Adriano Pupilli Architects Pty Ltd

Long Reef SLSC

Acoustic Assessment

December 2019

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1. Introduction

1.1 Introduction

GHD has prepared an acoustic assessment for the proposed Long Reef Surf Life Saving Club (SLSC) and associated community services buildings to be located at Long Reef Beach, Collaroy. The objective of this assessment is to assess noise emission from the use and operation of the proposed facilities, and where required, provide noise mitigation measures to achieve the relevant requirements of the Northern Beaches Council

1.2 Scope of works

This report has been prepared to support the Development Application (DA) for the proposed terrace. The DA will be lodged with Northern Beaches Council.

The scope of this assessment includes:

- Undertake background noise monitoring to establish noise criteria in accordance with the requirements of North Beaches Council
- Assessment of the operational noise emission from the use and operation of the facilities in accordance with the requirements of the Northern Beaches Council
- Provide mitigation measures, where required, to reduce noise emission to acceptable levels.

This report has been prepared with consideration of the following documents:

- Warringah Development Control Plan (2011)

The assessment is based on the architectural drawings provided by Adriano Pupulli Architects dated 03 December 2019.

1.3 Limitations

This report: has been prepared by GHD for Adriano Pupilli Architects Pty Ltd and *may only be used and relied on by Adriano Pupilli Architects Pty Ltd for the purpose agreed between GHD and the Adriano Pupilli Architects Pty Ltd as set out in section 1 of this report.*

GHD otherwise disclaims responsibility to any person other than Adriano Pupilli Architects Pty Ltd 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. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Adriano Pupilli Architects Pty Ltd 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.

Site conditions (including the presence of hazardous substances and/or site contamination) may change

2. Proposal description

The proposal includes the use and operation of:

- A two storey function facility
- A boat shed
- A one storey bathroom facility
- Gym facilities
- Additional separate boat and board storage area
- An attached café

The proposal includes the following operational hours:

- 5:00 am to 7:00 am
  - fitness activities, including classes available in function and gym facilities
- 7:00 am to midnight
  - fitness activities, including classes available in function and gym facilities
  - large event functions available in function facility
- midnight to 1:00 am
  - last hour of service for large event functions, including pack down
- All hours
  - emergency surf life-saving operations and general Club Member operations and activities

The facilities are proposed to be located at the existing Long Reef Surf Life Saving Club at Long Reef Beach, as shown in Figure 2-1.

Figure 2-1 Site location

Table 2-1 presents a list of the nearest sensitive receivers to the proposal site.

Table 2-1 Surrounding sensitive receivers

Receiver ID	Receiver type	Address
R01	Residential	913 Pittwater Road, Collaroy
R02	Residential	915 Pittwater Road, Collaroy
R03	Residential	917 Pittwater Road, Collaroy
R04	Residential	919 Pittwater Road, Collaroy
R05	Residential	921 Pittwater Road, Collaroy
R06	Residential	923 Pittwater Road, Collaroy
R07	Residential	925 Pittwater Road, Collaroy
R08	Residential	927 Pittwater Road, Collaroy
R09	Residential	929 Pittwater Road, Collaroy
R10	Residential	931 Pittwater Road, Collaroy
R11	Residential	933 Pittwater Road, Collaroy
R12	Residential	935 Pittwater Road, Collaroy
R13	Residential	937 Pittwater Road, Collaroy
R14	Residential	939 Pittwater Road, Collaroy
R15	Residential	85 Cumberland Avenue, Collaroy
R16	Residential	87 Cumberland Avenue, Collaroy
R17	Residential	89 Cumberland Avenue, Collaroy
R18	Residential	91 Cumberland Avenue, Collaroy
R19	Residential	93 Cumberland Avenue, Collaroy
R20	Residential	95 Cumberland Avenue, Collaroy
R21	Residential	97 Cumberland Avenue, Collaroy
R22	Residential	99 Cumberland Avenue, Collaroy

3. Noise monitoring

3.1 Noise monitoring methodology

The methodology for the noise monitoring program includes the following:

- Identification of sensitive receivers including residences and other sensitive land uses in the vicinity of the proposal
- Noise logging was conducted from Wednesday 11 September to Monday 23 September, 2019 at a location representative of the nearest sensitive receiver to the proposal
- A calibration check was performed on the noise monitoring equipment using a sound level calibrator with a sound pressure level of 94 dB(A) 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 ± 0.5 dB(A).
- Noise monitoring was undertaken using a Rion NL-52 environmental noise logger. The noise logger was programmed to accumulate L_{A90}, L_{A10}, and L_{Aeq} noise descriptors continuously over the entire monitoring period.
- The data collected by the loggers 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 Bureau of Meteorology's Terrey Hills AWS (SN 066059).
- All noise monitoring activities were undertaken and processed in accordance with the Noise Policy for Industry (NPI, 2017) long term monitoring method. All noise logger settings and descriptors used were based on this method.

3.2 Summary of noise monitoring results

Details of the noise monitoring equipment and location are provided in Table 3-1. Noise logger data results are summarised in Table 3-2. Noise monitoring charts are presented in Appendix A.

Table 3-1 Background noise monitoring details

Location	Equipment Details	Equipment settings	Logger photo
Rear garden of 939 Pittwater Road, Collaroy	Rion NL-52 SN: 00131629	A-weighted Fast time response 15 minute intervals Pre/post calibration variance: -0.2 dB	

Table 3-2 Summary of noise monitoring results

Location	Background noise level $L_{A90(15min)}$, dB(A)			Ambient noise level $L_{Aeq(15min)}$, dB(A)		
	Day	Evening	Night	Day	Evening	Night
939 Pittwater Road, Collaroy	45	44	41	53	50	48

3.3 International Standard ISO 226 : 2003

The ISO 226 :2003 – Normal Equal-Loudness-Level contours presents *Tf* values for the threshold of human hearing in third octave bands. The *Tf* corresponding to each octave band centre frequency is presented in Table 3-3 below.

Table 3-3 Threshold of human hearing (ISO 226:2003 Table 1)

Weighting	dB in octave bands [Hz]								
	31.5	63	125	250	500	1000	2000	4000	8000
Z - weighted	59.5	37.5	22.1	11.4	4.4	2.4	-1.3	-5.4	12.6
A - weighted	20.1	11.3	6	2.8	1.2	2.4	-0.1	-4.4	11.5

Where background noise levels are below the threshold of human hearing, the A-weighted threshold of human hearing will be used.

3.4 Octave band noise monitoring results

The criteria presented in Section 4 requires the assessment of noise emission in octave bands. Octave band background noise levels are presented in Table 3-4.

Table 3-4 Octave band background noise levels

Time period	RBL L_{A90} in octave bands [Hz], dB(A)								
	31.5	63	125	250	500	1000	2000	4000	8000
Day	20(15)[1]	23	26	33	38	40	36	27	19
Evening	20(11)[1]	20	25	33	39	40	35	26	18
Night	20(7)[1]	15	22	31	36	36	31	23	17

Notes:

1. The human threshold of hearing has been used over the reported RBL (see Section 3.3). Numbers in brackets are the measured noise level

4. Noise criteria

4.1 Warringah Development Control Plan

The Warringah Development Control Plan (2011) provides the following requirements for noise emission associated with the use and operation of a development:

D3 Noise

Objectives

- *To encourage innovative design solutions to improve the urban environment*
- *To ensure that noise emission does not unreasonably diminish the amenity of the area or result in noise intrusion which would be unreasonable for occupants, users or visitors.*

Requirements

1. *Noise from combined operation of all mechanical plant and equipment must not generate noise levels that exceed the ambient background noise by more than 5dB(A) when measured in accordance with the NSW Industrial Noise Policy at the receiving boundary of residential and other noise sensitive land uses.*

The *NSW Industrial Noise Policy* has since been superseded by the *Noise Policy for Industry* (2017). The criteria for such pertaining to mechanical plant, as well as other sources of noise, is presented below in Section 4.3.

4.2 Protection of the Environment Operations Act 1997

Under the POEO Act 1997, the subject premises should not emit “offensive noise”. Under the POEO Act “offensive noise” means noise that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:

1. Is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or
2. Interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted.

In lieu of any numerical noise emission criteria within the POEO Act 1997, compliance with the NPI criteria should ensure the acoustic amenity of the sensitive receivers within the study area is adequately protected.

4.3 Noise Policy for Industry, 2017 (NPI)

In addition to the requirements above the NSW Environment Protection Authority’s *Noise Policy for Industry* (NPI) (which supersedes the Industrial Noise Policy) provides a suitable framework for the assessment of noise emission from the licensed venue to nearby residential and commercial receivers.

The NPI provides amenity criteria that are designed to limit the total noise level from all sources near a receiver. The NPI noise criteria are planning levels and are not mandatory limits required by legislation however the noise criteria will assist the determining authority to assess operational noise impacts. Where noise criteria are predicted to be exceeded, feasible and reasonable noise mitigation strategies should be considered. Feasible and reasonable noise mitigation measures should consider the economic, social and environmental costs and benefits of the development against the noise impacts.

