Long Reef Golf Club Redevelopment – DA Acoustic Assessment

Long Reef Golf Club Ltd
2 Anzac Avenue,
Collaroy NSW 2097

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TABLE OF CONTENTS

TABLES

FIGURES

1 INTRODUCTION

Pulse White Noise Acoustics (PWNA) have been engaged by Long Reef Golf Club Ltd to undertake an acoustic assessment of the proposed redevelopment of the Long Reef Golf Club Clubhouse situated at 2 Anzac Avenue, Collaroy, NSW.

1.1 Project Description

The proposed development includes the following scope of works:

- Alterations and additions to create a refurbished two (2) storey Club House
- The ground floor is proposed to provide the following areas:
    - new lobby entry space
    - three (3) community / meeting rooms
    - two (2) bar areas
    - members lounge with external terrace area
    - commercial kitchen
    - dining area
    - amenities
    - office spaces
    - storage rooms
    - keg room
    - kiosk
    - covered outdoor terrace dining area; and
    - garden seating area.
- The new first floor level will provide the following areas:
    - lobby and entry area
    - back of house space
    - Member & Community multi-use rooms
    - amenities
    - members lounge and terrace area; and
    - two (2) outdoor terrace areas
- Revised vehicular access from Anzac Avenue

- Shared pedestrian zone along existing access road for increased safety consisting of raised pavements and improved footpaths
- Tree removal and associated replanting
- Removal and reinstatement of solar panels on roof

1.2 Operational Parameters

As part of this proposal the following operational conditions are proposed, these form the basis of our assessment detailed in following sections.

- Operational Hours:
    - 6:00am to 12:00am (midnight), Monday to Sunday.
- Patrons:
    - This assessment assumed the following maximum number of patrons in each area (not necessarily an overall total):
        - Members Lounge – 98
        - Covered Terrace Dining – 50
        - Dining – 96
        - Communal Area – 77
        - Meeting / Community Room 1 (Ground) – 22
        - Meeting / Community Room 2 (Ground)– 60
        - Meeting / Community Room 3 (Ground)– 24
        - Members Presentation Space / Meeting Rooms / Function Room 4 (L1)– 150
        - Gardening Seating – 96

The development will be assessed against relevant statutory regulations and guidelines including the following.

- Northern Beaches Council document titled *Warringah Development Control Plan (DCP) 2011* and *Warringah Local Environmental Plan (LEC) 2011*.
- New South Wales (NSW) Environmental Protection Authority (EPA) document titled *Noise Policy for Industry 2017 (NPI).*
- New South Wales (NSW) Department of Environment, Climate Change and Water NSW document titled *NSW Road Noise Policy (RNP) 2011*.
- New South Wales (NSW) Department of Environment, Climate Change and Water NSW document titled *Interim Construction Noise Guideline (ICNG) 2009*.
- NSW Liquor and Gaming typically imposed noise conditions.

Typical floor plates for the future club redevelopment are provided in Figure 1 and Figure 2.

Figure 1 Proposed Ground Level Floor Plan

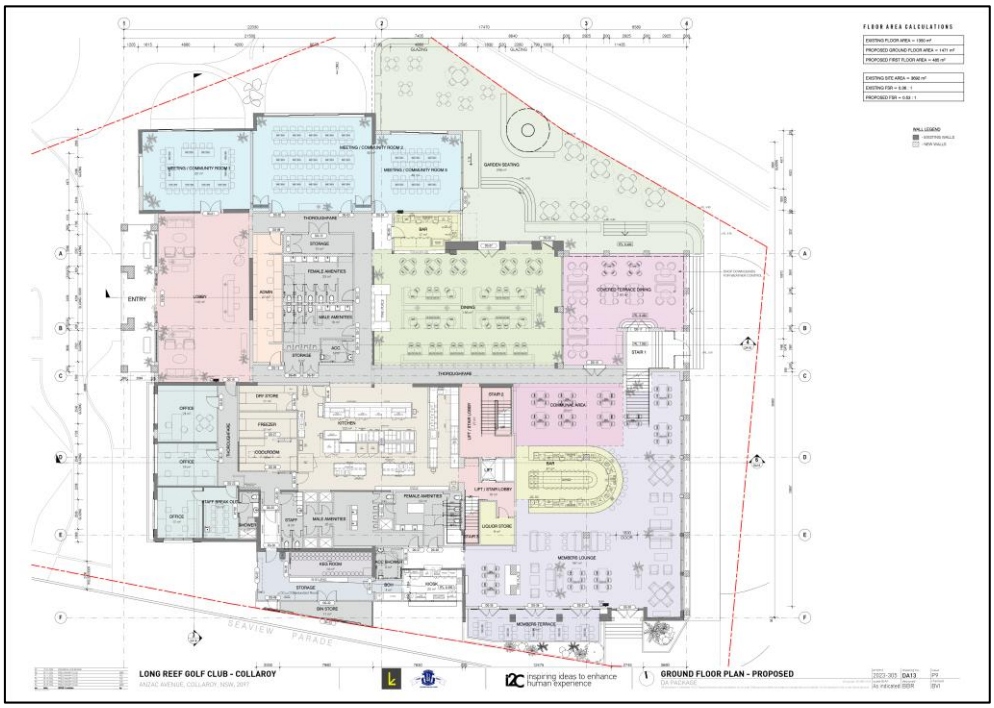
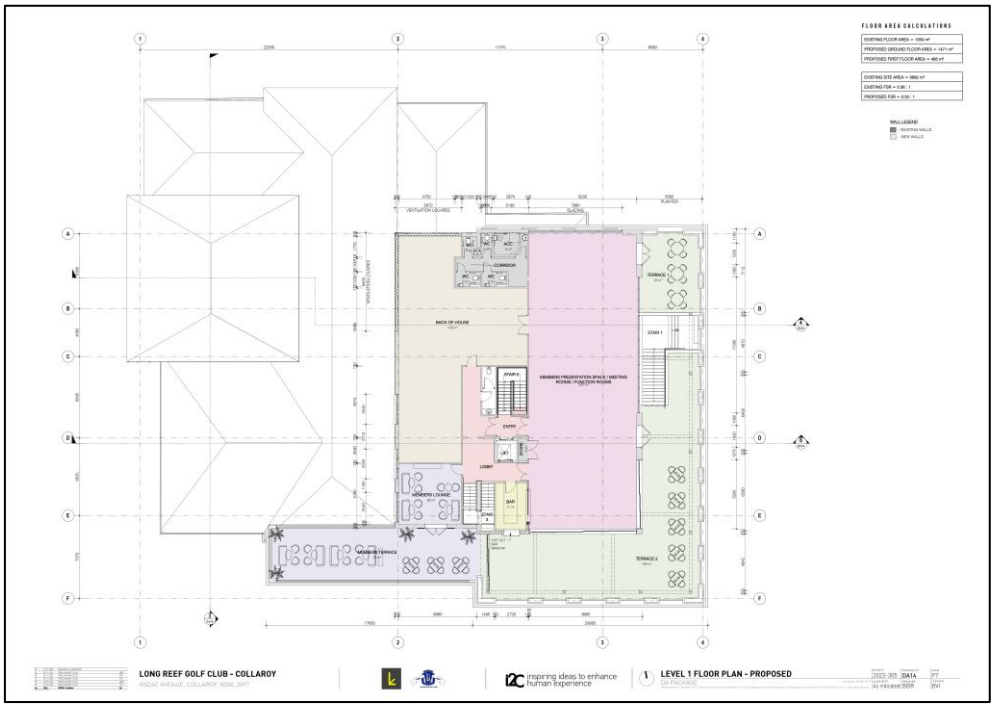


Figure 2 First Floor Plan



2 SITE DESCRIPTION AND SURROUNDING RECEIVERS

The Site is positioned within the suburb of Collaroy, which forms part of the Northern Beaches Local Government Area (LGA). The Site is located at the eastern end of Anzac Avenue, Collaroy. The Site is located within Griffith Park which includes the Long Reef Golf Course (LRGC), Griffith Park Playing Field and amenities building, Collaroy Tennis Club, Long Reef Surf Lifesaving Club and associated facilities.

The Site is zoned RE1 Public Recreation and is subject to the provisions of Warringah Local Environmental Plan 2011. The Site is situated on the southern side of Anzac Avenue between Seaview Parade to the west and Fisherman's Beach to the east.

In its current state, the Site comprises the existing LRGC Club House which is a single storey rendered brick building with hipped tile roof and part flat metal roof. The Club House has been subject to various additions and extensions over the years and is no longer fit for purpose. There is an existing at grade parking area to the west of the existing building that will remain largely unchanged.

The Site adjoins Fisherman's Beach to the north and east, open reserve and Fisherman's Beach Boat Ramp to the east, an access road to car parking along the foreshore, Pro Shop and golf course to the south and south-west and low-density residential housing to the north-west.

The wider Site context is a combination of recreational and sporting facilities within Griffith Park, beach and intertidal areas, and low-density residential development.

The nearest sensitive noise receivers to the development are detailed below:

Receiver 1 - Existing residential dwellings located across Anzac Avenue to the north situated at 1A, 1B, 1C and 1D Seaview Parade, Collaroy.

Receiver 2 - Existing residential dwellings located across Anzac Avenue to the north-west situated at 2, 4 and 6 Seaview Parade, Collaroy.

A site map has been provided below which identifies and surrounding receivers and monitoring locations, see Figure 3.

Figure 3 Site Map, Measurement Location and Surrounding Receivers – Sourced from SixMaps NSW

3 NOISE DESCRIPTORS AND TERMINOLOGY

Environmental noise constantly varies in level with time. It is therefore necessary to measure environmental noise in terms of quantifiable time periods and statistical descriptors. Typically, environmental noise is measured over 15-minute periods and relevant statistical descriptors of the fluctuating noise are determined to quantify the measured level.

Noise (or sound) consists of minute fluctuations in atmospheric pressure capable of detection by human hearing. Noise levels are expressed in terms of decibels, abbreviated as dB or dB(A), the A indicating that the noise levels have been frequency weighted to approximate the characteristics of normal human hearing. Because noise is measured using a logarithmic scale, 'normal' arithmetic does not apply, e.g. adding two sources of sound of an equal value results in an increase of 3dB (i.e. 60 dBA + 60 dBA = 63 dBA). A change of 1 dB or 2 dB in the level of a sound is difficult for most people to detect, whilst a 3 dB – 5 dB change corresponds to a small but noticeable change in loudness. A 10 dB change roughly corresponds to a doubling or halving in loudness.

The most relevant environmental noise descriptors are the LAeq, LA1, LA10 and LA90 noise levels. The LAeq noise level represents the "equivalent energy average noise level". This parameter is derived by integrating the noise level measured over the measurement period and is equivalent to a level that would have been experienced had the fluctuating noise level remained constant during the measured time period.

The LA1, LA10 and LA90 levels are the levels exceeded for 1%, 10% and 90% of the sample period. These levels are sometimes thought of as the typical maximum noise level, the average repeatable maximum and average repeatable minimum noise levels, respectively.

Specific acoustic terminology is used in this assessment report. An explanation of common acoustic terms is included as Appendix A.

4 EXISTING NOISE ENVIRONMENT

4.1 Unattended Noise Monitoring

An unattended noise survey was conducted between Tuesday 1st August 2023 and Monday 14th August 2023 along the south fence line of the residence at 1A Seaview Parade as shown in Figure 3 above. This survey was conducted to measure the existing background noise level. All data in the graphs presented in Appendix B have not been corrected (i.e., raw data is presented).

Instrumentation for the survey comprised one SvanTek 971 sound level meter (serial number 131680). Calibration of the logger was checked prior to and following the measurements. Drift in calibration did not exceed ±0.5 dB. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates.

Charts presenting summaries of the measured daily noise data are attached in Appendix B. The charts present each 24-hour period and show the LA1, LA10, LAeq and LA90 noise levels for the corresponding 15-minute periods. This data has been filtered to remove periods affected by adverse weather conditions based on weather information.

Based on the unattended noise measurements, the results of the survey have been presented below.

In order to assess the acoustical implications of the development at nearby noise sensitive receivers, the measured background noise data of the logger was processed in accordance with the NSW EPA's *Noise Policy for Industry* (NPI, 2017).

The Rating Background Noise Level (RBL) is the background noise level used for assessment purposes at the nearest potentially affected receiver. It is the 90th percentile of the daily background noise levels during each assessment period, being day, evening and night. RBL $L_{A90\ (15minute)}$ and L_{Aeq} noise levels are presented in the table belowTable 2.

Data affected by adverse meteorological conditions and by spurious and uncharacteristic events have been excluded from the results, and also excluded from the data used to determine the noise emission criteria. Meteorological information has been obtained from the Terrey Hills AWS (ID 066059) which is located within 30km. Levels presented below are processed results with extraneous weather events removed.

Table 1 Measured Ambient Noise Levels corresponding to the NPI's Assessment Time Periods

Measurement Location	Daytime[1] 7:00 am to 6:00 pm		Evening[1] 6:00 pm to 10:00 pm		Night-time[1] 10:00 pm to 7:00 am	
	L_{A90}[2] (dBA)	L_{Aeq}[3] (dBA)	L_{A90}[2] (dBA)	L_{Aeq}[3] (dBA)	L_{A90}[2] (dBA)	L_{Aeq}[3] (dBA)
1A Seaview Parade, Collaroy (see Figure 1)	42	49	41	46	41	45

Note 1: For Monday to Saturday, Daytime 7:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 7:00 am. On Sundays and Public Holidays, Daytime 8:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 8:00 am.

Note 2: The LA90 noise level is representative of the "average minimum background sound level" (in the absence of the source under consideration), or simply the background level.

Note 3: The LAeq is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.

4.2 Attended Noise Monitoring

An attended noise survey was conducted on Monday 21st October 2024 between 9:00am and 10:15am and 9:30pm and 10:30pm and at the locations shown in Figure 3 above.

The attended noise measurements were conducted using a Brüel & Kjær Type 2250 sound level meter (serial number 2709757). Calibration of the sound level meter was checked prior to and following the measurements using a Brüel & Kjær Type 4231 sound calibrator (serial number 3009148). The calibrator emitted a calibration tone of 94 dB at 1 KHz. The drift in calibration did not exceed ±0.5 dB. All equipment carries appropriate and current NATA (or manufacturer) calibration certificates.

In order to assess the acoustical implications of the development at nearby noise sensitive receivers, the measured background noise data was processed in accordance with the NSW EPA's *Noise Policy for Industry* (NPI, 2017).

Table 2 Measured Ambient Noise Levels corresponding to the NPI's Assessment Time Periods

Measurement Location	Measured Noise Level (dBA)		Measurement Observations
	$L_{A90\ 15\text{-minute}}$ [1] (dBA)	$L_{Aeq\ 15\text{-minute}}$ [2] (dBA)	
Monday 21st October 2024 between **9:00am and 10:15am**			
Anzac Avenue (1a Seaview) (see Figure 1)	55	59	Distance traffic noise from Pittwater Road, noise from the beach and Occasional movement along Anzac Avenue
Anzac Avenue (2a Seaview) (see Figure 1)	53	59	Distance traffic noise from Pittwater Road, noise from the beach and Occasional movement along Anzac Avenue
South-east corner of Existing Club (see Figure 1)	54	59	Distance traffic noise from Pittwater Road, noise from the beach and Occasional movement along Anzac Avenue
Monday 21st October 2024 between **9:30pm and 10:30pm**			
Anzac Avenue (1a Seaview) (see Figure 1)	52	55	Distance traffic noise from Pittwater Road, noise from the beach and Occasional movement along Anzac Avenue
Anzac Avenue (2a Seaview) (see Figure 1)	49	53	Distance traffic noise from Pittwater Road, noise from the beach and Occasional movement along Anzac Avenue
South-east corner of Existing Club (see Figure 1)	50	52	Distance traffic noise from Pittwater Road, noise from the beach and Occasional movement along Anzac Avenue

Note 1: The L_{A90} noise level is representative of the "average minimum background sound level" (in the absence of the source under consideration), or simply the background level.

Note 2: The L_{Aeq} is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.

In addition to the overall broadband noise levels identified above, the attended measurement was recording the associated single octave (1/1) noise spectra. These are provided below.

Table 3 Measured Single Octave (1/1) Spectra

Location [1]	L_{Z90} Octave Band Centre Frequency, Hz									Overall dBA L_{A90}
	31.5	63	125	250	500	1k	2k	4k	8k	
Monday 21st October 2024 between **9:00am and 10:15am**										
Anzac Avenue (1a Seaview) (see Figure 1)	60	57	52	49	48	49	46	43	39	**53**
Anzac Avenue (2a Seaview) (see Figure 1)	59	57	52	48	47	47	43	38	32	**51**
South-east corner of Existing Club (see Figure 1)	60	59	58	50	49	49	45	39	33	**53**
Monday 21st October 2024 between **9:30pm and 10:30pm**										
Anzac Avenue (1a Seaview) (see Figure 1)	56	51	50	47	46	46	44	41	37	**51**
Anzac Avenue (2a Seaview) (see Figure 1)	56	52	49	46	44	44	40	35	31	**48**
South-east corner of Existing Club (see Figure 1)	56	53	56	48	46	46	42	37	31	**50**

Note 1: The L_{90} & LA_{90} noise level is representative of the "average minimum background sound level" (in the absence of the source under consideration), or simply the background level.

4.3 Discussion of Measured Noise Levels (Attended vs. Unattended)

As mentioned above, the unattended noise monitor was installed within the southern fence line of 1a Seaview Parade (as shown in the figure below). The noise monitor was installed on ground level and did not have a direct line of sight to the roadway of the club. As such the measured noise levels compared to the attended noise measurements detailed above are significantly lower. The attended noise measurements were conducted on ground level with full line of sight to the roadway as shown below.

Whilst each set of measurements were conducted in different situations they are both relevant to the project. The attended noise measurements conducted at ground level with direct line of sight to the roadway represent the criteria to the upper levels of the surrounding residences which are not shielded from the boundary fence. Whilst the unattended noise monitor is more representative of existing background noise levels for the spaces on ground level which have shielding from the boundary fence.

For the purpose of this assessment (being conservative) we are going to adopt the most stringent RBL's from the unattended noise monitor.

Figure 4 Site Measurement Locations – Site Photos – Attended vs. Unattended

Attended Noise Measurement – 1a Seaview	Attended Noise Measurement – 2a Seaview
	
Unattended Noise Measurement	
	

5 ACOUSTIC CRITERIA

5.1 Noise Intrusion Criteria

5.1.1 Northern Beaches Council (Formerly Warringah Council) Environmental Plan (LEP) 2011 & Development Control Plan (DCP) 2011

Acoustic requirements relevant to the future internal noise levels for the site are not provided in the Warringah LEP or DCP 2011 documents. Therefore, requirements of the *Australian and New Zealand Standard AS/NZS 2107:2016 – Acoustics – Recommended design sound levels and reverberation times for building interiors* will be adopted.

5.1.2 Australian and New Zealand Standard AS/NZS 2107:2016 – Acoustics – Recommended design sound levels and reverberation times for building interiors

Recommended ambient noise levels and reverberation times for internal spaces are given in a number of publications including Table 1 of Australian / New Zealand Standard 2107:2016 "*Acoustics - Recommended design sound levels and reverberation times for building interiors"*. Unlike the previous version of this Standard, this latest edition recommends a range with lower and upper levels (rather than "satisfactory" and "maximum" internal noise levels) for building interiors based on room designation and location of the development relative to external noise sources. This change has occurred due to the fact that sound levels below 'satisfactory' could be interpreted as desirable, but the opposite may in fact be the case. Levels below those which were listed as 'satisfactory' can lead to inadequate acoustic masking resulting in loss of acoustic isolation and speech privacy.

