Appendix C

Outstanding Issues and Action Plan

APPENDIX 1 OUTSTANDING ISSUES AND ACTION PLAN

Post Execution of Alliance Contract

ISSUE / ACTIONS	COMMENT AND RECOMMENDED ACTION	TIMING FOR IMPLEMENTATION
Construction Reference Group (CRG) meetings	At the award of the Alliance contract, Main Roads and the Alliance partner will need to confirm whether to use a Construction Reference Group and if so, the selection process for membership will be in accordance with Main Roads protocols. It is recommended two Construction Reference Groups are formed. • Northern and Central • Southern Terms and conditions must align with Main Roads protocols.	Following execution of the Alliance Contract
Indigenous Heritage	The Alliance should look for opportunities to proactively engage the Traditional Owners in meaningful engagement or advocacy roles.	Following execution of the Alliance contract
Emergency Access	While this issue has been considered / presented at the CRG meetings, there is still some residual concern in the community about fire and emergency plans for the areas affected during and after construction of the BORR. The matter was recently raised in Parliament and the response provided by Minister for Emergency Services may prove useful in addressing this matter in future forums / correspondence.	This issue should be reviewed by the Alliance as part of the detailed design. The Alliance should reassemble the stakeholder group consulted on this issue to further discuss and demonstrate they are aware of its importance to the local community.
Yalinda Bridge Design	Residents adjacent to / in the vicinity of the Yalinda Road Bridge remain concerned about the visual impacts of this infrastructure. The Alliance should engage with this section of the local community to demonstrate they are aware of the importance of this issue and to collect concerns or ideas for further consideration in the detailed design. They should present the concept design and address questions regarding access, height, lighting, noise mitigation.	Following execution of the Alliance contract and at regular intervals as required.
Property Damage	Sections of the community perceive property damage will result from construction of the BORR. Information explaining the use of property	Following execution of the Alliance contract.

ISSUE / ACTIONS	COMMENT AND RECOMMENDED ACTION	TIMING FOR IMPLEMENTATION
	precondition surveys should be released to landowners within the eligible boundary to explain this process and address initial concern. The Alliance should issue correspondence to all eligible property owners to explain the precondition survey process and reassure them of the low likelihood of this risk event.	A proposed timeframe should be created to include all aspects of the property condition survey program.
Project Enabling Group (PEG)	It is recommended this group be reconvened during the delivery phase and meet bi-monthly (quarterly as a minimum) to continue dialogue at a regional level. Discussions on specific localised issues or approvals could be managed with each LGA individually or via Technical Working Group(s).	Following execution of the Alliance contract. Bi-monthly (quarterly as a minimum)
Regional Local Government Advisory Group	It is recommended the members of this group are incorporated into a new Project Steering Committee during the delivery phase.	Following execution of the Alliance contract. Initially Bi-monthly moving to quarterly
Aboriginal Participation Advisory Group	This group was established to support the implementation of the Aboriginal participation objectives for the project. The Alliance should actively facilitate regular meetings of this group and provide updates, implement recommendations, and report on progress against targets.	Quarterly or as agreed during the design and construction phase.
Local Business Content Advisory Group	This group was established to maximise opportunities for local business content within the project. The Alliance should actively facilitate regular meetings of this group and provide updates, implement recommendations, and report on progress against targets.	Quarterly or as agreed during the design and construction phase.
Community Contact Cards	It is recommended the Alliance issue contact cards to all property owners within 500 metres of the alignment, and to other impacted stakeholders outside of this catchment, to promote the Alliance CSE team.	Within 60 days of the execution of the Alliance contract
Project Signage / Branding	It is recommended that signage be installed at key locations along the alignment to promote the contact details for the Alliance CSE team.	Within 60 days of the execution of the Alliance contract
Community Information Sessions / Public Displays	It is recommended the Alliance use this forum to present their design concepts, construction methodology, program and management plans.	Following execution of the Alliance contract Within the first three months, the first session should be scheduled at three venues (northern, central and southern). The Alliance will schedule sessions as required throughout the project delivery timed at key project

ISSUE / ACTIONS	COMMENT AND RECOMMENDED ACTION	TIMING FOR IMPLEMENTATION
		milestones or to support key project decisions / announcements.
Public Queries / Public Enquiry Line	It is recommended that 138 138 be used as the central contact for public queries. It is recommended that the Alliance use CONNECT to register all public queries and complaints. All contact should be acknowledged within 48 hours of the contact occurring and ideally closed out within 10 business days. The Alliance must provide an out of hours telephone contact for construction issues to be made available to Main Roads and CIC.	Initially during the RFP phase and then following execution of the Alliance contract. Maintained for whole of project and for three months following project completion.
Media Queries Register	It is recommended that Main Roads / Alliance maintain a register of all media queries and responses throughout delivery to ensure consistency.	Following execution of the Alliance contract. Maintained for whole of project.
LGA Briefings	It is recommended that the Alliance schedule quarterly briefings for all LGAs (elected members) to maintain proactive communication / promotion of project milestones and progress.	Following execution of the Alliance contract. Quarterly or as required.
Members of Parliament Briefings	It is recommended that Main Roads / Alliance schedule quarterly briefings for Local Members of Parliament to maintain proactive communication / promotion of project milestones and progress. CRG presentations or any other publications released by the Alliance as background information may be provided to MPs as required.	Following execution of the Alliance contract. Quarterly or as required.
Liaison with Affected Businesses	The Alliance will liaise with all businesses directly to inform them of upcoming construction activities that are likely to have any impact on traffic flow in the area around the Site or access tobusinesses.	Following execution of the Alliance contract. Minimum quarterly but more frequently as required to support the construction program, traffic staging.
Animation	It is recommended that high-definition animation of the project be generated to explain the project scope, alignment and traffic use. Building Information Modelling (BIM) should be used to explain significant construction elements / techniques to stakeholder groups such as the Construction Reference Group.	Following detailed design To support major project elements or construction impacts
Market Research	Professional market research of the local community must be provided to monitor communication and stakeholder engagement issues. This will	Following execution of the Alliance contract.

ISSUE / ACTIONS	COMMENT AND RECOMMENDED ACTION	TIMING FOR IMPLEMENTATION
	include a baseline Project awareness survey. Market research will monitor local community and stakeholder awareness; timeliness and usefulness of Alliance information; preferred communications channels; and Project sentiment.	Wave 1 should be conducted within 60 days of execution of the Alliance contract (to establish baseline). Subsequent waves to be conducted at 6 monthly intervals from the start of construction until completion.
Site visits	It is recommended the CRG, if formed, and other key stakeholder reference groups such as the PEG are invited to tour the site with key Alliance personnel to observe progress. A multi-seat vehicle should be provided by the Alliance for this purpose. Consideration should be given to providing viewing platforms or stages for observation purposes.	Following execution of the Alliance contract. Six monthly or as required for milestone events.
Existing Solar Lighting Raymond Rd and Ransom Drive	Shire of Harvey solar lighting at the intersection of Raymond Road and Ranson Drive to be removed and returned to the Shire.	Just prior to works in the vicinity
Lakes Road fire break	The existing Lakes Road that is redundant is to be ripped only and retained as a fire break.	When road becomes redundant.

Appendix D

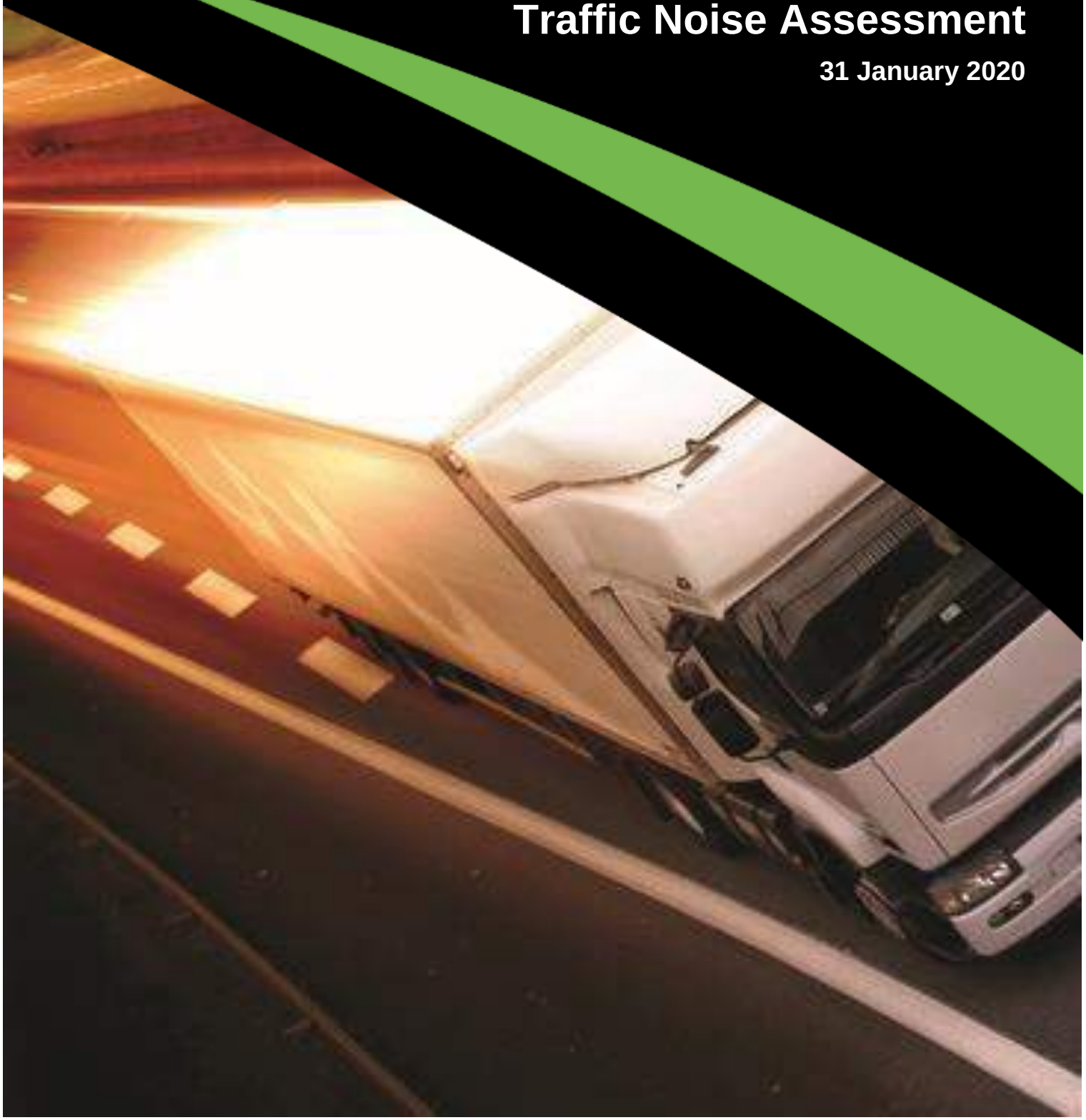
Traffic Noise Assessment

BORR Team

Bunbury Outer Ring Road
Northern and Central Sections

Traffic Noise Assessment

31 January 2020



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APPENDICES

Document Control

Revision	Date	Description	Prepared	Reviewed	Approved
A	29/01/2019	Draft for Main Roads review	BORR Team	CG	PM
B	28/02/2019	Draft for Main Roads review	BORR Team	CG	PM
C	2/04/2019	Draft for Main Roads review	BORR Team	CG	PM
D	10/5/2019	Draft for Main Roads review	BORR Team	CM	PM
E	31/01/2020	For EPA review	BORR Team	MJ	FH

ABBREVIATIONS

Term	Definition
BORR	Bunbury Outer Ring Road
BoM	Bureau of Meteorology
CoRTN	United Kingdom Department of Transport, Calculation of Road Traffic Noise (Algorithm)
CS	Chip seal
DA	Development Application
DGA	Dense grade asphalt
GBRS	Greater Bunbury Regional Scheme
HGV	Heavy goods vehicle
LV	Light vehicle
PSP	Principal shared path
SPP 5.4	*State Planning Policy 5.4 - Road and Rail Noise*
SWTC	Scope of Works and Technical Criteria
NSR	Noise sensitive receiver

Note: Refer to Appendix B for an explanation of the noise terminology used throughout this report.

1 INTRODUCTION

1.1 General

The Commissioner of Main Roads Western Australia (Main Roads) is proposing to construct and operate the Northern and Central sections of the Bunbury Outer Ring Road (BORR) project (Figure 1, Appendix A). The BORR is a planned Controlled Access Highway linking the Forrest Highway and Bussell Highway, and will provide a high standard route for access to the Bunbury Port. The completed BORR will also provide an effective bypass of Bunbury for inter-regional traffic and freight, reducing traffic on the local road network, and facilitate proposed development to the east of the city of Bunbury.

BORR forms a major component of the planned regional road network for the Greater Bunbury area.

The proposed BORR comprises three sections:

- 'BORR Northern Section' – Forrest Highway to Boyanup-Picton Road
- 'BORR Central Section' – Boyanup-Picton Road to South Western Highway (south), an existing 4 km section which was completed in May 2013, along with a 3 km extension of Willinge Drive southwards to South Western Highway
- 'BORR Southern Section' – South Western Highway (near Bunbury Airport) to Bussell Highway.

This document refers to BORR Northern and Central sections only.

The Central Section has been previously constructed however further improvements are proposed for this section, including the extension of Willinge Drive southwards to South Western Highway.

1.2 Project description

The Proposal is located within the City of Bunbury and Shires of Capel, Dardanup and Harvey, and at its closest point is approximately 6 km south-east of Bunbury and 200 km south of Perth.

The Proposal includes construction and operation of BORR North and Central sections. These sections comprise 19 km of new dual carriageway and associated bridges, interchanges and other road infrastructure including, but not limited to, culverts, lighting, noise barriers, fencing, landscaping, road safety barriers and signs. The components of the Proposal are described below.

The area being referred by Main Roads is up to 651 hectares (ha), which includes existing road reserves, agricultural land and native vegetation. This area is referred to as the Proposal area. The Proposal area excludes areas within BORR Central Section which was constructed in 2013. The Proposal area is illustrated in Figure 1 (Appendix A).

The Project will include the following components:

- 19 km of new rural freeway standard, dual carriageway
- A grade separated interchange at the intersection of Forrest Highway, Paris Road and Clifton Road
- A grade separated interchange at Raymond Road
- A grade separated interchange at South West Highway
- A grade separated interchange at Waterloo (Wireless Road)
- A grade separated interchange at Willinge Drive

- Extension of Willinge Drive south (3 km) to intersect with South West Highway
- New local roads and existing local road modifications
- Utility modifications

1.3 Report purpose

This Report presents the revised findings of a traffic noise assessment that is based upon the Ultimate Design concept. The Report identifies the noise sensitive receptors that will require some form of mitigation treatment to satisfy the noise criteria prescribed within State Planning Policy 5.4 [1]. This report incorporates final road layouts particularly in relation to the revised layout at Raymond Road and South Western Highway which has resulted in a change to traffic volume numbers and percentage of HGV's.

This report also provides clarification in relation to the EPA notice requiring information for assessment dated 17 July 2019. Issue # 4 requests clarification for noise impact and mitigation as below:

- *'Section 4.8.5 of the referral supporting document provides an assessment of the day time noise and exceedances. Please provide clarification and a further detailed assessment outlining both day-time noise and night-time noise and any expected exceedances.'*

  The above is addressed in Section 4.4 of this report, with figures 4.6 to 4.11 highlighting any residence that is predicted to be subject to outdoor noise levels above the applicable noise target.

- *'Given that most of the 44 properties that are expected to receive noise levels above the State Planning Policy 5.4 limits are located in the northern alignment adjacent to the existing Forrest Highway in Australind, please provide additional justification for the absence of noise walls (as per Appendix A Figure 23) to mitigate noise impacts to this community.'*

  Recommendation is provided in Section 4.4 of this report to provide noise wall mitigation for the area of Kingston adjacent to the existing Forrest Highway. The predicted noise mitigation effect on the outdoor noise levels at the particular residences is presented in Figures 4.6 to 4.11, which demonstrates the before and post construction noise wall mitigation outdoor noise levels.

This Report has been prepared to inform the environmental referral to the Environmental Protection Authority under the *Environmental Protection Act 1986*.

1.4 Scope of work

The road traffic noise assessment scope of work is as follows:

- Development of a road traffic noise model based on existing (2018) traffic flows on surrounding roads and predicted future (2041) traffic flows on the BORR Project and existing roads.
- Validation of noise model by comparing forecast 2018 noise levels to noise measurements of existing roads.
- Assessment of future (2041) predicted noise levels in order to identify sensitive receptors which will require some form of noise mitigation treatment to satisfy the noise criteria prescribed within SPP 5.4.
- A comprehensive report on the noise model and results.
- Clarification and further detailed assessment outlining both day-time and night-time predicted outdoor noise levels at NSRs and highlighting any expected exceedances.

[1] Department of Planning, Lands and Heritage (2019) *State Planning Policy 5.4 - Road and Rail Noise*

- Clarification of expected outdoor noise levels at properties in Kingston abutting the northern section of the Forrest Highway and presentation of noise mitigation strategy through the installation of noise walls with predicted results.

1.5 Approach

The road traffic noise assessment was completed as follows:

- Identification of noise sensitive receptors and selection of locations for unattended noise monitoring at existing roads in proximity to sensitive receptors and the current BORR alignment.
- Unattended noise monitoring was undertaken for one week at each site. Noise monitoring was used to provide existing noise measurements and to validate the noise model.
- Develop a validated road traffic noise model to assess noise impacts from the potential increase in traffic movements associated with the project.
- Use validated noise model to quantify noise impact and determine if measures are required to mitigate noise to sensitive receptors in line with criteria established by the *State Planning Policy 5.4 - Road and Rail Noise* (SPP 5.4).

1.6 Limitations

This report may only be used and relied on for the purpose set out in Sections 1.4 and 1.5 of this report. The services undertaken in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. There is no responsibility nor obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions described in this report. Liability arising from any of the assumptions being incorrect is disclaimed.

This report has been prepared on the basis of information provided by others, which has not independently verified or checked beyond the agreed scope of work.

The opinions, conclusions and any recommendations in this report are also based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points. Site conditions may change after the date of this Report. There will be no acceptance of responsibility arising from, or in connection with, any change to the site conditions. There is no responsibility for updating this report if the site conditions change.

Responsibility to third parties arising in connection with this report or any implied warranties and conditions is disclaimed, to the extent legally permissible.

2 NOISE CRITERIA

2.1 Road traffic noise

State Planning Policy 5.4 - Road and Rail Noise (SPP 5.4) [2] outlines the most relevant criteria for transportation noise. SPP 5.4 has been adopted by the Western Australian Planning Commission as a whole of Government approach to managing noise from transportation sources.

Table 2-1 outlines outdoor noise criteria applying to proposals for new major roads and major road upgrades under SPP 5.4.

Table 2-1 Outdoor noise criteria

Time period	New road	Major upgrade to road
$L_{Aeq\ (Day)}$ 6:00 am to 10:00 pm	L_{Aeq} 55 dB	L_{Aeq} 60 dB
$L_{Aeq\ (Night)}$ 10:00 pm to 6:00 am	L_{Aeq} 50 dB	L_{Aeq} 55 dB

Table 2-2 (an extract from Table 1 of SPP 5.4) identifies the State's transport corridors and the trigger distances to which the policy applies. The roads along with approximate trigger distances for each transport corridor classification, can also be viewed on the Department's public mapping viewer[3] and also are identified in maps (Schedule 1, 2 and 3 of the policy). These roads have been identified as their freight function and/or high traffic volumes are considered to significantly generate noise in excess of the policies noise targets.

SPP 5.4 also states that *"The designation of land within the trigger distances outlined in Table 2-2 should not be interpreted to imply that land is affected by noise and/or that areas outside the trigger distances are un-affected by noise."*.

Table 2-2 Transport corridor classification and trigger distances

Transport corridor classification	Trigger distance	Distance measured from
Strategic freight and major traffic routes **Roads as defined by Perth and Peel Planning Frameworks and/or roads with either 500 or more Class 7 to 12 Austroads vehicles per day, and/or 50,000 per day traffic volume**	300 metres	Road carriageway edge
Other significant freight/traffic routes **These are generally any State administered road and/or local government road identified as being a future State administered road (red road)**	200 metres	Road carriageway edge

[2] Department of Planning, Lands and Heritage (2019) *State Planning Policy 5.4 Road and Rail Noise*
[3] Department of Planning, Lands and Heritage public map viewer, PlanWA at www.dplh.wa.gov. au.

and other roads that meets the criteria of either >= 100 Class 7 to 12 Austroads vehicles daily or >= 23,000 daily traffic count (averaged equivalent to 25,000 vehicles passenger car units under region schemes).		

As this Project involves both upgrades to an existing major road and a new road, the following SPP 5.4 policy measures apply:

- Screening traffic noise assessment and, if necessary, a detailed assessment in accordance with the guidelines.
- Practicable techniques for noise avoidance and mitigation measures should be considered in accordance with section 4 of the SPP 5.4 guidelines [4].
- The proponent should prepare a noise management plan for the redevelopment works in accordance with the guidelines, and in consultation with the state environmental agency and local government.

Section 4 of the SPP 5.4 guidelines refers to possible noise management and mitigation measures such as using separation distances, noise attenuation barriers and building design.

Section 3.2.1 of the SPP 5.4 guidelines refers to reasonable and practicable measures, recognising that it may sometimes not be reasonable and practical to meet noise target criteria. Measures are expected to be implemented to balance reasonable and practical considerations including noise benefit, cost, feasibility, community preferences, amenity impacts, safety, security and conflict with other planning and transport policies.

[4] Department of Planning, Lands and Heritage (2019) *Road and Rail Noise Guidelines*

3 NOISE MONITORING

3.1 Noise monitoring locations

Noise monitoring was used to measure existing noise levels experienced by receptors located within the Proposal Area. Unattended noise monitoring was undertaken at eight locations of which five sites were deemed as providing valid data during their logging period. The data from the three logging locations that was not utilised was unusable due to a range of conditions from meteorological conditions and corrupted data. The five data sources provided appropriate locations within the vicinity of the proposed alignment of BORR Northern and Central sections for the purpose of validating noise predictions made using the model.

Monitoring locations were chosen so as to be located on existing road sections which are forecast to contribute to combined noise levels at the properties most affected by BORR Northern and Central sections. The monitoring locations were also identified as being safe and secure for unattended equipment, minimising the risk of theft or vandalism.

A summary of relevant information such as site coordinates, distance to the nearest road and a photo of noise logger setup for the five representative sites are provided in Table 3-1. Noise monitoring site summaries for each site are provided in Appendix C. The five utilised monitoring locations are shown in Figure 3-1.

Table 3-1 Noise monitoring location summary

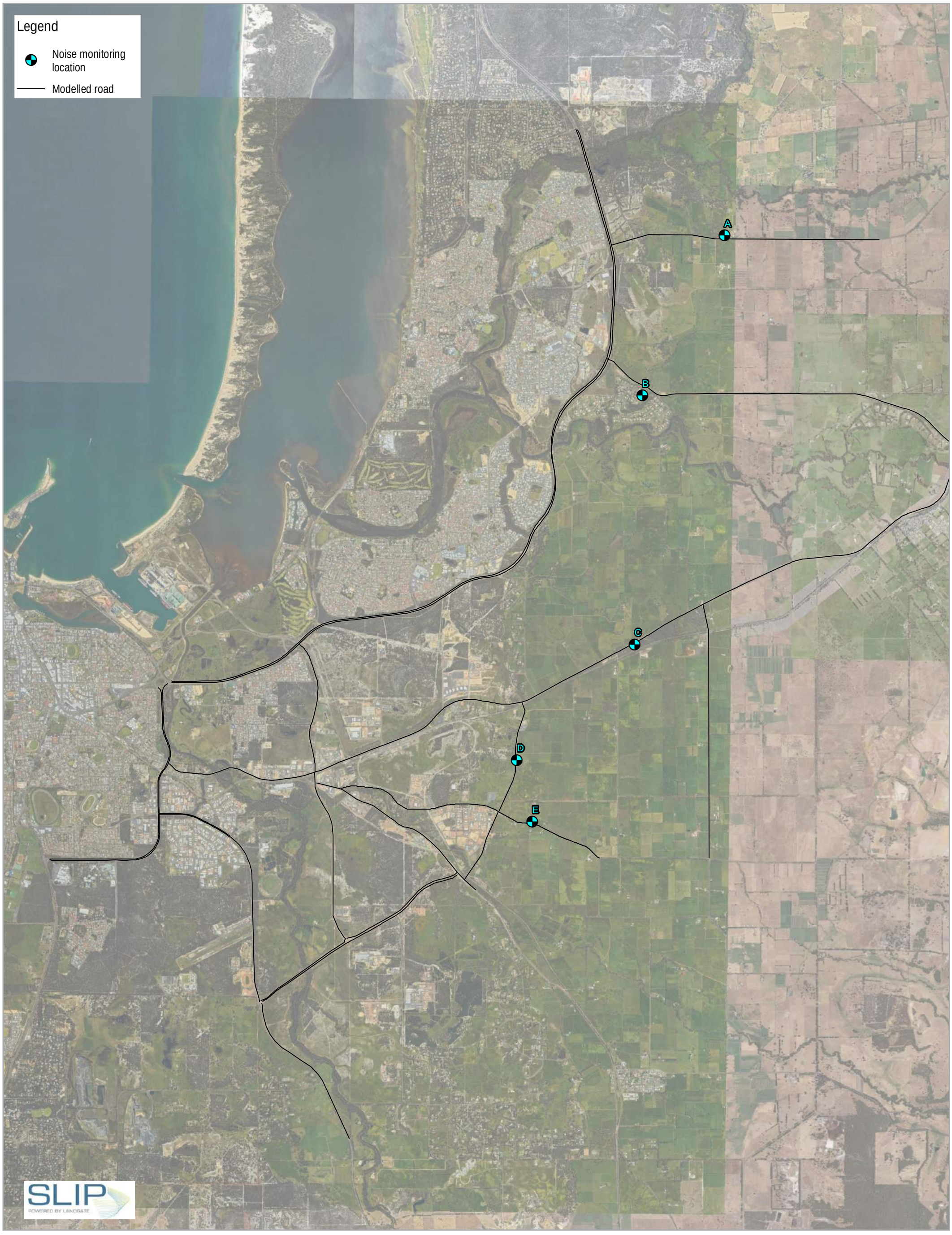
Site ID	Address	Road	PCG94 Easting (m)	PCG94 Northing (m)	Distance of logger to road (m)	Noise logger setup
A	662 Clifton Road, Brunswick	Clifton Road (2840 VPD)	46060	117874	50	

Site ID	Address	Road	PCG94 Easting (m)	PCG94 Northing (m)	Distance of logger to road (m)	Noise logger setup
B	15 Bevan Loop, Roelands	Raymond Road (3800 VPD)	44606	115041	150	

Site ID	Address	Road	PCG94 Easting (m)	PCG94 Northing (m)	Distance of logger to road (m)	Noise logger setup
C	14411 South Western Highway, Waterloo	South Western Highway (North) (6512 VPD)	44468	110634	15	

Site ID	Address	Road	PCG94 Easting (m)	PCG94 Northing (m)	Distance of logger to road (m)	Noise logger setup
D	105 Martin-Pelusey Road, Waterloo	Martin-Pelusey Road (3120 VPD)	42384	108581	20	

Site ID	Address	Road	PCG94 Easting (m)	PCG94 Northing (m)	Distance of logger to road (m)	Noise logger setup
E	365 Harris Rd, Paradise	Harris Road (288 VPD)	42657	107493	30	



Paper Size ISO A3

0 0.5 1 1.5 2

Kilometres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

BORR Team

Australian Government
BUILDING OUR FUTURE

mainroads WESTERN AUSTRALIA
BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road IPS

Noise monitoring locations

Project No.	61-37041
Revision No.	0
Date	04/12/2019

FIGURE 3-1

G:\61\37041\19_0_GIS\Maps\Working\BORRNorth_NoiseFigs\6137041_3-1_NoiseMonitoringLocations_Rev0.mxd
Print date: 05 Dec 2019 - 12:40

Data source: BORR Team: Noise monitoring locations, Modelled roads - 20190307; Landgate: WA Now Aerial Imagery - accessed 20191204. Created by: mmikkonen

3.2 Unattended noise monitoring methodology

Unattended noise logging for Sites A, B, D and E was conducted from 10 to 26 September 2018 and logging at Site C was conducted from 13 to 20 December 2018.

