Report

Noise Impact Assessment

Tarrone Power Station

OCTOBER 2009

Prepared for

AGL Energy Limited

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Executive Summary

URS Australia Pty Ltd (URS) has been commissioned by AGL Energy Limited (AGL) to undertake a noise impact assessment for the proposed gas-fired power station at Tarrone, Victoria. This assessment has been prepared to support a referral being made to the Victorian Government to determine whether an Environment Effects Statement (EES) would be required and in support of an EPA Works Approval application that would be submitted for the proposed site.

The likely noise issues pertaining to the proposed development include noise associated with the construction and operation of the facility. The proposed site could operate at any time thus an assessment of sleep disturbance for the nearest potentially affected noise sensitive receptors has also been considered in this study.

The nearest potentially affected noise sensitive receptor locations have been identified and the predicted noise impacts of the proposed site on these locations have been assessed with consideration of the following relevant state guidelines:

- Victoria Environment Protection Act 1970;
- State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) No.N-1, Victoria EPA 1989;
- Interim guidelines for control of noise from industry in country Victoria N3/89, Victoria EPA, 1989
- Noise Control Guidelines Publication 1254, Victoria EPA, 2008
- Environment Protection (Residential Noise) Regulations 2008: Regulatory Impact Statement (Publication No 1230, June 2008), Victorian EPA,; and
- Guidelines for Community Noise, World Health Organisation (WHO), 1999

The noise limits have been conservatively established by adopting the lowest permissible noise limits to assess the proposed construction and operation with the consideration of above guidelines and the background noise monitoring. Detailed results of noise measurements and the noise criteria applicable to the development are presented in Sections 3 and 4. Daily noise logging plots are also provided in Appendix D.

Noise impacts of the proposed construction and operation have been predicted using an acoustic computer model created in SoundPLAN Version 6.5. Details of the area's topography, receptor locations and sound power levels of the noise sources have been incorporated into the noise model. Typical and 'worst-case' scenarios have been taken into consideration throughout the noise modelling. Detailed results of the predictive modelling are provided in Sections 5.3 and 5.4.

This study has found that the noise criteria can be achieved with no further noise mitigation measures beyond those already proposed by AGL and the standard noise management practices detailed in Section 6.

On the basis of this assessment, it is therefore concluded that noise impacts of the proposed construction and operation of the power station are not expected to degrade the existing acoustic environment nor create annoyance to the community surrounding the plant.

1

Introduction

URS Australia Pty Ltd (URS) has been commissioned by AGL Energy Limited (AGL) to undertake a noise impact assessment for the proposed gas-fired power station at Tarrone, Victoria, which will be referred to as “the site” for the purpose of this report.

This assessment has been prepared to support a referral being made to the Victorian Government to determine whether an Environment Effects Statement (EES) would be required and in support of an EPA Works Approval application that would be submitted for the proposed site.

Noise impacts associated with the site’s proposed construction and operation have been assessed in accordance with the requirements of the Victoria ‘Environment Protection Act 1970’, and relevant guidelines of the Victoria Environment Protection Authority (EPA), primarily the ‘Interim Guidelines for Control of Noise from Industry in Country Victoria N3/89’, but with consideration of the ‘State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) No.N-1’ and the ‘Noise Control Guidelines TG 302/92’.

Potential for sleep disturbance has also been assessed as the proposed development is a peaking power station and could operate at any time.

1.1 Scope of Assessment

The scope of this assessment is to:

- Provide a description of the existing acoustic environment and the proposed development;
- Establish appropriate project-specific noise criteria;
- Predict potential noise impacts by means of noise modelling and calculations;
- Assess predicted noise levels against the established noise criteria;
- Provide recommendations for appropriate noise mitigation measures and/or noise management practices where required;
- Provide a statement of potential noise impacts; and
- Report the findings of the assessment.

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Site and Project Description

2.1 Site Location

The proposed power station is located on a 75 hectare site approximately 20 kilometres north of Port-Fairy, in the Tarrone area of Moyne Shire Council, on the corner of Riordans Road and Landers Lane.

The surrounding land use is designated as a farming zone and the nearest of which is 6 kilometres west of the proposed site. Within the farming zone are scattered farm houses; the closest dwelling is 1.2 kilometres north-east of the site boundary and the closest dwelling to the gas turbines is 1.5 kilometres.

The site itself and the surrounding area are relatively flat.

