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DA Acoustic Assessment

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Project ID	20210011.1
Document Title	DA Acoustic Assessment
Attention To	Pacific Drive Pty Ltd

Revision	Date	Document Reference	Prepared By	Checked By	Approved By
0	4/02/2021	20210011.1/0402A/R0/WY	WY		GW
1	19/04/2022	20210011.1/1904A/R1/WY	WY		GC
2	3/05/2022	20210011.1/0305A/R2/WY	WY		GC
3	11/05/2022	20210011.1/1105A/R3/WY	WY		GC

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1 INTRODUCTION

Acoustic Logic (AL) has been engaged to conduct an acoustic assessment of potential noise impacts associated with the proposed development at 10-16 Pacific Drive, Port Macquarie.

This document addresses noise impacts associated with the following:

- Noise intrusion to project site from adjacent roadways, and
- Noise emissions from mechanical plant to service the project site (in principle).

AL have utilised the following documents and regulations in the assessment of noise intrusion to the development:

- Port Macquarie-Hastings Council DCP 2013
- Australian Standard AS2107:2016 *Recommended Design Sound Levels and Reverberation Times for Building Interiors*, and
- NSW Environmental Protection Agency (EPA) *Noise Policy for Industry* (NPI) 2017.

AL confirms that the development can comply with all of the aforementioned authorities and standards on the proviso that the acoustic treatments nominated in this report are adopted.

This assessment has been conducted using the Dickson Rothschild Design architectural drawings for DA Submission (Project *No. 22-020*, Revision E, dated 10 May 2022)

2 SITE DESCRIPTION

The proposed development comprises of five storeys of residential units with an associated carpark on ground level and basement level.

Investigation has been carried out by this office in regards to the existing properties and noise impacts surrounding the proposed development, which is detailed below:

- Existing residential blocks surrounding the project site, and
- Pacific Drive Road bounding the site to the east.

The nearest noise receivers around the site include:

- **R1:** Residential Receiver 1 – Multi-storey residential receivers to the north at 2-6 Windmill Street and 7-9 Pacific Drive
- **R2:** Residential Receiver 2 – Multi-storey residential receiver to the south at 17 Pacific Drive, and
- **R3:** Residential Receiver 3 – Single storey residential receiver to the west at 6-8 Macquarie Place and 3 Home Street.

A site map, measurement description and surrounding receivers are presented in Figure 1 below.

Project Site

Residential Receivers

Figure 1 – Project Site
Source: NSW Six Maps

Unattended Noise Monitor

Attended Measurements

3 NOISE DESCRIPTORS

Traffic noise constantly varies in level, due to fluctuations in traffic speed, vehicle types, road conditions and traffic densities. Accordingly, it is not possible to accurately determine prevailing traffic noise conditions by measuring a single, instantaneous noise level. To accurately determine the effects of traffic noise a 15-minute measurement interval is utilised. Over this period, noise levels are monitored on a continuous basis and statistical and integrating techniques are used to determine noise description parameters. These parameters are used to measure how much annoyance would be caused by a particular noise source.

In the case of environmental noise, three principal measurement parameters are used, namely L_{10}, L_{90} and L_{eq}.

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

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

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

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

Current practice favours the L_{eq} parameter as a means of measuring traffic noise, whereas the L_{10} parameter has been used in the past and is still incorporated in some codes. For the reasons outlined above, the L_{90} parameter is not used to assess traffic noise intrusion.

4 AMBIENT NOISE SURVEY

NSW EPA's Rating Background Noise Level (RBL) assessment procedure requires determination of background noise level for each day (the ABL) then the median of the individual days as set out for the entire monitoring period.

Appendices in this report present results of unattended noise monitoring conducted at the project site. Weather affected data was excluded from the assessment. The processed RBL (lowest 10th percentile noise levels during operation time period) are presented in Table 4-1.

4.1 MEASUREMENT POSITION

One unattended noise monitor was located near the centre of the open field at 10-16 Pacific Drive, Port Macquarie approximately 45m from the kerb. The microphone was 1.5m above ground level with full view of the road but at a slightly lower level due to the decline in elevation. Refer to Figure 1 for detailed location.

4.2 MEASUREMENT PERIOD

Unattended noise monitoring was conducted from Friday 15th of January 2021 to Saturday 23rd of January 2021. Attended noise measurements were undertaken between the hours of 11:30am and 12:30pm on Friday 15th of January 2021.

4.3 MEASUREMENT EQUIPMENT

Equipment used consisted of Acoustic Research Laboratories Pty Ltd noise loggers. The loggers were set to A-weighted fast response and was programmed to store 15-minute statistical noise levels throughout the monitoring period. The monitors were calibrated at the start and end of the monitoring period using a Rion NC-73 calibrator. No significant drift was noted. Noise logger data is provided in Appendix One – Unattended Noise Monitoring.

4.4 SUMMARISED RATING BACKGROUND NOISE LEVELS

Table 4-1 – Measured Noise Levels

Monitor	Time of day	Rating Background Noise Level dB(A)$_{L90(Period)}$
10-16 Pacific Drive, Port Macquarie	Day (7am – 6pm)	43
	Evening (6pm – 10pm)	40
	Night (10pm – 7am)	37

On review of the monitoring data, the measured L_{90} noise levels during high wind speed days do not increase background noise levels significantly as periods with little to no wind. This demonstrates that even though wind speeds measured at Port Macquarie (the closest weather station) exceed EPA guidelines, either:

- The wind speed on site at this time was significantly lower than at Port Macquarie, and/or
- The wind on site was not sufficiently consistent to increase background noise levels compared to calm periods.

Notwithstanding the above, periods of adverse weather have been eliminated when determining the rating background noise level at the site. Summarised rating background noise levels for the project site and immediate surroundings are presented below.

5 EXTERNAL NOISE INTRUSION ASSESSMENT

Site investigation indicates that the major external noise source around project site is from road traffic noise along Windsor Road to the west of the project site, which carries high volumes of traffic flow.

5.1 NOISE INTRUSION CRITERIA

A noise intrusion assessment has been conducted based on the requirements of the following acoustic noise criteria and standards:

- Port Macquarie-Hastings Council DCP 2013, and
- Australian Standard AS2107:2016 – '*Recommended Design Sound Levels and Reverberation Times for Building Interiors.*'

5.1.1 Port Macquarie-Hastings Council DCP 2013

Port Macquarie-Hastings Council DCP 2013 states the following with regard to residential flat buildings.

C2: Residential Flat Development, Tourist and Visitor Accommodation, and Mixed Use Development

Acoustic Privacy

79. Objective

- *To protect the acoustic privacy of onsite and nearby residents.*

Development Provisions

a) Buildings are designed so that:

- *Busy noisy areas within the apartment face the street; and*
- *Quiet areas face the rear or side of the lot*
- *Bedrooms have line of sight separation of minimum 3m from parking areas, streets and shared driveways.*

b) Openings of adjacent dwellings should be separated by a distance of at least 6m.

80. Objective

- *To protect the acoustic privacy within the apartments and in private open space.*

Development Provisions

a) Uses are to be coupled internally and between apartments i.e., noisy internal and noisy external spaces should be placed together.

Port Macquarie-Hastings Council DCP 2013 has no specific controls with regard to noise intrusion into sensitive spaces, therefore AS2107:2016 shall be adopted.

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

AS2107:2016: Recommended design sound levels and reverberation times for building interiors specifies allowable internal noise levels for internal spaces within residential buildings. Table 1, in Section 5 of AS2107:2016, gives the following maximum internal noise levels for residential buildings near major roads.