It is noted that whilst the logging at Site C was undertaken during the school holiday period, the traffic on South West Highway is not forecast to be significantly different from normal work days. This is borne out by results from the permanent traffic count stations on Forest Highway, Bussell Highway and Coalfields Highway. With the latter, some 6.5 km from the logger site, showing that in general school holiday periods have a similar volume profile by day of the week and hour of the day to that of normal days.

During the measurement campaign, Site A experienced an equipment failure and only recorded three days of measurements, of which only one day and two nights were valid due to meteorological conditions. Given the low sensitivity of the model to noise emission from this road for overall predictions at sensitive receptors, this data is considered to be adequate for validation purposes. Site B was also subject to non-ideal meteorological conditions during this time period, however due to the longer duration of the measurement, three valid weekday periods were able to be obtained.

The instruments were programmed to accumulate environmental noise data continuously over sampling periods of 15-minutes for the entire monitoring period. Table 3-2 provides details of the noise logger and which site the loggers were used.

Table 3-2 Noise monitoring equipment summary

Specification	Type	Sites
Model	SVAN 955	A, B, D, E
	Rion NL18	C
Serial number	27621	B, E
	27625	A, D
	0099828	C
Type	Type 1	A – E
Time interval	15-minutes	A – E
Frequency weighting	A weighted	A – E

Prior to deployment and at monitoring completion, the loggers were calibrated with a sound pressure level of 94 dB at 1 kHz using a Larson Davis CAL200 sound level calibrator. The data collected by the loggers was downloaded and analysed and any invalid data removed.

All noise sampling activities were undertaken with consideration to the specifications outlined in *AS2702-1984 Acoustics – Methods for the Measurement of Road Traffic Noise*.

3.3 Noise monitoring results

Sampled noise levels for the monitoring period are provided graphically in Appendix D along with the corresponding meteorological conditions during the monitoring period at each site, including precipitation and wind speed and direction for each site. Sample periods of rainfall of > 0.2 mm and/or wind speed > 19 km/h at the noise logger have been highlighted for consideration for exclusion in Appendix D, as per procedures specified by MRWA *Appendix 23 – Traffic Noise Measurement Specification*. These data points have generally been excluded from the L_{Aeq} calculation, except for Site C (which was determined to have little

impact from wind speeds by considering data with lower wind speeds, and the close proximity of the logger to the road).

Daily noise monitoring results for each site are shown in Table 3-4, with entries significantly affected by meteorological conditions removed. The overall weekday and weekend-inclusive noise levels at each site are presented in Table 3-3.

The attended noise monitoring results are considered to be acceptable for noise model validation (refer to Section 4.3), with the exception of Site E. The CoRTN algorithms are only applicable where traffic volumes are greater than 1000 vehicles per day. Site E does not meet this requirement (288 VPD) and therefore has not been used for the purpose of model validation.

Table 3-3 Overall traffic noise facade levels measured at each site

	$L_{Aeq\ (Day)}$ dB (6:00 am to 10:00 pm)		$L_{Aeq\ (Night)}$ dB (10:00 pm to 6:00 am)	
Site ID	**Weekday**	**Weekly**	**Weekday**	**Weekly**
A	54.3	54.3	46.5	46.5
B	51.1	54.5	43.1	43.4
C	71.1	70.7	66.6	66.6
D	60.2	59.4	51.0	50.2
E	51.8	50.7	44.5	45.2

Table 3-4 Noise logging results for all sites – Weekday average

	$L_{Aeq\ (Day)}$ dB (6:00 am to 10:00 pm)		$L_{Aeq\ (Night)}$ dB (10:00 pm to 6:00 am)	
1st monitoring period	**A**	**B**	**A**	**B**
Monday, 10 Sept 2018	54.0	-	43.8	42.9
Tuesday, 11 Sept 2018	55.2	51.5	48.1	42.4
Wednesday, 12 Sept 2018	53.5	51.0	-	44.3
Thursday, 13 Sept 2018	-	50.8	-	42.9
Friday, 14 Sept 2018	-	-	-	42.5
Saturday, 15 Sept 2018	-	59.8	-	44.2
Sunday, 16 Sept 2018	-	48.6	-	43.9
Monday, 17 Sept 2018	-	-	-	-

2nd monitoring period	D	E	D	E
Monday, 17 Sept 2018	-	-	-	40.0
Tuesday, 18 Sept 2018	-	52.4	-	44.6
Wednesday, 19 Sept 2018	60.7	54.2	50.9	44.7
Thursday, 20 Sept 2018	61.4	49.5	51.9	46.4
Friday, 21 Sept 2018	59.9	48.5	51.6	44.8
Saturday, 22 Sept 2018	58.2	48.3	48.8	46.5
Sunday, 23 Sept 2018	55.9	45.8	47.3	46.6
Monday, 24 Sept 2018	58.3	-	48.8	-
3rd monitoring period	**C**		**C**	
Thursday, 14 Dec 2018	-		-	
Friday, 15 Dec 2018	71.3		66.9	
Saturday, 16 Dec 2018	69.6		64.0	
Sunday, 17 Dec 2018	68.3		63.2	
Monday, 18 Dec 2018	71.1		66.8	
Tuesday, 19 Dec 2018	71.2		67.0	
Wednesday, 20 Dec 2018	71.3		-	

4 NOISE MODELLING

4.1 Noise model

Noise modelling was undertaken using CadnaA 2019. CadnaA is a computer program for the calculation, assessment and prognosis of noise exposure. Environmental noise propagation in CadnaA was calculated using the CoRTN algorithm with the -1.7 dB adjustment for Australian roads as recommended in the SPP 5.4 guideline. A -8.0 dB correction is applied to the exhaust and -0.8 dB to the engine (based on Transportation Noise Reference Book, Paul Nelson, 1987), so as to provide consistent results with the CoRTN algorithms for the no barrier scenario. Where noise levels are predicted at a residence, this is at 1.0 metre from the facade, resulting in a + 2.5 dB correction due to reflected noise.

Noise modelling assumptions and model configurations to reflect the design and site specific conditions are presented in Table 4-1.

Table 4-1 Noise modelling assumptions and configurations

Inputs/Assumptions	Data Incorporated into Noise Model
Noise model	CadnaA 2019
Prediction algorithm	United Kingdom Department of Transport, Calculation of Road Traffic Noise (CoRTN)
Heavy vehicle %	Day and night heavy vehicle (HV) percentages assumed to be the same as current measured traffic data.
Existing traffic speeds, volumes and road surfaces	As shown in Table 4-3
Future traffic speeds, volumes and road surfaces	Speeds for future design year as provided by the design team, refer to Table 4-4
Low traffic flow correction	Enabled
Road gradient	Taken into account based upon the concept Ultimate Road Design.
Terrain resolution	5 m ground contours with spot heights for earthworks, triangular grid.
Buildings	Buildings modelled at 3.5 m height, digitised from aerial imagery
Façade noise maps	1.4 m receiver height (ground floor), 1 m from building façade
Road surface adjustments	Existing (2018): • 10 mm chip seal: +2.5 dB • 14 mm chip seal: +3.5 dB Future (2041 Build): • Interchange (on/off ramps and connecting roads – up to 100 m on approach) and Raymond Rd (west of BORR): DGA: + 0 dB • All other areas of BORR: 14 mm chip seal: +3.5 dB • Minor rural roads: 10 mm chip seal: +2.5 dB
Façade correction	+2.5 dB to account for noise reflected from the façade

Inputs/Assumptions	Data Incorporated into Noise Model
CoRTN conversion factor L_{A10} - L_{Aeq}	3 dB
CoRTN factor	-1.7 dB (adapted to Australian conditions through research undertaken by the Australian Road Research Board)
Source height	Light vehicles 0.5 m Heavy vehicles – Engine at 1.5 m (-0.8 dB), exhaust at 3.6 m (-8 dB)
Receiver heights	1.4 m above ground level
Ground absorption	Roads are reflecting (G=0), all other areas outside road reserve, G=0.7
Fences and existing noise walls	Significant fences and noise walls have been included in the model

4.2 Traffic data

Short-term traffic counts

The Bunbury Outer Ring Road Integrated Project Team provided the existing and design traffic volumes for the noise model. The existing volumes were based on the short term count data available and the 2041 volumes were based on the 2041 land use scenario.

Short-term traffic counts located at 31 major roads were provided by to the BORR Team by Main Roads, and was used for verification of the existing (2018) modelling scenario. The traffic survey was undertaken in between 2015 to 2018 and used to extract total traffic counts during the day (6:00 am to 10:00 pm) and night (10:00 pm to 6:00 am).

Traffic count data from four permanent sites was also provided by Main Roads. The permanent count sites were not used to verify the noise model, as the count sites were not located within the noise model domain. However, as the traffic data was measured over a longer period (1 December 2015 to 1 June 2018), permanent traffic counts were used to analyse trends in traffic counts.

The locations of the short-term traffic counters are described in Table 4-2, and are shown in Figure 4-1.

In order to provide the 16-hour day volume and the 8-hour night volume existing traffic flow profiles and heavy vehicle percentages also were applied to the 2041 forecast volumes. For further information on the existing traffic, reference can be made to the Existing Traffic Data Report (BORR-00-RP-NO-0003 Rev C).

Table 4-2 Main Roads traffic count sites and description

Count ID number	Location description
C1	South Western Hwy, south of Coalfields Road
C2	South Western Hwy, west of Wireless Road
C3	Robertson Drive
C4	South Western Hwy, east of Dodson Road
C5	Raymond Road
C6	Willinge Drive
C7	Boyanup-Picton Road

Count ID number	Location description
C8	South Western Hwy, east of Dodson Rd
C9	South Western Hwy, west of Dodson Rd
C10	Bussell Hwy, south of South Western Hwy
C11	South Western Hwy, north of Brittain Rd
C12	South Western Hwy, east of Dodson Road
C13	BORR, east of Willinge Drive
C14	BORR, west of Willinge Drive
C15	Eelup Rotary, eastern leg
C16	Eelup Rotary, southern leg
C17	Forrest Hwy, between Eaton Drive and Hynes Road
C18	Forrest Hwy, between Eaton Drive and Old Coast Road
C19	Forrest Hwy, between Raymond Road and Hynes Road
C20	South Western Hwy, approximately 200 m East of Hynes Rd
C21	Harris Road, between Boyanup-Picton Road and Golding Cres
C23	Raymond Rd, between Balaclava Road and Inkerman Road
C24	South Western Hwy , between Henty Brook Road and Waterloo Road
C25	South Western Hwy, north of Kelly Road (Coalfields Road)
C26	Willinge Drive, north of BORR
C27	Forrest Highway, north of Old Coast Road
C28	South Western Hwy at north Boyanup Road
C29	Clifton Road
C30	Waterloo Road, south of South Western Hwy
C31	Martin-Pelusey Road, north of Boyannup Picton Rd

Paper Size ISO A3

0 0.5 1 1.5 2

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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Traffic count locations - Short term

Project No.	61-37041
Revision No.	0
Date	04/12/2019

FIGURE 4-1

G:\61\37041\19_0_GIS\Maps\Working\BORRNorth_NoiseFigs\6137041_4-1_TrafficCountLocations_Rev0.mxd
Print date: 04 Dec 2019 - 15:25

Data source: BORR Team: Traffic count locations - 20190513; Landgate: WA Now Aerial Imagery - accessed 20191204, Main roads - 2018. Created by: mmikkonen

Traffic Volume for 2018 existing and 2041 build scenarios

Traffic volume data was extracted for both total daily average (6:00 am to 10:00 pm) and total night average (10:00 pm to 6:00 am). This was then calculated as an hourly average for use with the CoRTN algorithm.

Table 4-3 provides traffic data used for the 2018 model, and Table 4-4 provides traffic data used for the 2041 model. Figure 4-2 and Figure 4-3 show the locations of the roads.

A road surface correction of 3.5 dB corresponds to 14 mm chip seal, 2.5 dB to 10 mm chip seal and 0 dB to dense graded asphalt.

Table 4-3 Average weekday traffic data for 2018 existing scenario

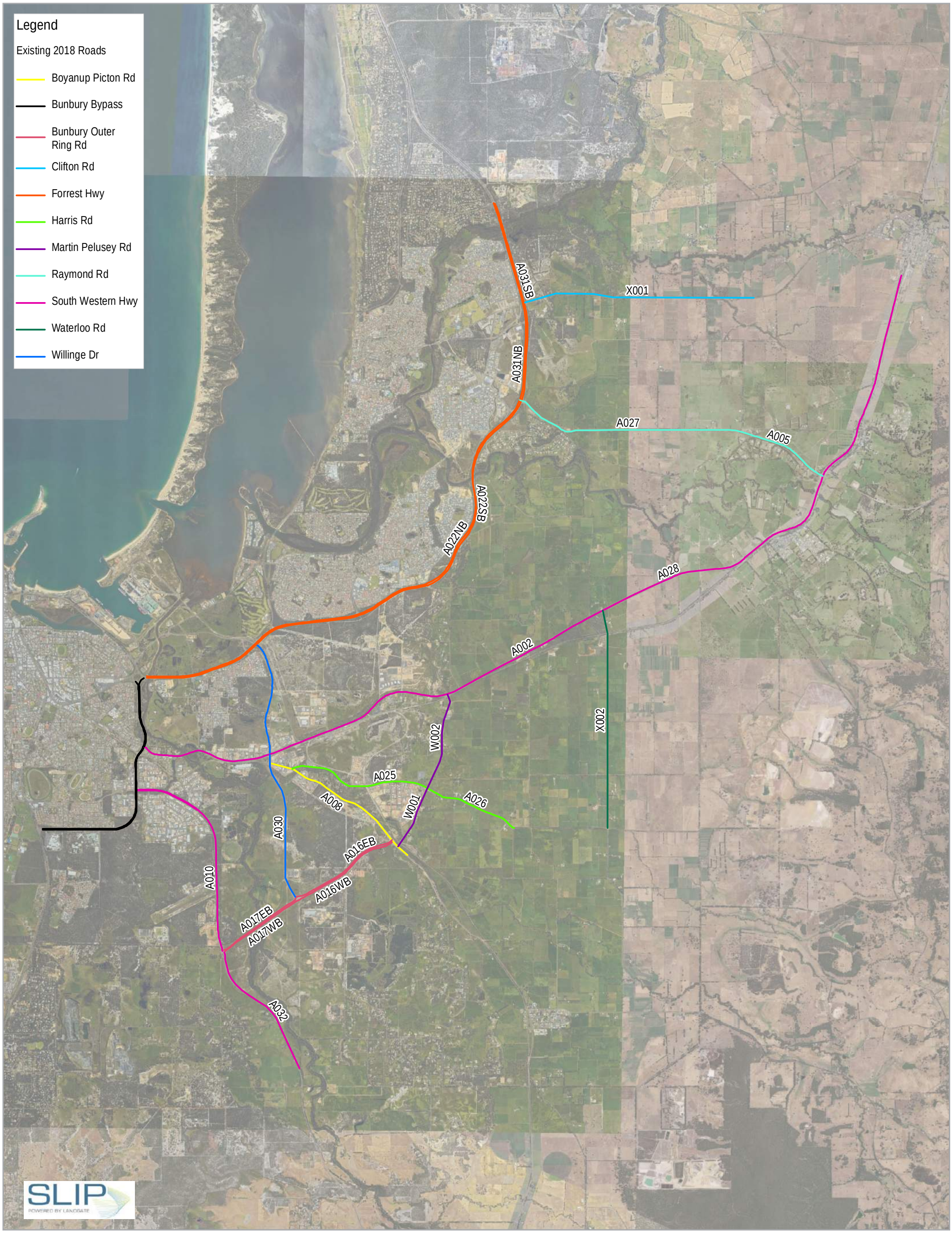
Road ID	Road name	VPH (day)	VPH (night)	%HV (day)	%HV (night)	Speed limit	Road surface
A002	South Western Hwy - Hynes Rd & Waterloo Rd	367	80	20	17	100	3.5
A005	Raymond Rd - East of Alma Rd	210	49	10	12	100	3.5
A008	Boyanup Picton Rd	258	24	16	16	90	3.5
A010	South Western Hwy - N of Bunbury Outer Ring Rd	521	101	15	30	80	3.5
A016EB	Bunbury Outer Ring Rd - E of Willinge Dr EB	92	27	23	15	100	3.5
A016WB	Bunbury Outer Ring Rd - E of Willinge Dr WB	87	15	17	35	100	3.5
A017EB	Bunbury Outer Ring Rd - W of Willinge Dr EB	129	35	25	13	100	3.5
A017WB	Bunbury Outer Ring Rd - W of Willinge Dr WB	104	17	29	50	100	3.5
A022NB	Forrest Hwy - Raymond Rd & Hynes Rd NB	545	97	12	19	100	3.5
A022SB	Forrest Hwy - Raymond Rd & Hynes Rd SB	568	74	14	20	100	3.5
A025	Harris Rd - W of Martin Pelusey Rd	80	19	30	19	80	2.5
A026	Harris Rd - E of Martin Pelusey Rd	13	10	11	6	80	2.5
A027	Raymond Rd - W of Alma Rd	209	57	11	13	80	3.5
A028	South Western Hwy - Henty Brook Rd & Waterloo Rd	399	86	18	12	100	3.5
A030	Willinge Dr - S of South Western Hwy	141	30	31	39	90	3.5
A031NB	Forrest Hwy - N of Raymonds Rd NB	575	111	13	24	110	3.5
A031SB	Forrest Hwy - N of Raymonds Rd SB	630	75	14	25	110	3.5
A032	South Western Hwy - S of Bunbury Outer Ring Rd	404	50	15	30	110	3.5
X001	Clifton Rd	166	23	5	3	100	2.5
X002	Waterloo Rd - S of South Western Hwy	52	6	36	53	100	2.5
W001	Martin Pelusey Rd - N of Boyanup Picton Rd	178	34	20	20	80	2.5
W002	Martin Pelusey Rd - S of South Western Hwy	178	34	20	20	80	2.5

Table 4-4 Average weekday traffic data for 2041 build scenario

Road ID	Road name	VPH (day)	VPH (night)	%HV (day)	%HV (night)	Speed limit	Road surface
A002	South Western Hwy - Hynes Rd & Waterloo Rd	517	113	20	17	80	3.5
A005	Raymond Rd - East of BORR	119	28	10	20	80	3.5
A008	Boyanup Picton Rd	411	38	16	17	90	3.5
A010	South Western Hwy - N of Bunbury Outer Ring Rd	233	28	15	35	80	3.5
A016EB	Bunbury Outer Ring Rd - E of Willinge Dr EB - Mod.	869	168	15	24	100	3.5
A016WB	Bunbury Outer Ring Rd - E of Willinge Dr WB - Mod.	883	105	15.00	25.00	100	3.5
A017EB	Bunbury Outer Ring Rd - W of Willinge Dr EB - Mod.	830	160	15.00	24.00	100	3.5
A017WB	Bunbury Outer Ring Rd - W of Willinge Dr WB - Mod.	833	99	15.00	25.00	100	3.5
A022NB	Forrest Hwy - Raymond Rd & Hynes Rd NB	833	99	15	25.00	80	3.5
A022SB	Forrest Hwy - Raymond Rd & Hynes Rd SB	569	101	12.00	19.00	80	3.5
A025	Harris Rd - W of Martin Pelusey Rd	585	76	14.00	20.00	80	2.5
A027EB	Raymond Rd - W of BORR EB	181	85	11.00	10.00	80	0
A027WB	Raymond Rd - W of BORR WB	225	21	11.00	23.00	80	0
A028	South Western Hwy - Henty Brook Rd & Waterloo Rd	712	154	19.00	12.00	100	3.5
A030	Willinge Dr - S of South Western Hwy - Mod.	355	110	30.00	16.00	90	3.5
A032	South Western Hwy - S of Bunbury Outer Ring Rd	352	43	15.00	30.00	110	3.5
B001NB	BORR - Willinge Drive Extension NB	304	58	30.00	41.00	90	3.5
B001SB	BORR - Willinge Drive Extension SB	291	70	32.00	37.00	90	3.5
B002EB	BORR - MP to Waterloo Interchange EB	869	168	15	24.00	110	3.5
B002WB	BORR - MP to Waterloo Interchange WB	883	105	15	25.00	110	3.5
B003NB	BORR - Waterloo Interchange to SWH NB	851	165	15	24.00	110	3.5
B003SB	BORR - Waterloo Interchange to SWH SB	862	103	15	25.00	110	3.5
B004NB	BORR - SWH to Raymond Road NB	809	156	15	24.00	110	3.5
B004SB	BORR - SWH to Raymond Road SB	820	98	15	25.00	110	3.5
B005NB	BORR - Raymond Road to Paris/Clifton NB	651	126	15	24.00	110	3.5
B005SB	BORR - Raymond Road to Paris/Clifton SB	667	80	15	25.00	110	3.5

Road ID	Road name	VPH (day)	VPH (night)	%HV (day)	%HV (night)	Speed limit	Road surface
B006NB	BORR - Paris/Clifton Forrest Highway North NB	651	126	15	24.00	110	3.5
B006SB	BORR - Paris/Clifton Forrest Highway North SB	857	102	15	25.00	110	3.5
B007	BORR SB to Forrest Ramp	101	12	15	25.00	80	0
B008NB	BORR - Forrest Hwy N of Raymond Road NB	270	52	15	24.00	80	3.5
B008SB	BORR - Forrest Hwy N of Raymond Road to BORR Merge SB	339	40	15	25.00	80	3.5
B009	BORR - Forrest SB Paris/Clifton to BORR Merge	547	88	15.00	25.00	80	3.5
B010	BORR - Paris/Clifton to Forrest Highway NB Merge	181	35	15	24.00	60	3.5
B011N	BORR - Forrest Highway / BORR North NB	832	161	15	24.00	110	3.5
B011S	BORR - Forrest Highway / BORR North SB	857	102	15	25.00	110	3.5
B012	BORR -Paris/Clifton WEST	759	124	6.00	3.00	80	2.5
B013	BORR - Paris/Clifton MIDDLE	200	25	6.00	3.00	80	0
B014	BORR - Paris/Clifton EAST	114	16	5.00	4.00	80	2.5
W001	BORR - Waterloo Loop Rd	232	45	20.00	22.00	70	2.5
W002	Martin Pelusey Rd - S of South Western Hwy	770	149	20.00	22.00	70	2.5
W003	BORR - Waterloo Wireless Rd - Link Road	690	162	30.00	55.00	70	2.5
W004N	BORR - Waterloo Wireless Rd - S of Link Road NB	74	22	30.00	19.00	70	2.5
W004S	BORR - Waterloo Wireless Rd - S of Link Road SB	73	24	27.00	12.00	70	2.5
W005	BORR - Waterloo Wireless Rd - N of Link Road	525	123	30.00	55.00	70	2.5
W006NB	BORR - Waterloo Wireless Rd - S of BORR NB	57	11	30.00	41.00	70	2.5
W006SB	BORR - Waterloo Wireless Rd - S of BORR SB	54	13	32.00	37.00	70	2.5
X001	Clifton Rd	114	16	5.00	5.00	100	2.5
Y001	BORR - Raymond Road off ramp NB	201	39	15	24.00	70	3.5
Y002	BORR - Raymond Road on ramp SB	196	23	15	25.00	70	3.5
Y003	BORR - South Western Highway off ramp NB	288	56	15	24.00	80	3.5
Y004	BORR - South Western Highway on ramp SB	294	35	15	25.00	80	3.5
Y005	BORR - Waterloo Wireless off ramp EB	76	15	15	24.00	70	3.5
Y006	BORR - Waterloo Wireless on ramp WB	76	9	15	25.00	70	3.5

Road ID	Road name	VPH (day)	VPH (night)	%HV (day)	%HV (night)	Speed limit	Road surface
Y007	BORR - Waterloo Wireless on ramp EB	58	11	15	24.00	70	3.5
Y008	BORR - Waterloo Wireless off ramp WB	55	7	15	25.00	70	3.5
Y009	BORR - Willinge Dr off ramp EB	160	31	15	24.00	70	3.5
Y010	BORR - Willinge Dr on ramp EB	158	19	15	25.00	70	3.5
Y011	BORR - Willinge Dr on ramp WB	199	38	15	24.00	70	3.5
Y012	BORR - Willinge Dr off ramp WB	207	25	15	25.00	70	3.5
Y013	BORR - Raymond Road on ramp NB	46	9	15	24.00	70	3.5
Y014	BORR - Raymond Road off ramp SB	48	6	15	25.00	70	3.5
Y015	SWH NBnd on Ramp	246	48	15	24.00	70	3.5
Y016	SWH Sbnd off Ramp	252	30	15	25.00	70	3.5



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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
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2018 Existing scenario road locations

Project No.	61-37041
Revision No.	0
Date	04/12/2019

FIGURE 4-2

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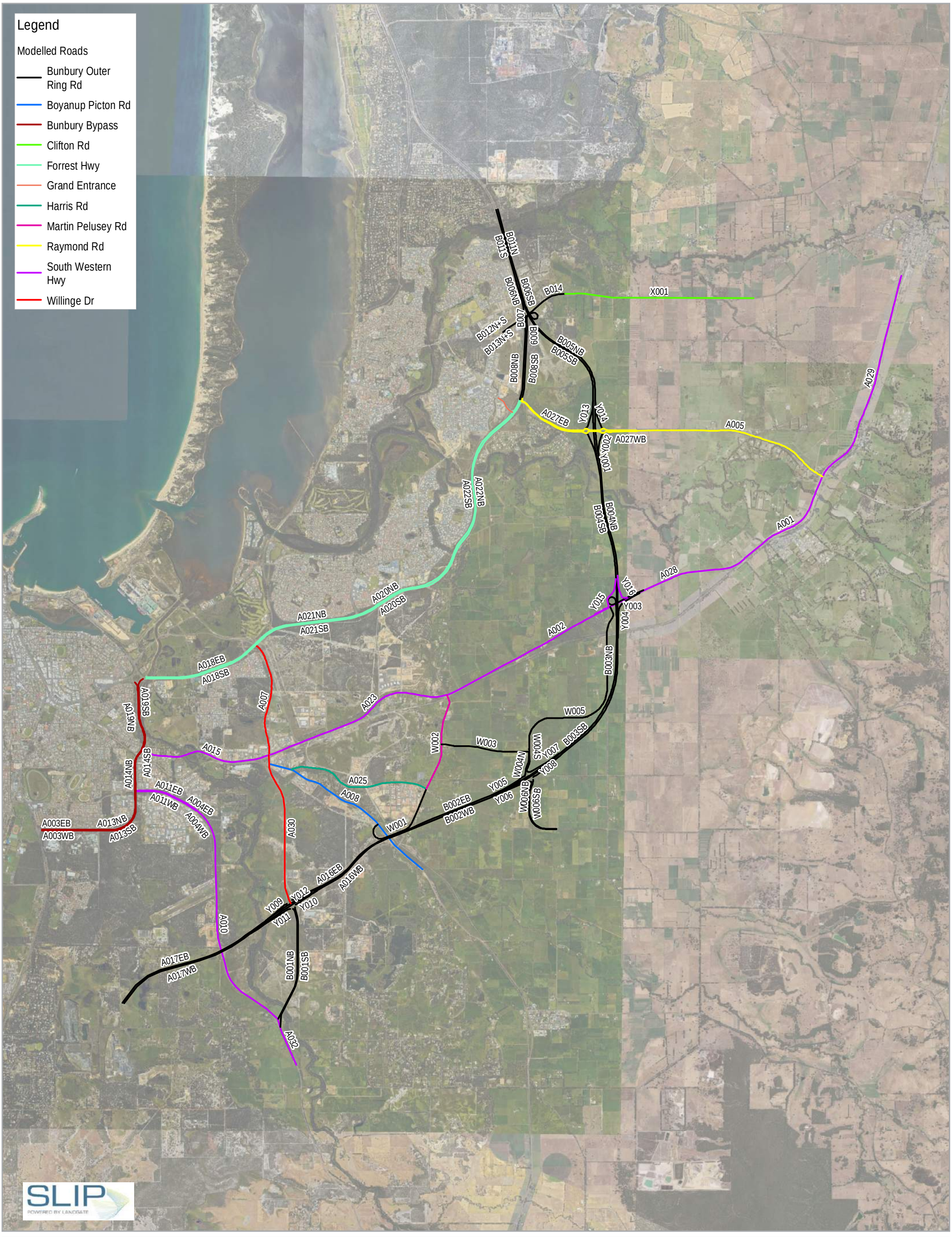
Print date: 04 Dec 2019 - 15:21

Data source: BORR Team: Existing 2018 roads - 20190307; Landgate: WA Now Aerial Imagery - accessed 20191204. Created by: mmikkonen



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Map Projection: Transverse Mercator
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2041 Build scenario road locations

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Revision No.	0
Date	04/12/2019

FIGURE 4-3

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Print date: 04 Dec 2019 - 15:11

Data source: BORR Team: Modelled roads - 20191204; Landgate: WA Now Aerial Imagery - accessed 20191204. . Created by: mmikkonen

4.3 Noise model validation

The purpose of noise model validation is to demonstrate that the noise model produced for the existing situation, is an accurate representation of the real world within the limitations of the prediction algorithm and to identify errors associated with geospatial data and modelling approach. This is to provide greater confidence in the recommendations and assessment completed for the 2041 scenario.

