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LOT 109 ASTRA AEROLAB PRECINCT, WILLIAMTOWN

Acoustic Assessment for DA

2 November 2022

EJE Architecture

TM778-01F02 Acoustic Assessment for DA (r3)

40 YEARS 1982-2022 ACOUSTIC ENGINEERING EXCELLENCE

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1 Introduction

Renzo Tonin & Associates has undertaken an acoustic assessment of the proposed industrial and commercial development known as Lot 109 of the Astra Aerolab Development at Williamtown as part of the Development Application.

From our assessment of the site location, the following potential acoustic issues were identified:

- Aircraft noise intrusion into the proposed development (particularly the office spaces)
- External noise emissions to neighbours from mechanical plant and equipment and use of the premises;

An acoustic assessment has been undertaken at the proposed development site between Wednesday 24th August and Wednesday 31st August 2022 to determine ambient noise levels impacting the proposed development site. In addition, aircraft noise measurements were undertaken at the proposed development site on Tuesday 5th April 2022.

The assessment of the above acoustic components was undertaken in accordance with NSW EPA Noise Policy for Industry (NPfI) and Australian Standards.

The existing aircraft noise levels at the building facades were used to determine the sound insulation rating requirements for the external building elements in accordance with the acoustic criteria nominated for this development.

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001. Appendix A contains a glossary of acoustic terms used in this report.

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2 Site Description

The proposed industrial commercial development is to be located at Lot 109 of the Astra Aerolab Precinct at Newcastle Airport, Williamtown. The precinct is a current greenfield site that is proposed to house a series of industrial and airport specific commercial developments. This may include a hotel in future stages, however this is yet to be determined.

The development is to consist of 4 industrial warehouse facilities. Lot 109/1 and Lot 109/2 are to consist of 2 tenancies each with workshops and 2 levels of office space. The use of Lots 109/3 and 109/4 are unknown at this stage, however, are expected to be industrial/ commercial in nature

The nearest residential receivers are rural homes located along Cabbage Tree Road to the south, located approximately 600m from the development site. The existing Mecure Hotel is located approximately 400m to the east of the proposed development site. Built up areas immediately surrounding Newcastle Airport are industrial and commercial, with the RAAF base located to the north of the airport.

Figure 1 – Site and surrounds

3 Existing Acoustic Environment

3.1 Ambient and Background Noise Survey

An unattended long-term noise monitor was installed at the vacant Lot 109 at Astra Aerolab at the approximate centre of the site to determine the existing level of ambient and background noise surrounding the site from Wednesday 24th to Wednesday 31st August 2022. As shown in Figure 1, the noise monitor was installed at Location L1 shown on the map above.

The noise monitor records noise levels on a continuous basis and stored data every fifteen minutes. The monitors were calibrated before and after measurements and no significant deviation in calibration was noted. The noise monitoring equipment used here complies with Australian Standard 1259.2-1990 "Acoustics - Sound Level Meters" and is designated as Type 2 instruments suitable for field use.

Detailed results of the background and ambient noise monitoring undertaken on site are presented in Appendix C.

Short term noise measurements were also undertaken of aircraft flyovers. These details are presented in Section 4 of this report.

3.2 Measured Background Noise

The results of the long-term noise monitoring have been summarised in accordance with the Noise Policy for Industry (NPfI) requirements published by the NSW Environment Protection Authority (EPA) and are presented in Table 2 below.

Table 1: Measured Site Background Noise Level

Monitoring Location	Ambient L_{Aeq} Noise Levels			Background L_{A90} Noise Levels		
	Day	Evening	Night	Day	Evening	Night
Lot 109, Astra Aerolab Precinct, Newcastle Airport	57	48	45	37	41	39

Notes:

Day, Evening & Night assessment periods are defined in accordance NSW EPA's NPfI as follows.

1. Day is defined as 7:00am to 6:00pm, Monday to Saturday; 8:00am to 6:00pm Sundays & Public Holidays.
2. Evening is defined as 6:00pm to 10:00pm, Monday to Sunday & Public Holidays
3. Night is defined as 10:00pm to 7:00am, Monday to Saturday; 10:00pm to 8:00am Sundays & Public Holidays

The representative background noise levels (L_{A90}) are used in defining external noise emission from the development such as industrial use, mechanical ventilation and air-conditioning systems in accordance to the EPA Noise Policy for Industry.

4 Aircraft Noise Intrusion

4.1 Aircraft Noise Intrusion Criteria

Aircraft noise intrusion from take-off, landing and circuit training operations at civil aerodromes or military airfields is assessed using Australian Standard AS2021-2015 – '*Acoustics – Aircraft Noise Intrusion – Building Siting and Construction*'. This section of the report outlines the application of AS2021. The site specific assessment is presented in Section 4.

The scope of AS2021 is stated as:

> *This Standard, together with the relevant Australian Noise Exposure Forecast (ANEF) chart provides guidelines for determining-*
>
> *whether the extent of aircraft noise intrusion makes building sites 'acceptable', 'unacceptable' or 'conditionally acceptable' for the types of activity to be, or being, undertaken (Clause 2.3);*
>
> *for 'conditionally acceptable' sites, the extent of noise reduction required to provide acceptable noise levels indoors for the types of activity to be, or being, undertaken; and*
>
> *the type of building construction necessary to provide a given noise reduction, provided that external windows and doors are closed.*

4.1.1 Building site acceptability

AS2021 contains advice on the acceptability of building sites based on Australian Noise Exposure Forecast (ANEF) zones. The ANEF chart provides a predicted cumulative exposure to aircraft flyover noise in communities near aerodromes. The chart presents zones represented by noise contours overlaid on a locality map specific to an airport. The ANEF system was developed as a land use planning tool aimed at controlling encroachment on airports by noise sensitive buildings.

Table 2.1 of AS2021 sets acceptability zones for different building types and land uses. The table categorises building sites as either 'Acceptable', 'Conditionally Acceptable' or 'Unacceptable' relative to different ANEF levels. Table 1 reproduces the sections of AS2021 Table 2.1 relevant to the subject site.

Table 1: Building site acceptability based on ANEF zones (Table 2.1 of AS2021)

Building type	ANEF zone of site		
	Acceptable	Conditional	Unacceptable
Commercial Building	Less than ANEF 25	25 to 35 ANEF	Greater than 35 ANEF

Building type	ANEF zone of site		
	Acceptable	Conditional	Unacceptable

Notes:
4. The actual location of the ANEF 20 contour is difficult to define accurately, mainly because of variation in aircraft flight paths. Because of this, the procedure of Clause 2.3.2 may be followed for building sites outside or near the ANEF 20 contour.
5. Within ANEF 20 to ANEF 25, some people may find that the land is not compatible with residential or educational uses. Land use authorities may consider that the incorporation of noise control features in the construction of residences or schools is appropriate.
6. This Standard does not recommend development in unacceptable areas. However, where the relevant planning authority determines that any development may be necessary within existing built-up areas designated as unacceptable, it is recommended that such development should achieve the required ANR determined according to Clause 3.2. For residences, schools, etc., the effect of aircraft noise on outdoor areas associated with the buildings should be considered.

Table 2: Description of building site acceptability

Zone	Description
Acceptable	If from Table 2.1, the building site is classified as 'acceptable', there is usually no need for the building construction to provide protection specifically against aircraft noise. However, it should not be inferred that aircraft noise will be unnoticeable in areas outside the ANEF 20 contour. (See Notes 1, 2 and 3 of Table 2.1.)
Conditionally Acceptable	If from Table 2.1, the building site is classified as 'conditionally acceptable', the maximum aircraft noise levels for the relevant aircraft and the required noise reduction should be determined from the procedure of Clauses 3.1 and 3.2, and the aircraft noise attenuation to be expected from the proposed construction should be determined in accordance with Clause 3.3 (see Notes 1 and 3 of Table 2.1).
Unacceptable	If, from Table 2.1 the building site is classified as 'unacceptable', construction of the proposed building should not normally be considered. Where in the community interest redevelopment is to occur in such areas, e.g. a hotel in the immediate vicinity of an aerodrome, refer to the notes to Table 2.1.

4.1.2 Indoor design sound levels for determination of aircraft noise reduction

The indoor design sound level for the activity or building type under consideration is outlined in AS2021 Table 3.3. Table 3 reproduces the criteria relevant to the subject site.

Table 3: Indoor design sound levels for determination of aircraft noise reduction (Table 3.3 from AS2021)

Building type and activity	Indoor design sound level*, dB(A)
Commercial buildings, offices and shops	
Private offices, conference rooms,	55
Drafting, open offices	65
Typing, data processing	70
Shops, supermarkets, showrooms	75
Industrial	
Inspection, analysis, precision work	75
Light machinery, assembly, benchwork	80

Building type and activity	Indoor design sound level*, dB(A)

Notes * These indoor design sound levels are not intended to be used for measurement of adequacy of construction. For measurement of the adequacy of construction against aircraft noise intrusion see Appendix D of the Standard.

7. The indoor design sound levels in Column 2 are hypothesized values based on Australian experience. A design sound level is the maximum level (dB(A)) from an aircraft flyover which, when heard inside a building by the average listener, will be judged as not intrusive or annoying by that listener while carrying out the specified activity. Owing to the variability of subjective responses to aircraft noise, these figures will not provide sufficiently low interior noise levels for occupants who have a particular sensitivity to aircraft noise.
8. Some of these levels, because of the short duration of individual aircraft flyovers, exceed some other criteria published by Standards Australia for indoor background noise levels (see AS/NZS 2107).
9. The indoor design sound levels are intended for the sole purpose of designing adequate construction against aircraft noise intrusion and are not intended to be used for assessing the effects of noise. Land use planning authorities may have their own internal noise level requirements which may be used in place of the levels above.
10. For opera and concert halls and theatres, and for recording, broadcast and television studios and similar buildings where noise intrusion is unacceptable, specialist acoustic advice should always be obtained.
11. Certain activities in schools may be considered particularly noise sensitive and 50 dB(A) may be a more desirable indoor sound level to select for any teaching areas used for such activities. However, the effect of other noise sources should be considered.
12. The provisions of this Standard relating to different internal design sound levels for different indoor spaces could result in the use of different construction and materials in contiguous spaces, and require the construction of substantial barriers between habitable spaces, e.g. heavy self-closing internal doors, detracting from the amenity of the building. Therefore consideration should be given to a uniform perimeter insulation approach.

