

Victoria to New South Wales Interconnector West (VNI West) (NSW)

Technical paper 7 – Noise and Vibration Impact Assessment



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Transgrid

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New South Wales
Interconnector West
(VNI West) (NSW)**

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Noise and vibration
impact assessment

wsp

July 2025

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WSP acknowledges that every project we work on takes place on First Peoples lands.
We recognise Aboriginal and Torres Strait Islander Peoples as the first scientists and engineers and pay our respects to Elders past and present.

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Abbreviations

Term/acronym	Definition
AC	alternating current
AN	audible noise
ANL	amenity noise level
ANZECC	Australian and New Zealand Environment and Conservation Council
AS	Australian Standard
AVTG	Assessing Vibration: A Technical Guideline (NSW Department of Environment and Conservation, 2006)
BoM	Bureau of Meteorology
BS	British Standard
CEMP	Construction Environmental Management Plan
CNVG-R	Construction Noise and Vibration Guideline – Roads
CNVMP	Construction noise and environment management sub-plan
CSEP	Community and Stakeholder Engagement Plan
CSSI	critical state significant infrastructure
DC	direct current
DECCW	former (NSW) Department of Environment, Climate Change and Water
DIN 4150	<i>German Standard DIN 4150-3: Structural vibration – Effects of vibration on structures</i>
DPE	(NSW) Department of Planning and Environment (until January 2024)
DPHI	(NSW) Department of Planning, Housing and Infrastructure (post January 2024)
DPIE	(NSW) Department of Planning, Infrastructure and Environment
EIS	environmental impact statement
EMF	electric and magnetic fields
EP&A Act	(NSW) <i>Environmental Planning and Assessment Act 1979</i>
EP&A Regulation	(NSW) Environmental Planning and Assessment Regulation 2021
EPA	(NSW) Environment Protection Authority
HV	High Voltage
Hz	Hertz
ICNG	Interim Construction Noise Guideline
ISO	International Organization for Standardization
km	kilometres
kV	kilovolt

Term/acronym	Definition
m	metres
MW	megawatts
NCA	Noise Catchment Area
NMLs	Noise Management Levels
NPfI	NSW Noise Policy for Industry (NSW Environment Protection Authority, 2017)
NSW	New South Wales
OOHW	outside of hours work
PAD	Potential Archaeological Deposits
POEO Act	(NSW) <i>Protection of the Environment Operations Act 1997</i>
PPV	peak particle velocity
PNTL	project noise trigger level
RBL	Rating Background Level
REZ	renewable energy zone
RFI	radio frequency interference
SEARs	Secretary Environmental Assessment Requirements
SH	standard hours
SPL	Sound Pressure Level
SSI	state significant infrastructure
SWL	Sound Power Level
V	Volts

Glossary of terms

Term	Definition
background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L ₉₀ noise level (see below).
corona noise	The ionisation of air surrounding the high voltage transmission lines causing the conductors to glow and producing a hissing noise.
decibels (dB)	The level of noise is measured objectively using a sound level meter. The range of pressure variations associated with everyday living may span over a range of a million to one. Instead of expressing pressure in this enormous range of unit, it is convenient to condense this range to a logarithmic scale and give it the units of decibels. The following are examples of the decibel readings of every day steady or quasi-steady sounds: — 0 dB <i>the faintest sound we can hear under perfect conditions</i> — 20 dB <i>quiet bedroom at night or recording studio</i> — 30 dB <i>quiet library or quiet location in the country</i> — 40 dB <i>living room</i> — 50 dB <i>typical office space or ambience in the city at night</i> — 60 dB <i>normal conversational speech</i> — 70 dB <i>a car passing by</i> — 80 dB <i>kerbside of a busy road</i> — 90 dB <i>truck passing by</i> — 100 dB <i>nightclub</i> — 110 dB <i>rock band or 2 m from a jackhammer</i> — 120 dB <i>70 m from a jet aircraft</i> — 130 dB <i>threshold of pain</i> — 140 dB <i>25 m from a jet aircraft.</i>
dBA: A-weighted decibels	The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the 'A' filter. A sound level measured with this filter switched in is denoted as dB(A). Most environmental noise is measured using the 'A' filter.
dB(C): C-weighted decibels	'C' weighted adjustments are relatively flat across lower frequencies, and as such are better suited for the assessment of low frequency noise.
frequency	The time rate for each wave peak (of a sound wave) to pass a given point. Frequency is measured in hertz (Hz).

Term	Definition
Interconnector	An electricity interconnector is a connection that allows power to flow in both directions between regions in the National Electricity Market (NEM), providing access to a larger number of electricity generators and greater ability to meet varying demand where and when it is needed most.
loudness	A 3 dB increase represents a doubling of the sound pressure, however an increase of about 10 dB is required before the sound will subjectively appear to be twice as loud. That is, a sound of 85 dB is twice as loud as a sound of 75 dB which is twice as loud as a sound of 65 dB and so on. That is, the sound of 85 dB is four times as loud as a sound of 65 dB. The smallest change which can be readily heard is approximately 2 dB. An increase beyond 5 dB is considered to represent the level at which a change in loudness begins to be clearly perceived.
L ₉₀	The level of noise exceeded for 90% of the time for which a given sound is measured. The bottom 10% of the sample is the L ₉₀ noise level expressed in units of dB(A).
L _{eq}	Equivalent sound pressure level (similar to average noise level) – the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring. The sound weighting of the noise measurement is commonly added, for example L _{Aeq} or L _{Ceq} .
L _{Max}	The maximum noise level during a specified period.
Project footprint (the)	Refers to the generally 200 m wide corridor area that may be directly impacted by the project including all proposed infrastructure elements (including the proposed transmission line corridor, substation site works and other ancillary works) as well as locations for proposed construction elements such as temporary worker accommodation facilities, construction compounds, access tracks and site access points, laydown and staging areas, concrete batching plants, brake and winch sites and site offices.
Rating Background Level (RBL)	Defined by the NSW EPA as the median value of the (lower) tenth percentile of L ₉₀ ambient background noise levels for day, evening or night periods, measured over a number of days during the monitoring period.
Relevant future projects	A proposed or under construction project within the cumulative impact study area, whereby the construction or operation may coincide with the project, potentially resulting in cumulative noise or vibration impacts.
Sound pressure level (SPL)	The level of sound pressure at a specific location, expressed in decibels.
Sound power level (SWL)	A measure of the acoustic energy emitted from a source of noise, expressed in decibels.
Transgrid (or ‘the proponent’)	The manager and operator of the high voltage electricity transmission network in New South Wales and the Australian Capital Territory with connections to Victoria and Queensland. Transgrid manages the network that is the backbone of the NEM, which enables energy trading between Australia’s three largest states along the east coast.
Transmission line alignment	The location of the transmission line structures along the middle of the transmission line transmission line easement.

Term	Definition
Transmission line easement	The area surrounding and including the transmission lines that allows access, construction and maintenance work to take place. The easement grants a right of access and for construction, maintenance and operation of the transmission line and other operational assets The easements for the new 500 kV transmission line between the NSW/Victorian border and the expanded Dinawan substation would typically be 70 m wide. However, transposition locations would require wider easements up to 110 m wide. The replacement of the 330 kV transmission line between Ivydale Road, Wagga and the future Gugaa 500 kV substation, Livingstone Gully Road would occur within the existing 60 m wide easement.
Transmission line structure	Proposed free standing structures to support the transmission lines.
VNI West	An interconnector of about 450 km between the power grids of NSW and Victoria. Specifically, VNI West would connect the EnergyConnect (NSW – Eastern section) project (at the new Dinawan substation in NSW) with the Western Renewables Link proposal (at Bulgana in Victoria) via a new substation near Kerang (in Victoria).
VNI West (NSW) ('the project')	The NSW component of VNI West includes: — a new 500 kV transmission line connection between the NSW/Victorian border and Transgrid's Dinawan substation (currently under construction as part of the EnergyConnect (NSW – Eastern section) project) — replacement of a section of existing single circuit 330 kV transmission line to a double circuit 330 kV line generally between Ivydale Road in Gregadoo and Transgrid's future Gugaa 500 kV substation, Livingstone Gully Road (which is subject to a separate planning approval as part of the HumeLink project) — expansion of the future Dinawan 330 kV substation to include a new 500 kV switchyard and two new 330 kV bays — connection and transmission line diversion works at both the Wagga 330 kV substation and the future Gugaa 500 kV substation, Livingstone Gully Road to connect the new transmission line infrastructure — ancillary activities to support construction and operation of the project.

Executive summary

Project overview

Transgrid and Transmission Company Victoria (TCV) are jointly developing a new electrical connection between NSW and Victoria called the Victoria to NSW Interconnector West project (VNI West). Transgrid is responsible for seeking the required planning approval and delivering the NSW component of VNI West (referred to as ‘the project’ or ‘VNI West (NSW)’) in the Riverina Region of NSW.

The project would provide the NSW 500 kV double circuit overhead transmission line component of the connection between the NSW/Victorian border near Murrabit and the future Dinawan substation (currently being constructed as part of the EnergyConnect (NSW – Eastern section) project approval). The project would also include replacement of around nine kilometres of an existing overhead single circuit 330 kV transmission line (Line 51) with a double circuit 330 kV transmission line generally between Ivydale Road (south of the existing Wagga substation) and the future Gugaa 500 kV substation, Livingstone Gully Road (which is subject to separate planning approval under the HumeLink project (SSI-36656827)). The project would also include an expansion of the future Dinawan substation and connection works at both the existing Wagga 330 kV substation and the future Gugaa 500 kV substation, Livingstone Gully Road.

This technical paper assesses the potential impacts to noise and vibration from the construction and operation of the project and has been prepared to support and inform the Environmental Impact Statement (EIS) for the project.

The impacts have been assessed in accordance with the Secretary’s Environmental Assessment Requirements (SEARs) issued by the Department of Planning, Housing and Infrastructure (DPHI), and against the relevant legislation and guidelines as they apply to noise and vibration.

Legislative and policy context

Impacts on noise and vibration from construction and operation of the project have been assessed in accordance with the relevant policies and guidelines including:

- *Interim Construction Noise Guideline (ICNG)* (DECCW, 2009)
 - *NSW Road Noise Policy (RNP)* (DECCW, 2011)
 - *Noise Policy for Industry (NPfI)* (NSW EPA 2,017)
 - *Assessing Vibration: A Technical Guideline (AVTG)* (DEC, 2006).
 - *Cumulative Impact Assessment Guidelines for State Significant Projects* (DPE, 2022).
-

Methodology

The assessment of construction and operational noise and vibration involved:

- defining the study area for noise and vibration based on the proposed activities, sensitive receivers within the surrounding environment, and the anticipated level of impact
- a baseline noise monitoring survey to determine the existing environment of the study area
- predictive modelling of noise levels at sensitive receivers to inform the assessment of the potential impacts to amenity from the construction and operation of the project
- calculation of safe working distances for plant and equipment for the management of ground borne vibration during construction activities

- an assessment of the potential cumulative impacts of noise and vibration from the project in combination with other known developments within the vicinity of the project
 - a summary of recommended mitigation and management measures to avoid, minimise and manage any potential impacts of noise and vibration from construction and/or operation of the project.
-

Existing environment

The project is located within a rural setting, primarily dominated by agricultural and rural residential land uses. The existing noise environment varies over the study area, which is split into the two distinct areas of:

- NSW/Victorian border to the future Dinawan substation
- the network augmentation works between the existing Wagga 330 kV substation and the future Gugaa 500 kV substation, Livingstone Gully Road.

The local noise environment is influenced by natural sounds including insect and bird noise and local road traffic. Six Noise Catchment Areas (NCAs) have been defined for the study area to classify groups of sensitive receivers that are likely to have a similar existing noise environment and experience similar impacts from the project.

The main arterial roads in the project footprint include Kidman Way, the Cobb Highway, Wanganella-Moulamein Road, Murrabit Road, and Gregadoo East Road. The current construction of the EnergyConnect (NSW – Eastern section) project may contribute to the local noise environment at some locations.

Assessment of impacts

Construction noise and vibration impacts

Construction of the project would result in potential noise impacts to surrounding sensitive receivers. The potential impacts would vary across the project depending on timing, intensity and location of construction activities. Construction would generate noise from:

- construction work within the project footprint associated with transmission lines, access tracks and substations
- construction and operation of construction compounds and temporary worker accommodation facilities
- traffic generation along construction traffic routes outside the project footprint
- aircraft noise from helicopter and drone use for construction.

Construction work for the project would generally occur in standard day-time hours between 7 am and 6 pm Monday to Friday, and 8 am to 1 pm on Saturday. Some construction work stages will need to occur outside of these standard hours, and potential noise impacts during these periods has been assessed only where required.

Across all construction works, no receivers are predicted to be highly noise affected (where noise levels exceed 75 dBA $L_{eq15min}$).

Construction noise from transmission lines

The construction of transmission lines would involve around seven separate activities at each transmission line structure, with each activity taking between one to four weeks each structure. Generally, the work will occur during standard day-time hours, with specific activities potentially required outside of these hours. Out of hours work is unlikely to be required for all transmission line structures. However, the noise assessment considered out of hours work all along the transmission line alignment as a conservative assessment.

Noise from transmission line construction would be greatest during site establishment works during standard working hours, and greatest during the assembly and erection of transmission line structures when undertaken outside of standard hours. These work stages are estimated to occur for 1–4 weeks per structure over 12 months, and 2 weeks per structure over 13 months, respectively. At worst, up to five sensitive receivers are predicted to be impacted in NCAs 1 to 4 during standard working hours and up to 14 receivers outside of these hours. In NCAs 5 and 6, the impact increases, with up to 21 receivers impacted during standard hours and up to 36 outside standard hours. No receivers are predicted to be highly noise affected (>75 dB).

Noise from access tracks construction would be greatest during earthworks and upgrade works, which may also need to occur outside of standard work hours. This work stage may occur for up to 3 weeks per access track, over 12 months. Where access track construction occurs during standard working hours, noise levels may exceed the relevant criteria at up to 11 properties located along the transmission alignment from NSW/Victoria border to Dinawan substation (NCAs 1-4), and 34 properties located along the network augmentation works (NCAs 5-6). A majority of these exceedances (33) are less than 10 dB above NMLs.

Work outside standard hours is unlikely to be required for all access tracks, and only where a road occupancy licence (or similar) is required. However, the noise assessment considered out of hours works at all access tracks. This out of hours assessment predicted exceedances may occur at up to 31 receivers in NCA 1 to 4 and 104 receivers in NCAs 5 and 6. Where night works are necessary, sleep disturbance impacts during this construction work stage are predicted at up to 65 receivers and potential sleep awakening impacts at up to 18 receivers.

Construction noise from telecommunication facilities (optical repeater sites)

Construction of two telecommunication facilities (optical repeater sites) is required for the project. The locations of the two telecommunication facilities (optical repeater sites) are relatively isolated and the construction equipment required is minimal. As a result, no construction noise impacts are predicted.

Construction noise from combined temporary worker accommodation facilities and construction compounds

Up to five combined temporary worker accommodation facilities and laydown compounds would be required along the length of the project to support construction. Once established, they will operate for 24 hours a day, seven days a week until construction of the project concludes. This may be up to 20 months in duration.

No properties located along the transmission alignment from NSW/Victorian border to Dinawan substation (NCAs 1–4) are predicted to experience construction noise impacts from the construction compounds/laydowns and temporary worker accommodation facilities.

Of the options assessed, four combined temporary worker accommodation facility and construction compound options in NCAs 5 and 6 including Gregadoo Road A (option 2), Gregadoo Road B (option 3) and Livingstone Gully Road (option 4) are predicted to cause exceedances. The loudest work stage is the construction stage. The assessment shows that construction noise levels during this stage would exceed the standard working hours NML of 45 dBA $L_{eq}(15min)$ at up to nine receivers. All exceedances are less than 10 dB above criteria.

Where specific activities for these temporary worker accommodation facility and construction compounds is undertaken outside of standard hours, exceedances may occur at up to 36 receivers, with potential sleep disturbance impacts at up to 21 of these receivers.

Construction noise from construction compounds/laydown areas

Up to two standalone construction compounds/laydown areas would be required for the construction of the project. The establishment of the construction compound/laydown areas may take up to 12 months to complete. Of the options assessed, only the construction compound/laydown area at Fisher Lane, Wetuppa (western option 1) is predicted to have construction noise impacts.

Three receivers may experience noise impacts during standard working hours, and outside of these hours, if required. Sleep disturbance impacts are also predicted at these three receivers. During these work periods outside of standard working hours, noise levels may exceed the relevant criteria by 15–25 dBA at two of these receivers.

Construction road traffic noise

Construction road traffic noise has been considered on the identified construction routes for the project. This has been assessed in accordance with the Road Noise Policy (RNP), which considers the increase in traffic noise compared to existing road traffic noise, and for the total road noise to exceed a certain threshold. This assessment concluded that road noise levels at any receivers surrounding the construction traffic route are not predicted to exceed this criteria.

Construction aircraft noise

Aerial methods of constructions may be required for the project, including the stringing of transmission lines, which would involve either helicopters or drones. Due to the transitory nature of their proposed usage, aircraft used in the project would produce short-term, transient noise as they operate and as such, their noise is assessed against different criteria to ground-based construction works.

The assessment of aircraft noise from helicopters and drones used during construction has predicted minimal exceedances of at most 1 dBA in each NCA from the aircraft noise criteria. Noise from helicopters departing and arriving at combined temporary worker accommodation facilities and construction compounds would be short term and has been predicted to reach 75 dBA L_{max} at one receiver in NCA 5. Helicopter noise levels from stringing and platform work were also predicted to exceed 75 dBA L_{max} at one receiver in NCA 6. The usage of drones instead of helicopters may reduce aircraft noise levels by approximately 20 dBA.

For a site to be deemed unacceptable as a building site for a house, the number of non-jet aircraft flights generating noise levels greater than 75 dBA L_{max} over a receiver site would need to be greater than 30 per day, which is not required for the project. The number of flights from project aircraft is likely to be considerably less.

Construction vibration

Up to three structures have been identified within the recommended minimum safe working distances for potential cosmetic damage. These identified buildings are unoccupied structures close to the transmission line alignment within NCA 4. No heritage items are predicted to be impacted by ground vibration. Potential vibration impacts during construction are considered minor and readily managed with standard construction vibration mitigation measures.

Operational noise impacts

Operation of high voltage transmission lines carry the risk of generating audible noise during certain meteorological conditions, for example during wet weather. Such phenomena are driven by the conductor's Surface Voltage Gradient (SVG) and accumulation of dust or water droplets on the transmission line's conductor surface. This audible noise is called corona noise and it is more prominent during weather conditions with rain, mist or fog.

Corona noise impacts have been predicted to potentially exceed Project Noise Trigger Levels at two receivers, which are located in NCA 6. The extent of exceedance is considered negligible.

It is important to consider that corona noise only occurs under conditions of high dust, mist, or rain. During heavier rain events, general ambient noise levels in the environment would likely be higher and therefore have a masking effect over any possible corona discharge noise. Noise disturbance under such circumstances is therefore likely to be low risk. It is noted that misty conditions typically occur for only short durations and limit the transmission of noise through larger distances.

Operational noise impacts as a result of infrequent maintenance activities are expected to occur only once per year on average, and generally do not generate significant noise. As such, they do not represent a substantial noise impact. No noise impacts have been predicted for all other operational aspects of the project.

Cumulative noise impacts

The cumulative impact assessment considers other relevant future projects along with the project and assesses the scale and nature of the cumulative noise and vibration impacts of the developments. A total of nine relevant future projects were assessed for potential cumulative noise impacts.

The extent and magnitude of any impact is dependent on timing and overlap of individual construction activities. The largest number of impacts are predicted when construction activities for the project and HumeLink overlap, and may affect all 129 identified sensitive receivers in NCAs 5 and 6. However, it is expected that the overlap in construction period may occur for up to six months. Similarly, 91 receivers may experience cumulative construction noise impacts for the project and the EnergyConnect (NSW – Eastern section) project. Also, four receivers in NCA 1 may experience cumulative construction noise impacts where out of hours works overlap for the project and VNI West (Victoria).

Up to 84 sensitive receivers located in NCA 5 may also experience cumulative construction noise impacts due to the construction of the Belhaven BESS for up to 12 months. Also, up to 24 sensitive receivers in NCA 6 may experience cumulative construction noise impacts due to the construction of the Livingstone Solar Farm for up to 24 months, and VNI152 may also experience cumulative operational noise impacts.

The remaining cumulative construction noise impacts are limited to isolated receivers, which are likely to have agreements with the respective projects by which they might be impacted by. This includes Dinawan Solar Farm, Dinawan Wind Farm – East, and Yanco Delta Wind Farm.

No cumulative operational noise impacts are predicted between the project and the surrounding related projects.

Recommended management and mitigation

In response to the identified potential impacts, construction noise and vibration mitigation and management measures have been recommended. All feasible and reasonable measures would be applied to reduce the potential noise and vibration impacts from the project. Construction impacts will primarily be managed by a detailed construction noise and vibration management sub-plan to be prepared prior to commencement of construction and based on the detailed construction methodology. This would be a sub-plan to the overarching Construction Environmental Management Plan.

The CNVMP will identify measures to avoid and reduce the potential for noise and vibration impacts, and include details of community consultation in relation to noise and vibration. It will also review final design and construction methodology and include the consideration of noise and vibration mitigation measures recommended in this assessment.

Operational noise impacts are predicted to occur at two residential receivers in NCA 6 in close proximity to the transmission line, however the noise levels are considered negligible and do not require further consideration. However, given the conservative assumptions used in this assessment and the infrequency of meteorological conditions potentially generating coronal noise, it is recommended that noise monitoring is undertaken during commissioning of the transmission line to confirm the extent of these noise impacts before mitigation is implemented.

The noise impacts from helicopters and drones are expected to be generally minor. However, the aircraft noise assessment indicates that aircraft noise levels can be mitigated by approximately 20 dB by using drones for stringing work rather than AS350 helicopters.

1 Introduction

This chapter provides an overview and background to the NSW component of the Victoria to NSW Interconnector West (VNI West) project, including a summary of the project and the purpose and structure of this technical paper.

1.1 Project context and overview

Transgrid and Transmission Company Victoria (TCV) are jointly developing a new electrical connection between NSW and Victoria called the Victoria to NSW Interconnector West project (VNI West). VNI West would form a second transmission link between NSW and Victoria to harness clean, low-cost electricity from Renewable Energy Zones (REZ) in both states and improve the reliability and security of electricity supply. VNI West is a priority project for the Australian Energy Market Operator (AEMO), and the Commonwealth and NSW and Victorian governments.

VNI West proposes the construction, operation and ongoing maintenance of a high voltage, 500 kilovolt (kV) double circuit overhead transmission line that would connect the high voltage electricity grids in NSW and Victoria. Specifically, VNI West would link the Western Renewables Link proposal (at Bulgana in Victoria) with the EnergyConnect (NSW – Eastern section) project (SSI-9172452) at the future Dinawan substation in NSW (currently in construction). The connection would be made via a new substation near Kerang in Victoria (refer to Figure 1.1).

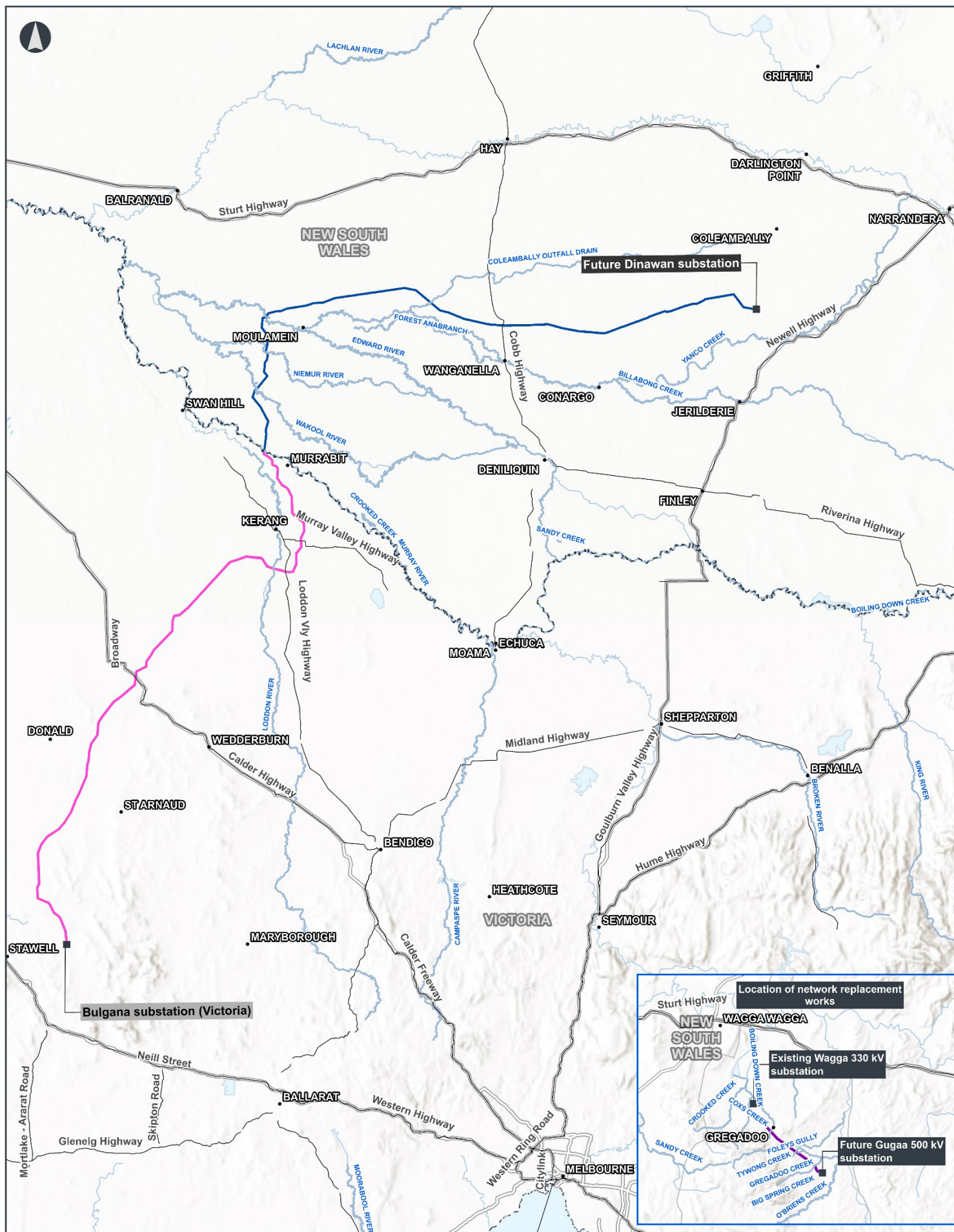
Transgrid (the proponent) is responsible for seeking the required planning approval and delivering the NSW component of VNI West (referred to as ‘the project’ or ‘VNI West (NSW)’) in the Riverina Region of NSW and would provide the 500 kV transmission line component of the connection for the VNI West project. The project would be located between the NSW/Victorian border near Murrabit (Victoria) and the future Dinawan substation (the 330 kV component of which is currently being constructed as part of the EnergyConnect (NSW – Eastern section) project). The project would also include replacement of around nine kilometres of an existing single circuit 330 kV transmission line (Line 51) with a double circuit 330 kV transmission line generally between Ivydale Road (south of the existing Wagga 330 kV substation) and the future Gugaa 500 kV substation, Livingstone Gully Road (which is subject to separate planning approval as part of the HumeLink project (SSI-36656827)). The project would also include an expansion of the future Dinawan substation and substation connection works at both the existing Wagga 330 kV substation and the future Gugaa 500 kV substation, Livingstone Gully Road.

TCV, in association with the AEMO Victoria, is responsible for seeking the required planning approval and the delivery of the Victorian component of the VNI West project (VNI West (Victoria)), from the crossing point on the NSW/Victorian border to a connection with the Western Renewables Link near Bulgana, via a new proposed substation near Kerang. The Victorian component is subject to a separate planning and environmental approvals under the applicable Victorian State and Commonwealth jurisdictional requirements.

1.1.1 Project objectives

The primary objective of VNI West is to reduce the cost of providing secure electricity transmission between NSW and Victoria in the near term and facilitate the longer-term transition of the energy sector across the National Electricity Market (NEM) to low emission energy generation sources. More specifically, the project aims to:

- provide reliable and affordable electricity to customers
- improve energy security of the south western transmission network, enable greater sharing of energy between NSW and Victoria and help to unlock the potential capacity of proposed REZs in the region
- support the national transition to a lower carbon emission energy system by enabling more renewable energy generation to enter the market, supporting Australia’s emissions reduction targets
- support the development of a greater mix of renewable energy in the NEM.



1.2 The project

Transgrid is seeking approval under Division 5.2, Part 5 of the *Environmental Planning and Assessment Act 1979* (NSW) (the EP&A Act) to construct and operate the project. The project was declared as Critical State Significant Infrastructure (Critical SSI) under Section 5.13 of the EP&A Act on 19 June 2024.

The project was also declared a ‘controlled action’ on 4 September 2024 (EPBC Act 2024/09871) by the (Commonwealth) Department of Climate Change, Energy, the Environment and Water ((Commonwealth DCCEEW) and as such also requires a separate approval under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act). As a result of the need for Commonwealth approval, the project will be subject to the bilateral assessment process that has been established between the Australian and NSW governments.

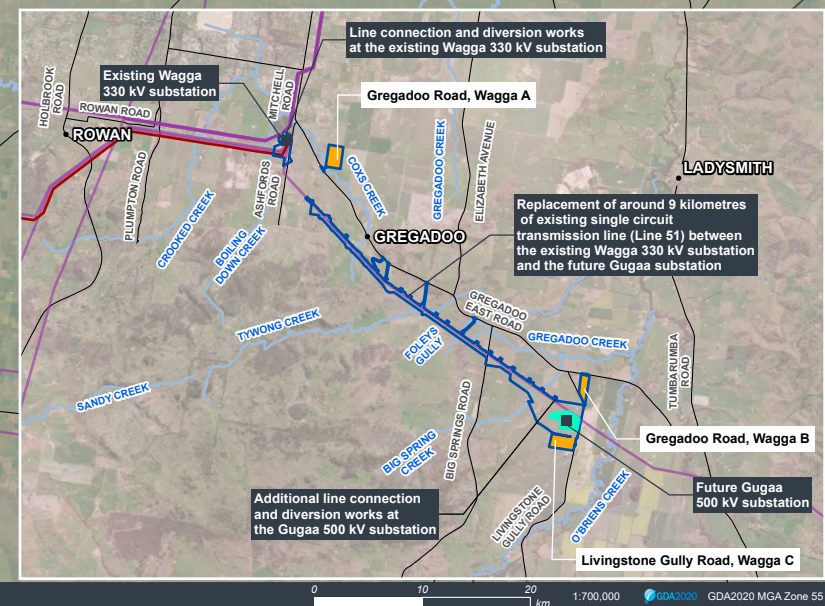
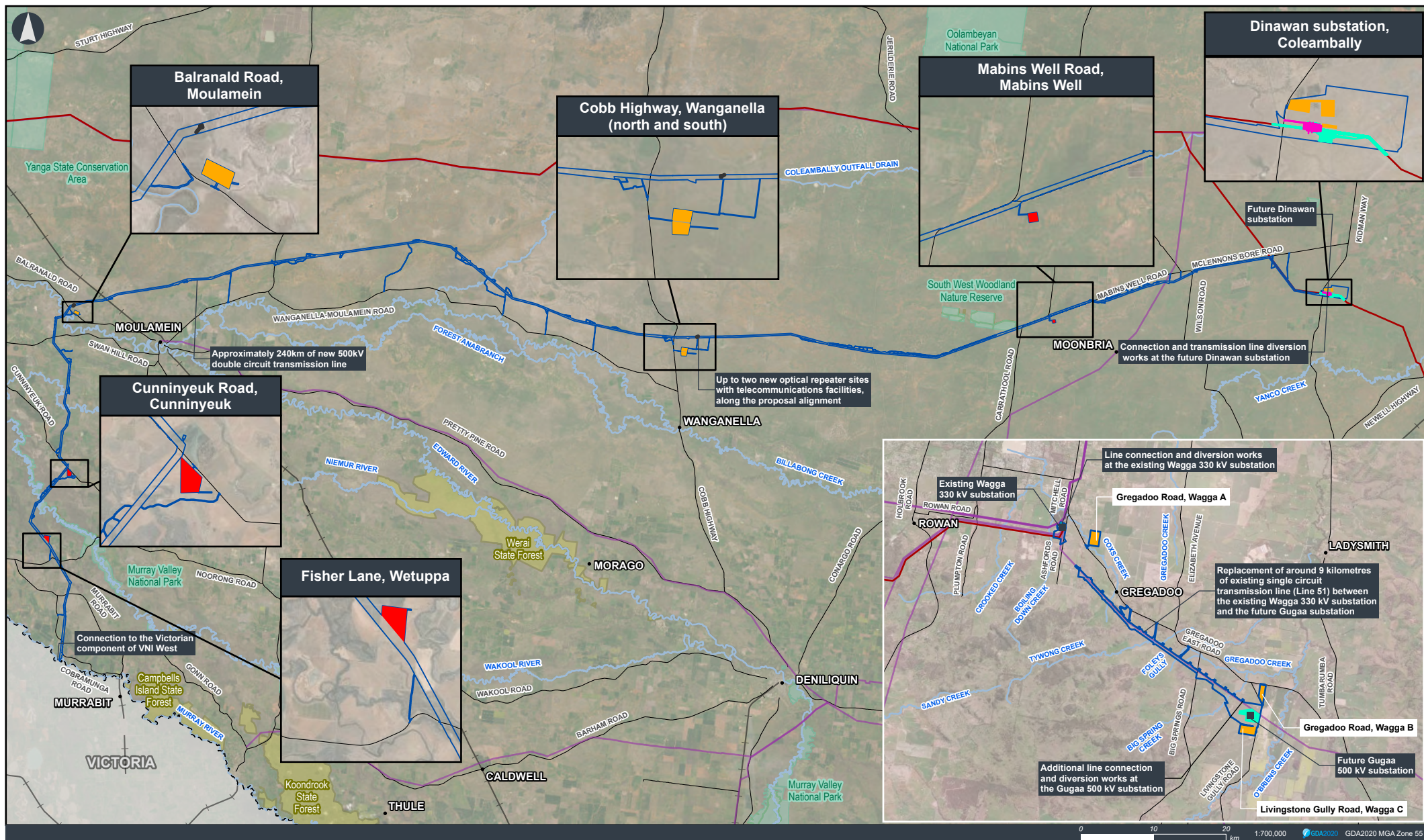
1.2.1 Key features of the project

The key elements of the project would be located within the project footprint and would include infrastructure such as the transmission lines and transmission line structures, the 500 kV expansion component of the future Dinawan substation and some additional ancillary features. The overall scope of the project includes the following key components:

- transmission line works comprising:
 - a new 500 kV double circuit overhead transmission line around 240 kilometres in length between the NSW/Victoria border near Murrabit, and the future Dinawan substation
 - replacement of around nine kilometres of an existing 330 kV single circuit overhead transmission line (Line 51), generally between Ivydale Road (south of the existing Wagga 330 kV substation) and the future Gugaa 500 kV substation, Livingstone Gully Road, with a new 330 kV double circuit overhead transmission line. The new transmission line structures for this section of the project would be up to around 56 metres in height
- substation works comprising:
 - connection and line diversion works at the future Dinawan substation to allow for connection of the proposed 500 kV switchyard
 - expansion of the future Dinawan substation to include a new 500 kV switchyard and two new 330 kV transformer bays
 - connection and line diversion work at the existing Wagga 330 kV substation and at the future Gugaa 500 kV substation, Livingstone Gully Road to allow for connection to the newly replaced Line 51
- ancillary activities comprising:
 - new and upgraded temporary and permanent access tracks
 - construction of utilities infrastructure and power supply
 - installation and operation of two telecommunication facilities (optical repeater sites) along the transmission line between the NSW/Victorian border and future Dinawan substation including connections to the local power supply
 - temporary facilities required for construction of the project including construction compounds, temporary worker accommodation facilities, laydown and staging areas, stockpiling areas, concrete batching plants, brake and winch sites, site offices, parking areas, and utilities supplies.

All components of the project would be located within the project footprint shown Figure 1.2.

The project footprint is the area that has been assessed in this EIS as being directly affected by the construction, operation and maintenance of the project.



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VNI West (NSW)

Figure 1.2
Overview of the
VNI West (NSW) Project

The 500 kV transmission line between the NSW/Victorian border and the future Dinawan substation would be located within an easement approximately 70 metres wide except at two transposition locations (where the conductors of a transmission line swap positions to improve transmission voltage balance) requiring a wider 110 metre easement for around one kilometre in length.

The section of the transmission line to be replaced generally between Ivydale Road (south of the existing Wagga 330 kV substation) and the future Gugaa 500 kV substation, Livingstone Gully Road would be contained within the existing 60 metre easement. These easements would provide a legal right of access to construct, operate and maintain the transmission lines and other operational assets associated with these lines.

A detailed description of the project features and construction methods is further described in Chapter 3 (Project description) of the main EIS document.

1.2.2 Construction

1.2.2.1 Key construction work

Key construction work for the project would typically include (but not be limited to):

- pre-construction minor works which would include:
 - installation of mitigation measures, including but not limited to erosion and sediment controls, temporary exclusion fencing and monitoring equipment
 - property acquisition adjustment work including installation of property fencing, barricades and gates
- site establishment works, which may include (but not be limited to):
 - establishment of combined temporary worker accommodation facilities and construction compounds, including excavations, surface preparation, access roads and utility connections
 - vegetation clearing
 - road and intersection improvement works (where required)
 - establishment of access tracks and watercourse crossings
 - relocating, adjusting or protecting utilities
- construction of the proposed transmission lines, which would include (but not be limited to):
 - earthwork (including establishment of construction pads) and the construction of footings and foundations for each transmission line structure
 - erection of the new transmission line structures using crane(s) and/or helicopter(s), noting, where cranes are proposed, is assumed that the final height of the cranes would extend around 20 metres above the respective transmission line structure heights
 - stringing of the conductors and overhead earth wires and optical ground wire (utilising either ground-based and/or helicopter/drone stringing construction methods)
 - installation of earthing conductors
 - testing and commissioning of the transmission lines

- works to replace around nine kilometres of Line 51 generally between Ivydale Road (south of the existing Wagga 330 kV substation) and the future Gugaa 500 kV substation, Livingstone Gully Road, which would include (but not be limited to):
 - demolition of existing transmission line structures and footings and removal of waste materials
 - erection of the new transmission line structures
 - stringing of the conductors and overhead earth wires and optical ground wire
 - testing and commissioning of the new transmission lines
- expansion of the future Dinawan substation, which would include (but not be limited to):
 - civil construction works including earthworks
 - slab construction for the new 500 kV switchyard and 330 kV transformer bays
 - electrical fit out with new substation equipment
 - testing and commissioning of the new substation equipment
- utility service connections to telecommunication facilities (optical repeater sites) and construction compounds/temporary worker accommodation facilities, and adjustments of existing utilities that intersect the transmission line corridor (as required)
- connection and transmission line diversion works at the existing Wagga 330 kV substation and future Gugaa 500 kV substation, Livingstone Gully Road.

Prior to energisation of the infrastructure, a series of pre-commissioning activities would be conducted. This would include testing the new transmission lines and additional substation infrastructure.

A detailed description of construction work for the project is further outlined in Chapter 3 (Project description) of the main EIS document.

1.2.2.2 Construction program

Subject to NSW and Commonwealth planning approvals and potential construction staging, the project is expected to commence in late 2026 (site establishment works phase). Once construction has commenced, the project is estimated to take around two years to complete. Initial operation is anticipated to commence by early 2029, and at full capacity by late 2029. Site decommissioning and remediation would extend up to around six months beyond the initial commissioning (operational) phase, with estimated completion by the end of 2029.

The final construction program would be confirmed as part of the finalisation of the project development following approval of the project.

1.2.2.3 Indicative duration of transmission line structure construction

Construction at each transmission line structure would be intermittent and construction activities would not occur for the full duration at any one location. Figure 1.3 presents an indicative duration of construction activities associated with the transmission line structures. These durations could vary and breaks between activities may be shorter, which may lead to longer inactive periods in subsequent stages of construction at an individual transmission line structure. Duration of any particular construction activity, and respite periods, may vary for a number of reasons including (but not limited to), multiple work fronts, resource and engineering constraints, works sequencing, and location.

These activities would also have multiple work fronts, therefore (for example) foundation works or structure erection would be occurring in several locations, along the transmission line easement, at the same time.

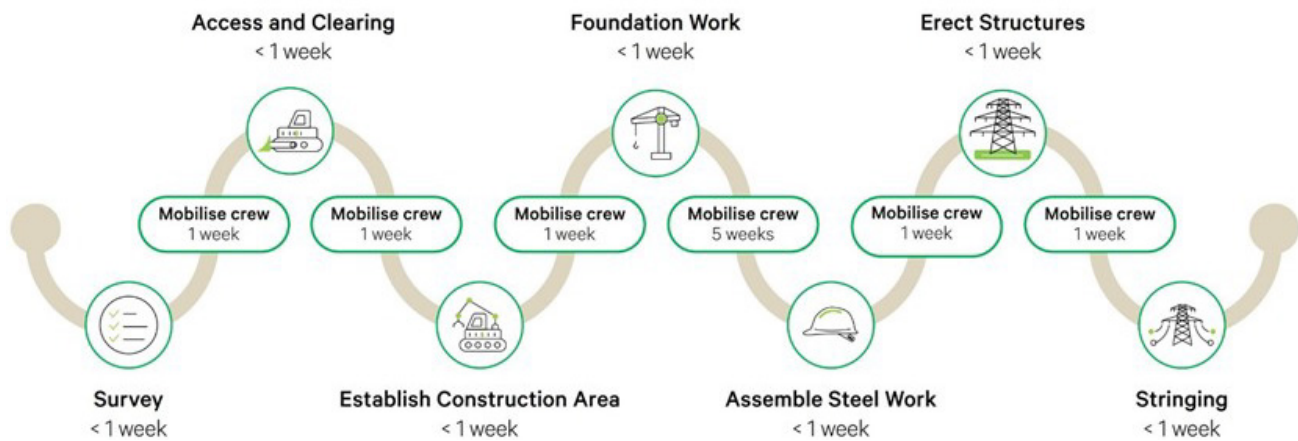


Figure 1.3 Indicative duration and sequence of construction activities for transmission line structures

1.2.3 Operation

Once operational, the new infrastructure would be inspected by field staff and contractors on a regular basis, with other operational activities occurring in the event of an emergency (as required). Key maintenance activities would include:

- regular inspection (ground and aerial) and maintenance of transmission lines and structures, including annual fly overs and routine ground inspections on an approximate six-yearly cycle
- vegetation clearing/trimming within the transmission line easement, and access along road/tracks
- inspection and maintenance of the future Dinawan substation including:
 - routine substation infrastructure inspection (such as transformers, electrical plant and equipment and fire detection systems) throughout the year
 - routine/planned substation maintenance of equipment, property and switchyard areas on a scheduled basis
 - ad hoc fault and emergency works for repair of any damaged infrastructure (for example through a weather event or other failure of infrastructure)
 - maintenance of asset protection zones (as required)
- inspection and maintenance of other ancillary infrastructure including the telecommunication facilities and associated asset protection zones
- stormwater drainage maintenance.

It is expected that these activities would only require light vehicles and/or small to medium plant (depending on the work required).

1.3 Purpose of this technical report

The purpose of this technical paper is to identify and assess the potential noise and vibration impacts in relation to the construction and operation of the project and has been prepared to support and inform the Environmental Impact Statement (EIS). It responds directly to the project's Secretary's Environmental Assessment Requirements (SEARs) issued by the NSW Department of Planning, Housing and Infrastructure (DPHI) on 22 May 2025 (refer to section 1.3.1).

This report has the following objectives:

- to determine construction and operation noise and vibration criteria respectively in accordance with relevant legislation, policies, and guidelines
- to assess potential noise and vibration impacts during construction of the project
- to provide suitable recommendations for the mitigation of any identified construction noise and/or vibration exceedances
- to assess potential operational noise impacts from the project
- to provide recommendations for reasonable and practicable operational mitigation and management measures, where required.

1.3.1 Secretary's Environmental Assessment Requirements

This technical paper addresses the SEARs relevant to the assessment of noise and vibration. The requirements specific to this assessment and where these aspects are addressed in this technical report are outlined in Table 1.1.

Table 1.1 Secretary's Environmental Assessment Requirements – Noise and vibration

Ref.	Secretary's environmental assessment requirements	Where addressed in the EIS
Key issues	Noise: — including an assessment of the construction noise impacts of the project in accordance with the <i>Interim Construction Noise Guideline</i> (ICNG), blasting impacts, cumulative noise impacts (considering other developments in the area), and operational noise impacts in accordance with the <i>NSW Noise Policy for Industry</i> (2017), including corona noise; and — provide details of measures to mitigate and/or manage potential impacts.	— Construction noise and vibration (Chapter 5) — Blasting is not proposed as part of the construction methodology for project. As such, blasting has not been considered in this assessment — Operational noise, including corona noise (Chapter 6) — Cumulative noise (Chapter 7) — Management and mitigation measures (Chapter 8)

1.3.2 Related technical papers

This technical paper is linked to the assessments completed in the following technical papers:

- *Technical paper 2 – Aboriginal Cultural Heritage Assessment Report* (Navin Officer, 2025a): relevant to potential vibration impacts to items of Aboriginal heritage.
- *Technical paper 8 – Traffic and transport impact assessment* (WSP, 2025a): relevant to potential road traffic noise impacts).
- *Technical paper 11 – Non-Aboriginal heritage impact assessment* (Navin Officer, 2025b): relevant to potential vibration impacts to items of non-Aboriginal heritage.

1.4 Structure of this report

The structure and content of this technical paper is as follows:

- Chapter 1 – provides an introduction to this technical paper (this chapter)
- Chapter 2 – outlines the methodology adopted for this noise and vibration impact assessment
- Chapter 3 – describes the existing environment of the study area as it relates to noise and vibration
- Chapter 4 – provides an overview of the regulatory context for the assessment, including an overview of the legislation, policy and guidelines that apply to the project
- Chapter 5 – describes the potential impacts to noise and vibration from construction of the project
- Chapter 6 – describes the potential impacts to noise and vibration from operation of the project
- Chapter 7 – describes the potential cumulative impacts to noise and vibration from construction and operation of the project and any other concurrent projects
- Chapter 8 – provides recommended mitigation and management measures to avoid, minimise and manage any potential impacts of noise and vibration from construction and/or operation of the project
- Chapter 9 – identifies the key reports and documents used to prepare this paper.

Appendices to this report includes:

- Appendix A – Existing environment – additional information
- Appendix B – Construction noise and vibration assessment – detailed results
- Appendix C – VNI West Audible Noise and Radio Frequency Interference Study – Beca.

2 Methodology

2.1 Overview

This section outlines the methodology adopted for assessing the project's potential to generate noise and vibration impacts. The assessment has adopted regulatory guidelines and standards to establish noise and vibration criteria and limits to define where impacts may be experienced and to quantify the performance of recommended noise and vibration management measures. The assessment has been completed in accordance with the SEARs, policies and guidelines outlined in Table 4.1. Figure 1.1 presents the locations of the project components discussed in this section.

The key steps of the methodology for undertaking the noise and vibration impact assessment included:

- defining the study area for noise and vibration based on the proposed activities, sensitive receivers within the surrounding environment, and the anticipated level of impact
 - a baseline noise monitoring survey to determine the existing environment of the study area
 - reference to regulatory guidelines and standards to establish noise and vibration criteria and limits to define where impacts may be experienced and to quantify the performance of recommended noise and vibration management measures
 - predictive modelling of noise levels at sensitive receivers to inform the assessment of the potential impacts to amenity from the construction and operation of the project
 - calculation of safe working distances for plant and equipment for the management of ground borne vibration during construction activities
 - an assessment of the potential cumulative impacts of noise and vibration from the project in combination with other known developments within the vicinity of the project
 - recommending mitigation and management measures to avoid, minimise and manage any potential impacts of noise and vibration from construction and/or operation of the project.
-

2.2 Study area

The distance in which noise and vibration sensitive receivers may experience noise and vibration impacts from the project were used to determine the study area.

To define an appropriate size for the study area for this assessment, preliminary calculations were undertaken to determine this likely maximum extent of construction and operational noise impacts. These calculations considered the likely maximum noise levels of construction and operational plant and equipment, as well as the distance between the project footprint to sensitive receivers. This was used to determine the likely distance at which compliance with noise criteria and limits would be achieved. This area was defined as the study area and includes all noise and vibration sensitive receivers within a three kilometre radius of the project footprint.

Construction road traffic noise impacts have considered representative minimum separation distances along the nominated access routes between the road corridor and typical nearest noise sensitive receivers. Figure 2.1 details the study area used when determining noise and vibration impacts for the project.

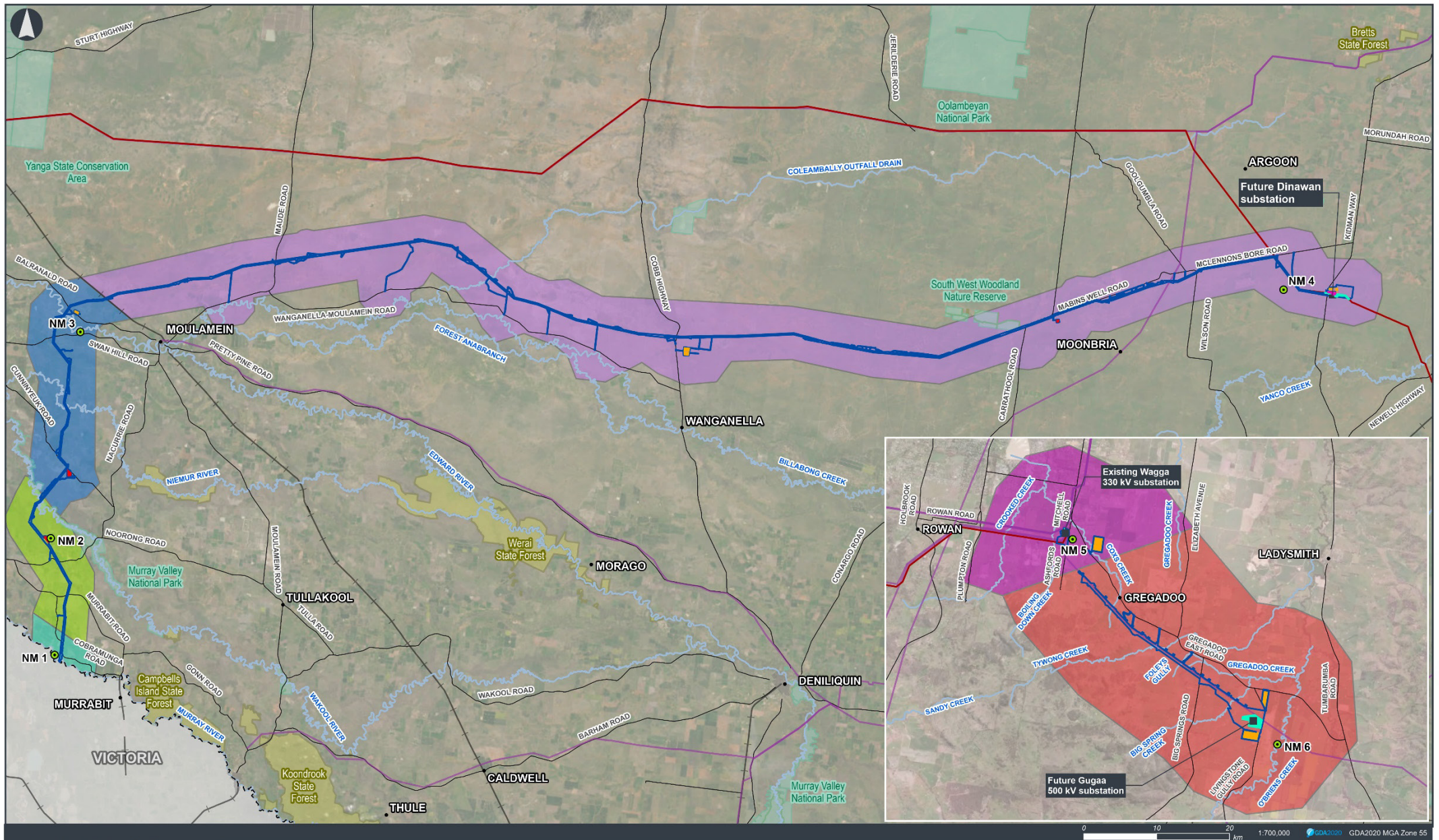
2.2.1 Noise catchment areas

Noise Catchment Areas (NCAs) have been defined for the study area to classify groups of sensitive receivers that are likely to have a similar existing noise environment and experience similar impacts from the project. NCAs were determined through reference to aerial imagery and land-use maps and verified during the noise monitoring surveys.

All NCAs defined for the study area were found to be highly rural in nature and are described in Table 2.1 and shown in Figure 2.1.

Table 2.1 Noise catchment areas

NCA	Representative monitoring location	Region/description of noise environment	Approximate number of sensitive receivers
NSW/Victoria border to Dinawan substation			
NCA 1	NM01	Cobramunga region north of the NSW/Victorian border. Consists mostly of farmland, and the Murray River.	13
NCA 2	NM02	Wetuppa region, consisting of open farmland and bushland of Murray Valley National Park.	19
NCA 3	NM03	Moulamein region, consisting of low density farmland with regional arterial roads entering Moulamein township.	17
NCA 4	NM04	Very low density consisting of rural areas along the east-west section of the alignment. The future Dinawan substation is located to the east.	10
Existing Wagga 330 kV substation to future Gugaa 500 kV substation, Livingstone Gully Road			
NCA 5	NM05	Northern extent of the network augmentation works between the existing Wagga 330 kV substation and future Gugaa 500 kV substation, Livingstone Gully Road, consisting of semi-rural residential properties, and industrial noise sources including Wagga 330 kV substation and Gregadoo Waste Management Centre.	82
NCA 6	NM06	Gregadoo region, consisting of rural residential properties, dominated by local road traffic noise.	47



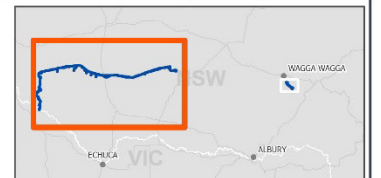
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VNI West – Technical Paper
Noise

Figure 2.1
Study area, noise monitoring
locations and NCA

Legend

- | | | | | |
|--|--|--|-------------------------|---------|
| — Rail line | — Existing transmission line | □ Project footprint | ■ Noise catchment areas | ■ NCA 6 |
| — Main road | — Dinawan substation works - proposed 500 kV | — NSW/Victorian border | ■ NCA 1 | |
| — Named waterway | — Dinawan substation works - existing 330 kV | ■ Combined temporary worker accommodation facility | ■ NCA 2 | |
| — EnergyConnect (NSW - Eastern section) project (under construction) | ■ Substation | ■ Construction compound | ■ NCA 3 | |
| | ■ National park | ● Noise monitoring locations | ■ NCA 4 | |
| | ■ State forest | | ■ NCA 5 | |



2.2.2 Noise and vibration sensitive receivers

Sensitive receivers within the study area with the potential to be impacted by noise and vibration during construction and operation of the project were identified by reviewing recent aerial imagery, field validated where possible, and observations made during the noise monitoring surveys.

