Road Traffic Noise Impact Assessment

Rainbow Beach, Bonny Hills

Report Number 630.11162R1

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Road Traffic Noise Impact Assessment

Rainbow Beach, Bonny Hills

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1 INTRODUCTION

SLR Consulting Australia Pty Ltd (SLR) has been commissioned been commissioned by King & Campbell Pty Ltd (King & Campbell) to conduct a road traffic noise impact assessment (NIA) for the proposed subdivision of Lot 1 DP 1193553, Lots 1, 2, 3 and 4 DP 1150758 and Lot 5 DP 25886, Ocean Drive, Bonny Hills in accordance with Concept Approval 06_0085.

The purpose of this assessment was to determine the impact of road traffic noise from the Ocean Drive on the proposed subdivisions and to identify and recommend ameliorative measures to mitigate noise impacts over the Project Site.

This traffic NIA has been prepared with reference to the following NSW Environmental Protection Authority (EPA) policy documents:

- Road Noise Policy (RNP); and
- Industrial Noise Policy (INP).

In addition, reference has also been made to relevant Australian Standards (AS 2107-2000 and AS 3671-1989), Department of Planning (DoP) State Environmental Planning Policy (SEPP) (Infrastructure) 2007, the Port Macquarie Hastings Council (PMHC) *Hastings Urban Growth Strategy* (HUGS) and Port Macquarie Hastings Council (PMHC) Development Control Plan (DCP) 2011 Part 5, 2001.

1.1 Acoustic Terminology

The following report uses specialist acoustic terminology. An explanation of common terms is provided in **Appendix A**.

2 SITE DETAILS

The Project Site is within the Rainbow Beach, also known as ‘Area 14’ or the Lake Cathie – Bonny Hills Growth Area located between the existing villages of Lake Cathie and Bonny Hills. Noise from Ocean Drive has the potential to impact the Project Site investigation area.

Ocean Drive is a two lane arterial road that bounds the Project Sites northern and western boundaries. 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.

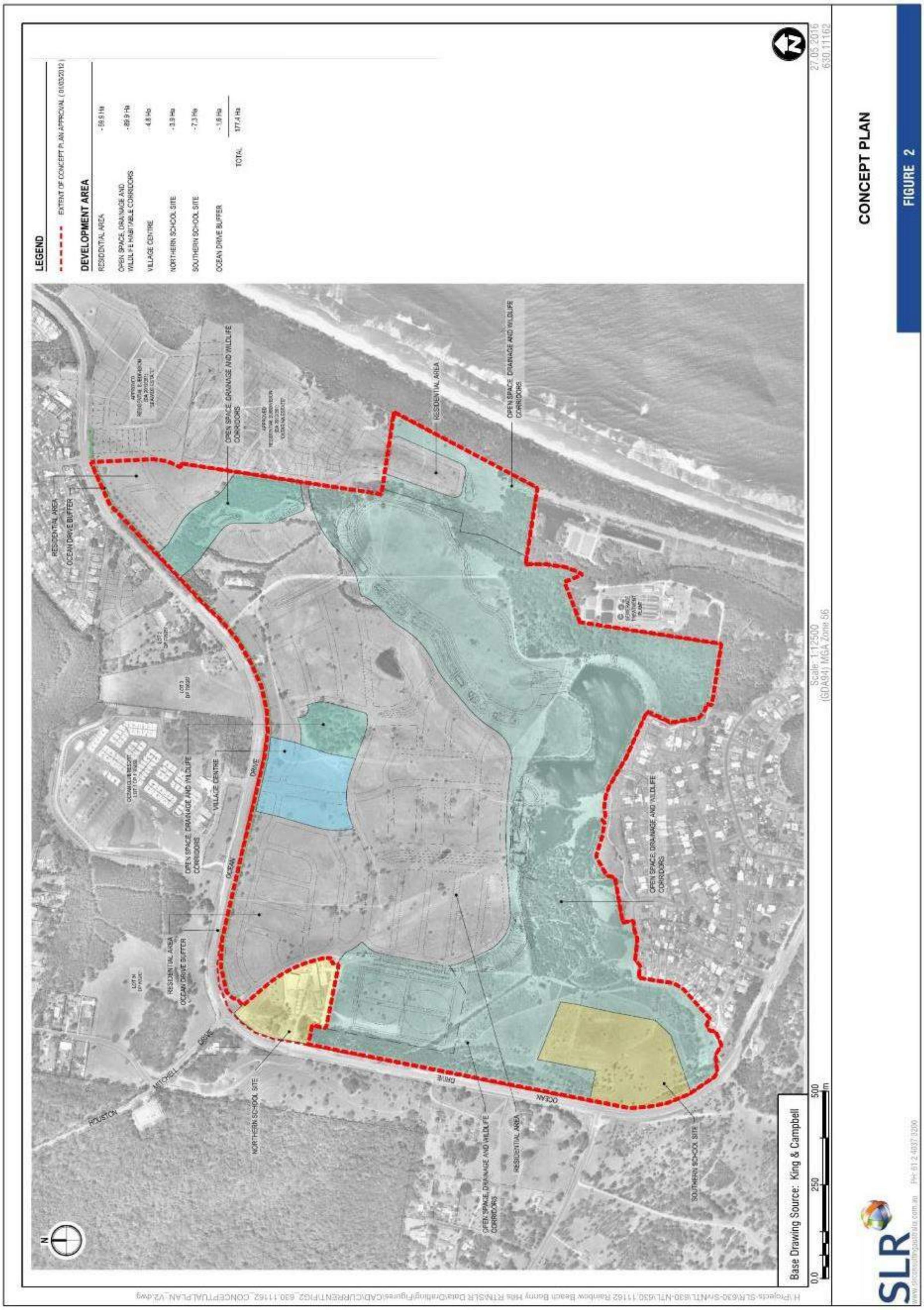
The subject properties are Lot 1 DP 1193553, Lots 1, 2, 3 and 4 DP 1150758 and Lot 5 DP 25886. The proposed development application will seek approval for the following:

- Torrens title subdivision of the residential area delineated in Concept Approval MP 06_0085 to create approximately 1,000 lots, including some future development lots.
- Torrens title subdivision of the development area within Lot 5 DP 25886 delineated in Concept Approval MP 06_0085 into individual residential lots as a stage of development.
- Torrens title subdivision to create future development lots within the area identified as the Greater Lake Cathie Bonny Hills Village Centre.
- Torrens title subdivision of the southern school site for future development purposes.

Figure 1 provides a plan showing the location of the Project Site within the broader Area 14 urban areas. **Figure 2** provides details of the Concept Plan of the Project Site.

Figure 1 Project Site Locality

Figure 2 Concept Plan



3 ROAD TRAFFIC NOISE IMPACT ASSESSMENT PROCEDURES

3.1 Road Noise Policy

The Environment Protection Authority (EPA) has released the NSW Road Noise Policy (RNP, March 2011) which provides noise criteria for proposed residential developments adjacent to major roads. With relevance to the proposed subdivision it states that "*Land use developers must meet internal noise goals in the Infrastructure SEPP (Department of Planning NSW 2007) for sensitive developments near busy roads*."

The Department of Planning (DoP) State Environmental Planning Policy (SEPP) (Infrastructure) 2007 outlines provisions to ensure noise sensitive developments located near major roadways are not adversely affected by road traffic noise.

The policy applies to (and is mandatory for) developments located near major roadways where the annual average daily traffic (AADT) volume exceeds 40,000 vehicles and the relevant consent authority considers that the roadway is likely to cause adverse noise impacts.

In other circumstances, the DNRCBR guidelines provide best practice advice where the proposed development is adjacent to a road with an AADT volume of 20,000 to 40,000 vehicles, or where the consent authority considers development is likely to be adversely affected by road noise or vibration.

Residential developments adjacent to roadways which meet these criteria must demonstrate that appropriate ameliorative measures have been applied to ensure the following internal noise level criteria are met.

- L_{Aeq} noise level not exceeding 35 dBA between 10pm and 7am, in any bedroom within the development.
- L_{Aeq} noise level not exceeding 40 dBA between 10pm and 7am, in any other room within the development (excluding garage, kitchen, bathroom or hallway).

Although the major roads in the vicinity of this location do not experience 40,000 vehicles per day, these criteria have been utilised for the purpose of assessing potential road traffic noise impacts as they are consistent with the relevant acceptable internal noise levels provided in Australian Standard AS2107:2000 *Acoustic – Recommended design sound levels and reverberation times for building interiors*, SEPP Guidelines and the internal noise guidelines for residential receivers provided in the NSW Department of Planning *Development Near Rail Corridors and Busy Roads – Interim Guideline* (December 2008) (refer to **Table 1**).

Table 1 Noise Criteria – Residential and Non Residential Buildings

Type of Occupancy	Noise Level	Applicable Time Period
Sleeping areas (bedroom)	35 dBA	Night 10pm to 7am
Other habitable rooms (excl. garages, kitchens, bathrooms & hallways)	40 dBA	At any time. (Day 7am to 10pm , Night 10 pm to 7am)
Educational Institutions including child care centres	40 dBA	Recommended Max level dBA
Places of Worship	40 dBA	Recommended Max level dBA
Hospitals		Recommended Max level dBA
- Wards	35 dBA	
- Other noise sensitive areas	45 dBA	

Note: Airborne Noise is calculated as LAeq(9hour)(10pm to 7am) and LAeq(15hour)(7am to 10pm).

Furthermore, Australian Standard AS3671 – 1989 *Acoustics – Road traffic noise intrusion – Building siting and construction* provides guidelines for determining the type of building construction necessary to achieve acceptable internal noise levels. **Table 2** summarises the recommended building construction categories outlined in AS3671 – 1989.

Table 2 Definition of Construction Categories – AS3671-1989

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

Furthermore, Port Macquarie Hastings Council (PMHC) has confirmed that it would not be considered reasonable to take action to reduce predicted noise levels, through the adoption of noise barriers and/or architectural treatments, if predicted road traffic noise goals are no more than 3 dBA above the relevant noise goal.

4 EXISTING ACOUSTICAL ENVIRONMENT

4.1 Methodology

A site inspection was conducted on Tuesday 9 December 2014 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. Three (3) type EL-215 environmental noise loggers were positioned at the subject site to record ambient noise levels from Tuesday 9 December 2014 until Thursday 18 December 2014, inclusive. Operator attended noise surveys were conducted during logger retrieval for a period of 15 minutes at each noise logger location.

All instrumentation used during noise measurements complied with the requirements of AS IEC 61672.1-2004 and carried 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 3**.

Table 3 Unattended Noise Monitoring Information

Logger Serial Number	Location	Comments
16-207-043	Monitoring Location M1 S 31.57602 E 152.82495	Approx. 13m from Ocean Drive
16-306-047	Monitoring Location M2 S 31.56673 E 152.82979	Approx. 17m from Ocean Drive
16-203-524	Monitoring Location M3 S 31.56683 E 152.83828	Approx. 13m from Ocean Drive

Figure 3 provides a plan showing noise logger locations.

Figure 3 Noise Monitoring Locations

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 18 km/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 B**. A summary of noise levels measured during the unattended noise monitoring program is provided in **Table 4**.

Table 4 Unattended Noise Monitoring Results Summary

Location	Ambient Noise Levels (dBA re 20 µPa)			
	LAeq(15 hour) Day	LAeq(1 hour) Day	LAeq(9 hour) Night	LAeq(1hour) Night
Monitoring Location M1	64.7 dBA	67.0 dBA	59.4 dBA	66.2 dBA
Monitoring Location M2	61.8 dBA	64.1 dBA	57.0 dBA	63.5 dBA
Monitoring Location M3	63.7 dBA	66.0 dBA	58.3 dBA	64.4 dBA

Note: The LAeq(1hour) descriptor is the noisiest 1 hour of the relevant period; day (7am to 10pm) or night (10pm to 7am).

All noise levels reported here are free-field measurements, meaning that no noise reflections occurred from building façades near the noise monitoring locations.

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 and their contributions to the total ambient noise level, in particular, road traffic noise. Measurements were undertaken using a Bruel & Kjaer type 1 2270 (s/n 2679354) 1/3 octave integrating sound level meter. The results of the operator-attended noise surveys are provided in **Table 5**.

Table 5 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 LAmax (dBA)
		LAmax	LA1	LA10	LAeq	LA90	
Monitoring Location M1	09/12/2014 2:13pm Wind: 2.3 m/s Temp: 25.6°C	81	76	73	68	52	Ocean Drive (constant) 68 to 81 dBA Insects 48 to 50 dBA Traffic major contributor
Monitoring Location M2	09/12/2014 2:42pm Wind: 2.3 m/s Temp: 25.6°C	73	71	68	63	49	Ocean Drive (constant) 63 to 73 dBA Tree in wind 50 to 51 dBA Traffic major contributor
Monitoring Location M3	09/12/2014 3:19Pm Wind: 2.3 m/s Temp: 25.6°C	78	74	71	66	51	Ocean Drive (constant) 66 to 78 dBA Traffic major contributor

5 ROAD TRAFFIC NOISE MODELLING

5.1 Methodology and Assumptions

Road traffic noise predictions were carried out using the UK Department of Transport, *Calculation of Road Traffic Noise* (CoRTN 1988) algorithms incorporated in the SoundPLAN (version 7.1) 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 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 representative of single storey and two storey dwellings, respectively. A hypothetical two-storey dwelling has been modelled on the first few rows of houses fronting Ocean drive and the proposed noise walls as shown in **Figure 4** have been assumed.

In the original United Kingdom version of the CoRTN algorithms, 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.

Topographic information for the study area was supplied by King & Campbell The noise model used this information together with road traffic volume information.

As a worst case scenario for the proposed subdivision Year 2029 traffic volume information has been utilised in the noise model.

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 2014 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 2014. SLR has 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 6**.

Table 6 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)**
2014	Ocean Drive	7233	473	6.1%	6.1%
2029	Ocean Drive	10323	675	4%	4%

It is also relevant to note that a road surface correction of minus 3 dB has been applied to the 2029 noise prediction as the current road surface fronting the Development Site has been replaced by 40 mm asphalt concrete.

Figure 4 Noise Barriers Assumed in Noise Model

5.2 Noise Model Validation

Road traffic noise levels were predicted for 2014 and compared to current noise levels measured at three 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 2014 noise results were adjusted to reflect measured 2014 traffic levels along Ocean Drive and for façade correction. The results of the single point receiver calculations are provided in **Table 7** and compared to the measured noise levels.

Table 7 Comparison of Predicted and Measured Road Traffic Noise Levels, 2014

Location No.		SoundPLAN Prediction	Measured 2014	Difference (Prediction-Measured)
Monitoring Location 1	Daytime $L_{Aeq(15hour)}$	64.4 dBA	64.7 dBA	-0.3 dB
	Night-time $L_{Aeq(9hour)}$	58.8 dBA	59.4 dBA	-0.6 dB
Monitoring Location 2	Daytime $L_{Aeq(15hour)}$	62.8 dBA	61.8 dBA	1 dB
	Night-time $L_{Aeq(9hour)}$	57.5 dBA	57.0 dBA	0.5 dB
Monitoring Location 3	Daytime $L_{Aeq(15hour)}$	64.6 dBA	63.7 dBA	0.9 dB
	Night-time $L_{Aeq(9hour)}$	58.8 dBA	58.3 dBA	0.5 dB

The results indicate that predicted day time $L_{Aeq(15hour)}$ and night-time $L_{Aeq(9hour)}$ noise levels at both monitoring locations are within 1 dBA of measured data. Therefore, the noise model is considered to have excellent correlation with measured results and is deemed suitable for predicting road traffic noise levels at all potentially affected receiver locations within the investigation area.

6 ROAD TRAFFIC NOISE PREDICTIONS

6.1 Road Traffic Noise Prediction Results

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

- **Appendix C1** - Daytime 2029 – 1.5 m Above ground (single storey dwelling)
- **Appendix C2** - Daytime 2029 – 4.5 m Above ground (Two storey dwelling)
- **Appendix C3** - Night-time 2029 – 1.5 m Above ground (single storey dwelling)
- **Appendix C4** - Night-time 2029 – 4.5 m Above ground (Two storey dwelling)

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

The noise reduction required to meet relevant internal noise goals and the associated construction categories has been determined. The results of this analysis are provided in **Table 8**.

Table 8 Traffic Noise Reduction Required to Achieve Recommended Internal Noise Goals

Type of Occupancy	Required Noise Reduction	Affected Area	Architectural Treatment
Single Storey and Two Storey			
Living Areas	25 dBA – 35 dBA	Where daytime noise is predicted greater than 65 dBA – no affected lots	Construction Category 3
	10 dBA - 25 dBA	Where daytime noise is predicted between 50 dBA and 65 dBA	Construction Category 2
	Up to 10 dBA	Where daytime noise is predicted less than 50 dBA	Construction Category 1 (standard construction)
Sleeping Areas (night-time only)	25 dBA – 35 dBA	Where night-time noise is predicted greater than 60 dBA – no affected lots	Construction Category 3
	10 dBA - 25 dBA	Where night-time noise is predicted between 45 dBA and 60 dBA	Construction Category 2
	Up to 10 dBA	Where night-time noise is predicted less than 45 dBA	Construction Category 1 (standard construction)

Generally, all lots within the investigation area require category 1 or 2 construction. In all instances where windows are required to be closed to achieve internal noise levels (construction category 2), 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. However, this doesn’t prevent the residential occupants from opening the windows during quieter periods.

Appendix D provides additional details of the standard construction for each category of noise control treatment.

7 RECOMENDATIONS

7.1 Commercial/Industrial Receivers

In general less noise sensitive receivers or land uses should be located adjacent to roadways where possible. Such receivers would be commercial/industrial type receivers where external noise levels are less critical and mitigation by design of external facades and glazing can achieve acceptable internal noise levels.