Internal noise levels due to the combined contributions of external noise intrusion and mechanical ventilation plant should not exceed the maximum levels recommended in this Standard. The levels for areas relevant to this development are given in Table 4 below. The mid to maximum points of the internal noise level ranges are generally adopted as the internal design noise criteria for the combined effect of mechanical services and external noise intrusion. In this report we will confine our recommendations to dBA levels, however, where the background noise appears to be unbalanced, AS/NZS 2107:2016 provides direction in terms of suitable diagnostic tools that can be used to assess the spectrum distribution of the background noise.

Table 4 Recommended Design Sound Levels

Type of Occupancy/Activity	Design sound level range dBA (LAeq,t)	Project Design Noise Level [1] dBA (LAeq,t)
Municipal Buildings		
Bars	< 50	**< 50**
Function areas	40 to 45	**45**
Change rooms	< 50	**< 50**

Note 1: Overall recommended level for mechanical services noise and intrusive noise, combined.

Note 2: The L_{Aeq} is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.

Section 6.18 of AS/NZ 2107:2016 notes that the presence of discrete frequencies or narrow band signals may cause the sound level to vary spatially within a particular area and be a source of distraction for occupants. Where this occurs, the sound level shall be determined as the highest level measured in the occupied location(s).

If tonal components are significant characteristics of the sound within a measurement time interval, an adjustment shall be applied for that time interval to the measured A-weighted sound pressure level to allow for the additional annoyance. If the background sounds include spectral imbalance, then the RC (Mark II) levels indicated in the Standard should be referenced (see also Appendix D of AS/NZ 2107:2016 for additional guidance).

Generally, where the final noise levels are within +/- 2 dB of the specified level given above, the design criteria will be considered met. Both the upper and lower limits will need to be satisfied especially where privacy is important or where noise intrusion to be avoided.

5.2 Noise Emission Criteria

5.2.1 Northern Beaches Council (Formerly Warringah Council) Local Environmental Plan (LEP) 2011 & Development Control Plan (DCP) 2011

Warringah Council DCP, Part D (Design), Subsection D3 (Noise) requires the following:

D3 Noise

Applies to Land

This control applies to land to which Warringah Local Environmental Plan 2011 applies.

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.*

   See also NSW Industrial Noise Policy Appendices

2. *Development near existing noise generating activities, such as industry and roads, is to be designed to mitigate the effect of that noise.*

3. *Waste collection and delivery vehicles are not to operate in the vicinity of residential uses between 10pm and 6am.*

4. *Where possible, locate noise sensitive rooms such as bedrooms and private open space away from noise sources. For example, locate kitchens or service areas closer to busy road frontages and bedrooms away from road frontages.*

5. *Where possible, locate noise sources away from the bedroom areas of adjoining dwellings/properties to minimise impact.*

5.2.2 NSW EPA Noise Policy for Industry (NPI) 2017

In NSW, the control of noise emissions is the responsibility of Local Governments and the NSW Environment Protection Authority (NSW EPA).

The NSW EPA has recently released a document titled Noise Policy for Industry (NSW NPI) which provides a framework and process for determining external noise criteria for the assessment of noise emission from industrial developments. The NSW NPI criteria for industrial noise sources have two components:

- Controlling the intrusive noise impacts for residents and other sensitive receivers in the short term; and
- Maintaining noise level amenity of particular land uses for residents and sensitive receivers in other land uses.

5.2.2.1 Intrusive Noise Impacts (Residential Receivers)

The NSW NPI states that the noise from any single source should not intrude greatly above the prevailing background noise level. Industrial noises are generally considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (LAeq), measured over a 15-minute period, does not exceed the background noise level measured in the absence of the source by more than 5 dB(A). This is often termed the Intrusiveness Criterion.

The 'Rating Background Level' (RBL) is the background noise level to be used for assessment purposes and is determined by the methods given in the NSW NPI. Using the rating background noise level approach results in the intrusiveness criterion being met for 90% of the time. Adjustments are to be applied to the level of noise produced by the source that is received at the assessment point where the noise source contains annoying characteristics such as tonality or impulsiveness.

5.2.2.2 Protecting Noise Amenity (All Receivers)

To limit continuing increase in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified in Table 2.2 of the NSW NPI. That is, the ambient L_{Aeq} noise level should not exceed the level appropriate for the locality and land use. This is often termed the 'Background Creep' or Amenity Criterion.

The amenity assessment is based on noise criteria specified for a particular land use and corresponding sensitivity to noise. The cumulative effect of noise from industrial sources needs to be considered in assessing the impact. These criteria relate only to other continuous industrial-type noise and do not include road, rail or community noise. If the existing (measured) industrial-type noise level approaches the criterion value, then the NSW NPI sets maximum noise emission levels from new sources with the objective of ensuring that the cumulative levels do not significantly exceed the criterion.

Project amenity noise level for industrial developments is specified as the recommended amenity noise level (Table 2.2 of the NPI) minus 5 dB(A). To standardise the time periods for the intrusiveness and amenity noise levels, this policy assumes that the LAeq,15min will be taken to be equal to the $L_{Aeq,period}$ + 3 decibels (dB).

Where the resultant project amenity noise level is 10 dB or more lower than the existing traffic noise level, the project amenity noise levels can be set at 15 dB below existing traffic noise levels (i.e. $L_{Aeq,period(traffic)}$ minus 15 dBA).

5.2.2.3 Residential Receivers – Area Classification

The NSW NPI characteristics the "Suburban Residential" noise environment as an area that has the following characteristics:

- *Suburban – an area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry. This often has the following characteristic: evening ambient noise levels defined by the natural environment and human activity.*

As shown below, the site and its surrounding receivers are within an area made up of R2, RRE1 and E1 type developments. Based on classifications, measured ambient noise levels and description and using table 2.3 of the NPI (see below), we believe that the most appropriate classification for the development site is Suburban.

Figure 5 NPI Extract - Table 2.3 Determining which of the residential receiver categories applies

Table 2.3: Determining which of the residential receiver categories applies.

Receiver category	Typical planning zoning – standard instrument*	Typical existing background noise levels	Description
Rural residential	RU1 – primary production RU2 – rural landscape RU4 – primary production small lots R5 – large lot residential E4 – environmental living	Daytime RBL <40 dB(A) Evening RBL <35 dB(A) Night RBL <30 dB(A)	**Rural** – an area with an acoustical environment that is dominated by natural sounds, having little or no road traffic noise and generally characterised by low background noise levels. Settlement patterns would be typically sparse. Note: Where background noise levels are higher than those presented in column 3 due to existing industry or intensive agricultural activities, the selection of a higher noise amenity area should be considered.
Suburban residential	RU5 – village RU6 – transition	Daytime RBL<45 dB(A) Evening RBL<40 dB(A)	**Suburban** – an area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry. This area often has the
	R2 – low density residential R3 – medium density residential E2 – environmental conservation E3 – environmental management	Night RBL <35dB(A)	following characteristic: evening ambient noise levels defined by the natural environment and human activity.
Urban residential	R1 – general residential R4 – high density residential B1 – neighbourhood centre (boarding houses and shop-top housing) B2 – local centre (boarding houses) B4 – mixed use	Daytime RBL> 45 dB(A) Evening RBL> 40 dB(A) Night RBL >35 dB(A)	**Urban** – an area with an acoustical environment that: • is dominated by 'urban hum' or industrial source noise, where urban hum means the aggregate sound of many unidentifiable, mostly traffic and/or industrial related sound sources • has through-traffic with characteristically heavy and continuous traffic flows during peak periods • is near commercial districts or industrial districts • has any combination of the above.

Notes: *As cited in Standard Instrument – Principal Local Environmental Plan, New South Wales Government, Version 15 August 2014. RBL = rating background noise level.

Figure 6 NSW ePlanning Spatial Viewer

Resultant amenity levels for Suburban Residential Receiver and other surrounding land uses are shown below.

Table 5 NSW NPI – Recommended L_{Aeq} Noise Levels from Noise Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day[1]	Recommended Amenity Noise Level ($L_{Aeq, period}$)[2] (dBA)
Residence	Urban	Day	60
		Evening	50
		Night	45
Commercial premises	-	When in use	65
Passive Recreation	-	When in use	50
Active Recreation	-	When in use	55

Note 1: For Monday to Saturday, Daytime 7:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 7:00 am. On Sundays and Public Holidays, Daytime 8:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 8:00 am

Note 2: The L_{Aeq} is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.

5.2.2.4 Maximum Noise Level Event (Sleeping Disturbance)

Section 2.5 of the NPI states the following:

> *The potential for sleep disturbance from maximum noise level events from premises during the night-time period needs to be considered. Sleep disturbance is considered to be both awakenings and disturbance to sleep stages.*
>
> *Where the subject development/premises night-time noise levels at a residential location exceed:*
>
> - *LAeq,15min 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or*
> - *LAFmax 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater,* a detailed maximum noise level event assessment should be undertaken.

As outlined in sections above, the measured rating background noise level during the night hours (10:00pm to 7:00am) was **41dBA $L_{A90\ (Period)}$.**

- Therefore, the resultant RBL + 15 dB is **56 dBA L_{AFMax}** and will be adopted for this assessment as this is greater than 52dBA.
- Therefore, the resultant RBL + 5 dB is **46 dBA $L_{Aeq(15\text{-}minute)}$** and will be adopted for this assessment as this is greater than 40dBA.

5.2.2.5 Project Specific External Noise Emission Criteria

The intrusive, amenity and maximum noise event criteria for noise emissions, derived from the measured data, are presented in Table 6. These criteria are nominated for the purpose of determining the operational noise limits for building services associated with the development which can potentially affect noise sensitive receivers.

For each assessment period, the lower (i.e., the more stringent – in accordance with the procedure of the NSW EPA NPI) of the amenity or intrusive criteria are adopted. These are shown in bold text in Table 6.

Table 6 External noise level criteria in accordance with the NSW NPI

Receiver Locations	Time of Day [1]	Project Amenity Noise Level, $L_{Aeq, period}$ [2 4] (dBA)	Measured $L_{A90, 15\ min}$ (RBL) [3] (dBA)	Measured $L_{Aeq, period}$ Noise Level [4] (dBA)	Intrusive $L_{Aeq, 15\ min\ Criterion}$ [4] for New Sources (dBA)	Amenity $L_{Aeq, 15\ min\ Criterion}$ [4 5] for New Sources (dBA)
Residential Receivers (All)	Day	50	42	49	**47**	53
	Evening	40	41	46	46	**43**
	Night	35	41	45	46	**38**

Note 1: For Monday to Saturday, Daytime 7:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 1:00 am. On Sundays and Public Holidays, Daytime 8:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 7:00 am.

Note 2: Project Amenity Noise Levels corresponding to "Suburban" areas, equivalent to the Recommended Amenity Noise Levels minus 5 dBA.

Note 3: LA90 Background Noise or Rating Background Level.

Note 4: The LAeq is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound

Note 5: According to Section 2.2 of the NSW NPI, the LAeq, 15 minutes is equal to the LAeq, period + 3 dB.

Note 6: Project Noise Trigger Levels are shown in bold.

Note 7: As per Section 2.3 of the NPfI the evening PTNL must not be set greater than the daytime period, as such the PTNL for the evening is to be set as the daytime noise level.

In addition, a maximum noise level criterion of is **56 dBA L_{AFMax}** and **46 dBA $L_{Aeq(15\text{-}minute)}$** during the night period (10:00pm to 7:00am) at residential receivers also applies:

5.2.3 NSW Liquor & Gaming Typical Acoustic Requirements

Section 79 of the Liquor Act 2007 provides mechanisms for complaints to be made when `the amenity of local areas is disturbed by the use of licensed premises and registered clubs (including disturbances caused by patrons). These complaints are addressed by the Director of Liquor and Gaming, and in this process they may impose temporary or permanent noise conditions on the licensed venue. Typical noise conditions that are imposed upon licensed premises are as follows:

> *The LA10* noise level emitted from the licensed premises shall not exceed the background noise level in any Octave Band Centre Frequency (31.5 Hz – 8k Hz inclusive) by more than 5 dB between 07:00 am and 12:00 midnight at the boundary of any affected residence.*
>
> *The LA10* noise level emitted from the licensed premises shall not exceed the background noise level in any Octave Band Centre Frequency (31.5 Hz – 8k Hz inclusive) between 12:00 midnight and 07:00 am at the boundary of any affected residence.*
>
> *Notwithstanding compliance with the above, the noise from the licensed premises shall not be audible within any habitable room in any residential premises between the hours of 12:00 midnight and 07:00 am.*
>
> ** For the purposes of this condition, the LA10 can be taken as the average maximum deflection of the noise emission from the licensed premises.*
>
> *This is a minimum standard. In some instances the Director may specify a time earlier than midnight in respect of the above condition.*

Interior noise levels which still exceed safe hearing levels are in no way supported or condoned by the Director.

Note: NSW Liquor and Gaming criteria does not contain any requirements for commercial or industrial receivers. Noise impacts to these receivers will adopt the broadband criteria outlined in the NSW EPA NPI 2017, see above.

These criteria are applicable to noise emissions from the licensed venue component of the development, excluding noise from mechanical services. For external noise emissions, octave band spectral criteria for each assessment period have been summarised in Table 7 below.

Table 7 Liquor & Gaming NSW – L_{A10} Criteria (external) – Residential Criteria Only

Time Period	Parameter [1]	Octave Band Centre Frequency, Hz									Overall dBA
		31.5	63	125	250	500	1k	2k	4k	8k	
7:00am to 6:00pm	**Receiver 1 and 2**										
	Measured L_{A90} [2]	49	46	41	38	37	38	35	32	28	42
(Background + 5dBA)	Resulting Criteria L_{A10}	**54**	**51**	**46**	**43**	**42**	**43**	**40**	**37**	**33**	**47**
6:00pm to 10:00pm	**Receiver 1 and 2**										
	Measured L_{A90} [2]	47	42	41	38	37	37	35	32	28	41
(Background + 5dBA)	Resulting Criteria L_{A10}	**52**	**47**	**46**	**43**	**42**	**42**	**40**	**37**	**33**	**46**
10:00pm to 12:00am (midnight)	**Receiver 1 and 2**										
	Measured L_{A90} [2]	47	42	41	38	37	37	35	32	28	41
(Background + 5dBA)	Resulting Criteria L_{A10}	**52**	**47**	**46**	**43**	**42**	**42**	**40**	**37**	**33**	**46**

Note 1: LA90 Background Noise or Rating Background Level.

Note 2: NSW Liquor and Gaming requirements have been determined based on the 1/1 octaves measured during the attended noise survey and adjusted to the more stringent unattended noise monitoring done at the residential receiver locations.

Note:

- In accordance with the operational parameters proposed the venue does not seek approval to operate after midnight. As such the Background + 0dBA and inaudibility criteria are not being assessed.

5.2.4 NSW EPA (Formerly DECCW) NSW Road Noise Policy (RNP) 2011

For existing residences and other sensitive land uses affected by additional traffic on existing roads, the NSW Road Noise Policy states that for noise associated with increased road traffic generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB during both day and night-time periods. An increase of 2 dB represents a minor impact that is considered barely perceptible to the average person.

5.3 Construction Noise and Vibration Criteria

5.3.1 Construction Noise Criteria

Relevant construction noise criteria applicable to this project are outlined below.

5.3.1.1 Northern Beaches Council (Formerly Warringah Council) Environmental Plan (LEP) 2011 & Development Control Plan (DCP) 2011

Acoustic requirements relevant to construction noise and vibration levels emitted from the site are not provided in the Warringah LEP or DCP 2011 documents. Therefore, requirements of the NSW EPA ICNG 2009 will be adopted. Each is discussed in detail below.

5.3.1.2 NSW EPA (Former DECC) Interim Construction Noise Guideline (ICNG) 2009

Noise criteria for construction and demolition activities are discussed in the Interim Construction Noise Guideline (ICNG). The ICNG also recommends procedures to address potential impacts of construction noise on residences and other sensitive land uses. The main objectives of the ICNG are summarised as follows:

- Promote a clear understanding of ways to identify and minimise noise from construction works.
- Focus on applying all "feasible" and "reasonable" work practices to minimise construction noise impacts.
- Encourage construction to be undertaken only during the recommended standard hours unless approval is given for works that cannot be undertaken during these hours.
- Streamline the assessment and approval stages and reduce time spent dealing with complaints at the project implementation stage; and
- Provide flexibility in selecting site-specific feasible and reasonable work practices to minimise noise impacts.

The ICNG contains a quantitative assessment method which is applicable to this project. Guidance levels are given for airborne noise at residences and other sensitive land uses.

The quantitative assessment method involves predicting noise levels at sensitive receivers and comparing them with the Noise Management Levels (NMLs). The NML affectation categories for residential receivers have been reproduced from the guideline and are listed in the table below.

Table 8 NMLs for quantitative assessment at residences

Time of Day	Noise Management Level $L_{Aeq(15minute)}$ [1,2]	How to Apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq(15minute)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account:

		1. Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences. 2. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside the recommended standard hours above	Noise affected RBL + 5 dB	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dB above the noise affected level, the proponent should notify the community.

Note 1: Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

Note 2: The RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours). The term RBL is described in detail in the NSW Industrial Noise Policy (EPA 2000).

Based on the measured background noise levels summarised in the sections above, and the NMLs outlined above, the construction noise criteria to be used in this assessment are listed below.

Additionally, construction requirements to offices, retail outlets is 70 dBA $L_{Aeq\ (15\ minute)}$ (Externally).

Table 9 NMLs as basis for the acoustic assessment

Receiver Types	NML, dB $L_{Aeq(15minute)}$	
	Standard Hours **Monday to Friday: 7:00am to 6:00pm** **Saturday: 8:00am to 1:00pm**	**Outside Standard Hours** **All hours not listed in the adjacent column.**
Residences (Measured externally)	NAFL: **52** (RBL (42) + 10dB) HNAL: **75**	RBL + 5dB

Note 1: The LAeq is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.

5.3.2 Construction Vibration Criteria

Effects of ground borne vibration on buildings may be segregated into the following three categories:

- Human comfort – vibration in which the occupants or users of the building are inconvenienced or possibly disturbed.
- Effects on building contents – where vibration can cause damage to fixtures, fittings, and other non-building related objects.
- Effects on building structures – where vibration can compromise the integrity of the building or structure itself.

5.3.2.1 Vibration Criteria – Human Comfort

Vibration effects relating specifically to the human comfort aspects of the project are taken from AV-TG. This type of impact can be further categorised and assessed using the appropriate criterion as follows:

- Continuous vibration – from uninterrupted sources.
- Impulsive vibration – up to three instances of sudden impact e.g., dropping heavy items, per monitoring period.
- Intermittent vibration – such as from drilling, compacting or activities that would result in continuous vibration if operated continuously.

Table 10 Continuous vibration acceleration criteria (m/s2) 1 Hz-80 Hz

Location	Assessment period	Preferred Values		Maximum Values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010

Table 11 Impulsive vibration acceleration criteria (m/s2) 1 Hz-80 Hz

Location	Assessment period	Preferred Values		Maximum Values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14

Table 12 Intermittent vibration impacts criteria (m/s1.75) 1 Hz-80 Hz

Location	Daytime		Night-time	
	Preferred Values	Maximum Values	Preferred Values	Maximum Values
Residences	0.20	0.40	0.13	0.26

5.3.2.2 Vibration Criteria – Building Contents and Structure

The vibration effects on the building itself are assessed against international standards as follows:

- For transient vibration: British Standard BS 7385: Part 2-1993 "Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration" (BSI 1993); and
- For continuous or repetitive vibration: German DIN 4150: Part 3 – 1999 "Effects of Vibration on Structure" (DIN 1999).

5.3.2.3 British Standard BS 7385 Part 2 - 1993

For transient vibration, as discussed in standard BS 7385 Part 2-1993, the criteria are based on peak particle velocity (mm/s) which is to be measured at the base of the building. These are summarised in Table 13 and illustrated in Figure 7.