2.2.2.1 Noise sensitive receivers

Studies have shown that there are direct links between noise and health. The Guidelines for Community Noise (World Health Organisation, 1999) details that adverse health effects from environmental noise can include stress related illnesses, high blood pressure, speech interference, hearing loss, sleep disruption, and lost productivity. Adherence to the relevant construction and operational noise policies, standards, and guidelines (as outlined in Chapter 4) can greatly reduce the potential for such adverse health impacts.

Noise sensitive receivers are defined in relevant NSW legislation and guidelines, and generally include land uses potentially affected by noise impacts such as residential, educational, medical and recreational areas.

One hundred and eighty-three (183) residential noise sensitive receivers have been identified within the study area and are presented graphically with unique identifiers in Appendix A2. In addition to residential receivers, four passive recreational receivers identified as camping sites on the Murray River are located in NCA 1, and one industrial receiver is located approximately one kilometre north of the existing Wagga 330 kV substation in NCA 5. It is noted that the Murray Valley National Park – Wetuppa and South West Regional Woodland Nature Reserves are located within the study area, however no designated public areas were identified within the study area and as such they have not been considered as noise sensitive receivers.

2.2.2.2 Vibration sensitive receivers

Vibration sensitive receivers include all regularly occupied buildings, utilities and sensitive structures within the study area. At sufficient levels, vibration can lead to cosmetic (and possibly structural) building damage as well as disturbance to occupants (human comfort). All identified noise sensitive receivers are also considered potentially vibration sensitive and have been assessed for possible vibration impacts during construction of the project.

Vibration can also affect sensitive structures, which can include heritage listed buildings. Given the proposed construction methodology, vibration impacts have the potential to affect vibration sensitive heritage structures up to a distance of 100 m from the project footprint.

From a review of *Technical paper 11 – Non-Aboriginal heritage impact assessment* (Navin Officer, 2025b) for this project, no non-Aboriginal heritage items have been identified with the potential to be damaged by ground vibration within this range.

Technical paper 2 – Aboriginal Cultural Heritage Assessment Report (Navin Officer, 2025a) identifies a range of Aboriginal cultural heritage items. Vibration impacts to Aboriginal heritage sites are not expected, as the nature of Aboriginal cultural heritage sites found within the project footprint are not considered to be vibration sensitive.

Therefore, vibration impacts on heritage items have not been assessed in this report. However, criteria have been nominated so further assessment can occur if unexpected heritage items are identified during construction.

Non-residential vibration sensitive receivers may also include sensitive land uses such as medical imaging, research or other technical facilities. However, no receivers of this type have been identified within the study area.

2.3 Noise monitoring methodology

Determining the existing noise environment of the study area involved quantifying and characterising the existing noise environment through noise monitoring, determining the assessment study area, identifying sensitive receivers, and identification of the existing meteorological conditions of the study area.

The baseline environmental noise surveys involved a combination of unattended and attended noise monitoring to quantify the pre-construction noise environment at locations representative of the sensitive receivers along the project. The monitoring was carried out in accordance with the *Australian Standard 1055:1997 – Acoustics – Description and Measurement of Environmental Noise (AS 1055)* and *Approved Methods for the Measurement and Analysis of Environmental Noise in NSW* (EPA, 2022).

Unattended noise monitoring was carried out between 10 September 2024 and 12 February 2025 using a combination of Ngara and Rion NL-42 noise logging devices. Attended noise monitoring, by WSP's acoustic consultants, was undertaken over 15-minute intervals with a Type 1 sound level meter collocated with the noise logging equipment. Field calibration was checked before and after each measurement with no drift (± 0.0 dB) observed. Monitoring was completed in accordance with *AS1055.1 Part 1: General procedures*.

2.3.1 Noise monitoring locations

Noise monitoring locations were selected to be representative of the existing background noise environments in the vicinity of the project and to establish construction and operational noise goals. Table 2.2 outlines the noise monitoring locations selected for the project which are presented graphically in Figure 2.1.

As a portion of the network augmentation between the existing Wagga 330 kV substation and future Gugaa 500 kV substation, Livingstone Gully Road overlaps with the HumeLink project, the noise monitoring data obtained and reported as part of *HumeLink – Technical Report 9 – Noise and Vibration* (SLR, 2023) (the HumeLink Report) has been adopted for NCAs 5 and 6. In consideration of the identified low background noise levels and the lack of any substantial development in the area, these results are considered likely to remain representative of current background noise levels at these locations.

Table 2.2 Noise monitoring locations

ID	NCA	Address	Locality
NM01	1	913 Cobramunga Road, Cobramunga	Cobramunga, New South Wales/Victoria border
NM02	2	246 Fisher Lane, Wetuppa	Wetuppa
NM03	3	1164 Swan Hill Road, Moulamein	Moulamein
NM04	4	137 Cadell Road, Jerilderie	Highly rural areas surround Dinawan substation
NM05 ¹	5	83 Ashfords Road, Gregadoo ²	North-western Gregadoo
NM06 ³	6	1070 Livingstone Gully Road, Gregadoo ²	South-eastern Gregadoo

(1) Presented as L01 in the HumeLink Report

(2) As presented in the HumeLink Report

(3) Presented as L02 in the HumeLink Report

2.4 Construction methodology

This section provides a description of the key construction work for the project. Detailed construction planning, including timing, phasing and work sequencing, would be refined and confirmed by the construction contractors during detailed design.

2.4.1 Construction overview

Key works for the project are described in section 2.4.3 and Table 2.4, and would typically include (but not limited to):

- site establishment
- main construction work – transmission lines
- main construction work – substations
- main construction work – telecommunication facilities (optical repeater sites)
- commissioning and demobilisation.

These key stages would not necessarily take place in the order stated above and some stages may take place concurrently. Further information on the construction program and timing is provided in section 2.4.2. Detailed discussion of construction phases is provided in the Chapter 3 – Project description of the EIS.

For the assessment of construction noise and vibration, the key construction works listed above have been separated into different construction phases. As relevant to construction noise and vibration assessment, the construction phases listed in Table 2.4.

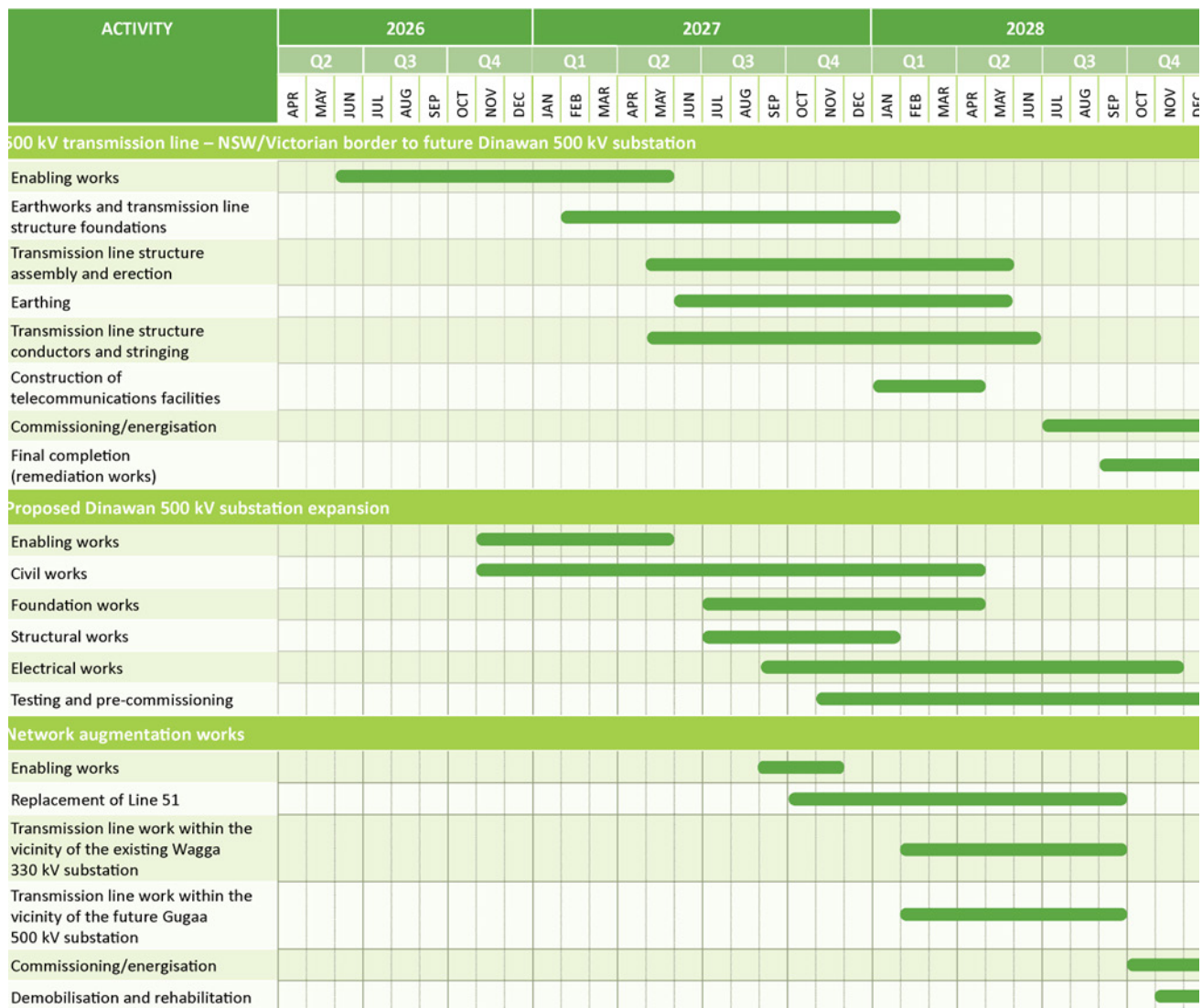
Blasting is not proposed for the construction of the project and is not discussed further.

2.4.2 Indicative construction program

Construction of the project is expected to commence in 2026 (site establishment works phase), subject to NSW Government and Commonwealth planning approvals. The main construction work phase for the transmission line, replacement transmission lines and the proposed Dinawan substation expansion would take up to around 24 months. The proposed Dinawan substation expansion and network augmentation works are expected to be commissioned/energised in late 2028 with initial operation to commence by early 2029, with the system at full capacity by around the end of 2029.

Removal and re-instatement of the temporary facilities (combined temporary worker accommodation facilities and construction compounds) and restoration would extend around four to six months beyond the commencement of the initial commissioning phase, with estimated completion by late 2028.

Figure 2.2 presents an indicative construction program for the project (following planning approval). The indicative staging strategy for construction is discussed in section 2.4. Construction at each transmission line structure would be intermittent and construction activities would not occur for the full duration for each phase of construction as expressed in Figure 2.2.



2.4.3 Construction facilities

Several construction compounds/laydowns and temporary worker accommodation facilities would be required to support the construction of the project.

In addition, up to two standalone construction compounds/laydown areas would be required for the construction of the project. Similar to the temporary worker accommodation facilities, multiple site location options for the western-most compound location have been identified (at either Wetuppa or Cunninyeuk).

The project would seek to re-use, if available, the temporary worker accommodation facilities and construction compound established at the future Dinawan substation as part of the EnergyConnect (NSW – Eastern Section) project. If re-use is not possible, an additional temporary worker accommodation facility and construction compound would be located north of the existing facility on land owned by Transgrid. This assessment has assessed the additional temporary worker accommodation facility and construction compound.

The temporary worker accommodation facilities and laydown compounds are summarised in Table 2.3.

Table 2.3 Summary of proposed construction compounds and temporary worker accommodation facilities

Site name	Proposed use
Fisher Lane, Wetuppa (western option 1)	Construction compound/laydown area
Cunninyeuk Road, Cunninyeuk (western option 2)	
Balranald Road, Moulamein	Combined temporary worker accommodation facility and construction compound
Cobb Highway, Wanganella (north)	Combined temporary worker accommodation facility and construction compound
Cobb Highway, Wanganella (south)	Combined temporary worker accommodation facility and construction compound
Mabins Well Road, Mabins Well	Construction compound/laydown area
Dinawan substation, Coleambally ¹	Combined temporary worker accommodation facility and construction compound
Gregadoo Road, Wagga A (Wagga option 2)	Combined temporary worker accommodation facility and construction compound
Gregadoo Road, Wagga B (Wagga option 3)	
Livingstone Gully Road (Wagga option 4)	

(1) The project would seek to re-use, if available, the temporary worker accommodation established within the Dinawan substation precinct as part of the EnergyConnect (NSW – Eastern Section) project. Should the existing temporary worker accommodation facility not be available for the project, an additional temporary worker accommodation facility and construction compound would be located north of the existing facility on land owned by Transgrid.

The construction compounds would accommodate a range of facilities including, but not limited to:

- storage, stockpile and laydown areas
- vehicle and equipment storage and parking
- maintenance sheds.

In addition to the above, the temporary worker accommodation facilities and construction compounds would also include:

- concrete batching plants
- helipad/helicopter support facilities
- demountable site offices and amenities.

Helipad/helicopter facilities

Helicopters may be used to deliver materials and equipment and to transfer personnel to the project footprints along the transmission line easement. Helicopters may also be used for stringing of the transmission lines (to be determined during finalisation of the proposed construction methodology).

To enable helicopters to operate safely and allow easy access to the site, helicopter landing pads (helipad) would be required. Each helipad is expected to occupy an area of around 30 metres by 30 metres and would be rehabilitated after construction. These areas would typically be located on existing disturbed land not subject to inundation and a reasonable distance from watercourses, sensitive receivers and drainage lines.

Helipads are proposed to be located within combined temporary worker accommodation facility and construction compounds, allowing for helicopters to be based at these sites at night. Helicopters may also be based overnight at nearby airports including Griffith, Wagga Wagga and Swan Hill Airports. Along the transmission line alignment, helicopters would use brake and winch sites as landing areas during standard construction hours, as required.

2.4.4 Construction work hours and duration

The standard construction hours would be as per the *Interim Construction Noise Guideline* (DECC, 2009):

- 7 am to 6 pm Monday to Friday
- 8 am to 1 pm Saturday
- no construction work on Sundays or public holidays.

Some activities would be required outside these standard construction hours for safety, technical or public infrastructure operational reasons (e.g. to minimise utility or traffic disruptions). A summary of the proposed construction hours for the project is detailed in Table 2.4.

Extension of the standard construction hours may be investigated to assist in the delivery of the project. Any proposed extension of standard construction hours would be subject to additional environmental assessment as required.

The temporary worker accommodation facilities would be operational 24 hours a day, seven days a week.

Table 2.4 Construction phases and working hours

Construction phase	Estimated duration ¹	Hours of work ²			
		Standard hours	Day OOH	Evening OOH	Night OOH
Transmission line					
Site establishment and vegetation clearance	1–4 weeks per structure over 12 months	✓	–	–	–
Earthworks and footing construction, or dismantling of existing transmission line structures	1 week per structure over 12 months	✓	✓	–	–
Assembly and erection of transmission line structures	2 weeks per structure over 13 months	✓	✓	✓	✓
Stringing of the conductors and overhead earth wires (OHEW) and optical ground wire (OPGW)	1–3 weeks per structure over 14 months	✓	✓	✓	–
Conductor brake & winch	3 weeks per structure over 14 months	✓	✓	✓	–
Commissioning	1 week per structure 6 months	✓	✓	✓	✓
Demobilisation	1 week per structure over 4 months	✓	–	–	–

Construction phase	Estimated duration ¹	Hours of work ²			
		Standard hours	Day OOH	Evening OOH	Night OOH
Future Dinawan 500 kV substation					
Site establishment and vegetation clearance	7 months	✓	–	–	–
Civil construction works	18 months	✓	✓	✓	✓
Electrical construction works	15 months	✓	✓	✓	✓
Surfacing and stabilising works	10 months	✓	-	-	-
Commissioning	14 months	✓	✓	✓	✓
Demobilisation	1 month	✓	–	–	–
Existing Wagga 330 kV substation and future Gugaa 500 kV substation, Livingstone Gully Road					
Electrical construction works	7 months	✓	–	–	–
Commissioning	1 month	✓	–	–	–
Access track					
Vegetation clearing	1 week per access track over 12 months	✓	–	–	–
Earthworks and upgrades	3 weeks per access track over	✓	✓ ³	✓ ³	✓ ³
Telecommunication facilities (optical repeater sites)					
Construction works	4 months	✓	–	–	–
Combined temporary worker accommodation facility and construction compound					
Site establishment and vegetation clearance	3 to 4 weeks	✓	✓	✓	✓
Construction works	2 months	✓	✓	✓	✓
Operations	20 months	✓	✓	✓	✓
Construction compound/laydown areas					
Site establishment and vegetation clearance	3 to 4 weeks	✓	✓	✓	✓
Construction works	2 months	✓	✓	✓	✓
Operations	20 months	✓	✓	✓	✓

(1) Durations are indicative and to be confirmed by the construction contractor

(2) OOH = outside of recommended standard hours as defined in section 4.2.1.1

(3) Only where a road occupancy licence (or similar is required)

2.4.4.1 Out of hours work

A series of work outside the proposed construction hours for the project are anticipated including (but not limited to) the following:

- transmission line construction at crossings of a main road as these locations are expected to have restricted construction hours requiring some night work for activities such as conductor stringing over the crossing(s)
- work where a road occupancy licence (or similar) is required, depending on the licence conditions
- transmission line cutover and commissioning
- the delivery of equipment or materials outside standard hours requested by police or other authorities for safety reasons (such as the delivery of transformer units)
- limited substation assembly work (such as oil filling of the transformers and pre-commissioning testing)
- emergency work to avoid the loss of lives and/or property and/or to prevent environmental harm
- work timed to correlate with system planning outages (likely 24-hour operations when required to minimise impact to electrical supply services)
- situations where agreement is reached with affected sensitive receivers
- potential utilities adjustment works (in consultation with the requirements of asset operators)
- large concrete pours (including concrete batching plant operation which may require commencement before 7 am for early pours)
- activities that do not generate noise that exceeds the applicable noise management level at any sensitive receiver.

During detailed construction planning, a program would be determined to identify the required night work periods (including dates and durations). Except for emergencies, construction works would be carried out in accordance with the out of hours work protocol (where required) and would not take place outside construction hours without prior notification in line with that protocol.

Additional measures would also be implemented where work would potentially exceed noise management levels in proximity to sensitive receivers, which would be included as part of a construction noise and vibration management sub-plan (CNVMP).

2.4.5 Construction vehicle movements

Construction vehicles would transport equipment, waste, materials and spoil, as well as workers. The following construction vehicle movements have also been considered:

- larger volumes of heavy vehicles would occur during the main construction work associated with the substations and transmission lines and would mainly be associated with the delivery of materials to work sites and construction compounds
- most of the light vehicle movements would be limited to construction staff travelling to and from individual sites
- non-standard or oversized and/or over-mass (OSOM) loads would be required for the substation work (e.g. for transformer transport).

Indicative daily vehicle movements for the project are outlined in Table 2.5. These vehicle movements are based on the expected typical and peak construction period for the project. The vehicle movements stated in Table 2.5 would be confirmed during finalisation of the project design and construction planning and included in the Traffic and Transport Management Plan (TTMP). Further detail on the existing and project generated traffic movements is provided in *Technical paper 8 – Traffic and transport impact assessment* (WSP, 2025b).

Table 2.5 Indicative vehicle movements (per day) during construction

Construction facilities	Light vehicles		Heavy vehicles	
	Typical daily movements	Max. daily movements	Typical daily movements	Max. daily movements
Fisher Lane, Wetuppa (western option 1)	26	42	24	45
Cunninyeuk Road, Cunninyeuk (western option 2)				
Balranald Road, Moulamein ¹	142	198	224	534
Cobb Highway, Wanganella (north) ¹	142	198	224	534
Cobb Highway, Wanganella (south) ¹	142	198	224	534
Mabins Well Road, Mabins Well	26	42	24	45
Dinawan substation, Colleambally ¹	142	198	224	534
Gregadoo Road, Wagga A (Wagga option 2) ¹	26	48	24	45
Gregadoo Road, Wagga B (Wagga option 3) ¹				
Livingstone Gully Road, Wagga (Wagga option 4) ¹				

(1) Vehicle movements include total for combined construction compound/laydown area and temporary workers accommodation facility

The following assumptions apply to the indicative vehicle movements:

- vehicle movements are each way (i.e. a heavy/light vehicle arriving and leaving a site, either within a day or separate days counts as two movements)
- typical and maximum daily movements are based on the current program of work.

Construction vehicle traffic would be greatest during the main earthworks and civil construction activities. Most of the light vehicle movements associated with the construction work would generally be limited to construction staff travelling to and from individual sites for work from the temporary worker accommodation facilities.

In addition to construction traffic impacts, it is noted that *Technical paper 8 – Traffic and transport impact assessment* (WSP, 2025b) also considers pre-construction traffic impacts. This addition is a specific request by Transport for New South Wales (TfNSW) for the assessment of traffic and transport impacts, and not for the potential noise resulting from pre-construction traffic. Any potential traffic volume increase due to pre-construction activities is expected to be minimal and significantly less than construction traffic volumes.

2.5 Noise assessment methodology

2.5.1 General modelling assumptions

A detailed 3-dimensional noise model has been prepared for the project to assess potential noise impacts during construction and operation of each project component. Noise levels for construction were modelled for typical activities under calm meteorological conditions (as required and detailed in section 2.5.3.1) to estimate noise impacts at the nearest receivers. Operational impacts have been assessed for both neutral and noise-enhancing meteorological conditions.

A noise model was created with SoundPLAN 8.2 modelling software and the CONCAWE algorithm was adopted to assess the noise levels from key noise sources.

Key modelling parameters and assumptions are shown in Table 2.6.

Table 2.6 Construction and operational noise modelling inputs and assumptions

Parameter	Modelling input
Ground absorption	Ground absorption factors are set to 0.75 which is indicative of mixed grass/open vegetation located throughout the study area.
Terrain data	Terrain data have been provided by NSW Six Maps.
Meteorological conditions	Neutral conditions: Stability category D, 0 m/s wind from source to receiver (construction and operation). Noise-enhancing conditions: Stability category F, 2 m/s wind from source to receiver (refer section 2.5.3.1) (operation only).
Buildings	Sensitive receivers are modelled as point receivers only (free-field levels).
Receiver height	The receiver heights are set at 1.5 m above ground level as per ICNG.
Location of noise sources	Due to the preliminary nature of detailed site layouts, noise sources have generally been placed at the nearest site boundary to each receiver for the assessment of worst-case potential impacts.
Modelled sound power levels	As described in section 2.5.3. Noise sources were typically modelled at 2.5 m height above ground level, representative of the general height noise-emitting sources of construction machinery.
Assessment parameter/duration	L_{Aeq} (15 minutes) (construction sources and future Dinawan substation). Instantaneous L_{Amax} (construction sources and future Dinawan substation circuit breakers).
Assumed hours	Construction and operational noise may occur at any time of day (day, evening, night). The operational of the temporary worker accommodation facilities would operate outside standard hours. The other construction works that may occur outside of standard hours have been presented in Chapter 5.
Attention-drawing characteristics	The application of annoyance penalties to noise sources have been considered as described in section 4.2.2.

2.5.2 Construction assessment methodology

Indicative construction fleet and staging was sourced for the project based on experience on other major transmission projects. Sound power level profiles associated with the construction equipment were developed outlining the equipment used at each construction stage, utilisation and number of plant. Sound power levels (SWLs) for individual plant items were generally sourced from the (former) Roads and Maritime Services' Construction Noise Estimator (part of the Construction Noise and Vibration Guideline – Roads (CNVG -R)), which provides regulator-accepted sound power information for construction equipment.

Where additional SWLs were required, these were sourced from similar industry standard databases. All equipment was conservatively assumed to be operating simultaneously within each work stage. These SWLs are provided in detail in Appendix B1.

2.5.2.1 Construction noise assessment

Prediction of construction noise levels from the construction activities has been conservatively calculated in accordance with the general modelling assumptions in section 2.5.1, taking into account likely reductions in noise due to air absorption, topographical screening and ground absorption. A maximum potential impact has been predicted, based on the nearest extents of the project footprint to noise sensitive receivers.

As discussed in section 2.4.4 construction activities would typically be carried out during standard hours, however some works may be required to be undertaken outside of these hours. As such the assessment has considered potential standard and OOHW noise impacts. Expected work stages required to occur outside of standard hours are listed in Table 2.4 and will be further refined in the CNVMP.

2.5.2.2 Construction vibration assessment

Where vibration intensive plant such as vibratory rollers, hydraulic hammers, bored piling rigs or jackhammers are used, vibration would be managed to minimise disturbance to building occupants and to avoid damage to buildings and other structures.

The CNVG-R summarises the relevant minimum working distances for certain vibration generating activities with regard to cosmetic damage and human comfort impacts. These distances have been calculated according to the Assessing Vibration: A Technical Guideline (NSW Department of Environment and Conservation, 2006) (AVTG), British Standard BS 7385-2:1993 – Evaluation and measurement for vibration in buildings and Guide to damage levels from groundborne vibration (1993) (BS7385) and German Standard DIN 4150-3: Structural Vibration – effects of vibration on structures (DIN 4150-3).

Table 2.7 indicates the minimum working distances for typical items of vibration intensive plant applicable to this project that must be complied with unless additional mitigation is employed.

Table 2.7 Minimum working distances for vibration intensive plant

Plant item	Rating/description	Minimum working distance (metres)		
		Cosmetic damage (BS 7385) ¹	Heritage (DIN 4150-3) ¹	Human response (AVTG)
Small hydraulic hammer	300 kg – 5 to 12 tonne excavator	2	5	7
Medium hydraulic hammer	900 kg – 12 to 18 tonne excavator	7	15	23
Large hydraulic hammer	1600 kg – 18 to 34 tonne excavator	22	44	73
Pile boring	≤800 mm diameter	2	5	4
Vibratory Roller	> 300 kN (typically 13–18 tonnes)	15	54	100

(1) Source: adapted from CNVG-R, TfNSW, 2022

The minimum working distances presented are indicative and would vary depending on the item of plant and local geotechnical conditions. The cosmetic damage thresholds apply to typical buildings under typical geotechnical conditions and vibration monitoring is recommended at specific sites, including heritage items deemed vibration sensitive and located within 100 m of any vibration intensive work.

In relation to human response, the nominated minimum working distances relate to continuous vibration. For most construction activities, vibration emissions are intermittent and higher vibration levels over shorter periods are acceptable. Additional assessment should be undertaken where the human response criteria are exceeded.

The relevant minimum safe working distance for each work stage was determined in reference to the proposed equipment and buffer zones were created to geographically capture all receivers within these distances.

2.5.2.3 Construction traffic noise assessment

Construction traffic volumes have been assessed for all identified construction routes to the nearest potentially affected residential receivers. The likely routes for these vehicles and project traffic numbers have been adapted from *Technical paper 8 – Traffic and transport impact assessment* (WSP, 2025b).

Quantitative increases in road traffic noise as a result of additional construction traffic have been calculated using the Calculation of Road Traffic Noise (UK Department of Transport, 1988) (CoRTN) calculation method to confirm compliance with RNP NMLs at the nearest representative receiver distances for each route. CoRTN is a standard road noise prediction method approved for use by Australian regulatory bodies. Base noise calculation assumptions are presented in section 2.5.1 and specific road traffic calculation assumptions are provided in Table 2.8.

Table 2.8 Road noise modelling assumptions

Parameter	Modelling input
Vehicle numbers and speeds	15 hour/9 hour traffic volumes required have been adapted from the peak midblock volumes data contained within <i>Technical paper 8 – Traffic and transport impact assessment</i> (WSP, 2025b)
Surface corrections	0 for sealed roads, +7 for unsealed roads
Delivery hours	All construction traffic has been assumed to occur during daytime hours only

It is noted that deliveries may occur during the night period, however these activities fall under the ‘delivery of oversized plant or structures’ category of works allowed outside standard hours in line with the ICNG. OSOM vehicle movements for the project will include the delivery of substation components to the future Dinawan 500 kV substation.

In order to assess the construction traffic noise impact on nearby receivers, existing traffic levels in each direction and predicted construction traffic volumes on key construction routes were considered.

The potential day and night-time construction road traffic noise impacts on the road network have been predicted using the CoRTN (Calculation of Road Traffic Noise) algorithm. A typical ‘worst case’ separation distance is identified for the closest receivers from each of the roads identified in the construction road network. This methodology aligns with the relevant guidelines and standards, and considers the low risk of construction road traffic noise impacts. The assessed worst-case distance between the nominated receiver and the road corridor is provided along with the results of the construction traffic noise assessment in section 5.1.7.

The modelled traffic volumes for key construction routes that were assessed are presented in Appendix B2.

2.5.2.4 Construction aircraft noise assessment

Helicopters may be used to deliver materials and equipment and to transfer personnel to the project footprint during construction. Helicopters and drones may also be used for stringing transmission lines and assisting with platform works (e.g. removal of joint covers, installation of conductor spacers, bird diverters, and marker balls along the line).

The use of helicopters and drones within the project footprint has been assessed against the established construction aircraft noise criteria presented in the HumeLink report. This assessment is summarised in section 4.2.1.5. The L_{Amax} noise descriptor best represents the indicative maximum transient noise level at ground level during nearby aircraft overflight.

Aircraft noise model methodology

The ICNG does not provide guidance for assessing aircraft noise emissions as part of construction, and as such, the approach implemented in the HumeLink project has been used for this project. This assessment evaluated the number of receivers impacted by aircraft noise levels exceeding 75 dBA and 85 dBA L_{max} . The 75 dBA and 85 dBA L_{max} criteria are used in AS 2021 as unacceptable maximum sound level targets for building site acceptability for residential houses, schools, and hospitals, based on the number of flights per day at light (non-jet) aviation aerodromes. More detail regarding the construction aircraft noise modelling methodology is found in section 4.2.1.5.

An overview of the noise modelling software and the data collected to develop the aircraft noise model is outlined in Appendix B5.1.

Modelled scenarios

The aircraft modelling assessment considers the following scenarios:

- departure and arrival of helicopters at the helipads located within the combined temporary worker accommodation facility and construction compounds
- overflights of helicopters and drones within the transmission line corridor for stringing and platform works
- departure and arrival of helicopters and drones at brake and winch sites.

Modelled aircraft

The following aircraft noise sources were included in the model:

- Airbus AS350/H125 single engine helicopter used for stringing work (including break and winch activities) inside the transmission line corridor as well as departures and arrivals at the helipads.
- Airbus EC135/H135 twin engine helicopter used for platform work inside transmission line corridor as well as departures and arrivals at the helipads.
- Drones are assumed to be multi-rotor aircraft with a maximum take-off weight of approximately 50 kilograms (such as the Callisto 50 or similar models) and used for stringing and platform work inside the transmission line corridor. For noise modelling purposes, these drones have been represented as a Robinson R22 light utility helicopter (maximum take-off weight of 621 kilogram) with a 10 dB noise reduction applied. This approach is based on a similar noise modelling methodology for drones used for the HumeLink project.

Modelling assumptions

The aircraft noise model and assessment are based on the following assumptions:

- **Helicopter and drone operations at brake and winch site**

Helicopter and drones within the transmission line corridor will use brake and winch sites as landing areas during standard construction hours. The location of the transmission lines will be finalised after the detailed design stage, which may impact the location of brake and winch sites. To determine the noise impact of helicopter and drone arrivals and departures at these sites, an assessment has been undertaken to establish a buffer zone requirement to minimise noise impact on sensitive receivers. Aircraft noise at these sites will need to be considered during the preparation of the CNVMP.

- **Flight paths for helicopter operations outside of the project footprint**

Flight paths for helicopter operations outside of the project footprint is not known at this stage and are therefore currently excluded from the assessment. However, it is understood that the noise impact from helicopters travelling to and from the project footprint would generally be managed by flying the helicopters at a minimum height of 1,000 ft above ground level (AGL) over towns and 500 ft AGL over unpopulated areas, subject to approval from the Civil Aviation Safety Authority (CASA) and Airservices Australia (Airservices). According to the aircraft noise modelling conducted for the HumeLink project (*SLR Report 160550-AMD-KK-009*, dated May 16, 2024),

helicopters flying at altitudes at 1,000 ft AGL are expected to produce noise levels up to 70 dBA $L_{\max}$ for sensitive receivers directly beneath the flight path, which is comparable to or lower than that of a passing car.

More detailed assumptions are presented in Appendix B5.1.

2.5.3 Operational assessment methodology

The operational noise assessment has considered:

- corona noise from transmission lines
- transmission line and substation maintenance (including operation road noise); and
- noise from fixed plant within the future Dinawan substation expansion site.

Work within the vicinity of the existing Wagga 330 kV substation and the future Gugaa 500 kV substation, Livingstone Gully Road would not change the existing operational or maintenance requirements for these substations. The proposed work within the substations is limited to low noise impacts work such as connection or disconnection of transmission lines. As such, an operational noise assessment for these substations is not required.

Any operational noise associated with the telecommunications facilities are expected to be negligible, as no significant noise generation is predicted at these sites. Therefore, an operational noise assessment for telecommunications facilities is not required.

2.5.3.1 Meteorology

Certain meteorological conditions can enhance the propagation of noise, and their influence is required to be accounted for where they are found to be a feature of the environment in the vicinity of the project. These are described in the NPfI and summarised in Table 2.9.

Table 2.9 Standard and noise enhancing meteorological conditions

Meteorological conditions	Parameters
Neutral meteorological conditions	Day/evening/night: Stability categories A-D with wind speed up to 0.5 m/s at 10 m above ground level.
Noise-enhancing meteorological conditions	Night: Stability categories A-D with light winds (up to 3 m/s at 10 m above ground level) and/or stability category F with winds up to 2 m/s at 10 m above ground level.

Where the occurrence of noise-enhancing conditions is ‘significant’ (i.e. occurs for more than 30% of the time), noise levels from the project must also be assessed under these conditions as defined in the NPfI.

For the purposes of operational noise assessment, neutral and noise-enhancing meteorological conditions were considered.

2.5.3.2 Modifying factors for annoying characteristics

Certain noise characteristics have a higher potential to cause annoyance, generally requiring additional considerations during assessment. Tonality, low frequency emphasis and intermittency are generally considered to be attention-drawing noise characteristics and can cause greater disturbance. On the other hand, short-term single noise events, such as steady engine noise are likely to be less disturbing and may warrant some relaxation in the applicable noise criteria.

Transmission line corona noise is generated by arcing of electricity across the surface of transmission lines and is characterised by a broadband crackling noise, along with a 100 Hz tonal characteristic, which has been accounted for in the *Victoria to New South Wales Interconnector West (VNI West), Audible Noise and Radio Interference Study RevD* (Beca Pty Ltd, 2025) (Beca AN study). Analysis of the transformers proposed for use at the future Dinawan substation expansion shows that they exhibit a dominant tonal characteristic and as such, the appropriate modifying factors summarised in section 4.2.2.4 have been applied.

2.5.3.3 Transmission line corona noise assessment

Operation of high voltage transmission lines carry the risk of generating audible noise during certain meteorological conditions, for example during wet weather.

Such phenomena are driven by the conductor's Surface Voltage Gradient (SVG) and accumulation of pollution and water droplets on the transmission line's conductor surface. Corona noise is therefore more prominent during weather conditions with rain, mist or fog. Such audible noise is understood to be typically characterised by a broadband crackling noise with a possible, more prominent, tonal component at 100 Hz. It is noted however that this tonal component is typically below the threshold set by the NPfI for tonal noise.

The extent and level of noise associated with corona discharges are primarily influenced by the following factors:

- maximum surface voltage gradient
- meteorological/air pollution conditions (including mist, dust or light rain).

Although corona noise may occur under misty conditions, advice from the BoM indicates that as mist is a qualitative descriptor, it cannot be reliably measured or reported. The BoM has advised that mist will generally be recorded as fine rainfall and as such the number of rainfall days per year will include most mist days. Air quality in the region of the project is generally good as described in the *Technical paper 15 – Air quality impact assessment* (WSP, 2025b), and it is not expected that air pollution would significantly contribute to corona discharge.

Calculated corona noise levels

Corona noise levels have been calculated in the Beca AN Study using the EPRI method as recommended by Transgrid (Transmission Line Design Manual – Major New Build, Rev 2.0, D2023/00450, Transgrid, 2023), which is provided in Appendix C. This report has identified a buffer distance for the project, beyond which compliance with operational noise criteria is expected to occur. This assessment has used the buffer distance to identify potentially impacted sensitive receivers and estimate their likely extent of exceedance of Project Noise Trigger Levels (PNTLs).

Meteorological impacts

Section 3.4 of the Beca AN study (see Appendix C) outlines historic meteorological data for the study area. This has been reproduced in Table 2.10 and indicates the number of rain days per year and as such, the likelihood of corona noise occurring during any period of a day.

Table 2.10 Rainfall statistics (BoM, 2024)

Transmission line	Bureau of Meteorology station		Rain days (per year)		Rain rate (mm/hr)		Annual percentage of days with wet conditions
	Location	Station ID	Mean	STD ¹	Mean	STD ¹	
VNI West 500 kV double circuit	Swan Hill	77094	85.1	3	0.47	2.48	23%
	Deniliquin	74258	95.6	4	0.56	2.79	26%
	Griffith	75041	48.5	1	0.59	3.04	13%
	Yanco	74037	93.6	3	0.63	3.12	26%
TL-51 330 kV double circuit	Wagga Wagga	72150	72.3	2	0.8	3.54	20%
	Kapooka (Defence)	74272	N/A	N/A	0.86	3.86	N/A

(1) Standard deviation

Audible corona noise is not expected to be a constant occurrence but is only present during mild, wet and misty conditions. Based on the meteorological conditions identified for the area, the expected annual frequency of these conditions is expected to occur for some period of time during 13–26 per cent of days.

2.5.3.4 Future Dinawan substation expansion assessment

Potential operational noise impacts from the future Dinawan substation expansion have been assessed with the following significant noise sources proposed:

- six single-phase 500 kV/330 kV transformers
- four three-phase shunt reactors (including two spare reactors)
- 500 kV circuit breaker switchgear equipment.

Transformers and shunt reactors have been modelled as L_{Aeq} noise sources and circuit breaker switches have been assessed against L_{Amax} noise criteria as outlined in section 4.2.1.3. The assessments are presented in Chapter 6.

Circuit breaker switches trigger infrequently and are required for the safe and stable operation of the power network. As such, these noise events do not typically affect the background noise environment, and the assessment has therefore only been considered against the L_{Amax} noise criteria (refer section 4.2.2.5). Activation of the switches results in short term impulsive noise events which generate noise levels in the order of 115 dB L_{AFmax} .

The noise levels for all equipment has been based on the results of attended noise monitoring at a number of large NSW substation sites.

The equipment and estimated SWLs in Table 2.11 have been modelled for future Dinawan substation expansion. Cumulative noise emissions from the transformers are expected to form the loudest components of plant and would dominate the noise environment.

Table 2.11 Primary noise generating equipment at the future Dinawan substation expansion

Equipment	Number of plant (indicative)	Sound power level dB per unit $L_{Aeq}(15 \text{ minutes})$	Sound Power Level dB per unit $L_{Amax} (15 \text{ minutes})$
Power transformers	6	105	—
Shunt reactors	4	94	—
Circuit breaker switches	—	—	115
Total		113	115

As the site layout is not finalised, the total noise level has been placed at the nearest boundary location to each receiver to represent a conservative prediction of noise impacts.

2.5.3.5 Permanent access tracks

Access to the transmission line easement for operational purposes would preferentially use existing public and private roads and tracks, although access tracks created for construction may be retained during operation of the project to provide safe access.

These permanent access tracks would only be used occasionally and would carry a very low volume of vehicles. The potential for use of these access tracks to result in an operational noise impact is therefore expected to be significantly below the relevant criteria and is discussed further in section 6.2.

2.6 Cumulative assessment methodology

The assessment of cumulative noise impacts from the project and relevant future projects is consistent with the requirements of the *Cumulative Impact Assessment Guidelines for State Significant Projects* (NSW Department of Planning, Industry and Environment (DPIE), 2022). These guidelines define cumulative impacts as those arising as a result of incremental, sustained and combined effects of human action and natural variations over time that can be both positive and negative. These impacts can be caused by the compounding effects of a single project or multiple projects in an area, and by the accumulation of effects from past, current and future activities as they arise.

Further detail on cumulative impact assessment approach and the other projects considered in the cumulative impact assessment is provided in Chapter 24 (Cumulative impacts) of the EIS.

2.6.1 Cumulative impact study area

Relevant future projects located within the cumulative impact study area have been identified in Chapter 24 (Cumulative impacts) of the EIS. As construction and operational noise impacts are rarely experienced beyond three kilometres from the noise source, any relevant future projects beyond a total of six kilometres from the project are unlikely to generate cumulative noise impacts.

Cumulative vibration impacts are considered highly unlikely to arise from adjoining projects, as vibration impacts are rarely experienced beyond 200 metres, which is a distance unlikely to correlate with concurrent projects and construction durations. As such, cumulative vibration impacts have not been considered further in this paper.

2.6.2 Cumulative impact assessment approach

The cumulative impact assessment approach involved considering the impacts of the project together with the impacts of other relevant future projects. Relevant projects with potential for cumulative impacts with the project were identified through a review of publicly available information and environmental impact assessments.

The cumulative impact assessment related to noise involved:

- reviewing the nature and scale of potential noise impacts with overlapping project timeframes, as described in publicly available planning documents for the identified projects. Where the scheduling of identified projects was found to potentially overlap with the schedule for this project, further assessment was undertaken
- a three kilometre potential impact zone around each external project and this project was analysed and where impacts during the construction or operation of the project have been predicted within this zone, further consideration of impacts was carried out for these receivers
- noise impacts described in any existing environmental studies for the overlapping external projects were reviewed and the nature of any potential overlapping impacts have been described. Due to the large separation distances, cumulative vibration impacts are highly unlikely and have not been quantitatively assessed
- high level noise mitigation measures were recommended for application where receivers or areas have been identified as potentially subject to cumulative noise impacts.

2.6.3 Assumptions, uncertainties and limitations

The primary limitation in this assessment method has been the availability and format of quantitative predictions of noise impacts and project timing for relevant future projects. In addition, the large number of receivers, and conflicting quality of data across projects has made correlations between receivers difficult. In accordance with the *Cumulative Impact Assessment Guidelines for State Significant Projects* (DPIE, 2021), a combination of quantitative assessment (where there is sufficient information available) and qualitative assessment (where there is insufficient information available) may be required for some project. Conclusions have been based on a high level review of existing environmental studies in conjunction with predictions made in this report.

2.7 Noise and vibration impact mitigation and management measures

2.7.1 General mitigation measures

Noise and vibration impact mitigation and management measures have been developed to reduce the effects of noise and vibration impacts that have been predicted for operational and construction components of the project. Where impacts have been predicted, all reasonable and feasible mitigation measures should be considered.

A feasible mitigation measure can be engineered and is practical to build and/or implement, given project constraints such as safety, maintenance and reliability requirements. It may also include options such as amending operational practices (for example, changing a noisy operation to a less-sensitive period or location) to achieve noise reduction.

Selecting reasonable measures from those that are feasible involves judging whether the overall noise benefits outweigh the overall adverse social, economic and environmental effects, including the cost of the mitigation measure. It considers the extent of exceedance, the cost benefit of mitigation and community views.

2.7.2 Operational noise mitigation

With regards to mitigation investigation, NPfI states that:

“Where the project noise trigger level is exceeded, assess the feasible and reasonable mitigation measures that could be implemented to reduce noise down towards the relevant project noise trigger level. If it is reasonable to achieve these levels, the proponents should do so. If not, then achievable noise levels should be identified. It is not mandatory to achieve the trigger levels but the assessment should provide justification if they cannot be met. An assessment of the acceptability of residual impacts should also be provided.”

Guidance is provided in NPfI in regard to definition of ‘feasible’ and ‘reasonable’ mitigation as well as a generic list of mitigation measures.

From an acoustic perspective, possible strategies to mitigate noise are typically investigated in the following order (decreasing preference):

- 1 land use planning and provision of appropriate buffer distances
- 2 noise control at the noise source
- 3 noise control along the noise transfer path
- 4 noise control at the receiver.

2.7.2.1 Land use planning and provision of appropriate buffer distances

From an acoustic perspective, consideration to provide greater buffer distances between noise-generating developments where possible is recommended. This can have its limitations and should be considered with factors other than acoustics.

Avoidance and minimisation of impacts to sensitive receivers has been a key consideration during the development of the project, including the selection of ancillary construction sites. This has assisted in minimising potential noise and vibration impacts at sensitive receivers during construction and operation.

2.7.2.2 Noise control at the noise source

Generally, noise control at the source is considered as most effective in improving the overall acoustic outcomes at sensitive receivers. This may include sourcing equipment with lower acoustic specifications or providing localised noise shielding or housing equipment within sound insulated enclosures.

2.7.2.3 Noise control along the noise transfer path

This typically involves the investigation and implementation of noise barriers (in the form of walls or earth mound) to block the direct line of sight between noise sources and receivers. Noise barriers are most effective when closer to the noise source or receiver. Implementation of noise barrier is considered more feasible and reasonable to provide protection for groups of closely spaced receivers and not considered cost-effective for isolated receivers.

2.7.2.4 Noise control at the receiver

Following consideration of all feasible and reasonable source and pathway noise mitigation measures, the NPfI allows for receiver property treatment to be considered for any residual noise impacts. The NPfI states that receiver-based treatment is typically only applicable for isolated residences in rural areas and may include upgrade of various construction elements of the dwellings and voluntary property acquisition.

In accordance with NPfI, receivers with a residual noise impact are defined as receivers with exceedances of the project noise trigger levels under the best-achievable acoustic outcome from a development. Residual noise impacts are identified after all feasible and reasonable source and pathway noise mitigation measures have been considered.

The significance of project-related residual noise impacts experienced by receivers determined in accordance with NPfI, is summarised in Table 2.12 and the correlating levels of receiver-based treatment are summarised in Table 2.13.

Table 2.12 Significance of residual noise impacts (source: NPfI)

If the predicted noise level minus the project noise trigger level is:	And the total cumulative industrial noise level is:	Then the significance of residual noise level is:
≤ 2 dB	Not applicable	Negligible
≥ 3 but ≤ 5 dB	< recommended amenity noise level or > recommended amenity noise level, but the increase in total cumulative industrial noise level resulting from the development is less than or equal to 1 dB	Marginal
≥ 3 but ≤ 5 dB	> recommended amenity noise level and the increase in total cumulative industrial noise level resulting from the development is more than 1 dB	Moderate
> 5 dB	≤ recommended amenity noise level	Moderate
> 5 dB	> recommended amenity noise level	Significant

Table 2.13 Examples of receiver-based treatments to mitigate residual noise impacts (source: NPfI)

Significance of residual noise level	Example of potential treatment
Negligible	The exceedances would not be discernible by the average listener and therefore would not warrant receiver-based treatments or controls.
Marginal	Provide mechanical ventilation/comfort condition systems to enable windows to be closed without compromising internal air quality/amenity.
Moderate	As for 'marginal', but also upgraded façade elements, such as windows, doors or roof insulation, to further increase the ability of the building façade to reduce noise levels.
Significant	May include suitable commercial agreements, where considered feasible and reasonable.

To provide an appropriate indoor acoustic amenity for residential dwellings, appropriate internal ambient noise level targets are typically established per *AS/NZS 2107:2016 Acoustics—Recommended design sound levels and reverberation times for building interiors*. The recommended internal design targets for residential buildings in rural areas is provided in Table 2.14.

Table 2.14 AS 2107: Internal noise and reverberation criteria (residential buildings)

Type of occupancy/activity	Recommended design sound level L_{eq} , dBA
Houses in rural areas with negligible transportation	
Sleeping areas	25–30

AS2107:2016 does not provide specific guidance for less sensitive spaces such as living areas for “houses in rural areas with negligible transportation”, however it would be reasonable that these noise targets are 5 dB lower. This should be confirmed following an inspection of each potentially impacted receiver building, which would help optimise the required level of treatment in each internal space of the dwellings.

The following overall noise reductions can generally be expected through the following scenarios:

- reduction of 5 to 10 dB with a building façade with an opened window or door that is not greater than 20 per cent of the overall wall area
- reduction of ≥ 20 dB is typically achievable through a closed and well-sealed building envelope of standard timber-framed construction with external and internal claddings.

A discussion of recommended operational noise mitigation is presented in Chapter 8.

3 Existing environment

The existing noise environment varies over the study area, which is split into the two distinct areas of:

- NSW/Victorian border to the future Dinawan substation
- the network augmentation between the existing Wagga 330 kV substation and the future Gugaa 500 kV substation, Livingstone Gully Road.

However, land uses within the study area are generally characterised as rural, primarily dominated by agricultural and rural residential land uses. The primary activities which dominate the existing noise levels include a combination of natural noises (such as birds and insects) and farming activities, including livestock and broad-acre crops.

The main arterial roads in the project footprint include Kidman Way, the Cobb Highway, Wanganella-Moulamein Road, Murrabit Road, and Gregadoo East Road. The concurrent construction of the EnergyConnect (NSW Eastern Section) project may contribute to the local noise environment at some locations.

3.1 Noise monitoring

3.1.1 *Unattended monitoring*

Weather conditions during the monitoring period were obtained from representative BoM weather stations for each region of the study area. The details of the weather stations used for the consideration of each unattended monitoring location is detailed in Table 3.1.

Unattended monitoring results are summarised in Table 3.2 with daily, detailed logger charts presented in Appendix A1.

Table 3.1 BoM weather stations

Noise monitoring ID ¹	Bureau of Meteorology station	
	Station ID	Station name
NM01	077094	Swan Hill Aerodrome
NM02		
NM03		
NM04	074258	Deniliquin Airport AWS
NM05	072150	Wagga Wagga
NM06		

(1) NM05 and NM06 have sourced from the Humelink Report

Periods of adverse weather have been processed in accordance with the procedures outlined in Fact Sheet D of the NPfI, which includes the removal of any periods of rainfall and periods where wind was recorded at levels greater than 5 m/s. Following the removal of this data, a general minimum of seven days of valid data was obtained for each site. The exception to this is NM02, where four days of valid data was collected due to a battery failure. However, it was determined that the data obtained was representative of the noise environment in its corresponding NCA for the purposes of this assessment.

Table 3.2 Unattended noise measurement results

ID	Rating background level, (RBL) dBA			Ambient noise level dB $L_{Aeq,15\text{ min}}$		
	Day ¹	Evening ¹	Night ¹	Day ¹	Evening ¹	Night ¹
NM01	29	35	33	51	48	49
NM02	27	25	<25	45	40	34
NM03	32	<25	<25	50	44	45
NM04	33	<25	<25	49	41	42
NM05 ²	31	29	26	46	43	38
NM06 ²	29	<25	<25	52	41	42

- (1) Time periods defined as – Day: 7 am to 6 pm Monday to Saturday, 8 am to 6 pm Sunday; Evening: 6 pm to 10 pm Monday to Sunday; Night: 10 pm to 7 am Monday to Saturday, 10 pm to 8 am Sunday
- (2) As presented in the HumeLink Report

3.1.2 Attended monitoring

To characterise the existing noise environment, short term (attended) noise measurements were undertaken co-located with the unattended noise monitoring outlined in section 3.1.1, and are summarised in Table 3.3. Weather conditions during monitoring were observed by site staff to be suitable for monitoring, with 2.5 to 3 m/s southerly winds and light cloud cover observed.

Background noise levels were generally observed to be low during the daytime period and dominated by rural and natural sounds, typical of a rural land use area. Low background noise levels of approximately 25 to 40 dBA were generally observed, which is consistent with the findings of the unattended noise monitoring program.

Table 3.3 Attended noise measurement results

ID	Date and time	Measured noise level dB			Comments
		$L_{A90,15\text{min}}$	$L_{Aeq,15\text{min}}$	$L_{Amax,15\text{min}}$	
NM01	12 February 2025 14:18 – 14:33	30.0	40.3	64.5	Rural noise environment: Insects, birdlife, wind, and occasional noise from nearby livestock infrastructure
NM02	13 September 2024 10:01 – 10:16	26.3	35.8	61.6	Rural noise environment: Livestock, birds, insects and wind
NM03	12 September 2024 16:55 – 17:10	44.7	52.4	64.4	Rural noise environment: Wind in nearby foliage, occasional road traffic noise on Swan Hill Road, birds and insects
NM04	12 September 2024 10:26 – 10:41	39.6	44.2	72.0	Rural noise environment: Livestock, occasional noise from nearby farm shed, birds, insects and wind
NM05 ¹	19 October 2020 14:55 – 15:10	33	43	62	Local traffic, birds, electricity substation, insects
NM06 ¹	3 May 2022 08:38 – 08:53	33	50	70	Ambient noise environment at this location is influenced by road traffic noise and wildlife noise

- (1) As presented in the HumeLink Report

4 Legislative and policy context

Environmental planning approval for the project is required in accordance with the EP&A Act. The project is also a controlled action and therefore requires Commonwealth assessment and approval under the EPBC Act.

This section describes the Commonwealth and State legislation and policy relevant to the assessment of noise and vibration impacts.

4.1 Policy, standards and guidelines

The acceptability of noise and vibration impacts in NSW is governed by the Protection of the Environment Operations (Noise Control) Regulation 2017 under the Protection of the Environment Operations Act. These documents set the framework to define noise amenity.

