Noise Impact Assessment

Thrumster Business Park - Rezoning

Love Project Management

Po Box 161, Wauchope NSW 2446

Prepared by:

SLR Consulting Australia

SLR Project No.: 630.V14754

19 July 2024

Revision: v1.1

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
v1.0	16 August 2023	Shannon Harvey	Martin Davenport	Martin Davenport
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Basis of Report

This report has been prepared by SLR Consulting Australia (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Love Project Management (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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1.0 Introduction

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Love Project Management (LPM) to undertake a noise impact assessment (NIA) of potential noise related impacts upon the proposed rezoned E3 – Productivity Support land within the Thrumster Business Park (the Project) from future surrounding industrial land uses and the Port Macquarie Airport.

The purpose of this assessment is to consider the feasibility of the proposed Productivity Support zoned land in terms of potential land use conflicts arising from the potential development of additional permitted uses for shop top housing and serviced apartments, with regard to potential noise impacts from future industrial land uses and the Port Macquarie Airport.

The following report uses specialist acoustic terminology. An explanation of common terms is provided in **Appendix A**.

2.0 Project Description

The Thrumster Business Park is located at 314 John Oxley Drive, Thrumster, being Lot 2 DP 1245588. The subject land is currently zoned as E4 - General Industrial and is currently vacant of structures. The subject allotment was created as part of DA 2014/114 for a staged subdivision comprising of serviced apartments, shop top housing and industrial lots. In addition, the subject land is located in proximity to the Australian Noise Exposure Forecast (ANEF) of the Port Macquarie Airport.

The proposal seeks to rezone a small area of the Thrumster Business Park to E3 – Productivity Support. The subject land of the proposed E3 zoning is split into two Precincts. Precinct A contains 16,733 m^2 of land, and Precinct B contains 14,010 m^2 of land, being a total of approximately 3.07 hectares of land.

Figure 1 shows the precinct plan and Project area where **Figure 2** shows the Project locality.

Figure 1 Precinct Plan and Project Area

0 0.5 1 km

Scale: 1:30,000 at A4
Coordinate System: GDA 1994 MGA Zone 56

Date Drawn: 30-May-2024
Project Number: 630.V14754

Data Source:
Nearmap March 2024

SLR

SITE LOCALITY

FIGURE 2

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3.0 Assessment Criteria

3.1 NSW Noise Policy for Industry

The EPA has regulatory responsibility for the control of noise from “scheduled premises” under the *Protection of the Environment Operations Act, 1997*. In implementing the NPfI, the EPA has two broad objectives:

- Controlling intrusive noise levels in the short term; and
- Maintaining noise amenity levels for particular land uses over the medium to long-term.

In general terms, the NPfI sets out procedures for establishing the project intrusiveness $L_{Aeq(15minute)}$ and project amenity $L_{Aeq(period)}$ noise levels, with a view to determining the lower (that is, the more stringent) being the Project Trigger Noise Level (PTNL). Section 2.1 of the NPfI states:

> *The project intrusiveness noise level aims to protect against significant changes in noise levels, whilst the project amenity noise level seeks to protect against cumulative noise impacts from industry and maintain amenity for particular land uses. Applying the most stringent requirement as the project noise trigger level ensures that both intrusive noise is limited and amenity is protected and that no single industry can unacceptably change the noise level of an area.*

The intrusiveness trigger level essentially means that the equivalent continuous noise level (L_{Aeq}) of the source should not be more than 5 dBA above the measured (or default) Rating Background Level (RBL).

The amenity assessment is based on amenity noise levels specific to the land use and associated activities. The proposal seeks to rezone a small area of the Thrumster Business Park to E3 – Productivity Support. Due to the potential for industrial land uses within the productivity support zoned area, the resulting amenity classification for shop top residential receivers located within the E3 – Productivity Support zone will be classified as “Industrial” as per the NPfI which notes the following:

> *“for isolated residences within an industrial zone the industrial amenity level would usually apply”*

The NPfI Recommended and Project amenity noise levels for potential receiver types is shown in **Table 1** and relate only to industrial/commercial-type noise and do not include road, rail or community noise.

Table 1 Recommended Total L_{Aeq} Noise Levels from All Industrial Noise Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended Amenity $L_{Aeq(period)}$ Noise Level (dBA)	Recommended Amenity Intrusive $L_{Aeq(15minute)}$ Noise Level (dBA)[1]
Industrial [2]	All	When in use	70	73
Commercial	All	When in use	65	68
Hotels, motels, caretakers' quarters, holiday accommodation, permanent resident caravan parks. (i.e serviced apartments)	Urban	Day	65	68
		Evening	55	58
		Night	50	53

Note 1: 3 dB has been added to the LAeq(period) noise level to standardise time periods for amenity noise levels LAeq(period) to LAeq(15minute) noise levels as per the NPfI.