4.2 Aircraft noise assessment

4.2.1 Site assessment – building acceptability

Based on the ANEF 2039 chart the subject site is located between the ANEF 30-35 contours, as shown in Figure 2.

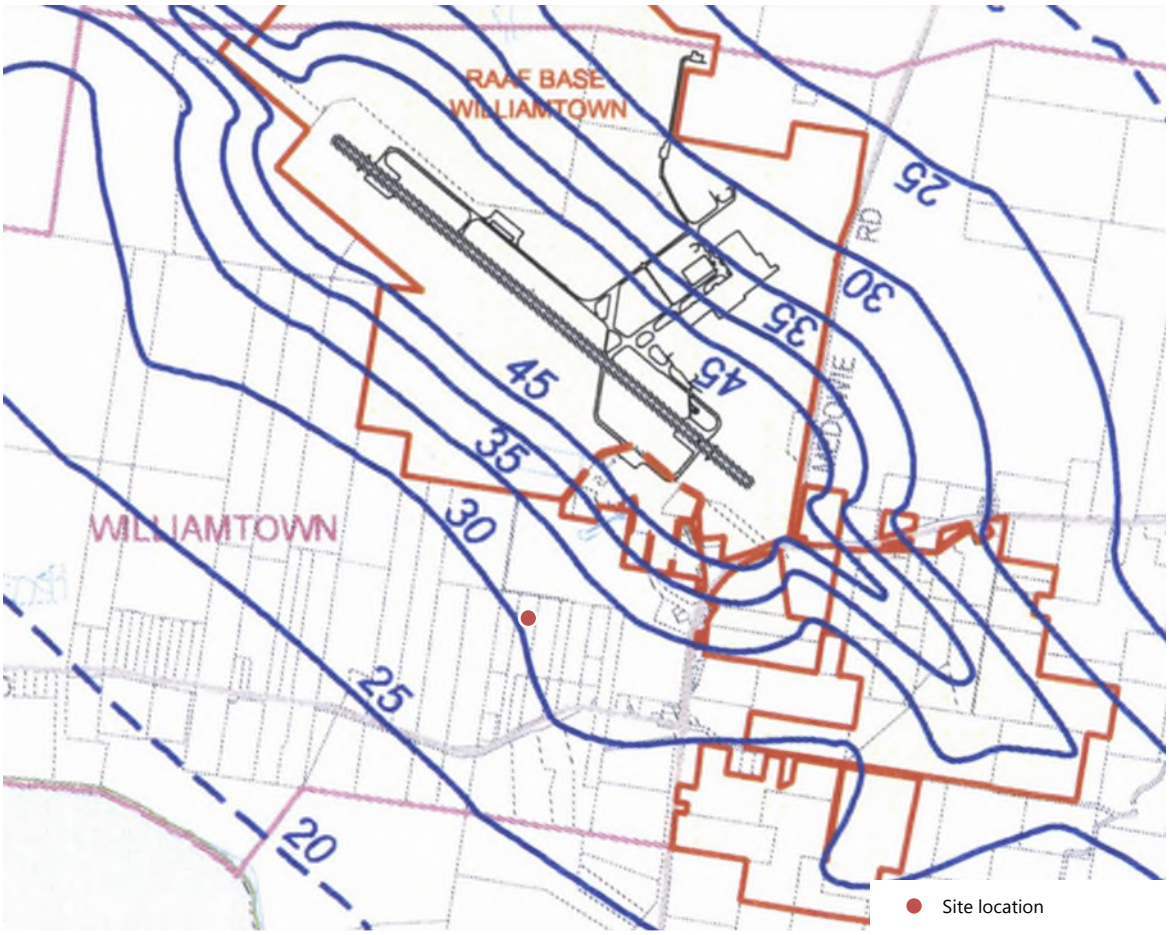


Figure 2: Subject site and ANEF overlay

For the identified ANEF zones, Table 4 summarises the acceptability of proposed uses for the subject site.

Table 4: Acceptability of uses for site

Building type	Less than 20 ANEF	20-25 ANEF	25-30 ANEF	30-35 ANEF	35-40 ANEF	Greater than 40 ANEF
Commercial Building	Acceptable	Acceptable	Conditionally Acceptable	Conditionally Acceptable	Unacceptable	Unacceptable

According to the ANEF map, the property lies within the *Conditionally Acceptable* zone for the commercial development as nominated in Australian Standards AS2021-2015 – "Acoustics – Aircraft Noise Intrusion – Building Siting and Construction".

4.2.2 Maximum aircraft noise levels

4.2.2.1 Measured Levels

A continuous noise monitor was set up at the site of 109 Astra Aerolab Precinct on Tuesday 5th April from 12.30pm to 3.30pm to measure aircraft flyovers, including Joint Strike Fighter operations, other military aircraft operations, and commercial aircraft movements. Refer to Appendix B for the location and the results of the monitoring.

A permanent noise monitor is also positioned the south of the proposed site on Cabbage Tree Road [Source: https://defence.gov.au/AircraftNoise/interactive/Update/wlm.html#9]. The location of the monitor is shown in the figure below. Events were correlated to measured data to confirm that measured noise levels represent typical maximum noise levels from Newcastle Airport.

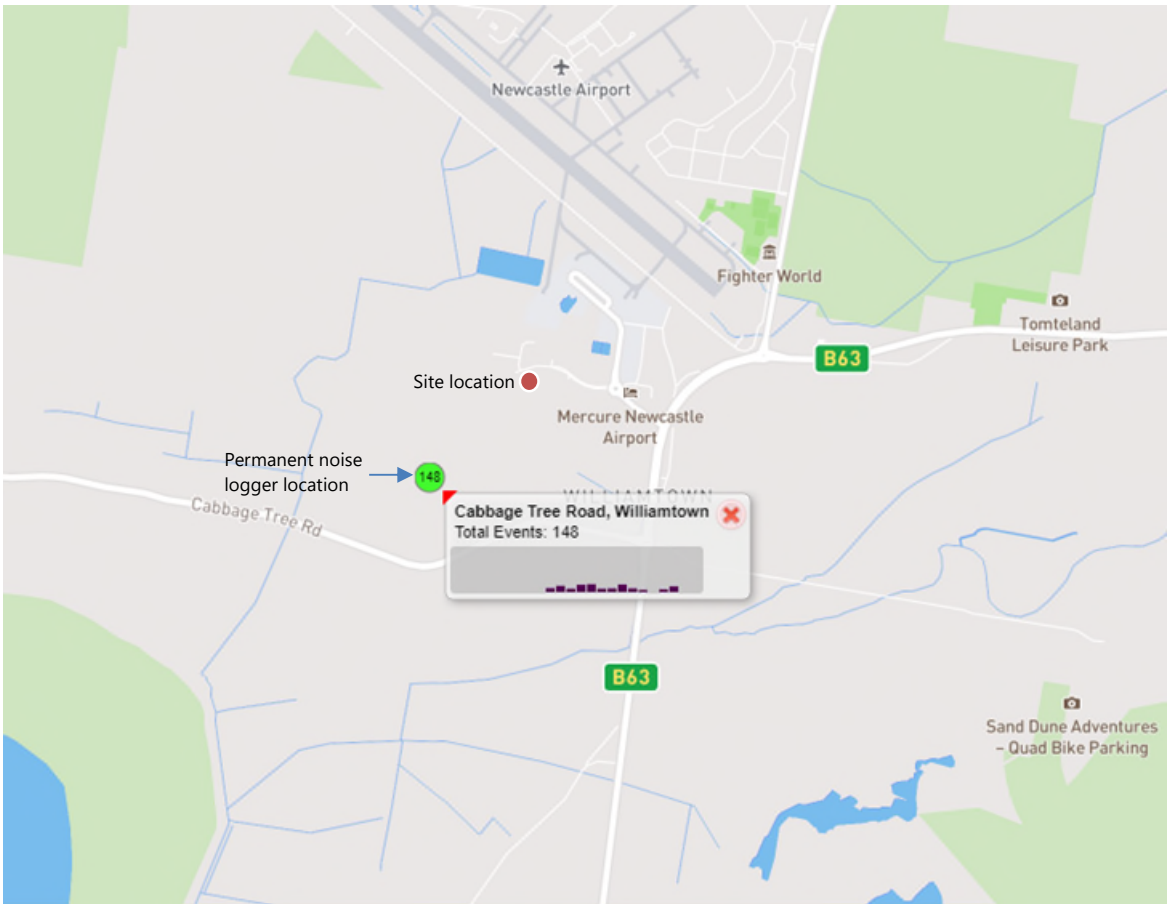


Figure 3- Location of permanent noise logger

4.2.2.2 Calculated civil aircraft noise levels - AS2021:2015

Aircraft noise exposure levels were calculated for the development site based on Australian Standard AS2021-2015. Buildings are required to be designed to meet the relevant internal noise levels presented

in Table 3. The Aircraft Noise Reduction (ANR) for the building type construction is determined using the maximum external aircraft noise level and the indoor design sound level.

To determine resultant aircraft noise levels the following factors were considered as specified in the Standard;

- The site's position relative to each runway, including take-off and landing distances and runway centre line offsets;
- Elevation of the site compared with the elevation of the runways; and,
- Type of aircraft and associated maximum noise level during take-off and landing.

