



Beveridge Williams
20 June 2023

5483 & 5495 Princes Highway, Traralgon

Noise Impact Assessment

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Project 5483 & 5495 Princes Highway, Traralgon
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1. Introduction

Octave Acoustics was engaged by Beveridge Williams to provide a noise impact assessment relating to the proposed rezoning of the green-field site located at 5483 and 5495 Princes Highway, Traralgon (Subject Site).

The rezoning is to permit the development of a residential subdivision covering an area equivalent to 58 hectares. The subdivision is to consist of 603 lots, split into three residential precincts with a small commercial precinct at the intersection of Bradford Drive and Princes Highway.

The site is abutted by the following infrastructure:

- Princes Highway (zoned TRZ2 Transport Zone 2) to the south.
- The Bairnsdale Railway Line (BRL) (zoned TRZ1 Transport Zone 1) located approximately 70m to the south.
- Latrobe Regional Airport (LVA) approximately 500m west of the Site.

This report summarises the results of noise monitoring and measurements at the Subject Site, and assesses aircraft, road, and rail noise impacts on the Subject Site with respect to the relevant standards and legislation. This addresses the relevant component of the brief from the Victorian Department of Transport and Planning, which is as follows:

A report addressing the requirements of Clause 18.02-7S of the Latrobe Planning Scheme, the Latrobe Regional Airport Master Plan 2015 and the National Airports Safeguarding Framework and any other requirements as relevant.

2. Criteria

2.1. Aircraft Noise

2.1.1. National Airports Safeguarding Framework

The relevant component of the National Airports Safeguarding Framework (NASF) is *Guideline A: Measures for Managing Impacts of Aircraft Noise*. Section I of Guideline A relates to rezoning of greenfield areas for noise sensitive uses, and states:

It is important that consideration be given to the application of the following approach to land use planning:

- i) No new designations or zoning changes that would provide for noise sensitive developments within a 20 ANEF where that land was previously rural or for non urban purposes (in keeping with AS2021).*
- ii) Zoning for noise-sensitive development be avoided where ultimate capacity or long range noise modelling for the airport indicates either:
 - 20 or more daily events greater than 70 dB(A);
 - 50 or more daily events of greater than 65 dB(A); or
 - 100 events or more daily events of greater than 60 dB(A).*
- iii) Zoning for noise-sensitive development should take into account likely night time movements and their impact on residents' sleeping patterns. For example, where there are more than 6 events predicted between the hours of 11pm to 6am which create a 60 dB(A) or greater noise impact, measures for aircraft noise amelioration and restriction on noise sensitive development may be appropriate.*

The above approach could be used as additional guidance by strategic planners and weighed along with other relevant strategic considerations.

The NASF defines noise sensitive uses as:

Residential, education establishments, offices, hospitals, aged care, churches, religious activities, theatres, cinemas, recording studios, court houses, libraries and galleries as specified as a 'noise sensitive developments' in AS2021.

2.1.2. AS2021:2015 Acoustics – Aircraft Noise Intrusion

Australian Standard AS2021 *Acoustics – Aircraft noise intrusion – Building siting and construction*, together with the relevant Australian Noise Exposure Forecast (ANEF) chart or locality map for the aerodrome under consideration, provides guidelines for determining:

- a. whether the extent of aircraft noise intrusion makes building sites 'acceptable', 'unacceptable' or 'conditionally acceptable' for the types of activity to be, or being, undertaken;
- b. for 'conditionally acceptable' sites, the extent of noise reduction required to provide acceptable noise levels indoors for the types of activity to be, or being, undertaken; and
- c. the type of building construction necessary to provide a given noise reduction, provided that external windows and doors are closed.

Building site acceptability is first determined based on the ANEF zone of the site. Criteria for each building type in the proposed development are summarised in Table 1.

Table 1: Building Site Acceptability Based on ANEF Zones

Building type	ANEF zone of site		
	Acceptable	Conditionally acceptable	Unacceptable
Residential	Less than 20 ANEF ¹	20 to 25 ANEF ²	Greater than 20 ANEF
Commercial	Less than 25 ANEF	25 to 35 ANEF	Greater than 35 ANEF

Note 1: The actual location of the 20 ANEF contour is difficult to define accurately, mainly because of variation in aircraft flight paths. Because of this, the procedure of for 'conditionally acceptable' land may be followed for building sites outside but near to the 20 ANEF contour.

Note 2: Within 20 ANEF to 25 ANEF, some people may find that the land is not compatible with residential or educational uses. Land use authorities may consider that the incorporation of noise control features in the construction of residences or schools is appropriate.

If the site is "acceptable", no further consideration of the Standard is necessary. For "conditionally acceptable" sites, relevant aircraft types and their associated maximum noise levels at the site are calculated. The required aircraft noise reduction (ANR) to reach the indoor design sound level for the room (Table 2) is then calculated, and the building plan is modified to achieve the required reduction.

Table 2: AS2021 Indoor Design Sound Levels

Building Type and Activity	Indoor Design Sound Level, L _{Amax} dB
Houses, home units, flats, caravan parks	
Sleeping areas, dedicated lounges	50
Other habitable spaces	55
Bathrooms, toilets, laundries	60
Commercial buildings, offices, and shops	
Private offices, conference rooms	55
Drafting, open offices	65
Typing, data processing	70
Shops, supermarkets, showrooms	75

2.1.3. Latrobe Planning Scheme

Section 18.02-7S of the Latrobe Planning Scheme concerns airports and airfields. With regards to aircraft noise, the stated strategy of the planning scheme is to:

Minimise the detrimental effects of aircraft noise when planning for areas around airports and airfields.

Limit the intensification of noise-sensitive land uses, and avoid zoning or overlay changes that allow noise-sensitive land use and development, where ultimate capacity or long-range noise modelling indicates an area is within a 20 Australian Noise Exposure Forecast (ANEF) contour or higher.

Avoid zoning or overlay changes that allow noise-sensitive land uses outside the Urban Growth Boundary, and encourage measures to reduce the impact of aircraft noise in planning for areas within the Urban Growth Boundary, where ultimate capacity or long-range noise modelling indicates an area is within 'number above' contours (N Contours) representing:

- 20 or more daily events greater than 70 dB(A).
- 50 or more daily events of greater than 65 dB(A).
- 100 or more daily events greater than 60 dB(A).
- 6 events or more between the hours of 11pm to 6am greater than 60 dB(A).

These figures agree with the recommendations laid out in the NASF.

Additionally, the Latrobe Planning Scheme requires that planning for areas around airports and airfields is carried out in accordance with an approved strategy or master plan for the airport or airfield, i.e., the Latrobe Regional Airport Master Plan.

2.1.4. Latrobe Regional Airport Master Plan 2015 (Updated 2019)

The Latrobe Regional Airport Master Plan (Master Plan) sets out the long-term strategy for planning around the Latrobe Regional Airport. It aims to facilitate appropriate development around the airport and surrounds, and implements safeguarding requirements to ensure that nearby development is compatible with aircraft activity.

With respect to safeguarding developments against aircraft noise, the Master Plan refers to the airport's Australian Noise Exposure Forecast (ANEF) and its corresponding Airport Environs Overlay (AEO) for implementing land use recommendations within AS2021.

The Master Plan also notes that the current AEO for the Latrobe Regional Airport was based on the 2010 ANEF prepared in 1998. The Master Plan includes a 2019 draft ANEC (Australian Noise Exposure Concept), which accounts for factors of:

- Revised expectations regarding the likely number, frequency and type of aircraft movements that may occur in future;
- Incremental changes in the sophistication of the noise modelling software since the time the current ANEF was prepared;
- Helicopter movements could form a substantial element of future activity, and are generally noisier than fixed wing general aviation movements.

In addition to the requirements in AS2021, the Master Plan references the criteria laid out in NASF Guideline A to minimise the zoning of noise-exposed land for regional development. As NASF Guideline A recognises that the 20 ANEF and 25 ANEF zones do not capture all high noise affected areas around an airport, N-above contours based on the 2019 draft ANEC are included in the Master Plan. These contours indicate the number of aircraft noise events greater than or equal to a specified noise level expected to occur on an average day, based on a long-range forecast of the airport activity.

2.2. VicRoads Traffic Noise Policy

Traffic noise level objectives are set in the VicRoads *Traffic Noise Reduction Policy* and *VicRoads Requirements of Developers – Noise Sensitive Uses*. Objectives for sensitive receivers are divided into residential dwellings (Category A) and community buildings (Category B) as summarised in Table 3.

Table 3: VicRoads Noise Level Objectives

Building Type	Noise Level Objective
Category A (residential dwellings, aged person homes, hospitals, motels, caravan parks, other residential buildings)	$L_{A10(18hr)}$ 63 dB(A) measured between 6am and midnight
Category B (schools, kindergartens, libraries, other community buildings)	$L_{A10(12hr)}$ 63 dB(A) measured between 6am and 6pm

VicRoads *Requirements of Developers* states that for single and multi-unit low level developments where it is practical to erect a noise barrier to protect a large number of buildings, additional design requirements are as follows:

- No new allotment should be created such that there is insufficient space at the 75 dB(A) noise contour, to erect a house or other noise sensitive development, (that is, the area of the allotment at the 75 dB(A) contour or lesser noise level, must be of a sufficient size to build a dwelling).
- The developer shall attenuate traffic noise from a Freeway to a level of 63 dB(A) or less, at the most exposed façade of the noise sensitive building.
- 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 façade, window and door opening should be of a minimum size.
- Council should request the developer to provide a report by a qualified acoustic consultant outlining the necessary noise control measures to achieve the preferred actions outlined above.
- The adopted noise attenuation requirements will be met for 10 years after finalisation of the development or, where relevant, for each stage of the development.
- The noise fence shall have a design life of not less than 50 years.

2.3. Victoria Passenger Rail Infrastructure Noise Policy

The Victoria Passenger Rail Infrastructure Noise Policy states that in considering changing land use near an existing passenger rail corridor, transport bodies and planning authorities should consider the receivers and investigation thresholds set out Table 4.

Table 4: Investigation Thresholds for a Change in Land Use Near an Existing Rail Corridor

Time	Type of Receiver	Investigation Threshold(s)
Day (6am – 10pm) dB(A) external	Residential dwellings Noise sensitive community buildings	65 L_{Aeq} OR 85 L_{Amax}
Night (10pm – 6am) dB(A) external	Residential dwellings	60 L_{Aeq} OR 85 L_{Amax}

If the assessment shows that the investigation thresholds will be exceeded, the Passenger Rail Infrastructure Noise Policy states that the following options should be considered:

1. Options that would avoid exposure to rail noise of sensitive receivers (for example, places where people sleep) through the way land is used, for example:
 - a. specifying the types of land use in proximity to rail infrastructure
 - b. requiring set-back from the rail reserve
 - c. encouraging the location of non-sensitive receivers (for example, commercial uses) in proximity to the rail corridor.
2. Options that would reduce or mitigate the exposure to rail noise of the sensitive receivers through building and architectural treatments, for example:
 - a. requiring developers to consider building orientation, placement on site and design of floor plans
 - b. use of building materials including double-glazing that can help reduce or mitigate internal noise in a building.

3. Site Assessment

Noise monitoring was carried out between the 5th and 16th of May 2023 using logger L1, and between the 5th and 18th of May 2023 using logger L2, at the locations shown in Figure 1. An attended noise measurement (M1) was also taken on the 5th of May to observe the impact of different types of aircraft. Full results of measurements and monitoring are presented in Appendix F.