2.2 Noise Sensitive Receptors

The nearest potentially affected noise sensitive receptor locations have been identified from examination of aerial photographs using Google Earth and a site inspection conducted in December 2008 as follows:

Table 2-1 Noise Sensitive Receptors

Receptor	Address	Approx. Distance from Gas Turbines	Nearest Site Boundary	Status
A	Riordans Road	2250 m	SW	Unoccupied
B	386 Tarrone North Road	1750 m	NE	Unoccupied
C	426 Tarrone North Road	1550 m	NE	Unoccupied
D	473 Tarrone North Road	1700 m	E	Occupied
E	573 Tarrone North Road	2050 m	SE	Occupied
F	589 Tarrone North Road	2250 m	SE	Occupied
G	574 Tarrone North Road	1950 m	SE	Occupied
H	96 Coomete Road	5000 m	NE	Occupancy not known
I	3 Poyntons Road	5900 m	NE	Occupancy not known
J	8 Poyntons Road	7000 m	NE	Occupancy not known

Notes: Locations H, I and J are only considered for the proposed pipeline construction.

Figure 2-1 shows the location of these receptors described above, together with a reference 1 kilometre radius circle from the centre of the site.

2.3 Project Description

AGL proposes development of an open-cycle gas turbine peaking (OCGT) power station. The capacity of the power station will depend on the type of turbine that is selected for the final design. Option A would consist of four E class turbines (approximately 4 x 180MW = 720 MW) and Option B would consist of three F class turbines (approximately 3 x 280MW = 840 MW). The power station facility would also include lay-down area, electrical substation, and an 8 to 10 kilometres long underground gas pipeline. Each gas turbine area would consist of a main enclosure housing the turbines, an exhaust stack and transformer.

2 Site and Project Description

AGL and Meridian Energy are investigating development of the approved Macarthur Wind Farm located approximately 10 kilometres north of the proposed power station site. Power from the wind farm will be connected to the 500 kV electricity grid at a new 500 MVA substation at the site proposed for the power station.

The proposed power station would supply electricity to the grid using the electrical connection from the wind farm. Gas would be supplied to the power station from a new pipeline from the SeaGas pipeline in the rural locality of Willatook, approximately 10 kilometres to the north-east.

Two pipeline corridors are currently being investigated; an east-west corridor to the SEA Gas Pipeline at Willatook and a north-south corridor to the SEA Gas Pipeline to the north of Heywood-Woolsthorpe Road

The typical operating hours of the proposed facility will be approximately 5% of the year or 440 hours. The facility would typically operate during periods of peak demand associated with the morning and evening peaks, particularly at times of extreme weather, however may operate at any time during the day or night and at any time of the year. Therefore, the noise study has considered all weather conditions and all times of day and night.