Using these factors, the resultant maximum noise levels were determined for each aircraft type. This calculation is not based on ANEF contours but on the location of the site relative to the runway. Newcastle Airport has 1 runway, 12/30, with operations capable in both directions. Take-offs and landings to the south-east most impact the proposed development site.

It should be noted that Newcastle Airport is a mainly domestic airport (including Lord Howe Island and New Zealand) and military base and does not typically see the arrival and departure of larger international jets. In accordance with clause 3.1.4 of the Standard, "where there is evidence that the particular aircraft type and movement which produced that noise level do not constitute a typical operation, then the noise level can be ignored and the next lowest noise level selected". Aircraft types are confirmed via the Newcastle Airport website.

Table 5 below shows the maximum design noise level at the development site.

Table 5: Maximum Noise Levels at Assessment Location as per AS2021

Aircraft Type	Mode of Operation	Maximum Noise Level dB(A)
Airbus A320-232	Departure south-east	71
Boeing 737-800	Departure south-east	73
Saab 340	Departure south-east	69
Dash 8	Departure south-east	60
Airbus A320-232	Landing south-east	54
Boeing 737-800	Landing south-east	59
Saab 340	Landing south-east	52
Dash 8	Landing south-east	45

It should be noted that variations in flight paths and aircraft operational characteristics may generate external noise levels greater than calculated here. The noise survey undertaken at the site confirms the noise levels presented above.

Based on the surveys and available data, the maximum typical noise event is from the Joint Strike Fighter take off and circuit training operations of 90dB(A).

Table 6 below shows the required ANR for areas in the proposed development based on a maximum noise level of 90dB(A).

Table 6: Required Aircraft Noise Reduction for the Proposed Development

Area	Required ANR
Commercial buildings, offices and shops	
Private offices, conference rooms,	35
Drafting, open offices	25
Typing, data processing	20
Shops, supermarkets, showrooms	15
Industrial	
Inspection, analysis, precision work	15
Light machinery, assembly, benchwork	10

4.3 Noise Intrusion Recommendations

Appendix G of AS2021:2015 provides one method for determining appropriate building materials and constructions to achieve a required ANR value. While Appendix G is intended to serve only as a guide to the types of construction, it has been used here to demonstrate the ability of proposed building types to satisfy the internal noise levels required of AS2021.

In general, where a specific ANR is required, buildings require external windows and doors to be kept closed, as when opened for ventilation purposes the aircraft noise reduction of the building envelope will be significantly reduced. Where it is necessary to close windows and doors to comply with this Standard, building ventilation should be designed in accordance with the Building Code of Australia on the assumption that windows and doors are not operable. Mechanical ventilation or air conditioning systems complying with AS 1668.2 should be installed.

The ANR is calculated by subtracting the indoor design level from the maximum aircraft noise level. The resulting value is an estimate of the ANR in dB(A) to be achieved by the building's envelope.

AS2021 also provides guidance on the type of construction necessary to achieve the required ANR. Various rooms in a building may require different indoor design levels and consequently different treatment.

For the subject site, in-principle treatment for building construction has been established in order to demonstrate the ability of the buildings to be designed appropriately for the proposed uses.

For typical buildings, the weakest elements of the building construction in regard to noise intrusion are doors and windows (glazed). Table 7 outlines the calculated Weighted Sound Reduction Index (R_w) Ratings for windows, doors, wall structures, and the roof/ceiling structure associated with typical residential building design based on the Maximum Aircraft Noise Level of 90dB(A).

In addition to this, noise calculations were performed using design software developed in this office which take into account external noise levels, facade transmission loss and room sound absorption characteristics. These room characteristics are based on a typical office fit out of a carpet tiled floor and a plasterboard/ ceiling tile ceiling installed. The resulting Rw rating required for each element is summarised in Table 7 below.

Table 7: Recommended Forms of Construction

Occupancy	Facade Element	Proposed Form of Construction	Minimum Required Sound Insulation Rating of Assembly	Laboratory Test Number or Reference
General Office Space				
Foyers	Windows	Curtain wall glazing (similar to 13.52mm laminated glass)	Rw 38	ESTIMATE
	External Walls	Standard concrete or masonry construction	Rw 50	ESTIMATE
	Roof	Metal Roof with insulation hard under. A noise barrier level consisting of either FC sheeting or 16mm fire rated plasterboard, 200mm thick acoustic insulation, a minimum 300mm air gap, and a ceiling consisting of 1 layer of 13mm plasterboard	Rw 50	ESTIMATE
Open Office areas	Windows	Curtain wall glazing (similar to 13.52mm laminated glass)	Rw 38	ESTIMATE
	External Walls	Standard concrete or masonry construction	Rw 50	ESTIMATE
	Roof	Metal Roof with insulation hard under. A noise barrier level consisting of either 9mm FC sheeting or 16mm fire rated plasterboard, 200mm thick acoustic insulation, a minimum 300mm air gap, and a ceiling consisting of 1 layer of 13mm plasterboard	Rw 50	ESTIMATE
Private offices	Windows	Curtain wall glazing (double glazing consisting of 13.52mm laminated glass, a minimum 150mm airgap, 10.38mm laminated glass)	Rw 47	ESTIMATE
	External Walls	Standard concrete or masonry with internal plasterboard lining and insulation	Rw 54	ESTIMATE
	Roof	Concrete slab with suspended ceiling or; Metal Roof with insulation hard under. A noise barrier level consisting of either 9mm FC sheeting or 16mm fire rated plasterboard, 200mm thick acoustic insulation, a minimum 300mm air gap, and a ceiling consisting of 2 layers of 16mm fire rated plasterboard	Rw 55	ESTIMATE
Industrial units				
General industrial floor area	Windows	High light windows - standard 6mm float or toughened glass	R_w 25	ESTIMATE
	External Walls	Framed and insulated walls with metal cladding externally and with internal plasterboard or FC lining, or Standard masonry (concrete or blockwork) construction	R_w 35	ESTIMATE
	Doors	Aluminium/ steel doors	Rw 20	ESTIMATE
	Roof	Metal deck roof with insulation hard under	Rw 25	ESTIMATE

By way of explanation, the Sound Insulation Rating R_w and $R_w + C_{tr}$ are measures of the noise reduction property of the partition, a higher rating implying a higher sound reduction performance.

Occupancy	Facade Element	Proposed Form of Construction	Minimum Required Sound Insulation Rating of Assembly	Laboratory Test Number or Reference

LEGEND where no appropriate test certificate exists:-

13. ESTIMATE – The client is advised not to commence detailing or otherwise commit to partition construction systems which have not been tested in an approved laboratory or for which an opinion only is available. Testing of partition construction systems is a component of the quality control of the design process and should be viewed as a priority because there is no guarantee the forecast results will be achieved thereby necessitating the use of an alternative which may affect the cost and timing of the project. No responsibility is taken for use of or reliance upon untested partition construction systems, estimates or opinions. The advice provided here is in respect of acoustics only.
14. ESTIMATE – APPROVED FOR CONSTRUCTION: Use of the form of construction is approved prior to laboratory certification. To complete the quality control of the design process and confirm the acoustical performance of the construction, we recommend testing in a laboratory to confirm the acoustic rating as soon as practicable.
15. ESTIMATE – TEST NOT REQUIRED: Use of the form of construction is approved without laboratory certification. The R_w and $R_w + C_{tr}$ of the form of construction exceeds the project requirements.
16. In accordance with Clauses FV5.1 and FV5.2 of Part F5 of the BCA.

NOTES FOR WALL CONSTRUCTIONS:

17. DO NOT daub fix plasterboard directly to masonry walls without express approval.

GENERAL

18. The sealing of all gaps in partitions is critical in a sound rated construction. Use only sealer approved by the acoustic consultant.
19. Check design of all junction details with acoustic consultant prior to construction.
20. Check the necessity for HOLD POINTS with the acoustic consultant to certify that all building details have been correctly interpreted and constructed.
21. The information provided in this table is subject to modification and review without notice.
22. The advice provided here is in respect of acoustics only. Supplementary professional advice may need to be sought in respect of fire ratings, structural design, buildability, fitness for purpose and the like.
23. In wet areas 13mm moisture-resistant plasterboard may be used in lieu of 13mm standard plasterboard.
24. 9mm Villaboard or 9mm fibre cement may be used in lieu of 13mm moisture and fire resistant plasterboard

The recommendations made above are based on the DA drawings provided. Due to the difficulties in continuity of the façade where meeting rooms and private offices are located along the glazed façade, it is our recommendation to relocate private offices and meeting rooms to the core of the building, away from the glazed facades. This will prevent issues with the construction of the development facades regarding the placement of private offices.

Nonetheless, if the construction details recommended for private offices in Table 7 are installed, the rooms are capable of complying with the indoor design sound levels specified in AS2021:2015 Table 3.3 (reproduced in Table 3 above).

Industrial units have been assessed to the higher acoustic requirement of ANR 15.

A full acoustic assessment is to be undertaken during the detailed design phase of the development.

Before committing to any form of construction or committing to any contractor, advice should be sought from an acoustic consultant to certify that the forms of construction selected comply with the criteria nominated in this report and adequate provisions are made for any variations which may occur as a result of changes to the recommended forms of construction.

5 Noise Emission

5.1 Noise Emission Criteria

5.1.1 NSW Noise Policy for Industry

Noise impact is assessed I accordance with the NSW 'Noise Policy for Industry' (NPfI), 2017. The assessment procedure has two components:

- Controlling intrusive noise impacts in the short-term for residences; and
- Maintaining noise level amenity for residences and other land uses.

In accordance with the NPfI, noise impact should be assessed against the project noise trigger level which is the lower value of the project intrusiveness noise levels and project amenity noise levels.