The NPI reports the following with regards to proposal intrusiveness noise levels:

2.3 Proposal intrusiveness noise level

The intrusiveness of an industrial noise source may generally be considered acceptable if the level of noise from the source (represented by the L_{Aeq} descriptor), measured over a 15-minute period, does not exceed the background noise level by more than 5 dB when beyond a minimum threshold. This intrusiveness noise level seeks to limit the degree of change a new noise source introduces to an existing environment.

The NPI proposal intrusiveness criteria is presented in Table 4-1.

Table 4-1 Proposal intrusiveness criteria (NPI), dB(A)

Receiver type	Time of day	RBL, $L_{A90(15min)}$, dB(A)	Proposal intrusiveness noise criteria $L_{Aeq(15min)}$, dB(A)
Residential	Day (7:00 am to 6:00 pm)	45	50
	Evening (6:00 pm to 10:00 pm)	44	49
	Night (10:00 pm to 7:00 am)	41	46

The NPI also presents criteria for proposal amenity noise levels, which is defined as the recommended amenity noise level minus 5 dB. Table 4-2 presents proposal amenity noise criteria from the NPI.

Table 4-2 NPI amenity criteria

Type of receiver	Time of day	Recommended amenity noise level $L_{Aeq(period}$, dB(A)	Proposal amenity noise criteria $L_{Aeq(15min)}$, dB(A)[1]
Residential (Suburban)	Day	55	53
	Evening	45	43
	Night	40	38

Notes:

1) A – 3 dB correction has been applied to convert the noise descriptor from $L_{Aeq(period)}$ to $L_{Aeq(15min)}$

The NPI provides guidance for the assessment of sleep disturbance for short-term noise events. The NPI defines the sleep disturbance criteria during the night time at a residential location as L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB, which is greater. The proposal criteria for sleep disturbance is presented below in Table 4-3.

Table 4-3 NPI sleep disturbance criteria

Time period	Prevailing RBL $L_{A90(15min)}$, dB(A)	Sleep disturbance criteria L_{AFmax}, dB(A)
Night time	41	56

The proposal specific criteria for the NPI is presented below in Table 4-3.

Table 4-4 NPI proposal specific criteria

Type of receiver	Time of day	Noise descriptor	Noise criteria, dB(A)		
			Intrusiveness	Amenity	Proposal
Residential	Day	$L_{Aeq(15min)}$	***50***	53	50
	Evening	$L_{Aeq(15min)}$	49	***43***	43
	Night	$L_{Aeq(15min)}$	46	***38***	38
	Night	L_{AFmax}	56		

4.4 Liquor and Gaming New South Wales (LGNSW)

It is proposed that the SLSC will be licensed for the sale of alcohol. As such, an assessment against the standard conditions imposed on licensed venues by Liquor and Gaming New South Wales (LGNSW) has been undertaken.

The standard conditions imposed on licensed venues by LGNSW are presented below.

The L_{A10} noise emitted from the licensed premises shall not exceed the background noise level in any octave band frequency (31.5 Hz to 8 kHz inclusive) by more than 5 dB(A) between 7.00am and midnight at the boundary at any affected residence.

The L_{A10} noise level emitted from the licensed premises shall not exceed the background noise in any octave band centre frequency (31.5 Hz to 8 kHz inclusive) between midnight and 7.00am at the boundary of any affected residence.

Notwithstanding compliance of the above, noise from the licensed premises shall not be audible in any habitable room in any residential premises between the hours of midnight and 7.00am.

The LGNSW octave band noise criteria is presented below in Table 4-5.

Table 4-5 LGNSW octave band noise criteria for residential receivers

Time of day	RBL L_{A90} in octave bands [Hz], dB(A)								
	31.5	63	125	250	500	1000	2000	4000	8000
Day	20	23	26	33	38	40	36	27	19
Evening	20	20	25	33	39	40	35	26	18
Night	20	15	22	31	36	36	31	23	17
Time of day	LGNSW $L_{A10(15min)}$ criteria is octave bands [Hz], dB(A)								
	31.5	63	125	250	500	1000	2000	4000	8000
Day	25	28	31	38	43	45	41	32	24
Evening	25	25	30	38	44	45	40	31	23
Night (10:00 pm – 12:00 am)	25	20	27	36	41	41	36	28	22
Night (12:00 am – 7:00 am)	20	15	22	31	36	36	31	23	17

4.5 Emergency operations

There is no guidance for the assessment of noise from emergency operations from a SLSC. The *Interim Construction Noise Guideline* (EPA, 2009), whilst intended for construction activities, it allows “emergency works” to be conducted at any time to avoid the loss of life without requiring assessment. As such noise emission from emergency surf life-saving operations, including the deployment of water vessels or alarms in an emergency situation, are not required to be assessed, and not expected to occur frequently enough to significantly impact sensitive receivers.

5. Assessment of impacts

5.1 Modelling methodology and scenario

Noise modelling was undertaken using CadnaA 2019. CadnaA is a computer program for the calculation, assessment and prognosis of noise exposure. Environmental noise propagation in CadnaA was calculated using the ISO 9713-2 algorithm.

The following noise modelling assumptions were made to establish site specific conditions:

- The residential area was modelled assuming hard ground with a ground absorption coefficient of 0.75
- Modelled scenarios take into account the shielding effect from surrounding buildings and structures on and adjacent to the site
- Receivers were modelled at a height of 1.5 m (ground floor) and 4.5 m (first floor)

The following meteorological conditions used in the model:

- Atmospheric air absorption was based on an average temperature of 10°C and an average humidity of 75 % (conservative)
- Atmospheric propagation conditions were modelled with moderate inversions from source to receiver (ISO 9613)

The assessment of noise emission from the SLSC has been assessed against the relevant noise emission criteria. The resulting scenarios and assumptions for the assessment are as follows.

Scenario 1: Maximum noise emission – 7:00 am to 10:00 pm

This scenario represents the SLSC at maximum noise emission of a large event. The SLSC is at full capacity with live/amplified music played inside the function facility and ambient music played on the outside deck. The assumptions for the scenario are as follows:

- 320 patrons distributed evenly between the indoor function space and outdoor deck area:
  - 70% patrons talking with normal voices – Sound power level (SWL) 73 dB(A) each
  - 20% patrons talking with raised voices – SWL 80 dB(A) each
  - 10% patrons talking with loud voices – SWL 87 dB(A) each
  - Glass partitioning doors separating indoor function space and outdoor deck are open
  - It is assumed that 50% of patrons are talking at any given time
- 3 speakers playing background music on the outdoor deck area – each SWL 85 dB(A)
- Amplified music/live band playing inside indoor function space – internal reverberant sound pressure level (SPL) 91 dB(A)
- 2 carparks with 60 spaces each – SWL 73 dB(A) (based on LfU Study 2007)

Scenario 2: Function space doors closed – 10:00 pm to 12:00 am

This scenario represented the SLSC at a reduced noise emission in order to protect the acoustic amenity of the surrounding receivers. The doors to between the function facility and outside deck are now closed with no ambient music played on the outside deck. The assumptions for the scenario are as follows:

- 320 patrons distributed evenly between the indoor function space and outdoor deck area:

  - 70% patrons talking with normal voices – Sound power level (SWL) 73 dB(A) each
  - 20% patrons talking with raised voices – SWL 80 dB(A) each
  - 10% patrons talking with loud voices – SWL 87 dB(A) each
  - Glass partitioning doors separating indoor function space and outdoor deck are closed – minimum thickness 10.38 mm laminated glass
  - It is assumed that 50% of patrons are talking at any given time
- 2 car parks with 60 spaces each – SWL 73 dB(A) (based on LfU Study 2007)
- Amplified music/live band playing inside indoor function space – internal reverberant sound pressure level (SPL) 91 dB(A)
- No amplified or background music to be played in the outside deck area

Scenario 3: Patrons inside – midnight to 1:00 am

This scenario represents the SLSC at its lowest noise emission. Any live/amplified music within the function facility has now finished. This is the last hour of service for any functions, with only ambient background music played in the function facility and all patrons now located within the function facility only. The assumptions for the scenario are as follows:

- 320 patrons distributed within the indoor function space:
  - 70% patrons talking with normal voices – Sound power level (SWL) 73 dB(A) each
  - 20% patrons talking with raised voices – SWL 80 dB(A) each
  - 10% patrons talking with loud voices – SWL 87 dB(A) each
  - Glass partitioning doors separating indoor function space and outdoor deck are closed – minimum thickness 10.38 mm laminated glass
  - It is assumed that 50% of patrons are talking at any given time
- 2 car parks with 60 spaces each – SWL 73 dB(A) (based on LfU Study 2007)
- Ambient music playing inside indoor function space – internal reverberant SPL 85 dB(A)

Scenario 4: Gym noise – 5:00 am to 7:00 am

This scenario represents the SLSC during early morning gym use. Patrons may utilise the gym space and function facility during this time, and will also include fitness classes. It will be assumed that the glass partitioning doors to the gym and function facility will be open and music will be playing inside. The carpark may be in use at this time. The assumptions for the scenario are as follows:

- Internal reverberant sound pressure level (SPL) for gym space and function facility – 82 dB(A)[1]
- Outdoor glass partitioning to gym and function space doors open – 0 Rw sound reduction
- 2 car parks with 60 spaces each – SWL 73 dB(A) (based on LfU Study 2007)

No significant noise from other SLSC operations or mechanical plant is expected to contribute to the overall noise emission and has not been included in the assessment. At a distance of 175 m (the approximate distance between the location of mechanical plant and the nearest residential receivers), the attenuation of noise (from distance, shielding, ground and atmospheric absorption) from mechanical plant likely to be installed at the site (generally SWL <90 dB(A)) will be great enough that its contribution to the received noise levels will be negligible. At

[1] Source noise data taken from similar gym noise assessments

detailed design, a detailed assessment should be considered to confirm the mechanical plant noise levels at the nearest receivers will be compliant with the relevant noise criteria.