7.2 Residential Receivers

In all instances where windows are required to be closed (ie 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. However, this does not prevent the property owner from opening windows and doors during quieter periods.

Generally to reduce internal noise levels to below acceptable levels for future residential dwellings, design and construction suggestions include, but are not limited to, the following:

- Locate dwellings on each allotment as far as possible from the noise source.
- Minimise the size and number of windows facing the noise source.
- Locate noise insensitive areas such as the kitchen, storage areas and laundry toward the noise source.
- Use construction techniques that focus on sealing gaps around windows, doors, ceiling spaces, etc.
- Use thick glass or double glazing.
- Use solid core doors and appropriate door seals.

8 CONCLUSION

SLR has completed a traffic noise impact assessment for the proposed subdivision of Lot 1 DP 1193553, Lots 1, 2, 3 and 4 DP 1150758 and Lot 5 DP 25886, Ocean Drive, Bonny Hills in accordance with Concept Approval 06_0085.

Assessment of the impact of road traffic noise on the proposed subdivisions was carried out using a SoundPLAN environmental acoustic model of the site.

Results from the SoundPLAN model have been utilised in determining mitigation measures and construction types suitable for the proposed development.

Provided the recommendations in this report are implemented, it is expected that this development will be able to satisfy the relevant internal noise criteria requirement.

9 REFERENCES

- Area 14 Paramics Modelling Report, Bitzios Consulting Pty Ltd, June 2009.
- AS2107:2000 Acoustic – Recommended design sound levels and reverberation times for building interiors*,* Australian standards, 2000.
- AS3671:1989 Acoustics – Road traffic noise intrusion – Building siting and construction, Australian Standard, 1989.
- Development Control Plan Part 5*,* Port Macquarie Hastings Council, *2011*.
- Development Near Rail Corridors and Busy Roads – Interim Guideline, NSW Department of Planning, December 2008.
- Road Noise Policy, NSW Environment Protection Authority, 2011.
- State Environmental Planning Policy (Infrastructure), Department of Planning, 2007
- Urban Growth Management Strategy, Port Macquarie Hastings Council, 14 December 2010.
- 30-1939R1D2 Traffic Noise Impact Assessment Stage 1A (draft), SLR Consulting Pty Ltd, 11 November 2010.
- 30-1939R1 Traffic Noise Impact Assessment Stage 1B - Area 14 Milland P/L & Seawide P/L Properties, SLR Consulting Pty Ltd, 5 July 2010.
- 630.01939.00100R1 Traffic Noise Impact Assessment – Ocean Club Resort – Phase 6, SLR Consulting Pty Ltd, 17 April 2015.
- 630.11297-R1 Noise Impact Assessment Lot 34 DP 803801, Corner Houston Mitchell Drive and Ocean Drive, Lake Cathie, SLR Consulting Pty Ltd, 4 November 2015

1 Sound Level or Noise Level

The terms "sound" and "noise" are almost interchangeable, except that in common usage "noise" is often used to refer to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure capable of evoking the sense of hearing. The human ear responds to changes in sound pressure over a very wide range. The loudest sound pressure to which the human ear responds is ten million times greater than the softest. The decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

The symbols SPL, L or L_P are commonly used to represent Sound Pressure Level. The symbol L_A represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2E-5 Pa.

2 "A" Weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an "A-weighting" filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4000 Hz), and less sensitive at lower and higher frequencies. Thus, the level of a sound in dBA is a good measure of the loudness of that sound. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dBA or 2 dBA in the level of a sound is difficult for most people to detect, whilst a 3 dBA to 5 dBA change corresponds to a small but noticeable change in loudness. A 10 dBA change corresponds to an approximate doubling or halving in loudness. The table below lists examples of typical noise levels

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130	Threshold of pain	Intolerable
120 110	Heavy rock concert Grinding on steel	Extremely noisy
100 90	Loud car horn at 3 m Construction site with pneumatic hammering	Very noisy
80 70	Kerbside of busy street Loud radio or television	Loud
60 50	Department store General Office	Moderate to quiet
40 30	Inside private office Inside bedroom	Quiet to very quiet
20	Unoccupied recording studio	Almost silent

Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as "linear", and the units are expressed as dB(lin) or dB(Z).

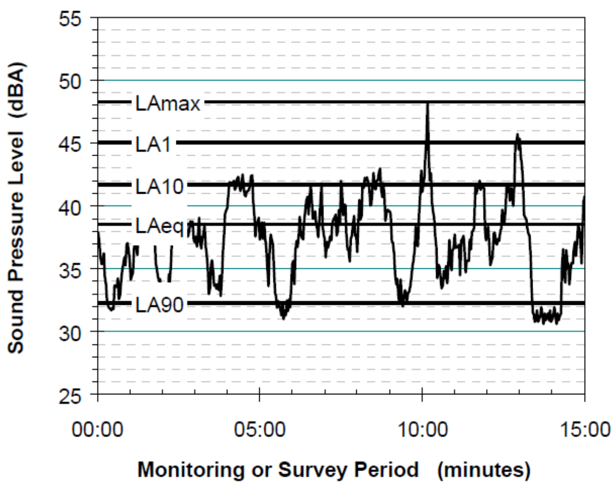
3 Sound Power Level

The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit 1E-12 W.
The relationship between Sound Power and Sound Pressure may be likened to an electric radiator, which is characterised by a power rating, but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

4 Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels L_{AN}, where L_{AN} is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the L_{A1} is the noise level exceeded for 1% of the time, L_{A10} the noise exceeded for 10% of the time, and so on.

The following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.



Of particular relevance, are:

L_{A1} The noise level exceeded for 1% of the 15 minute interval.

L_{A10} The noise level exceed for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

L_{A90} The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

L_{Aeq} The A-weighted equivalent noise level (basically the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

When dealing with numerous days of statistical noise data, it is sometimes necessary to define the typical noise levels at a given monitoring location for a particular time of day. A standardised method is available for determining these representative levels.

This method produces a level representing the "repeatable minimum" L_{A90} noise level over the daytime and night-time measurement periods, as required by the EPA. In addition the method produces mean or "average" levels representative of the other descriptors (L_{Aeq}, L_{A10}, etc).

5 Tonality

Tonal noise contains one or more prominent tones (ie distinct frequency components), and is normally regarded as more offensive than "broad band" noise.

6 Impulsiveness

An impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.

7 Frequency Analysis

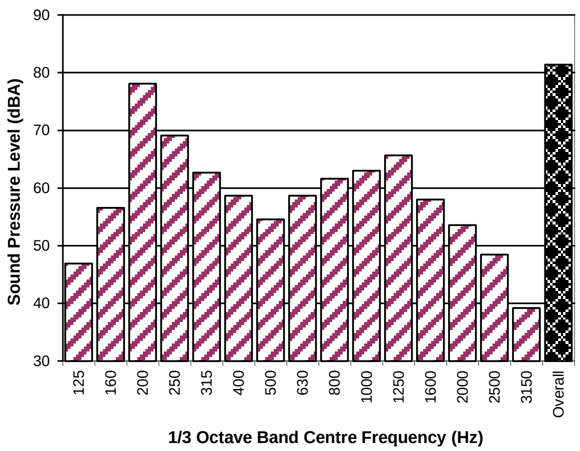
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal. This analysis was traditionally carried out using analogue electronic filters, but is now normally carried out using Fast Fourier Transform (FFT) analysers.

The units for frequency are Hertz (Hz), which represent the number of cycles per second.

Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (3 bands in each octave band)
- Narrow band (where the spectrum is divided into 400 or more bands of equal width)

The following figure shows a 1/3 octave band frequency analysis where the noise is dominated by the 200 Hz band. Note that the indicated level of each individual band is less than the overall level, which is the logarithmic sum of the bands.



8 Vibration

Vibration may be defined as cyclic or transient motion. This motion can be measured in terms of its displacement, velocity or acceleration. Most assessments of human response to vibration or the risk of damage to buildings use measurements of vibration velocity. These may be expressed in terms of "peak" velocity or "rms" velocity.

The former is the maximum instantaneous velocity, without any averaging, and is sometimes referred to as "peak particle velocity", or PPV. The latter incorporates "root mean squared" averaging over some defined time period.

Vibration measurements may be carried out in a single axis or alternatively as triaxial measurements. Where triaxial measurements are used, the axes are commonly designated vertical, longitudinal (aligned toward the source) and transverse.

The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated. A vibration level V, expressed in mm/s can be converted to decibels by the formula $20 \log (V/V_o)$, where V_o is the reference level (1E-6 mm/s). Care is required in this regard, as other reference levels are used by some organizations.

9 Human Perception of Vibration

People are able to "feel" vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience and expectations, and on other connotations associated with the perceived source of the vibration. For example, the vibration that a person responds to as "normal" in a car, bus or train is considerably higher than what is perceived as "normal" in a shop, office or dwelling.

10 Over-Pressure

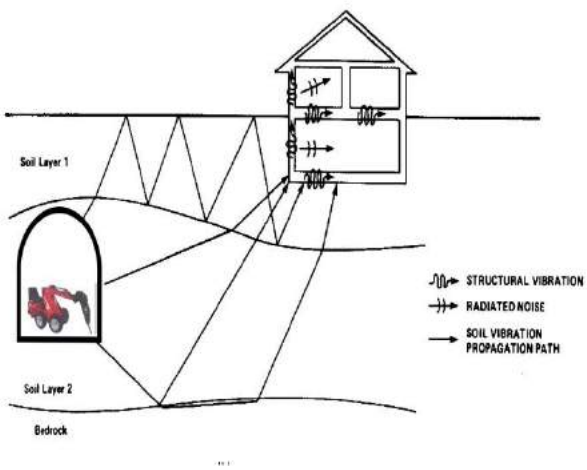
The term "over-pressure" is used to describe the air pressure pulse emitted during blasting or similar events. The peak level of an event is normally measured using a microphone in the same manner as linear noise (ie unweighted), at frequencies both in and below the audible range.

11 Regenerated Noise

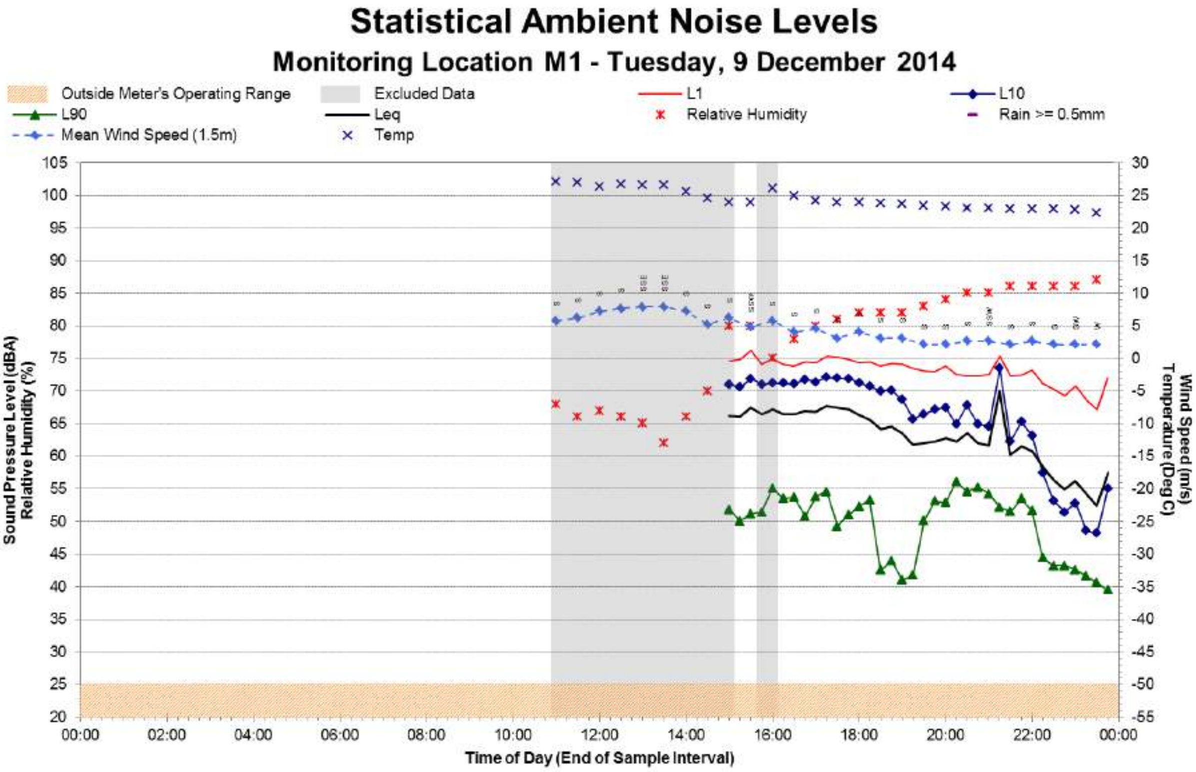
Noise that propagates through a structure as vibration and is radiated by vibrating wall and floor surfaces is termed "regenerated noise", "structure-borne noise", or sometimes "ground-borne noise". Regenerated noise originates as vibration and propagates between the source and receiver through the ground and/or building structural elements, rather than through the air.

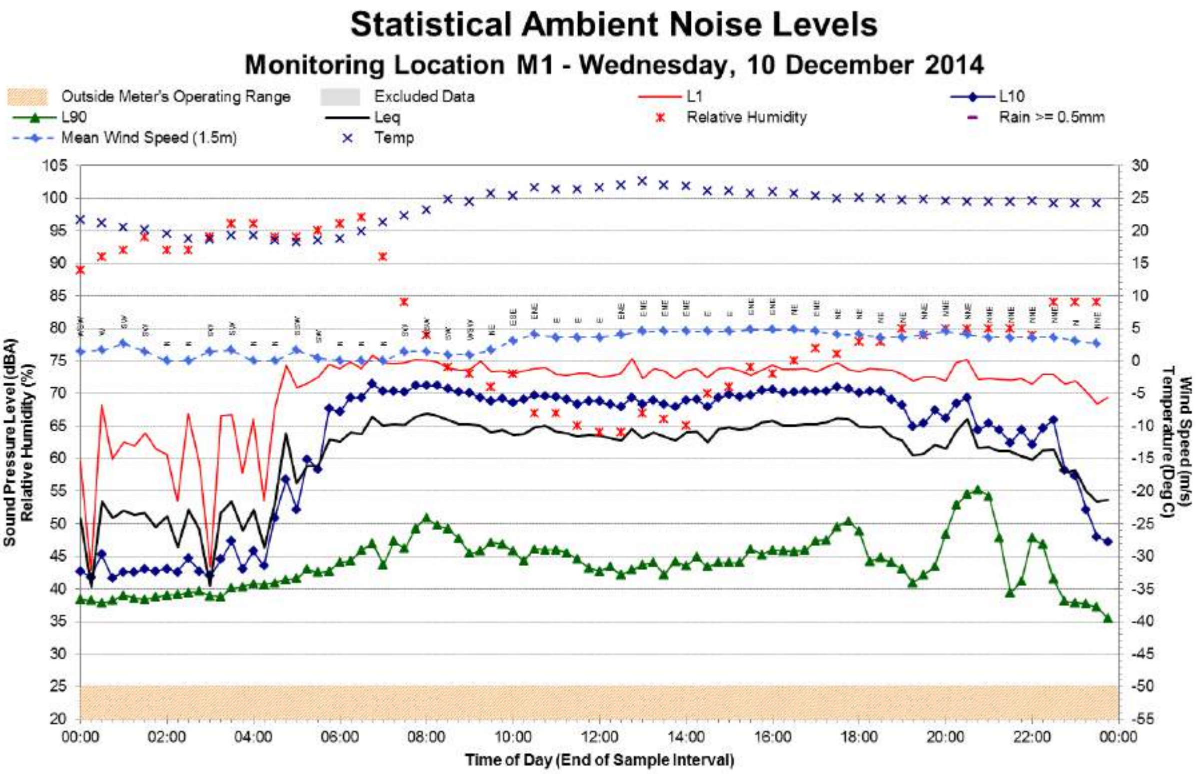
Typical sources of regenerated noise include tunnelling works, underground railways, excavation plant (eg rockbreakers), and building services plant (eg fans, compressors and generators).

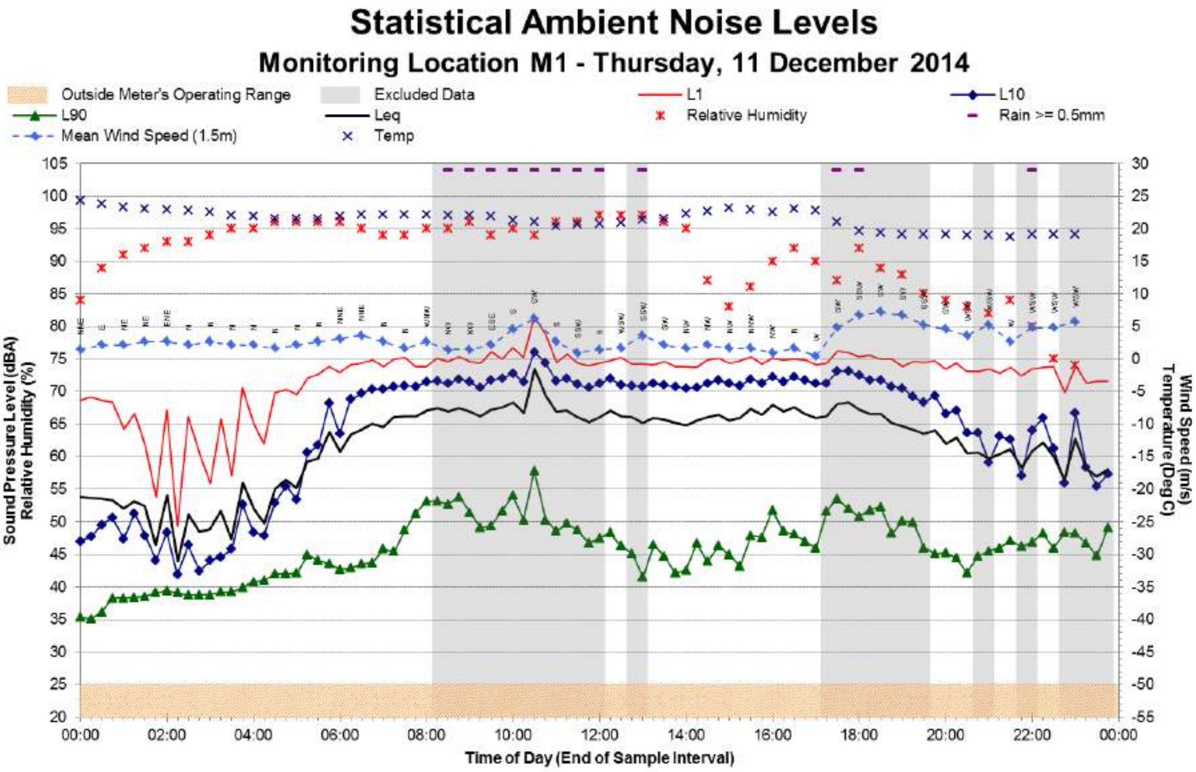
The following figure presents the various paths by which vibration and regenerated noise may be transmitted between a source and receiver for construction activities occurring within a tunnel.

