Noise Assessment

Additions to Existing Health Service Facility
173-175 Chilsholm Road
Ashtonfield, NSW

Prepared for: SLR Consulting Australia Pty Ltd
April 2023
MAC231761-01RP1

MAC
Muller Acoustic Consulting

Document Information

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173 – 175 Chisholm Road

Ashtonfield NSW

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CONTENTS

1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by SLR Consulting Australia Pty Ltd (SLR) to prepare a Noise Assessment (NA) to quantify emissions from proposed additions to the existing health service facility (the 'project') located at Maitland Private Hospital (MPH), 173 – 175 Chisholm Road, Ashtonfield, NSW.

The NA has quantified potential operational, sleep disturbance and construction noise emissions from the project and recommends reasonable and feasible noise controls where required. This assessment has been undertaken in accordance with the following documents:

- NSW Department of Environment and Climate Change (DECCW) – NSW Interim Construction Noise Guideline (ICNG), July 2009;
- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI) 2017;
- NSW Department of Environment, Climate Change and Water (DECCW) – NSW Road Noise Policy (RNP), March 2011;
- NSW Department of Environment and Conservation (DEC) – NSW Environmental Noise Management – Assessing Vibration: a Technical Guideline (the NSW vibration guideline), February 2006;
- NSW Environment Protection Authority (EPA's), Approved methods for the measurement and analysis of environmental noise in NSW, 2022; and
- Australian Standard AS 1055:2018 - Acoustics - Description and measurement of environmental noise - General Procedures;
- Standards Australia AS/NZS 2107:2016 (AS2107) – Acoustics - Recommended Design Sound Levels and Reverberation Times for Building Interiors.

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 General

The project is to be established at the existing Maitland Private Hospital, 173 – 175 Chisholm Road, Ashtonfield, NSW. The project includes the construction of a new carpark for up to 57 patient vehicles in the southeast corner of the site, that will connect to the existing upper-level carpark. In addition, an extension to the existing northern consulting building is proposed via expanding the third floor on the northern end of the building. The additional building space will comprise of the following facilities:

- nine consulting/Interview rooms;
- 12 treatments bays;
- three wardrooms;
- one reception desk;
- one staff base;
- drug and treatment rooms; and
- amenities and storage spaces.

The project also proposes the relocation of existing mechanical plant and addition of new plant to serve the additional spaces. The plant will be located on the rooftop of the extension. **Appendix B** provides the site layout plans of the project.

The locality surrounding the project site comprises predominantly of residential land uses. The surrounding noise catchment consists of residential receivers situated to the south, east and west of the project site, with the nearest proposed residential receiver at a setback distance of approximately 5m from the project southern boundary. The project is bound to the west by Chisolm Road with residential receivers and the New England Highway to the north of the site. The acoustic environment surrounding the project site is dominated by traffic noise from vehicles travelling along the New England Highway as well as noise from the project site and nearby commercial sites.

2.1.1 Receiver Review

A review of receivers in close proximity to the project has been completed and are summarised in **Table 1. Figure 1** provides a locality plan showing the position of these receivers in relation to the project.

Table 1 Receiver Locations

Receiver	Receiver Type	Receiver Height	Coordinates (GDA94/MGA56)	
			Easting	Northing
R01	Residential	1.5m	368871	6373937
R02	Residential	1.5m	368867	6373958
R03	Residential	1.5m	368868	6373981
R04	Residential	1.5m	368851	6373988
R05	Residential	1.5m	368829	6373990
R06	Residential	1.5m	368806	6373995
R07	Residential	1.5m	368785	6374011
R08	Residential	1.5m	368769	6374037
R09	Residential	1.5/4m	368585	6373971
R10	Residential	1.5/4m	368582	6373955
R11	Residential	1.5/4m	368560	6373935
R12	Residential	1.5/4m	368495	6373906
R13	Residential	1.5/4m	368499	6373874
R14	Residential	1.5m	368502	6373852
R15	Residential	1.5m	368580	6373872
R16	Residential	1.5m	368594	6373858
R17	Residential	1.5m	368607	6373843
R18	Residential	1.5m	368622	6373818
R19	Residential	1.5m	368646	6373800
R20	Residential	1.5m	368659	6373778
R21	Residential	1.5m	368670	6373769
R22	Residential	1.5m	368683	6373754
R23	Residential	1.5m	368700	6373734
R24	Residential	1.5m	368721	6373728
R25	Residential	1.5m	368725	6373745
R26	Residential	1.5m	368732	6373760
R27	Residential	1.5m	368729	6373774
R28	Residential	1.5m	368735	6373792
R29	Residential	1.5m	368738	6373810
TA01	Temporary Accommodation	1.5/5m	368579	6374000

2.2 Proposed Activities

There are several key activities associated with the project that have the potential to generate acoustic impacts on nearby receivers.

Table 2 provides a summary of project noise sources and the assessment period in which they propose to occur.

Table 2 Noise Generating Activities

Activity/Source	Period	Operational
Onsite light vehicles	Day	✓
	Evening	✓
	Night	✓
Mechanical Plant	Day	✓
	Evening	✓
	Night	✓

FIGURE 1

Locality Plan

MAC231761

Maitland Private Hospital

Additions and Alterations

KEY

- Attended Location
- Logger Location
- Receivers

0 20 40 60 80 100 m

N

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3 Noise Policy and Guidelines

3.1 Noise Policy for Industry

The EPA released the Noise Policy for Industry (NPI) in October 2017 which provides a process for establishing noise criteria for consents and licenses enabling the EPA to regulate noise emissions from scheduled premises under the Protection of the Environment Operations Act 1997. The objectives of the NPI are to:

- provide noise criteria that is used to assess the change in both short term and long-term noise levels;
- provide a clear and consistent framework for assessing environmental noise impacts from industrial premises and industrial development proposals;
- promote the use of best-practice noise mitigation measures that are feasible and reasonable where potential impacts have been identified; and
- support a process to guide the determination of achievable noise limits for planning approvals and/or licences, considering the matters that must be considered under the relevant legislation (such as the economic and social benefits and impacts of industrial development).

The policy sets out a process for industrial noise management involving the following key steps:

1. Determine the Project Noise Trigger Levels (PNTLs) (ie criteria) for a development. These are the levels (criteria), above which noise management measures are required to be considered. They are derived by considering two factors: shorter-term intrusiveness due to changes in the noise environment; and maintaining the noise amenity of an area.
2. Predict or measure the noise levels produced by the development with regard to the presence of annoying noise characteristics and meteorological effects such as temperature inversions and wind.
3. Compare the predicted or measured noise level with the PNTL, assessing impacts and the need for noise mitigation and management measures.
4. Consider residual noise impacts - that is, where noise levels exceed the PNTLs after the application of feasible and reasonable noise mitigation measures. This may involve balancing economic, social and environmental costs and benefits from the proposed development against the noise impacts, including consultation with the affected community where impacts are expected to be significant.
5. Set statutory compliance levels that reflect the best achievable and agreed noise limits for the development.
6. Monitor and report environmental noise levels from the development.

3.1.1 Project Noise Trigger Levels (PNTL)

The policy sets out the procedure to determine the PNTLs relevant to an industrial development. The PNTL is the lower (ie, the more stringent) of the **Project Intrusiveness Noise Level** (PINL) and **Project Amenity Noise Level** (PANL) determined in accordance with Section 2.3 and Section 2.4 of the NPI.

3.1.2 Rating Background Level (RBL)

The Rating Background Level (RBL) is a determined parameter from noise monitoring and is used for assessment purposes. As per the NPI, the RBL is an overall single figure background level representing each assessment period (day, evening and night) over the noise monitoring period. The measured RBLs relevant to the project are contained in **Section 4**.

3.1.3 Project Intrusiveness Noise Level (PINL)

The PINL ($LA_{eq(15min)}$) is the RBL + 5dB and seeks to limit the degree of change a new noise source introduces to an existing environment. Hence, when assessing intrusiveness, background noise levels need to be measured.

Background noise levels need to be determined before intrusive noise can be assessed. The NPI states that background noise levels to be measured are those that are present at the time of the noise assessment and without the subject development operating. For the assessment of modifications to existing premises, the noise from the existing premises should be excluded from background noise measurements. It is note that the exception is where the premises has been operating for a significant period of time and is considered a normal part of the acoustic environment; it may be included in the background noise assessment under the following circumstances:

- the development must have been operating for a period in excess of 10 years in the assessment period/s being considered and is considered a normal part of the acoustic environment; and,
- the development must be operating in accordance with noise limits and requirements imposed in a consent or licence and/or be applying best practice.

Where a project intrusiveness noise level has been derived in this way, the derived level applies for a period of 10 years to avoid continuous incremental increases in intrusiveness noise levels. This approach is consistent with the purpose of the intrusiveness noise level to limit significant change in the acoustic environment. The purpose of the project amenity noise level is to moderate against background noise creep.

3.1.4 Project Amenity Noise Level (PANL)

The PANL is relevant to a specific land use or locality. To limit continuing increases in intrusiveness levels, the ambient noise level within an area from all combined industrial sources should remain below the recommended amenity noise levels specified in Table 2.2 (of the NPI). The NPI defines two categories of amenity noise levels:

- **Amenity Noise Levels (ANL)** – are determined considering all current and future industrial noise within a receiver area; and
- **Project Amenity Noise Level (PANL)** – is the recommended level for a receiver area, specifically focusing the project being assessed.

Additionally, Section 2.4 of the NPI states: "to ensure that industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area, a project amenity noise level applies for each new source of industrial noise as follows":

PANL for new industrial developments = recommended **ANL** minus 5dBA.

The following exceptions apply when deriving the PANL:

- areas with high traffic noise levels;
- proposed developments in major industrial clusters;
- existing industrial noise and cumulative industrial noise effects; and
- greenfield sites.

The NPI states with respect to high traffic noise areas:

The level of transport noise, road traffic noise in particular, may be high enough to make noise from an industrial source effectively inaudible, even though the LAeq noise level from that industrial noise source may exceed the project amenity noise level. In such cases the project amenity noise level may be derived from the LAeq, period(traffic) minus 15 dB(A).

Where relevant this assessment has considered influences of traffic with respect to amenity noise levels (ie areas where existing traffic noise levels are 10dB greater than the recommended amenity noise level).

The recommended amenity noise levels as per Table 2.2 of the NPI are reproduced in **Table 3**.

Table 3 Amenity Noise Levels

Receiver Type	Noise Amenity Area	Time of day	Recommended amenity noise level dB LAeq(period)
Residential	Rural	Day	50
		Evening	45
		Night	40

Table 3 Amenity Noise Levels			
Receiver Type	Noise Amenity Area	Time of day	Recommended amenity noise level dB LAeq(period)
	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	5dB above the recommended amenity noise level for a residence for the relevant noise amenity area and time of day
School Classroom	All	Noisiest 1-hour period when in use	35 (internal) 45 (external)
Hospital ward			
- internal	All	Noisiest 1-hour	35
- external	All	Noisiest 1-hour	50
Place of worship - internal	All	When in use	40
Passive Recreation	All	When in use	50
Active Recreation	All	When in use	55
Commercial premises	All	When in use	65
Industrial	All	When in use	70

Notes: The recommended amenity noise levels refer only to noise from industrial noise 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 levels represent outdoor levels except where otherwise stated.

Types of receivers are defined as rural residential; suburban residential; urban residential; industrial interface; commercial; industrial – see Table 2.3 and Section 2.7 of the NPI.

Note 1: 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.

3.1.5 Maximum Noise Assessment Trigger Levels

The potential for sleep disturbance from maximum noise level events from a project during the night-time period needs to be considered. The NPI considers sleep disturbance to be both awakenings and disturbance to sleep stages.

Where night-time noise levels from a development/premises at a residential location exceed the following criteria, a detailed maximum noise level event assessment should be undertaken:

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

A detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period.

Other factors that may be important in assessing the impacts on sleep disturbance include:

- how often the events would occur;
- the distribution of likely events across the night-time period and the existing ambient maximum events in the absence of the development;
- whether there are times of day when there is a clear change in the noise environment (such as during early morning shoulder periods); and
- current understanding of effects of maximum noise level events at night.

3.1.6 Temporary Accommodation

The NPI defines a residence as a lawful and permanent structure in a land use zone that permits for residential use and is not associated with a commercial undertaking such as a motel, hotel or aged care facility. Notwithstanding, to confirm temporary occupants within commercial residences, such as motels, hotels and aged care facilities, are not affected by sleep disturbance, a maximum noise level assessment should be undertaken.

The NPI outlines that additional guidance on maximum noise level assessments may be sourced from the EPA NSW Road Noise Policy (RNP). Section 5.4 of the RNP outlines that a maximum internal noise level of 50-55dBA is unlikely to awaken people from sleep. Taking into account a 10dB loss for a partially open window an external level of 65dBA in unlikely to awaken internal occupants.

This level has been adopted to assess the impact of maximum noise events on occupant of commercial residential land uses to safeguard against sleep disturbance. The recommended amenity noise level for the night period will be adopted for awakening assessment for these receivers.

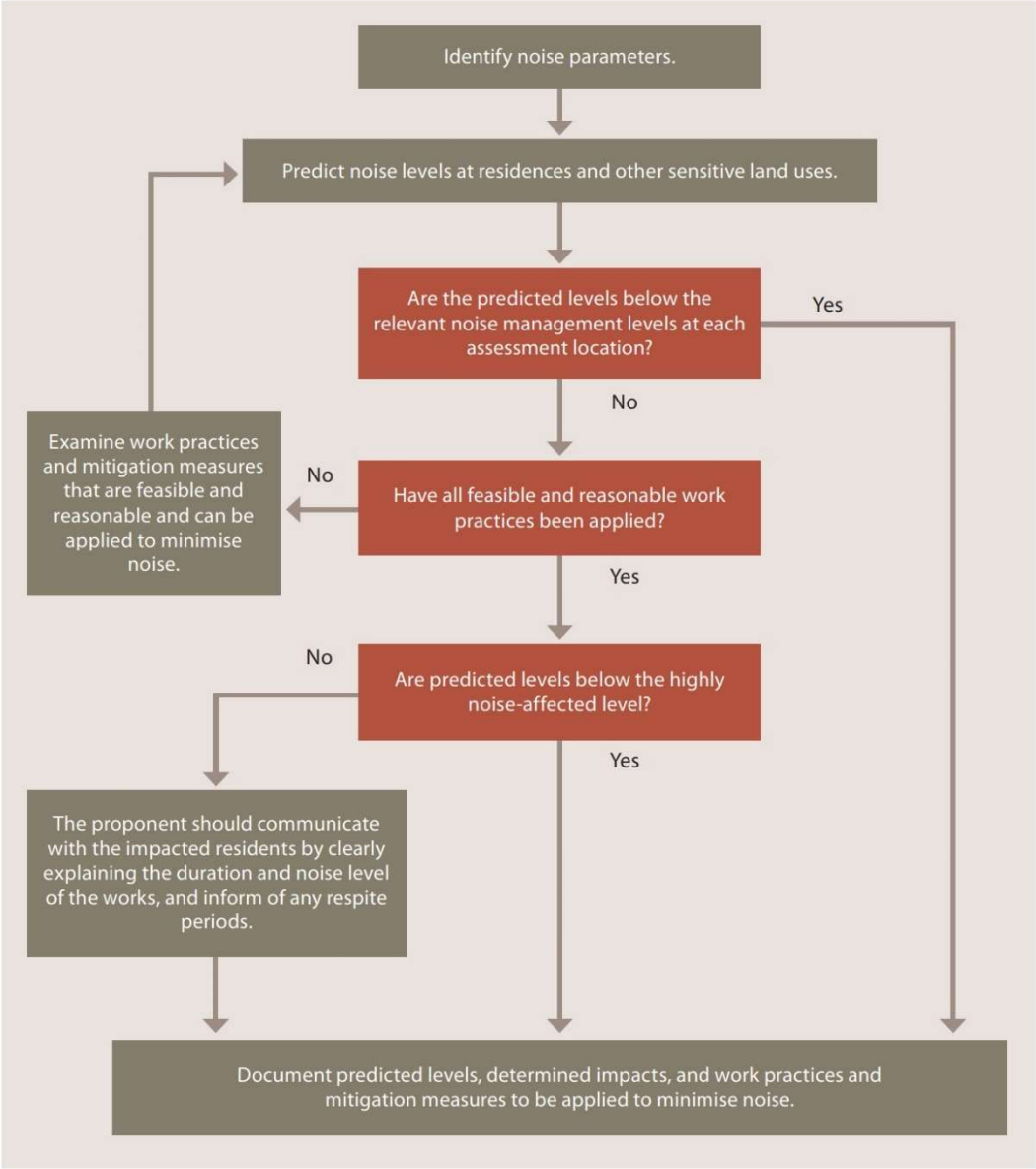
3.2 Interim Construction Noise Guideline

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 NA has adopted a quantitative assessment approach which is summarised in **Figure 2.** 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.

Figure 2 Quantitative Assessment Processes for Assessing and Managing Construction Noise



Source: Department of Environment and Climate Change, 2009.

3.2.1 Standard Hours for Construction

Table 4 presents the ICNG recommended standard hours for construction works.

Table 4 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.

3.2.2 Construction Noise Management Levels

Section 4 of the ICNG 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 5** reproduces the ICNG Noise Management Level (NML) for residential receivers. The NML is determined by adding 10dB (standard hours) or 5dB for Out of Hours (OOH) to the Rating Background Level (RBL) for each specific assessment period.

Table 5 Noise Management Levels		
Time of Day	Management Level LAeq(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 work to be carried out, the expected noise levels and duration, as well as contact details.
	Highly Noise Affected 75dBA (HNA)	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 work near schools, or mid-morning or mid-afternoon for work near residences; and 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 work 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 of the ICNG.

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 noise management levels for noise assessment purposes and is the median of the ABL's.

3.3 Vibration Criteria

3.3.1 Cosmetic Damage Criteria

British Standard BS 7385: Part 2-1993 “Evaluation and measurement for vibration in buildings Part 2”, gives guidance on the levels of vibration which building structures could be damaged. BS7385 also takes into consideration the frequency of the vibration which is critical when assessing the likelihood of building damage.

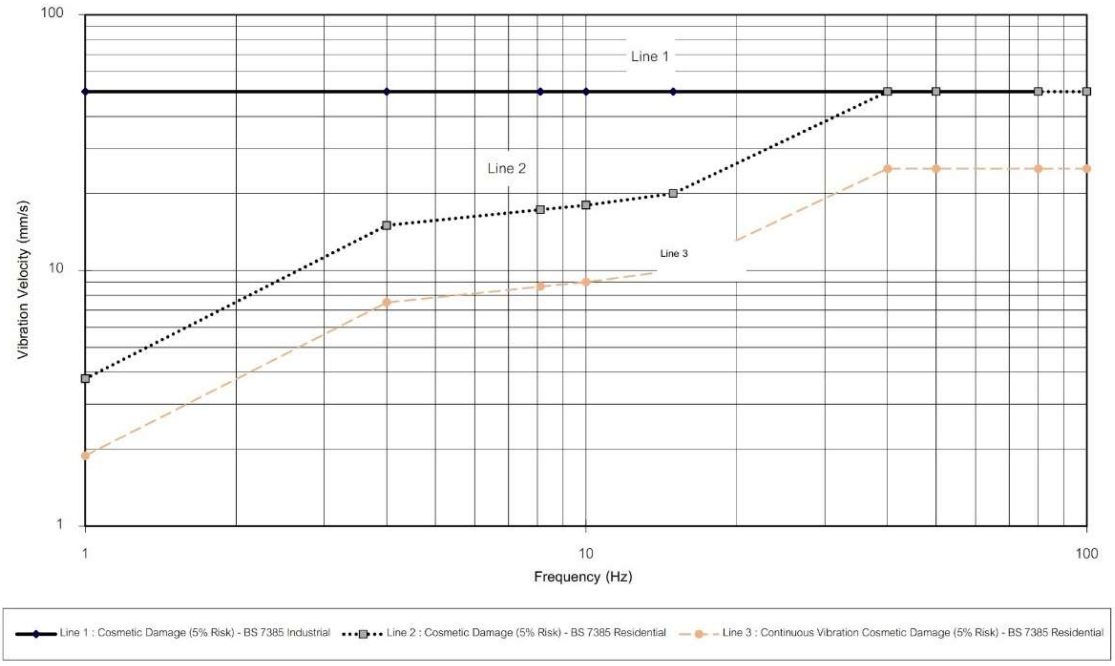
Guide values are set for building vibration based on the lowest vibration levels above which damage has been credibly demonstrated. These levels are judged to result in a minimum risk of vibration-induced damage, where minimal risk for a named effect is usually taken as a 95% probability of no effect.

The recommended limits (guide values) for transient vibration to ensure minimal risk of cosmetic damage to residential and heavy commercial/industrial buildings are presented in **Table 6**, with a visual representation presented in **Figure 4**. Where sources of continuous vibration may give rise to dynamic magnification due to resonance, the values provided in **Table 6** should be reduced by 50%, this is especially the case with respect to Peak Particle Velocity (PPV) at lower frequencies.

Table 6 Transient Vibration Guide Values - Minimal Risk of Cosmetic Damage

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

Figure 4 – Transient Vibration Guide Values - Minimal Risk of Cosmetic Damage



3.3.2 Human Comfort – Assessing Vibration a Technical Guideline

Humans are far more sensitive to vibration than is commonly realised and may detect vibration levels which are well below levels that may cause damage to buildings or structures. Assessing vibration: a technical guideline was published in February of 2006 by the DECC and is based on guidelines contained in BS 6472 – 1992, Evaluation of human exposure to vibration in buildings (1-80 Hz) and provides guidance on assessing vibration against human comfort.

The guideline presents preferred and maximum vibration values for use in assessing human responses to vibration and provides recommendations for measurement and evaluation techniques. At vibration values below the preferred values, there is a low probability of adverse comment or disturbance to building occupants. Where all feasible and reasonable mitigation measures have been applied and vibration values are still beyond the maximum value, it is recommended the operator negotiate directly with the affected community.

The guideline defines three vibration types and provides direction for assessing and evaluating the applicable criteria. Table 2.1 of the guideline provides examples of the three vibration types and has been reproduced in **Table 7**.

Table 7 Examples of types of vibration (from Table 2.1 of the guideline)		
Continuous Vibration	Impulsive Vibration	Intermittent Vibration
Machinery, steady road traffic, continuous construction activity (such as tunnel boring machinery)	Infrequent: Activities that create up to three distinct vibration events in an assessment period, e.g. occasional dropping of heavy equipment, occasional loading and unloading. Blasting is assessed using ANZECC (1990)	Trains, intermittent nearby construction activity, passing heavy vehicles, forging machines, impact pile driving, jack hammers. Where the number of vibration events in an assessment period is three or fewer these would be assessed against impulsive vibration criteria.

Continuous Vibration

Appendix C of the guideline outlines acceptable criteria for human exposure to continuous vibration (1-80 Hz), the criteria are dependent on both the time of activity (usually daytime or night-time) and the occupied place being assessed. **Table 8** reproduces the preferred and maximum criteria relating to measured peak velocity.

Table 8 Criteria for Exposure to Continuous Vibration			
Place	Time[1]	Peak Velocity (mm/s)	
		Preferred	Maximum
Critical working Areas (e.g. hospital operating theatres, precision laboratories)	Day or Night	0.14	0.28
Residences	Day	0.28	0.56
	Night	0.20	0.40
Offices	Day or Night	0.56	1.1
Workshops	Day or Night	1.1	2.2

Note: rms velocity (mm/s) and vibration velocity value (dB re 10^{-9} mm/s) values given for most critical frequency >8Hz assuming sinusoidal motion.

