Report

Noise Assessment for Rezoning

9 Gaudrons Rd, Sapphire Beach

FactorXSolutions

16 February, 2021
Rev 1 (Final)

Report Details

Noise Assessment for Rezoning - 9 Gaudrons Rd, Sapphire Beach

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Endorsements

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1. INTRODUCTION

Advitech Pty Limited (trading as Advitech Environmental) was engaged by FactorX Solutions to conduct a noise assessment for the property at 9 Gaudrons Rd, Sapphire Beach. A proposal exists to rezone the land at this address for residential use, and then divide the lots into multiple residential addresses. As the land is adjacent to the Pacific Motorway, a noise assessment is required in order to determine the exposure of potential residences to road noise, and provide recommendations for management of potential road noise impacts.

It should be noted that this report was prepared by Advitech Pty Limited for FactorXSolutions ('the customer') in accordance with the scope of work and specific requirements agreed between Advitech and the customer. This report was prepared with background information, terms of reference and assumptions agreed with the customer. The report is not intended for use by any other individual or organisation and as such, Advitech will not accept liability for use of the information contained in this report, other than that which was intended at the time of writing. It should also be noted that information contained within any draft report is subject to change as a result of final checking or the availability of additional information.

2. BACKGROUND AND OBJECTIVES

This assessment concerns the property at 9 Gaudrons Rd, Sapphire Beach. The property is located immediately west of the Pacific Highway, adjacent to the Sapphire Beach interchange. A horticultural business currently operates on the site; however the proponent seeks to rezone subdivide the property into residential housing blocks.

As part of determining the suitability of the area for residential housing, an assessment of noise impacts from the Pacific Motorway is required. This assessment will use the guidelines in the NSW Road Noise Policy (RNP) and *Development near Rail Corridors and Busy Roads* (DNRCBR) to determine the suitability of the site for residential development (including any requirements for noise mitigation). An aerial image of the current site and surrounds is provided in **Figure 1**.

Figure 1: Monitoring locations at 9 Gaudrons Rd

9 Gaudrons Road ( ) and Pacific Highway ( ). Attended monitoring locations are marked ( )

3. METHODOLOGY

Road noise levels across the site were evaluated using noise propagation modelling software Predictor. In order to accurately evaluate road noise at the site, the local traffic volumes and road conditions must be accounted for in the model. Modelled noise levels may be then compared to limit conditions, and recommendations made for potential noise mitigation requirements.

3.1 Assessment of Road Noise Impacts

Guidelines for the assessment of road traffic noise are provided by the NSW RNP and DNRCBR. The RNP establishes the following guidance on acceptable noise levels for *existing* residential receivers adjacent:

- existing motorways or arterial roads:
  - day period (7am to 10pm): external $L_{Aeq,15hour}$ 60dB(A)
  - night period (10pm to 7am): external $L_{Aeq,9hour}$ 55dB(A)
- new motorways or arterial roads:
  - day period (7am to 10pm): external $L_{Aeq,15hour}$ 55dB(A)
  - night period (10pm to 7am): external $L_{Aeq,9hour}$ 50dB(A)

While the RNP provides context around acceptable noise levels, the DNRCBR supports the practical implementation of the Infrastructure SEPP (2008) and establishes requirements for assessment of *new* residential developments adjacent to existing busy roads. For the purposes of the DNRCBR, a busy road is defined as:

- any road specified in Clause 102 of the Infrastructure State Environmental Planning Policy (SEPP); or
- any other road with an average annual daily traffic (AADT) volume of more than 20,000 vehicles.

The DNRCBR provides guidance on acceptable *internal* noise levels for new residential development adjacent to busy roads (or rail corridors). These internal noise goals may be applied in lieu of external noise limits for the purposes of assessing acceptability of a development. The internal noise level goals outlined in the DNRCBR (via the Infrastructure SEPP) are:

- 35dB(A) for bedrooms during the night-time period; and
- 40dB(A) for other habitable rooms.

Paired with an understanding of road traffic noise levels at the development site, the DNRCBR also provides guidance on typical acoustic treatments that would be required to achieve the internal noise level goals. Specific requirements for acoustic treatment may be referenced against DNRCBR 'Categories of Noise Control Treatment' as a means of:

- evaluating the level of development constraint that road traffic noise may impose on the site,
  - and used to identify areas where residential development may be unsuitable (based on noise levels) or prohibitively costly (based on acoustic treatment requirements); and / or
- providing recommendations for acoustic treatment that may subsequently be adopted as a condition of any development approval.

The DNRCBR establishes treatment categories 1 through 6. Category 1 represents the lowest level of noise mitigation, whereas Category 6 indicates a high level of road noise impact and typically carries recommendation for professional design of acoustic treatment. The DNRCBR treatment categories are often used in concert with road traffic noise contours to map acoustic requirements (if any) across the development site. That methodology is applied to this assessment.