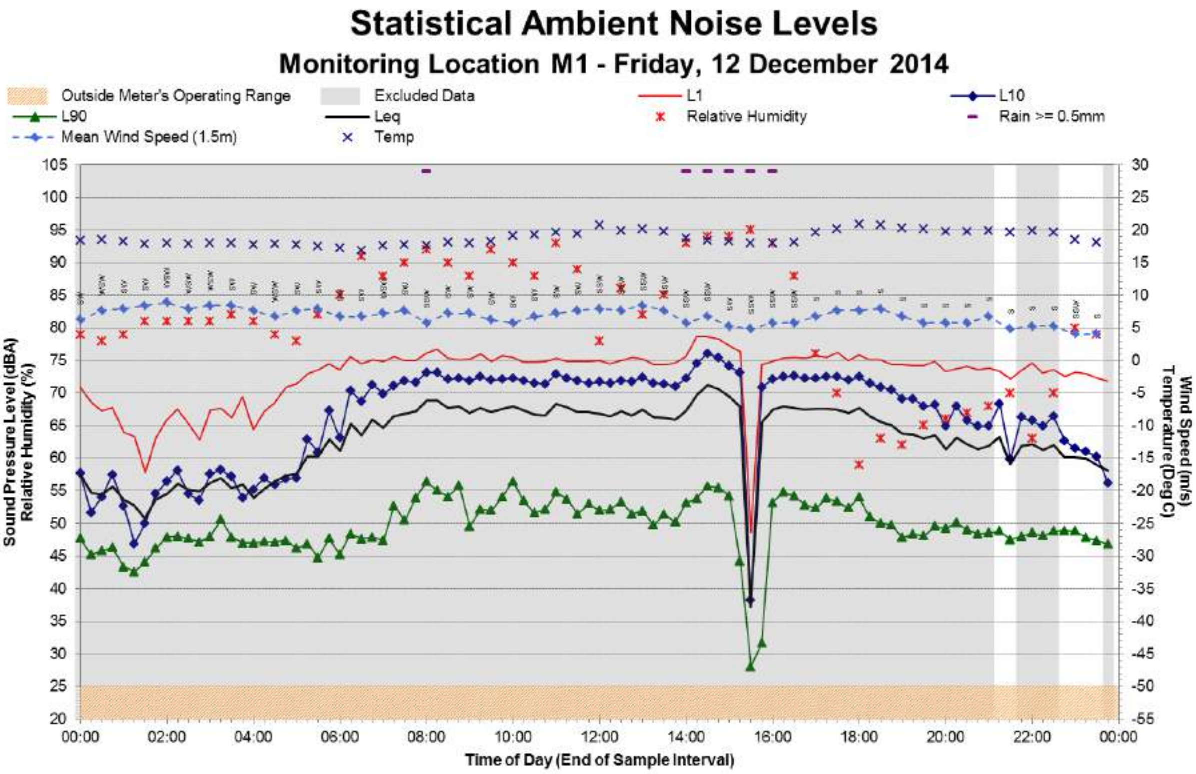


The term "regenerated noise" is also used to describe other types of noise that are emitted from the primary source as a different form of energy. One example would be a fan with a silencer, where the fan is the energy source and primary noise source. The silencer may effectively reduce the fan noise, but some additional noise may be created by the aerodynamic effect of the silencer in the airstream. This "secondary" noise may be referred to as regenerated noise.


Statistical Ambient Noise Levels
Monitoring Location M1 - Tuesday, 9 December 2014
Outside Meter's Operating Range
Excluded Data
L1
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Temp
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (m/s)
Temperature (Deg C)
Time of Day (End of Sample Interval)

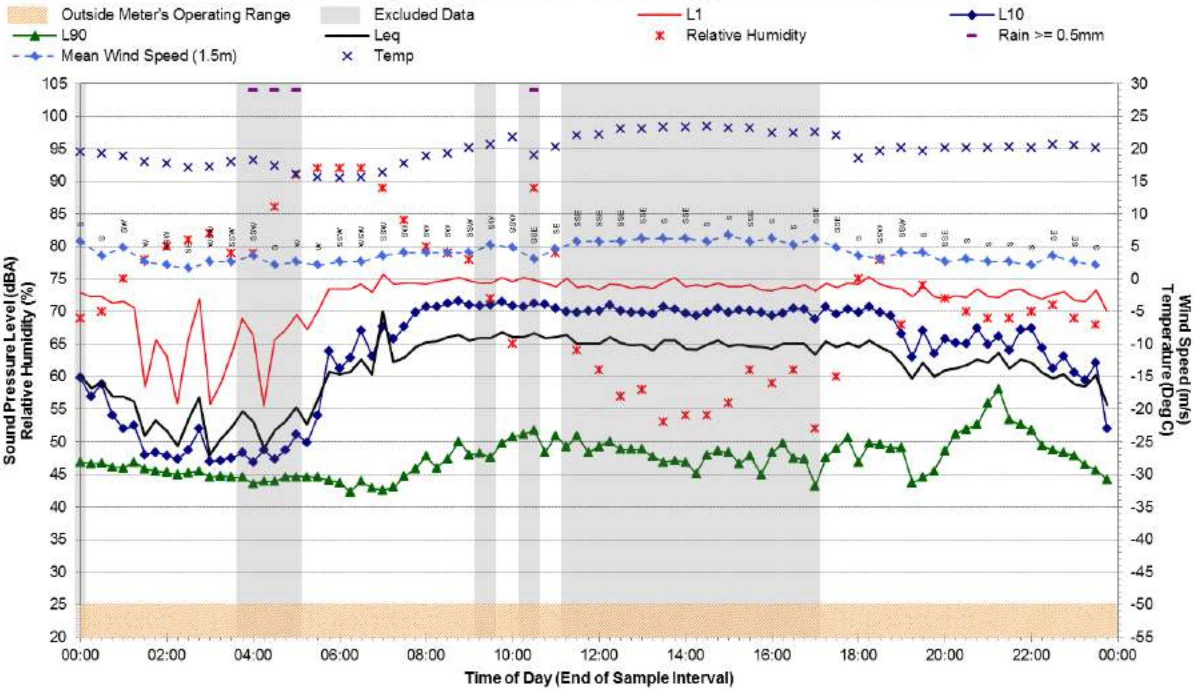

Statistical Ambient Noise Levels
Monitoring Location M1 - Wednesday, 10 December 2014
Outside Meter's Operating Range
Excluded Data
L1
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Temp
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (m/s)
Temperature (Deg C)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Monitoring Location M1 - Thursday, 11 December 2014
Outside Meter's Operating Range
Excluded Data
L1
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Temp
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (m/s)
Temperature (Deg C)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Monitoring Location M1 - Friday, 12 December 2014
Outside Meter's Operating Range
Excluded Data
L1
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Temp
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (m/s)
Temperature (Deg C)
Time of Day (End of Sample Interval)

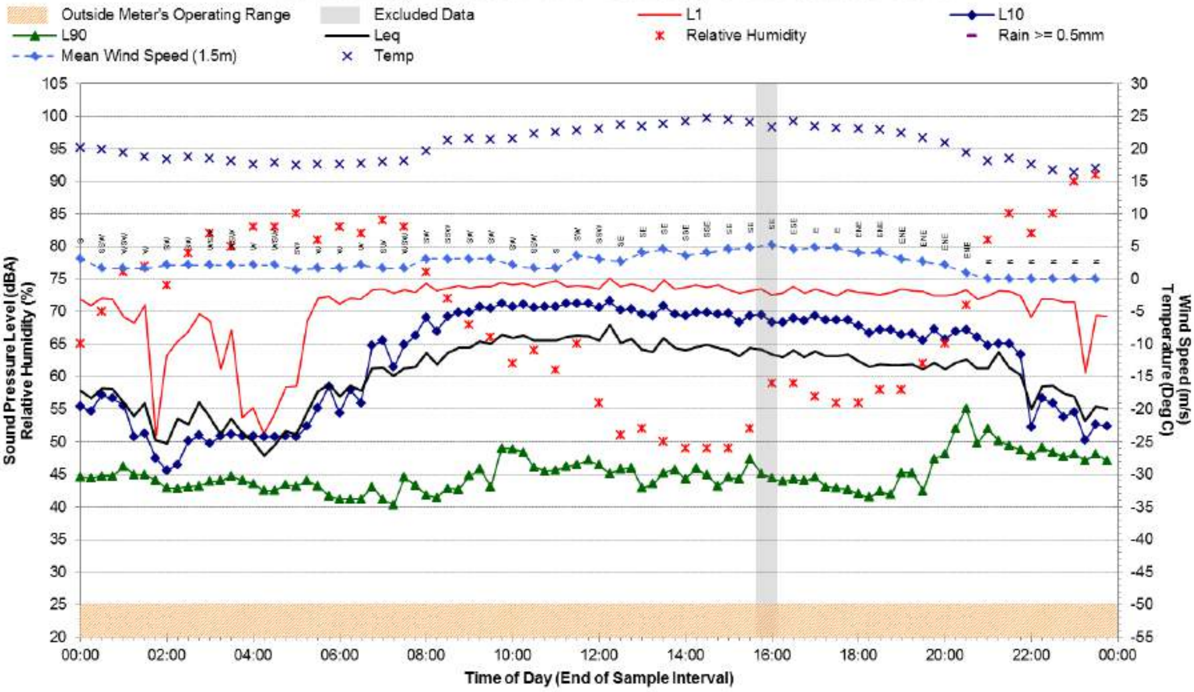
Statistical Ambient Noise Levels

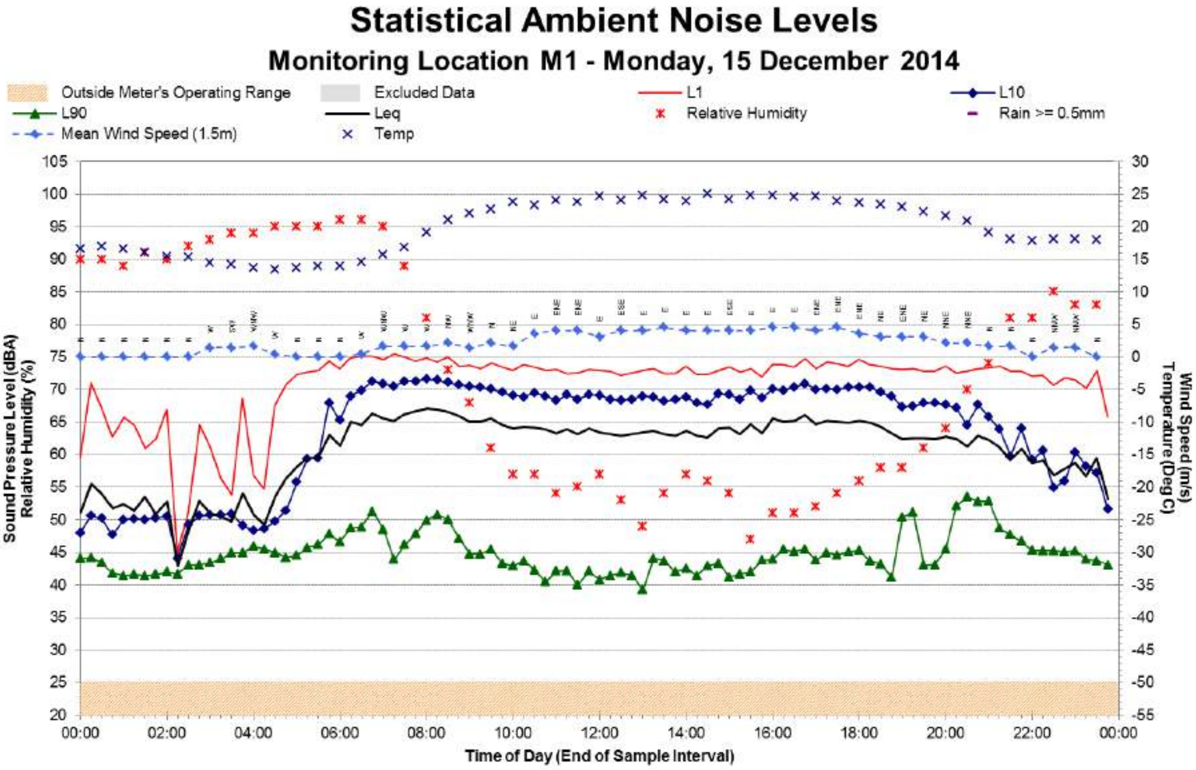
Monitoring Location M1 - Saturday, 13 December 2014



