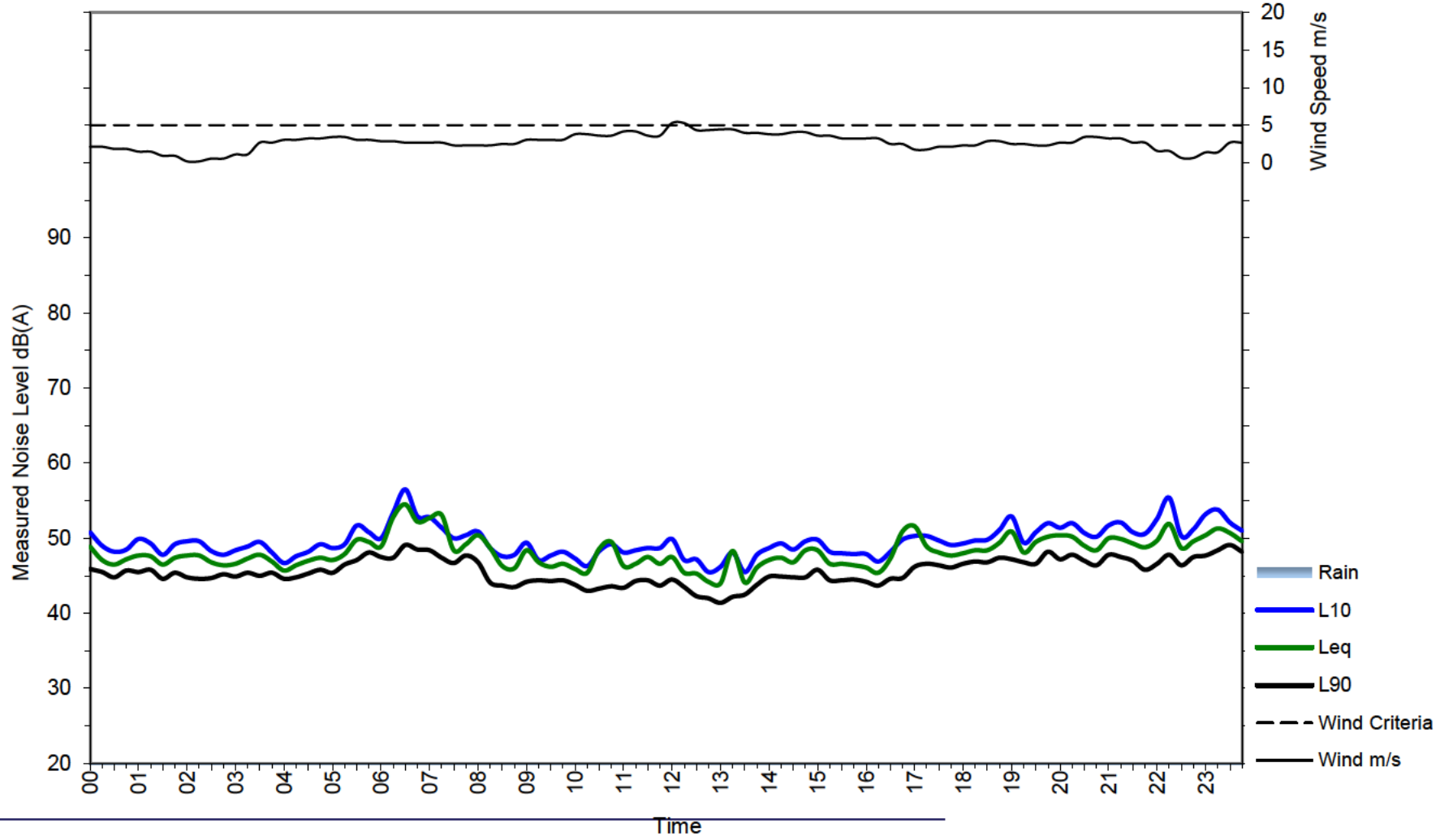
35-47 Stennett Road, Ingleburn

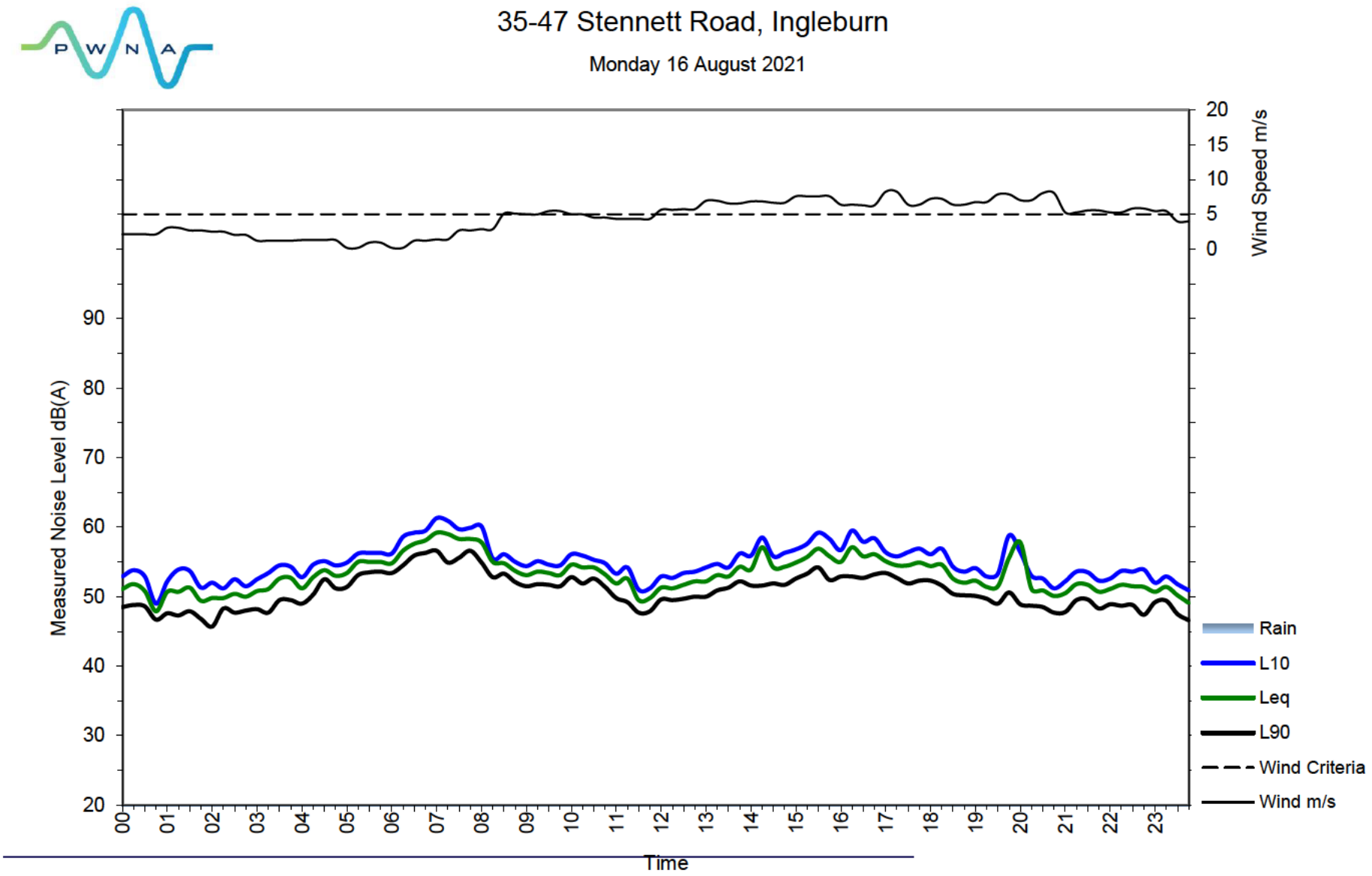
