Noise Impact Assessment

Multi Dwelling Residential Development
10-12 Burrundulla Avenue
Mudgee, NSW

Prepared for: Mid-Western Regional Council
February 2024
MAC231784-01RP1V1

Muller Acoustic Consulting

Document Information

Noise Impact Assessment

Multi Dwelling Residential Development

10- 12 Burrundulla Avenue

Mudgee, NSW

Prepared for: Mid-Western Regional Council

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1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by Mid-Western Regional Council (MWRC) to prepare a Noise Impact Assessment (NIA) for a multi dwelling residential subdivision at 10- 12 Burrundulla Avenue, Mudgee, NSW.

A NIA is required as part of the Development Application (DA) being prepared for lodgement by MWRC. The purpose of the NIA is to quantify potential environmental noise emissions associated with the construction of the project and generation of road traffic noise on the local road network. Where impacts are identified, the assessment includes recommendations for potential noise mitigation and management measures.

The assessment has been undertaken in accordance with the following documents:

- NSW Environment Protection Authority (EPA's), Noise Policy for Industry (NPI), 2017;
- NSW Environment Protection Authority (EPA), Road Noise Policy (RNP), 2011;
- NSW Environment Protection Authority (EPA's), Approved Methods for the measurement and analysis of environmental noise in NSW, 2022;
- Department of Environment and Climate Change (DECC), Interim Construction Noise Guideline (ICNG), 2009;
- Department of Environment and Conservation (DEC), Assessing Vibration: A technical guideline (AVATG), 2006;
- Standards Australia AS 2436-2010 Guide to Noise Control on Construction, Maintenance and Demolition Sites;
- Standards Australia AS 1055:2018 (AS 1055) – Acoustics – Description and Measurement of Environmental Noise;
- British Standard BS 7385-2:1993: Evaluation and measurement of vibration in buildings; and
- German Standard DIN 4150 – Part 3 – Structural Vibration in Buildings - Effects of Vibration of Structures.

A glossary of terms, definitions and abbreviations used in this report is provided in **Appendix A**.

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2 Project Description

2.1 Background

MAC understands that MWRC are proposing to develop a residential subdivision on a 1.67 hectare (ha) parcel of land at L122 DP1074283 (10-12 Burrundulla Avenue), Mudgee, NSW (the project) (refer **Figure 1**). The project will comprise 47 Key Worker houses (a variety of home designs and sizes) on the former Mudgee Bowling Club site. The subdivision layout plan is provided in **Appendix B**.

Physical works associated with the project would include:

- clearing and grubbing, including bulk earthworks;
- installation of utilities;
- internal road construction; and
- dwelling construction.

It is anticipated that all construction works would be undertaken during standard construction hours.

2.1.1 Receiver Review

A review of aerial imagery and geospatial information identified that the noise environment surrounding the project site is typical of a suburban environment, with dominant sources likely to include road traffic noise from the local road network, general suburban hum and environmental noise from birds and insects.

The project site is bounded on each side by existing residential properties, with land zoned general residential (R1) to the east of Burrundulla Avenue and land zoned medium density residential (R3) to the north, south and west of the project site. Accommodation services, including bed and breakfast accommodation, and short-term rental accommodation are also located within the surrounding area, with the closest accommodation situated immediately adjacent to the northeast extent of the project site.

The level of affectation for each receiver is influenced by the activity that is being undertaken and the distance and exposure of each receiver to the proposal site. It is noted that the area of affectation is the distance from the project where receivers may experience noise levels above the relevant noise management levels. The locality plan identifying the position of the potentially affected receivers is provided in **Figure 2**.

FIGURE 1

Location Map

MAC231784-01

10-12 Burrundulla Avenue

KEY

Project Site

0 40 80 120 160 200 m

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FIGURE 2

Surrounding Receivers

MAC231784-01

10-12 Burrundulla Avenue

KEY

- Project Site
- Unattended Noise Loggers

Sensitive Receivers

- Residential
- Accommodation
- Active Recreation

0 30 60 90 120 m

N

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3 Noise Policy and Guidelines

3.1 Interim Construction Noise Guideline

The ICNG sets out procedures to identify and address the impacts of construction noise on residences and other sensitive land uses. This section provides a summary of noise objectives that are applicable to the assessment. The ICNG provides two methodologies for the assessment of construction noise emissions:

- quantitative, which is suited to major construction projects with typical durations of more than three weeks; and
- qualitative, which is suited to short term infrastructure maintenance (< three weeks).

The qualitative assessment methodology is a more simplified approach that relies on noise management strategies. This study has adopted a quantitative assessment approach which is summarised in **Figure 3.** The quantitative approach includes identification of potentially affected receivers, derivation of the construction noise management levels, quantification of potential noise impact at receivers via predictive modelling and, provides management and mitigation recommendations.

3.1.1 Standard Hours for Construction

Table 1 summaries the ICNG recommended standard hours for construction works.

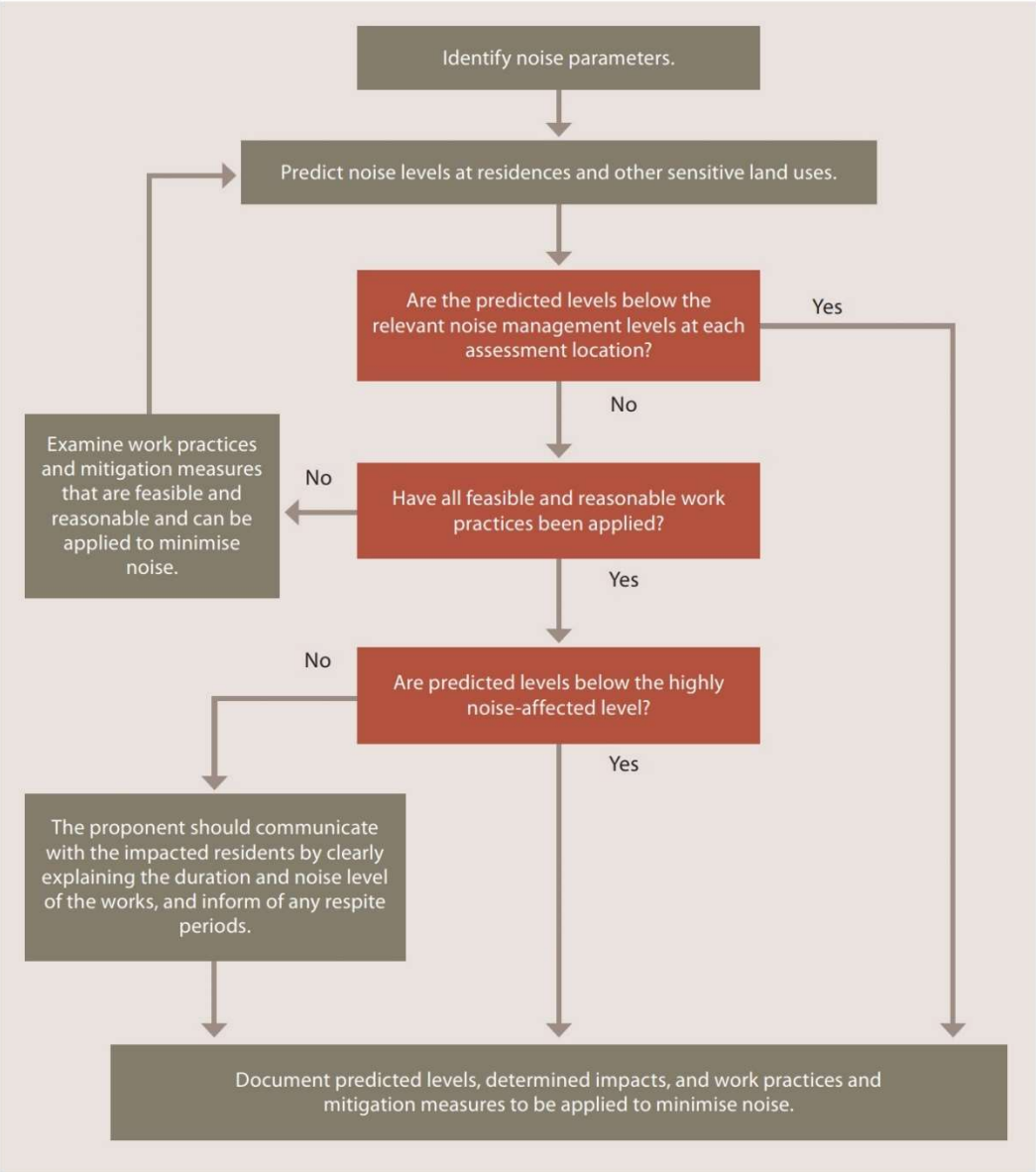
Table 1 Recommended Standard Hours for Construction

Daytime	Construction Hours
Monday to Friday	7am to 6pm
Saturdays	8am to 1pm
Sundays or Public Holidays	No construction

These recommended hours do not apply in the event of direction from police, or other relevant authorities, for safety reasons or where required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm.

Construction activities are anticipated to be undertaken during standard construction hours only.

Figure 3 Quantitative Assessment Processes for Assessing and Managing Construction Noise



Source: Department of Environment and Climate Change, 2009.

3.1.2 Construction Noise Management Levels

Section 4 of the ICNG (DECC, 2009) details the quantitative assessment method involving predicting noise levels and comparing them with the Noise Management Level (NML) and are important indicators of the potential level of construction noise impact. **Table 2** reproduces the ICNG management levels for residential receivers. The construction Noise Management Level (NML) is the sum of the management level and relevant Rating Background Level (RBL) for each specific assessment period. **Table 3** reproduces the ICNG management levels for other receiver types.

Table 2 ICNG Residential Management Levels

Time of Day	Management Level $LA_{eq(15min)}$[1]	How to Apply
Recommended standard hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or public holidays.	Noise affected RBL + 10dB.	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured LAeq(15min) 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 75dBA.	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: • 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. • 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 + 5dB.	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 5dBA above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2.

Note 1: The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the construction NML for noise assessment purposes and is the median of the ABL's.

Table 3 Noise Management Levels for Other Noise Sensitive Receivers		
Land use	Where objective applies	Management Level $LA_{eq(15min)}$[1]
Classrooms at schools and other educational institutions	Internal noise level	45dB
Hospital wards and operating theatres	Internal noise level	45dB
Places of worship	Internal noise level	45dB
Active recreation areas	External noise level	65dB
Passive recreation areas	External noise level	60dB
Commercial premises[2]	External noise level	70dB
Industrial premises	External noise level	75dB

Note 1: Noise management levels apply when receiver areas are in use only.

Note 2: Commercial premises includes offices and retail outlets.

For noise sensitive business not considered under the commercial premises definition (ie childcare centres, theatres and accommodation services), suitable noise management levels should be determined on a project-by-project basis with reference to the recommended 'maximum' internal noise levels in AS2107:2016 *Acoustics – Recommended design sound levels and reverberation times for building interiors.*

Where the predicted or measured $LA_{eq(15min)}$ noise level is greater than the NML, the proponent should apply all feasible and reasonable work practices to meet the relevant NML.

3.1.3 Construction Sleep Disturbance

Section 4.3 of the ICNG (DECC, 2009) states that a sleep disturbance assessment is required where construction activities are planned to occur for more than two consecutive nights. Given that construction activities are anticipated to occur during standard construction hours, sleep disturbance has not been considered in this assessment.

3.2 Road Noise Policy

The road traffic noise criteria are provided in the Department of Environment, Climate Change and Water NSW (DECCW), Road Noise Policy (RNP), 2011. The policy sets out noise criteria applicable to different road classifications for the purpose of quantifying traffic noise impacts. Road noise criteria relevant to this assessment are presented in detail in **Section 5.3**.

4 Existing Environment

4.1 Unattended Noise Monitoring

To quantify the existing background noise environment of the area, unattended noise monitoring was conducted at two locations. Unattended monitor (L1) was selected as representative of the ambient environment surrounding the project site and road traffic noise along Burrundulla Avenue, while unattended monitor (L2) was selected only to quantity road traffic noise along George Street. Observations at the monitoring locations identified that environmental noise (birds), local road noise and domestic noise (lawn mowing) dominated the noise environment. The selected monitoring locations are shown in **Figure 2.**

The unattended noise survey was conducted in general accordance with the procedures described in Standards Australia AS 1055:2018, "Acoustics – Description and Measurement of Environmental Noise".

The noise measurements were carried out using Svantek 977 noise analysers from Thursday 9 March 2023 to Friday 17 March 2023. The acoustic instrumentation used carries current NATA calibration and complies with AS/NZS IEC 61672.1-2019-Electroacoustics - Sound level meters - Specifications. Calibration of instrumentation was checked prior to and following the measurements. Drift in calibration did not exceed ±0.5dBA. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates with records of all calibrations maintained by MAC as per Approved Methods for the measurement and analysis of environmental noise in NSW (EPA, 2022).

Data affected by adverse meteorological conditions have been excluded from the results in accordance with methodologies provided in Fact Sheet A4 of the NPI. These criteria are used in conjunction with the intrusiveness criteria to determine the limiting criteria. The results of long-term unattended noise monitoring are provided in **Table 4** for ambient noise levels and **Table 5** for road traffic noise levels. The noise monitoring charts and daily Assessment Background Levels (ABLs) are provided in **Appendix C**.

Table 4 Background Noise Monitoring Summary

Location	Representative Receivers	Measured Background Noise Level (dB LA_{90}) RBL[1]			Measured dB $LA_{eq(period)}$		
		Day	Evening	Night	Day	Evening	Night
L1	Suburban	35	35 (37)[2]	34	57	52	49

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

Note 1: Excludes periods of wind or rain affected data. Meteorological data obtained from the Bureau of Meteorology weather station Mudgee Airport AWS 32.6°S 149.6°E 471m AMSL.

Note 2: In accordance with the NPI, the evening and night period RBLs should be set no higher than the RBL for the less sensitive day period.

