Appendix H – Noise Assessment Reports

Margaret River Bypass

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Transport Noise Assessment

Margaret River Bypass

Reference: 12042120-01

Report: 12042120-01

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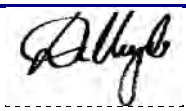
Prepared By:	Daniel Lloyd 
Position:	Project Director
Verified	Terry George 
Date:	25 October 2012

CONTENTS

APPENDICES

1 INTRODUCTION

This assessment has been undertaken to determine the future traffic noise levels at noise sensitive receivers located adjacent to the proposed Margaret River Bypass. The project area is in shown in *Figure 1.1*.

Three options are assessed. The first two options relate to a variation in the dual-carriageway alignment, as shown within the red square in *Figure 1.1*. The black lines represent Alignment 1, and the blue lines represent Alignment 2. The third option is a single carriageway road that broadly follows the Alignment 2.

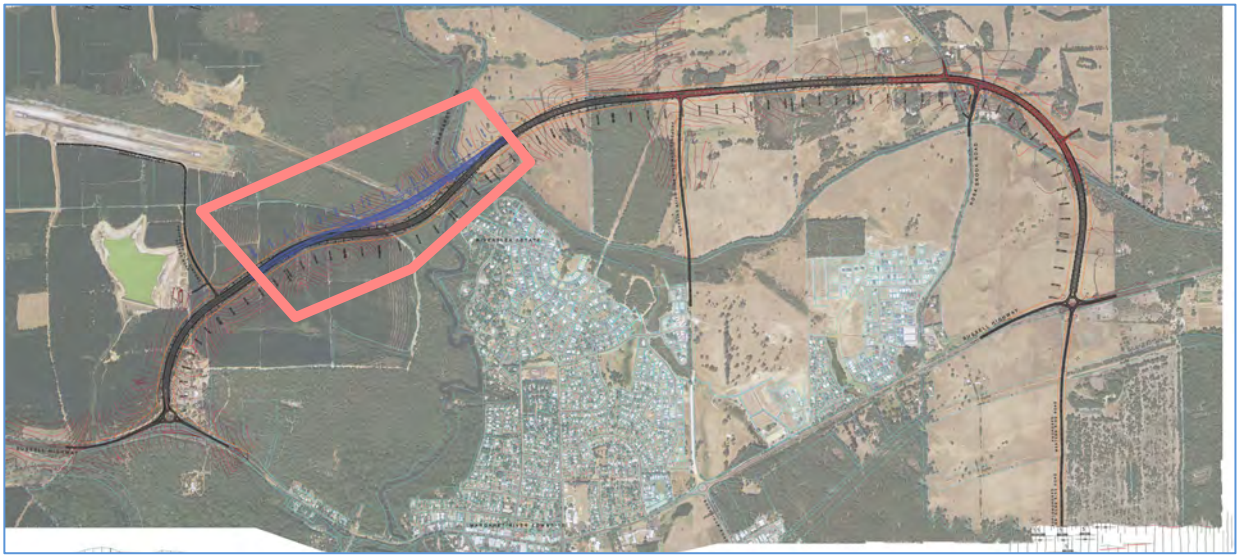


Figure 1.1 Project Area

For each option, consideration has been given to the expected traffic volumes on the proposed bypass assuming the following scenarios:

- Soon after Bypass opening (2014);
- Future (2031) traffic volumes assuming "low development" of the Margaret River region; and
- Future (2031) traffic volumes assuming "full development" of the Margaret River region.

The results of the assessment are compared against the criteria contained within *State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning*. Where these criteria are exceeded, noise mitigation options and the effectiveness of these options in broad terms are provided.

Appendix B contains a description of some of the terminology used throughout this report.

2 CRITERIA

When constructing a new transport corridor adjacent to existing or future planned noise sensitive premises, the relevant noise level criteria in Western Australia is the *State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning* (hereafter referred to as the Policy) produced by the Western Australian Planning Commission (WAPC).

The Policy's outdoor noise criteria are shown below in *Table 2.1*. These criteria apply at any point 1-metre from a habitable façade of a noise sensitive premises and in one outdoor living area.

Table 2.1 – Outdoor Noise Criteria

Period	Target	Limit
Day (6am to 10pm)	55 dB $L_{Aeq(\textbf{Day})}$	60 dB $L_{Aeq(\textbf{Day})}$
Night (10pm to 6am)	50 dB $L_{Aeq(Night)}$	55 dB $L_{Aeq(Night)}$

The 5 dB difference between the *target* and *limit* is referred to as the *margin*.

In the application of the noise criteria to new major road infrastructure projects, the objective of the Policy is that the new infrastructure be designed and constructed so that the noise emissions are at a level that—

- provides an acceptable level of acoustic amenity for existing noise-sensitive land uses and for the planning of new noise-sensitive developments;
- is consistent with other planning policies and community expectations; and
- is practicably achievable.

For transport infrastructure projects within the scope of this policy, a noise assessment should be conducted in accordance with the guidelines, to predict future noise levels resulting from the project and to identify relevant noise mitigation measures.

If a transport infrastructure project will emit transport noise levels that meet the noise target, no further measures are required under this policy. Otherwise, transport infrastructure providers should design mitigation measures to achieve the noise *limit* of $L_{Aeq(Day)}$ 60 dB and $L_{Aeq(Night)}$ 55 dB, when assessed at one metre from the façade at ground floor level.

Transport infrastructure providers are also required to consider design measures to meet the noise *target* of $L_{Aeq(Day)}$ 55 dB and $L_{Aeq(Night)}$ 50 dB and to implement these measures where reasonable and practicable.

If a new major road infrastructure project is to be constructed in the vicinity of a future noise-sensitive land use, mitigation measures should be implemented in accordance with this part of the policy. For this purpose, a proposed noise-sensitive land use is any noise sensitive development that is subject to an approved detailed area plan, subdivision approval or development approval, such that the transport infrastructure provider is able to adequately design noise mitigation measures to protect that development. In these instances, the infrastructure provider and developer are both responsible for ensuring that the objectives of this policy are achieved, and a mutually beneficial noise management plan, including individual responsibilities, should be negotiated between the parties.

It is recognised that in some cases it may not be practicable to achieve the noise criteria. In these circumstances reference should be made to section 5.8 of the Policy and the guidelines. Section 5.8 of the Policy states:

This policy applies a performance-based approach to the management and mitigation of transport noise. It is recognised that in a number of instances it may not be reasonable and practicable to meet the noise target criteria. Where transport noise is above the target level, measures are

expected to be implemented that best balance reasonable and practicable considerations, such as noise benefit, cost, feasibility, community preferences, amenity impacts, safety, security and conflict with other planning and transport policies. In these cases the community should also be consulted to assist in identifying best overall solutions. The guidelines assist in outlining ways in which some reasonable and practicable limitations can be addressed in a manner that also minimises transport noise.

It is further acknowledged that there may also be situations in which the noise limit cannot practicably be achieved, especially in the case of major redevelopment of existing transport infrastructure. Similarly, it may not be practicable to achieve acceptable indoor noise levels if the new development is located very close to the transport corridor. In these situations the primary focus should be on achieving the lowest level of noise, with other reasonable and practicable considerations being secondary to this objective.

In cases where the noise limit or indoor noise criteria cannot practicably be met, longer term strategies for land use planning, transport policy and vehicle emissions should be considered to minimise transport noise impact over time.

3 METHODOLOGY

Noise measurements and modelling have been undertaken in accordance with the requirements of the Policy as described below in *Sections 3.1 and 3.2*.

3.1 Site Measurements

Noise monitoring was undertaken at three (3) locations in order to:

- Quantify the existing noise levels;
- Determine the differences between different acoustic parameters ($L_{A10,18hour}$, $L_{Aeq\ (Day)}$ and $L_{Aeq\ (Night)}$); and
- Calibrate the noise model.

Sound pressure levels were measured in accordance with Australian Standard 2702-1984: *Acoustics - Method For Measurement of Road Traffic Noise*. For measurement locations adjacent to a building, the logger was positioned at one metre from the façade of interest and the microphone height was 1.4 metres above ground floor level. The logger was also placed at least one metre from any corner of the building.

The instrumentation used was ARL Ngara noise data loggers, pictured below in *Figure 3.1*. The ARL Ngara noise data loggers comply with the instrumentation requirements of *Australian Standard 2702-1984 Acoustics - Methods for the Measurement of Road Traffic Noise*. Each logger was field calibrated before and after the measurement session and found to be accurate to within +/- 1 dB. Lloyd George Acoustics holds current NATA laboratory calibration certificate for the loggers.

Noise loggers were set-up to obtain 5 full weekdays between 14 and 18 May 2012. The measurement locations are detailed below and shown in *Figure 3.2*.

Logger 1 167 Rosa Brook Road, Margaret River;

Logger 2 40 Riverslea Drive, Margaret River;

Logger 3 Bussell Hwy – Approximately 3 km north of Margaret River.

From the hourly measurements, the $L_{A10,18\ hour}$, $L_{Aeq,24\ hour}$, $L_{Aeq\ (Day)}$ and $L_{Aeq\ (Night)}$ values were determined for each complete measurement day. These results were averaged and the mean level reported. The noise data collected was verified by inspection and professional judgement. Where hourly data was considered atypical, an estimated value was inserted and highlighted by bold italic lettering in the data sheet.

Figure 3.1 – Automatic Noise Data Logger

Figure 3.2 – Location of Noise Data Loggers

3.2 Noise Modelling

The computer programme *SoundPLAN 7.1* was utilised, incorporating the *Calculation of Road Traffic Noise* (CoRTN) algorithms, modified to reflect Australian conditions. The modifications included the following:

- Vehicles were separated into heavy (Austroads Class 3 upwards) and non-heavy (Austroads Classes 1 & 2) with non-heavy vehicles having a source height of 0.5 metres above road level and heavy vehicles having two sources, at heights of 1.5 metres and 3.6 metres above road level, to represent the engine and exhaust respectively. By splitting the noise source into three, allows for less barrier attenuation for high level sources where barriers are to be considered. Note that corrections are applied to the exhaust of –8.0 dB (based on *Transportation Noise Reference Book, Paul Nelson, 1987*) and to the engine source of –0.8 dB, so as to provide consistent results with the CoRTN algorithms for the no barrier scenario.

- An adjustment of –1.7 dB has been applied to the predicted levels based on the findings of *An Evaluation of the U.K. DoE Traffic Noise Prediction*; Australian Road Research Board, Report 122 ARRB – NAASRA Planning Group 1982.

Predictions are made at heights of 1.4 metres (single storey residence) and at 1.0 metre from a building facade (resulting in a + 2.5 dB correction due to reflected noise).

Various input data are included in the modelling such as ground topography, road design and traffic volumes, etc. These model inputs are discussed below.

3.2.1 Ground Topography, Road Design & Cadastral Data

Main Roads provided 3-dimentional topographical and road design data. The contours were at 1 metre intervals and covered the road design and noise sensitive premises of concern.

3.2.2 Traffic Data

Traffic data includes:

- Traffic Volumes –

  Traffic volumes representing the “soon after bypass opening” and “future” scenarios are shown in *Figures 3.3 to 3.5*. The future scenarios relate to the year 2031 and assume either low or full development of the Margaret River region. The traffic volumes were obtained from Main Roads.

- Vehicle Speed –

  The vehicle speeds used in the noise modelling are as follows:

  Bypass Speed 110 km/h

  Rosa Brook Rd 70 km/h

Figure 3.3 Traffic Volumes (x10) Assuming Soon After Bypass Opening (2014)

Figure 3.4 Future (2031) Traffic Modelled Volumes (x10) Assuming "Low Development"

Figure 3.5 Future (2031) Traffic Modelled Volumes (x10 for daily flow) Assuming "Full Development"

- Road Surface –

The difference in noise emission between road surface types, when compared to Dense Graded Asphalt, is shown below in *Table 3.1*. The road surface for the proposed bypass is assumed to be 14mm Chip Seal.

Table 3.1 – Noise Relationship Between Different Road Surfaces

Road Surfaces						
Chip Seal			Asphalt			
14mm	10mm	5mm	Dense Graded	Novachip	Stone Mastic	Open Graded
+3.5 dB	+2.5 dB	+1.5 dB	0.0 dB	-0.2 dB	-1.0 dB	-2.5 dB

3.2.3 Ground Attenuation

The ground attenuation has been assumed to be 0.0 (0%) within the road reserve, 1.0 (100%) for other areas. Note 0.0 represents hard reflective surfaces such as bitumen and water and 1.00 represents absorptive surfaces such as grass.

3.2.4 Parameter Conversion

The CoRTN algorithms used in the *SoundPlan* modelling package were originally developed to calculate the $L_{A10,18hour}$ noise level. The Policy however uses $L_{Aeq\ (Day)}$ and $L_{Aeq\ (Night)}$. The relationship between the parameters varies depending on the composition of traffic on the road (volumes in each period and percentage heavy vehicles). For this project, the results of the measured noise levels adjacent to Bussell Highway (Location 3) where used to convert these parameters.

4 RESULTS

4.1 Noise Monitoring

The results of the noise monitoring are summarised below in *Table 4.1* and shown graphically in *Figures 4.1 to 4.3*.

Table 4.1 – Measured Average Noise Levels – Monitoring Locations

Location	Average Weekday Noise Level, dB		
	$L_{A10,18hour}$	$L_{Aeq\ (Day)}$	$L_{Aeq\ (Night)}$
1. 167 Rosa Brook Road	42	44	32
2. 40 Riverslea Drive	46	48	38
3. Bussell Highway*	70	69	58

* Used to calibrate future traffic.

The average difference between the $L_{Aeq\ (Day)}$ and $L_{Aeq\ (Night)}$ for the existing Bussell Highway is 11 dB. This same difference has been assumed to exist in future years. As such, it is the daytime noise levels that will dictate compliance with the Policy since these are at least 5 dB higher than night-time levels. The parameter conversion from $L_{A10,18hour}$ to $L_{Aeq\ (Day)}$ as described in Section 3.2.4, is -0.7 dB.

