reef Acoustic Consulting

Wednesday, 13 December 2023

Project ID: 2023.073_669-683 OSHR Vaucluse

669-683 Old South Head Road,
Vaucluse NSW 2030

Attention: Daniel West (Blare Management)

Acoustic Report for DA submission

Document Details

Reef Acoustics Reference	2023.073.REPORT_669-683 OSHR Vaucluse
Revision	5
Date	13 December 2023
Project Name	Acoustic Report for DA
Project Address	669-683 Old South Head Road, Vaucluse
Client Details	Blare Management Level 1, 19-23 Hollywood Avenue, Bondi Junction NSW 2022
Attention	Daniel West (Blare Management)
Authorised	AS

Australian Acoustical Society

Attila
SZABO
#1557
Membership Type
Member
Member Since
05 July, 2019

w: reefacoustics.com.au e: info@reefacoustics.com.au t: 0423 168 164 abn: 67 648 439 178

reef Acoustic Consulting

Contents

1 Executive Summary

Reef Acoustics has been engaged by Blare Management to prepare an Acoustic Report for the Development Application (DA) of the proposed mixed use development for seniors housing (including independent living units) with a small component of retail floor space.

The proposed development is located at 669-683 Old South Head Road, Vaucluse. It is understood that two previously approved DA's for 669 Old South Head Road (DA-374/2020) and 671-683 Old South Head Road (DA-455/2021) are being consolidated into a single development, with a new Development Application being prepared for Waverley Council.

The consolidated site will provide a better urban outcome, improved amenity for all and an integrated design to better utilise the space. The proposed development will include approximately 31 units across two buildings with a 9m separation. The new design will reduce overall bulk and scale, as well as providing better access to public and communal spaces. Ground Floor includes a Retail lot on the corner of Oceanview Avenue and Old South Head Road.

This Acoustic Report describes the following:

- Identify the nearest sensitive receivers to the development
- Define the potential noise impacts including noise intrusion and emission
- Outline the monitoring that has been conducted and establish ambient and traffic noise levels for the site
- Identify relevant requirements and establish appropriate criteria for the site
- Conduct an initial assessment and provide recommendations for noise mitigation

The recommendations provided in this report will need to be refined as the design is further developed during the next project phase. This report has been provided to all project stakeholders to allow initial coordination and inclusion of acoustic elements as required.

2 Introduction

This assessment has examined the potential noise impacts from road traffic on the residential components of the project. Operational noise emissions have also been addressed, including noise from mechanical plant, onsite vehicle movements, waste collection, loading dock use and other noise generating events associated with the site operation. These elements are at this point in the application process only addressed briefly, flagging any concerns, and confirming that requirements of development controls can and will be met through the provision of future detail and design. This report also assesses the potential for noise intrusion on the proposed development from traffic noise on adjacent and nearby roads.

The assessment utilises data from noise monitoring and criteria that has been previously established as part of the document titled 'Noise Impact Assessment' prepared by SLR Consulting dated October, 2021. This report was submitted to Waverley Council as part of a previously approved DA application (DA-455/2021 with

consent granted 18/10/2022). This assessment utilises previous monitoring data to establish traffic noise levels and ambient noise levels impacting the space; includes a review of all conceptual architectural building envelope elements affecting the internal acoustic amenity of receivers; and discusses any measures that will need to be implemented in order to achieve the required target criteria.

3 Project Description

3.1 Site Overview and Layout

The project site is located at 669-683 Old South Head Road, Vaucluse. The site is bounded by Old South Head Road to the west and Oceanview Avenue to the south. The neighbouring premises include a residential apartment block to the north (687 Old South Head Road), a residential apartment block to the east (2 Oceanview Avenue), a mixture of residential dwellings and retail premises across Old South Head Road to the west, and a mixture of residential and retail/commercial receivers across Oceanview Avenue to the south.

The site location is shown in Figure *1* below.

Figure 1 - Site Plan

***Note:** Unattended monitoring locations represent previous monitoring conducted in 2021 by SLR Consulting. Attended location monitoring was conducted by Reef Acoustics in October 2023 to validate ambient and traffic monitoring data.

3.2 Nearest Sensitive Receivers

The nearest sensitive receivers are the directly adjacent residential receivers at 2 Oceanview Avenue and 685-687 Old South Head Road- which are both multi-storey residential blocks that directly overlook the site. It should be noted that the receivers at 685-687 Old South Head Road are adjacent to and overlook the carpark down ramp (adjacent balcony is located 5m from the down ramp location), while the receivers at 2 Oceanview Avenue are adjacent to and overlook the internal courtyard/dining terrace and pool area (with a distance of 15m between nearest balcony and the pool). These are considered the two most critical acoustic concerns that will need to be addressed appropriately. As both of these receivers are closer than the nearest Commercial or Retail receiver, and the residential criteria is typically more stringent, our assessment will be conducted to these two adjacent residential properties, delegating them as the nearest most-sensitive receivers.

3.3 Proposed Development

The proposed development involves demolition of the existing low density residential dwellings and the construction of a 5-storey mixed-use seniors development consisting of:

- 2 Basement Levels of Parking
- Lower Ground Floor: Gym, Sauna, Indoor/Outdoor pool, outdoor terrace, co-working space, Café, residential communal facilities and 1 residential apartment
- Upper Ground Floor: Retail, Meeting/Boardroom, Lobby, and 7 residential apartments
- Level 1: 10 residential apartments
- Level 2: 10 residential apartments
- Level 3: 3 residential apartments
- Rooftop Plant

Access to the basement parking is via a ramp off the northern edge of the site on Old South Head Road. The access ramp runs adjacent to the northern site boundary.

3.4 Potential Noise Impacts

The development is proposed to be a mixed land use zone, comprising of Residential, Commercial and Retail. The potential noise and vibration impacts which may arise as a result of the proposed development include:

- Mechanical plant and equipment noise (rooftop, basement and individual balconies)
- Vehicles entering/exiting the basement carpark via the ramp on the northern site boundary.
- Gym and Pool Noise
- Noise from use of outdoor communal spaces
- Waste transfer noise and operations

Noise emissions from the proposed development will be required to be appropriately controlled at any off-site noise sensitive receivers.

4 Existing Acoustic Environment

The existing noise environment at the site is dominated by road traffic from Old South Head Road, which is adjacent to the site. Other existing noise sources include mechanical plant located southwest of the site across Old South Head Road at various commercial properties.

Previous monitoring has been conducted by SLR Consulting as part of development application DA-455/2021. Details were outlined in the report previously submitted to Council titled 'Noise Impact Assessment' report reference 'SLR Ref:610.30547=R01' Version v0.2 dated October 2021. The results of this monitoring including establishment of criteria has been used in this report to confirm traffic noise levels and ambient noise levels. Attended measurements were conducted by Reef Acoustics during the peak traffic periods to validate/calibrate the SLR monitoring as required.

4.1 Ambient Noise Survey

The SLR noise survey was used to determine the existing noise environment and to set criteria used to assess the potential impacts from the development proposal.

To quantify and characterise the existing ambient noise environment, the traffic noise levels and other acoustic characteristics of the site- noise surveys were conducted during September 2021.

Two noise loggers were deployed, one to the rear of 681 Old South Head Road to determine ambient noise levels, and one in the front yard of the existing premises to determine traffic noise levels.

The measured noise levels have been used to establish existing road traffic noise levels as well as background noise levels to assess potential noise impacts associated with the project.

Additionally, 15-minute attended noise measurements were conducted at the locations indicated in Figure *1* to validate that the measurements taken by SLR Consulting in 2021 were still appropriate to our assessment.

Table 1 below identifies the instrumentation used in our measurements.

Table 1 - Equipment List

Equipment	Location
NTi Audio XL2-TA (S/N A2A-18887-E0)	Attended measurements
Pulsar Model 105 Acoustic Calibrator (S/N 83439)	-

All equipment was calibrated before and after use, and no drift in calibration was detected.

4.2 Unattended Noise Monitoring

The noise loggers measured noise levels in 15-minute sampling periods continuously to determine the existing LAeq, LA90 and other relevant statistical noise descriptors during the daytime, evening and night-time periods. The equipment was set up with the microphone extending 1.5m above ground at both locations. The microphones were fitted with a windshield.

Noise monitoring instrumentation used was compliant with the requirements of *AS IEC 61672.1-2004: Electroacoustics – Sound level meters – Specifications* and carried current National Association of Testing Authorities (NATA) (or manufacturer) calibration certificates. The calibration of the equipment was checked both before and after the survey and the variation in calibration was found to be within acceptable limits.

The logging positions were selected to capture a representative sample of the ambient noise characters of the site to establish the noise emission criteria, as well as determine the traffic noise levels intruding upon the site.

The measured data has been filtered to remove data affected by adverse weather conditions following reference to the weather reports recorded at the Bureau of Meteorology (BOM) Observatory Hill weather station.

Daily graphs representing the measured noise data are attached in Appendix A. The graphs represent each 24-hour period by incorporating the LA90, LAeq, LAmin and LAmax noise levels for the corresponding 15 minute periods. The results of unattended noise monitoring are shown in Table *2* below.

Table 2 - Measured Ambient Noise Levels corresponding to EPA NPfI assessment time periods

Noise Monitoring Location	Period	L_{A90} (RBL)	L_{Aeq}
Location 1 (at front site boundary of 681 Old South Head Road)	Daytime	48	60
	Evening	37	57
	Night-time	30	52
Location 2 (at rear site boundary of 681 Old South Head Road)	Daytime	38	50
	Evening	34	44
	Night-time	30	44

The time periods correspond to the assessment periods defined in the NPfI. Daytime refers to the hours between 7:00am and 6:00pm. Evening period refers to the hours between 6:00pm and 10:00pm. Night period refers to the hours between 10:00pm and 7:00am. On Sundays and Public Holidays, the NPfI defines these periods differently, with Daytime defined as 8:00am-6:00pm, Evening as 6:00pm-10:00pm, and Night as 10:00pm-8:00am.

To conduct a traffic noise assessment, the NSW Road Noise Policy defines the appropriate assessment time periods, shown with results summarised in Table *2* below. Long-term monitoring was conducted along the front and rear of the site. Propagation calculations were used to evaluate the likely noise levels impacting the other facades, as monitoring in these locations was not possible. Further to this,

attended measurements in various other locations during unattended monitoring were used to validate and calibrate unattended logger levels to other facades.

Table 3 – Measured Existing Traffic Noise Levels Extrapolated to all Facades

Proposed Facade	Period	L_{A90} (RBL)
	Daytime (7am-10pm) dB(A) L_{Aeq} (15hour)	Night-time (10pm-7am) dB(A) L_{Aeq} (9hour)
Proposed façade facing Old South Head Road	59	52
Rear façade facing adjacent property (2 Oceanview Avenue)	51	44
Façade facing Oceanview Avenue	56	48
Façade facing adjacent property to the north (685-687 Old South Head Road)	54	46

4.3 Attended Noise Measurements

Operator attended measurements were conducted on 30 October 2023 to validate previous unattended monitoring and confirm peak traffic noise levels. During each measurement the operator noted the various sources and contributing level.

Calibration of the sound level meter was checked before and after each measurement and the variation in calibration was found to be within acceptable limits at all times.

The noise environment at each of the attended measurement locations is detailed in Table 4.

Table 4 – Summary of attended noise monitoring results

Measurement Location	Measurement Details	**Measured Noise Levels (dBA)**			**Description of Ambient Noise Sources – Typical LAmax Levels**
		L_{A90}	L_{Aeq}	L_{Amax}	
A1 (along kerb outside 683 Old South Head Road)	16:00 – 16:30 30/10/2023	63.8	71.6	77.7	Ambient noise – 64 dBA Light Vehicles – 72 dBA Heavy Vehicles – 80 dBA
A2 (along kerb outside 675 Old South Head Road)	16:30-17:00 30/10/2023	63.2	69.1	77.4	Ambient noise – 64 dBA Light Vehicles – 72 dBA Heavy Vehicles – 80 dBA

It was observed that the noise environment on Old South Head Road during peak hours was dominated solely by traffic noise, while Oceanview Avenue was also dominated by distant traffic noise from Old South Head Road and occasional local through traffic.

Note that unattended measurements were conducted approximately 15m from the center of Old South Head Road, while attended measurements were conducted at a distance of 7m from the centre of the road. Additionally we have estimated 3dB of shielding due to the fence and road exposure. This corresponds to a correction of -9dB in our attended measurements to compare them to the logger data. We can then compare the 15-minute periods from our attended measurements with the adjusted values for the corresponding times in the unattended results. Doing so confirmed an approximate 1-3 dB difference between the attended measurements from 2023, and the unattended measurements in the corresponding periods from 2021. This is a strong correlation and confirms traffic and ambient levels have likely not changed significantly over the 2021 to 2023 period. Therefore, the logger data from 2021 is deemed still valid, and previously established criteria shall be used in ongoing assessments.

5 Noise Assessment Criteria

5.1 Waverley Council DCP 2022

Part C2 of the Development Control Plan (Other Residential Development) contains the following clause relating to acoustic privacy:

> *2.19 Acoustic Privacy –*
> *Acoustic privacy is a measure of sound insulation between dwellings and between external and internal spaces. Designing for acoustic privacy relates to the location and separation of buildings within a development and the arrangement of dwellings and internal spaces within dwellings.*
>
> *Objective*
> *(a) To ensure a high level of amenity for residents.*
> *(b) To effectively manage the interface between non-residential uses and residential accommodation.*
>
> *Controls*
> *(a) Soundproofing of all dwelling units by such means as acoustic glazing is required to reduce noise impacts on residents.*
> *(b) Minimise noise transmission between dwellings by:*
> *i. Locating noisy and quieter areas next to other noisy or quiet areas, e.g. living rooms adjacent to living rooms, and bedrooms adjacent to bedrooms.*
> *ii. Using storage or circulation zones within an dwelling to buffer noise from adjacent dwellings, mechanical services or corridors and lobby areas and minimising the amount of party (shared) walls with other dwellings.*

5.2 State Environment Planning Policy (SEPP) (Transport and Infrastructure) 2021

The relevant planning controls from the SEPP are reproduced below.

> **State Environment Planning Policy (Transport and Infrastructure) 2021.**
> **Clause 2.120:**
> The consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded:
> (a) In any bedroom in the residential accommodation – 35 dB(A) at any time between 10pm and 7am,
> (b) Anywhere else in the residential accommodation (other than a garage, kitchen, bathroom or hallway) – 40 dB(A) at any time.

This assessment will specifically address the above requirement, as well as address any other requirements that may need to be addressed as per the NSW Department of Planning document – Development Near Rail Corridors and Busy Roads – Interim Guideline.

