

166 Main Road Cafe

Noise Impact Assessment



Ref: 25125 166 Main Road Cafe NIA_02
4 March 2026



Executive Summary

Development of a cafe within an existing building is proposed at 166 Main Road, Austins Ferry. The site is located within a General Residential zone and is in close proximity to existing sensitive receivers. As such, Council has requested a Noise Impact Assessment against Section 8.0 of the Tasmanian Planning Scheme, with NVC engaged by Pinnacle Drafting to carry out such an assessment.

The cafe is proposed for day time operation only and broadly comprises dine-in and takeaway food and beverage sales, and includes an outdoor courtyard for patron seating.

Unattended noise monitoring was carried out on site, with results showing that noise from vehicles passing by was a consistent noise source, as was existing mechanical plant noise from the neighbouring IGA. Noise levels were relatively consistent throughout the day due to vehicles on Main Road, whilst night time noise levels were largely controlled by IGA mechanical plant equipment and vehicles passing by intermittently.

To quantify the noise emissions from site, software noise modelling of the proposed cafe operations was carried out, with results showing the following:

- Noise from proposed mechanical plant equipment is predicted to satisfy the 40 dBA criterion for fixed mechanical plant equipment outlined within the Environmental Management and Pollution Control (Noise) Regulations.
 - Mechanical plant noise from site is predicted to be below the measured background noise level, and thus is expected to be inaudible.
- Noise from general operations have been predicted to generally comply with the Tasmanian Environmental Protection Policy (Noise) 2009 criterion of 50 dBA, with the exception of the nearest receiver to the west of site where noise levels exceed the criterion by nominally 2 dB.
 - This exceedance is primarily a result of music within the courtyard, and thus noise control is required. Control of noise emissions from music within the courtyard includes limiting the volume of courtyard music, achieved by:
 - Ensuring noise levels do not exceed a conversational level when located 1 m from the speaker.

Following the implementation of the above noise control, noise levels are predicted to satisfy the relevant adopted project criteria, and thus will not result in a loss of residential amenity at surrounding sensitive receivers. As such, clauses 8.3.1-P1, 8.3.1-A3 and 8.3.1-P4 of the Tasmanian Planning Scheme are satisfied.

166 Main Road Cafe Noise Impact Assessment

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Table of Contents

<i>Executive Summary</i>	2
1. Introduction	6
2. Background	7
2.1. Site and Surroundings	7
2.2. Proposed Development	8
2.3. Noise-Sensitive Receivers	9
3. Assessment Criteria	10
3.1. Adopted Project Criteria	11
4. Noise Measurements	12
4.1. Purpose and Measurement Location	12
4.2. Measurement Methodology and Equipment	12
4.3. Measurement Conditions	12
4.4. Measurement Results	13
4.5. Observations and Findings	13
5. Noise Modelling	14
5.1. Model Input Data	14
5.2. Predicted Results	16
6. Discussion	17
7. Noise Control	18
8. Assessment	19
<i>Appendix A – Additional Figures</i>	<i>20</i>
<i>Appendix B – Acoustic Glossary</i>	<i>21</i>

Table of Figures

Figure 2.1: Site and Surrounding Area	7
Figure 2.2: Proposed Layout	8
Figure 2.3: Nearby Sensitive Receivers	9
Figure 4.1: Noise Measurement Location	12
Figure 4.2: Measured Noise Trend and Spectrogram	13
Figure 5.1: Noise Model Layout	15
Figure 7.1: Recommended Kitchen Exhaust Barrier Location	18
Figure A.1: View of Site - From Main Road (East to West)	20
Figure A.2: Typical Noise Trend During Operating Hours - Leq(1-sec)	20

Table of Tables

Table 2.1: Proposed Operating Hours	8
Table 3.1: Summary of Assessment Criteria	11
Table 4.1: Summary of Measured Noise Levels	13
Table 5.1: Modelled Source Sound Power Levels	15
Table 5.2: Summary of Predicted Noise Levels - Mechanical Plant	16
Table 5.3: Summary of Predicted Noise Levels - General Operations	16
Table 8.1: Summary of Assessment	19

1. INTRODUCTION

Development of a cafe is proposed within an unoccupied existing building at 166 Main Road, Austins Ferry. The proposed site is located within a General Residential zone, and is surrounded by residential dwellings in close proximity. As such, Council has issued an RFI requesting a Noise Impact Assessment against the Tasmanian Planning Scheme. Pinnacle Drafting has engaged NVC to carry out such an assessment, the methodology and results of which are summarised in this report, completed by NVC in January 2026.

2. BACKGROUND

2.1. Site and Surroundings

The site is located at 166 Main Road, Austins Ferry, within a General Residential zone (red overlay in Figure 2.1, below). The lot is shared between the proposed cafe and two existing residential dwellings, as shown in Figure 2.1, below. To the north and south are residential dwellings, with Main Road located immediately adjacent site to the east (within a Utilities zone denoted by yellow overlay in Figure 2.1), with additional residential dwellings beyond the road. An existing supermarket (IGA) is located immediately to the south of site and operates from 7AM to 7PM every day.

The land surrounding site slopes from west to east, with the cafe located on a flat portion at the same elevation as Main Road. As such, a nominally 2 m high embankment is located to the west and north of the cafe, with a nominal 1.5 m tall timber fence located on top of the embankment.

Figure 2.1, below, shows satellite imagery of site and the surrounding area, with the lot and the cafe denoted by the solid and broken white outlines respectively, and the top of the aforementioned embankment shown by the blue line (see Figure A.1 in *Appendix A* for view of site from east).