3.2 Site Inspection

In order to determine the effect of existing road conditions on noise levels, a series of attended and unattended noise measurements were undertaken on 26 November and 8 December 2020. During these measurements, sound level meters recorded noise levels at various locations on the site (marked in **Figure 1**). At the same time, traffic movements for both directions on the Pacific Highway were counted for a period of one hour (via manual survey).

Traffic on the exit ramp to Gaudrons Rd was not counted. This road segment is much lower volume and slower speed than the Pacific Highway and site topography also provides significant shielding of this carriageway. Noise contributions from this road segment were expected to be minimal, and this was confirmed as part of initial site inspection and evaluation of road noise impacts.

The equipment used for noise measurements is listed in **Table 1**, and the vehicle counts and measured levels during monitoring are given in **Table 2**. These values are used as inputs to the validation model detailed in **Section 3.4**. The sound level meters were calibrated before and after the measurements, and the calibrations were found to be within 0.5 dB.

Table 1: Monitoring Equipment

Make / Model	Serial no.	Last Calibrated
ARL EL-316	16-203-513	22/3/2018
SVAN 971	60686	23/4/2020
SVAN SV-30A	7906	24/7/2020

Table 2: Attended Monitoring Results

Date & Time	Measurement Location	Measured Level ($L_{Aeq,1hr}$)	Light Vehicles		Heavy Vehicles	
			Northbound	Southbound	Northbound	Southbound
26 Nov 12:35	Northeast	62	842	789	56	74
26 Nov 12:35	South	53				
8 Dec 6:40	Northeast	62	582	1128	104	77

3.3 Traffic Volume Calculations

Traffic volumes used in this assessment were taken from the 2019 Coffs Harbour Bypass Environmental Impact Statement (EIS) – Appendix G (Noise and Vibration Assessment). This document provides projected traffic volumes for the opening year of the bypass (2024) and ten years afterward (2034). These volumes are listed at various points on the bypass; the northernmost point is the closest to the section of motorway under assessment in this report and so these values were adopted. The relevant vehicle speed was listed as 110 km/hr.

The Coffs Harbour EIS includes average one-hour light and heavy vehicle volumes for daytime (7am-10pm) and night-time (10pm-7am). These 1-hour average data were used to evaluate volumes relevant to the day (15hours) and night (9hours) period. The relevant traffic volumes are stated in **Table 3**.

Table 3: Modelled Traffic Volumes

Time	Direction	Average Hourly Volume		Heavy Vehicle %	
		2024	2034	2024	2034
Day	Northbound	726	851	12%	12%
	Southbound	843	912	10%	10%
Night	Northbound	267	379	17%	17%
	Southbound	301	374	13%	13%

3.4 Noise Model

Open source terrain data representative of the site and surrounds was obtained via query of the ELVIS – Elevation and Depth – Foundation Spatial Data portal. The query returned a series of Tiled 1km x 1km Digital Elevation Models (DEM) for the domain; these were merged and analysed (extraction of 2m contour intervals) using QGIS (an open source Geographic Information System software package).

Following assembly of terrain data, a noise model representing the site was constructed in Predictor (version 8.11). The model was run using the Calculation of Road Traffic Noise (CoRTN) algorithm, with road surface and inclination adjustments used as variables during the validation process.

Initially, the model was validated by constructing 1-hour traffic flows equivalent to those observed by manual traffic counts during the attended noise measurements. The resulting calculated levels at the attended monitoring positions were compared to measured levels during the attended monitoring; the results are compared in **Table 4**.

Table 4: Model Validation

Date & Location	Measured ($L_{Aeq,1h}$)	Modelled ($L_{Aeq,1h}$)	Difference
25 Nov Northeast	62	61	-0.3
25 Nov South	53	54	0.3
8 Dec Northeast	62	62	0.1

As the modelled levels are within 2 dB of the measured levels, the model is considered to be valid in accordance with the *Noise Model Validation Guideline.* Once successfully validated, the model was run again using the longer term traffic volume data provided in **Table 3** . Final versions of the model were then run using a gridded receiver layer, enabling extrapolation of road traffic noise level contours across the site.

3.5 Assessment of Suitability and Recommendations for Acoustic Treatment

Once road traffic noise levels across the site are understood, evaluation of site suitability (or requirements for acoustic treatment) may be undertaken in line with the DNRCBR. Noise contours may be used to map acoustic constraints, and condition requirements for acoustic treatment across the site. In providing this analysis, it must be noted that as the design and placement of the residences (or subdivision Lots) has not yet been determined, potential shielding of houses positioned behind other houses was not accounted for. This ensures the assessment represents the 'worst case' impacts. Levels were calculated at a height of 1.5 metres, appropriate for a single storey residence.

4. RESULTS

The DNRCBR provides information regarding construction categories which are appropriate to facades receiving various levels of road noise. These construction categories are designed to ensure new residences constructed near existing busy roads are able to achieve appropriate internal levels (gas established in Table 3.1 of the DNRCBR and reproduced in **Section 3.1**) so that residential amenity is not affected. The aim of this report is to map out the requirements for the DNRCBR construction categories that would apply to any residences that may be constructed on the site.