Attended measurements and monitoring were carried out using NTi XL2 sound level meters which were calibrated before and after the assessment period using a Bruel Kjaer 4231 calibrator. No drift in calibration was detected. The NTi XL2 meters comply with the requirements of IEC 61672-1:2013 Sound Level Meters and are classified as Class 1 instruments. The calibrator complies with the requirements of IEC 60942:2004 Sound Calibrators. The XL2s and calibrator carry current NATA certification or manufacturer's certification if less than two years old.

Weather data for the monitoring period was obtained from the nearest Bureau of Meteorology weather station at Latrobe Valley AWS. Wind speed at 1.5m was calculated from wind speed measured at the 10m anemometer height applying the algorithms in AS/NZS 1170.02-2011 Structural Design Actions - Wind Actions. Periods of rain or excess wind (> 18 km/h) were excluded from the calculations, and are shown overlaid on measurement results in Appendix F.



Figure 1: Site Context

4. Measurement Results

4.1. Attended Measurement

An attended measurement (M1) was taken on Friday 5th May 2023 to observe the types of aircraft activity and their noise impacts on the Site. The measurement was a duration of 1 hour and 46 minutes, and was taken from 13:15 – 14:57. Aircraft type, registration and height was obtained from ADS-B Exchange and cross-checked against notes taken during the measurement period. A summary of activities recorded during the attended measurement is presented in Table 5.

Table 5: Summary of Aircraft Activity During Attended Measurement

Time	Type	Registration	Max Noise L _A max dB	Height (ft)	Activity Description
13:19 – 13:24	PA44 (4 seat twin-engine plane)	VH-OXK	58	5975	Training loops
13:46 – 13:59	C310 (4-6 seat twin-engine plane)	VH-UPZ	66	700	Training loops, landing
14:14 – 14:15	Helicopter ¹	-	83	-	Fly over
14:21 – 14:22	BE10 (7 seat twin-turboprop plane)	VH-EJV	66	11950	Fly over
14:34 – 14:36	AS50 (light helicopter)	VH-THY	65	750	Landing
14:40 – 14:41	P28A (2-4 seat single-engine plane)	VH-UMB	67	700	Landing and take-off
14:45 – 14:58	P28A (2-4 seat single-engine plane)	VH-UMB	65	3525	Training loops

Note: 1. Helicopter observed does not appear on flight tracker.

4.2. Aircraft Noise Monitoring

Logger L1 was placed at the location on site most affected by noise from the nearby Latrobe Regional Airport to monitor aircraft noise impacts, and ran for a duration of 11 days. BOM weather data was used to identify periods of rain or high wind speeds, and days with more than 3 hours of adverse weather were excluded from consideration.

To avoid a single aircraft pass being counted as multiple events as the sound fluctuates, an event is counted when the threshold level is exceeded for 2 or more seconds, and finishes when sound has fallen below the threshold for at least 30 seconds.

Many of the noise events captured during the period were not associated with aircraft noise, for example birds, livestock, and farm equipment. To identify the number of aircraft noise events, two days of maximum noise level events were classified by listening to the sound recording and correlating noise events with flight data. This information was used to build a frequency filter to classify the remaining data to count all aircraft noise events, summarised in Table 6.

Table 6: Summary of Aircraft Noise Events at L1 During Monitoring Period

Period	Number of Occurrences Above Threshold per Day		
	L _{ASmax} > 60 dB(A)	L _{ASmax} > 65 dB(A)	L _{ASmax} > 70 dB(A)
Average (5 th – 16 th May 2023)	33	19	7
Day with maximum number of events (13 th May 2023)	57	29	19

Impact on residents sleeping patterns is considered by analysing the number of noise events greater than L_{ASmax} 60 dB(A) between 11pm and 6am, shown in Table 7.

Table 7: Night-Time (11pm – 6am) Aircraft Noise Events at L1 During Monitoring Period

Period	Number of Occurrences per Night of L _{ASmax} > 60 dB(A)
Average (5 th – 16 th May 2023)	0.8
Night with maximum number of events (6 th May 2023)	6

4.3. Road and Rail Noise Monitoring

Logger L2 was located to measure road and rail noise impacts from the Princes Highway and Bairnsdale Railway Line, and ran for a duration of 13 days. To best isolate road and rail noise, the equipment was placed in the corner of the Site least affected by aircraft noise and closest to the road and rail transport corridors, 170m from the road.

Periods of rain or high wind were excluded from the calculations. Per Appendix C of the VicRoads *Road Design Note – Interpretation and application of VicRoads Traffic Noise Reduction Policy 2005*, the average L_{A10, 18hr} of the monitoring period was calculated as the arithmetic average of the L_{A10, 18hr} levels for periods which had less than 3 hours of data excluded due to weather.

Similarly, the average L_{Aeq, day} was calculated as the logarithmic average of the L_{Aeq, day} measurements for periods with less than 3 hours of data excluded due to weather. Average L_{Aeq, night} was calculated as the logarithmic average of L_{Aeq, night} measurements for periods with less than 1 hour of data excluded due to weather.

The average noise levels recorded at L2 over the monitoring period are presented in Table 8 below.

Table 8: Summary of Road and Rail Noise Monitoring

Date	L_{A10, 18hr} (6am-midnight)	L_{Aeq, day} (6am – 10pm)	L_{Aeq, night} (10pm – 6am)
Fri, 5 May 2023	n/a	n/a	n/a
Sat, 6 May 2023	n/a	n/a	51
Sun, 7 May 2023	n/a	n/a	53
Mon, 8 May 2023	n/a	n/a	n/a
Tue, 9 May 2023	n/a	59	n/a
Wed, 10 May 2023	62	59	55
Thu, 11 May 2023	64	61	56
Fri, 12 May 2023	64	61	56
Sat, 13 May 2023	62	59	54
Sun, 14 May 2023	62	59	56
Mon, 15 May 2023	63	60	58
Tue, 16 May 2023	n/a	n/a	57
Wed, 17 May 2023	64	61	56
Thu, 18 May 2023	63	60	n/a
Average (5th – 18th May 2023)	63	60	56

5. Noise Assessment

5.1. Aircraft Noise

5.1.1. ANEF Zones

The Subject Site lies outside of both the 20 and 25 ANEF zones on the Latrobe Regional Airport Environs Overlay (Figure 2) based on the Latrobe Regional Airport ANEF. It therefore falls within the 'acceptable' region under AS2021 and does not require further consideration under the Standard.

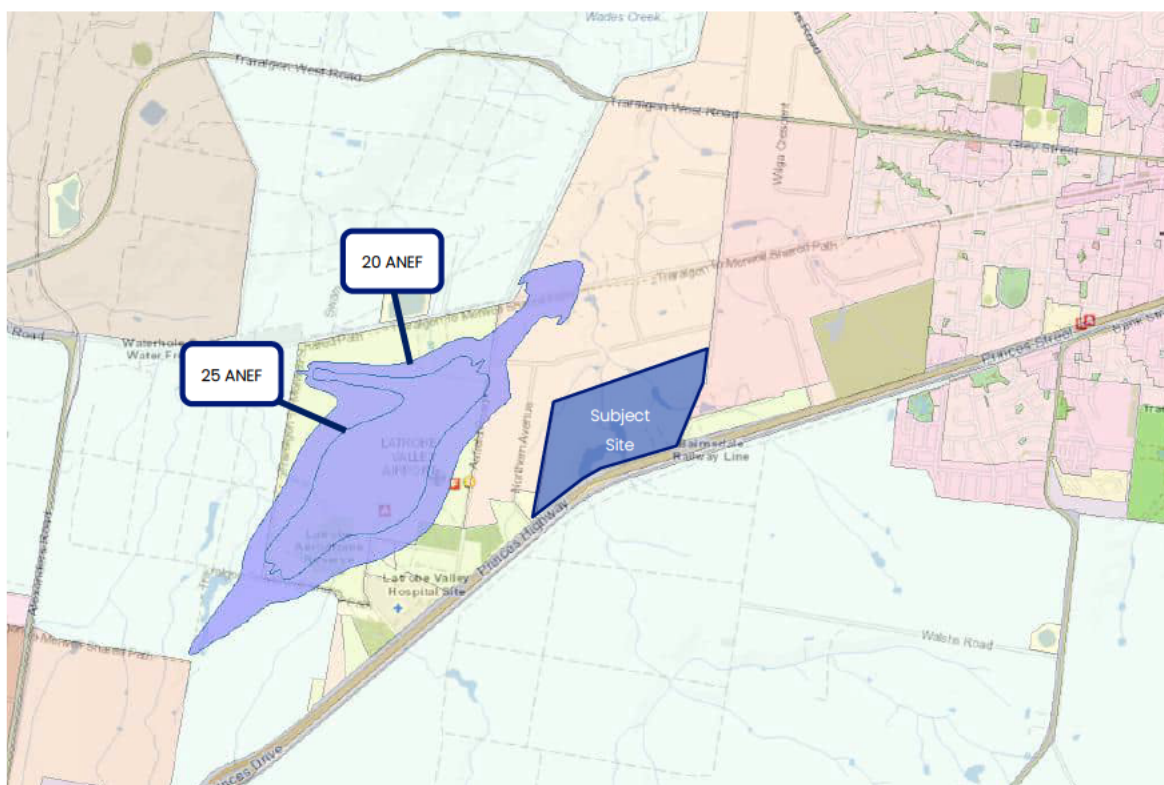


Figure 2: Latrobe Regional Airport Environs Overlay

5.1.2. N-Above Contours

To assess compliance with the Latrobe Planning Scheme and the NASF, the N-above contour maps from the Latrobe Regional Airport Master Plan 2019 (Appendix B) were used to find the long-range N-above values predicted at the most affected location on site. As the N-above maps are based on the draft ANEC, the N-above values were cross-checked against the day with most aircraft noise events during the monitoring period. Worst case values for the site are compared with the NASF criteria in Table 9.

Table 9: NASF Compliance Based on N-Above Contours

Maximum Level, $L_{A_{max}}$ dB	NASF Criteria	Worst Case N-Above from Contours		Worst Case N-Above from Measured Events	
		N-Above	Compliance	N-Above	Compliance
70	< 20 daily events	25	Non-compliant in north-western corner	19	Marginally complies
65	< 50 daily events	45	Complies	29	Complies
60	< 100 daily events	60	Complies	57	Complies

The N-above contour maps predict compliance across the site, apart from the north-western corner, which long-range modelling predicts as having more than 20 daily events greater than 70dB(A). These findings correlate with the monitoring data, which found only marginal compliance with the 70dB(A) criterion for the day with the most aircraft movements.

Under NASF recommendations, consideration should be given to avoiding zoning noise-sensitive development in the north-western corner of the site. One option is to zone a park or a less sensitive use in this area.

Alternatively, if noise-sensitive development is to be constructed at this location, measures to reduce the impact of aircraft noise should be taken in accordance with the Latrobe Planning Scheme. The required noise reduction for residences is determined by following the Construction Guidelines in Section 3.3 of AS2021. The 95th percentile of aircraft noise events recorded was used to represent the typical worst aircraft noise, which was $L_{A_{max}}$ 77 dB.

Assessment results are presented in Table 10, and indicate possible construction assemblies to satisfy the required noise reduction.

