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Development Application Noise Emission Assessment Report

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1 INTRODUCTION

This report presents our assessment of the proposed new Hillsong Church and associated facilities to be located at 1 Water Street, Werrington.

This report identifies and assesses the major noise sources which are associated with the site (vehicle noise, music noise, mechanical plant noise, child care etc). The assessment is based on the requirements of local council DCP and NSW Environment Protection Authority's Industrial Noise Policy.

The assessment is based on the architectural drawings provided to this office by NBRS + Partners dated 9 February 2017.

2 SITE DESCRIPTION

The proposed development is a one to three storey complex and contains a number of functional spaces including a 1350 seat auditorium, 400 seat youth ministry, offices, childcare & associated back of house spaces.

The proposed operational activities and hours for the development as provided by the client are as follows:

Activity	Maximum Patronage	Hours of Operation
Child Care Centre	89 Children + 19 staff	Monday to Friday 7am-6pm
Child Ministry	400	Accessed by staff at all times; any noise generating activity (music / service) limited to 7am-10.30pm
Main Auditorium (1,350 seats)	1350	Accessed by staff at all times; any noise generating activity (music / service) limited to 7am-10.30pm
City Care	10-15 individuals per day	Monday to Friday 9am-5pm
Youth Ministry	400	Friday 6pm-10.30pm

The surrounding land uses in the vicinity of the site are as follows:

To the north:

- Directly to the north, across a green field site zoned as light industrial (IN2), is low density residential development on Walker Street (approx. 450m away)
- Further north is the Werrington Train Station.

To the South:

- Directly south of the site is a residential cottage.
- Further to the south of the site, across the Great Western Highway, is low density residential development (approx. 200m), however noise emission compliance at the residential cottage will result in compliance at these locations.

To the east:

- Directly to the east of the site is Wollemi College (however this site will be generally unaffected by the facility's operations as only the Child Care Centre and City Care operate at concurrent times).

To the west:

- Directly to the west of the site is Cobham Correctional Centre.

Figure 1 shows the site map and measurement location.

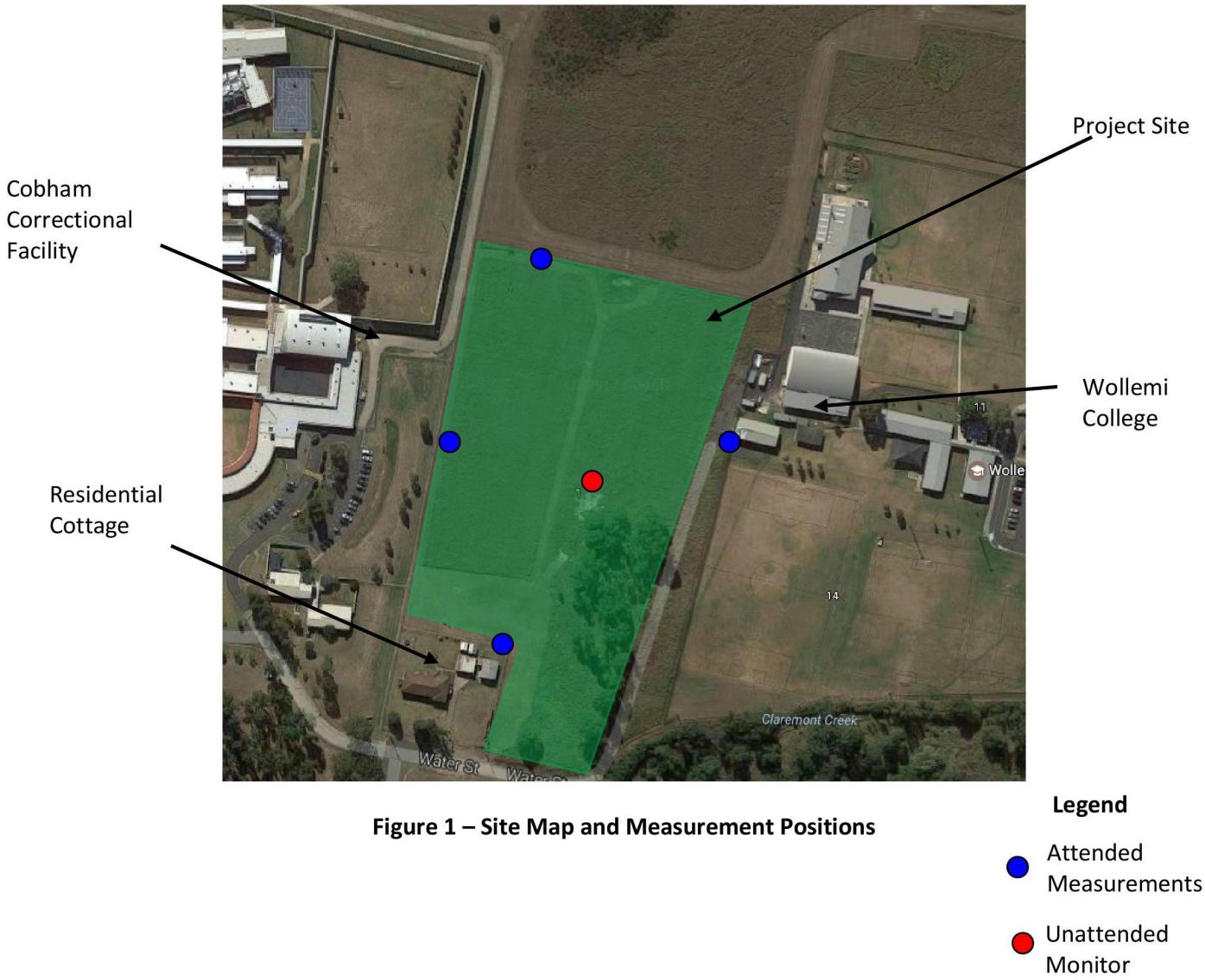


Figure 1 – Site Map and Measurement Positions

3 NOISE DESCRIPTORS

Environmental noise constantly varies. Accordingly, it is not possible to accurately determine prevailing environmental noise conditions by measuring a single, instantaneous noise level.

To accurately determine the environmental noise a 15-20 minute measurement interval is utilised. Over this period, noise levels are monitored on a continuous basis and statistical and integrating techniques are used to determine noise description parameters.

In analysing environmental noise, three-principle measurement parameters are used, namely L_{10}, L_{90} and L_{eq}.

The L_{10} and L_{90} measurement parameters are statistical levels that represent the average maximum and average minimum noise levels respectively, over the measurement intervals.

The L_{10} parameter is commonly used to measure noise produced by a particular intrusive noise source since it represents the average of the loudest noise levels produced by the source.

Conversely, the L_{90} level (which is commonly referred to as the background noise level) represents the noise level heard in the quieter periods during a measurement interval. The L_{90} parameter is used to set the allowable noise level for new, potentially intrusive noise sources since the disturbance caused by the new source will depend on how audible it is above the pre-existing noise environment, particularly during quiet periods, as represented by the L_{90} level.

The L_{eq} parameter represents the average noise energy during a measurement period. This parameter is derived by integrating the noise levels measured over the 15 minute period. L_{eq} is important in the assessment of traffic noise impact as it closely corresponds with human perception of a changing noise environment; such is the character of environmental noise.

The L1 noise level is the level exceeded for 1 per cent of the time and approximates the typical maximum noise level from a particular source.

4 BACKGROUND NOISE MEASUREMENTS

Background noise measurements were conducted around the site in order to characterise the existing acoustic environment.

An unattended long-term noise monitor was installed on the site as indicated in Figure 1. Supplementary attended measurements were conducted around the site boundary and at the nearest sensitive receivers.

The long-term monitoring is conducted from 13 to 20 December 2016 with attended measurements conducted on both 13 and 20 December.