Note 2: Including isolated residential receiver types within an industrial zone

3.2 NSW Interim Construction Noise Guideline

The NSW Environment Protection Authority's (EPA's) Interim Construction Noise Guideline (ICNG) sets out noise management levels for residential and other noise-sensitive receivers and outlines how they are to be applied.

The ICNG requires project specific Noise Management Levels (NMLs) to be established for noise affected receivers. In the event construction noise levels are predicted to be above the NMLs, feasible and reasonable work practices are to be investigated to minimise noise emissions.

3.2.1 Commercial and Industrial Receivers

The ICNG explains that due to the broad range of sensitivities that commercial or industrial land can have to noise from construction, the process of defining management levels is separated into two categories:

- Industrial premises: external $L_{Aeq(15minute)}$ 75 dBA; and
- Offices, retail outlets: external $L_{Aeq(15minute)}$ 70 dBA.

3.3 Aircraft Noise Criteria

The Port Macquarie-Hastings Development Control Plan 2013 makes reference to the management of aircraft noise from the Port Macquarie Airport on future residential residents.

The most common and appropriate assessment methodology would be consideration of the development with regard to Australian Standard 2021:2015 *"Acoustics – Aircraft Noise Intrusion – Building Siting and Construction"* (AS 2021). Aircraft noise is assessed in **Section 4.2**.

4.0 Methodology

4.1 Noise Assessment

The potential noise levels from the likely industrial land uses have been predicted to the proposed rezoned land using SoundPLAN v8.2 noise modelling software. The model includes ground topography and representative noise sources from likely future industrial land uses.

SLR has examined numerous industrial developments and developed a range of representative sound power levels for different scales of industrial operations. The proposed land use strategy for the adjacent E4 Industrial zoned land is typically “low-noise” industrial use. A description of the development type and the representative sound power level (SWL) used in the computer noise model for each allotment are provided in **Table 2**.

The potential impacts have been determined by comparing the predicted noise levels to the NPfI recommended amenity noise level in a 15 minute assessment period.

Table 2 Representative Noise Source

Noise Source	Description	Sound Power Level
“Low noise” industrial premise (A total of 45 premises)	E.g. warehousing, logistics, industrial/commercial retailer	105 dBA per premise[1]
Note 1: It has been assumed that the surrounding industrial premises would be 100% utilised during the daytime period, 40% utilised during the evening and 5% utilised during the night-time period.		

The following assumptions have been made for the purpose of modelling noise from the subject site:

- No hypothetical future buildings or structures have been incorporated across the site.
- Modelled noise sources have been spread evenly across the allotments.
- Modelled noise sources have been assumed not to contain characteristics such as tonality, impulsiveness, intermittency, irregularity or dominant low frequency content. Based on previous experience, these modifying factors do not typically apply to most sources that operate within low noise generating industrial developments.
- Due to the proximity of rezoned land to likely future industrial noise sources predictions have been conducted under calm weather conditions as noise enhancing meteorological conditions would not have any significant effect

4.1.1 Predicted Noise Levels

Both Precinct A and Precinct B are proposed to be rezoned to E3 – Productivity Support and have the potential to be used for light industrial and commercial land uses as well as shop top housing and serviced apartments . Precinct A and B are located adjacent to existing E4 Industrial zoned land.

Predicted noise levels at Precinct A and Precinct B are provided in **Table 3**.

Table 3 Predicted Industrial Noise Levels

Precinct	Land Use	Time of Day	Predicted $L_{Aeq(15minute)}$ Noise Level (dBA)	Recommended Amenity Intrusive $L_{Aeq(15minute)}$ Noise Level (dBA)
Precinct A	Industrial [3]	When in use[1]	57-65	73
	Commercial	When in use[1]	57-65	68
	Serviced apartments	Day	57-65	68
		Evening	53-61	58
		Night	44-52	53
Precinct B	Industrial [3]	When in use[1]	60-65	73
	Commercial	When in use[1]	60-65	68
	Serviced apartments	Day	60-65	68
		Evening	56-61	58
		Night	47-52	53

Note 1: Highest noise level predicted during the relevant day evening, night-time period.
Note 2: Including isolated residential receiver types within an industrial zone.

Maximum predicted $L_{Aeq(15minute)}$ noise levels for Precinct A and Precinct B are 65 dBA during the day, 61 dBA during the evening and 52 dBA during the night. Predicted $L_{Aeq(15minute)}$ levels are expected to comply with the recommended Industrial (including isolated residential receiver types) noise level of 73 dBA.

For potential serviced apartments within Precinct A and B, predicted noise levels are within the recommended amenity intrusive $L_{Aeq(15minute)}$ noise level at all times.

It should be noted that the predicted noise levels presented here are conservative; it is possible that considerable screening of acoustically significant activities would be provided by buildings once the site is developed. Furthermore, no specific noise mitigation measures have been included in the noise model.