Table 10: Noise Reduction Required for Dwellings in N-Above 20 70dB(A) Contour

Room Type	Indoor Design Sound Level, dB(A)	Building Element	Required R_w	Indicative Construction ₅
Bedroom ₁	50	Windows	35	Double glazed awning window, 6mm float / 12mm air / 10.38mm laminate
		Walls	34	Direct fixed weatherboard to timber frame with 70mm studs, 10mm plasterboard on both sides, 75mm thick 10kg/m ³ glasswool insulation.
		Roof/ceiling	37	Standard dwelling construction ₆
Living Room ₂	50	Windows	34	Double glazed awning window, 6mm float / 12mm air / 6.38mm laminate
		Walls	31	Direct fixed weatherboard to timber frame with 70mm studs, 10mm plasterboard on internal side, 75mm thick 10kg/m ³ glasswool insulation.
		Roof/ceiling	37	Standard dwelling construction ₆
Kitchen ₃	55	Windows	30	Double glazed awning window, 6mm float / 12mm air / 6mm float
		Walls	30	Direct fixed weatherboard to timber frame with 70mm studs, 10mm plasterboard on internal side, 75mm thick 10kg/m ³ glasswool insulation.
		Roof/ceiling	32	Standard dwelling construction ₆
Bathroom ₄	60	Windows	21	Single glazed awning window, 4mm float
		Walls	28	Direct fixed weatherboard to timber frame with 70mm studs, 10mm plasterboard on internal side, 75mm thick 10kg/m ³ glasswool insulation.
		Roof/ceiling	27	Standard dwelling construction ₆

Notes:

1. Bedroom 5x5x2.7m, window = 14m², walls = 13m², ceiling = 25m².
2. Living room 8x8x2.7m, window = 29m², walls = 14m², ceiling = 64m².
3. Kitchen 5x4x2.7m, window = 11m², walls = 13m², ceiling = 20m².
4. Bathroom 3x4x2.7m, window = 3m², walls = 16m², ceiling = 12m².
5. Indicative construction is not provided as a specification but rather to inform the Contractor as to the types of construction that may satisfy the R_w performance requirements. It is the responsibility of the Contractor to ensure that the chosen construction assemblies satisfy the performance requirement. This is best done by obtaining a laboratory test.
6. Standard ceiling construction: e.g. Pitched steel roof with 60mm roofing blanket, 13mm plasterboard ceiling with 165mm thick 10kg/m³ glasswool insulation; or pitched tiled roof with 13mm plasterboard ceiling and 165mm thick 10kg/m³ glasswool insulation.

The NASF also specifies a limit for the number of night-time aircraft noise events above 60 dB(A). Flight data showed that on the night of the 6th of May, 4 out of the 6 noise events recorded were caused by the same

helicopter. All other nights of noise data showed either zero or one occurrence of aircraft noise above 60 dB(A). It can be concluded that the night of the 6th of May is an outlier, and that the average number of night-time events is more representative of the site. This indicates compliance with the night-time noise criteria in the Latrobe Planning Scheme and NASF, as shown in Table 11.

Table 11: Night-Time Aircraft Noise Events

Maximum Level, L_{A5max} dB	NASF Criteria	Average Number of Events Measured	Compliance
60	< 6 night-time events	0.8	Complies

Provided that the required noise reduction is achieved for dwellings in the north-western corner, the development is considered to achieve compliance with the Latrobe Planning Scheme, the Latrobe Regional Airport Master Plan, and the NASF.

5.2. Road Noise

5.2.1. Road Noise Model

Traffic Volume Data from the Victoria Department of Transport was used to identify the traffic levels along the Princes Highway adjacent to the Subject Site. The traffic volume was projected to 2033 using the growth rate from the Traffic Volume Data, as it is required that noise measures must be met 10 years after finalisation of the development.

Table 12: VicRoads Traffic Volume Data

	Princes Highway Eastbound	Princes Highway Westbound
Vehicles per day (2020)	16,000	16,000
Percentage heavy vehicles	11%	11%
Growth rate	1.5%	1.5%
Projected vehicles per day (2033)	19,417	19,417
Projected 18-hour traffic volume (2033) ₁	18,446	18,446

Note: ₁ 18-hour traffic volumes have been computed by applying a 0.95 factor to total traffic volumes.

3D computer modelling of traffic noise levels on the Princes Highway was carried out in CadnaA software, implementing the United Kingdom Department of Transport Welsh Office *Calculation of Road Traffic Noise*, 1988 (CoRTN) prediction method. The average $L_{A10,18hr}$ of all days during the measurement period was compared against the noise model, and used to tune the parameters of the model until agreement was reached between the model and measured data.

Table 13: Measured and Modelled Road Traffic Noise Levels at L2

Metric	Type of Receiver	Average $L_{A10, 18hr}$ Measured	Modelled CoRTN $L_{A10, 18hr}$
$L_{A10(18hr)}$ (6am – midnight)	Residential dwellings	63	64

The following factors were incorporated into the 2022 traffic noise model:

- Ground absorption for greenfield area $G = 0.7$
- Surface correction = 0 dB
- Eastbound vehicles travelling at 80 km/h and westbound vehicles travelling at 100 km/h

5.2.2. VicRoads Traffic Noise Policy

Projected 2033 traffic volumes were input to the noise model to compute the noise impacts at the facades of potential residences. Compliance with the Traffic Noise Reduction Policy is achieved with the construction of a 4m tall noise wall on the southern boundary of the Subject Site, and 1.8m acoustically rated fencing between the commercial area and residential lots, meeting the requirements outlined in Section 5.4 and to the extent shown in Appendix E. Noise maps computed with and without the noise wall are included in Appendix C and D.

Table 14: 2033 Modelled Road Traffic Noise at Potentially Most Affected Residential Facade

Metric	Type of Receiver	Criteria, $L_{A10, 18hr}$ dB	$L_{A10, 18hr}$ dB No Noise Wall	$L_{A10, 18hr}$ dB with Noise Wall
$L_{A10(18hr)}$ (6am – midnight)	Residential dwellings	63	74	61

The following additional factors were incorporated into the 2033 traffic noise model:

- Ground absorption for developed area $G = 0$
- Façade reflection
- Receiver height 1.5m above ground level, assuming single storey residences.

5.3. Rail Noise

5.3.1. Average Rail Noise

Average noise levels due to rail are significantly below road noise levels from the Princes Highway. Rail noise is therefore expected to comply with the L_{Aeq} requirements laid out in the Rail Infrastructure Noise Policy.

5.3.2. Maximum Rail Noise

The loudest noise event associated with rail infrastructure is a train horn sounding. A typical train horn was modelled with a sound pressure level of 110 dB(A) at 15m, using the frequency spectrum of the loudest train horn event recorded during the monitoring period. Noise impacts of a train horn sounding at the worst-case location were calculated at the nearest proposed sensitive receiver, with the proposed noise wall installed per the markup in Appendix E. Table 15 compares calculation results with the Passenger Rail Infrastructure Noise Policy investigation threshold.

Table 15: Maximum Rail Noise Levels at Nearest Sensitive Receiver

Receiver	Façade L _{Amax} dB with Noise Wall	Investigation Threshold L _{Amax} dB	Further Investigation Required?
Southern façade of potential residence closest to the train line	82	85	No

The maximum noise at potential residential facades is below the investigation threshold specified in the Passenger Rail Infrastructure Noise Policy, indicating that no further treatment is required.

5.4. Acoustic Barrier Requirements

A 4m tall acoustically rated noise wall is to be constructed along the southern boundary of the Site. At the western corner it is to extend 180m north along the western boundary of the Site, and the eastern end is to terminate at the corner of the residential lots adjacent to the commercial area.

Additional 1.8m tall acoustically rated fencing is to be installed on the boundary between the residential lots on the south-eastern corner of the Site and the commercial area. There is to be no gap between the 4m wall and the 1.8m fencing.

Both the 4m noise wall and 1.8m fencing must meet VicRoads requirements. The acoustic and construction requirements are detailed in the following VicRoads documents:

- VicRoads Bridge Technical Note 007 – Code of Practice *Noise Attenuation Walls*, V1.1 June 2018
- VicRoads Standards Specification Section 765 – Noise Attenuation Walls, January 2018

Requirements are summarised as follows:

- Noise walls may be constructed using fibre cement sheeting, treated timber, lightweight aerated concrete, transparent acrylic panels, glass and profiled or flat steel cladding.
- The noise wall shall have:
 - A non-porous construction with a surface density of 20kg/m² at its thinnest point; or
 - A sound insulation rating $R_w + C_{tr}$ of at least 25dB when determined in accordance with AS/NZS ISO 717-1 using results from a NATA accredited laboratory.
- The noise wall shall have no gaps or holes in it, or the likelihood of such occurring through natural causes or deformations, thus allowing noise to pass through; and
- The noise wall must be designed and built in an acceptable manner so that noise will not pass underneath it.
- The noise wall shall have a design life of not less than 50 years.

Markup of the extent of the 4m wall and 1.8m fencing is shown in Appendix E. Refer to Appendix G for detailed noise wall specifications.

6. Conclusion

Octave Acoustics has carried out a detailed noise impact assessment for the proposed rezoning of the green-field site located at 5483 & 5495 Princes Highway, Traralgon. The proposed development is potentially affected by noise from several sources, including:

- Aircraft activities at the Latrobe Regional Airport, located approximately 500m west of the Site.
- Road traffic on the Princes Highway to the south of the Site.
- Trains on the Bairnsdale Railway Line to the south of the Site, beyond the Princes Highway.

Assessment of potential aircraft noise impacts was conducted with respect to the Latrobe Planning Scheme framework, considering the National Airports Safeguarding Framework and the Latrobe Regional Airport Master Plan. This assessment indicates that the proposed development is acceptable on the condition that any dwellings predicted to experience more than 20 daily events of 70 dB(A), per the N-Above Contours in the Master Plan, are treated to reduce the impact of aircraft noise in accordance with the procedure in AS2021 Appendix G. The acoustic requirements for construction of residences in this pocket of land are specified in Section 5.1.2, and are to be met by any dwelling overlapping with the region marked up in Appendix E. Additionally, it is recommended that the presence of aircraft noise be formally disclosed to residents of the proposed development.

Assessment of road and rail noise impacts indicate that compliance with the VicRoads Traffic Policy and the Rail Infrastructure Noise Policy can be achieved with the construction of a 4m tall noise wall on the southern perimeter of the development (Appendix E), per the requirements specified in Section 5.4.

Appendix A: Glossary of Terms

'A' Frequency Weighting

The 'A' frequency weighting roughly approximates to the Fletcher–Munson 40 phon equal loudness contour. The human loudness perception at various frequencies and sound pressure levels is equated to the level of 40 dB at 1 kHz. The human ear is less sensitive to low frequency sound and very high frequency sound than midrange frequency sound (i.e. 500 Hz to 6 kHz). Humans are most sensitive to midrange frequency sounds, such as a child's scream. Sound level meters have inbuilt frequency weighting networks that very roughly approximates the human loudness response at low sound levels. It should be noted that the human loudness response is not the same as the human annoyance response to sound. Here low frequency sounds can be more annoying than midrange frequency sounds even at very low loudness levels. The 'A' weighting is the most commonly used frequency weighting for occupational and environmental noise assessments. However, for environmental noise assessments, adjustments for the character of the sound will often be required.

AMBIENT NOISE

The ambient noise level at a particular location is the overall environmental noise level caused by all noise sources in the area, both near and far, including all forms of traffic, industry, lawnmowers, wind in foliage, insects, animals, etc. Usually assessed as an energy average over a set time period 'T' (LAeq,T).