Equipment used consisted of an Acoustic Research Laboratories Pty Ltd noise logger and a Norsonics 140 Sound Level Analyser. The noise measurement equipment was set to A-weighted fast response and was programmed to store 15-minute statistical noise levels throughout the monitoring period. The monitor was calibrated at the start and end of the monitoring period using a Rion NC-73 calibrator and Norsonics 1251 precision calibrator. No significant drift was noted. Noise logger data is provided in Appendix 1.

Measured background noise levels are presented in Table 1.

Table 1 – Rating Background Noise Levels

Time Period	Measured Ambient Noise Levels dB(A) L_{A90}
Day (7am-6pm)	45
Evening (6pm-10pm)	45
Night (10pm-11pm shoulder period)	42
Night	37

Note: As the proposed high noise generating activities including music are to be operational until 10:30pm only, the night time noise assessment includes the period of 10pm to 11pm only. Mechanical services will be assessed to the 10pm to 7am period as minor services will operate throughout the night period.

5 ASSESSMENT CRITERIA

5.1 GENERAL NOISE EMISSIONS

The EPA Industrial Noise Policy is the relevant guideline for assessing noise emissions from the facility.

The EPA Industrial Noise Policy, has two criteria which need to be satisfied namely Intrusiveness and Amenity. These are described below:

- *Intrusiveness Criteria* – This guideline is intended to limit the audibility of noise emissions at residential receivers and requires that noise emissions measured using the L_{eq} descriptor not exceed the background noise level by more than 5 dB(A). Where applicable, the intrusive noise level should be penalised (increased) to account for any annoying characteristics such as tonality.
- *Amenity Criteria* – This guideline is intended to limit the absolute noise level from all "industrial" noise sources such as mechanical plant to a level that is consistent with the general environment.

The EPA's Industrial Noise Policy sets out acceptable noise levels for various localities. Table 2.1 on page 16 of the policy indicates 4 categories to distinguish different residential areas. They are rural, suburban, urban and urban/industrial interface. Under the policy the nearest residence would be assessed against the suburban criteria. Noise levels are to be assessed at the property boundary or nearby dwelling, or at the balcony or façade of an apartment.

The project external noise level criteria based on the INP criteria are detailed in Table 2 below. As the correctional facility has sleeping areas, it has been deemed to be a "residential" receiver.

Table 2 – Noise Emission Requirements – Receivers (Suburban)

Receiver Type	Time of Day	Intrusiveness Noise Objective dB(A)$L_{eq(15min)}$	Amenity Noise Objective dB(A)$L_{eq(Period)}$
Suburban	Day (7am-6pm)	50	55
	Evening (6pm-9pm)	50	45
	Night – Shoulder Period (10pm to 11pm)	47	42.5*
	Night (10pm – 7am)	42	40
School Classroom	When in Use	N/A	35 (internally) / 45 externally **

*Taken as the midpoint between the evening and night Amenity noise goals.
** Noise objective of 45dB(A) externally based on a 10dB(A) reduction for an open window.

5.2 SLEEP AROUSAL

The L_1 noise level of any specific noise source should not exceed the background noise level (L_{90}) by more than 15 dB(A) outside a resident's bedroom window between the hours of 10pm and 7am. If the noise events are within this, then sleep arousal impacts are unlikely and no further analysis is needed. This is consistent with the Noise Guide for Local Government. As the background noise level is 42dB(A) at the quietest operational period during the night time (10pm to 11pm shoulder period) the sleep disturbance criterion is 57dB(A) L_1 outside the closest bedroom window during this period.

5.3 NOISE FROM INCREASED TRAFFIC GENERATION ON PUBLIC STREETS

Council's DCP has no specific noise criteria with respect to traffic generation associated with developments. In the absence of this, EPA guidelines can be used for assistance. For land use developments with the potential to create additional traffic the development should comply with the requirements for new developments detailed in the EPA Road Noise Policy. Increased noise levels on The Great Western Highway will be assessed against the "arterial" road acoustic criteria.

Noise levels generated by traffic should not exceed the noise levels set out in the table below when measured at a nearby property.

Table 3 – Criteria for Traffic Noise Generated by New Developments

Time of day	Criteria for Acceptable Traffic Noise Level Arterial Roads
Day (7am to 10pm)	60 $L_{Aeq(15hr)}$
Night (10pm to 7am)	55 $L_{Aeq(9hr)}$

However, if existing noise levels exceed those in the table below, the new development must not cause an increase noise of more than 2dB.

5.4 NOISE EMISSION CRITERIA FOR THE PROPOSED CHILDCARE CENTRE

The criteria adopted by the Land and Environment Court shall be adopted for the assessment of noise emissions from the proposed child care centre.

5.4.1 Decisions of the Land and Environment Court

The Association of Australian Acoustical Consultants adopts a "background+10dB(A)" noise emission goal for the use of outdoor spaces of child care centres.

This more lenient goal is in recognition that:

- Noise from children playing is not typically considered as intrusive as industrial noise (or other noise sources typically required to comply with a "background+5dB(A)" criteria), and should therefore not be held to the same criteria;

- There are very limited building controls that can practically be implemented for control of noise from outdoor areas; and

- The outdoor play areas are used only for limited periods of the day, at times when nearby properties are typically less noise sensitive.

The AAAC guidelines recommend a "background +10dB(A)" criteria for periods of 2 hours per day, and "background+5dB(A)" for other periods, or other noise sources at the site (vehicle, plant noise, noise from internal areas).

These criteria have also been adopted by the Land and Environment Court in a number of decisions, including *Mesabo Pty Limited v Mosman Municipal Council* [2004] NSWLEC 492.

5.4.2 Child Care Criteria

For this assessment, we propose that:

- Outdoor play areas be permitted to generate a noise level of 10dB(A)L_{eq} above the background noise level for up to 2 hours per day.

- All other noise sources must not generate a noise level exceeding background levels by more than 5dB(A)L_{eq}.

A summary is presented below:

Table 4 – Noise Emission Objectives at Residential Receivers

Location	Time of day	Background Level dB(A)L_{90}	Noise Emission Objective	
			Outdoor Play Areas (2 hours per day) dB(A)$L_{eq\ (15min)}$	Other Noise Sources dB(A)$L_{eq\ (15min)}$
Residential Properties to the south (cottage) and west (correctional facility)	Day (7am to 6pm)	**45**	**55**	**50**

6 NOISE EMISSION ASSESSMENT

The following noise sources will be assessed:

- Music breakout during church services within the main auditorium and youth ministry;
- Vehicle noise from carpark and loading dock;
- Noise associated with the outdoor child care areas; and
- Mechanical Equipment

6.1 MUSIC ACTIVITIES NOISE EMISSION ASSESSMENT

6.1.1 Amplified Music in Auditorium during Sunday Church Services and Friday Youth Ministry

Amplified music will be the loudest typical noise generated within the complex. The noise will be assessed at the nearest residences boundaries.

6.1.1.1 Noise Source

Acoustic Logic Consultancy has conducted a noise test of a church with similar size during a typical Sunday service session within a similar facility. The measurement was taken using a CEL-593 Type 1 Sound Level Analyser. Measurements were conducted during a session with amplified music. Measured sound pressure level within the auditorium is presented in Table 5 below.

Table 5 – Measured Activity Noise Levels SPL dB(A)L_{eq}

Event	31.5Hz	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Amplified Music (96L_{eq} dB(A))	99	99	91	93	94	91	88	81	78

6.1.1.2 Noise Emission Prediction

The prediction will be based on the following assumptions:

- The internal sound pressure level within the Auditorium and Youth Ministry will be up to 96dB(A)L_{eq}.. It has been advised by the client that the Auditorium and Youth Ministry will not have amplified music concurrently within the two spaces.
- All entry doors are closed during services.
- Recommended acoustic treatments in Section 7 of this report.

Predicted noise levels as a results of services within the main Auditorium and Youth Ministry are presented in Table 6 below.

