Acoustics Report

Development Application





Revision Schedule

Revision No.	Date	Description	Prepared by	Quality Reviewer	Independent Reviewer	Project Manager Final Approval
001	09/05/2023	Issued for Use	BEM	IK	IK	IK
002	10/05/2023	Issued for Use	BEM	IK	IK	IK

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Executive Summary

Stantec Australia Pty Ltd (Stantec) has been appointed by Citygate Properties Pty Ltd (care of Hillam Architects) to provide acoustic advice for the Leschenault Quays project, including an environmental noise impact assessment. The project will see the development of a multi-storey mixed-use development to be located at Lots 51 and 59 Austral Parade, East Bunbury WA.

In support of the Development Application, an acoustic assessment has been carried out in order to satisfy the requirements stated in the relevant policies and guidelines applicable to the project. This includes:

- Western Australian Environmental Protection (Noise) Regulation 1997 (EPNR);
- Australian and New Zealand Standard AS/NZS 2107:2016 Acoustics Recommended design sound levels and reverberation times for building interiors (AS2107); and
- National Construction Code 2019 Volume 1 Amendment 1, Building Code of Australia Class 2, 3 and 9c Buildings (NCC 2019).

The acoustic criteria derived from the aforementioned documentation forms the basis of acoustic design for the project and includes the following acoustic parameters;

- Airborne sound insulation and impact sound isolation between adjoining apartments;
- Internal noise levels resulting from noise intrusion due to external sources (e.g. traffic); and
- Noise emissions from the proposed development to the nearest noise sensitive receivers.

Traffic Noise Intrusion

Traffic noise intrusion assessment has been carried out and the minimum recommended external façade construction has been provided in the form of glazing and wall configurations. The predicted noise levels at the building façades allow for a 20-year design horizon.

The following external glazing configurations are recommended in order to achieve the internal noise targets stipulated in AS 2107:

- North and East Facades Double Glazing: 6mm glass / 12mm air gap / 6.38mm laminated glass;
- South and West Facades, Internal Courtyard Facades Double Glazing: 6mm glass / 12mm air gap / 6mm glass;
- Commercial Tenancies 6mm glass.

Port of Bunbury Annual Reports state that port noise emissions are compliant with the noise Regulations. Based on feedback from the Client, it is assumed that the nearby entertainment venue also complies with the Regulations. Therefore, these noise sources are considerably below the predicted traffic noise levels and have been excluded from the assessment.

Café Noise Emissions

While the use of the commercial tenancies is to be confirmed, one is proposed to be a café. The following preliminary recommendation is provided and should be reviewed based on proposed layout during the design phase:

- Any café alfresco areas are not to be used between the hours of 10pm 7am;
- Any outdoor music must be at an ambient or background level to allow normal conversation to occur without increasing vocal effort.



Mechanical Services Noise Emissions

Limiting Sound Power Levels have been provided for key mechanical services items, such that compliance to the EPNR can be maintained. Equipment should be selected and/or attenuated as the design develops to ensure continued compliance with the assigned levels.

The following Sound Power Level brief is provided to maintain compliance with the noise Regulations at all times;

- External mechanical plant, including any Refrigeration Condensers (up to 2 units) and Kitchen Extract Fans (1 unit) shall have Sound Power Level no greater than 78 dB(A) per unit, or be acoustically treated to achieve equivalent noise emissions;
- Typical treatments include over-sized KEFs with slower rotational speed, inline KEFs with kitchen-grade lined ductwork and/or attenuators, solid or acoustic louvre screening for condenser units.

Carpark Noise Emissions

The proposed carpark is internal to the development on the Ground Floor. This is predicted to improve vehicle noise emissions over the existing condition (~60 exposed car bays for commercial developments).

The following shall be considered to mitigate any disturbance due to the operation of the carpark gates:

- The motors selected for automated gates should be of the quietest type reasonably available;
- The gates should be appropriately vibration isolated from the building structure so as not to transmit any vibration into the apartments; and
- The gates should be maintained regularly and the tracks cleaned to minimise any friction generated noise.

