MARSHALL DAY Acoustics

CREAMERY ROAD PSP
ACOUSTIC ASSESSMENT

Rp 001 R01 20220484 | 18 November 2022

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Project: **CREAMERY ROAD PSP**

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EXECUTIVE SUMMARY

The City of Greater Geelong are finalising the Creamery Road Precinct Structure Plan (CRPSP), the first precinct to be developed within the Western Geelong Growth Area.

This report assesses acoustic considerations associated with noise sensitive uses as part of the CRPSP development, including recommendations for the management of road traffic, rail and industrial noise in the vicinity of the site.

Relevant acoustic design criteria/target noise objectives have been established with reference to guidelines and standards used in Victoria to assess and control environmental noise.

These target noise objectives can be practicably achieved using a combination of appropriate site layout design, roadside barriers and appropriate building envelope construction. Indicative noise barrier heights and locations have been provided and sound insulation performance requirements for building envelopes has been nominated.

These preliminary noise mitigation measures are considered both feasible and reasonable and do not deviate from commonly used practices at similar developments. The recommendations are preliminary, intended for planning purposes and to inform feasibility to develop the site for noise sensitive use. They are by no means a final design that must be adopted at this stage of the project, but rather serve as a guide to inform of the nature and extent of the types of treatments.

It is recommended these are reviewed at the detailed design development stages to verify the measures required to address noise.

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1.0 INTRODUCTION

The City of Greater Geelong is in the process of finalising the Creamery Road Precinct Structure Plan (CRPSP). The CRPSP is the first precinct to be developed within the Western Geelong Growth Area, which forms part of the wider Northern and Western Geelong Growth Areas.

The CRPSP development site is approximately 350 hectares and has the potential to develop more than 3000 dwellings.

This acoustic assessment has been prepared to accompany the CRPSP and include recommendations for the management of road traffic, rail noise and industrial noise in the vicinity.

The recommendations presented in this report are preliminary and intended for planning purposes to inform feasibility. As such, this report has been prepared to illustrate that relevant acoustic design criteria can be achieved but the recommendations, especially pertaining to building envelope construction and roadside barriers, are by no means a final design that must be adopted at this stage of the project. Instead, the recommendations serve as a guide to inform of the nature and extent of the types of treatments required and to demonstrate the feasibility of achieving relevant target noise objectives. The recommendations are to be reviewed at the design development stages to verify the measures required to address noise.

A glossary of acoustic terminology used throughout this report is provided in Appendix A.

2.0 PROJECT OVERVIEW

The Creamery Road Precinct Structure Plan (CRPSP) site is bounded by the following:

- Geelong-Ballarat railway corridor to the north, with existing residential allotments beyond;
- Geelong Ring Road to the east, with existing residential allotments beyond;
- Midland Highway (Ballarat Road) to the south. An existing quarry is located on the south side of road; and
- Geelong-Ballan Road to the west with existing large residential allotments beyond.

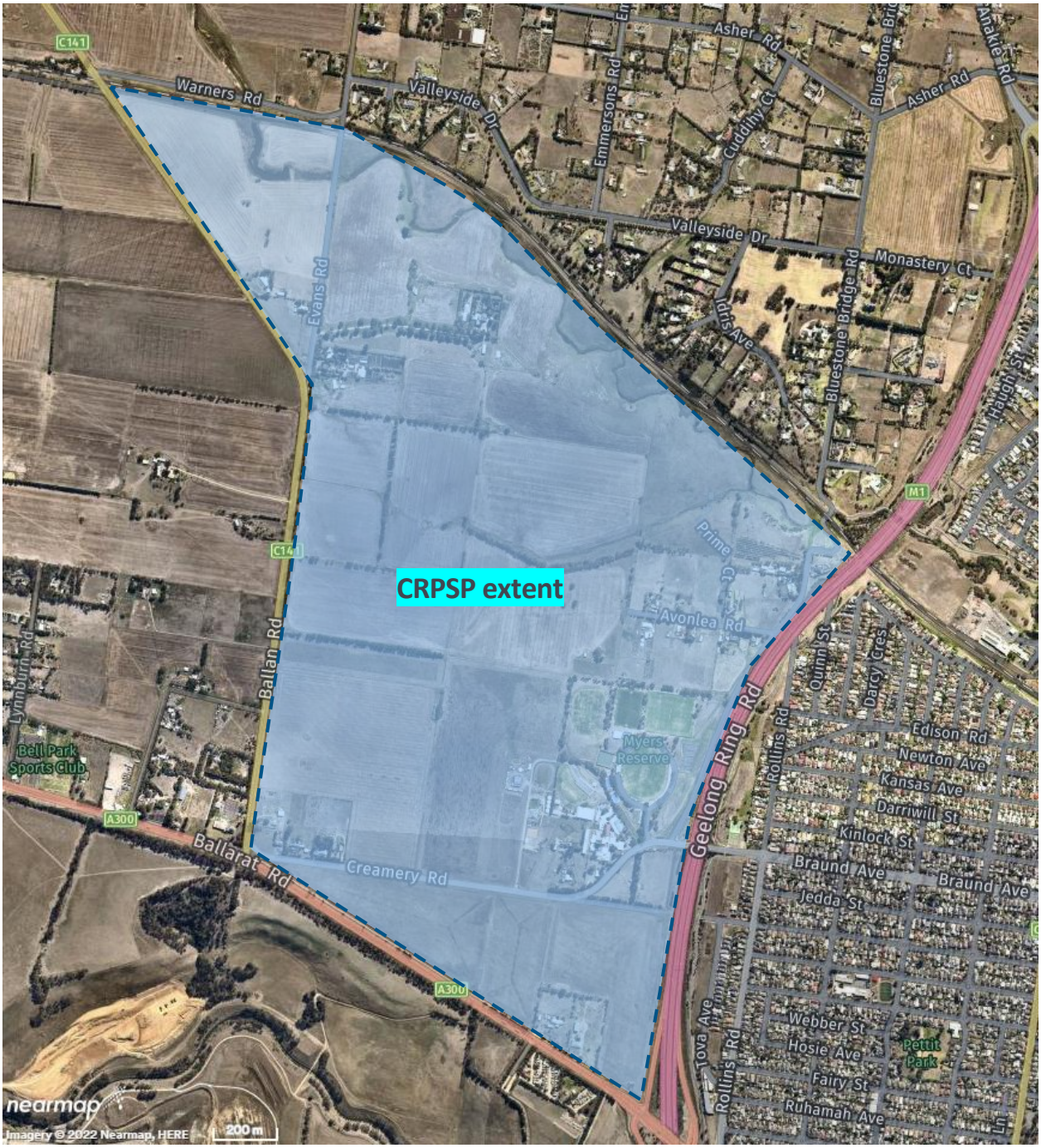
The CRPSP site extent is shown in Figure 1.

Noise considerations for the development of the site include:

- Road traffic noise
- Rail traffic noise
- Industrial/commercial noise, primarily associated with the existing Batesford Quarry to the south.

Appendix B shows the CRPSP layout and proposed land uses, including areas for noise sensitive development.

Figure 1: CRPSP site extent and surrounds



3.0 ENVIRONMENTAL NOISE REQUIREMENTS

Various guidelines and standards are used in Victoria to assess and control environmental noise for new noise sensitive development.

Clause 13.05-1S of the Geelong Planning Scheme outlines high level objectives to assist in the management of noise effects on sensitive land uses.

> ***Objective***
>
> *To assist the management of noise effects on sensitive land uses.*
>
> ***Strategy***
>
> *Ensure that development is not prejudiced and community amenity and human health is not adversely impacted by noise emissions.*
>
> *Minimise the impact on human health from noise exposure to occupants of sensitive land uses (residential use, child care centre, school, education centre, residential aged care centre or hospital) near the transport system and other noise emission sources through suitable building siting and design (including orientation and internal layout), urban design and land use separation techniques as appropriate to the land use functions and character of the area.*

The planning scheme sets out and gives effect to consider, as relevant, the following policies, guidelines and documents:

- The noise requirements in accordance with the *Environment Protection Regulations 2021* under the *Environment Protection Act 2017*.
- EPA Publication 1826.4 *Noise limit and assessment protocol for the control of noise from commercial, industry and trade premises and entertainment venues*
- Environment Reference Standard (Gazette No. S 245, 26 May 2021)
- Passenger Rail Infrastructure Noise Policy (Victorian Government, 2013)
- VicTrack Rail Development Interface Guidelines (VicTrack, 2019)

A summary of the key guidelines and policies relevant to this assessment is presented in Table 1, with further details provided in Appendix C.

Table 1: Legislation and guidelines relevant to the PSP

Document	Overview
Environment Protection Act 2017 (the Act)	The Act provides the overarching legislative framework for the protection of the environment in Victoria. It establishes a general environmental duty to minimise the risks of harm to human health or the environment from pollution or waste, including noise, so far as reasonably practicable. The Act does not specify noise limit values but prohibits the emission of unreasonable or aggravated noise from non-residential premises. It provides general definitions of unreasonable and aggravated noise; definitions that are specific to commercial, industrial and trade premises are provided in supporting publications. Part 3.2 of the Act outlines the General Environmental Duty (see below), which requires anyone engaging in an activity posing a risk of harm to human health and/or the environment from pollution to minimise those risks to prevent harm as far as reasonably practicable. Section 93 of the Act provides for the creation of an environmental reference standard to be used to assess and report on environmental conditions in the whole or any part of Victoria (see below).
Environment Protection Regulations 2021 (the Regulations)	The objectives of the Regulations are to further the purposes of, and give effect to, the Act. The Regulations also define outdoor sensitive areas, commercial, industrial and trade premises, as well as indoor, outdoor and live entertainment venues and events. Part 5.3 of the Regulations sets out requirements that are specific to environmental noise. Division 1 states that the prediction, measurement, assessment or analysis of noise within a noise sensitive area for the purposes of the Act or the Regulations must be conducted in accordance with the Noise Protocol (see below). Division 3 stipulates requirements that are specific to commercial, industrial and trade premises. Division 4 applies to music noise from entertainment venues and events. Noise from these types of premises and venues is prescribed as unreasonable if it exceeds a noise limit or alternative criterion determined in accordance with the Noise Protocol. Additional matters addressed in Divisions 3 and 4 include assessment time periods, minimum noise limit values, management of cumulative noise from multiple premises, noise sensitive areas where assessment requirements apply, definition of frequency spectrum as a prescribed factor, and a definition for aggravated noise.
EPA Publication 1826.4 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues* dated May 2021 (Noise Protocol)	The Noise Protocol defines the method for setting the noise limits for new and existing commercial, industrial and trade premises and entertainment venues in Victoria. It also outlines the steps that must be followed to undertake an assessment (measurement or prediction) of the effective noise level within a noise sensitive area or at an alternative assessment location. A comparison between the effective noise level and the relevant noise limit or the relevant alternative assessment criterion will determine whether the noise that is emitted from the premises is unreasonable under the Regulations. The noise limits for commercial, industrial and trade premises are determined based on land zoning and background noise levels, and are separately designated for day, evening and night periods.

Document	Overview
Environment Reference Standard dated 25 May 2021 (ERS)	The ERS sets out environmental values for ambient sound that are sought to be achieved and maintained in Victoria and standards to support those values. The indicators and objectives within the standard provide a benchmark for comparing desired outcomes to the actual state of the environment and a basis for assessing actual and potential risks to the environmental values. The ERS is not a compliance standard, and the values listed within the ERS for different land uses are explicitly not noise limits nor design criteria. The primary function of the ERS is to provide assessment and reporting benchmarks for environmental values. The ERS is primarily relevant for aspects of the environment that are not the subject of prescriptive regulation. These aspects include the noise of industry in natural areas, or the additional noise from public roads as a result of industry related traffic. Conversely, the indicators and objectives within the ERS are generally not relevant for aspects of the environment that are the subject of prescriptive regulation (i.e. noise from industry in noise sensitive areas that is directly regulated by the Noise Protocol).
VicRoads' (now Department of Transport) *Traffic Noise Reduction Policy 2005* *Requirements of Developers – Noise Sensitive Uses*	This document recommends traffic noise level objectives adopted by VicRoads when constructing new or upgrading existing roads. In addition, the Department of Transport has developed guidelines for new noise sensitive development near major, existing roads. These guidelines recommend developers undertake some combination of the following: • Erect traffic noise barriers of sufficient height and suitable construction to reduce external noise levels to 63 dB $L_{A10(18h)}$ or less at the ground floor level of exposed dwellings • Provide sound insulation treatment to residential dwellings sufficient to achieve compliance with the recommended internal noise levels specified in Australian/New Zealand Standard 2107-2016 *Acoustics - Recommended design sound levels and reverberation times for building interiors* (AS 2107)
VicTrack Rail Development Interface Guidelines	Provides guidance on how to establish an appropriate development interface with railway land. Respects the strategic importance of the railway land and that future development does not adversely affect existing and future transport operations.
Victorian Passenger Rail Infrastructure Noise Policy (VPRINP)	Sets 'investigation thresholds' for the assessment of noise from rail infrastructure. These thresholds consider noise from rail pass by, which if exceeded, indicate that mitigation should be considered.