It must be noted that whilst the proposed SLSC includes operational hours from 6:00 am, it is only for the use of training facilities and classes. It is expected that the noise emission from such will not contribute to the overall noise emission and has also not been included in the assessment.

5.2 Noise assessment

5.2.1 NPI noise assessment

Results of the NPI noise assessment for the 3 operational scenarios are presented below in

Table 5-1 NPI noise assessment results

Receiver ID	Scenario 1, dB(A) 7:00 am to 10:00 pm		Scenario 2, dB(A) 10:00 pm to 12:00 am		Scenario 3, dB(A) 12:00 am to 1:00 am		Scenario 4, dB(A) 5:00 am to 7:00 am	
	Criteria	Noise level	Criteria	Noise level	Criteria	Noise level	Criteria	Noise level
R01	53	41	43	29	38	24	38	35
R02		42		30		25		35
R03		42		30		26		35
R04		36		23		15		25
R05		43		31		28		35
R06		42		31		28		35
R07		42		32		29		35
R08		43		32		29		34
R09		42		32		29		33
R10		42		31		28		32
R11		41		31		27		31
R12		40		30		25		30
R13		38		29		23		28
R14		37		29		22		27
R15		33		22		14		22
R16		34		24		19		24
R17		35		24		19		25
R18		37		25		20		27
R19		39		25		18		29
R20		38		25		17		28
R21		28		20		14		19
R22		38		26		19		30

5.2.2 LGNSW noise assessment

Results for the LGNSW octave band noise assessment for operational scenarios 1, 2 and 3 are presented below in Table 5-2, Table 5-3 and Table 5-4. The most stringent criteria for each scenario is presented alongside the received noise levels.

Operational scenario 4 has not been assessed against the LGNSW octave-band noise criteria as this assessment is focused on assessing noise from entertainment venues and not from gyms or gym activities

Table 5-2 LGNSW octave band noise assessment – Scenario 1 7:00 am to 10:00 pm

Time of day	LGNSW octave band $L_{A10(15min)}$ noise criteria in octave bands [Hz], dB(A)								
	31.5	63	125	250	500	1000	2000	4000	8000
Day	25	28	31	38	43	45	41	32	24
Evening	25	25	30	38	44	45	40	31	23
Receiver ID	Predicted $L_{A10(15min)}$ in octave bands [Hz], dB(A)								
	31.5	63	125	250	500	1000	2000	4000	8000
R01	0	9	28	36	38	41	34	20	0
R02	0	9	29	36	38	42	34	21	0
R03	0	9	29	37	39	42	35	22	0
R04	0	9	25	32	33	35	27	11	0
R05	0	9	29	37	39	43	36	23	0
R06	0	9	29	36	39	42	35	22	0
R07	0	9	29	36	39	42	35	22	0
R08	0	9	29	36	39	42	36	22	0
R09	0	9	28	36	38	42	36	22	0
R10	0	8	28	36	38	42	35	21	0
R11	0	8	27	35	38	41	35	20	0
R12	0	7	27	35	36	39	34	19	0
R13	0	7	26	34	35	36	29	14	0
R14	0	6	25	34	35	36	28	13	0
R15	0	3	23	32	31	30	21	4	0
R16	0	4	24	32	32	31	22	5	0
R17	0	5	24	33	33	32	23	7	0
R18	0	6	25	34	35	35	27	11	0
R19	0	8	26	35	37	38	30	15	0
R20	0	6	25	34	35	36	29	13	0
R21	0	5	20	27	25	25	17	3	0
R22	0	8	26	33	34	37	30	15	0

Table 5-3 LGNSW octave band noise assessment – Scenario 2 10:00 pm to midnight

Time of day	LGNSW octave band $L_{A10(15min)}$ noise criteria in octave bands [Hz], dB(A)								
	31.5	63	125	250	500	1000	2000	4000	8000
Night (10pm – 12am)	25	20	27	36	41	41	36	28	22
Receiver ID	**Predicted $L_{A10(15min)}$ in octave bands [Hz], dB(A)**								
	31.5	63	125	250	500	1000	2000	4000	8000
R01	4	19	22	29	35	39	31	19	14
R02	4	19	22	29	35	39	31	19	14
R03	4	19	22	29	35	39	31	19	14
R04	6	21	18	23	28	30	21	6	0
R05	5	20	23	29	35	39	31	19	15
R06	5	20	23	29	35	38	31	19	15
R07	5	20	23	29	35	38	31	19	15
R08	5	20	23	29	34	38	31	18	14
R09	5	20	22	29	34	38	30	18	13
R10	5	20	22	29	34	37	30	17	11
R11	5	20	22	29	34	37	29	16	9
R12	5	20	22	29	32	34	29	15	5
R13	4	20	21	29	31	31	23	10	1
R14	4	19	21	29	30	31	23	9	0
R15	0	15	16	23	26	24	14	0	0
R16	3	17	17	24	27	25	15	0	0
R17	3	18	18	24	28	27	17	1	0
R18	3	17	18	25	29	29	19	3	2
R19	5	21	19	25	32	33	25	10	2
R20	4	18	18	25	30	31	22	8	1
R21	3	16	13	19	19	18	8	0	0
R22	5	20	20	26	29	31	23	8	5

Table 5-4 LGNSW octave band noise assessment – Scenario 3 midnight to 1:00 am

Time of day	LGNSW octave band $L_{A10(15min)}$ noise criteria in octave bands [Hz], dB(A)								
	31.5	63	125	250	500	1000	2000	4000	8000
Night (12am to 7am)	20	13	20	30	34	35	30	22	17
Receiver ID	Predicted $L_{A10(15min)}$ in octave bands [Hz], dB(A)								
	31.5	63	125	250	500	1000	2000	4000	8000
R01	0	0	2	10	12	11	2	0	0
R02	0	0	3	10	13	11	2	0	0
R03	0	0	3	10	13	11	2	0	0
R04	0	1	0	3	5	2	0	0	0
R05	0	0	3	10	13	11	2	0	0
R06	0	0	3	11	13	11	2	0	0
R07	0	0	3	11	13	11	2	0	0
R08	0	0	3	11	13	11	2	0	0
R09	0	1	3	11	13	11	2	0	0
R10	0	1	3	11	13	11	1	0	0
R11	0	1	3	11	13	11	1	0	0
R12	0	1	2	11	13	11	1	0	0
R13	0	0	1	11	13	11	0	0	0
R14	0	0	1	11	13	10	0	0	0
R15	0	0	0	4	4	0	0	0	0
R16	0	0	0	5	5	1	0	0	0
R17	0	0	0	5	6	2	0	0	0
R18	0	0	0	6	8	4	0	0	0
R19	0	1	0	6	9	6	0	0	0
R20	0	0	0	6	8	4	0	0	0
R21	0	0	0	0	0	0	0	0	0
R22	0	0	0	8	9	6	0	0	0

5.2.3 Sleep disturbance assessment

The assessment of sleep disturbance form the use and operation of the proposed SLSC is based on the following scenarios that represent maximum noise level events, and is assessed against the NPI sleep disturbance criteria:

- SD1: Snare drum (or equivalent) inside function space – SWL 105 dB(A)
- SD2: Car door slam in the car park (sound power level of 85 dB(A)
- SD3: Patron shouting in outdoor deck area – SWL 90 dB(A)

It is expected that maximum noise events from within the SLSC would be similar to this or less.

The results of the sleep disturbance noise assessment are presented in Table 5-5.

Table 5-5 Sleep disturbance assessment

Receiver ID	Receiver type	Criteria L_{AFmax}, dB(A)	Predicted max noise level at receiver L_{AFmax}, dB(A)			Compliance
			SD1	SD2	SD3	
R01	Residential	56	27	35	28	Yes
R02			27	37	29	Yes
R03			28	38	30	Yes
R04			22	34	22	Yes
R05			28	42	30	Yes
R06			28	44	30	Yes
R07			28	46	30	Yes
R08			28	48	30	Yes
R09			28	48	30	Yes
R10			27	46	29	Yes
R11			27	44	29	Yes
R12			25	41	26	Yes
R13			24	39	23	Yes
R14			23	37	23	Yes
R15			20	25	17	Yes
R16			21	32	18	Yes
R17			22	34	19	Yes
R18			24	33	22	Yes
R19			26	34	26	Yes
R20			25	29	24	Yes
R21			12	32	10	Yes
R22			24	22	25	Yes

5.3 Discussion

The results of the NPI, LGNSW and sleep disturbance noise assessments indicate the following:

- The proposed operational scenarios are compliant with both the NPI and LGNSW criteria
- The maximum noise emission from the SLSC is compliant with the sleep disturbance criteria.

