Shoalhaven Starches Modification 31

Noise and Vibration Impact Assessment

Manildra Group

26 August 2025

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Executive summary

This report is subject to, and must be read in conjunction with, the limitations set out in section 1.7 and the assumptions and qualifications contained throughout the Report.

Assessment overview

GHD was engaged by Manildra to conduct a noise and vibration impact assessment for a proposed modification to the approved Shoalhaven Starches Expansion Project (SSEP). The modification seeks to deploy a suite of heat recovery updates and enabling infrastructure to capture and transform waste heat into usable energy to drive the ethanol, starch and gluten manufacturing processes.

Construction assessment findings

A construction noise assessment was undertaken to determine potential for increase in noise levels at sensitive receivers. Construction noise management levels were established from measured background noise levels.

Four construction scenarios were modelled to predict noise levels at representative sensitive receivers. The predicted noise levels indicate compliance with the noise management levels for the majority of construction activities at most of the sensitive receivers. However, foundation works and piling works may exceed the noise management level at one receiver and as such mitigation measures have been recommended.

Operational assessment findings

Noise sources associated with the operation of the proposed modification were identified and modelled in the site-wide noise model developed by GHD as part of the noise pollution reduction program. The predicted noise levels from the proposed modification were assessed against design noise goals (15 dB below the Environment Protection Licence and Development Consent 06_0228 Condition 12) and show compliance at all sensitive receivers. An analysis for annoying noise characteristics was undertaken and found that the proposed modification does not contain tonal or low frequency noise characteristics.

Additionally, cumulative noise levels of the following scenarios have been predicted:

– Current operations including the proposed modification and the rail line
– Current operations including all approved but not yet constructed modifications, the proposed modification and the rail line.

Predicted noise levels were analysed for annoying noise characteristics and found low frequency noise to be present at all sensitive receivers. The cumulative noise levels were assessed against the EPL noise limits, which show exceedances at all sensitive receivers. This is consistent with the Stage 1 of the Noise Pollution Reduction Program (Noise PRP) outcomes and a noise mitigation strategy has been developed within the PRP to address the exceedances. Nonetheless, for acoustic compliance, the bi-annual compliance measurement data should be referred to.

The proposed modification is anticipated to have no contribution to the overall noise levels from the site as the predicted noise levels are below the design noise goals. In addition, the proposed modification would reduce noise emitted from the Distillery cooling tower array because of a reduction in required cooling capacity.

Recommended construction mitigation measures are provided in Section 8.1 and recommendations for further detailed design of the proposed modification to minimise operational noise are provided in Section 8.2.

Key terms, acronyms and abbreviations

Term	Definition
A-weighting	The frequency weightings used in sound level measurements are often related to the response of the human ear so that the meter better responds to what you actually hear.
AWS	Automated Weather Station
Background noise	The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is described using the L90 descriptor.
C-weighting	C-weighting is an adjustment made to sound-level measurements that takes account of low-frequency components of noise within the audibility range of humans
CNMP	Construction Noise Management Plan
CNVG	Construction Noise and Vibration Guideline (Transport for NSW, 2024)
CNVMP	Construction Noise and Vibration Management Plan
Cumulative ANYC	Cumulative, Approved but Not Yet Constructed
dB	Decibel is the unit used for expressing the sound pressure level (SPL) or power level (SWL) in acoustics.
dBA	Decibel expressed with the frequency weighting filter used to measure 'A-weighted' sound pressure levels, which conforms approximately to the human ear response, as our hearing is less sensitive at low and high frequencies. The dBZ value is the unweighted sound pressure level.
DDG	Distiller's Dried Grain
DECC	NSW Department of Environment and Climate Change
DECCW	NSW Department of Environment, Climate Change and Water
EPA	NSW Environment Protection Authority
EPL	Environmental Protection Licence
GHD	GHD Pty Ltd
HVAC	Heating, Ventilation, and Air Conditioning
Hz	The measure of frequency of sound wave oscillations per second. 1 oscillation per second equals 1 hertz.
ICNG	Interim Construction Noise Guideline (DECC, 2009)
ID	Identification
ISO	International Organization for Standardization
$L_{Aeq,period}$	Equivalent sound pressure 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.
$L_{A90,\ period}$	The A-weighted sound pressure level that is exceeded for 90% of the time over which a given sound is measured. This is considered to represent the background noise e.g. $L_{A90,15min.}$
L_{Amax}	The absolute maximum noise level in a noise sample.
LFN	Low Frequency Noise
MOD31	Modification 31 of the Shoalhaven Starches Expansion Project
MVR	Mechanical Vapour Recovery
NCA	Noise Catchment Area
NML	Noise Management Level
Noise enhancing conditions	Wind and temperature inversion conditions

Term	Definition
Noise PRP	Noise Pollution Reduction Program
NPfI	Noise Policy for Industry (EPA, 2017)
NSW	New South Wales
NVIA	Noise and Vibration Impact Assessment
RAN	Royal Australian Navy
RBL	Rating Background Level
RNP	Road Noise Policy (DECCW, 2011)
RW	Sound transmission loss of a material or building element. The value is a single number rating that indicates how effective the material or building element reduces airborne sound transmission
SN	Serial Number
SSEP	Shoalhaven Starches Expansion Project
SWNM	Site-wide noise model
SWL	Sound power level
WWTP	Wastewater Treatment Plant

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1. Introduction

1.1 Background

GHD was engaged by Shoalhaven Starches Pty Ltd (Manildra) to conduct a noise and vibration impact assessment for a proposed modification to the Shoalhaven Starches Expansion Project (SSEP) (Modification 31 or MOD31).

Manildra operates the Shoalhaven Starches factory (the factory) at Bolong Road, Bomaderry, near Nowra, in NSW (the site). At the factory, flour and grains are processed to produce ethanol, starch, gluten, glucose and distiller's dried grain (DDG).

Manildra is the holder of Environment Protection Licence (EPL) number 883 issued by the New South Wales Environmental Protection Authority (NSW EPA).

1.2 Purpose and scope of this report

This report addresses the relevant requirements in the NSW Secretary's Environmental Assessment Requirements (SEARs) for the project issued in March 2025 (as outlined in Section 1.3) and assesses the potential noise and vibration impacts associated with the project. Specifically, this report describes the background and scope of the proposed modification with respect to potential noise and vibration impacts during construction and operation of MOD31.

1.3 Secretary's environmental assessment requirements

The SEARs relevant to noise and vibration, together with a reference to where they are addressed in this report, are outlined in Table 1.1.

Table 1.1 Noise and vibration SEARs

Requirements	Where addressed in this report
Noise and vibration	
A quantitative noise and vibration impact assessment undertaken by a suitably qualified acoustic consultant in accordance with the relevant Environment Protection Authority guidelines and Australian Standards which includes:	
– identification of all noise sources or potential sources from the development	Section 6.1 provides a description of noise sources associated with the components of the proposed modification.
– identification of impacts associated with site emission and traffic generation at noise affected sensitive receivers	Section 5 describes the impacts during construction of the proposed modification. Section 0 provides a qualitative assessment of road traffic noise because of traffic generation during the construction of the proposed modification. Section 6 describes the impacts during operation of the proposed modification.
– details of noise monitoring survey, background noise levels and noise emission levels of proposed activities	Section 2.2 describes the noise monitoring survey and established background noise levels.

Requirements	Where addressed in this report
– consideration of annoying characteristics of noise and prevailing meteorological conditions in the study area	Section 6.2.1 describes the analysis for annoying noise characteristics.
– the cumulative impacts of the development and all current operations of the site – the cumulative impacts of the development including all current operations and all approved but not yet constructed components of the site	Section 6.2.2 describes the predicted impacts from the current operations of the site, including the proposed modification and impacts from the current operations including all approved but not yet constructed modifications.
– details and analysis of the effectiveness of proposed management and mitigation measures to adequately manage identified impacts, including a clear identification of residual noise and vibration following application of mitigation these measures and details of any proposed compliance monitoring programs.	Section 7 provides mitigation measures to manage the identified impacts and considerations for further detail design of the proposed modification.

1.4 General site overview

Wheat flour and grains (wheat) are processed at the Manildra factory to produce ethanol, starch, gluten and glucose. Solid wastes are treated to produce DDG, with liquid wastes being transferred to the environmental farm wastewater treatment plant. Excess treated wastewater is irrigated onto pasture. The main processing and materials treatment areas (plant group areas) at Shoalhaven Starches comprise the:

– Flour mill
  - The flour mill is used to mill wheat grain into flour which is then further processed through the various site processing plants to produce starch, gluten, glucose and ethanol. All remaining mill feed and pollard (flour sieving rejects) is processed through the DDG dryers for sale as stock feed. Flours from the various grinding operations are collected and blended together before passing through final treatment and weighing operations to bulk storage bins. Flour is taken from these bins for use in existing site production processes.

– Starch & Gluten plant
  - Within the starch plant, flour is processed to separate the starch from gluten (the protein component of flour). The starch is graded, dried and packed for shipment. Different grades of starch are manufactured for food and paper making applications. Starch that is not used for these applications is used as a raw material for the ethanol plant. Gluten is dried and sold for use in the food industry.
  - Aqueous (water-based) wastes are reused within the plant or are transferred to the environmental farm wastewater treatment plant.

– Glucose plant
  - The glucose plant (contained within the starch plant area) houses two lines; the ‘confectioners’ glucose line and the ‘brewers’ glucose line. Confectioner’s glucose is distinguished by having been demineralised to remove latent odours and flavours that might be carried through to the final product by the glucose.
  - Both processes use starch as the raw material. The starch is broken down to its constituent glucose molecules using enzymatic and hydrolytic processes. Water is removed from the resulting solutions using evaporation to produce glucose and brewer’s solutions of desired concentration. The glucose product is shipped to customers in bulk containers.
  - The glucose manufacturing process generates aqueous wastes, mostly condensate from the evaporators, which is reused during regeneration of the ion exchangers.

– Ethanol and distillation plants
  - Waste starch from the starch plant is transferred to the ethanol plant and fermented to produce ethanol. Starch, which is in suspension, is heated in jet cookers before being fermented.
  - Fermentation is carried out in fermentation vessels using the treated substrate to which an ethanol-producing yeast inoculum has been added. The yeast inoculum is generated using yeast propagator vessels, these being seeded using commercial strains of yeast.
  - Wastes from the fermenters are transferred to the DDG plant for processing. Fermentation liquor from the ethanol plant is transferred to the distillation plant where water and other impurities are removed to produce various grades of ethanol.

– DDG plant
  - Wastes from the ethanol and distillation plant are dewatered in decanter centrifuges and dried in steam dryers to produce granular DDG. Light phase from the DDG decanters is evaporated to recover soluble protein (syrup) and produce clear condensate (liquid line). The syrup is added to the dryer feed for recovery of the solids (solids line). DDG granular product is transferred to the DDG Pellet Plant for pelletising; the DDG pellets are stored in silos. Some of the granular DDG product is stored in a storage shed until it is loaded into trucks in the DDG load-out area.

– Packing plant
  - Dried gluten/starch will be pneumatically transferred from the existing site to the new packing plant (currently under construction) via underground pipes. This dried material is proposed to be stored in silos.

- The packing plant will consist of seven silos that will store either gluten or starch product. The medium and large silos are to be filled 24 hours a day, seven days a week, while the small silos can be filled at any time of the day for eight hours.

– Environmental farm
  - A number of wastewater streams are produced at the factory. These consist of five clear condensate streams (distillation plant condensate, evaporator condensate, DDG condensate, a small flow from the carbon dioxide plant and boiler blowdown) and a combined 'dirty' stream from the factory processes. The 'dirty' wastewater streams are combined in the farm tank (located at the factory) and pumped to the wastewater treatment plant. Treated water is pumped back to the factory for re-use, while excess treated water is stored in dams for irrigation on the farm.
– Co-generators and boilers
  - Steam, which is used in various processes throughout the factory, is generated by using a combination of gas fired boilers (all existing boilers would be converted to operate on gas) and two gas fired co-generation turbine generators.
  - The site intends to rely primarily on the gas-fired co-generation plant to provide the baseload energy and steam production requirements for site operations. Certain boilers would operate at reduced capacity to meet any unexpected peaks in steam demands whilst other boilers would be allocated to standby duty (offline and not operating) for use during maintenance of the co-generation plant.
– Biofilters
  - Exhaust air from odorous sources at the DDG plant is captured and ducted to two existing soil-bed biofilters, each having a surface area of 100 m^2, located at the southwest corner of the factory (on the southern margin of the container storage area). An additional biofilter is currently undergoing commissioning. The biofilters comprise a bed of organic bark and compost material (the matrix), with distribution of the odorous airstream through the floor of the biofilter via a manifold. Biological oxidation of odorous compounds takes place as the foul air percolates upward through the matrix. The oxidation is achieved by a population of microorganisms in the bed.
  - While the efficiency of biofilters destroying odorous components of the waste air varies according to a range of factors including soil moisture, composition and temperature, it is very high. Any odour in the exhaust air from the biofilter is due to the inherent odour of the matrix materials and typically has an 'earthy' characteristic.

1.5 Summary of the proposed modification

MOD31 seeks to deploy a suite of heat recovery updates and enabling infrastructure to capture and transform waste heat into usable energy to drive the ethanol, starch and gluten manufacturing processes. This will ultimately reduce the amount of virgin steam that is required by 75 tph (637,500 tpa) displacing the need to burn natural gas at the plant's onsite co-generation plant and other gas-fired boilers.

To facilitate this, MOD31 proposes to:

– Introduce mechanical vapour recovery (MVR) technology stack and enabling infrastructure onto the beverage-grade ethanol distillery.
– Reconfigure and consolidate the distillation column for increased efficiency, including replacing aging infrastructure.
– Install a heat recovery system onto the DDG dryers which will capture hot process gasses and transfer through a heat exchanger to process water that heats the air.

A summary of site changes proposed as part of MOD31 and anticipated changes in noise emissions is provided in Table 1.2.

Table 1.2 Summary of MOD31 works with respect to noise emissions

Factory component	Proposed MOD31 works	Anticipated changes in noise emissions
DDG dryers 4 and 5	Installation of heat recovery system	Additional noise producing equipment for the heat recovery system.
Distillery	Introduce mechanical vapour recovery technology stack	Additional noise producing equipment adjacent to the Distillery including a heat recovery building.
Distillery cooling tower array	Reduction in cooling water demand	Reduction in required cooling towers to meet cooling water demand.

1.6 Context of modification

It is noted that the NSW EPA has issued a Noise Pollution Reduction Program (Noise PRP) as part of an amendment to Manildra's EPL number 883. GHD has completed the first stage of the Noise PRP, which included the identification of all existing noise sources on the site and identification of mitigation measures to be implemented and reviewed for feasibility.

GHD has developed a site-wide noise model (SWNM) for the site as described in the report *Shoalhaven Starches Pollution Reduction Program – Noise Compliance Investigation* (GHD, 2025).

1.7 Limitations

This report: has been prepared by GHD for Manildra Group and may only be used and relied on by Manildra Group for the purpose agreed between GHD and Manildra Group as set out in section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Manildra Group arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section 1.8 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Manildra Group and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

1.8 Assumptions

The preparation of this report relied on the following assumptions:

– The SWNM developed by GHD as described in the report *Shoalhaven Starches Pollution Reduction Program – Noise Compliance Investigation* (GHD, 2025) was used to assess cumulative noise levels.

– The SWNM was updated to include approved, but not yet constructed modifications based on noise and vibration impact assessments (where available) and measurement data collected by GHD during the noise monitoring program for the Noise PRP. The following additions were added to the SWNM:

- Northern packing plant (modification 9 and 21). Noise levels have been sourced from the report *Shoalhaven Starches – MOD 9 & 21 – Packing Plant Design Noise Verification* (Day Design, 2024).
- DDG dryers 6 and 7 (modification 11). It is assumed these dryers are identical to DDG dryers 4 and 5 and have been duplicated.
- Product dryer north of Starch Dryer 5 (modification 16 and 17). Noise levels have been based on measurements undertaken of the baghouse of Gluten Dryer 8.

– The noise modelling methodology assumptions are outlined in Section 4.

– The noise model was validated using near-field and far-field monitoring locations with consideration to the meteorological conditions during the nighttime period as described in Section 4.4.

– As rail noise was not included in the SWNM and the EPA has advised that rail noise is part of the licenced premises, rail noise levels have been sourced from Table 54 and 55 of the report *Environmental Noise Impact Assessment – Proposed Extension of Existing Rail Line and Extension to Product Dryer Building 3 & 4 (Rev E)* (Day Design, 2025). The rail noise levels have been used to determine the cumulative noise levels (current site, approved but not yet constructed modifications and the proposed modification) presented in this report.

– The SWNM was developed based on noise measurements undertaken using a sound intensity probe, which is able to account for noise directivity and allows for measurements close to the sources. However, the sound intensity probe is not able to measure frequency bands below 25 Hz.

  As the Noise Policy for Industry (EPA, 2017) requires assessment of low frequency noise characteristics to the 10 Hz one-third octave band, the sound intensity probe measurement data was supplemented with one-third octave measurement data between 10 and 25 Hz from Class 1 sound level meters at locations in the vicinity of the noise source.

2. Existing environment

2.1 Sensitive receivers

Noise and vibration sensitive receivers are defined based on the type of occupancy and the activities performed in the land use. Sensitive noise and vibration receivers could include:

– residential dwellings
– classrooms
– hospitals
– places of worship
– passive and active recreational areas such as parks, sporting fields, golf courses. Note that these recreational areas are only considered sensitive when they are in use or occupied
– hotels, motels, caretaker's quarters, holiday accommodation and permanent resident caravan parks.

To assess noise levels from the site, noise sensitive receivers within 1.5 km have been considered and representative receivers in each direction have been identified. A total of 13 receivers has been included in the noise model. Details of these receivers are outlined in Table 2.1 and are shown on Figure 2.1.

Receiver R5 is located relatively close to the site and represents Burraga/Pig Island. The noise levels at this receiver have been included in this report for informational purposes, however, this receiver is currently an uninhabited dwelling.

Table 2.1 Sensitive receivers

Receiver ID	Address	Receiver type	Land use	Direction from receiver to main site
EPL assessment locations				
R1	135 Terara Road, Terara	Residential	RU1 – Primary Production	North
R2	45 Ferry Lane, Terara	Residential	R2 – Low density residential	Northeast
R3	41A Meroo Street, Bomaderry	Residential	MU1 – Mixed use	Southeast
R4	1-3 Meroo Street, Bomaderry	Residential	R1 – General residential	Southeast
R7	19 Meroo Street, Bomaderry	Residential	MU1 – Mixed use	Southeast
R8	1 Nobblers Lane, Terara	Residential	RU1 – Primary Production	North
R9	2 Tarawara Street, Bomaderry	Residential	MU1 – Mixed use	East southeast
R10	10 Tarawara Street, Bomaderry	Residential	R3 – Medium Density Residential	Southeast
R11	17 Coomea Street, Bomaderry	Residential	R3 – Medium Density Residential	Southeast
R12	6 Birriley Street, Bomaderry	Residential	R3 – Medium Density Residential	Southeast
R13	1 Coomea Street, Bomaderry	Residential	R1 – General residential	Southeast
Additional residential locations				
R5	Burraga/Pig Island, Terara	Residential – uninhabited[1]	RU1 – Primary Production	West
R6	39 Hanigans Lane, Bolong	Residential	RU1 – Primary Production	Southwest

Legend

- Site boundary
- Modelled buildings
- Cadastre lots

Receiver

- NCA1
- NCA2
- NCA3

Paper Size ANSI A

0 200 400 m

Map Projection: Grid Map of Australia
Horizontal Datum: GDA2020
Grid: Grid Map of Australia GDA2020 Zone 56

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Site and representative sensitive receivers

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FIGURE 2.1

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Data Source: Nearmap

Created By: Matthijs Oosterlaken

2.2 Existing noise environment

2.2.1 Noise monitoring

Noise monitoring was undertaken from 9 December 2024 until 19 December 2024 at three locations representative of residential receivers to quantify and characterise the existing ambient noise environment across the study area.

The long-term noise monitoring program was undertaken in accordance with the *Approved methods for measurement and analysis of environmental noise* (EPA, 2022) and rating background noise levels (RBLs) were calculated in accordance with the NPfI. The full noise monitoring methodology is outlined in Appendix A. The noise monitoring locations are shown on Figure 2.3 and the unattended noise monitoring results are presented in Table .

Table 2.2 Unattended noise monitoring results – GHD 2024

Location	NCA	Rating background level (dBA)			Ambient noise level $L_{Aeq,period}$ (dBA)		
		Day	Evening	Night	Day	Evening	Night
L1 – 1 Nobblers Lane, Terara	NCA01	38	32	32 (33[1])	55	51	44
L6 – 17 Dalwah Street, Bomaderry	NCA02	41	41 (44[1])	35	56	54	47
L5 – 280 Bolong Road, Bolong	NCA03	43	38	38 (42[1])	61	58	55

Notes:

1. Where the measured background level for a period exceeds the previous period, the RBL of the previous period is adopted in accordance with the NPfI to protect the more sensitive evening and night periods.

As noted in the NPfI:

> *"For the assessment of modifications to existing premises, the noise from the existing premises should be excluded from background noise measurements. The exception is where the premises have been operating for a significant period of time and is considered a normal part of the acoustic environment; it may be included in the background noise assessment under the following circumstances:*
>
> – *The development must have been operating for a period in excess of 10 years in the assessment period/s being considered and is considered a normal part of the acoustic environment; and,*
> – *The development must be operating in accordance with noise limits and requirements imposed in a consent or licence and/or be applying best practice."*

Although the existing premises has been operational for more than 10 years, it is noted that noise limits of the EPL and Development Consent 06_0228 are currently not met (as described in Section 6.2.2). As such, the RBLs should be established without noise from the premises.

In Table 2 of the report *Environmental Noise Impact Assessment – Proposed Extension of Existing Rail Line and Extension to Product Dryer Building 3 & 4 (Rev E)* (Day Design, 2025), Day Design established RBLs whilst the site was both online and offline during April and October 2024. The RBLs whilst the site was offline have been adopted for the purpose of this assessment. The adopted RBLs for the three NCAs and used reference data from the Day Design report are detailed in Table 2.3.

It is noted that this is considered to be a conservative approach, as typically the Shoalhaven Starches site would be operational and contribute to the existing noise environment.

Table 2.3 Adopted rating background noise levels based on the Day Design noise monitoring during plant shutdown

NCA	Rating background level (dBA)			Source
	Day	Evening	Night	
NCA01 (Terara)	35 (32)[1]	34	30[2]	Monitoring location DD17
NCA02 (Bomaderry)	49	42	38	Monitoring location DD1
NCA03 (Bolong)	36	36 (40)[3]	36 (37)[3]	Monitoring location DD11

Notes:

1. The NPfI minimum background noise level of 35 dBA was adopted for the daytime.
2. Data for nighttime during plant shutdown was unavailable due to logger power failure. As such, the NPfI minimum background noise level of 30 dBA for the nighttime was adopted.
3. Where the measured background level for a period exceeds the previous period, the RBL of the previous period is adopted in accordance with the NPfI to protect the more sensitive evening and night periods.

2.2.2 Meteorological conditions during noise monitoring

Weather conditions, wind and rain, during monitoring period, from 9 December until 19 December 2024, were obtained from the on-site weather station. This data was used to exclude periods of rain or where wind speeds were greater than 5 m/s at the microphone height. No rain was recorded during the monitoring period and a wind rose of the wind vectors recorded is shown in Figure 2.2 for each of the assessment periods.

The wind roses show that the average windspeed is higher during the day and evening periods than the night periods and the wind direction shifts from northeast during the day to south and southwest during the evening and night periods.

The wind vector data during the night period was analysed in further detail to determine the magnitude of noise-enhancing conditions for each receiver using the calculation for the C_{met} correction term outlined in ISO9613-2:2024 for the purposes of model validation. It is noted that ISO9613-2:1996 does not provide an explicit calculation method for this term, and as such ISO9613-2:2024 was only used to calculate the C_{met} correction term. The noise model predictions were undertaken using ISO9613-2:1996, as detailed in Section 4.

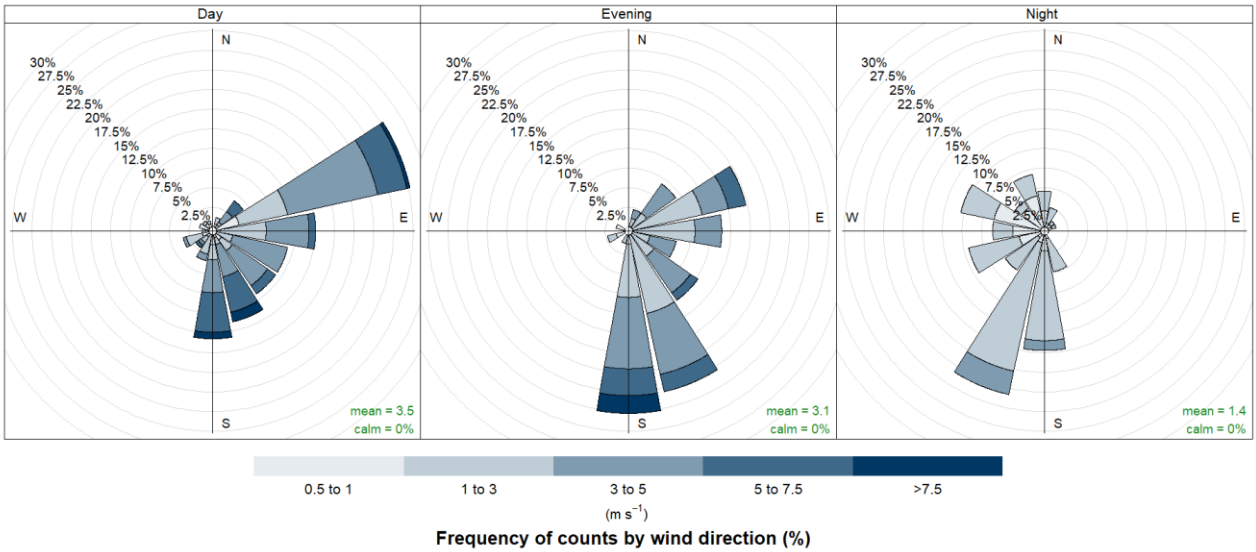

Figure 2.2 Assessment period wind rose during monitoring period

Legend

Monitoring locations
- Near field
- Far field

Modelled buildings

Site boundary

Paper Size ANSI A

0 250 500 m

N

Map Projection: Grid Map of Australia
Horizontal Datum: GDA2020
Grid: Grid Map of Australia GDA2020 Zone 56

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Noise monitoring locations

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FIGURE 2.3

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Data Source: Nearmap

Created By: Matthijs Oosterlaken

2.3 Meteorological conditions

2.3.1 Atmospheric conditions

Temperature and humidity affect how sound is absorbed by the atmosphere. With a fixed temperature at 15 ºC, a decrease in relative humidity from 80% to 20% can decrease the sound level at a listener standing 800 metres from the noise source by 3 dB (at 1000 Hz). Fixing the relative humidity at 80%, an increase in temperature from 15 ºC to 30 ºC can decrease the sound level at 800 metres from the noise source by 3 dB (at 1000 Hz).

Adopting an average temperature of 10 °C and average humidity of 70% is generally representative of the atmospheric conditions for environmental noise propagation and is considered appropriate for the purposes of this assessment.

2.3.2 Noise enhancing conditions

Certain meteorological/weather conditions can increase noise levels at a receiver by focusing wave propagation paths towards a single point. This will occur during temperature inversions (atmospheric conditions where temperature increases with height above ground level), and where there is a wind gradient (that is, wind velocities increase with height) with wind direction from the source to the receiver. These conditions are defined in the following way in the *Noise Policy for Industry* (EPA, 2017) (NPfI)*:*

– Wind gradients when the atmospheric stability is unstable or neutral (categories A – D) and the source-to-receiver wind speed is 3 m/s or less, or

– Temperature inversions, during the night-period, when the atmospheric stability is moderately to extremely stable (category F) and the source-to-receiver wind speed is 2 m/s or less.

A review of meteorological conditions at the Nowra Royal Australian Navy (RAN) Air Station Automatic Weather Station (AWS) (2020 – 2024) was undertaken to determine the significance of noise-enhancing meteorological conditions and atmospheric conditions on noise propagation in accordance with the NPfI. Although Manildra has an on-site weather station, the meteorological analysis for noise enhancing conditions was undertaken using the RAN AWS data as more historical data was available.

2.3.2.1 Atmospheric stability

The atmospheric stability is defined in the NPfI using the Pasquill-Gifford stability scheme, where stability categories A – C represent unstable atmospheric conditions, category D is representative of neutral conditions and categories E – F represent stable conditions. Stability categories have been determined using the Turner Scheme, as described in Fact Sheet D1 of the NPfI.

Temperature inversions occur during the night-time period in moderate to extreme stable atmospheric conditions (category F) and when combined with light winds (less than 2m/s) have the potential to increase noise levels from ground operations. Wind gradients can occur during unstable or neutral conditions (categories A – D) and when combined with light winds (less than 2m/s) have the potential to increase noise levels from ground operations.

2.3.2.2 Frequency of winds

To determine the significance of noise-enhancing meteorological conditions the wind speed and wind direction is required. Noise-enhancing conditions occur during light winds, up to 3 m/s, in the source to receiver direction. To determine the significance of these conditions the vector component of the wind is analysed.

A thorough review of the vector components of hourly wind data from 2020 – 2024 was undertaken for data from the Bureau of Meteorology (BoM) Nowra RAN Air Station AWS (number 068072). The BoM observations are approximately 12 km southwest of the site. Figure 2.4 shows the wind roses (2020 – 2024) for wind speeds less than 3 m/s and 2 m/s in each NPfI assessment period and for each season. The wind roses show significant portion of light winds from the northwest during autumn and winter, shifting to the east and southeast during spring and summer.

2.3.2.3 Assessment of significance

The NPfI recommends consideration of the effects of temperature inversions and wind gradients with wind direction from the source to the receiver if they are “significant”. The NPfI defines “significant” as occurring for 30% of the time in any assessment period and season in the direction of sensitive receivers. Table 2.5 provides a summary of the percentage occurrence of noise-enhancing conditions for 16 wind compass directions.

While the EPL requires, by condition L5.5, that the limits apply under noise enhancing conditions, the analysis shows that only receivers in some directions and only in some assessment periods experience significant noise enhancing conditions. Noise-enhancing conditions are significant during the day and night periods in autumn and winter for receivers located east to southeast of the site and during the day period in summer for receivers located northwest and of the site.

The significance of noise enhancing conditions at each of the sensitive receptors is outlined in Table 2.4. As the analysis identified that significant noise-enhancing effects are significant for some of the model receivers, as per the NPfI, both adverse and neutral conditions should be included in noise modelling.

Table 2.4 Assessment of significance of noise enhancing conditions at receiver locations

Receiver ID	Address	Direction from receiver to main site	Significant noise enhancing conditions?
R1	135 Terara Road, Terara	North	No
R2	45 Ferry Lane, Terara	Northeast	No
R3	41A Meroo Street, Bomaderry	Southeast	Yes (Summer day)
R4	1-3 Meroo Street, Bomaderry	Southeast	Yes (Summer day)
R5	Burraga/Pig Island, Terara	West	Yes (Winter night)
R6	39 Hanigans Lane, Bolong	Southwest	No
R7	19 Meroo Street, Bomaderry	Southeast	Yes (Summer day)
R8	1 Nobblers Lane, Terara	North	No
R9	2 Tarawara Street, Bomaderry	East southeast	Yes (Summer day)
R10	10 Tarawara Street, Bomaderry	Southeast	Yes (Summer day)
R11	17 Coomea Street, Bomaderry	Southeast	Yes (Summer day)
R12	6 Birriley Street, Bomaderry	Southeast	Yes (Summer day)
R13	1 Coomea Street, Bomaderry	Southeast	Yes (Summer day)

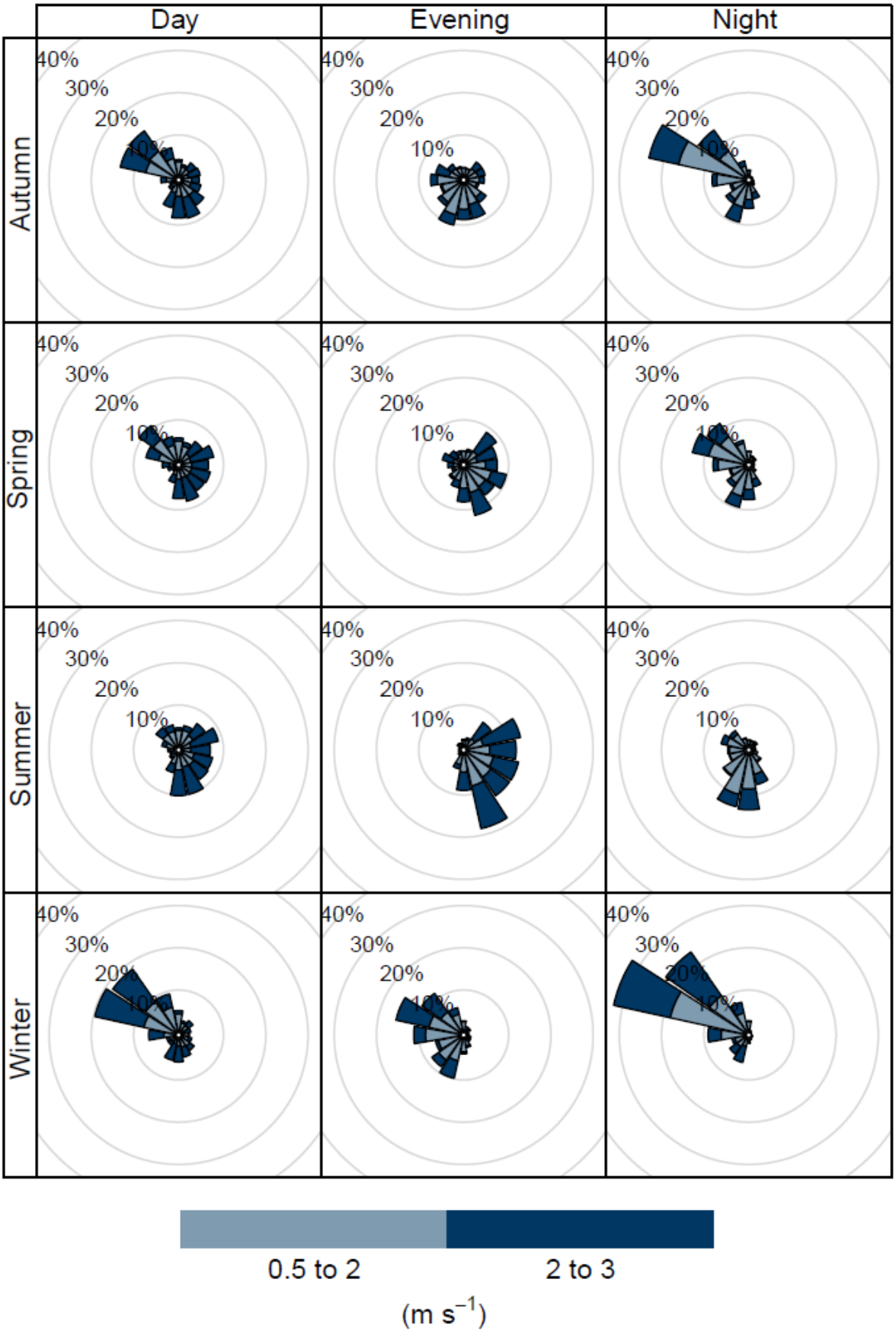


Figure 2.4 *Wind roses – frequency of counts by wind direction (%) – Nowra RAN Air Station AWS 2020 – 2024*

Table 2.5 Significant noise-enhancing conditions analysis – Nowra RAN Air Station AWS 2020 - 2024

Wind direction	Summer				Autumn				Winter				Spring			
	Day	Evening	Night		Day	Evening	Night		Day	Evening	Night		Day	Evening	Night	
	A – D	A – D	A – D	F	A – D	A – D	A – D	F	A – D	A – D	A – D	F	A – D	A – D	A – D	F
N	21%	3%	1%	8%	25%	2%	0%	11%	24%	0%	0%	14%	23%	4%	1%	15%
NNE	24%	8%	1%	6%	19%	3%	0%	4%	15%	0%	0%	6%	21%	7%	0%	9%
NE	25%	14%	0%	5%	16%	4%	0%	2%	11%	0%	0%	2%	21%	10%	0%	5%
ENE	27%	19%	0%	5%	17%	5%	0%	1%	9%	0%	0%	1%	22%	14%	0%	3%
E	29%	23%	0%	6%	20%	6%	0%	1%	10%	1%	0%	0%	23%	16%	0%	3%
ESE	**32%**	27%	1%	9%	23%	7%	0%	3%	11%	1%	0%	1%	25%	18%	0%	5%
SE	**33%**	23%	2%	15%	26%	7%	0%	6%	13%	1%	0%	1%	24%	16%	1%	8%
SSE	**32%**	18%	3%	23%	27%	5%	0%	11%	15%	1%	0%	2%	23%	13%	1%	14%
S	27%	13%	4%	27%	25%	4%	0%	15%	14%	1%	0%	4%	18%	9%	1%	17%
SSW	22%	8%	4%	28%	21%	3%	0%	18%	13%	1%	0%	6%	15%	6%	2%	19%
SW	16%	3%	4%	28%	17%	1%	0%	22%	14%	0%	0%	10%	12%	3%	2%	22%
WSW	11%	2%	4%	24%	20%	1%	0%	**33%**	21%	0%	0%	24%	12%	3%	2%	25%
W	12%	1%	3%	19%	25%	1%	0%	**35%**	29%	0%	0%	**31%**	17%	3%	2%	26%
WNW	14%	1%	3%	15%	29%	1%	0%	**33%**	**33%**	0%	0%	**32%**	20%	3%	2%	26%
NW	17%	2%	3%	13%	**31%**	1%	0%	**32%**	**35%**	0%	0%	**32%**	23%	3%	2%	26%
NNW	19%	2%	2%	11%	**31%**	1%	0%	26%	**33%**	0%	0%	28%	24%	3%	1%	21%

3. Noise criteria

3.1 Development Consent 06_0228

The site is subject to Development Consent 06_0228, last modified on 19 December 2024 under the *Environmental Planning and Assessment Act 1979* authorising Manildra to carry out development of the site in accordance with the statement of commitments and the conditions of the consent. It is noted that the Development Consent only applies to the current site and approved modifications, and is not applicable to the proposed modification. Nonetheless, the Development Consent includes several conditions which are considered relevant to the noise assessment, which are reproduced below:

Hours of Operation

11. The Applicant shall comply with the restrictions in Table 1.

Table 1: Construction and Operation Hours for the Development

Activity	Day	Time
Construction	Monday – Friday	7:00 am to 6:00 pm
	Saturday	8:00 am to 1:00 pm
	Sunday and Public Holidays	Nil
Piling activities	Monday – Friday	9:00 am to 5:00 pm
Operation	All days	Any time
Use of Paper Mill site	Monday – Saturday	7:00 am to 6:00 pm
	Sunday and Public Holidays	8:00 am to 6:00 pm

Note: Construction activities may be conducted outside the hours in Table 1 provided that the activities are not audible at any residence beyond the boundary of the site.

Noise Limits

12. The Applicant shall ensure that noise from the development does not exceed the noise limits in Table 2.

Table 2: Development Noise Limits

Location	Day/Evening/Night $L_{Aeq,15minute}$ dBA	Night $L_{A1,1\ minute}$ dBA
1 – Terara on the South side of the Shoalhaven River	38	48
2, 3 & 4 – DILWra on the south side of the Shoalhaven River	38	48
5 – Meroo Street, Bomaderry	42	52
6 – Other residential locations in Bomaderry	40	50
R1 – 390 Bolong Road Bomaderry	40	-
R2 – Pig (Burraga/Pig) Island	40	-
R3 – 39 Hanigans Lane Bomaderry	40	-
R4 – 1 Bryant Street Terara	40	-

Noise Management Plan

13. During construction, the Applicant shall implement all reasonable and feasible measures to minimise the construction noise impacts of the development.

13A. The Application shall implement a Construction Noise Management Plan (CNMP) to manage the noise impacts of construction of the Development and each modification. The CNMP shall:

a. Be prepared in accordance with the EPA's Interim Construction Noise Guideline;'

b. Be approved by the Secretary prior to the commencement of piling works;

c. Include procedures for notifying affected residences of the timing and duration of piling works, including scheduled respite periods; and

d. Include procedures for proactively responding to noise complaints and implementing all reasonable and feasible work practices to limit noise impacts.

14. The Applicant shall prepare a Noise Management Plan for the development to satisfaction of the Secretary. This plan must:

a. Be prepared by a suitably qualified and experienced expert in consultation with EPA, and be submitted to the Secretary for approval within 3 months of this consent;

b. Describe the measures that would be implemented to control the noise impacts of the development

c. Identify trigger levels for remedial action; and

d. Include a program to:

- *Investigate ways to reduce the noise impacts of the development; and*
- *Monitor the noise impacts of the development using a combination of real-time and supplementary attended monitoring measures, which includes a protocol for evaluating compliance with the noise limits.*

3.2 Environment Protection Licence

The site is currently subject to an EPL number 883, dated 23 September 2024 under the *Protection of the Environment Operations Act 1997* ('the Act') authorising Manildra to undertake chemical production, chemical storage and agricultural processing activities at the site.

Clause L5 of the EPL provides the following noise limits at residential premises:

L5 Noise limits

L5.1 *The LAeq (15 min) sound pressure level contribution generated from the premises must not exceed the following levels when measured at or near the boundary of any residential premises:*

Location	Day (7am to 6pm) $L_{Aeq,15\ min}$	Evening (6pm to 10pm) $L_{Aeq,15\ min}$	Night (10pm to 7am) $L_{Aeq,15\ min}$	Night (10pm to 7am) $L_{A1,1\ min}$
At locations in Terrara on the south side of the Shoalhaven River	38	38	38	48
At locations in Nowra on the south side of the Shoalhaven River	38	38	38	48
At locations in Meroo Street, Bomaderry	42	42	42	52
At other residential locations in Bomaderry	40	40	40	50

L5.2 *Noise from the premises is to be measured at the most affected point or within the residential boundary, or at the most affected point within 30m of a dwelling where the dwelling is more than 30m from the boundary, to determine compliance with condition L5.1.*

The modification factors in Fact Sheet C of the Noise Policy for Industry shall also be applied to the measured noise levels where applicable.

L5.3 *Noise from the premises is to be measured at 1 metre from the dwelling facade to determine compliance with the LA1(1 minute) noise limit in condition L5.1.*

L5.4 *Where it can be demonstrated that direct measurement of noise from the premises is impractical, the EPA may accept alternative means of determining compliance (see Chapter 7 of the Noise Policy for Industry).*

L5.5 *The noise emission limits identified in condition L5.1 apply under meteorological conditions of:*
a) Wind speed up to 3 metres per second at 10 metres above ground level; or
b) Temperature inversion conditions of up to 3°C/100 metres and wind speed up to 2 metres per second at 10 metres above ground level.

3.3 Noise management plan

Previous approval for the Shoalhaven Starches Expansion Project, required the preparation of a Noise Management Plan to address and manage noise emission from the expansion project.

The Shoalhaven Starches Noise Management Plan originally prepared 31 October 2009 and revised 7 September 2010 addresses, among other things, acoustic criteria relating to the Shoalhaven Starches complex and any new developments. Section 3 of the plan lists noise limits from the EPL as shown in Section 3.2 above and states:

> *"Compliance testing conducted on a regular basis on behalf of the Mill* [Shoalhaven Starches complex] *has found noise emission from the premises satisfies the EPA criteria as a result of works on the Shoalhaven Starches site. In order to ensure that there is no increase in noise emission from the subject premises, with respect to the noise criteria nominated by the EPA in License Condition 6.3* [now 5.1]*, the design goal for such additional plant should be at least 10 dB below the criteria nominated by the EPA"*

Given the number of modifications subsequent to the original approval and locations of new noise sources, it is recommended that the noise design goals for any additional items of plant are set to a minimum 15 dB below the EPL noise limit to mitigate any increase in overall noise emission from the existing site.

3.4 Construction noise criteria

Construction noise management levels (NML) at sensitive residential receivers are provided in Table 3.1. The NML during recommended standard hours (Monday to Friday: 7 am to 6 pm, Saturday: 8 am to 1 pm and no work on Sundays or public holidays) represent a noise level that, if exceeded, would require management measures including:

– Reasonable and feasible work practices.
– Contact with the residences to inform them of the nature of works to be carried out, the expected noise levels, durations and contact details.

The management measures are aimed at reducing noise impacts at the residential receivers. However, it may not be reasonable and feasible to reduce noise levels to below the noise affected management level. The noise affected NML during recommended standard hours are not intended as a noise limit but rather a level where noise management is required

The *Interim Construction Noise Guideline* (DECC, 2009) (ICNG) acknowledges that the following activities have justification to be undertaken outside the recommended standard construction hours assuming that all reasonable and feasible mitigation measures are implemented to minimise the impacts to the surrounding sensitive land uses:

– The delivery of oversized plant or structures that police or other authorities determine to 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.
– Works where a proponent demonstrates and justifies a need to operate outside the recommended standard construction hours.
– Works which maintain noise levels at receivers to below the NML outside of the recommended standard construction hours.

Table 3.1 Residential construction noise management levels

Time of day	Noise management levels $L_{Aeq,15\ min}$	Application notes
Recommended standard hours	Noise affected RBL + 10 dBA	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq,15\ min}$ 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: 1. Times identified by the community when they are less sensitive to noise (such as before and after school, or mid-morning or midafternoon for works near residences) 1. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5 dBA	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 measures have been applied and noise is more than 5 dBA above the noise affected level, the proponent should negotiate with the community.

A summary of the NMLs is presented in Table 3.2 below. In establishing the NMLs, the RBLs whilst the Shoalhaven Starches site was offline were used (refer to Table 2.3).

Table 3.2 Project noise management levels

Receiver type	Construction noise management levels, $L_{Aeq,15\ min}$ dBA				
	Standard recommended hours		Outside recommended hours		
	Noise affected	Highly noise affected	Day	Evening	Night
Residential – NCA01 (Terara)	45	75	40	39	35[1]
Residential – NCA02 (Bomaderry)	59	75	54	47	43
Residential – NCA03 (Bolong)	46	75	41	41	41

Note 1: The NML during the OOHW nighttime has adopted the minimum background noise level of 30 dBA as per the NPfI.

3.5 Road traffic noise criteria

The *NSW Road Noise Policy* (DECCW, 2011) (RNP) provides traffic noise criteria for residential receivers in the vicinity of existing arterial and local roads. The criteria (reproduced in Table 3.3) are applied to operational and construction traffic on public roads to identify potential road traffic noise impacts and the requirement for reasonable and feasible mitigation measures.

Table 3.3 Road traffic noise criteria

Road category	Type of development	Day 7 am to 10 pm	Night 10 pm to 7 am
Freeway/arterial/ sub-arterial roads	Existing residence affected by additional traffic on arterial roads generated by land use developments	60 $L_{Aeq,15hr}$	55 $L_{Aeq,9hr}$

Road category	Type of development	Day 7 am to 10 pm	Night 10 pm to 7 am
Local roads	Existing residences affect by noise from new local road corridors Existing residence affected by additional traffic on local roads generated by land use developments	55 $L_{Aeq,1hr}$	50 $L_{Aeq,1hr}$

Additionally, the RNP application notes state that *"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 wherever the noise level without the development is within 2 dB of, or exceeds, the relevant day or night criterion."*

Therefore, if the road traffic noise increase is within 2 dBA of current levels during construction or operation of the project, then the objectives of the RNP are met and no specific mitigation measures are required, regardless of whether values presented in Table 3.3 are exceeded.

3.6 Operational noise criteria

3.6.1 Noise Policy for Industry

3.6.1.1 Applicability of the NPfI

The NPfI provides guidance on the assessment of operational noise impacts. The guideline includes both intrusiveness and project amenity noise levels that are designed to protect receivers from noise significantly louder than the background level, and to limit the total noise level from industry near a receiver.

The NPfI project noise trigger levels provide an objective for assessing a project and are not mandatory limits required by legislation. The project noise trigger levels assist the regulatory authorities to establish licensing conditions. Where project noise trigger levels are predicted to be exceeded, feasible and reasonable noise mitigation strategies should be considered. In circumstances where noise criteria cannot be achieved, residual noise impacts are used to assess noise impacts and manage noise from the site in negotiation between the regulatory authority and community. The regulatory authority then sets statutory compliance levels that reflect the achievable and agreed noise limits from the development.

The intrusiveness noise level controls the relative audibility of operational noise compared to the background level at residential receivers. The amenity noise level limit the total level of extraneous noise for all receiver types. Both levels are calculated and the lower of the two in each time period is set as the project noise trigger level. The intrusiveness noise level is assessed over a 15-minute period however the amenity noise level is assessed over the day, evening or nighttime period. For the purposes of assessment to standardise the approach the NPfI recommends that the $L_{Aeq,15min}$ = $L_{Aeq,period}$ + 3 dBA unless an alternative approach can be justified.

3.6.1.1 Intrusiveness noise level

The intrusiveness noise level is determined by a 5 dB addition to the measured or adopted background noise level with a minimum intrusiveness noise level of 35 dBA for the evening and night period and 40 dBA for the day period. The NPfI recommends that the intrusiveness noise level for the evening and night period should not exceed the daytime period. The intrusiveness noise levels are only applicable to residential receivers.

3.6.1.2 Amenity noise level and project amenity noise level

The recommended amenity noise level applies to all industrial noise in the area which when combined should remain below the recommended amenity noise level. The recommended amenity noise level represents the total industrial noise sought to be achieved at a receiver location from all new and approved sources.

Residential receiver areas are characterised into 'urban', 'suburban', 'rural' based on land uses and the existing level of noise from industry and road traffic. With consideration to the NPfI 'noise amenity area' classification, the residential receivers are located in 'RU1 – primary production', 'MU1 – mixed use', 'R1 – General residential' and 'R2 – low density residential' land use areas and have been considered as 'Rural Residential' for this assessment.

The project amenity noise level is the objective for noise from a single premises and is set at 5 dBA below the recommended amenity noise level to ensure that the industrial noise levels remain within the recommended amenity noise level. However, where numerous industrial sites are to be redeveloped or are proposed in an area it may be relevant to divide the amenity level amongst the additional new noise generating premises. While the project site is situated amongst a number of other industrial sources, this expansion is not included in a larger development and would constitute a single premises expansion.

3.6.2 Sleep disturbance

The potential for sleep disturbance from maximum noise level events from the premises during the nighttime period requires consideration. Sleep disturbance is considered to be both awakenings and disturbance to sleep stages.

The NPfI states that where the project exceeds the following screening noise trigger levels at a residential location, a detailed maximum noise level event assessment should be undertaken:

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

The NPfI states the following regarding detailed maximum noise level event assessments:

> *The detailed assessment should cover the predicted maximum noise level, the extent to which the maximum noise level exceeds the RBL, and the number of times this happens during the night-time period.*
>
> *Other factors that may be important in assessing the extent of impacts on sleep include:*
>
> – *how often high noise events will occur*
> – *the distribution of likely events across the nighttime period and the existing ambient maximum events in the absence of the subject development*
> – *whether there are times of day when there is a clear change in the noise environment (such as during early-morning shoulder periods)*
> – *current scientific literature available at the time of the assessment regarding the impacts of maximum noise level ents at night.*
>
> *Maximum noise level event assessments should be based on the L_{AFmax} descriptor on an event basis under 'fast' time response.*
>
> *The detailed assessment should consider all feasible and reasonable noise mitigation measures with a goal of achieving the above trigger levels.*

3.6.3 Modifying factor corrections

The NPfI requires that modifying factor corrections are applied if the noise sources contain tonal, intermittent or low frequency characteristics, which have the potential to increase annoyance. The modifying factor corrections are detailed in Table 3.4.