4.0 EXISTING NOISE ENVIROMENT

Noise monitoring within the site was undertaken in July 2022, primarily to quantify noise levels due to existing road traffic, and rail noise levels.

Noise levels were measured in general accordance with Appendix C of the Road Design Note RDN 06-01 *Interpretation and Application of VicRoads Traffic Noise Reduction Policy 2005*. Further details regarding the noise measurements, including monitoring locations are contained in Appendix D.

Table 2 summarises the measured road traffic noise levels at each monitoring location.

Table 2: Measured average road noise levels during acceptable or marginal weather conditions, dB

Parameter	L1	L2	L3
$L_{A10(18h)}$ (6 am - midnight)	57	54	56
$L_{Aeq(16h)}$ (6 am – 10 pm)	56	54	57
$L_{Aeq(8h)}$ (10 pm – 6 am)	52	55	53

Table 3 summarises the measured rail traffic noise levels at monitoring location L2, adjacent the rail corridor.

Table 3: Measured range of rail noise levels, dB

Parameter	L2
$L_{Aeq(16h)}$ (6 am – 10 pm)	53 - 58
$L_{Aeq(8h)}$ (10 pm – 6 am)	54 - 55
L_{Amax}	78 - 96

5.0 ROAD TRAFFIC NOISE ASSESSMENT

The following section outlines an assessment of road traffic noise across the CRPSP site.

5.1 Noise modelling method

To calculate road traffic noise levels across the CRPSP site, noise modelling was undertaken in accordance with the *Calculation of Road Traffic Noise* (CoRTN) method implemented in SoundPLAN v8.2 noise modelling software.

The noise modelling enables area wide calculations of road traffic, accounting for local terrain, atmospheric and ground conditions, road surface, traffic flow, and reflective or screening elements such as barriers or buildings.

5.1.1 Assumptions

Propagation conditions

The following assumptions were made:

- 50 % soft ground was assumed for ground effect attenuation as the intervening ground between the motorway and site is primarily vegetated
- A facade correction of +2.5 dB was applied to the predicted future noise levels from road traffic
- No dwellings or other structures were entered into the model and therefore shielding by intervening buildings has not been accounted for. The actual noise levels at dwellings located to the west of the first row of dwellings are therefore likely to be lower than the predicted noise levels
- Digital terrain data of the site, acquired from publicly available sources.

Traffic and road conditions

Table 4 provides a summary of the traffic volume data for 'current (2022) conditions,' to coincide when the noise measurements were undertaken.

Table 4: Existing traffic volume and composition (source: *Traffic Volumes for Freeways and Arterial Roads*, Department of Transport)

Road	Details	Annual Average Daily Traffic 24 hour (AADT)	Heavy vehicles (%HV)
Geelong-Ballan Road	Two-way	2073	11
Midland Highway (Ballarat Road)	West of Geelong-Ballan Road, two-way	1180	15
Midland Highway (Ballarat Road)	East of Geelong-Ballan Road, two-way	12800	16
Geelong Ring Road (Princes Freeway)	North bound	23000	10
Geelong Ring Road (Princes Freeway)	South bound	24000	11

The *Requirements of Developers – Noise Sensitive Uses* guidelines require future road traffic noise levels to be assessed based on future traffic volumes expected 10 years after finalisation of the development. In this case, future traffic volumes for the surrounding road network have been provided for the year 2035.[1]

[1] *Forecast traffic volumes*, Email 5 August and 5 October 2022, prepared by Stantec

Table 5 provides a summary of the forecast traffic volume data for the year 2035. Should the design year change as the project progresses, the resultant noise mitigation requirements may change proportionally.

Table 5: Future traffic volume and composition (source: reference (1))

Road	Details	Annual Average Daily Traffic 24 hour (AADT)	Heavy vehicles (%HV)
Geelong-Ballan Road	North of Midland Highway (Ballarat Road), two-way	10435	7.4
Midland Highway (Ballarat Road)	West of Geelong Ring Road, two-way	41871	7.4
Geelong Ring Road (Princes Freeway)	Two-way	84230	18.4

For noise modelling purposes, the 18-hour traffic volumes were set to 95 % of the AADT values.

The traffic speeds in the noise model are as detailed in Table 6, based on combination of observations on site (existing) and future forecast changes.

Table 6: Traffic speeds existing and future conditions, km/h

Road	Details	Existing	Future (refer Figure 2)
Geelong-Ballan Road	North of Midland Highway (Ballarat Road)	80	60
Geelong-Ballan Road	South of Evans Road	80	80
Geelong-Ballan Road	North of Evans Road	80	100
Midland Highway (Ballarat Road)	West of Geelong Ring Road	80	80
Geelong Ring Road (Princes Freeway)	-	100	100

Figure 2: Future forecast road traffic speeds (source: reference (1))

5.1.2 Model validation

The noise monitoring locations (refer Appendix D) were entered into the noise model and the existing noise levels modelled based on the existing traffic data in Table 4.

The modelled noise levels were compared to the measured noise levels, shown in Table 7.

Table 7: Measured and modelled noise levels (existing traffic data), dB $L_{A10(18h)}$

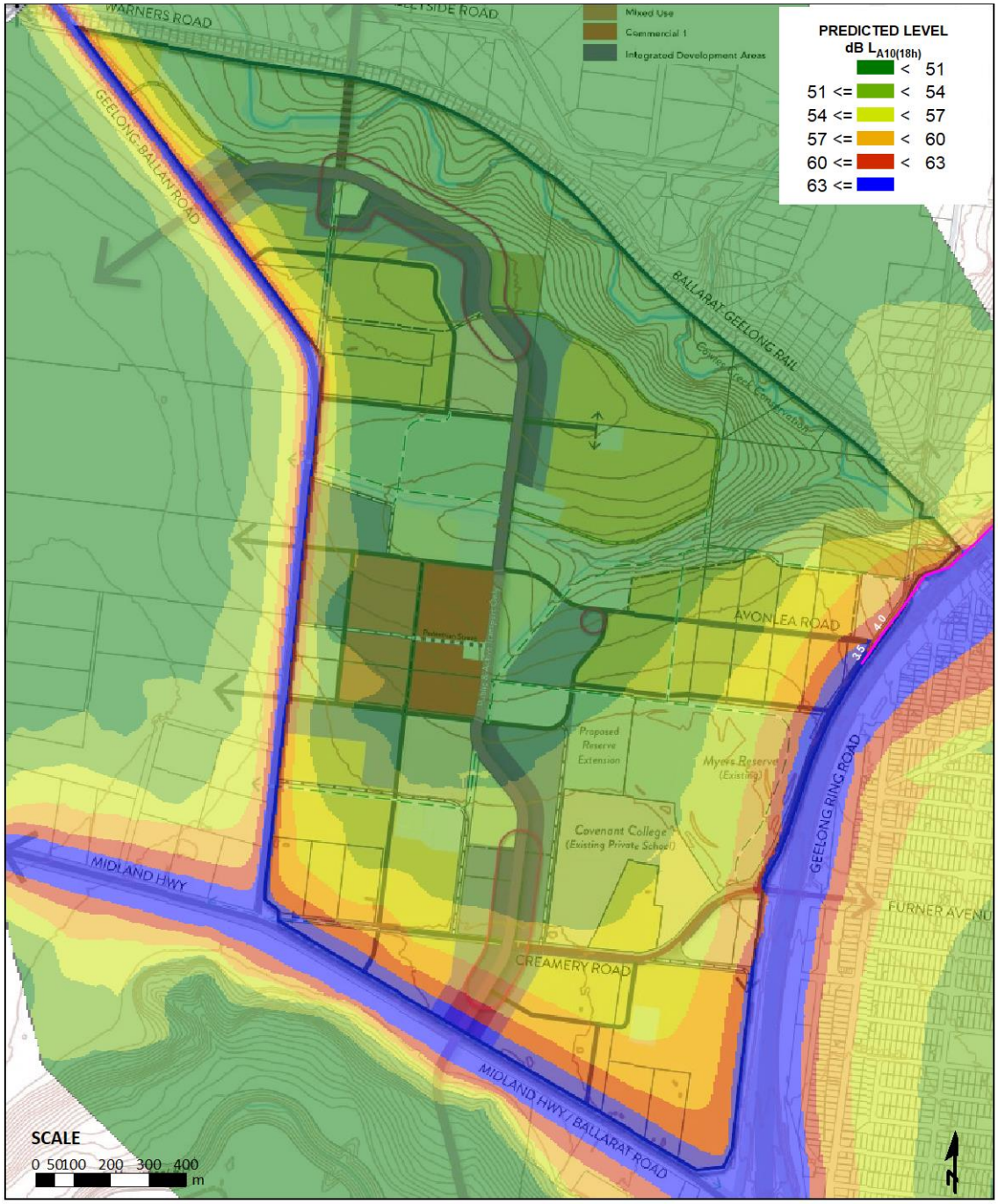
Description	L1	L2	L3
Measured (free-field)	57	54 (2)	56
Modelled (1)	60	50	59
Difference	+3	-4	+3

Note: (1) modelled values shown do not include facade correction, i.e. free-field
(2) measured value includes influence of noise from trains

The predicted levels at L1 and L2, where road traffic noise was the dominant feature of the noise environment, are above the measured noise levels by a consistent margin. A factor of -3 dB has therefore been used to adjust the noise model for local conditions.

The modelled road traffic noise levels for existing conditions are shown in Figure 3.

Figure 3: Modelled existing road traffic noise levels (1.5 m AGL)



5.1.3 Modelling scenarios

To inform the potential mitigation requirements on site, the following scenarios were modelled:

- No noise mitigation
- Noise barriers to achieve 63 dB $L_{A10(18h)}$ at ground floor of future potential dwellings
- A combination of noise barriers and site layout, such as proposed building setback.

Further mitigation requirements for individual dwellings, discussed in Section 5.3, may therefore be required for multi-storey developments or in instances where the proposed layout/setback in combination with any proposed noise barrier indicates road traffic noise levels above 63 dB $L_{A10(18h)}$.

5.2 Predicted noise levels

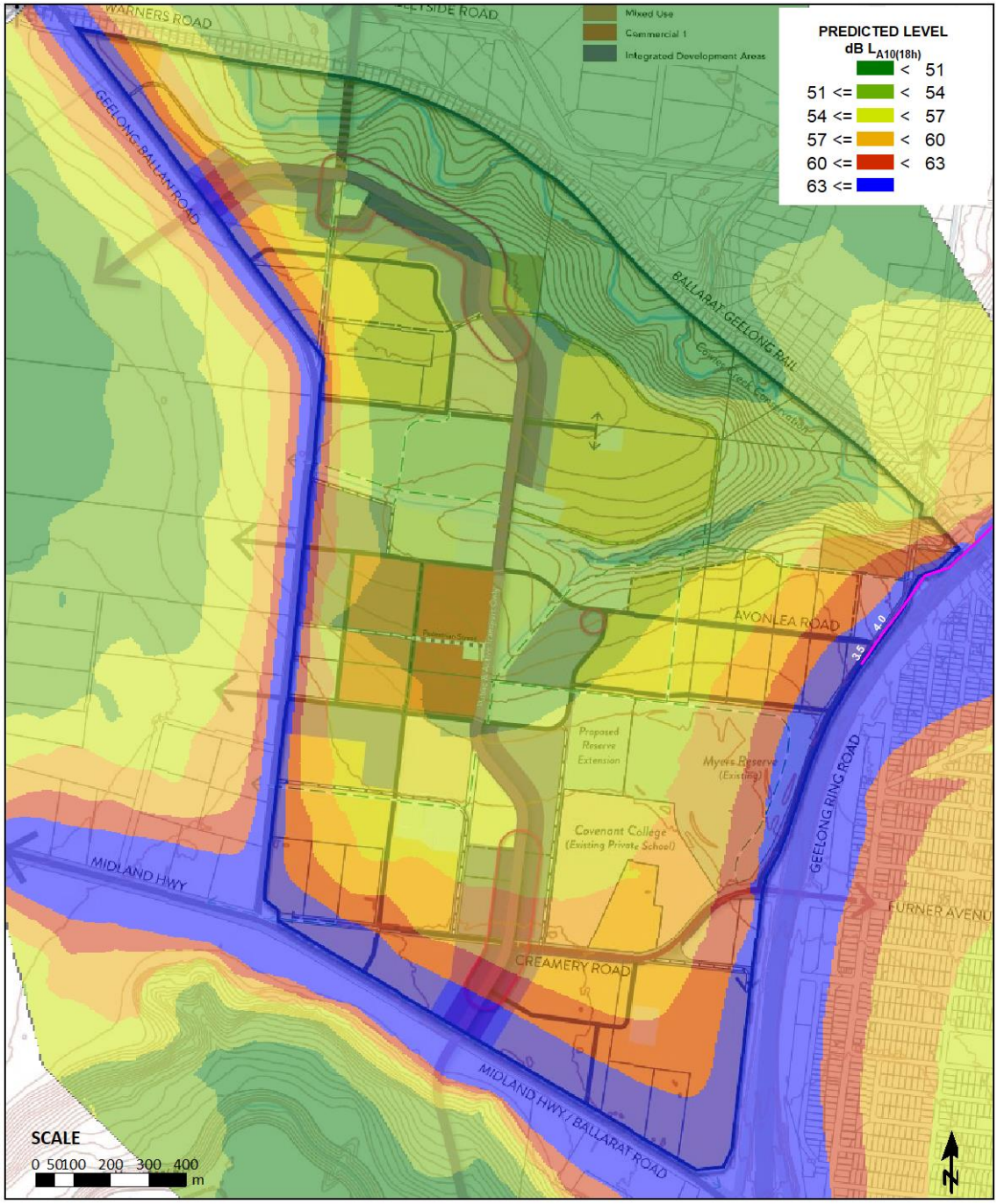
5.2.1 No noise mitigation

Figure 4 presents a noise level contour map showing predicted traffic noise levels for the year 2035 with no noise mitigation in place. As shown, the target noise objective of 63 dB $L_{A10(18h)}$ is predicted to be exceeded in parts of the CRSP site (dark blue areas to south, east and west) where future noise-sensitive development is proposed, particularly at southern and south-eastern ends.