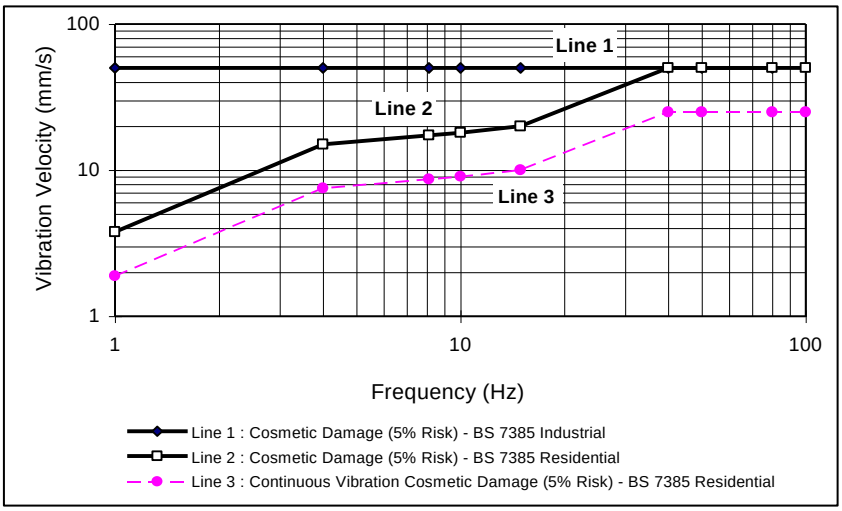
Table 13 Transient vibration criteria as per standard BS 7385 Part 2 – 1993

Line in Figure 7	Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
		4 Hz to 15 Hz	15 Hz and Above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
2	Unreinforced or light framed structures Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Standard BS 7385 Part 2 – 1993 states that the values in Table 13 relate to transient vibration which does not cause resonant responses in buildings.

Where the dynamic loading caused by continuous vibration events is such that it results in dynamic magnification due to resonance (especially at the lower frequencies where lower guide values apply), then the values in Table 13 may need to be reduced by up to 50% (refer to Line 3 in Figure 7).

Figure 7 BS 7385 Part 2 – 1993, graph of transient vibration values for cosmetic damage



In the lower frequency region where strains associated with a given vibration velocity magnitude are higher, the recommended values corresponding to Line 2 are reduced. Below a frequency of 4 Hz, where a high displacement is associated with the relatively low peak component particle velocity value, a maximum displacement of 0.6 mm (zero to peak) is recommended. This displacement is equivalent to a vibration velocity of 3.7 mm/s at 1 Hz.

The standard also states that minor damage is possible at vibration magnitudes which are greater than twice those given in , and major damage to a building structure may occur at values greater than four times the tabulated values.

Fatigue considerations are also addressed in the standard, and it is concluded that unless the calculation indicates that the magnitude and number of load reversals is significant (in respect of the fatigue life of building materials) then the values in should not be reduced for fatigue considerations.

5.3.2.4 German Standard DIN 4150 Part 3 - 1999

For continuous or repetitive vibration, standard DIN 4150 Part 3-1999 provides criteria based on values for peak particle velocity (mm/s) measured at the foundation of the building; these are summarised in Table 14. The criteria are frequency dependent and specific to particular categories of structures.

Table 14 Structural damage criteria as per standard DIN 4150 Part 3 – 1999

Type of Structure	Peak Component Particle Velocity, mm/s			
	Vibration at the foundation at a frequency of			Vibration of horizontal plane of highest floor at all frequencies
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz [1]	
Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
Structures that, because of their sensitivity to vibration, do not correspond to those listed in lines 1 and 2 and are of great intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8

5.3.3 Construction Traffic Noise Criteria

For existing residences and other sensitive land uses affected by additional traffic on existing roads, the NSW Road Noise Policy (RNP) states that for noise associated with increased road traffic generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB during both day and night-time periods. An increase of 2 dB represents a minor impact that is considered barely perceptible to the average person.

6 ACOUSTIC ASSESSMENT

Assessment of each of the noise element associated with the proposal is outlined below.

6.1 Building Envelope Assessment

Preliminary façade acoustic treatments based on the external levels from surrounding roads and other environmental noise as discussed in the sections above.

Additionally, the façade systems (in particular the glass) are not determined based on the acoustic mitigation measures for noise emissions to neighbouring residential receivers.

6.1.1 Glazing Recommendations

The recommended sound transmission loss requirement required to satisfy the specified internal noise level criteria outlined above are summarised below.

Please note for windows, this performance is not only subject to the glazing selection but also to the construction of the window frame and the frame seal selection. Therefore, it is recommended that the window manufacturer should confirm that the required sound insulation can be achieved. It is anticipated that the window system should comprise Q-Lon (or equivalent) or fin seals with deep C channels as part of the window track **(i.e., Performance levels outlined above need to be achieved with glazed panels + frame + seals).**

Table 15 In-principle Glazing Recommendations.

Occupancy Area [1]	Façade Orientation	Minimum Glazing System Rating Requirements [1]	Indicative Construction [1]
Ground Level			
Meeting /Community Room 1	Northern and Western	Rw (C;Ctr): 35 (-2;-6)	10.38mm Laminated Glazing **OR** 6mm Float / 12mm Airgap + 6mm Float
Meeting /Community Room 2	Northern	Rw (C;Ctr): 35 (-2;-6)	10.38mm Laminated Glazing **OR** 6mm Float / 12mm Airgap + 6mm Float
Meeting /Community Room 3	Northern and Eastern	Rw (C;Ctr): 35 (-2;-6)	10.38mm Laminated Glazing **OR** 6mm Float / 12mm Airgap + 6mm Float
Lobby	Western	Rw (C;Ctr): 35 (-2;-6)	10.38mm Laminated Glazing **OR** 6mm Float / 12mm Airgap + 6mm Float
Dining	Northern and Eastern	Rw (C;Ctr): 35 (-2;-6)	10.38mm Laminated Glazing **OR** 6mm Float / 12mm Airgap + 6mm Float
Offices	Western and Southern	Rw (C;Ctr): 31 (-2;-6)	6.38mm Laminated Glazing **OR** 5mm Float / 12mm Airgap + 5mm Float
Communal Area	Northern	Rw (C;Ctr): 35 (-2;-6)	10.38mm Laminated Glazing **OR** 6mm Float / 12mm Airgap + 6mm Float

Occupancy Area 1	Façade Orientation	Minimum Glazing System Rating Requirements 1	Indicative Construction 1
Ground Level			
Members Lounge	Eastern and Southern	Rw (C;Ctr): 35 (-2;-6)	10.38mm Laminated Glazing **OR** 6mm Float / 12mm Airgap + 6mm Float
Level 1			
Multipurpose Room	Northern, Eastern and Southern	Rw (C;Ctr): 35 (-2;-6)	10.38mm Laminated Glazing **OR** 6mm Float / 12mm Airgap + 6mm Float
Members Lounge	Southern and Western	Rw (C;Ctr): 35 (-2;-6)	10.38mm Laminated Glazing **OR** 6mm Float / 12mm Airgap + 6mm Float
Back of House	Western	Rw (C;Ctr): 31 (-2;-6)	6.38mm Laminated Glazing **OR** 5mm Float / 12mm Airgap + 5mm Float

Note 1: These are preliminary selections will be confirmed in the detailed design stage once the layouts and façade orientations are finalised.

Note 2: Glazing recommendations have been formulated in conjunction with noise emission control mitigation measures.

6.1.2 External Wall Construction

External wall constructions which are constructed from a concrete or masonry construction will be acoustically sufficient and no further acoustic upgrading is required. However, for wall systems constructed from a lightweight cladding system, the following construction is recommended.

Table 16 Recommended Light Weight External Wall Construction

Location	Occupancy Area [1]	External Lining	Studwork System	Internal Lining
All facades	All Areas	Façade Cladding System (Assumed to be equal to 9mm Fibre Cement Sheeting or equal)	Min. 92mm Steel Studwork with 75mm thick 14kg/m^3 glasswool insulation in the cavity	1 x 13mm Fyrchek Plasterboard **OR** 1 x 9mm Fibre Cement Sheeting
				1 x 13mm Standard Plasterboard **OR** 1 x 6mm Fibre Cement Sheeting

Note 1: Recommended constructions are identical for each level.

Note 2: These are preliminary selections will be confirmed in the detailed design stage once the layouts and façade orientations are finalised.

Note 3: Alternate constructions are suitable on assumption equal acoustic performance is achieved.

Note 4: Glazing recommendations have been formulated in conjunction with noise emission control mitigation measures.

If penetrations through any external skin are required, all gaps remaining in the penetration are to be filled with an acoustic grade sealant which provides an equal or better performance to the system being penetrated.

6.1.3 External Roof Construction

External roofs will be constructed from a concrete system and will not require any additional acoustic treatments. If penetrations through any external skin are required, all gaps remaining in the penetration are to be filled with an acoustic grade sealant which provides an equal or better performance to the system being penetrated.

6.2 Engineering Services Assessment

Five mechanical/refrigeration systems are proposed to be installed; each are discussed below:

1 Kitchen Exhaust System

2 Air Conditioning Plant.

3 Toilet Exhaust System.

4 Refrigeration Plant.

At this stage of the project the exact selections of the mechanical equipment to be installed are not known. However, to ensure the proposed layouts and locations for the systems are acoustically acceptable a "Proof of Concept" assessment is conducted below. The assumptions for fan selections detailed below are from our experience.

Kitchen Exhaust System

For the commercial kitchen exhaust systems, it is anticipated that the physical fans would be installed within the kitchen or on the roof. On the assumption of the Sound Power Level above and the ductwork that is installed is acoustically treated with 50mm internal lining or attenuators (depending on the exact location/selection), compliance with the acoustic requirements outlined in section 5.1 would be achieved.

Air Conditioning System

Air conditioning condensers are recommended to have the following acoustic treatments installed.

- Condenser plant are to be isolated from the base building structure with a rubber pad.
- Night operation mode must be in operation between 9:00pm and 7:00am and provided a minimum of 4-5dBA.

Toilet Exhaust System

Toilet exhaust fans, it is anticipated that the physical fans would be installed within the ceiling void of the toilets or on the roof. It is recommended that 2m with acoustic insulation is added to the rigid ducting is used on the intake and discharge side of the fan, on this assumption compliance would be achieved.

Refrigeration Systems

It is envisaged that the refrigeration plant will be located on the roof of the building and would be acoustically attenuated by an acoustic screen or enclosure. All plant however is recommended to be vibration isolated.

Summary, it is recommended that prior to the issue of a Construction Certificate a detailed acoustic assessment of the proposed building services is undertaken to determine the exact acoustic mitigation measures required. Based on the preliminary review we believe what is being proposed is acoustically acceptable and likely to meet the noise emission criteria.

6.3 Licensed Venue Assessment

The assessment of licensed noise emissions from the development using this operating scenario has been made against the Liquor and Gaming NSW criteria identified previously.

6.3.1 Assumed Operating Parameters

- Operation of the facility is between 6:00am and 12:00am (midnight), seven (7) days a week. These hours align the current golf, dining and multipurpose operations of the club.
- Typically, the operation hours reflect the typical following activities:
    - Opening to midafternoon – golf operations (i.e. members)
    - Midday to dinner – food and beverage operations (i.e. members and guests)
    - Evening to close – food and beverage operations and multipurpose.
- The assumed maximum number of patrons in each relevant area of the development is outlined below, this is not necessarily an overall number permitted:
    - **Ground Level**
        - Meeting / Community Room 1 – maximum of 22 people (internal)
        - Meeting / Community Room 2 – maximum of 60 people (internal)
        - Meeting / Community Room 3 – maximum of 24 people (internal)
        - Dining – maximum of 96 people (internal)
        - Covered Terrace Dining – maximum of 50 people (external)
        - Garden Seating – maximum of 96 people (external)
        - Communal area – maximum of 70 people (internal)
        - Members Lounge (ground) – maximum of 96 people (internal) or
        - Members Terrace (ground) – This space is an extension of the Members Internal Lounge, this space does not propose any additional people, rather out of the 96 people permitted in the lounge, a maximum of 30 people could be located outside.
    - **Level One (1)**
        - Members Lounge (level 1) – maximum of 16 people (internal) or
        - Members Terrace (level 1) – maximum of 30 people (external)
        - Level 1 Members Presentation Space / Meeting Rooms / Function Rooms (level 1) – maximum of 150 people (external) or

  - Terrace 1 (level 1) – This space is an extension of the Level 1 Multipurpose Space, this space does not propose any additional people, rather out of the 150 people permitted in the Level 1 Multipurpose Space, a maximum of 20 people could be located outside.

  - Terrace 2 (level 1) – This space is an extension of the Level 1 Multipurpose Space, this space does not propose any additional people, rather out of the 150 people permitted in the Level 1 Multipurpose Space, a maximum of 150 people could be located outside.

- For the purpose of this assessment, it is assumed the following Sound Power Noise Levels for patrons in different areas of the development:

  - For internal and external which are designated for dining/food and beverage type activities a **Sound Power Level (Lw) of 68dBA**. This has been formulated in accordance with the published noise levels from Klark Teknik (The Audio System Designer Technical Reference, Chapman Partnership).

  - For internal and external which are designated for multipurpose or bar type activities a single person speaking with a raised voice has a **Sound Power Level (Lw) of 76dBA**. This has been formulated in accordance with the published noise levels from Klark Teknik (The Audio System Designer Technical Reference, Chapman Partnership).

- Additionally, we assumed that one in every three patrons are talking at any one time in each of the nominated areas. A relatively conservative calculation.

- With regards to background music within the internal areas (ONLY) we have assumed a Sound Pressure Level (SPL) of **65 dBA $L_{Aeq\ (15\text{-}minute)}$**. For the multipurpose room on level one (1) we have assumed a higher noise level of **95dBA $L_{Aeq\ (15\text{-}minute)}$ for amplified music**.

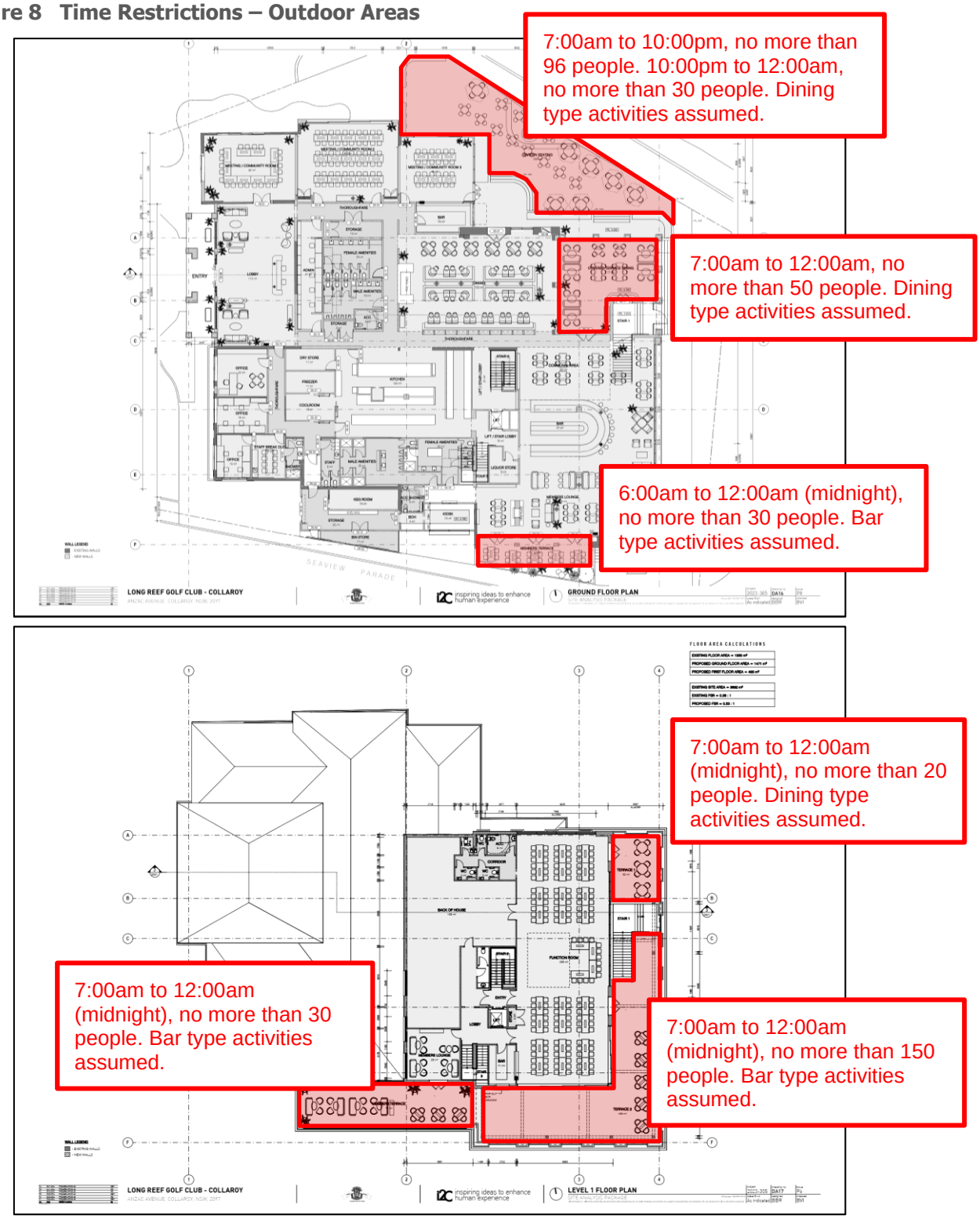
- Windows and doors have been assumed to generally be open, they are required to be closed during the following scenarios:

  - During the use of amplified music (not including background music)

  - **ALL** Windows and doors are all required to be closed **after 10:00pm and before 7:00am**, regardless of whether there is amplified music, background music or not.

- Use of the outdoor areas is limited in regard to operation hours as per the markup below.