A summary of the relevant legislation and policy that apply to this project is provided in Table 4.1. A full description of how these policies and assessment guidelines have been applied to the assessment of project noise and vibration impacts is included in section 4.2.

Table 4.1 Relevant legislation and policy

Acoustic aspect	Description	Relevant assessment guidelines
Airborne noise	Construction noise	— Interim Construction Noise Guideline (ICNG) (DECCW, 2009)
	Construction traffic noise	— NSW Road Noise Policy (RNP) (DECCW, 2011)
	Sleep disturbance from construction noise	— Interim Construction Noise Guideline (DECCW, 2009) — NSW Road Noise Policy (DECCW, 2011)
	Operational industrial noise	— Noise Policy for Industry (NPfI) (NSW EPA 2017)
	Sleep disturbance from operational noise	— NPfI
	Existing ambient, background and industrial noise levels	— NPfI — <i>Australian Standard AS 1055: Description and measurement of environmental noise (2018)</i>
Vibration	Human comfort	— Assessing Vibration: A Technical Guideline (AVTG) (DEC, 2006)
	Construction vibration effect on structures (structural or cosmetic damage)	— <i>German Standard DIN 4150-3:2016-2 Structural Vibration – effects of vibration on structures (2016)</i> — <i>British Standard BS 7385-2:1993 – Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration (1993)</i>
Management	Mitigation and management of construction noise and vibration issues	— ICNG (DECCW, 2009) — NPfI (EPA, 2017)
Cumulative impacts	Project-level cumulative impacts related to State significant projects	Cumulative Impact Assessment Guidelines for State Significant Projects (DPE, 2022)

4.2 Noise and vibration criteria

Construction and operational noise and vibration criteria have been established after review of relevant noise and vibration legislation, policy and guidance and have been developed with reference to the results of monitoring outlined in section 3.1.

4.2.1 Construction criteria

4.2.1.1 Interim construction noise guideline

The ICNG is used to assess and manage potential impacts from construction noise on residents and ‘other’ sensitive land uses. The ICNG uses Noise Management Levels (NMLs) to determine the noise level at which the project is expected to impact noise sensitive receivers and require the implementation of reasonable and feasible noise management and mitigation to minimise these impacts. These management levels are presented in section 4.2.1.2.

Table 4.2 defines how the NMLs are applied for residential receivers, based on existing Rating Background Levels (RBL) of noise in the study area. Residential receivers are deemed likely to be affected by noise where predicted construction noise levels exceed the NML. The ICNG outlines that if the predicted noise levels exceed 75 dBA at a residential receiver, the receiver is deemed to be ‘highly noise affected’ and require additional targeted mitigation measures to minimise potential noise impacts during construction.

Table 4.2 Construction noise management levels for residential receivers and working hours (Source: Table 2 of the NSW ICNG)

Working hours	NML dBA $L_{eq(15\text{ min})}^{1,2}$	How NML are applied
Recommended standard hours (SH) ³ : — Monday – Friday: 7 am – 6 pm — Saturday: 8 am – 1 pm — No work on Sundays or public holidays	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured dBA $L_{eq(15\text{ min})}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: — 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.

Working hours	NML dBA $L_{eq(15\ min)}^{1,2}$	How NML are applied
Periods outside recommended standard hours of work (OOHW)	Noise affected RBL + 5 dB	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dB above the noise affected level, the proponent of any development works project should negotiate with the community.

- (1) Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 metres above ground level. If the property boundary is more than 30 metres from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 metres of the residence.
- (2) The RBL is the overall background noise level representing each assessment period (day/evening/night) over the whole monitoring period. The term RBL is described in detail in the NSW NPfI.
- (3) Recommended standard hours for normal construction work, excluding blasting, as per ICNG Table 1.

Source: ICNG

4.2.1.2 Construction noise management levels

As discussed in section 4.2.1.1, construction NMLs are derived using RBLs in accordance with the ICNG.

Table 4.3 provides a summary of the applicable NMLs based on the background noise monitoring (refer section 3.1).

Table 4.3 Construction NMLs for residential receivers

NCA	Description	RBLs dBA			NMLs, $L_{eq(15\ min)}$ dBA ¹			
		Day	Evening	Night	Day (SH)	Day (OOHW)	Evening (OOHW)	Night (OOHW)
1	Cobramunga	35 ²	30 ^{2,3}	30 ^{2,3}	45	35	35	35
2	Wetuppa	35 ²	30 ²	30 ²	45	35	35	35
3	Moulamein	35 ²	30 ²	30 ²	45	35	35	35
4	Highly rural areas	35 ²	30 ²	30 ²	45	35	35	35
5	Wagga Wagga	35 ²	30 ²	30 ²	45	35	35	35
6	Gregadoo	35 ²	30 ²	30 ²	45	35	35	35

- (1) SH = recommended standard working hours, OOHW = outside of recommended standard hours work as defined in section 4.2.1.1.
- (2) Section 2.3 of the NPfI states that minimum RBLs should be applied to the noise monitoring results. As such, where background levels (section 3.1) are below 35 dBA during the day period, and 30 dBA during the evening and night periods, levels have been set to these minimum intrusiveness levels.
- (3) In accordance with the NPfI, it is recommended that evening criteria is set no higher than the day criteria and the night criteria should not be set any higher than the evening criteria. This reflects community expectations that night-time noise goals are more conservative than daytime.

Table 4.4 lists the NMLs that have been adopted for non-residential sensitive receivers, such as commercial, industrial or education land uses. The NMLs apply when the premises are in use during any assessment period. Five non-residential sensitive receivers, including an industrial building and four passive recreational areas, were identified within the study area.

Table 4.4 Construction NML for non-residential receivers

Land use	NMLs ($L_{eq(15\text{ min})}$ dBA)
Passive recreation areas	External noise level – 60
Industrial premises	External noise level – 75

4.2.1.3 Sleep disturbance

The ICNG provides for some types of work to be undertaken outside of recommended standard hours. These include:

- the delivery of oversized plant or structures that police or other authorities determine require special arrangements to transport along public roads
- emergency work to avoid the loss of life or damage to property, or to prevent environmental harm
- maintenance and repair of public infrastructure where disruption to essential services and/or considerations of worker safety do not allow work within standard hours
- public infrastructure works that shorten the length of the project and are supported by the affected community
- works where a proponent demonstrates and justifies a need to operate outside the recommended standard hours.

Where work outside of standard hours is required, the potential for impacts to sensitive receivers from transient maximum noise level events and sleep disturbance impacts due to construction activities during the night-time period is detailed in the NPfI. Maximum noise impacts may cause awakening events, while maintained elevated levels of noise may reduce the quality of sleep. As such, the sleep disturbance criteria for construction noise are presented in two forms and are presented as:

- $L_{eq(15\text{ min})}$ 40 dBA or the rating background level plus 5 dB, whichever is the greater, and/or
- L_{Fmax} 52 dBA or the rating background level plus 15 dB, whichever is the greater.

Based on the measurements detailed in section 3.1, external maximum noise level event criteria are presented in Table 4.5.

Table 4.5 Sleep disturbance criteria (residential receivers only)

Location	Night-time RBL dBA	$L_{Aeq(15\text{ min})}$ criteria dB	L_{AFmax} criteria dB
All NCAs	30	40	52

4.2.1.4 Construction road traffic noise criteria

Potential impacts from construction traffic noise associated with the project has been assessed using guidance from the RNP. The assessment compares the predicted construction traffic volumes from the project against existing traffic volumes on the road network to determine potential changes in noise levels. The assessment only considers construction traffic volumes on the road network. Construction traffic movements within the project footprint were assessed as part of the overall construction noise assessment conducted in accordance with the ICNG.

The RNP makes a distinction between the assessment of road traffic noise from freeway/arterial/sub-arterial roads and local roads. Freeway/arterial/sub-arterial roads are assessed over day (7 am to 10 pm) and night (10 pm to 7 am) periods, while local roads are assessed during the maximum 1 hour time period.

Table 4.6 presents a summary of applicable road traffic criteria for residential receivers.

The application notes from the RNP detail the requirements for operation-generated traffic noise as follows:

For existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level as a result of the development should be limited to 2 dB above that of the noise level without the development. This limit applies where the noise level without the development is within 2 dB of, or exceeds, the relevant day or night noise assessment criterion.

Therefore, if the road traffic noise levels increase by more than 2 dBA as a result of the proposed construction traffic, and the criteria outlined in Table 4.6 are exceeded, mitigation options should be investigated.

Table 4.6 Road traffic noise criteria for receivers on existing roads affected by the additional traffic from land use developments

Road type	External road traffic noise criteria ¹	
	Day 7 am – 10 pm	Night 10 pm – 7 am
Freeway/arterial/sub-arterial roads	60 dBA $L_{Aeq(15hr)}$ and increase >2 dB	55 dBA $L_{Aeq(9hr)}$ and increase >2 dB
Local roads	55 dBA $L_{Aeq(1hr)}$ and increase >2 dB	50 dBA $L_{Aeq(1hr)}$ and increase >2 dB

(1) Façade corrected noise levels.

4.2.1.5 Construction aircraft noise criteria

Noise emissions from aircraft operations in Australia are governed by the Air Navigation (Aircraft Noise) Regulations 2018, established under the Air Navigation Act 1920. These regulations cover noise emissions from various aircraft, including helicopters and remotely piloted aircraft (RPAs, commonly known as drones), used to deliver materials and equipment and to transfer personnel to the project footprint during construction.

The regulations mandate that a noise certificate be issued for aircraft or RPAs that meet the relevant standards. This certificate certifies that the aircraft meets the required noise emission standards. However, aircraft operations for construction activities are not regulated under the Protection of the Environment Operations Act 1997 (POEO Act) in NSW.

In Australia, aircraft noise is typically assessed against the Building Site Acceptability criteria set out in Australian Standard 2021:2015 Acoustics – Aircraft noise intrusion - Building siting and construction (AS 2021). This standard uses the Australian Noise Exposure Forecast (ANEF) system for land use planning around airports. However, the ANEF system is not intended to present information about potential impacts from aircraft noise, such as those from construction operations involving helicopters and drones, that may be experienced within the community.

A previous aircraft noise assessment for the use of helicopters and drones during construction was undertaken as part of the HumeLink project. This assessment evaluated the number of receivers impacted by aircraft noise levels exceeding 75 dBA and 85 dBA L_{max} . The 75 dBA and 85 dBA L_{max} criteria are used in AS 2021 as unacceptable maximum sound level targets for building site acceptability for residential houses, schools, and hospitals, based on the number of flights per day at light (non-jet) aviation aerodromes.

The ICNG does not provide guidance for assessing aircraft noise emissions as part of construction, and as such, the approach implemented in the HumeLink project has been used for this project. Furthermore, the results of the construction aircraft noise assessment has been presented separately from the construction noise assessment as they are assessed against different criteria and have differing modelling methodologies.

4.2.1.6 Construction vibration criteria

Construction vibration can lead to:

- cosmetic building damage (and structural damage in extreme cases)
- loss of amenity due to perceptible vibration, termed human comfort
- impacts on the condition and structural integrity of buildings or infrastructure.

Importantly, cosmetic damage is regarded as minor in nature; it is readily repairable and does not affect a building's structural integrity. It is described as hairline cracks on drywall surfaces, hairline cracks in mortar joints and cement render, enlargement of existing cracks, and separation of partitions or intermediate walls from load bearing walls. If there is no significant risk of cosmetic building damage, then structural damage is not considered a significant risk and is not assessed.

Cosmetic damage

Australian Standard AS2187.2-2006 Explosives – Storage, Transport and Use provides guidance for the assessment of cosmetic damage to buildings caused by vibration. This section of the standard is based on the *British Standard BS 7385-2:1993 – Evaluation and measurement for vibration in buildings* and is used as a guide to assess the likelihood of building damage from ground vibration including piling, compaction, construction equipment and road and rail traffic.

Table 4.7 presents the guideline limits for cosmetic damage for short term vibration.

Table 4.7 Transient vibration guide values for cosmetic damage (BS 7385)

Type of building	Peak component particle velocity in frequency range of predominant pulse	
	4 – 15 Hz	15 Hz and above
Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
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

Note: values referred to are at the base of the building

Human comfort

Potential human comfort impacts from vibration are considered using a vibration dose value (VDVs) above which it is considered there is a risk that the amenity and comfort of people occupying buildings would be affected by vibration from construction works. These limits are taken from AVTG.

The AVTG also specifies limits for continuous and impulsive vibration. The vibration limits are expressed in root-mean-square (RMS) acceleration (m/s^2) and peak particle velocity (mm/s) in Appendix C of AVTG.

Table 4.8 presents the limits (vibration dose values, VDVs).

Table 4.8 Vibration limits (human exposure) for intermittent vibration

Location	VDV day (7 am – 10 pm)		VDV night (10 pm – 7 am)	
	Preferred	Maximum	Preferred	Maximum
Residences	0.20	0.40	0.13	0.26

The vibration guideline also specifies limits for continuous and impulsive vibration. The vibration limits are presented in Table 2-2 and Appendix C of AVTG and are reproduced in Table 4.9 for relevant receiver types.

Table 4.9 Preferred and maximum values for continuous and impulsive vibration

Location	Assessment period	RMS acceleration (m/s ²)				Peak particle velocity (mm/s)	
		Preferred values		Maximum values		Pref. values	Max. values
		z-axis	x and y axes	z-axis	x and y axes		
Continuous vibration							
Residences	Day 7 am – 10 pm	0.010	0.0071	0.020	0.014	0.28	0.56
	Night 10 pm – 7 am	0.007	0.005	0.014	0.010	0.20	0.40
Impulsive vibration							
Residences	Day 7 am – 10 pm	0.3	0.21	0.60	0.42	8.6	17.0
	Night 10 pm – 7 am	0.10	0.071	0.20	0.14	2.8	5.6

4.2.2 Operational noise criteria

Assessment of on-site operational noise sources is guided by NPfI, which is applicable to all industrial noise sources from activities such as the project.

The assessment procedure for industrial noise sources outlines two components:

- controlling intrusive noise impacts in the short-term for residences
- maintaining noise level amenity for particular land uses for residences and other land uses.

In assessing the noise impact of industrial sources, both components must be taken into account for residential receivers. As the project is expected to operate 24 hours a day, the night-time criteria are likely to be the controlling time criteria and have been used as the basis of the assessment.

4.2.2.1 Project intrusiveness noise level

The project intrusiveness noise level for residential receivers prescribed in the NSW NPfI is summarised as:

$$L_{eq} (15 \text{ minute}) \leq \text{Rating Background Level } (L_{90}) + 5 \text{ dBA}$$

The project intrusiveness noise levels have been established for the project based on the RBLs as outlined in section 3.1 in accordance with the NSW NPfI and are presented in Table 4.10.

Table 4.10 Established project intrusiveness noise level (dB $L_{Aeq} 15 \text{ min}$)

NCA	Time period ¹	RBL dBA	Project intrusiveness noise level (RBL + 5 dB)
All NCAs	Day	35 ²	40
	Evening	30 ²	35
	Night	30 ²	35

- (1) Day: the period from 7 am to 6 pm Monday to Saturday; or 8 am to 6 pm on Sundays and public holidays; evening: the period from 6 pm to 10 pm; night: the remaining periods.
- (2) In accordance with NPfI, where the measured rating background level is less than 30 dBA for the evening and night periods, it is set to 30 dBA. When it is found to be less than 35 dBA for the day period, it is set to 35 dBA.

4.2.2.2 Project amenity noise levels

To limit continuing increases in ambient noise levels (i.e. background noise level creep), the maximum amenity noise level within an area from industrial noise sources should not normally exceed the amenity noise levels prescribed in the NSW NPfI.

The recommended amenity noise levels represent the objective for total industrial noise from all sources at a receiver location, whereas the project amenity noise level represents the objective for noise from a single industrial development at a receiver location, defined as the recommended noise levels listed below (Table 2.2 of NPI) minus 5 dBA.

The amenity criteria have been established at the identified receivers based on their typical designation of 'rural residential' land use at receivers. The established amenity criteria applicable to the project are presented in Table 4.11.

Table 4.11 Established project amenity noise level

Type of receiver	Recommended amenity noise level (ANL) dBA $L_{eq, period}^3$	Project adjusted ANL dBA $L_{eq, period}^{1,2,3}$		
		Day	Evening	Night
Residential – rural	Day: 50 Evening: 45 Night: 40	45	40	35
Passive recreation	When in use: 50	45		
Industrial premises	When in use: 70	65		

- (1) A -5 dB factor is applied to project amenity noise levels to ensure that industrial noise levels at noise sensitive receivers (existing plus new) remain within the recommended amenity noise levels within the NPfI
- (2) Amenity levels for non-residential receivers only apply when the premises are in use
- (3) Day: the period from 7 am to 6 pm Monday to Saturday; or 8 am to 6 pm on Sundays and public holidays; evening: the period from 6 pm to 10 pm; night: the remaining periods.

4.2.2.3 Project noise trigger levels

In assessing the operational noise impact of the project on surrounding residential receivers, both the intrusiveness and amenity criterion must be considered. In most cases, only one criterion will become the limiting criterion and form the project noise trigger levels (PNTL) for the industrial source under assessment.

To standardise the time periods for the intrusiveness and amenity noise levels, the following conversion between $L_{eq(15 min)}$ (amenity) and $L_{Aeq 15 min}$ (intrusiveness) have been applied (as per Section 2.2 of the NSW NPfI):

$$L_{Aeq(15 min)} = L_{Aeq(period)} + 3 \text{ dB}$$

In accordance with Section 2.2 of the NSW NPfI, all project noise trigger levels and limits are expressed as $L_{eq(15 min)}$, unless otherwise expressed. A summary of all relevant criteria is presented in Table 4.12. Identified non-residential receivers within the project area include passive recreational areas and industrial facilities only.

Table 4.12 Summary of project noise trigger levels (PNTL)

Receiver location	Assessment/ receiver type	Project noise trigger levels dBA $L_{eq}(15 \text{ min})$		
		Day ¹	Evening ¹	Night ¹
Residential receivers – All NCAs	Intrusiveness ²	40	35	35
	Amenity ³	48	43	38
	PNTL – Residential	40	35	35
Passive recreation	Amenity	48 ⁴		
Industrial premises	Amenity	68 ⁴		

- (1) Day: the period from 7:00 am to 6.00 pm Monday to Saturday; or 8.00 am to 6.00 pm on Sundays and public holidays; evening: the period from 6.00 pm to 10.00 pm; night: the remaining periods.
- (2) $L_{eq, 15\text{min}} = L_{eq, \text{period}} + 3 \text{ dB}$
- (3) Existing background noise levels measured as discussed in section 3.1
- (4) When in use

4.2.2.4 Modifying factors for annoying characteristics

Certain noise characteristics have a higher potential to cause annoyance, generally requiring additional considerations. Tonality, low frequency emphasis and intermittency are generally considered to be attention-drawing and can cause greater disturbance. On the other hand, short-term single noise events are likely to be less disturbing and may warrant some relaxation in the applicable noise criteria.

Table C1 from the NPfI prescribes the appropriate corrections required for annoying characteristics of noise, and the relevant entries of which has been reproduced and summarised in Table 4.13.

Table 4.13 Summary of relevant corrections for annoying characteristics

Factor	Assessment/measurement	When to apply	Correction ¹
Tonal noise	One-third octave band analysis using the objective method for assessing the audibility of tones in noise – simplified method (ISO1996.2-2007 – Annex D).	Level of one-third octave band exceeds the level of the adjacent bands on both sides by: — 5 dB or more if the centre frequency of the band containing the tone is in the range 500–10,000 Hz — 8 dB or more if the centre frequency of the band containing the tone is in the range 160–400 Hz — 15 dB or more if the centre frequency of the band containing the tone is in the range 25–125 Hz.	5 dB ²

- (1) Corrections to be added to the measured or predicted levels, except in the case of duration where the adjustment is to be made to the criterion.
- (2) Where a source emits tonal and low-frequency noise, only one 5 dB correction should be applied if the tone is in the low-frequency range, that is, at or below 160 Hz.

4.2.2.5 Maximum noise level assessment and sleep disturbance

The potential for operational noise impacts resulting from transient maximum noise level events and sleep disturbance during the night-time period is detailed in the NPfI. Maximum noise impacts may cause awakening events, while maintained elevated levels of noise may reduce the quality of sleep. As such, the sleep disturbance criteria for construction noise are presented in two forms and are presented as:

- $L_{eq(15min)}$ 40 dBA or the rating background level plus 5 dB, whichever is the greater, and/or
- L_{Fmax} 52 dBA or the rating background level plus 15 dB, whichever is the greater.

Where maximum noise levels at a residential location exceed the criteria, a detailed maximum noise level event assessment should be undertaken. Based on the measurements detailed in section 3.1, external maximum noise level event criteria are presented in Table 4.14.

Table 4.14 Sleep disturbance criteria

Location	Night-time RBL dBA	$L_{eq(15min)}$ criteria dBA (Sleep disturbance)	L_{Fmax} criteria dBA (Awakening)
All residential receivers	30	40	52

Where exceedances are predicted, additional assessment may be required. The NPfI refers to the RNP for further guidance on sleep disturbance impacts, which states that maximum internal noise levels below 50–55 dBA are unlikely to awaken people from sleep, and 1–2 noise events per night, with maximum internal noise levels of 65–70 dBA not likely to affect health and wellbeing.

5 Construction assessment

This chapter presents the assessment of construction noise, construction vibration and construction traffic noise associated with the project.

This chapter has considered the impacts of construction activities within the identified areas associated with the project. This includes the transmission line, access tracks, substations, telecommunication facilities (optical repeater sites), combined temporary worker accommodation facilities and construction compounds, and standalone construction compound/laydown areas.

5.1 Construction noise assessment

The following sections present a summary and discussion of the results of the construction noise assessment for each construction activity. Detailed results are presented in relevant appendices as follows:

- Appendix B3: Full results tables of predicted construction noise level exceedances for all assessed receivers for all scenarios.
- Appendix B4: Mapping of predicted noise levels for the worst-case construction scenario under each key work stage in the form of noise contours.

As discussed in section 2.4.4, construction activities would typically be carried out during standard hours and the temporary worker accommodation facilities would operate 24 hours a day, seven days a week. However, some construction works may also be required to be undertaken outside of the standard hours. As such the assessment has considered potential standard and OOHW noise impacts, and specific working hours are outlined in Table 2.4.

5.1.1 Transmission lines

5.1.1.1 Transmission line works impacting on residential receivers

Construction of transmission lines would occur progressively along the transmission line alignment with transmission line structures typically spaced between around 300 and 600 metres apart. The construction scenarios are relatively short in duration for each transmission line structure and the impacts for noise sensitive receivers would vary as construction moves along the transmission line alignment.

Given the linear nature of the construction works for the project transmission lines, noise levels have been calculated assuming all construction activities within each work stage occur simultaneously, anywhere within the project footprint. Actual construction noise levels are expected to vary based on the final transmission line structure location design along the defined alignment and the actual setback distances of receivers from these areas. Therefore, construction noise predictions have been presented as a worst case, conservative scenario to represent the potential construction noise impact.

Detailed results of the construction noise assessment associated with the transmission lines works are presented in Appendix B3.1, and a summary of total exceedances is presented in Table 5.1 and Table 5.2.

The assessment shows that construction noise levels are predicted to be the highest during the site establishment and vegetation clearance works. This work stage may occur for one to four weeks per structure over 12 months, with any resulting noise impacts likely being shorter in duration as the construction works progress through the alignment.

Noise levels at standard hours during this stage have been predicted to exceed NMLs at up to:

- five residential receivers located along the transmission alignment from the NSW/Victorian border to Dinawan substation (NCAs 1–4)
- 21 residential receivers located along the network augmentation works (NCAs 5–6).

Table 5.1 Summary of total exceedances for transmission lines work stages – standard hours

Project element	Estimated duration	Number of receivers			
		Highly noise affected (>75 dBA)	With NML exceedance		
			0–10 dBA	10–20 dBA	>20 dBA
Site establishment, early works, and set out works	1–4 weeks per structure over 12 months	0	17	8	1
Earth working, footing construction, or dismantling of transmission line structures	1 week per structure over 12 months	0	13	3	0
Assembly and erection of transmission line structures	2 weeks per structure over 13 months	0	13	3	0
Stringing of the conductors, OHEW, and OPGW ¹	3 weeks per structure over 14 months	0	7	2	0
Brake & winch sites	3 weeks per structure over 14 months	0	0	0	0
Commissioning	1 week per structure 6 months	0	2	0	0
Demobilisation	1 week per structure over 4 months	0	13	3	0

(1) Does not include potential noise impacts from aircraft (refer section 5.1.8)

Table 5.2 Summary of total exceedances for transmission lines work stages – OOH

Project element	Number of receivers with NML exceedance			
	0–5 dBA	5–15 dBA	15–25 dBA	>25 dBA
Site establishment, early works, and set out works ¹	0	0	0	0
Earth working, footing construction, or dismantling of transmission line structures ²	15	26	7	2
Assembly and erection of transmission line structures	15	26	7	2
Stringing of the conductors, OHEW, and OPGW ^{3, 4}	14	18	3	0
Brake & winch sites ³	1	0	0	0
Commissioning	2	9	0	0
Demobilisation ¹	0	0	0	0

(1) Not occurring outside of standard hours

(2) Not occurring during evening and night OOH

(3) Not occurring during night OOH

(4) Does not include potential noise impacts from aircraft (refer section 5.1.8)

A majority of these exceedances are considered minor (17 of these exceedances are <10 dB above NMLs). None of these receivers is predicted to be highly noise affected (>75 dBA) during all work stages. Most exceedances are predicted to occur in NCA 6, which represents isolated rural properties located along the network augmentation works. Any potential noise impacts generated through the use of aircraft has been assessed and presented in section 5.1.8.

OOHW will be required for specific activities, although is unlikely to be required for all transmission line structures. However, the noise assessment considered OOH all along the transmission line alignment. If OOH is required, impacts are generally higher due to the lower background noise levels during the evening and nighttime periods. The loudest work stage expected to occur OOH is the assembly and erection of transmission line structures work stage, which may occur at all OOH periods. Where this work stage is undertaken outside of standard hours (including the daytime periods of Saturday afternoons and Sundays), exceedances may occur at up to:

- 14 residential receivers located along the transmission alignment from NSW/Victorian border to Dinawan substation
- 36 residential receivers located along the network augmentation works.

Two of these receivers may exceed OOH NMLs by more than 25 dBA, however the impact would only occur where OOH is carried out within 180 metres of sensitive receivers.

It is noted that activity outside of standard hours during this work stage is expected to involve the delivery of equipment or materials as requested by police or other authorities for safety reasons (such as the delivery of transformer units). Thus any potential OOH noise impacts are expected to be infrequent and not to occur throughout the entire work stage period.

Where night-time OOH is necessary, sleep disturbance impacts are predicted to be highest during the assembly and erection of transmission line structures work stage where exceedances are predicted at up to 50 receivers. Nine of these receivers, all located in NCA 6, may also experience sleep awakening impacts during this work stage. The assembly and erection of transmission line structures work stage may occur for 2 weeks per structure over 13 months with any resulting noise impacts likely being shorter in duration as the construction works progress through the alignment.

It is also noted that exceedances during all periods standard hours would not occur simultaneously at all residential receivers.

No exceedances of NMLs have been predicted for non-residential receivers. Mitigation and management measures to minimise the predicted impacts are considered in Chapter 8.

5.1.2 Substations

5.1.2.1 Future Dinawan 500 kV substation expansion work

Due to the large separation distance between the project footprint and the nearest noise sensitive receiver (approximately 7.1 kilometres) no construction noise impacts from the works at the future Dinawan 500 kV substation are predicted to occur at residences during standard working hours and out of hours. A summary of total exceedances is presented in Table 5.3 and Table 5.4.

No residential receivers are predicted to be affected with potential sleep disturbance and sleep awakening impacts. As such no mitigation measure is required for the future Dinawan 500 kV substation expansion construction work activities. No exceedances of NMLs have been predicted for all non-residential receivers.

Table 5.3 Summary of total exceedances for Future Dinawan 500 kV substation expansion work stages – standard hours

Project element	Number of receivers			
	Highly noise affected (>75 dBA)	With NML exceedance		
		0–10 dBA	10–20 dBA	>20 dBA
All construction stages	0	0	0	0

Table 5.4 Summary of total exceedances for Future Dinawan 500 kV substation expansion work stages – OOH

Project element	Number of receivers with NML exceedance			
	0–5 dBA	5–15 dBA	15–25 dBA	>25 dBA
All construction stages	0	0	0	0

5.1.2.2 Existing Wagga 330 kV substation

The construction works expected at the existing Wagga 330 kV substation include any disconnection and connection of transmission line conductors within the switchyard.

The predicted number of residential receivers with exceedances of the NMLs due to construction activities during each work stage at the existing Wagga 330 kV substation are summarised in Table 5.5 and Table 5.6, and a summary of total exceedances is presented in Appendix B3.2. The assessment shows that construction noise levels are predicted to be the highest during the electrical construction works stage, which may occur for up to approximately 7 months. Noise levels during this stage have been predicted to exceed NMLs at up to two residential receivers in NCA 5 during standard working hours. One of these exceedances is approximately 15 dB above NMLs, whilst the other considered minor (<10 dB above NMLs).

No out of hours work is currently expected at the existing Wagga 330 kV substation. Therefore, noise impacts outside of standard hours (including any sleep impacts) will not occur.

No exceedances of NMLs have been predicted at all non-residential receivers.

Mitigation and management measures to minimise the predicted impacts are considered in Chapter 8.

Table 5.5 Summary of total exceedances for existing Wagga 330 kV substation – standard hours

Project element	Estimated duration	Number of receivers			
		Highly noise affected (>75 dBA)	With NML exceedance		
			0–10 dBA	10–20 dBA	>20 dBA
Electrical construction works	7 months	0	1	1	0
Commissioning	1 month	0	1	0	0

Table 5.6 Summary of total exceedances for existing Wagga 330 kV substation – OOH

Project element	Number of receivers with NML exceedance			
	0–5 dBA	5–15 dBA	15–25 dBA	>25 dBA
Electrical construction works ¹	0	0	0	0
Commissioning ¹	0	0	0	0

(1) Not occurring outside of standard hours

5.1.2.3 Future Gugaa 500 kV substation, Livingstone Gully Road

The construction works expected at the future Gugaa 500 kV substation, Livingstone Gully Road include any disconnection and connection of transmission line conductors within the switchyard.

The predicted number of residential receivers with exceedances of the NMLs due to construction activities during each work stage at the future Gugaa 500 kV substation, Livingstone Gully Road are summarised in Table 5.7 and Table 5.8, and a summary of total exceedances is presented in Appendix B3.4.

The assessment shows that construction noise levels are predicted to be the highest during the electrical construction works stage, which may occur for up to 7 months. Noise levels during this stage have been predicted to exceed NMLs at one residential receiver in NCA 6 during standard working hours. This exceedance is considered minor, being <10 dB above NMLs.

No out of hours work is currently expected at the future Gugaa 500 kV substation, Livingstone Gully Road. Therefore, noise impacts outside of standard hours (including any sleep impacts) will be nil.

No exceedances of NMLs have been predicted at all non-residential receivers.

Mitigation and management measures to minimise the predicted impacts are considered in Chapter 8.

Table 5.7 Summary of total exceedances for the future Gugaa 500 kV substation, Livingstone Gully Road – standard hours

Project element	Estimated duration	Number of receivers			
		Highly noise affected (>75 dBA)	With NML exceedance		
			0–10 dBA	10–20 dBA	>20 dBA
Electrical construction works	7 months	0	1	0	0
Commissioning	1 month	0	0	0	0

Table 5.8 Summary of total exceedances for future Gugaa 500 kV substation, Livingstone Gully Road – OOH

Project element	Number of receivers with NML exceedance			
	0–5 dBA	5–15 dBA	15–25 dBA	>25 dBA
Electrical construction works ¹	0	0	0	0
Commissioning ¹	0	0	0	0

(1) Not occurring outside of standard hours

5.1.3 Access tracks

Detailed results of the construction noise assessment associated with the access track works are presented in Appendix B3.5, and a summary of total exceedances is presented in Table 5.9 and Table 5.10. Access tracks are located within the project footprint, as shown in Figure 1.2.

The assessment shows that construction noise levels are predicted to be the highest during the earthworks and upgrade work stages, which may occur for 3 weeks per access track over 12 months. During standard hours, noise levels have been predicted to exceed NMLs at up to:

- 11 residential receivers located along the transmission alignment from NSW/Victoria border to Dinawan substation (NCAs 1–4)
- 34 residential receivers located along the network augmentation works (NCAs 5–6).

A majority of these exceedances (33) are considered minor (<10 dB above NMLs).

It is noted that the earthworks and upgrade work stage will only occur outside of standard hours where a road occupancy licence (or similar) is required. It is anticipated that the works are likely to only occur for up to 2–3 nights if required. If this work is undertaken outside of standard hours, exceedances may occur at up to:

- 31 residential receivers located along the transmission alignment from NSW/Victorian border to Dinawan substation
- 104 residential receivers located along the network augmentation works.

No residential receivers are predicted to be highly affected during all construction stages.

Where OOH is necessary, sleep disturbance impacts during this construction work stage are predicted at up to 65 receivers and potential sleep awakening impacts at up to 18 receivers.

Along the network augmentation works section, the majority (sleep disturbance – 34 and sleep awakening – 13) of the receivers are located in NCA 6. Along the transmission alignment from NSW/Victoria border to Dinawan substation section, the majority (sleep disturbance – 12 and sleep awakening – 2) of the receivers are located in NCA 2.

It is expected that the project will re-use some access tracks established for HumeLink in NCAs 5 and 6, and as such construction activities such as vegetation clearance and earthworks may not be required in these areas. Therefore, any impacts presented in these NCAs depicts a conservative assessment. Where required, the construction of access tracks may occur for 3 weeks per access track over 12 months, with any resulting noise impacts likely being shorter in duration as the construction works progress through the alignment.

Whilst construction traffic volumes for individual access tracks is not available at this stage of assessment, noise generated by construction vehicles using the newly constructed access tracks is likely to be considerably less than the other construction work stages for access tracks. Furthermore, the majority of construction traffic is likely to occur at the start and end of the standard working day, and be overall short-term. Further assessment of construction traffic noise on access tracks should be considered in the CNVMP when detailed construction traffic volumes on these tracks is known.

No exceedances of NMLs have been predicted at all non-residential receivers.

Mitigation and management measures to minimise the predicted impacts are considered in Chapter 8.

Table 5.9 Summary of total exceedances for access tracks work stages – standard hours

Project element	Estimated duration	Number of receivers			
		Highly noise affected (>75 dBA)	With NML exceedance		
			0–10 dBA	10–20 dBA	>20 dBA
Vegetation clearance	1 week per access track over 12 months	0	21	7	1
Earthworks and upgrades	3 weeks per access track over 12 months	0	33	11	1

Table 5.10 Summary of total exceedances for access tracks work stages – OOH

Project element	Number of receivers with NML exceedance			
	0–5 dBA	5–15 dBA	15–25 dBA	>25 dBA
Vegetation clearance ¹	0	0	0	0
Earthworks and upgrades	65	50	16	4

(1) Not occurring outside of standard hours

5.1.4 Telecommunication facilities (optical repeater sites)

A summary of total exceedances is presented in Table 5.11 and Table 5.12.

Construction noise impacts from construction of the telecommunication facilities (optical repeater sites) along the alignment of the 500 kV transmission line at Moulamein and north of Wanganella are generally expected to be minor with no exceedances predicted during standard working hours. No residential receivers are predicted to be highly noise affected.

No out of hours work is currently expected for the telecommunication facilities (optical repeater sites). Therefore, noise impacts outside of standard hours (including any sleep impacts) will be nil.

No exceedances of NMLs have been predicted at non-residential receivers.

No mitigation and management measures are required during construction works at the telecommunication facilities (optical repeater sites).

Table 5.11 Summary of total exceedances for telecommunications facilities (optical repeater sites) work stages – standard hours

Project element	Number of receivers			
	Highly noise affected (>75 dBA)	With NML exceedance		
		0–10 dBA	10–20 dBA	>20 dBA
All construction stages	0	0	0	0

Table 5.12 Summary of total exceedances for telecommunications facilities (optical repeater sites) work stages – OOH

Project element	Number of receivers with NML exceedance			
	0–5 dBA	5–15 dBA	15–25 dBA	>25 dBA
All construction stages ¹	0	0	0	0

(1) Not occurring outside of standard hours

5.1.5 Combined temporary worker accommodation facility and construction compounds

A construction noise assessment was conducted for the new combined temporary worker accommodation facility and construction compounds proposed for the project (including where options are identified). Detailed results of these assessments are presented in from Appendix B3.7 to B3.13 and a summary of total exceedances for the combined temporary worker accommodation facility and construction compounds are presented in Table 5.13 and Table 5.14.

Table 5.13 Summary of total exceedances for combined temporary worker accommodation facility and construction compounds – standard hours

Project element	Estimated duration	Number of receivers			
		Highly noise affected (>75 dBA)	With NML exceedance		
			0–10 dBA	10–20 dBA	>20 dBA
Balranald Road, Moulamein					
All construction stages	—	0	0	0	0
Cobb Highway, Wanganella (north)					
All construction stages	—	0	0	0	0
Cobb Highway, Wanganella (south)					
All construction stages	—	0	0	0	0
Dinawan substation, Coleambally					
All construction stages	—	0	0	0	0
Gregadoo Road A (option 2)					
Site establishment and vegetation clearance	3–4 weeks	0	2	0	0
Construction	2 months	0	5	0	0
Operation	20 months	0	1	0	0
Gregadoo Road B (option 3)					
Site establishment and vegetation clearance	3–4 weeks	0	1	1	0
Construction	2 months	0	3	0	1
Operation	20 months	0	0	1	0
Livingstone Gully Road (option 4)					
Site establishment and vegetation clearance	3–4 weeks	0	1	0	0
Construction	2 months	0	1	0	0
Operation	20 months	0	0	0	0

Table 5.14 Summary of total exceedances for combined temporary worker accommodation facility and construction compounds – OOH

Project element	Number of receivers with NML exceedance			
	0–5 dBA	5–15 dBA	15–25 dBA	>25 dBA
Balranald Road, Moulamein				
All construction stages	0	0	0	0
Cobb Highway, Wanganella (north)				
All construction stages	0	0	0	0
Cobb Highway, Wanganella (south)				
All construction stages	0	0	0	0
Dinawan substation, Coleambally				
All construction stages	0	0	0	0
Gregadoo Road A (option 2)				
Site establishment and vegetation clearance	7	16	0	0
Construction	13	17	1	0
Operation	12	6	0	0
Gregadoo Road B (option 3)				
Site establishment and vegetation clearance	3	4	0	1
Construction	6	5	0	1
Operation	1	3	0	1
Livingstone Gully Road (option 4)				
Site establishment and vegetation clearance	2	1	0	0
Construction	2	2	0	0
Operation	0	1	0	0

For the combined temporary worker accommodation facilities and construction compounds that would support the NSW/Victoria border to Dinawan substation component (NCAs 1-4), noise generated by the construction and operation of the sites would not exceed the NMLs during and outside standard hours. This is due to the large separation distances between these sites and the nearest noise sensitive receivers. For all the listed sites in NCAs 1-4, no residential receivers are predicted to be highly noise affected, and no sleep disturbance and sleep awakening impacts are predicted. Mitigation and management measures are not required for these combined temporary worker accommodation facility and construction compounds.

For the combined temporary worker accommodation facility and construction compound options for the network augmentation works section (NCAs 5-6) at Gregadoo Road A (option 2), Gregadoo Road B (option 3) and Livingstone Gully Road (option 4), numerous exceedances of the NML are predicted. The loudest work stage is the construction stage. The assessment shows that construction noise levels during this stage would exceed NMLs at up to five receivers located in NCA 5 and four receivers located in NCA 6 during standard working hours. All exceedances are considered minor (<10 dB above NMLs). No receivers are predicted to be highly noise affected.

The construction of combined temporary worker accommodation facilities and construction compounds may occur for up to two months. Where the construction work stage for these construction compounds is undertaken outside of standard hours, exceedances may occur at up to 24 receivers located in NCA 5 and up to 12 receivers in NCA 6. It is noted that activity outside of standard hours is expected to involve the delivery of equipment or materials as requested by police or other authorities for safety reasons (such as the delivery of transformer units). Thus any potential OOHW noise impacts are expected to be infrequent and not to occur continuously throughout the entire 2 month construction work stage period.

If night work is necessary, sleep disturbance impacts during this construction work stage are predicted at up to 16 receivers located in NCA 5 and up to five receivers in NCA 6. Potential sleep awakening impacts are predicted at up to two receivers in NCA 5 and up to three receivers in NCA 6. These impacts would only occur if OOHW is carried out, and occurs within the vicinity of sensitive receiver.

In NCA 5, following the completion of construction works, one exceedance may occur as a result of operations during standard working hours and up to 16 exceedances may occur during outside of standard hours. This exceedance is likely to occur where noisy equipment such excavators are used during standard and outside of standard hours. Combined temporary worker accommodation facilities and construction compounds are expected to operate for the remaining duration of the project, which may be up to 20 months.

In NCA 6, following the completion of construction works, one exceedance may occur as a result of operations during standard working hours and up to five exceedances may occur during outside of standard hours. This exceedance is likely to occur where noisy equipment such excavators or hand tools are used during standard and outside of standard hours.

No exceedances of NMLs have been predicted at all non-residential receivers.

Mitigation and management measures to minimise the predicted impacts are considered in Chapter 8.

5.1.6 Construction compounds/laydown areas

Construction noise assessments have been conducted for the three proposed construction compounds/laydown areas; Fisher Lane, Wetuppa (western option 1), Cunninyeuk Road, Cunninyeuk (western option 2), and Mabins Well Road, Mabins Well. Detailed results of this assessment are presented in Appendix B3.14 to B3.16 and a summary of total exceedances for all construction compound/laydown areas is presented in Table 5.15 and Table 5.16.

Table 5.15 Summary of total exceedances for construction compound/ laydown areas work stages – standard hours

Project element	Estimated duration	Number of receivers			
		Highly noise affected (>75 dBA)	With NML exceedance		
			0–10 dBA	10–20 dBA	>20 dBA
Fisher Lane, Wetuppa (Western option 1)					
Site establishment and vegetation clearance	3–4 weeks	0	2	0	0
Construction	2 months	0	2	1	0
Operation	20 months	0	2	0	0
Cunninyeuk Road, Cunninyeuk (Western option 2)					
All construction stages	–	0	0	0	0
Mabins Well Road, Mabins Well					
All construction stages	–	0	0	0	0

Table 5.16 Summary of total exceedances for construction compound/ laydown areas work stages – OOH

Project element	Number of receivers with NML exceedance			
	0–5 dBA	5–15 dBA	15–25 dBA	>25 dBA
Fisher Lane, Wetuppa (western option 1)				
Site establishment and vegetation clearance	0	1	2	0
Construction	0	1	2	0
Operation	0	3	0	0
Cunninyeuk Road, Cunninyeuk (Western option 2)				
All construction stages	0	0	0	0
Mabins Well Road, Mabins Well				
All construction stages	0	0	0	0

Due to the large separation distances between the project and the nearest noise sensitive receivers, construction noise impacts from the construction compounds in NCAs 1-4 at Cunninyeuk Road, Cunninyeuk and Mabins Well Road, Mabins Well are expected to be nil, with no exceedances predicted during standard working hours. No exceedances are predicted during out of hours works, if required. No potential impacts are predicted on any residential receivers with potential sleep disturbance and sleep awakening during construction work stages. No mitigation and management measures are required during construction works for these combined temporary accommodation and construction compounds.

The assessment at Fisher Lane, Wetuppa shows noise levels have been predicted to exceed NMLs at up to three residential receivers located in NCA 2 during standard working hours. These receivers are VNI025, VNI026, and VNI027. No receivers are expected to be highly noise affected. These three receivers are predicted to have exceedances during out of hours works, if work is required outside standard hours. Up to three exceedances are predicted with potential sleep disturbance and up to two receivers are predicted with potential sleep awakening during construction work stages. The establishment of the construction compound/ laydown areas may take up to 2 months to complete.

It is noted that activity outside of standard hours is expected to involve the delivery of equipment or materials as requested by police or other authorities for safety reasons (such as the delivery of transformer units). Thus any potential OOH noise impacts are expected to be infrequent and not to occur throughout the entire 2 month construction work stage period.

In NCA 2, after the completion of construction works, up to three exceedances may occur as a result of operations during standard working hours and outside of standard hours. This is likely to occur where noisy equipment such as excavators are used during standard hours and outside of standard hours. The construction compound/laydown areas are expected to operate for the remainder of the project schedule, which may be up to 20 months.

No exceedances of NMLs have been predicted at all non-residential receivers.

Mitigation and management measures to minimise the predicted impacts are considered in Chapter 8.

5.1.7 Construction road traffic noise

Additional road traffic generated on existing roads due to the construction of the project has the potential to increase road noise impacts at nearby noise sensitive receivers. The durations of construction road noise impacts could vary, and breaks between activities may be shorter which may lead to longer inactive periods in subsequent stages of construction, for example at individual transmission line structures. Durations of any particular construction activity, and respite periods, may vary for a number of reasons including (but not limited to), multiple work fronts, resource and engineering constraints, works sequencing, and location.

These activities would also have multiple work fronts, such as foundation works or structure erection, which would be occurring in several locations along the transmission line easement at the same time.

The daytime and night-time predicted construction traffic noise levels at the worst-impacted receivers along each major construction access route are presented in Table 5.17 with the relative increase presented in brackets, as well as a qualitative discussion for each construction access route. This represents a conservative assessment, as peak traffic volumes are used for construction road noise calculations, and may vary with time. In general, construction road noise is unlikely to exceed 60 dBA on existing roads.

Overall, no exceedances of the relevant criteria established in section 4.2.1.4 are predicted, so noise impacts from construction road traffic are expected to be nil. As outlined in section 2.4.5, any potential traffic volume increase due to pre-construction activities is expected to be significantly less than construction traffic volumes, and therefore no noise impacts from pre-construction road traffic are predicted.

Table 5.17 Predicted impacts of construction traffic noise along key access routes

Road	Road type	Project road noise NML (dBA)		Typical indicative worst-case distance of a receiver from the road (m)	Indicative receiver noise level (increase from existing) (dBA)		Qualitative discussion
		Day $L_{Aeq}(15hr)$	Night $L_{Aeq}(9hr)$		Day	Night	
Balranald Road, Moulamein	Arterial	60	55	100	52 (+4)	37 (+0)	Construction road traffic noise produced by the project would increase overall road noise by approximately 4 dBA during the day, and no increase during the night. Given predicted road noise level does not exceed its respective NML, no impacts are predicted. Construction road traffic noise complies with the criteria.
Cedar Avenue, Moulamein	Arterial	60	55	40	55 (+3)	42 (+0)	Construction road traffic noise produced by the project would increase overall road noise by approximately 3 dBA during the day, and no increase during the night. Given predicted road noise level does not exceed its respective NML, no impacts are predicted. Construction road traffic noise complies with the criteria.
Conargo Road, Conargo	Arterial	60	55	30	58 (+1)	49 (+0)	Construction road traffic noise produced by the project would increase overall road noise by a barely perceptible level during the day, and no increase during the night. Given predicted road noise level does not exceed its respective NML, no impacts are predicted. Construction road traffic noise comply to the criteria.

Road	Road type	Project road noise NML (dBA)		Typical indicative worst-case distance of a receiver from the road (m)	Indicative receiver noise level (increase from existing) (dBA)		Qualitative discussion
		Day $L_{Aeq}(15hr)$	Night $L_{Aeq}(9hr)$		Day	Night	
Kidman Way, Gala Vale	Arterial	60	55	70	59 (+1)	51 (+0)	Construction road traffic noise produced by the project would increase overall road noise by a barely perceptible level during the day, and no increase during the night. Given predicted road noise level does not exceed its respective NML, no impacts are predicted. Construction road traffic noise comply to the criteria.
Maude Road, north of Moulamein	Arterial	60	55	140	53 (+4)	41 (+0)	Construction road traffic noise produced by the project would increase overall road noise by approximately 4 dBA during the daytime only, and no increase during the night. However, construction road traffic noise complies with the respective criteria as the predicted noise level does not exceed its respective NML.
Swan Hill Road, Dilpurra	Arterial	60	55	70	53 (+0)	46 (+0)	Construction road traffic noise produced by the project would increase overall road noise by a barely perceptible level during the day, and no increase during the night. Construction road traffic noise complies with the criteria.
Tallow Street, Moulamein	Arterial	60	55	20	59 (+2)	48 (+0)	Construction road traffic noise produced by the project would increase overall road noise by approximately 2 dBA during the day, and no increase during the night. Construction road traffic noise complies with the criteria.

Road	Road type	Project road noise NML (dBA)		Typical indicative worst-case distance of a receiver from the road (m)	Indicative receiver noise level (increase from existing) (dBA)		Qualitative discussion
		Day $L_{Aeq}(15hr)$	Night $L_{Aeq}(9hr)$		Day	Night	
Wakool Road, Wakool	Arterial	60	55	40	54 (+0)	47 (+0)	Construction road traffic noise produced by the project would increase overall road noise by a barely perceptible level during the day, and no increase during the night. Construction road traffic noise complies with the criteria.
Lockhart Road, Brookdale	Arterial	60	55	40	61 (+1)	54 (+0)	Construction road traffic noise produced by the project would increase overall road noise by a barely perceptible level during the day, and no increase during the night. Construction road traffic noise complies with the criteria.
Cobb Highway north of 16 Mile Gums Rest Area	Highway	60	55	>3000	41 (+2)	32 (+0)	Construction road traffic noise produced by the project would increase overall road noise by a barely perceptible level during the day, and no increase during the night.
Moulamein Road north of Swan Hill Road	Collector	60	55	>3000	39 (+1)	29 (+0)	The nearest residential receivers are more than 3,000 m away from the selected roads. Any construction road traffic noise beyond this distance is likely to be inaudible. Given the large separation distances to sensitive receivers, no impacts are predicted. Construction road traffic noise complies with the criteria.
Moulamein Road south of Noorong Road	Arterial	60	55	>3000	36 (+0)	27 (+0)	
Newell Highway north of Williams Road	Highway	60	55	>3000	44 (+0)	40 (+0)	

Road	Road type	Project road noise NML (dBA)		Typical indicative worst-case distance of a receiver from the road (m)	Indicative receiver noise level (increase from existing) (dBA)		Qualitative discussion
		Day $L_{Aeq}(15hr)$	Night $L_{Aeq}(9hr)$		Day	Night	
Newell Highway near Yanco Creek	Highway	60	55	>3000	44 (+1)	39 (+0)	
Sturt Highway west of Pevensey Rest Area, Hay	Highway	60	55	>3000	44 (+0)	40 (+0)	

Day 7 am – 10 pm, Night 10 pm – 7 am

Bold indicates a potential exceedance of road traffic noise NMLs

5.1.8 Construction aircraft noise

The following sections summarise the predicted aircraft noise impact from helicopters and drones used during construction. Indicative $L_{\max}$ noise levels are presented to illustrate expected transient noise level at ground level during nearby aircraft overflight. The construction aircraft noise assessment assumes that aircraft noise events will occur during daytime hours, as it is unlikely that helicopters and drones would be operated during evening and night-time periods. The aircraft noise levels predicted at noise sensitive receivers are summarised in Appendix B5 and presented graphically as noise contours in Appendix B6.

The assessment conducted is indicative and would be confirmed once locations of helipads and brake and winch sites are finalised as part of detailed design.

5.1.8.1 Aircraft noise from departure and arrivals at helipads of combined temporary worker accommodation facilities and construction compounds

The predicted number of residential receivers exceeding the ≥ 75 dBA $L_{\max}$ construction aircraft noise criterion, as outlined in section 4.2.1.5, due to aircraft operations during construction, is summarised in Table 5.18. The predicted aircraft noise for residential receivers does not exceed ≥ 85 dBA $L_{\max}$.

Table 5.18 Summary of receivers that meet or exceed 75 dBA $L_{\max}$ for helicopter departure and arrivals at combined temporary worker accommodation facilities and construction compounds

Departure and arrivals combined temporary worker accommodation facilities and construction compounds	Number of receivers meeting or exceeding 75 dBA $L_{\max}$ criterion
AS350 helicopters	
Balranald Road, Moulamein	0
Dinawan substation, Coleambally	0
Cobb Highway, Wanganella (north)	0
Cobb Highway, Wanganella (south)	0
Gregadoo Road, Wagga A (Wagga option 2)	2
Gregadoo Road, Wagga B (Wagga option 3)	1
Livingstone Gully Road, Wagga (Wagga option 4)	0
EC-135 helicopters	
Balranald Road, Moulamein	0
Dinawan substation, Coleambally	0
Cobb Highway, Wanganella (north)	0
Cobb Highway, Wanganella (south)	0
Gregadoo Road, Wagga A (Wagga option 2)	1
Gregadoo Road, Wagga B (Wagga option 3)	1
Livingstone Gully Road, Wagga (Wagga option 4)	0

Noise levels of 75 dBA $L_{\max}$ from construction aircraft have been predicted for receiver VNI226 from Gregadoo Road, Wagga A (Wagga option 2), located in NCA 5, and receiver VNI163 from Gregadoo Road, Wagga B (Wagga option 3), located in NCA 6. These levels meet the ≥ 75 dBA $L_{\max}$ construction aircraft noise criterion.

Exceedance of the ≥ 75 dBA $L_{\max}$ construction aircraft noise criterion is predicted for receiver VNI108 from Gregadoo Road, Wagga A (Wagga option 2), located in NCA 5. The predicted exceedance is 1 dB above the criterion for both AS350 and EC-135 helicopters.

Mitigation and management measures to minimise the predicted impacts are considered in Chapter 8.

5.1.8.2 Aircraft noise from stringing and platform work within the transmission line corridor

The predicted number of residential receivers exceeding 75 dBA $L_{\max}$ construction aircraft noise criteria, due to aircraft stringing and platform work operations during construction (refer to section 2.5.2.4), are summarised in Table 5.19. The predicted aircraft noise levels from helicopter or drone stringing and platform work did not exceed 85 dBA $L_{\max}$ at residential receivers in any NCA.

Table 5.19 Summary of total 75 dBA $L_{\max}$ exceedances for helicopter operations within transmission line corridor

Helicopter and drone operation within transmission line corridor	Number of receivers
	Exceedances of ≥ 75 dBA $L_{\max}$
Drone stringing and platform work	0
AS350 stringing	3
EC-135 platform work	1

Noise levels of 75 dBA $L_{\max}$ from AS350 stringing operations within the transmission line corridor been predicted for receivers VNI128 and VNI219 located in NCA 6. These levels meet the ≥ 75 dBA $L_{\max}$ construction aircraft noise criterion.