Table 3.4 Modifying factor corrections

Factor	Assessment/ measurement	When to apply	Correction[1,2]
Tonal noise	One-third octave or narrow band analysis	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 above 400 Hz – 8 dB or more if the centre frequency of the band containing the tone is 160 to 400 Hz inclusive – 15 dB or more if the centre frequency of the band containing the tone is below 160 Hz.	5 dBA[2]

Factor	Assessment/ measurement	When to apply	Correction[1,2]
Low frequency noise	Measurement of C-weighted and A-weighted level	Measure/assess C and A weighted $L_{eq,T}$ levels over same time period. Correction to be applied if the difference between the two levels is 15 dB or more and: – Where any of the one-third octave noise levels in Table C2 (reproduced in Table 3.4) are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dBA positive adjustment to measured/predicted A-weighted levels for the evening/night period. – Where any of the one-third octave noise levels in Table C2 (reproduced in Table 3.4) are exceeded by more than 5 dBA and cannot be mitigated, a 5 dBA positive adjustment to measured/predicted A-weighted noise levels applies for the evening/night period and a dBA positive adjustment for the daytime period.	2 or 5 dBA[2]
Intermittent noise	Subjectively assessed	When the night-time noise level drops to that of the background noise level with a noticeable change in noise level of at least 5 dBA.	5 dBA

Notes:

1. Where two or more modifying factors are present the maximum correction is limited to 10 dBA.
2. Where a source emits a tonal and low-frequency noise, only one 5 dB correction should be applied if the tone is in the low frequency range.

Table 3.5 One-third octave band low frequency noise thresholds

Frequency (Hz)	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
dB(Z)	92	89	86	77	69	61	54	50	50	48	48	46	44

3.6.4 Project specific noise criteria

The project specific noise criteria for MOD31 are shown in Table 3.6 below. At receivers R5 and R6, the EPL does not provide a noise limit. However, section 12 of Schedule 3 of Development Consent 06_0228 does provide an $L_{Aeq,15min}$ noise limit of 40 dBA during the daytime, evening and nighttime period at these receivers and have been adopted for the purpose of this assessment.

The $L_{Aeq,15min}$ noise levels from the site are assessed as follows:

– noise emission from proposed plant and equipment associated with MOD31 is assessed against the design goal, which is established as 15 dB below the EPL and Development Consent 06_0228 noise limits

– cumulative noise emission from the current operation of the site, including MOD31 are assessed against the EPL noise limits

– cumulative noise emission from the current operations and all approved but not yet constructed components of the site are assessed against the EPL noise limits.

The EPL includes $L_{A1,1min}$ noise limits for assessment of sleep disturbance for the EPL assessment locations. The L_{Amax} descriptor has been adopted in this report for the assessment of sleep disturbance, as this is consistent with the methodology described in the NPfI and is considered to be an equivalent descriptor to quantify maximum noise levels.

As the EPL nor the Development Consent 06_0228 provide an L_{Amax} limit for receivers R5 and R6, the L_{Amax} criteria is derived in accordance with the NPfI methodology using the established RBL from monitoring location L5.

Table 3.6 Operational noise criteria

Receiver ID	Address	Noise limit during day, evening and night $L_{Aeq,15min}$ (dBA)	Noise limit night L_{Amax}	MOD31 design noise goal $L_{Aeq,15min}$ (dBA)
EPL assessment locations – Noise limits based on the EPL				
R1	135 Terara Road, Terara	38	48	23 (38 - 15)
R2	45 Ferry Lane, Terara	38	48	23 (38 - 15)
R3	41A Meroo Street, Bomaderry	42	52	27 (42 - 15)
R4	1-3 Meroo Street, Bomaderry	42	52	27 (42 - 15)
R7	19 Meroo Street, Bomaderry	42	52	27 (42 - 15)
R8	1 Nobblers Lane, Terara	38	48	23 (38 - 15)
R9	2 Tarawara Street, Bomaderry	42	52	27 (42 - 15)
R10	10 Tarawara Street, Bomaderry	40	50	25 (40 - 15)
R11	17 Coomea Street, Bomaderry	40	50	25 (40 - 15)
R12	6 Birriley Street, Bomaderry	40	50	25 (40 - 15)
R13	1 Coomea Street, Bomaderry	40	50	25 (40 - 15)
Additional residential locations – Noise limits based on condition 12 of Development Consent 06_0228 Schedule 3				
R5[1]	Burraga/Pig Island, Terara	40[2]	53[3]	25 (40 - 15)
R6	39 Hanigans Lane, Bolong	40[2]	53[2]	25 (40 - 15)

Notes:

1. The dwelling on Burraga/Pig Island is uninhabited. Noise levels and assessment against the noise limits in this NVIA have been included for information purposes.
2. The EPL does not provide noise limits for receivers R5 and R6, however, the Development Consent 06_0228 does include an operational noise limit of 40 dBA during all time periods for these receivers and has been included as such.
3. Based on the established RBL in Bolong (monitoring location L5) as per the NPfI.

4. Noise modelling methodology

4.1 Noise propagation algorithm

The *ISO 9613-2:1996 'Acoustics – Attenuation of sound during propagation outdoors'* (ISO, 1996) standard is an internationally recognised method for predicting environmental noise propagation in outdoor conditions. In simple terms, the ISO9613-2 method calculates the sound level at a receiver location as follows:

$$Lp = Lw + D_c - (A_{div} + A_{atm} + A_{gr} + A_{bar})$$

Where:

- **L_p** is the predicted octave-band sound pressure level at the receiver in decibels
- **L_w** is the octave-band sound power level produced by the point sound source relative to a reference sound power of one picowatt (1 pW), expressed in decibels
- **D_c** is the directivity correction, in decibels, that describes the extent by which the equivalent continuous sound pressure level from the point sound source deviates in a specified direction from the level of an omnidirectional point sound source producing the sound power level L_W (SWL), expressed in decibels
- **A_{div}** is the attenuation due to distance from the source to a receiver (geometric divergence)
- **A_{atm}** is the attenuation due to atmospheric absorption, which depends on distance, temperature, humidity, and the frequency of the sound
- **A_{gr}** is the attenuation due to the absorptive/reflective properties of the ground cover between the source and receiver (e.g., soft vs. hard ground)
- **A_{bar}** is the attenuation from screening/barriers such as ground terrain, buildings and physical structures, which reduce sound by blocking and diffracting it (depends on relative barrier height, material, and the source/receiver location)

4.2 Noise enhancing weather

A review of the significance of noise enhancing weather conditions was undertaken and is outlined in Section 2.3. It was determined that receivers in certain directions from the site may experience noise enhancing conditions more than 30% of the time and these conditions should be considered in the assessment. However, for other receivers in the study area noise enhancing conditions would not occur often and consideration of neutral conditions should be made for these receivers and as such both favourable and neutral conditions should be included in the noise modelling.

The ISO 9613-2 method assumes a light source to receiver wind which is considered to be favourable weather conditions that can enhance sound propagation, leading to higher noise levels at greater distances. To account for neutral conditions the downwind sound pressure level can be corrected to set conditions where meteorological conditions may not be favourable at all times using the C_{met} correction factor in the following equation:

$$L_{p\,(downwind)} = L_{p\,(average)} - C_{met}$$

For:

$C_{met} = 0$ if $d_p \leq 10 \cdot (h_S + h_R)$

$C_{met} = C_0[1 - \frac{10(h_S+h_R)}{d_p}]$ if $d_p > 10 \cdot (h_S + h_R)$

Where:

- **h_S** is the source height, expressed in metres
- **h_R** is the receiver height, expressed in metres

– **d_p** is the distance between the source and receiver projected to the horizontal ground plane, expressed in metres
– **C_0** is a correction factor, expressed in decibels, which depends on meteorological statistics for wind speed and direction, and temperature gradients which may depend on the angular orientation of the direction between the source and receiver

For this assessment the C_{met} correction has been used to correct modelled levels using measured wind conditions during monitoring periods for the purpose of model calibration as well as to account for neutral conditions in prediction of noise levels. To determine the C_0 coefficient for C_{met}, the equation provided in Annex C of ISO9613-2:2024 was used as ISO9613-2:1996 does not provide this explicit equation. During monitoring periods, wind vectors measured on site were utilised in this equation. To determine the correction for neutral conditions it was assumed that wind speeds are evenly distributed in all compass directions resulting in C_0 of 1.2.

4.3 Noise modelling program

Noise modelling was undertaken using SoundPLAN 9.1. SoundPLAN is a computer program for the calculation, assessment and prognosis of noise exposure. The software implements various environmental noise propagation algorithms, including the adopted ISO 9613-2:1996 algorithm. General parameters used in the SoundPLAN noise model are listed in Table 4.1.

Table 4.1 SoundPLAN noise modelling parameters

Input	Description
Model settings	
Prediction algorithm	ISO 9613-2:1996
Weather conditions	Based on an average temperature of 10°C and an average humidity of 70% (conservative).
Meteorological conditions	C_{met} adjustment to account for both neutral and noise enhancing (adverse) conditions as described in Section 4.2 Neutral: C_0 = 1.2 dB Adverse: C_0 = 0 dB
Model inputs	
Topography	5 metre intervals based on the digital elevation model 5 m Grid of Australia.
Receiver heights	1.5 metres above floor height (e.g. 1.5m for ground floor and 4.5m for first floor)
Buildings	For buildings outside of the site, footprints and heights have been sourced from the iNoise model developed by Day Design. Building footprints within the site are based on a georeferenced computer-aided design drawing where available. The building heights are based on elevation drawings provided by Manildra where available. Where no heights were available, an estimate was made based on photographs taken during the site visit and aerial imagery.
Reflections	The noise predictions consider two orders of reflection.
Ground absorption	0 for all bodies of water 0.25 for industrial premises and roads 0.75 for all other areas, which represents a mix of hard and soft ground.

4.4 Site wide noise model validation

As part of the Noise PRP, a SWNM was developed using at-source measurements as described in the report *Shoalhaven Starches Pollution Reduction Program – Noise Compliance Investigation* (GHD, 2025). The noise model results from the site-wide noise model were compared to noise monitoring undertaken in the near and far field from the site. The noise monitoring locations are shown in Figure 2.3.

A detailed description of the validation is provided in Appendix B. A summary of the validation is provided below.

4.4.1 Near field

Noise levels were measured at 14 locations near the site to validate the SWNM. These locations were selected to be close to noise sources but not directly affected by single noise sources. A comparison of measured and modelled L_{Aeq} and L_{A90} nighttime noise levels showed that most differences were within an acceptable 3 dB margin, accounting for the site's complexity and multiple noise sources. The L_{A90} was used for validation to avoid short-term noise fluctuations. The model slightly underpredicted noise levels on average by 1.1 dB, possibly due to nearby traffic or rail sources not included in the model. These findings need to be considered in conjunction with the far field monitoring described in Section 4.4.2.

4.4.2 Far field

Noise monitoring was carried out at seven locations up to 1,300 metres from the site to validate the noise model in all directions. Measurement data between midnight and 5am was used as this period is the least likely to be affected by extraneous noise providing confidence that measured levels consist of noise from the site only.

Meteorological conditions during the monitoring periods, presented in Section 3.2.2, have been analysed, particularly wind direction, to account for possible variability in measured levels across multiple nights. Calculation using the frequency of wind in each direction has been completed in accordance with Annex C of ISO9613.2:2024 to calculate the C_0 coefficient for the C_{met} parameter for each of 12 source to receiver directions.

For most receivers, predicted noise levels have been compared to the L_{Aeq}. The modelled level is input as an L_{Aeq} and as the time period chosen for comparison aims to exclude extraneous noise, the measured level would be closest to the L_{Aeq}. At locations L4 and L5, however, other external noise sources are still present during this nighttime period and therefore the L_{A90} level has been used for comparison at these locations.

A detailed description of the validation for each location, daily measured noise levels and predicted noise levels with consideration to the meteorological conditions are provided in Appendix B. Table 4.2 provides the average difference between the measured and predicted noise levels for the L_{Aeq} and L_{A90} noise levels.

Table 4.2 Average difference between measured and predicted noise levels

Location	Difference between average measured and predicted noise level (dBA)	
	L_{Aeq}	L_{A90}
Location 1	1.9	5.6
Location 2	-0.4	3.2
Location 3	1.3	3.2
Location 4	-5.6	-1.8
Location 5	-3.7	2.3
Location 6	-0.5	4
Location 8	-0.2	1.6

5. Construction noise impact assessment

5.1 Construction methodology

5.1.1 Construction hours

Construction of the proposed modification would occur during the recommended standard construction hours defined in the ICNG of:

– 7.00am – 6.00pm weekdays
– 8.00am – 1.00pm on Saturdays
– No construction on Sundays or public holidays

Some activities may be scheduled outside of standard construction hours, which could include:

– Work determined to comply with the relevant NMLs at the nearest sensitive receiver
– The delivery of materials by heavy vehicles outside standard construction hours as required by the NSW Police or other authorities for safety reasons. For example, oversize or over mass loads where delivery during the daytime is not possible due to impacts on daytime traffic
– Emergency situations where it is required to avoid the loss of lives and properties and/or to prevent environmental harm.

5.1.2 Construction equipment and materials

The construction works will consist of earthworks, foundation works including piling, pouring of concrete and construction of the buildings and gantries, and installation of all plant and equipment.

Plant and equipment needed for the proposed modification would be determined during the construction planning phase. Noise level data has been obtained from the Australian Standards *AS2436 – Guide to noise and vibration control on construction, demolition and maintenance sites* (Australian Standard, 2010) and the *Construction Noise and Vibration Guideline (Roads)* (Transport for NSW, 2024) (CNVG). Other equipment may be used; however, it is anticipated that they would produce similar net noise emissions when used concurrently with the equipment listed. Table 5.1 presents the construction equipment proposed for each construction scenario.

Table 5.1 Construction equipment and assumed sound power levels

Equipment	Sound power level (dBA)	Source
Concrete pump	108	AS2436
Mobile crane	113	TfNSW CNVG
Excavator	107	AS2436
Electric hand tools	102	AS2436
Bored piling rig	111	AS2436
Concrete truck	109	TfNSW CNVG
Truck (> 20 tonne)	107	AS2436

5.2 Noise modelling methodology

Noise modelling was undertaken using SoundPLAN 9.1 using the same modelling parameters as described in Section 4.3.

Construction scenarios for the purpose of noise modelling have been developed based on the information outlined in Section 5.1.2. These construction scenarios are presented in Table 5.2.

Noise modelling of these scenarios has been conducted to determine the potential construction noise levels at the surrounding noise sensitive receivers. The magnitude of off-site noise impacts associated with construction is dependent upon a number of factors, including:

– The intensity and location of construction activities
– The type of equipment used
– Existing background noise levels
– Intervening terrain and structures
– Weather conditions during construction works.

The noise modelling assumes that the two loudest items of equipment in the scenario are operating at maximum capacity simultaneously at the closest distance between the construction works and the sensitive receiver. This approach is considered conservative.

Table 5.2 Construction scenarios

Scenario ID	Description	Equipment	Scenario sound power level (dBA)
CS1	Earthworks	Excavator, truck	110
CS2	Foundation works and piling activities	Boring piling rig, mobile crane, trucks	115
CS3	Concrete works	Concrete truck and concrete pump, truck	112
CS4	Plant and equipment installation and commissioning	Mobile crane, electric hand tools	114

5.3 Construction noise modelling results

Construction noise levels have been predicted at the sensitive receivers with consideration to the NML derived from the ICNG. The predicted L_{Aeq} noise levels along with the standard hours NMLs for each receiver is presented in Table 5.3.

Received noise levels shown in red indicate an exceedance of the NML. Based on the predicted noise levels, all construction scenarios are predicted to result in noise levels below the NML, except for CS2 (foundation works and piling activities). During these construction activities, receiver R2 is predicted to experience noise levels of 1 dB above the NML. All other sensitive receivers are predicted to experience noise levels below the NML.

Despite using conservative RBLs, there is a 1 dB exceedance which is considered to be very minor and specific construction noise management measures are not required. However, reasonable and feasible mitigation measures are recommended in Section 8.1 to be implemented to minimise noise impacts from the construction of the proposed modification.

Table 5.3 Predicted noise levels during construction activities

Receiver ID	NCA	Address	Noise Management Level (dBA)	Predicted construction noise level $L_{Aeq,15min}$ (dBA)			
				CS1	CS2	CS3	CS4
R1	NCA1	135 Terara Road, Terara	45	32	37	34	36
R2	NCA1	45 Ferry Lane, Terara	45	41	46	42	45
R3	NCA2	41A Meroo Street, Bomaderry	59	47	52	48	51
R4	NCA2	1-3 Meroo Street, Bomaderry	59	42	47	43	46
R5	NCA3	Burraga Island	46	37	42	39	41
R6	NCA3	39 Hanigans Lane, Bolong	46	30	35	31	34
R7	NCA2	19 Meroo Street, Bomaderry	59	43	48	44	47

Receiver ID	NCA	Address	Noise Management Level (dBA)	Predicted construction noise level $L_{Aeq,15min}$ (dBA)			
				CS1	CS2	CS3	CS4
R8	NCA1	1 Nobblers Lane, Terara	45	31	36	33	35
R9	NCA2	2 Tarawara Street, Bomaderry	59	45	50	47	49
R10	NCA2	10 Tarawara Street, Bomaderry	59	39	44	41	43
R11	NCA2	17 Coomea Street, Bomaderry	59	42	47	43	46
R12	NCA2	6 Birriley Street, Bomaderry	59	42	47	43	46
R13	NCA2	1 Coomea Street, Bomaderry	59	39	44	41	43

6. Operational noise impact assessment

6.1 Modification 31 plant and equipment

MOD31 consists of the following components:

– Heat recovery system at DDG dryers 4 and 5
– Heat recovery building north of the Distillery, across Bolong Road
– Mechanical vapour recovery technology at the east side of the Distillery.

Additionally, the required cooling capacity for the Distillery would be reduced after MOD31 is operational. The noise sources for each component of MOD31 are described in the following sections.

6.1.1 DDG dryer 4 and 5 heat recovery system

The plant and equipment associated with the heat recovery system at DDG dryers 4 and 5 consists of several pumps and a booster fan at each dryer. Sound power levels of the equipment have been based on the power usage provided by Manildra.

An overview of the plant and equipment DDG dryer 4 and 5 heat recovery system is shown in Table 6.1. A detailed overview of the noise source inputs is provided in Appendix C.

Table 6.1 DDG dryers 4 and 5 heat recovery system noise sources

Plant and equipment	Number of items	Sound power level per unit (dBA)
CIP pump	1	82
Recirculated Hot Water Pump	2	90
Process Condensate pump	2	75
Wet Scrubber outlet booster fan	2	87
Process Condensate pump	2	75
Seal water pump	2	75

6.1.2 Heat recovery building

The heat recovery building will house a total of 16 fans allowing for optimal heat dissipation. The building is strategically located north of Bolong Road and is constructed with three floors, of which the ground floor contains the switch room and the above floors each house 8 fans. The fans are the primary noise source within the building. Additionally, several HVAC units are situated on the northern side of the building to allow for ventilation and climate control within the building.

An overview of the sound power levels of the plant and equipment associated with the heat recovery building is shown in Table 6.2. A detailed overview of the noise source inputs is provided in Appendix C.

The heat recovery building design considers two options:

1. **Open-top structure**: the heat recovery building would be designed to have an open-top structure. As open-top structures increase environmental noise emissions, the heat recovery building would be designed to achieve an internal noise level of 66 dBA on the top floor. This would be achieved by implementing insulation and cladding to equipment where possible, installing absorbative panelling on the walls and floors, or installing enclosures around equipment.
2. **Enclosed roof**: the heat recovery building would be designed with a closed roof structure. The internal noise level would be designed to achieve a noise level of 89 dBA.

Regardless of whether a roofless enclosure or an enclosed roof structure is selected for the heat recovery building, the critical requirement is that the sound power level emitted from the top of the heat recovery building must not

exceed 89 dBA, as presented in Table 6.2. This design criterion ensures that compliance with the design noise goal is achieved, independent of the structural choice.

The sound power level of the heat recovery building features is based on the following:

– An R_W of 32 dB for closed façade and roof features, representative of a 7cm thick sandwich panel with fibreglass (10kg/m^3).
– A 5 dB correction for converting the diffuse noise level to a direct noise level.
– The surface area of the façade and roof based on dimensions 48m (length) by 15m (width) by 24m (height).

The sound power level of the HVAC units is based on measurements of similar equipment on the site.

Table 6.2 Heat recovery building noise sources

Plant and equipment		Number of items	Sound power level per item (dBA)	Internal noise level goal (dBA)
Heat recovery building – Top	Open-top structure	1	89	66
	Closed roof	1	89	89
Heat recovery building – north façade		1	86	89
Heat recovery building – east façade		1	86	89
Heat recovery building – south façade		1	91	89
Heat recovery building – west façade		1	81	89
HVAC units		4	81	Not applicable

6.1.3 Mechanical vapour recovery

The MVR stack would be located east of the existing Distillery and includes 8 pumps at the base. Sound power levels of the equipment have been based on the power usage provided by Manildra. Table 6.3 shows an overview of the noise sources and sound power levels. A detailed overview of the noise source inputs is provided in Appendix C.

Table 6.3 Mechanical vapour recovery noise sources

Plant and equipment	Number of items	Sound power level per item (dBA)
MVR Pump	8	85

6.1.4 Distillery cooling capacity reduction

The installation of the heat recovery systems would allow for turning off 5 of the 8 cooling cells of the Distillery cooling tower array. Figure 6.1 shows which cooling cells would be turned off once MOD31 is operational and have been deactivated in the modelling scenarios.

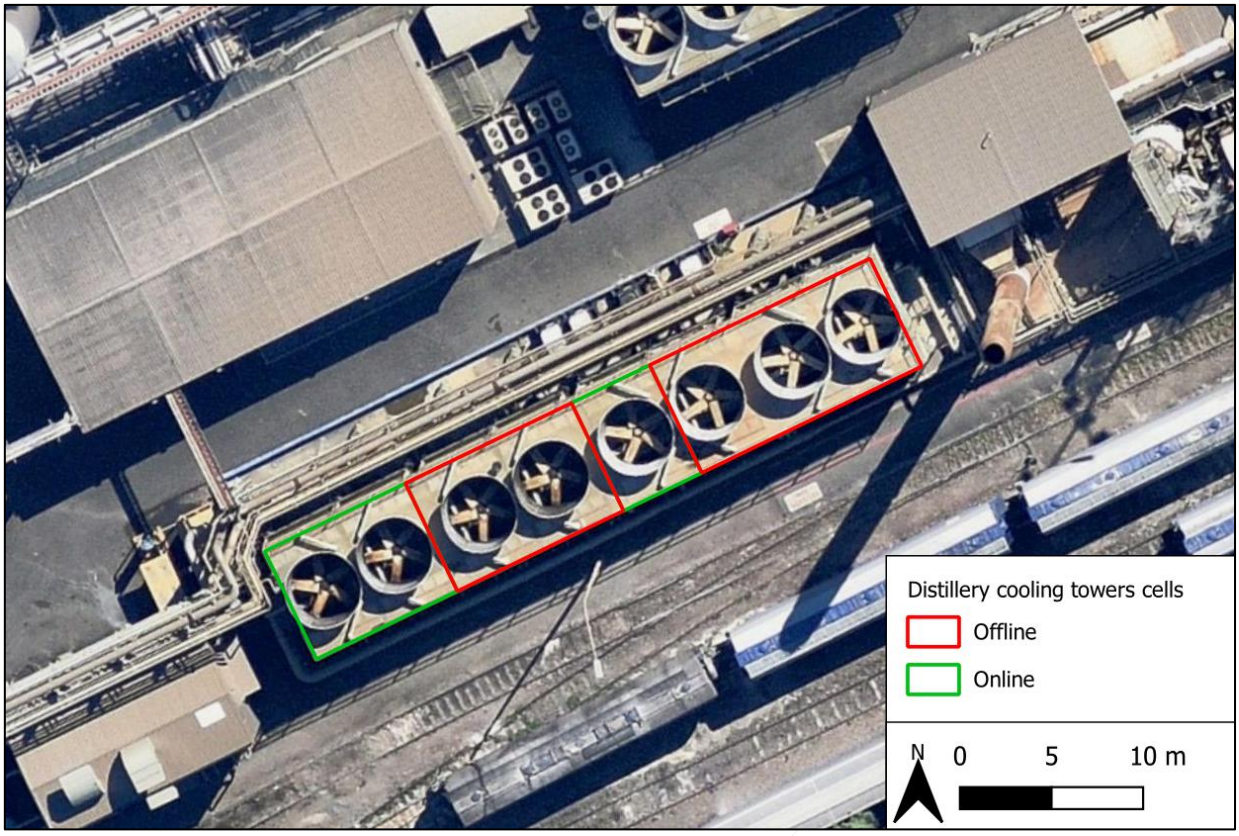


Figure 6.1 Distillery cooling tower cells status after Modification 31

6.2 Operational noise modelling results

6.2.1 Annoying characteristics analysis

One-third octave results have been analysed for tonal and low frequency characteristics for both the existing site and the proposed modification.

6.2.1.1 Tonal noise

The analysis for tonal frequency characteristics indicates that none of the triggers have been met for either MOD31 on its own or the existing site including MOD31. As such, no tonal noise corrections have been applied to the predicted noise levels.

6.2.1.2 Low frequency noise

The analysis for low frequency noise characteristics indicates the following:

– The noise levels of MOD31 individually does contain low frequency noise characteristics, with the difference between the C-weighted and A-weighted noise levels at sensitive receivers being more than 15 dB. However, the low frequency noise thresholds (refer to Table 3.5) are not exceeded at the sensitive receivers. Therefore, no penalty for low frequency noise has been applied to presented noise levels of MOD31 individually.
– The cumulative noise levels of the current site, including MOD31, contain low frequency noise levels with the difference between the C-weighted and A-weighted noise levels at sensitive receivers being more than 15 dB. Additionally, the low frequency noise thresholds (refer to Table 3.5) are predicted to be exceeded at the sensitive receivers by more than 5 dB in several one-third octave bands. Therefore, a 2 dB (daytime) and 5 dB (evening and nighttime) penalty for low frequency noise is applied to the predicted noise levels.

The analysis of predicted low frequency noise levels at sensitive receivers is provided in Appendix D. An overview of the applied corrections at all sensitive receivers is shown in Table 6.4 below. It is noted the low frequency noise corrections are only applied to the predicted cumulative noise levels.

Table 6.4 Applied low frequency noise penalty at sensitive receivers

Receiver ID	Address	Low frequency noise correction on cumulative noise levels (dB)	
		Day	Evening and night
R1	135 Terara Road, Terara	2	5
R2	45 Ferry Lane, Terrara	2	5
R3	41A Meroo St, Bomaderry	2	5
R4	1-3 Meroo St, Bomaderry NSW 2541	2	5
R5	Burraga Island	2	5
R6	39 Hanigans Ln, Bolong NSW 2540	2	5
R7	19 Meroo St, Bomaderry NSW 2541	2	5
R8	1 Nobblers Ln, Terara NSW 2540	2	5
R9	2 Tarawara Street, Bomaderry	2	5
R10	10 Tarawara Street, Bomaderry	2	5
R11	17 Coomea Street, Bomaderry	2	5
R12	6 Birriley Street, Bomaderry	2	5
R13	1 Coomea Street, Bomaderry	2	5

6.2.2 Predicted operational noise levels

Predicted operational noise levels have been provided for the following scenarios:

– **MOD31**: noise from proposed plant and equipment associated with MOD31
– **Cumulative**: cumulative noise from current site operations, including MOD31
– **Cumulative approved not yet constructed (ANYC)**: cumulative noise from current operations plus all approved but not yet constructed components, including MOD31.

The predicted operational noise levels for each of the above scenarios have been assessed in the following sections.

6.2.2.1 Modification 31 noise levels

The $L_{Aeq,15min}$ operational noise levels from MOD31 are predicted to be below the MOD31 design noise goal (refer to Section 3.6.4) at all sensitive receivers as shown in Table 6.5.

As noise levels from MOD31 are predicted to not exceed the low frequency noise thresholds at any of the sensitive receivers, no correction for low frequency noise characteristics have been applied to the predicted noise levels.

Noise contours of the MOD31 noise levels are shown in Figure 6.4.

Table 6.5 Modification 31 predicted noise levels

Receiver ID	NCA	Address	MOD31 design noise goal $L_{Aeq,15min}$ (dBA)	Predicted noise level from MOD31 $L_{Aeq,15min}$ (dBA)	
				Neutral conditions	Noise enhancing conditions
R1	NCA1	135 Terara Road, Terara	23	17	18
R2	NCA1	45 Ferry Lane, Terara	23	20	21
R3	NCA2	41A Meroo Street, Bomaderry	27	25	26
R4	NCA2	1-3 Meroo Street, Bomaderry	27	23	24
R5	NCA3	Burraga Island	25	22	23

Receiver ID	NCA	Address	MOD31 design noise goal $L_{Aeq,15min}$ (dBA)	Predicted noise level from MOD31 $L_{Aeq,15min}$ (dBA)	
				Neutral conditions	Noise enhancing conditions
R6	NCA3	39 Hanigans Lane, Bolong	25	14	15
R7	NCA2	19 Meroo Street, Bomaderry	27	24	25
R8	NCA1	1 Nobblers Lane, Terara	23	17	18
R9	NCA2	2 Tarawara Street, Bomaderry	27	24	25
R10	NCA2	10 Tarawara Street, Bomaderry	25	18	19
R11	NCA2	17 Coomea Street, Bomaderry	25	23	24
R12	NCA2	6 Birriley Street, Bomaderry	25	23	24
R13	NCA2	1 Coomea Street, Bomaderry	25	21	22

6.2.2.2 Cumulative noise levels

The predicted $L_{Aeq,15min}$ operational noise levels from the cumulative scenarios during neutral and noise enhancing weather conditions are shown in Figure 6.2 and Figure 6.3 respectively. The cumulative operational noise levels are assessed against the EPL limits and have been corrected for low frequency noise as described in Section 6.2.1.2, are denoted between brackets. Tables detailing exact noise levels at all receivers are included in Appendix E.

The cumulative noise levels, including approved but not yet constructed modifications and MOD31, are predicted to exceed the EPL noise limits at all locations. For acoustic compliance data, the bi-annual noise compliance audits should be referred to.

However, it is clear from the difference in predicted noise level from MOD31 individually compared to the cumulative noise levels, that there is no contribution to the overall noise levels from the site. At all receivers, the MOD31 are below the design noise goal and well below the existing noise emitted from the site and rail line. It is also worth noting that MOD31 allows for a reduction in cooling tower capacity of the Distillery cooling tower array. This slightly lowers the overall noise emissions of the site.

Noise contours of the cumulative noise levels (excluding rail noise) are shown in Figure 6.5 and Figure 6.6. Noise contours of the rail line extension as part of Modification 25 (MOD25) are shown in Figure 6.7. These contours have been sourced from the report *Environmental Noise Impact Assessment – Proposed Extension of Existing Rail Line and Extension to Product Dryer Building 3 & 4 (Rev E)* (Day Design, 2025).

6.2.3 Sleep disturbance impacts

Although the proposed modification would be operational 24 hours per day, the steady operation of the equipment associated with the proposed modification is not expected to cause significant noise level events. As such, no sleep disturbance impacts are anticipated because of the proposed modification.

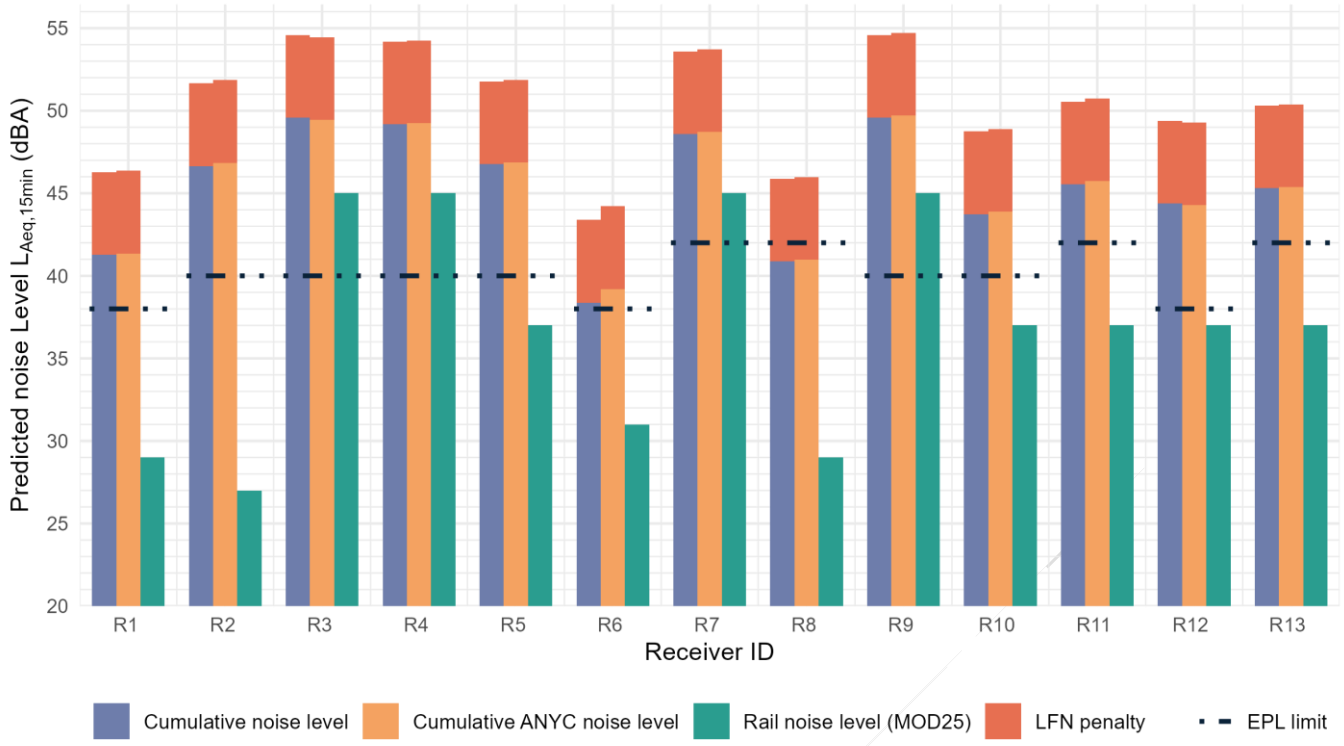


Figure 6.2 ***Rail and cumulative noise levels – neutral weather conditions***

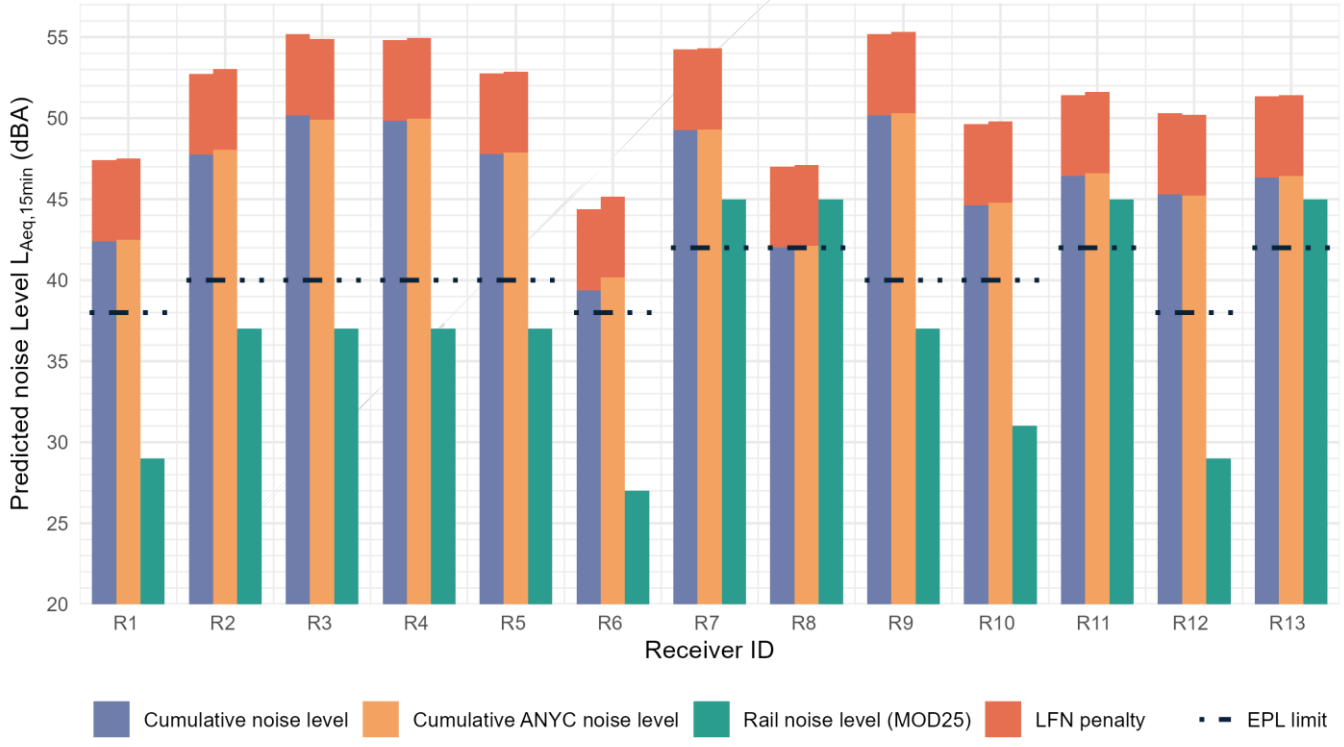
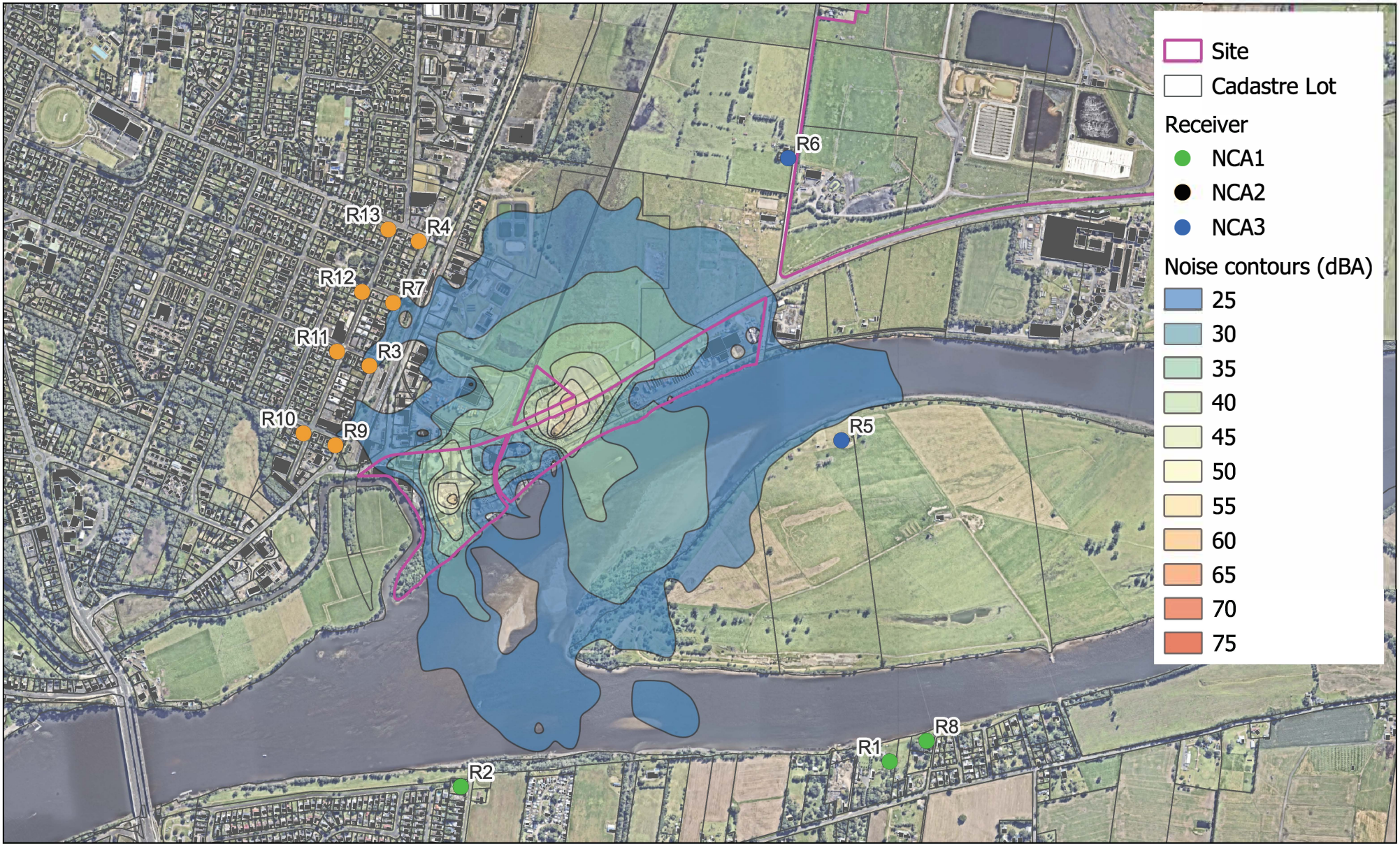


Figure 6.3 ***Rail and cumulative noise levels – noise enhancing weather conditions***



Paper Size ANSI A

0 250 500 m

Map Projection: Grid Map of Australia
Horizontal Datum: GDA2020
Grid: Grid Map of Australia GDA2020 Zone 56

Manildra

Shoalhaven Starches Modification 31

Operational noise levels (LAeq,15min) - MOD31

Project No. **12645127**
Revision No. **-**
Date. **2025-06-24**

FIGURE 6.4

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Data Source: Nearmap

Created By: Matthijs Oosterlaken

Paper Size ANSI A

0 250 500 m

Map Projection: Grid Map of Australia
Horizontal Datum: GDA2020
Grid: Grid Map of Australia GDA2020 Zone 56

Manildra

Shoalhaven Starches Modification 31

Operational noise levels (LAeq,15min) - Cumulative (current operation and MOD31)

Project No. **12645127**
Revision No. -
Date. **2025-06-24**

FIGURE 6.5

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Data Source: Nearmap

Created By: Matthijs Oosterlaken

Paper Size ANSI A

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Map Projection: Grid Map of Australia
Horizontal Datum: GDA2020
Grid: Grid Map of Australia GDA2020 Zone 56

Manildra

Shoalhaven Starches Modification 31

Operational noise levels (LAeq,15min) - Cumulative (current operation, approved but not yet constructed modifications and MOD31)

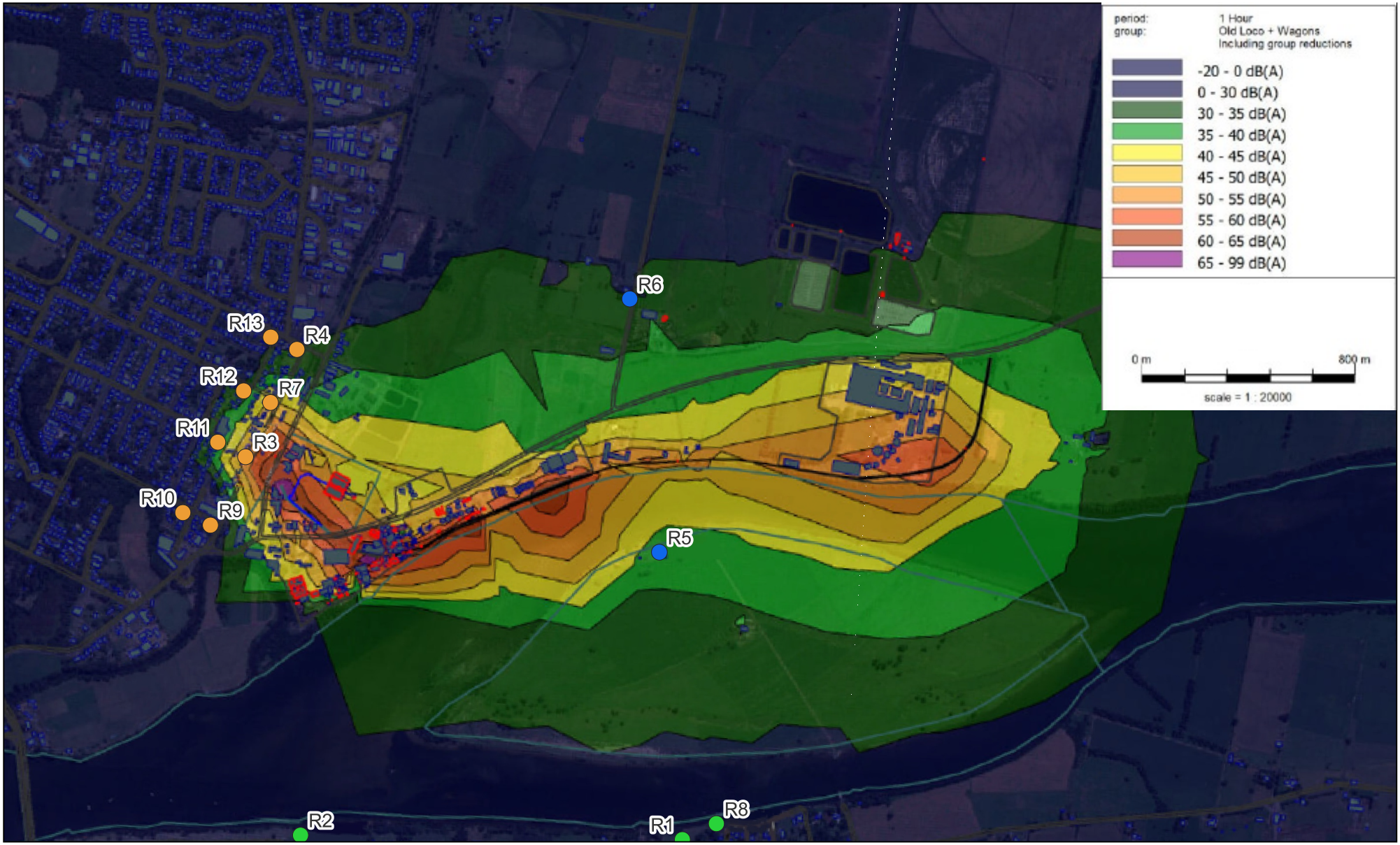
Project No. **12645127**
Revision No. -
Date. **2025-06-24**

FIGURE 6.6

Document Path: \\ghdnet\ghd\AU\Sydney\Projects\21\12645127\Tech\Noise\03_GIS\MOD31_Figs.qgz

Data Source: Nearmap

Created By: Matthijs Oosterlaken



Receiver

- NCA1
- NCA2
- NCA3

Paper Size ANSI A

0 250 500 m

Map Projection: Grid Map of Australia
Horizontal Datum: GDA2020
Grid: Grid Map of Australia GDA2020 Zone 56

Manildra

Shoalhaven Starches Modification 31

Operational noise levels (LAeq,15min) - existing rolling stock, MSW730 mini noise wall installed. Neutral met conditions

Project No. **12645127**
Revision No. **-**
Date. **2025-08-05**

FIGURE 6.7

Document Path: \\ghdnet\ghd\AU\Sydney\Projects\21\12645127\Tech\Noise\03_GIS\MOD31_Figs.qgz

Data Source: Noise contours as presented in Appendix 51-A of Environmental Noise Impact Assessment – Proposed Extension of Existing Rail Line and Extension to Product Dryer Building 3 & 4 (Rev E) (Day Design, 2025).

Created By: Matthijs Oosterlaken

7. Road traffic noise impact assessment

7.1.1 Existing road network

Traffic accessing and egressing the site uses Bolong Road, which runs east-west from Gerroa Road at Coolangatta and the Princess Highway at Bomaderry. Bolong Road and Jennings Lane (east of the Supagas site) is an approved restricted vehicle route providing for vehicles up to and including 26m B-Doubles and is classified as a regional road as per the NSW Road Network Classifications.[1]

As Bolong Road provides connection between the Princess Highway and local roads, it is considered to be a sub-arterial road as per the *NSW Road Noise Policy* (DECCW, 2011) (RNP).

7.1.2 Existing traffic volumes

In lieu of traffic volumes based on a weeklong traffic count, traffic counts of the existing volumes on Bolong Road were sourced from the report *Nowra Bridge Project Traffic and Transport Assessment* (ARUP, 2018). These volumes were established based on traffic counts undertaken in December 2017. It is noted that these volumes are almost 10 years old. However, it is likely that traffic volumes have grown over the last few years. The adopted volumes are considered conservative, as the increase in noise level would be greater with lower existing volumes compared to higher existing volumes.

For the purpose of assessing the nighttime traffic volumes, it is assumed that 10 percent of the existing traffic movements occur during the nighttime (10pm to 7am).

Table 7.1 Existing traffic volumes Bolong Road

Road	Period	Existing two-way weekday daily traffic volumes		
		Light vehicles	Heavy vehicles	Total
Bolong Road	Day (7am-10pm)	12,393	1,377	13,770
	Night (10pm-7am)	1,377	153	1,530

7.1.3 Traffic generation

Construction traffic generation is expected to comprise of no more than 20 truck trips generated per day. Construction traffic would access the site via the existing access to the site via Bolong Road. Operation of the project is not anticipated to generate additional traffic to or from the site.

7.1.4 Prediction methodology

The road traffic noise assessment considers existing traffic volumes and proposed traffic generation, percentage of heavy vehicles, time periods and road surface types in the calculations. Traffic noise modelling was conducted using the *Calculation of Road Traffic Noise* (CoRTN) (Department of Transport, Welsh Office, 1988) algorithm for Bolong Road.

7.1.5 Road traffic noise impacts

The increase in road traffic noise level at the residence closest to Bolong Road during construction of the modification is presented in Table 7.2. Along Bolong Road. The table shows that along Bolong Road the road traffic noise levels do not increase by more than 2 dB and as such no impacts are anticipated at receivers.

[1] https://maps.transport.nsw.gov.au/egeomaps/road-network-classification/index.html

Table 7.2 Predicted increase in road traffic noise levels during construction

Road	Road type	Distance to nearest residence (m)	Period	Daytime controlling criteria (dBA)	Existing noise level (dBA)	Predicted noise level (dBA)	Noise level increase difference (dB)	Consideration for mitigation?
Bolong Road	Sub-arterial road	15[1]	Day	60 $L_{Aeq,15hr}$	67.7	67.7	0.0	No
			Night	55 $L_{Aeq,9hr}$	60.4	60.4	0.0	No

Note: The nearest residence is 66 Bolong Road.

8. Mitigation measures

8.1 Construction noise mitigation measures

Despite using conservative RBLs, there is a 1 dB exceedance which is considered to be very minor and specific construction noise management measures are not required. However, reasonable and feasible mitigation measures are detailed below to reduce the potential impact on the surrounding receivers and sensitive land uses during construction. These measures should be incorporated into the construction noise management plan (CNMP) developed for the proposed modification.

