acousticdynamics

Environmental Noise Impact Assessment

Proposed Mixed-Use Development
21 Oaks Avenue, Dee Why, NSW

Client:

Cite Developments
No. 2 Pty Ltd

C/o- Gartner Trovato
Architects Pty Ltd

21 December 2023

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GLOSSARY

NOISE

Noise is produced through rapid variations in air pressure at audible frequencies (20 Hz – 20 kHz). Most noise sources vary with time. The measurement of a variable noise source requires the ability to describe the sound over a particular duration of time. A series of industry standard statistical descriptors have been developed to describe variable noise, as outlined below.

NOISE DESCRIPTORS

L_{eq} – The sound pressure level averaged over the measurement period. It can be considered as the equivalent continuous steady-state sound pressure level, which would have the same total acoustic energy as the real fluctuating noise over the same time period.

$L_{Aeq(15min)}$ – The A-weighted average equivalent sound level over a 15-minute period.

L_{A90} – The A-weighted noise level that has been exceeded for 90% of the measurement duration. This descriptor is used to describe the background noise level.

RBL – Rating Background Level. The overall, single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period (as opposed to over each 24-hour period used for assessment background level). This is the level used for assessment purposes.

dB – Decibels. The fundamental unit of sound, a Bell is defined as the logarithm of the ratio of the sound pressure squared over the reference pressure squared. A Decibel is one-tenth of a Bell. Probably the most common usage of the Decibel in reference to sound loudness is dB sound pressure level (SPL), referenced to the nominal threshold of human hearing. For sound in air and other gases, dB (SPL) is relative to 20 micropascals (μPa) = 2×10^{-5} Pa, the quietest sound a human can hear.

R_w – Weighted Sound Reduction Index. A measure of sound insulation performance of a building element. The higher the number, the better the insulation performance.

A-WEIGHTING

"A-weighting" refers to a prescribed amplitude versus frequency curve used to "weight" noise measurements to represent the frequency response of the human ear. Simply, the human ear is less sensitive to noise at some frequencies and more sensitive to noise at other frequencies. A-weighting is a method to present a measurement or calculation result with a number representing how humans subjectively hear different frequencies at different levels.

NOISE CHARACTER, NOISE LEVEL AND ANNOYANCE

The perception of a given sound to be deemed annoying or acceptable is greatly influenced by the character of the sound and how it contrasts with the character of the background noise. A noise source may be measured to have only a marginal difference to the background noise level but may be perceived as annoying due to the character of the noise.

Acoustic Dynamics' analysis of noise considers both the noise level and sound character in the assessment of annoyance and impact on amenity.

1 INTRODUCTION

1.1 EXECUTIVE SUMMARY

Acoustic Dynamics is engaged by **Gartner Trovato Architects** on behalf of **Cite Developments** to conduct an assessment of environmental noise emission resulting from typical operations associated with the proposed mixed-use development located at 21 Oaks Avenue, Dee Why, NSW, for the purposes of submission as part of a Development Application.

This document provides a technical assessment, as well as recommendations for construction materials and methods to achieve compliance with the relevant acoustic design criteria and requirements of:

(a) Northern Beaches Council;
(b) The NSW Department of Planning and Environment;
(c) The NSW Environment Protection Authority;
(d) The Australian Building Codes Board; and
(e) Australian Standards.

1.2 PROJECT DESCRIPTION

The project site is located at 21 Oaks Avenue, Dee Why, situated within a Mixed Use (MU1) land zone within the Northern Beaches Council area of NSW. The site is bounded by mixed-use commercial and residential developments.

The project proposal is to include the following:

- Demolition of the existing building;
- Construction of a mixed-use development consisting of two basement car park levels, two levels of mixed parking, residential apartments and commercial retail tenancies and five levels of residential apartments;
- Installation and operation of various items of mechanical plant, ventilation and building services.

The project site, adjacent receivers and surrounding area are shown in the Location Map and Aerial Image presented within **Appendix A**.

1.3 SCOPE OF WORKS

Acoustic Dynamics is engaged to provide an assessment of the acoustic design as part of a Development Application, **suitable for submission to the relevant authorities**, confirming the proposed development will satisfy the clients design goals and comply with the various relevant acoustic criteria.

The scope of the assessment is to include the following:

- Review of legislation, Council criteria and Australian Standards relevant to noise emission, for the proposed development;
- Conduct unattended noise monitoring within the vicinity of the subject site to determine existing environmental noise levels and to establish project specific noise criteria;
- Prediction of likely noise emission from proposed mechanical plant, vehicle movements, residential common areas and various other sources at the development site; and
- Recommendation of noise management measures, construction materials and techniques to achieve compliance with the relevant acoustic requirements and criteria.

2 ASSESSMENT CRITERIA AND STANDARDS

Acoustic Dynamics has reviewed local planning and development control instruments, government policies and legislation, standards and guidelines that are applicable to the proposal. The relevant sections of this review and the most stringent criteria applicable to this assessment are presented below.

2.1 LOCAL GOVERNMENT AND COUNCIL CRITERIA

2.1.1 PRE-LODGEMENT MEETING NOTES

Acoustic Dynamics has reviewed Council's pre-lodgement meeting comments regarding the proposal and the following comments relevant to this assessment are included below:

"Environmental Health

An acoustic report will need to be prepared to address potential noise issues during demolition, construction and for the development once operational. The report is to address the following but not limited to:

1. *Is noise from the demo and construction going to cause a noise disturbance to the neighbouring residents? How will this be managed?*
2. *Vibration issues that may impact on neighbouring residents during demolition.*
3. *Acoustic report will need to consider location of windows for the residential units, how close are they to air con units outside if applicable, any exhaust outlets that may impact on the residential receivers?*
4. *Pump room on level 1 – will it cause an noise disturbance.*
5. *Noise from vehicle use on Oaks Avenue affecting bedrooms Oaks Avenue,*

6. *Noise from vehicles associated with the development using ground floor – will there be noise impacts to residents on level 1.*

7. *Retail on ground level affecting Units on Level 1,*

8. *Lift noise impacting of residential receivers.*

9. *What form of ventilation is proposed for the kitchen area in each apartment? Odour issue and noise*

10. *Mechanical exhaust needed – inlet and discharge outlet location, smoke odour*

A site specific management plan required. It will need to address how dust/air generation will be managed, how is noise from demolition and construction to be managed and what is the complaints process."

2.1.2 LOCAL PLANNING AND DEVELOPMENT CONTROL INSTRUMENTS

Acoustic Dynamics has reviewed the relevant local planning and development control instruments, including the following documents:

- *Warringah Local Environmental Plan 2011* (LEP); and
- *Warringah Development Control Plan 2011* (DCP).

Acoustic Dynamics' review of the Warringah DCP indicated the following information relevant to this assessment:

*"**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."*

Council can enforce the requirements within the relevant local planning and development control instruments under the *Environmental Planning and Assessment Act of 1979*.

2.2 STATE GOVERNMENT POLICIES AND LEGISLATION

Acoustic Dynamics has conducted a review of the relevant state environmental planning policies, legislative acts and statutory instruments, including the following documents:

- *State Environmental Planning Policy (Exempt and Complying Development Codes) 2008*;
- *Protection of the Environment Operations Act 1997*; and
- *Protection of the Environment Operations (Noise Control) Regulation 2017*.

References to various acoustic requirements applicable to this assessment are summarised below.

2.2.1 STATE ENVIRONMENTAL PLANNING POLICY (EXEMPT AND COMPLYING DEVELOPMENT CODES) 2008

The Codes SEPP includes noise related development standards for the installation of air conditioners, water heaters and pumps on residential premises.

Noise related standards for the installation of air conditioning units include:

*"**2.6 Development standards***

(1) The standards specified for that development, if for residential uses only, are that the development must—

(f1) be designed so as not to operate—

(i) during peak time—at a noise level that exceeds 5 dB(A) above the ambient background noise level measured at any property boundary, or
(ii) during off peak time—at a noise level that is audible in habitable rooms of adjoining residences"

The following definitions are also included:

*"**peak time** means–*

(a) the time between 8:00 am and 10:00 pm on any Saturday, Sunday or public holiday, or
(b) the time between 7:00 am and 10:00 pm on any other day."

*"**off peak time** means any time other than peak time."*

2.2.2 PROTECTION OF THE ENVIRONMENT OPERATIONS ACT 1997

The POEO Act provides generic regulatory instruments that can be applied to manage noise emission from a development site. Acoustic Dynamics advises that the operation of building services and other sources associated with the development not generate *"offensive noise",* as defined within the Act:

*"**offensive noise** means noise–*

(a) that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:

(i) is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or
(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or

(b) that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances, prescribed by the regulations."

2.2.3 PROTECTION OF THE ENVIRONMENT OPERATIONS (NOISE CONTROL) REGULATION 2017

The Noise Control Regulation provides a regulatory response to control noise emission from air conditioning units on residential premises:

"45 Use of air conditioners on residential premises

A person is guilty of an offence if–

(a) the person causes or permits an air conditioner to be used on residential premises in such a manner that it emits noise that can be heard within any room in any other residential premises (that is not a garage, storage area, bathroom, laundry, toilet or pantry) whether or not any door or window to that room is open–

(i) before 8 am or after 10 pm on any Saturday, Sunday or public holiday, or
(ii) before 7 am or after 10 pm on any other day"

2.3 NSW ENVIRONMENT PROTECTION AUTHORITY

Acoustic Dynamics has reviewed various assessment guidelines and criteria published by the NSW Environment Protection Authority (EPA), including the following documents:

- *Noise Policy for Industry 2017* (NPfI);
- *Road Noise Policy 2011* (RNP); and
- *Noise Guide for Local Government 2013* (NGLG).

2.3.1 NOISE POLICY FOR INDUSTRY 2017

The NPfI outlines and establishes noise criteria for industrial and other noise sources in various zoning areas. The following criteria have been applied for the assessment of noise emission associated with the use and operation of the development.

PROJECT INTRUSIVENESS NOISE LEVEL

The intrusiveness noise level is determined as follows:

$L_{Aeq, 15min}$ = rating background noise level + 5 dB	
where:	
$L_{Aeq, 15min}$	represents the equivalent continuous (energy average) A-weighted sound pressure level of the source over 15 minutes.
and	
Rating background noise level	represents the background level to be used for assessment purposes, as determined by the method outlined in Fact Sheets A and B.