AUDIBLE

Audible refers to a sound that can be heard. There are a range of audibility grades, varying from "barely audible", "just audible" to "clearly audible" and "prominent".

BACKGROUND NOISE LEVEL

Total silence does not exist in the natural or built-environments, only varying degrees of noise. The Background Noise Level is the minimum repeatable level of noise measured in the absence of the noise under investigation and any other short-term noises such as those caused by all forms of traffic, industry, lawnmowers, wind in foliage, insects, animals, etc. It is quantified by the noise level that is exceeded for 90 % of the measurement period 'T' (LA90,T). Background Noise Levels are often determined for the day, evening and night time periods where relevant. This is done by statistically analysing the range of time period (typically 15 minute) measurements over multiple days (often 7

days). For a 15-minute measurement period the Background Noise Level is set at the quietest level that occurs at 1.5 minutes.

'C' FREQUENCY WEIGHTING

The 'C' frequency weighting approximates the 100 phon equal loudness contour. The human ear frequency response is more linear at high sound levels and the 100 phon equal loudness contour attempts to represent this at various frequencies at sound levels of approximately 100 dB.

DECIBEL

The decibel (dB) is a logarithmic scale that allows a wide range of values to be compressed into a more comprehensible range, typically 0 dB to 120 dB. The decibel is ten times the logarithm of the ratio of any two quantities that relate to the flow of energy (i.e. power). When used in acoustics it is the ratio of the square of the sound pressure level to a reference sound pressure level, the ratio of the sound power level to a reference sound power level, or the ratio of the sound intensity level to a reference sound intensity level. See also Sound Pressure Level and Sound Power Level. Noise levels in decibels cannot be added arithmetically since they are logarithmic numbers. If one machine is generating a noise level of 50 dB, and another similar machine is placed beside it, the level will increase to 53 dB (from $10 \log_{10}(10^{(50/10)} + 10^{(50/10)})$) and not 100 dB. In theory, ten similar machines placed side by side will increase the sound level by 10 dB, and one hundred machines increase the sound level by 20 dB. The human ear has a vast sound-sensitivity range of over a thousand billion to one, so the logarithmic decibel scale is useful for acoustical assessments.

dBA – See 'A' frequency weighting

dB(C) – See 'C' frequency weighting

EQUIVALENT CONTINUOUS SOUND LEVEL, LAeq

Many sounds, such as road traffic noise or construction noise, vary repeatedly in level over a period of time. More sophisticated sound level meters have an integrating/averaging electronic device inbuilt, which will display the energy time-average (equivalent continuous sound level - LAeq) of the 'A' frequency weighted sound pressure level. Because the decibel scale is a logarithmic ratio, the higher noise levels have far more sound energy, and therefore the LAeq 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.

'F' (FAST) TIME WEIGHTING

Sound level meter design-goal time constant which is 0.125 seconds.

FREE FIELD

In acoustics a free field is a measurement area not subject to significant reflection of acoustical energy. A free field measurement is typically not closer than 3.5 metres to any large flat object (other than the ground) such as a fence or wall or inside an anechoic chamber.

FREQUENCY

The number of oscillations or cycles of a wave motion per unit time, the SI unit is the hertz (Hz). 1 Hz is equivalent to one cycle per second. 1000 Hz is 1 kHz.

LOUDNESS

The volume to which a sound is audible to a listener is a subjective term referred to as loudness. Humans generally perceive an approximate doubling of loudness when the sound level increases by about 10 dB and an approximate halving of loudness when the sound level decreases by about 10 dB.

MAXIMUM NOISE LEVEL, LAFmax

The root-mean-square (rms) maximum sound pressure level measured with sound level meter using the 'A' frequency weighting and the 'F' (Fast) time weighting. Often used for noise assessments other than aircraft.

MAXIMUM NOISE LEVEL, LASmax

The root-mean-square (rms) maximum sound pressure level measured with sound level meter using the 'A' frequency weighting and the 'S' (Slow) time weighting. Often used for aircraft noise assessments.

NOISE

Noise is unwanted, harmful or inharmonious (discordant) sound. Sound is wave motion within matter, be it gaseous, liquid or solid. Noise usually includes vibration as well as sound.

OFFENSIVE NOISE

Reference: Dictionary of the NSW Protection of the Environment Operations Act 1997).

"Offensive Noise means noise:

(a) that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:

(i) is harmful to (or likely to be harmful to) a person who is outside the premise from which it is emitted, or

(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or

(b) that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances prescribed by the regulations."

'S' (SLOW) TIME WEIGHTING

Sound level meter design-goal time constant which is 1 second.

SOUND ATTENUATION

A reduction of sound due to distance, enclosure or some other device. If an enclosure is placed around a machine, or an attenuator (muffler or silencer) is fitted to a duct, the noise emission is reduced or attenuated. An enclosure that attenuates the noise level by 20 dB reduces the sound energy by one hundred times.

SOUND EXPOSURE LEVEL (LAE)

Integration (summation) rather than an average of the sound energy over a set time period. Use to assess single noise events such as truck or train pass by or aircraft flyovers. The sound exposure level is related to the energy average (LAeq,T) by the formula $LA_{eq,T} = LAE - 10 \log_{10} T$. The abbreviation (SEL) is sometimes inconsistently used in place of the symbol (LAE).

SOUND PRESSURE

The rms sound pressure measured in pascals (Pa). A pascal is a unit equivalent to a newton per square metre (N/m²).

SOUND PRESSURE LEVEL, Lp

The level of sound measured on a sound level meter and expressed in decibels (dB). Where $L_p = 10 \log_{10} (P_a/P_0)^2$ dB (or $20 \log_{10} (P_a/P_0)$ dB) where P_a is the rms sound pressure in Pascal and P_0 is a reference sound pressure conventionally chosen is 20 μ Pa (20×10^{-6} Pa) for airborne sound. L_p varies with distance from a noise source.

SOUND POWER

The rms sound power measured in watts (W). The watt is a unit defined as one joule per second. A

measures the rate of energy flow, conversion or transfer.

SOUND POWER LEVEL, L_w

The sound power level of a noise source is the inherent noise of the device. Therefore, sound power level does not vary with distance from the noise source or with a different acoustic environment. $L_w = L_p + 10 \log_{10} 'a'$ dB,

re: 1pW, (10^{-12} watts) where 'a' is the measurement noise-emission area (m^2) in a free field.

SOUND TRANSMISSION LOSS

The amount in decibels by which a random sound is reduced as it passes through a sound barrier. A method for the measurement of airborne Sound Transmission Loss of a building partition is given in Australian Standard AS1191 - 2002.

STATISTICAL NOISE LEVELS, L_n

Noise which varies in level over a specific period of time 'T' (standard measurement times are often 15-minute periods) may be quantified in terms of various statistical descriptors with some common examples:

The noise level, in decibels, exceeded for 1% of the measurement time period, when 'A' frequency weighted and 'F' time weighted is reference to as $L_{AF1,T}$. This may be used for describing short-term noise levels such as could cause sleep arousal during the night.

The noise level, in decibels, exceeded for 10% of the measurement time period, when 'A' frequency weighted and 'F' time weighted is reference to as $L_{AF10,T}$. In most countries the $L_{AF10,T}$ is measured over periods of 15 minutes, and is used to describe the average maximum noise level.

The noise level, in decibels, exceeded for 90% of the measurement time period, when 'A' frequency weighted and 'F' time weighted is reference to as $L_{AF90,T}$. In most countries the $L_{AF90,T}$ is measured over periods of 15 minutes, and is used to describe the average minimum or background noise level.

WEIGHTED SOUND REDUCTION INDEX, R_w

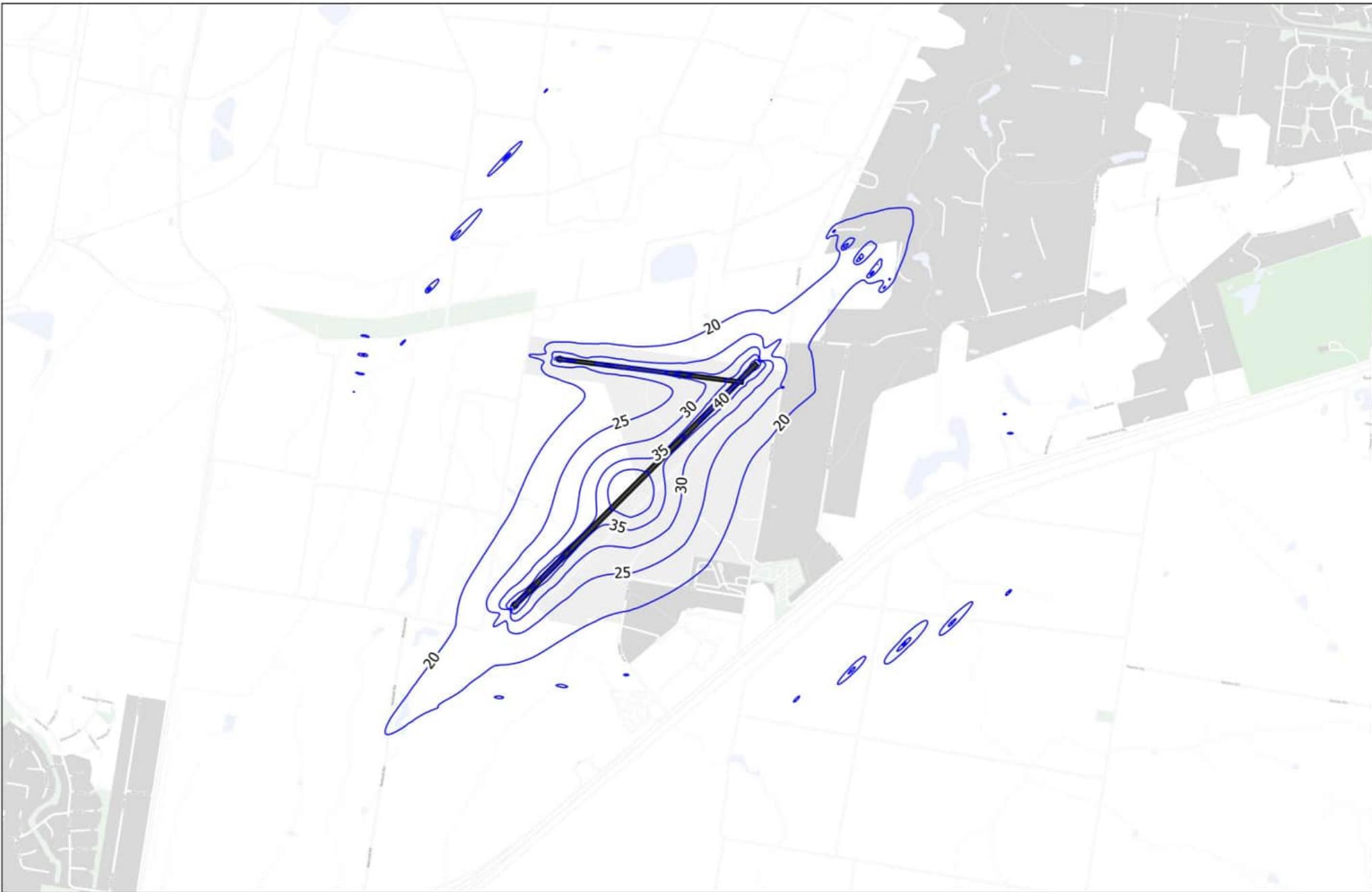
This is a single number rating of the airborne sound insulation of a wall, partition or ceiling. The sound reduction is normally measured over a frequency range of 100 Hz to 3.150 kHz and averaged in accordance with ISO standard weighting curves (Refer AS/NZS 1276.1:1999). Internal partition wall R_w+C ratings are frequency weighted to simulate insulation from human voice noise. The R_w+C is similar in value to the STC rating value. External walls, doors and windows may be R_w+C_{tr} rated to

simulate insulation from road traffic noise. The spectrum adaptation term C_{tr} adjustment factor takes account of low frequency noise. The weighted sound reduction index is normally similar or slightly lower number than the STC rating value.

