AECOM

Bayswater B Power Station

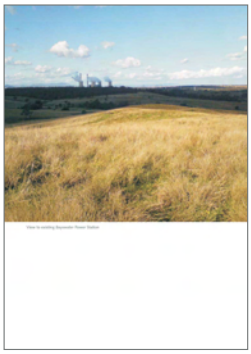
Environmental Assessment

September 2009

APPENDIX E - H

Prepared for Macquarie Generation
34 Griffiths Road| Lambton | New South Wales | 2299 |T +61 2 4968 7499 | F + 61 2 4968 7433
www.macgen.com.au

Prepared by AECOM
Level 5, 828 Pacific Highway | Gordon | New South Wales | 2073 | T +61 2 8484 8999 | F +61 2 8484 8989
www.aecom.com


Macquarie Generation Bayswater B Project - Environmental Assessment Publications

Volume 1

Main Report

Volume 2

Appendix A-D

Appendix A
Record of Minister's Opinion

Appendix B
Director General's Requirements

Appendix C
Agency and Stakeholder Letters

Appendix D
Air Quality Assessment

Volume 3

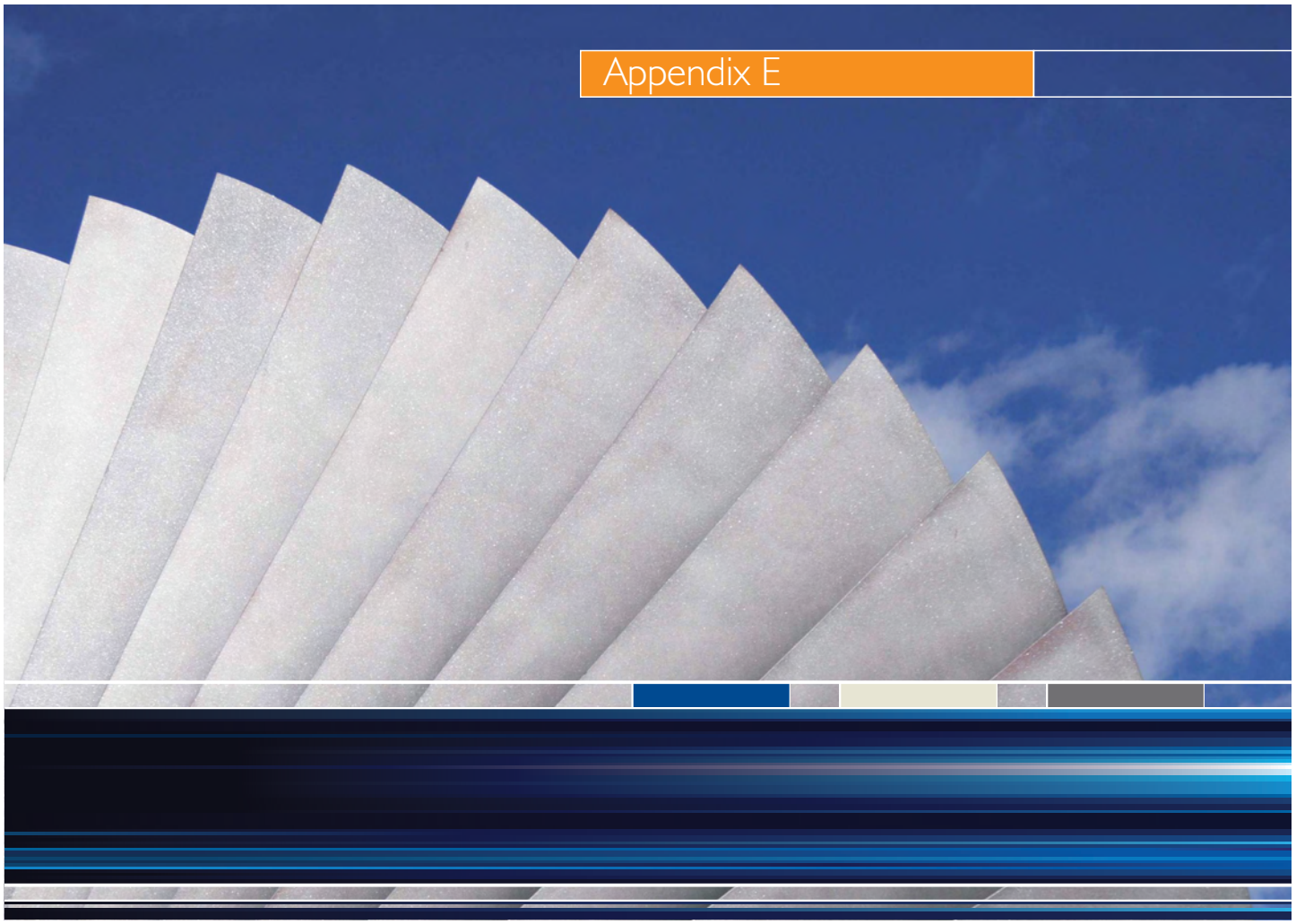
Appendix E-H

Appendix E
Noise Assessment

Appendix F
Flora, Fauna and Bushfire Assessment

Appendix G
Heritage Assessment

Appendix H
Preliminary Hazard Assessment and Plume Rise Assessment



Appendix E

Noise Assessment

AECOM

Bayswater B Power Station
Noise and Vibration Assessment

Macquarie Generation

16 September 2009
Document No.: 60100965.RPT01.03

Noise and Vibration Assessment

Prepared for

Macquarie Generation

Prepared by

AECOM Australia Pty Ltd
Level 11, 44 Market Street, Sydney NSW 2000, PO Box Q410, QVB Post Office NSW 1230, Australia
T +61 2 8295 3600 F +61 2 9262 5060 www.aecom.com
ABN 20 093 846 925

16 September 2009

60100965

Quality Information

Document Noise and Vibration Assessment

Ref 60100965

Date 16 September 2009

Prepared by Patrick Martinez

Reviewed by Tom Cockings

Revision History

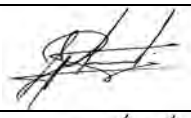
Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
00	28/08/2009	Draft For Client Review	Patrick Martinez Principal Acoustic Engineer	
01	04/09/2009	Final Draft	Patrick Martinez Principal Acoustic Engineer	
02	08/09/2009	Final Draft Revised	Patrick Martinez Principal Acoustic Engineer	
03	16/09/2009	Final Report	Patrick Martinez Principal Acoustic Engineer	

Table of Contents

1.0 Introduction

Macquarie Generation (MacGen) is seeking Concept Plan Approval for the construction and operation of a 2,000 MW power station, on land within its ownership adjacent to the existing Bayswater Power Station. The proposed project is known as the Bayswater B Power Station and will be powered by either coal (using ultra-supercritical generation technology) or natural gas (using combined gas turbine generation technology).

AECOM has been commissioned by MacGen to undertake an impact assessment of the noise and vibration associated with the construction and operation of the proposed Bayswater B Power Station.

This impact assessment addresses the Director-General's Environmental Assessment Requirements (EARs) by considering the impact of noise and vibration on nearby noise sensitive receivers during the construction and operational phase of the Bayswater B Power Station.

The EARs' key assessment requirements relating to noise are reproduced below.

Director-General's Requirements
Noise *- Impacts - the Environmental Assessment must include a comprehensive operational noise impact assessment for the project, prepared in accordance with NSW Industrial Noise Policy (EPA, 2000) considering worst case operating scenarios and meteorological conditions, representative monitoring and receiver locations, and cumulative impacts from the adjacent Bayswater-Liddell generating complex, surrounding mining operations (as relevant) and the connection/upgrade of the Antiene coal conveyor. The assessment must consider the potential for low frequency noise generation and peak noise events with the potential to cause sleep disturbance. The Environmental Assessment must also consider the potential for:*

- *Construction noise impacts consistent with the DECC's "construction noise – existing guidelines" available electronically at http://www.environment.nsw.gov.au/noise/constructionnoise.htm*
- *Vibration impacts during construction and operation consistent with Assessing Vibration A Technical Guideline (DECC, 2006); and*
- *Traffic generated noise during construction and operation consistent with Environmental Criteria for Road Traffic Noise (EPA, 1999).*

The Environmental Assessment must include a framework for the mitigation, management and monitoring of noise impacts, particularly with respect to sensitive receptors likely to be significantly impacted by the cumulative noise impacts in the local area.

2.0 Bayswater B Power Station

2.1 Background

MacGen owns and operates Liddell and Bayswater Power Stations between Singleton and Muswellbrook in the Upper Hunter Valley. MacGen is now the proponent for Concept Plan Approval for the construction and operation of a 2000 MW power station, being either coal or gas-fired generation, on land within its ownership adjacent to the existing Bayswater Power Station.

2.2 Location

The Bayswater Power Station site comprises approximately 1,200 ha of land and is located off the New England Highway, approximately 20 kilometres south of Muswellbrook, NSW. Bayswater Power Station is located within the Muswellbrook Local Government Area (LGA). It is noted that Plashett Dam, which is used as part of the existing power station operations, is located within the Singleton LGA.

The proposed Bayswater B Power Station would be located to the south west of the existing Bayswater Power Station, adjacent to Plashett Dam, on land owned by MacGen, refer to Figure 1.

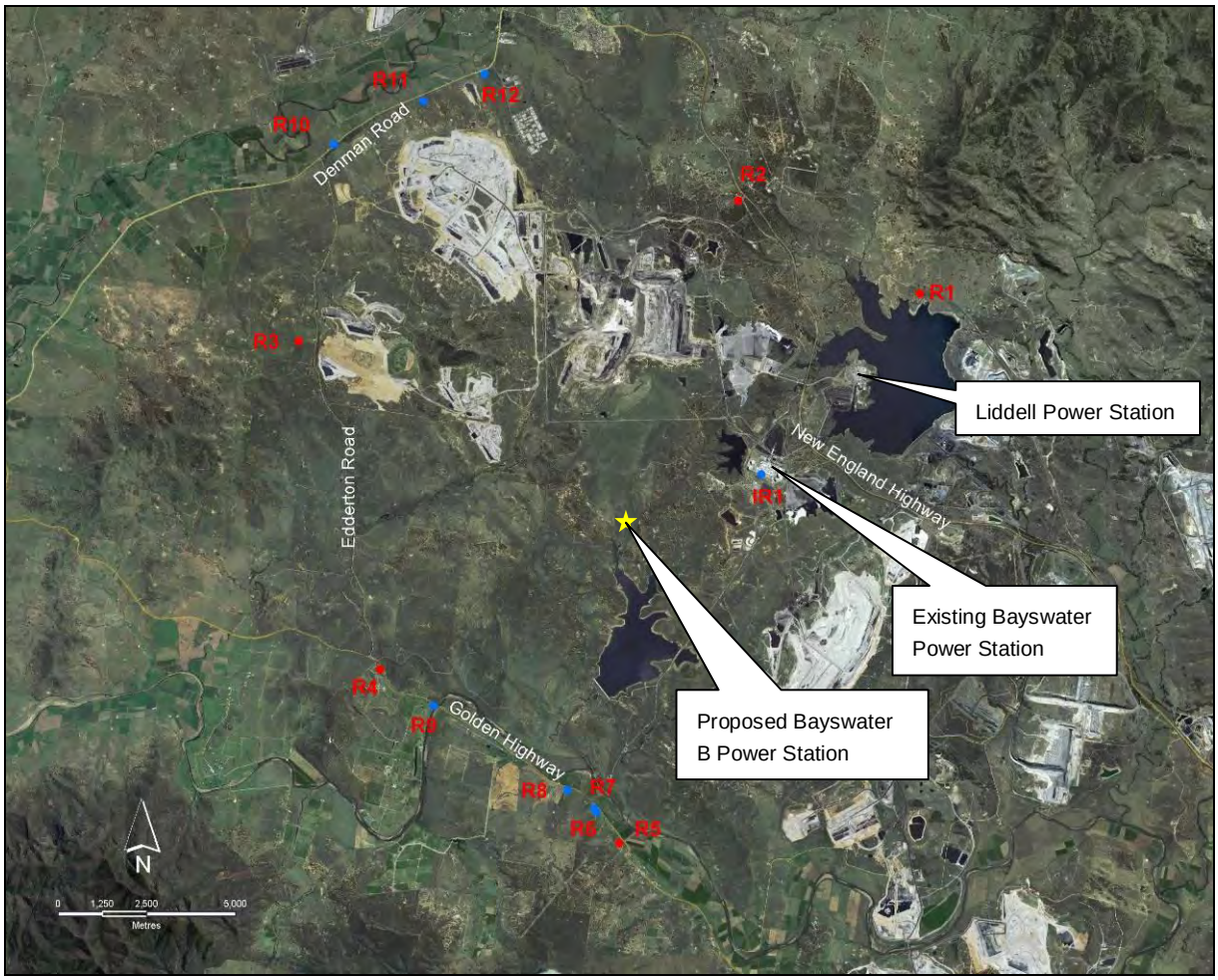


Figure 1 - Aerial photograph of the project site and closest noise sensitive receivers and noise monitoring locations

2.3 Project objectives

The Bayswater B Power Station is proposed in order to support the need within the next decade for additional baseload electricity generation. MacGen has identified that this proposed project has the appropriate environmental, economic and technical solutions to meet the base load demand in the NSW electricity market.

In addition, MacGen has nominated as part of its project objectives, the need to balance the environmental, social and economic impacts of the proposal, in order to provide a solution to electricity supply which is as sustainable as possible.

Key project outcomes for the proposed project have been identified as:

- Develop a project that will help to meet base load power generation demand;
- Develop a project that can be constructed and become operational within the timeframe required;
- Develop a project that will be of sufficient scale to allow for best thermal efficiency and best efficiency in capital cost;
- Maximise the use of existing infrastructure to reduce potential constraints and impacts from the project;
- Optimise access to fuel sources (both coal and gas);
- Minimise potential impacts on residents and sensitive environments;
- Support the NSW government in providing increased baseload electricity supply and reliability;
- Provide additional base load power in the context of ongoing government initiatives with respect to population and economic growth and future development needs;
- Ensure land use compatibility to avoid land use conflicts with other parties or development; and
- Ensure consistency with strategic land use objectives of Muswellbrook and Singleton Council in order to support local planning objectives.

2.4 Coal fired generation technology

MacGen has adopted Pulverised Coal Fired Ultra Supercritical (USC) Thermal Plant technology to maximise plant thermal efficiency and minimise greenhouse emissions.

Significant noise generating infrastructure and equipment associated with the coal fired option include:

- ID fans;
- Stacks;
- Coal conveyor;
- Air cooled condensers; and
- Ash Conveyor.

The coal fired equipment selection is presented in Appendix B and the layout is presented in Figure 2.

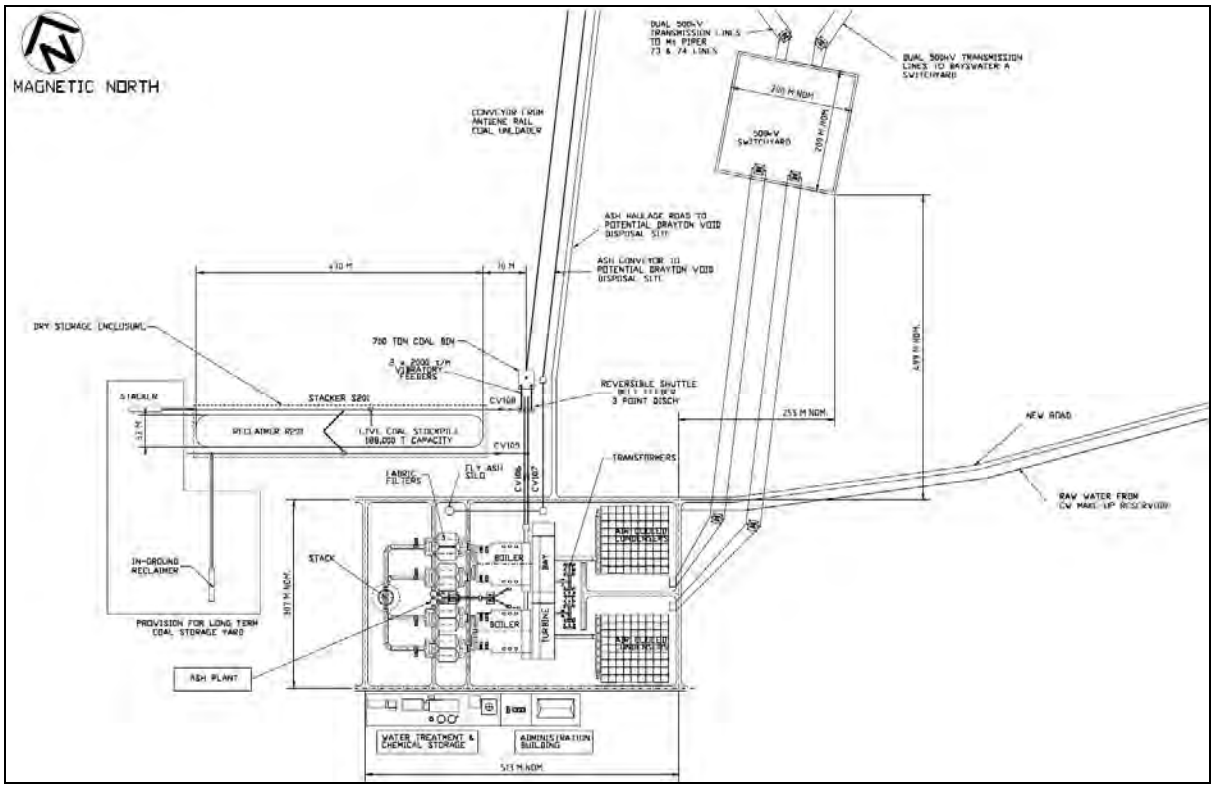


Figure 2 – Coal fired power station layout

2.5 Gas fired technology

MacGen has adopted Gas Fired Combined Cycle Gas Turbine (CCGT) Plant with F-Class Gas Turbine technology to maximise plant thermal efficiency and minimise greenhouse emissions. This technology is based on five gas turbine units with exhaust gases being emitted from five wake free stacks. CCGT technology has high efficiency due to the combination of a gas turbine and a steam turbine in each unit.

Significant noise generating infrastructure and equipment associated with the coal fired option include:

- ID fans;
- HRSG stack;
- Fuel gas compressor;
- Compressor inlet;
- Gas turbine; and
- Air cooled condenser.

The gas fired equipment selection is presented in Appendix B and the layout is presented in Figure 3.

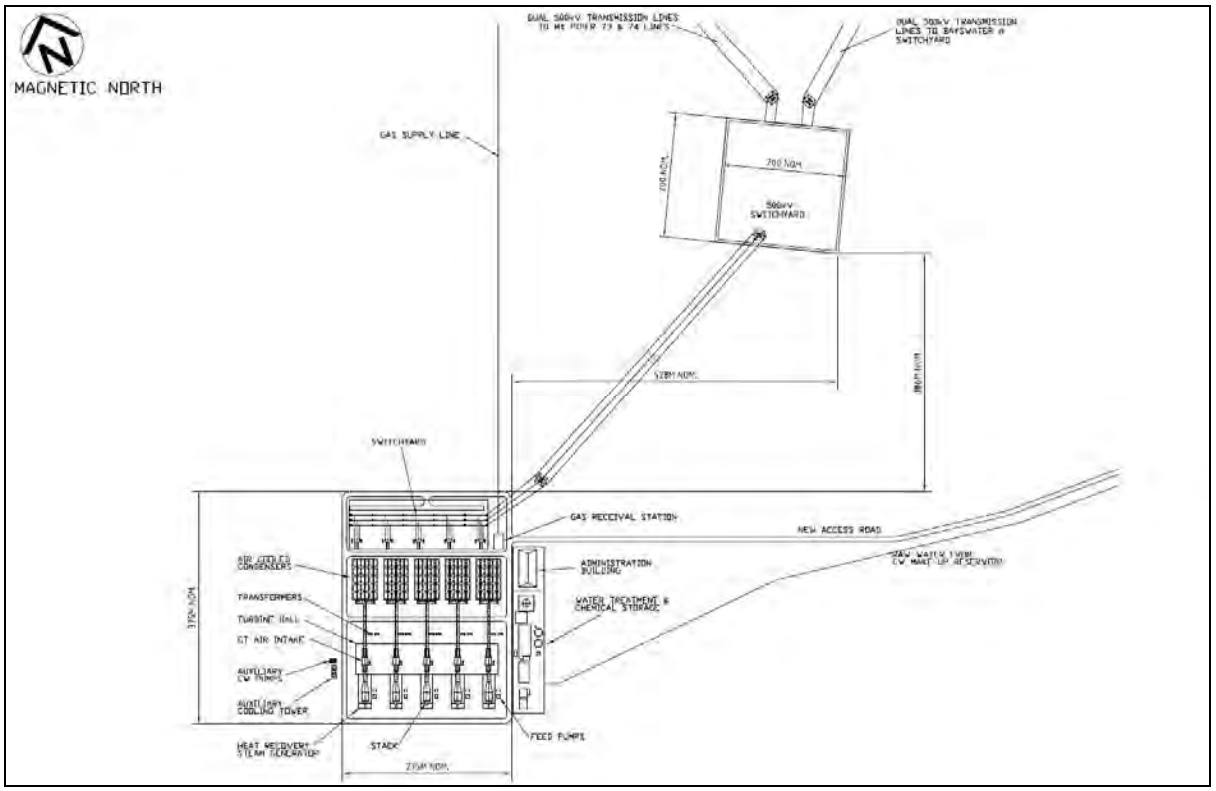


Figure 3 – Gas fired power station layout

2.6 Noise sensitive receivers

The nearest residential locations (noise sensitive) to the proposed Bayswater B Power Station were identified as:

- Residences located north of the site next to the New England Highway, represented by assessment location R2;
- Residences located north east of the site next to Hebden Road, represented by assessment location R1;
- Residences located south of the site next to the Golden Highway, represented by assessment locations R5, R6, R7 and R8;
- Residences located south west of the site next to the Golden Highway, represented by assessment locations R4 and R9;
- Residences located north west of the site next to Edderton Road, represented by assessment location R3;
- Residences located north west of the site next to Denman Road, represented by assessment locations R10, R11 and R12, and;
- The nearest industrial noise receiver has been identified as the existing Bayswater Power Station, represented by assessment location IR1. No residential receivers were identified within 10 km east of the site.

For clarification refer to Figure 1 for noise sensitive receiver locations and Table 1 for description of noise monitoring locations.

3.0 Ambient Noise Monitoring

3.1 Noise monitoring locations

In order to establish the existing noise environment adjacent to the project area, ambient noise monitoring was conducted at five representative locations (refer to Figure 1). The five chosen monitoring locations are representative of other assessment locations within the area, this was determine from the site inspection and from aerial photographs depicting land use surrounding the site, refer to Section 3.7 for a description of noise assessment locations.

The noise monitoring was conducted in accordance with the NSW Department of Environment, Climate Change and Water (DECCW) Industrial Noise Policy (INP) requirements. These locations were selected after a detailed inspection of the project area taking into consideration sensitive locations and other noise sources which may influence the measurements.

Table 1 presents the selected monitoring locations, whilst Figure 1 shows these noise monitoring locations.

Table 1: Ambient noise monitoring locations

Location Noise Monitoring Survey Duration	Description/ Address Land Use Zoning[2]	Instrumentation	Comments
R1[1] Start: 30 Jun 09 Finish: 09 Jul 09	Lake Liddell Reserve Camping and Recreation Area, 400 Hebden Road Public Recreation RE1	Infobyte IM4 sound analyser. Brüel & Kjær Type 2250 integrating sound level meter	Noise sensitive residential receiver. Chosen to determine operational and construction noise emissions criteria. Assessment location to determine noise levels impacting on residential receivers. Noise logger located approximately 1.5 m above ground level and approximately 1 m from a facade.
R2 Start: 30 Jun 09 Finish:09 Jul 09	Lot 4 Antiene Estate, just off Pamger Drive Primary Production RU1	Infobyte IM4 sound analyser Brüel & Kjær Type 2250 integrating sound level meter	Noise sensitive residential receiver. Chosen to determine operational and construction noise emissions criteria. Assessment location to determine noise levels impacting on residential receivers. Noise logger located in front garden approximately 1.5 m above ground level and approximately 1 m from a facade.
R3 Start: 30 Jun 09	Side of Edderton Road near farm houses (possibly occupied)	Infobyte IM3 sound analyser Brüel & Kjær	Noise sensitive residential receiver. Chosen to determine operational and construction noise emissions

Location Noise Monitoring Survey Duration	Description/ Address Land Use Zoning[2]	Instrumentation	Comments
Finish: 09 Jul 09	Primary Production RU1	Type 2250 integrating sound level meter	criteria. Assessment location to determine noise levels impacting on residential receivers. Noise logger located approximately 7 m from the side of Edderton Road, approximately 1.5 m above ground level.
R4 Start: 30 Jun 09 Finish: 09 Jul 09	Arrowfield Winery Primary Production RU1	SVAN 949 sound analyser Brüel & Kjær Type 2250 integrating sound level meter	Noise sensitive residential receiver. Chosen to determine operational and construction noise emissions criteria. Assessment location to determine noise levels impacting on residential receivers. Noise logger located in front garden approximately 1.5 m above ground level and approximately 1 m from a facade.
R5 Start: 30 Jun 09 Finish:09 Jul 09	4 Pearse Road, Jerrys Plains Rural Small Holdings 1(d)	Infobyte IM3 sound analyser Brüel & Kjær Type 2250 integrating sound level meter	Noise sensitive residential receiver. Chosen to determine operational and construction noise emissions criteria. Assessment location to determine noise levels impacting on residential receivers. Noise logger located approximately 1.5 m above ground level and approximately 1 m from a facade.

Notes:

1. Lake Liddell Reserve Camping and Recreation Area Day has been defined as residential area in the absence of specific noise criteria for camping areas (more noise sensitive compared to recreational area).
2. Land Use Zoning based on Muswellbrook Council and Singleton Council LEPs.

3.2 Unattended continuous noise monitoring

Five loggers were used to continuously measure background noise levels between Tuesday 9 June 2009 and Thursday 9 July 2009. The selected locations are considered to be representative of the noise sensitive receivers in the area.

A noise logger measures the noise level over the sample period and then determines L_{A1}, L_{A10}, L_{A90}, L_{Amax} and L_{Aeq} levels of the noise environment. The L_{A1}, L_{A10} and L_{A90} levels are the levels exceeded for 1%, 10% and 90% of the sample period respectively. The L_{Amax} is indicative of maximum noise levels due to individual noise events. The L_{A90} is taken as the background noise level.

The results of the noise monitoring have been processed in accordance with the procedures contained in the DECCW's INP and the DECCW's Environmental Criteria for Road Traffic Noise (ECRTN).

The assessment background level (ABL) is established by determining the lowest tenth-percentile level of the L_{A90} noise data acquired over each period of interest. The background noise level or rating background level (RBL) representing the day, evening and night-time assessment periods is based on the median of individual ABLs determined over the entire monitoring duration. The RBL is representative of the average minimum background sound level (in the absence of the source under consideration), or simply the background level. The L_{Aeq} is essentially the average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.
The calculated assessment background levels (ABLs) and existing L_{Aeq} ambient noise levels for each noise monitoring location for each assessment period, (day, evening and night) are presented in Appendix D.

Graphical representation of the logging results are shown in Appendix E.

A summary of the calculated RBLs and existing L_{Aeq} ambient noise levels are presented in Table 2.