Table 8.1 Construction noise mitigation measures

Action required	Details
General controls	
Site inductions	All employees, contractors and subcontractors are to receive an environmental induction. The induction should include: – All relevant project specific and standard noise mitigation measures – Relevant licence and approval conditions – Permissible hours of work – Location of nearest sensitive receivers – Construction employee parking areas – Designated loading/unloading areas and procedures – Site opening/closing times (including deliveries) – Environmental incident procedures.
Behavioural practices	No swearing or unnecessary shouting or loud stereos/radios on site. No dropping of materials from height, throwing of metal items and slamming of doors.
Implement community consultation measures	Contact will be established with the local residents and the construction program and progress communicated on a regular basis, particularly when noisy activities are planned. Affected receivers will be notified of the intended work, its duration and times of occurrence. This may include a local community update letters for specific construction activities and a project info line.
Implement complaints management measures	Complaints will be managed in accordance with the procedure outlined below. Signage at each site will clearly and visibly provide a contact number and name to receive complaints and enquiries about construction. In this instance the response would be to: – Verbally respond to complainant – Provide a written response within seven calendar days if the complaint cannot be resolved verbally – Log the complaint, and any actions taken with regards to the complaint within a complaints register – Undertake monitoring at the complainant's residence(s) – Investigate the nature and reasons of the impact – Investigate and implement further mitigation measures to minimise the impact
Source controls	
Construction hours and scheduling	Comply with the recommended standard construction hours outlined by the ICNG, unless out of hours work has been approved. No truck movements before 7.00 am or after 6.00 pm. For any work that would take place outside of normal construction hours: – Undertake an assessment of the potential noise impacts associated with the proposed activities and outline specific mitigation measures.

Action required	Details
	– Residents potentially affected by such activities will be notified at least five days before hand. – Minimise consecutive night activities in the same locality and provide periods of quiet if activities occur for extended periods during the night. – Conduct activities in a manner that eliminates or minimises the need for audible warning alarms.
Equipment selection	Use quieter construction methods where reasonable and feasible (e.g. vibratory or bored piling instead of impact hammer piling).
Use and siting of plant	Simultaneous operation of noisy plant within discernible range of a sensitive receiver is to be avoided. The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. Plant used intermittently to be throttled down or shut down. Noise-emitting plant to be directed away from sensitive receivers.
Plan worksites and activities to minimise noise	Plan traffic flow, parking and loading unloading areas to minimise reversing movements within the site.
Minimise disturbance arising from delivery of goods to construction sites	Loading and unloading of materials/deliveries is to occur during standard construction hours. Contractors are to avoid dropping materials from height where practicable, during loading and unloading. Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible.

8.2 Operational noise mitigation measures

In order to achieve compliance with the design noise goal for MOD31 established in Section 3.6.4, it is recommended to implement the following mitigation measures into the detailed design of the plant.

Table 8.2 Operational noise mitigation measures

Component	Action required	Details
Further detailed design		
DDG dryer 4 and 5 heat recovery system	Equipment selection	The sound power levels of the equipment should be equal or lower than those presented in Table 6.1.
	Positioning of equipment	Equipment should be positioned during detailed design to maximise shielding by existing structures where reasonably possible.
Heat recovery building	Detailed design of building	The detailed design of the heat recovery building should consider the following: – The sound power level of building features (facades and roofs) should be equal or lower than the levels presented in Table 6.2. – During the detailed design, the sound power levels of building features should be estimated based on the proposed equipment within the buildings and the transmission loss and dimensions of the building features. – Where ventilation openings are required in the building facades, these should be fitted with acoustic louvres. – Ventilation openings should be positioned in the southern and eastern façade as much as reasonably possible. – If the building is designed with an open-top structure, the internal noise level should be at most 66 dBA. This would be achieved by implementing insulation and cladding to equipment where possible, installing absorbative panelling on the walls and floors, or installing enclosures around equipment.
	Equipment selection	The selection of HVAC units for the heat recovery building should have equal or lower sound power levels than the levels presented in Table 6.2. The selection of equipment within the heat recovery building should consider quieter options where reasonable and feasible to minimise building breakout noise.

Component	Action required	Details
Mechanical vapour recovery	Equipment selection	The sound power levels of the equipment should be equal or lower than those presented in Table 6.3.
	Positioning of equipment	Equipment should be positioned during detailed design to maximise shielding by existing structures where reasonably possible.
Pipelines and ducts	Insulation and lagging	Insulating and lagging of pipelines is recommended to reduce pipeline noise, particularly in areas where fluid or gas flows cause vibration or turbulent flow noise.
Noise validation		
All components	Noise validation report prior to construction	In accordance with Development Consent condition 14M, a noise validation report will be prepared prior to construction, to demonstrate compliance with the design noise goals can be achieved based on the detailed design. If required, mitigation measures to reduce noise levels to achieve the design noise goals should be provided in the noise validation report.
All components	Noise validation report during operation	Once the proposed modification is operational, a noise validation assessment would be undertaken to confirm if noise levels comply with the predictions detailed in the noise validation report.

9. Conclusion

GHD was engaged by Manildra to conduct a noise and vibration impact assessment for a proposed modification to the approved SSEP. The modification seeks to deploy a suite of heat recovery updates and enabling infrastructure to capture and transform waste heat into usable energy to drive the ethanol, starch and gluten manufacturing processes.

A construction noise assessment was undertaken to determine potential for increase noise levels at sensitive receivers. Construction noise management levels were established using background noise levels which were established using the conducted background noise monitoring. Four construction scenarios were modelled to predict noise levels at representative sensitive receivers. The predicted noise levels indicate compliance with the noise management levels for the majority of construction activities at most of the sensitive receivers. However, foundation works and piling works may exceed the noise management level at one receiver (R2) and as such mitigation measures have been recommended.

Noise sources associated with the operation of the proposed modification were identified and modelled in the site-wide noise model developed by GHD as part of the noise pollution reduction program. The predicted noise levels from the proposed modification were assessed against design noise goals and shows compliance with the design noise goals at all sensitive receivers. An analysis for annoying noise characteristics was undertaken and found that the proposed modification does not contain tonal or low frequency noise characteristics.

Additionally, cumulative noise levels of the following scenarios have been predicted:

– Current operations including the proposed modification and the rail line
– Current operations including all approved but not yet constructed modifications, the proposed modification and the rail line.

Predicted noise levels were analysed for annoying noise characteristics and found low frequency noise to be present at all sensitive receivers. The noise levels were assessed against the EPL noise limits, which shows exceedances at all sensitive receivers from existing noise sources. However, for acoustic compliance data, the bi-annual compliance data should be referred to.

Nonetheless, the proposed modification is anticipated to have no contribution to the overall noise levels from the site as the predicted noise levels are below the design noise goals. In addition, the proposed modification would reduce noise emitted from the Distillery cooling tower array because of a reduction in required cooling capacity.

Recommended construction mitigation measures are provided in Section 8.1 and recommendations for further detailed design of the proposed modification to minimise operational noise are provided in Section 8.2.

10. References

ARUP. (2018). *Nowra Bridge Project Traffic and Transport Assessment.*
Australian Standard. (2010). *AS2436: Guide to Noise Control on Construction, Maintenance and Demolition Site.*
Day Design. (2024). *Shoalhaven Starches – MOD 9 & 21 – Packing Plant Design Noise Verification .*
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DECCW. (2011). *NSW Road Noise Policy.*
Department of Transport, Welsh Office. (1988). *Calculation of Road Traffic Noise (CoRTN).*
EPA. (2017). *Noise Policy for Industry.*
EPA. (2022). *Approved methods for the measurement and analysis of environmental noise in NSW.*
GHD. (2025). *Shoalhaven Starches Pollution Reduction Program – Noise Compliance Investigation .*
ISO. (1996). *Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation.*
Transport for NSW. (2024). *Construction Noise and Vibration Guideline (Roads).*

Appendices

Appendix A

Noise monitoring methodology and daily monitoring charts

A-1 Noise monitoring methodology

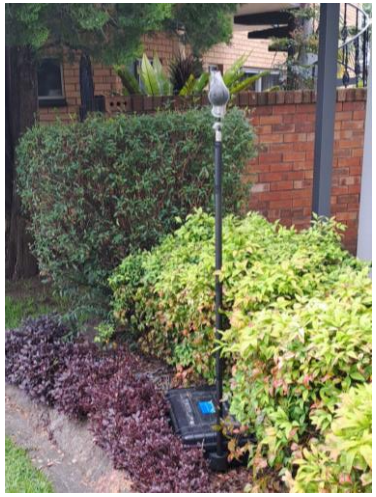
Long-term unattended noise monitoring was undertaken from 9 December 2024 until 19 December 2024 at seven far-field locations, three of which were representative of residential receivers. Throughout the noise monitoring program, at a total of 14 locations noise loggers were deployed on the site in close proximity to the plant and equipment.

The methodology for the noise monitoring program included the following:

– All monitoring activities were undertaken with consideration of the specifications outlined in the Australian Standard *AS1055 Description and measurement of environmental noise* (2018) and *Approved methods for measurement and analysis of environmental noise* (EPA, 2022).
– A calibration check was performed on the noise monitoring equipment using a sound level calibrator with a sound pressure level of 94 dBA at 1 kHz. At completion of the measurements, the meter's calibration was re-checked to ensure the sensitivity of the noise monitoring equipment had not varied. The noise loggers were found to be within the acceptable tolerance of ± 1 dBA.
– Noise monitoring was undertaken using two Svantek SVAN977 environmental noise loggers. The noise loggers were programmed to accumulate L_{A90}, L_{A10}, and L_{Aeq} noise descriptors continuously over the entire monitoring period.
– The data collected by the logger was downloaded and analysed, and any invalid data removed. Invalid data generally refers to periods of time where average wind speeds were greater than 5 m/s, or when rainfall occurred. Meteorological data was sourced from the Manildra's on-site AWS. The weather station is located on the Manildra site and is considered to be a valid distance from the site for filtering purpose in accordance with the *Noise Policy for Industry* (EPA, 2017).

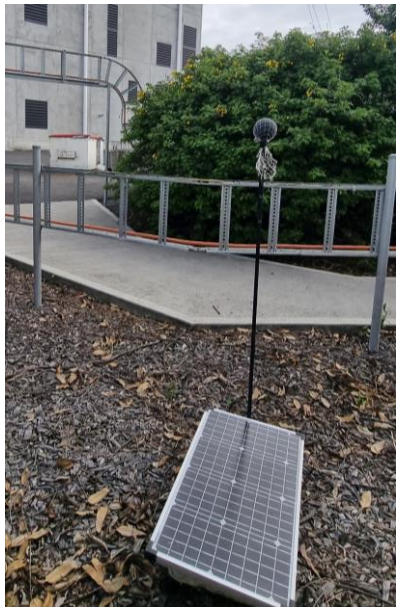
Details of the monitoring equipment and location are provided in the tables below. Additionally, daily graphs of the monitoring results are included below.

Table A.1 Noise monitoring equipment details

Logger type	Logger ID	Location description	Equipment details	Equipment settings	Logger photo
Far field	L1	1 Nobblers Lane, Terara	Sound level meter SVAN977 (SN: 45748) Class 1 sound level meter IEC 61672-3:2013-compliant Manufactured prior to 2019 Calibrator BnK type 4231 Class 1 sound level calibrator IEC 61672-3:2013-compliant Manufactured prior to 2017 SN: 3025447	Weighting: A-weighted Response type: Fast Interval period: 15 minutes Pre to post calibration variance: 0.1 dB	
Far field	L2	58 Riverview Road, Nowra	Sound level meter SVAN977 (SN: 36820) Class 1 sound level meter IEC 61672-3:2013-compliant Manufactured prior to 2019 Calibrator BnK type 4231 Class 1 sound level calibrator IEC 61672-3:2013-compliant Manufactured prior to 2017 SN: 3025447	Weighting: A-weighted Response type: Fast Interval period: 15 minutes Pre to post calibration variance: 0.6 dB	
Far field	L3	Shoalhaven Starches office	Sound level meter SVAN977 (SN: 69215) Class 1 sound level meter IEC 61672-3:2013-compliant Manufactured prior to 2019 Calibrator BnK type 4231 Class 1 sound level calibrator IEC 61672-3:2013-compliant	Weighting: A-weighted Response type: Fast Interval period: 15 minutes Pre to post calibration variance: 0.1 dB	No picture available

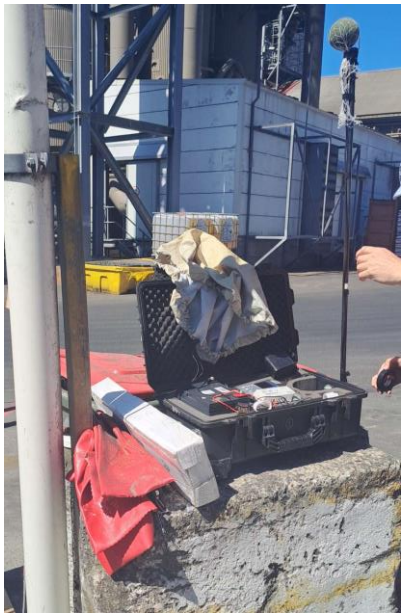
Logger type	Logger ID	Location description	Equipment details	Equipment settings	Logger photo
			Manufactured prior to 2017 SN: 3025447		
Far field	L4	Shoalhaven Starches north of packer plant	Sound level meter SVAN977 (SN: 97447) Class 1 sound level meter IEC 61672-3:2013-compliant Manufactured prior to 2019 Calibrator BnK type 4231 Class 1 sound level calibrator IEC 61672-3:2013-compliant Manufactured prior to 2017 SN: 3025447	Weighting: A-weighted Response type: Fast Interval period: 15 minutes Pre to post calibration variance: 0.8 dB	
Far field	L5	280 Bolong Road, Bolong	Sound level meter SVAN977 (SN: 45733) Class 1 sound level meter IEC 61672-3:2013-compliant Manufactured prior to 2019 Calibrator BnK type 4231 Class 1 sound level calibrator IEC 61672-3:2013-compliant Manufactured prior to 2017 SN: 3025447	Weighting: A-weighted Response type: Fast Interval period: 15 minutes Pre to post calibration variance: 0.1 dB	

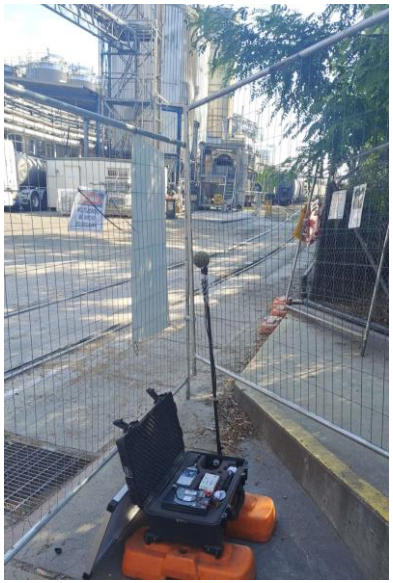
Logger type	Logger ID	Location description	Equipment details	Equipment settings	Logger photo
Far field	L6	17 Dalwah Street, Bomaderry	Sound level meter SVAN977 (SN: 99442) Class 1 sound level meter IEC 61672-3:2013-compliant Manufactured prior to 2019 Calibrator BnK type 4231 Class 1 sound level calibrator IEC 61672-3:2013-compliant Manufactured prior to 2017 SN: 3025447	Weighting: A-weighted Response type: Fast Interval period: 15 minutes Pre to post calibration variance: 0.3 dB	
Far field	L8	Shoalhaven Starches Water Treatment Plant	Sound level meter SVAN977 (SN: 45744) Class 1 sound level meter IEC 61672-3:2013-compliant Manufactured prior to 2019 Calibrator BnK type 4231 Class 1 sound level calibrator IEC 61672-3:2013-compliant Manufactured prior to 2017 SN: 3025447	Weighting: A-weighted Response type: Fast Interval period: 15 minutes Pre to post calibration variance: 0.5 dB	

Logger type	Logger ID	Location description	Equipment details	Equipment settings	Logger photo
Near field	S1	North of Cogen plant	Sound level meter SVAN977 (SN: 36824) Class 1 sound level meter IEC 61672-3:2013-compliant Manufactured prior to 2019 Calibrator BnK type 4231 Class 1 sound level calibrator IEC 61672-3:2013-compliant Manufactured prior to 2017 SN: 3025447	Weighting: A-weighted Response type: Fast Interval period: 1 minute Pre to post calibration variance: -0.2 dB	
Near field	S2	North of pellet plant	Sound level meter SVAN977 (SN: 59668) Class 1 sound level meter IEC 61672-3:2013-compliant Manufactured prior to 2019 Calibrator BnK type 4231 Class 1 sound level calibrator IEC 61672-3:2013-compliant Manufactured prior to 2017 SN: 3025447	Weighting: A-weighted Response type: Fast Interval period: 1 minute Pre to post calibration variance: -0.1 dB	

Logger type	Logger ID	Location description	Equipment details	Equipment settings	Logger photo
Near field	S3	Biofilter corner	Sound level meter SVAN977 (SN: 36826) Class 1 sound level meter IEC 61672-3:2013-compliant Manufactured prior to 2019 Calibrator BnK type 4231 Class 1 sound level calibrator IEC 61672-3:2013-compliant Manufactured prior to 2017 SN: 3025447	Weighting: A-weighted Response type: Fast Interval period: 1 minute Pre to post calibration variance: 0.0 dB	
Near field	S4	South of pellet plant	Sound level meter SVAN977 (SN: 36825) Class 1 sound level meter IEC 61672-3:2013-compliant Manufactured prior to 2019 Calibrator BnK type 4231 Class 1 sound level calibrator IEC 61672-3:2013-compliant Manufactured prior to 2017 SN: 3025447	Weighting: A-weighted Response type: Fast Interval period: 1 minute Pre to post calibration variance: -0.1 dB	

Logger type	Logger ID	Location description	Equipment details	Equipment settings	Logger photo
Near field	S5	South of stillage corner	Sound level meter SVAN977 (SN: 36825) Class 1 sound level meter IEC 61672-3:2013-compliant Manufactured prior to 2019 Calibrator BnK type 4231 Class 1 sound level calibrator IEC 61672-3:2013-compliant Manufactured prior to 2017 SN: 3025447	Weighting: A-weighted Response type: Fast Interval period: 1 minute Pre to post calibration variance: 0.1 dB	
Near field	S6	North of protein plant	Sound level meter SVAN977 (SN: 36826) Class 1 sound level meter IEC 61672-3:2013-compliant Manufactured prior to 2019 Calibrator BnK type 4231 Class 1 sound level calibrator IEC 61672-3:2013-compliant Manufactured prior to 2017 SN: 3025447	Weighting: A-weighted Response type: Fast Interval period: 1 minute Pre to post calibration variance: 0.0 dB	

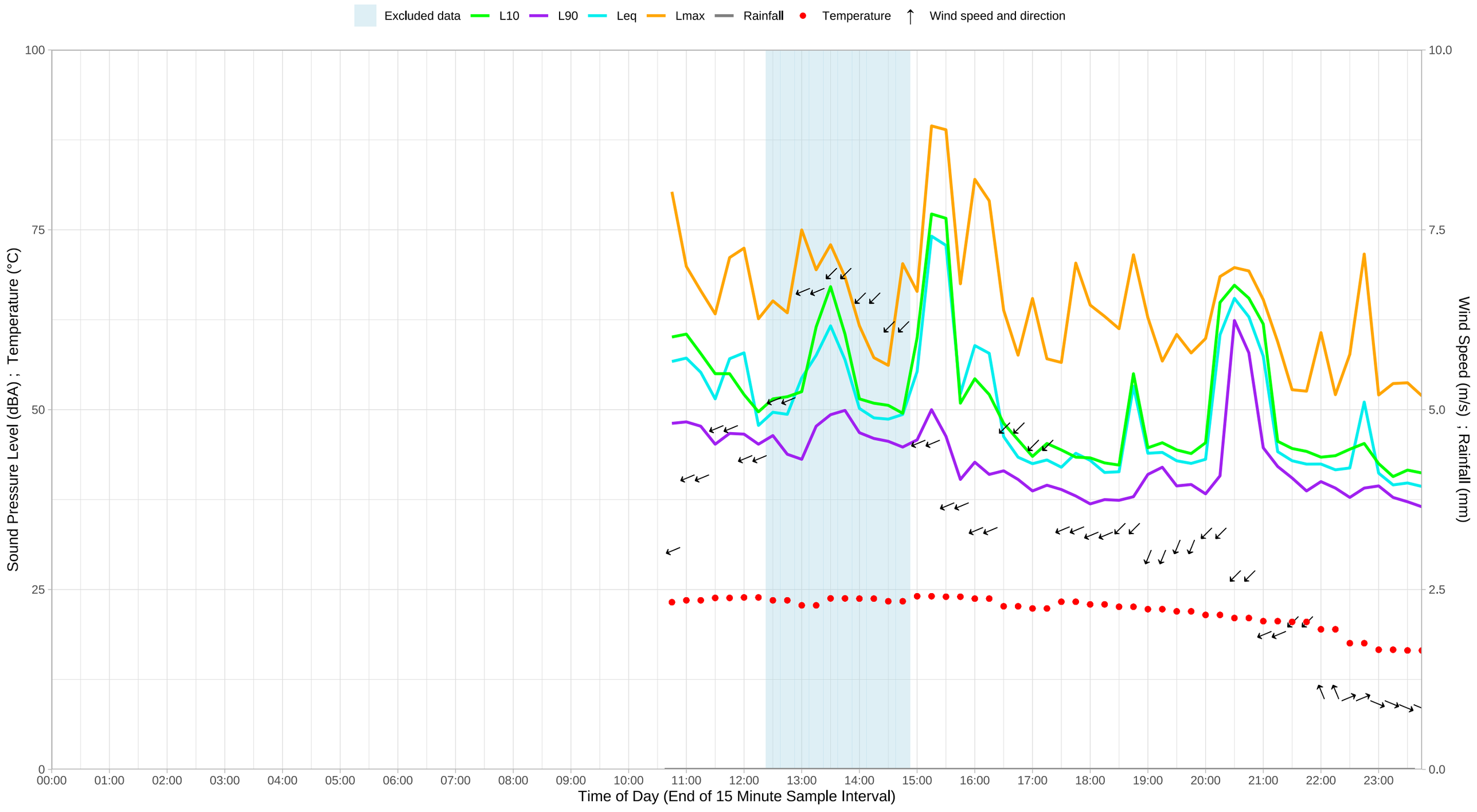
Logger type	Logger ID	Location description	Equipment details	Equipment settings	Logger photo
Near field	S7	Next to railway gate along Bolong Road	Sound level meter SVAN977 (SN: 36824) Class 1 sound level meter IEC 61672-3:2013-compliant Manufactured prior to 2019 Calibrator BnK type 4231 Class 1 sound level calibrator IEC 61672-3:2013-compliant Manufactured prior to 2017 SN: 3025447	Weighting: A-weighted Response type: Fast Interval period: 1 minute Pre to post calibration variance: 0.0 dB	
Near field	S8	Between GD8 and evaporators	Sound level meter SVAN977 (SN: 59668) Class 1 sound level meter IEC 61672-3:2013-compliant Manufactured prior to 2019 Calibrator BnK type 4231 Class 1 sound level calibrator IEC 61672-3:2013-compliant Manufactured prior to 2017 SN: 3025447	Weighting: A-weighted Response type: Fast Interval period: 1 minute Pre to post calibration variance: -0.2 dB	

Logger type	Logger ID	Location description	Equipment details	Equipment settings	Logger photo
Near field	S9	South of grain unloader	Sound level meter SVAN977 (SN: 36825) Class 1 sound level meter IEC 61672-3:2013-compliant Manufactured prior to 2019 Calibrator BnK type 4231 Class 1 sound level calibrator IEC 61672-3:2013-compliant Manufactured prior to 2017 SN: 3025447	Weighting: A-weighted Response type: Fast Interval period: 1 minute Pre to post calibration variance: -0.3 dB	
Near field	S10	Southwest of flour mill, near edge of railway	Sound level meter SVAN977 (SN: 59668) Class 1 sound level meter IEC 61672-3:2013-compliant Manufactured prior to 2019 Calibrator BnK type 4231 Class 1 sound level calibrator IEC 61672-3:2013-compliant Manufactured prior to 2017 SN: 3025447	Weighting: A-weighted Response type: Fast Interval period: 1 minute Pre to post calibration variance: -0.3 dB	

Logger type	Logger ID	Location description	Equipment details	Equipment settings	Logger photo
Near field	S11	South of firewater pipework south of ethanol control room	Sound level meter SVAN977 (SN: 36824) Class 1 sound level meter IEC 61672-3:2013-compliant Manufactured prior to 2019 Calibrator BnK type 4231 Class 1 sound level calibrator IEC 61672-3:2013-compliant Manufactured prior to 2017 SN: 3025447	Weighting: A-weighted Response type: Fast Interval period: 1 minute Pre to post calibration variance: 0.3 dB	
Near field	S12	Northeast of gluten dryer 6 dry end	Sound level meter SVAN977 (SN: 36826) Class 1 sound level meter IEC 61672-3:2013-compliant Manufactured prior to 2019 Calibrator BnK type 4231 Class 1 sound level calibrator IEC 61672-3:2013-compliant Manufactured prior to 2017 SN: 3025447	Weighting: A-weighted Response type: Fast Interval period: 1 minute Pre to post calibration variance: 0.1 dB	

Logger type	Logger ID	Location description	Equipment details	Equipment settings	Logger photo
Near field	S13	Southeast of eastern evaporators	Sound level meter SVAN977 (SN: 36825) Class 1 sound level meter IEC 61672-3:2013-compliant Manufactured prior to 2019 Calibrator BnK type 4231 Class 1 sound level calibrator IEC 61672-3:2013-compliant Manufactured prior to 2017 SN: 3025447	Weighting: A-weighted Response type: Fast Interval period: 1 minute Pre to post calibration variance: 1.0 dB	
Near field	S14	Northeast of eastern evaporators	Sound level meter SVAN977 (SN: 36826) Class 1 sound level meter IEC 61672-3:2013-compliant Manufactured prior to 2019 Calibrator BnK type 4231 Class 1 sound level calibrator IEC 61672-3:2013-compliant Manufactured prior to 2017 SN: 3025447	Weighting: A-weighted Response type: Fast Interval period: 1 minute Pre to post calibration variance: 0.0 dB	

Statistical Ambient Noise Levels
L1
Monday 09 December 2024



Statistical Ambient Noise Levels
L1
Tuesday 10 December 2024

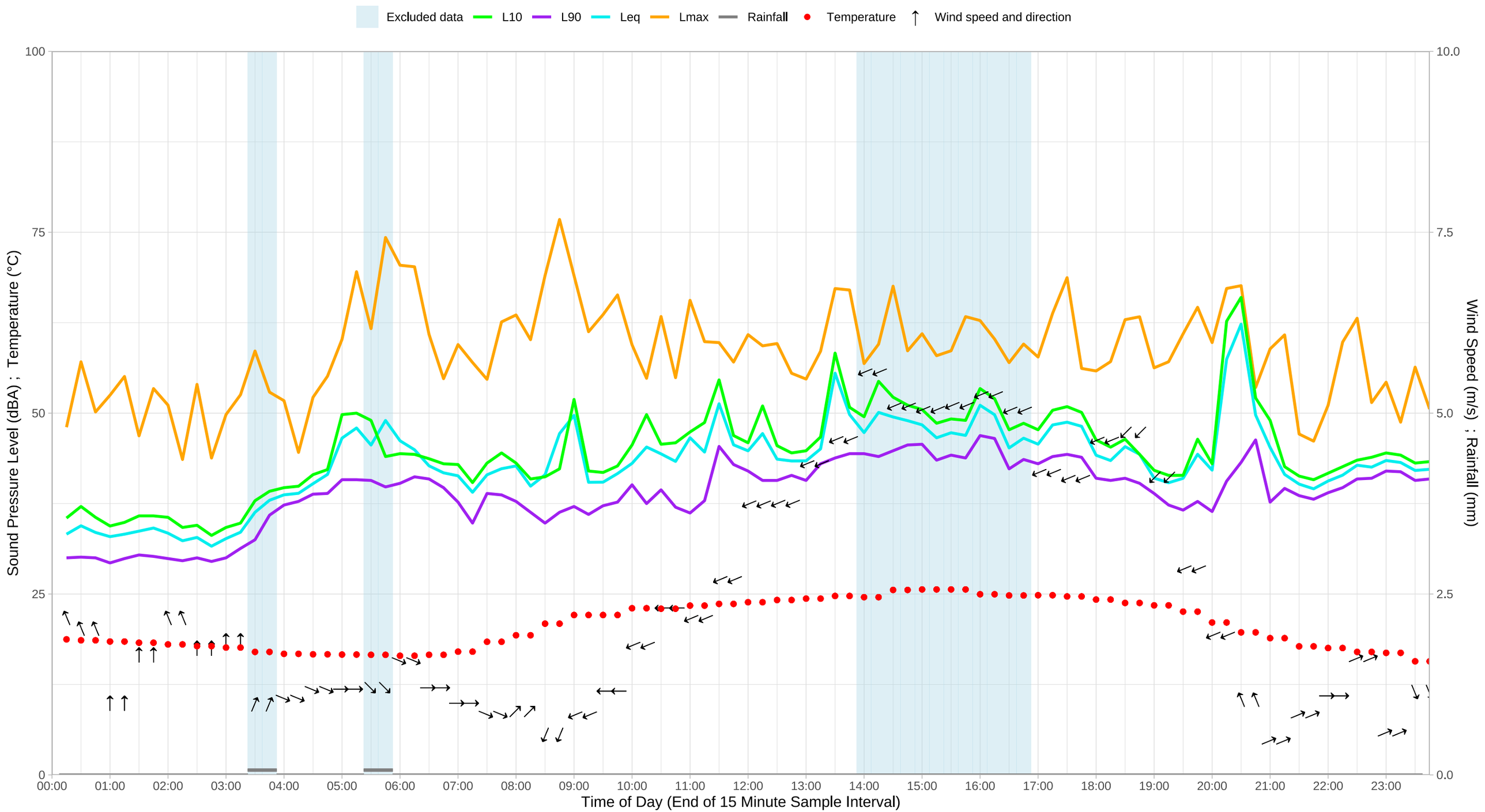
Excluded data | L10 | L90 | Leq | Lmax | Rainfall | Temperature | Wind speed and direction

Sound Pressure Level (dBA) ; Temperature (°C)

Wind Speed (m/s) ; Rainfall (mm)

Time of Day (End of 15 Minute Sample Interval)

Statistical Ambient Noise Levels
L1
Wednesday 11 December 2024



Statistical Ambient Noise Levels
L1
Thursday 12 December 2024

Excluded data | L10 | L90 | Leq | Lmax | Rainfall | Temperature | Wind speed and direction

Sound Pressure Level (dBA) ; Temperature (°C)

100
75
50
25
0

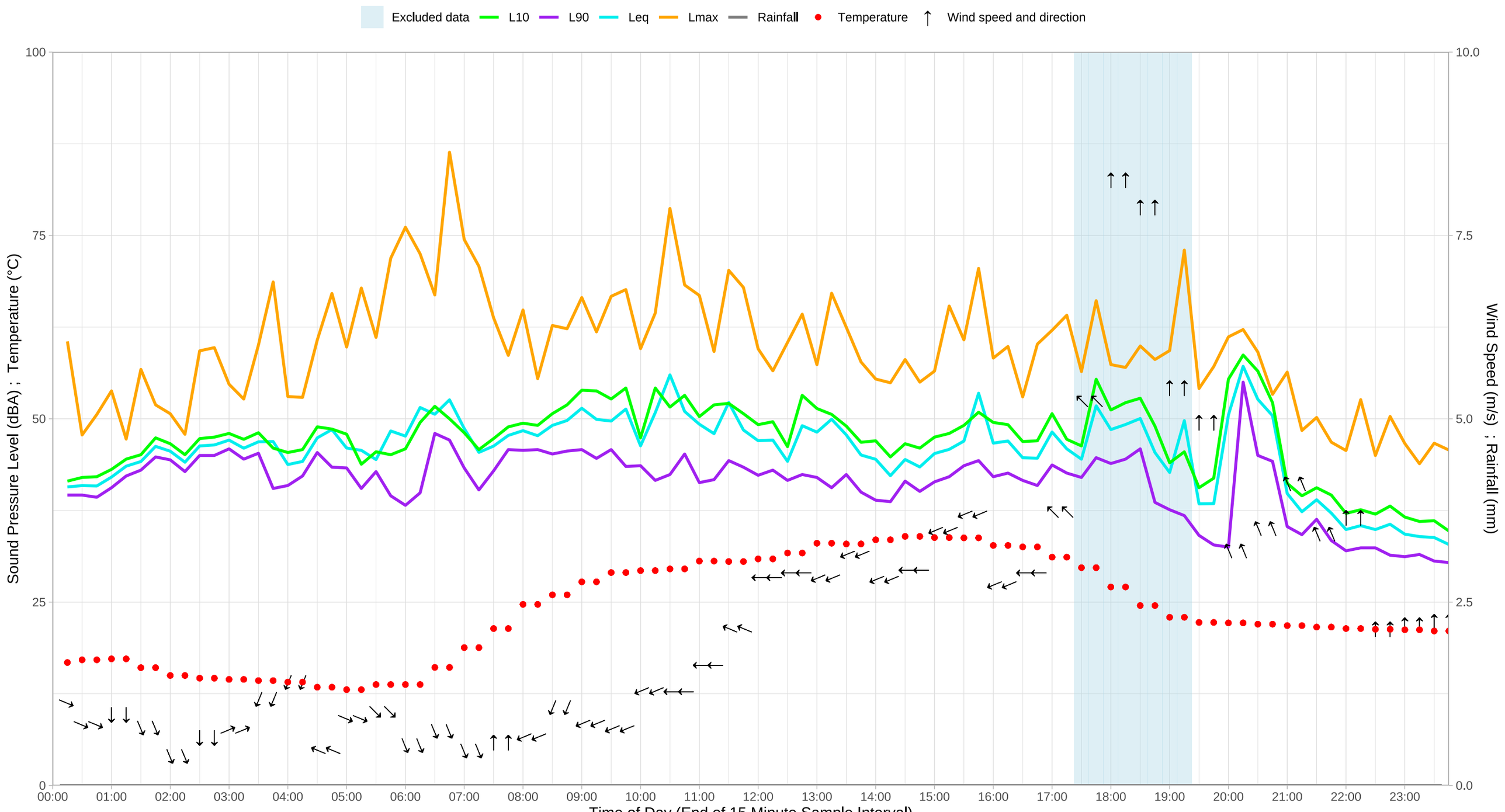
10.0
7.5
5.0
2.5
0.0

Wind Speed (m/s) ; Rainfall (mm)

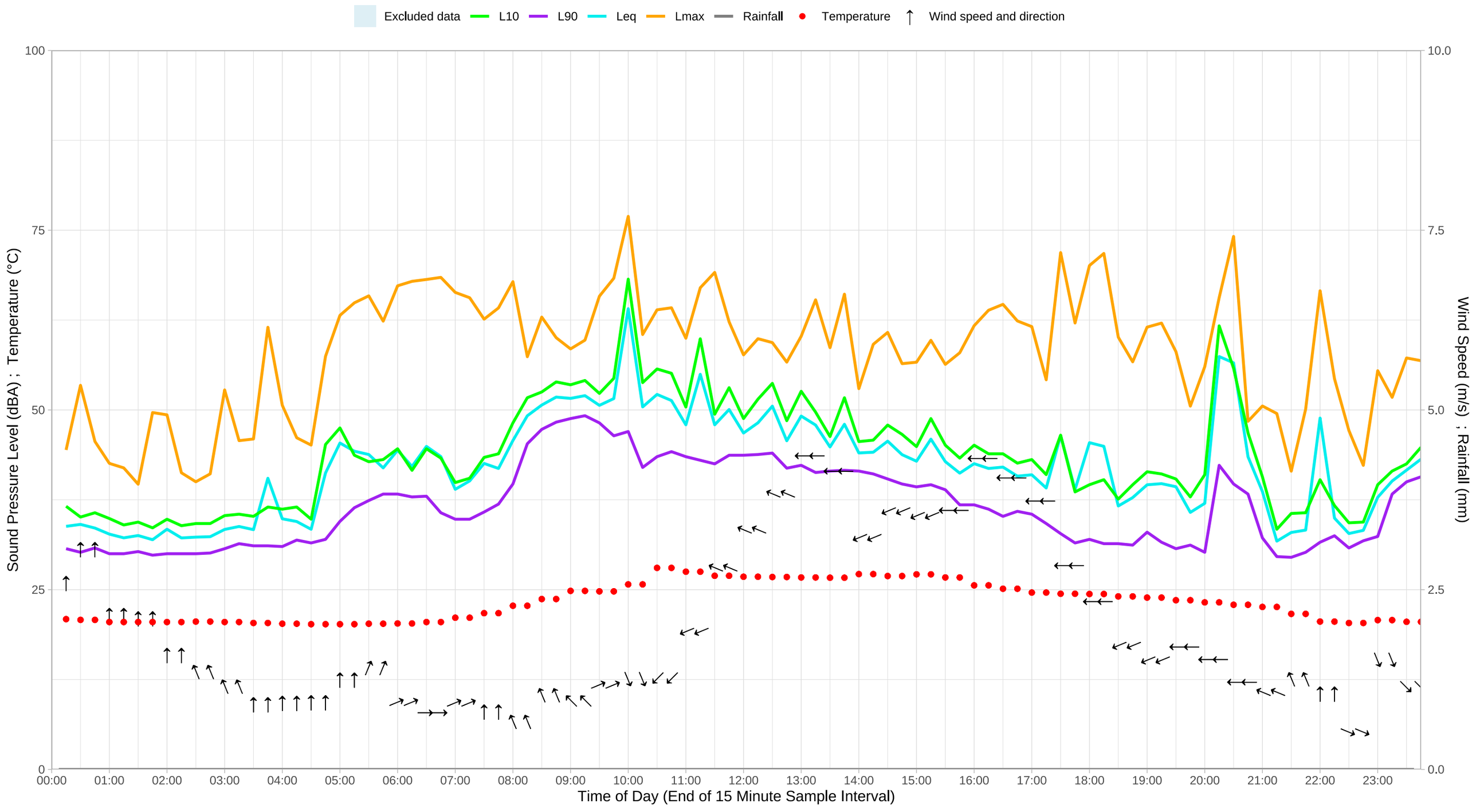
00:00 01:00 02:00 03:00 04:00 05:00 06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00

Time of Day (End of 15 Minute Sample Interval)

Statistical Ambient Noise Levels
L1
Friday 13 December 2024



Statistical Ambient Noise Levels
L1
Saturday 14 December 2024



Statistical Ambient Noise Levels
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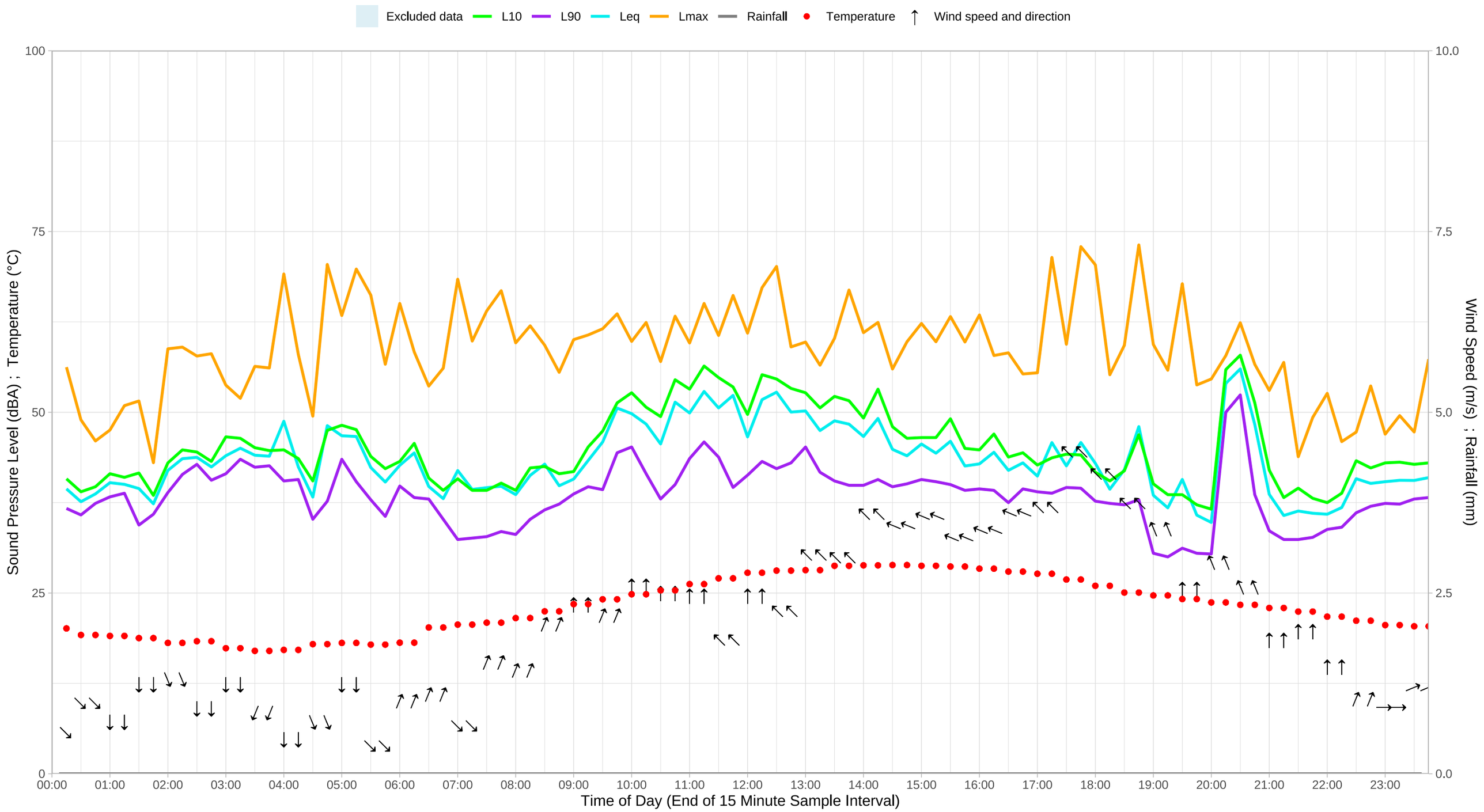
Sunday 15 December 2024



Statistical Ambient Noise Levels
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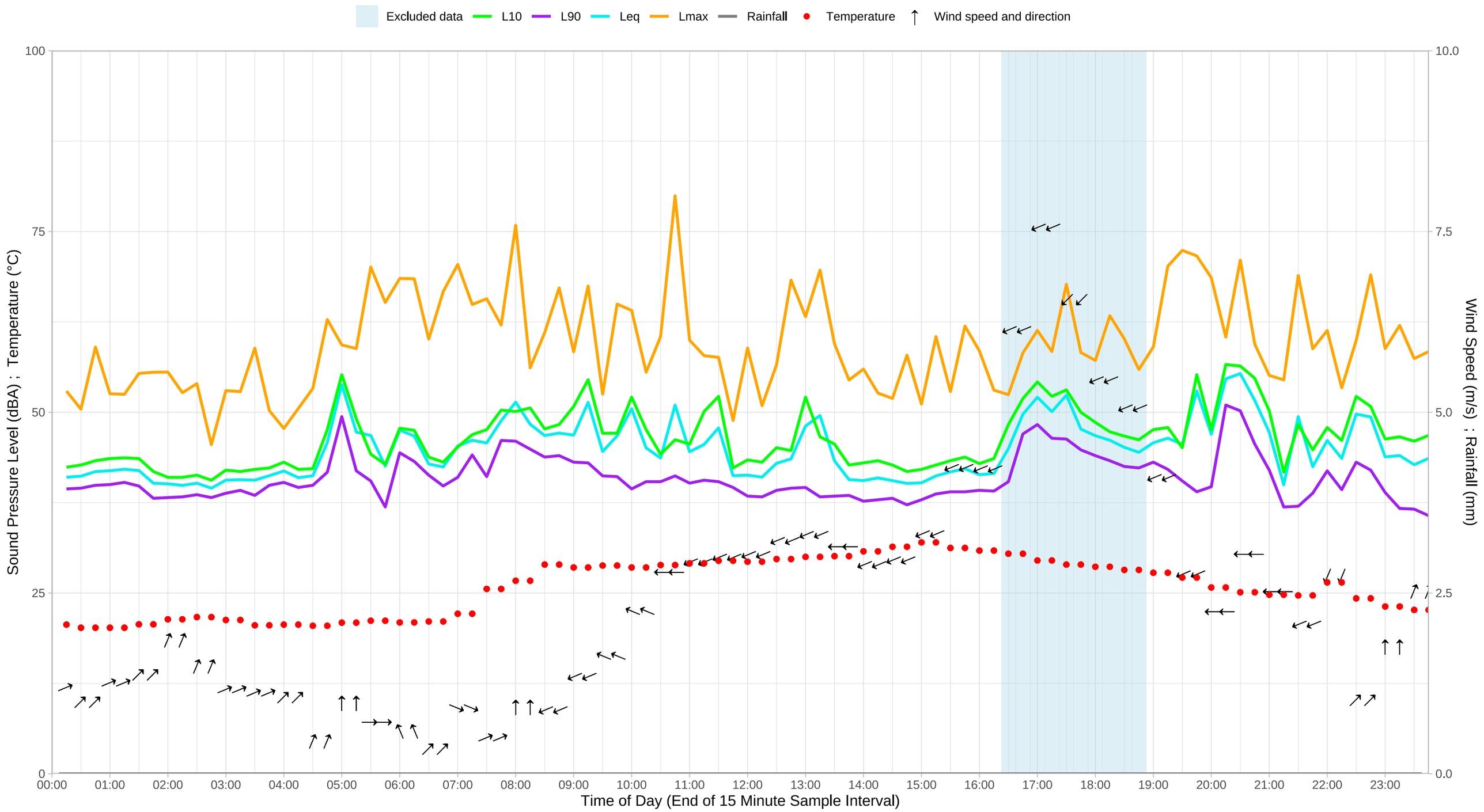
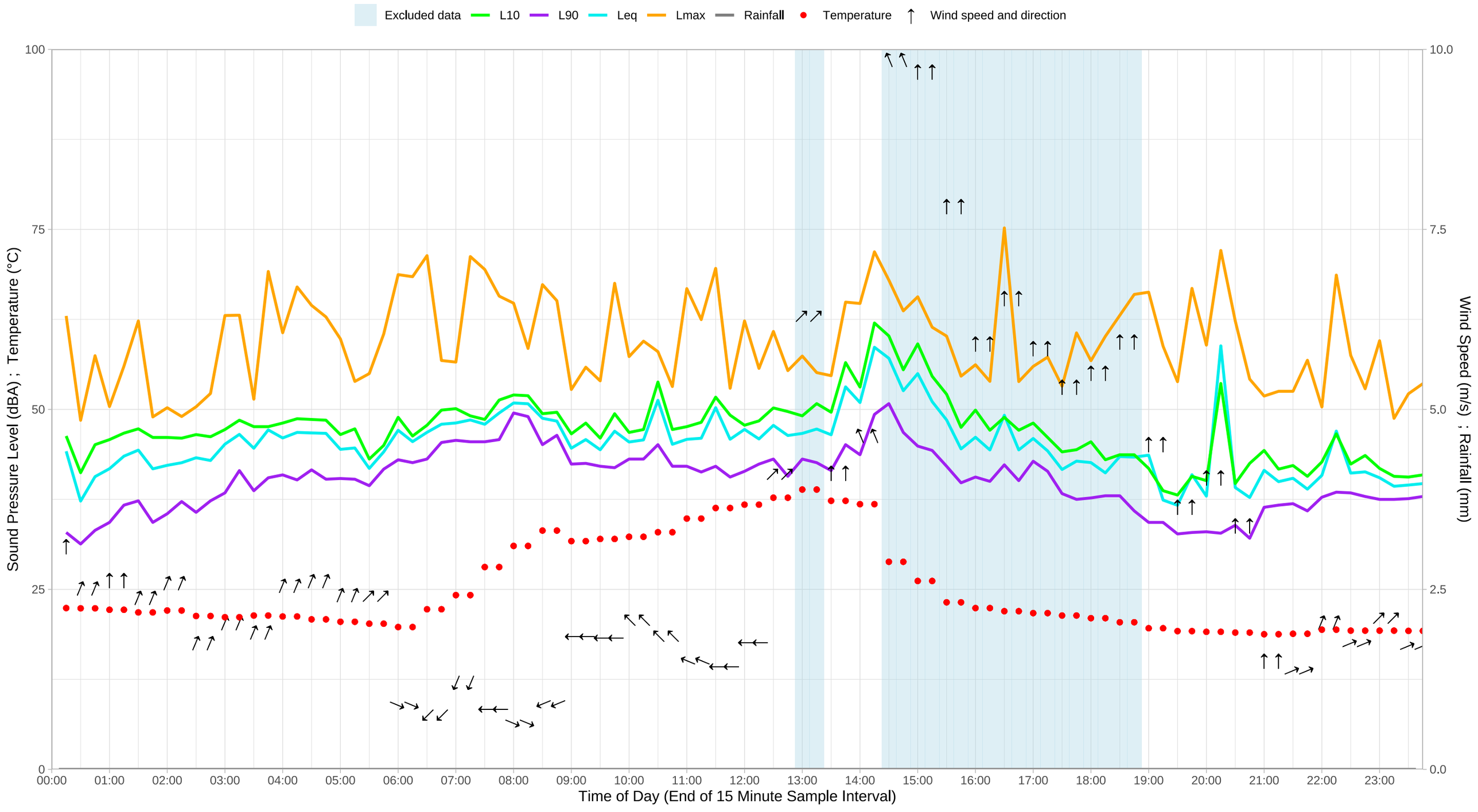
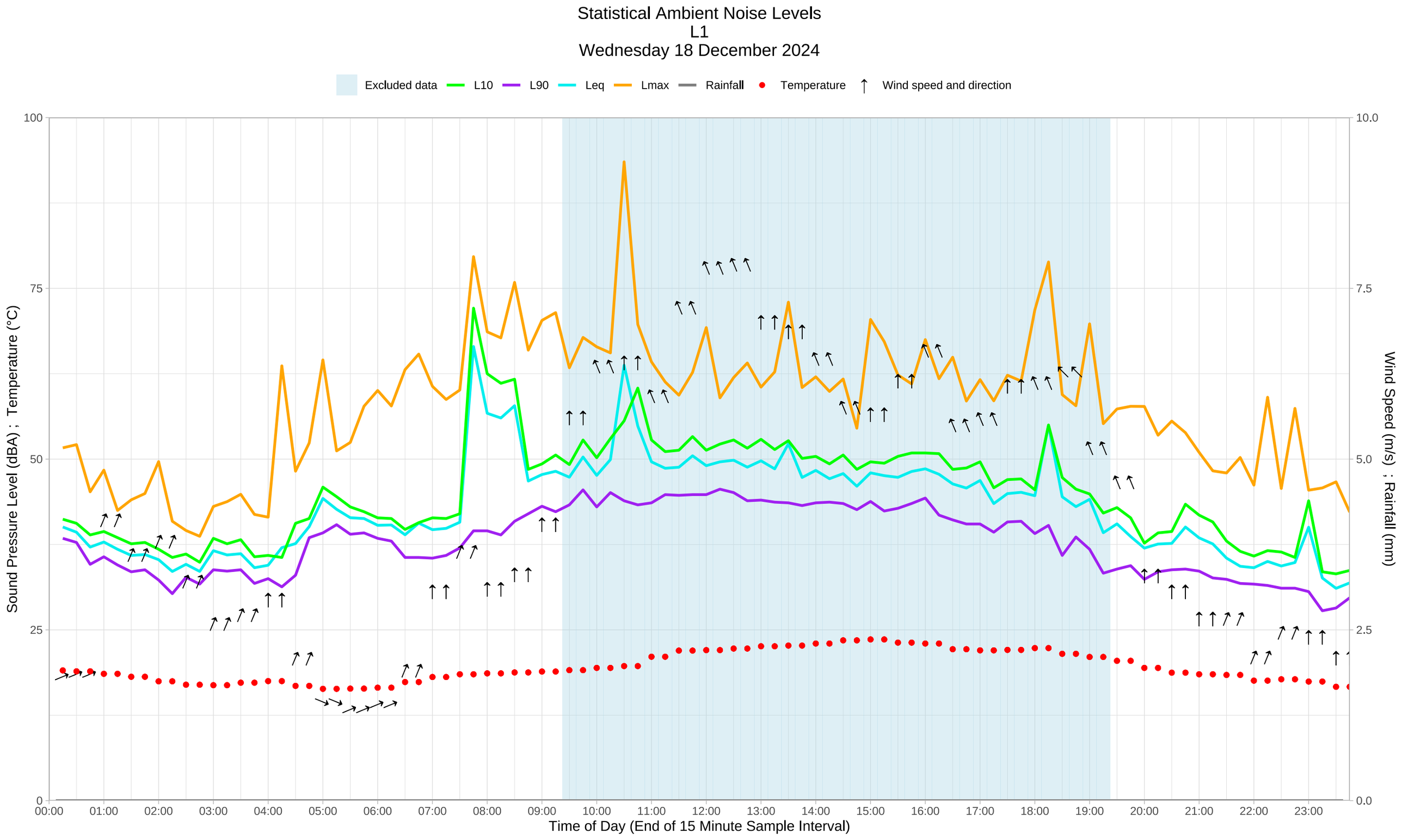
Monday 16 December 2024