Accordingly, mitigation measures are required to achieve relevant target noise objectives, discussed further in Section 5.3.

Areas throughout the CRPSP site where the target noise objective is achieved without the need for barriers can be developed prior to the construction of any noise barrier(s).

Figure 4: Predicted future road traffic noise levels (1.5 m AGL) – no mitigation



Legend

Barrier

Project: Creamery Road PSP
Project number: 20220484
Client name: City of Greater Geelong
Version: SoundPLAN 8.2
Prediction method: CoRTN
Model number: 01
Run No & Title: 0/GNM(1002,2) - 0.5;
File: road future_no mit
Prediction Height: 1.5 m

Creamery Road PSP

Future Road Traffic Noise Levels
No noise mitigation (ground)

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5.2.2 Preliminary noise barrier design

This section describes a preliminary noise barrier design and configuration to demonstrate feasibility of compliance with the target noise objective 63 dB $L_{A10(18h)}$ at ground floor of future potential dwellings.

The design of noise barriers is to be based on finished site levels and consider screening provided by the landform.

Several design elements of the noise barriers will require refinement as the project progresses.

Based on previous project experience, it is expected that the alignment and design of the noise barrier may need to be refined and incorporate feedback from Department of Transport, and any civil engineering considerations. In addition, there may be changes in terrain height on the site to represent final finished levels, accommodate drainage or other considerations.

Once any terrain changes have been determined and the final noise barrier alignment has been agreed, the noise barrier will require detailed noise modelling to optimise the height requirements.

Noise barriers are recommended at the southern site boundary of the CRPSP site, with returns on the eastern and western boundaries, refer Figure 5.

In addition, it is recommended that the existing barrier at the north-eastern site boundary adjacent the Geelong Ring Road (approximately 4 m high), is increased in height extended further south, refer Figure 6.

Figure 5: South site boundary – new

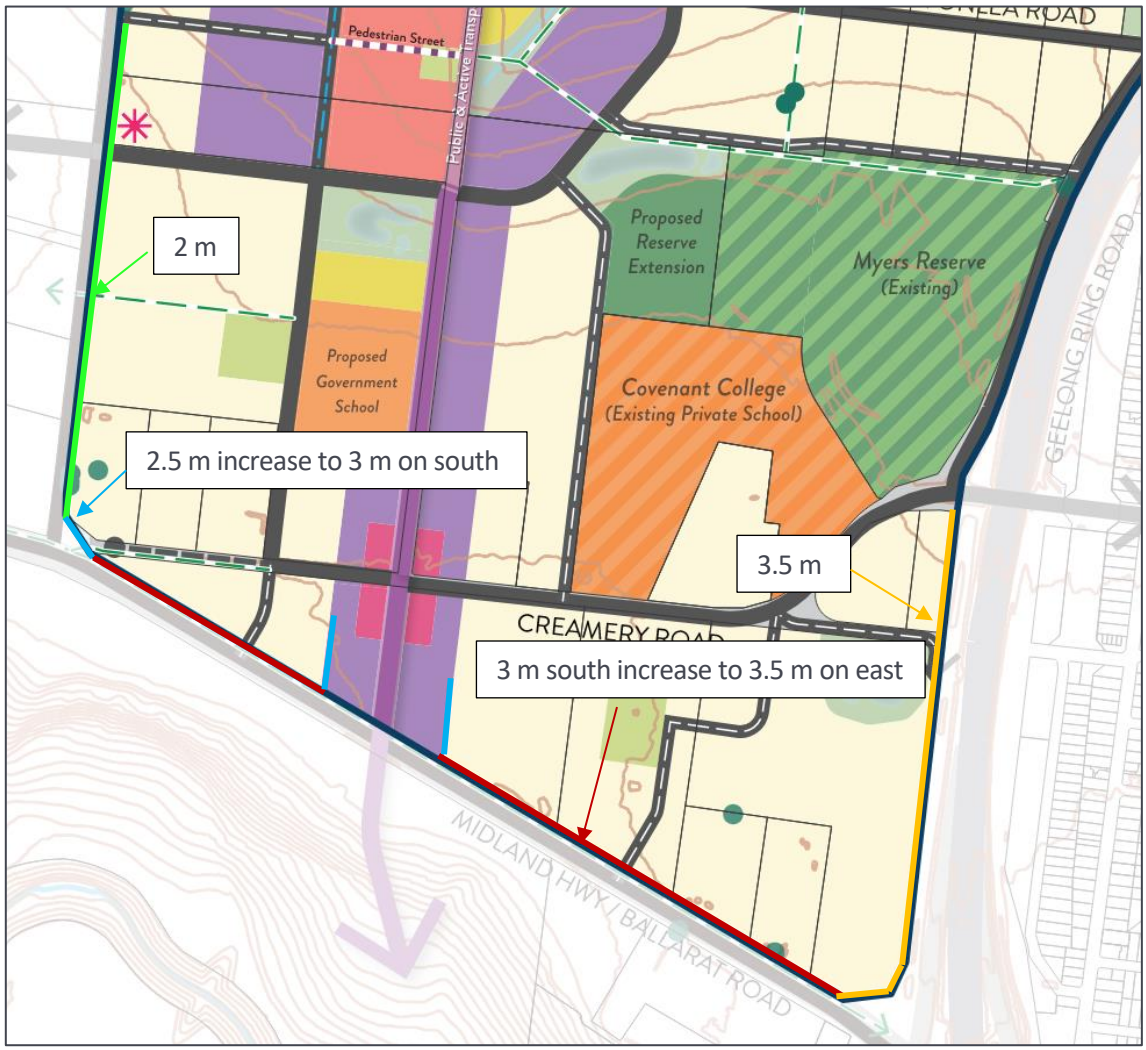


Figure 6: North-East boundary – extension of existing barrier (purple)

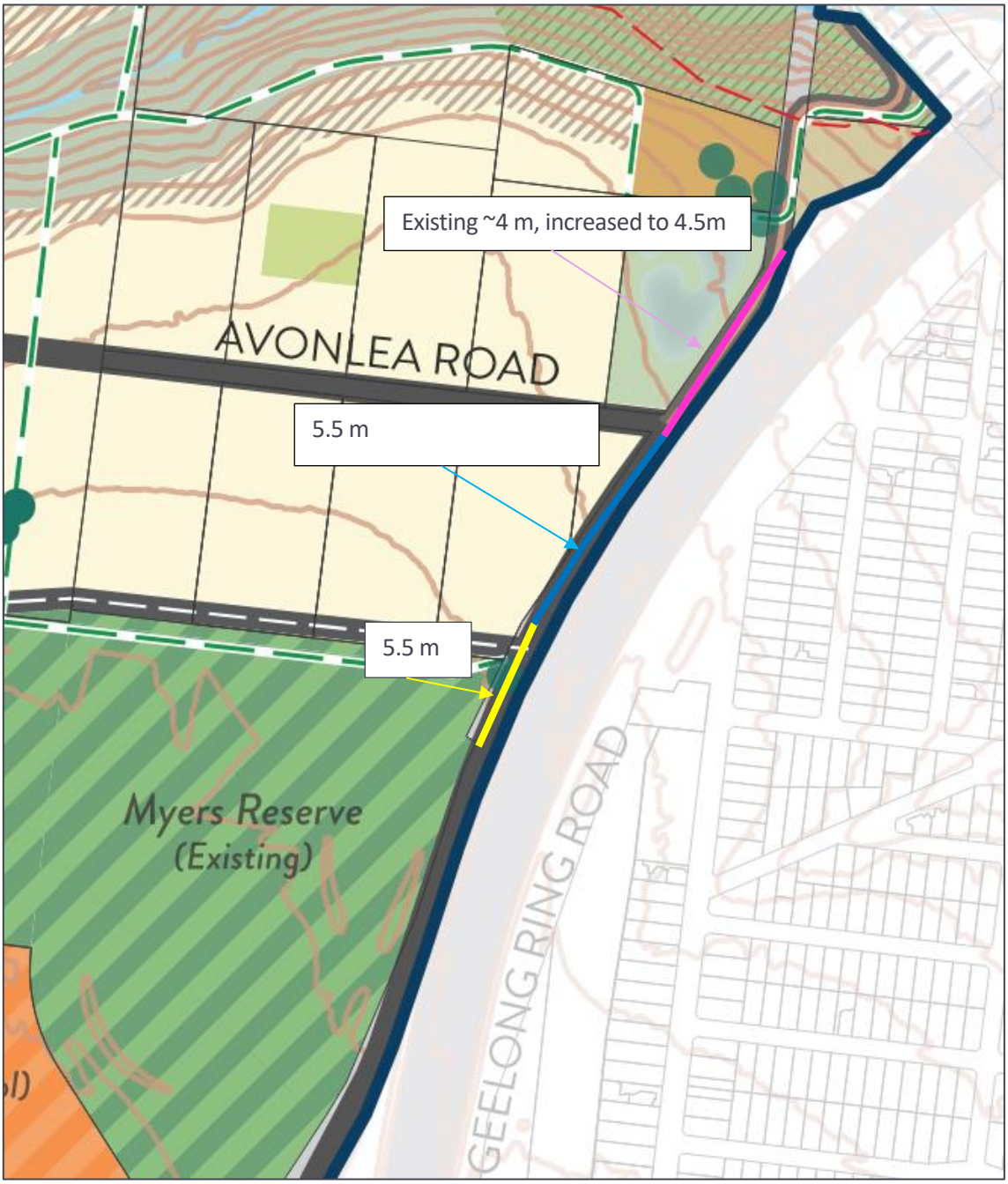
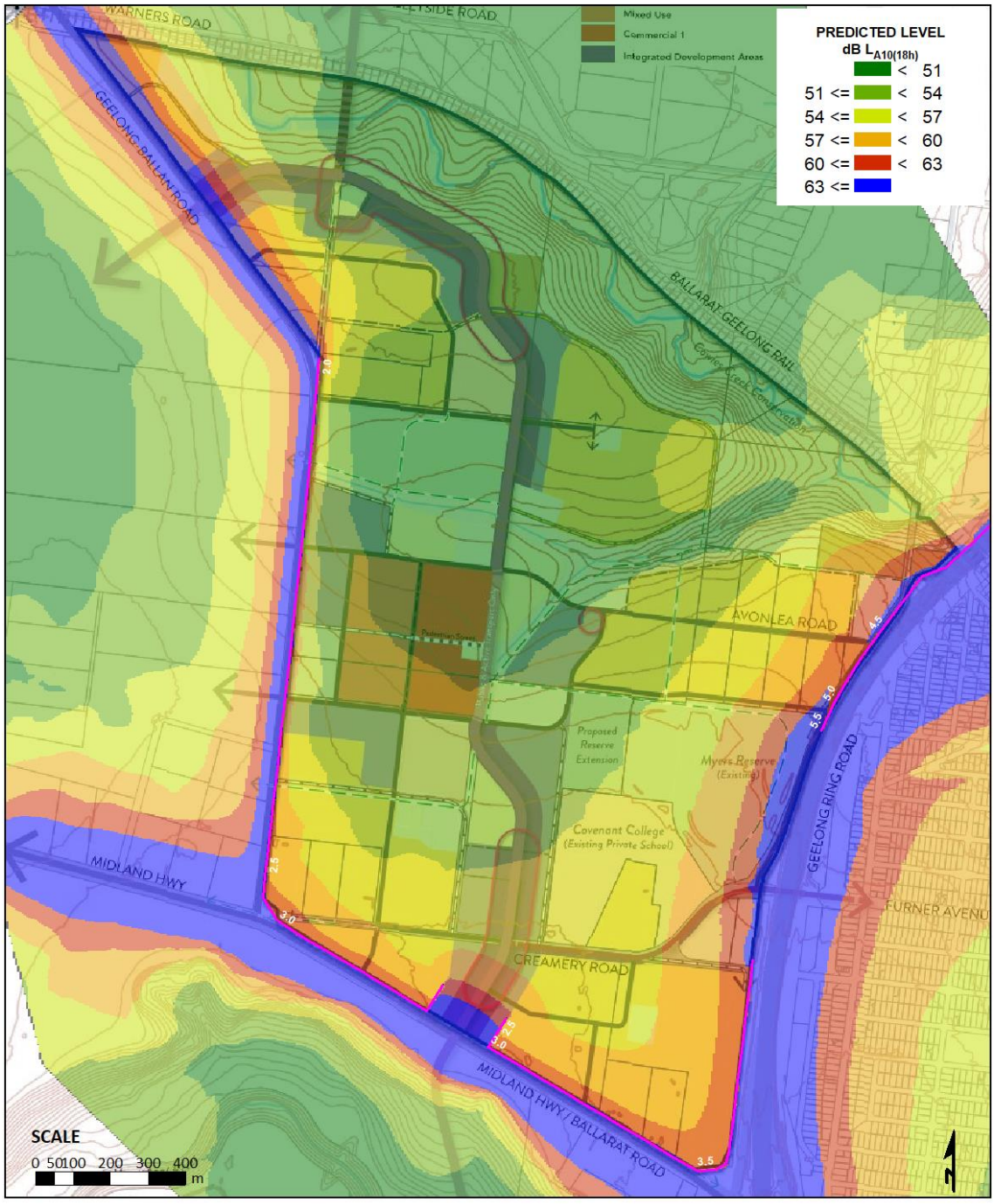


Figure 7 presents the predicted noise levels at ground floor locations with the preliminary noise barrier design in place. As shown, the target noise objective of 63 dB $L_{A10(18h)}$ is achieved across the CRPSP site where future noise-sensitive development is proposed.