Table 4-5 shows the measured noise levels, predicted noise levels and the difference between measured and predicted noise levels at the five chosen locations within the study area. The results are discussed below by drawing a comparison between measured and predicted noise levels.

A review of the difference between predicted and measured noise levels in Table 4-5 shows that the predicted noise levels are generally within a tolerance of +/- 3 dB, except for site E. This logger location was in an area with lower traffic volumes and it appears that the results may have been dominated by other ambient noise sources than actual road noise emission. This site is therefore disregarded from the calibration process.

We note that site C which was located only 15 m away from the side of the South Western Hwy and is also the most accurate of the modelled locations when compared to the monitored noise levels. It also demonstrates a difference of 4.5 dB between the $L_{Aeq(Day)}$ and $L_{Aeq(Night)}$ which is very similar to the SPP 5.4 difference between day and night outdoor noise criteria 5 dB differential. It is this site that is considered to be the most representative or BORR noise levels and the day/night relationship.

We have applied the site C -1.4 dB correction to the predicted noise model levels to correlate with in-situ noise level at this site. The overall existing noise model is considered valid to undertake the assessment.

Table 4-5 Noise model validation

Location	Distance from logger to road (m)	Measured LAeq dB		Difference between measured LAeq(Day) and LAeq(Night)	Modelled LAeq(Day)	Over prediction (dB)
		LAeq(Day)	LAeq(Night)	dB	dB	
Site A **662 Clifton Road, Brunswick**	65	54.3	46.5	7.8	57.1	2.8
Site B **15 Bevan Loop, Roelands**	150	51.1	43.1	8	52.6	1.5
Site C **14411 South Western Highway, Waterloo**	**15**	**71.1**	**66.6**	**4.5**	**72.5**	**1.4**
Site D **105 Martin-Pelusey Road, Waterloo**	20	60.2	51.0	9.2	62.2	2.0
Site E **365 Harris Rd, Paradise**	30	51.8	44.5	7.3	48.3	-3.5*

4.4 Predicted noise levels

The predicted existing (2018) day (Figure 4-4) and night (Figure 4-5) road traffic noise maps are presented as are the predicted future (2041) day (Figure 4-6) and night (Figure 4-7) noise maps (2041) with BORR present and no noise mitigation treatment. The revised figures presented are based on some altered road layouts and traffic volumes. Most sensitive receivers were found to have a predicted day L_{Aeq} noise level more than 5 dB above the night L_{Aeq} noise level, and therefore where compliance with the SPP 5.4 noise criteria are predicted to be achieved during the day, they are also predicted to be achieved at night. For the purposes of evaluation in this report the SPP 5.4 $L_{Aeq(Day)}$ outdoor noise target is used as the governing factor.

For clarity, predictions at non-residential structures such as commercial use, sheds and garages are not included as SPP 5.4 does not apply at these structures.

Exceedances

With reference to Section 2, SPP 5.4 provides different outdoor noise targets dependent on whether the noise sensitive residence is located in proximity to a road that will be a majorly upgraded road or a new road.

Residences within proximity to upgraded roads

Without any noise mitigation treatment, 49 properties are predicted to experience noise levels above the SPP 5.4 noise target for upgraded roads of $L_{Aeq(Day)}$ 60 dB in 2041. This figure has risen from the previous 2041 modelling due to a change in road layout, traffic volume figures, percentage of HGV's and SPP 5.4 amendments. It is noted that the vast majority of these properties (40) are located adjacent to the existing Forrest Highway, north of the BORR/Forrest Interchange in the Kingston estate area to the west of the road. Traffic noise emission for properties closest to the Forrest Highway in this area are forecast to receive levels up to $L_{Aeq(Day)}$ 68 dB. Residences closest to the road are the most exposed to noise with the buildings further back partially screened from noise by the buildings to front.

Where multiple dwellings are located close together located adjacent to a road one of the most efficient and effective methods of noise mitigation is through the installation of one continuous noise wall in line with the road noise source. In recognising the challenges in achieving noise level reduction where existing road infrastructure is surrounded by existing noise-sensitive development, the Project aims to mitigate noise levels to as low as possible and at a minimum to meet L_{Aeq} 60 dB day noise limit.

It is also noted that upgrades are proposed for the alignment of Raymond Road which will also include final resurfacing with low noise emission dense graded asphalt. These residences which are deemed to have the $L_{Aeq(Day)}$ 60 dB outdoor noise criteria are predicted to be compliant post these works.

Residences within proximity to new roads

Without any noise mitigation treatment, 38 properties are predicted to experience noise levels above the SPP 5.4 noise target for new roads of $L_{Aeq(Day)}$ 55 dB in 2041. The majority of these residences are located in rural one off developments located adjacent to the alignment of the BORR.

Noise mitigation

In total 87 properties have been identified in 2041 as potentially being exposed to traffic related noise above their relevant SPP 5.4 outdoor noise target. These properties have been highlighted in Figure 4.8 for exceeding the day noise target (blue dots) or Figure 4.9 for night noise target (blue dots).

For more densely populated areas such as Kingston where over-exposure of noise has been predicted, the most suitable mitigation of traffic noise emission is by the installation of noise control walls, which will reduce the predicted future ambient environmental noise at the nearby noise sensitive receptors. A noise wall is a structure built between the road and a residential property to reduce traffic noise to the residence and are not only expected to provide a reduction of up to eight decibels post construction noise of the upgraded road in this area, but also provide the potential ability for abatement of noise and dust during the construction phase of this project. SPP 5.4 requires that for walls to be considered suitable for the attenuation of noise that they must be constructed of a mass with surface density 15 kg/m^2. Proposed walls for this area will meet this criteria being constructed of concrete panels, steel posts and painted or coloured concrete finish in a neutral tone. Where possible and generally where the height of walls is proposed to be above 2.7 – 3.8 m

high, it is proposed to install high density acrylic/perspex to the top part of wall to ensure good light transfer to garden areas of the residences.

With the above noise wall mitigation located in the Kingston area all residences to the west of the Forrest Highway are predicted to experience outdoor noise levels that satisfy the SPP 5.4 noise target for upgraded roads of $L_{Aeq(Day)}$ 60 dB and $L_{Aeq(Night)}$ 55 dB in 2041.

Where the residences are sparsely located then architectural treatment package provide a practical solution, consisting of, for example, upgraded glazing and mechanical ventilation (to allow windows to be kept closed). Specific architectural treatment packages are determined for each individual sensitive receptor following completion of an architectural treatment inspection. SPP 5.4 guidance document provides example treatment packages.

However due to the isolated nature of the existing sensitive receptors along the route and cognisant of the current and future land use planning (e.g. rural farmland to future industrial park), mitigation treatment will be discussed on a one-to-one basis with impacted landowners.

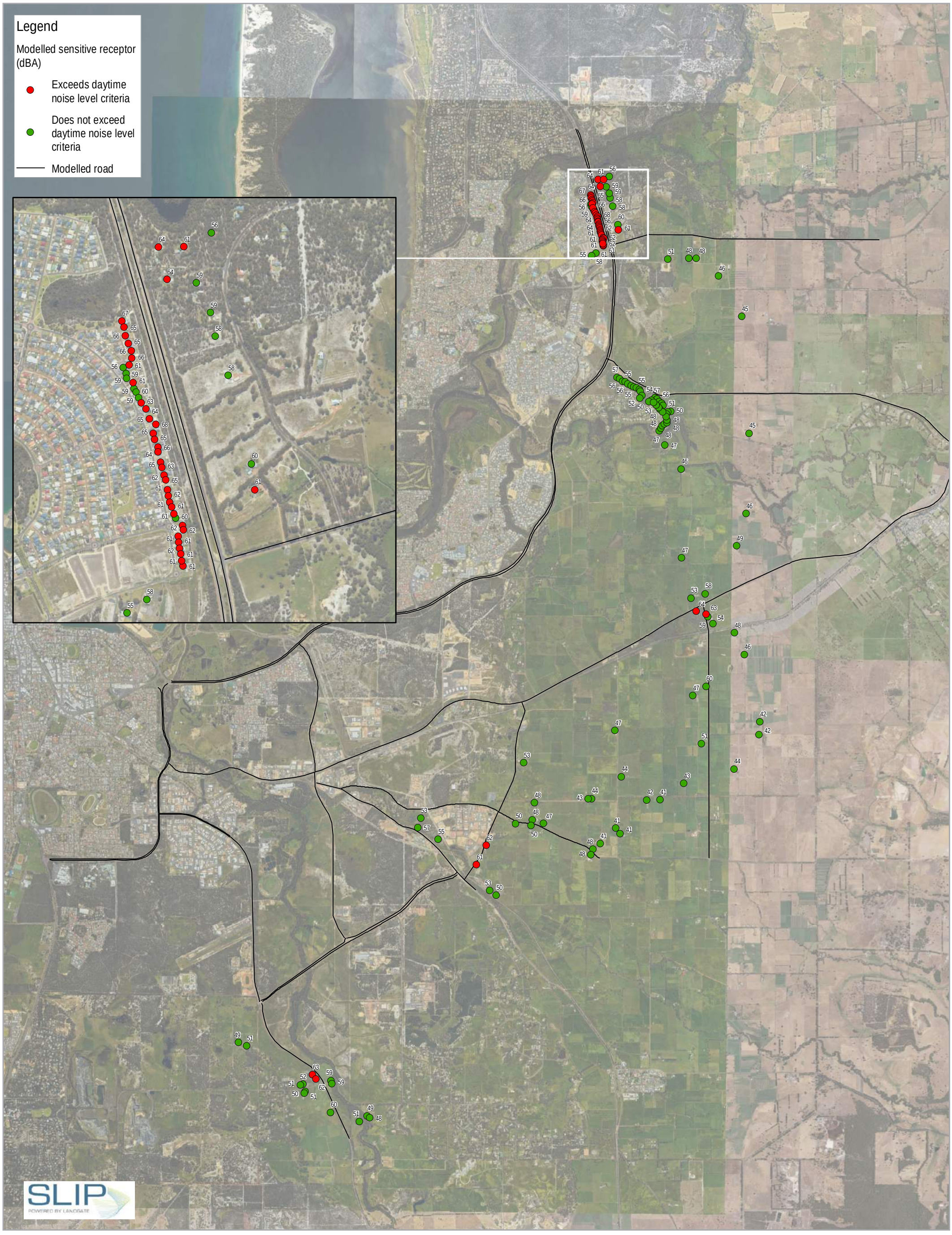
These properties that will require specific architectural treatment have been highlighted in Figure 4.8 for exceeding their day noise target (red dots) or Figure 4.9 for night noise target (red dots).

Bridge expansion joints

Where located close to sensitive receptors, bridge expansion joints may lead to elevated noise levels, depending on the type of joint installed and ongoing maintenance. Bridge expansion joints are not included in noise modelling procedures used for assessing road projects, as the approved calculation algorithms, such as CoRTN, do not parameterise noise from such sources.

Bridge expansion joint selection during detailed design will take into consideration noise impacts on surrounding sensitive receptors.

(Appendix SCM: 12.1A)



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Kilometres

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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Traffic noise $L_{Aeq\ (Day)}$ dB
Existing 2018 noise levels at the most affected façade

Project No.	61-37041
Revision No.	3
Date	22/01/2020

FIGURE 4-4

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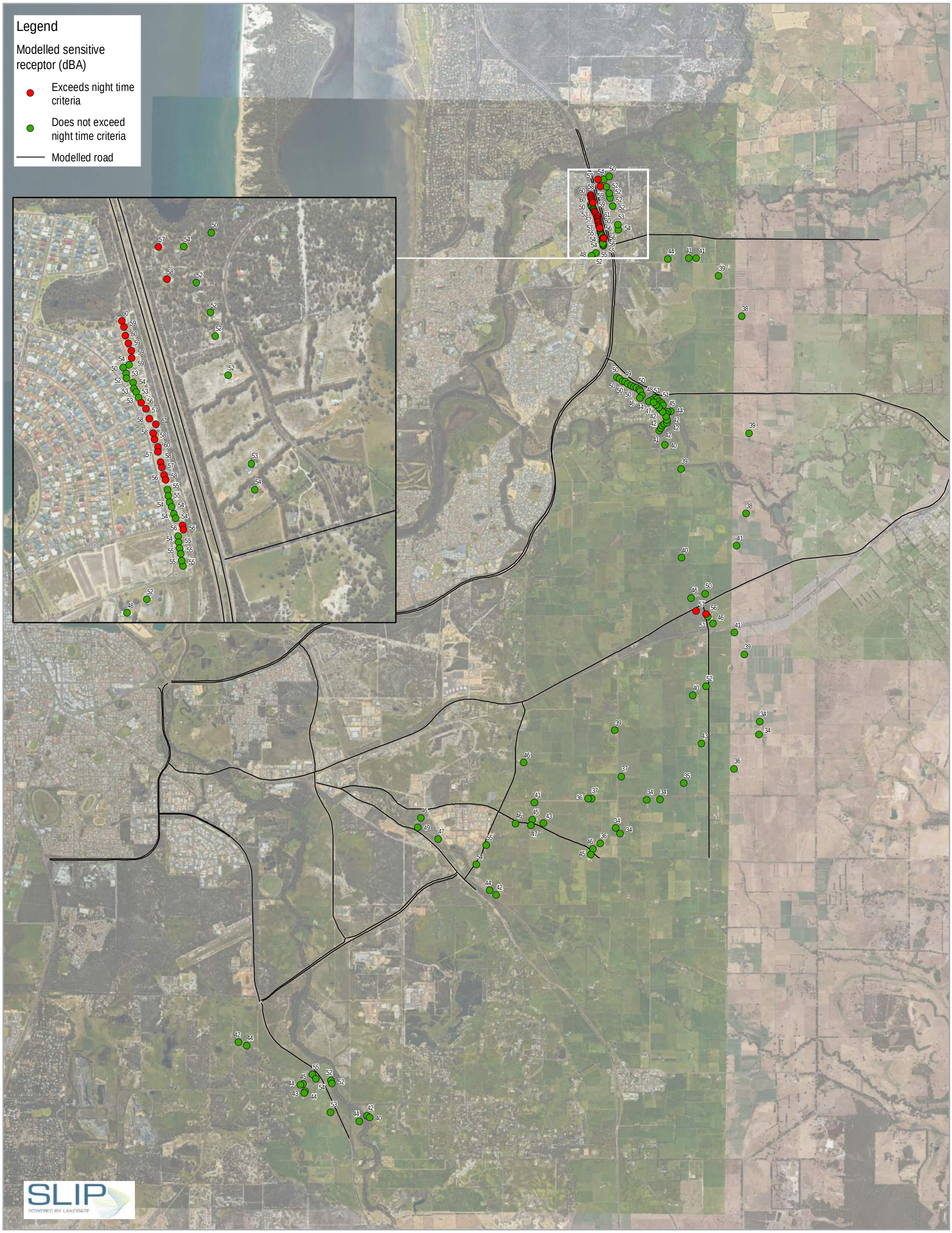
Data source: BORR Team: Noise level predictions, Modelled roads - 20200120; Landgate: WA Now Aerial Imagery - accessed 20200120. Created by: mmikkonen

(Appendix SCM: 12.1A)



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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
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Traffic noise $L_{Aeq\ (Night)}$ dB
Existing 2018 noise levels at the most affected façade

Project No.	61-37041
Revision No.	3
Date	20/01/2020

FIGURE 4-5

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Print date: 24 Jan 2020 - 16:49

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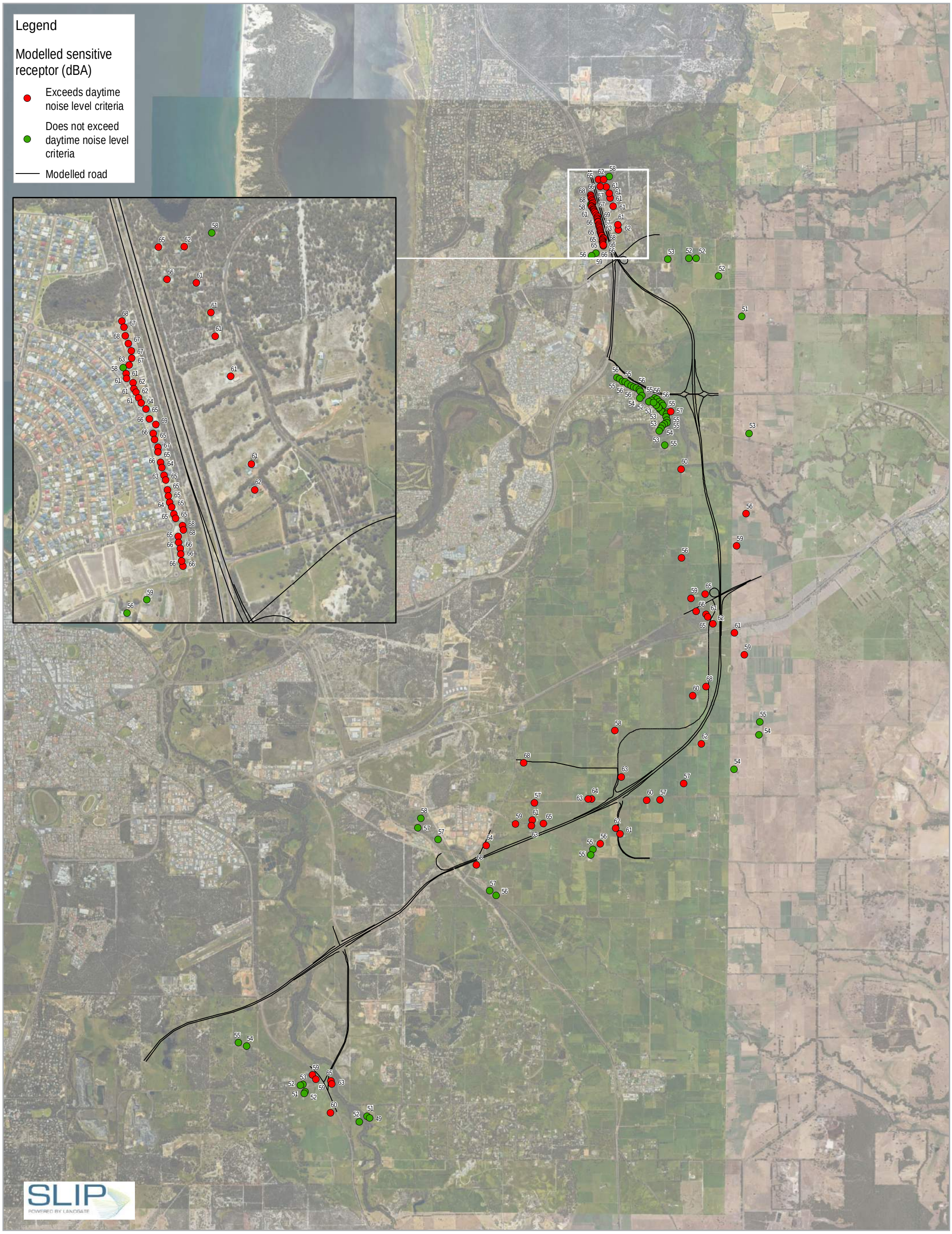
(Appendix SCM: 12.1A)



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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
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Bunbury Outer Ring Road IPS

Forecast traffic noise $L_{Aeq\ (Day)}$ **dB**
Build 2041 noise levels at the most affected façade - No treatment

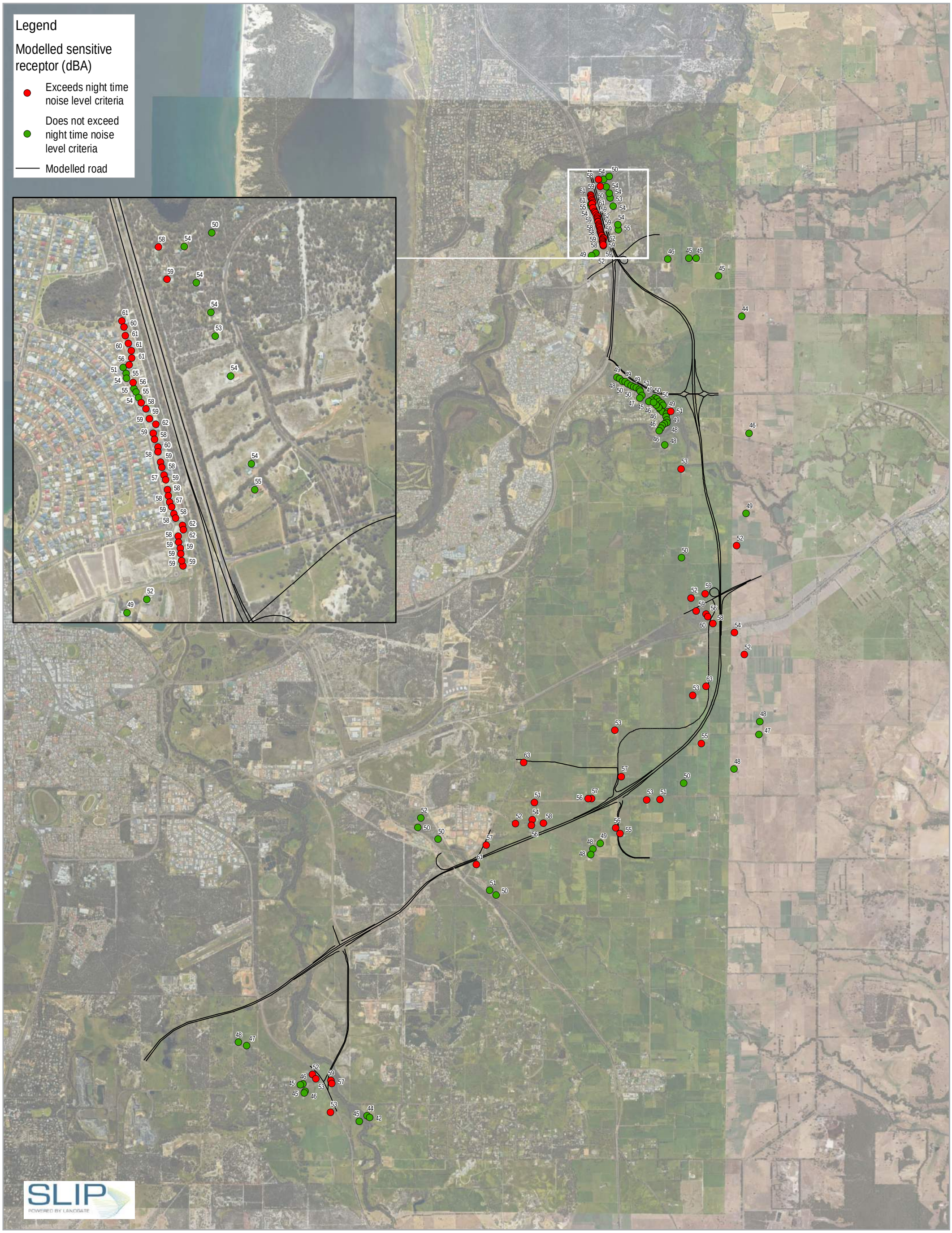
Project No.	61-37041
Revision No.	2
Date	22/01/2020

FIGURE 4-6

G:\61\37041\19_0_GIS\Maps\Working\BORRNorth_NoiseFigs\6137041_4-6_2041NoTreatmentDay_Rev2.mxd
Print date: 24 Jan 2020 - 10:12

Data source: BORR Team: Noise level predictions, Modelled roads - 20200120; Landgate: WA Now Aerial Imagery - accessed 20200120. Created by: mmikkonen

(Appendix SCM: 12.1A)



Paper Size ISO A3

0 0.5 1 1.5 2

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

N

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Main Roads Western Australia
Bunbury Outer Ring Road IPS

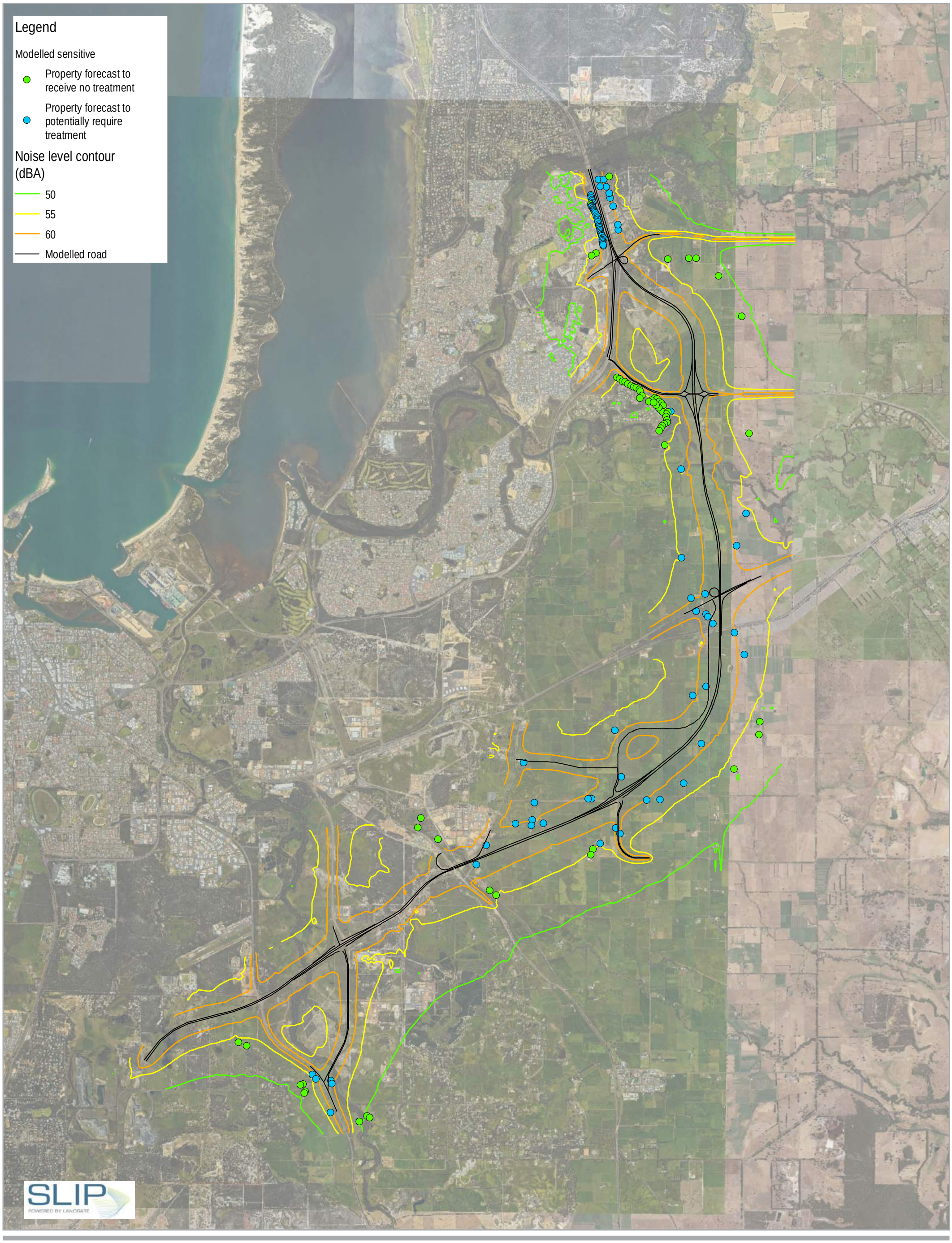
Forecast traffic noise L_{Aeq} (Night) **dB**
Build 2041 noise levels at the most affected façade - No treatment