Delivery Noise Emissions

Typical delivery movements have been assessed for compliance against the environmental noise regulations (EPNR) at the nearest sensitive receivers. The following management measures are required for the external delivery bay:

- Truck deliveries via the external loading bay shall be limited to daytime hours (7am 7pm Monday to Saturday); and
- Truck deliveries via the external loading bay shall be scheduled and limited to less than 24 minutes in any 4-hour period (EPNR L₁ assessment criteria).

Waste Collection

Under the EPNR Regulation 14A, the assigned noise levels of Regulation 7 do not apply to waste collection (both domestic and commercial sources).

Generally, collection times cannot be confirmed for residential waste collections, however councils' endeavour to conduct waste collection during the hours 0700 – 1900 hr Monday to Saturday in accordance with the WA Department of Environmental Regulation's *Draft Guide to Management of Noise from Waste Collection and Other Works* (December 2014).



1. Introduction

1.1 Overview

Stantec has been appointed by Citygate Properties Pty Ltd (care of Hillam Architects) to provide acoustic advice for the Leschenault Quays project in East Bunbury WA, including and environmental noise impact assessment.

This report presents the key acoustic considerations and criteria pertinent to the project. The criteria will form the basis of the acoustic design for the following areas;

- Traffic noise impact on the development;
- Noise emissions from deliveries, café patrons, car parking; and
- Noise emissions from the mechanical equipment servicing the building.

1.2 Project Layout

The project site is in the City of Bunbury local government area (Local Planning Scheme No. 8).

The site itself, commercial developments to the north and carpark to the east are zoned as Local Centres.

The nearest residences on Hough Rd and Austral Parade are zoned as Mixed-use Residential, with Residential zoning for the other nearby houses shown in Figure 1. Refer to Figure 2 for the zoning map.



Source: NearMaps

Figure 1: Project Site and Surrounds



2. Acoustic Criteria

The acoustic criteria presented in this Development Application report are derived from the following documentation;

- Western Australian Environmental Protection (Noise) Regulation 1997 (EPNR);
- Australian and New Zealand Standard AS/NZS 2107:2016 Acoustics Recommended design sound levels and reverberation times for building interiors (AS2107); and
- National Construction Code 2019 Volume 1 Amendment 1, Building Code of Australia Class 2, 3 and 9c Buildings (NCC 2019).

2.1 Environmental Protection (Noise) Regulations 1997

Environmental noise impacts resulting from the noise emissions from the project are addressed through the Environmental Protection Act 1986, with the regulatory requirements detailed in the Environmental Protection (Noise) Regulations 1997 (EPNR).

The EPNR establishes the maximum permissible noise emission levels (assigned levels) to be received at all adjacent noise sensitive premises during specific periods of the day as a result of the cumulative noise emissions from all sources proposed for the project site. Compliance to relevant noise limits outlined in the EPNR is compulsory.

The EPNR states noise emissions from any premises are considered not to *significantly contribute to* the noise at a receiver if the noise emissions are 5 dB or below the assigned levels.

In brief, the assigned levels are determined by considering of the amount of commercial and industrial zones, as well as main transport corridors and sporting venues surrounding the noise sensitive premises. The assigned levels apply at premises receiving the noise (noise sensitive receiver) and not to areas within the project site or lot. In addition, the Environmental Protection (Noise) Regulations 1997 identify the following in Schedule 3, clause 2A.

"If the land within either of the circles is categorised on the land use map as land in respect of which mixed uses are permitted, the use of that land that results in the highest influencing factor is to be used in the determination of the influencing factor."

The nearest noise sensitive receivers have been considered as the residential properties surrounding the area, with the closest noise sensitive receivers being located at Hough St, East Bunbury.

For the purpose of determining the Influencing factor, the land zoning provided on the City of Bunbury's online mapping system (Local Planning Scheme No. 8 and Greater Bunbury Regional Scheme) has been used to ascertain land use. The available traffic data has been presented in Table 1.

