HEGGIES

REPORT 30-1939-R1

Revision 1

Traffic Noise Impact Assessment
Stage 1B - Area 14
Milland P/L & Seawide P/L Properties

PREPARED FOR

King & Campbell Pty Ltd
PO Box 243
Port Macquarie NSW 2444

5 JULY 2010

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Traffic Noise Impact Assessment

Stage 1B - Area 14

Milland P/L & Seawide P/L Properties

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EXECUTIVE SUMMARY

Heggies Pty Ltd (Heggies) has been commissioned by King & Campbell Pty Ltd to conduct a road traffic noise impact assessment for part of the proposed new urban development along Ocean Drive (south of Port Macquarie, New South Wales) between Lake Cathie and Bonny Hills. The area may ultimately cater for 9,900 residents in what is currently known as Area 14 Lake Cathie Bonny Hills.

The purpose of this assessment was to determine the impact of road traffic noise for Stage 1B of Area 14, and to identify and recommend ameliorative measures to mitigate road traffic noise impacts for residential developments (single and 2 storey) adjacent to Ocean Drive over the investigation area.

Noise modelling of the project area was carried out using the UK Department of Transport, *"Calculation of Road Traffic Noise"* (CORTN 1988) algorithms incorporated in the SoundPLAN noise modelling software. The modelling allows for traffic volume and mix, type of road surface, vehicle speed, road gradient, reflections off building surfaces, ground absorption and shielding from ground topography and physical noise barriers.

Two (2) scenarios were modelled in SoundPLAN for the purposes of this traffic noise impact assessment:

- Scenario 2009 – the baseline scenario which assumes 2009 traffic volume information with Stage 1B of Area 14 not constructed and therefore all projected traffic using the Ocean Drive; and
- Scenario 2029 – the twenty (20) year projection scenario assuming 2029 traffic volume information and Stage 1B of Area 14 is constructed.

Results of modelling are presented in the form of noise contours for daytime and night-time for the relevant scenarios. The noise contour plots are contained in the following appendices:

Appendix B1 - Daytime 2009 (no stage 1B of area 14)
Appendix B2 – Night-time 2009 (no stage 1B of area 14)

Appendix C1 - Daytime 2029 (with stage 1B of area 14) No Mitigation
Appendix C2 – Night-time 2029 (with stage 1B of area 14) No Mitigation

Appendix D1a - Daytime 2029 (with stage 1B of area 14) Post Mitigation first storey
Appendix D1b - Daytime 2029 (with stage 1B of area 14) Post Mitigation second storey
Appendix D2a – Night-time 2029 (with stage 1B of area 14) Post Mitigation first storey
Appendix D2b – Night-time 2029 (with stage 1B of area 14) Post Mitigation second storey

The Predicted noise levels have been used to recommend mitigation measures and construction types suitable for the Stage 1B of Area 14.

Provided the recommendations in this report are implemented, it is expected that this development will be able to satisfy the relevant noise criteria requirements of AS 2107:2000 and the ECTRN.

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1 INTRODUCTION

Heggies Pty Ltd (Heggies) has been commissioned by King Campbell Pty Ltd to conduct a road traffic noise impact assessment (NIA) for part of the proposed new urban development within the designated Urban Growth area identified as Area 14 in the Greater Lake Cathie and Bonny Hills Urban Design Master Plan (2003).

The purpose of this assessment was to determine the impact of road traffic noise from Ocean Drive on stages 1B of the proposed development in area 14 and to identify and recommend ameliorative measures to mitigate traffic noise impacts adjacent to Ocean Drive for residential development.

The NIA will form part of a Part 3A Concept Plan Application on the subject properties.

This traffic noise impact assessment has been prepared with reference to the following NSW Department of Environment, Climate Change and Water (DECCW) policy documents:

- Environmental Criteria for Road Traffic Noise (ECRTN); and
- Industrial Noise Policy (INP).

In addition, reference has also been made to relevant Australian Standards (AS 2107-2000 and AS 3671-1989).

2 SITE DETAILS

The subject properties are Lot 1 DP 374315 and Lot 4 DP 615261 Ocean Drive immediately south of Lake Cathie. The combined site area of Lot 1 and Lot 4 is 33.42ha. The Part 3A Concept Plan application for Stage 1B comprises:

- Low Density Residential – approximately 214-268 dwellings
- Medium Density Residential – approximately 68 dwellings
- Hilltop Village – Commercial/Residential Tourist – approximately 26 ground level commercial/tourist units and 120-140 Medium-sized residential tourist apartments.
- Environmental Works.

Figure 1 provides a plan showing the location of Stage 1B (labelled A) within the broader Area 14 urban areas. **Figure 2** provides details of the Concept Plan Application on the subject property.

Figure 1 Stage 1B Investigation Area

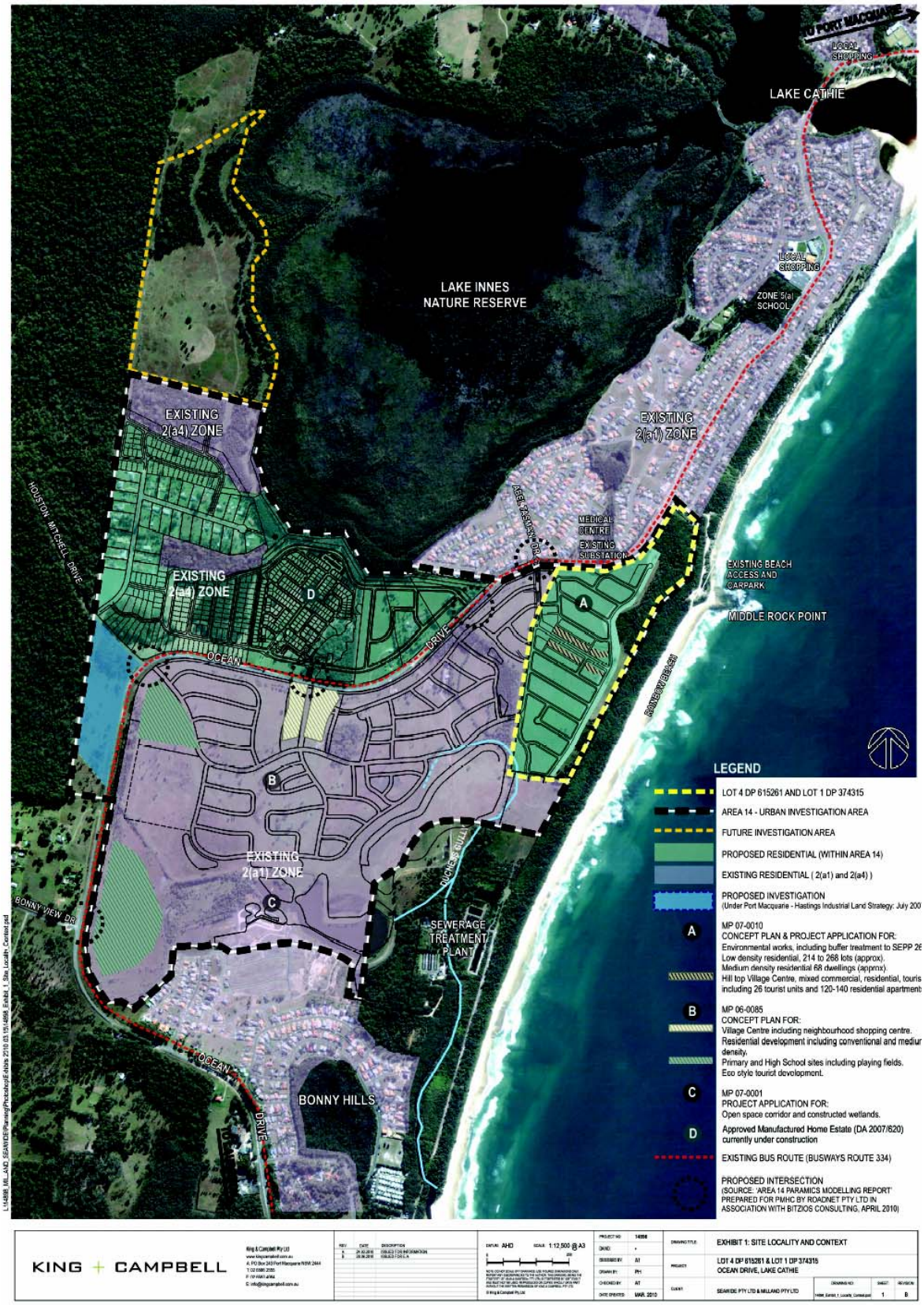
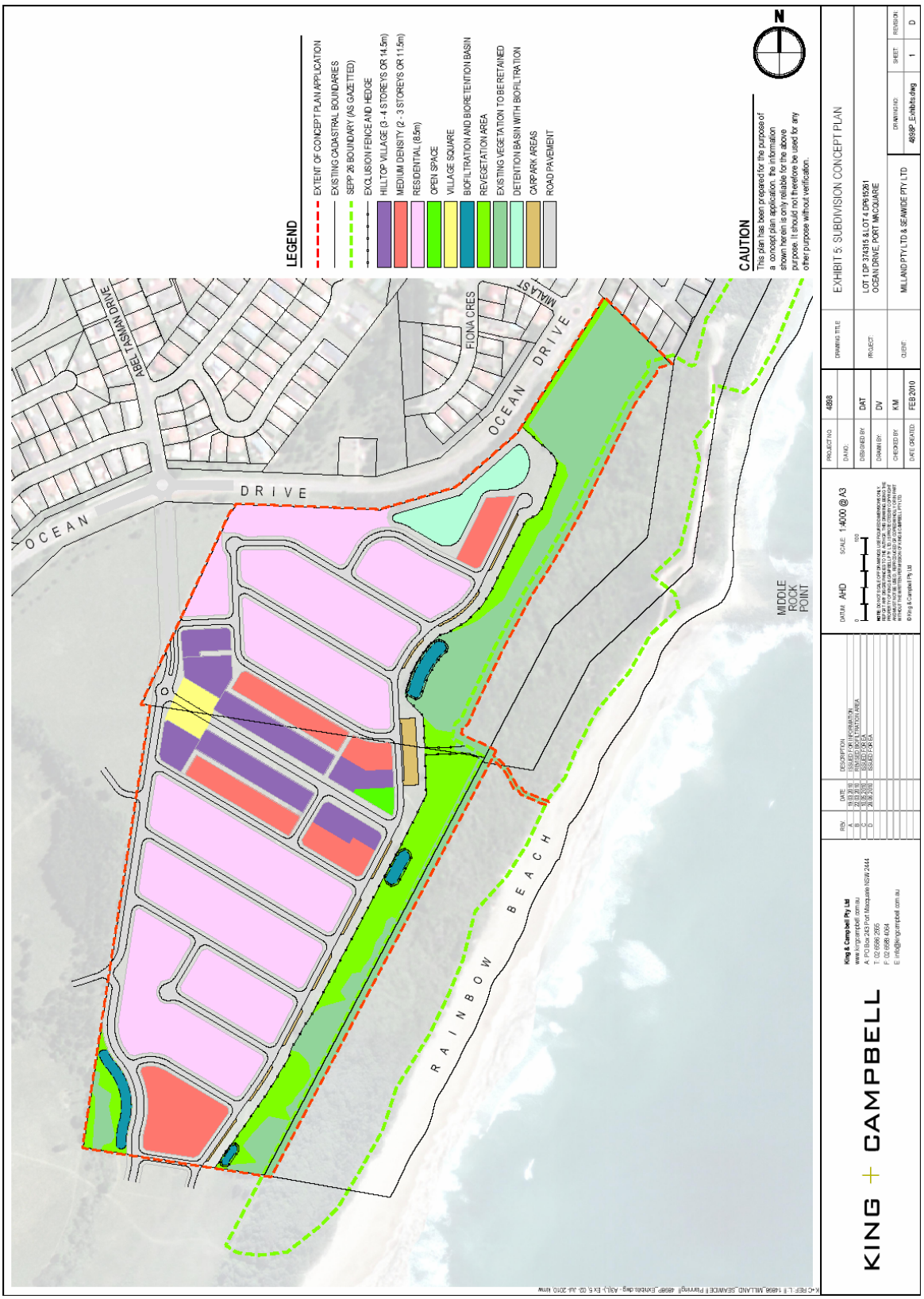


Figure 2 Stage 1B Concept Plan



2.1 Ocean Drive

Ocean Drive is a two lane arterial road that bounds the Stage 1B investigation area northern boundary. It is the primary arterial road connecting the coastal town centres of Bonny Hills, Laurieton and Lake Cathie to the regional centre of Port Macquarie.