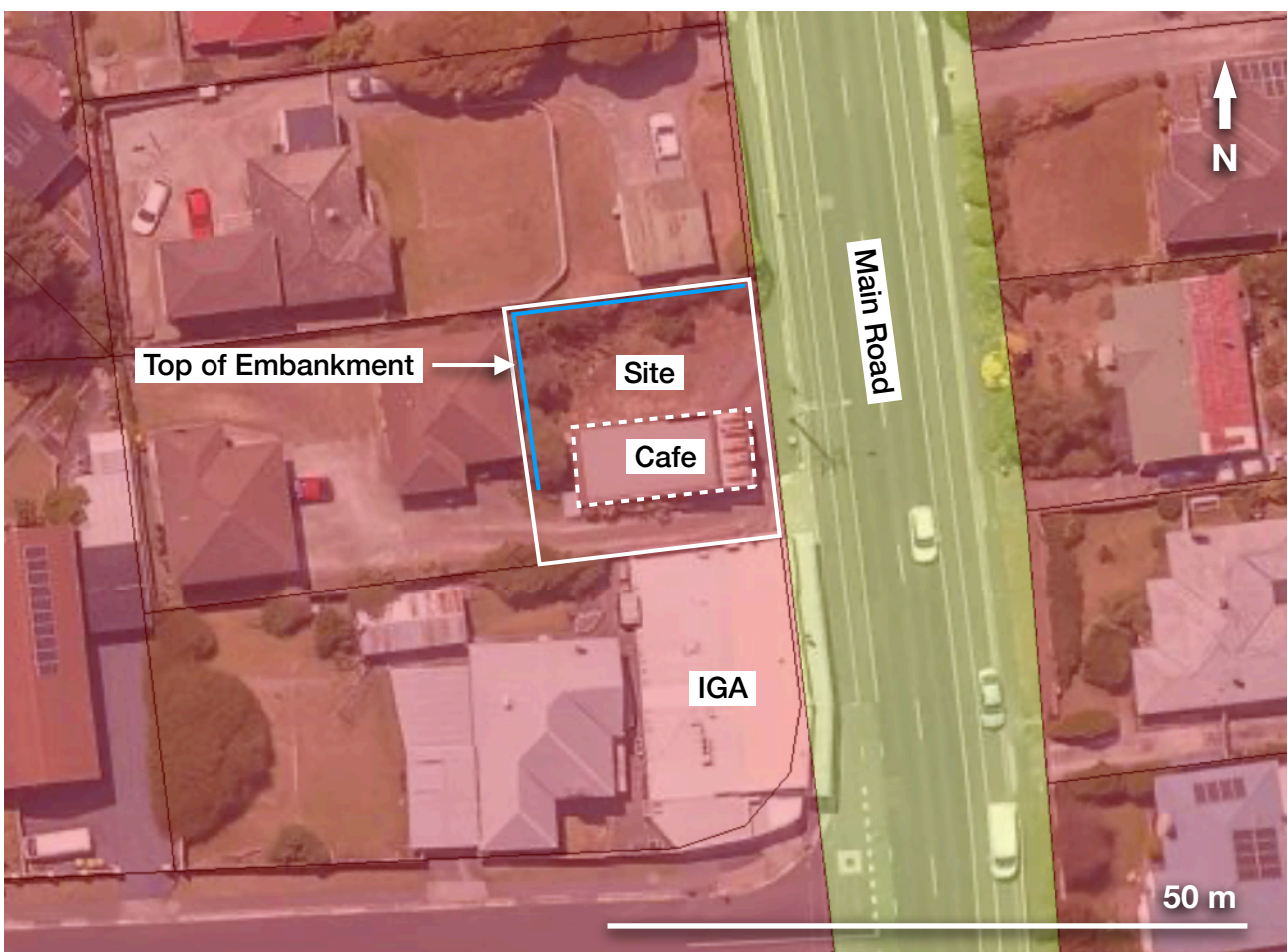


FIGURE 2.1: SITE AND SURROUNDING AREA

2.2. Proposed Development

The proposal comprises a cafe located within an existing brick building, with the front facade proposed to consist of entirely glazing. The cafe is to comprise coffee and food sales internally, with patron seating areas adjacent the footpath and within the outdoor courtyard, to the east and north of the cafe building respectively. A service window is also proposed on the northern wall of the cafe building.

Amenities and a small kitchen are proposed within the building, and thus a commercial range hood, toilet exhaust fan, and air conditioning equipment are proposed. It is noted that there are no external openings directly to the kitchen.

Figure 2.2, below, shows the approximate proposed site layout.