Table 5 Unattended Noise Monitoring Results – Road Traffic Noise		
ID	Measured Road Traffic Noise dB LA_{eq}	
	Day Period (7am to 10pm)	Night Period (10pm to 7am)
L1	56	48
L2	50	45

Note: Road noise is assessed over two periods, Day 7am to 10pm and Night 10pm to 7am (ie no evening).

5 Assessment Criteria

5.1 Construction Noise Criteria

The relevant Noise Management Levels (NMLs) for standard construction hours are presented in **Table 6**. Accommodation services in the immediate surrounds of the project site have been identified as predominantly bed and breakfast or short-term rental accommodation types. Hence, accommodation services are conservatively assessed against the residential receiver type NML.

It is noted that no construction works outside of standard construction hours are proposed.

Table 6 Construction Noise Management Levels

Receiver	Assessment Period	Measured RBL dB LA_{90}	NML dB $LA_{eq(15min)}$
Residential[1]	Standard Hours	35	45 (RBL+10dBA)
Active Recreation	When in use	N/A	65 (external)

Note 1: Residential land use category includes accommodation services.

5.2 Construction Vibration

Department of Environment and Conservation (DEC) 2006, *Assessing Vibration: A Technical Guideline* (the Guideline) provides guidance on determining effects of vibration on buildings occupants. The Guideline does not address vibration induced damage to structures, blast induced vibration effects or structure borne noise effects.

The Construction Noise & Vibration Strategy (CNVS, V4.2 Transport for NSW, 2019) sets out safe working distances to achieve the human response and cosmetic damage criteria for vibration. The key vibration generating source proposed to be used is a vibratory roller for road construction. **Table 7** provides the minimum working distances for the use of various vibratory rollers to nearby receivers to meet the relevant criteria. It is important to note that the minimum working distances are indicative and will vary depending on the particular item of plant and local geotechnical conditions.

Table 7 Minimum Working Distances or Vibratory Plant (m)

Plant item	Rating / Description	Minimum working distance	
		Cosmetic damage (BS 7385)	Human response (OH&E)
Vibratory Roller	< 50 kN (Typically 1-2 tonnes)	5m	15m to 20m
	< 100 kN (Typically 2-4 tonnes)	6m	20m
	< 200 kN (Typically 4-6 tonnes)	12m	40m
	< 300 kN (Typically 7-13 tonnes)	15m	100m
	> 300 kN (Typically 13-18 tonnes)	20m	100m
	> 300 kN (> 18 tonnes)	25m	100m
Steel Drum Roller	Hamm HD70 (Oscillating Mode)	2m	8m
	Hamm HD70 (Static Mode)	1m	4m
Asphalt Paver	Vogele Super 1800-3	1m	4m

Note: Source, CNVS (Roads and Maritime, 2019).

5.3 Road Traffic Noise Criteria

The road traffic noise criteria are provided in the RNP. For this assessment, the 'local road' category has been adopted for Burrundulla Avenue and George Street. The relevant road traffic noise criteria are provided in the RNP and are presented in **Table 8** for residential receivers.

Table 8 Road Traffic Noise Assessment Criteria

Road category	Type of project/development	Assessment Criteria – dBA	
		Day (7am to 10pm)	Night (10pm to 7am)
Local Roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	55dB LAeq(1hr)	50dB LAeq(1hr)

Additionally, the RNP states where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to 2dBA, which is generally accepted as the threshold of perceptibility to a change in noise level.

6 Modelling Methodology

A computer model was developed to quantify project noise emissions to neighbouring receivers for typical construction activities and operations. DGMR (iNoise, Version 2023.02) noise modelling software was used to quantify noise emissions from typical construction activities. iNoise is a new intuitive and quality assured software for industrial noise calculations in the environment. 3D noise modelling is considered industry best practice for assessing noise emissions from projects.

The model incorporated a three-dimensional digital terrain map giving all relevant topographic information used in the modelling process. Additionally, the model uses relevant noise source data, ground type, attenuation from barrier or buildings and atmospheric information to predict noise levels at the nearest potentially affected receivers. Where relevant, modifying factors in accordance with Fact Sheet C of the NPI have been applied to calculations.

The model calculation method used to predict noise levels was in accordance with ISO 9613-1 'Acoustics - Attenuation of sound during propagation outdoors. Part 1: Calculation of the absorption of sound by the atmosphere' and ISO 9613-2 'Acoustics - Attenuation of sound during propagation outdoors. Part 2: General method of calculation' including corrections for meteorological conditions using CONCAWE[1]. The ISO 9613 standard from 1996 is the most used noise prediction method worldwide. Many countries refer to ISO 9613 in their noise legislation. However, the ISO 9613 standard does not contain guidelines for quality assured software implementation, which leads to differences between applications in calculated results. In 2015 this changed with the release of ISO/TR 17534-3. This quality standard gives clear recommendations for interpreting the ISO 9613 method. iNoise fully supports these recommendations. The models and results for the 19 test cases are included in the software.

6.1 Construction Assessment Methodology

Construction activities are proposed to be progressive and will occur at several locations simultaneously. Noise emissions were modelled for the following four scenarios:

- bulk earthworks including drainage structures;
- installation of utilities;
- construction of internal roads and kerbing; and
- construction of dwellings.

[1] Report no. 4/18, "the propagation of noise from petroleum and petrochemical complexes to neighbouring communities", Prepared by C.J. Manning, M.Sc., M.I.O.A. Acoustic Technology Limited (Ref.AT 931), CONCAWE, Den Haag May 1981

Noise emission data and assumptions used in this assessment are summarised in **Table 9**.

Table 9 Construction Equipment Sound Power Levels, Lw dBA (re 10^{-12} W)		
Noise Source/Item	Utilisation %	Total Lw
Site Clearing, Earthworks and Drainage		
Bulldozer (D6)	100% utilisation	108
Tracked Excavator (35t)	100% utilisation	110
Chainsaw	50% utilisation	111
Tipper Trucks	4/hr	108
Compactor	100% utilisation	106
Padfoot Roller	100% utilisation	109
Total – Site Clearing & Earthworks		**117**
Installation of Utilities		
Road Trucks	4/hr	103
Franna Crane (20t)	100% utilisation	98
Backhoe	100% utilisation	104
Tracked Excavator (35t)	100% utilisation	110
Total – Utilities		**112**
Road Pavement & Kerbing		
Pavement Laying Machine	100% utilisation	114
Road Trucks	4/hr	103
Asphalt Truck & Sprayer	100% utilisation	106
Concrete Truck	100% utilisation	109
Smooth Drum Roller	100% utilisation	108
Total – Roads		**117**
Dwelling Construction		
Hand Tools	100% utilisation	97
Power Tools	100% utilisation	**105**
Material Deliveries	4/hr	**103**
Total – Dwelling Construction		**108**

6.2 Road Traffic Noise Assessment Methodology

6.2.1 Road Traffic Noise Model

Due to the low traffic volumes on the local road network, particularly during the night period, road traffic noise calculation methods such as Calculation of Road Traffic Noise (CRTN - ISBN 0 11 550847 3) by Department of Transport (UK) 1988 or Traffic Noise Model (TNM) by the United States Department of Transport, Federal Highway Administration are not considered appropriate as they are primarily intended to calculate noise emissions from motorways and highways. Therefore, road traffic noise has been modelled using iNoise modelling software using ISO 9613-1 and ISO 9613-2 calculation methods, representing the road traffic as "moving sources" along the transport routes using the parameters presented in **Table 10.**

Table 10 Road Traffic Noise Modelling Parameters

Noise Source/Item	Lw dBA re 10^{-12} W	Speed, km/h	Source Height[1]	Receiver Height[1]	Correction Factor
Light Vehicle	96	40	0.5m	1.5m	+2.5dB Façade Correction -1.7dB ARRB Correction

Note 1: Height above ground level.

Section 5 of the Traffic and Parking Assessment (TTPP, 2023) provides peak hour traffic projections using an average generation rate of 0.73 movements per dwelling for the AM peak and 0.77 movements per dwelling for the PM peak. The total traffic generation during the peak traffic periods would be 38 movements during the AM peak and 40 movements during the PM peak, with 80% of movements distributed to/from George Street and 20% distributed to/from Burrundulla Avenue. Night period (10pm to 7am) peak hourly traffic movements are conservatively assumed to be 20% of the day period peak volume. The assessed peak hour traffic volumes from the project are provided in **Table 11**.

Table 11 Modelled Peak Hour Traffic Generation

Road Segment	Project Peak Hour Traffic Movements (v/hr)	
	Day Period	Night Period
George Street	32	6
Burrundulla Avenue	8	2

6.2.2 Existing Road Traffic Noise

It is understood that detailed traffic counts have not been undertaken for the local road network, including Burrundulla Avenue and George Street. Hence, existing road traffic noise levels were determined through a combination of direct measurement and modelling.

$LA_{eq(period)}$ noise levels were measured at monitoring locations L1 (Burrundulla Avenue) and L2 (George Street). It is noted that the $LA_{eq(period)}$ noise levels are a measure of all noise sources in the locality. Therefore, the $LA_{eq(period)}$ noise levels were adjusted by -3dBA to account for extraneous noise sources (ie domestic noise, distant traffic, environmental noise etc).

To determine the existing road traffic noise levels at the nearest residential receivers, a model was prepared to calculate the difference in noise levels between the monitoring locations and the nearest residential receiver locations. The difference in noise levels was then applied to the measured noise levels as a correction factor to determine the existing road traffic noise levels.

As the noise monitoring was undertaken in the free field, a +2.5dB correction factor was applied to determine the existing noise levels at the dwelling façade as per the RNP. A summary of the existing road traffic noise levels is provided in **Table 12**.

Table 12 Existing Road Traffic Noise Levels

Road Segment	Existing Road Traffic Noise Levels, dB $LA_{eq(period)}$[1]	
	Day (7am to 10pm)	Night (10pm to 7am)
Burrundulla Avenue	53.6	45.9
George Street	52.0	47.5

Note 1: Includes +2.5dB façade correction factor.

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7 Noise Assessment Results

7.1 Construction Noise Assessment

Construction noise levels have been predicted for sensitive receiver locations for each of the construction scenarios described in **Section 6.1**.

A summary of the predicted $LA_{eq(15min)}$ noise emissions are presented for the most affected receiver location for residential receivers and active recreation areas (Apex Park) in **Table 13**. Predicted levels exceeding the NMLs are displayed in **BOLD** text. **Table 14** provides a summary of the predicted noise affected area for each construction scenario, which is the distance from the project site where noise levels are predicted to exceed the NMLs. For detailed mapping of the affected areas, noise contours for each modelled scenario are presented in **Figure 4** to **Figure 7**.

Table 13 Summary of Noise Assessment Results – Most Affected Receivers

Receiver Type	Period	NML (dB LA_{eq})	Highest Predicted dB LA_{eq} Per Scenario			
			Earthworks	Utilities	Internal Roads	Dwellings
Residential	Standard	45	**67**	**64**	**70**	**59**
Accommodation			**67**	**62**	**64**	**63**
Active Recreation	When in use	65	48	45	46	43

Note: Exceedance of relevant NMLs highlighted and shown in **BOLD**.

The results of the assessment demonstrate that $LA_{eq(15min)}$ noise emissions would be above the relevant NMLs for the nearest residential receivers during each construction scenario. The highest $LA_{eq(15min)}$ noise levels are predicted for residential receivers at up to 70dB at Unit 12, 11-13 George Street, 17 George Street and 12 Dennison Street during construction of the internal roads. Construction noise emissions are not predicted to exceed the NMLs for non-residential receivers during any of the construction scenarios.

Table 14 Summary of Noise Assessment Results – Affected Distances

Receiver Type	Period	NML (dB LA_{eq})	Affected Distance (m)			
			Earthworks	Utilities	Internal Roads	Dwellings
Residential	Standard	45	~375	~220	~340	~175

The results of the analysis demonstrate that residential receivers, including accommodation services, within approximately 375m of the project site would potentially experience noise levels above the NML for standard construction hours during earthworks / site clearing. During the installation of utilities, residential receivers within approximately 220m would potentially experience noise levels above the standard hours NML, while residential receivers within approximately 340m and 175m would potentially experience noise levels above the standard hours NML during construction of internal roads and dwelling construction respectively.

No receivers are predicted to experience noise levels above the highly noise affected management level of 75dB $LA_{eq(15min)}$.

It is noted that the assessment assumed that all construction plant and equipment would operate simultaneously and at full capacity for the duration of the construction period. Therefore, the results of the assessment represent the upper range of potential site noise emissions, and maximum extent of noise affected areas.

FIGURE 4

Construction Noise Contours

Scenario 1 - Earthworks

MAC231784-01

10-12 Burrundulla Avenue

KEY

Project Site

LAeq(15min) Noise Contours

- 45dB
- 50dB
- 55dB
- 60dB
- 65dB
- 70dB

0 40 80 120 160 200 m

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FIGURE 5

Construction Noise Contours

Scenario 2 - Utilities

MAC231784-01

10-12 Burrundulla Avenue

KEY

Project Site

LAeq(15min) Noise Contours

- 45dB
- 50dB
- 55dB
- 60dB
- 65dB
- 70dB

0 40 80 120 160 200 m

N

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MORTIMER STREET
LEWIS STREET
LAWSON STREET
GLADSTONE STREET
RIVER LANE
JULIA COURT
MULGOA WAY
DENISON STREET
MEALEY STREET
CEDAR AVENUE
GUNDYS LANE
LOCHIEL LANE
BURRUNDULLA AVENUE
WINBOURNE STREET
HORATIO STREET
LYONS LANE
GEORGE STREET
SYDNEY ROAD
INGLIS STREET
FIGURE 6
Construction Noise Contours
Scenario 3 - Internal Roads
MAC231784-01
10-12 Burrundulla Avenue
KEY
Project Site
LAeq(15min) Noise Contours
45dB
50dB
55dB
60dB
65dB
70dB
0
40
80
120
160
200 m
N
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FIGURE 7

Construction Noise Contours

Scenario 4 - Dwellings

MAC231784-01

10-12 Burrundulla Avenue

KEY

Project Site

LAeq(15min) Noise Contours

- 45dB
- 50dB
- 55dB
- 60dB
- 65dB
- 70dB

0 40 80 120 160 200 m

N

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7.2 Construction Vibration Assessment

A review of minimum working distances was undertaken in accordance with the TfNSW CNVS to determine whether vibration intensive activities may result in vibration levels above the human response or cosmetic damage criteria. It is understood that the construction activity with the highest potential for vibration is the use of a vibratory roller during construction of the internal roads.