Table 2 – Summary of RBLs and existing L_{Aeq} ambient noise levels dB(A)

Location	Rating Background Levels (RBLs) - L_{A90}			Ambient Noise Levels - L_{Aeq}		
	Day[1]	Evening[2]	Night[3]	Day[1]	Evening[2]	Night[3]
R1	36	36[5]	36[5]	49	50	50
R2	48	40	37	55	54	52
R3	31	30[4]	30[4]	62	57	56
R4	30[4]	30[4]	30[4]	50	44	46
R5	35	30[4]	30[4]	48	46	45

Notes:

1. Day is defined as 7:00am to 6:00pm, Monday to Saturday and 8:00am to 6:00pm Sundays & Public Holidays.
2. Evening is defined as 6:00pm to 10:00pm, Monday to Sunday & Public Holidays.
3. Night is defined as 10:00pm to 7:00am, Monday to Saturday and 10:00pm to 8:00am Sundays & Public Holidays.
4. Where the RBL is calculated to be less than 30 dB(A), then the RBL is set to 30 dB(A) in accordance with DECCW's INP recommendations.
5. The DECCW's INP application notes recommends that when higher background noise levels (RBL) occur in the evening and night-time assessment periods, that the criteria are generally set to the lower daytime criteria in accordance with community expectations.

3.3 Traffic noise

Location R2 noise survey results have been used to determine existing traffic noise levels on the New England Highway. Measured traffic noise levels are presented in Table 3.

Table 3 – Measured traffic noise levels (R1)

Measurement Location	Noise Level, dB(A)	
	Day, $L_{Aeq\ (15hr)}$	Night, $L_{Aeq\ (9hr)}$
In front of Lot 4 Antiene Estate, just off Pamger Drive overlooking the New England Highway	62	59

Notes:

1. Day is defined as 7:00am to 10:00pm.
2. Night is defined as 10:00pm to 7am.

3. The noise measurements were conducted in a “free field” environment without the influence of any noise reflected from a facade. Therefore the measured noise levels have been increased by 2.5dB to account for the facade reflections in accordance with ECRTN guidelines.

3.4 Instrumentation

The long-term unattended noise loggers; Infobyte IM4 sound analyser and SVAN 949 sound analyser equipment comply with Australian Standard 1259.2-1990 “Acoustics - Sound Level Meters – Part 2: Integrating - averaging” and are designated as a Type 2 instrument having an accuracy suitable for field use.

The long-term unattended noise logger equipment, Infobyte IM3 sound analyser sound analyser complies with Australian Standard 1259.2-1990 “Acoustics - Sound Level Meters – Part 2: Integrating - averaging” and is designated as a Type 1 instrument having an accuracy suitable for field and laboratory use.

The long-term noise loggers were calibrated before and after the measurements with no significant drift in calibration.

Attended noise measurements were conducted using a Brüel & Kjær Type 2250 integrating sound level meter. The Brüel & Kjær Type 2250 integrating sound level meter is designated as a Type 1 instrument and has an accuracy suitable for field use. The sound level meter was calibrated before and after the measurements with no significant drift in calibration observed.
All the acoustic instrumentation employed during the noise measurements comply with the requirements of AS 1259.2-1990 “Acoustics - Sound Level Meters. Part 2: Integrating - Averaging”. All equipment used for this report have valid calibration certificates.

3.5 Meteorological data

Weather data for the area was sourced from MacGen to identify periods of adverse weather occurring during the noise monitoring period. Extraneous noise events and noise data adversely affected by weather, e.g. wind and rain, were excluded as required by the DECCW’s INP guidelines.

Long term meteorological data was provided by Katestone Environmental (Bayswater B Power Station project Air Quality Consultant) to determine the direction of dominant wind conditions, and prevalence of temperature inversions and wind speed and directions in the area.

3.6 Attended noise monitoring

Attended noise measurements of existing ambient conditions were conducted at Location R1 to Location R5. The measurements were made to assist in quantifying the contributing noise sources at the different monitoring locations. Where applicable, industrial noise contributions were quantified by filtering out other noise sources (e.g. traffic, insects, etc).

3.6.1 Attended noise monitoring results

The results of the attended noise measurements are presented in Table 4.

Table 4 – Attended noise measurement results dB(A)

Location	Date and Time	Measured Sound Pressure Level, dB(A)		Notes
		L_{Aeq}	L_{A90}	
R1 Lake Liddell Reserve Camping and	30 Jun 09 12:13	41	36	Wind, up to 52 dB(A) Birds, 43 dB(A) 1 car, 46 dB(A)

Location	Date and Time	Measured Sound Pressure Level, dB(A)		Notes
		L_{Aeq}	L_{A90}	
Recreation Area, 400 Hebden Road				Possible noise from power station 50dB @ 125 Hz Industrial noise contribution ~ 34 dB(A)
	30 Jun 09 22:13	53	40	Train, 73 dB(A), 2 in 15 min Quiet low frequency noise possibly from Liddell Power Station Wind in trees, birds, frogs Distant traffic just audible Industrial noise contribution ~ 33 dB(A)
R2 Lot 4 Antiene Estate, just off Pamger Drive	30 Jun 09 12:55	57[1]	55	Constant traffic, up to 65 dB(A) Few birds and a light wind Negligible industrial noise contribution.
	30 Jun 09 22:40	53[1]	43	Mainly trucks, 61-69 dB(A) and cars, 55-58 dB(A) Negligible industrial noise contribution.
R3 Side of Edderton road near farm houses (possibly occupied)	30 Jun 09 13:48	59	39	A few cars, 71 – 78 dB(A) Light wind and a few birds Negligible industrial noise contribution.
	30 Jun 09 23.16	48	41	Wind and insects Negligible industrial noise contribution.
R4 Arrowfield Winery	30 Jun 09 14:22	54	48	Cars, 50 – 57 dB(A) and a few trucks, 60 – 63 dB(A) - Windy Negligible industrial noise contribution.
	30 Jun 09 23:44	43	29	Few cars, 50-53 dB(A) and 1 truck, 58 dB(A) Negligible industrial noise contribution.
R5 4 Pearse Road, Jerrys Plains	30 Jun 09 15:12	54	46	Light wind Cars, 50 – 57 dB(A), trucks up to 63 dB(A) Birds, 40 – 64 dB(A) Negligible industrial noise contribution.
	1 Jul 09 0:13	38	29	Dog, rooster 1 car, 55 dB(A) Negligible industrial noise contribution.

Notes:

1. Adjusted to logger location from measurement location.

3.7 Noise assessment locations

In addition to the noise monitoring locations identified in Table 1, additional assessment locations (R6, R7, R8, R9, R10, R11 and R12), have been selected to conduct the noise and vibration impact assessment. The assessment locations R6, R7, R8, R9, R10, R11 and R12 have been assigned representative existing noise levels based on one of the noise monitoring locations. For example, noise environment for assessment locations R6, R7 and R8 are representative of the noise environment measured at noise monitoring location R5.

The noise monitoring and equivalent assessment locations are summarised in Table 5 below. The type of assessment carried out at each assessment location is also identified in the table, determined from the site inspection and from aerial photographs depicting land use surrounding the site.

Table 5 – Assessment locations

Assessment Location Land Use Zoning[1]	Equivalent Noise Monitoring Location	Comments
R6 Rural/Primary Production	R5	Representative of residential receivers. Construction and operational noise impact.
R7 Rural/Primary Production	R5	Representative of residential receivers. Construction and operational noise impact.
R8 Rural/Primary Production	R5	Representative of residential receivers. Construction and operational noise impact.
R9 Primary Production RU1	R4	Representative of residential receivers. Construction and operational noise impact.
R10 Primary Production RU1	R3	Representative of residential receivers. Construction and operational noise impact.
R11 Primary Production RU1	R3	Representative of residential receivers. Construction and operational noise impact.
R12 Primary Production RU1	R3	Representative of residential receivers. Construction and operational noise impact.
IR1 Infrastructure SP2	NA	Industrial receiver. Construction and operational noise impact.

Notes:

1. Land Use Zoning based on Muswellbrook Council and Singleton Council LEPs.

4.0 Construction Noise and Vibration Criteria

4.1 Construction noise criteria

In July 2009 the NSW Department of Environment, Climate Change and Water (DECCW) published the *Interim Construction Noise Guidelines (ICNG)* for use in construction noise assessment. This document replaces the previous publication the *Environmental Noise Control Manual (ENCM)* and is used as the basis for establishing construction noise criteria for the proposed development.

Under the existing DECCW policy a construction noise management plan is required to be compiled by the Contractor, prior to construction commencing. Noise level objectives must be set for the daytime and evening periods, and must be complied with where reasonably practicable. Work that is proposed outside of standard working hours, as defined in the *ICNG*, generally requires strong justification.

The noise management plan should detail the '*best practice*' construction methods to be used, presenting a reasonable and feasible approach. The plan should identify the extent of the residential area affected and assess the impact on residents. The plan should detail any community relation programs that are planned e.g. prior notification for particularly noisy activities, letter box drop regarding out of hours construction work to be undertaken and a 24 hour contact phone number for residents to call should they have any complaints or questions.

The *ICNG* defines what is considered to be feasible and reasonable as follows:

> *"Feasible*
>
> *A work practice or abatement measure is feasible if it is capable of being put into practice or of being engineered and is practical to build given project constraints such as safety and maintenance requirements.*
>
> *Reasonable*
>
> *Selecting reasonable measures from those that are feasible involves making a judgment to determine whether the overall noise benefits outweigh the overall adverse social, economic and environmental effects, including the cost of the measure."*

The *ICNG* recommends that a quantitative assessment is carried out for all *'major construction projects that are typically subject to the EIA process'*. A quantitative assessment, based on a likely '*worst case*' construction scenario, has been carried out for the Bayswater B Power Station.

Predicted noise levels at nearby sensitive receivers (residential, commercial and industrial premises) are compared to the levels provided in Section 4 of the *ICNG*. Where an exceedance of the criteria is predicted the *ICNG* advises that the proponent should apply all feasible and reasonable work practises to minimise the noise impact.

Criteria for residential receivers are set using the information in Table 6.

Table 6 – Noise at residences using quantitative assessment

Time of Day	Management Level $L_{Aeq\ (15min)}$ [1]	How to Apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq\ (15\ min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: • times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences • if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5 dB	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. • For guidance on negotiating agreements see section 7.2.2 of the ICNG.

Notes:

1. Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

4.1.1 Construction noise management levels

It is assumed that the construction activities will take place predominantly during recommended standard working hours (7.00 am – 6.00 pm Monday to Friday and 8.00 am – 1.00 pm Saturday). However, oversized loads and emergency work may need to be conducted outside recommended standard working hours.

Construction noise management levels for the most affected residential receivers are shown in Table 7.

Table 7 – Construction noise management levels – Residential receivers

Residential Receivers	Daytime RBL L_{A90} dB(A)	Daytime Noise Management Levels L_{Aeq} dB(A)	Evening RBL L_{A90} dB(A)	Evening Noise Management Levels L_{Aeq} dB(A)	Night-time RBL L_{A90} dB(A)	Night time Noise Management Limit L_{Aeq} dB(A)
R1	36	46	36	41	36	41
R2	48	58	40	45	37	42
R3	31	41	30	35	30	35
R4	30	40	30	35	30	35
R5	35	45	30	35	30	35
R6	35	45	30	35	30	35
R7	35	45	30	35	30	35
R8	35	45	30	35	30	35
R9	30	40	30	35	30	35
R10	30	40	30	35	30	35
R11	30	40	30	35	30	35
R12	30	40	30	35	30	35

Criteria for other sensitive land uses around town of Jerrys Plains, such as schools, places of worship are shown in Table 8.

Table 8 – Construction noise management levels – Sensitive land uses other than residential

Land Use	Management Level, $L_{Aeq\ (15\ min)}$ (applies when properties are in use)
Classrooms at schools and other educational institutions	Internal noise level 45 dB(A)
Places of worship	Internal noise level 45 dB(A)

Land Use	Management Level, $L_{Aeq\ (15\ min)}$ (applies when properties are in use)
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level 65 dB(A)
Passive recreation areas(characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External noise level 60 dB(A)
Community centres	Depends on the intended use of the centre. Refer to the recommended 'maximum' internal levels in AS2107 for specific uses.

Criteria for industrial (e.g. existing Bayswater Power Station) and commercial premises (e.g. winery, general stores), are shown below:

- Industrial premises: external $L_{Aeq\ (15min)}$ 75 dB(A), and
- Offices, retail outlets: external $L_{Aeq\ (15min)}$ 70 dB(A).

4.2 Construction vibration criteria

Unlike the criteria applicable to noise emissions, vibration criteria are the same for both the construction and operational phases of this project. DECCW's '*Assessing Vibration: a technical guideline*', (DECCW, 2006) has been designed to be used in evaluating and assessing the effects on amenity of vibration emissions from industry, transportation and machinery. The guideline is used in assessments of vibration impacts caused by the construction and operation of new developments.

Vibration criteria are set primarily according to whether the particular activities of interest are continuous in nature or intermittent, whether they occur during the daytime or night-time and the type of receiver to be assessed e.g. commercial or residential.

The effects of vibration in buildings can be divided into three main categories:

- Those in which the occupants or users of the building are inconvenienced or possibly disturbed, i.e. human disturbance or discomfort;
- Those in which the integrity of the building or the structure itself may be prejudiced; and
- Those where the building contents may be affected.

Therefore, vibration levels at sensitive receiver locations must be controlled so as to prevent discomfort and regenerated noise, and in some extreme cases, structural damage.

For the proposed Bayswater B Power Station, the nearest residential receivers (vibration sensitive) are located more than 5 km from the proposed development site. The existing Bayswater Power Station (industrial development) is located approximately 2.5 km from the proposed Bayswater B Power Station site. This facility is neither noise nor vibration sensitive. At such distances, the risk of discomfort, regenerated noise and structural damage impacting receivers is extremely low and needs not to be considered further.

Vibration levels on residential receivers due to additional traffic generated by the proposed development during the construction phase are considered insignificant. This is due to the small number of additional heavy vehicles forecast during the construction phase of the project, refer to Section 10.0 for construction traffic numbers. Therefore, from a vibration perspective, the issue of impacts caused by the construction and operation of the Bayswater B Power Station need not be considered further.

5.0 Operational Noise and Vibration Criteria

5.1 Operational noise criteria

Noise generated within the Bayswater B Power Station development site boundary, including noise from plant, truck movements, rail movements, conveyors, loading/unloading activities, mechanical services associated with site buildings, must be assessed in accordance with the DECCW's INP guidelines.

Noise of the type that would be generated by the Bayswater B Power Station is classified under the INP as '*industrial noise*'

The DECCW's INP assessment procedure for industrial noise sources has two components, which are:

- Controlling intrusive noise impacts in the short term for residences; and
- Maintaining noise level amenity for particular land uses and for residences.

5.1.1 Intrusive noise impacts

The INP states that the noise from any single source should not intrude greatly above the prevailing background noise level. Industrial noises are generally considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (L_{Aeq}), measured over a 15 minute period, does not exceed the background noise level measured in the absence of the source by more than 5 dB. This is termed the *Intrusiveness Criterion*. The *Rating Background Level* (RBL) is the background noise level to be used for assessment purposes and is determined by the methods given in Section 3.1 of the INP.

Adjustments are to be applied to the level of noise produced if the noise at the receiver contains annoying characteristics such as tonality or impulsiveness.

5.1.2 Protecting noise amenity

To limit continuing increases in noise levels, the maximum ambient noise level resulting from industrial type noise sources should not normally exceed the acceptable noise levels specified in *Table 2.1* of the INP. That is, the background noise level should not exceed the level appropriate for the particular locality and land use. This is termed the Amenity criterion.

For a residential receiver in a rural area, the recommended amenity criteria are shown in Table 9. In addition, Table 9 also presents recommended amenity criteria noise levels for other different land uses.

The recommended maximum values provide guidance on an upper limit to the level of noise from industry and industrial type facilities. In all cases it is expected that all feasible and reasonable mitigation measures would be applied before the recommended maximum noise levels are referenced.

Table 9 – Recommended L_{Aeq} noise levels from industrial noise sources

Type of receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level dB(A)	
			Acceptable	Recommended Upper Limit
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45

Type of receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level dB(A)	
			Acceptable	Recommended Upper Limit
School classrooms - internal	All	Noisiest 1-hour period when in use	35	40
Place of worship - internal	All	When in use	40	45
Area specifically reserved for passive recreation (e.g. National Park)	All	When in use	50	55
Active recreation area (e.g. School playground, golf course)	All	When in use	55	60
Commercial premises	All	When in use	65	70
Industrial premises	All	When in use	70	75

Where there are high levels of existing industrial or transportation type noise then noise from the new source must be controlled to preserve the amenity of the area. Table 2.2 in the INP provides modification factors for areas with existing high levels of industrial or transportation noise.

Due to this contribution from existing industrial type noise sources the amenity criteria has been modified as per the recommendations in Table 2.2 of the INP.

5.1.3 Cumulative impact

The site specific environmental noise criteria, which are derived based on existing ambient conditions take into account the cumulative impact from all other industrial noise type activities (e.g. existing Bayswater Power Station, Liddell Power Station, mining activities etc.) within the area adjacent to the proposed new power station. This is achieved by complying with the amenity criteria which has been designed to limit continuing increases in noise levels due to new industrial type noise sources.

5.1.4 Resultant environmental noise criteria

The resultant operational intrusive and amenity noise emission criteria for the proposed Bayswater B Power Station are given in Table 10. As the noise emissions from the proposed power station would be dominated by relatively constant noise, the $L_{Aeq, period}$ has been assumed to be equal to the assessed $L_{Aeq, 15\ min}$ for the worst case operational scenario. This ensures compliance with both criteria at sensitive residential receivers and represents a conservative approach.

The amenity criteria have been established based on the existing industrial type noise levels experienced at locations R1, R2 and R3 with reference to Table 2.2. “Modification to acceptable noise level (ANL) to account for existing level of industrial noise” in the INP document.

The Project Specific Noise Levels (PSNL) for the various assessment periods, at the nearby residences are shown with shading in Table 10. For relatively constant noise emissions during the

various assessment periods, the PSNL becomes the lower of either the intrusiveness or amenity criterion, this represents a conservative approach.

A summary of the resultant operational environmental noise criteria are given in Table 10.

Table 10 – Resultant operational environmental noise criteria

Receiver	Period	RBL (L_{A90})	Intrusive Criterion RBL + 5 ($L_{Aeq, period}$)	Ambient ($L_{Aeq, period}$)	Amenity Criteria ($L_{Aeq, period}$)
R1	Day	36	41	49	50
	Evening	36	41	50	45
	Night	36	41	50	40
R2	Day	48	53	55	50
	Evening	40	45	54	45
	Night	37	42	52	40
R3	Day	31	36	62	52
	Evening	30	35	57	47
	Night	30	35	56	46
R4	Day	30	35	50	50
	Evening	30	35	44	45
	Night	30	35	46	40
R5	Day	35	40	48	50
	Evening	30	35	46	45
	Night	30	35	45	40
Liddell Power Station	N/A	N/A	N/A	N/A	70
Bayswater Power Station	N/A	N/A	N/A	N/A	70

The criteria presented in Table 10 are applicable for all the industrial type noise sources within the proposed development site at the nearest residential receivers most likely to be affected.

5.1.5 Meteorological effects

The DECCW has requested that adverse meteorological conditions be model (i.e. wind conditions, 3 m/s from all directions and F-class inversion) regardless of the findings from the meteorological assessment. Therefore, temperature inversion and adverse wind conditions will need to be modelled and assessed, refer to Section 8.0 for the operational noise assessment.

5.2 Sleep disturbance criteria

DECCW's INP has recently been updated with application notes which discuss sleep disturbance and its objective assessment.

To minimise the risk of sleep disturbance as a result of industrial type operations during the night-time period, the DECCW's INP application notes recommends that, the $L_{A1(1\ minute)}$ noise level outside a bedroom window should not exceed the L_{A90} background noise level by more than 15 dB(A) during the night-time period (10.00 pm to 7.00 am). DECCW considers it is appropriate to use this metric as a screening criterion to assess the likelihood of sleep disturbance. If this screening criterion is found to be exceeded then a more detailed analysis must be undertaken and include the extent that the maximum noise level exceeds the background noise level and the number of times this is likely to happen during the night-time period.

Based on the measured background noise levels during the night, the sleep disturbance criteria for the nearest noise sensitive residential receivers are presented in Table 11.

Table 11 – Night-time sleep disturbance criteria

Location	Measured RBL $L_{A90,\ 15\ mins}$ dB(A)	Sleep Disturbance Criteria $L_{A1\ (1\ minute)}$ dB(A)
R1	40	55
R2	37	52
R3	30	45
R4	30	45
R5	30	45
R6	30	45
R7	30	45
R8	30	45
R9	30	45
R10	30	45
R11	30	45
R12	30	45

5.3 Operational vibration criteria

Unlike the criteria applicable to noise emissions, vibration criteria are the same for both the construction and operational phases of this project. The DECCW's '*Assessing Vibration: a technical guideline*', (DECCW, 2006) has been designed to be used in evaluating and assessing the effects on amenity of vibration emissions from industry, transportation and machinery. The guideline is used in assessments of vibration impacts caused by the construction and operation of new developments. Vibration criteria are set primarily according to whether the particular activities of interest are continuous in nature or intermittent, whether they occur during the daytime or night-time and the type of receiver to be assessed e.g. commercial or residential.

The effects of vibration in buildings can be divided into three main categories:

- Those in which the occupants or users of the building are inconvenienced or possibly disturbed, i.e. human disturbance or discomfort;
- Those in which the integrity of the building or the structure itself may be prejudiced; and
- Those where the building contents may be affected.

Therefore, vibration levels at sensitive receiver locations must be controlled so as to prevent discomfort and regenerated noise, and in some extreme cases, structural damage.

For the proposed Bayswater B Power Station, the nearest residential receivers (vibration sensitive) are located more than 5 km from the proposed development site. The existing Bayswater Power Station (industrial development) is located approximately 2.5 km from the proposed Bayswater B Power Station site. This facility is neither noise nor vibration sensitive. At such distances, the risk of discomfort, regenerated noise and structural damage impacting receivers is extremely low and needs not to be considered further.

Vibration levels on residential receivers due to additional traffic generated by the proposed development during the operational phase are considered insignificant. This is due to the small number of additional heavy vehicles forecast during the operational phase of the project, refer to Section 10.0 for operational traffic numbers.

Therefore, from a vibration perspective, the issue of impacts caused by the construction and operation of the Bayswater B Power Station need not be considered further.

6.0 Road Traffic Noise Criteria

DECCW's Environmental Criteria for Road Traffic Noise (ECRTN) has been used to assess the noise arising from traffic generated by the proposed development. The ECRTN guidelines are applicable for traffic movements generated during the construction phase of the project as well as additional traffic generated during the operational phase.

6.1 Existing road traffic noise levels

The main road providing access to the proposed development is the New England Highway. This road would be classified as an existing freeway/arterial road. Table 12 presents the road traffic noise criteria from the DECCW for land use developments with a potential to create additional traffic on existing freeways/ arterial roads. The external noise criteria are applied 1 m from the external facade of the affected building.

Table 12 - Road traffic noise criteria – Freeways / Arterial roads

Period	Parameter	Criterion
Existing Freeway/Arterial Roads		
Day (7:00 am – 10:00 pm)	$L_{Aeq\ (15hr)}$	60 dB(A)
Night (10:00 pm – 7:00 am)	$L_{Aeq\ (9hr)}$	55 dB(A)

Note that where the criteria have already been exceeded the DECCW recommends that:

> *"Where feasible and reasonable, existing noise levels should be mitigated to meet the noise criteria. Examples of applicable strategies include appropriate location of private access roads; regulating times of use; using clustering; using quiet vehicles; and using barriers and acoustic treatments.*
>
> *In all cases traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dB."*

The existing traffic noise along the New England Highway already exceeds the recommended design criteria for this type of road, refer to Section 3.3 for measured traffic noise levels. Therefore, application of the ECRTN criteria would then be to ensure that, at a minimum, traffic arising from the proposed development would not lead to an increase in existing noise levels of more than 2 dB.

7.0 Construction Noise Assessment

The construction of Bayswater B Power Station will involve various stages and activities as outlined below in Table 13.

Table 13 – Bayswater B Power Station – Construction program

Bayswater B Power Station Construction Program
Site establishment
Site establishment includes the set up of facilities and services to support the construction activities. The main activities are to establish facilities such as access roads, offices, amenities, construction camp, initial storage areas and stores buildings, security arrangements, etc and arrange critical services such as power, water, communications, etc. During this early stage, any additional geotechnical investigations are completed to enable detailed foundation designs to be finalised.
Site preparation
Site preparation involves primarily civil works to clear and level the main power plant site and surrounding areas as applicable (e.g. coal storage areas, lay-down areas, etc), establish drainage systems, install facilities for underground services (e.g. reticulated water, electrical conduits), etc ready for erection of the equipment. The establishment of a concrete batching plant and facilities for processing fill materials.
Excavation and construction of foundations and underground services
Depending on the final foundation design, excavation for foundations will be undertaken. It is anticipated excavations up to 5m for concrete foundations and piling to a depth of up to 30m may be necessary for major plant foundations. Formwork is assembled, concrete is poured and completed foundations are back-filled. Once the major plant foundations are complete, foundations for other structures, plant and equipment can commence. Where specific underground services are required (e.g. gas supply pipeline), these services are installed in conjunction with the foundation works to avoid subsequent excavation and disturbance of the foundations.
Plant buildings and structures
Generally once the foundations are complete, erection of plant buildings and structures can commence. First the basic “shell” of the building is completed to allow access for lifting and installation of equipment into the building. It also maximises the space available for site-run minor pipework and cabling. Once the equipment is installed, the construction of the building can be completed. Major structures such as boiler and turbine building are constructed first followed by other service buildings (water treatment plant, air cooled condenser, etc). Due to the large exclusion zone around its base, the stack is also constructed early in the programme.
On-site pre-assembly of component parts and installation
Equipment and components will be progressively delivered to site. The size of most deliveries will be dictated by the method of transport and any associated limitations. Larger equipment will be delivered in modules or components for pre-assembly at site prior to installation.

7.1 Equipment installation (mechanical, electrical, controls)

As access to building and structures becomes available, installation plant and equipment progressively occurs. Mechanical, electrical and control equipment are installed and systems are connected by pipework and cabling. Extensive inspection and testing of the equipment is carried out throughout installation to ensure plant is set for operation.

7.2 Construction noise assessment scenario

Two construction scenarios have been modelled, for the purpose of this assessment, it has been assumed that construction activities will be the same for both the coal fired and gas fired options.

The two construction scenarios are considered to be the nosiest activities and are described below:

- Site preparation which will include large civil construction equipment noise sources such as concrete batching plant, pile drivers, backhoes, compactors, concrete mixer trucks, graders, flat bed trucks, dump trucks, compressors; and
- During steelwork/equipment which will include cranes, heavy haul low loaders, flat bed delivery trucks, man lifts, generators, pneumatic tools, welders, forklifts.

The acoustic impact at sensitive receptors resulting from construction activities has been assessed based on a likely construction scenario. The assumed scenario is considered to be representative of likely site activities and the impact has been assessed based on the 'worst case' i.e. the shortest distance between source and receivers.

Typical sound power levels used for the construction noise assessment have been included in Appendix C.

The predicted construction noise levels at nearby sensitive receivers are shown in Table 14 and Table 15. Noise contour plots for the two construction scenarios are presented in Appendix F .