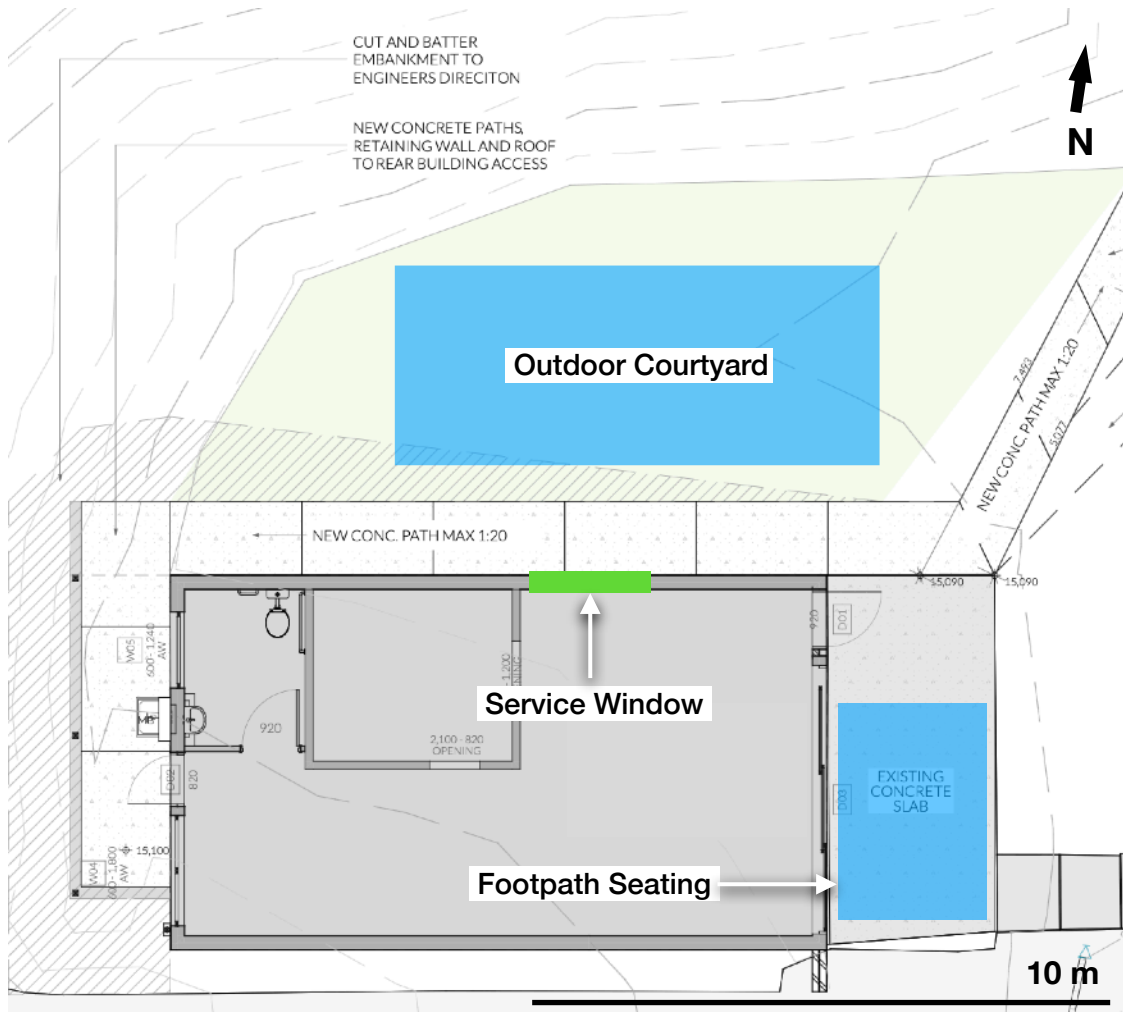


FIGURE 2.2: PROPOSED LAYOUT

The proposed operating hours of the cafe are summarised in Table 2.1, below.

TABLE 2.1: PROPOSED OPERATING HOURS

Day	Hours of Operation
Weekdays	6AM to 2PM
Weekends	6AM to 2PM
Public Holiday	6AM to 2PM

Note that all commercial vehicle movements are proposed to occur within the hours noted under Clause 8.3.1-A3 (see Section 3 of this report), and thus the Acceptable Solutions for this clause is satisfied.

2.3. Noise-Sensitive Receivers

The key surrounding sensitive receivers worst-affected by noise emissions from the cafe are denoted locations R1 to R4 and are shown in Figure 2.3, below. These locations have been chosen due to being the nearest sensitive receivers to site in their respective directions.

Given the topography, locations R1, R2 and R4 are at a greater elevation compared to Main Road, and are located nominally 3 m above the road’s surface, with location R3 located at a slightly lower elevation compared to Main Road.

It is noted that whilst location R1 shares a lot with the cafe, it is considered a sensitive receiver for the purpose of this assessment.



FIGURE 2.3: NEARBY SENSITIVE RECEIVERS

3. ASSESSMENT CRITERIA

Section 8.0 of the Tasmanian Planning Scheme (the Scheme) contains criteria for a General Residential zone. In particular, Clause 8.3.1 details criteria specific to noise emissions for a Discretionary use such as a cafe within a General Residential zone. The relevant parts of this clause have been reproduced below:

Objective:	That Discretionary uses do not cause an unreasonable loss of amenity to adjacent sensitive uses.	
Acceptable Solutions		Performance Criteria
<p>A1 Hours of operation of a use listed as Discretionary, excluding Emergency Services, must be within the hours of 8.00am to 6.00pm.</p>	<p>P1 Hours of operation of a use listed as Discretionary, excluding Emergency Services, must not cause an unreasonable loss of amenity to adjacent sensitive uses, having regard to:</p> <ul style="list-style-type: none"> (a) the timing, duration or extent of vehicle movements; and (b) noise, lighting or other emissions. 	
<p>A3 Commercial vehicle movements and the unloading and loading of commercial vehicles for a use listed as Discretionary, excluding Emergency Services, must be within the hours of:</p> <ul style="list-style-type: none"> (a) 7.00am to 7.00pm Monday to Friday; (b) 9.00am to 12 noon Saturday; and (c) nil on Sunday and public holidays. 	<p>P3 Commercial vehicle movements and the unloading and loading of commercial vehicles for a use listed as Discretionary, excluding Emergency Services, must not cause an unreasonable loss of amenity to adjacent sensitive uses, having regard to:</p> <ul style="list-style-type: none"> (a) the time and duration of commercial vehicle movements; (b) the number and frequency of commercial vehicle movements; (c) the size of commercial vehicles involved; (d) manoeuvring required by the commercial vehicles, including the amount of reversing and associated warning noise; (e) any existing or proposed noise mitigation measures between the vehicle movement areas and sensitive use; (f) potential conflicts with other traffic; and (g) existing levels of amenity. 	
<p>A4 No Acceptable Solution.</p>	<p>P4 A use listed as Discretionary must not cause an unreasonable loss of amenity to adjacent sensitive uses, having regard to:</p> <ul style="list-style-type: none"> (a) the intensity and scale of the use; (b) the emissions generated by the use; (c) the type and intensity of traffic generated by the use; (d) the impact on the character of the area; and (e) the need for the use in that location. 	

As shown above, the Scheme provides criteria sufficient to satisfy the objective of Clause 8.3.1, however does not provide numerical criteria against which an assessment can be made. Therefore, the *Tasmanian Environmental Protection Policy (Noise) 2009*¹ (TAS Noise EPP) and *Environmental Management and Pollution Control (Noise) Regulations*² (TAS Noise Regulations) have been referred to for appropriate noise criteria.