Table 1: Traffic count data (MRWA)

Toomood Openidate	EPNR Classification ²⁾	Average Daily Traffic Volumes					
Transport Corridors		2014/15	2015/16	2016/17	2017/18	2018/19	2019/2020
Koombana Dr ¹⁾ (East of Hough Rd)	Major Road	_	16,640	_	—	_	_
Austral Pde ¹⁾ (East of Hough Rd)	_	4,140		_	—	_	_
Hayes St (West of Albert Rd)	_	_	_		2,589	2,769	_

1) Data from Main Roads WA South West Traffic Digest 2014/15 – 2019/20. Data not available from Main Roads WA Traffic Map website as at 8^{th} May 2023.



2) As defined by the EPNR. Secondary roads have between 6,000-15,000 vehicles per day. Major roads have greater than 15,000 vehicles per day.

2.1.1 Influencing Factor

The influencing factor results from identifying major roads, commercial and industrial areas for all nearest noise sensitive receivers is 3 dB, as summarised in Table 2.

Table 2: Influencing factor (IF) for Noise Sensitive Receivers

Noise Sensitive Premises	Commercial Zones	Industrial Zones	Transport Corridors	Influencing Factor
3 Hough Rd, East Bunbury	45 % within a 100 m radius 2 % within a 450 m radius	3 % within a 450 m radius (Bunbury Port)	Koombana Dr (Major road) within 450m	5 dB



Source: City of Bunbury online mapping system

Figure 2: Zoning Map of Nearest Sensitive Receiver

2.1.2 Assigned Noise Levels for Nearest Sensitive Receiver

Table 3 summarizes the assigned levels at the nearest noise sensitive premises. It is required that all noise emissions from the development are below the assigned level for all defined periods of the day and at the lot boundary of the receiver or

Leschenault Quays

15m from any associated building. It is noted that the EPNR assigned levels only apply at the premises receiving the noise only and not to noise within the site.

Table 3: A	Assigned	levels for	3 Hough	Rd
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Type of premises receiving Time of day		Assigned Level (dB)		
10136		L _{A10}	L _{A1}	L _{Amax}
Noise sensitive premises: Highly	0700 to 1900 hours Monday to Saturday	50	60	70
	0900 to 1900 hours Sunday & public holidays	45	55	70
	1900 to 2200 hours all days	45	55	60
	2200 hours on any day to 0700 hours Monday to Saturday, and 0900 hours Sunday & public holidays	40	50	60
Noise sensitive premises: any area other than highly sensitive areas	All Hours	60	75	80
Commercial premises	All Hours	60	75	80
Industrial and utility premises	All Hours	65	80	90

2.1.3 Noise Character Adjustments

Regulation 7 states that the noise character must be "free" of annoying characteristics, namely ---

- Tonality, e.g. whining, droning;
- Modulation, e.g. like a siren; and
- Impulsiveness, e.g. banging, thumping.

Regulation 9 (1) establishes the methodology for determining noise characteristics. If these characteristics cannot be reasonably and practicably removed, a series of adjustments to the measured levels are required, indicated in Table 4.

Table 4: Noise character adjustment

Adjustment where noise emission is not music these adjustments are cumulative to a maximum of 15 dB Adjustment where noise emission is music				
Where tonality is present	Where modulation is present	Where impulsiveness is present	Where impulsiveness is not present	Where impulsiveness is present
+ 5 dB	+ 5 dB	+ 10 dB	+ 10 dB	+ 15 dB

2.1.4 Noise Emissions from Mechanical Services

At this stage no information has been on mechanical equipment. Typically, projects of this type involve noise emissions from mechanical services such as air handling units, condensers and exhaust fans.

It is important that noise emissions from the site do not present any form of tonality, modulation or impulsiveness (as defined by the EPNR).



Given that data from mechanical plant manufacturers is generally limited to broadband data or in 1/1 octave band value, it is not possible to objectively determine tonality, as it is described in the EPNR. 1/3 octave band data is required yet is typically unavailable.

Therefore, a +5 dB correction shall be conservatively assigned when assessing noise emissions from mechanical equipment. In summary, Noise emissions from mechanical equipment shall comply with L_{A10} 35 dB at the nearest noise sensitive receivers.