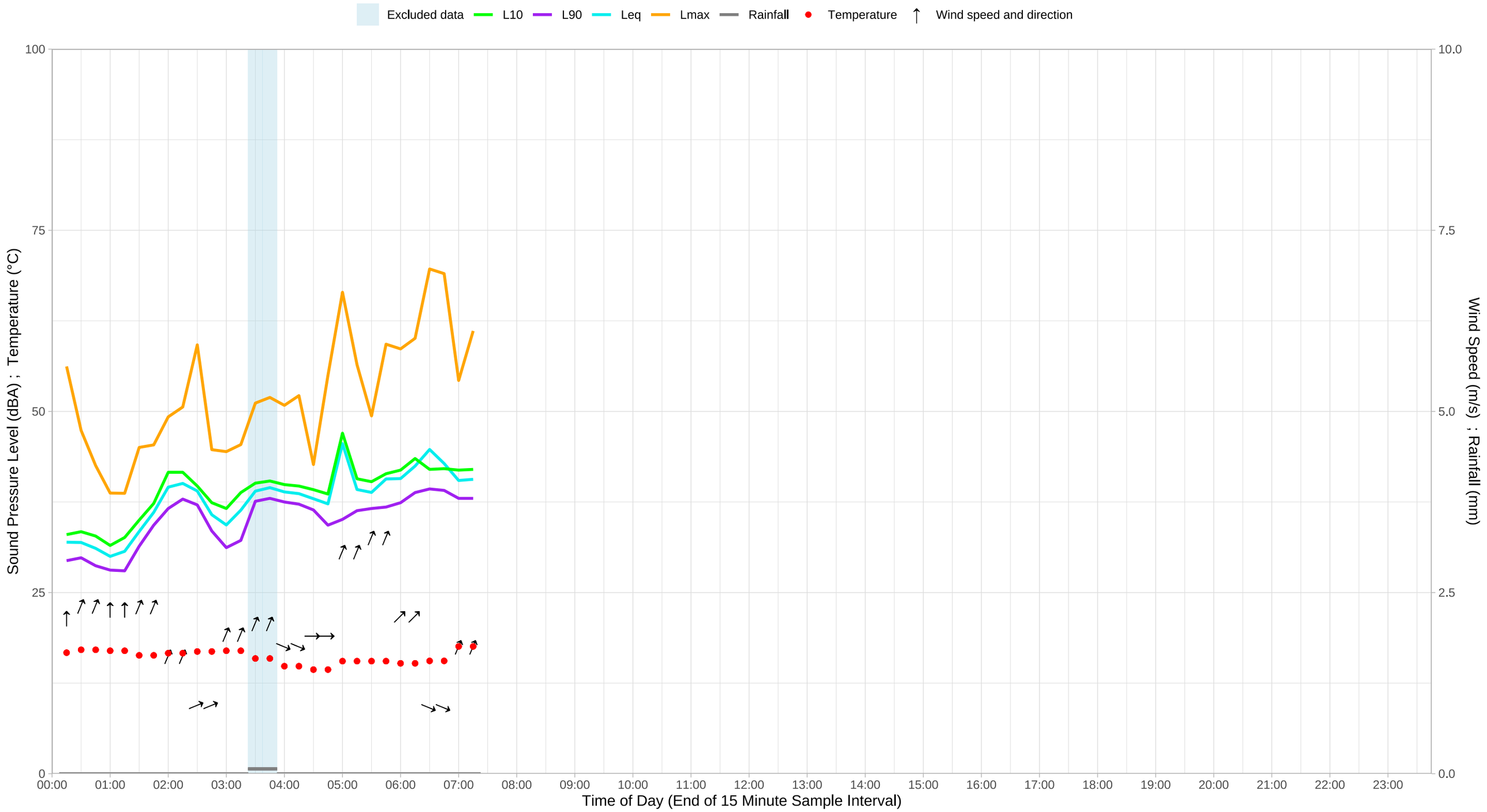
Statistical Ambient Noise Levels
L1
Tuesday 17 December 2024



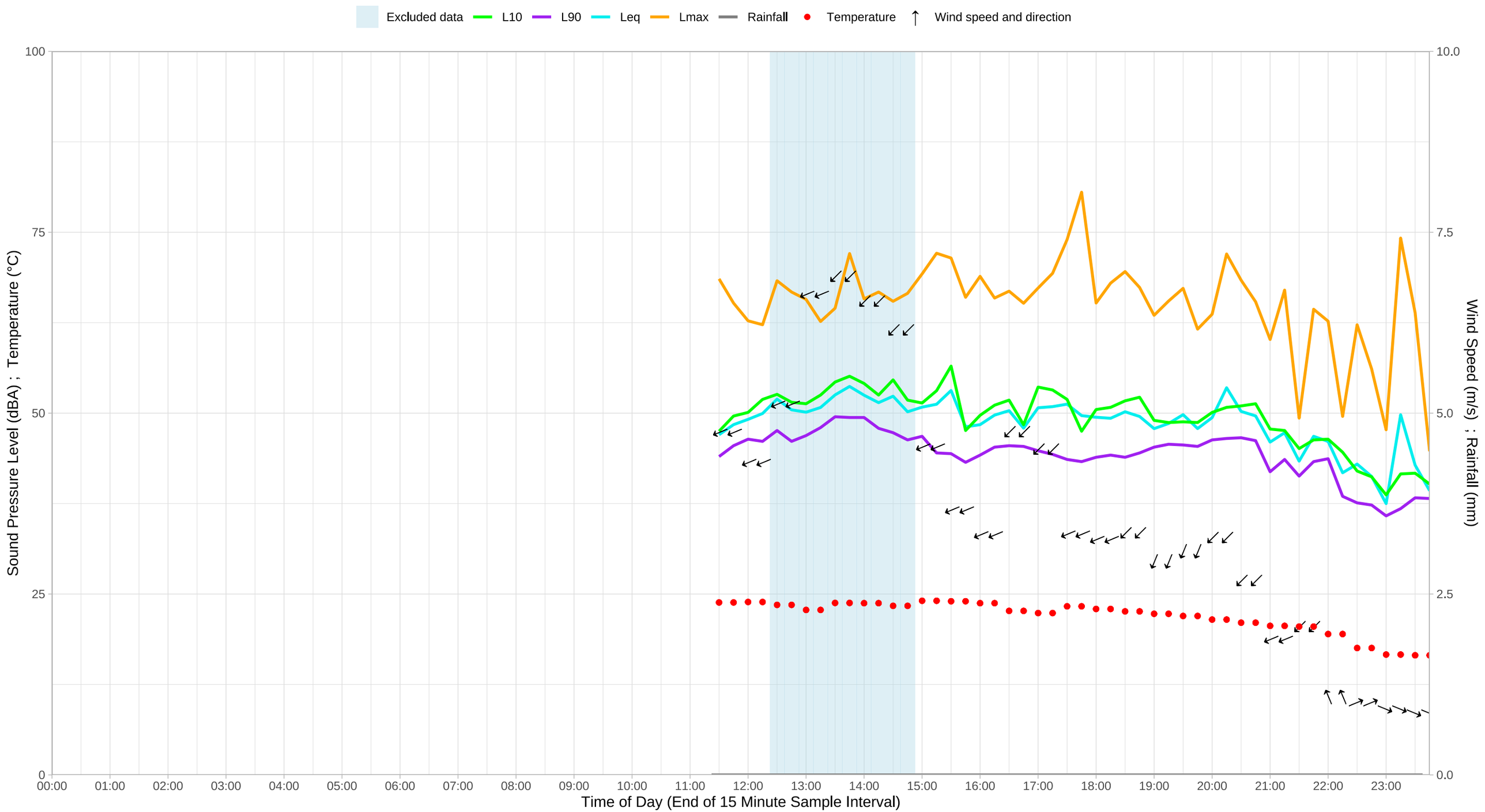
Statistical Ambient Noise Levels
L1
Wednesday 18 December 2024



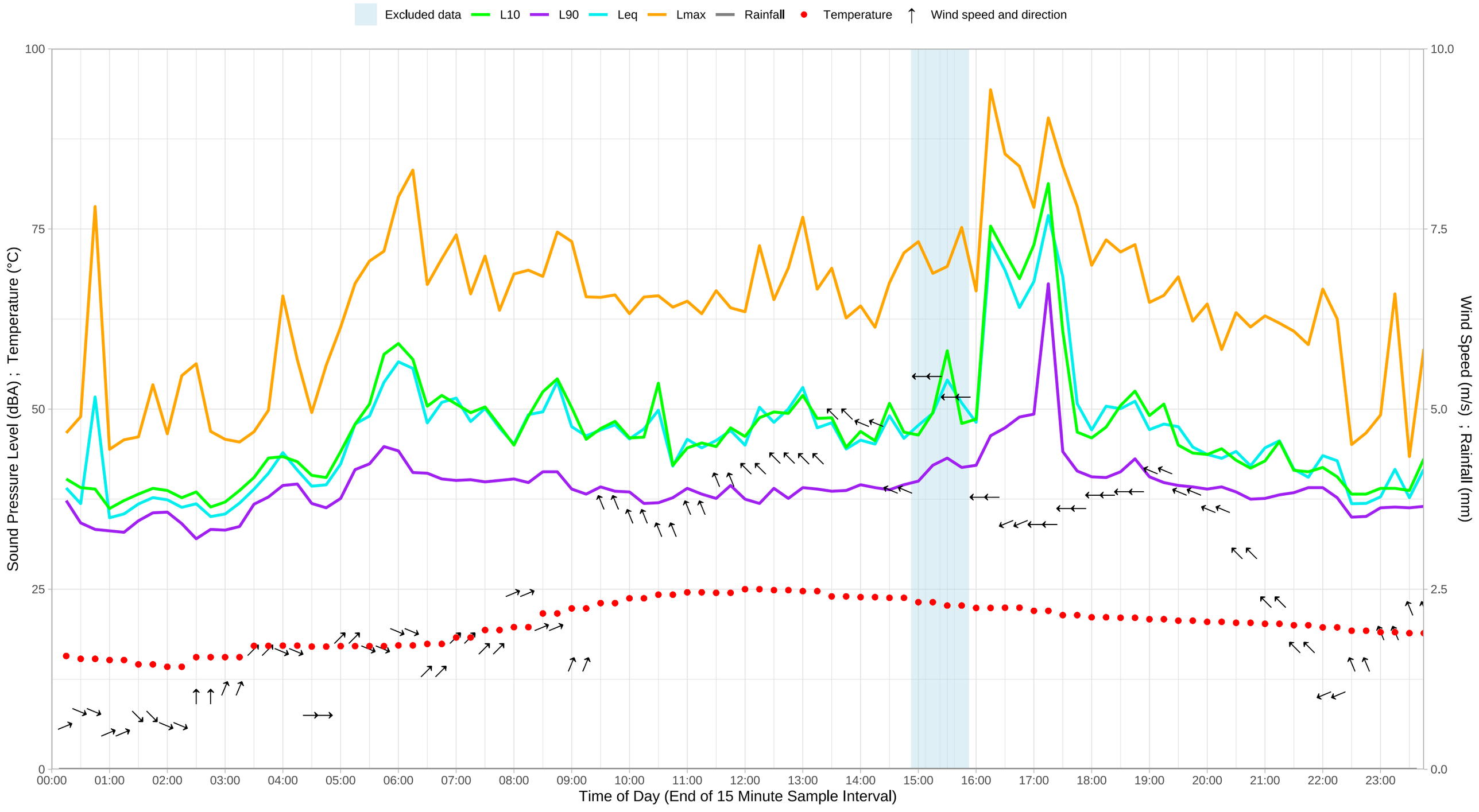
Statistical Ambient Noise Levels
L1
Thursday 19 December 2024



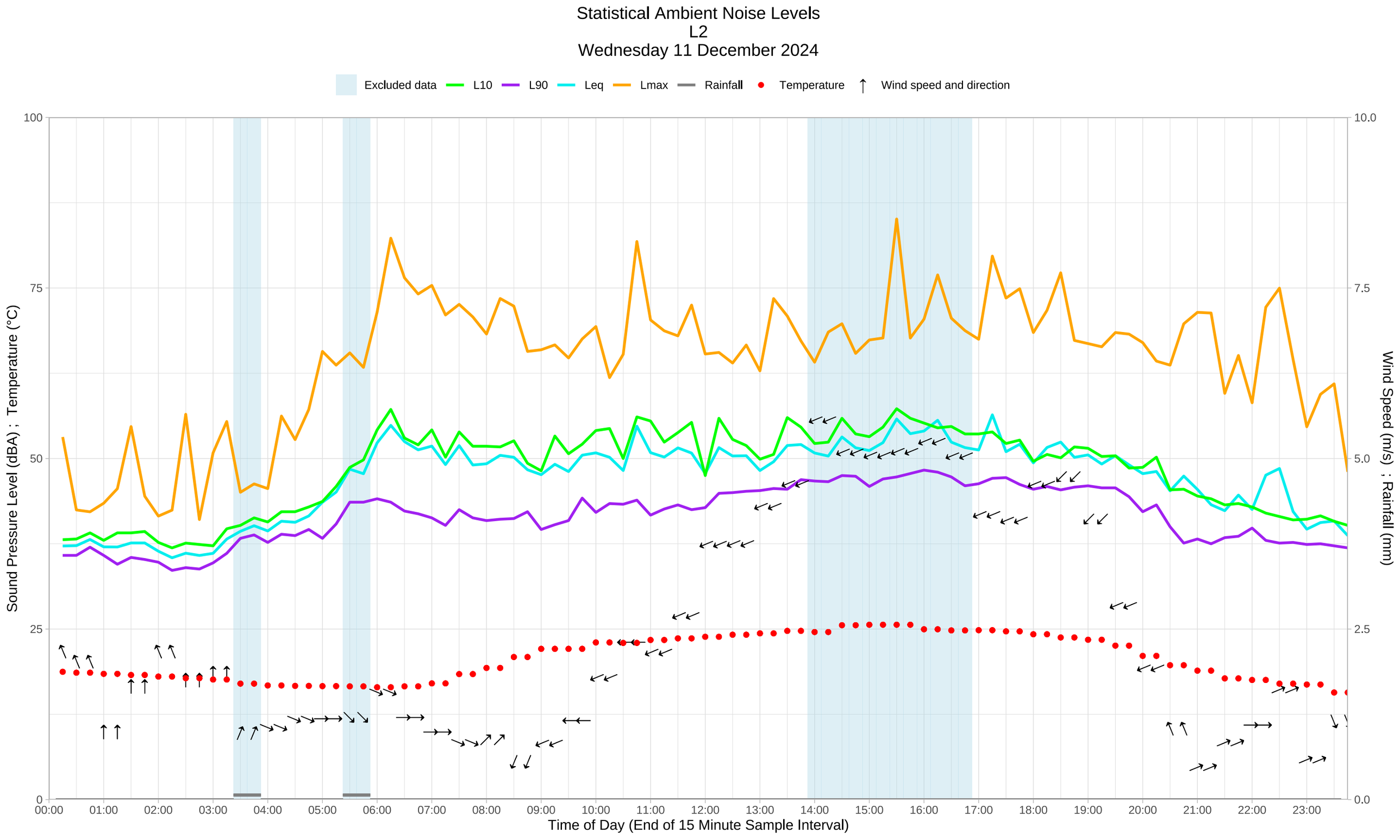
Statistical Ambient Noise Levels
L2
Monday 09 December 2024



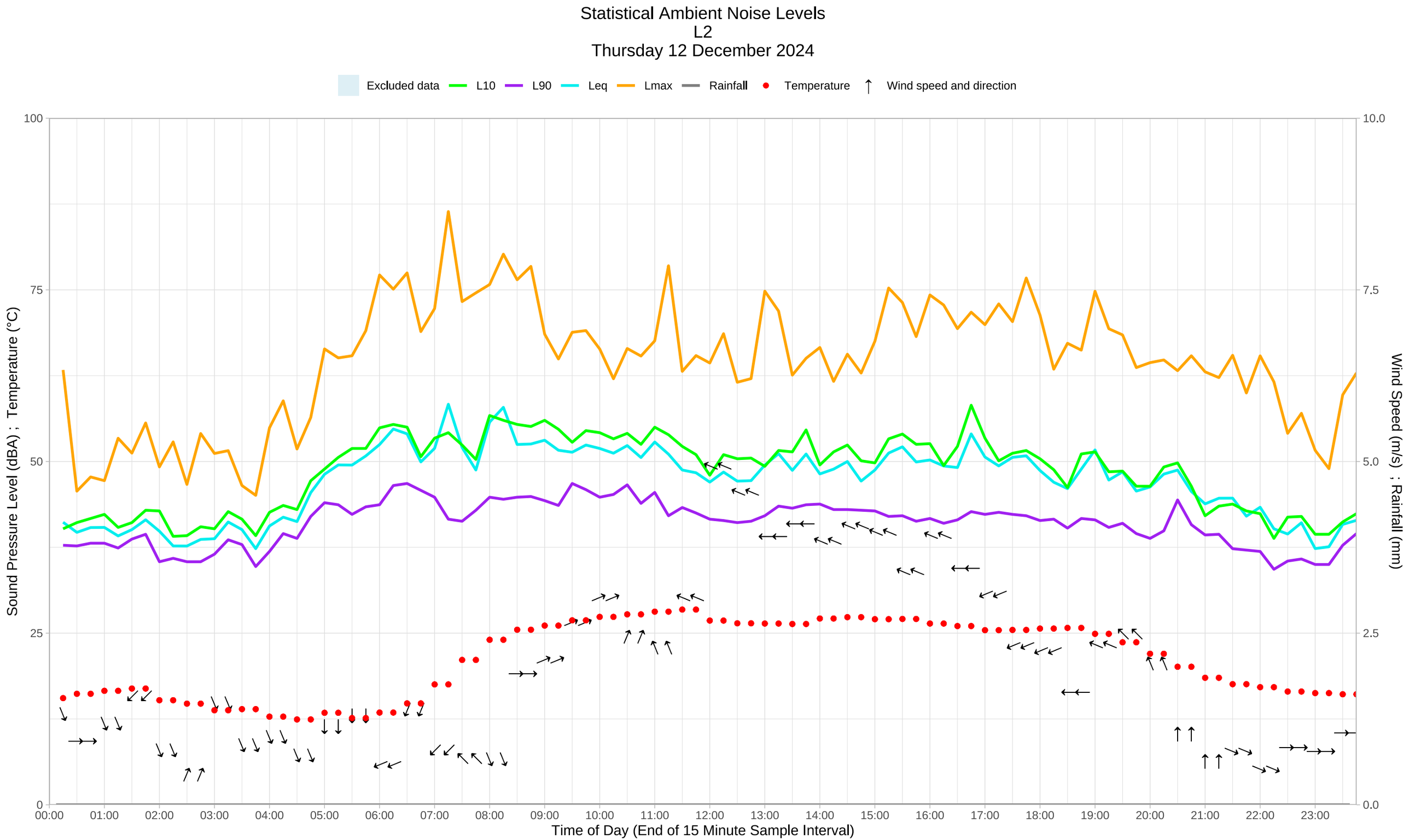
Statistical Ambient Noise Levels
L2
Tuesday 10 December 2024



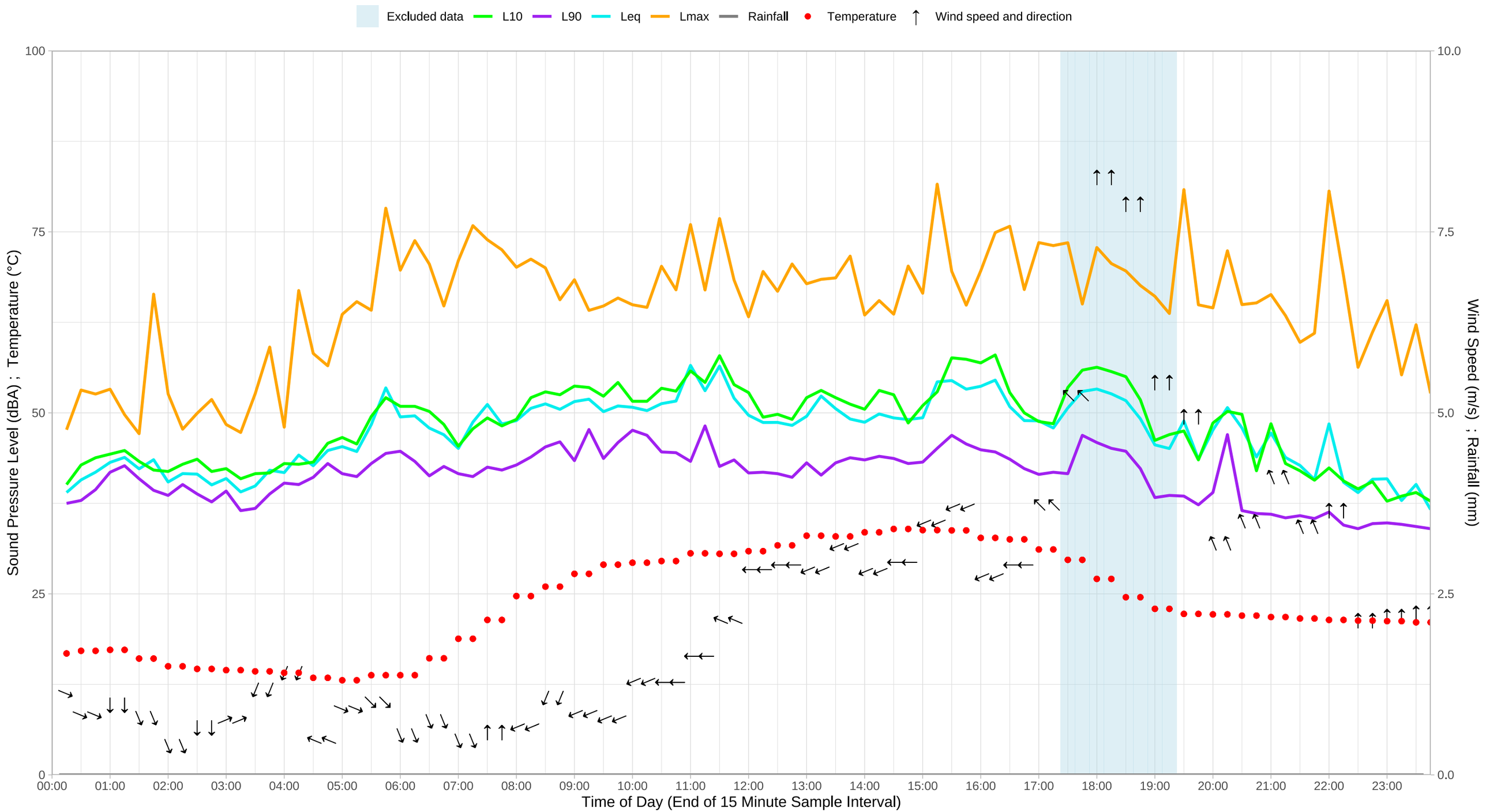
Statistical Ambient Noise Levels
L2
Wednesday 11 December 2024



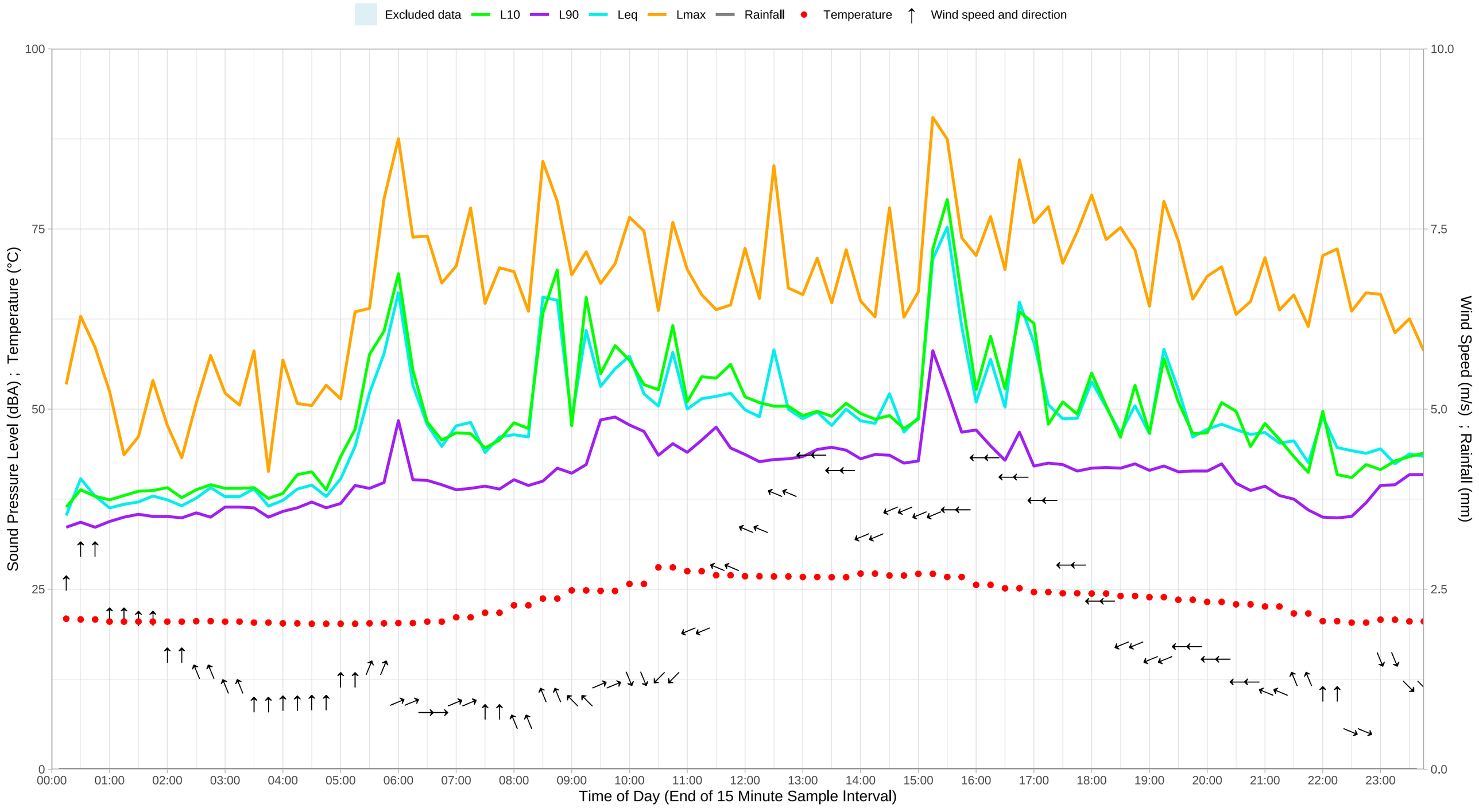
Statistical Ambient Noise Levels
L2
Thursday 12 December 2024



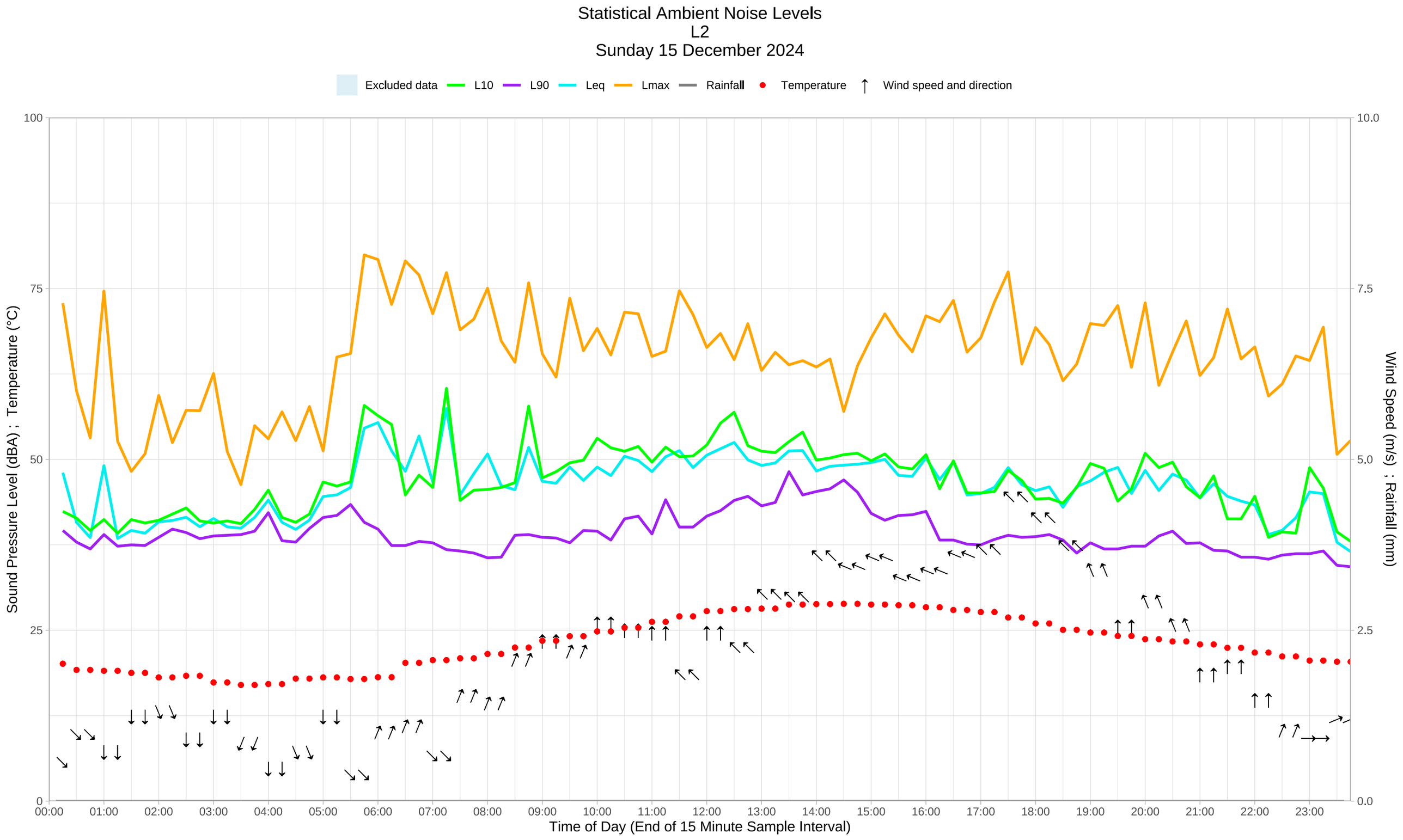
Statistical Ambient Noise Levels
L2
Friday 13 December 2024



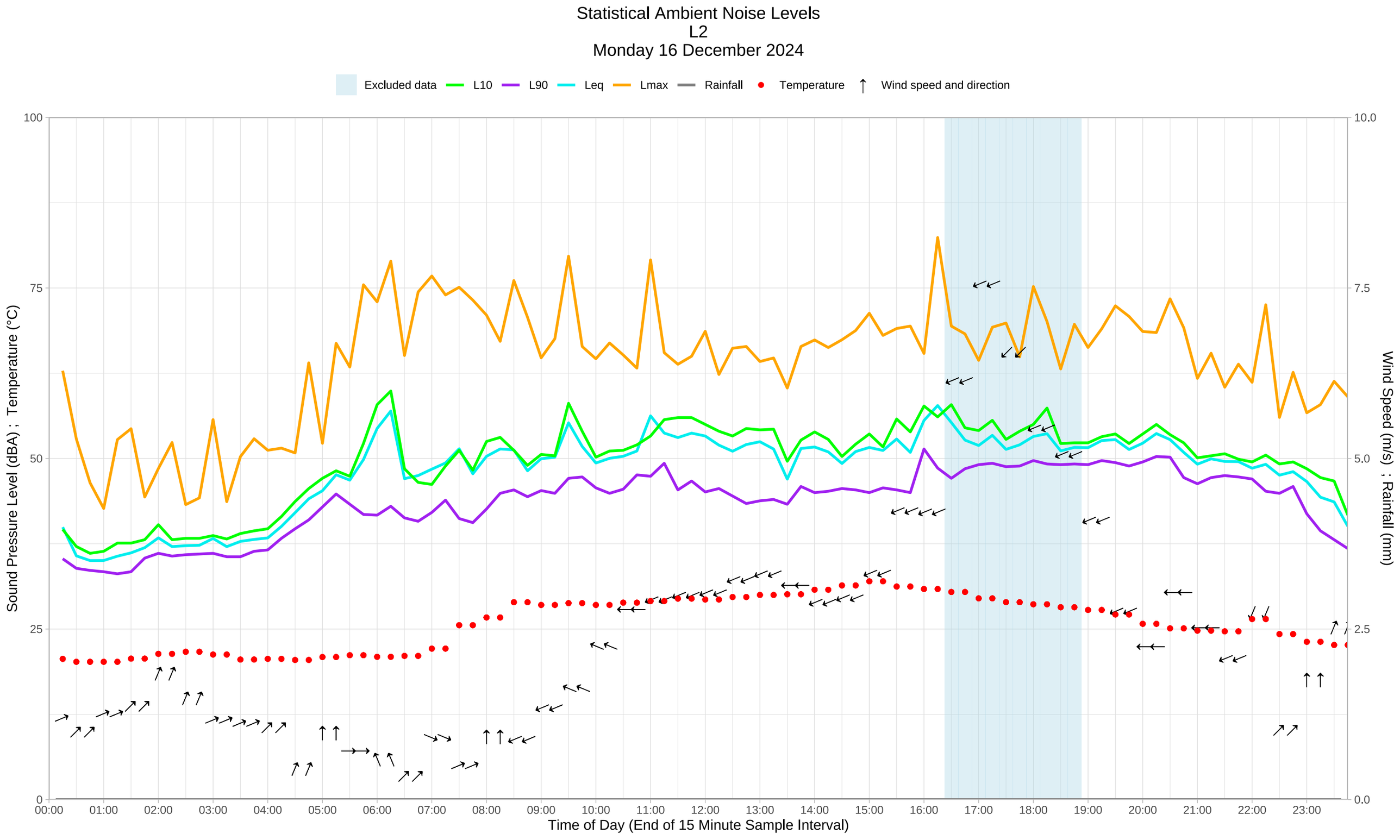
Statistical Ambient Noise Levels
L2
Saturday 14 December 2024



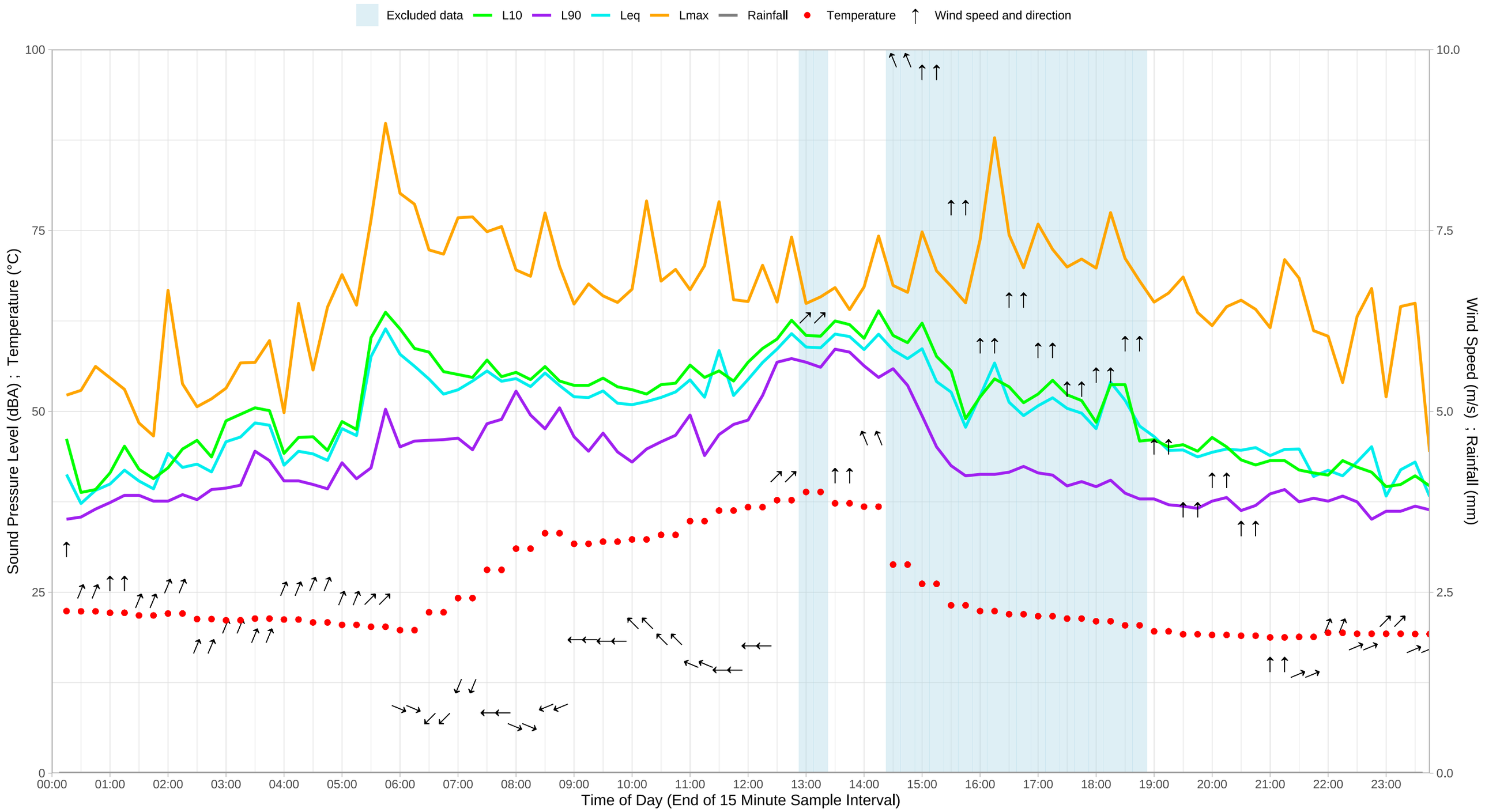
Statistical Ambient Noise Levels
L2
Sunday 15 December 2024



Statistical Ambient Noise Levels
L2
Monday 16 December 2024



Statistical Ambient Noise Levels
L2
Tuesday 17 December 2024



Statistical Ambient Noise Levels
L2
Wednesday 18 December 2024

Excluded data | L10 | L90 | Leq | Lmax | Rainfall | Temperature | Wind speed and direction

Sound Pressure Level (dBA) ; Temperature (°C)

100
75
50
25
0

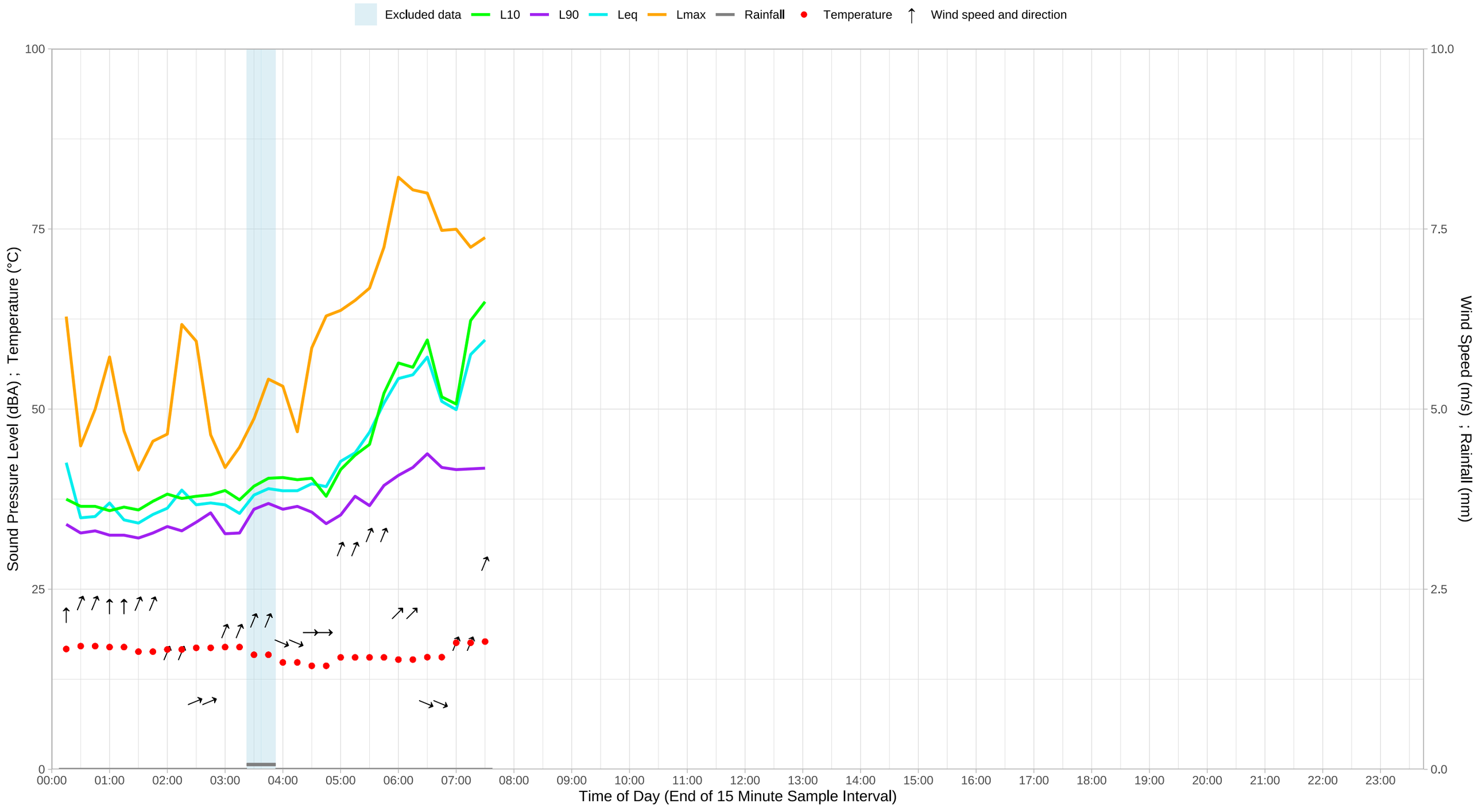
10.0
7.5
5.0
2.5
0.0

Wind Speed (m/s) ; Rainfall (mm)

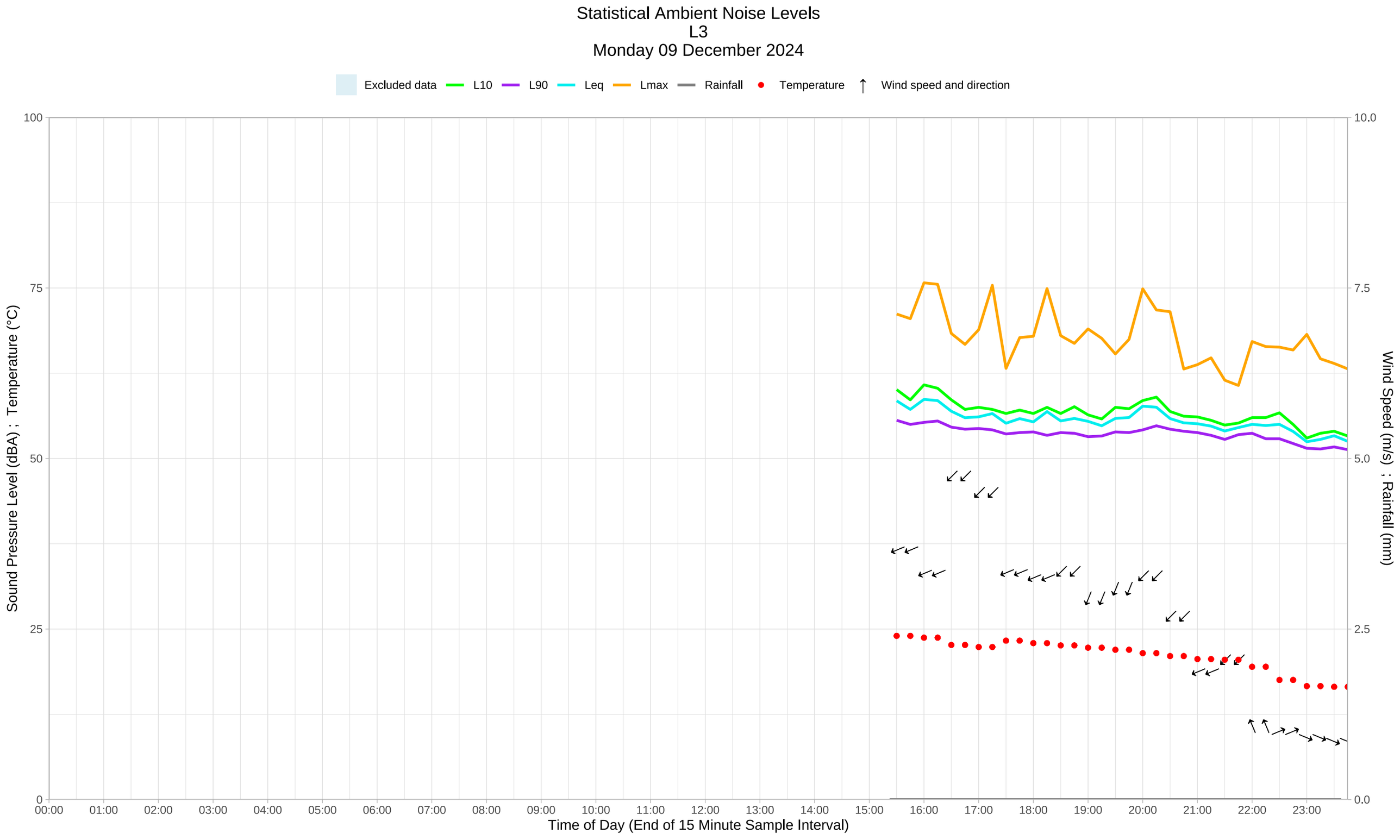
00:00 01:00 02:00 03:00 04:00 05:00 06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00

Time of Day (End of 15 Minute Sample Interval)

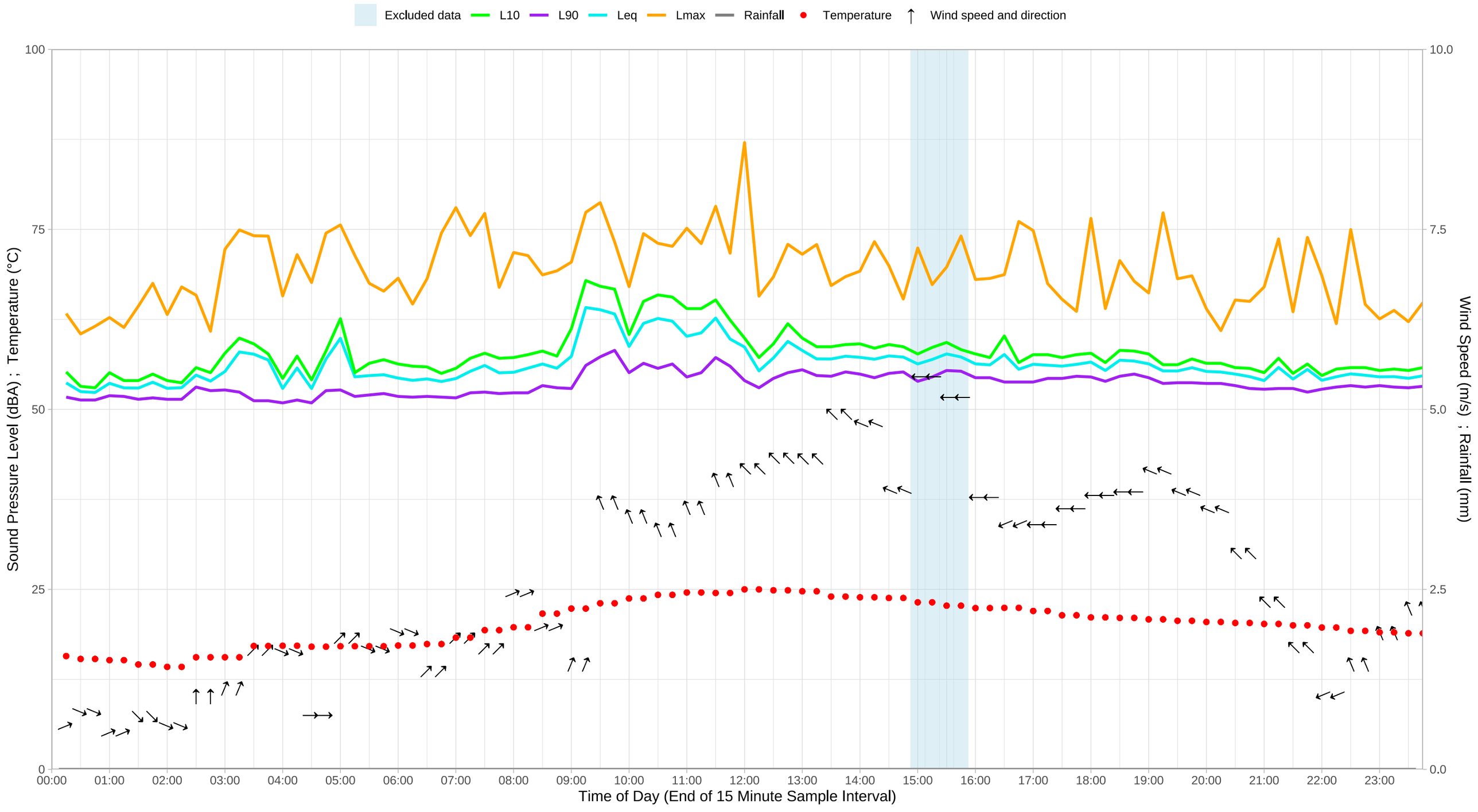
Statistical Ambient Noise Levels
L2
Thursday 19 December 2024