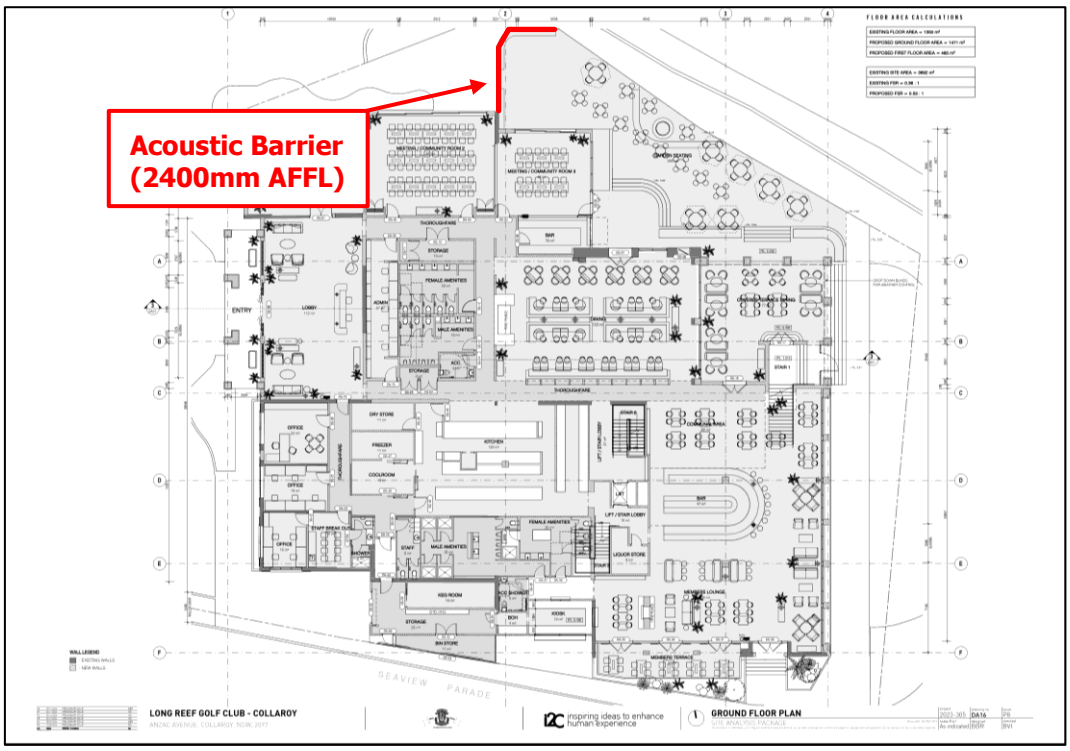
Figure 8 Time Restrictions – Outdoor Areas

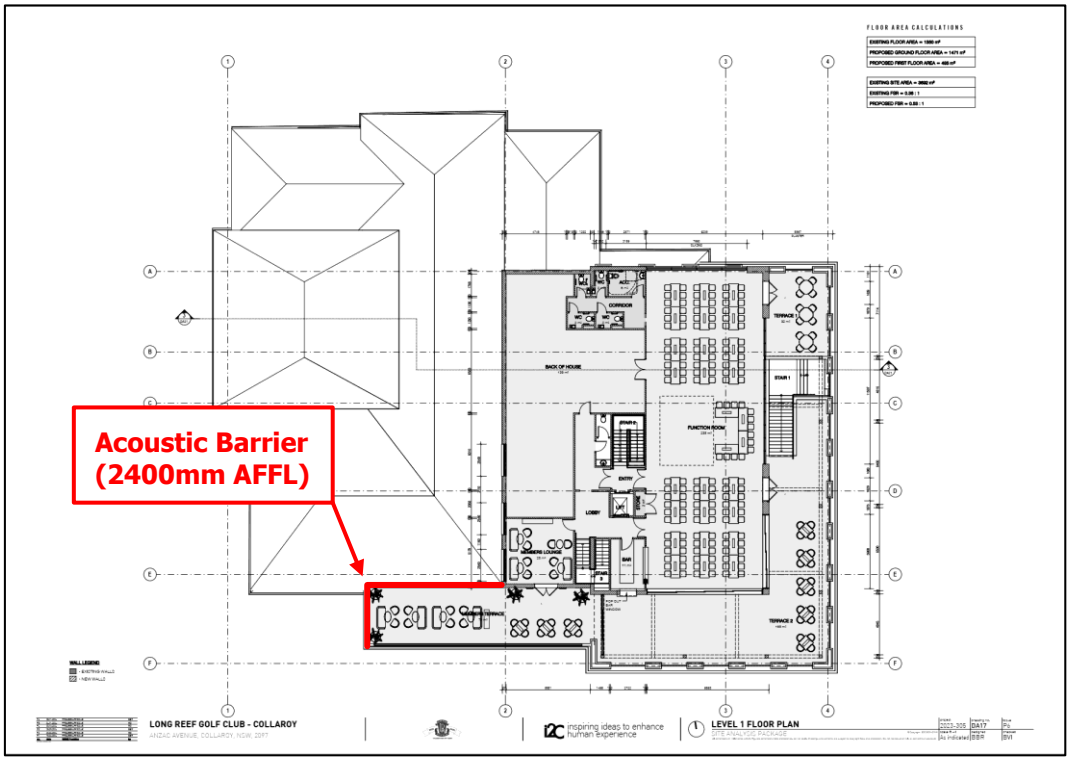


- Building envelope constructions (walls, glazing and roofs) are constructed as per the recommendations as outlined in section 6.1.

- Acoustic barriers are recommended and required as per the following markup. All barriers are to have a minimum R_w 35 construction (either 10.38mm Laminated Glazing **or** two (2) layers of Fibre Cement Sheeting – or equal).

Figure 9 Acoustic Barriers (Location and Heights)





6.3.2 Predicted Noise Levels

Outlined below are the predicted noise levels from the full operation of the facility during each of the proposed operating periods (day, evening and late night). Predicted noise levels are presented in accordance with the NSW Liquor and Gaming requirement of 1/1 octaves $L_{A10\ (15\text{-minute})}$.

Predicted noise levels to the surrounding residential receivers are based on a full capacity within the venue and during the proposed operation hours detailed above.

Table 17 Receiver 1 – Predicted Noise Levels to 1a Seaview

Parameter		Octave Band Centre Frequency, Hz									Overall dBA
		31.5	63	125	250	500	1000	2000	4000	8000	
Day: 7:00am to 6:00pm (BG+5dBA)											
Windows Open (Background Music)	Predicted Noise Level	35	35	35	45	46	40	36	31	25	46
	L&G NSW criterion	54	51	46	43	42	43	40	37	33	47
	Compliance?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Windows Closed (Amplified Music)	Predicted Noise Level	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
	L&G NSW criterion	54	51	46	43	42	43	40	37	33	47
	Compliance?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Evening: 6:00pm to 10:00pm (BG+5dBA)											
Windows Open (Background Music)	Predicted Noise Level	35	35	35	45	46	40	36	31	25	46
	L&G NSW criterion	52	47	46	43	42	42	40	37	33	46
	Compliance?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Windows Closed (Amplified Music)	Predicted Noise Level	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
	L&G NSW criterion	52	47	46	43	42	42	40	37	33	46
	Compliance?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Night: 6:00am to 7:00am (Morning Golf Operations) and 10:00pm to 12:00am (Food and Beverage Operations and Multipurpose) (BG+5dBA)											
Windows Open (Background Music)	Predicted Noise Level	35	35	35	45	46	40	36	31	25	46
	L&G NSW criterion	52	47	46	43	42	42	40	37	33	46
	Compliance?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Windows Closed (Amplified Music)	Predicted Noise Level	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
	L&G NSW criterion	**52**	**47**	**46**	**43**	**42**	**42**	**40**	**37**	**33**	**46**
	Compliance?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

Compliance is achieved on the proviso the acoustic mitigation measures as outlined in Section 7 below are implemented.

Table 18 Receiver 2 – Predicted Noise Levels to 2a Seaview

Parameter		Octave Band Centre Frequency, Hz									Overall dBA
		31.5	63	125	250	500	1000	2000	4000	8000	
Day: 7:00am to 6:00pm (BG+5dBA)											
Windows Open (Background Music)	Predicted Noise Level	29	29	29	39	40	34	30	25	20	40
	L&G NSW criterion	54	51	46	43	42	43	40	37	33	47
	Compliance?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Windows Closed (Amplified Music)	Predicted Noise Level	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
	L&G NSW criterion	54	51	46	43	42	43	40	37	33	47
	Compliance?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Evening: 6:00pm to 10:00pm (BG+5dBA)											
Windows Open (Background Music)	Predicted Noise Level	29	29	29	39	40	34	30	25	20	40
	L&G NSW criterion	52	47	46	43	42	42	40	37	33	46
	Compliance?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Windows Closed (Amplified Music)	Predicted Noise Level	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
	L&G NSW criterion	52	47	46	43	42	42	40	37	33	46
	Compliance?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Night: 6:00am to 7:00am (Morning Golf Operations) and 10:00pm to 12:00am (Food and Beverage Operations and Multipurpose) (BG+5dBA)											
Windows Open (Background Music)	Predicted Noise Level	29	29	29	39	40	34	30	25	20	40
	L&G NSW criterion	52	47	46	43	42	42	40	37	33	46
	Compliance?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Windows Closed (Amplified Music)	Predicted Noise Level	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
	L&G NSW criterion	52	47	46	43	42	42	40	37	33	46
	Compliance?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

Compliance is achieved on the proviso the acoustic mitigation measures as outlined in Section 7 below are implemented.

6.4 Loading Dock Acoustic Assessment

Located along the southern façade of the building is the loading dock and back of house areas associated with the development. It is proposed that the loading dock and back of house areas will be in use most days and cater for several deliveries each day.

A review of the noise impacts associated with loading activities occurring the during the day and evening period and compliance at the neighbouring residential receivers across Anzac Avenue and receivers to the north will likely be achieved.

It is recommended that the loading dock is not used during the night period of 10:00pm and 7:00am. This is also in line with the Warringah Council DCP.

6.5 Noise Impacts on Surrounding Roadways

As outlined in the PTW traffic report a minimal net increase of additional vehicles are proposed, as such any new noise impacts from the increase in vehicle movements along Anzac Avenue are to be assessed in accordance with the NSW EPA Road Noise Policy (RNP) 2011.

A peak hour increase proposed for the number vehicles associated with the development will not exceed a 2dBA increase at a residential receiver as summarised in the NSW EPA RNP to be barely perceptible to the average person and therefore considered acoustically acceptable.

6.6 Construction Noise and Vibration Assessment

A preliminary acoustic assessment of the noise and vibrations impact during the construction of the development has been undertaken below.

6.6.1 Construction Activity Noise Assessment

A review of the noise levels likely to be emitted from the site because of the demolition and construction works has been undertaken. Based on the proximity of the surrounding receivers and the works area, we expect there is likely to be periods where noise emission are likely to exceed the Noise Affected Level (NAL) and in some cases the Highly Noise Affected Level (HNAL). As such the works will require a site-specific Construction Noise & Vibration Sub Plan (CNVMSP) to be prepared for the site.

This plan should plan be undertaken in accordance with the relevant NSW EPA documents around noise and vibration (such as the ICNG and Assessing Vibration- a technical guideline.).

Outlined in sections 6.6.3 to 6.6.3.13 PWNA have provided detailed list of possible mitigation measures which could be implemented to reduce these expected noise levels at neighbouring properties. These are all to be considered as part of the preparation of this plan prior to the issue of a Construction Certificate (CC).

6.6.1.1 Construction Traffic Noise Assessment

From the criteria, it is noted that vehicle numbers on surrounding roads would need to increase by around 60% from existing traffic flows, for a 2 dB increase in road traffic noise to occur. As noted previously, a 2 dB increase in road traffic noise is not considered to be noticeable.

Based on the number of vehicles projected over each of the construction phases, it is concluded that noise impacts from construction traffic is unlikely to have an impact at the nearest affected properties. As a result, no further assessment is required.

6.6.2 Vibration Assessment

In order to maintain compliance with the human comfort vibration criteria discussed in Section 5.3, it is recommended that the indicative safe distances listed in Table 19 should be maintained. These indicative safe distances should be validated prior to the start of construction works by undertaking measurements of vibration levels generated by construction and demolition equipment to be used on site.

Since the criteria for scientific or medical equipment (should any of these exist close to the site) can be more stringent than those required for human comfort, vibration validating measurements should be conducted at each site to determine the vibration level and potential impact onto this sensitive equipment.

Additionally, any vibration levels should be assessed in accordance with the criteria discussed in Section 5.3.2. This information should also be included as part of a Construction Noise Vibration Management Sub Plan (CNVMSP).

Table 19 Recommended indicative safe working distances for vibration intensive plant

Plant	Rating / Description	Safe Working Distances (m)	
		Cosmetic Damage (BS 7385: Part 2 DIN 4150: Part 3)	Human Comfort (AVTG)
Vibratory roller	< 50 kN (Typically 1 – 2 tonnes)	5	15 – 20
	< 100 kN (Typically 2 – 4 tonnes)	6	20
	< 200 kN (Typically 4 – 6 tonnes)	12	40
	< 300 kN (Typically 7 – 13 tonnes)	15	100
	> 300 kN (Typically more than 13 tonnes)	20	100
Small hydraulic hammer	300 kg, typically 5 – 12 tonnes excavator	2	7
Medium hydraulic hammer	900 kg, typically 12 – 18 tonnes excavator	7	23
Large hydraulic hammer	1600 kg, typically 18 – 34 tonnes excavator	22	73
Vibratory pile driver	Sheet piles	2 – 20	20
Jackhammer	Hand held	1	Avoid contact with structure and steel reinforcements

6.6.3 Recommended Noise and Vibration Mitigation Measures

6.6.3.1 Acoustic Management Procedures

6.6.3.1.1 Summary of Management Procedures

Table 20 below summarises the management procedures recommended for airborne noise and vibration impact. These procedures are also further discussed in the report.

Table 20 Summary of mitigation procedures

Procedure	Abbreviation	Description
General Management Measures	GMM	Introduce best-practice general mitigation measures in the workplace which are aimed at reducing the acoustic impact onto the nearest affected receivers.
Project Notification	PN	Issue project updates to stakeholders, discussing overviews of current and upcoming works. Advanced warning of potential disruptions can be included. Content and length to be determined on a project-by-project basis.
Verification Monitoring	V	Monitoring to comprise attended or unattended acoustic surveys. The purpose of the monitoring is to confirm measured levels are consistent with the predictions in the acoustic assessment, and to verify that the mitigation procedures are appropriate for the affected receivers. If the measured levels are higher than those predicted, then the measures will need to be reviewed and the management plan will need to be amended.
Complaints Management System	CMS	Implement a management system which includes procedures for receiving and addressing complaints from affected stakeholders
Specific Notification	SN	Individual letters or phone calls to notify stakeholders that noise levels are likely to exceed noise objectives. Alternatively, contractor could visit stakeholders individually in order to brief them in regard to the noise impact and the mitigation measures that will be implemented.

The application of these procedures is in relation to the exceedances over the relevant criteria. For airborne noise, the criteria are based on NMLs. The allocation of these procedures is discussed in Section 6.6.3.1.2.

For vibration, the criteria either correspond to human comfort, building damage or scientific and medical equipment. The application of these procedures is discussed in Section 6.6.3.1.3.

6.6.3.1.2 Allocation of Noise Management Procedures

For residences, the management procedures have been allocated based on noise level exceedances at the affected properties, which occur over the designated NMLs. The allocation of these procedures is summarised in Table 20 below.

Table 21 Allocation of noise management procedures – Residential Receivers

Construction Hours	Exceedance over NML (dB)	Management Procedures (see definition above)
Standard Hours Mon – Fri: 7:00 am to 6:00 pm Sat: 8:00 am – 1:00 pm	0 - 3	GMM, CMS, AC
	4 - 10	GMM, CMS, AC, V 1
	11 - 20	GMM, CMS, PN, AC, V 1
	> 21	GMM, CMS, PN, AC, SN, V 1
	> 75dBA	GMM, CMS, PN, AC, SN, RO, V 1
Outside Standard Hours (If applicable)	Specific NMP will be undertaken should this be required.	
Verification monitoring to be undertaken upon complaints received from affected receivers.		

6.6.3.1.3 Allocation of Vibration Management Procedures

Table 22 below summarises the vibration management procedures to be adopted based on exceedance scenarios (i.e., whether the exceedance occurs over human comfort criteria, building damage criteria, or criteria for scientific and medical equipment). Please note these management procedures apply for any type of affected receiver (i.e., for residences as well as non-residential receivers).

Table 22 Allocation of vibration management procedures

Construction Hours	Exceedance Scenario	Management Procedures
Standard Hours Mon – Fri: 7:00 am to 6:00 pm Sat: 8:00 am – 1:00 pm	Over human comfort criteria (refer to Section 6.6.2)	GMM, CMS, AC, SN, V 1
	Over building damage criteria (refer to Section 6.6.2)	GMM, CMS, AC, SN, VM, RO, V 1
Outside Standard Hours (If applicable)	Specific VMP will be undertaken should this be required.	
Verification monitoring to be undertaken upon complaints received from affected receivers.		

6.6.3.2 Site Specific Noise Mitigation Measures

6.6.3.3 General Comments

The contractor will, where reasonable and feasible, apply best practice noise mitigation measures. These measures shall include the following:

- Maximising the offset distance between plant items and nearby noise sensitive receivers.
- Preventing noisy plant working simultaneously and adjacent to sensitive receivers.
- Minimising consecutive works in the same site area.
- Orienting equipment away from noise sensitive areas.
- Carrying out loading and unloading away from noise sensitive areas.

In order to minimise noise impacts during the works, the contractor will take all reasonable and feasible measures to mitigate noise effects.

The contractor will also take reasonable steps to control noise from all plant and equipment. Examples of appropriate noise control include efficient silencers and low noise mufflers.

The contractor should apply all feasible and reasonable work practices to meet the NMLs and inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels, duration of noise generating construction works, and the contact details for the proposal.

6.6.3.4 Noise Monitoring

Noise measurements are an effective way of providing feedback to the contractor which acoustic mitigation measures are providing community benefit. As such the site-specific Construction Noise and Vibration Management Sub Plan (CNVMSP) should detail the strategy being proposed (if determined it is required).

6.6.3.5 Alternate Equipment or Process

Exceedance of the site's NMLs should result in an investigation as to whether alternate equipment could be used, or a difference process could be undertaken.

In some cases, the investigation may conclude that no possible other equipment can be used, however, a different process could be undertaken.

6.6.3.6 Acoustic Enclosures/Screening

Typically, on a construction site there are three different types of plant that will be used: mobile plant (i.e., excavators, skid steers, etc.), semi mobile plant (i.e., hand tools generally) or static plant (i.e., diesel generators).

For plant items which are static it is recommended that, in the event exceedances are being measured due to operation of the plant item, an acoustic enclosure/screen is constructed to reduce impacts. These systems can be constructed from Fibre Cement (FC) sheeting or, if airflow is required, acoustic attenuators or louvres.

For semi mobile plant, relocation of plant should be investigated to either be operated in an enclosed space or at locations away from a receiver.

With mobile plant it is generally not possible to treat these sources. However, investigations into the machine itself may result in a reduction of noise (i.e., mufflers/attenuators etc).

6.6.3.7 Vibration Mitigation Measures

6.6.3.8 General Comments

As part of the CNVMP, the following vibration mitigation measures should be implemented:

- Any vibration generating plant and equipment is to be in areas within the site in order to lower the vibration impacts.
- Investigate the feasibility of rescheduling the hours of operation of major vibration generating plant and equipment.
- Use lower vibration generating items of construction plant and equipment; that is, smaller capacity plant.
- Minimise conducting vibration generating works consecutively in the same area (if applicable).
- Use only dampened rock breakers and/or "city" rock breakers to minimise the impacts associated with rock breaking works.

6.6.3.9 Vibration Monitoring

Vibration measurements are an effective way of providing feedback to the contractor which acoustic mitigation measures are providing community benefit. As such the site-specific Construction Noise and Vibration Management Sub Plan (CNVMSP) should detail the strategy being proposed (if determined it is required).

6.6.3.10 Community Consultation

Key engagement methods include:

- Formal and information briefings and meetings
- Workshops.
- Door Knocks.
- Letterbox Drops.
- Email Notifications.

6.6.3.11 Complaints Management System

The Contractor is to establish a communication register for recording incoming complaints. The registration of a particular item will remain open until the complaint has been appropriately dealt with.

All complaints should be investigated by the Contractor in accordance with the procedures outlined in Australia Standard 2436-2010. In addition, the following procedures are an example of the procedures that are to be specifically adopted for complaints relating to noise.

Upon receipt of a complaint the Contractor is to:

- Try to ascertain from the complaint which appliance is causing the problem i.e., inside or outside the site and in what position.
- Establish from the monitoring equipment if the allowable noise levels have been complied with.
- Establish if the appliance positioning has previously been highlighted as a problem area. If not and the noise levels are above the allowable limit, then the equipment and its position shall be noted.
- Move machinery if the allowable levels have been exceeded or take other acoustic remedial action.
- The Site Supervisor is to ensure that a report of any incident is provided to the Project Manager.
- The Project Manager is to provide a report on the incident to the relevant stakeholders.
- The Contractor is to provide a 24-hour telephone contact number and this number is to be prominently displayed on the site.