3.1. Adopted Project Criteria

Taking the criteria from the TAS Noise EPP and TAS Noise Regulations, Table 3.1, below, summarises the adopted project criteria.

TABLE 3.1: SUMMARY OF ASSESSMENT CRITERIA

Criterion	Metric	Applicability
≤ 50 dBA	Leq _(16-hour)	General noise emissions. Applicable at private outdoor space.
≤ 40 dBA	Instantaneous	Mechanical plant noise emissions. Applicable 1 m from the residential facade.

Satisfying the above criteria is deemed appropriate in ensuring that the use does not cause an unreasonable loss of amenity to adjacent sensitive uses, and thus will satisfy the Scheme requirements.

¹ ‘*Tasmanian Environmental Protection Policy (Noise) 2009*’, Department of Environment, Parks, Heritage and Arts, 2009

² ‘*Environmental Management and Pollution Control (Noise) Regulations 2016*’, Tasmanian Legislation, 2016

4. NOISE MEASUREMENTS

4.1. Purpose and Measurement Location

Long-term unattended noise measurements have been carried out by NVC between the 21st and 28th of January 2026 to quantify the existing acoustic environment in the area surrounding site. Measurements were carried out at location A, which was selected as being representative of the existing acoustic environment at the worst-affected sensitive receiver locations. The measurement location (location A) is located a similar distance from Main Road as the four identified receiver locations, and thus is exposed to similar levels of traffic noise as locations R1 to R4.

Note that the measurement location has clear line of sight to Main Road towards the east and south-east, and is largely screened from the road to the north-east by the neighbouring shed. As such, measured noise levels are expected to be a conservative representation of the existing noise levels at location R3 (R3 has a greater field of view of Main Road, and thus noise levels are expected to be slightly higher at location R3 than those measured at location A).

Figure 4.1, below, shows the noise measurement location in relation to the proposed cafe.



FIGURE 4.1: NOISE MEASUREMENT LOCATION

4.2. Measurement Methodology and Equipment

Measurements used a Svan Type 1 sound level meter, logging in A-weighted decibels with a *Fast* response time. Calibration was checked before and after with a Larson Davis CAL200 acoustic calibrator.

The data set comprised overall levels, one-third octave spectra and full statistical data at 10-minute intervals, with spectra and overall levels also recorded at 1-second intervals.

4.3. Measurement Conditions

Across the noise measurement period, weather conditions were ideal for noise measurements, with minimal wind and rain.

4.4. Measurement Results

The results of the noise measurements are summarised in Table 4.1, below, with the measured noise trend and spectrogram presented in Figure 4.2.

TABLE 4.1: SUMMARY OF MEASURED NOISE LEVELS

Time Period	Sound Pressure Level, dBA		
	L10	L90	LEQ
Day Time (6AM to 10PM)	60	43	56
Night Time (10PM to 6AM)	44	31	45

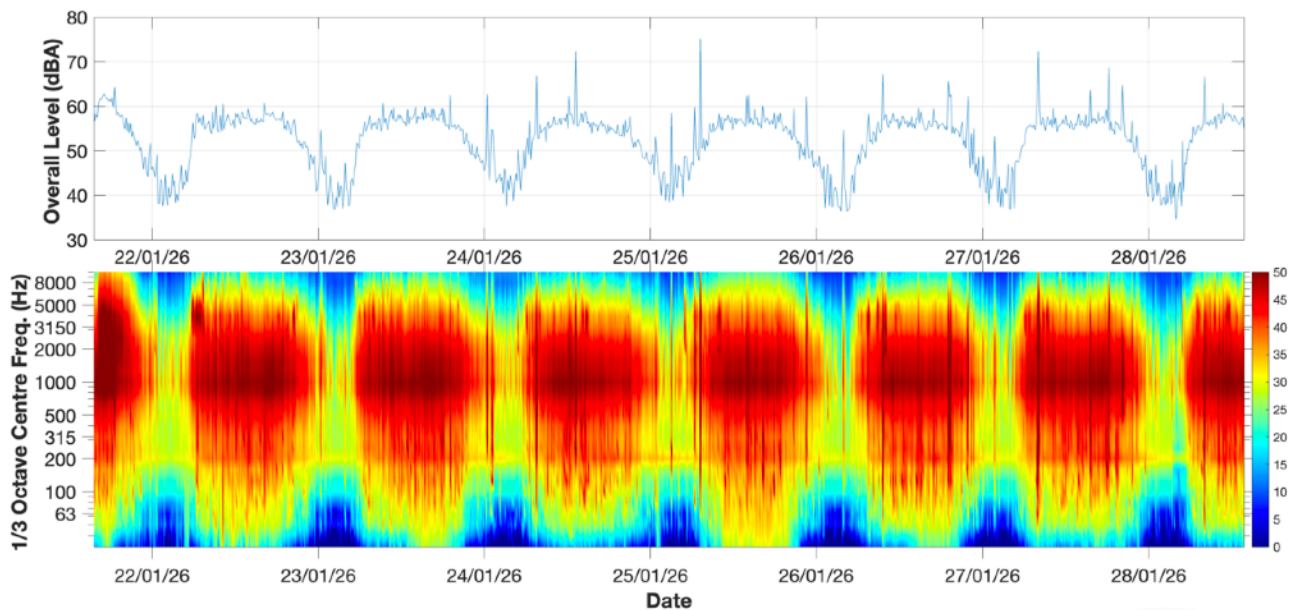


FIGURE 4.2: MEASURED NOISE TREND AND SPECTROGRAM

4.5. Observations and Findings

The following observations and findings are relevant:

- Noise from passing vehicles on Main Road was the dominant noise source and was consistent during the day time, generally controlling the Leq and L10 noise levels.
 - Light vehicles continuously passed by during the day, and sporadically during the night.
 - Distant vehicle noise from Main Road and surrounding roadways contributed significantly to the background (L90) during both day and night time periods.
 - Some heavy vehicles were observed to pass by whilst on site during the day, though these were very sporadic.
- Mechanical plant equipment associated with the existing IGA operated consistently. This is clearly visible in the measured noise data, with this mechanical plant equipment switching on and off consistently across the whole noise measurement period.
 - During the day time, noise from the mechanical plant equipment was perceived to control the background, along with noise from distant traffic on Main Road.
 - During the night time, noise from the mechanical plant equipment largely controlled the Leq.