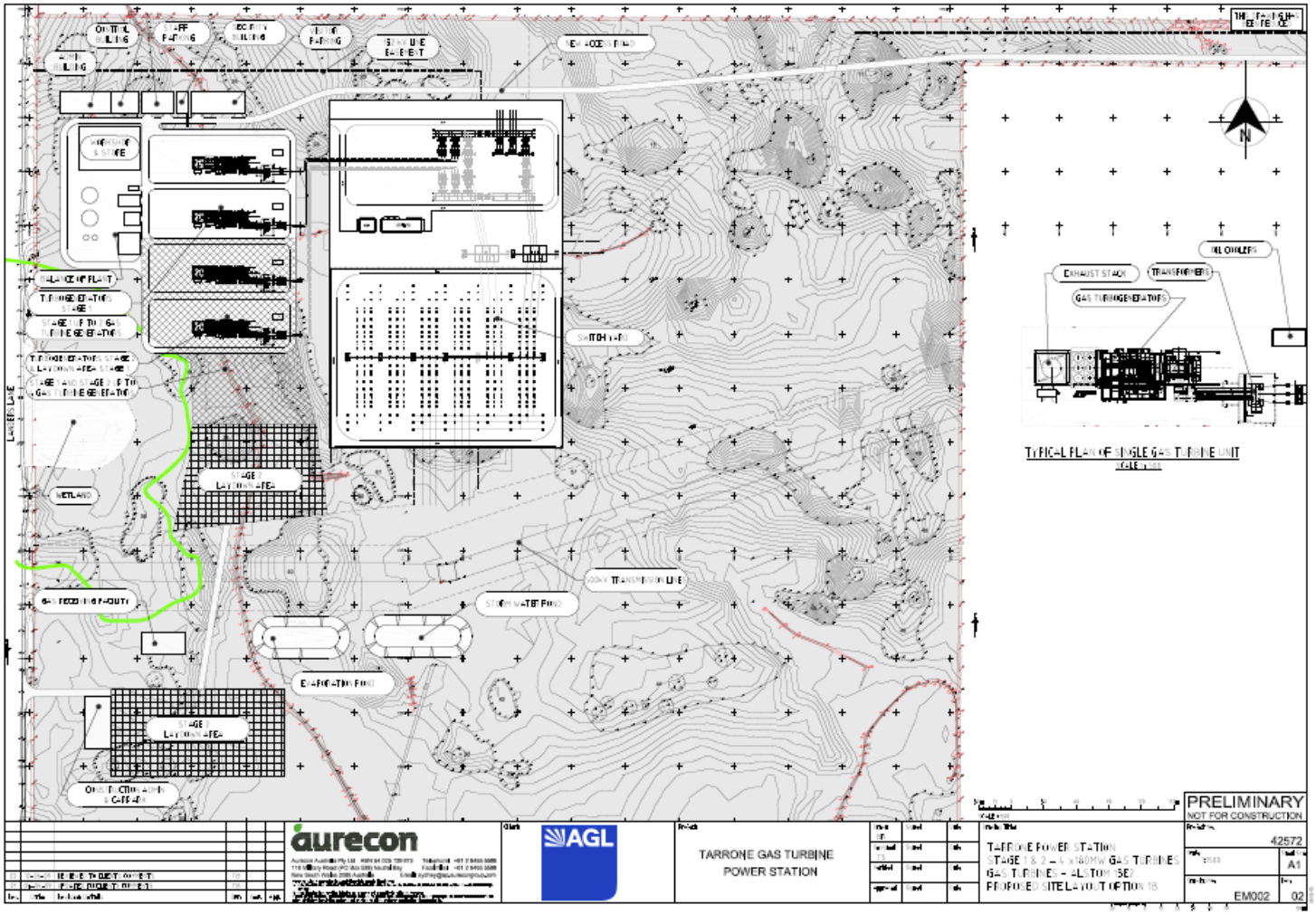
2 Site and Project Description

Figure 2-1 Aerial Photo Showing Site and Receptor Locations

Source: Aerial image from Google Earth (URS Copyright, Google Earth Pro 2009)

2 Site and Project Description

Figure 2-2 Preliminary Site Layout



3

Existing Acoustic Environment

3.1 Noise Measurement Methodology

Noise measurements have been conducted by long-term unattended monitoring and short-term attended monitoring at selected noise sensitive receptors.

All the noise measurements were undertaken generally in accordance with AS1055:1997 “Acoustics – Description and Measurement of Environmental Noise”

The long-term noise monitoring was undertaken using Acoustic Research Laboratories (ARL) Environmental Noise Loggers, Model EL-316. These instruments comply with AS IEC 61672.1 – 2004 “Electroacoustics – Sound level meters – Specifications” and are designated as a Type 1 instrument suitable for field and laboratory use. The noise loggers were positioned with the microphones at 1.2 metres above ground level and were set to statistically process and store the measured noise levels every 15 minutes for the whole monitoring period. The noise loggers were calibrated before logging and the calibration was checked after logging using an acoustic calibrator consistent with AS IEC 61672 requirements. No significant discrepancies (greater than 0.5 dB) were noticed in the reference calibration sound signals pre and post measurements.

To analyse the measured long-term noise levels, meteorological data provided by the nearest Bureau of Meteorology (BOM) Automatic Weather Station (AWS), (Port Fairy AWS ID: 90175) to the site have been reviewed. Any noise monitoring periods affected by adverse weather conditions (rain and wind) were excluded from the final data analysis. The height difference between the AWS (10 metres above the ground level) and the sound level meter (1.2 metres above the ground level) was taken into consideration with a correction factor to modify wind speed used for the data analysis. This method complies with the guidelines specified in Section 4.2.5.1 of the AS 1170.2:2002 “Structural design actions – Wind actions”

The short-term attended noise monitoring was undertaken using a Larson Davis LXT1 sound level meter which complies with AS IEC 61672.1 – 2004 “Electroacoustics – Sound level meters – Specifications” and is designated as a Type 1 instrument suitable for field and laboratory use. The sound level meter was positioned for each measurement with the microphone approximately 1.2 metres above the ground level. The sound level meter was calibrated using an acoustic calibrator before measurement sessions and the calibration was checked at the end of measurement sessions. No significant discrepancies (greater than 0.1 dB) were noted in the reference calibration sound signals pre and post measurements.

The short-term noise monitoring was conducted on warm days with slight wind gusts (< average speed of less than 3 m/s) and partial cloud cover. The weather conditions during the measurement periods would not have adversely affected the results.

All the instrumentation used was calibrated by a NATA accredited acoustic laboratory within two years prior to the measurement period.