Exceedance of the ≥ 75 dBA $L_{\max}$ construction aircraft noise criterion is predicted for both stringing and platform work within the transmission line corridor, which is at receiver VNI220 in NCA 6. The exceedance is marginal, at 1 dB above criterion for both AS350 and EC-135 helicopters. Mitigation and management measures to minimise the predicted impacts are considered in Chapter 8.

5.1.8.3 Aircraft noise from brake and winch sites

Aircraft noise predictions for arrivals and departures at brake and winch sites have been modelled based on typical aircraft altitudes, corresponding to the structural height of transmission line structures (56 m to 76 m). The noise model predicts that an AS350 helicopter arriving and departing from a brake and winch site would produce a 75 dBA $L_{\max}$ contour with a diameter of approximately 690 m around the landing area.

Therefore, a buffer zone of approximately 345 m on either side of the brake and winch site is recommended when selecting the location of the brake and winch sites to minimise noise impact on sensitive receivers. No sensitive receivers are within 345 m of brake and winch sites, thus noise impacts from aircraft taking off and landing at brake and winch sites is expected to be minimal.

The 75 dBA $L_{\max}$ buffer zone can be reduced to approximately 55 m if using drones at the site. As minimal impacts are predicted through the use of a AS350 helicopter at brake and winch sites, any noise impact of drone usage at brake and winch sites is considerably less than if a AS350 helicopter is used.

5.1.9 Discussion

The worst-case construction noise impacts for different project elements has been summarised as below. Detailed modelling predictions for each receiver are provided in Appendix B3, and the location of each noise sensitive receiver is detailed in Appendix A2.

Noise impacts would be minor for most construction works within the project footprint. Noise levels are predicted to comply with NMLs during standard hours at the majority of noise sensitive receivers in the study area, however when works are undertaken OOH for specific operational needs, noise levels are predicted to be more noticeable and predicted to exceed NMLs for those temporary periods at more receivers. Noise levels exceeding NMLs are predicted to potentially occur at some point during construction at 57 sensitive receivers during standard hours and 152 sensitive receivers during OOHW.

Most exceedances are predicted to occur at rural residential receivers within NCAs 5 and 6, with considerably lower number of impacted receivers throughout NCAs 1-4. Given the short duration of most impacts, these exceedances are not predicted to generally occur for extended periods of time (refer expected duration of work stages in Table 2.4). No receivers are predicted to be potentially highly noise affected (>75 dBA $L_{eq}(15 \text{ min})$) across all NCAs. Typically, work stages involving earthworks, and/or vegetation clearance are expected to be the loudest OOHW stage at most sites and this work should be avoided during night-time periods where reasonable and feasible. These work stages may occur for up to 1–4 weeks per structure over 12 months for transmission lines, and up to 3 weeks per access track over 12 months.

In general, construction works related to transmission line and access track construction are predicted to generate the highest amount of impact, throughout all periods. However, this can be partially attributed to the large footprint of these works. Furthermore, these works are transitory and will progress throughout the footprint as the project progresses, and total duration of impacts should be shorter than the predicted overall work duration.

The predicted construction noise levels are conservative, assuming all plant identified in Appendix B1 is operational at any one time. As such actual noise levels could generally be expected to be below these predicted noise levels at any identified noise-sensitive receiver. Further, as stated above, most construction works would be transitory (i.e. they would progress along the transmission line corridor to build the transmission line and associated transmission line structures progressively), and as such these predictions would not be sustained through the entire construction period at each receiver.

For construction road noise, predicted levels are unlikely to exceed 60 dBA from the road alignment. For all the listed local roads that will be used during construction works, construction road traffic noise produced by the project is not expected to exceed the respective NMLs for day and night periods.

The assessment of aircraft noise from helicopters and drones used during construction has predicted minimal exceedances in each NCA. Noise from AS350 and EC-135 helicopters departing and arriving at combined temporary worker accommodation facilities and construction compounds is expected to exceed 75 dBA L_{max} at one residential receiver in NCA 5. Similarly, helicopter noise levels from stringing and platform work are predicted to exceed 75 dBA L_{max} at one residential receiver in NCA 6. Overall, the resulting noise exceedances from helicopters and drones are expected to be minimal. The aircraft noise assessment indicates that using drones for stringing work within NCAs, rather than AS350 helicopters, can mitigate aircraft noise levels by approximately 20 dBA.

As mentioned in section 4.2.1.5, does not present information about potential impacts from construction operations involving helicopters and drones that may be experienced within the community. However, Appendix E of AS 2021 provides an indication of building site acceptability based on the aircraft noise levels to which a site will be exposed.

As outlined in AS2021, for a site to be deemed unacceptable as a building site for a house, home unit, flat, caravan park, school, hospital, or nursing home, the number of non-jet aircraft flights generating noise levels ≥ 75 dBA L_{max} over a receiver site would need to be greater than 30 per day. The number of overflights from project aircraft is likely to be considerably less.

Around two stringing pulls would be able to occur per day while using aerial stringing methods. This would allow for around three to four days per six kilometres of transmission line stringing. This would occur within a five-day on/ five-day off approach. Depending on the location of the works, the works would also require around two refuels per day at the nearest temporary worker accommodation facility with a helipad (i.e. two liftoffs, two landings).

As the aircraft noise assessment has not considered the number of flights from existing aircraft not associated with the project flown over the NCA receiver sites, noise management and mitigation measures may be necessary to minimise the identified impact, as presented in Chapter 8.

5.2 Construction vibration

5.2.1 Predicted vibration impacts

Based on the potential vibration generating plant identified for construction (refer to section 5.1), the minimum working distances from the project footprint were identified. Works stages where sensitive receivers were identified within the minimum working distances are presented in Table 5.20.

Table 5.20 Predicted vibration impacts

NCA	Predicted number of sensitive receivers within minimum working distances	
	Cosmetic damage	Human response
Transmission lines		
NCA 4	3	0
NCA 1-3, 5-6	0	0
Future Dinawan 500 kV substation		
NCA 1-6	0	0
Future Gugaa 500 kV substation, Livingstone Gully Road		
NCA 1-6	0	0
Existing Wagga 330 kV substation		
NCA 1-6	0	0
Access tracks		
NCA 1-6	0	0
Telecommunication facilities (optical repeater sites)		
NCA 1-6	0	0
Combined temporary worker accommodation facilities and construction compounds/laydown		
NCA 1-6	0	0
Construction compound/laydown areas		
NCA 1-6	0	0

5.2.2 Discussion

Throughout all work stages of the project across the project footprint, no receivers were identified that could experience potential human comfort impacts.

Up to three structures in NCA 4 (VNI300, VNI301, and VNI302) have been identified within the recommended minimum safe working distances for potential cosmetic damage. The location of these structures is presented graphically in Appendix B7. All identified buildings are unoccupied structures such as sheds and an industrial structure, and as such are not expected to generate impacts to human comfort. These three structures are located in close proximity to the transmission line alignment. The potential strain induced in a structure by a vibratory event depends on the dynamic characteristics of the structure.

Utilities, pipelines and infrastructure are generally more robust than cosmetic features of residential receivers and as such, where cosmetic damage minimum distances are complied with, damage to these items is considered highly unlikely. If the final power rating or proposed equipment changes from that indicated in Appendix B1, further assessment would be required to update the findings of this assessment, in particular where these changes may affect the three identified structures previously mentioned.

Vibration mitigation measures to minimise the predicted impacts have been recommended in section 8.4.1.3.

6 Operational noise assessment

This section presents the assessment of operational noise, including noise associated with the project-relevant PNTLs as outlined in the NPfI. Impacts have considered the operational noise levels associated with the proposed transmission line and substations.

6.1 Transmission line corona noise

The Beca AN Study (see Appendix C) predicts the corona noise levels likely to be associated with the project, and concluded an Audible Noise risk zone within which the impacts of corona noise from the transmission line may exceed the NPfI minimum intrusiveness Project Noise Trigger Level of 35 dB(A) under adverse meteorological conditions.

For the 500 kV double circuit transmission line from the NSW/Victorian border to Dinawan, this AN risk zone extends 395 metres from the centre of the alignment. For the network augmentation between the existing Wagga 330 kV substation and future Gugaa 500 kV substation, Livingstone Gully Road, the AN risk zone extends 359 metres from the 330 kV double circuit transmission line.

It is noted that the network augmentation works are within an existing easement, and adjacent to existing high voltage transmission lines. In this area, there may be existing corona noise impacts.

Two residential receivers, VNI128 and VNI152 were found to be within the AN risk zone, which are located in NCA 6. The details of these receivers is outlined in Table 6.1. Figure 4 and Figure 5 from the Beca AN Study graphs the potential audible noise level in relation to distance from the 500 kV double circuit transmission line and the 330 kV double circuit transmission line respectively, and has been used to approximate the audible noise level at each receiver within the AN risk zone.

Table 6.1 Residential receivers within audible noise risk zone

Receiver ID	NCA	Approximate distance from transmission alignment (metres)	Approximate AN noise level (dBA) ¹	Extent of exceedance (dBA)	NPfI extent of impact ²
VNI128	6	250	37	2	Negligible
VNI152	6	339	36	1	Negligible

(1) With reference to Figure 5 of the Beca AN Study

(2) With reference to definitions in Table 2.12 and eligible for mitigation outlined in Table 2.13.

VNI128 and VNI152 are predicted to have an exceedance of 2 dBA and 1 dBA respectively, which is typically considered minor and undetectable to the average person and therefore would not warrant receiver-based treatments or controls, as described in Table 2.13 and as outlined in the NPfI. Furthermore, corona noise would be generated by the existing transmission line located between the existing Wagga 330 kV substation and future Gugaa 500 kV substation, Livingstone Gully Road, and this is therefore not a new noise source in the area.

It is important to consider that corona noise only occurs under conditions of high dust, mist, or rain. During heavier rain events, general ambient noise levels in the environment would likely be higher and therefore potentially have a masking effect over any possible corona discharge noise. Noise disturbance under such circumstances is therefore likely to be low risk. It is noted that misty conditions typically occur for only short durations.

As outlined in Section 2.5.3.3, audible corona discharge noise is not expected to be a constant occurrence but is only present during mild, wet and misty conditions. Based on the meteorological conditions identified for the area, as detailed in Table 2.10, the expected annual frequency of these conditions at VNI128 and VNI152 is approximately 72 days per year. It is important to note that these conditions would not usually occur for full days and include only periods of rainfall or mist. The audible noise emissions due to corona discharge from the transmission lines do not exceed the night-time noise limits under fair weather conditions. Mitigation and management measures for corona noise are outlined in section 8.5.

6.2 Transmission line and substation maintenance

For transmission line maintenance, the maintenance activities are expected to be infrequent (up to once per year). If and when required, these activities are also expected to be either transient/of short duration or local to a specific section/transmission line structure. Likely maintenance activities would include:

- regular inspection and maintenance of transmission lines and transmission line structures including:
 - an annual fly over as part of seasonal bushfire prevention surveys (using helicopters and/or drones)
 - routine infrastructure inspection on a six-yearly cycle for self-supporting structures and three-yearly cycle for guyed structures. This would typically involve two to three maintenance crews driving a light vehicle from public roads to the easement utilising access tracks, then along the easement inspecting each transmission line structure in turn. Transmission line structures would be inspected both from the ground and by personnel climbing the structure
 - reactive transmission line maintenance in response to unexpected issues identified during routine inspections. This would typically involve maintenance workers using light vehicles, an elevated work platform and a medium sized truck to rectify any defects found during routine inspections. Generally, this would occur within the same maintenance cycles as the routine infrastructure inspection
- ad hoc fault and emergency fly over(s) to assess infrastructure condition should an unplanned outage occur (for example through a weather event or other failure of infrastructure). This maintenance would occur as required. The amount of maintenance and/or crew required for repair of any damaged infrastructure would depend on the extent of repairs required.

Possible risk of noise impacts associated with these activities is therefore expected to be minimal. As a result, any operational road noise impacts are also expected to be negligible, due to the expected minimal road traffic volume increase.

Maintenance activities at the expanded Dinawan substation are likely to require infrequent access via light vehicles of small to medium sized plant. Increased noise impacts are likely to be associated with the replacement of major project components only. Equipment is expected to have a service life of around 50 years. Maintenance would be regularly undertaken for the different infrastructure components and plant items such as transformers. These components would be replaced/refurbished towards the end of their serviceable life, allowing the service life of the sites to be extended.

Based on these factors, and the negligible risk of ongoing operational noise impacts at these sites, noise impacts associated with ongoing maintenance of the expanded Dinawan substation is not expected.

6.3 Operational substation noise

6.3.1 *Existing Wagga 330 kV substation*

As outlined in section 2.5.3, work within the existing Wagga 330 kV substation would not change its existing operational or maintenance requirements. The proposed work within the substation is limited to low noise impacts work such as connection or disconnection of transmission lines. As such, no additional operational noise impacts are expected.

6.3.2 *Future Gugaa 500 kV substation, Livingstone Gully Road*

As outlined in section 2.5.3, work within the future Gugaa 500 kV substation, Livingstone Gully Road would not change its existing operational or maintenance requirements. The proposed work within the substation is limited to low noise impacts work such as connection or disconnection of transmission lines. As such, no additional operational noise impacts are expected.

6.3.3 *Future Dinawan 500 kV substation*

As presented in section 2.5.3.4, the proposed noise-generating items located at the expanded future Dinawan substation site includes power transformers, shunt reactors, and circuit breakers. These have been modelled under standard and noise-enhancing meteorological conditions.

The nearest receiver to the future Dinawan substation is VNI064, at a distance of approximately 7.1 kilometres. For reference, the results of the operational noise modelling at this receiver is presented in Table 6.2.

All predicted operational noise from the expanded Dinawan substation site would be inaudible at all sensitive receivers due to large separation distances, and therefore all receivers comply with the relevant NPfI criteria, including sleep disturbance impacts during emergency circuit breaker activation. Where the operational equipment is consistent with the modelled scenarios outlined in section 2.5.3, mitigation is not expected to be required at the future Dinawan substation.

Table 6.2 Predicted future Dinawan substation operational noise levels

Receiver ID	NCA	Project noise trigger levels L _{eq,15 min} dBA			Sleep awakening criteria L _{FMax} dBA	Predicted operational noise levels L _{eq,15 min} dBA ¹		Predicted sleep awakening noise levels L _{Fmax} dBA	
		Day	Evening	Night		Neutral meteorological conditions	Noise-enhancing meteorological conditions	Neutral meteorological conditions	Noise-enhancing meteorological conditions
64	4	40	35	35	52	0	0	0	0

(1) Includes a 5 dB penalty for annoying characteristics

7 Cumulative noise assessment

The cumulative impact assessment considers other nearby developments along with the project and assesses the scale and nature of the cumulative impacts on key issues.

The assessment is consistent with the requirements of the Cumulative Impact Assessment Guidelines for State Significant Projects (NSW Department of Planning, Industry and Environment (DPIE), 2022). These guidelines define cumulative impacts as those arising as a result of incremental, sustained and combined effects of human action and natural variations over time that can be both positive and negative. These impacts can be caused by the compounding effects of a single project or multiple projects in an area, and by the accumulation of effects from past, current and future activities as they arise.

Further detail on cumulative impact assessment approach and the other projects considered in the cumulative impact assessment is provided in Chapter 24 (Cumulative impacts) of the EIS.

7.1 Projects considered

The relevant future projects that were considered as having the potential to result in cumulative noise impacts with the project are listed in Table 7.1. The location of the major relevant future projects are provided in Figure 7.1.

Table 7.1 Projects considered for cumulative assessment

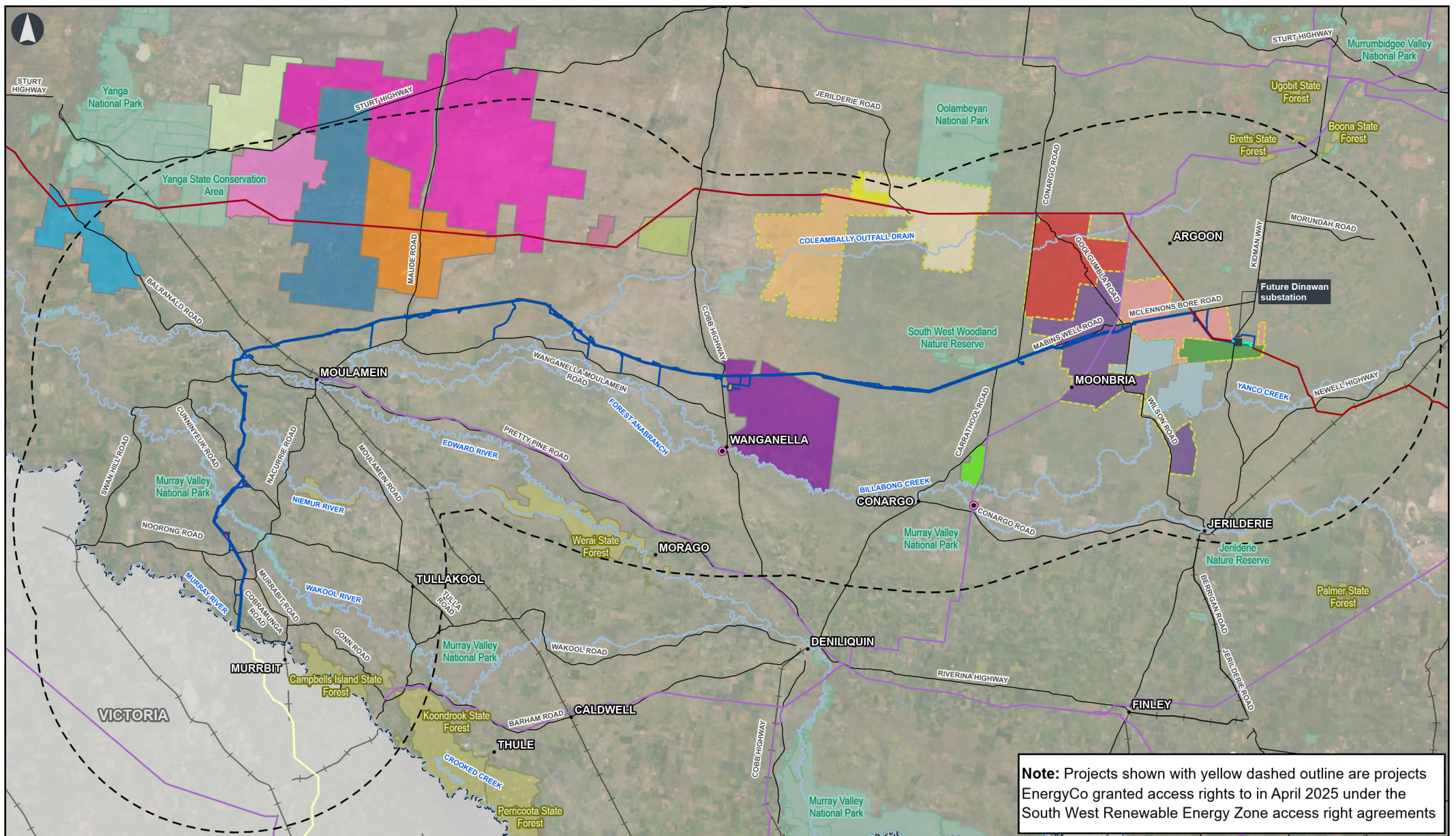
Related developments		
1. VNI West (Victoria)	2. EnergyConnect (NSW – Eastern section) (SSI-9172452)	3. HumeLink (SSI-36656827)
Projects currently subject to environmental assessment		
4. Junction Rivers Wind Farm (SSD-30448824)	11. Pottinger Wind Farm (SSD-59235464)	18. Dinawan Solar Farm (SSD-50725959)
5. Keri Keri Wind Farm (SSD-38358962)	12. Pottinger Solar Farm (SSD-59254709)	19. Dinawan Wind Farm (SSD-50725708)
6. Wilan Wind Farm (SSD-51306206)	13. Billabong Creek Environmental Water Regulators (SSI-50831979)	20. Argoon Wind Farm (SSD-64935522)
7. Baldon Wind Farm (SSD-40138508)	14. Bullawah Wind Farm (SSD-50505215)	21. Belhaven Battery Energy Storage System (SSD-57575973)
8. Tchelery Wind Farm (SSD-59701722)	15. Romani Solar Farm (SSD-67105475)	22. Livingstone Solar Farm (SSD-80114208)
9. Abercrombie Wind Farm (SSD-77340978)	16. West Nyangay Solar Farm (SSD-74990235)	23. Mangoplah Battery Energy Storage System (SSD-77527735)
10. Wanganella Wind Farm (SSD-78102208)	17. Conargo Wind Farm (SSD-70611708)	
Approved or changed projects		
24. Yanco Delta Wind Farm (SSD-41743746)	25. Gregadoo Solar Farm (SSD-8825)	26. Inland Rail (Albury to Illabo) (SSI-10055)

7.1.1 South West Renewable Energy Zone access right agreements

In April 2025, EnergyCo granted access rights to six wind, solar and large-scale battery projects with a combined generation capacity of 3.56 gigawatts. These project consisted of the following as shown previously in Table 7.1:

- Yanco Delta Wind Farm (project 24)
- Dinawan Energy Hub – consisting of the Dinawan Solar Farm and Dinawan Wind Farm (projects 18 and 19 respectively)
- Pottinger Energy Park – consisting of the Pottinger Solar Farm and Pottinger Wind Farm (projects 11 and 12 respectively)
- Bullawah Wind Farm (project 14).

The combined generation capacity of these proposed or approved projects represents the initial allocation of access rights under the South West Renewable Energy Zone access scheme. In making this decision, the maximum capacity for access rights assigned to each proposed renewable energy project is lower than what has been identified in planning assessment documentation for those projects, and it would alter the likelihood of some of the remaining projects in the South West Renewable Energy Zone proceeding in the short-term. However, for the purposes of this cumulative assessment it is assumed that all identified projects would proceed as described in the relevant planning assessment documentation available at the time of the assessment (in line with the *Cumulative Impact Assessment Guidelines for State Significant Projects* (NSW DPIE, 2022)).



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VNI West – EIS

Figure 7.1a
Cumulative impact projects

Legend

- Rail line
- Main road
- Named waterway
- EnergyConnect (NSW - Eastern section) project (under construction)

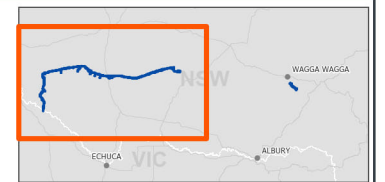
- Existing transmission line
- Dinawan substation works - proposed 500 kV
- Dinawan substation works - existing 330 kV
- National park
- State forest

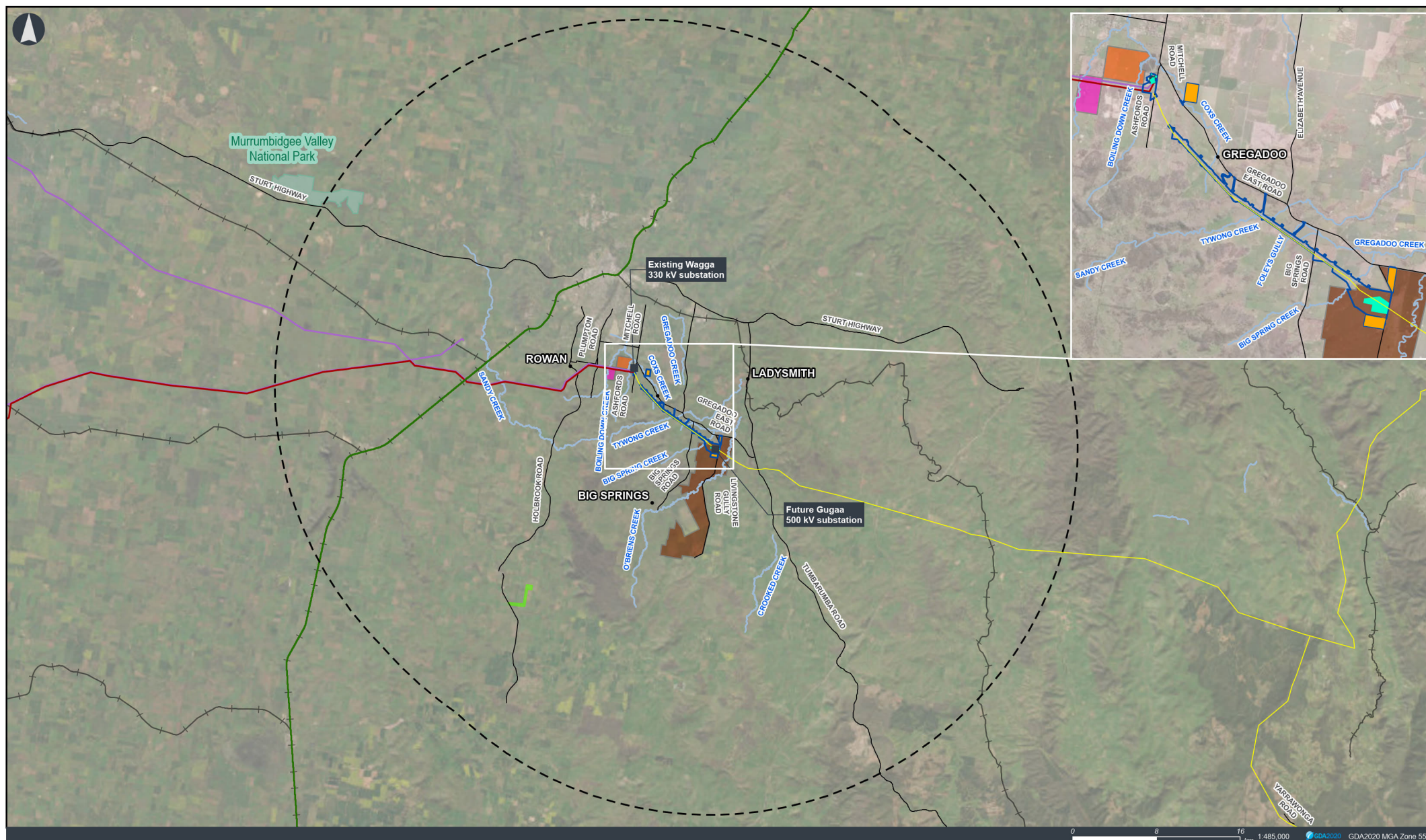
- Project footprint
- NSW/Victorian border
- Cumulative Study area
- Combined temporary worker accommodation facility
- Construction compound

- Billabong Creek Environmental Water Regulators
- Relevant future projects**
- Abercrombie Wind Farm
- Argoon Wind Farm
- Baldon Wind Farm
- Dinawan Solar Farm

- Dinawan Wind Farm (East)
- Dinawan Wind Farm (West)
- Pottinger Wind Farm
- Tcheleri Wind Farm
- Yanco Delta Wind Farm
- Wilan Wind Farm
- Bullawah Wind Farm

- Junction Rivers Wind Farm
- Keri Keri Wind Farm
- Pottinger Solar Farm
- Romani Solar Farm
- West Nyangay Solar Farm
- Conargo Wind Farm
- Wanganella Wind Farm





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VNI West – EIS

Figure 7.1b
Cumulative impact projects

Legend

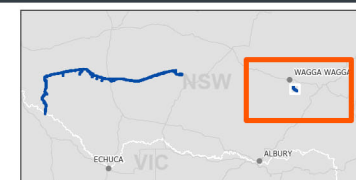
- Rail line
- Main road
- Named waterway
- EnergyConnect (NSW - Eastern section) project (under construction)

- Existing transmission line
- Substation
- National park

- Project footprint
- Cumulative Study area
- Combined temporary worker accommodation facility

- HumeLink
- Albury to Illabo
- Relevant future projects**
- Livingstone Solar Farm
- Belhaven Battery Energy Storage System
- Gregadoo Solar Farm

- Mangoplah Battery Energy Storage System



7.2 Cumulative impact assessment

Relevant projects with potential for cumulative noise impacts with the project were assessed where construction and operational durations overlap with the project, and are within six kilometres of the project, in accordance with the methodology outlined in section 2.6. Further detail on the relevant projects considered in the cumulative impact assessment is provided in Chapter 24 (Cumulative impacts) of the EIS.

No cumulative vibration impacts are expected due to the separation distance between the project, sensitive receivers, and other projects assessed for cumulative impact. Furthermore, construction works involving vibratory equipment at the project and any nearby cumulative projects also utilising vibratory equipment is highly unlikely.

7.2.1 VNI West (Victoria)

VNI West (Victoria) would consist of around 240 kilometres of new 500 kV transmission line between the connection point with VNI West (Victoria) and Bulgana, Victoria. It has a direct connection with the project at the Murray River crossing.

Where construction between these two projects coincides, cumulative noise impacts may occur at numerous receivers in NCA 1 during the construction of the transmission line and access tracks. Three receivers (VNI007, VNI008, and VNI013) are predicted to exceed OOH NMLs during the loudest of these work stages. During the worst-case cumulative noise scenario, levels may be up to 3 dB louder than the maximum predicted level from either project, which may result in one additional receiver (VNI006) marginally exceeding OOH NMLs. The location of these receivers can be seen in Appendix A2. No additional exceedances of daytime NMLs are expected.

The overall duration of works at the NSW/Victorian border to future Dinawan 500 kV substation may be up to 24 months. However, it is noted that the transmission line and access tracks activities are linear in nature and works would progressively move along the proposed alignment, resulting in impacts for less than the overall 24 month duration. The loudest work stage for each of these activities is likely to occur for up to three weeks per structure or access track over 12 months, and therefore any worst-case cumulative noise impacts are expected to be minimal in duration.

No additional receivers are expected to exceed the relevant construction NMLs where works coincide across both projects.

No operational noise impact from the project is predicted at these receivers and as such, no cumulative noise impacts are considered likely.

7.2.2 EnergyConnect (NSW – Eastern section)

The EnergyConnect (NSW – Eastern section) project involves the upgrade and expansion of the existing Wagga 330 kV substation, construction of the future Dinawan substation and transmission line infrastructure between the Buronga and Wagga substations. Construction of these two projects may coincide for up to three months.

If construction activities coincide, cumulative noise impacts may occur during the construction of transmission line and access tracks at all 82 receivers in NCA 5. One impacted receiver is located in NCA 4 (VNI064), and eight receivers are within NCA 6. During worst case cumulative noise impacts, levels may be up to 3 dB louder than the maximum predicted level from either project. It is noted that both of these activities are linear in nature and works would progressively move along the proposed alignment, significantly reducing the likely of works coinciding in close proximity to a particular sensitive receiver.

Among these receivers, the worst impacted receiver is VNI220. This receiver may experience construction noise levels from the project up to 60 dBA during access tracks – earthworks and upgrades construction work stage. If construction of EnergyConnect (NSW – Eastern section) is concurrent with the project, then cumulative construction noise levels for VNI220 receiver may increase to 63 dBA. Increases of this extent may result in an additional 26 receivers exceeding the project NMLs where works coincide across both projects.

However, it is anticipated that the construction noise impacts from EnergyConnect (NSW – Eastern section) project would be minimised as a result of the implementation of noise mitigation and management measures. This would likely decrease the cumulative construction noise with the project.

Cumulative operational noise impacts are not expected between these two projects. The only receivers predicted to be impacted by operational noise from the project is VNI128 and VNI152 due to corona noise, as detailed in section 6.1, which are not predicted to be affected by operational noise generated as part of the EnergyConnect (NSW – Eastern section) project.

7.2.3 *HumeLink*

As the network augmentation works aligns with HumeLink, and shares support facilities such as access tracks, cumulative noise impacts may occur during transmission line construction and site establishment at all 129 receivers in NCAs 5 and 6, where construction coincides. The construction works for these two projects may coincide for up to 6 months. During worst-case cumulative noise impacts, levels may be up to 3 dB louder than the maximum predicted level from either project. It is noted that the transmission line construction is linear in nature for both project and works would progressively move along the proposed transmission alignment, significantly reducing the likely of works coinciding in close proximity to a particular sensitive receiver. As such, impacts from consecutive construction activities are considered less likely.

No mitigated exceedances of operational PNTLs are expected for HumeLink where the two projects overlap. As such, there is a low likelihood of cumulative operational impacts with this project.

7.2.4 *Dinawan Solar Farm*

The proposed Dinawan Solar Farm is located 200 metres south of the project and receiver VNI64. This receiver is located at the eastern end of NCA 4, approximately 7.1 km from the Future Dinawan 500 kV substation. Where construction activities coincide, cumulative noise impacts may occur during access tracks construction at this receiver. During worst case cumulative noise impacts, levels may be up to 3 dB louder than the maximum predicted level from either project.

Under this scenario, this receiver may experience construction noise levels from the project up to 39 dBA during access tracks – earthworks and upgrades construction work stage for up to 3 weeks per access track over 12 months, and is therefore a short-term cumulative noise impact. If construction of Dinawan Solar Farm is concurrent with the project, then cumulative construction noise levels may increase to 42 dBA.

However, it is assumed the landholder of VNI64 has an established agreement with Spark Renewables. This agreement may include measures to mitigate or compensate for construction noise generated by Dinawan Solar Farm, which may reduce any cumulative noise impacts.

No additional receivers are expected to exceed the relevant construction NMLs where works coincide across both projects.

It is predicted that Dinawan Solar Farm would comply with NPfI criteria at all surrounding receivers, and there are no operational noise impacts predicted at this receiver from the project. As such, there is a low likelihood of cumulative operational impacts with this project.

7.2.5 *Dinawan Wind Farm – East*

This wind farm is located within three kilometres of the project. Where construction activities coincide, cumulative noise impacts may occur during transmission line and access tracks construction at one receiver (VNI64). This receiver is located at the eastern end of NCA 4, approximately 7.1 km from the Future Dinawan 500 kV substation. During worst case cumulative noise impacts, noise levels may be up to 3 dB louder than the maximum predicted level from either project.

This receiver may experience construction noise levels from the project up to 39 dBA during access tracks – earthworks and upgrades construction work stage. If construction of Dinawan Wind Farm – East is concurrent with the project, then cumulative construction noise levels may increase to 42 dBA. This work stage will occur for three weeks per access track over 12 months and is thus expected to only be a short-term cumulative impact.

However, it is assumed the landholder of VNI64 has an established agreement with Spark Renewables. This agreement may include measures to mitigate or compensate for construction noise generated by Dinawan Wind Farm – East, which may reduce any cumulative noise impacts.

No additional receivers are expected to exceed the relevant construction NMLs where works coincide across both projects.

No operational noise impact from the project is predicted at this receiver and as such, cumulative noise impacts are not expected.

7.2.6 Yanco Delta Wind Farm

Yanco Delta Wind Farm is located within three kilometres west of the project and receivers VNI62 (11) and VNI63 (3). These receivers are located in NCA 4 and can be visualised in Appendix A2. Where construction activities coincide, cumulative noise impacts may occur during transmission line and access tracks construction at these receivers.

VNI62 is designated as an associated receiver, and VNI63 as a host receiver, for the Yanco Delta Wind Farm, thus it is assumed there are agreements in place between the respective landholders and that project's developers. This agreement may include measures to mitigate or compensate for noise generated by Yanco Delta Wind Farm.

No construction noise impacts are predicted at VNI62 during all working periods. However, where construction occurs for Yanco Delta Wind Farm during evening and night OOH periods, noise levels may be up to 40 dBA at VNI63. The access tracks – earthworks and upgrades construction work stage is predicted to produce the highest OOH noise levels from the project at VNI63, at 32 dB.

Therefore, the resulting cumulative construction noise level at VNI63 may be up to 41 dBA, where OOHW coincide between the two projects. Where these two projects proceed consecutively, the potential for increased annoyance, particularly during out of hours work should be managed appropriately. This work stage will occur for three weeks per access track over 12 months and is thus expected to only be a short-term cumulative impact.

No additional receivers are expected to exceed the relevant construction NMLs where works coincide across both projects.

No operational noise impacts from the project is predicted at this receiver and as such, cumulative noise impacts are not expected. Furthermore, corona noise is more likely to occur during calm weather conditions, as opposed to wind turbine noise generally increasing with wind speed.

7.2.7 Gregadoo Solar Farm

This solar farm is located three kilometres west of the project and includes numerous shared receivers. The construction of Gregadoo Solar Farm is expected to be completed six months before the commencement of the project construction. Cumulative construction noise impacts are not expected between these two projects.

It is predicted that Gregadoo Solar Farm would comply with NPfI criteria at all surrounding receivers, and as such there is a low likelihood of cumulative operational impacts with the project.

7.2.8 *Belhaven Battery Energy Storage System*

The Belhaven Battery Energy Storage System (BESS) project is located approximately 1.4 km west of the existing Wagga 330 kV substation, and the study area includes numerous shared receivers. Where construction activities coincide, cumulative noise impacts may occur during transmission line, existing Wagga 330 kV substation, Gregadoo Road, Wagga A and access tracks construction at up to 84 receivers. Construction of Belhaven BESS is expected to occur for 12 months between 2025 and 2026.

The construction work stages expected to occur for the project during this period include site establishment works. Detailed noise assessment for the Belhaven BESS project has not been undertaken at the time this report was prepared, and as such further quantitative assessment of cumulative construction noise impacts is limited.

The only receivers expected to be impacted by operational noise from the project is VNI128 and VNI152, in NCA 6, due to corona noise. However, these receivers are approximately six kilometres from the Belhaven BESS project, which is unlikely to be audible at this distance. As such there is a low likelihood of cumulative operational impacts with the project.

7.2.9 *Livingstone Solar Farm*

The Livingstone Solar Farm is primarily located south of NCA 6, and the study area includes numerous shared receivers. Where construction activities coincide, cumulative noise impacts may occur at up to 24 receivers in NCA 6 during works for the transmission line, future Gugaa 500 kV substation, Livingstone Gully Road, access tracks, Gregadoo Road, Wagga B, and Livingstone Gully Road construction compounds.

The construction of the Livingstone Solar Farm is expected to occur over 12 to 24 months. However, detailed noise assessment of the Livingstone Solar Farm has not been undertaken at the time this report was prepared, and as such further quantitative assessment of cumulative construction noise impacts is limited.

The only receivers expected to be impacted by operational noise from the project is VNI128 and VNI152, in NCA 6, due to corona noise. Only VNI152 may experience cumulative operational noise impacts as it is approximately 930 m from the Livingstone Solar Farm. However, as previously mentioned, detailed noise assessment of the Livingstone Solar Farm has not been undertaken at the time this report was prepared, and as such further quantitative assessment of cumulative operational noise impacts is limited. During worst case cumulative noise impacts, noise levels may be up to 3 dB louder than the maximum predicted level from either project.

7.3 Discussion

This assessment has identified a range of potential noise impacts during the construction phase, however the extent and magnitude of any impact is dependent on timing and overlap of individual construction activities. The largest number of impacts are predicted when construction activities for the project and HumeLink overlap, and may affect all identified sensitive receivers in NCAs 5 and 6. However, it is expected that the overlap may occur for up to 6 months. Similarly, 91 receivers may experience cumulative construction noise impacts for the project and the EnergyConnect (NSW – Eastern section) project. Also, four receivers in NCA 1 may experience cumulative construction noise impacts where OOHW overlap for the project and VNI West (Victoria).

Up to 84 sensitive receivers located in NCA 5 may also experience cumulative construction noise impacts due to the construction of the Belhaven BESS for up to 12 months. Also, up to 24 sensitive receivers in NCA 6 may experience cumulative construction noise impacts due to the construction of the Livingstone Solar Farm for up to 24 months, and VNI152 may also experience cumulative operational noise impacts. As detailed noise assessment for these projects has not been undertaken at the time this report was prepared, further quantitative assessment of cumulative construction and operational noise impacts is limited.

Any remaining cumulative construction noise impacts are limited to isolated receivers, which have agreements with the respective projects by which they might be impacted by. This includes Dinawan Solar Farm, Dinawan Wind Farm – East, and Yanco Delta Wind Farm.

No cumulative operational noise impacts are predicted between the project and all other surrounding related projects. Mitigation measures to manage any potential cumulative impacts during construction are provided in section 8.6.

8 Management and mitigation measures

8.1 Environmental management

This chapter describes how the project would be managed to reduce potential environmental impacts throughout detailed design, construction and operation.

The approach to environmental management and mitigation of potential noise and vibration impacts for the construction of the project would be carried out through the development of a project specific Construction Environmental Management Plan (CEMP) for the main construction works, and the implementation of individual property management plans developed in consultation with landowners.

Operation of the project would be managed through Transgrid's EMS, which is accredited to ISO 14001 requirements. The EMS includes an Environmental Assessment Framework, which contains checklists, procedures, guidance notes and an Environmental Handbook (Transgrid, 2021) to assess and manage the potential impacts of maintenance activities.

8.2 Actions already undertaken to avoid and minimise impacts

Avoidance and minimisation of impacts to sensitive receivers has been a key consideration during the development of the project, including the selection of construction compounds and temporary accommodation facilities. This has assisted in avoiding and minimising potential noise and vibration impacts at sensitive receivers during construction and operation.

8.3 Mitigation measures

Site-specific mitigation measures have been proposed to minimise noise and vibration impacts associated with the project. Mitigation measures are presented in Table 8.1, Table 8.4, and Table 8.5.

8.4 Construction

8.4.1 Construction environmental management

8.4.1.1 Construction noise

Construction noise would be managed by a detailed CNVMP to be prepared prior to commencement of construction. This would be a sub-plan to the CEMP and would be based on the detailed construction methodology, locations of works sites activities, durations, equipment types and numbers.

The CNVMP would as a minimum:

- confirm nearby sensitive receivers
- assess the potential impacts from the proposed construction methods and staging, including road traffic noise
- where management levels would be exceeded examine feasible and reasonable noise mitigation and develop associated noise and vibration monitoring programs, as required
- develop processes for the notification and consultation with potentially noise affected receivers about upcoming noisy activities

- develop an out of hours work protocol
- develop strategies, assign roles, and responsibilities for noise and vibration complaints, to be managed through a complaints management system. This would include construction noise compliance monitoring at affected receivers to confirm the measured construction noise contribution and that the implemented mitigation measures are appropriate and effective.

8.4.1.2 Standard construction noise mitigation

The NML exceedances are primarily temporary and confined to isolated rural residences during construction of foundations and access track construction.

Where impacts are predicted, reasonable and feasible mitigation measures to minimise noise levels from construction work have been proposed. The construction schedule and equipment and worksite locations would be subject to further refinement as part of the detailed design process, however as detailed above, a CNVMP is to be prepared as part of the CEMP and would identify measures to schedule these activities appropriately to reduce potential for noise impacts where practicable.

Where reasonable and feasible, construction, particularly high noise generating works in close proximity to receivers should be carried out during the standard daytime working hours. The measures outlined in Table 8.1 are recommended to mitigate and manage the potential for noise impacts during construction of the project. These measures have been developed with reference to the ICNG and the impacts identified in this assessment.

Table 8.1 Proposed construction noise mitigation measures

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
NV1	Construction noise (source controls)	As part of development of the detailed design and construction methodology, all reasonable and feasible mitigation measures will be considered, confirmed and implemented to minimise construction noise impacts and to avoid exceedances of the applicable noise management levels at adjacent sensitive receivers, where practicable. Measures that may achieve this outcome may include, but not limited to the following: — portable temporary noise screens will be erected adjacent to stationary or long term static noise sources, or noise generating items, where reasonable and feasible — spotters, “smart” reversing alarms, or broadband reversing alarms will be used in place of traditional tonal beeper reversing alarms, particularly on equipment where reversing alarms are frequently in use such as rollers, loaders or compactors — noise source controls, such as the use of residential class mufflers, will be used reduce noise from all plant including cranes, excavators and trucks — the offset distance between noisy plant items and sensitive receivers will be maximised, where reasonable and feasible — machinery will be operated in a manner which reduces maximum noise level events such as shaking excavator buckets, dropping materials into trucks from a height or steel on steel contact — construction plant and equipment will be turned off when not in use — helicopters will generally not be operated during evening and night-time periods, with additional reasonable and feasible mitigation identified in consultation with affected landholders if operation during the evening and night-time is necessary.	Detailed design/ pre-construction/ construction	All locations where exceedances of the applicable construction noise criteria are predicted at nearby sensitive receivers

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
NV2	Construction noise (administrative controls)	Opportunities to reduce exceedances of the applicable construction noise goals through the implementation of administrative controls will be examined, confirmed and implemented where reasonable and feasible. Controls to be considered will include, but not limited to the following: — environmental awareness training and inductions for site personnel will include noise mitigation techniques/measures to be implemented when on site and accessing the site — plant and equipment will be selected based on noise emission levels. This will include the consideration of alternative stringing methods, such as the use of drones instead of helicopters where aircraft is required for stringing — noise-intensive works will be limited to less sensitive construction hours (i.e. away from early morning and late afternoon periods) as far as practicable, when working in the vicinity of sensitive receivers — plant and equipment will be well maintained to ensure that excessive noise is not generated — the provision of respite periods for helicopter take off/landing will be considered at the combined temporary worker accommodation facilities and construction compounds where exceedances are predicted — any works undertaken outside standard working hours will be further assessed in accordance with the Interim Construction Noise Guideline and the Construction Noise and Vibration Guideline (Roads) by the construction contractors. This will consider implementation of additional construction noise mitigation measures outlined in the Interim Construction Noise Guideline.	Detailed design/ pre-construction/ construction	All locations where exceedances of the applicable construction noise criteria are predicted at nearby sensitive receivers

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
NV3	Construction noise	Proactive community consultation will be undertaken to consider opportunities to reduce the impacts of construction noise levels where reasonable and feasible. Controls to be considered will include, but not limited to the following: — sensitive receivers potentially affected by the works will be notified of construction activities at least seven days prior to works starting. The notification would include information on the nature of and duration of works, expected noise levels and contact details of project representatives — the community will be kept regularly informed of noise intensive activities in the immediate area.	Pre-construction	All locations where exceedances of the applicable construction noise criteria are predicted at nearby sensitive receivers
NV4	Construction noise	An out-of-hours work protocol that details how the project will identify, assess and approve out of hours work outside standard construction hours that are likely to generate noise levels that exceed the relevant noise management levels at sensitive receivers will be developed and implemented. The protocol will include provisions to: — carry out additional assessments for work proposed outside standard construction hours, to confirm noise levels at potentially affected sensitive receivers and determine suitable mitigation measures to minimise noise levels — notify and engage with potentially noise affected receivers about upcoming work outside standard construction hours and address any associated complaints — identify appropriate respite for noise affected receivers (where required). The out-of-hours work protocol will not apply to the operation of the temporary worker accommodation facilities.	Detailed design and construction	All locations where OOHW is required

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
NV5	Construction aircraft noise	Management strategies will be put in place to reduce aircraft noise at sensitive locations, wherever feasible and suitable. These strategies may include (but are not limited to): — conducting consultation to inform nearby sensitive locations about upcoming aircraft-related activities. This will involve the use of helipads within combined temporary worker accommodation facilities and construction compounds, flight paths outside the project area, stringing break and winch sites or other tasks within the transmission line corridor. Notifications will include scheduled dates, locations, approximate hours, and a description of the planned work — giving priority to helipad locations at combined temporary worker accommodation facilities and construction compounds and break and winch sites within the transmission line corridor that are maximally distanced from sensitive areas — adjusting flight paths between helipads and the transmission line corridor to prevent repeated helicopter noise at sensitive locations — operating aircraft in compliance with Airservices Australia's Environmental Principles and Procedures for Minimising Aircraft Noise (Airservices Australia, 2002) and the Fly Neighbourly Guide (Fly Neighbourly/Environmental Working Group of Vertical Aviation International, 2024).	Detailed design and construction	All locations where exceedances of the applicable construction noise criteria are predicted at nearby sensitive receivers

8.4.1.3 Additional construction noise mitigation

Following the implementation of the standard ICNG mitigation measures outlined in section 8.4.1.2, additional mitigation measures outlined in Table 8.2 should be considered where residual noise impacts remain.

This table presents various measures that are non-project specific, and should be implemented if residual construction noise levels still exceed NMLs after basic noise mitigation measures are implemented.

Table 8.2 Additional noise mitigation measures

Predicted airborne $L_{eq(15min)}$ noise level at receiver		Additional mitigation measures	
Perception ¹	dBA above NML	Type ²	Mitigation level ³
All hours			
75 dBA or greater	–	N, V, PC, RO	HA
Standard Hours: Mon-Fri (7 am–6 pm), Sat (8 am–1 pm), Sun/Pub Holidays (Nil)			
Noticeable	0	–	NML
Clearly audible	< 10	–	NML
Moderately intrusive	10 to 20	N, V	NML + 10
Highly intrusive	> 20	N, V	NML + 20
Outside of standard hours (other hours)			
Noticeable	0 to 5	N	NML
Clearly audible	5 to 15	N, V, RO	NML + 5
Moderately intrusive	15 to 25	N, V, PC, SN, RO	NML + 15
Highly intrusive	> 25		NML + 25

(1) Perception relates to the level above the RBL

(2) V = Verification, N = Notification, PC = Phone Calls, RO = Respite offers, IB = Individual Briefings, SN = Specific notifications,

(3) NML = Noise Management Level (refer to section 4.2.1.2), HA = Highly Affected (>75 dBA $L_{eq15min}$ – applies to residences only)

Definitions of the additional construction noise mitigation measures outlined in Table 8.2 are detailed in Table 8.3.

Table 8.3 Description of additional mitigation measures identified

Additional mitigation measures	Description
Notification (letterbox drop or equivalent)	Advanced warning of works and potential disruptions can assist in reducing the impact on the community. The notification may consist of a letterbox drop (or equivalent) detailing work activities, time periods over which these will occur, impacts and mitigation measures. Notification should be a minimum of seven calendar days prior to the start of works. The approval conditions for projects may also specify requirements for notification to the community about works that may impact on them.
Specific notifications (SN)	Specific notifications are letterbox dropped (or equivalent) to identified receivers no later than a week ahead of construction activities that are likely to exceed the applicable noise objectives. The specific notification provides additional information when relevant and informative to more highly affected receivers than covered in general letterbox drops. This form of communication is used to support periodic notifications, or to advise of unscheduled works.

Additional mitigation measures	Description
Phone calls (PC)	Phone calls detailing relevant information made to identified receivers within seven calendar days of the commencement of applicable construction activities. Phone calls provide affected receivers with personalised contact and tailored advice, with the opportunity to provide comments on the proposed work and specific needs. Where the receiver cannot be telephoned then an alternative form of engagement should be used.
Respite offers (RO)	Respite offers should be considered where there are high-noise and vibration-generating activities near identified receivers. As a guide, work should be carried out in continuous blocks that do not exceed three hours each with a minimum respite period of one hour between each block. The actual duration of each block of work and respite should be flexible to accommodate the usage of, and amenity at, nearby receivers. The purpose is to provide receivers with respite from an ongoing impact.
Verification (V)	Verification of noise and vibration levels should be undertaken as part of regular checks of noise levels or following complaints. This verification should include measurement of the background noise level and construction noise.

8.4.1.4 Construction vibration mitigation

Potential cosmetic vibration impacts have been identified during construction at three unoccupied structures.

Management and mitigation measures are proposed as a matter of best practice to minimise the potential for any risk.

Although no heritage impacts are predicted, where items are subsequently identified during future works, further assessment should be undertaken.

It is noted that a heritage item is not automatically classified as vibration sensitive, and the specific vibration sensitivity of each item will require further consideration as design progresses and will be subject to further assessment within the CNVMP.

AVTG provides general guidance for limiting vibration impacts during construction. Relevant recommendations have been reproduced in Table 8.4, and should be considered as appropriate where the potential for vibration impacts has been identified in this report.

Table 8.4 Construction vibration mitigation

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
NV6	Construction vibration	Where construction is likely to result in vibration levels that exceed relevant criteria at sensitive receivers, mitigation and management will be implemented where practicable and appropriate. This will include (but is not limited to) the following measures: — avoid the use of vibration-intensive plant at distances where human discomfort will result — confirm with affected landowners if there are any additional structures within safe working distances of construction — substitute lower vibration-intensive plant and methods (for example use a smaller machine, lower power settings or alternative equipment) — sequence operations to avoid or minimise concurrent vibration intensive activities — schedule the use of vibration-sensitive equipment during the least sensitive times of the day — inform and consult with potentially affected receivers about upcoming vibration-intensive activities.	Detailed design/ pre-construction	All locations where exceedances of the applicable construction vibration criteria are predicted at sensitive receivers
NV7	Heritage vibration impacts	Where additional heritage items are identified during detailed design and / or construction works, potential vibration impacts will be assessed further and suitable mitigation measures adopted if required.	Detailed design/ construction	Any additional heritage item

8.5 Operation

8.5.1 Operational environmental management

8.5.1.1 Transmission line – Corona noise

Based on the predicted potential exceedances from corona noise described in Table 6.1, operational noise mitigation options to reduce potential noise impacts should be investigated at receivers VNI128 and VNI152 which have been identified as potentially marginally impacted. This may include monitoring after the commissioning of the project at the residences where potential operational noise levels are predicted to exceed project trigger levels. In accordance with Npfl methodology outlined in section 2.5.3.5, negligible exceedances do not typically require any mitigation.

Should any at-property treatments be required at receiver VNI128 or VNI152, various guideline documents are available in NSW to advise on appropriate construction methods to facilitate property treatment (for example DPIE's *Development Near Rail Corridors and Busy Roads – Interim Guideline*, TfNSW's *At-Receiver Treatment Guideline*).

Where required, at-property treatments would need to be determined in consultation with the landholder and informed by a detailed building condition survey and final predicted noise levels.

8.5.1.2 Operational mitigation measures

A summary of the proposed operational mitigation measures for the project is presented in Table 8.5.