Note 1: Daytime is 7am to 10pm and Night-time is 10pm to 7am.

Impulsive Vibration

Appendix C of the guideline outlines acceptable criteria for human exposure to impulsive vibration (1-80 Hz), these criteria are dependent on both the time of activity (usually daytime or night-time) and the occupied place being assessed. Impulsive vibration (as defined in Section 2.1 of the guideline) is generally associated with infrequent activities that create up to three (3) distinct vibration events in an assessment period e.g. occasional dropping of heavy equipment, occasional loading and unloading. **Table 9** reproduces the preferred and maximum criteria relating to measured peak velocity.

Table 9 Criteria for Exposure to Impulsive Vibration			
Place	Time[1]	Assessment Criteria	
		Peak Velocity (mm/s)	
		Preferred	Maximum
Critical working Areas (e.g. hospital operating theatres, precision laboratories)	Day or Night-time	0.14	0.28
Residences	Daytime	8.6	17.0
	Night-time	2.8	5.6
Offices	Day or Night-time	18.0	36.0
Workshops	Day or Night-time	18.0	36.0

Note 1: Daytime is 7am to 10pm and Night-time is 10pm to 7am.

Intermittent Vibration

Intermittent vibration (as defined in Section 2.1 of the guideline) is assessed using the vibration dose concept which relates to vibration magnitude and exposure time.

Intermittent vibration is representative of activities such as impact hammering, rolling or general excavation work (such as an excavator tracking).

Section 2.4 of the Guideline provides acceptable values for intermittent vibration in terms of vibration dose values (VDV) which requires the measurement of the overall weighted RMS (root mean square) acceleration levels over the frequency range 1-80 Hz. To calculate VDV the following formula (refer section 2.4.1 of the guideline) was used:

$$VDV = \left[\int_0^T a^4(t)dt\right]^{0.25}$$

Where VDV is the vibration dose value in $m/s^{1.75}$, a (t) is the frequency-weighted RMS of acceleration in m/s^2 and T is the total period of the day (in seconds) during which vibration may occur.

The Acceptable Vibration Dose Values (VDV) for Intermittent Vibration is reproduced in **Table 10**.

Table 10 Acceptable Vibration Dose Values (VDV) for Intermittent Vibration				
Location	Daytime		Night-time	
	Preferred Value, $m/s^{1.75}$	Maximum Value, $m/s^{1.75}$	Preferred Value, $m/s^{1.75}$	Maximum Value, $m/s^{1.75}$
Critical Areas	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

Note: Daytime is 7am to 10pm and Night-time is 10pm to 7am.

Note: These criteria are indicative only, and there may be a need to assess intermittent values against continuous or impulsive criteria for critical areas.

There is a low probability of adverse comment or disturbance to building occupants at vibration values below the preferred values. Adverse comment or complaints may be expected if vibration values approach the maximum values. The guideline states that activities should be designed to meet the preferred values where an area is not already exposed to vibration.

3.4 Road Noise Policy

The road traffic noise criteria are provided in the 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 5.4.

3.5 Development Near Rail Corridors and Busy Roads – Interim Guidelines

Guidance for the specification of internal noise levels of habitable rooms is prescribed in Department of Planning's (DoP) Development near Rail Corridors and Busy Roads – Interim Guidelines (2008) ('the guideline').

The guideline outlines in Clause 87 (Road) of the State Environmental Planning Policy (SEPP) for Infrastructure (Infrastructure SEPP) the requirement to undertake an assessment of noise sensitive receivers:

"Development for any of the following purposes that is on land that is in or immediately adjacent to a rail corridor and the consent authority considers development is likely to be adversely affected by rail noise or vibration:

- *building for residential use*
- *place of public worship*
- *a hospital*
- *an educational establishment or childcare centre"*

Table 3.1 of the guideline clarifies that the above noise criteria are to be determined as an $LA_{eq(15hr)}$ for the daytime and $LA_{eq(9hr)}$ for the night-time period. In addition, Table 3.1 also outlines the applicable internal criteria for hospital spaces:

- *wards 35dBA*
- *other noise sensitive areas 45dBA*

The guideline assists in the planning, design and assessment of development in, or adjacent to, rail corridors and busy roads and supports the Infrastructure SEPP. The guidelines are mandatory for developments proposed adjacent to busy roads with an Annual Average Daily Traffic (AADT) of greater than 40,000 vehicles or for projects where traffic noise impacts are anticipated.

Traffic volumes for the New England Highway were sourced from the permanent traffic counter (station ID 05140) located at the junction of the New England Highway and Emerald Street, East Maitland, which is 2.5km North of MPH.

The report identifies an Annual Average Daily Traffic (AADT) of up to 38,358 vehicles for 2018 which is considered consistent with flows along the highway. In 2019, counts were only undertaken in a westbound direction with a total westbound AADT of 20,953 which are consistent with 2019 westbound flow of 20953. Traffic flows for 2023 were calculated based on a 2% annual increase and found to be approximately 43,500 vehicle per day. The marked speed limit of the New England Highway adjacent to the MPH is 60km/hr.

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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 representative of the ambient environments surrounding the project site. The selected monitoring location is shown in **Figure 1** and is considered representative of surrounding residential receivers as per Fact Sheet B1.1 of the NPI.

The unattended noise surveys were conducted in general accordance with the procedures described in Australian Standard AS 1055:2018, "Acoustics – Description and Measurement of Environmental Noise".

The measurements were carried out using two Svantek 977 noise analyser from Friday 17 February 2023 to Monday 27 February 2023. All acoustic instrumentation used carries 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) and complies with AS/NZS IEC 61672.1-2019-Electroacoustics - Sound level meters - Specifications. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ±0.5dBA. Observations on-site identified the surrounding locality was typical of an urban environment, with traffic and commercial noise audible.

Data affected by adverse meteorological conditions have been excluded from the results in accordance with methodologies provided in Fact Sheet A4 of the NPI. Residential receivers situated in the surrounding area have been classified under the EPA's urban amenity category. This criteria is used in conjunction with the intrusiveness criteria to determine the limiting criteria. The results of long-term unattended noise monitoring are provided in **Table 11**. The measured daily ABLs for the background monitoring are provided in **Table C1** in **Appendix C** along with the daily noise monitoring charts.

Table 11 Background Noise Monitoring Summary

Monitoring Location	Period[1]	Measured Background Noise Level (LA90) dB RBL	Measured dB LAeq
L1 (R1-R11, R27-R29)	Day	54	62
	Evening	49	60
	Night	40	55
L2 (R12-R26)	Day	46	59
	Evening	43	59
	Night	40	54

Note: Excludes periods of wind or rain affected data. Meteorological data obtained from the Bureau of Meteorology weather station Maitland Airport AWSS, 32.7°S 151.5°E 28m AMSL.

Note 1: 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.

4.2 Attended Noise Monitoring

To supplement the unattended noise assessment and to quantify the changes in ambient noise in the community surrounding the operation, one 15 minute attended measurement was completed at each logger location.

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

The acoustic instrumentation used carries current NATA calibration and complies with AS/NZS IEC 61672.1-2019-Electroacoustics - Sound level meters - Specifications. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ±0.5dBA. All equipment carries appropriate and current NATA (or manufacturer) calibration certificates with records of all calibrations maintained by MAC as per the EPA's Approved methods for the measurement and analysis of environmental noise in NSW (EPA, 2022).

The attended noise monitoring was conducted using one Svantek 971 noise analyser at the site (see **Figure 1**) on Friday 17 February 2023 to quantify ambient background noise levels.

The attended measurement was completed during calm and clear meteorological conditions and confirmed that ambient traffic and commercial noise dominated the surrounding environment. The results of the short-term noise measurement and observations are summarised in **Table 12**.

Table 12 Operator-Attended Noise Survey Results

Date/Time (hrs)	Noise Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
	L_{Amax}	L_{Aeq}	L_{A90}		
Location Att1					
17/2/2023 11:03	71	66	63	WD: NE WS: 0.5m/s Rain: Nil	Traffic 58-71 Insects 60-66 Birds 50-62
Location Att2					
17/2/2023 11:47	79	62	52	WD: N WS: 1.0m/s Rain: Nil	Insects 45-60 Traffic 45-79 Birds 40-56

5 Assessment Criteria

5.1 Operational Noise

5.1.1 Intrusiveness Noise Levels

The PINL are presented in **Table 13** and have been determined based on the RBL +5dBA and only apply to residential receivers.

Table 13 Project Intrusiveness Noise Levels

Location	Receiver Type	Period[1]	Measured RBL dB LA_{90}	PINL dB $LA_{eq(15min)}$
L1 (R1-R11, R27-R29)	Residential	Day	54	59
		Evening	49	54
		Night	40	45
L2 (R12-R26)	Residential	Day	46	51
		Evening	43	48
		Night	40	45

Note 1: 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.

5.1.2 Amenity Noise Levels and Project Amenity Noise Levels

The PANL for residential receivers and other receiver types (ie non-residential) potentially affected by the project are presented in **Table 14.**

Table 14 Amenity Noise Levels and Project Amenity Noise Levels

Receiver Type	Noise Amenity Area	Assessment Period[1]	NPI Recommended ANL dB $LA_{eq(period)}$	ANL dB $LA_{eq(period)}$[2]	PANL dB $LA_{eq(15min)}$[3]
L1 (R1-R11, R27-R29)	Urban	Day	60	55	58
		Evening	50	45	48
		Night	45	40	43
L2 (R12-R26)	Urban	Day	60	55	58
		Evening	50	45	48
		Night	45	40	43
Temporary Accommodation	Urban	Day	65	60	63
		Evening	55	50	53
		Night	50	45	48

Note 1: 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 2: Project Amenity Noise Level equals the Amenity Noise Level -5dB as there is other industry in the area.

Note 3: Includes a +3dB adjustment to the amenity period level to convert to a 15-minute assessment period as per Section 2.2 of the NPI.

Note 4: External level based on 10dB loss through partially open window.

5.1.3 Project Noise Trigger Levels

The PNTL are the lower of either the PINL or the PANL. **Table 15** presents the derivation of the PNTLs in accordance with the methodologies outlined in the NPI.

Table 15 Project Noise Trigger Levels

Location	Noise Amenity Area	Assessment Period[1]	PINL dB $L_{Aeq(15min)}$	PANL dB $L_{Aeq(15min)}$	PNTL dB $L_{Aeq(15min)}$
L1 (R1-R11, R27-R29)	Urban	Day	59	58	58
		Evening	54	48	48
		Night	45	43	43
L2 (R12-R26)	Urban	Day	51	58	51
		Evening	48	48	48
		Night	45	43	43
Hotels Motels	Urban	Day	N/A	63	63
		Evening	N/A	53	53
		Night	N/A	48	48

Note 1: 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.

5.2 Maximum Noise Trigger Levels

The maximum noise trigger levels shown in **Table 16** are based on night-time RBLs and trigger levels as per Section 2.5 of the NPI. The trigger levels will be applied to transient noise events that have the potential to cause sleep disturbance.

Table 16 Maximum Noise Trigger Levels (Night)

L1 Residential Receivers (R1-R11, R27-R29)			
$L_{Aeq(15min)}$		L_{Amax}	
40dB $L_{Aeq(15min)}$ or RBL + 5dB		52dB L_{Amax} or RBL + 15dB	
Trigger	40	Trigger	52
RBL +5dB	45	RBL +15dB	55
Highest	**45**	**Highest**	**55**
L2 Residential Receivers (R12-R26)			
$L_{Aeq(15min)}$		L_{Amax}	
40dB $L_{Aeq(15min)}$ or RBL + 5dB		52dB L_{Amax} or RBL + 15dB	
Trigger	40	Trigger	52
RBL +5dB	45	RBL +15dB	55
Highest	**45**	**Highest**	**55**
Temporary Accommodation Receivers (TA01)			
$L_{Aeq(15min}$		L_{Amax}	
N/A		65	

Note: Monday to Saturday; Night 10pm to 7am. On Sundays and Public Holidays Night 10pm to 8am.

Note: NPI identifies that maximum of the two values is to be adopted which is shown in bold font.

5.3 Construction Noise

The relevant Noise Management Levels (NMLs) for standard construction hours are presented in **Table 17**.

Table 17 Construction Noise Management Levels

Catchment (No) Receiver ID	Assessment Period[1]	Adopted RBL dB L_{A90}	NML dB $L_{Aeq(15min)}$
L1 (R1-R11, R27-R29)	Standard Hours	54	64 (RBL+10dBA)
L2 (R12-R26)	Standard Hours	46	56 (RBL+10dBA)
Commercial Premises (TA01)[2]	When in use	N/A	70 (external)

Note 1: Refer to Table 4 for Standard Recommended Hours for Construction.

Note 2: Includes temporary accommodation receivers.

5.4 Road Traffic Noise

Table 18 presents the road traffic noise assessment criteria reproduced from the RNP relevant to this assessment.

Table 18 Road Traffic Noise Assessment Criteria

Road category	Type of project/development	Assessment Criteria – dBA	
		Day (7am to 10pm)	Night (10pm to 7am)
Freeways/arterial/ sub-arterial Roads	Existing residences affected by additional traffic on freeways/arterial/sub-arterial roads generated by land use developments	60dB LAeq(15hr)	55dB LAeq(9hr)

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 using DGMR (iNoise, Version 2023.1) noise modelling software. iNoise is an 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 and ISO 9613:2 including corrections for meteorological conditions using CONCAWE[1]. The ISO 9613 standards are 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 Sound Power Levels

Table 19 presents the sound power level for each noise source modelled in the operational and maximum noise level assessments. It is noted that sound power levels were sourced from manufacturer's specifications or from in-field measurements at similar project sites. The sound power levels have been adjusted to account for duration over a 15-minute period.

Table 19 Acoustically Significant Sources – Sound Power Levels (*re 10-12 Watts*)

Item and number modelled per 15 minutes	Individual Sound Power Level, dB $LA_{eq(15min)}$	Total source Sound Power Level, dB $LA_{eq(15min)}$	Source Height[1]
Operational			
Total Roof Top Combined Mechanical Plant (x24)	78	92	1.0m
Car park idle, start up and drive off (x20)	73	86	0.5m
Sleep disturbance assessment (LAmax), Night-time periods (10pm to 7am)			
Car Door Slam	87		1.5m

[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

6.2 Construction Scenarios

Four construction scenarios were considered as part of this construction assessment. The construction fleets for each scenario are presented in **Table 20**.

Table 20 Construction Scenarios & Fleet Sound Power Levels dB LAeq(15min) – Construction Phase

Item	SWLs	Construction Scenarios			
		S1 General Construction Proposed Extension	S2 General Construction Proposed Carpark	S3 Rooftop Mechanical Plant Installation	S4 Extension Fitout
Skid Steer/ Posi Track	104	✓	✓		
Trucks	108	✓	✓		
EWP	97	✓	✓	✓X2	✓
Generator	103	✓X2	✓X2	✓	✓
Jackhammer	113	✓	✓		
Concrete Pumps	109	✓	✓		
Concrete Trucks	108	✓	✓		
Hand Tools	97	✓	✓	✓X2	✓X3
Moxi / 14t Dumpy	108	✓	✓		
20t Rubber Duck/EX	105	✓	✓		
60-100t Crane	108			✓	
T&D's, Bogies, Semi-Trailers, Hookbins, Hiabs	103			✓	✓
Telehandlers	103			✓	
Total Fleet SWL[1]	108	120	113	113	114

6.3 Mitigation Included in Design and Noise Control Recommendations

The noise model incorporated the following recommendations and noise controls:

- the project is constructed as per the site design and plans (as presented in **Appendix** B) which includes the barrier attenuation provided by the project buildings orientation;
- the mechanical AC plant are assumed to be located on the rooftop of the proposed additional project building; and
- there is a 50% reduction in onsite light vehicles during the night period.

7 Noise Assessment Results

7.1 Operational Noise Assessment

Noise predictions from all operation noise sources have been quantified at surrounding receivers. The coincidence of all plant occurring onsite simultaneously for an entire 15-minute period is unlikely. However, it is probable that several plant may operate simultaneously on occasion for a limited duration. To account for this, modelling has adopted the $LA_{eq(15min)}$ contribution of sources which were derived from in-field measurements of operation sources or activities. Results of the noise modelling predictions are presented in **Table 21**.

Table 21 Operational Noise Predictions – All Receivers[1]							
Residential Receivers							
Rec No	Predicted Noise Level dB $LA_{eq(15min)}$			PNTL dB $LA_{eq(15min)}$			Comply
	Day	Evening	Night	Day	Evening	Night	
R01	<35	<35	<35	58	48	43	✓
R02	<35	<35	<35	58	48	43	✓
R03	<35	<35	<35	58	48	43	✓
R04	<35	<35	<35	58	48	43	✓
R05	<35	<35	<35	58	48	43	✓
R06	<35	<35	<35	58	48	43	✓
R07	<35	<35	<35	58	48	43	✓
R08	<35	<35	<35	58	48	43	✓
R09	<35	<35	<35	58	48	43	✓
R10	<35	<35	<35	58	48	43	✓
R11	<35	<35	<35	58	48	43	✓
R12	<35	<35	<35	51	48	43	✓
R13	<35	<35	<35	51	48	43	✓
R14	<35	<35	<35	51	48	43	✓
R15	<35	<35	<35	51	48	43	✓
R16	<35	<35	<35	51	48	43	✓
R17	<35	<35	<35	51	48	43	✓
R18	<35	<35	<35	51	48	43	✓
R19	<35	<35	<35	51	48	43	✓
R20	<35	<35	<35	51	48	43	✓
R21	<35	<35	<35	51	48	43	✓
R22	38	38	35	51	48	43	✓
R23	38	38	35	51	48	43	✓
R24	40	40	37	51	48	43	✓
R25	42	42	39	51	48	43	✓
R26	43	43	40	51	48	43	✓
R27	43	43	40	58	48	43	✓
R28	39	39	36	58	48	43	✓
R29	36	36	<35	58	48	43	✓
TA01	<35	<35	<35	63	53	48	✓

7.2 Maximum Noise Level Assessment

In assessing maximum noise events, typical L_{Amax} noise levels from transient events were assessed at the nearest residential receivers. For the sleep disturbance assessment, a sound power level of 87dBA for car door slams were adopted for maximum noise level (L_{Amax}) events during the night period.

Predicted noise levels from $L_{Aeq(15min)}$ and L_{Amax} events for assessed receivers are presented in **Table 22.** Results identify that the maximum noise trigger levels will be satisfied for all assessed receivers.

Table 22 Maximum Noise Level Assessment (Night)[1]							
		Predicted Noise Level dB L_{Amax}			Trigger Levels		
Receiver	dB $L_{Aeq(15min)}$	Carpark Door Slam Western Space	Carpark Door Slam Southern Space	Carpark Door Slam Eastern Space	dB $L_{Aeq(15min)}$	dB L_{Amax}	Compliant
R01	<35	<35	<35	<35	45	55	✓
R02	<35	<35	<35	<35	45	55	✓
R03	<35	<35	<35	<35	45	55	✓
R04	<35	<35	<35	<35	45	55	✓
R05	<35	<35	<35	<35	45	55	✓
R06	<35	<35	<35	<35	45	55	✓
R07	<35	<35	<35	<35	45	55	✓
R08	<35	<35	<35	<35	45	55	✓
R09	<35	<35	<35	<35	45	55	✓
R10	<35	<35	<35	<35	45	55	✓
R11	<35	<35	<35	<35	45	55	✓
R12	<35	<35	<35	<35	45	55	✓
R13	<35	<35	<35	<35	45	55	✓
R14	<35	<35	<35	<35	45	55	✓
R15	<35	<35	<35	<35	45	55	✓
R16	<35	<35	<35	<35	45	55	✓
R17	<35	<35	<35	<35	45	55	✓
R18	<35	<35	<35	<35	45	55	✓
R19	<35	<35	<35	<35	45	55	✓
R20	<35	40	<35	<35	45	55	✓
R21	<35	43	<35	<35	45	55	✓
R22	35	46	39	<35	45	55	✓
R23	35	40	43	<35	45	55	✓
R24	37	36	48	37	45	55	✓
R25	39	38	49	41	45	55	✓
R26	40	38	44	45	45	55	✓
R27	40	37	40	49	45	55	✓
R28	36	<35	36	46	45	55	✓
R29	<35	<35	<35	40	45	55	✓
TA01	<35	<35	<35	<35	N/A	65	✓

Note 1: Monday to Saturday; Night 10pm to 7am. On Sundays and Public Holidays Night 10pm to 8am.

7.3 Construction Noise Assessment

Table 23 presents the results of modelled construction noise emissions. Predictions identify that emissions from construction are above the noise management levels at several assessed receivers during various construction phases. Accordingly, recommendations to reduce the impact of construction noise emissions on surrounding receivers are provided in **Section 0**.

Table 23 Construction Noise Levels – All Receivers

Receiver	Period[1]	Predicted Noise Level dB $LA_{eq(15min)}$				Management Level dB $LA_{eq(15min)}$	Comply
		Scenario 1	Scenario 2	Scenario 3	Scenario 4		
R01	Day	53	49	47	50	64	✓
R02	Day	54	46	48	50	64	✓
R03	Day	54	42	48	49	64	✓
R04	Day	48	40	42	49	64	✓
R05	Day	56	41	50	53	64	✓
R06	Day	57	42	51	53	64	✓
R07	Day	58	39	52	54	64	✓
R08	Day	58	33	52	54	64	✓
R09	Day	69	40	40	63	64	X
R10	Day	69	39	39	63	64	X
R11	Day	65	40	40	59	64	X
R12	Day	57	51	51	51	56	X
R13	Day	55	53	53	49	56	✓
R14	Day	53	54	47	40	56	✓
R15	Day	48	54	42	39	56	✓
R16	Day	44	57	38	39	56	X
R17	Day	44	63	38	40	56	X
R18	Day	42	68	36	37	56	X
R19	Day	40	70	34	35	56	X
R20	Day	41	74	35	36	56	X
R21	Day	39	77	33	35	56	X
R22	Day	38	76	32	35	56	X
R23	Day	34	72	28	31	56	X
R24	Day	35	70	29	34	56	X
R25	Day	36	73	30	32	56	X
R26	Day	37	74	31	33	56	X
R27	Day	39	76	33	35	64	X
R28	Day	37	72	31	34	64	X
R29	Day	41	70	35	39	64	X
TA01	Day	65	37	59	54	70	✓

Note 1: Refer to Table 4 for Standard Recommended Hours for Construction.

7.4 Assessment of Construction Vibration Impacts

The major potential sources of construction vibration include jackhammers. Generally, jackhammering would take place at the project during the excavation phase for the carpark and the demo of the existing rooftop. **Table 24** provides the minimum working distances for the use of various vibration intensive sources to nearby receivers to meet cosmetic damage and human response criteria. For a handheld jackhammer, compliance with the cosmetic damage criteria is expected where the minimum offset distance of 1m is maintained from the nearest residential receivers. No residential receivers are located within 1m of the works therefore the potential to be affected by construction generated vibration is considered minimal.