3.2 Noise Measurement Locations

Noise monitoring locations were chosen after examination of satellite imagery of the locality and a site inspection. Consideration was given in selecting the monitoring locations to enable unattended long-term noise monitoring to establish the representative noise trend at the nearest receptors. The locations were also chosen so that the noise loggers would not have been affected by extraneous noise (e.g. cattle, pumps, etc) which could result in unrepresentative elevated background noise levels.

3 Existing Acoustic Environment

The two nearest noise sensitive receptor locations to the site were selected for the long-term noise monitoring, and several short-term attended locations were chosen to supplement the long-term noise monitoring. These locations are considered representative of the most potentially affected noise sensitive receptor locations near the site.

A brief description of each measurement location is given below:

- Location D: At 473 Tarrone North Road, located approximately 1,600 metres to the north-west of the site. This location was used for long-term unattended noise monitoring to obtain background noise levels representative of Locations B, C and D.

  The predominant noise sources at this location were local fauna (birds) and occasional road traffic during the daytime period and local fauna (birds and insects) during the evening and the night-time period. No industrial noise was audible at this location.

  Short-term attended noise measurements were also conducted at this location to supplement the long-term noise monitoring.

- Location G: At 574 Tarrone North Road, located approximately 1,800 metres to the south-east of the site. This location was utilised for long-term unattended noise monitoring to obtain background noise levels representative of Locations A, E, F and G. Location A has been included in this group as the noise logging at Location G would have been less affected by road traffic noise from Tarrone North Road than at Location D, therefore the noise logging at Location G which would have better represented the background noise at Location A.

  The predominant noise sources at this location were local fauna (birds) and occasional road traffic during the daytime period and local fauna (birds and insects) during the evening and night-time period. No industrial noise was audible at this location.

  Short-term attended noise measurements were also conducted at this location to supplement the long-term noise monitoring.

- Short-term attended noise measurements were conducted at Locations A, B, C, E and F. Background noise levels at these locations have found to be similar to those at Locations D and G.

3.3 Noise Measurement Results

The results of the long-term noise monitoring are summarised in Table 3-1, Table 3-2 and Table 3-3. The results of the short-term noise monitoring are summarised in Table 3-4.

Any 15-minute period affected by adverse weather conditions or likely extraneous noise were excluded from calculation.

For the purpose of INP assessment, the following time of day is defined:

- Day: 7.00 am – 6.00 pm, Monday to Saturday; or 8.00 am – 6.00 pm on Sundays and public holidays
- Evening: 6.00 pm – 10.00 pm, all days
- Night: 10.00 pm – 7.00 am, Monday to Saturday; or 10.00 pm – 8.00 am on Sundays and public holidays

Daily noise monitoring plots are provided in Appendix D.

3 Existing Acoustic Environment

Table 3-1 Measured Noise Levels - 473 Tarrone North Road (D)

Date	Background Noise Level L_{A90} dB(A)			Ambient Noise Level L_{Aeq} dB(A)		
	Day	Evening	Night	Day	Evening	Night
Tuesday, 3 February 2009		30	26		48	39
Wednesday, 4 February 2009	30	27	24	45	48	39
Thursday, 5 February 2009	31	28	26	46	48	37
Friday, 6 February 2009	27	26	26	46	50	39
Saturday, 7 February 2009	31	30	27	47	47	35
Sunday, 8 February 2009	30	27	23	45	43	38
Monday, 9 February 2009	32	25	23	45	50	41
Tuesday, 10 February 2009	31	-	-	49	-	-
Wednesday, 11 February 2009	-	30	-	-	45	-
Thursday, 12 February 2009	-	-	24	-	-	38
Friday, 13 February 2009	30			44		
Median Value (RBL)	**31**	**28**	**25**			
Logarithmic Average				**46**	**48**	**38**

Notes: • All measurements in periods showing "-" were affected by adverse weather conditions or extraneous noise.

Table 3-2 Measured Noise Levels - 574 Tarrone North Road (G)

Date	Background Noise Level L_{A90} dB(A)			Ambient Noise Level L_{Aeq} dB(A)		
	Day	Evening	Night	Day	Evening	Night
Tuesday, 3 February 2009		31	24		45	40
Wednesday, 4 February 2009	34	29	24	45	44	32
Thursday, 5 February 2009	36	28	24	46	44	37
Friday, 6 February 2009	33	29	26	45	43	39
Saturday, 7 February 2009	33	37	25	45	47	35
Sunday, 8 February 2009	30	30	23	47	42	36
Monday, 9 February 2009	32	27	23	47	43	37
Tuesday, 10 February 2009	33	-	-	49	-	-
Wednesday, 11 February 2009	-	37	-	-	46	-
Thursday, 12 February 2009	-	-	24	-	-	38
Friday, 13 February 2009	34			45		
Median Value (RBL)	**33**	**29**	**24**			
Logarithmic Average				**46**	**45**	**38**

Notes: • All measurements in periods showing "-" were affected by adverse weather conditions or extraneous noise.