5.3 Development Near Rail Corridors and Busy Roads – Interim Guideline 2008

The Department of Planning's *Development near Rail Corridors and Busy Roads – Interim Guideline (2008)* aims to assist in the planning, design and assessment of developments in, or adjacent to busy roads and supports the specific provisions of the SEPP (Infrastructure) 2007 in relation to road traffic noise.

In circumstances where a development is adjacent to a road that contains an annual average daily traffic (AADT) volume of between 20,000-40,000 vehicles (based on the road traffic volume data published by RMS), the guidelines provide best practice advice.

Traffic volumes on Old South Head Road outside the site are provided by TfNSW, and have been identified in the Traffic Report for the site titled 'Traffic and Parking Assessment' prepared by Transport and Traffic Planning Associates (TTPA) reference 23201, Issue B dated December 2023. The report identifies the AADT as 25,317 on Old South Head Road north of Newcastle Street.

As the road segment has an AADT over 20,000 an assessment as per the requirements of the DoP 'Development near Rail Corridors and Busy Roads – Interim Guideline' is necessary.

Table 5 details the internal noise criteria applicable for new residential buildings near main roads as specified in the Transport and Infrastructure SEPP.

Table 5 – Road Traffic Noise Assessment Criteria from the SEPP (Transport and Infrastructure) 2021

Internal Space	Time Period	Internal Noise Level (with windows closed)
Sleeping areas	Night-time (10pm to 7am)	35 dB(A)
Other habitable rooms	At any time	40 dB(A)

It is common practice in the industry to assume a 10dB loss from external to internal through an open window. If predicted internal noise levels with windows or doors open exceed the criteria in Table 5 by more than 10 dB, the design of the ventilation for these

rooms should enable occupants to close windows during noisier periods, and also meet the ventilation requirements of the Building Code of Australia.
Where windows must be closed, the adopted ventilation system must meet the requirements of the Building Code of Australia and Australian Standard 1668 – *The use of ventilation and air conditioning in buildings* by utilising mechanical ventilation to provide residents with the option to close windows to reduce noise.
While providing residents with the option to close windows or doors, operable windows and doors can be utilised to ensure natural ventilation can also be provided within the spaces.

5.4 Noise Policy for Industry 2017

External noise emission criteria have been established from the Noise Policy for Industry. The policy sets out the procedure to determine the project noise trigger levels relevant to a particular development. If it is predicted that the development is likely to cause the project noise trigger level to be exceeded at existing noise-sensitive receivers, management measures need to be considered to seek to reduce the predicted noise level.

The Intrusiveness noise level is based on the measured background noise levels. In accordance with the NPfI, the equivalent continuous noise level (LAeq) of the source should not exceed the measured Rating Background Level (RBL) by more than 5 dBA over any 15 minute period within any assessment period.
The Amenity noise level is based on land use and associated activities (and their sensitivity to noise emissions). The study has used the classification of 'Urban Residential' for the purpose of this assessment, corresponding to an area dominated by "urban hum" with characteristically heavy and continuous traffic flows during peak periods and near commercial / industrial districts.
The processed results of the unattended noise monitoring have been used to establish the project noise trigger levels highlighted in yellow for the nearest residential receiver location.

Table 6 - Project noise trigger levels for receivers surrounding the site

Receiver	Time of Day	Recommended Amenity Noise Level (dBA)	Measured RBL[1] LA90(15minute) (dBA)	Measured LAeq(period) Noise Level (dBA)	Project Noise Trigger Levels (dBA)	
					Intrusiveness LAeq(15minute)	Amenity[2] LAeq(period)
Residential Along Old South Head Road	Day	55	48	60	**53**	53
	Evening	45	37	57	**42**	42[3]
	Night	40	30	52	**35**	37[3]
Residential to the rear of the site	Day	55	38	50	**43**	53
	Evening	45	34	44	**39**	43
	Night	40	30	44	**35**	38
Commercial	When in use	65	-	-	-	**63**

Note 1: RBL = Rating Background Level
Note 2: The project amenity noise levels have been converted to a 15-minute level by adding 3 dB, as outlined in the NPfI.
Note 3: The measured LAeq noise level was dominated by existing road traffic noise and exceeds the recommended amenity noise level by 10 dB or more, therefore, the 'high traffic project amenity noise level' is the existing LAeq(traffic) noise level minus 15 dB, as outlined in the NPfI.

Table 7 below summarises the relevant criteria at the neighbouring residential boundary.

Table 7 - Project Specific criteria at nearest residential receiver

Receiver Location	Period	LA90 (RBL)	Noise Objectives
Receiver 1, 685-687 Old South Head Road	Daytime	48	**53 dB(A) Leq,15min**
	Evening	37	**42 dB(A) Leq,15min**
	Night-time	30	**35 dB(A) Leq,15min**

5.5 Internal Noise Levels as per AS/NZS 2107:2016

The standard AS/NZS 2107:2016 – Acoustics – Recommended design sound levels and reverberation times for building interiors provides guidance on internal noise level requirements for buildings of various uses.

Table 8 below lists internal design acoustic criteria for this project depending on the type/use of different rooms for steady state noise (such as noise from air-conditioning systems and road traffic). Recommendations for each space are in terms of an averaged A-weighted sound pressure level (LAeq).

Table 8 – Internal design acoustic criteria from AS/NZS 2107:2016

Type of occupancy/activity	Design sound level range, LAeq dBA
Residential Buildings Houses and apartments in inner city areas or entertainment districts or near major roads	
Apartment common areas (e.g. foyer, lift lobby)	45 to 50
Living areas	35 to 45
Sleeping areas (night time)	35 to 40
Work areas	35 to 45
Hotels and Motels	
Dining Rooms	40 to 45
Foyers and recreation areas	45 to 50
Shop Buildings	
Small retail stores	<50
Other Spaces	
Enclosed carparks	<65
Bars and Lounges	<50

It is common practise in the industry to assume a 10 dB loss from external to internal through an open window. If predicted noise levels with windows or doors open exceed the criteria in Table 8 by more than 10 dB, the design of the ventilation for these rooms should enable occupants to close windows during noisier periods, and also meet the ventilation requirements of the Building Code of Australia.

While providing residents with the option to close windows or doors, operable windows and doors can be utilised to ensure natural ventilation can also be provided within the spaces.

5.6 Summarised Project Specific Internal Noise Criteria

The most relevant criteria from the sources outlined above are shown in Table 9. Other spaces

Table 9 – Project Specific Road Traffic Noise Assessment Criteria

Space/Activity Type	Internal Noise Requirements
Residential Sleeping Areas	35 dB(A) $L_{Aeq\ (9hour)}$
Residential Living Areas	40 dB(A) $L_{Aeq\ (15hour)}$

Other than the above spaces, Table 8 should be referenced for requirements of more specific areas.

6 Noise Emission Assessment

6.1 Mechanical Plant/Equipment

A review of the current drawings indicates that typical sources of noise associated with this type of mixed-use development may include:

- Noise from mechanical equipment, including air-conditioning, carpark ventilation fans, corridor ventilation systems, fire pump and fire control equipment.
- Domestic air-conditioner noise (from balcony or roof-mounted units etc).

Environmental noise emissions from any fixed plant will be required to be assessed during the detailed design stages to ensure compliance with the applicable NPfI levels specified in Section 5.4. The assessment will include typical day, evening and night-time operation and emergency operations Acoustic mitigation measures will be applied to the design where necessary. These may include:

- Selection of quieter equipment
- Selection of equipment location
- Acoustic louvres
- Acoustic attenuators
- Acoustically lined ductwork
- Acoustic barriers and enclosures

At this point in the design, mechanical equipment requirements and selections have not been specified. A preliminary assessment has been conducted to determine the allowable noise levels at the edge of the development to achieve compliance at the residential receivers. Plant Rooms in the Basement will have to be reviewed to ensure there is no ductwork impacting both receivers within the development, as well as adjacent receivers through and intake/exhaust ductwork and louvres. Rooftop plant locations have been shown and are appropriately positioned, but will need to be assessed during detailed design to determine noise contribution from specific equipment sizing and models to confirm whether any vertical screening will be needed around the rooftop enclosures to break line-of-sight from adjacent receivers at 2 Oceanview Avenue and 687 Old South Head Road. Details will be confirmed during the detailed design stage once unit models and specific locations have been selected.

Table 10 – Allowable SPL at site boundary due to mechanical equipment

Receiver Location	Criteria, dB(A)	Assumed distance from Plant to receiver	Allowable combined sound pressure level at site boundary
Adjacent site boundary of 687 Old South Head Road	35	10m	41
Adjacent site boundary of 2 Oceanview Avenue	35	12m	39

Note that the above allowable SPL is moderate, and likely to be achieved using typical noise mitigation measures such as screening and potentially an enclosure (on the rooftop), or duct treatment and louvres for basement equipment. Mechanical systems must be designed to incorporate the relevant mitigation measures to achieve the above allowable level.

A typical spectrum has been compiled representing a number of fans and condensers. This has been used with the results from Table *10* above to provide an indicative maximum permissible combined sound level at the site boundaries.

Table 11 - Indicative maximum permissible combined sound level at the site boundary edge facing receivers

	Maximum Allowable Sound Pressure Level of all equipment, SWL								
Equipment	63	125	250	500	1k	2k	4k	8k	Overall, dB(A)
Combined level from all equipment measured at the site boundary of 2 Oceanview Avenue	43	43	40	37	33	30	27	19	39
Combined level from all equipment measured at the site boundary of 687 Old South Head Road	45	45	42	39	35	32	29	21	41

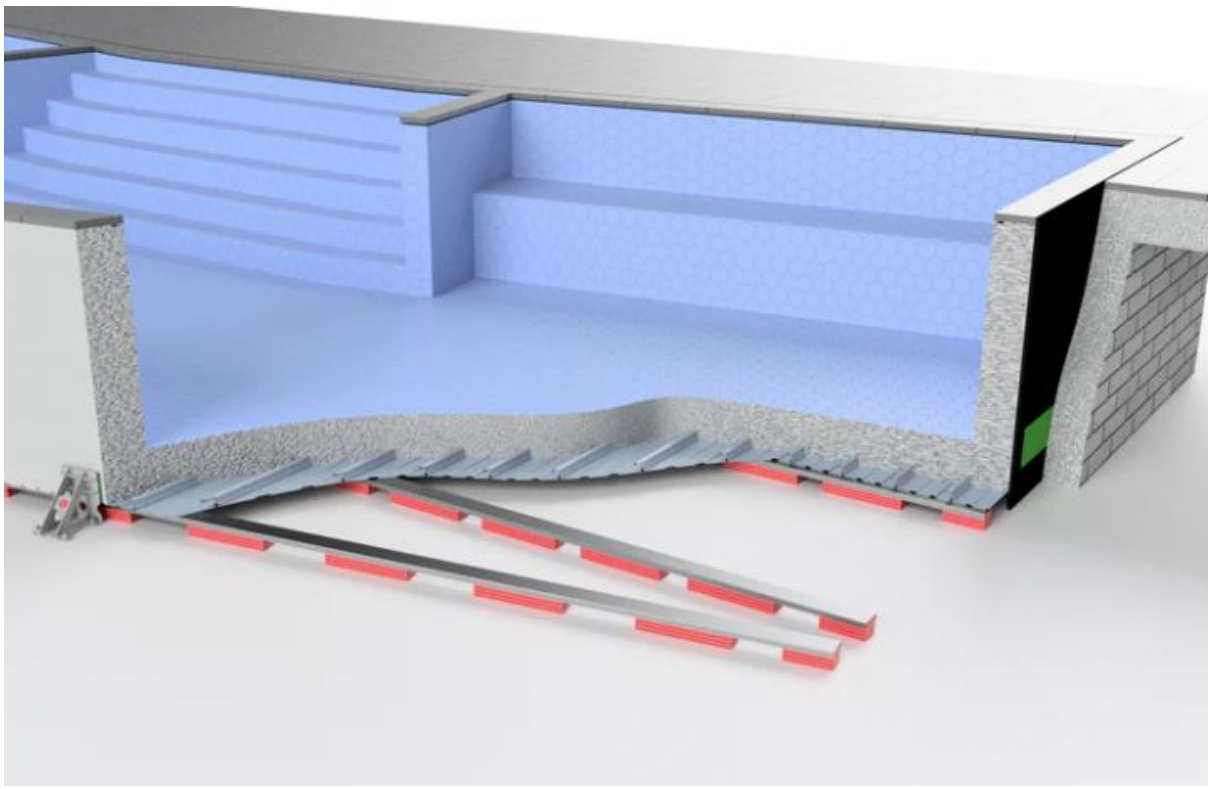
6.2 Outdoor Pool and Dining Terrace

The pool proposed for the development includes a small indoor and a small outdoor space. The indoor pool is approximately 20m^2, while the outdoor section is approximately 40m^2. The pool is quite small and shallow, meaning misuse of the space or high impact activities such as diving would be difficult and unlikely. Further to this, as it is a seniors development we are unlikely to have issues with noise or misuse. The pool is likely to be used for gentle exercise and recreation. Two considerations will need to be made if the pool is expected to be used by public as well:

- The proposal shows the pool physically connected to the external wall of the building, which continues to be the wall of the Bedroom in the apartment above. Consideration will have to be given to this construction detail, with vibration from the pool decoupled from the structural wall through provision of a 20mm thick isolating compressible foam (such as Embeltom foam). See Figure 2 for more detail.
- Additionally, the base of the pool needs to be isolated from the slab below. Proposing use of a pad isolation system (Embelton Super Shearflex) where small sections of the pad are spaced in a linear fashion with a steel runner across the top. Bondek slab will have to be poured on top of this. Thickness of the isolation pad and steel rail approximately 60mm, with 50mm to be accounted for the Bondek section of the slab. See Figure 2 for more detail.
- Effective management of the use of the space is important. Signage will need to be provided to confirm that noise to adjacent receivers is a concern. The pools

use by public guests should be limited to daytime and evening hours to avoid noise negatively affecting the internal and adjacent receivers during the night period as per the NPfI criteria (10pm to 7am).

Figure 2 - Embelton diagram of Shearflex pads on steel rails under a Bondek slab. Black foam also used on the right to isolate the wall.



If the pool is not expected to be used frequently by public, the issues associated with the pool from seniors use is negligible and additional treatment will not be needed.