Table 24 Minimum Working Distances or Vibratory Plant (m)

Plant item	Rating / Description	Minimum working distance	
		Cosmetic damage (BS 7385)	Human response (OH&E Vibration guideline)
Vibratory Roller	< 50 kN (Typically 1-2 tonnes)	5 m	15 m to 20 m
	< 100 kN (Typically 2-4 tonnes)	6 m	20 m
	< 200 kN (Typically 4-6 tonnes)	12 m	40 m
	< 300 kN (Typically 7-13 tonnes)	15 m	100 m
	> 300 kN (Typically 13-18 tonnes)	20 m	100 m
	> 300 kN (> 18 tonnes)	25 m	100 m
Small Hydraulic Hammer	(300 kg - 5 to 12t excavator)	2 m	7 m
Medium Hydraulic Hammer	(900 kg – 12 to 18t excavator)	7 m	23 m
Large Hydraulic Hammer	(1600 kg – 18 to 34t excavator)	22 m	73 m
Vibratory Pile Driver	Sheet piles	2 m to 20 m	20 m
Pile Boring	≤ 800 mm	2 m (nominal)	4 m
Jackhammer	Hand held	1 m (nominal)	2 m

Note: Source, CNVG (Roads and Maritime, 2016)

7.5 Road Traffic Noise Intrusion

A review of the traffic flows and speed limit adjacent to MPH identifies standard glass is inadequate acoustically and could reduce the attenuation performance of the overall building facade. A minimum of Category 2 treatments are required to adequately attenuation road traffic noise intrusion to the northern façade of the proposed building extension, facing the New England Highway. A summary of the Category 2 treatment requirements as per Appendix C of the guideline are provided below:

- Category 2 (C2) glazing requirements include – Windows/Sliding Doors: Openable with minimum 6mm monolithic glass and full perimeter acoustic seals.

Additional upgrade options include thicker laminated glass or double-glazed laminated windows with an air gap between panels. The frames and air gaps should be adequately sealed to optimise noise reduction. This is especially pertinent to the upper levels of the building which is more exposed (due to elevation) to noise sources such as roads.

A full summary of the required treatments for each category as per Appendix C of the guideline are presented in **Appendix D** of this report.

7.6 Road Traffic Noise Assessment

Access to the new hospital car park would be from Chisholm Road, just off The New England Highway, passing only dwellings facing onto the New England Highway.

As the existing traffic noise levels measured at L1 are already above the applicable 15hr and 9hr criteria at this location, an assessment has been completed to investigate if the additional traffic associated with the new car park would increase the traffic noise levels by 2dB.

A review of annual average daily traffic (AADT) volumes from the TfNSW traffic volume viewer (station ID: 05140), identifies that the New England Highway carries approximately 43,500 vehicles per day. An increase in road traffic noise of greater than 2dB, would require a 60% increase in traffic volumes, or an additional 26,000 vehicles daily. Hence, as the project would not result in a significant increase in traffic volumes, road traffic noise levels would remain below the 2dBA increase criterion.

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8 Construction Recommendations

The results of the Noise Assessment demonstrate that levels during standard construction hours are predicted to be above the applicable ICNG noise management levels at several of the nearest receivers during various construction phases. Accordingly, it is recommended that noise management and mitigation measures be adopted during noise intensive construction activities to limit impact on surrounding receivers.

Recommendations for consideration during construction activities for this operation may include:

- implement boundary fences/retaining walls as early as possible to maximise their attenuation benefits to surrounding receivers;
- toolbox and induction of personnel prior to shift to discuss noise control measures that may be implemented to reduce noise emissions to the community;
- where possible use mobile screens or construction hording to act as barriers between construction works and receivers;
- all plant should be shut down when not in use. Plant to be parked/started at farthest point from relevant assessment locations;
- operating plant in a conservative manner (no over-revving);
- selection of the quietest suitable machinery available for each activity;
- avoidance of noisy plant/machinery working simultaneously where practicable;
- minimisation of metallic impact noise;
- all plant are to utilise a broadband reverse alarm in lieu of the traditional hi frequency type reverse alarm; and
- undertake letter box drops to notify receivers of potential works.

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9 Discussion and Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Assessment to quantify emissions from the proposed additions to existing health service facility (the 'project') at Maitland Private Hospital (MPH), 173 – 175 Chisholm Road, Ashtonfield, NSW.

The results of the NA demonstrate that noise emissions from the operation would satisfy the relevant PNTLs at all assessed receivers for all assessment periods once noise controls for the project are implemented (see Section 6.3):

- the project is constructed as per the site design and plans (as presented in Appendix B) which includes the barrier attenuation provided by the project buildings orientation;
- the mechanical AC plant are assumed to be located on the rooftop of the proposed additional project building; and
- there is a 50% reduction in onsite light vehicles during the night period.

Furthermore, sleep disturbance is not anticipated, as emissions from maximum noise events (ie car door slams,) are predicted to satisfy the NPIs maximum noise trigger levels.

Modelled noise emissions from construction activities identify that predicted noise emissions are above the applicable construction management levels at several receivers during various phases of the construction works. Therefore, noise management measures are provided in this report to reduce potential impacts on surrounding receivers.

The results of the operational road traffic noise assessment demonstrates that due to high existing traffic volumes on the New England Highway, the change in noise levels at the nearest residential receivers would remain below the 2dBA increase criterion. Hence, it is considered that there would be no additional impact from road traffic noise resulting from the project.

A review of road traffic parameters identified that standard glazing (such as 3mm monolithic glass) on the eastern facade windows would not be adequate to attenuate internal levels to satisfy relevant criteria. It is recommended that as a minimum, Category 2 treatments (see Appendix D) be implemented to reduce road traffic noise to satisfy relevant internal criteria.

Vibration emissions during construction should be managed appropriately with minimum working distances established once plant used for the project is selected.

In summary, the Noise 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**.

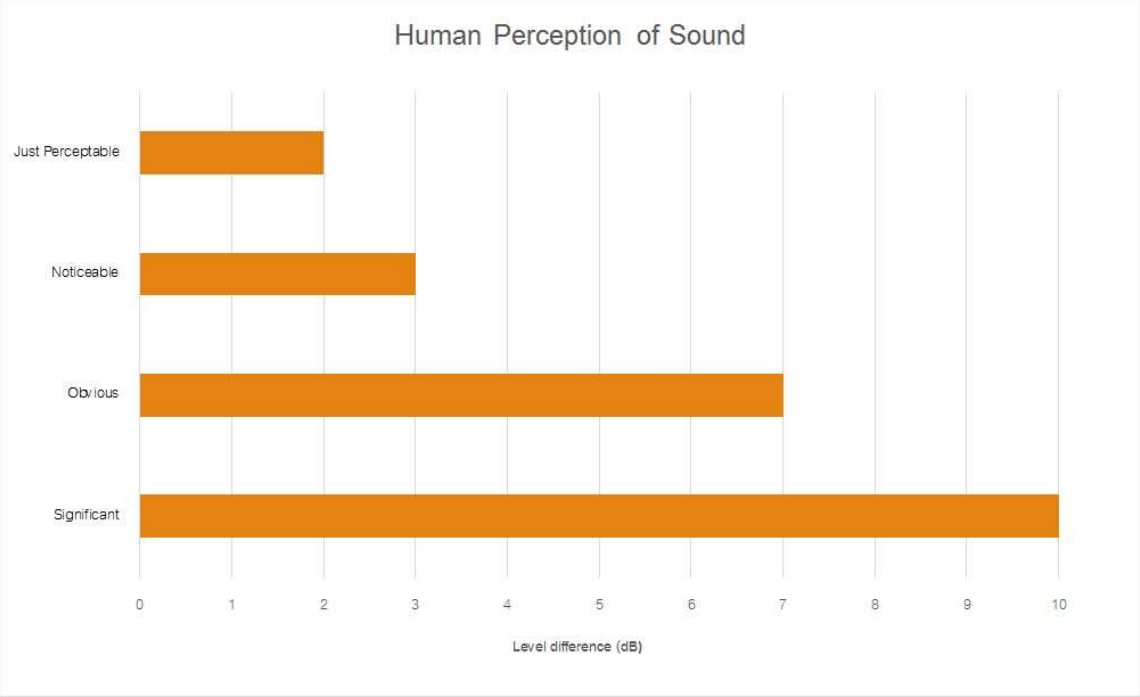
Table A1 Glossary of Acoustical Terms

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 – Site Plans

Sheet List

Sheet Number	Sheet Name
DA000	COVER PAGE AND DRAWING LIST
DA001	SITE CONTEXT
DA002	EXISTING SITE PLAN
DA010	DEMOLITION PLAN
DA020	PROPOSED - SITE PLAN
DA023	PROPOSED - SECOND FLOOR PLAN
DA024	EXISTING - GL CARPARK
DA025	PROPOSED - UPPER DECK CAR PARK
DA026	PROPOSED - ROOF PLAN
DA030	PROPOSED - ONCOLOGY ELEVATIONS
DA031	PROPOSED - CARPARK ELEVATIONS
DA032	PROPOSED - CARPARK SECTIONS
DA050	PROPOSED - MATERIALS SCHEDULE
DA060	EXISTING - 22 DEC SHADOW DIAGRAMS
DA062	PROPOSED - 22 DEC SHADOW DIAGRAM
DA063	EXISTING - 22 JUNE SHADOW DIAGRAMS
DA064	PROPOSED - 22 JUNE SHADOW DIAGRAM
DA065	EXISTING - 23 SEPT SHADOW DIAGRAMS
DA066	PROPOSED - 22 SEPT SHADOW DIAGRAM
DA067	COMPARISON RENDER

DEVELOPMENT SUMMARY

GFA		
EXISITNG GFA	12145	m²
PROPOSED GFA	675	m²
TOTAL GFA	12820	m²
CAR PARK		
EXISTING CAR PARK	229	
EXISTING ACCESSIBLE CAR PARK	7	
LOST CAR PARK	0	
PROPOSED CAR PARK	63	
PROPOSED ACCESSIBLE CAR...		
TOTAL CAR SPACE	299	
BED NUMBERS		
EXISTING BED	172	
LOST BED		
PROPOSED BED	3	
TOTAL BED	175	

ISSUE	REVISION	JASN	CHK / APP	DATE
-	ISSUE FOR DA	TT	RP	6.12.2021

CONSULTANTS:

NORTHROP

healthecare

redeye constructions

marline

HSPC HEALTH ARCHITECTS

REASON FOR ISSUE
PRELIMINARY

PROJECT No.:
9-19-0020

PROJECT:
VAITLAND STAGE 7

PROJECT ADDRESS:
173-175 Chisholm Rd
Ashtonfield NSW 2323
CLIENT:
HealtheCare Australia

DRAWING TITLE:
COVER PAGE AND DRAWING LIST

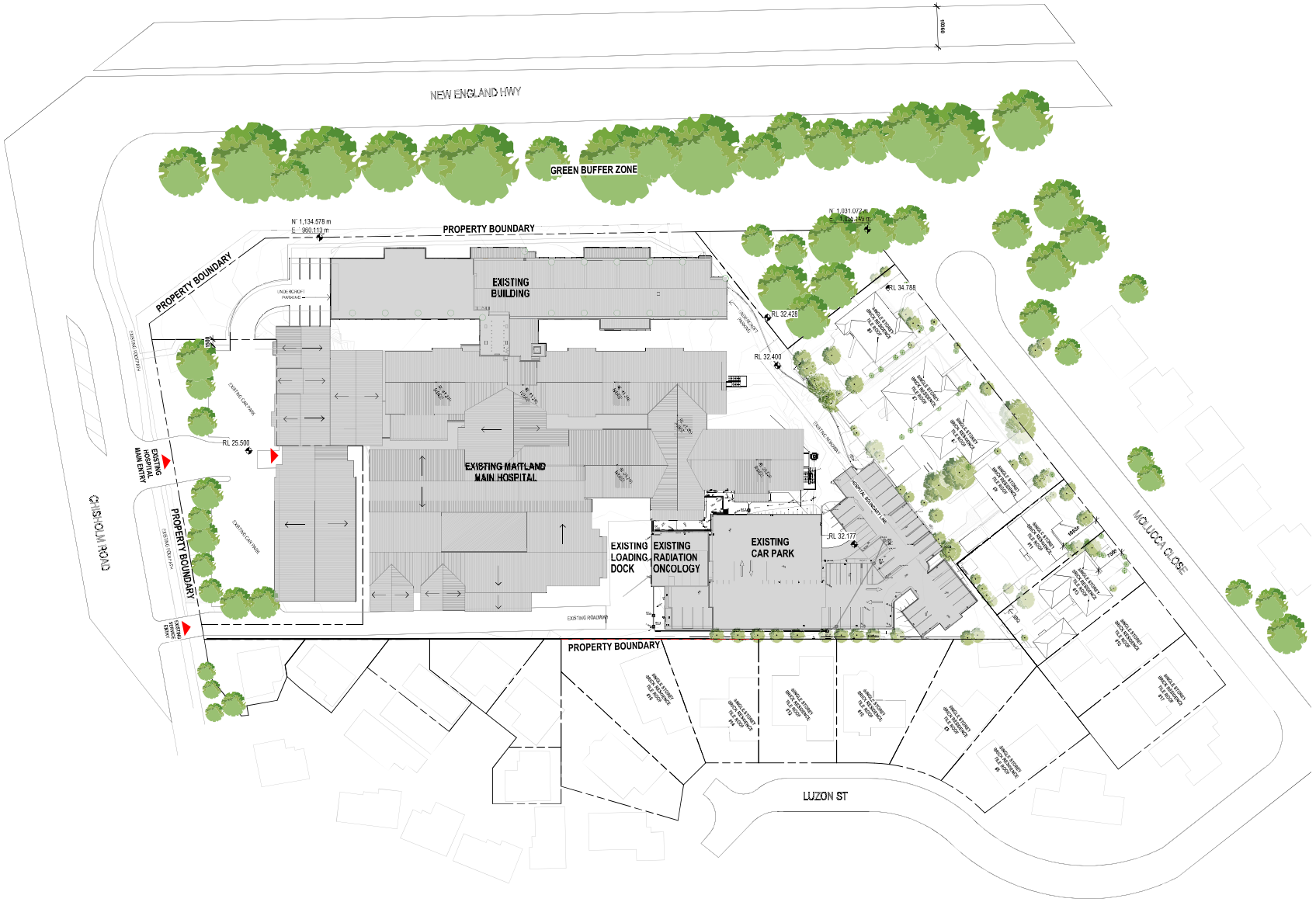
SCALE:
@ A1

PROJECT DATE:
Issue Date

DRAWING No.:
DA000

REVISION:
-

20/12/2022 10:19:47 AM



1 EXISTING SITE PLAN
Scale 1 : 500

HSPC
HEALTH ARCHITECTS

MAITLAND STAGE 7
173-175 Chisholm Rd
Ashtonfield NSW 2323
PROJECT NO:
9-19-0020

REASON FOR ISSUE:
PRELIMINARY

EXISTING SITE PLAN

REV:	ISSUE:	DATE:	SCALE:
-	-	11/15/22	1 : 500 @ A1

DA002

HSPC
HEALTH ARCHITECTS

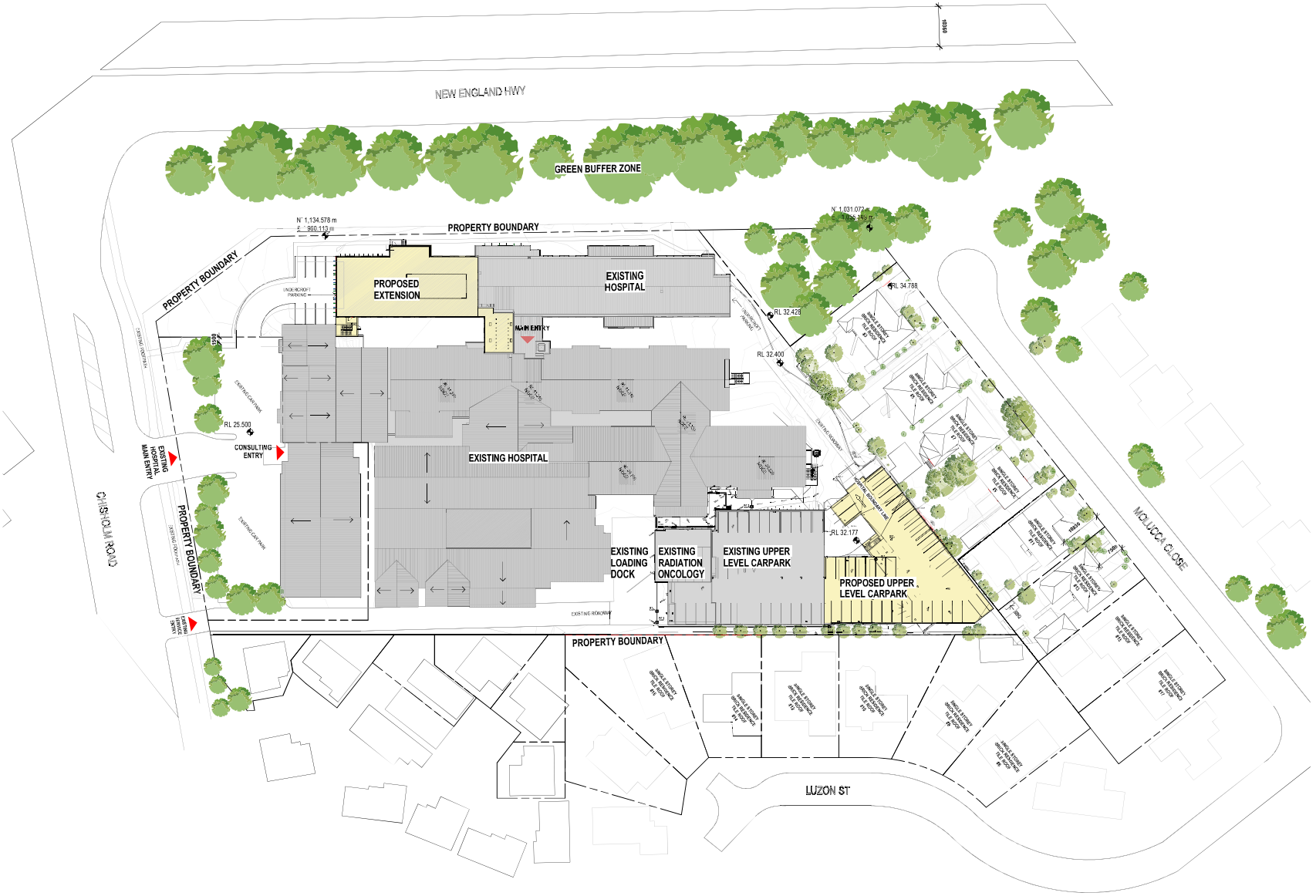
MAITLAND STAGE 7
173-175 Chisholm Rd
Ashtonfield NSW 2323
PROJECT NO:
9-19-0020

REASON FOR ISSUE:
PRELIMINARY

DEMOLITION PLAN

REV:	ISSUE:	DATE:	SCALE:
-	-	11/15/22	1 : 200 @ A1

DA010



HSPC
HEALTH ARCHITECTS

MAITLAND STAGE 7
173-175 Chisholm Rd
Ashtonfield NSW 2323
PROJECT NO:
9-19-0020

REASON FOR ISSUE:
PRELIMINARY

PROPOSED - SITE PLAN

REV:	ISSUE:	DATE:	SCALE:
-	-	11/15/22	As indicated @ A1

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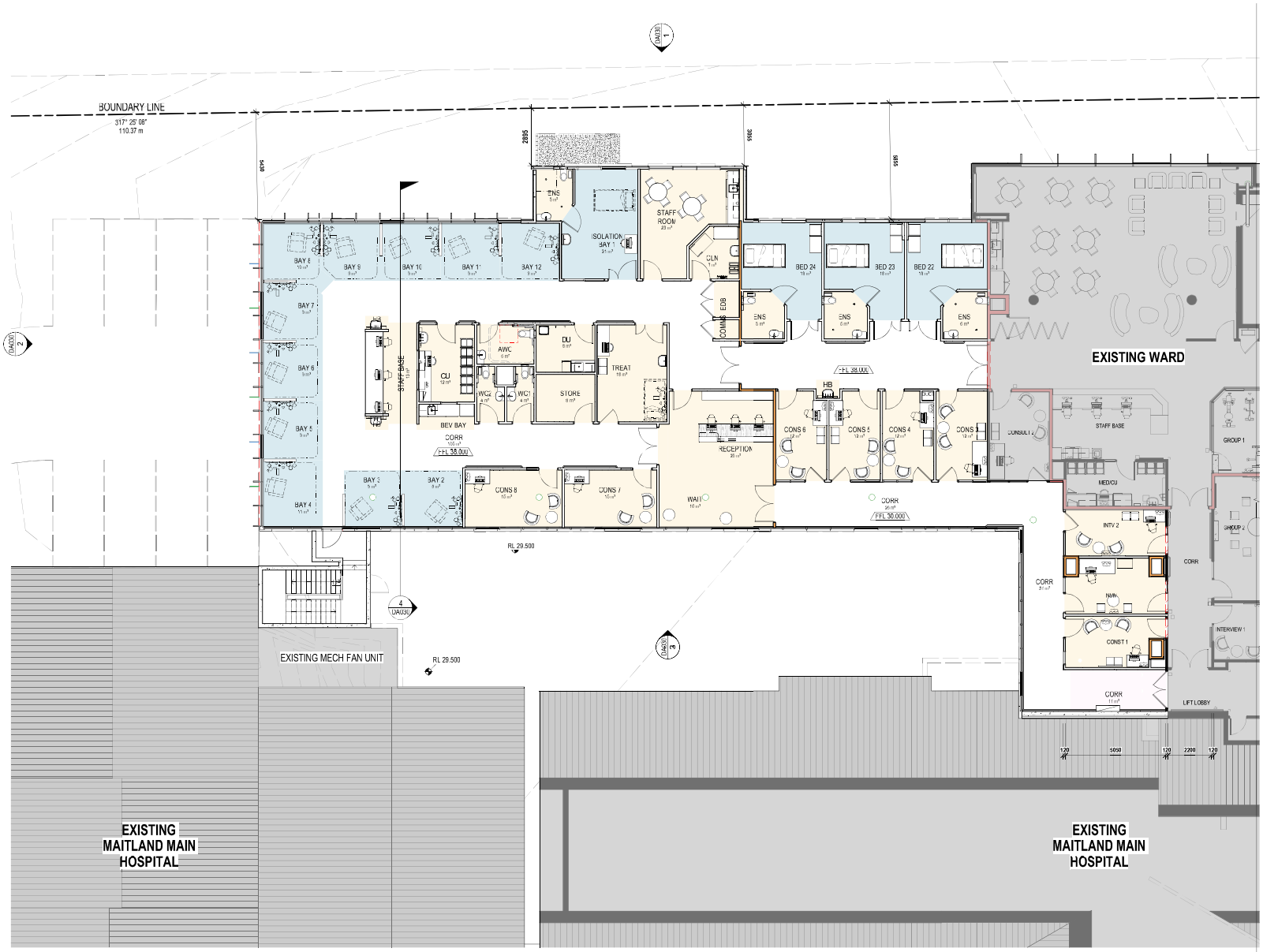