The daily noise logging results generally show consistent noise levels throughout each daily period at both locations. The results at both monitoring locations show similar trend and background noise levels.

3 Existing Acoustic Environment

An overall representative ambient noise level (AL) is determined by logarithmic averaging of each assessment period for the entire monitoring period, and background noise level (BL) is determined by taking the median value of each assessment period for the entire monitoring period. Table 3-3 presents a summary of overall ambient and background noise levels and at each monitoring location.

Table 3-3 Summary of Measured Noise Levels

Location	Background Noise Level (BL) L_{A90} dB(A)			Ambient Noise Level (AL) L_{Aeq} dB(A)		
	Day	Evening	Night	Day	Evening	Night
D: 473 Tarrone North Road	31	28	25	45	45	38
G: 574 Tarrone North Road	33	29	24	46	44	37

The background noise levels presented above were used to derive the noise limits for the noise impact assessment of the proposed construction and operation of the site which is described in Section 4.2 of this report.

Table 3-4 presents the short-term attended noise measurement results.

Table 3-4 Attended Measurement Results

Location	Date / Time	Background $L_{A90\ (5\text{-}10min)}$ dB(A)	Ambient $L_{Aeq\ (5\text{-}10min)}$ dB(A)	Comments
A Riordans Road	Tuesday, 3 February 2009 / 11:30 pm	26	28	Environment governed by local fauna (insects). No other noise was noted.
	Wednesday, 4 February 2009 / 8:15 am	33	36	Environment governed by local fauna (birds and cattle). No industrial noise was noted.
B 426 Tarrone North Road	Wednesday, 4 February 2009 / 12:25 am	27	29	Environment governed by local fauna (insects). No other noise was noted.
	Wednesday, 4 February 2009 / 8:45 am	39	44	Environment governed by local fauna (birds and cattle) and occasional road traffic on Tarrone North Road. No other noise was noted.
C 386 Tarrone North Road	Wednesday, 4 February 2009 / 12:35 am	27	28	Environment governed by local fauna (insects). No other noise was noted.
	Wednesday, 4 February 2009 / 8:40 am	41	44	Environment governed by local fauna (birds and cattle) and occasional road traffic on Tarrone North Road. No other noise was noted.
D 473 Tarrone North	Wednesday, 4 February 2009 / 12:10 am	27	28	Environment governed by local fauna (insects). No other noise was noted.

3 Existing Acoustic Environment

Location	Date / Time	Background $L_{A90\ (5\text{-}10min)}$ dB(A)	Ambient $L_{Aeq\ (5\text{-}10min)}$ dB(A)	Comments
Road	Wednesday, 4 February 2009 / 8:45 am	35	37	Environment governed by local fauna (birds and cattle) and occasional road traffic on Tarrone North Road. No other noise was noted.
E 573 Tarrone North Road	Wednesday, 4 February 2009 / 8:30 am	42	45	Environment governed by local fauna (birds and cattle) and occasional road traffic on Tarrone North Road. No other noise was noted.
F 589 Tarrone North Road	Wednesday, 4 February 2009 / 8:50 am	39	43	Environment governed by local fauna (birds and cattle) and occasional road traffic on Tarrone North Road. No other noise was noted.
G 574 Tarrone North Road	Tuesday, 3 February 2009 / 11:45 pm	27	30	Environment governed by local fauna (insects). No other noise was noted.
	Wednesday, 4 February 2009 / 8:25 am	40	43	Environment governed by local fauna (birds and cattle) and occasional road traffic on Tarrone North Road. No other noise was noted.

It is noted that noise monitoring has not been conducted at Locations H, I and J. However, considering the sound sources in the vicinity of these receptors, background noise levels obtained from Locations D and G have been adopted to establish noise criteria at these locations. It is our opinion that this approach provides a conservative assessment for these locations.