Project No.	61-37041
Revision No.	2
Date	20/01/2020

FIGURE 4-7

G:\61\37041\19_0_GIS\Maps\Working\BORRNorth_NoiseFigs\6137041_4-7_2041NoTreatmentNight_Rev2.mxd
Print date: 24 Jan 2020 - 13:13

Data source: BORR Team: Noise level predictions, Modelled roads - 20200120; Landgate: WA Now Aerial Imagery - accessed 20200120.. Created by: mmikkonen



Paper Size ISO A3

0 0.5 1 1.5 2

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

N

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Main Roads Western Australia
Bunbury Outer Ring Road IPS

Forecast traffic noise $L_{Aeq\ (Day)}$ dB
Build 2041 noise contours - No treatment

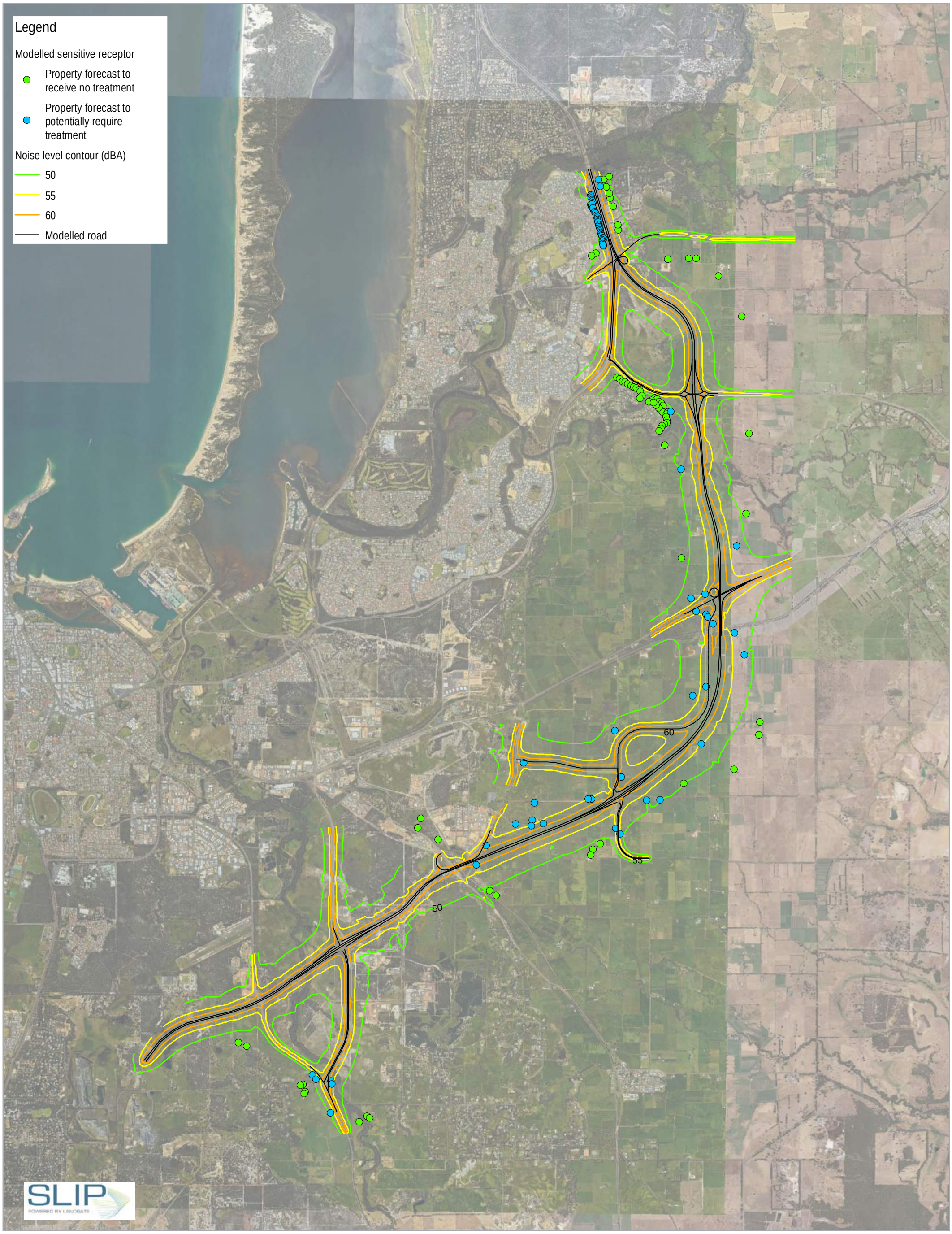
Project No.	61-37041
Revision No.	2
Date	22/01/2020

FIGURE 4-8

G:\61\37041\19_0_GIS\Maps\Working\BORRNorth_NoiseFigs\6137041_4-8_2041TrafficNoiseNoTreatmentDay_Rev2.mxd
Print date: 24 Jan 2020 - 10:14

Data source: BORR Team: Noise level predictions, Modelled roads, Noise level contour (dBA) - 20200120; Landgate: WA Now Aerial Imagery - accessed 20200120. Created by: mmikkonen

(Appendix SCM: 12.1A)



Paper Size ISO A3

0 0.5 1 1.5 2

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

N

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road IPS

Forecast traffic noise L_{Aeq} (Night) dB
Build 2041 noise contours - No treatment

Project No.	61-37041
Revision No.	2
Date	22/01/2020

FIGURE 4-9

G:\61\37041\19_0_GIS\Maps\Working\BORRNorth_NoiseFigs\6137041_4-9_2041TrafficNoiseNoTreatmentNight_Rev2.mxd
Print date: 24 Jan 2020 - 13:14

Data source: BORR Team: Noise level predictions, Modelled roads, Noise level contour (dBA) - 20200120; Landgate: WA Now Aerial Imagery - accessed 20200120. Created by: mmikkonen

Paper Size ISO A3

0 50 100 150 200

Metres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road IPS

Forecast **traffic noise** L_{Aeq} **(Day) dB -** Build 2041 noise levels **at the most affected** façade - **with noise** barriers to meet the 60 dB **outdoor** noise **target** at properties affected by upgraded roads

Project No.	61-37041
Revision No.	4
Date	22/01/2020

FIGURE 4-10

G:\61\37041\19_0_GIS\Maps\Working\BORRNorth_NoiseFigs\6137041_4-10_2041WithTreatmentDay_Rev4.mxd
Print date: 22 Jan 2020 - 15:32

Data source: BORR Team: Noise level predictions, Modelled roads - 20200120, Potential noise wall - 20190228; Landgate: WA Now Aerial Imagery - accessed 20200120. Created by: mmikkonen

(Appendix SCM: 12.1A)

Paper Size ISO A3

0 50 100 150 200

Metres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road IPS

Forecast **traffic noise** L_{Aeq} **(N**ight**) dB -** Build 2041 noise levels **at the most affected** façade - **w**ith **noise** barriers to meet the 55 dB **outdoor** noise **target** at properties affected by upgraded roads

Project No.	61-37041
Revision No.	3
Date	22/01/2020

FIGURE 4-11

G:\61\37041\19_0_GIS\Maps\Working\BORRNorth_NoiseFigs\6137041_4-11_2041WithTreatmentNight_Rev3.mxd
Print date: 22 Jan 2020 - 11:13

Data source: BORR Team: Noise level predictions, Modelled roads - 20200120, Potential noise wall - 20190228; Landgate: WA Now Aerial Imagery - accessed 20200120. Created by: mmikkonen

4.5 Conclusions

A revised road traffic noise assessment has been undertaken to predict the impact of the BORR build scenario for 2041 forecast. The model was validated using 2018 noise measurements.

The noise modelling has identified sensitive receptors which require some form of noise mitigation in order to meet the outdoor noise targets of SPP 5.4. Main Roads is committed to satisfying the noise criteria as per SPP 5.4 and will now commence discussions with impacted landowners regarding form of potential mitigation treatment measures.

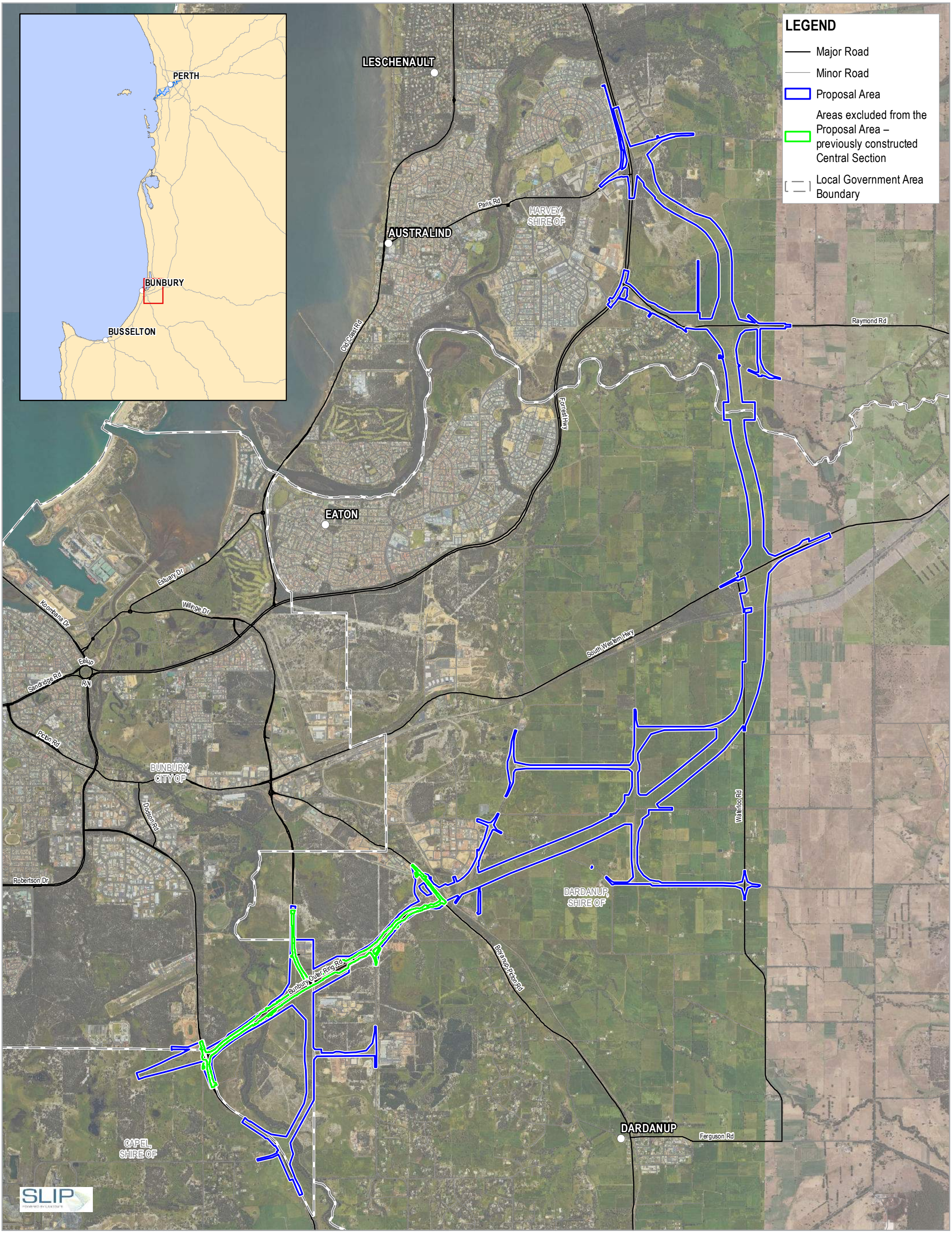
Without any noise mitigation treatment, 40 properties in the Kingston area west of the Forrest Highway are predicted to experience noise levels above the SPP 5.4 outdoor noise target for upgraded roads of $L_{Aeq(Day)}$ 60 dB or $L_{Aeq(Night)}$ 55 dB in 2041. However with the suggested noise wall mitigation installation all of these residences are predicted to experience outdoor noise levels that satisfy the SPP 5.4 noise target for upgraded roads.

For the 47 remaining properties predicted to experience noise levels above the SPP 5.4 outdoor noise target architectural packages will be offered. The specific treatment will be assessed on an individual house basis.

APPENDIX A

Project overview

(Appendix SCM: 12.1A)



Paper Size ISO A3

0 0.5 1 1.5 2

Kilometres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

BORR Team

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road Northern and Central Section
Response to EPA Notice of Decision to Assess: Additional Information Request

Proposal Area

Project No. **61-37041**
Revision No. **0**
Date **29/01/2020**

FIGURE 1

G:\61\37041\19_0_GIS\Maps\Working\BORRNorth_ARIFigures\6137041_001_TheProposal_Rev0.mxd
Print date: 29 Jan 2020 - 13:19

Data source: Geoscience Australia: GeoData Topo 250k Series III - 2006; Landgate: Roads, LGA Boundaries - 20180501, Imagery - WA Now accessed 20200129; BORR: Proposal Area - 201910, Excluded area - 20190227. Created by: mmikkonen

APPENDIX B

Noise Terminology

APPENDIX B NOISE TERMINOLOGY

Ambient noise	**Level of noise from all sources, including background noise from near and far and the source of interest**
A-weighted	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. A-weighted sound level is described as L_A dB.
Background noise	Noise level from sources other than the source of concern.
dB	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.
Hz	Units for frequency are known as Hertz.
Impulsive noise	An impulsive noise source has a short-term banging, clunking or explosive sound. The quantitative definition of impulsiveness is: "A variation in the emission of a noise where the difference between L_{Apeak} and L_{Amax} slow is more than 15 dB when determined for a single representative event".
$L_{A\ slow}$	This is the noise level in decibels, obtained using A-weighting and S time weighting as specified in AS1259.1-1990. Unless assessing modulation, all measurements use the slow time weighting characteristic.
$L_{A\ fast}$	This is the noise level in decibels, obtained using A-weighting and F time weighting as specified in AS1259.1-1990. This is used when assessing the presence of modulation only.
$L_{A\ peak}$	This is the maximum reading in decibels using A-weighting and P time weighting as specified in S1259.1-1990.
$L_{A\ max}$	L_{Amax} level is the maximum A-weighted noise level during a particular measurement.
L_{A1}	L_{A1} level is the A-weighted noise level which is exceeded for 1% of the measurement period and is considered to represent the average of the maximum noise levels measured.
L_{A10}	L_{A10} level is the A-weighted noise level which is exceeded for 10% of the measurement period and is considered to represent the intrusive noise level.
L_{A90}	L_{A90} level is the A-weighted noise level which is exceeded for 90% of the measurement period and is considered to represent the background 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.
$L_{Aeq(Day)}$	The $L_{Aeq(16\ hour)}$ for the time period 6 am to 10 pm.
$L_{Aeq(Night)}$	The $L_{Aeq\ (8\ hour)}$ for the time period 10 pm to 6 am.
L_{Amax} assigned level	Means an assigned level which, measured as a L_{Aslow} value, is not to be exceeded at any time.
L_{A1} assigned level	Means an assigned level which, measured as a L_{Aslow} value, is not to be exceeded for more than one percent of the representative assessment period.

L_{A10} assigned level	Means an assigned level which, measured as a L_{Aslow} value, is not to be exceeded for more than 10 percent of the representative assessment period.
Linear	Sound levels measured without any weightings are referred to as 'linear' and the units are expressed as dB(lin).
$L_{linear, peak}$	Maximum reading in decibels obtained using P-time-weighting characteristic as specified in AS 1259.1-1990.
Maximum design sound level	The level of noise above which most people occupying the space start to become dissatisfied with the level of noise.
Modulating noise	A modulating source is regular, cyclic and audible and is present for at least 10 percent of the measurement period. The quantitative definition of modulation is: • Is more than 3 dB L_{Afast} or is more than 3 dB L_{Afast} in any one-third octave band • Is present for at least 10 percent of the representative assessment period • Is regular, cyclic and audible
One-third octave band	Means a band of frequencies spanning one-third of an octave and having a centre frequency between 25 Hz and 20,000 Hz inclusive.
Representative assessment period	Means a period of time not less than 15 minutes and not exceeding four hrs, determined by an inspector or authorised person to be appropriate for the assessment of a noise emission, having regard to the type and nature of the noise emission.
Reverberation time	Of an enclosure, for a sound of a given frequency or frequency band, the time that would be required for the reverberantly decaying sound pressure level in the enclosure to decrease by 60 decibels.
RMS	Root mean square level; used to represent the average level of a wave form such as vibration.
Satisfactory design sound level	The level of noise that has been found to be acceptable by most people for the environment in question and also to be not intrusive.
Sound pressure level	The sound pressure level of a noise source is dependent upon its surroundings (influenced by distance, ground absorption, topography, meteorological conditions etc.) and is what the human ear actually hears. Noise modelling predicts the sound pressure level from the sound power levels taking into account ground absorption, barrier effects, distance etc.
Sound power level (L_W)	Under normal conditions, a given sound source will radiate the same amount of energy, irrespective of its surroundings, being the sound power level. The sound power level of a noise source cannot be directly measured using a sound level meter but is calculated based on measured sound pressure levels at known distances. Noise modelling incorporates source sound power levels as part of the input data.
Specific noise	Relates to the component of the ambient noise that is of interest. This can be referred to as the noise of concern or the noise of interest
Tonal noise	A tonal noise source can be described as a source that has a distinctive noise emission in one or more frequencies. An example would be whining or droning. The quantitative definition of tonality is: • The presence in the noise emission of tonal characteristics where the difference between - – The A-weighted sound pressure level in any one-third octave band – The arithmetic average of the A-weighted sound pressure levels in the two adjacent one-third octave bands is greater than 3 dB when the sound

	pressure levels are determined as $L_{Aeq,T}$ levels where the time period T is greater than 10% of the representative assessment period, or greater than 8 dB at any time when the sound pressure levels are determined as $L_{A\ slow}$ levels. This is relatively common in most noise sources.

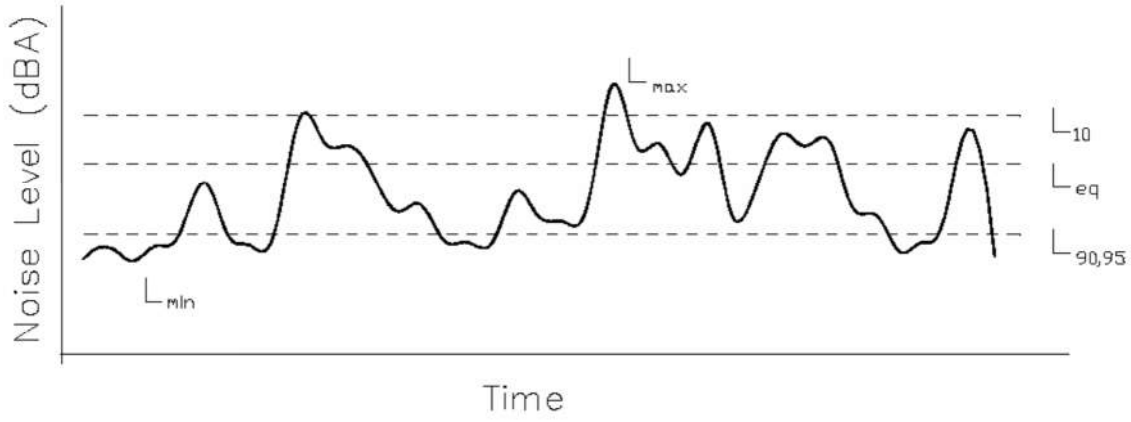
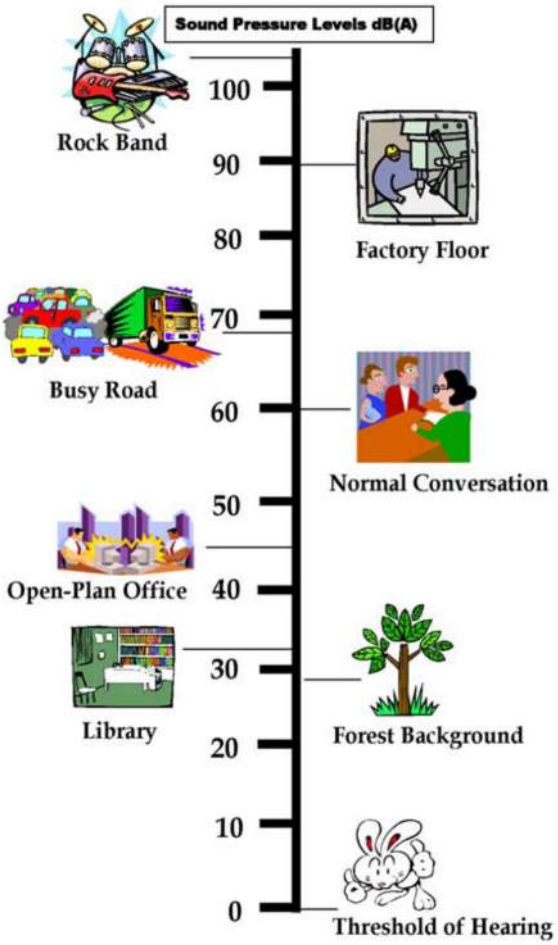


Chart of Noise Level Descriptors



Typical Noise Levels

APPENDIX C

MONITORING SITE SUMMARIES

(Appendix SCM: 12.1A)

(NORTH)

SOUND LEVEL RECORDING FORM

Project No: 61370411 Date 10.09.18

Project Name: BORR Page 1 of 3

Client: MRWA Performed by AST/GF

Site: 662 CLIFTON RD BRUNSWICK Monitoring Position

SLM Make: SVAN /Model: 955 /Serial N°: 27625

CAL Make: L. DAVIS /Model: 200 /Serial N°: 10469 /Level 94 (dB) /Frequency: 1000 (Hz)

SLM=Sound Level Meter CAL=Calibrator (pistonphone)

1. Monitoring Interval: 15 (mins)
2. Start Time: 10.45 10.09.18 Finish Time: —
3. Calibration performed before monitoring: 94.0 dB Y/N factor= 0.0 dBA
4. Calibration performed after monitoring: — Y/N factor= dBA

L_{eq} = L1= Lpeak=

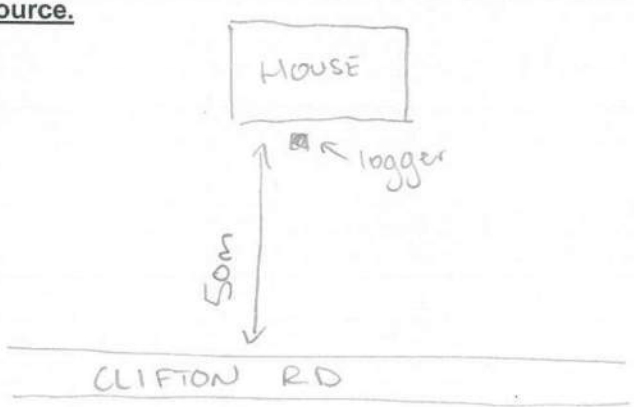
L_{10}= Lmax= L90=

Lmin= Height of meter 1.5m *(1.2m minimum)*

Weather Conditions at time of Monitoring

Wind Speed	m/second
(note: max allowable = 5m/sec)	
Approximate Direction =	
Ambient Temperature =	°C
Relative Humidity	%
Cloud Cover	%
Inversion Layer	Y/N
Others (fog, drizzle)	

Sketch of Monitoring Location and Distance to Noise Source. NTS



DISTINCTIVE NOISE SOURCES Dominant noise source

DROP OFF
56 dB car passing Clifton Rd
61 dB several cars passing
49 dB Wind
46 dB No cars (ambient)
56 dB Birds chirping
65 dB Truck passing

NOISE CHARACTER (broad band , impulsive, tonal)

METER SETTINGS (Linear, exponential:, weightings; a, b, c,: fast, slow, impulsive)

Note: file corrupted giving "FS ERR"
logger recorded for several days only.

log name: 1
start file : 1
last file : -

(Appendix SCM: 12.1A)

SITE B

(NORTH)

SOUND LEVEL RECORDING FORM

Project No: 6137041 Date 10.09.18

Project Name: BORR Page 2 of 3

Client: MRWA Performed by AST / GF

Site: 15 BEVAN LOOP, ROELANDS Monitoring Position

SLM Make: SVAN /Model: 955 /Serial N°: 27621

CAL Make: L. DAVIS /Model: 200 /Serial N°: 10469 /Level: 94 (dB) /Frequency: 1000 (Hz)

SLM=Sound Level Meter CAL=Calibrator (pistonphone)

1. Monitoring Interval: 15 (mins)
2. Start Time: 12.56 10.9.18 Finish Time: 17.09.18
3. Calibration performed before monitoring: 94.0 dB Y/N factor= 0.0 dBA
4. Calibration performed after monitoring: 94.1 dB Y/N factor= +0.1 dBA

L_{eq} = L1= Lpeak=

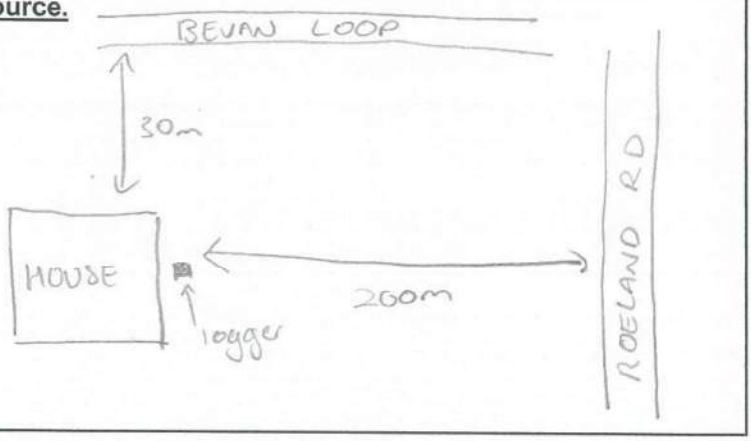
L_{10}= Lmax= L90=

Lmin= Height of meter 1.5m *(1.2m minimum)*

Weather Conditions at time of Monitoring

Wind Speed Still	m/second
(note: max allowable = 5m/sec)	
Approximate Direction =	
Ambient Temperature =	°C
Relative Humidity	%
Cloud Cover	%
Inversion Layer	Y/N
Others (fog, drizzle)	

Sketch of Monitoring Location and Distance to Noise Source. NTS



DROP OFF

DISTINCTIVE NOISE SOURCES

57.5dB cars passing
52.9 dB wind

Dominant noise source

PICK UP
55dB Truck passing Roelands Rd
43dB No distinct source (ambient)
55dB Lawn mower.

NOISE CHARACTER (broad band , impulsive, tonal)

METER SETTINGS (Linear, exponential:, weightings; a, b, c,: fast, slow, impulsive)

log name: log 2
start file: 3
last file: 660

(Appendix SCM: 12.1A)

Site C

SOUND LEVEL RECORDING FORM

Project No:

Date 13.12.18

Project Name: BOAR

Page 1 of 1

Client: MRWA

Performed by JL & GF

Site: 1441 S.W Highway (Lot 65)

Monitoring Position

SLM Make: RION /Model: /Serial Nº:

CAL Make: LD /Model: /Serial Nº: /Level : (dB) /Frequency: (Hz)

SLM=Sound Level Meter *CAL=Calibrator (pistonphone)*

1. Monitoring Interval: 15 (mins)

2. Start Time: 15:00 Finish Time: 15:15

3. Calibration performed before monitoring: Y/N factor= 94.2 dBA @14:58 RION

4. Calibration performed after monitoring: Lm: 94.1 Y/N factor= 93.6 dBA @15:13

L_{eq} = L1= Lpeak= LD 93.7@14:55

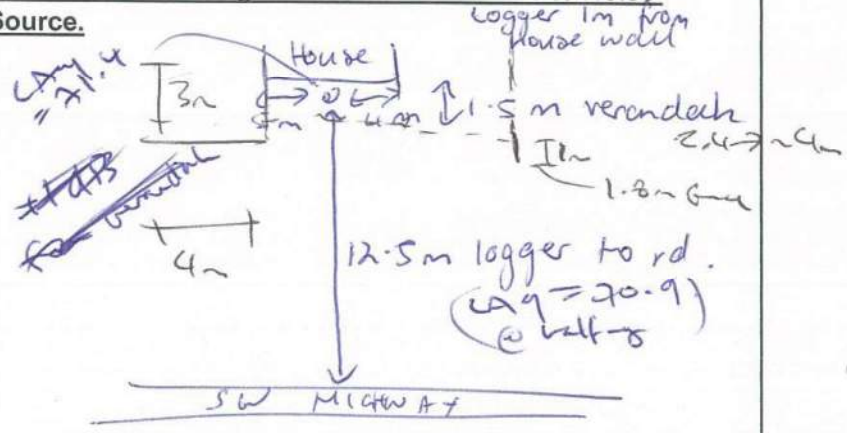
L_{10}= Lmax= L90=

Lmin= Height of meter (1.2m minimum) Locks 2 & 4

Weather Conditions at time of Monitoring

Wind Speed	m/second
(note: max allowable = 5m/sec)	
Approximate Direction =	
Ambient Temperature =	°C
Relative Humidity	%
Cloud Cover	%
Inversion Layer	Y/N
Others (fog, drizzle)	

Sketch of Monitoring Location and Distance to Noise Source.