In addition to the predicted noise levels, the development of the currently vacant E4 zoned land to the east of the proposed rezoning area could also impact upon any proposed development in the E3 zoned areas. Further assessment of noise impacts for individual lots will need to be undertaken on a case-by-case basis at the Development Application (DA) stage for the proposed land use.

In order to reduce the potential for land use conflicts it is recommended that any serviced apartments or shop top housing proposed in the E3 zoned areas be designed to meet the relevant internal noise goals provided in Australian Standard AS/NZS 2107:2016 *Acoustics – Recommended design sound levels and reverberation times for building interiors* and incorporate good design practices as follows:

- Consideration of noise impacts at the planning / concept planning stage when there is greater opportunity to incorporate setbacks, building orientation and height controls or noise barriers.
- Locate sleeping and other habitable areas within buildings furthest from the noise source. Conversely, locating less sensitive areas (laundries, bathrooms, corridors, stairs, etc) towards the noise source increases the separation distance to the sensitive areas.
- Minimise the number of doors and windows facing the noise source.

- Implement noise barriers. A noise barrier may consist of a natural slope of the land, earth mounding or a solid barrier or any combination of these.
- Use of podiums, balconies and courtyards to increase the travel path of noise to noise-sensitive areas.
- Careful consideration/design of building elements including walls, windows, doors and roofs.

The relevant internal noise goals for areas within a habitable building, taking into account the future acoustic amenity of the area, are provided in **Table 4**.

Table 4 Design Sound Levels for Different Areas of Occupancy in Buildings.

Type of occupancy/activity	Design Sound Level Range (L_{Aeq})
Houses and apartments in inner city areas or entertainment districts near major roads	
Living and work areas	35 dBA to 45 dBA
Sleeping areas (at night-time)	35 dBA to 40 dBA
Hotels and motels in inner city areas or entertainment districts or near major roads	
Sleeping areas (night-time)	35 dBA to 40 dBA

Industrial noise levels impinging upon 'noise sensitive' receiver types could be greatly reduced from judicious planning with potentially noisier developments located further from potential 'noise sensitive' receiver types as well as the use of equipment incorporating 'quiet' engineering design, the addition of acoustically designed enclosures, noise barriers or using management techniques. Further discussion in this regard is provided in **Section 4.1.3**.

Notwithstanding, it is highly unlikely that industrial noise intrusion, provided that industrial development in the area is designed to meet the NPfI recommended overall amenity criteria for industrial receiver types, would preclude the development of serviced apartments or shop top housing within the E3 rezoned land or that particularly onerous construction would be required to reduce internal noise levels to acceptable levels for developments having regard to good acoustic design practices.

4.1.2 Predicted Construction Noise Levels

Noise sources likely to be associated with construction works on potential industrial premises within the Project area are based on assumptions only, as information is unknown on construction scenarios proposed for the individual lots. Likely equipment used in the construction of potential industrial premises have been assumed and are listed in **Table 5**. Noise levels have been obtained from an SLR database of similar plant and equipment. As it is highly unlikely that construction will occur at all surrounding allotments simultaneously, SLR have modelled the below sources as a construction scenario at each lot adjacent and closest to the lots in the proposed rezoning area only.

Table 5 Indicative Construction Sources

Equipment	Sound Power Level (dBA)	Total Sound Power Level (dBA)
Concrete Mixer	104	117
Crane	105	
Excavator	103	
Truck	103	
Dozer	116	
Roller	114	
Hand Tools	90	

Predicted noise levels from construction are in the order of 68 dBA to 76 dBA. Predicted noise levels suggest an exceedance of the ICNG NMLs for both industrial and commercial receivers.

It should be noted that the assessment of construction noise levels is conservative as calculations assume all items of construction equipment are in use at the same time and for a full 15 minute period. The impacts represent construction noise levels without mitigation applied. It is possible that considerable screening of acoustically significant activities would be provided by buildings once the area becomes developed. Furthermore, no specific noise mitigation measures have been included in the noise model. Further assessment of construction noise impacts for individual lots will need to be undertaken on a case by case basis at the Development Application (DA) stage for the proposed land use.

General mitigation measures and management for construction noise is discussed in **Section 4.1.4**.

4.1.3 General Noise Mitigation Recommendations

Section 3.4 of the NPfI outlines feasible and reasonable noise mitigation measures for mitigating noise from industrial developments.

Measures for reducing noise impacts from industrial activities follow three main control strategies:

- Reducing noise at the source.
- Reducing noise in transmission to the receiver.
- Reducing noise at the receiver.

These control strategies should be considered in a hierarchical way so that all the measures that reduce noise for a large number of receivers (that is, source controls) are exhausted before more localised mitigation measures are considered.