Figure 8 presents the predicted noise levels at first floor, with the preliminary noise barrier design in place. As shown, the target noise objective of 63 dB $L_{A10(18h)}$ is predicted to be exceeded in parts (dark blue areas to south and east) of the CRPSP site where future noise-sensitive development is proposed. These are areas where the facades of buildings will need to be carefully designed to achieve the proposed internal noise level criteria.

Figure 7: Predicted future road traffic noise levels (1.5 m AGL) – mitigation to meet 63 dB $L_{A10(18h)}$



Legend

Barrier

Project:	Creamery Road PSP
Project number:	20220484
Client name:	City of Greater Geelong
Version:	SoundPLAN 8.2
Prediction method:	CoRTN
Model number:	01
Run No & Title:	0/GNM(1003,2) - 0.5;
File:	road future_mit_63GF
Prediction Height:	1.5 m

Creamery Road PSP

Future Road Traffic Noise Levels
Noise Barriers to 63 dB LA10(18h) (ground)

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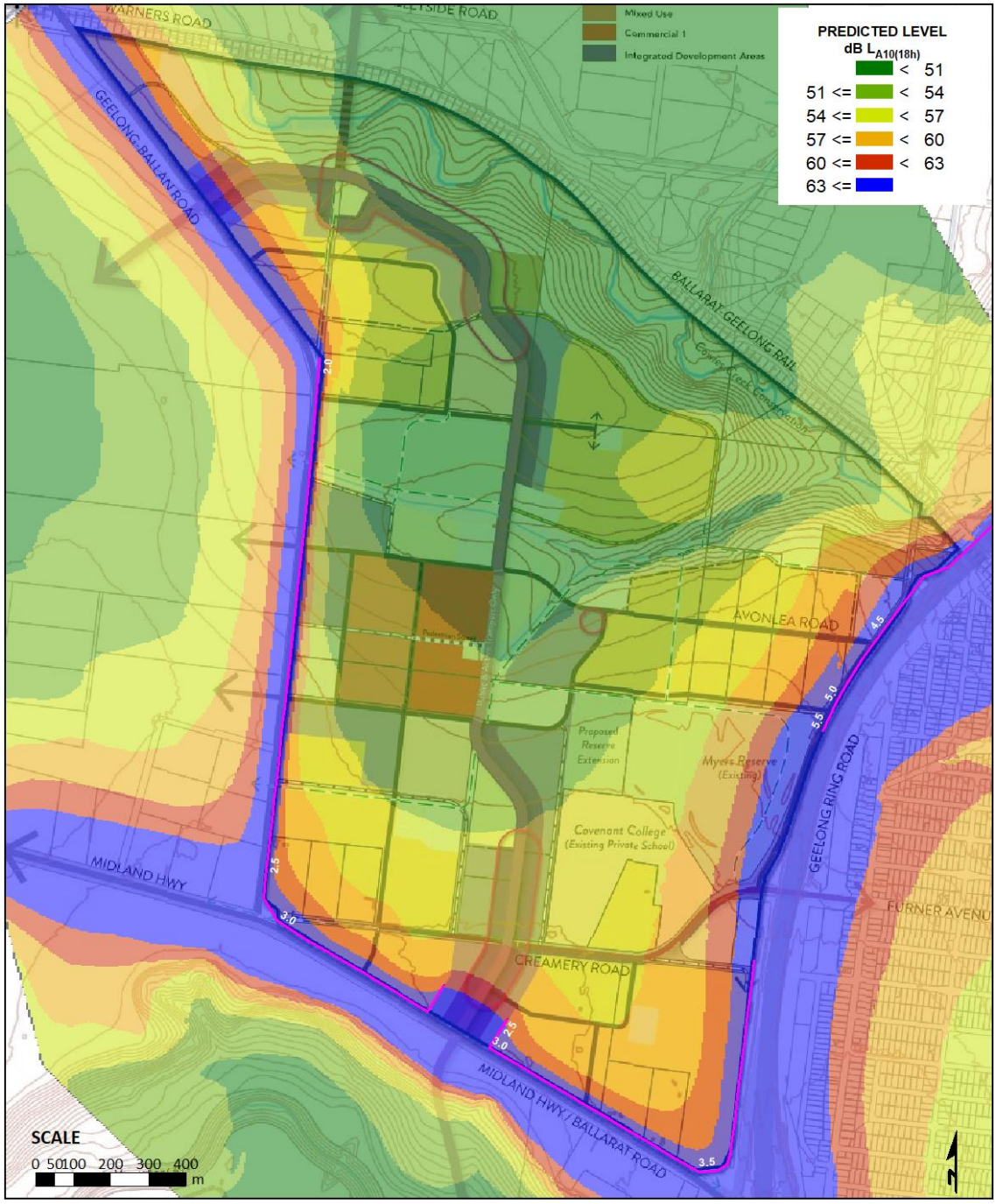
Figure 8: Predicted future road traffic noise levels (4.5 m AGL (upper floors) – mitigation to meet 63 dB $L_{A10(18h)}$



Legend	
Barrier	
Project: Creamery Road PSP	
Project number: 20220484	
Client name: City of Greater Geelong	
Version: SoundPLAN 8.2	
Prediction method: CoRTN	
Model number: 01	
Run No & Title: 0/GNM(1004,2) - 0.5;	
File: road future_mit_63GF_1F	
Prediction Height: 4.5 m	
Creamery Road PSP	
Future Road Traffic Noise Levels - first floor Noise Barriers to 63 dB LA10(18h) (ground)	
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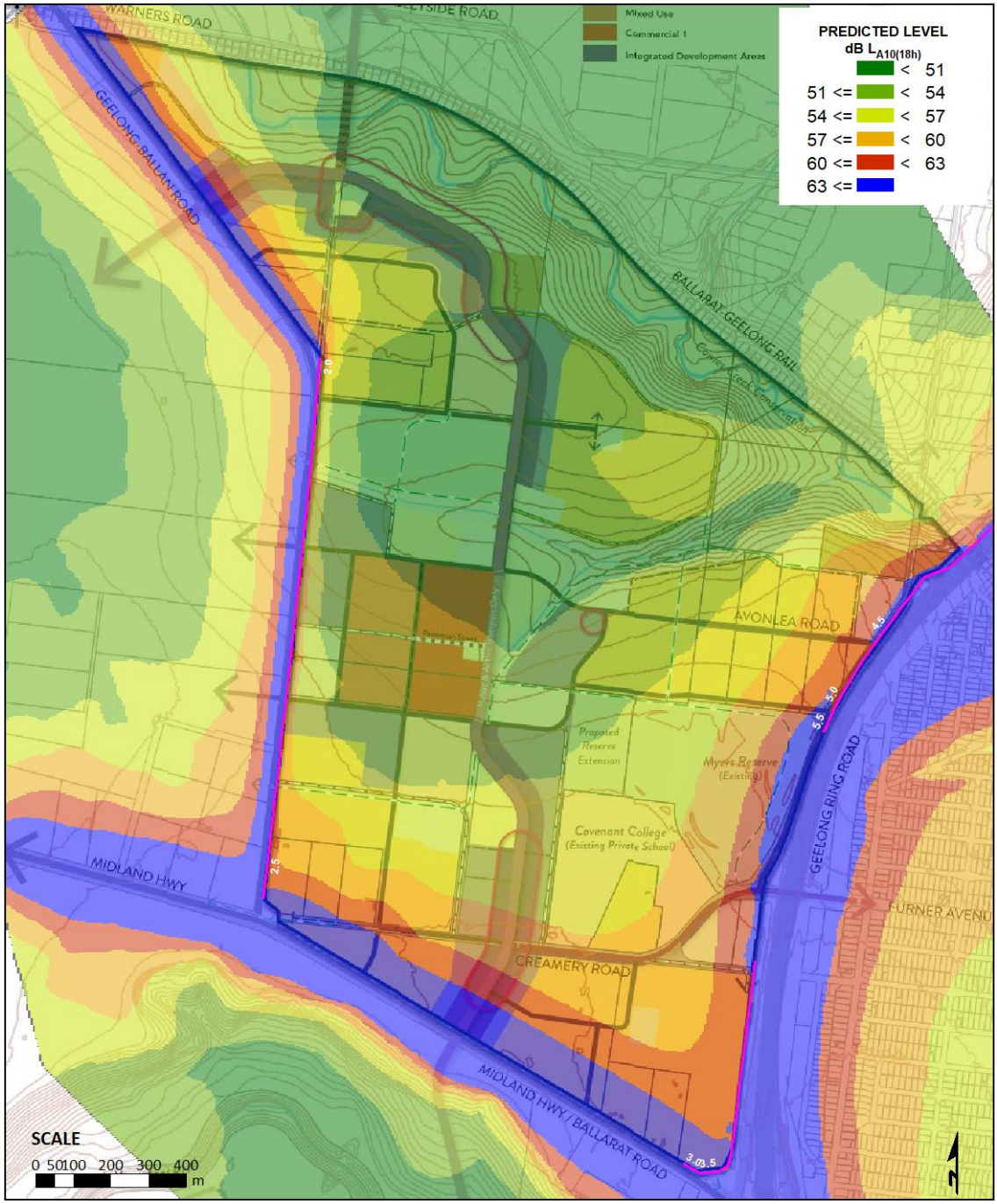
Figure 9 presents the predicted noise levels at ground floor locations with the preliminary noise barrier design in place, however excluding barriers on the south site boundary, as an option requested by Council. As shown, the target noise objective of 63 dB $L_{A10(18h)}$ is predicted to be exceeded in parts (dark blue areas to south) where future noise-sensitive development is proposed. Accordingly, additional mitigation measures would be required, such as maintaining a minimum setback from the road, or strategic layout/building envelope design, discussed further in Section 5.3.

Figure 9: Predicted future road traffic noise levels (1.5 m AGL) – Council request design



5.3 Traffic noise control options

5.3.1 Noise barrier construction

The noise barrier(s) must be of a non-porous construction with no gaps and a surface density of at least 20 kg/m^2 at its thinnest point; or a construction that has a sound insulation rating value of $R_w + C_{tr}$ of at least 25 dB, in accordance with Department of Transport (VicRoads') Bridge Technical Note BTN 007 V1.1 *Code of Practice Noise Attenuation Walls* dated June 2018 (BTN 007).

Example materials include:

- Double skin Colorbond fence either side of 90 mm timber/steel frame with insulation provided in the cavity
- 3 mm thick steel (e.g. Bluescope HW350 – Corten)
- 40 m thick timber (e.g. pine)
- 15 mm thick Perspex or polycarbonate
- 75 mm brick or concrete
- Earth bunding.

It is critical that the barrier is well sealed and free of any holes or gaps, and there must be no gap at the base of the barrier. It is recommended that the base of the barrier is buried to a depth of 10-20 cm.

5.3.2 Design layout

The *Guide to the Reduction of Traffic Noise* provides dwelling layout advice, which is recommended to be incorporated as part of the development design.

Some design and layout examples to reduce road traffic noise inside dwellings include the following:

- Locate the house as far away from the road corridor as possible
- Locate sheds or garages so that they shield the house from noise. Use the house and other buildings (e.g. sheds) to shield outdoor living areas such as courtyards or barbecue area
- Locate noise-sensitive rooms such as bedrooms at the rear of the house or as far as possible from the road
- If designing a two-storey house, the ground floor is easier to protect from noise than the upper floor. Noise-sensitive rooms like bedrooms will generally be quieter if located downstairs
- Heavy (masonry), non-porous facade materials such as brick provide better noise insulation relative to lightweight materials
- Minimise the number of doors and windows on the side(s) of the house exposed to noise
- Provide solid core doors with noise seals on the side(s) of the house exposed to noise.
- Provide thick laminated glass or double glazing for windows or glass doors exposed to the road

5.3.3 Facade specification

As described in Section 5.2, noise barriers are likely required to achieve the external noise levels, at ground floor locations.

In instances where the predicted road traffic noise levels are above the criteria level, e.g. multi storey development (dark blue areas Figure 8) or where alternative barrier layouts have been investigated (dark blue areas Figure 9), it is recommended that a design requirement be included on future development stages.