2.2 Internal Noise Levels and Reverberation Times

The criteria recommended below are based on the limits presented in Australian / New Zealand Standard 'Acoustics – *Recommended design sound levels and reverberation times for building interiors'* (AS/NZS 2107:2016). The levels stated in AS2107 apply to the combined internal noise levels from building services and external sources. The internal noise level criteria in AS2107 recommend continuous equivalent (L_{Aeq}) levels for background noise. This document is a common reference for establishing satisfactory goals for quasi-static mechanical and external traffic noise ingress.

Table 5: Design internal noise levels from AS2107

Type of Occupancy/Activity	AS/NZS 2107:2016 Recommended Design Sound Level Range L _{eq} dBA
Living areas	30 - 40
Work areas	35 – 40
Sleeping areas (night-time)	30 – 35
Apartment common areas (e.g. foyer, lift lobby, lounges, dining, games room)	45 – 50
General retail tenancies	< 50
Café	40 – 50
Enclosed carpark	< 65

AS/NZS 2107:2016 provides recommended reverberation times for optimising the acoustic amenity in occupied spaces. The relevant reverberation times have been outlined in Table 6.

Table 6: Recommended reverberation times from AS2107

Type of Occupancy/Activity	Recommended reverberation time (T), s
Sleeping areas (night-time)	—
Living areas	—
Work areas	—
Apartment common areas (e.g. foyer, lift lobby, lounges, dining, games room)	See Note 1
General Areas	
Enclosed carpark	—



Type of Occupancy/Activity	Recommended reverberation time (T), s
General retail tenancies	See Note 1
Café	See Note 1

1) Reverberation time should be minimised as far as practicable for noise control.

2.3 Sound Transmissions and Insulation — National Construction Code 2019

The acoustic requirements for inter-tenancy walls, floors etc. in residential buildings are outlined in the National Construction Code 2019 Volume 1, Building Code of Australia Class 2, 3 and 9c Buildings (NCC 2019). The acoustic requirements outlined in NCC 2019 are summarised in Table 7.

It is anticipated that all of the apartments will be Class 2, Building Certifier to confirm.

Table 7: Sound insulation requirements in accordance with NCC 2019

Construction	Condition	Deemed-to-Satisfy Requirements	Verification Requirements			
Walls	Airborne Sound Insulation					
	Between sole-occupancy units	Minimum R _w + C _{tr} 50	Minimum D _{nT,w} + C _{tr} 45			
	Between a sole-occupancy unit and a plant room, lift shaft, stairway corridor, public corridor or the like	Minimum R _w 50	Minimum D _{nT,w} 45			
	Impact Sound Insulation					
	Between a laundry, kitchen, bathroom or sanitary compartment in a sole-occupancy unit, and a habitable room in an adjoining unit	Discontinuous construction 1)	As deemed to satisfy			
	Between a sole-occupancy unit and a plant room or lift shaft	Discontinuous construction ¹⁾	As deemed to satisfy			
Floors	Airborne Sound Insulation					
	Between sole-occupancy units and between sole occupancy unit and lift shaft, stairway or public corridor	Minimum R _w + C _{tr} 50	Minimum D _{nT,w} + C _{tr} 45			
	Impact Sound Insulation					
	Between sole-occupancy units and between sole occupancy unit and lift shaft, stairway or public corridor	Maximum L _{n,w} 62	Maximum L _{nT,w} 62			
Services	Airborne Sound Insulation					
	Between a habitable room (other than a kitchen) in a sole- occupancy unit and a duct, soil, waste or water supply pipe duct (if the duct or pipe is located in a wall or floor cavity and serves or passes through more than one sole- occupancy unit)	Minimum R _w + C _{tr} 40	N/A			

Construction	Condition	Deemed-to-Satisfy Requirements	Verification Requirements
	Between a kitchen or non-habitable room in a sole- occupancy unit and a duct, soil, waste or water supply pipe duct (if the duct or pipe is located in a wall or floor cavity and serves or passes through more than one sole- occupancy unit	Minimum R _w + C _{tr} 25	N/A
	If a storm water pipe passes through a sole-occupancy unit (habitable room other than kitchen)	Minimum R _w + C _{tr} 40	N/A
	If a storm water pipe passes through a sole-occupancy unit (kitchen or non-habitable room)	Minimum R _w + C _{tr} 25	N/A

1) For the purposes of this Part, "discontinuous construction" means a wall having a minimum 20 mm cavity between two separate leaves.