3 TRAFFIC NOISE IMPACT ASSESSMENT PROCEDURES

3.1 Environmental Criteria for Road Traffic Noise

The DECCW *Environmental Criteria for Road Traffic Noise* (ECRTN May 1999) presents guidelines for road traffic noise assessment. The policy document provides road traffic noise criteria for proposed roads or residential developments as well as criteria for other sensitive land uses.

Table 1 presents the most relevant ECRTN criteria for proposed residential development affected by freeway or arterial road (Ocean Drive) traffic noise. Noise levels provided in **Table 1** are external noise levels and refer only to road traffic noise; they do not include ambient noise from other sources.

Table 1 Road Traffic Noise Criteria for Residential and Other Sensitive Land Uses

	Criteria		
Type of Development/ Sensitive Land Use	**Day 7am – 10pm**	**Night 10pm – 7am**	**Where Criteria Are Already Exceeded/ Noise Mitigation Measures**
New residential land use developments affected by freeway/arterial traffic noise	$L_{Aeq(15hour)}$ 55 dBA	$L_{Aeq(9hour)}$ 50 dBA	Where feasible and reasonable, existing noise levels should be reduced to meet the noise criteria via judicious design and construction of the development. Locations, internal layouts, building materials and construction should be chosen so as to minimise noise impacts.
Proposed school classrooms	$L_{Aeq(1hour)}$ 40 dBA (internal)	-	To achieve internal noise criteria in the short term, the most practicable mitigation measures are often related to building or façade treatments. In the medium to longer term, strategies such as regulation of exhaust noise from in-service vehicles, limitations on exhaust brake use, and restricting access for sensitive areas or during sensitive times to low noise vehicles can be applied to mitigate noise impacts across the road system. Other measures include improved planning, design and construction of sensitive land use developments; reduced new vehicle emission standards; greater use of public transport; and alternative methods of freight haulage. These medium- to long-term strategies apply equally to mitigating internal and external noise levels. Where existing levels of traffic noise exceed the criteria, all feasible and reasonable noise control measures should be evaluated and applied. Where this has been done and the internal or external criteria (as appropriate) cannot be achieved, the proposed road or land use development should be designed so as not to increase existing road traffic noise levels by more than 0.5 dBA for new roads and 2 dBA for redeveloped roads or land use development with potential to create additional traffic.
Hospital Wards	$L_{Aeq(1hour)}$ 35 dBA (internal)	$L_{Aeq(1hour)}$ 35 dBA (internal)	
Places of worship	$L_{Aeq(1hour)}$ 40 dBA (internal)	$L_{Aeq(1hour)}$ 40 dBA (internal)	
Active recreation (eg golf courses)	$L_{Aeq(15hour)}$ 60 dBA	-	
Passive recreation and school playgrounds	$L_{Aeq(15hour)}$ 55 dBA	-	

With regard to internal noise levels the ECRTN recommends, in the absence of any local codes, that internal noise levels in sleeping areas of between 35 dBA and 40 dBA are acceptable.

The ECRTN also provides guidance in the determination of sleep disturbance noise goals and draws the following conclusions in relation to sleep disturbance:

- Maximum internal noise levels below 50–55 dBA are unlikely to cause awakening reactions.
- One or two noise events per night, with maximum internal noise levels of 65–70 dBA, are not likely to affect health and wellbeing significantly.
- At the current level of understanding it is not possible to develop noise level criteria for sleep disturbance that would have the equivalent level of confidence as those noise criteria used for annoyance reactions.

3.2 Australian Standards

Australian Standard AS 2107-2000 *"Acoustics - Recommended design sound levels and reverberation times for building interiors"* recommends suitable internal noise levels for residential habitation and other buildings. The buildings should be constructed to achieve an internal noise level equal to or lower than the levels outlined in **Table 2**. How this is achieved will depend strongly on the location, orientation and type of construction of each building.

Table 2 AS 2107-2000 Internal Noise Level Criteria – Residential Buildings

Type of Occupancy - Houses and Apartments near Major Roads	**Recommended design sound level, L_{Aeq} (dBA)**	
	Satisfactory	**Maximum**
Living Areas	35 dBA	45 dBA
Sleeping Areas	30 dBA	40 dBA
Work Areas	35 dBA	45 dBA
Common Areas	45 dBA	55 dBA

Care should be taken in applying the "Satisfactory Design Levels" set out in **Table 2**. Some of these levels are relatively low and, while providing a suitable target for a prestige "up market" development with above-the-norm quality, achievement of these levels might be too onerous for a building of general, but still good, quality standard. The "Maximum Design Levels" are more indicative of the standards applicable for the latter type of development.

Australian Standard AS 3671-1989 *"Acoustics - Road traffic noise intrusion - Building siting and construction"* is concerned with the reduction of road traffic noise intrusion in buildings in areas near major roads. This standard provides guidelines for determining the type of building construction necessary to achieve acceptable internal noise levels. **Table 3** summarises the recommended building construction categories outlined in AS 3671-1989.

Table 3 Definition of Construction Categories

Category Type	Definition	Approximate Traffic Noise Reduction
Category 1	Standard construction; openings, including open windows and doors may comprise up to 10% of the exposed facade.	Up to 10 dBA
Category 2	Standard construction, except for light-weight elements such as fibrous cement or metal cladding or all-glass facades. Windows, doors and other openings must be closed.	> 10 dBA ≤ 25 dBA
Category 3	Special construction. Windows, doors and other openings must be closed.	> 25 dBA ≤ 35 dBA
Category 4	Specialist acoustic advice should be sought.	> 35 dBA

3.3 Project Specific Road Traffic Noise Goals

The criteria supplied in the ECRTN have been adopted for the purposes of this noise assessment. The noise descriptors utilised in the ECRTN are unambiguous and the noise criteria specified are consistent with the relevant Australian Standards. The relevant road traffic noise criteria for the subject development used in this assessment are provided in **Table 4**.

Table 4 Road Traffic Noise Criteria

Type of Development	Criteria		
	Day 7 am - 10 pm	**Night 10 pm - 7 am**	**Where Criteria are Already Exceeded**
New residential land use developments affected by freeway/arterial traffic noise	$L_{Aeq(15hour)}$ 55 dBA	$L_{Aeq(9hour)}$ 50 dBA	Where feasible and reasonable, existing noise levels should be reduced to meet the noise criteria via judicious design and construction of the development. Locations, internal layouts, building materials and construction should be chosen so as to minimise noise impacts.

Furthermore, if these external noise goals are achieved it is likely that recommended internal noise goals (AS2107) will also be achieved. For the purpose of this assessment internal noise goals of L_{Aeq} 45 dBA and 40 dBA have been adopted for day and night-time, respectively.

4 EXISTING ACOUSTICAL ENVIRONMENT

4.1 Methodology

A site inspection was conducted on Thursday 30 July 2009 to gain an appreciation of the study area and to commence the noise monitoring program. Both short-term operator attended noise surveys and long-term unattended noise monitoring was conducted. Two (2) type EL-215 environmental noise loggers were positioned at the subject site to record ambient noise levels over a period of eight (7) days from Thursday 30 July 2009 until Thursday 6 August 2009, inclusive. Operator attended noise surveys were conducted during logger deployment and retrieval for a period of 15 minutes at each noise logger location.

All acoustic instrumentation employed by Heggies throughout the monitoring programme has been designed to comply with the requirements of AS 1259.2-1990, "*Sound Level Meters*" and carries current NATA or manufacturer calibration certificates. Instrument calibration was checked before and after each measurement survey, with the variation in calibrated levels not exceeding ±0.5 dBA.

4.2 Unattended Noise Monitoring

Details of noise logger locations, and the equipment utilised for the survey, are provided in **Table 5**.

Table 5 Unattended Noise Monitoring Information

Logger Serial Number	Location	Comments
194561	1. Adjacent Ocean Drive S 31°34'0.96" E 152°50'14.84"	Approx. 18m from Ocean Drive
194802	2. Adjacent Ocean Drive S 31°33'48.72"E 152°50'42.14"	Approx. 16m from Ocean drive

Figure 3 provides a plan showing noise logger locations adjacent to Ocean Drive.

Figure 3 Noise Monitoring Locations

Source: Google Earth

The noise loggers were set to record statistical indices over 15-minute intervals including L_{Amax}, L_{A1}, L_{A10}, L_{A90} and L_{Aeq} noise levels.

Weather data for the survey period was obtained from the nearest Bureau of Meteorology weather station located at Port Macquarie Airport, approximately 14 km north of the monitoring locations. Unattended noise data corresponding with periods of rainfall and/or wind speeds in excess of 5 m/s (approximately 18km/hr) were discarded in accordance with Industrial Noise Policy (INP) data exclusion methodology.

Results of the unattended noise monitoring program are provided in graphical format in **Appendix A**. A summary of noise levels measured during the unattended noise monitoring program is provided in **Table 6**.

Table 6 Unattended Noise Monitoring Results Summary

Location	Road Traffic Noise			
	LAeq(15 hour)	LAeq(1 hour) Day	LAeq(9 hour)	LAeq(1hour) Night
1. 1355 Ocean Drive	63 dBA	65 dBA	56 dBA	60 dBA
2. Opposite Lake Cathie Medical Centre	62 dBA	64 dBA	56 dBA	60 dBA

Note: The LAeq(1hour) descriptor is the noisiest 1 hour of the relevant period; day (7.00 am to 10.00 pm) or night (10.00 pm to 7.00 am).

All noise levels reported here are free-field measurements as there was no building facades within the logging area.

4.3 Operator Attended Noise Surveys

The purpose of the operator-attended noise surveys was to determine the character and duration of various noise sources to the total ambient noise level, in particular, road traffic noise. The results of the operator-attended noise surveys are provided in **Table 7**.

Table 7 Operator Attended Noise Survey Results

Noise Logger Location	Date/ Start time/ Weather	Primary Noise Descriptor (dBA re 20 μPa)					Description of Noise Emission, Typical Maximum Levels L_{Amax} (dBA)
		L_{Amax}	L_{A1}	L_{A10}	L_{Aeq}	L_{A90}	
1355 Ocean Drive	30/7/2009 1303 Wind: Calm Temp: 24°C	76	72	67	63	46	Passing cars: 46 to 70 dBA Passing trucks: 50 to 76 dBA Traffic major contributor
Opposite Lake Cathie Medical Centre	30/7/2009 1335 Wind: Calm Temp: 21°C	74	72	69	64	50	Passing cars: 50 to 68 dBA Passing trucks: 60 to 74 dBA Traffic major contributor

5 TRAFFIC NOISE MODELLING

5.1 Methodology and Assumptions

Noise modelling of the project area was carried out using the UK Department of Transport, *"Calculation of Road Traffic Noise"* (CORTN 1988) algorithms incorporated in the SoundPLAN noise modelling software. The modelling allows for traffic volume and mix, type of road surface, vehicle speed, road gradient, reflections off building surfaces, ground absorption and shielding from ground topography and physical noise barriers.

The algorithm output of CORTN (fundamentally an L_{A10} predictor) has been modified to calculate the relevant L_{Aeq} road traffic noise emission descriptors, as required.

All reported noise levels are "facade-corrected". The predicted noise levels have been adjusted upwards to include a notional 2.5 dBA reflection within the noise model computation.

The predicted levels are for receiver points 1.5 m and 4.5m above the external ground level.

