North Tuncurry Development Project (NTDP)

Existing Conditions, Opportunities and Constraints.

Prepared for: Landcom
20 February 2019
MAC180772RP1

Muller Acoustic Consulting

Road Noise Assessment for the North Tuncurry Development Project (NTDP)

Existing Conditions, Opportunities and Constraints Report

Road Noise Assessment Report

Summary

Objectives

This assessment was prepared primarily to evaluate potential road noise intrusion from The Lakes Way to the North Tuncurry Development Project (NTDP) site.

The secondary purpose of the assessment was to complete a review of potential construction noise impacts on the surrounding community that may arise from future construction activities within the NTDP.

Technical Notes

This report forms part of an addendum to the original project (originally completed in 2014 by EMM) (the 'historic assessment'). This report addresses policy and guideline changes since the completion of the historic assessment report and also compares historic noise monitoring with contemporary noise monitoring levels. The results of which were deemed to remain consistent and representative for the project.

Methods and findings

The assessment has been completed in accordance with the following policies and guidelines:

- Department of Planning (DoP) 2008, *Development Near Rail Corridors and Busy Roads Interim Guideline*;
- NSW Environment Protection Authority (EPA) 2011, *Road Noise Policy* (RNP);
- Department of Environment and Climate Change (DECC) 2009*, Interim Construction Noise Guideline* (ICNG);
- Australian Standard AS3671-1989 : Acoustics – Road traffic noise intrusion- Building siting and construction; and
- Environment Protection Authority (EPA) 2017, *NSW Noise Policy for Industry* (NPI).

A historic noise model (EMM, 2014) was established to predict noise intrusion from road traffic to the NTDP site with reference to the proposed Master Plan footprint provided by Landcom. The model was calibrated against four monitoring reference locations on the NTDP site within close proximity to The Lakes Way.

Existing and predicted future road traffic noise was identified to satisfy relevant guideline criteria for residential land use when compared against the proposed Master Plan footprint. Furthermore, proposed industrial zones proposed for construction adjacent to The Lakes Way are expected to satisfy criteria outlined in AS3671.

Construction noise from potential future works were assessed and identified to have the potential to generate elevated noise levels at neighbouring receptors and therefore would need to be managed.

Conclusions

A quantitative assessment of road noise has been completed for the NTDP. Residences constructed within the proposed Master Plan footprint would satisfy the relevant noise criteria.

Contents

1. Objectives of assessment

At a glance

Landcom is proposing to rezone the North Tuncurry Development Project (NTDP) site. The primary purpose of this assessment is to evaluate if road noise intrusion from The Lakes Way has the potential to adversely affect areas within the subdivision. The secondary purpose of the assessment is to complete a review of potential construction noise impacts on the surrounding community that may arise from future construction activities within the NTDP.

Muller Acoustic Consulting Pty Ltd has been commissioned by Landcom to complete a review of and update the historic road traffic noise intrusion assessment for the proposed NTDP. The noise assessment has been prepared to assist in development of the proposed Master Plan for the site.

This report addresses several noise related issues associated with the project including:

- quantifying the existing ambient environment within the NTDP;
- predicting noise levels within the NTDP site for current and future traffic volumes;
- review noise mitigation options to reduce traffic noise intrusion to the site, where required; and
- provide a concise assessment of construction noise levels associated with the establishment of the site.

2. Site and Project Descriptions

At a glance

The North Tuncurry Development Project (the Project) will be carried out on a 615 ha parcel of Crown Land on the Mid North Coast of NSW. Landcom and the Crown Lands Branch of NSW Trade and Investment (Lands) are facilitating rezoning of the land.

Background

The NTDP site is approximately 615 ha of coastal heathland located between The Lakes Way and Nine Mile Beach in the Great Lakes Local Government Area (LGA).

The site is Crown land under the control of the NSW Department of Primary Industry (DPI).

A Project Delivery Agreement (PDA) has been signed by Landcom, which will facilitate development of the site for a range of land uses including residential, open space, retail and employment.

The Site

Tuncurry is located in the Great Lakes LGA on the entrance to Wallis Lake, approximately 320 km north of Sydney. Figure 1 presents the proposed locality plan that includes the proposed Master Plan footprint. The site is located on the eastern side of The Lakes Way, directly to the north of, and adjoining, the Tuncurry town centre. It is an irregular shaped waterfront parcel of land situated on a peninsula that has been created by the Wallamba River to the west. The site enjoys an ocean beach frontage of more than 4.5 km and has a frontage to The Lakes Way and Northern Parkway.

The Site's Context

The site is located adjacent to (and north of) the Tuncurry town centre. Existing development and land uses surrounding the site include the Darawank Nature Reserve comprising undeveloped heath and coastal scrub to the north, Nine Mile Beach and the Pacific Ocean to the east, The Lakes Way and low scale residential uses to the west, and educational and low scale residential properties, playing fields, club and cemetery to the south. The site is located approximately 3.5 km north of the Tuncurry-Forster twin towns, 160 km north of Newcastle CBD and 30 km south-east of Taree. Distance to the Pacific Highway is approximately 11 km via The Lakes Way and Failford Road.

The site has been earmarked as the priority new release area to address the regional housing needs of the Mid North Coast Region. Accordingly, the site presents a significant opportunity to provide residential dwellings and retail and employment activities within close proximity to existing infrastructure and established services. The introduction of retail and employment uses can be supported by the proposed residential uses envisaged for the site, which will be a key way of ensuring housing targets can be met by Great Lakes Council in the mid to long term. Given the undersupply of readily available residential land, large sites or land suitable for conversion in the area, the NTDP provides an excellent opportunity to meet a variety of housing typologies in demand.

The Project

Landcom are proposing to deliver a mixed use development on the site that meets the State Government's objectives to increase housing supply, provide community benefits and create jobs.

The Project specifically incorporates the following components:

- land use type and distribution;
- dwelling yield / density (approximately 2,123 dwellings);
- concept location of retail / commercial / industrial/ community floor space within the site;
- identification and location of open space and drainage, environmental conservation lands, and local active and passive recreation facilities;
- road network layout;
- utilities (including power, telecommunications and gas), infrastructure strategy, potable water strategy, sewer concept plan and water cycle management plan;
- location and dimensions of Bushfire Asset Protection Zones; and
- appropriate conservation of European and Aboriginal heritage located on the site.

A variety of housing types is proposed to be delivered. The range of densities will enable a variety of dwelling types, allow for social / demographic diversity and provide a proportion of dwellings at affordable price points. The proposed Master Plan also considers the location of retail and other employment generating uses predominantly at the southern end of the site, adjacent to the existing Tuncurry Township. Additional employment uses and eco-village facilities in the northern portion of the site are also proposed, subject to further investigations confirming site suitability.

The NTDP provides the opportunity for new localised retail facilities to service the new residential population. There is a clear opportunity to provide a high quality and aesthetically pleasing development which connects to and interfaces with the existing development to the south and the foreshore to the east. The NTDP provides an excellent place-making opportunity on a key, well-located site where demand for additional dwelling stock and mix of residential types is relatively high.

It is proposed to develop the site progressively over a number of stages. The proposed Master Plan address the staging and delivery of the overall development having regard to the progressive delivery of necessary infrastructure, services and facilities and market demand.

It is noted that under the proposed Master Plan, residential lots within the northern section of the NTDP, which has a speed limit of 100 km/h, would be located between 250 m to 370 m from the road alignment. Residential lots within the southern section, which has a speed limit of 50 km/h, buildings would be located 215 m to 280 m from the road alignment.

3. Site analysis

At a glance

Monitoring of existing ambient noise levels was completed in 2013 and again in 2018 to establish the level and character of the existing noise environment for the site. This is used to determine the noise levels at potential future residential locations in the NTDP, and is also used in calibrating the noise model. The 2018 monitoring data identified that noise levels changed less than 2dB hence historic modelling results remain representative for the project site.

Background noise assessment

Ambient noise levels at the site were re-assessed by MAC and included attended monitoring and unattended noise logging.

Unattended logging

Unattended noise logging was completed from 12 December 2018 to 21 December 2018 inclusive, with attended 15-minute noise surveys completed at logger deployment on 12 December 2018. The primary intention of the attended monitoring is to qualify the noise sources and characteristics in the area, while the noise logging is intended to quantify these levels and determine their consistency over an appropriate period.

Unattended monitoring was competed using Svantek Type 1 Sound and Vibration Analysers. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ±0.5dBA. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates. Data affected by adverse meteorological conditions have been excluded from the results in accordance with methodologies provided in Fact Sheet A4 of the NPI. The GPS coordinates of the installation positions of the loggers are provided in Table 1.

Table 1 Noise logging coordinates

Logger location	X Coordinates	Y Coordinates	Distance to The Lakes Way (m)[2]
1	452019	6441998	64
2	452003	6443278	90
3	452057	6442705	76
4	452168	6442676	190

Notes: 1. All coordinates are presented as Map Grid Australia, Zone 56.
2. Measurement to centre of The Lakes Way.

The results of the survey confirmed that The Lakes Way traffic is the dominant source in the area. A summary of the logged noise measurements is shown in Table 2. Logger charts for all monitoring locations are shown in Appendix A, while Figure 1 shows the master plan for the project.

Figure 1 - North Tuncurry Master Plan

Table 2 Noise logging results

Location	Day RBL dB(A)	Evening RBL dB(A)	Night RBL dB(A)	Day $L_{eq(15\text{-}hr)}$, dB(A)	Night $L_{eq(9\text{-}hr)}$, dB(A)
Logger 1	44	40	37	52	45
Logger 2	46	40	36	55	47
Logger 3	42	39	35	51	46
Logger 4	39	39	36	53	43

Attended measurements

Svantek 971 sound analysers were used to conduct 15-minute measurements, record octave frequency and statistical noise indices. The meter was calibrated before and at the completion of the survey. The instruments were within NATA laboratory calibration period during the time of these readings and certificates can be made available on request.

The results of the survey confirmed that The Lakes Way traffic is the dominant source in the area. A summary of the measured noise level is shown in Table 3.

Table 3 Attended noise monitoring

Location	Start Time (hrs)	Noise descriptor (dB(A) ref 20µPa)		Observations
		$LA_{eq(15\text{-}min)}$	$LA_{90(15\text{-}min)}$	
Logger 1	11:35	45	41	Traffic dominant, birds audible
Logger 2	13:39	51	46	Traffic dominant, birds occasionally and ocean noise just perceptible
Logger 3	12:24	47	40	Traffic dominant, birds audible
Logger 4	12:53	42	39	Traffic dominant, birds and wind audible, ocean noise just perceptible

4. Regulatory context

At a glance

The assessment has been completed in accordance with the following policies and guidelines:

- Department of Planning (DoP) 2008, *Development Near Rail Corridors and Busy Roads Interim Guideline;*

- NSW Environment Protection Authority (EPA) 2011, *Road Noise Policy* (RNP);

- Department of Environment and Climate Change (DECC) 2009, *Interim Construction Noise Guideline (ICNG); and*

- EPA 2017, *NSW Noise Policy for Industry (NPI).*

Development Near Rail Corridors and Busy Roads Interim Guideline

Guidance for the specification of internal noise levels of habitable rooms is prescribed in DoP's Development near Rail Corridors and Busy Roads – Interim Guidelines (2008) ('the guideline'). This guideline outlines internal criterion levels expressed in Clause 102 (Road):

"If the development is for the purpose of a building for residential use, the consent authority must be satisfied that appropriate measures will be taken to ensure that the following L_{Aeq} levels are not exceeded:

- *In any bedroom in the building : 35 dB(A) at any time 10pm–7am; and*
- *Anywhere else in the building (other than a garage, kitchen, bathroom or hallway): 40 dB(A) at any time."*

Table 3.1 of the guideline clarifies that the noise criteria above are to be determined as an Leq,15hr for the daytime and Leq,9hr for the night time period.

The guideline assists in the planning, design and assessment of development in, or adjacent to, rail corridors and busy roads and supports the State Environmental Planning Policy (SEPP) for infrastructure (infrastructure SEPP). The guidelines are mandatory for residential developments proposed adjacent to busy roads with an Annual Average Daily Traffic (AADT) of greater than 40,000 vehicles. The Lakes Way has an AADT volume of less than 12,000 (recorded at the Roads and Maritime Service (RMS) traffic counting station 09.405 (AECOM, 2013)). To validate that these levels remain relevant for this assessment, a comparison of AADT levels has been completed against data provided via the updated Traffic Management and Accessibility Report (TMA) (AECOM, 2019). The TMA report identifies that the background traffic growth for the project area is 0.9 percent per annum. Therefore, this growth is negligible with respect to changes in noise levels and hence validates the insignificant changes to measured road traffic noise levels for this assessment. Notwithstanding, the guideline has been adopted for this assessment as its methodologies and screening tests are considered good practice.

Section 5.3.2 of the guideline provides screening tests for single and dual occupancy dwellings. The screening tests provide varying categories of noise control treatments for dwellings taking into consideration distance to the road and amount of traffic. The guideline presents two screen tests for a 60/70 km/hr and 100/110 km/hr zones that are reproduced in Figure 2 and Figure 3 respectively. The screening tests have been adopted in this assessment to provide guidance on building categories for the NTDP.

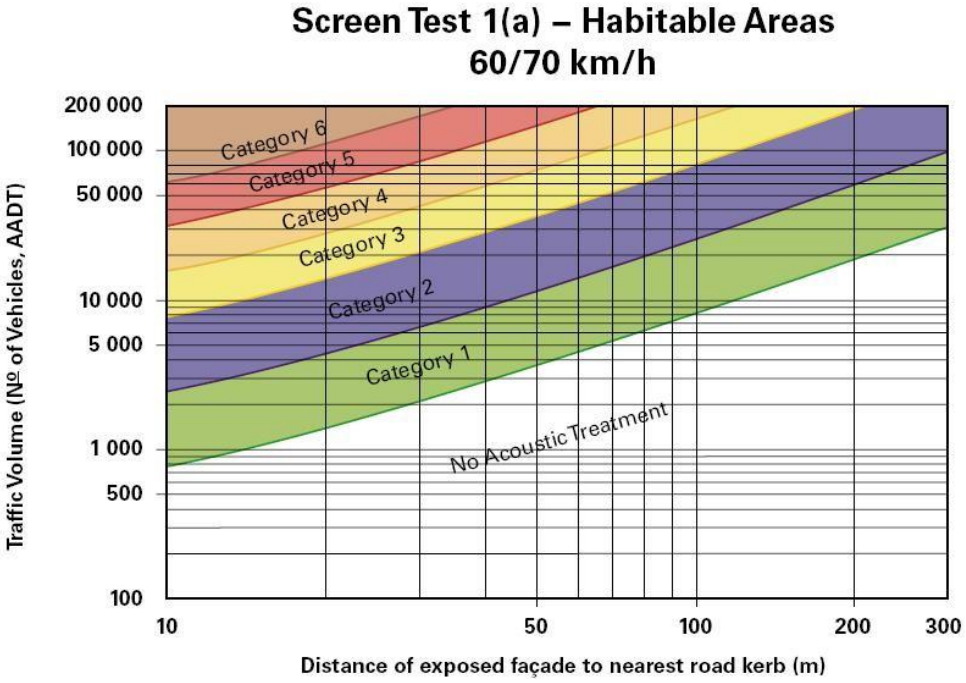


Figure 2 Screen test for habitable areas of single/dual occupancy dwellings adjacent to 60/70 km/hr zones.

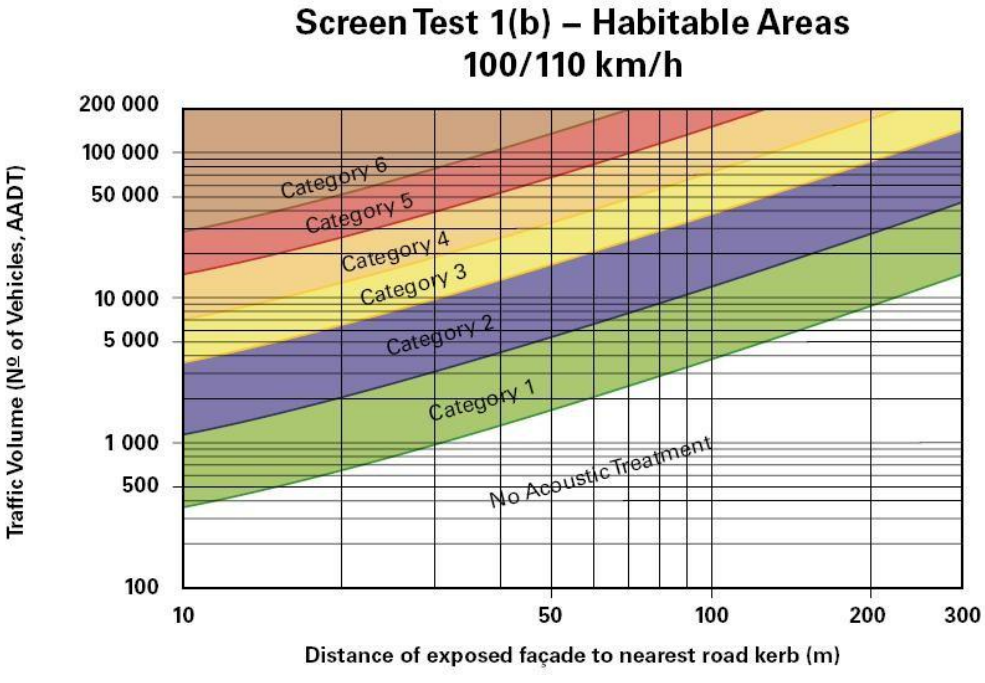


Figure 3 Screen test for habitable areas of single/dual occupancy dwellings adjacent to 100/110 km/hr zones.

Based on an AADT of 12,000 vehicles and the distance from the northern and southern sections of the NTDP to The Lakes Way, buildings located within the proposed Master Plan would not require noise control treatment based on the *Development near Rail Corridors and Busy Roads – Interim Guidelines* (2008).

Road Noise Policy

The NSW EPA's *Road Noise Policy* (RNP) (EPA 2011) has been reviewed and is designed to quantify the noise intrusion from the road network on existing receptors. As this proposal is currently in the rezoning phase with no existing receptors, the RNP criteria are not applicable to this assessment.

Industrial receptors

Australian Standard AS3671-1989 : Acoustics – *Road traffic noise intrusion- Building siting and construction* provides screening criteria for industrial receivers adjacent to roads. The standard recommends that for industrial buildings exposed to road traffic noise levels of ≤60 dB(A), category 1 construction (or standard construction) is required.

Construction

Construction noise would be assessed in accordance with the Department of Environment and Climate Change's (DECC 2009) *Interim Construction Noise Guideline* (ICNG). The ICNG provides two methodologies to assess construction noise emissions:

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

A quantitative assessment requires noise emission predictions from construction activities at the nearest receptors, while the qualitative assessment is a simplified approach that relies more on noise management strategies.

This study has adopted a quantitative assessment approach. The qualitative aspects of the assessment include identification of receptors, description of works involved and proposed management measures that include a complaints handling procedure.

Table 4 provides noise management levels for residential receptors reproduced from the ICNG.

Table 4 Construction Noise Criteria for Residences

Time of day	Management level $LA_{eq(15\text{-}min)}$	Application
Recommended standard hours: Monday to Friday 7 am to 6 pm, Saturday 8 am to 1 pm, no work on Sundays or public holidays.	Noise-affected RBL + 10 dB.	The noise-affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $LA_{eq(15\text{-}min)}$ is greater than the noise-affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A).	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: i) times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid- afternoon for works near residences); ii) 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 dB.	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise- affected level, the proponent should negotiate with the community. • For guidance on negotiating agreements see Section 7.2.2 of the ICNG.

Source: ICNG (DECC 2009)

Table 5 is an extract from the ICNG and provides noise management levels for sensitive land uses (non-residential receptors) for standard and out of hours periods.

Table 5 Noise at sensitive land uses (other than residences)

Land use	Management level, $LA_{eq(15\text{-}min)}$ (applies when properties are being used)
Classrooms at schools and other educational institutions.	Internal noise level 45dB(A).
Hospital wards and operating theatres.	Internal noise level 45dB(A).
Places of worship.	Internal noise level 45dB(A).
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion).	External noise level 65dB(A).
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation).	External noise level 60dB(A).
Community centres.	Depends on the intended use of the centre. Refer to the recommended 'maximum' internal levels in AS2107 for specific uses.

Source: ICNG (DECC 2009)

Section 2.2 of the ICNG recommends the following standard hours for construction where noise from these activities is audible at residential premises:

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

The ICNG recommends that noise levels at receptors as a result of construction activities during standard working hours are limited to an $L_{Aeq(15\text{-}min)}$ of RBL+10 dB(A) with a highly noise-affected maximum of 75 dB(A). The NTDP specific construction noise criteria for recommended standard hours based on the lowest measured RBL of 39 dB(A) (see Section 3 for derived RBLs), is 49 dB(A) $L_{Aeq(15\text{-}min)}$. Furthermore, it is recommended that outside of these standard hours, noise at receptors is to be limited to an $L_{Aeq(15\text{-}min)}$ of RBL+5 dB(A), and only where out-of-hours works can be strongly justified.

5. Methods and results

At a glance

This section provides the adopted methodologies and results for the road traffic noise modelling and construction noise assessments.

Road noise modelling methodology

A number of methods are available for predicting road traffic noise. The RNP recommends the use of the *Calculation of Road Traffic Noise* (CORTN) algorithm, as developed by the UK Department of Transport. In summary, this method incorporates consideration of traffic flow volume, average speed, percentage of heavy vehicles, and road gradient to establish noise source strength, and includes attenuation via spherical spreading (or cylindrical in the case of a line source such as a road), soft ground, atmospheric absorption and screening from buildings or barriers.

Brüel and Kjær Predictor noise modelling software (version 8.14) was used in the historic assessment to develop a noise prediction model based on the above method.

Traffic statistics, including AADT and heavy vehicle volumes for the section of The Lakes Way were supplied by AECOM (2013). Data used was for station 09.405, 200 m north of Chapmans Road on The Lakes Way. The AADT from station 09.405 assessment does not contain hourly distributions, which is required for noise modelling. Therefore, hourly flow distributions for the Wallis Lake Bridge (AECOM, 2013) were assumed to be consistent with Chapmans Road which are 94.2 % day time traffic and 5.8 % night time traffic.

The traffic volumes were projected to 2023 assuming a 0.9% growth rate (AECOM, 2013). Heavy vehicle percentages (HVP) were not available and were therefore assumed at five percent for day and 20 percent for night. Notwithstanding, historic noise model results show accurate correlation when calibrated against 2018 in field measurements and identify that the adopted HVP are indicative for The Lakes Way. Table 6 presents a summary of AADT volumes adopted in the noise model assessment.

Table 6 Modelled traffic volumes – The Lakes Way (station 09.405)

Period	AADT	Percentage Heavy Vehicles
	2013	
Day	10,997	5
Night	673	20
	2023	
Day	12,028	5
Night	737	20

Construction noise modelling methodology

Historic noise calculations were completed to determine the potential range in noise levels associated with construction for the nearest receptors to the proposed site, where clearing and site establishment works may occur.