2.4 Further Acoustic Considerations

Based on Stantec Acoustics review of the documentation, the following should also be factored into acoustic assessment:

- It is expected that the design will incorporate a ground level carpark and with apartments above/adjacent. The concrete slab between the ground and first floors should be a minimum of 150mm thick. Recommendations for the automatic access gates have been provided in Section 6.1.1;
- The proposed Gym is adjacent an apartment and co-working / reading space. Spatial allowance should be made for a 150mm set down to accommodate a typical vibration isolating sprung floor system. Special consideration will need to be given to the partitions in this area.



3. Architectural Acoustics

3.1 External Envelope

3.1.1 External Wall

Based on the architectural layouts, it is evident that the building envelope will consist of a combination of solid and glazed elements. The noise intrusion has been calculated for all façade elements, which is relative to their surface area.

Where solid elements are used as the external wall, the walls are required to achieve $R_W + C_{tr}$ 45 as a minimum to achieve acceptable internal noise levels.

Typically, this can be achieved with the following configuration:

• 90mm brick, 70mm air gap, 90mm brick. 13mm cement render to each outside face. Cavity ties to be resilient type.

Alternative construction material may be used to achieve the required performance. This will, however, require review and approval of the Acoustic Engineer.

Where <u>lightweight construction</u> is proposed, this will result in <u>reduced acoustic performance</u> specifically in the lower frequencies. As a result, this may have some impact on the recommended glazing types.

3.1.2 External Glazing

Glazing configurations to achieve the required internal noise levels have been provided for all residential units, taking into consideration the predicted increase in external noise levels over a 20-year design horizon. This configuration is to achieve acceptable internal noise levels considering traffic noise generated from the identified transport corridors.

Traffic noise is considered the dominant source, given that the Bunbury Port Annual Reports state that their operations are compliant to the noise Regulations, as well as client feedback that the nearby entertainment venue is likely to comply with the Regulations.

Table 8 summarises the general preliminary glazing requirements. To ensure compliance to the recommended internal noise levels specified in AS2107, the following treatments as detailed in Table 8 shall be applied.

Intrusion Glazing Assessment Noise Level Facades **Minimum Glazing System Configuration** Perf. Condition¹ Rw+Ctr² dB(A) Apartments -**Double Glazing:** 33 North & East 6mm glass / 12mm air gap / 6.38mm laminate glass Apartments -Future Traffic **Double Glazing:** 65 South, West & 29 Noise Levels 6mm glass / 12mm air gap / 6mm glass Internal Courtyard Commercial Single Glazing: 28 Tenancies 6mm glass

Table 8: External Glazing Requirements

Note 1: Assumed 3% annual growth rate in traffic volumes with 20-year design horizon to 2043.

Note 2: Glazing performance provided for glass only. Overall performance of the glazing system including the frames and seals shall not degrade by more than 3 dB from the performance requirement stated.



3.1.3 Roof Construction

Whilst it is not a mandatory requirement of the NCC, rain noise intrusion for any lightweight roof shall be considered with a view of ensuring an adequate level of amenity for occupants. Additionally, roof construction should be adequately designed to control external noise intrusion from noise sources identified in this report. The following construction is adequate to fulfil the requirements.

One layer of Colorbond sheet metal or similar (0.42 mm); and

- 60 mm thick high-density Anticon insulation hard-fixed to the underside of roof and over steel purlins;
- Minimum ceiling cavity to be 300mm;
- Suspended ceiling system; and
- Min. 50 mm thick glass wool insulation (min. 14kg/m³);
- One layer of 13 mm standard plasterboard.



4. Noise Modelling Parameters

Noise emissions from the proposed development will be primarily due to:

- Patron activity in alfresco areas;
- Deliveries;
- Mechanical services equipment; and
- Waste collection and rubbish disposal.

Noise emissions were calculated using 3D noise modelling software, SoundPLAN v8.2. Noise contours are provided in Appendix B.