Mitigation measures are presented in Section 6 to ensure compliance with the relevant noise criteria.

6. Mitigation measures

The results of the noise assessment presented in Section 0 indicate the following operational procedure presented in Table 6-1 will need to be in place for the SLSC to be compliant with the relevant noise emission criteria presented in Section 4.

Table 6-1 Operational procedure

Representative scenario	Time of day	Operations
Scenario 4	5 am to 7 am	• Gym and function facilities are open for fitness activities and classes • Glass partitioning doors to gym and function facility may be open
Scenario 1	7 am to 10 pm	• Ambient music may now be played on outside deck • Partitioning doors separating outside deck to inside function space can now be open • Amplified DJ/live band music may now be played inside the function space
Scenario 2	10 pm to 12 am	• Ambient music on outside deck is not to be played • All doors separating the outside deck to the inside function space must be closed. They may only be opened for the ingress and egress of patrons between the two spaces • Amplified DJ/live band music may be played inside function space
Scenario 3	12 am to 1 am	• All patrons are to be moved indoors prior to 12 am • Doors separating the outside deck to the inside function space are to remain closed • Amplified DJ/live music is to cease; only ambient background music may be played inside function space
-	1 am to 5 am	• No amplified music or ambient music is to be played
-	24 hours	• SLSC may be used for emergency surf life-saving operations • General club member operations and activities may take place. Excessive noise is to be kept to a minimum.

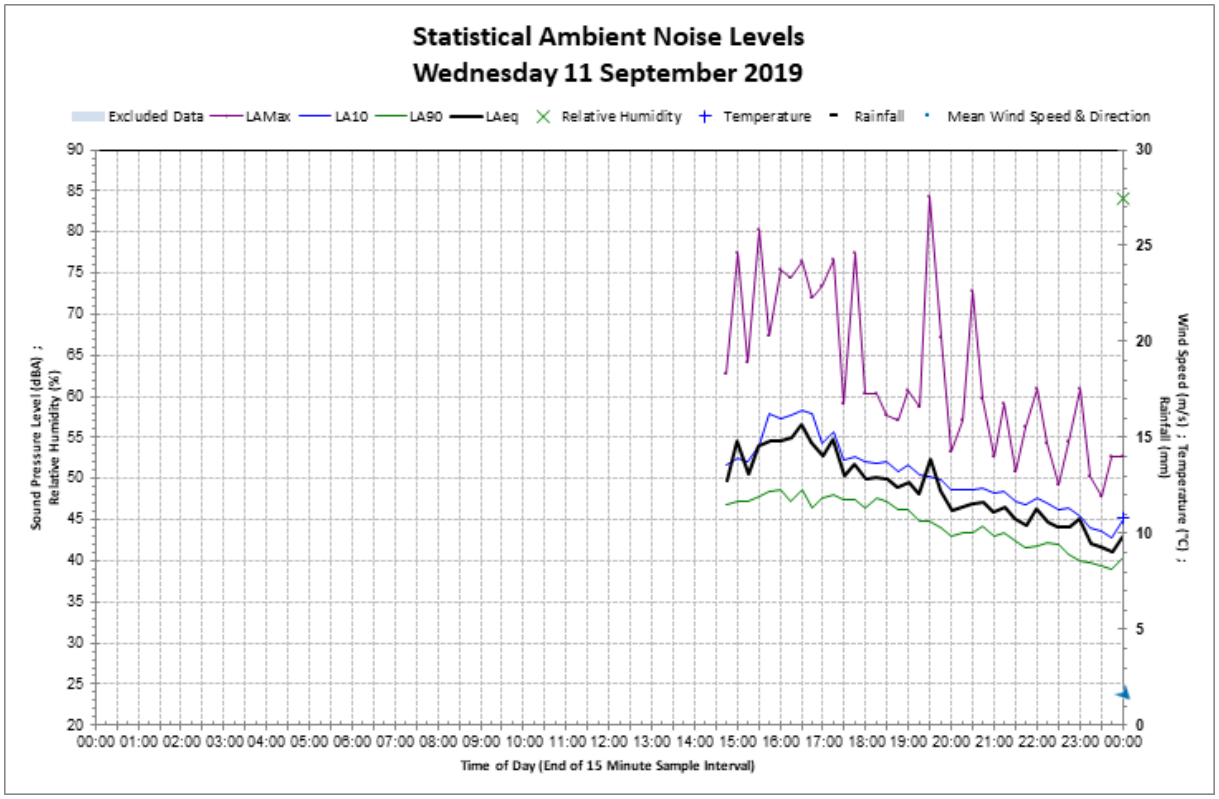
The following additional mitigation measures are provided in order to ensure that compliance with the relevant acoustic criteria is maintained and the acoustic amenity of the nearby receivers is adequately protected:

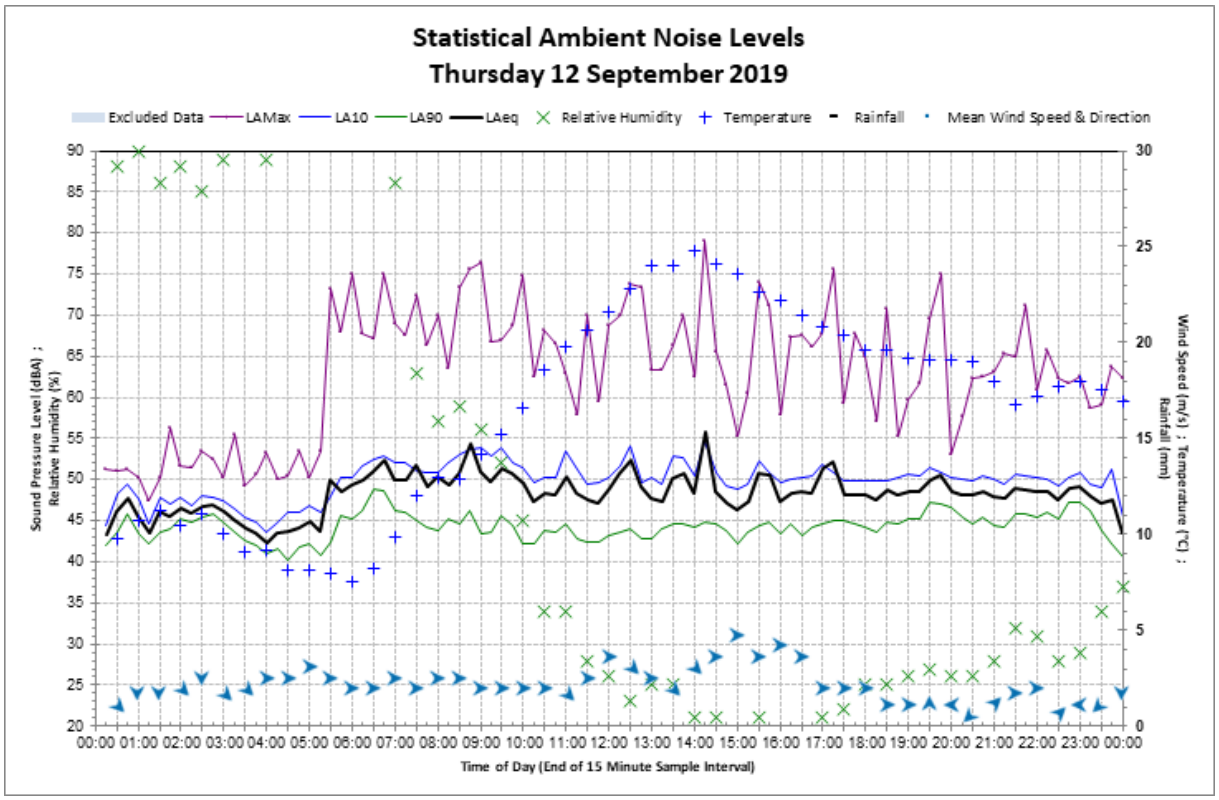
- Glazing on the northern façade of the indoor function space is to be minimum 10.38 mm thick laminated glass.
- All other façade may be constructed of standard glazing.
- The erection of clear signage at the entry/exit of the venue advising patrons that they must not generate excessive noise and leave the premises in a quiet and sensible manor to minimise any potential impacts on the surrounding amenity.
- For all speakers located in the outdoor courtyard area:
  - They should be directed away from the residential receivers to the west on Pittwater road. They may be directed north, east or south
  - The volume of the speakers should be set at SWL of $L_{Aeq(15min)}$ 85 dB(A) or a sound pressure level of $L_{Aeq(15min)}$ 77 dB(A) at 1 metre
- Emptying glass bottles in bins is to be conducted during the day time hours only (7 am to 6 pm Monday to Saturday and 8 am to 6 pm on Sundays and Public Holidays). Glass bottles should be crushed prior to disposal, if possible
- Mechanical plant should be maintained correctly and in proper working order so as to minimise excessive noise
- Mechanical plant to be installed at the SLSC should have a maximum sound power level of 90 dB(A). If any items of mechanical plant with SWL > 90 dB(A) is proposed, specific advice from an acoustic consultant should be sought prior to its installation.