A review of aerial photography identifies that the nearest residential receivers are located within approximately 2m of the project boundary, and within 5m of the nearest proposed internal road. Based on the minimum working distances provided in **Table 7**, where vibratory rolling is undertaken on internal roads, the nearest residential receivers would potentially experience vibration levels above the cosmetic damage criterion.

Once the final vibratory plant has been selected a review of minimum offset distances should be conducted. Where minimum working distances are exceeded, a different construction method with lower source vibration levels should be considered or exclusion areas established.

7.3 Road Traffic Noise Assessment

Road traffic noise levels from predicted traffic generated by the project were modelled to the nearest receivers on George Street and Burrundulla Avenue. The project related road traffic noise levels were compared to measured $LA_{eq(period)}$ noise levels to determine the potential increase in road traffic noise levels and assessed against the relevant criteria.

The results of the assessment to the most affected receivers on George Street and Burrundulla Avenue are presented in **Table 15**.

Table 15 Road Traffic Noise Assessment – Most Affected Receivers

Travel Route	Period	Criteria, dB $LA_{eq(1hr)}$	Road Traffic Noise dB $LA_{eq(period)}$[1]			Change
			Existing	Project	Future	
Burrundulla Avenue	Day (7am to 10pm)	55	53.6	41.6	53.9	+0.3
	Night (10pm to 7am)	50	45.9	35.5	46.3	+0.4
George Street	Day (7am to 10pm)	55	52.0	48.0	53.5	+1.5
	Night (10pm to 7am)	50	47.5	40.7	48.3	+0.8

Note 1: Includes façade correction of +2.5dB and ARRB correction of -1.7dB.

The results of the assessment demonstrate future road traffic noise levels, comprising existing traffic and project generated traffic would remain below the relevant criteria for the nearest most affected residences on Burrundulla Avenue and George Street. Furthermore, the change in noise levels resulting from the project would be up to +0.4dB $LA_{eq(period)}$ for receivers on Burrundulla Avenue and +1.5dB $LA_{eq(period)}$ for receivers on George Street. Hence, it is considered that the change in noise levels would not result in an additional noise impact at any of the assessed receiver locations.

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8 Recommendations

8.1 Construction Noise Recommendations

The results of the NIA demonstrate that levels during standard construction periods are anticipated to exceed the relevant NMLs for residential receivers and accommodation services during each stage of construction.

To minimise the potential impacts of construction generated noise on nearby sensitive receivers, the following mitigation strategies (see **Table 16**) may be employed to manage noise. Employing these strategies could potentially result in noise level reductions ranging:

- Standard Mitigation – up to 10dBA in instances where space requirements place limitations on the attenuation options available; and
- Level 1 Mitigation – potentially up to 20dBA depending on mixture of measures and noise sources in operation, location and proximity to receivers.

Table 16 Construction Noise Mitigation Measures

Mitigation Level	Mitigation Measures
Standard Mitigation	▪ Toolbox and induction of personnel prior to shift to discuss noise control measures that may be implemented to reduce noise emissions to surrounding receivers; ▪ Training (of employees to conduct quieter work practices); ▪ Avoid shouting, and minimise loud talking where neighbours can be affected; ▪ Equipment which is used intermittently is to be shut down when not in use; ▪ Where possible, machinery will be located/orientated to direct noise away from the closest sensitive receivers; ▪ Undertake regular maintenance of machinery to minimise noise emissions. Maintenance will be confined to standard daytime construction hours and where possible, away from noise sensitive receivers; ▪ The quietest suitable machinery reasonably available will be selected for each work activity; ▪ Avoid queuing of vehicles adjacent to any receivers; ▪ Where practicable, ensure noisy plant/machinery are not working simultaneously in close proximity to receivers; ▪ Where possible, all plant are to utilise a broad band reverse alarm in lieu of the traditional hi-frequency type reverse alarm; and ▪ Minimising the need for reversing or movement alarms.

Table 16 Construction Noise Mitigation Measures	
Mitigation Level	Mitigation Measures
Level 1 Mitigation (Including Standard Mitigation Level)	▪ Scheduling of construction activities to minimise the number of work fronts and simultaneous activities occurring along the boundary to minimise noise levels; ▪ Reduce throttle setting and turn off equipment when not being used; ▪ Wherever possible, subject to feasibility and reasonability, the quietest plant and equipment should be utilised in combination with management measures to minimise noise impacts; ▪ Where vehicle queuing is required, for example due to safety reasons, engines are to be switched off to reduce their overall noise impacts on receivers; ▪ Where available, use temporary site buildings and materials stockpiles as noise barriers; and ▪ Use mobile noise screens (which can achieve noise reductions of up to 8dBA), optimise the positioning of plant and equipment to minimise line of site to receivers or substitute noisy equipment to reduce the noise level at nearby receivers for these activities.

8.2 Vibration Management Recommendations

In general, to minimise vibration impacts during construction/demolition activities, it is recommended that vibrating plant selection takes into account relevant offset distances to receivers to achieve both the human comfort and structural damage criteria.

9 Discussion and Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Impact Assessment for the construction of the proposed multi dwelling (Key Worker) residential subdivision at 10- 12 Burrundulla Avenue, Mudgee, NSW.

The results of the Noise Impact Assessment demonstrate that construction noise levels have potential to exceed relevant construction NMLs for residential receivers during each of the construction phases. During the noisiest activities, identified as earthworks / site clearing and construction of internal roads, construction noise levels of up to 70dB $LA_{eq(15min)}$ are predicted at the nearest residential receivers. Furthermore, residential receivers within approximately 375m of the project site are predicted to experience noise levels above the NML for standard construction hours.

Recommendations have been provided to minimise the potential noise impacts from construction activities. It is important to note that enabling works (ie earthworks, installation of utilities and construction of internal roads), which have the greatest potential for elevated noise levels, would progress quickly. It is also noted that the assessment is highly conservative, assuming all construction equipment operates simultaneously and at full capacity for the duration of the construction period. The results therefore represent the upper range of expected site noise emissions.

A qualitative assessment of potential vibration impacts has been completed. The results of the assessment demonstrate that due to the close proximity of the project site to the neighbouring dwellings, the use of vibratory equipment, such as vibrating rollers, would potentially result in vibration levels above the cosmetic damage criteria. Hence, the safe working distances in **Table 7** should be considered in the selection of plant and equipment.

Assessment of road traffic noise impacts to residents on Burrundulla Avenue and George Street demonstrated that road traffic noise levels are anticipated to remain below the relevant criteria at all assessed receiver locations. Furthermore, increases in road traffic noise levels are predicted to remain below the threshold of perceptibility of 2dBA. Hence, it is considered that the change in noise levels would not result in an additional noise impact at any of the assessed receiver locations.

In summary, the Noise Impact Assessment supports the Development Application for the project incorporating the recommendations and controls outlined in this report.

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Appendix A – Glossary of Terms

A number of technical terms have been used in this report and are explained in **Table A1**.

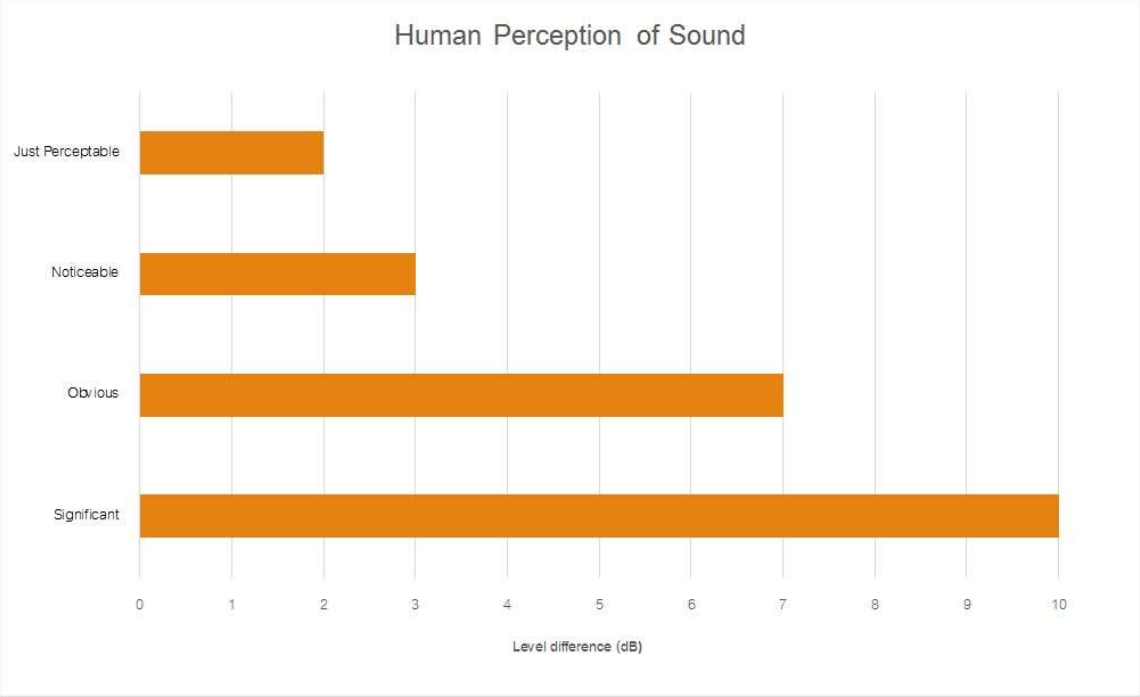
Table A1 Glossary of Acoustical Terms

Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L90 statistical noise levels.
Ambient Noise	The total noise associated with a given environment. Typically, a composite of sounds from all sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to sound.
Background Noise	The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is usually represented by the LA90 descriptor
dBA	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(Z), dB(L)	Decibels Z-weighted or decibels Linear (unweighted).
Extraneous Noise	Sound resulting from activities that are not typical of the area.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA10	A sound level which is exceeded 10% of the time.
LA90	Commonly referred to as the background noise, this is the level exceeded 90% of the time.
LAeq	Represents the average noise energy or equivalent sound pressure level over a given period.
LAmax	The maximum sound pressure level received at the microphone during a measuring interval.
Masking	The phenomenon of one sound interfering with the perception of another sound. For example, the interference of traffic noise with use of a public telephone on a busy street.
RBL	The Rating Background Level (RBL) as defined in the NPI, is an overall single figure representing the background level for each assessment period over the whole monitoring period. The RBL, as defined is the median of ABL values over the whole monitoring period.
Sound power level (Lw or SWL)	This is a measure of the total power radiated by a source in the form of sound and is given by 10.log10 (W/Wo). Where W is the sound power in watts to the reference level of 10^{-12} watts.
Sound pressure level (Lp or SPL)	the level of sound pressure; as measured at a distance by a standard sound level meter. This differs from Lw in that it is the sound level at a receiver position as opposed to the sound 'intensity' of the source.

Table A2 provides a list of common noise sources and their typical sound level.

Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA	
Source	Typical Sound Pressure Level
Threshold of pain	140
Jet engine	130
Hydraulic hammer	120
Chainsaw	110
Industrial workshop	100
Lawn-mower (operator position)	90
Heavy traffic (footpath)	80
Elevated speech	70
Typical conversation	60
Ambient suburban environment	40
Ambient rural environment	30
Bedroom (night with windows closed)	20
Threshold of hearing	0

Figure A1 – Human Perception of Sound



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Appendix B – Subdivision Layout

N O T F O R C O N S T R U C T I O N

ARCHITECT

INTEGRATED DESIGN GROUP
ARCHITECTURE MASTERPLANNING INTERIORS

© Integrated Design Group Pty Ltd
ABN 84 115 006 329
Nominated Architect
Simon Thorne reg. no. 7093
info@idgarchitects.com.au
www.idgarchitects.com.au

NOTES
1. Figured dimensions take precedence over scaled drawings
2. Contractors to check and verify all levels datum and dimensions on site
3. All materials and workmanship to be in accordance with current written manufacturers instructions, local regulations and SAA codes
4. Conflicting information to be brought to notice of the architect and clarification sought before proceeding with any works
5. All drawings are not for construction and are subject to further design development, consultant input, council and legislative requirements
6. Refer to General notes page for legend and abbreviations

DISCIPLINES

Access	#Access (name/contact)
Acoustic	#Acoustic (name/contact)
Arborist	#Arborist (name/contact)
BCA	#BCA (name/contact)
Landscape	LAND (name/contact)
Surveyor	SURVEYOR (name/contact)
Planner	PLANNER (name/contact)
Traffic	#Traffic (name/contact)
Waste	#Waste (name/contact)

DISCIPLINES

Civil	CIVIL (name/contact)
Electrical	ELEC (name/contact)
Geotech	#Geotech (name/contact)
Hydraulic	HYD (name/contact)
Mechanical	MECH (name/contact)
Structure	STRUCT (name/contact)
Builder	BUILDER (name/contact)
PCA	PCA (name/contact)

CLIENT
MID-WESTERN REGIONAL COUNCIL

PROJECT
AFFORDABLE HOUSING DEVELOPMENT

SITE: 10 BURRUNDULLA AVENUE, MUDGEE, NSW,
REF: MRC22098

REVISION

Date	Rev	Description
3/4/2023	A	ISSUE FOR CONSULTANT COORDINATION
9/6/2023	B	ISSUE FOR CONSULTANT COORDINATION
21/7/2023	C	ISSUE FOR CONSULTANT COORDINATION
25/1/2024	D	ISSUE FOR CONSULTANT COORDINATION
13/2/2024	E	ISSUE FOR CONSULTANT COORDINATION
22/2/2024	F	ISSUE FOR CONSULTANT COORDINATION