4.1 Noise Propagation Algorithm

The ISO 9613-2:1996 prediction algorithm has been used in this assessment. ISO 9613-2 specifies an engineering method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of sources. The method predicts the equivalent continuous downwind octave band sound pressure level (as described in parts 1 to 3 of ISO 1996) under meteorological conditions favourable to propagation from sources of known sound emission.

4.2 Receivers

All noise receivers were located at 1.4 m above each floor level and 1 m away from the receiving façade. Reflected noise from the building façade is included in the received noise levels. A reflection order of 3 was used in all assessments.

Receiving points were also modelled at the residential lot boundaries, being within 15m of a highly sensitive occupied building.

4.3 Topography and Ground Condition

Terrain contours were sourced from *Geoscience Australia*, *Digital Elevation Model (DEM)* 5 Metre Grid of Australia derived from LiDAR, 2015.

A ground absorption coefficient of 0 (reflective) was used for roads and paved surfaces. Vegetated areas were modelled with a ground condition of 0.6.



5. Café Noise Emissions

The commercial tenancy at the corner of Austral Parade and King Rd will potentially be a Café.

External patronage in alfresco areas is expected to dominate noise emissions. At this stage, alfresco areas are not nominated on the drawings.

Alfresco patron noise emissions have been modelled to ensure compliance to the EPNR. The modelled patron alfresco area is shown in Figure 3.



Figure 3: Cafe patron alfresco area

5.1 Patron Sound Power Levels

Sound Power Levels for the Alfresco were predicted using the formula presented by Probst 1994 ("*Geräuschentwicklung von Sportanlagen und deren Quantifizierung für immissionsschutzgerechte Prognosen*. Predicted Sound Power Levels were benchmarked against the local document "*Licenced Premises Noise Assessment Technical Guideline*". Version 1.0, Association of Australian Acoustical Consultants, AAAC, 2019 and found to be within the range of predictions used by Acoustical Consultants in Australia (Australian Acoustical Society WA Division Technical Meeting, March 2016).

Table 9: Alfresco Patron Sound Power Levels used in Assessment

Area	Number of Patrons	Sound Power Level LwA10
Café Alfresco	24	83 dB(A)

5.2 Music Noise

Any outdoor music must be set at a level such that it is inaudible at external receivers. Music noise received attracts adjustments of up to +15 dB per the EPNR and may result in non-compliance.



Any outdoor music must be at an ambient or background level to allow normal conversation to occur without increasing vocal effort. On this basis, music noise noise was not modelled.

The predicted noise levels due to external patrons at the nearest noise sensitive receivers have been summarised in Table 12.

5.3 Results

Table 10: Predicted Café Patron Noise Emissions

Address	Zoning	Highest Predicted Noise Level L _{A10} dB(A)	Evening/Sun EPNR Criteria L _{A10} dB(A)	Comparison to EPNR
161 Stirling St		45		Complies
2 King Rd	Mixed-use Residential	38	45	Complies
159 Stirling St	rtooldormai	38		Complies

The results are compliant with the Evening/Sunday criteria of the EPNR, therefore:

- Café alfresco area is not to be used between the hours of 10pm 7am; and
- Any outdoor music must be at an ambient or background level to allow normal conversation to occur without increasing vocal effort.



6. Mechanical Services Noise Emission

Noise generated via the mechanical services from the proposed development is required to comply with the EPNR criteria at all nearest sensitive receivers.

At the time of writing this report, details of major plant items, plant rooms and their locations have not been provided. As there are no plant spaces on the General Arrangement drawings, the plant is assumed to be located on the roof.

The design should ensure that mechanical plant selected for the development is the quietest possible, is located away from noise sensitive premises and shielded and/or attenuated as required to meet the assigned levels of the EPNR.

The following major plant may be associated with the development:

- HVAC Condenser Units;
- Cool Room / Freezer refrigeration condensers (24hr operation); and
- Kitchen extract fan (not operating between 10pm 7am).

The following preliminary equipment Sound Power Levels or equivalent level of attenuation are recommended:

- Cool Room / Freezer Condenser Units (up to 2 units):
 - Sound Power Level no greater than 78 dB(A) per unit. If mounted on the roof, position will need to be reviewed and solid acoustic screening is likely to be required;
- Kitchen Extract Fan (1 unit):
 - Sound Power Level no greater than 75 dB(A) per unit. This typically requires an inline fan with kitchen grade internally lined ductwork on the outlet, or an over-sized fan operating at lower speed.