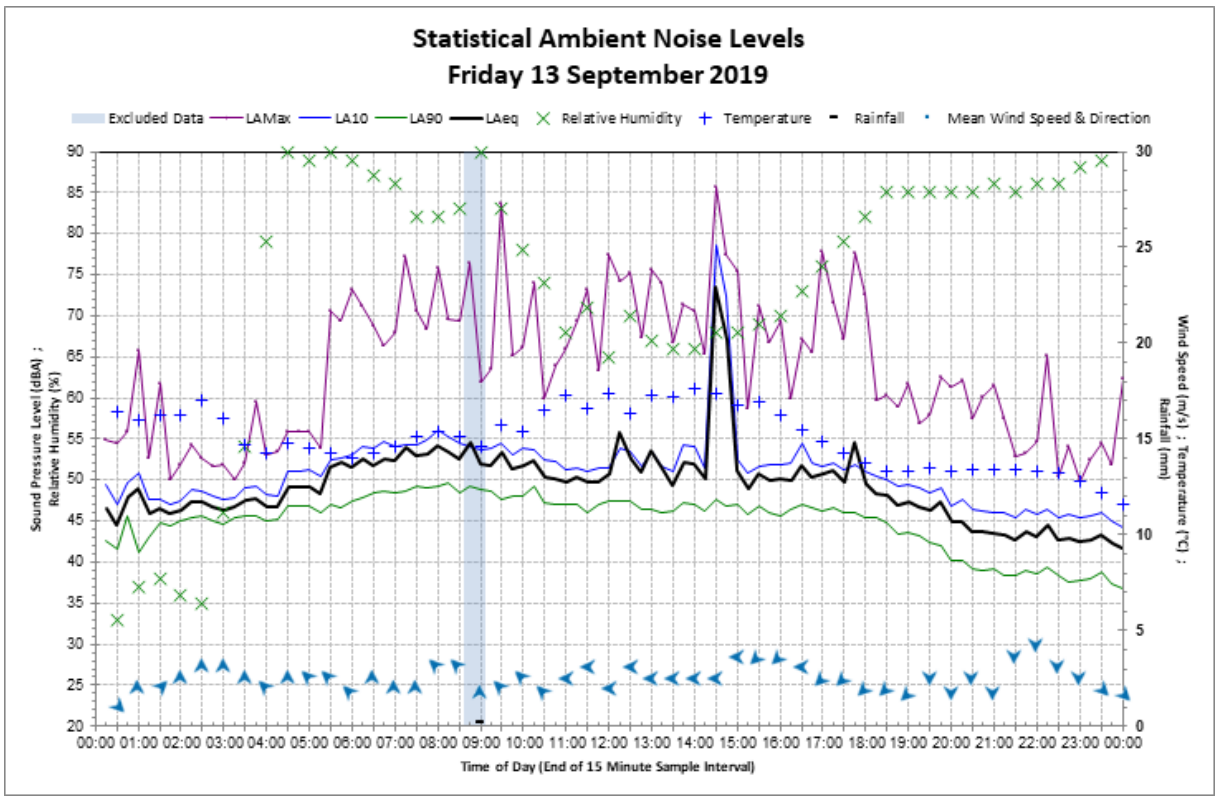
7. Conclusion

Based on the noise modelling assumptions and assessment of the operation of the proposed Long Reef SLSC, GHD considers the development should achieve the relevant noise emission criteria presented in Section 4. With the mitigation measures presented in Section 6 implemented, the proposed SLSC should not adversely affect the acoustic amenity of the surrounding residential area.