HSPC HEALTH ARCHITECTS

MAITLAND STAGE 7
173-175 Chisholm Rd
Ashtonfield NSW 2323
PROJECT NO: 9-19-0020

REASON FOR ISSUE: PRELIMINARY

PROPOSED - SECOND FLOOR PLAN

REV:	ISSUE:	DATE:	SCALE:
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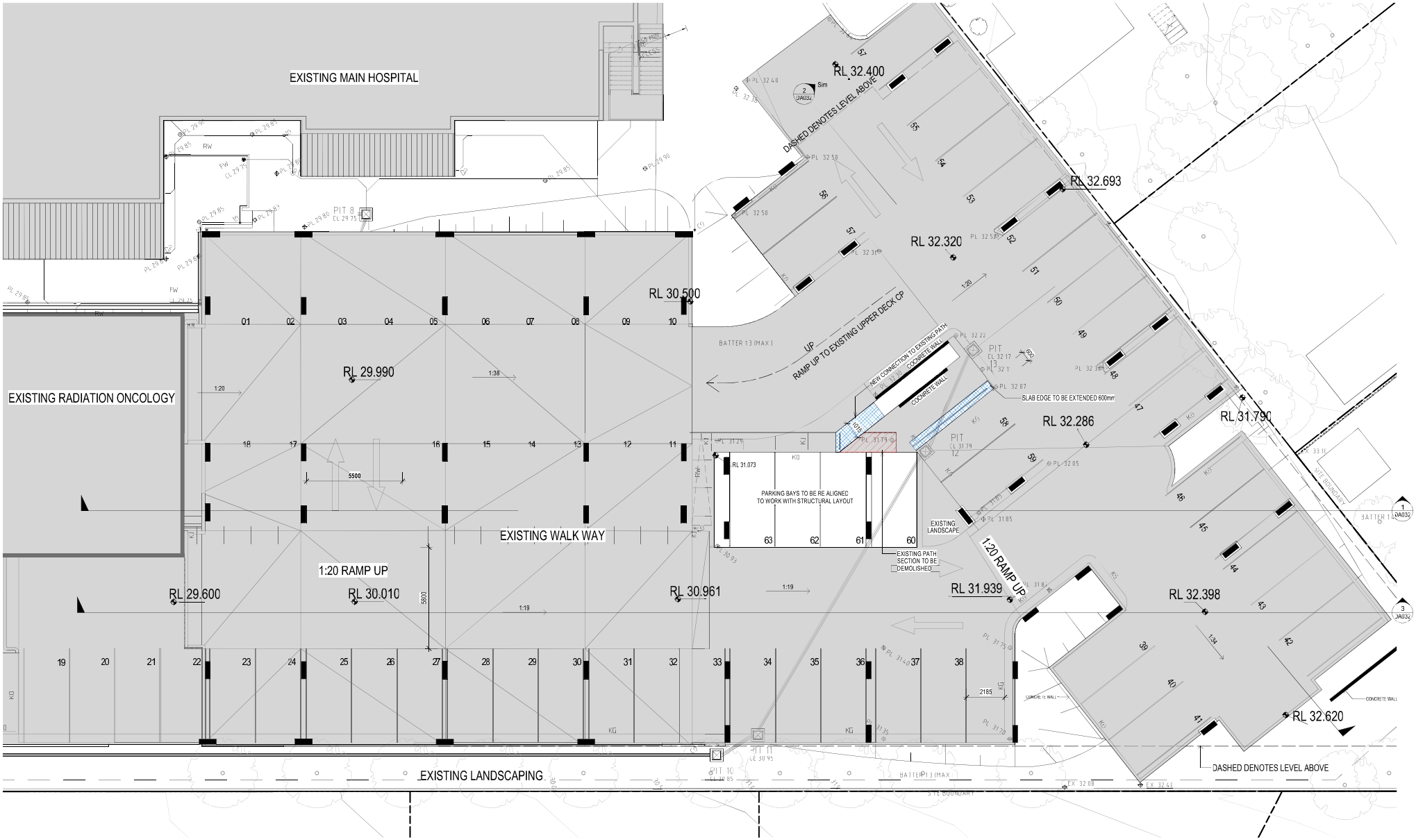

HSPC
HEALTH ARCHITECTS

MAITLAND STAGE 7
173-175 Chisholm Rd
Ashtonfield NSW 2323

PROJECT NO:
9-19-0020

REASON FOR ISSUE:
PRELIMINARY

EXISTING - GL CARPARK

REV:	ISSUE:	DATE:	SCALE:
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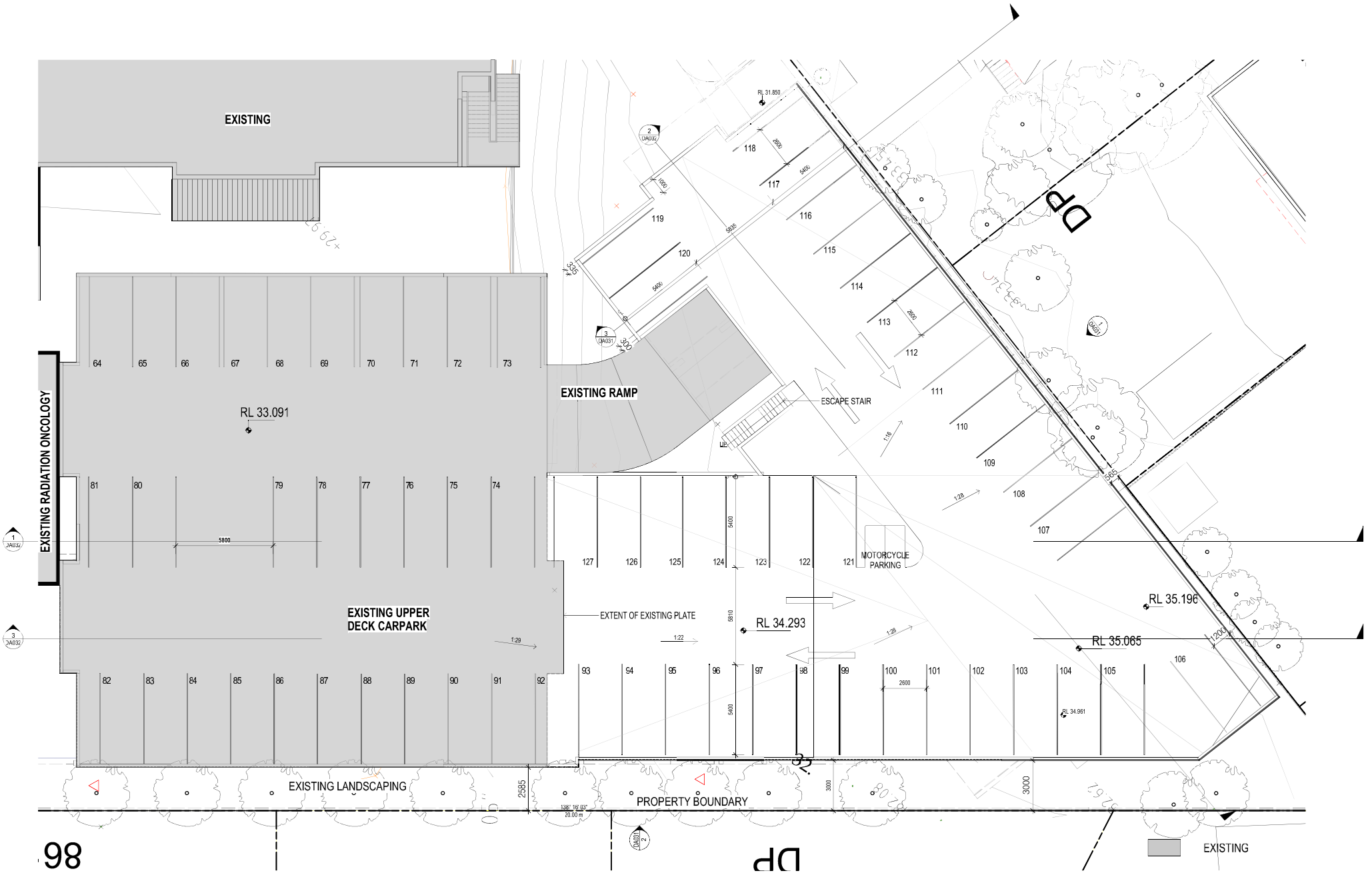

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HSPC
HEALTH ARCHITECTS

MAITLAND STAGE 7
173-175 Chisholm Rd
Ashtonfield NSW 2323
PROJECT NO:
9-19-0020

REASON FOR ISSUE:
PRELIMINARY

PROPOSED - UPPER DECK CAR PARK

REV:	ISSUE:	DATE:	SCALE:
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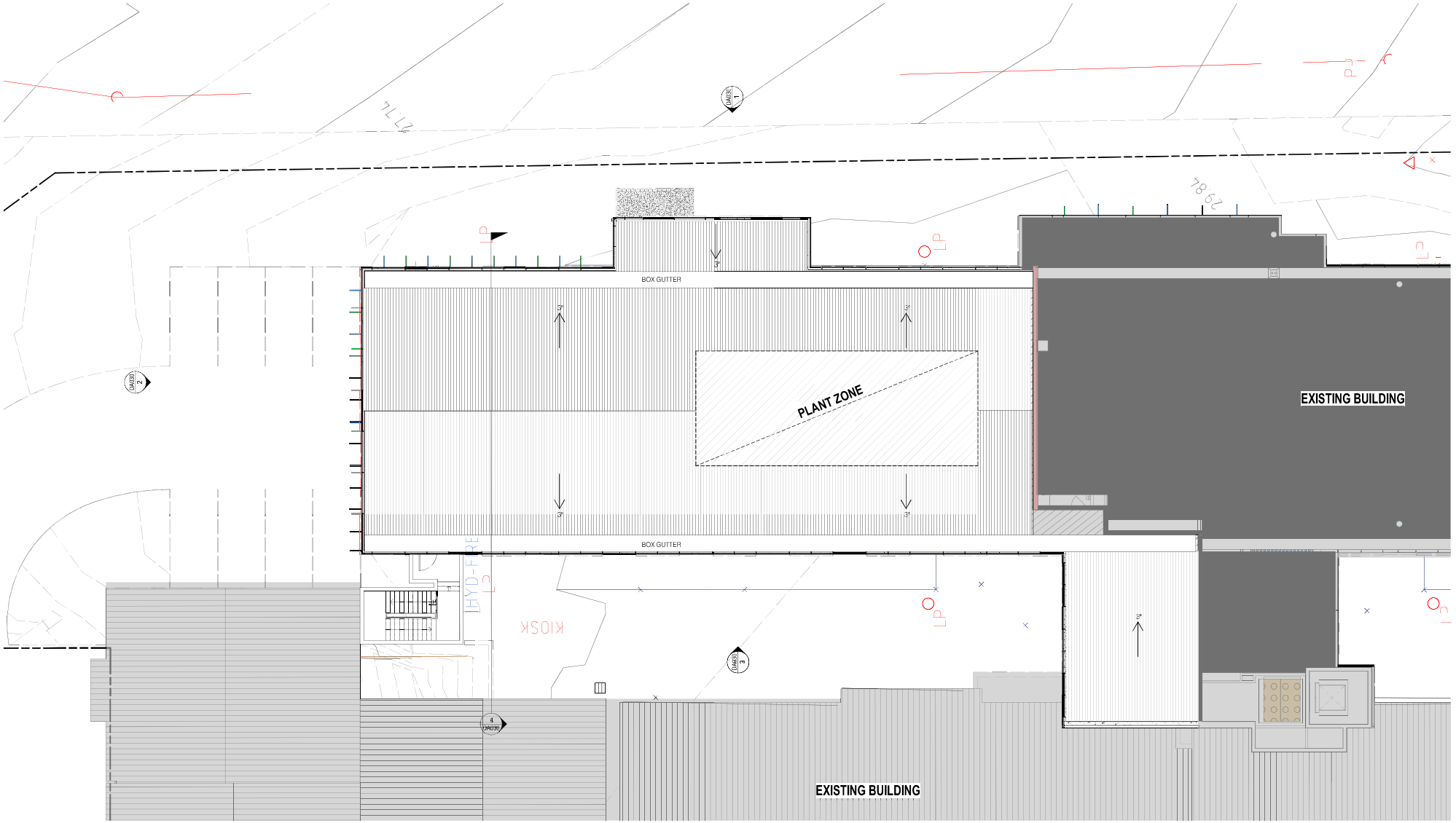

HSPC
HEALTH ARCHITECTS

MAITLAND STAGE 7
173-175 Chisholm Rd
Ashtonfield NSW 2323
PROJECT NO:
9-19-0020

REASON FOR ISSUE:
PRELIMINARY

PROPOSED - ROOF PLAN

REV:	ISSUE:	DATE:	SCALE:
-	-	11/15/22	1 : 100 @ A1

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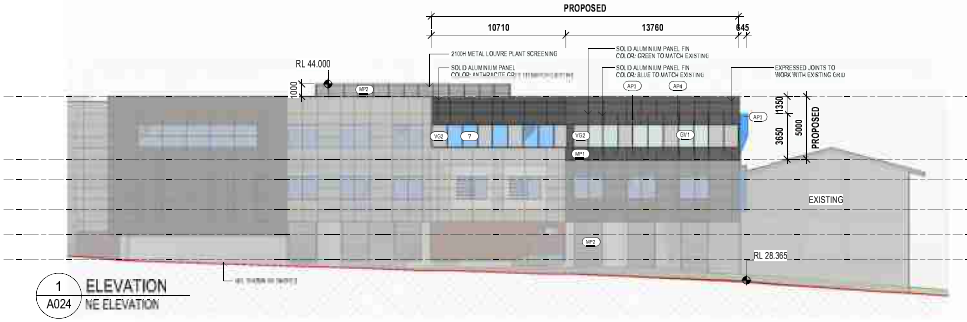

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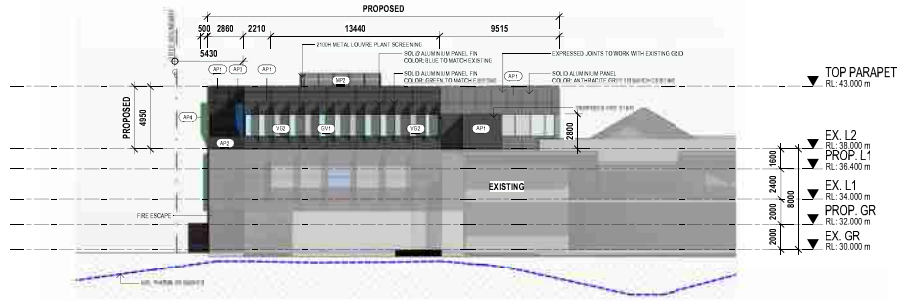
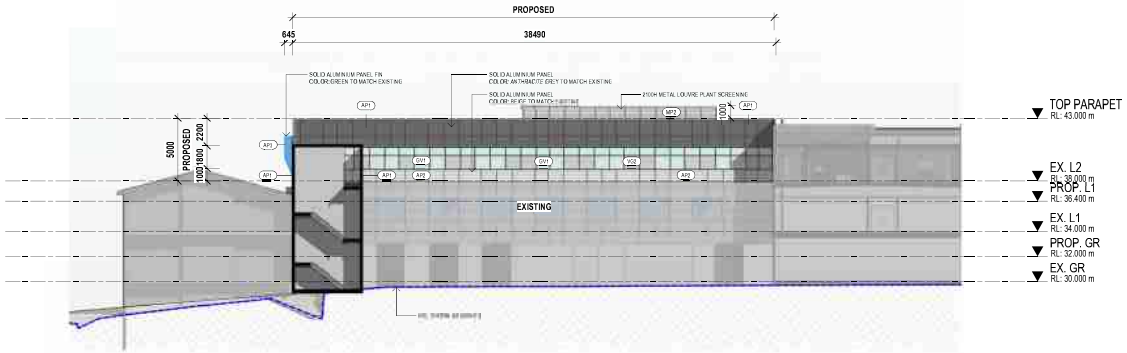


2 A024 ELEVATION
NORTH ELEVATION
1 : 200



3 A024 ELEVATION
SW ELEVATION
1 : 200

4 A031 SECTION A-A
Scale 1 : 100

EXISTING

HSPC
HEALTH ARCHITECTS

MAITLAND STAGE 7
173-175 Chisholm Rd
Ashtonfield NSW 2323
PROJECT NO:
9-19-0020

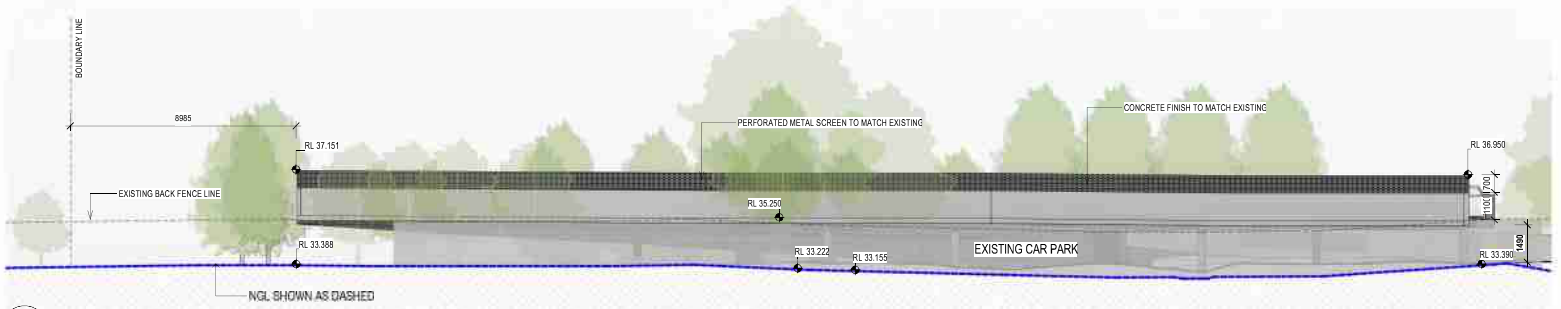
REASON FOR ISSUE:
PRELIMINARY

PROPOSED - ONCOLOGY ELEVATIONS

REV:	ISSUE:	DATE:	SCALE:
-	-	11/15/22	As indicated @ A1

DA030

EXISTING



1 DA025 ELEVATION
CP - EAST ELEVATION
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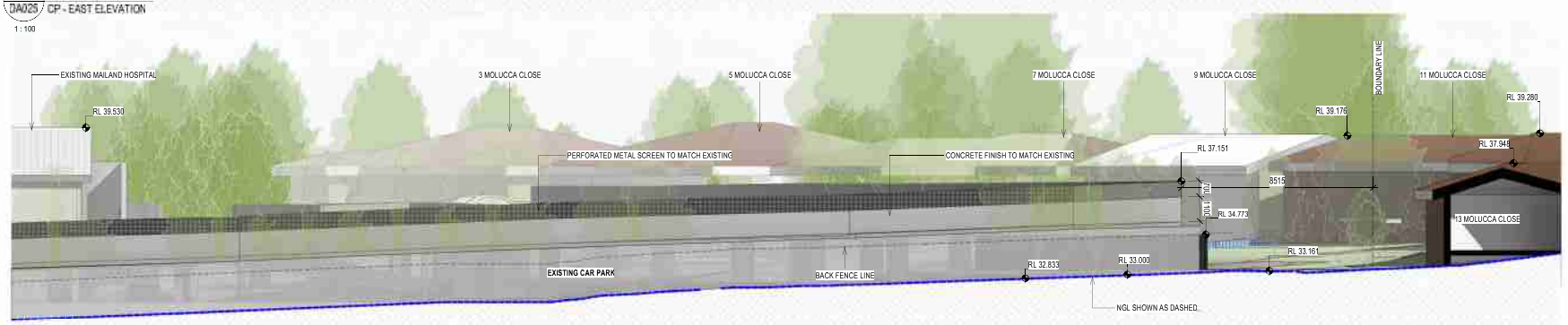
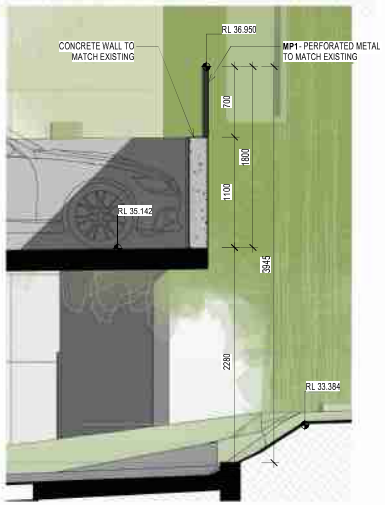


2 DA025 ELEVATION
CP - SOUTH ELEVATION
1 : 100

3 DA025 PROPOSED CARPARK HEIGHT DIAGRAM
Scale 1 : 100



4 DA031 CARPARK SCREENING DETAIL
Scale 1 : 25

HSPC HEALTH ARCHITECTS

MAITLAND STAGE 7
173-175 Chisholm Rd
Ashtonfield NSW 2323
PROJECT NO: 9-19-0020

REASON FOR ISSUE: PRELIMINARY

PROPOSED - CARPARK ELEVATIONS

REV:	ISSUE:	DATE:	SCALE:
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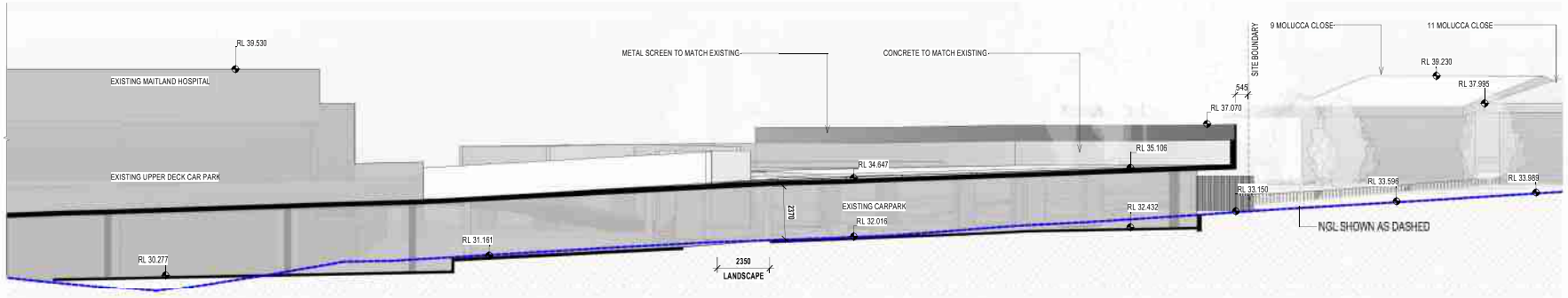

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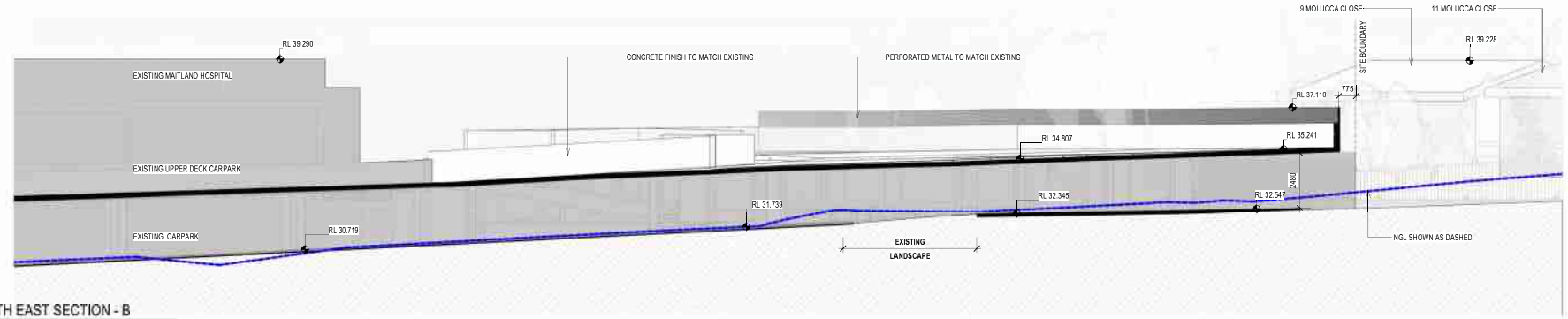
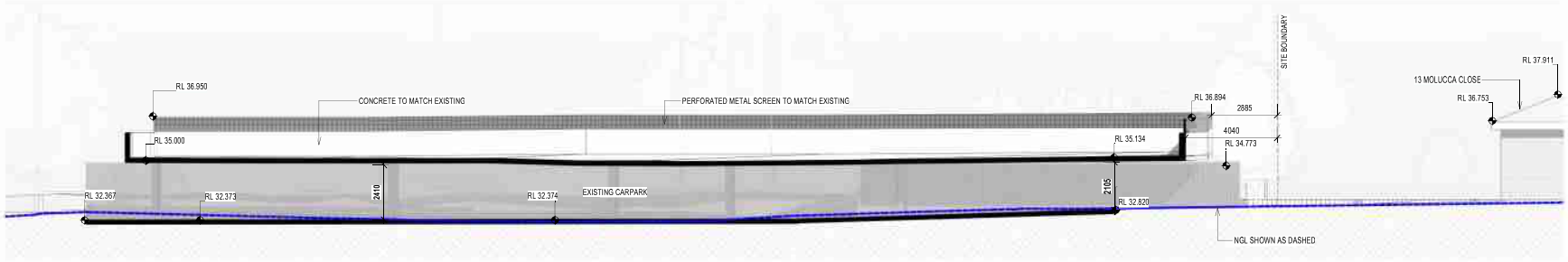


3 DA024 NORTH EAST SECTION - B
Scale 1 : 100



2 DA024 EAST SECTION
Scale 1 : 100

HSPC
HEALTH ARCHITECTS

MAITLAND STAGE 7
173-175 Chisholm Rd
Ashtonfield NSW 2323
PROJECT NO:
9-19-0020

REASON FOR ISSUE:
PRELIMINARY

PROPOSED - CARPARK SECTIONS

REV:	ISSUE:	DATE:	SCALE:
-	-	11/15/22	1 : 100 @ A1

EXISTING

DA032

Appendix C – Noise Monitoring Charts

Table C25 Background Noise Monitoring Summary – Location 1						
Date	Measured Background Noise Level (LA_{90}) dB ABL[1]			Measured dB $LA_{eq(period)}$		
	Day	Evening	Night	Day	Evening	Night
Friday-17-Feb-23	--	49	39	--	61	54
Saturday-18-Feb-23	54	50	--	63	61	--
Sunday-19-Feb-23	53	46	41	63	58	56
Monday-20-Feb-23	55	48	43	63	60	--
Tuesday-21-Feb-23	55	47	42	63	59	57
Wednesday-22-Feb-23	--	49	38	--	58	56
Thursday-23-Feb-23	55	51	40	62	59	56
Friday-24-Feb-23	55	49	40	62	61	53
Saturday-25-Feb-23	51	49	42	61	60	52
Sunday-26-Feb-23	51	47	40	59	58	55
Monday-27-Feb-23	--	--	--	--	--	--
Location1 – RBL / Leq Overall	54	49	40	62	60	55

Note 1: Assessment background level (ABL) – the single-figure background level representing each assessment period day, evening and night as per NPI Fact Sheet A.