DRAWING
SITE PLAN

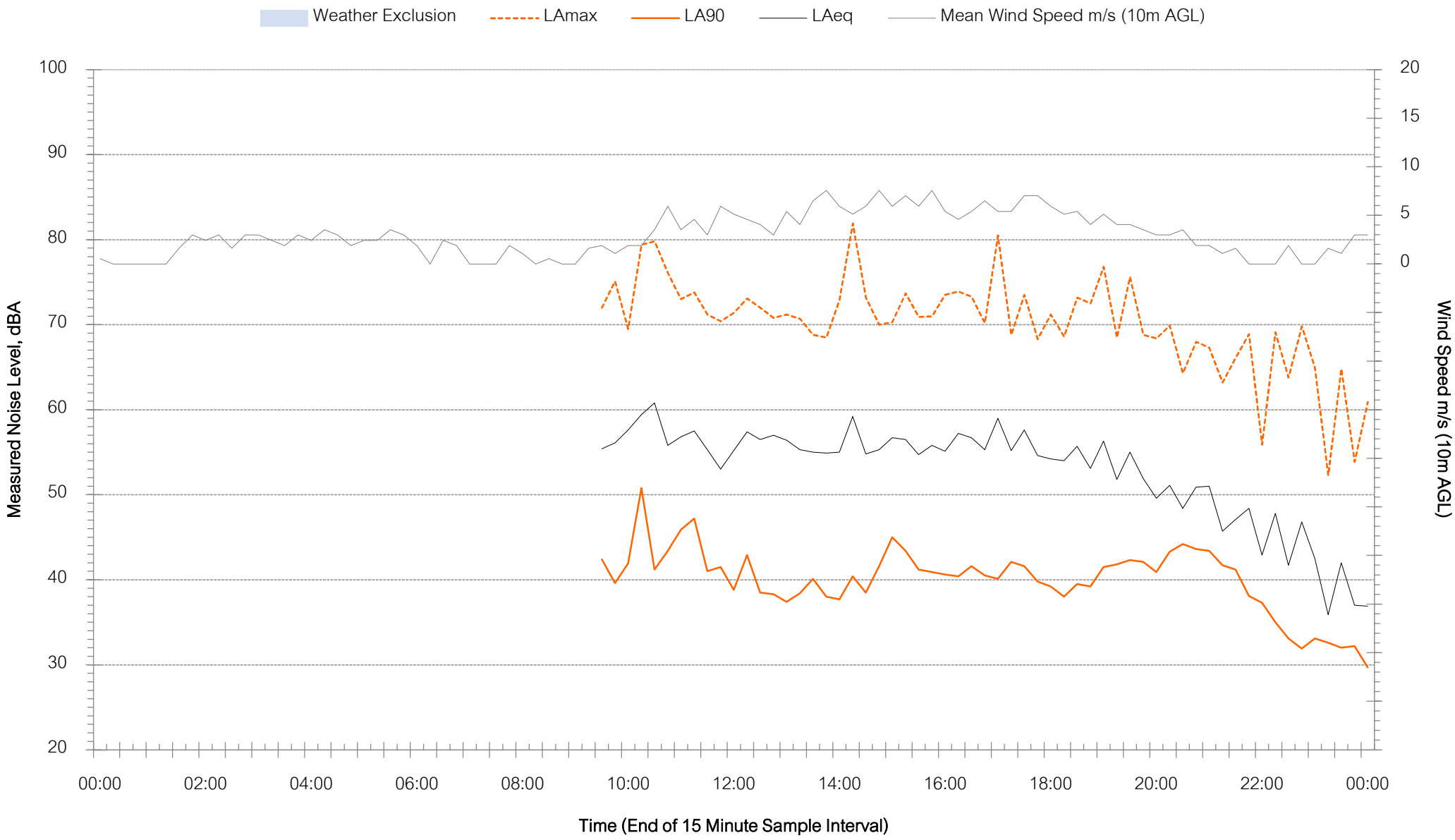
DRAWING DD-0101 ISSUE F

DRAWN EV | TG | AE
CHECKED AE
SCALE 1:300 @ a1

Appendix C – Unattended Monitoring Charts

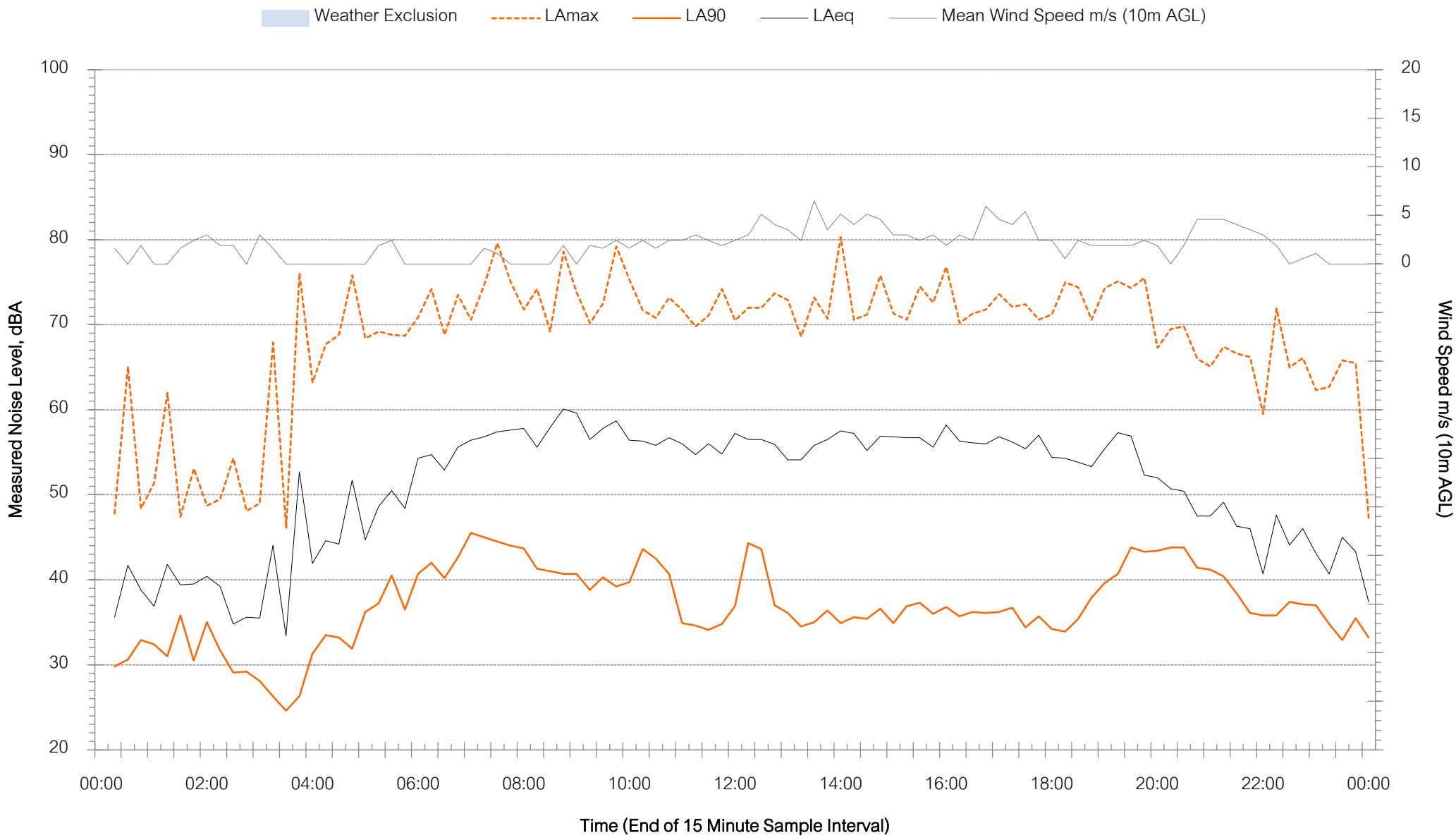
Background Noise Levels

Burrundulla Avenue, Mudgee - Thursday 9 March 2023



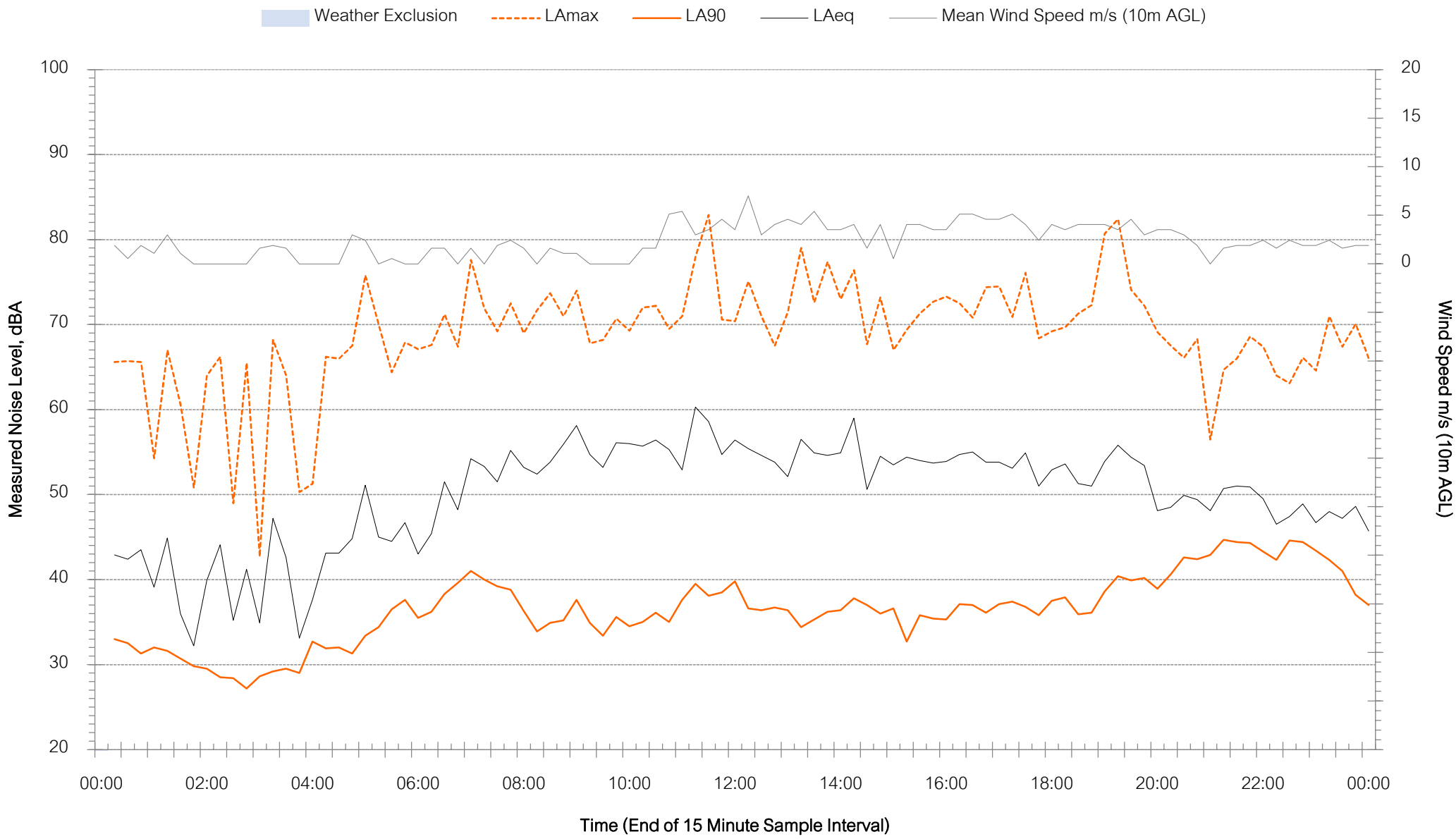
Background Noise Levels

Burrundulla Avenue, Mudgee - Friday 10 March 2023



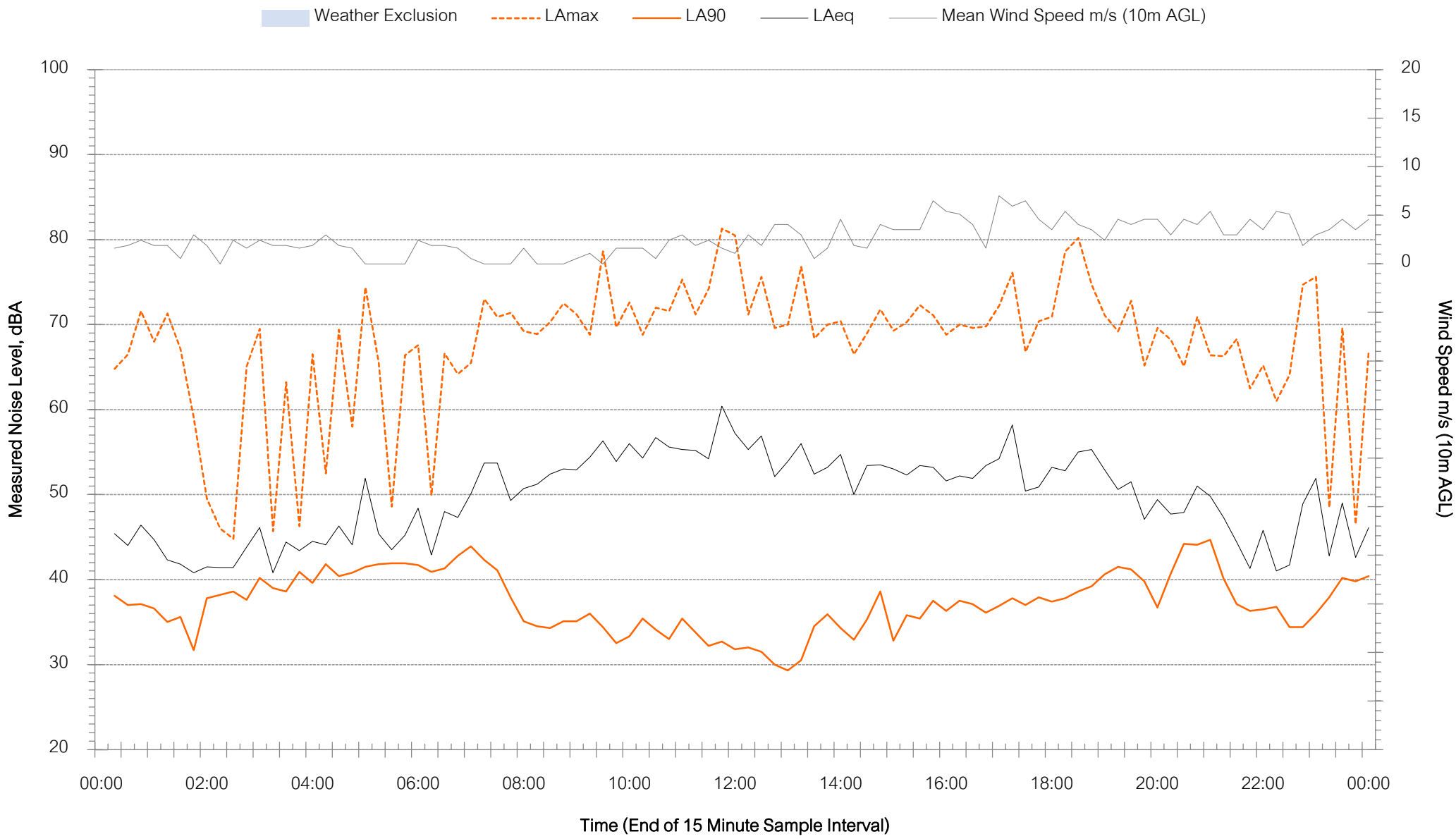
Background Noise Levels

Burrundulla Avenue, Mudgee - Saturday 11 March 2023