4

Project Acoustic Criteria

4.1 Legislation and Guidelines

The potential noise impacts of the site have been assessed with consideration of the following documents:

- Victoria *Environment Protection Act 1970* – Section 46: Emission of noise to comply with policy;
- Victoria EPA, *Interim Guidelines for Control of Noise from Industry in Country Victoria N3/89*;
- Victoria EPA, *State Environment Protection Policy (SEPP) (Control of Noise from Commerce, Industry and Trade) No.N-1*;
- Victoria EPA, *Noise Control Guidelines TG302/92*.
- Victoria EPA, *Environment Protection (Residential Noise) Regulations 2008: Regulatory Impact Statement* (Publication No 1230, June 2008); and
- World Health Organisation (WHO), *Guidelines for Community Noise*

The SEPP No.N-1 only applies to the Melbourne metropolitan area, and the N3/89 guidelines should be applied to industries in areas outside Metropolitan Melbourne where the background noise levels are very low (less than 25 dB(A) during the night-time period or less than 30 dB(A) during the daytime and evening period). Noise limits in provincial cities and rural areas where background noise levels are comparable to Metropolitan Melbourne are to be determined using the procedures of the SEPP No. N-1.

The N3/89 and TG302/92 are therefore considered to be the most appropriate documents to assess potential noise impacts from the site.

The relevance of these guidelines is outlined in the following sections.

4.2 Operational Noise Criteria

4.2.1 Victoria EPA Interim Guidelines N3/89

The guidelines state that where background noise levels are very low (less than 30 dB(A) during the daytime and evening period or 25 dB(A) during the night-time period), the minimum limits for noise from industry, when measured at residential premises, should be:

- Day: **45** dB(A)
- Evening: **37** dB(A)
- Night: **32** dB(A)

The following approaches have been applied to ensure a conservative noise assessment:

- Daytime noise limit: Adopt the lowest permissible noise limit although the measured daytime background noise levels in the receptor locations were slightly above the 30 dB(A) threshold, i.e. 31 and 33 dB(A);
- Night-time noise limit: Apply the lowest measured night-time background noise level (24 dB(A)) for all receptor locations instead of applying 25 dB(A) to Locations B,C and D, and therefore adopt the lowest permissible night-time noise limit for all receptor locations; and
- Evening noise limit: Adopt the lowest permissible night-time noise limit instead of the evening noise limit.

The Guidelines do not specify which acoustic descriptor (e.g. L_{Aeq}, L_{A10}, or L_{Amax}) should be used to describe the noise limits. However, use of the $\mathbf{L_{Aeq}}$ is consistent with the requirements set out in the Victoria EPA SEPP No.N-1.

4 Project Acoustic Criteria

Table 4-1 summarises the selected operational noise criteria applicable to all receptor locations.

Table 4-1 Operational Noise Limit

Receptor Locations	Operational Noise Limit $L_{Aeq,15min}$ dB(A)	
	Day	Evening & Night
A, B, C, D, E, F & G	45	32
Notes: Time of Day: Day: 7.00 am – 6.00 pm / Evening: 6.00 pm – 10.00 pm / Night: 10.00 pm – 7.00 am		

4.2.2 Sleep Disturbance

In addition to the criteria in 4.2.1, an assessment of sleep disturbance for the potentially affected noise sensitive receptors has also been considered in this study. Where there exists the possibility that instantaneous, short-duration, high-level noise events may occur during night-time hours (10.00 pm – 7.00 am), consideration should be given to the potential for the disturbance of sleep within residences.

Victoria EPA *Environment Protection (Residential Noise) Regulations 2008: Regulatory Impact Statement* makes reference to the World Health Organisation (WHO)'s *Guidelines for Community Noise (Berglund B, Lindvall T and Schwela D H 1999)* for sleep disturbance caused by noise impacts.

The WHO suggests that the equivalent noise level (L_{eq}) and maximum noise level (L_{max}) inside bedroom should be limited to 30-35 dB(A) and 45 dB(A) respectively. When considering internal noise levels from an external noise source, it is common practice to assume that windows are partially open to allow natural ventilation on warm nights.

The noise reduction through partially opened windows is estimated to be 10 dB(A), as specified in *AS 3671-1989: Acoustics – Road Traffic Noise Intrusion – Building Siting and Construction* [SEPP N-1 provides adjustments for closed windows and façades (15 dB(A)) and doubled glazed windows (25 dB(A)) but not open windows].

To achieve the internal noise levels described above, the noise levels outside bedroom windows, should be limited to 45 dB(A) L_{Aeq} and **55 dB(A) L_{Amax}** respectively. However, the 45 dB(A) L_{Aeq} noise limit is supplanted by the more stringent **32 dB(A) L_{Aeq}** limit established in 4.2.1 for the night-time period.

4.3 Construction Noise Criteria

The Victoria EPA *Interim Guidelines for Control of Noise from Industry in Country Victoria N3/89* also set out the daytime construction noise limit, which is to be 10 dB above the lowest permissible daytime noise limit, except where this would result in a limit greater than 68 dB(A).