In the original United Kingdom version of the CORTN Model, all traffic noise "sources" are located 0.5 m above the pavement. This approach is appropriate as a "standard" calculation method and yields reasonable consistency from project to project. The predicted noise levels are considered reasonably accurate for roadway conditions having a clear line of sight from receivers to the traffic.

Where noise barriers (including the edges of cuttings) are present however, the CORTN barrier reduction algorithm would tend to over-predict the reductions for truck engine and exhaust noise components, which have effective source heights above pavement considerably greater than 0.5 m.

For this project therefore, the SoundPLAN traffic noise source "strings" have been modified to incorporate four effective noise sources (and heights) in each carriageway. These comprise a "cars" source with height of 0.5 m above pavement and three "truck" sources at three separate heights representing truck tyres (0.5 m), truck engines (1.5 m) and truck exhausts (3.5 m).

The truck sources have relative sound power emission levels (compared to total truck sound power) of -5.4 dBA, -2.4 dBA and -8.5 dBA for tyres, engines and exhausts, respectively. These modifications ensure that the noise predictions (particularly in the presence of noise barriers) address the significance of the elevated heights of noise emission from truck engines and exhausts.

Two (2) scenarios were modelled for the purposes of this traffic noise impact assessment:

- Scenario 2009 – the baseline scenario which assumes 2009 traffic volume information with the Stage 1B Project developed; and
- Scenario 2029 – the twenty (20) year projection scenario assuming predicted 2029 traffic volume information.

Topographic information for the study area was supplied by King + Campbell Pty. Ltd. The noise model used this information together with road traffic volume information. It should be noted that the investigation area has no buildings to warrant consideration of shielding effects on road traffic noise levels.

Road traffic volume information was adopted from the Bitzios Consulting Pty Ltd document titled: "Area 14 Paramics Modelling Report" dated June 2009. The Annual Average Daily Traffic (AADT) data was used to project 2009 and 2029 road traffic volume information for Ocean Drive based on predicted growth trends. The AADT does not provide details on traffic composition and therefore a heavy traffic composition of 6.1% was assumed for 2009. Heggies have been advised by King & Campbell that as Area 14 becomes more uniformly urbanised it will become less suitable for heavy vehicle traffic. Therefore, heavy vehicle composition of 4% has been assumed for 2029.

Details of parameters utilised in the noise model are provided in **Table 8**.

Table 8 Road Traffic Volumes Utilised in Noise Model

Description		Average Daily Vehicle Count (Both Directions)		Percentage of Heavy Vehicles	
Year	Road Traffic Source	Daytime (7am-10pm)	Night-Time (10pm-7am)	Daytime (7am-10pm)	Night-Time (10pm-7am)
2009	Ocean Drive	6424	411	6.1%	6.1%
2029	Ocean Drive	26767	1710	4%	4%

Additionally, a graphic house was modelled on each proposed residential lot immediately adjacent to Ocean Drive. The purpose of this was to provide an indication of the likely acoustic shielding provided by residential dwellings as the site is developed. All generic buildings have been assumed to be two (2) storey dwellings.

We note that likely additional shielding of road traffic noise from Ocean Drive would be provided by future buildings.

It is also relevant to note that a road surface correction of 2dBA has been applied to the 2029 noise prediction as it understood that current road surface will be replaced by 70mm asphalt concrete.

5.2 Noise Model Validation

Road traffic noise levels were predicted for 2009 and compared to current noise levels measured at two locations adjacent Ocean Drive. This validation of the noise model is a key component of the modelling process. Validation of the model was enabled by carrying out single point receiver (SPR) calculations at the Ocean Drive monitoring locations. Modelled 2009 noise results were adjusted to reflect measured 2009 traffic levels along Ocean Drive and for façade correction. The results of the SPR calculations are provided in **Table 9** and compared to predicted noise levels.

Table 9 Comparison of Predicted and Measured Road Traffic Noise Levels, 2009

Location No.		SoundPLAN Prediction	Measured 200	Difference (Prediction-Measured)
Ocean Drive monitoring location 1	Daytime LAeq(15hour)	66 dBA	66 dBA	0 dBA
	Night-time LAeq(9hour)	59 dBA	59 dBA	0 dBA
Ocean Drive monitoring location 2	Daytime LAeq(15hour)	66 dBA	65 dBA	+1 dBA
	Night-time LAeq(9hour)	59 dBA	59 dBA	0 dBA

*Measured results at this location include a façade correction of +2.5 dBA to account for free-field measurement.

The results indicate that predicted $L_{Aeq(15hour)}$ noise levels are within +1 dBA and $L_{Aeq(9hour)}$ noise levels are within ±0 dBA of measured data. Therefore, the noise model is considered to have excellent correlation with measured results and therefore is deemed suitable for predicting road traffic noise levels at all potentially affected receiver locations for the project.

6 ROAD TRAFFIC PREDICTIONS

Noise level predictions are presented as noise contour plots for day and night-time periods for Scenario 2009 and also for Scenario 2029. The noise contour plots are contained in the following appendices:

Appendix B1 - Daytime 2009 (no stage 1B of area 14)
Appendix B2 – Night-time 2009 (no stage 1B of area 14)

Appendix C1 - Daytime 2029 (with stage 1B of area 14) No Mitigation
Appendix C2 – Night-time 2029 (with stage 1B of area 14) No Mitigation

The noise contour predictions are *external* noise levels at first storey and have been adjusted (increased) by 2.5 dBA to reflect façade noise levels.

6.1 Predicted Noise Levels 2009

For the 2009 daytime scenario, predicted road traffic noise levels above $L_{Aeq(15hour)}$ 55 dBA (criteria for residential properties) are shown in the dark blue, yellow, orange and red zones.

For the 2009 night-time scenario, predicted road traffic noise levels above $L_{Aeq(9hour)}$ 50 dBA (residential noise criteria) are shown in the light blue, dark blue, yellow, orange and red zones.

6.2 Predicted Noise Levels 2029

For the 2029 daytime scenario, predicted road traffic noise levels above $L_{Aeq(15hour)}$ 55 dBA (criteria for residential properties) are shown in the dark blue, yellow, orange and red zones.

For the 2029 night-time scenario, predicted road traffic noise levels above $L_{Aeq(9hour)}$ 50 dBA (residential noise criteria) are shown in the light blue, dark blue, yellow, orange and red zones.

7 NOISE MITIGATION MEASURES

7.1 Noise Mitigation Design

In designing noise mitigation appropriate for the Stage 1B Area 14 development the following parameters were considered:

- Predicted exceedance of external day-time and night-time noise criteria;
- Visual amenity of the occupant;
- Visual aspect of the development from Ocean Drive:
- Residential occupation.

Noise barriers were considered to be the most effective means to mitigate traffic noise in an effort to meet the ECRTN external noise criteria for the Stage 1B Area 14 development. The favoured noise barrier configuration giving regard to the preceding parameters is contained in **Table 10**.

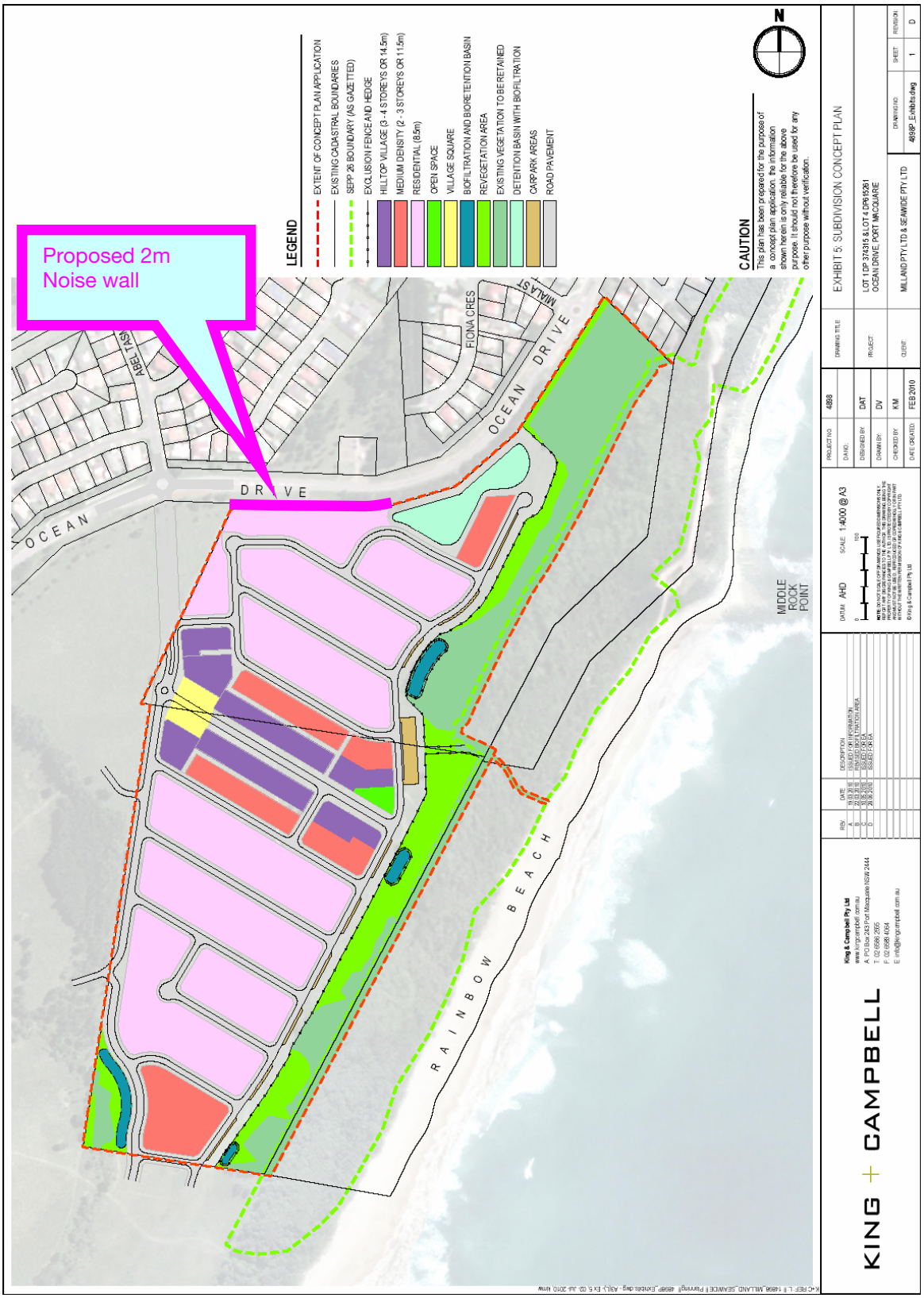
Table 10 Noise Barrier Options

Noise Barrier	**Barrier location**
	Along Ocean Drive
Wall height	**2m**

The Location of the proposed noise barrier is contained in **Figure 4**.

There are many options available for the design of noise barriers. They could, for example, consist of a wall construction from concrete or timber. To retain some visual amenity transparent panels could also be used. The noise barrier could also consist of earth mounds or a combination of any of these. The noise wall and/or bund should be continuous and contain no gaps. It is however essential that the nominal mass of the material used in the barrier construction should not be less than 15 kg/m^2.

Figure 4 Modelled Noise Barrier Ocean Drive Stage



7.2 Predicted Noise Levels Post Mitigation

Noise level predictions, incorporating the use of the proposed noise barrier, are presented as noise contour plots for day and night-time periods for Scenario 2029 in the following appendices:

Appendix D1a - Daytime 2029 (with stage 1B of area 14) Post Mitigation first storey
Appendix D1b - Daytime 2029 (with stage 1B of area 14) Post Mitigation second storey
Appendix D2a – Night-time 2029 (with stage 1B of area 14) Post Mitigation first storey
Appendix D2b – Night-time 2029 (with stage 1B of area 14) Post Mitigation second storey

The noise contour predictions are *external* noise levels at first storey (1.5m above ground level) and second storey (4.5m above ground level) and have been adjusted (increased) by 2.5 dBA to incorporate façade refleted noise levels.