Table 14 – Predicted construction noise levels – Site Preparation

Receiver	Description	Construction Noise Limit dB(A)			Predicted L_{Aeq} Noise Levels, dB(A)			Predicted Exceedance dB(A)		
		Day	Even.	Night	Day	Even.	Night	Day	Even.	Night
R1	Lake Liddell Camping Reserve	51	46	46	10	10	10	-	-	-
R2	Lot 4 Antiene Estate	50	45	45	10	10	10	-	-	-
R3	Edderton Road Farm House	45	40	40	3	3	3	-	-	-
R4	Arrowfield Winery	45	40	40	0	0	0	-	-	-
R5	6 Pierce Road	45	40	40	11	11	11	-	-	-
R6	Residence Golden Highway	45	40	40	14	14	14	-	-	-
R7	Residence Golden Highway	45	40	40	14	14	14	-	-	-
R8	Residence on Golden Highway	45	40	40	14	14	14	-	-	-
R9	Coolmore	45	40	40	2	2	2	-	-	-
R10	Residence Denman Road	45	40	40	0	0	0	-	-	-
R11	Residence Denman Road	45	40	40	0	0	0	-	-	-

Table 15 – Predicted construction noise levels – Steel works and erection

Receiver	Description	Construction Noise Limit dB(A)			Predicted L_{Aeq} Noise Levels, dB(A)			Predicted Exceedance dB(A)		
		Day	Even.	Night	Day	Even.	Night	Day	Even.	Night
R1	Lake Liddell Camping Reserve	51	46	46	16	16	16	-	-	-
R2	Lot 4 Antiene Estate	50	45	45	16	16	16	-	-	-
R3	Edderton Road Farm House	45	40	40	12	12	12	-	-	-
R4	Arrowfield Winery	45	40	40	5	5	5	-	-	-
R5	6 Pierce Road	45	40	40	19	19	19	-	-	-
R6	Residence Golden Highway	45	40	40	20	20	20	-	-	-
R7	Residence Golden Highway	45	40	40	20	20	20	-	-	-
R8	Residence on Golden Highway	45	40	40	20	20	20	-	-	-
R9	Coolmore	45	40	40	5	5	5	-	-	-
R10	Residence Denman Road	45	40	40	0	0	0	-	-	-
R11	Residence Denman Road	45	40	40	0	0	0	-	-	-

Construction activities associated with the two construction scenarios do not result in any predicted exceedance of the criteria at nearby sensitive residential locations during the daytime, evening and night-time periods

7.2.1 Discussion

The construction noise impact assessment results presented in Table 14 and Table 15 are for neutral weather conditions. The predicted construction noise levels are well below the established construction noise criteria. Under adverse weather conditions construction noise levels may increase by up to 6 dB(A), however, construction noise levels would still remain well below the established construction noise criteria at all assessment locations during the daytime, evening and night-time periods.

The predicted construction noise emissions from the proposed Bayswater B Power Station indicates compliance under adverse meteorological conditions at all assessment locations during the daytime, evening and night-time periods.

7.2.2 Industrial premises

The noise impact at the closest industrial type receivers, existing Bayswater Power Station is predicted to be 56 dB(A). This complies with the construction noise criteria for industrial type premises.

8.0 Operational Noise Assessment

8.1 Environmental noise model

The proposed Bayswater B Power Station will operate 24 hours per day, 7 days a week, with similar capacity during the day, evening and night-time periods. Based on the Project Specific Noise Levels presented in Section 5.1.4 for the day, evening and night-time periods, the night-time criteria are the most stringent criteria. Compliance with the night-time criteria will therefore ensure compliance with the day and evening criteria.

The operational noise levels were predicted using an implementation of CONCAWE[1] algorithms in the SoundPLAN[2] noise propagation software.

As part of the operation noise assessment, two models have been prepared and assessed, namely:

1. Coal fired model, and;
2. Gas fired model.

The noise models take into account significant noise source sound level emissions and locations, screening effects, receiver locations, ground topography and noise attenuation due to geometrical spreading air absorption, ground absorption and the effects of the prevailing weather conditions.

The noise model was based on ground topography, general plant site layouts and plant equipment sound power levels provided by WorleyParsons for the purpose of the study.

All residential receivers were modelled at a height of 1.5 m above ground level. Noise predictions were carried out at the nearest residential receivers surrounding the proposed site. Noise predictions have also been predicted at the nearest industrial premise - the existing Bayswater Power Station.

8.2 Assumptions

The following assumptions were utilised for the assessment of the environmental noise emission:

- The power stations were modelled based on the major noise sources from each building, as provided by WorleyParsons design team;
- Sundry noise sources such as valve and pipe noise, submersible pumps, gantry cranes, etc. are expected to have a negligible effect on the final results and have not been included;
- The coal fired plant was modelled with the contribution of the coal and ash conveyor belts as presented in Figure 2, and;
- Power station equipment source noise levels listed in Appendix B.

8.3 INP assessment of prevailing weather conditions

Certain meteorological conditions may increase noise levels by re-directing sound-wave propagation paths. Such refraction of sound waves will occur during temperature inversions and where there is air movement (wind) with a direction from the source to receiver. The NSW Industrial Noise Policy details a method for assessing the increase in noise levels caused by temperature inversions.

The initial screening procedure has been performed resulting in increases in predicted noise levels greater than 3 dB(A), therefore, in accordance with the INP guidelines further work was undertaken to

1 CONCAWE – The oil companies' international study group for conservation of clean air and water – Europe (established in 1963) Report 4/81 "The propagation of noise from petroleum and petrochemical complexes to neighbouring communities".

2 SoundPLAN 6.5 is a suite of computer noise propagation programs.

establish the prevailing meteorological conditions applicable at the development site and at nearby sensitive receivers.

8.3.1 Wind

When present, the wind speed is modelled in the direction of source to receiver for all source and receiver locations. This represents a worst case assessment at each individual receiver.

The INP states that wind effects need to be assessed where wind is a feature of the area. Wind is considered to be a feature where source-to-receiver wind speeds (at 10 m height) of 3 m/s or below occur for 30 % of the time or more in any assessment period in any season.

An assessment of the prevalence of wind effects has been carried out for the site by Katestone Environmental which identified source to receiver winds of up to 3 m/s occur at the site for more than 30% of the period in any season. For the night time period these winds occur in the north west, west north west, south east and south south easterly directions.

8.3.2 Temperature inversions

The INP states that temperature inversion effects need to be assessed where temperature inversions are a feature of the area. Temperature inversions are considered to be a feature where they occur for more than 30% of the total night-time period (or approximately 2 nights per week) during the winter months.

An assessment of the prevalence of temperature inversion effects has been carried out for the site by Katestone Environmental which found that significant temperature inversions do not occur at the site for more than 30% of winter night-time period.

8.3.3 Meteorological conditions modelled

The DECCW has requested that adverse meteorological conditions be model (i.e. wind conditions, 3 m/s from all directions and F-class inversion) regardless of the findings from the meteorological assessment. Therefore, the noise contribution of the proposed operational scenarios at the nearest residential and industrial type receivers has been estimated based on the following meteorological parameters:

Night-time - Calm meteorological conditions

Night-time calm meteorological conditions are described by 10^{o} C air temperature, 70% Relative Humidity, 0.5 m/s wind speed, 0^{o} C/100 m temperature gradient and an air stability class D. Table 16 and Table 17 present the computed noise emissions from the SoundPLAN model at the nearest noise assessment locations under calm meteorological conditions.

Adverse wind conditions

Wind conditions model for the two options were:

- 3 m/s from all directions.

Temperature Inversion

- F-class Inversion: 3^{o}C/100m;
- Source-to-receiver drainage-wind speed 2m/s (measured at 10 metres above ground level)

Table 16 and Table 17 present the computed noise emissions from the SoundPLAN model at the nearest noise assessment locations under adverse wind and temperature inversion conditions.

8.4 Gas fired operational noise modelling results

Based on the assumptions and modelling parameters as set out in the previous sections, the following operational noise levels were predicted at nearby receivers under calm and adverse meteorological conditions. The predicted operational noise levels for the gas fired power station are presented in Table 16.

Noise contour plots for the gas fired operational scenario are presented in Appendix F for night-time neutral and adverse weather conditions.

Table 16 – Gas fired option predicted operational noise levels (night-time)

Receiver	Location	Neutral			Worst Case Wind Conditions[1] 3 m/s From all Directions			Temperature Inversion Stability Class F		
		Result	Criterion	Exceed	Result	Criterion	Exceed	Result	Criterion	Exceed
R1	Lake Liddell Camping Reserve	25	41	-	30	41	-	30	41	-
R2	Lot 4 Antiene Estate	25	40	-	30	40	-	30	40	-
R3	Edderton Road Farm House	24	35	-	28	35	-	28	35	-
R4	Arrowfield Winery	17	35	-	21	35	-	21	35	-
R5	6 Pierce Road	27	35	-	32	35	-	32	35	-
R6	Residence Golden Highway	28	35	-	33	35	-	33	35	-
R7	Residence Golden Highway	28	35	-	33	35	-	33	35	-
R8	Residence on Golden Highway	28	35	-	33	35	-	33	35	-
R9	Coolmore	29	35	-	33	35	-	33	35	-
R10	Residence Denman Road	20	35	-	24	35	-	24	35	-
R11	Residence Denman Road	19	35	-	22	35	-	22	35	-
R12	Residence Denman Road	18	35	-	15	35	-	15	35	-
IR1	Bayswater Power Station office	39	70	-	44	70	-	44	70	-

Notes:

1. This represents a conservative assessment since it is not possible for the wind to be blowing in multiple directions at the same time.

8.5 Coal fired operational noise modelling results

Based on the assumptions and modelling parameters as set out in the previous sections, the following operational noise levels were predicted at nearby receivers under calm and adverse meteorological

conditions. The predicted operational noise levels for the coal fired power station are presented in Table 16.

Noise contour plots for the coal fired operational scenario are presented in Appendix F for night-time neutral and adverse weather conditions.

Table 17 – Coal fired option predicted operational noise levels (night-time)

Receiver	Location	Neutral			Worst Case Wind Conditions[1] 3 m/s From all Directions			Temperature Inversion Stability Class F		
		Result	Criterion	Exceed	Result	Criterion	Exceed	Result	Criterion	Exceed
R1	Lake Liddell Camping Reserve	25	41	-	30	41	-	30	41	-
R2	Lot 4 Antiene Estate	22	40	-	27	40	-	27	40	-
R3	Edderton Road Farm House	17	35	-	21	35	-	21	35	-
R4	Arrowfield Winery	14	35	-	17	35	-	17	35	-
R5	6 Pierce Road	21	35	-	26	35	-	26	35	-
R6	Residence Golden Highway	22	35	-	27	35	-	27	35	-
R7	Residence Golden Highway	22	35	-	27	35	-	27	35	-
R8	Residence on Golden Highway	22	35	-	27	35	-	27	35	-
R9	Coolmore	20	35	-	24	35	-	24	35	-
R10	Residence Denman Road	13	35	-	17	35	-	17	35	-
R11	Residence Denman Road	12	35	-	15	35	-	15	35	-
R12	Residence Denman Road	11	35	-	9	35	-	9	35	-
IR1	Bayswater Power Station office	46	70	-	52	70	-	52	70	-

Notes:

1. This represents a conservative assessment since it is not possible for the wind to be blowing in multiple directions at the same time.

8.6 Discussion

All predicted operational noise levels for the both the coal and gas fired options under neutral and adverse weather conditions, worst wind conditions (i.e. wind blowing from all directions) and temperature inversion (stability class F) comply with the site specific operational noise criteria at all nearby residential receivers during the daytime, evening and night-time periods.

8.6.1 Low frequency noise

Under the DECCW's INP guidelines, Section 4 '*Modifying factor adjustments*' low frequency noise can be assessed by comparing the overall dB(A) level to the overall dB(C) level (dB(C) or C-weighting is designed to be more responsive to low frequency noise). Where the overall dB(C) – dB(A) is greater than 15 dB, low frequency noise may be considered part of the noise environment.
During the detailed plant equipment selection it is recommended that plant equipment selection takes into consideration low frequency issues to avoid any potential low frequency 'annoyance' characteristics.

8.7 Sleep disturbance

The application notes for the DECCW *Industrial Noise Policy* (2000) recommend that sleep disturbance is assessed based on the emergence of the $L_{A1\ (1\ minute)}$ noise level over the corresponding $L_{A90\ (15\ minute)}$ noise level.

The following screening criterion for sleep disturbance is recommended for the assessment of sleep disturbance:

$$L_{A1\ (1\ minute)} < L_{A90\ (15\ minute)} + 15\ dB(A)$$

The night-time noise emissions from the plant would generally be associated with relatively constant activities. Therefore no significant peak noise events would be expected.

The 5 km separation between the site and the nearest receivers means that the maximum external noise levels are not predicted to exceed 40 dB(A) due to the night-time operations of the Bayswater B Power Station. Therefore, the assessment indicates compliance at all assessment locations during the night-time period.

9.0 Antiene Rail Loop – Noise and Vibration Impact Assessment

It is understood that if the coal fired option was chosen, an additional 6.5 million tonnes per annum of coal would be required to be brought to site. This means that train movements on the Antiene Rail Loop will increase from five movements per day (year 2012) to six movements per day (year 2015) to seven movements per day (year 2016) due to the requirements of the proposed coal fired option of Bayswater B Power Station.

The noise and vibration impact assessment prepared by Spectrum Acoustics Pty Ltd (reference: Project No. 04085, September 2004), as part of the Antiene Rail Unloader – Statement of Environmental Effects (prepared by HLA 15 April 2005) assessed the effect of noise and vibration generated by operation of the rail unloader and rail traffic on the rail loop on nearby residences. The Antiene Rail Loop Noise and Vibration Impact Assessment assumes a worst case scenario and mentions that '*At maximum capacity an average of eight trains per day will access the unloader*'.

Considering the proposed coal fired option of Bayswater B Power Station will increase train movements on the Antiene Rail Loop from five movements per day (2012) to seven movements per day (2016), the noise and vibration impact assessment of the Antiene Rail Loop is valid for the proposed increase in train movements.

It is understood that no further construction will be required at the Antiene Rail Unloader. The project would merely require the additional use of the site. While this would require an amendment to the existing approval (which is currently capped at 15 million tonnes per annum), it is considered in relation to this project that no significant noise impacts will arise as a result of the increased use.

10.0 Road Traffic Noise Assessment

10.1 Operational traffic noise

Based on the forecast trip generation volumes (insert reference), the average daily traffic flow along New England Highway, with a coal fired power station, is estimated to increase from 10,581 to 10,881 which equates to an increase of 2.8%. With a gas fired power station, the average traffic would increase from 10,581 to 10,791, representing a 2.0% increase. The traffic document also states that the traffic impact on residential roads for both scenarios would be minimal.

An increase in traffic volume as stated in Table 18 would increase overall traffic noise levels by significantly less than 1 dB(A). This will therefore comply with the criteria as detailed in Section 6.0 which states that the increase in noise due to road traffic due to site operations cannot exceed 2 dB(A). No further assessment is required as a result.

Table 18 Total Trip Generation of Bayswater B Power Station

	Maintenance Staff	Operation Staff (Two Shifts)	Office Staff	Heavy Vehicles	Total Trips
Coal Fired	130	64	100	6	300
Gas Fired	70	64	70	6	210

Source: AECOM, 2009

10.2 Construction traffic noise

Based on the forecast trip generation volumes, the average traffic flows along New England Highway, during the construction phase, is estimated to increase to 11,181 per day, representing a 5.7% increase. The traffic document also stated that the impact of private vehicles on local roads will be minimal.

An increase in construction traffic volume as stated in Table 19 would increase overall traffic noise levels by significantly less than 1 dB(A). It is however recommended that heavy vehicle traffic (excluding oversized loads and emergency work) be restricted to movements during daytime hours.

Table 19 Assumed traffic generation – Construction stage

Generated Vehicles	Daily Trip Generation
Buses	20
Private Vehicles	380
Heavy Vehicles	200
Total	600

Source: AECOM, 2009

11.0 General Recommendations

The noise and vibration impacts at sensitive receivers resulting from the assumed construction and operational scenarios are predicted to comply at all assessment locations during the daytime, evening and night-time periods. The following sections present general recommendations to be implemented prior to the commencement of construction and operational activities associated with the Bayswater B Power Station project.

11.1 Construction phase

Prior to the commencement of site preparation works or construction of the Bayswater B Power Station it is recommended that the proponent prepares a Construction Noise Management Plan outlining noise mitigation measures, noise monitoring and management procedures to be implemented to minimise noise impacts during the construction phase of the project.

The DECCW "*Draft Construction Noise Guidelines"* recommends that the proponent demonstrates best practicable means and include noise mitigation measures in the construction management plan to minimise the noise impact at sensitive receivers. This may include the work practices described below.

Community notification

- Contact potentially noise-affected neighbours at the earliest possible time before any site work begins;
- Inform potentially noise-affected neighbours about the nature of the construction stages and the noisier activities – for example excavation and rock-breaking;
- Give clear indication to potentially noise-affected neighbours of how long noisy activities will take;
- Describe any noise controls, such as walls to be built first that will reduce noise, temporary noise walls, or use of silenced equipment;
- Keep potentially noise-affected neighbours up to date on progress;
- Provide contact details on a site board at the front of the site, and keep a complaints register suited to the scale of works;
- Ask about any concerns that potentially noise-affected neighbours may have and discuss possible solutions;
- Provide a copy of the noise management plan to potentially noise-affected neighbours.

Noise monitoring

- Initial monitoring to be undertaken within one week following construction activities commencing on site to validate predicted noise and vibration limits, and on at least a monthly basis thereafter for the duration of construction; and
- Noise monitoring to be undertaken in response to complaints.

Operate plant in a quiet and efficient manner

- Turn off plant that is not being used;
- Examine, and implement where feasible and reasonable, alternative work practices which generate less noise – for example use hydraulic rock splitters instead of rockbreakers, or electric equipment instead of diesel or petrol powered equipment;
- Examine, and implement where feasible and reasonable, the option of using silenced equipment.
- Ensure plant is regularly maintained;
- Locate noisy plant away from potentially noise-affected neighbours or behind barriers, such as sheds or walls; and
- Where reasonable, provide respite periods for very noisy activities.

Involve workers in minimising noise

- Avoid dropping materials from a height;
- Talk to workers about noise from the works and how it can be reduced; and
- Use radios and stereos indoors rather than outdoors.

Handle complaints

- Review, and implement where feasible and reasonable, work practices to minimise noise from construction that are the subject of noise complaints.

11.2 Operational phase

It is recommended that the proponent prepares an Operational Noise Management Plan outlining noise mitigation measures, noise monitoring and management procedures to be implemented to minimise noise impacts during the operation phase of the project.

The DECCW "Industrial Noise Policy" recommends that the proponent demonstrates best management practice (BMP) means and include noise mitigation measures in the operational management plan to minimise the noise impact at sensitive receivers. This may include the best management practices described below.

- Using components that do not emit tonal or low-frequency noise, using trenches, cuttings, tunnels and barriers for transport routes;
- Using conveyor systems with low noise output, paying particular attention to rollers;
- Maintaining plant and equipment to ensure that the designers' noise-output specifications continue to be met during the operation phase of the projects;
- Using 'smart' reversing alarms;
- Where low-frequency noise is difficult to isolate, seeking specialist advice about machinery redesign;
- Reducing tonal noise through machinery redesign, enclosure; applying engineering noise control;
- Within 90 days of the project commencing operation, monitor environmental noise levels at noise sensitive locations to determine compliance with the consent/licence conditions;
- Monitor noise levels as a result of community complaints. This may be done in addition to noise monitoring at various stages of the development described above, or could stand alone as the sole driver for performance monitoring; and
- Establish a complaint hotline to record receiver complaints regarding the development, a system for logging complaints and dealing with them.

12.0 Conclusions

The impacts of noise and vibration associated with the construction and operation of the proposed Bayswater B Power Station have been assessed. The assessments have been carried out based on two proposed fuel source scenarios, by either coal (using ultra-supercritical generation technology) or natural gas (using combined cycle generation technology).

The scope of the assessment included noise measurement surveys, noise and vibration model predictions for construction and operational scenarios, a noise and vibration impact assessment relative to appropriate criteria and recommendations for noise and vibration control measures where necessary.

This impact assessment addresses the Director-General's key assessment requirements relating to noise by considering the impact of noise and vibration on nearby noise sensitive receivers during the construction and operational phase of the proposed Bayswater B Power Station. The noise and vibration assessment was carried out in accordance with NSW regulatory requirements which results in addressing the assessment as follows:

Construction noise and vibration
The construction noise and vibration assessment was conducted in accordance with NSW Department of Environment, Climate Change and Water (DECCW) '*Interim Construction Noise Guidelines' (ICNG)*. The construction noise assessment indicates compliance with DECCW's ICNG acoustic requirements at all assessment locations during the daytime, evening and night-time periods.

The construction vibration assessment indicates that due to the large buffer distance between the Bayswater B Power Station site and nearby residential receivers, the risk of discomfort, regenerated noise and structural damage impacting on receivers is extremely low.

Operational noise and vibration
The operational noise assessment was conducted in accordance with NSW DECCW's Industrial Noise Policy (INP) guidelines.
The operational noise impact assessment indicates compliance under adverse meteorological conditions at all assessment locations during the daytime, evening and night-time periods.

No items of plant and equipment used in either the gas fired or coal fired options are expected to generate significant levels of vibration and therefore, operational vibration impacts are consequently expected to be negligible.

Sleep disturbance
The sleep disturbance assessment was conducted in accordance with NSW DECCW's Industrial Noise Policy (INP) guidelines. The assessment indicates compliance at all assessment locations during the night-time period.

Road traffic noise
The road traffic noise assessment was conducted in accordance with NSW DECCW's Environmental Criteria for Road Traffic Noise (ECRTN) guidelines.
The road traffic noise assessment associated with construction and operational phase of the Bayswater B Power Station indicates compliance with DECCW ECRTN acoustic criteria.

Antiene Rail Loop
Review of the noise impact assessment prepared by Spectrum Acoustics (reference: Project No. 04085, September 2004), as part of the Antiene Rail Unloader – Statement of Environmental Effects (prepared by HLA 15 April 2005) indicates that this assessment is still valid for the proposed increase in train movements on the loop. As such, no significant impacts have been identified.

Appendix A Glossary of Acoustical Terminology

Glossary of Acoustical Terminology

The following is a brief description of acoustic terminology used in this report.

Sound power level	The total sound emitted by a source
Sound pressure level	The amount of sound at a specified point
Decibel [dB]	The measurement unit of sound
A Weighted decibels [dB(A])	The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).
Decibel scale	The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. A 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB increase in the sound pressure level corresponds to a perceived doubling in volume. Examples of decibel levels of common sounds are as follows: 0dB(A) Threshold of human hearing 30dB(A) A quiet country park 40dB(A) Whisper in a library 50dB(A) Open office space 70dB(A) Inside a car on a freeway 80dB(A) Outboard motor 90dB(A) Heavy truck pass-by 100dB(A) Jackhammer/Subway train 110 dB(A) Rock Concert 115dB(A) Limit of sound permitted in industry 120dB(A) 747 take off at 250 metres
Frequency [f]	The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high pitched sound and a low frequency to a low pitched sound.
Equivalent continuous sound level [L_{eq}]	The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy.
L_{max}	The maximum sound pressure level measured over the measurement period
L_{min}	The minimum sound pressure level measured over the measurement period
L_{10}	The sound pressure level exceeded for 10% of the measurement period. For 10% of the measurement period it was louder than the L_{10}.
L_{90}	The sound pressure level exceeded for 90% of the measurement period. For 90% of the measurement period it was louder than the L_{90}.
Ambient noise	The all-encompassing noise at a point composed of sound from all sources near and far.
Background noise	The underlying level of noise present in the ambient noise when extraneous noise (such as transient traffic and dogs barking) is removed. The L_{90} sound pressure level is used to quantify background noise.
Traffic noise	The total noise resulting from road traffic. The L_{eq} sound pressure level is used to quantify traffic noise.

Day	The period from 0700 to 1800 h Monday to Saturday and 0800 to 1800 h Sundays and Public Holidays.
Evening	The period from 1800 to 2200 h Monday to Sunday and Public Holidays.
Night	The period from 2200 to 0700 h Monday to Saturday and 2200 to 0800 h Sundays and Public Holidays.
Assessment background level [ABL]	The overall background level for each day, evening and night period for **each day** of the noise monitoring.
Rating background level [RBL]	The overall background level for each day, evening and night period for the **entire length** of noise monitoring.

*Definitions of a number of terms have been adapted from Australian Standard AS1633:1985 *"Acoustics – Glossary of terms and related symbols"*, the DECCW's NSW Industrial Noise Policy and the DECCW's Environmental Criteria for Road Traffic Noise.

Appendix B Equipment Selection Sound Power Levels

Table B1 – Equipment sound power levels

Equipment	Sound Power Levels, L_W dB								
	Octave Frequency Bands, Hz								
	31.5	63	125	250	500	1000	2000	4000	8000
Coal Fired Plant									
Steam Turbine Generator	116	122	120	115	111	107	104	96	90
Main Steam Boiler	125	124	119	113	112	110	108	108	109
Coal Pulverising Mill	99	99	99	95	93	90	89	84	75
Fabric Filter	99	99	99	95	93	90	89	84	75
Fabric Filter Air Blower	105	101	106	105	103	106	110	107	101
ID Fans[1]	122	118	116	112	113	114	113	113	115
FD Fans	126	127	128	129	129	129	127	123	122
Primary Air Fan	132	133	134	135	135	135	133	129	128
Air Cooled Condenser	120	123	123	119	119	118	115	107	104
Air Compressors	103	99	104	103	101	104	109	106	99
Boiler Feed Pump	103	109	107	111	117	117	115	103	99
Generator Step Up Transformer	111	117	119	114	114	108	103	98	91
ACW Cooling Tower	110	113	113	110	107	103	100	97	89
Coal Stockyard and Reclaim	112	113	109	106	107	103	99	97	89
Coal Conveyor	88	90	88	81	93	87	84	75	68
Coal Plant Bulldozer	110	114	119	122	117	115	112	106	100
Stack	125	120	121	113	104	95	83	76	65
Ash Truck									
Gas Fired Plant									
Compressor Inlet[2]	121	109	99	96	102	123	121	116	113
Gas Turbine	115	125	120	120	111	110	119	122	110
HRSG Stack	128	133	129	124	124	119	114	98	90
Air Cooled Condenser Gas	113	116	116	112	112	111	108	100	97
Auxiliary Cooling Tower	108	111	111	108	105	101	98	95	87
Fuel Gas Compressor	119	122	122	119	116	112	109	106	98
Boiler Feed Pump HP	88	94	92	96	102	102	100	88	84
Boiler Feed Pump IP	85	91	89	93	99	99	97	85	81

Equipment	Sound Power Levels, L_W dB								
	Octave Frequency Bands, Hz								
	31.5	63	125	250	500	1000	2000	4000	8000
Generator Step Up Transformer	105	111	113	108	108	102	97	92	85

Notes:

1. Attenuated equipment, using Option 1 attenuator.
2. Attenuated equipment, using Option 2 attenuator.

Table B2 – Equipment information

Equipment	Indoor or Outdoor	Number in Plant	Elevation (relative to site elevation 144 m)	Sound Power Level, L_{Aeq} dB(A)
Coal Fired Power Station				
Steam Turbine Generator	✓	2	20	113
Main Steam Boiler	✓	2	0-95	117
Coal Pulverising Mill		12	0	96
Fabric Filter			22	96
Fabric Filter Air Blower		8	0	114
ID Fans		4	0	140
FD Fans	✓	4	0	134
Primary Air Fan	✓	4	0	140
Air Cooled Condenser		2	38	122
Air Compressors	✓	4	0	113
Boiler Feed Pump	✓	2	0	121
Generator Step Up Transformer		2	0	114
ACW Cooling Tower		3	7	109
Coal Stockyard and Reclaim		1	20	108
Coal Plant Bulldozer		1	20	120
Stack		1	250	109
Gas Fired Power Station				
Compressor Inlet		5	18	158
Gas Turbine		5	0	125
HRSG Stack		5	55	125

Equipment	Indoor or Outdoor	Number in Plant	Elevation (relative to site elevation 144 m)	Sound Power Level, L_{Aeq} dB(A)
Air Cooled Condenser Gas		5	18	115
Auxiliary Cooling Tower		1	7	107
Fuel Gas Compressor		3	0	118
Boiler Feed Pump HP		10	0	106
Boiler Feed Pump IP		10	0	103
Generator Step Up Transformer		5	0	108

Notes:

1. Indoor equipment has been assumed to be located within a room with Rw 45 hollow concrete block walls.

Table B3 – Silencer attenuation

Silencer Option	Attenuation, dB								
	Frequency in Octave Bands, Hz								
	32	63	125	250	500	1000	2000	4000	8000
1	10	15	18	23	22	21	20	16	13
2	14	21	26	34	33	32	31	29	27

Appendix C Construction Activities and Equipment

Table C1 – Construction activities and plant equipment

Equipment	Number of Modelled	Sound Power Level for 1 Unit - L_{Aeq} dB(A)
Site Preparation		
Batching Plant	1	121
Vibratory Pile Driver	2	105
Backhoe	1	85
Compactors	1	124
Concrete Truck	2	107
Grader	1	120
Flat Bed Truck	2	100
Dump Truck	2	107
Compressors	1	110
Steelwork/Equipment Erection		
Crawler Cranes	2	115
Tower Cranes	1	108
Lorry Mounted Cranes	1	120
Flat Bed Truck	2	100
Heavy Haul Low Loader	2	107
Excavators	2	118
Man Lift	3	97
Generators	3	119
Grinder	1	106
Chipping Hammer/Chisel	1	119
Fork Lift	2	119

Appendix D Calculated ABLs, RBLs and Existing L_{Aeq} Ambient Noise Levels

D1 - Location R1 – Lake Liddell

Table D1 – Summary of measured ambient noise levels dB(A)

Date	Assessment Background Levels (ABLs) - L_{A90}			Ambient Noise Levels - L_{Aeq}		
	Day[1]	Evening[2]	Night[3]	Day[1]	Evening[2]	Night[3]
Tuesday 30 June, 2009		36			55	
Wednesday 01 July, 2009		42	41		49	50
Thursday 02 July, 2009		40			47	
Friday 03 July, 2009		45	45		49	51
Saturday 04 July, 2009		44	44		48	51
Sunday 05 July, 2009	35	41	41	49	49	48
Monday 06 July, 2009	33	34	40	48	49	51
Tuesday 07 July, 2009	38	37	42	50	50	51
Wednesday 08 July, 2009	37	39	43	49	50	50
Thursday 09 July, 2009	36	41		48	50	
RBL	**36**	**40**	**42**	-	-	-
Log Average (L_{Aeq})	-	-	-	**49**	**50**	**50**

Notes:

1. Day is defined as 7:00am to 6:00pm, Monday to Saturday and 8:00am to 6:00pm Sundays & Public Holidays.
2. Evening is defined as 6:00pm to 10:00pm, Monday to Sunday & Public Holidays.
3. Night is defined as 10:00pm to 7:00am, Monday to Saturday and 10:00pm to 8:00am Sundays & Public Holidays
4. Where the RBL is calculated to be less than 30 dB(A), then the RBL is set to 30 dB(A) in accordance with DECCW's INP recommendations.
5. ABL - The assessment background level (ABL) is established by determining the lowest tenth-percentile level of the L_{A90} noise data acquired over each period of interest.
6. RBL - Rating Background Noise Level (RBL) is representative of the average minimum background sound level (in the absence of the source under consideration), or simply the background level. It is the median of the daily background noise levels during each assessment period, being day, evening and night..
7. The L_{Aeq} is essentially the average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.