5.1.1.1 Project intrusive noise levels

According to the NPfI, the intrusiveness of a noise source may generally be considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented by the $L_{Aeq,15min}$ descriptor) does not exceed the background noise level measured in the absence of the source by more than 5dB(A). The project intrusiveness noise level, which is only applicable to residential receivers, is determined as follows:

- $L_{Aeq,15minute}$ Intrusiveness noise level = Rating Background Level ('RBL') plus 5dB(A)

Based on the background noise monitoring results and the proposed operating hours of the facility, the intrusiveness noise levels for residential receivers are reproduced in Table 8 below.

Table 8 Intrusiveness Noise Levels

Receiver	Intrusiveness noise level, $L_{Aeq,15min}$		
	Day	Evening	Night
Nearest residents	37 + 5 = 42	41 + 5 = 46	39 + 5 = 44

Notes: Day: 7:00 to 18:00 Monday to Saturday and 8:00 to 18:00 Sundays & Public Holidays
Evening: 18:00 to 22:00 Monday to Sunday & Public Holidays
Night: 22:00 to 7:00 Monday to Saturday and 22:00 to 8:00 Sundays & Public Holidays

5.1.1.2 Amenity noise levels

The project amenity noise levels for different time periods of day are determined in accordance with Section 2.4 of the NPfI. The NPfI recommends amenity noise levels ($L_{Aq,period}$) for various receivers including residential, commercial, industrial receivers and sensitive receivers such as schools, hotels, hospitals, churches and parks. These "recommended amenity noise levels" represent the objective for

total industrial noise experienced at receiver location. However, when assessing a single industrial development and its impact on an area, "project amenity noise levels" apply.

The recommended amenity noise levels applicable for the subject area are reproduced in Table 9 overleaf.

Table 9: Project Amenity Noise Levels

Type of Receiver	Noise Amenity Area	Time of Day	Recommended amenity noise level, L_{Aeq}, dB(A)
Residential	Suburban	Day	55
		Evening	45
		Night	40
	Urban	Day	60
		Evening	50
		Night	45
Hotels, motels, caretakers' quarters, holiday accommodation, permanent resident caravan parks	See column 4	See column 4	5 dB(A) above the recommended amenity noise level for a residence for the relevant noise amenity area and time of day
Passive recreation (e.g. national park)	All	When in use	50
Active recreation (e.g. school playground, golf course)	All	When in use	55
Commercial premises	All	When in use	65
Industrial premises	All	When in use	70
Industrial interface (applicable only to residential noise amenity areas)	All	When in use	Add 5 dB(A) to recommended noise amenity area

Notes:
1. Daytime 7.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 7.00 am.
2. 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.
3. The L_{Aeq} index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.
4. The recommended amenity noise levels refer only to noise from industrial sources. However, they refer to noise from all such sources at the receiver location, and not only noise due to a specific project under consideration. The level

To ensure that the total industrial noise level (existing plus new) remain within the recommended amenity noise levels for an area, the project amenity noise level that applies for each new industrial noise source is determined as follows:

- $L_{Aeq,period}$ Project amenity noise level = $L_{Aeq,period}$ Recommended amenity noise level – 5dB(A)

Furthermore, given that the intrusiveness noise level is based on a 15 minute assessment period and the project amenity noise level is based on day, evening and night assessment periods, the NPfI provides the following guidance on adjusting the $L_{Aeq,period}$ level to a representative $L_{Aeq,15minute}$ level in order to standardise the time periods.

- $L_{Aeq,15minute} = L_{Aeq,period} + 3dB(A)$

Note, whilst the NPfI includes the above simplification, in the event this 15 minute amenity level is exceeded, a particular assessment of activities and durations can be conducted to determine the period average noise level.

The project amenity noise levels ($L_{Aeq, 15min}$) applied for this project are reproduced in Table 10 below, based on an 'Urban' Noise Amenity Area.

Table 10 Project Amenity Noise Levels

Type of Receiver	Noise Amenity Area	Time of Day	Project Amenity Noise Level, dB(A)	
			$L_{Aeq, Period}$	$L_{Aeq, 15min}$
Residence	Rural	Day	50	37+3=40
		Evening	45	41+3=44
		Night	40	39+3=42
Commercial Premises	All	When in use	65 – 5 = 60	60 + 3 = 63
Active recreation	All	When in use	55 – 5 = 50	55 + 3 = 58
Hotels	Urban	Day	60	37+5+3=45
		Evening	55	41+5+3=49
		Night	50	39+5+3=47

Notes:
1. Daytime 7.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 7.00 am.
2. 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.
3. The L_{Aeq} index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.
4. Where a greenfield development is proposed and it can be demonstrated that existing levels of industrial noise are more than 5dB lower than the relevant recommended amenity noise level, then the amenity noise level applies

In accordance with Section 2.4 of the NPfI, the following **exceptions** to the above method to derive the project amenity noise level apply:

1. In areas with high traffic noise levels (see Section 2.4.1 of the NPfI).
2. In proposed developments in major industrial clusters (see Section 2.4.2 of the NPfI).
3. Where the resultant project amenity noise level is 10dB, or more, lower than the existing industrial noise level. In this case the project amenity noise levels can be set at 10dB 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 the development.

The tabulated NPfI trigger levels are shown on the following page in Table 11.

The following table presents the site-specific noise production criteria for residential receivers from industrial noise sources, including mechanical plant.

Table 11: L_{Aeq} Design Criterion for Noise Production from Industrial Premises (EPA NPfI) – at residences and hotels

Time of Day	Column 1	Column 2	Column 3	Column 4
	Rating Background Level (RBL) L_{A90}	Intrusiveness Criterion (RBL+5)	Project Amenity Noise Level $L_{Aeq,15min}$ (PANL)	Project Noise Trigger Level $L_{Aeq,15min}$ dB(A)
Day (7am to 6pm)	37	42	40	40
Evening (6pm to 10pm)	41	46	44	44
Night (10pm to 7am)	39	44	42	42

Explanatory notes:

Column 1 – RBL measured in accordance with the NPfI and outlined in Table 4 above

Column 3 – Project Amenity Noise Level determined based on 'Residential - rural' area in Table 2.2 (Amenity noise levels) of the EPA's NPfI minus 5dB. Hotel receiver is based on 'Hotel – Urban'.

Column 4 – Project Noise Trigger Level is the lower value of project intrusiveness noise level and project amenity noise level

Where necessary, noise amelioration treatment will be incorporated in the design to ensure that noise levels comply with the recommended EPA's INP noise emission criteria noted above.

5.1.1.3 Sleep disturbance noise levels

The potential for sleep disturbance from maximum noise level events from premises during the night-time period needs to be considered. In accordance with NPfI, a detailed maximum noise level event assessment should be undertaken where the subject development night-time noise levels at a residential location exceed:

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

Where there are noise events found to exceed the initial screening level, further analysis is undertaken to identify:

- The likely number of events that might occur during the night assessment period,
- The extent to which the maximum noise level exceeds the rating background noise level.

The sleep disturbance noise levels for the project are presented in Table 12.

Table 12: Sleep disturbance assessment levels

Receiver type	Assessment Level $L_{Aeq,15min}$	Assessment Level L_{AFmax}
Residential/ Hotel	39 + 5 = 44	39 + 15 = 54

Based on the distances to residential receivers and the hours operation of the development, sleep disturbance levels are likely to be exceeded as a result of the use of the site.

5.2 Operational Noise Emission from Development

The project noise emission goals were presented in Section 5. This section presents the project noise emission controls.

5.3 Use

The site is to consist of 4 large warehouse/ industrial buildings with Lots 1/109 and 2/109 to contain adjoining office facilities. The buildings are to be delivered as cold shells and the use of the industrial premises are not yet known. Each tenancy will be subject to a separate DA where the noise associated with the particular use of the premises to be assessed at that time.

The nearest residential receivers are some 600m south of the proposed development site, however, due to the lack of intervening structures and the existing low background noise levels, the potential impacts on the residential receivers cannot be discounted.

As the proposed uses of the site are currently unknown, predictions have been made based on heavy industry (manufacturing) conducted over a 24hour period. Noise data from our extensive database has been used for the assessment.

Table 13: Predicted noise level assessment

Source	Receiver	Time Period	Description	Overall noise level, dB(A)
Manufacturing (inc duct extractor, welding, drilling, sanding) – Sound Pressure Level 102dB(A) LAeq, 15 min	Rural residences on Cabbage Tree Road (600m south of site)	15min period	Predicted noise level	33
			Noise goal	40
	Commercial receiver- Lot 106 Astra Aerolab Precinct (100m north of centre of site)	15min period	Predicted noise level	46
			Noise goal	63
	Mecure Hotel (400m east of site)	15min period	Predicted noise level	37
			Noise goal	45

Note: 1. Daytime 7:00am to 6:00pm;
2. Evening 6:00pm to 10:00pm
3. Night 10:00pm to 7:00am

Based on the assessment above, site use is likely to comply with the nominated acoustic criteria at the residences and surrounding hotel and commercial receivers. A full assessment of each facility's use should be undertaken when more detail is available. If high noise uses are proposed, management procedures (such as closing roller shutter doors) and noise treatments (including shielding of individual plant and machine items) may be required.

5.4 Traffic generation

Traffic generation as a whole has been assessed as part of the Masterplan for the precinct. This assessment relates to traffic generated from Lot 109 only.

A preliminary traffic assessment has been undertaken by SECA Solution (Ref: P2430 EJE Astra Aerolab 109 dated 8th September 2022). The report provides preliminary predictions for traffic generated by the site.

Traffic Generated by the stie is predicted to be:

- 76 trips in the AM
- 84 trips in the PM
- 846 trips daily (423 inbound, 424 outbound)

Based on the traffic assessment for the Masterplan, the traffic report states that "*Traffic associated with the masterplan approval has been distributed to the broader road network and assessed as part of the modelling. There has been no significant change to the broader road network to see any difference in that previously assessed*".

There are no criteria set for industrial and commercial receivers for traffic noise generation in the NSW EPA's Road Noise Policy.