Table 6 – Predicted Music Noise Emission – Internal Service Music

Receiver	Time of Day	Predicted Level dB(A)L_{eq}	Project Objectives dB(A)L_{eq}	Compliance
Southern Residential Cottage*	Night Time (10pm to 11pm)	40**	42.5	Yes
Cobham Correctional Centre*	Night Time (10pm to 11pm)	39**	42.5	Yes

*The residential receivers at this location represent the potentially worst affected receivers. Compliance at this location represents compliance at all other locations.

** Noise emissions have EPA modifying factors for intermittent noise applied.

6.2 CHILD CARE

6.2.1 Typical Outdoor Playing Noise Data

6.2.1.1 Outdoor Play Area Noise Measurements

Outdoor play area noise measurements were undertaken at Child Care Centre, 8 Central Avenue Mosman by this office on the 11th February 2005. Details of the measurements are presented below. Noise measurements were taken of the 3 to 6 year age group (8 children) at play. This group represents the most active of the age groups and hence are likely to generate the maximum noise levels. Although noise measurements have not been conducted for the 0-2 year age group, it would be expected that they would be likely to generate lower levels of sound than the older age group.

6.2.1.2 Measurement Location

Measurements were taken during the morning play session within the outdoor play area with 8 children present. The measurements were taken at noted distances to the children playing with the measured levels presented below.

6.2.1.3 Measurement Equipment

Noise measurements were obtained using a CEL-593 Type 1 Sound Level Analyser, set to A-weighted fast response. The sound level meter was calibrated at the beginning and the end of the measurement using a Rion NC-73 calibrator; no significant drift was detected. All measurements were taken on A-weighted fast response mode.

6.2.1.4 Measured Noise Levels

Table 7 - Measured Children Activity Noise Levels dB(A) L_{A10}

LOCATION	Activity	Distance	NOISE LEVEL
Outdoor Play Area	Bikes + Sandpit play	3m	66
	Blocks + Sandpit play	4m	64
	Stepping Blocks + Sandpit play	4m	57
	Play gym + Sand pit play	3-4m	65

6.2.2 Predicted Noise Levels

Noise emissions from the play areas are predicted based on the following assumptions:

- The measured typical children's play noise data above
- Play areas are assumed to be operating at the nominated capacity, and the children are distributed evenly across the outdoor play area.
- Outdoor playing time will be restricted to between 8am and 6pm
- The recommended constructions and management controls presented in Section 7 of this report have been implemented in the building.

The noise level at the nearest residents was predicted using the above data and by taking into account any expected noise reduction provided by the building fabric, distance losses, directivity, barrier effects, number of children playing etc.

Table below shows the predicted noise levels from the children in outdoor play area.

Table 8 - Predicted Noise Levels from Outdoor Play

Receptor	Predicted Noise Level $L_{eq,\ 15min}$ dB(A)	Criteria $L_{eq,\ 15min}$ dB(A)	Complies
Southern Residential Cottage	<40 External	55 External	Yes
Cobham Correctional Centre	53 External	55 External	Yes

6.3 VEHICLE NOISE (CAR PARK / LOADING DOCK

6.3.1.1 General Operation

Noise associated with the use of the loading dock and car park will likely consist of:

- Trucks moving into or out of the loading dock;
- Materials handling within the loading dock; and
- Cars manoeuvring and entering / exiting car parks

Noise generated on the proposed site will be assessed with reference to the EPA Industrial Noise Policy criteria presented in Section 5. Predictions will be made based on the following data/assumptions:

Table 9 – Loading Dock / Car Park Noise Source Data

Noise Source	Noise Level (sound power level) dB(A) L_{eq}
Truck engine (semi-trailer driving at approx 5km/h)	105
Materials handling	90
Car manoeuvring (approx 10km/h)	82

- Relative position of noise source and noise receiver, taking into account distance attenuation, air absorption, adverse weather and noise screening (where appropriate).

- It is assumed it takes approximately two minute for a truck to manoeuvre into or out of the loading dock to Great Western Highway.

Operational noise levels as a result of the operation of the loading dock are predicted and assessed against relevant criteria from Section 5 below. Operational noise levels have been assessed against the EPA night period noise criteria for residential receivers as this period has the most stringent criteria for the assumed use of the car park. The loading dock has been assessed against the evening period as this represents the most stringent time period for the operation of the dock (7am to 10pm).

Table 10 – Noise Emissions - Loading Dock / Car Park

Receiver Location	Noise Source	Predicted Noise Level – dB(A)$L_{eq(period)}$	Amenity Criteria dB(A)$L_{eq(period)}$	Intrusiveness Criteria Night dB(A)$L_{eq(15\ min)}$	Complies
Cobham Facility	Truck manoeuvring to/from loading dock	35dB(A)L_{eq}	45dB(A)L_{eq}	47dB(A)L_{eq}	Yes
	Materials Handling within loading dock	<30dB(A)L_{eq}	42.5dB(A)L_{eq}	47dB(A)L_{eq}	Yes
	Cars manoeuvring; entering / exiting	<35dB(A) L_{eq}	42.5dB(A) L_{eq}	47dB(A)L_{eq}	Yes
Residence to the south	Truck manoeuvring to/from loading dock	<20dB(A)L_{eq}	45dB(A)L_{eq}	47dB(A)L_{eq}	Yes
	Materials Handling within loading dock	<10dB(A)L_{eq}	42.5dB(A)L_{eq}	47dB(A)L_{eq}	Yes
	Cars manoeuvring; entering / exiting	41dB(A)L_{eq}*	42.5dB(A)L_{eq}	47dB(A)L_{eq}	Yes
Wollemi College	Truck manoeuvring to/from loading dock	40dB(A) L_{eq}	45dB(A) L_{eq}	N/A	Yes
	Materials Handling within loading dock	<30dB(A) L_{eq}	45dB(A) L_{eq}	N/A	Yes
	Cars manoeuvring; entering / exiting	43dB(A)L_{eq}	45dB(A) L_{eq}	N/A	Yes

*Based on implementation of treatments set out in Section 7.

All operational noise associated with the use of the loading dock and car parks is predicted to comply at nearest affected receivers with implementation of treatments nominated in Section 7.

Compliance at the locations listed within the table above demonstrates compliance at all receivers.

6.3.1.2 Short Term Noise Events (Sleep Arousal)

An assessment of the impact of car doors shutting (which represents the loudest event associated with this activity) has been undertaken. Car doors slamming has been measured by the office to be 90dB(A) $L_{1(1min)}$. All predictions take into account the relative position of noise source and noise receiver, distance attenuation, air absorption, adverse weather and noise screening (where appropriate).

Predicted noise levels are as follows:

Table 11 - Sleep Arousal Emergence Assessment

Receiver Location	Noise Source	Predicted Noise Level dB(A)$L_{1(1min)}$	Sleep Disturbance Screening Criteria dB(A) $L_{1(1min)}$	Awakening Reaction Test Required?
Cobham Facility	Car door slamming car park	50	57	Compliant - No further assessment required
Residence to the south	Car door slamming car park	49*	57	Compliant - No further assessment required

*Prediction based on implementation of treatments set out in Section 7.

All short term noise events associated with the operation of the car park are predicted to fully comply with the sleep disturbance screening criteria.

6.4 MECHANICAL NOISE EMISSION ASSESSMENT

All mechanical plant for the proposed development shall be selected and treated to comply with the EPA Industrial Noise Policy. At this stage, no mechanical plant has been selected. If necessary, acoustic treatments for mechanical plant should be determined at CC stage, with the provision of acoustic screens, silencers etc as necessary.

The plantroom on the western boundary may require treatments to the discharges of AHUs to control noise to the Cobham Facility.

6.5 INCREASED TRAFFIC ON PUBLIC STREETS

Vehicular access to and from the site will be via The Great Western Highway, an arterial road. As The Great Western Highway is an arterial road, additional noise as a result of increased traffic generation from the site will not be significant and less than 1dB(A) which is compliant the recommendations of the NSW Road Noise Policy.

It is noted that the Water Street entrance is subject to an upgrade (by others) and these works should comply with the NSW Road Noise Policy.