The design requirement would be to incorporate appropriate sound insulation in the facade, so that internal road traffic noise levels can achieve the recommended levels outlined in Australian/New Zealand Standard AS/NZS 2107-2016 *Acoustics - Recommended design sound levels and reverberation times for building interiors* (AS 2107).

Such a design requirement would require developers to have their designs reviewed by a qualified acoustic consultant, and if necessary, amended to reflect their recommendations to meet the design internal noise levels in AS 2107.

The relevant design internal levels to be achieved are as follows:

- 35 - 40 dB $L_{Aeq,8h}$ (10 pm - 6 am) for bedrooms
- 35 - 45 dB $L_{Aeq,16h}$ (6 am - 10 pm) for other habitable (living) areas

An example of such a design requirement would be as follows:

> *The building (and associated works) must be constructed in such a way to mitigate road traffic noise levels associated with the new road and meet the design internal noise levels set out in Australian/New Zealand Standard 2107-2016 Acoustics - Recommended design sound levels and reverberation times for building interiors.*

6.0 RAIL NOISE ASSESSMENT

The following section outlines an assessment of rail noise at areas to the north of the CRPSP site adjacent the existing freight rail corridor.

6.1 Design noise levels

6.1.1 Internal

Based on the limited freight movements during a night period (typically no more than two (2) trains), it is recommended a design internal noise level 65 dB L_{Amax} be adopted for sleeping areas.

It is understood there may be a proposed change in future to allow passenger rail on the current line.

Given the more frequent nature of passenger rail compared with freight, it is recommended a design internal noise level 55 dB L_{Amax} be adopted for sleeping areas and 60 dB L_{Amax} for other living areas should passenger rail become a feature of the current line.

6.1.2 External

Noise monitoring data obtained at location L2 (refer Appendix D) is considered representative of freight rail noise levels at the facade of future dwellings within the CRPSP.

The highest measured equivalent night time noise level was 58 dB $L_{Aeq,8h}$, while the measured maximum noise level[2] was 96 dB L_{Amax}.

6.2 Rail traffic noise control options

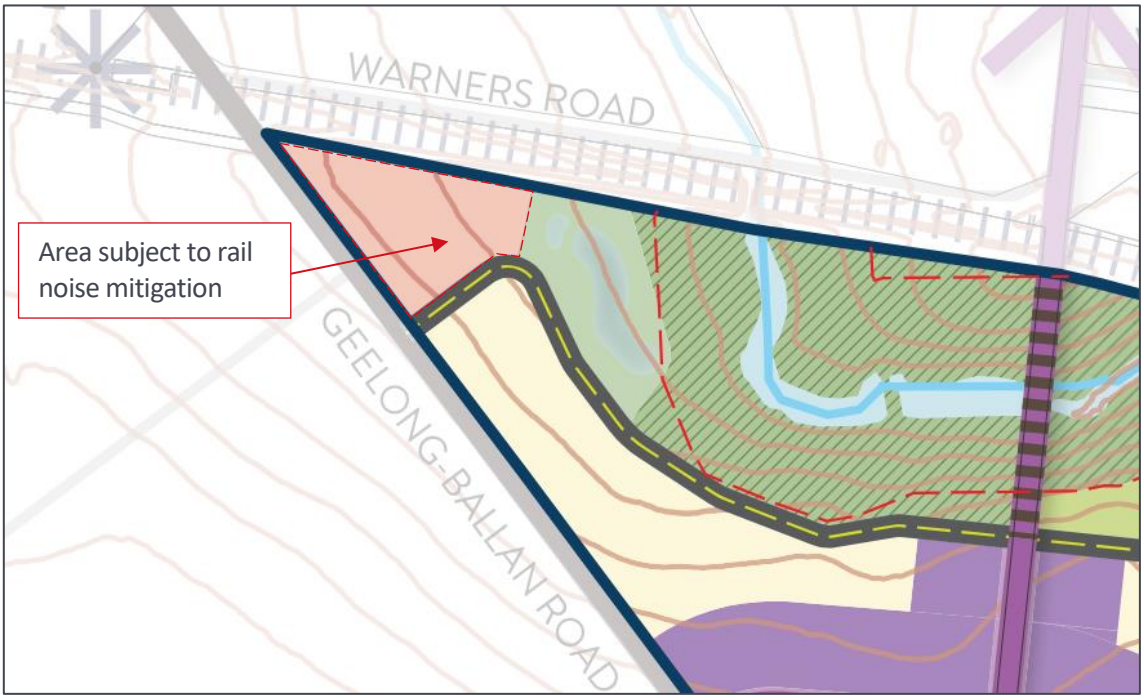
Noise barriers along the northern site boundary adjacent the rail corridor is an option for mitigating external noise levels from rail. It is however understood to not be a feasible option for several reasons, including the existing Cowies Creek conservation park.

Furthermore, the VicTracks' *Rail Development Interface Requirements,* states "*acoustic walls on railway land boundaries should only be used as a last resort*" due to a range of issues that noise barriers can cause for railways, including crash hazards and impacts on signals and sighting.

The following recommendations apply to new noise sensitive development within 120 m of the existing rail line, refer Figure 10 based on the current CRPSP development layout.

[2] In accordance with current practice in Victoria for the assessment of rail noise, design maximum noise level is determined as the 95th percentile value of measured maximum train pass-by noise levels

Figure 10: Noise sensitive area adjacent rail corridor subject to rail noise mitigation



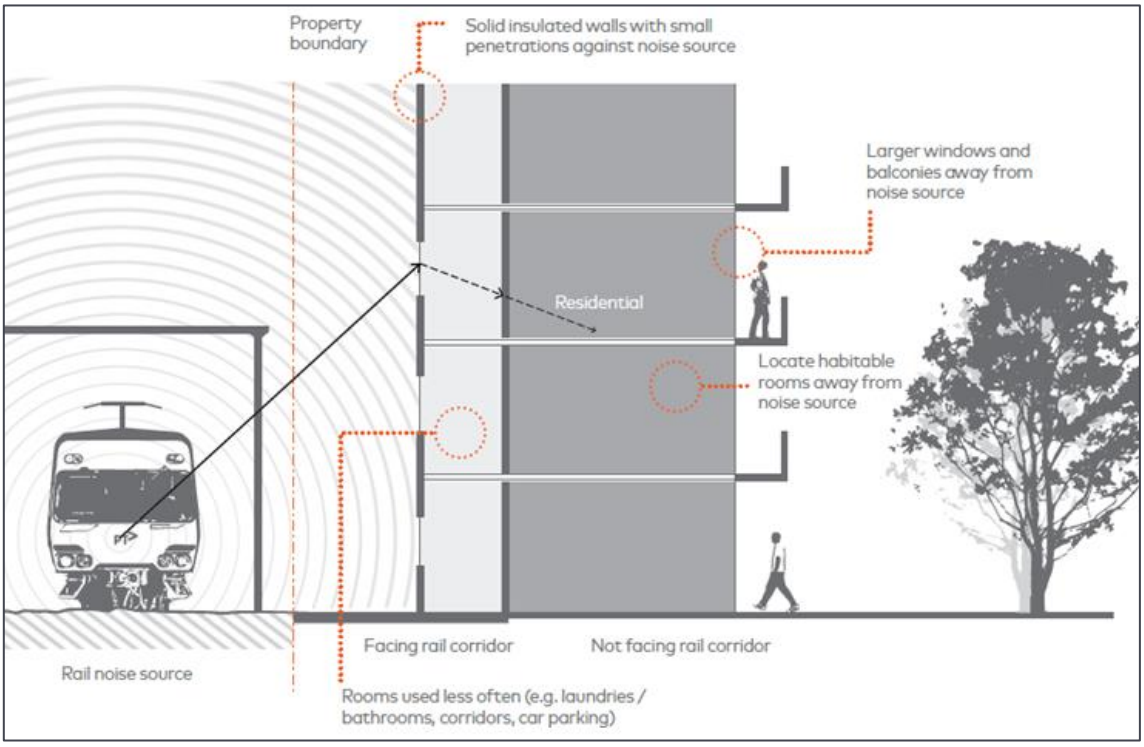
6.2.1 Design layout

As per the mitigation of road traffic noise, it is recommended dwelling layout design be considered and incorporated as part of development design guidelines.

Design and layout examples to reduce rail noise include the following:

- Where possible, design residential buildings so that bedrooms and living areas are located away from the rail corridor (see Figure 11) locating non-sensitive areas such as bathrooms, laundries, and corridors on the rail corridor side between the rail corridor and accommodation units to provide screening
- Maximise solid building mass adjacent to the rail corridor
- Configure building layouts to reduce the impact of noise. For example, by extending walled areas or maximising the built form to act as a noise barrier
- Consider the type of materials used adjacent the rail corridor as lightweight constructions generally have poor acoustic performance compared to masonry
- Minimise the size and use of windows adjacent to the rail corridor
- In scenarios where sleeping areas face the railway corridor, consider the use of semi-enclosed winter gardens or acoustic double glazing.

Figure 11: Best practice design advice for sensitive areas near rail (*VicTrack Rail Development Interface Guidelines)*



6.2.2 Facade specification

From experience on other rail lines carrying both freight and passenger trains, maximum noise levels from freight trains are typically 10 dB higher than passenger trains; accordingly designing to meet internal noise levels from freight would infer meeting the internal noise levels from passenger trains.

It is recommended a design requirement be included to incorporate appropriate sound insulation for the facade. Such a design requirement would require developers to have their designs reviewed by a qualified acoustic consultant, and if necessary, amended to reflect their recommendations to meet the maximum internal design noise levels from rail, detailed in Table 8.

Table 8: Rail internal design noise levels, dB L_{Amax}

Rail type	Sleeping areas	Other habitable (living areas)
Passenger train	55	60
Freight train	65	70

7.0 INDUSTRIAL NOISE

Based on a review of publicly available aerial imagery and site inspection by MDA, future noise sensitive uses at the south of CRPSP site (refer Figure 12) may be subject to industrial noise from the existing quarry located on the south side of Ballarat Road.

Figure 12: Noise sensitive uses adjacent existing industry

In accordance with the Noise Protocol, noise from industry sites needs to achieve the relevant noise limits at the nearest existing residential dwellings, noting there are a number currently located within the CRPSP site and where future noise sensitive uses may be located. Accordingly, where compliance with relevant noise limits from the quarry is achieved at existing locations, compliance is inferred at other potential future residential dwellings.

The noise protocol limits applicable to noise from existing industry is provided in Table 9.

Table 9: Noise protocol limits

Period	Day of week	Time period	Noise limit, dB $L_{Aeq,30min}$
Day	Monday - Saturday	7 am – 6 pm	58
Evening	Monday - Saturday	6 pm – 10 pm	44
	Sunday, Public Holidays	7 am – 10 pm	
Night	Monday - Sunday	10 pm - 7 am	43

From site measurements and observations, existing ambient levels are above the noise protocol limits, primarily due to road traffic noise, also evidenced by industrial noise from the quarry being inaudible during site observations.

Based on the proposed noise reduction measures for road traffic noise, it is expected that noise from industry would readily achieve relevant noise protocol limits at future noise sensitive uses within the CRPSP site. As such, noise from commercial/industry uses are not considered further within this report.

8.0 DISCUSSION

8.1 Noise mitigation

Central to the EP Act is the concept of the general environmental duty, which requires a person who is engaging in an activity that may give rise to risks of harm to human health or the environment from pollution (including noise) or waste must minimise those risks, so far as reasonably practicable.

Compliance with the general environmental duty is independent of compliance with the noise limits developed under the EP Regulations and the Noise Protocol or the objectives outlined in *Traffic Noise Reduction Policy*.

There is currently some uncertainty regarding the application of the general environmental duty to residential development. If developing land is considered an 'activity' under the EP Act, then the general environmental duty may also apply to the development of the subject site.

Noise screening of road traffic noise by way of noise barriers and bunds

This report contains an assessment of road traffic noise in accordance with Department of Transport requirements, including the design and construction of noise barriers and other noise amelioration measures to achieve the target of 63 dB $L_{A10(18h)}$ outside dwellings within the CRPSP site.

- Section 5.2.2 of this report details the extents and heights of recommended barriers and/or earth bunds to achieve the target criteria at the ground floor of future dwellings within the development.
- Section 5.3.1 details appropriate construction materials and methods for the proposed noise barriers.
- Section 5.3.3 of this report notes that facades can be designed to appropriately mitigate rail noise levels.

Design of dwellings

Designing noise barriers to reduce noise at the ground floor of dwellings and in private open space is considered reasonable and practical and is commonplace for similar sites. Noise barriers are not considered to be a practical mitigation option to reduce noise to levels of dwellings above ground floor as the significant barrier height required would likely be incompatible with visual amenity outcomes for residents and would also be likely to result in impractical engineering controls to manage wind loading and structural support.

As such, noise from traffic can be reduced at upper levels of affected dwellings by designing facades so that internal noise levels defined in AS 2107 can be achieved.