Table 5-1 – Recommended Design Sound Levels

Space /Activity Type	Recommended Design Sound Levels
Bedrooms	35-40 dB(A)$L_{eq(10pm-7am)}$
Living Rooms	35-45 dB(A)$L_{eq(anytime)}$

5.1.3 Summarised External Noise Intrusion Criteria

The internal noise criteria adopted for each internal space is therefore summarised below based on the relevant State, Council and Australian Standard requirements.

Table 5-2 – Adopted Internal Noise Levels

Space / Activity Type	Required Internal Noise Level
Bedrooms	35 dB(A)$L_{eq(10pm-7am)}$
Living Rooms	40 dB(A)$L_{eq(anytime)}$

5.2 EXTERNAL NOISE MEASUREMENTS

This section of the report details noise measurements conducted at the site to establish surrounding environmental noise levels impacting the development (road traffic from Pacific Drive).

Traffic noise measurements were taken at the site of the proposed development. Measurements were performed generally in accordance with the Australian Standard AS1055 – "Description and measurement of environmental noise – General Procedures."

5.2.1 Measurement Equipment

Attended short term measurements of traffic noise were undertaken by this office. Measurements were conducted using a Norsonic 140 Sound Analyser. The analyser was set to fast response and calibrated before and after the measurements using a Norsonic Sound Calibrator type 1251. No significant drift was noted.

5.2.2 Measurement Location

Attended measurements were taken at the eastern boundary of lot 101 DP1244390 and at the centre of the site at 10-16 Pacific Drive. The sound level meter had an unobstructed view of traffic on the eastern boundary. Refer to Figure 1 for detailed location.

5.2.3 Measurement Period

Attended noise measurements were undertaken between the hours of 11:30am and 12:30pm on Friday 15th of January 2021.

5.2.4 Attended Noise Measurements

Attended noise measurements have been summarised below.

Table 5-3 – Attended Noise Measurements

Location	Measured Noise Levels dB(A)$L_{eq\ (15\ minute)}$
10-16 Pacific Drive Measurement was conducted 3m from kerb	68 dB(A)$L_{eq(15min)}$
10-16 Pacific Drive Measurement was conducted 45m from kerb	61 dB(A)$L_{eq(15min)}$

5.2.5 Summarised Noise Measurements

The results of both attended and unattended noise measurements have been summarised below. In determination of acoustic treatments, CoRTN road traffic modelling was used to calculate traffic noise levels resultant on the façades of the future development.

Predicted traffic noise levels at the worst affected façades of the proposed dwellings are detailed in the table below.

Table 5-4 – Predicted Façade Noise Levels

Location	Time of day	Traffic Noise Level at Façade dB(A)$_{Leq(Period)}$
10-16 Pacific Drive, Port Macquarie Eastern façade	Day (7am – 10pm)	63
	Night (10pm – 7am)	45

5.3 COMPLYING CONSTRUCTIONS

Assessment of façade requirements to achieve required indoor noise levels has been undertaken. Dimensions of rooms, setbacks from roadways, window openings and floor areas have been used. **Note: Façade constructions to be reviewed at CC stage based on construction drawings, pending final façade design.**

5.3.1 Glazed Windows and Doors

The following constructions will comply with the project noise objectives. Aluminium framed/sliding glass doors and windows will be satisfactory provided they meet the following criteria. All external windows and doors listed are required to be fitted with Q-lon type acoustic seals. (**Mohair Seals are unacceptable**).

Thicker glazing may be required for structural, safety or other purposes. Where it is required to use thicker glazing than scheduled, this will also be acoustically acceptable. Complying constructions are detailed in Table 5-5.

Table 5-5 – Complying Glazing Construction

Area	Glazing Thickness	Acoustic Seals
Sleeping Areas Facing Pacific Drive and Associated Side Façades	6.38mm Laminated	Yes
Living Rooms Facing Pacific Drive and Associated Side Façades	6mm Float	Yes
All Other Spaces	4mm Float	Yes

It is recommended that only window systems having test results indicating compliance with the required ratings obtained in a certified laboratory be used where windows with acoustic seals have been recommended.

In addition to complying with the minimum scheduled glazing thickness, the R_w rating of the glazing fitted into open-able frames and fixed into the building opening should not be lower than the values listed in Table 5-6 for all areas. Where nominated, this will require the use of acoustic seals around the full perimeter of open-able frames and the frame will need to be sealed into the building opening using a flexible sealant.

Table 5-6 – Minimum R_w of Glazing Assembly (with Acoustic Seals)

Glazing Assembly	Minimum R_w of Installed Window
4mm Float	27
6mm Float	29
6.38mm Laminated	31

5.3.2 External Wall Construction

External wall construction constructed from concrete/ masonry elements will not require acoustic upgrades. For walls that are constructed with lightweight materials, see Table 5-7 below.

Table 5-7 – Light Weight External Wall Construction

Space	Internal Lining	Stud System	External Lining
All Habitable Spaces	1 x 10mm plasterboard	Min 92mm Steel Stud with 75mm thick 11kg/m^3 glasswool insulation	1 x 9mm fibre cement sheet

There should not be vents on the internal skin of external walls. In the event that any penetrations are required through the external skin, an acoustic sealant should be used to minimise all gaps.

5.3.3 External Glazed Doors

All doors shall have glazing thicknesses equal to those in Section 5.3.1 and are to have Raven RP10 to the top and sides and Raven RP38 to the underside of a swing door.

Note that mohair seals in windows and doors <u>are not acceptable</u> where acoustic seals are required.

5.3.4 External Roof/Ceiling Construction

External roof construction from concrete elements, therefore no acoustic upgrades are required. In the event that any penetrations are required through the external skin, an acoustic sealant should be used to minimise all gaps.

6 NOISE EMISSION CRITERIA

The noise emission from the project site shall comply with the requirements of the following documents:

- Port Macquarie-Hastings Council DCP 2013, and
- NSW Department of Environment and Heritage, Environmental Protection Agency document – Noise Policy for Industry (NPI) 2017.

6.1 PORT MACQUARIE-HASTINGS COUNCIL DCP 2013

Port Macquarie-Hastings Council DCP 2013 has no specific noise emissions controls, therefore the NSW EPA Noise Policy for Industry shall be adopted.

6.2 NSW EPA NOISE POLICY FOR INDUSTRY (NPI) 2017

The EPA NPI has two criteria which both are required to be satisfied, namely Intrusiveness and amenity. The NPI sets out acceptable noise levels for various localities. The policy indicates four categories to assess the appropriate noise level at a site. They are rural, suburban, urban and urban/industrial interface. Under the policy the nearest residential receivers would be assessed against the urban criteria.

Noise levels are to be assessed at the property boundary or nearby dwelling, or at the balcony or façade of an apartment.

6.2.1 Intrusiveness Criterion

The guideline is intended to limit the audibility of noise emissions at residential receivers and requires that noise emissions measured using the L_{eq} descriptor not exceed the background noise level by more than 5dB(A). Where applicable, the intrusive noise level should be penalised (increased) to account for any annoying characteristics such as tonality.

Background noise levels adopted are presented in Table 4-1. Noise emissions from the site should comply with the noise levels presented below when measured at nearby property boundary.

6.2.2 Project Amenity Criterion

The guideline is intended to limit the absolute noise level from all noise sources to a level that is consistent with the general environment.

The EPA's NPI sets out acceptable noise levels for various localities. The recommended noise amenity area is based upon the measured background noise levels at the sensitive receiver. Based on the measured background noise levels detailed in Table 4-1, the Noise Policy for Industry suggests the adoption of the 'urban' categorisation.