6.3 Gym

The proposed gym is a small duty private space for senior residents only. It is approximately 50sqm and contains room for a number of exercise machines such as bicycles, treadmills etc, as well as small free weights. There is no expectation of high impact or noise producing equipment in the space such as heavy dumbbells, barbells, cardio or high impact spaces. Granted the free weights are limited to approximately 20kg dumbbells maximum, with typical rubber gym flooring below (proposing 50mm thick under the free weights area, and 20mm everywhere else).
Certain management practices will also be required, such as signage to avoid dropping weights unnecessarily or playing loud music; as well as provision of moveable rubber floor mats to use with free weights or other equipment (or providing rubber gym flooring throughout).

6.4 Bar/Cafe

The communal facilities which include co-working space, lounge, bar, café and dining spaces are small and a very low capacity is expected. There is not likely to be any concern of noise from this space as it will mostly be used by seniors and their guests. A separate management plan will be prepared for the use of the space, which will confirm hours of operation. These will need to be reviewed.

6.5 Carpark, Loading Dock and Waste Management

The development proposes a down ramp along the northern site boundary, with ramp from Old South Head Road down to the Basement. The ramp will be used by semi-rigid vehicles and waste collection trucks, with final collection/delivery operations occurring within the Basement. Noise from use of the ramp will need to be mitigated as the residential receivers of 685-687 Old South Head Road are directly adjacent to and overlooking the down ramp. Recommendations are as below:

- Provide a solid barrier on the site boundary side, as close to the ramp as possible. Barrier construction and height requirements to be detailed further into the design process, but as a minimum is required to break line-of-sight from the top storey of the adjacent building and any vehicle using the down-ramp (if this height is practical).
- Extend a roof covering as far along the down ramp as possible to enclose the ramp section.
- Provide absorptive material to the walls of the ramp area, but as a minimum on the southern wall of the ramp. A typical material used in this application is Pyrotek Reapor.

6.6 Additional Traffic generation from use of site

The industry standard for assessing noise from vehicle operations is that a doubling of vehicle operations over a 15-minute period will lead to an approximate 2 dB(A) increase in traffic noise. Considering the high traffic volumes on Old South Head Road, it can be concluded that there will be a negligible impact on traffic noise resulting from the additional parking spaces on site.

7 Traffic Noise Intrusion Assessment

7.1 Traffic Noise Levels

Based upon the results of the ambient noise monitoring presented in Section 4, we can see the traffic noise levels incident on all facades of the proposed development in Table *3*.

The predicted internal noise levels relevant to each façade of the project with reference to the design levels outlined in the SEPP (Infrastructure) are presented in **Table 12**. The façade notations are defined in Figure 3. Those spaces noted in the last column will require mechanical ventilation.

Figure 3 - Facade notation for glazing requirements

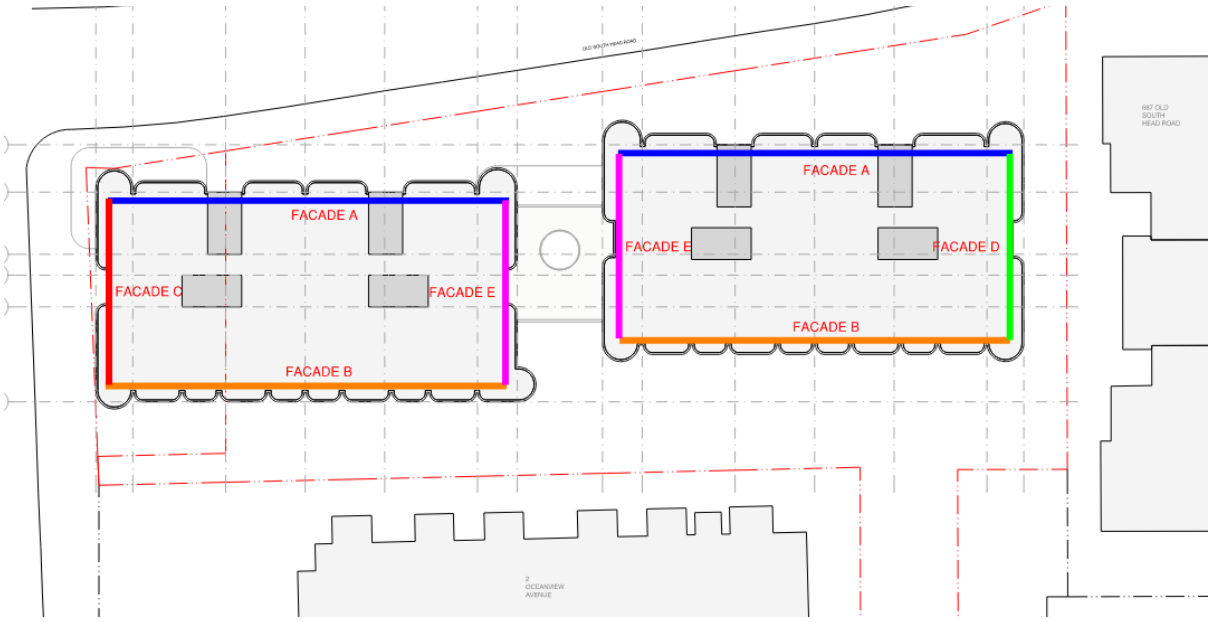


Table 12 – Predicted Internal Noise Levels

Facade	Occupancy Area	Descriptor	Predicted Open Window Internal Noise Level (dBA)	Internal Open Window Criteria (dBA)	Mechanical Ventilation Required? (Y/N)[1]
Façade A	Sleeping areas	LAeq (9hour)	42	45	N
	Other habitable areas	LAeq (15hour)	49	50	N
Façade B	Sleeping areas	LAeq (9hour)	34	45	N
	Other habitable areas	LAeq (15hour)	41	50	N
Façade C	Sleeping areas	LAeq (9hour)	38	45	N
	Other habitable areas	LAeq (15hour)	46	50	N
Façade D and E	Sleeping areas	LAeq (9hour)	36	45	N
	Other habitable areas	LAeq (15hour)	44	50	N

Note 1: Windows to living and sleeping spaces will need to be closed to achieve acceptable internal noise levels in certain areas. In such instances, an alternative means of ventilation is required to enable openings in the external façade (i.e. windows) to remain fully closed during noisy periods. Ventilation to the requirements of the Building Code of Australia F4.5 (b) and Australian Standard 1668.2 Table 4.2 should be provided. This means, as a minimum, providing fresh air at a rate of 5 litres/second per person in habitable rooms, to meet the requirements of AS 1668. Design input should be sought from an appropriately qualified mechanical consultant.
Note 2: It should be noted that not all spaces have windows to external. In these instances, open window criteria and thus mechanical ventilation requirements for acoustic purposes are not relevant.

It can be confirmed that mechanical ventilation is not a requirement for any of the apartments based on traffic noise levels.

7.2 Noise Intrusion Assessment Methodology

Traffic noise intrusion into the proposed development was assessed using the measured noise levels presented above. Calculations were undertaken taking into account the location of measurements, orientation of windows, barrier effects (where applicable), the total area of glazing, façade transmission loss and room sound absorption characteristics. In this way the likely interior noise levels can be predicted. It should be noted that as per the Schematic Plans, no elevations for the building have been provided. Therefore, it is assumed as a worst case that façade glazing will be full-height when determining glazed areas.

7.3 Construction Recommendations

Noise ingress generally involves several pathways, and is most common via the windows, doors, ventilation openings and the roof. The overall sound reduction of a building element is dependant upon the mass of the construction, the effective area and the extent of any gaps or openings.

Building elements (specifically glazing) with improved sound insulation properties will be required to meet the internal design levels for the project. The calculation of noise reduction performance requirements for building elements was undertaken using methodology contained in AS 3671:1989 and accounts for the following:

- Area and orientation of the glass
- The size and amount of absorption within the room
- The sound level and spectrum of the external noise source incident on the façade
- The sound insulation performance rating of the proposed glass across the entire spectrum

7.3.1 Glazed Windows and Doors

Minimum glazing recommendations are provided in Table 13 in order to meet the internal design levels.

Table 13 – Recommended Glazing Ratings

Façade ID	Room Type	Rw
All facades	Retail	29
	Coworking Space/Lounge	32
Façade A	Bedroom	32
	Living/Dining	32
Façade B	Bedroom	25
	Living/Dining	25
Façade C	Bedroom	29
	Living/Dining	29
Façade D/Façade E	Bedroom	29
	Living/Dining	29

When considering the recommended glazing requirements as documented in Table 13, it is important to consider the following:

- Window frames are not to degrade the performance of windows. Frames are to be not less than 2.5mm thick aluminium unless tests conducted in a NATA certified laboratory are provided demonstrating that the recommended acoustic ratings can be achieved with alternate products.
- Sliding doors for dwellings should be designed such that there is no degradation in the sound isolation (both Rw and Rw+Ctr) due to perimeter sealing. To comply, the doors should:
    - Each sliding door shall be fitted with at least one set of acoustic seals on both the inside and outside faces (i.e. 2 sets of acoustic rated seals for each sliding door). The seals are to be selected for both good acoustic performance and also ease of opening and closing. Acceptable seal systems include acoustic rated 'Q-lon' seals combined with felt inserts. Alternative fin and brush combined seals may also be acceptable.
    - Seals should be regularly checked and maintained to ensure long-term performance.
    - Have been tested in a NATA certified acoustical laboratory, and the results of the tests provided to Reef Acoustics prior to ordering of materials for manufacture.

The above recommendations are the minimum requirements for acoustics, and all glazing is also to conform to the relevant Codes.
Examples of some typical glazing types and their corresponding estimated Rw ratings are presented in Table 14.

Table 14 – Glazing Example Designs

Short Description	Full Description	Glazing Estimated Rating
		Rw
4mm float	4mm thick float glass. Brush seals to be provided as a minimum.	25
6mm float	6mm thick float glass. Acoustic seals to all doors and openable windows. Sliding doors not to compromise acoustic performance – as a minimum, fin and brush seals to be installed. Standard brush seals not acceptable.	29
6.38mm laminated	6.38mm thick laminated glass. Acoustic seals to all doors and openable windows. Sliding doors conditionally acceptable. As a minimum, combined fin and brush seals to be installed on all sliding doors. Standard brush seals not acceptable.	32
10.38mm laminated	10.38mm thick laminated glass. Hinged windows to be fitted with two sets of compressible seals. Sliding doors conditionally acceptable. As a minimum, two sets of seals to be installed to each side of sliding door frame. Vertical seals to include one set of Q-Lon compressible seals and one set of fin and fur seals. Combined fin and fur seals acceptable for horizontal sides of frame. E.g. Schlegel Silentfin seals. Standard brush seals not acceptable.	35
12.38mm laminated	12.38mm thick laminated glass. Hinged windows to be fitted with two sets of compressible seals. Sliding doors conditionally acceptable. As a minimum, two sets of seals to be installed to each side of sliding door frame. Vertical seals to include one set of Q-Lon compressible seals and one set of fin and fur seals. Combined fin and fur seals acceptable for horizontal sides of frame. Standard brush seals not acceptable.	37

7.3.2 Roof/Ceiling Construction

The roof should target a performance of Rw 40 dB. This will be achieved by the following typical constructions:

- Metal deck roof with timber framing and internal plasterboard ceiling
- Concrete slab roof minimum 90mm thick with internal plasterboard ceiling

Any alternate roof constructions that achieve a similar Rw 40 dB sound insulation performance can be substituted. Review and approval is recommended during the detail design phase.

7.3.3 External Wall Construction

Based on typical external wall constructions, preliminary noise intrusion calculations indicate that external walls will need to achieve a sound insulation performance of minimum Rw 50 dB.

Two compliant typical wall constructions considered during the preliminary investigation are as follows:

- Two skins of cavity brickwork consisting of 110mm brickwork and a clear minimum 20mm air cavity; FC or colorbond cladding.
- 150mm thick concrete

The wall construction will be required to be reviewed during detailed design to ensure any changes or details in the building envelope and or façade materials are verified. Any alternate construction may be substituted granted the overall wall construction achieves a sound insulation performance of Rw 50 dB.

Internal walls will be reviewed during the detailed design stage of the project to ensure amenity of the residents. An initial review confirms the approach of inter-tenancy walls being based on a 200mm thick concrete skin with render either side to be sufficient in achieving BCA requirements. Further analysis of the build-up of all internal walls will be conducted prior to CC.

8 Conclusion

Reef Acoustics has conducted a preliminary environmental noise impact assessment with regards to the planned mixed-use development at 669-683 Old South Head Road, Vaucluse.

Noise design objectives were set in accordance with the criteria set out in the NSW Noise Policy for Industry, AS/NZS 2107:2016, and the State Environmental Planning Policy (SEPP) (Infrastructure) 2017.

Mechanical plant and equipment specifications should be reassessed as part of later design stages, when final equipment selections have been made and precise layouts determined. Notwithstanding, it is envisaged that the project specific noise levels can be achieved through judicious equipment selection and design of mechanical plant in addition to inclusion of standard acoustic mitigation measures.

Road traffic noise intrusion was identified to be the main external source of noise impacting the development. This can be addressed through appropriate glazing selection, as well as other building envelope treatments to achieve compliance with the internal design noise levels. Following preliminary traffic noise intrusion and glazing calculations, it has been determined that typical lightweight glazing is sufficient, and there are no onerous or atypical requirements.

It has been concluded that the inclusion of the Gym, Pool, Coworking space and Lounge Area including Bar/Café, and outdoor terrace are not noise critical. They are all small spaces expected to have light use only by residents, thus not raising any noise emission concerns. However, the use of the outdoor pool space and Bar/Café should have their hours limited to ensure they do not affect the Night period as per the NPfI. The pool area (both indoor and outdoor) is adjacent to a structural wall, with apartment directly above. The pool shall be isolated from the wall by using some material such as Sylomer or other anti-vibration product; or through providing a physically separated construction. The carpark downramp will need to include a barrier to shield the adjacent residential receivers from noise associated with vehicles using the ramp.

Preliminary noise impacts onto the development were assessed based on a noise assessment of the site including attended and unattended traffic and ambient noise level monitoring. It is concluded that all areas are capable of complying with all relevant controls, subject to design development and further review by a suitably qualified acoustic consultant.

Overall, it is concluded that the proposed development will have limited acoustic impacts and the applicable environmental noise emission criteria can be complied with at the adjacent residential receivers.