D2 - Location R2 – Lot 4 Antiene Estate

Table D2 – Summary of measured ambient noise levels dB(A)

Date	Assessment Background Levels (ABLs) - L_{A90}			Ambient Noise Levels - L_{Aeq}		
	Day[1]	Evening[2]	Night[3]	Day[1]	Evening[2]	Night[3]
Tuesday 30 June, 2009		43			56	
Wednesday 01 July, 2009		41	40		54	53
Thursday 02 July, 2009		45			55	
Friday 03 July, 2009		44	39		54	51
Saturday 04 July, 2009		40	37		52	50
Sunday 05 July, 2009	46	39	35	54	55	52
Monday 06 July, 2009	47	39	36	55	54	52
Tuesday 07 July, 2009	48	40	38	56	52	51
Wednesday 08 July, 2009	49	41	36	55	54	53
Thursday 09 July, 2009	49	40		56	52	
RBL	**48**	**40**	**37**	-	-	-
Log Average (L_{Aeq})	-	-	-	**55**	**54**	**52**

D3 - Location R3 – Edderton Road

Table D3 – Summary of measured ambient noise levels dB(A)

Date	Assessment Background Levels (ABLs) - L_{A90}			Ambient Noise Levels - L_{Aeq}		
	Day[1]	Evening[2]	Night[3]	Day[1]	Evening[2]	Night[3]
Tuesday 30 June, 2009		29			57	
Wednesday 01 July, 2009		33	39		56	57
Thursday 02 July, 2009		39			58	
Friday 03 July, 2009		25	32		58	54
Saturday 04 July, 2009		27	25		56	53
Sunday 05 July, 2009	30	26	24	61	58	56
Monday 06 July, 2009	28	24	23	62	56	57
Tuesday 07 July, 2009	31	27	28	62	56	56
Wednesday 08 July, 2009	34	31	32	62	57	55
RBL	**31**	**30[4]**	**30[4]**	-	-	-
Log Average (L_{Aeq})	-	-	-	**62**	**57**	**56**

D4 - Location R4 – Arrowfield Winery

Table D4 – Summary of measured ambient noise levels dB(A)

Date	Assessment Background Levels (ABLs) - L_{A90}			Ambient Noise Levels - L_{Aeq}		
	Day[1]	Evening[2]	Night[3]	Day[1]	Evening[2]	Night[3]
Tuesday 30 June, 2009		23			45	
Wednesday 01 July, 2009		25	20		43	46
Thursday 02 July, 2009		32			44	
Friday 03 July, 2009		26	25		42	46
Saturday 04 July, 2009		28	27		40	43
Sunday 05 July, 2009	27	21	24	47	44	45
Monday 06 July, 2009	26	21	21	51	44	47
Tuesday 07 July, 2009	29	24	25	50	47	46
RBL	**30**[4]	**30**[4]	**30**[4]	-	-	-
Log Average (L_{Aeq})	-	-	-	**50**	**44**	**46**

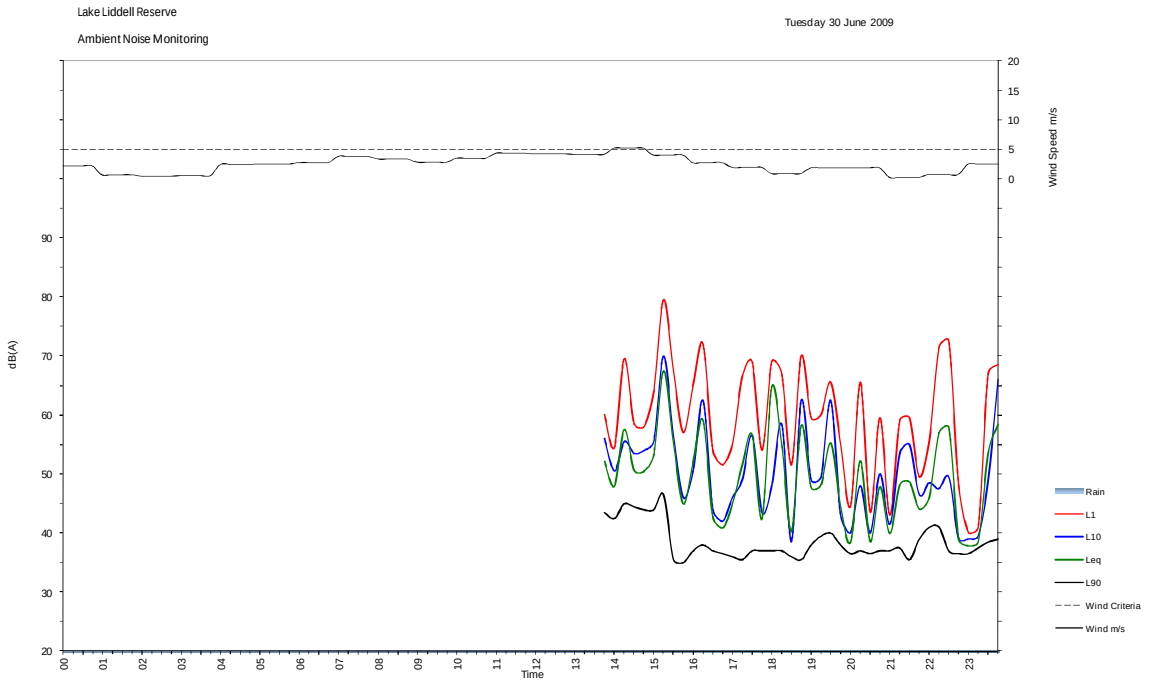
D5 - Location R5 – 4 Pearse Road, Jerrys Plains

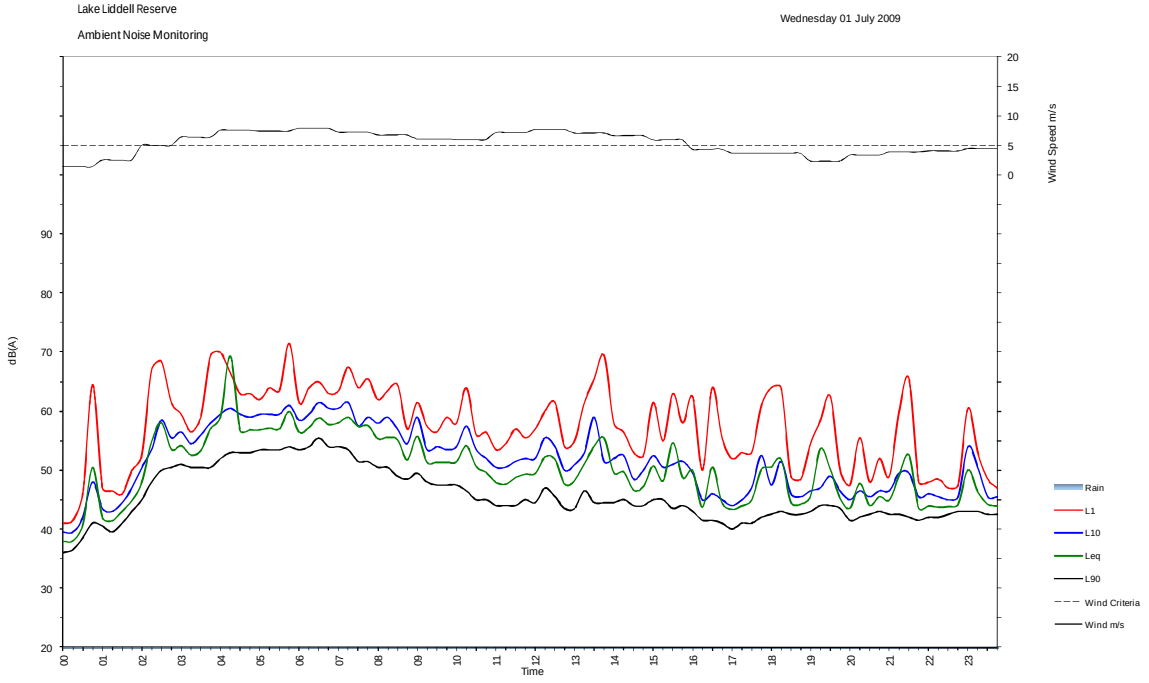
Table D5 – Summary of measured ambient noise levels dB(A)

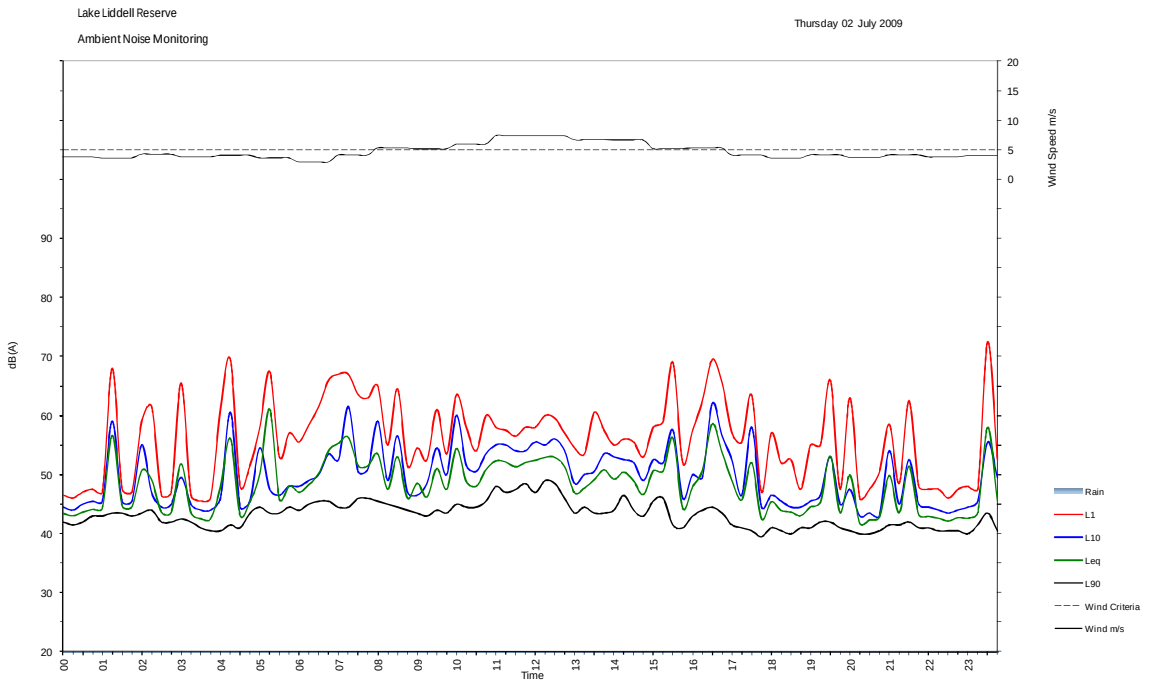
Date	Assessment Background Levels (ABLs) - L_{A90}			Ambient Noise Levels - L_{Aeq}		
	Day[1]	Evening[2]	Night[3]	Day[1]	Evening[2]	Night[3]
Tuesday 30 June, 2009		25			45	
Wednesday 01 July, 2009		32	30		45	44
Thursday 02 July, 2009		24			45	
Friday 03 July, 2009		33	23		45	43
Saturday 04 July, 2009		41	30		51	48
Sunday 05 July, 2009	34	23	24	47	45	44
Monday 06 July, 2009	35	23	23	48	45	44
Tuesday 07 July, 2009	33	26	26	48	44	44
Wednesday 08 July, 2009	36	27	28	49	45	43
Thursday 09 July, 2009	36	29	27	48	45	44
RBL	**35**	**30**[4]	**30**[4]	-	-	-
Log Average (L_{Aeq})	-	-	-	**48**	**46**	**45**

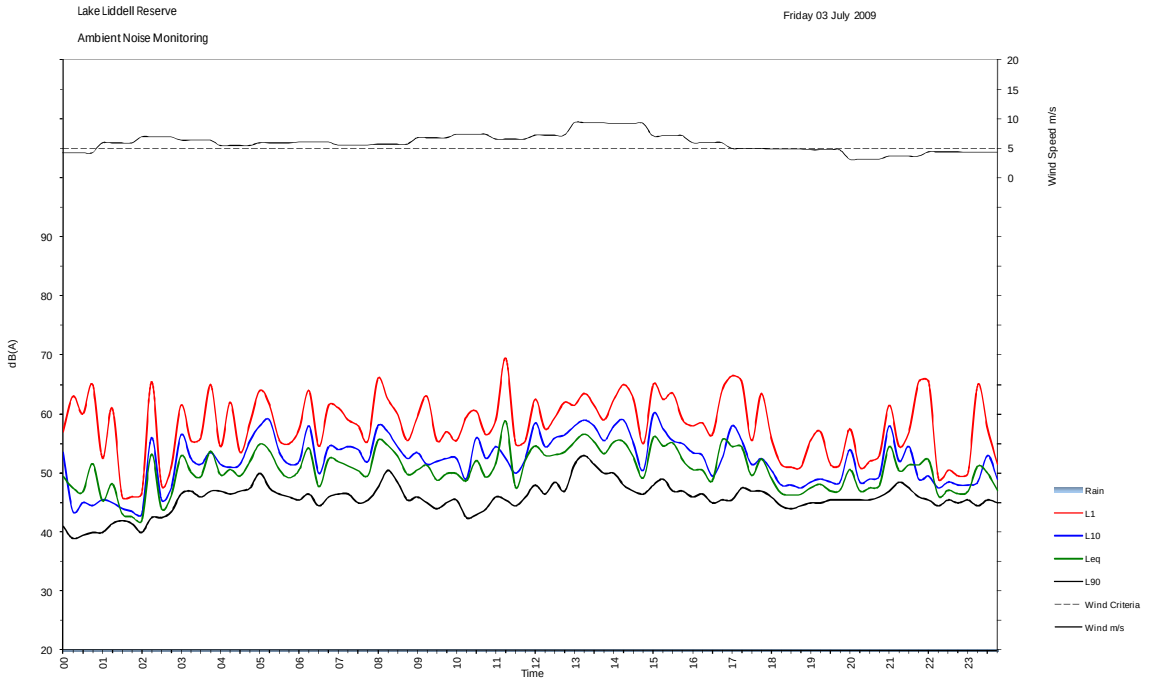
Appendix E Noise Logger Graphs

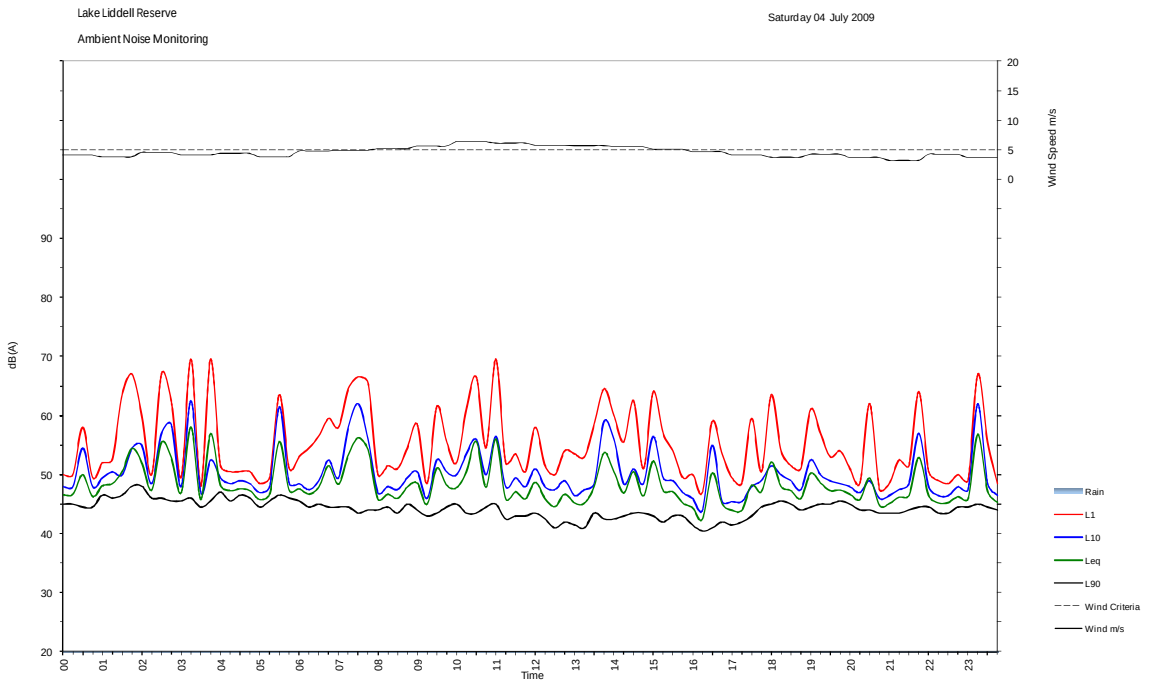
E1 - Location R1 – Lake Liddell

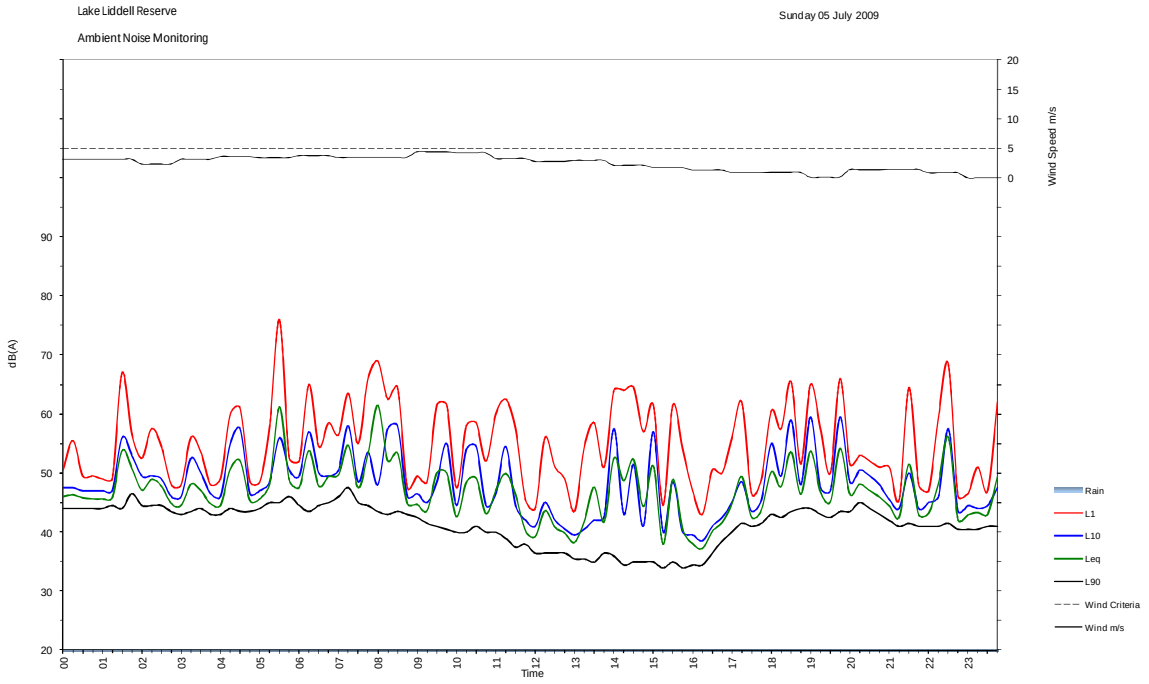


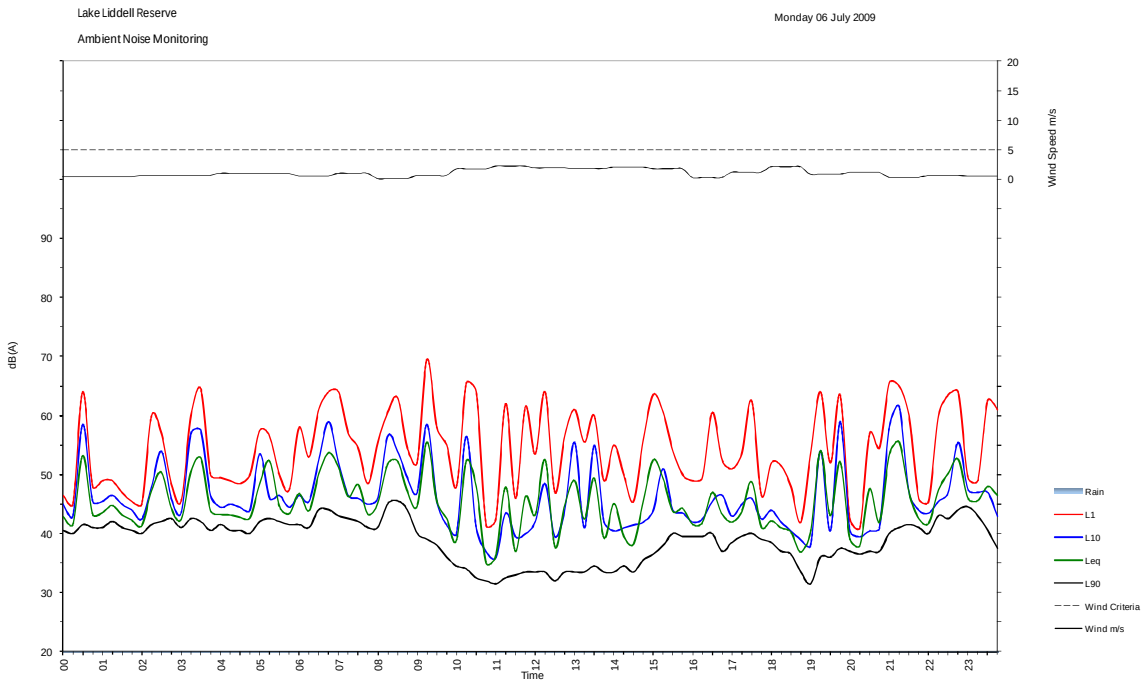


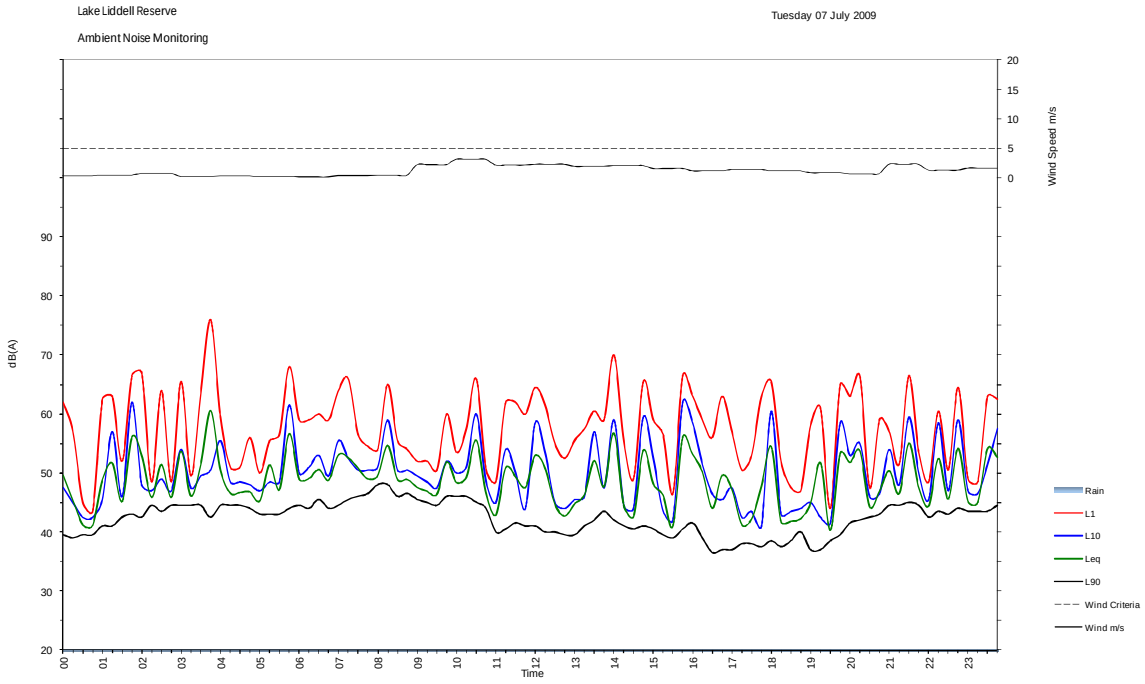

Lake Liddell Reserve
Ambient Noise Monitoring
Thursday 02 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