Saturday 14 August 2021



35-47 Stennett Road, Ingleburn

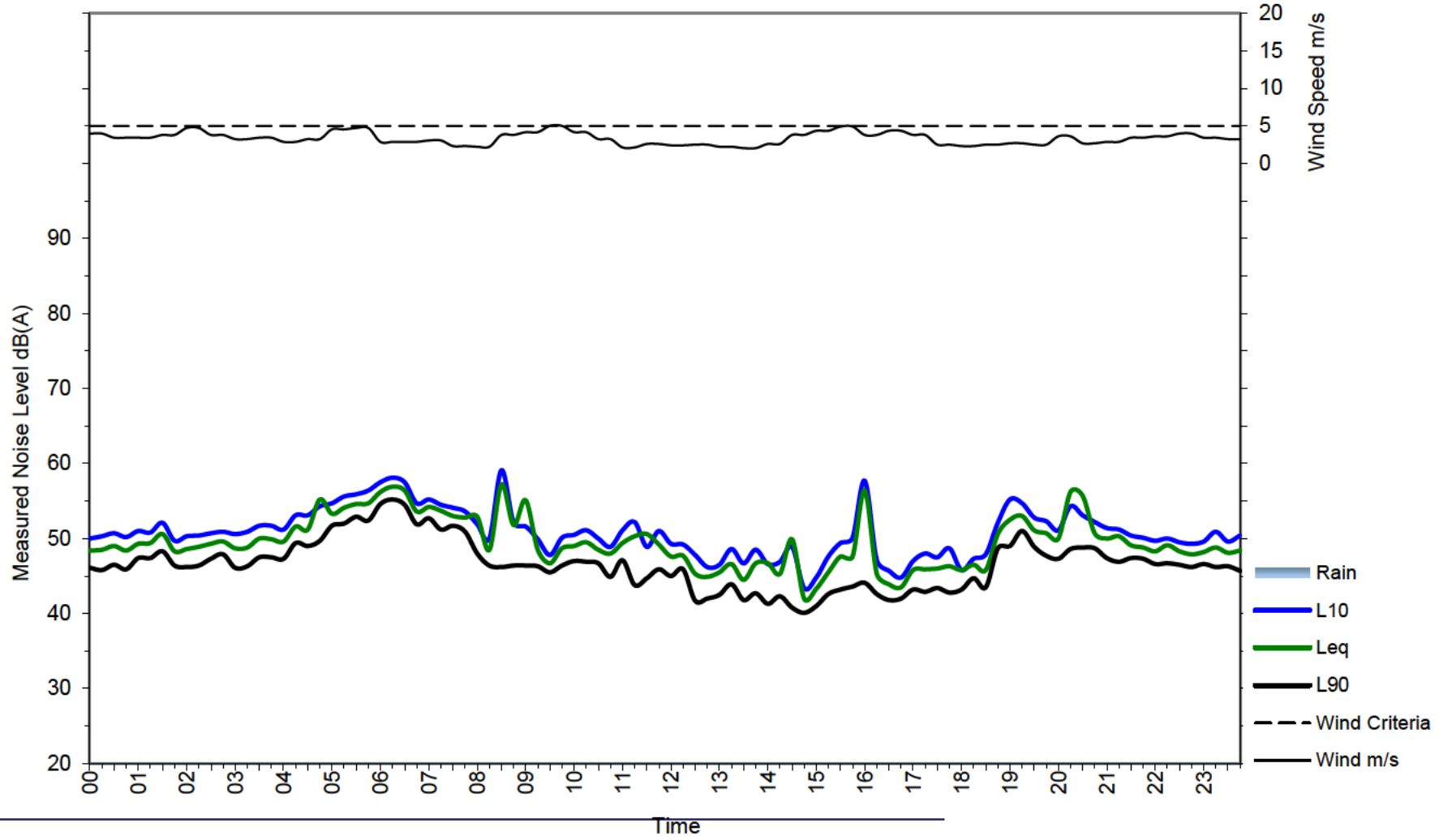
Sunday 15 August 2021




35-47 Stennett Road, Ingleburn
Monday 16 August 2021
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L10
Leq
L90
Wind Criteria
Wind m/s