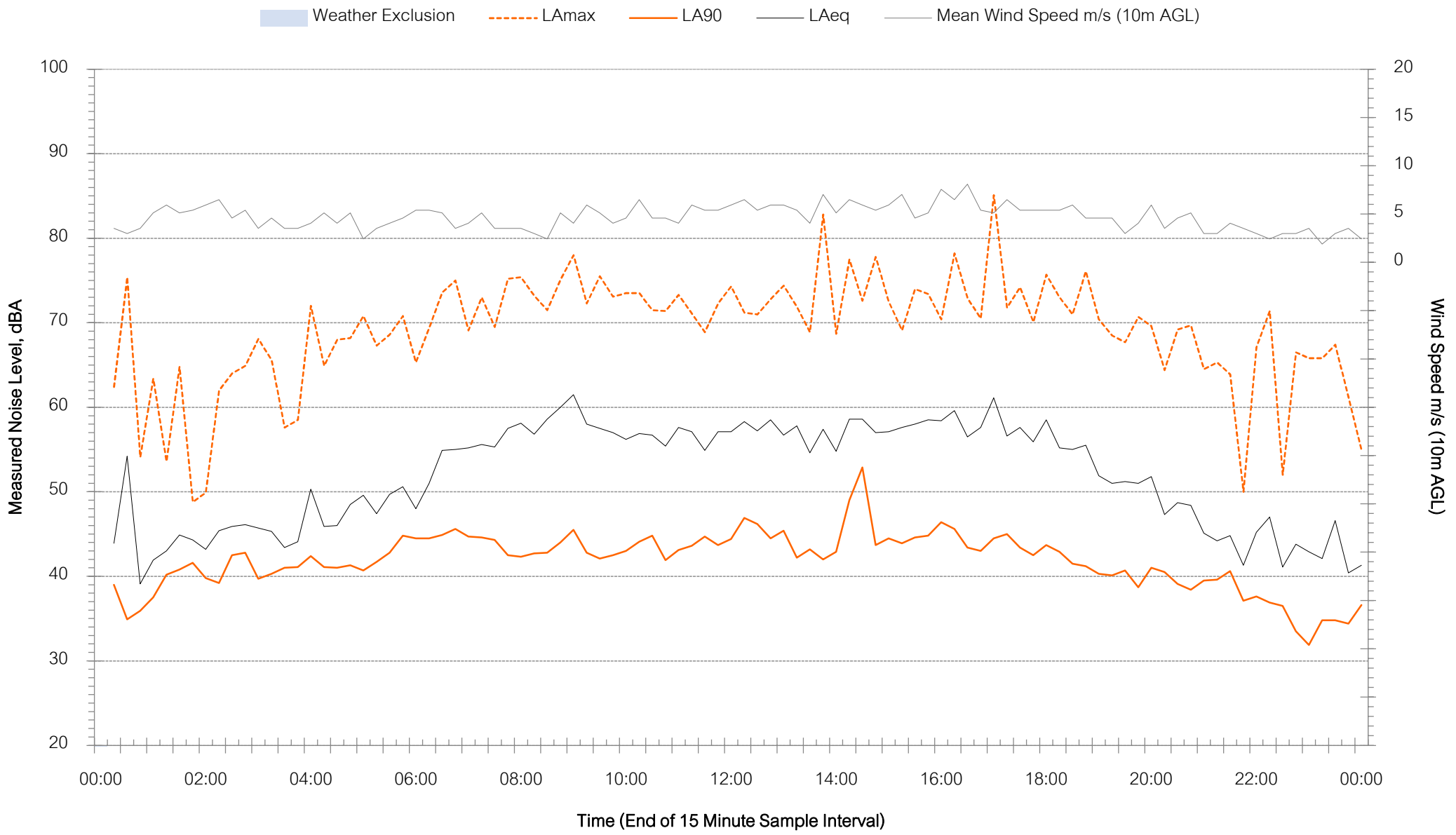
Background Noise Levels

Burrundulla Avenue, Mudgee - Sunday 12 March 2023



Background Noise Levels

Burrundulla Avenue, Mudgee - Monday 13 March 2023



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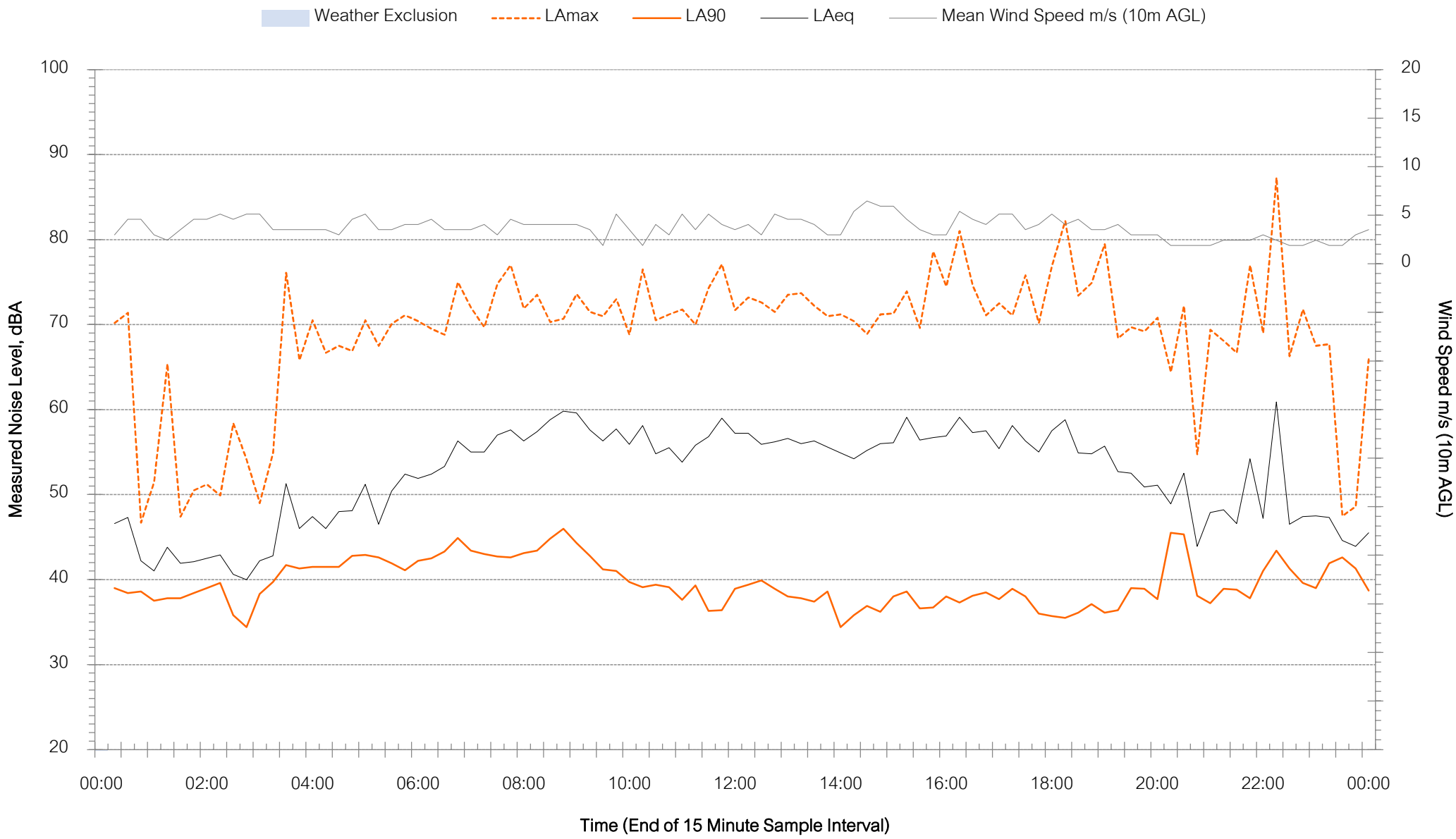
Burrundulla Avenue, Mudgee - Tuesday 14 March 2023



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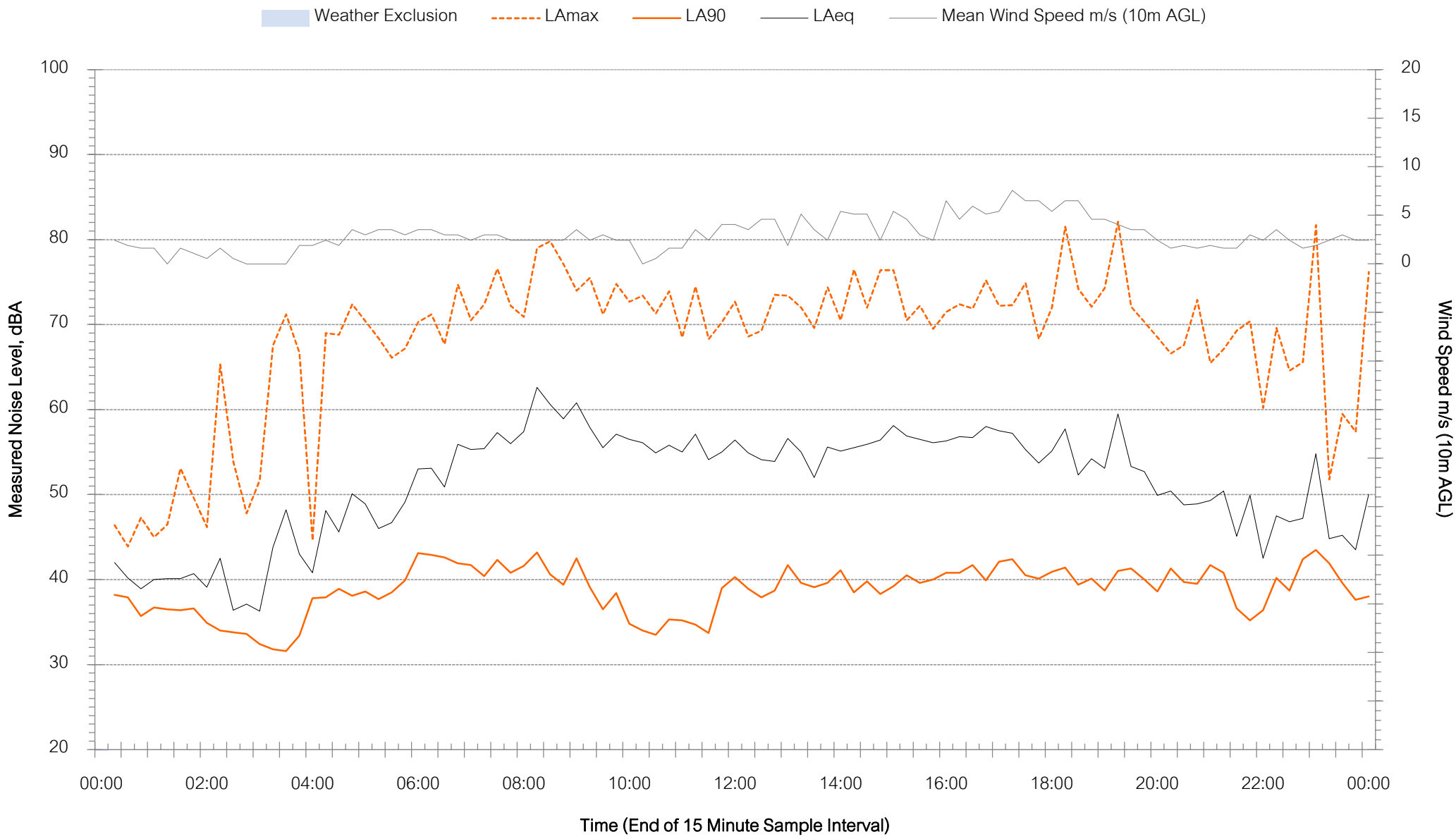
Burrundulla Avenue, Mudgee - Wednesday 15 March 2023