7.3 Architectural Treatments

7.3.1 Ocean Drive

The following mitigation measures are recommended for properties adjacent to the Ocean Drive:

Stage 1B

In circumstances where external noise levels are likely to be above the recommended ECRTN noise goals[1](which is often the case near major roads, and many inner city areas) special attention needs to be paid to the acoustic design of the building envelope in order to reduce these noise levels to acceptable internal levels.

For the proposed development, a number of mitigation scenarios were considered in reducing external noise levels. The mitigations measures identified in **Section 7** were the most practical in provide noise mitigation measures to satisfy the external noise criteria. However, where external noise levels were not met, consideration should be given to satisfying the internal noise criteria discussed in **Section 3**.

The level of traffic noise attenuation from outside the building to inside the building, achieved with windows open (allowing for natural ventilation) is typically 10 dBA. Standard window glazing (4 mm) will typically attenuate traffic noise levels from outside the building to inside the building by 20 dBA with windows closed.

The required road traffic noise reduction has been determined for each residential lot assuming a noise-sensitive area (ie living or sleeping area) is located on the façade where noise predictions have been conducted. Where this reduction is less than 10 dBA Category 1 construction methods (refer **Table 3**) will likely reduce internal traffic noise levels to below recommended values. Where this reduction is greater than 10 dBA but less than 25 dBA then Category 2 construction methods (refer **Table 3**) will likely reduce internal traffic noise levels to below recommended values.

Results of this analysis are provided in **Table 11** and **Table 12**.

[1] It should also be noted that the noise criteria presented within the ECRTN noise policy document are guidelines and non-mandatory.

Table 11 Day-time Road Traffic Noise Reduction Required to Achieve Recommended Internal Noise Goals

Type of Occupancy	Required Noise Reduction	Relevant Lots	Architectural Treatment
Single Storey (refer to Appendix D1a contour plot results)			
Living Areas	Up to 10 dBA	Lots in the Green Zone (<50dBA)	Construction Category 1
		Lots in the Light Blue Zone (50-55dBA)	
		Lots in the Dark Blue Zone (55-60dBA)	Construction Category 2
		Lots in the Yellow Zone (60-65dBA)	
Sleeping Areas	Up to 10 dBA	Lots in the Green Zone (<50dBA)	Construction Category 1
		Lots in the Light Blue Zone (50-55dBA)	
		Lots in the Dark Blue Zone (55-60dBA)	Construction Category 2
		Lots in the Yellow Zone (60-65dBA)	
Second Storey (refer to Appendix D1b contour plot results)			
Living Areas	Up to 10 dBA	Lots in the Green Zone (<50dBA)	Construction Category 1
		Lots in the Light Blue Zone (50-55dBA)	
	10 dBA - 25 dBA	Lots in the Dark Blue Zone (55-60dBA)	Construction Category 2
		Lots in the Yellow Zone (60-65dBA)	
		Lots in the Orange Zone (65-70dBA)	
Sleeping Areas	Up to 10 dBA	Lots in the Green Zone (<50dBA)	Construction Category 1
		Lots in the Light Blue Zone (50-55dBA)	
	10 dBA - 25 dBA	Lots in the Dark Blue Zone (55-60dBA)	Construction Category 2
		Lots in the Yellow Zone (60-65dBA)	
		Lots in the Orange Zone (65-70dBA)	

Table 12 Night-time Road Traffic Noise Reduction Required to Achieve Recommended Internal Noise Goals

Type of Occupancy	Required Noise Reduction	Relevant Lots	Architectural Treatment
Single Storey (refer to Appendix D2a contour plot results)			
Living Areas	Up to 10 dBA	Lots in the Green Zone (<50dBA)	Construction Category 1
	10 dBA - 25 dBA	Lots in the Light Blue Zone (50-55dBA)	Construction Category 2
		Lots in the Dark Blue Zone (55-60dBA)	
Sleeping Areas	Up to 10 dBA	Lots in the Green Zone (<50dBA)	Construction Category 1
	10 dBA - 25 dBA	Lots in the Light Blue Zone (50-55dBA)	Construction Category 2
		Lots in the Dark Blue Zone (55-60dBA)	
Second Storey (refer to Appendix D2b contour plot results)			
Living Areas	Up to 10 dBA	Lots in the Green Zone (<50dBA)	Construction Category 1
	10 dBA - 25 dBA	Lots in the Light Blue Zone (50-55dBA)	Construction Category 2
		Lots in the Dark Blue Zone (55-60dBA)	
Sleeping Areas	Up to 10 dBA	Lots in the Green Zone (<50dBA)	Construction Category 1
	10 dBA - 25 dBA	Lots in the Light Blue Zone (50-55dBA)	Construction Category 2
		Lots in the Dark Blue Zone (55-60dBA)	

In all instances where windows are required to be closed (construction category 2) to achieve internal noise levels, alternative means of achieving the requirement for “comfort ventilation” will need to be considered to enable openings in the external facade (i.e. windows and doors) to remain fully closed during noisy periods.

Provided the recommendations in this report are implemented, it is expected that this development will be able to satisfy the relevant noise criteria requirements of AS 2107:2000 and the ECTRN.

It should be noted that mitigation recommendations apply to two storey dwellings. The upper floors of three storey (or higher) dwellings will need further consideration and possibly additional mitigation. These multiple storey dwellings should be assessed on a case by case basis.

8 CONCLUSION

Heggies have completed a traffic noise impact assessment for the development of Stage 1B within the designated Urban Growth Area 14, south of Port Macquarie, NSW.

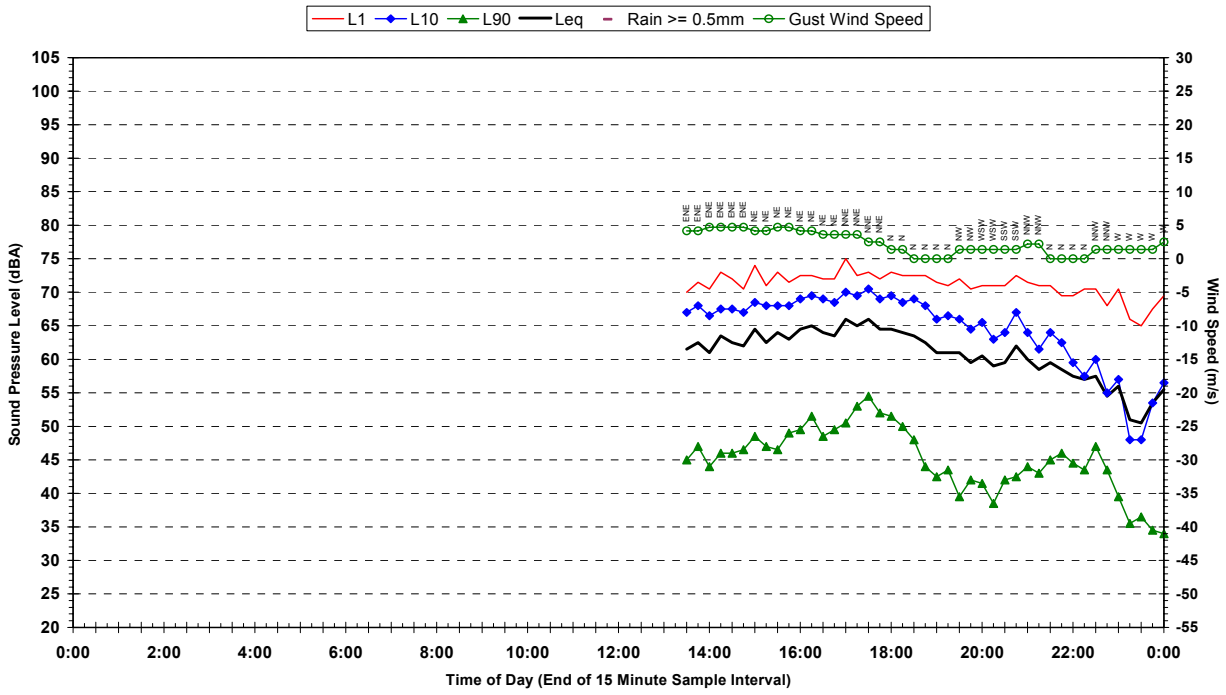
A rigorous noise monitoring and modelling program has been used to assess the current and future impact of road traffic throughout the Stage 1B investigation area using a SoundPLAN environmental acoustic model.

Results from the SoundPLAN model have been used to plot noise contours and to provide single point receiver levels over the investigation area. These predicted noise levels have been used to recommend mitigation measures and construction types suitable for the Stage 1B Area 14 development.

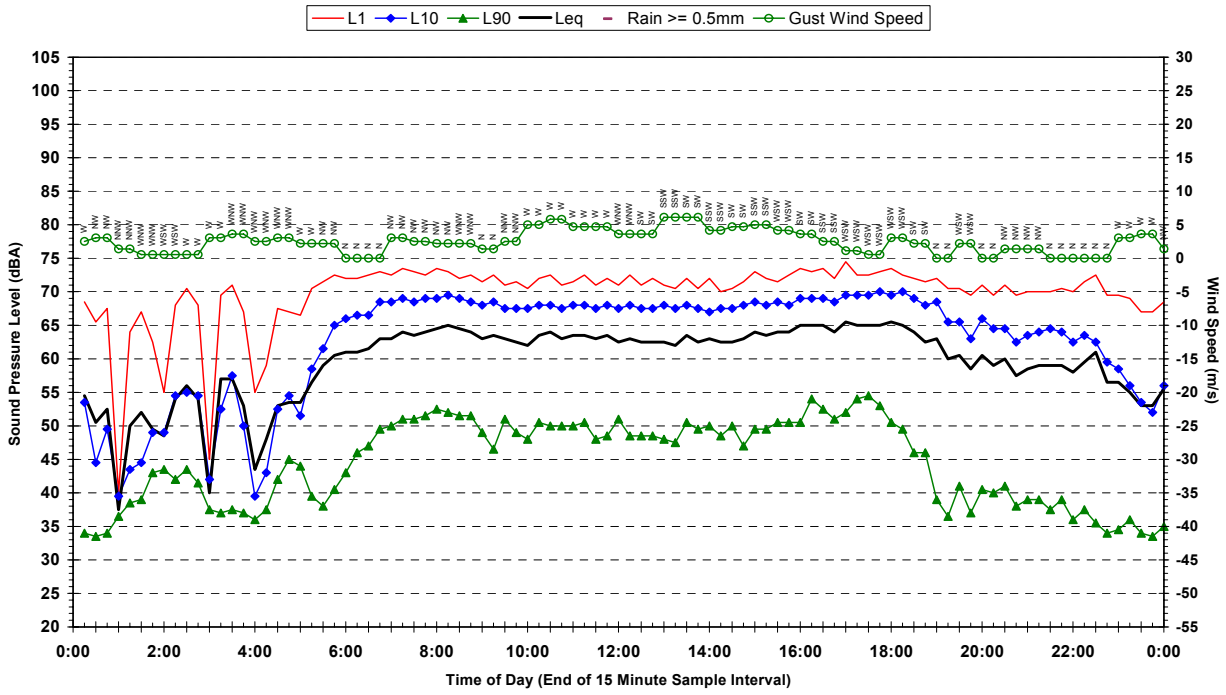
Provided the recommendations in this report are implemented, it is expected that this development will be able to satisfy the relevant noise criteria requirements of AS 2107:2000 and the ECRTN.