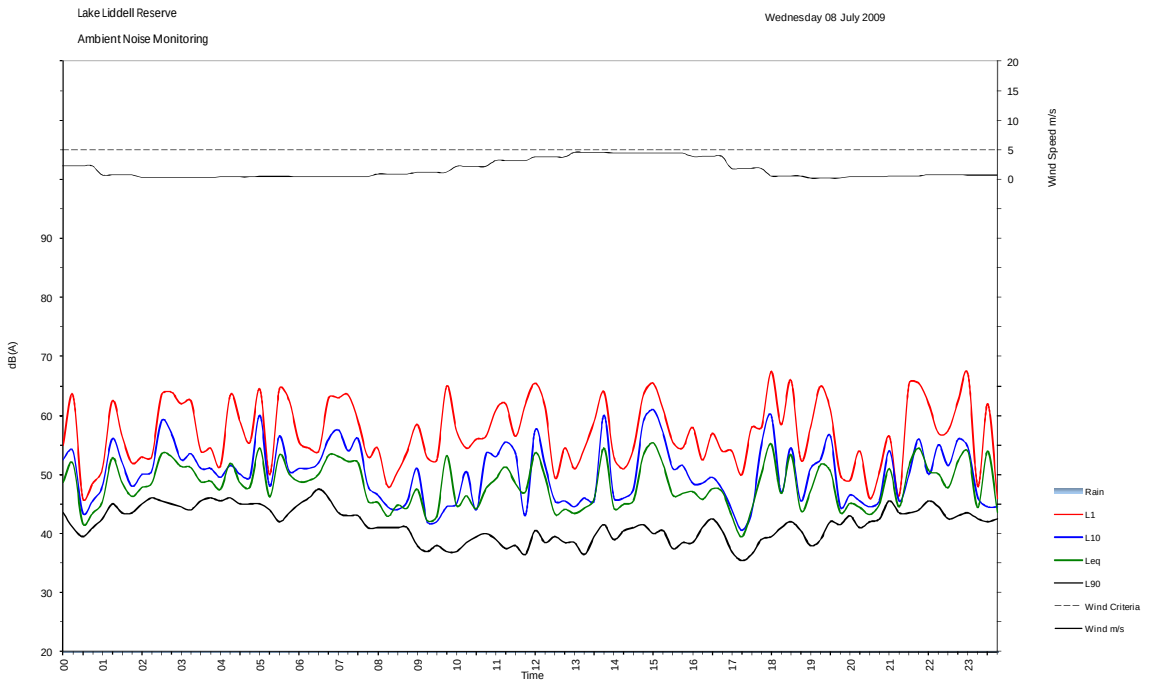

Lake Liddell Reserve
Ambient Noise Monitoring
Friday 03 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

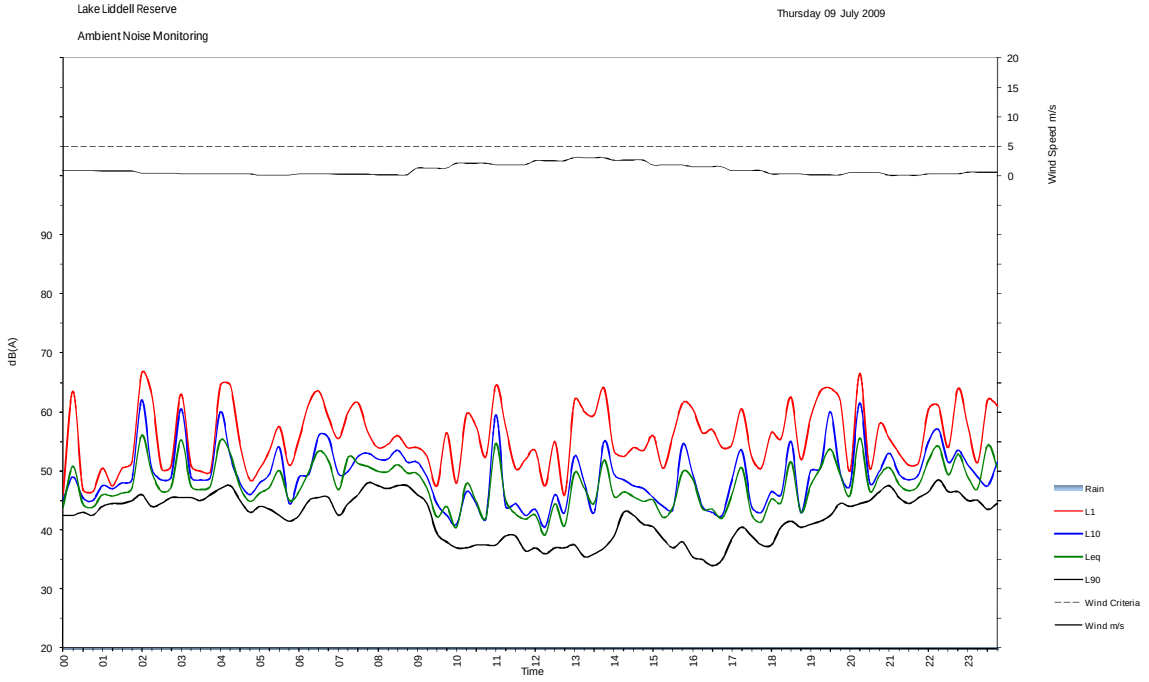

Lake Liddell Reserve
Ambient Noise Monitoring
Saturday 04 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

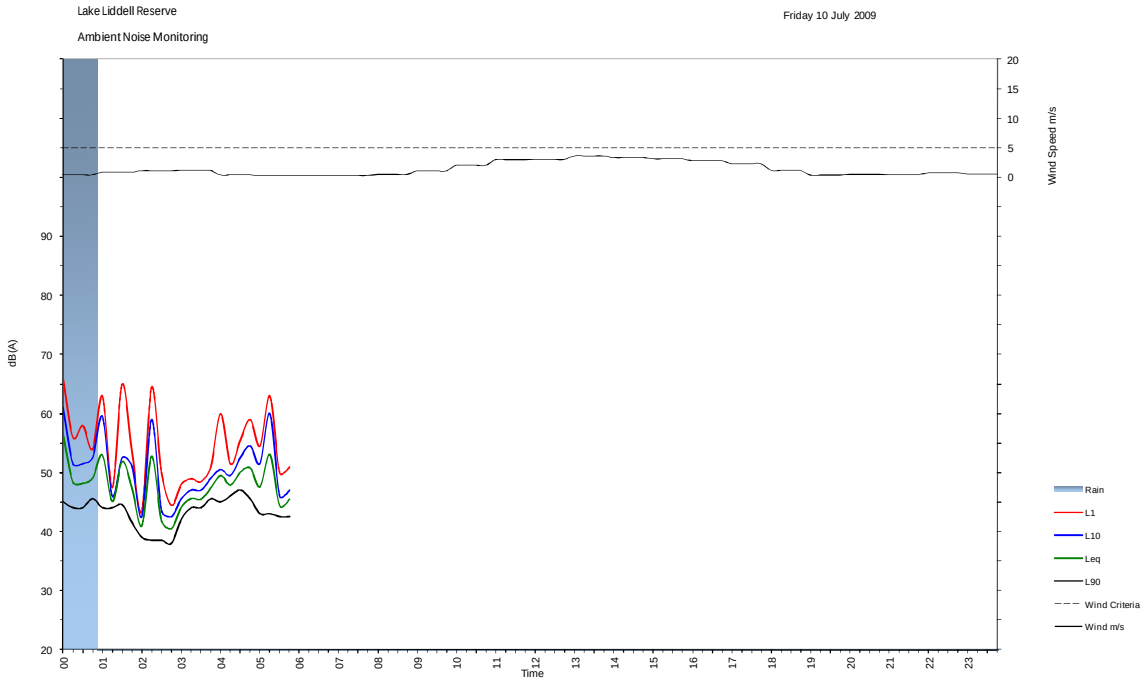

Lake Liddell Reserve
Ambient Noise Monitoring
Sunday 05 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


Lake Liddell Reserve
Ambient Noise Monitoring
Monday 06 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

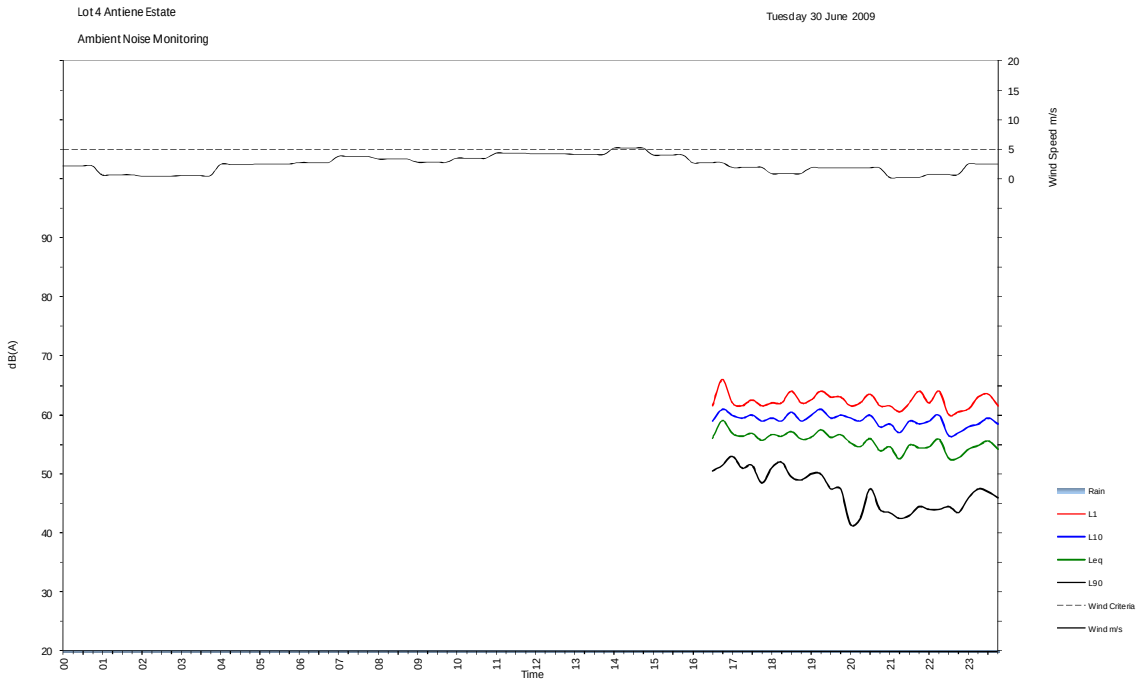

Lake Liddell Reserve
Ambient Noise Monitoring
Tuesday 07 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

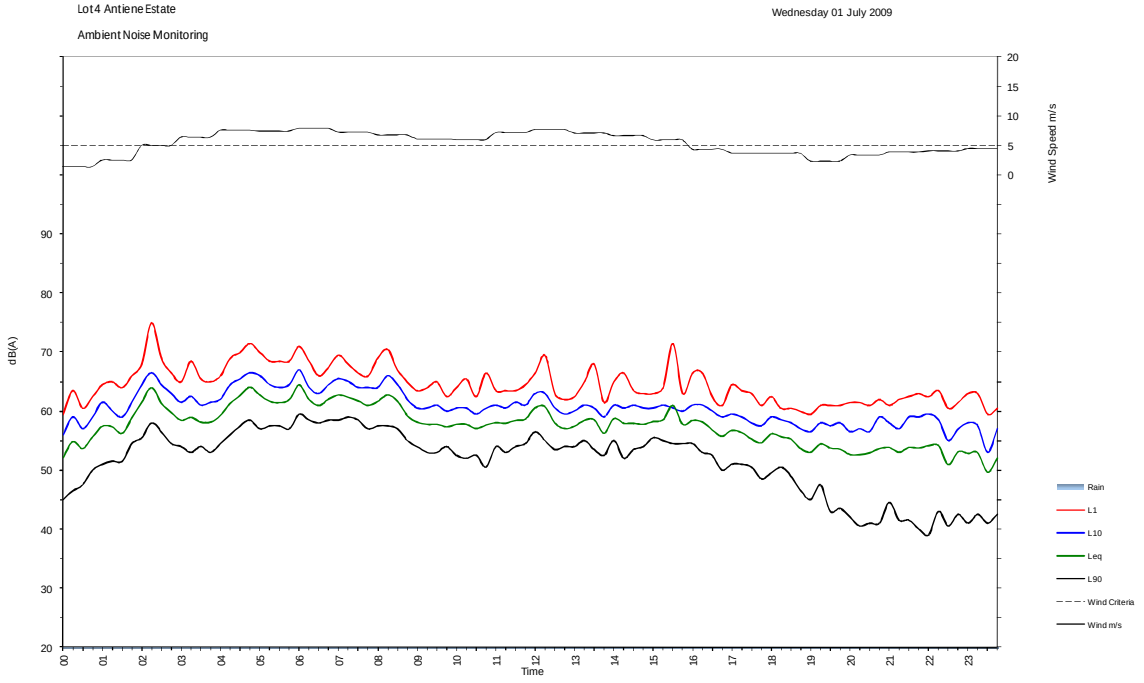

Lake Liddell Reserve
Ambient Noise Monitoring
Wednesday 08 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

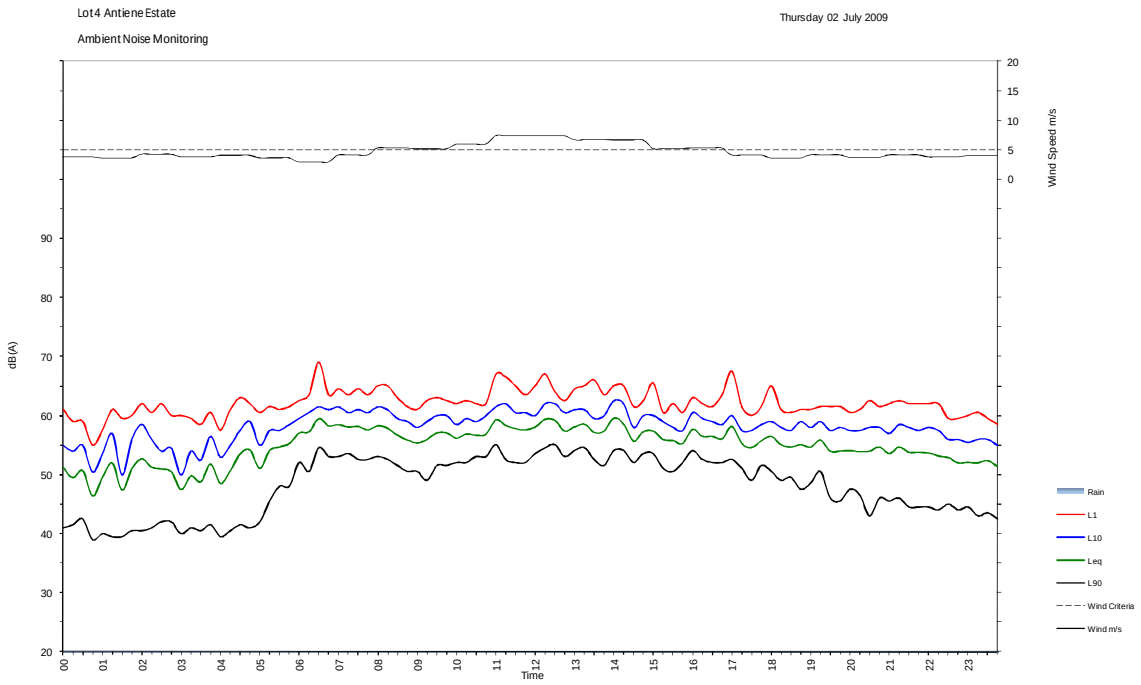

Lake Liddell Reserve
Ambient Noise Monitoring
Thursday 09 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

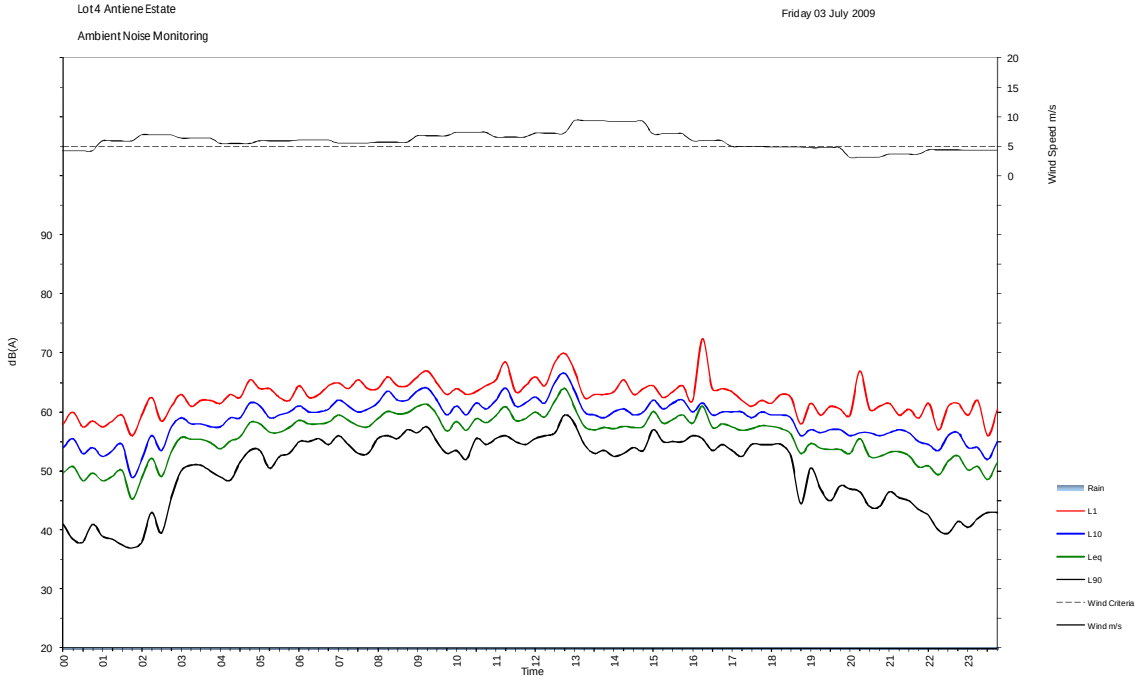

Lake Liddell Reserve
Ambient Noise Monitoring
Friday 10 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

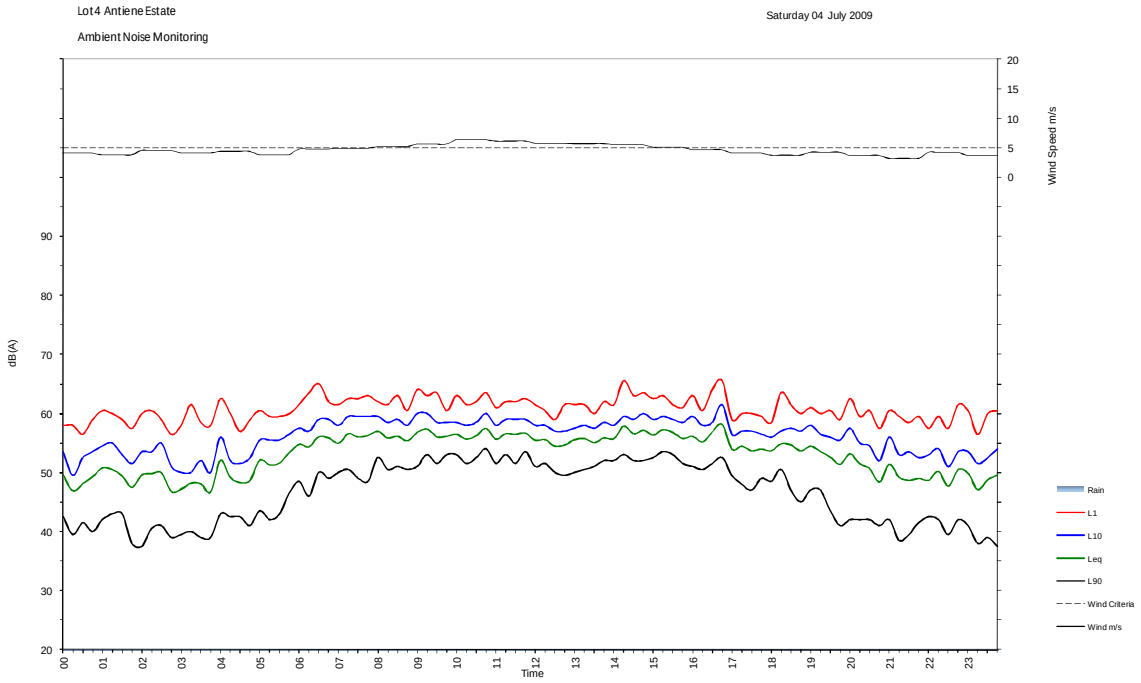
E2 - Location R2 – Lot 4 Antiene Estate

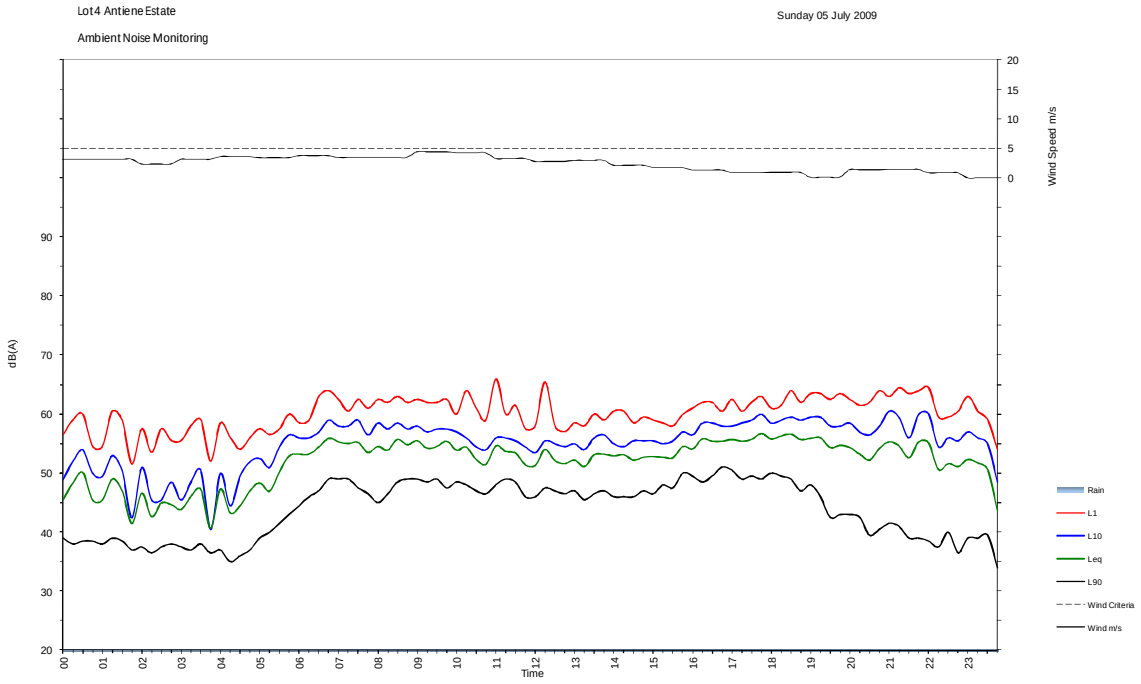


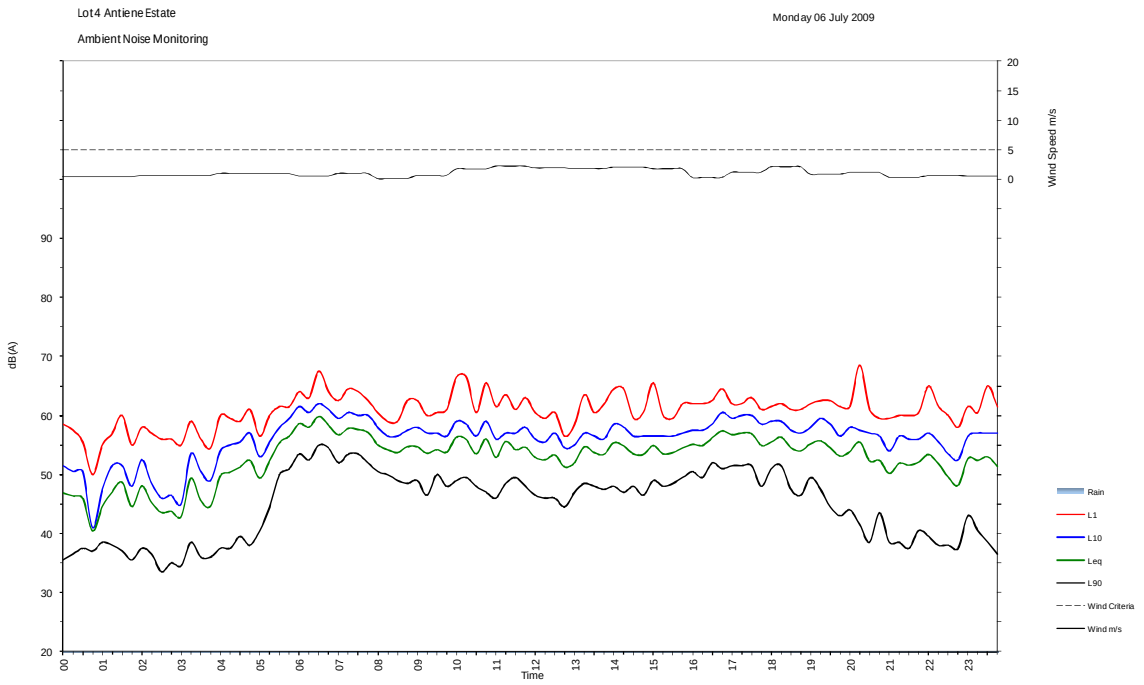


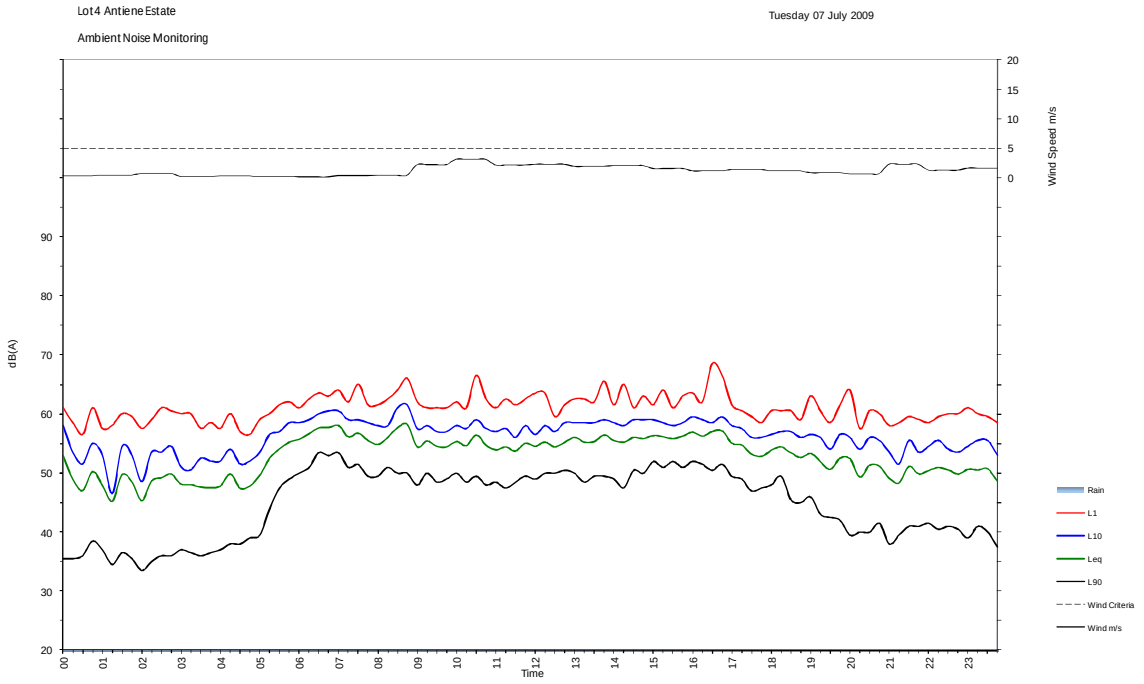

Lot 4 Antiene Estate
Ambient Noise Monitoring
Thursday 02 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