Appendix A - Noise monitoring charts



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Excluded Data
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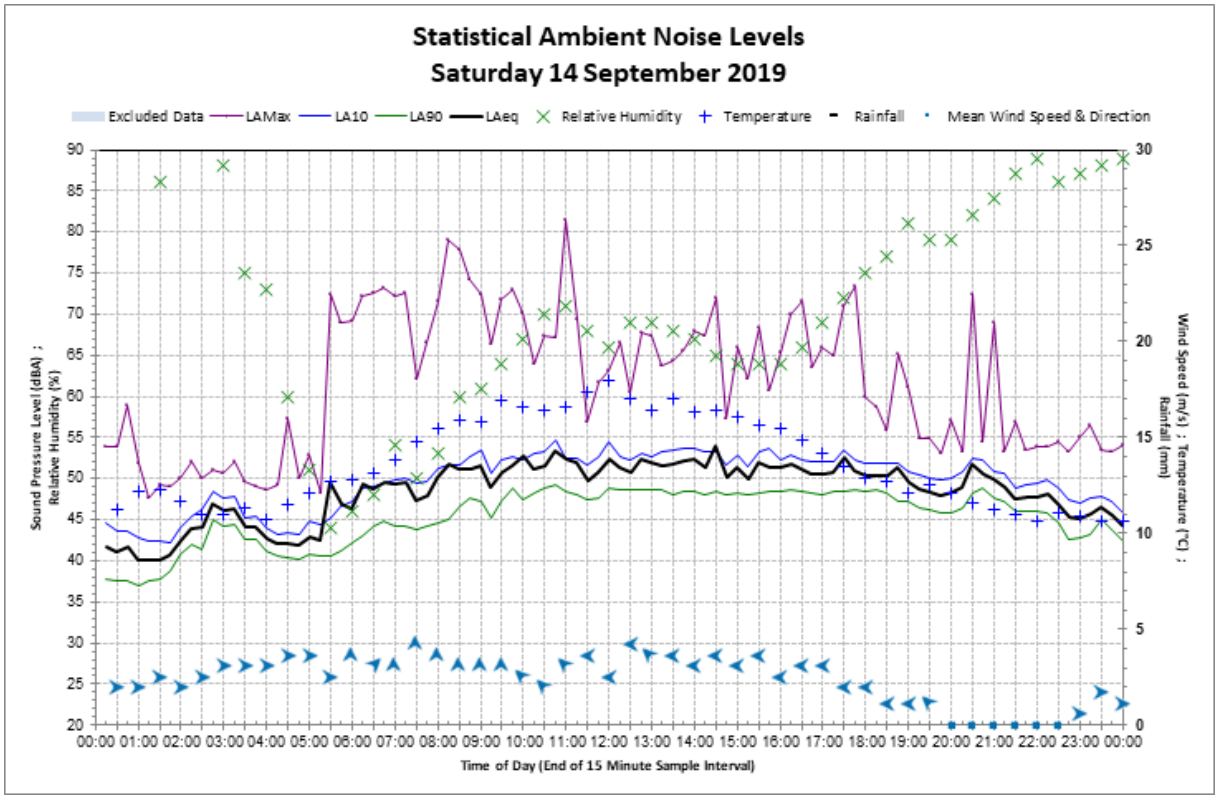
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)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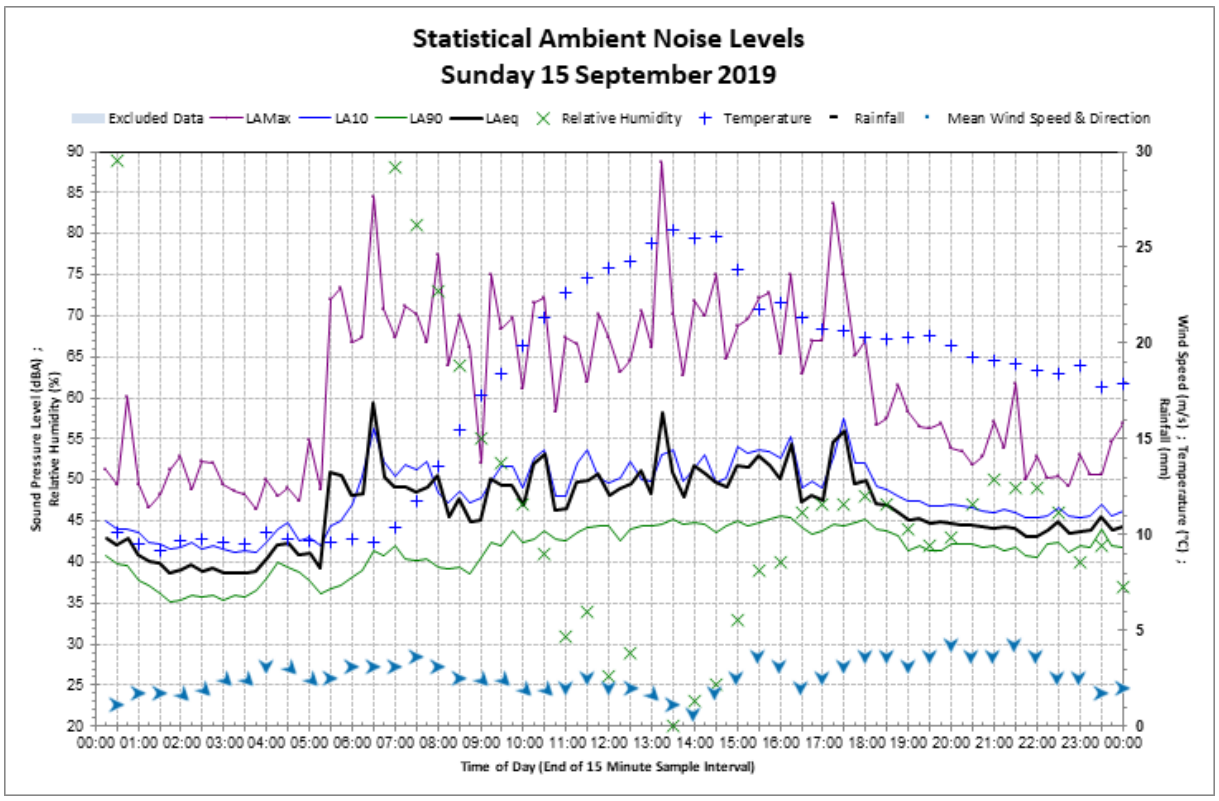
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)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Temperature
Rainfall
Mean Wind Speed & Direction
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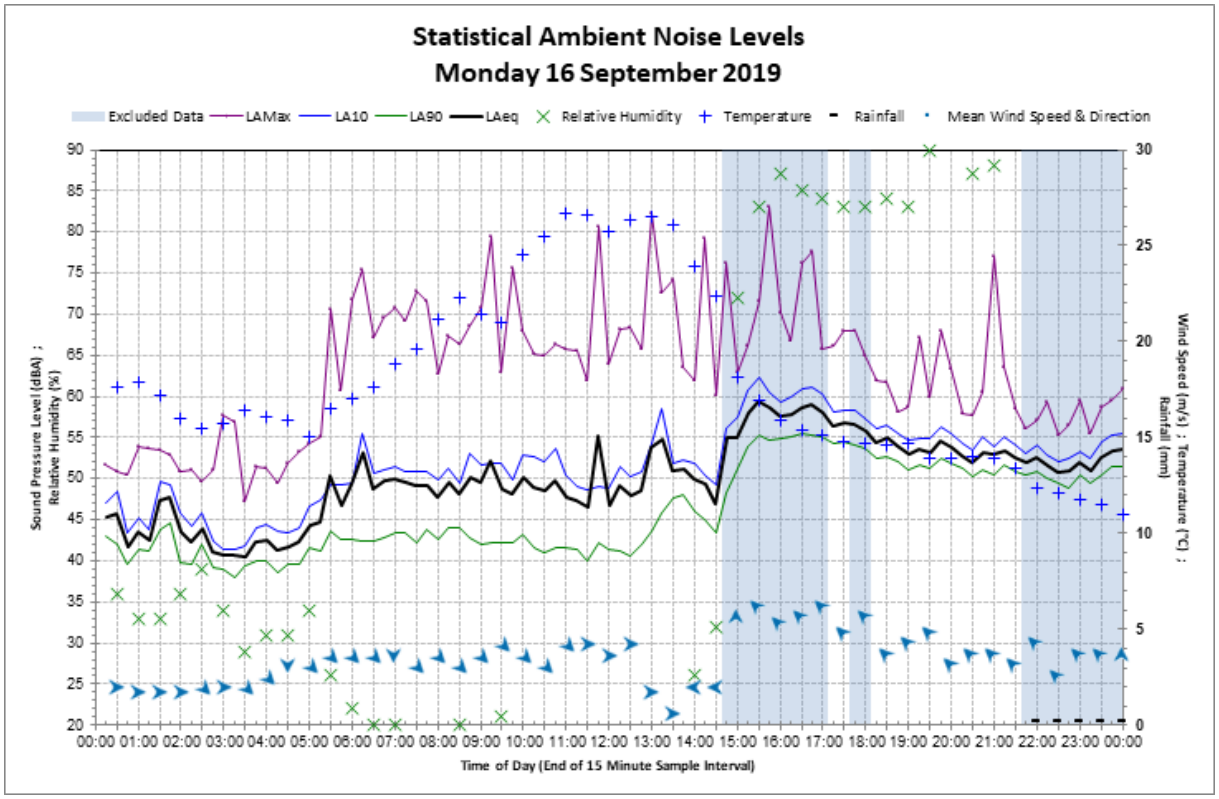
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)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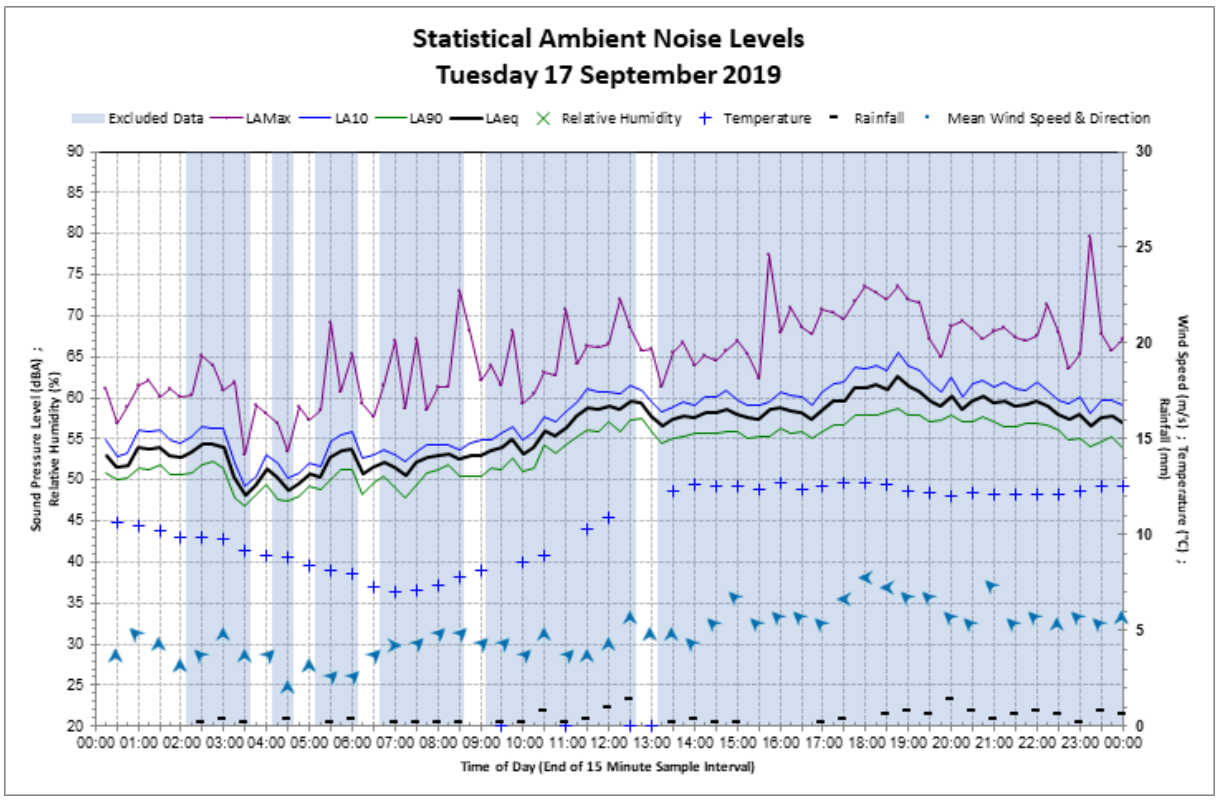
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)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LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