STATISTICAL AMBBIENT NOISE LEVELS

Statistical Ambient Noise Levels
Logger Location 1 - Thursday 30 July 2009

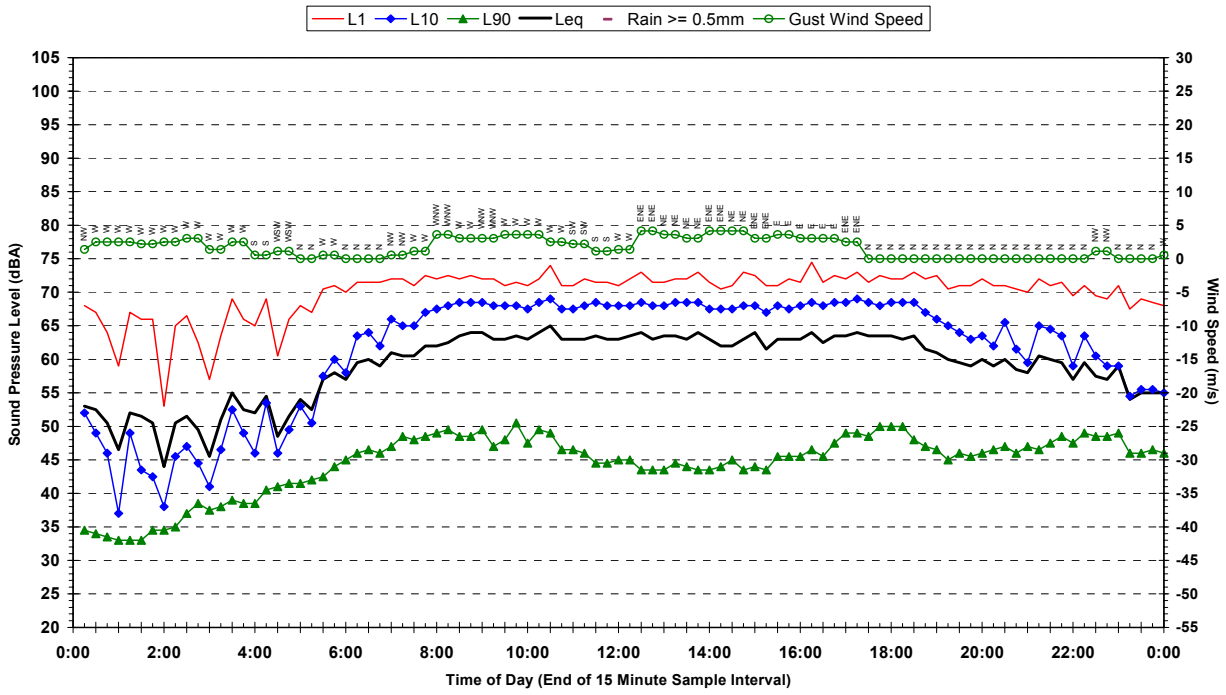


Statistical Ambient Noise Levels
Logger Location 1 - Friday 31 July 2009

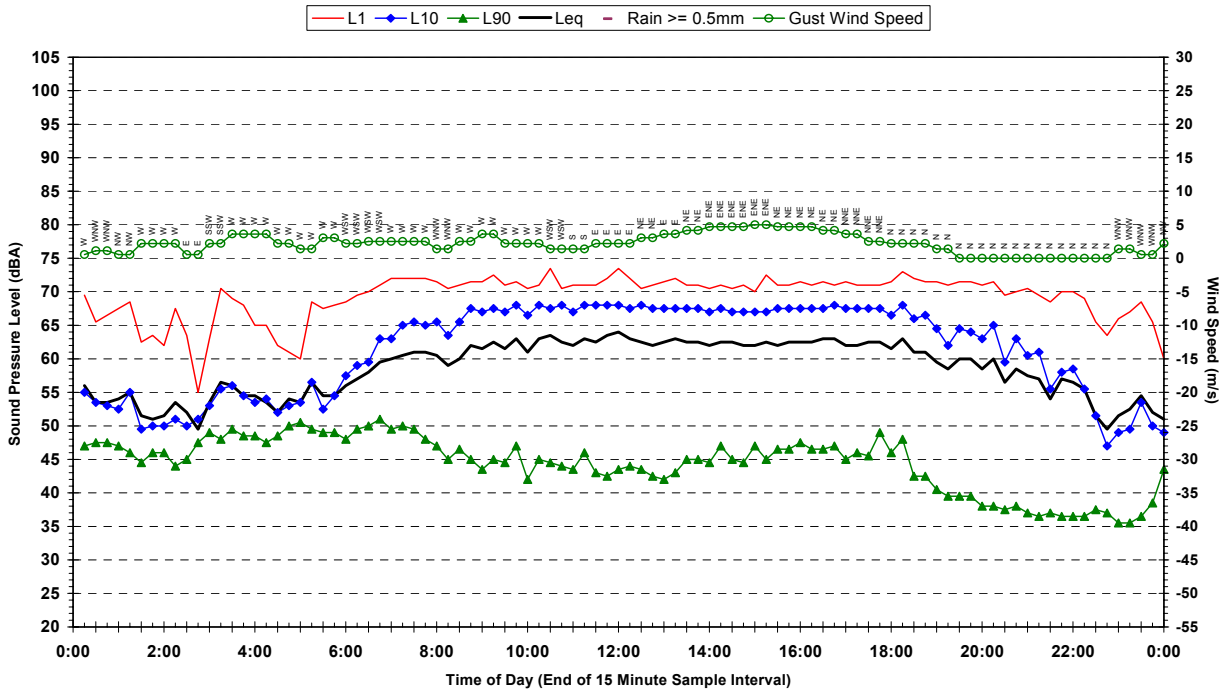


STATISTICAL AMBBIENT NOISE LEVELS

Statistical Ambient Noise Levels
Logger Location 1 - Saturday 1 August 2009

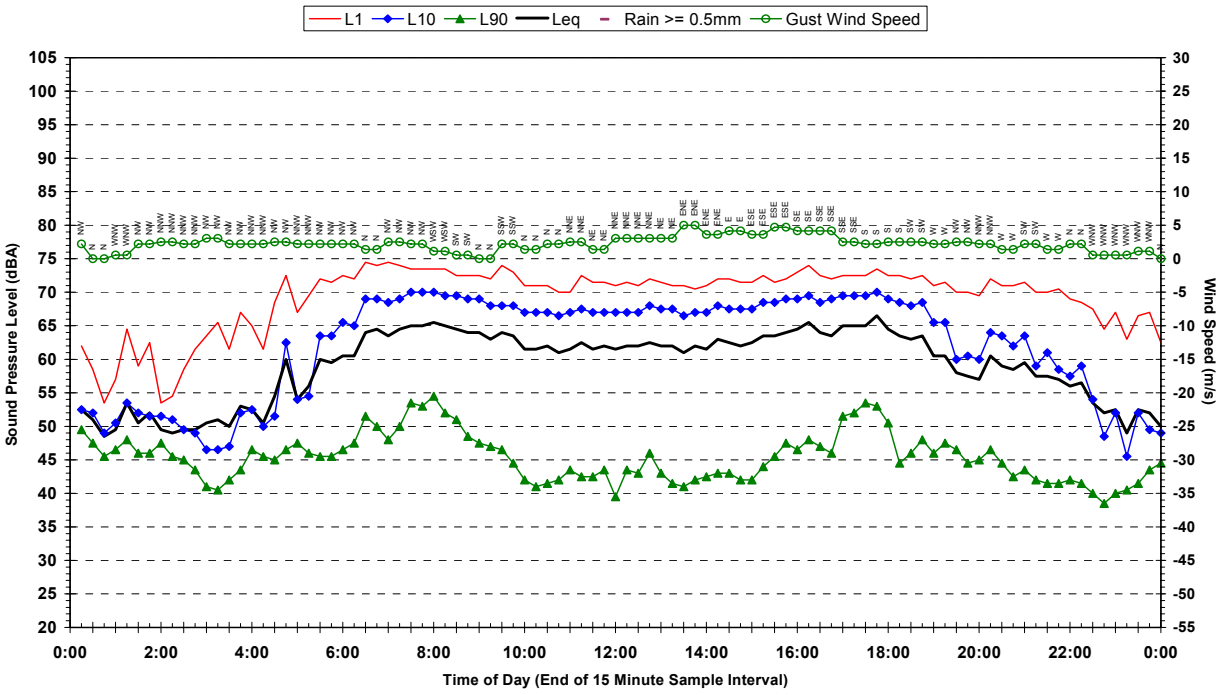


Statistical Ambient Noise Levels
Logger Location 1 - Sunday 2 August 2009

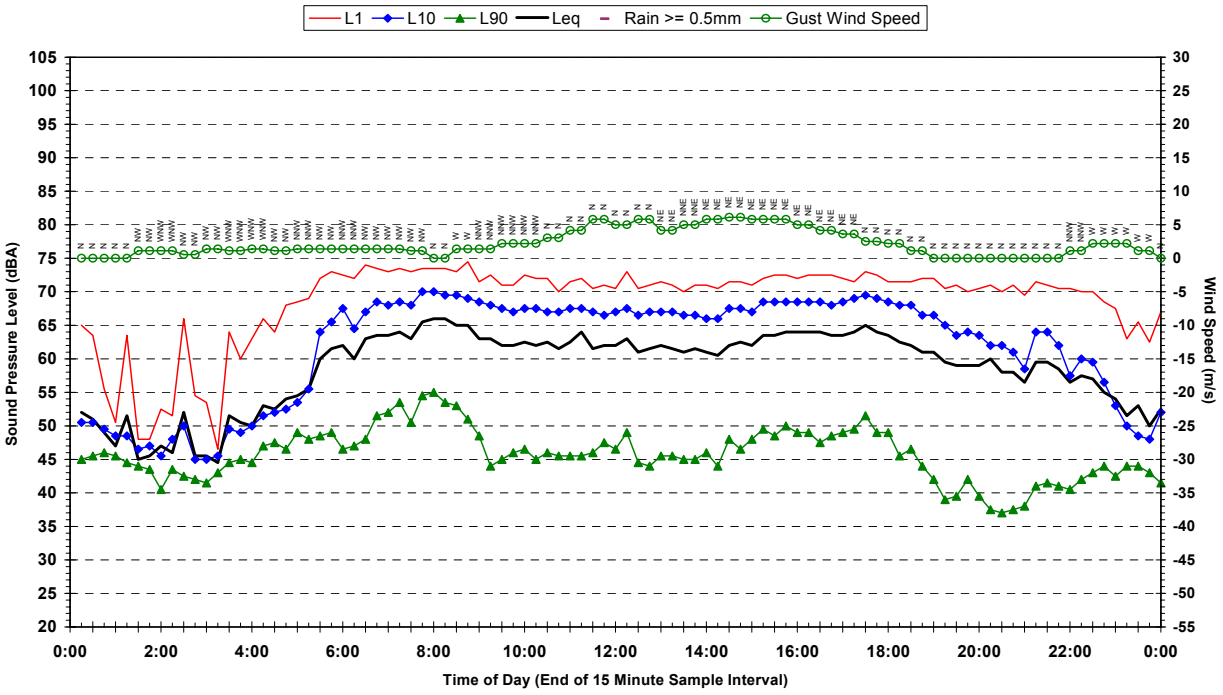


STATISTICAL AMBBIENT NOISE LEVELS

Statistical Ambient Noise Levels
Logger Location 1 - Monday 3 August 2009

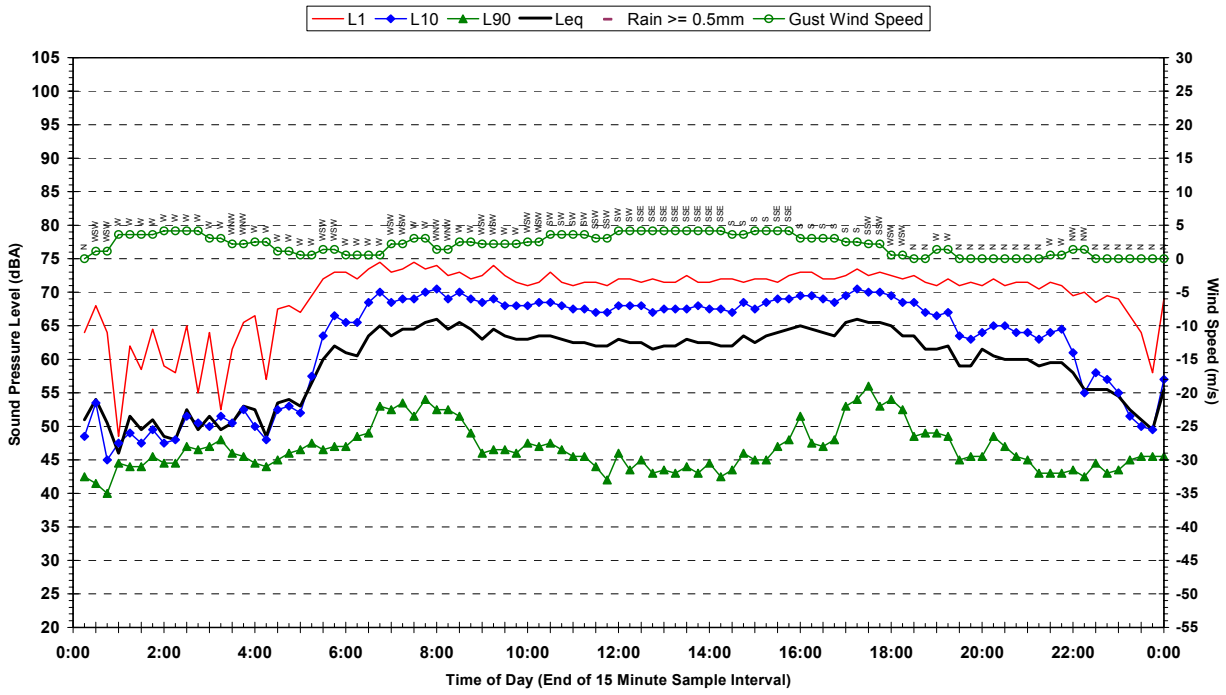


Statistical Ambient Noise Levels
Logger Location 1 - Tuesday 4 August 2009

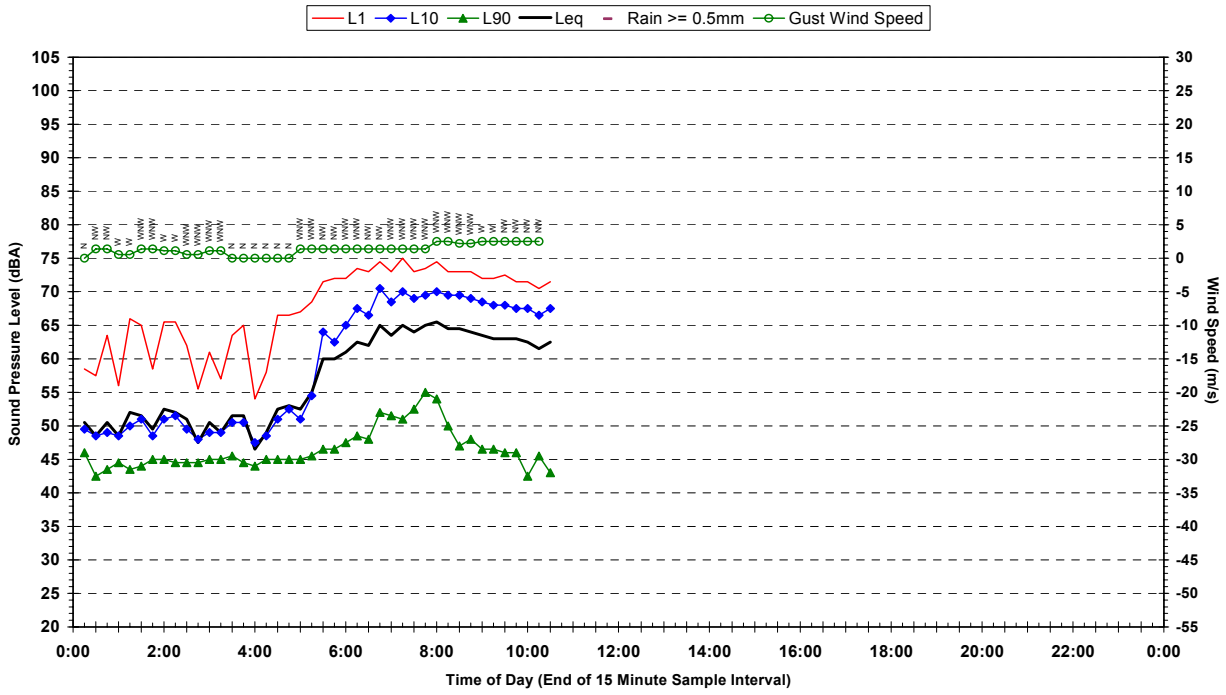


STATISTICAL AMBBIENT NOISE LEVELS

Statistical Ambient Noise Levels
Logger Location 1 - Wednesday 5 August 2009

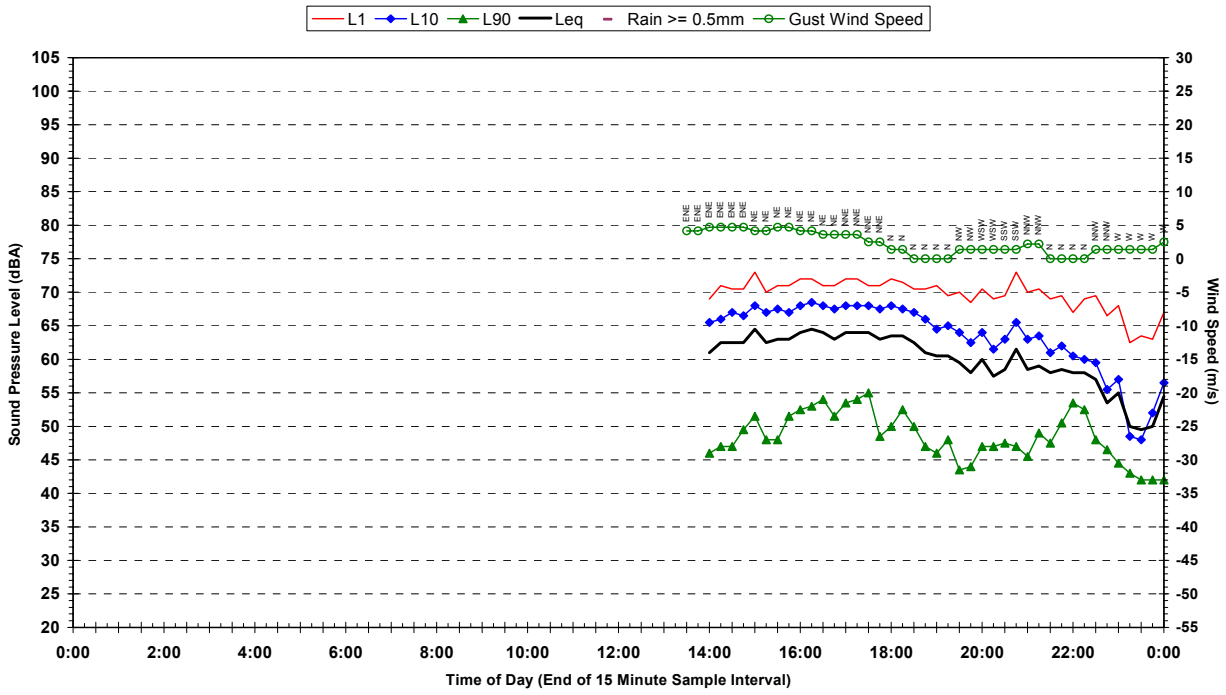


Statistical Ambient Noise Levels
Logger Location 1 - Thursday 6 August 2009

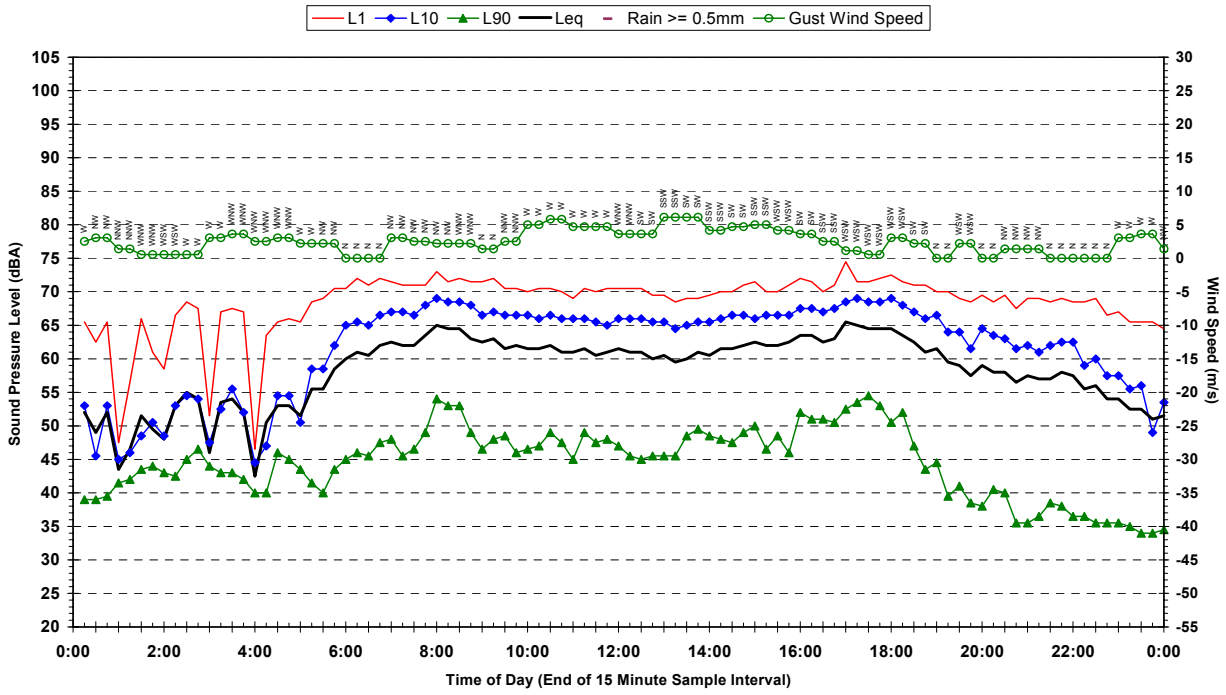


STATISTICAL AMBBIENT NOISE LEVELS

Statistical Ambient Noise Levels
Logger location 2 - Thursday 30 July 2009

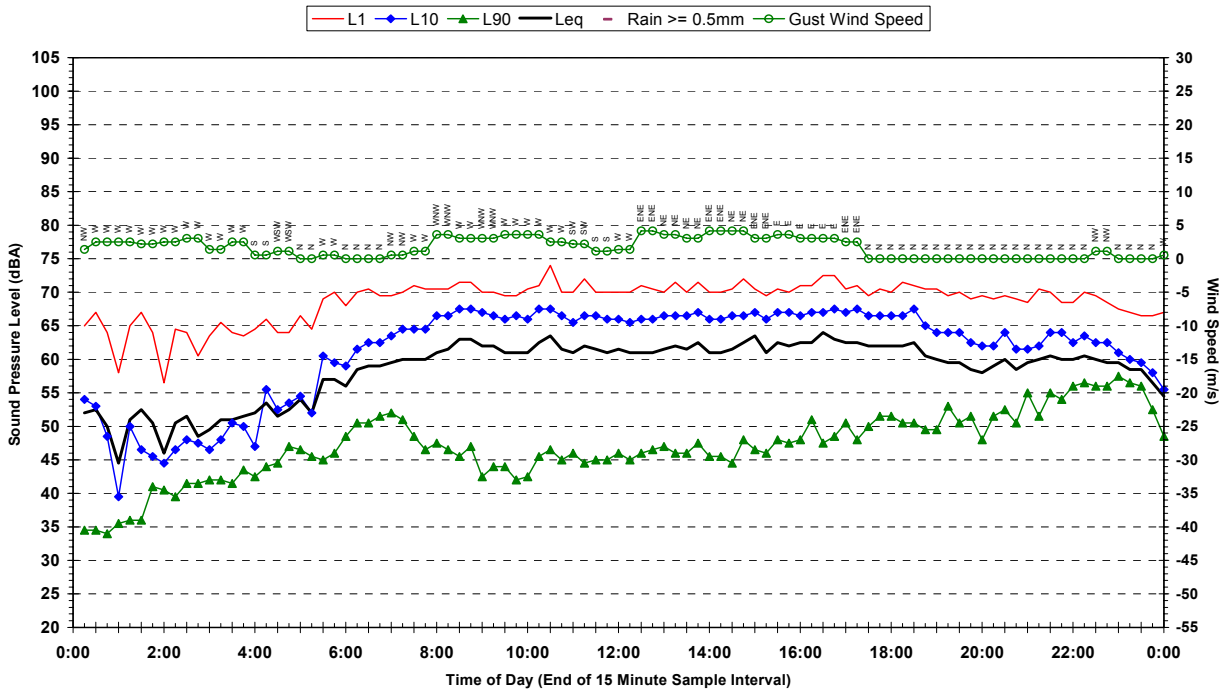


Statistical Ambient Noise Levels
Logger location 2 - Friday 31 July 2009

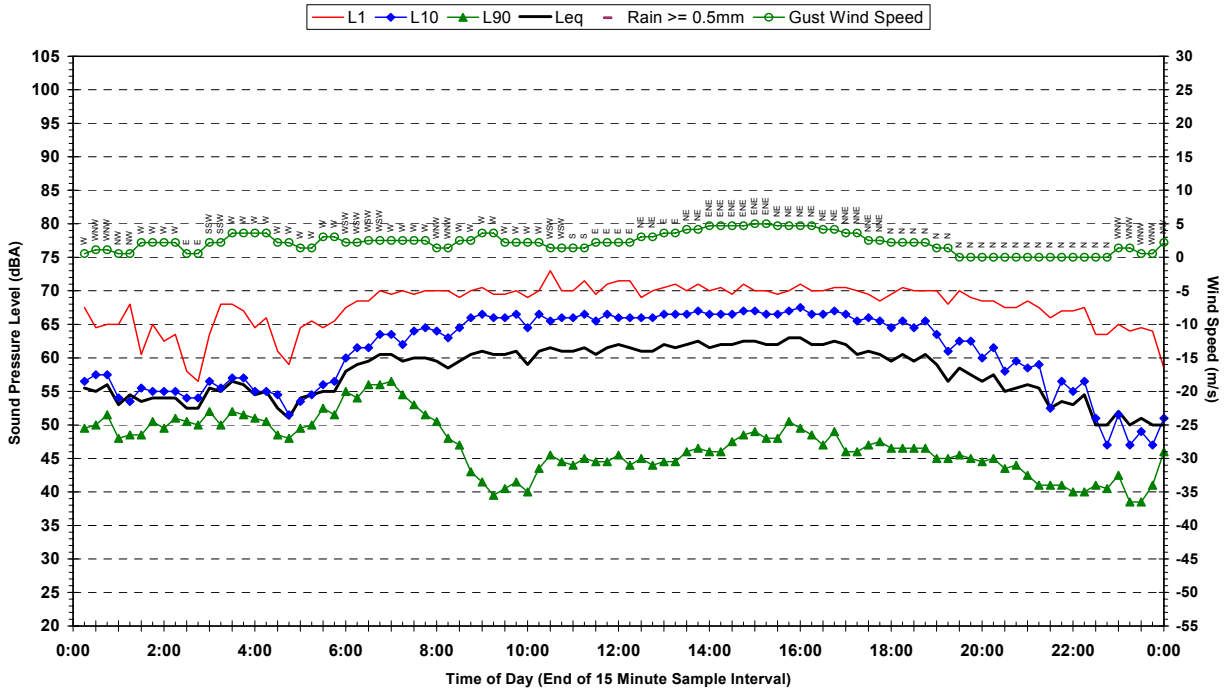


STATISTICAL AMBBIENT NOISE LEVELS