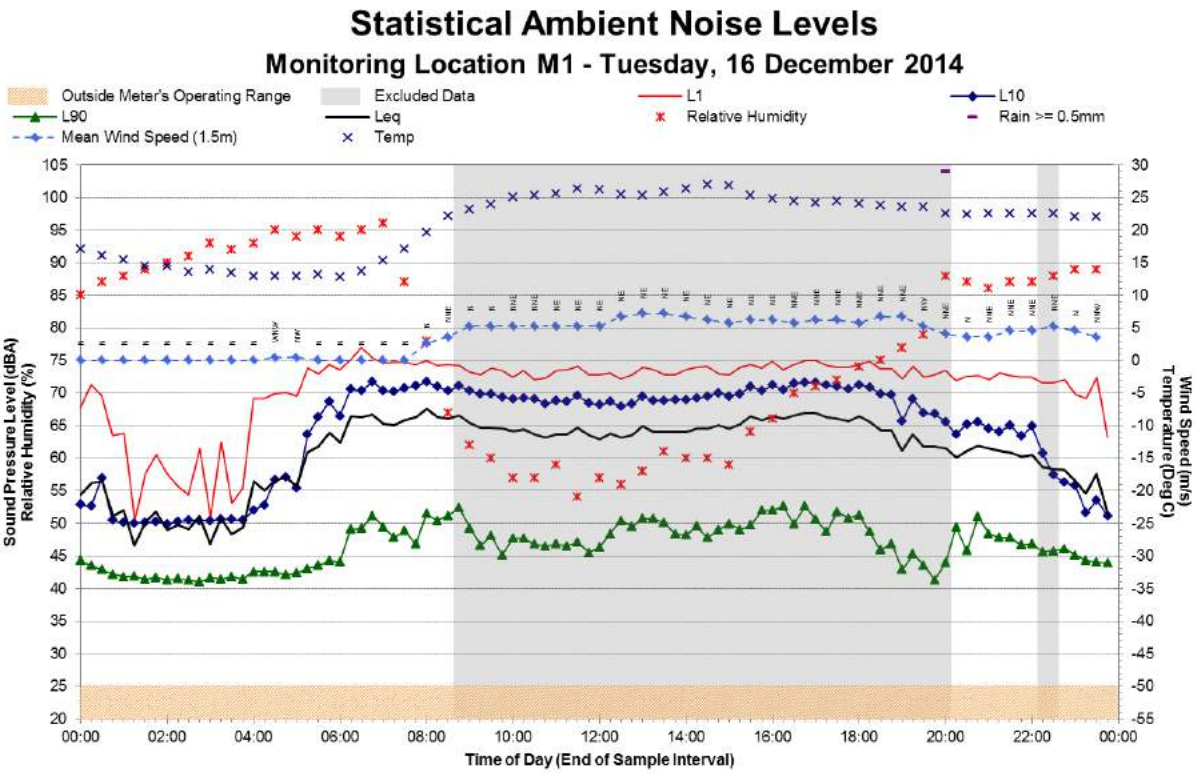
Statistical Ambient Noise Levels

Monitoring Location M1 - Sunday, 14 December 2014

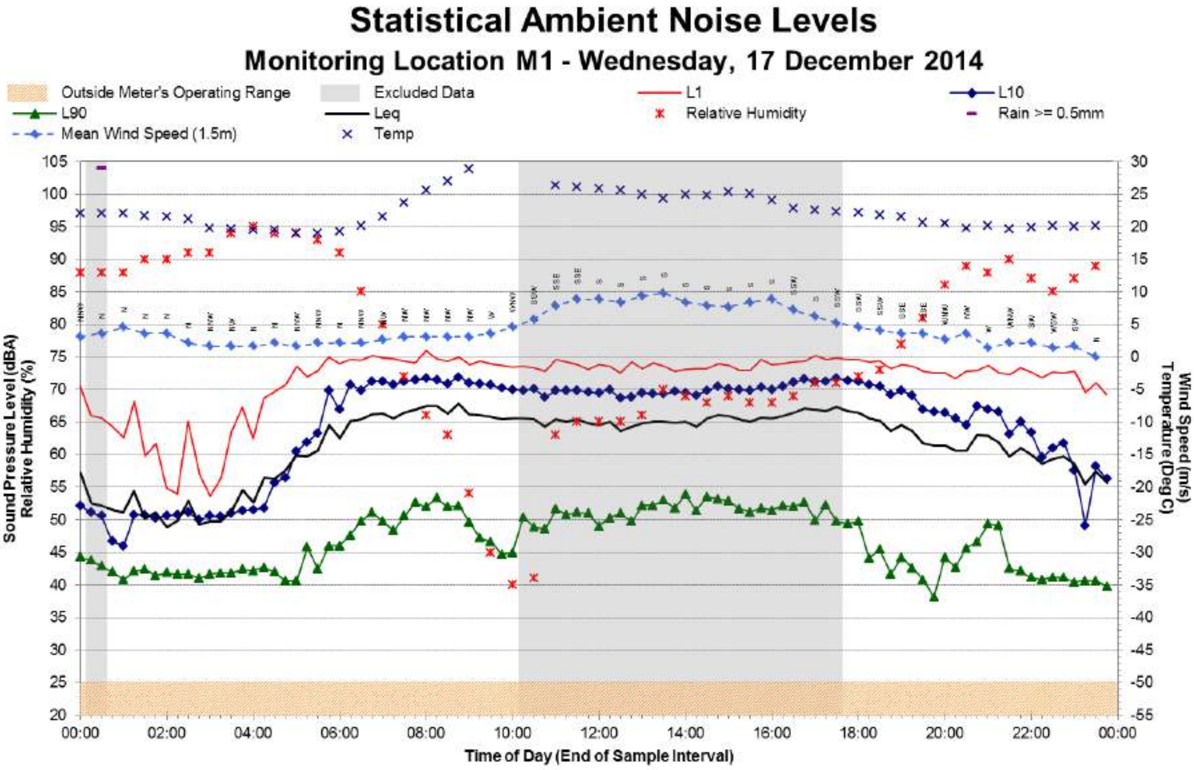


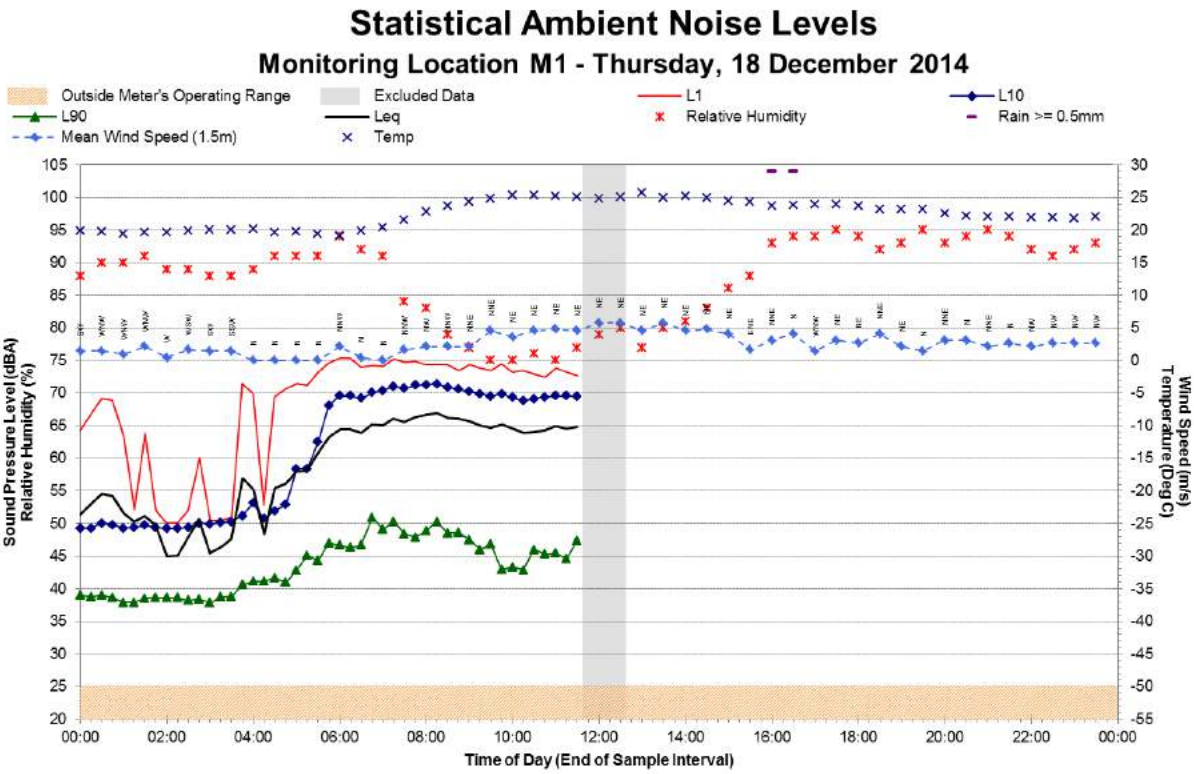


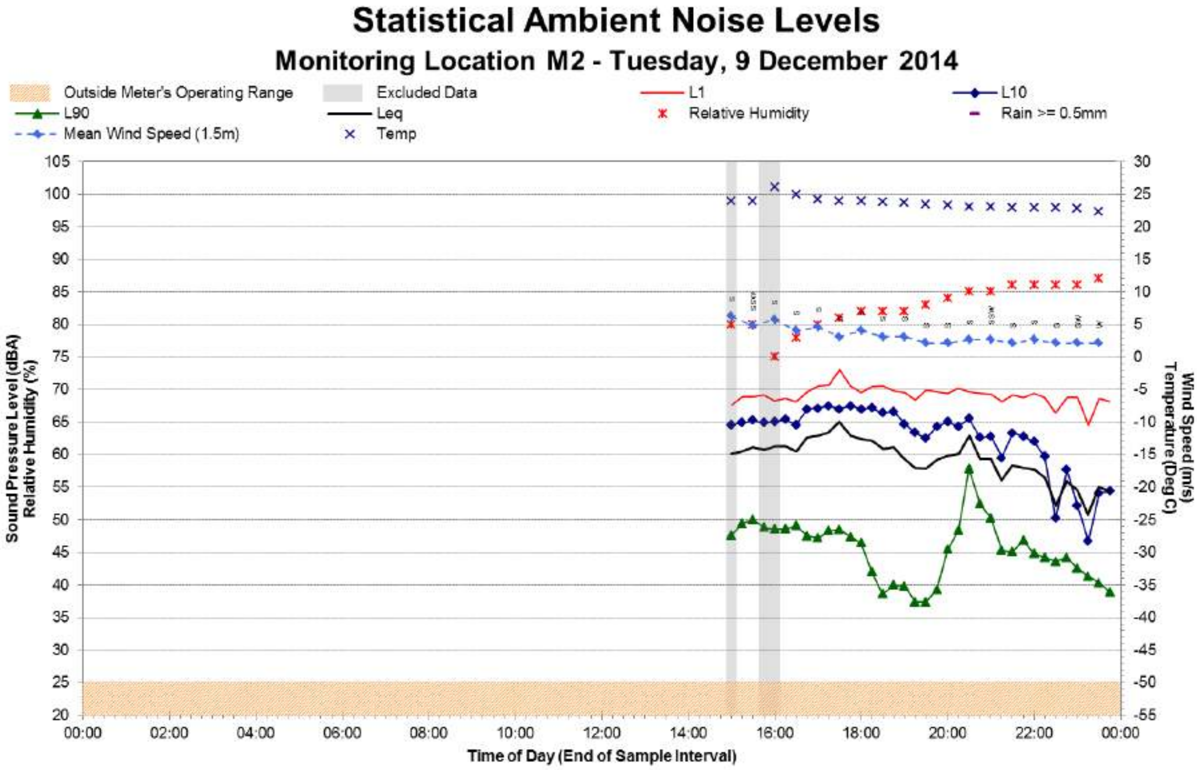
Statistical Ambient Noise Levels
Monitoring Location M1 - Monday, 15 December 2014
Outside Meter's Operating Range
Excluded Data
L1
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Temp
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (m/s)
Temperature (Deg C)
Time of Day (End of Sample Interval)

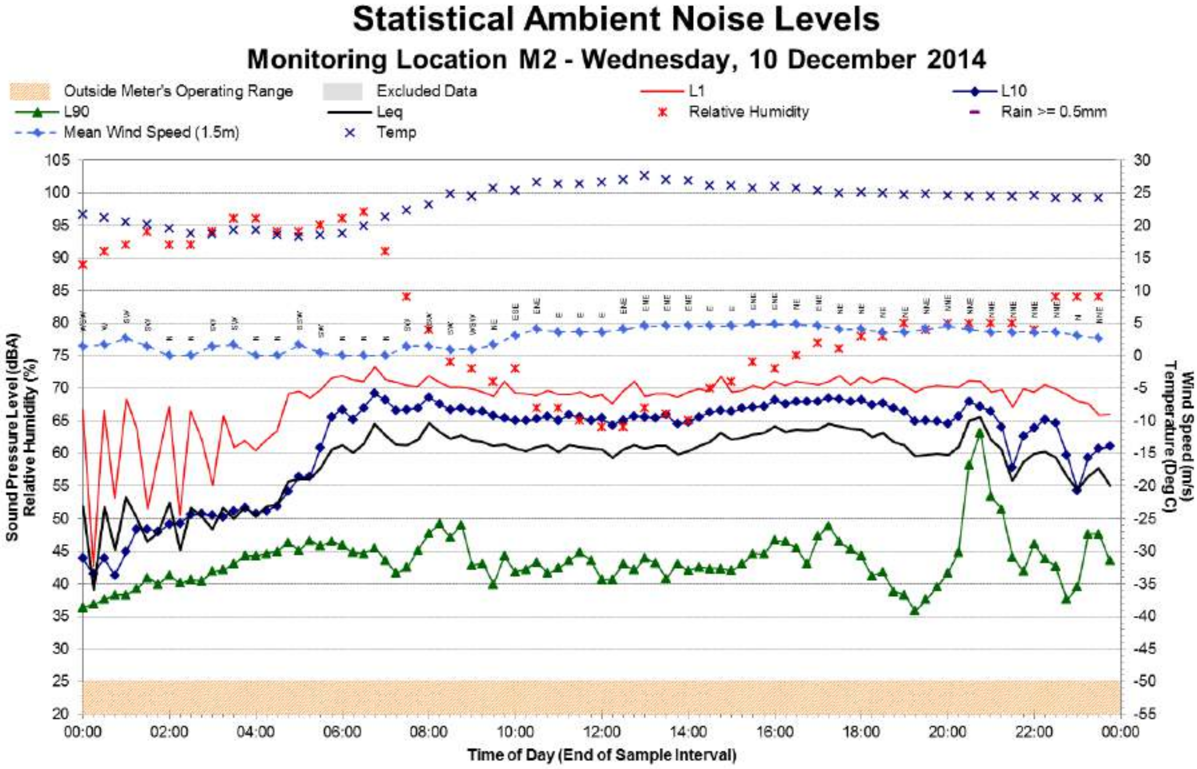


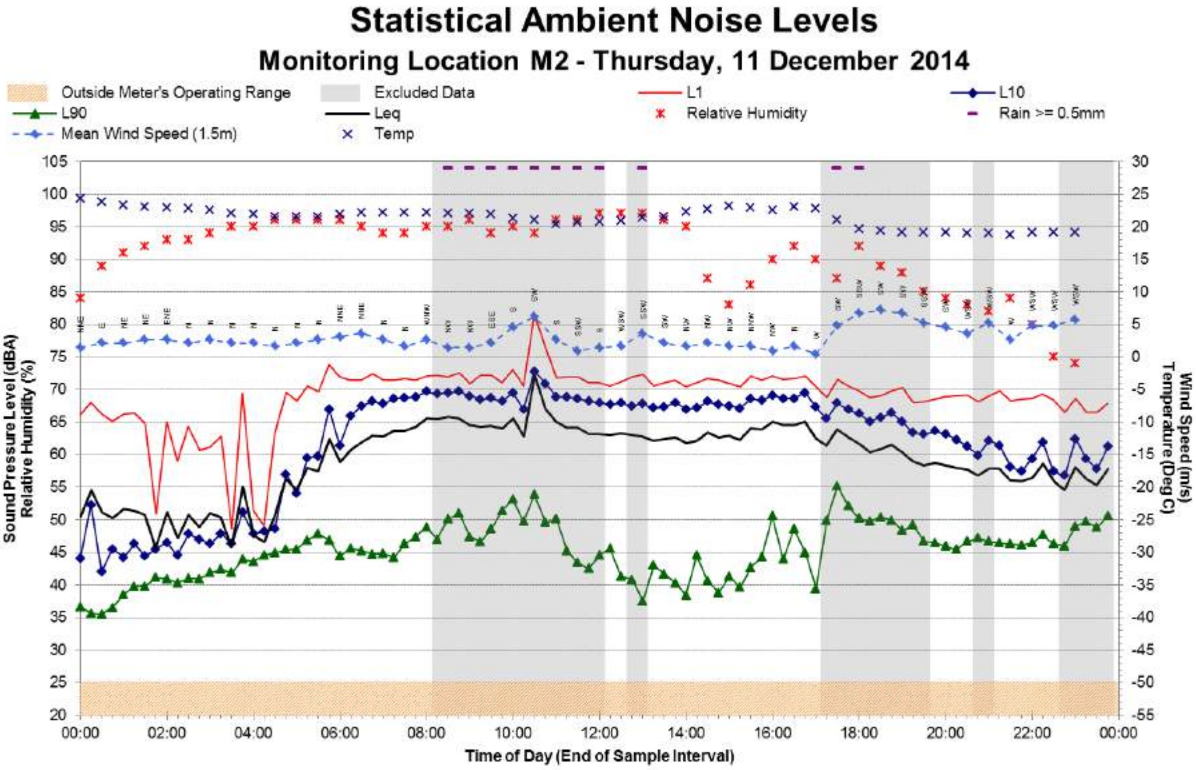
Statistical Ambient Noise Levels
Monitoring Location M1 - Tuesday, 16 December 2014
Outside Meter's Operating Range
Excluded Data
L1
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Temp
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (m/s)
Temperature (Deg C)
Time of Day (End of Sample Interval)

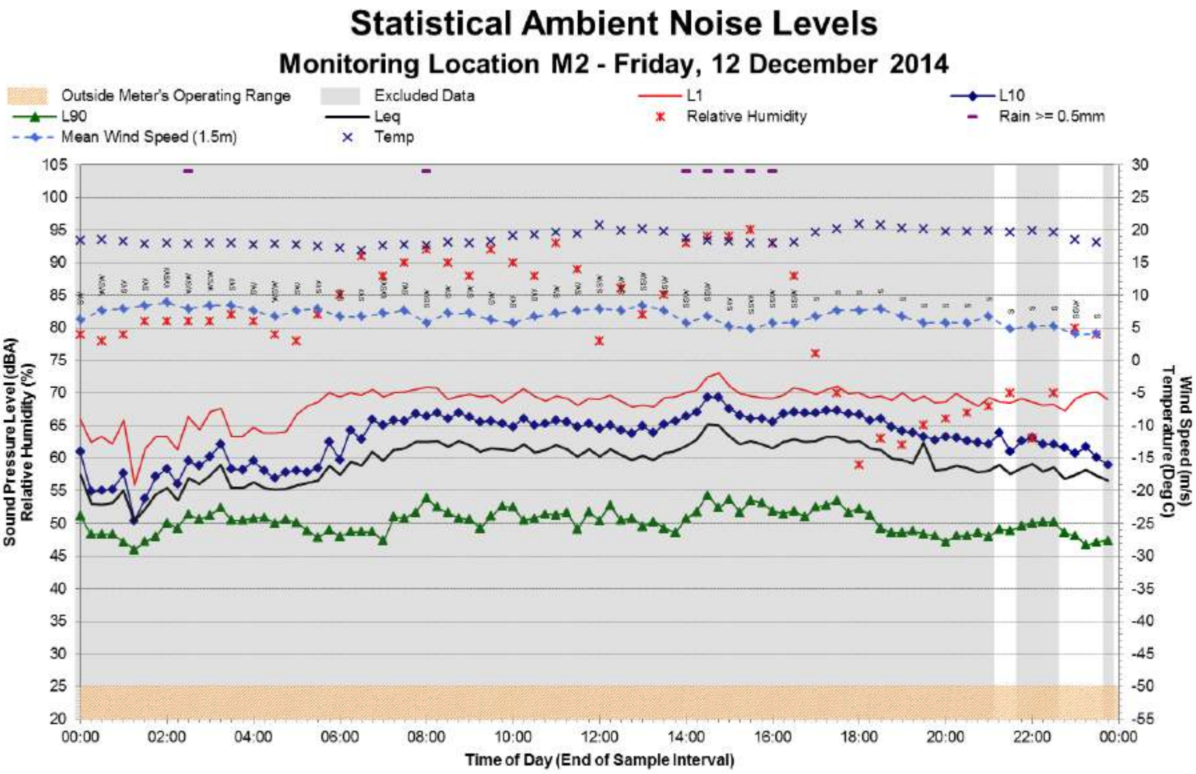

Statistical Ambient Noise Levels
Monitoring Location M1 - Wednesday, 17 December 2014
Outside Meter's Operating Range
Excluded Data
L1
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Temp
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (m/s)
Temperature (Deg C)
Time of Day (End of Sample Interval)