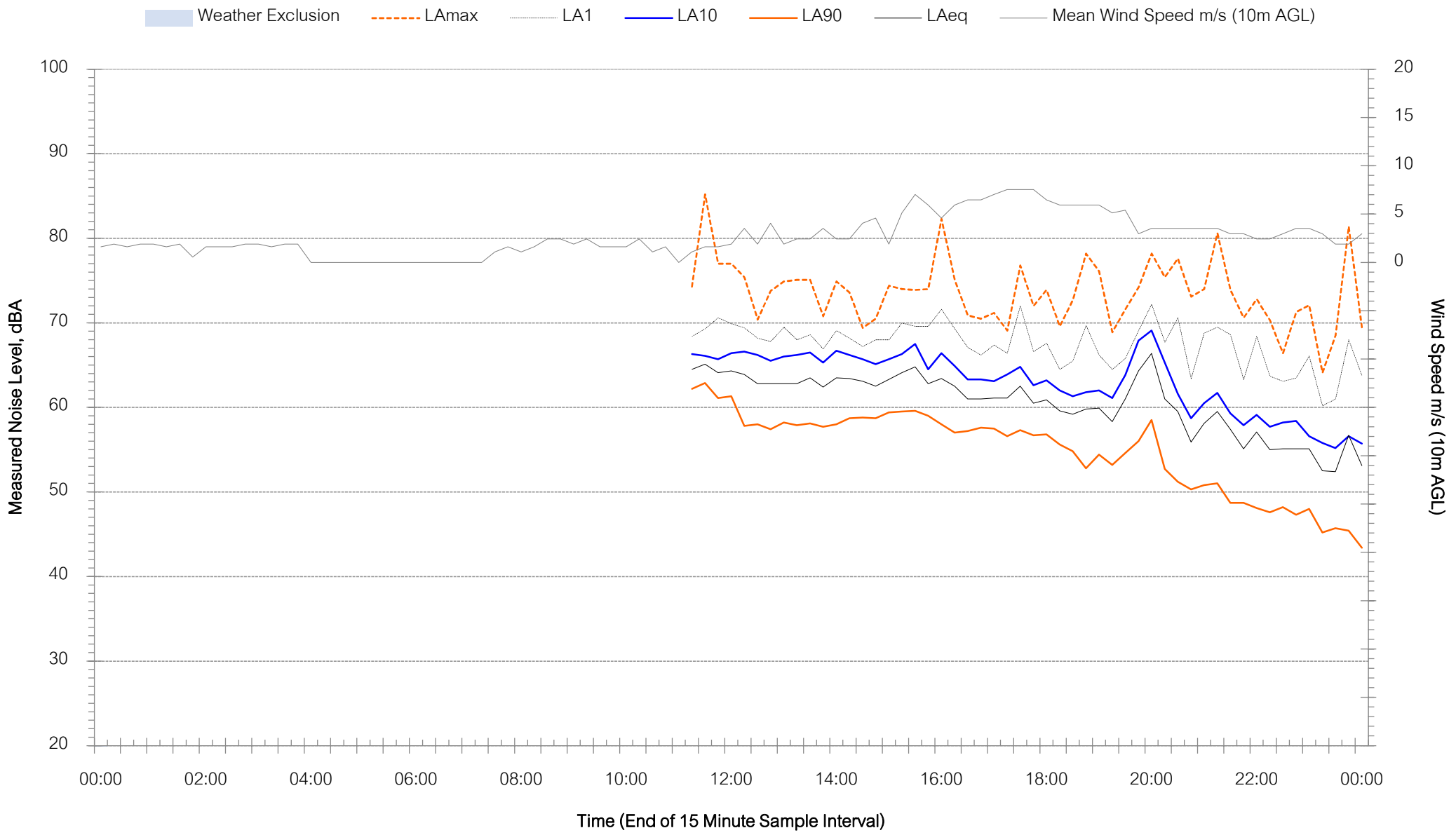
Table C26 Background Noise Monitoring Summary – Location 2

Date	Measured Background Noise Level (LA90) dB ABL[1]			Measured dB LAeq(period)		
	Day	Evening	Night	Day	Evening	Night
Friday-17-Feb-23	--	43	40	--	57	50
Saturday-18-Feb-23	43	40	--	59	58	--
Sunday-19-Feb-23	43	39	39	59	55	53
Monday-20-Feb-23	45	43	38	58	56	51
Tuesday-21-Feb-23	46	41	35	58	57	54
Wednesday-22-Feb-23	--	46	38	--	62	55
Thursday-23-Feb-23	48	48	47	60	63	54
Friday-24-Feb-23	48	46	48	59	59	56
Saturday-25-Feb-23	46	45	44	59	58	53
Sunday-26-Feb-23	42	43	42	59	56	54
Monday-27-Feb-23	--	--	--	--	--	--
Location1 – RBL / Leq Overall	46	43	40	59	59	54

Note 1: Assessment background level (ABL) – the single-figure background level representing each assessment period day, evening and night as per NPI Fact Sheet A.

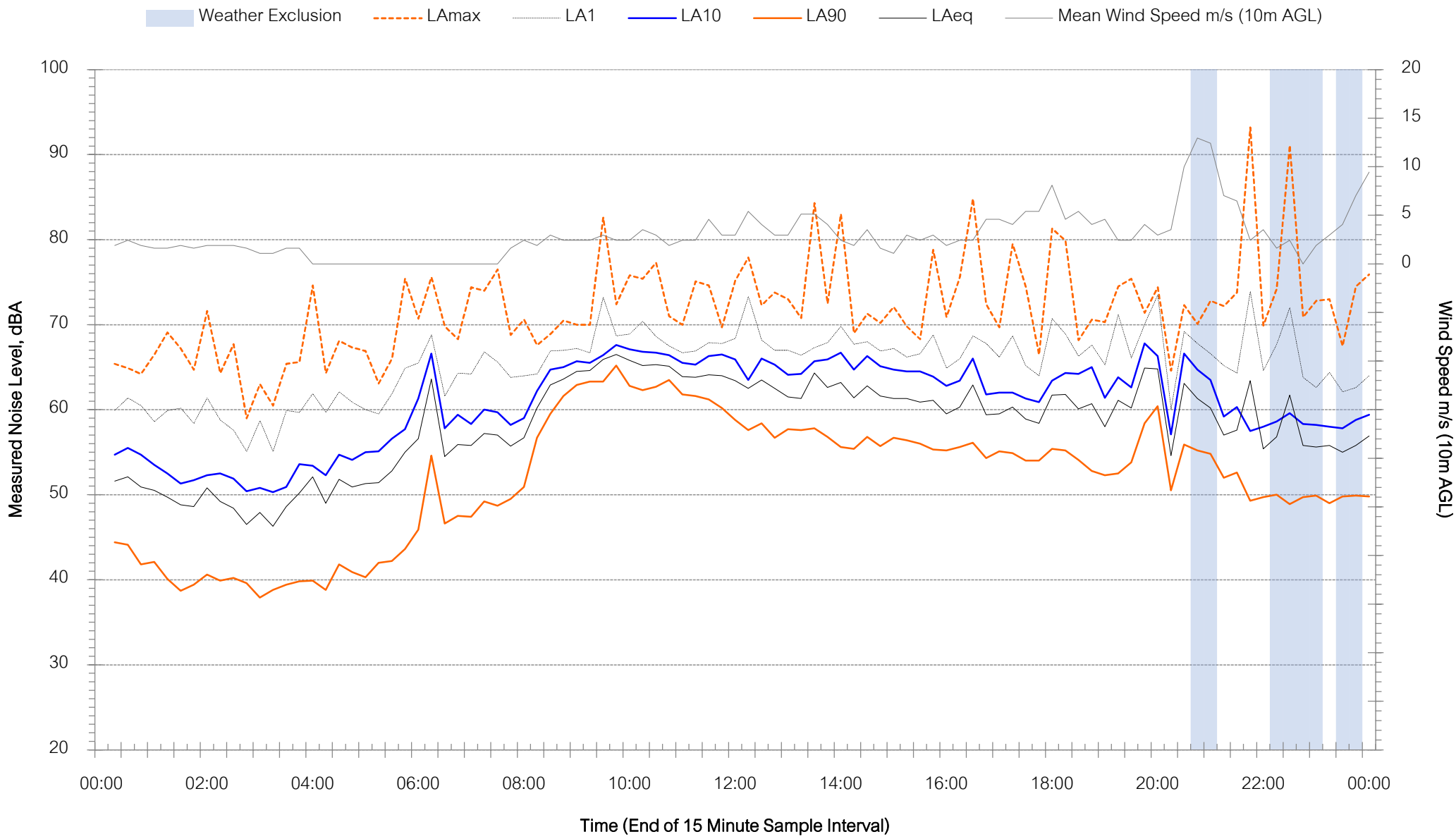
Background Noise Levels

Corner of Chisholm Road and New England Highway, East Maitland - Friday 17 February 2023



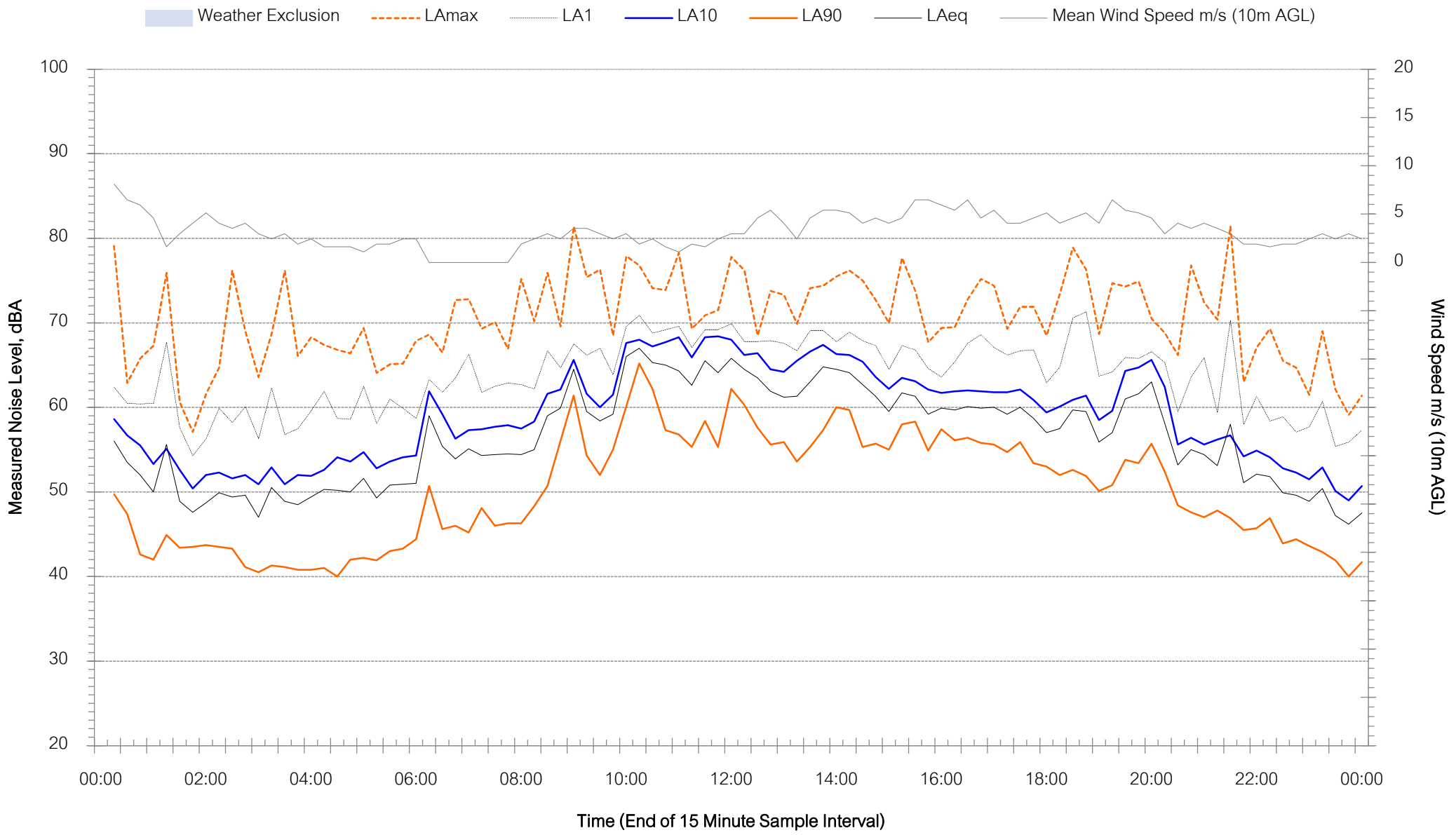
Background Noise Levels

Corner of Chisholm Road and New England Highway, East Maitland - Saturday 18 February 2023



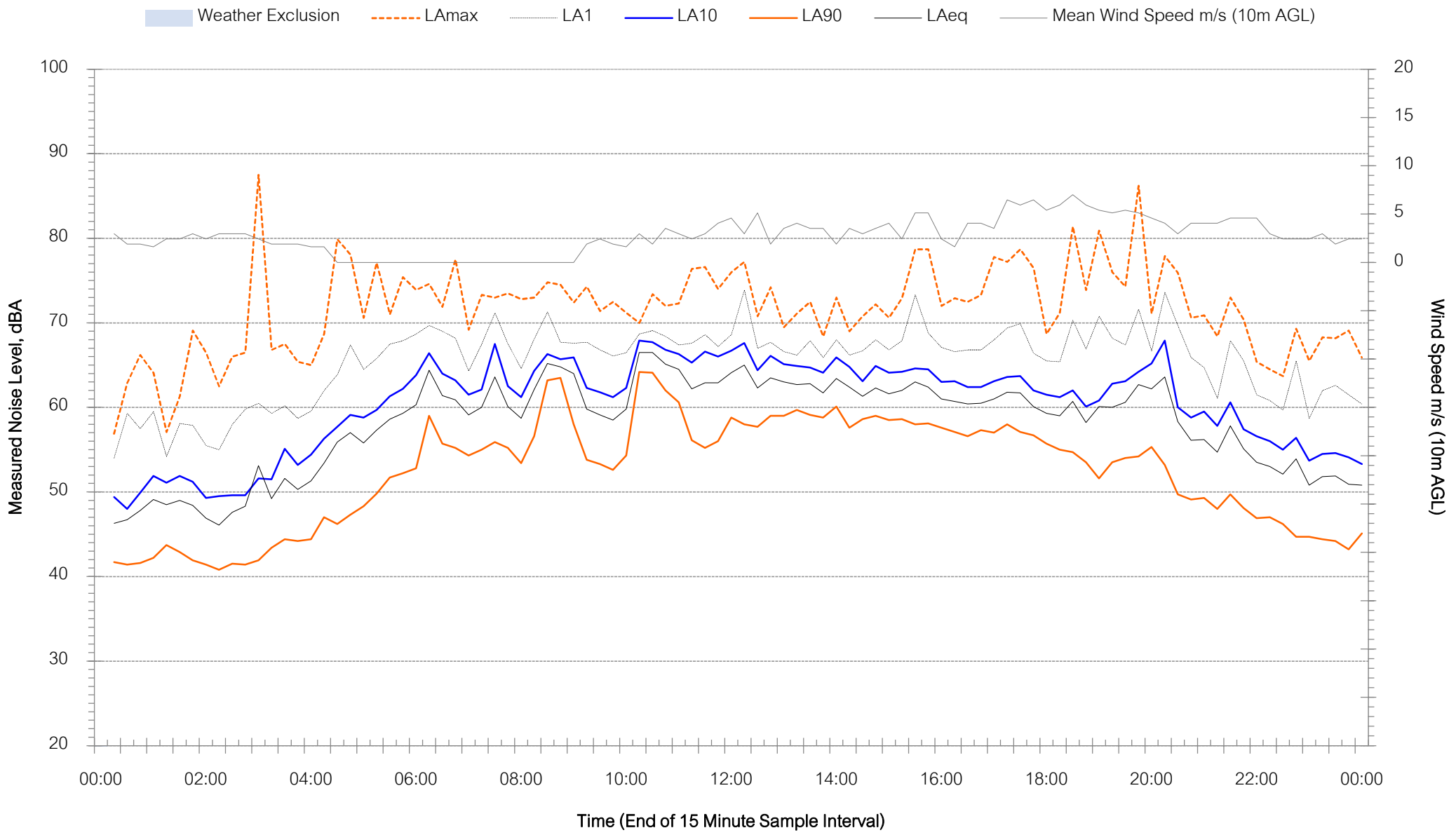
Background Noise Levels

Corner of Chisholm Road and New England Highway, East Maitland - Sunday 19 February 2023



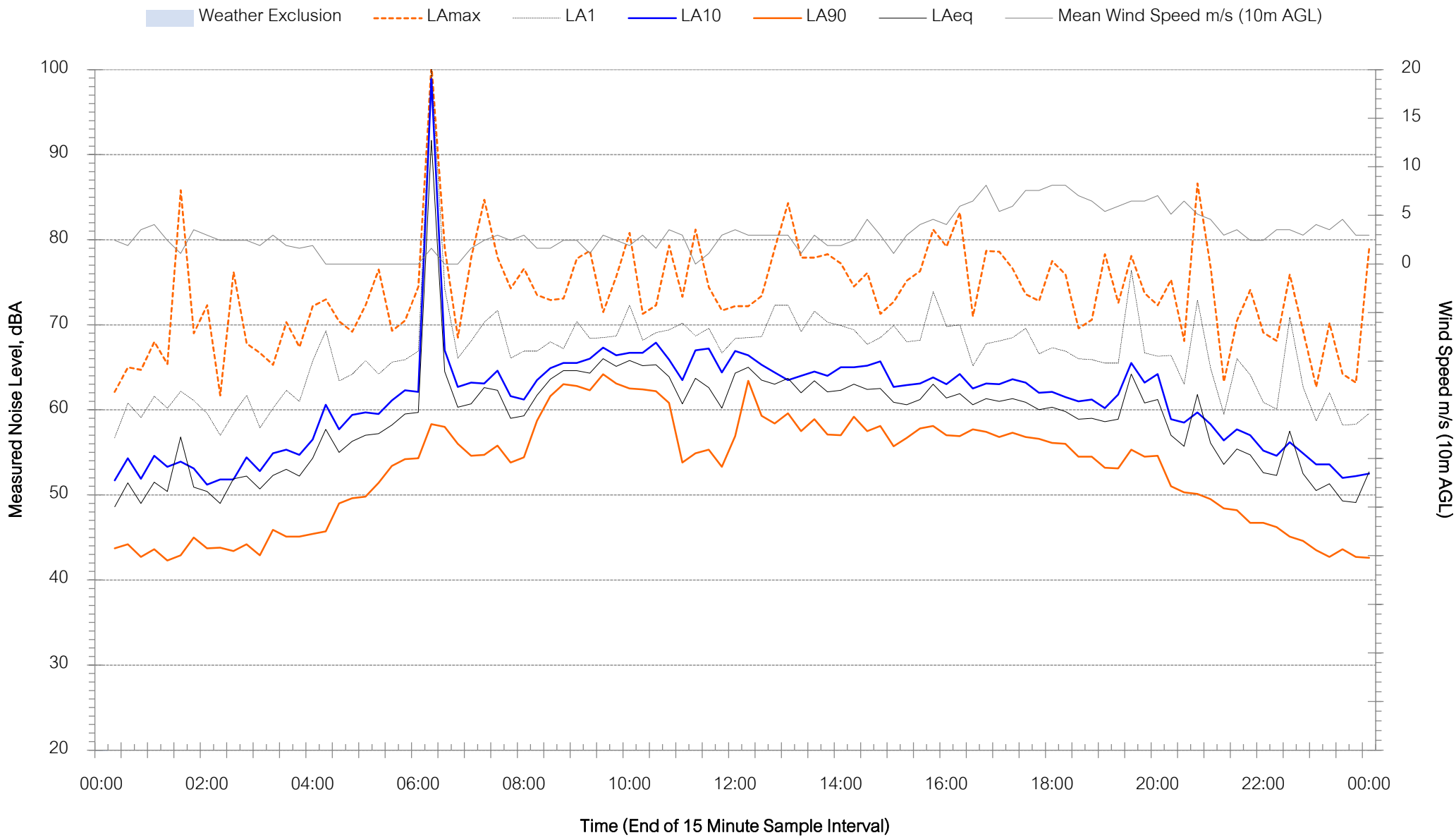
Background Noise Levels

Corner of Chisholm Road and New England Highway, East Maitland - Monday 20 February 2023