7 RECOMMENDATIONS

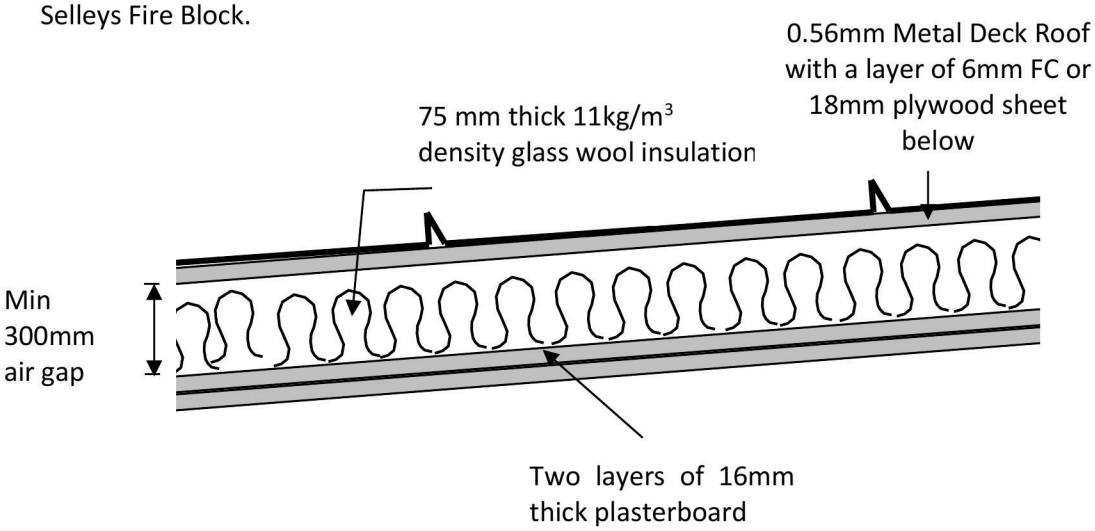
Noise emissions from the proposed development will comply with the nominated criteria provided that the following recommended building controls and treatments are adopted:

- Glazing to the external façade of the Youth Ministry should be 10.38mm laminated glass. Glass doors are to be fitted with full perimeter acoustic seals.

- Glazing to all areas of the external façade should be minimum 6mm glass with acoustic seals around perimeter.

- The external wall of the BOH and loadings dock of the main auditorium is to be minimum 190mm blockwork.

- The ceiling/roof construction for the Auditorium and Youth Ministry (and any areas with amplified music) should be as illustrated below. Penetrations in ceilings *(such as for light fittings etc.)* must be sealed gap free with a flexible 100% polyurethane sealant equal to Selleys Fire Block.



- External wall of masonry construction does not require any acoustic upgrades, all junctions and penetrations must be sealed gap free.

- Internal child care areas are to have windows shut on the southern façade during active play within internal areas.

- A 2.4m boundary fence should be constructed on the boundary of the car park and the residence in the location shown in green below. Fence may be constructed from lapped and capped timber, FC sheet, or Colorbond. The fence is to be imperforate (no gaps) and is to extend to the concrete slab of the car park.

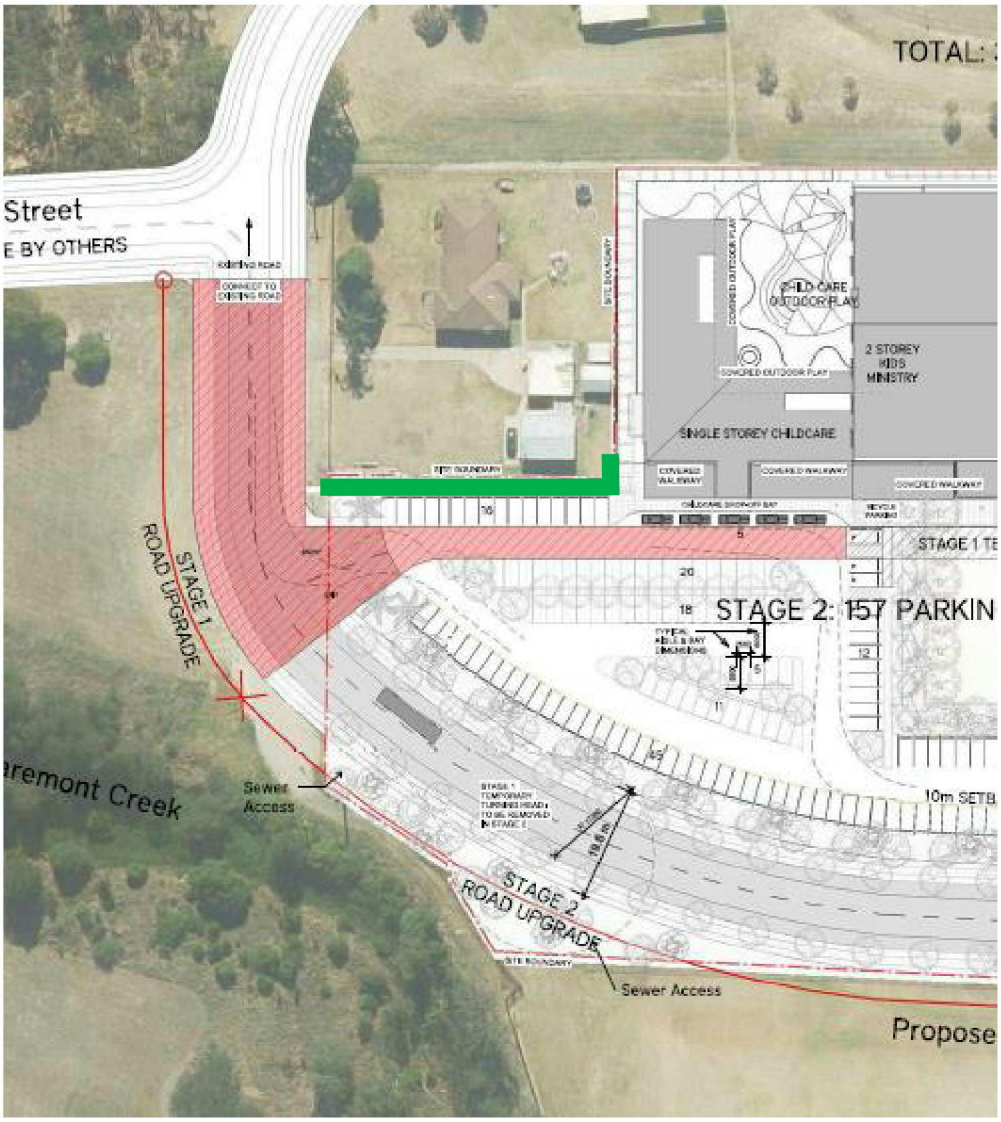


Figure 2 – Boundary Fence

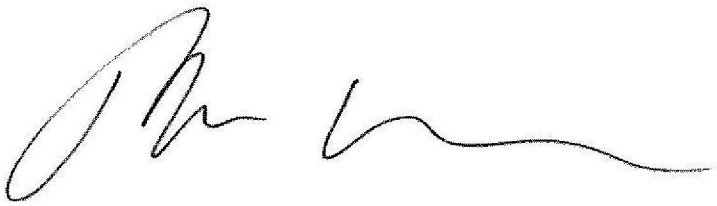
- The car park pavement shall be smooth and level to ensure minimal vertical displacement and potential for noise generated by wheel to concrete impacts. The surface finish shall be of a type that minimises squealing of car tyres.
- Concrete to have a broom finish or similar, to prevent tyre squeal.
- Signs reminding staff and visitors to minimise noise at night shall be installed at entry and exit points from the car park.
- Traffic calming devices should be applied to control vehicle speeds 10km/Hour.
- No speed humps are to be installed within the car park.
- Grates and any cover plates are to be fixed flush and tight.
- Mechanical plant is to be reviewed at CC stage to ensure compliance with noise emission goals presented in Section 5.