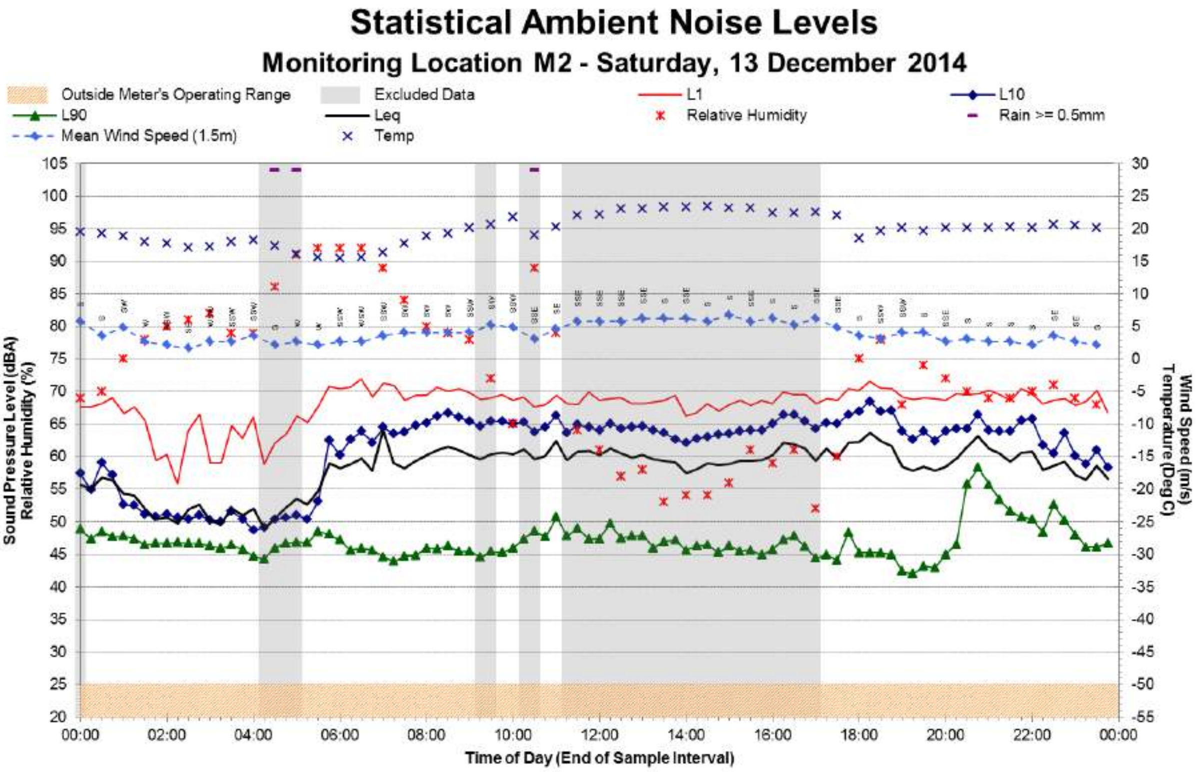

Statistical Ambient Noise Levels
Monitoring Location M1 - Thursday, 18 December 2014
Outside Meter's Operating Range
Excluded Data
L1
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Temp
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (m/s)
Temperature (Deg C)
Time of Day (End of Sample Interval)

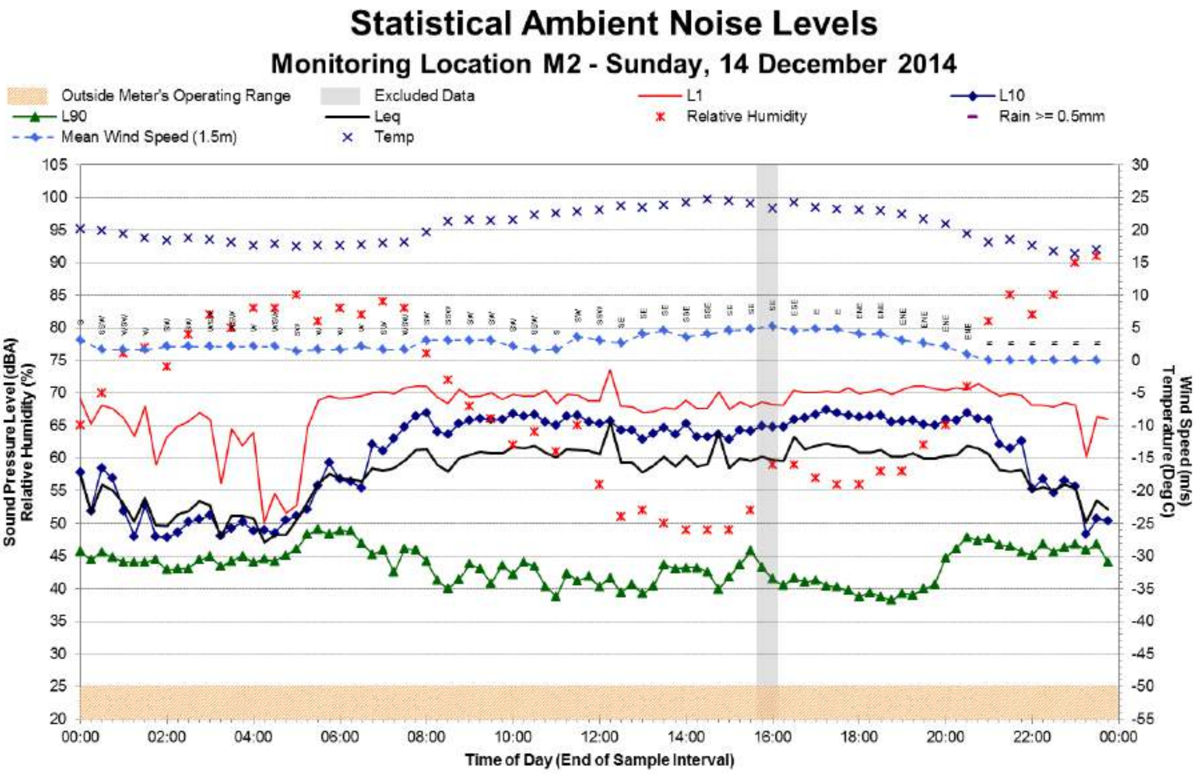

Statistical Ambient Noise Levels
Monitoring Location M2 - Tuesday, 9 December 2014
Outside Meter's Operating Range
Excluded Data
L1
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Temp
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (m/s)
Temperature (Deg C)
Time of Day (End of Sample Interval)

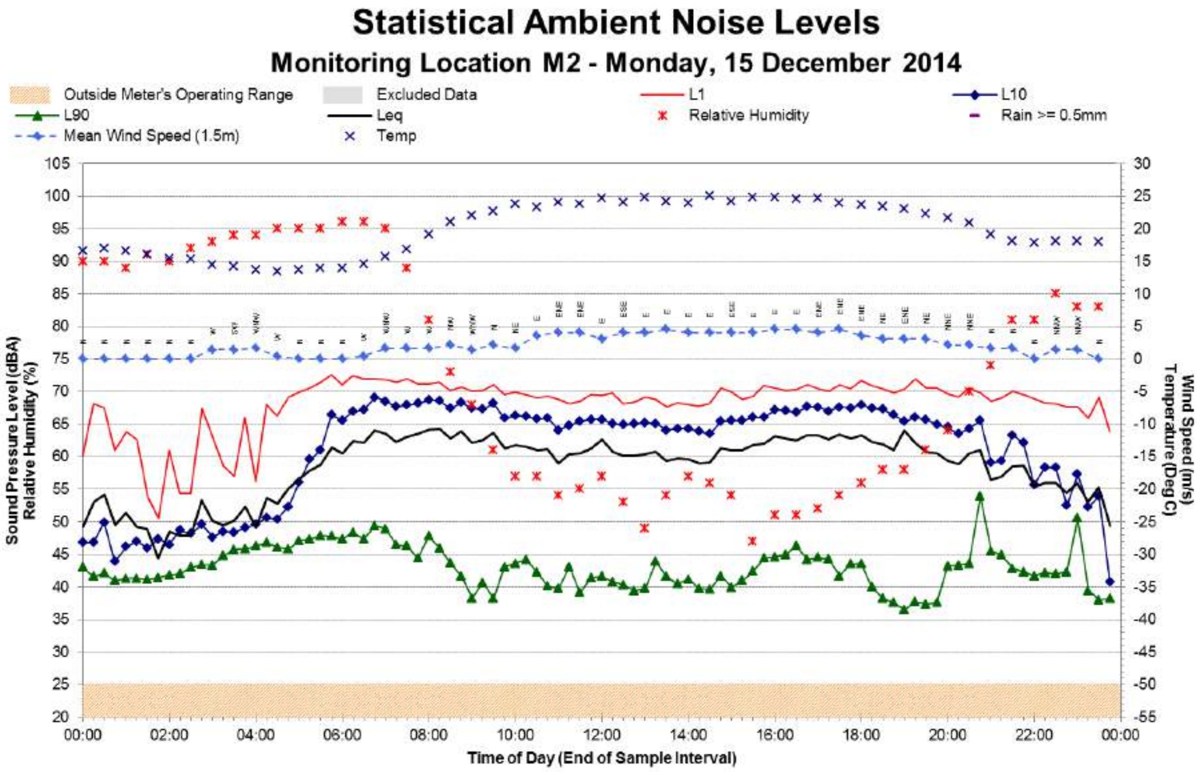

Statistical Ambient Noise Levels
Monitoring Location M2 - Wednesday, 10 December 2014
Outside Meter's Operating Range
Excluded Data
L1
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Temp
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (m/s)
Temperature (Deg C)
Time of Day (End of Sample Interval)

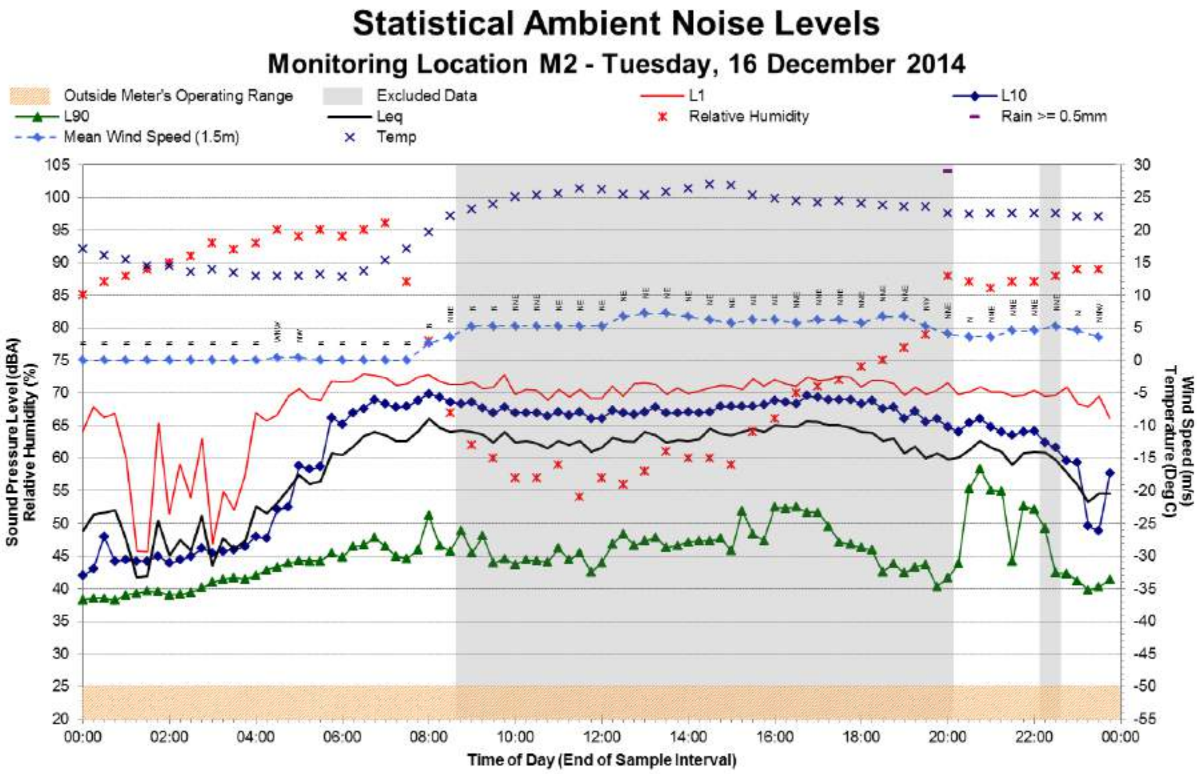

Statistical Ambient Noise Levels
Monitoring Location M2 - Thursday, 11 December 2014
Outside Meter's Operating Range
Excluded Data
L1
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Temp
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (m/s)
Temperature (Deg C)
Time of Day (End of Sample Interval)

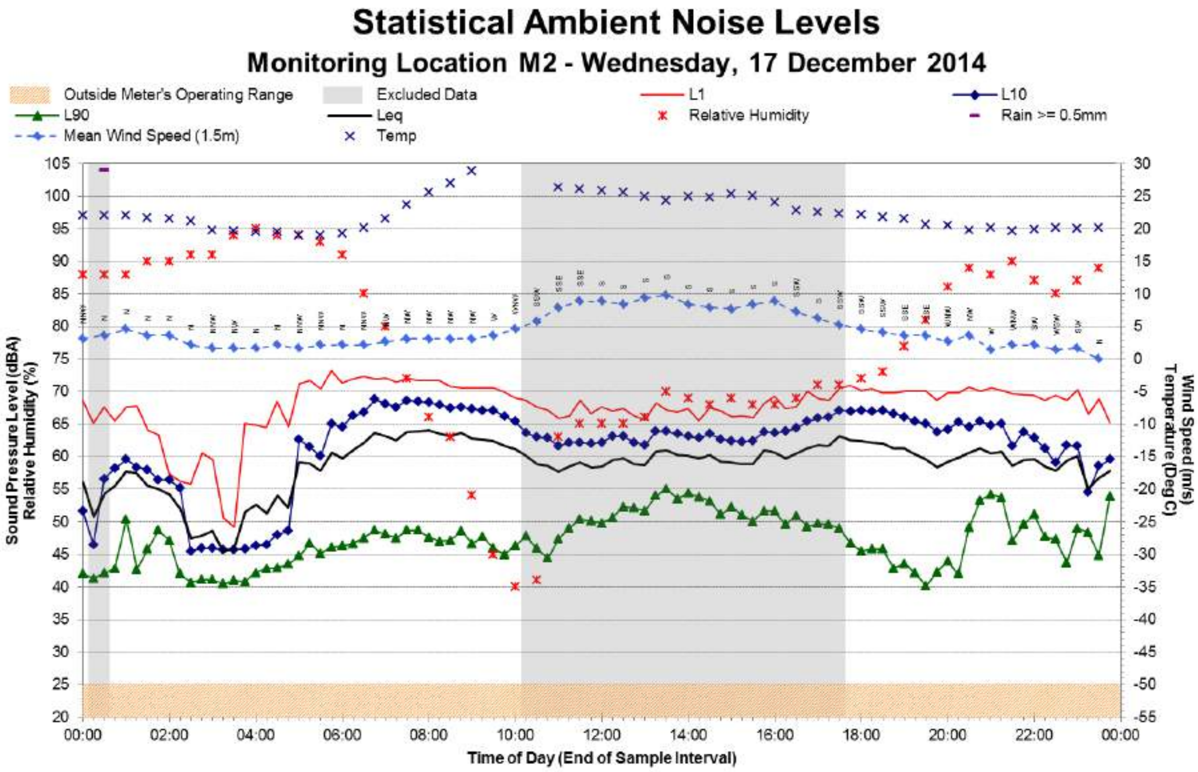

Statistical Ambient Noise Levels
Monitoring Location M2 - Friday, 12 December 2014
Outside Meter's Operating Range
Excluded Data
L1
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Temp
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (m/s)
Temperature (Deg C)
Time of Day (End of Sample Interval)

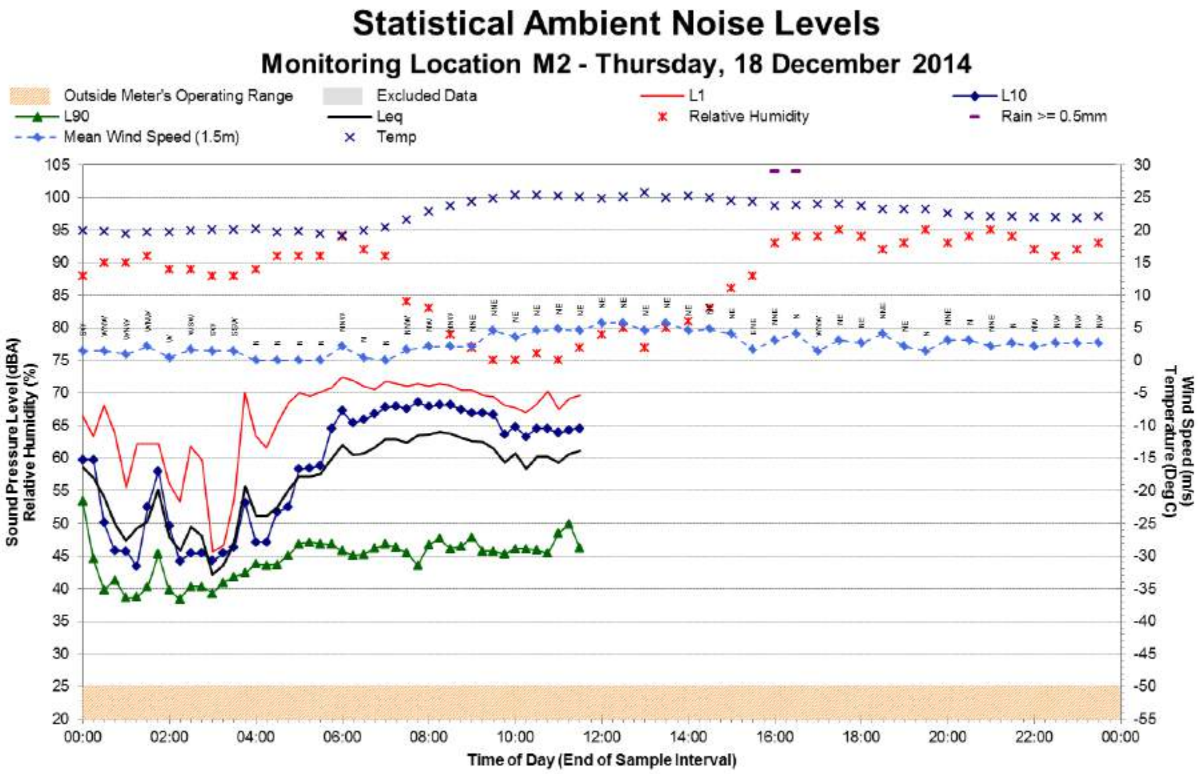

Statistical Ambient Noise Levels
Monitoring Location M2 - Saturday, 13 December 2014
Outside Meter's Operating Range
Excluded Data
L1
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Temp
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (m/s)
Temperature (Deg C)
Time of Day (End of Sample Interval)