PROJECT AMENITY NOISE LEVEL

The recommended amenity noise levels represent the objective for **total** industrial noise at a receiver location, whereas the **project amenity noise level** represents the objective for a noise from a **single** industrial development at a receiver location.

To ensure industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area, a project amenity noise level applies for each new source of industrial noise as follows:

Project amenity noise level for industrial developments = recommended amenity noise level (Table 2.2) minus 5 dB(A)

The NPfI provides exceptions to the above method to derive the project amenity noise level.

Exception 3 states:

> "*Where the resultant project amenity noise level is 10 dB or more lower than the existing industrial noise level. In this case the project amenity noise levels can be set at 10 dB below existing industrial noise levels if it can be demonstrated that existing industrial noise levels are unlikely to reduce over time.*"

2.3.2 ROAD NOISE POLICY 2011

The RNP document provides road traffic noise criteria for proposed roads as well as other developments with the potential to have an impact in relation to traffic noise generation.

The noise criteria applicable to the subject site is presented below.

Table 2.2 Road Traffic Noise Assessment Criteria for Residential Land Uses

Road category	Type of project / land use	Assessment Criteria [dB]	
		Day (7am – 10pm)	Night (10pm – 7am)
Local roads	6. Existing residences affected by **additional traffic** on existing local roads generated by land use developments	$L_{Aeq,\ (1\ hour)}$ 55 (external)	$L_{Aeq,\ (1\ hour)}$ 50 (external)

Accepted application of the Section 2.4 of the RNP is that where road traffic noise levels already exceed the assessment criteria, an increase of less than 2 dB represents a minor impact that is barely perceptible to the average person.

2.3.3 SLEEP DISTURBANCE CRITERION

Acoustic Dynamics advises that sleep disturbance is a complex issue, and the potential for sleep disturbance to occur depends on both the level of noise at a residential receiver, and the number of events that occur.

The NSW EPA has investigated overseas and Australian research on sleep disturbance. The assessment of noise for sleep disturbance relies on the application of a screening that indicates the potential for this to occur. The EPA's NGLG provides the following guidance for such a screening test:

> *"Currently, there is no definitive guideline to indicate a noise level that causes sleep disturbance and more research is needed to better define this relationship. Where likely disturbance to sleep is being assessed, a screening test can be applied that indicates the potential for this to occur. For example, this could be where the subject noise exceeds the background noise level by more than 15 dB(A). The most appropriate descriptors for a source relating to sleep disturbance would be $L_{A1(1\ minute)}$ (the level exceeded for 1% of the specified time period of 1 minute) or L_{Amax} (the maximum level during the specified time period) with measurement outside the bedroom window."*

Additionally, the guidelines of the NPfI provide the following additional information:

> *"Where the subject development/premises night-time noise levels at a residential location exceed:*
> - *$L_{Aeq,15min}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater; and/or*
> - *L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is greater".*

Further to the above information, the following summarizes the sleep disturbance criterion:

$L_{Aeq,15min} \leq 40$ dB or $L_{Aeq,15min} \leq$ (RBL + 5 dB), whichever is greater

AND

L_{Amax} or $L_{A1(1\ minute)} \leq L_{A90}$ + 15 dB or 52 dB(A), whichever is greater

In addition to the above, the EPA has previously published the following additional information relating to findings of significant research carried out for sleep disturbance:

> *"Maximum internal noise levels below 50-55 dBA are unlikely to cause awakening reactions… One or more noise events per night, with maximum internal noise levels of 65-70 dBA, are not likely to affect health and wellbeing significantly."*

3 NOISE MEASUREMENT EQUIPMENT AND STANDARDS

All measurements were conducted in general accordance with AS 1055.1:2018 *Acoustics – Description and Measurement of Environmental Noise Part 1: General Procedures*. Sound measurements were carried out using precision sound level meters conforming to the requirements of IEC 61672.1:2002 *Electroacoustics: Sound Level Meters – Part 1: Specifications*. The instrumentation used during the survey is set out in **Table 3.1**.

Table 3.1 Noise Survey Instrumentation

Type	Serial Number	Instrument Description
2250	2679541	Brüel & Kjaer Modular Precision Sound Level Meter
4189	2670479	Brüel & Kjaer 12.5 mm Prepolarised Condenser Microphone
4230	1234136	Brüel & Kjaer Acoustic Calibrator
EL-316	16-306-020	ARL Environmental Noise Logger

The reference sound pressure level was checked prior to and after the measurements using the acoustic calibrator and remained within acceptable limits.

4 OPERATIONAL NOISE EMISSION ASSESSMENT

The following section provides an assessment of environmental noise impacts and operational noise emission associated with the use of the development at the closest receiver properties, against the various noise criteria and objectives.

4.1 PROJECT NOISE EMISSION CRITERIA AND OBJECTIVES

To establish the acoustic environment at the subject site in accordance with the guidelines of the NPfI, unattended noise monitoring was conducted between Wednesday 6 December 2023 and Wednesday 13 December 2023. The noise logger was shielded from direct noise associated with vehicular traffic or mechanical plant associated with the development.

Acoustic Dynamics advises the measurement location, shown in **Appendix A**, is representative of the existing noise environment of the nearest sensitive receivers. Results from the long-term noise monitoring are presented in **Appendix B**.

Following the general procedures of the NPfI, a summary of the established noise environment is presented below.

Table 4.1 Measured External Noise Levels and Project Noise Objectives for Nearest Receivers

Location	Assessment Period	L_{A90} Rating Background Noise Level (RBL) [dB]	Measured L_{Aeq} Noise Level [dB]	Project Intrusiveness Noise Level $L_{Aeq,15min}$ [dB]	Project Amenity Noise Level $L_{Aeq,15min}$ [dB]	Project Noise Trigger Level $L_{Aeq,15min}$ [dB]
Residential Receivers	Day (7am[1] to 6pm)	56	67	61	57[3]	**57**
	Evening (6pm to 10pm)	53	64	58	54[3]	**54**
	Night (10pm to 7am[1])	42	60	47	50[3]	**47**
Commercial Receivers	At any time	—	—	—	60	**60**

Note: 1) 8:00am on Sundays and public holidays.

2) Amenity adjustment based on "*Urban*" residential receiver type. Acoustic Dynamics advises that the amenity level has been set as 10 dB below the existing industrial noise levels (i.e. **$L_{Aeq,\ period}$ – 10 dB**), in accordance with NPfI exception 3. Due to the numerous items of existing mechanical plant servicing tenancies and commercial developments within close proximity to the site, the existing industrial noise levels are unlikely to reduce over time.

3) Project Noise Trigger Level is the lowest value of Project Intrusiveness or Project Amenity Noise Level after conversion to the L_{Aeq} equivalent value.

Acoustic Dynamics advises that external emission from additional road traffic on surrounding roads must not exceed the following noise levels, in accordance with the EPA's RNP:

Table 4.2 Road Traffic Noise Assessment Criteria for Residential Land Uses

Receiver Location	Assessment Criteria [dB]	
	Day (7am – 10pm)	Night (10pm – 7am)
Nearest property boundary of residential receiver	$L_{Aeq,\ (1\ hour)}$ 55 (external)	$L_{Aeq,\ (1\ hour)}$ 50 (external)

In accordance with the EPA's NGLG and NPfI guidelines outlined in **Section 2.4**, the following sleep disturbance screening criterion has been applied for this project:

Sleep Disturbance Criteria:
$L_{Aeq,15min}$ **≤ 47 dB**
AND
L_{Amax} or $L_{A1(1\ minute)}$ **≤ 57 dB**

Acoustic Dynamics advises that achieving compliance with the relevant noise emission objectives applicable at the boundaries of the nearest sensitive receivers will adequately protect the acoustic amenity of all nearby receivers.

4.2 NOISE EMISSION ASSESSMENT METHODOLOGY

Acoustic modelling was undertaken using noise modelling software *(CadnaA Version 2023)*. CadnaA calculates environmental noise propagation according to the applicable international and ISO standards, including the ISO 9613 algorithm.

Within our calculations and acoustic modelling, noise emission contributions from the development have been considered taking the following factors into account:

- Airborne noise losses due to distance and ground topography;
- Losses due to direction and diffraction;
- Increases due to reflections; and
- Acoustic shielding.

The following assumptions were made regarding the noise model configuration:

1. All development facades are constructed to be of hard, reflective surfaces;

2. All four (4) commercial retail tenancies will operate during typical business hours of 7:00am until 6:00pm;

3. All four (4) commercial retail tenancies will be serviced by air-conditioning systems located within the basement, during business hours only;

4. All residential units will be serviced by individual split ducted air-conditioning systems located on resident balconies on the northern and southern facades only, which will operate at normal capacity between 7:00am and 10:00pm, and reduced capacity at night time (estimated 50% of units operational at any moment in time;

5. A car park exhaust fan will be located within the basement, with discharge on the development rooftop;

6. The car park exhaust fan will be programmed to operate only when carbon monoxide levels exceed a set point and is unlikely to operate at night-time;

7. All other mechanical ventilation units and pumps (waste services, pump room, communications room) will be located within the basement and ducted with discharge on the rooftop, where required;

8. An estimated maximum of 60 resident vehicles will enter or leave the residential car park, using the available 20 number of spaces within any 60-minute period; and

9. The communal open space will be open to residents for passive recreational use, with an estimated conservative maximum of 30 occupants using the space at any time between the hours of 7:00am and 10:00pm only.

Further to the above, **Scenario A** is defined as development operations between 7:00am and 10:00pm, and **Scenario B** is defined as development operations between 10:00pm and 7:00am (or 8:00am on weekends and public holidays). Noise prediction results for these scenarios are presented within the following sections.

4.3 NOISE SOURCES AND OPERATIONS

Acoustic Dynamics has assessed the following noise sources and operations. The noise data presented below has been established based on information provided by the proponent, short-term measurements and inspections conducted on-site, or referenced from our database of nearfield measurements at similar developments.

Acoustic Dynamics advises that mechanical plant information was not available at the time this report was prepared and has assumed that any mechanical plant servicing the development will be appropriately selected and located prior to obtaining construction certification.