Modelled noise levels associated with road traffic on the Pacific Highway were used to infer the relevant DNRCBR construction categories across the site. Examination of the modelling results indicates that the 10-year horizon (2034) daytime (7am-10pm) noise levels show the greatest potential for noise impacts on residences. As such, these results are used as the basis for recommendations. The relationship between noise levels and DNRCBR construction categories was inferred from:

- modelled external road noise levels;
- acceptable internal noise levels;
- typical noise reductions provided by glazing (as this is typically the acoustically weakest point of a dwelling).

Analysis provided in **Table 5** and **Figure 2** indicate the level of acoustic treatment (as per the DNRCBR construction category) that would be required for residential dwellings across the site to ensure internal noise levels consistent with the requirements of the DNRCBR.

Table 5: Construction Tiers

Construction Category	Façade Noise Level (L_{Aeq})[1]	Additional Comments
Category 1	35-49	Alternative ventilation should be provided (so that residents may keep windows closed)
Category 2	49-52	Alternative ventilation should be provided (so that residents may keep windows closed)
Category 3	52-57	Alternative ventilation should be provided (so that residents may keep windows closed)
Category 4	57-60	Alternative ventilation should be provided (so that residents may keep windows closed)
Category 5	60-68	Specialist acoustic advice is required for entry doors located in these areas. Alternative ventilation should be provided (so that residents may keep windows closed)

Note 1: Façade noise levels included in **Table 5** represent free field road noise levels, while analysis of construction categories presented in **Figure 2** does include a +2.5dB façade correction.

Further detail outlining the requirements of each construction categories (as per DNRCBR appendix C) are included as **Appendix I** of this report. It is noted that jagged lines present in contour plots are cosmetic, and an artefact of the contour calculation. Noise contour maps for all modelled periods are included in **Appendix II**.

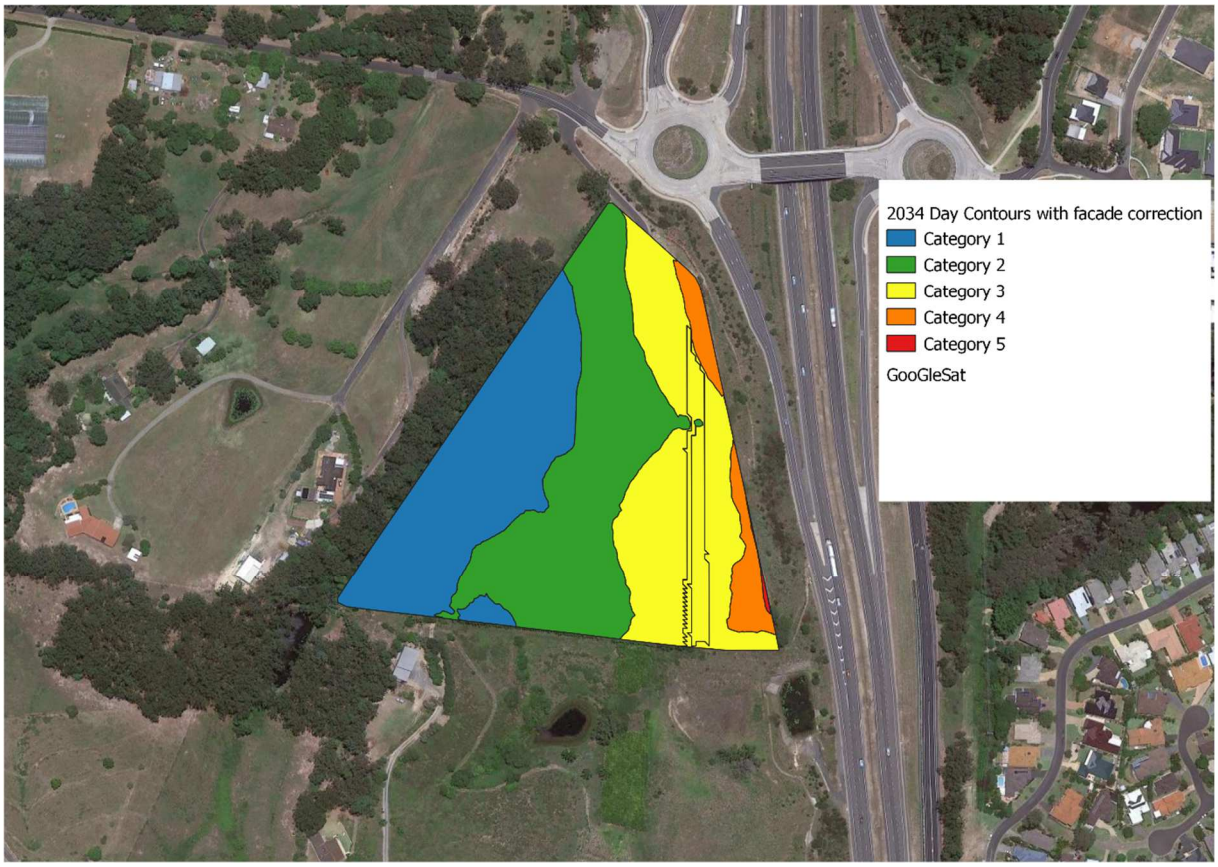


Figure 2: Construction tiers as per Table 5

5. RECOMMENDATIONS AND CONCLUSIONS

The results of modelling show that the site is affected by road noise across its entire area. As such, care must be taken in the design and construction of residences to ensure residential amenity is maintained. Most of the site falls into Category 1 to Category 3 construction categories, with smaller areas requiring Category 4 or 5. Noise mitigation goals may be assisted by preferentially siting residences to the west of the subdivisions, where noise levels experienced will be lower.