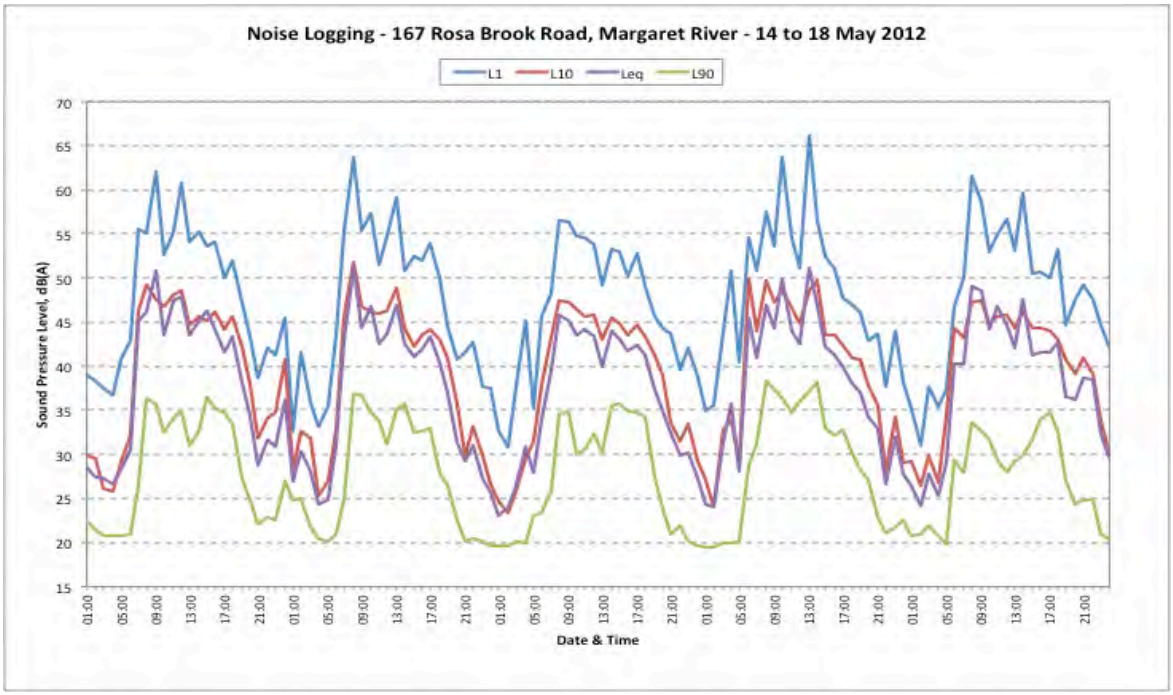


Figure 4.1 Results for Rosa Brook Road

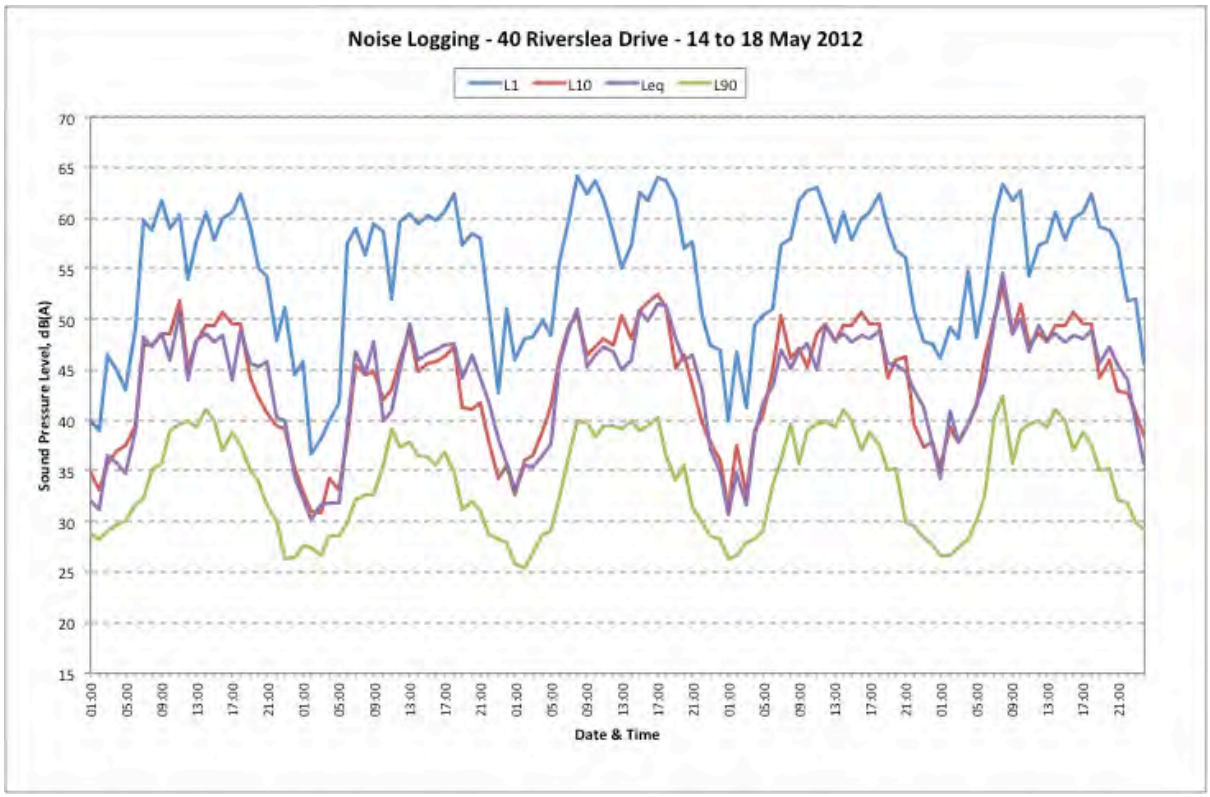


Figure 4.2 Results for Riverslea Drive

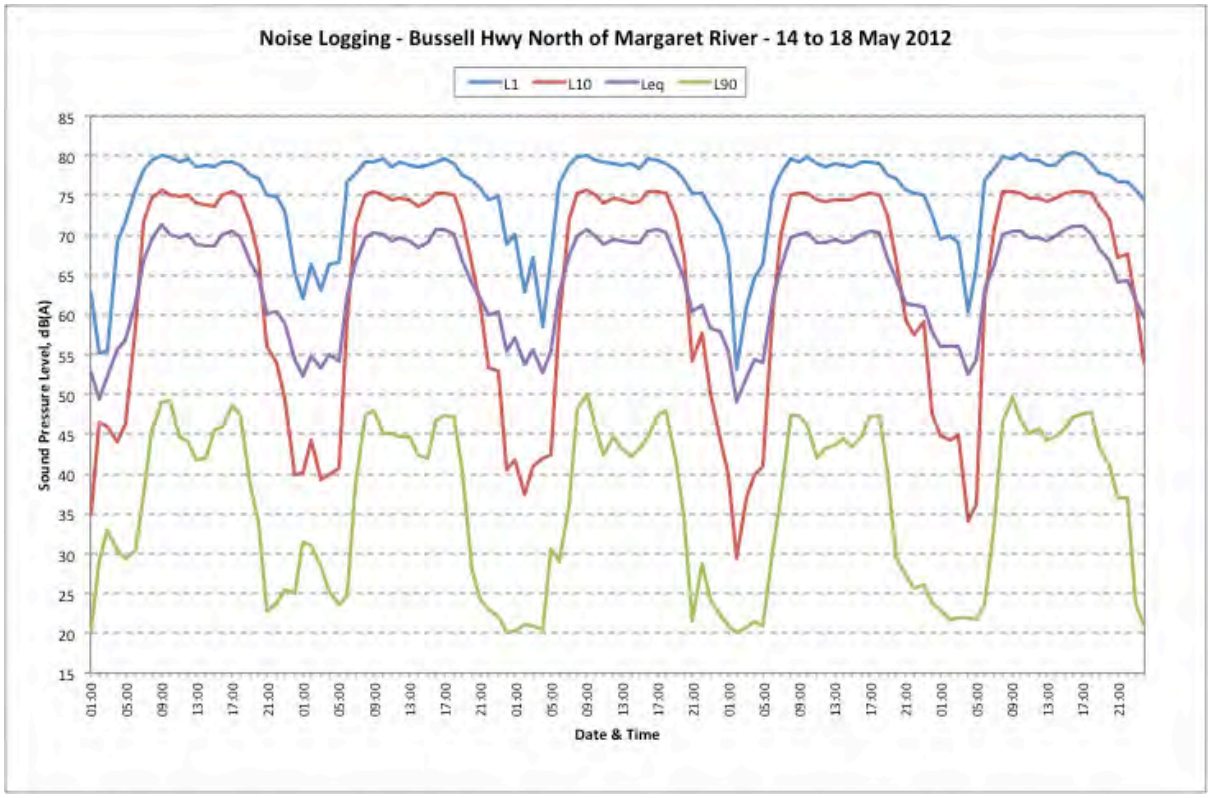


Figure 4.3 Results for Bussell Highway

4.2 Noise Modelling

The results of the noise modelling to each receiver location, shown in *Figures 4.4 and 4.5*, are presented in *Tables 4.2 to 4.4*. The cells shaded blue shows receivers predicted to be within the margin between the Policy's *target* and *limit* criteria and the cells shaded yellow show receivers predicted to be above the Policy's *limit* criteria. Noise level contour plots for each scenario are shown in *Figures 4.6 to 4.14* respectively.

Table 4.2 - Noise Prediction Results for Alignment Option 1 (Dual Carriageway)

Rec No	Traffic Noise Level $L_{Aeq,day}$ dB			Rec No	Traffic Noise Level $L_{Aeq,day}$ dB			Rec No	Traffic Noise Level $L_{Aeq,day}$ dB		
	Soon After	Low Dev	Full Dev		Soon After	Low Dev	Full Dev		Soon After	Low Dev	Full Dev
1	49	51	55	10	51	53	57	19	53	55	58
2	52	55	58	11	48	51	54	20	52	53	57
3	54	57	60	12	48	50	54	21	54	55	59
4	55	57	61	13	42	45	48	22	54	55	59
5	55	58	61	14	44	46	50	23	54	56	59
6	55	58	61	15	46	48	52	24	55	57	60
7	55	57	61	16	53	55	58	25	48	50	54
8	52	55	58	17	57	58	62	26	49	51	55
9	54	57	61	18	56	58	61	27	48	51	55

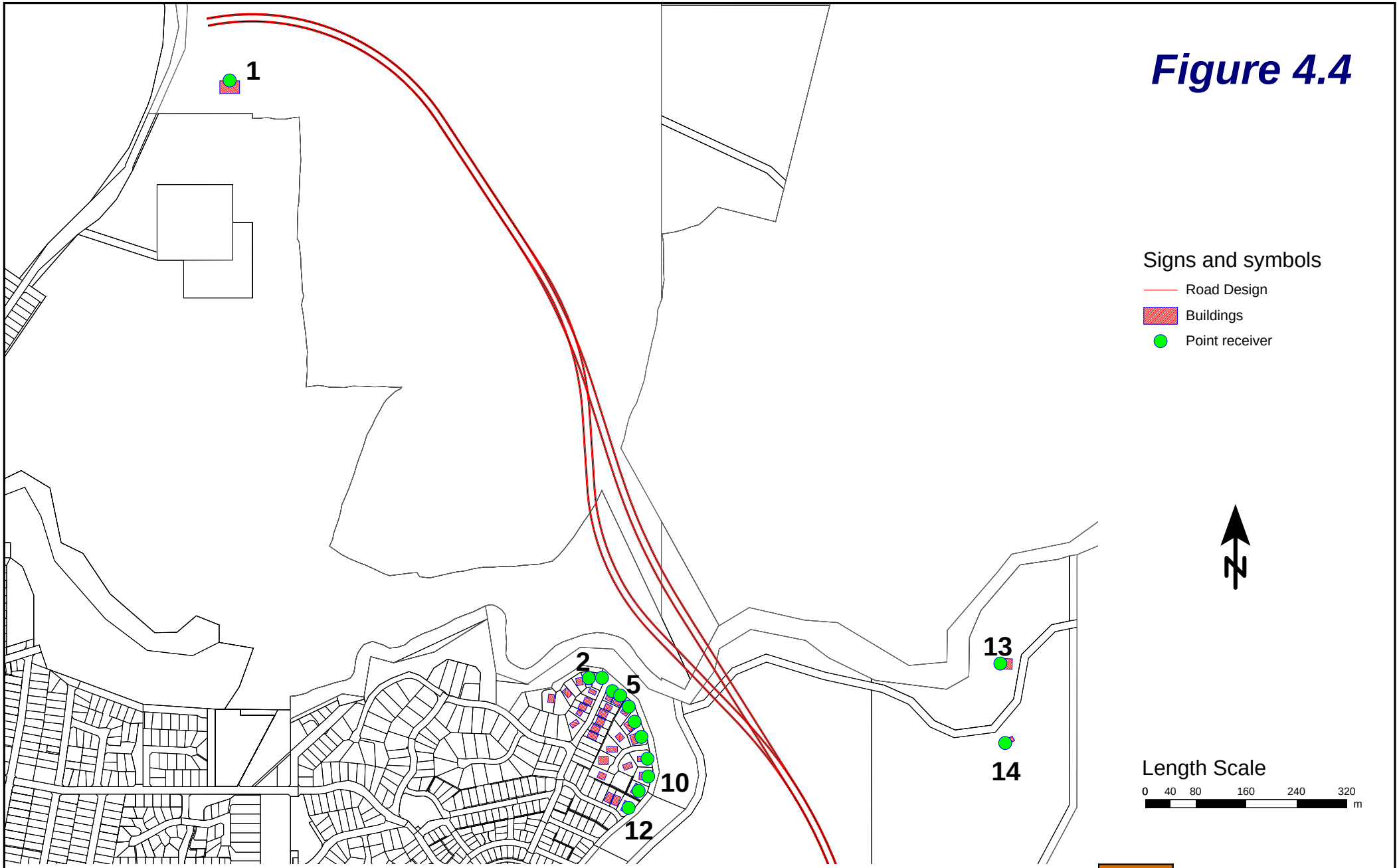
Table 4.3 - Noise Prediction Results for Alignment Option 2 (Dual Carriageway)

Rec No	Traffic Noise Level $L_{Aeq,day}$ dB			Rec No	Traffic Noise Level $L_{Aeq,day}$ dB			Rec No	Traffic Noise Level $L_{Aeq,day}$ dB		
	Soon After	Low Dev	Full Dev		Soon After	Low Dev	Full Dev		Soon After	Low Dev	Full Dev
1	49	51	55	10	50	53	56	19	53	55	58
2	47	49	53	11	48	51	54	20	52	53	57
3	50	53	56	12	48	50	54	21	54	55	59
4	51	53	57	13	43	45	49	22	54	55	59
5	51	54	57	14	44	46	50	23	54	56	59
6	52	54	58	15	46	48	51	24	55	57	60
7	52	54	58	16	53	55	58	25	48	50	54
8	51	54	57	17	57	58	62	26	49	51	55
9	52	55	58	18	56	58	61	27	48	51	55

Table 4.4 – Noise Prediction Results for Single Carriageway

Rec No	Traffic Noise Level $L_{Aeq,day}$ dB			Rec No	Traffic Noise Level $L_{Aeq,day}$ dB			Rec No	Traffic Noise Level $L_{Aeq,day}$ dB		
	Soon After	Low Dev	Full Dev		Soon After	Low Dev	Full Dev		Soon After	Low Dev	Full Dev
1	49	51	55	10	51	53	57	19	53	55	58
2	47	49	53	11	49	51	55	20	51	53	57
3	50	53	57	12	48	50	54	21	53	55	58
4	51	53	57	13	42	45	48	22	53	55	58
5	52	54	58	14	44	46	50	23	54	55	59
6	52	55	58	15	46	48	52	24	55	57	60
7	52	55	58	16	54	55	59	25	48	50	54
8	51	54	57	17	57	59	62	26	49	51	55
9	52	55	59	18	57	58	62	27	49	51	55