Table 4.3 Associated Noise Sources and Operations

Source	Quantity	Source Sound Power Level L_w [dB(A)]
Communal Areas		
Groups of three residents, one talking normally and the other two listening	10	68
Mechanical Equipment		
Car park supply / exhaust fans discharge on rooftop	2	85
Other plant room exhaust fans discharge on rooftop	6	70
Small (single fan) residential condenser unit	20	65
Vehicle Movements		
Garbage truck, driving at a speed of 5 km/h	20 / 15 min	92
Resident vehicles, driving at a speed of 5 km/h	60 / 1 hr	81

4.4 NEAREST RECEIVERS

The cumulative noise impact has been assessed to the potentially most affected point at the adjacent sensitive receiver properties and presented below.

Table 4.4 Nearest Sensitive Receiver Locations

Source	Location	Direction
Residential Receivers		
R_1	888 Pittwater Road, Dee Why	North
R_2	30 Pacific Parade, Dee Why	South
R_3	28 Pacific Parade, Dee Why	South
Commercial Receivers		
B_1	23 Oaks Avenue, Dee Why	East
B_2	19 Oaks Avenue, Dee Why	West

Acoustic Dynamics advises that by achieving compliance with the nearest sensitive receiver locations, compliance will also be achieved at all other sensitive receiver locations further away.

4.5 EXTERNAL NOISE EMISSION LEVELS

The calculated maximum external noise emission levels at the nearest receiver locations are presented against the relevant noise emission criteria below.

The assessment location for **external noise emission** is defined as the most affected point on or within any sensitive receiver property boundary. Examples of this location may be:

- 1.5m above ground level;
- On a balcony at 1.5m above floor level; and
- Outside a window on the ground or higher floors, at a height of 300mm below the head of the window.

Acoustic Dynamics advises the calculated **external** noise emission levels are conservatively based on **maximum capacity** operations at the development. Acoustic Dynamics advises that such a scenario is unlikely to occur and noise levels are likely to be below those calculated for the majority of the time.

Table 4.5 Calculated External Noise Emission Levels & Relevant Noise Criteria (Scenario A)

Receiver	Assessment Period	Noise Source[2]	Maximum $L_{Aeq(1hr/15min)}$ Noise Emission Level [dB][3,4]	Noise Emission L_{Aeq} Criterion [dB]	Complies ?
R_1	Day & Evening (7:00am[1] to 10:00pm)	Commercial Areas	32	**54**	**Yes**
		Mechanical Plant	39		
		Vehicle Movements	30		
		Cumulative Total	**40**		
R_2		Commercial Areas	3		**Yes**
		Mechanical Plant	43		
		Vehicle Movements	Negligible		
		Cumulative Total	**43**		
R_3		Commercial Areas	1		**Yes**
		Mechanical Plant	40		
		Vehicle Movements	Negligible		
		Cumulative Total	**40**		
B_1	Day (7:00am to 6:00pm)	Commercial Areas	44	**63**	**Yes**
		Mechanical Plant	40		
		Vehicle Movements	35		
		Cumulative Total	**45**		
B_2		Commercial Areas	44		**Yes**
		Mechanical Plant	49		
		Vehicle Movements	41		
		Cumulative Total	**50**		

Note: 1) 8:00am on weekends and public holidays.

2) Scenario operations, noise sources and modelling assumptions are detailed in **Section 4.2** and **Section 4.3**.

3) Acoustic Dynamics assumes noise sources will operate continuously over the assessment period.

4) Includes the benefits of recommendations outlined in **Section 6**.

Table 4.6 Calculated External Noise Emission Levels & Relevant Noise Criteria (Scenario B)

Receiver	Assessment Period	Noise Source[1]	Maximum $L_{Aeq(1hr/15min)}$ Noise Emission Level [dB][2,3]	Noise Emission L_{Aeq} Criterion [dB]	Complies ?
R_1	Night (10:00pm to 7:00am)	Mechanical Plant	38	**47**	**Yes**
		Vehicle Movements	27		
		Cumulative Total	**38**		
R_2		Mechanical Plant	41		**Yes**
		Vehicle Movements	Negligible		
		Cumulative Total	**41**		
R_3		Mechanical Plant	38		**Yes**
		Vehicle Movements	Negligible		
		Cumulative Total	**38**		

Note: 1) Scenario operations, noise sources and modelling assumptions are detailed in **Section 4.2** and **Section 4.3**.
2) Acoustic Dynamics assumes noise sources will operate continuously over the assessment period.
3) Includes the benefits of recommendations outlined in **Section 6**.

4.6 ROAD TRAFFIC NOISE LEVELS

Acoustic Dynamics understands that residents and visitors who drive will access the development via surrounding local roads. Vehicles utilising local roads are assessed in consideration of the relevant RNP criteria.

The calculated maximum noise emission levels at the nearest residential receivers, due to vehicles utilising surrounding local roads, are presented below. The predicted nose levels are based on an estimated maximum number of 60 vehicles along Oaks Avenue during an early morning peak hour period.

Acoustic Dynamics advises that by achieving compliance with the nearest sensitive receiver locations, compliance will also be achieved at all other sensitive receiver locations further away.

Table 4.7 Calculated Road Traffic Noise Emission Levels & Relevant Noise Criteria

Sensitive Receiver	Predicted Maximum $L_{Aeq,1hr}$ Sound Pressure Level [dB][1]	Relevant $L_{Aeq,1hr}$ Criterion [dB][2,3]	Complies?
Residential receivers along Oaks Avenue	43	**50**	**Yes**

Note: 1) Predicted L_{Aeq} noise level is the maximum noise level measured within a 1-hour period.
2) Measured noise level within a 1-hour period during the night-time assessment period (10:00pm until 7:00am on weekdays, or 8:00am on weekends and public holidays).
3) Compliance with this most sensitive assessment period criterion ensures compliance during all other less stringent assessment periods.

4.7 SLEEP DISTURBANCE

Acoustic Dynamics has determined the potential maximum $L_{A1(60\,Sec)}$ **external** noise emission level from the development resulting from closing car doors along Oaks Avenue, when measured at the nearest residential receivers during the night-time assessment period.

Table 4.8 Calculated Maximum Instantaneous External Noise Levels & Relevant Noise Criteria

Sensitive Receiver	Source	Predicted Maximum L_{Amax} Sound Pressure Level [dB][1]	L_{Amax} Sleep Disturbance Criterion [dB][2]	Complies?
Residential receivers along Oaks Avenue	Closing Car Doors	45	**57**	**Yes**

Note: 1) Predicted L_{Amax} noise level is the maximum instantaneous measured noise level.
2) Maximum instantaneous noise level measured during the night-time assessment period (10:00pm until 7:00am on weekdays, or 8:00am on weekends and public holidays).

Acoustic Dynamics advises that instantaneous noise events that exceed the external sleep disturbance criterion at the nearest residential receivers are unlikely to cause awakening reactions, following incorporation of the recommendations provided in **Section 6**.

5 DISCUSSION

Our assessment of the various acoustic impacts associated with the proposed development indicate the following:

1. Noise emission resulting from the ongoing use and operations of the proposed development is **predicted to comply** with the relevant noise emission criteria of Northern Beaches Council, the NSW EPA and applicable legislation during the proposed hours of operation when assessed at the nearest sensitive receivers, following the incorporation of the construction and design recommendations in **Section 6**;

2. Noise emission associated with additional traffic on surrounding local roads is **predicted to comply** with the NSW EPA when assessed at the nearest sensitive receivers;

3. Maximum instantaneous external noise events are **predicted to comply** with the NSW EPA's guidelines on sleep disturbance when assessed at the nearest sensitive receivers;

4. Acoustic Dynamics advises that instantaneous noise events that exceed the external sleep disturbance criterion at the nearest residential receivers are unlikely to cause awakening reactions, following incorporation of our recommendations in **Section 6**;

5. There is **low risk** of acoustic disturbance to the nearest sensitive residential, commercial and industrial receivers during the proposed hours of operation;

6. To ensure the assessment is conducted in a conservative manner, noise emission has been assessed as a **worst-case** scenario (i.e. all noise generating activities and noise sources occurring simultaneously and at maximum capacity). Generally, noise emission associated with the operation of the facility is **predicted to be lower** than the calculations presented; and

7. The noise calculations and operational assumptions should not be considered prescriptive. They are modelling assumptions that have been used to demonstrate typical noise sources and operations associated with the facility **can be designed to achieve compliance** with the relevant criteria.

6 RECOMMENDATIONS AND DESIGN ADVICE

The following recommendations are provided to ensure the development is designed and constructed to achieve compliance with the relevant acoustic requirements.

Acoustic Dynamics advises the following recommendations are general in nature and understands that specific acoustic aspects of the development will be reviewed and finalised through the design development stages.

The following recommendations may be adjusted during the preparation of construction documentation once detailed information for the project has been prepared and reviewed by an appropriately qualified acoustic consultant.

6.1 BUILDING NOISE MANAGEMENT PLAN

Acoustic Dynamics recommends the consideration of a building noise management plan incorporating best management practices and procedures to protect the acoustic amenity of building occupants and the surrounding area. Such a plan may be prepared and enforced by the managing Strata Committee.

Such a management plan should outline policies and procedures to ensure noise emission from the development is kept to a minimum, including:

1. Noise and vibration induction of all site staff, including the explanation of noise and vibration control and a discussion of project specific reduction strategies;

2. All guests should be made aware of the potential for causing disturbance to neighbours and that they are to conduct themselves in a manner that does not adversely impact the amenity of neighbouring residents;

3. Ensure guests arrive and leave in a quiet and sensible manner to minimise any potential impacts on the surrounding amenity, including signage reminding guests to be aware of their neighbours and to conduct themselves in a quiet manner;

4. All common areas will require careful management to ensure guests are not engaging in behaviour that could cause offence to neighbouring residents. Types of potentially offensive behaviour may include:

    - Excessively loud talking;
    - Excessive loud laughter;
    - Inadequate control or supervision of children;
    - Mobile phone conversations in external areas of the property;
    - Playing of music (stereo/hi-fi, phone speaker, boom box, guitars or similar); or
    - Any other similar types of behaviour;

5. Outdoor common areas should be restricted to daytime and evening hours only (i.e. no use prior to 7:00am or after 10:00pm);

6. A night-time noise curfew should be implemented for the internal areas of the development (i.e. no loud noise generating activities to occur in internal areas after 10:00pm or prior to 7:00am. This would include excessive television volume, music or conversations);

7. The idling of cars or lengthy conversations/phone calls within the driveway area, particularly during the early morning and late-night period is to be strictly discouraged;

8. Impact noise due to entry doors and gates closing should be suitably addressed. Gates should have an anti-gate slammer to prevent forced closing of the gate. All entry doors should be securely fastened to ensure vibration or rattling noise is reduced with rubber seals installed to reduce surface impact noise; and

9. Implementation of an appropriate community liaison procedure, including a noise and vibration complaint procedure and means of ongoing communication with nearby potentially affected receivers once development operations begin.