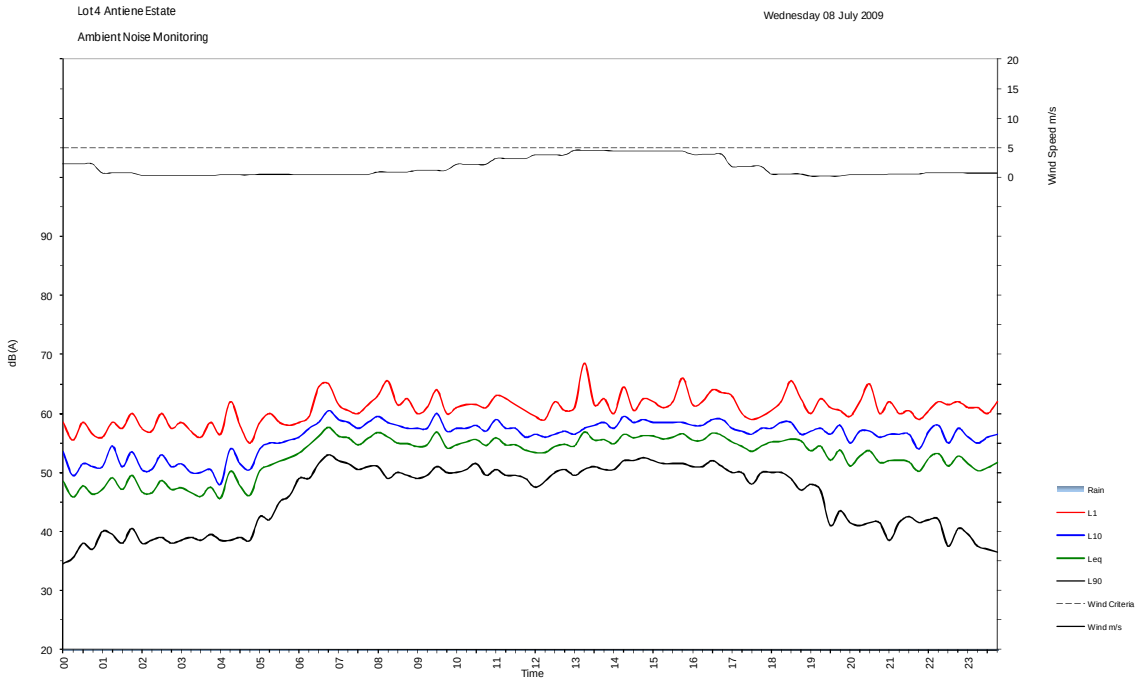

Lot 4 Antiene Estate
Ambient Noise Monitoring
Friday 03 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

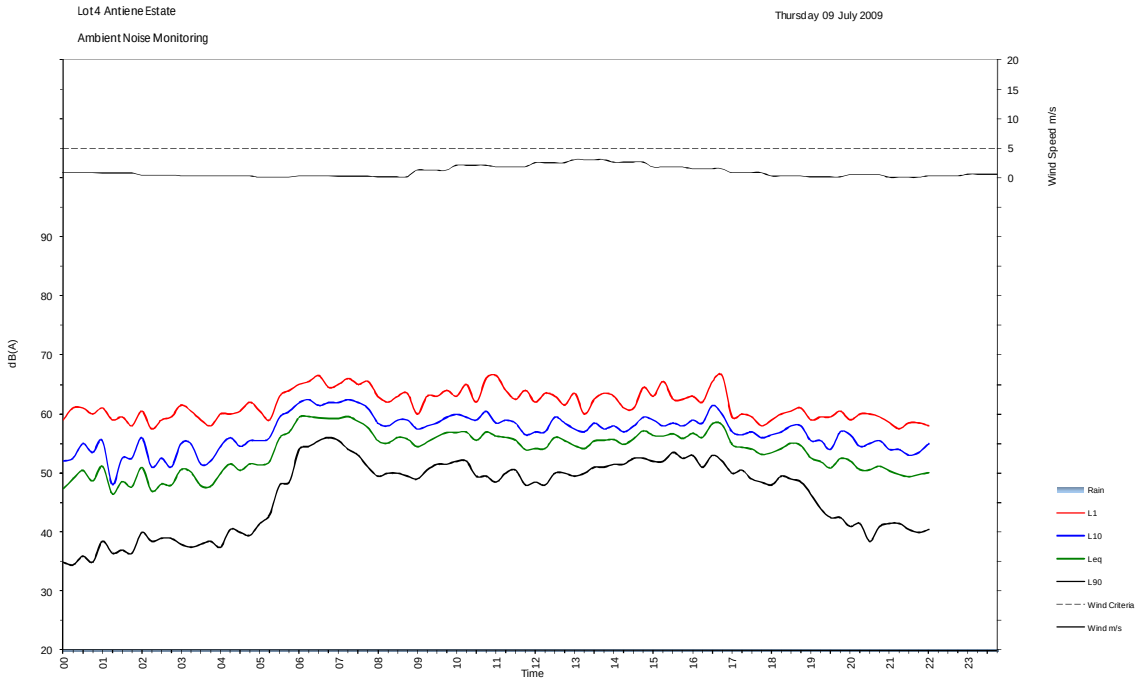

Lot 4 Antiene Estate
Ambient Noise Monitoring
Saturday 04 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


Lot 4 Antiene Estate
Ambient Noise Monitoring
Sunday 05 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

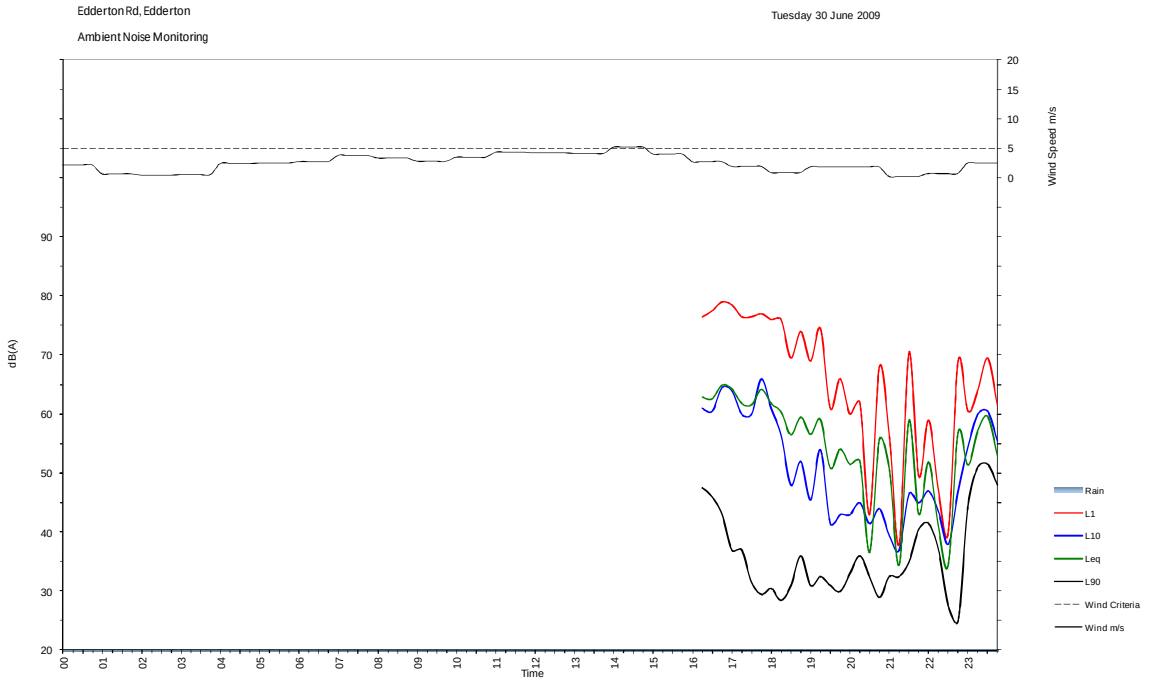

Lot 4 Antiene Estate
Ambient Noise Monitoring
Monday 06 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

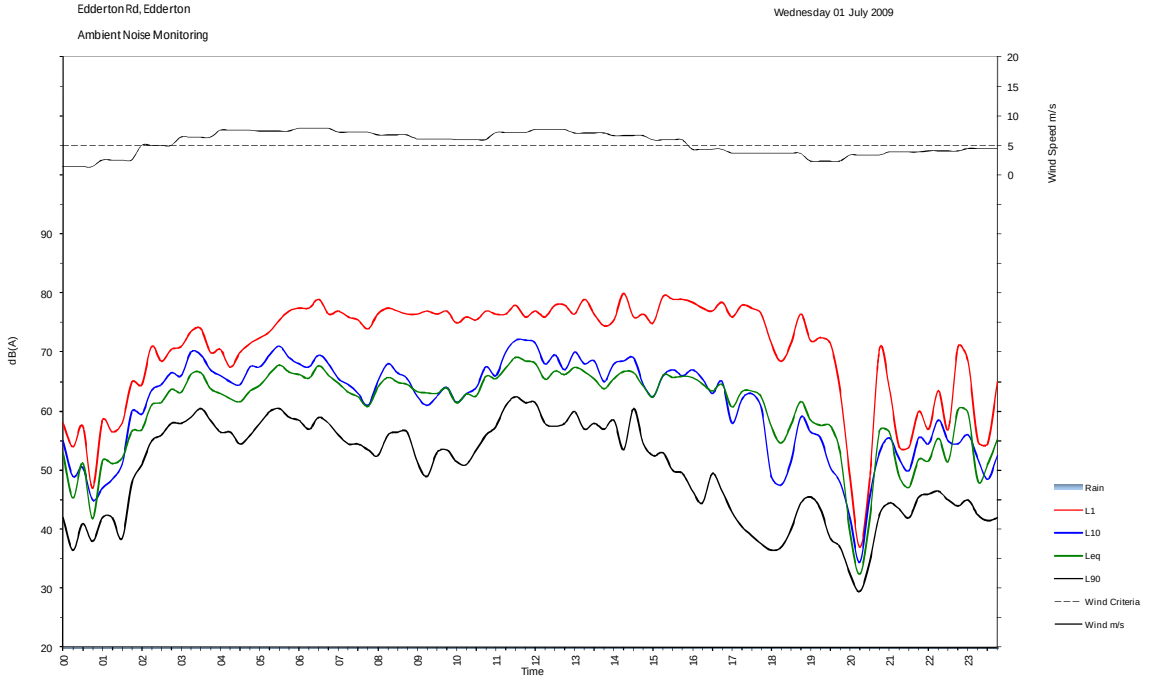

Lot 4 Antiene Estate
Ambient Noise Monitoring
Tuesday 07 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

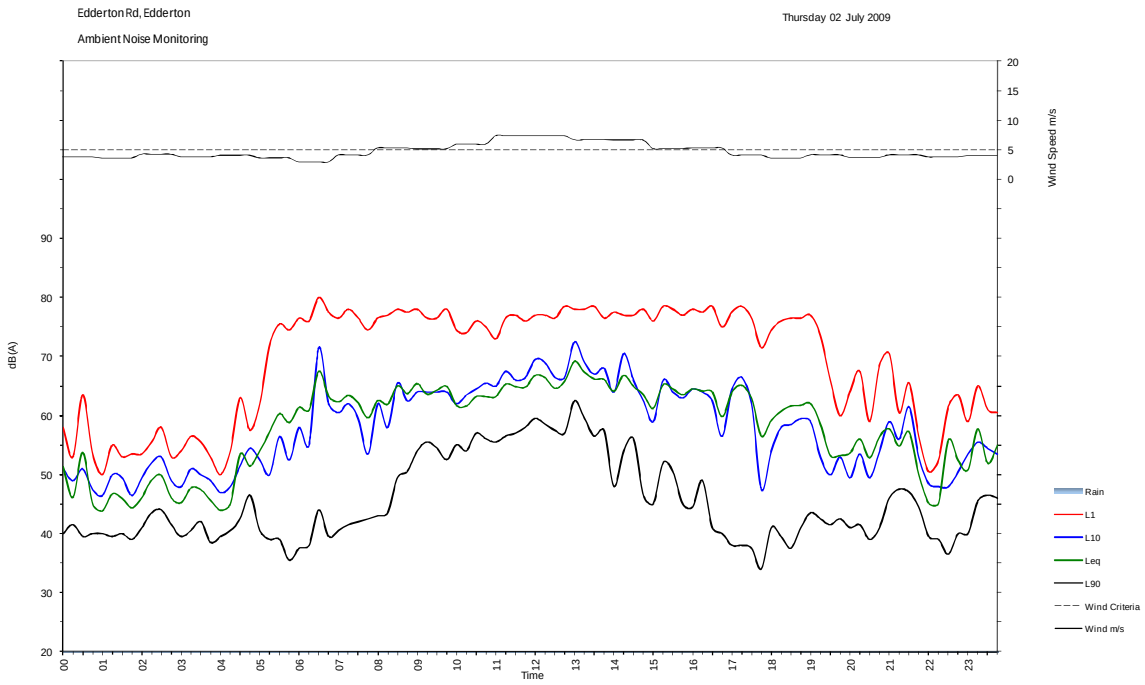

Lot 4 Antiene Estate
Ambient Noise Monitoring
Wednesday 08 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

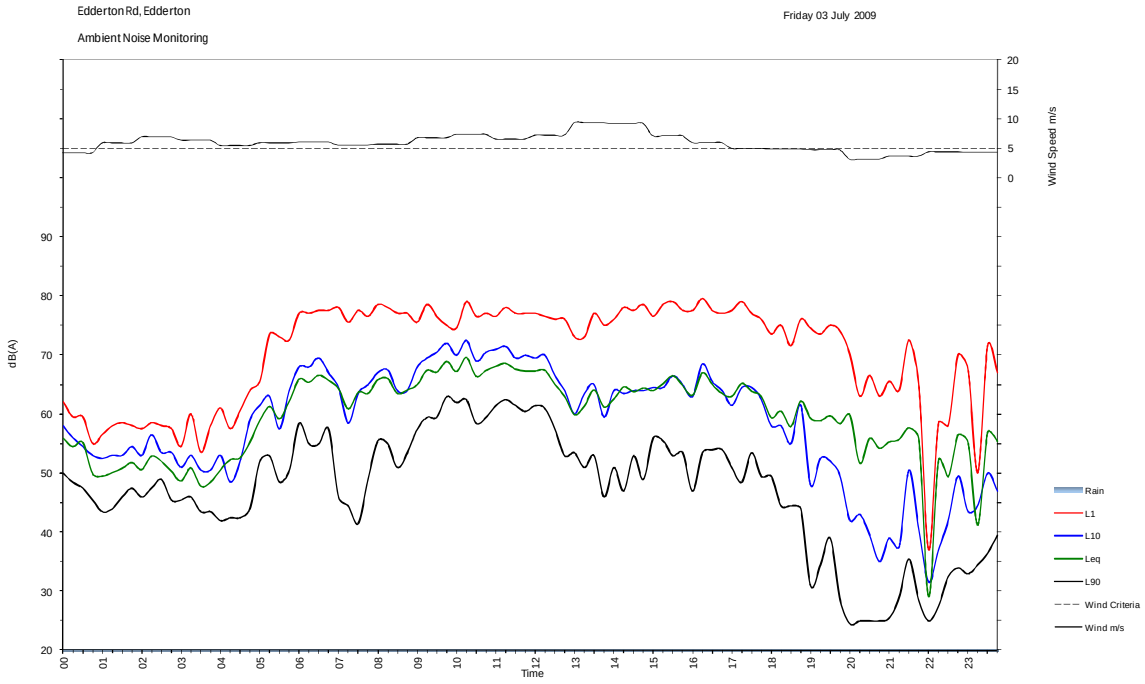

Lot 4 Antiene Estate
Ambient Noise Monitoring
Thursday 09 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

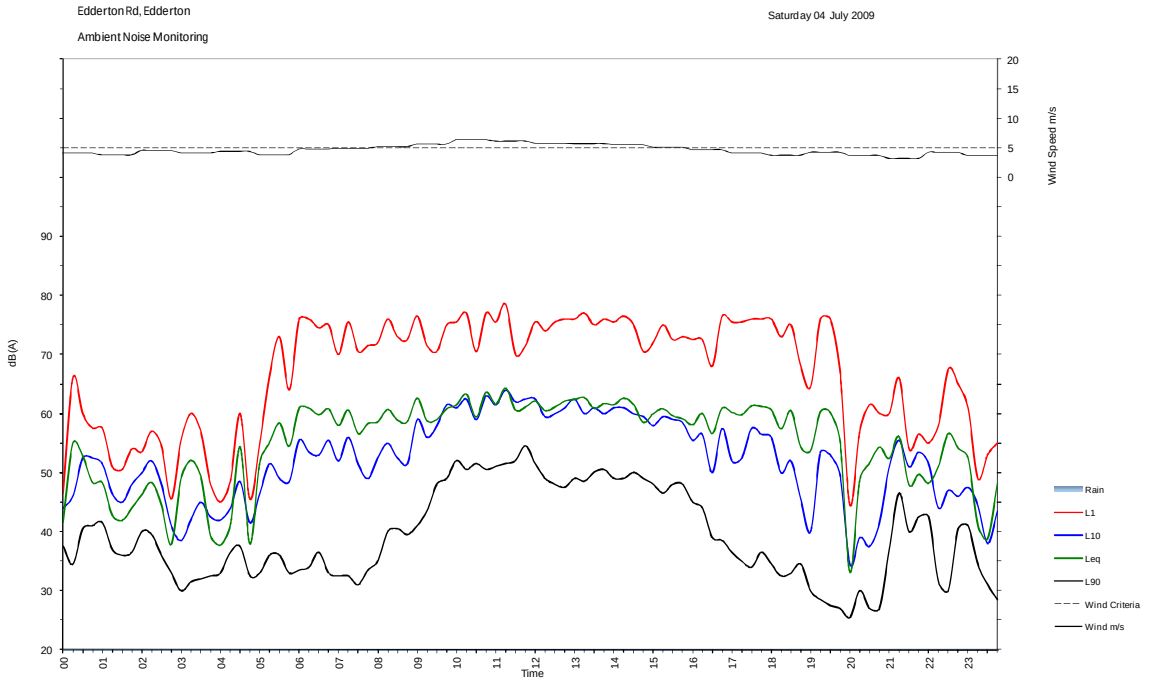
E3 - Location R3 – Edderton Road

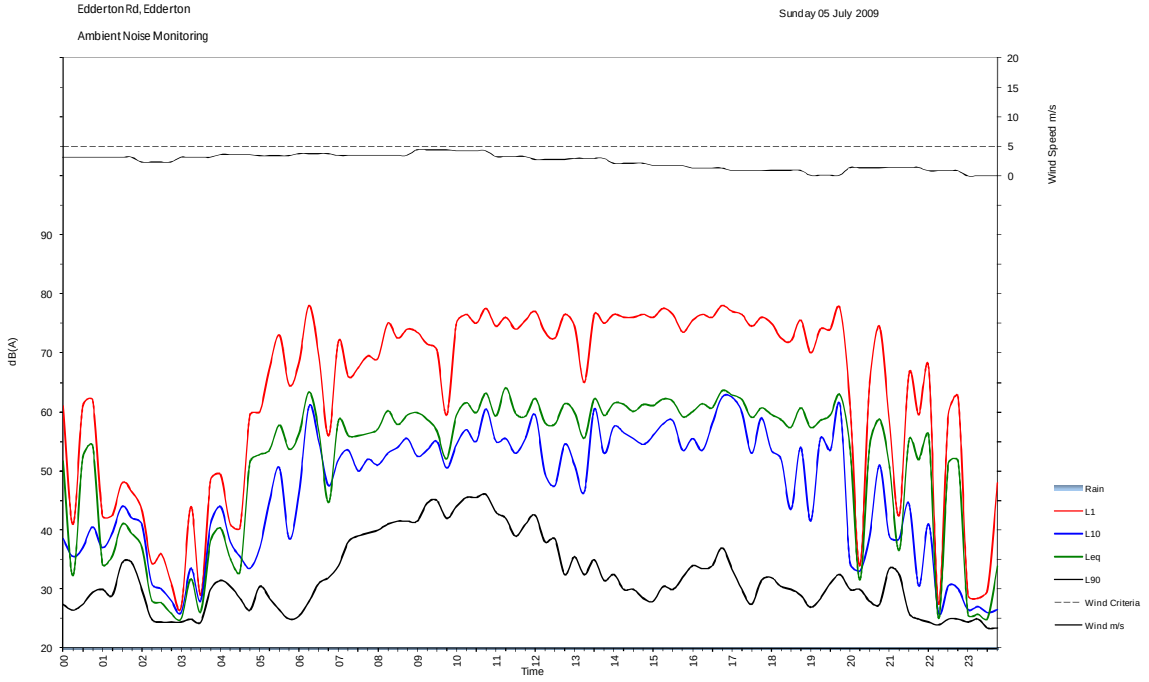


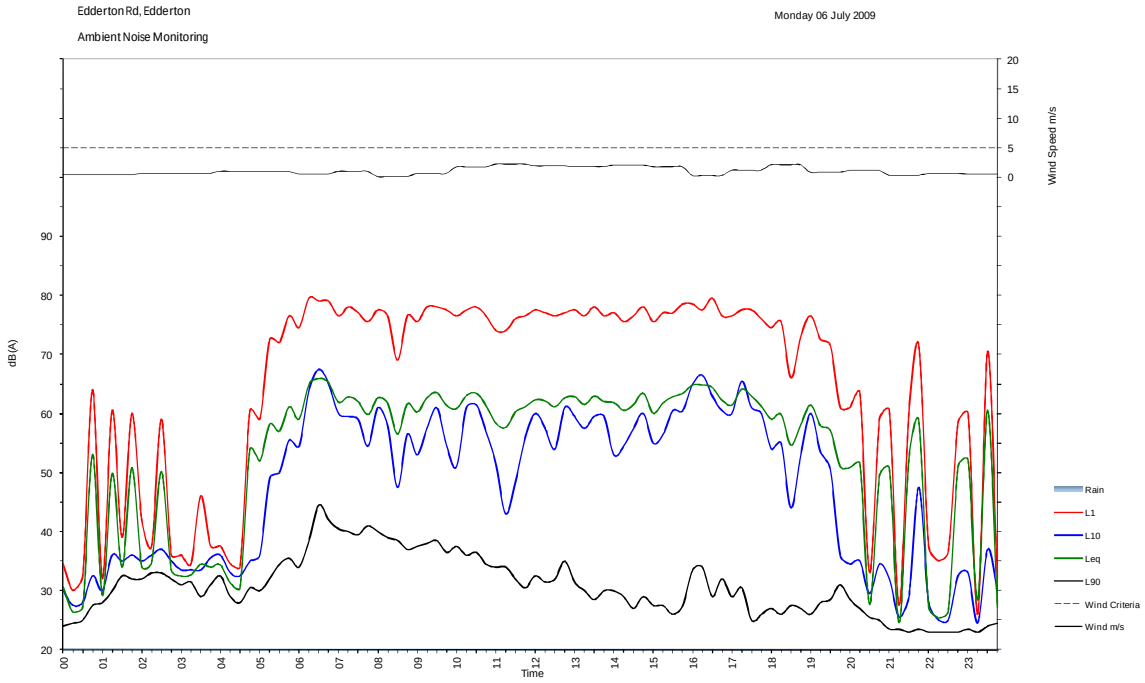


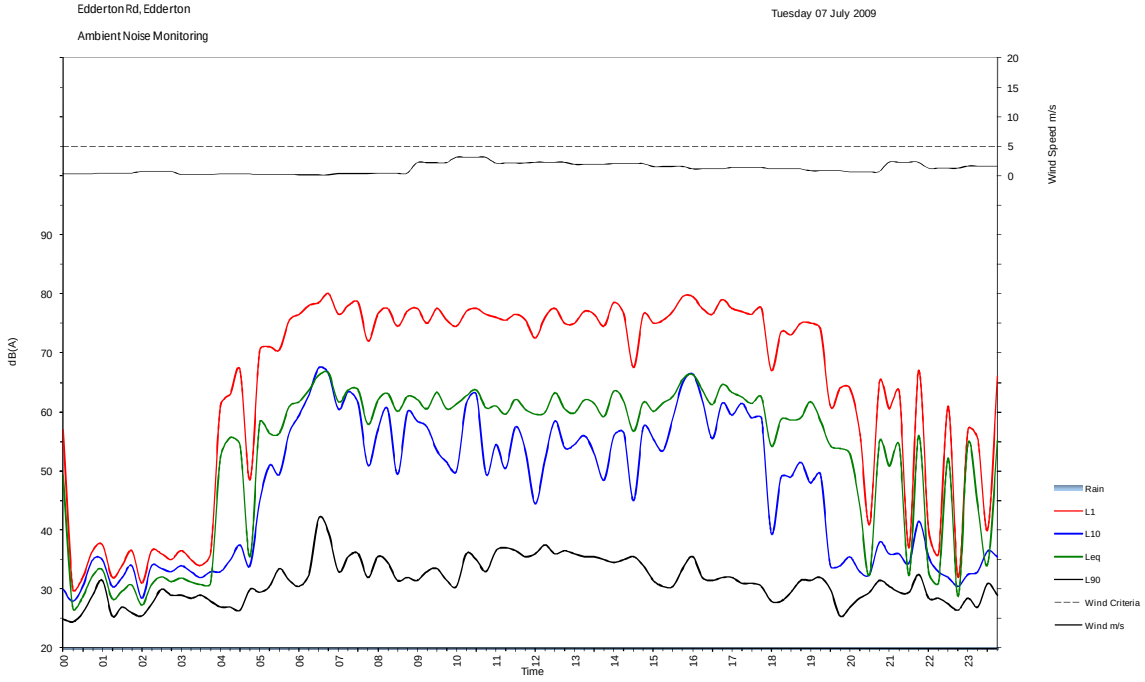

Edderton Rd, Edderton
Ambient Noise Monitoring
Thursday 02 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

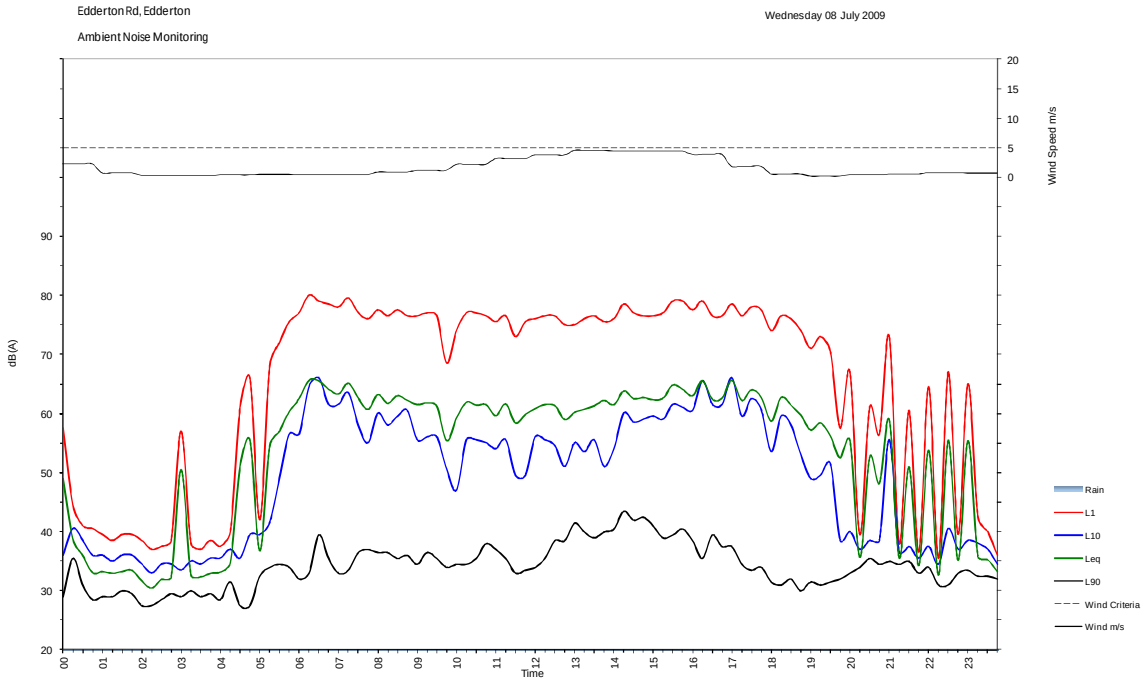

Edderton Rd, Edderton
Ambient Noise Monitoring
Friday 03 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