As the mechanical design progresses, acoustic review should be undertaken to ensure that the predicted noise emissions remain complaint with the EPNR. Further, noise intrusion into the apartments will need to be assessed as the design progresses.

6.1.1 Carpark Gates

Access gates to the ground level carpark have apartments located directly above/adjacent. The following shall be considered to mitigate any disturbance to the residents due to the operation of the gates:

- The motors selected for automated gates should be of the quietest type reasonably available;
- The gates should be appropriately vibration isolated from the building structure so as not to transmit any vibration into the apartments; and
- The gates should be maintained regularly and the tracks cleaned to minimise any friction generated noise.



7. **Delivery Noise Emissions**

Use of the external delivery bay on Hough Rd will dominate delivery noise emissions.

The external delivery bay is shown in Figure 4. Note that the Regulations are not applicable to vehicle propulsion and braking systems while using public roads.

As part of the acoustic assessment the noise impact from deliveries on the nearest sensitive receivers were assessed to the WA Environmental Protection (Noise) Regulations 1997.

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D G Н F F RL 1.200 RL 1.190 GREGA Rt-1.500 Hatched NLA = 309m2 RL 1.500 MONO Entry 2 RL 1.500 Residents







Noise emissions from truck movements and associated operations within these areas are generally formed by a combination of successive and transient, noise events. This typically includes:

- Moving truck (engine noise, acceleration, deceleration, brake squeals, compression release, reversing beepers); and
- Truck unloading activities (hydraulic lifts, pallet jacks).



Noise Sources

Noise sources are considered to be medium rigid service vehicles (trucks), similar in size to private waste collection vehicles which may utilise the same loading area. The assessment has considered the following scenarios:

- Moving truck activities: Arrival, reversing and departure; and
- Loading truck activities: Trucks are parked and being unloaded with pallet jacks. The sound power levels used in the model have been summarised in Table 11.

Table 11: Sound Power Levels of Noise Sources

Noise Source	Sound Power Level, dB(A)
Service truck arrival or departure movements	96 ⁽¹⁾
Service truck unloading activities	85(1)

1. Noise levels obtained from previous measurements of similar noise sources on Stantec projects.

Waste compaction noise has been excluded from the predictions. The provision of compactors is yet to be confirmed, however due to the location of the bins within enclosed rooms at the centre of the development, environmental noise emissions from waste compaction is unlikely to be significant when compared with loading dock noise emissions.

OPERATING TIMES AND TRUCK NUMBERS

As delivery schedules and waste collection frequency are yet to be confirmed, the operating times listed below were assumed for the delivery bay. It assumed that only one truck would be present at any time.

- Commercial deliveries:
 - Monday to Saturday: 0700 AM 1900 PM

Noise emissions from waste collection are discussed in Section 8.

7.1 Results and Recommendations

The predicted noise levels due to the loading dock at nearest noise sensitive receivers have been summarised in Table 12.

Table 12: Predicted Delivery Noise Emissions

Address	Zoning	Highest Predicted Noise Level L _{A1} dB(A)	Day Time EPNR Criteria L _{A1} dB(A)	Comparison to EPNR
3 Hough Rd	Mixed-use Residential Residential	60	60	Complies
5 Austral Pde		50		Complies
11 Hough Rd		50		Complies

Note 1: Premises is assumed to be a residence and was sold as such in 2013 (Source: realestate.com.au).

Noise from the delivery bay is predicted to be compliant to the EPNR L1 criteria, and therefore:

• Deliveries shall be scheduled and limited to less than 24 minutes in any 4-hour period (in order to meet the EPNR L₁ assessment definition).



8. Waste Collection

Under the EPNR Regulation 14A, the assigned noise levels of Regulation 7 do not apply to waste collection (both domestic and commercial sources), provided:

- The works are carried out in the quietest reasonable and practicable manner;
- The equipment used to carry out the works is the quietest reasonable available; and
- In the case where a noise management plan is required (e.g. works are to occur outside of 0700 1900 hours Monday through Saturday or 0900 1900 hours Sundays and public holidays), the plan is submitted and approved, with works carried out according to the plan.