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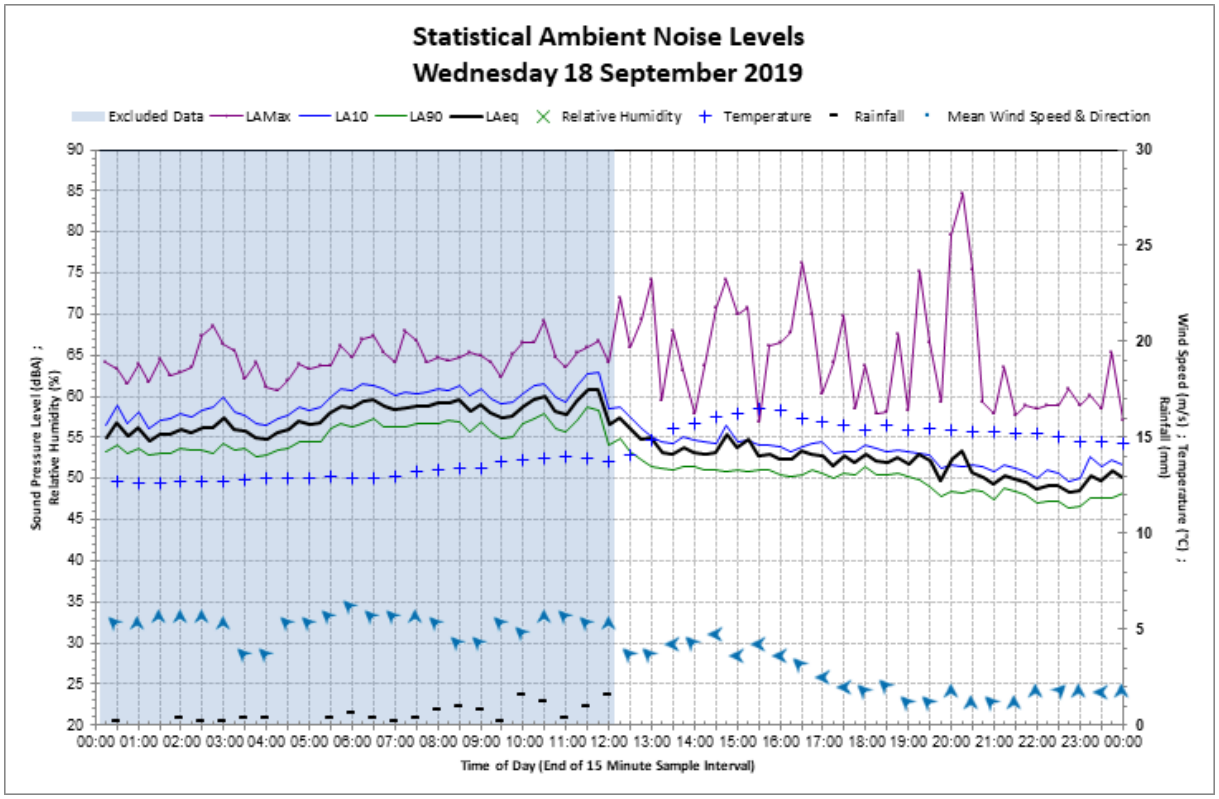
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)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LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
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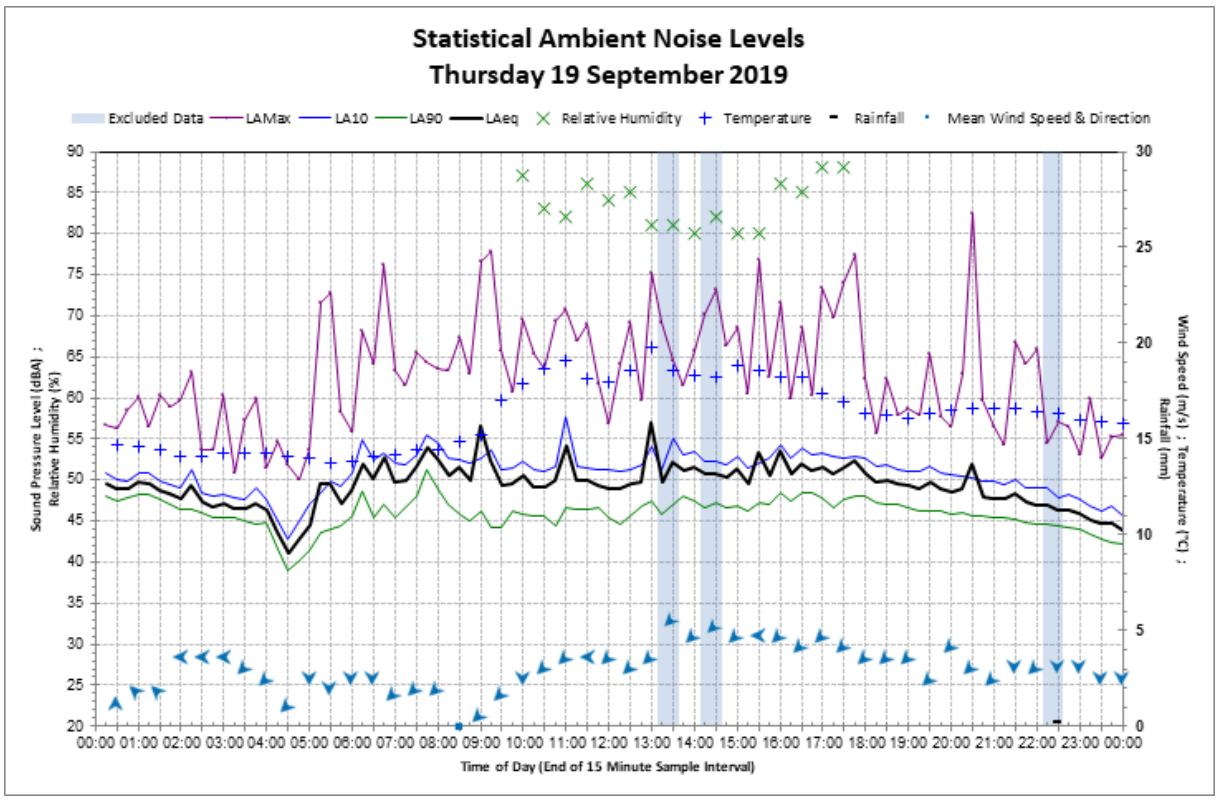
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)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Temperature
Rainfall
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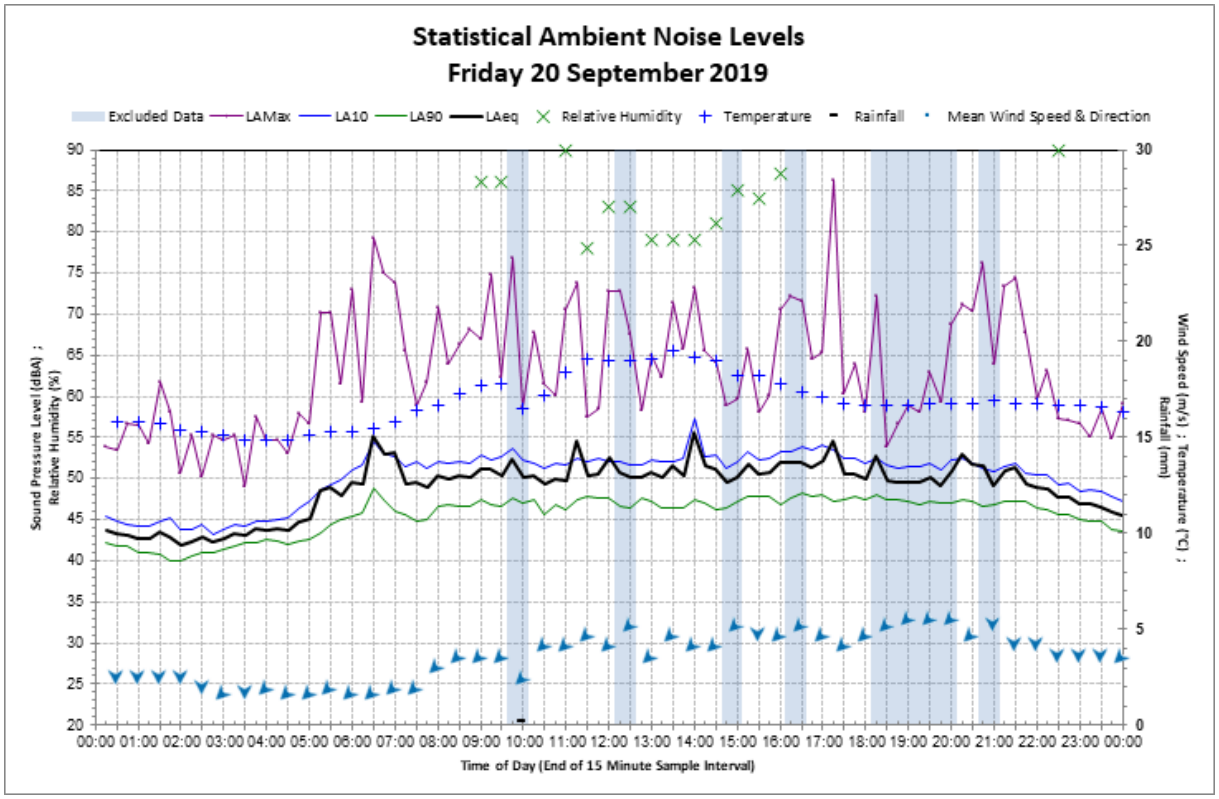
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)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Temperature
Rainfall
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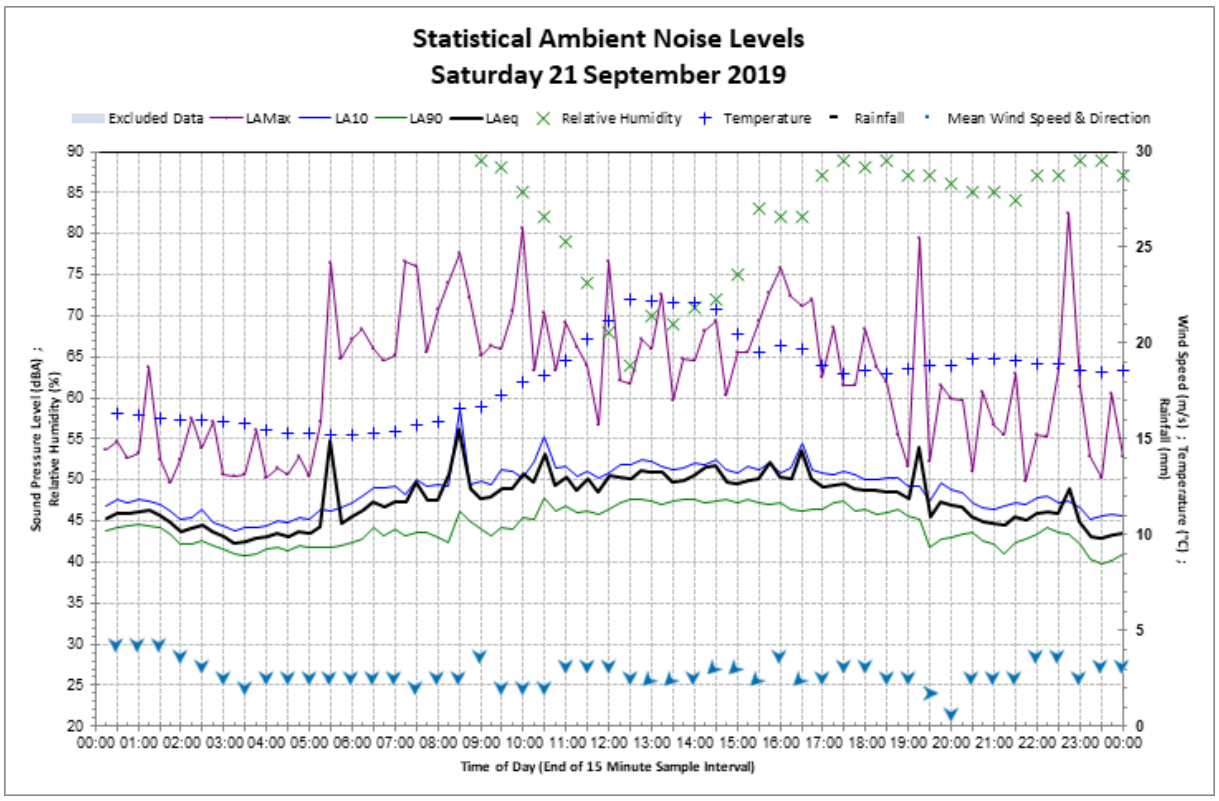