Figure 4.4



Margaret River Bypass Project - Northern Receiver Locations

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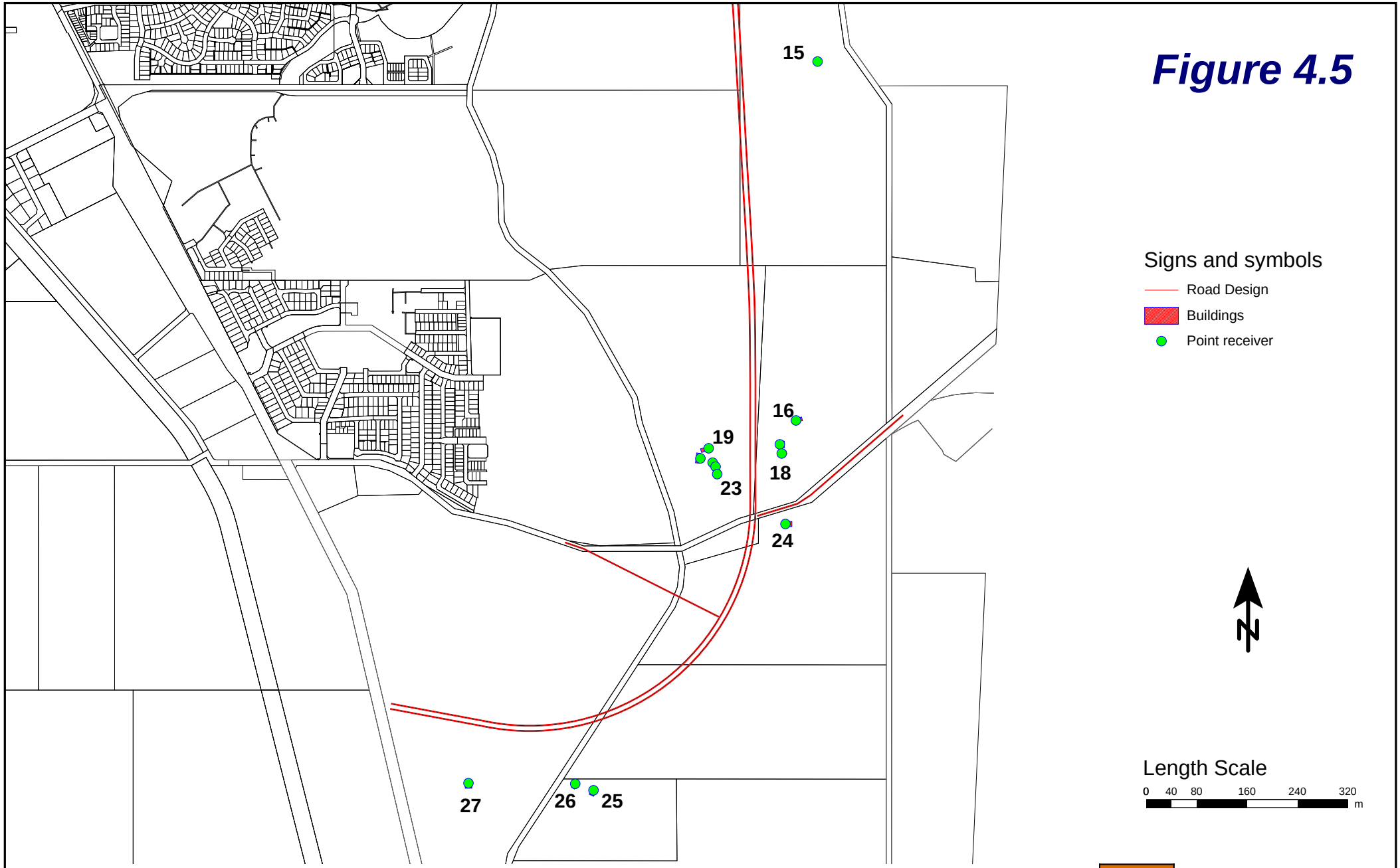
Figure 4.5



Margaret River Bypass Project - Southern Receiver Locations

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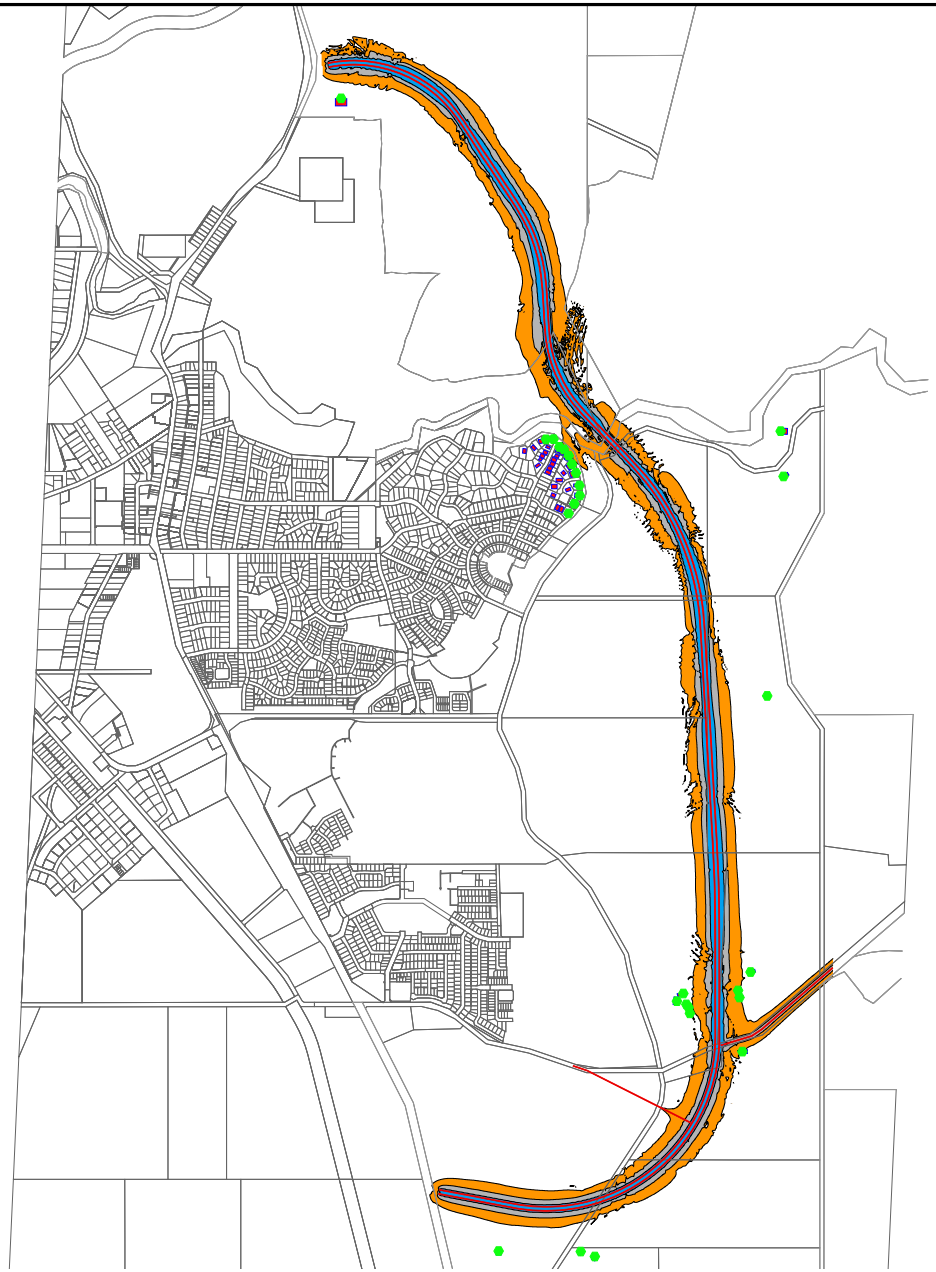
Figure 4.6



Traffic Noise level
$L_{Aeq,(day)}$ dB

	<=	55	Below Target
55 <	<=	60	Above Target - Below Limit
60 <	<=	65	Above Limit
65 <			

N

Signs and symbols

- Road Design
- Buildings
- Point Receiver

Length Scale

0 40 80 160 240 320 m

Margaret River Bypass - Alignment 1 Dual Carriageway - Soon After Road Opening

$L_{Aeq,(day)}$ Noise Level Contours - Without Noise Mitigation

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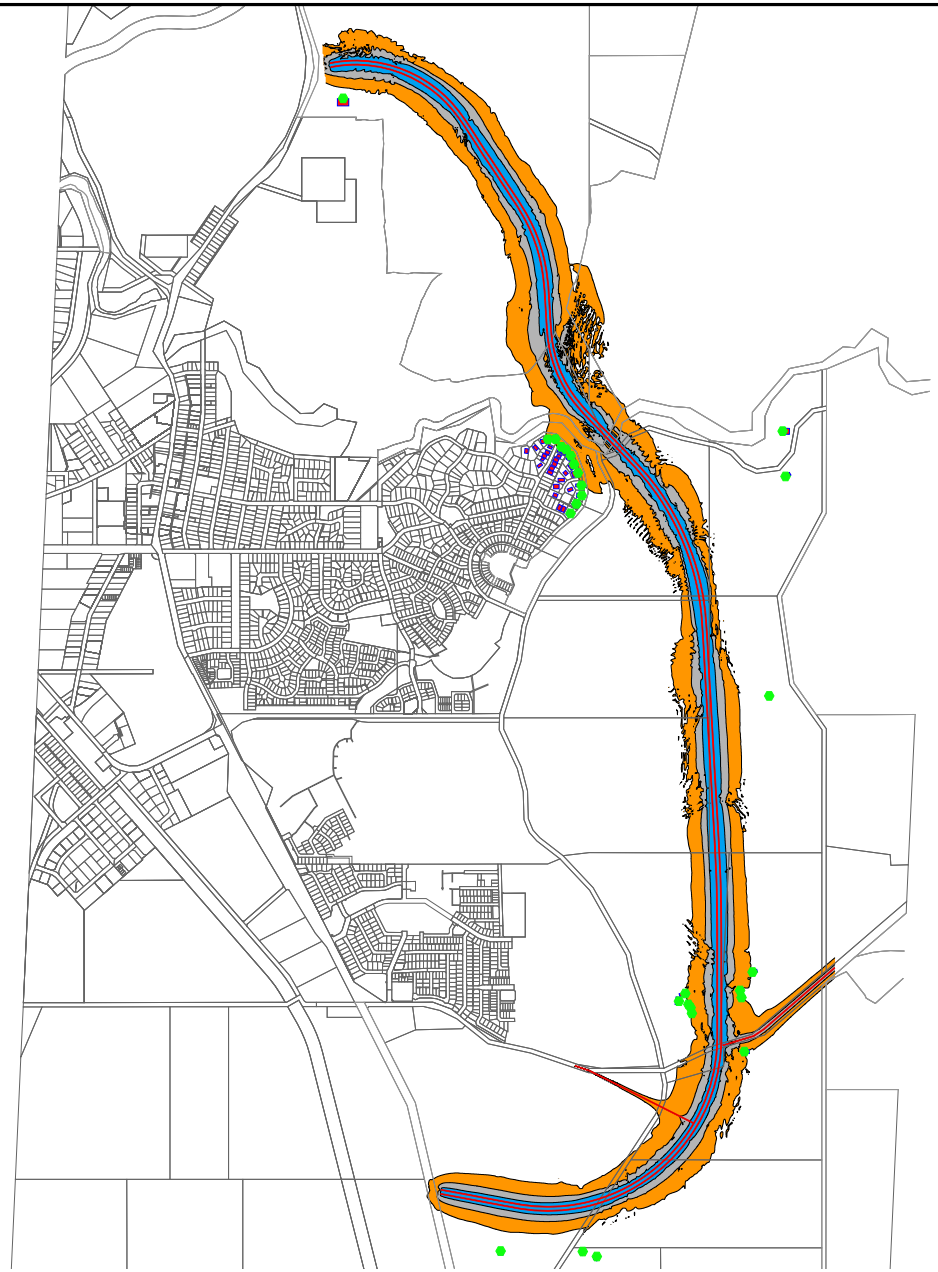
Figure 4.7



Traffic Noise level
$L_{Aeq,(day)}$ dB

	<=	55	Below Target
55 <	<=	60	Above Target - Below Limit
60 <	<=	65	Above Limit
65 <			

N

Signs and symbols

- Road Design
- Buildings
- Point Receiver

Length Scale

0 40 80 160 240 320 m

Margaret River Bypass - Alignment 1 Dual Carriageway - Future Traffic Volumes - Low Development

$L_{Aeq,(day)}$ Noise Level Contours - Without Noise Mitigation

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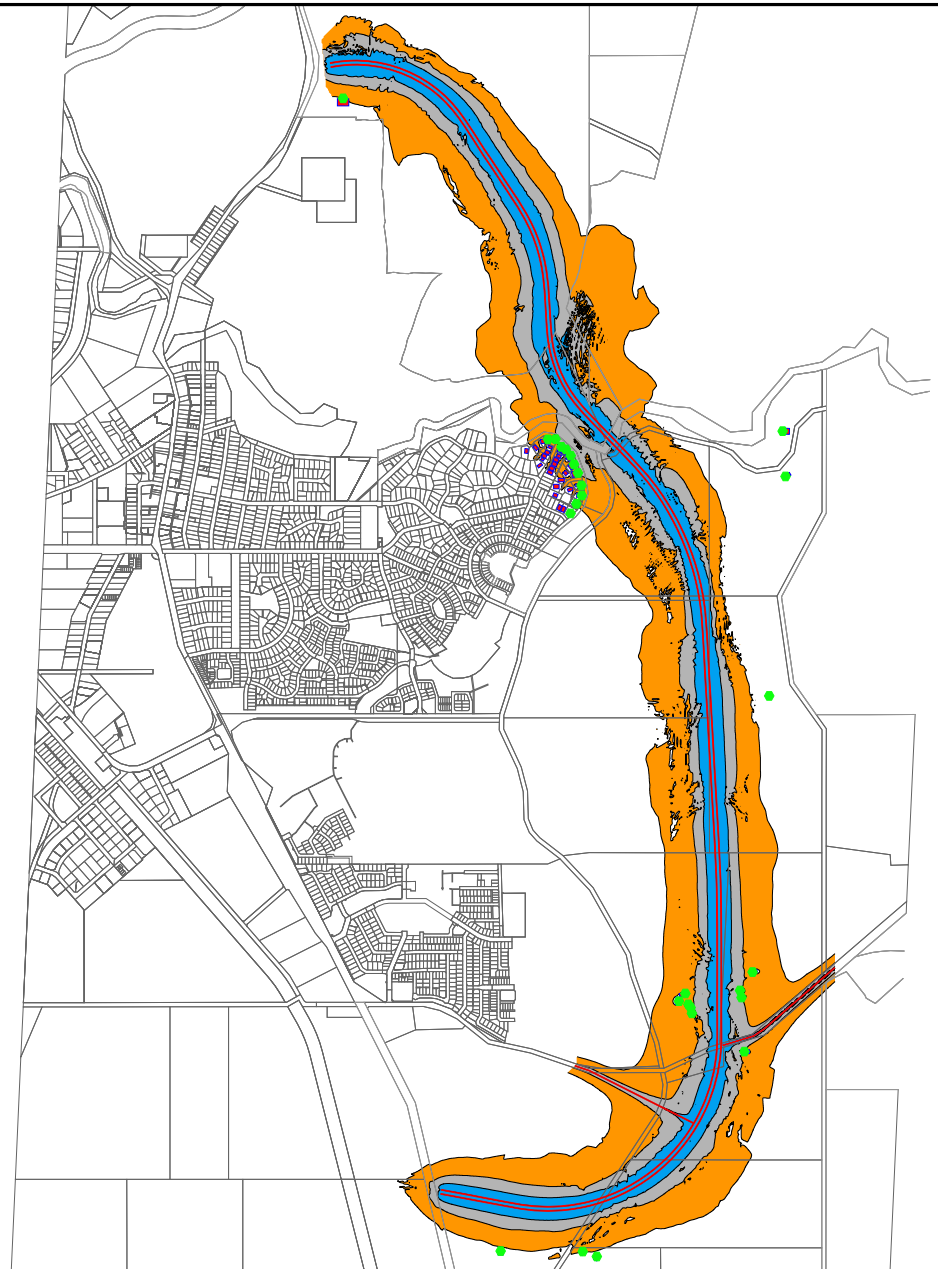
Figure 4.8