While dwelling plans are not yet available at this stage in the planning process, the document '*Guidelines for Developers*' recommends the following measures to be implemented in addition to screening provided by a barrier:

> *The noise sensitive buildings adjacent to the Freeway should also be designed and constructed to protect internal noise sensitive areas. That is, the building layout should have the service areas (laundry, bathroom, garage, etc,) facing the freeway whilst the noise sensitive uses (bedrooms, living areas, etc,) are located away from the freeway side of the building. Furthermore, for the exposed facade, window and door openings should be of a minimum size.*

A similar approach to the above can be adopted for noise sensitive development adjacent the rail corridor, i.e. adopt appropriate layout design and sound insulation measures to dwelling facades to achieve internal amenity consistent with the recommended levels.

8.2 Environmental Reference Standard

The Environmental Reference Standard (ERS) referred by the Victorian Environment Protection Authority (EPA), includes environmental values, indicators and objectives that describe environmental and human health outcomes to be achieved or maintained in the whole or in parts of Victoria.

These values, indicators and objectives are used to assess and report on changing environmental conditions by providing a reference point for decision makers to consider whether a proposal or activity is consistent with the environmental values identified in the ERS. The ERS also allows decision makers to evaluate potential impacts on human health and the environment that may result from a proposal or activity. The ERS is not a compliance standard, and the values listed within the ERS for different land uses are explicitly not noise limits nor design criteria.

The 63 dB $L_{A10(18h)}$ criteria level is approximately equivalent to the objectives for ambient sound for category I land use defined in the ERS. The relevant categories for the development site are categories II and III (including residential, mixed-use, and open space land uses), which reference objectives lower than those for category I.

Following implementation of noise screening measures, noise levels at ground level would range from 63 dB $L_{A10(18h)}$ at future noise sensitive development locations immediately adjacent the site, reducing to levels below 60 dB $L_{A10(18h)}$ for most of the development site. These predicted noise levels do not consider screening that would be provided by the built form of dwellings. Once dwellings are constructed on site, it is anticipated that road traffic noise levels across most of the site would be lower than indicated by the predicted noise levels, and for the most part, consistent or below the ERS ambient sound objectives for category II and category III land uses.

The external noise impact is generally the highest for the lots closest to the roads or rail reserve; lots located further into the development would benefit from noise attenuation from distance and screening of intervening dwellings, thus many locations within the development would be expected to achieve the ERS objectives.

Given the most-affected dwellings on the project boundary would be exposed to noise levels higher than the objectives for their relevant land use categories, consideration has been given to building siting, orientation, and layout to minimise noise exposure. Protecting amenity for residential development adjacent high noise sources (road or rail) focuses on provision of appropriate internal noise levels by way of consideration of siting and internal layout, as well as specifying building envelope constructions to achieve internal noise levels consistent with planning standards.

9.0 SUMMARY

The City of Greater Geelong is in the process of finalising the Creamery Road Precinct Structure Plan (CRPSP). This is the first precinct to be developed within the Western Geelong Growth Area, which forms part of the wider Northern and Western Geelong Growth Areas.

This acoustic assessment has been prepared to accompany the CRPSP and includes recommendations for the management of road traffic, rail noise and industrial noise in the vicinity.

The assessment has been based on:

- Masterplan layout of site, including where future noise-sensitive development, including residential uses are proposed
- External and internal design acoustic levels determined in accordance with relevant guidelines and legislation
- Measurements of noise conditions undertaken at the subject site in July 2022
- Noise modelling to calculate future road traffic noise levels across the CRPSP site

The assessment has shown that without any mitigation, road traffic and rail noise would be above the criteria level across areas within the site.

Noise modelling demonstrates that road traffic noise levels on the subject site can be mitigated in accordance with Department of Transport requirements. A preliminary noise barrier configuration has been outlined showing the following:

- Noise barriers (or bunds) along the road reserve adjacent to the west, south and south east site boundaries, varying in height between 2 m and 3.5 m
- Extension and increase of height to existing barrier along the road reserve adjacent the north-east site boundary up to 5.5 m

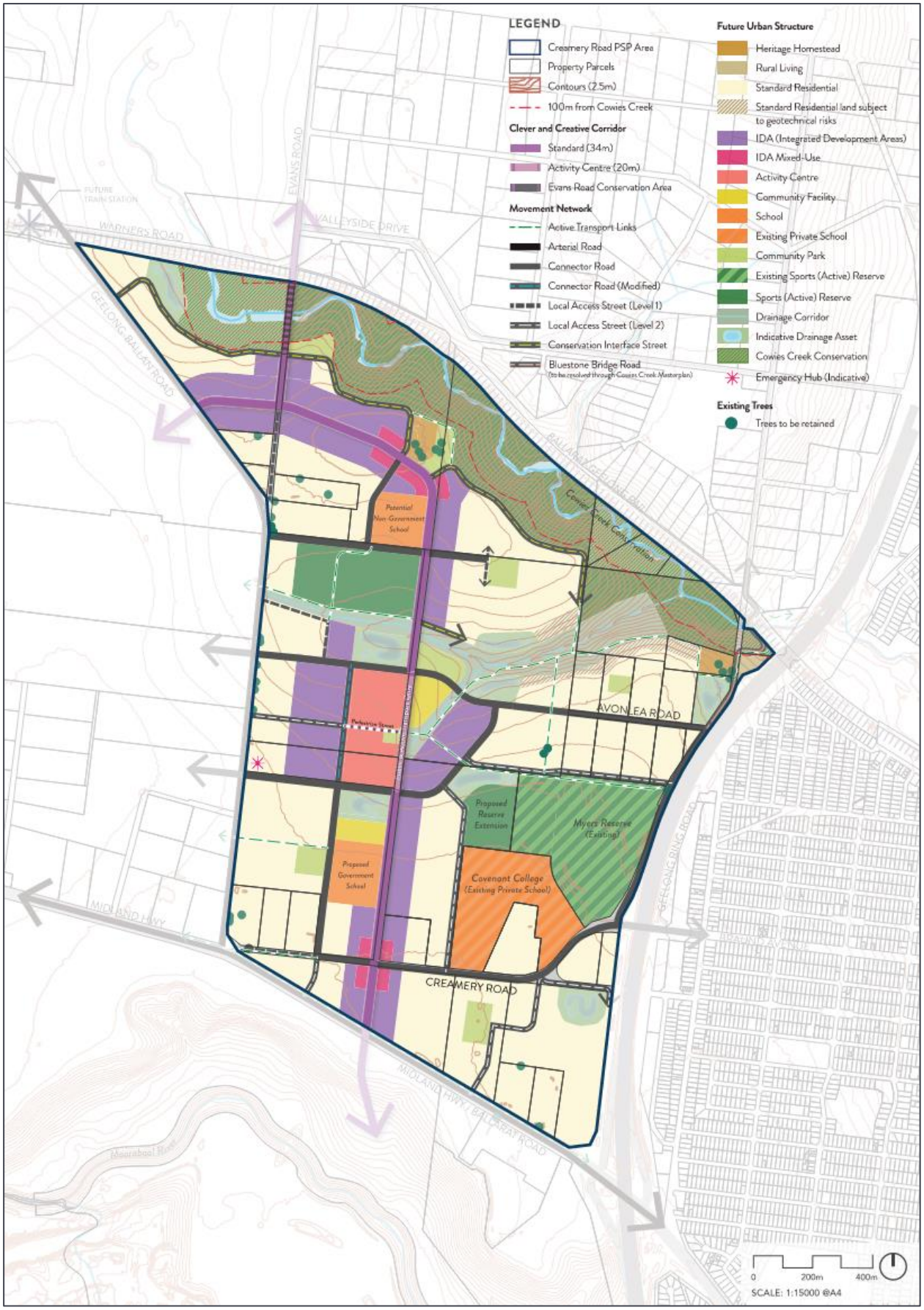
For the mitigation of rail noise, it is recommended a design requirement be incorporated such that future dwelling exposed to rail incorporate appropriate sound insulation for building facades.

The recommendations are preliminary and intended for planning purposes to inform feasibility, and to illustrate that relevant acoustic design criteria can be achieved. Recommendations are to be reviewed at the design development stages to verify the measures required to address noise.

APPENDIX A GLOSSARY OF TERMINOLOGY

A-weighting	A set of frequency-dependent sound level adjustments that are used to better represent how humans hear sounds. Humans are less sensitive to low and very high frequency sounds. Sound levels using an "A" frequency weighting are expressed as dB L_A. Alternative ways of expressing A-weighted decibels are dBA or dB(A).
C_{tr}	A sound insulation adjustment, commonly used with the R_w and $D_{nT,w}$ single number rating systems. C_{tr} adjusts for low frequency noise, like noise from traffic. C_{tr} values typically range from about -4 to about -12.
dB	Decibel. The unit of sound level.
Frequency	Sound occurs over a range of frequencies, extending from the very low (e.g. thunder) to the very high (e.g. mosquito buzz). Measured in units of Hertz (Hz). Humans typically hear sounds between 20 Hz and 20 kHz. High frequency acuity naturally reduces with age most adults can hear up to 15 kHz.
Hertz (Hz)	The unit of frequency, named after Gustav Hertz (1887-1975). One hertz is one pressure cycle of sound per second. One thousand hertz – 1000 cycles per second – is a kilohertz (kHz).
L_{A10}	The A-weighted sound level exceeded for 10% of the measurement period, measured in dB. Commonly referred to as the average maximum noise level.
$L_{A10(18h)}$	The average of the 18 one-hour L_{A10} values between 6 am and midnight (6 am – midnight).
L_{A90}	The A-weighted sound level exceeded for 90 % of the measurement period, measured in dB. Commonly referred to as the background noise level.
L_{Amax}	The A-weighted maximum sound level. The highest sound level which occurs during the measurement period. Usually measured with a fast time–weighting i.e. L_{AFmax}
R_w	Weighted Sound Reduction Index. A single number system for quantifying the transmission loss through a building element. The measured transmission loss, in third octave bands from 100 Hz to 3.15 kHz, is compared to a standard reference contour to determine the single number value. Can only be measured in laboratory conditions
Sound insulation	The ability of a material or construction to reduce sound travelling through it.

APPENDIX B CREAMERY ROAD PSP DEVELOPMENT LAYOUT



APPENDIX C NOISE POLICY, GUIDELINES AND BENCHMARKS

C1 Environment Protection Regulations 2021

The *Environment Protection Act 2017* does not specify noise limit values or technical aspects of environmental noise, but sets out legal requirements to comply with the Environment Protection Regulations described below. Clause 166 of the Act essentially places the onus of achieving compliance with noise limits on commercial premises.

The *Environment Protection Regulations 2021* (the Regulations) are made under section 465 of the Act and impose obligations in relation to environmental protection, including noise. The Regulations state that a person who conducts a prediction, measurement, assessment or analysis of noise within a noise sensitive area must do so in accordance with the Noise Protocol. Noise from industrial, commercial and trade premises or entertainment venues or events is prescribed as unreasonable if it exceeds a noise limit or alternative criterion determined in accordance with the Noise Protocol.

Key matters addressed in the regulations include:

- Definition of commercial, industrial and trade premises, which is essentially any premises that is not a residential premises, a road or a railway. It is noted that noise from common building services equipment (such as shared condensing units and kitchen exhaust fans) is assessable
- Definition of an indoor music entertainment venue
- Definition of noise sensitive areas where the noise limits are assessed, which broadly include:
  - a residential building
  - temporary accommodation
  - hospital corrective institution
  - retirement or residential village
  - A room for learning in a child care centre, kindergarten or school
  - A tourist establishment, campground or caravan park
- Assessment time periods
- Noise sources that must not be taken into account
- Minimum noise limit values
- Management of cumulative noise from multiple premises.

Part 5.3 the Regulations addresses noise emissions from commercial, industrial and trade premises, which are defined as any premises except the following:

(a) residential premises (other than common plant under the control of an owners corporation);

(b) a street or road, including every carriageway, footpath, reservation and traffic island on any street or road;

(c) a railway track used by rolling stock in connection with the provision of a freight service or passenger service—

(i) while travelling on a railway track or tramway track; or

(ii) while entering or exiting a siding, yard, depot or workshop;

(d) a railway track used by rolling stock in connection with the provision of a passenger service, while in a siding, yard, depot or workshop and is—

(i) powering up to commence to be used in connection with the provision of a passenger service; or

(ii) shutting down after being used in connection with the provision of a passenger service;

(e) the premises situated at Lower Esplanade, St Kilda and known as "Luna Park" and being the whole of the land more particularly described in Certificate of Title Volume 1204 Folio 109

Note: The maintenance, cleaning or loading of rolling stock stabled in a siding, yard, depot or workshop are included within the meaning of commercial, industrial and trade premises.