General mitigation measures for General Industrial land uses may include:

- Using best management practice that adopts particular operational procedures that minimises noise while retaining productive efficiency. Examples include:
  - Scheduling the use of noisy equipment at the least-sensitive time of day.
  - Not operating, or reducing operations at night.
  - Keeping equipment well-maintained and operating it in a proper and efficient manner
- Using best available technology economically achievable. Examples include:

  - Considering alternatives to tonal reversing alarm (where work health and safety is appropriately considered).
  - Using quieter equipment with efficient attenuation.
- Implement noise barriers. Barriers can take a number of forms including free-standing walls between a source and a receiver, grass or earth mounds or bunds, and trenches or cuttings within which noise sources are sited.

4.1.4 Standard Construction Mitigation and Management

The ICNG acknowledges that where construction activity occurs on construction sites in close proximity to sensitive receptors, the potential for disturbance from noise and vibration is significant.

It is common and often unavoidable for the NMLs to be exceeded in situations where construction activities occur in the vicinity of sensitive receptors. As a result of the exceedances, the construction contractor will be required to use all reasonable and feasible noise mitigation and management measures to reduce noise generation and impacts at nearby receptors.

The Construction Contractor will, where reasonable and feasible, apply best practice noise mitigation measures including:

- Judicious selection of mechanical plant and equipment (e.g. quieter machinery and power tools).
- Maximising the offset distance between noisy plant items and nearby noise sensitive receivers.
- Avoiding the coincidence of noisy plant working simultaneously close together and adjacent to sensitive receivers.
- If possible, undertake noisy works after 9:00 am when disruption to residences would be less likely.
- Orienting equipment away from noise-sensitive areas.
- Carrying out loading and unloading away from noise-sensitive areas.
- Trucks being on-site must not idle.
- Localised shielding of noisy equipment.
- Minimising consecutive works in the same locality.
- Considering periods of respite.

Once more specific information regarding the proposed construction methodology, equipment and phasing is known, it is recommended that the managing contractor produces a comprehensive Construction Noise and Vibration Management Plan incorporating the mitigation and management strategies recommended above and is developed through consultation with the surrounding community and local authority.

4.2 AS 2021 Assessment – Aircraft Noise Assessment

4.2.1 Site Classification and ANEF Contours

AS 2021 ranks sites as “unacceptable”, “conditionally acceptable” or “acceptable” for various types of development based on the site location relative to the Australian Noise Exposure Forecast (ANEF) contours.

The 2030 ANEF contours for the Port Macquarie Airport from the 2010 Airport Masterplan are shown in **Figure 3**. The site does not sit within the ANEF contours and sits less than the 20 ANEF zone which indicates that the site is “acceptable” for residential type land use as defined in AS 2021. This would generally mean that no further consideration is generally necessary.

However, from discussions with Council and Port Macquarie Airport management it is understood that a new Airport Masterplan and updated ANEF contours for the future operation of Port Macquarie Airport are currently underway. It is understood that this update would potentially result in the 20 ANEF contour encompassing part of the proposed E3 zoned land. The 25 ANEF contour however is likely to remain well outside of the proposed E3 zoned land.