The nearest residential receptors are situated to the west of The Lakes Way, with the near point to the proposed Master Plan footprint approximately 50 m from Manning Street and The Lakes Way. Other receptors are the Great Lakes College Campus and TAFE approximately 70 m to the south of the NTDP proposed Master Plan in the Northern Parkway.

The construction noise impact assessment has adopted the items of equipment presented in Table 7 and associated noise emission data. The items have been reviewed and are considered indicative of items of plant used for clearing works considering the preliminary stages of this assessment.

Table 7 Sound power level of equipment

Equipment	Number of plant	Representative $L_{eq(15\text{-}min)}$ Sound power level, dB(A)
Road truck	2	96
Dozer	1	111
Loaders	1	105
Excavator	1	107

Road noise modelling results

Road noise from The Lakes Way was modelled to four reference locations, in order to calibrate the model to current conditions. Additionally, predictions for a +10 year scenario (2023) were completed with traffic volumes projected from 2013 measurements to 2023 assuming a 0.9% growth rate in background traffic levels. This is not strictly required for this assessment, however is considered good practice and has been completed to raise any potential future constraints.

Table 8 presents a comparison of modelled day noise levels against measured day levels for the four reference locations. The data correlates well for the three closest logging locations as is discussed later.

Table 8 Comparison of modelled versus measured daytime noise levels

Year/location	Modelled $L_{eq-15hr}$, dB(A)	Measured $L_{eq-15hr}$, dB(A)	Difference, dB(A)
	2013		
Logger 1	54.2	52.9 (52)	1.1
Logger 2	52.83	52.5 (55)	0.3
Logger 3	51.9	51.1 (51)	0.8
Logger 4	47.26	50.5 (53)	-3.2
	2023		
Logger 1	54.4	N/A	N/A
Logger 2	53.3	N/A	N/A
Logger 3	52.3	N/A	N/A
Logger 4	47.7	N/A	N/A

Notes: *1. All results presented are 'free field' and assume single storey dwelling.*
2. Bracketed values indicate 2018 noise monitoring data.

Table 9 presents a comparison of modelled versus measured night time noise levels for the four reference locations.

Table 9 Comparison of modelled versus measured night time noise levels

Year/location	Modelled L_{eq-9hr}, dB(A)	Measured dB(A)L_{eq-9hr}	Difference, dB(A)
	2013		
Logger 1	46.1	46.8 (45)	-0.7
Logger 2	46.5	47.7 (47)	-1.2
Logger 3	44.6	45.0 (46)	-0.4
Logger 4	39.9	44.5 (43)	-4.6
	2023		
Logger 1	46.6	N/A	N/A
Logger 2	47.0	N/A	N/A
Logger 3	45.1	N/A	N/A
Logger 4	40.4	N/A	N/A

Notes: *1. All results presented are 'free field' and assume single storey dwelling.*
2. Bracketed values indicate 2018 noise monitoring data.

6. Assessment

At a glance

This section provides discussion on the modelled results and assessed levels taking into consideration the relevant criteria.

Figure 4 to Figure 7 present the $L_{Aeq\ (15\text{-}hr)}$ and $L_{Aeq\ (9\text{-}hr)}$ road traffic noise contours. A comparison using the noise model outputs was made at each of the noise logger locations, in order to calibrate the model to current conditions.

Generally, the modelled levels correlate with measured levels, with the exception of Logger 4, where ambient noise sources unrelated to traffic elevate levels, particularly at night. Of the four loggers, Location 4 is furthest from The Lakes Way, therefore non-road noise sources are more likely to influence measured data.

Measured and predicted noise levels indicate that the varying speed limits on The Lakes Way influence received noise levels within the NTDP, essentially creating two different zones of affectation within the NTDP.

The assessment has been analysed taking into consideration the two speed zones and compares internal results against the criterion for a windows open scenario.

Figure 4 - 2013 Daytime LAeq(15hr) - Traffic Noise Levels

Muller Acoustic Consulting Pty Ltd

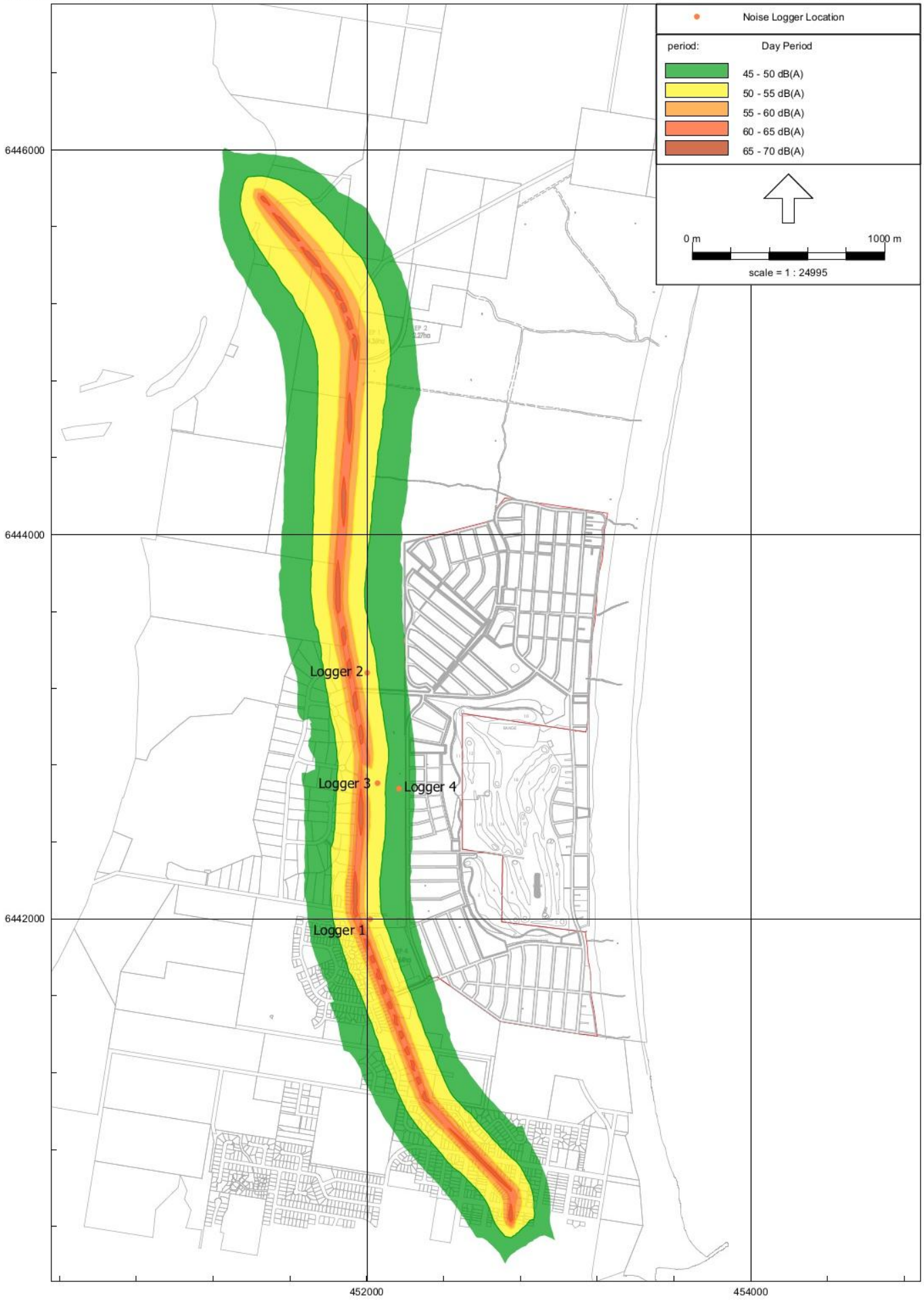


Figure 5 - 2013 Night LAeq(9hr) - Traffic Noise Levels

Muller Acoustic Consulting Pty Ltd

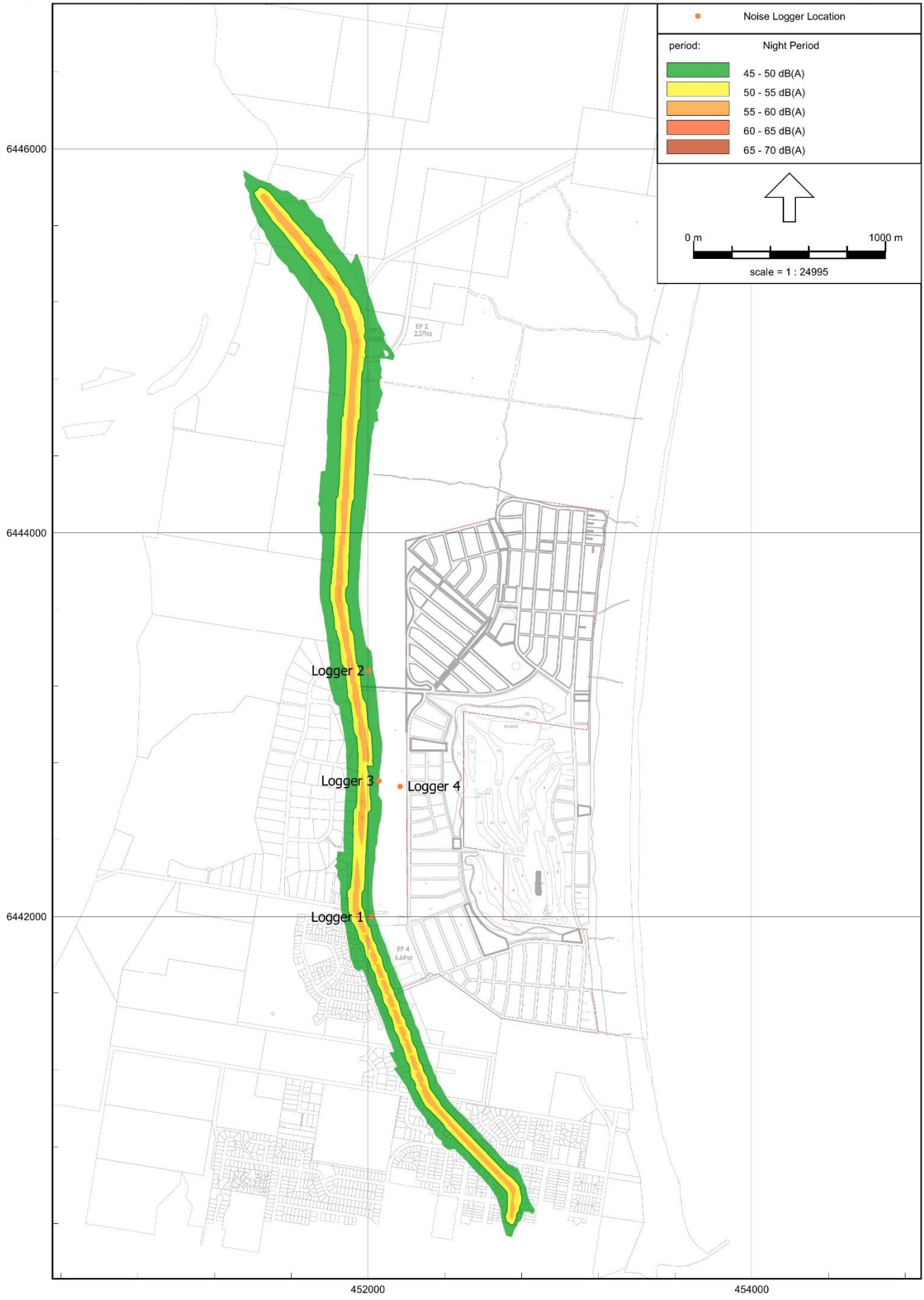


Figure 6 - 2023 Daytime LAeq(15hr) - Traffic Noise Levels

Muller Acoustic Consulting Pty Ltd

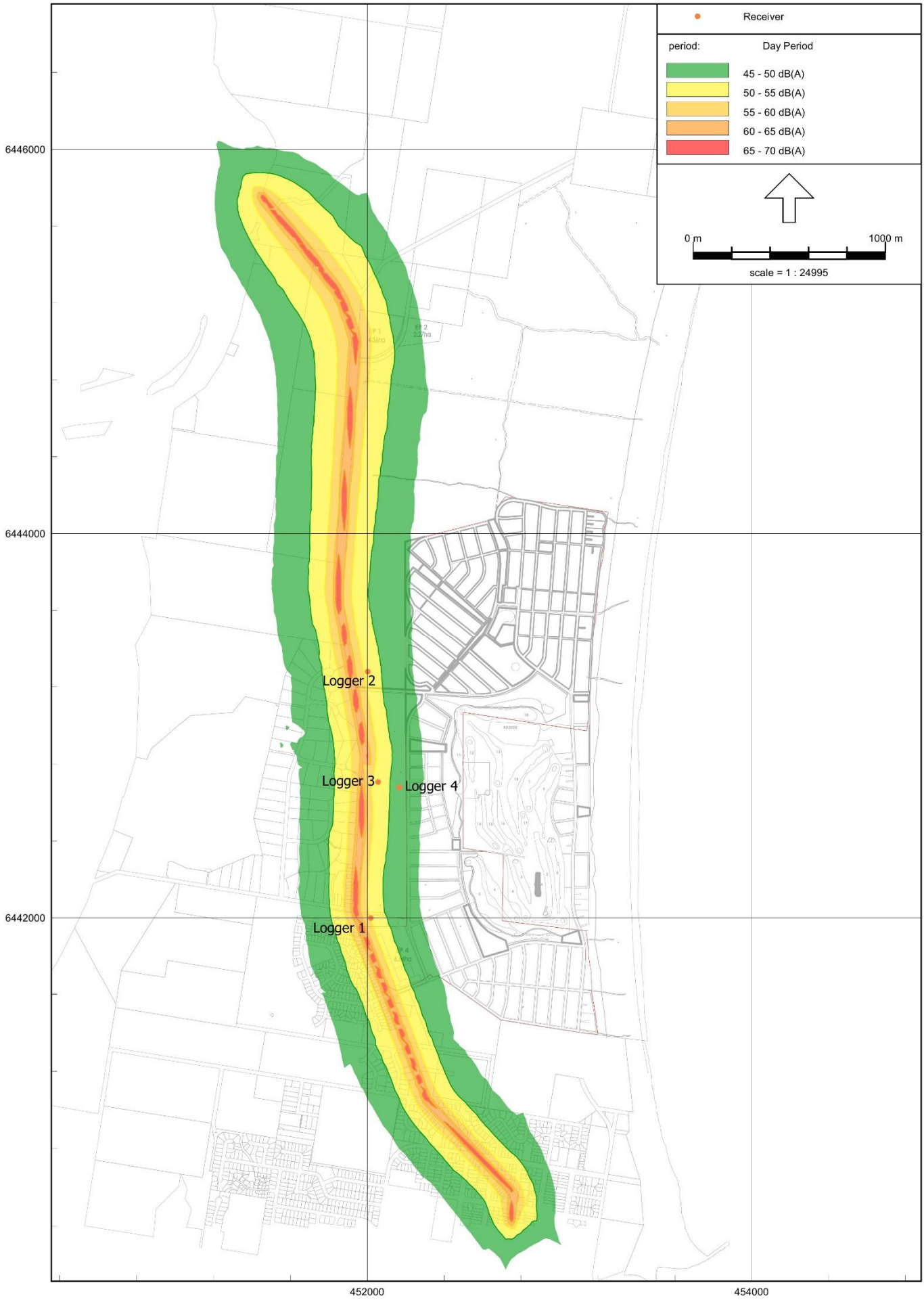
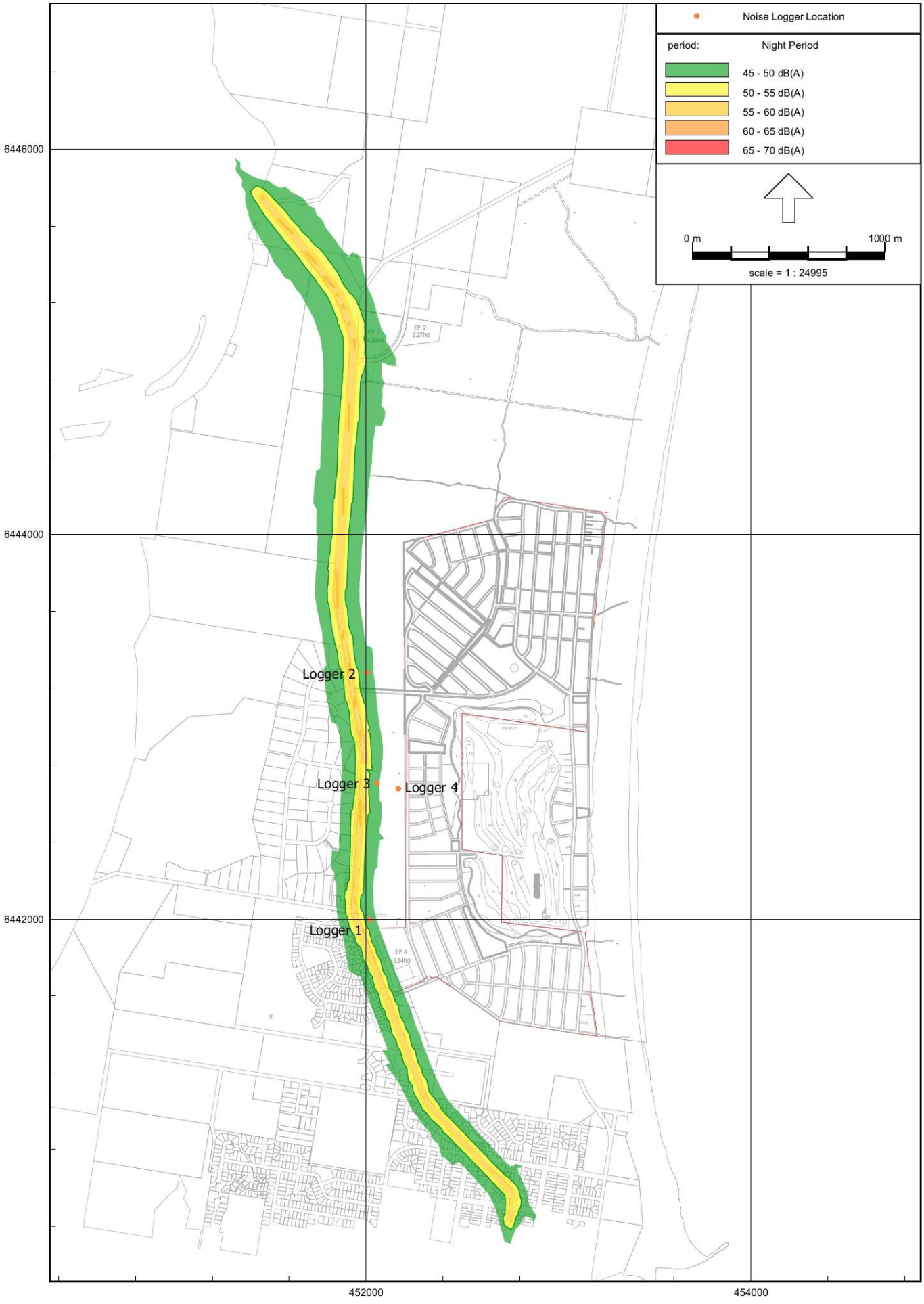


Figure 7 - 2023 Night LAeq(9hr) - Traffic Noise Levels

Muller Acoustic Consulting Pty Ltd



Windows open scenario

Assuming the windows open scenario, where a 10 dB reduction from external to internal would be achieved, findings are summarised in Table 10.

Table 10 Distance to compliance for NTDP – windows open scenario

Year	Section of NTDP / Speed limit	Distance required from The Lakes Way to achieve compliance with criteria (m)
2013	Northern section – 100 km/h	Day – 150 m Night – 100 m
2013	Southern section – 50 km/h	Day – 75 m Night – 50 m
2023	Northern section – 100 km/h	Day – 180 m Night – 110 m
2023	Southern section – 50 km/h	Day – 90 m Night – 65 m

It is noted that under the proposed Master Plan, buildings in the northern section of the NTDP would be located between 250 m to 370 m from the road alignment, and the southern section 215 m to 280 m from the road alignment.

In summary for the 2013 scenario, dwellings of standard construction materials could be constructed within the proposed Master Plan footprint at a perpendicular distance of 150 m or greater from the northern section of The Lakes Way and satisfy the relevant noise criteria.

For the southern section of The Lakes Way, the DoP criteria would be satisfied at a perpendicular distance of 75 m.

Based on these results it is considered that the dwellings to be constructed in the northern and southern sections of The Lakes Way are located at a sufficient distance that road noise levels from The Lakes Way will satisfy the relevant criteria for both 2013 and 2023.

It is noted that the north-eastern and southern sections of the proposed Master Plan footprint are planned for industrial and business use and not residential use. It is anticipated that buildings in these sections would be of standard construction and therefore satisfy criteria presented in AS3671 for industrial buildings exposed to road traffic noise levels of ≤60 dB(A).

Windows closed scenario

Assuming the windows closed scenario, a minimum 20 dB reduction from external to internal would be achieved. Therefore, with windows closed, the distance from The Lakes Way to achieve compliance would be reduced further from the results in Table 10.

Construction

Noise modelling included the assessment of construction equipment operating at the near point to residential receptors in Manning Street and The Lakes Way (opposite the NTDP) for standard construction hours. Additionally, an assessment of emissions to the Lakes College Campus and TAFE approximately 70 m to the south of the proposed Master Plan footprint in the Northern Parkway was completed.

The anticipated maximum $L_{Aeq(15\text{-}min)}$ levels from construction work are presented in Table 11. The maximum noise level is expected when all plant operate simultaneously over one fifteen minute period.

Table 11 Construction noise impacts, standard construction hours

Receptor	Predicted worst case $L_{eq(15\text{-}min)}$ noise level, dB(A)	Standard hours criteria, $L_{eq(15\text{-}min)}$	Highly affected criterion, $L_{eq(15\text{-}min)}$
Manning Street and The Lakes Way receptors ~50m	71	50	75
Lakes College Campus / TAFE ~70m	58[1]	45[1]	N/A

Notes: 1. Internal levels.

Results of a noise assessment of construction activities identifies that the criteria for standard hours construction are not likely to be satisfied for the minimum offset distances to residential or educational receptors. Notwithstanding, the calculated levels are expected to remain below the highly affected residential noise criterion.

It is recommended that prior to clearing works a construction noise and vibration management plan be completed to quantify and manage impacts on the surrounding community.

7. Summary

At a glance

This section provides a review of opportunities and constraints based on the outcomes of the results, findings and recommendations for the assessment.

Constraints

Road noise

Measured and predicted noise levels indicate that the varying speed limits on The Lakes Way influence received noise levels within the NTDP, essentially creating two different zones of affectation.