DISTINCTIVE NOISE SOURCES Dominant noise source

LD handheld attended 93.7 cal. m from road.

18/12/13 09

CAR 76 75 79 76 73 75 71 75 76 73 75 75 74 76 75

TRUCK 79 74 83 78 83 82 83 86 83 84 79 80 83 82 78

CAR 76 74 76 77 77 76 73 77 76 79 77 77 77 78 74 76 72

TRUCK 85 83

CAR 71 76 78 78 76 79 74 75 74 77 75 74 76 75 77 76 75

Motorbike 70 81

MULTIPLE CAR 78 78 81 78 80 81 76

NOISE CHARACTER (broad band , impulsive, tonal) 70.9

METER SETTINGS (Linear, exponential:, weightings; a, b, c,: fast, slow, impulsive)

CICADA 46 47 49 50 47

(Appendix SCM: 12.1A)

(CENTRAL)

SOUND LEVEL RECORDING FORM

Project No: 6137041 Date 17.09.18

Project Name: BORR Page 3 of 3

Client: MRWA Performed by AST / LF

Site: 105 MARTIN-PELUSEY RD, WATERLOO Monitoring Position

SLM Make: SVAN /Model: 955 /Serial Nº: 27625

CAL Make: L. DAVIS /Model: 200 /Serial Nº: 10469 /Level : 94 (dB) /Frequency: 1000 (Hz)

SLM=Sound Level Meter CAL=Calibrator (pistonphone)

1. Monitoring Interval: 15 (mins)
2. Start Time: 13:09 17.09.18 Finish Time: 10:23 25.09.18
3. Calibration performed before monitoring: 94 dB Y/N factor= 0.0 dBA
4. Calibration performed after monitoring: 93.8 dB Y/N factor= -0.2 dBA

L_{eq} = L1= Lpeak=

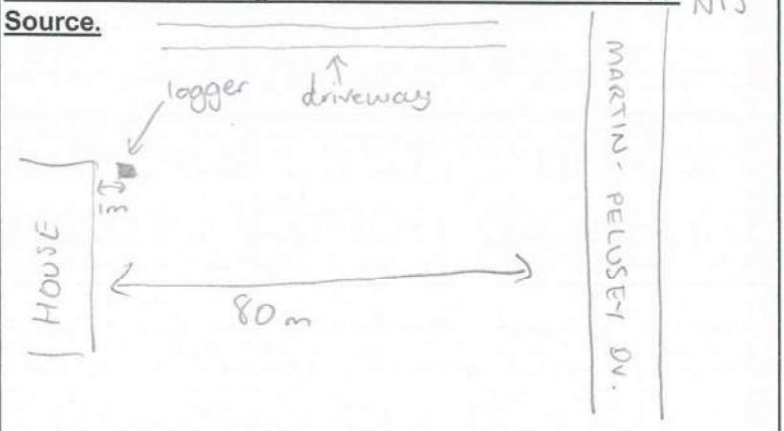
L_{10}= Lmax= L90=

Lmin= Height of meter 1.5m *(1.2m minimum)*

Weather Conditions at time of Monitoring

Wind Speed	m/second
(note: max allowable = 5m/sec)	
Approximate Direction =	
Ambient Temperature =	°C
Relative Humidity	%
Cloud Cover	%
Inversion Layer	Y/N
Others (fog, drizzle)	

Sketch of Monitoring Location and Distance to Noise Source. NTS



DISTINCTIVE NOISE SOURCES Dominant noise source cars on M-P dr.

DROP OFF	PICK UP
58dB car passing	60.6dB lorry passing
55dB distant horn	60.9dB several cars passing
67.0dB semi-trailer passing	54.2dB distant train horn sounding
64.1dB Ute passing	45.8dB birds
58.5dB car passing	63.4dB small truck passing
70.0dB several trucks	65.5dB FWD passing
71.7dB car backfiring	68.6dB cars + truck
56.0dB car passing / 53.0dB birds	57.9dB car in driveway
NOISE CHARACTER (broad band , impulsive, tonal)	47.9dB birds.

METER SETTINGS (Linear, exponential:, weightings; a, b, c,: fast, slow, impulsive)

log name: log1
start file: 1
last file : 755

(Appendix SCM: 12.1A)

(CENTRAL)

SOUND LEVEL RECORDING FORM

Project No: 6137041 Date 17.09.18

Project Name: BORR Page 2 of 3

Client: MRWA Performed by AST / GF

Site: 365 HARRIS RD, PARADISE Monitoring Position

SLM Make: SVAN /Model: 955 /Serial N°: 27621

CAL Make: L. DAVIS /Model: 200 /Serial N°: 10469 /Level : 94 (dB) /Frequency: 1000 (Hz)

SLM=Sound Level Meter CAL=Calibrator (pistonphone)

1. Monitoring Interval: 15 (mins)
2. Start Time: 12:15 17.09.18 Finish Time: –
3. Calibration performed before monitoring: 94 dB Y/N factor= 0.0 dBA
4. Calibration performed after monitoring: – Y/N factor= dBA

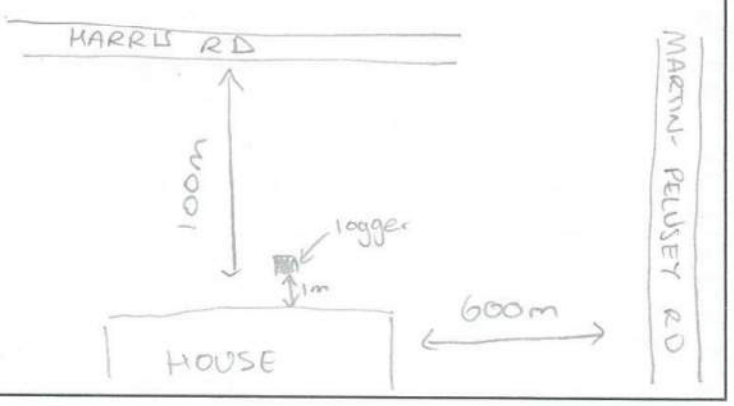
L_{eq} = L1= Lpeak=

L_{10}= Lmax= L90=

Lmin= Height of meter 1.5m (1.2m minimum)

Weather Conditions at time of Monitoring	
Wind Speed	m/second
(note: max allowable = 5m/sec)	
Approximate Direction =	
Ambient Temperature =	°C
Relative Humidity	%
Cloud Cover	%
Inversion Layer	Y/N
Others (fog, drizzle)	

Sketch of Monitoring Location and Distance to Noise Source. NTS



DISTINCTIVE NOISE SOURCES Dominant noise source

DROP OFF
44.9 dB lawn mower (distant)
56.8 dB passing car
48.4 dB Wind and birds
37.1 dB no dominant noises (ambient)
59.5 dB passing ute
61.0 dB tractor on Harris Rd
61.4 dB passing car
61.5 dB passing truck

NOISE CHARACTER (broad band , impulsive, tonal)

METER SETTINGS (Linear, exponential:, weightings; a, b, c,: fast, slow, impulsive)

Note: battery dead on arrival to retrieve logger.

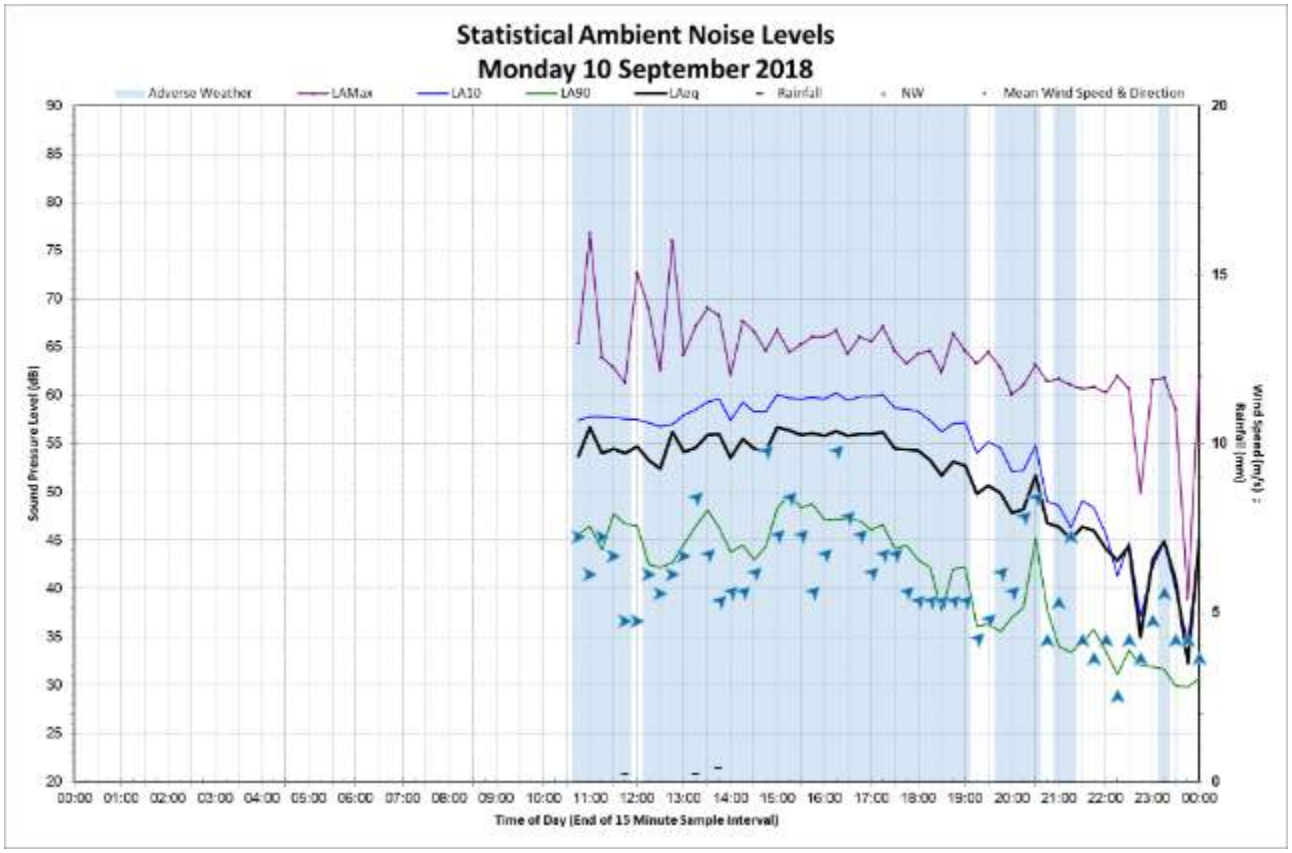
Log name: log5
start file : 1
end file: –

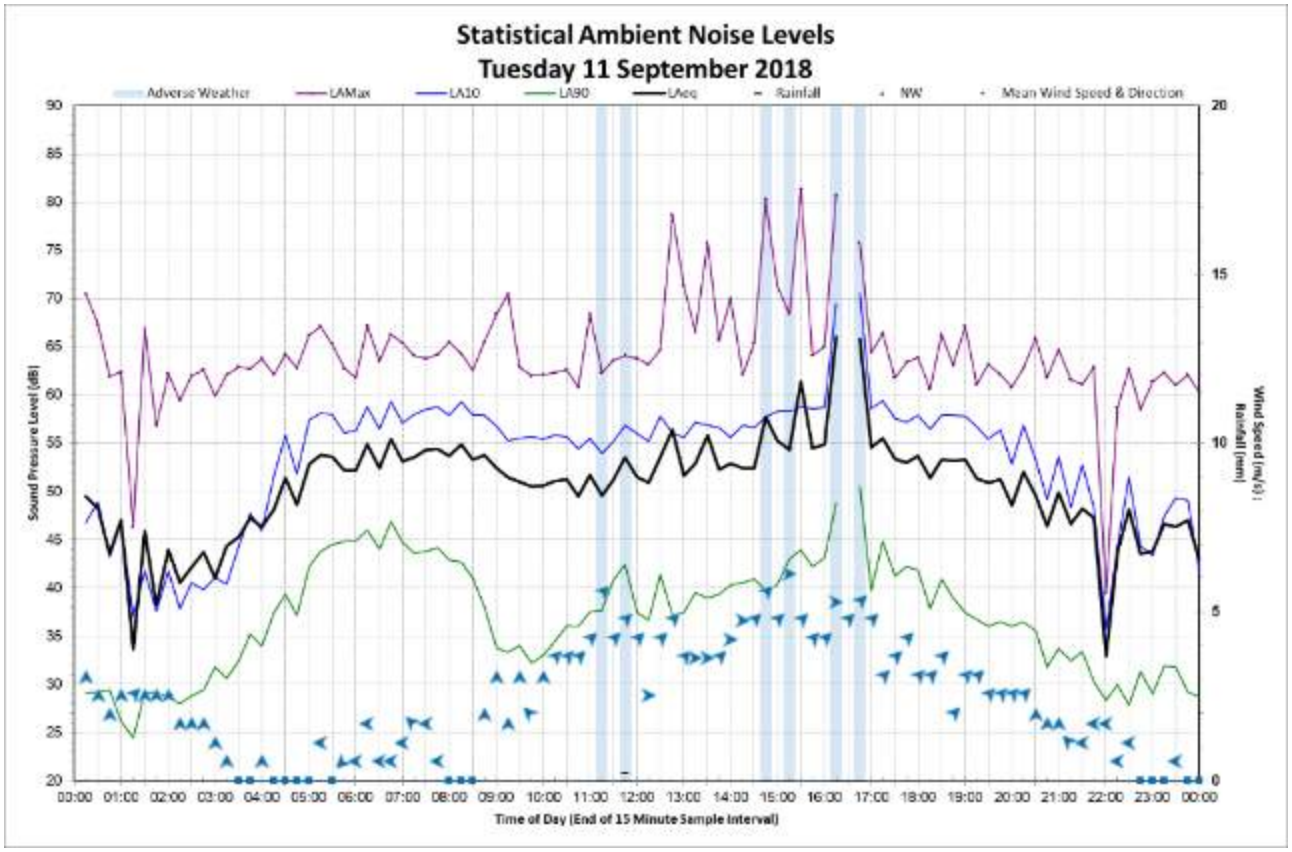
APPENDIX D

MONITORING RESULTS

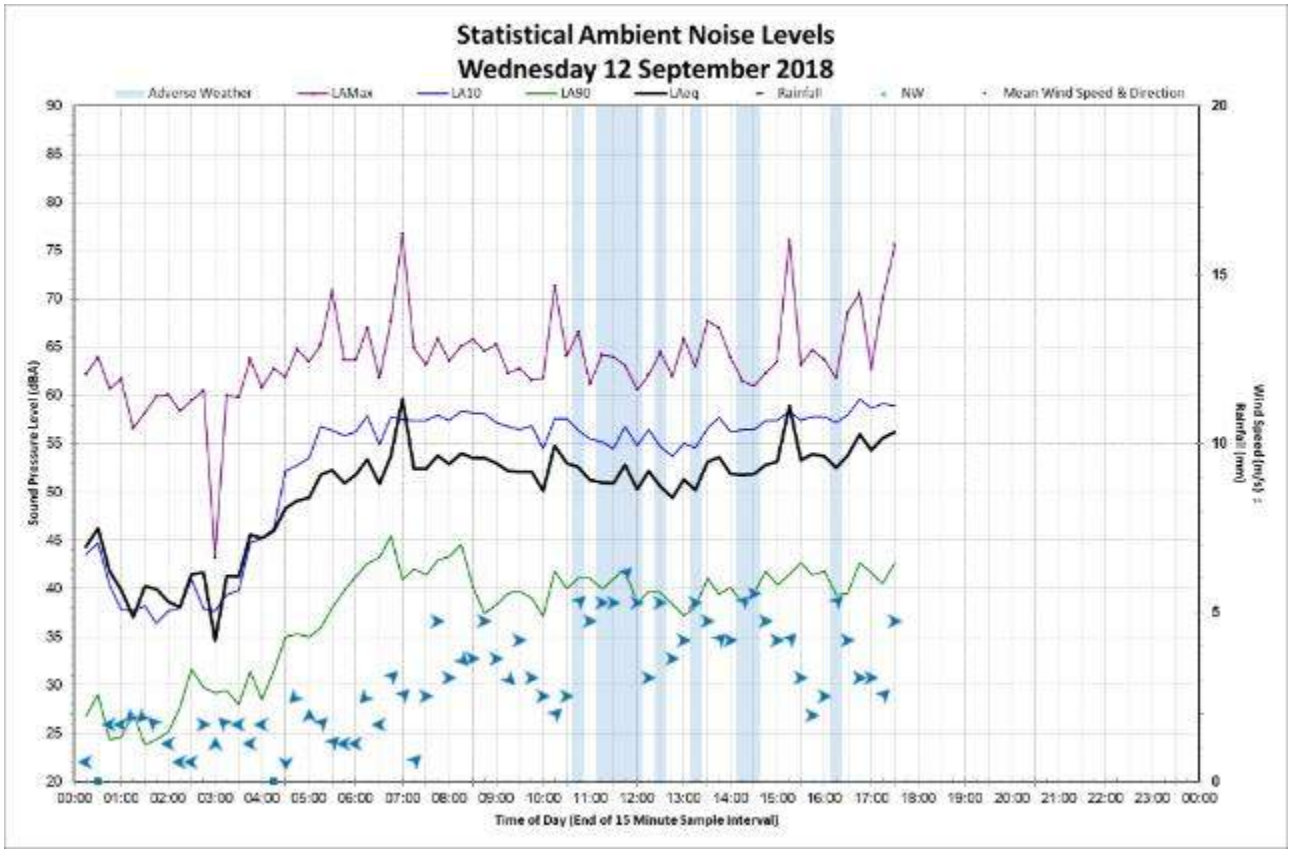
(Appendix SCM: 12.1A)

Site A – 662 Clifton Road



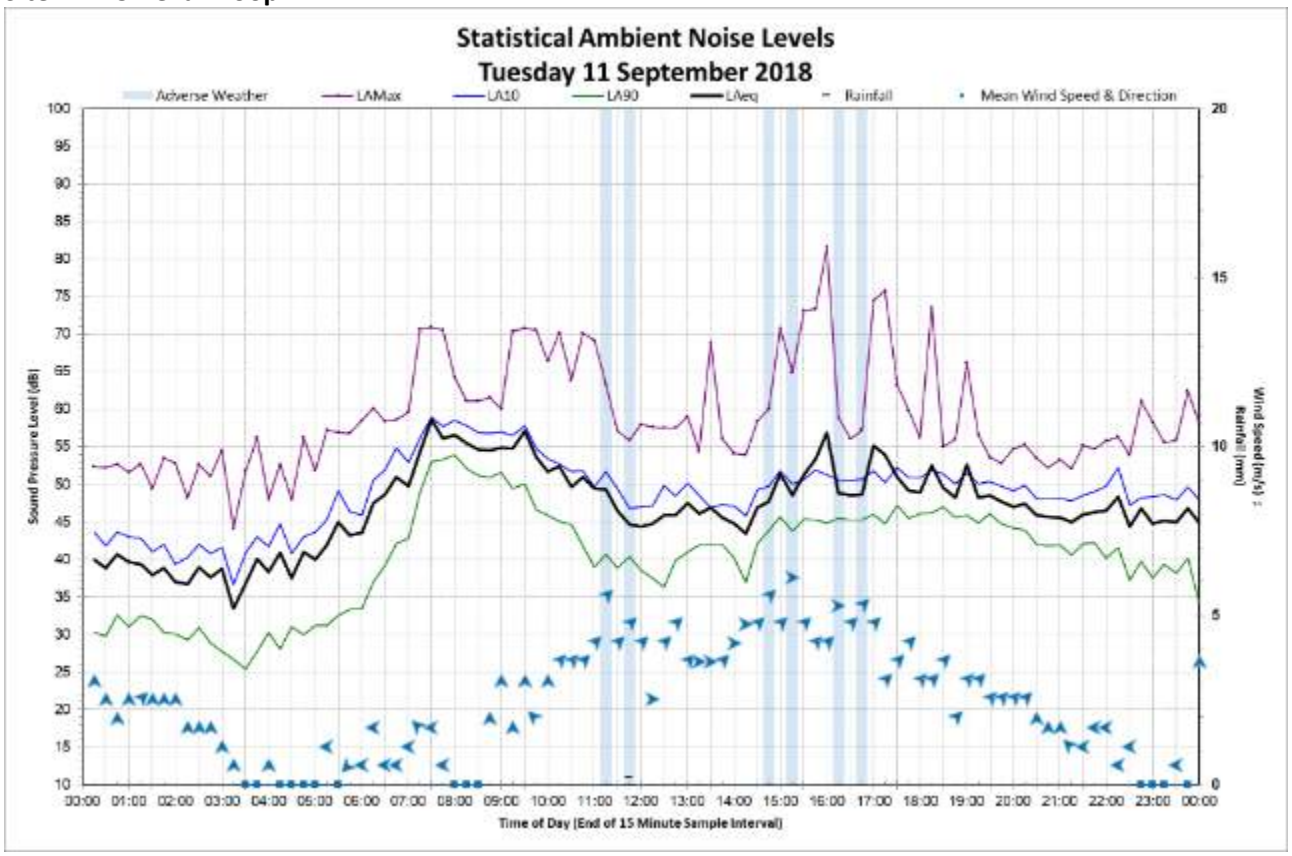


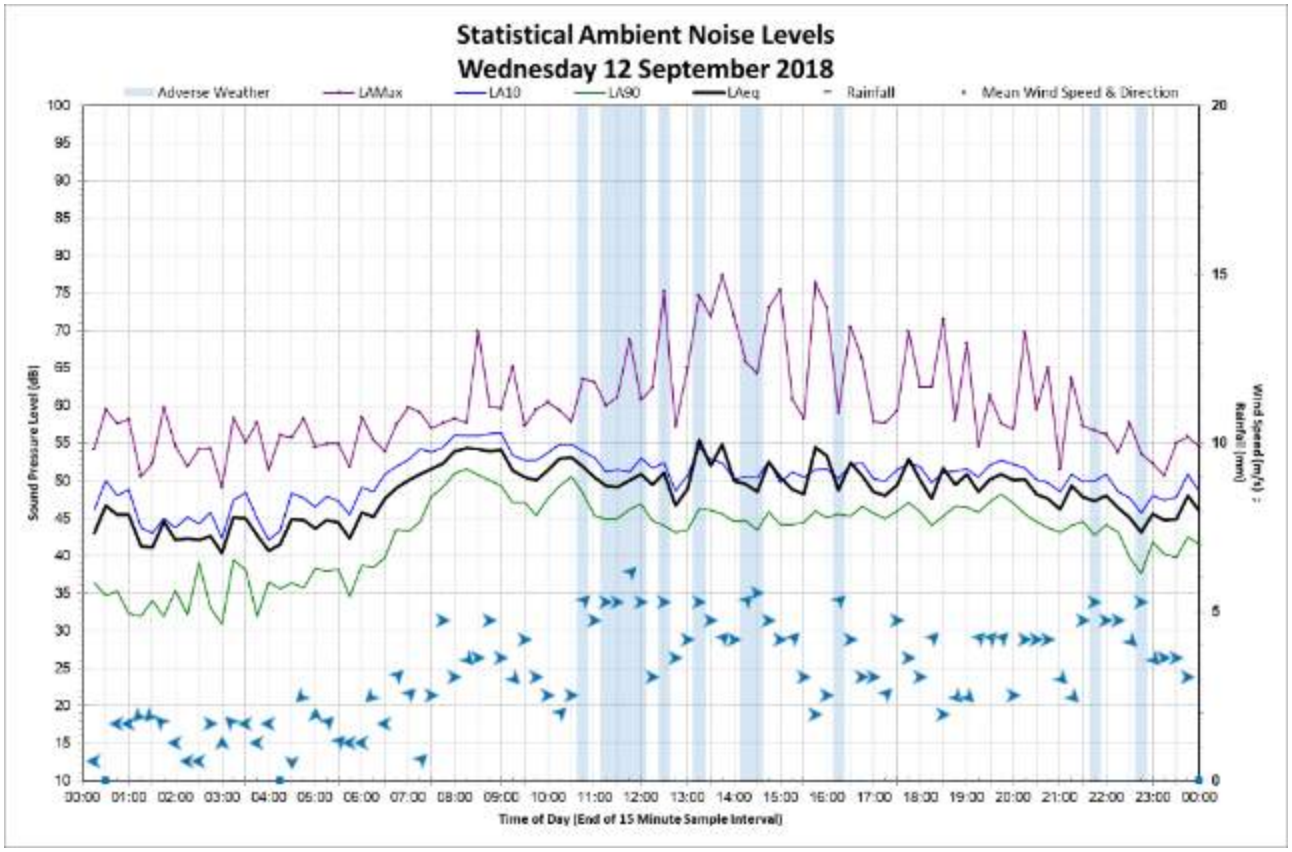
(Appendix SCM: 12.1A)



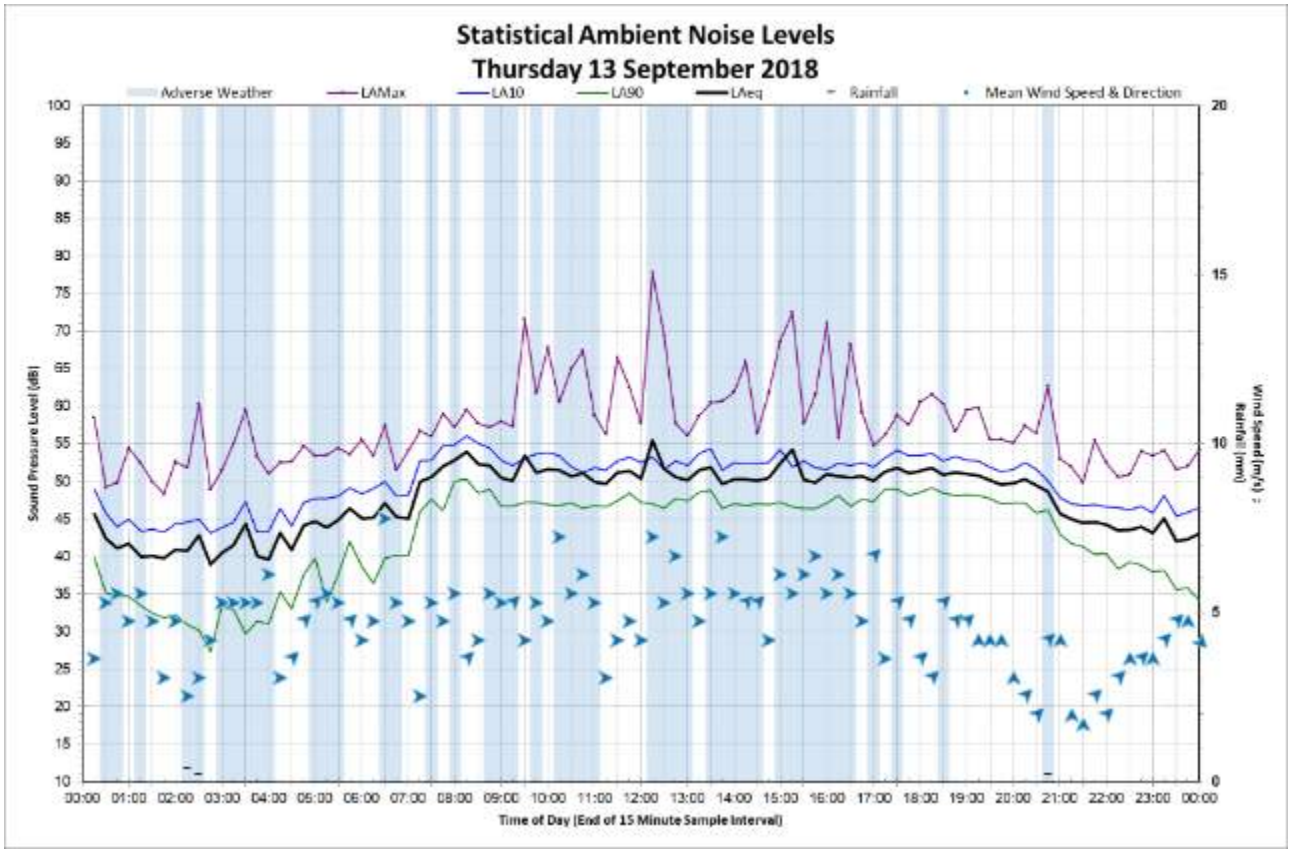
(Appendix SCM: 12.1A)