5. NOISE MODELLING

Predictions of the noise levels at the surrounding sensitive receivers as a result of cafe noise emissions have been carried out using *iNoise*³ software, which implements the ISO 9613⁴ algorithms for environmental noise. The predictions account for geometric divergence, barrier attenuation, atmospheric absorption, reflections and screening from buildings, and ground absorption.

5.1. Model Input Data

The following key considerations are relevant to the software noise model:

- 1 m topographical contours (from LiDAR data) have been used for the site and surrounding area.
- The ground has been assumed to have a ground factor of 0.5 (50% reflective) over the entire model.
- All building façades and barrier construction are modelled with a reflection factor of 0.8 (80% reflective).
- As per the TAS Noise Measurement Procedures Manual⁵, noise levels across the site due to general operational noise are predicted at 1.2 m above ground level.
 - Noise from mechanical plant equipment has been predicted at nominally 2 m above ground level at a distance of 1 m from the worst-affected facade of each receiver location.
- Existing fences to the north, south and west of the cafe have been modelled as barriers representative of their approximate locations.
 - All fences are modelled to be nominally 1.5 m tall, as measured whilst on site.
- Source sound power levels and the height at which they have been modelled are summarised below in Table 5.1.
 - All mechanical plant equipment is assumed to be operating continuously and simultaneously during the day time period only.
 - Mechanical plant equipment is based on NVC's experience with similar projects, with all sound power level data taken from manufacturer data.
 - Relevant details regarding patron and music noise has been taken from NVC's database of previously measured data and the AAAC's Licensed Premises Noise Assessment Technical Guideline⁶.
 - A total of 30 patrons has been modelled on site, with 18 patrons within the outdoor courtyard, 8 patrons internally, and 4 patrons within the outdoor seating area adjacent the footpath.
 - A speaking group of three has been assumed, representative of one in three patrons speaking simultaneously.
 - Music is modelled such that music is at a conversational level (60 dBA) at the centre of the courtyard. This is typically considered appropriate for cafes in which background music operates.

³ iNoise V2024.2 Pro, DGMR Software

⁴ 'ISO 9613 - Attenuation of sound during propagation outdoors', International Organization for Standardization, 1996

⁵ 'Noise Measurement Procedures Manual', 2nd Ed., Department of Environment, Parks, Heritage and Arts, 2008

⁶ 'Licensed Premises Noise Assessment Technical Guideline', V2.0, Association of Australian Acoustical Consultants, 2020

TABLE 5.1: MODELLED SOURCE SOUND POWER LEVELS

Source	Description	Qty.	SWL (dBA)
AC Unit	Representative of an AC unit with 16.5 kW heating capacity. (E.g. Mitsubishi PUMY-SP140VKMD-A)	1	65
Kitchen Exhaust	Representative of a typical rooftop commercial kitchen exhaust fan. (E.g. Fantech CE314V)	1	68
Toilet Exhaust	Representative of a typical bathroom exhaust fan. (E.g. Fantech MV132E)	1	63
Courtyard Music	Music at a typical conversational level in the middle of the outdoor courtyard.	1	82
Footpath Music	Music at a typical conversational level in the middle of the outdoor seating area adjacent the footpath.	1	75
Patrons	Representative of a person speaking at a normal conversational level.	30	69
Service Window	Representative of patrons internally speaking at a conversational level, with some internal background music.	1	67 *

* Internal Reverberant Sound Pressure Level

Figure 5.1, below, shows the layout of modelled noise sources. Note that the music and patron sources on the footpath are modelled beneath the existing awning.