Current traffic noise levels limit the potential positioning of dwellings to offset distances of:

- 150 m (limited by day period) from The Lakes Way for the Northern Section of the NTDP (100 km/hr zone) for an unmitigated (worst case) situation.

Residences constructed within the proposed Master Plan footprint (as shown) would satisfy the relevant noise criteria. Proposed industrial areas are expected to satisfy criteria outlined in AS3671.

Construction

Results of the construction noise assessment show that the criteria for standard hours construction are not likely to be satisfied for the minimum off set distances to residential or educational receptors. Notwithstanding, the calculated levels are expected to remain below the highly affected noise criterion.

It is recommended a detailed assessment for construction traffic noise and construction noise as part of future development applications is undertaken.

Opportunities

Road noise

The inclusion of a vegetation buffer between The Lakes Way and the proposed Master Plan footprint has provided additional noise attenuation for the proposal that sees the relevant criteria satisfied for all lots.

Construction

There is an opportunity to effectively mitigate and manage noise levels associated with construction and clearing works at NTDP. It is recommended that prior to clearing works, a detailed construction noise and vibration management plan be completed.

The main objective of the construction noise and vibration management plan would be to:

- ensure that as far as practicable construction activities meet construction noise and vibration goals across the allowed hours of operation; and

- implement reasonable and feasible best practice noise controls to minimise noise emissions and/or exposure duration at affected receptors where noise and vibration levels are above relevant goals.

Furthermore, any construction traffic noise and construction noise will be subject to detailed assessment as part of future development applications.

8. References

AECOM 2013, *Preliminary Transport Study of Existing Conditions, Opportunities and Constraints, Assessment Report*.

Australian Standard AS3671-1989 : *Acoustics – Road traffic noise intrusion- Building siting and construction*.

Department of Environment and Climate Change (DECC) 2009, *Interim Construction Noise Guideline* (ICNG).

NSW Environment Protection Authority (EPA) 2017, *Noise Policy for Industry* NSW (NPI).

Environmental Protection Authority (EPA) 2011, *Road Noise Policy* (RNP).

New South Wales Department of Planning (now DP&I) 2008, *Development Near Rail Corridors and Busy Roads – Interim Guideline*.

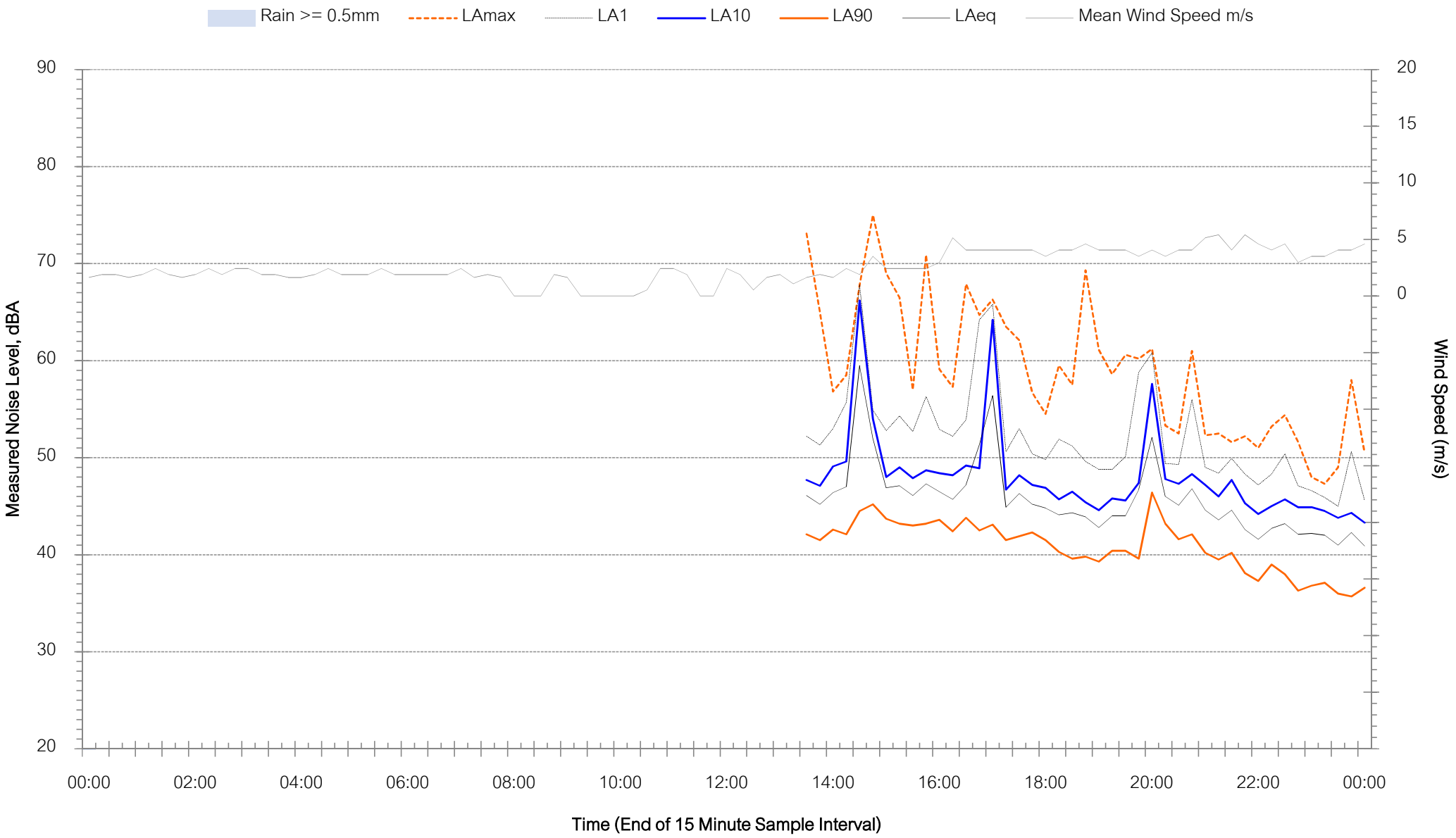
Road Noise Assessment – North Tuncurry Development Project (NTDP), EMGA Mitchell McLennan (2014).