'Z' FREQUENCY WEIGHTING

The 'Z' (Zero) frequency weighting is 0 dB within the nominal 1/3 octave band frequency range centred on 10 Hz to 20 kHz. This is within the tolerance limits given in AS IEC 61672.1-2004: 'Electroacoustics - Sound level meters - Specifications'.

Appendix B: Aircraft Noise Contour Maps



Latrobe Airport ANEC
Medium forecast scenario

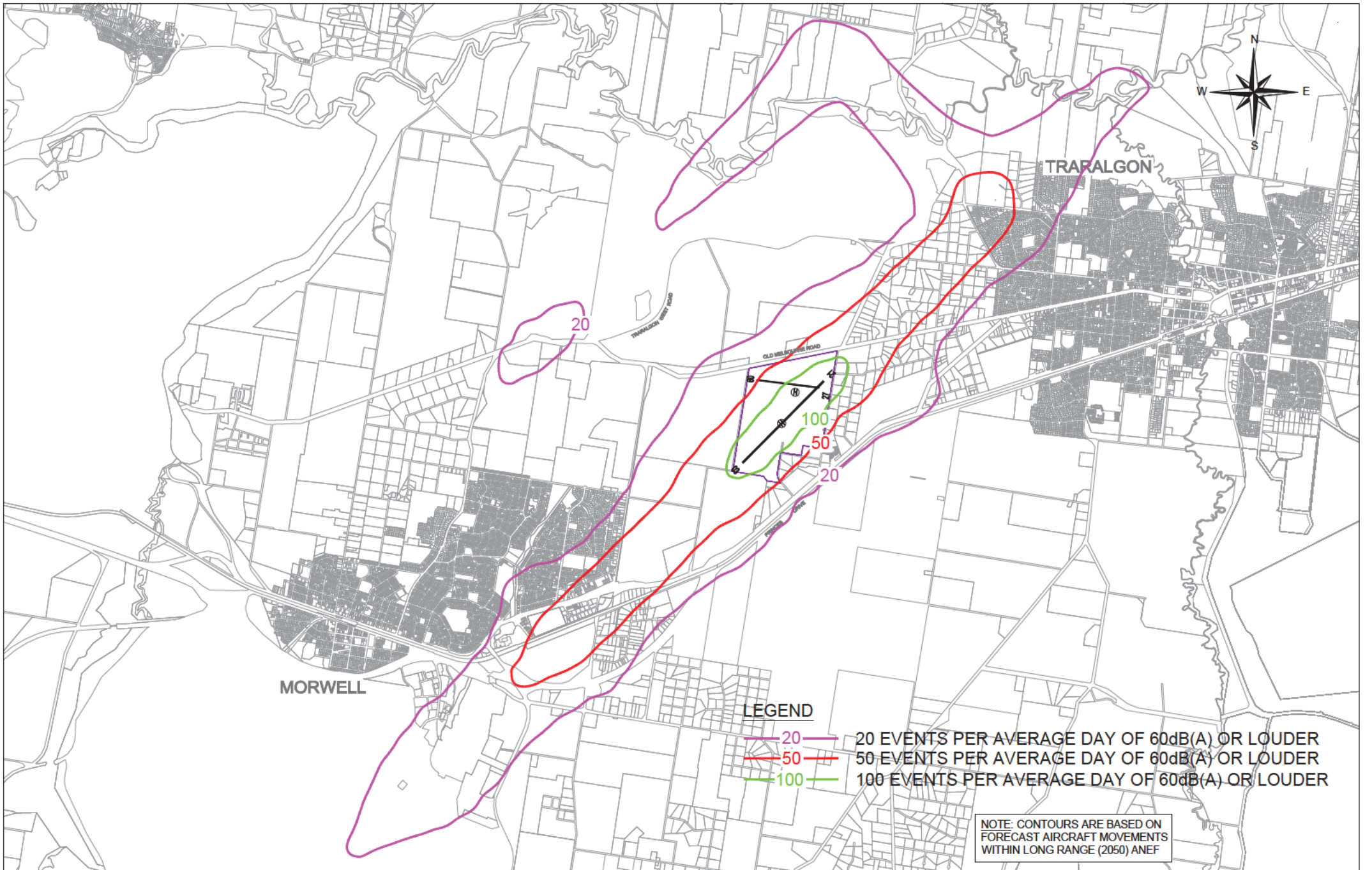
Legend

 ANEC contour

DRAFT

0 250 500 750 1000 m





No.	Date	By	Amendment	Checked
1	20/07/10	MJ	FWHL	
0	20/07/10	MD	DMAT	

REHBEIN Airport Consulting

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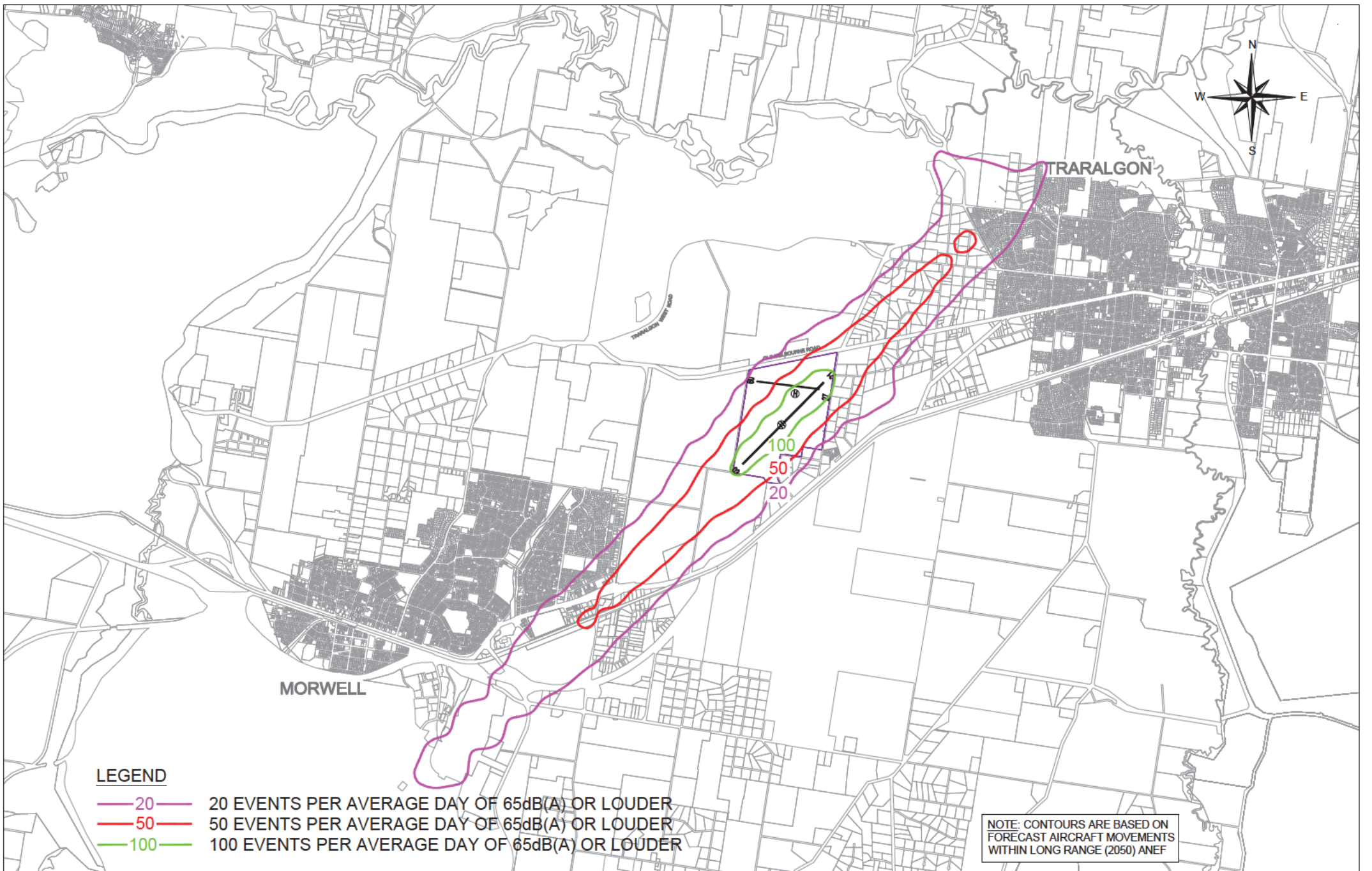
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Title: N60 CONTOURS

Client: Latrobe City Council

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Designer: ND	Approver: BLH		
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LEGEND

- 20 20 EVENTS PER AVERAGE DAY OF 65dB(A) OR LOUDER
- 50 50 EVENTS PER AVERAGE DAY OF 65dB(A) OR LOUDER
- 100 100 EVENTS PER AVERAGE DAY OF 65dB(A) OR LOUDER

NOTE: CONTOURS ARE BASED ON FORECAST AIRCRAFT MOVEMENTS WITHIN LONG RANGE (2050) ANEF

No.	Date	By	Amendment	Checked
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0	20/07/10	MD	DRAFT	