6.2 MECHANICAL SERVICES

Acoustic Dynamics understands that specific items of mechanical plant have not yet been selected. To achieve compliance with the relevant noise emission criteria, Acoustic Dynamics advises that mechanical plant should be selected such that the overall sound power levels of items do not exceed the levels specified below:

Table 6.1 Recommended Maximum Sound Power Levels for Mechanical Plant

Source	Recommended Maximum Sound Power Level L_w [dB(A)]
Car park supply / exhaust fan outlets (at rooftop)	75
Other rooftop supply / exhaust outlets (at rooftop)	65
Domestic exhaust outlets (at facade or rooftop)	50
Small residential condenser units (on balconies)	65[1]

Note: 1) Condenser units shall be appropriately located such that sufficient shielding is provided and they are directed away from residential receivers.

The following recommendations for mechanical plant are also provided:

1. All items of mechanical plant shall be isolated from the wall and supporting structure with rubber pads to prevent the transmission of vibration from the condenser units;

2. If located on residential balconies, air condenser units must be oriented away from residential receivers and appropriately positioned behind structures that can provide an appropriate level of shielding, such as a solid balustrade or retaining wall;

3. Access doors to fans located within plant rooms shall be sealed with neoprene gaskets to provide an airtight seal between the door and frame;

4. All connections between fans, ductwork, pipes and pipe connectors shall be properly aligned using a suitable flexible material, and all penetrations shall be acoustically sealed;

5. Acoustic Dynamics recommends the ductwork connecting all domestic exhaust fans to the exhaust grilles be lined internally with rockwool of minimum thickness 25 mm, or equivalent;

6. All pumps and motor assemblies shall be selected with the highest efficiency and fitted with efficient muffler or silencer design. Where feasible, consider using quieter engines, such as electric instead of internal combustion;

7. Where feasible, all pumps and motor assemblies shall be mounted on a concrete filled inertia block and completely isolated from the supporting building structure; and

8. Where necessary, consider using efficient pump enclosures to minimise noise emission.

Acoustic Dynamics recommends that a full **mechanical noise emission assessment** be completed by an appropriately qualified acoustical consultant prior to obtaining construction certification.

6.3 BASEMENT LEVEL CAR PARK

The following recommendations are provided to minimise structural vibration transmission and floor slab excitation to the various areas of the development and surrounding area:

1. Vehicular crossing points and access driveways should be smooth and free of deformities to avoid impact noises. A broom floor finish is recommended to minimise squealing or traction noise from vehicle tyres;

2. Expansion joints at vehicle circulation paths shall be minimised, where feasible;

3. Speed bumps and wheel stops should be avoided, where feasible. Where speed bumps and wheel stops are required, resilient rubber wheel stops shall be installed; and

4. All car park roller door components such as the motor, roller tracks and guides or other mountings should be decoupled from the building structure through the use of resilient pads, mounts and fittings.

6.4 INTERNAL ACOUSTIC PRIVACY

Acoustic Dynamics understands that specific materials and construction specifications of internal partitions are yet to be determined and will be finalised prior to obtaining construction certification.

At this stage of the design, Acoustic Dynamics considers that the development can be designed to achieve compliance with the Building Code of Australia (BCA) during the finalisation of construction documentation. It is recommended that a full **internal acoustic privacy assessment** be conducted by an appropriately qualified acoustical consultant prior to obtaining construction certification.

6.5 COMMERCIAL TENANCIES

Acoustic Dynamics understands the three (3) commercial tenancies on the ground floor are to be used for retail use.

Acoustic Dynamics has considered noise emission from these tenancies and predicts the operation of these tenancies will have negligible acoustic impact on neighbouring residential occupants. At this stage of the development design, Acoustic Dynamics considers that the tenancies can be designed to ensure the acoustic impacts on the surrounding environment is minimised, prior to finalising construction certification.

If these tenancies propose to operate as anything other than typical commercial retail, Acoustic Dynamics recommends that an **operational noise emission assessment** be conducted for each retail tenancy prior to occupancy.

6.6 BUILDING MATERIAL CERTIFICATION

Acoustic Dynamics advises that all building materials specified must be tested and certified by a locally recognised and accepted testing agency in respect of their intended use. Where appropriate, materials and noise mitigation measures specified by Acoustic Dynamics must be certified by a locally recognised and qualified professional for suitability (structural, wind loading, or other) for the intended use.

7 CONCLUSION

Acoustic Dynamics has conducted an acoustic assessment of external noise intrusion, internal acoustic privacy and operational noise emission for the proposed residential development located at 21 Oaks Avenue, Dee Why, NSW.

A review of the applicable local planning and development control instruments, government policies and legislation, and various standards and guidelines was conducted in accordance with the requirements of:

(a) Northern Beaches Council;
(b) The NSW Department of Planning and Environment;
(c) The NSW Environment Protection Authority;
(d) The Australian Building Codes Board; and
(e) Australian Standards.

Further to our calculations and noise modelling in **Section 5**, Acoustic Dynamics advises that noise emission associated with the proposed development is predicted to comply with the relevant requirements of Northern Beaches Council and the NSW EPA and that the acoustic amenity of all nearby receivers will be adequately protected, following the implementation of the recommendations provided within **Section 6**.

Acoustic Opinion

Further to our site survey, noise monitoring and measurements, our review of the relevant acoustic criteria and requirements, and our calculations, Acoustic Dynamics advises that the proposal can be designed to comply with the relevant acoustic criteria of Northern Beaches Council, the NSW EPA and Australian Standards with the incorporation of our recommendations detailed within this report.

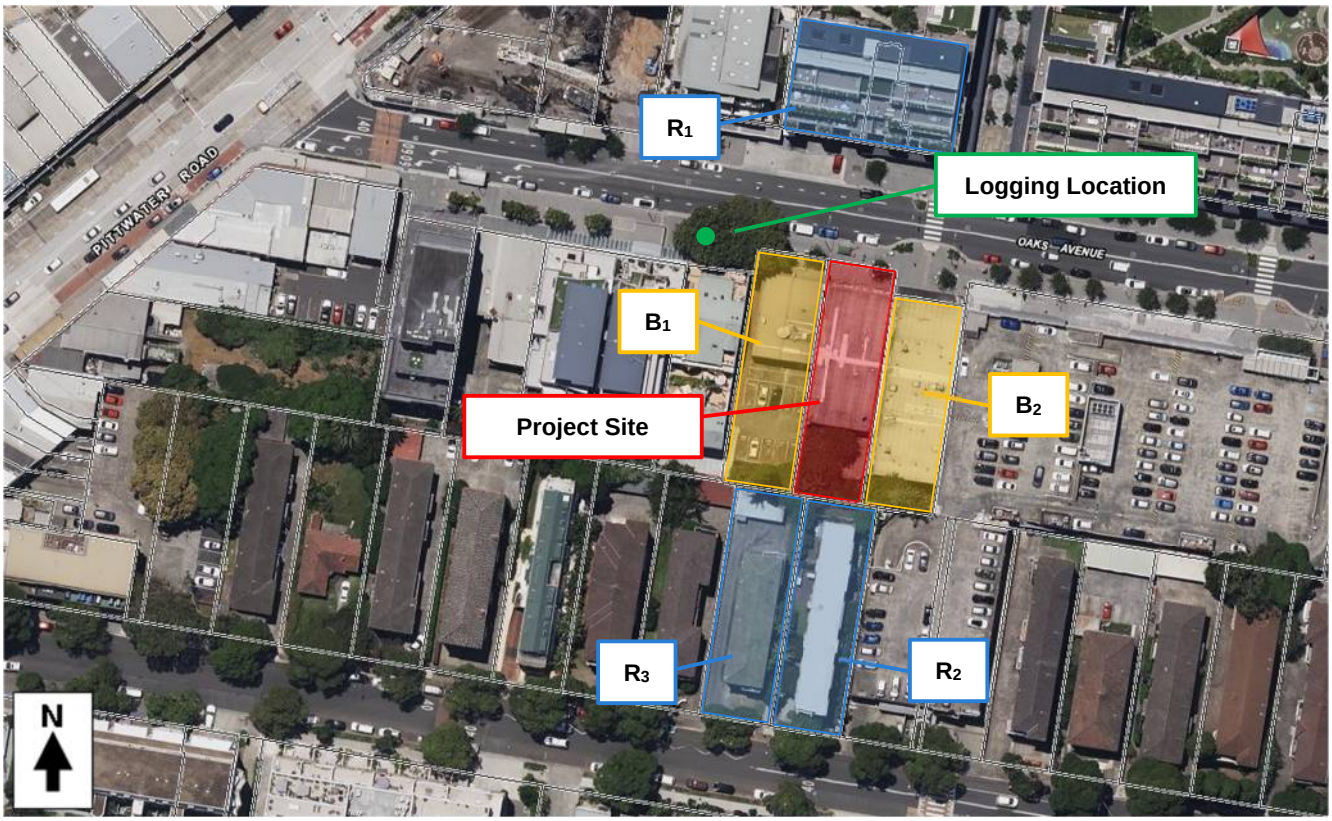
It is our opinion that the acoustic risks associated with the proposal can be adequately controlled and the amenity of all residents and neighbouring properties can be satisfactorily protected.

We trust that the above information meets with your present requirements and expectations. Please do not hesitate to contact us on 02 9908 1270 should you require more information.