Table 8.5 Summary of operational noise mitigation measures

Mitigation ID	Impact	Mitigation measure	Timing	Applicable location(s)
NV8	Operational noise	A detailed operational noise assessment will be undertaken based on the final project transmission line route, conductor arrangement and confirmation of any property acquisitions, to confirm potentially noise affected receivers. For each residence where potential operational noise levels are predicted to exceed project trigger levels, noise monitoring to confirm actual operational noise levels would be carried out: — at representative locations within six months of the commencement of operation; and — at the request of the landowner of the residence at any time within 2 years after the commencement of operation. The noise monitoring will occur during weather/atmospheric conditions conducive to generating the corona effect. For residences where the monitoring identifies corona discharge noise levels above 35 dB(A) $L_{Aeq, 15min}$ (including potential NPfI corrections where applicable) at the reasonably most affected point of the residence, consultation will be undertaken with the landowner of the affected residence to identify solutions. Once the appropriate solutions have been agreed with the landowner, these will be implemented within 12 months.	Detailed design/ operation	VNI128 and VNI152

8.6 Cumulative impact mitigation

The management of identified cumulative noise impacts will require coordination between these identified projects. These may occur if concurrent or consecutive noisy construction activities occur. The management and mitigation measures are outlined in Chapter 24 (Cumulative impacts) of the EIS to reduce the extent of identified cumulative impacts. Coordination and engagement with proponents and/or construction contractors of relevant future projects will occur during detailed design and construction to confirm the potential cumulative impacts and timing of activities that have potential cumulative impacts. The relevant future projects to be considered for cumulative noise impacts are:

- VNI West (Victoria)
- EnergyConnect (NSW – Eastern section)
- HumeLink
- Dinawan Solar Farm
- Dinawan Wind Farm – East
- Yanco Delta Wind Farm
- Belhaven BESS
- Livingstone Solar Farm.

8.7 Effectiveness of mitigation measures

8.7.1 Construction

The adoption of the recommended standard noise mitigation measures during construction activities will reduce the severity and minimise the impact of the predicted construction noise. Additional construction noise mitigation may be required where residual noise impacts remain, as outlined in section 8.4.1.3, and where implemented, should mitigate any remaining construction noise impacts. Further detail of required mitigation measures would be confirmed in the CNVMP.

Land use planning measures such as locating high noise activities behind noise barriers such as stockpiles from receivers is the most preferable form of noise mitigation and will provide the most benefit. The viability of this mitigation would be confirmed in the CNVMP.

The implementation of noise controls on equipment, including regular maintenance, the use of broadband reversing beepers (or alternatives), lower noise plant or temporary screening will reduce the generation and transmission of noise to potentially affected receivers.

Planning and scheduling measures, including the provision of respite periods, particularly during drone or helicopter operations (if required) and high quality communication and complaints investigation will reduce the severity of impacts and annoyance during high noise periods.

The implementation of the recommended construction vibration mitigation measures is expected to mitigate all predicted construction vibration impacts.

8.7.2 Operation

During periods of wet weather, negligible noise impacts have been predicted to occur as a result of corona noise. Operational noise monitoring of coronal noise, and subsequent implementation of at receiver acoustic treatments, where required, is expected to be the only feasible noise mitigation method to reduce these impacts. Where these are required and effectively installed, internal noise levels are expected to be acceptable.

9 References

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- Department of Environment and Climate Change, 2009, *Interim Construction Noise Guideline* (ICNG).
- Department of Planning and Environment, 2022, *Cumulative Impact Assessment Guidelines for State Significant Projects*.
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- German Standard DIN 4150-3: *Structural Vibration - effects of vibration on structures*.
- Navin Officer (2025a) *Technical paper 2 – Aboriginal cultural heritage assessment*.
- Navin Officer (2025b) *Technical paper 11 – Historic heritage*.
- NSW Environmental Protection Authority, 2017, *Noise Policy for Industry* (NPII).
- Roads and Maritime, 2016, *Construction Noise and Vibration Guideline*.
- Roads and Traffic Authority, 2001, *Environmental Noise Management Manual* (ENMM).
- SLR (2023) *HumeLink – Technical Report 9 – Noise and Vibration*.
- Transgrid, 2021. *Environmental Handbook*.
- Transport for NSW, 2023, *Construction Noise and Vibration Guideline - Roads* (CNVG-R).
- WSP (2021) *EnergyConnect (NSW – Eastern Section) – Technical Report 8 – Noise and vibration impact assessment*.
- WSP (2025b) *Technical paper 8 – Traffic and transport impact assessment*.
- WSP (2025b) *Technical paper 15 – Air quality impact assessment*.

10 Limitations statement

This Report is provided by WSP Australia Pty Limited (*WSP*) for Transgrid (*Client*) in response to specific instructions from the Client and in accordance with WSP's proposal and agreement with the Client (*Agreement*).

10.1 Permitted purpose

This Report is provided by WSP for the purpose described in the Agreement and no responsibility is accepted by WSP for the use of the Report in whole or in part, for any other purpose (*Permitted Purpose*).

10.2 Qualifications and assumptions

The services undertaken by WSP in preparing this Report were limited to those specifically detailed in the Report and are subject to the scope, qualifications, assumptions and limitations set out in the Report or otherwise communicated to the Client.

Except as otherwise stated in the Report and to the extent that statements, opinions, facts, conclusion and/or recommendations in the Report (*Conclusions*) are based in whole or in part on information provided by the Client and other parties identified in the report (*Information*), those Conclusions are based on assumptions by WSP of the reliability, adequacy, accuracy and completeness of the Information and have not been verified. WSP accepts no responsibility for the Information.

WSP has prepared the Report without regard to any special interest of any person other than the Client when undertaking the services described in the Agreement or in preparing the Report.

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Appendix A

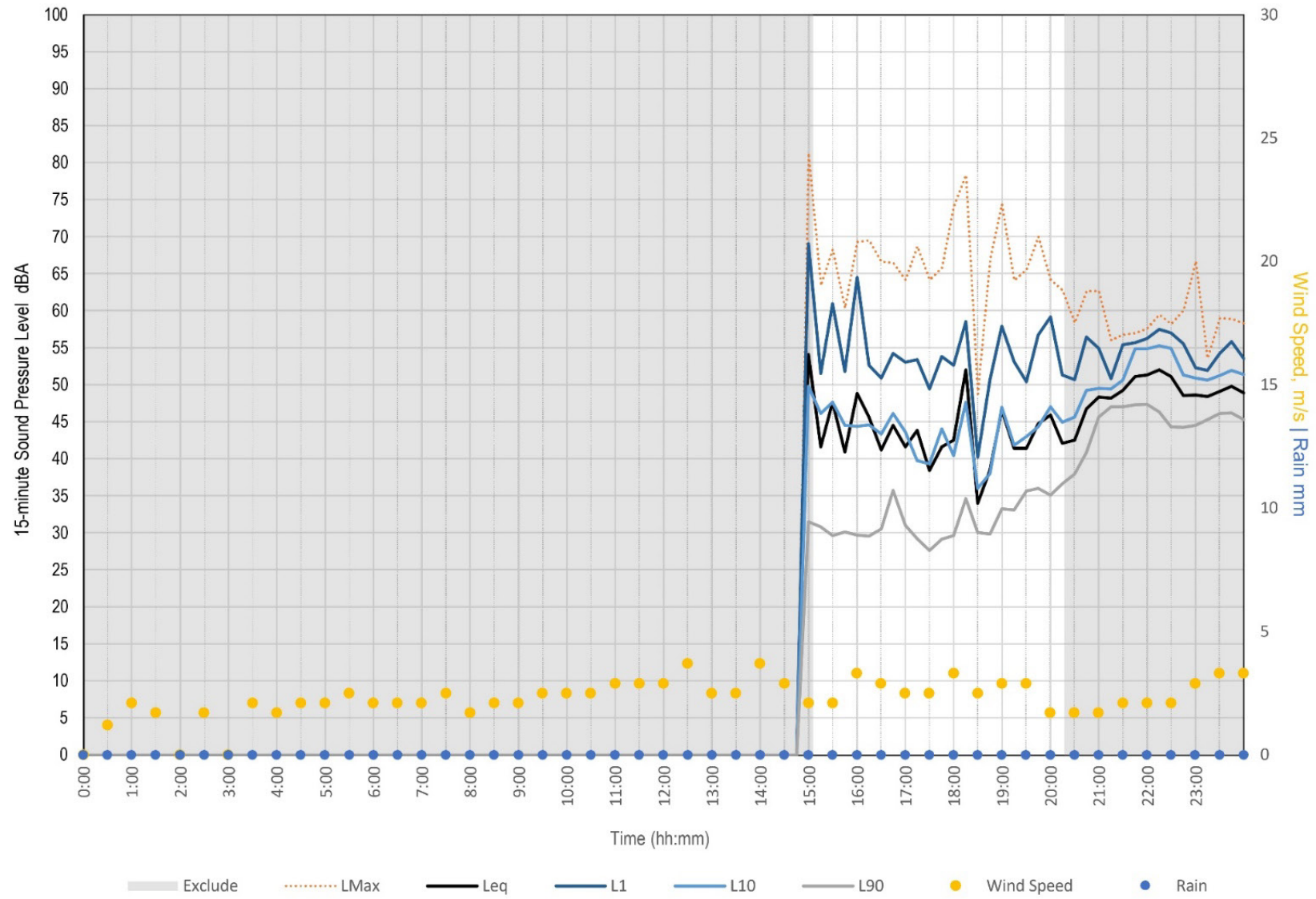
Existing environment – additional information



A1 Detailed noise monitoring results

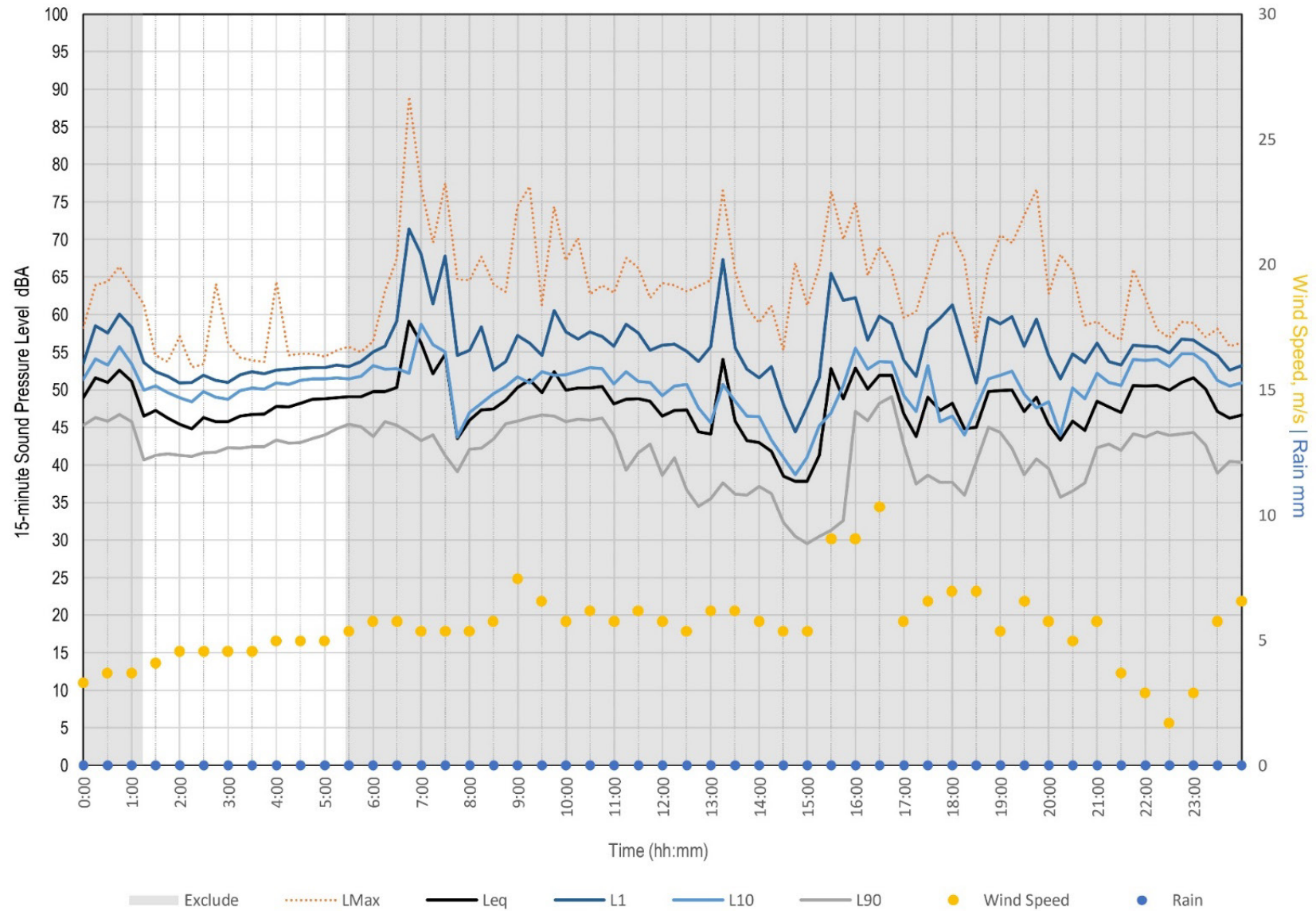
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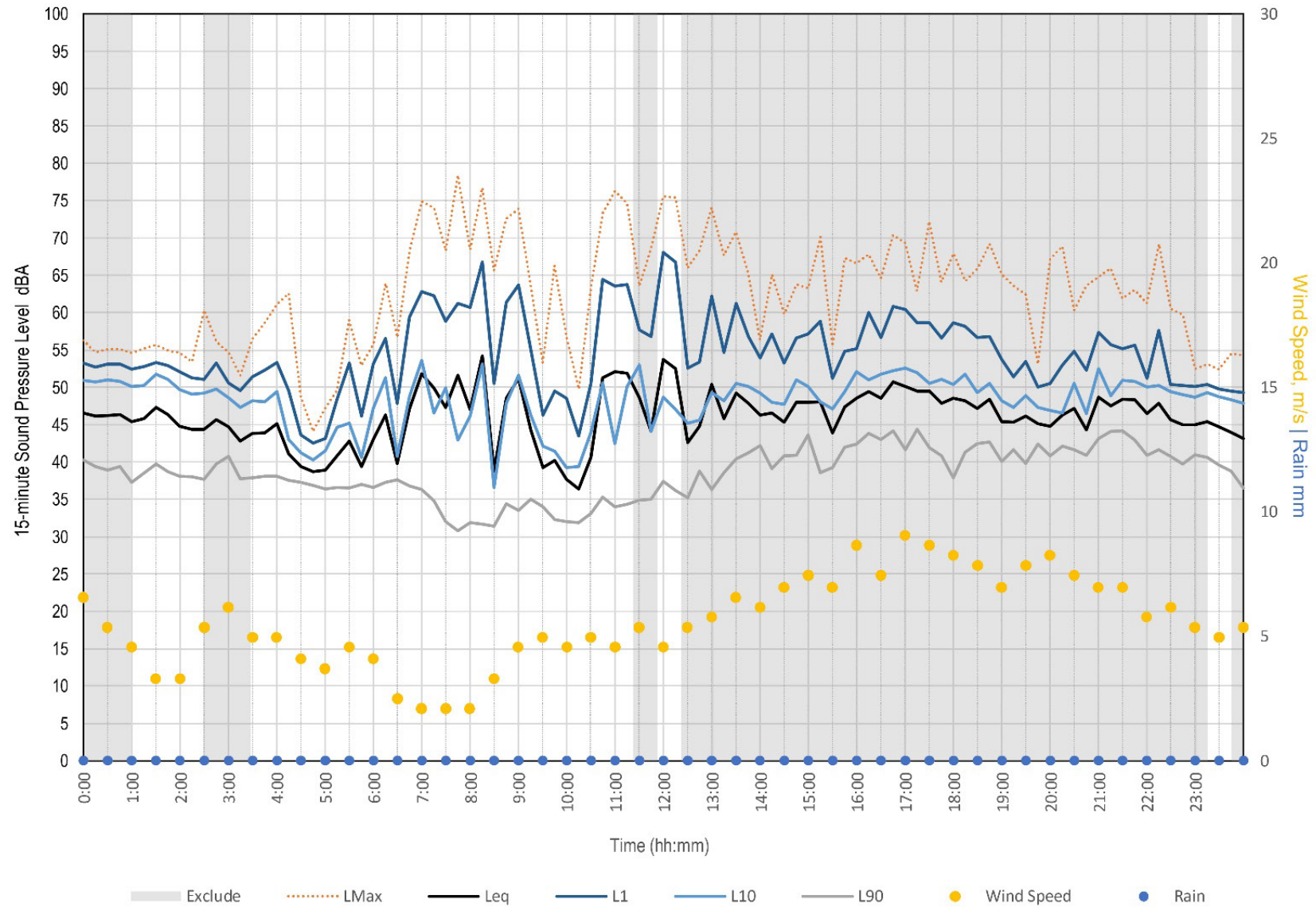
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Thursday, 13 February 2025



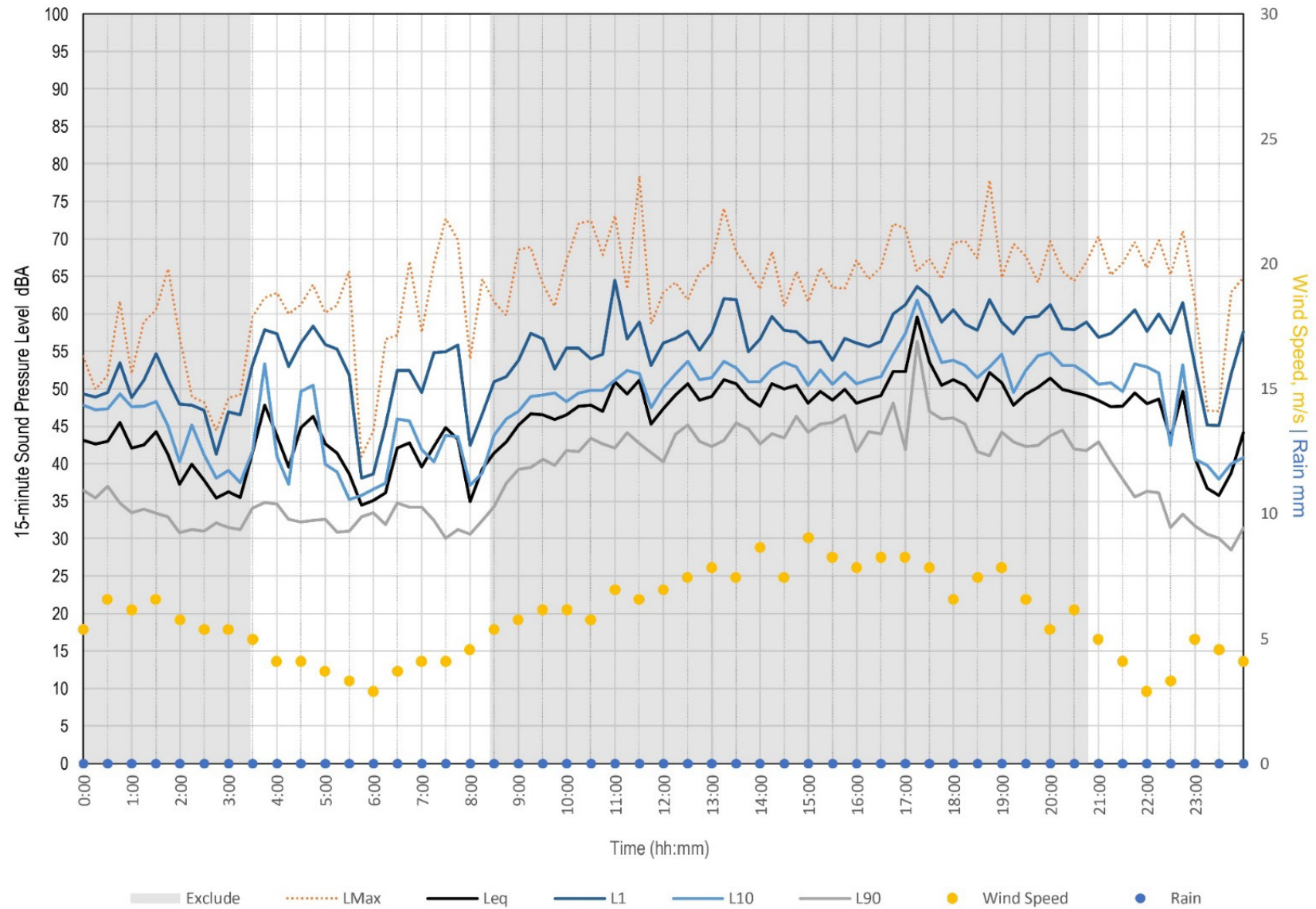
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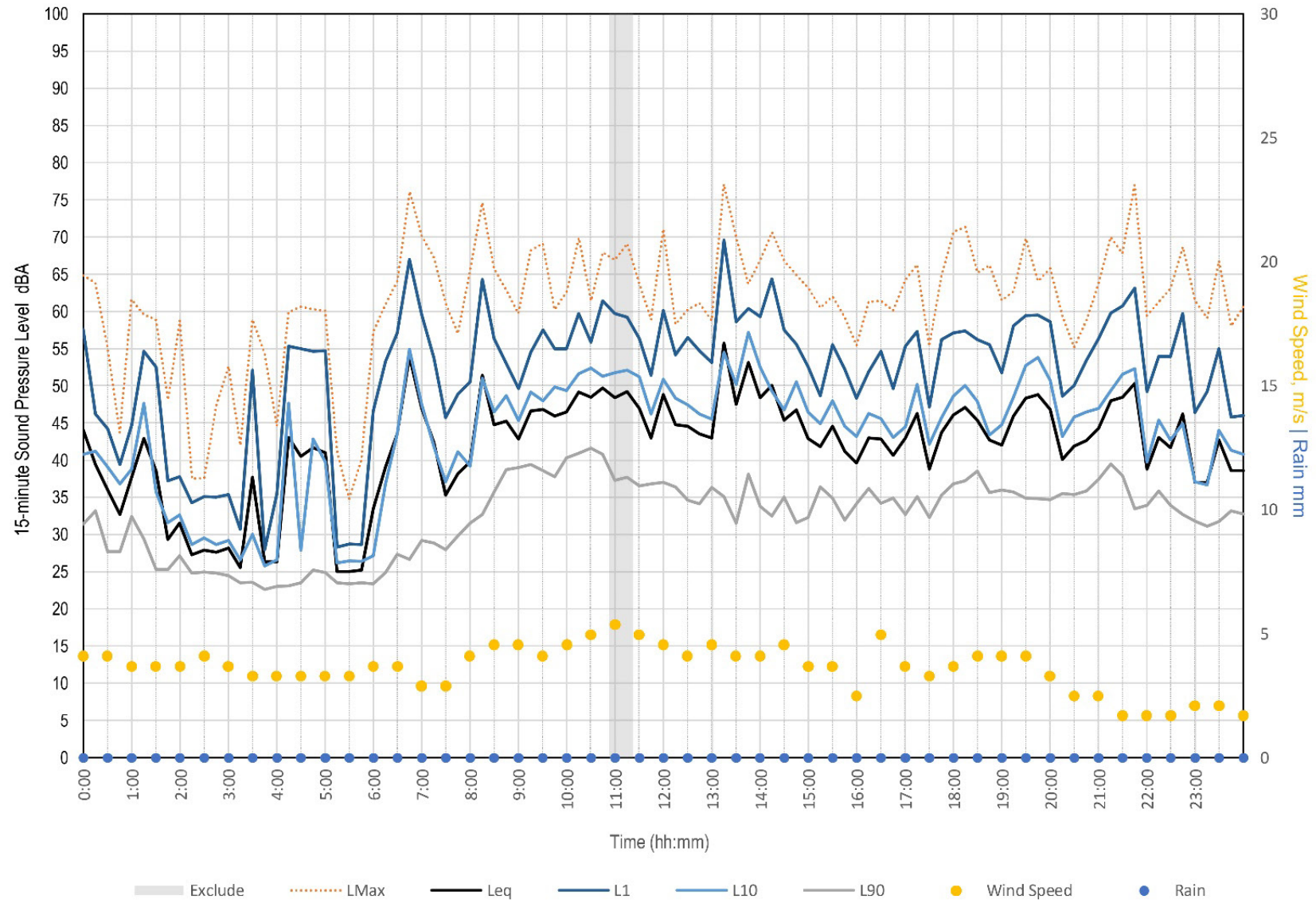
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Saturday, 15 February 2025



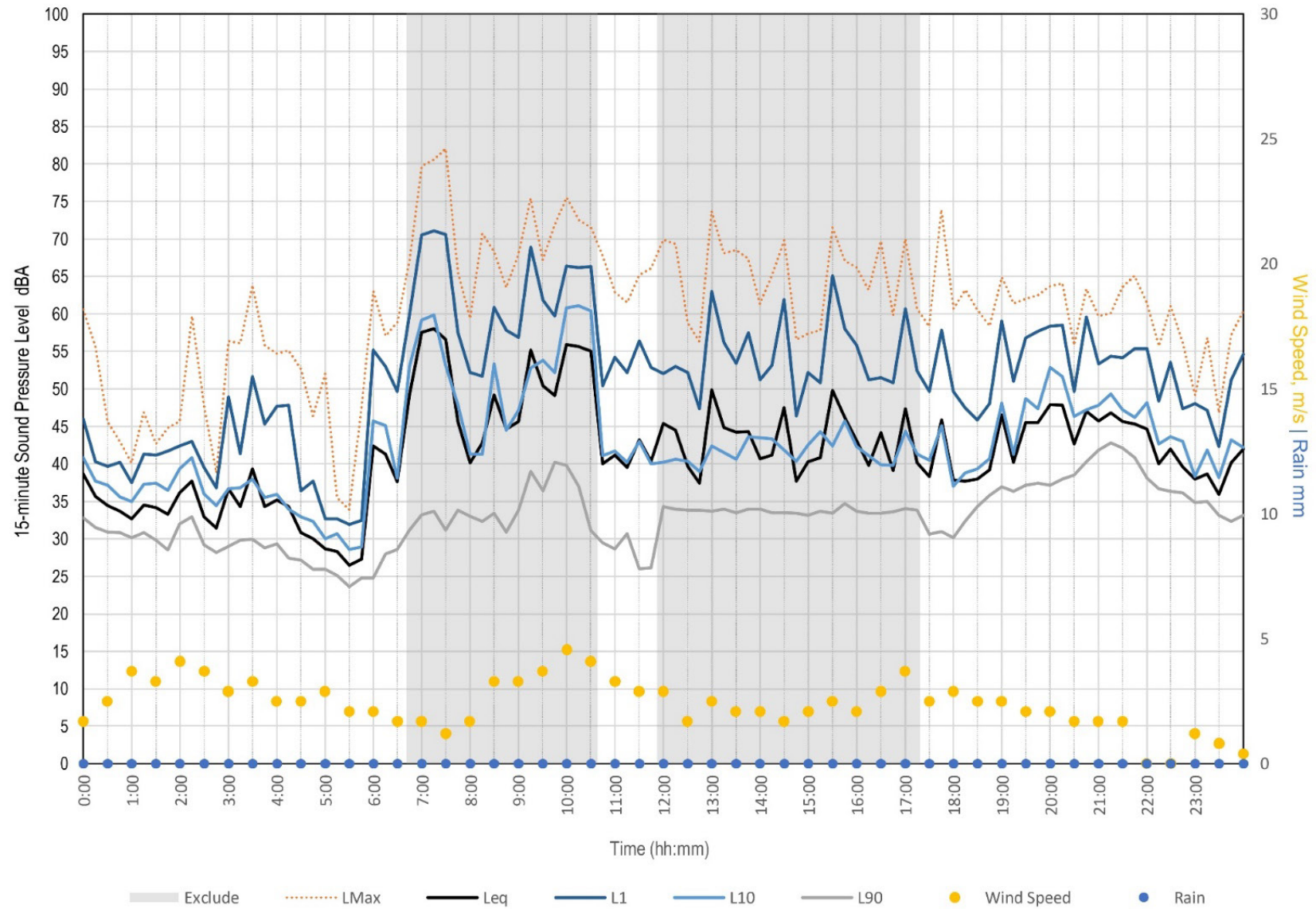
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Sunday, 16 February 2025



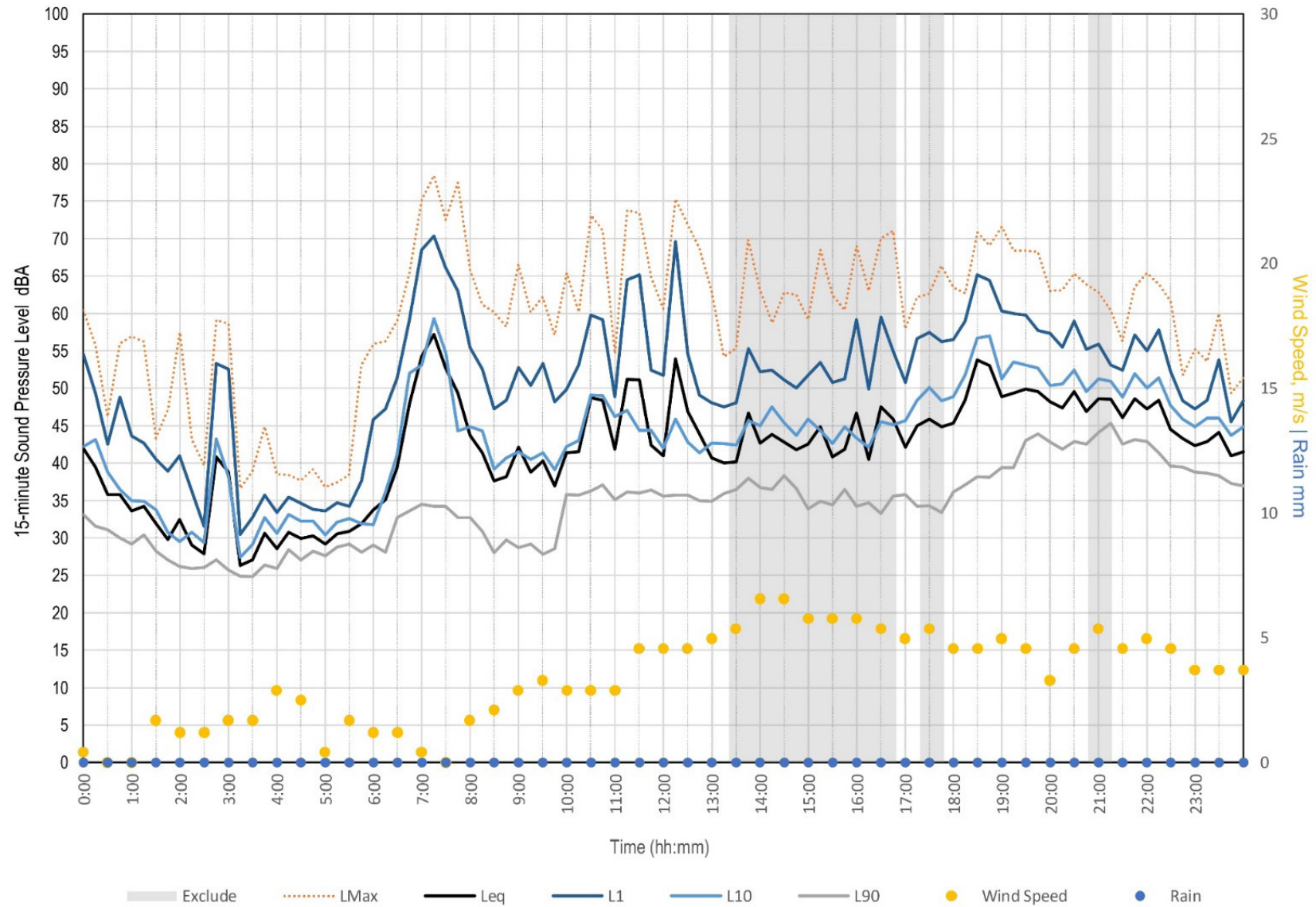
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Monday, 17 February 2025