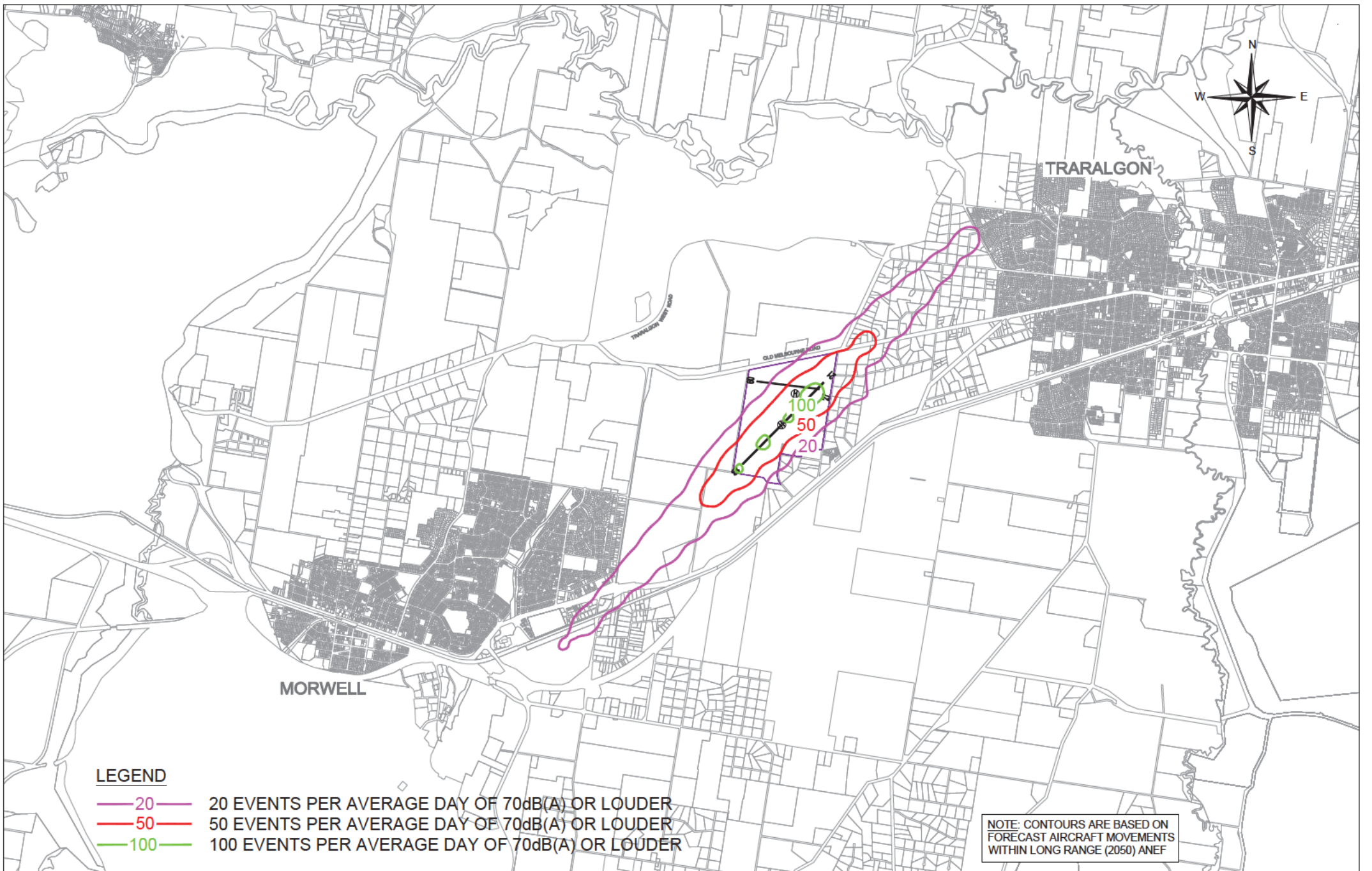
REHBEIN Airport Consulting
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Project: **LATROBE AIRPORT MASTER PLAN 2015**
 Title: **N65 CONTOURS**

Client: **Latrobe City Council**

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LEGEND

- 20 20 EVENTS PER AVERAGE DAY OF 70dB(A) OR LOUDER
- 50 50 EVENTS PER AVERAGE DAY OF 70dB(A) OR LOUDER
- 100 100 EVENTS PER AVERAGE DAY OF 70dB(A) OR LOUDER

NOTE: CONTOURS ARE BASED ON FORECAST AIRCRAFT MOVEMENTS WITHIN LONG RANGE (2050) ANEF

No.	Date	By	Amendment	Checked
1	20/07/10	MJ	FWHL	
0	20/07/10	MD	EMPT	

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Project: **LATROBE AIRPORT MASTER PLAN 2015**

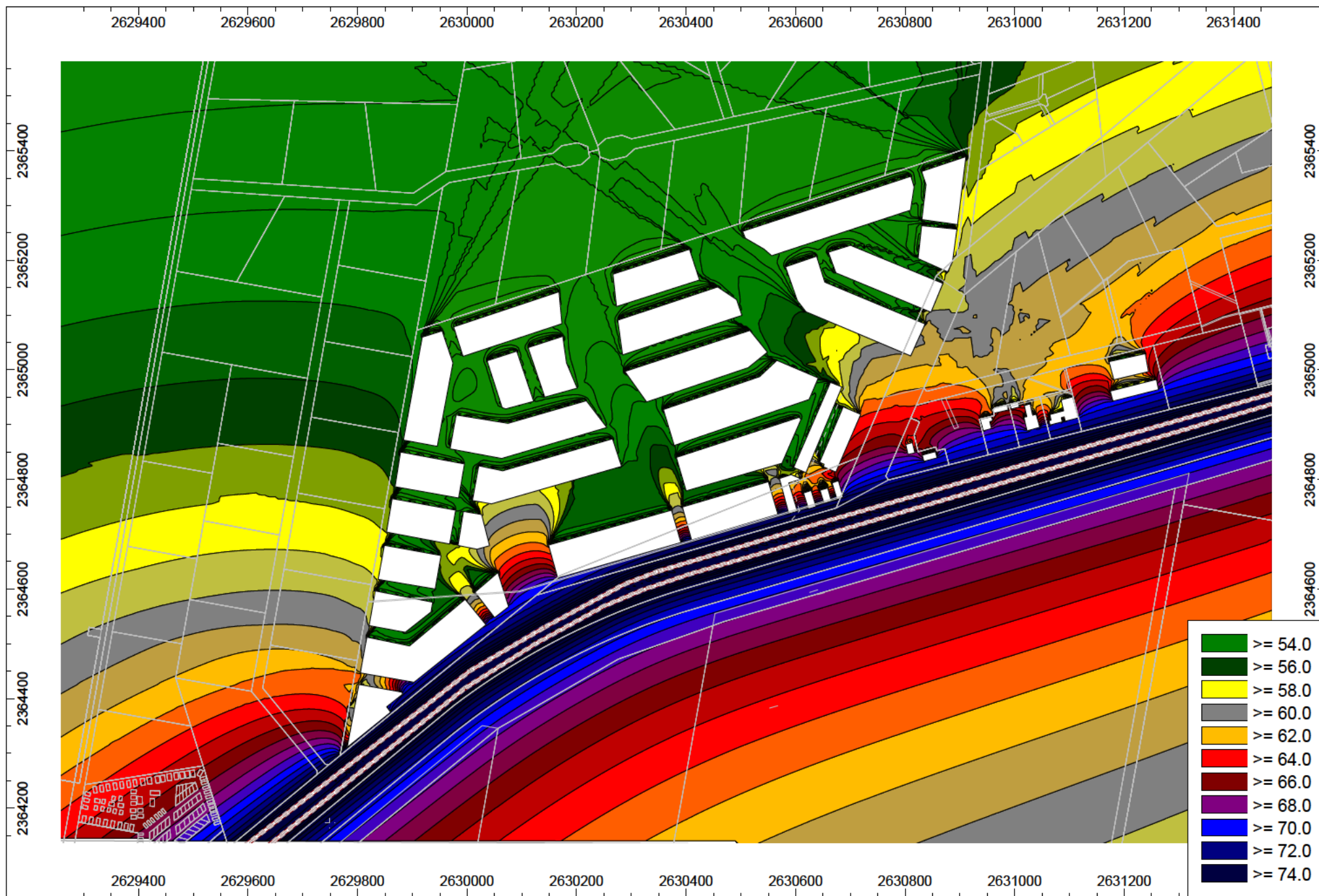
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Client: **Latrobe City Council**

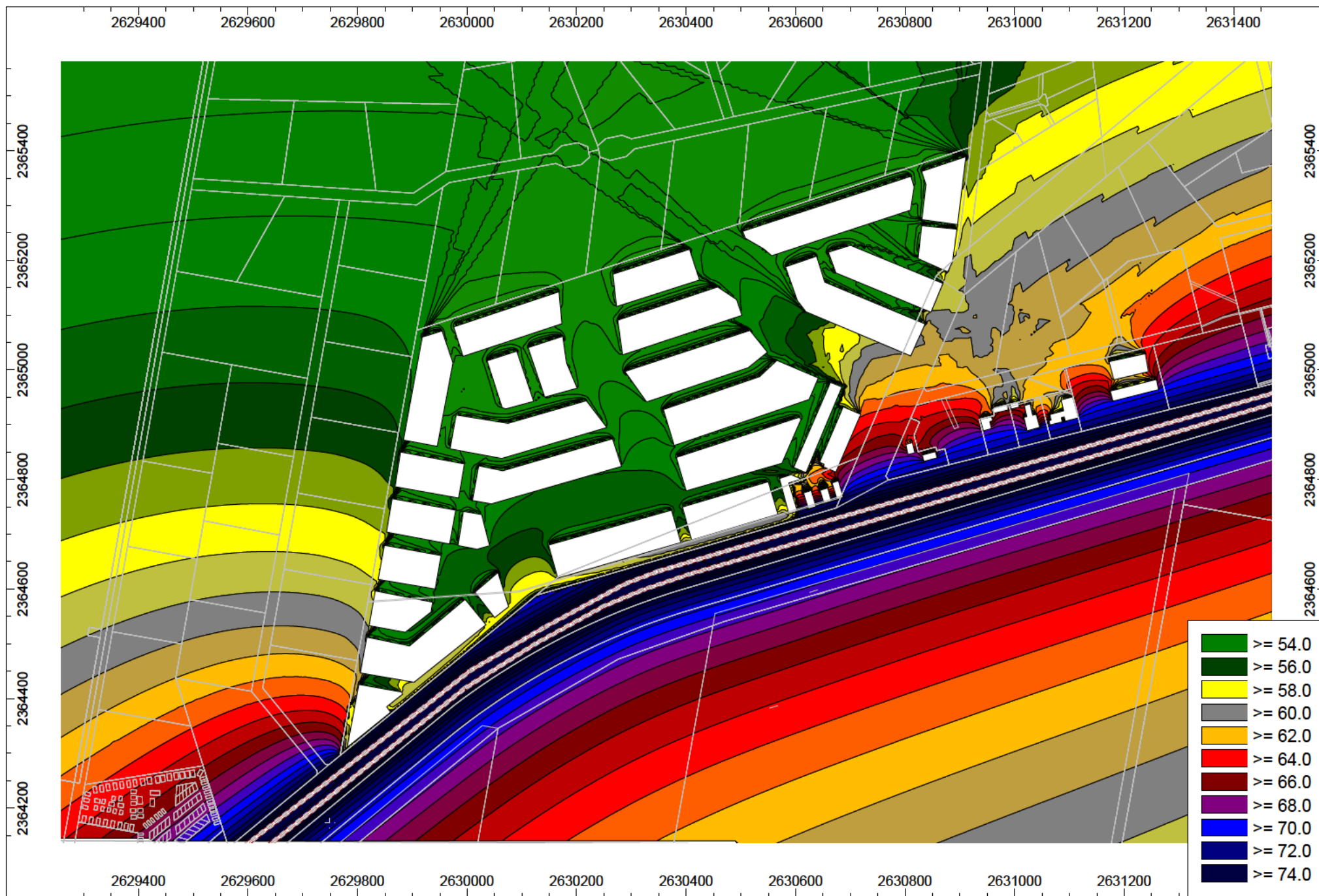
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Appendix C: Road Noise Contour Map Without Noise Wall