8 CONCLUSION

This report presents our assessment of potential noise emission associated with the proposed Hillsong Church to be located at 1 Water Street, Werrington.

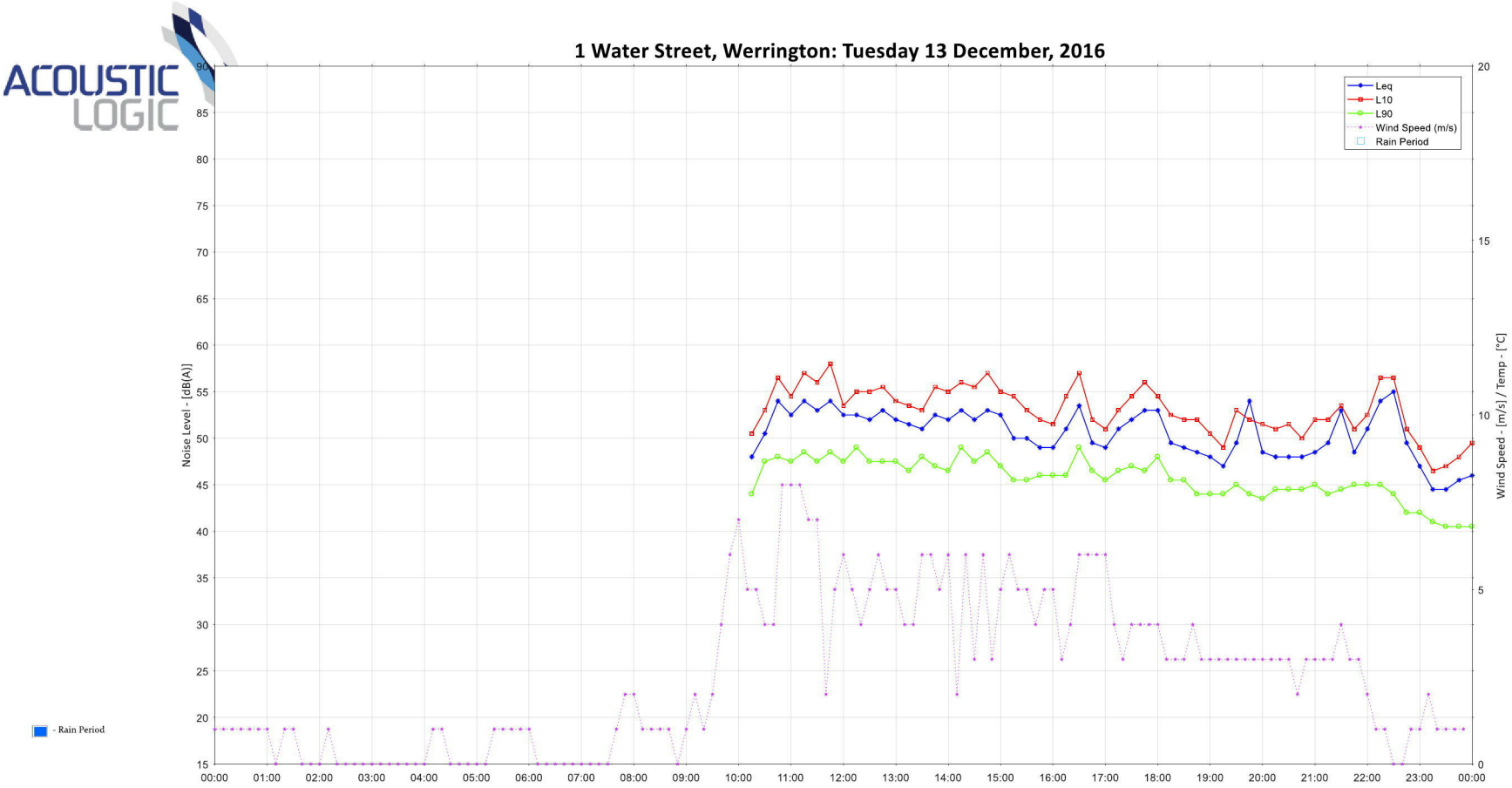
The assessment of noise impacts on neighbouring properties indicates that the proposed development will comply with the recommended noise goals presented in Section 5 provided that the acoustic treatments presented in Section 7 are adopted.

We trust this information is satisfactory. Please contact us should you have any further queries.



Thomas Aubusson MAAS

APPENDIX 1: NOISE LOGGING DATA



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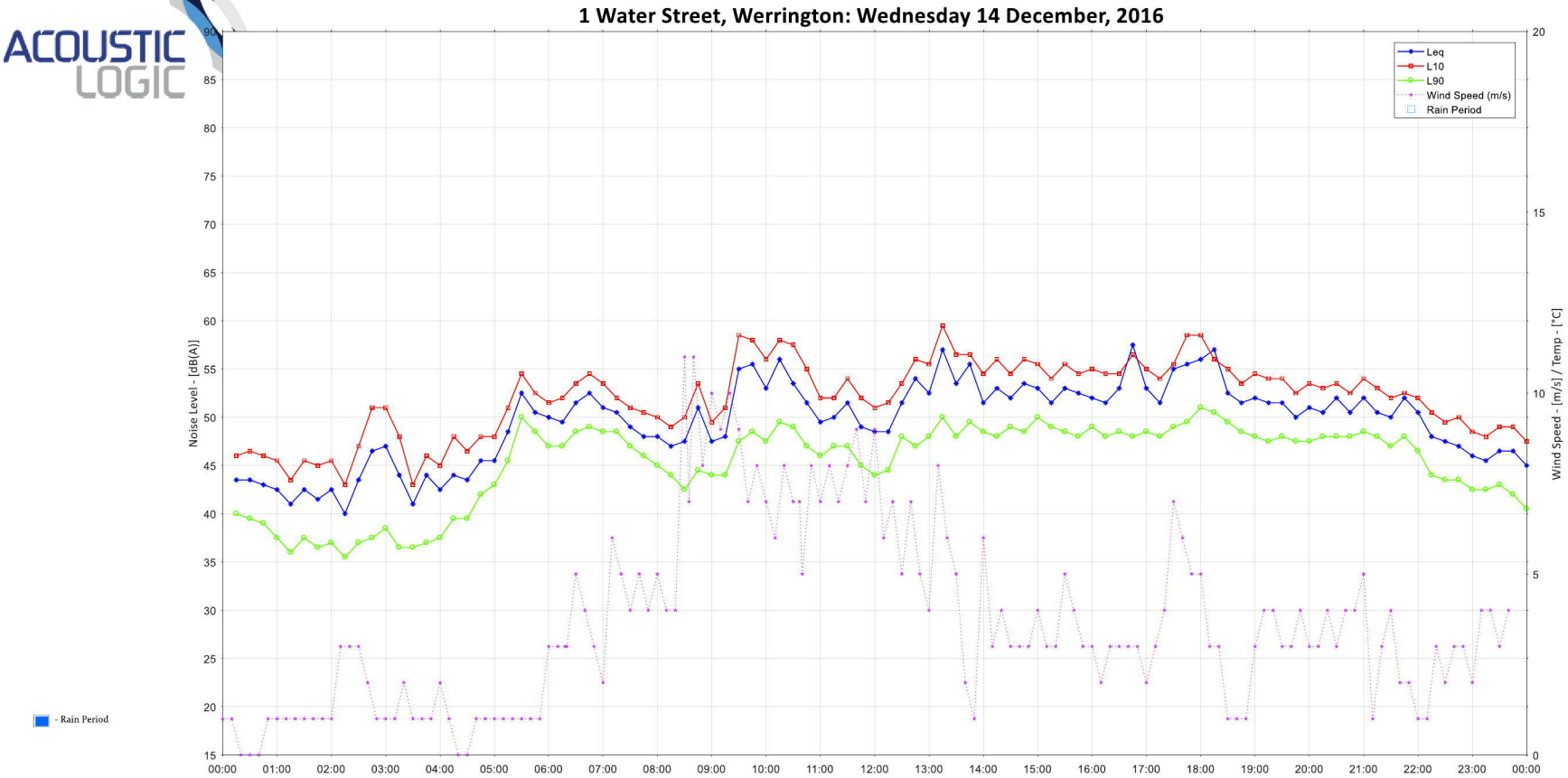