APPENDIX A — LOCATION MAP, AERIAL IMAGE AND DRAWINGS

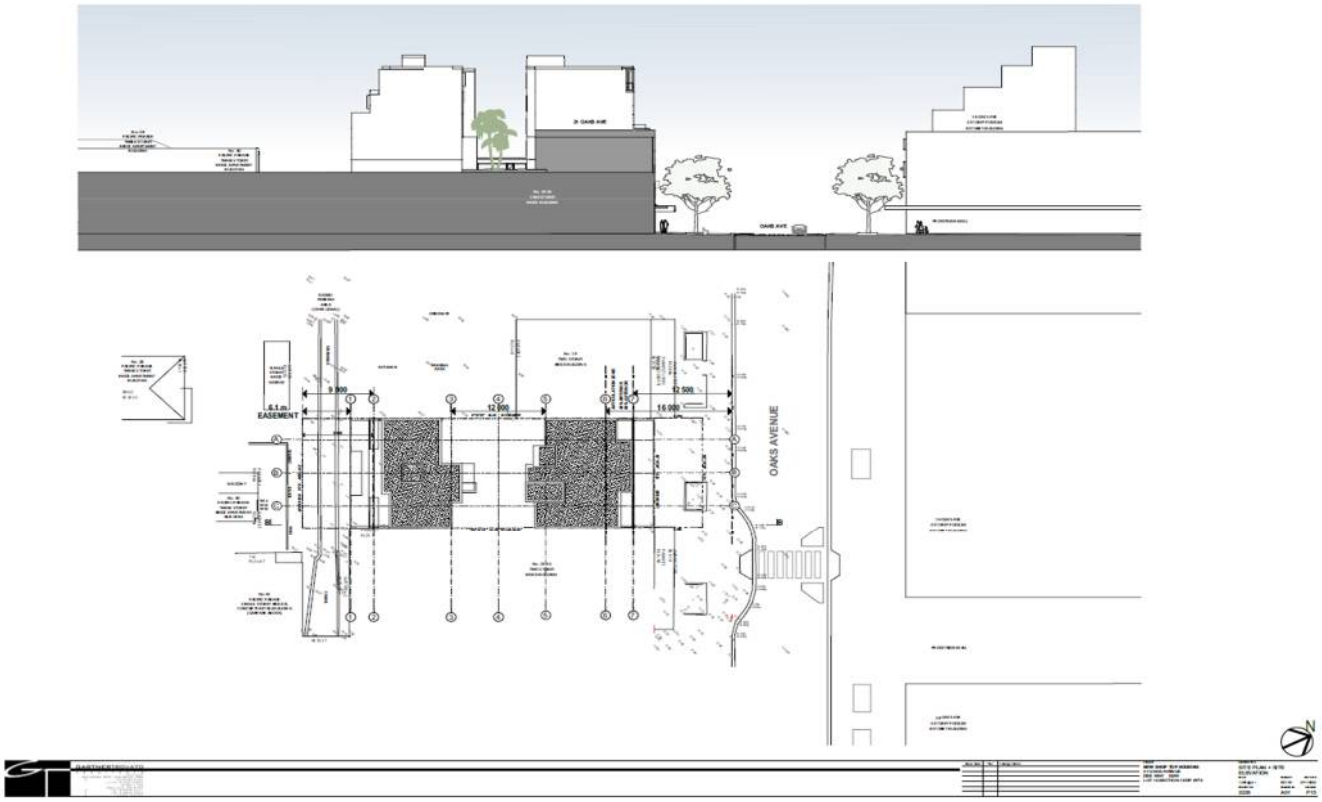
A.1 LOCATION MAP (COURTESY OF SIX MAPS)

A.2 AERIAL IMAGE (COURTESY OF SIX MAPS)

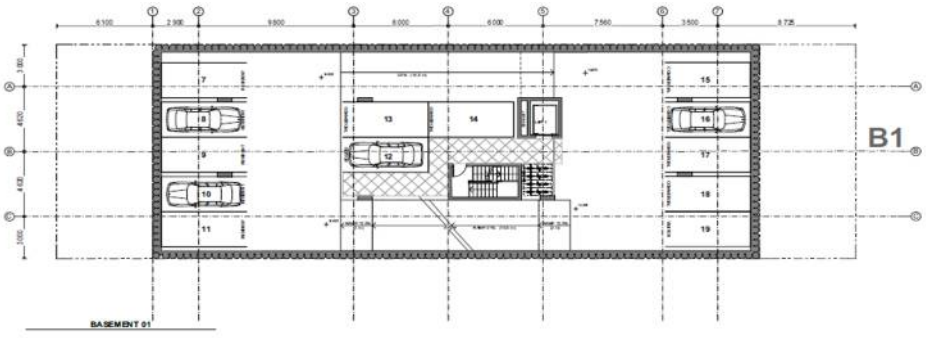


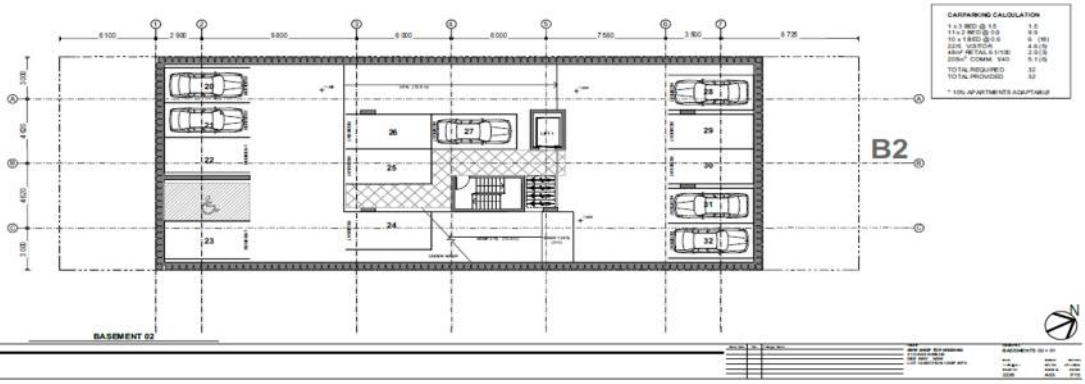
A.3 ARCHITECTURAL PLANS (COURTESEY OF GARTNER TROVATO)