The construction noise limit applicable to the site is therefore 45 + 10 = **55 dB(A) L_{Aeq}**.

The EPA *Noise Control Guidelines (Publication 1254, October 2008)* additionally specify the following for construction noise:

4 Project Acoustic Criteria

- **Normal working hours**

  The requirements specified in the Guidelines apply during the hours of

  — 7.00 am to 6.00 pm, Monday to Friday;
  — 7.00 am to 1.00 pm, Saturdays.

- **Weekend/Evening working hours**

  Noise levels at any residential premises should not exceed background noise by:

  — 10 dB(A) or more for up to 18 months after project commencement.
  — 5 dB(A) or more after 18 months.

  during the hours of:

  — 6.00 pm to 10.00 pm, Monday to Friday
  — 1.00 pm – 10.00 pm, Saturdays
  — 7.00 am – 10.00 pm, Sundays & public holidays

- **Night period**

  Noise should be inaudible within a habitable room of any residential premises during the hours of:

  — 10.00 pm to 7.00 am, Monday to Sunday

Table 4-2 presents the construction noise limits applicable the development:

Table 4-2 Construction Noise Limit

Time of Day	Construction Period	Noise Limit (L_{Aeq}), dB(A)
Normal working hours[1]	Any period	45 + 10 = **55**
Weekend & Evening working hours[2]	Up to 18 months	28 + 10 = **38**
	Greater than 18 months	28 + 5 = **33**
Night period[3]	Any period	Inaudible[4]

Notes:
1. 7.00 am – 6.00 pm on Monday to Friday / 7.00 am – 1.00 pm on Saturdays
2. 6.00 pm – 10.00 pm on Monday to Friday / 1.00 pm – 10.00 pm on Saturdays / 7.00 am – 1.00 pm on Sundays and public holidays
3. 10.00 pm – 7.00 am on All days
4. when assessed within a habitable room of any residential premises

5

Assessment of Potential Noise Impacts

5.1 Calculation Methodology

Noise levels due to the proposed construction and the operation of the site at the identified noise sensitive receptor locations have been predicted using an acoustic computer model created in SoundPLAN Version 6.5. This program is used internationally and recognised by regulators and authorities throughout Australia.

The noise model was constructed to allow the prediction of cumulative noise levels from the site including the contribution of each noise source. The noise model takes into account:

- sound power levels of each source;
- receptor locations;
- screening effects due to topography;
- meteorological effects and attenuation due to distance; and
- ground and atmospheric absorption.

The noise calculations have been carried out using the L_{Aeq} descriptor to assess the operational and construction noise impacts.

The program allows the use of various noise prediction algorithms. To calculate noise emission levels under neutral and adverse meteorological conditions, the CONCAWE algorithm which is designed for industrial sites has been used. The effects of meteorological conditions are explained in more detail in Section 5.2 below.

5.2 Meteorological Conditions

Adverse meteorological conditions have the potential to increase noise levels at a receptor. Such phenomena generally occur during temperature inversions or where there is a wind gradient with wind direction from the source to the receptor. It is known that these meteorological effects typically increase noise levels by 5 to 10 dB, and even greater than 10 dB in extreme conditions.

Temperature inversions generally occur during the night-time and early morning periods, thus the most significant meteorological effect during the daytime period is wind.

The prevailing meteorological conditions for the site were assessed using yearly meteorological data collected from a BOM weather station located in Warrnambool in 2007 and incorporated into an air dispersion program, TAPM (V4). It is noted that the meteorological data used to analyse the long-term noise logging was from a BOM weather station located in Port Fairy. Yearly meteorological data was not available from the Port Fair weather station, therefore the yearly data used for the analysis in this section was obtained from the next closest weather station located in Warrnambool.

The wind rose data used in the assessment are presented in Appendix B.

The meteorological analysis gave the results in Table 5-1:

Table 5-1 Prevailing Meteorological Conditions

Time of Day	Pasquill Stability Class	Wind Speed (m/s)	Wind Direction
Day (7.00 am – 6.00 pm)	D	6	Southerly & Northerly
Evening & Night (6.00 pm – 7.00 am)	D	4	Northerly & North-westerly

5.3 Operational Noise

5.3.1 Sound Power Levels

Table 5-2 presents the sound power levels (SWL) of equipment that have been identified as the primary on-site noise sources. Sound power levels of these sources have been provided by AGL Energy Limited in octave frequency bands. These levels represent the noisiest type of engine which could be selected for each of the two different turbine configuration options and thus represent worst case scenario.