Architectural decisions will also play a role in determining the amenity of residents. For example, placing less sensitive areas (e.g. bathrooms, laundries, kitchens) along the façade facing the road and more sensitive areas (e.g. living rooms, bedrooms) in positions where they will be shielded will provide a significant improvement in noise isolation without introducing additional costs from heavier construction materials. The DNRCBR provides advice regarding such decisions which may prove valuable in the residential development of the site.

While this assessment (or the DNRCBR) does not seek to provide detailed guidance or specific recommendations for the acoustic treatment of individual dwellings, it demonstrates the extent of road traffic noise impacts. It also indicates that management of these impacts may be reasonably achieved via at-dwelling treatments, and thus that road noise levels should not preclude residential development at this site.

6. REFERENCES

The following information was used in the preparation of this report:

1. AS1055-2018: Acoustics – Description and measurement of environmental noise;
2. AS 2706-1984: Numerical Values: Rounding and interpretation of limiting values;
3. ELVIS – Elevation and Depth – Foundation Spatial Data (web portal, https://elevation.fsdf.org.au (accessed 8 December, 2020);
4. Google Maps aerial imagery (2021);
5. NSW Department of Planning (2008): *Development near Rail Corridors and Busy Roads – Interim Guideline;*
6. NSW Department of Environment, Climate Change & Water (2011): *Road Noise Policy;*
7. NSW Roads & Maritime Services (2019): *Coffs Harbour Bypass Environmental Impact Statement – Appendix G & Sub-appendix F;*
8. NSW Roads & Maritime Services (2018). *Noise Model Validation Guideline;*
9. NSW Spatial Services: *SIX Maps* (cadastral data).

Appendix I Development near Rail Corridors and Busy Roads: Appendix C - Acoustic Treatment of Residences

Appendix C – Acoustic Treatment of Residences

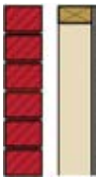
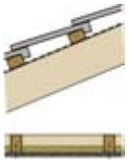
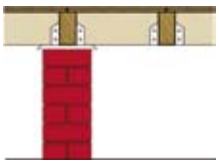
The following table sets out standard (or deemed-to-satisfy) constructions for each category of noise control treatment for the sleeping areas and other habitable areas of single / dual occupancy residential developments only. The assumptions made in the noise modelling are as follows:

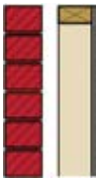
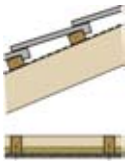
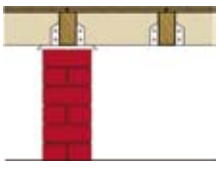
- Typical layout of a modern dwelling taken from a recent large residential development in an outer Sydney suburb
- Bedrooms and other habitable rooms are exposed to road noise

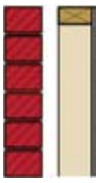
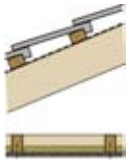
ACOUSTIC PERFORMANCE OF BUILDING ELEMENTS

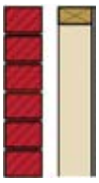
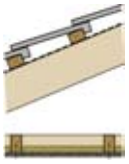
The acoustic performances assumed of each building element in deriving the Standard Constructions for each category of noise control treatment presented in the preceding Table, are presented below in terms of Weighted Sound Reduction Index (Rw) values, which can be used to find alternatives to the standard constructions presented in this Appendix:

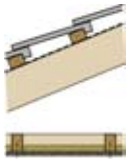
Category of Noise Control Treatment	R_w of Building Elements (minimum assumed)				
	Windows/Sliding Doors	Frontage Facade	Roof	Entry Door	Floor
Category 1	24	38	40	28	29
Category 2	27	45	43	30	29
Category 3	32	52	48	33	50
Category 4	35	55	52	33	50
Category 5	43	55	55	40	50

Category No.	Building Element	Standard Constructions	sample
1	**Windows/Sliding Doors**	Openable with minimum 4mm monolithic glass and standard weather seals	
	Frontage Facade	**Timber Frame or Cladding:** 6mm fibre cement sheeting or weatherboards or plank cladding externally, 90mm deep timber stud or 92mm metal stud, 13mm standard plasterboard internally	
		Brick Veneer: 110mm brick, 90mm timber stud or 92mm metal stud, minimum 50mm clearance between masonry and stud frame, 10mm standard plasterboard internally	
		Double Brick Cavity: 2 leaves of 110mm brickwork separated by 50mm gap	
	Roof	Pitched concrete or terracotta tile or metal sheet roof with sarking, 10mm plasterboard ceiling fixed to ceiling joists, R1.5 insulation batts in roof cavity.	
	Entry Door	35mm solid core timber door fitted with full perimeter acoustic seals	
	Floor	1 layer of 19mm structural floor boards, timber joist on piers	
		Concrete slab floor on ground	