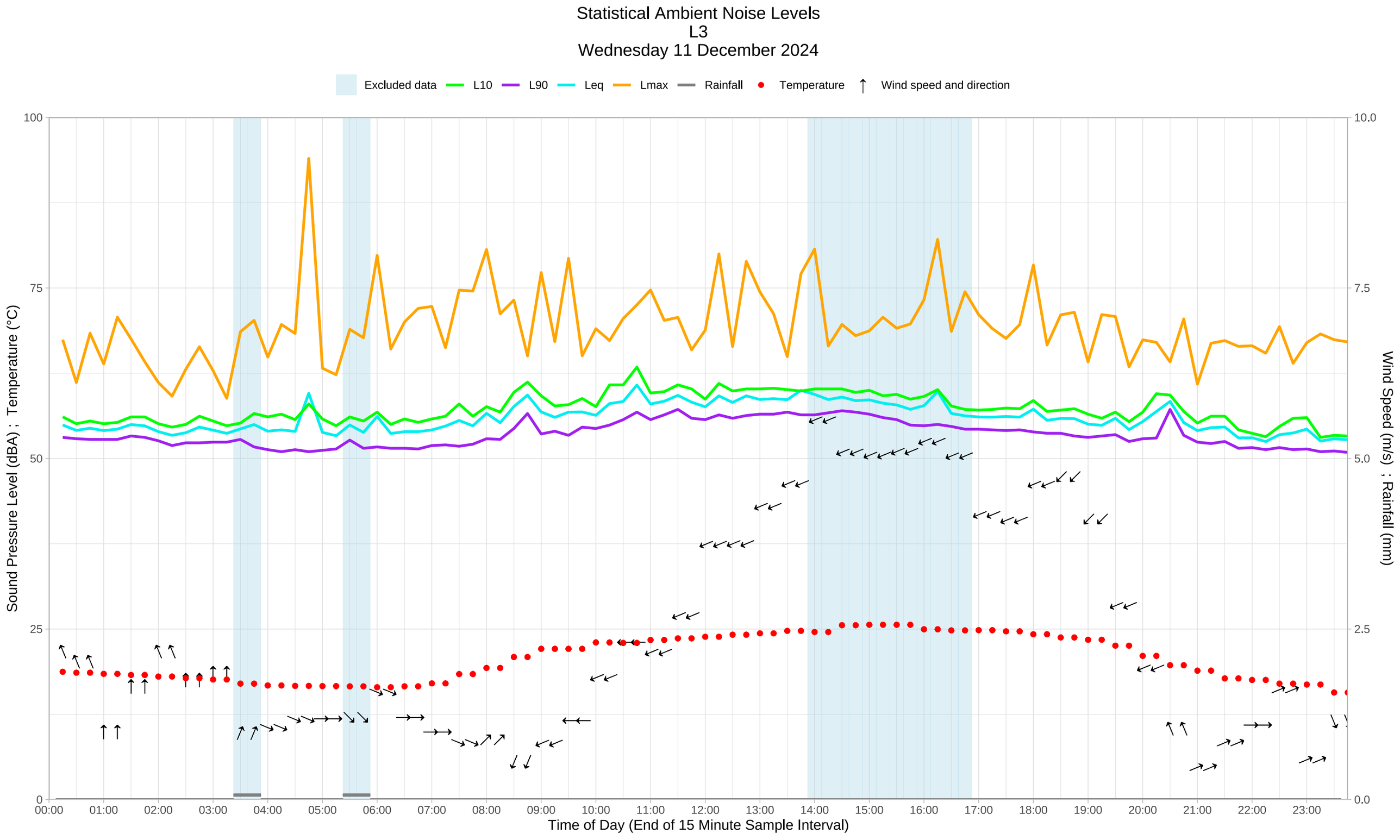
Statistical Ambient Noise Levels
L3
Monday 09 December 2024



Statistical Ambient Noise Levels
L3
Tuesday 10 December 2024



Statistical Ambient Noise Levels
L3
Wednesday 11 December 2024



Statistical Ambient Noise Levels
L3
Thursday 12 December 2024

Excluded data | L10 | L90 | Leq | Lmax | Rainfall | Temperature | Wind speed and direction

Sound Pressure Level (dBA) ; Temperature (°C)

100
75
50
25
0

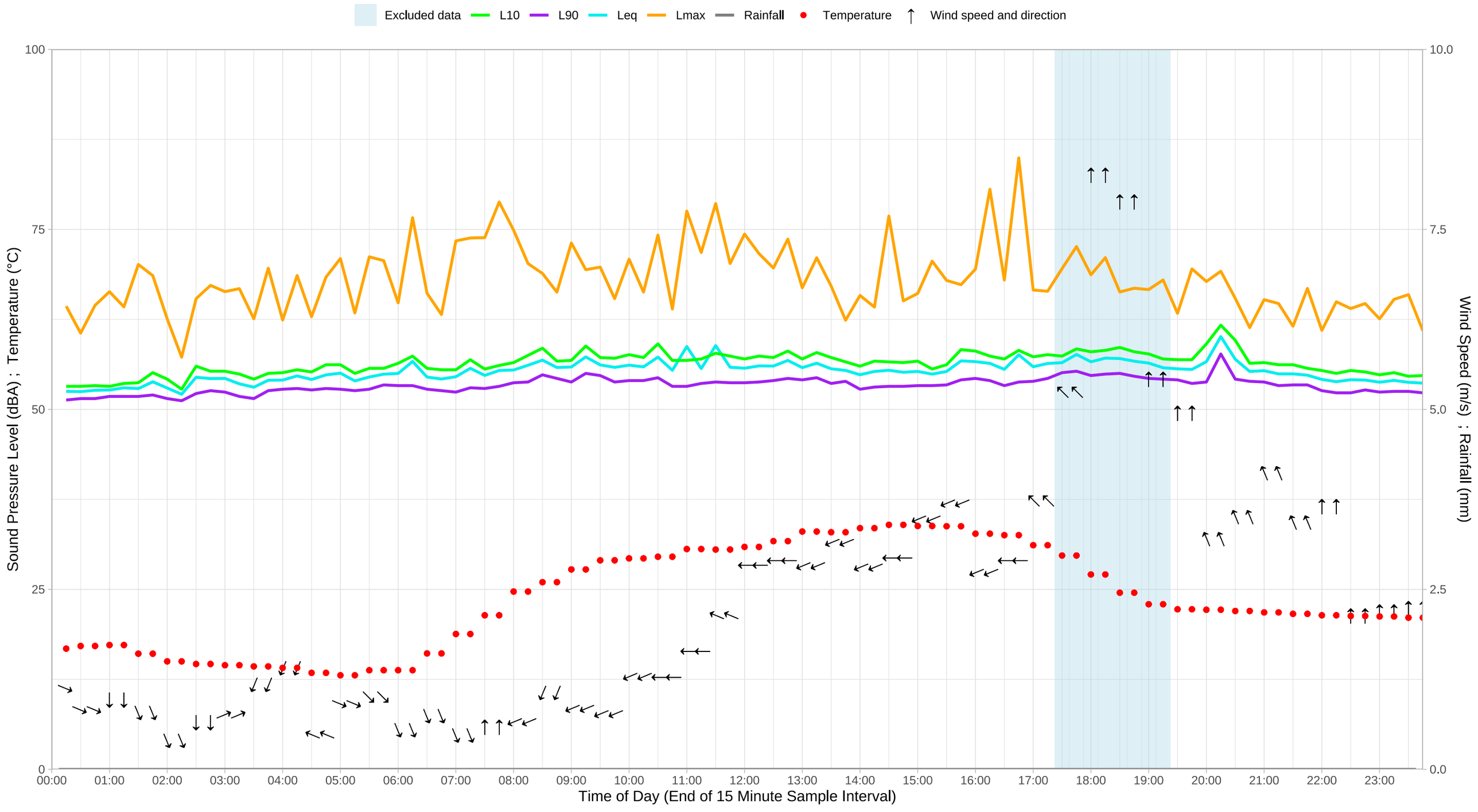
Wind Speed (m/s) ; Rainfall (mm)

10.0
7.5
5.0
2.5
0.0

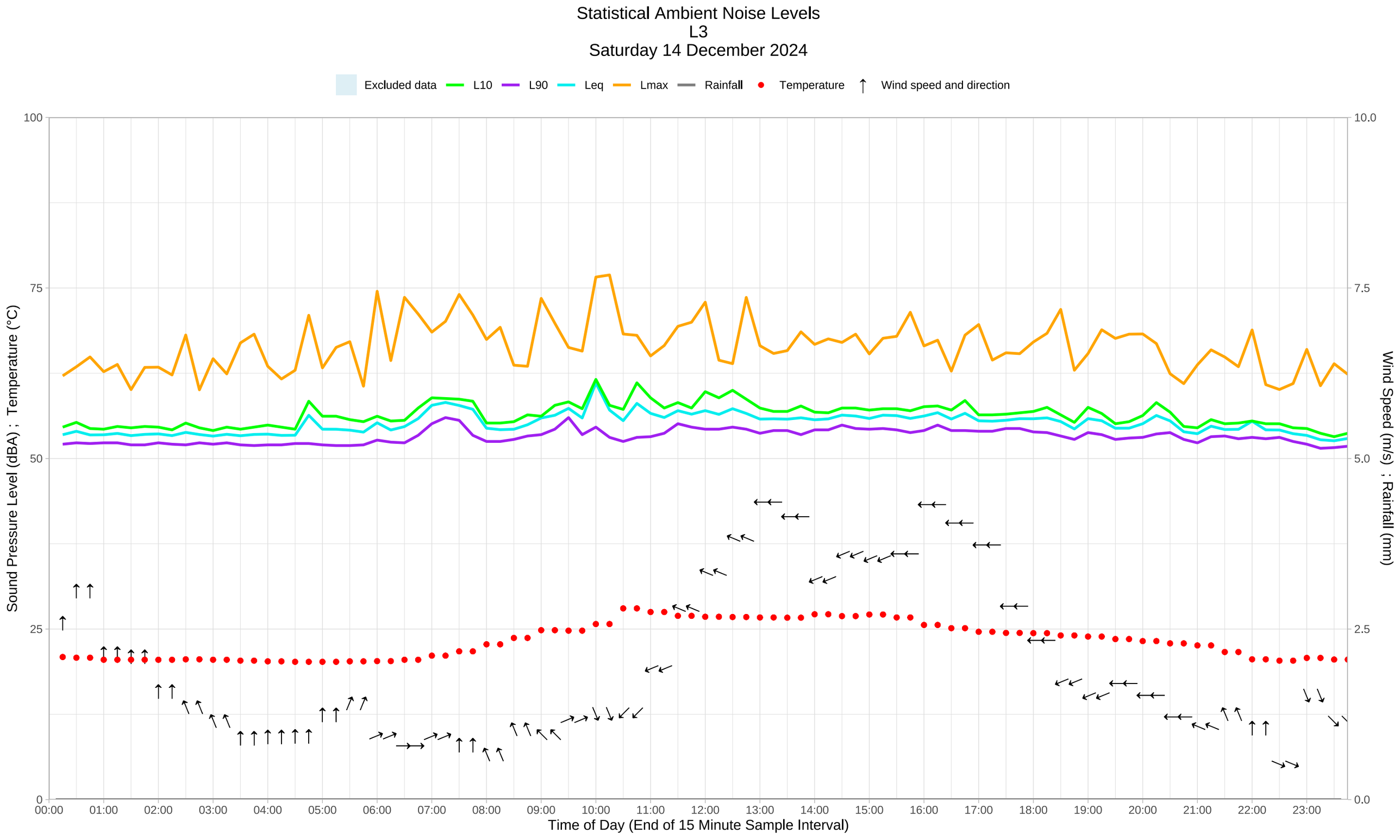
00:00 01:00 02:00 03:00 04:00 05:00 06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00

Time of Day (End of 15 Minute Sample Interval)

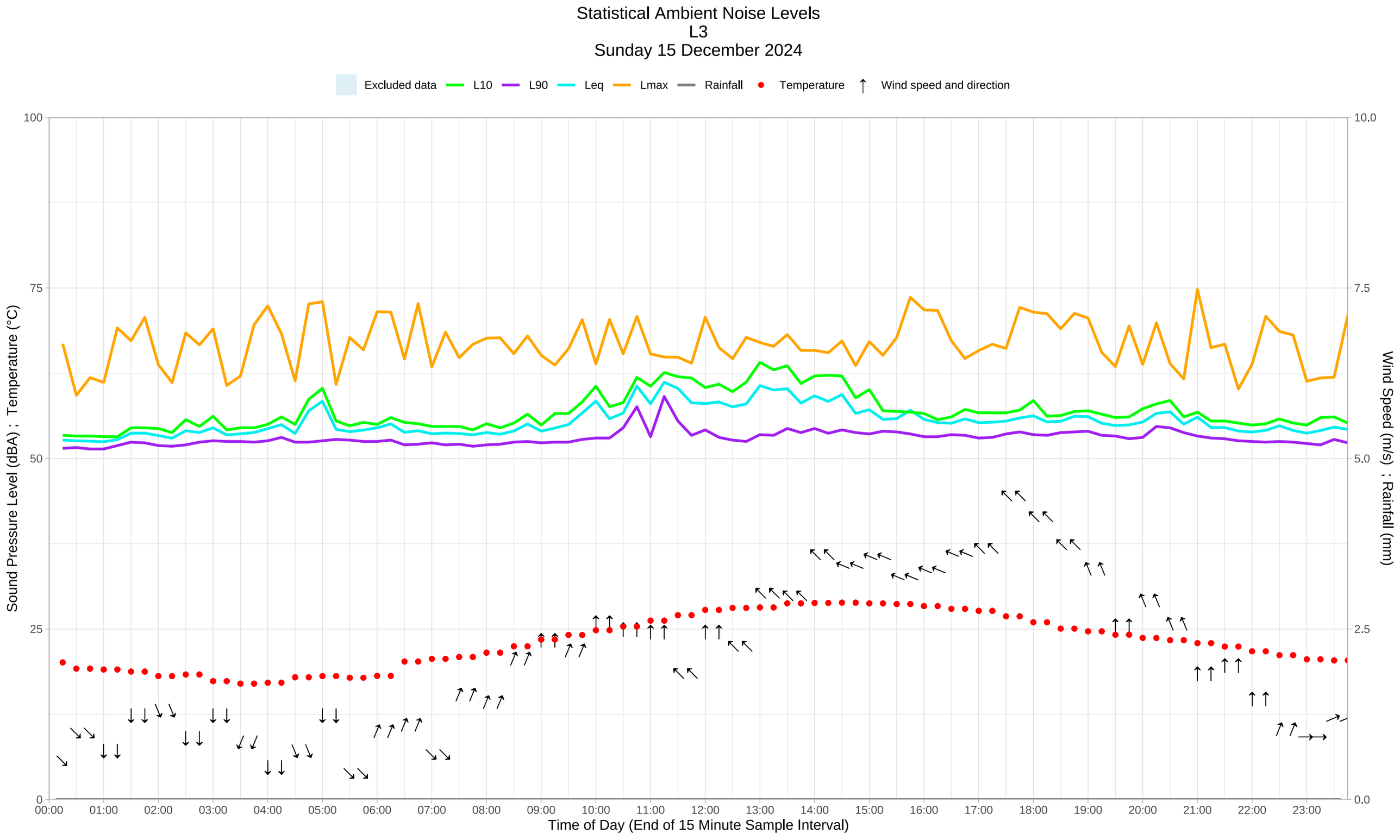
Statistical Ambient Noise Levels
L3
Friday 13 December 2024



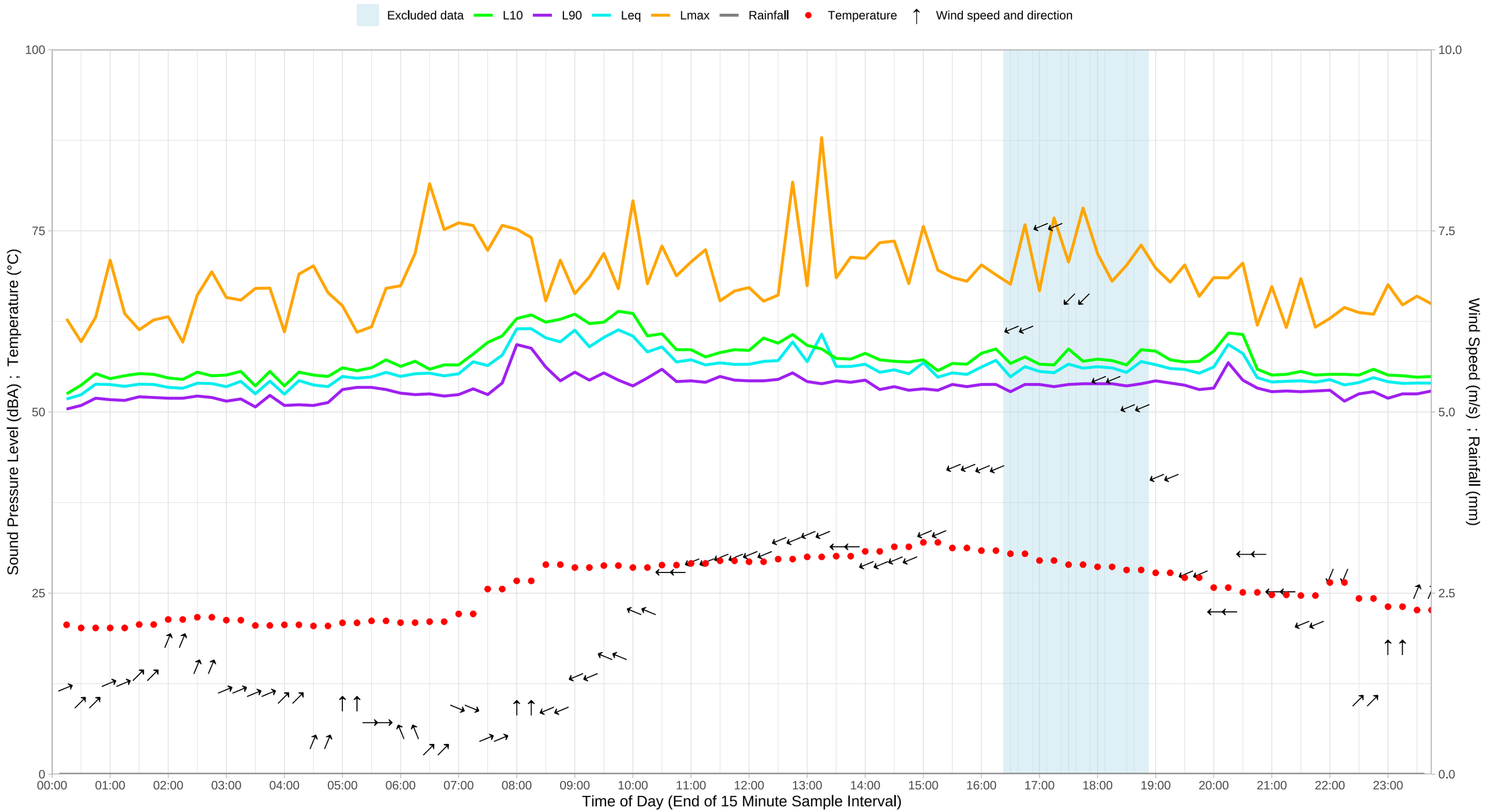
Statistical Ambient Noise Levels
L3
Saturday 14 December 2024



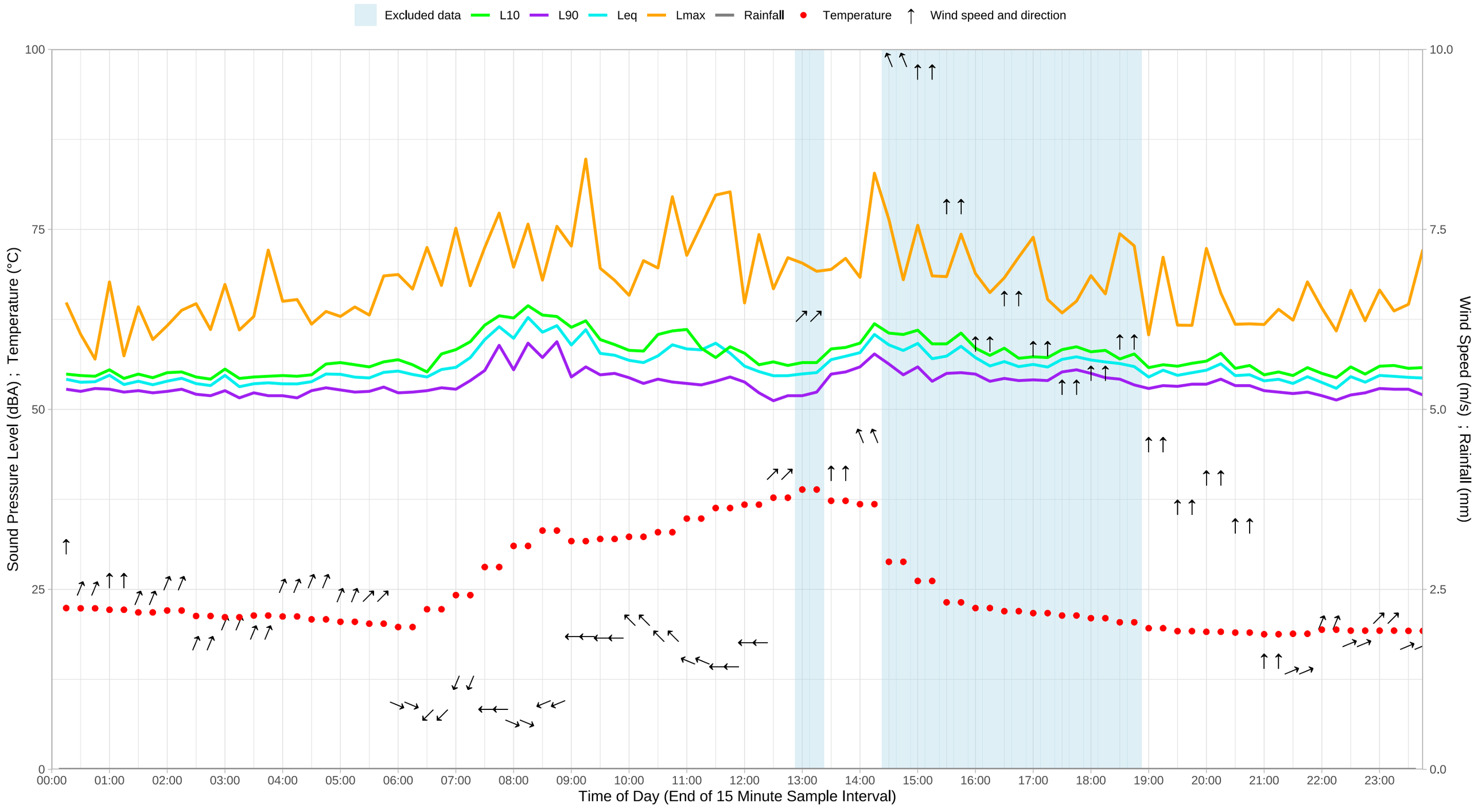
Statistical Ambient Noise Levels
L3
Sunday 15 December 2024



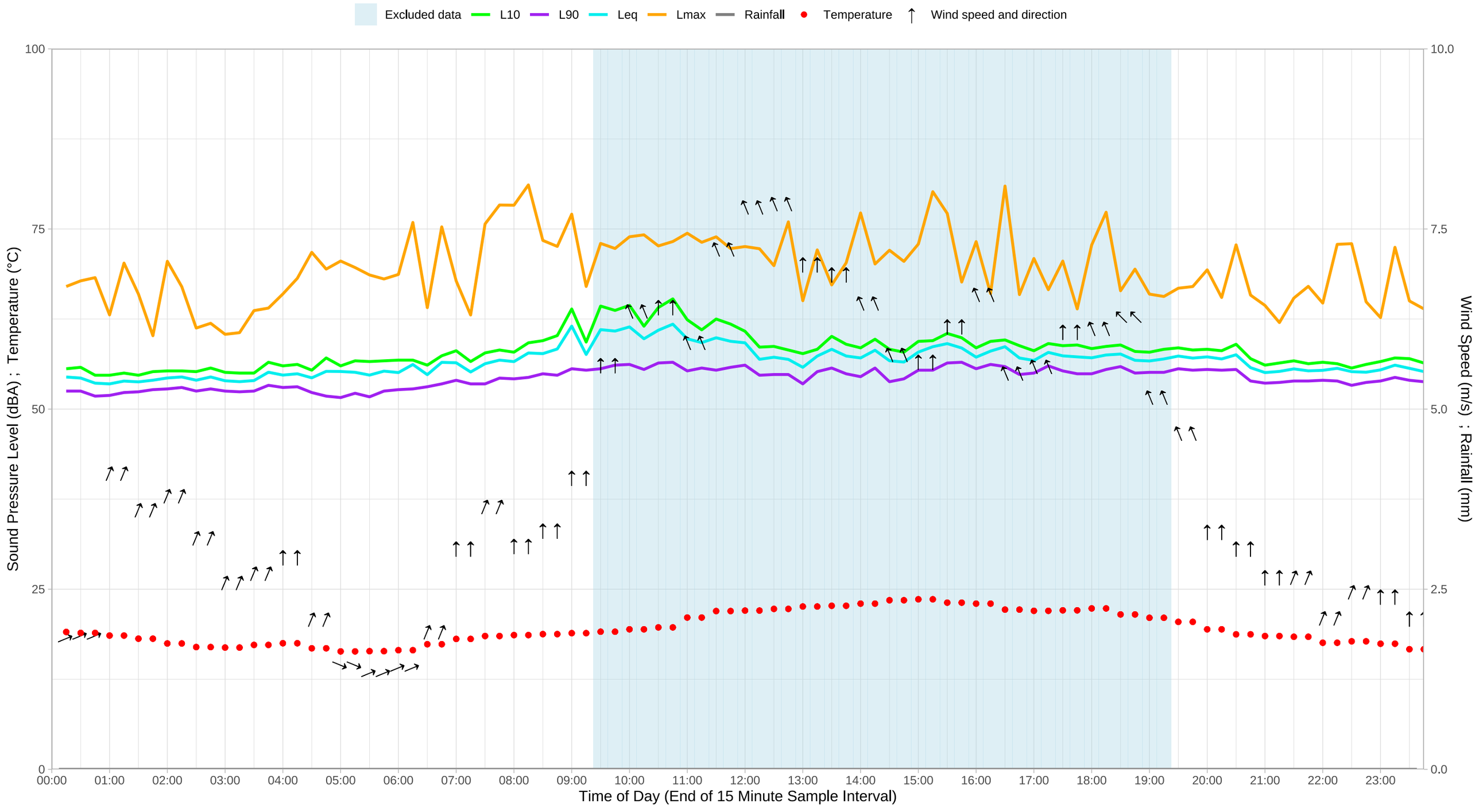
Statistical Ambient Noise Levels
L3
Monday 16 December 2024



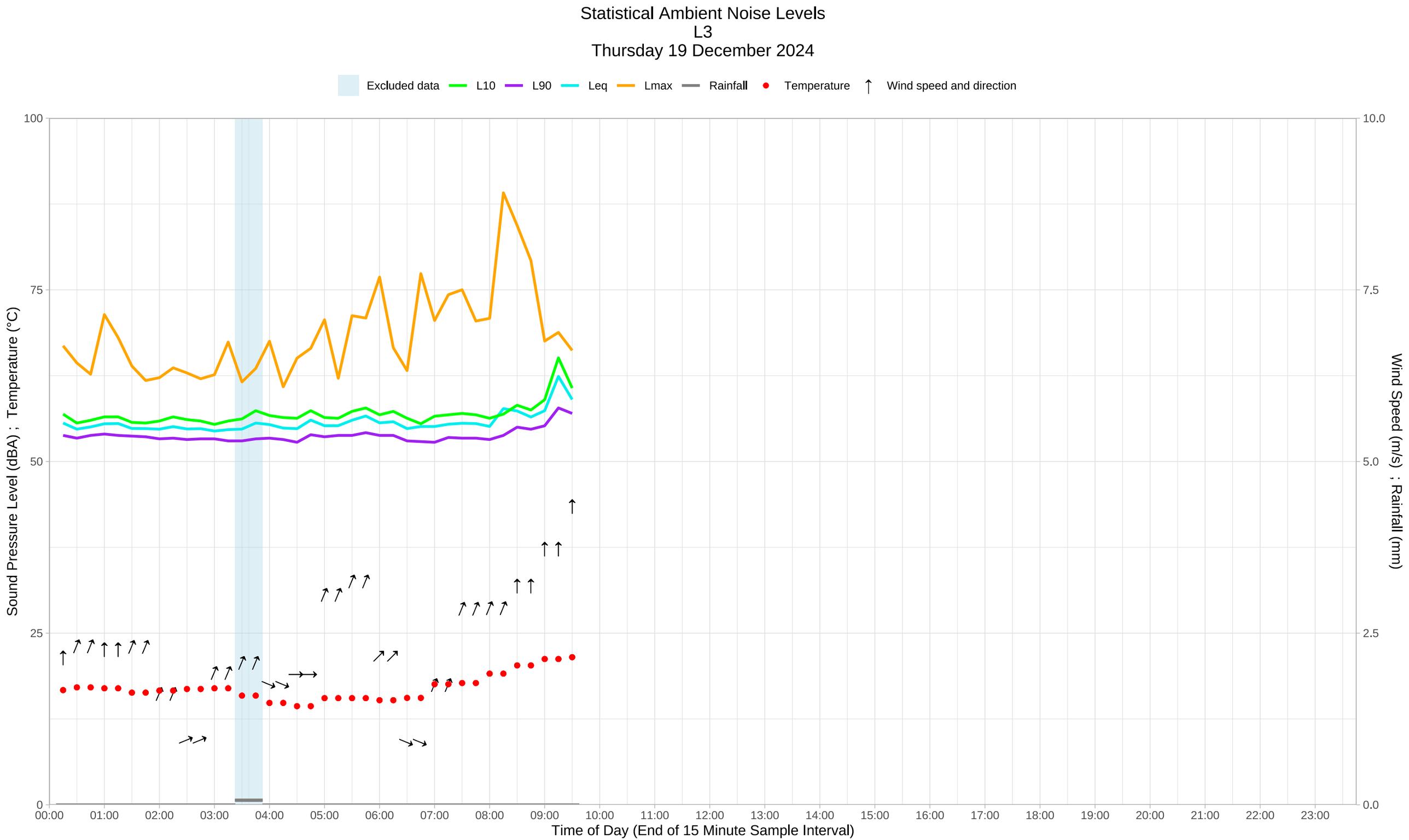
Statistical Ambient Noise Levels
L3
Tuesday 17 December 2024



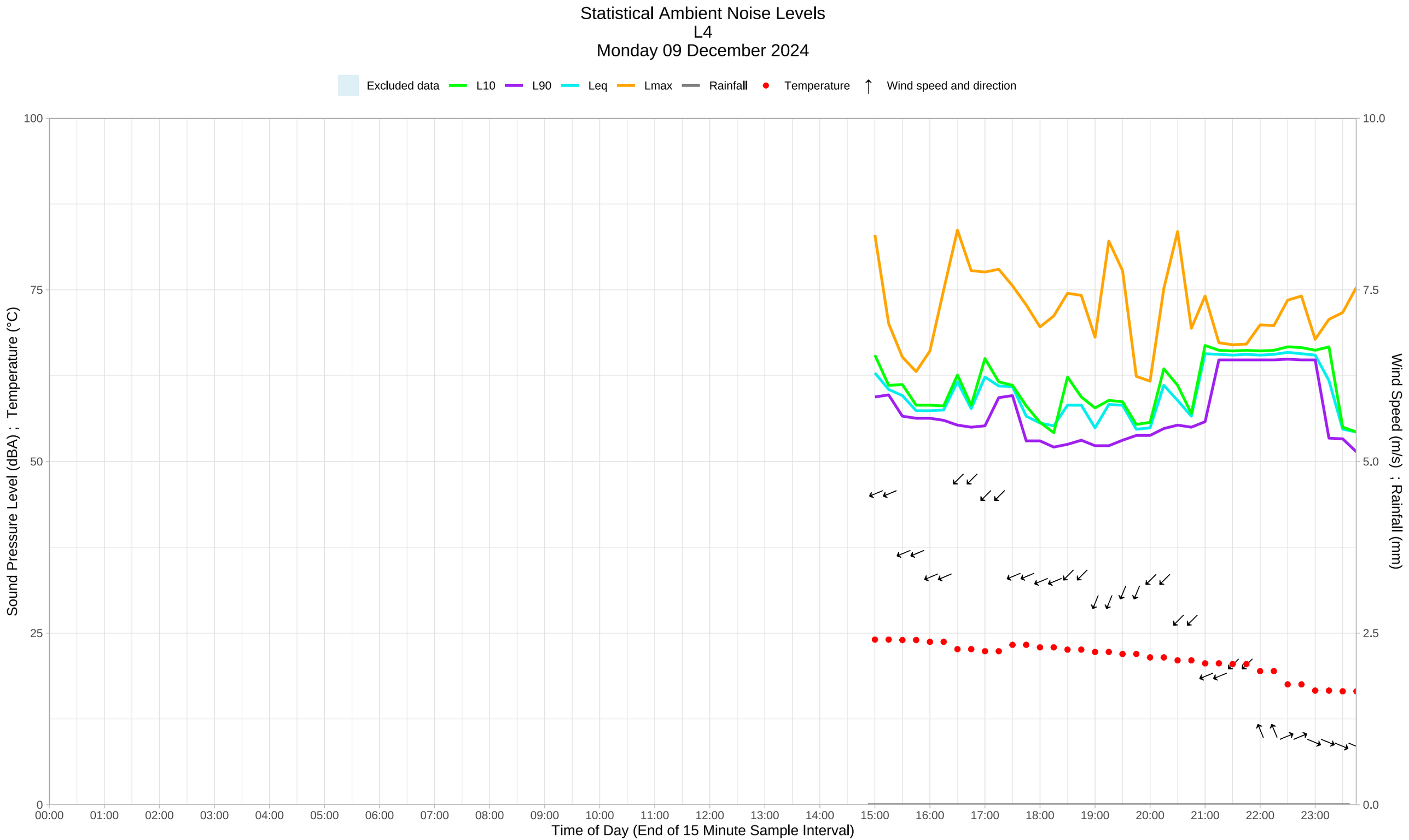
Statistical Ambient Noise Levels
L3
Wednesday 18 December 2024



Statistical Ambient Noise Levels
L3
Thursday 19 December 2024



Statistical Ambient Noise Levels
L4
Monday 09 December 2024



Statistical Ambient Noise Levels
L4
Tuesday 10 December 2024

Excluded data | L10 | L90 | Leq | Lmax | Rainfall | Temperature | Wind speed and direction

Sound Pressure Level (dBA) ; Temperature (°C)

Wind Speed (m/s) ; Rainfall (mm)

Time of Day (End of 15 Minute Sample Interval)

Statistical Ambient Noise Levels
L4
Wednesday 11 December 2024

Excluded data | L10 | L90 | Leq | Lmax | Rainfall | Temperature | Wind speed and direction

Sound Pressure Level (dBA) ; Temperature (°C)

Wind Speed (m/s) ; Rainfall (mm)

Time of Day (End of 15 Minute Sample Interval)

Statistical Ambient Noise Levels
L4
Thursday 12 December 2024

Excluded data | L10 | L90 | Leq | Lmax | Rainfall | Temperature | Wind speed and direction

Sound Pressure Level (dBA) ; Temperature (°C)

100
75
50
25
0

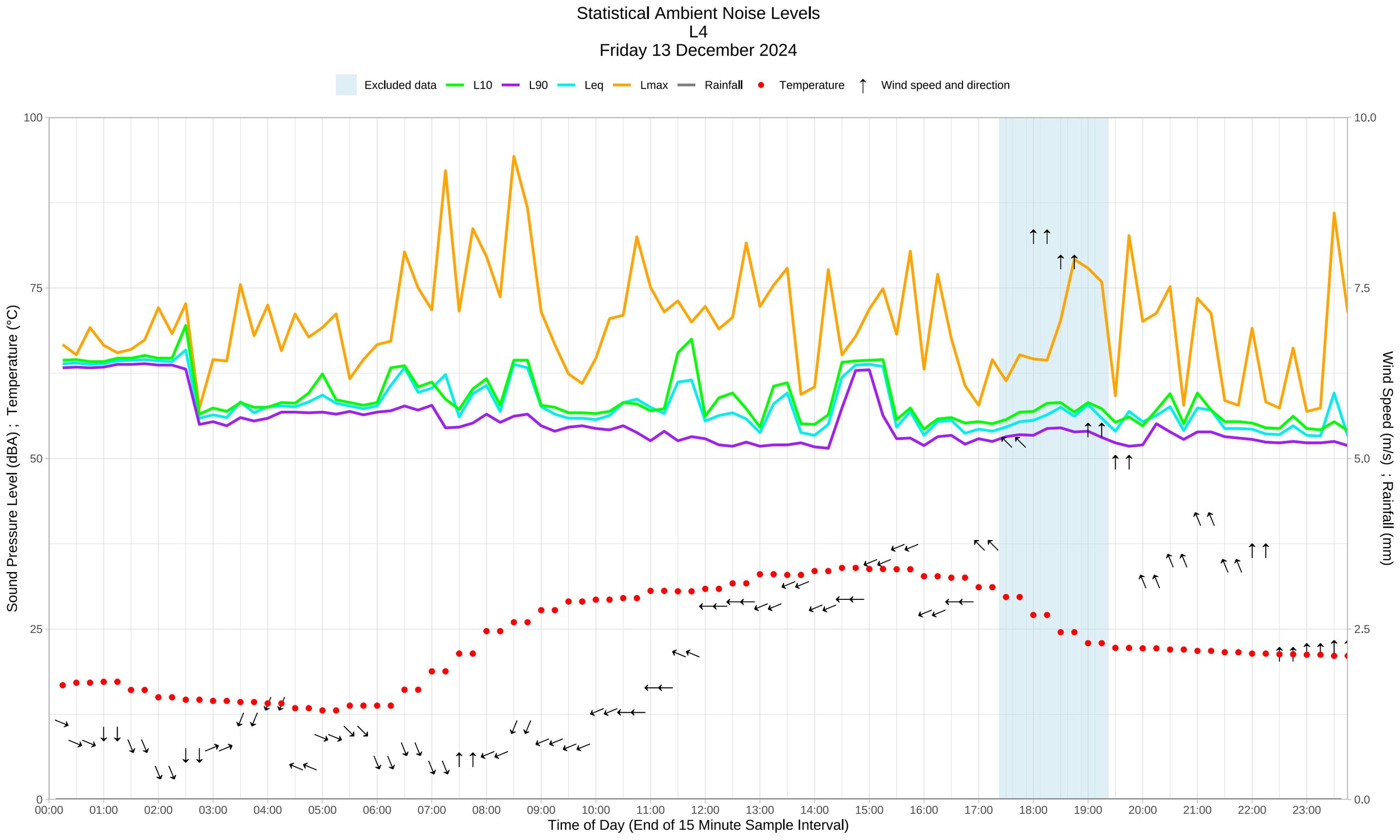
10.0
7.5
5.0
2.5
0.0

Wind Speed (m/s) ; Rainfall (mm)

00:00 01:00 02:00 03:00 04:00 05:00 06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00

Time of Day (End of 15 Minute Sample Interval)

Statistical Ambient Noise Levels
L4
Friday 13 December 2024



Statistical Ambient Noise Levels
L4
Saturday 14 December 2024

Excluded data | L10 | L90 | Leq | Lmax | Rainfall | Temperature | Wind speed and direction

Sound Pressure Level (dBA) ; Temperature (°C)

Wind Speed (m/s) ; Rainfall (mm)

Time of Day (End of 15 Minute Sample Interval)

Statistical Ambient Noise Levels
L4
Sunday 15 December 2024

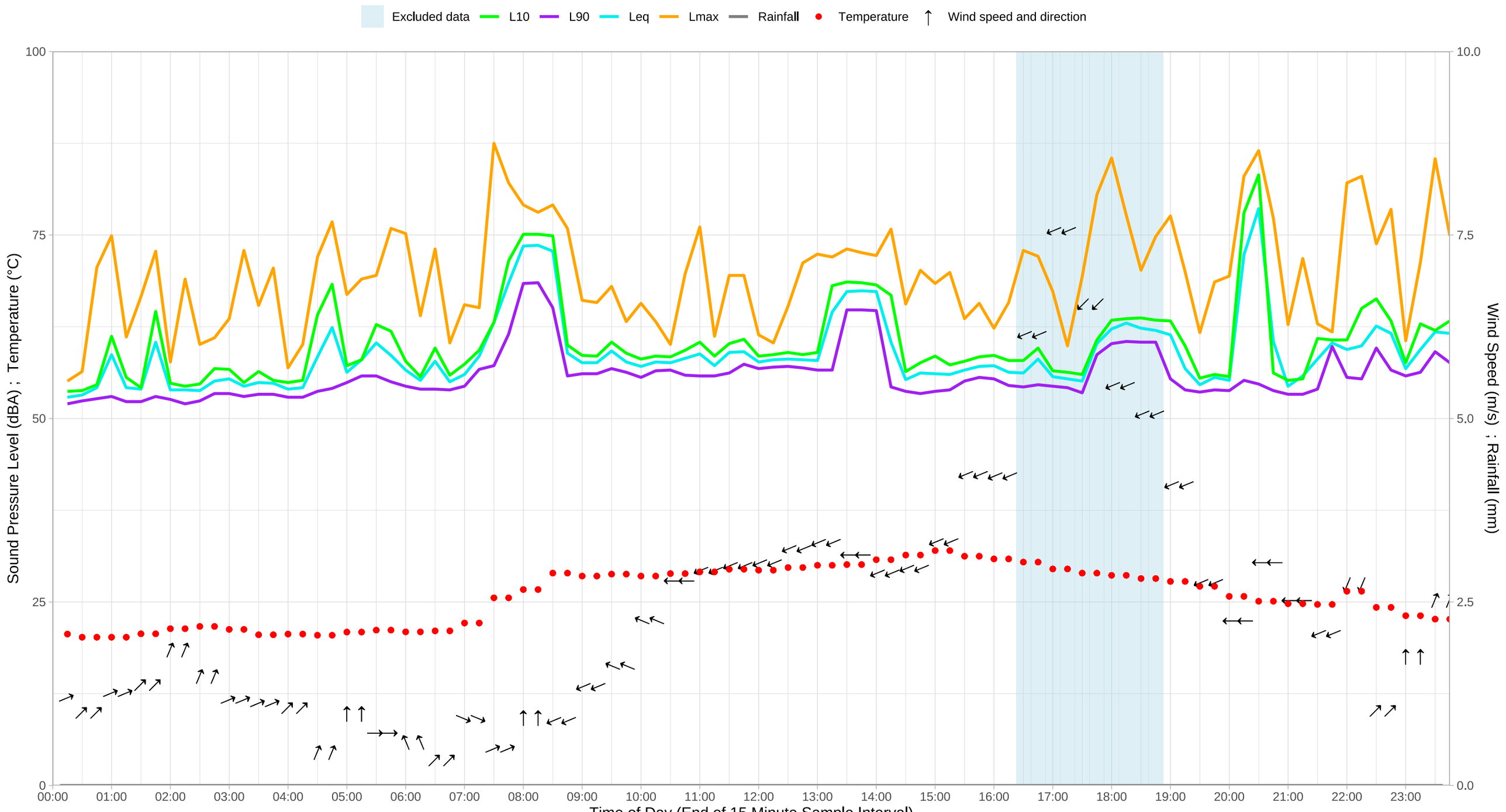
Excluded data | L10 | L90 | Leq | Lmax | Rainfall | Temperature | Wind speed and direction

Sound Pressure Level (dBA) ; Temperature (°C)

Wind Speed (m/s) ; Rainfall (mm)

Time of Day (End of 15 Minute Sample Interval)

Statistical Ambient Noise Levels
L4
Monday 16 December 2024



Statistical Ambient Noise Levels
L4
Tuesday 17 December 2024

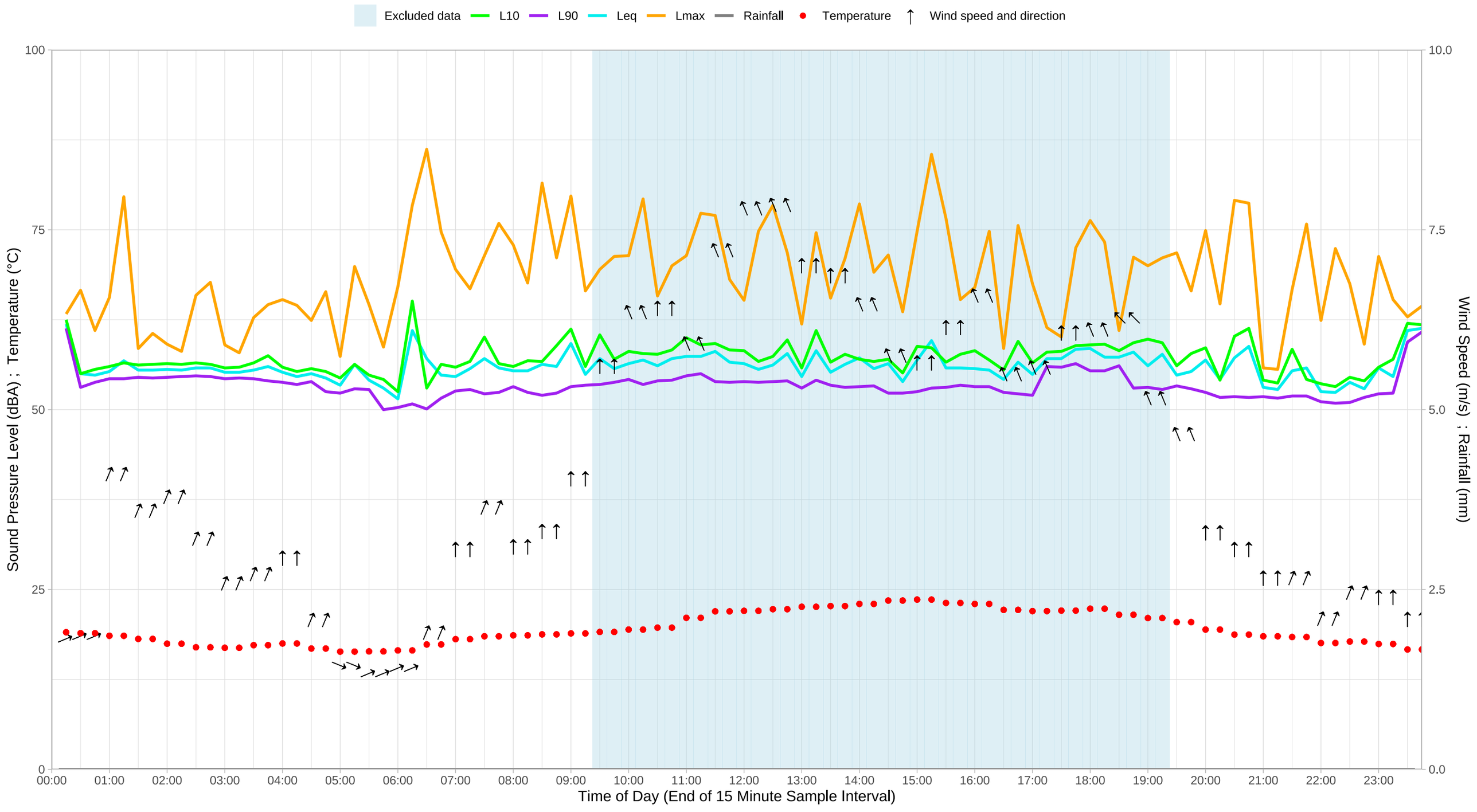
Excluded data | L10 | L90 | Leq | Lmax | Rainfall | Temperature | Wind speed and direction

Sound Pressure Level (dBA) ; Temperature (°C)

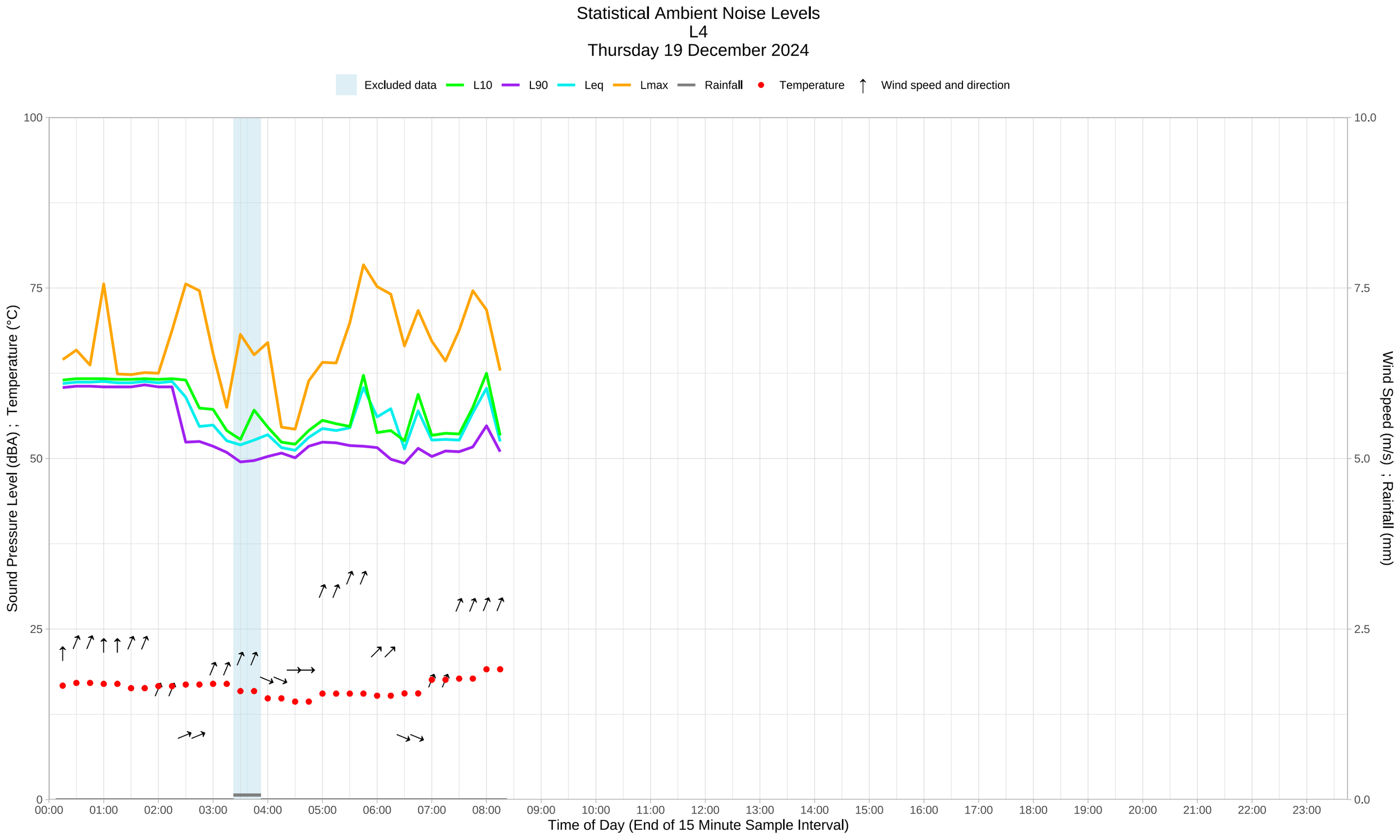
Wind Speed (m/s) ; Rainfall (mm)