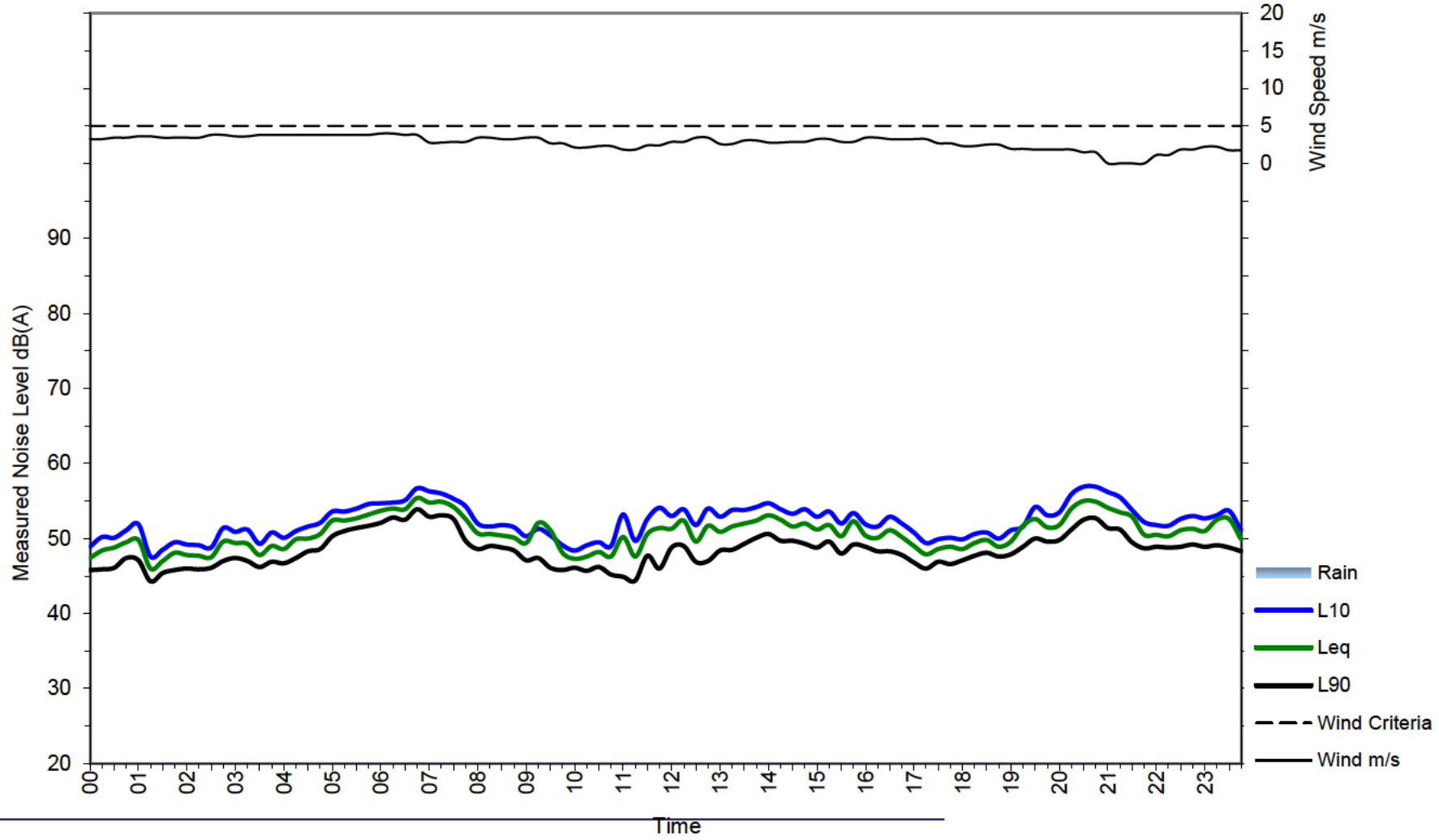
35-47 Stennett Road, Ingleburn

Tuesday 17 August 2021



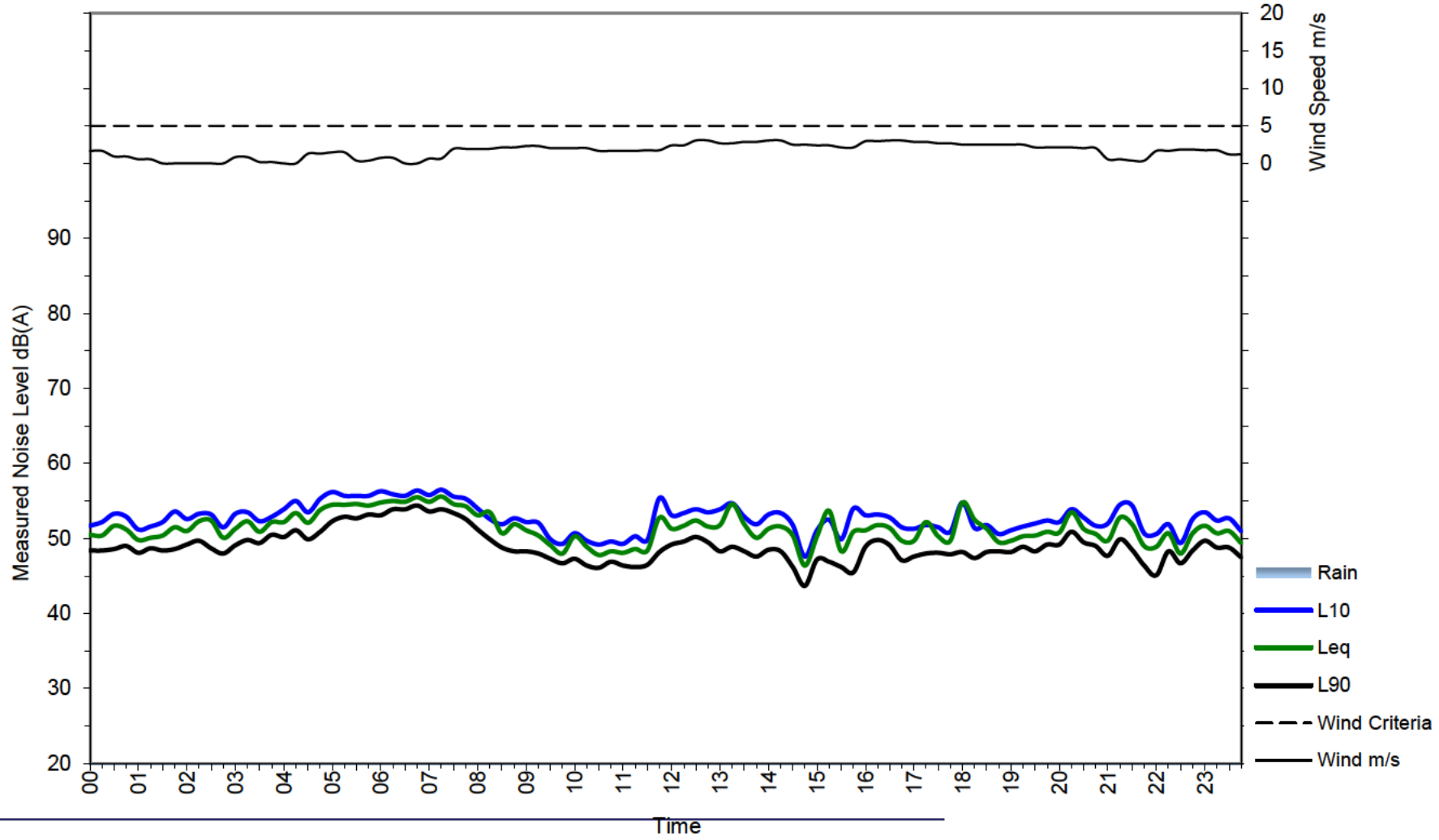