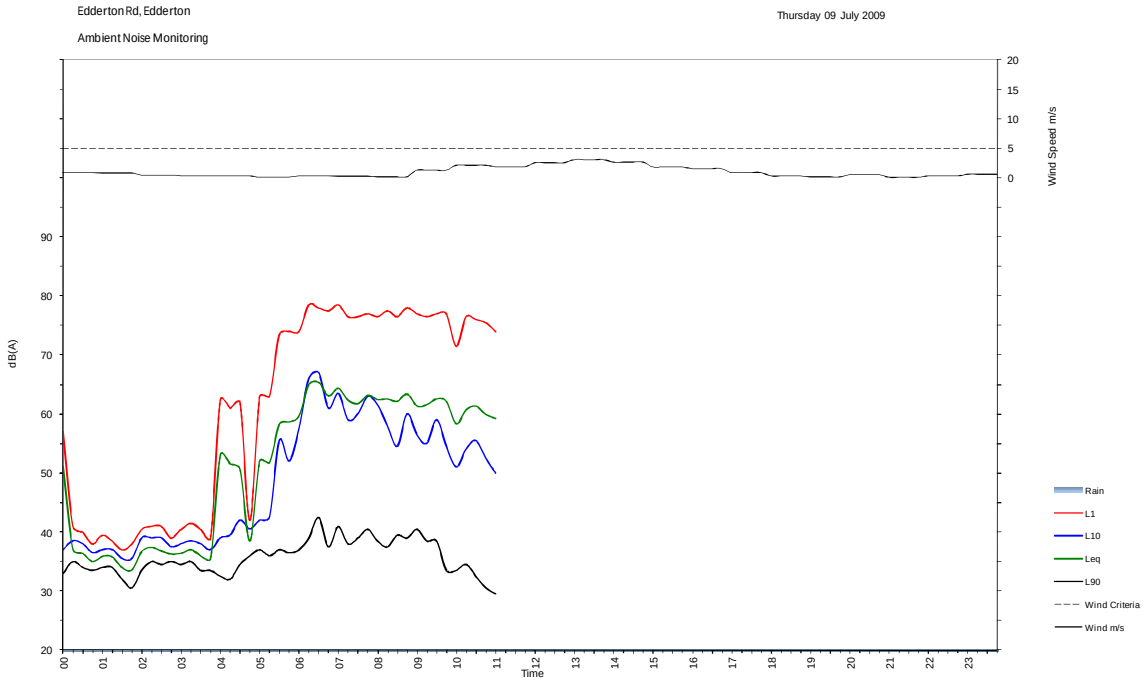

Edderton Rd, Edderton
Ambient Noise Monitoring
Saturday 04 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


Edderton Rd, Edderton
Ambient Noise Monitoring
Sunday 05 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

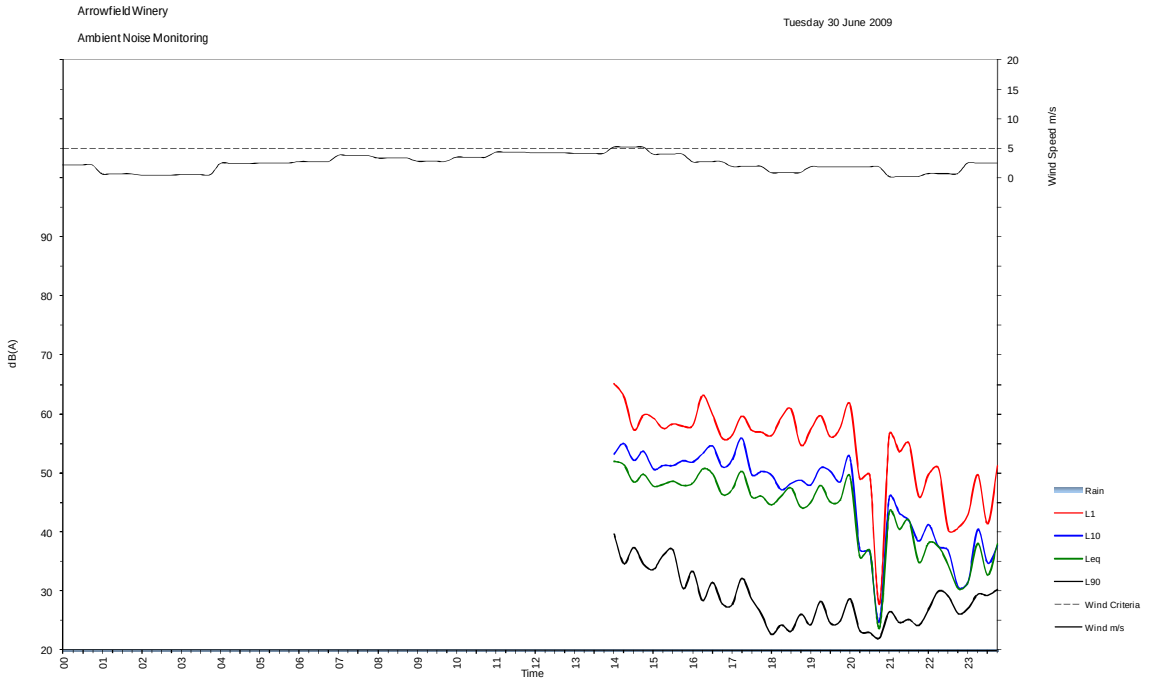

Edderton Rd, Edderton
Ambient Noise Monitoring
Monday 06 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

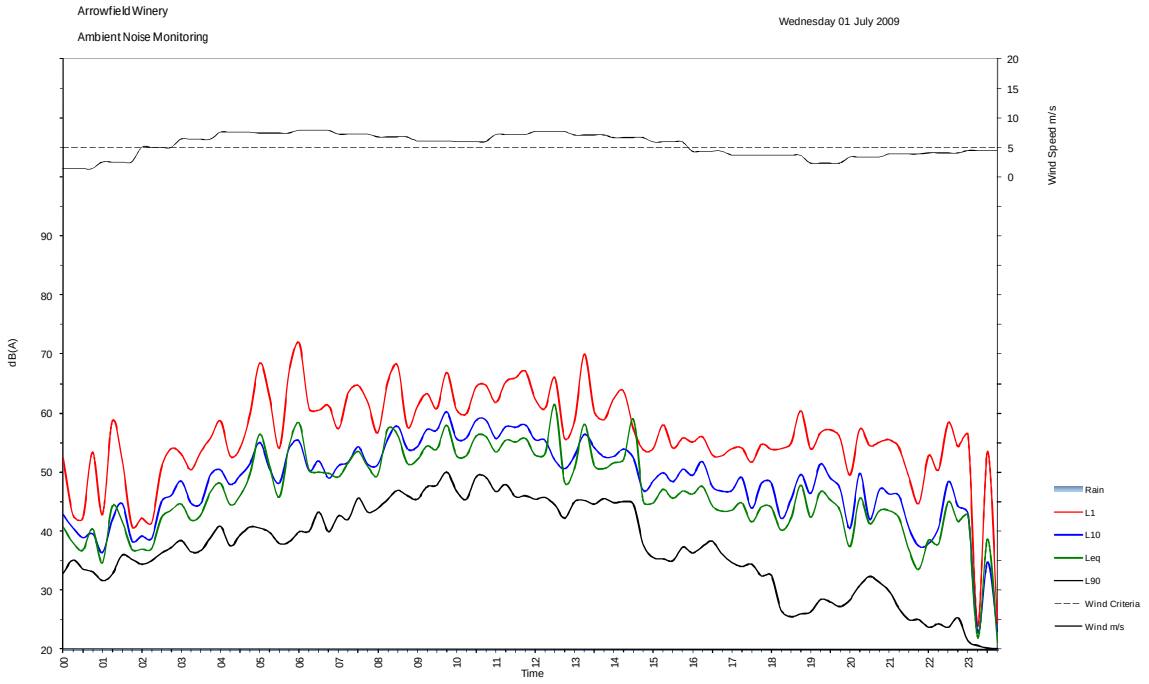

Edderton Rd, Edderton
Ambient Noise Monitoring
Tuesday 07 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

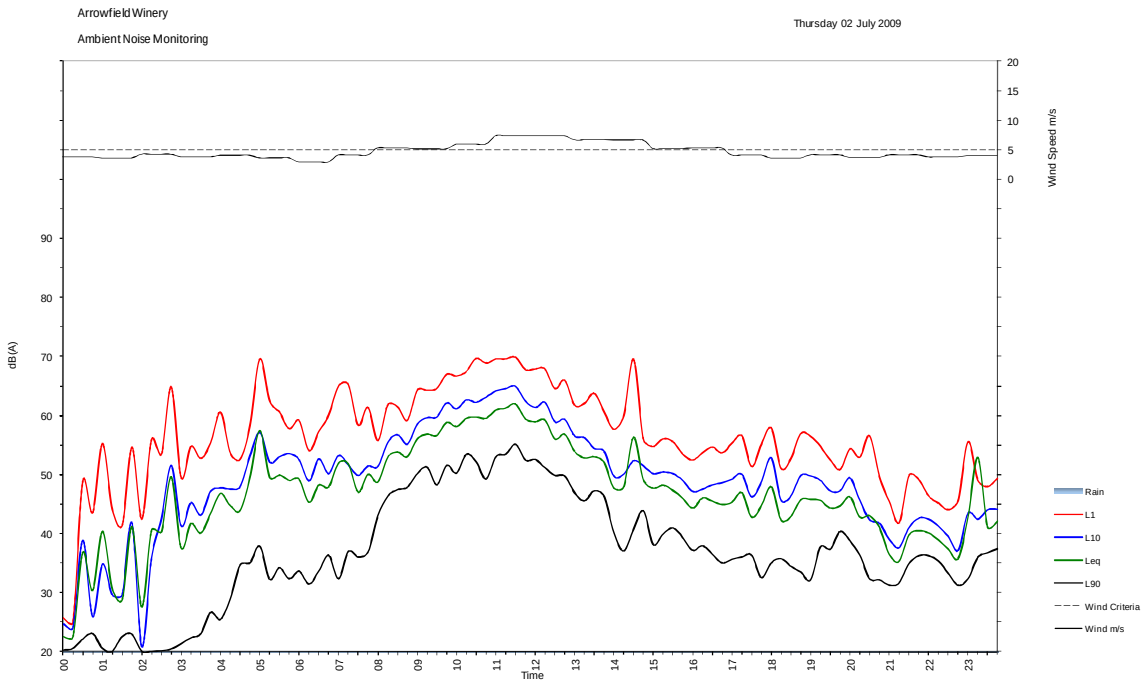

Edderton Rd, Edderton
Ambient Noise Monitoring
Wednesday 08 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

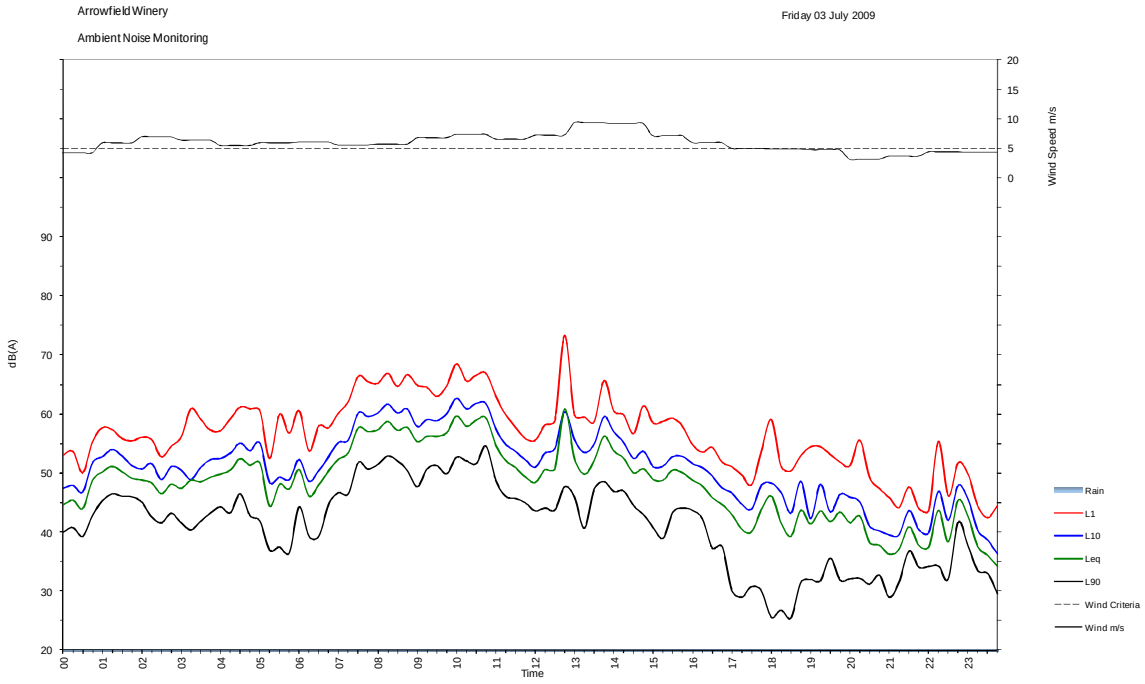

Edderton Rd, Edderton
Ambient Noise Monitoring
Thursday 09 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

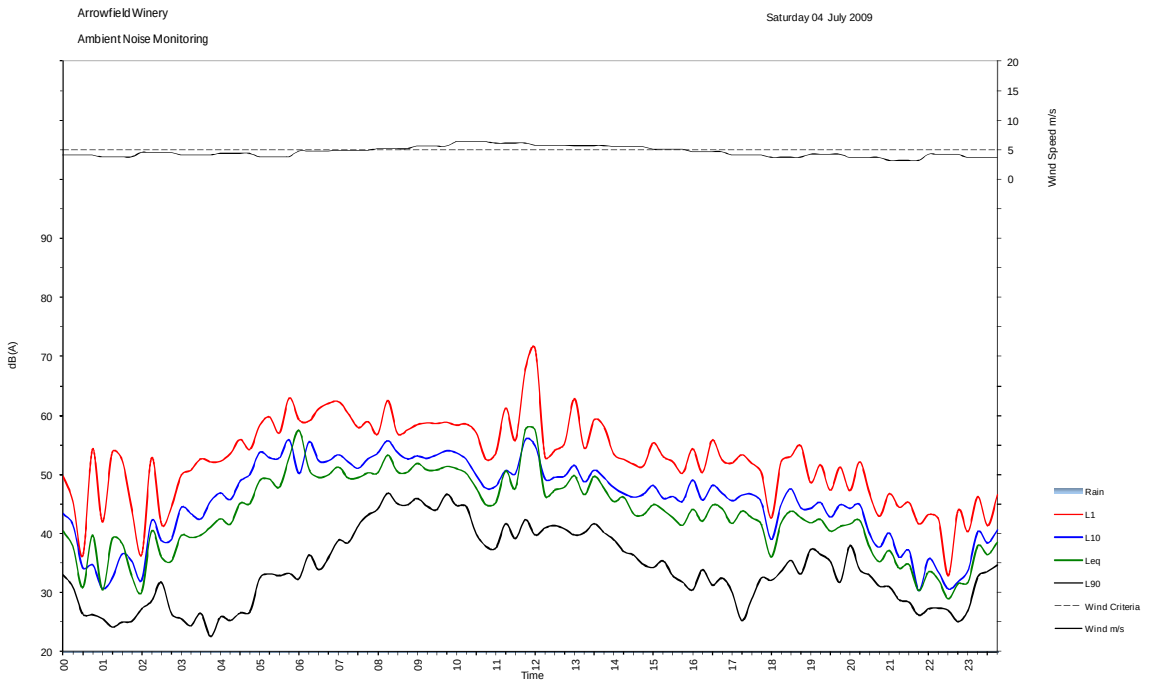
E4 - Location R4 – Arrowfield Winery

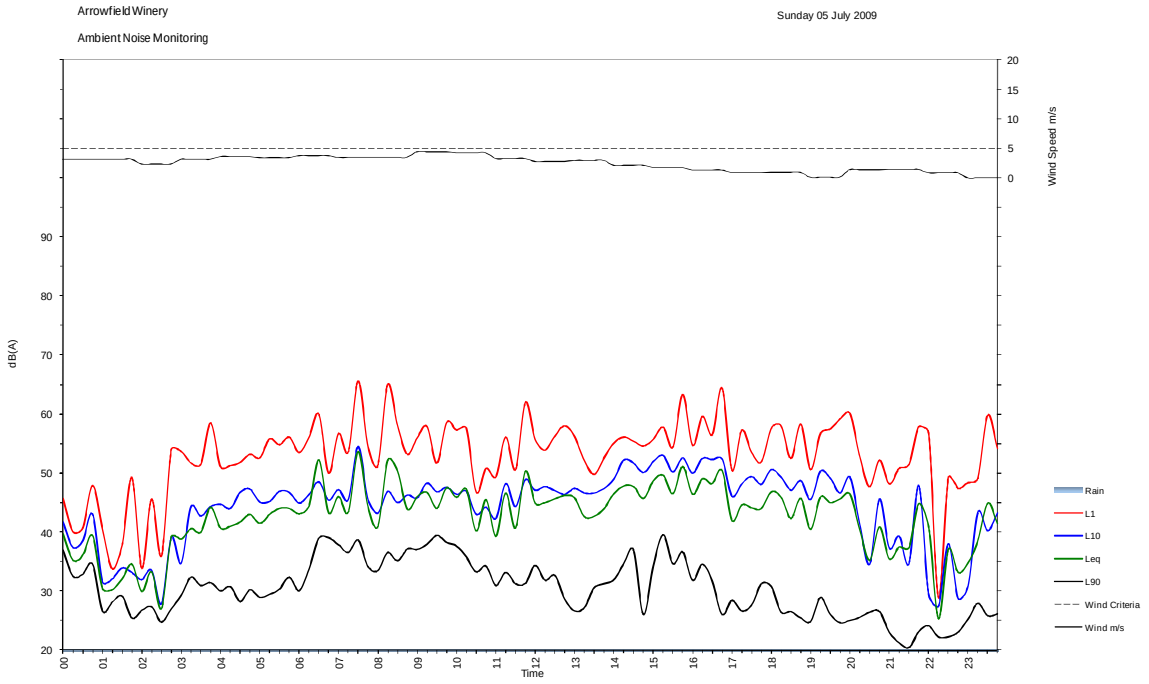


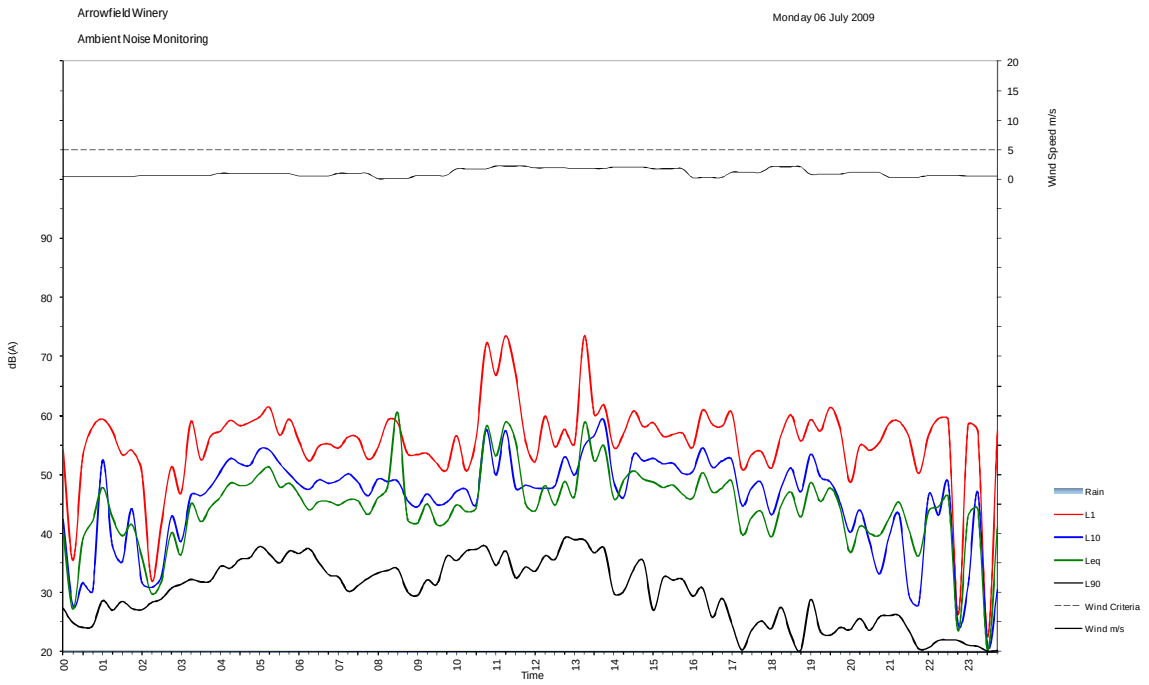


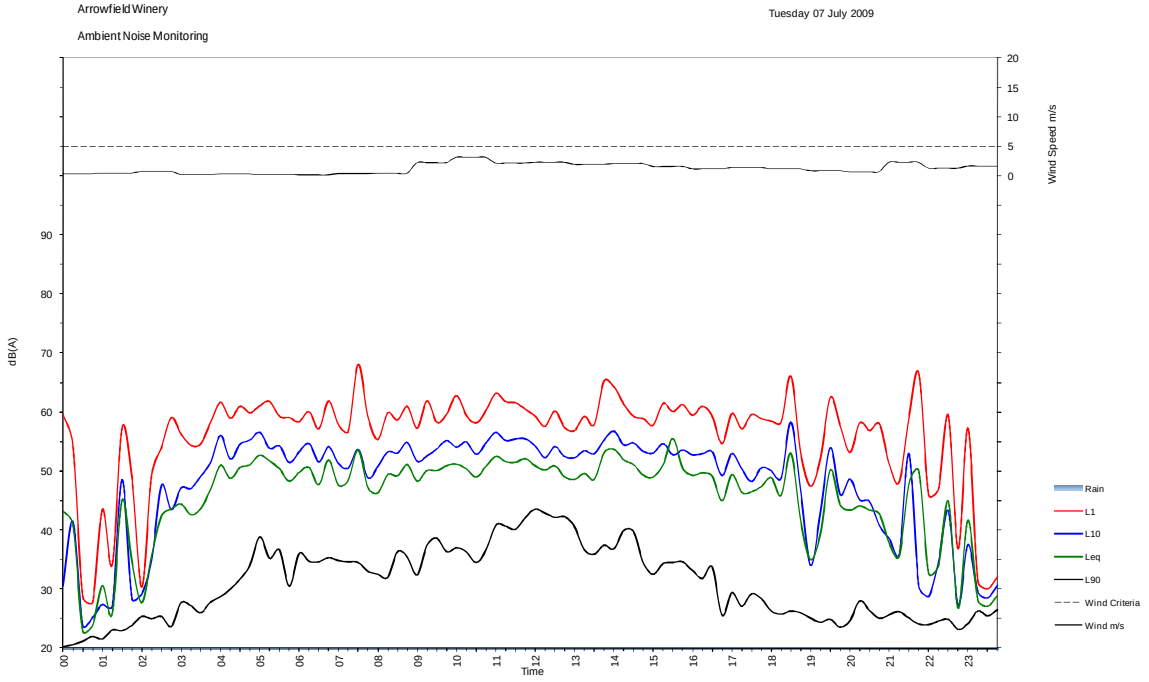

Arrowfield Winery
Ambient Noise Monitoring
Thursday 02 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

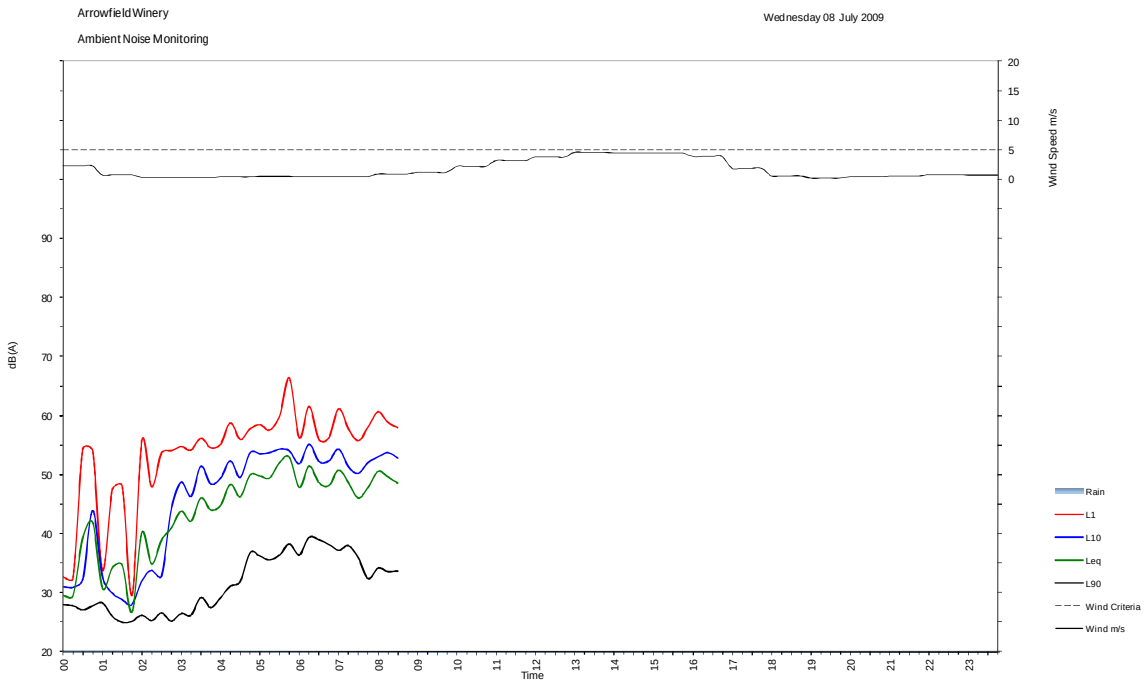

Arrowfield Winery
Ambient Noise Monitoring
Friday 03 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


Arrowfield Winery
Ambient Noise Monitoring
Saturday 04 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

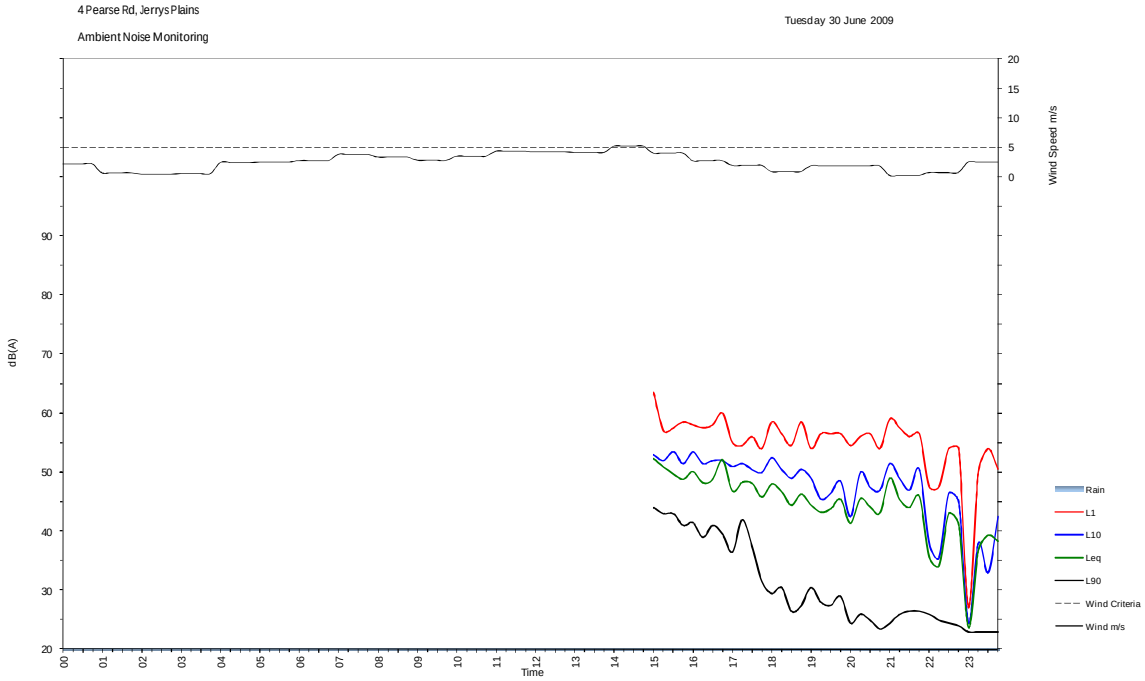

Arrowfield Winery
Ambient Noise Monitoring
Sunday 05 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