Traffic Noise level
$L_{Aeq,(day)}$ dB

	<=	55	Below Target
55 <	<=	60	Above Target - Below Limit
60 <	<=	65	Above Limit
65 <			

N

Signs and symbols

- Road Design
- Buildings
- Point Receiver

Length Scale

0 40 80 160 240 320 m

Margaret River Bypass - Alignment 1 Dual Carriageway - Future Traffic Volumes - Full Development
$L_{Aeq,(day)}$ Noise Level Contours - Without Noise Mitigation

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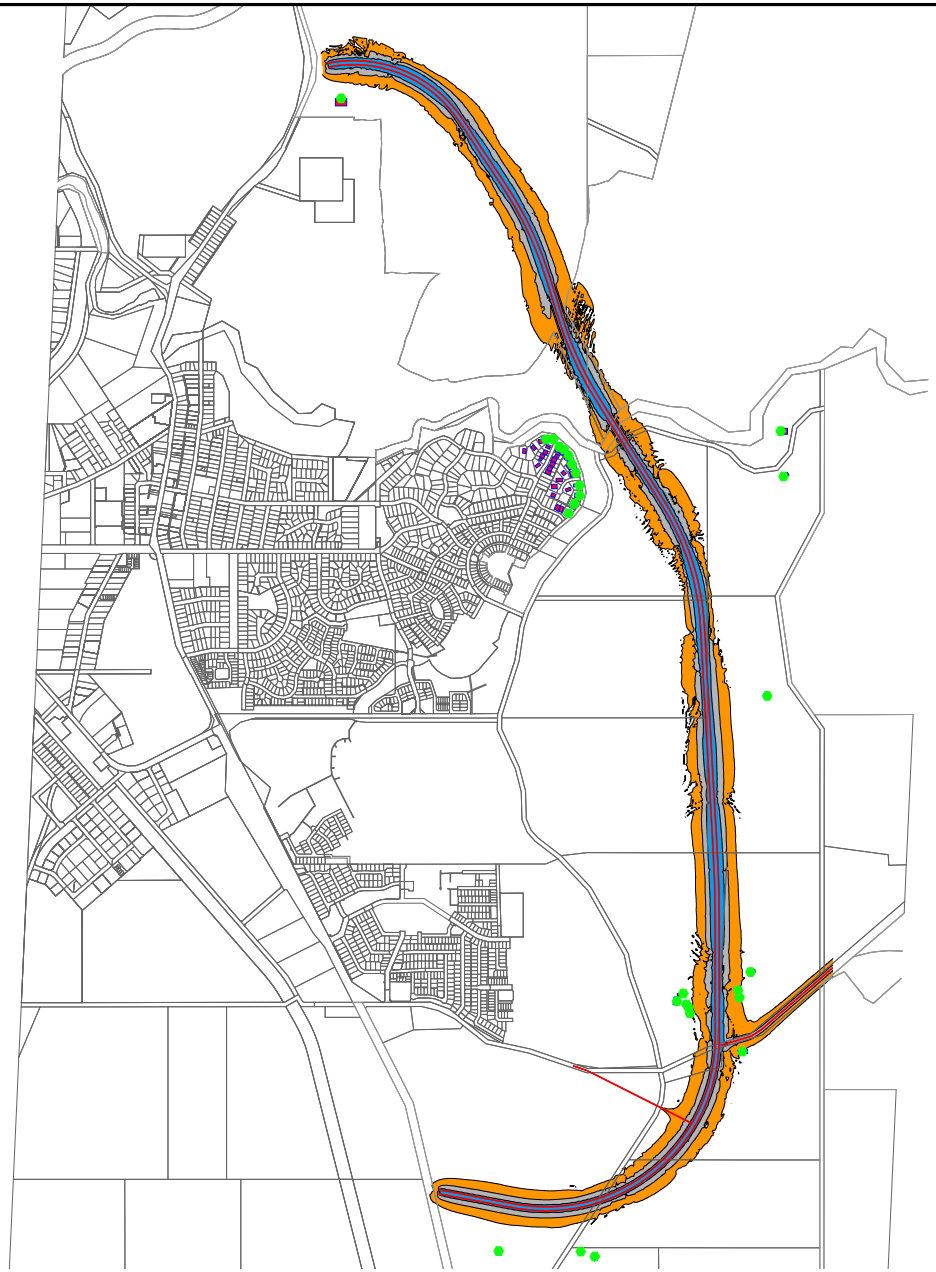
Figure 4.9



Traffic Noise level
$L_{Aeq,(day)}$ dB

		<=	55	Below Target
55 <		<=	60	Above Target - Below Limit
60 <		<=	65	Above Limit
65 <				

N

Signs and symbols

- Road Design
- Buildings
- Point Receiver

Length Scale

0 40 80 160 240 320 m

Margaret River Bypass - Alignment 2 Dual Carriageway - Soon After Road Opening

$L_{Aeq,(day)}$ Noise Level Contours - Without Noise Mitigation

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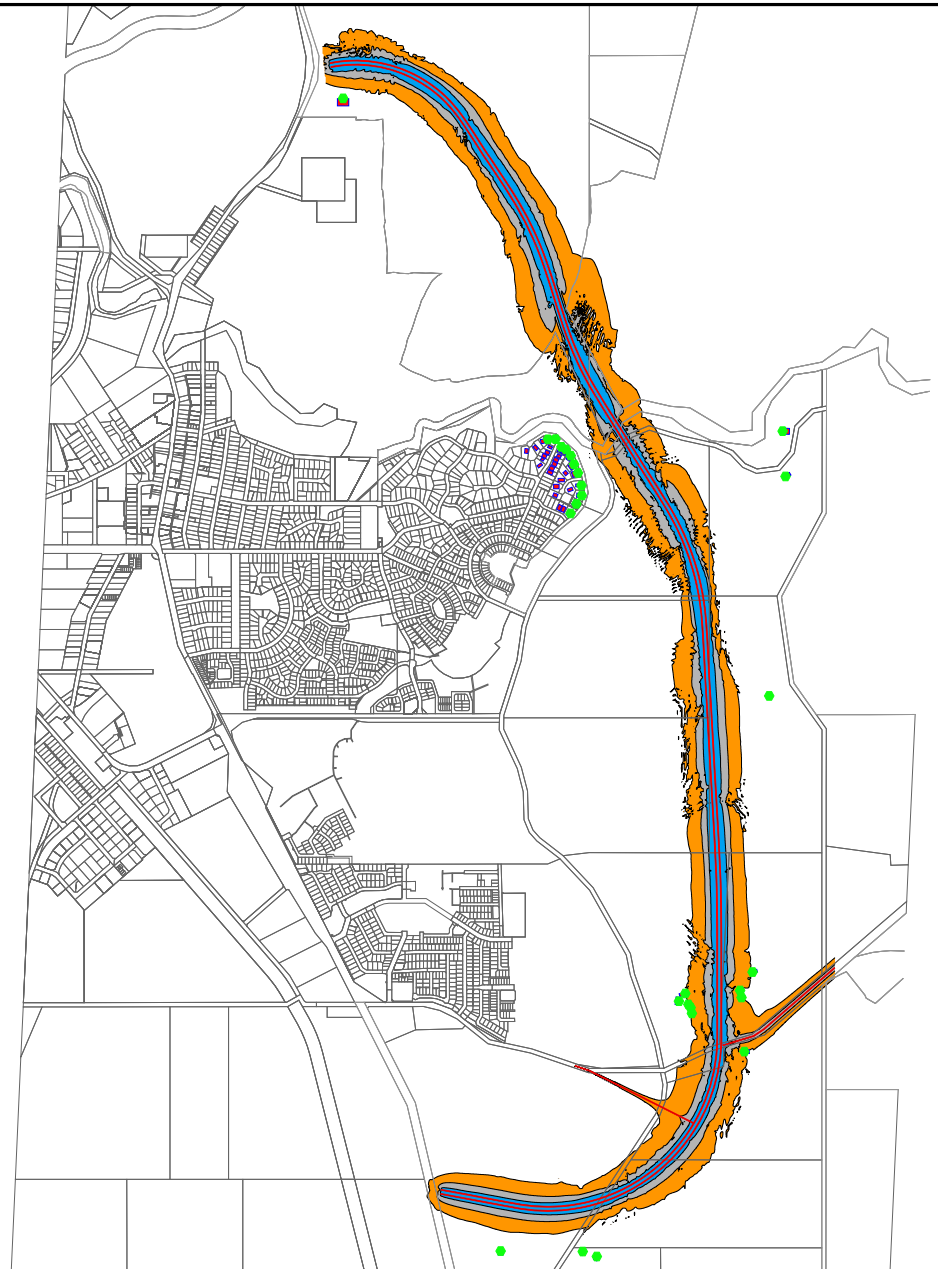
Figure 4.10



Traffic Noise level
$L_{Aeq,(day)}$ dB

	<=	55	Below Target
55 <	<=	60	Above Target - Below Limit
60 <	<=	65	Above Limit
65 <			

Signs and symbols

- Road Design
- Buildings
- Point Receiver

Length Scale

0 40 80 160 240 320 m

Margaret River Bypass - Alignment 2 Dual Carriageway - Future Traffic Volumes - Low Development

$L_{Aeq,(day)}$ Noise Level Contours - Without Noise Mitigation

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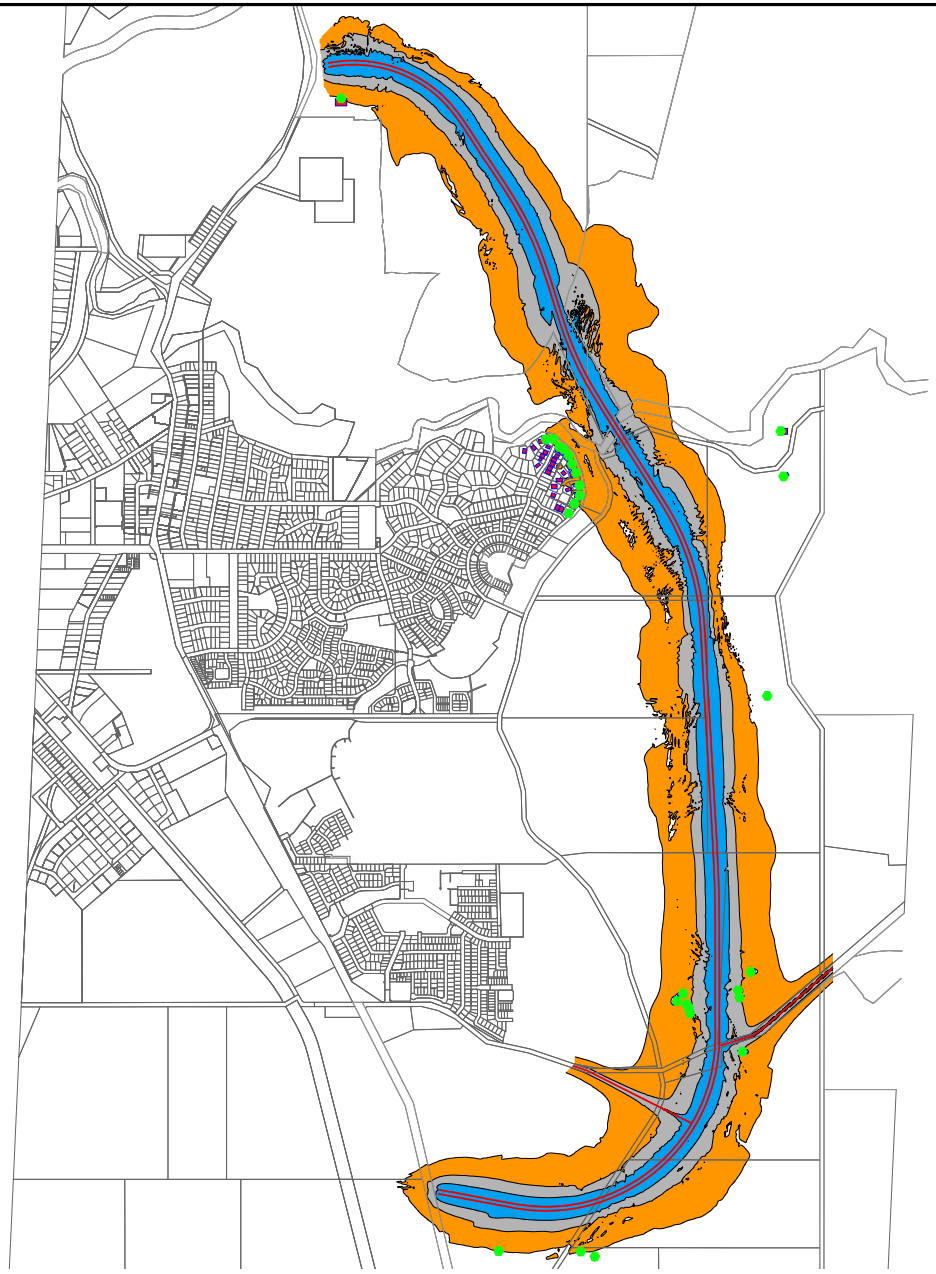
Figure 4.11



Traffic Noise level
$L_{Aeq,(day)}$ dB

	<=	55	Below Target
55 <	<=	60	Above Target - Below Limit
60 <	<=	65	Above Limit
65 <			

N

Signs and symbols

- Road Design
- Buildings
- Point Receiver

Length Scale

0 40 80 160 240 320 m

Margaret River Bypass - Alignment 2 Dual Carriageway - Future Traffic Volumes - Full Development
$L_{Aeq,(day)}$ Noise Level Contours - Without Noise Mitigation