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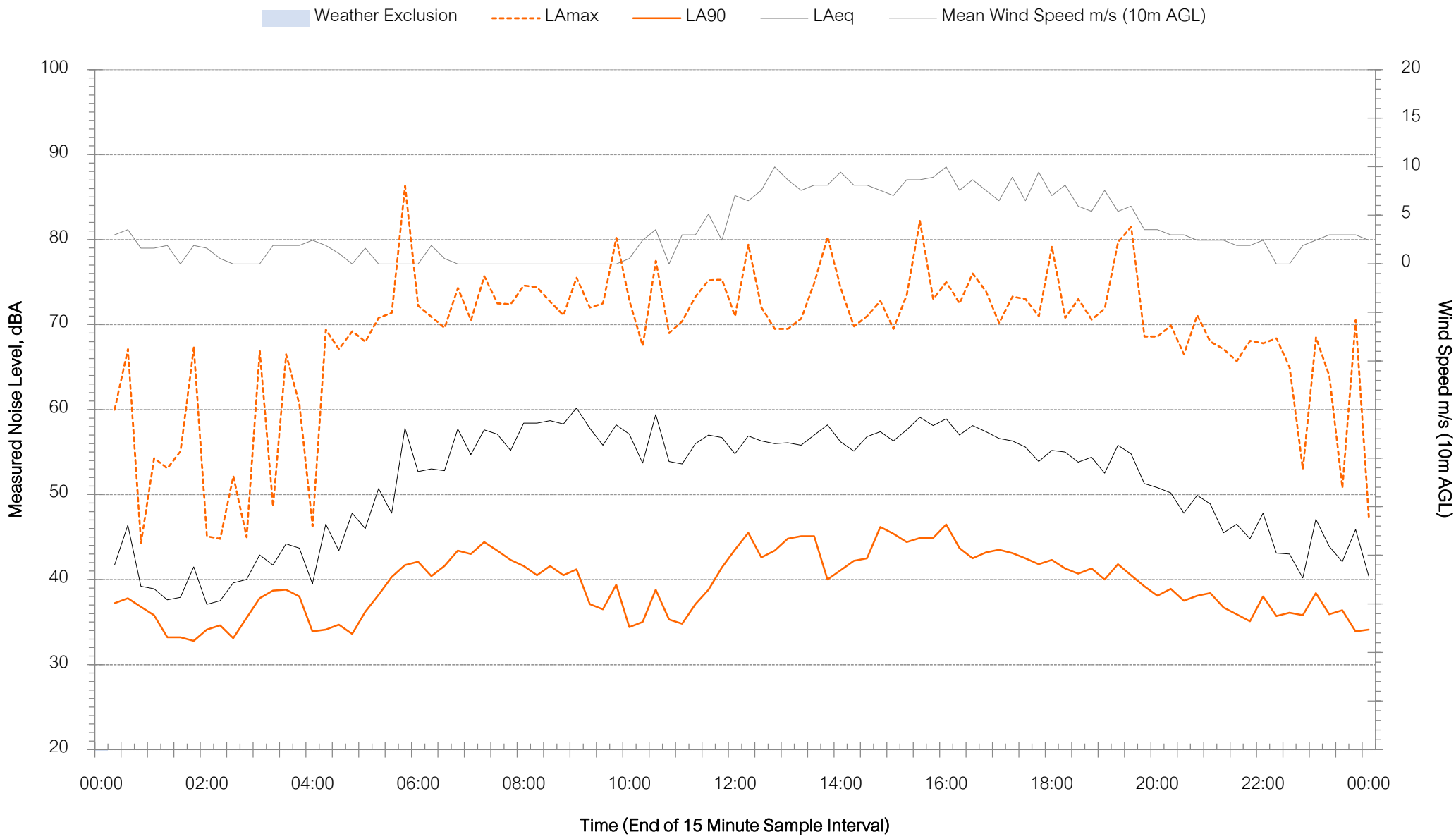

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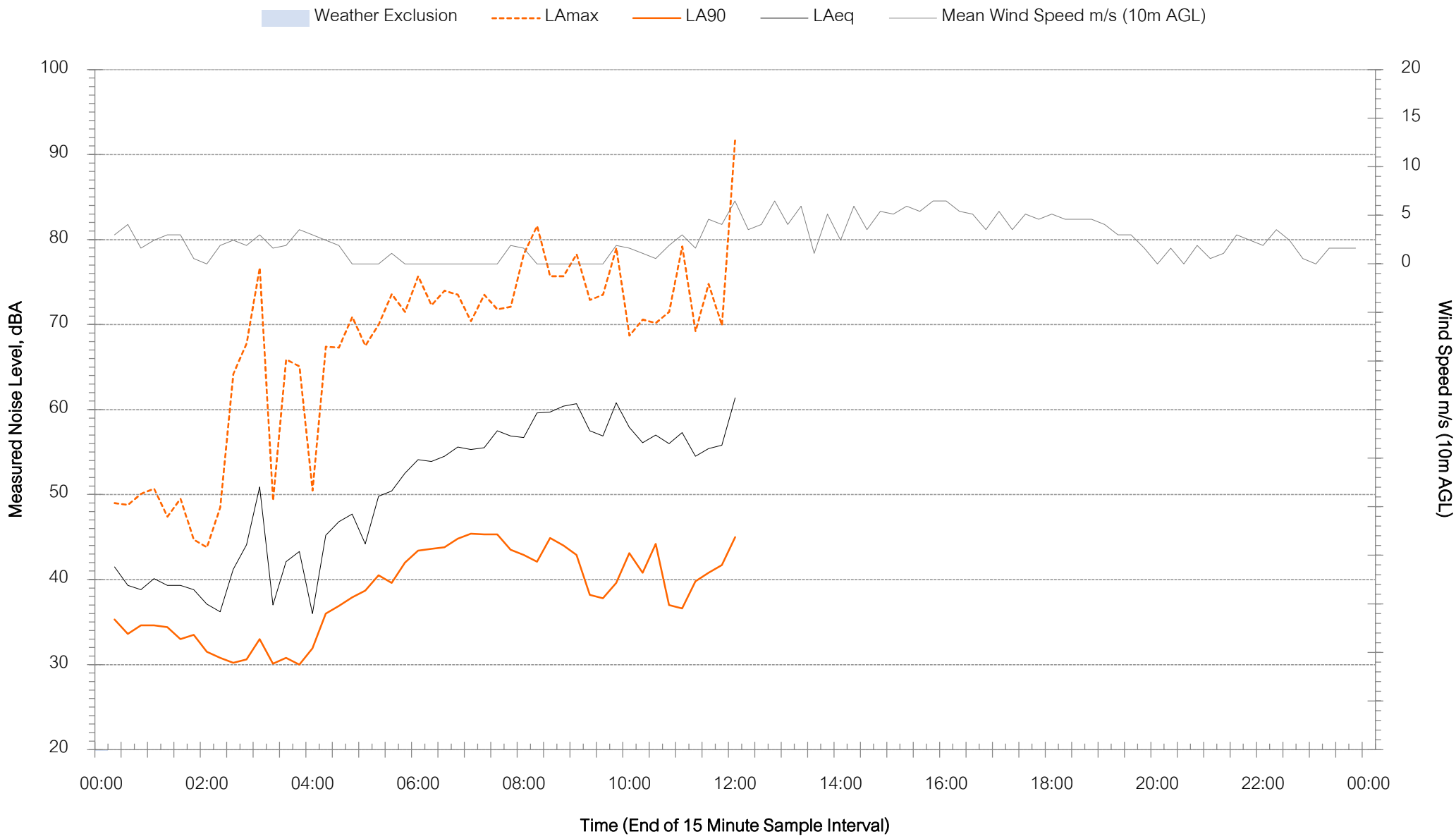
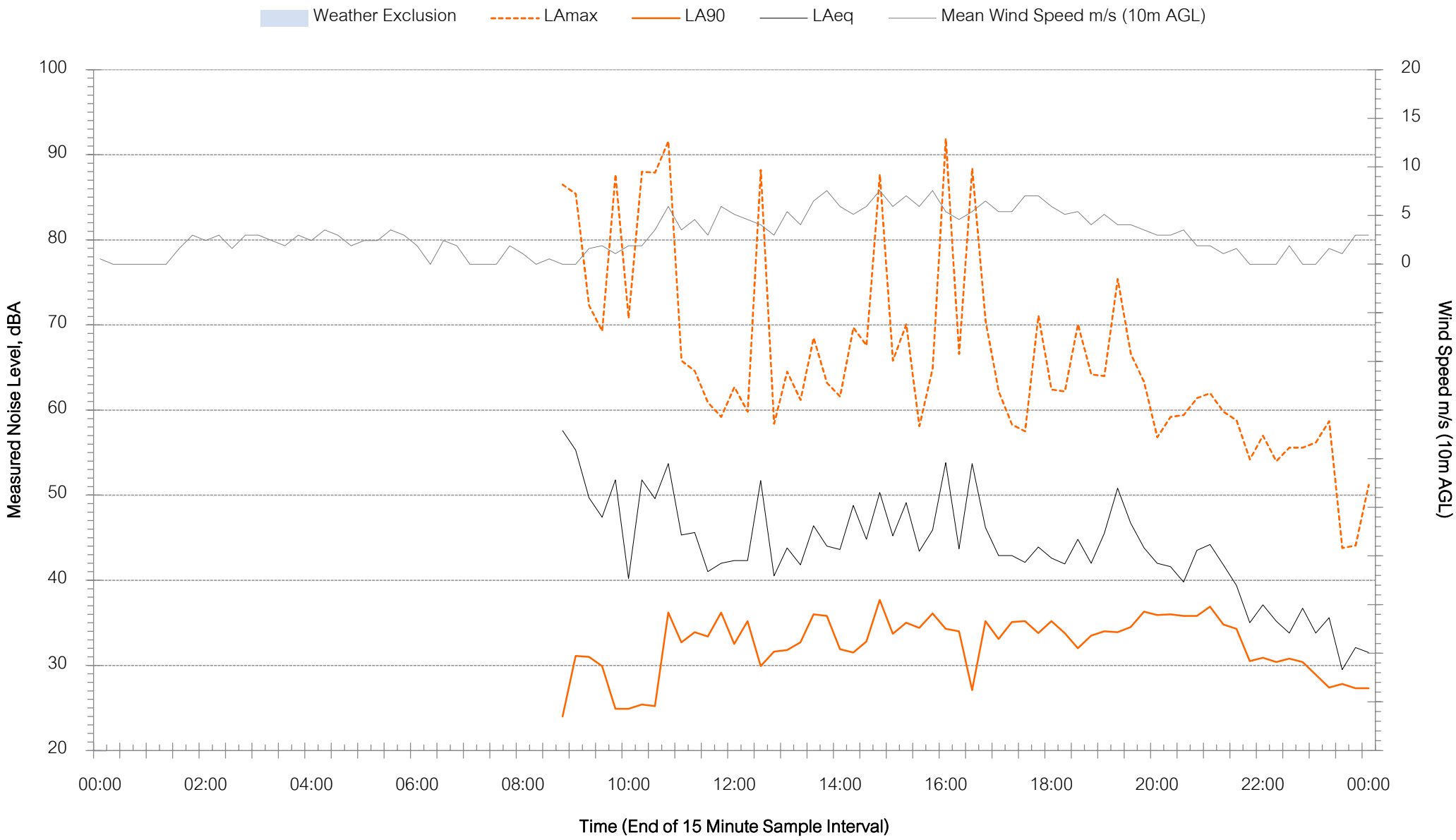


Background Noise Levels

George Street, Mudgee - Thursday 9 March 2023



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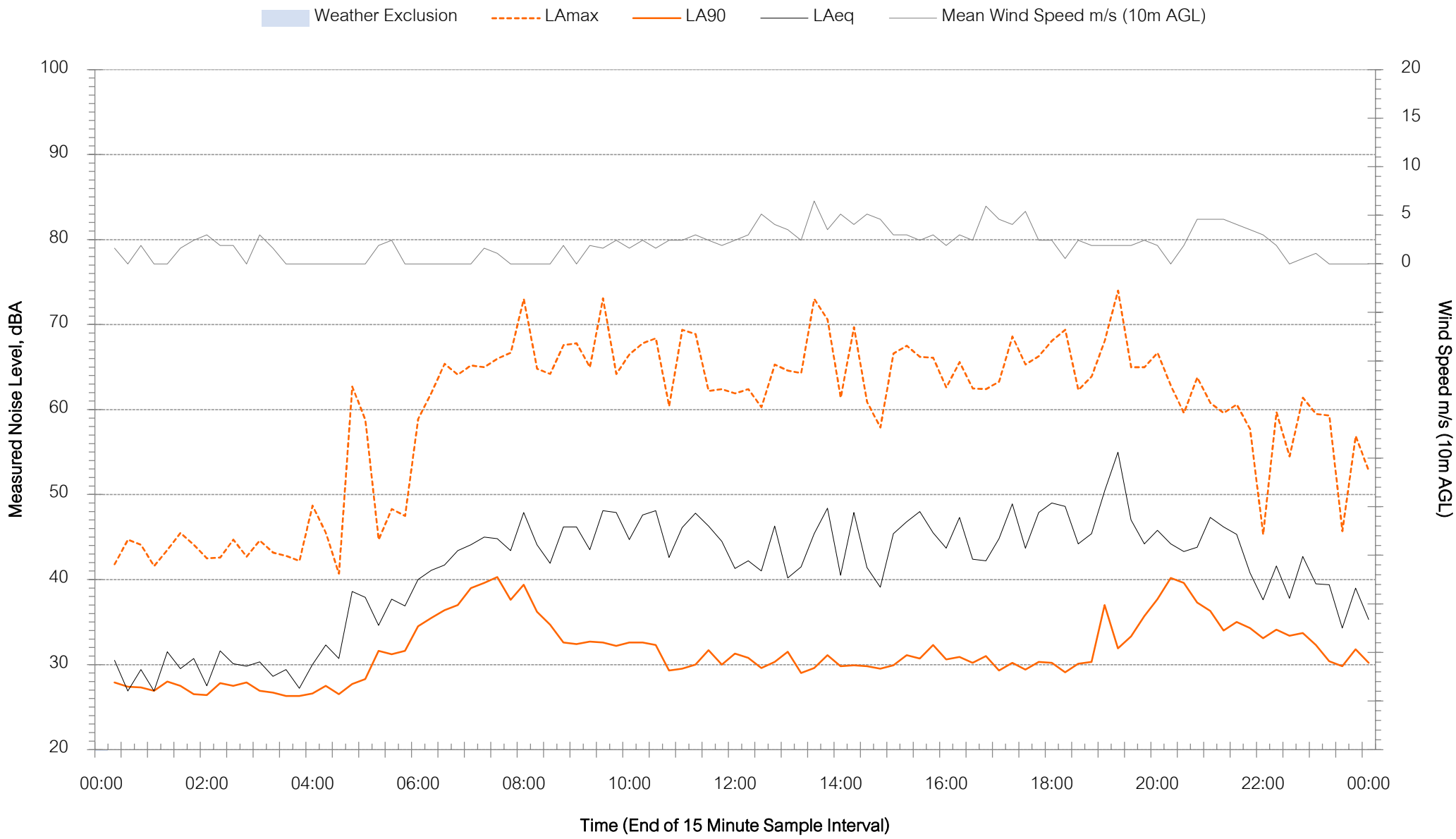