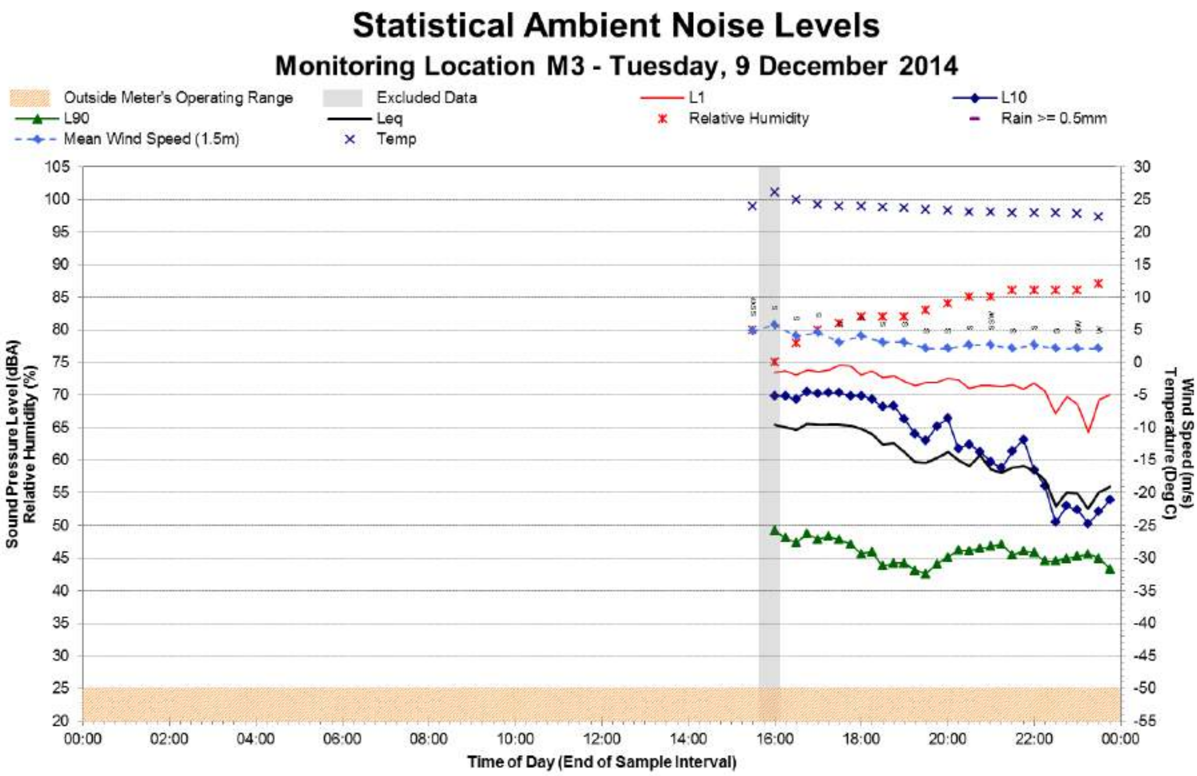

Statistical Ambient Noise Levels
Monitoring Location M2 - Sunday, 14 December 2014
Outside Meter's Operating Range
Excluded Data
L1
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Temp
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (m/s)
Temperature (Deg C)
Time of Day (End of Sample Interval)

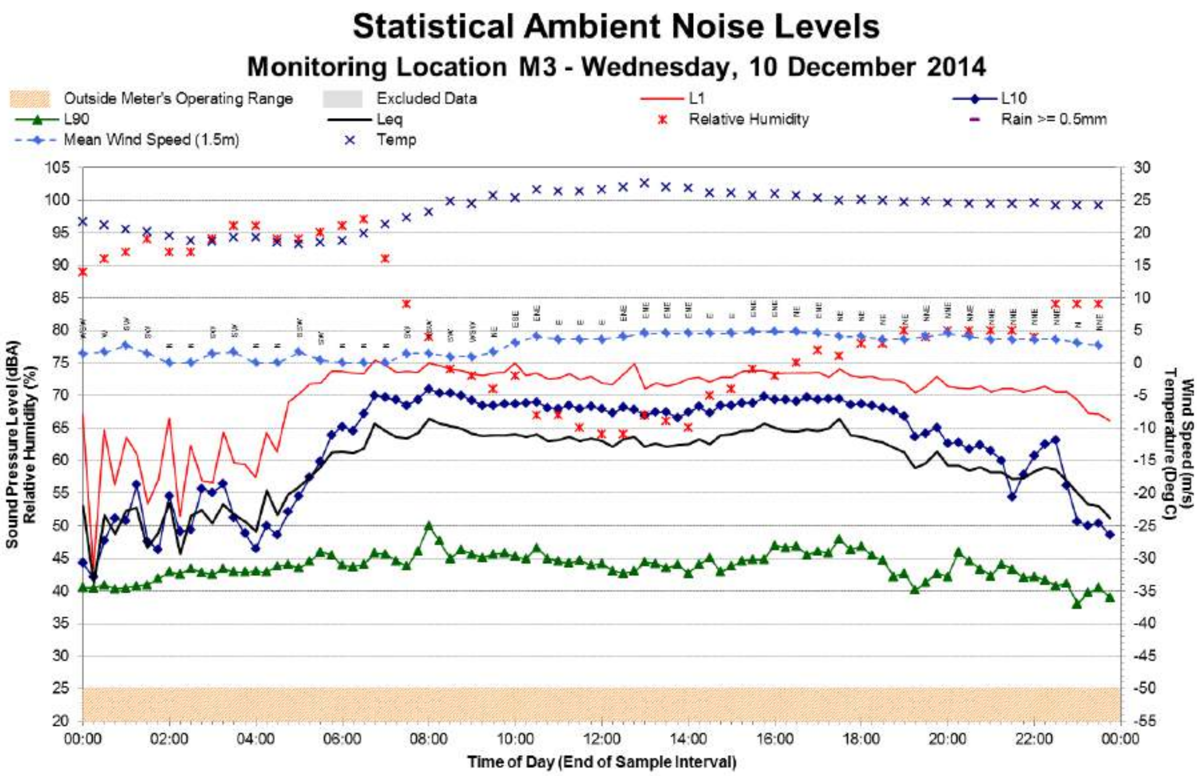

Statistical Ambient Noise Levels
Monitoring Location M2 - Monday, 15 December 2014
Outside Meter's Operating Range
Excluded Data
L1
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Temp
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (m/s)
Temperature (Deg C)
Time of Day (End of Sample Interval)

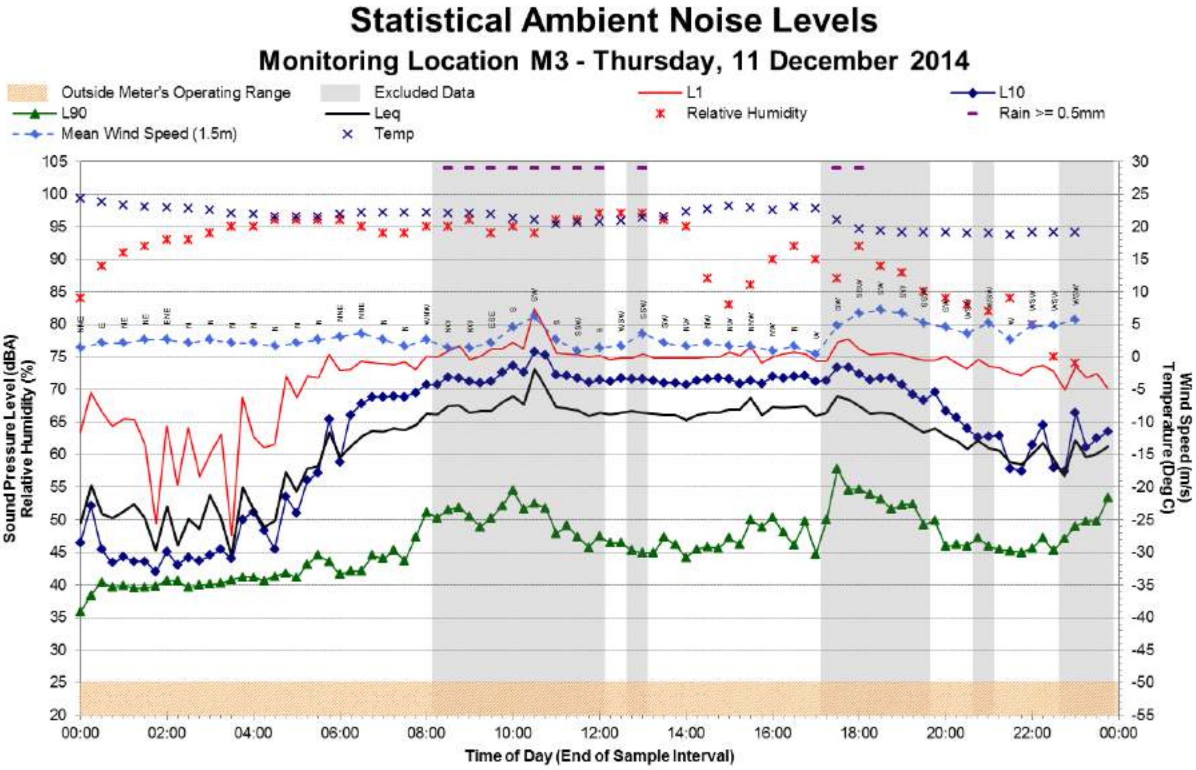

Statistical Ambient Noise Levels
Monitoring Location M2 - Tuesday, 16 December 2014
Outside Meter's Operating Range
Excluded Data
L1
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Temp
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (m/s)
Temperature (Deg C)
Time of Day (End of Sample Interval)

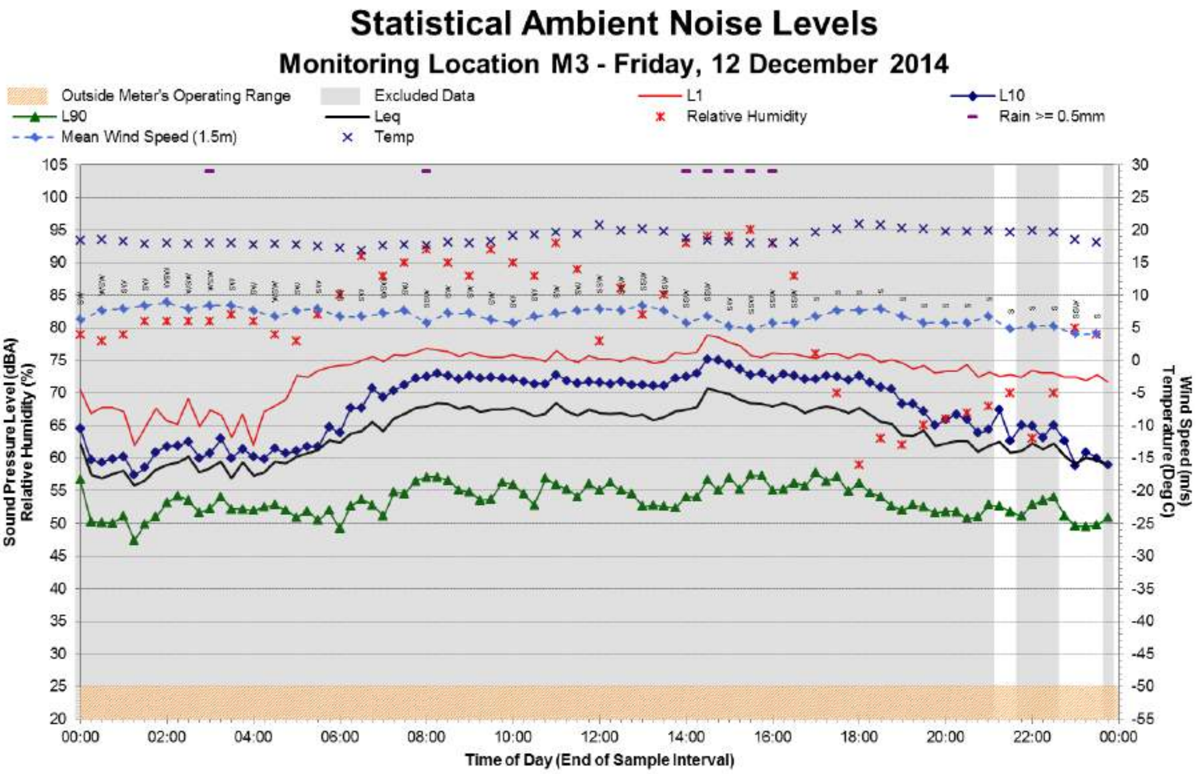

Statistical Ambient Noise Levels
Monitoring Location M2 - Wednesday, 17 December 2014
Outside Meter's Operating Range
Excluded Data
L1
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Temp
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (m/s)
Temperature (Deg C)
Time of Day (End of Sample Interval)

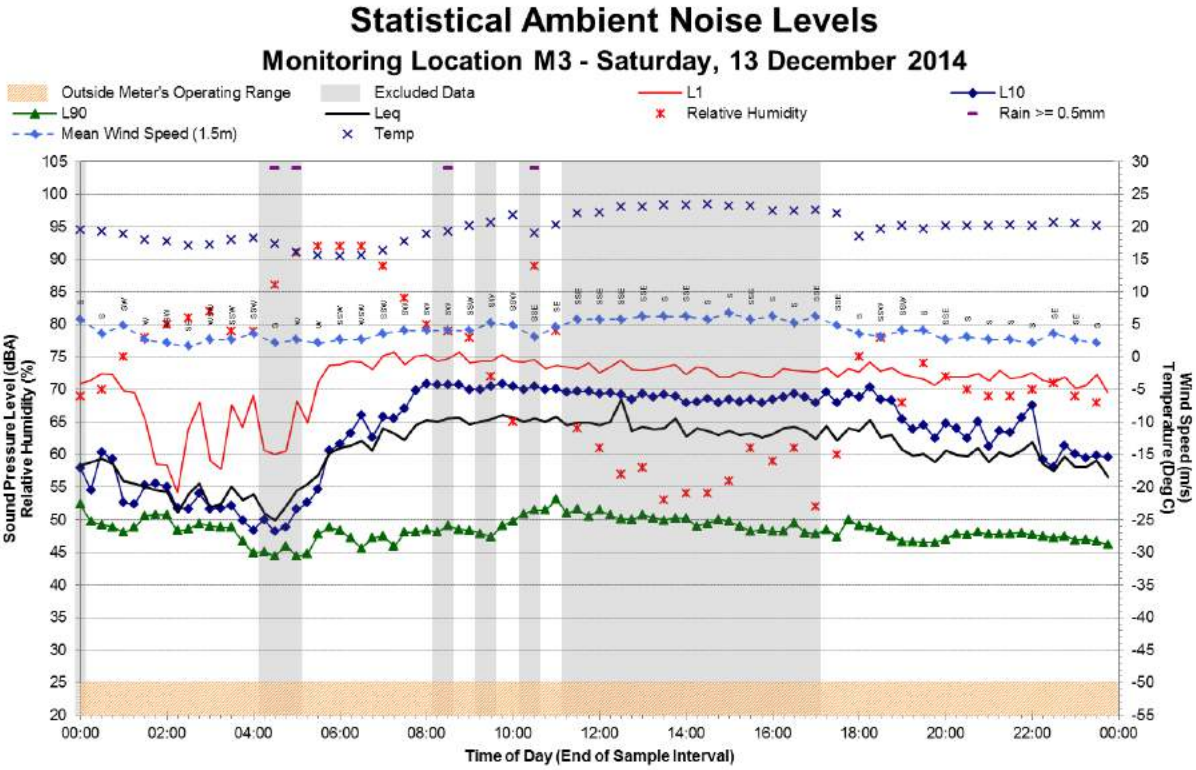

Statistical Ambient Noise Levels
Monitoring Location M2 - Thursday, 18 December 2014
Outside Meter's Operating Range
Excluded Data
L1
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Temp
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (m/s)
Temperature (Deg C)
Time of Day (End of Sample Interval)