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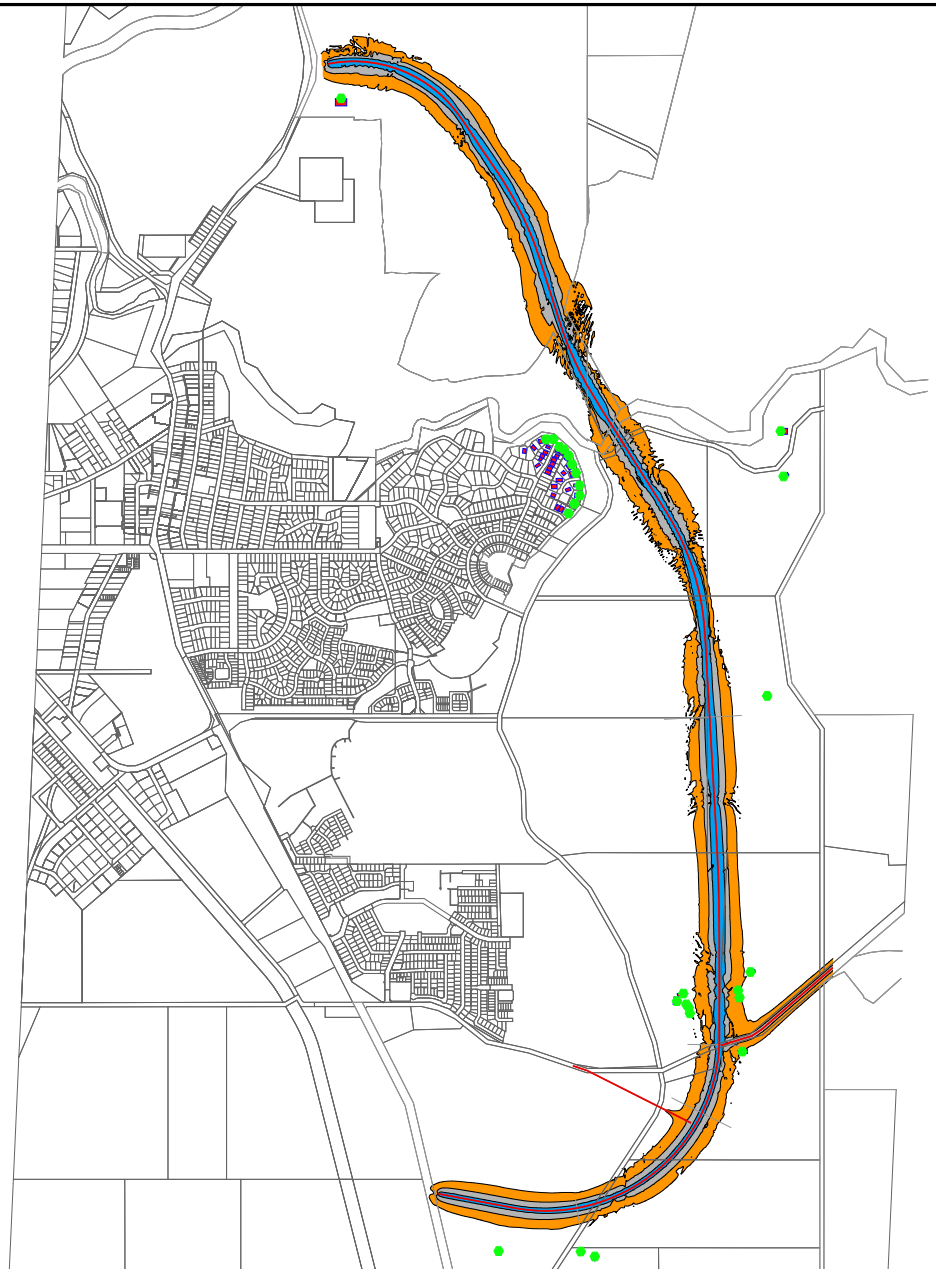
Figure 4.12



Traffic Noise level
$L_{Aeq,(day)}$ dB

	<=	55	Below Target
55 <	<=	60	Above Target - Below Limit
60 <	<=	65	Above Limit
65 <			

N

Signs and symbols

- Road Design
- Buildings
- Point Receiver

Length Scale

0 40 80 160 240 320 m

Margaret River Bypass - Single Carriageway - Soon After Road Opening

$L_{Aeq,(day)}$ Noise Level Contours - Without Noise Mitigation

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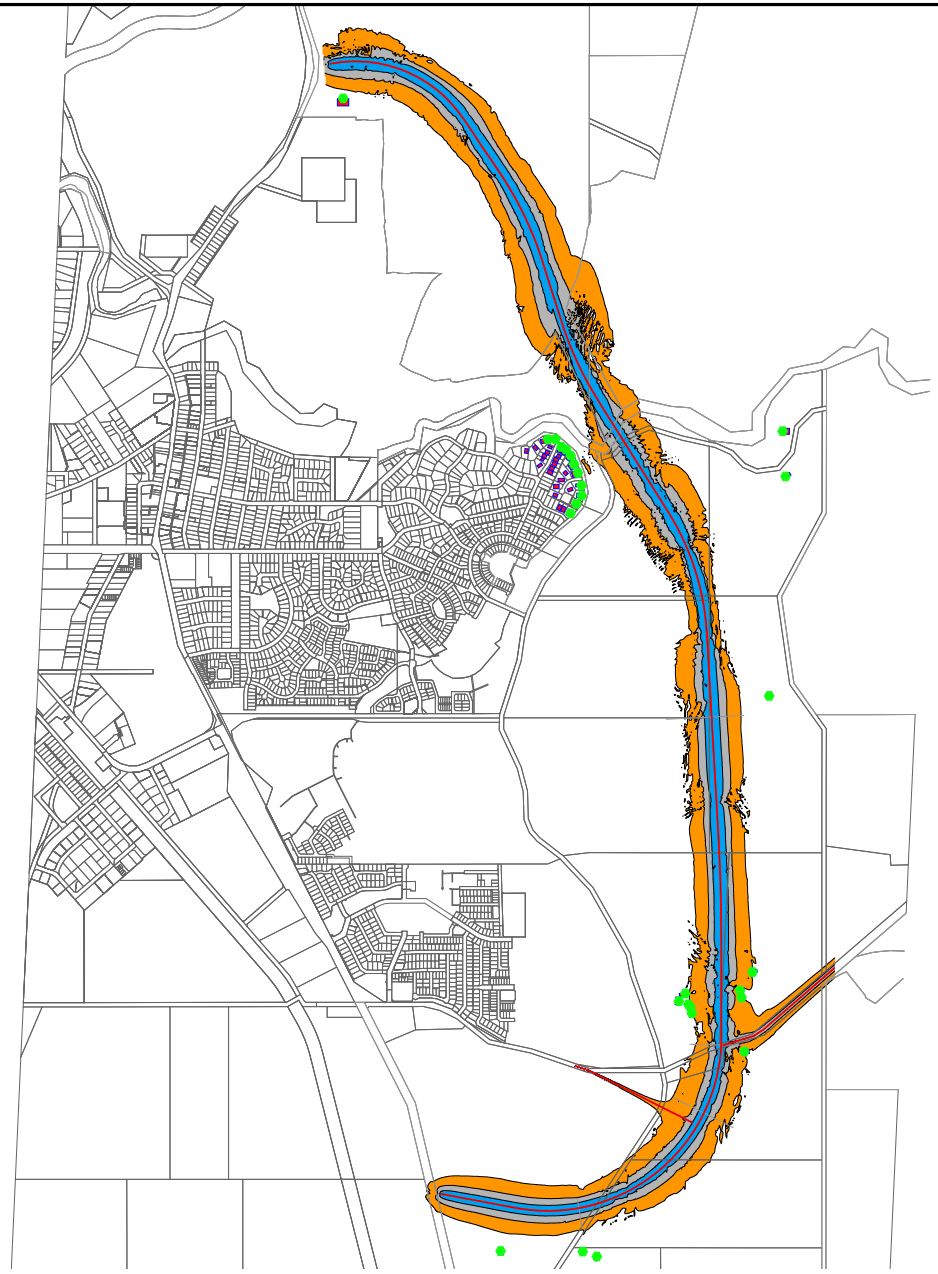
Figure 4.13



Traffic Noise level
$L_{Aeq,(day)}$ dB

	<=	55	Below Target
55 <	<=	60	Above Target - Below Limit
60 <	<=	65	Above Limit
65 <			

N

Signs and symbols

- Road Design
- Buildings
- Point Receiver

Length Scale

0 40 80 160 240 320 m

Margaret River Bypass - Single Carriageway - Future Traffic Volumes - Low Development

$L_{Aeq,(day)}$ Noise Level Contours - Without Noise Mitigation

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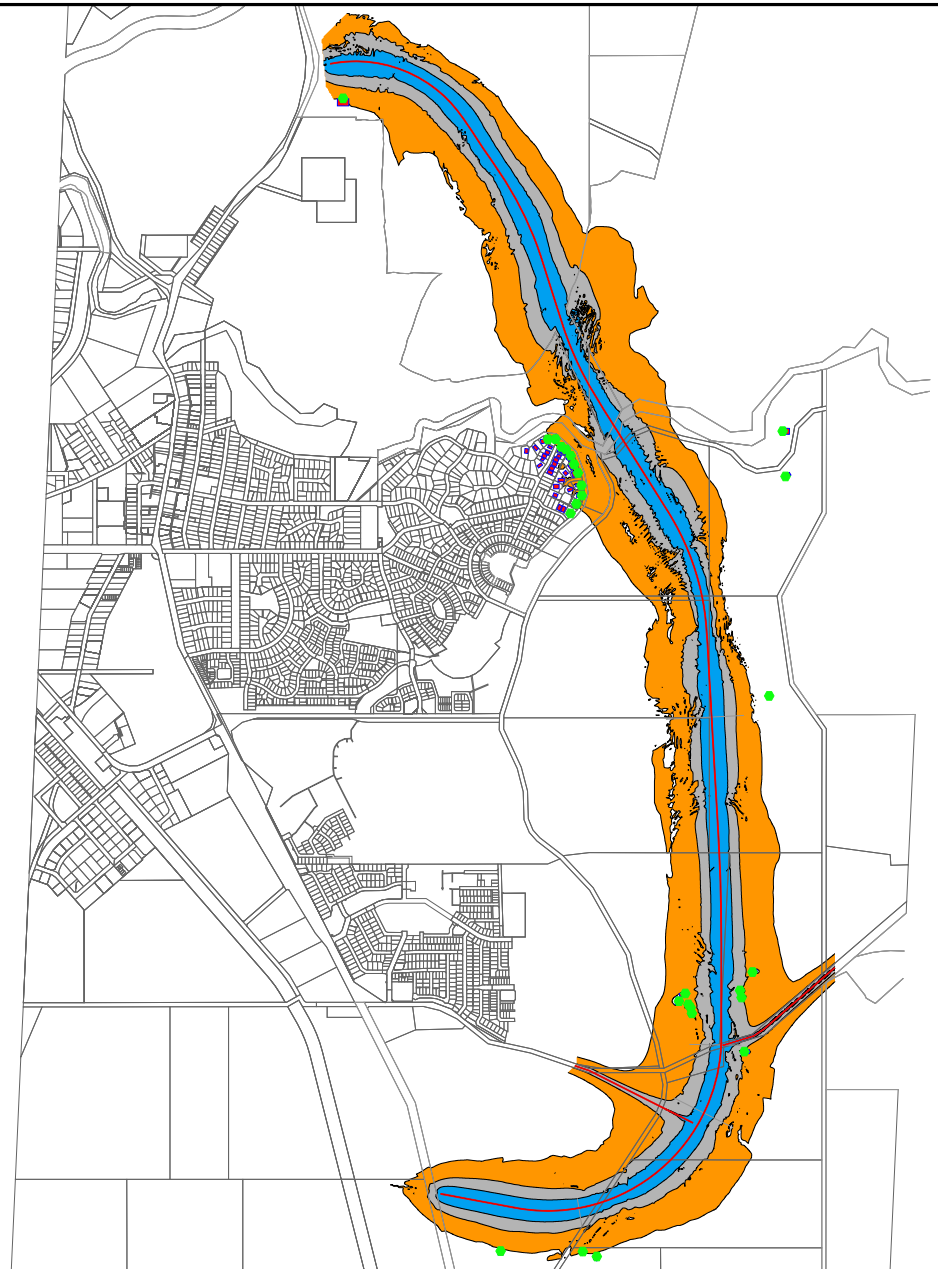
Figure 4.14



Traffic Noise level
$L_{Aeq,(day)}$ dB

	<=	55	Below Target
55 <	<=	60	Above Target - Below Limit
60 <	<=	65	Above Limit
65 <			

N

Signs and symbols

- Road Design
- Buildings
- Point Receiver

Length Scale

0 40 80 160 240 320 m

Margaret River Bypass - Single Carriageway - Future Traffic Volumes - Full Development
$L_{Aeq,(day)}$ Noise Level Contours - Without Noise Mitigation

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5 ASSESSMENT

Under the Policy, transport infrastructure providers are required to design the transport corridor to, where practicable, achieve the noise *limit* of $L_{Aeq(Day)}$ 60 dB and $L_{Aeq(Night)}$ 55 dB, when assessed at ground floor level, one metre from the facade of a noise sensitive premises. Transport infrastructure providers are also required to consider design measures to meet the noise *target* of $L_{Aeq(Day)}$ 55 dB and $L_{Aeq(Night)}$ 50 dB and to implement these measures where reasonable and practicable. Where the future noise level from a transport infrastructure project is predicted to meet the noise *target* at noise sensitive premises, no further measures are required. It should be noted that in line with the Policy, only future traffic volume scenarios are considered in this section of the report.

5.1 Alignment 1 – Dual Carriageway

Assuming the "low development" scenario for Margaret River, there are no receivers predicted to exceed the *limit* criteria and 10 receivers predicted to be within the margin between the *target* and the *limit*.

Assuming the "full development" scenario for Margaret River, there are seven receivers predicted to exceed the *limit* criteria and 11 receivers predicted to be within the margin between the *target* and the *limit*.

Under the policy, noise mitigation would only be required for the "full development" scenario and would only need to be considered for the "low development" scenario. It can be seen that one noise control option that should be considered, is the adoption of Alignment 2.

5.2 Alignment 2– Dual Carriageway

Assuming the "low development" scenario for Margaret River, there are no receivers predicted to exceed the *limit* criteria and four (4) receivers predicted to be within the margin between the *target* and the *limit*.

Assuming the "full development" scenario for Margaret River, there are two (2) receivers predicted to exceed the *limit* criteria and 15 receivers predicted to be within the margin between the *target* and the *limit*.

Therefore, under the policy, noise mitigation would only be required for the "full development" scenario and would only need to be considered for the "low development" scenario.

5.3 Single Carriageway

Assuming the "low development" scenario for Margaret River, there are no receivers predicted to exceed the *limit* criteria and three (3) receivers predicted to be within the margin between the *target* and the *limit*.

Assuming the "full development" scenario for Margaret River, there are two (2) receivers predicted to exceed the *limit* criteria and 15 receivers predicted to be within the margin between the *target* and the *limit*.

Therefore, under the policy, noise mitigation would only be required for the "full development" scenario and would only need to be considered for the "low development" scenario.

6 NOISE CONTROL OPTONS

For a new transport corridor, there are four main options for noise control under the Policy. These being:

- Road designed to minimise noise impacts (such as the corridor being in cut, or a significant distance from receivers);
- Quieter road surfacing;
- Noise barriers; and
- Facade protection to affected houses.

6.1 Road Design

This option is adequately covered by the consideration of using Alignment 2 in lieu of Alignment 1. It can be seen from the results tables that a significant reduction in traffic noise is achieved at some critical locations assuming this option.

6.2 Road Surfacing

The road design, as modelled, assumes a 14mm chip seal road surface. This would be considered as the noisiest (and cheapest) of the road surfaces and is used extensively for rural road networks due to its low maintenance costs and longevity.

By replacing the Chip Seal road surface with Dense Graded Asphalt in strategic areas, in particular where traffic noise is predicted to exceed the *target*, a reduction in traffic noise levels of up to 3.5 dB could be achieved. Using this noise control option would result in all receivers being below the *limit* for all of the "full development" scenarios.