Appendix A

Noise Logging Charts

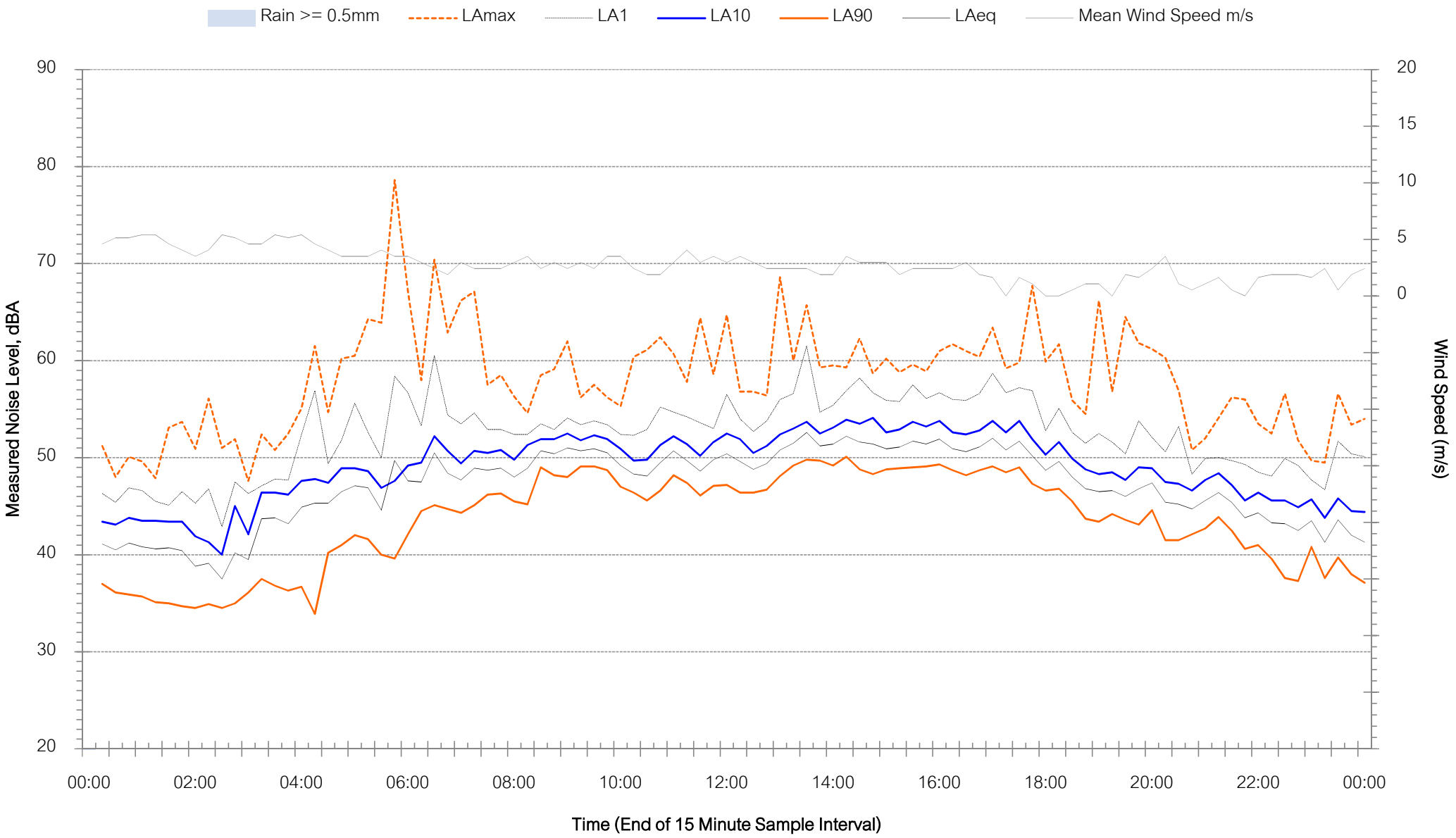
Background Noise Levels

Logger 1 - Wednesday 12 December 2018



Background Noise Levels

Logger 1 - Thursday 13 December 2018

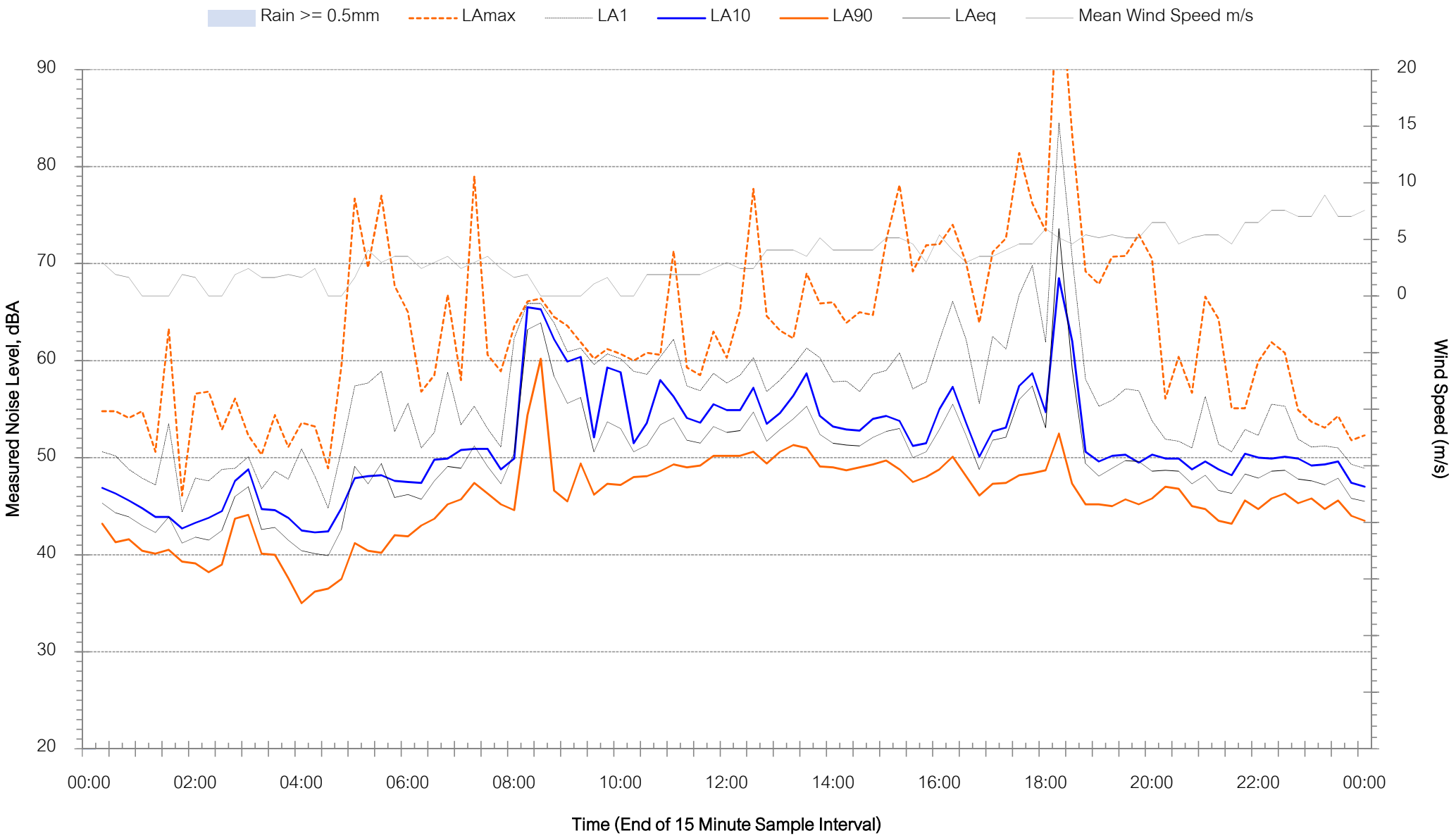


Background Noise Levels

Logger 1 - Friday 14 December 2018

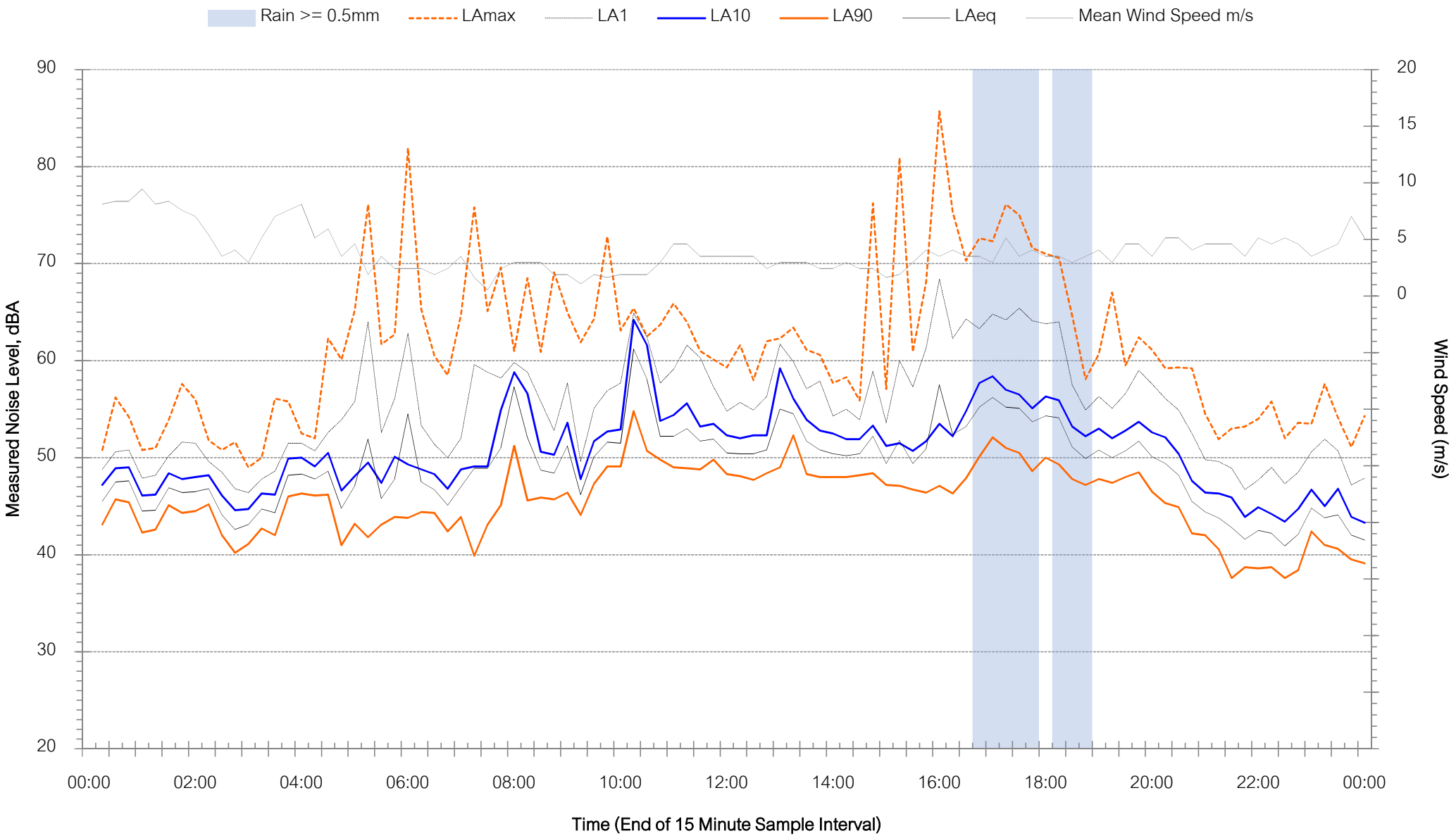
Background Noise Levels

Logger 1 - Saturday 15 December 2018



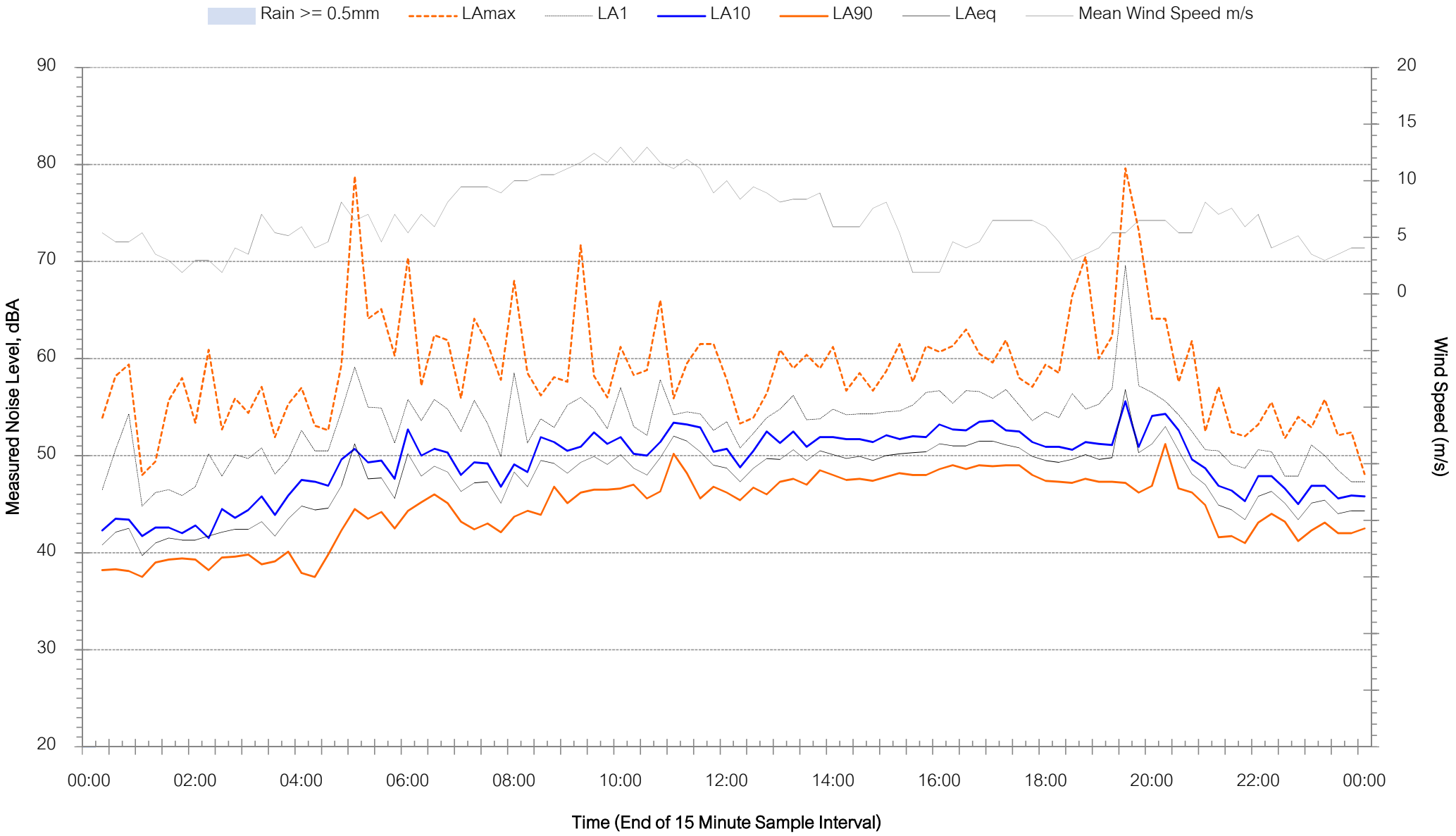
Background Noise Levels

Logger 1 - Sunday 16 December 2018



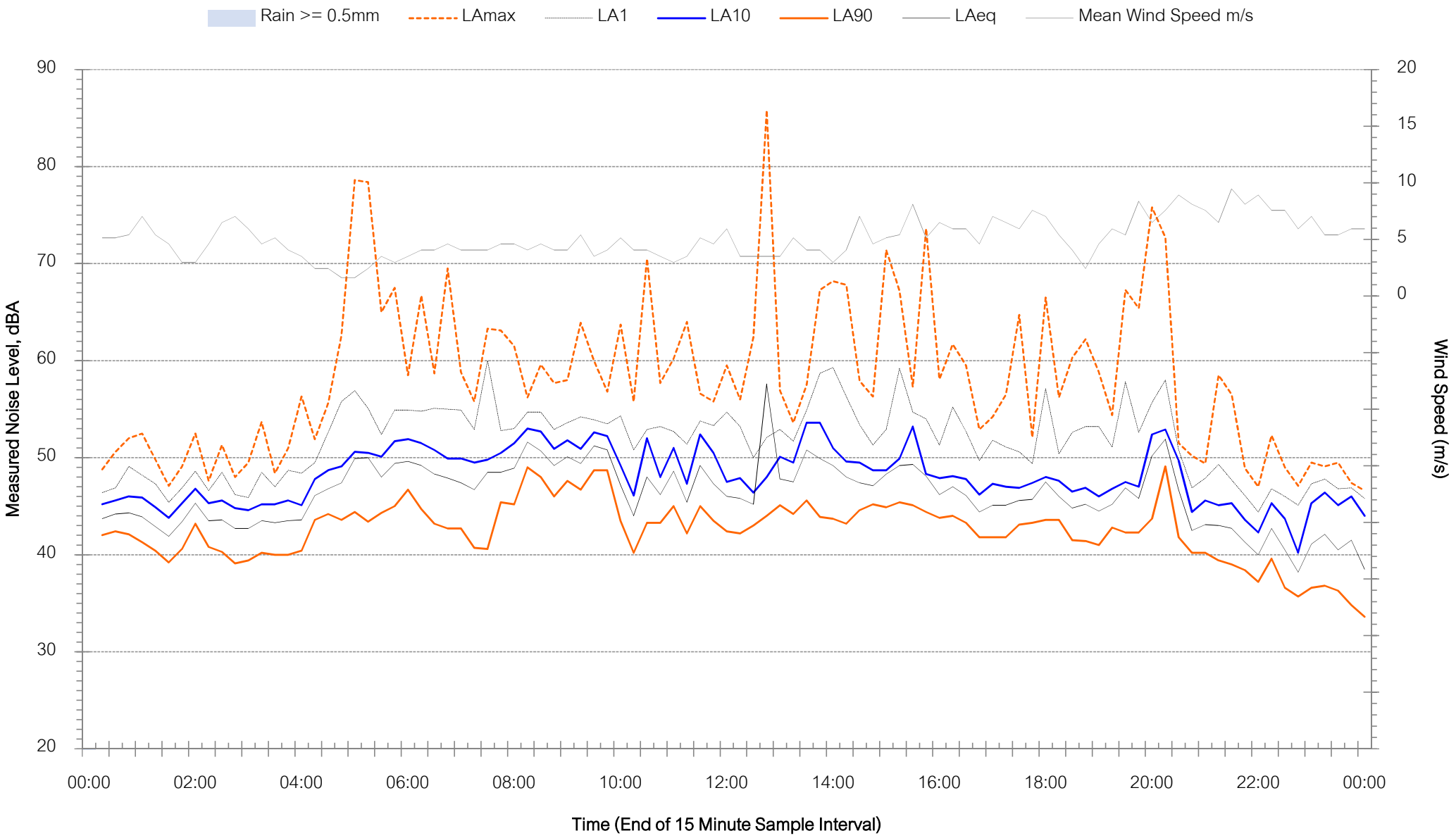
Background Noise Levels

Logger 1 - Monday 17 December 2018



Background Noise Levels

Logger 1 - Tuesday 18 December 2018



Background Noise Levels

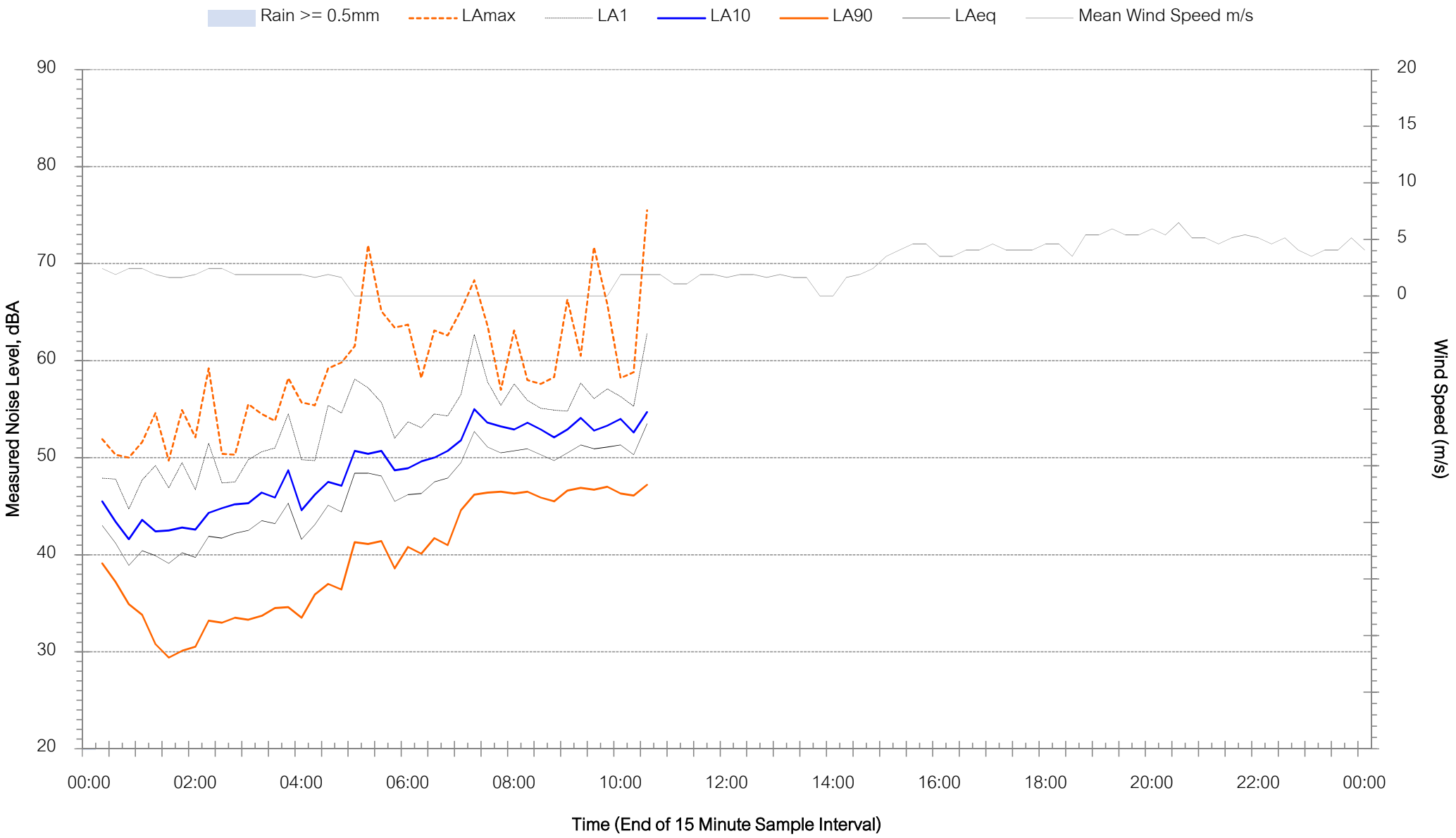
Logger 1 - Wednesday 19 December 2018

Background Noise Levels

Logger 1 - Thursday 20 December 2018

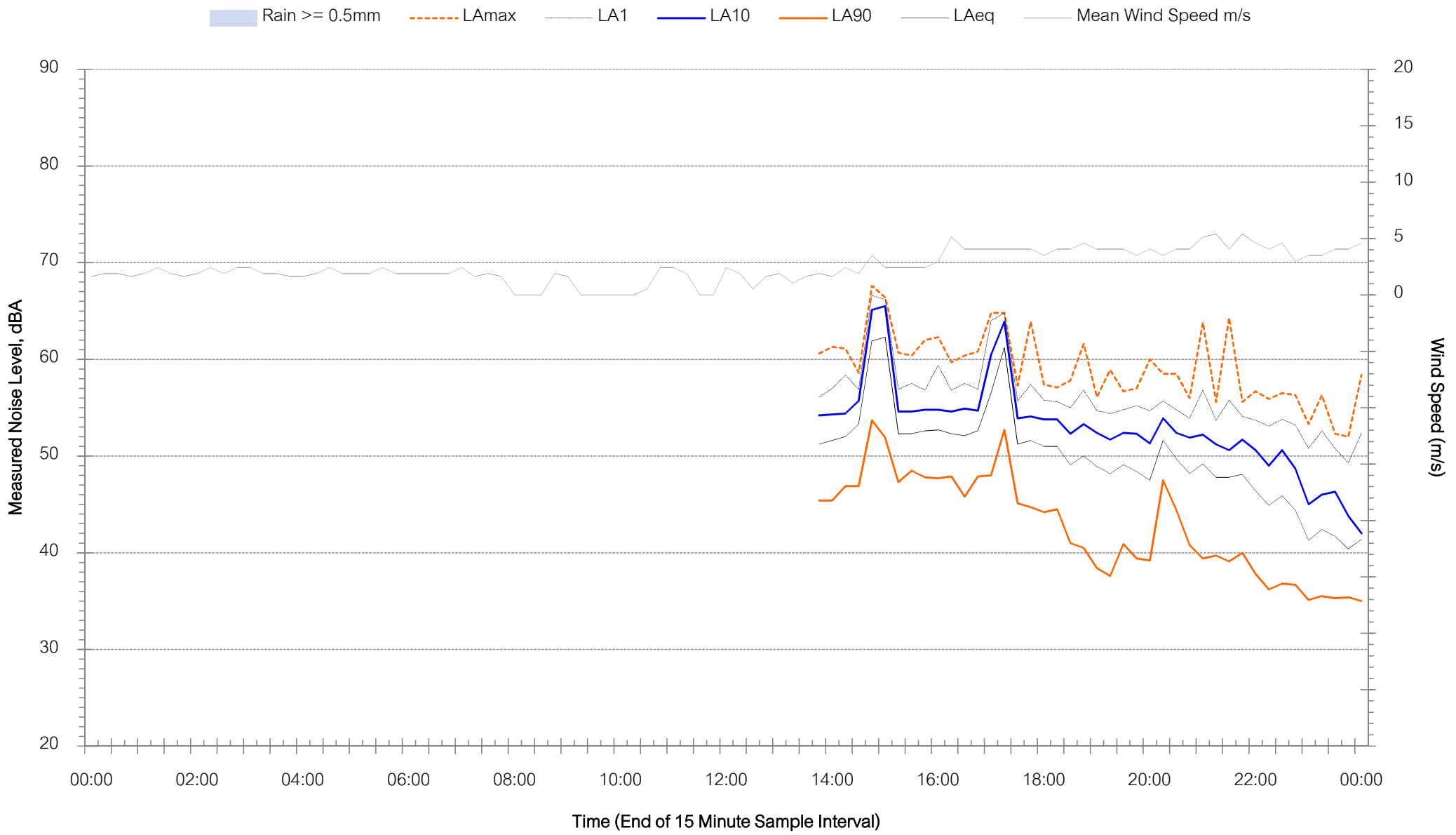
Background Noise Levels

Logger 1 - Friday 21 December 2018



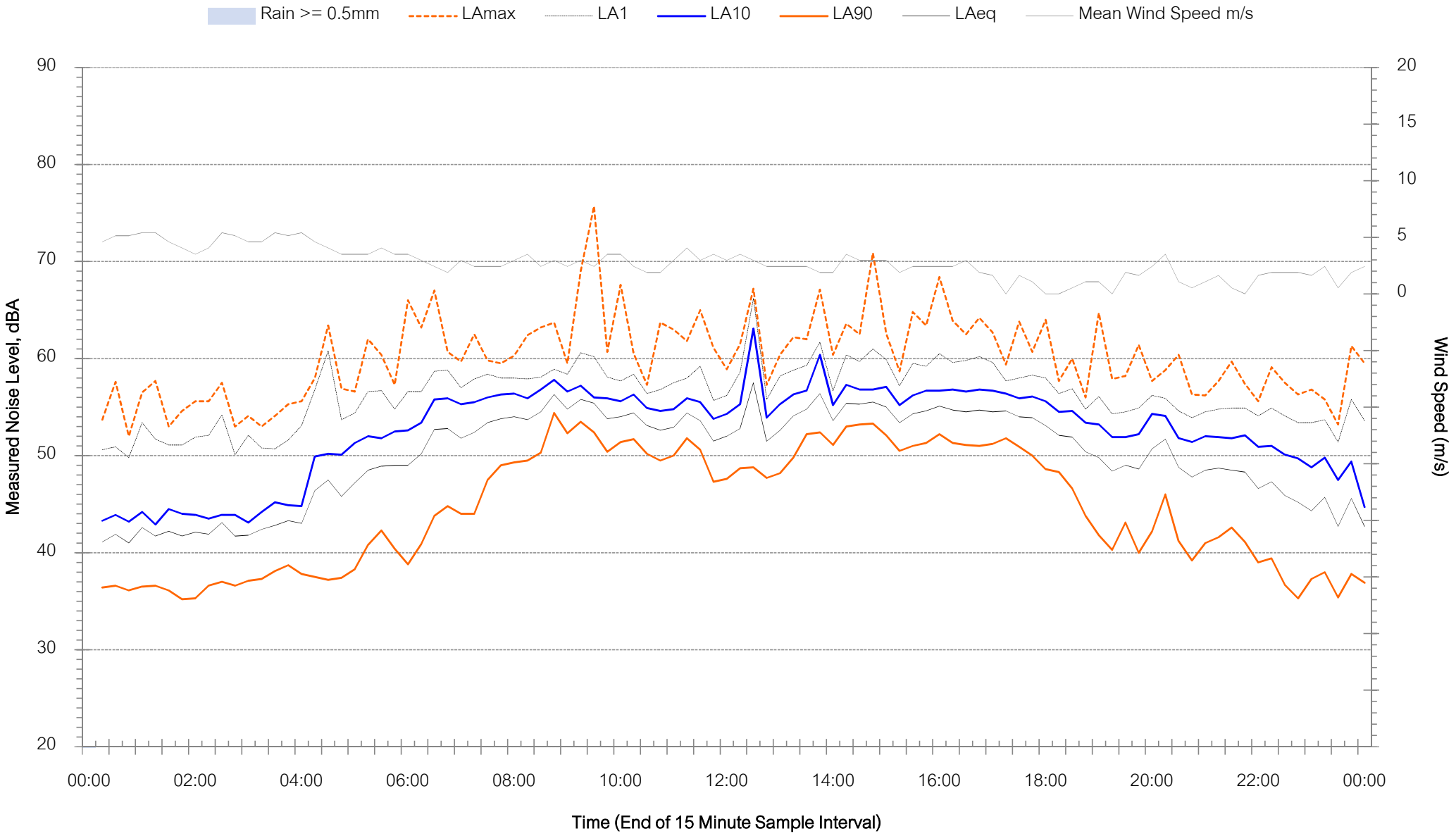
Background Noise Levels

Logger 2 - Wednesday 12 December 2018



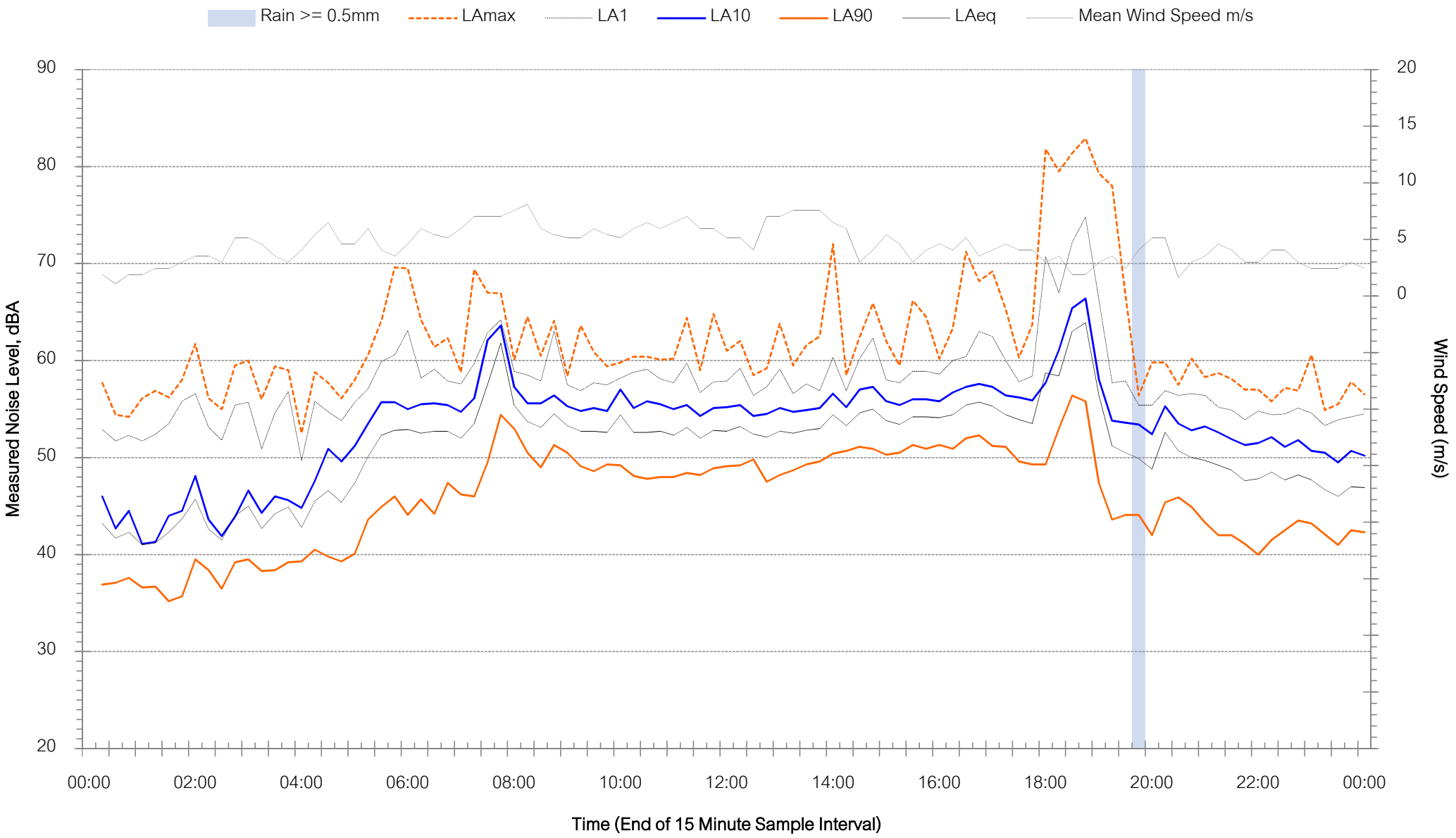
Background Noise Levels