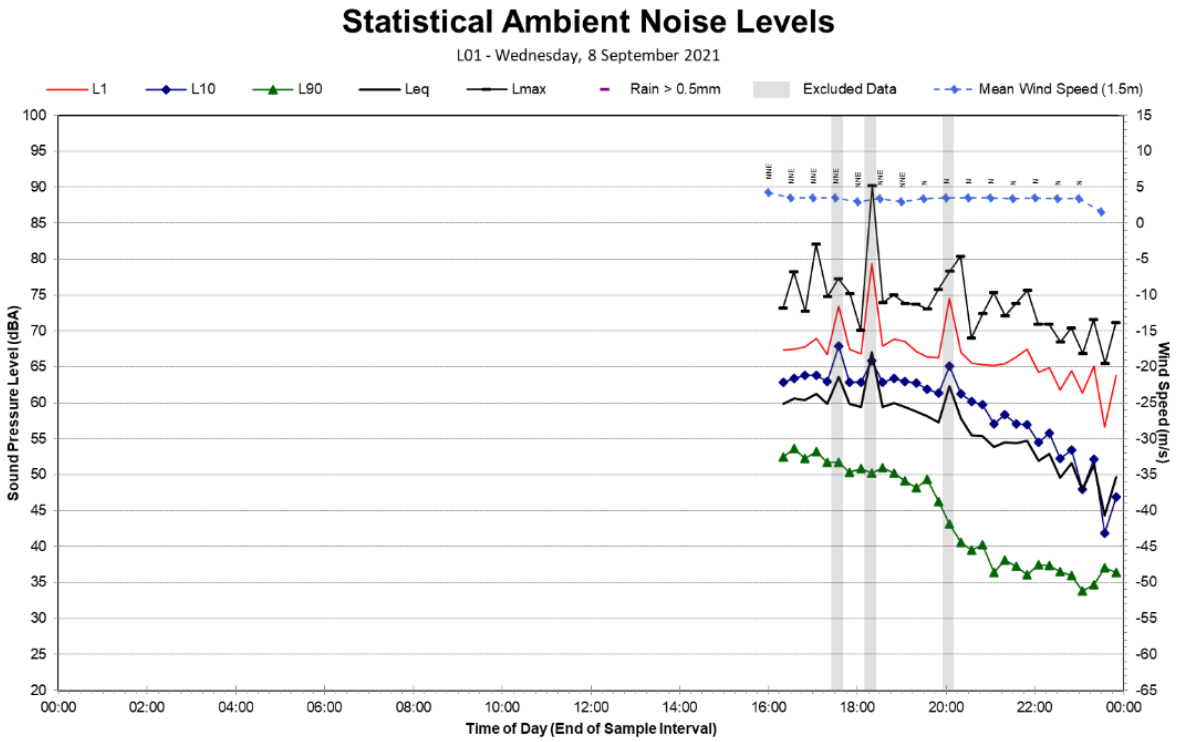
I confirm I am an active and practising member of the Australian Acoustic Society (AAS), and Engineers Australia. I have been practising Acoustic Consultancy for a continuous period of 10 years and am considered to be a qualified Acoustician.

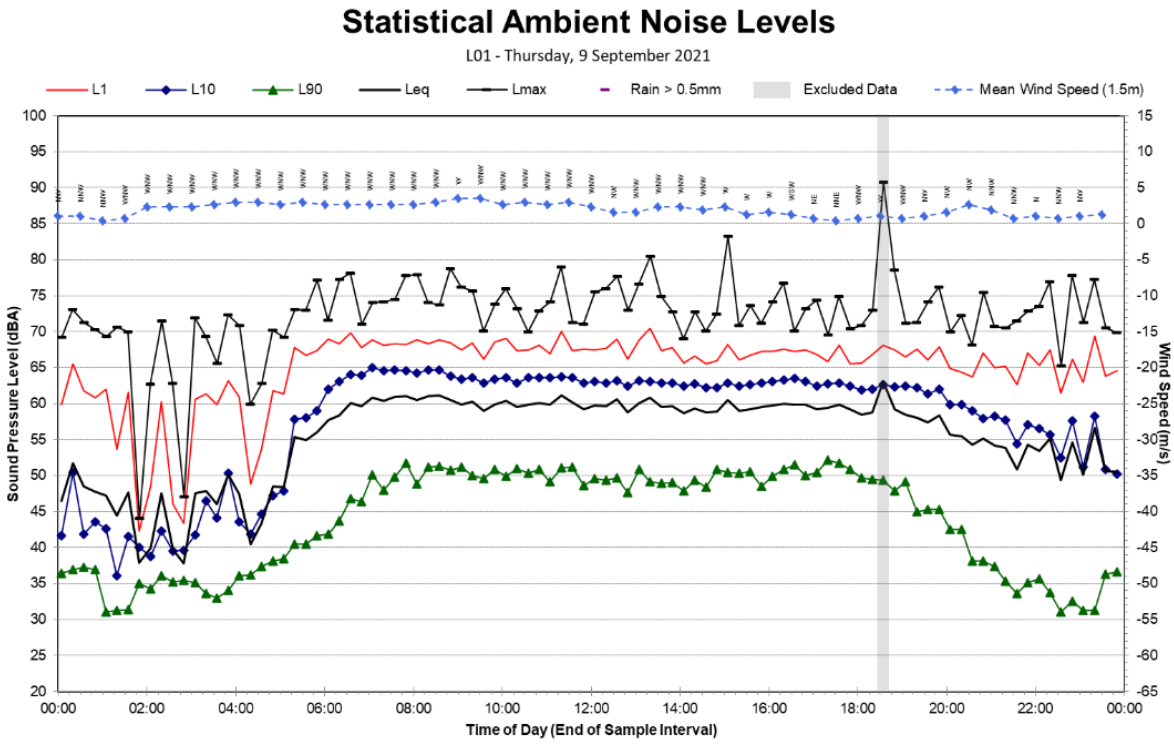
If any additional information or clarification is required to supplement this report, please do not hesitate to contact me on a.szabo@reefacoustics.com.au.

Best regards,

Attila Szabo
Reef Acoustics

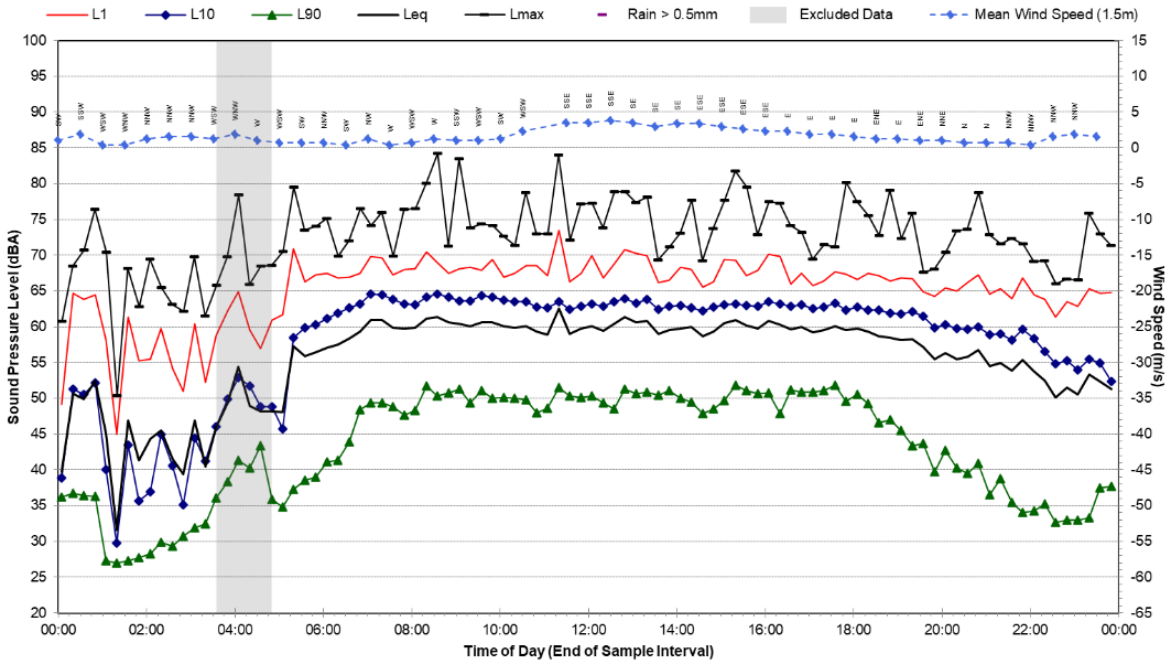
APPENDIX A – STATISTICAL AMBIENT NOISE LEVEL GRAPHS (SLR CONSULTING PRIOR MEASUREMENTS)