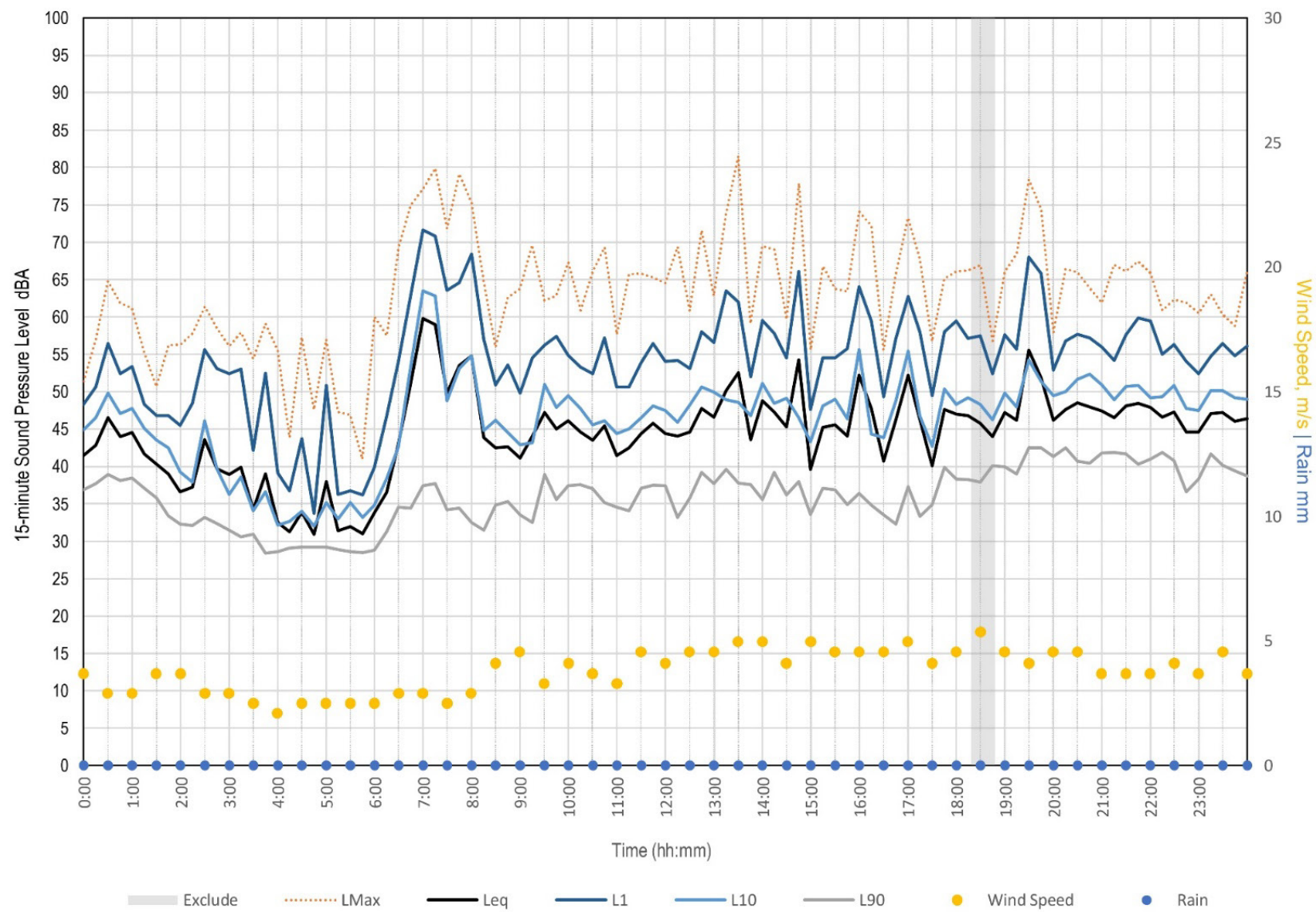
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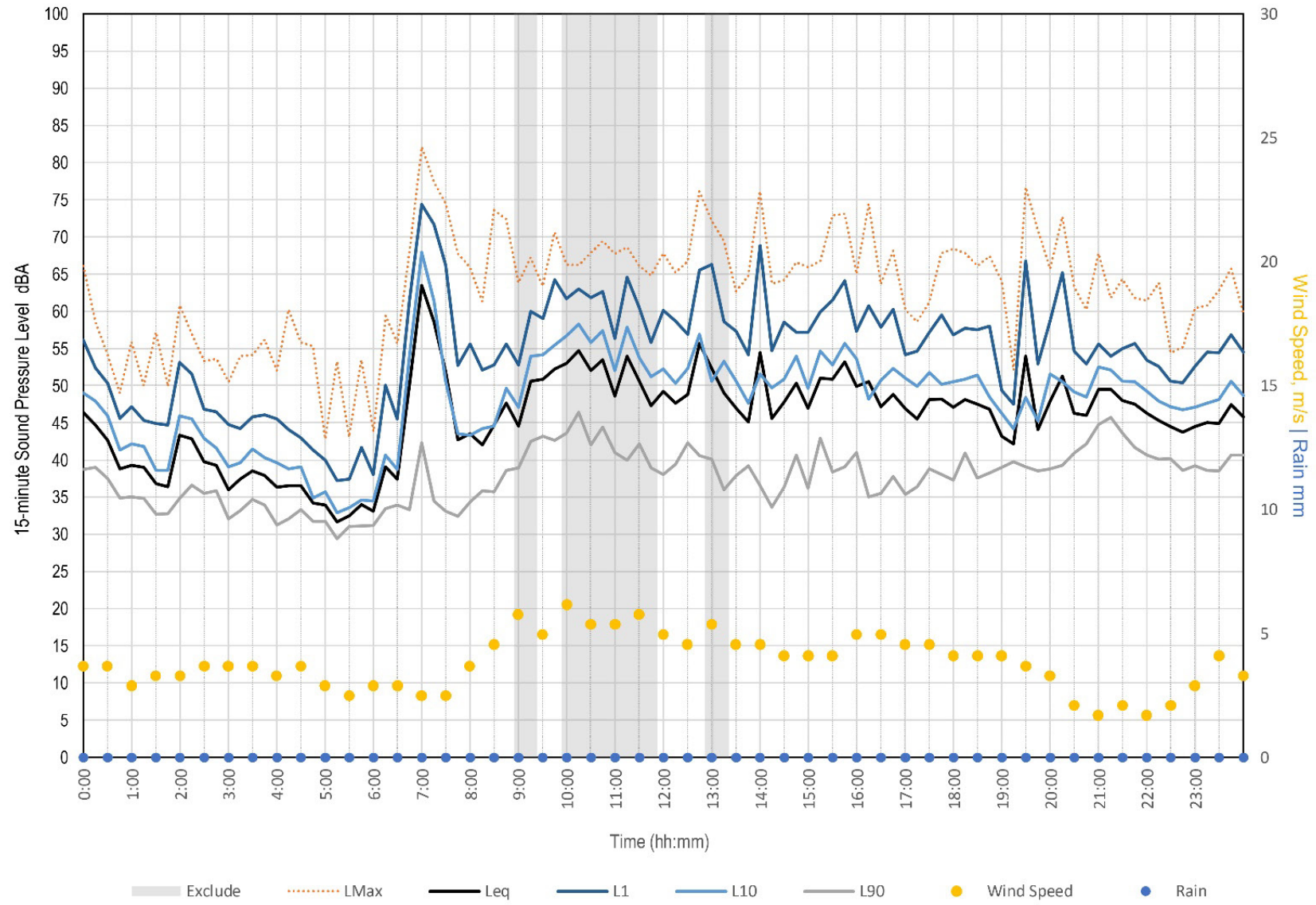
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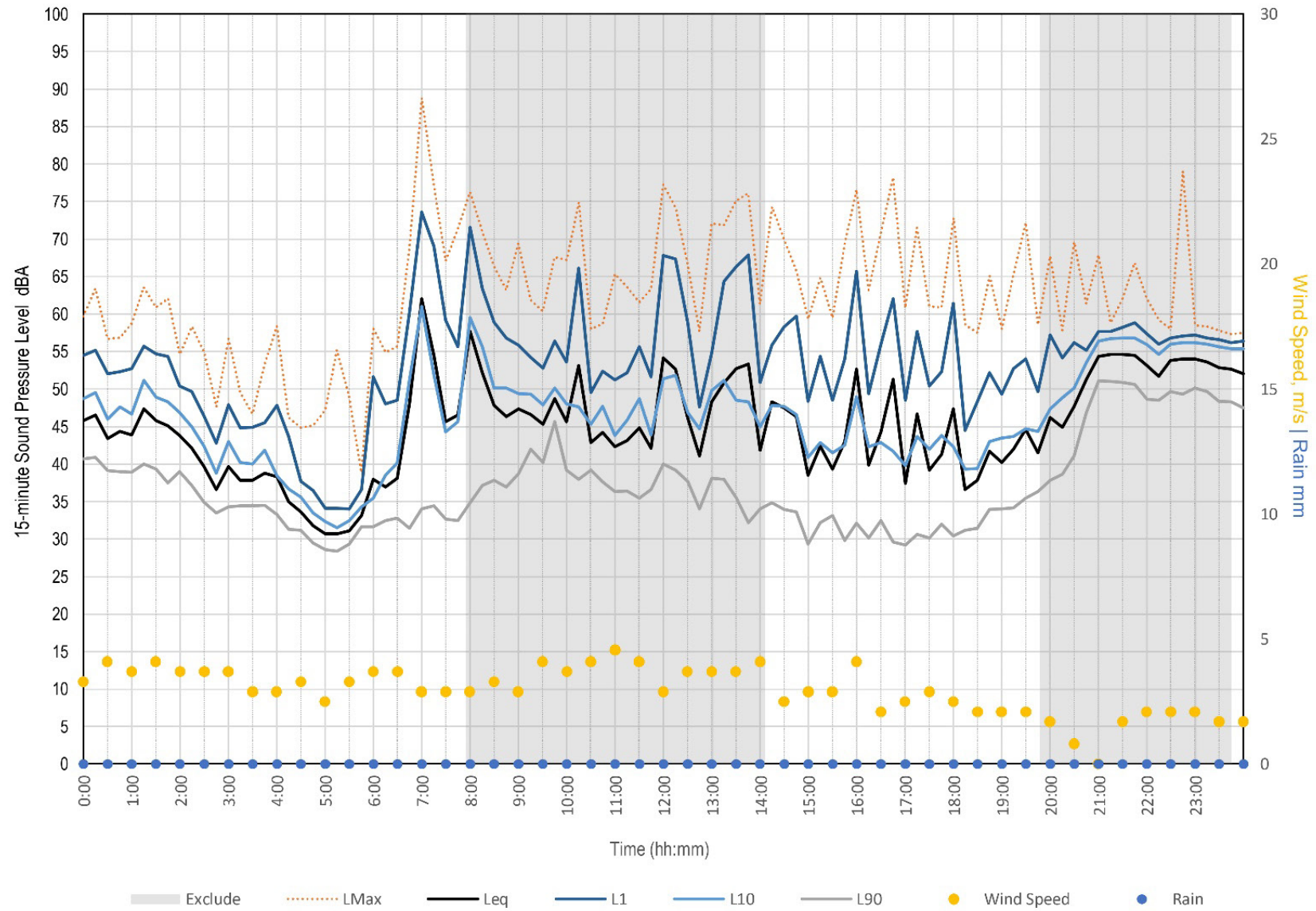
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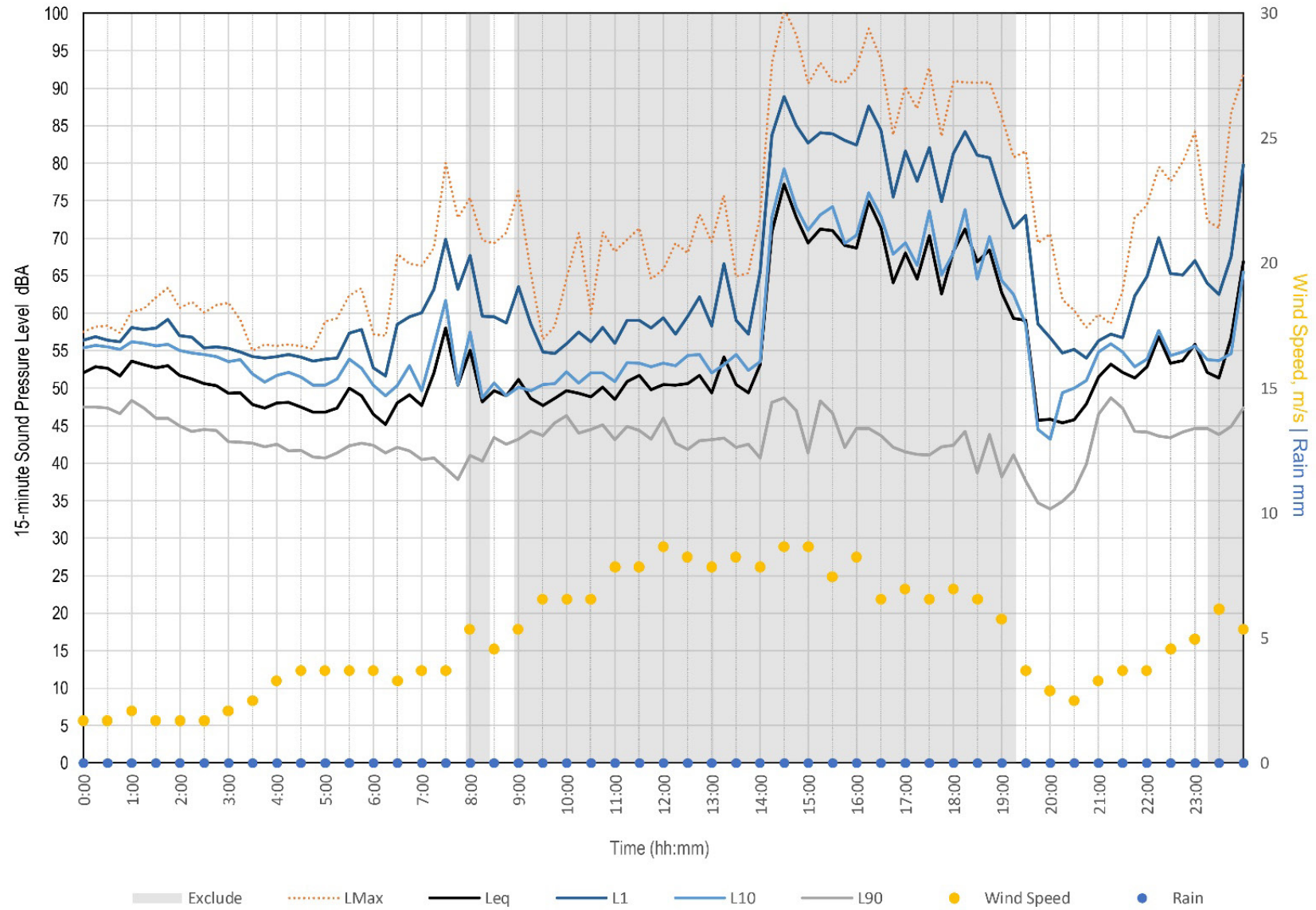
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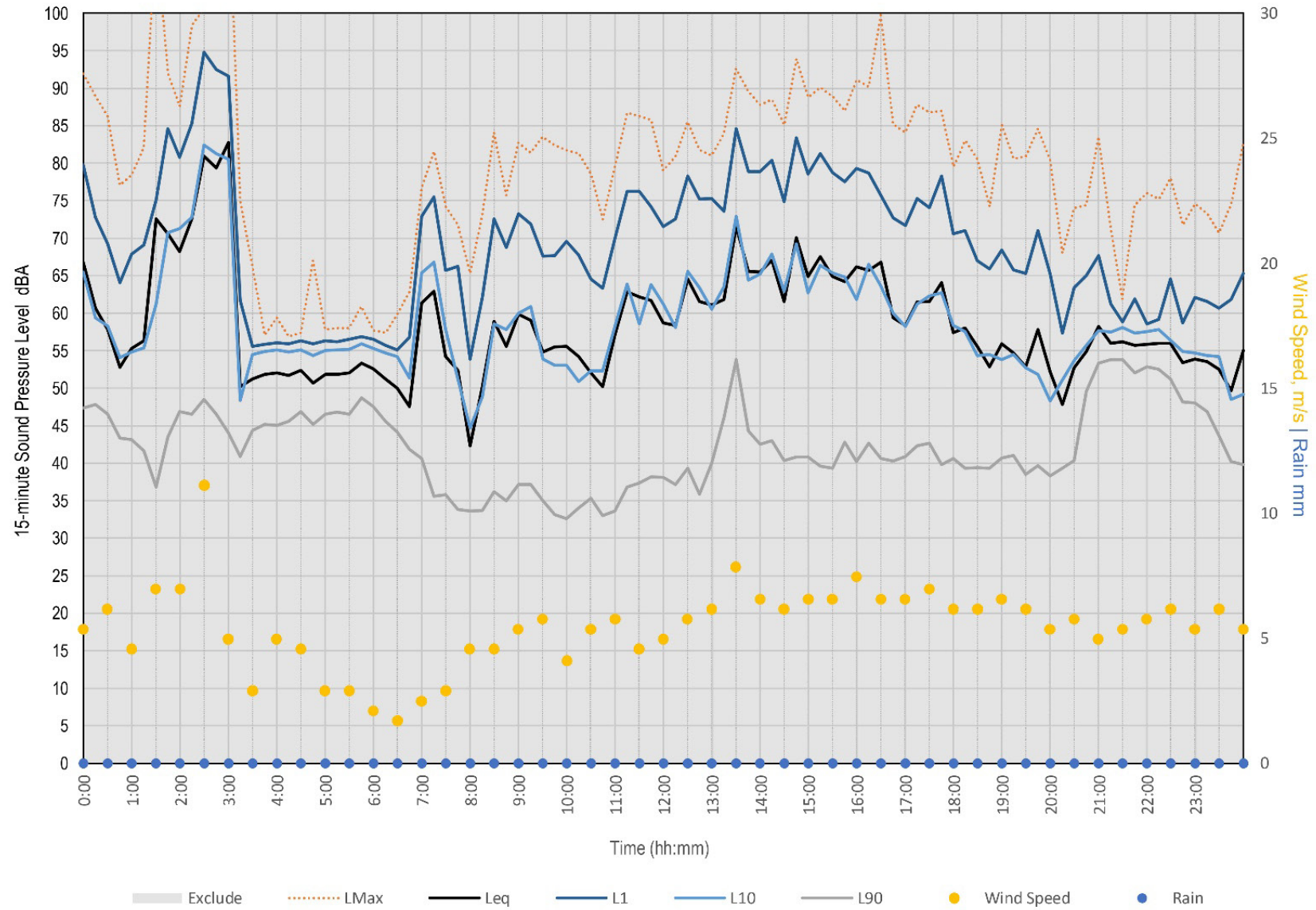
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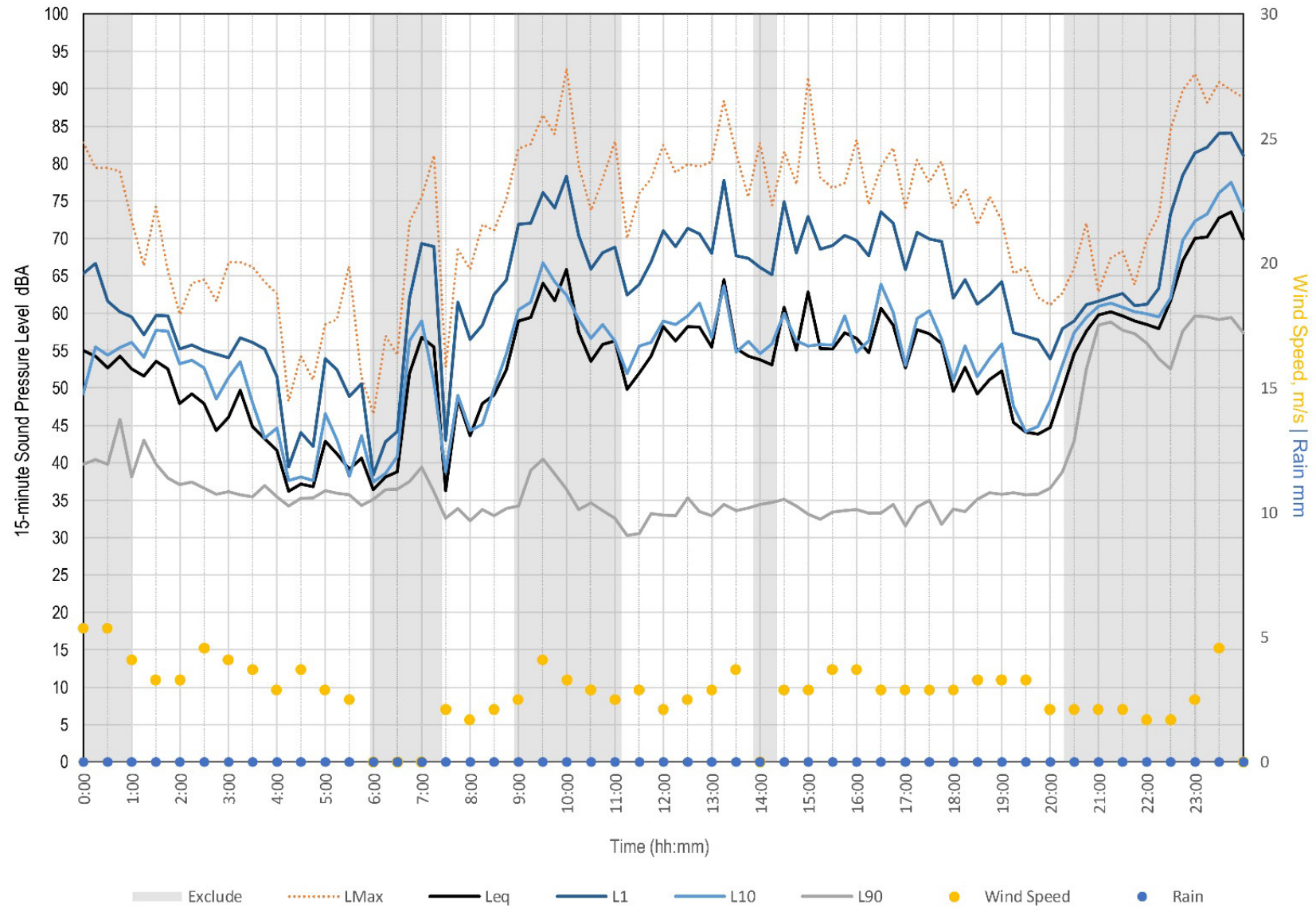
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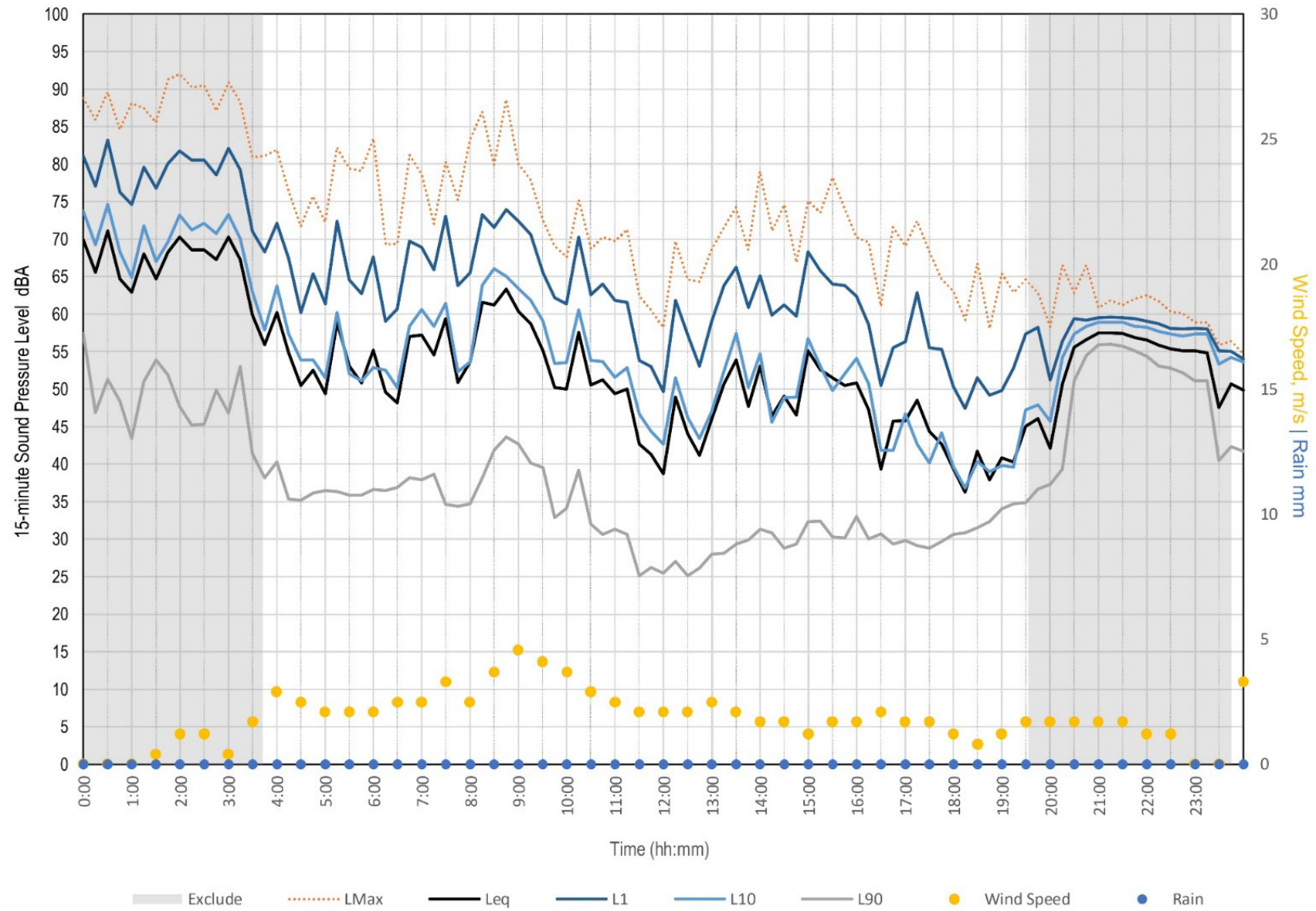
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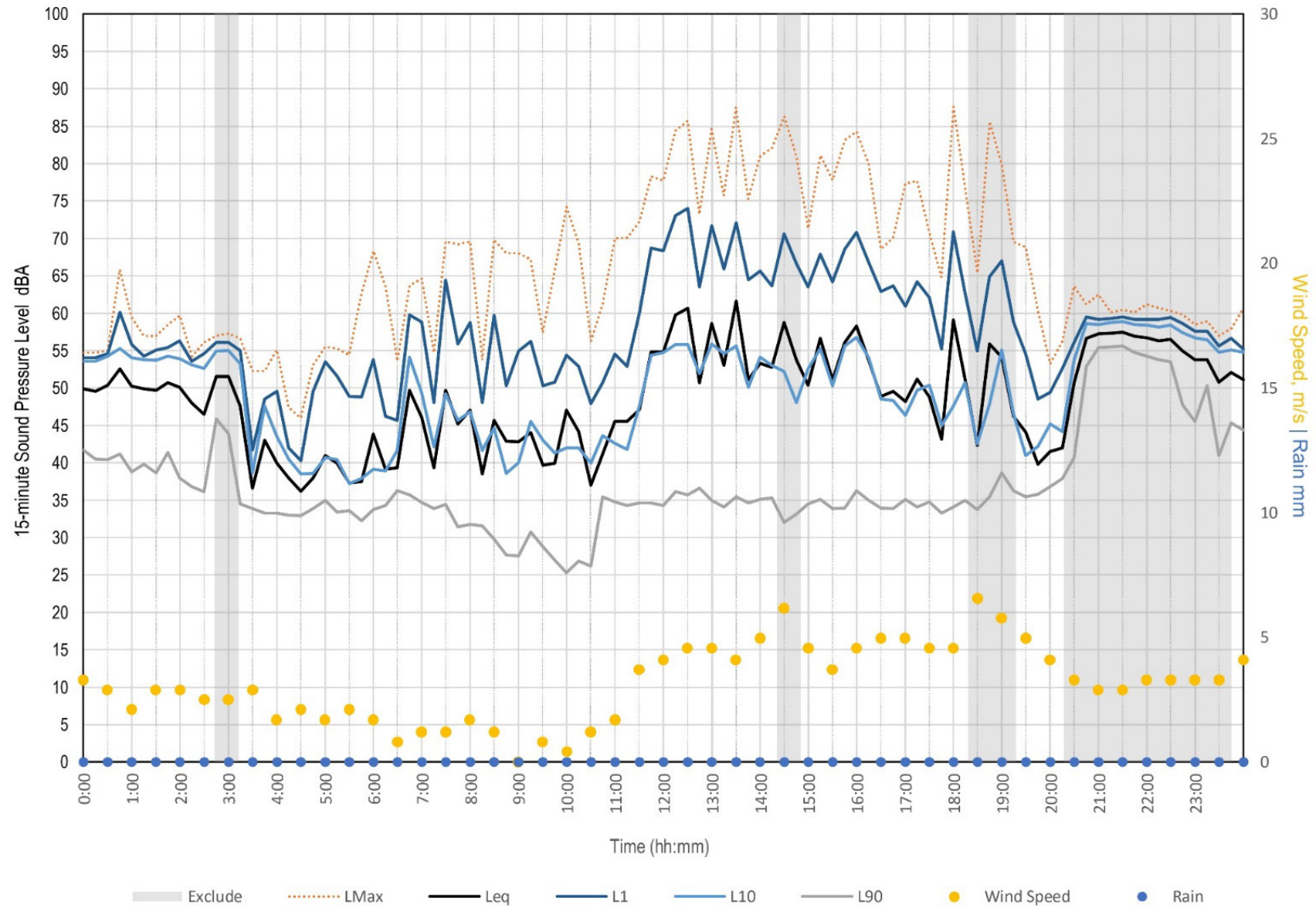
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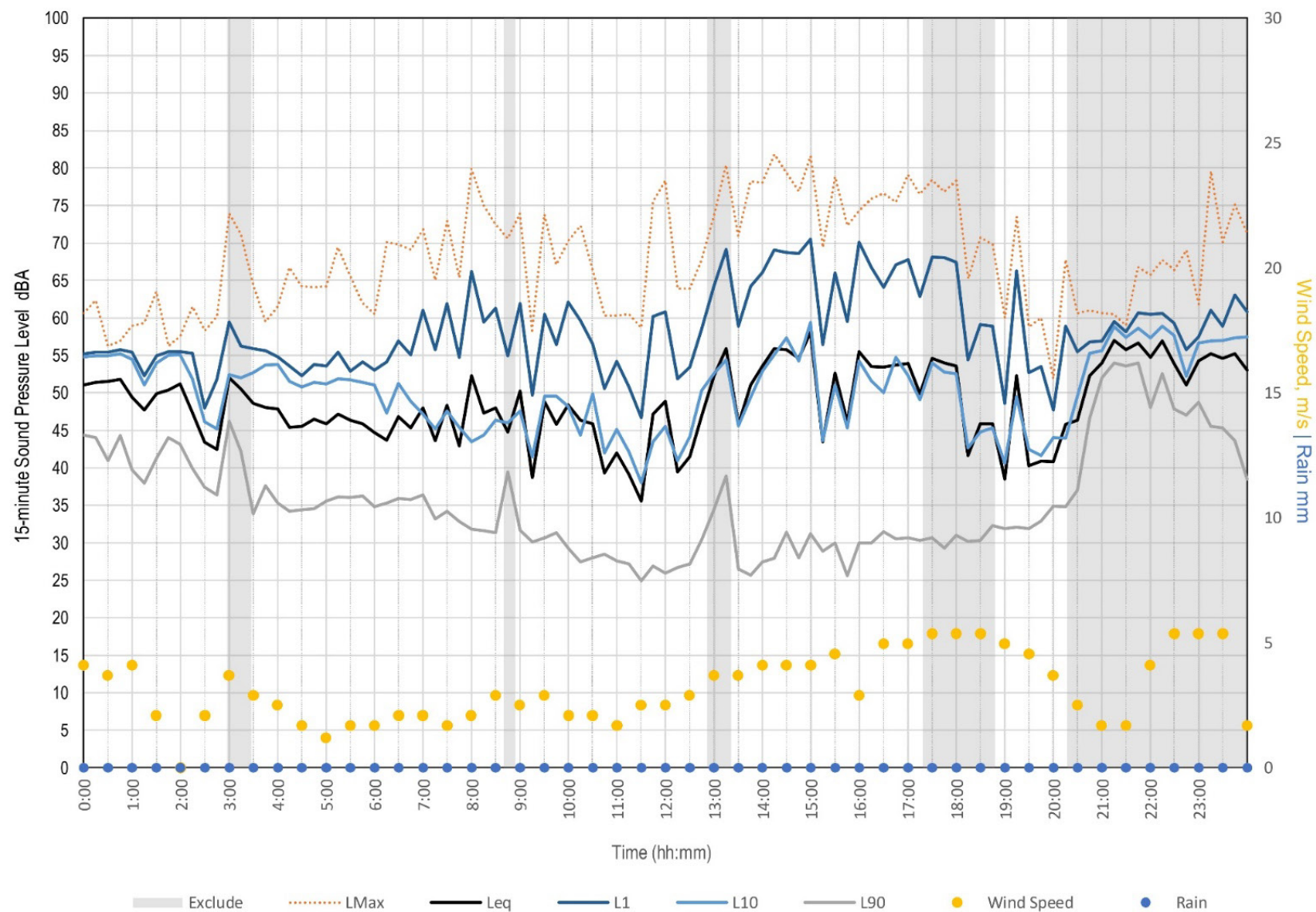
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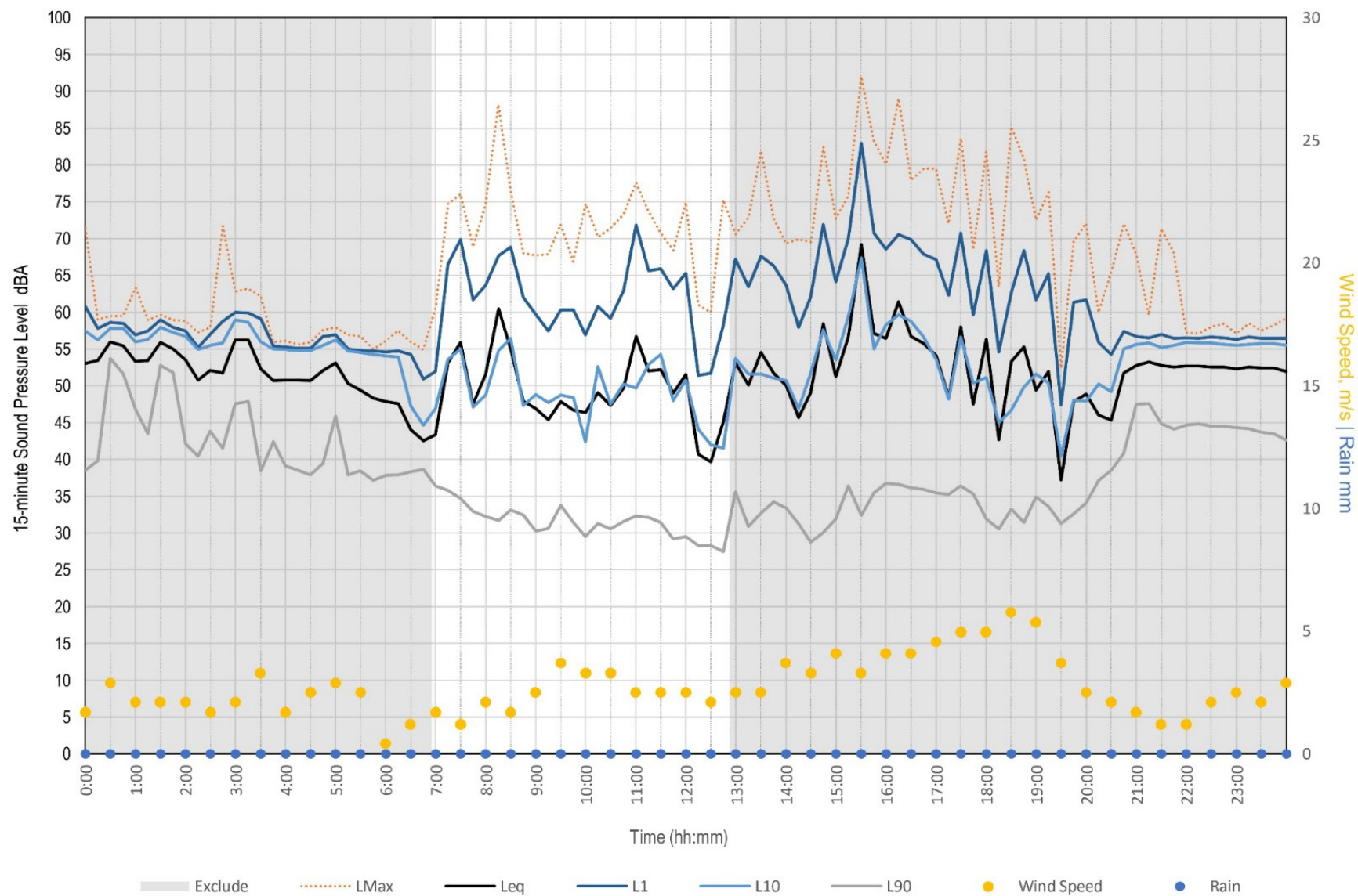
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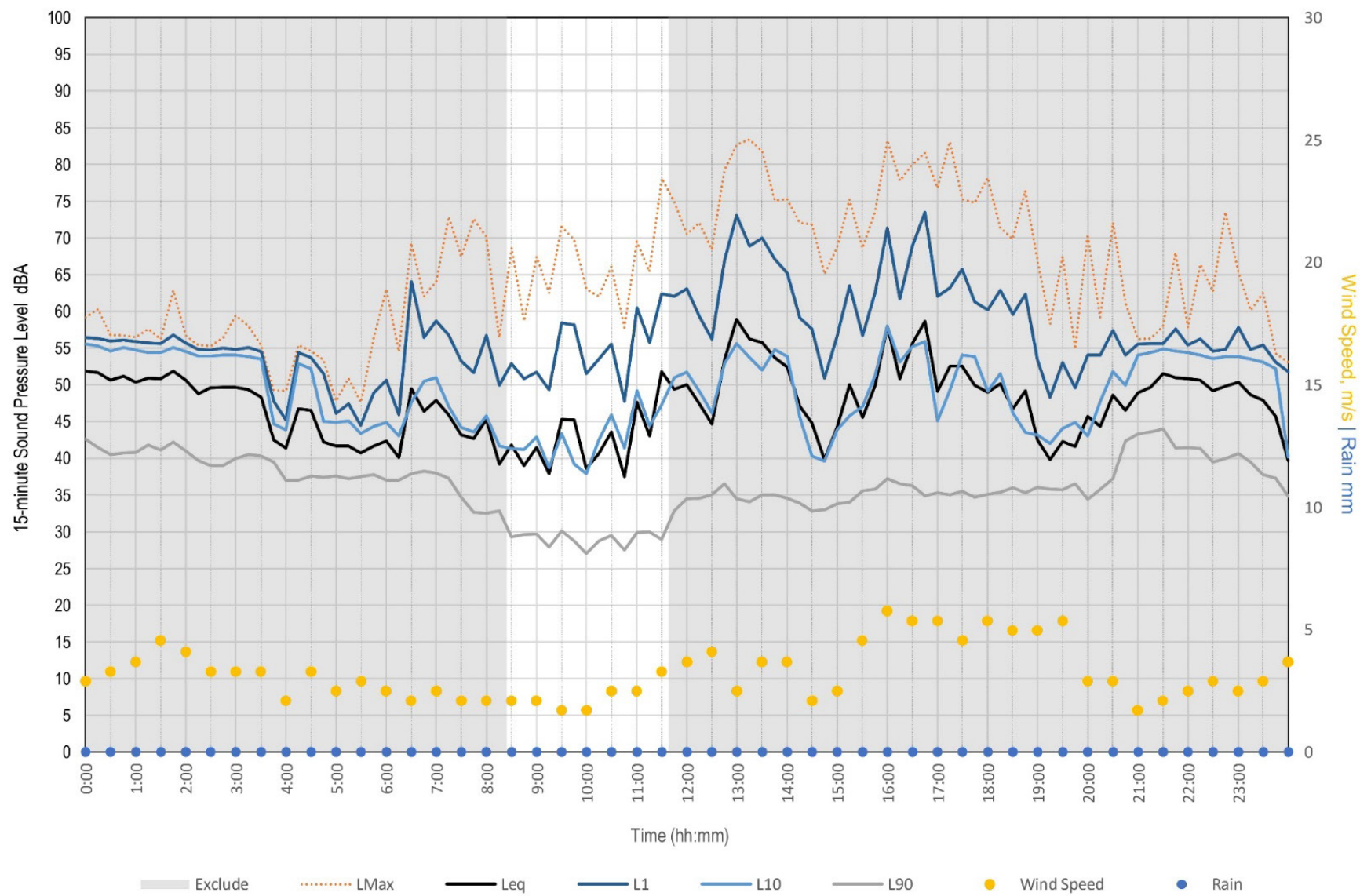
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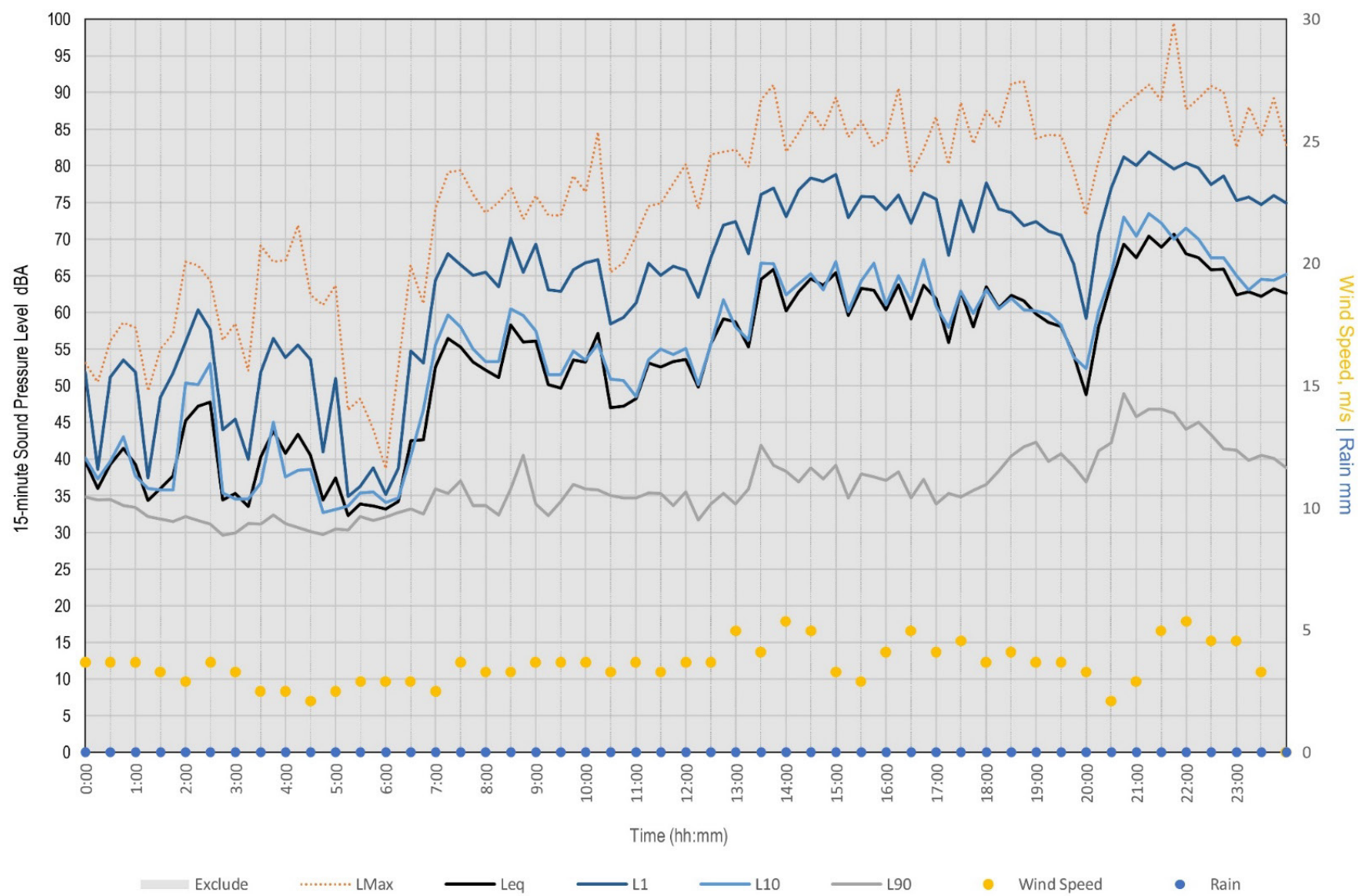
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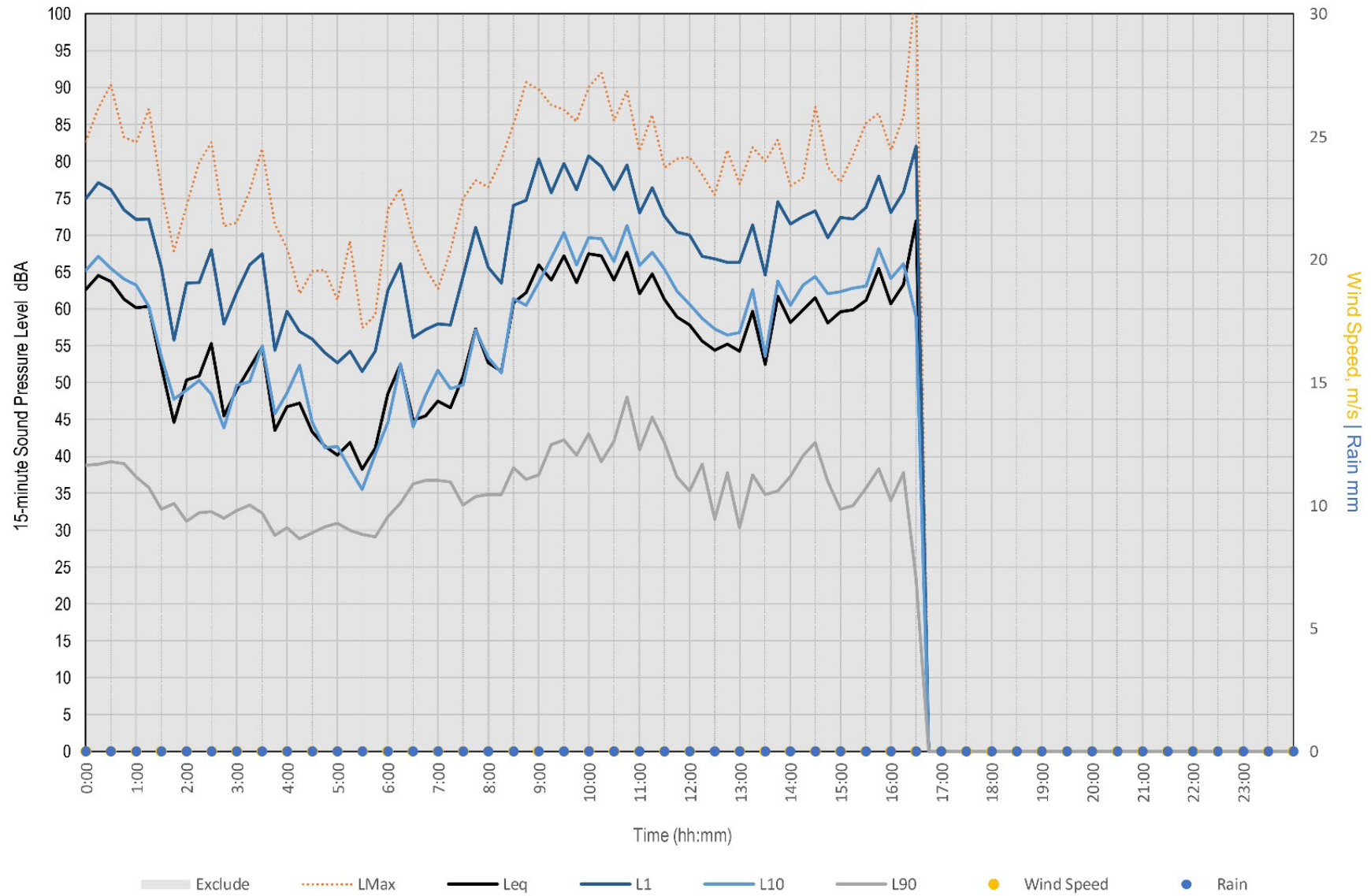
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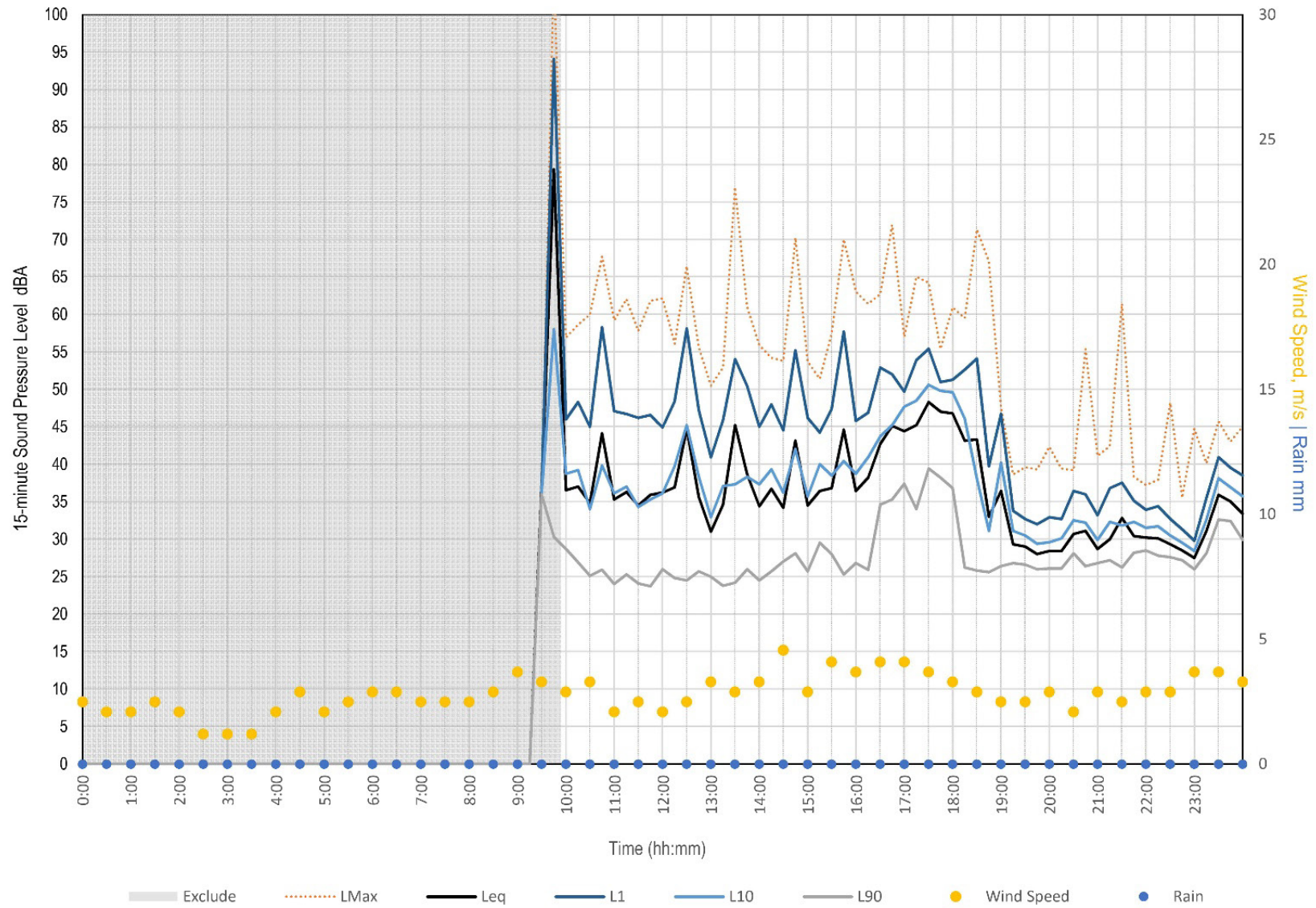
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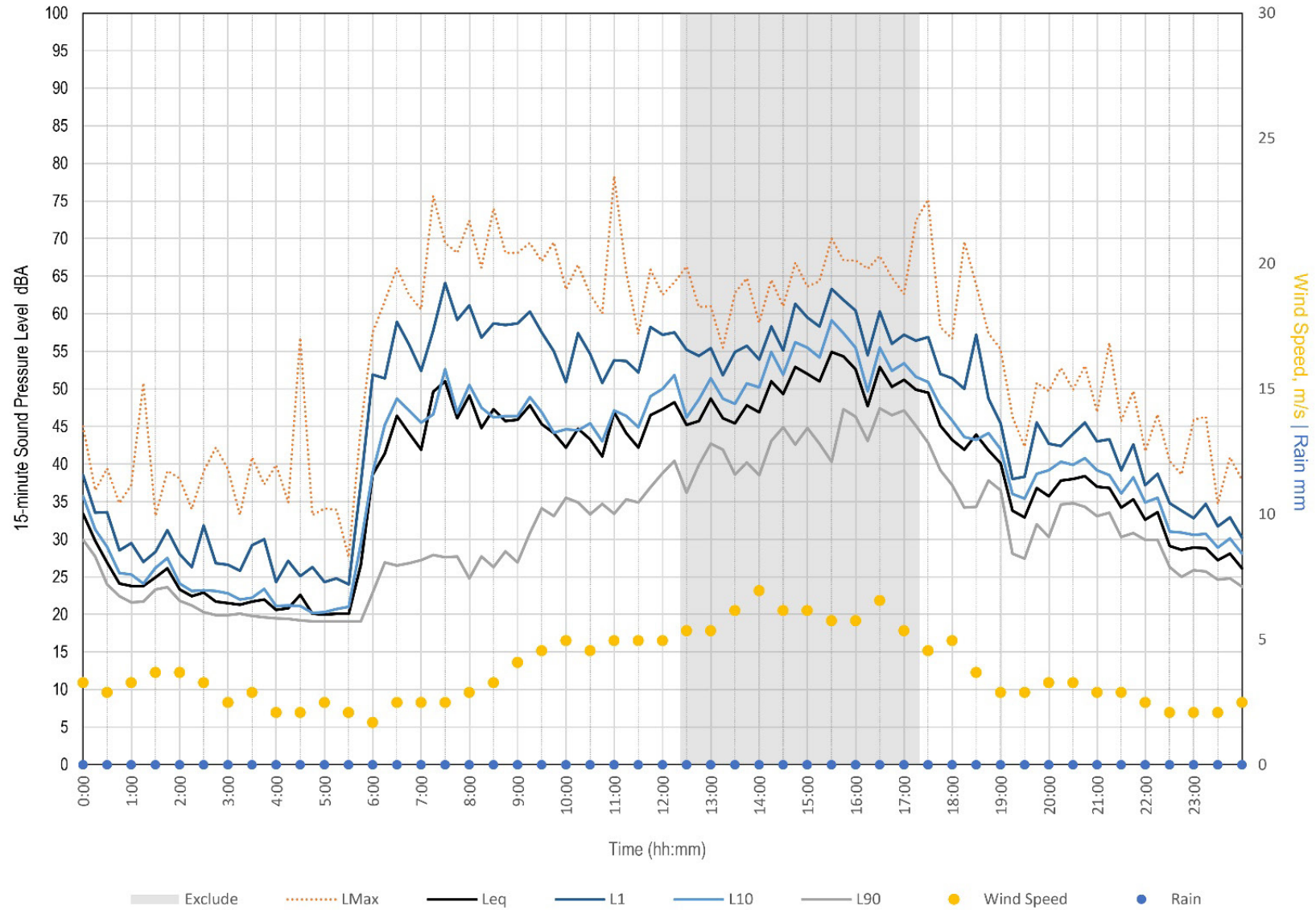
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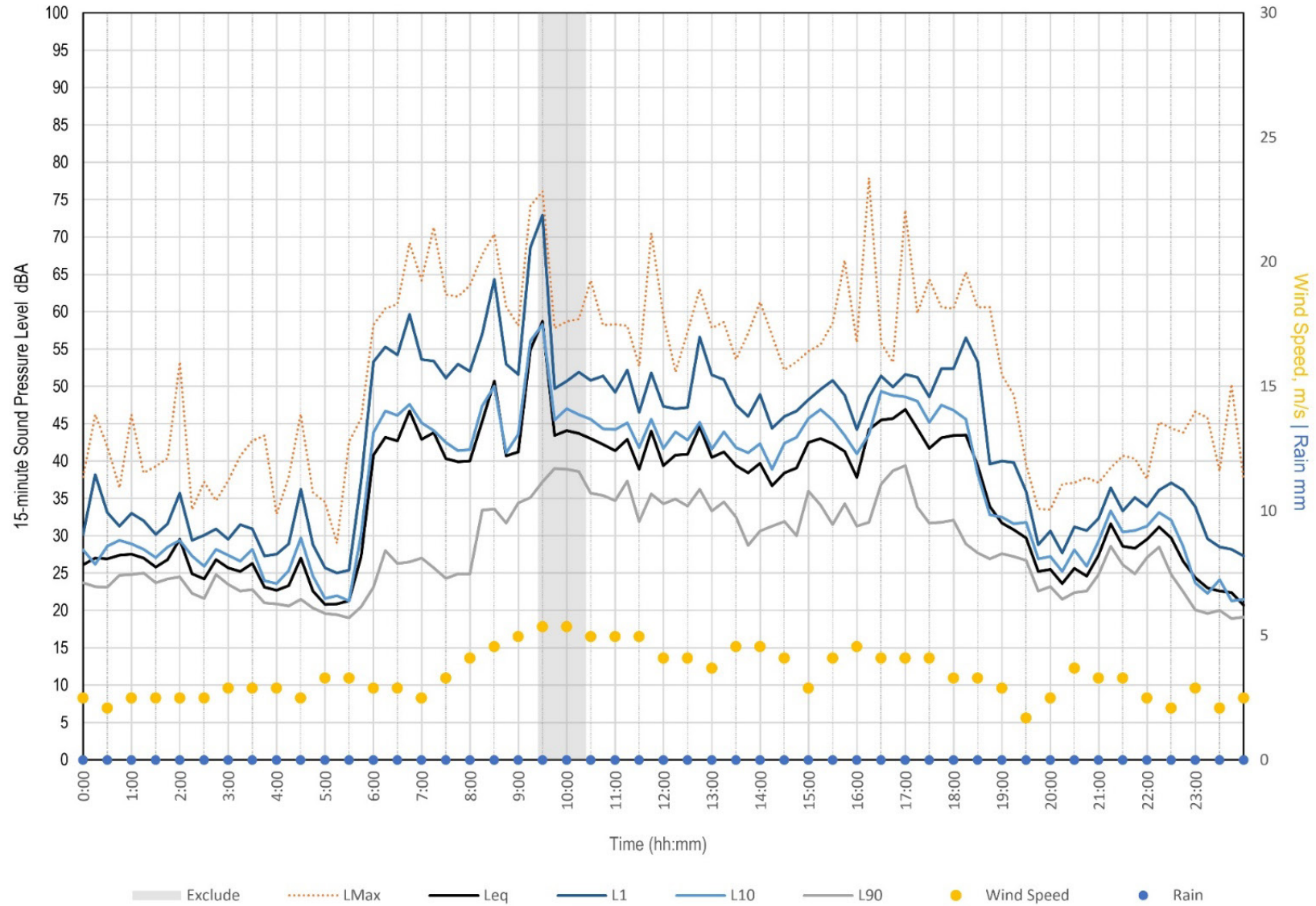
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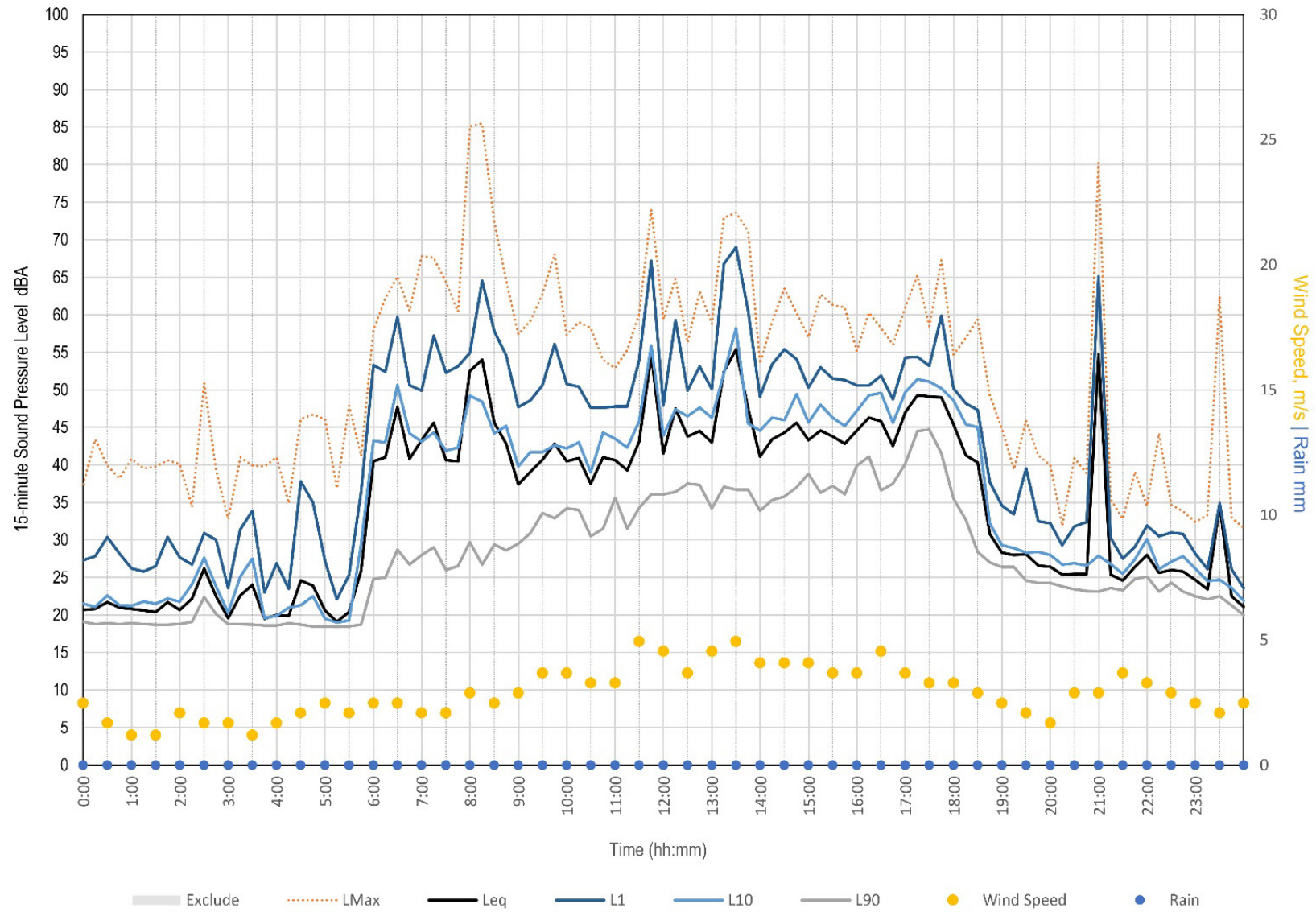
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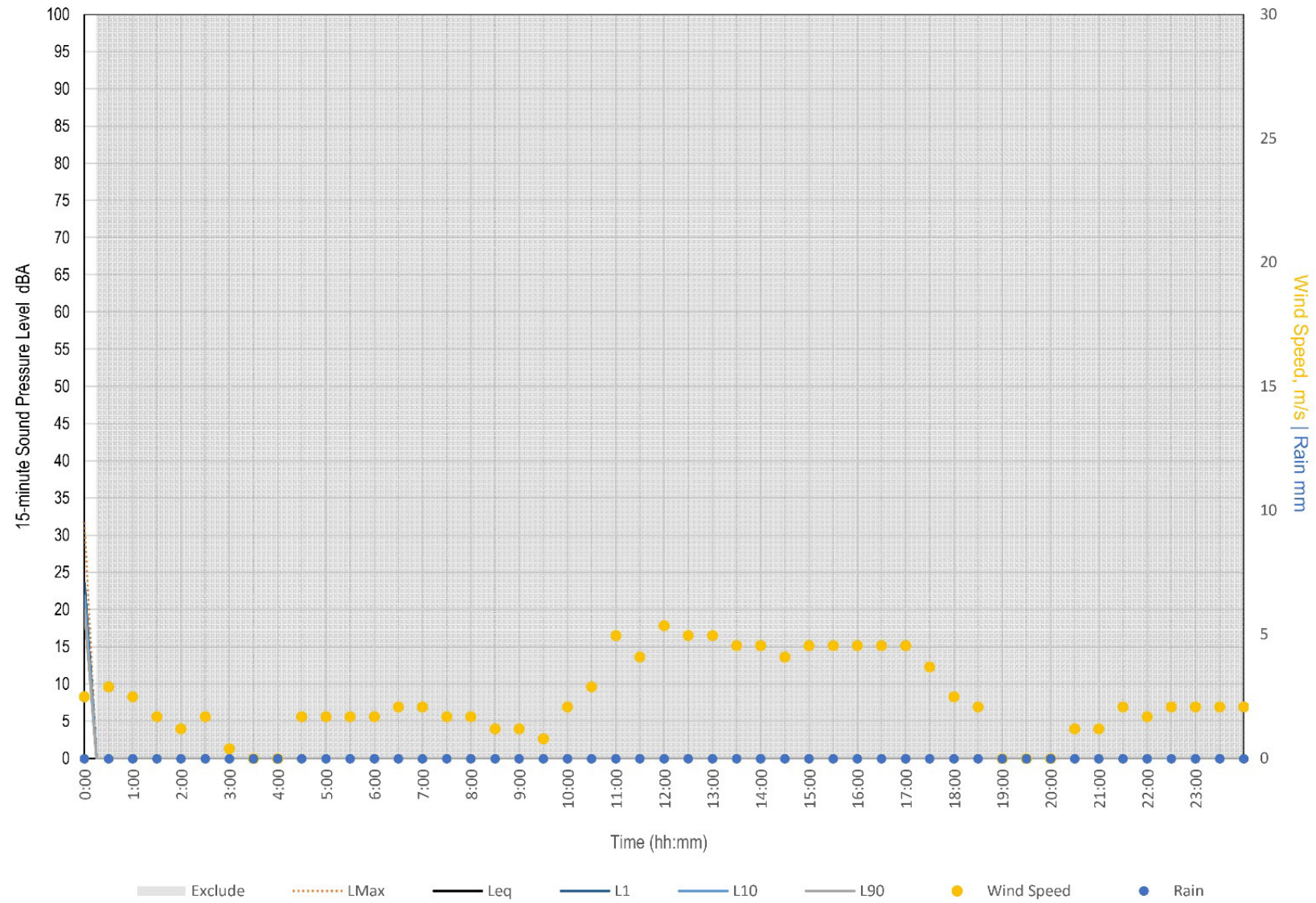
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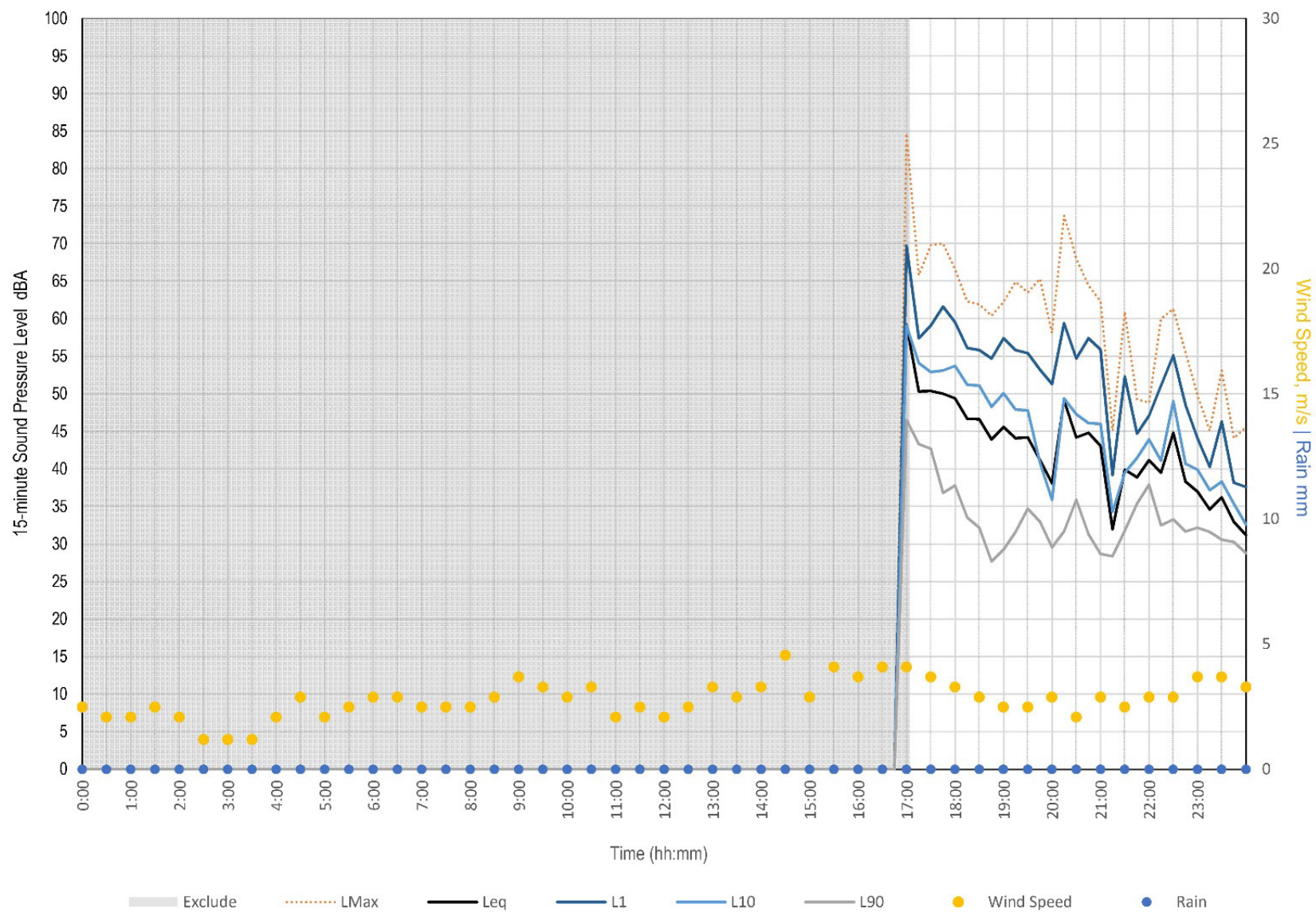
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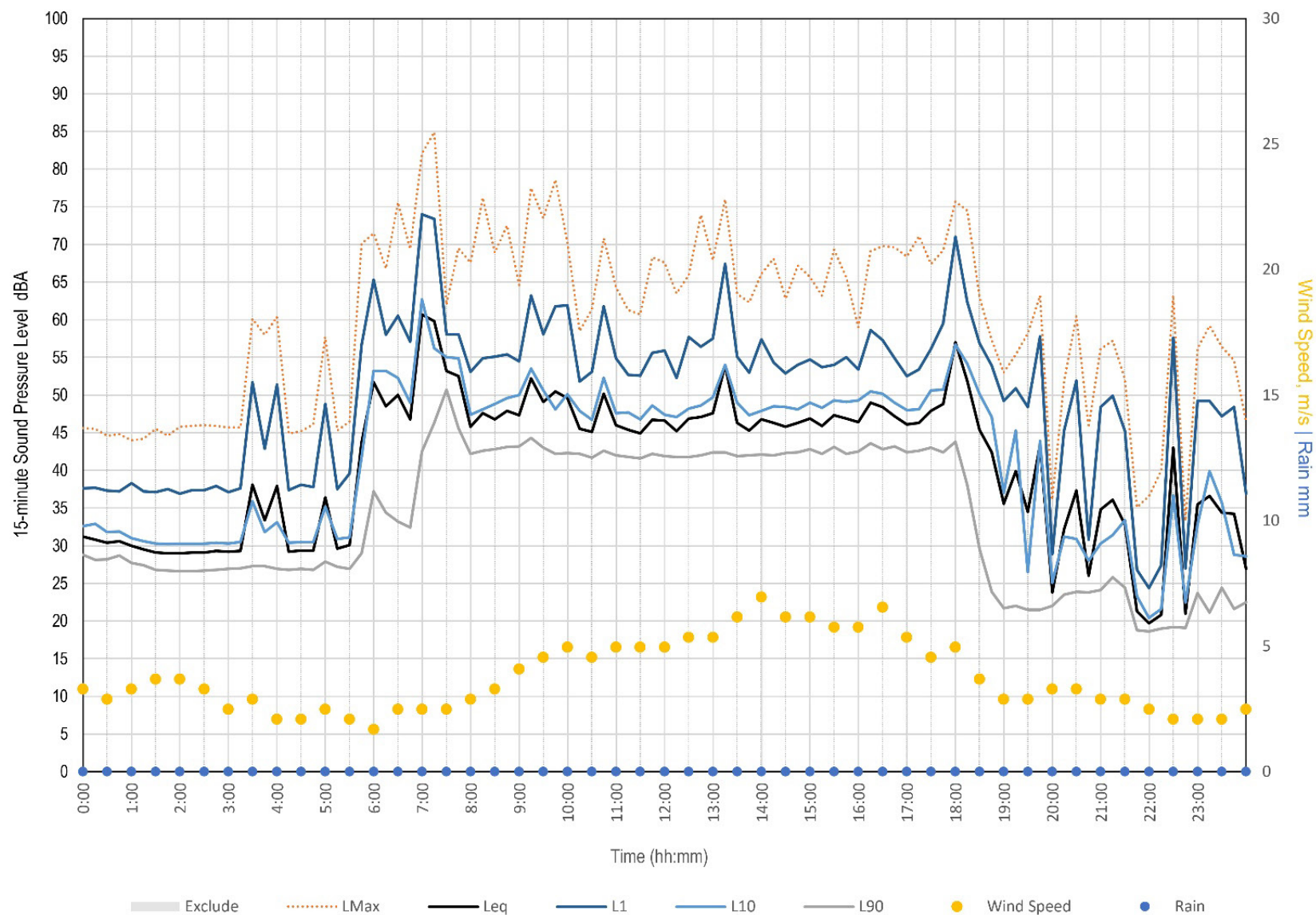
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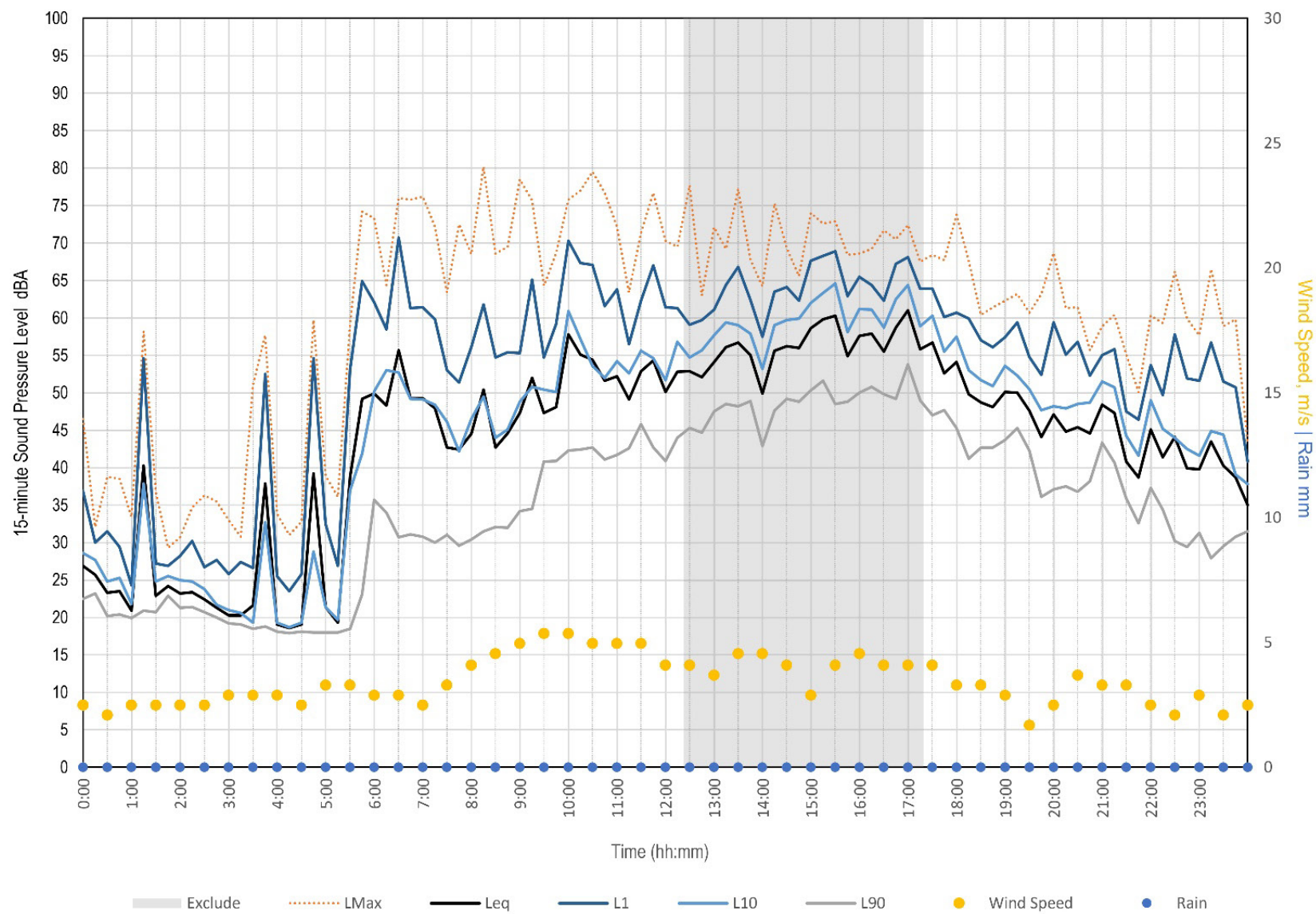
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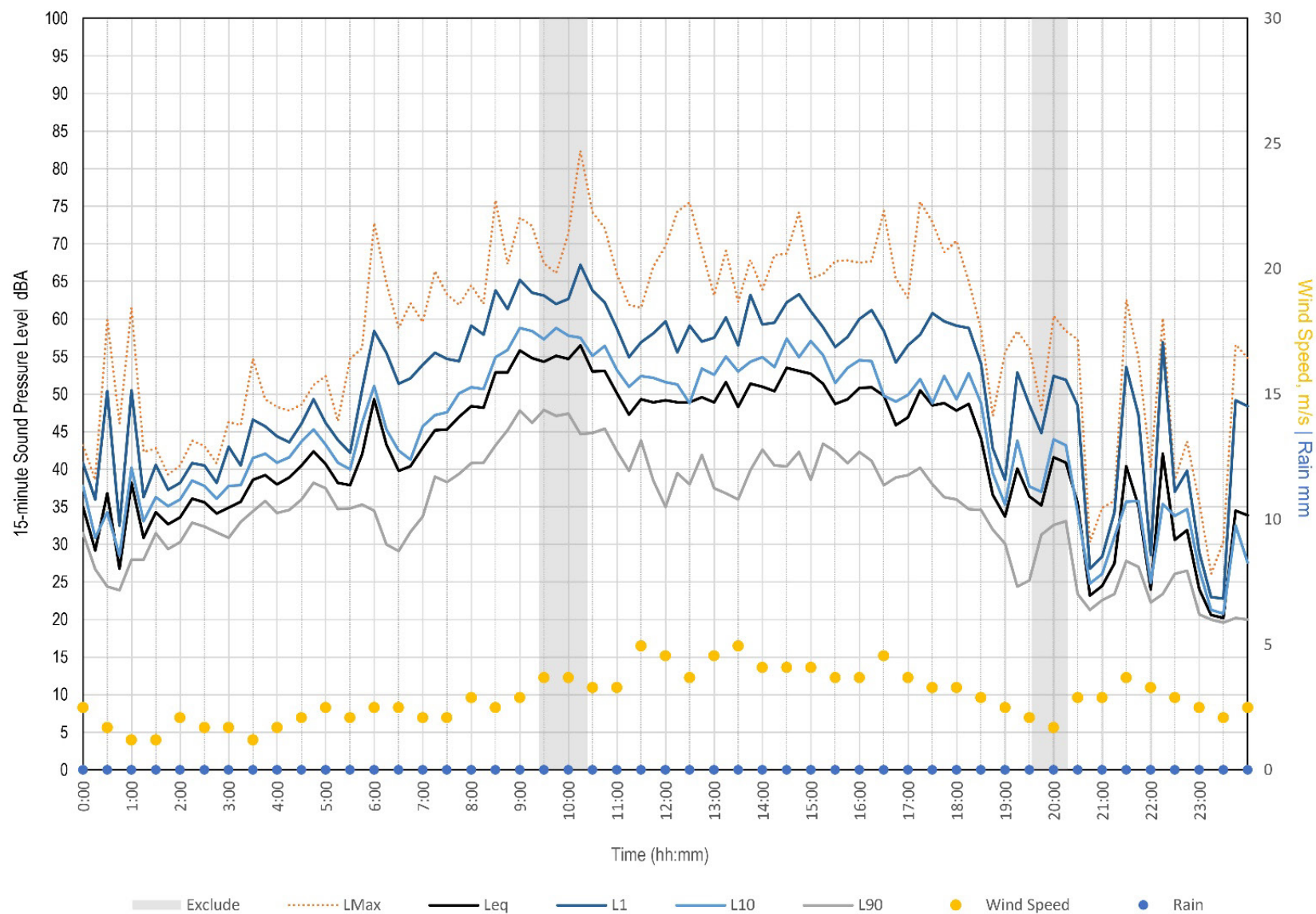
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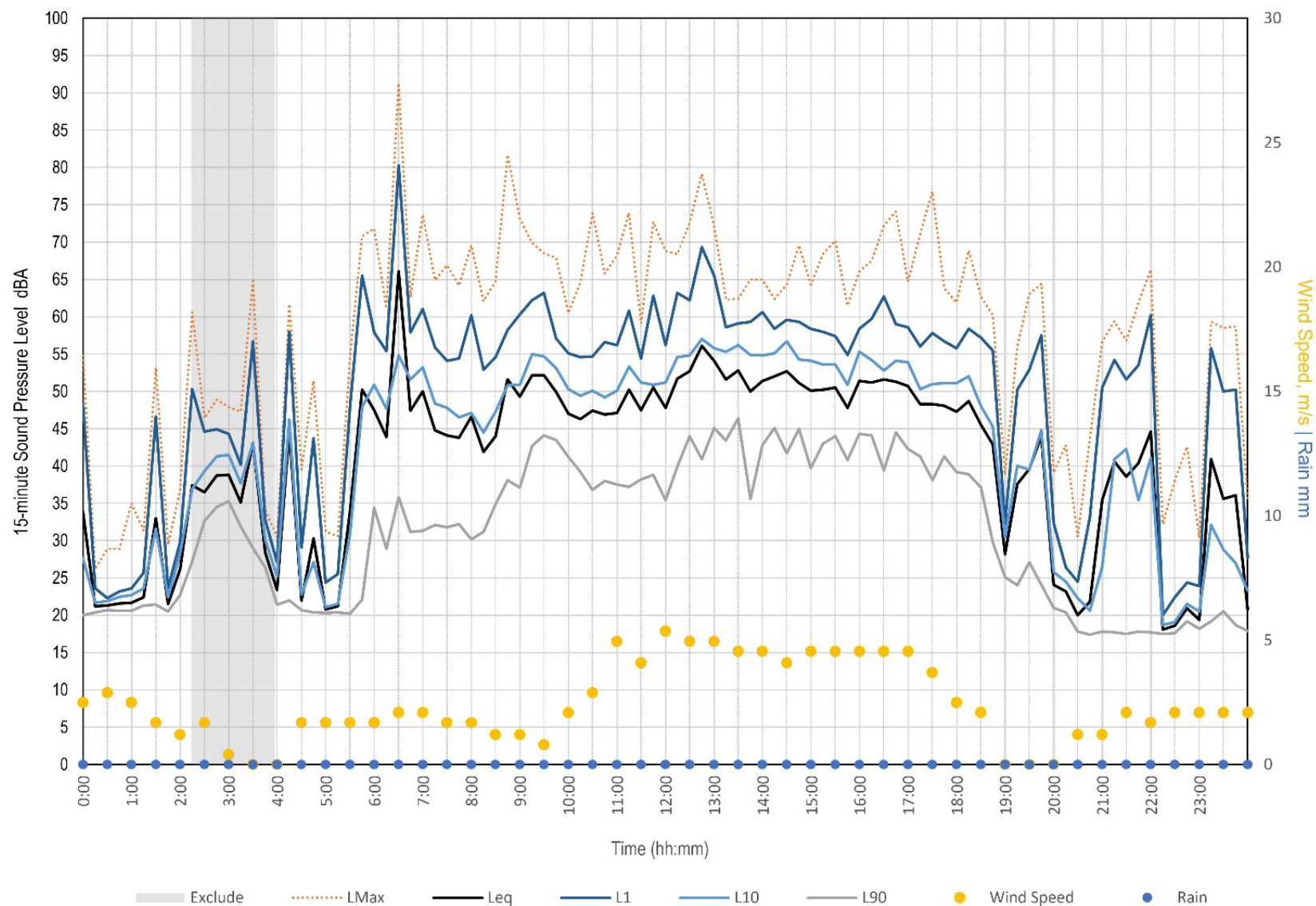
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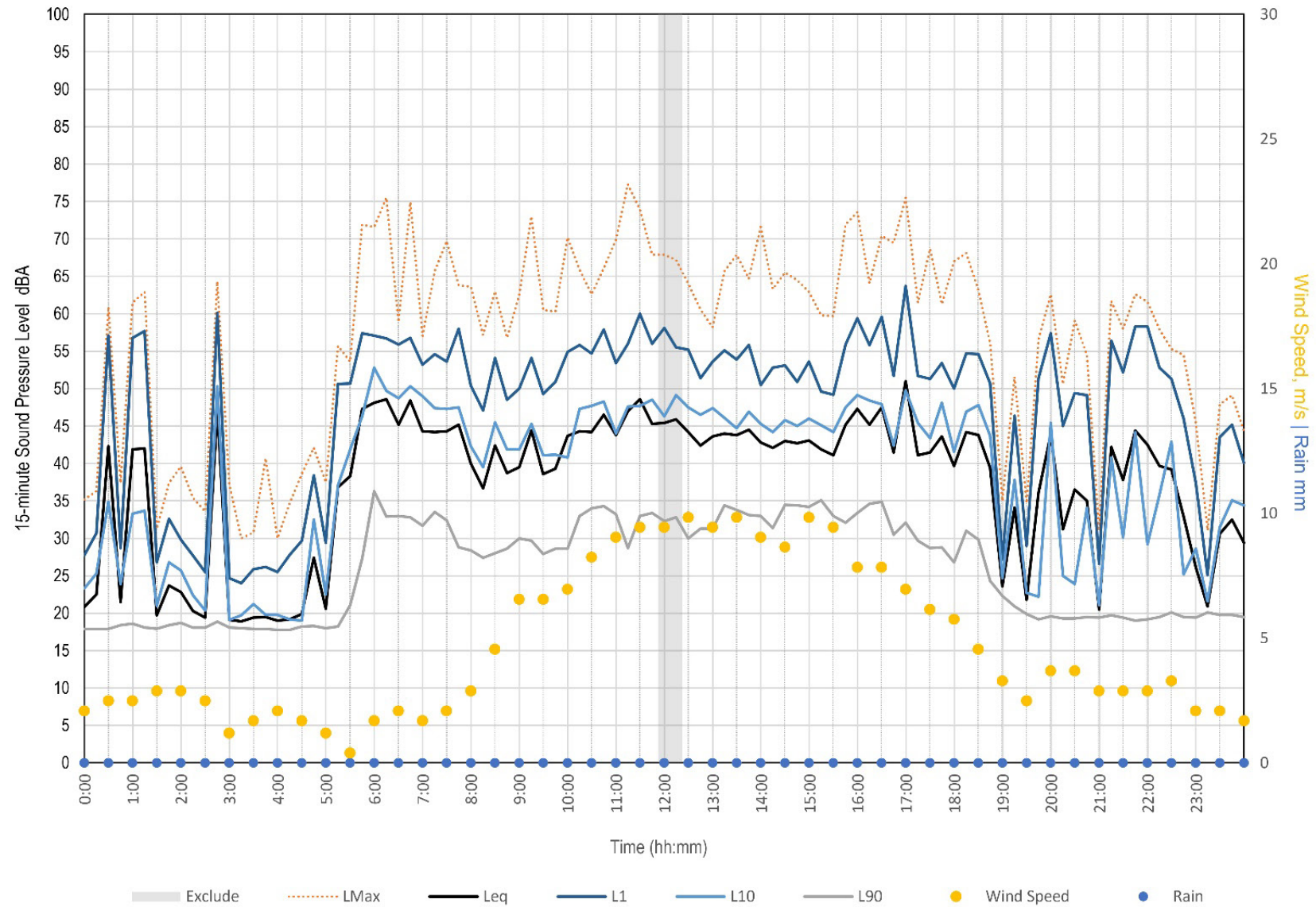
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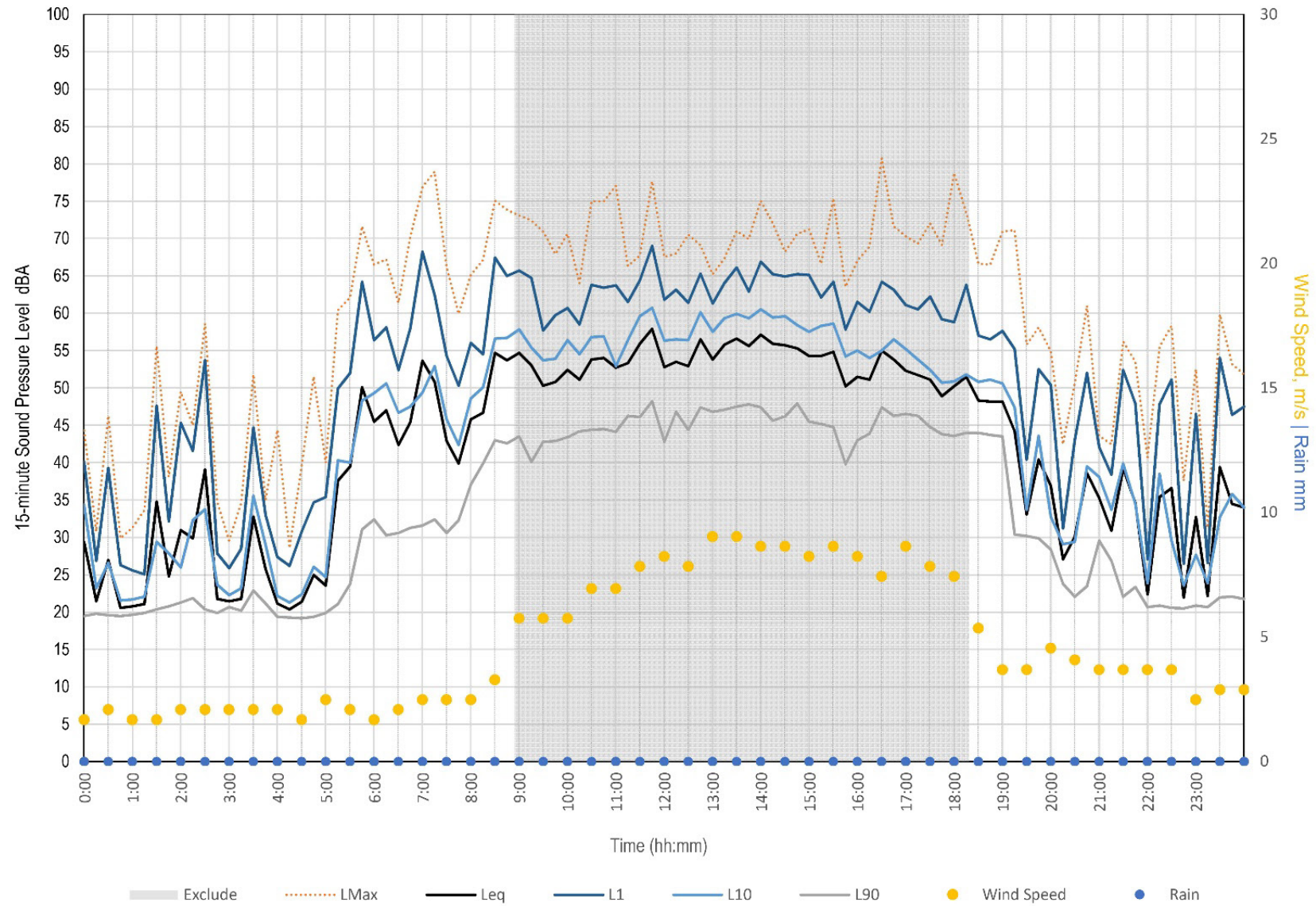
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Tuesday, 17 September 2024