A.3.1 SITE PLAN AND SITE ANALYSIS PLAN

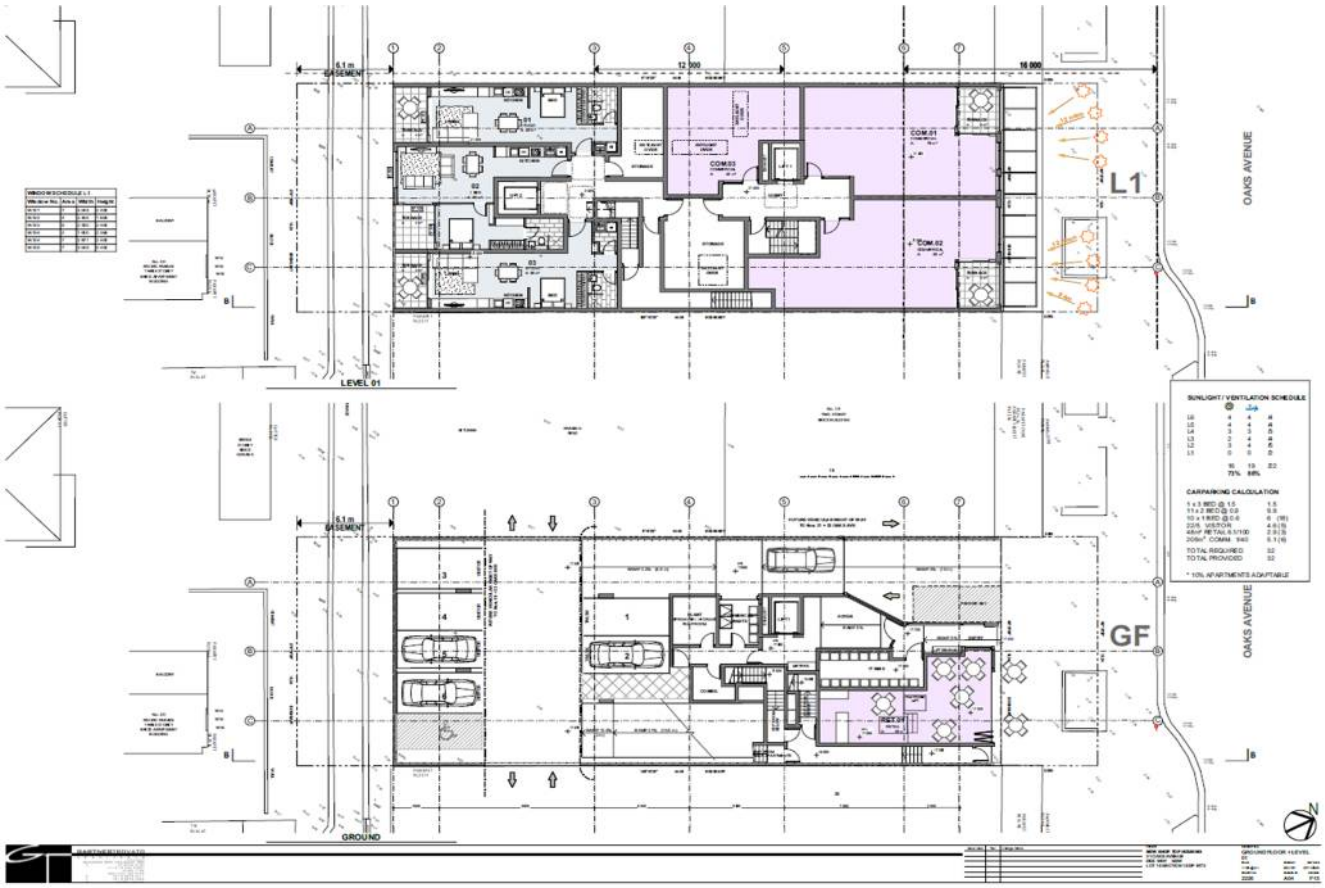


A.3.2 BASEMENTS B1 AND B2





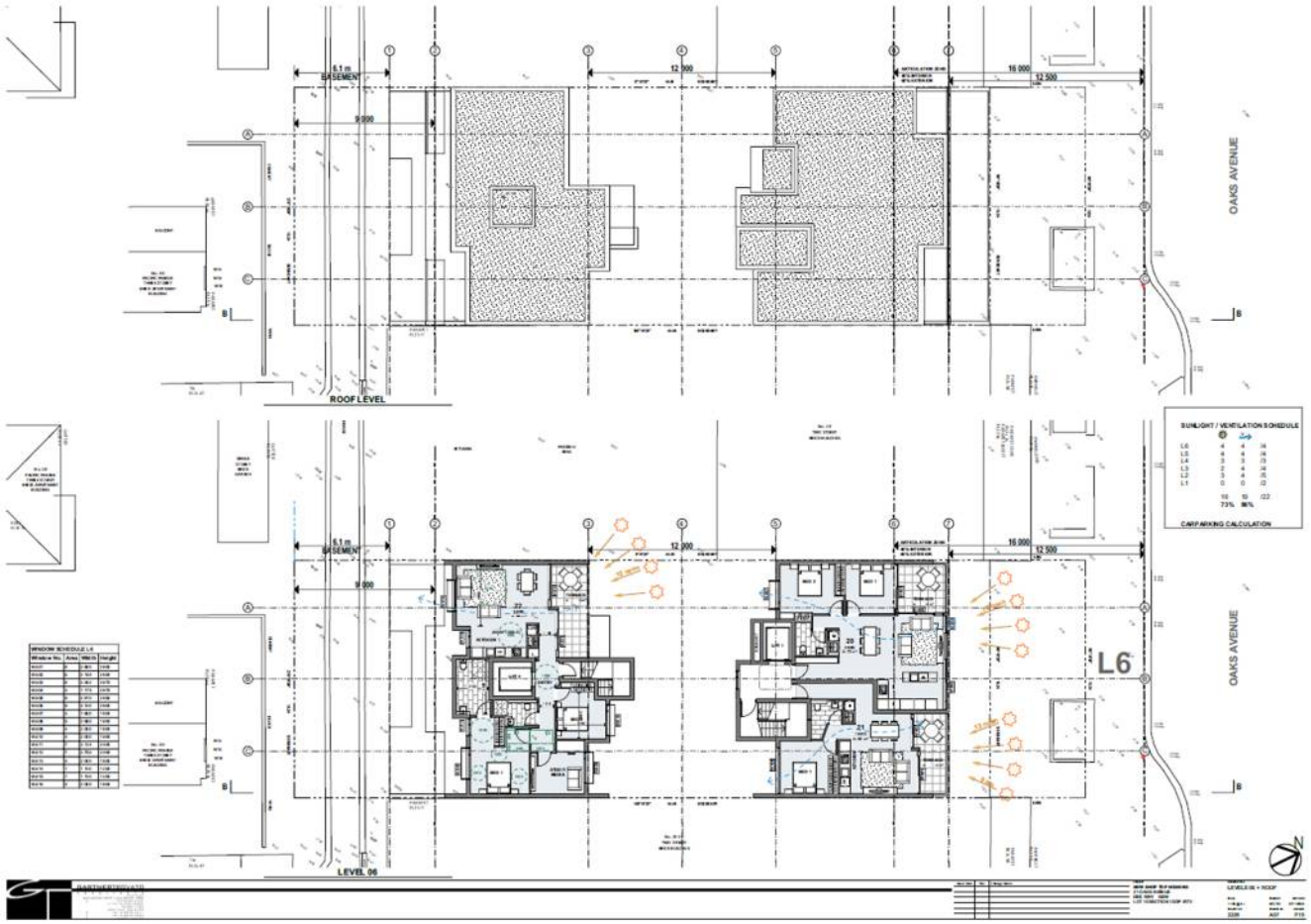
A.3.3 GROUND FLOOR AND LEVEL L1



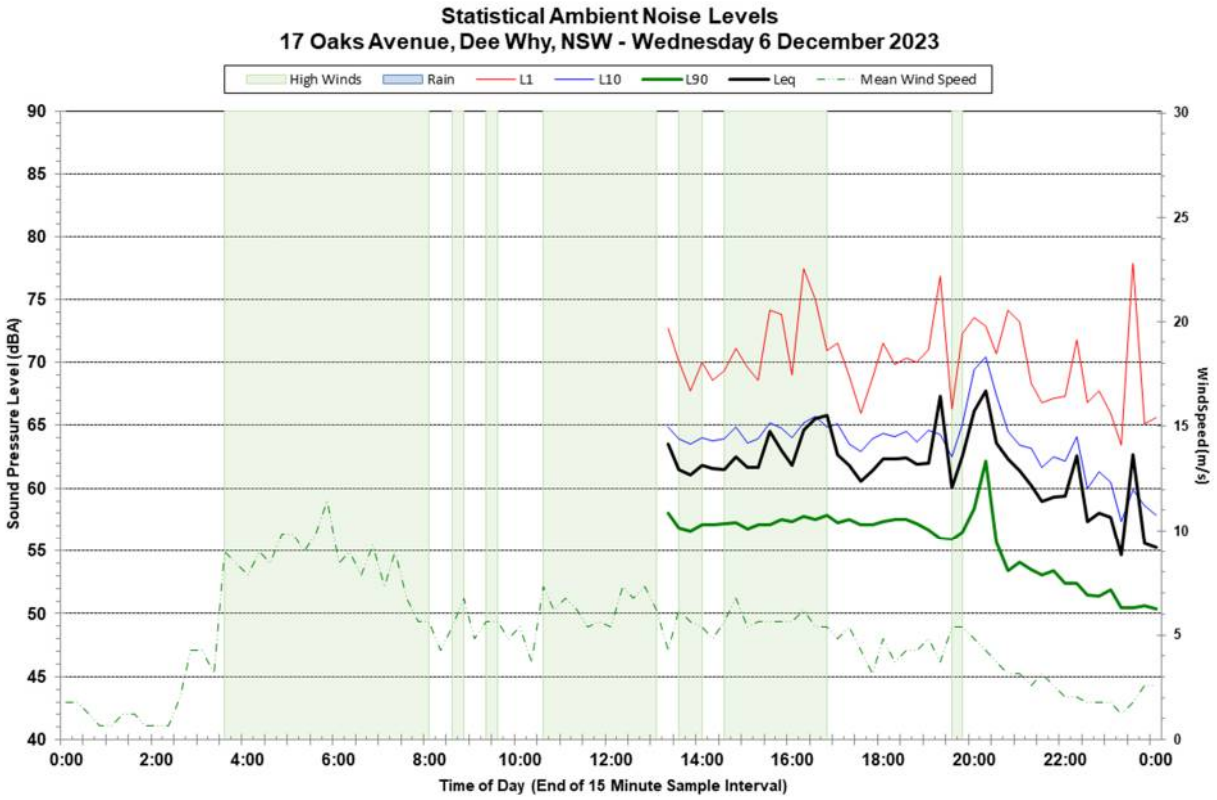
A.3.4 LEVELS L2 AND L3

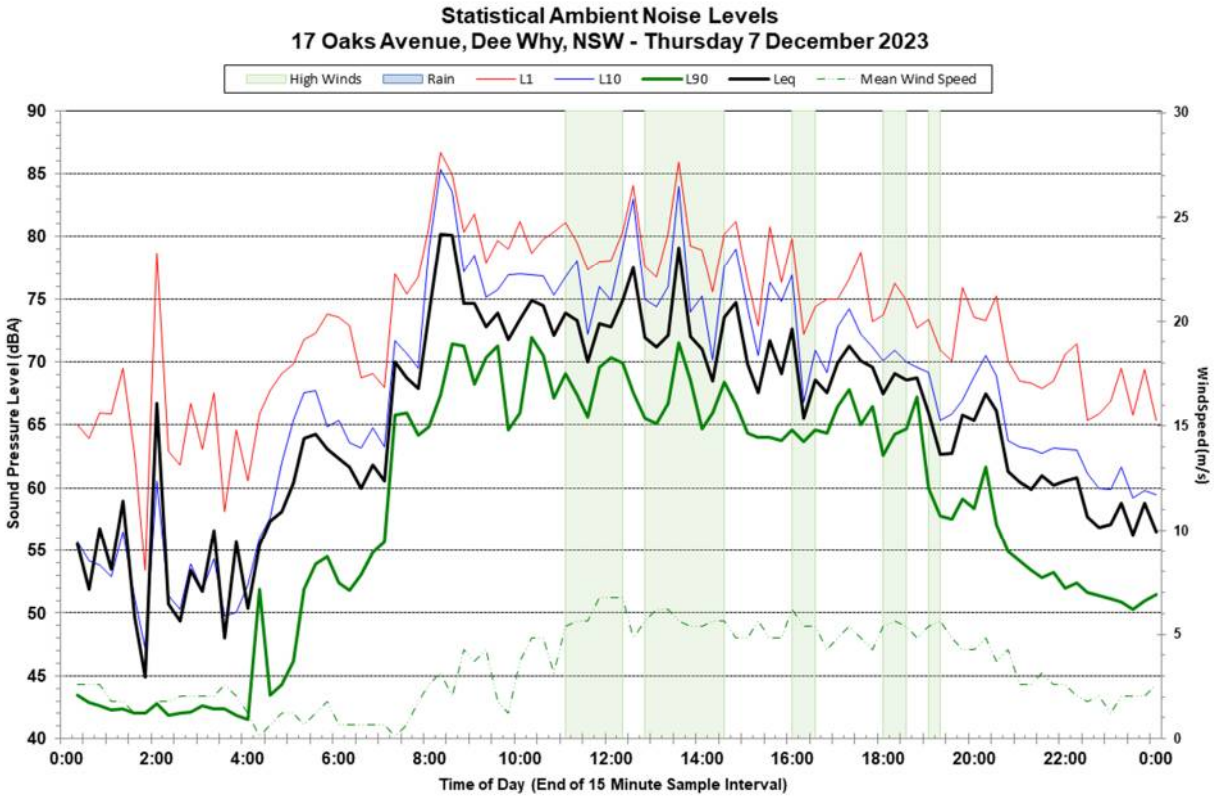
A.3.5 LEVELS L4 AND L5

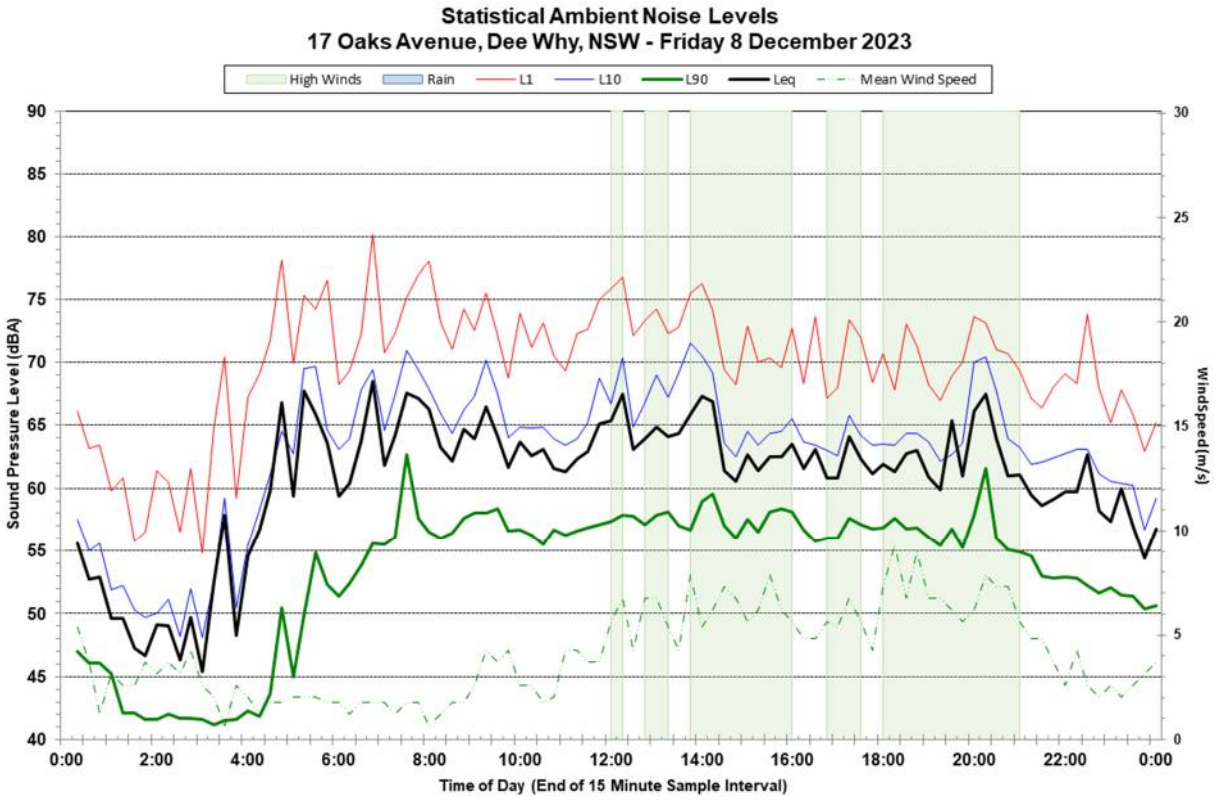
A.3.6 LEVELS L6 AND ROOF

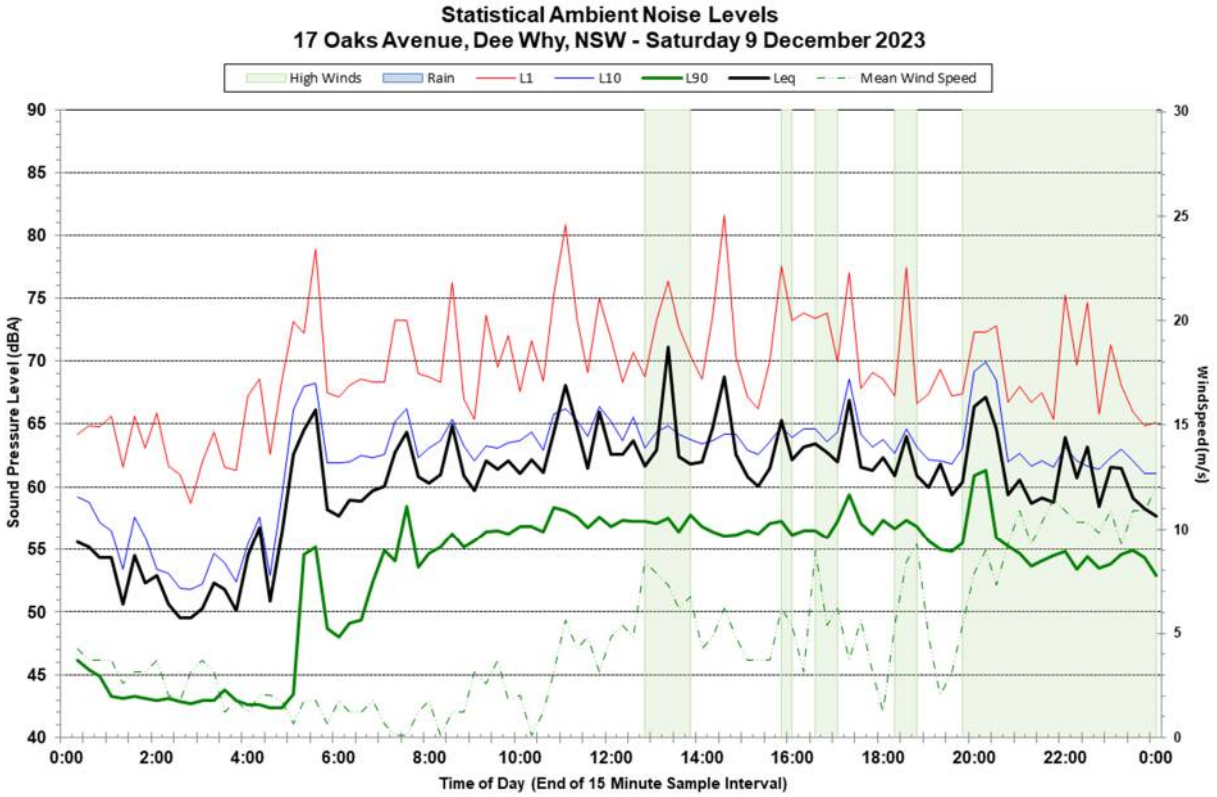


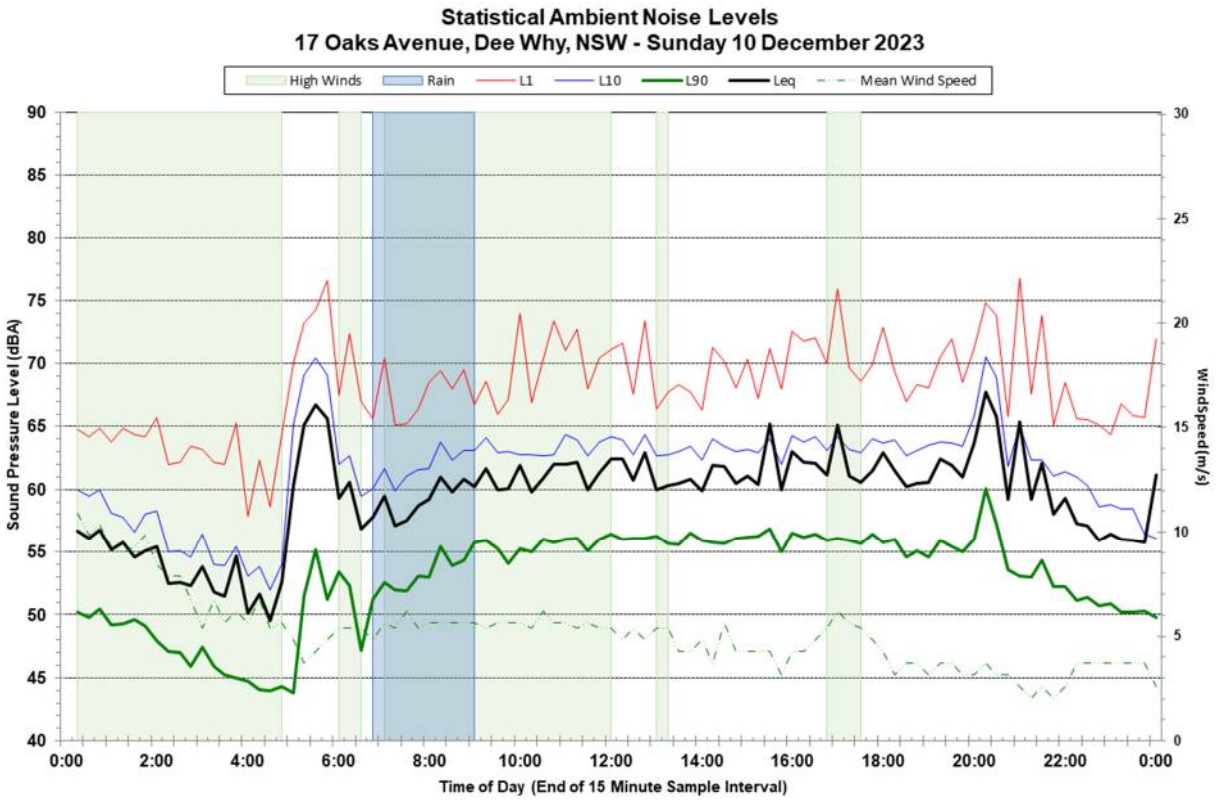
APPENDIX B — UNATTENDED NOISE MONITORING STATISTICAL GRAPHS

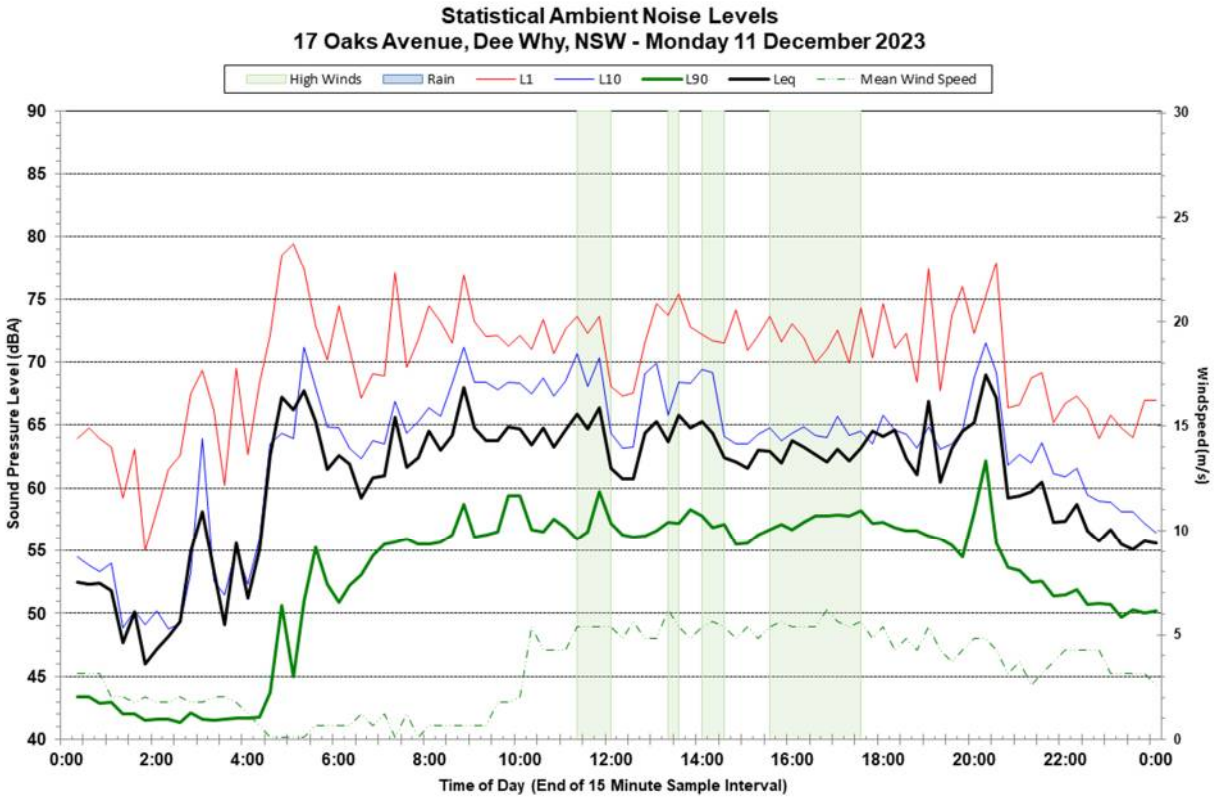


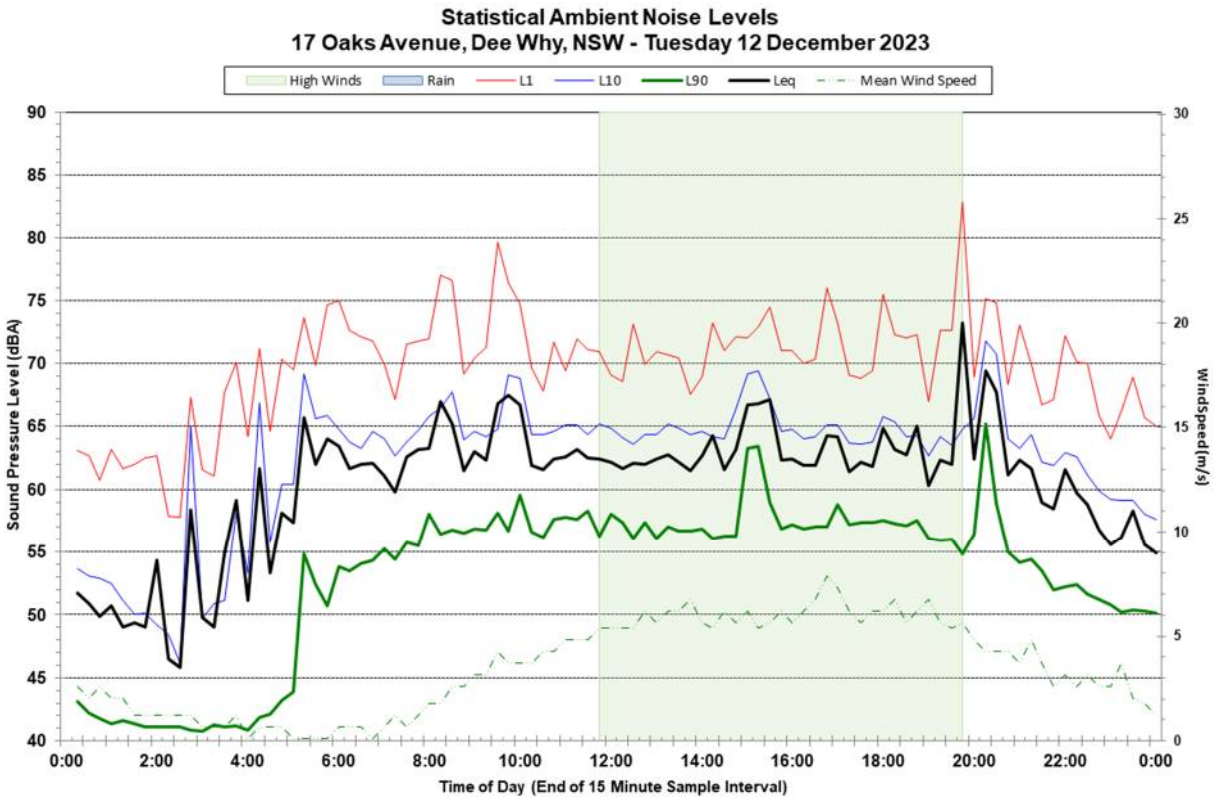