Category No.	Building Element	Standard Constructions	sample
2	**Windows/Sliding Doors**	Openable with minimum 6mm monolithic glass and full perimeter acoustic seals	
	Frontage Facade	**Timber Frame or Cladding Construction:** 6mm fibre cement sheeting or weatherboards or plank cladding externally, 90mm deep timber stud or 92mm metal stud, 13mm standard plasterboard internally with R2 insulation in wall cavity.	
		Brick Veneer Construction: 110mm brick, 90mm timber stud frame or 92mm metal stud, minimum 50mm clearance between masonry and stud frame, 10mm standard plasterboard internally.	
		Double Brick Cavity Construction: 2 leaves of 110mm brickwork separated by 50mm gap	
	Roof	Pitched concrete or terracotta tile or metal sheet roof with sarking, 10mm plasterboard ceiling fixed to ceiling joists, R2 insulation batts in roof cavity.	
	Entry Door	40mm solid core timber door fitted with full perimeter acoustic seals	
	Floor	1 layer of 19mm structural floor boards, timber joist on piers	
		Concrete slab floor on ground	

Category No.	Building Element	Standard Constructions	sample
3	**Windows/Sliding Doors**	Openable with minimum 6.38mm laminated glass and full perimeter acoustic seals	
	Frontage Facade	**Brick Veneer Construction:** 110mm brick, 90mm timber stud or 92mm metal stud, minimum 50mm clearance between masonry and stud frame, 10mm standard plasterboard internally.	
		Double Brick Cavity Construction: 2 leaves of 110mm brickwork separated by 50mm gap	
	Roof	Pitched concrete or terracotta tile or sheet metal roof with sarking, 1 layer of 13mm sound-rated plasterboard fixed to ceiling joists, R2 insulation batts in roof cavity.	
	Entry Door	45mm solid core timber door fitted with full perimeter acoustic seals	
	Floor	Concrete slab floor on ground	

Category No.	Building Element	Standard Constructions	sample
4	**Windows/Sliding Doors**	Openable with minimum 10.38mm laminated glass and full perimeter acoustic seals	
	Frontage Facade	**Brick Veneer Construction:** 110mm brick, 90mm timber stud or 92mm metal stud, minimum 50mm clearance between masonry and stud frame, R2 insulation batts in wall cavity, 10mm standard plasterboard internally.	
		Double Brick Cavity Construction: 2 leaves of 110mm brickwork separated by 50mm gap	
	Roof	Pitched concrete or terracotta tile or sheet metal roof with sarking, 2 layers of 10mm sound-rated plasterboard fixed to ceiling joists, R2 insulation batts in roof cavity.	
	Entry Door	45mm solid core timber door fitted with full perimeter acoustic seals	
	Floor	Concrete slab floor on ground	

Category No.	Building Element	Standard Constructions	sample
5	**Windows/Sliding Doors**	Openable Double Glazing with separate panes: 5mm monolithic glass, 100mm air gap, 5mm monolithic glass with full perimeter acoustic seals.	
	Frontage Facade	**Double Brick Cavity Construction:** 2 leaves of 110mm brickwork separated by 50mm gap with cement render to the external face of the wall and cement render or 13mm plasterboard direct fixed to internal faces of the wall.	
	Roof	Pitched concrete or terracotta tile or sheet metal roof with sarking, 2 layers of 10mm sound-rated plasterboard fixed to ceiling joist using resilient mounts, R2 insulation batts in roof cavity	
	Entry Door	Special high performance acoustic door required - Consult an Acoustic Engineer	*Door to acoustic consultant's specifications*
	Floor	Concrete slab floor on ground	
6	**All**	Consult an Acoustic Engineer	