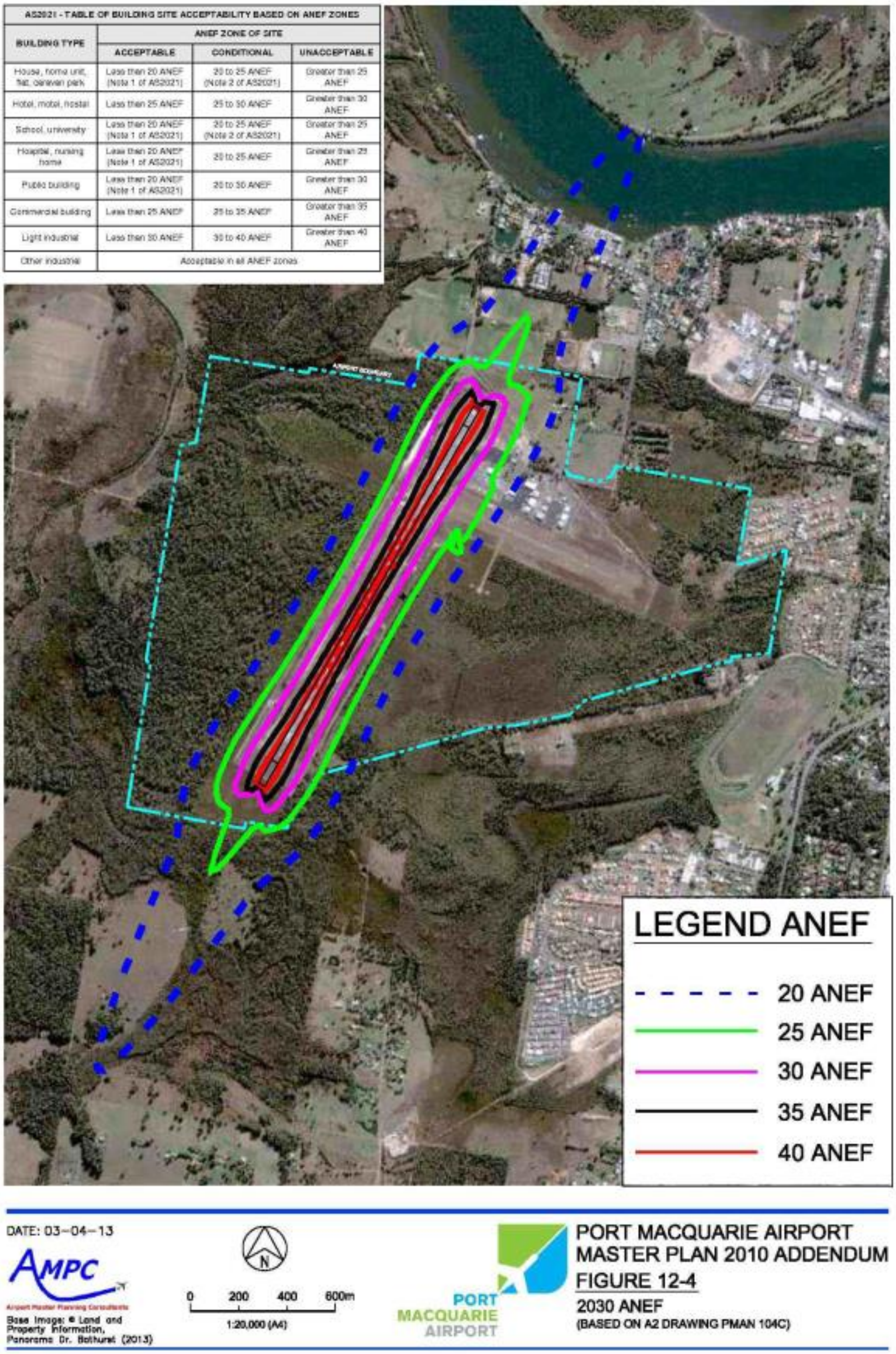
Within the 20 ANEF contour residential land use is ‘conditionally acceptable’ with motels, hotels and hostels being ‘acceptable’.

Given that the future location of the 20 ANEF contour may encompass proposed E3 zoned land a general assessment of likely maximum internal nose levels due to aircraft noise intrusion from the Port Macquarie Airport has been conducted in accordance with AS 2021 methodology.

A more detailed assessment may be required at the Development Application (DA) stage for individual lots to determine the minimum construction requirements for proposed building types once the updated Airport Master plan is made available.

In addition, the proposal does not seek to alter maximum building heights permitted in proximity to the Port Macquarie obstacle limitation surface (OLS) mapping.

Figure 3 Port Macquarie Airport ANEF Contours



AS2021 - TABLE OF BUILDING SITE ACCEPTABILITY BASED ON ANEF ZONES

BUILDING TYPE	ANEF ZONE OF SITE		
	ACCEPTABLE	CONDITIONAL	UNACCEPTABLE
House, home unit, flat, caravan park	Less than 20 ANEF (Note 1 of AS2021)	20 to 25 ANEF (Note 2 of AS2021)	Greater than 25 ANEF
Hotel, motel, hostel	Less than 25 ANEF	25 to 30 ANEF	Greater than 30 ANEF
School, university	Less than 20 ANEF (Note 1 of AS2021)	20 to 25 ANEF (Note 2 of AS2021)	Greater than 25 ANEF
Hospital, nursing home	Less than 20 ANEF (Note 1 of AS2021)	20 to 25 ANEF	Greater than 25 ANEF
Public building	Less than 20 ANEF (Note 1 of AS2021)	20 to 30 ANEF	Greater than 30 ANEF
Commercial building	Less than 25 ANEF	25 to 35 ANEF	Greater than 35 ANEF
Light industrial	Less than 30 ANEF	30 to 40 ANEF	Greater than 40 ANEF
Other industrial	Acceptable in all ANEF zones		

4.2.2 Procedure

Based on the aircraft types commonly in use at the Port Macquarie Airport, aircraft noise levels at the site may be determined.

Port Macquarie Airport is operational between the general hours of 5:00 am to 8:00 pm Monday to Friday, 5:00 am to 11:30 pm on Saturday and 10:00 am to 8:00 pm on Sunday and caters for a variety of aircrafts.

The aircraft noise levels can be found using tables of aircraft noise data provided in AS 2021, taking into consideration the distance of the site from the closer end of the nearest runway (DL), the distance from the furthest end of the nearest runway (DT) and the perpendicular side distance to a projection of the extended runway centre-line and passing through the building site (DS).