6.6.3.12 Contingency Plans

Contingency plans are required to address noise or vibration problems if excessive levels are measured at surrounding sensitive receivers and/or if justified complaints occur. Such plans could include:

- Stop the onsite works.
- Identify the source of the main equipment within specific areas of the site which is producing the most construction noise and vibration at the sensitive receivers; and
- Review the identified equipment and determine if an alternate piece of equipment can be used or the process can be altered.
- In the event an alternate piece of equipment or process can be used, works can re-commence.
- In the event an alternate piece of equipment or process cannot be determined implement a construction assessment to be performed by a suitably qualified acoustic consultant.

6.6.3.13 General Mitigation Measures (Australia Standard 2436-2010)

As well as the above project specific noise mitigation controls, AS 2436-2010 "Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites" sets out numerous practical recommendations to assist in mitigating construction noise emissions. Examples of strategies that could be implemented on the subject project are listed below, including the typical noise reduction achieved, where applicable.

6.6.3.14 Adoption of Universal Work Practices

- Regular reinforcement (such as at toolbox talks) of the need to minimise noise and vibration.
- Regular identification of noisy activities and adoption of improvement techniques.
- Avoiding the use of portable radios, public address systems or other methods of site communication that may unnecessarily impact upon nearby sensitive receivers.
- Where possible, avoiding the use of equipment that generates impulsive noise.
- Minimising the need for vehicle reversing for example (particularly at night), by arranging for one-way site traffic routes.
- Use of broadband audible alarms on vehicles and elevated work platforms used on site.
- Minimising the movement of materials and plant and unnecessary metal-on-metal contact.
- Minimising truck movements.

6.6.3.15 Plant and Equipment

- Choosing quieter plant and equipment based on the optimal power and size to most efficiently perform the required tasks.
- Selecting plant and equipment with low vibration generation characteristics.
- Operating plant and equipment in the quietest and most efficient manner.

6.6.3.16 On Site Noise Mitigation

- Maximising the distance between noise activities and noise sensitive land uses.
- Installing purpose-built noise barriers, acoustic sheds and enclosures.

6.6.3.17 Work Scheduling

- Scheduling work to coincide with non-sensitive periods.
- Planning deliveries and access to the site to occur quietly and efficiently and organising parking only within designated areas located away from the sensitive receivers.
- Optimising the number of deliveries to the site by amalgamating loads where possible and scheduling arrivals within designated hours.
- Including contract conditions that include penalties for non-compliance with reasonable instructions by the principal to minimise noise or arrange suitable scheduling.

6.6.3.18 Source Noise Control Strategies

Some ways of controlling noise at the source are:

- Where reasonably practical, noisy plant or processes should be replaced by less noisy alternatives.
- Modify existing equipment: Engines and exhausts are typically the dominant noise sources on mobile plant such as cranes, graders, excavators, trucks, etc. In order to minimise noise emissions, residential grade mufflers should be fitted on all mobile plant utilised on site.
- Siting of equipment: locating noisy equipment behind structures that act as barriers, or at the greatest distance from the noise-sensitive area; or orienting the equipment so that noise emissions are directed away from any sensitive areas, to achieve the maximum attenuation of noise.
- Regular and effective maintenance.

6.6.4 Discussion of Resulting Construction Noise Levels with Mitigation

In sections 6.6.3 to 6.6.3.13 PWNA have provided detailed list of possible mitigation measures which could be implemented to reduce these expected noise levels at neighbouring properties. In some cases the noise levels expected with the some of the listed mitigation measures would be significant.

Regarding the acoustic benefit of some of the listed acoustic mitigation measures, the following would be expected:

- Implementation of acoustic enclosures/screening (section 6.6.3.6) for static/fix plant a reduction between 10 - 20dBA would be expected based on the scenario.
- When work scheduling (section 6.6.3.17) is implemented (i.e. noisy works occurring between certain times) will significantly reduce noise levels at surrounding receiver locations by greater than 20dBA.
- Use of broadband reversing alarms, or quackers (section 6.6.3.13) will provide an approximate 5dBA reduction.
- Through the selection of quieter plant (section 6.6.3.15) this can reduce noise levels by up to 10dBA, plant specific.
- Implementation of mufflers and silencers on motor engines can reduce noise levels by up to 8dBA.

- Ensuring good community consultation (section 6.6.3.10) would not necessarily have an associated noise reduction, however, provide the community awareness and confidence in the works being undertaken. This reduces community annoyance when noisy activities begin/occur.

- Through the successful management of construction traffic (section 6.6.3.13) and ensuring vehicles follow the dedicated traffic routes developed during the preparation of the site-specific management plans will ensure one way traffic movements have minimised acoustic impacts on neighbouring properties.

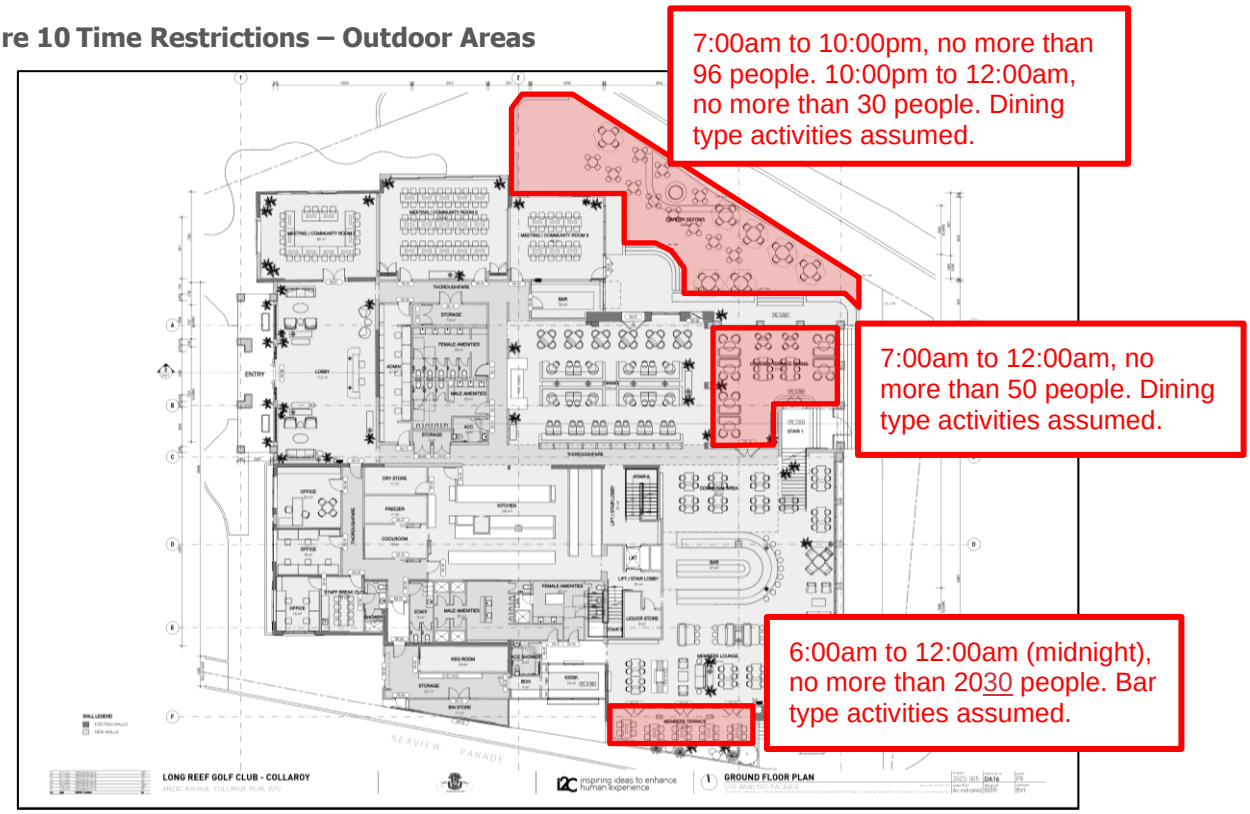
7 ASSESSMENT RESULTS AND RECOMMENDATIONS

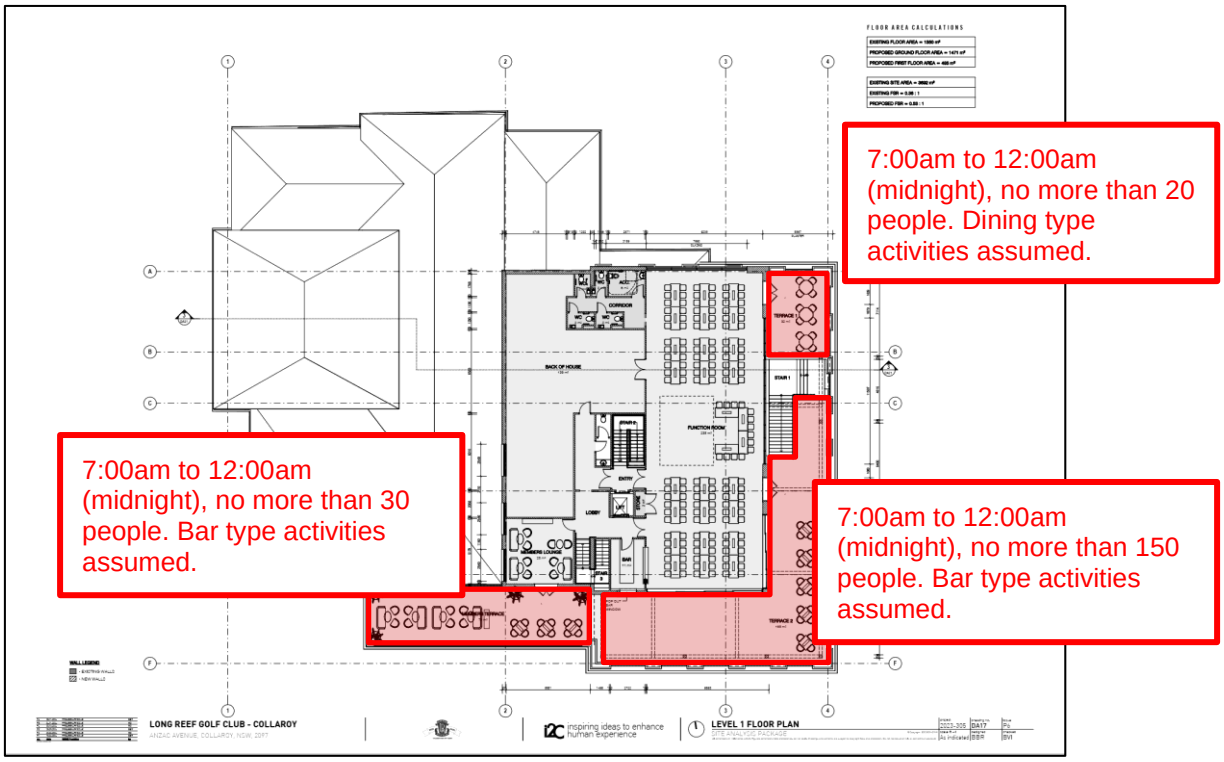
Predicted noise levels from the operation of the proposed food premise in full operation (all patrons and background music) has been predicted. To ensure compliance is achieved, the following recommendations must be implemented:

- Operation of the facility is between 6:00am and 12:00am (midnight), seven (7) days a week. These hours align the current golf, dining and member/community operations of the club.
- The assumed maximum number of patrons in each relevant area of the development is outlined below, this is not necessarily an overall number permitted:
  - **Ground Level**
    - Meeting / Community Room 1 – maximum of 22 people (internal)
    - Meeting / Community Room 2 – maximum of 60 people (internal)
    - Meeting / Community Room 3 – maximum of 24 people (internal)
    - Dining – maximum of 96 people (internal)
    - Covered Terrace Dining – maximum of 50 people (external)
    - Garden Seating – maximum of 96 people (external)
    - Communal area – maximum of 70 people (internal)
    - Members Lounge (ground) – maximum of 96 people (internal) or
    - Members Terrace (ground) – This space is an extension of the Members Internal Lounge, this space does not propose any additional people, rather out of the 96 people permitted in the lounge, a maximum of 30 people could be located outside.
  - **Level One (1)**
    - Members Lounge (level 1) – maximum of 16 people (internal) or
    - Members Terrace (level 1) – maximum of 30 people (external)
    - Level 1 Members Presentation Space / Meeting Room / Function Rooms (level 1) – maximum of 150 people (external) or
    - Terrace 1 (level 1) – This space is an extension of the Level 1 Multipurpose Space, this space does not propose any additional people, rather out of the 150 people permitted in the Level 1 Multipurpose Space, a maximum of 20 people could be located outside.
    - Terrace 2 (level 1) – This space is an extension of the Level 1 Multipurpose Space, this space does not propose any additional people, rather out of the 150 people permitted in the Level 1 Multipurpose Space, a maximum of 150 people could be located outside.

- With regards to background music within the internal areas (ONLY) we have assumed a Sound Pressure Level (SPL) of **65 dBA $L_{Aeq\ (15\text{-}minute)}$**. For the multipurpose room on level one (1) we have assumed a higher noise level of **95dBA $L_{Aeq\ (15\text{-}minute)}$ for amplified music**.
- Windows and doors have been assumed to generally be open, they are required to be closed during the following scenarios:
  - During the use of amplified music (not including background music)
  - **ALL** Windows and doors are all required to be closed **after 10:00pm and before 7:00am**, regardless of whether there is amplified music, background music or not.
- Use of the loading dock is limited to 7:00am to 10:00pm.
- A contact number must be displayed for the purposes of receiving any complaints if they arrive.
- Signs must be displayed at all exits reminding patrons to be mindful of noise when leaving the premise.
- All mechanical selections and layouts must be reviewed prior to installation to ensure compliance with the project requirements outlined in section 5 above.
- Use of the outdoor areas is limited in regard to operation hours as per the markup below.

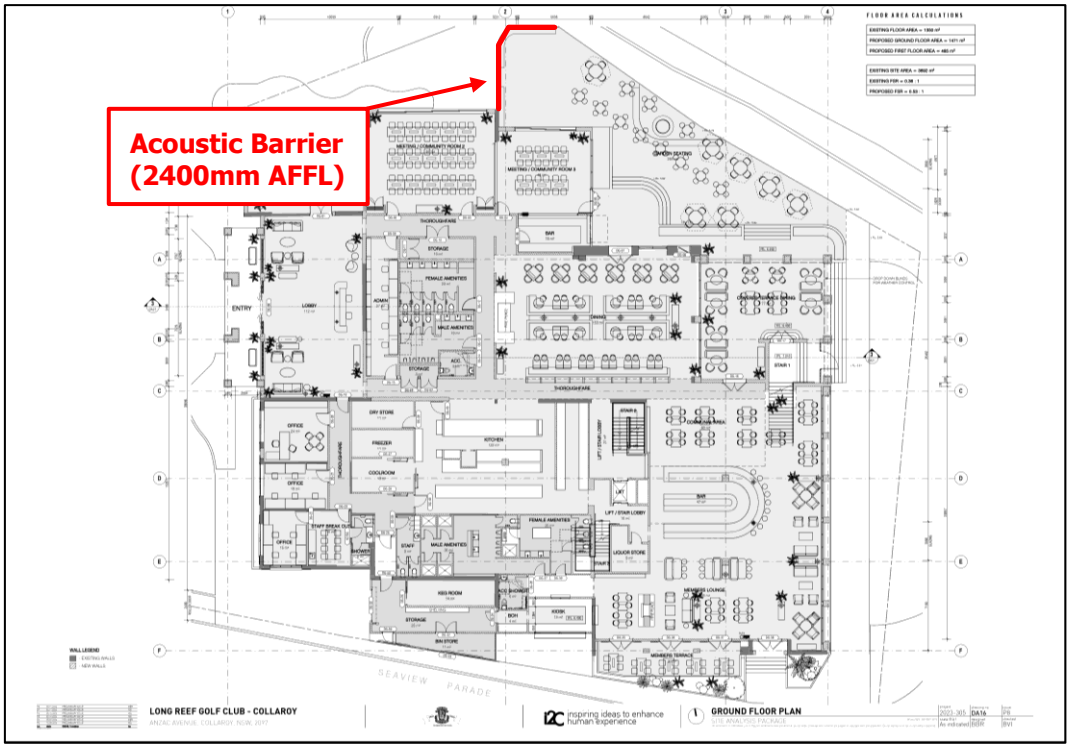
Figure 10 Time Restrictions – Outdoor Areas

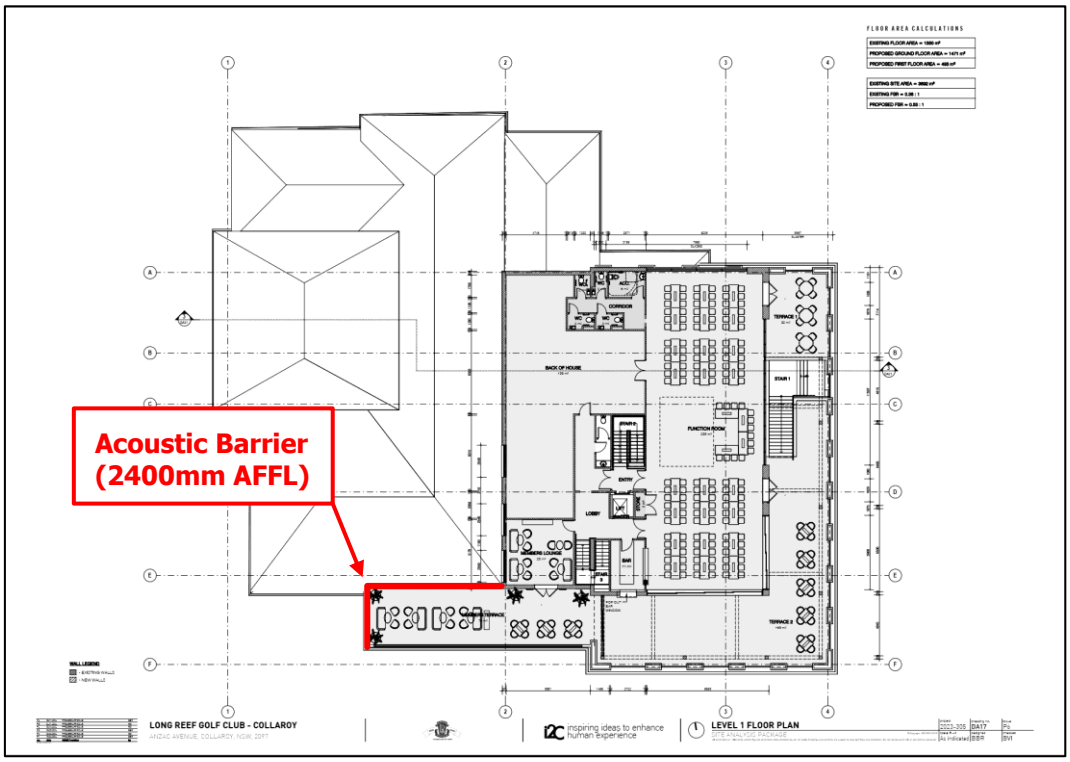




- Building envelope constructions (walls, glazing and roofs) are constructed as per the recommendations as outlined in section 6.1.
- Acoustic barriers are recommended and required as per the following markup. All barriers are to have a minimum R_w 35 construction (either 10.38mm Laminated Glazing **or** two (2) layers of Fibre Cement Sheeting – or equal).

Figure 11 Acoustic Barriers (Location and Heights)





On the assumption the recommendations outlined are incorporated compliance with the acoustic project criteria outlined in section 5 above will be achieved.

8 CONCLUSION

Pulse White Noise Acoustics (PWNA) have been engaged by Long Reef Golf Club Ltd to undertake an acoustic assessment of the proposed redevelopment of the Long Reef Golf Club Clubhouse situated at 2 Anzac Avenue, Collaroy, NSW.