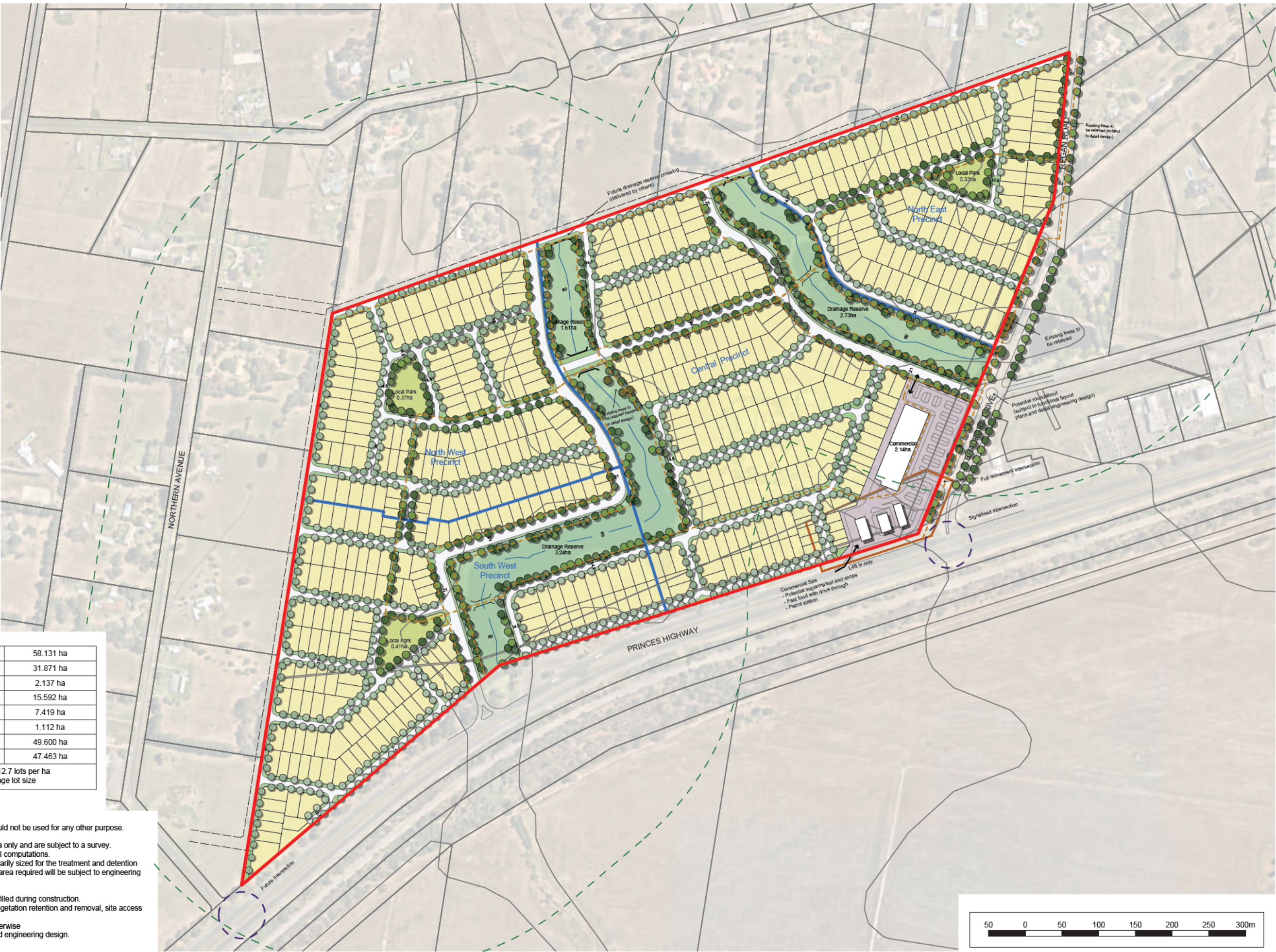
Appendix D: Road Noise Contour Map With Noise Wall



Appendix E: Development Plan Markup

LEGEND

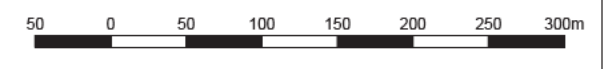
- Title boundary (approx.)
- Precinct boundary
- Existing contours (10m interval)
- Residential Lots
- Commercial
- Naturestrip (indicative)
- Road pavement (indicative)
- Drainage reserve
- Local park
- Key pedestrian network
- Local park 400m local park catchment
- CHMP area



Site (Approx.) - VICMAP data only	58.131 ha
* Residential Lots	31.871 ha
* Commercial	2.137 ha
* Non-Arterial Roads	15.592 ha
Drainage Reserve	7.419 ha
Local Park (4.5% of the NDA)	1.112 ha
Net Developable Area	49.600 ha
Net Developable Area (excl. Commercial)	47.463 ha
Estimated Lot Yield	603 lots @ 12.7 lots per ha 529m ² average lot size

* Indicates inclusion in NDA

- Notes:**
- ☒ This plan was prepared as a **PROPOSAL** only and should not be used for any other purpose.
 - ☒ This plan is subject to Council approval.
 - ☒ The boundaries on this plan are based on VICMAP data only and are subject to a survey.
 - ☒ All dimensions and areas are subject to survey and final computations.
 - ☒ The **DRAINAGE RESERVE SHOWN** has been preliminarily sized for the treatment and detention of stormwater to Council requirements. The layout and area required will be subject to engineering detail design and Council approval.
 - ☒ This plan is subject to a rezone process.
 - ☒ Existing dams located within construction areas will be filled during construction.
 - ☒ Further investigation may be required for fire buffers, vegetation retention and removal, site access and egress, and aboriginal and cultural heritage.
 - ☒ All roads are 16m local access level 1 unless noted otherwise.
 - ☒ Road pavement is indicative only and subject to detailed engineering design.
 - ☒ Arc dimensions shown are length of arc (not chord).