The relative elevations of the site and the airport are also considered. As information on the location of buildings for each lot is unknown, SLR have assumed the location of a building in a lot closest to the runway as a conservative assessment approach. The approximate elevation levels of the site and the airport are 23 m and 2 m respectively. As the relative height difference is more than 10 m adjustments to the flight path distances is required.

The applicable distances for the site have been determined in accordance with the AS 2021 methodology as summarised in **Table 6**.

Table 6 Port Macquarie Airport to Precinct B Lot 128

Component	Distances, m		
	Landing (DL)	Take off (DT)	Side Projection (DS)
Assumed building on lot 128			
Distance	1,065	2,910	290
Elevation adjustment	-380	-220	N/A
Effective distance	685	2,690	290

AS 2021 provides a detailed list of aircraft currently in regular use in Australia. Port Macquarie Airport caters for a variety of general aviation aircraft types ranging from ultra-light to medium sized jet models. The aircraft types most commonly in service at the port Macquarie Airport as described in the Port Macquarie Airport ANEF Master Plan 2010 would be the Embraer E170 jet aircraft, Bombardier Dash 8 Q400 and 300 series turbo prop aircraft, British Aerospace J41 and Fairchild Metro 3 series turbo prop aircraft and Boeing B737-800W.

The AS 2021 maximum aircraft noise level charts provide a value for the site location based on the information shown in Table 6 for the common aircraft type using the airport.

Based on the sound power information for the types of aircraft likely to be commonly used at the airport, a maximum noise level of approximately 88 dBA would be expected at the nearest lot boundary. That would be generated by a Boeing B737 during take-off.

4.2.3 Maximum Internal Noise Levels due to Aircraft Noise Intrusion

Recommended indoor design sound levels (effective maximum levels) for various areas of a range of building types and uses are provided in Table 3.3 of AS 2021. The indoor design sound levels for various occupancies within a residence are presented in **Table 7**.

Table 7 Indoor Design Sound Levels – Residential Building

Area of Occupancy Indoor	Design Sound Level (dBA)
Sleeping Areas[1]	50
Other Habitable Areas	55
Bathrooms, Toilets, etc	60
Note 1: Intended to apply during the night-time period only, ie 10:00 pm until 7:00 am. This reverts to the "Other Habitable Areas" criterion at all other times.	

4.2.4 Aircraft Noise Reduction

The aircraft noise reduction (ANR), ie the level of sound attenuation required by the building envelope, is determined for the future dwelling based on the identified external aircraft noise level at the site and the indoor design sound levels.

The aircraft noise reduction (ANR) to be obtained by the building construction for each of the occupancies has been described in **Table 8**.

Table 8 Required Aircraft Noise Reduction

Area of Occupancy	Maximum External Aircraft Noise Level (dBA)	Indoor Design Sound Level (dBA)	Aircraft Noise Reduction (ANR) (dBA)
Sleeping Areas[1]	88	50	38
Other Habitable Areas	88	55	33
Bathrooms, Toilets, etc	88	60	28
Note 1: Required aircraft noise reduction for sleeping areas also applies for sleeping areas within a Childcare Centre.			

The internal design sound levels and the ANR assume that windows and external entry doors are closed. It is necessary for windows and doors to remain closed to comply with AS 2021. Therefore, ventilation in accordance with the relevant standards, including the Building Code of Australia must be provided.

4.2.5 Building Construction Requirements

AS 2021 provides a calculation procedure for determining the necessary acoustic rating, expressed as a Weighted Sound Reduction Index (Rw) of individual building elements. The calculation procedure establishes the required sound insulation performance of each building envelope component (ie external wall, roof/ceiling, glazing, entry doors where applicable), so that the internal noise level is achieved whilst an equal contribution of aircraft noise energy is distributed across each component. Consequently, building envelope components with a greater surface area must offer greater sound insulation performance.

As building plans and elevations for the individual lots is unknown at this stage, SLR have assessed a typical dwelling design using example constructions for external wall, roof/ceiling envelopes that could be appropriate for achieving the required aircraft noise reduction. Example constructions are shown in **Table 9**. Habitable areas assessed include a master bedroom with dimensions of 3.7 m by 3.1 m, a second bedroom with dimensions 3.7 m by 3.1 m and a living/dining area with dimensions 9.6 m by 6 m.

Table 9 Example Constructions and Sound Insulation Rating

Building Element	Example Construction	Minimum Sound Insulation Performance, Rw
Roof/ceiling	Colourbond sheet roofing, sarking/insulation blanket over roof trusses, 2 x 13 mm plasterboard ceiling with at least 800 mm cavity, cavity insulation (minimum 50 mm thick, 20 kg/m^3 density)	48
External walls	14 mm weatherboard cladding (Board laps caulked), 2x 13 mm plasterboard internal lining and cavity insulation.	48

Based on the sound insulation performance that would be achieved by the example external wall and roof/ceiling constructions, it will be the glazing or external entry doors that will control aircraft noise intrusion into the dwelling.