Appendix II Modelling Results

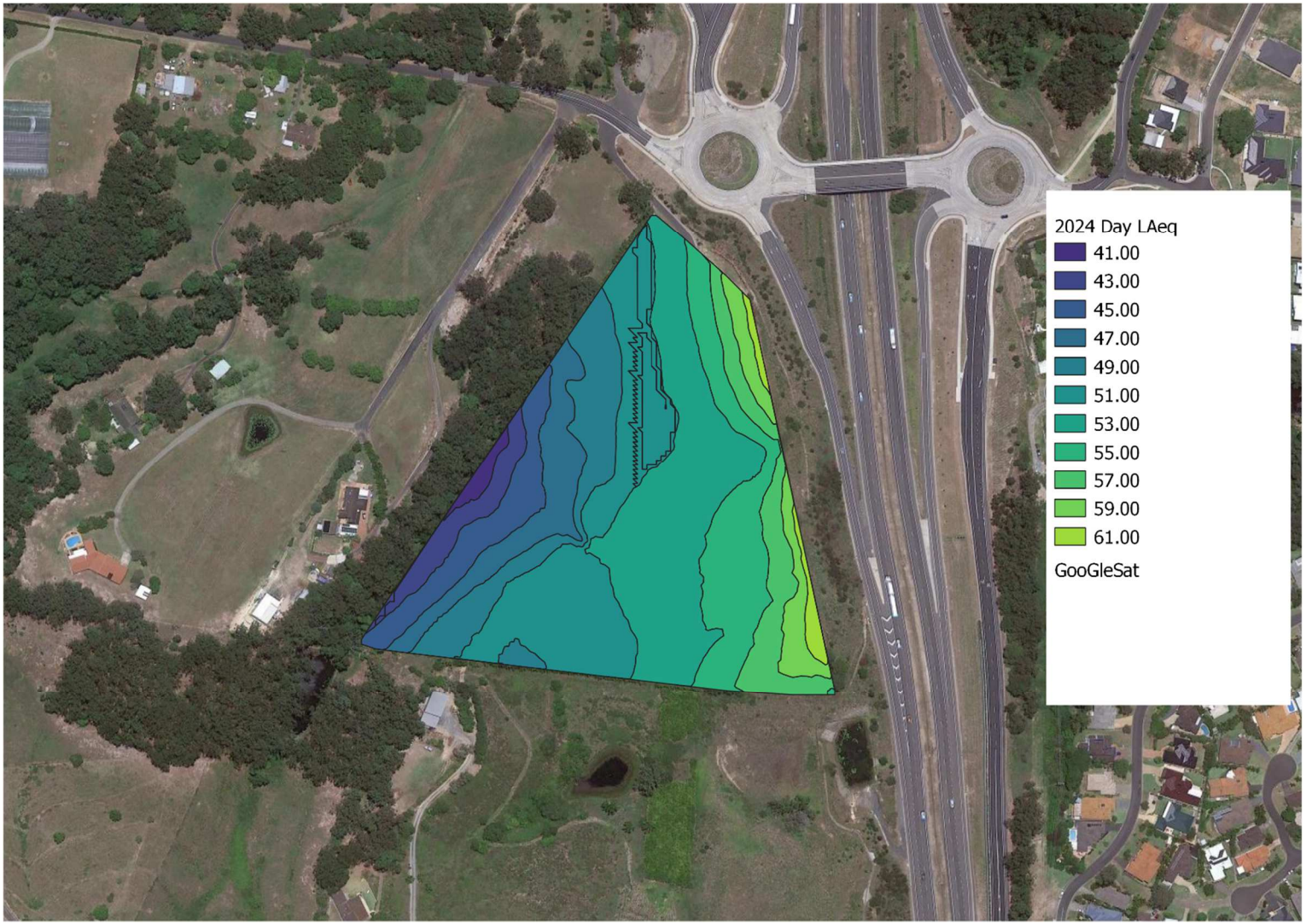


Figure 3: Noise contours for daytime ($L_{Aeq,15hr}$) levels, 2024 traffic