- Minimum acoustic performances and associated indicative constructions for the building envelope have been provided in section 6.1 of this report. The recommended treatments have been provided to ensure compliance with the objectives presented in section 5.

- To control noise impacts at external receivers, recommended indicative treatments for major engineering services have been provided in section 6.2. From our review we have formulated the following opinion:

    - At this stage of the project the exact selections/locations of plant items are not known. A preliminary assessment, however, has been carried out using our experience with similar types of developments and the typical plant items installed in each type of plant room.

    - From this review we recommend the selection of high-performance acoustic treatment to ensure that the operation of the plant items comply with the project criteria. Therefore, it is recommended that prior to the issue of a Construction Certificate (CC) a detailed acoustic assessment is undertaken to ensure all cumulative noise from engineering services (including the roof plant room) comply with the requirements as listed in section.

- Detailed acoustic modelling has indicated that noise from the operation of the licensed venue elements of the development are likely to result in compliance with the typically imposed NSW Liquor and Gaming acoustic requirements. To ensure compliance, recommended building and management controls are recommended in this report.

- A review of the proposed loading dock activities associated with the clubhouse redevelopment have been undertaken and do not believe the operation will affect the acoustic amenity of existing surrounding residential receivers.

- An assessment of the impacts associated with number of vehicles on surrounding public roads around the site and the impact is less than 2dBA and therefore is compliant with the NSW EPA RNP.

For any additional information please do not hesitate to contact the person below.

Regards,

Matthew Furlong
Principal Acoustic Engineer
PULSE WHITE NOISE ACOUSTICS PTY LTD
AAS Member and AAAC Member Firm

APPENDIX A – ACOUSTIC GLOSSARY

The following is a brief description of the acoustic terminology used in this report.

Ambient Sound The totally encompassing sound in a given situation at a given time, usually composed of sound from all sources near and far.

Audible Range The limits of frequency which are audible or heard as sound. The normal ear in young adults detects sound having frequencies in the region 20 Hz to 20 kHz, although it is possible for some people to detect frequencies outside these limits.

Character, acoustic The total of the qualities making up the individuality of the noise. The pitch or shape of a sound's frequency content (spectrum) dictate a sound's character.

Decibel [dB] The level of noise is measured objectively using a Sound Level Meter. The following are examples of the decibel readings of every day sounds;

0dB	the faintest sound we can hear
30dB	a quiet library or in a quiet location in the country
45dB	typical office space. Ambience in the city at night
60dB	Martin Place at lunch time
70dB	the sound of a car passing on the street
80dB	loud music played at home
90dB	the sound of a truck passing on the street
100dB	the sound of a rock band
115dB	limit of sound permitted in industry
120dB	deafening

dB(A) *A-weighted decibels* The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter. The sound pressure level in dB(A) gives a close indication of the subjective loudness of the noise.

Frequency Frequency is synonymous to *pitch*. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.

Loudness A rise of 10 dB in sound level corresponds approximately to a doubling of subjective loudness. That is, a sound of 85 dB is twice as loud as a sound of 75 dB which is twice as loud as a sound of 65 dB and so on

L_{Max} The maximum sound pressure level measured over a given period.

L_{Min} The minimum sound pressure level measured over a given period.

L_1 The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.

L_{10} The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.

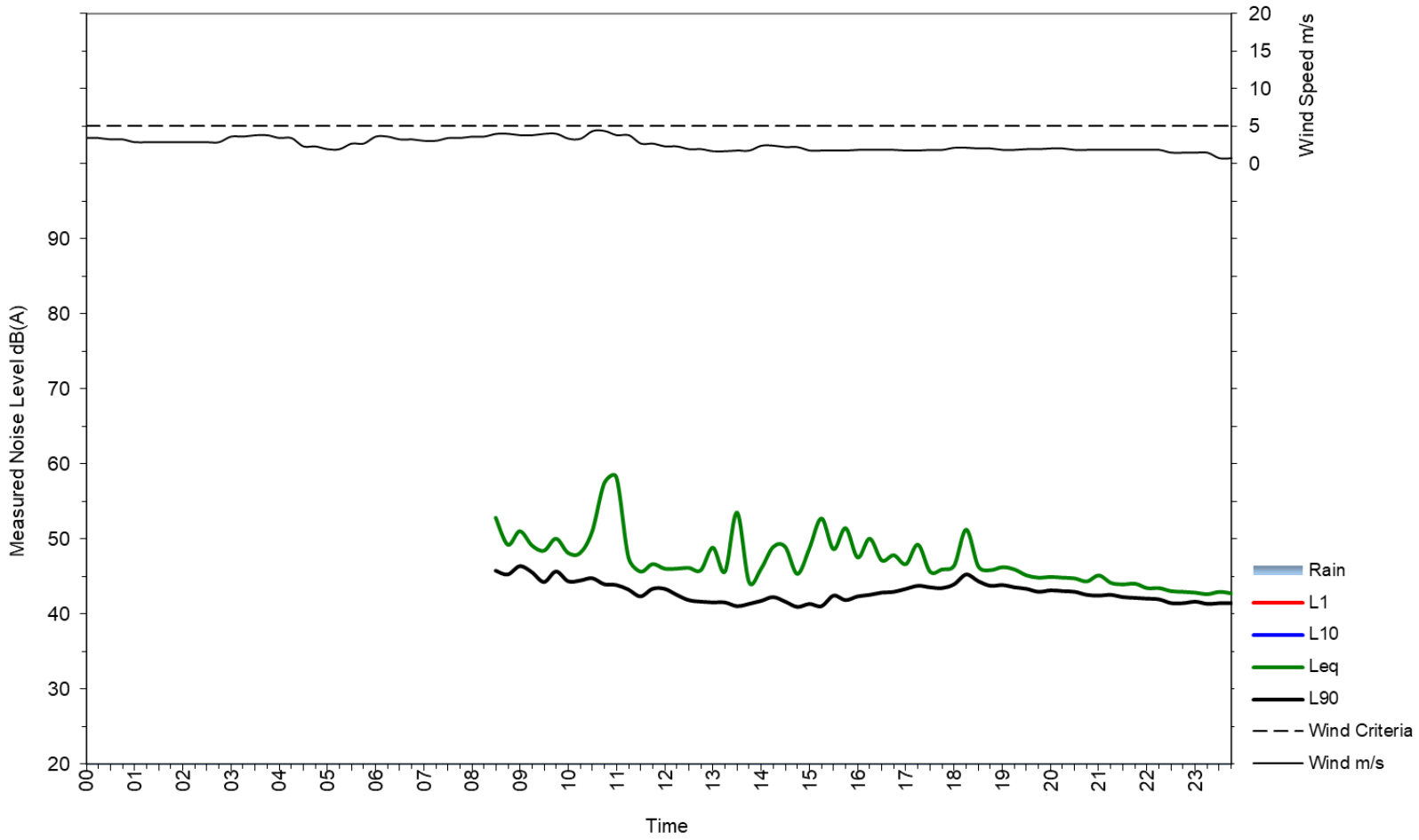
L_{90} The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L_{90} noise level expressed in units of dB(A).

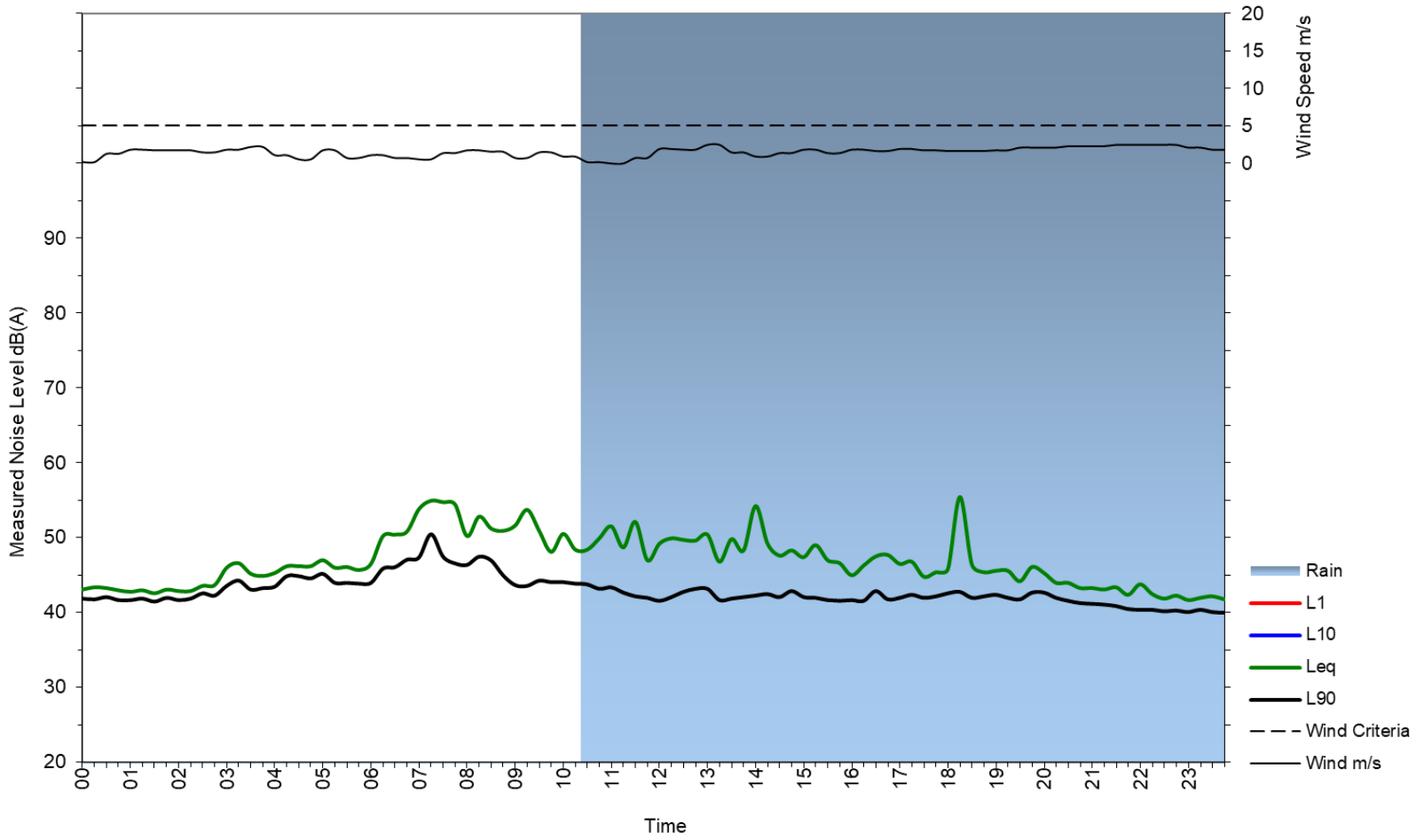
L_{eq} The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.

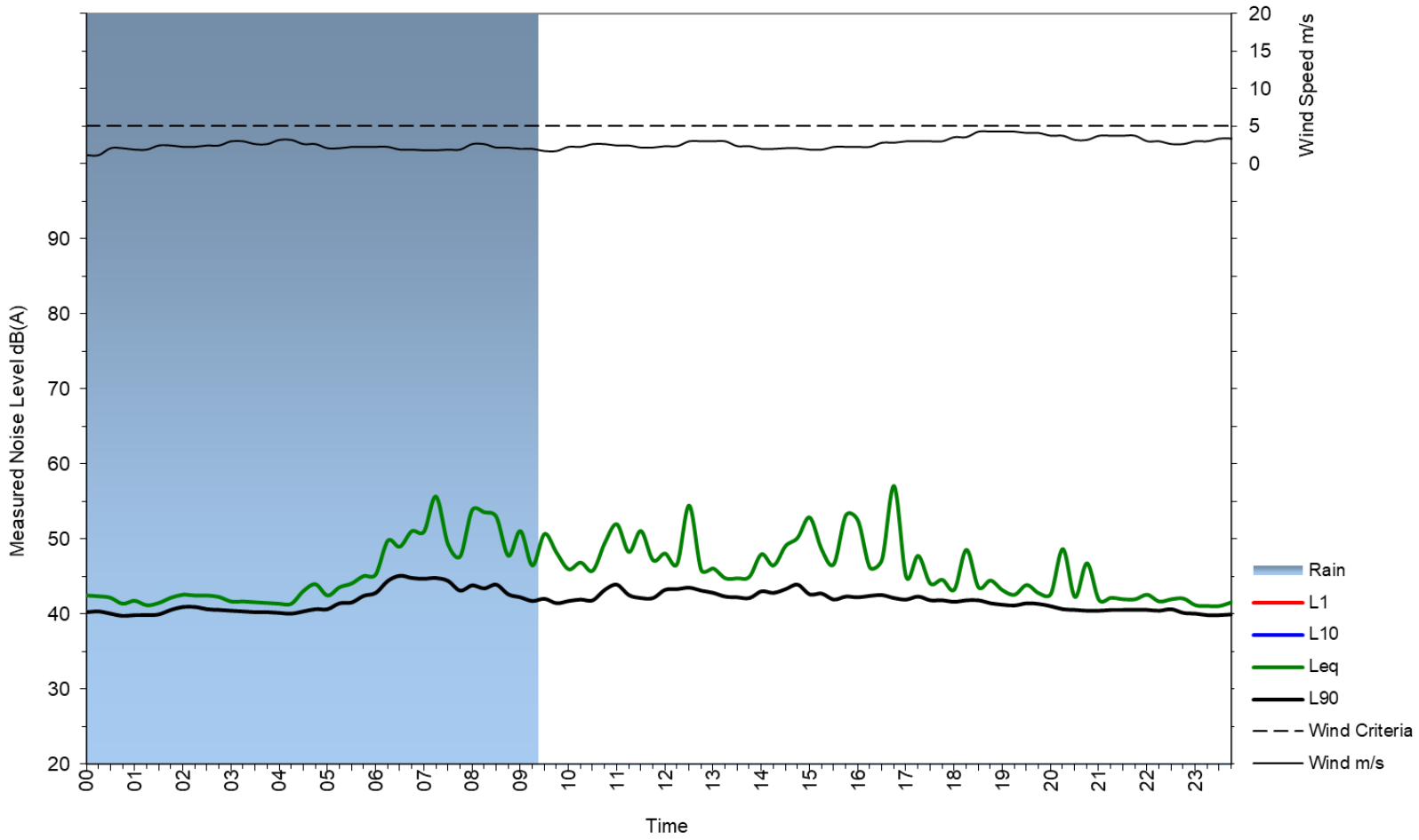
Background Sound Low The average of the lowest levels of the sound levels measured in an affected area in the absence of noise from occupants and from unwanted, external ambient noise sources. Usually taken to mean the L_{A90} value

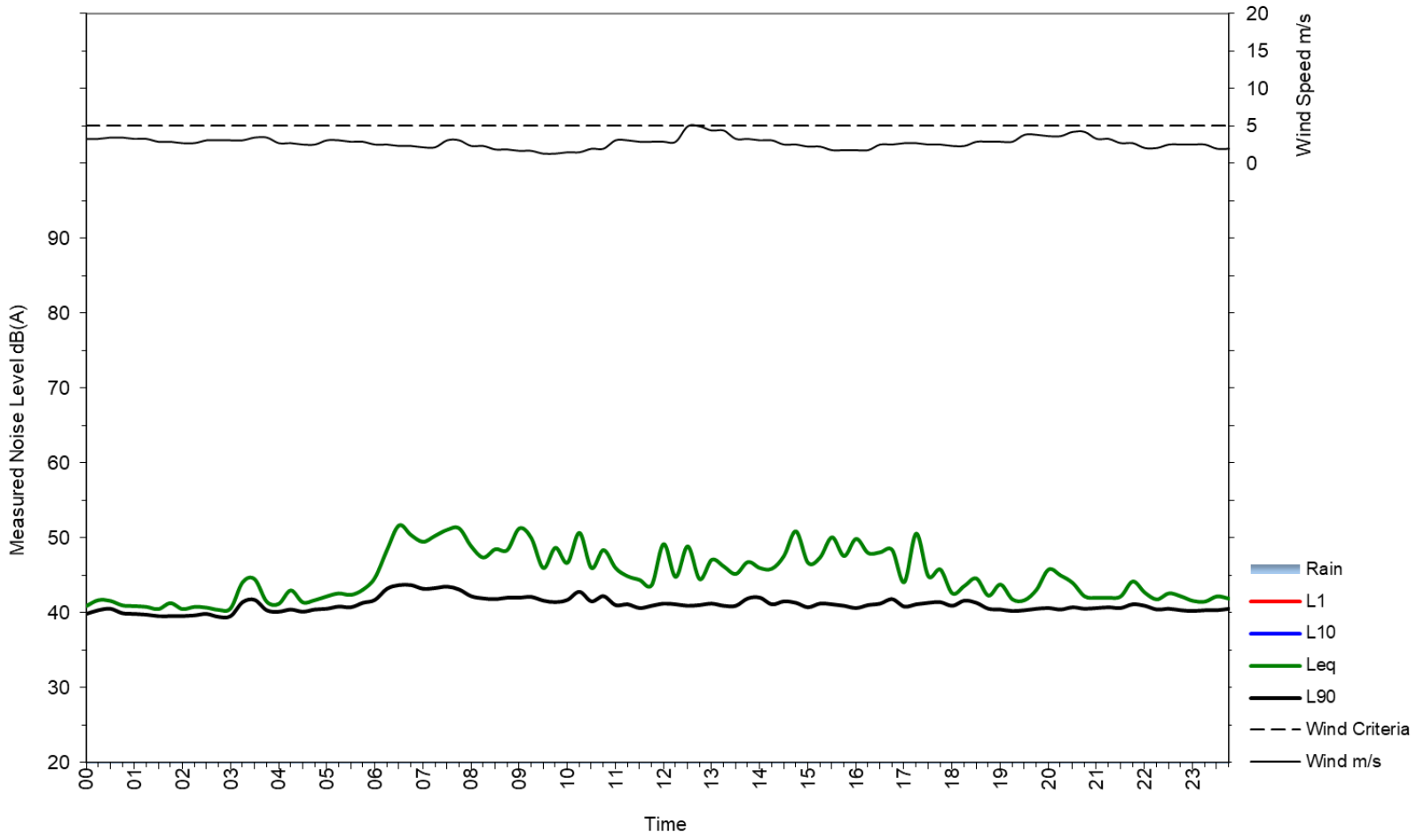
Ctr	A frequency adaptation term applied in accordance with the procedures described in ISO 717.
dB (A)	'A' Weighted overall sound pressure level
Noise Reduction	The difference in sound pressure level between any two areas. The term "noise reduction" does not specify any grade or performance quality unless accompanied by a specification of the units and conditions under which the units shall apply
NR Noise Rating	Single number evaluation of the background noise level. The NR level is normally around 5 to 6 dB below the "A" weighted noise level. The NR curve describes a spectrum of noise levels and is categorised by the level at 1000 Hz ie the NR 50 curve has a value of 50 dB at 1000 Hz. The NR rating is a tangential system where a noise spectrum is classified by the NR curve that just encompasses the entire noise spectrum consideration.
R_w	Weighted Sound Reduction Index - Laboratory test measurement procedure that provides a single number indication of the acoustic performance of a partition or single element. Calculation procedures for Rw are defined in ISO 140-2:1991 "Measurement of Sound Insulation in Buildings and of Building Elements Part 2: Determination, verification and application of precision data".
R'_w	Field obtained Weighted Sound Reduction Index - this figure is generally up to 3-5 lower than the laboratory test determined level data due to flanked sound transmission and imperfect site construction.
Sound Isolation	A reference to the degree of acoustical separation between any two areas. Sound isolation may refer to sound transmission loss of a partition or to noise reduction from any unwanted noise source. The term "sound isolation" does not specify any grade or performance quality and requires the units to be specified for any contractual condition
Sound Pressure Level, L_P dB	A measurement obtained directly using a microphone and sound level meter. Sound pressure level varies with distance from a source and with changes to the measuring environment. Sound pressure level equals 20 times the logarithm to the base 10 of the ratio of the rms sound pressure to the reference sound pressure of 20 micro Pascals.
Sound Power Level, L_W dB	Sound power level is a measure of the sound energy emitted by a source, does not change with distance, and cannot be directly measured. Sound power level of a machine may vary depending on the actual operating load and is calculated from sound pressure level measurements with appropriate corrections for distance and/or environmental conditions. Sound power levels is equal to 10 times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power of 1 picoWatt
Speech Privacy	A non-technical term but one of common usage. Speech privacy and speech intelligibility are opposites and a high level of speech privacy means a low level of speech intelligibility. It should be recognised that acceptable levels of speech privacy do not require that speech from an adjacent room is inaudible.
Transmission Loss	Equivalent to Sound Transmission Loss and to Sound Reduction Index in terminology used in countries other than Australia. A formal test rating of sound transmission properties of any construction, by usually a wall, floor, roof etc. The transmission loss of all materials varies with frequency and may be determined by either laboratory or field tests. Australian Standards apply to test methods for both situations.