Statistical Ambient Noise Levels
Logger location 2 - Saturday 1 August 2009

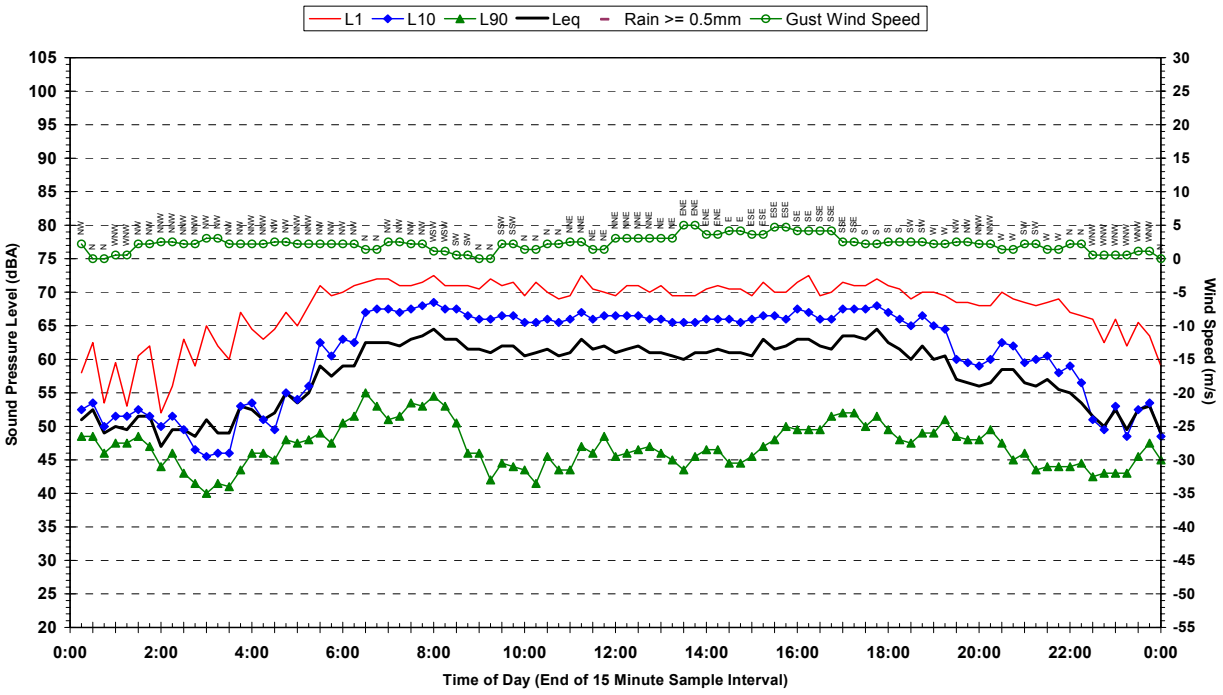


Statistical Ambient Noise Levels
Logger location 2 - Sunday 2 August 2009

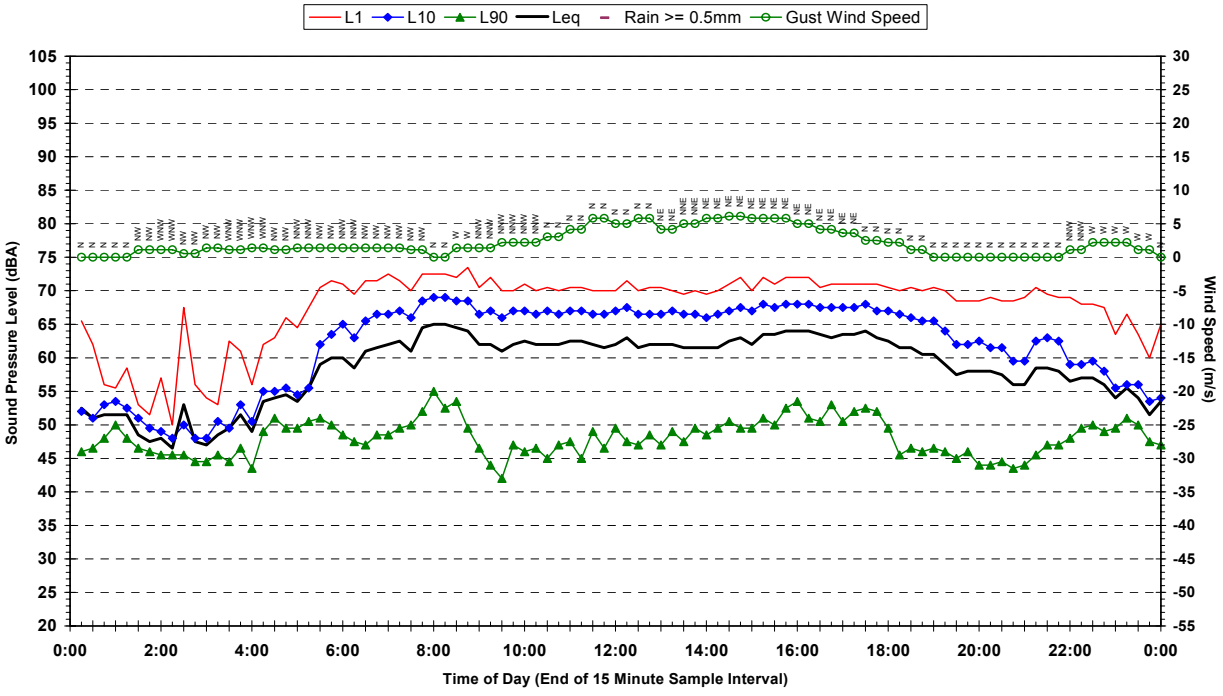


STATISTICAL AMBBIENT NOISE LEVELS

Statistical Ambient Noise Levels
Logger location 2 - Monday 3 August 2009

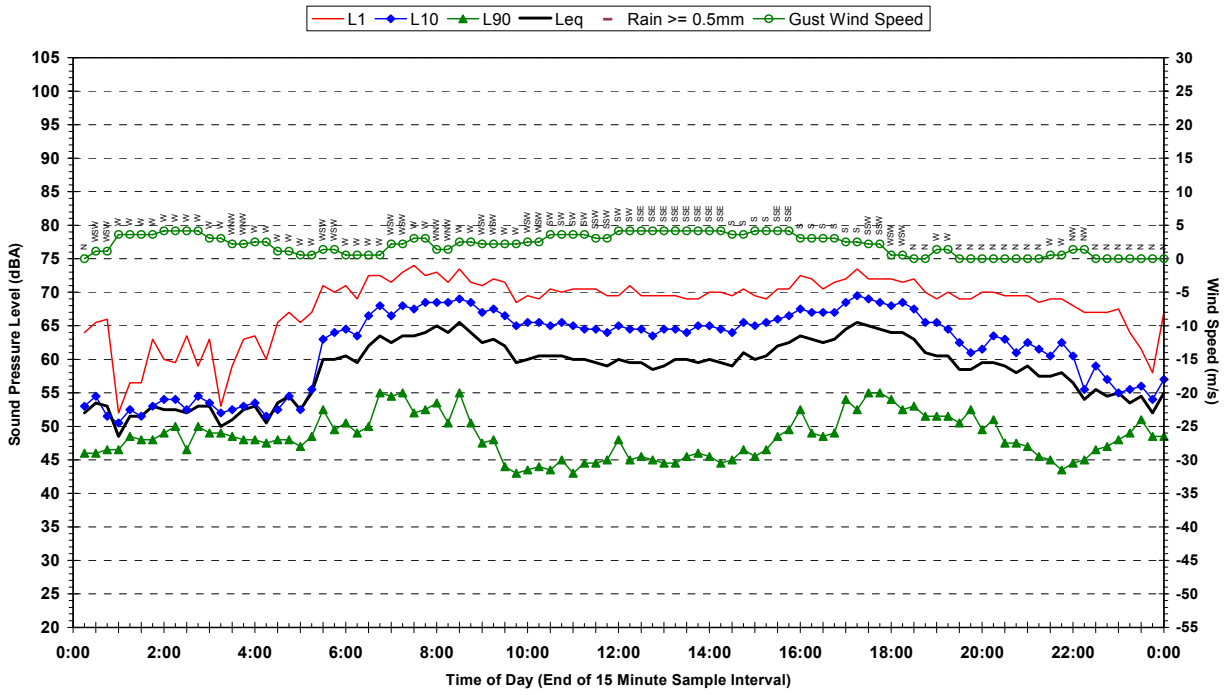


Statistical Ambient Noise Levels
Logger location 2 - Tuesday 4 August 2009

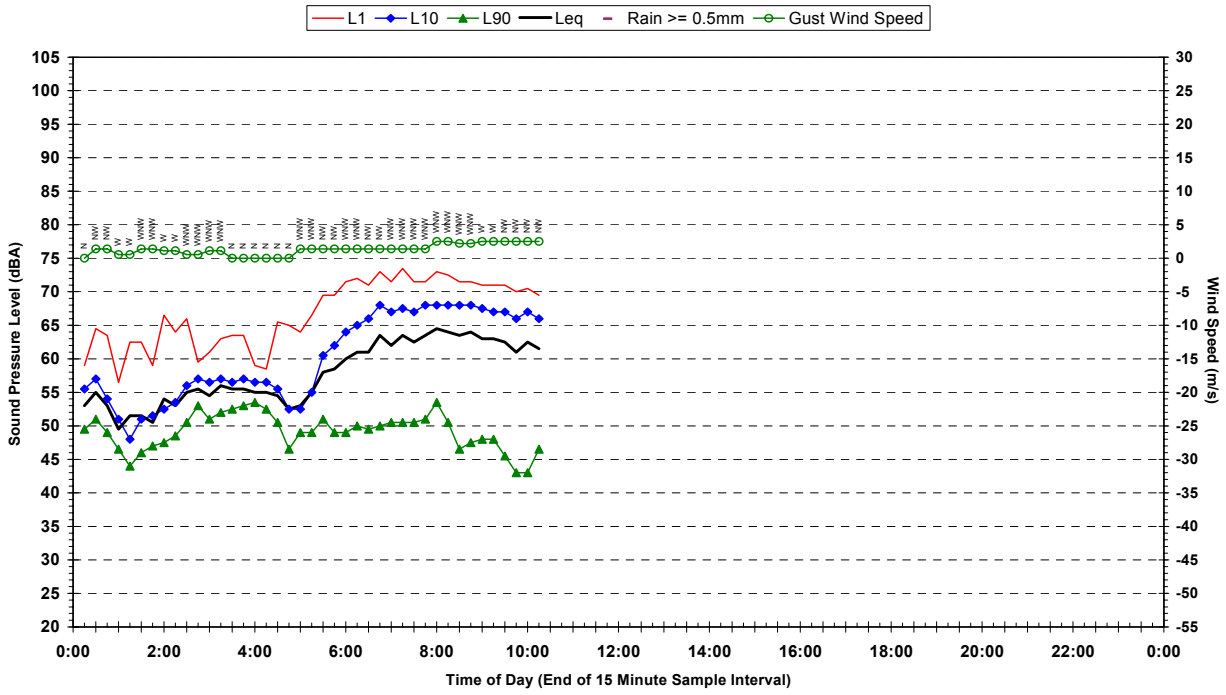


STATISTICAL AMBBIENT NOISE LEVELS

Statistical Ambient Noise Levels
Logger location 2 - Wednesday 5 August 2009

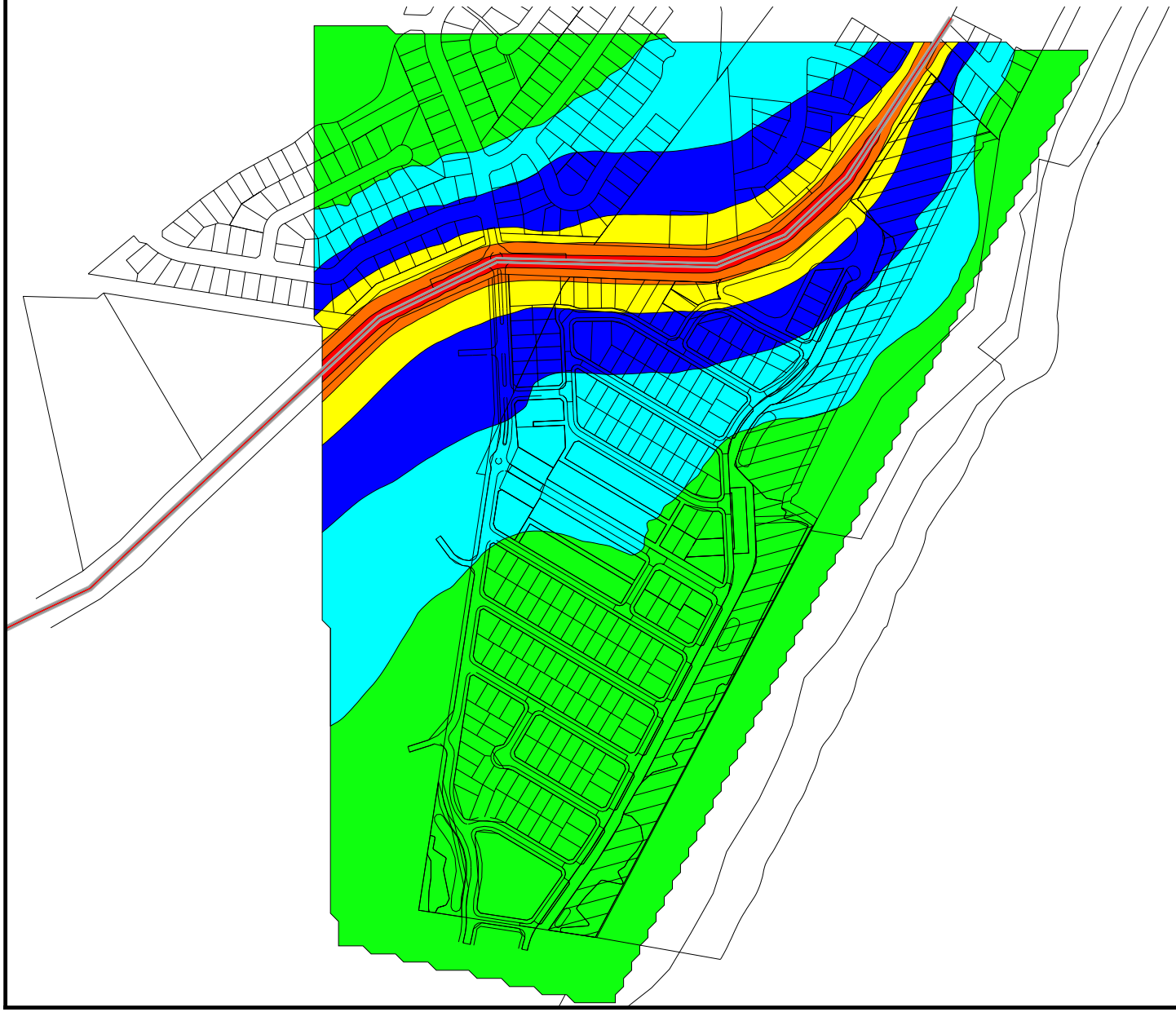


Statistical Ambient Noise Levels
Logger location 2 - Thursday 6 August 2009



Appendix B1 - 30-1939 Stage 1B Ocean Drive, Lake Cathie - Road Traffic Noise Assessment

2009 Road Traffic Noise Levels (dBA) - Day LAeq (15hour) @ 1.5m above ground - 2.5 dBA Facade Correction



Noise levels day dB(A)

	< 50
50 <=	< 55
55 <=	< 60
60 <=	< 65
65 <=	< 70
70 <=	

Signs and symbols

- Stage 1B Lot Layout
- Road Emission lines

N

Length Scale 1:7570

0 37.5 75 150 225 300 m

HEGGIES

Appendix B2 -30-1939 Stage 1B Ocean Drive, Lake Cathie - Road Traffic Noise Assessment

2009 Road Traffic Noise Levels (dBA) - Night LAeq (9hour) @ 1.5m above ground - 2.5 dBA Facade Correction

Noise levels night dB(A)

	< 50