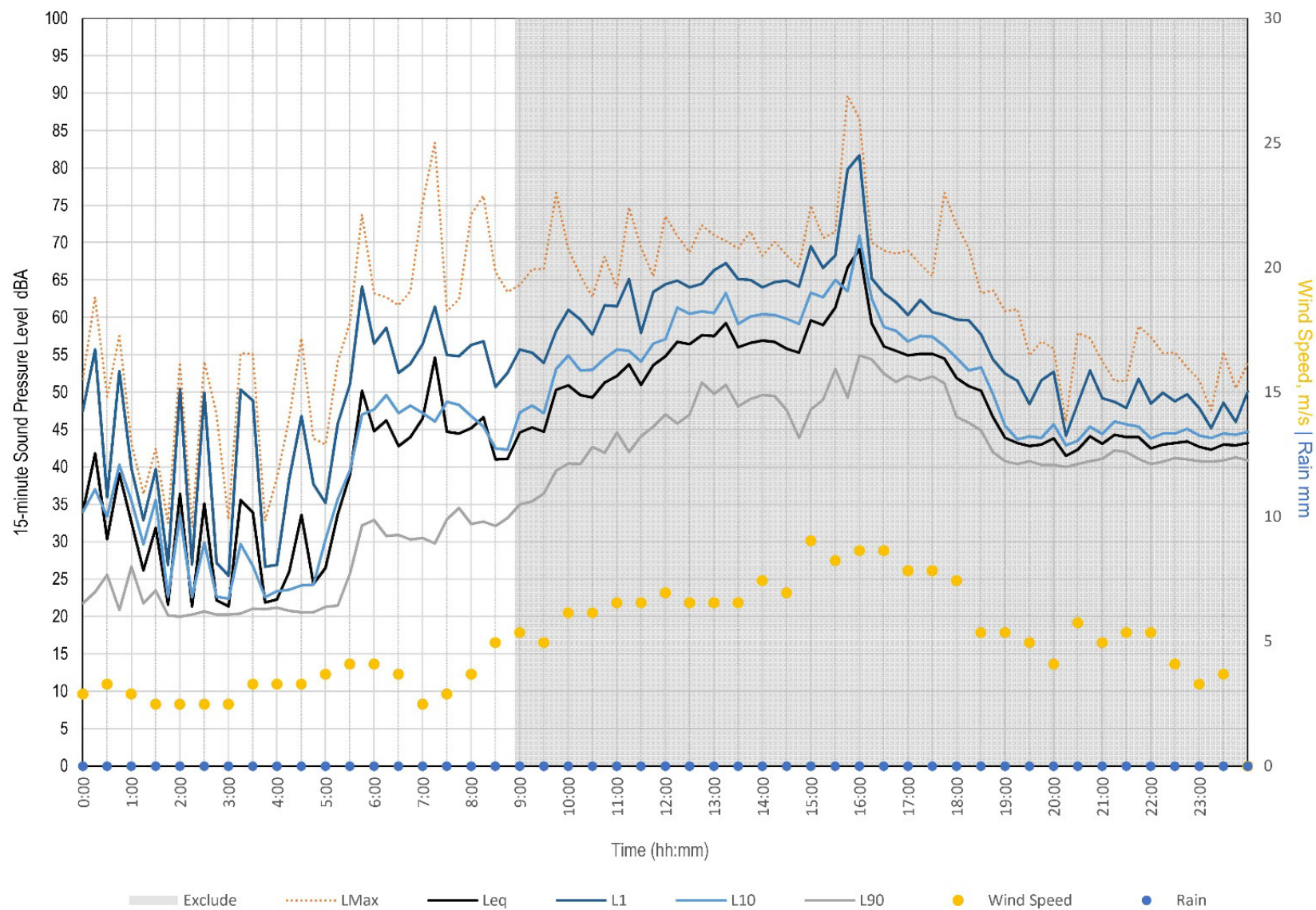
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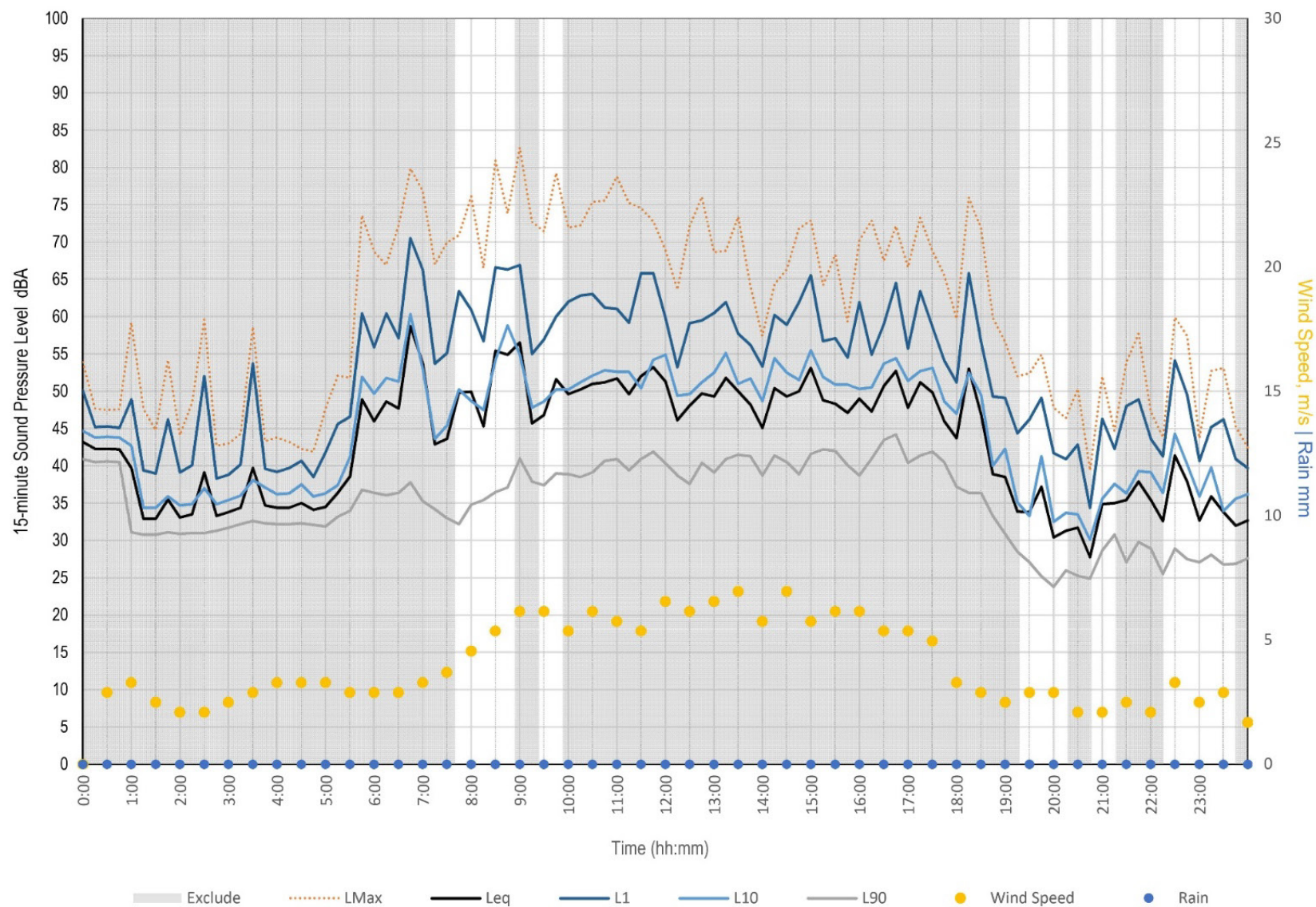
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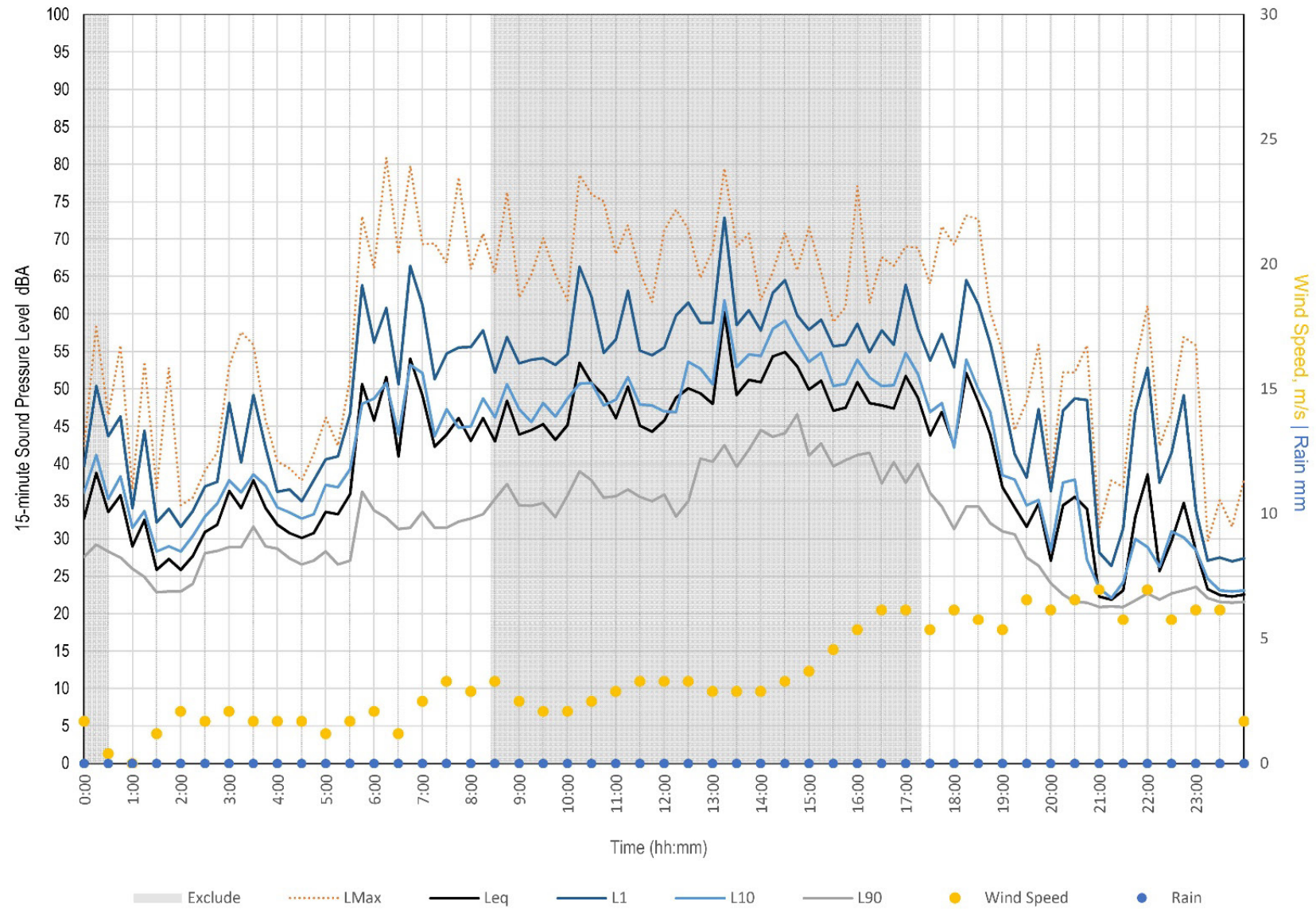
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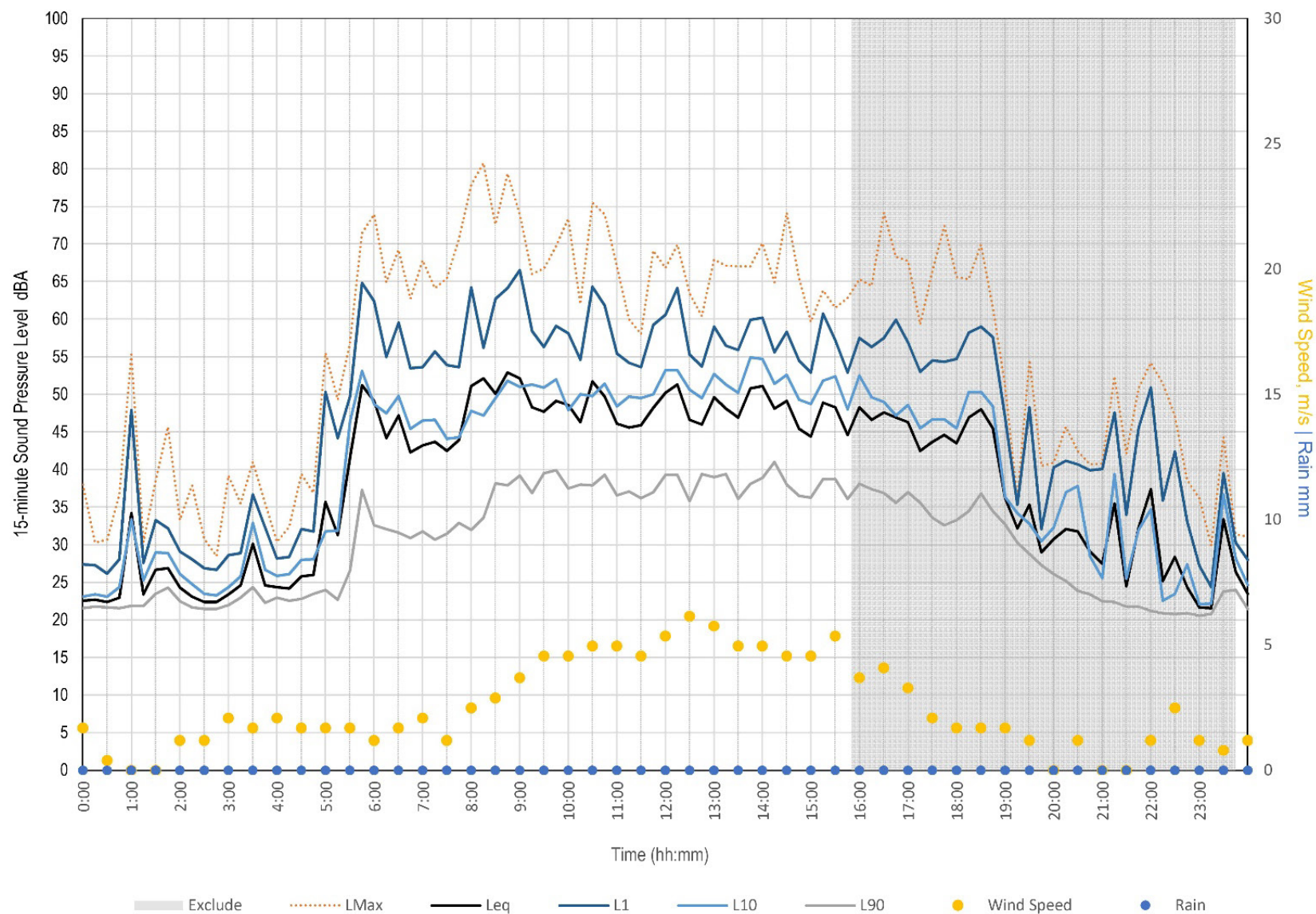
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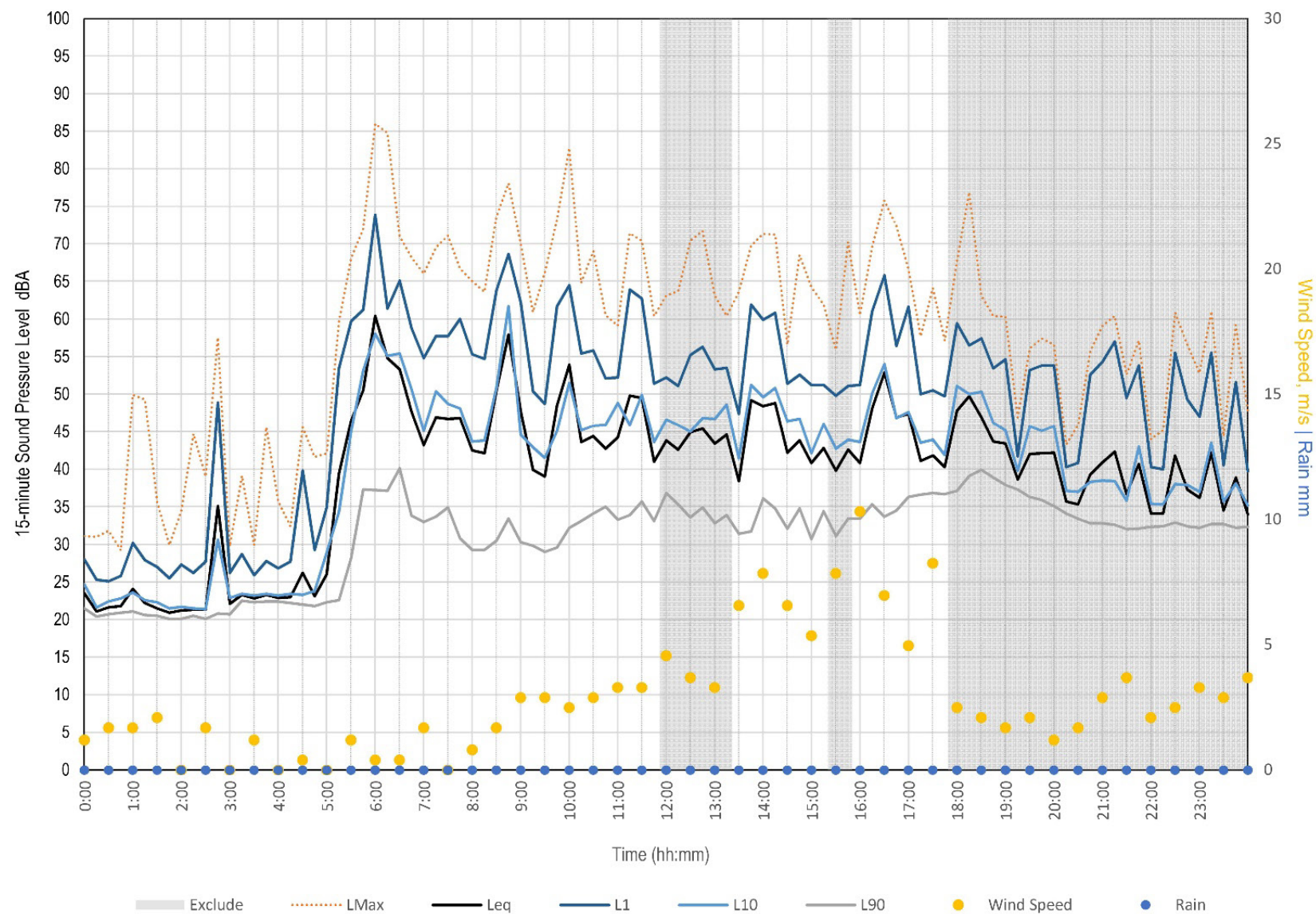
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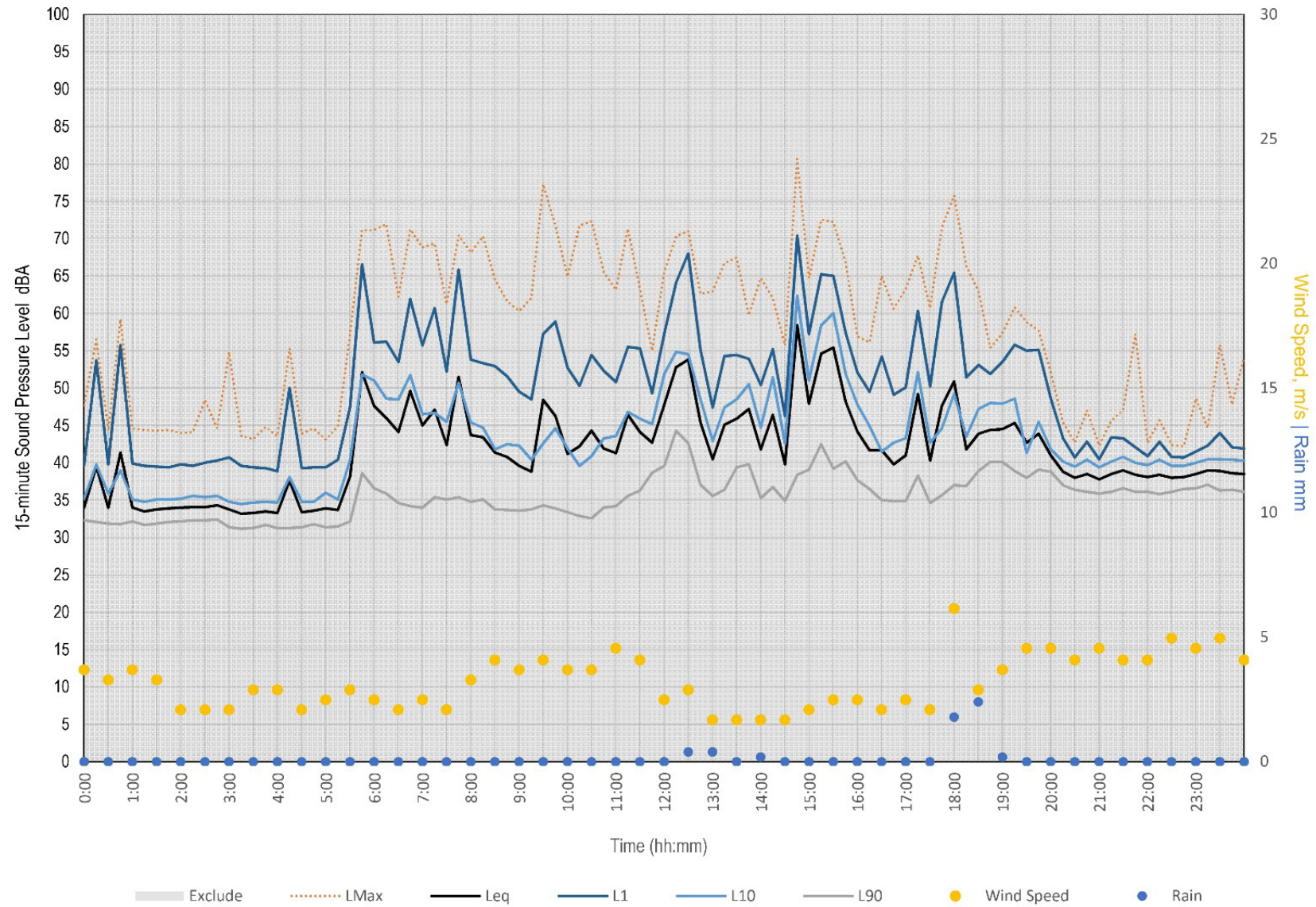
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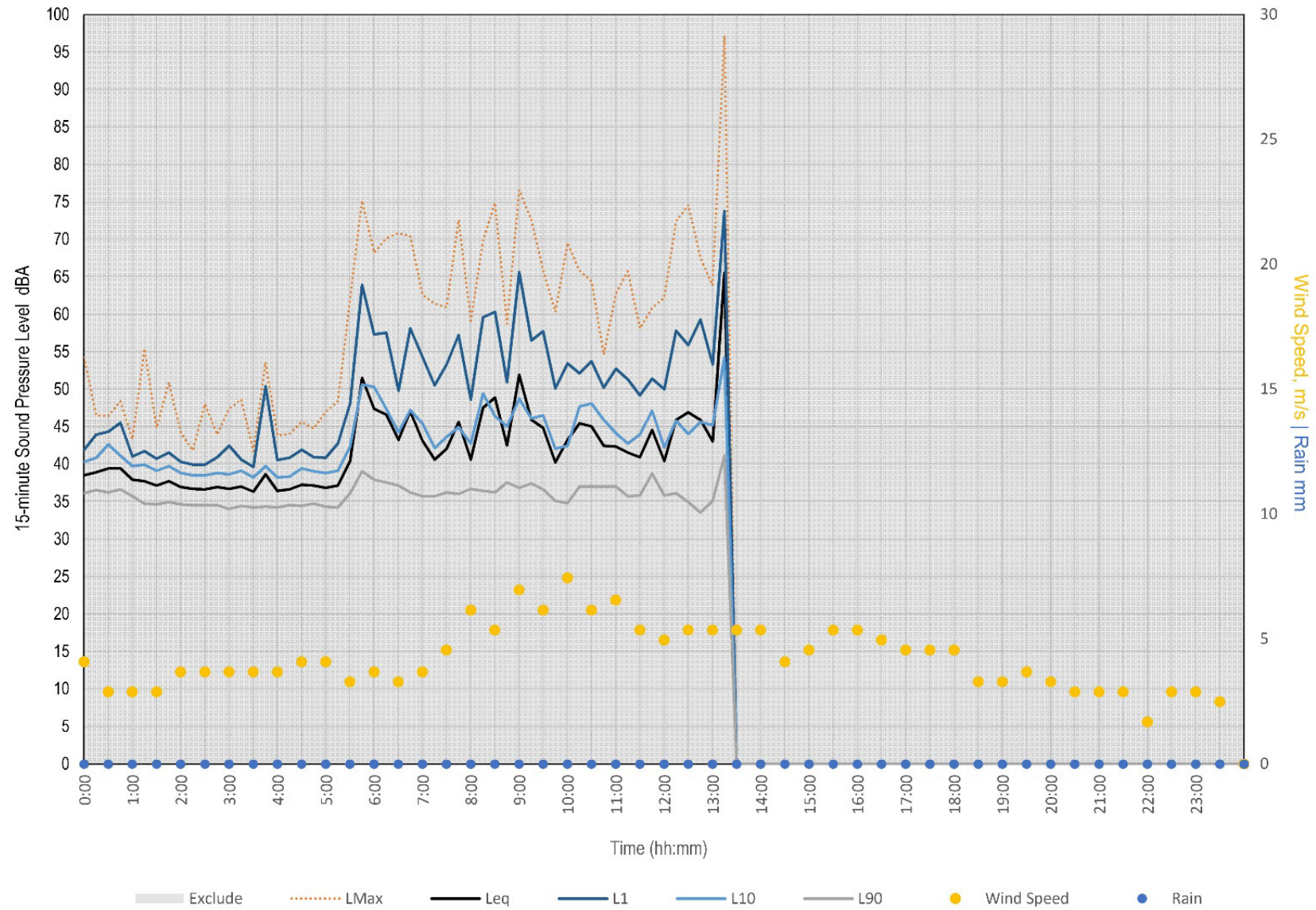
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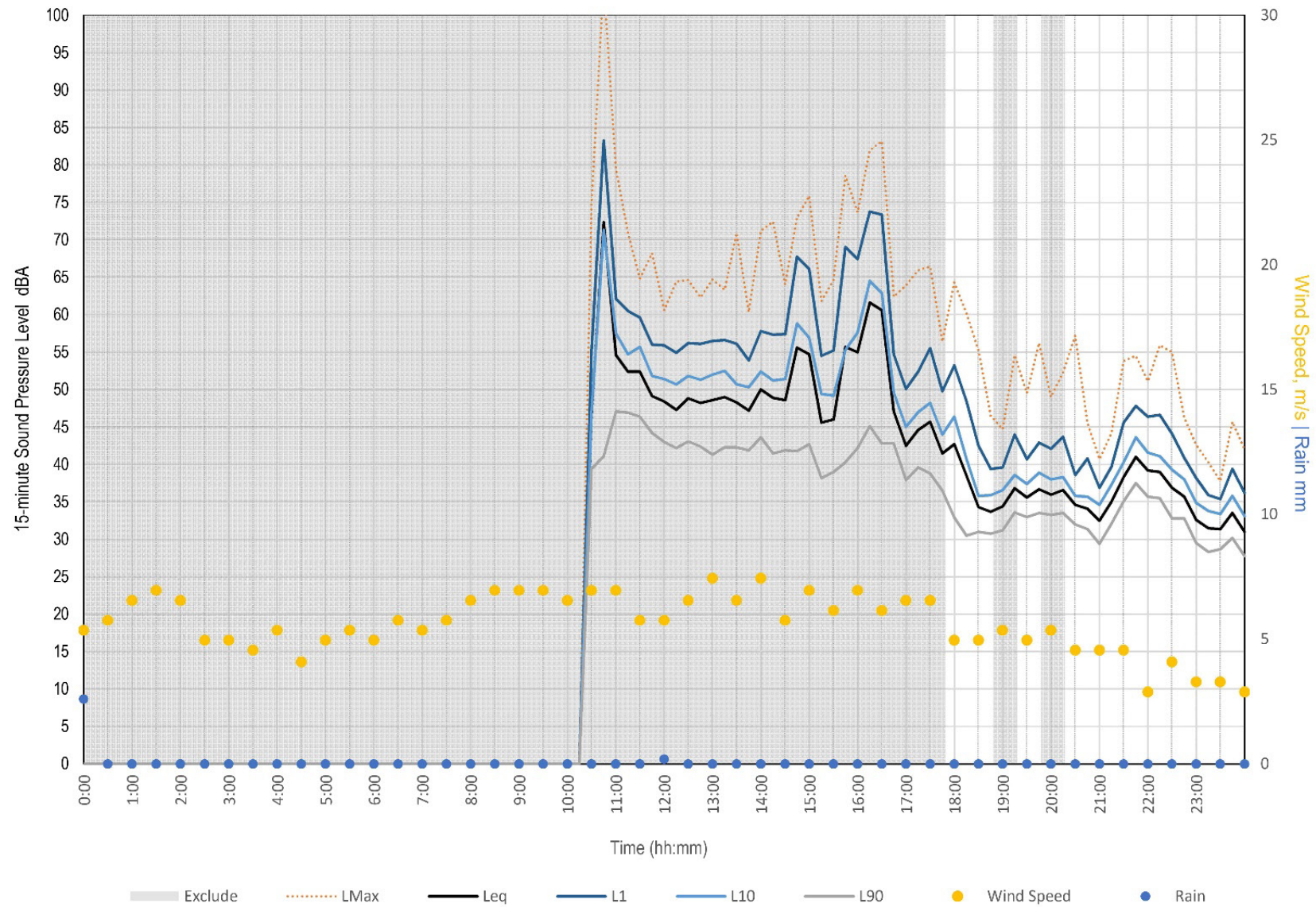
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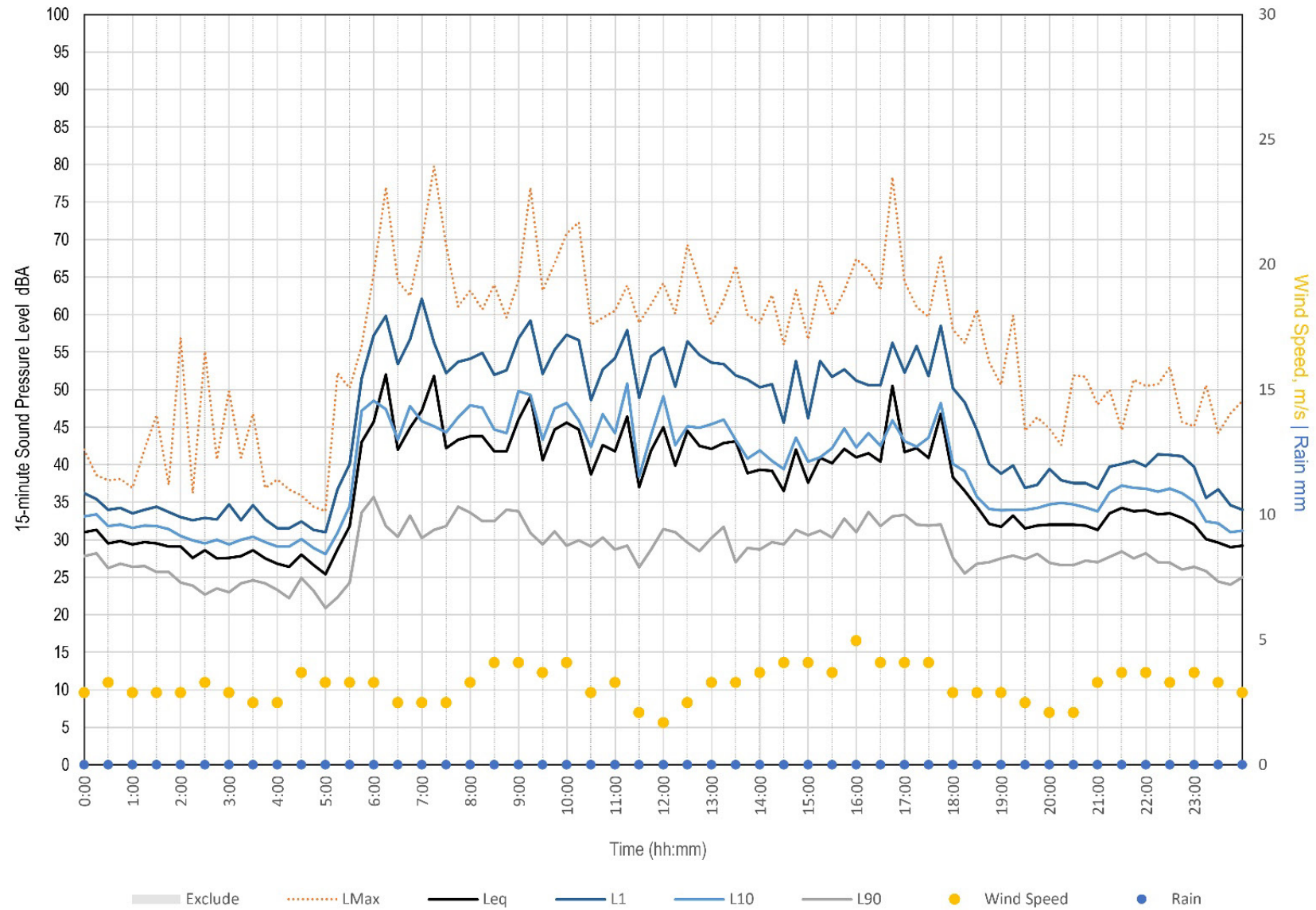
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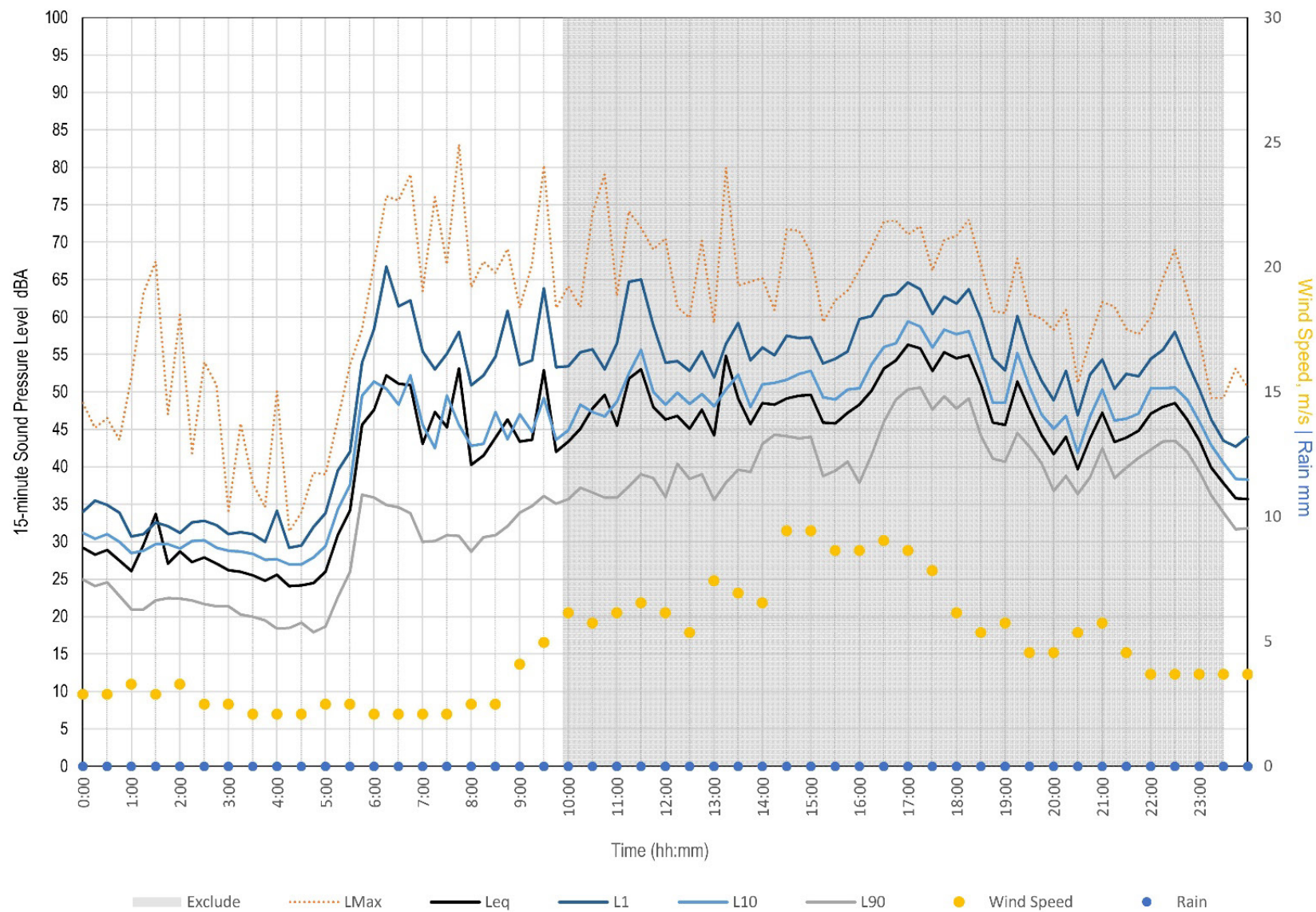
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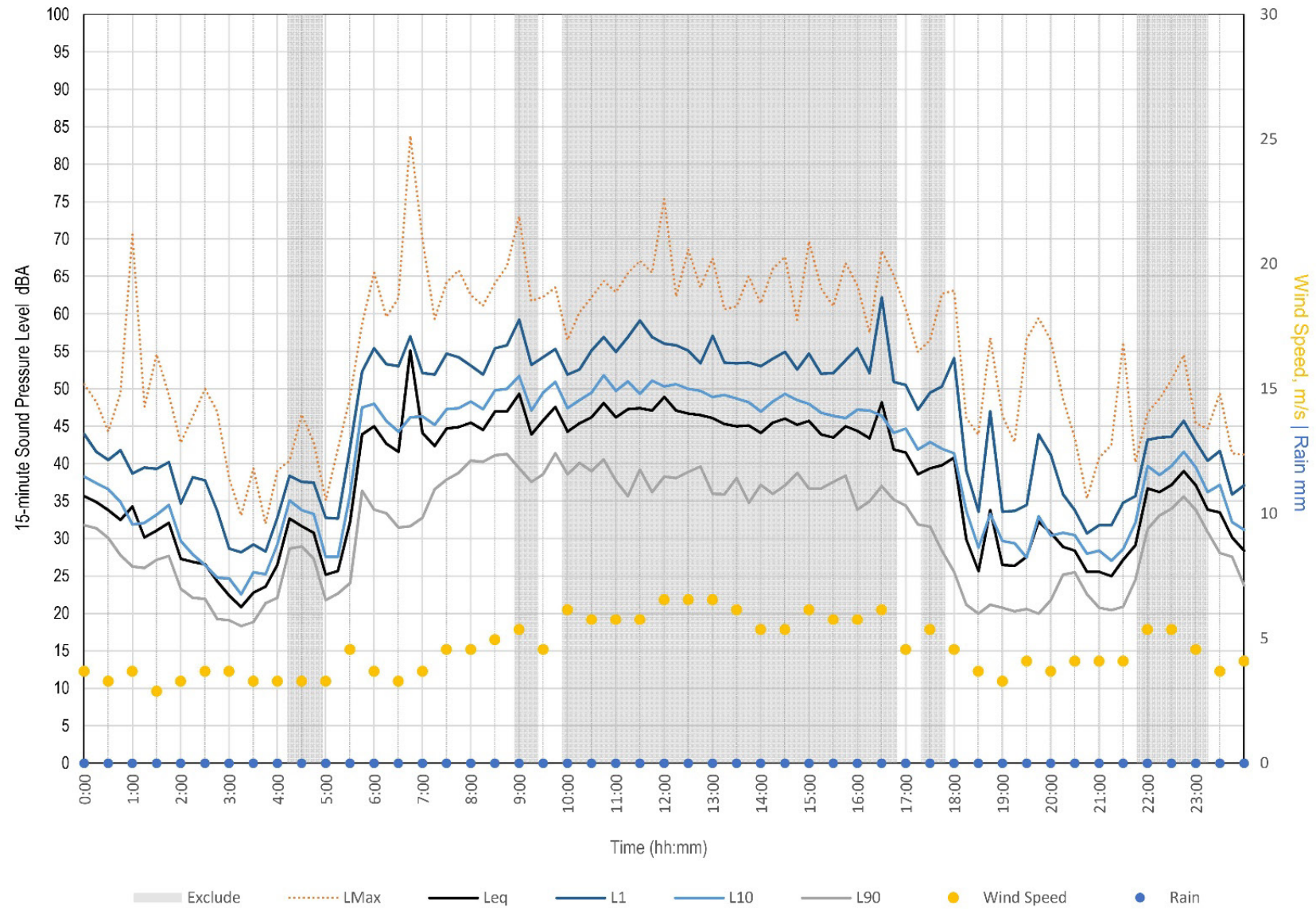
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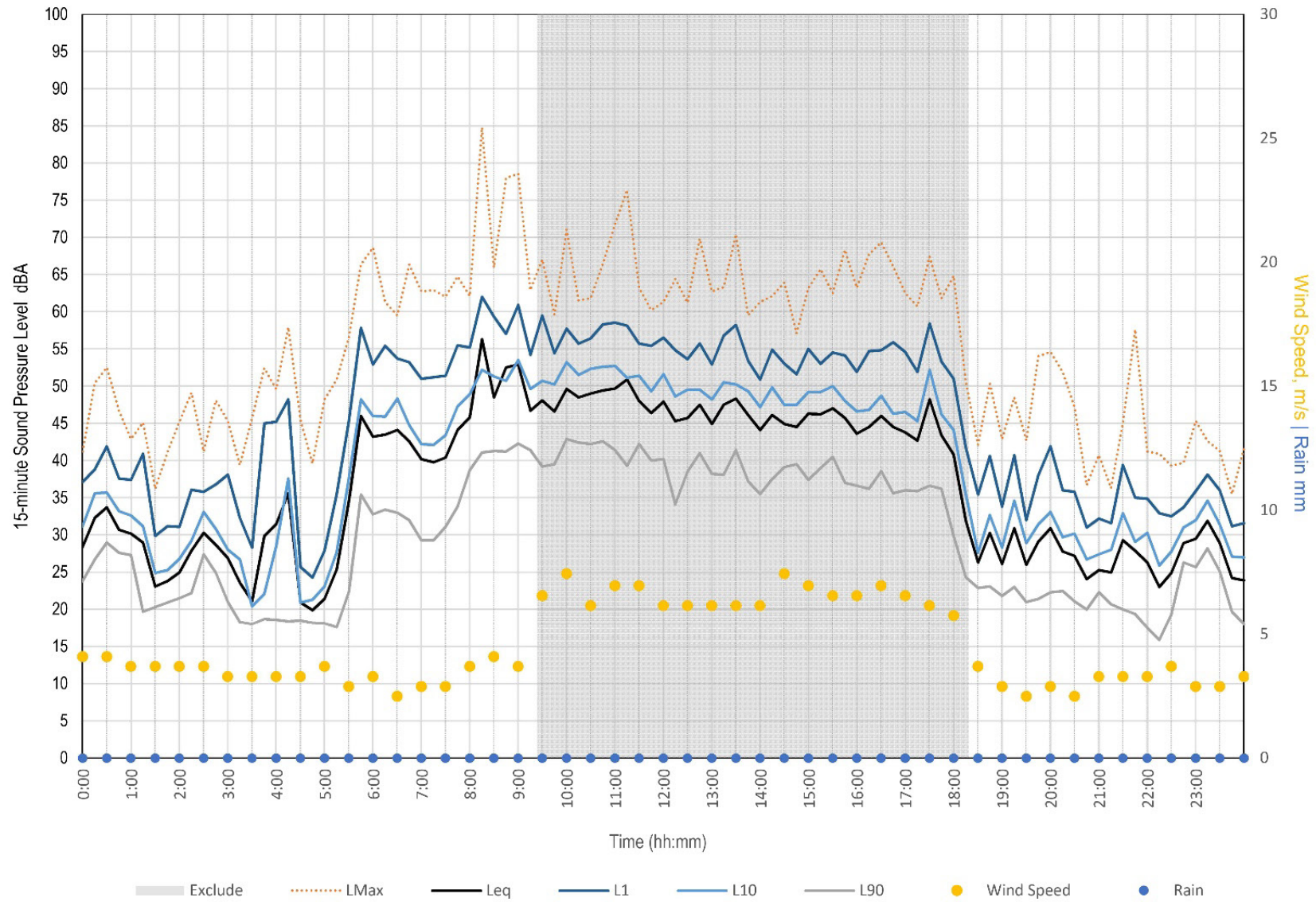
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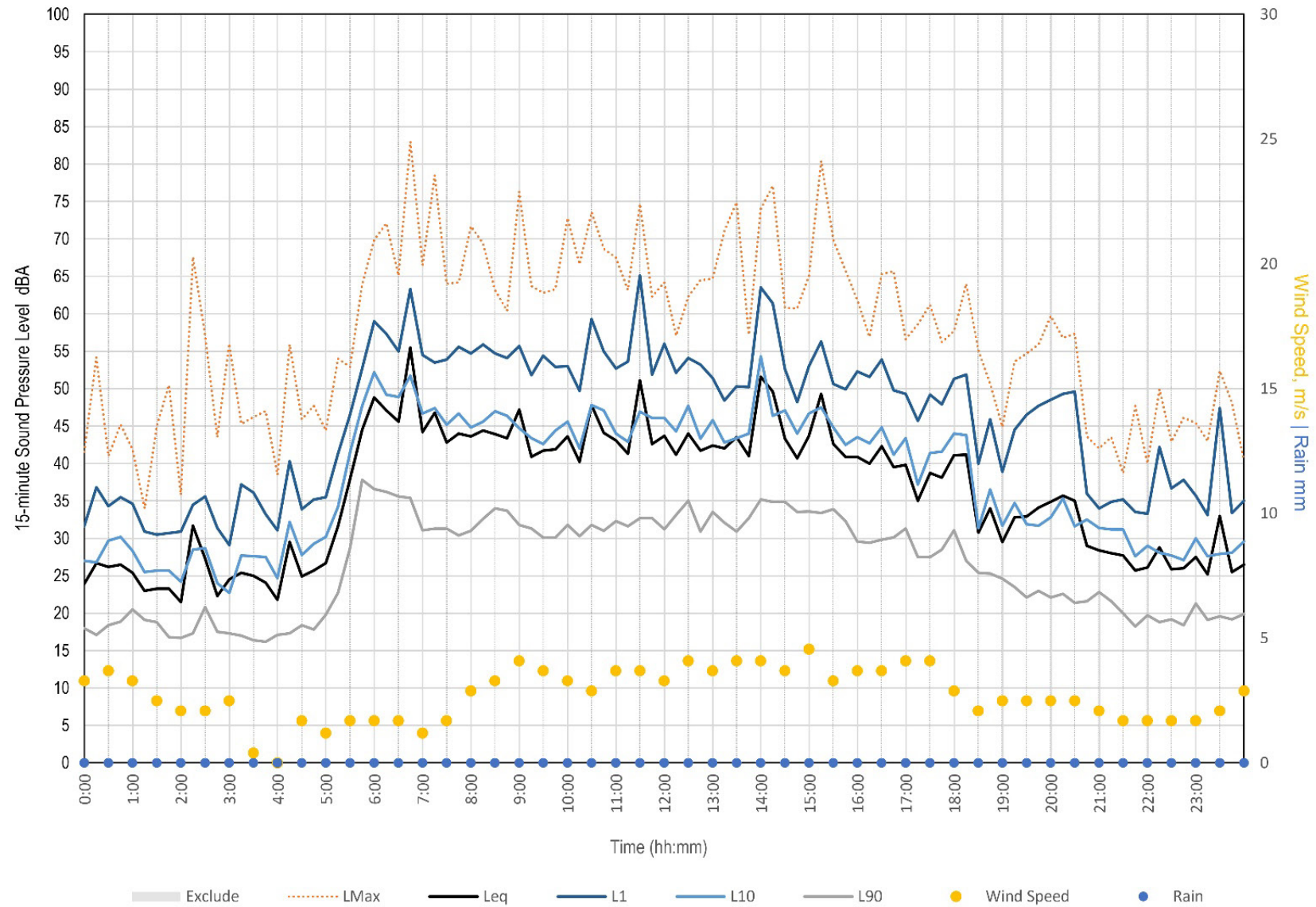
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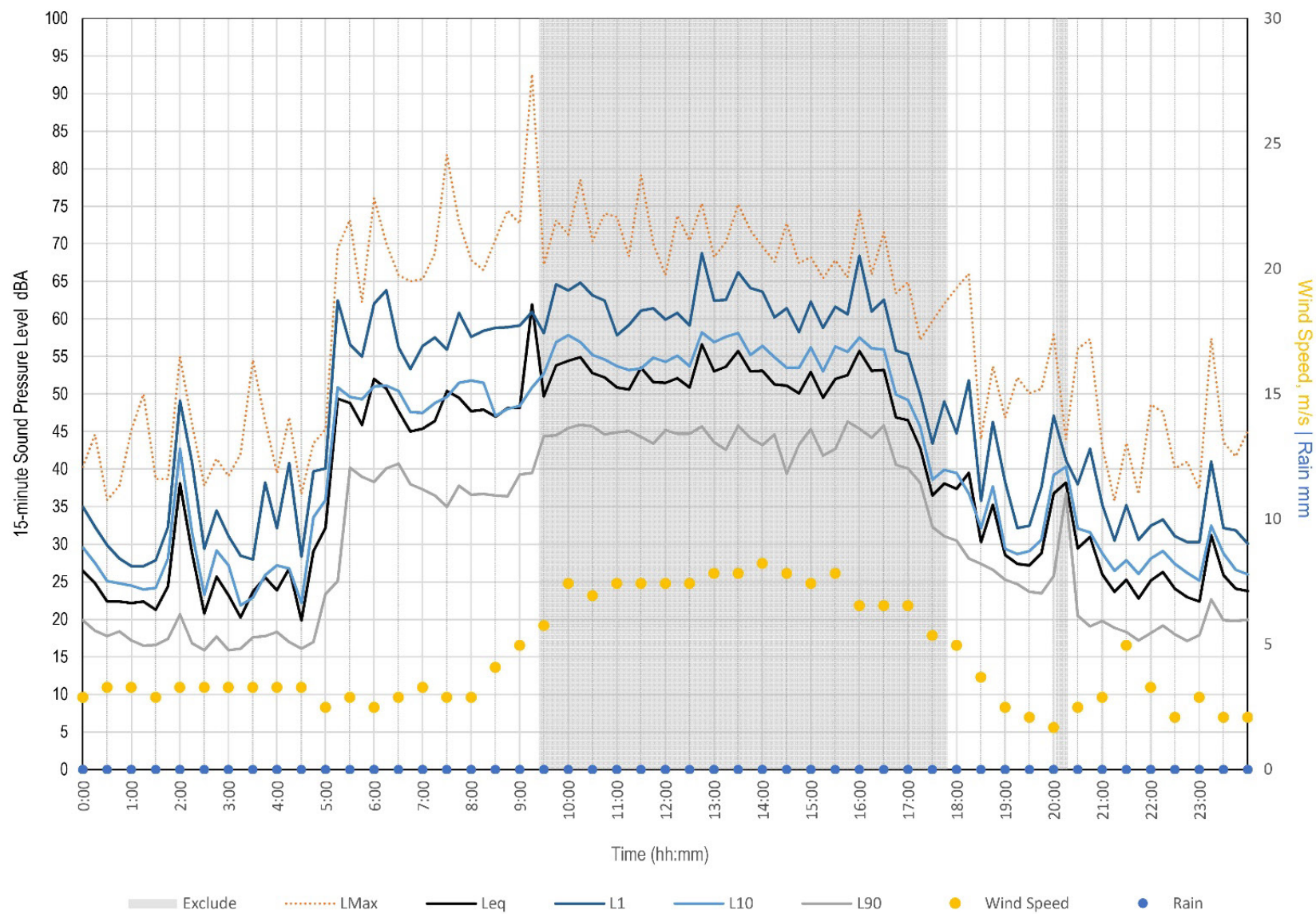
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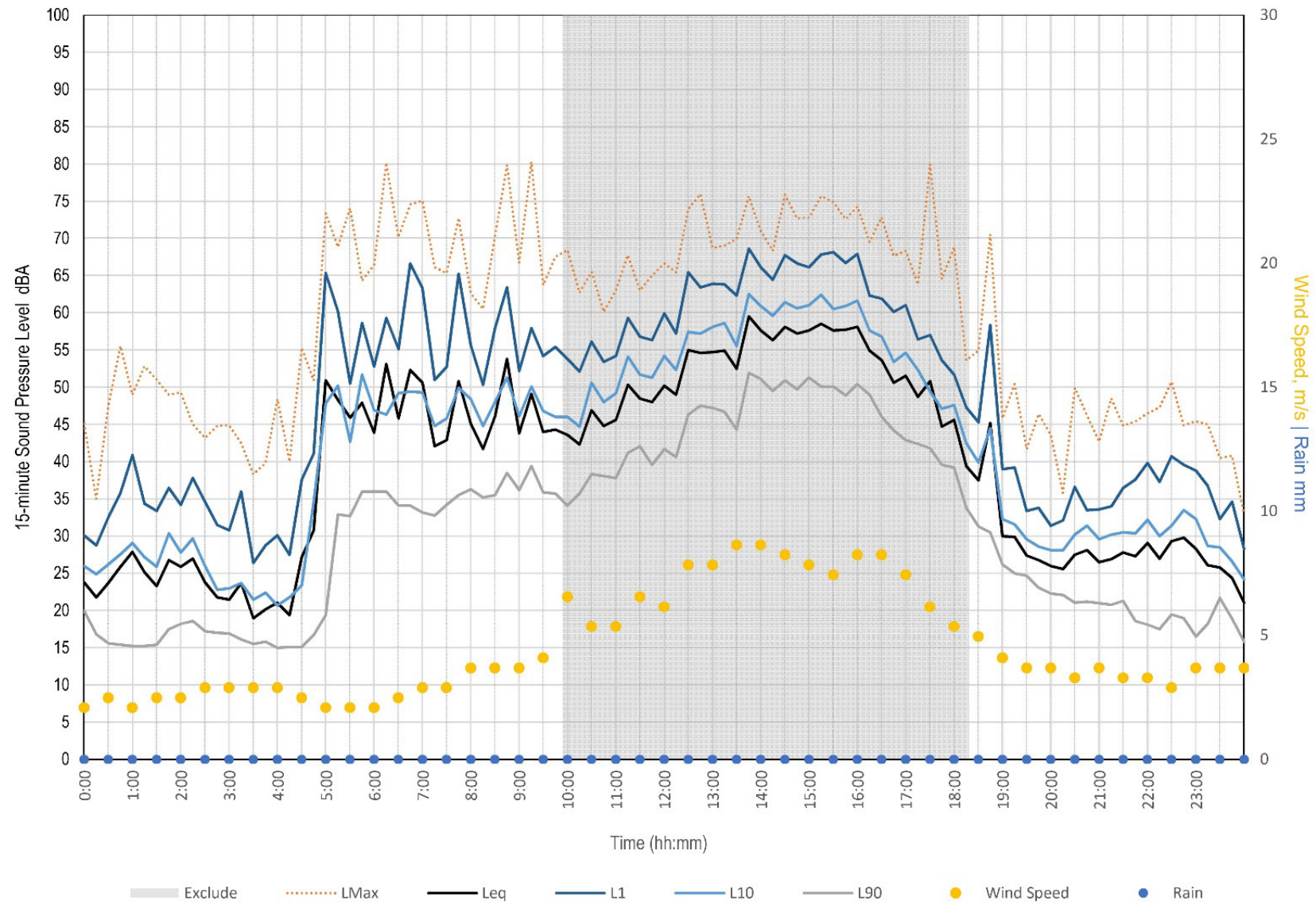
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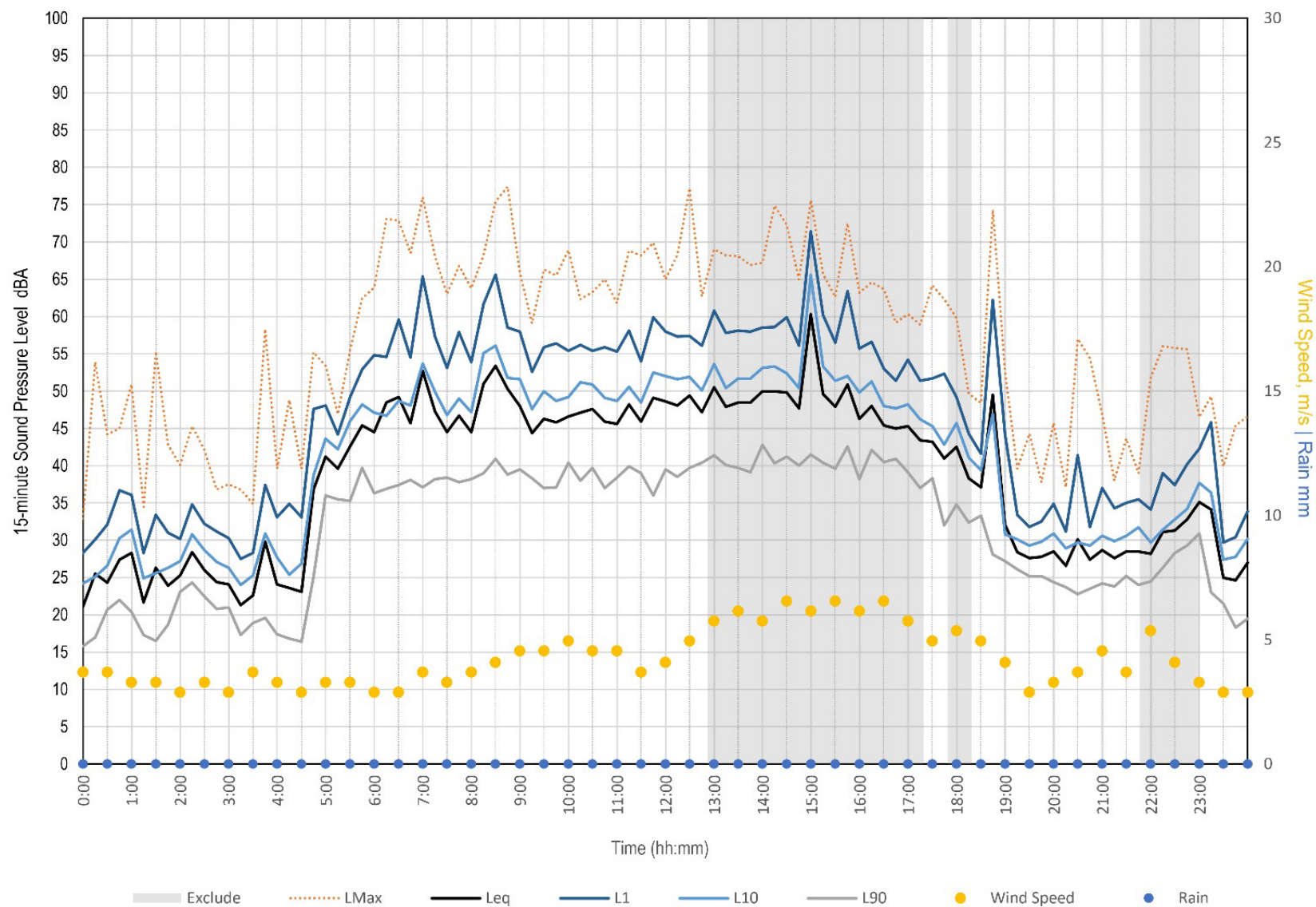
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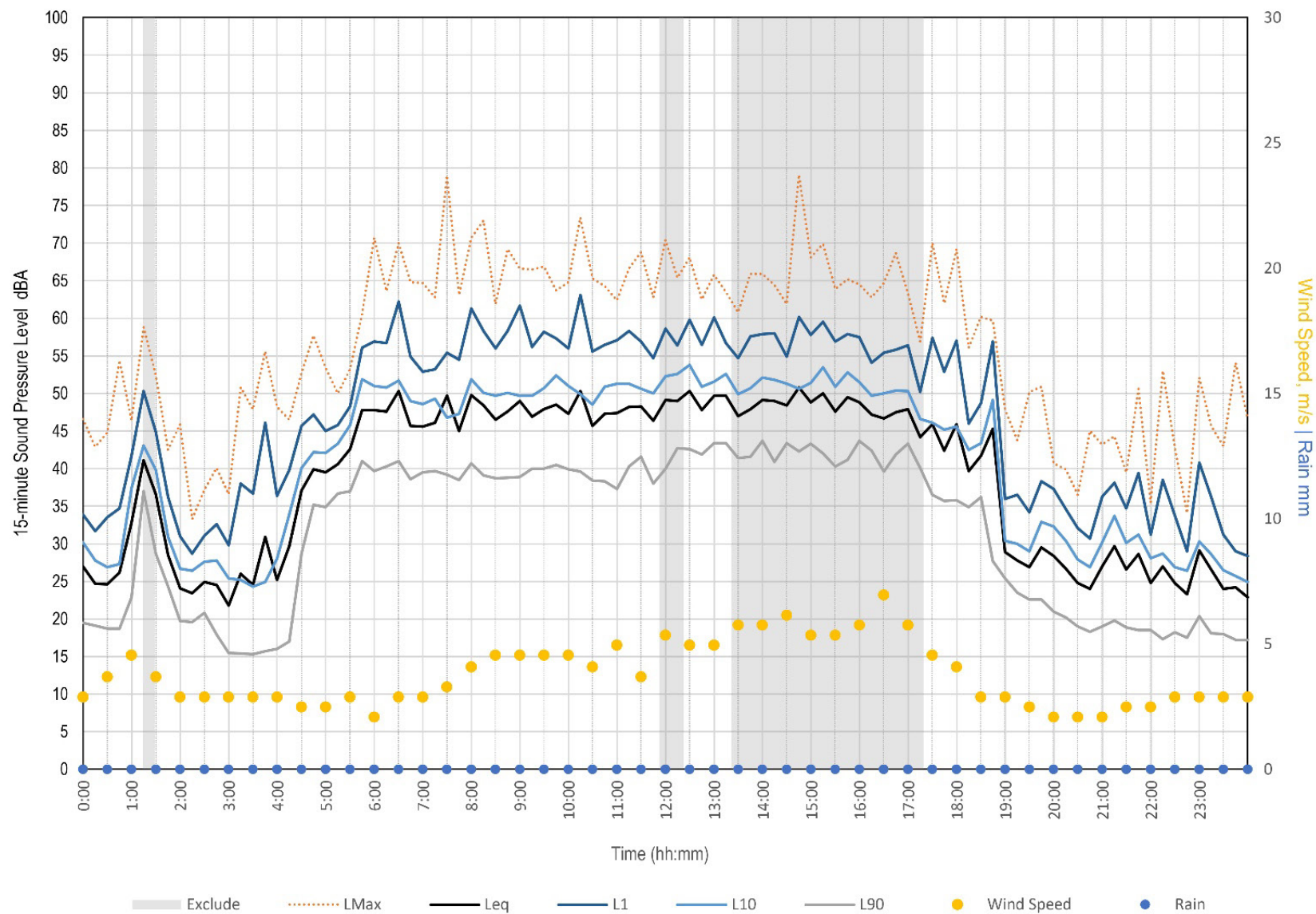
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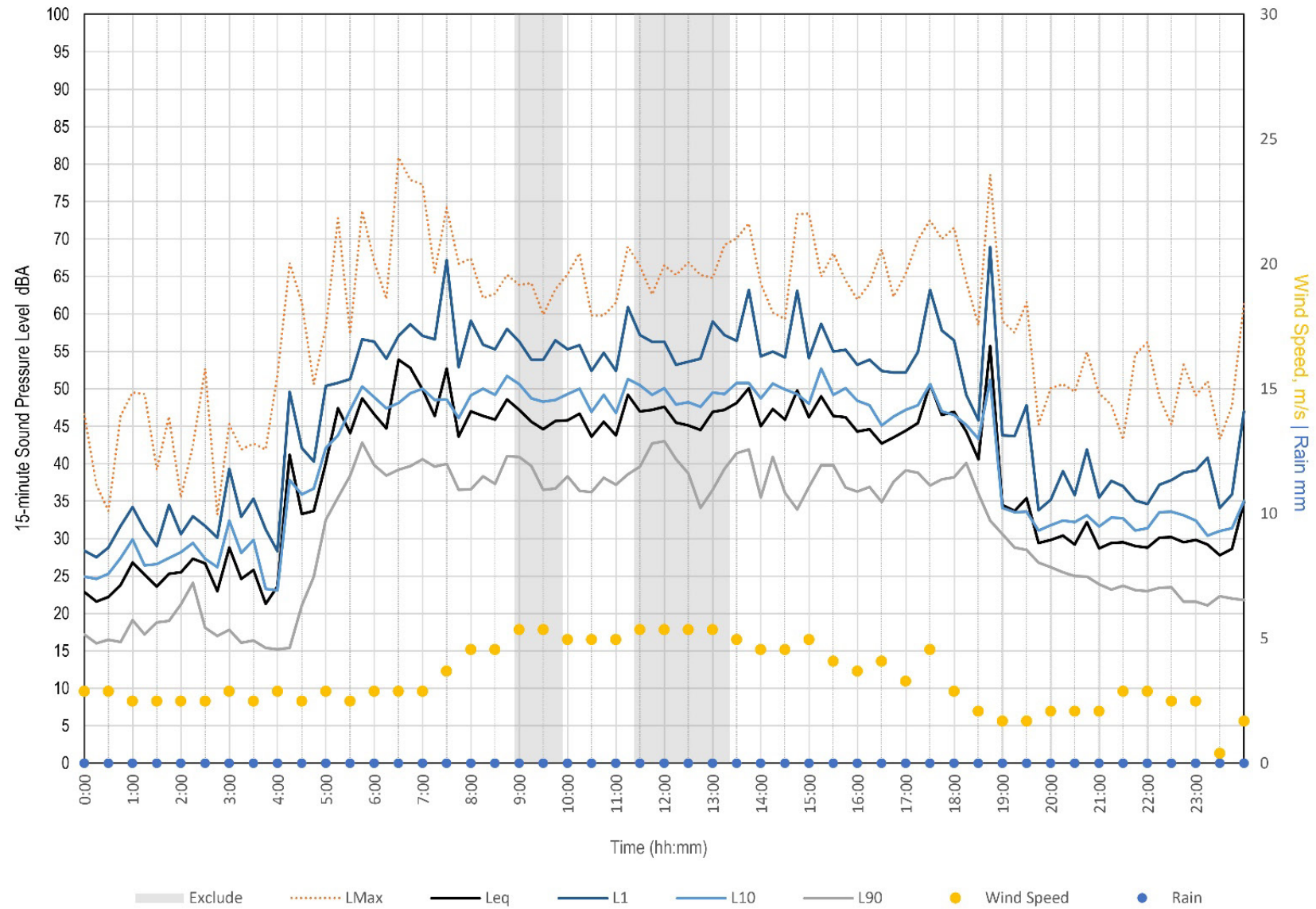
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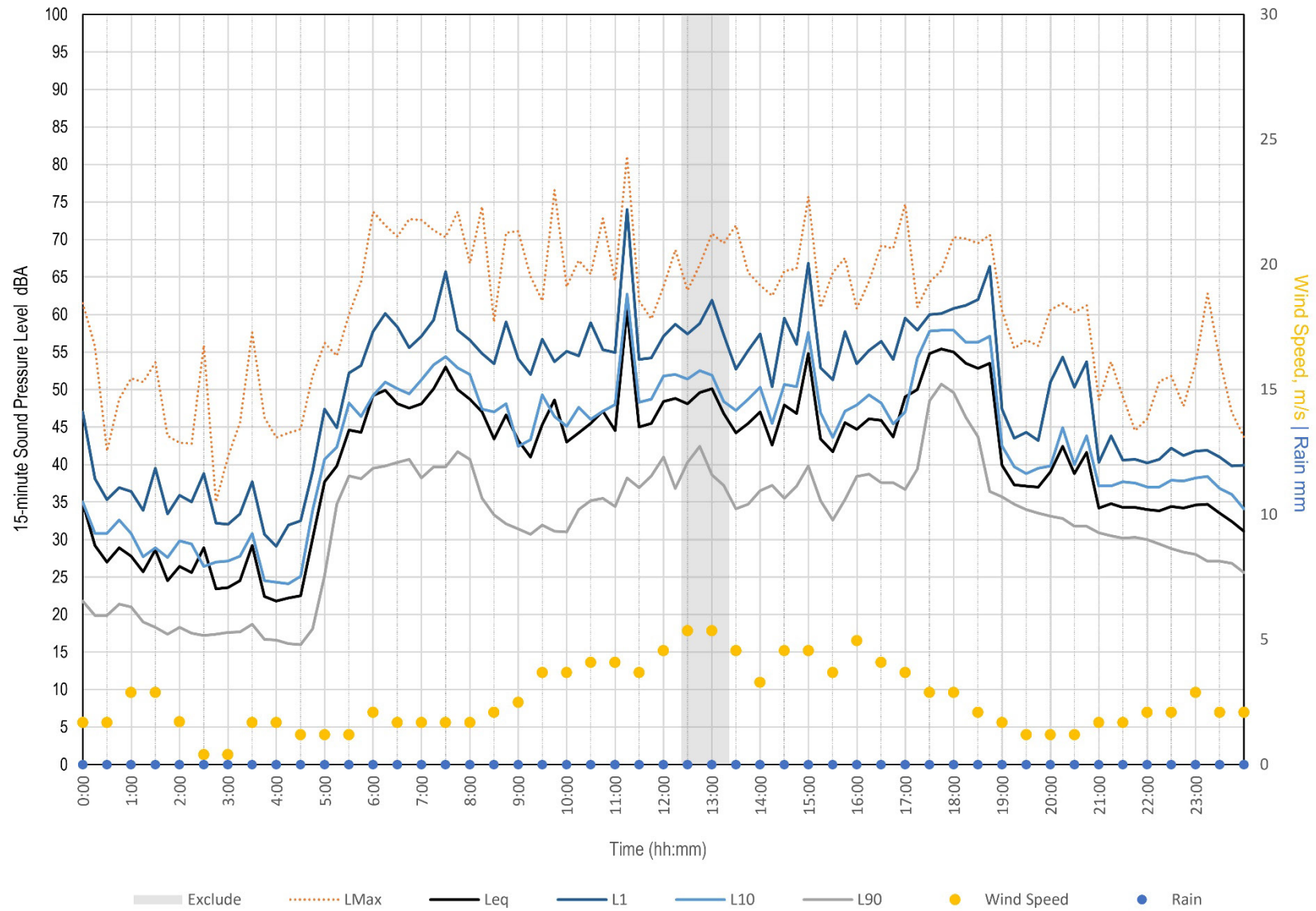
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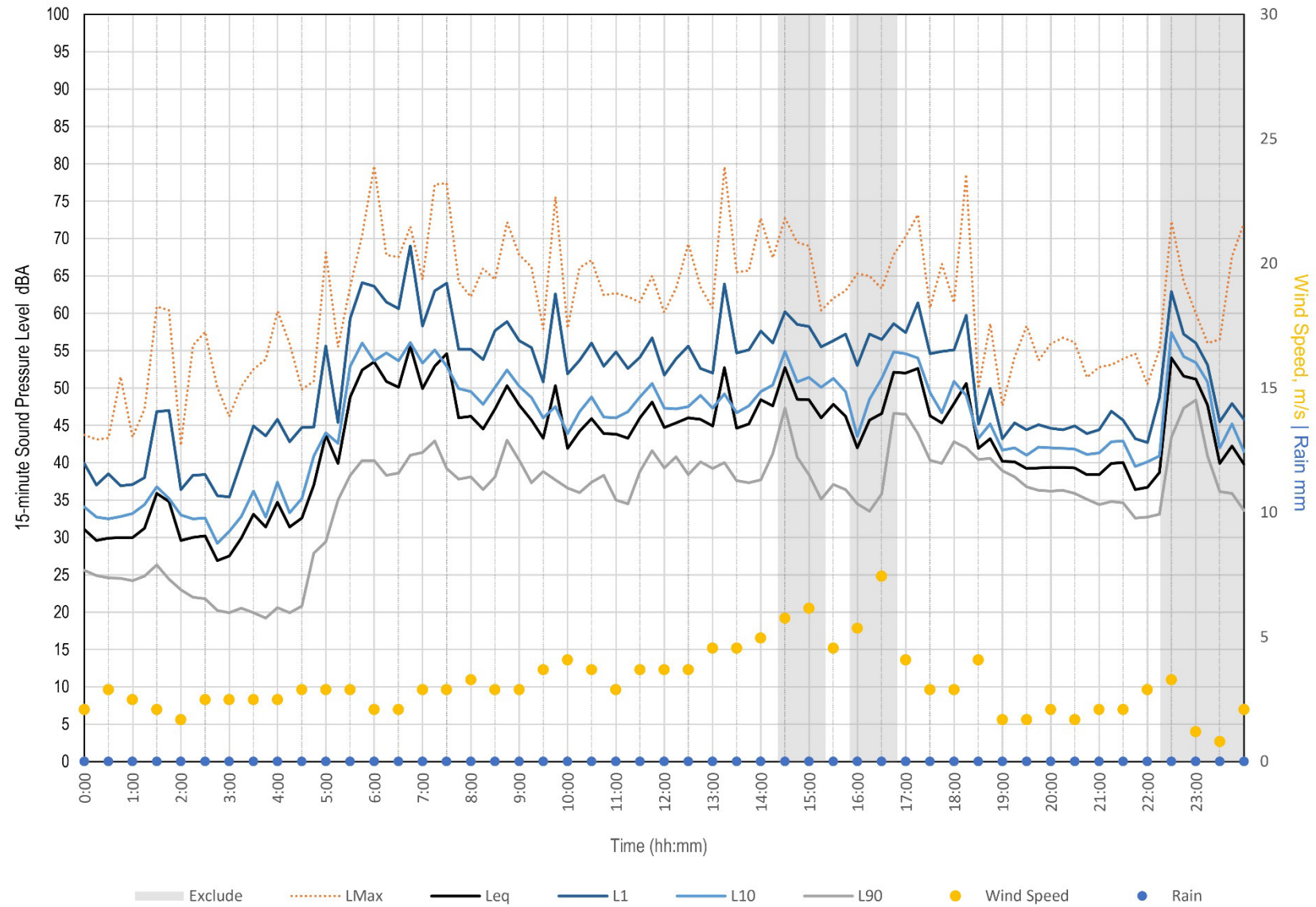
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Monday, 23 September 2024