The NPI requires project amenity noise levels to be calculated in the following manner:

$$L_{Aeq,15min} = \textit{Recommended Amenity Noise Level} - 5\ dB(A) + 3\ dB(A)$$

The amenity levels appropriate for the receivers surrounding the site are presented in Table 6-1.

Table 6-1 – EPA Amenity Noise Levels

Type of Receiver	Time of day	Recommended Noise Level dB(A)$L_{eq(period)}$	Project Amenity Noise Level dB(A)$L_{eq(15\ minute)}$
Residential – Urban	Day	60	58
	Evening	50	48
	Night	45	43

The NSW EPA Noise Policy for Industry (2017) defines:

- Day as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays
- Evening as the period from 6pm to 10pm.
- Night as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays

6.2.3 Sleep Arousal Criteria

The Noise Policy for Industry recommends the following noise limits to mitigate sleeping disturbance:

Where the subject development / premises night -time noise levels at a residential location exceed:

- *$L_{eq,15min}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or*
- *L_{Fmax} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater,*

a detailed maximum noise level even assessment should be undertaken.

Table 6-2 – Sleep Arousal Criteria for Residential Receivers

Receiver	Rating Background Noise Level (Night) dB(A)L_{90}	Emergence Level
Residences Surrounding Site Night (10pm – 7am)	37 dB(A) L_{90}	42 dB(A)$L_{eq,\ 15min}$; 52 dB(A)L_{Fmax}

6.3 SUMMARISED NOISE EMISSION CRITERIA

Table 6-3 – EPA NPI Noise Emission Criteria (Residents Surrounding Project Site)

Time Period	Assessment Background Noise Level dB(A)L_{90}	Project Amenity Criteria dB(A) L_{eq}	Intrusiveness Criteria $L_{eq(15min)}$	NPI Criteria for Sleep Disturbance
Day	43	58	**48**	N/A
Evening	40	48	**45**	N/A
Night	37	43	**42**	**42 dB(A)$L_{eq, 15min}$; 52 dB(A)L_{Fmax}**

The project noise trigger levels are indicated by the bolded values in the table above.

7 NOISE EMISSIONS ASSESSMENT

7.1 NOISE FROM MECHANICAL PLANT WITHIN PROPOSED SITE GENERALLY

Detailed plant selection and location has not been undertaken at this stage. Satisfactory levels will be achievable through appropriate plant selection, location and if necessary, standard acoustic treatments such as duct lining, acoustic silencers and enclosures. Noise emissions from all mechanical services to the closest residential and commercial receivers should comply with the requirements of Section 6.3.

Detailed acoustic review should be undertaken at CC stage to determine acoustic treatments to control noise emissions to satisfactory levels.

7.1.1 Preliminary Mechanical Treatment Advice

An indicative assessment of initial design of primary plant items is presented below.

- Refrigeration equipment:
  - Locate condensers as far as practicable from adjacent noise sensitive development. Noise screening (using either a dedicated noise screen or the building shell between the condensers and noise sensitive buildings).
  - Night time operational speeds shall be restricted with a night mode card.
- Major fans (typically with a sound power over 80dB(A) – such as major toilet exhaust, car park exhausts, car park supply and major relief air fans) may require acoustic treatment if located externally near sensitive receivers. It is recommended that axial (as opposed to roof mounted fans) are to be used as this will enable acoustic treatment to be incorporated within ductwork running to atmosphere and with attenuators if necessary. Indicatively a 1d unpodded attenuator with 2m of 50mm internally lined ductwork.

Cumulative assessment of both plant noise with other noise sources is recommended when conducting acoustic design of plant items.

Compliance with EPA acoustic criteria (as set out in Section 5.1.3) will be achievable, provided that detailed acoustic review of plant items is undertaken once plant is selected, and acoustic treatments similar to those outlined above are adopted.

The above recommendations are indicative. Detailed acoustic review should be undertaken at CC stage to determine acoustic treatments to control noise emissions to satisfactory levels.

7.2 USAGE OF THE POOL AREA

The pool area shall be shielded to residents at **R3** to the west through the boundary fence along the western site boundary. The fence will be a typical 1.8m high acoustically sealed barrier, constructed of lapped and capped timber, plexiglass, 4mm Perspex, Colorbond, 9mm fibrous cement sheet or equivalent, installed with no gaps between the panels, and maximum of a 20mm gap at the bottom to allow water flow if required.

Pool plant shall allow for acoustic attenuation if required, which will be assessed at CC stage as discussed in the previous section.

To limit extraneous noise from usage of the pool, the pool shall not be used during the night time period (10pm – 7am).

7.3 NOISE TO DWELLINGS WITHIN THE SITE

Noise to dwellings within the site do not have a statutory requirement. At CC stage, an acoustic specification is prepared to provide specific details on architectural, mechanical and hydraulic treatment. Typically, noise levels emitted by the mechanical plant to terraces, balconies and outside facades containing apartment windows on the development site to not exceed the A-weighted background noise level + 5 dB(A) (i.e., the L_{90} noise level) at any time during the day, evening or night. This includes assessment of pool plant.

Detailed acoustic review should be undertaken at CC stage to determine acoustic treatments to control noise emissions to satisfactory levels.

7.4 CARPARK NOISE

Assessment of the carpark noise emissions has been undertaken based on the number of carpark spaces. An estimated 74 vehicle movements during peak hour movements in the day and evening time (the maximum number of carpark spaces), translating to approximately 19 movements in a 15 minute period. Night time traffic movements have been based on half the carpark filling in one hour (38 movements), translating to approximately 10 movements in a 15 minute period. Note that each movement include both entering and exiting of the carpark. Calculations have been made to predict noise levels occurring at sensitive receivers during a 15 minute peak of traffic movements, with the worst affected residential receiver being the southern residential receiver **R2**.

The following noise emission data for vehicle-related noise sources measured by this office have been used for the assessment.

Table 7-1 – Sound Power Levels of Typical Car Movements

Car Movement	Sound Power Level, dB(A)
Car Manoeuvring @ 10km/h	84 $L_{eq(15\ min)}$
Car Door Slamming	96 L_{max}
Car Starting	91 L_{max}

The following noise levels have been predicted accounting for driveway setbacks, receiver locations, barrier effects and complying controls presented in Section 7.7.

Table 7-2 – Predicted Noise Levels to R2 Northern Façade

Time Period	Predicted Noise	Criteria	Complies?
Day (7am to 6pm)	39 $L_{eq(15\ min)}$	48 dB(A) $L_{eq(15\ min)}$	Yes
Evening (6pm to 10pm)	39 $L_{eq(15\ min)}$	45 dB(A) $L_{eq(15\ min)}$	Yes
Night (10pm to 7am)	36 $L_{eq(15\ min)}$	42 dB(A) $L_{eq(15\ min)}$	Yes
Sleep disturbance L_{max}	46 L_{max}	52 dB(A) L_{max}	Yes

7.5 WASTE COLLECTION

The primary noise associated with waste collection will consist of trucks moving into or out of the collection area.

Noise emission predictions at the nearby development will be made based on the following data/assumptions:

- A typical truck sound power level of 105 dB(A) Leq
- There are no more than two truck movements in any 15 minute period during day time periods
- There is no more than one truck movement in any 15 minute period during evening periods
- No trucks are allowed during the night time period, and
- It is calculated to take approximately 5 seconds for a truck to manoeuvre into and out of the waste collection area.