50 <=	< 55
55 <=	< 60
60 <=	< 65
65 <=	< 70
70 <=	

Signs and symbols

Stage 1B Lot Layout

Road Emission lines

N

Length Scale 1:7570

0 37.5 75 150 225 300 m

HEGGIES

Appendix C1 - 30-1939 Stage 1B Ocean Drive, Lake Cathie - Road Traffic Noise Assessment

2029 Road Traffic Noise Levels (dBA) - Day LAeq (15hour) @ 1.5m above ground - 2.5 dBA Facade Correction - No Mitigation

Noise levels day dB(A)

	< 50
50 <=	< 55
55 <=	< 60
60 <=	< 65
65 <=	< 70
70 <=	

Signs and symbols

- Stage 1B Lot Layout
- Road Emission lines

N

Length Scale 1:7570

0 37.5 75 150 225 300 m

HEGGIES

Appendix C2 - 30-1939 Stage 1B Ocean Drive, Lake Cathie - Road Traffic Noise Assessment

2029 Road Traffic Noise Levels (dBA) - Night LAeq (9hour) @ 1.5m above ground - 2.5 dBA Facade Correction - No Mitigation

Noise levels Night dB(A)

	< 50
50 <=	< 55
55 <=	< 60
60 <=	< 65
65 <=	< 70
70 <=	

Signs and symbols

- Stage 1B Lot Layout
- Road Emission lines

N

Length Scale 1:7570

0 37.5 75 150 225 300 m

HEGGIES

Appendix D1a - 30-1939 Stage 1B Ocean Drive, Lake Cathie - Road Traffic Noise Assessment

2029 Road Traffic Noise Levels (dBA) - Day LAeq (15hour) @ 1.5m above ground - 2m High Noise wall - 2.5 dBA Facade Correction

Noise levels day dB(A)

	< 50
50 <=	< 55
55 <=	< 60
60 <=	< 65
65 <=	< 70
70 <=	

Signs and symbols

- Stage 1B Lot Layout
- Road Emission lines
- 2m High Noise Wall