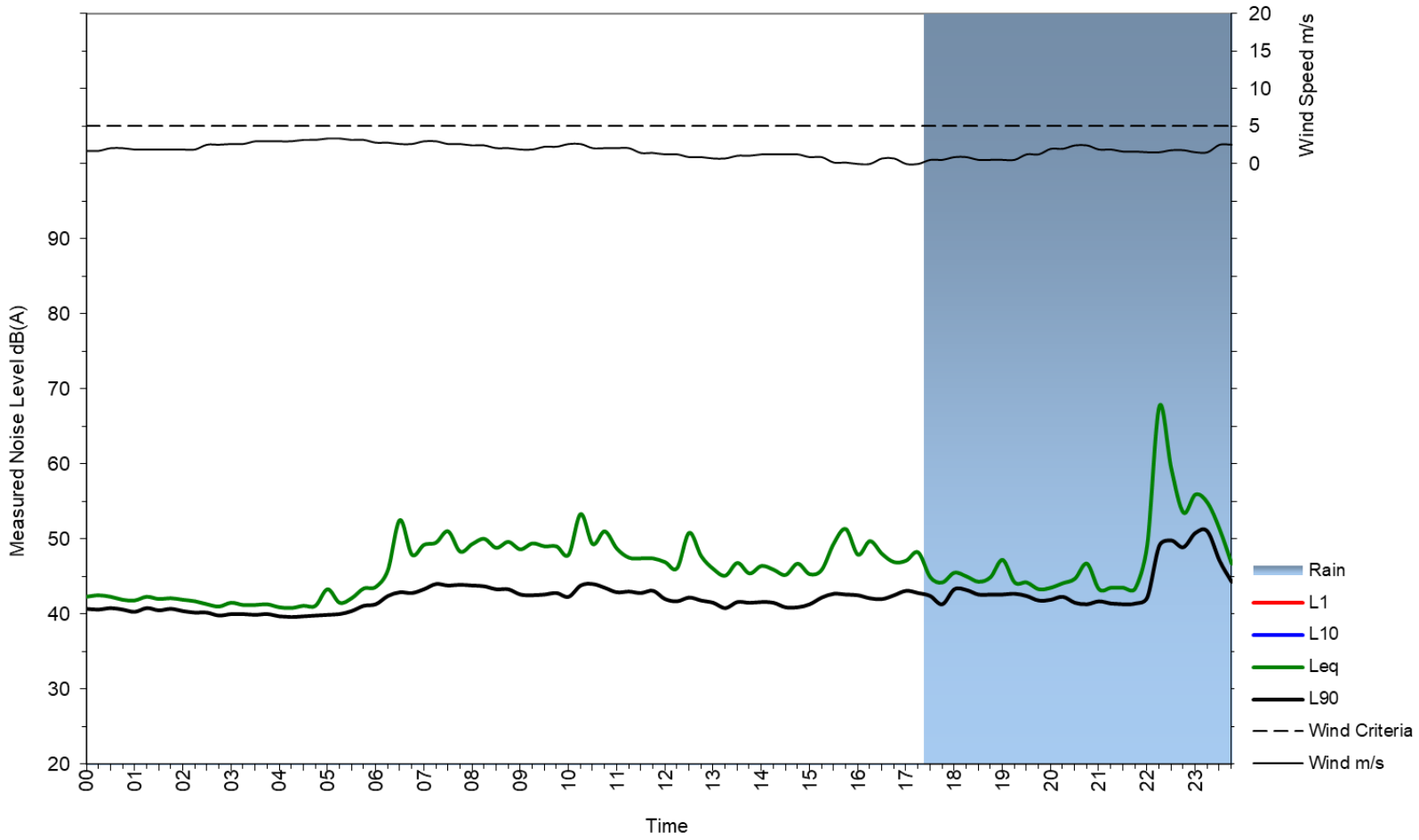
APPENDIX B – UNATTENDED NOISE MONITORING

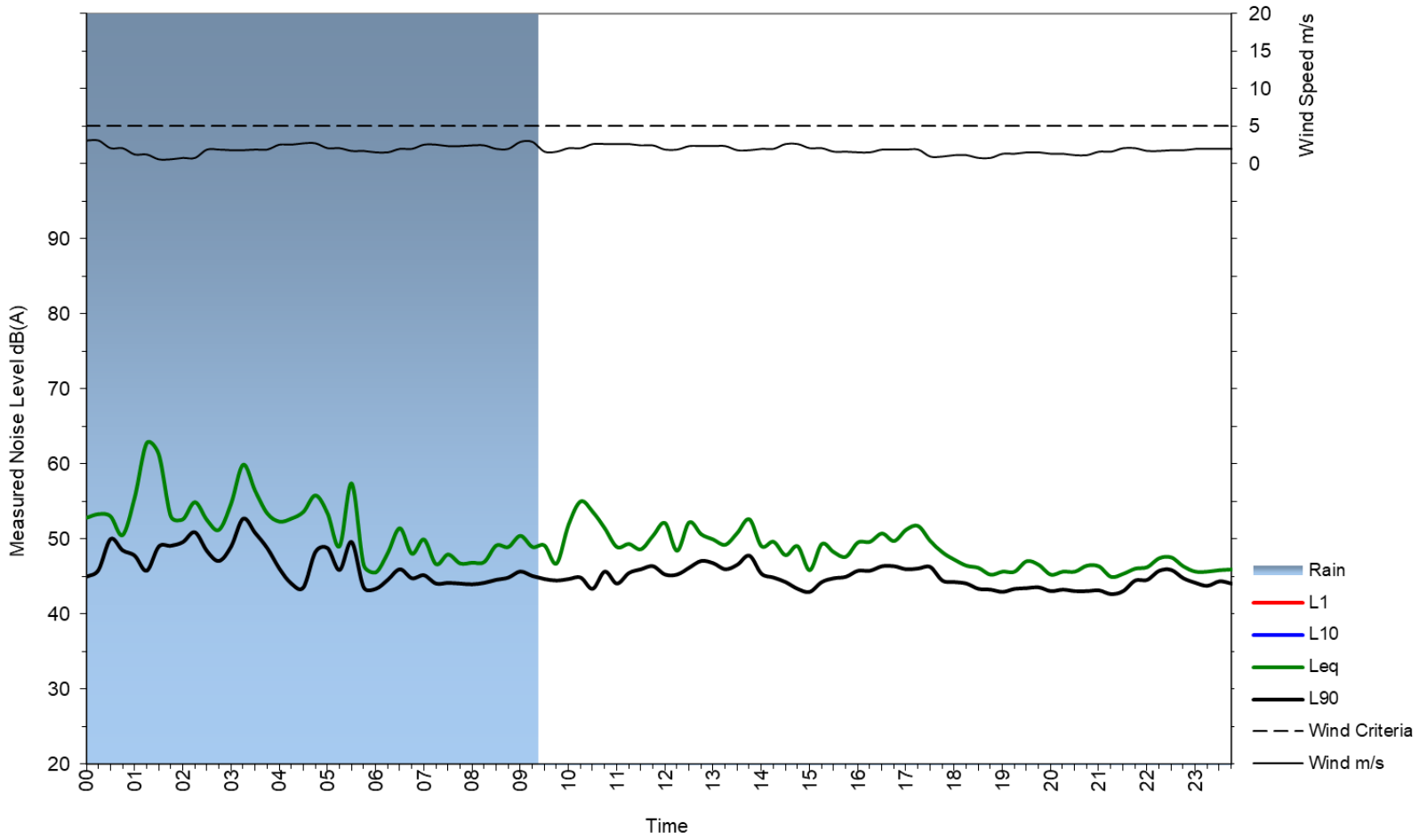

Long Reef Golf Club
Tuesday 01 August 2023
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

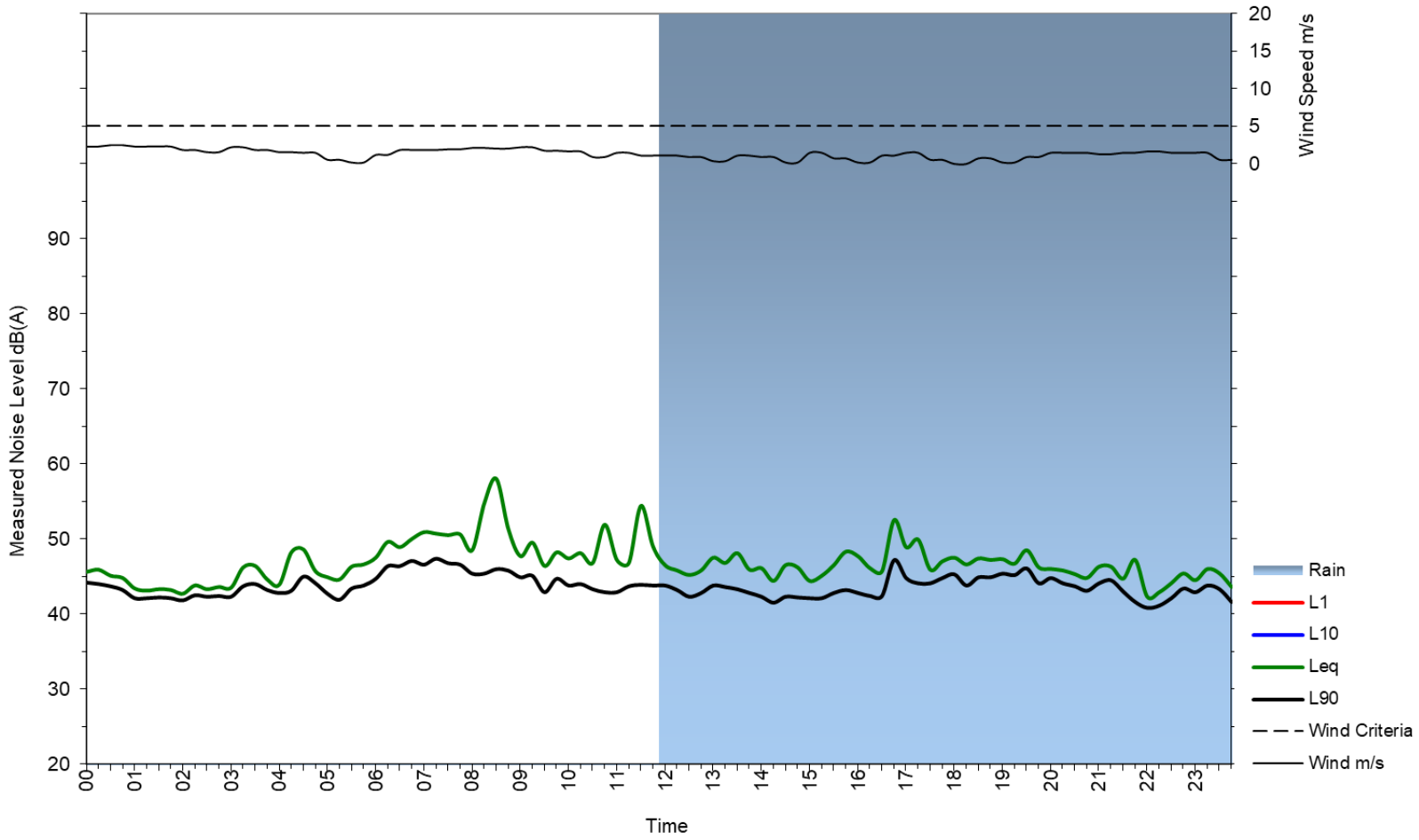

Long Reef Golf Club
Wednesday 02 August 2023
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

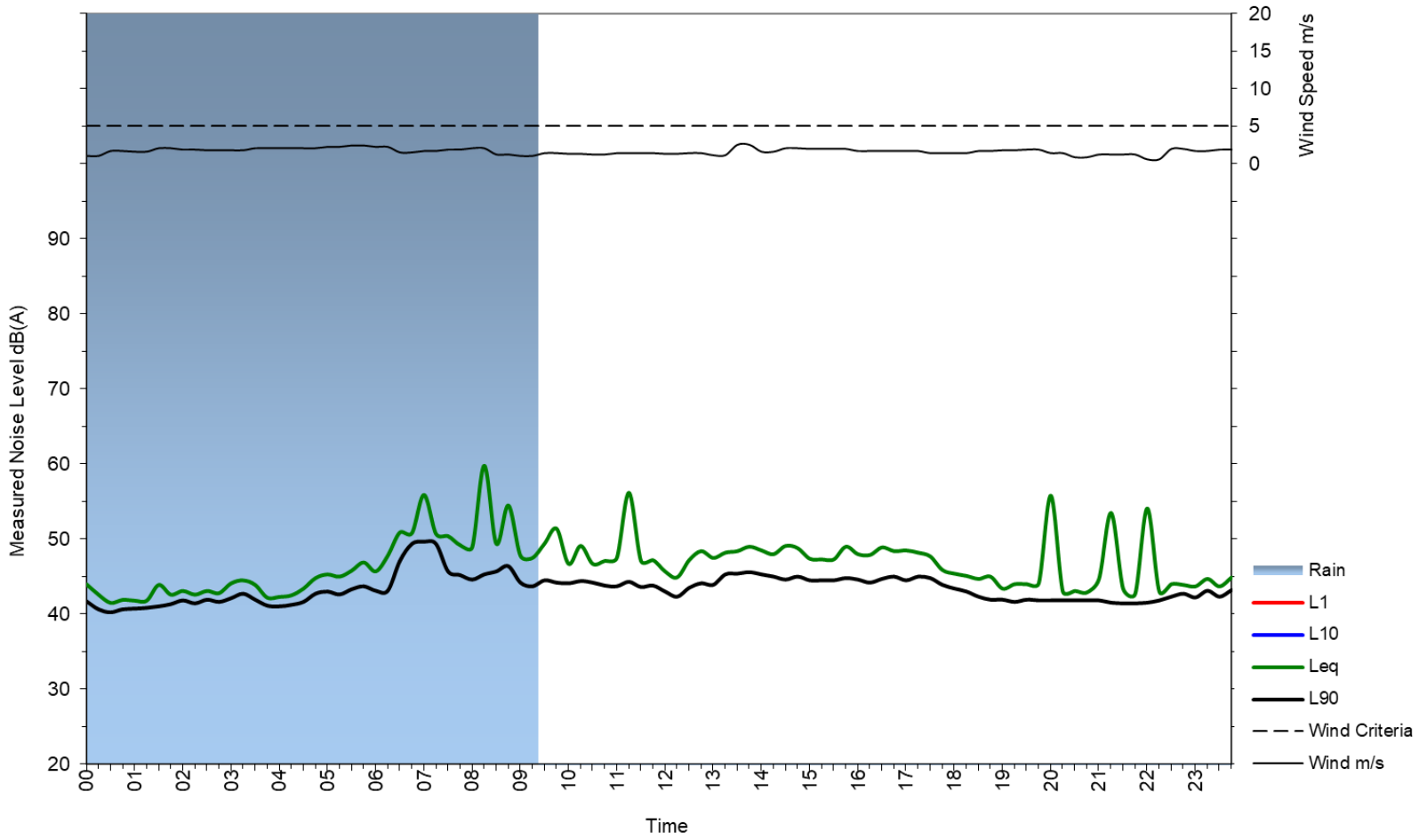

Long Reef Golf Club
Thursday 03 August 2023
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

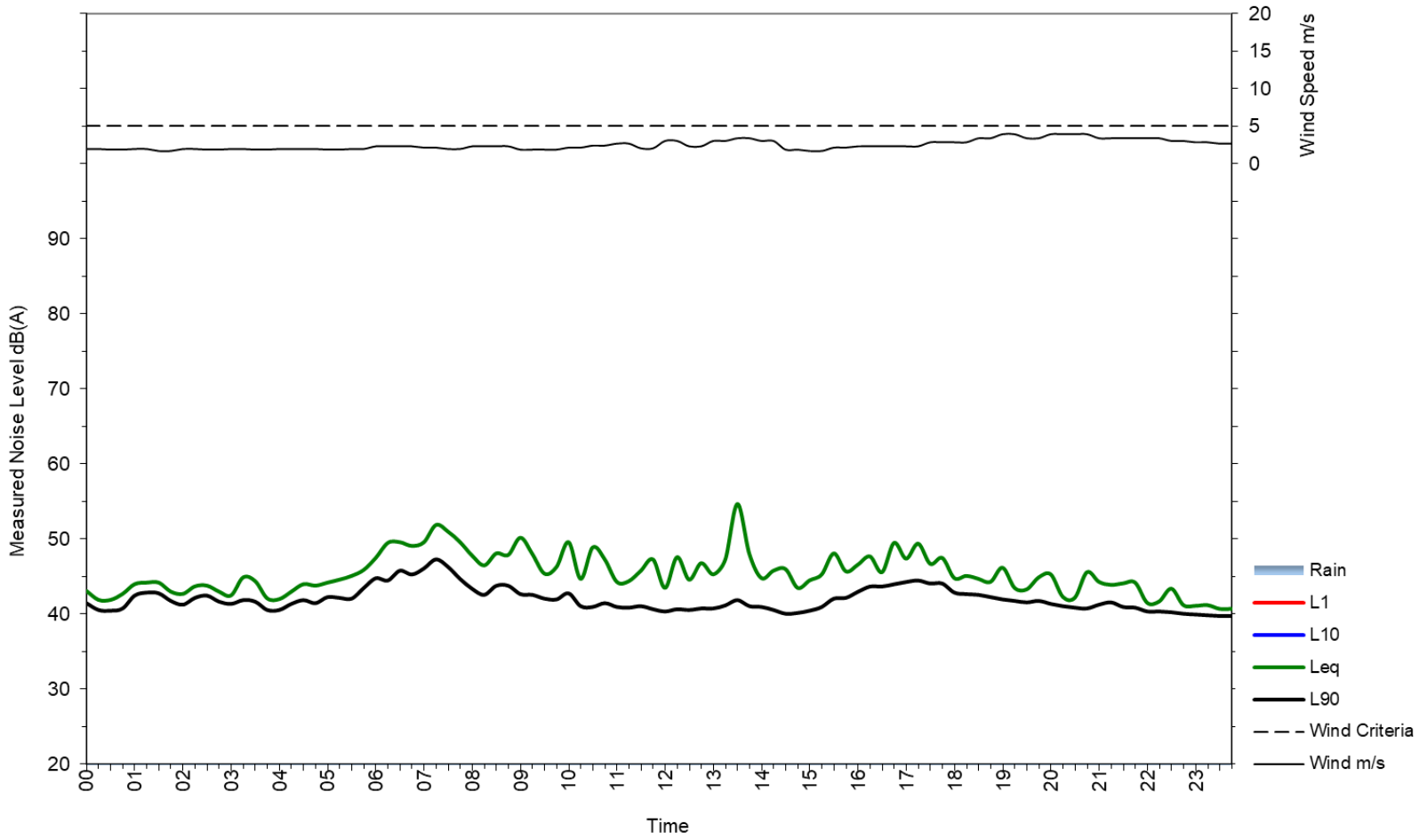

Long Reef Golf Club
Friday 04 August 2023
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