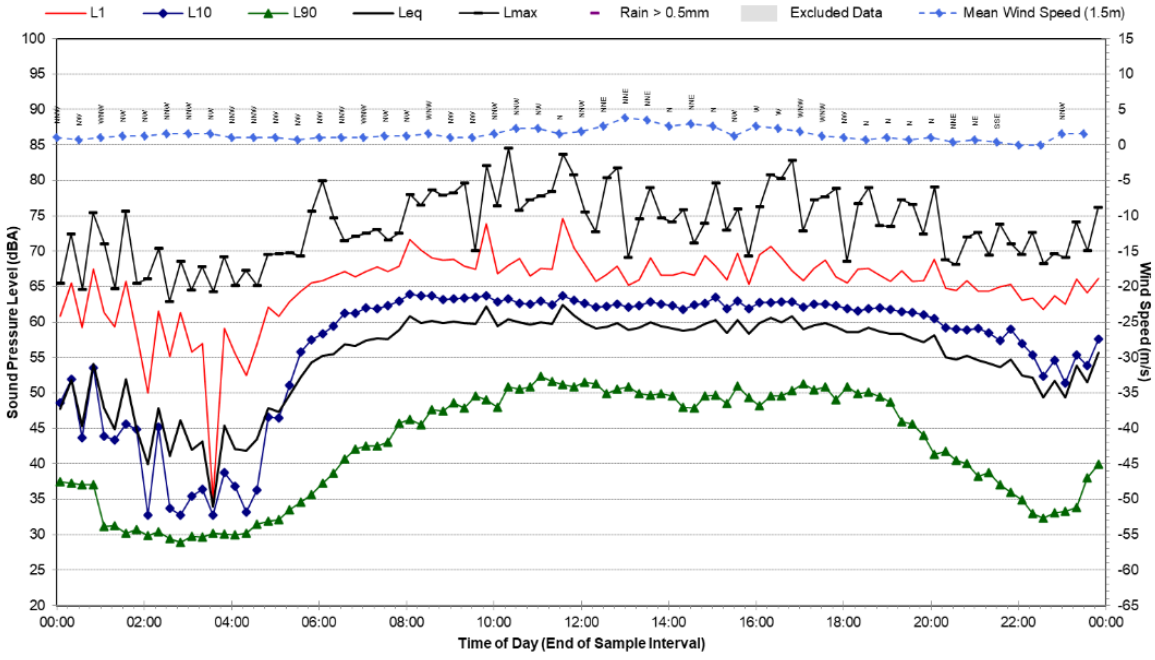
Statistical Ambient Noise Levels

L01 - Friday, 10 September 2021



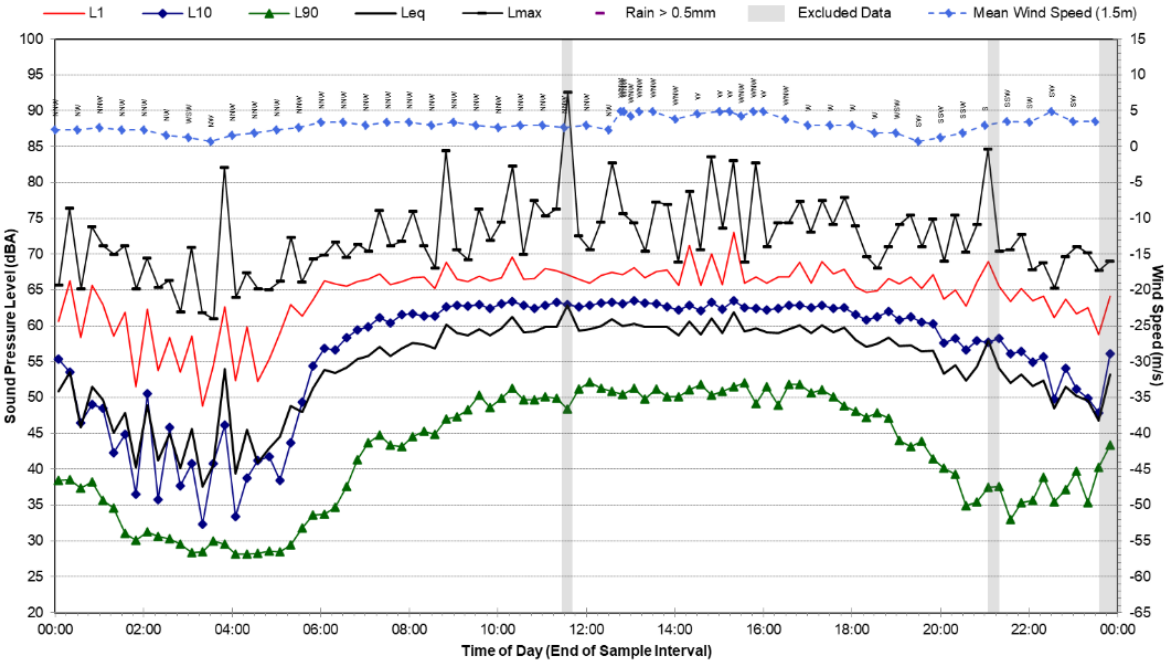
Statistical Ambient Noise Levels

L01 - Saturday, 11 September 2021



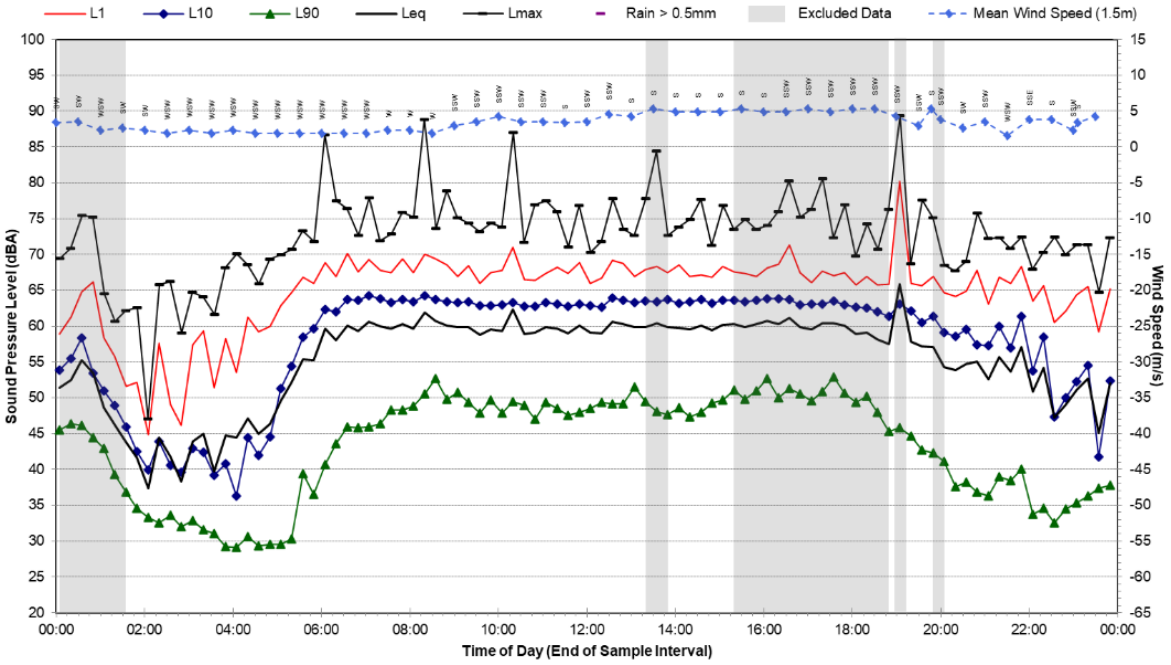
Statistical Ambient Noise Levels

L01 - Sunday, 12 September 2021



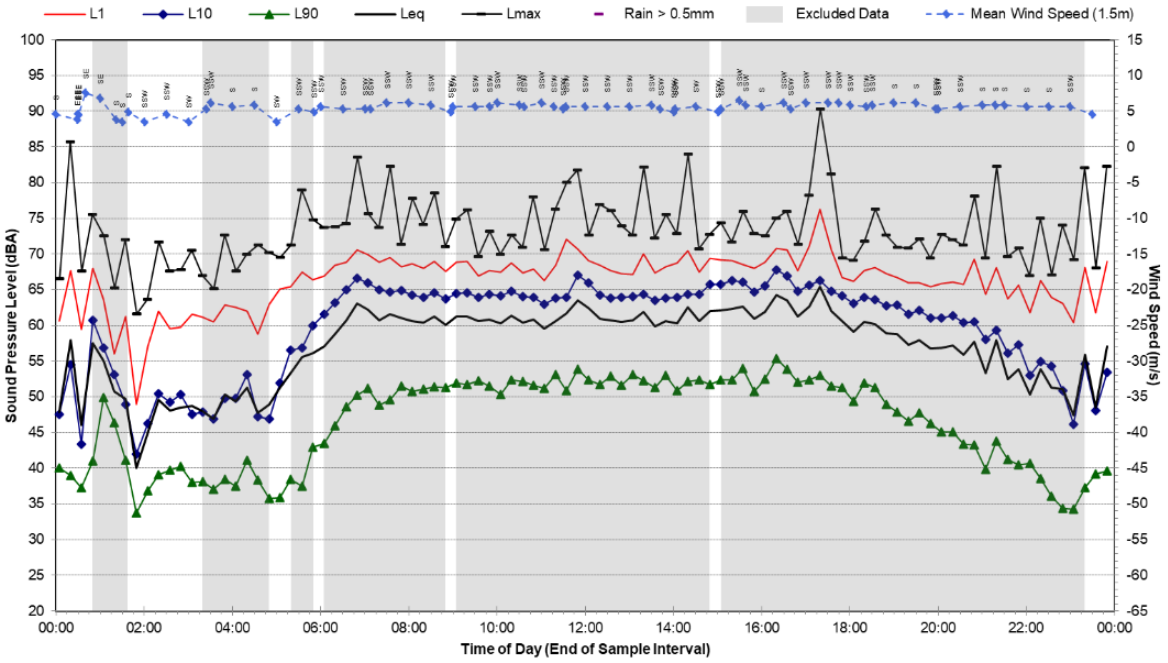
Statistical Ambient Noise Levels

L01 - Monday, 13 September 2021



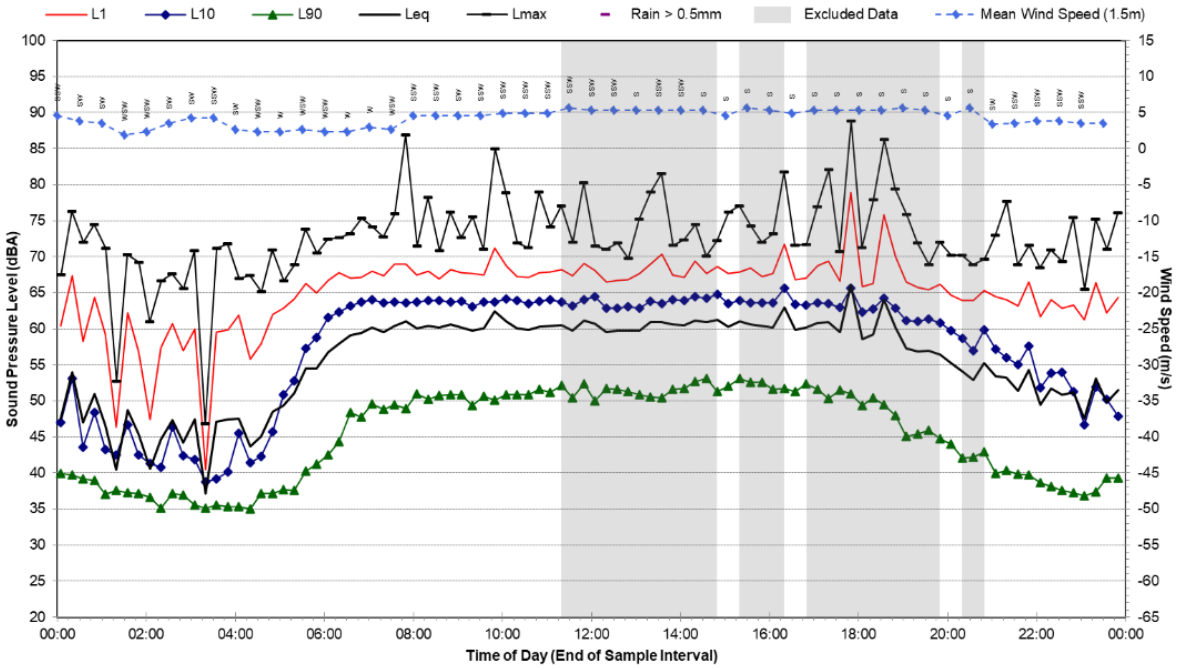
Statistical Ambient Noise Levels

L01 - Tuesday, 14 September 2021



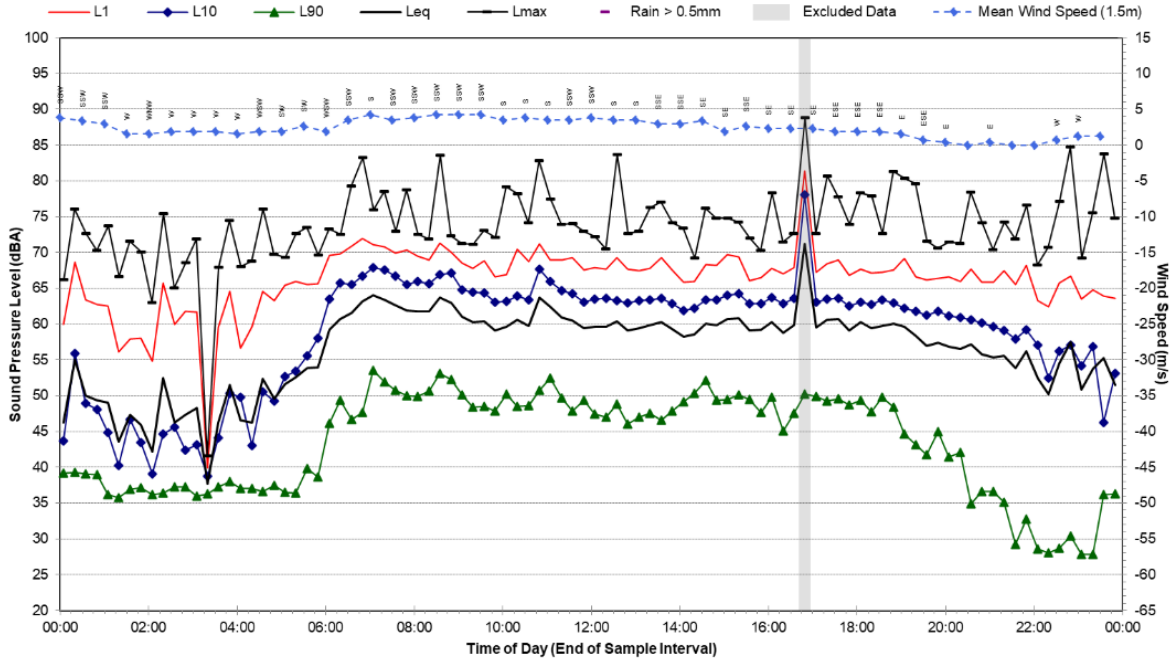
Statistical Ambient Noise Levels