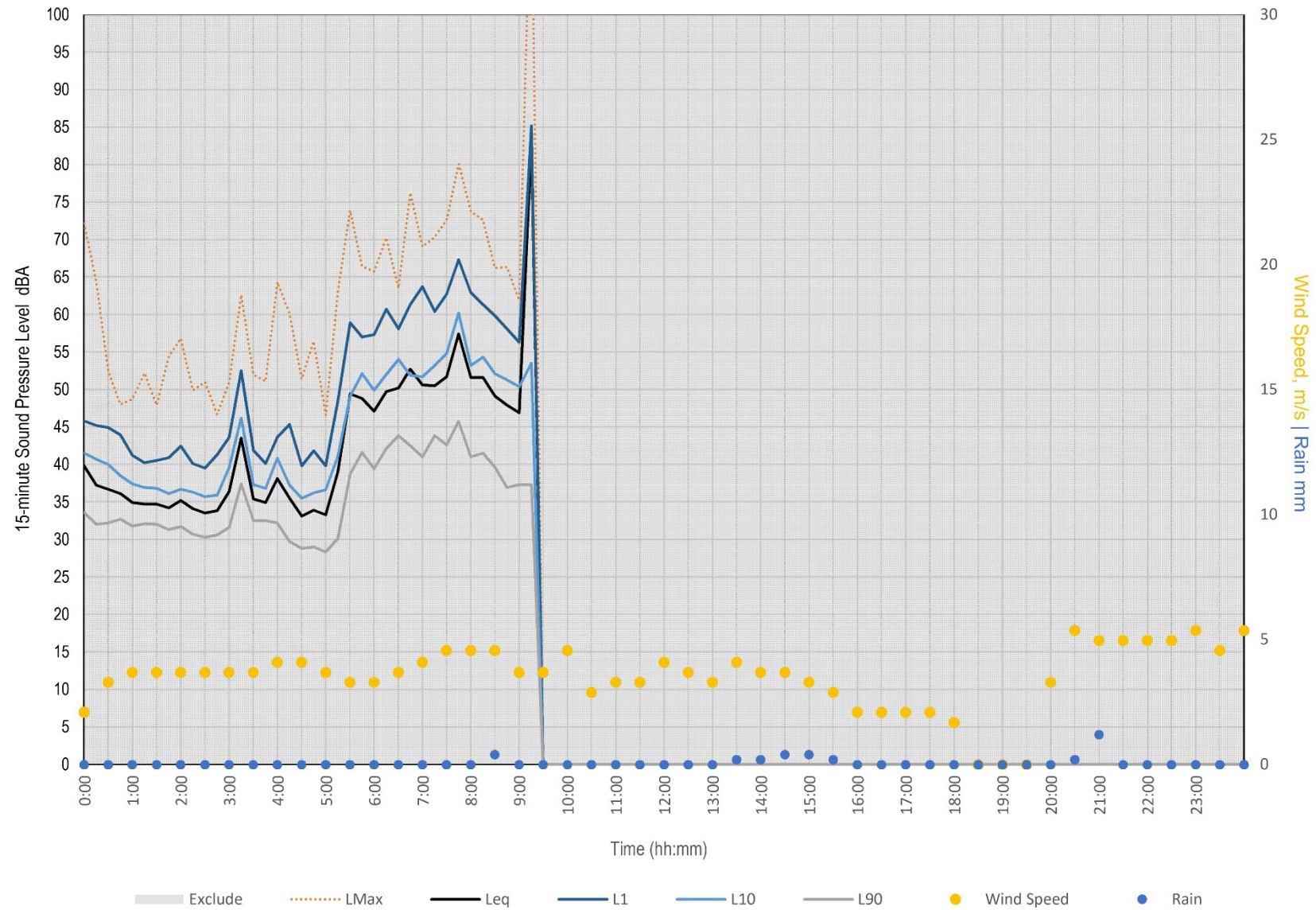
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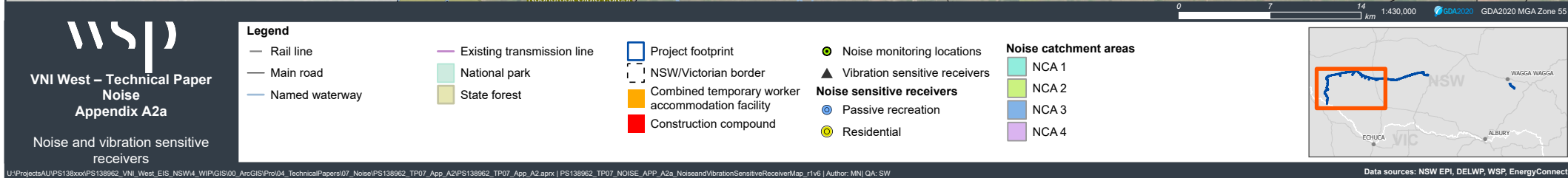
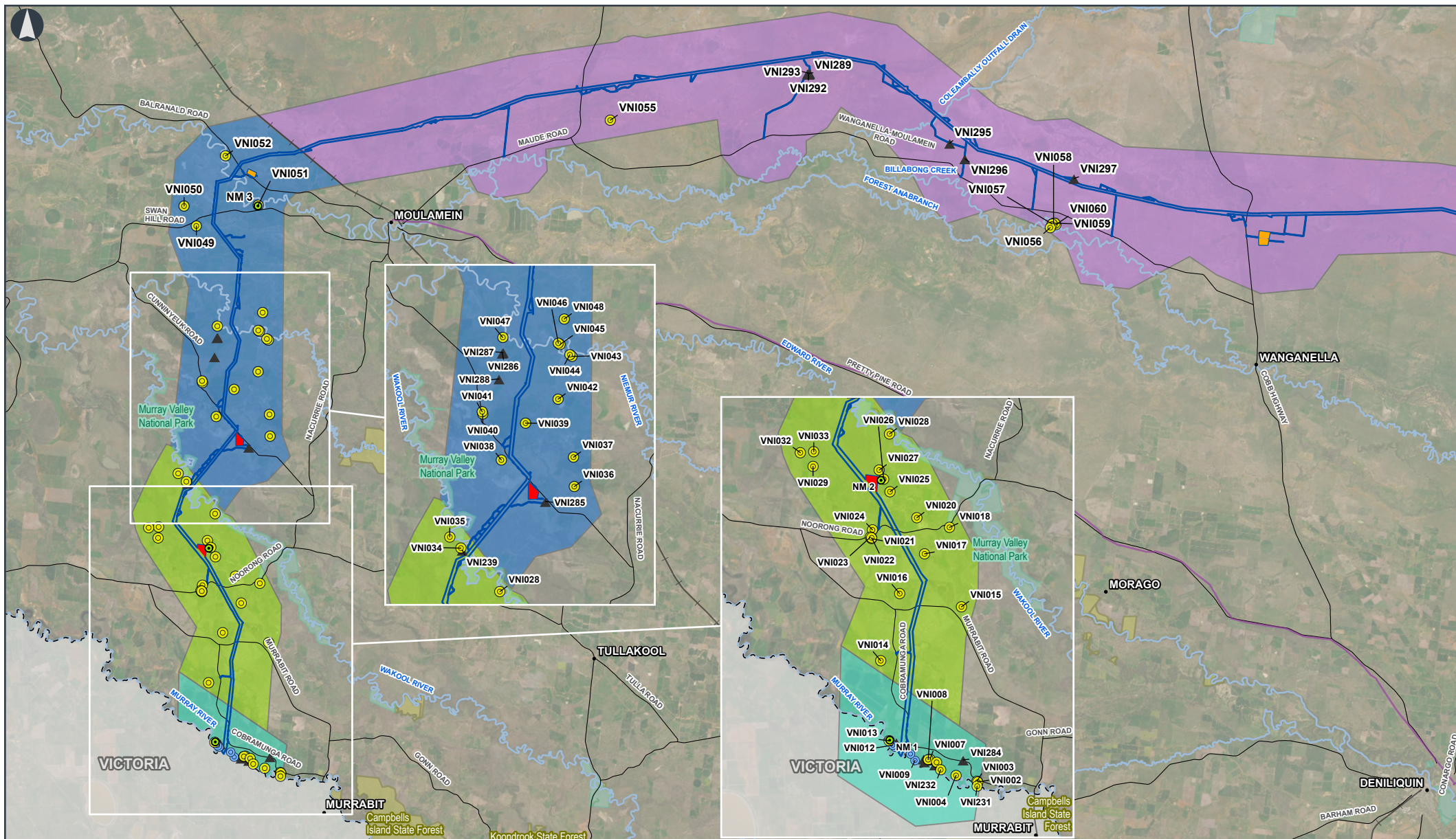


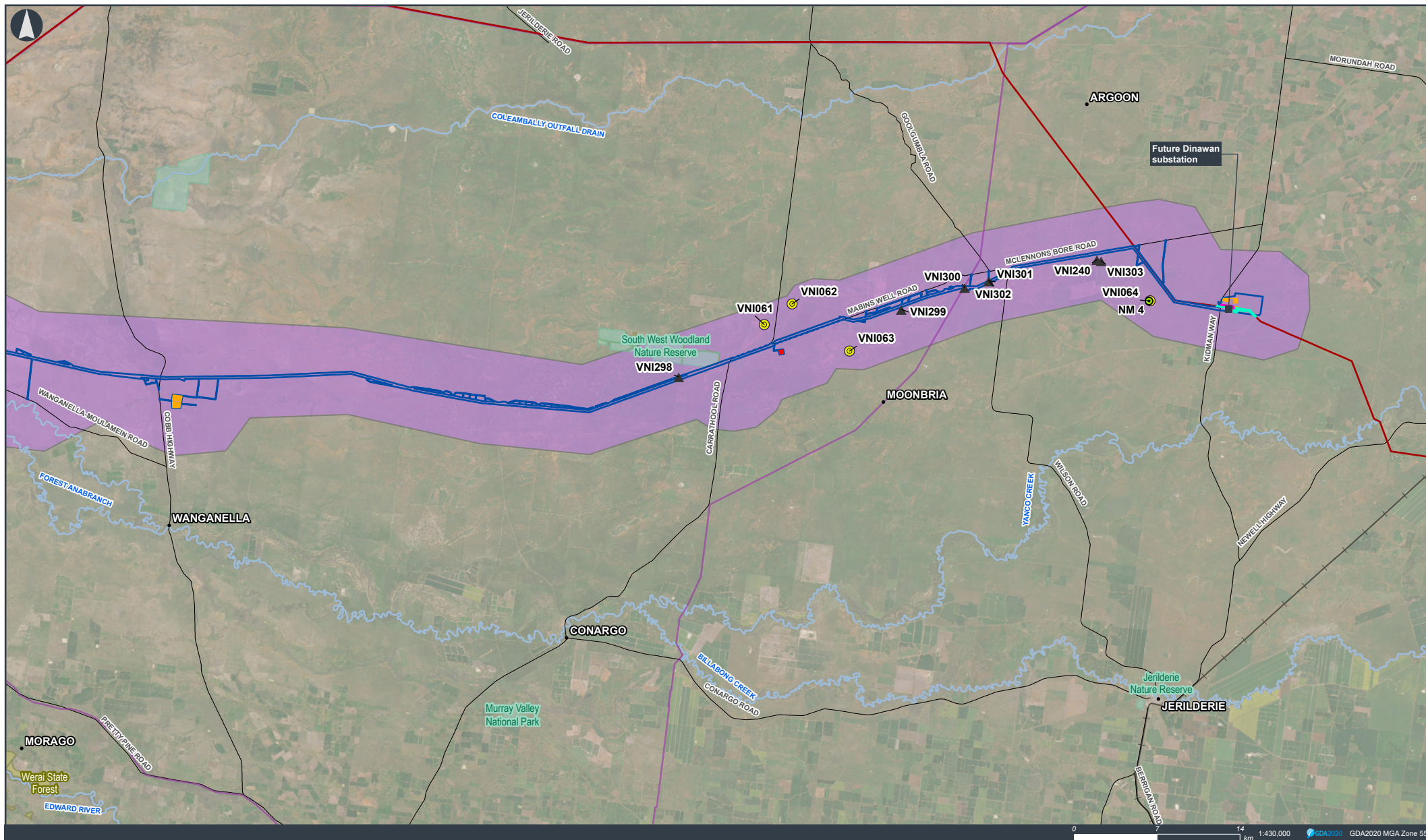
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Wednesday, 25 September 2024



A2 Noise and vibration sensitive receiver maps



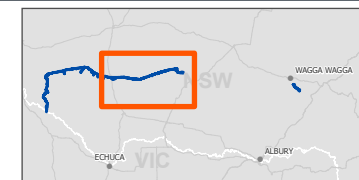


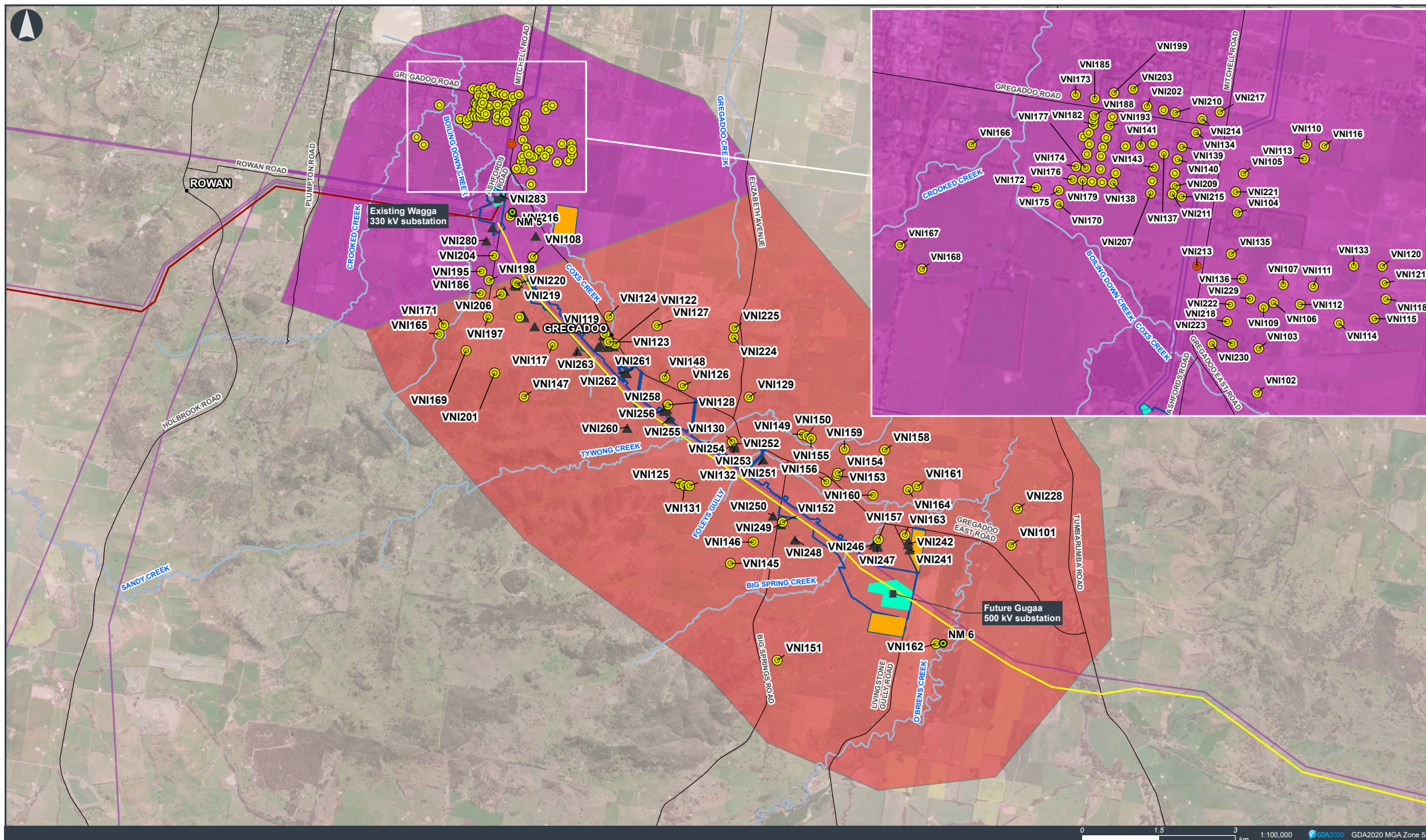
VNI West – Technical Paper
Noise
Appendix A2b

Noise and vibration sensitive
receivers

Legend

- | | | | | |
|--|--|--|----------------------------------|------------------------------|
| — Rail line | — Existing transmission line | □ Project footprint | ● Noise monitoring locations | Noise catchment areas |
| — Main road | — Dinawan substation works - proposed 500 kV | ■ Combined temporary worker accommodation facility | ▲ Vibration sensitive receivers | ■ NCA 4 |
| — Named waterway | — Dinawan substation works - existing 330 kV | ■ Construction compound | Noise sensitive receivers | |
| — EnergyConnect (NSW - Eastern section) project (under construction) | ■ National park | | ● Residential | |
| | ■ State forest | | | |





VNI West – Technical Paper
Noise
Appendix A2c

Noise and vibration sensitive
receivers

Legend

— Main road

— Named waterway

— EnergyConnect (NSW -

— Eastern section) project (under
construction)

— Existing transmission line

— HumeLink TL

— Substation

— Project footprint

— Combined temporary worker
accommodation facility

● Noise monitoring locations

▲ Vibration sensitive receivers

● Industrial

● Residential

Noise catchment areas

NCA 5

NCA 6