In terms of traffic generated onto existing roads surrounding the development, traffic generated from the site, State Roads will carry traffic to and from the site and precinct as a whole. From Williamtown Drive, traffic can either head north or south along Nelson Bay Drive, with further traffic splits onto Medowie Road to the north and Cabbage Tree Road to the south.

The table below presents the relevant traffic noise generation criteria at the nearest residential receivers.

Table 14: Traffic Noise Generation Criteria - Residences

Road Category	Type of project/ land use	Assessment Criteria	
		Day (7am - 10pm)	Night (10pm - 7am)
Freeway/ arterial/ sub-arterial roads	Existing residents affected by additional traffic on existing freeway/ arterial/ sub-arterial roads generated by land use developments	LAeq, (15 hour) 60 (external)	LAeq, (15 hour) 55 (external)

Given the site is anticipated to produce a maximum of 84 trips during a peak 1 hour period, would not give rise to increased overall traffic noise levels at the nearest residential receivers along Nelson Bay Road, Medowie Road and Cabbage Tree Road.

5.5 Mechanical Plant and Equipment

5.5.1 Recommended Noise Control Measures for Mechanical Plant

Mechanical plant such as exhaust systems, air-conditioning, mechanical ventilation and refrigeration associated with the development has the potential to impact on nearby noise sensitive properties.

As complete details of mechanical plant are not available at this stage of the development the following in principle noise control advice are provided.

- Acoustic assessment of mechanical services equipment will be required to be undertaken during the detail design phase of the development to ensure that they shall not either singularly or in total emit noise levels which exceed the noise limits in established in Table 11.
- Mechanical plant noise emission can be controllable by appropriate mechanical system design and implementation of common engineering methods that may include any of the following;
  - procurement of 'quiet' plant
  - strategic positioning of roof and balcony plant equipment away from sensitive neighbouring premises, maximising the intervening shielding between the plant and sensitive neighbouring premises
  - installation of commercially available silencers or acoustic attenuators for air discharge and air intakes of plant
  - acoustically lined and lagged ductwork
  - provide acoustic screens and/or acoustic louvres between plant and sensitive neighbouring premises
  - provide partially enclosed or fully enclosed acoustic enclosure over plant
  - Mechanical plant shall have their noise specifications and proposed locations checked prior to installation
  - Fans shall be mounted on vibration isolators and balanced in accordance with Australian Standard 2625 "Rotating and Reciprocating Machinery - Mechanical Vibration"

5.5.2 Mechanical plant noise assessment (in-principle)

Rooftop and ground level plant at the proposed development may include cooling towers, chillers, exhaust fans, ventilation fans, air handling units and hot and cold water pumps. The following acoustic treatments are to be considered.

- Screening and acoustic louvres around the chiller, pump and cooling tower plant area,
- Acoustic lining to air handling units,
- Attenuators added to exhaust and other ventilation fans where required, and

A full and detailed assessment with fully documented acoustic treatments will be undertaken at the detailed design phase of the development, followed by construction/installation supervision of mechanical plant and equipment acoustic treatment. Compliance testing following the installation of the plant should also be undertaken.

6 Construction Noise

The nature of the construction processes proposed for the development does not present difficulties in ensuring that the associated noise limits at surrounding properties are achieved. The major construction activities proposed on this site are concrete pours and general building works.

Construction and building work will be adequately managed so as to minimise disruption to the local community and the environment.

The NSW Interim Construction Noise Guideline sets out management noise levels and time restrictions for construction activities. The aims of the guideline are to control and manage noise on all building sites within the local area.

Since detail of the construction equipment such as exact type, size, number and operating time are not know at this stage, in-principle noise control measures are provided in Section 6.1 below which may be implemented to minimise any noise exceedances to the noise sensitive receptors where that may occur.

6.1 General Engineering Noise Control

Implementation of noise control measures, such as those suggested in Australian Standard 2436-1981 "Guide to Noise Control on Construction, Maintenance and Demolition Sites", are expected to reduce predicted construction noise levels. Reference to Australian Standard 2436-1981, Appendix E, Table E1 suggests possible remedies and alternatives to reduce noise emission levels from typical construction equipment. Table E2 in Appendix E presents typical examples of noise reductions achievable after treatment of various noise sources. Table E3 in Appendix E presents the relative effectiveness of various forms of noise control treatment.

Table 15 below present noise control methods, practical examples and expected noise reductions according to AS2436 and according to Renzo Tonin & Associates' opinion based on experience with past projects.

Table 15: Relative Effectiveness of Various Forms of Noise Control, dBA

Noise Control Method	Practical Examples	Typical noise reduction possible in practice		Maximum noise reduction possible in practice	
		AS 2436	Renzo Tonin & Assoc.	AS 2436	Renzo Tonin & Assoc.
Screening	Acoustic barriers such as earth mounds, temporary or permanent noise barriers	7 to 10	5 to 10	15	15
Acoustic Enclosures	Engine casing lagged with acoustic insulation and plywood	15 to 30	10 to 20	50	30
Engine Silencing	Residential class mufflers	5 to 10	5 to 10	20	20
Substitution by alternative process	Use electric motors in preference to diesel or petrol	15 to 25	15 to 25	60	40

The Renzo Tonin & Associates' listed noise reductions are conservatively low and should be referred to in preference to those of AS2436, for this assessment.

To ensure efficient noise attenuation performance is achieved throughout the project, it is recommended acoustic engineers work closely with the construction contractors and carry out preliminary testing prior to commencement of works.

In addition to physical noise controls, the following general noise management measures should be followed:

- Plant and equipment should be properly maintained
- Provide special attention to the use and maintenance of 'noise control' or 'silencing' kits fitted to machines to ensure they perform as intended
- Strategically position plant on site to reduce the emission of noise to the surrounding neighbourhood and to site personnel
- Avoid unnecessary noise when carrying out manual operations and when operating plant
- Any equipment not in use for extended periods during construction work should be switched off
- Noise compliance monitoring for all major equipment and activities on site should be undertaken prior to their commencement of work on site.
- In addition to the noise mitigation measures outlined above, a management procedure would need to be put in place to deal with noise complaints that may arise from construction activities. Each complaint would need to be investigated and appropriate noise amelioration measures put in place to mitigate future occurrences, where the noise in question is in excess of allowable limits.
- Good relations with people living and working in the vicinity of a construction site should be established at the beginning of a project and be maintained throughout the project, as this is of paramount importance. Keeping people informed of progress and taking complaints seriously and dealing with them expeditiously is critical. The person selected to liaise with the community should be adequately trained and experienced in such matters.
- Where noise level exceedances cannot be avoided, then consideration should be given to implementing time restrictions and/or providing periods of repose for neighbouring receptors.

7 Conclusion

Renzo Tonin & Associates have completed an assessment of noise emission from and noise intrusion into the proposed industrial/ commercial development at Lot 109 Astra Aerolab Precinct, Newcastle Airport, Williamtown.

Recommendations to comply with noise emission and noise intrusion criteria for the site, including mechanical plant, use of the site and construction noise have been presented in the body of this report.

Façade treatments for the treatment of aircraft noise intrusion to comply with the requirements of Australian Standard AS2021:2015 have been made in Section 4 of this report.

In conclusion, the proposed site is capable of complying with all relevant acoustic criteria through means of standard acoustic treatment and management subject to further acoustic assessment during the detailed design phase.

Appendix A contains a glossary of acoustic terms used in this report.

APPENDIX A Glossary of terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment Point	A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of common sounds in our daytime environment:

threshold of hearing	0 dB	The faintest sound we can hear
	10 dB	Human breathing
almost silent	20 dB	
	30 dB	Quiet bedroom or in a quiet national park location
generally quiet	40 dB	Library
	50 dB	Typical office space or ambience in the city at night
moderately loud	60 dB	CBD mall at lunch time
	70 dB	The sound of a car passing on the street
loud	80 dB	Loud music played at home
	90 dB	The sound of a truck passing on the street
very loud	100 dB	Indoor rock band concert
	110 dB	Operating a chainsaw or jackhammer
extremely loud	120 dB	Jet plane take-off at 100m away
threshold of pain	130 dB	
	140 dB	Military jet take-off at 25m away

dB(A)	A-weighted decibels. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.

Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.
L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