Table 7-3 – Predicted Noise Emissions from Waste Collection Area

Receiver Location	Time Period	Predicted Noise Level dB(A) $L_{eq(15\ min)}$	Acoustic Criteria dB(A) $L_{eq(15\ min)}$	Compliance
R2 eastern façade (17 Pacific Drive)	Day (7am to 6pm)	42	48	Yes
	Evening (6pm to 10pm)	39	43	Yes

7.6 CUMULATIVE PREDICTED NOISE EMISSIONS

Cumulative noise emission predictions to the most sensitive receivers around the development are summaries below. Detailed acoustic review should be undertaken at CC stage to determine mechanical acoustic treatments to control noise emissions to satisfactory levels. The worst affected receiver is **R2** and has been summarised below.

Table 7-4 – Predicted Cumulative Noise Levels to Residential Receiver R2

Time Period	Predicted Noise	Criteria	Complies?
Day (7am to 6pm)	44 $L_{eq(15\ min)}$	48 dB(A) $L_{eq(15\ min)}$	Yes
Evening (6pm to 10pm)	42 $L_{eq(15\ min)}$	45 dB(A) $L_{eq(15\ min)}$	Yes
Night (10pm to 7am)	36 $L_{eq(15\ min)}$	42 dB(A) $L_{eq(15\ min)}$	Yes
Sleep disturbance L_{max}	46 L_{max}	52 dB(A) L_{max}	Yes

Predicted noise emissions from waste collection operation and carpark usage readily comply with the requirements of the NSW EPA Noise Policy for Industry when assessed to the surround sensitive noise receivers during the day, evening and night time periods.

If it is proposed to operate the waste collection area during the night time period (10pm – 7am), it must be accompanied by a separate plan of managements demonstrating how acoustic controls for the site will be achieved. This may include the absorptive treatments to the area, scheduling of deliveries and times of operation.

7.7 COMPLYING CONTROLS

All feasible and reasonable noise mitigation measures have been applied to reduce noise levels and the following complying controls are presented:

- The number of truck movements for the waste collection area is to be limited to the following:
    - 2 movements per 15 minutes in the day time period (7am – 6pm)
    - 1 movement per 15 minutes in the evening time (6pm – 10pm), and
    - No allowable usage of the waste collection area during the night time period (10pm – 7am).
- Engines should be turned off during operational waste collection movements if possible, thus effectively having no idling noise during operation.
- Pool area shall not be used during the night time period (10pm – 7am).

8 CONSTRUCTION NOISE AND VIBRATION IMPACTS

8.1 NOISE OBJECTIVES

Noise associated with construction activities on the site will be assessed in conjunction with the following documents and guidelines:

- The NSW DECC *Interim Construction Noise Guideline* (ICNG) 2009, and
- AS2436:2010 *Guide to Noise Control on Construction, Maintenance and Demolition Sites*.

8.1.1 NSW DECC Interim Construction Noise Guideline (2009)

The EPA Interim Construction Noise Guideline (ICNG) assessment requires:

- Determination of noise management levels (based on ambient noise monitoring);
- Review of operational noise levels at nearby development; and
- If necessary, recommendation of noise controls strategies in the event that compliance with noise emission management levels is not possible.

EPA guidelines adopt differing strategies for noise control depending on the predicted noise level at the nearest residences:

- *"Noise affected" level. Where construction noise is predicted to exceed the "noise affected" level at a nearby residence, the proponent should take reasonable/feasible work practices to ensure compliance with the "noise affected level". For residential properties, the "noise affected" level occurs when construction noise exceeds ambient levels by more than 10dB(A)Leq(15min).*
- *"Highly noise affected level". Where noise emissions are such that nearby properties are "highly noise affected", noise controls such as respite periods should be considered. For residential properties, the "highly noise affected" level occurs when construction noise exceeds 75dB(A)Leq(15min) at nearby residences.*

In addition to the above management levels for residential receivers, the ICNG nominates a Management Level of 70dB(A) $L_{eq(15min)}$ at commercial receiver facades (typical office, retail). And a Management Level of RBL + 5 dB(A) for any work done outside of standard hours.

A summary of the above recommended noise levels from the ICNG is presented below.

Table 8-1 – Noise Management Levels at Residential Property Boundaries

"Noise Affected" Level - dB(A)$L_{eq(15min)}$ Standard Hours	**"Highly Noise Affected" Level – dB(A)$L_{eq(15min)}$**
53 externally at façade	75

Where noise from the construction works is above the "noise affected" level, the proponent should apply any feasible and reasonable work practices to minimise noise. The "noise affected level is representative of a level where there may be some community reaction to noise.

If noise emissions are likely to exceed 75 dB(A)$L_{eq(15min)}$ "highly noise affected" at the boundary of surrounding affected residential receivers, the receiver is deemed to be "highly noise affected". The "highly noise affected" level is representative of a level where strong community reaction to noise is expected. Introduction of management controls such as scheduling of noisy periods, or respite periods is then recommended.

8.1.2 Australian Standard AS2436:2010 "*Guide to Noise Control on Construction, Maintenance and Demolition Sites*"

The Australian Standard AS2436 states that where all reasonable and available measures have been taken to reduce construction noise, mitigation strategies may be put in place to reduce levels noise levels to within a reasonable and acceptable level.

For the control and regulation of noise from construction sites, AS2436:1981 nominates the following:

a. That reasonable suitable noise criterion is established,

b. That all practicable measures be taken on the building site to regulate noise emissions, including the siting of noisy static processes to locations of the site where they can be shielded, selecting less noisy processes, and if required regulating construction hours, and

c. The undertaking of noise monitoring where non-compliance occurs to assist in the management and control of noise emission from the construction site.

The guideline reflects on feasible and reasonable mitigation strategies, management controls and public liaising in the effort to reach realistic comprises between construction sites and potential noise affected receivers.

Based on these criteria the following procedure will be used to assess noise emissions:

- Predict noise levels produced by typical construction activities at the sensitive receivers.
- Adopt management conditions as per AS2436 in the event of a non-compliance.

8.2 VIBRATION OBJECTIVES

Vibration caused by construction at any residence or structure outside the subject site will be assessed with reference to:

- For structural damage vibration, German Standard DIN 4150-3 *Structural Vibration: Effects of Vibration on Structures*; and
- For human exposure to vibration, Department of Environment and Conservation NSW "Assessing Vibration: A Technical Guideline" (Feb 2006) is based on the guidelines contained in BS 6472:1992 *Guide to Evaluate Human Exposure to Vibration in Buildings (1Hz to 80Hz)* for low probability of adverse comment.

The criteria and the application of this standard are discussed in separate sections below.

8.2.1 Structure Borne Vibrations

German Standard DIN 4150-3 (1999-02) provides a guideline for acceptable levels of vibration velocity in building foundations, to assess the effects of vibration on structures. The table give guidance on the maximum accepted values of velocity at the foundation and in the plane of the highest floor of various types of buildings, to prevent any structural damage.

The table below lists the peak particle velocity, which is the maximum absolute value of the velocity signals for the three orthogonal components. This is measured as a maximum value of any of the three orthogonal component particle velocities when measured at the foundation, and the maximum levels measured in the x- and y-horizontal directions in the plane of the floor of the uppermost storey.

Table 8-2 – DIN 4150-3 (1999-02) Safe Limits for Building Vibration

TYPE OF STRUCTURE		PEAK PARTICLE VELOCITY (mms^{-1})			
		At Foundation at a Frequency of			Plane of Floor of Uppermost Storey
		< 10Hz	10Hz to 50Hz	50Hz to 100Hz	All Frequencies
1	Buildings used in commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g., buildings that are under a preservation order)	3	3 to 8	8 to 10	8

8.2.2 Assessing Amenity

The NSW EPA's *Assessing Vibration – a technical guideline* is based on the guidelines contained in British Standard BS 6472-1992 '*Guide to Evaluate Human Exposure to Vibration Buildings (1Hz to 80Hz*'. This guideline provides procedures for assessing tactile vibration and regenerated noise within potentially affected buildings.