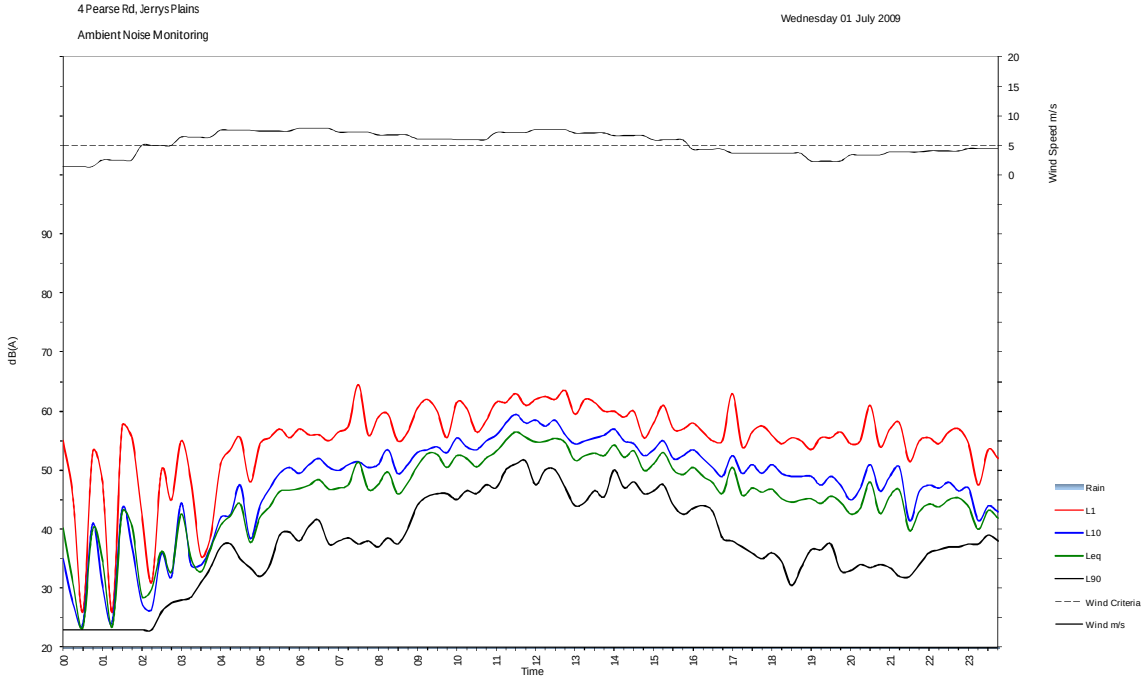

Arrowfield Winery
Ambient Noise Monitoring
Monday 06 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

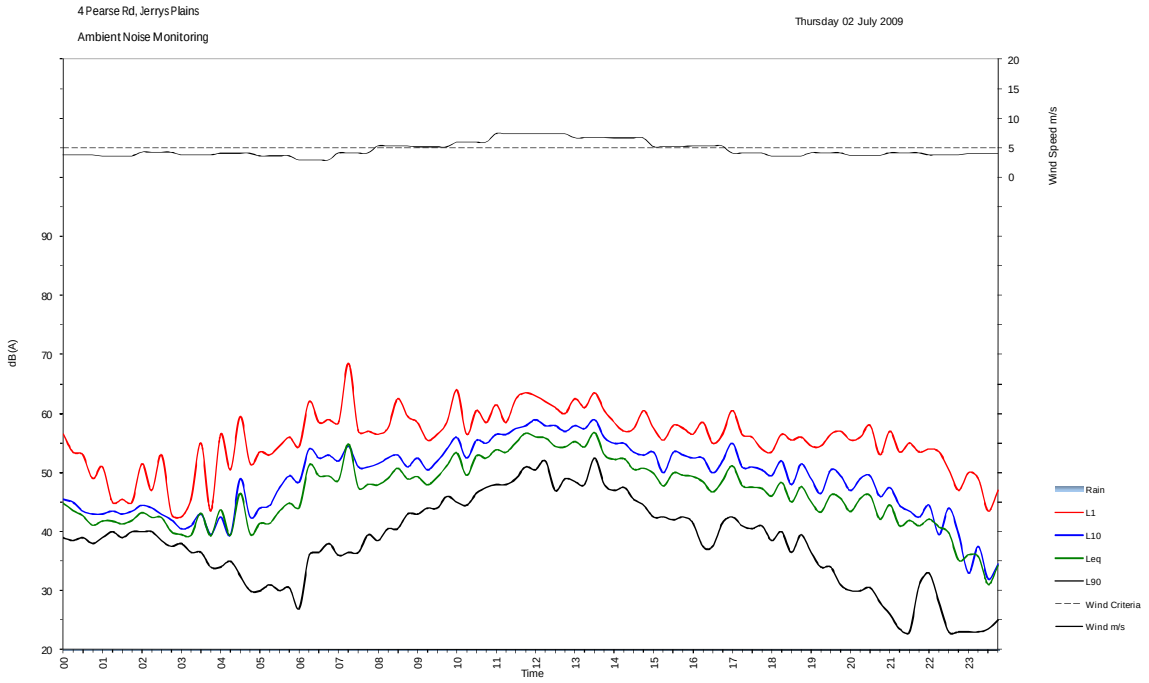

Arrowfield Winery
Ambient Noise Monitoring
Tuesday 07 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

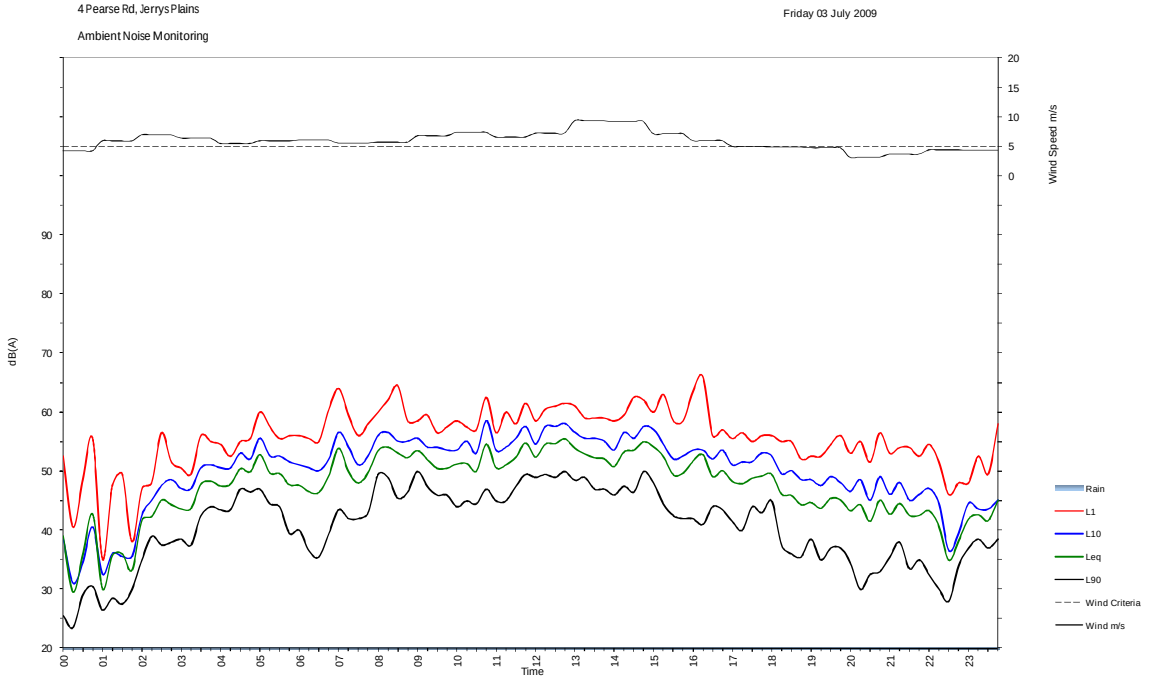

Arrowfield Winery
Ambient Noise Monitoring
Wednesday 08 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

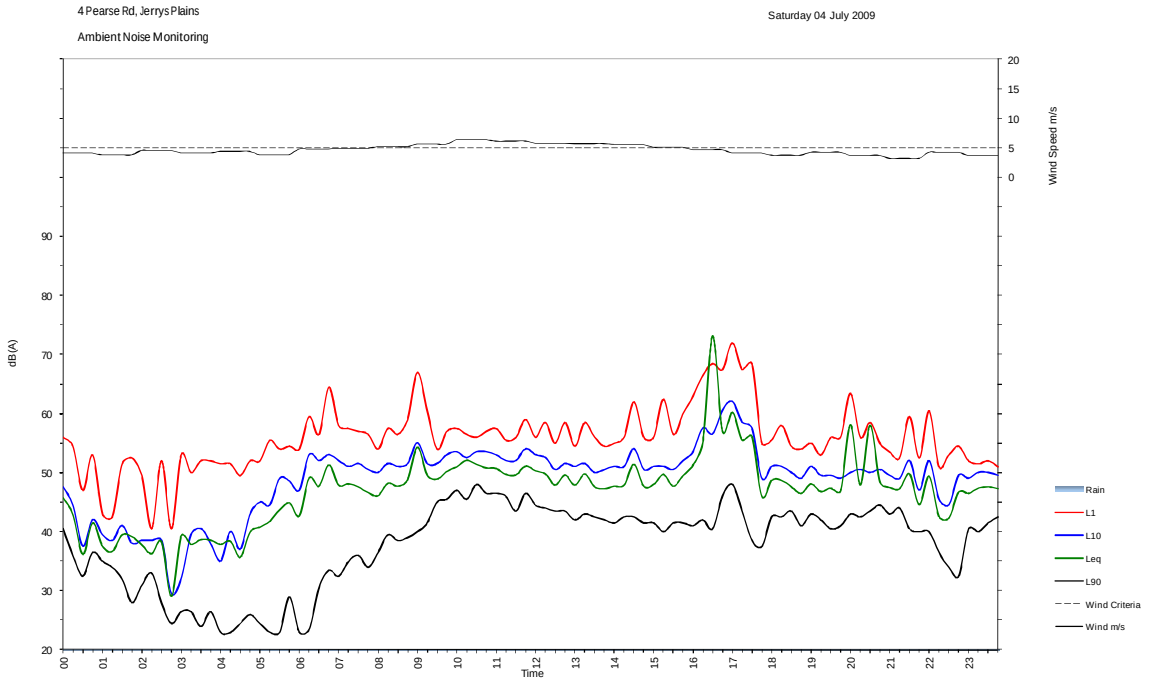
E5 - Location R5 – 4 Pearse Road, Jerrys Plains

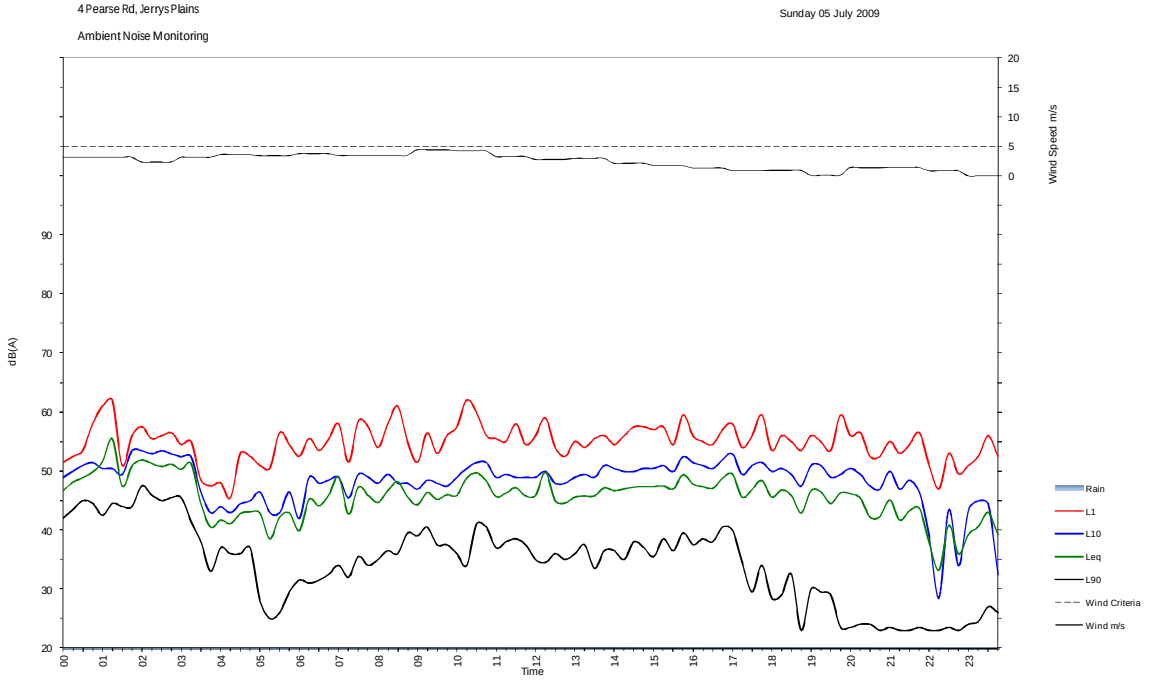


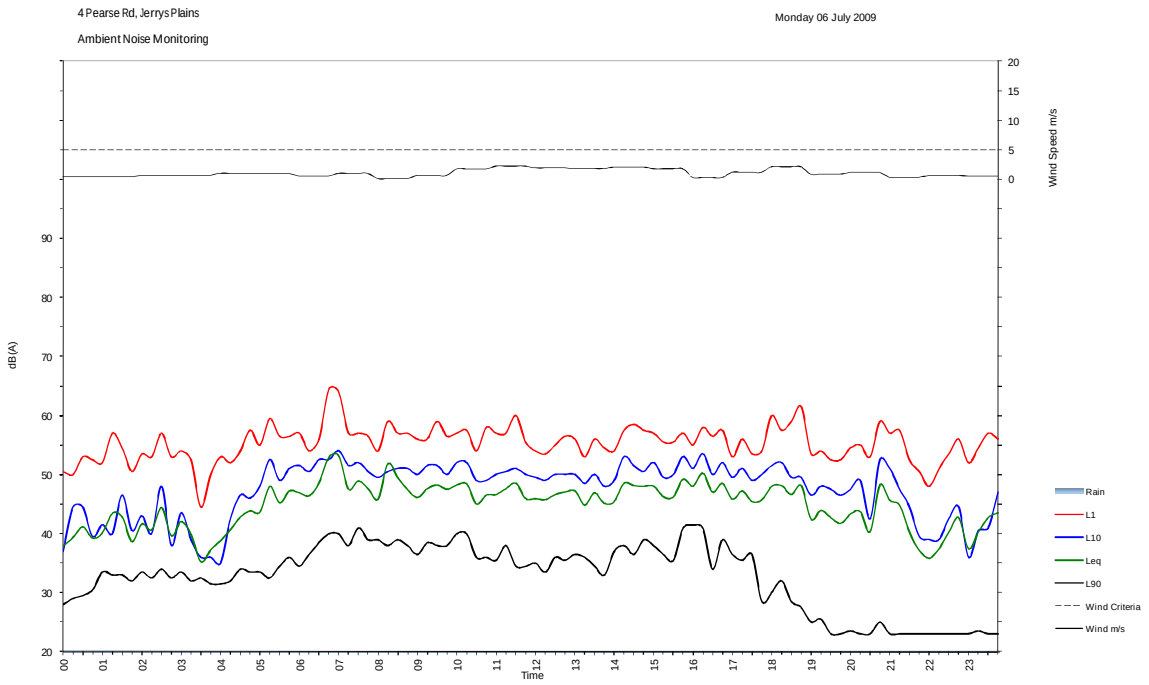


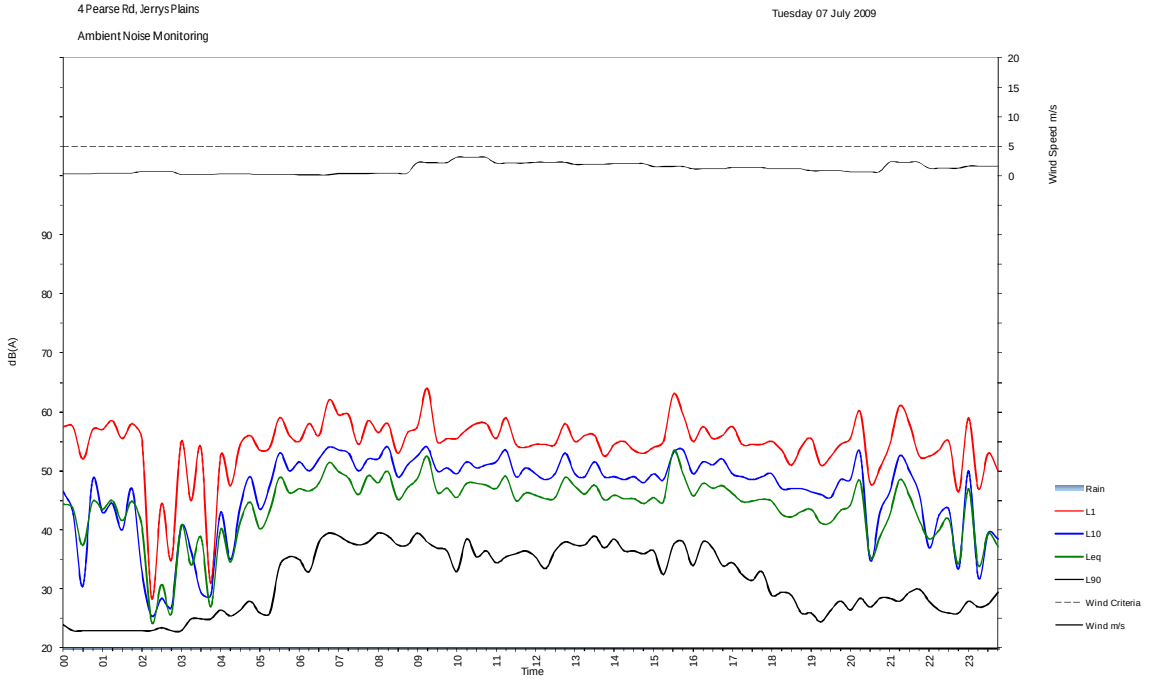

4 Pearse Rd, Jerrys Plains
Ambient Noise Monitoring
Thursday 02 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

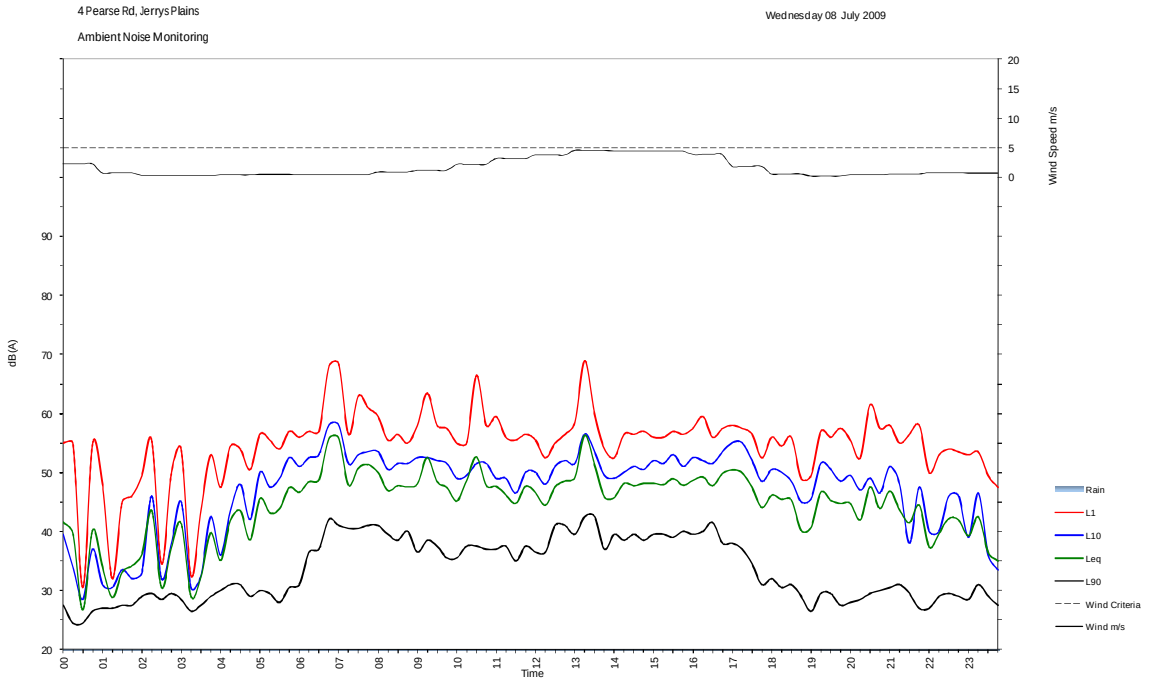

4 Pearse Rd, Jerrys Plains
Ambient Noise Monitoring
Friday 03 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

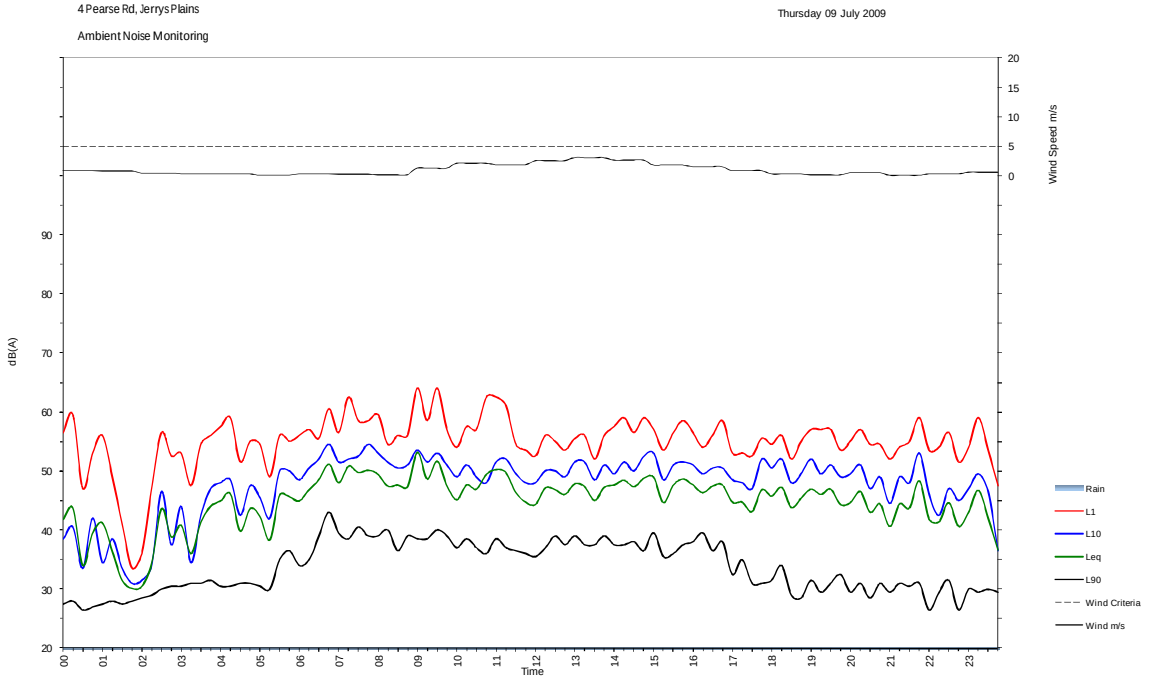

4 Pearse Rd, Jerrys Plains
Ambient Noise Monitoring
Saturday 04 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

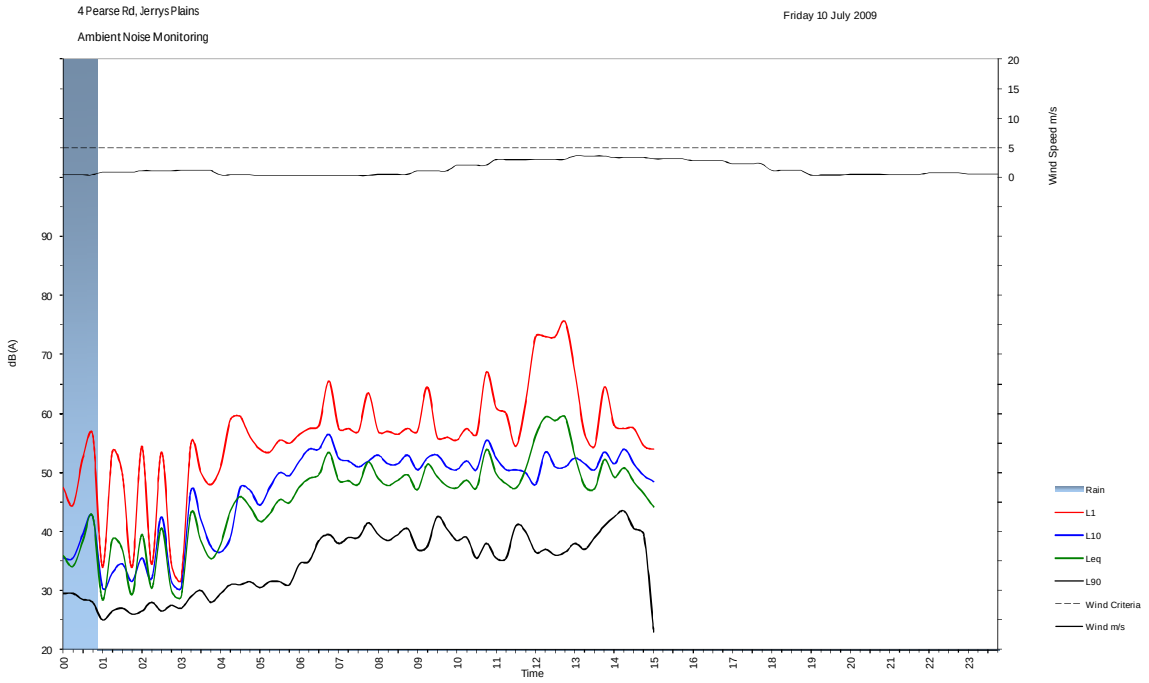

4 Pearse Rd, Jerrys Plains
Ambient Noise Monitoring
Sunday 05 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


4 Pearse Rd, Jerrys Plains
Ambient Noise Monitoring
Monday 06 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


4 Pearse Rd, Jerrys Plains
Ambient Noise Monitoring
Tuesday 07 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


4 Pearse Rd, Jerrys Plains
Ambient Noise Monitoring
Wednesday 08 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


4 Pearse Rd, Jerrys Plains
Ambient Noise Monitoring
Thursday 09 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


4 Pearse Rd, Jerrys Plains
Ambient Noise Monitoring
Friday 10 July 2009
dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s