L01 - Wednesday, 15 September 2021



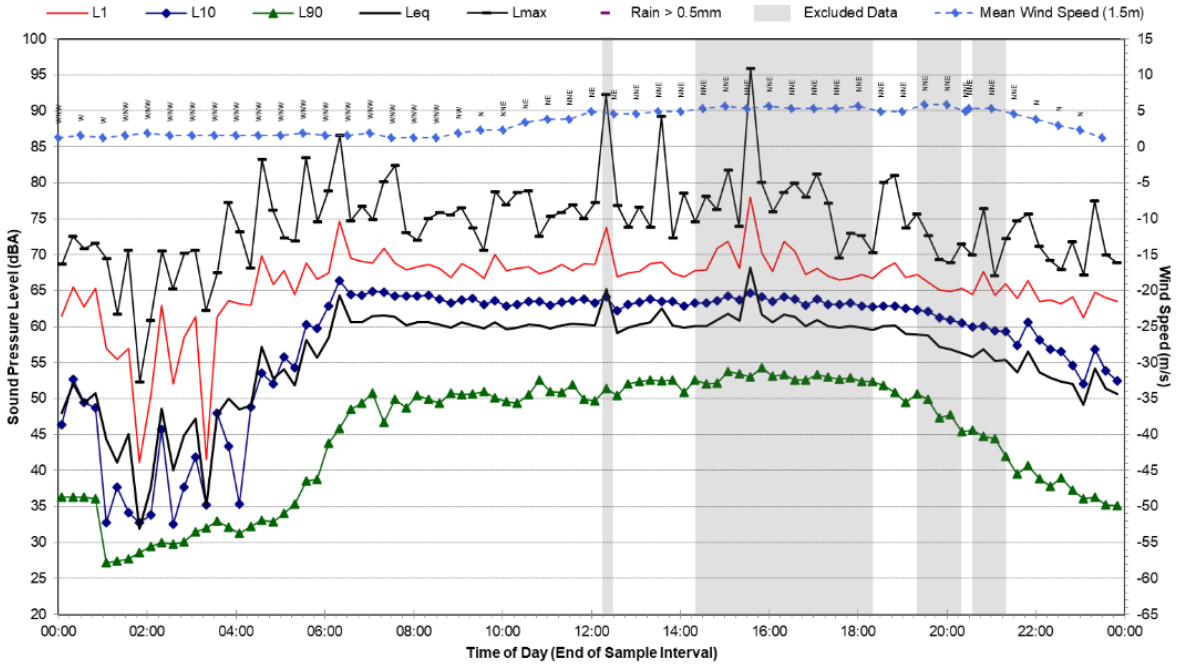
Statistical Ambient Noise Levels

L01 - Thursday, 16 September 2021



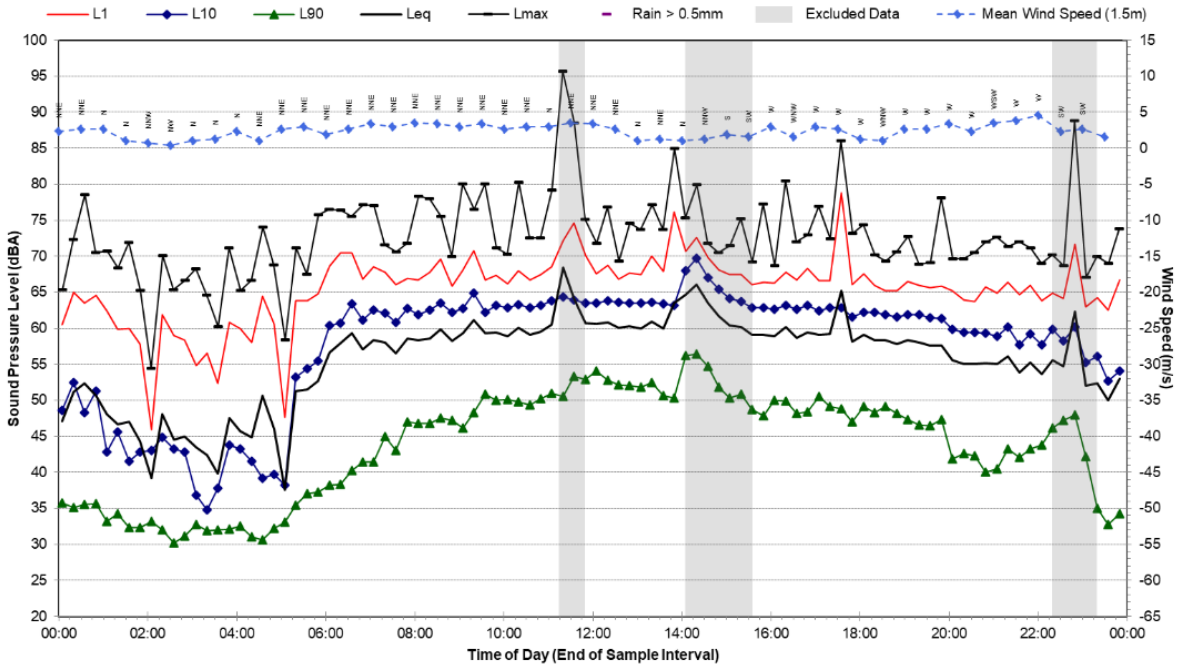
Statistical Ambient Noise Levels

L01 - Friday, 17 September 2021



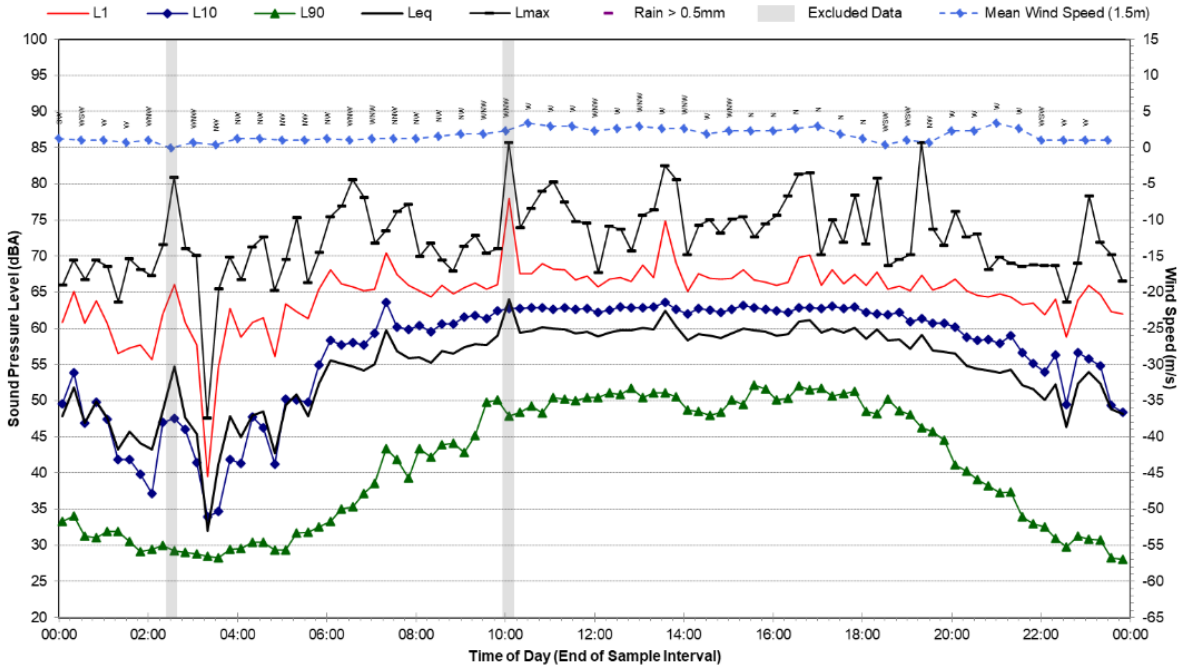
Statistical Ambient Noise Levels

L01 - Saturday, 18 September 2021



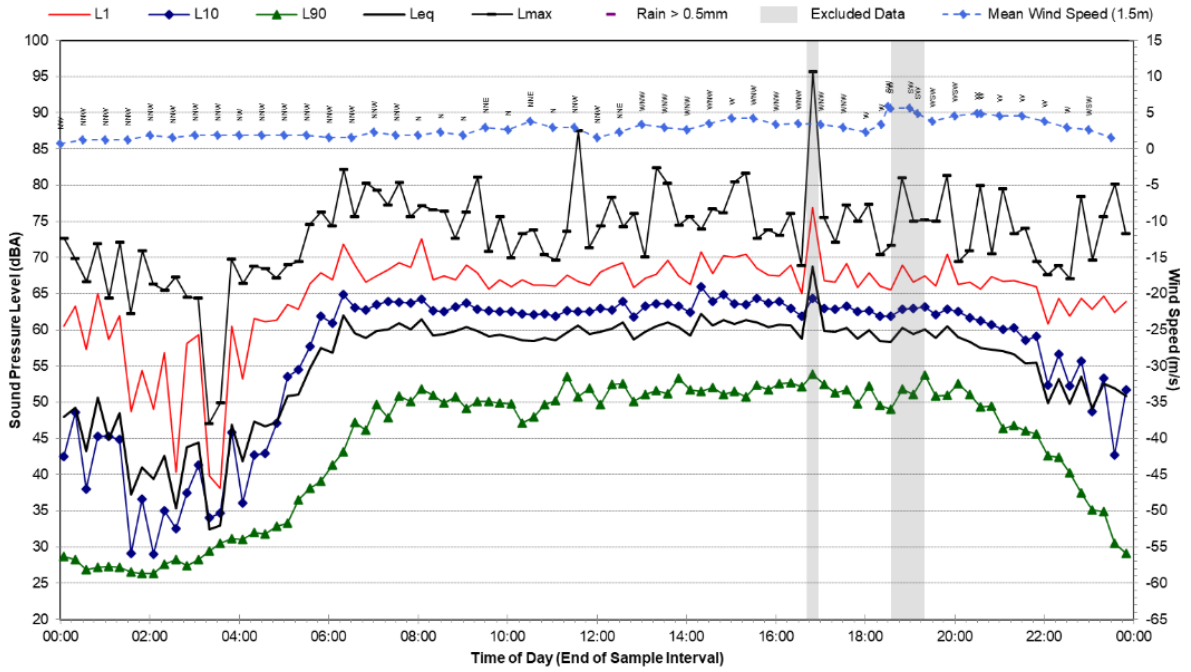
Statistical Ambient Noise Levels

L01 - Sunday, 19 September 2021



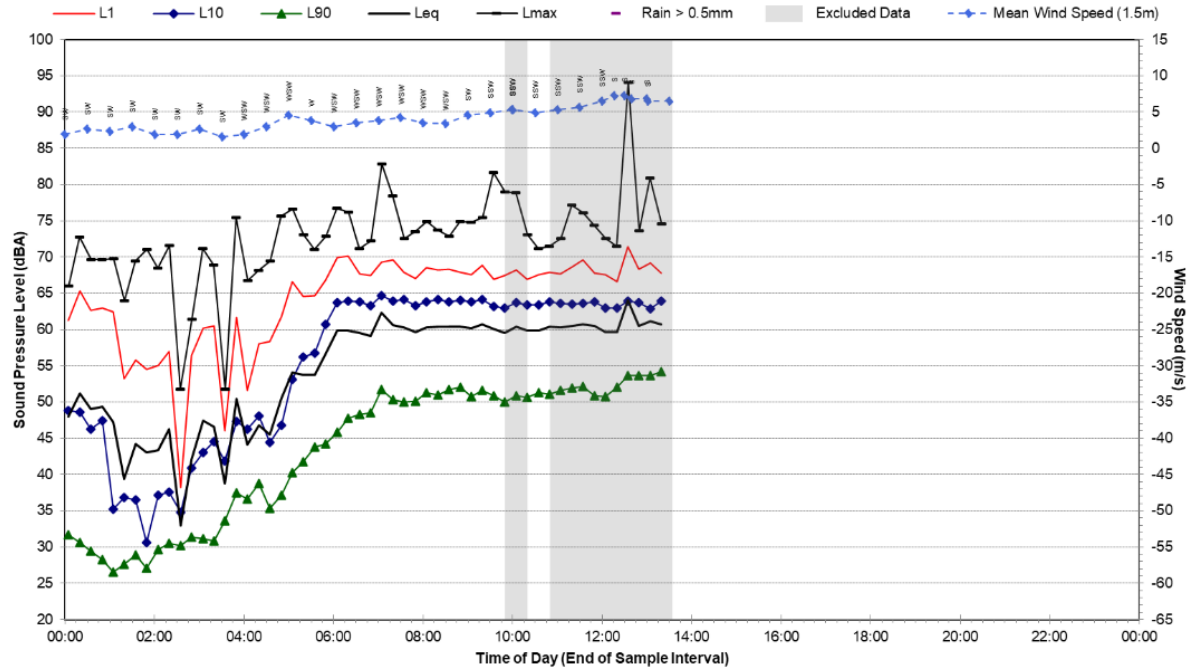
Statistical Ambient Noise Levels

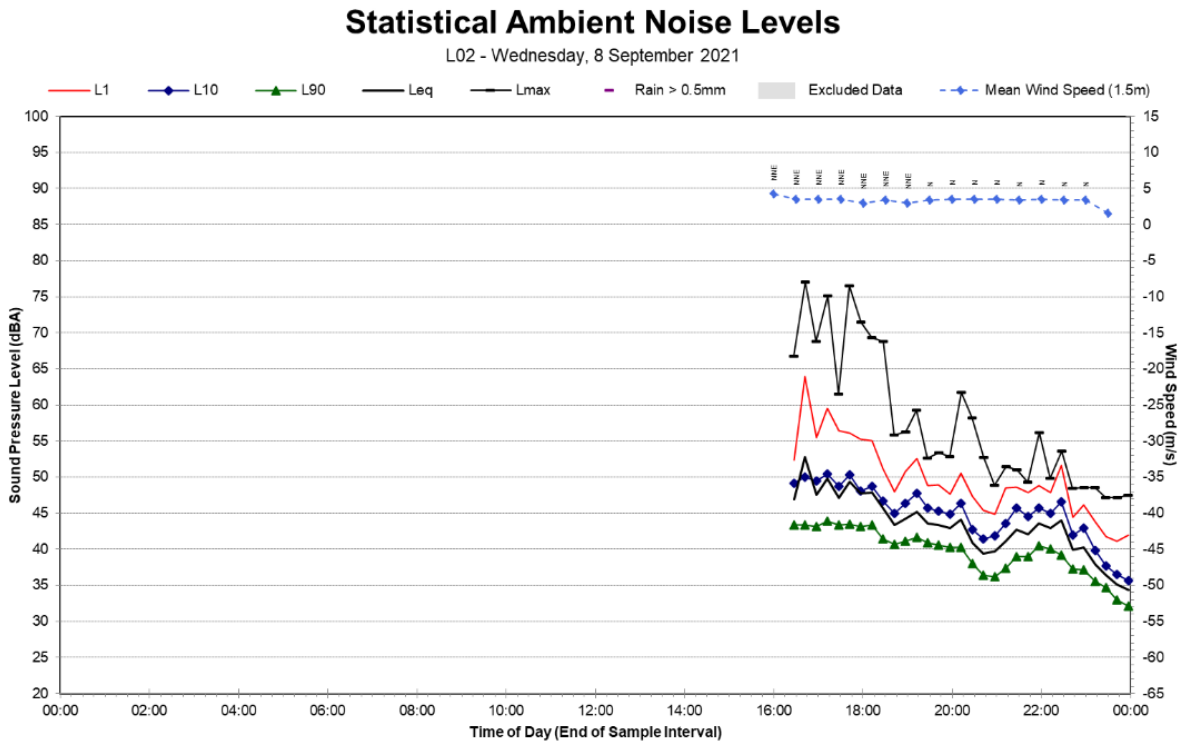
L01 - Monday, 20 September 2021