Time of Day (End of 15 Minute Sample Interval)

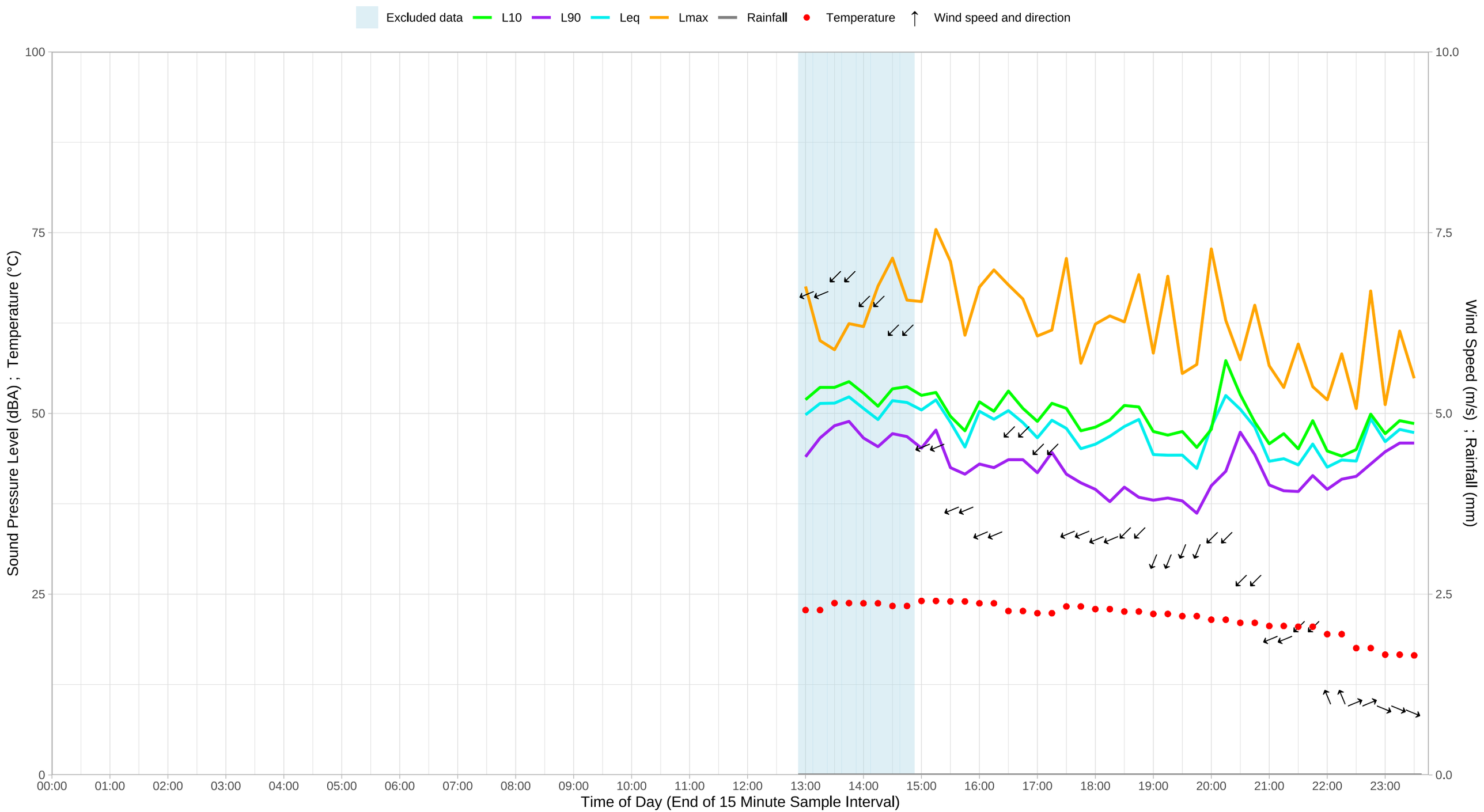
Statistical Ambient Noise Levels
L4
Wednesday 18 December 2024



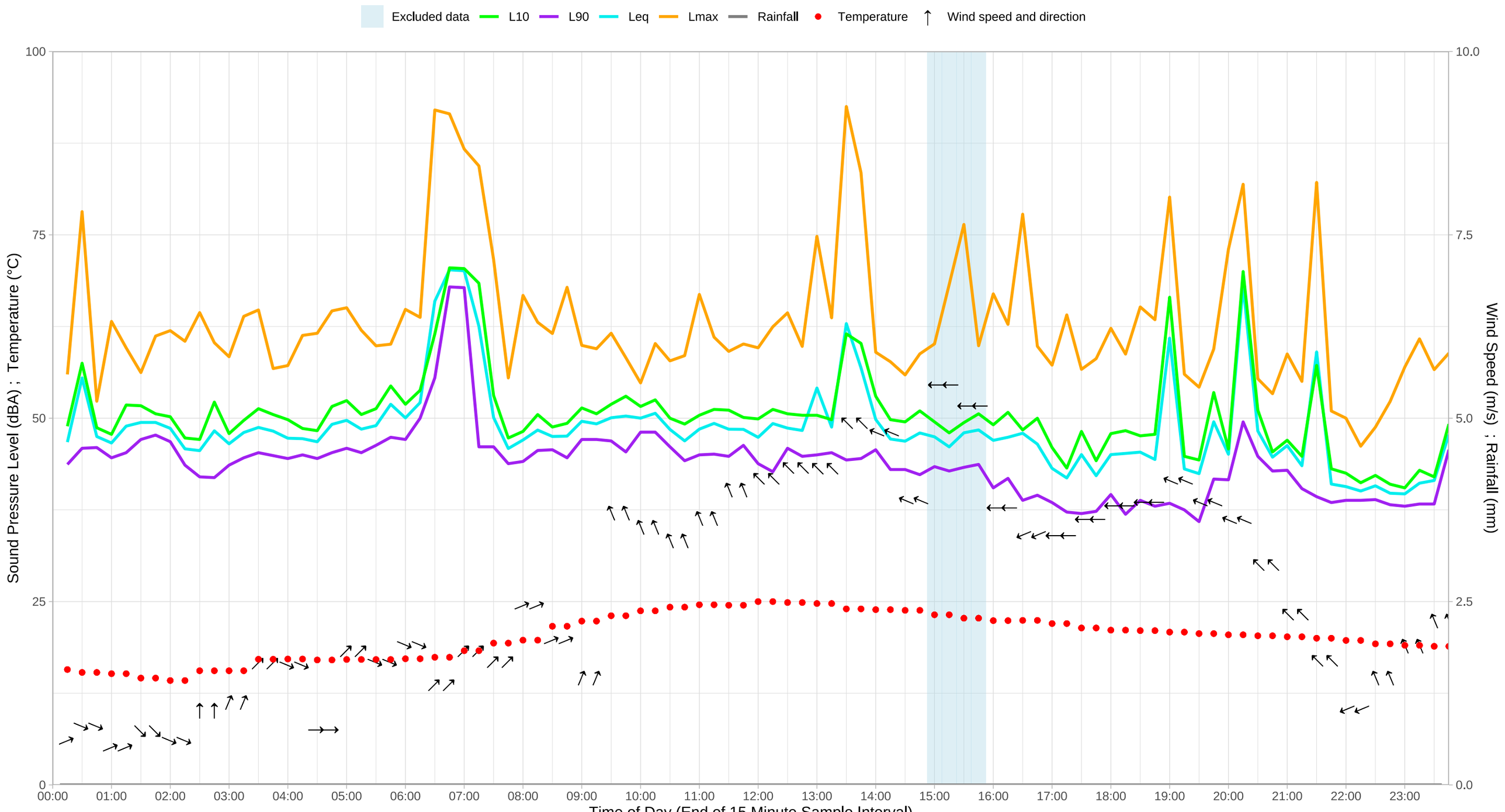
Statistical Ambient Noise Levels
L4
Thursday 19 December 2024



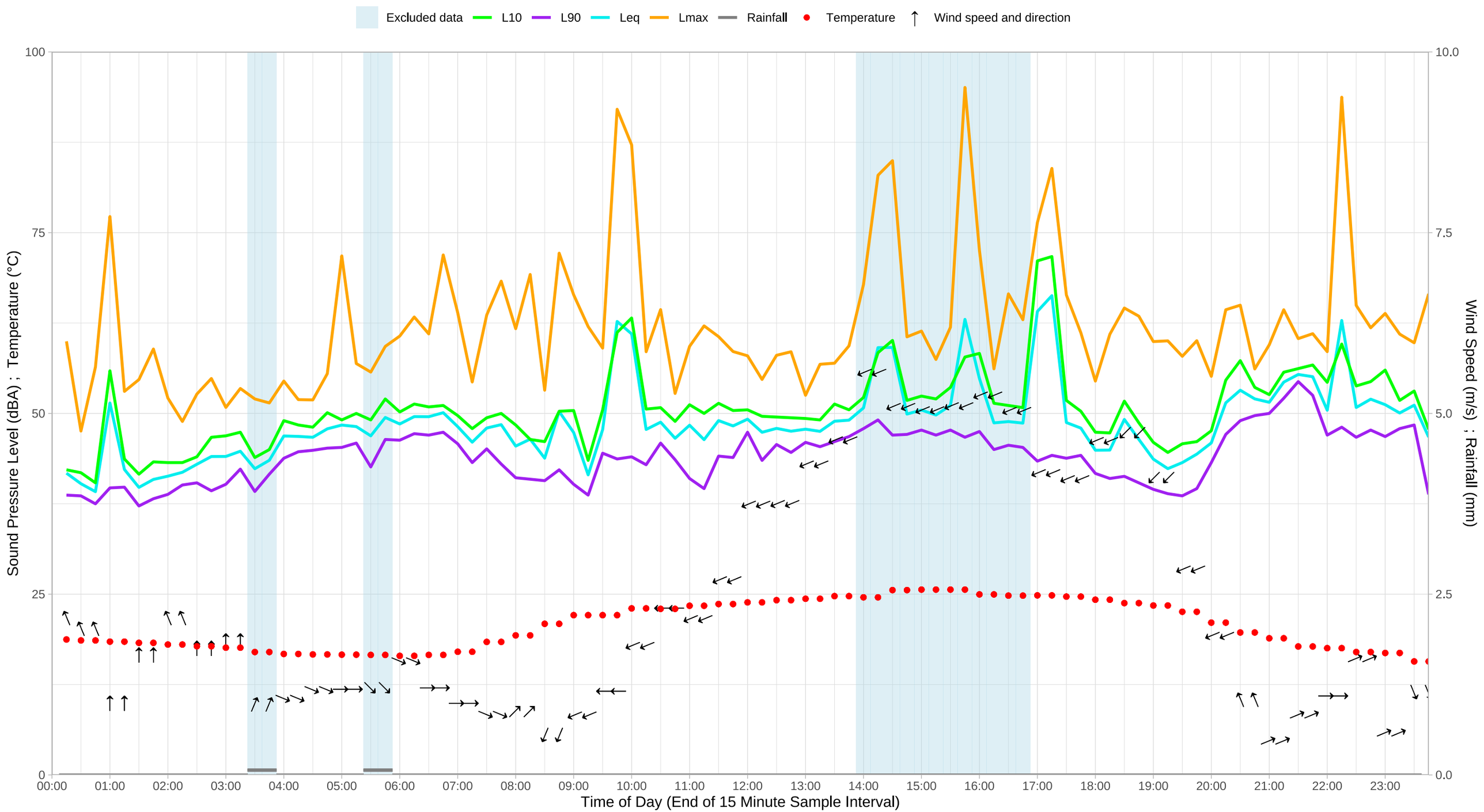
Statistical Ambient Noise Levels
L5
Monday 09 December 2024



Statistical Ambient Noise Levels
L5
Tuesday 10 December 2024



Statistical Ambient Noise Levels
L5
Wednesday 11 December 2024



Statistical Ambient Noise Levels
L5
Thursday 12 December 2024

Excluded data | L10 | L90 | Leq | Lmax | Rainfall | Temperature | Wind speed and direction

Sound Pressure Level (dBA) ; Temperature (°C)

Wind Speed (m/s) ; Rainfall (mm)

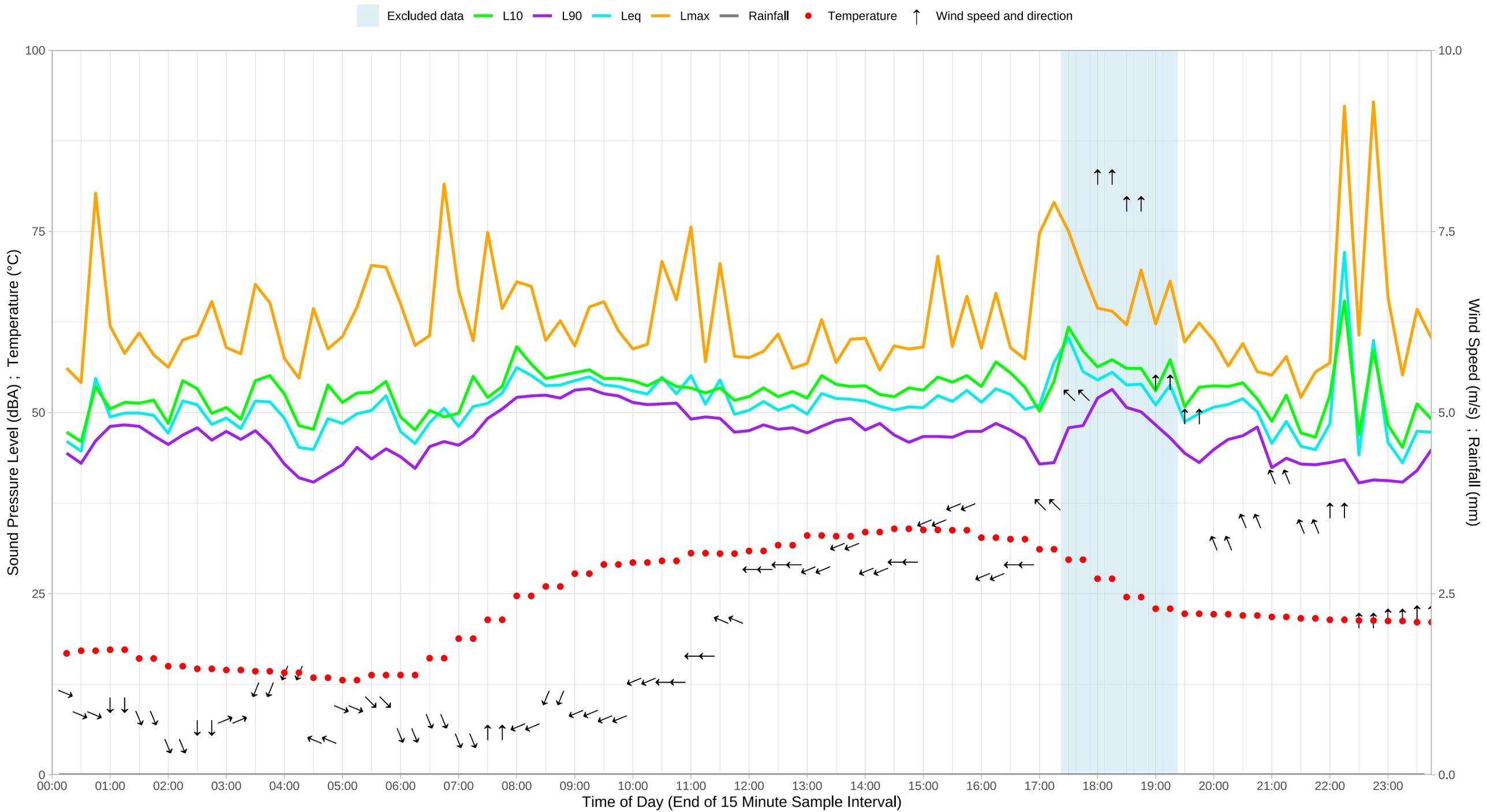
100 | 75 | 50 | 25 | 0

10.0 | 7.5 | 5.0 | 2.5 | 0.0

00:00 | 01:00 | 02:00 | 03:00 | 04:00 | 05:00 | 06:00 | 07:00 | 08:00 | 09:00 | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 | 17:00 | 18:00 | 19:00 | 20:00 | 21:00 | 22:00 | 23:00

Time of Day (End of 15 Minute Sample Interval)

Statistical Ambient Noise Levels
L5
Friday 13 December 2024



Statistical Ambient Noise Levels
L5
Saturday 14 December 2024

Excluded data | L10 | L90 | Leq | Lmax | Rainfall | Temperature | Wind speed and direction

Sound Pressure Level (dBA) ; Temperature (°C)

Wind Speed (m/s) ; Rainfall (mm)

Time of Day (End of 15 Minute Sample Interval)

Statistical Ambient Noise Levels
L5
Sunday 15 December 2024

Excluded data | L10 | L90 | Leq | Lmax | Rainfall | Temperature | Wind speed and direction

Sound Pressure Level (dBA) ; Temperature (°C)

100
75
50
25
0

10.0
7.5
5.0
2.5
0.0

Wind Speed (m/s) ; Rainfall (mm)

00:00 01:00 02:00 03:00 04:00 05:00 06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00

Time of Day (End of 15 Minute Sample Interval)

Statistical Ambient Noise Levels
L5
Monday 16 December 2024

Excluded data | L10 | L90 | Leq | Lmax | Rainfall | Temperature | Wind speed and direction

Sound Pressure Level (dBA) ; Temperature (°C)

Wind Speed (m/s) ; Rainfall (mm)

Time of Day (End of 15 Minute Sample Interval)

Statistical Ambient Noise Levels
L5
Tuesday 17 December 2024

Excluded data | L10 | L90 | Leq | Lmax | Rainfall | Temperature | Wind speed and direction

Sound Pressure Level (dBA) ; Temperature (°C)

Wind Speed (m/s) ; Rainfall (mm)

Time of Day (End of 15 Minute Sample Interval)

Statistical Ambient Noise Levels
L5
Wednesday 18 December 2024

Excluded data | L10 | L90 | Leq | Lmax | Rainfall | Temperature | Wind speed and direction

Sound Pressure Level (dBA) ; Temperature (°C)

100
75
50
25
0

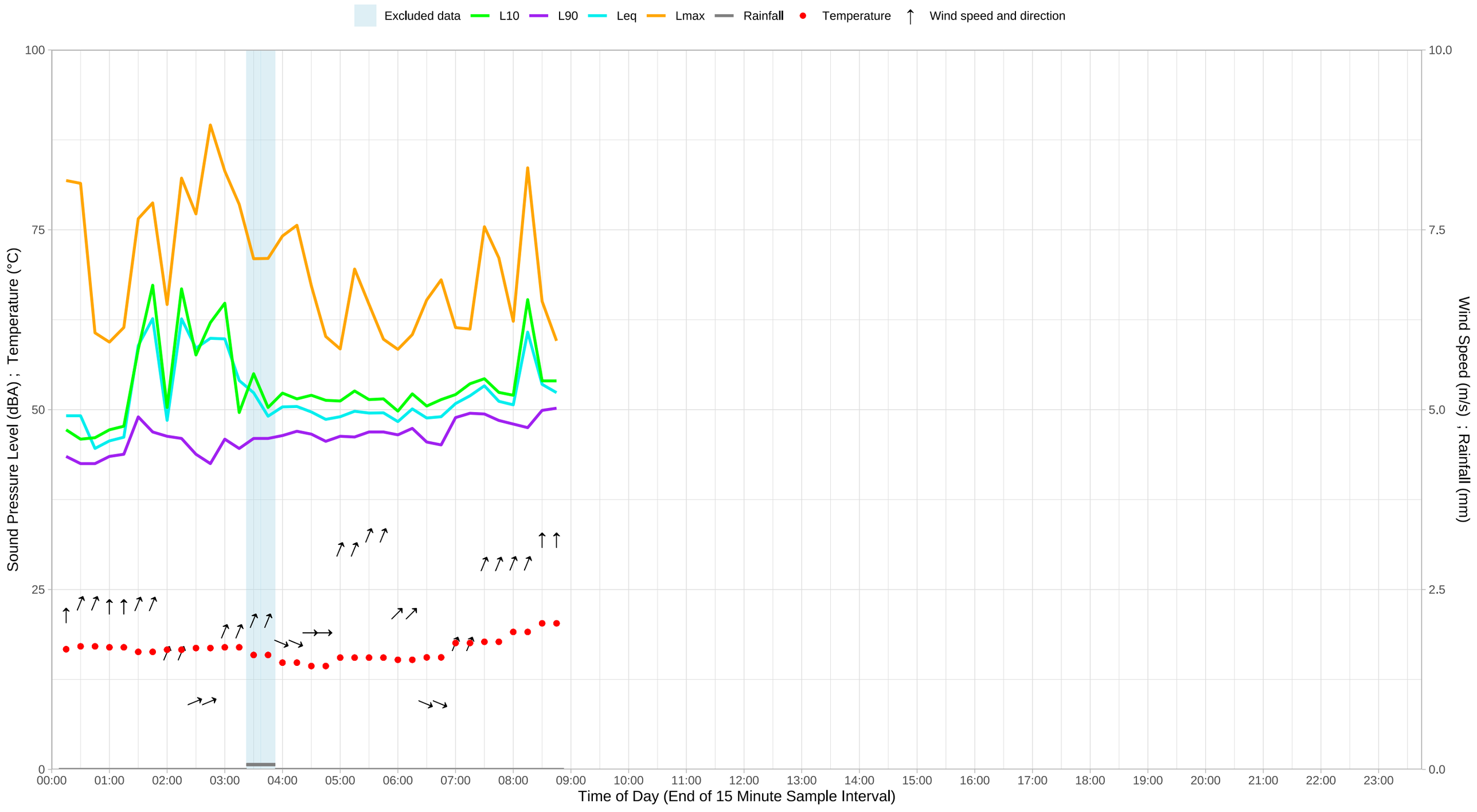
10.0
7.5
5.0
2.5
0.0

Wind Speed (m/s) ; Rainfall (mm)

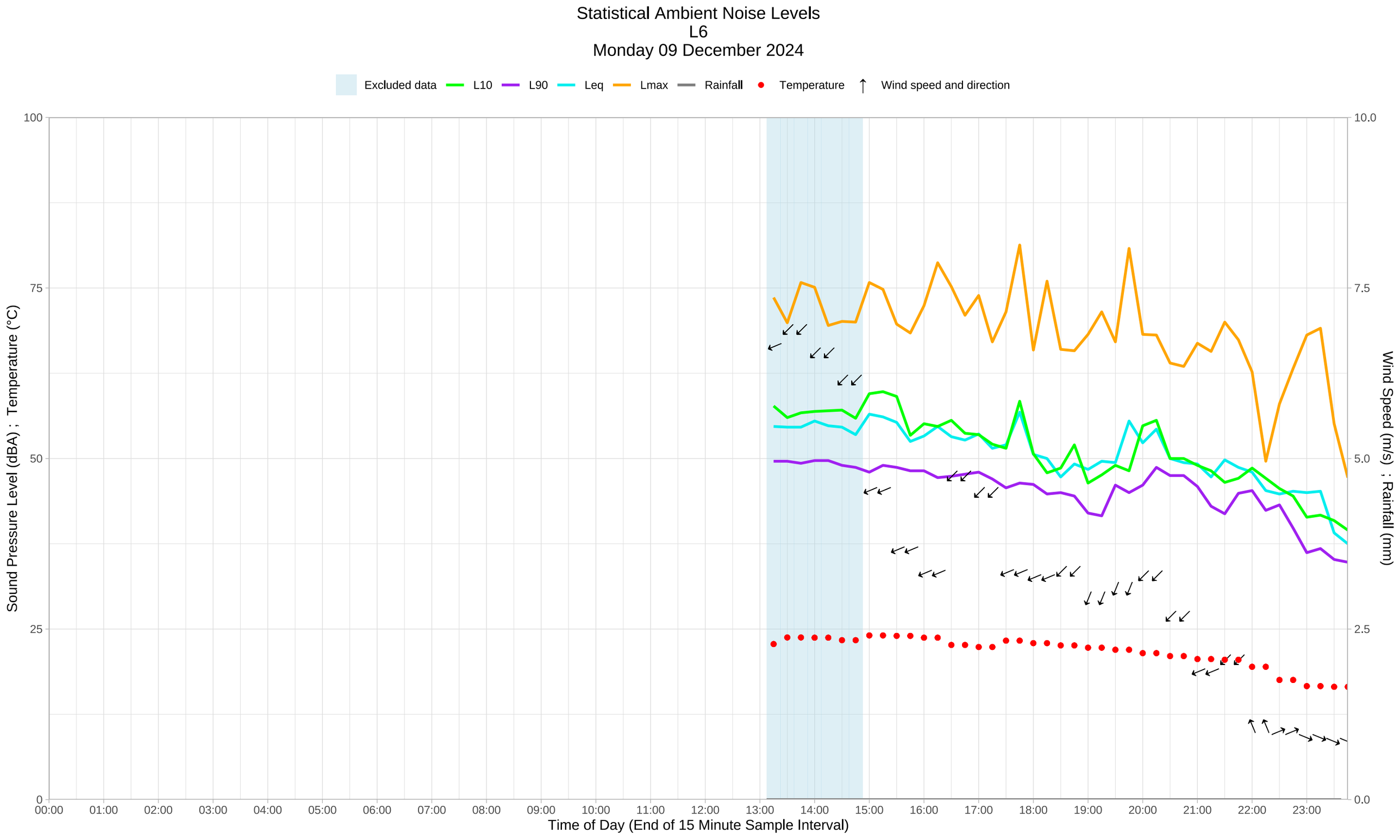
00:00 01:00 02:00 03:00 04:00 05:00 06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00

Time of Day (End of 15 Minute Sample Interval)

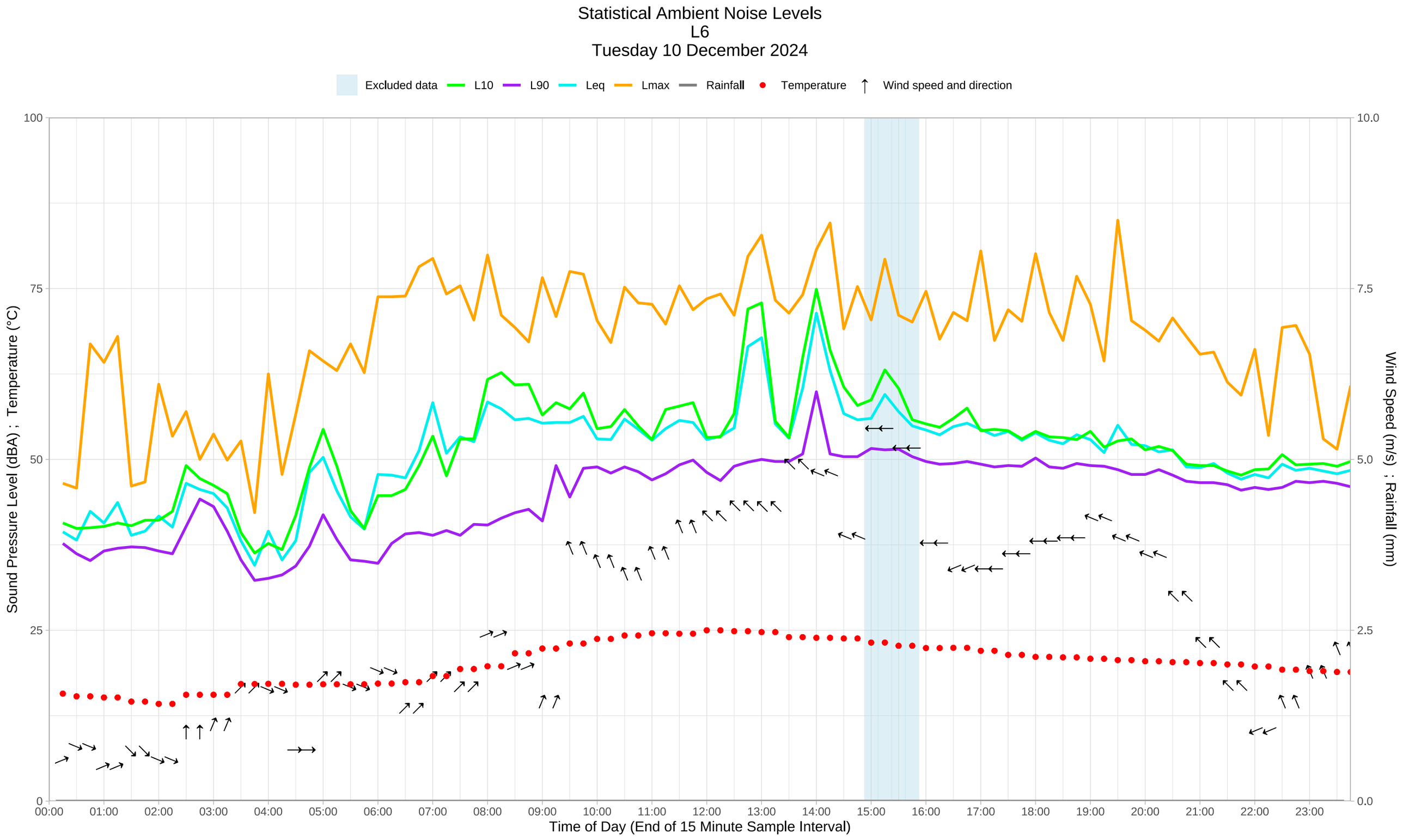
Statistical Ambient Noise Levels
L5
Thursday 19 December 2024



Statistical Ambient Noise Levels
L6
Monday 09 December 2024



Statistical Ambient Noise Levels
L6
Tuesday 10 December 2024



Statistical Ambient Noise Levels
L6
Wednesday 11 December 2024

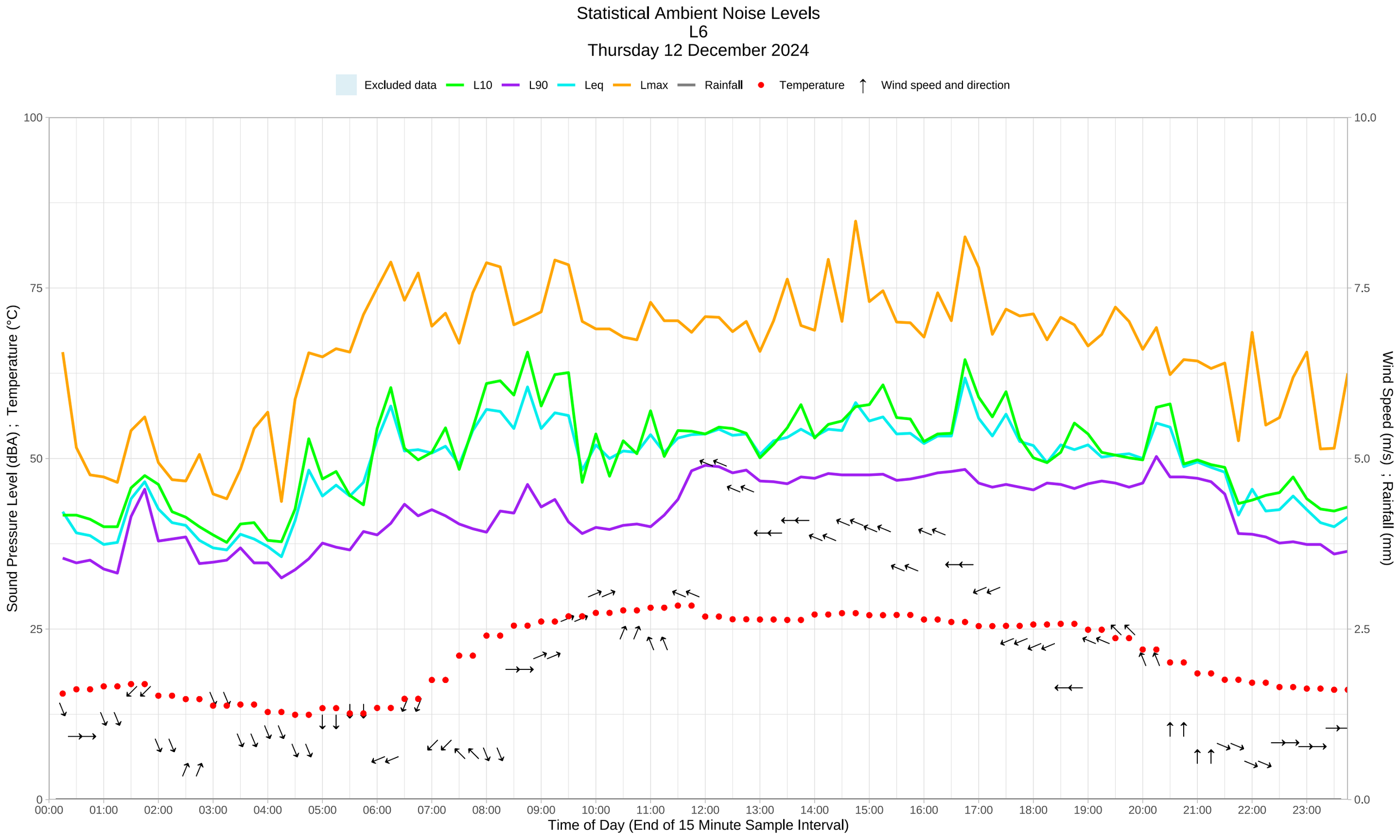
Excluded data | L10 | L90 | Leq | Lmax | Rainfall | Temperature | Wind speed and direction

Sound Pressure Level (dBA) ; Temperature (°C)

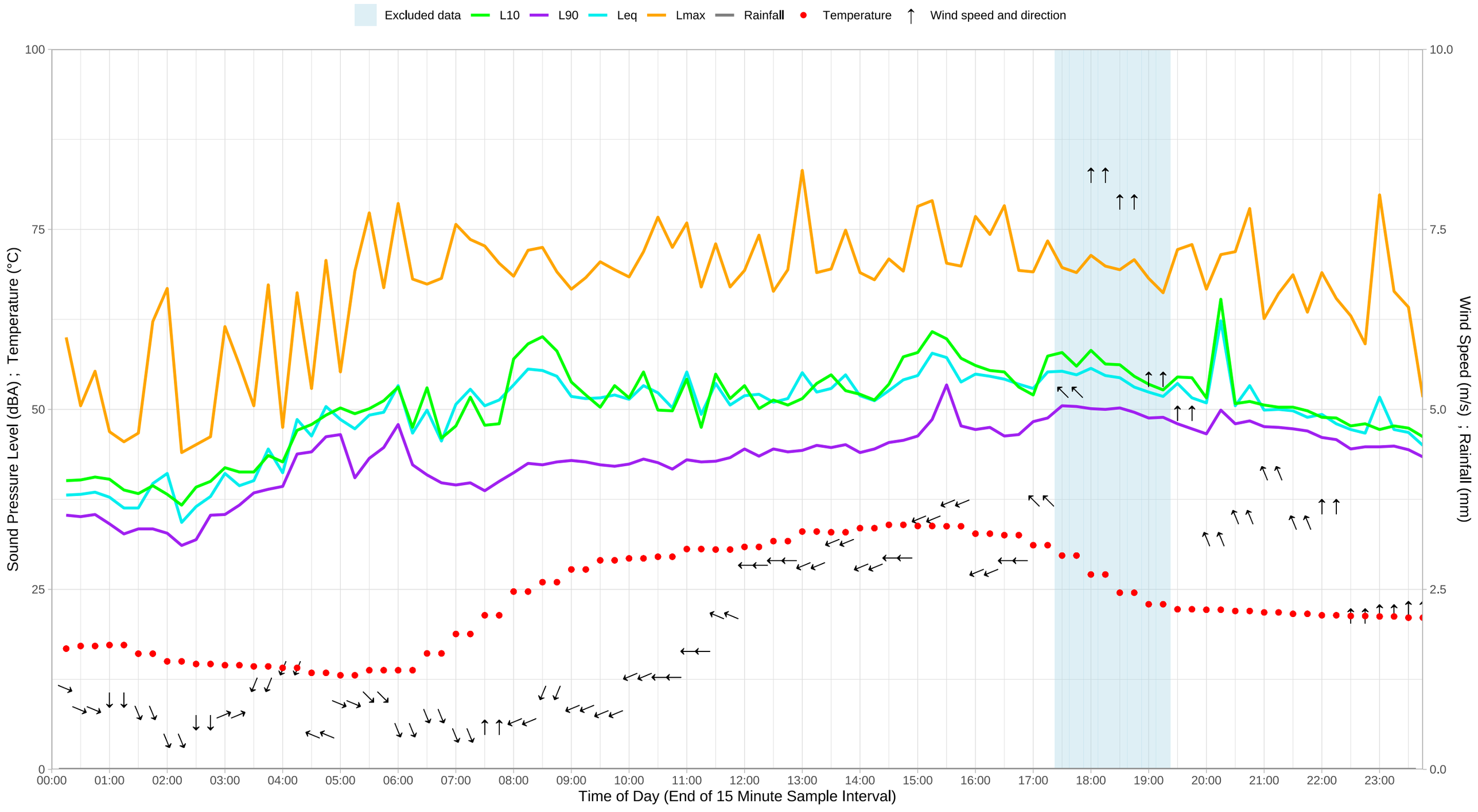
Wind Speed (m/s) ; Rainfall (mm)

Time of Day (End of 15 Minute Sample Interval)

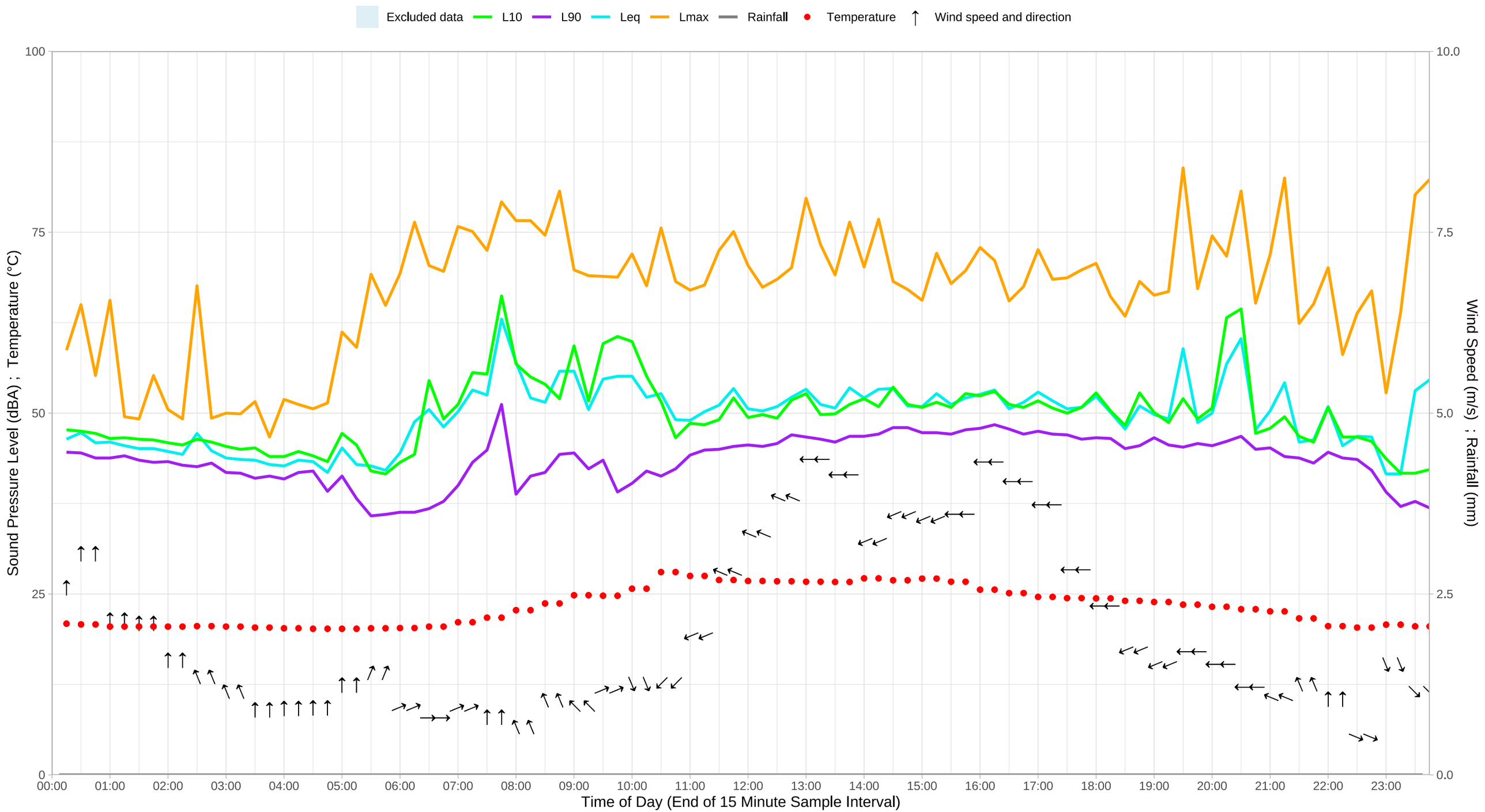
Statistical Ambient Noise Levels
L6
Thursday 12 December 2024



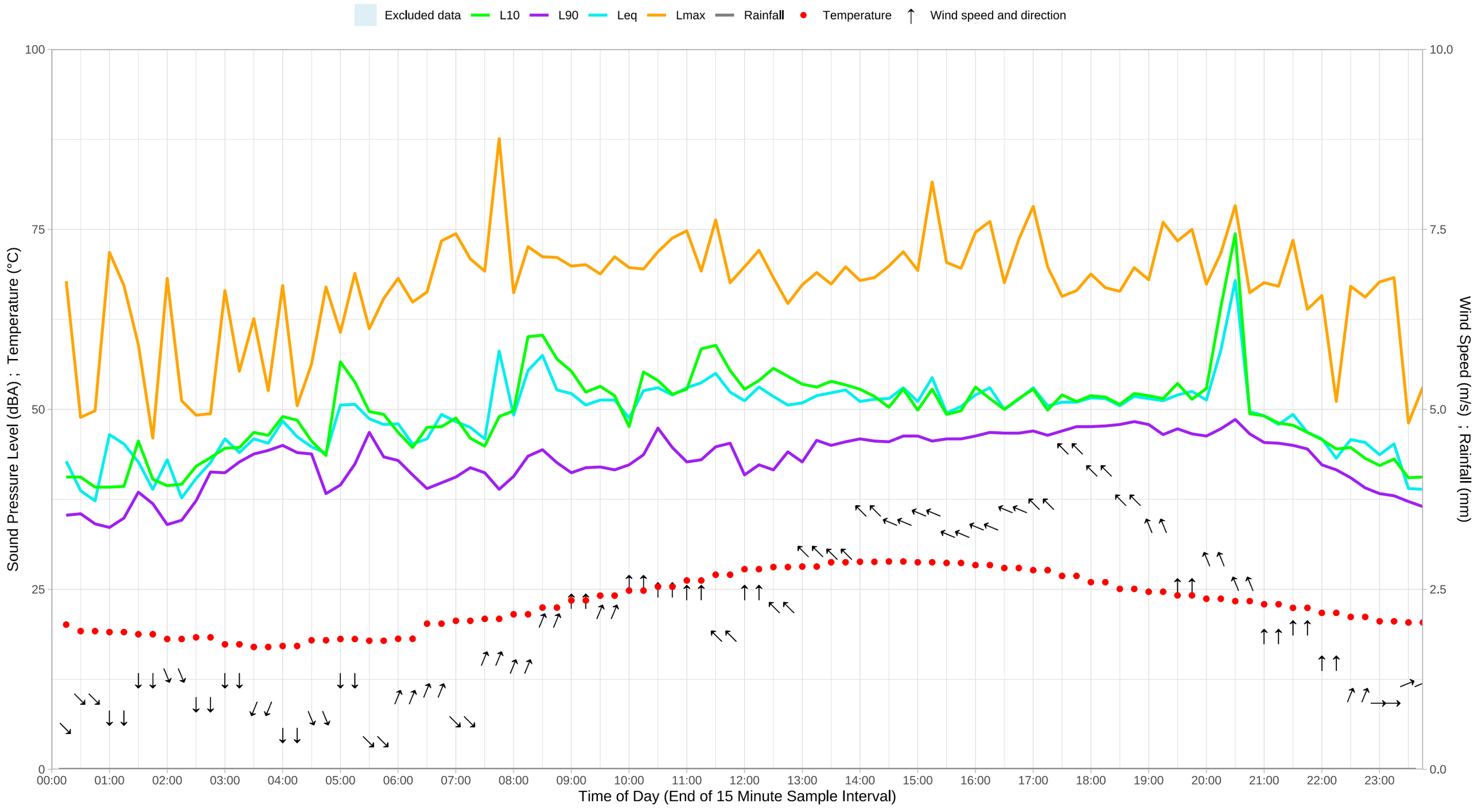
Statistical Ambient Noise Levels
L6
Friday 13 December 2024



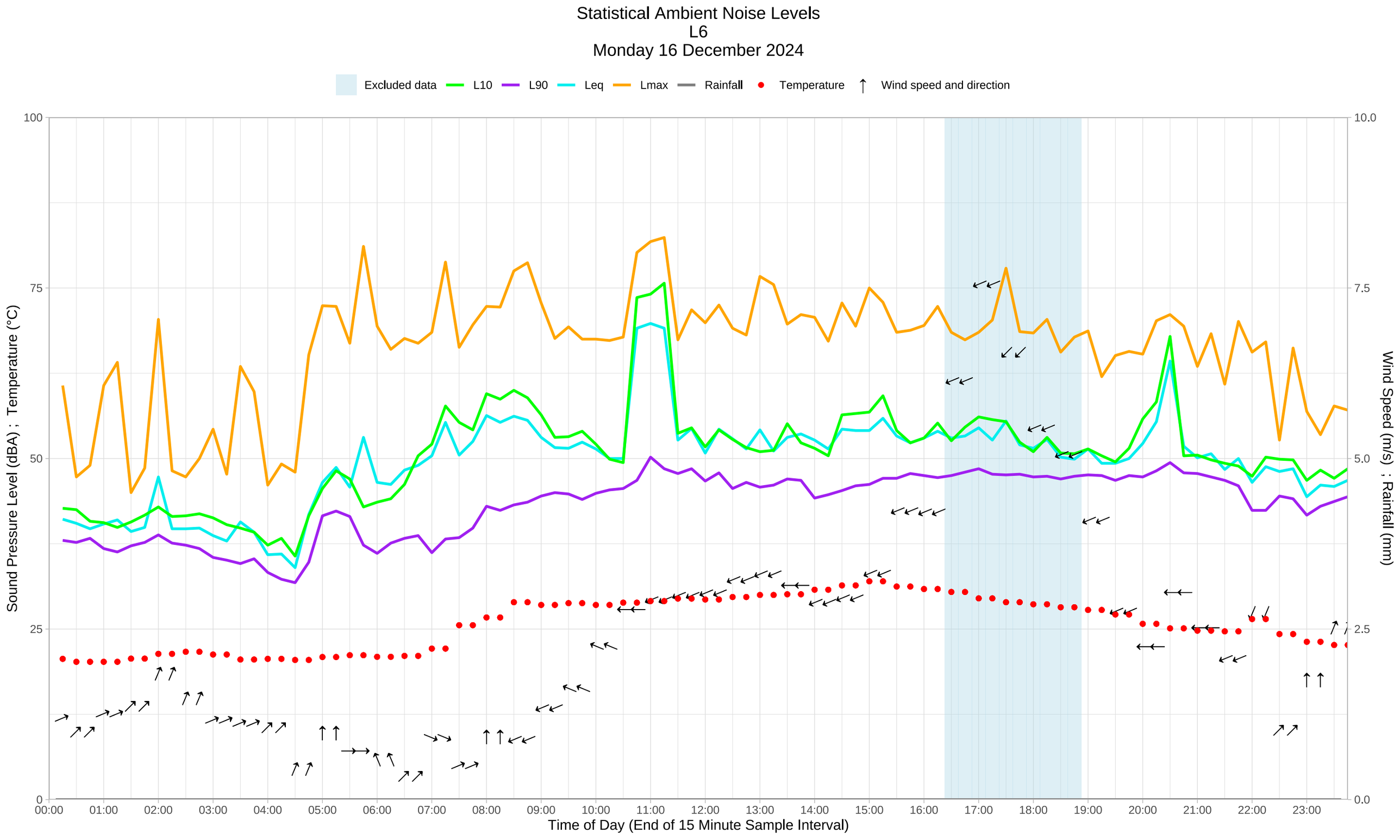
Statistical Ambient Noise Levels
L6
Saturday 14 December 2024



Statistical Ambient Noise Levels
L6
Sunday 15 December 2024



Statistical Ambient Noise Levels
L6
Monday 16 December 2024



Statistical Ambient Noise Levels
L6
Tuesday 17 December 2024

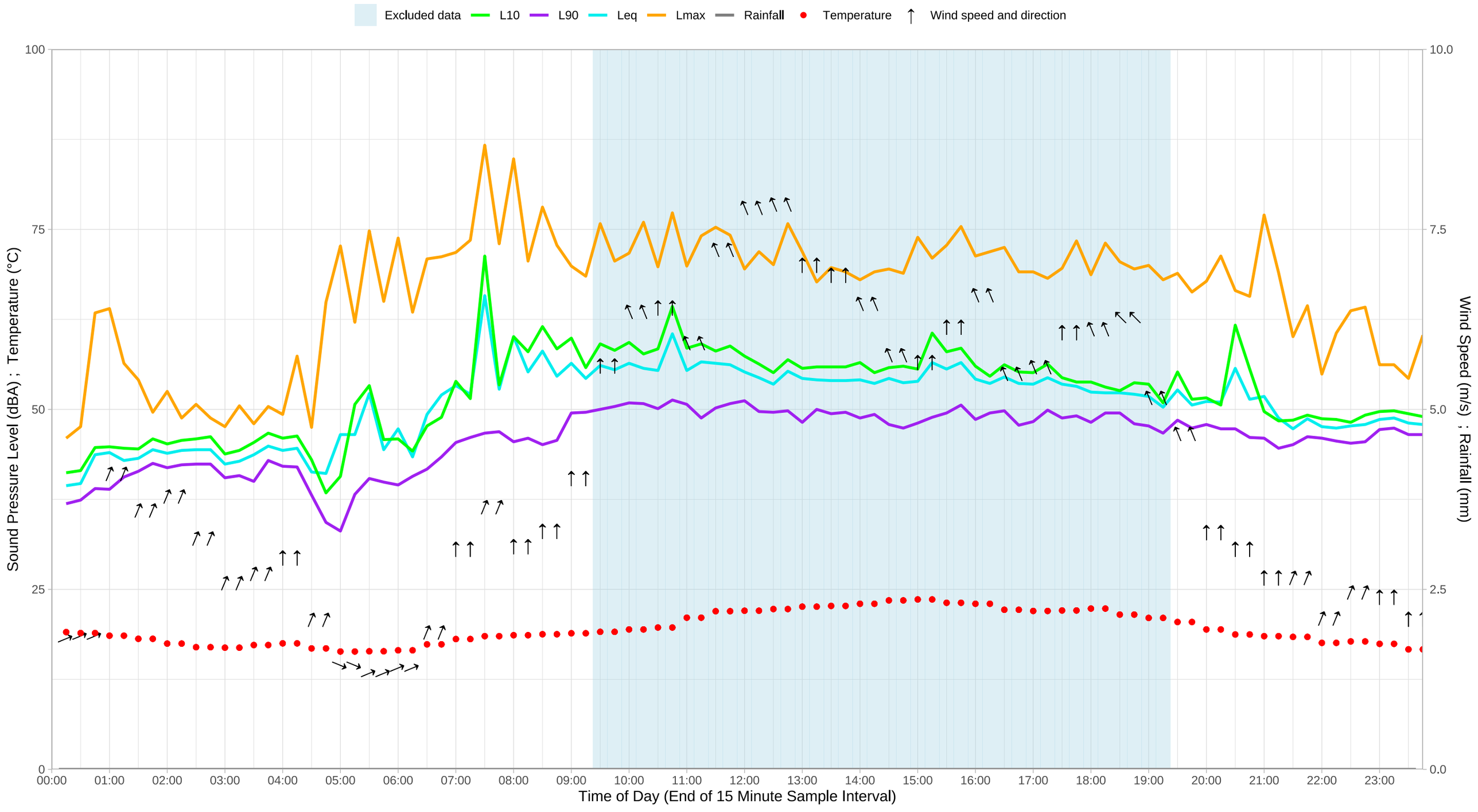
Excluded data | L10 | L90 | Leq | Lmax | Rainfall | Temperature | Wind speed and direction