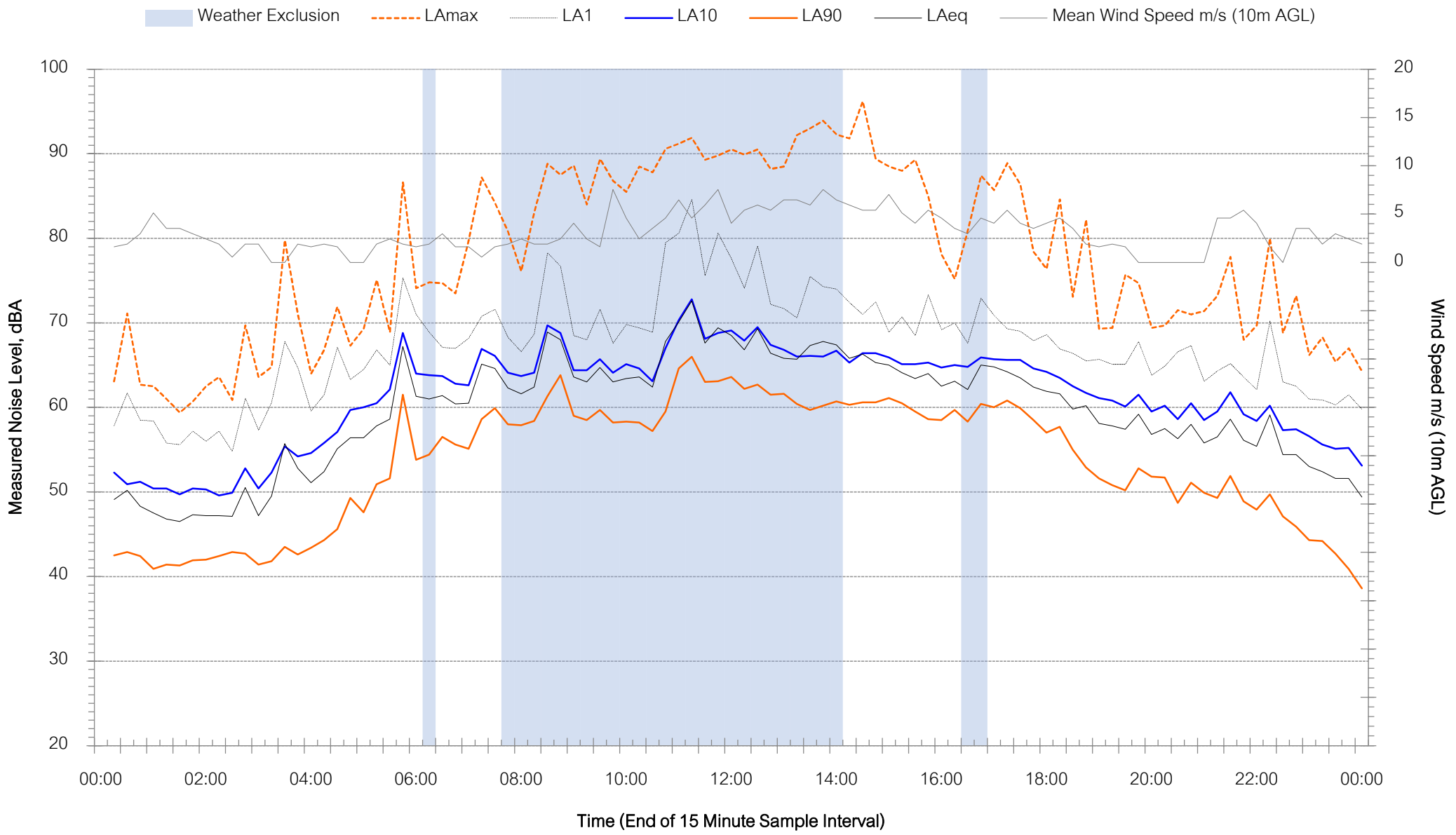
Background Noise Levels

Corner of Chisholm Road and New England Highway, East Maitland - Tuesday 21 February 2023



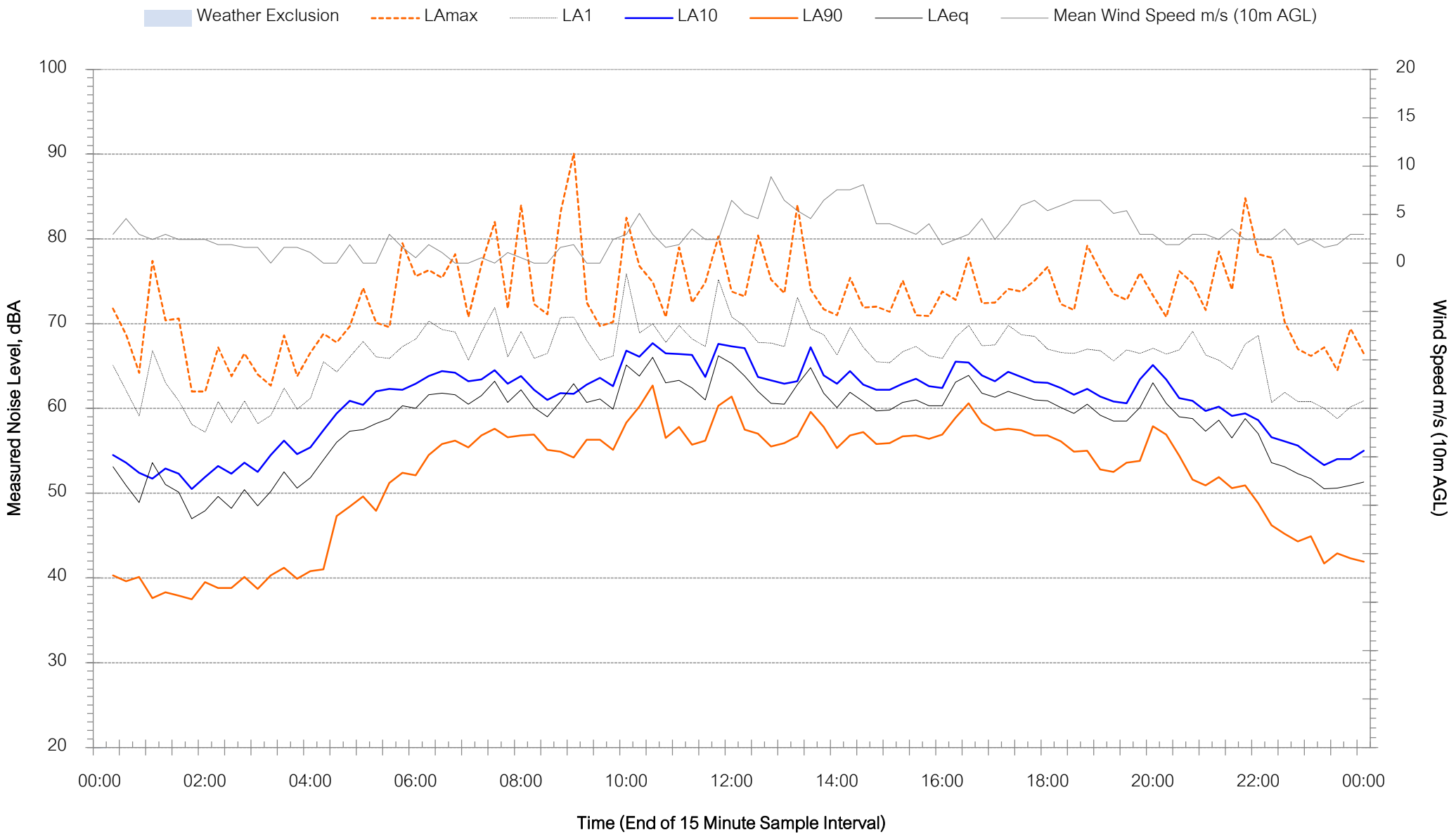
Background Noise Levels

Corner of Chisholm Road and New England Highway, East Maitland - Wednesday 22 February 2023



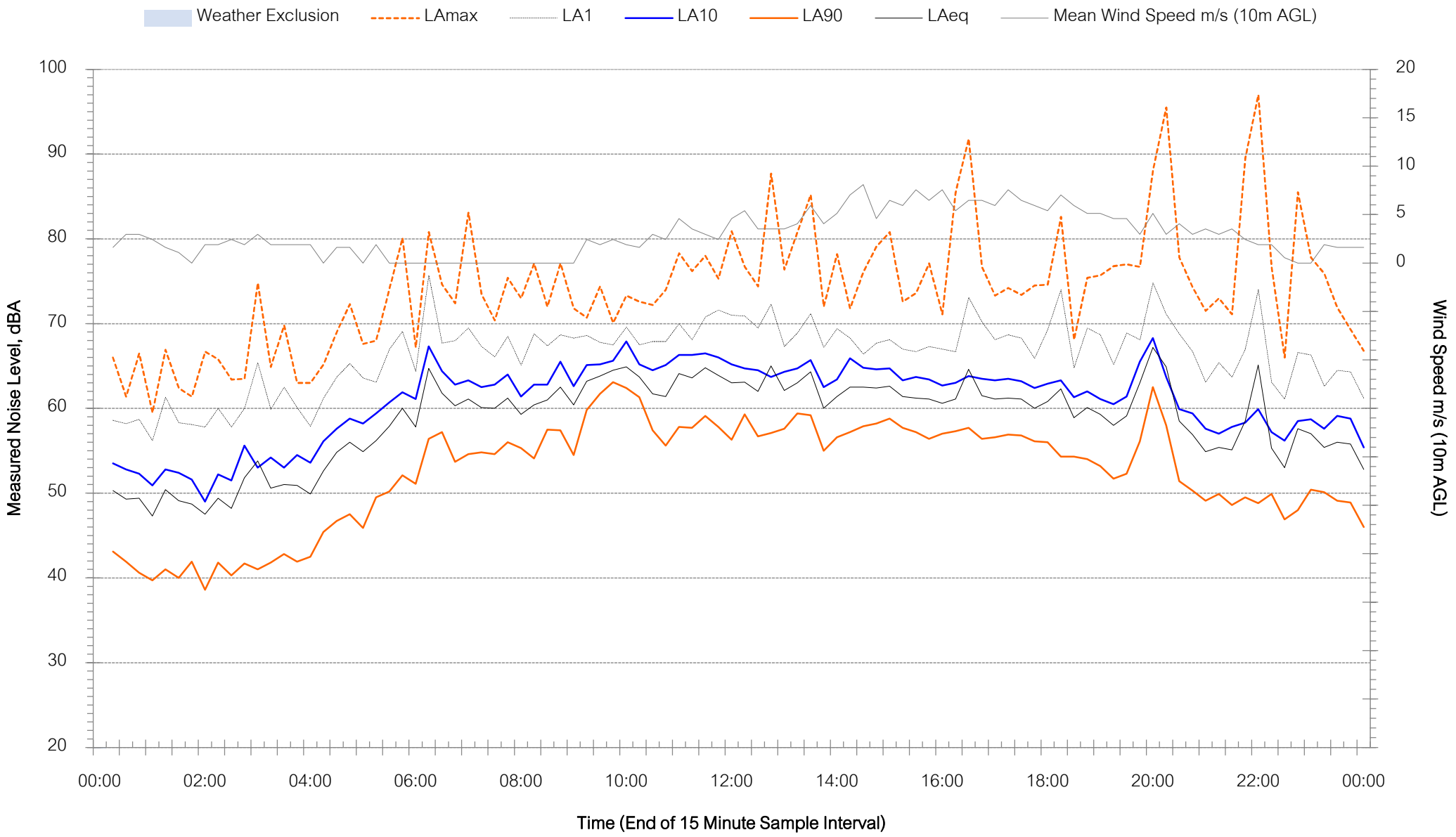
Background Noise Levels

Corner of Chisholm Road and New England Highway, East Maitland - Thursday 23 February 2023



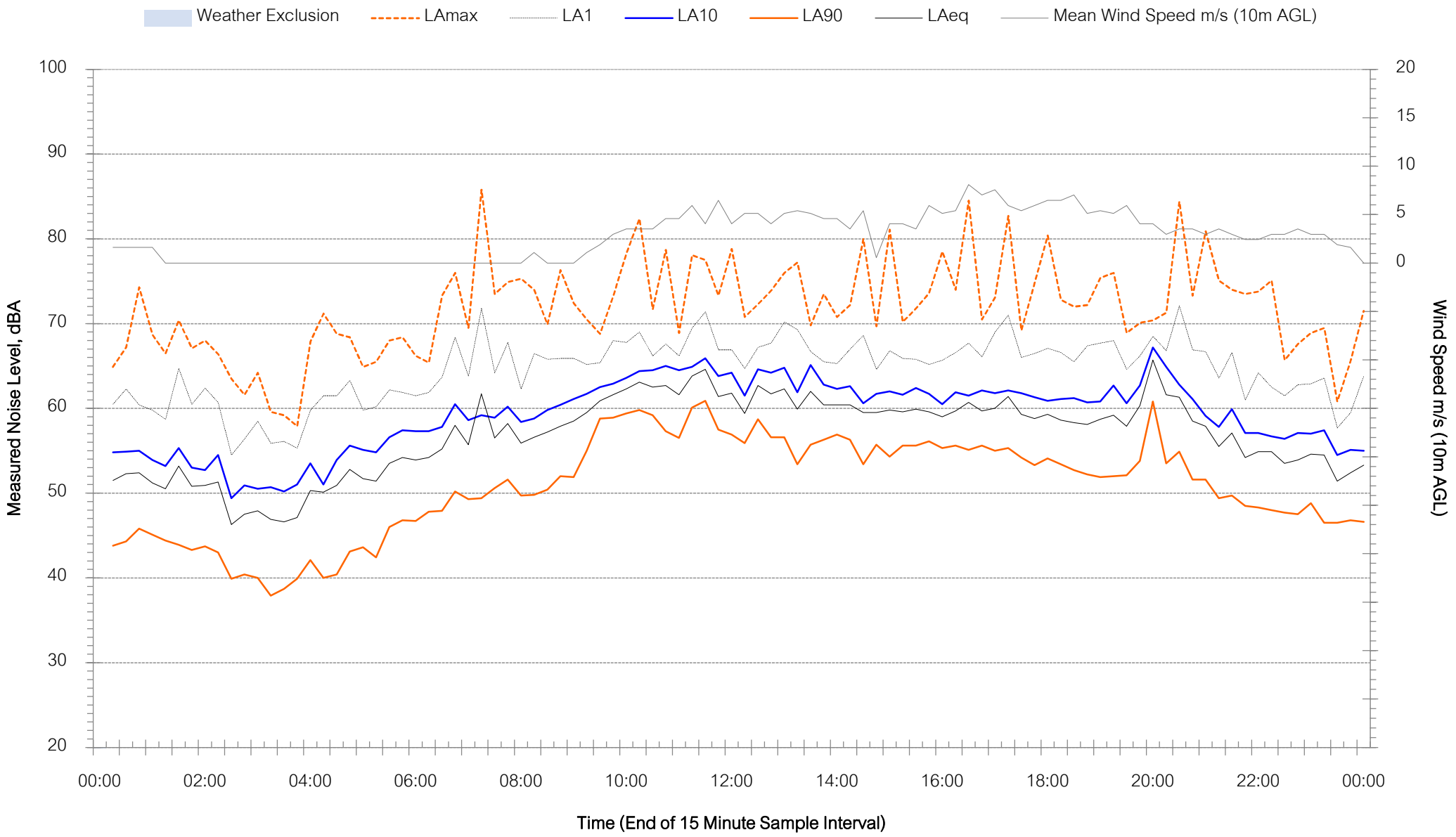
Background Noise Levels

Corner of Chisholm Road and New England Highway, East Maitland - Friday 24 February 2023



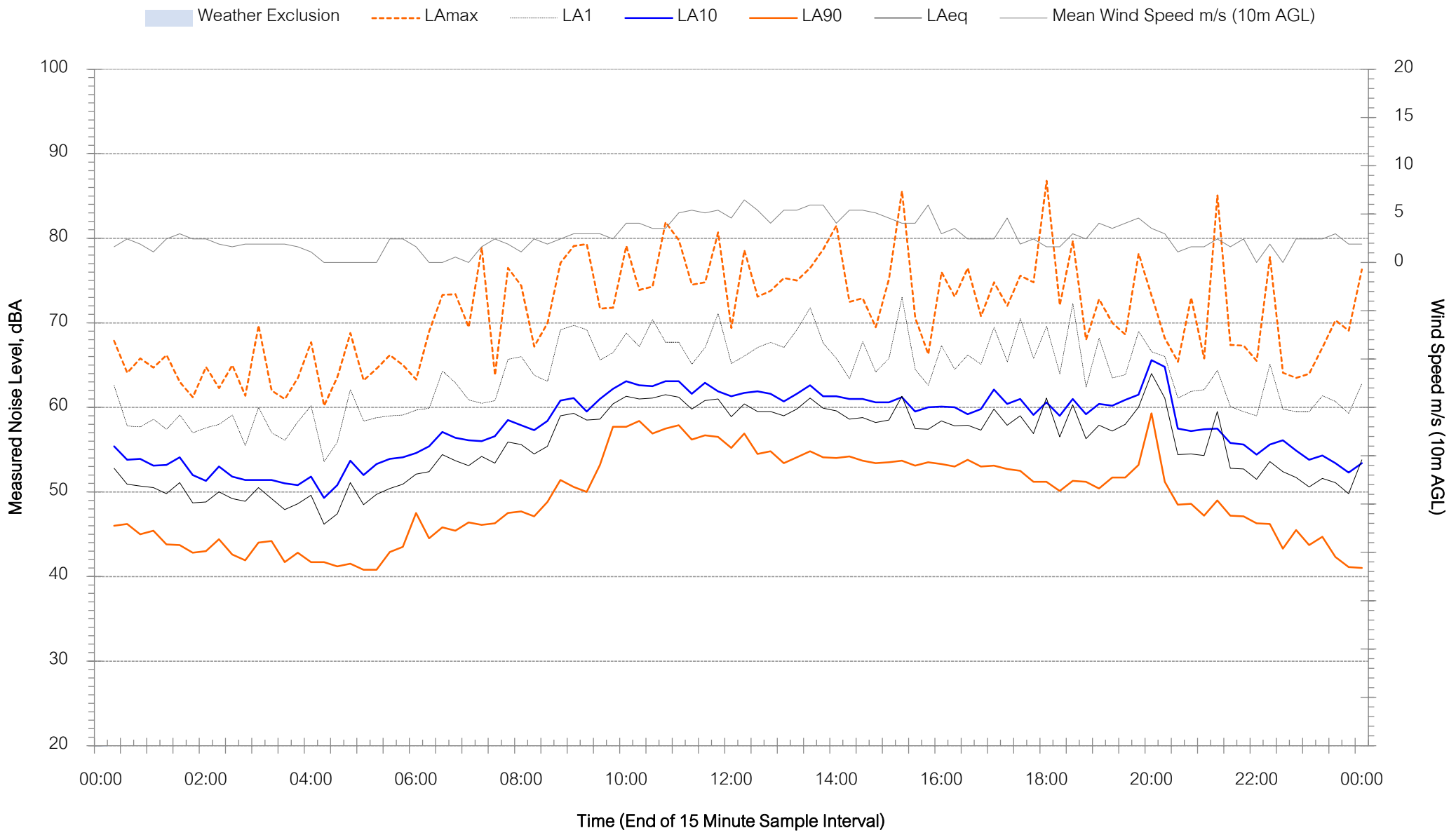
Background Noise Levels

Corner of Chisholm Road and New England Highway, East Maitland - Saturday 25 February 2023



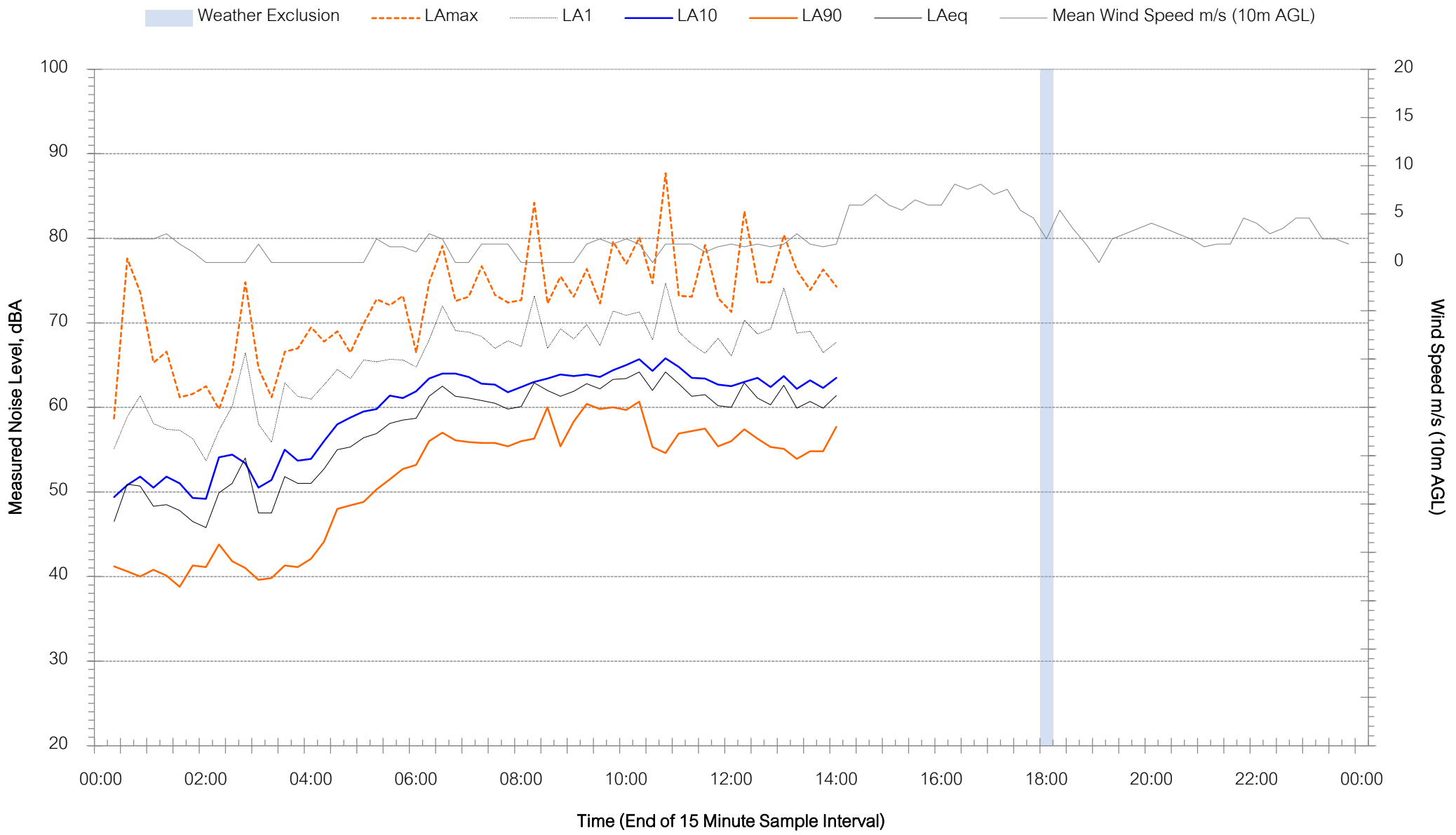
Background Noise Levels

Corner of Chisholm Road and New England Highway, East Maitland - Sunday 26 February 2023