The recommendations of this guideline should be adopted to assess and manage vibration from the site. Where vibration exceeds, or is likely to exceed, the recommended levels then an assessment of reasonable and feasible methods for the management of vibration should be undertaken.

Table 8-3 – BS 6472 Vibration Criteria

		RMS acceleration (m/s^2)		RMS velocity (mm/s)		Peak velocity (mm/s)	
Place	**Time**	**Preferred**	**Maximum**	**Preferred**	**Maximum**	**Preferred**	**Maximum**
Continuous Vibration							
Residences	Daytime	0.01	0.02	0.2	0.4	0.28	0.56
Offices	Day or night-time	0.02	0.04	0.4	0.8	0.56	1.1
Workshops		0.04	0.08	0.8	1.6	1.1	2.2
Impulsive Vibration							
Residences	Daytime	0.3	0.6	6.0	12.0	8.6	17.0
Offices	Day or night-time	0.64	1.28	13	26	18	36
Workshops		0.64	1.23	13	26	18	36

Note 1: Continuous vibration relates to vibration that continues uninterrupted for a defined period (usually throughout the daytime or night-time), e.g., continuous construction or maintenance activity. (DECC, 2006).

Note 2: Impulsive vibration relate to vibration that builds up rapidly to a peak followed by a damped decay and that may or may not involve several cycles of vibration (depending on frequency and damping), with up to three occurrences in an assessment period, e.g., occasional loading and unloading, or dropping of heavy equipment. (DECC, 2006).

8.3 PRELIMINARY COMMENT/ ASSESSMENT

Potential noise and vibration impacts are reviewed below to provide preliminary comment. A detailed construction noise and vibration management plan cannot be conducted at this stage as no builder has been selected.

8.4 NOISE IMPACTS

Understandably, noise impacts on nearby development will be dependent on the activity and where on the site the activity is undertaken. Excavation and piling works tend to be the loudest typical activity. Work close to the southern, western and northern boundaries will have the greatest impact on nearby residents.

Initial analysis indicates:

- Excavation/soil retention phase – Primary noise emissions occur during excavation and earth retention (bored piling), with equipment items typically having sound power levels of approximately 111 dB(A)$L_{eq(15min)}$. Excavators (dozers with bucket, saws or hammers) and piling works are typically the loudest activity during construction. Noise levels of between 60-86 dB(A) at the nearest residents, indicating that the ICNG Highly Noise Affected Level may be exceeded from time to time, with higher noise levels generated when working near the immediate site boundaries bounding nearby residents of the site.
- During the erection of structure, it is the use of hand tools (angle grinders etc) and concrete pumps which are the loudest typical activity (sound power levels of approximately 108 dB(A)$L_{eq(15min)}$). Noise levels of between 63-74 dB(A) at the nearest residents will potentially be generated, indicating possible exceedance of the Noise Management Level, but it is unlikely to exceed the Highly Noise Affected Level.
- Once construction of the building shell is complete, noise from hand tools will be relatively low, as the new building façade will provide considerable noise attenuation. Once the building shell is largely complete, use of hand tools in internal areas is unlikely to exceed Noise Management Levels.

Noise impacts can be minimised using the following:

- Selection of equipment and process.
- Location of static plant (particularly concrete pumps).
- Use of screens or enclosures and erection of hoarding (typically only feasible for static plant).
- Scheduling of noisy activities and provision of respite periods.

Detailed construction noise planning is typically undertaken after engagement of a builder and a construction program is prepared (i.e. – after DA stage) and therefore, detailed planning is not possible at this stage.

In light of the above, we recommend:

- During preparation of the construction program (CC stage), acoustic review of proposed construction activities and plant/methods should be undertaken to identify work items likely to exceed ICNG Noise Management Levels.
- For those activities likely to generate high noise levels, the analysis should identify where on the site are the areas likely to result in high noise levels. This will then assist in determining the likely time period for which high noise levels will occur.
- Identify feasible acoustic controls or management techniques (use of screens, scheduling of noisy works, notification of adjoining land users, respite periods) when excessive levels may occur.
- For activities where acoustic controls and management techniques still cannot guarantee compliant noise levels, implement a notification process whereby nearby development is made aware of the time and duration of noise intensive construction processes.

Through adoption of the above, noise impacts on nearby development can be suitably managed to prevent excessive impact.

8.5 VIBRATION IMPACTS

Excavation and earth retention works (bored piling) are the primary vibration generating activities.

Vibration impacts on the residential properties to the south west are unlikely to exceed the criteria outlined in Section 8.2.

If excavating in rock or installing driven piles in close proximity to the closest receiver. We recommend:

- Where practicable, excavation in rock should be done using rock saws as opposed to pneumatic hammers.
- If piling is required, use of augured or vibro piling should be used rather than impact piling.
- If there are complaints, during at least the initial stages of excavation and piling, vibration monitoring should be conducted to ensure excessive levels of vibration are not achieved. Any monitoring system should allow for rapid feedback to the contractor (for example, SMS notification)in the event that excessive levels are reached.

Adoption of the above will provide a framework to ensure that appropriate systems for monitoring and management of vibration can be implemented.

9 CONCLUSION

This report presents an acoustic assessment of noise impacts associated with the development to be located at 10-16 Pacific Drive, Port Macquarie.

Provided that the complying controls presented in Section 5.3 are adopted, internal noise levels for the development will comply with the acoustic requirements of the following documents:

- Port Macquarie-Hastings Council DCP 2013, and
- Australian Standard AS2107:2016 – 'Recommended Design Sound Levels and Reverberation Times for Building Interiors.'

External noise emissions criteria have been established in this report to satisfy the requirements of the following documents (with preliminary emissions recommendations provided in Section 7.1, to be iterated in CC Stage):

- Port Macquarie-Hastings Council DCP 2013, and
- NSW Department of Environment and Heritage, Environmental Protection Agency document – *'Noise Policy for Industry (NPI) 2017.'*

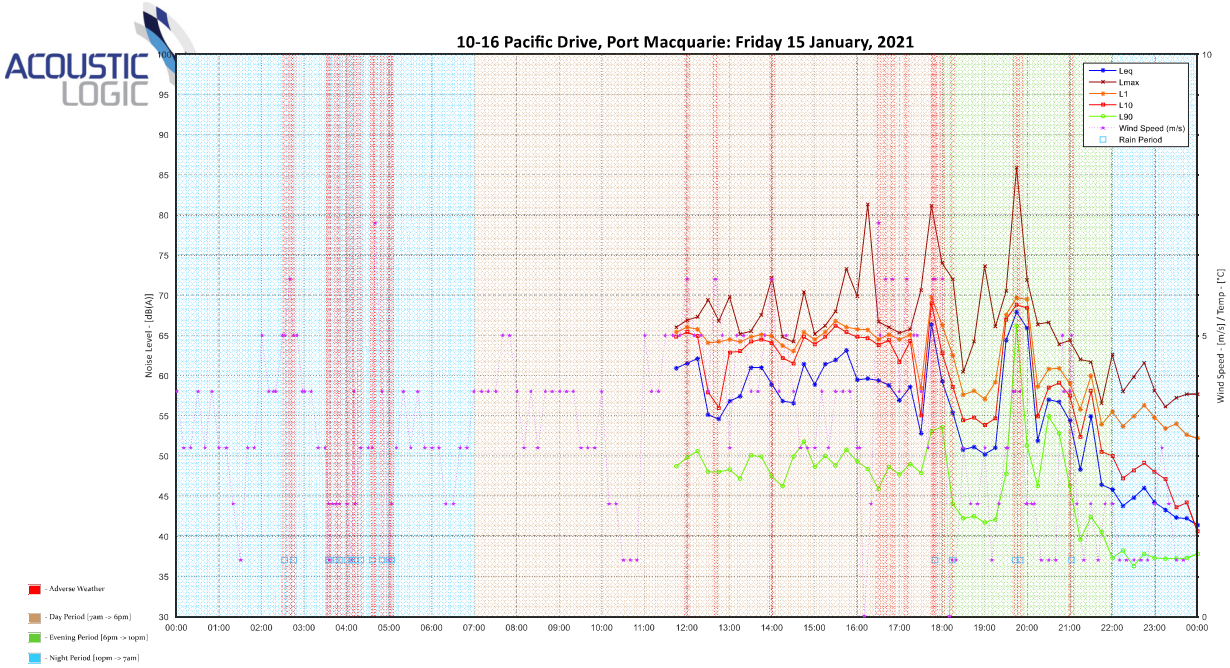
Construction noise and vibration management impacts have been established and preliminarily assessed in this report. A full construction noise and vibration management plan can be prepared in CC Stage.