Generally, collection times cannot be confirmed for residential waste collections, however councils' endeavour to conduct waste collection during the hours 0700 – 1900 hr Monday to Saturday in accordance with the WA Department of Environmental Regulation's *Draft Guide to Management of Noise from Waste Collection and Other Works* (December 2014).



9. Conclusion

As part of the development approval process for the Leschenault Quays project, an acoustic assessment has been carried out as detailed in this report.

Traffic noise assessment has been carried out and the minimum recommended external façade construction has been provided in the form of glazing and wall configurations.

Mechanical services should be selected or attenuated in order to achieve the limiting Sound Power Levels provided, to ensure compliance to the EPNR.

Management measures have been provided for the use of the café and external loading bay to maintain compliance with the EPNR.

Under the EPNR Regulation 14A, the assigned noise levels of Regulation 7 do not apply to waste collection (both domestic and commercial sources). Based on the delivery noise assessment, any additional impact on the acoustic amenity of neighboring residential buildings may be considered negligible.



Appendix A Glossary of Acoustic Terms

NOISE	
Acceptable Noise Level:	The acceptable LAeq noise level from industrial sources, recommended by the EPA (Table 2.1, INP). Note that this noise level refers to all industrial sources at the receiver location, and not only noise due to a specific project under consideration.
Adverse Weather:	Weather conditions that affect noise (wind and temperature inversions) that occur at a particular site for a significant period of time. The previous conditions are for wind occurring more than 30% of the time in any assessment period in any season and/or for temperature inversions occurring more than 30% of the nights in winter).
Acoustic Barrier:	Solid walls or partitions, solid fences, earth mounds, earth berms, buildings, etc. used to reduce noise.
Ambient Noise:	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment Period:	The period in a day over which assessments are made.
Assessment Location	The position at which noise measurements are undertaken or estimated.
Background Noise:	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level.
Decibel [dB]:	The units of sound pressure level.
dB(A):	A-weighted decibels. Noise measured using the A filter.
Extraneous Noise:	Noise resulting from activities that are not typical of the area. Atypical activities include construction, and traffic generated by holidays period and by special events such as concert or sporting events. Normal daily traffic is not considered to be extraneous.
Free Field:	An environment in which there are no acoustic reflective surfaces. Free field noise measurements are carried out outdoors at least 3.5m from any acoustic reflecting structures other than the ground
Frequency:	Frequency is synonymous to pitch. Frequency or pitch can be measured on a scale in units of Hertz (Hz).
Impulsive Noise:	Noise having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent Noise:	Level that drops to the background noise level several times during the period of observation.
LAmax	The maximum A-weighted sound pressure level measured over a period.
LAmin	The minimum A-weighted sound pressure level measured over a period.
LA1	The A-weighted sound pressure level that is exceeded for 1% of the time for which the sound is measured.
LA10	The A-weighted sound pressure level that is exceeded for 10% of the time for which the sound is measured.
LA90	The A-weighted level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
LAeq	The A-weighted "equivalent noise level" is the summation of noise events and integrated over a selected period of time.



LAeqT	The constant A-weighted sound which has the same energy as the fluctuating sound of the traffic, averaged over time T.
Reflection:	Sound wave changed in direction of propagation due to a solid object met on its path.
R-w:	The Sound Insulation Rating R-w is a measure of the noise reduction performance of the partition.
SEL:	Sound Exposure Level is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound Absorption:	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound Level Meter:	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound Pressure Level:	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound Power Level:	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise:	Containing a prominent frequency and characterised by a definite pitch.



Appendix B Noise Contours





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CAFE PATRON NOISE

NOISE CONTOUR AT 1.4m RECIEVER HEIGHT











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MECH PLANT NOISE

NOISE CONTOUR AT 1.4m RECIEVER HEIGHT











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DELIVERY BAY NOISE, L1

NOISE CONTOUR AT 1.4m RECIEVER HEIGHT









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