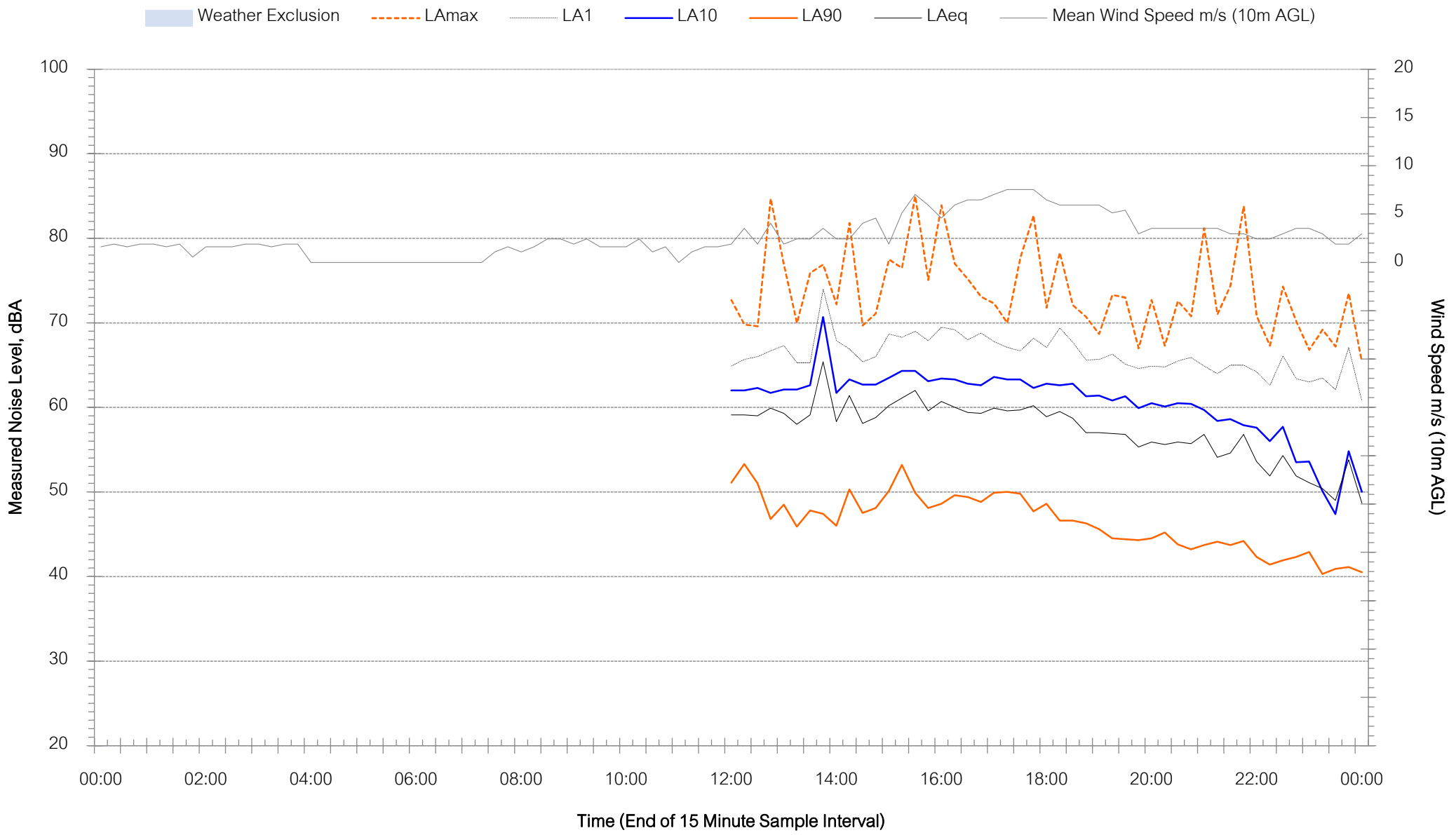
Background Noise Levels

Corner of Chisholm Road and New England Highway, East Maitland - Monday 27 February 2023