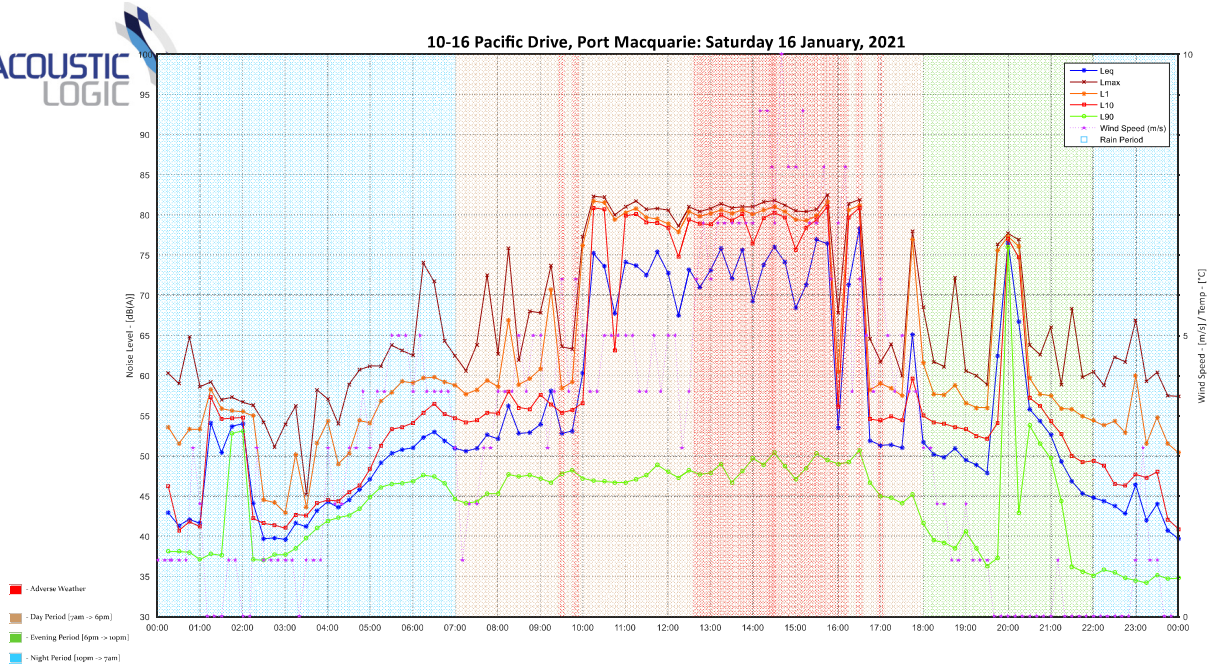
We trust this information is satisfactory. Please contact us should you have any further queries.

Yours faithfully,

Acoustic Logic Pty Ltd
Weber Yeh

APPENDIX ONE – UNATTENDED NOISE MONITORING


10-16 Pacific Drive, Port Macquarie: Friday 15 January, 2021
Noise Level - (dB(A))
Wind Speed - (m/s) / Temp - (°C)
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]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Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
Noise Level - (dB(A))
Wind Speed - (m/s) / Temp - (°C)
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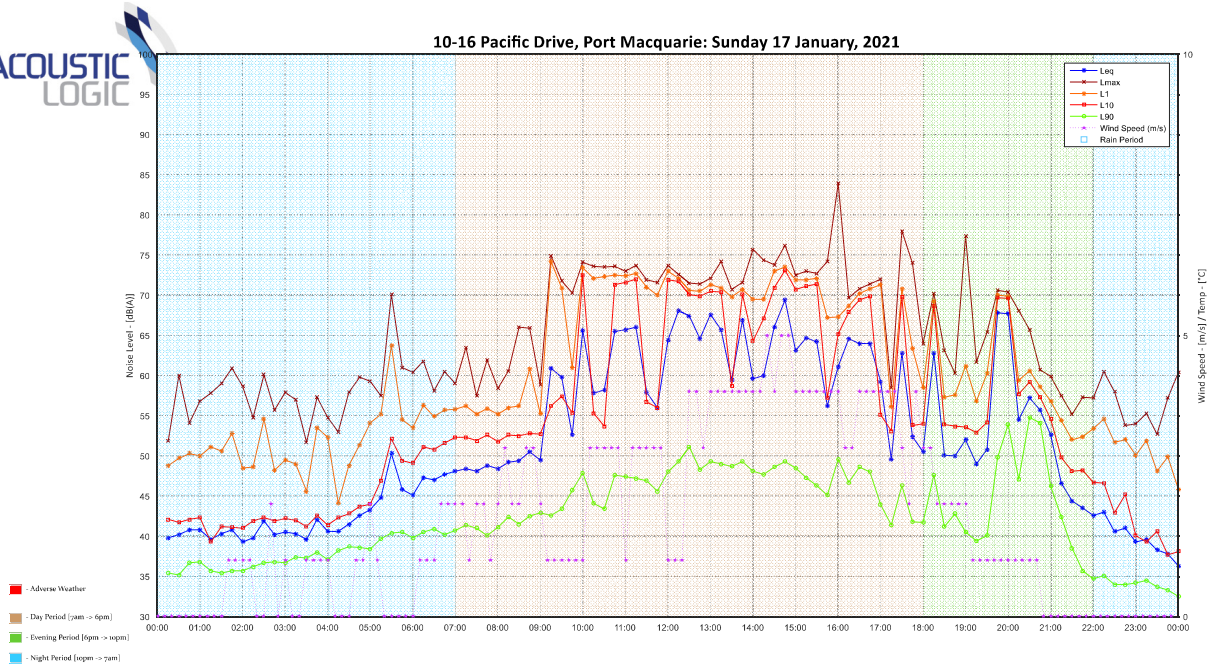
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]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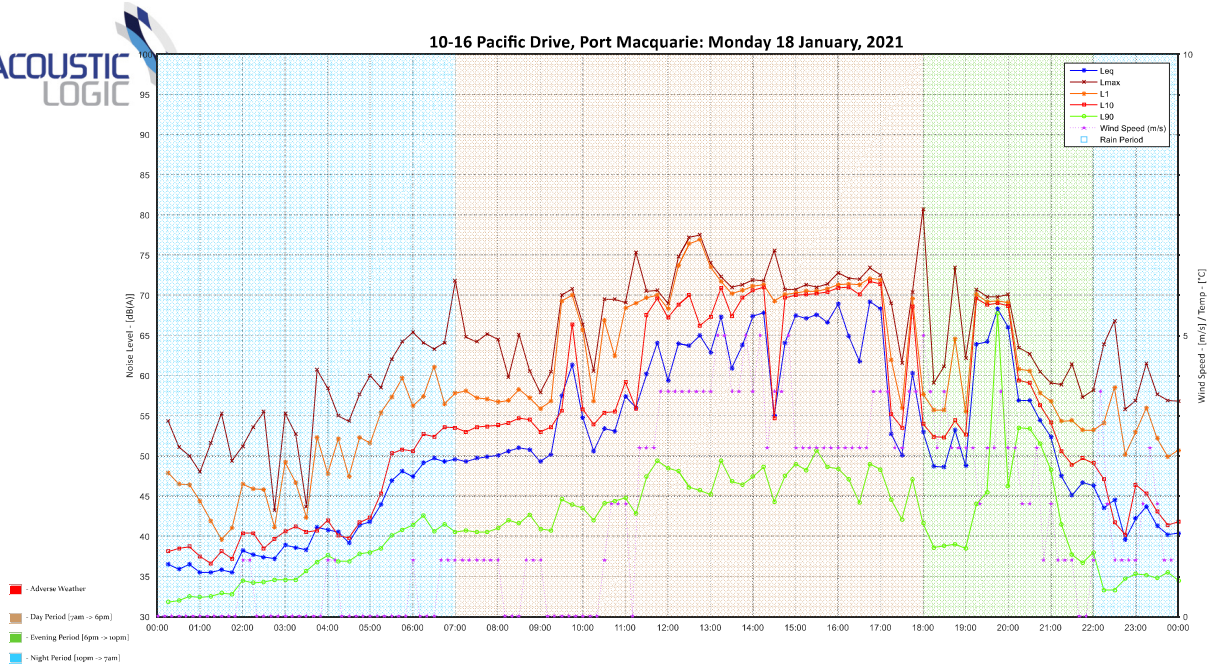
Wind Speed - (m/s) / Temp - (°C)
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]