Based on the AS 2021 methodology and the proposed dwelling design, the maximum Rw rating values for all glazing to the occupancies within the assessed dwelling are described in **Table 10**.

Table 10 Required Glazing Sound Insulation Performance Ratings

Dwelling	Occupancy	Minimum Sound Insulation Rating, Rw
House	Living/Dining	36
	Master Bed	41
	Bed	34

In order to achieve a lower required sound insulation rating for the glazing a nominated external wall and roof/ceiling with a higher sound insulation performance would be needed.

There are numerous manufacturers/suppliers of window or door systems that produce proprietary systems capable of achieving the nominated Rw ratings, including G James, Veridian and Lidco. Example constructions have been shown in **Table 11**, however the actual sound insulation performance will be a function of the window area/size and style, and the glazing type (eg float or laminated layer/s or acoustically-rated).

Table 11 Example Constructions for Glazing

Minimum Sound Insulation Performance, Rw	Example Construction[1]
26	6 mm float glass with acoustic seals
28	6.38 mm laminated glass with acoustic seals
30	8.38 mm laminated glass with acoustic seals
32 – 33	10.38 mm laminated glass with acoustic seals
36	12.38 mm laminated glass with acoustic seals or 10.38 VLam laminated glass
38	10.5 mm VLam Hush or 10 mm and 12 mm double glazing with a 6 mm gap
40	12.5 mm VLam Hush or 10 mm and 12 mm double glazing with a 6.38 mm gap
42	8 mm VFloat with 16 mm Gap and 8.5 mm VLam Hush
Note 1: Constructions are examples only. Other configurations will be acceptable provided the minimum Rw as specified is confirmed.	

Based on the AS 2021 methodology SLR have conducted a general assessment of aircraft noise for the nearest most potentially noise affected lot to the airport. The maximum level of aircraft noise expected at the lot is 88 dBA, generated by a Boeing B737. However, due to the infrequent use of the airport by this aircraft type, noise levels more likely experienced would generally be lower.

Further and more detailed assessment of aircraft noise for individual dwellings will need to be undertaken on a case by case basis at the Development Application (DA) stage for the proposed land use once the updated Airport Masterplan is developed, however it is highly unlikely that aircraft noise intrusion would preclude residential development at this location or that particularly onerous construction would be required to reduce internal aircraft noise levels to acceptable levels.

5.0 Conclusion

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Love Project Management (LPM) to undertake a Noise Impact Assessment of potential noise impacts from future industrial land uses and the Port Macquarie Airport on the proposed rezoned E3 – Productivity Support land within the Thrumster Business Park.

It is concluded that the rezoning to E3 – Productivity Support with additional permitted use for shop top housing and serviced apartments would not be precluded on the basis of noise from future industrial land uses and the airport provided that appropriate building acoustic design principals and mitigation measures are implemented to reduce internal industrial and aircraft noise levels. It is noted that construction or mitigation measures would be required to meet relevant noise criteria and that potential noise impacts would be addressed on a case by case basis at the DA stage for each development to assesses any potential noise impacts and avoid land use conflicts.

Appendix A   Acoustic Terminology

Noise Impact Assessment

Thrumster Business Park - Rezoning

Love Project Management

SLR Project No.: 630.V14754

19 July 2024

1. Sound Level or Noise Level

the terms ‘sound’ and ‘noise’ are almost interchangeable, except that ‘noise’ often refers to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure. the human ear responds to changes in sound pressure over a very wide range with the loudest sound pressure to which the human ear can respond being ten million times greater than the softest. the decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

the symbols SPL, L or LP are commonly used to represent Sound Pressure Level. the symbol LA represents A-weighted Sound Pressure Level. the standard reference unit for Sound Pressure Levels expressed in decibels is 2 x 10^{-5} Pa.

2. ‘A’ Weighted Sound Pressure Level

the overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an ‘A-weighting’ filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People’s hearing is most sensitive to sounds at mid frequencies (500 Hz to 4,000 Hz), and less sensitive at lower and higher frequencies. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dB or 2 dB in the level of a sound is difficult for most people to detect, whilst a 3 dB to 5 dB change corresponds to a small but noticeable change in loudness. A 10 dB change corresponds to an approximate doubling or halving in loudness. the table below lists examples of typical noise levels.

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130	Threshold of pain	Intolerable
120	Heavy rock concert	Extremely noisy
110	Grinding on steel	
100	Loud car horn at 3 m	Very noisy
90	Construction site with pneumatic hammering	
80	Kerbside of busy street	Loud
70	Loud radio or television	
60	Department store	Moderate to quiet
50	General Office	
40	Inside private Office	Quiet to very quiet
30	Inside bedroom	
20	Recording studio	Almost silent

Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as ‘linear’, and the units are expressed as dB(lin) or dB.