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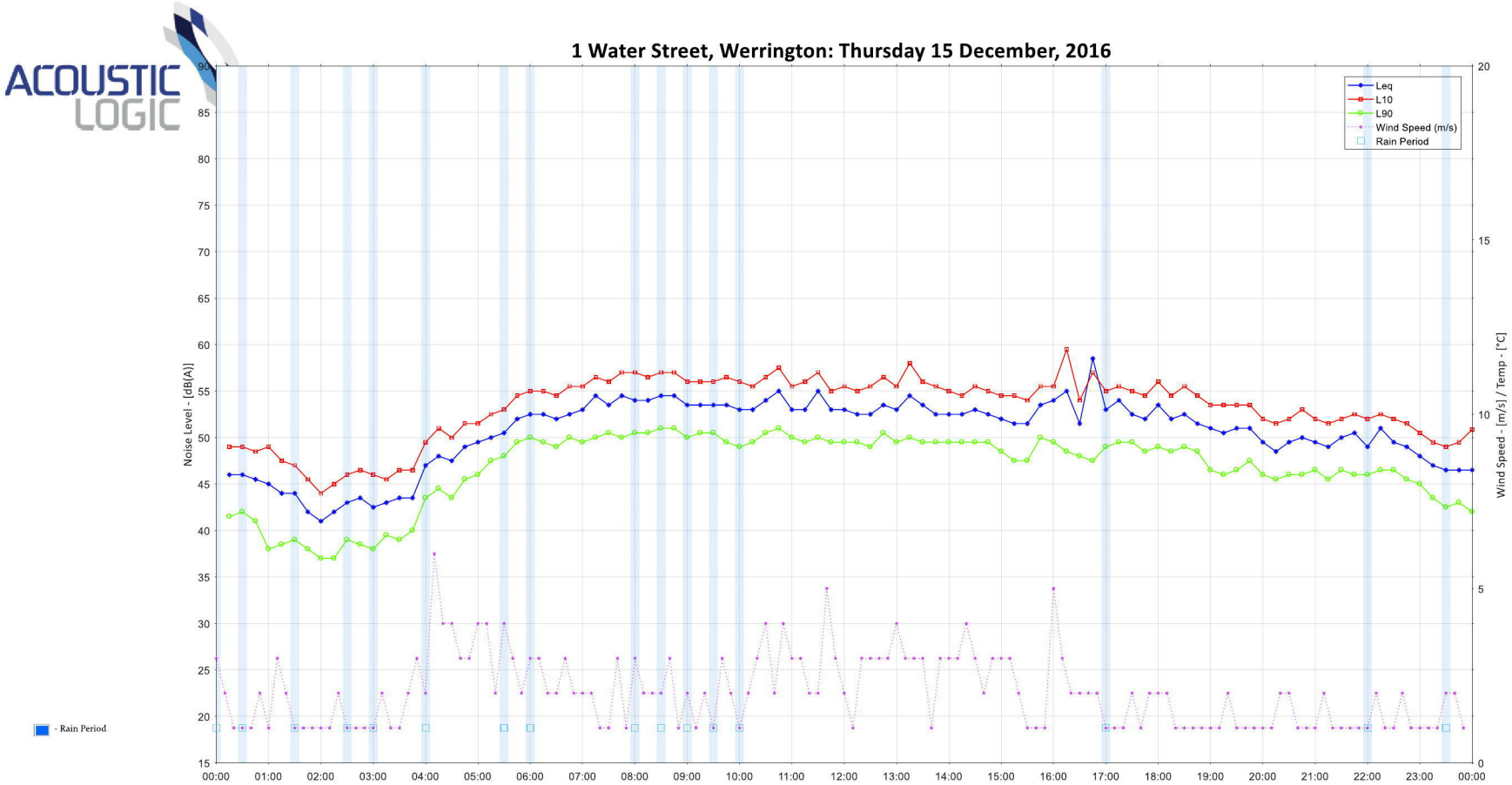

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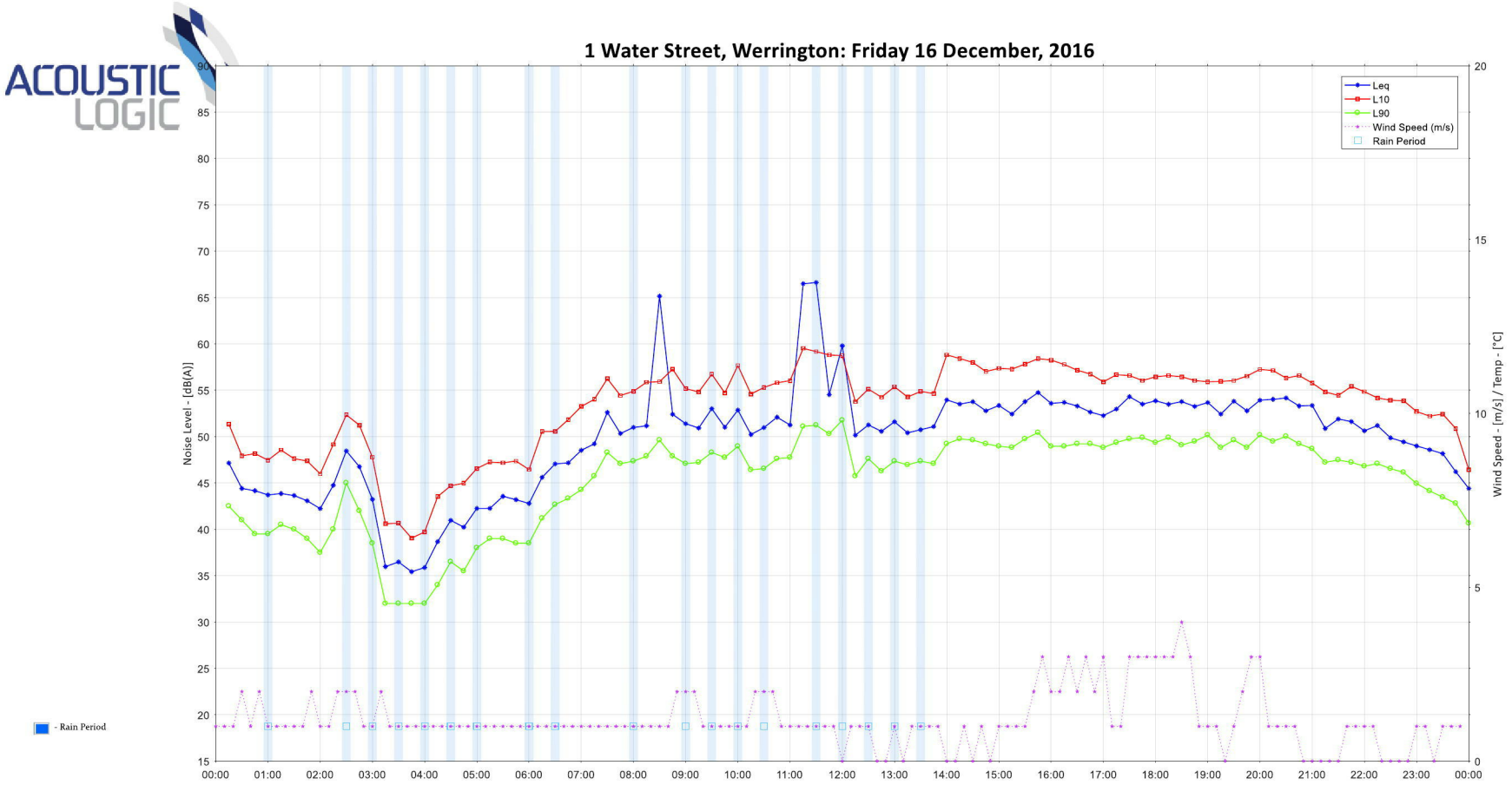