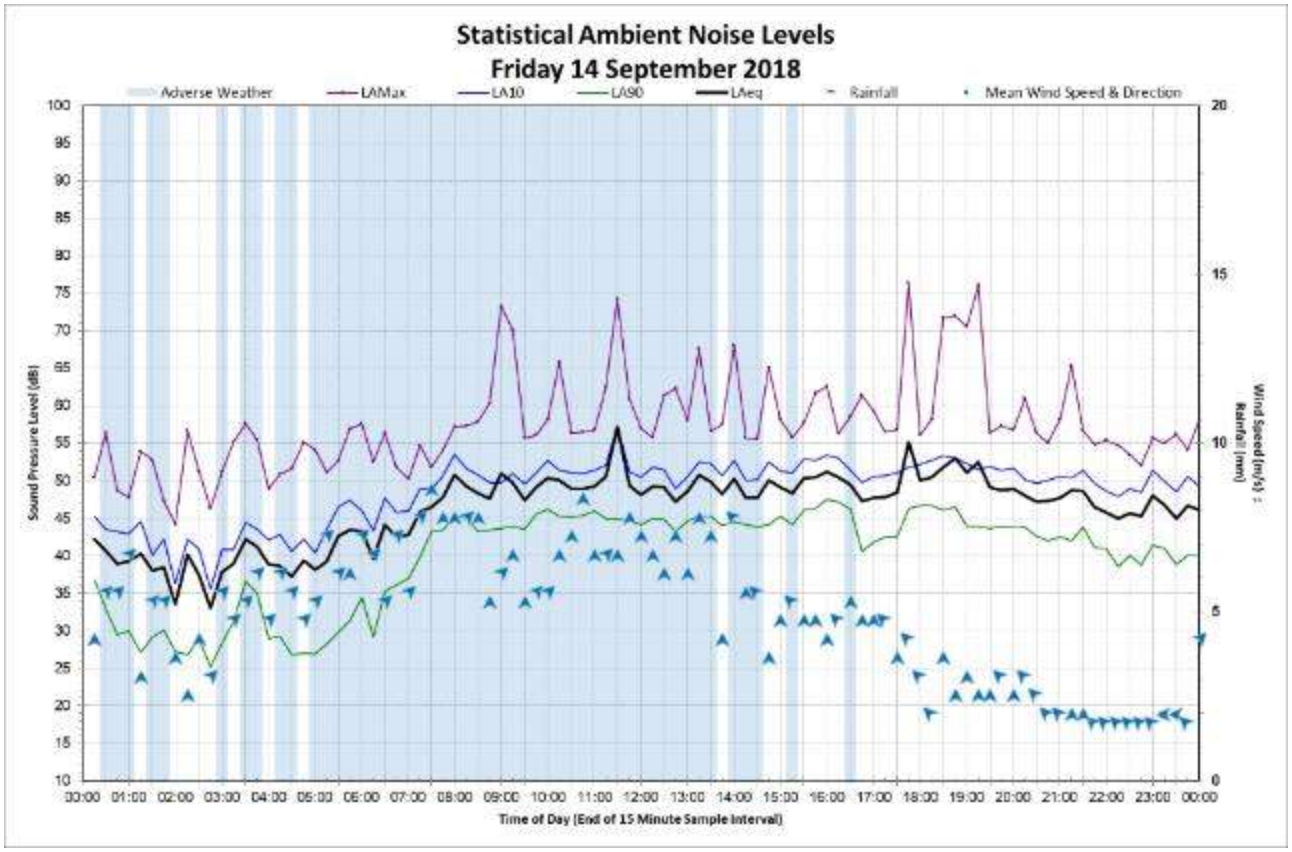
Site B – 15 Bevan Loop



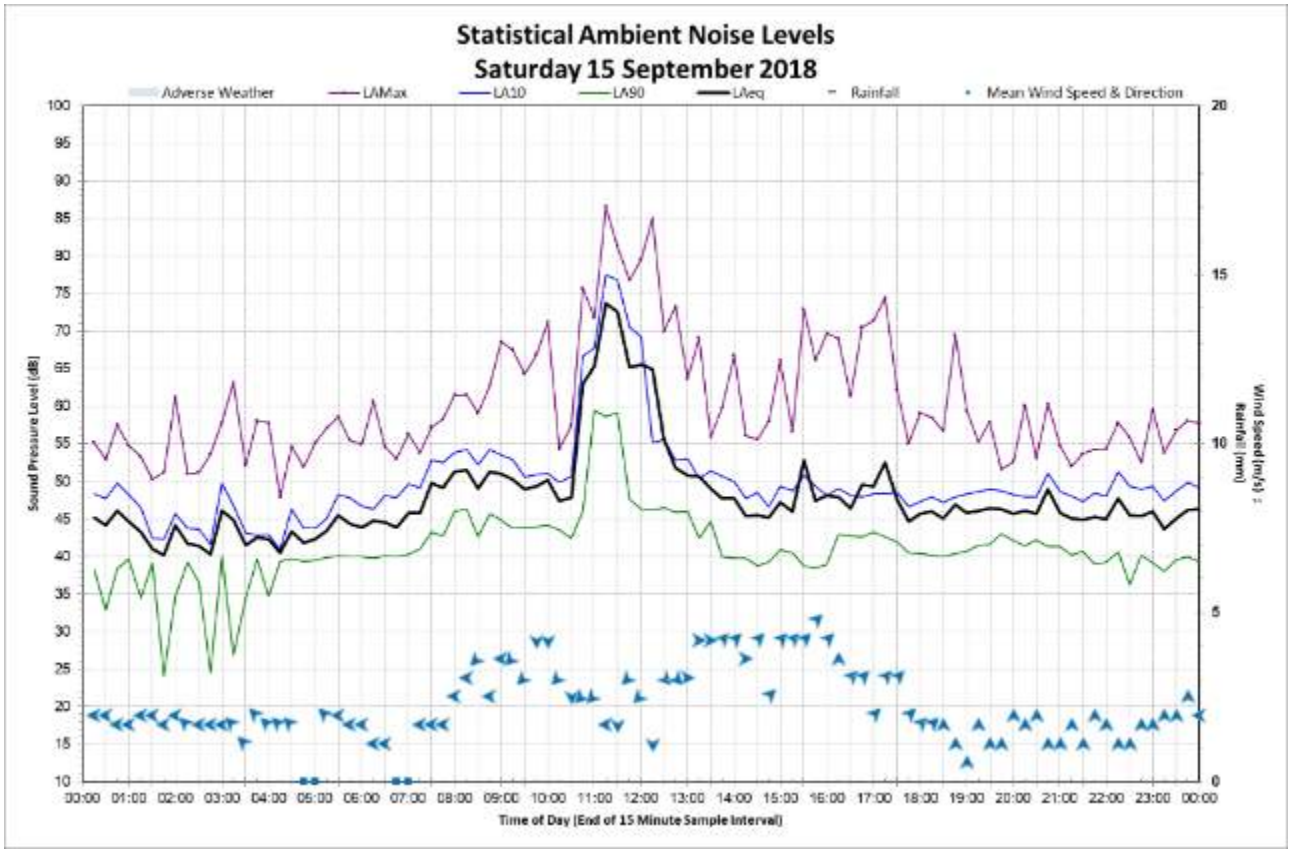


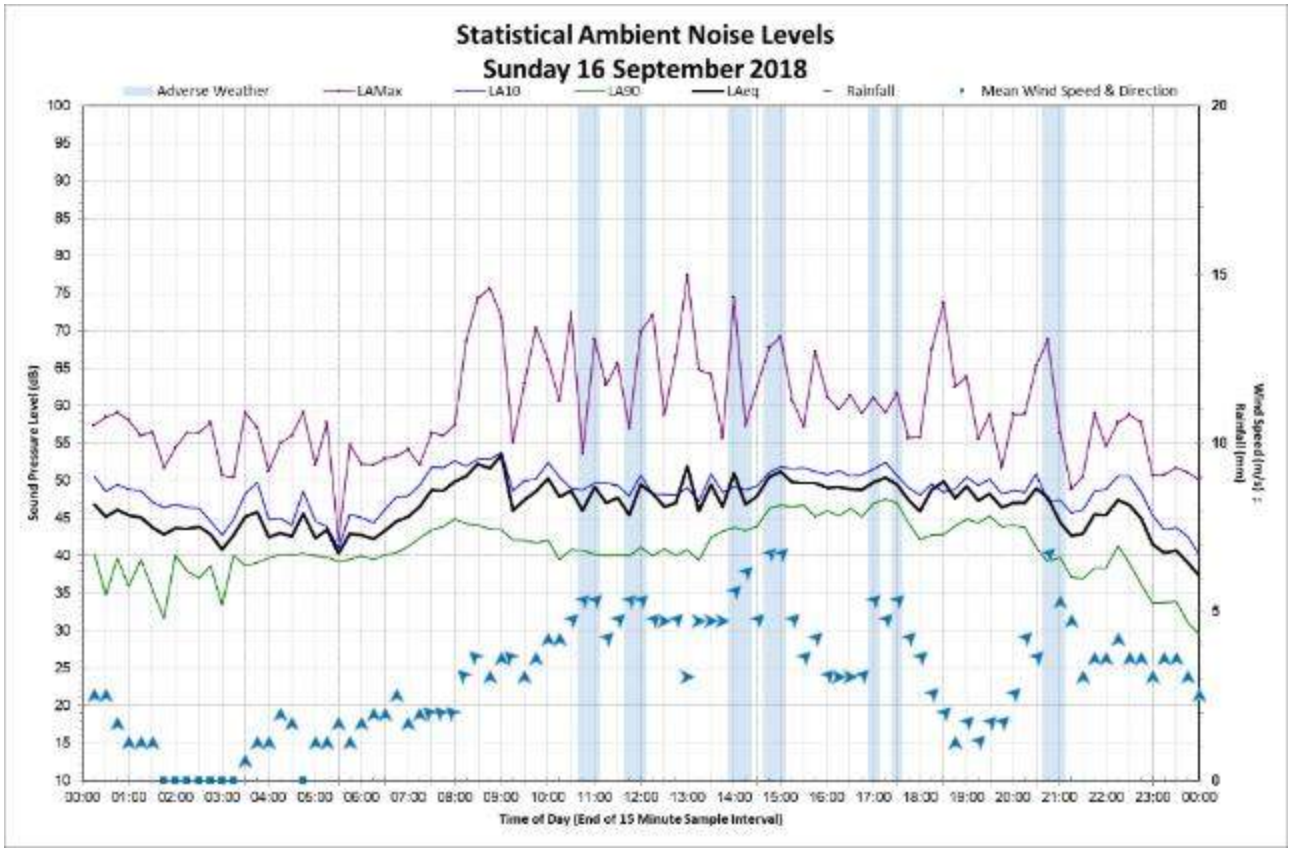
(Appendix SCM: 12.1A)



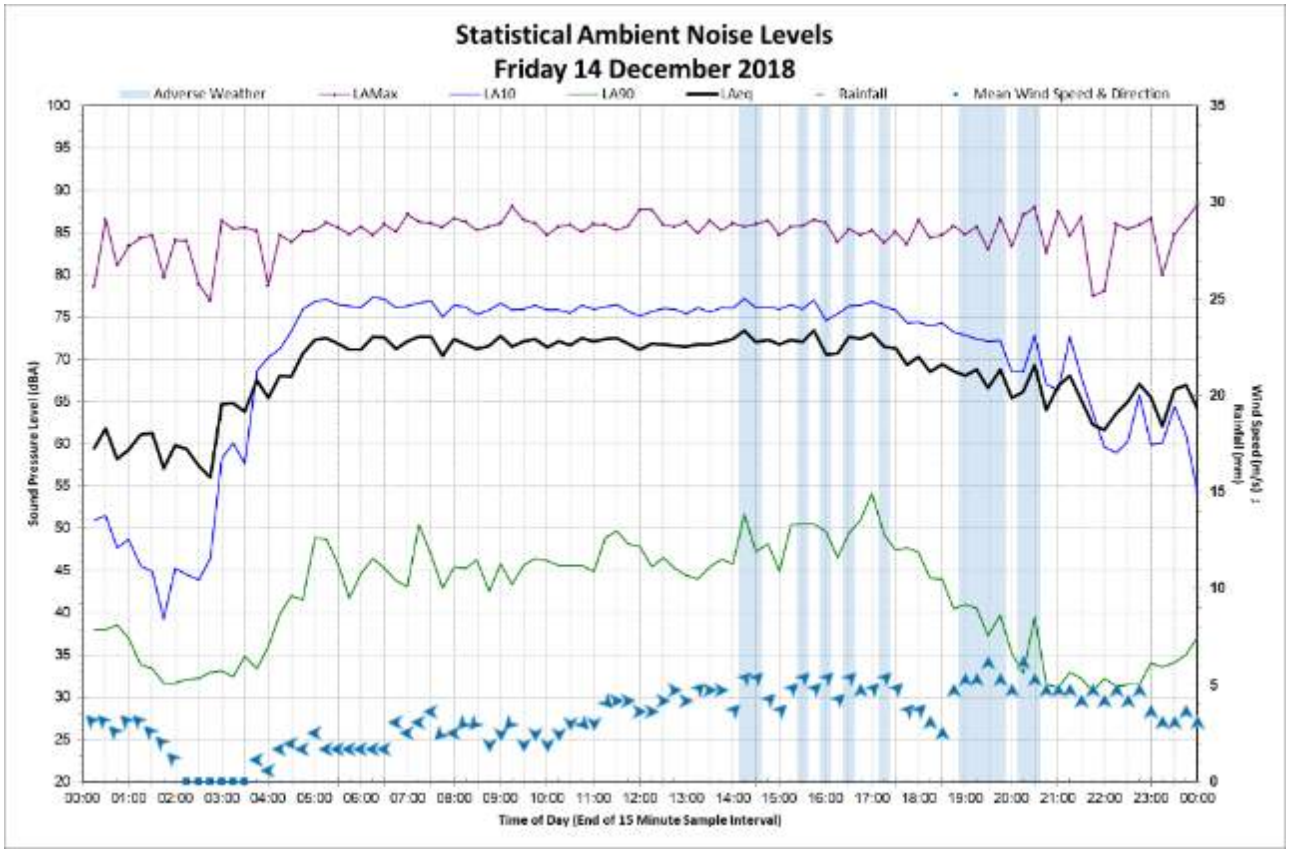


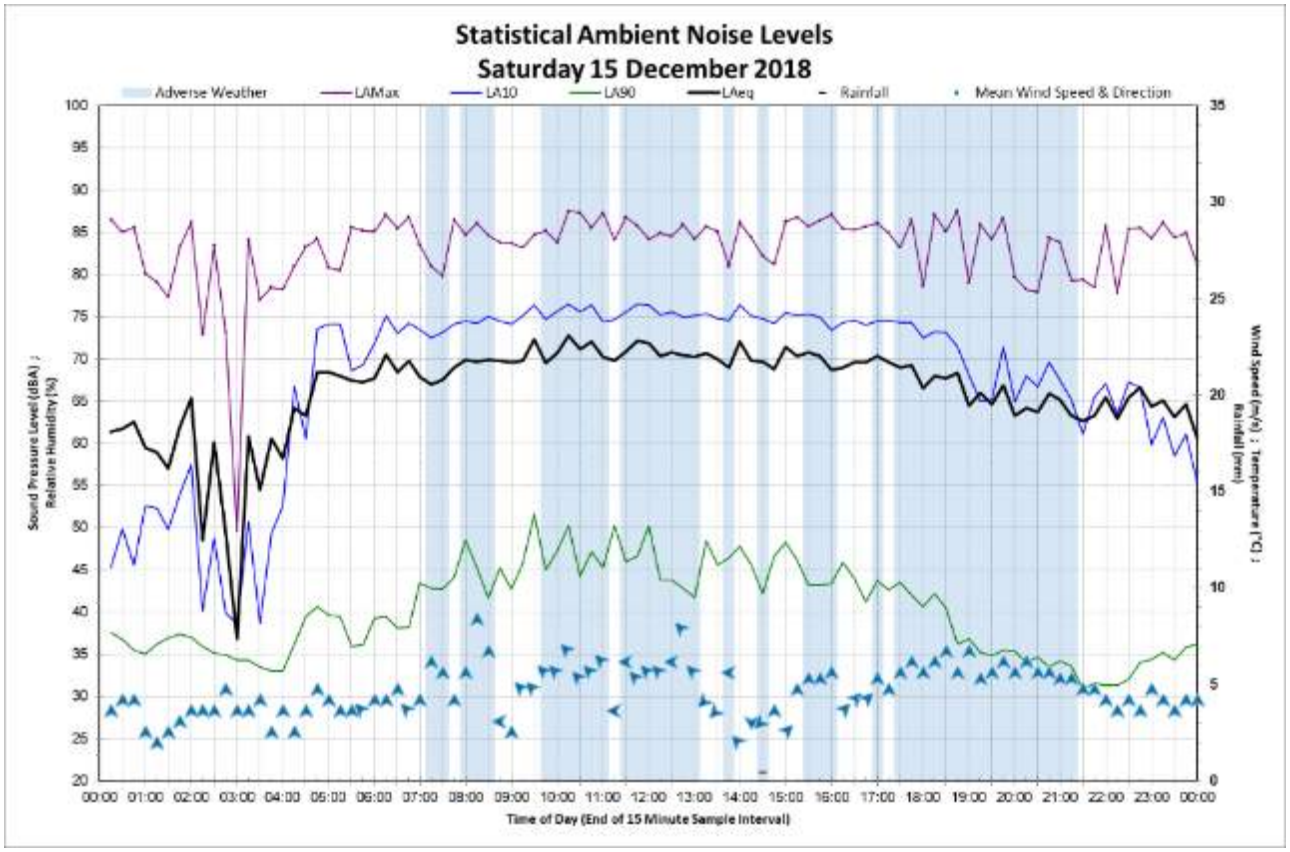
(Appendix SCM: 12.1A)