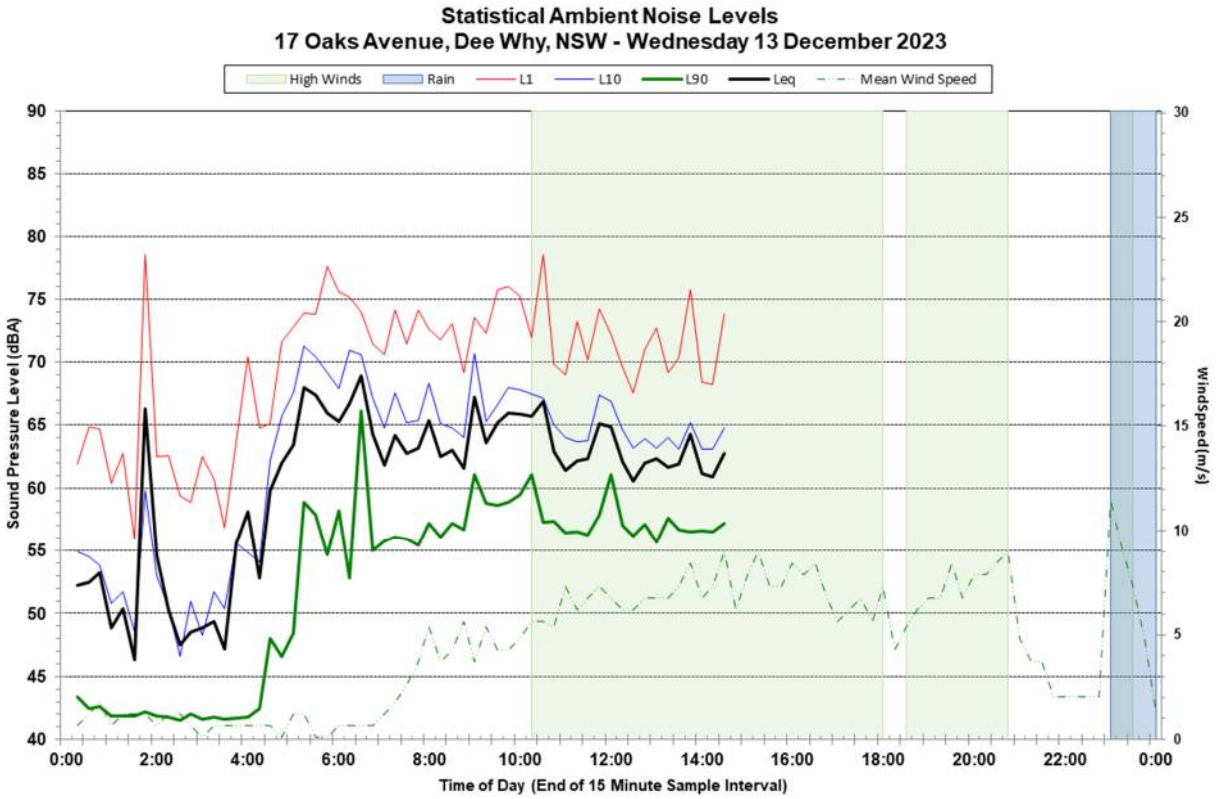

Statistical Ambient Noise Levels
17 Oaks Avenue, Dee Why, NSW - Friday 8 December 2023
High Winds
Rain
L1
L10
L90
Leq
Mean Wind Speed
Sound Pressure Level (dBA)
WindSpeed(m/s)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
17 Oaks Avenue, Dee Why, NSW - Saturday 9 December 2023
High Winds
Rain
L1
L10
L90
Leq
Mean Wind Speed
Sound Pressure Level (dBA)
Windspeed(m/s)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
17 Oaks Avenue, Dee Why, NSW - Sunday 10 December 2023
High Winds
Rain
L1
L10
L90
Leq
Mean Wind Speed
Sound Pressure Level (dBA)
WindSpeed(m/s)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
17 Oaks Avenue, Dee Why, NSW - Monday 11 December 2023
High Winds
Rain
L1
L10
L90
Leq
Mean Wind Speed
Sound Pressure Level (dBA)
WindSpeed(m/s)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
17 Oaks Avenue, Dee Why, NSW - Tuesday 12 December 2023
High Winds
Rain
L1
L10
L90
Leq
Mean Wind Speed
Sound Pressure Level (dBA)
Windspeed(m/s)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
17 Oaks Avenue, Dee Why, NSW - Wednesday 13 December 2023
High Winds
Rain
L1
L10
L90
Leq
Mean Wind Speed
Sound Pressure Level (dBA)
WindSpeed(m/s)
Time of Day (End of 15 Minute Sample Interval)