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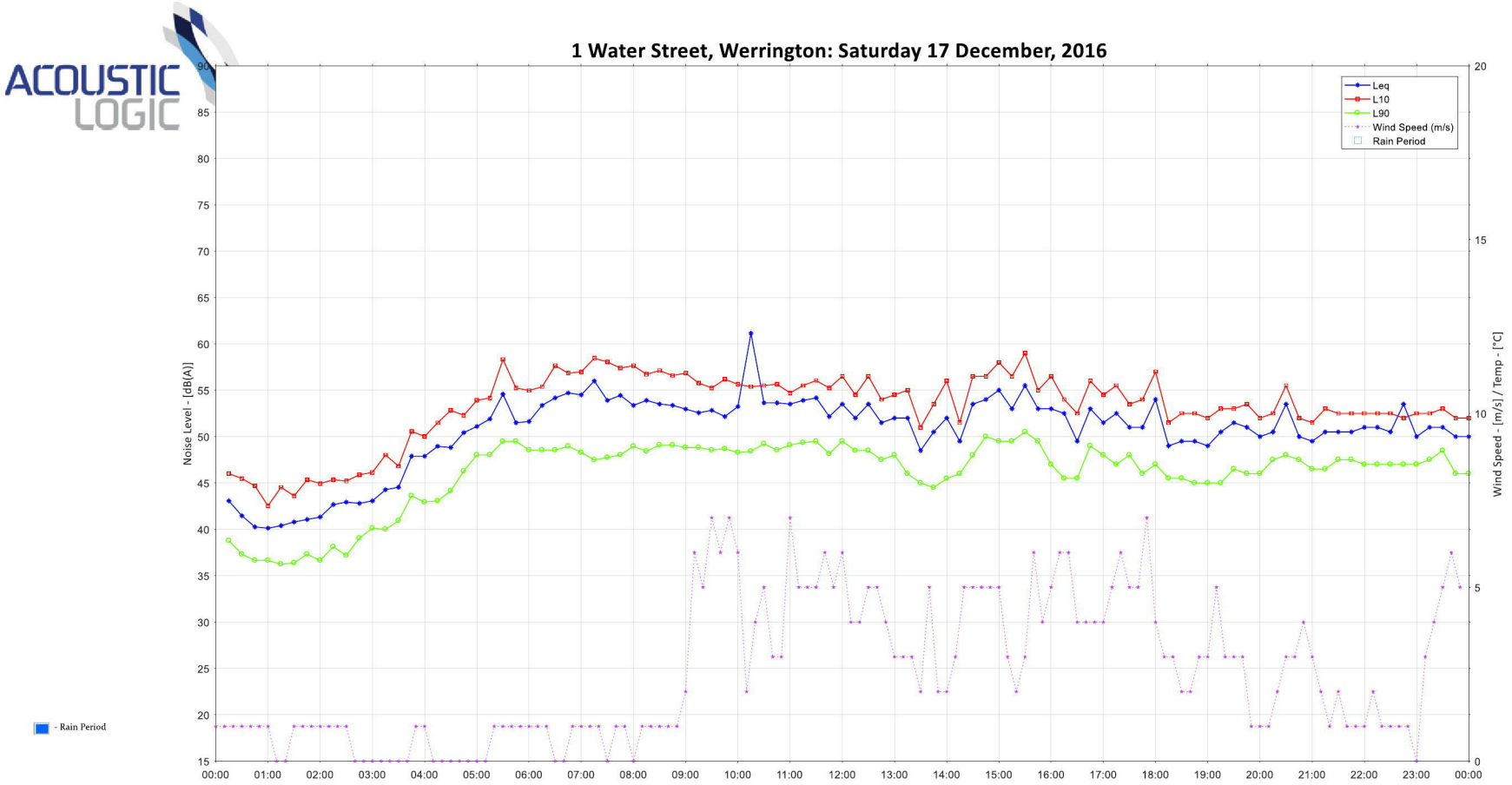

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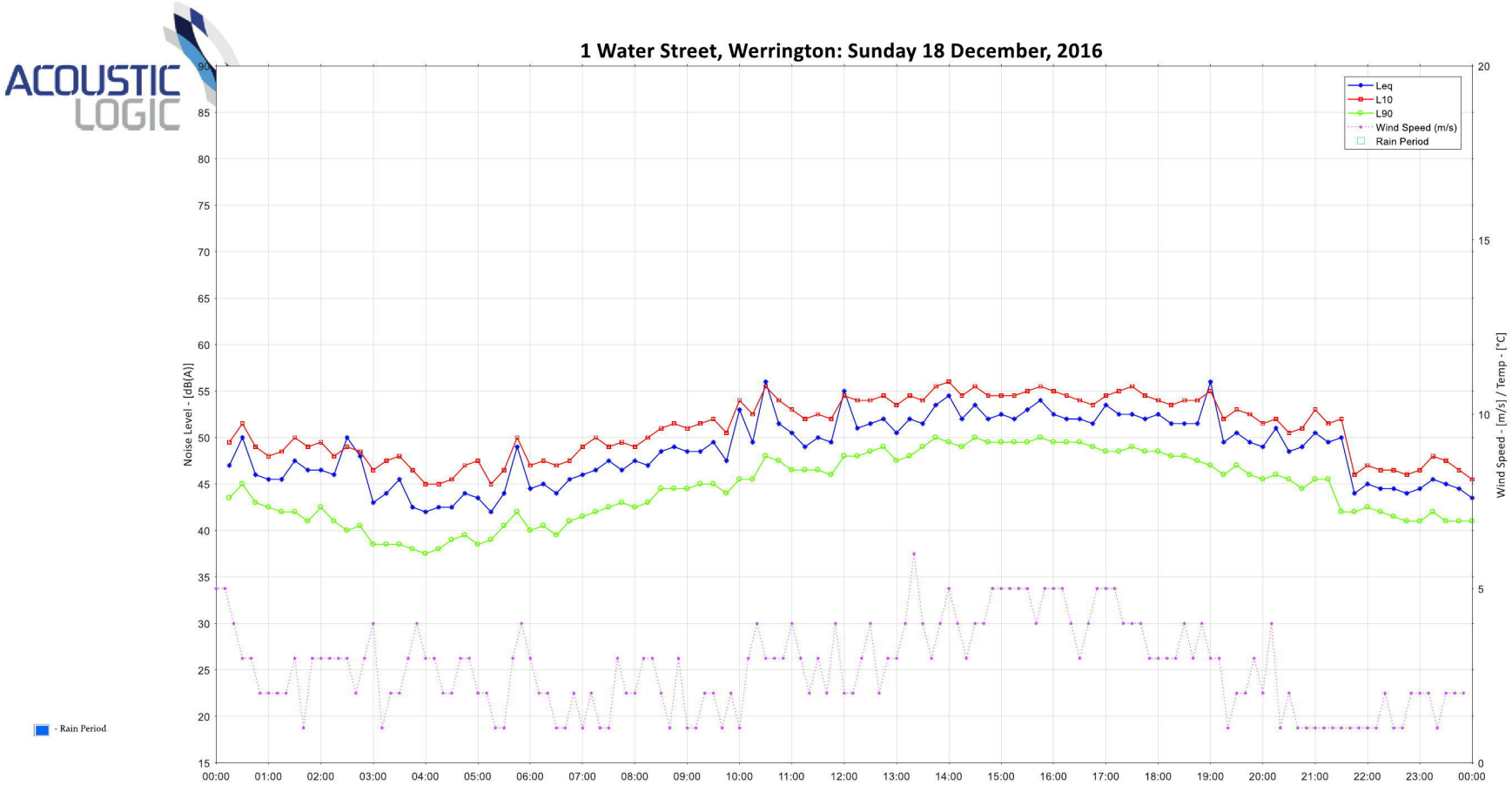