10-16 Pacific Drive, Port Macquarie: Monday 18 January, 2021
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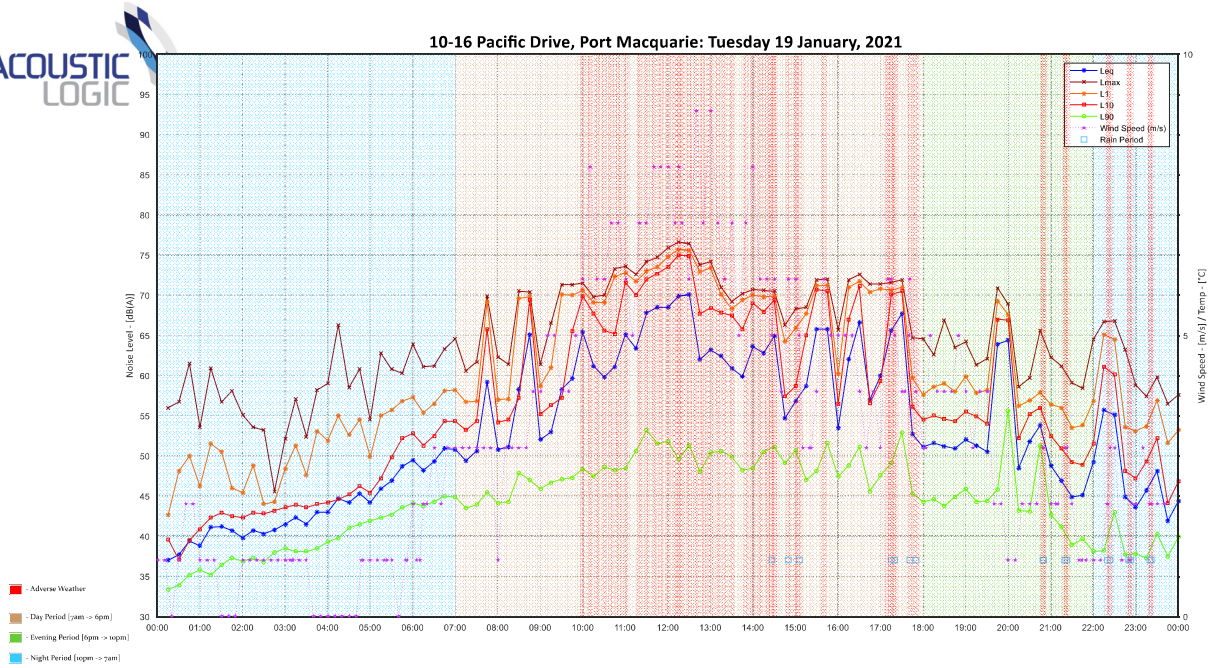
Wind Speed - (m/s) / Temp - (°C)
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]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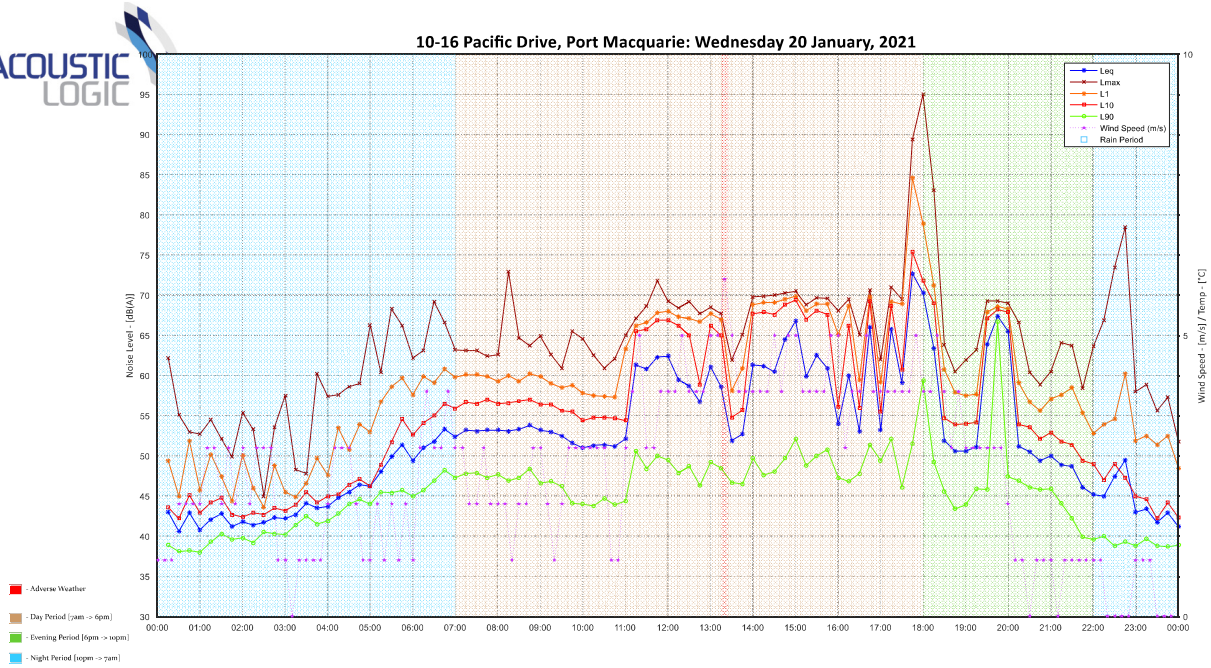
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]