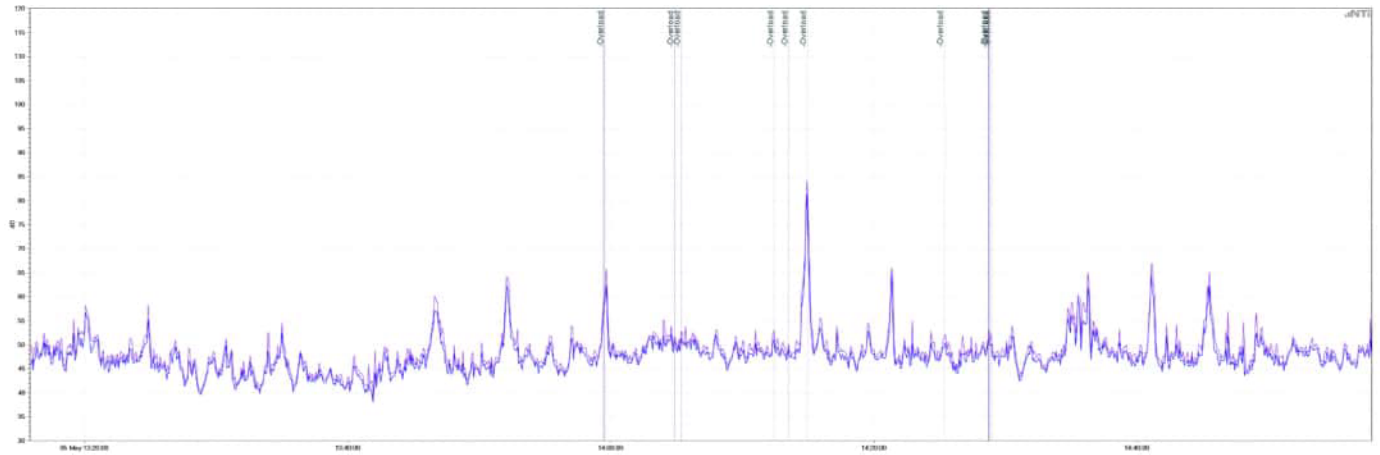


Appendix F: Noise Monitoring Results

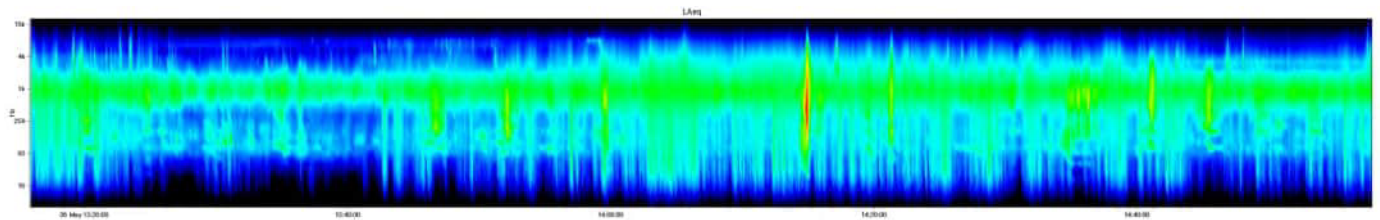
M1: Attended Aircraft Noise Measurement

Start: 2023-05-05 13:15:50

End: 2023-05-05 14:57:46



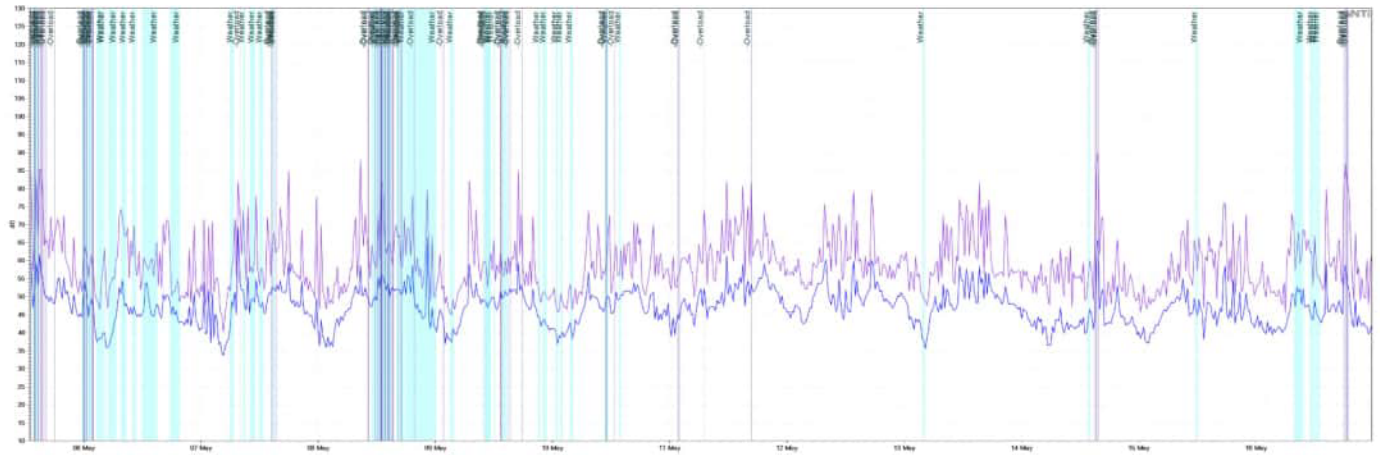
— LASmax_dt — LAeq_dt



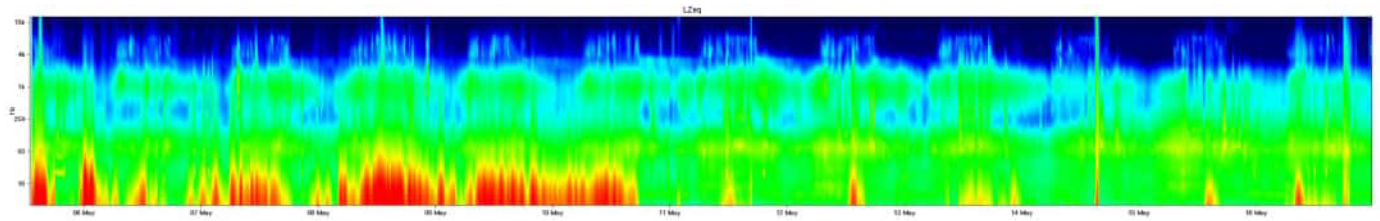
L1: Aircraft Noise Logger

Start: 2023-05-05 13:08:56

End: 2023-05-16 23:30:46



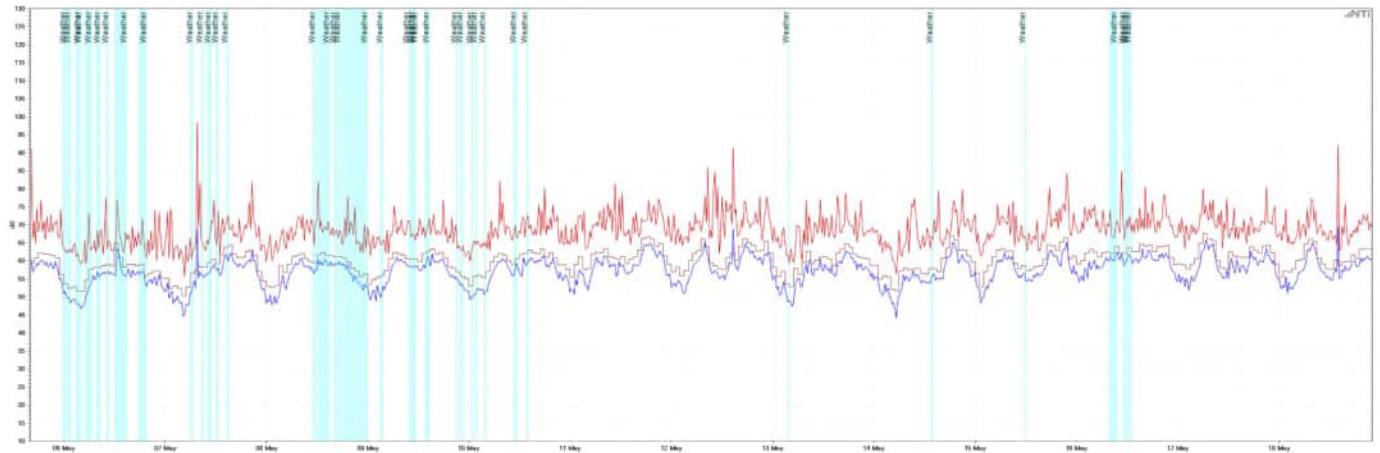
— LASmax_dt — LAeq_dt



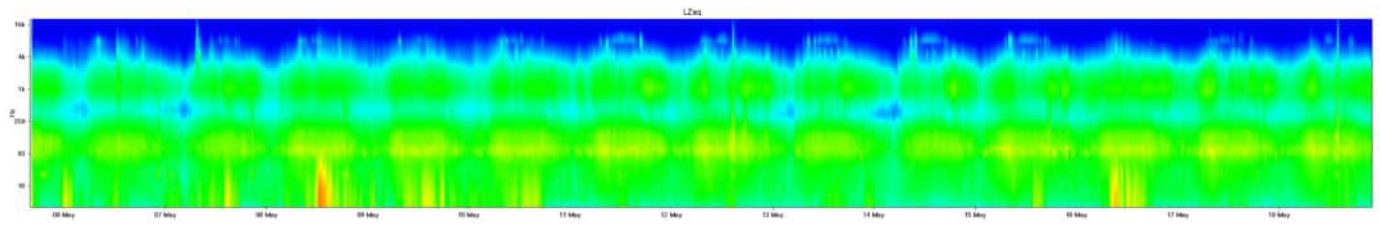
L2: Road and Rail Noise Logger

Start: 2023-05-05 16:02:22

End: 2023-05-18 21:48:32



— LAFmax_dt — LAeq_dt — L 10.0 %



Appendix G: VicRoads Code of Practice – Noise Attenuation Walls

Code of Practice

Noise attenuation walls

1. Introduction

BTN007 Noise attenuation walls states VicRoads' requirements for the structural and acoustic design of noise attenuation walls.

Bridge Technical Notes are a Code of Practice. Compliance with Bridge Technical Notes is mandatory.

Other than as stated in this document and relevant VicRoads standard specifications, the provisions of AS5100:2017 shall apply. Where this document differs from AS5100:2017, its requirements override those of AS5100:2017.

BTN007 is to read in conjunction with VicRoads Standards Specification Section 765.

In addition to structural design requirements, BTN007 includes certain requirements for acoustic design.

Noise attenuation walls shall also comply with AS5100.1 Cl.17.

The acoustic specification, type (reflective or absorptive), material (timber, concrete, steel, polycarbonate, or other composite materials) and location (including dimensions) of noise attenuation walls are determined by others prior to the structural design.

2. General requirements

Requirements for the structural and acoustic design, physical properties and location of noise attenuation walls are stated below.

In the absence of a NATA-approved laboratory, testing shall be conducted by a laboratory approved by VicRoads for this purpose. The laboratory and testing methodology shall be approved by VicRoads before testing commences.

2.1. Physical requirements

2.1.1. General

Requirements for physical properties:

- noise attenuation walls shall have the minimum area density stated in Standard Section 765
- the noise attenuation walls shall have sufficient intrinsic airborne sound insulation performance to ensure that, for all receivers, the sound transmitted directly through the

barrier is not less than 10 dB below the sound diffracted at the top of the barrier

The following is deemed to satisfy this requirement:

- a non-porous construction with no gaps and a surface density of at least 20 kg/m² at its thinnest point
or:
- a construction that has a sound insulation rating value of the weighted sound reduction index with spectrum adaptation term $R_w + C_{tr}$ of at least 25dB when determined in accordance with AS/NZS ISO 717-1 using results from a NATA-accredited laboratory.

The laboratory measurements of airborne sound insulation shall be conducted in accordance with AS 1191 or ISO 10140-2, with the test specimen mounted and assembled in the same manner as the manufactured device is used in practice. The side that would face the traffic shall face the source room. Where posts are employed in construction, at least one post shall be included in the specimen, with panels attached on both sides and the length of the panel on one side of the post shall be $\geq 2m$.

- noise attenuation wall components shall have the design life stated in Standard Section 765
- noise attenuation walls shall have no holes or gaps
- noise attenuation wall materials shall be resistant to vandalism such as impact damage, and components shall be readily replaceable
- noise attenuation walls shall be designed so that they will not reverberate or deflect excessively
- noise attenuation wall surfaces shall be smooth to facilitate removal of graffiti in accordance with Specification Section 685. Matt finishes shall not be permitted
- transparent panels adjacent to or over high-risk land such as rail or road ways shall incorporate filaments or some other means of preventing fragmentation and/or shattering of the panels in the event of an impact

The following general requirements shall also be considered:

- potential reflection of sunlight or vehicle headlights
- resistance of the proposed material to scratching or discolouration with age
- maintenance requirements for dust removal
- bird strike

2.1.2. Absorptive noise attenuation walls

In addition to the foregoing requirements, absorptive noise attenuation walls shall comply with the following:

Absorptive noise barriers shall have a sound absorption coefficient equal to or exceeding that shown in the table below, determined by measurements conducted in accordance with AS ISO 354 by a NATA-accredited laboratory.

The sound absorption measurements shall be conducted with the test specimen mounted and assembled in the same manner as the manufactured device that is used in practice with the same connections and seals between component parts. The test specimen shall be placed directly against one of the test chamber surfaces (floor, wall or ceiling) without gaps as far as possible. If posts are employed in construction, at least one post shall be included in the specimen with panels attached on both sides. The length of the panels on one side of the post shall be $\geq 2m$. The side that would face the traffic shall face the inner part of the test chamber.

Table 1 Coefficient of Absorption

Octave Band - Hz	125	250	500	1000	2000
Sound Absorption Coefficient	0.70	0.80	0.90	0.90	0.80

- the acoustic properties of sound absorptive materials shall not diminish over the design life of the noise attenuation wall.

2.1.3. Transparent noise attenuation walls

Material colour must not detract from road safety objectives or result in shadow tones being cast on private property. When transparent walls are used over, or adjacent to, a rail reserve the wall colour when viewed from the rail track must meet the requirements of the rail authority.

Materials for transparent noise attenuation walls:

- shall be resistant to scratching or discolouration with age
- shall be mounted in rubber gaskets to counteract the high coefficient of expansion
- may incorporate synthetic fibre reinforcement within the clear panel to increase strength.

2.2. Location

General requirements for location of noise attenuation walls:

- noise attenuation walls may be freestanding, or located on top of earth mounds or traffic barriers

- noise attenuation walls shall have sufficient clearance to avoid impact by high/wide vehicles
- noise attenuation walls shall be accessible from both sides for construction, repair and maintenance.

3. Design requirements

3.1. General

Timber posts shall not be used.

Fixings shall with the requirements of Standard Specification 765.

If a noise attenuation wall is located on a bridge over another road or a pedestrian path, the noise attenuation wall and its supporting structure shall be designed to prevent panels or fragments of panels from falling on to traffic or pedestrians as a result of vehicle impact (e.g. a continuous galvanised cable may be used to connect or support the panels).

If a noise attenuation wall is located on traffic barriers, it shall not include components that could penetrate an impacting vehicle.

Noise attenuation walls shall be designed in accordance with AS5100 together with additional criteria for wind loading as specified in Cl.3(b).

Designs that include materials outside of the scope of AS5100 shall be in accordance with the relevant Australian Standards.

Design details and components which could snag or penetrate impacting vehicles shall not be used.

3.2. Wind loading

Wind loads shall be derived from AS5100.2 Cl.25, with additional reference to AS/NZS1170.2, using the net design wind pressure for both serviceability and ultimate limit states.

The design wind speed shall be modified to reflect local terrain and topographic conditions as described below.

Under the action of serviceability wind-loading only, the maximum horizontal deflection of a wall post shall not exceed 1/125 of the post height.

3.2.1. Site conditions during the structure life

Site conditions leading to the highest design wind pressure shall be used in the design, e.g. the sheltering effect of buildings and trees in the vicinity of the noise attenuation wall shall be ignored.

3.2.2. Appendix D2 of AS/NZS 1170.2

The design shall allow for the increased wind load near the ends of noise attenuation walls in accordance with Appendix D2. Subject to consideration of acoustic performance, the height of noise attenuation walls at the ends may be reduced to reduce wind loads and improve appearance.

3.3. Foundation design

The foundation design shall meet the requirements of AS5100.3.

Noise attenuation wall foundations shall be checked for both serviceability and ultimate limit states, and designed to limit deflections to specified tolerances based on the requirements stated below.

Noise attenuation walls on earth mounds or on batters shall have a minimum 1m wide horizontal surface to both sides of the wall to:

- provide access for construction and maintenance
- ensure foundation stability (sliding and overturning)
- protect the foundation
- prevention the formation of gaps below the noise attenuation wall.

Spread (strip) foundations in earth mounds shall be a minimum of 1.5m from the edge of the filled batter.

Fill material for earth mounds shall, as a minimum, comprise Type B fill material placed and compacted to a minimum dry density of 98% standard compaction in accordance with Standard Specification 204.

Noise attenuation walls on disturbed material shall be provided with a piled foundation which shall be designed for the site conditions using appropriate soil parameters.

The effects of long term settlement and lateral movement of the noise attenuation wall due to embankment consolidation shall be considered in the design.

Foundation design for noise attenuation walls near the edge of embankments shall consider the potential embankment movement.

The designer shall specify requirements for earthworks on the drawings.

- The required construction tolerances are stated in Standard Section 765.

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Bridge Technical Notes are subject to periodic review and may be superseded.