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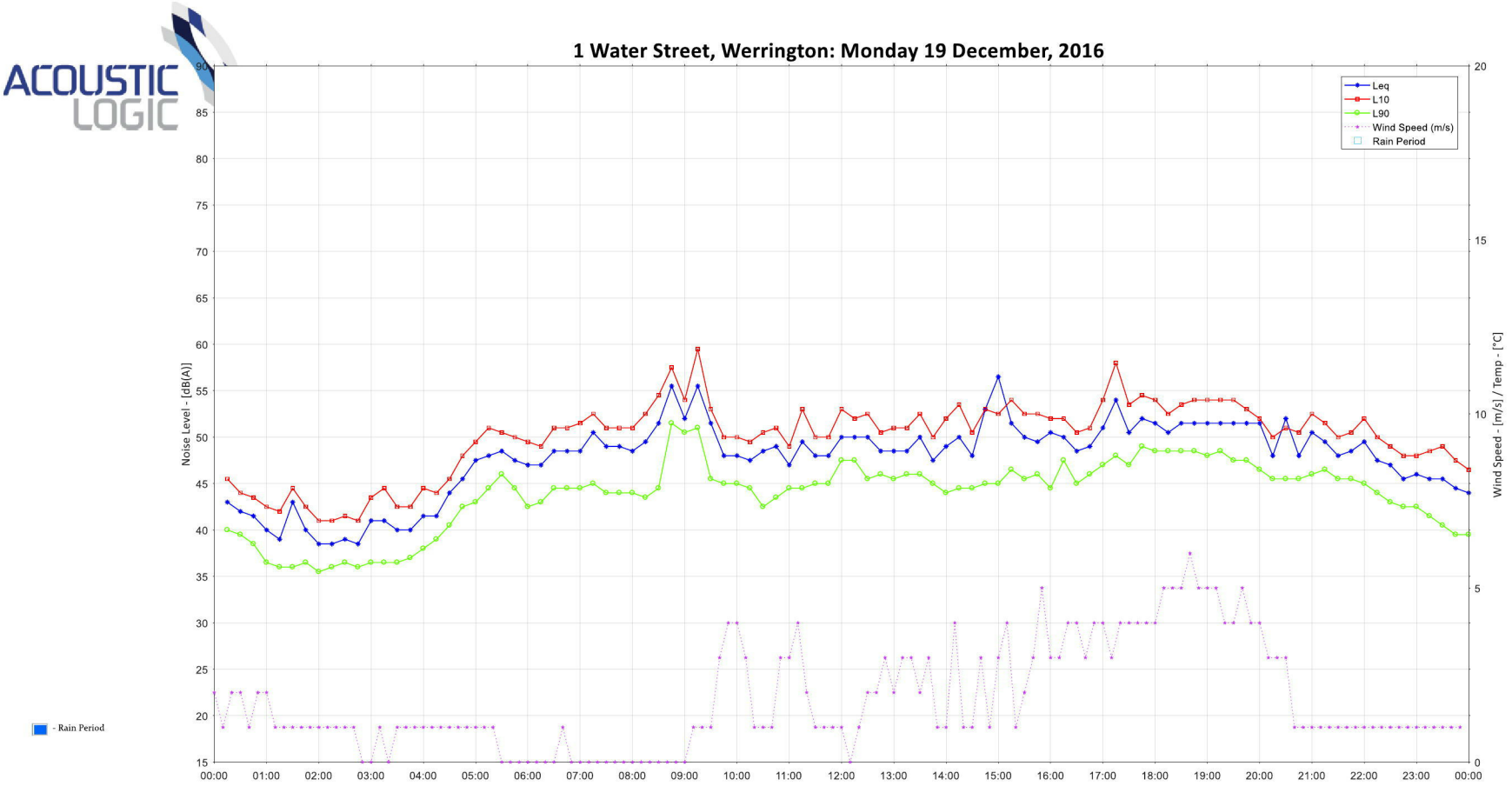

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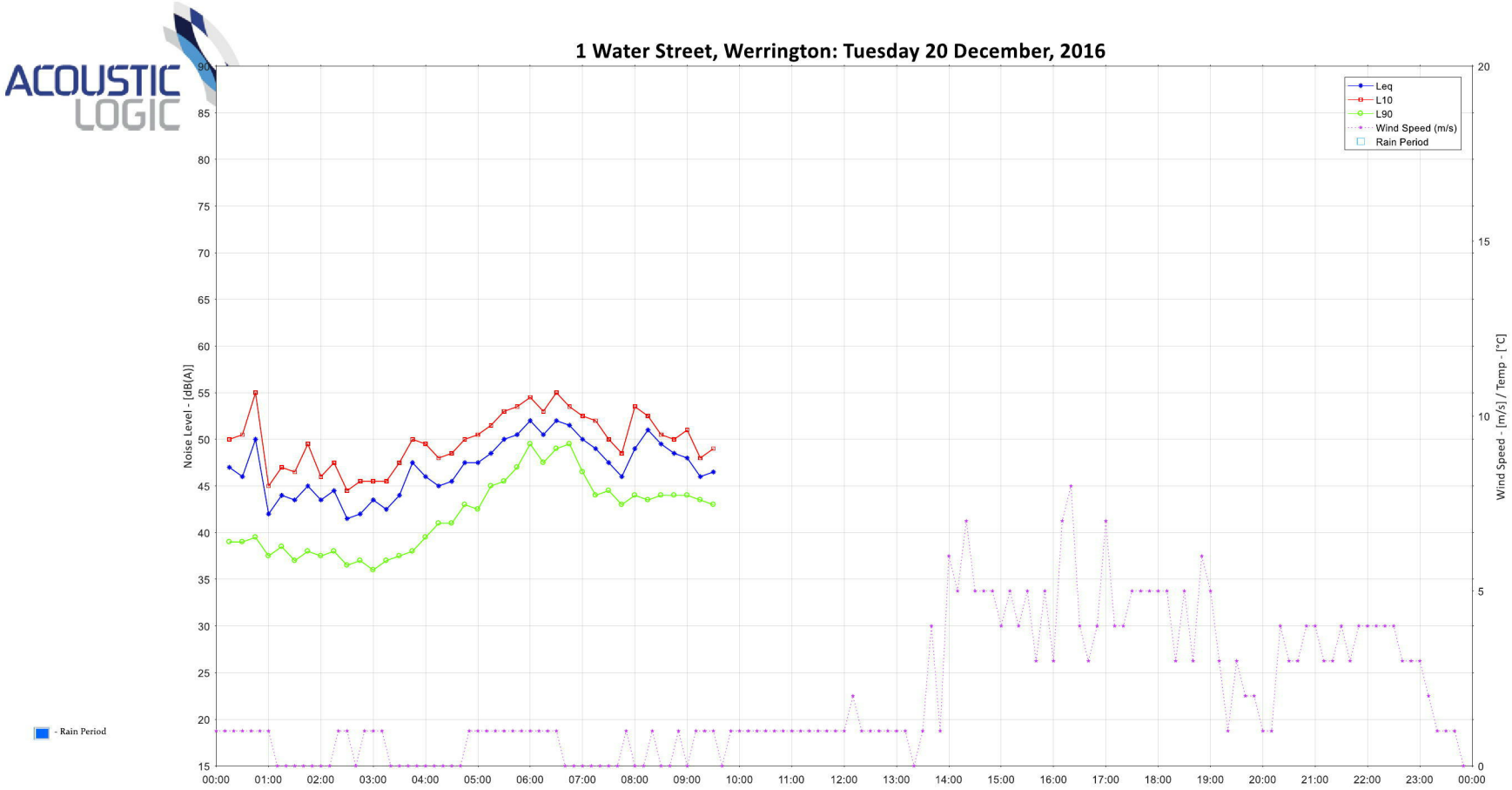

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