Traffic noise could be decreased by a further 2.5 dB by using Open Graded Asphalt in lieu of Dense Graded Asphalt. However, provision of asphalt surfacing requires careful consideration of other engineering factors, including maintaining of adequate skid resistance with high speed zonings.

6.3 Noise Barriers

The use of noise barriers at strategic locations can result in significant reductions in traffic noise. However, the high costs, visual impacts and maintenance issues (particularly graffiti) require careful consideration in regards to whether this option is practicable. For this project, a noise wall of between 3 and 4 metres high would be required.

It should be noted that a combination of a quieter road surface and a noise barrier could be used to achieve the target criteria at all locations.

6.4 Facade Protection

The Policy allows for the use of facade protection where it is considered impracticable to reduce the noise levels using other noise control methods. The Policy Guidelines provide two facade protection packages and these are reproduced in *Appendix A*. However, it should be noted that this option is generally only used when new residential developments are constructed adjacent to existing or future transport corridors. The facade protection appropriate for a residence is dependant upon the receiving transportation noise level. For those receivers predicted to receive a noise level in the margin between the *target* and the *limit* criteria (shaded blue in *Tables 4.2 to 4.4*), "Package A" protection would be required. For those receivers predicted to receive a noise level above the *limit* criteria (shaded yellow in *Tables 4.2 to 4.4*), "Package B" protection would be required.

7 CONCLUSION

The analysis has shown that traffic future noise levels along the proposed Margaret River Bypass are predicted to exceed the criteria of the *State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning* without noise mitigation measures.

The results of this assessment has shown that for the Alignment 1 dual carriageway option, the future traffic noise is predicted to be under the *limit* criteria at all noise sensitive receivers assuming the "low development" scenario for Margaret River and would exceed the *limit* criteria at seven noise sensitive receivers assuming the "full development" scenario for Margaret River.

For the Alignment 2 dual carriageway option, the future traffic noise is predicted to be under the *limit* criteria at all noise sensitive receivers assuming the "low development" scenario for Margaret River and would exceed the *limit* criteria at two noise sensitive receivers assuming the "full development" scenario for Margaret River.

For the single carriageway option, the future traffic noise is predicted to be under the *limit* criteria at all noise sensitive receivers assuming the "low development" scenario for Margaret River and would exceed the *limit* criteria at two noise sensitive receivers assuming the "full development" scenario for Margaret River.

Under the Policy, if the "low development" scenario for Margaret River is assumed, noise control should be considered with a view to achieving the target criteria at receivers. However, if the "full development" scenario is assumed, the road would need to incorporate noise control to ensure all receivers are below the *limit* criteria and further control considered to achieve the *target* criteria at receivers.

Overall, Alignment 2 and the Single Carriageway options would result in less noise impact to adjacent noise sensitive receivers.

Appendix A

Deemed-to-Satisfy Construction Standards

Noise insulation – "Deemed to Comply" packages for residential development

The following "deemed-to-comply" Packages outline noise insulation measures that are designed to ensure that the indoor noise standards in the Policy are achieved for residential developments in areas where outdoor noise levels will exceed the *target* noise levels by up to 8 dB(A).

The deemed-to-comply specifications are intended to simplify compliance with the noise criteria, and the relevant Package should be required as a condition of development. However, this should not remove the option to pursue alternative measures or designs. Departures from the deemed-to-comply specifications need to be accompanied by acoustic certification from a competent person, to the effect that the development will achieve the requirements of the Policy.

Superior construction standards, such as those specified in the "deemed-to-comply" packages, are now becoming more prevalent in residential buildings; and do not significantly increase the cost of building. A similar standard of construction has been recommended by the Western Australian Planning Commission for new housing in areas forecast to be seriously affected by aircraft noise.[1] That recommendation followed a comprehensive assessment of the efficacy and costs of noise attenuation measures, taking into account the recent changes in industry building standards as well as changes to the *Building Code of Australia*.

Where transport noise levels are more than 8 dB above the noise *target*, i.e. 3 dB above the noise *limit*, or where noise-sensitive development other than residential is proposed, a Detailed Assessment should be prepared by a competent person. The report should specify the level of noise reduction required and the noise insulation measures needed to comply with the Policy. The approval may require that the construction drawings be checked for compliance with the Detailed Assessment, and that follow-up verification be carried out to certify compliance.

[1] Statement of Planning Policy No 5.1, *Land Use Planning in the Vicinity of Perth Airport* and the accompanying report on *Aircraft Noise Insulation for Residential Development in the Vicinity of Perth Airport,* February 2004.

Package A: Noise levels within the *margin*

The following noise insulation package is designed to meet the indoor noise standards for residential developments in areas where noise levels exceed the noise target *but are within the* limit.

Area type	Orientation	Package A measures
Indoors		
Bedrooms	Facing road/rail corridor	• 6mm (minimum) laminated glazing • Fixed, casement or awning windows with seals • No external doors • Closed eaves • No vents to outside walls/eaves • Mechanical ventilation/airconditioning[2]
	Side-on to corridor	• 6mm (minimum) laminated glazing • Closed eaves • Mechanical ventilation/airconditioning
	Away from corridor	No requirements
Living and work areas[3]	Facing corridor	• 6mm (minimum) laminated glazing • Fixed, casement or awning windows with seals • 35mm (minimum) solid core external doors with acoustic seals[4] • Sliding doors must be fitted with acoustic seals • Closed eaves • No vents to outside walls/eaves • Mechanical ventilation/airconditioning
	Side-on to corridor	• 6mm (minimum) laminated glazing • Closed eaves • Mechanical ventilation/airconditioning
	Away from corridor	No requirements
Other indoor areas	Any	No requirements
Outdoors		
Outdoor living area[5]	Facing corridor	• Minimum 2.0m high solid fence (e.g. Hardifence, pinelap, or Colorbond) • Picket fences are not acceptable
	Side-on to corridor	
	Away from corridor	No requirements

[2] See section on Mechanical ventilation/airconditioning for further details and requirements.
[3] These deemed-to-comply guidelines adopt the definitions of indoor spaces used in AS 2107-2000. A comparable description for bedrooms, living and work areas is that defined by the Building Code of Australia as a "habitable room". The Building Code of Australia may be referenced if greater clarity is needed. A living or work area can be taken to mean any "habitable room" other than a bedroom. Note that there are no noise insulation requirements for utility areas such as bathrooms. The Building Code of Australia describes these utility spaces as "non-habitable rooms".
[4] Glazing panels are acceptable in external doors facing the transport corridor. However these must meet the minimum glazing requirements.
[5] The Policy requires that at least one outdoor living area be reasonably protected from transport noise. The protected area should meet the minimum space requirements for outdoor living areas, as defined in the Residential Design Codes of Western Australia.

Package B: Noise within 3 dB above the *limit*

The following noise insulation package is designed to meet the indoor noise standards for residential developments in areas where transport noise levels exceed the noise *limit* but by no more than 3 dB (See Table 1 in the Policy).

Area type	Orientation	Package B measures
Indoors		
Bedrooms	Facing road/rail corridor	• 10mm (minimum) laminated glazing • Fixed, casement or awning windows with seals • No external doors • Closed eaves • No vents to outside walls/eaves • Mechanical ventilation/airconditioning[6]
	Side-on to corridor	• 10mm (minimum) laminated glazing • Closed eaves • Mechanical ventilation/airconditioning
	Away from corridor	No requirements
Living and work areas[7]	Facing corridor	• 10mm (minimum) laminated glazing • Fixed, casement or awning windows with seals • 40mm (minimum) solid core external doors with acoustic seals[8] • Sliding doors must be fitted with acoustic seals • Closed eaves • No vents to outside walls/eaves • Mechanical ventilation/airconditioning
	Side-on to corridor	• 6mm (minimum) laminated glazing • Closed eaves • Mechanical ventilation/airconditioning
	Away from corridor	No requirements
Other indoor areas	Any	No requirements
Outdoors		
Outdoor living area[9]	Facing corridor	• Minimum 2.4m solid fence (e.g. brick, limestone or Hardifence) • Colorbond and picket fences are not acceptable
	Side-on to corridor	
	Away from corridor	No requirements

[6] See section on Mechanical ventilation/airconditioning for further details and requirements.

[7] These deemed-to-comply guidelines adopt the definitions of indoor spaces used in AS 2107-2000. A comparable description for bedrooms, living and work areas is that defined by the Building Code of Australia as a "habitable room". The Building Code of Australia may be referenced if greater clarity is needed. A living or work area can be taken to mean any "habitable room" other than a bedroom. Note that there are no noise insulation requirements for utility areas such as bathrooms. The Building Code of Australia describes these utility spaces as "non-habitable rooms".

[8] Glazing panels are acceptable in external doors facing the transport corridor. However these must meet the minimum glazing requirements.

[9] The Policy requires that at least one outdoor living area be reasonably protected from transport noise. The protected area should meet the minimum space requirements for outdoor living areas, as defined in the Residential Design Codes of Western Australia.

Mechanical ventilation/airconditioning
Where outdoor noise levels are above the "target", both Packages A and B require mechanical ventilation or airconditioning to ensure that windows can remain closed in order to achieve the indoor noise standards.
In implementing Packages A and B, the following need to be observed:

- evaporative airconditioning systems will not meet the requirements for Packages A and B because windows need to remain open;
- refrigerative airconditioning systems need to be designed to achieve fresh air ventilation requirements;
- air inlets need to be positioned facing away from the transport corridor where practicable;
- ductwork needs to be provided with adequate silencing to prevent noise intrusion.

Notification
Notifications on certificates of title and/or advice to prospective purchasers advising of the potential for noise impacts from road and rail corridors can be effective in warning people of the potential impacts of transport noise. Such advice can also bring to the attention of prospective developers the need and opportunities to reduce the impact of noise through sensitive design and construction of buildings and the location and/or screening of outdoor living areas.
Notification should be provided to prospective purchasers, and required as a condition of subdivision (including strata subdivision) for the purposes of noise-sensitive development or planning approval involving noise-sensitive development, where external noise levels are forecast or estimated to exceed the "target" criteria as defined by the Policy. In the case of subdivision and development, conditions of approval should include a requirement for registration of a notice on title, which is provided for under section 12A of the Town Planning and Development Act and section 70A of the Transfer of Land Act. An example of a suitable notice is given below.
Notice: This property is situated in the vicinity of a transport corridor, and is currently affected, or may in the future be affected, by transport noise. Further information about transport noise, including development restrictions and noise insulation requirements for noise-affected property, are available on request from the relevant local government offices.

Appendix B

Terminology

The following is an explanation of the terminology used throughout this report.

Decibel (dB)

The decibel is the unit that describes the sound pressure and sound power levels of a noise source. It is a logarithmic scale referenced to the threshold of hearing.

A-Weighting

An A-weighted noise level has been filtered in such a way as to represent the way in which the human ear perceives sound. This weighting reflects the fact that the human ear is not as sensitive to lower frequencies as it is to higher frequencies. An A-weighted sound level is described as L_A dB.

Sound Pressure Level (L_p)

The sound pressure level of a noise source is dependent upon its surroundings, being influenced by distance, ground absorption, topography, meteorological conditions etc and is what the human ear actually hears. Using the electric heater analogy above, the heat will vary depending upon where the heater is located, just as the sound pressure level will vary depending on the surroundings. Noise modelling predicts the sound pressure level from the sound power levels taking into account ground absorption, barrier effects, distance etc.

L_{Amax}

An L_{Amax} level is the maximum A-weighted noise level during a particular measurement.

L_{A1}

An L_{A1} level is the A-weighted noise level which is exceeded for one percent of the measurement period and is considered to represent the average of the maximum noise levels measured.

L_{A10}

An L_{A10} level is the A-weighted noise level which is exceeded for 10 percent of the measurement period and is considered to represent the "*intrusive*" noise level.

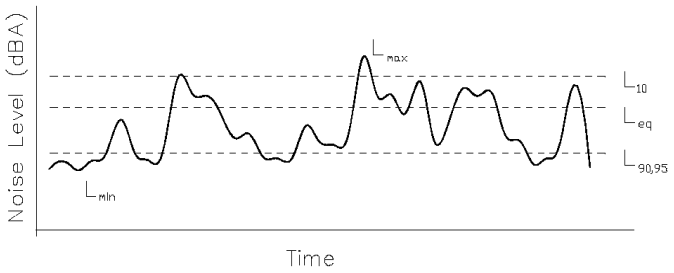
L_{Aeq}

The equivalent steady state A-weighted sound level ("equal energy") in decibels which, in a specified time period, contains the same acoustic energy as the time-varying level during the same period. It is considered to represent the "average" noise level.

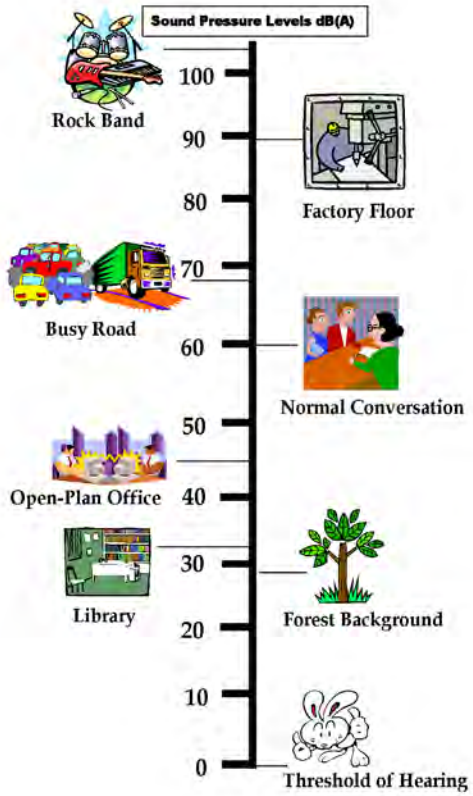
L_{A90}

An L_{A90} level is the A-weighted noise level which is exceeded for 90 percent of the measurement period and is considered to represent the "*background*" noise level.

Chart of Noise Level Descriptors



Typical Noise Levels



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Transport Noise Assessment

John Archibald Drive, Margaret River

Reference: 12042120-03

Report: 12042120-03

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Date:	20 November 2012

CONTENTS

APPENDICES

1 INTRODUCTION

This assessment has been undertaken to determine the future traffic noise levels at noise sensitive receivers located adjacent to the proposed John Archibald Drive, in Margaret River. This road is to be developed as part of the proposed Margaret River Bypass project.

In line with the assessment undertaken for the proposed Margaret River Bypass, consideration has been given to the expected traffic volumes on John Archibald Drive assuming the following scenarios:

- Soon after Bypass opening (2014);
- Future (2031) traffic volumes assuming "low development" of the Margaret River region; and
- Future (2031) traffic volumes assuming "full development" of the Margaret River region.

The results of the assessment are compared against the criteria contained within *State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning*. Where these criteria are exceeded, noise mitigation options and the effectiveness of these options in broad terms are provided.

Appendix B contains a description of some of the terminology used throughout this report.

2 CRITERIA

When constructing a new transport corridor adjacent to existing or future planned noise sensitive premises, the relevant noise level criteria in Western Australia is the *State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning* (hereafter referred to as the Policy) produced by the Western Australian Planning Commission (WAPC).

The Policy's outdoor noise criteria are shown below in *Table 2.1*. These criteria apply at any point 1-metre from a habitable façade of a noise sensitive premises and in one outdoor living area.