A noise sensitive area where the Regulations apply is defined as:

(a) that part of the land within the boundary of a parcel of land that is—

(i) within 10 metres of the outside of the external walls of any of the following buildings—

(A) a dwelling (including a residential care facility but not including a caretaker's house);

(B) a residential building;

(C) a noise sensitive residential use; or

(ii) within 10 metres of the outside of the external walls of any dormitory, ward, bedroom or living room of one or more of the following buildings—

(A) a caretaker's house;

(B) a hospital;

(C) a hotel;

(D) a residential hotel;

(E) a motel;

(F) a specialist disability accommodation;

(G) a corrective institution;

(H) a tourist establishment;

(I) a retirement village;

(J) a residential village; or

(iii) within 10 metres of the outside of the external walls of a classroom or any room in which learning occurs in the following buildings (during their operating hours)—

(A) a child care centre;

(B) a kindergarten;

(C) a primary school;

(D) a secondary school; or

(b) subject to paragraph (c), in the case of a rural area only, that part of the land within the boundary of—

(i) a tourist establishment; or

(ii) a campground; or

(iii) a caravan park; or

(c) despite paragraph (b), in the case of a rural area only, where an outdoor entertainment event or outdoor entertainment venue is being operated, that part of the land within the boundary of the following are not noise sensitive areas for the purposes of that event or venue—

(i) a tourist establishment;

(ii) a campground;

(iii) a caravan park;

Table 10 presents a summary of the relevant Divisions and Regulations from Part 5.3 – Noise.

Table 10: Summary of Part 5.3 – Noise

Section	Description
Division 1, Regulation 113	States that *a person who conducts a prediction, measurement, assessment or analysis of noise within a noise sensitive area for the purposes of the Act or these Regulations, must conduct the prediction, measurement, assessment or analysis in accordance with the Noise Protocol.*
Division 2	Applies to noise from residential premises
Regulation 114	Provides a set of ''prescribed items'' and ''prohibited times'' for determining unreasonable noise from residential premises. For example, an air conditioner is a prescribed item that is prohibited before 7 am and after 11 pm Monday to Friday, and before 9 am and after 11 pm on weekends and public holidays.
Regulation 115	Describes aggravated noise from residential premises as noise from the Regulation 114 prescribed items during prohibited times likely resulting in harm to human health or the environment.
Regulation 114	Provides a set of ''prescribed items'' and ''prohibited times'' for determining unreasonable noise from residential premises (e.g. lawn mowing is a prescribed item that is prohibited before 7 am and after 8 pm Monday to Friday and before 9 am and after 8 pm on weekends and public holidays.)
Regulation 115	Describes aggravated noise from residential premises as noise from the Regulation 114 ''prescribed items'' resulting in harm to human health or the environment
Division 3	Applies to noise from commercial, industrial and trade premises
Regulation 116	Defines the day, evening and night period as follows: Day: 0700 to 1800 hrs, Monday – Saturday Evening: 1800 to 2200 hrs, Monday – Saturday 0700 to 2200 hrs, Sunday and Public Holidays Night: 2200 to 0700 hrs the next day, Monday – Sunday
Regulation 117	In this Division, when the level of noise emitted from commercial, industrial and trade premises is assessed, the following sources of noise that could be expected at the proposed facility must not be taken into account: • Voices • Construction or demolition activity on building sites • Intruder, emergency or safety alarms or sirens • Equipment used in relation to an emergency • Non-commercial vehicles (except for maintenance activities).

Section	Description
Regulation 118	Defines noise as being unreasonable if it exceeds the Noise Protocol limits or the alternative assessment criteria that apply at an alternative assessment location. Defines the lowest base noise limits as follows: Major urban area: Day: 45 dB L_{Aeq} Evening: 40 dB L_{Aeq} Night: 35 dB L_{Aeq} Rural area: Day: 45 dB L_{Aeq} Evening: 37 dB L_{Aeq} Night: 32 dB L_{Aeq} The noise limit for commercial, industrial and trade premises for the night period must not exceed 55 dB $L_{eff.}$
Regulation 119	If multiple existing or proposed premises emit noise that contributes to the effective noise level at a noise sensitive receiver, all reasonable steps must be taken by the premises' management to ensure the combined noise level does not exceed the noise limit.
Regulation 120	This regulation essentially identifies that tonal aspects of noise must be considered when considering unreasonable noise for section 3(1)(a)(v) of the Act. The Noise Protocol provides a method of assessing tonal characteristics of noise from commercial, industrial and trade premises, with additional guidance on low frequency noise available in EPA Victoria Publication 1996 *Noise guideline – assessing low frequency noise.*
Regulation 121	Noise emitted from commercial, industrial and trade premises is prescribed to be aggravated noise if it exceeds the noise limits by more than 15 dB, or the following if lower: • 75 dB L_{Aeq} during the day, • 70 dB L_{Aeq} during the evening, or • 65 dB L_{Aeq} during the night.

C2 Road traffic noise – Department of Transport requirements

The *Traffic Noise Reduction Policy* is a document used to determine entitlement to noise barriers in situations where the Department of Transport takes responsibility for noise mitigation. The Policy recommends design objectives for use by the department when building new roads or upgrading existing roads in Victoria.

Where new noise sensitive developments are planned close to existing major traffic routes, the developer must take responsibility for noise mitigation. Department of Transport is a referral authority, and so has the right to seek to impose requirements on residential developers seeking planning approvals for land adjacent to department-controlled roads. The *Requirements of Developers – Noise Sensitive Uses* guidelines outlines mitigation requirements for new noise development adjacent freeways. These guidelines recommend developers undertake some combination of the following:

- Erect noise barriers of sufficient height and suitable construction to reduce external road traffic noise levels to 63 dB $L_{A10(18h)}$ or less at the ground floor level of residential dwellings
- Provide sound insulation treatment to residential dwellings sufficient to achieve compliance with the recommended internal noise levels specified in Australian/New Zealand Standard 2107-2016 *Acoustics - Recommended design sound levels and reverberation times for building interiors*.

Where external noise levels cannot achieve the 63 dB $L_{A10(18h)}$ criteria, noise barriers or bunds, in combination with a level of treatment to building facade, will generally be required.

C3 Road traffic noise – Internal noise levels

Australian/New Zealand Standard 2107-2016 *Acoustics - Recommended design sound levels and reverberation times for building interiors* (AS 2107) provides recommendations for acceptable internal noise levels.

Table 11 shows the recommended internal design sound levels in AS 2107 for *"houses and apartments in inner city areas or entertainment districts or near major roads,"* which are considered applicable to the development site.

Table 11: AS 2107 recommended internal design noise levels

Area	Recommended design sound level range, dB L_{Aeq}
Living areas	35 - 45
Sleeping areas	35 - 40
Work areas	35 - 45
Apartment common areas (eg, lobbies)	45 - 50

AS 2107 does not specify the measurement procedure to determine whether compliance has been achieved but does state the following:

> *In situations where traffic (or other) noise levels may vary widely over a 24-hour period, measurements to assess compliance with this Standard should be taken at the relevant time according to the area of occupancy or activity in the building.*

Given the above, it could be argued that compliance measurements for bedrooms should be made during the night period, in Victoria between 10 pm and 6 am (commonly referred to as the night period), although this does not allow for those occupants who may be shift workers or such like that may have a requirement to sleep during the day. For living areas, the compliance measurement should be made during the day/evening period between 6 am and 10 pm (commonly referred to as the day/evening period).

C4 VicTrack Rail Development Interface Guidelines

> *The purpose of this document is to provide guidance on how to establish an appropriate development interface with railway land.*
>
> *This will ensure development respects the strategic importance of the railway land and does not adversely affect existing and future transport operations.*

The document applies to anyone planning to do works or develop land adjacent to the rail corridor, and acknowledges, rail operations, both passenger and freight, generate noise and vibration.

The impact of noise and vibration from rail infrastructure can vary considerably depending on site characteristics and layout, as well as geography and land use. The noise mitigation section encourages strategic layout of dwellings and noise mitigations to target internal noise level criteria in residential dwellings, as follows:

> *Buildings within a noise influence area specified in the table* [reproduced in Table 12] *should be designed and constructed to achieve the following noise levels:*
>
> - *not greater than 35dB(A) for bedrooms, assessed as an LAeq,8h from 10pm to 6am*
> - *not greater than 40dB(A) for living areas, assessed LAeq,16h from 6am to 10pm.*

Table 12: Noise influence area

Railways as a noise source	Noise influence area
Railways servicing passengers in Victoria	80 m from the centre of the nearest track
Railways servicing freight outside metropolitan Melbourne	80 m from the centre of the nearest track
Railway servicing freight in metropolitan Melbourne	135 m from the centre of the nearest track

C5 Victorian Passenger Rail Infrastructure Noise Policy

The *Victorian Passenger Rail Infrastructure Noise Policy* (VPRINP) was released in April 2013.

Section 5 of the policy sets out the conditions under which transport bodies must apply the policy.

The policy sets 'investigation thresholds' for the assessment of noise. These are noise levels, which if exceeded, indicate that noise mitigation should be considered. It states that:

> *In considering changing land use near an existing passenger rail corridor, transport bodies and planning authorities should consider the receivers set out in Table B in Attachment 2. Transport bodies and planning authorities should consider whether the noise level produced at these receivers will exceed the investigation thresholds for the periods specified in Table B in Attachment 2.*
>
> *If an assessment shows the investigation thresholds are not exceeded, noise impacts should be considered a secondary matter. This means no further action need be considered under this policy.*

The investigation thresholds are defined in terms of:

- $L_{Aeq,16h}$ – equivalent continuous daytime (6 am – 10 pm) noise level
- $L_{Aeq,8h}$ – equivalent continuous night-time (10 pm - 6 am) noise level
- L_{Amax} – maximum noise level.

Investigation thresholds as referenced in Table B in Attachment 2 of the VPRINP for the redevelopment of land near existing rail infrastructure is detailed in Table 13.

Table 13: Investigation thresholds for changing allowable land use near an existing rail corridor

Time	Type of receiver	Investigation thresholds
Daytime (6 am – 10 pm)	Residential dwellings including aged person homes, hospitals, motels, caravan parks, and other buildings where people sleep. Noise sensitive community buildings including schools, kindergartens, libraries	65 dB $L_{Aeq,16h}$ or 85 dB L_{Amax}
Night-time (10 pm – 6 am)	Residential dwellings including aged person homes, hospitals, motels, caravan parks, and other buildings where people sleep.	60 dB $L_{Aeq,8h}$ or 85 dB L_{Amax}

The VPRINP investigation thresholds are not design criteria. Where the investigation thresholds are exceeded, then the following internal design targets are recommended by MDA based on sleep disturbance and Victorian Civil and Administrative Tribunal (VCAT) decisions:

- Bedrooms: 50 - 55 dB L_{Amax}
- Other living areas: 60 dB L_{Amax}

The VPRINP requires the maximum railway noise be based on the 95th percentile of the maximum for all measured events. Where practical, maximum noise levels of trains should meet internal sleep disturbance criteria with windows of apartments closed. The assessment should consider the airborne and structure-borne components.

These limits are based on a precedent set in VCAT regarding acceptable internal noise levels for residences adjacent to Tramway lines (Reference No. P2470/2003). In this case, a decision to grant a permit was made on the basis that the noise level of trains was not to exceed 55 dB L_{Amax} in bedrooms and 60 dB L_{Amax} in living areas. These levels were based on the commonly adopted sleep disturbance thresholds outlined in the *NSW Road Noise Policy.*

Since 2003, there have been two VCAT decisions which have recommended an internal noise limit of 50 dB L_{Amax} in bedrooms. However, there is no compelling case for the lower criterion as the decisions were not based on objective evidence presented to the Tribunal and are, in MDA's opinion, unnecessarily restrictive; 55 dB L_{Amax} is very close to the threshold of onset for noise-related sleep disturbance, and there is almost no significant difference (<1 %) in reported levels of sleep disturbance between 55 dB L_{Amax} and 50 dB $L_{Amax.}$

The above levels apply to noise from passenger trains. Given the less frequent nature of diesel freight movements, it is considered that an allowance of 5-10 dB above the respective design targets for passenger trains, could be applied to freight movements.

A review of the freight schedule indicates that there are up to eight (8) diesel freight movements in a 24 hour period, and typically no more than two (2) during a night period. On this basis, maximum external noise levels of 75 – 80 dB L_{Amax} (approximately 60-65 dB L_{Amax} internal) from diesel freight movements may be considered acceptable.

C6 Environmental Reference Standard (ERS)

EPA Publication 1992 Guide to the Environmental Reference Standard, dated June 2021, provides the following information in relation to the Environmental Reference Standard (ERS):

- The Environment Reference Standard (ERS) is a new legislative instrument made under the *Environment Protection Act 2017* (the Act). The ERS is an environmental benchmark. It brings together a collection of environmental values, indicators and objectives that describe environmental and human health outcomes to be achieved or maintained in the whole or in parts of Victoria. These values, indicators and objectives are used to assess and report on changing environmental conditions by providing a reference point for decision makers to consider whether a proposal or activity is consistent with the environmental values identified in the ERS. The ERS also allows decision makers to evaluate potential impacts on human health and the environment that may result from a proposal or activity. The ERS does not specify requirements that must be met by environmental managers or other duty holders.
- The ERS is a tool that can be used to assess the impacts on human health and the environment that may result from a proposal or activity, or from existing environmental conditions on a site. This application of the ERS must be seen within the context of preventing harm from pollution and waste as part of the broader environment protection framework under the Act. Because it is preventative in nature, this framework seeks to minimise risks of harm to human health and the environment rather than setting and authorising acceptable levels of pollution and waste. The focus on prevention allows for continual improvement in managing these risks as knowledge expands and more effective risk- reduction techniques and technologies emerge.

The environmental values defined in the ERS are contained in Table 14.