35-47 Stennett Road, Ingleburn

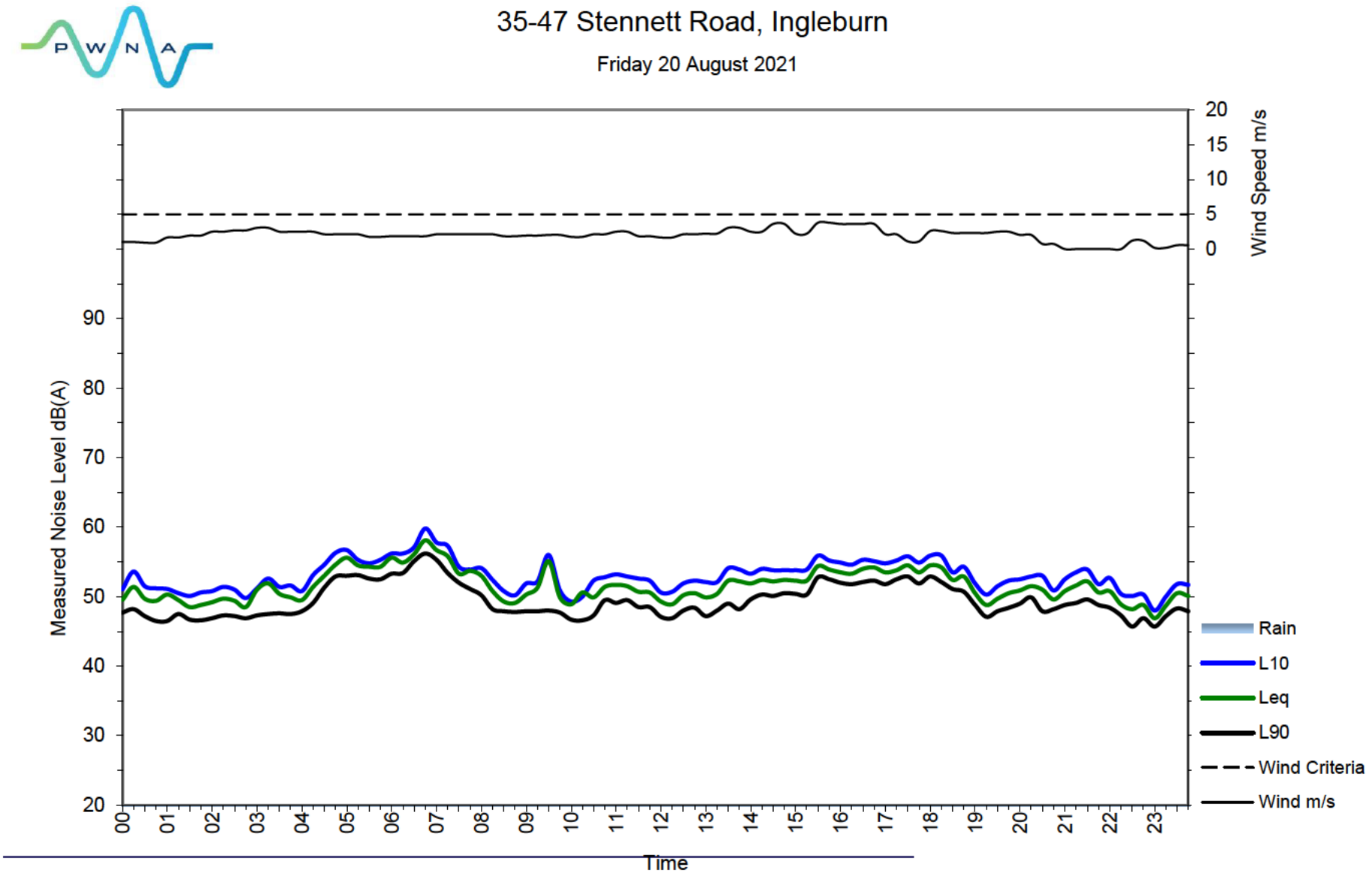
Wednesday 18 August 2021

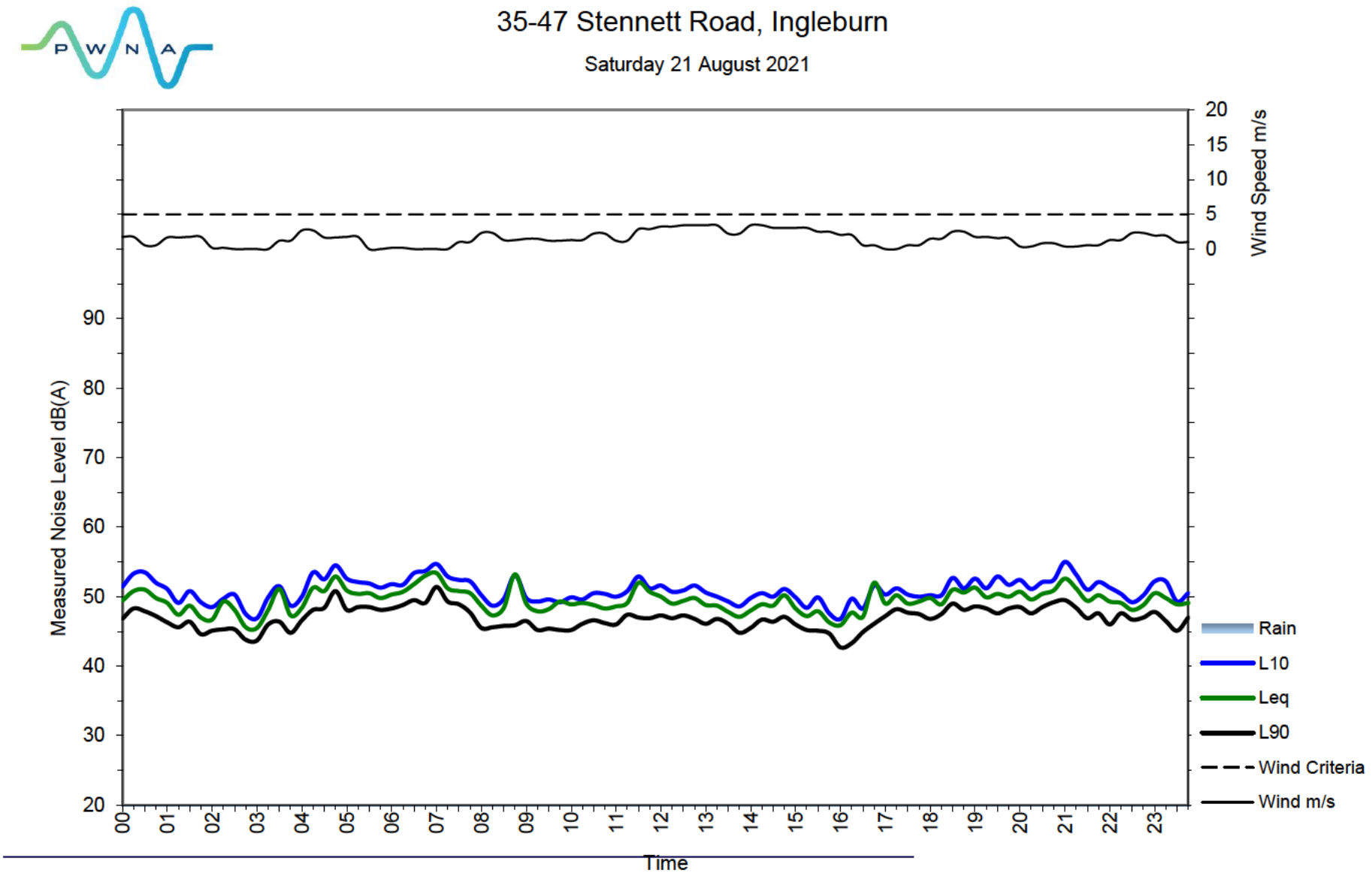