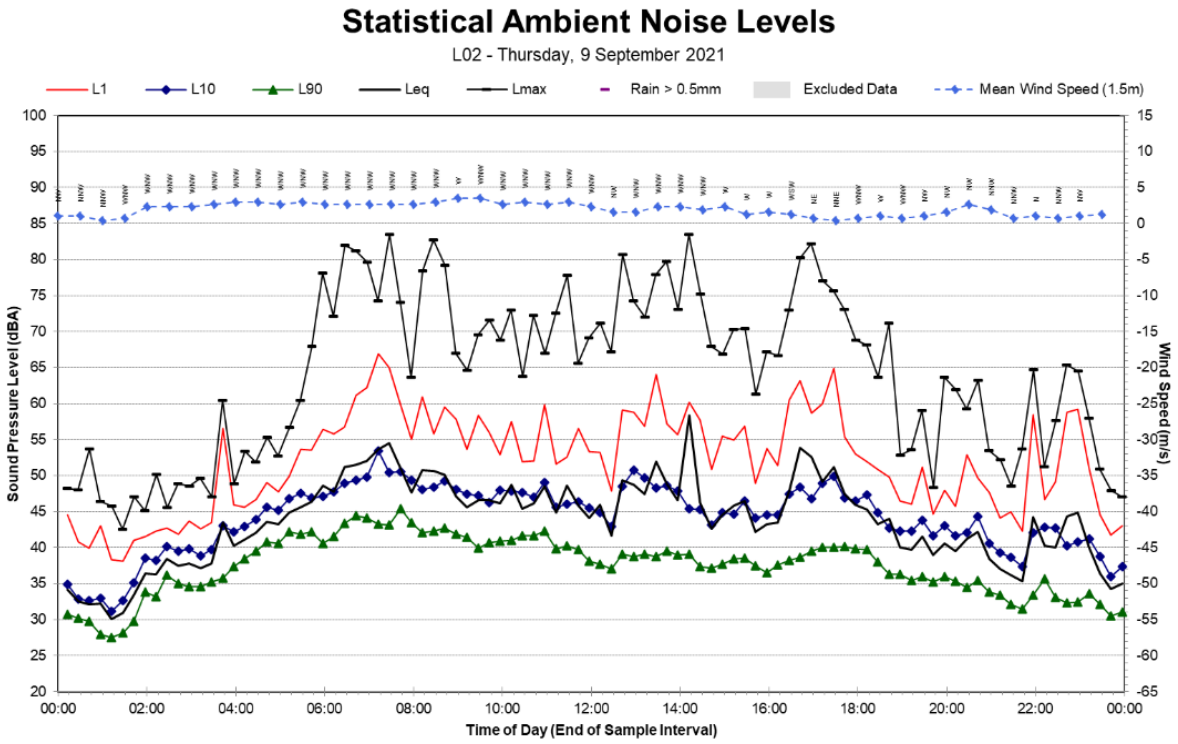


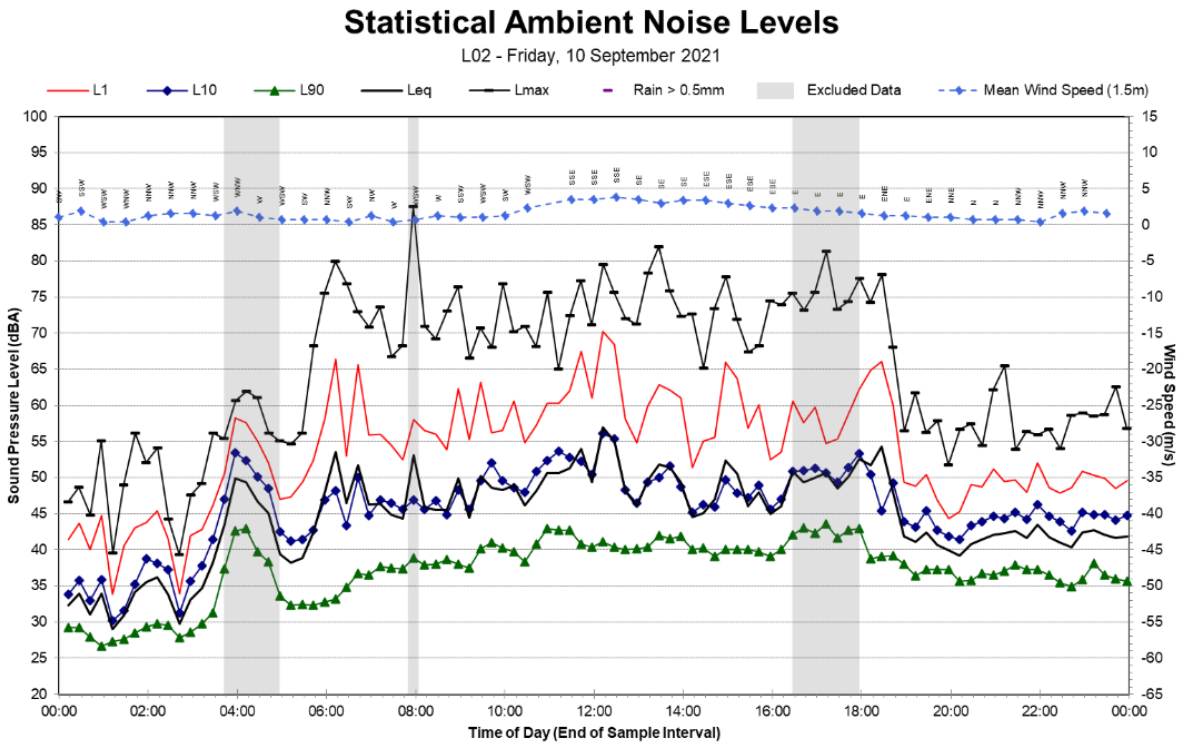
Statistical Ambient Noise Levels

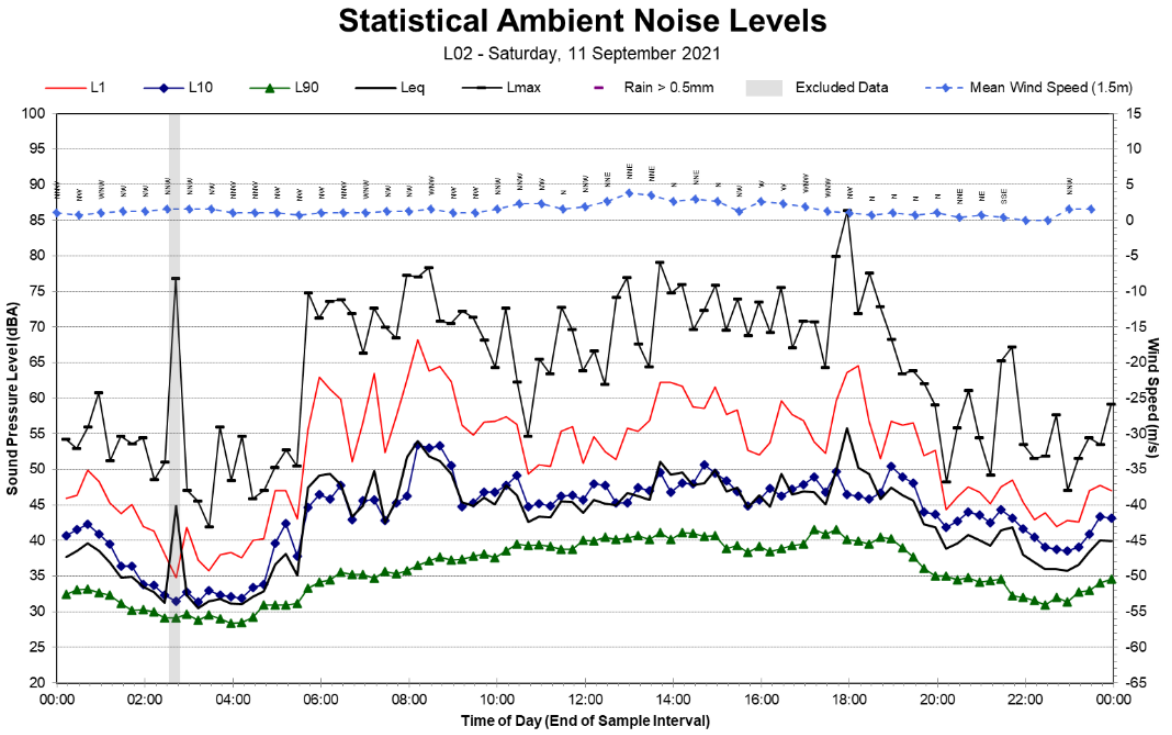
L01 - Tuesday, 21 September 2021




Statistical Ambient Noise Levels
L02 - Wednesday, 8 September 2021
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

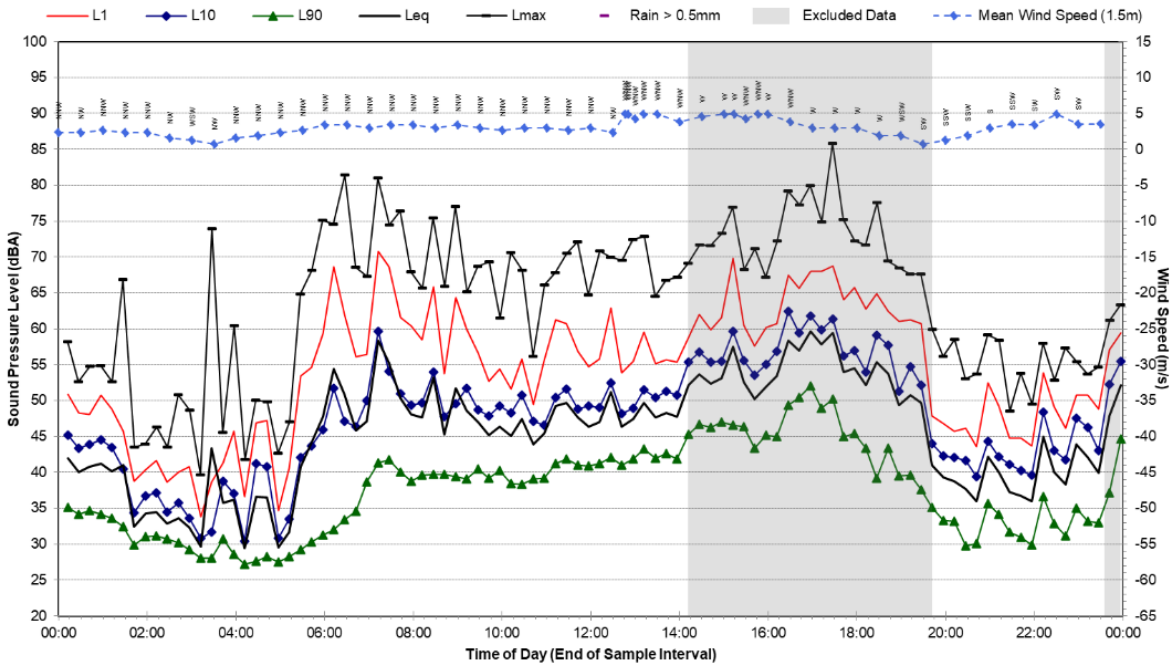

Statistical Ambient Noise Levels
L02 - Thursday, 9 September 2021
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L02 - Friday, 10 September 2021
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L02 - Saturday, 11 September 2021
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