Table 14: Environmental values of the ambient sound environment

Environmental value	Description of environmental value
Sleep during the night	An ambient sound environment that supports sleep during the night
Domestic and recreational activities	An ambient sound environment that supports recreational and domestic activities in a residential setting
Normal conversation	An ambient sound environment that allows for normal conversation indoors without the need to raise voices
Child learning and development	An ambient sound environment that supports cognitive development and learning in children
Human tranquillity and enjoyment outdoors in natural areas	An ambient sound environment that allows for the appreciation and enjoyment of the environment for its natural condition and the restorative benefits of tranquil soundscapes in natural areas
Musical entertainment	An ambient sound environment that recognises the community's demand for a wide range of musical entertainment.

The ERS outlines environmental indicators and objectives for various land use categories. These are reproduced in Table 15

Table 15: Land use categories for the ambient sound environment

Land Use Category	General Description	Planning Zones
Category I	An urban form with distinctive features or characteristics of taller buildings, high commercial and residential intensity and high site coverage.	Industrial Zone 1 (IN1Z) Industrial Zone 2 (IN2Z) Port Zone (PZ) Road 1 Zone (RDZ1) Capital City Zone (CCZ) Docklands Zone (DZ)
Category II	Medium rise building form with a strong urban or commercial character. Typically contains mixed land uses including activity centres and larger consolidated sites, and an active public realm.	Industrial Zone 3 (IN3Z) Commercial 1 Zone (C1Z) Commercial 2 Zone (C2Z) Commercial 3 Zone (C3Z) Activity Centre Zone (ACZ) Mixed Use Zone (MUZ) Road 2 Zone (RDZ2)
Category III	Lower rise building form including lower density residential development and detached housing typical of suburban residential settings or in towns of district or regional significance	Residential Growth Zone (RGZ) General Residential Zone (GRZ) Neighbourhood Residential Zone (NRZ) Urban Floodway Zone (UFZ) Public Park and Recreation Zone (PPRZ) Urban Growth Zone (UGZ)

Land Use Category	General Description	Planning Zones
Category IV	Lower density or sparse populations with settlements that include smaller hamlets, villages and small towns that are generally unsuited for further expansion. Land uses include primary industry and farming	Low Density Residential Zone (LDRZ) Township Zone (TZ) Rural Living Zone (RLZ) Green Wedge A Zone (GWAZ) Rural Conservation Zone (RCZ) Public Conservation and Resource Zone (PCRZ) Green Wedge Zone (GWZ) Farming Zone (FZ) Rural Activity Zone (RAZ)
Category V	Unique combinations of landscape, biodiversity and geodiversity. These natural areas typically provide undisturbed species habitat and enable people to see and interact with native vegetation and wildlife.	Natural areas are classified as land within Category V irrespective of the planning zones that apply to that land.
Category I, II, III or IV depending on surrounding land uses and the intent of the specific planning zone (which may have a diversity of uses) as specified in a schedule to the planning zone		Comprehensive Development Zone (CDZ) Priority Development Zone (PDZ) Special Use Zone (SUZ) Public Use Zone (PUZ)

The project site is likely to represent Category II or Category III once developed. The relevant indicators and objectives for these categories are presented in Table 16.

Table 16: Objectives for land-use categories II and III

Land use category	Indicators	Objectives
Category II	Outdoor $L_{Aeq,8h}$ from 10 pm to 6 am	50 dB L_{Aeq}
	Outdoor $L_{Aeq,16hr}$ from 6 am to 10 pm	55 dB L_{Aeq}
Category III	Outdoor $L_{Aeq,8h}$ from 10 pm to 6 am	40 dB L_{Aeq}
	Outdoor $L_{Aeq,16hr}$ from 6 am to 10 pm	50 dB L_{Aeq}

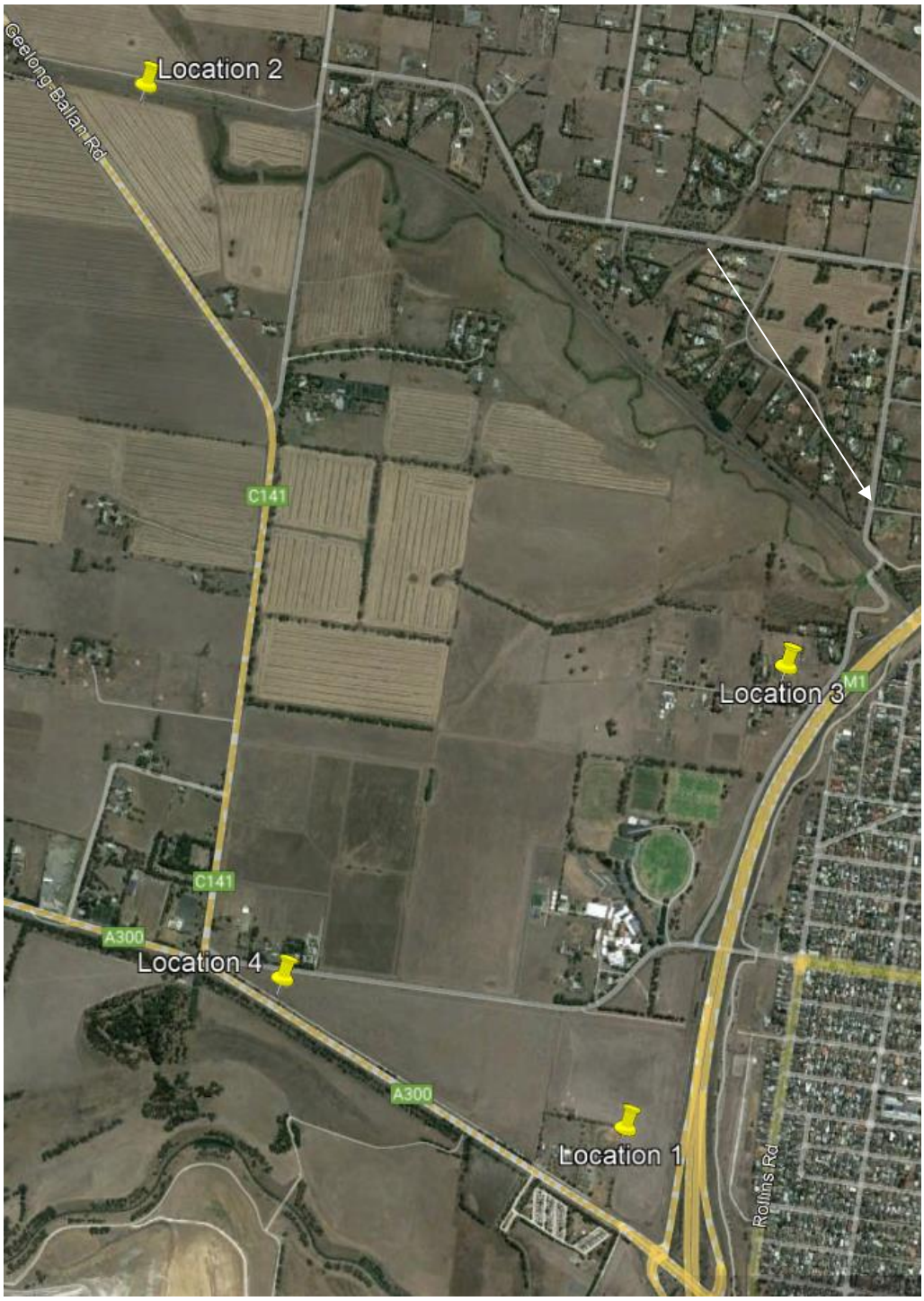
APPENDIX D EXISTING NOISE LEVELS

Noise levels across the CRPSP site were measured at four (4) locations, in July 2022. The noise monitoring locations are shown in Figure 13.

Measurements were obtained using Rion NL-31 environmental noise loggers; microphones fitted with windshields and mounted at a height of approximately 1.5 m above local ground level under free-field conditions. Noise levels were measured using the 'Fast' response time and A-weighting frequency network.

The equipment was checked before and after the survey and no significant drifts in sensitivity were observed. Upon retrieval, the noise monitor at Location 4 encountered an internal fault, and as such, the data was corrupted and therefore not reported.

Figure 13: Noise monitor location map



D1 Road traffic

A summary of measured noise levels is provided in Table 17. Weather data has been obtained from the Bureau of Meteorology's weather station at Geelong and Avalon, to identify periods of high wind or significant rainfall which may have affected the measurements.

Table 17: Measured noise levels, dB $L_{A10(18h)}$ (6 am – midnight)

Date	L1	L2	L3	Weather
Tuesday 12 July 2022	55	55	53	Acceptable
Wednesday 13 July 2022	57	57	56	Too rainy and windy
Thursday 14 July 2022	55	54	53	Marginal
Friday 15 July 2022	56	54	53	Marginal
Saturday 16 July 2022	59	48	57	Too windy
Sunday 17 July 2022	57	53	52	Too windy
Monday 18 July 2022	58	57	56	Too windy
Tuesday 19 July 2022	60	53	63	Acceptable
Wednesday 20 July 2022	58	-(1)	59	Acceptable
Averages				
Average on acceptable and marginal weekdays	57	54	56	
Number of acceptable and marginal weekdays	5	4	5	

Notes: (1) Battery depleted late Wednesday 20 July 2022

In accordance with the *Traffic Noise Measurement Requirements for Acoustic Consultants* (2011), the measurement survey period captured at least 3 days of valid data after adverse weather conditions or other reasons were discarded. 'Adverse weather conditions' are described as those where the local wind speed exceeds 3 m/s and during periods of rain. As such, the monitoring data is considered sufficient for this assessment.

D2 Ambient noise levels (road and rail)

Table 18: Measured noise levels, dB $L_{Aeq(16hr)}$ (6 am – 10 pm)

Date	L1	L2	L3	Weather
Tuesday 12 July 2022	54	54	53	Acceptable
Wednesday 13 July 2022	57	56	56	Too rainy and windy
Thursday 14 July 2022	54	55	52	Marginal
Friday 15 July 2022	55	54	52	Marginal
Saturday 16 July 2022	58	51	57	Too windy
Sunday 17 July 2022	57	55	54	Too windy
Monday 18 July 2022	57	55	56	Too windy
Tuesday 19 July 2022	59	52	62	Acceptable
Wednesday 20 July 2022	57	-(1)	58	Acceptable
Averages				
Average on acceptable and marginal weekdays	56	54	57	
Number of acceptable and marginal weekdays	5	4	5	

Notes: (1) Battery depleted late Wednesday 20 July 2022

Table 19: Measured noise levels, dB $L_{Aeq(8hr)}$ (10 pm – 6 am)

Date	L1	L2	L3	Weather
Tuesday 12 July 2022	48	54	48	Acceptable
Wednesday 13 July 2022	48	55	48	Too rainy and windy
Thursday 14 July 2022	50	55	48	Marginal
Friday 15 July 2022	50	58	51	Marginal
Saturday 16 July 2022	50	54	48	Too windy
Sunday 17 July 2022	49	53	45	Too windy
Monday 18 July 2022	50	59	51	Too windy
Tuesday 19 July 2022	55	54	56	Acceptable
Wednesday 20 July 2022	55	-(1)	55	Acceptable
Averages				
Average on acceptable and marginal weekdays	52	55	53	
Number of acceptable and marginal weekdays	5	4	5	

Notes: (1) Battery depleted late Wednesday 20 July 2022

D3 Maximum noise levels (rail)

Rail noise levels were measured at the site approximately 30 m from the rail line at location L2.

With reference to the Australian Rail Track Corporation (ARTC) train schedule, the measured maximum noise levels from trains are presented in Table 20.

Table 20: Measured maximum noise levels from train pass bys, dB L_{Amax}

Time of rail pass-by event[1]	dB L_{Amax}	Time of rail pass-by event[1]	dB L_{Amax}
Monday 11 July 2022 1615	84	Friday 15 July 2022 2230	96
Monday 11 July 2022 2000	78	Saturday 16 July 2022 1615	87
Monday 11 July 2022 2215	91	Sunday 17 July 2022 0945	79
Tuesday 12 July 2022 0945	92	Sunday 17 July 2022 1330	80
Tuesday 12 July 2022 1600	81	Sunday 17 July 2022 1545	81
Tuesday 12 July 2022 2315	88	Sunday 17 July 2022 1830	88
Wednesday 13 July 2022 915	80	Sunday 17 July 2022 2130	93
Wednesday 13 July 2022 1130	85	Monday 18 July 2022 0100	84
Wednesday 13 July 2022 2115	92	Tuesday 19 July 2022 0215	78
Wednesday 13 July 2022 2130	81	Tuesday 19 July 2022 0730	93
Thursday 14 July 2022 0600	84	Tuesday 19 July 2022 2200	87
Thursday 14 July 2022 1515	96	Tuesday 19 July 2022 2315	92
Thursday 14 July 2022 1715	96	Wednesday 20 July 2022 0215	96
Thursday 14 July 2022 1930	90	Wednesday 20 July 2022 1345	83
Friday 15 July 2022 0030	90	Wednesday 20 July 2022 1515	82
Friday 15 July 2022 1500	85	Wednesday 20 July 2022 2030	90

Notes: (1) Time indicates the start of each 15 minute period. The maximum noise event has occurred within the time + 15 mins