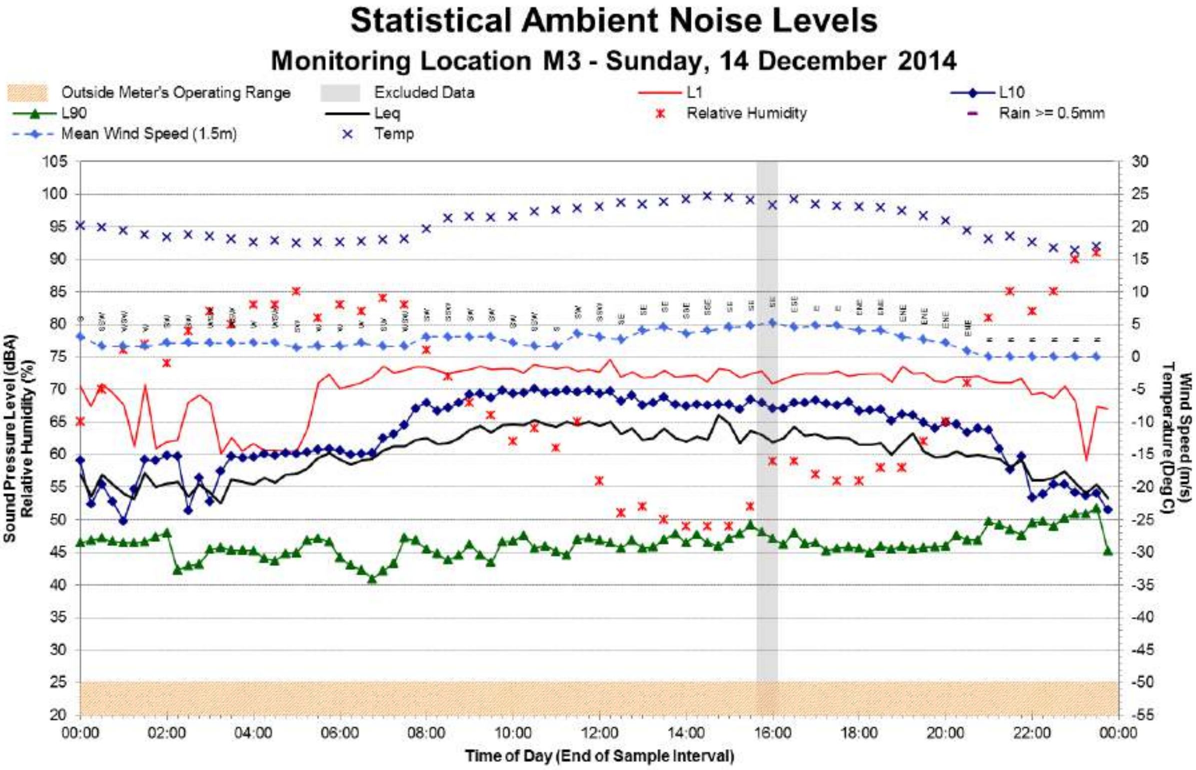

Statistical Ambient Noise Levels
Monitoring Location M3 - Tuesday, 9 December 2014
Outside Meter's Operating Range
Excluded Data
L1
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Temp
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (m/s)
Temperature (Deg C)
Time of Day (End of Sample Interval)

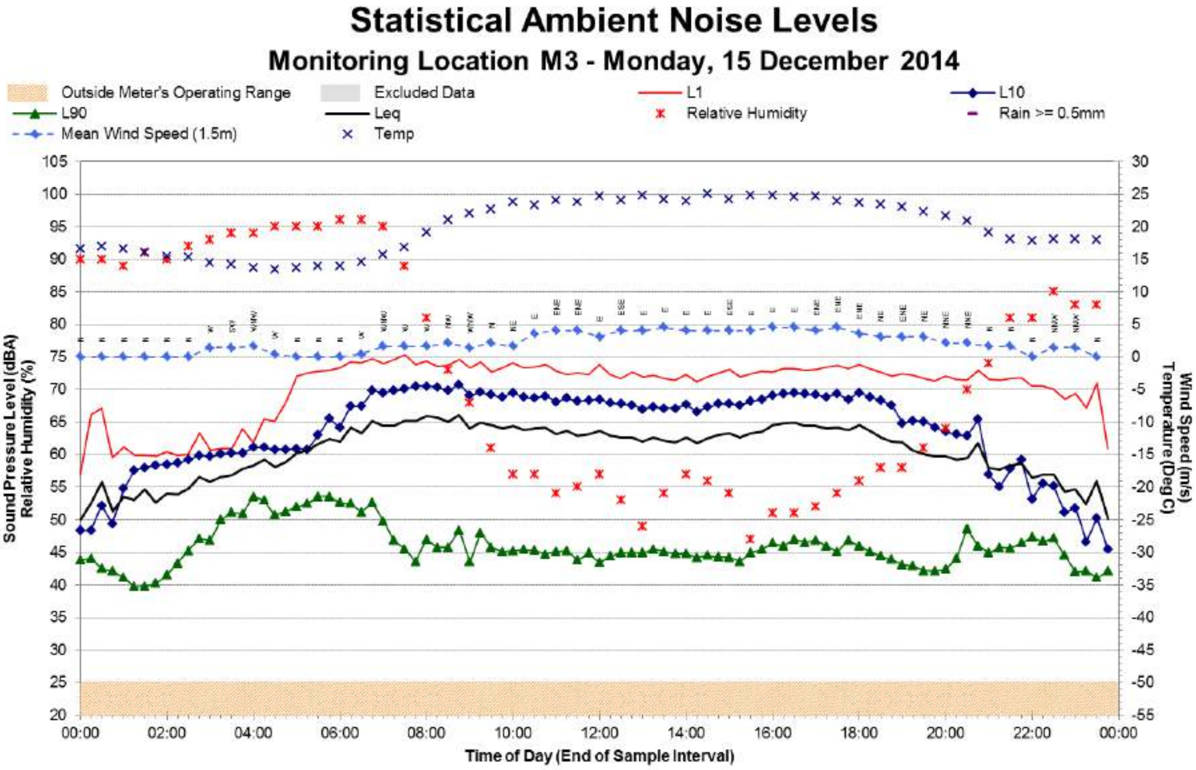

Statistical Ambient Noise Levels
Monitoring Location M3 - Wednesday, 10 December 2014
Outside Meter's Operating Range
Excluded Data
L1
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Temp
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (m/s)
Temperature (Deg C)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Monitoring Location M3 - Thursday, 11 December 2014
Outside Meter's Operating Range
Excluded Data
L1
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Temp
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (m/s)
Temperature (Deg C)
Time of Day (End of Sample Interval)

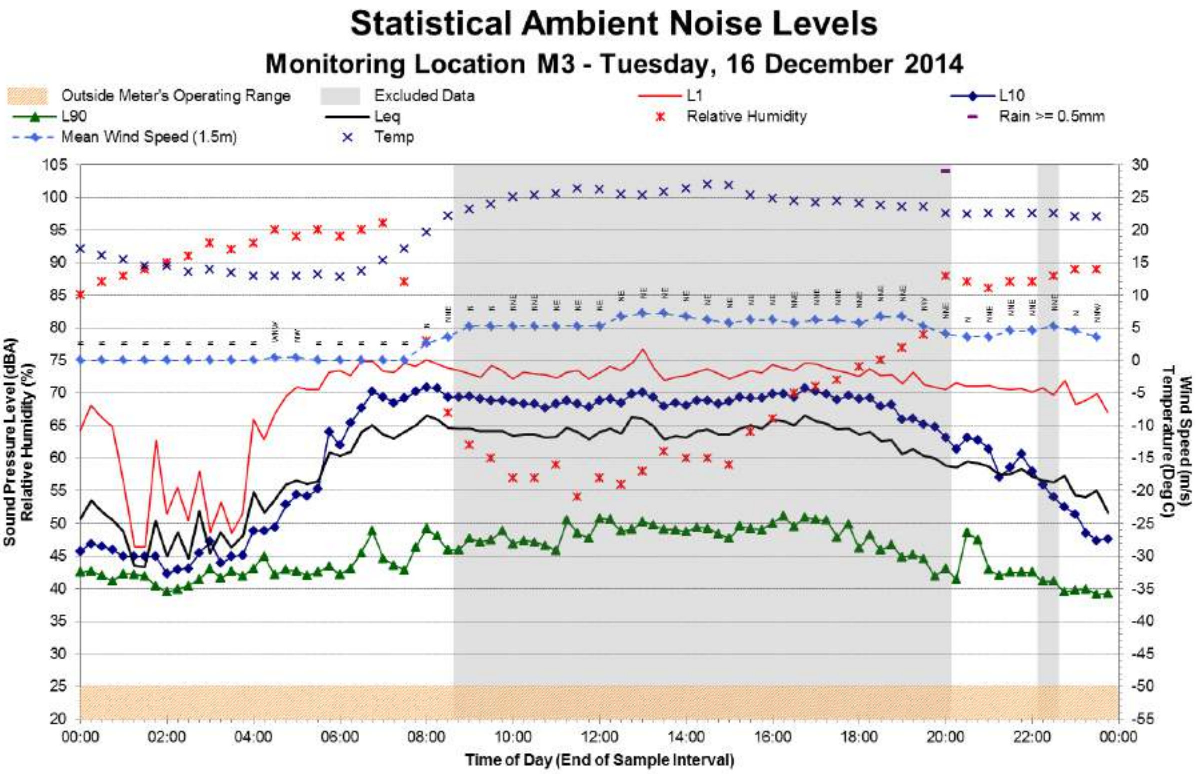

Statistical Ambient Noise Levels
Monitoring Location M3 - Friday, 12 December 2014
Outside Meter's Operating Range
Excluded Data
L1
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Temp
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (m/s)
Temperature (Deg C)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Monitoring Location M3 - Saturday, 13 December 2014
Outside Meter's Operating Range
Excluded Data
L1
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Temp
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (m/s)
Temperature (Deg C)
Time of Day (End of Sample Interval)

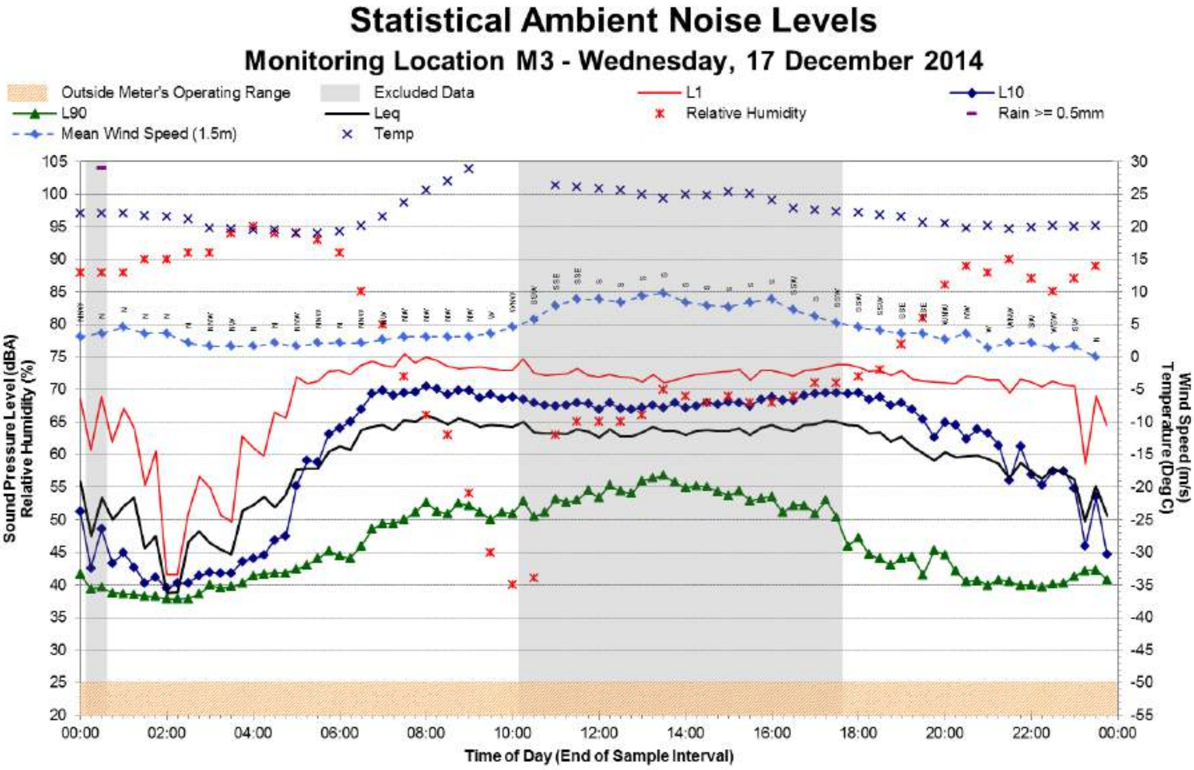

Statistical Ambient Noise Levels
Monitoring Location M3 - Sunday, 14 December 2014
Outside Meter's Operating Range
Excluded Data
L1
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Temp
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (m/s)
Temperature (Deg C)
Time of Day (End of Sample Interval)



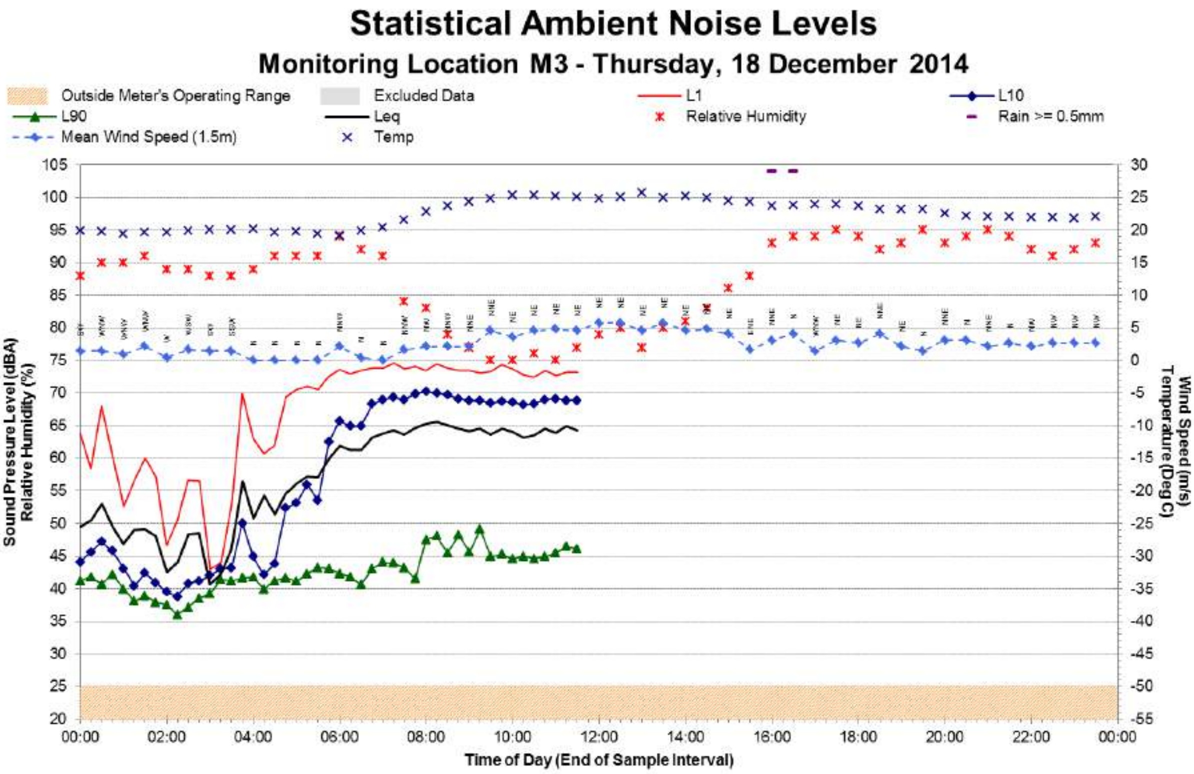
Statistical Ambient Noise Levels
Monitoring Location M3 - Monday, 15 December 2014
Outside Meter's Operating Range
Excluded Data
L1
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Temp
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (m/s)
Temperature (Deg C)
Time of Day (End of Sample Interval)



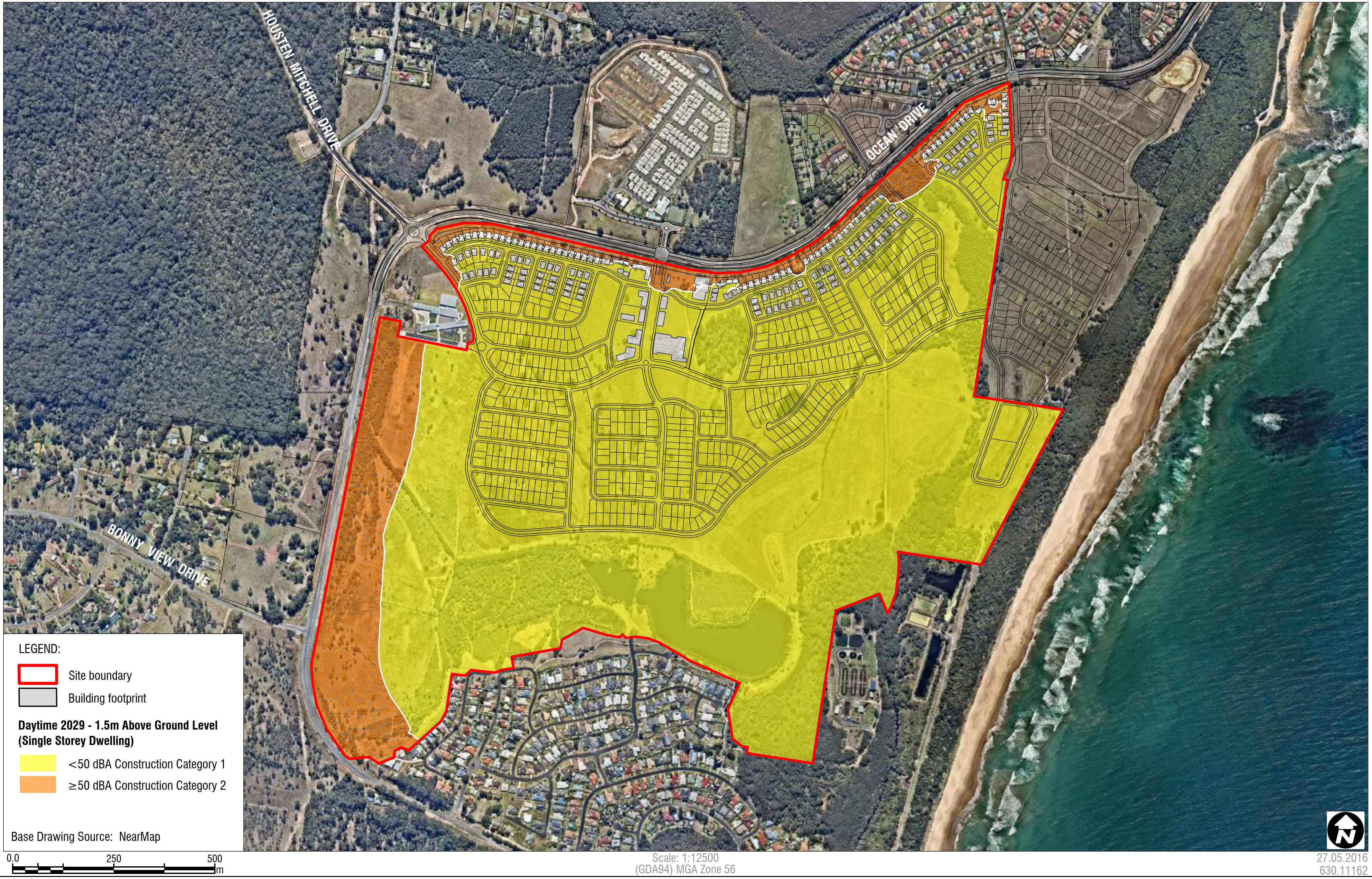
Statistical Ambient Noise Levels
Monitoring Location M3 - Tuesday, 16 December 2014
Outside Meter's Operating Range
Excluded Data
L1
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Temp
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (m/s)
Temperature (Deg C)
Time of Day (End of Sample Interval)