3. Sound Power Level

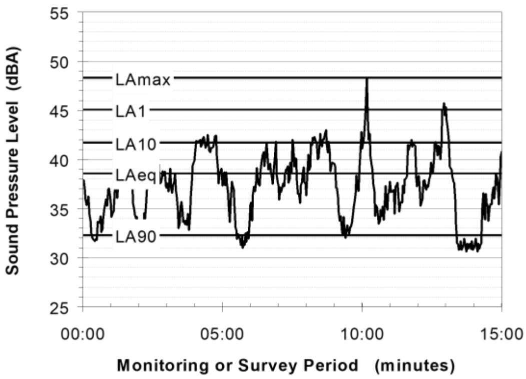
the Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit 10^{-12} W.

the relationship between Sound Power and Sound Pressure is similar to the effect of an electric radiator, which is characterised by a power rating but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

4. Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels LAN, where LAN is the A-weighted sound pressure level exceeded for N% of a given measurement period. for example, the LA1 is the noise level exceeded for 1% of the time, LA10 the noise exceeded for 10% of the time, and so on.

the following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.



of particular relevance, are:

L_{A1} the noise level exceeded for 1% of the 15 minute interval.

L_{A10} the noise level exceeded for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

L_{A90} the noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

L_{Aeq} the A-weighted equivalent noise level (basically, the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

5. Frequency Analysis

Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal.

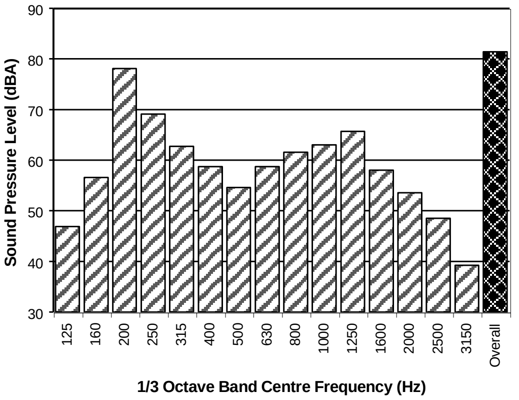
the units for frequency are Hertz (Hz), which represent the number of cycles per second.

Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (three bands in each octave band)

Narrow band (where the spectrum is divided into 400 or more bands of equal width)

the following figure shows a 1/3 octave band frequency analysis where the noise is dominated by the 200 Hz band. Note that the indicated level of each individual band is less than the overall level, which is the logarithmic sum of the bands.



6. Annoying Noise (Special Audible Characteristics)

A louder noise will generally be more annoying to nearby receivers than a quieter one. However, noise is often also found to be more annoying and result in larger impacts where the following characteristics are apparent:

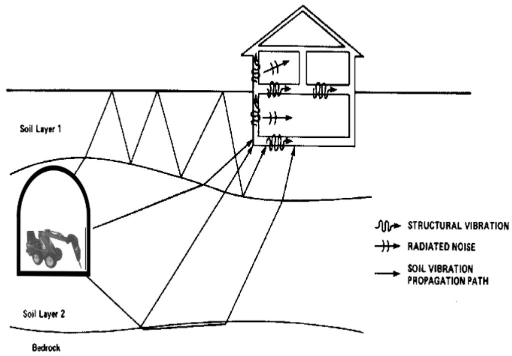
- **Tonality** - tonal noise contains one or more prominent tones (ie differences in distinct frequency components between adjoining octave or 1/3 octave bands), and is normally regarded as more annoying than 'broad band' noise.
- **Impulsiveness** - an impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.
- **Intermittency** - intermittent noise varies in level with the change in level being clearly audible. An example would include mechanical plant cycling on and Off.
- **Low Frequency Noise** - low frequency noise contains significant energy in the lower frequency bands, which are typically taken to be in the 10 to 160 Hz region.

7. Ground-borne Noise, Structure-borne Noise and Regenerated Noise

Noise that propagates through a structure as vibration and is radiated by vibrating wall and floor surfaces is termed 'structure-borne noise', 'ground-borne noise' or 'regenerated noise'. This noise originates as vibration and propagates between the source and receiver through the ground and/or building structural elements, rather than through the air.

Typical sources of ground-borne or structure-borne noise include tunnelling works, underground railways, excavation plant (eg rockbreakers), and building services plant (eg fans, compressors and generators).

the following figure presents an example of the various paths by which vibration and ground-borne noise may be transmitted between a source and receiver for construction activities occurring within a tunnel.



the term 'regenerated noise' is also used in other instances where energy is converted to noise away from the primary source. One example would be a fan blowing air through a discharge grill. the fan is the energy source and primary noise source. Additional noise may be created by the aerodynamic effect of the discharge grill in the airstream. This secondary noise is referred to as regenerated noise.

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