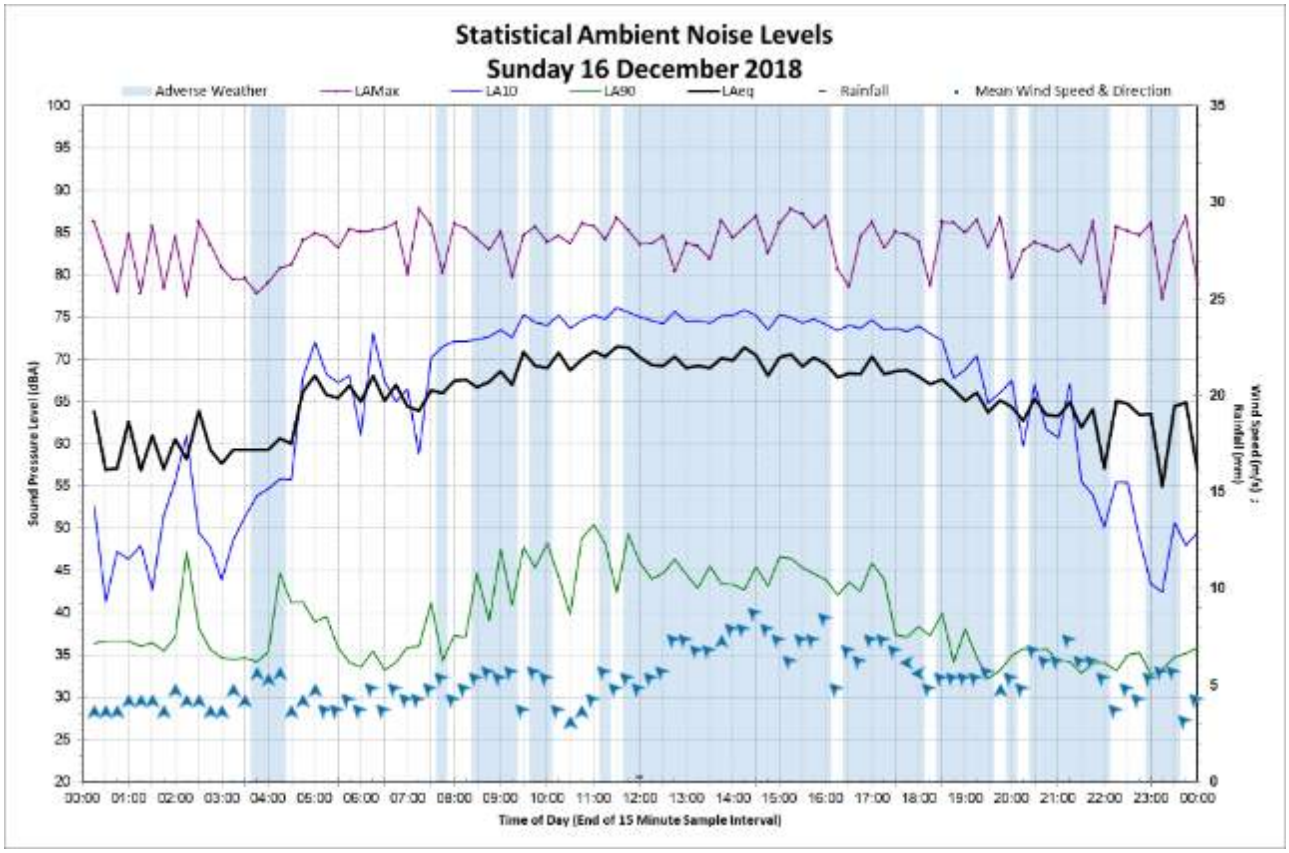


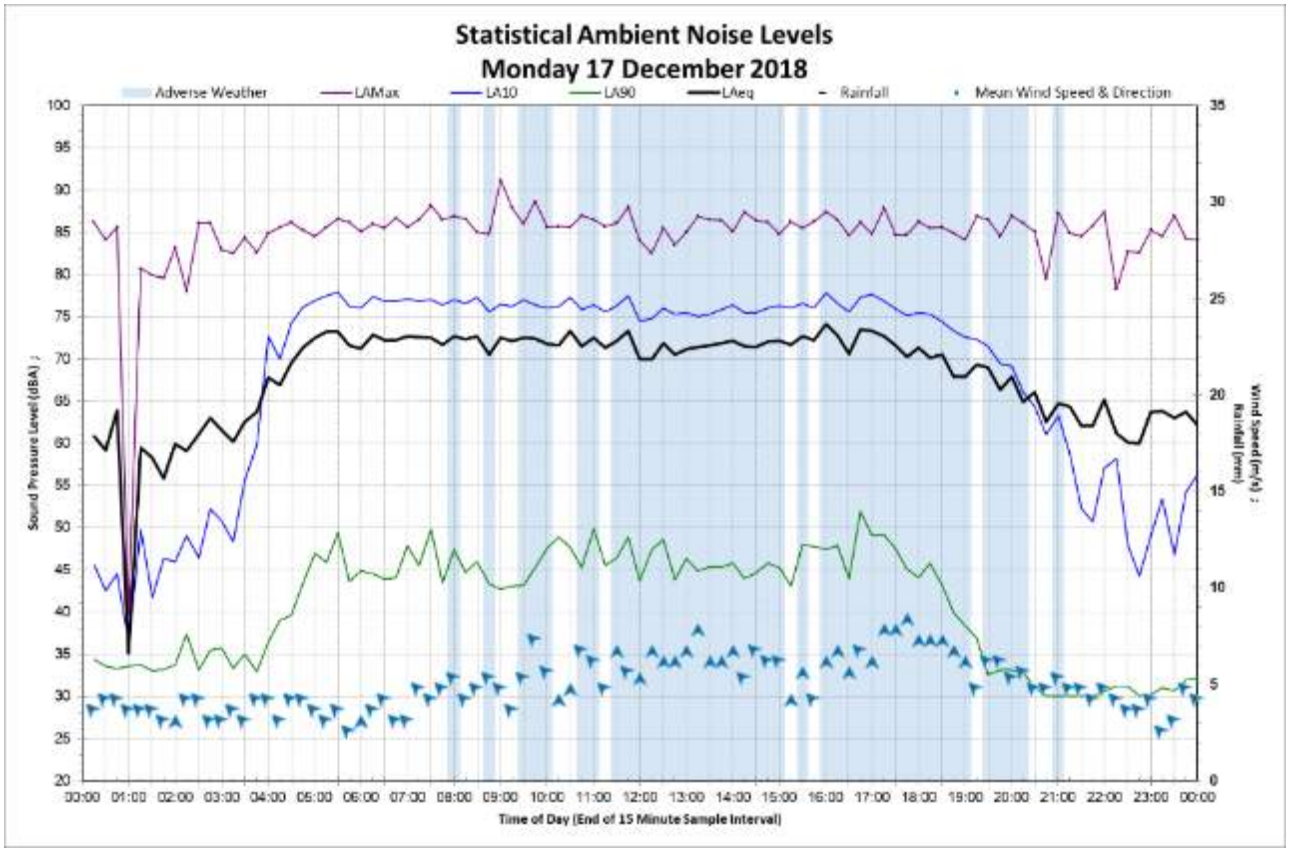
Site C – 14411 South Western Highway



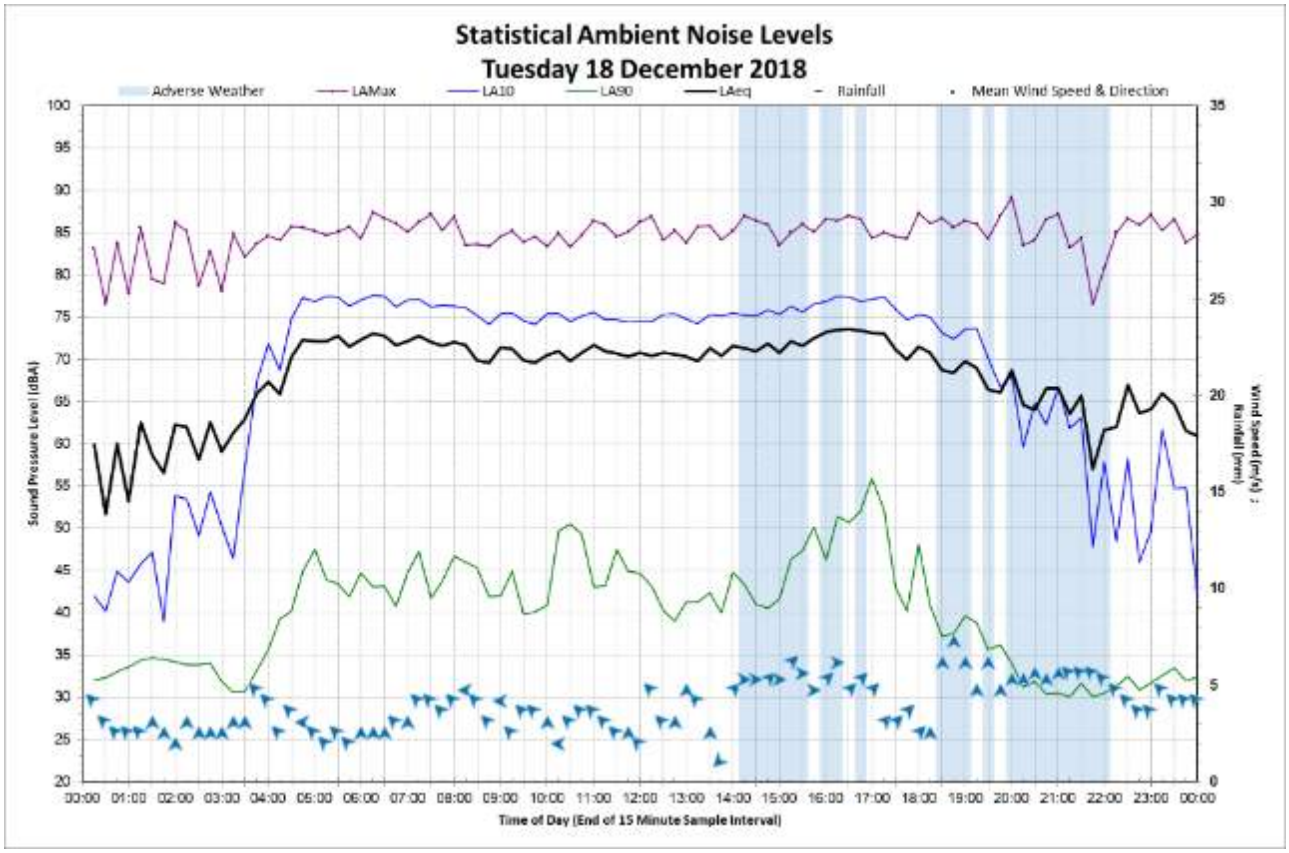


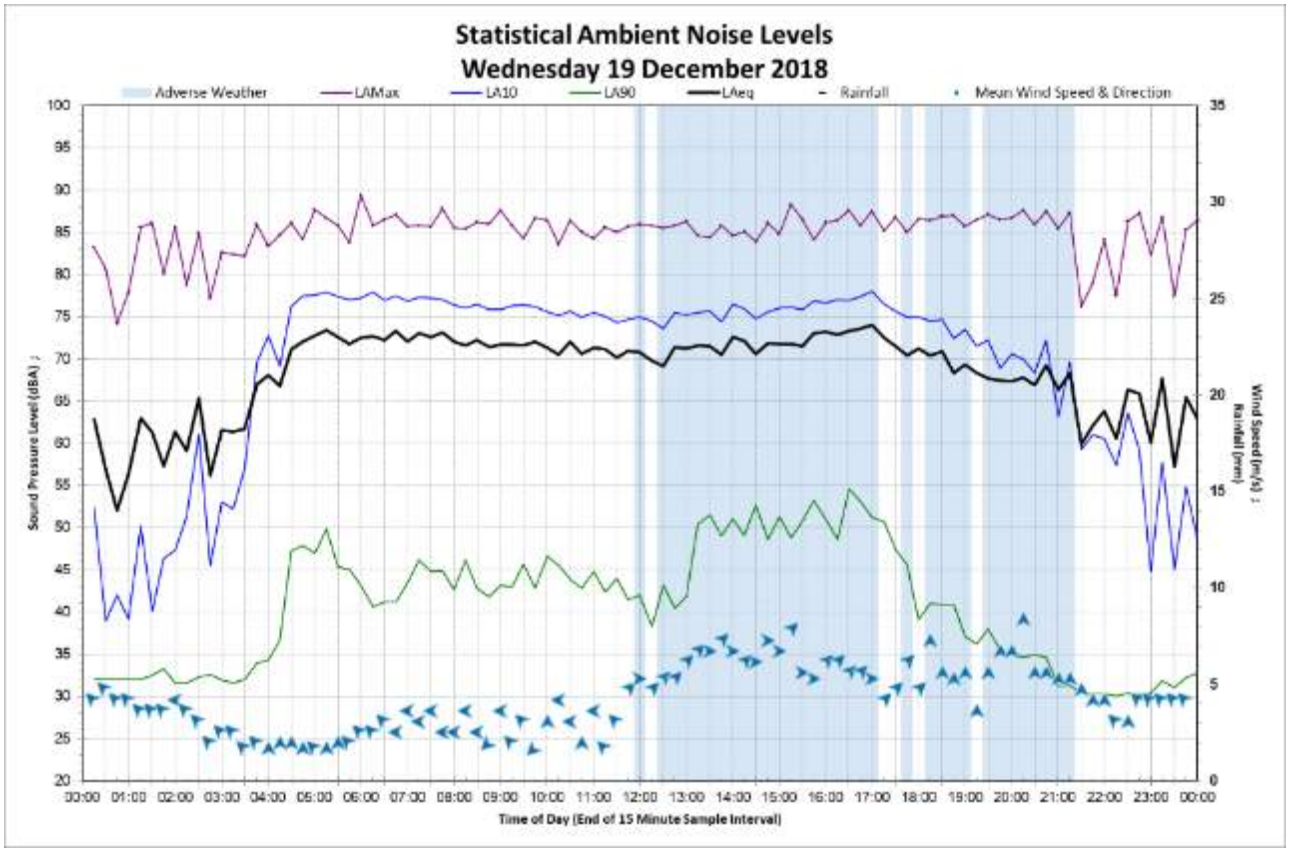
(Appendix SCM: 12.1A)





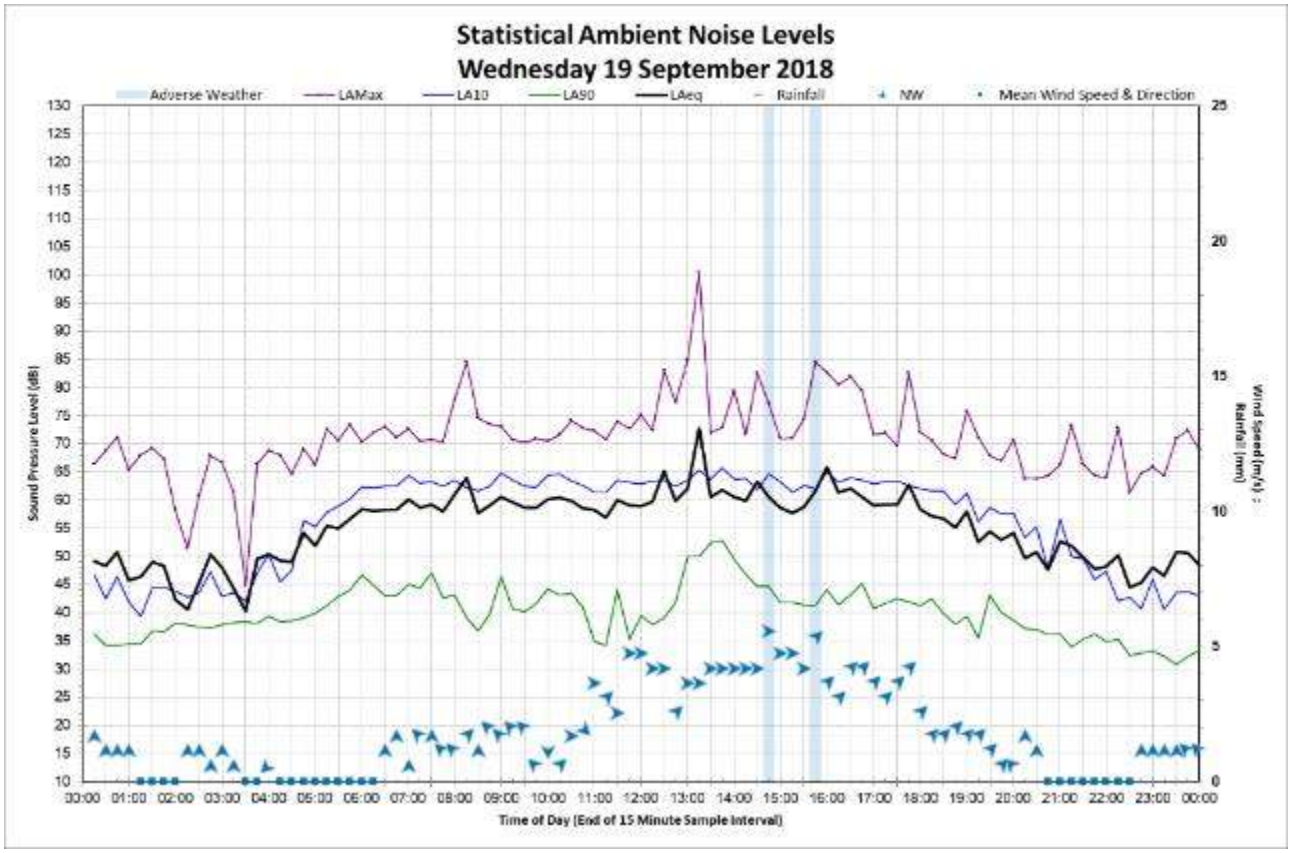
(Appendix SCM: 12.1A)

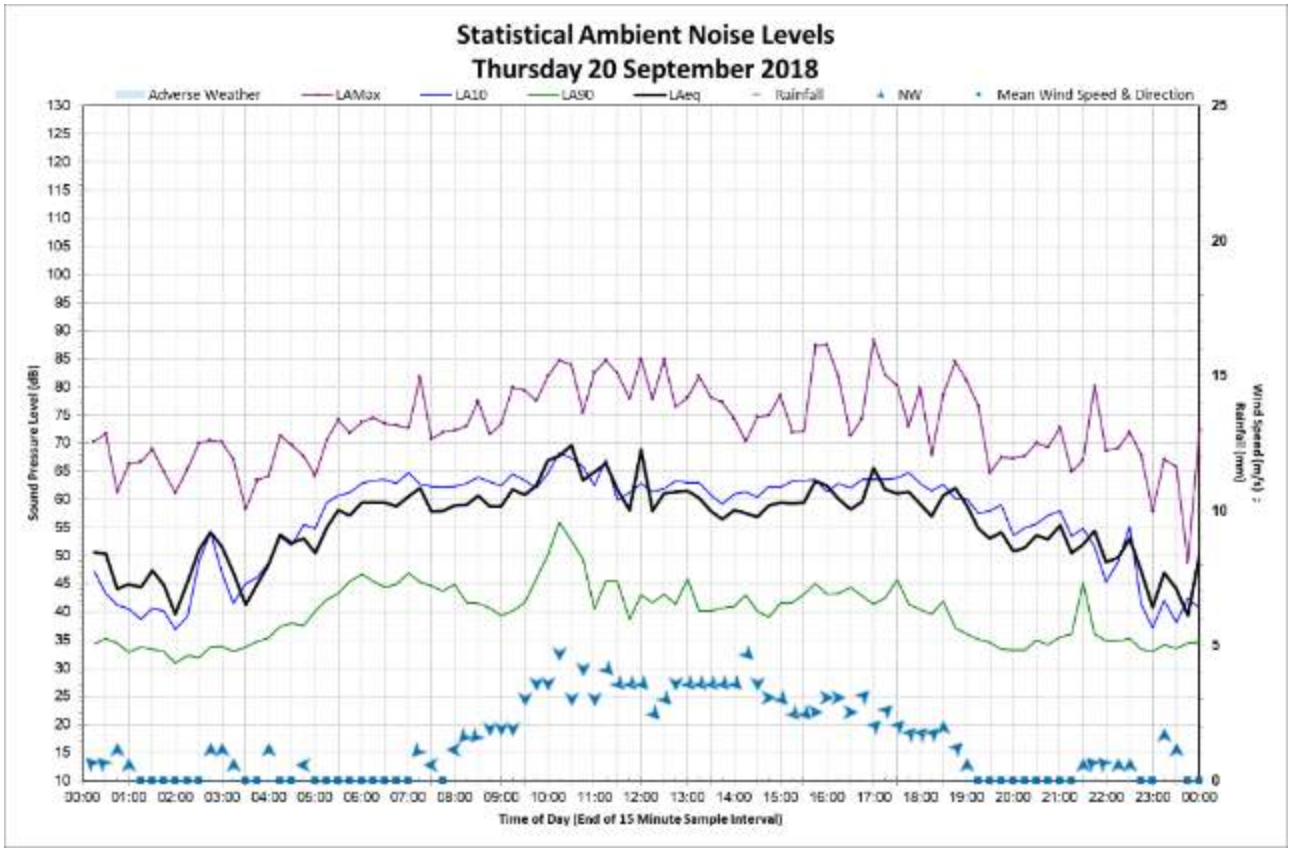




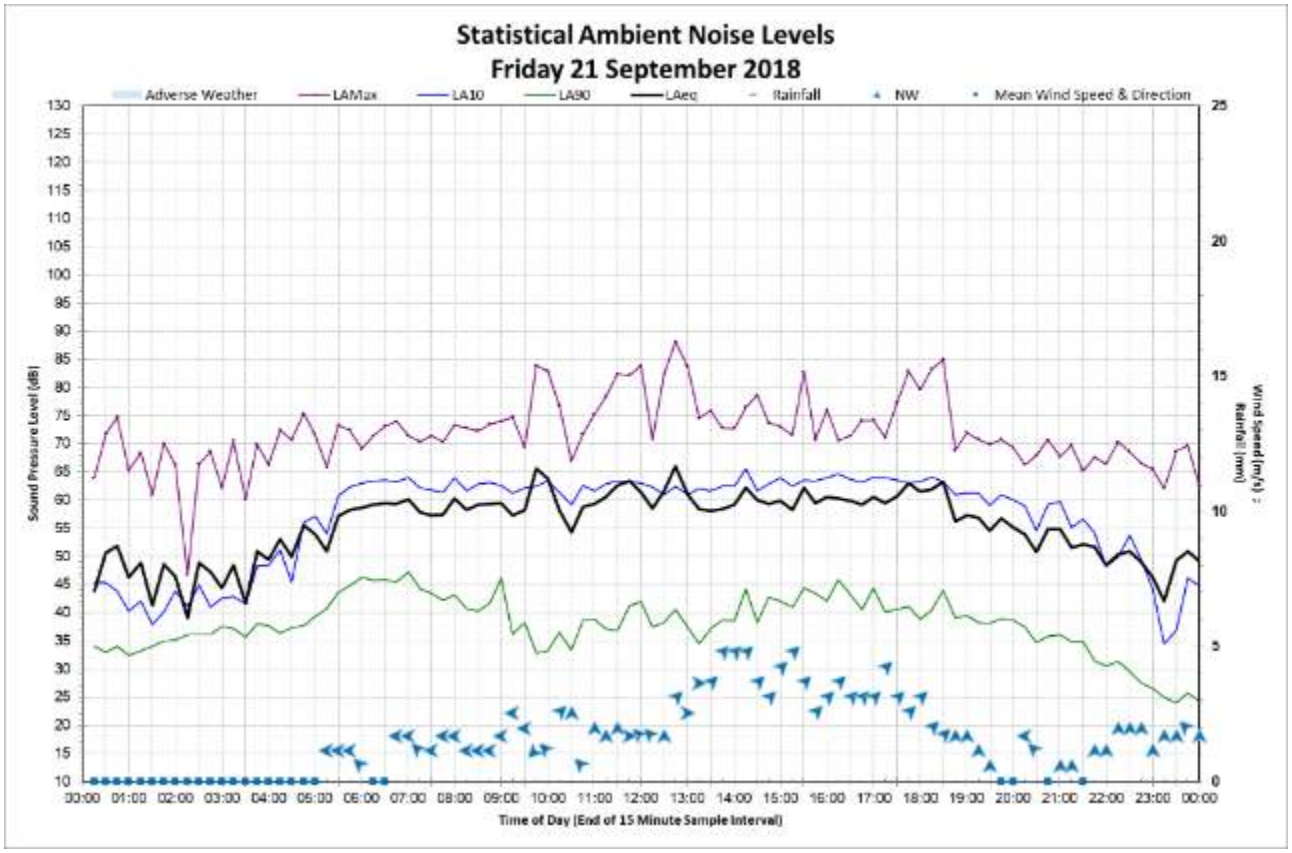
(Appendix SCM: 12.1A)

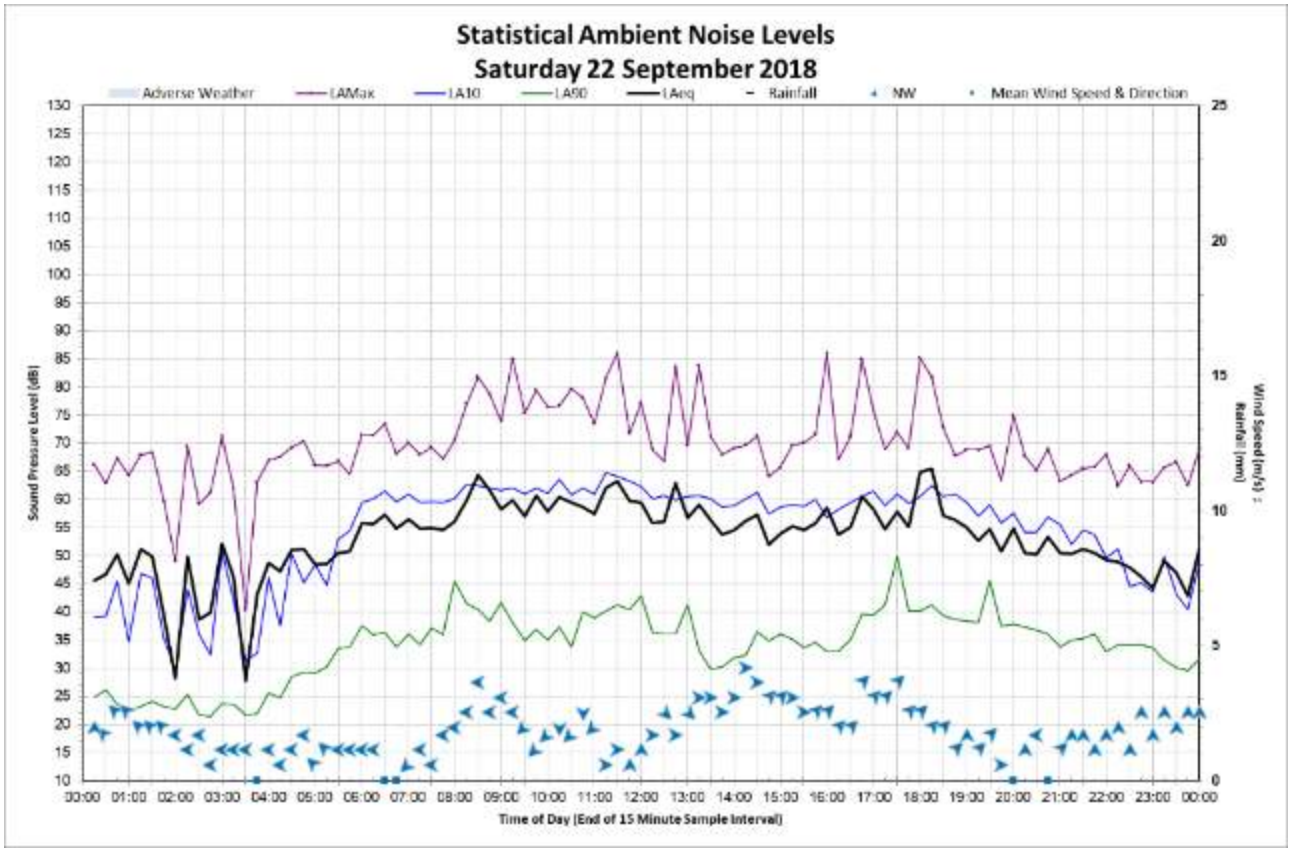
Site D – 105 Martin-Pelusey Road



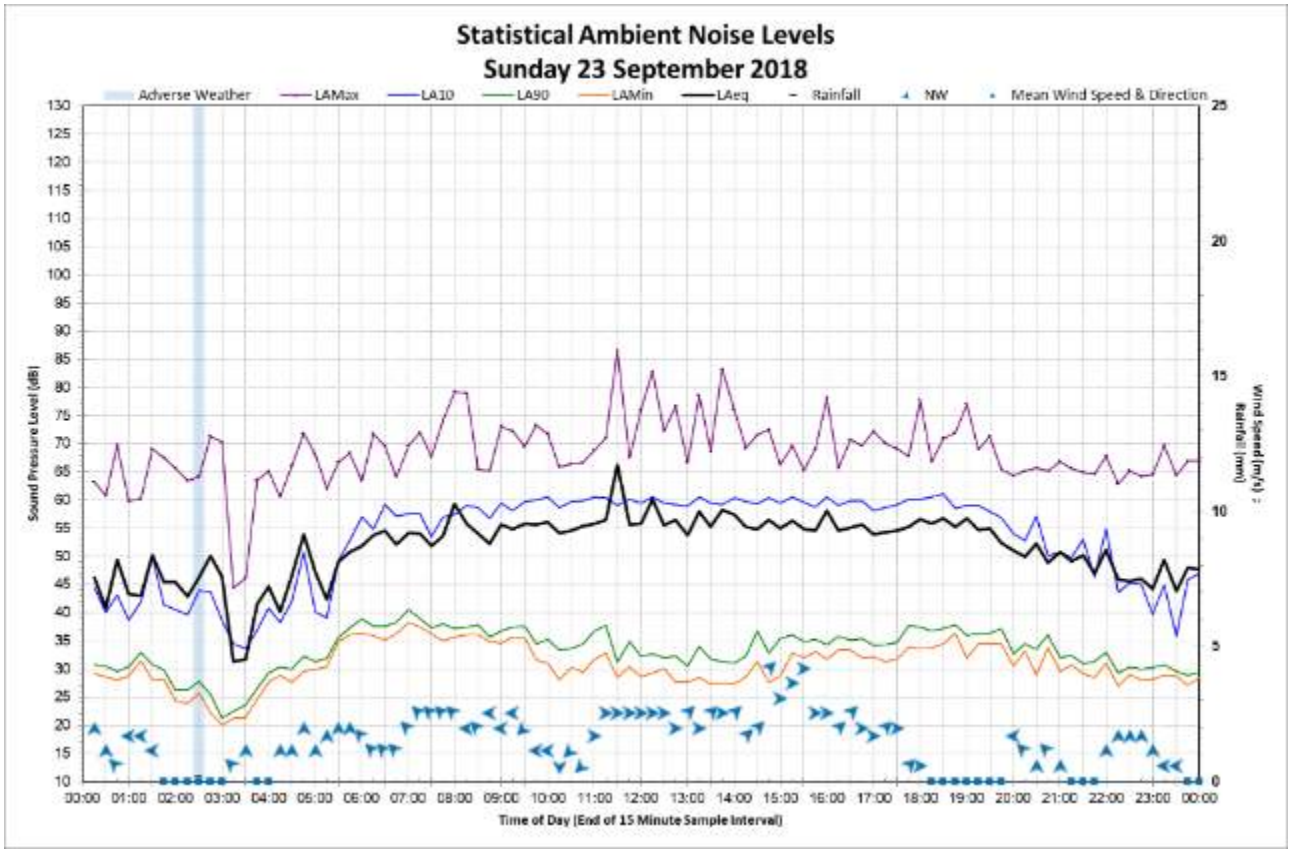


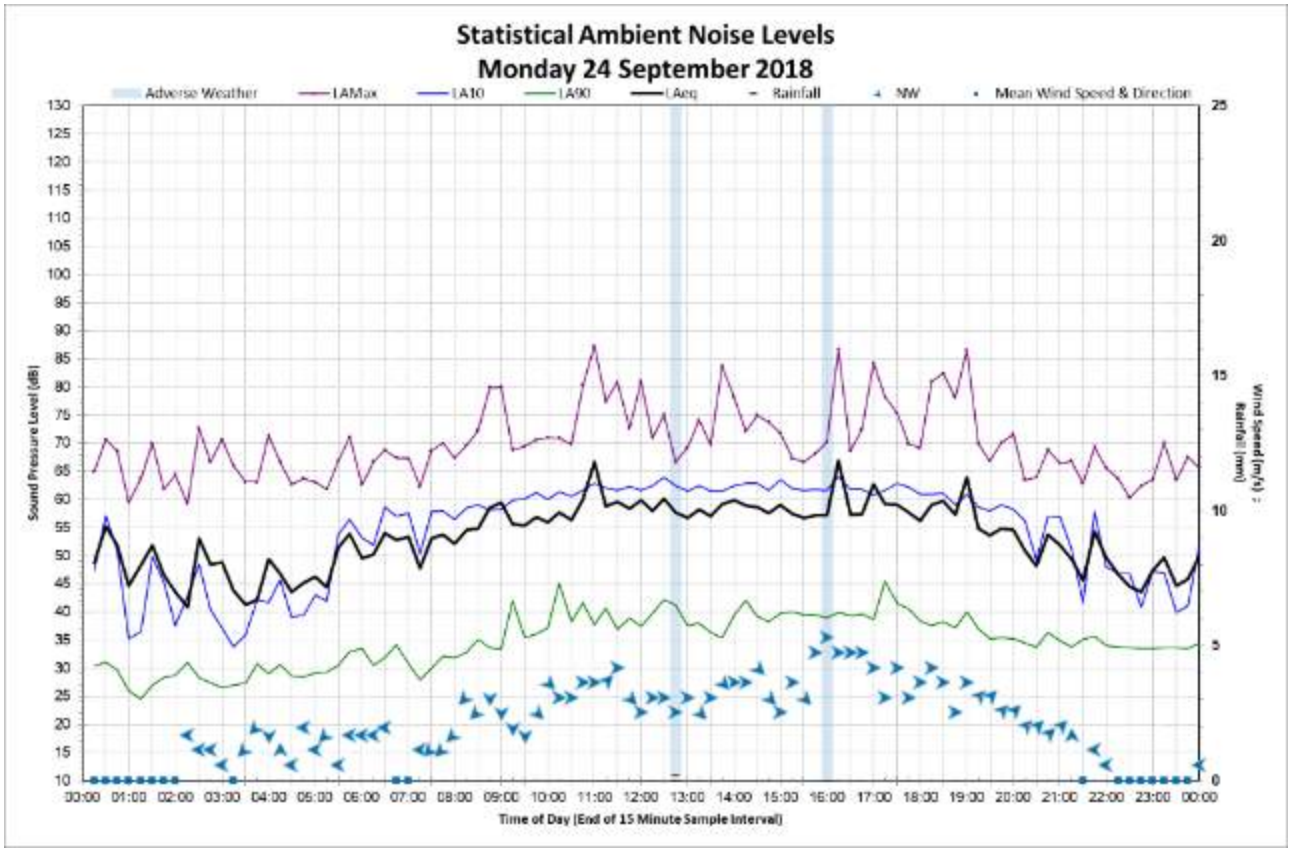
(Appendix SCM: 12.1A)





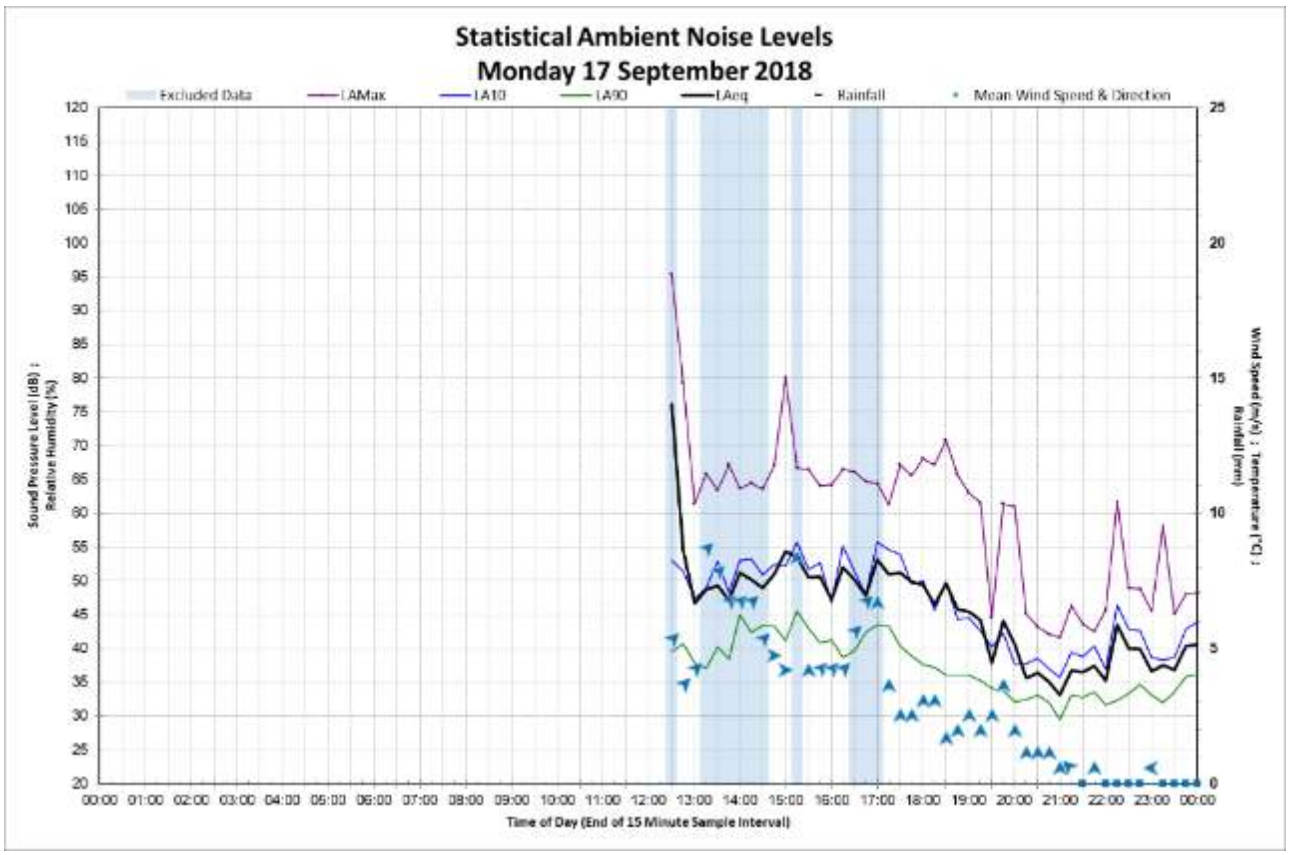
(Appendix SCM: 12.1A)