35-47 Stennett Road, Ingleburn

Thursday 19 August 2021

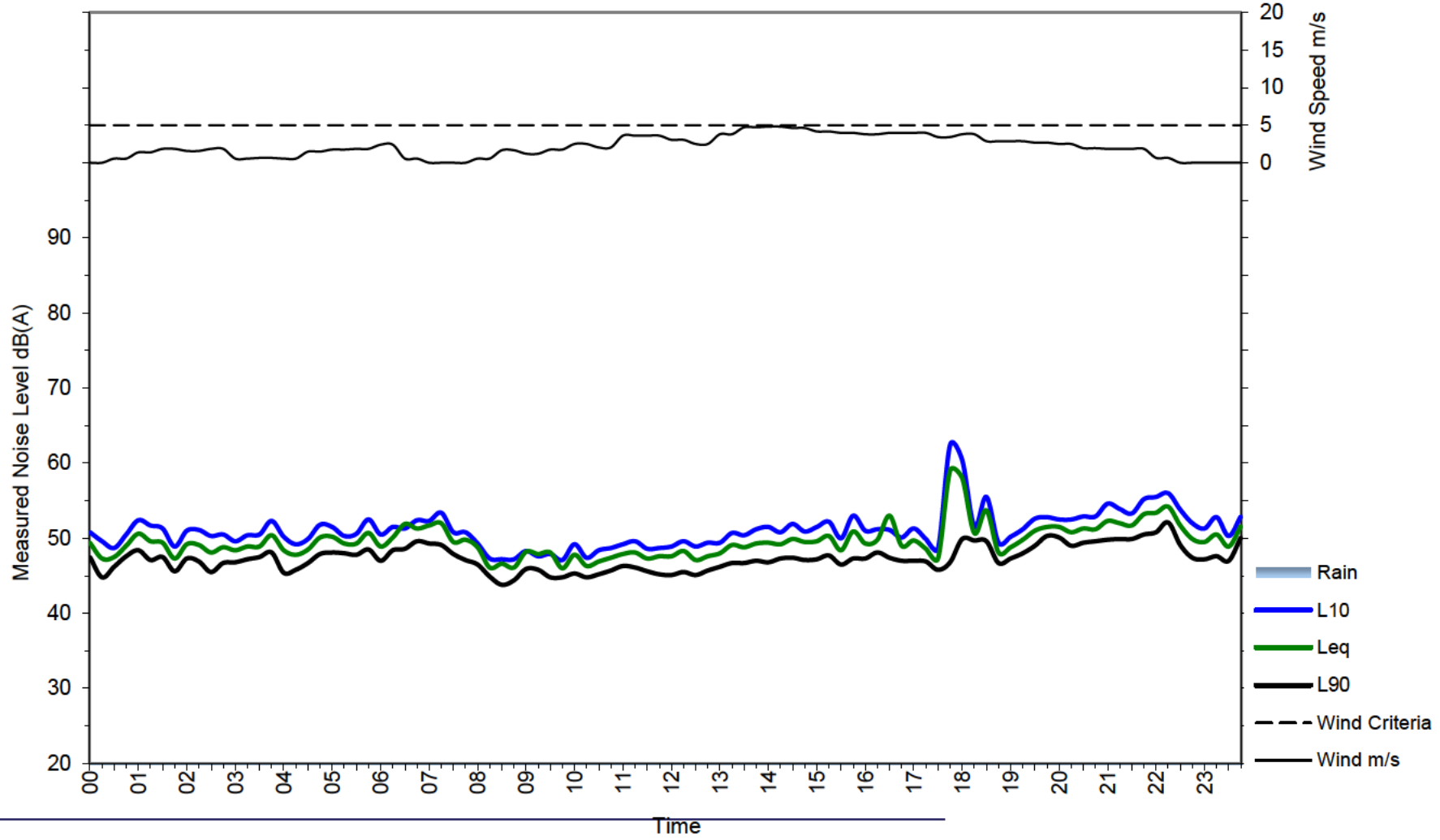



35-47 Stennett Road, Ingleburn
Friday 20 August 2021
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L10
Leq
L90
Wind Criteria
Wind m/s