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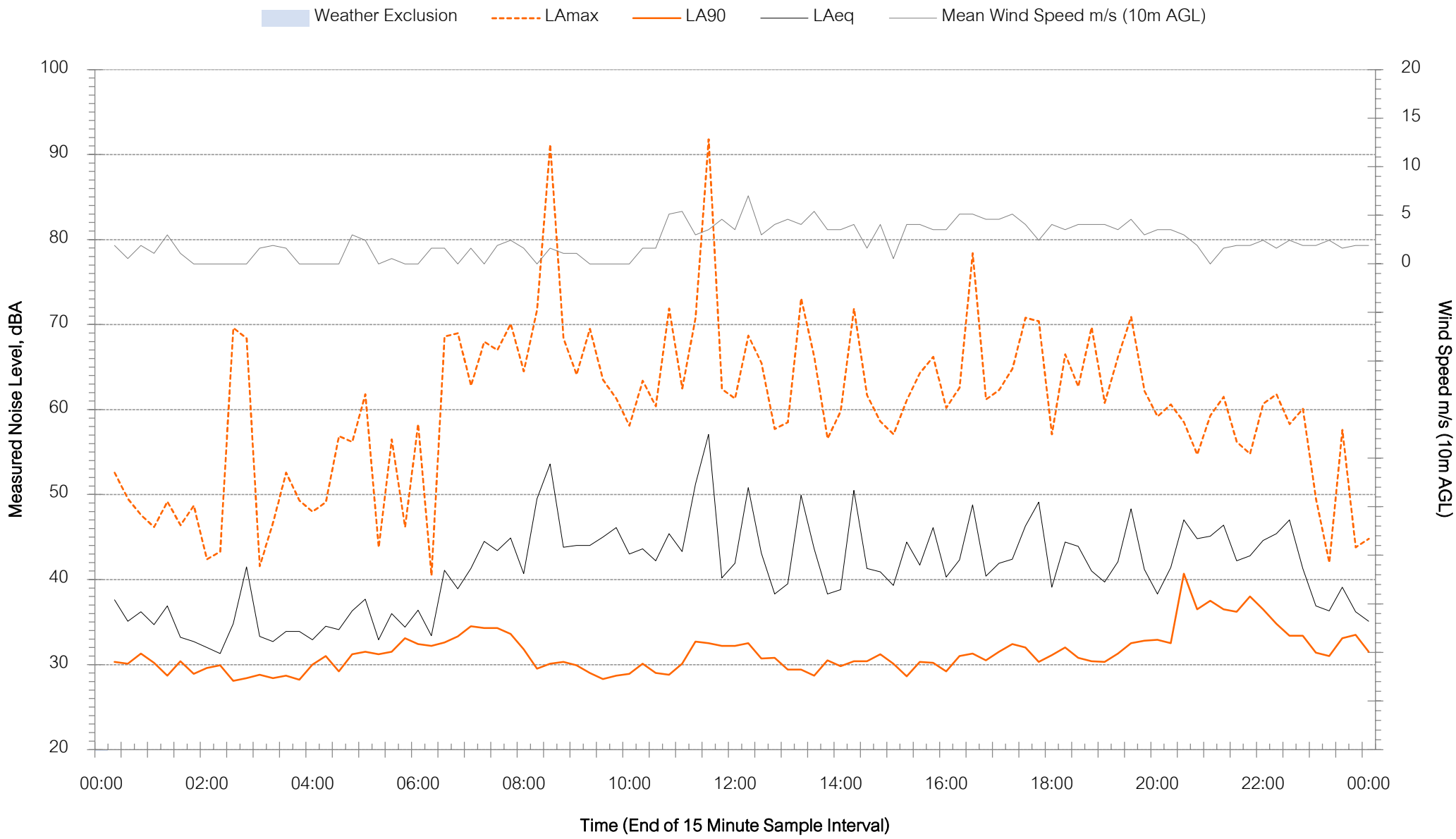
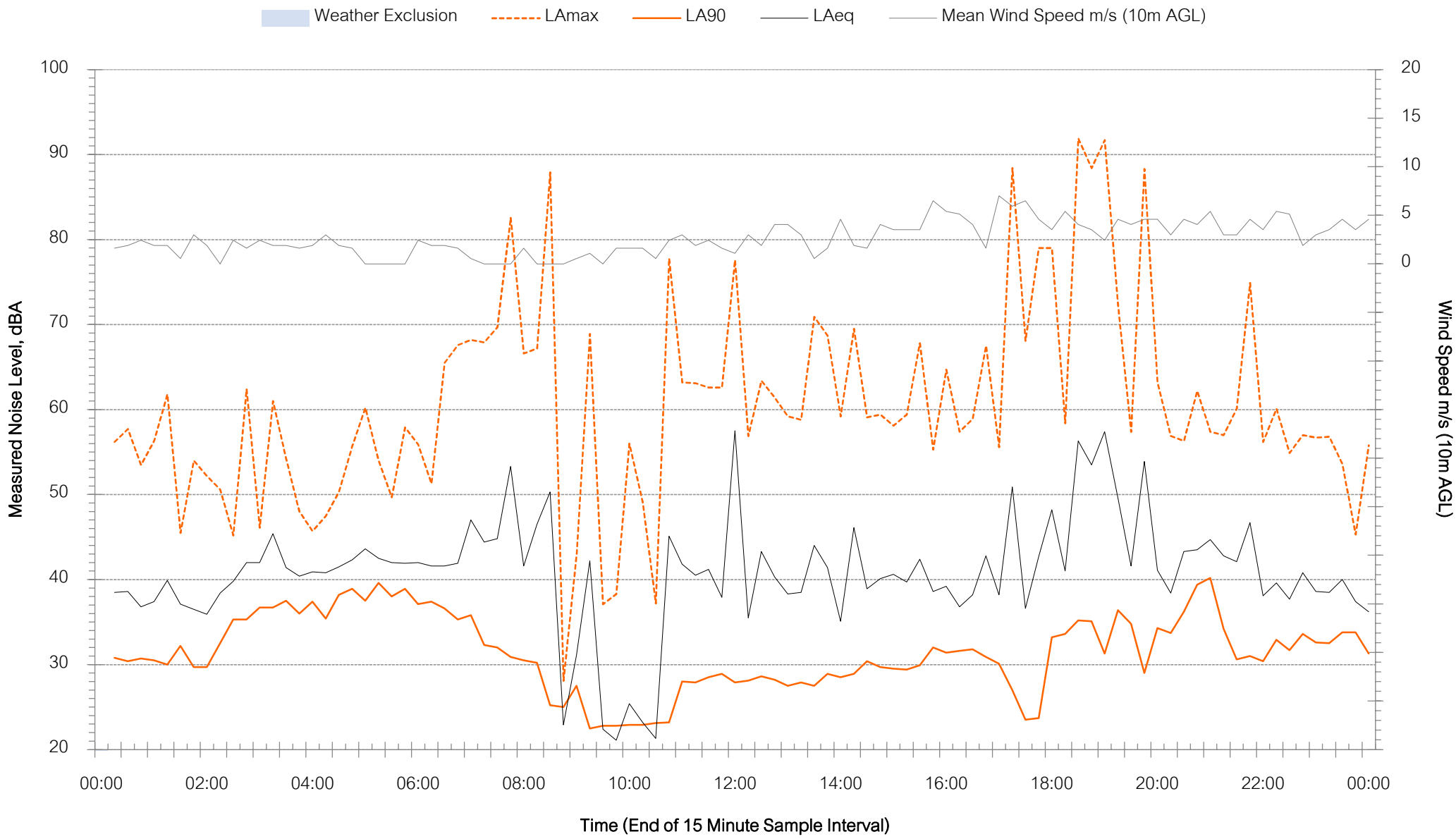
George Street, Mudgee - Saturday 11 March 2023



Background Noise Levels

George Street, Mudgee - Sunday 12 March 2023



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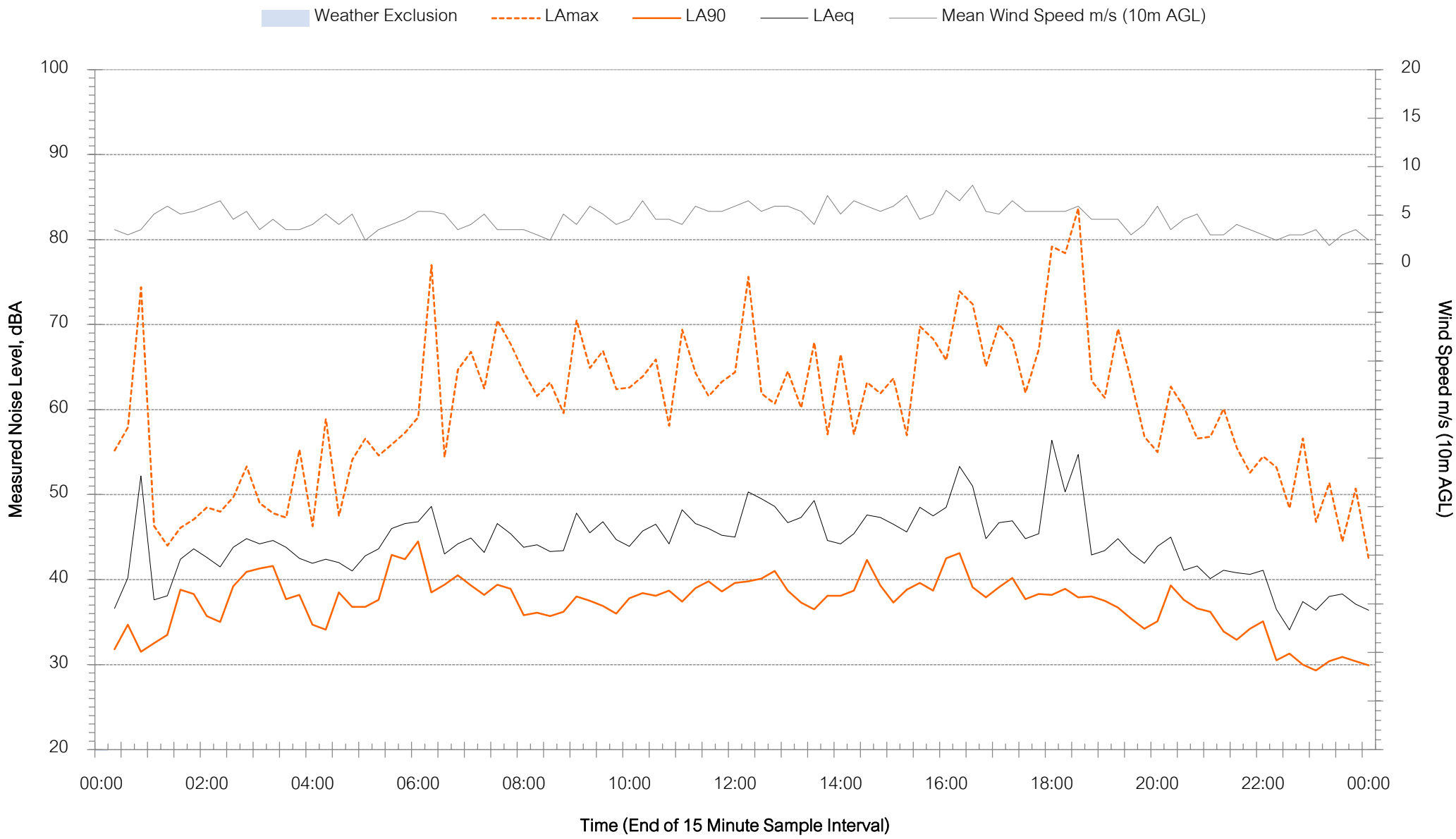
George Street, Mudgee - Monday 13 March 2023