Sound Pressure Level (dBA) ; Temperature (°C)

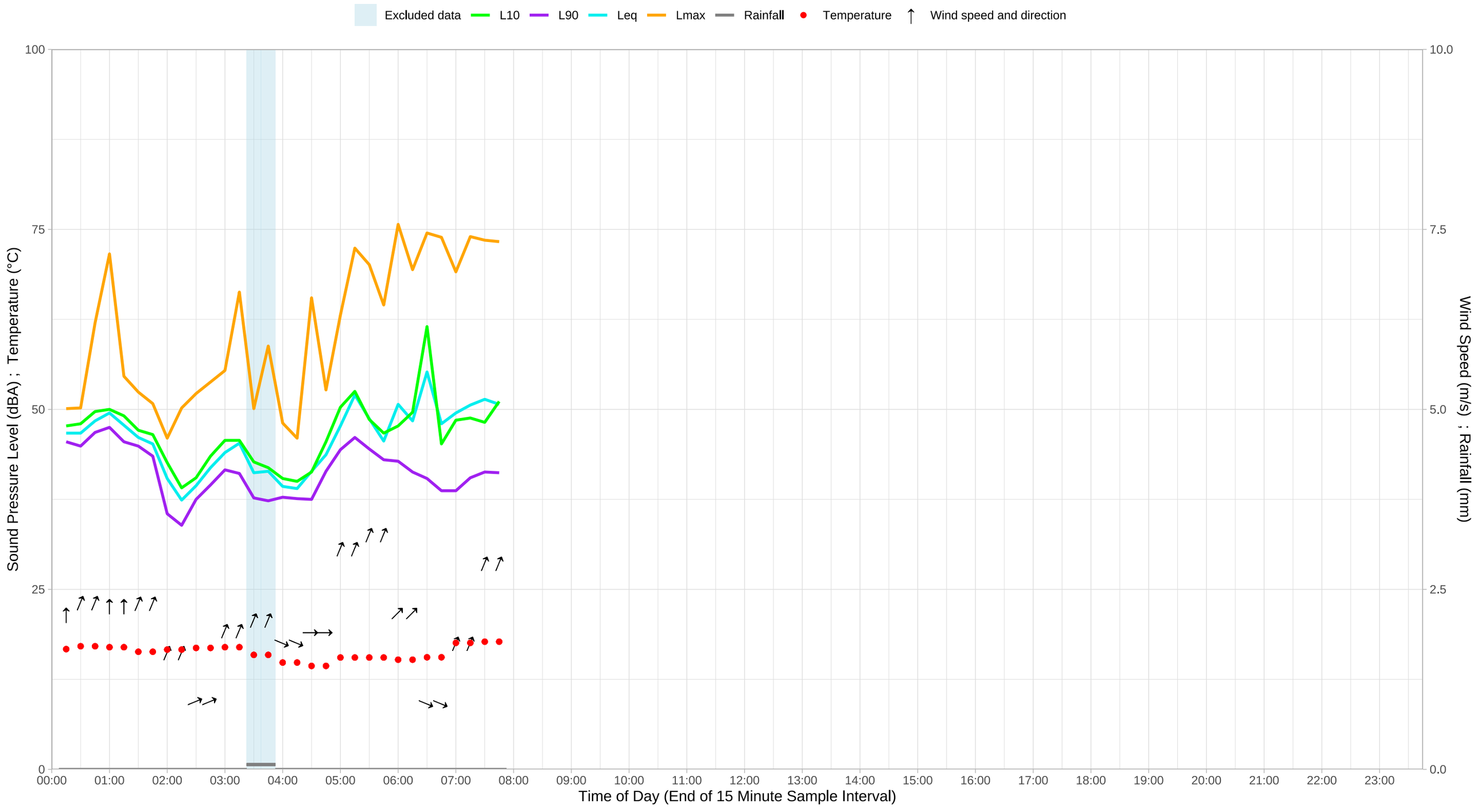
Wind Speed (m/s) ; Rainfall (mm)

Time of Day (End of 15 Minute Sample Interval)

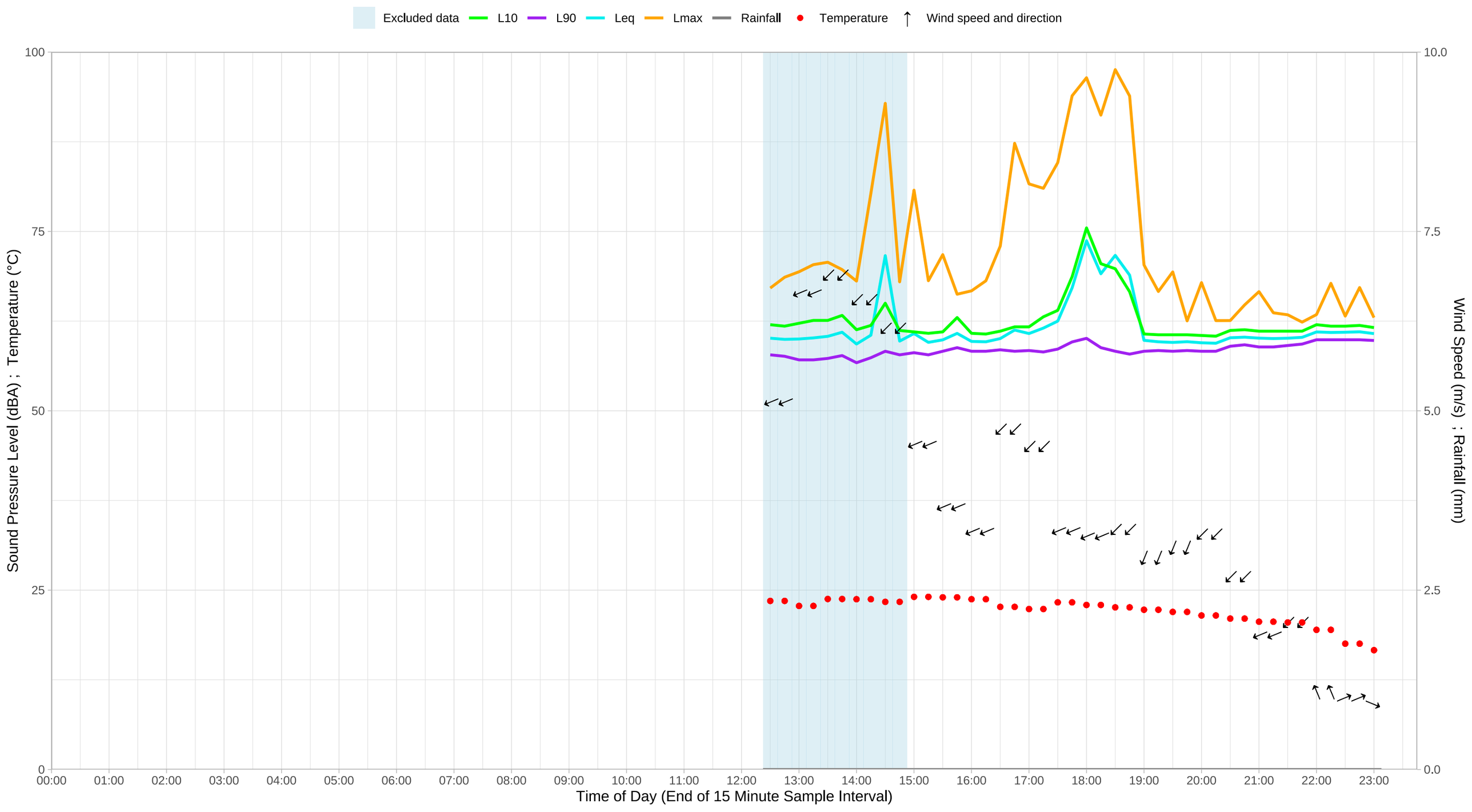
Statistical Ambient Noise Levels
L6
Wednesday 18 December 2024



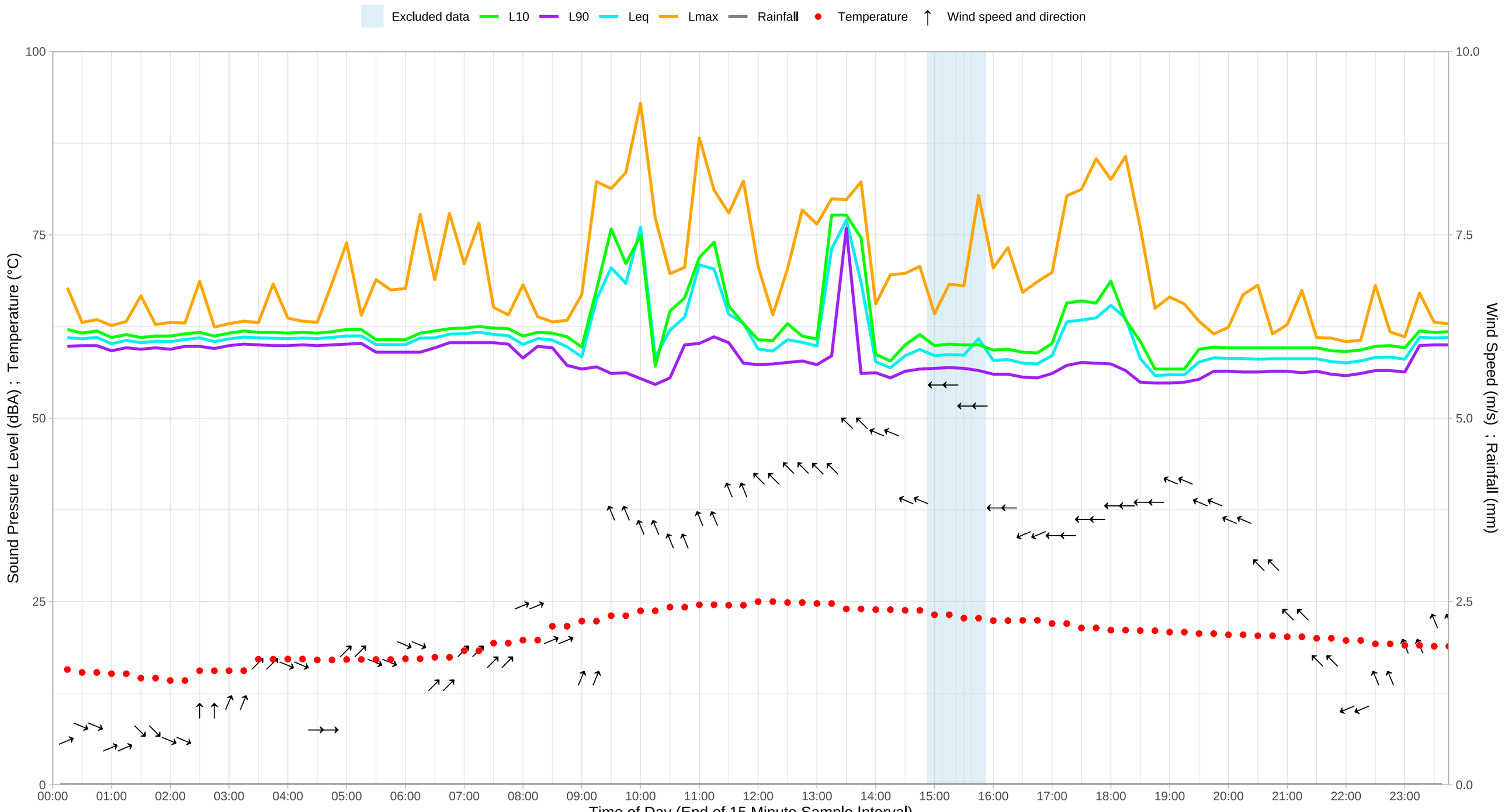
Statistical Ambient Noise Levels
L6
Thursday 19 December 2024



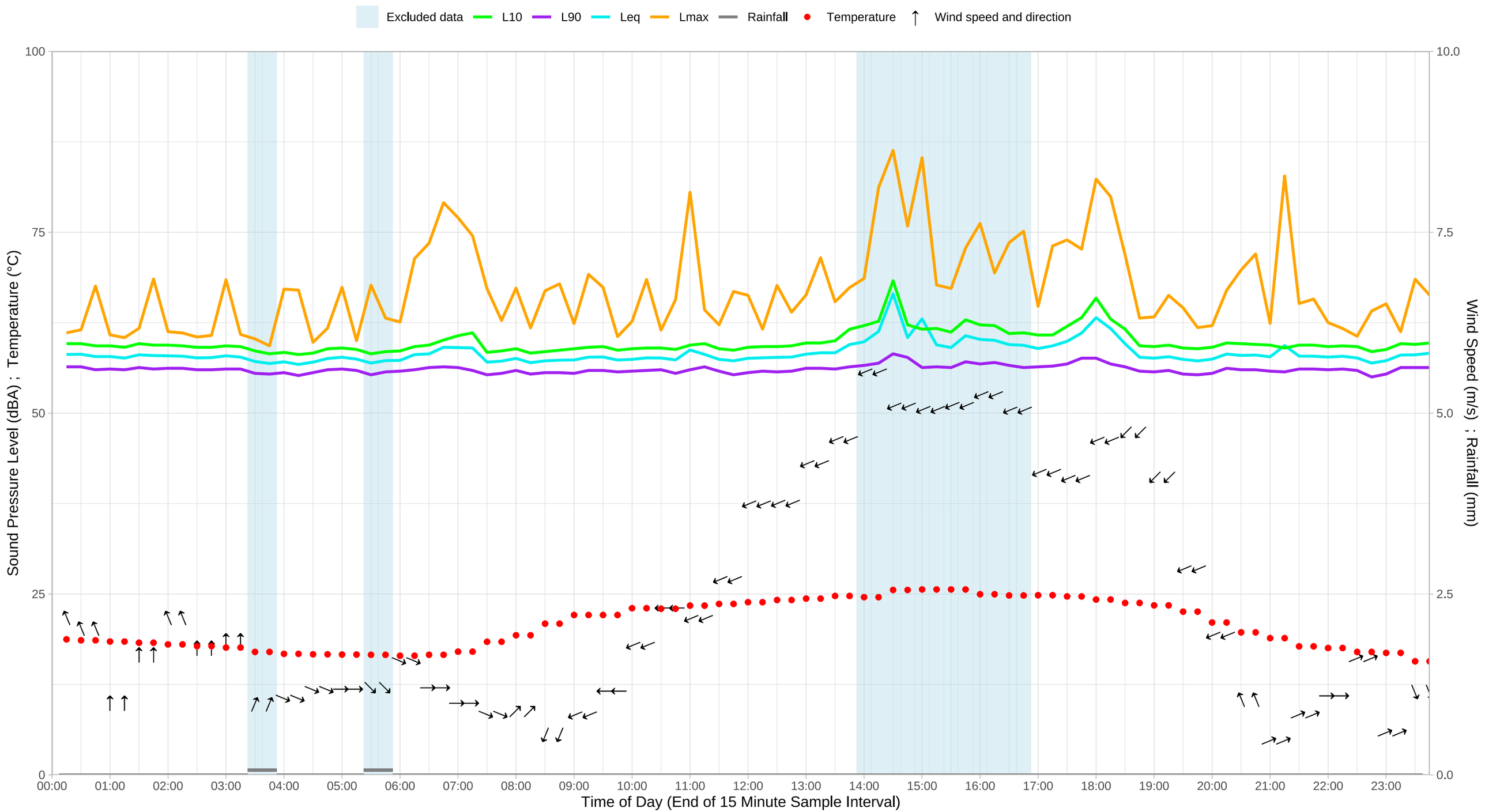
Statistical Ambient Noise Levels
L8
Monday 09 December 2024



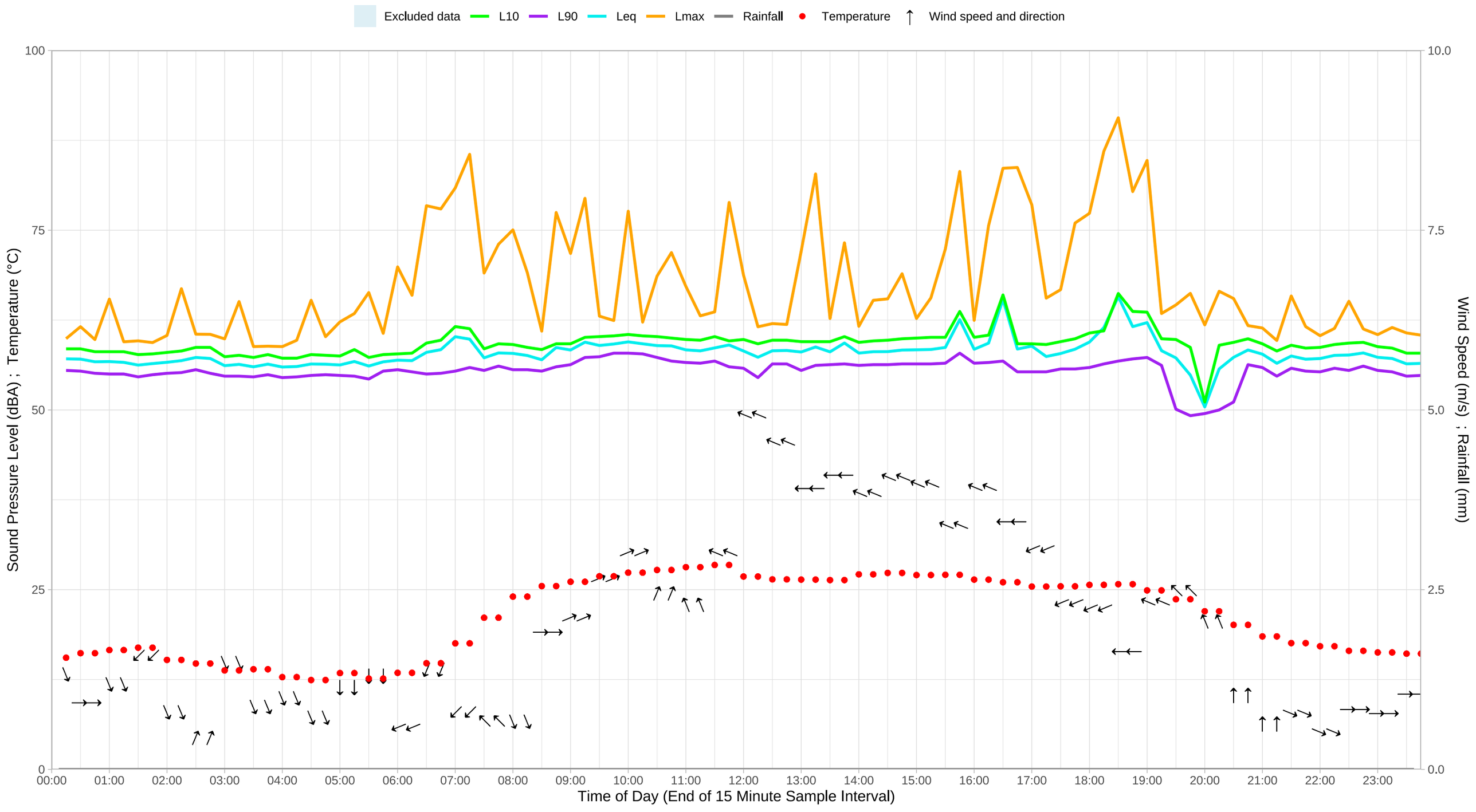
Statistical Ambient Noise Levels
L8
Tuesday 10 December 2024



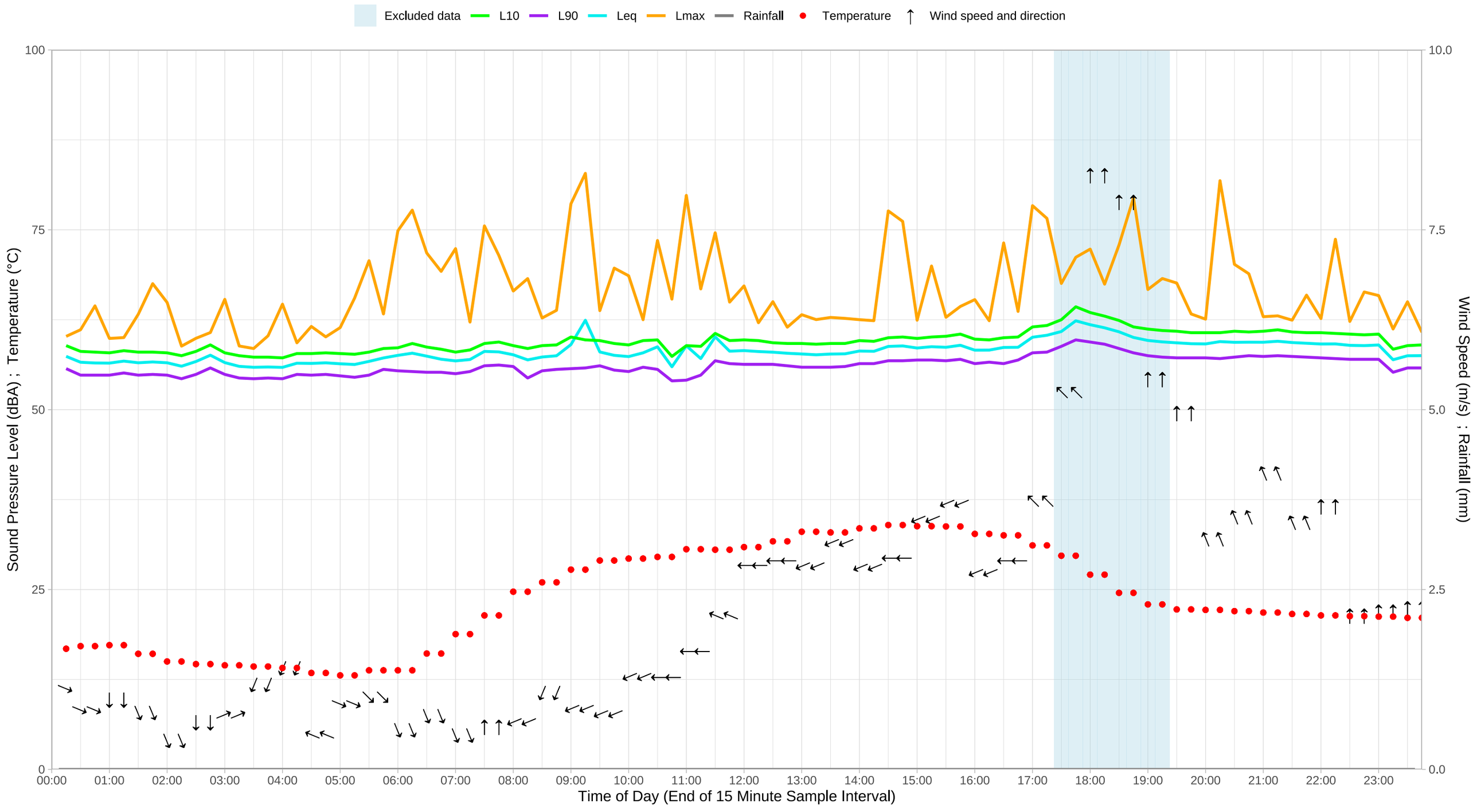
Statistical Ambient Noise Levels
L8
Wednesday 11 December 2024



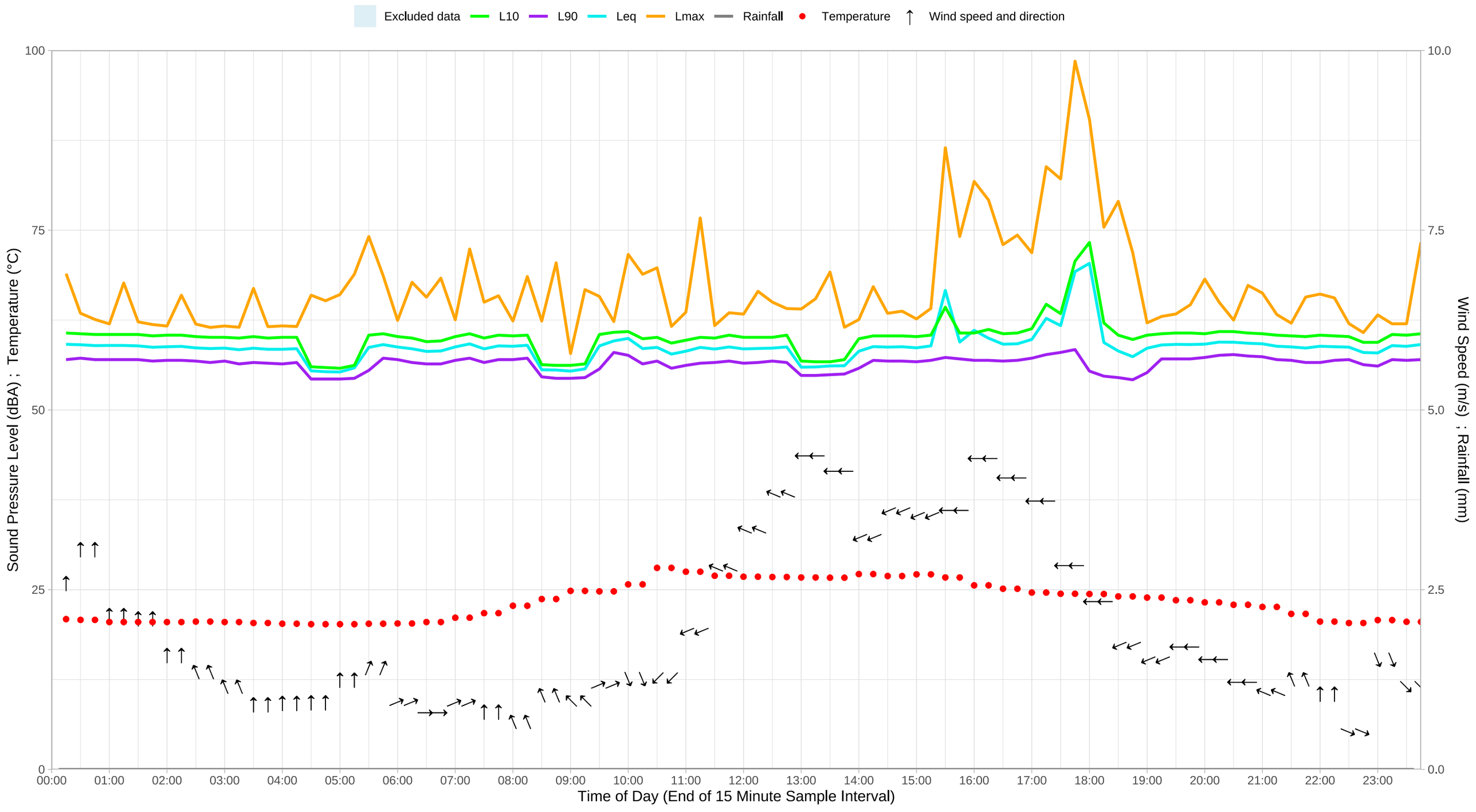
Statistical Ambient Noise Levels
L8
Thursday 12 December 2024



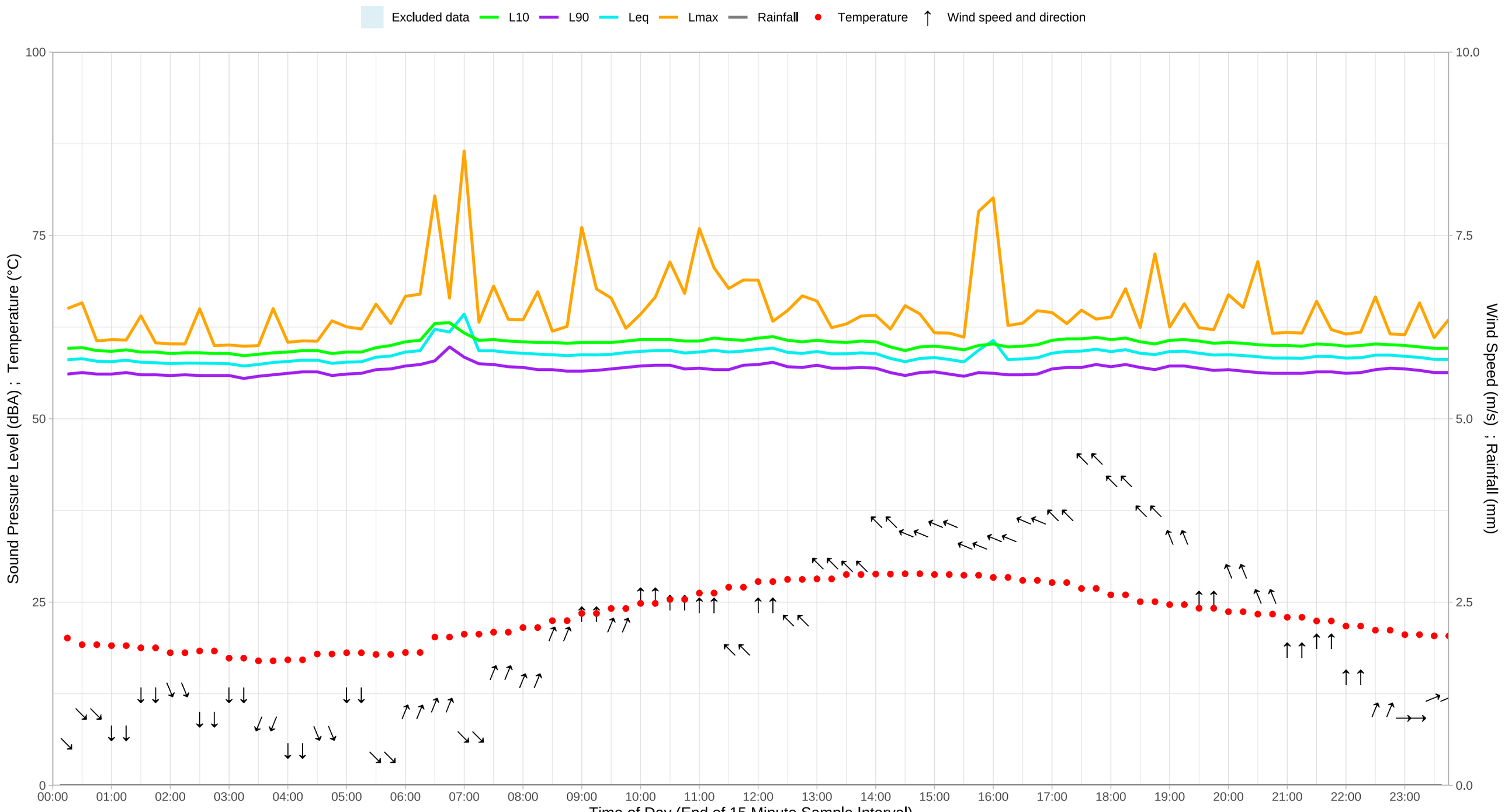
Statistical Ambient Noise Levels
L8
Friday 13 December 2024



Statistical Ambient Noise Levels
L8
Saturday 14 December 2024



Statistical Ambient Noise Levels
L8
Sunday 15 December 2024



Statistical Ambient Noise Levels
L8
Monday 16 December 2024

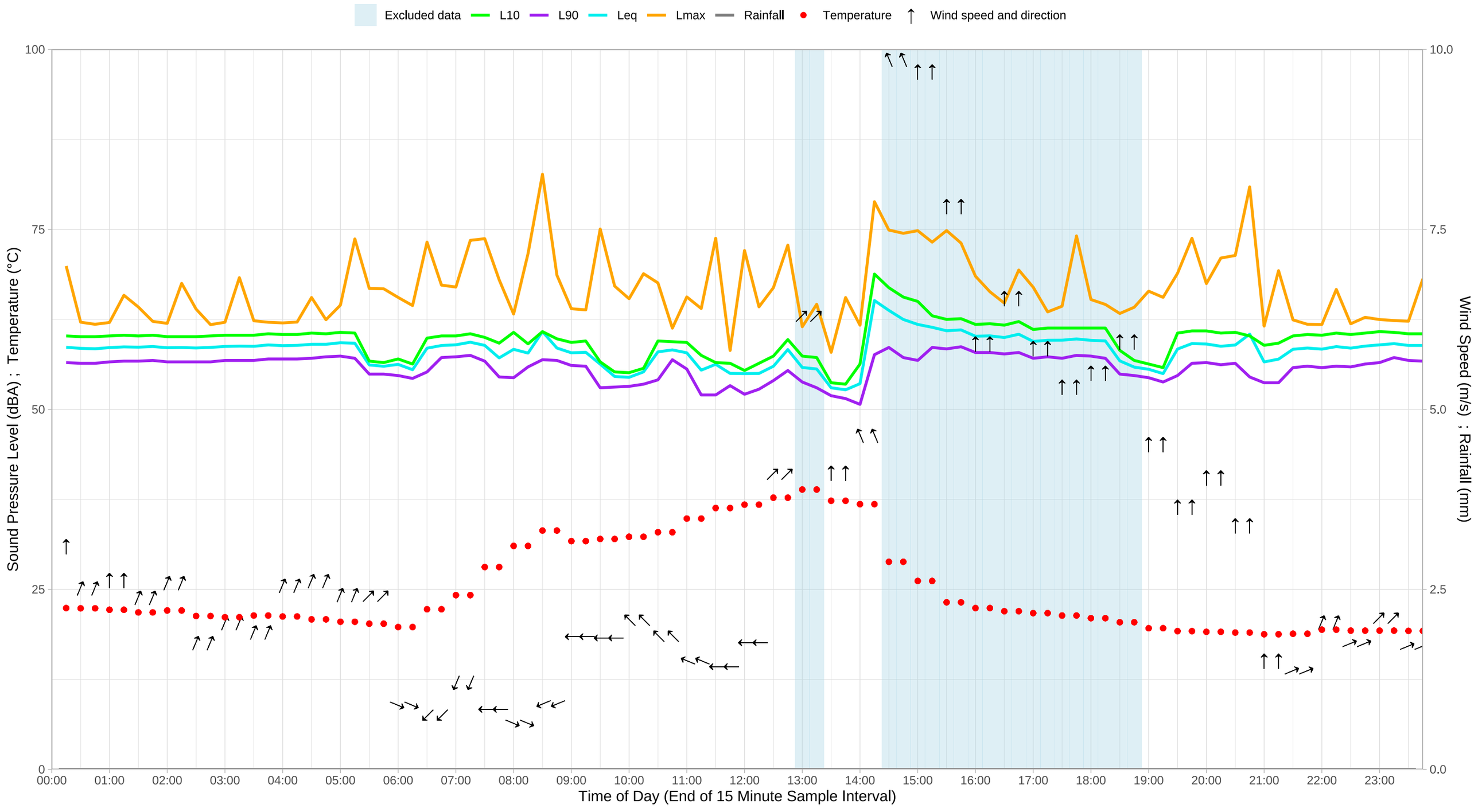
Excluded data | L10 | L90 | Leq | Lmax | Rainfall | Temperature | Wind speed and direction

Sound Pressure Level (dBA) ; Temperature (°C)

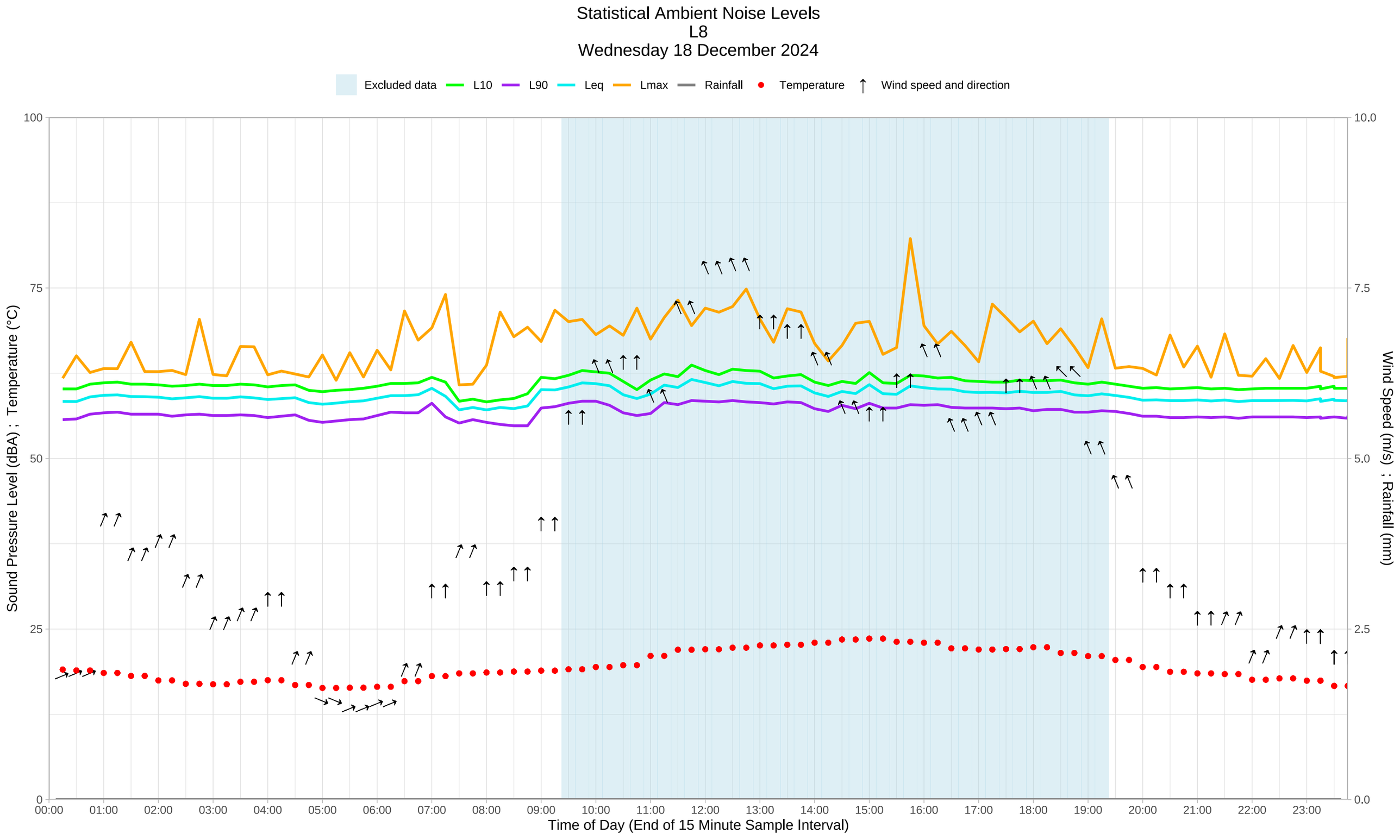
Wind Speed (m/s) ; Rainfall (mm)

Time of Day (End of 15 Minute Sample Interval)

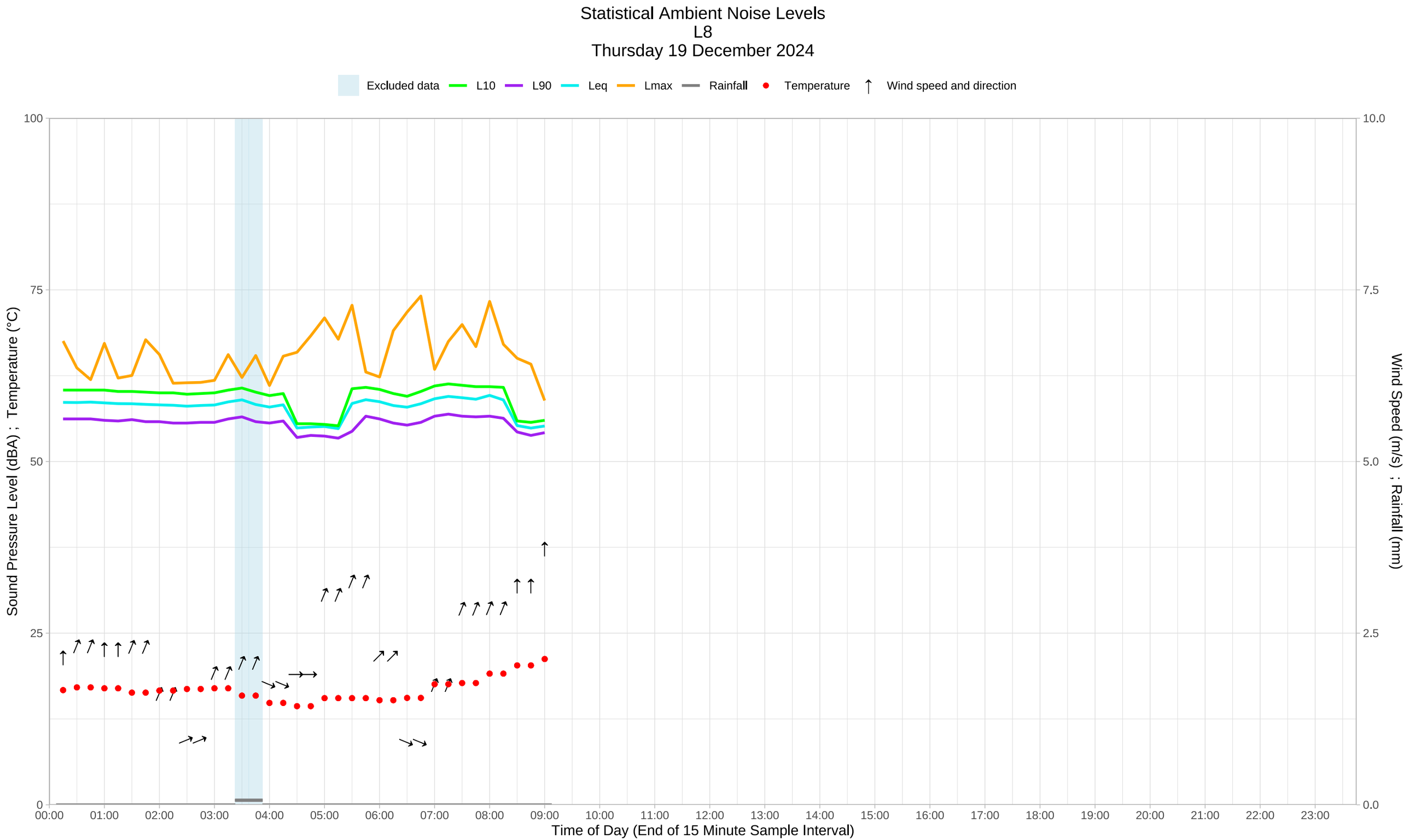
Statistical Ambient Noise Levels
L8
Tuesday 17 December 2024



Statistical Ambient Noise Levels
L8
Wednesday 18 December 2024



Statistical Ambient Noise Levels
L8
Thursday 19 December 2024



Appendix B

Site-wide noise model validation

B-1 Near field

Noise levels were measured at 14 locations in close proximity to the site. These sites were chosen to be at a reasonable distance from the identifiable noise sources with the purpose of validating the source levels input to the noise model. The locations of the near field monitoring are shown on Figure B.1. Table B.1 outlines the L_{Aeq} and L_{A90} measured noise levels during the night period at the 14 near field monitoring locations and the predicted level from the noise model. The difference from the predicted level to each of the measured levels is presented and where the difference is outside 3 dB it is indicated in bold text.

Generally, a 2 dB calibration factor is regarded as an acceptable margin of uncertainty when dealing with noise modelling and predictions for a site with a limited number of noise sources and structures causing reflections, shielding and diffraction. In the case of this site, a 3 dB calibration factor is considered more appropriate due to the following contributing factors related to the scale and complexity:

– The site contains a large number of operation noise sources at varying heights.
– The site includes complex structures, including tall vertical structures (silos) and dense equipment and pipeworks which can create complex sound propagation patterns.

Noise levels from operating equipment have been modelled as continuous steady levels. Short fluctuations in noise levels near the monitoring locations from activities such as cars or pedestrians passing by would increase the L_{Aeq} noise level. However, while these activities are loud relative to the location of the noise monitoring, in the far field would be insignificant. The night period has been chosen for validation with the aim to reduce the occurrence of this as much as possible. The L_{A90} noise level has been used to validate levels at these near field locations as this level would not include these short fluctuations of noise close to the microphone.

Comparison to the measured L_{A90} noise levels shows good calibration of the noise model, with an average difference to the modelled level across the locations of -1.1 dB, indicating a slight underprediction. Underprediction may be due to the proximity of some monitoring locations to Bolong Rd or the rail sources not included in the noise modelling. These results need to be considered in conjunction with the far field monitoring, presented below.

Table B.1 Near field noise monitoring validation

Monitoring location	Measured average noise level (dBA)		Predicted $L_{Aeq,15min}$ noise level (dBA)	Difference to measured level (dBA)	
	$L_{Aeq(15\ min)}$	$L_{A90(15\ min)}$		$L_{Aeq(15\ min)}$	$L_{A90(15\ min)}$
S1	61.2	58.4	60.0	-1.2	1.6
S2	71.4	69.7	70.4	-0.9	0.8
S3	58.9	55.2	55.5	**-3.4**	0.3
S4	71.6	69.2	67.1	**-4.5**	-2.1
S5	67.8	65.1	64.2	**-3.7**	-0.9
S6	72.1	71.1	68.7	**-3.3**	-2.4
S7	70.8	65.4	61.9	**-8.9**	**-3.6**
S8	73.0	72.2	68.8	**-4.3**	**-3.5**
S9	78.4	77.2	75.9	-2.5	-1.3
S10	73.5	67.4	64.7	**-8.8**	-2.8
S11	70.6	69.6	70.1	-0.5	0.5
S12	74.2	73.3	68.4	**-5.8**	**-4.9**
S13	72.3	71.1	71.0	-1.3	-0.1
S14	67.2	65.9	68.3	1.1	2.4
Average				**-3.4**	-1.1

Legend

Monitoring locations
- Near field

Modelled buildings

Site boundary

Paper Size ANSI A

0 100 200 m

N

Map Projection: Grid Map of Australia
Horizontal Datum: GDA2020
Grid: Grid Map of Australia GDA2020 Zone 56

GHD

Manildra

Shoalhaven Starches Modification 31

Near-field noise monitoring locations

Project No. **12645127**
Revision No. **-**
Date. **2025-06-23**

FIGURE B.1

Document Path: \\ghdnet\ghd\AU\Sydney\Projects\21\12645127\Tech\Noise\03_GIS\MOD31_Figs.qgz

Data Source: Nearmap

Created By: Matthijs Oosterlaken

B-2 Far field

Noise monitoring was conducted at seven locations distributed around the site at various distances, up to approximately 1,300 metres. Data measured at these locations has been used to validate the noise propagation model in each direction from the site to ensure predicted noise levels at the sensitive receiver locations are accurate. The locations at which monitoring was conducted are shown on Figure B.2 and the distance and direction of each location to the site is outlined in Table B.2.

Due to the separation distance to the site of these locations, other sources of noise that are not included in the noise model (extraneous noise) may contribute at these locations, particularly during the day when roads are active. Data from the period between 12:00am midnight and 5am has been analysed for the model validation as this period is the least likely to be affected by extraneous noise providing confidence that measured levels consist of noise from the site only.

Meteorological conditions during the monitoring periods, presented in Section 2.2.2, have been analysed, particularly wind direction, to account for possible variability in measured levels across multiple nights. Calculation using the frequency of wind in each direction has been completed in accordance with Annex C of ISO9613.2:2024 to calculate the C_0 coefficient for the C_{met} parameter for each of 12 source to receiver directions.

For most receivers, predicted noise levels have been compared to the L_{Aeq}. The modelled level is input as an L_{Aeq} and as the time period chosen for comparison aims to exclude extraneous noise, the measured level would be closest to the L_{Aeq}. At locations L4 and L5, however, other external noise sources are still present during this nighttime period and therefore the L_{A90} level has been used for comparison at these locations.

The following sections detail the comparison of measured levels to model predicted levels at each of the seven monitoring locations.

Table B.2 Far field monitoring locations

Location	Address	Distance from nearest point on the site (m)	Direction to the site
L1	1 Nobblers Lane, Terara	1260	S from Wastewater Treatment Plant (WWTP) SE from main site
L2	58 Riverview Road, Terara	600	SW from all sources
L3	32 Bolong Road, Bomaderry, south of Manildra office	Within site boundary	W from most of site NW from some nearest sources
L4	36 Railway Street, Bomaderry, north boundary of Manildra site, near packing plant	250	N and NW from main site SE from WWTP
L5	280 Bolong Road, Bolong	400	E from main site SW from WWTP
L6	17 Dalwah Street, Bomaderry	380	NW from main site SW from WWTP
L8	20 Hanigans Lane, Bolong, Manildra Group wastewater treatment plant	Within site boundary	NE from all sources

Legend

Monitoring locations
- Far field

Modelled buildings

Site boundary

Paper Size ANSI A

0 250 500 m

Map Projection: Grid Map of Australia
Horizontal Datum: GDA2020
Grid: Grid Map of Australia GDA2020 Zone 56

N

GHD

Manildra

Shoalhaven Starches Modification 31

Far-field noise monitoring locations

Project No. **12645127**
Revision No. **-**
Date. **2025-06-23**

FIGURE B.2

Document Path: \\ghdnet\ghd\AU\Sydney\Projects\21\12645127\Tech\Noise\03_GIS\MOD31_Figs.qgz

Data Source: Nearmap

Created By: Matthijs Oosterlaken

B-2-1 Location 1

Predicted noise levels at location 1 generally agree with the measured L_{Aeq} noise levels. Measured and predicted noise levels, and the difference between are presented in Table B.3. The measured levels across the five-hour period and the predicted noise level for each night are shown on Figure B.3.

On four nights, measured noise levels are significantly lower, approximately 6 dB, than other nights. These occur on 11, 14, 18 and 19 December 2024 as illustrated in the levels presented in Table B.3. On each of these nights the predominant wind direction is southerly, blowing from the receiver location south of the site towards the site, as denoted by arrows on Figure B.3. It is commonly accepted that these conditions can reduce noise levels by up to 6 dB, however the inclusion of the C_0 parameter did not account for this phenomenon to the extent it is seen in the measurement and predicted noise levels have over predicted the measured level on these four occasions.

The average difference between predicted noise levels and measured L_{Aeq} difference is 1.9 dB, within the accepted tolerance.