Logger 2 - Thursday 13 December 2018



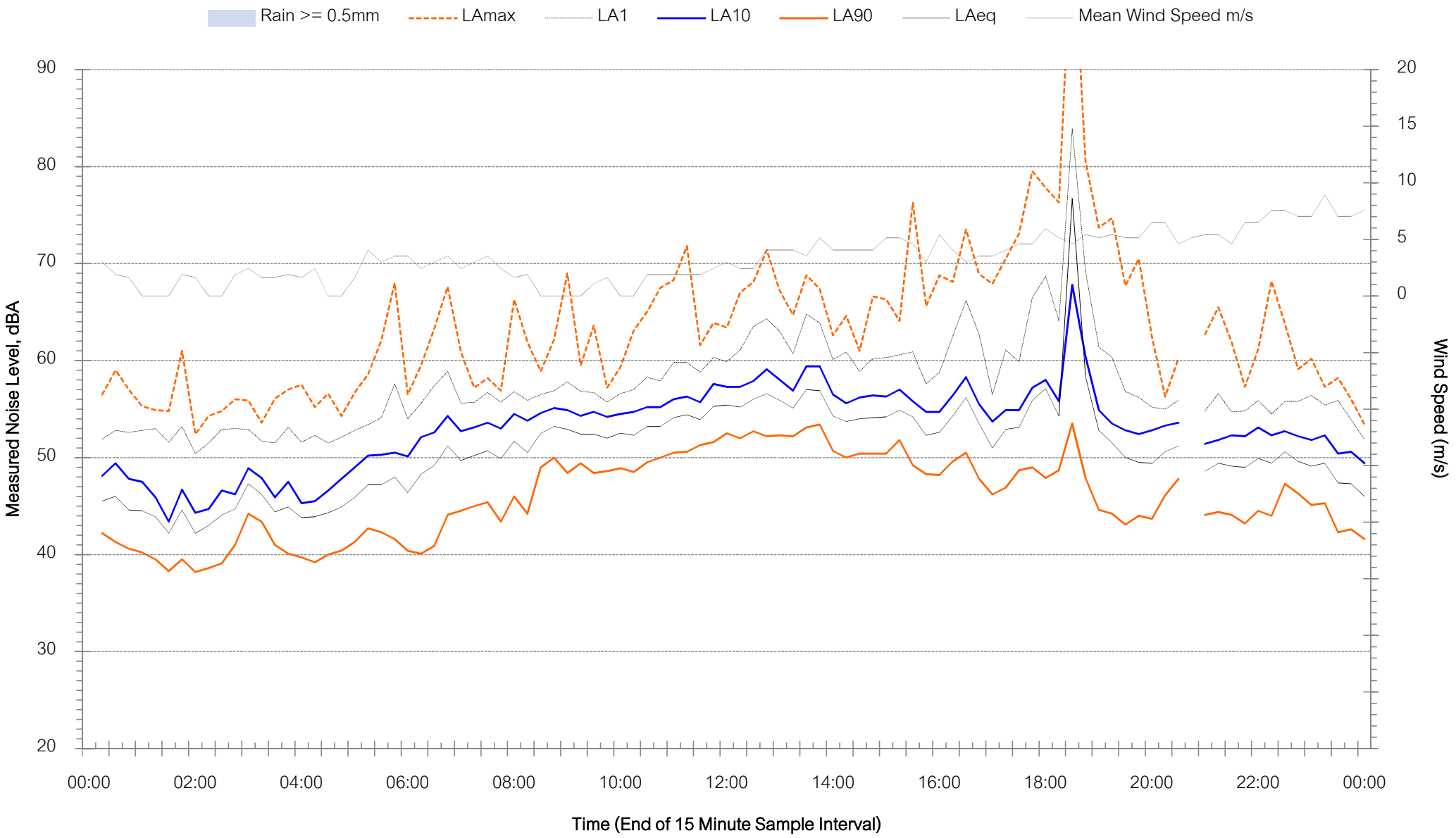
Background Noise Levels

Logger 2 - Friday 14 December 2018



Background Noise Levels

Logger 2 - Saturday 15 December 2018

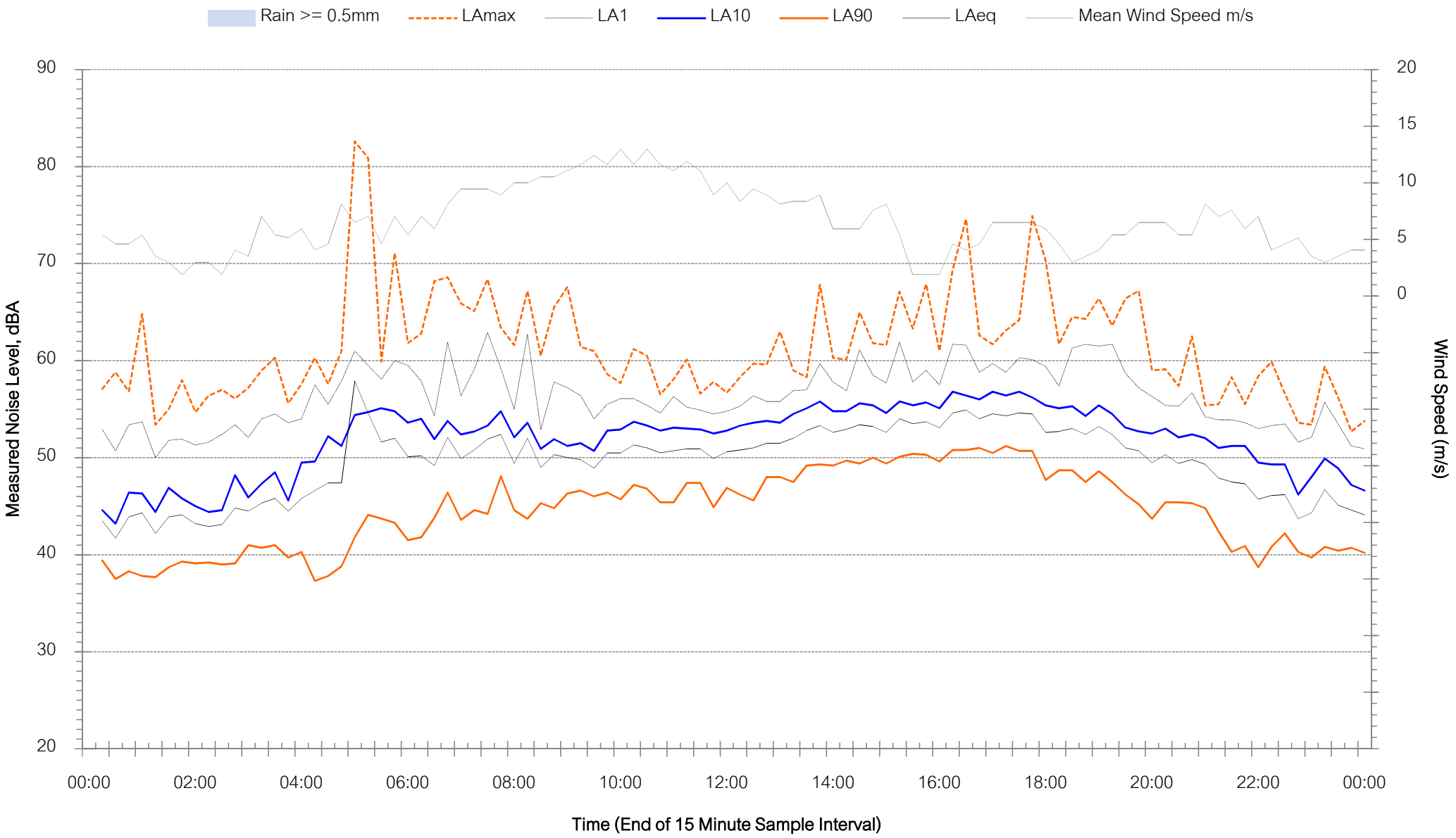


Background Noise Levels

Logger 2 - Sunday 16 December 2018

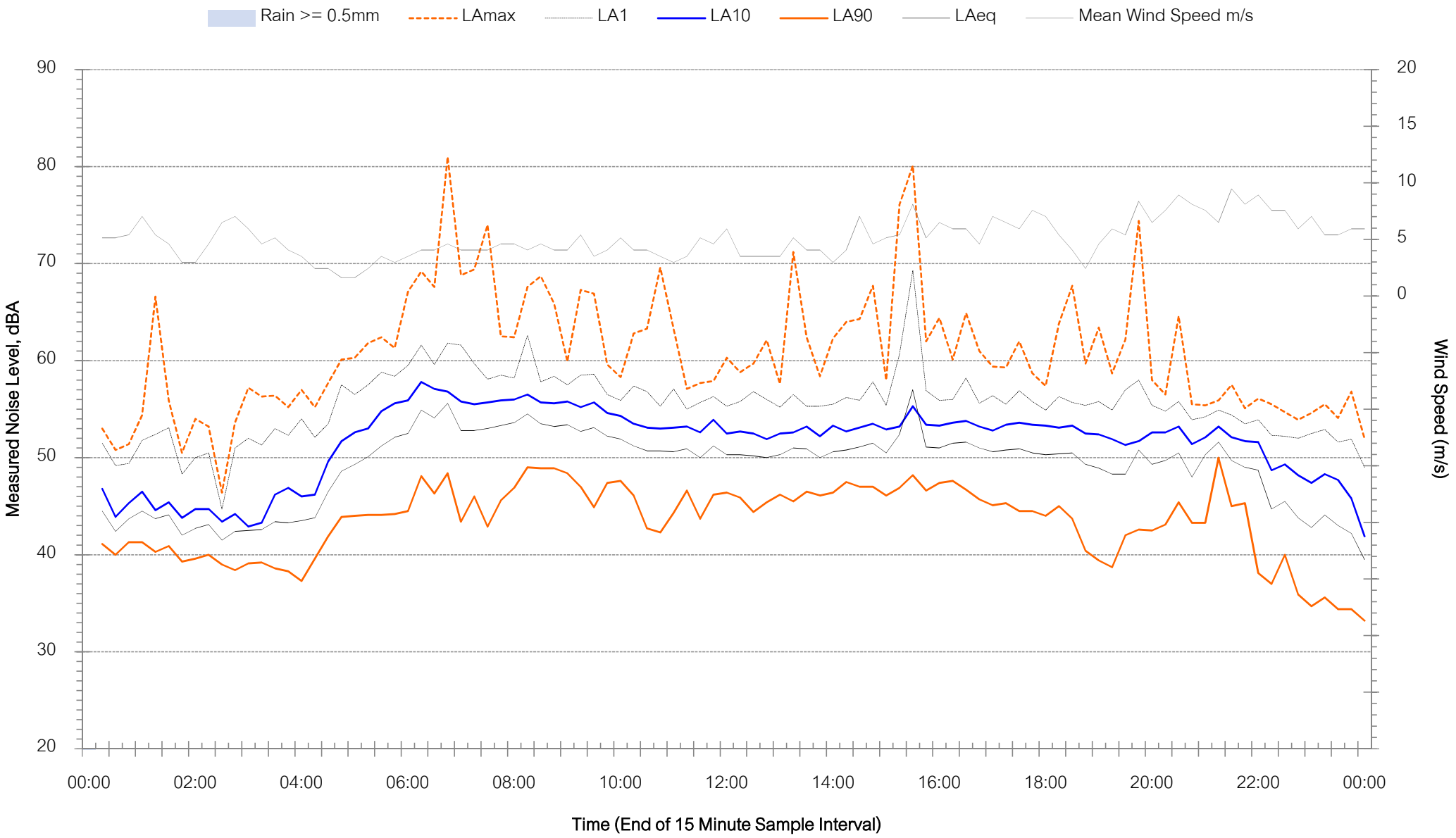
Background Noise Levels

Logger 2 - Monday 17 December 2018



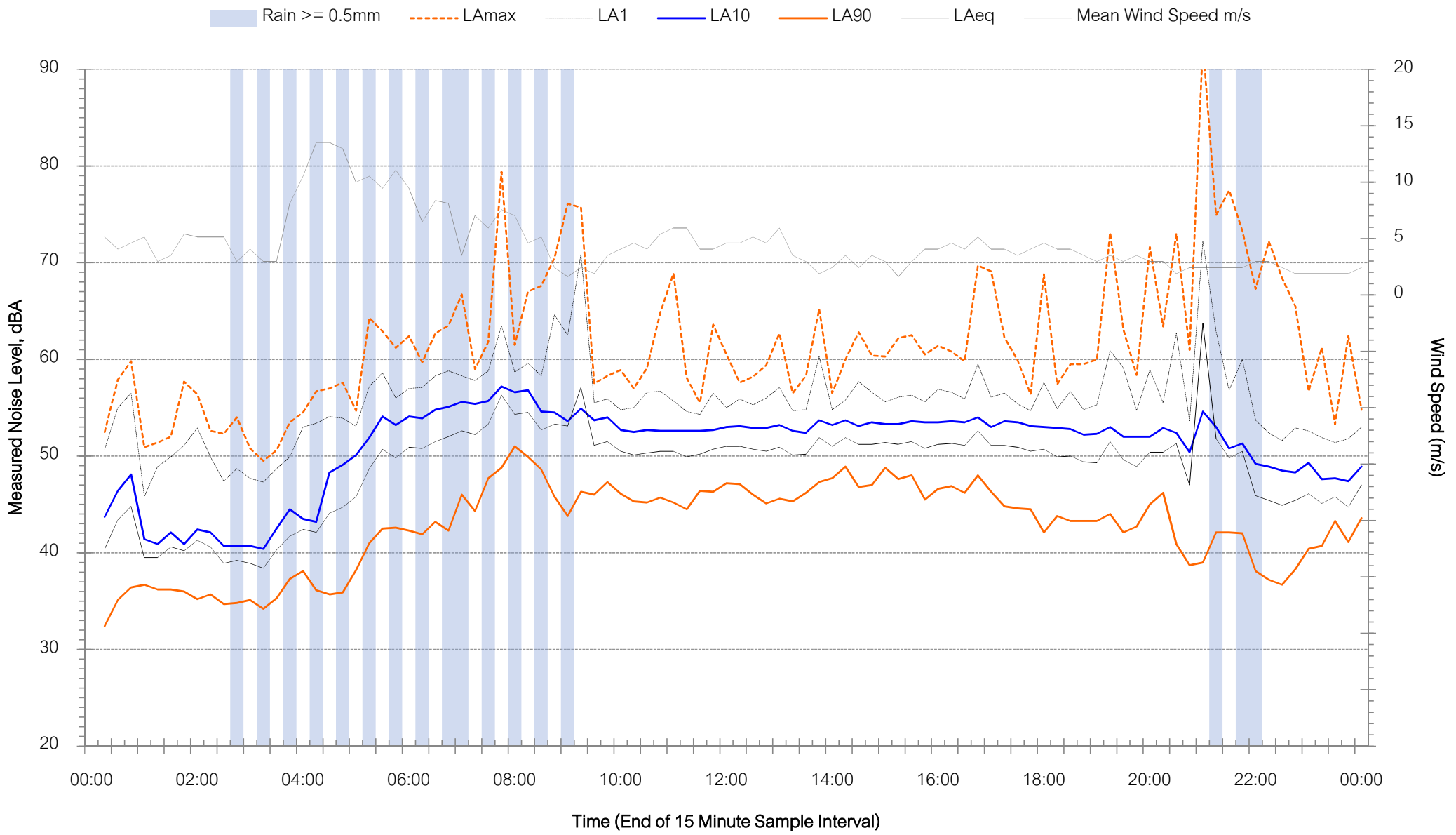
Background Noise Levels

Logger 2 - Tuesday 18 December 2018



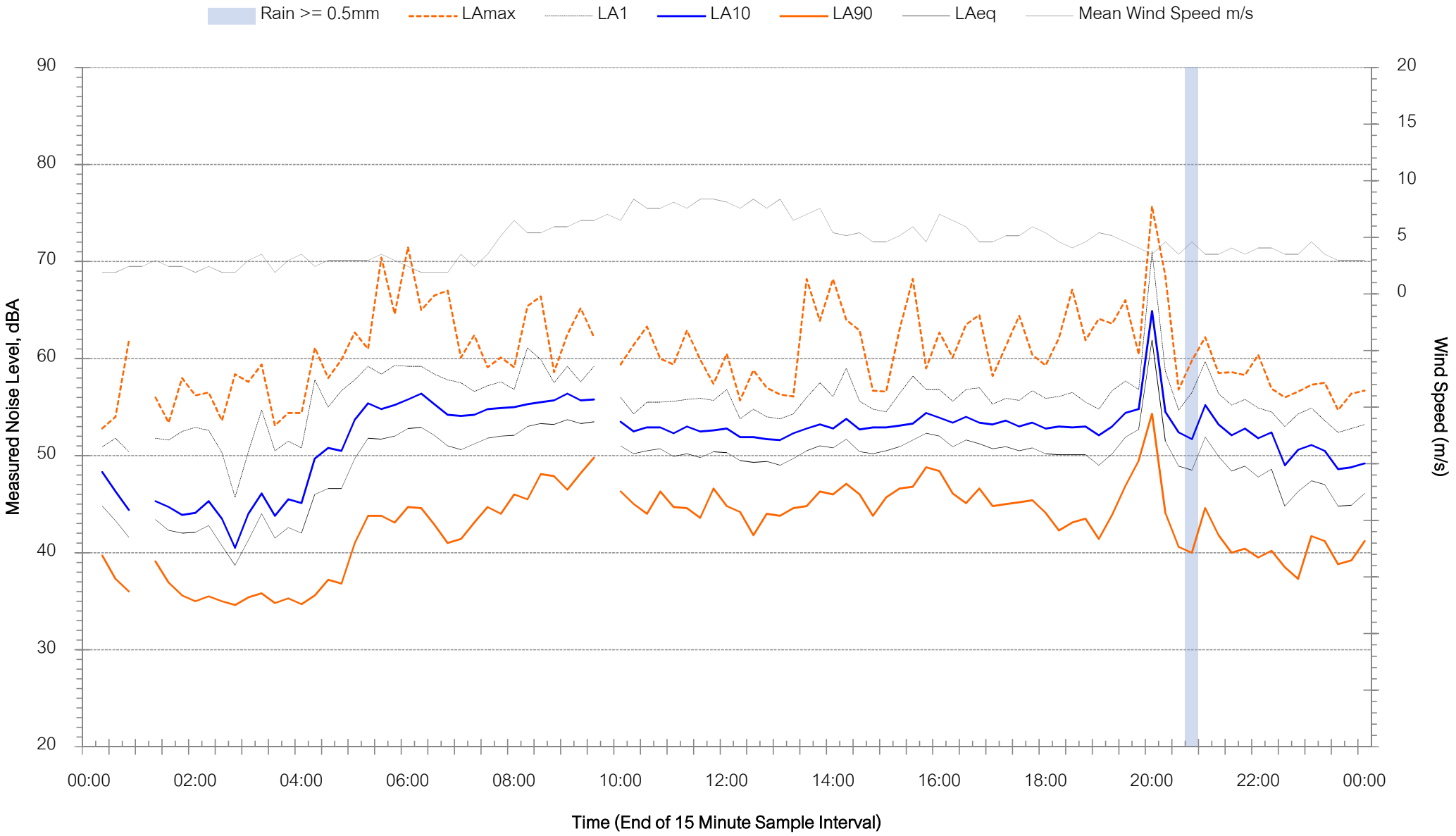
Background Noise Levels

Logger 2 - Wednesday 19 December 2018



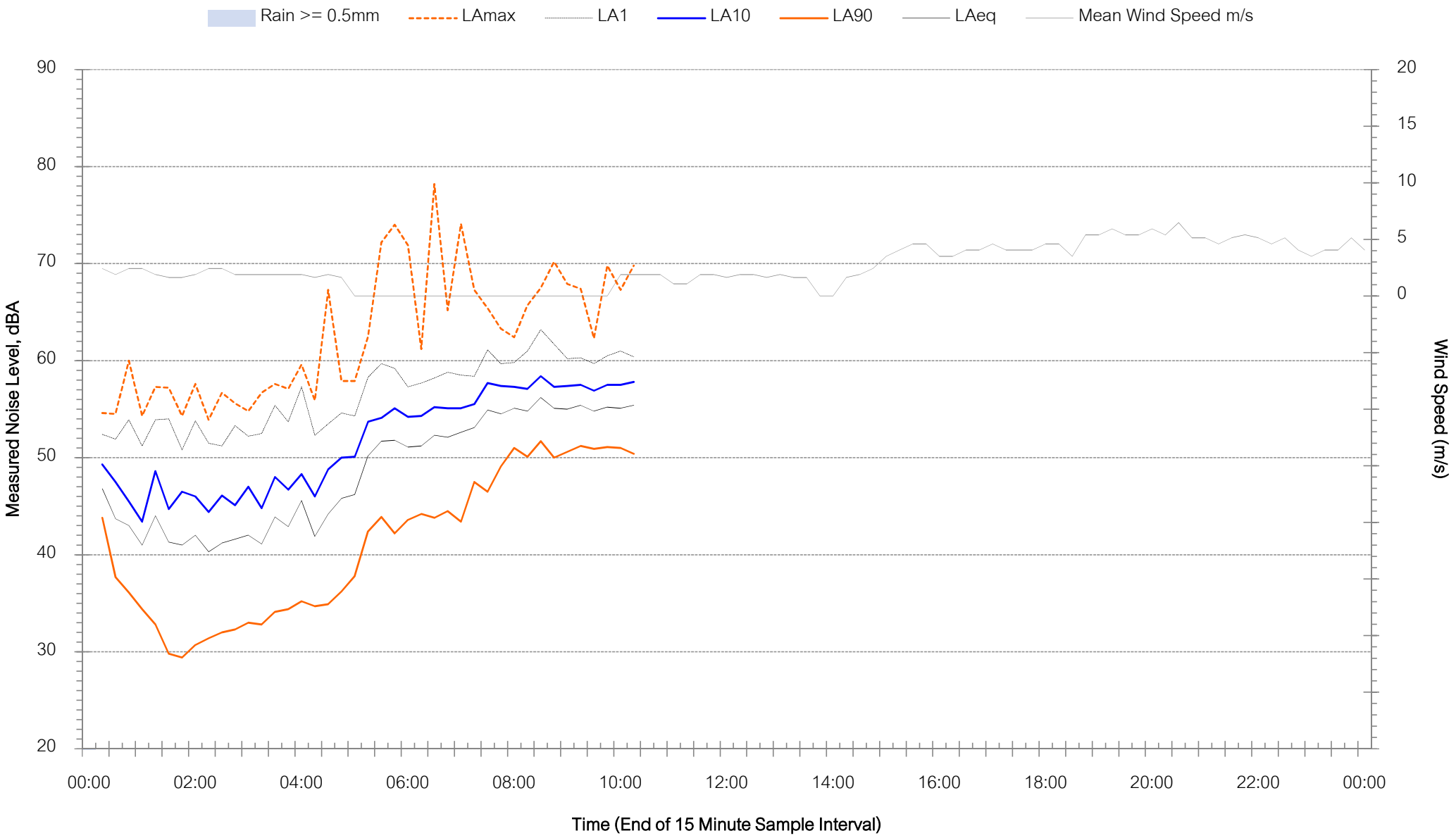
Background Noise Levels

Logger 2 - Thursday 20 December 2018



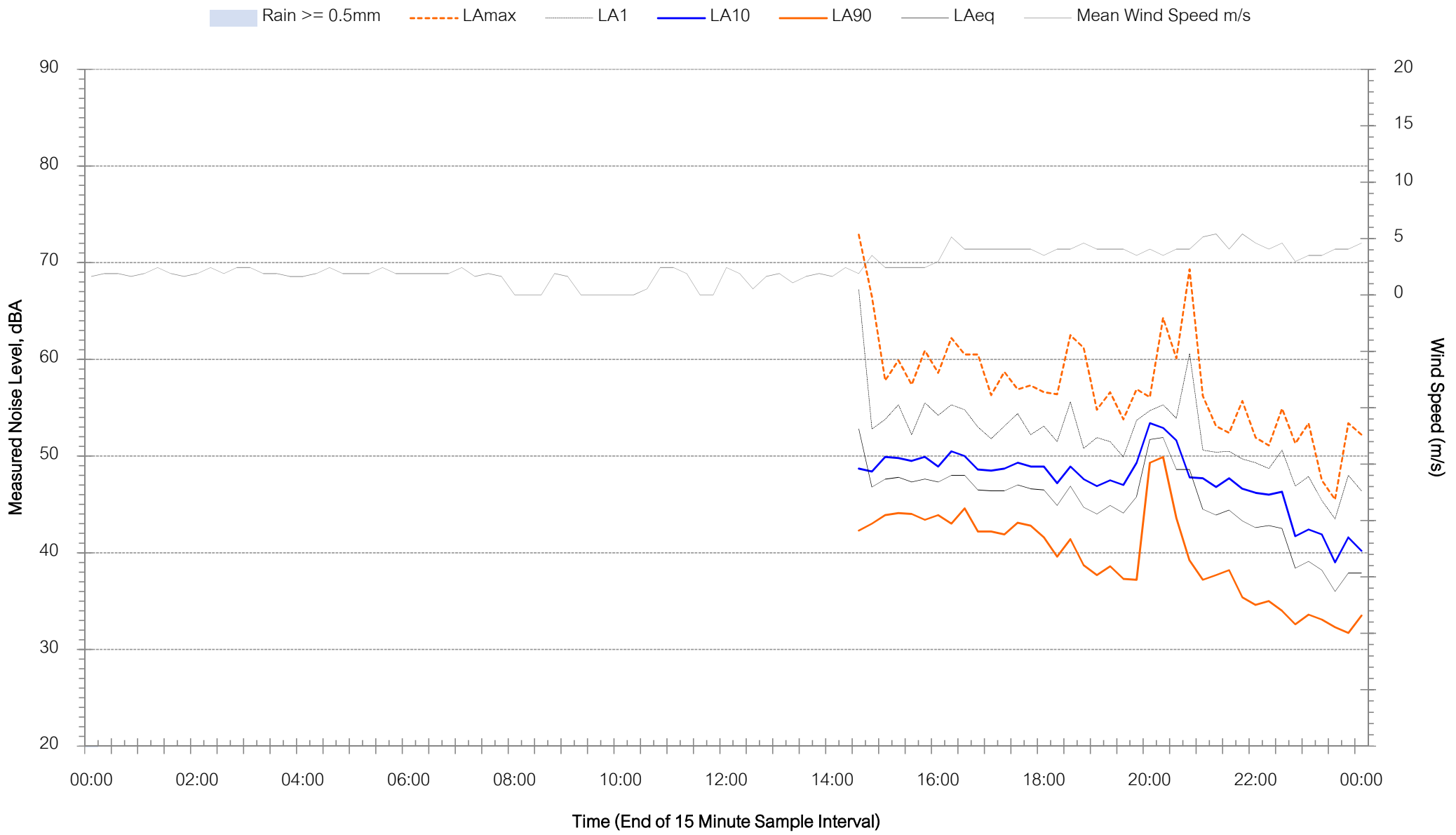
Background Noise Levels

Logger 2 - Friday 21 December 2018



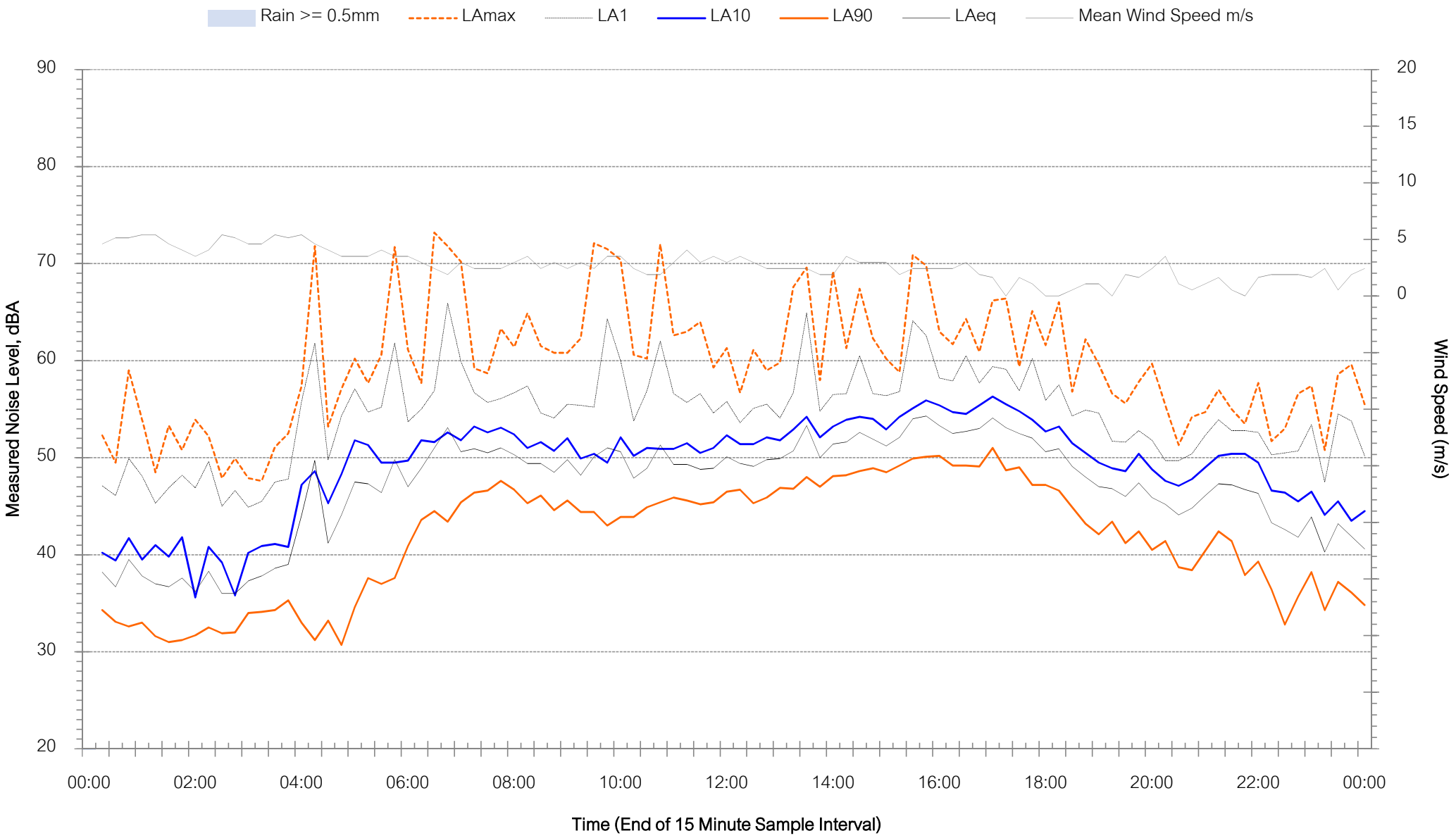
Background Noise Levels

Logger 3 - Wednesday 12 December 2018



Background Noise Levels

Logger 3 - Thursday 13 December 2018

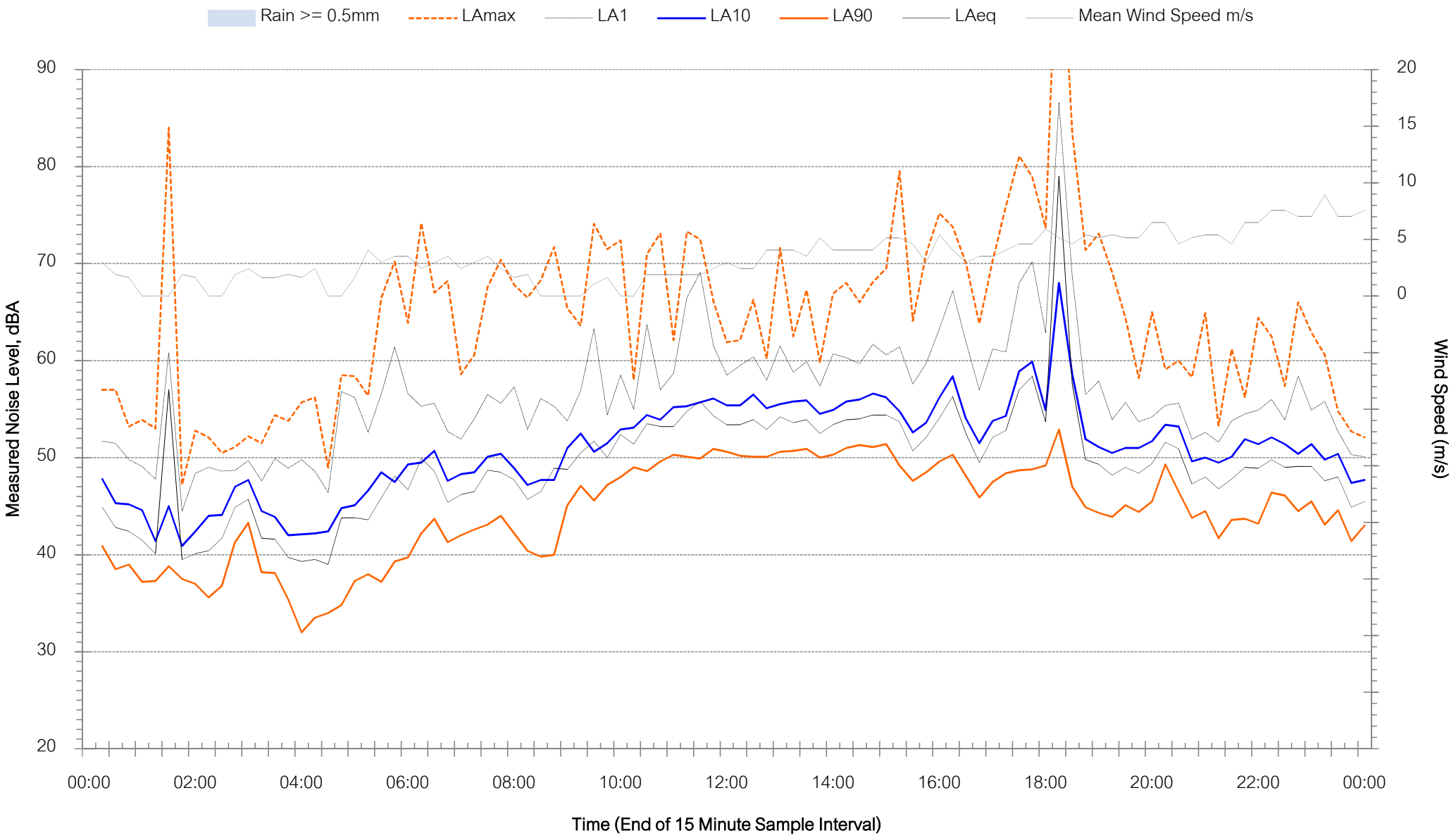


Background Noise Levels

Logger 3 - Friday 14 December 2018

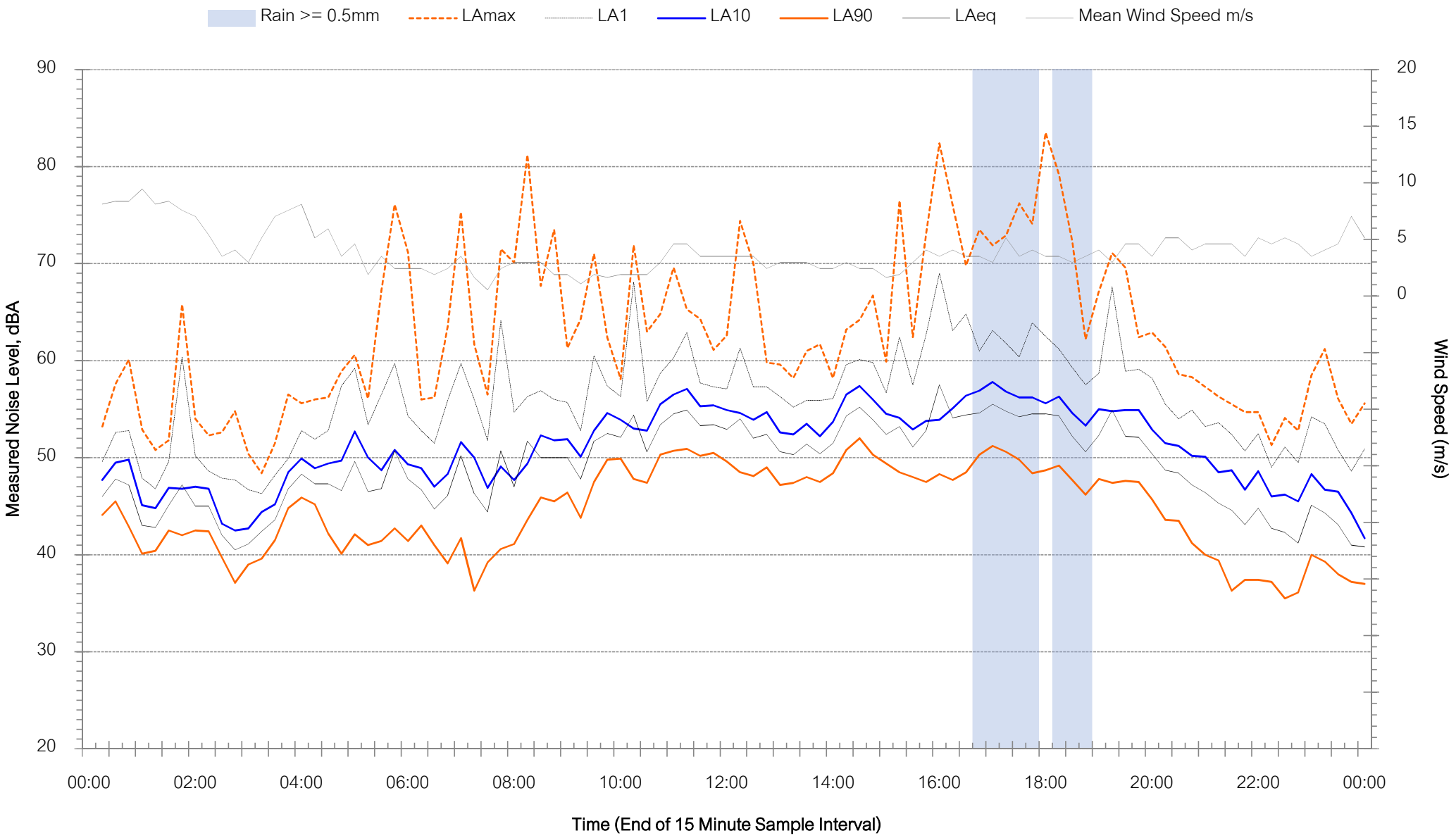