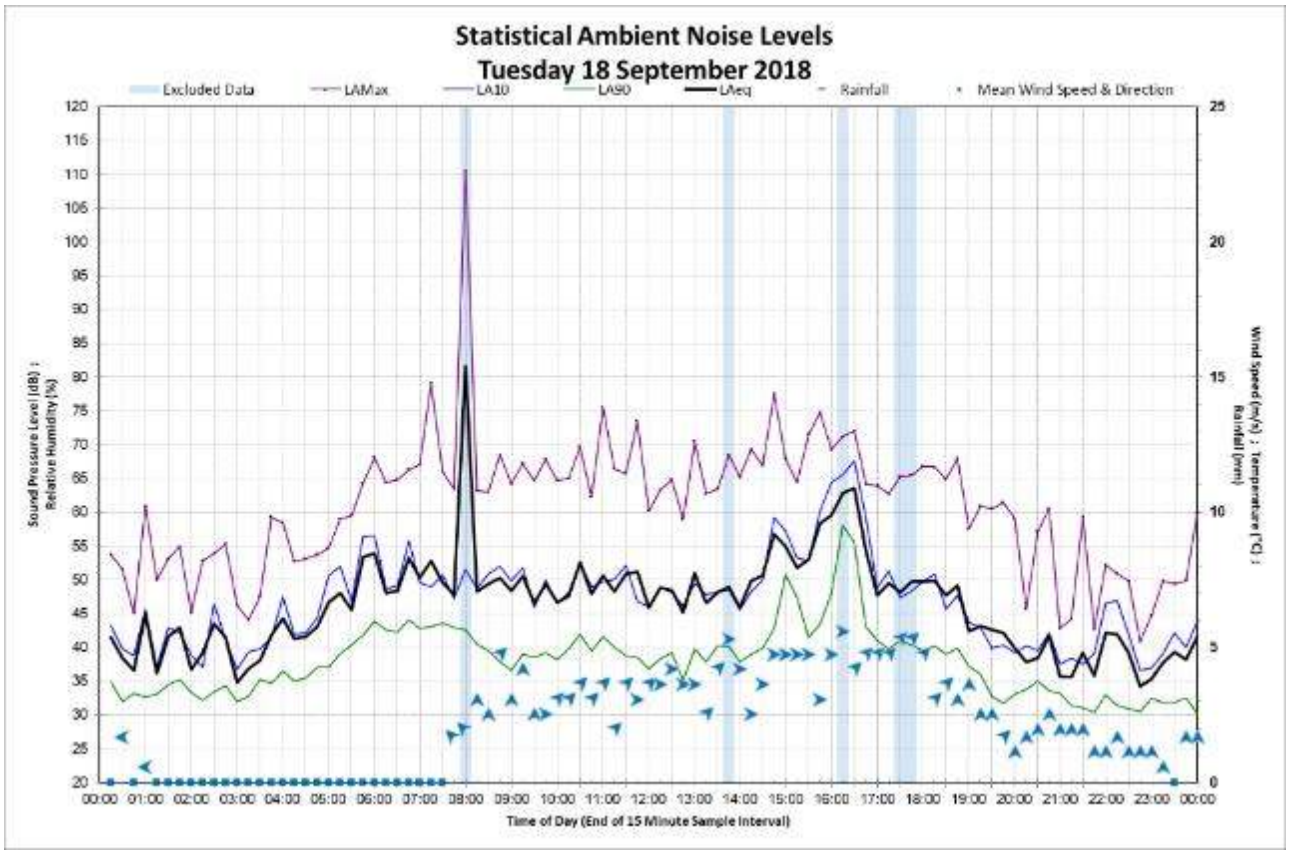




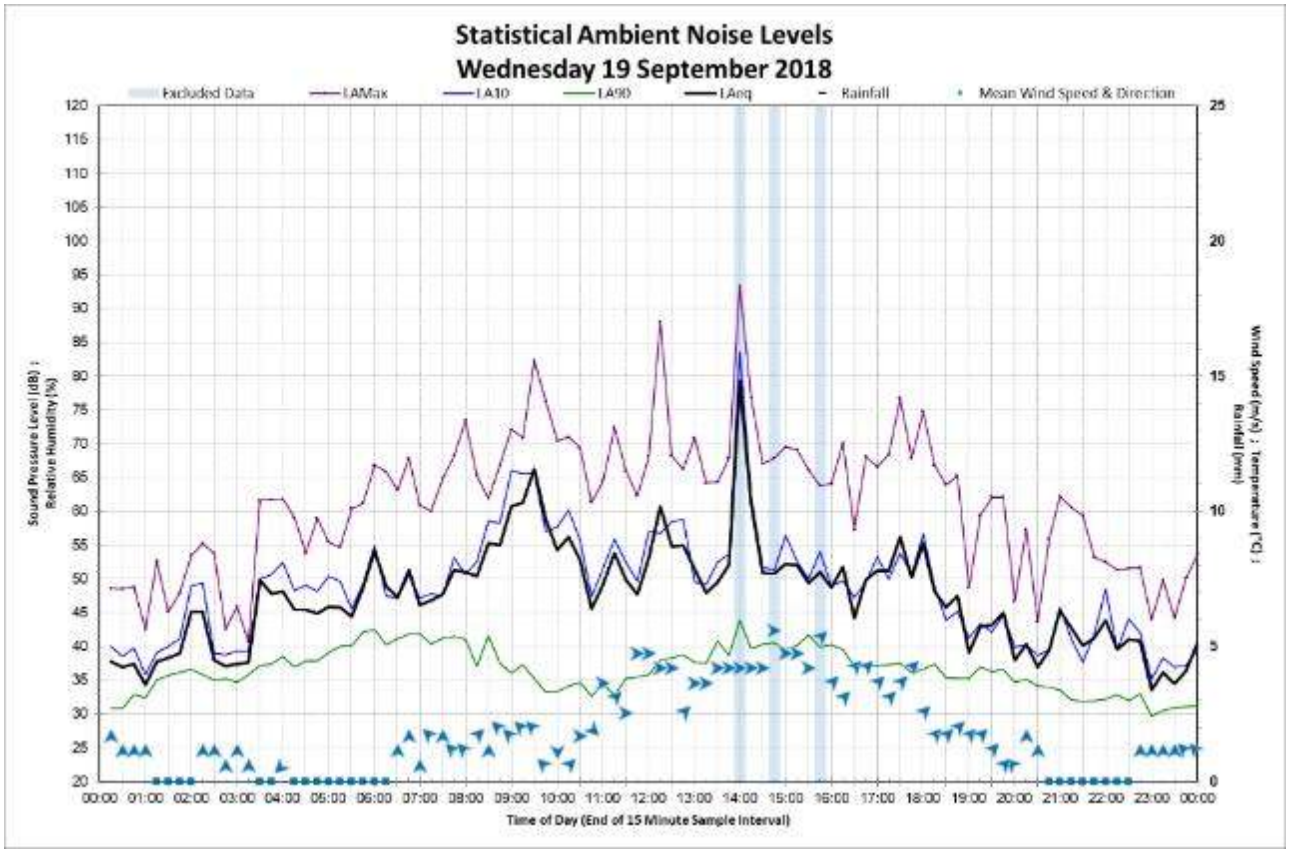
(Appendix SCM: 12.1A)

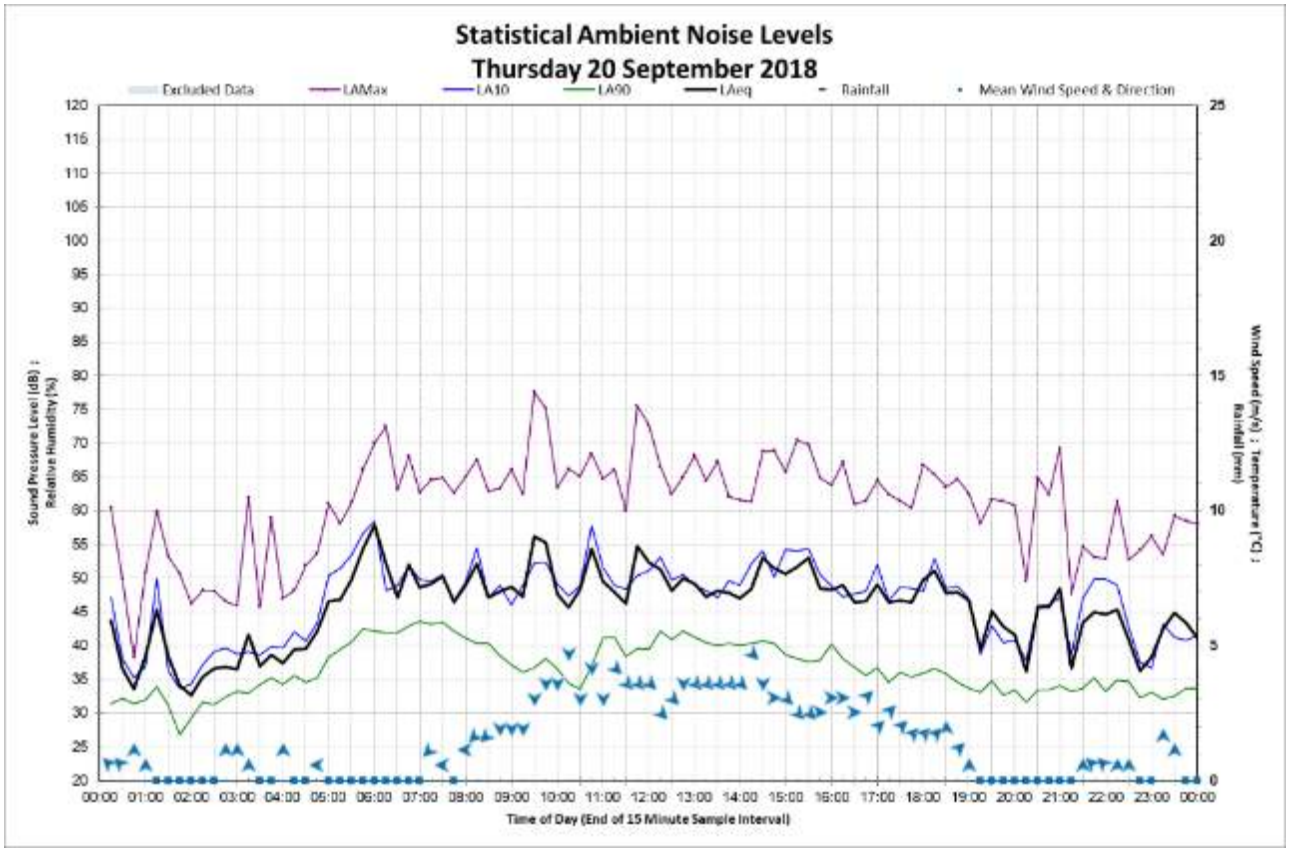
Site E – 365 Harris Road



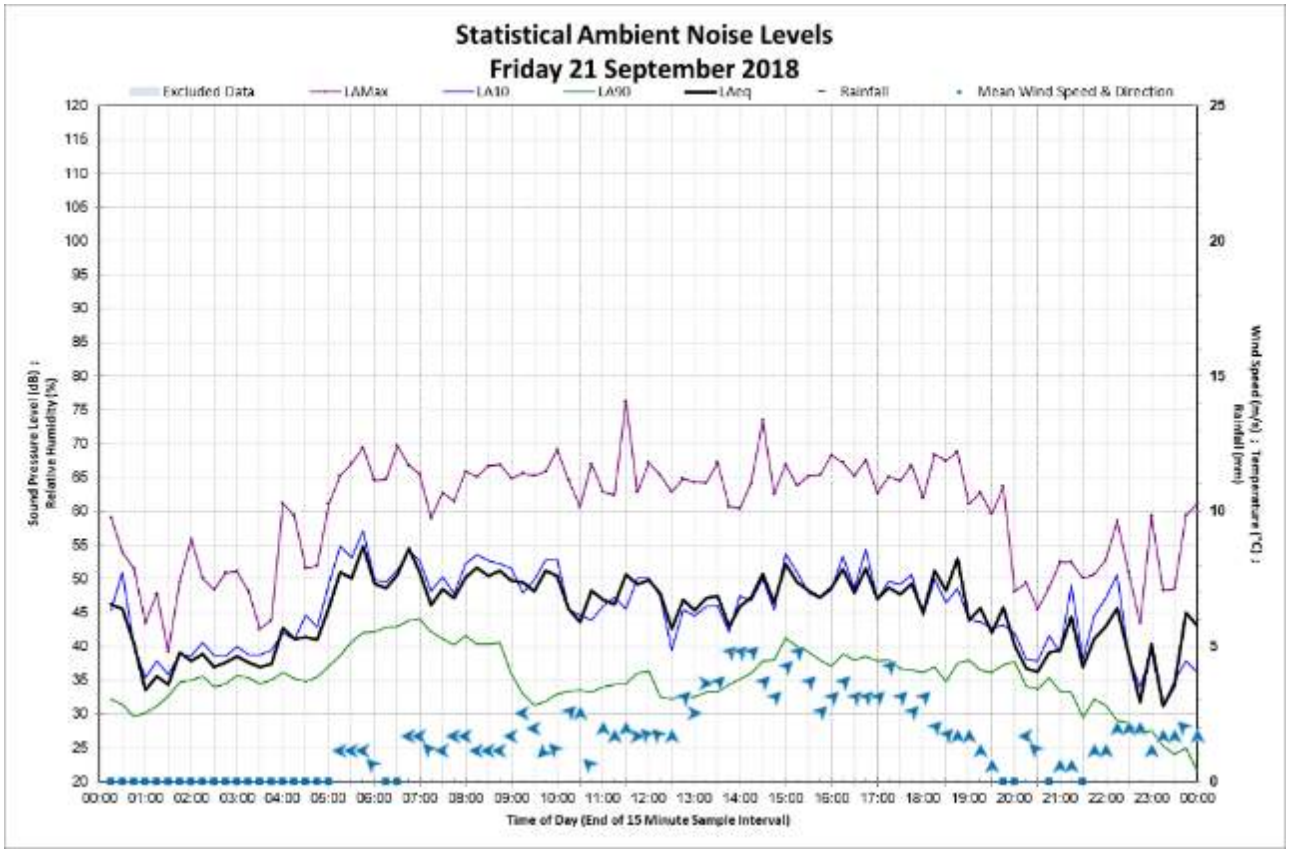


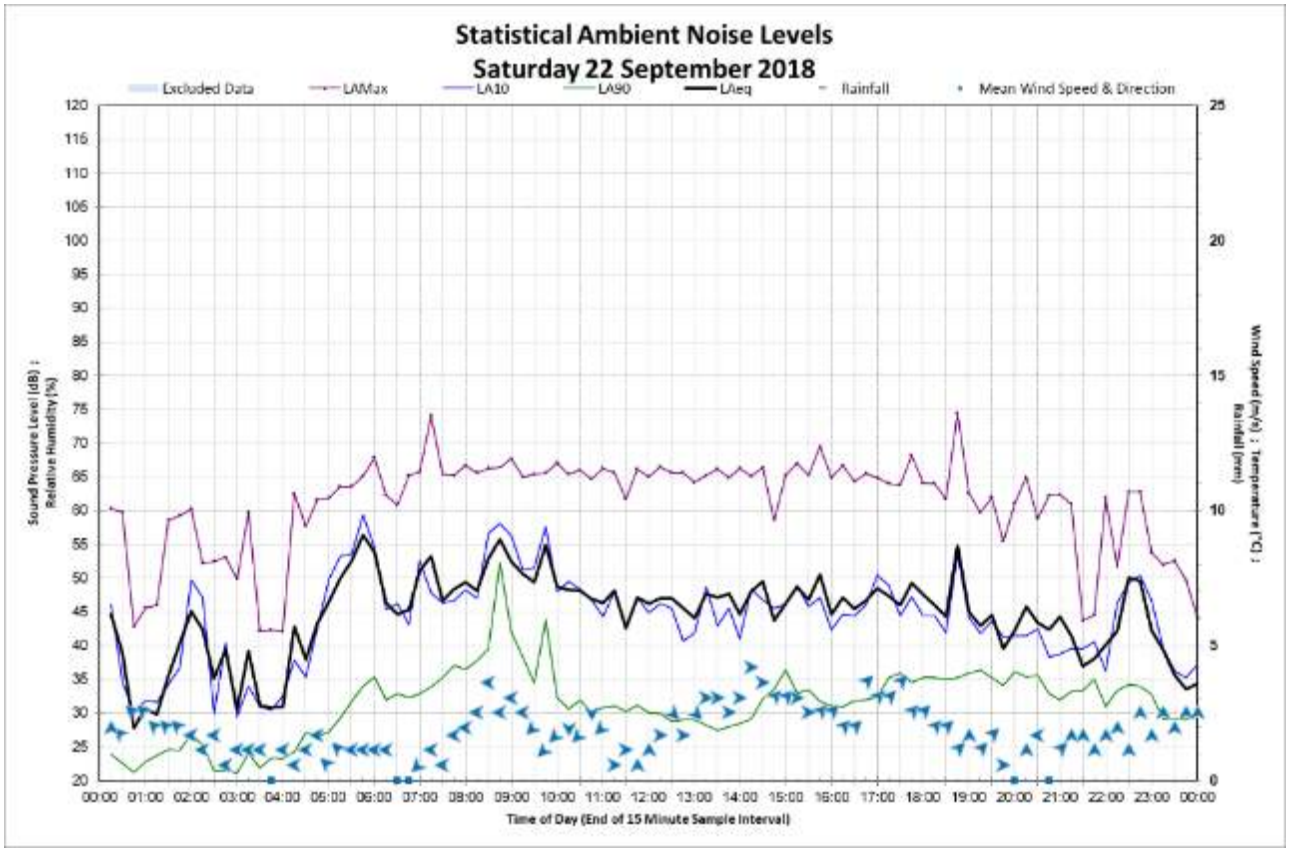
(Appendix SCM: 12.1A)





(Appendix SCM: 12.1A)





(Appendix SCM: 12.1A)

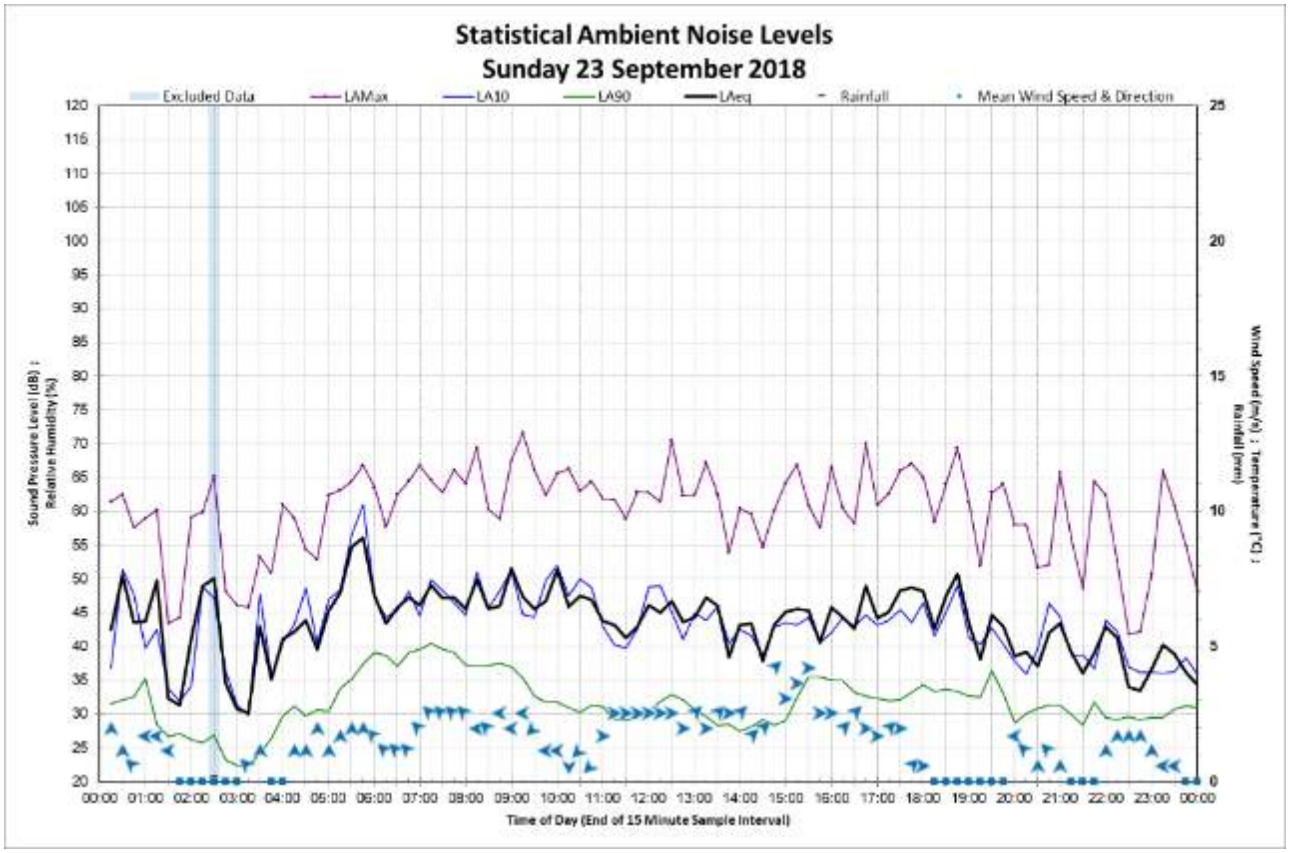


Table D1 Meteorlogical data for Bunbury[5]

Date	Temperature (°C)		Wind Speed (m/s)		Wind Direction (°)		Rainfall (mm)
	9:00 AM	3:00 PM	9:00 AM	3:00 PM	9:00 AM	3:00 PM	
10/09/2018	16.9	15.3	5.3	7.2	293	248	2.2
11/09/2018	12.7	15.6	3.1	4.7	180	248	0.6
12/09/2018	13.7	15.6	3.6	4.2	270	270	0
13/09/2018	15.3	15.9	5.3	6.1	270	270	0
14/09/2018	13.7	14.4	6.1	4.7	225	180	10
15/09/2018	11.2	14.3	3.6	4.2	90	248	0.2
16/09/2018	12.3	13.2	3.6	6.7	180	248	3.4
17/09/2018	13.2	14.6	3.1	4.2	225	270	0
18/09/2018	14.3	17.1	3.1	4.7	203	270	0.2
19/09/2018	13.9	16.2	1.7	4.7	135	270	0
20/09/2018	15.5	19.6	1.9	3.1	23	315	0
21/09/2018	14.6	17.5	1.7	4.2	113	248	2.8
22/09/2018	17.4	20.6	3.1	3.1	90	248	0.4
23/09/2018	16.2	21.7	1.9	3.1	113	270	0
24/09/2018	15.7	18.2	2.5	2.5	360	293	0
25/09/2018	17.1	18	4.7	5.6	225	248	0
26/09/2018	14.6	17.1	0.6	6.1	45	248	0
13/12/2018	18.5	22.8	3.6	5.6	158	270	0.0
14/12/2018	21.1	22.1	1.7	6.7	90	248	0.2
15/12/2018	21.5	23.3	1.7	6.1	158	248	0.0
16/12/2018	21.8	21.9	1.9	7.8	270	270	0.0
17/12/2018	17.6	16.6	8.6	9.7	270	270	0.8
18/12/2018	17.1	17.8	6.1	6.1	225	225	8.2
19/12/2018	17.3	23.3	4.7	4.2	158	158	2.8

[5] Bureau of Meteorology, (2018). Bunbury Daily Weather Observations. Available online: http://www.bom.gov.au/climate/. Accessed 11 Dec 2018

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Hillarys WA 6923
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4 February 2020

Fionnuala Hannon
GHD
10 Victoria Street
BUNBURY WA 6230

Fionnuala:

A Peer Review was undertaken of *Bunbury Outer Ring Road North Noise Assessment, Rev A*; dated 29 January 2019 by Lloyd George Acoustics and reported in *Peer Review, Bunbury Outer Ring Road*; Reference: 18124767-01 Draft, dated 12 February 2019.

Following the peer review and other updates undertaken by GHD, a new report was produced, being *Bunbury Outer Ring Road Northern and Central Sections, Traffic Noise Assessment, Rev D*, dated 10 May 2019. This report was also reviewed by Lloyd George Acoustics.

A further review has now been undertaken of the updated report, *Bunbury Outer Ring Road Northern and Central Sections, Traffic Noise Assessment, Rev E (draft)*, dated 24 January 2020. This report was also reviewed by Lloyd George Acoustics (30 January 2020), with queries responded to on the same day. We herewith advise the final version of this report to be adequate for the purposes of identifying potential noise impacts and potential mitigation for the proposed road project.

We trust this information is acceptable and should you have any queries, please do not hesitate to contact me.

Regards,

Terry George

BORR Team

Australian Government

BUILDING OUR FUTURE

mainroads WESTERN AUSTRALIA

BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

(Appendix SCM: 12.1A)

From: Cecilia Muller
Sent: Monday, 17 August 2020 3:02 PM
To: Governance Mailbox
Cc: Records Staff
Subject: FW: Attention: Susan Oosthuizen - Bunbury Outer Ring Road Project - North & Central Sections - Application for Planning Approval

Cecilia Muller has shared a OneDrive for Business file with you. To view it, click the link below.

200814 BORR Planning Application Report - Dardanup.pdf

Governance

Please create a case in Tardis for this GBRS application for the construction of the BORR, and list for DCU

Cecilia Muller
Planning Principal Officer

Shire of Dardanup | | PO Box 7016 | Eaton WA 6232
p: 08 9724 0386 | **m:** 0459 881 241 | **e:** cecilia.muller@dardanup.wa.gov.au

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From: Susan Oosthuizen <Susan.Oosthuizen@dardanup.wa.gov.au>
Sent: Monday, 17 August 2020 10:15 AM
To: Cecilia Muller <Cecilia.Muller@dardanup.wa.gov.au>
Cc: Gaylene Godfrey <Gaylene.Godfrey@dardanup.wa.gov.au>
Subject: FW: Attention: Susan Oosthuizen - Bunbury Outer Ring Road Project - North & Central Sections - Application for Planning Approval

Hi Cecilia

This is the BORR DA that has been refereed from Main Roads – we have 30 days to provide our advice, this needs to go to Council.

Thanks

Susan Oosthuizen
Director Sustainable Development

Shire of Dardanup | 1 Council Drive | PO Box 7016 | Eaton WA 6232
p: 08 9724 0396 | **m:** 0448 102 687 | **e:** Susan.Oosthuizen@dardanup.wa.gov.au

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From: MARSHALL Melinda (Con) <melinda.marshall@mainroads.wa.gov.au>
Sent: Monday, 17 August 2020 10:03 AM
To: Susan Oosthuizen <Susan.Oosthuizen@dardanup.wa.gov.au>; Records <records@dardanup.wa.gov.au>; Brod Meredith <Brod.Meredith@dplh.wa.gov.au>; Ben Muller <Ben.Muller@dplh.wa.gov.au>
Cc: PAROLO Alf (RRM) <alf.parolo@mainroads.wa.gov.au>
Subject: Attention: Susan Oosthuizen - Bunbury Outer Ring Road Project - North & Central Sections - Application for Planning Approval

Good Morning

Please find attached a link to an Application for Planning Approval for the Bunbury Outer Ring Road Project - North & Central Sections. If you have any queries please do not hesitate to contact Alf Parolo on 9323 4636 or Melinda Marshall on 0407 662 448.

Warm Regards

Melinda Marshall