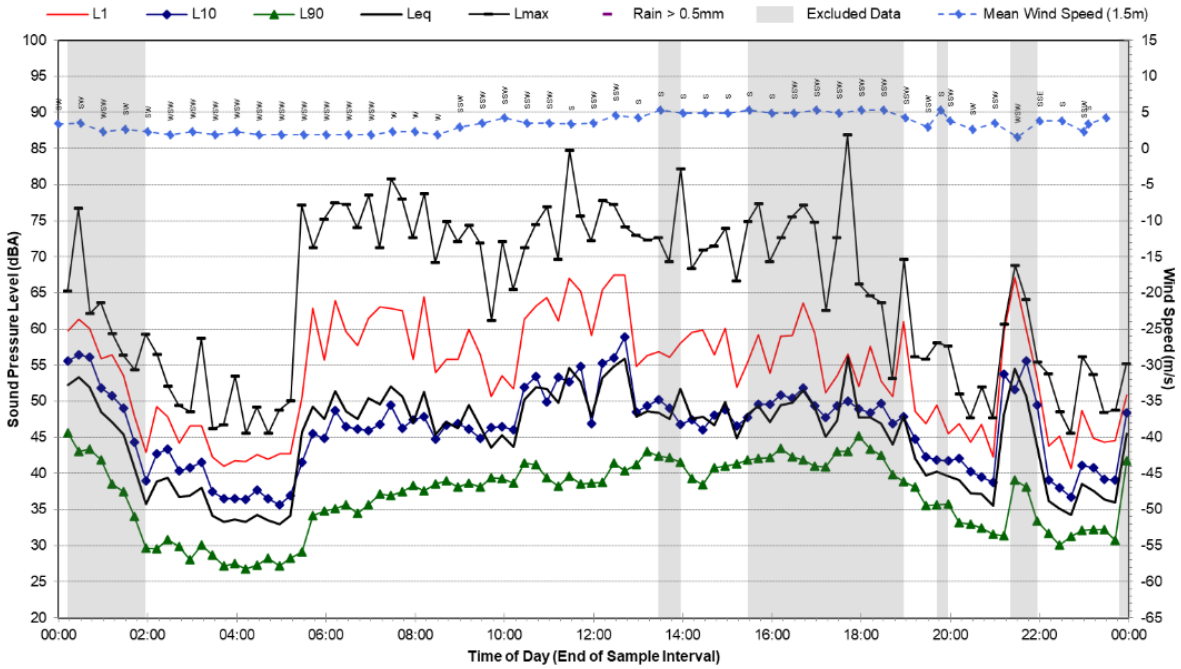
Statistical Ambient Noise Levels

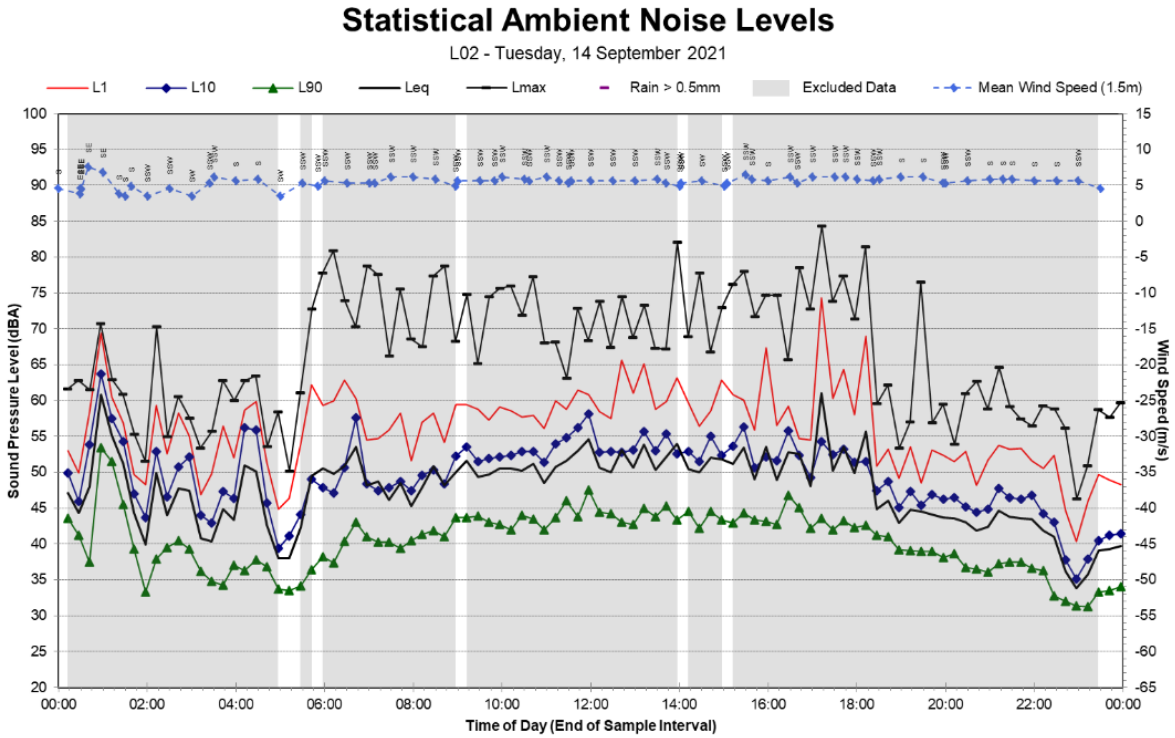
L02 - Sunday, 12 September 2021

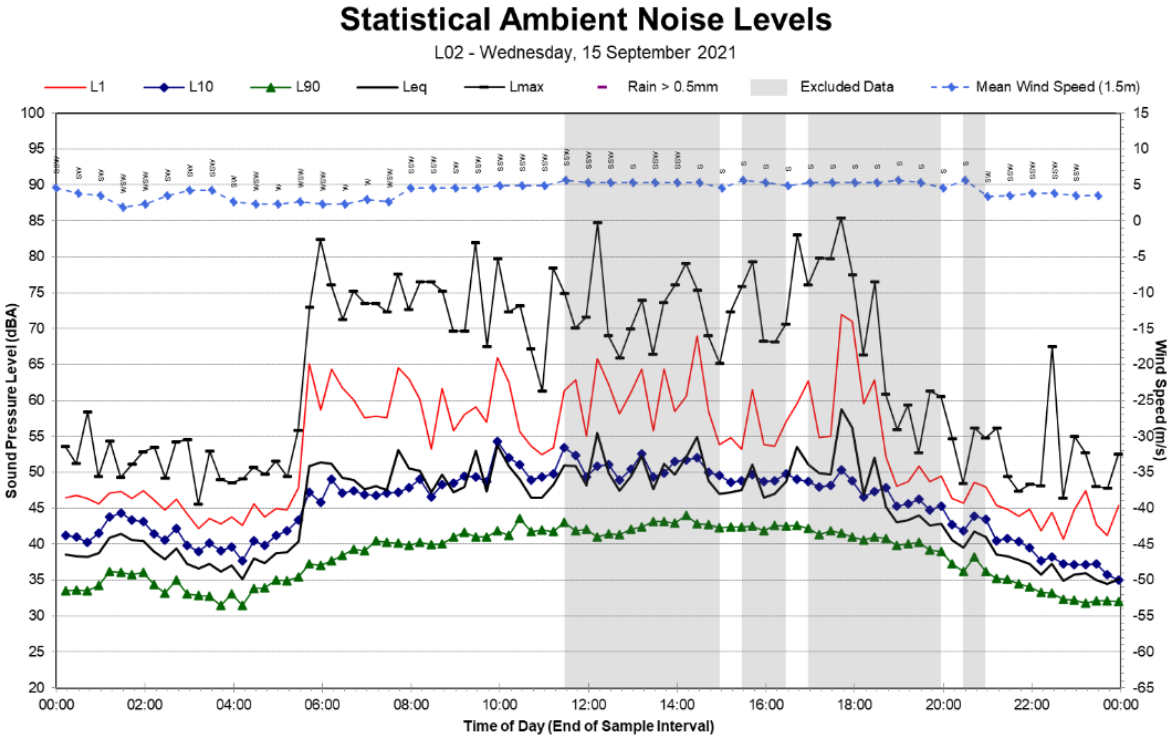


Statistical Ambient Noise Levels

L02 - Monday, 13 September 2021

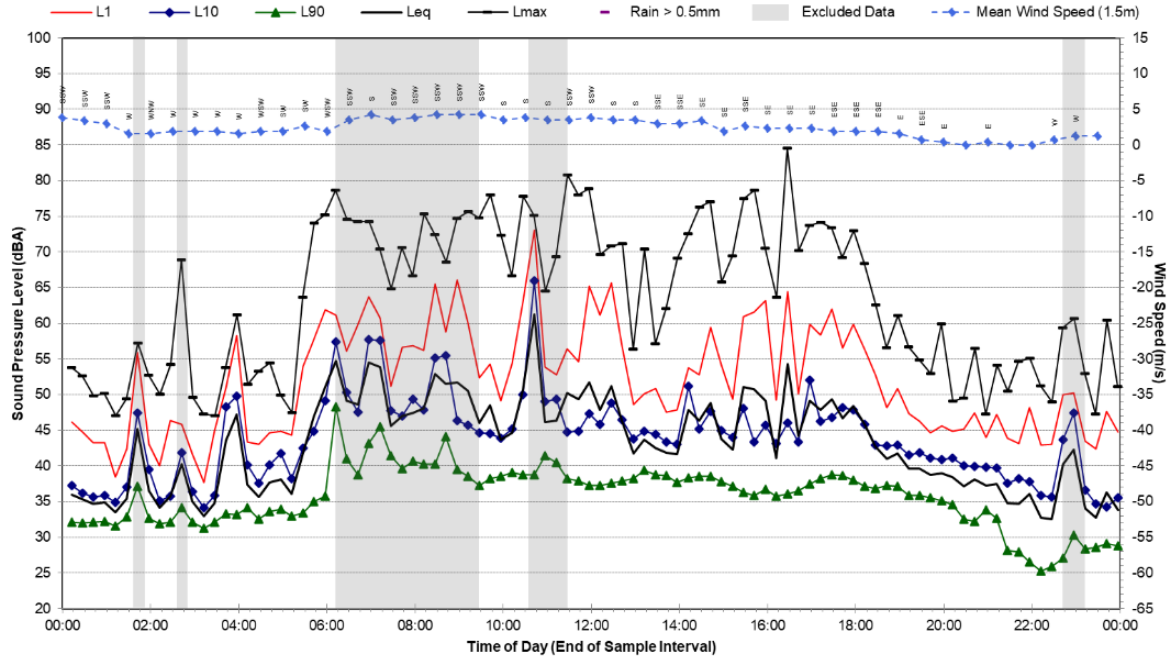



Statistical Ambient Noise Levels
L02 - Tuesday, 14 September 2021
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L02 - Wednesday, 15 September 2021
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

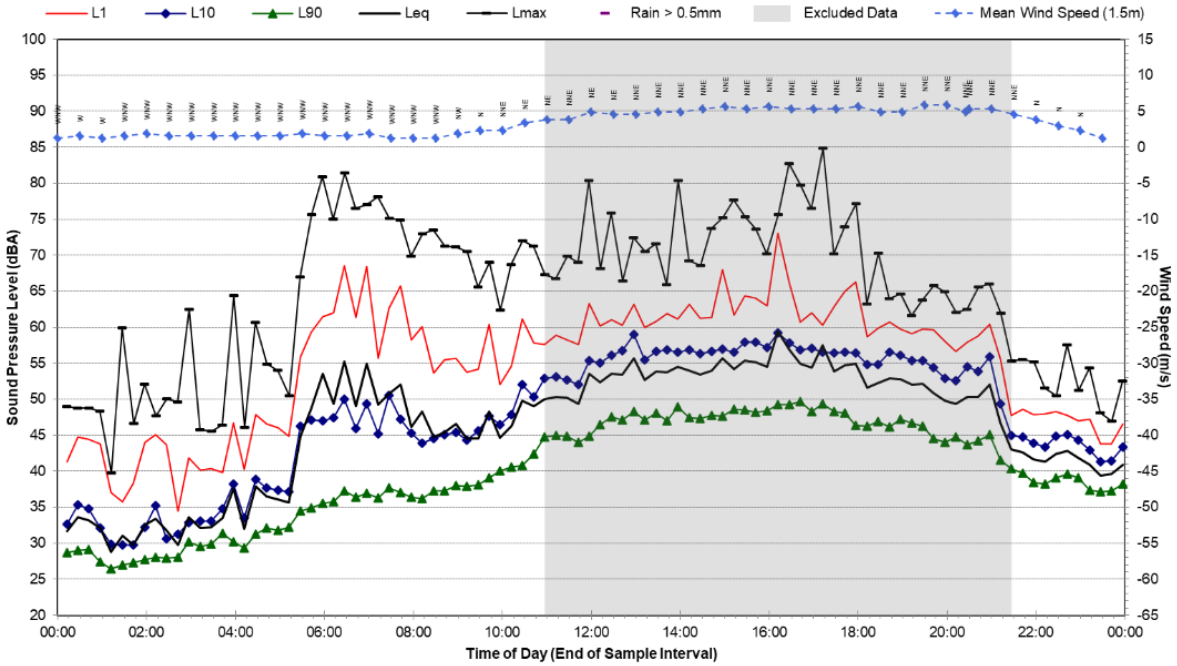
Statistical Ambient Noise Levels

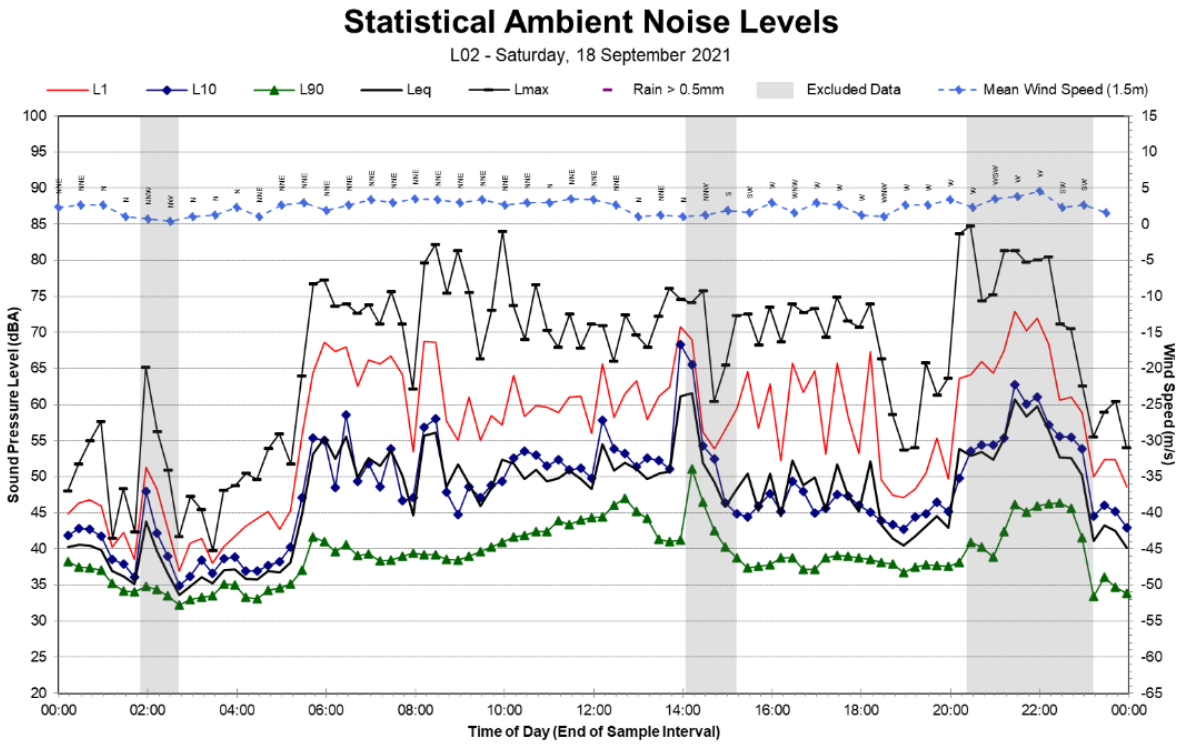
L02 - Thursday, 16 September 2021

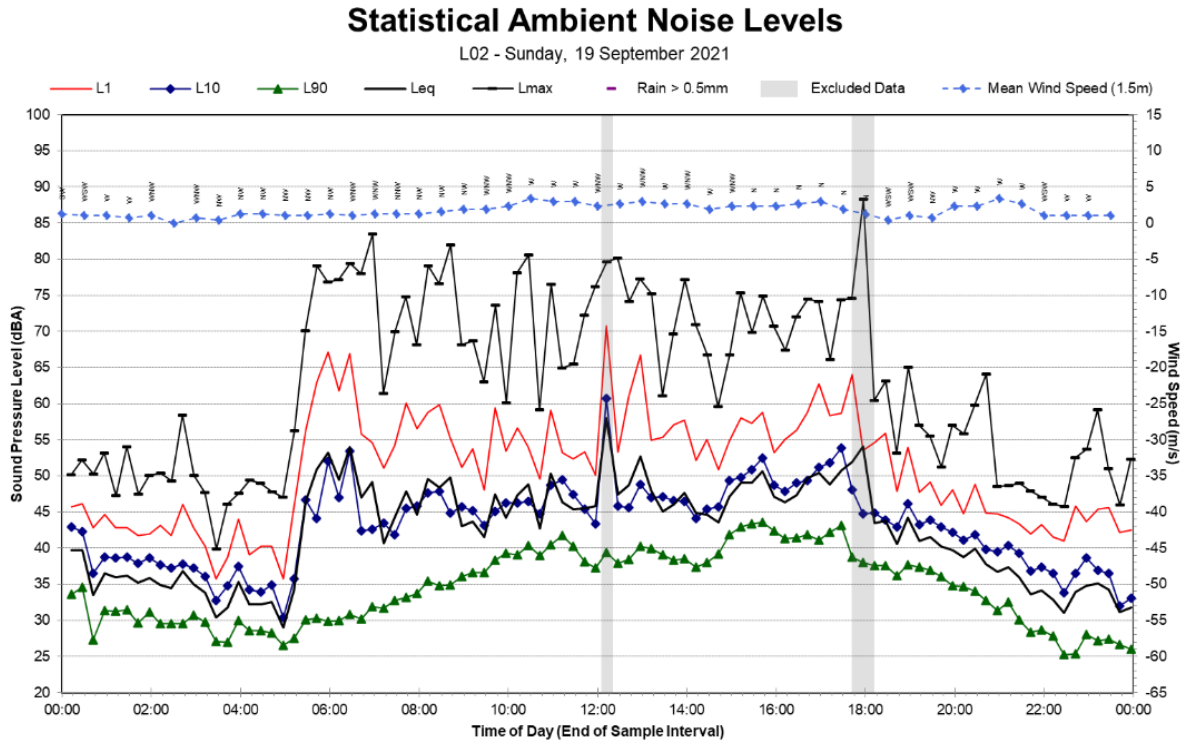


Statistical Ambient Noise Levels

L02 - Friday, 17 September 2021

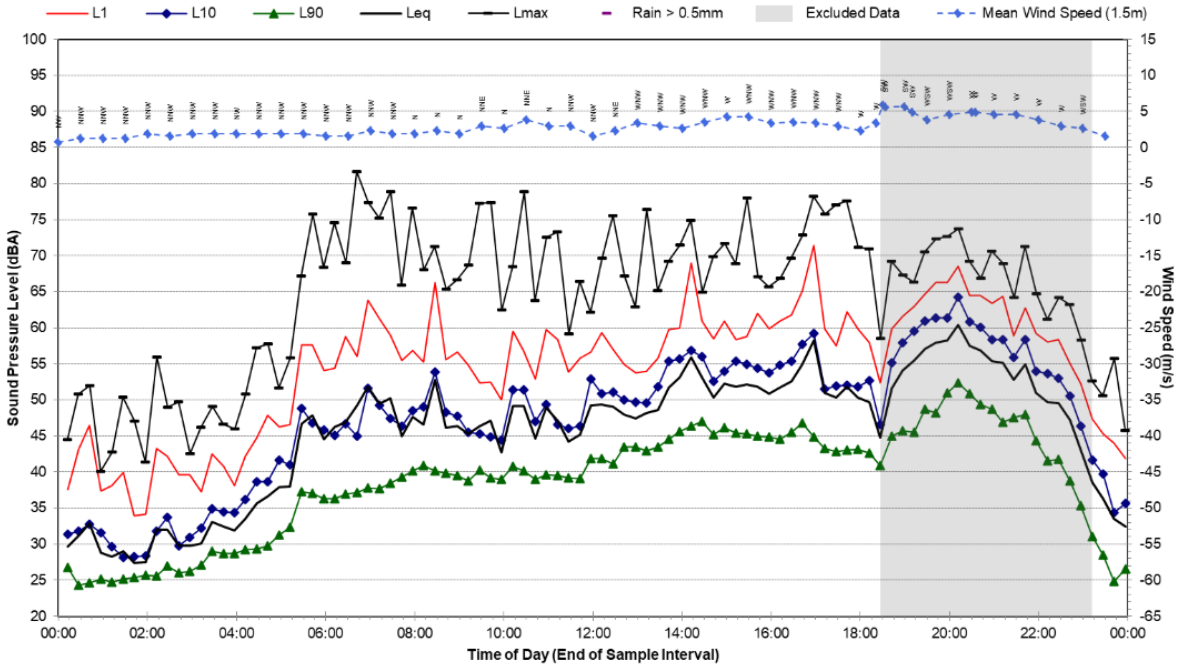



Statistical Ambient Noise Levels
L02 - Saturday, 18 September 2021
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L02 - Sunday, 19 September 2021
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

Statistical Ambient Noise Levels

L02 - Monday, 20 September 2021



Statistical Ambient Noise Levels

L02 - Tuesday, 21 September 2021