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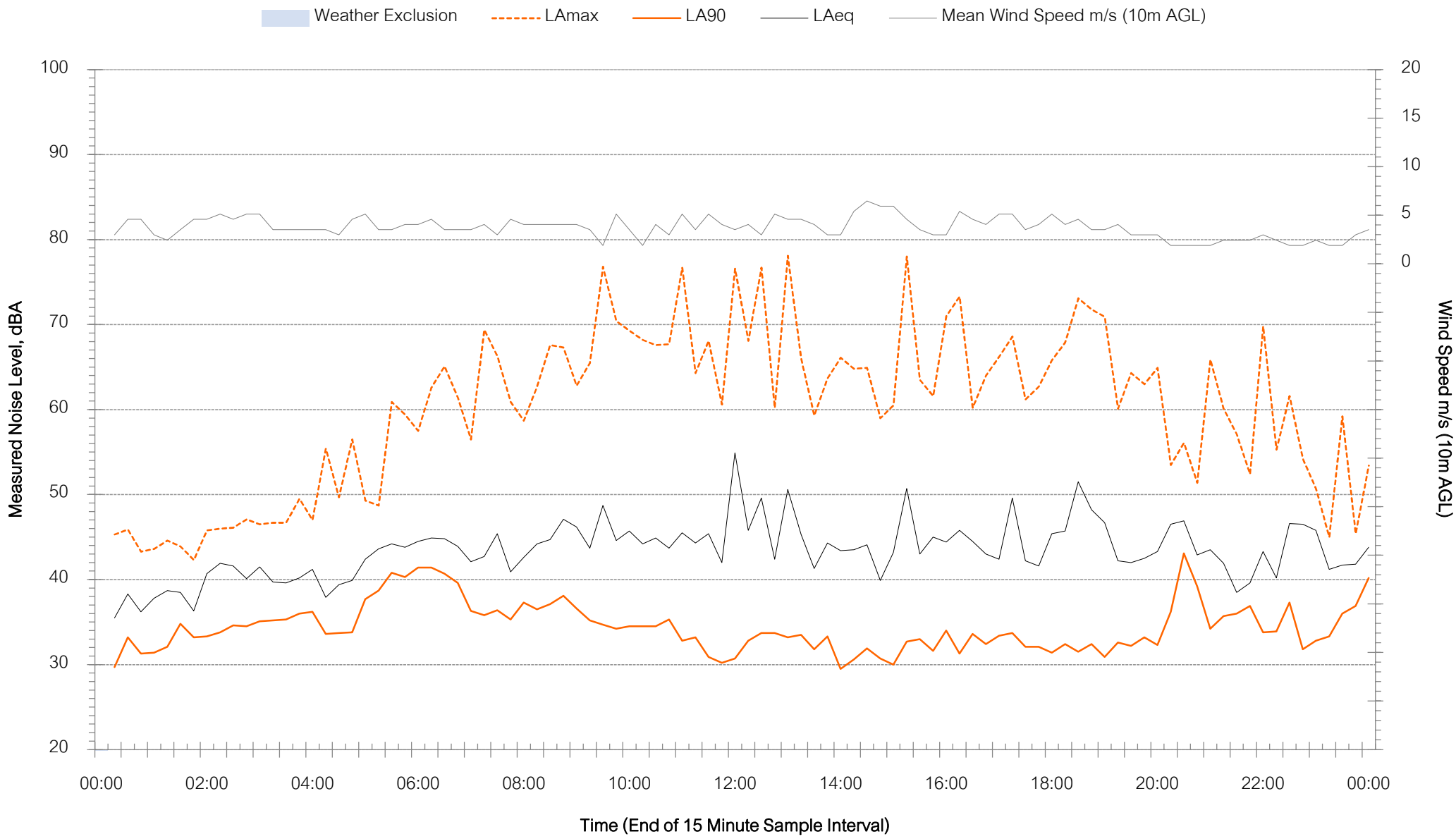

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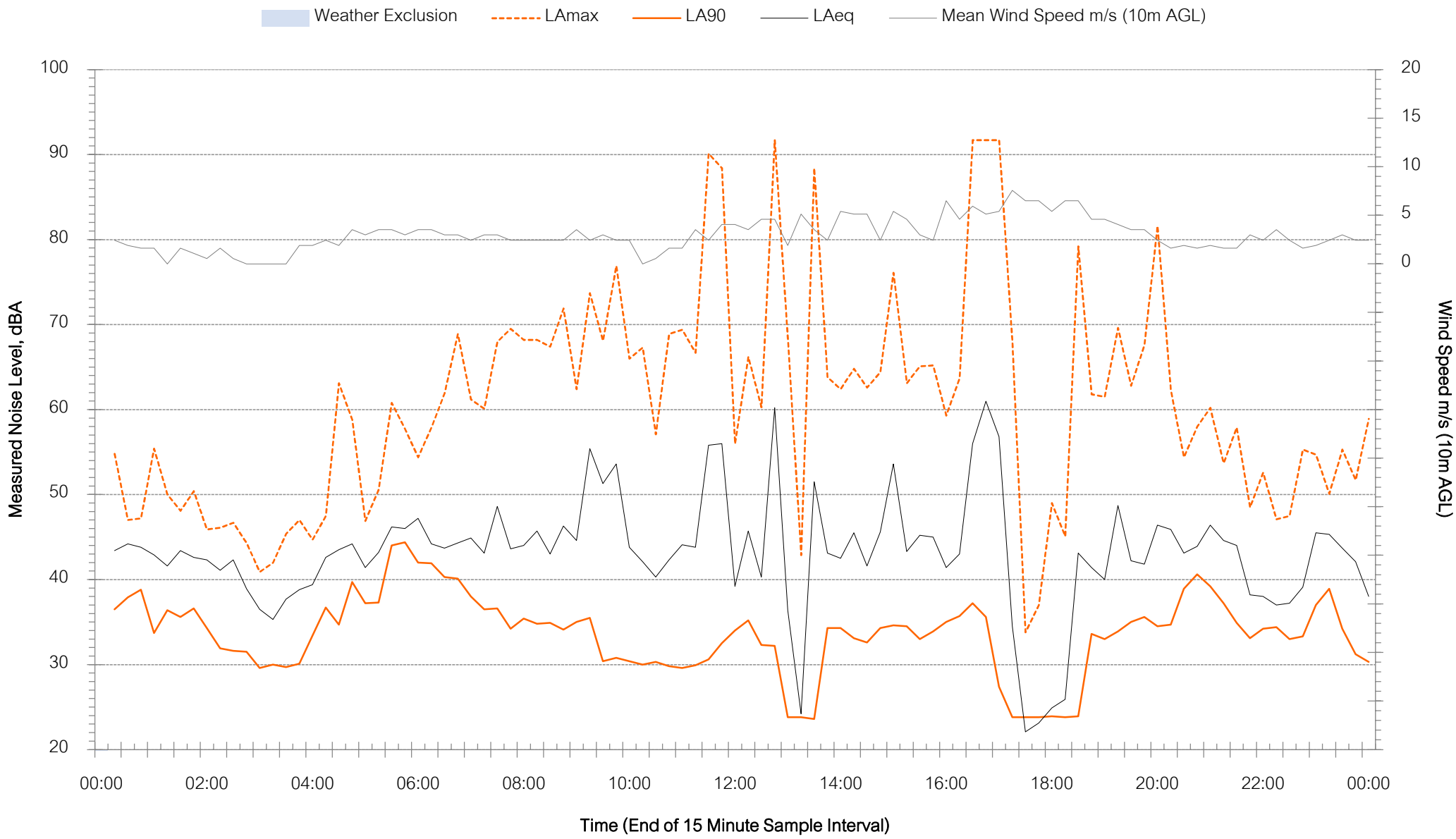

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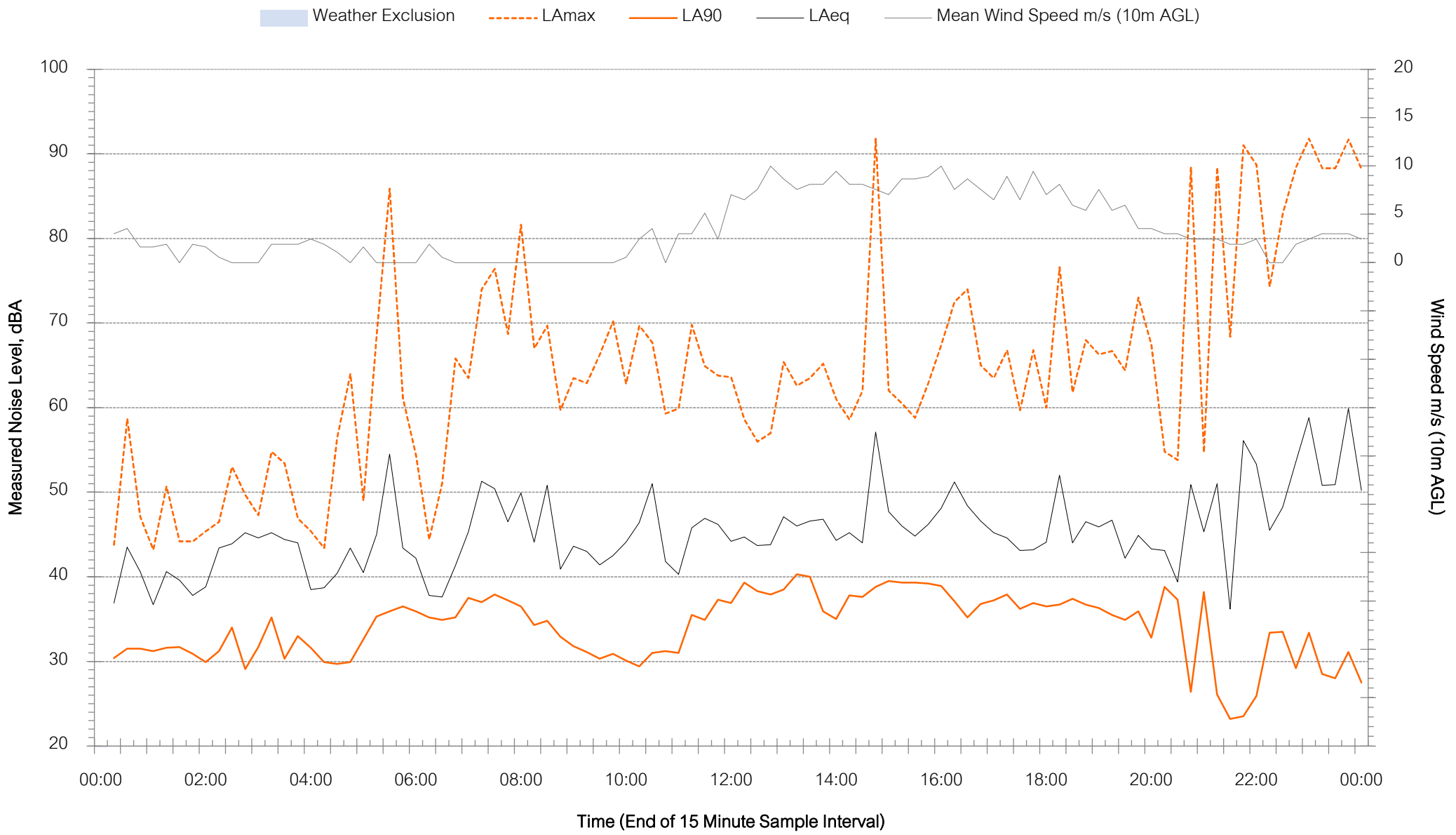

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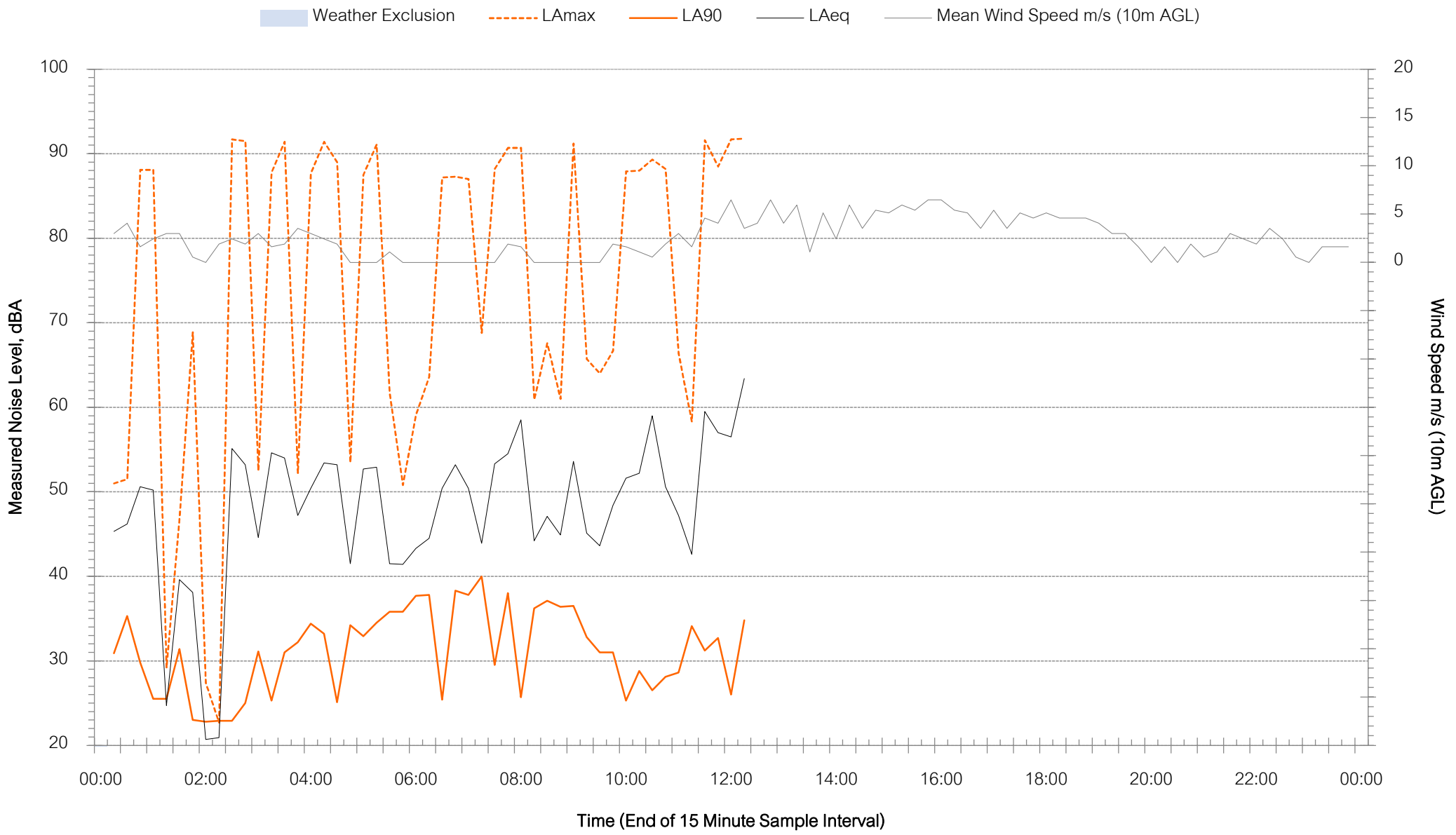

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MAC
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