Background Noise Levels

Logger 3 - Saturday 15 December 2018



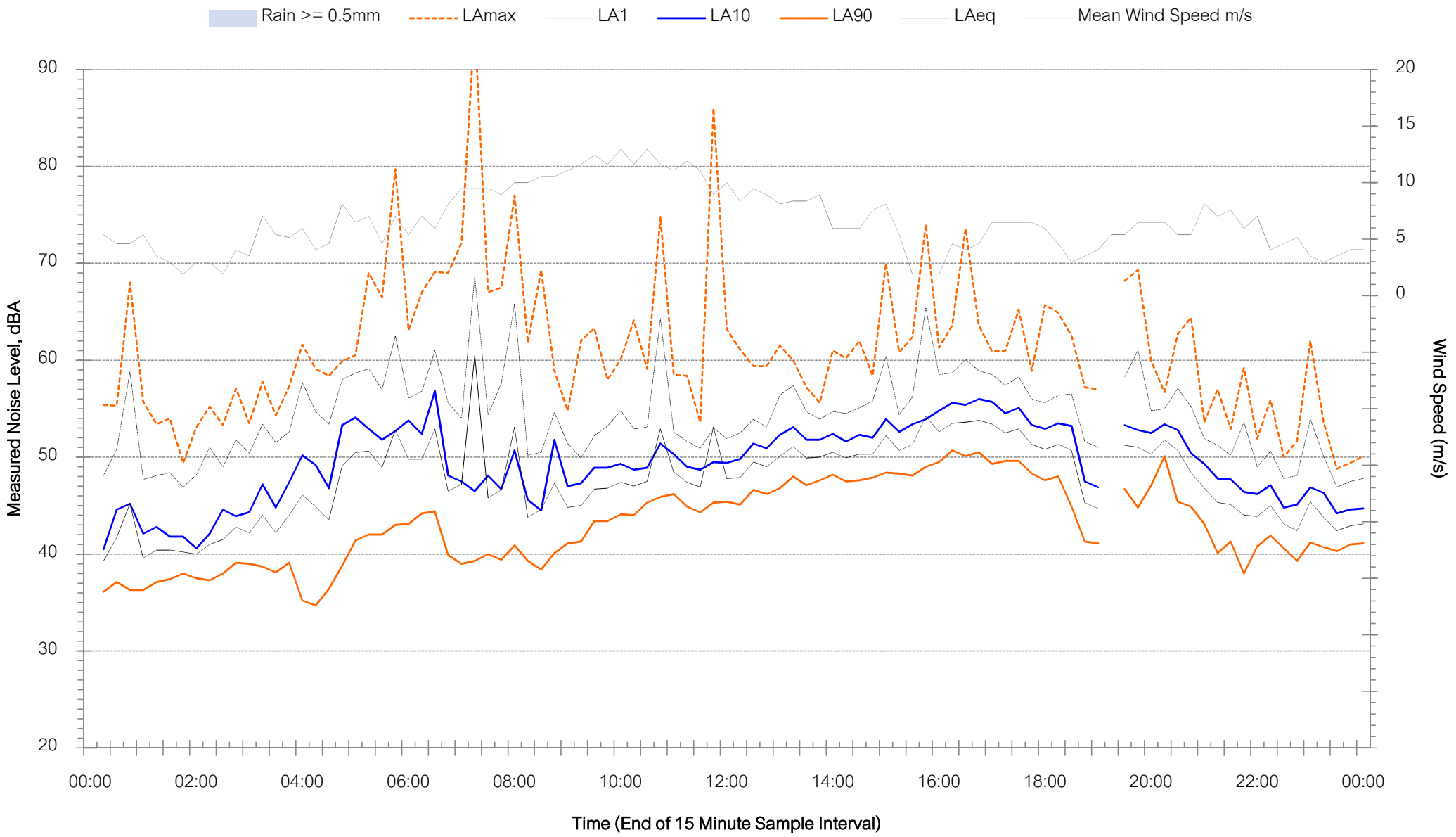
Background Noise Levels

Logger 3 - Sunday 16 December 2018



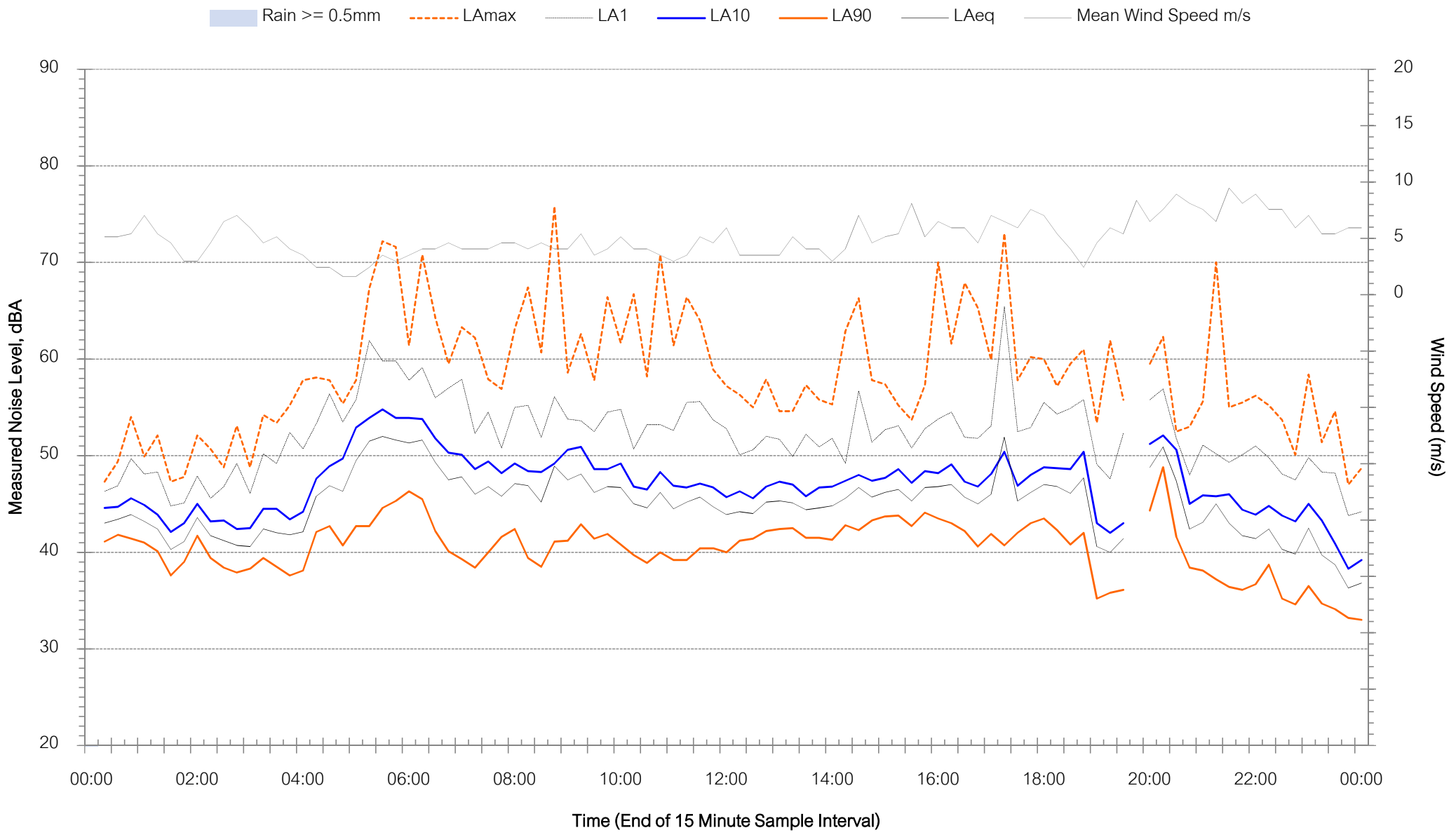
Background Noise Levels

Logger 3 - Monday 17 December 2018



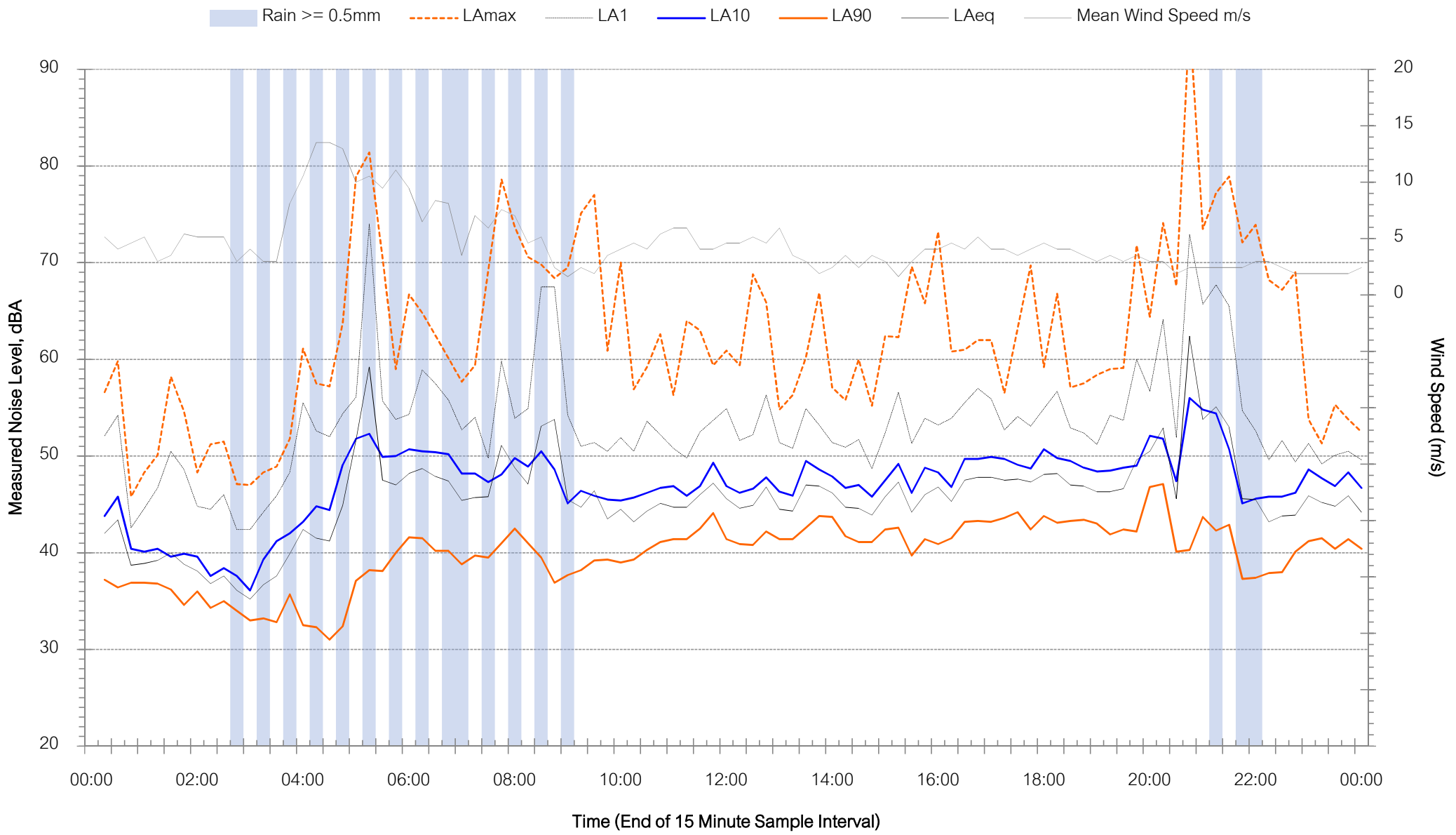
Background Noise Levels

Logger 3 - Tuesday 18 December 2018



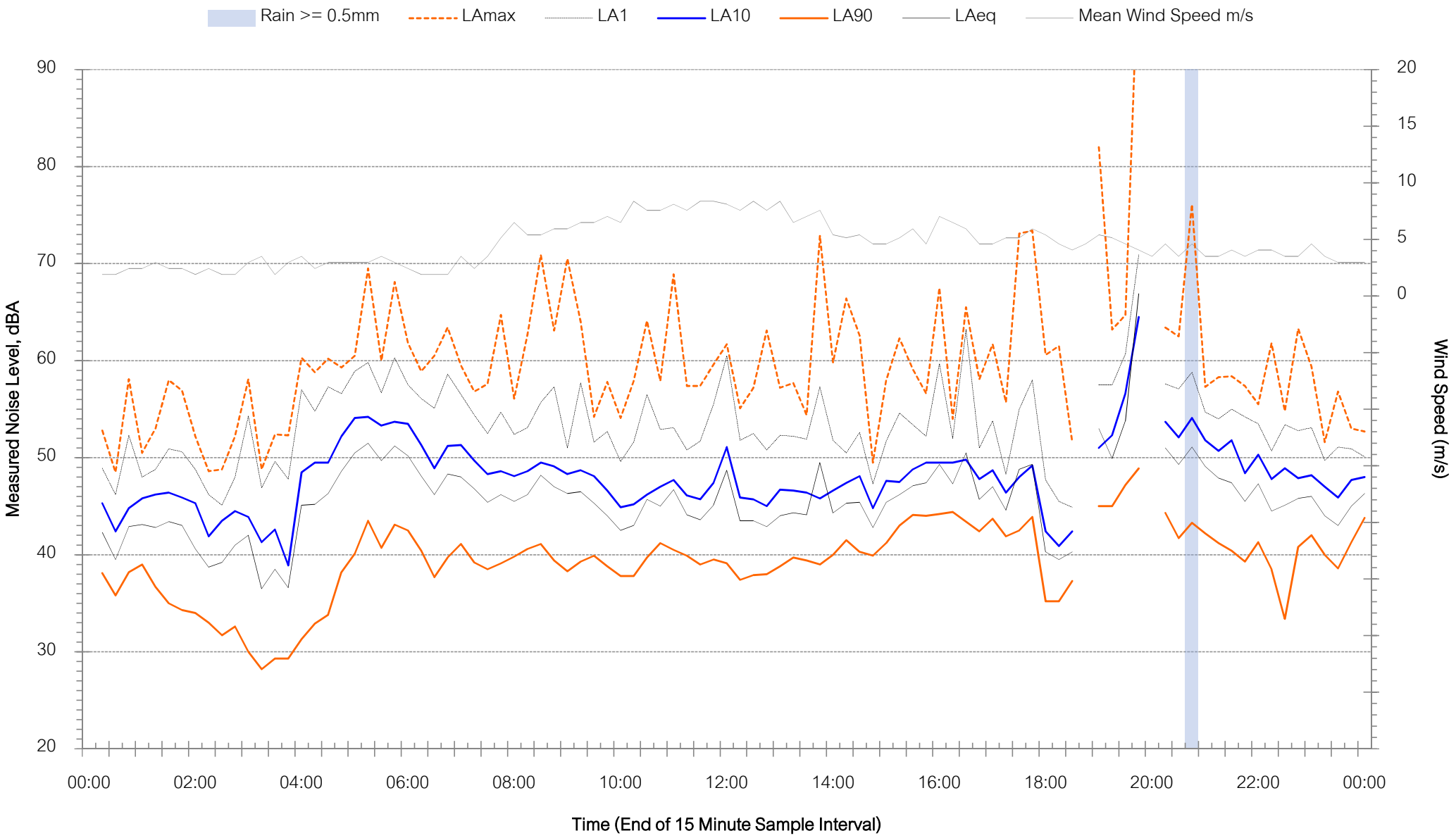
Background Noise Levels

Logger 3 - Wednesday 19 December 2018



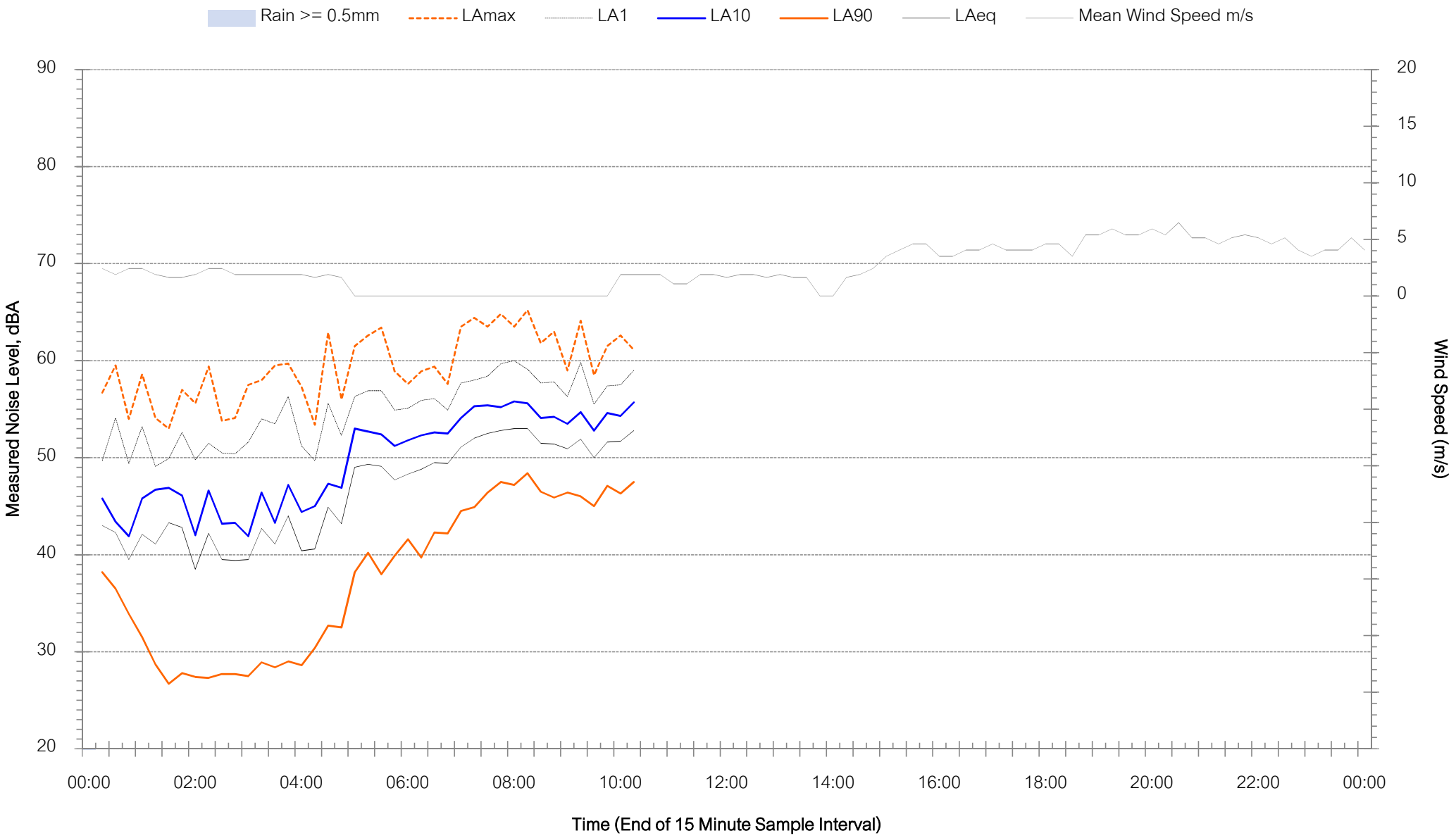
Background Noise Levels

Logger 3 - Thursday 20 December 2018



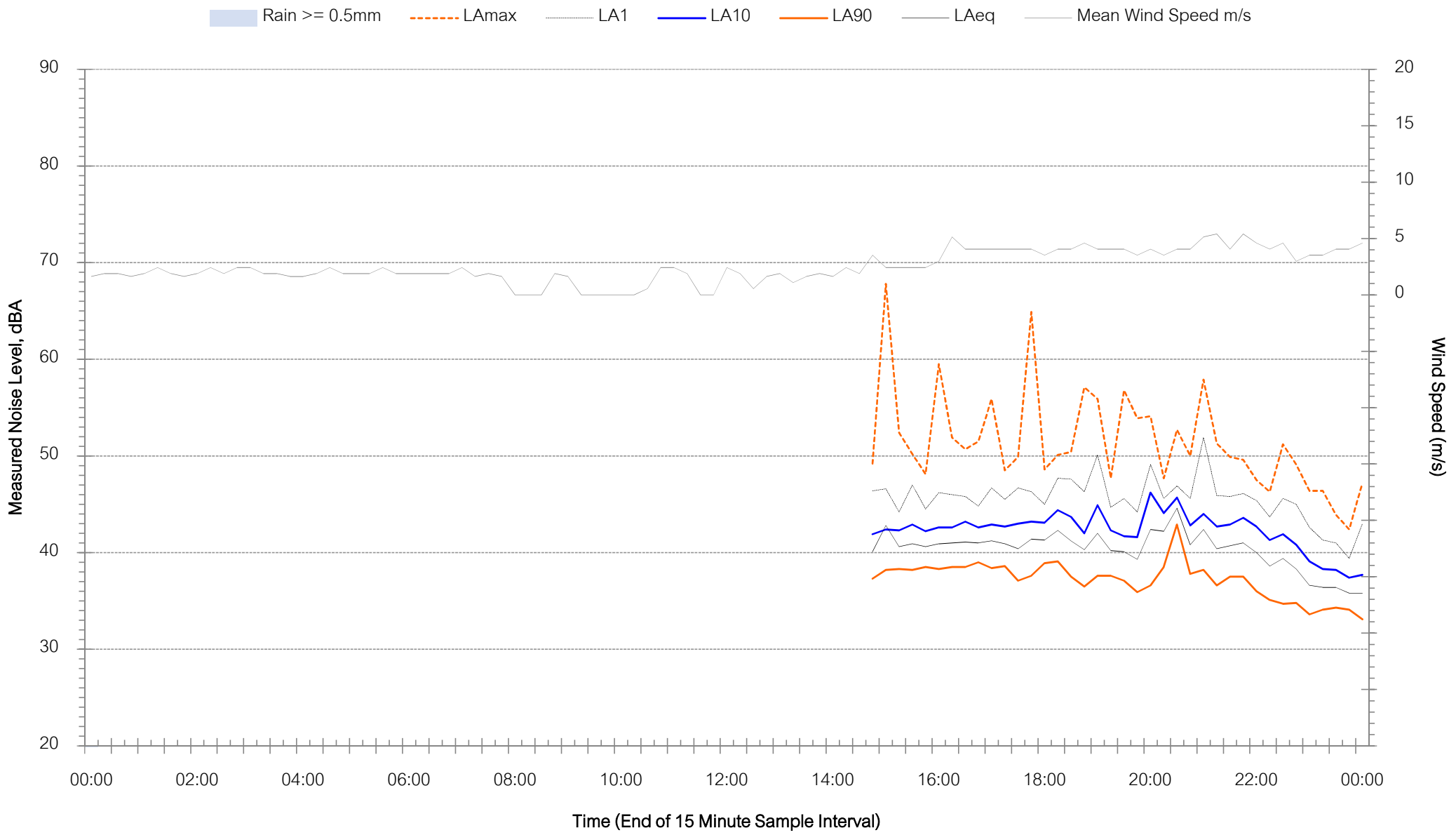
Background Noise Levels

Logger 3 - Friday 21 December 2018



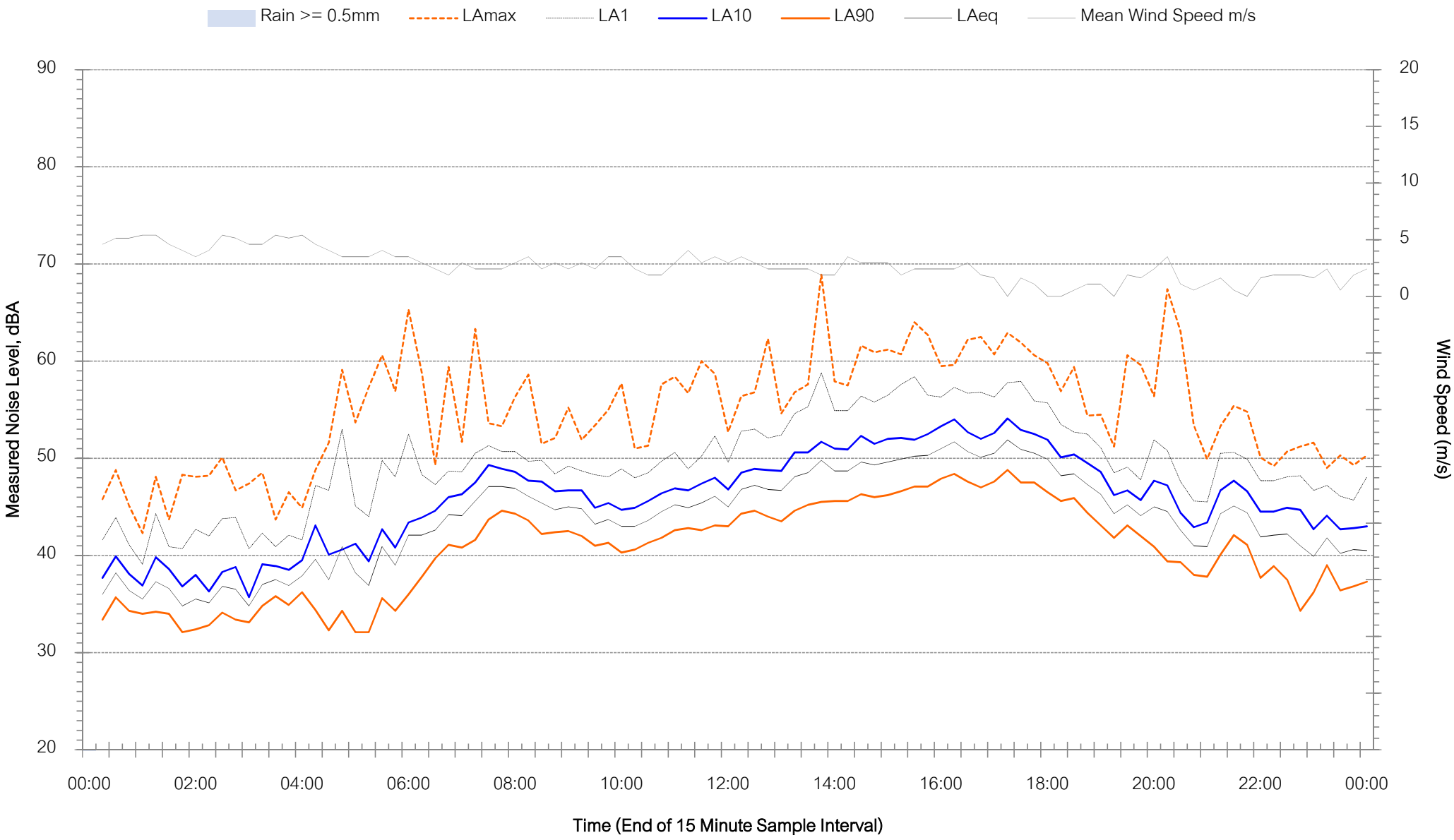
Background Noise Levels

Logger 4 - Wednesday 12 December 2018



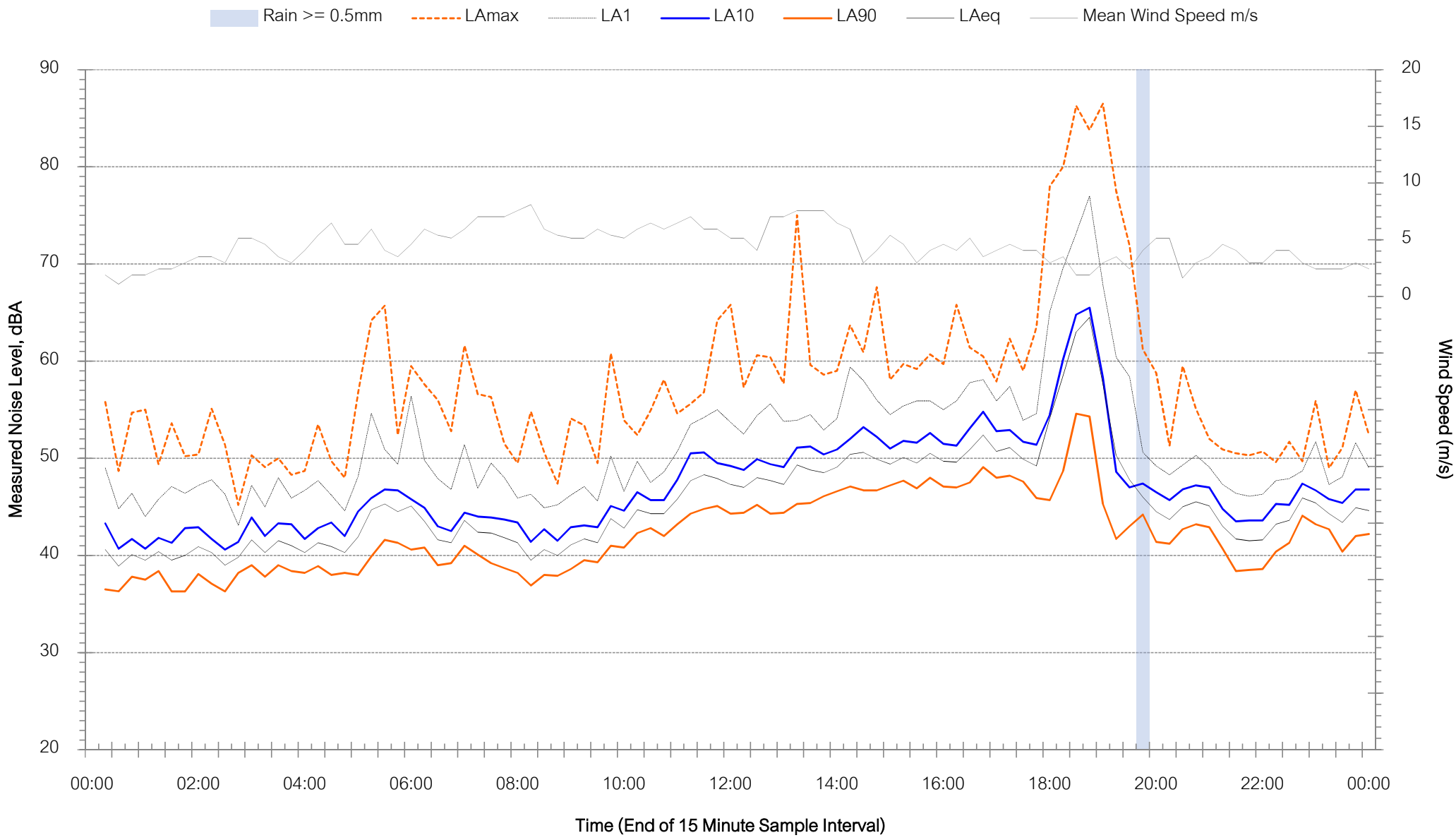
Background Noise Levels

Logger 4 - Thursday 13 December 2018



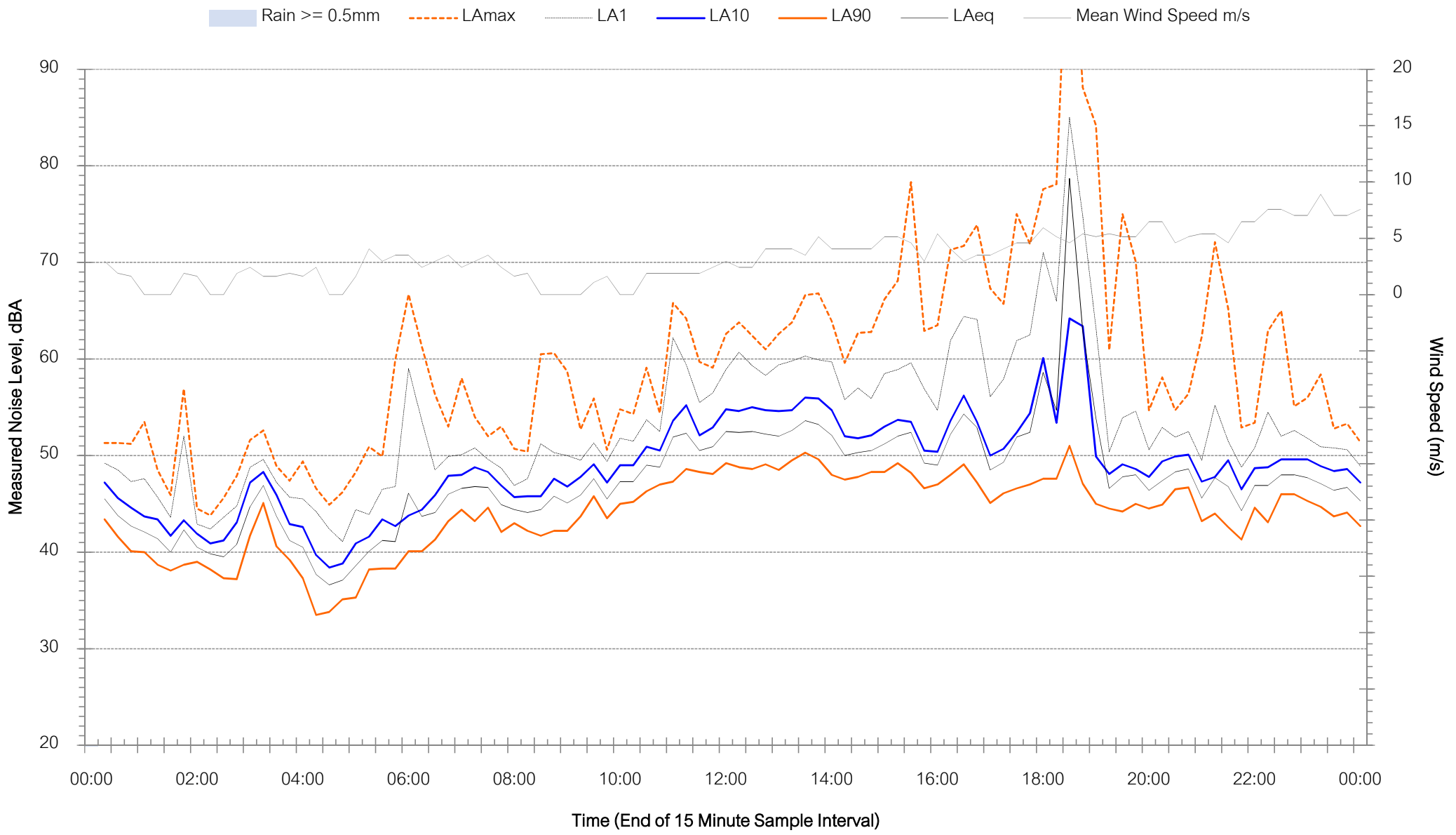
Background Noise Levels

Logger 4 - Friday 14 December 2018



Background Noise Levels

Logger 4 - Saturday 15 December 2018

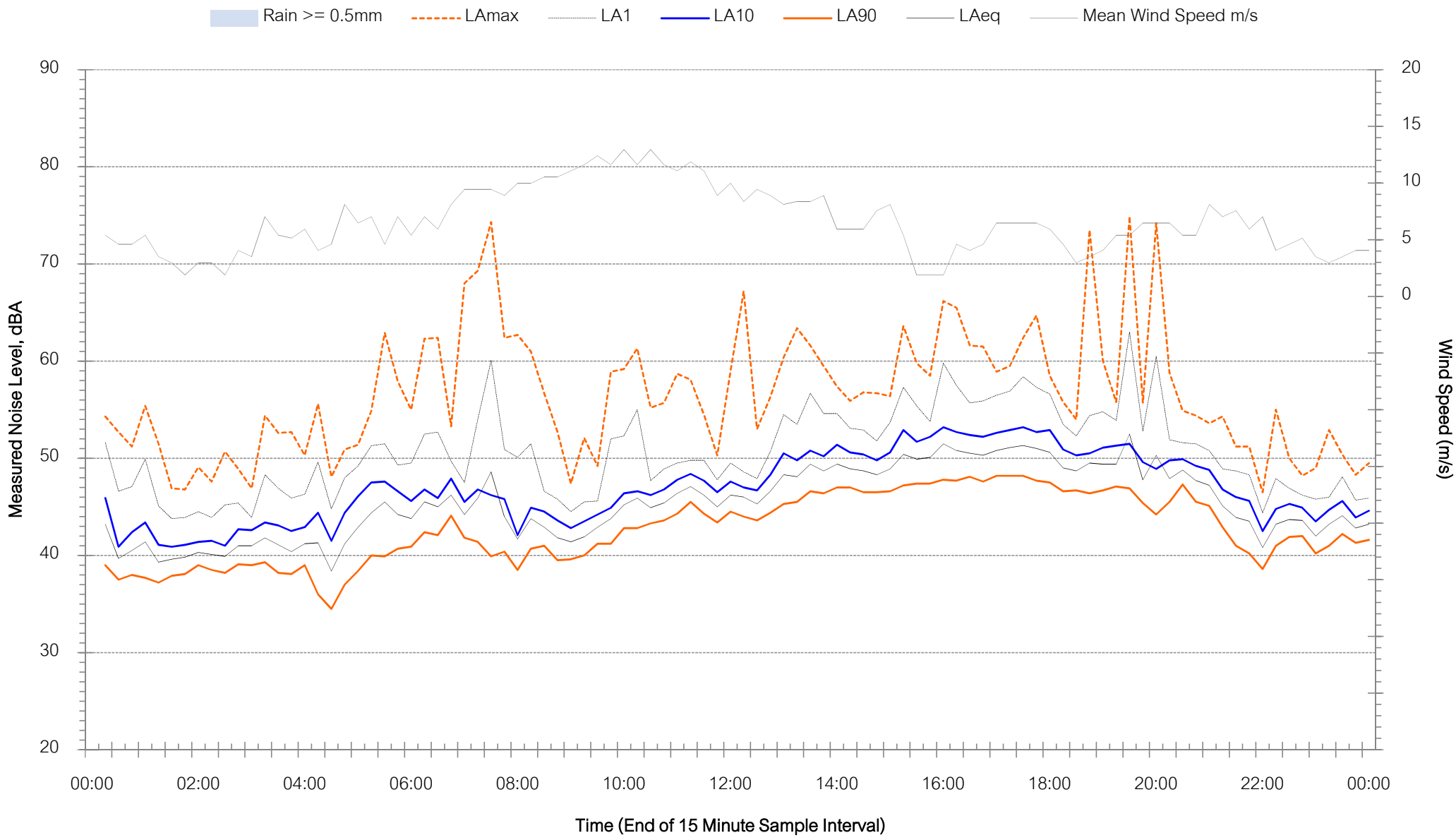