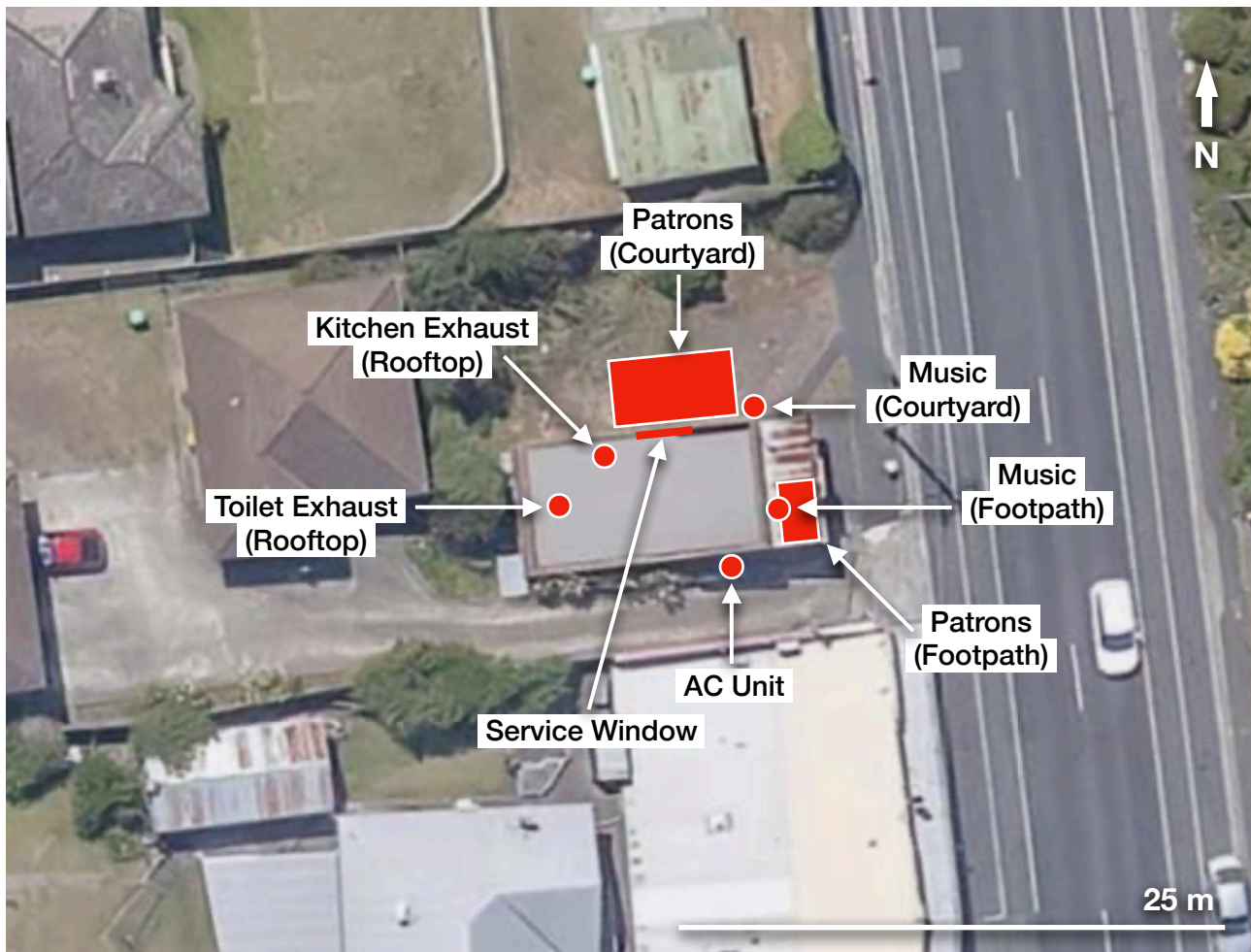


FIGURE 5.1: NOISE MODEL LAYOUT

5.2. Predicted Results

The results of the software noise modelling of noise emissions as a result of mechanical plant equipment and general operations are presented below in tables 5.2 and 5.3 respectively.

Note that Table 5.2 presents predicted noise levels at nominally 2 m above ground level, representative of the worst-affected facade at each of the four receiver locations.

TABLE 5.2: SUMMARY OF PREDICTED NOISE LEVELS - MECHANICAL PLANT

Source	Predicted Sound Pressure Level (dBA)			
	R1	R2	R3	R4
AC Unit	< 20	< 20	25	< 20
Kitchen Exhaust	38	27	23	29
Toilet Exhaust	35	23	< 20	26
Total	40	27	27	31

Table 5.3, below, presents the predicted noise levels within the worst-affected private outdoor space at each of the four receiver locations at a height of 1.2 m.

TABLE 5.3: SUMMARY OF PREDICTED NOISE LEVELS - GENERAL OPERATIONS

Source	Predicted Sound Pressure Level (dBA)			
	R1	R2	R3	R4
Mechanical Plant	40	29	28	33
Music (Courtyard)	50	39	44	24
Music (Footpath)	25	< 20	39	20
Patron (Courtyard)	46	33	37	< 20
Patrons (Footpath)	< 20	< 20	31	20
Service Window	32	< 20	24	< 20
Total (No Mechanical Plant)	51	40	46	27
Total (With Mechanical Plant)	52	41	46	34

6. DISCUSSION

The following key points are relevant to the assessment:

- Noise from mechanical plant equipment is expected to satisfy the 40 dBA criterion, and thus its use during the day and night time periods is acceptable.
 - Noise from the rooftop kitchen exhaust fan is predicted to be the dominant mechanical plant noise source, closely followed by the toilet exhaust, as shown in Table 5.2, above.
 - Comparison to the measured existing noise levels shows that mechanical plant noise is predicted to be below the measured day time background noise level.
 - Analysis of data shows that the existing noise level in the absence of proposed cafe operations rarely drops below 40 dBA during the cafe's proposed operating hours (see Figure A.2 in *Appendix A*), and thus noise from the proposed mechanical plant equipment is expected to be inaudible for the majority of the time.
- General operations are predicted to result in a noise level of 52 dBA at location R1, exceeding the 50 dBA day time criterion by nominally 2 dB.
 - As shown in Table 5.4, above, this exceedance is primarily a result of music within the courtyard, with a predicted noise level of nominally 50 dBA at location R1 from this music alone.
 - Section 7, below, presents recommendations for the control of noise from courtyard music.
 - Note that in the context of the existing acoustic environment, noise from general operations is predicted to be below the measured ambient (Leq) of 56 dBA. The ambient noise level is considered the noise that you would typically hear and includes all noise sources such as passing cars, distant cars, birds, passing pedestrians, existing mechanical plant equipment, and general residential noise. As such, noise from the cafe is not expected to be the dominant noise source in the area, however, is expected to be intermittently clearly audible.
- Noise levels from general operations on site are predicted to satisfy the 50 dBA criterion at locations R2 to R4.
 - At locations R2 and R4, noise from site is expected to be below the existing day time background noise level, and thus is expected to be inaudible.
 - Noise from site is predicted to exceed the measured background noise level of 43 dBA by nominally 3 dB at location R3, but remains comfortably below the measured ambient noise level. It is therefore expected to be audible but not the dominant noise source in the area.
 - In the context of the existing acoustic environment in which vehicles are consistently passing by and an ambient noise level of nominally 56 dBA has been measured, noise from site is not likely to be a dominant noise source at location R3, and thus is not expected to result in a loss of amenity.
- Noise emissions from within the cafe are expected to be entirely inaudible, with no specific glazing requirements.
- All commercial vehicle movements (deliveries and waste disposal) are proposed to occur within the hours outlined within Clause 8.3.1-A3, and thus the Acceptable Solutions for this clause is satisfied.