Table 2.1 - Outdoor Noise Criteria

Period	Target	Limit
Day (6am to 10pm)	55 dB $L_{Aeq(\mathbf{Day})}$	60 dB $L_{Aeq(\mathbf{Day})}$
Night (10pm to 6am)	50 dB $L_{Aeq(Night)}$	55 dB $L_{Aeq(Night)}$

The 5 dB difference between the *target* and *limit* is referred to as the *margin*.

In the application of the noise criteria to new major road infrastructure projects, the objective of the Policy is that the new infrastructure be designed and constructed so that the noise emissions are at a level that—

- provides an acceptable level of acoustic amenity for existing noise-sensitive land uses and for the planning of new noise-sensitive developments;
- is consistent with other planning policies and community expectations; and

- is practicably achievable.

For transport infrastructure projects within the scope of this policy, a noise assessment should be conducted in accordance with the guidelines, to predict future noise levels resulting from the project and to identify relevant noise mitigation measures.

If a transport infrastructure project will emit transport noise levels that meet the noise target, no further measures are required under this policy. Otherwise, transport infrastructure providers should design mitigation measures to achieve the noise *limit* of $L_{Aeq(Day)}$ 60 dB and $L_{Aeq(Night)}$ 55 dB, when assessed at one metre from the façade at ground floor level.

Transport infrastructure providers are also required to consider design measures to meet the noise *target* of $L_{Aeq(Day)}$ 55 dB and $L_{Aeq(Night)}$ 50 dB and to implement these measures where reasonable and practicable.

If a new major road infrastructure project is to be constructed in the vicinity of a future noise-sensitive land use, mitigation measures should be implemented in accordance with this part of the policy. For this purpose, a proposed noise-sensitive land use is any noise sensitive development that is subject to an approved detailed area plan, subdivision approval or development approval, such that the transport infrastructure provider is able to adequately design noise mitigation measures to protect that development. In these instances, the infrastructure provider and developer are both responsible for ensuring that the objectives of this policy are achieved, and a mutually beneficial noise management plan, including individual responsibilities, should be negotiated between the parties.

It is recognised that in some cases it may not be practicable to achieve the noise criteria. In these circumstances reference should be made to section 5.8 of the Policy and the guidelines. Section 5.8 of the Policy states:

This policy applies a performance-based approach to the management and mitigation of transport noise. It is recognised that in a number of instances it may not be reasonable and practicable to meet the noise target criteria. Where transport noise is above the target level, measures are expected to be implemented that best balance reasonable and practicable considerations, such as noise benefit, cost, feasibility, community preferences, amenity impacts, safety, security and conflict with other planning and transport policies. In these cases the community should also be consulted to assist in identifying best overall solutions. The guidelines assist in outlining ways in which some reasonable and practicable limitations can be addressed in a manner that also minimises transport noise.

It is further acknowledged that there may also be situations in which the noise limit cannot practicably be achieved, especially in the case of major redevelopment of existing transport infrastructure. Similarly, it may not be practicable to achieve acceptable indoor noise levels if the new development is located very close to the transport corridor. In these situations the primary focus should be on achieving the lowest level of noise, with other reasonable and practicable considerations being secondary to this objective.

In cases where the noise limit or indoor noise criteria cannot practicably be met, longer term strategies for land use planning, transport policy and vehicle emissions should be considered to minimise transport noise impact over time.

3 METHODOLOGY

Noise measurements and modelling have been undertaken in accordance with the requirements of the Policy as described below in *Sections 3.1 and 3.2*.

3.1 Site Measurements

Noise monitoring was undertaken at three (3) locations within Margaret River as part of the proposed Margaret River Bypass (ref Lloyd George Acoustics 12042120-01). This noise monitoring data has been used for this assessment in order to calibrate the noise prediction model.

3.2 Noise Modelling

The computer programme *SoundPLAN 7.1* was utilised, incorporating the *Calculation of Road Traffic Noise* (CoRTN) algorithms, modified to reflect Australian conditions. The modifications included the following:

- An adjustment of –1.7 dB has been applied to the predicted levels based on the findings of *An Evaluation of the U.K. DoE Traffic Noise Prediction*; Australian Road Research Board, Report 122 ARRB – NAASRA Planning Group 1982.

Predictions are made at heights of 1.4 metres (single storey residence) and at 1.0 metre from a building facade (resulting in a + 2.5 dB correction due to reflected noise).

Various input data are included in the modelling such as ground topography, road design and traffic volumes, etc. These model inputs are discussed below.

3.2.1 Ground Topography, Road Design & Cadastral Data

Main Roads provided 3-dimentional topographical and road alignment data in digital format. It is assumed that the road will follow the exiting land contours. The contours were at 5 metre intervals and covered the road alignment and noise sensitive premises of concern.

3.2.2 Traffic Data

Traffic data includes:

- Traffic Volumes –

  Traffic volumes representing the "soon after bypass opening" and the two future scenarios are shown below. The traffic volumes were obtained from Main Roads.

Table 3.1 – Traffic Volumes used in the Noise Modelling

Description	Soon After Opening	2031 Low Development	2031 Full Development	Percentage Heavy Veh
Bussell Hwy to Tingle Ave	1,500	2,400	5,200	20%
Tingle Ave to Bypass road alignment	1,100	1,480	5,000	20%

Note: 18-hour volumes are assumed to be 95% of the AAWT volumes.

- Vehicle Speed –

  The vehicle speed assumed in the noise modelling is 60 km/h.

3.2.3 Road Surface –

The difference in noise emission between road surface types, when compared to Dense Graded Asphalt, is shown below in *Table 3.2*. The road surface for John Archibald Drive is assumed to be 10 mm Chip Seal.

Table 3.2 – Noise Relationship Between Different Road Surfaces

Road Surfaces						
Chip Seal			Asphalt			
14mm	10mm	5mm	Dense Graded	Novachip	Stone Mastic	Open Graded
+3.5 dB	+2.5 dB	+1.5 dB	0.0 dB	-0.2 dB	-1.0 dB	-2.5 dB

3.2.4 Ground Attenuation

The ground attenuation has been assumed to be 0.0 (0%) for the road surfaces and 1.0 (100%) for other areas. Note 0.0 represents hard reflective surfaces such as bitumen and water and 1.00 represents absorptive surfaces such as grass.

3.2.5 Parameter Conversion

The CoRTN algorithms used in the *SoundPlan* modelling package were originally developed to calculate the $L_{A10,18hour}$ noise level. The Policy however uses $L_{Aeq\ (Day)}$ and $L_{Aeq\ (Night)}$ noise descriptors. The relationship between the parameters varies depending on the composition of traffic on the road (volumes in each period and percentage heavy vehicles). For this project, the results of the measured noise levels adjacent to Bussell Highway (Margaret River Bypass Assessment)) where used to convert these parameters.

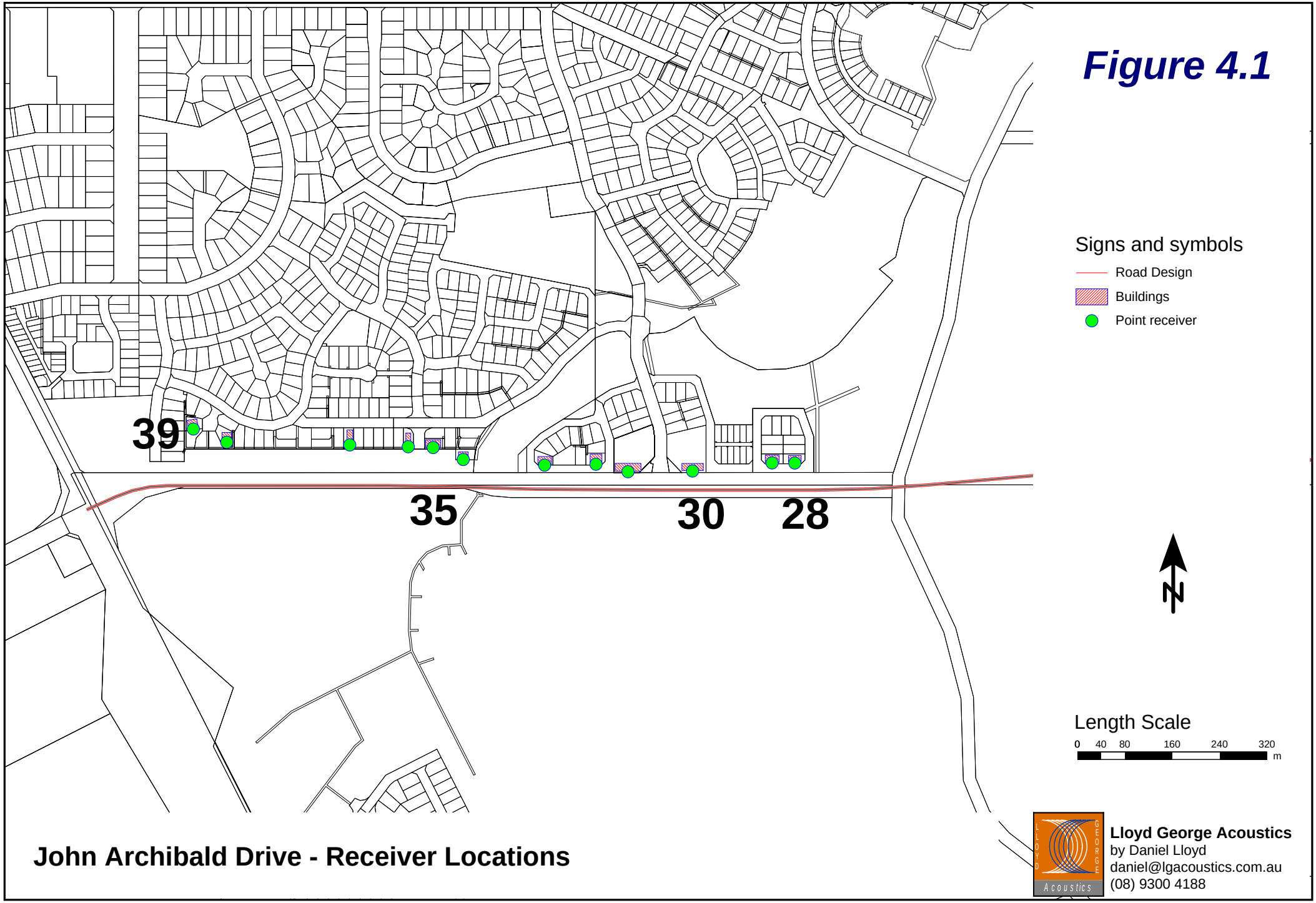
4 RESULTS

The results of the calibrated noise modelling to each receiver location, shown in *Figures 4.1,* are presented in *Table 4.1*. The cells shaded blue shows receivers predicted to be within the margin between the Policy's *target* and *limit* criteria and the cells shaded yellow show receivers predicted to be above the Policy's *limit* criteria. Noise level contour plots for each scenario are shown in *Figures 4.2 to 4.4* respectively. Please note that the receiver locations start at number 28 to avoid confusion with the Margaret River Bypass receiver locations.

Table 4.1 – Noise Prediction Results for Each Scenario

Rec No	Traffic Noise Level $L_{Aeq,day}$ dB		
	Soon After Road Opening	Future Low Development Scenario	Future Full Development Scenario
28	54	56	61
29	54	56	61
30	56	58	63
31	58	60	63
32	56	58	61
33	57	59	62
34	56	58	61
35	54	56	59
36	54	56	59
37	53	55	59
38	52	54	58
39	50	52	55

Figure 4.1



John Archibald Drive - Receiver Locations

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Figure 4.2

Length Scale

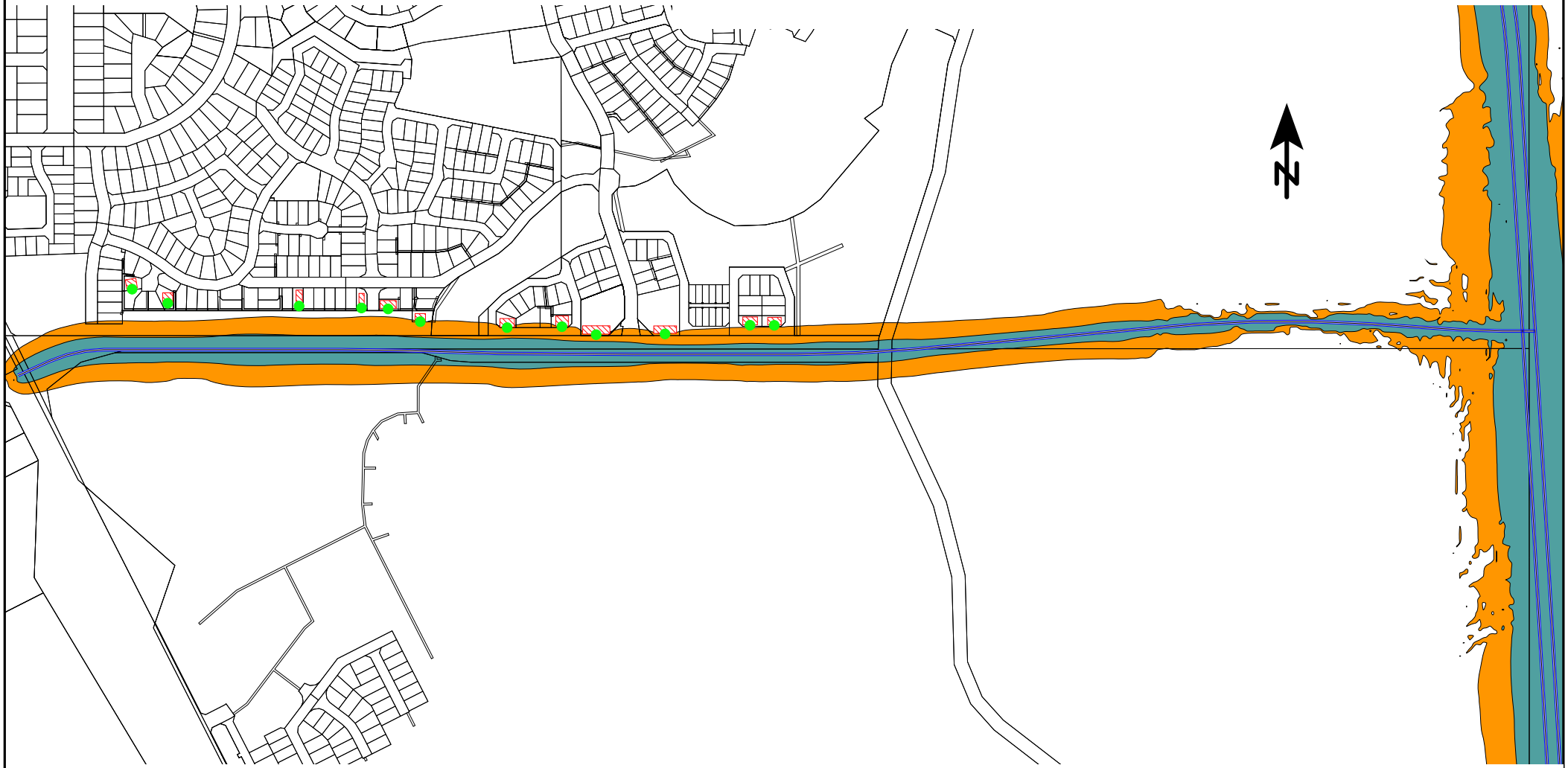
0 40 80 160 240 320 m

Signs and symbols

- Road Design
- Buildings
- Point receiver

Traffic Noise level
$L_{Aeq,(Day)}$ dB

	<=	55	Noise Target
55 <	<=	60	Above Noise Target - Below Noise Limit
60 <			Above Noise Limit



John Archibald Drive - Soon After Road Opening

$L_{Aeq,(Day)}$ Noise Level Contours - Without Noise Mitigation

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Figure 4.3

Length Scale

0 40 80 160 240 320 m

Signs and symbols

- Road Design
- Buildings
- Point receiver

Traffic Noise level
$L_{Aeq,(Day)}$ dB

	<=	55	Noise Target
55 <	<=	60	Above Noise Target - Below Noise Limit
60 <			Above Noise Limit

John Archibald Drive - Future Traffic Volumes - Low Development Scenario

$L_{Aeq,(Day)}$ Noise Level Contours - Without Noise Mitigation

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Length Scale

0 40 80 160 240 320 m

Signs and symbols

Road Design

Buildings

Point receiver

Traffic Noise level

$L_{Aeq,(Day)}$ dB

	<=	55	Noise Target
55 <	<=	60	Above Noise Target - Below Noise Limit
60 <			Above Noise Limit

Figure 4.4

John Archibald Drive - Future Traffic Volumes - Full Development Scenario

$L_{Aeq,(Day)}$ Noise Level Contours - Without Noise Mitigation

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5 ASSESSMENT

Under the Policy, transport infrastructure providers are required to design the transport corridor to, where practicable, achieve the noise *limit* of $L_{Aeq(Day)}$ 60 dB and $L_{Aeq(Night)}$ 55 dB, when assessed at ground floor level, one metre from the facade of a noise sensitive premises. Transport infrastructure providers are also required to consider design measures to meet the noise *target* of $L_{Aeq(Day)}$ 55 dB and $L_{Aeq(Night)}$ 50 dB and to implement these measures where reasonable and practicable. Where the future noise level from a transport infrastructure project is predicted to meet the noise *target* at noise sensitive premises, no further measures are required. It should be noted that in line with the Policy, only future traffic volume scenarios are considered in this section of the report.