10-16 Pacific Drive, Port Macquarie: Wednesday 20 January, 2021
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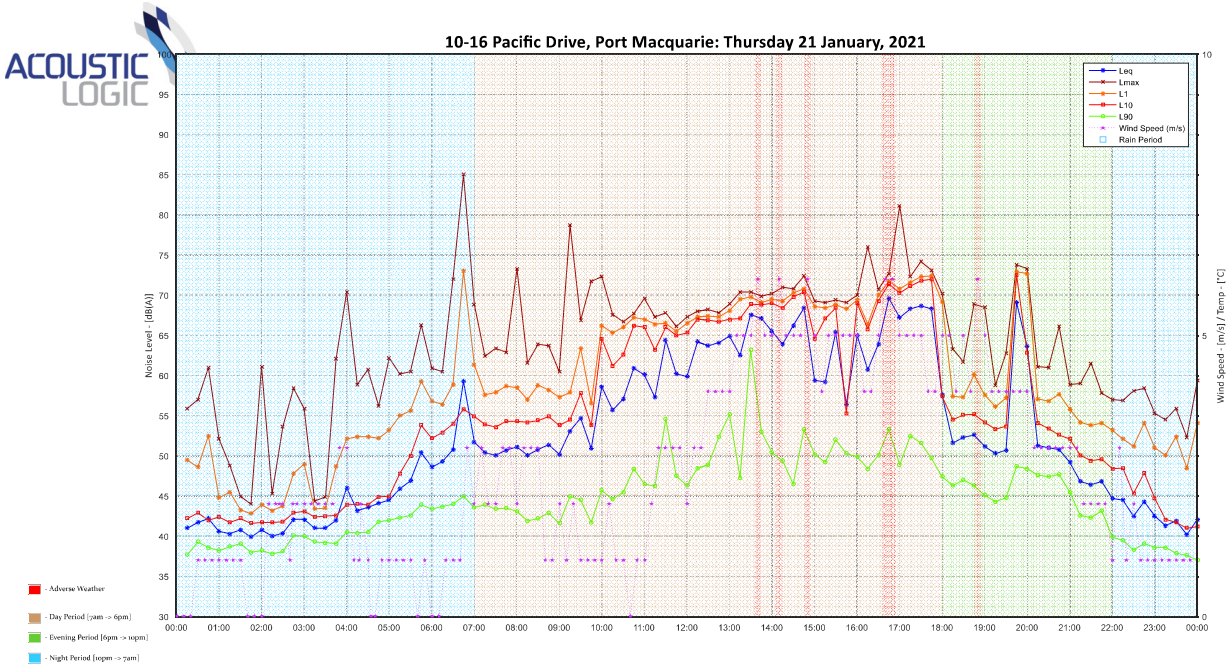
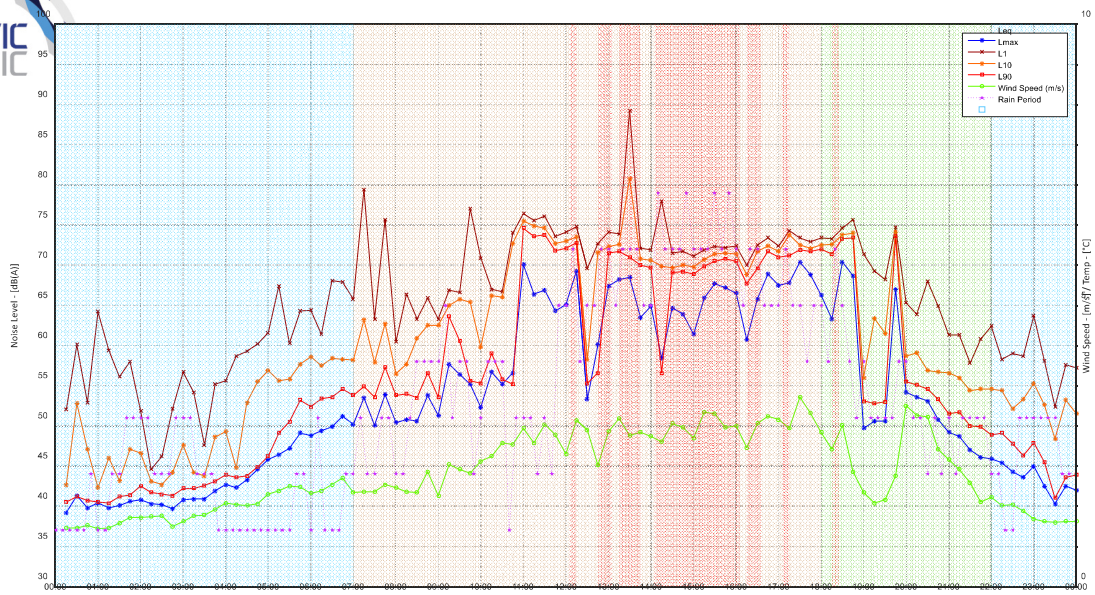
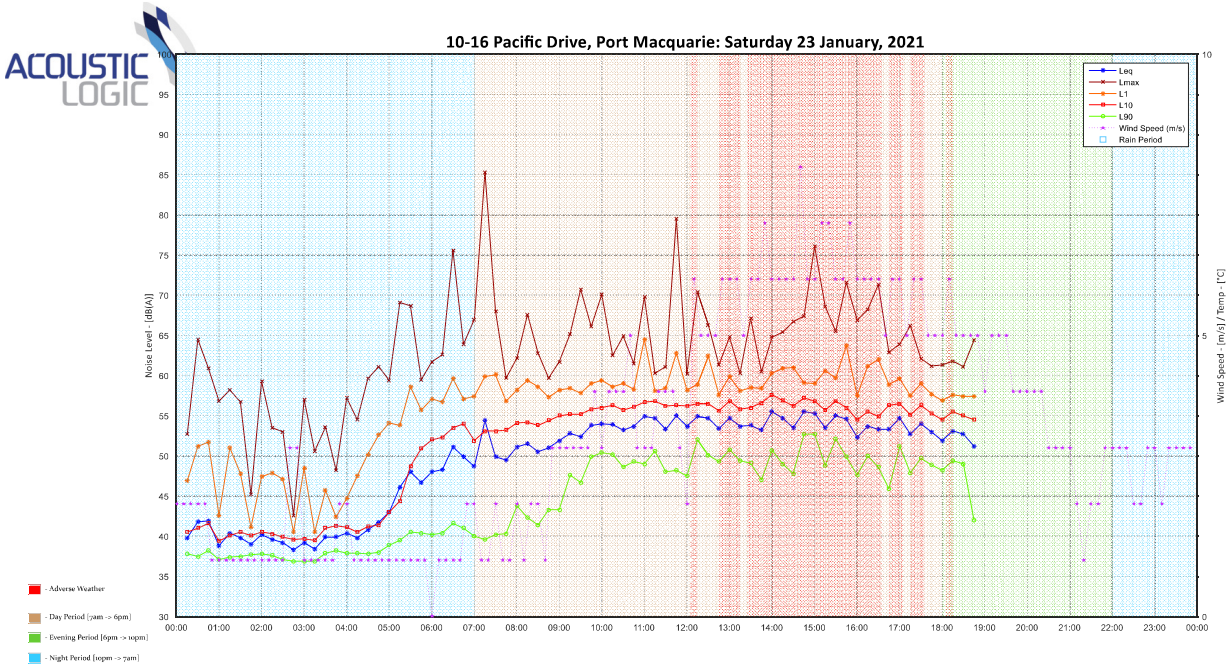
Wind Speed - (m/s) / Temp - (°C)
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]


10-16 Pacific Drive, Port Macquarie: Thursday 21 January, 2021
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

10-16 Pacific Drive, Port Macquarie: Friday 22 January, 2021

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Noise Level - (dB(A))
Wind Speed - (m/s) / Temp - (°C)
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]