7. NOISE CONTROL

Following the software noise modelling of proposed cafe operations, noise emissions from music within the courtyard are predicted to result in exceedance of the adopted project criteria. As such, the following is required:

- It is required that music is controlled such that a sound pressure level of nominally 45 dBA is maintained at the site boundary. For larger venues this is typically achieved by installation of volume limiting equipment, however, given the intended use case (small-scale cafe operations during the day time only), such measures would be considered unnecessary. As such, the following alternative provides a conservative method for controlling music noise to achieve and maintain compliance:
 - Locate music speakers at the north-western corner of the building, as shown in Figure 5.1, above.
 - Keep music to a conversational level when listening 1 m from the speaker.

In addition to the above requirement, the following is *recommended* (not strictly required) to minimise noise emissions from the kitchen exhaust fan.

- It is recommended that the kitchen exhaust fan is acoustically screened from location R1. This is achieved by the following:
 - Construct an acoustic barrier to the north and west of the kitchen exhaust fan (see Figure 7.1, below) with the following details:
 - A fixed material with a minimum surface mass of 5 kg/m². Examples of appropriate construction include 0.6 mm thick Colorbond, 9 mm structural plywood, or commercial noise barrier products.
 - Extends a minimum of 0.3 m above the top of the exhaust fan.
 - No gaps, including between the barrier and the top of the roof.

Note that implementation of this acoustic screening would decrease the audibility of the rooftop kitchen exhaust fan, particularly during the early morning, and thus would further reduce the likelihood of future complaint from surrounding sensitive receivers.



FIGURE 7.1: RECOMMENDED KITCHEN EXHAUST BARRIER LOCATION

8. ASSESSMENT

As shown in Section 5, above, noise emissions from general cafe operations are expected to satisfy the criteria at all locations except location R1, where noise levels are predicted to exceed the 50 dBA criterion by nominally 2 dB. This exceedance is primarily due to music within the courtyard, and thus noise control of this music is required, with appropriate noise control outlined in Section 7 of this report. Following the implementation of this requirement, noise levels from general operations are predicted to satisfy the relevant criterion, as shown in Table 8.1, below.

Noise emissions from mechanical plant equipment are expected to satisfy the 40 dBA criterion at all times. Noise from the kitchen exhaust is predicted to be the dominant noise source, and thus whilst noise control is not required, recommendations to reduce kitchen exhaust noise emissions are provided in Section 7 of this report.

Therefore, following the implementation of the noise control outlined above, the proposed cafe at 166 Main Road, Austins Ferry is not expected to cause an unreasonable loss of amenity to adjacent sensitive uses. As such, clauses 8.3.1-P1, 8.3.1-A3 and 8.3.1-P4 of the Tasmanian Planning Scheme are satisfied.

Table 8.1, below, presents a summary of the assessment following implementation of the noise control outlined within Section 7, above.

TABLE 8.1: SUMMARY OF ASSESSMENT

Source		Predicted Sound Pressure Level (dBA)			
		R1	R2	R3	R4
Mechanical Plant	Predicted Noise Level	38	26	27	31
	Criteria	40			
General Operations	Predicted Noise Level	49	38	43	34
	Criteria	50			
Satisfies Criteria?		Yes	Yes	Yes	Yes

Appendix A – Additional Figures

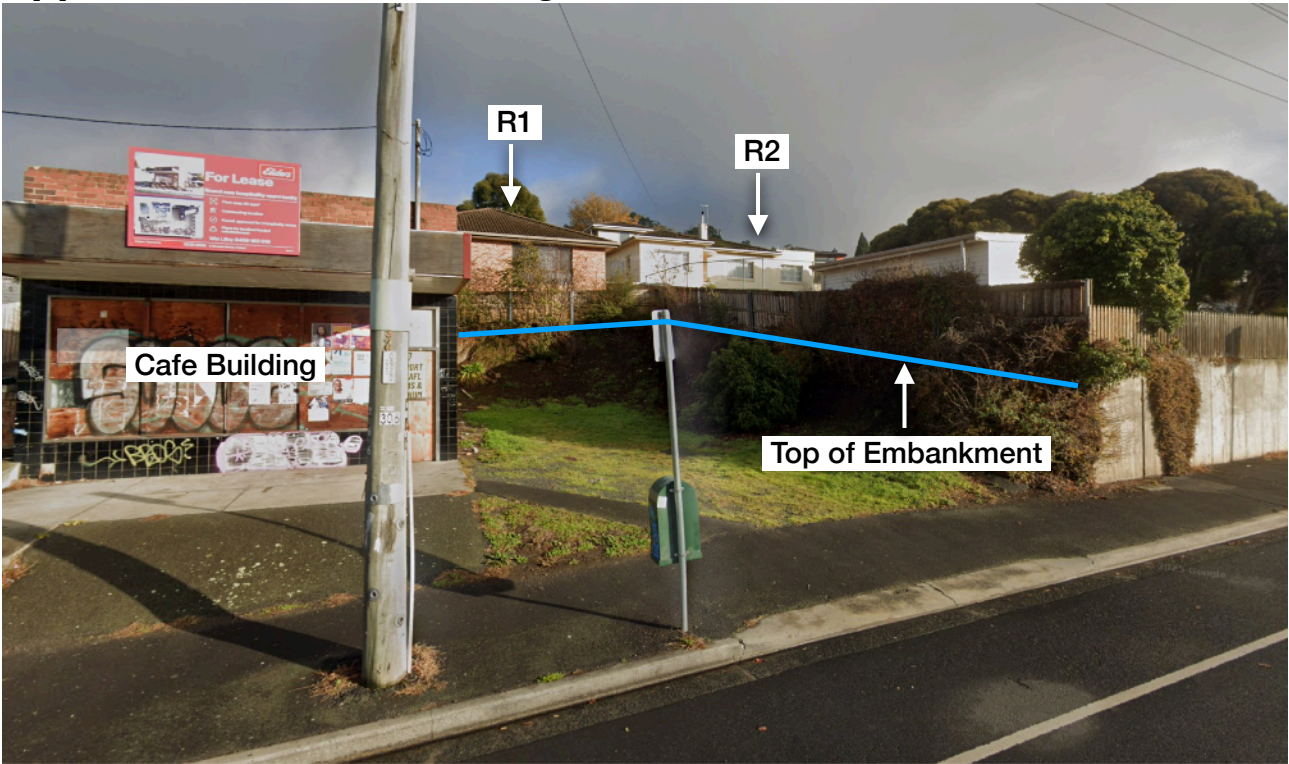


FIGURE A.1: VIEW OF SITE - FROM MAIN ROAD (EAST TO WEST)