Statistical Ambient Noise Levels
Monitoring Location M3 - Wednesday, 17 December 2014
Outside Meter's Operating Range
Excluded Data
L1
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Temp
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (m/s)
Temperature (Deg C)
Time of Day (End of Sample Interval)



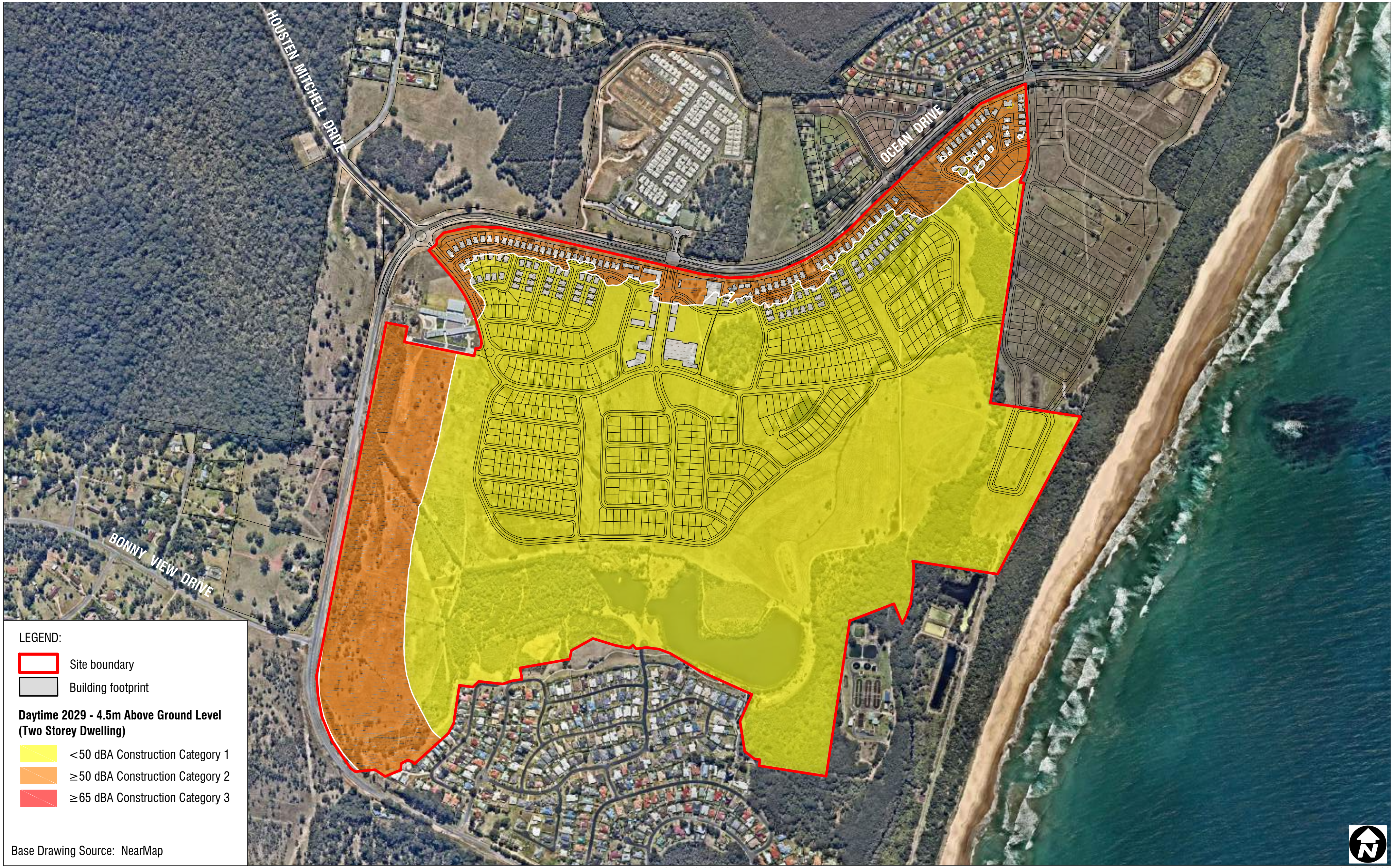
Statistical Ambient Noise Levels
Monitoring Location M3 - Thursday, 18 December 2014
Outside Meter's Operating Range
Excluded Data
L1
L10
L90
Leq
Relative Humidity
Rain >= 0.5mm
Mean Wind Speed (1.5m)
Temp
Sound Pressure Level (dBA)
Relative Humidity (%)
Wind Speed (m/s)
Temperature (Deg C)
Time of Day (End of Sample Interval)



DAYTIME 2029 - 1.5M ABOVE GROUND SINGLE STOREY DWELLING

APPENDIX C1

SLR
www.slrconsultingaustralia.com.au PH: 61 2 4037 3200



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0.0 250 500 m

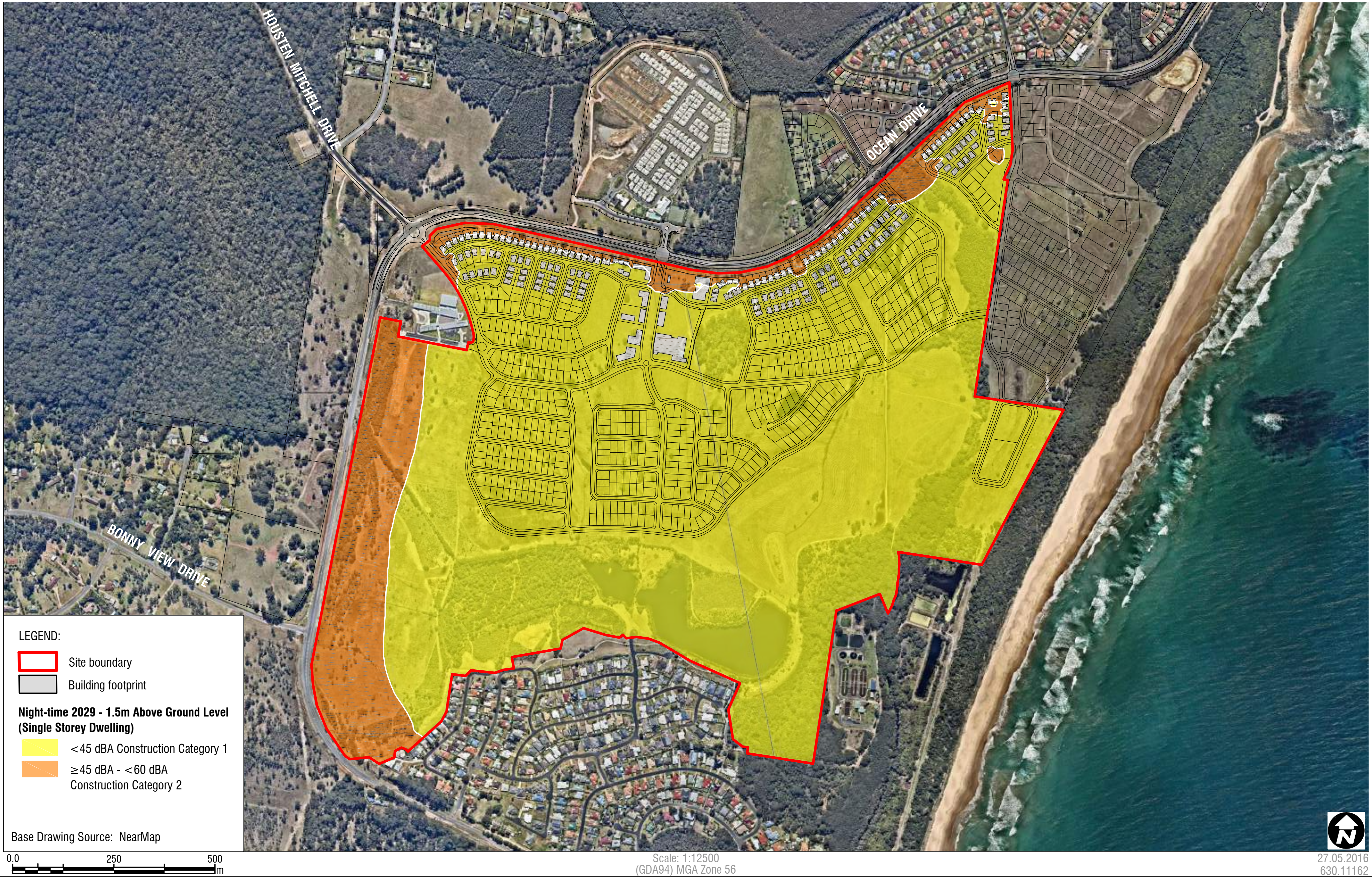
Scale: 1:12500
(GDA94) MGA Zone 56

27.05.2016
630.11162

SLR
www.slrconsultingaustralia.com.au PH: 61 2 4037 3200

DAYTIME 2029 - 4.5M ABOVE GROUND TWO STOREY DWELLING

APPENDIX C2



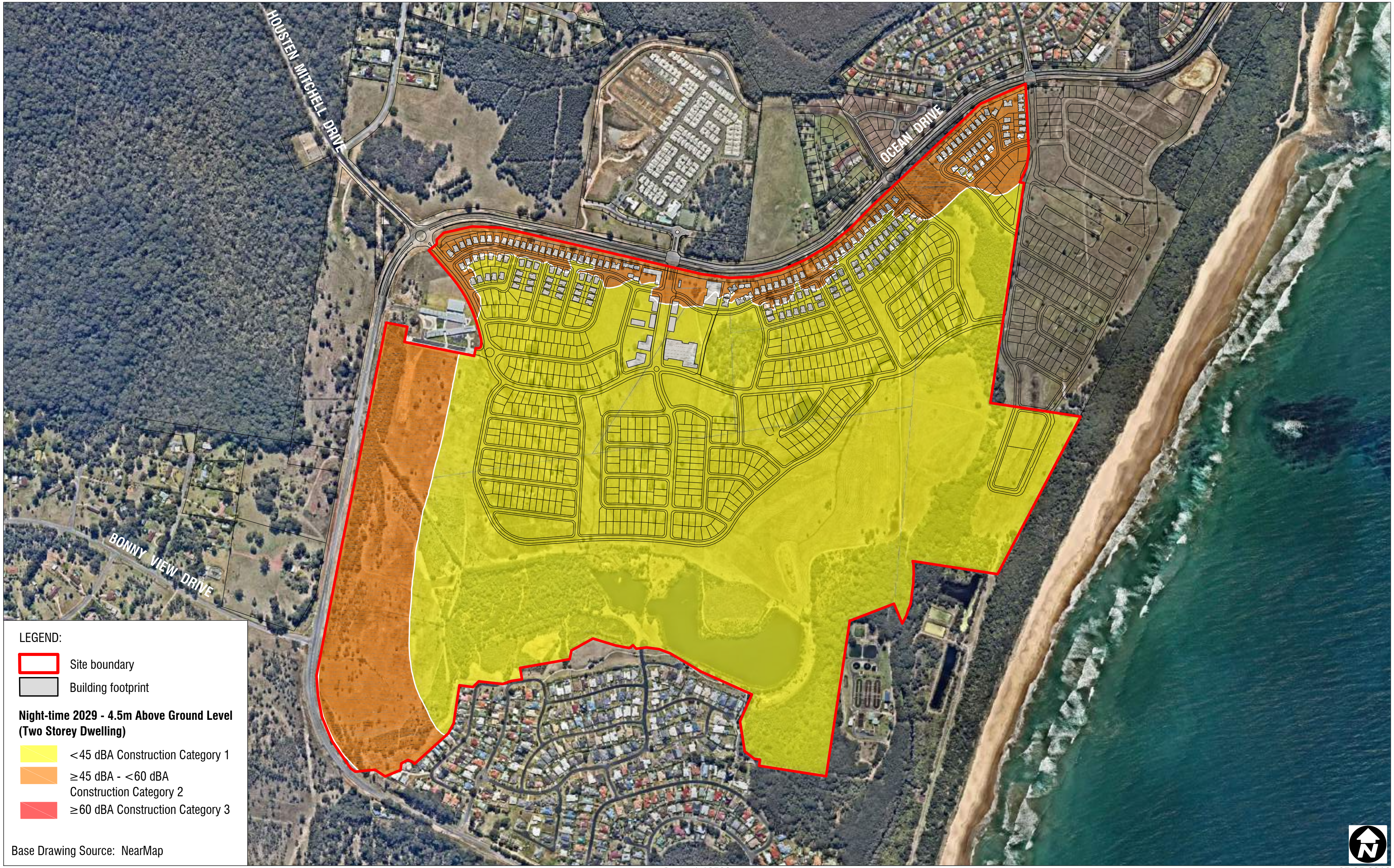
Scale: 1:12500
(GDA94) MGA Zone 56

27.05.2016
630.11162

SLR
www.slrconsultingaustralia.com.au PH: 61 2 4037 3200

NIGHT-TIME 2029 - 1.5M ABOVE GROUND SINGLE STOREY DWELLING

APPENDIX C3



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Scale: 1:12500
(GDA94) MGA Zone 56

27.05.2016
630.11162

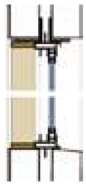
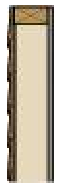
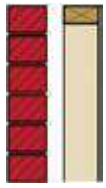
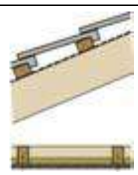
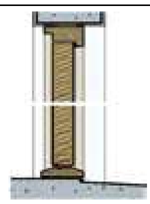
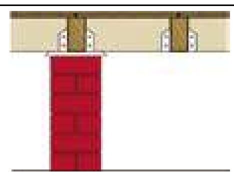
NIGHT-TIME 2029 - 4.5M ABOVE GROUND
TWO STOREY DWELLING

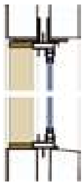
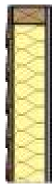
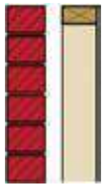
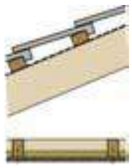
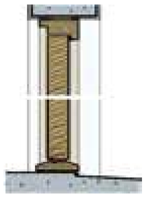
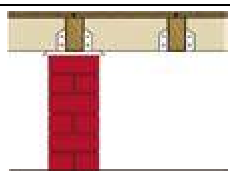
APPENDIX C4

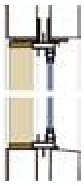
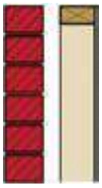
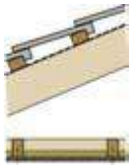
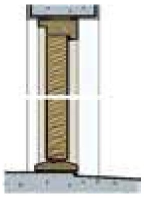
SLR
www.slrconsultingaustralia.com.au PH: 61 2 4037 3200

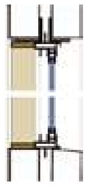
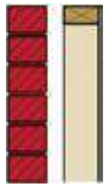
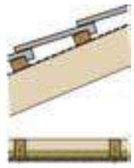
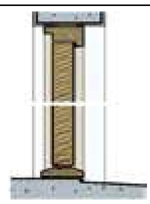
Acoustic Performance of Building Elements The acoustic performances assumed of each building element in deriving the Standard Constructions for each category of noise control treatment presented in the preceding Table, are presented below in terms of Weighted Sound Reduction Index (Rw) values, which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

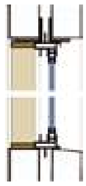
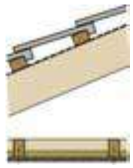
Category of Noise Control Treatment	**R_w of Building Elements (minimum assumed)**				
	Windows/Sliding Doors	**Frontage Facade**	**Roof**	**Entry Door**	**Floor**
Category 1	24	38	40	28	29
Category 2	27	45	43	30	29
Category 3	32	52	48	33	50
Category 4	35	55	52	33	50
Category 5	43	55	55	40	50

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

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

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

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

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