APPENDIX B Monitoring location and results

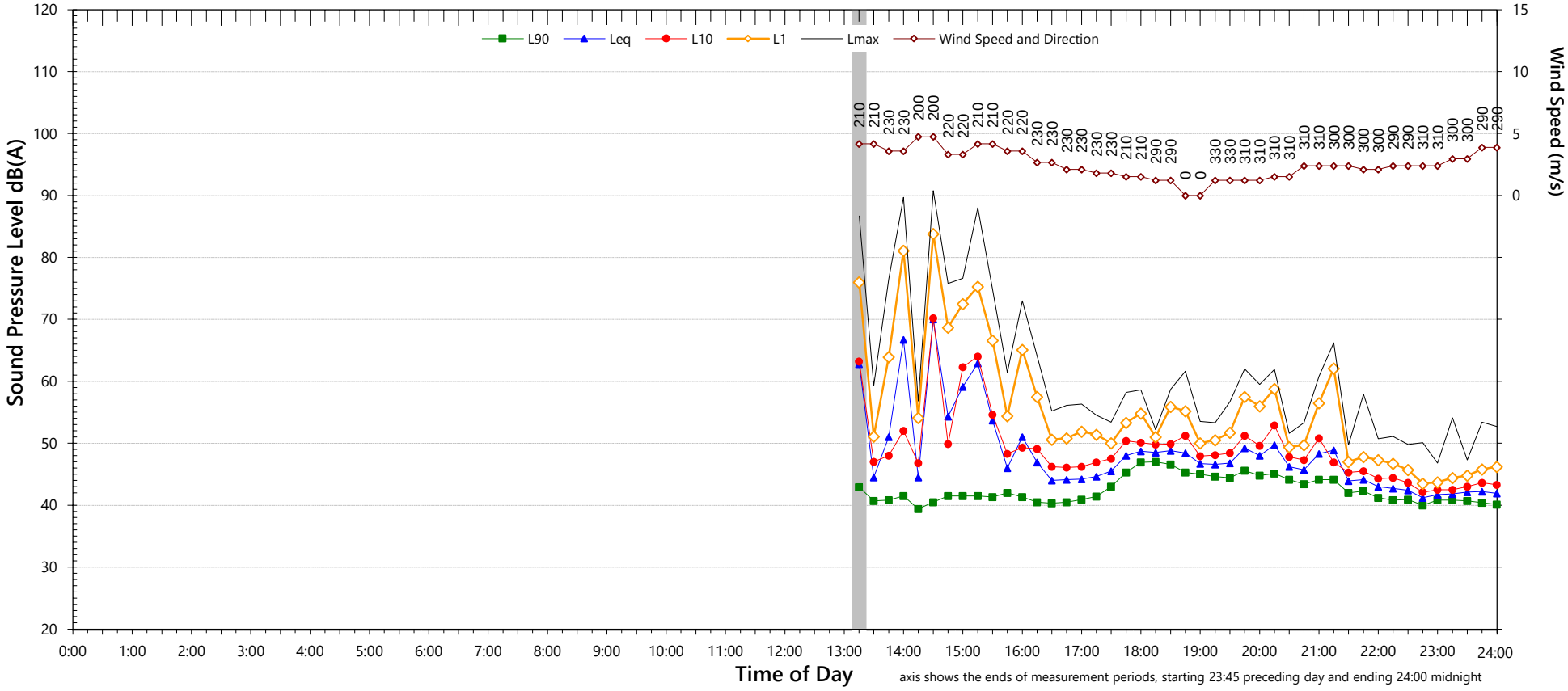
Location: Lot 109 Astra Aerolab Precinct

Duration: 24-31 August 2022

Unattended Noise Monitoring Results

Lot 109 Astra Aerolab Precinct

Wednesday, 24 August 2022



NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{A90} ABL	-	42	39
L_{Aeq}	-	47	43

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	70	to	70
L_{AFMax} - L_{Aeq} (Range)	20	to	20

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	-	46
$L_{Aeq\ 1hr}$ upper 10 percentile	-	46
$L_{Aeq\ 1hr}$ lower 10 percentile	-	43

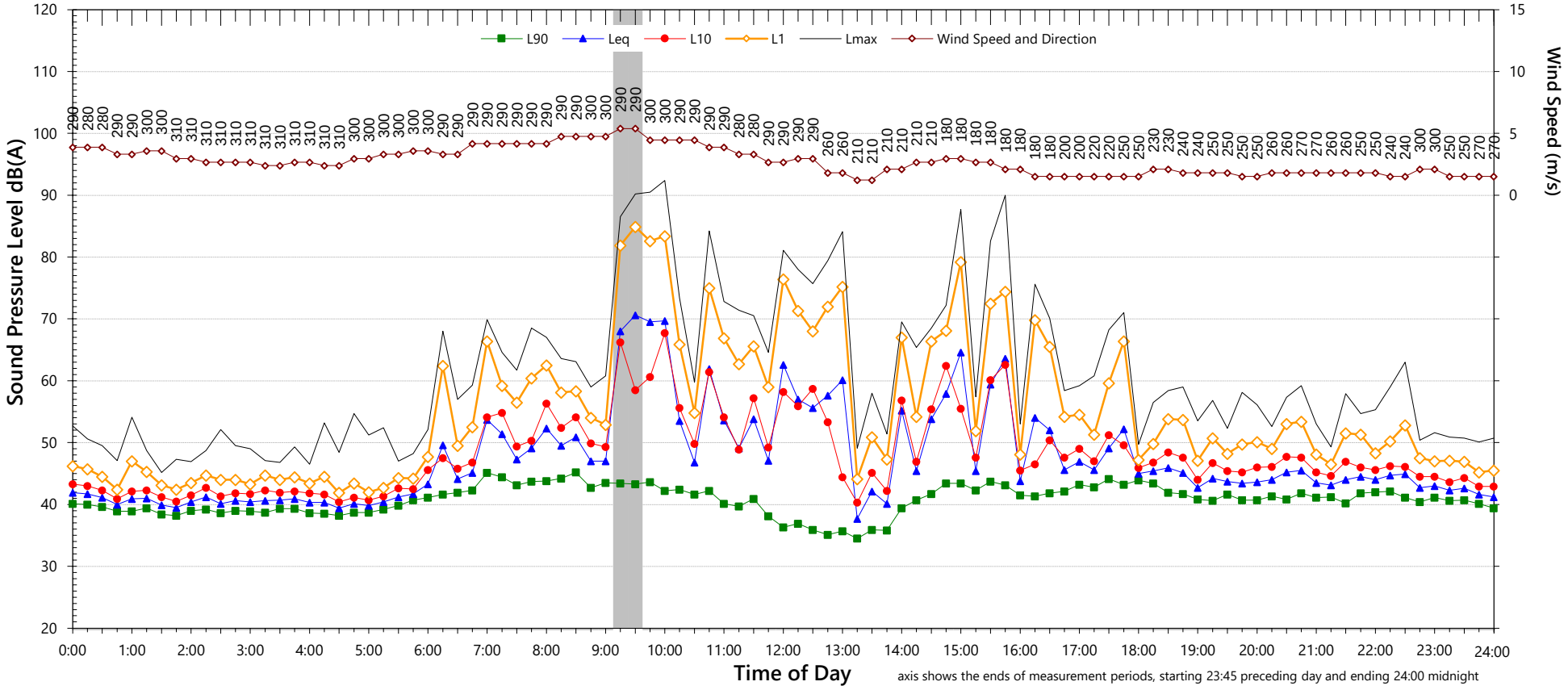
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

Lot 109 Astra Aerolab Precinct

Thursday, 25 August 2022



NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{A90} ABL	36	41	39
L_{Aeq}	59	44	44

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	67	to	67
L_{AFMax} - L_{Aeq} (Range)	18	to	19

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	60	47
$L_{Aeq\ 1hr}$ upper 10 percentile	62	49
$L_{Aeq\ 1hr}$ lower 10 percentile	47	43

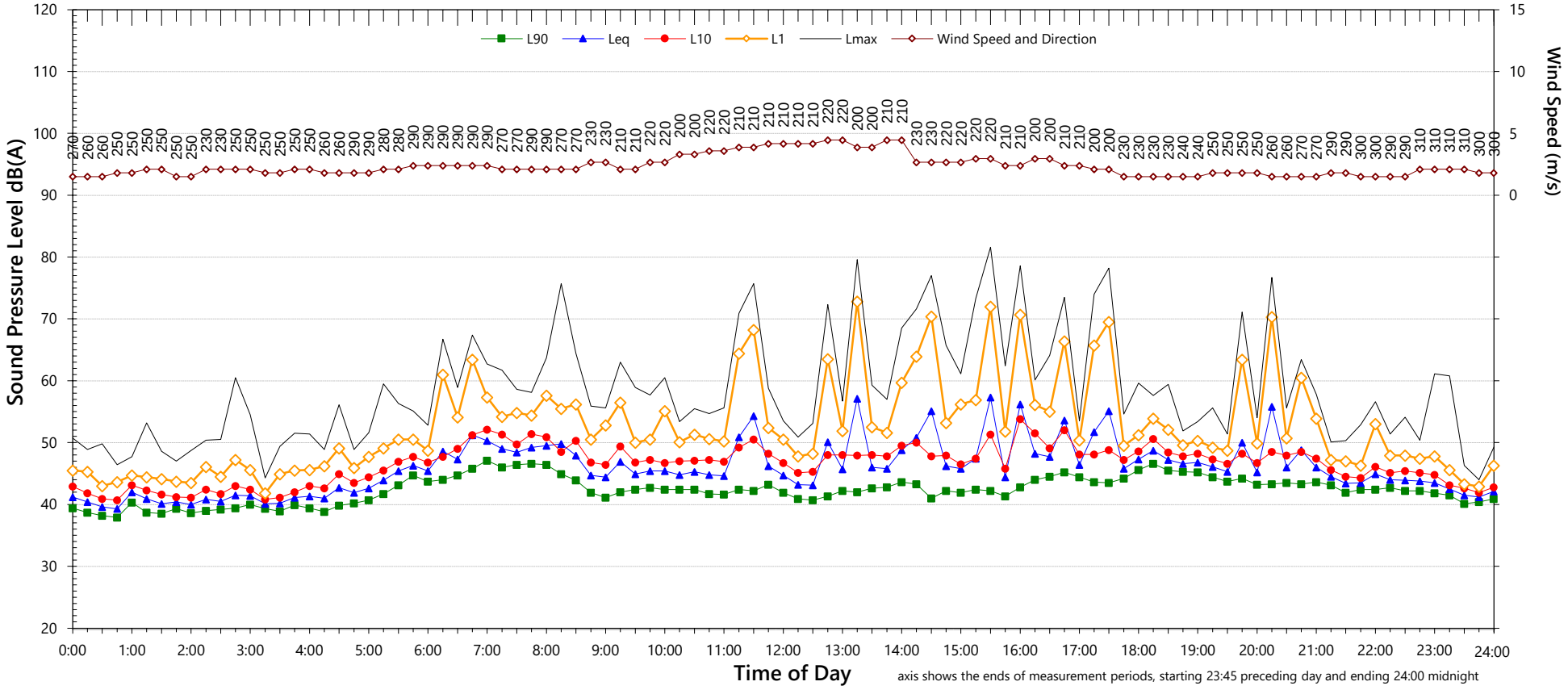
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

Lot 109 Astra Aerolab Precinct

Friday, 26 August 2022



axis shows the ends of measurement periods, starting 23:45 preceding day and ending 24:00 midnight

NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{A90} ABL	41	42	40
L_{Aeq}	50	48	44

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	72	to	74
L_{AFMax} - L_{Aeq} (Range)	17	to	28

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	52	46
$L_{Aeq\ 1hr}$ upper 10 percentile	54	49
$L_{Aeq\ 1hr}$ lower 10 percentile	48	44

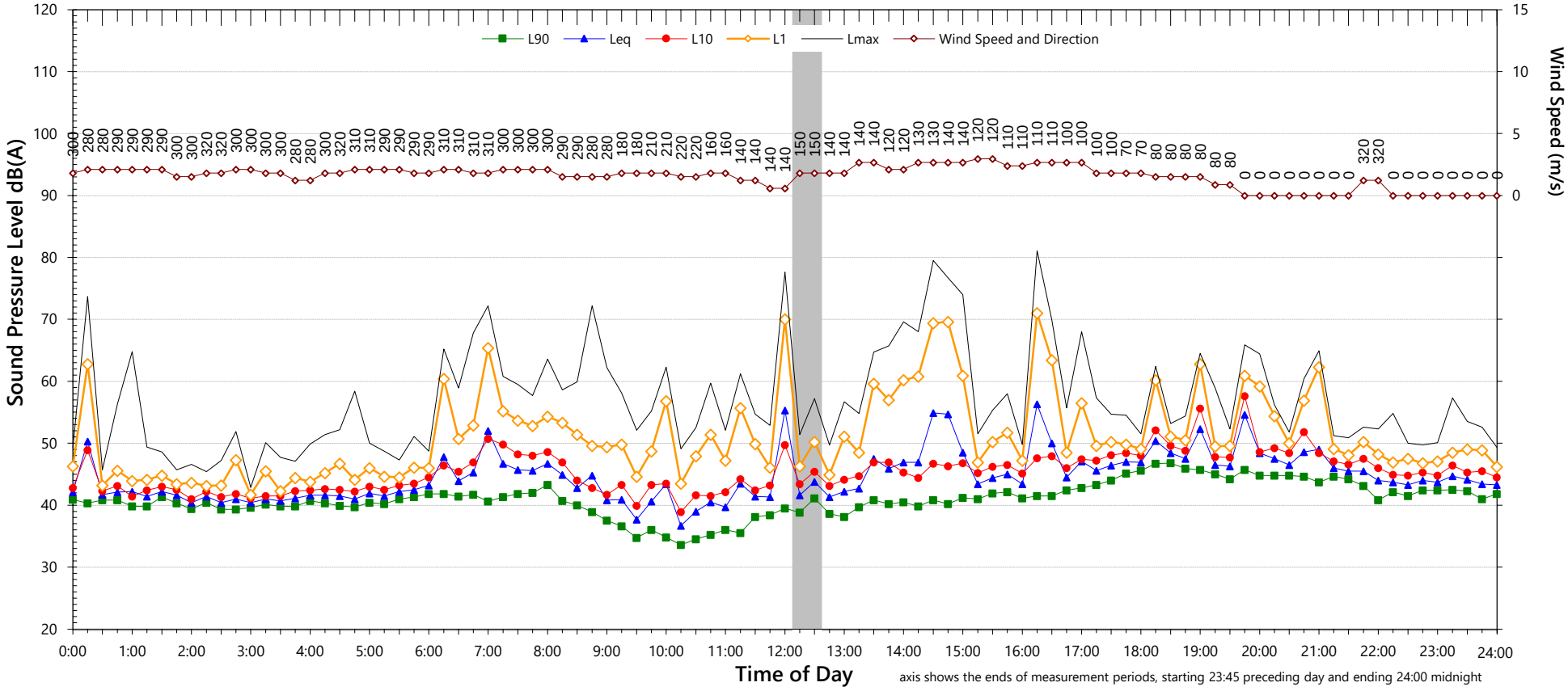
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

Lot 109 Astra Aerolab Precinct

Saturday, 27 August 2022



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	35	43	37
L_{Aeq}	48	49	43

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	67	to	68
L_{AFMax} - L_{Aeq} (Range)	16	to	26

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	51	45
$L_{Aeq\ 1hr}$ upper 10 percentile	54	46
$L_{Aeq\ 1hr}$ lower 10 percentile	44	44

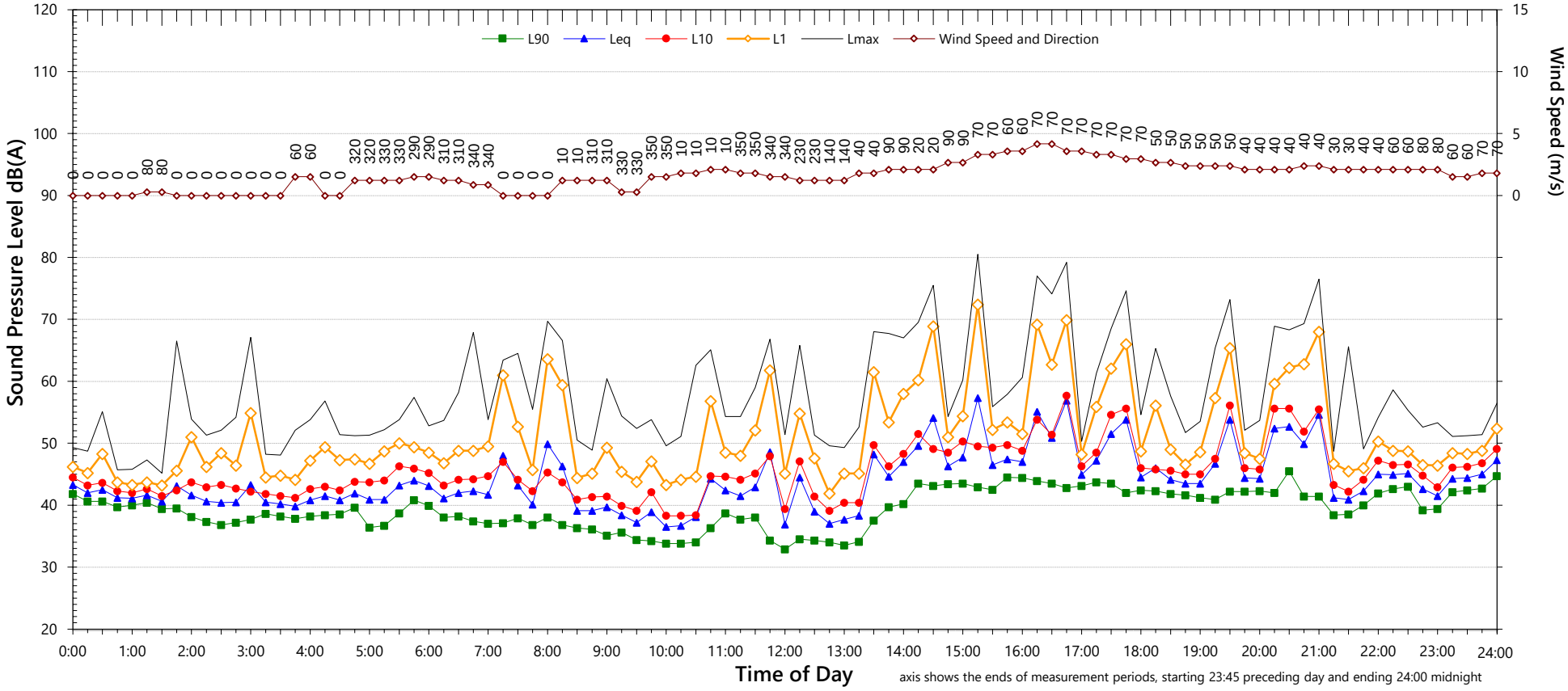
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

Lot 109 Astra Aerolab Precinct

Sunday, 28 August 2022



NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{A90} ABL	34	39	39
L_{Aeq}	49	49	48

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	72	to	72
L_{AFMax} - L_{Aeq} (Range)	17	to	18

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	51	50
$L_{Aeq\ 1hr}$ upper 10 percentile	55	51
$L_{Aeq\ 1hr}$ lower 10 percentile	43	46

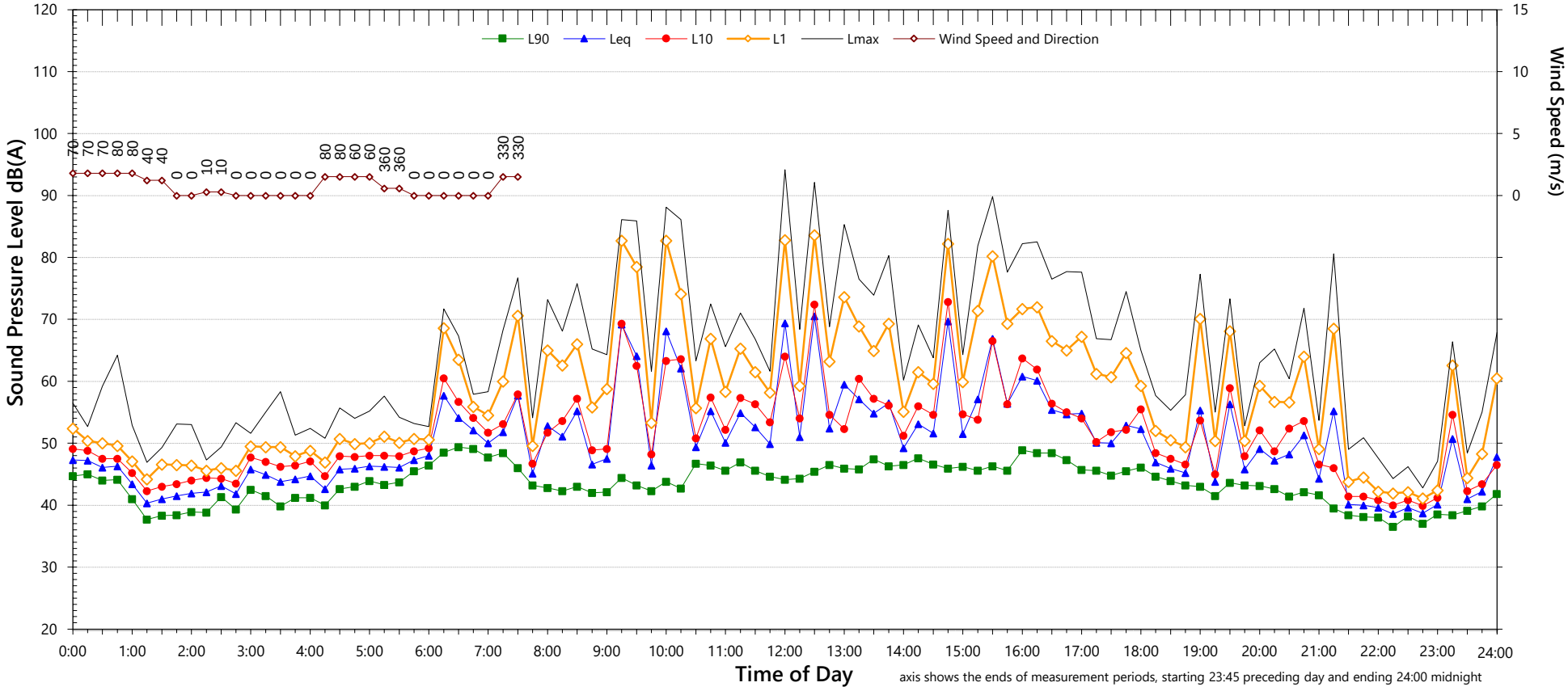
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