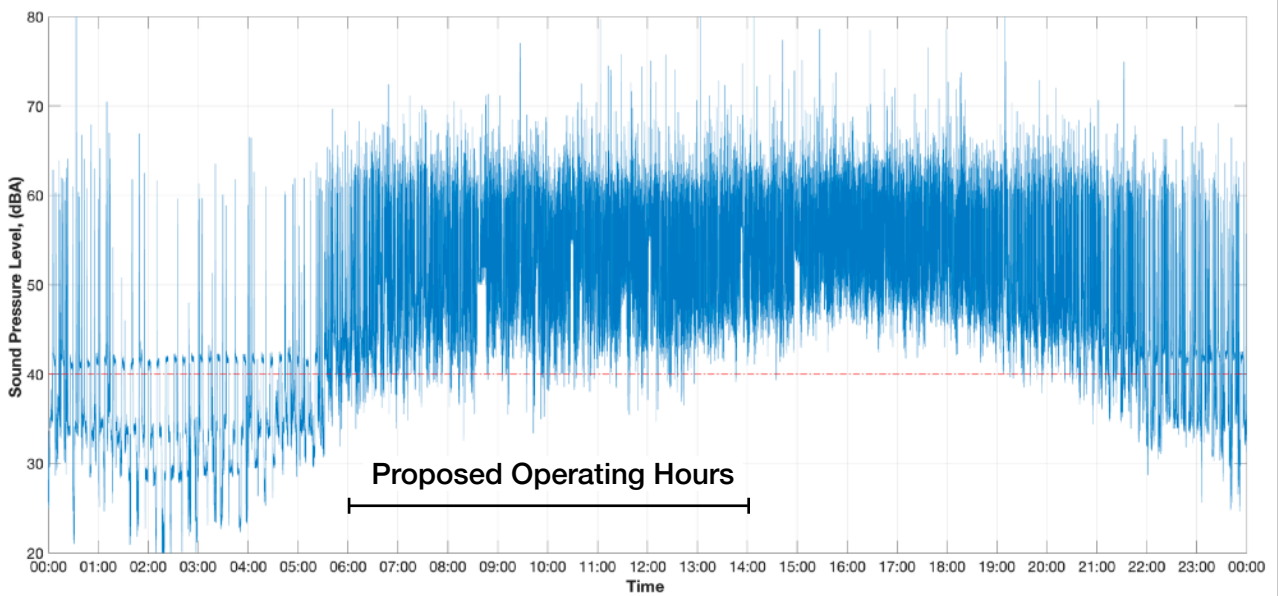


FIGURE A.2: TYPICAL NOISE TREND DURING OPERATING HOURS - LEQ(1-SEC)

Appendix B – Acoustic Glossary

<i>Ambient Noise</i>	All noise associated with a measurement, and typically ignoring the particular noise under investigation. Typically measured as Leq and will usually comprise noise from many sources.
<i>Background Noise</i>	Background noise describes the underlying level of noise present in the ambient noise. It may be described as the average of the minimum noise levels measured, and is typically measured by the statistical L90 level.
<i>Decibel [dB]</i>	The scale used for describing sound. It is a logarithmic scale that uses a reference sound pressure of 20 µPa, or reference sound power of 10 ⁻¹² Watts.
<i>dBA</i>	A-weighted decibel. The human ear does not perform linearly and is better at hearing high frequency rather than low frequency sounds, ie. low frequency sound at the same dB level as a high frequency sound will be perceived as quieter. To replicate the human ear response a frequency weighting, denoted as an A-weighting, is applied to the sound. A sound measured in this way is then an A-weighted sound pressure level with units dBA. Practically all noise is measured using the A-weighting.
<i>Leq</i>	Energy averaged sound pressure level over a period of time, usually 10 to 15 minutes. Units of decibels, typically A weighted (LAeq). Because the decibel scale is a logarithmic ratio, the higher noise levels have far more sound energy, and therefore the Leq level tends to indicate an average which is strongly influenced by short-term, high level noise events. Many studies show that human reaction to level-varying sounds tends to relate closer to the LAeq noise level than any other descriptor.
<i>Frequency</i>	Frequency is synonymous with pitch and has the units of Hertz (Hz) or cycles per second. A bass drum produces a low frequency sound, and a small bell a high frequency sound. The frequency range for human hearing is approximately 30Hz to 16kHz.
<i>L10, L90...</i>	Ln is the sound pressure level that is exceeded for n% of the time. Hence the L10 describes the noisier events during the interval, and L90 the quieter events. The L90 is often used to describe the background level. A significant variation between the L10 and L90 would indicate an environment where there is a strong variation in noise levels, and the background is not the dominant source. As the variation between the L10 and L90 decreases, the background becomes a more dominant.
<i>Lmax</i>	The instantaneous maximum level using the time response and frequency weighting set for the meter (typically Fast response, A weighted).
<i>Inversion</i>	A condition typically occurring on clear, still nights which is characterised by the air near the ground being colder than air at higher altitudes. The increasing speed of sound with altitude bends the sound back towards the ground causing a focussing of the sound in a small area. The inversion effect can cause increases in noise levels of 5 to 10 dB with greater increases in exceptional circumstances.