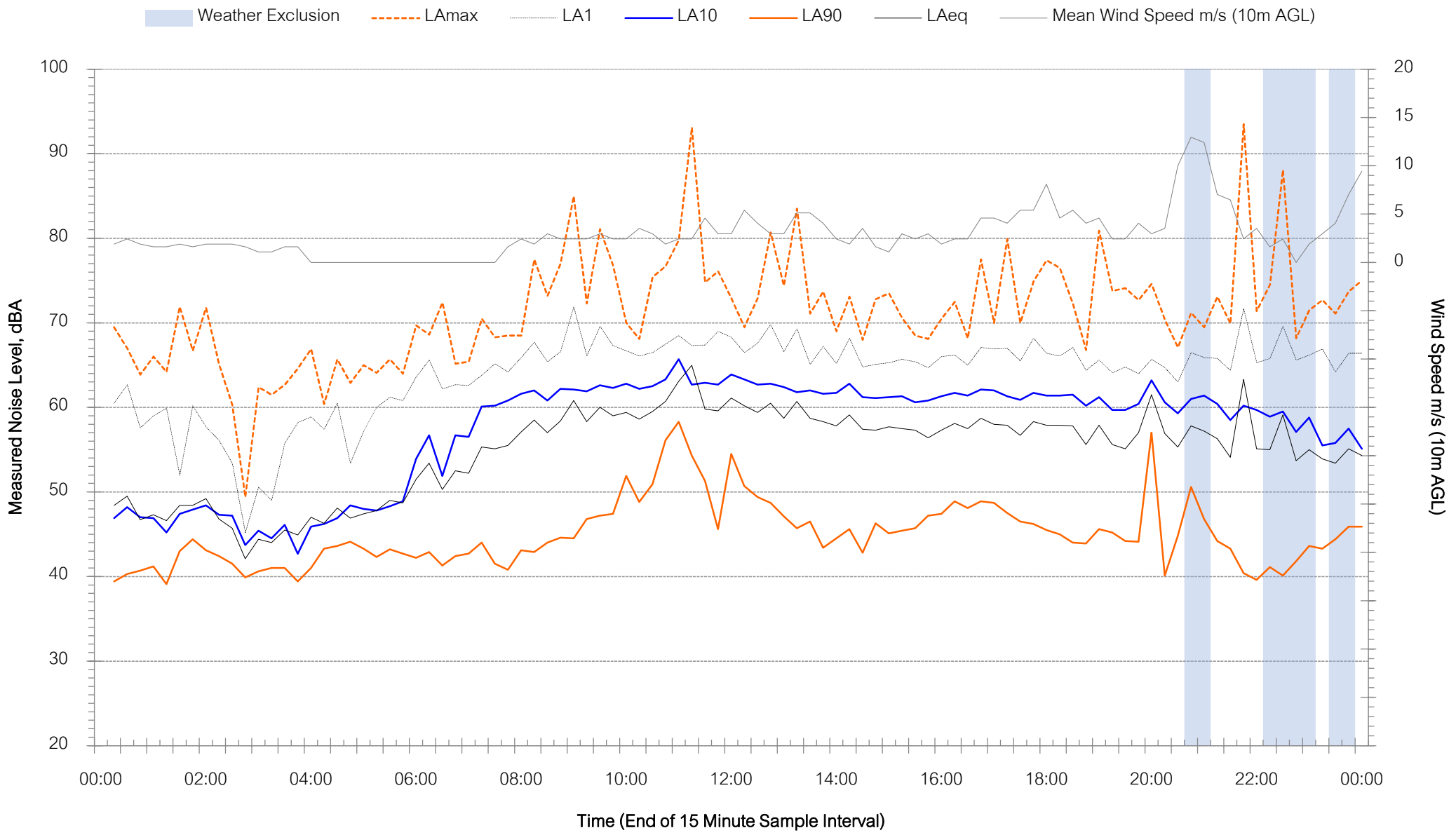
Background Noise Levels

143 Chisholm Road, East Maitland - Friday 17 February 2023



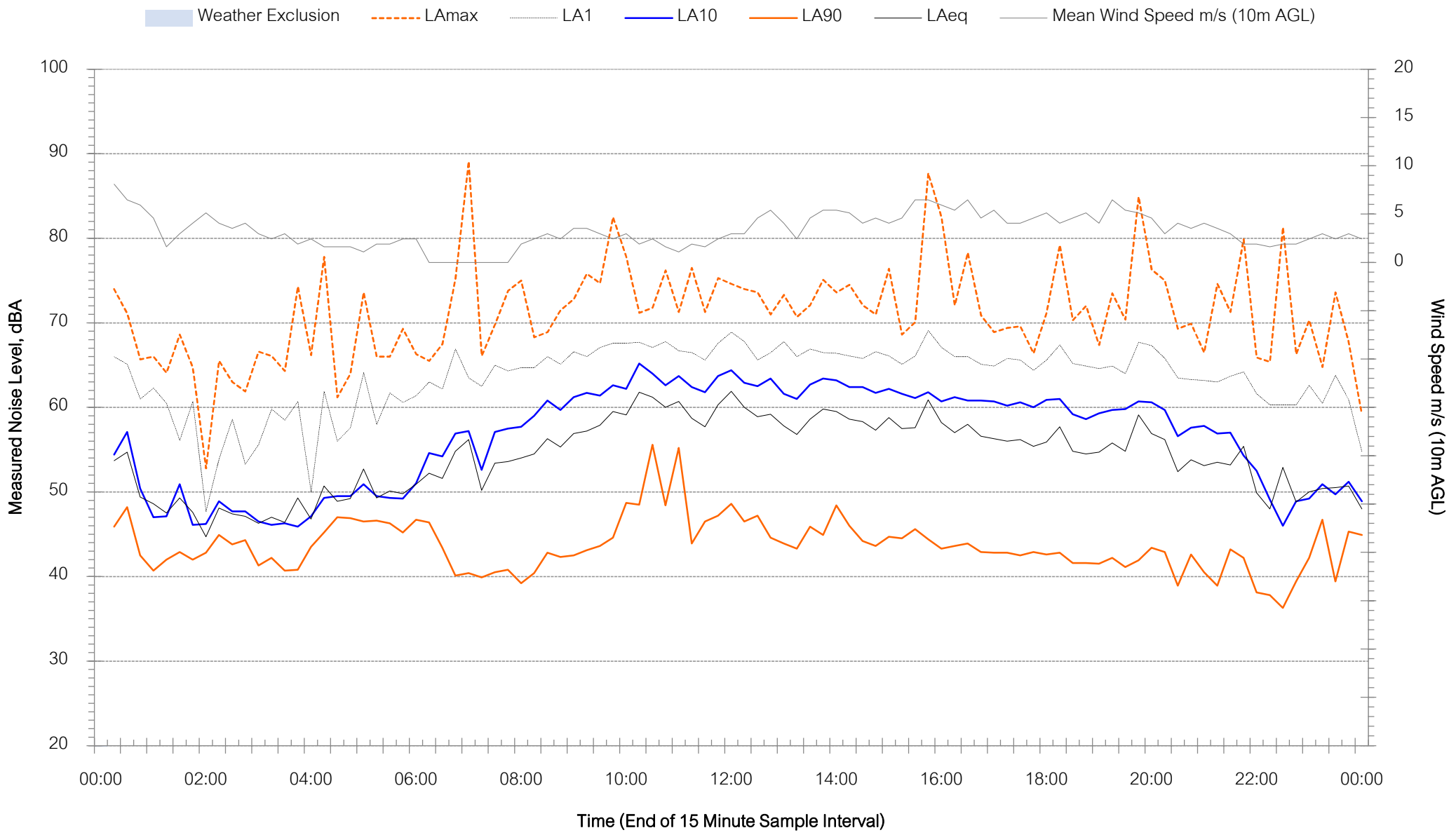
Background Noise Levels

143 Chisholm Road, East Maitland - Saturday 18 February 2023



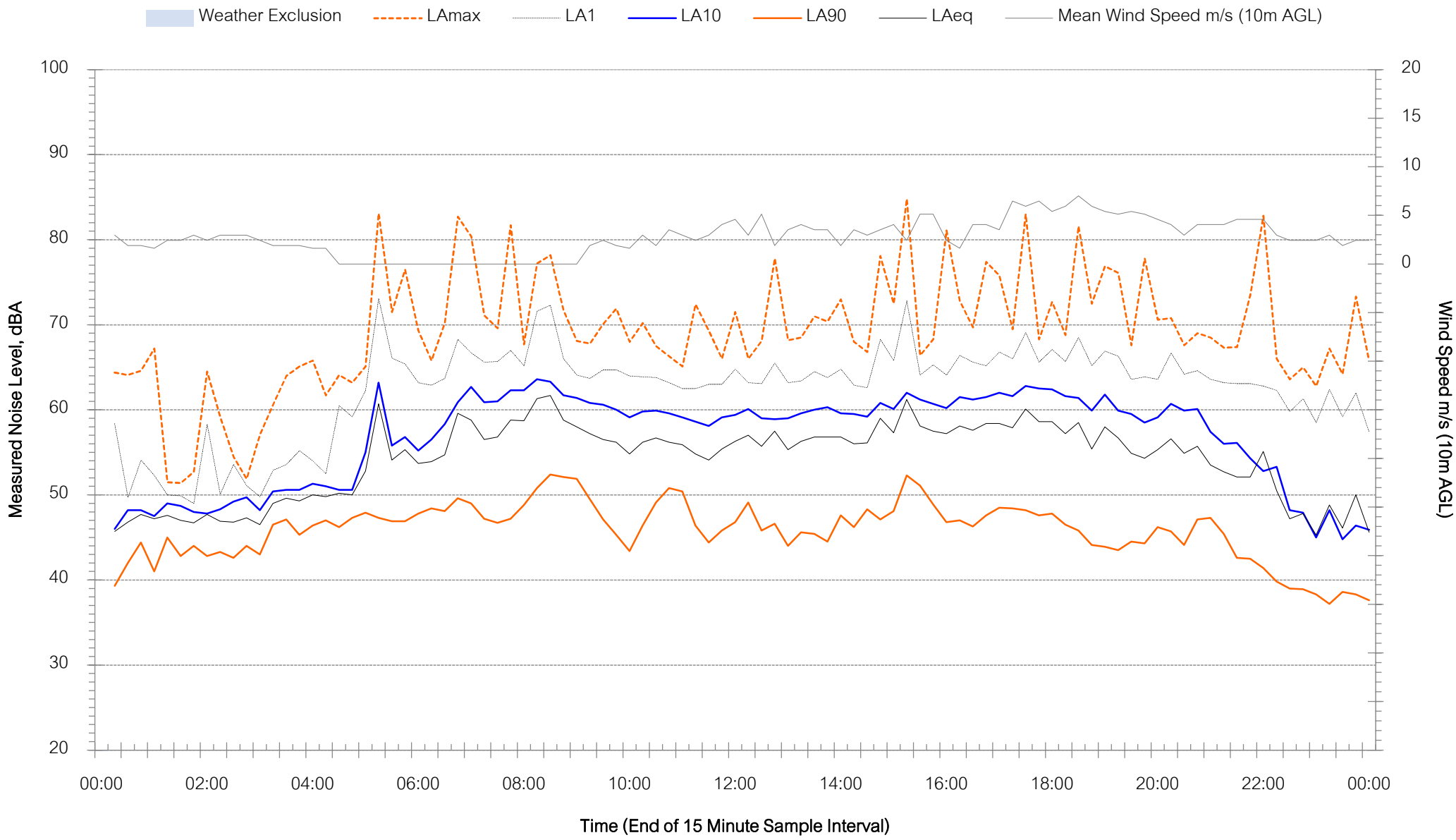
Background Noise Levels

143 Chisholm Road, East Maitland - Sunday 19 February 2023



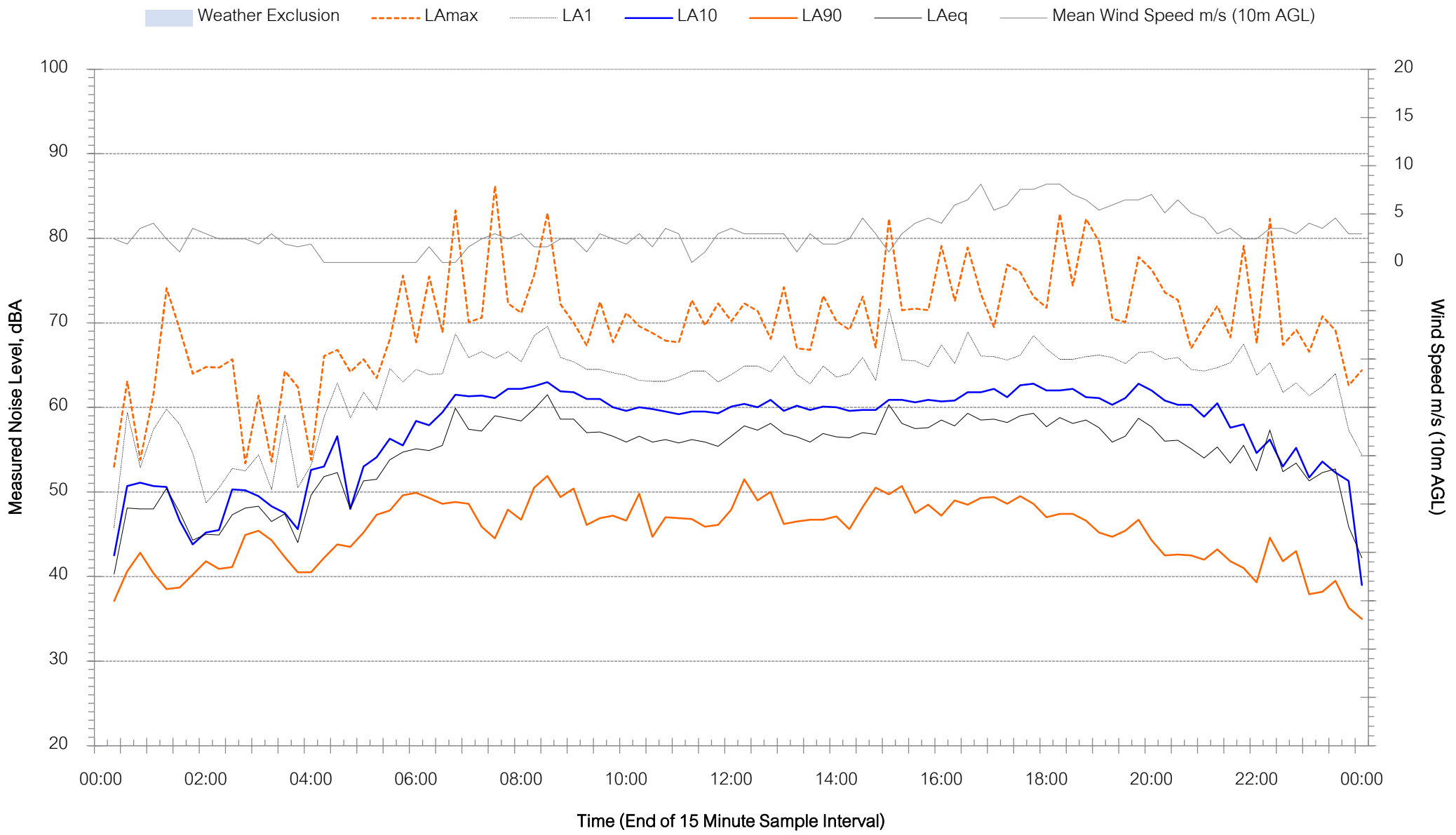
Background Noise Levels

143 Chisholm Road, East Maitland - Monday 20 February 2023



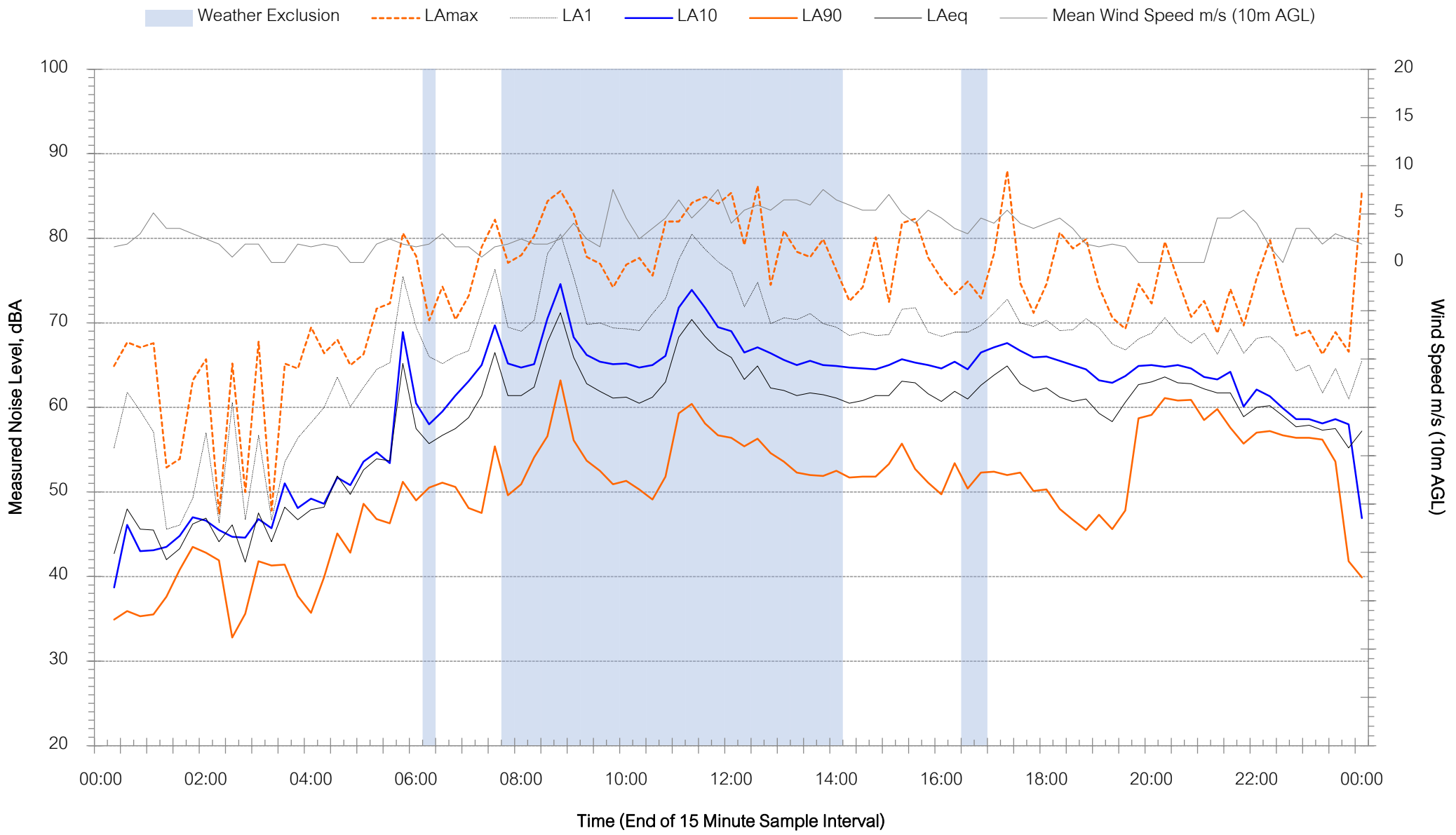
Background Noise Levels

143 Chisholm Road, East Maitland - Tuesday 21 February 2023



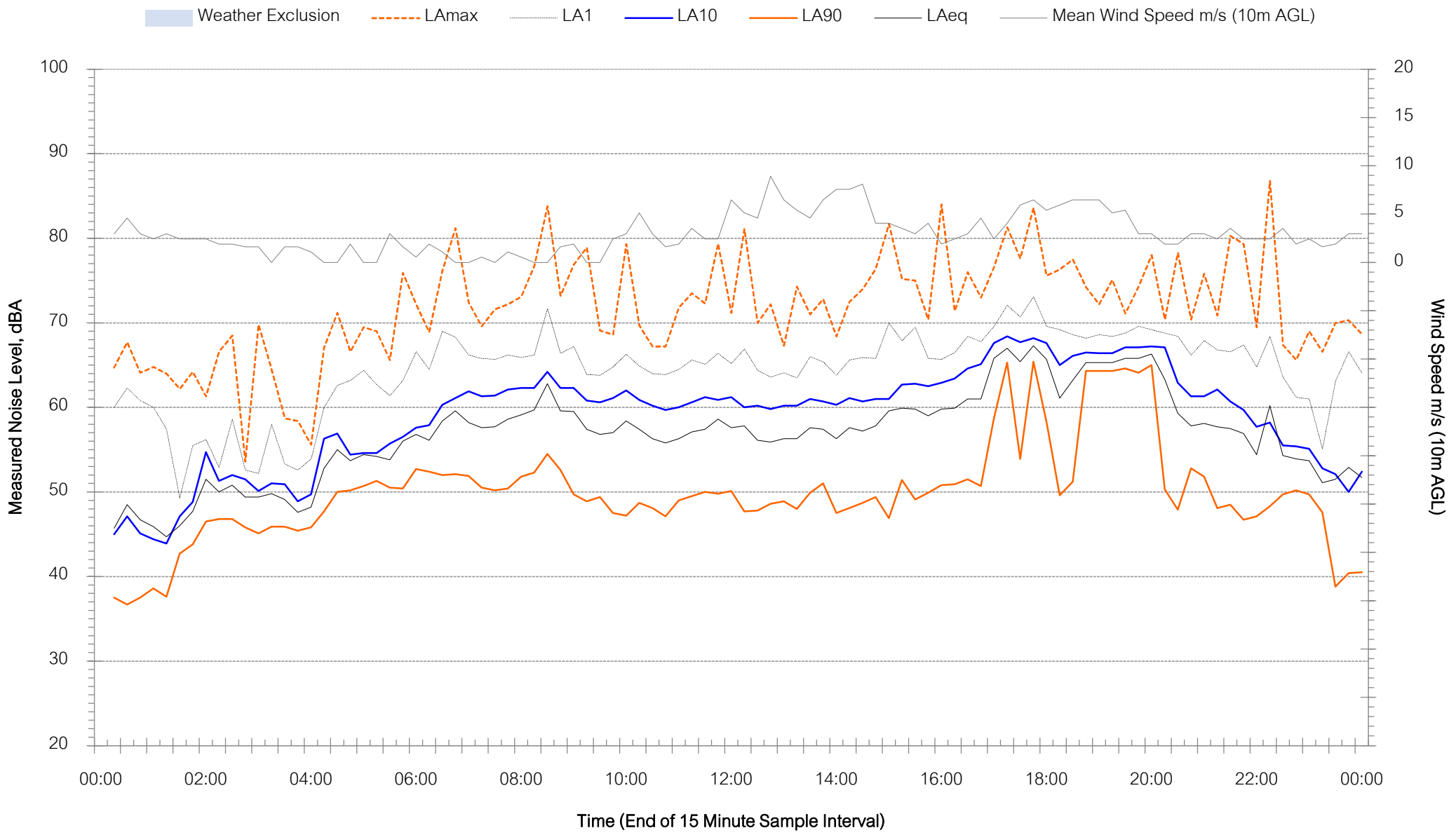
Background Noise Levels

143 Chisholm Road, East Maitland - Wednesday 22 February 2023



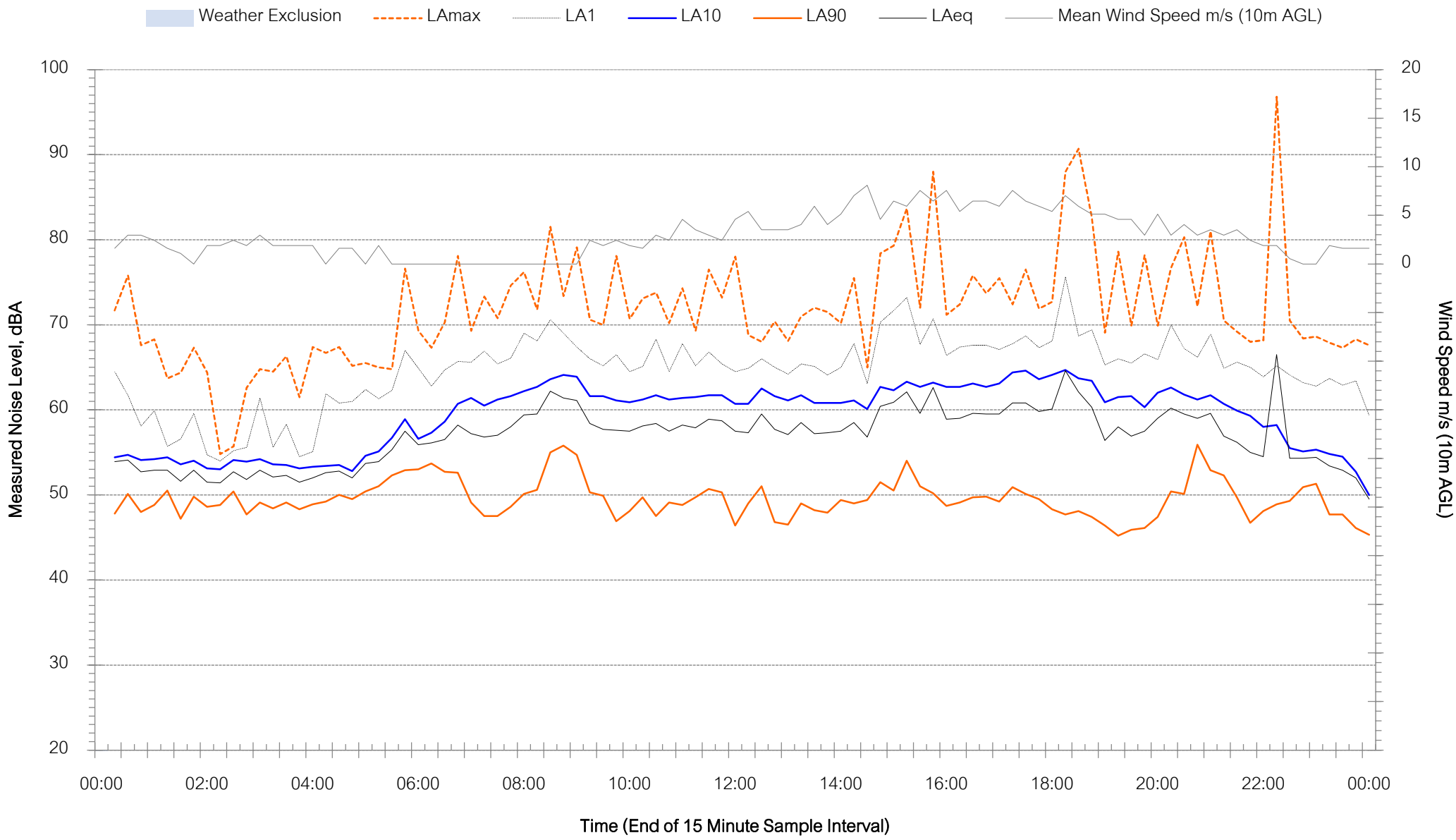
Background Noise Levels

143 Chisholm Road, East Maitland - Thursday 23 February 2023



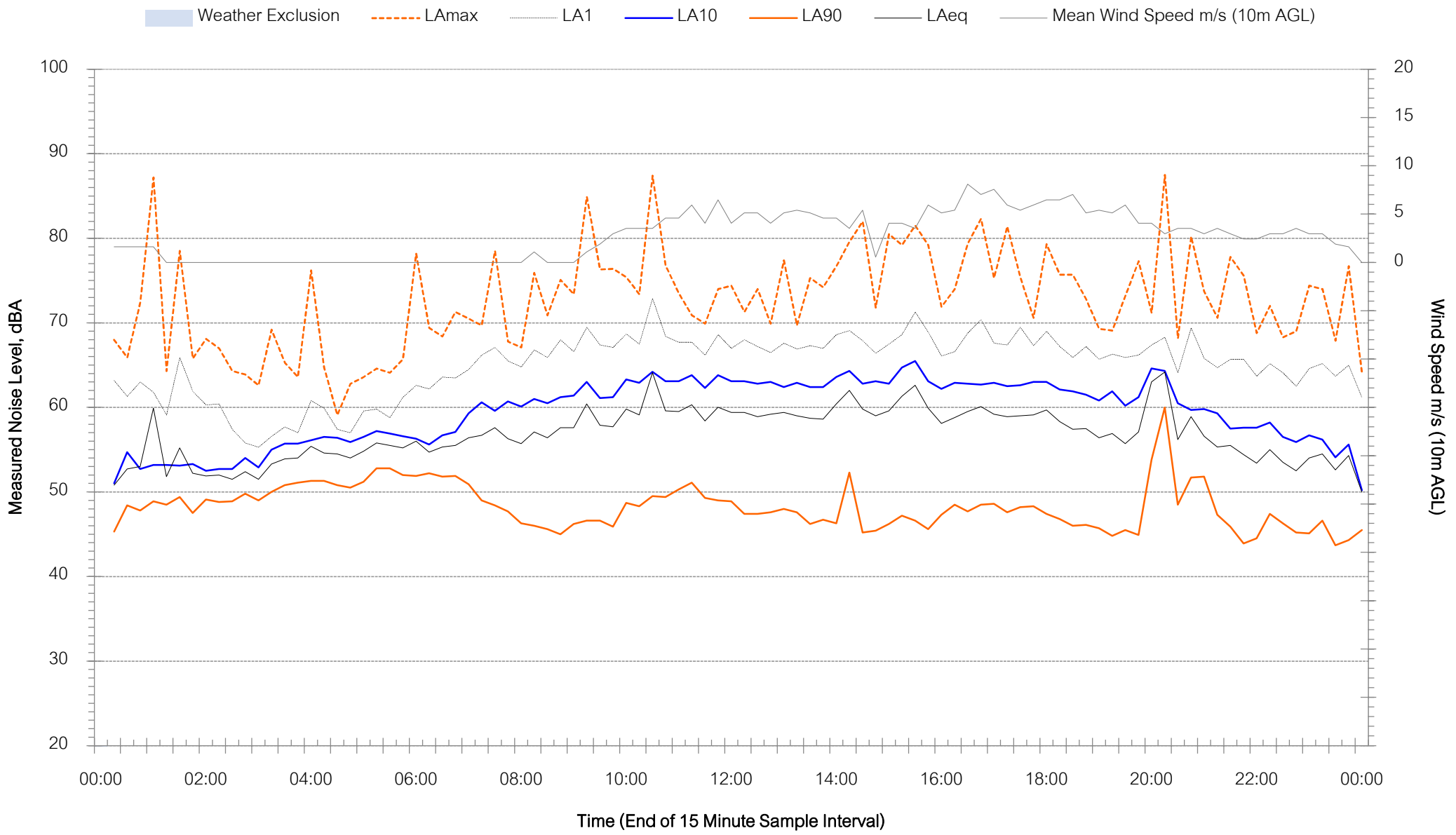
Background Noise Levels

143 Chisholm Road, East Maitland - Friday 24 February 2023



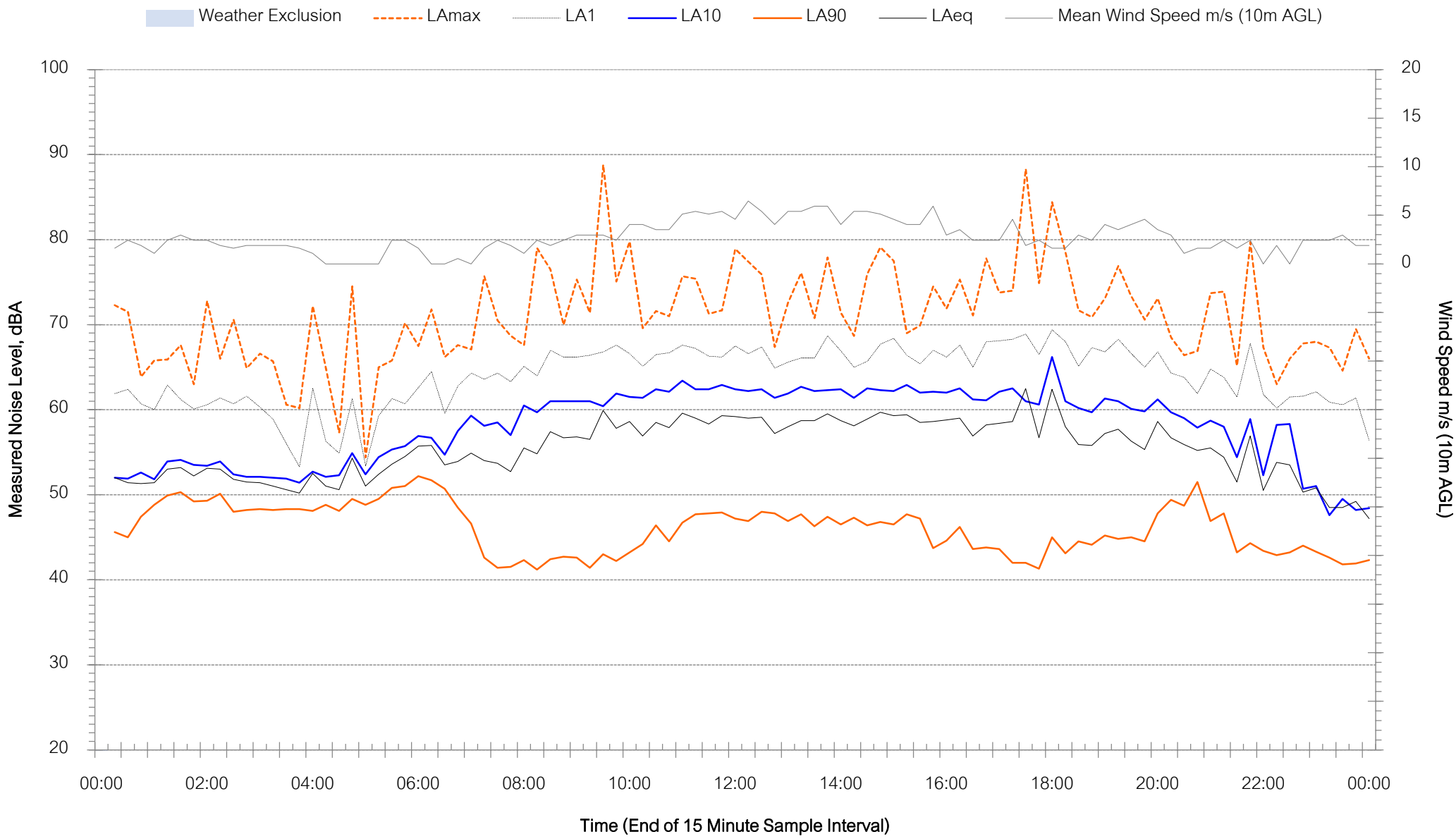
Background Noise Levels

143 Chisholm Road, East Maitland - Saturday 25 February 2023



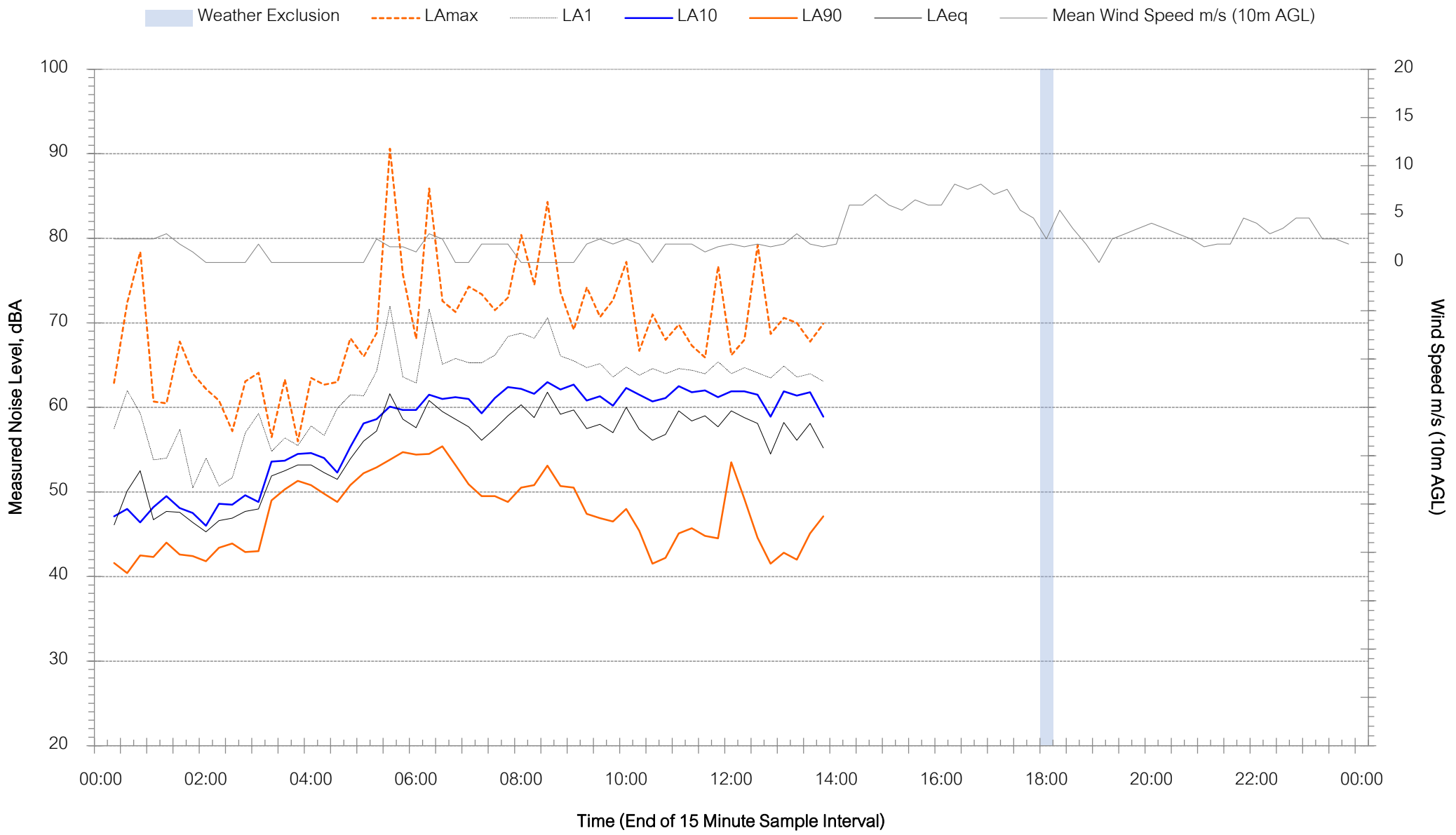
Background Noise Levels

143 Chisholm Road, East Maitland - Sunday 26 February 2023



Background Noise Levels

143 Chisholm Road, East Maitland - Monday 27 February 2023



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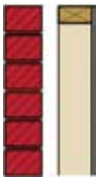
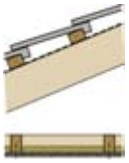
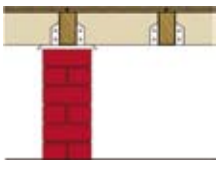
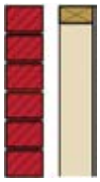
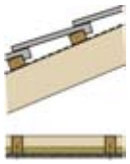
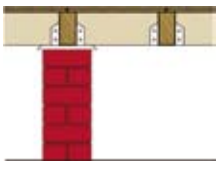
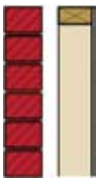
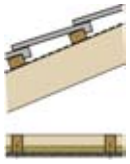
Appendix D – Category 1, 2 and 3

Construction Materials

Category No.	Building Element	Standard Constructions	sample
1	**Windows/Sliding Doors**	Openable with minimum 4mm monolithic glass and standard weather seals	
	Frontage Facade	**Timber Frame or Cladding:** 6mm fibre cement sheeting or weatherboards or plank cladding externally, 90mm deep timber stud or 92mm metal stud, 13mm standard plasterboard internally	
		Brick Veneer: 110mm brick, 90mm timber stud or 92mm metal stud, minimum 50mm clearance between masonry and stud frame, 10mm standard plasterboard internally	
		Double Brick Cavity: 2 leaves of 110mm brickwork separated by 50mm gap	
	Roof	Pitched concrete or terracotta tile or metal sheet roof with sarking, 10mm plasterboard ceiling fixed to ceiling joists, R1.5 insulation batts in roof cavity.	
	Entry Door	35mm solid core timber door fitted with full perimeter acoustic seals	
	Floor	1 layer of 19mm structural floor boards, timber joist on piers	
		Concrete slab floor on ground	

Category No.	Building Element	Standard Constructions	sample
2	**Windows/Sliding Doors**	Openable with minimum 6mm monolithic glass and full perimeter acoustic seals	
	Frontage Facade	**Timber Frame or Cladding Construction:** 6mm fibre cement sheeting or weatherboards or plank cladding externally, 90mm deep timber stud or 92mm metal stud, 13mm standard plasterboard internally with R2 insulation in wall cavity.	
		Brick Veneer Construction: 110mm brick, 90mm timber stud frame or 92mm metal stud, minimum 50mm clearance between masonry and stud frame, 10mm standard plasterboard internally.	
		Double Brick Cavity Construction: 2 leaves of 110mm brickwork separated by 50mm gap	
	Roof	Pitched concrete or terracotta tile or metal sheet roof with sarking, 10mm plasterboard ceiling fixed to ceiling joists, R2 insulation batts in roof cavity.	
	Entry Door	40mm solid core timber door fitted with full perimeter acoustic seals	
	Floor	1 layer of 19mm structural floor boards, timber joist on piers	
		Concrete slab floor on ground	

Category No.	Building Element	Standard Constructions	sample
3	**Windows/Sliding Doors**	Openable with minimum 6.38mm laminated glass and full perimeter acoustic seals	
	Frontage Facade	**Brick Veneer Construction:** 110mm brick, 90mm timber stud or 92mm metal stud, minimum 50mm clearance between masonry and stud frame, 10mm standard plasterboard internally.	
		Double Brick Cavity Construction: 2 leaves of 110mm brickwork separated by 50mm gap	
	Roof	Pitched concrete or terracotta tile or sheet metal roof with sarking, 1 layer of 13mm sound-rated plasterboard fixed to ceiling joists, R2 insulation batts in roof cavity.	
	Entry Door	45mm solid core timber door fitted with full perimeter acoustic seals	
	Floor	Concrete slab floor on ground	

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