Table B.3 Measured and predicted noise level comparison, Location 1

Date	Measured level (dBA)		Difference between L_{Aeq} and L_{A90} (dB)	Predicted $L_{Aeq,15min}$ noise level (dBA)	Difference, prediction – measurement (dB)	
	L_{Aeq}	L_{A90}		Modelled level	L_{Aeq}	L_{A90}
10/12/2024	41.4	37.9	3.4	43.6	2.2	**5.7**
11/12/2024	36.1	32.2	4	41.5	**5.4**	**9.3**
12/12/2024	43.7	41	2.8	44.2	0.5	**3.2**
13/12/2024	45.4	42.9	2.5	43.4	-2.0	0.5
14/12/2024	35	30.7	4.4	39.1	**4.1**	**8.4**
15/12/2024	43.3	39.2	4.1	44.1	0.8	**4.9**
16/12/2024	41.4	39.4	2.1	43.2	1.8	**3.8**
17/12/2024	44.5	37.3	7.3	40.7	**-3.8**	**3.5**
18/12/2024	36.9	33.9	3	42.1	**5.2**	**8.2**
19/12/2024	37	33.6	3.3	42.2	**5.3**	**8.6**
Average					1.9	**5.6**

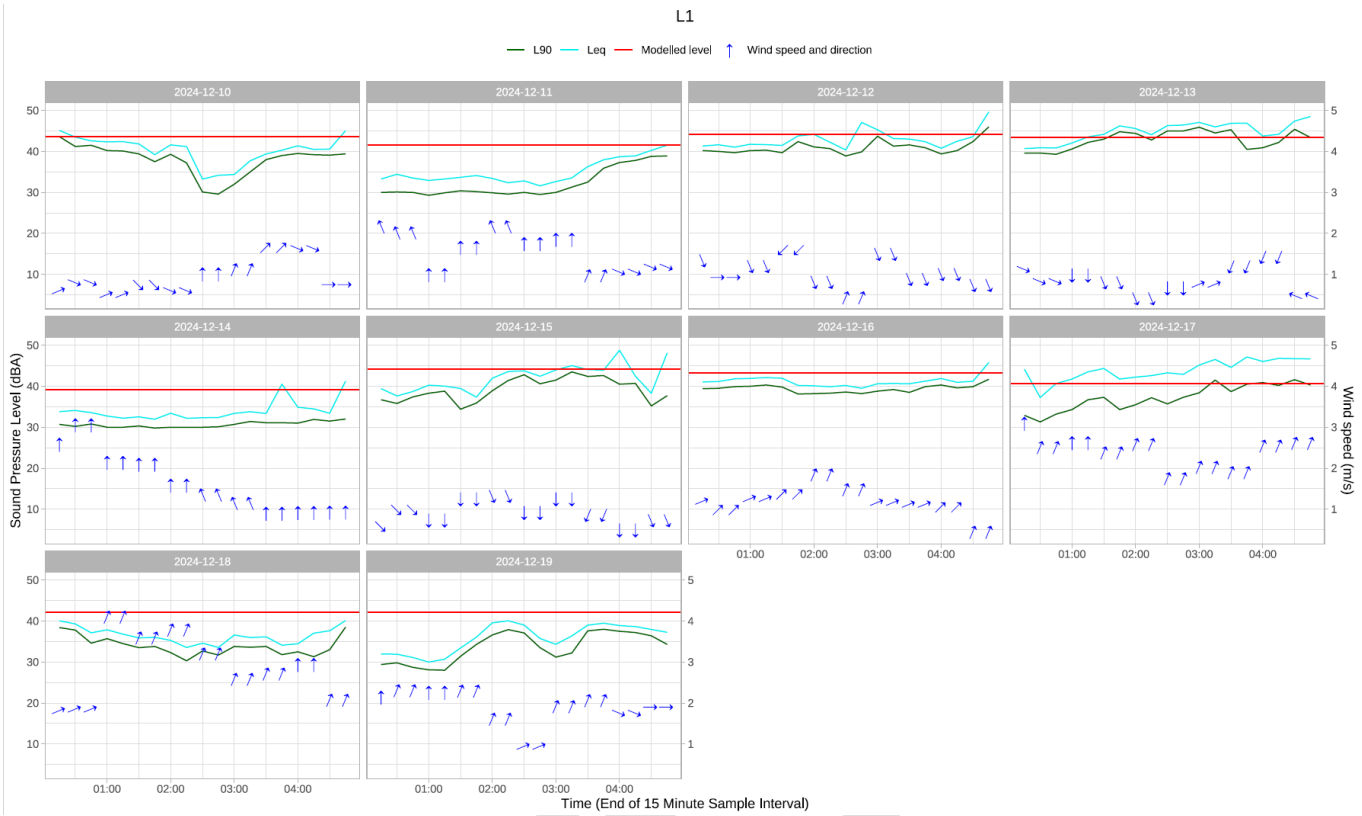


Figure B.3 Measured and predicted noise levels and wind conditions, Location 1

B-2-2 Location 2

Predicted noise levels at location 2 generally agree with the measured L_{Aeq} noise levels. Measured and predicted noise levels, and the difference between are presented in Table B.4. The measured levels across the five-hour period and the predicted noise level for each night are shown on Figure B.4.

Measured noise levels during the early morning of 17 December 2024 are significantly higher, 8.1 dB, than the predicted level for this period. The measured level is similar to the predicted level during other periods modelled and the discrepancy may be due to an over correction of the C0 parameter, or conversely extraneous noise from a source to the southwest that is enhanced by the dominant south-westerly wind on this evening.

The average difference between predicted noise levels and measured L_{Aeq} difference is -0.4 dB, and within the accepted tolerance.

Table B.4 Measured and predicted noise level comparison, Location 2

Date	Measured level (dBA)		Difference between L_{Aeq} and L_{A90} (dB)	Predicted $L_{Aeq,15min}$ noise level (dBA)	Difference, prediction – measurement (dB)	
	L_{Aeq}	L_{A90}		Modelled level	L_{Aeq}	L_{A90}
10/12/2024	41.7	35.2	6.5	40.4	-1.3	**5.2**
11/12/2024	38.4	36.2	2.1	40.1	1.7	**3.9**
12/12/2024	40.6	37.6	3.0	43.6	3.0	**6.0**
13/12/2024	42.1	39.5	2.6	43.0	0.9	**3.5**
14/12/2024	37.9	35.3	2.6	36.9	-1.0	1.6
15/12/2024	42.6	38.7	3.9	43.9	1.3	**5.2**
16/12/2024	38.6	35.8	2.8	37.5	-1.1	1.7
17/12/2024	43.8	38.9	4.9	35.7	**-8.1**	**-3.2**
18/12/2024	37.3	33.8	3.5	36.8	-0.5	**3.0**
19/12/2024	37.8	34.1	3.7	38.9	1.1	**4.8**
Average					-0.4	**3.2**

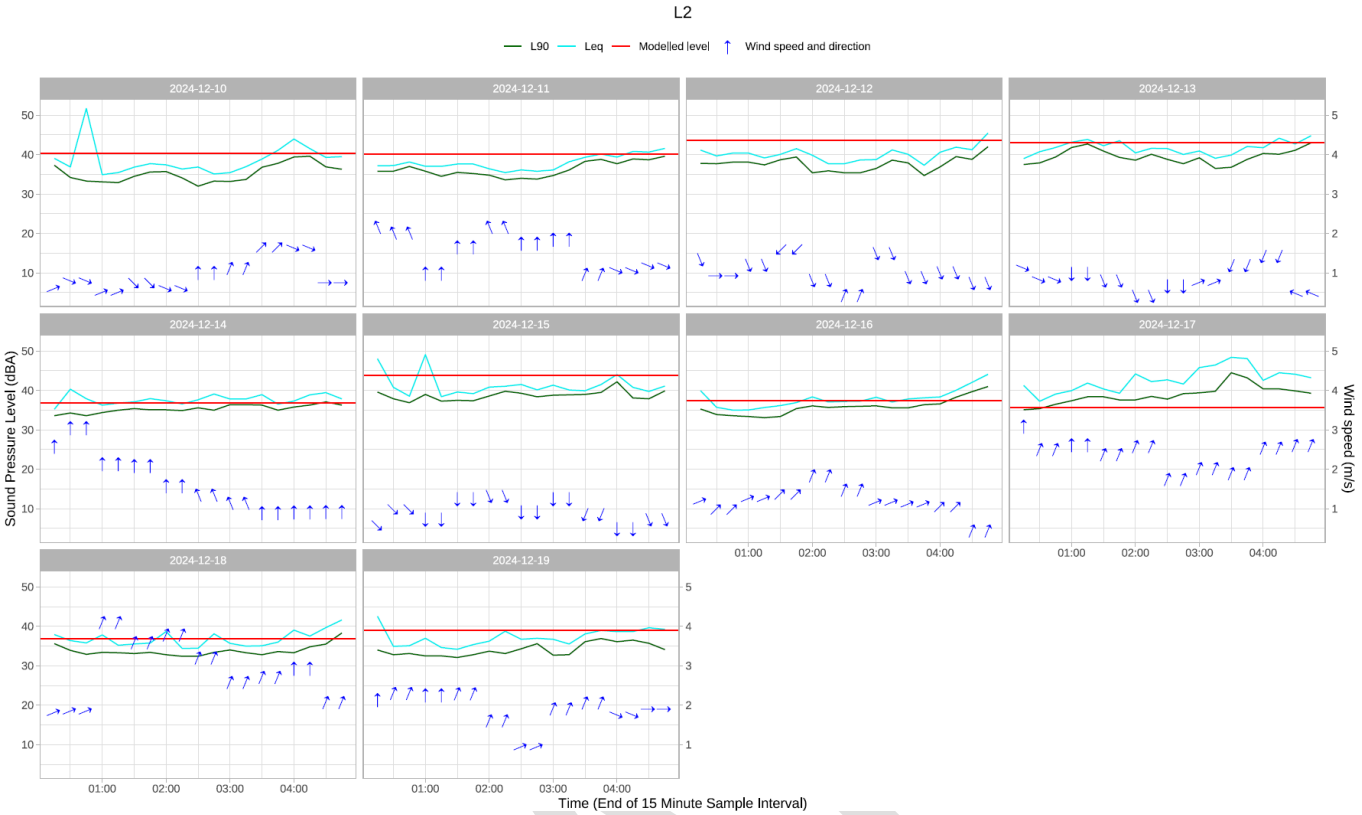


Figure B.4 Measured and predicted noise levels and wind conditions, Location 2

B-2-3 Location 3

Predicted noise levels at location 3 agree with the measured L_{Aeq} noise levels for all monitoring periods. Measured and predicted noise levels, and the difference between are presented in Table B.5. The measured levels across the five-hour period and the predicted noise level for each night are shown on Figure B.5. The average difference between predicted noise levels and measured L_{Aeq} difference is 1.3 dB, and within the accepted tolerance.

Table B.5 Measured and predicted noise level comparison, Location 3

Date	Measured level (dBA)		Difference between L_{Aeq} and L_{A90} (dB)	Predicted $L_{Aeq,15min}$ noise level (dBA)	Difference, prediction – measurement (dB)	
	L_{Aeq}	L_{A90}		Modelled level	L_{Aeq}	L_{A90}
10/12/2024	54.8	51.7	3.0	54.5	-0.3	2.8
11/12/2024	54.8	52.3	2.5	55.9	1.1	**3.6**
12/12/2024	53.3	51.5	1.8	54.3	1.0	2.8
13/12/2024	53.6	52.0	1.5	55.3	1.7	**3.3**
14/12/2024	53.7	52.1	1.6	56.5	2.8	**4.4**
15/12/2024	53.8	52.2	1.7	54.8	1.0	2.6
16/12/2024	53.5	51.5	2.0	55.0	1.5	**3.5**
17/12/2024	53.9	52.4	1.5	56.3	2.4	**3.9**
18/12/2024	54.3	52.5	1.7	55.7	1.4	**3.2**
19/12/2024	55.1	53.4	1.6	55.6	0.5	2.2
Average					1.3	**3.2**

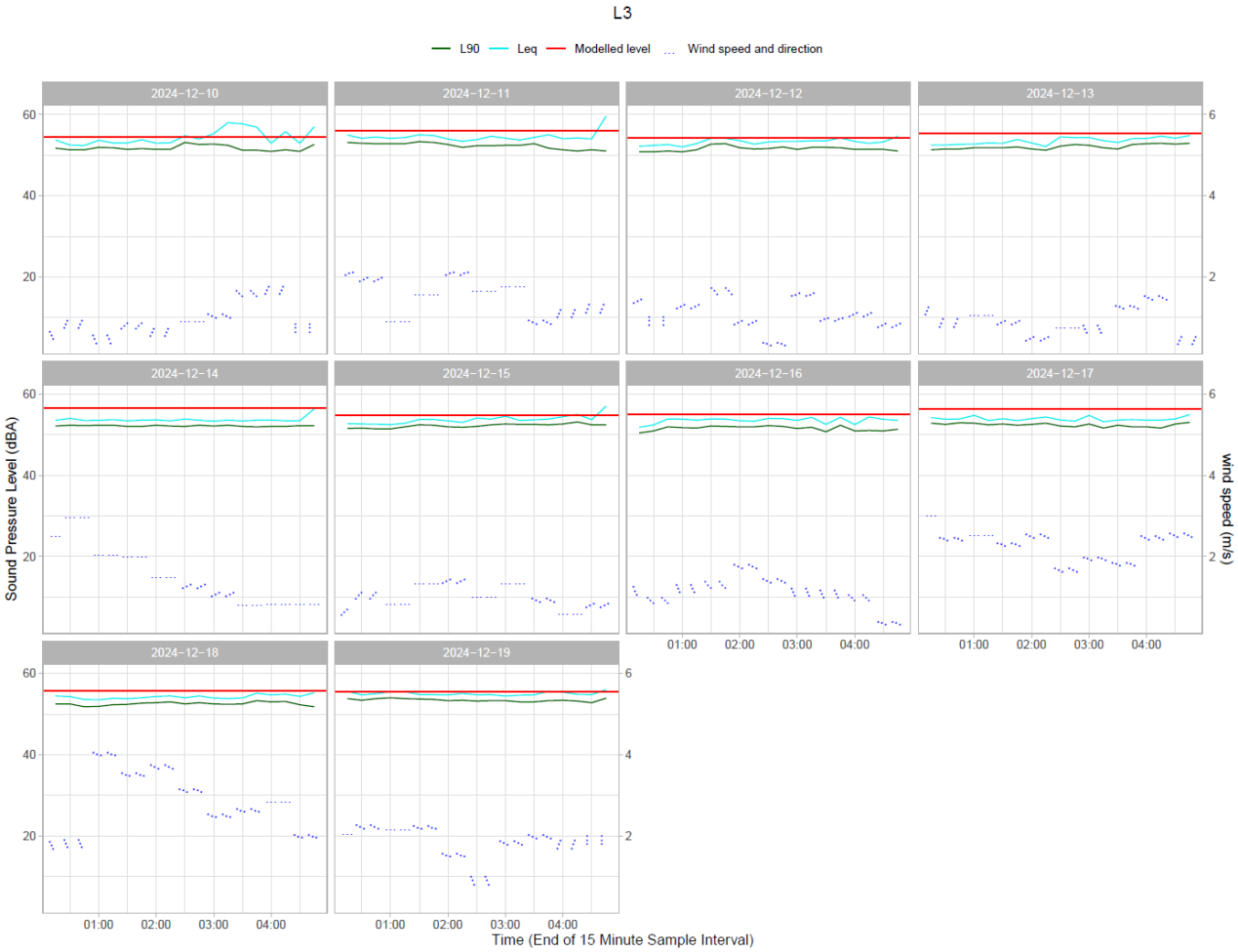


Figure B.5 Measured and predicted noise levels and wind conditions, Location 3

B-2-4 Location 4

Predicted noise levels at location 4 generally agree with the measured L_{A90} noise levels. Measured and predicted noise levels, and the difference between are presented in Table B.6. The measured levels across the five-hour period and the predicted noise level for each night are shown on Figure B.6.

At this location, as can be seen in Figure B.6, there are fluctuations in the measured L_{Aeq} independent of the L_{A90}. This typically indicates that there are short periods of noise above any continuous baseline noise and would likely be extraneous to the noise from the site. As such, for calibration of the noise levels from the site, the measured L_{A90} has been used for comparison, which excluded this extraneous noise.

On three occasions there is a sharp drop off around 3am of both the L_{Aeq} and the L_{A90} indicative of a nearby noise source turning off. It can be seen that the level prior to 3am is louder than the level measured on other nights, indicating this source is additional to the typical environment.

The average difference between predicted noise levels and measured L_{A90} difference is -1.8 dB, within the accepted tolerance. Excluding nights where the additional source was measured for part of the period, the average difference is -1.8 dB.

Table B.6 Measured and predicted noise level comparison, Location 4

Date	Measured level (dBA)		Difference between L_{Aeq} and L_{A90} (dB)	Predicted $L_{Aeq,15min}$ noise level (dBA)	Difference, prediction – measurement (dB)	
	L_{Aeq}	L_{A90}		Modelled level	L_{Aeq}	L_{A90}
10/12/2024	56.5	52.2	4.3	51.3	**-5.2**	-1.0
11/12/2024	56.9	53.5	3.4	53.1	**-3.8**	-0.4
12/12/2024	54.5	51.3	3.2	49.2	**-5.3**	-2.1
13/12/2024	62.3	59.9	2.4	51.6	**-10.7**	**-8.3**
14/12/2024	53.4	51.9	1.5	54.2	0.8	2.3
15/12/2024	57.7	56.0	1.7	50.0	**-7.7**	**-6.0**
16/12/2024	56.4	52.9	3.5	52.3	**-4.1**	-0.6
17/12/2024	64.8	52.5	12.3	53.9	**-10.9**	1.4
18/12/2024	56.1	54.5	1.7	53.3	-2.8	-1.2
19/12/2024	58.8	55.5	3.3	53.0	**-5.8**	-2.5
Average					**-5.6**	-1.8

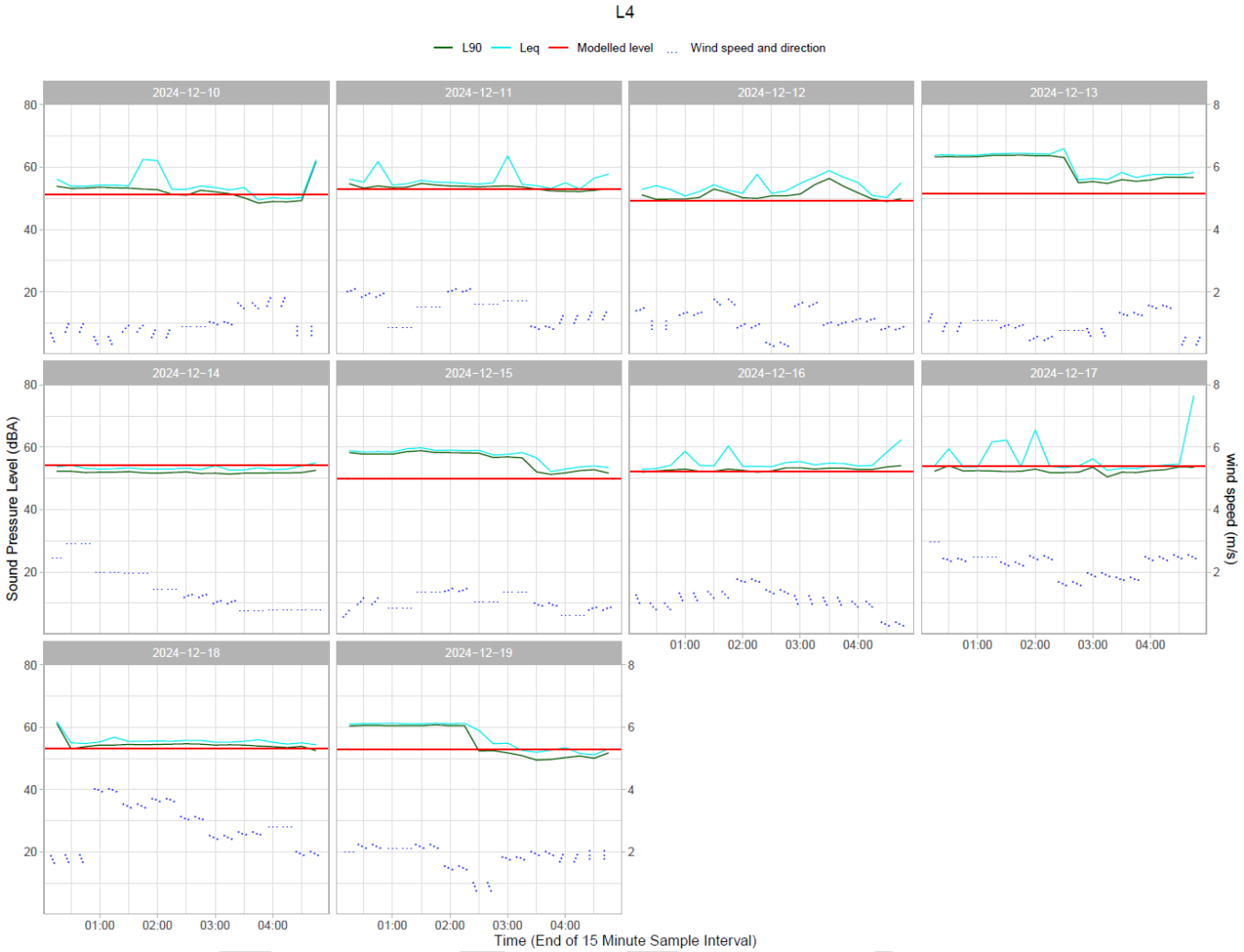


Figure B.6 Measured and predicted noise levels and wind conditions, Location 4

B-2-5 Location 5

Predicted noise levels at location 5 generally agree with the measured L_{A90} noise levels. Measured and predicted noise levels, and the difference between are presented in Table B.7. The measured levels across the five-hour period and the predicted noise level for each night are shown on Figure B.7.

Similar to Location 4, at this location there are fluctuations in the measured L_{Aeq} independent of the L_{A90}, as can be seen in Figure B.7, for a majority of the monitoring periods. This typically indicates that there are short periods of noise above any continuous baseline noise and would likely be extraneous to the noise from the site due to the proximity of this monitoring location to other noise sources know to be operational during the night period. As such, for calibration of the noise levels from the site, the measured L_{A90} has been used for comparison, which excluded this extraneous noise.

For some monitoring periods the noise modelling is over predicting the measured L_{A90} noise level. While all effort has been made to account for continuously operating equipment, including measurements GHD has taken of the neighbouring Supagas facility, for the purpose of validation, extraneous noise cannot always be accounted for.

The average difference between predicted noise levels and measured L_{A90} difference is 2.3 dB. Using the plots in Figure B.7, it can be seen that the modelled noise level generally agrees with the measurements when taking into account fluctuations that are likely from extraneous sources of noise.

Table B.7 Measured and predicted noise level comparison, Location 5

Date	Measured level (dBA)		Difference between L_{Aeq} and L_{A90} (dB)	Predicted $L_{Aeq,15min}$ noise level (dBA)	Difference, prediction – measurement (dB)	
	L_{Aeq}	L_{A90}		Modelled level	L_{Aeq}	L_{A90}
10/12/2024	48.8	44.9	4.0	47.2	-1.7	2.3
11/12/2024	44.9	40.5	4.4	46.8	1.9	**6.3**
12/12/2024	50.6	46.4	4.2	46.0	**-4.6**	-0.4
13/12/2024	49.8	45.5	4.3	45.5	**-4.3**	0.0
14/12/2024	53.2	42.0	11.2	46.8	**-6.4**	**4.8**
15/12/2024	53.8	45.3	8.5	45.3	**-8.5**	0.0
16/12/2024	49.4	43.8	5.6	47.3	-2.1	**3.5**
17/12/2024	47.4	43.8	3.6	47.1	-0.3	**3.3**
18/12/2024	48.7	45.8	2.9	47.2	-1.5	1.4
19/12/2024	56.4	45.2	11.2	47.1	**-9.3**	1.9
Average					**-3.7**	2.3

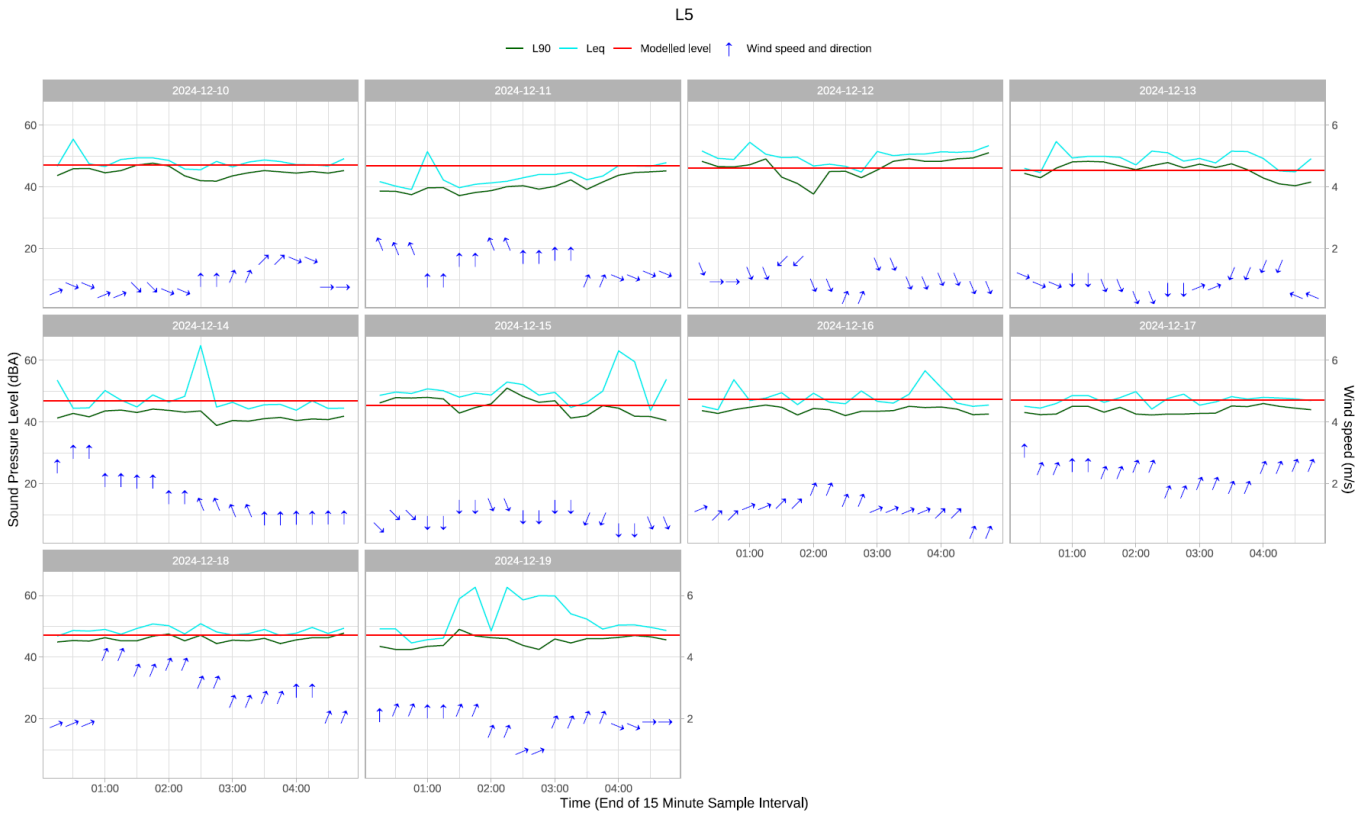


Figure B.7 Measured and predicted noise levels and wind conditions, Location 5

B-2-6 Location 6

Predicted noise levels at location 6 agree with the measured L_{Aeq} noise levels for all monitoring periods. Measured and predicted noise levels, and the difference between are presented in Table B.8. The measured levels across the five-hour period and the predicted noise level for each night are shown on Figure B.8. The average difference between predicted noise levels and measured L_{Aeq} difference is -0.5 dB, and within the accepted tolerance.

Table B.8 Measured and predicted noise level comparison, Location 6

Date	Measured level (dBA)		Difference between L_{Aeq} and L_{A90} (dB)	Predicted $L_{Aeq,15min}$ noise level (dBA)	Difference, prediction – measurement (dB)	
	L_{Aeq}	L_{A90}		Modelled level	L_{Aeq}	L_{A90}
10/12/2024	42.5	36.9	5.5	41	-1.5	**4.1**
11/12/2024	45.7	40.8	4.9	44.2	-1.5	**3.4**
12/12/2024	41.6	36.1	5.5	41.9	0.3	**5.8**
13/12/2024	42.9	36.5	6.4	43.3	0.4	**6.8**
14/12/2024	44.9	42.6	2.3	45.4	0.5	2.8
15/12/2024	44.1	38.9	5.2	42.9	-1.2	**4**
16/12/2024	40.6	36.1	4.5	41.9	1.3	**5.8**
17/12/2024	46.6	42.9	3.6	44.7	-1.9	1.8
18/12/2024	43.4	40.3	3	43.6	0.2	**3.3**
19/12/2024	44.7	40.9	3.8	43.5	-1.2	2.6
Average					-0.5	**4**

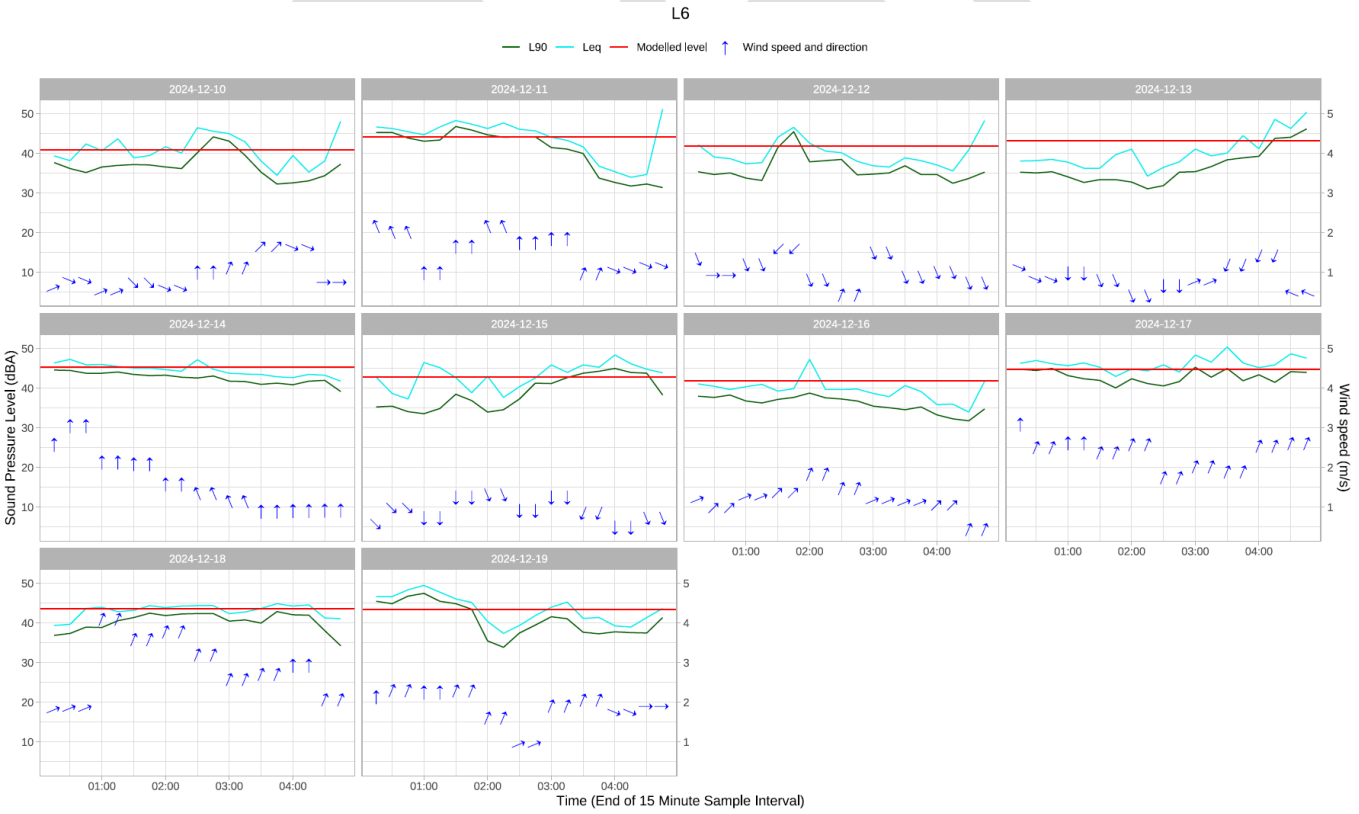


Figure B.8 Measured and predicted noise levels and wind conditions, Location 6

B-2-7 Location 8

Predicted noise levels at location 6 agree with the measured L_{Aeq} noise levels for all monitoring periods. Measured and predicted noise levels, and the difference between are presented in Table B.9. The measured levels across the five-hour period and the predicted noise level for each night are shown on Figure B.9. The average difference between predicted noise levels and measured L_{Aeq} difference is -0.2 dB, and within the accepted tolerance.

Table B.9 Measured and predicted noise level comparison, Location 8

Date	Measured level (dBA)		Difference between L_{Aeq} and L_{A90} (dB)	Predicted $L_{Aeq,15min}$ noise level (dBA)	Difference, prediction – measurement (dB)	
	L_{Aeq}	L_{A90}		Modelled level	L_{Aeq}	L_{A90}
10/12/2024	60.8	59.8	1	58.2	-2.6	-1.6
11/12/2024	57.6	56	1.7	58.3	0.7	2.3
12/12/2024	56.6	55	1.6	56.8	0.2	1.8
13/12/2024	56.5	54.8	1.7	57.6	1.1	2.8
14/12/2024	58.5	56.5	2	58.6	0.1	2.1
15/12/2024	57.7	56	1.7	56.5	-1.2	0.5
16/12/2024	58.7	56.9	1.8	58.5	-0.2	1.6
17/12/2024	58.7	56.8	2	58.6	-0.1	1.9
18/12/2024	58.9	56.3	2.6	58.5	-0.4	2.2
19/12/2024	58.1	55.7	2.4	58.4	0.3	2.7
Average					-0.2	1.6

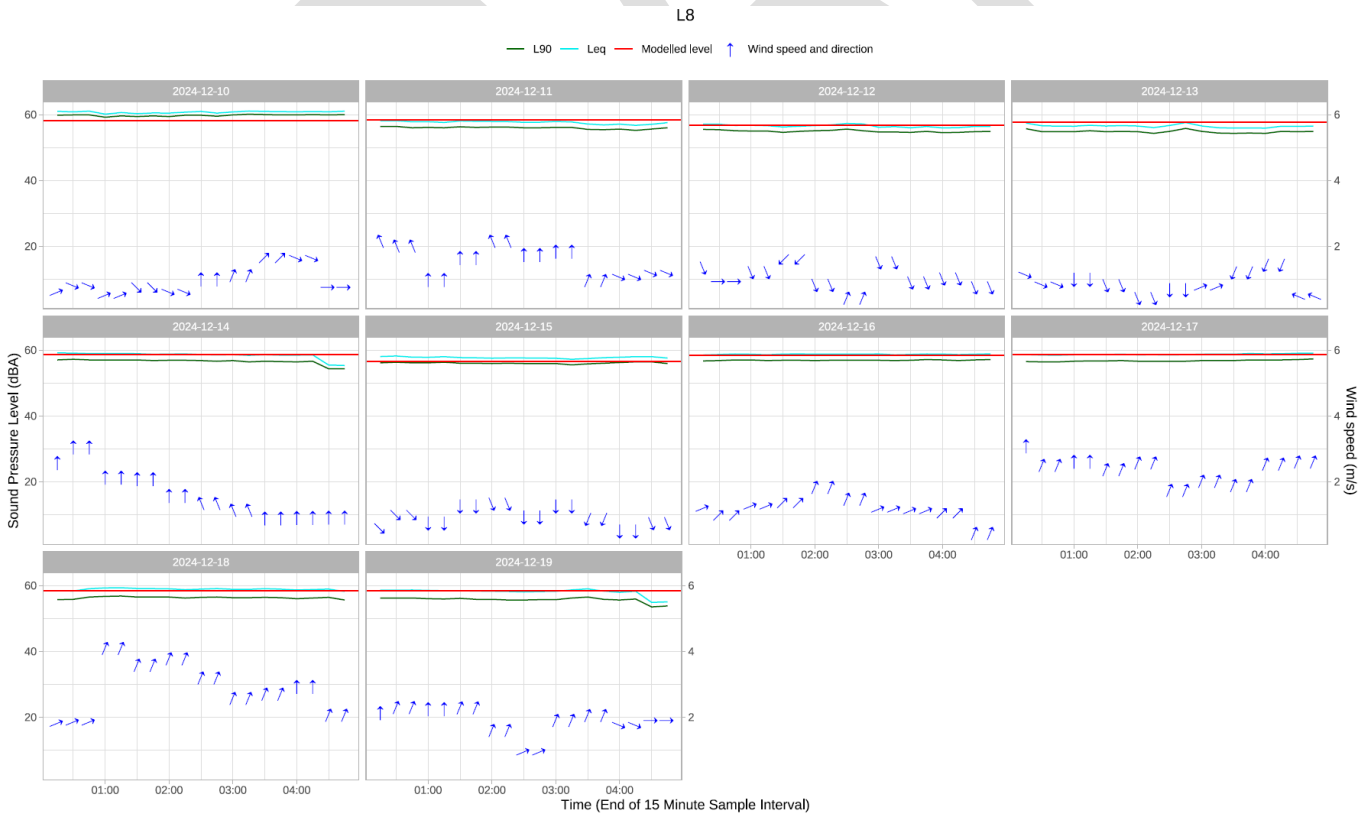


Figure B.9 Measured and predicted noise levels and wind conditions, Location 8

Appendix C

Noise model input data – MOD31

Component	Equipment	Number of items	Total sound power level	Sound Power Level per one-third octave band (dBA)																																
				10Hz	12.5Hz	16Hz	20Hz	25Hz	31.5Hz	40Hz	50Hz	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz	2kHz	2.5kHz	3.15kHz	4kHz	5kHz	6.3kHz	8kHz	10kHz
	CIP pump	1	82	2	15	16	21	32	34	37	39	40	42	59	51	58	49	53	56	59	59	64	61	64	72	65	64	63	66	79	71	67	75	68
	Recirculate pump	2	90	-3	8	18	28	39	42	38	43	48	38	47	57	64	64	68	72	76	79	78	79	82	81	79	78	77	75	77	74	68	73	69
	Process Condensate pump	2	75	-5	8	9	14	25	27	30	32	33	35	52	44	51	42	46	49	52	52	57	54	57	65	58	57	56	59	72	64	60	68	61
	Wet Scrubber outlet booster fan	2	87	21	29	39	47	61	67	61	63	66	67	72	73	81	82	71	73	73	74	69	68	67	68	72	72	71	69	63	62	60	58	53
DDG 4-5 Heat Exchange	Process Condensate pump	2	75	-5	8	9	14	25	27	30	32	33	35	52	44	51	42	46	49	52	52	57	54	57	65	58	57	56	59	72	64	60	68	61
	Seal water pump	2	75	-5	8	9	14	25	27	30	32	33	35	52	44	51	42	46	49	52	52	57	54	57	65	58	57	56	59	72	64	60	68	61
Distillery HRB pumps	Heat exchanger	8	85	-7	3	14	24	35	38	33	38	44	33	42	52	60	59	64	68	72	75	74	74	78	77	75	74	73	70	73	70	64	68	65
	Temperzone HVAC unit	4	81	0	14	14	19	30	37	25	41	37	45	70	54	54	57	56	62	62	63	70	79	72	58	56	53	58	61	52	46	38	28	37
	Roof	1	89	11	19	19	39	41	37	40	39	41	42	49	50	54	54	49	50	46	40	35	31	22	18	16	10	10	2	-3	-6	-4	-9	-18
	South façade	1	91	11	19	19	39	41	37	40	39	41	42	49	50	54	54	49	50	46	40	35	31	22	18	16	10	10	2	-3	-6	-4	-9	-18
	East façade	1	86	11	19	19	39	41	37	40	39	41	42	49	50	54	54	49	50	46	40	35	31	22	18	16	10	10	2	-3	-6	-4	-9	-18
Heat recovery building	North façade	1	86	7	15	15	34	36	32	36	34	36	38	45	46	50	50	45	46	41	36	30	27	17	14	11	6	5	-2	-7	-11	-8	-13	-22
	West façade	1	81	7	15	15	34	36	32	36	34	36	38	45	46	50	50	45	46	41	36	30	27	17	14	11	6	5	-2	-7	-11	-8	-13	-22

Appendix D

Modifying factor analysis results

Modification 31 individually

Receiver	Predicted noise level		Low frequency noise trigger 1
	dBA	dBC	Difference between dBC and dBA (dB)
R1	18	50	**32**
R2	21	49	**28**
R3	26	54	**28**
R4	24	53	**29**
R5	23	54	**31**
R6	15	52	**37**
R7	25	54	**28**
R8	18	49	**31**
R9	25	52	**27**
R10	19	50	**31**
R11	24	53	**28**
R12	24	53	**29**
R13	22	52	**30**

Low frequency noise trigger 2													
Receiver	Predicted one-third noise levels (dBZ)												
Frequencies (Hz)	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
LFN Thresholds	92	89	86	77	69	61	54	50	50	48	48	46	44
R1	46	47	40	53	49	41	38	33	30	28	26	23	25
R2	45	46	39	52	48	42	37	32	29	27	28	25	27
R3	51	51	44	56	53	46	42	36	34	32	32	28	30
R4	50	50	43	56	52	44	41	35	33	31	30	27	29
R5	51	52	44	57	53	45	42	37	34	32	31	28	30
R6	52	50	43	56	49	40	38	32	29	26	23	19	20
R7	50	51	44	57	53	45	42	36	34	32	31	28	30
R8	45	46	39	52	48	40	38	32	30	27	26	23	24
R9	50	50	43	55	51	44	40	34	32	30	31	27	28
R10	46	47	40	52	49	42	38	32	30	27	28	23	25
R11	50	50	42	55	52	45	41	36	34	31	31	27	30
R12	50	51	43	56	52	44	41	35	33	31	30	27	29
R13	49	50	42	55	51	43	40	35	33	31	30	27	29

	Exceeds LFN threshold by up to and including 5 dB and cannot be mitigated: a 2 dB penalty must be applied during evening/night
	Exceeds LFN threshold by more than 5 dB and cannot be mitigated: a 5 dB penalty must be applied during evening/night and a +2 dB penalty during the day

Cumulative noise levels

Receiver	Predicted noise level		Low frequency noise trigger 1
	dBA	dBC	Difference between dBC and dBA (dB)
R1	42	70	**28**
R2	48	72	**24**
R3	49	75	**26**
R4	48	74	**26**
R5	47	75	**27**
R6	39	68	**29**
R7	47	73	**26**
R8	42	70	**28**
R9	49	74	**26**
R10	44	70	**26**
R11	46	71	**25**
R12	45	72	**27**
R13	46	71	**25**

Low frequency noise trigger 2													
Receiver	Predicted one-third noise levels (dBZ)												
Frequencies (Hz)	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
LFN Thresholds	92	89	86	77	69	61	54	50	50	48	48	46	44
R1	65	65	63	65	69	66	64	62	59	56	48	44	43
R2	66	66	66	67	70	68	66	63	61	58	53	49	48
R3	70	70	69	72	74	70	67	65	61	59	53	49	49
R4	69	69	68	71	74	69	68	66	61	60	53	49	48
R5	71	70	68	70	74	71	69	66	63	60	53	49	48
R6	68	66	63	66	67	61	60	58	55	53	43	39	39
R7	70	70	69	69	73	67	67	65	61	58	52	48	46
R8	65	65	63	65	68	66	64	61	59	55	47	44	42
R9	68	69	68	71	74	69	67	64	60	59	53	49	49
R10	65	65	65	66	70	66	63	60	57	56	49	45	44
R11	69	69	66	68	71	66	64	63	59	57	51	47	46
R12	70	70	67	68	72	66	65	64	59	57	50	46	45
R13	67	67	66	67	71	65	65	63	59	58	50	46	45

	Exceeds LFN threshold by up to and including 5 dB and cannot be mitigated: a 2 dB penalty must be applied during evening/night
	Exceeds LFN threshold by more than 5 dB and cannot be mitigated: a 5 dB penalty must be applied during evening/night and a +2 dB penalty during the day

Appendix E

Cumulative noise levels

Table E.1 Predicted cumulative noise levels of the site – neutral weather conditions

Receiver ID	Address	EPL noise limit (dBA)	Rail noise (MOD25)[1]	Predicted noise level (dBA)[2]		Noise level is below design goal?			
				Cumulative	Cumulative ANYC	Cumulative (current, rail and MOD31)		Cumulative ANYC (current, approved but not yet constructed, rail and MOD31)	
						Without LFN penalty	With LFN penalty	Without LFN penalty	With LFN penalty
R1	135 Terara Road, Terara	38	29	46 (41 + 5)	46 (41 + 5)	Exceeds 4 dB	Exceeds 4 dB	Exceeds 9 dB	Exceeds 9 dB
R2	45 Ferry Lane, Terara	38	27	52 (47 + 5)	52 (47 + 5)	Exceeds 10 dB	Exceeds 10 dB	Exceeds 15 dB	Exceeds 15 dB
R3	41A Meroo Street, Bomaderry	42	45	55 (50 + 5)	54 (49 + 5)	Exceeds 8 dB	Exceeds 8 dB	Exceeds 13 dB	Exceeds 13 dB
R4	1-3 Meroo Street, Bomaderry	42	45	54 (49 + 5)	54 (49 + 5)	Exceeds 8 dB	Exceeds 8 dB	Exceeds 13 dB	Exceeds 13 dB
R5	Burraga Island	40	37	52 (47 + 5)	52 (47 + 5)	Exceeds 8 dB	Exceeds 8 dB	Exceeds 13 dB	Exceeds 13 dB
R6	39 Hanigans Lane, Bolong	40	31	43 (38 + 5)	44 (39 + 5)	Yes	Yes	Exceeds 4 dB	Exceeds 5 dB
R7	19 Meroo Street, Bomaderry	42	45	54 (49 + 5)	54 (49 + 5)	Exceeds 7 dB	Exceeds 7 dB	Exceeds 12 dB	Exceeds 12 dB
R8	1 Nobblers Lane, Terara	38	29	46 (41 + 5)	46 (41 + 5)	Exceeds 4 dB	Exceeds 4 dB	Exceeds 9 dB	Exceeds 9 dB
R9	2 Tarawara Street, Bomaderry	42	45	55 (50 + 5)	55 (50 + 5)	Exceeds 8 dB	Exceeds 8 dB	Exceeds 13 dB	Exceeds 13 dB
R10	10 Tarawara Street, Bomaderry	40	37	49 (44 + 5)	49 (44 + 5)	Exceeds 5 dB	Exceeds 5 dB	Exceeds 10 dB	Exceeds 10 dB
R11	17 Coomea Street, Bomaderry	40	37	51 (46 + 5)	51 (46 + 5)	Exceeds 6 dB	Exceeds 7 dB	Exceeds 11 dB	Exceeds 12 dB
R12	6 Birriley Street, Bomaderry	40	37	49 (44 + 5)	49 (44 + 5)	Exceeds 5 dB	Exceeds 5 dB	Exceeds 10 dB	Exceeds 10 dB
R13	1 Coomea Street, Bomaderry	40	37	50 (45 + 5)	50 (45 + 5)	Exceeds 6 dB	Exceeds 6 dB	Exceeds 11 dB	Exceeds 11 dB

Notes:

1. Rail noise levels have been sourced from Table 54 and 55 of the report *Environmental Noise Impact Assessment – Proposed Extension of Existing Rail Line and Extension to Product Dryer Building 3 & 4 (Rev E)* (Day Design, 2025). Conservatively, noise levels for existing rolling stock have been used.
2. A 5 dB correction has been applied at all receivers as described in Section 6.2.1.2.

Table E.2 Predicted cumulative noise levels of the site – noise enhancing weather conditions

Receiver ID	Address	EPL noise limit (dBA)	Rail noise (MOD25)[1]	Predicted noise level (dBA)[2,3]		Noise level is below design goal?			
				Cumulative	Cumulative ANYC	Cumulative (current, rail and MOD31)		Cumulative ANYC (current, approved but not yet constructed, rail and MOD31)	
						Without LFN penalty	With LFN penalty	Without LFN penalty	With LFN penalty
R1	135 Terara Road, Terara	38	29	47 (42 + 5)	47 (42 + 5)	Exceeds 4 dB	Exceeds 4 dB	Exceeds 9 dB	Exceeds 9 dB
R2	45 Ferry Lane, Terara	38	27	53 (48 + 5)	53 (48 + 5)	Exceeds 10 dB	Exceeds 10 dB	Exceeds 15 dB	Exceeds 15 dB
R3	41A Meroo Street, Bomaderry	42	45	55 (50 + 5)	55 (50 + 5)	Exceeds 8 dB	Exceeds 8 dB	Exceeds 13 dB	Exceeds 13 dB
R4	1-3 Meroo Street, Bomaderry	42	45	55 (50 + 5)	55 (50 + 5)	Exceeds 8 dB	Exceeds 8 dB	Exceeds 13 dB	Exceeds 13 dB
R5	Burraga Island	40	37	53 (48 + 5)	53 (48 + 5)	Exceeds 8 dB	Exceeds 8 dB	Exceeds 13 dB	Exceeds 13 dB
R6	39 Hanigans Lane, Bolong	40	31	44 (39 + 5)	45 (40 + 5)	Yes	Yes	Exceeds 4 dB	Exceeds 5 dB
R7	19 Meroo Street, Bomaderry	42	45	54 (49 + 5)	54 (49 + 5)	Exceeds 7 dB	Exceeds 7 dB	Exceeds 12 dB	Exceeds 12 dB
R8	1 Nobblers Lane, Terara	38	29	47 (42 + 5)	47 (42 + 5)	Exceeds 4 dB	Exceeds 4 dB	Exceeds 9 dB	Exceeds 9 dB
R9	2 Tarawara Street, Bomaderry	42	45	55 (50 + 5)	55 (50 + 5)	Exceeds 8 dB	Exceeds 8 dB	Exceeds 13 dB	Exceeds 13 dB
R10	10 Tarawara Street, Bomaderry	40	37	50 (45 + 5)	50 (45 + 5)	Exceeds 5 dB	Exceeds 5 dB	Exceeds 10 dB	Exceeds 10 dB
R11	17 Coomea Street, Bomaderry	40	37	51 (46 + 5)	52 (47 + 5)	Exceeds 6 dB	Exceeds 7 dB	Exceeds 11 dB	Exceeds 12 dB
R12	6 Birriley Street, Bomaderry	40	37	50 (45 + 5)	50 (45 + 5)	Exceeds 5 dB	Exceeds 5 dB	Exceeds 10 dB	Exceeds 10 dB
R13	1 Coomea Street, Bomaderry	40	37	51 (46 + 5)	51 (46 + 5)	Exceeds 6 dB	Exceeds 6 dB	Exceeds 11 dB	Exceeds 11 dB

Notes:

1. Rail noise levels have been sourced from Table 54 and 55 of the report *Environmental Noise Impact Assessment – Proposed Extension of Existing Rail Line and Extension to Product Dryer Building 3 & 4 (Rev E)* (Day Design, 2025). Conservatively, noise levels for existing rolling stock have been used.
2. A 5 dB correction has been applied at all receivers as described in Section 6.2.1.2.