N

Length Scale 1:7000

0 35 70 140 210 280 m

HEGGIES

Appendix D1b - 30-1939 Stage 1B Ocean Drive, Lake Cathie - Road Traffic Noise Assessment

2029 Road Traffic Noise Levels (dBA) - Day LAeq (15hour) @ 4.5m above ground - 2m High Noise wall - 2.5 dBA Facade Correction

Noise levels day dB(A)

	< 50
50 <=	< 55
55 <=	< 60
60 <=	< 65
65 <=	< 70
70 <=	

Signs and symbols

- Stage 1B Lot Layout
- Road Emission lines
- 2m High Noise Wall

N

Length Scale 1:7570

0 37.5 75 150 225 300 m

HEGGIES

Appendix D2a - 30-1939 Stage 1B Ocean Drive, Lake Cathie - Road Traffic Noise Assessment

2029 Road Traffic Noise Levels (dBA) - Night LAeq (9hour) @ 1.5m above ground - 2m High Noise wall - 2.5 dBA Facade Correction

Noise levels night dB(A)

	< 50
50 <=	< 55
55 <=	< 60
60 <=	< 65
65 <=	< 70
70 <=	

Signs and symbols

- Stage 1B Lot Layout
- Road Emission lines
- 2m High Noise Wall

N

Length Scale 1:7570

0 37.5 75 150 225 300 m

HEGGIES

Appendix D2b - 30-1939 Stage 1B Ocean Drive, Lake Cathie - Road Traffic Noise Assessment

2029 Road Traffic Noise Levels (dBA) - Night LAeq (9hour) @ 4.5m above ground - 2m High Noise wall - 2.5 dBA Facade Correction

Noise levels Night dB(A)

	< 50
50 <=	< 55
55 <=	< 60
60 <=	< 65
65 <=	< 70
70 <=	

Signs and symbols

- Stage 1B Lot Layout
- Road Emission lines
- 2m High Noise Wall

N

Length Scale 1:7570

0 37.5 75 150 225 300 m

HEGGIES