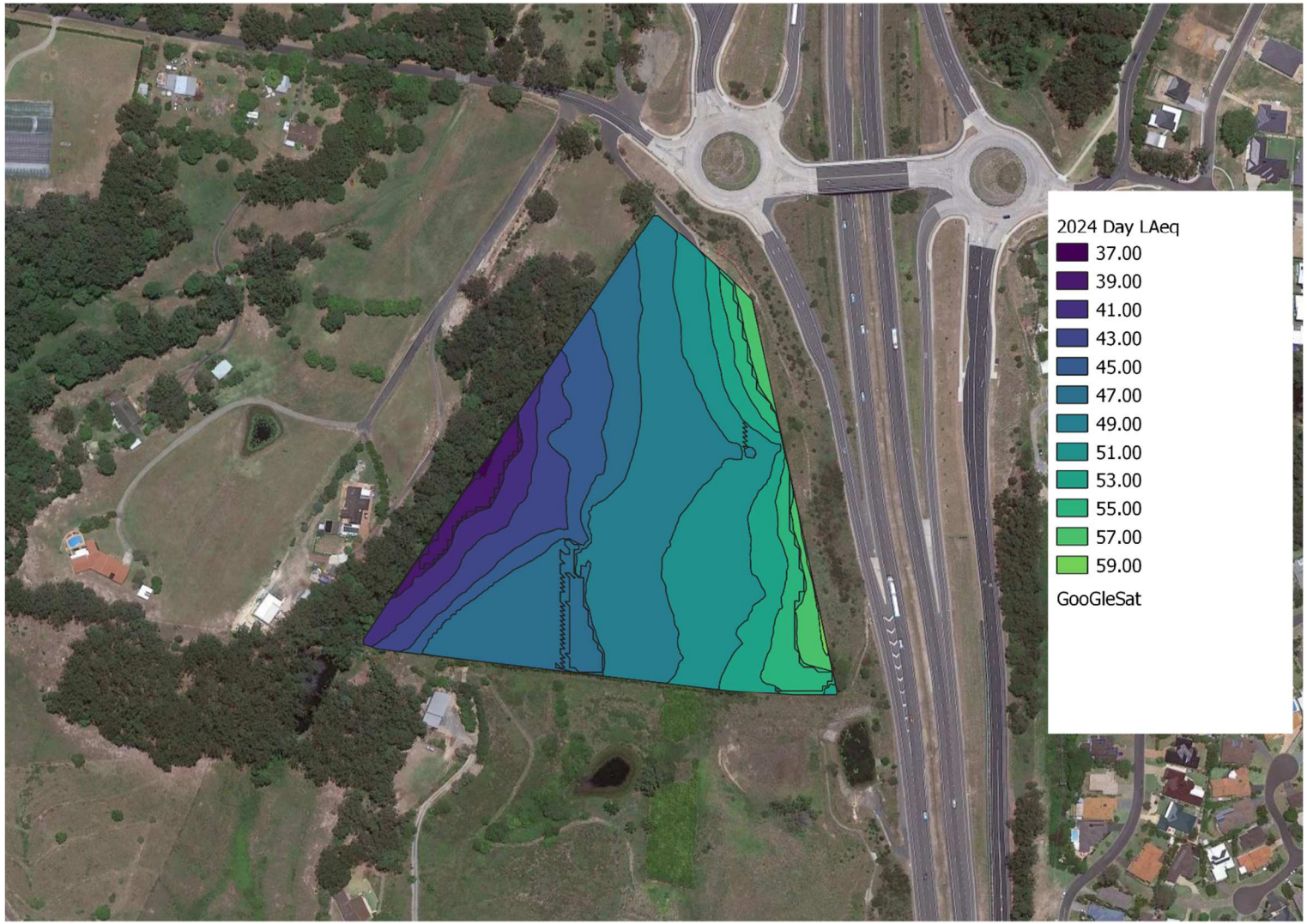


Figure 4: Noise contours for night-time ($L_{Aeq,9hr}$) levels, 2024 traffic

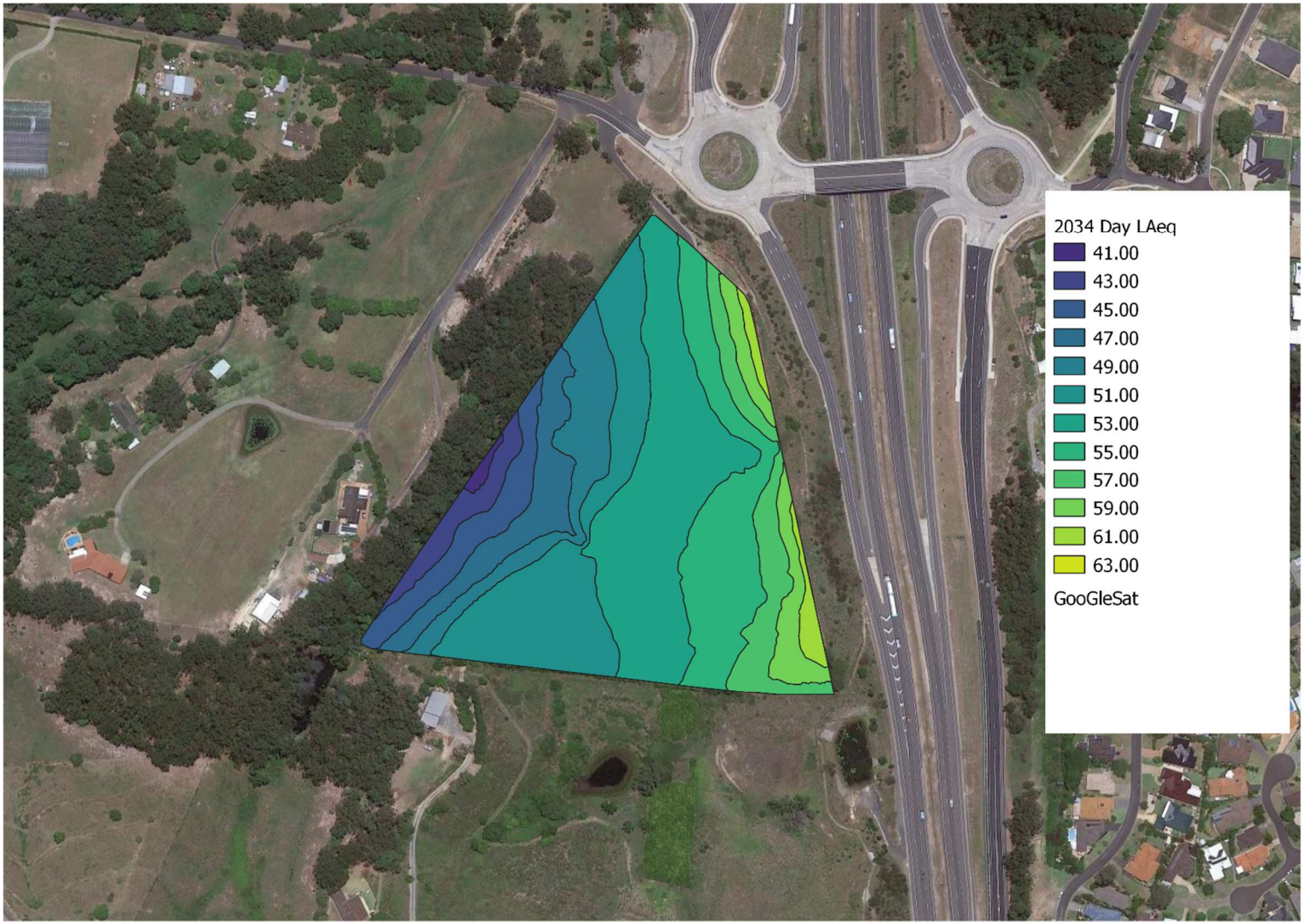