Background Noise Levels

Logger 4 - Sunday 16 December 2018

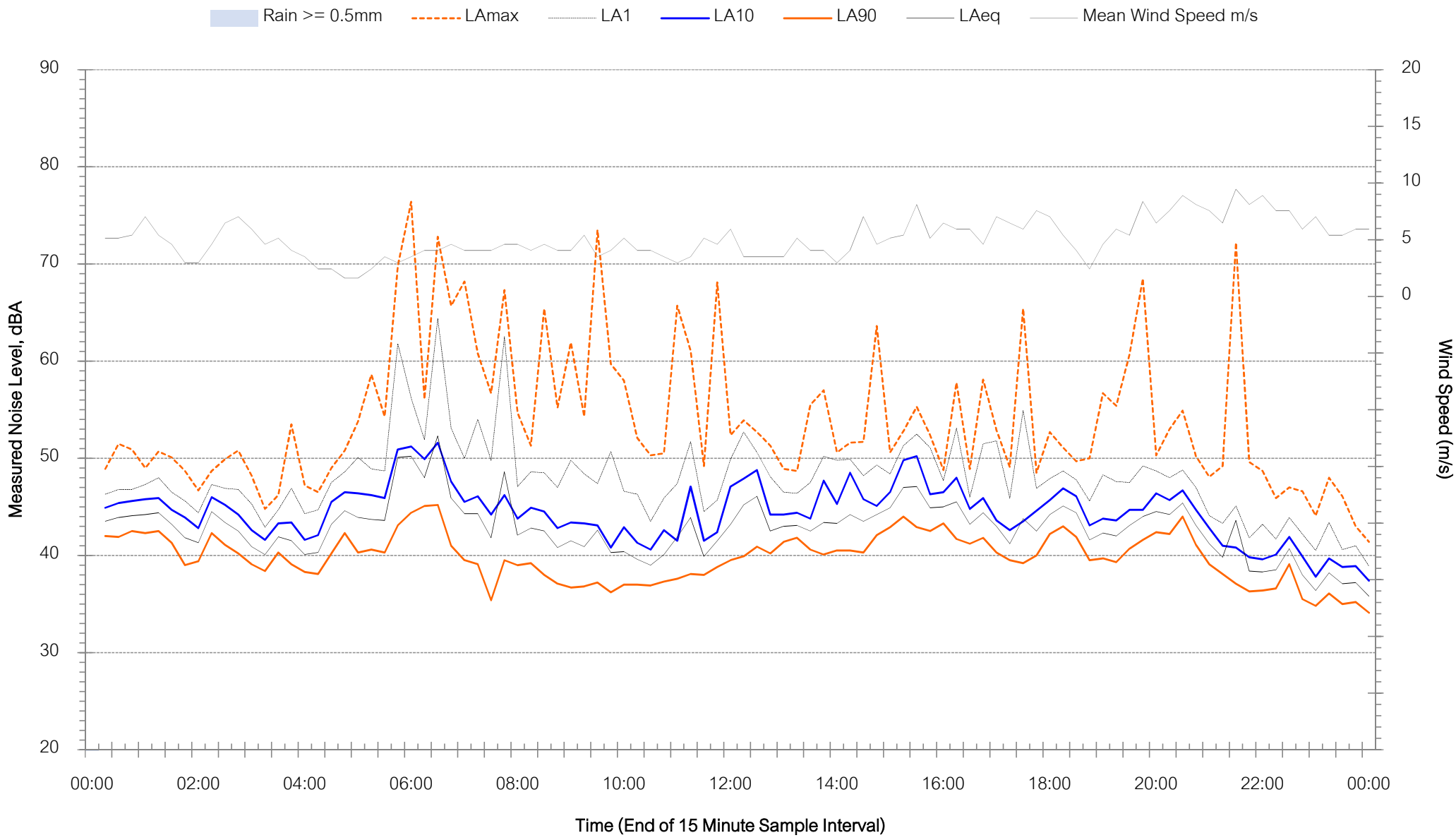
Background Noise Levels

Logger 4 - Monday 17 December 2018



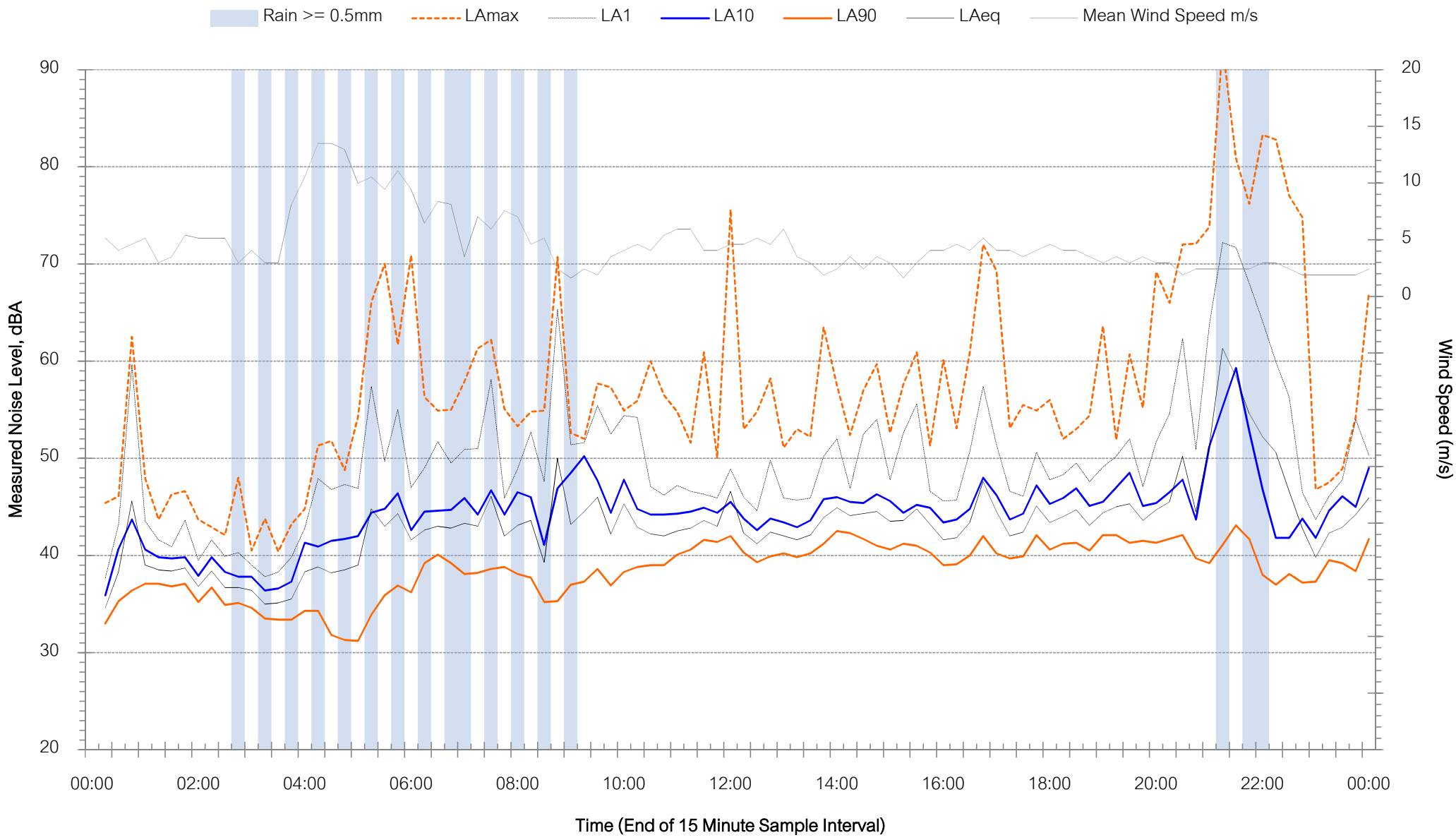
Background Noise Levels

Logger 4 - Tuesday 18 December 2018



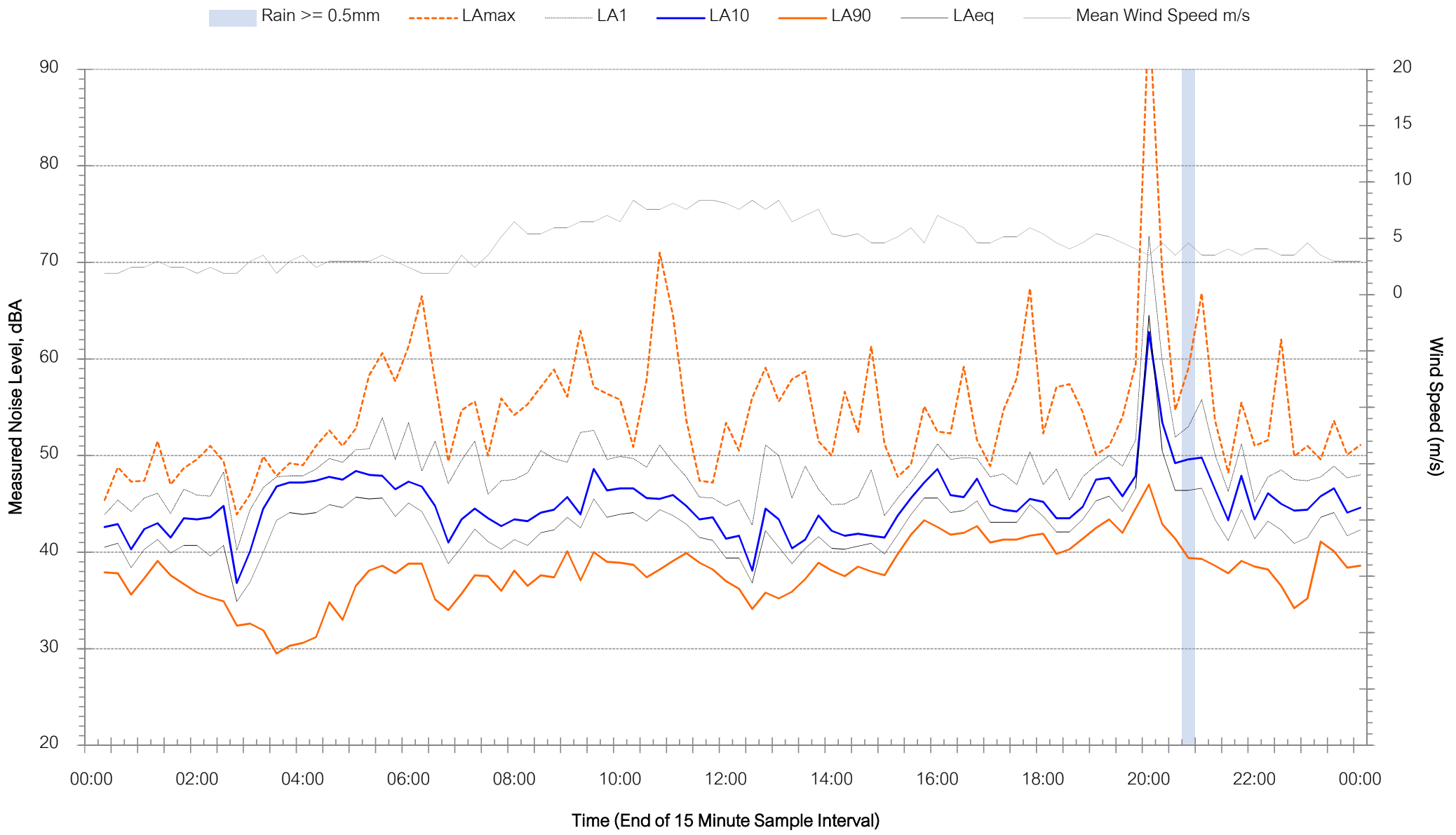
Background Noise Levels

Logger 4 - Wednesday 19 December 2018



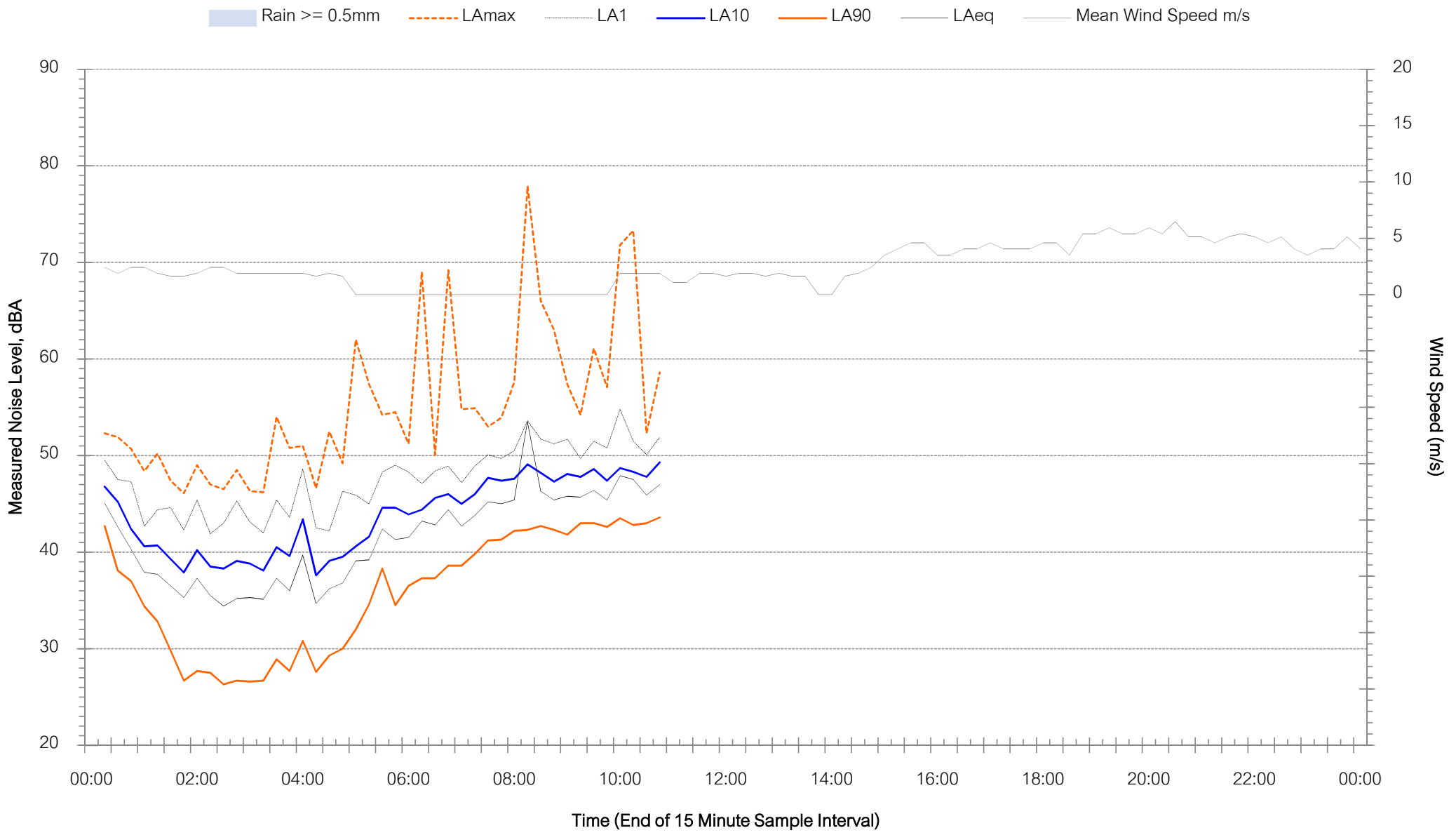
Background Noise Levels

Logger 4 - Thursday 20 December 2018



Background Noise Levels

Logger 4 - Friday 21 December 2018



Appendix B

Glossary of acoustic terms

A number of technical terms have been used in this report and are explained in Table B1.

Table B1 Glossary of Terms

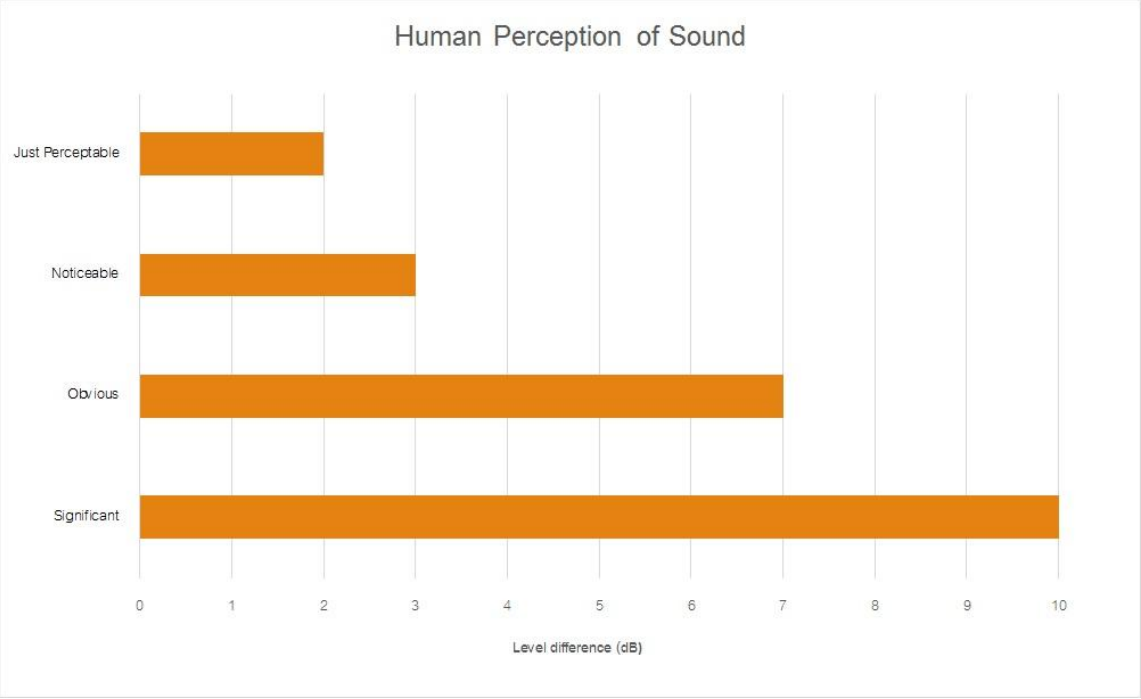
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L90 statistical noise levels.
Ambient Noise	The noise associated with a given environment. Typically a composite of sounds from many sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.
dBA	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(Z), dB(L)	Decibels Linear or decibels Z-weighted.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA_{10}	A noise level which is exceeded 10 % of the time. It is approximately equivalent to the average of maximum noise levels.
LA_{90}	Commonly referred to as the background noise, this is the level exceeded 90 % of the time.
LA_{eq}	The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period.
LA_{max}	The maximum root mean squared (rms) sound pressure level received at the microphone during a measuring interval.
RBL	The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the ABL's.
Sound power level (LW)	This is a measure of the total power radiated by a source. The sound power of a source is a fundamental location of the source and is independent of the surrounding environment. Or a measure of the energy emitted from a source as sound and is given by : = 10.log10 (W/Wo) Where : W is the sound power in watts and Wo is the sound reference power at 10-12 watts.

Table B2 provides a list of common noise sources and their typical sound level.

Table B2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA

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

Figure B1 – Human Perception of Sound



.