35-47 Stennett Road, Ingleburn
Saturday 21 August 2021
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L10
Leq
L90
Wind Criteria
Wind m/s

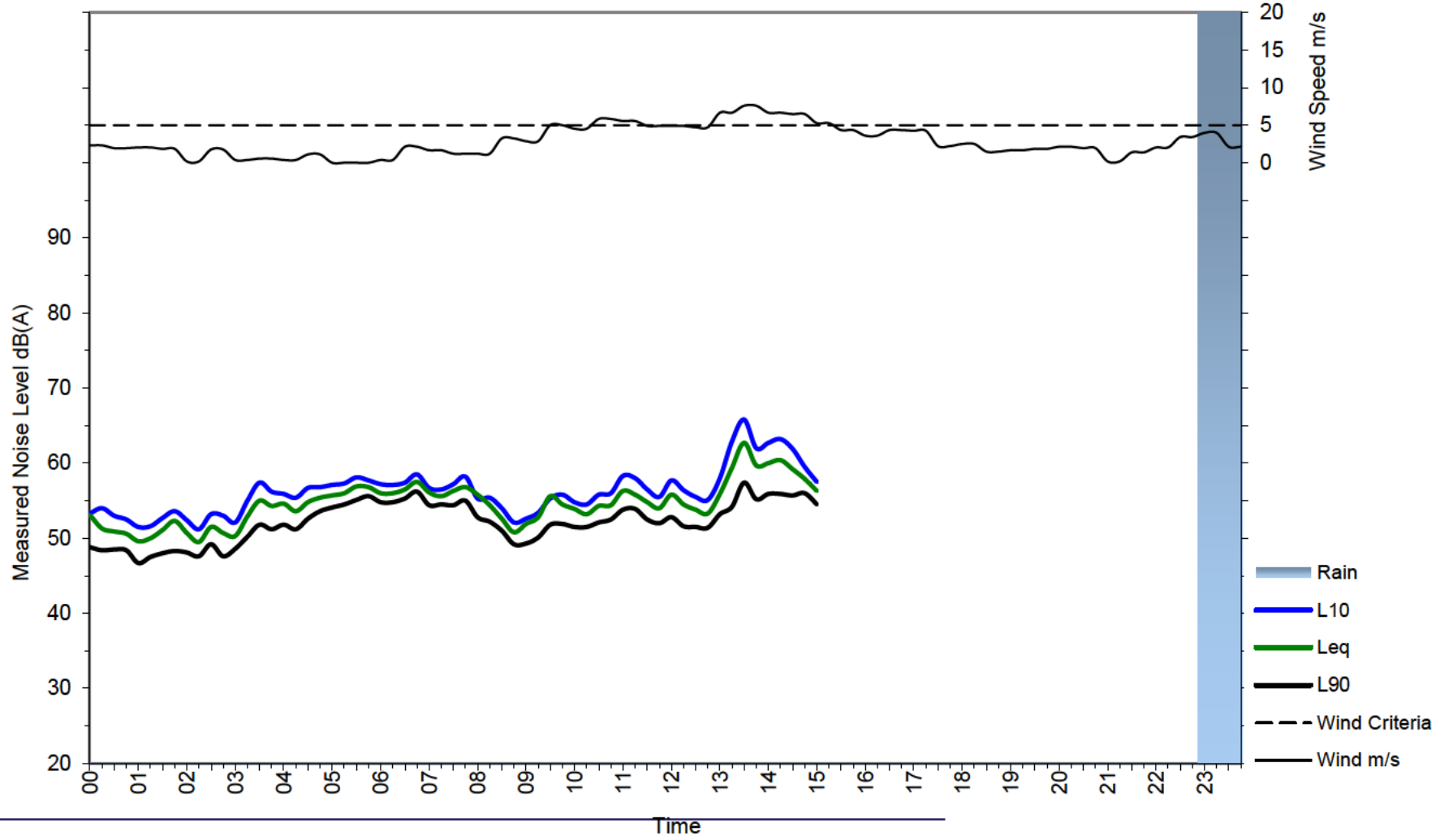
35-47 Stennett Road, Ingleburn

Sunday 22 August 2021



35-47 Stennett Road, Ingleburn

Monday 23 August 2021



11 APPENDIX C – RESULTING OF NOISE MODELLING

Noise Emission Modelling Daytime period

Noise Emission Modelling Evening and Night time periods