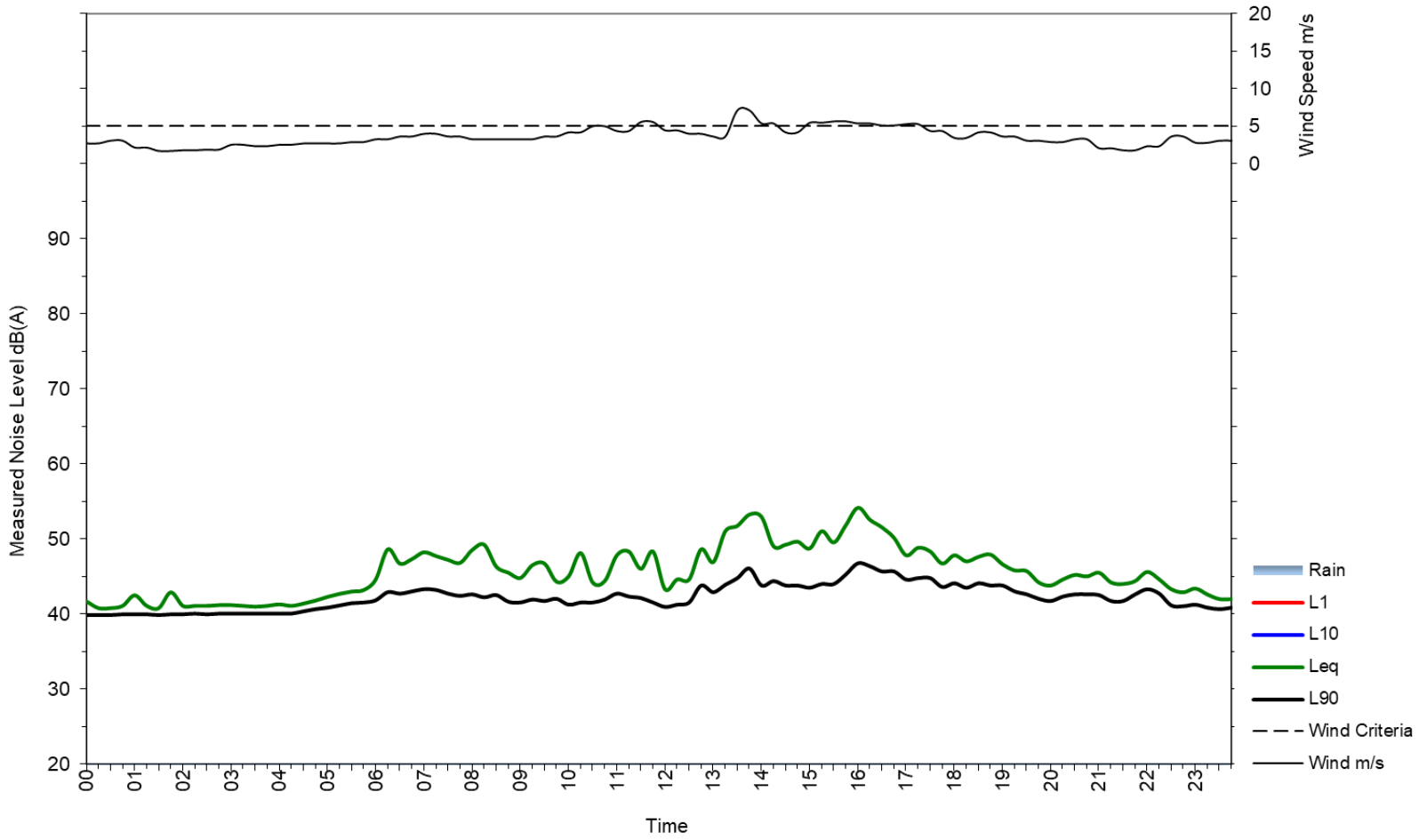

Long Reef Golf Club
Saturday 05 August 2023
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

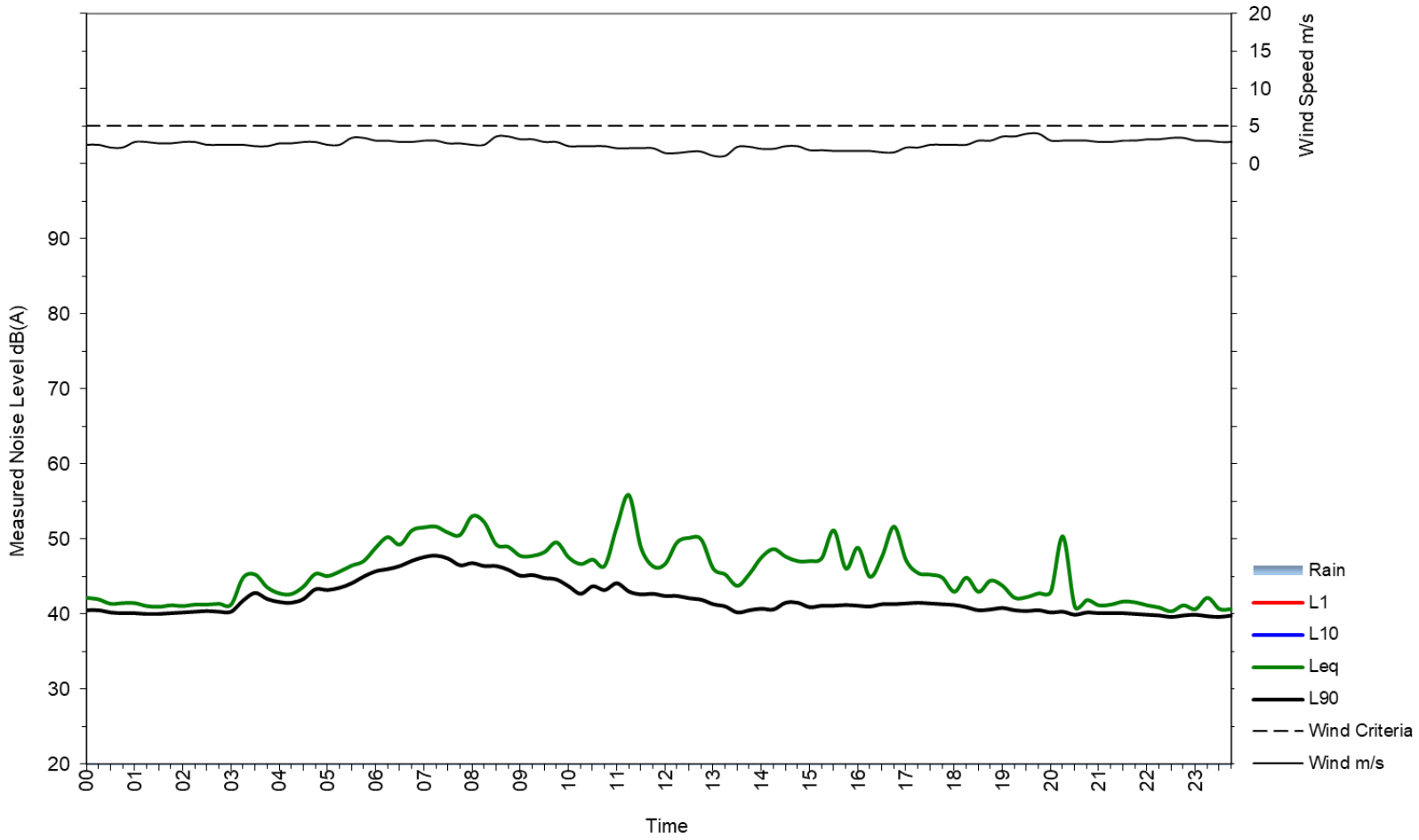

Long Reef Golf Club
Sunday 06 August 2023
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

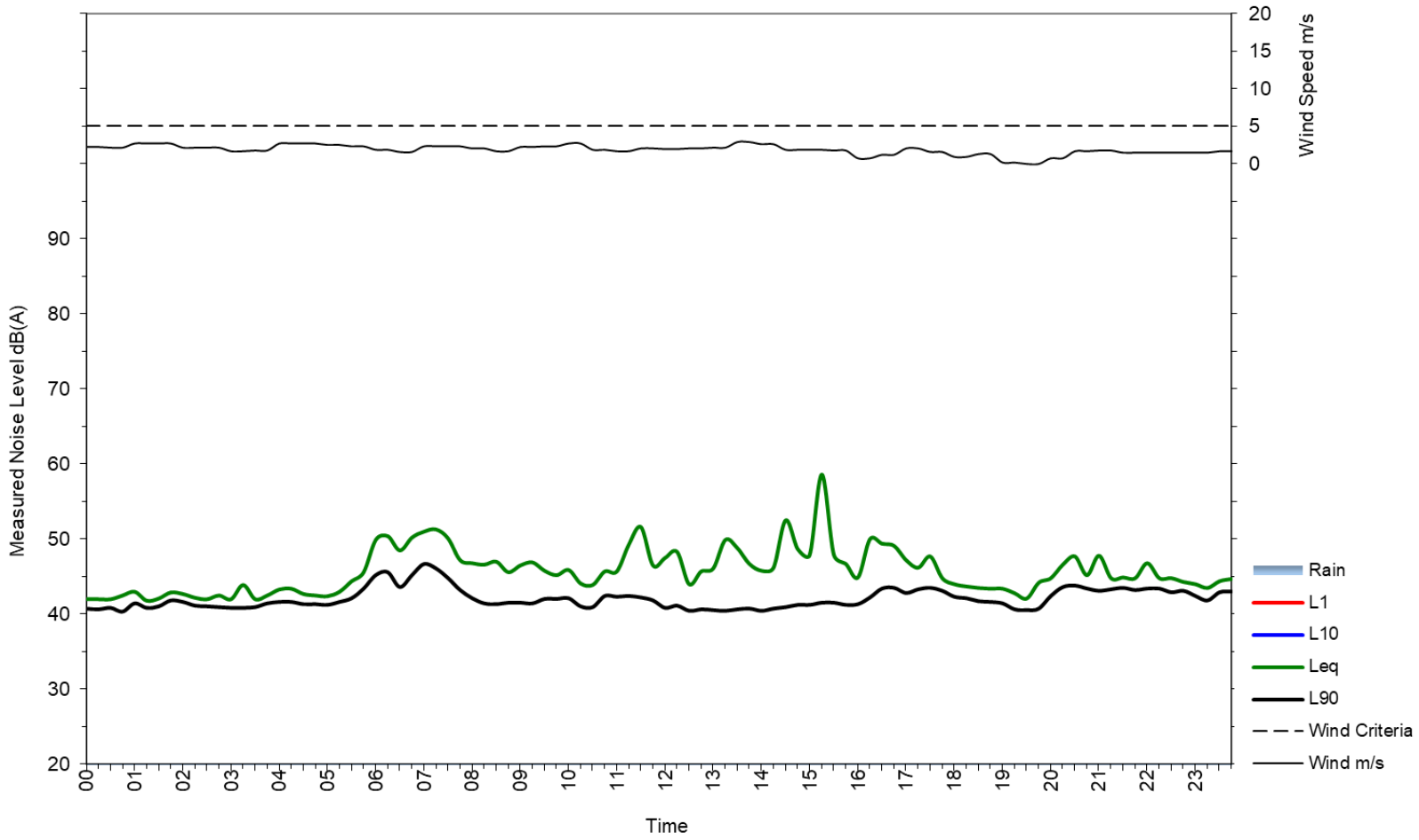

Long Reef Golf Club
Monday 07 August 2023
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

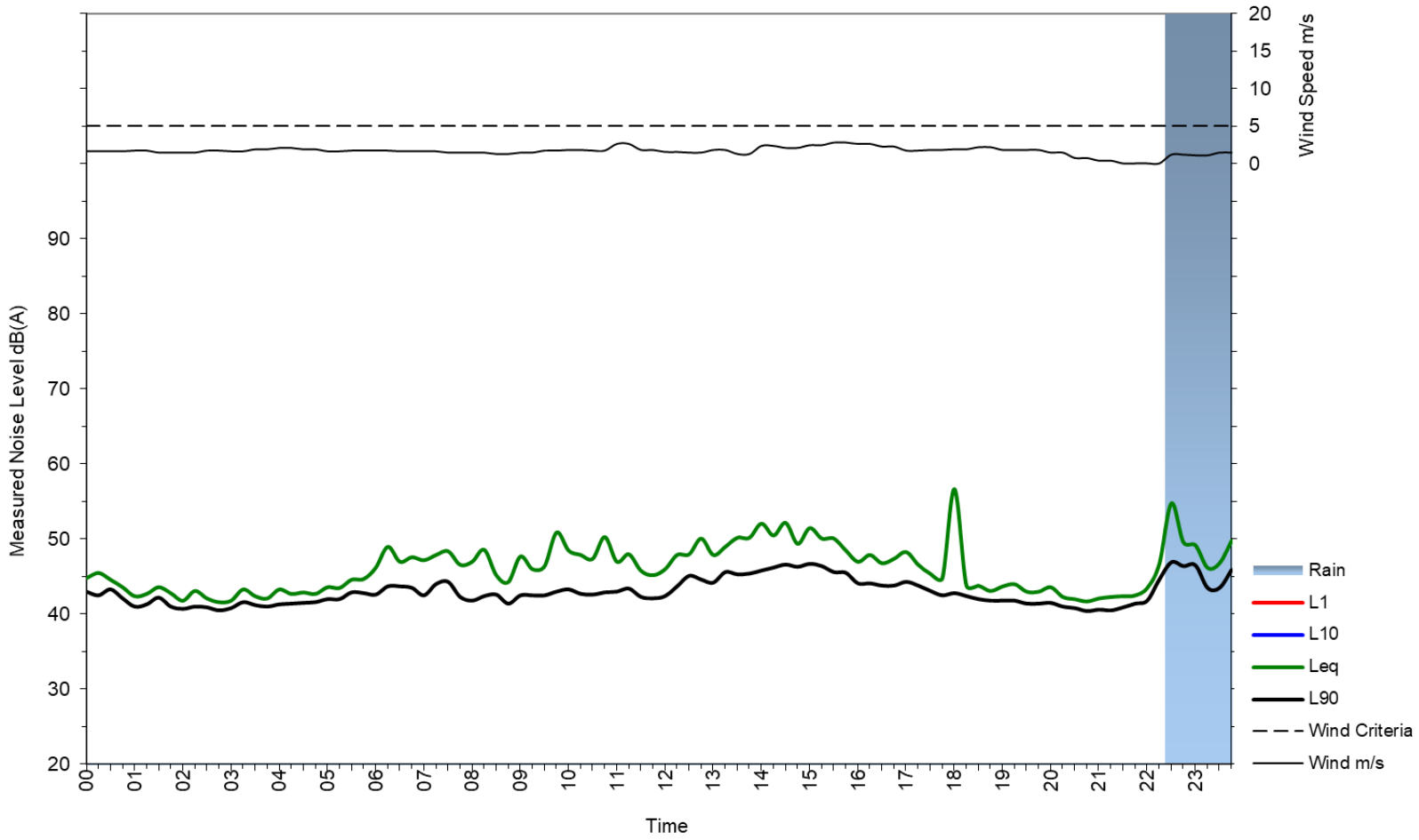

Long Reef Golf Club
Tuesday 08 August 2023
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

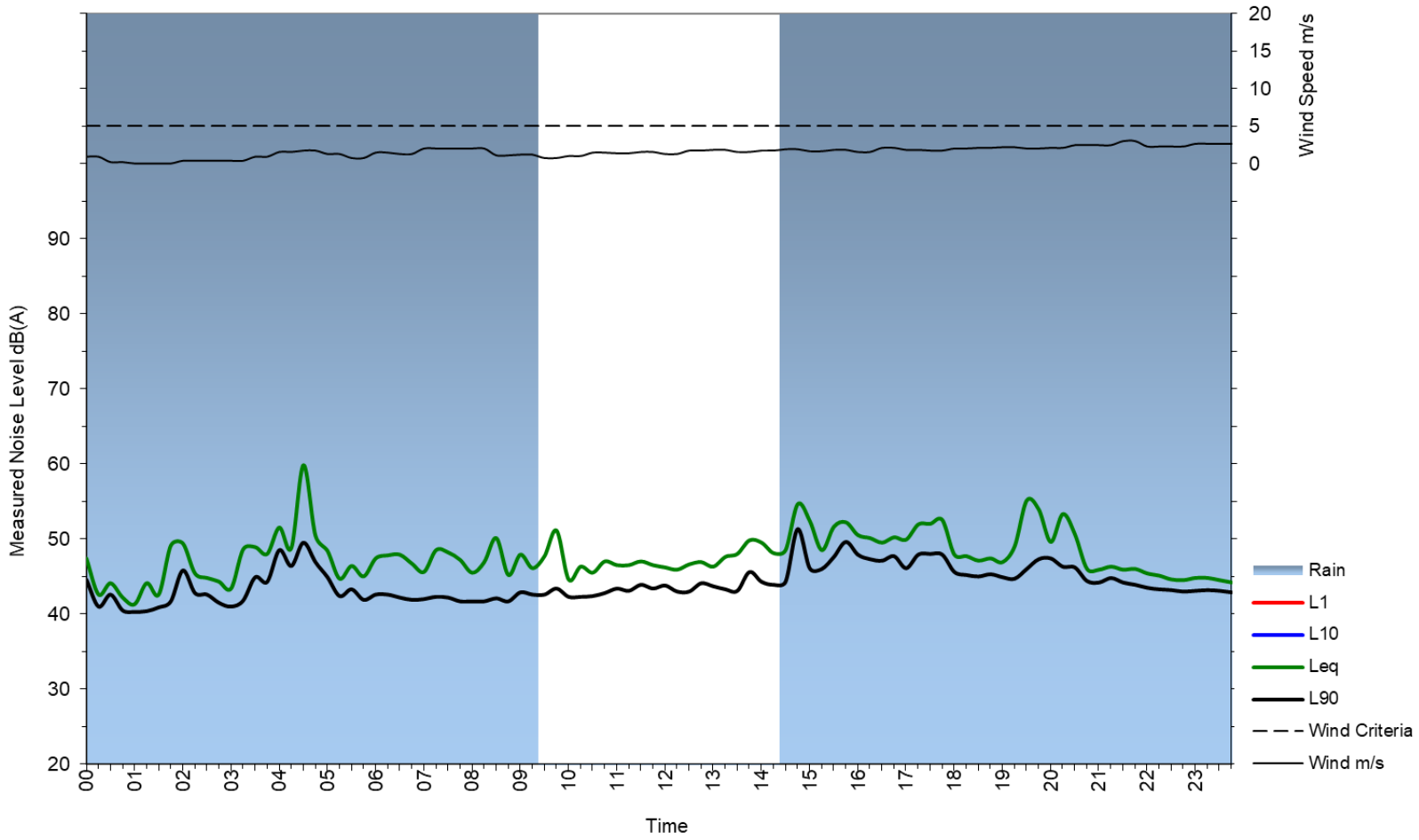

Long Reef Golf Club
Wednesday 09 August 2023
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


Long Reef Golf Club
Thursday 10 August 2023
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


Long Reef Golf Club
Friday 11 August 2023
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


Long Reef Golf Club
Saturday 12 August 2023
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


Long Reef Golf Club
Sunday 13 August 2023
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


Long Reef Golf Club
Monday 14 August 2023
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s