Assuming the "low development" scenario for Margaret River, there are no receivers predicted to exceed the *limit* criteria and 10 receivers predicted to be within the margin between the *target* and the *limit*.

Assuming the "full development" scenario for Margaret River, there are seven (7) receivers predicted to exceed the *limit* criteria and four (4) receivers predicted to be within the margin between the *target* and the *limit*.

Under the policy, noise mitigation would only be required for the "full development" scenario and would only need to be considered for the "low development" scenario.

6 NOISE CONTROL OPTONS

For a new transport corridor, there are four main options for noise control under the Policy. These being:

- Road designed to minimise noise impacts (such as the corridor being in cut, or an increased distance from receivers);
- Quieter road surfacing;
- Noise barriers; and
- Facade protection to affected houses.

6.1 Road Design

As the noise sensitive premises are currently all located to the north of John Archibald Drive, consideration should be given to moving the road alignment further south, away from the receivers.

6.2 Road Surfacing

The road design, as modelled, assumes 10mm chip seal. This would be considered as one of the noisiest (and cheapest) of the road surfaces and is used extensively for rural road networks due to its low maintenance costs and longevity.

By replacing the Chip Seal road surface with Dense Graded Asphalt, a reduction in traffic noise levels of up to 2.5 dB could be achieved at receivers adjacent to John Archibald Drive. Using this noise control option would result in all receivers being below the *limit* for all scenarios. Traffic noise could be decreased by a further 2.5 dB by using Open Graded Asphalt in lieu of Dense Graded Asphalt.

6.3 Noise Barriers

The use of noise barriers at strategic locations can result in significant reductions in traffic noise. However, the high costs, visual impacts and maintenance issues (particularly graffiti) require careful consideration in regards to whether this option is practicable. The use of localised property fencing may be an option for premises along John Archibald Drive, which is often considered to be less intrusive.

It should be noted that a combination of a quieter road surface and a noise barrier could be used to achieve the target criteria at all locations.

6.4 Facade Protection

The Policy allows for the use of facade protection where it is considered impracticable to reduce the noise levels using other noise control methods. The Policy Guidelines provide two facade protection packages and these are reproduced in *Appendix A*. However, it should be noted that this option is generally only used when new residential developments are constructed adjacent to existing or future transport corridors. The facade protection appropriate for a residence is dependant upon the receiving transportation noise level. For those receivers predicted to receive a noise level in the margin between the *target* and the *limit* criteria (shaded blue in *Table 4.1*), "Package A" protection would be required. For those receivers predicted to receive a noise level above the *limit* criteria (shaded yellow in *Tables 4.1*), "Package B" protection would be required.

7 CONCLUSION

The analysis has shown that future traffic noise levels along the proposed John Archibald Drive, Margaret River, are predicted to exceed the criteria of the *State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning* without noise mitigation measures, when assuming the "full development" scenario in Margaret River. Under this scenario, seven (7) receivers are predicted to exceed the *limit* criteria and noise control should be included in the design.

Should the "low development" scenario be considered as the most likely scenario, noise control should be considered if practicable.

Appendix A

Deemed-to-Satisfy Construction Standards

Noise insulation – "Deemed to Comply" packages for residential development

The following "deemed-to-comply" Packages outline noise insulation measures that are designed to ensure that the indoor noise standards in the Policy are achieved for residential developments in areas where outdoor noise levels will exceed the *target* noise levels by up to 8 dB(A).

The deemed-to-comply specifications are intended to simplify compliance with the noise criteria, and the relevant Package should be required as a condition of development. However, this should not remove the option to pursue alternative measures or designs. Departures from the deemed-to-comply specifications need to be accompanied by acoustic certification from a competent person, to the effect that the development will achieve the requirements of the Policy.

Superior construction standards, such as those specified in the "deemed-to-comply" packages, are now becoming more prevalent in residential buildings; and do not significantly increase the cost of building. A similar standard of construction has been recommended by the Western Australian Planning Commission for new housing in areas forecast to be seriously affected by aircraft noise.[1] That recommendation followed a comprehensive assessment of the efficacy and costs of noise attenuation measures, taking into account the recent changes in industry building standards as well as changes to the *Building Code of Australia*.

Where transport noise levels are more than 8 dB above the noise *target*, i.e. 3 dB above the noise *limit*, or where noise-sensitive development other than residential is proposed, a Detailed Assessment should be prepared by a competent person. The report should specify the level of noise reduction required and the noise insulation measures needed to comply with the Policy. The approval may require that the construction drawings be checked for compliance with the Detailed Assessment, and that follow-up verification be carried out to certify compliance.

[1] Statement of Planning Policy No 5.1, *Land Use Planning in the Vicinity of Perth Airport* and the accompanying report on *Aircraft Noise Insulation for Residential Development in the Vicinity of Perth Airport,* February 2004.

Package A: Noise levels within the *margin*

The following noise insulation package is designed to meet the indoor noise standards for residential developments in areas where noise levels exceed the noise target *but are within the* limit.

Area type	Orientation	Package A measures
Indoors		
Bedrooms	Facing road/rail corridor	• 6mm (minimum) laminated glazing • Fixed, casement or awning windows with seals • No external doors • Closed eaves • No vents to outside walls/eaves • Mechanical ventilation/airconditioning[2]
	Side-on to corridor	• 6mm (minimum) laminated glazing • Closed eaves • Mechanical ventilation/airconditioning
	Away from corridor	No requirements
Living and work areas[3]	Facing corridor	• 6mm (minimum) laminated glazing • Fixed, casement or awning windows with seals • 35mm (minimum) solid core external doors with acoustic seals[4] • Sliding doors must be fitted with acoustic seals • Closed eaves • No vents to outside walls/eaves • Mechanical ventilation/airconditioning
	Side-on to corridor	• 6mm (minimum) laminated glazing • Closed eaves • Mechanical ventilation/airconditioning
	Away from corridor	No requirements
Other indoor areas	Any	No requirements
Outdoors		
Outdoor living area[5]	Facing corridor	• Minimum 2.0m high solid fence (e.g. Hardifence, pinelap, or Colorbond) • Picket fences are not acceptable
	Side-on to corridor	
	Away from corridor	No requirements

[2] See section on Mechanical ventilation/airconditioning for further details and requirements.
[3] These deemed-to-comply guidelines adopt the definitions of indoor spaces used in AS 2107-2000. A comparable description for bedrooms, living and work areas is that defined by the Building Code of Australia as a "habitable room". The Building Code of Australia may be referenced if greater clarity is needed. A living or work area can be taken to mean any "habitable room" other than a bedroom. Note that there are no noise insulation requirements for utility areas such as bathrooms. The Building Code of Australia describes these utility spaces as "non-habitable rooms".
[4] Glazing panels are acceptable in external doors facing the transport corridor. However these must meet the minimum glazing requirements.
[5] The Policy requires that at least one outdoor living area be reasonably protected from transport noise. The protected area should meet the minimum space requirements for outdoor living areas, as defined in the Residential Design Codes of Western Australia.

Package B: Noise within 3 dB above the *limit*

The following noise insulation package is designed to meet the indoor noise standards for residential developments in areas where transport noise levels exceed the noise *limit* but by no more than 3 dB (See Table 1 in the Policy).

Area type	Orientation	Package B measures
Indoors		
Bedrooms	Facing road/rail corridor	• 10mm (minimum) laminated glazing • Fixed, casement or awning windows with seals • No external doors • Closed eaves • No vents to outside walls/eaves • Mechanical ventilation/airconditioning[6]
	Side-on to corridor	• 10mm (minimum) laminated glazing • Closed eaves • Mechanical ventilation/airconditioning
	Away from corridor	No requirements
Living and work areas[7]	Facing corridor	• 10mm (minimum) laminated glazing • Fixed, casement or awning windows with seals • 40mm (minimum) solid core external doors with acoustic seals[8] • Sliding doors must be fitted with acoustic seals • Closed eaves • No vents to outside walls/eaves • Mechanical ventilation/airconditioning
	Side-on to corridor	• 6mm (minimum) laminated glazing • Closed eaves • Mechanical ventilation/airconditioning
	Away from corridor	No requirements
Other indoor areas	Any	No requirements
Outdoors		
Outdoor living area[9]	Facing corridor	• Minimum 2.4m solid fence (e.g. brick, limestone or Hardifence) • Colorbond and picket fences are not acceptable
	Side-on to corridor	
	Away from corridor	No requirements

[6] See section on Mechanical ventilation/airconditioning for further details and requirements.

[7] These deemed-to-comply guidelines adopt the definitions of indoor spaces used in AS 2107-2000. A comparable description for bedrooms, living and work areas is that defined by the Building Code of Australia as a "habitable room". The Building Code of Australia may be referenced if greater clarity is needed. A living or work area can be taken to mean any "habitable room" other than a bedroom. Note that there are no noise insulation requirements for utility areas such as bathrooms. The Building Code of Australia describes these utility spaces as "non-habitable rooms".

[8] Glazing panels are acceptable in external doors facing the transport corridor. However these must meet the minimum glazing requirements.

[9] The Policy requires that at least one outdoor living area be reasonably protected from transport noise. The protected area should meet the minimum space requirements for outdoor living areas, as defined in the Residential Design Codes of Western Australia.

Mechanical ventilation/airconditioning
Where outdoor noise levels are above the "target", both Packages A and B require mechanical ventilation or airconditioning to ensure that windows can remain closed in order to achieve the indoor noise standards.
In implementing Packages A and B, the following need to be observed:

- evaporative airconditioning systems will not meet the requirements for Packages A and B because windows need to remain open;
- refrigerative airconditioning systems need to be designed to achieve fresh air ventilation requirements;
- air inlets need to be positioned facing away from the transport corridor where practicable;
- ductwork needs to be provided with adequate silencing to prevent noise intrusion.

Notification
Notifications on certificates of title and/or advice to prospective purchasers advising of the potential for noise impacts from road and rail corridors can be effective in warning people of the potential impacts of transport noise. Such advice can also bring to the attention of prospective developers the need and opportunities to reduce the impact of noise through sensitive design and construction of buildings and the location and/or screening of outdoor living areas.
Notification should be provided to prospective purchasers, and required as a condition of subdivision (including strata subdivision) for the purposes of noise-sensitive development or planning approval involving noise-sensitive development, where external noise levels are forecast or estimated to exceed the "target" criteria as defined by the Policy. In the case of subdivision and development, conditions of approval should include a requirement for registration of a notice on title, which is provided for under section 12A of the Town Planning and Development Act and section 70A of the Transfer of Land Act. An example of a suitable notice is given below.
Notice: This property is situated in the vicinity of a transport corridor, and is currently affected, or may in the future be affected, by transport noise. Further information about transport noise, including development restrictions and noise insulation requirements for noise-affected property, are available on request from the relevant local government offices.

Appendix B

Terminology

The following is an explanation of the terminology used throughout this report.

Decibel (dB)
The decibel is the unit that describes the sound pressure and sound power levels of a noise source. It is a logarithmic scale referenced to the threshold of hearing.

A-Weighting
An A-weighted noise level has been filtered in such a way as to represent the way in which the human ear perceives sound. This weighting reflects the fact that the human ear is not as sensitive to lower frequencies as it is to higher frequencies. An A-weighted sound level is described as L_A dB.

Sound Pressure Level (L_p)
The sound pressure level of a noise source is dependent upon its surroundings, being influenced by distance, ground absorption, topography, meteorological conditions etc and is what the human ear actually hears. Using the electric heater analogy above, the heat will vary depending upon where the heater is located, just as the sound pressure level will vary depending on the surroundings. Noise modelling predicts the sound pressure level from the sound power levels taking into account ground absorption, barrier effects, distance etc.

L_{Amax}
An L_{Amax} level is the maximum A-weighted noise level during a particular measurement.

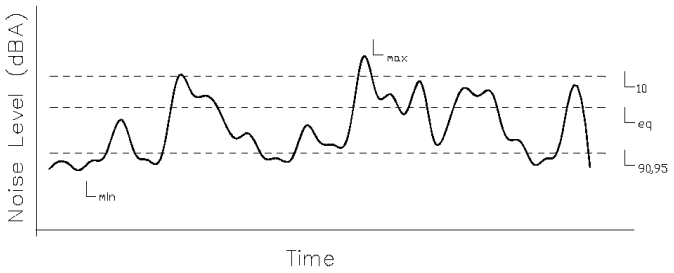
L_{A1}
An L_{A1} level is the A-weighted noise level which is exceeded for one percent of the measurement period and is considered to represent the average of the maximum noise levels measured.

L_{A10}
An L_{A10} level is the A-weighted noise level which is exceeded for 10 percent of the measurement period and is considered to represent the "*intrusive*" noise level.

L_{Aeq}
The equivalent steady state A-weighted sound level ("equal energy") in decibels which, in a specified time period, contains the same acoustic energy as the time-varying level during the same period. It is considered to represent the "average" noise level.

L_{A90}
An L_{A90} level is the A-weighted noise level which is exceeded for 90 percent of the measurement period and is considered to represent the "*background*" noise level.

Chart of Noise Level Descriptors



Typical Noise Levels