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)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LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
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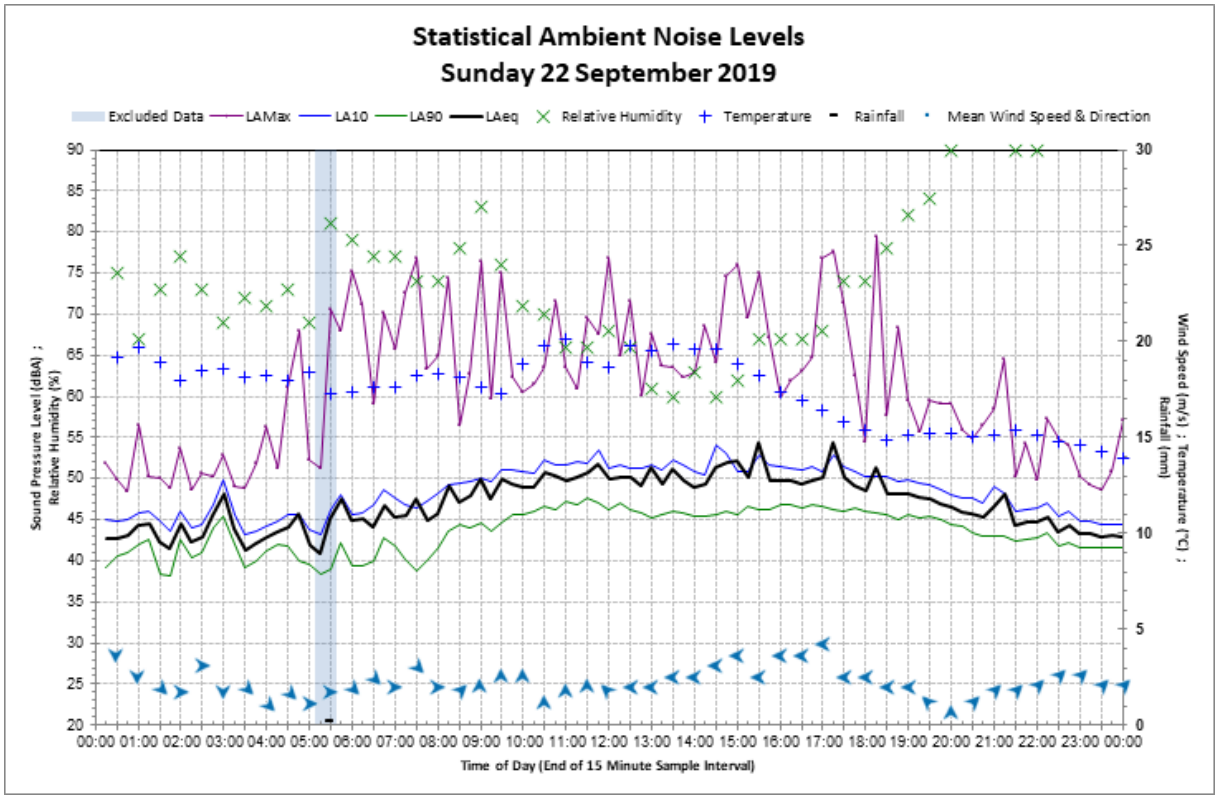
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)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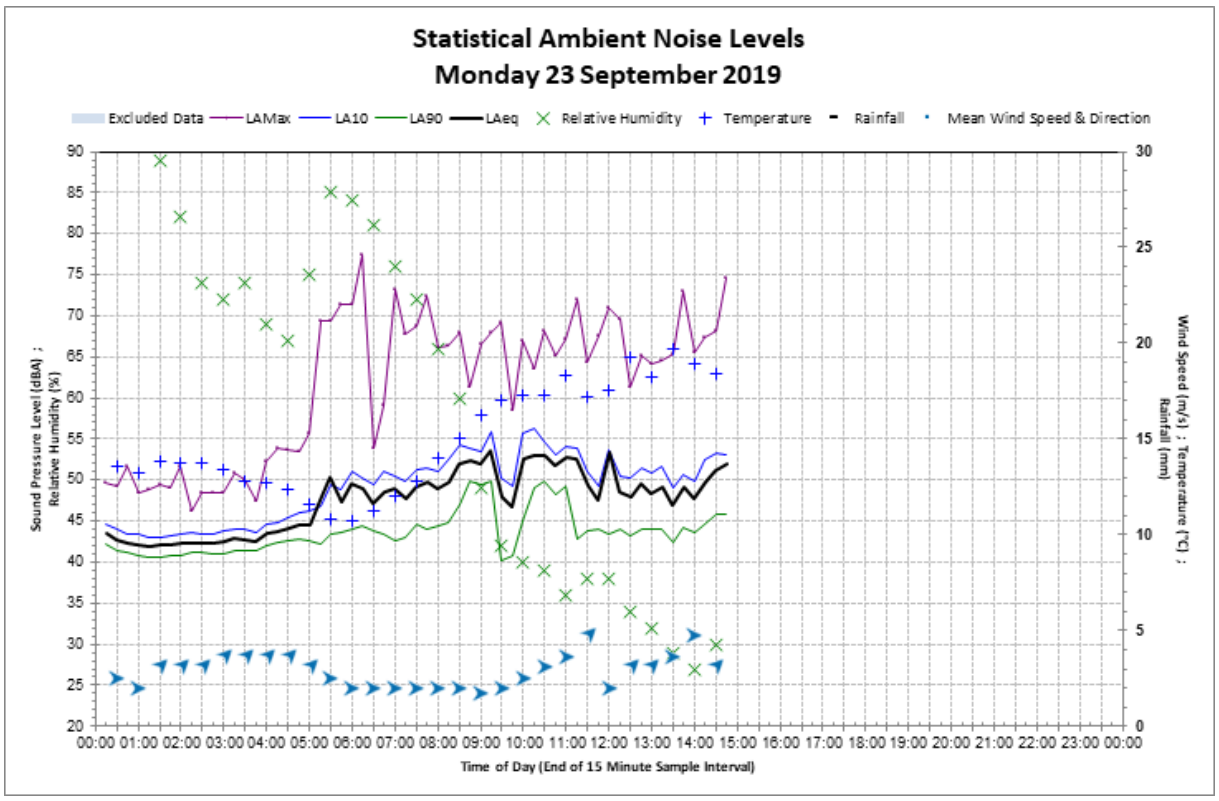
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Monday 23 September 2019
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

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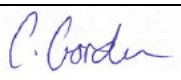
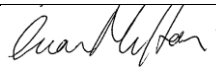
Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	A.Bagby	M.Velasco		E.Milton		22/10/2019
1	A.Bagby	C.Gordon		E.Milton		12/12/2019

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