Figure 5: Noise contours for daytime ($L_{Aeq,15hr}$) levels, 2034 traffic

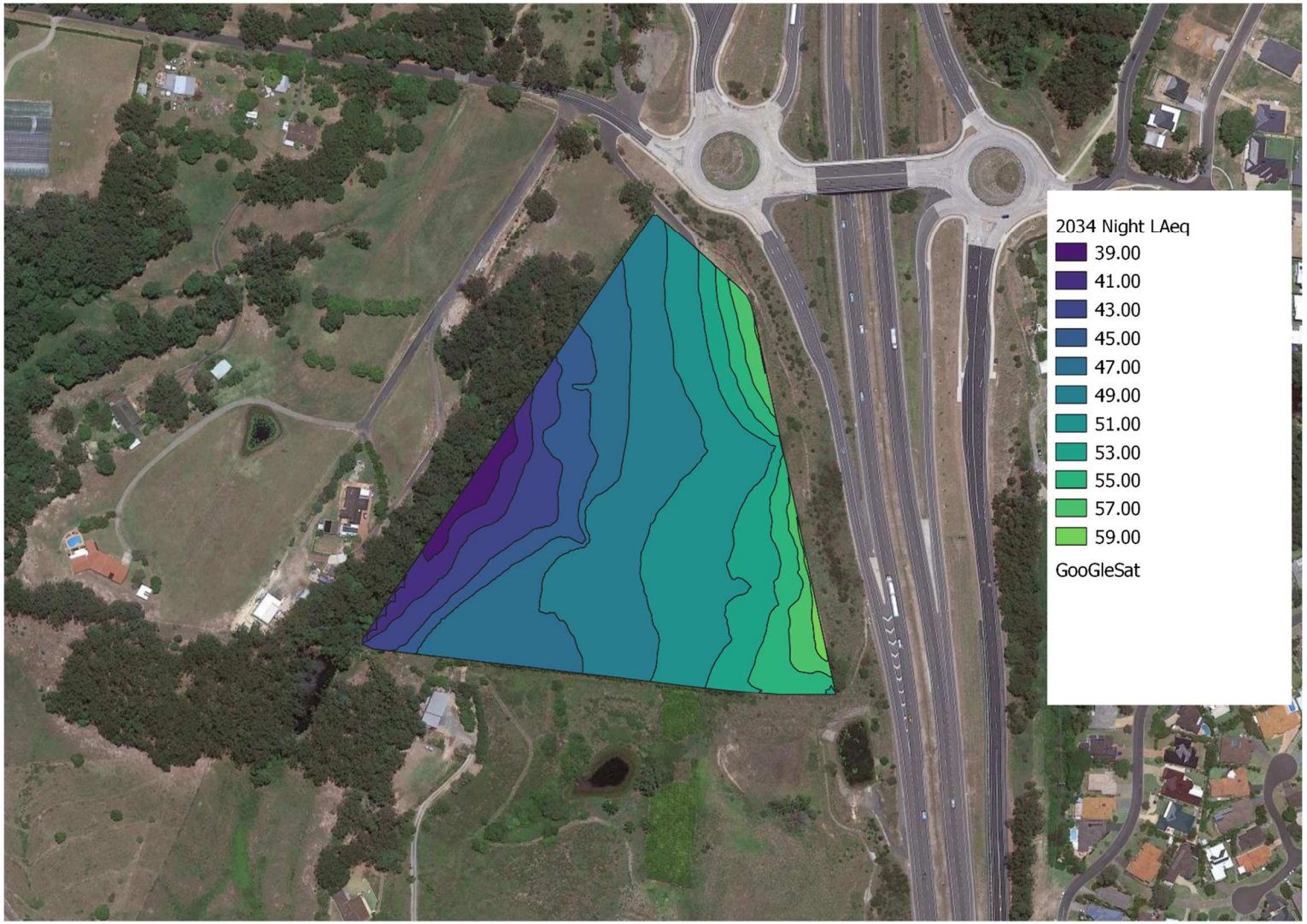


Figure 6: Noise contours for nighttime ($L_{Aeq,9hr}$) levels, 2034 traffic