Lot 109 Astra Aerolab Precinct

Monday, 29 August 2022



NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{A90} ABL	43	38	37
L_{Aeq}	62	50	46

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	68	to	75
L_{AFMax} - L_{Aeq} (Range)	16	to	23

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	63	48
$L_{Aeq\ 1hr}$ upper 10 percentile	67	52
$L_{Aeq\ 1hr}$ lower 10 percentile	52	42

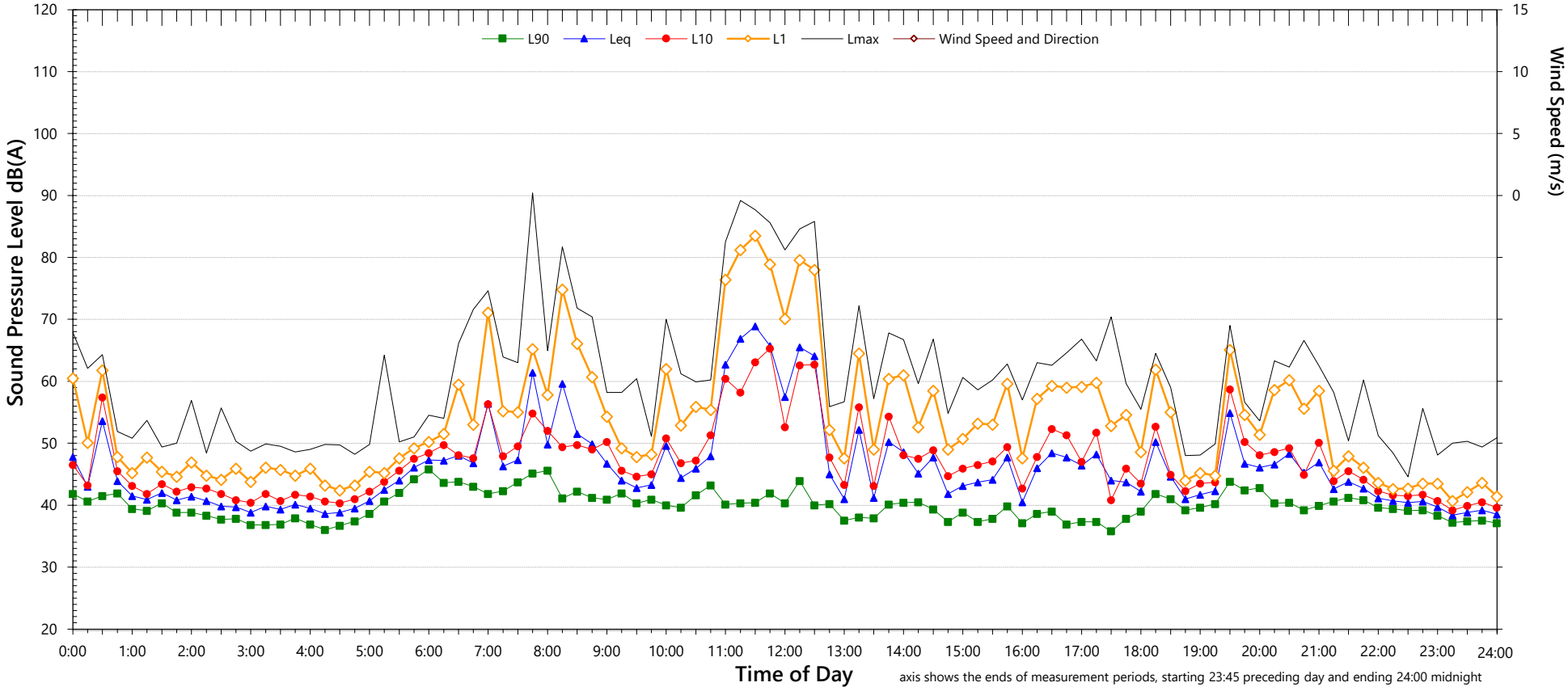
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

Lot 109 Astra Aerolab Precinct

Tuesday, 30 August 2022



NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{A90} ABL	37	39	37
L_{Aeq}	58	47	45

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	69	to	77
L_{AFMax} - L_{Aeq} (Range)	15	to	28

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	59	47
$L_{Aeq\ 1hr}$ upper 10 percentile	62	48
$L_{Aeq\ 1hr}$ lower 10 percentile	47	41

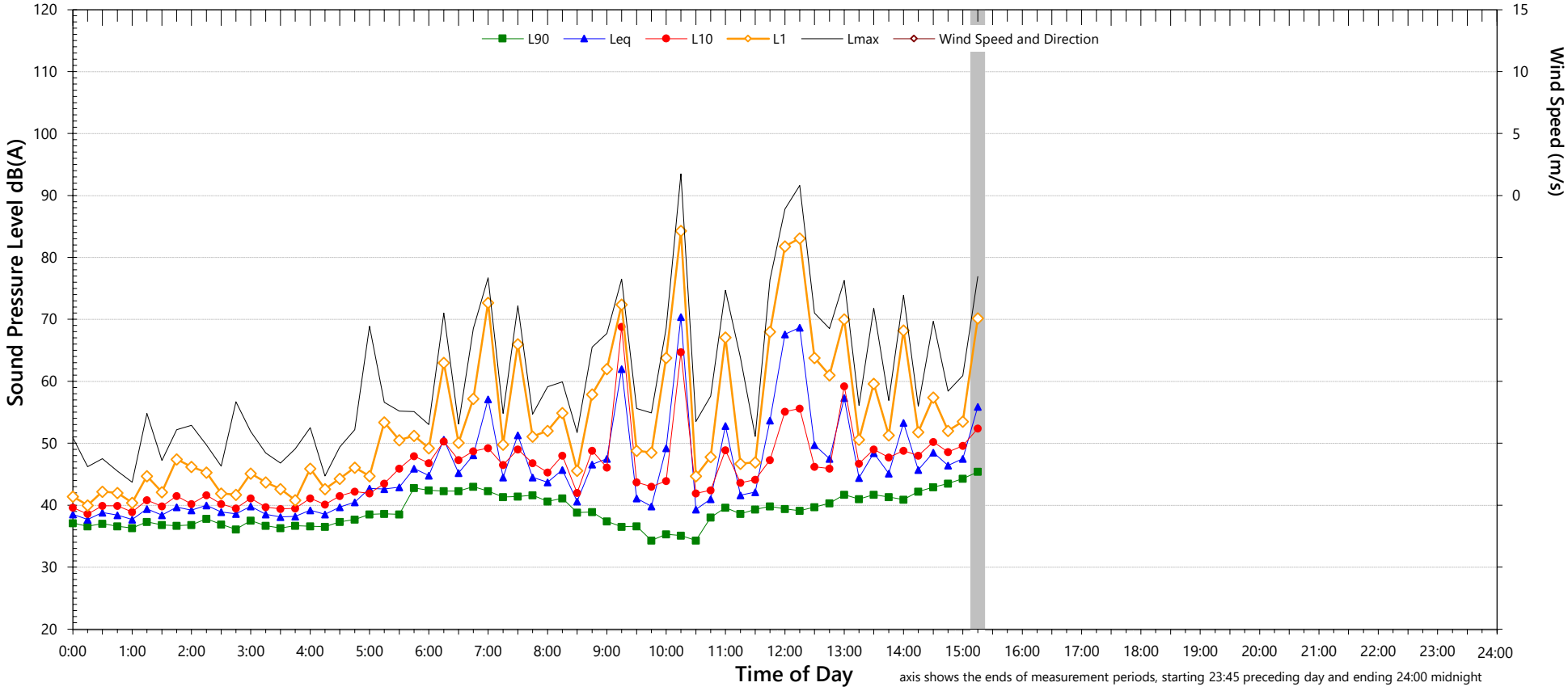
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

Lot 109 Astra Aerolab Precinct

Wednesday, 31 August 2022



NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{A90} ABL	-	-	-
L_{Aeq}	-	-	-

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	-	to	-
L_{AFMax} - L_{Aeq} (Range)	-	to	-

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	-	-
$L_{Aeq\ 1hr}$ upper 10 percentile	-	-
$L_{Aeq\ 1hr}$ lower 10 percentile	-	-

Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
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