The sound power levels presented in the table have been input into the noise model.

Sound power level of the exhaust stack has been not been determined at this stage, therefore the data has been estimated. The estimate is comparable to the sound power levels of similar engine stacks from previous studies.

Table 5-2 Sound Power Levels – Operational Equipment

Operational Noise Source		Estimated Overall Sound Power Level[1]	
		dB(Lin)	dB(A)
Inlet System (silencer included)	Inlet Ducting (filter house included)	107	95
	Inlet Filter Face	117	107
GT Power Train Package	Accessory Unit	111	103
	Inlet Plenum	104	103
	Turbine Compartment	119	113
	Exhaust Diffuser	125	112
	Load Compartment	114	105
	Liquid Fuel & Atomising Air (LF/AA) Module	111	103
Vent Fans	Turbine Compartment Vent Fans	112	104
	Exhaust Compartment Vent Fans	113	102
Exhaust Stack[1]	Stack Body	-	105
	Stack Opening	-	108
Substation (500 KV)	Transformer & Reactor (4 x 330 MVA)	-	106[2]

Notes:
1. Sound power level of the exhaust stack is an estimate. To ensure the compliance with the noise limit, noise from exhaust stack opening and body combined should not exceed 110 dB(A).
2. Estimated based on AS/NZS 60076.10:2009 – Power Transformers: Determination of sound levels.

5.3.2 Noise Modelling Scenarios

Potential noise impacts have been predicted separately for each of the following meteorological conditions. Table 5-3 provides a summary of each meteorological scenario.

Table 5-3 Meteorological Conditions used in Noise Modelling

Met. Scenario	Meteorological Condition				Calculation Standard
	Temperature (°C)	Relative Humidity (%)	Pasquill Stability Class	Wind Speed (m/s)	Wind Direction
A: Daytime Operation – Neutral Met. Conditions	20	60	D	0	n/a
B: Evening & Night-time Operation – Neutral Met Conditions	10	50	D	0	n/a
C: Daytime Operation – Adverse Met. Conditions	20	60	D	6	Southerly wind
D: Evening & Night Operation – Adverse Met. Conditions	10	50	D	4	North-westerly wind

The noise modelling has been conducted based on likely maximum operating conditions for each turbine option. In setting-up the noise model, all pre-defined sources were positioned according to the proposed site layout in the respective noise model. The precise positioning of the sources was not found to cause any significant uncertainty.

The following assumptions were also made in the noise modelling:

- Each noise generating activity operates continuously; and
- All the activities listed in each scenario occur simultaneously.

5.3.3 Predicted Operational Noise Levels

The results noise modelling results using neutral and adverse meteorological conditions are presented in Table 5-4.

Table 5-4 Predicted Operational Noise Levels

Receptor Location	Predicted Noise Levels (L_{Aeq}) dB(A)		Criterion (L_{Aeq}) dB(A)		Exceedance
	Neutral Met Conditions (Scenario A & B)	Adverse Met Conditions (Scenario C & D)	Day (Scenario A & C)	Night (Scenario B & D)	
A	23 (A) / 24 (B)	18 (C) / 20 (D)	45	32	No
B	29	33 (C) / 30 (D)	45	32	No
C	30	34 (C) / **33 (D)**	45	32	~ 1 dB (Night)

5 Assessment of Potential Noise Impacts

Receptor Location	Predicted Noise Levels (L_{Aeq}) dB(A)		Criterion (L_{Aeq}) dB(A)		Exceedance
	Neutral Met Conditions (Scenario A & B)	Adverse Met Conditions (Scenario C & D)	Day (Scenario A & C)	Night (Scenario B & D)	
D	26	30	45	32	No
E	23	27	45	32	No
F	< 20	< 20	45	32	No
G	23	28	45	32	No

Notes: Results in bold represent the exceedance of the respective noise limit.
Scenario A: Daytime operation under neutral meteorological conditions.
Scenario B: Evening & Night-time operation under neutral meteorological conditions.
Scenario C: Daytime operation under adverse meteorological conditions.
Scenario D: Evening & Night-time operation under adverse meteorological conditions.

The results presented in Table 5-4 show that the predicted noise levels generated by the proposed operation would generally be within the established noise criteria at all receptor locations under all conditions. Only marginal exceedance of the noise limit during the night-time period is predicted to occur at Location C under adverse meteorological conditions due to its proximity to the site. However, it should be noted that the predicted exceedance is only 1 dB which would barely be detectable by human ears. Furthermore, given that the power station is a peaking plant and the meteorological conditions that could adversely affect the noise levels are expected to occur less than 15 per cent of time, the exceedance is predicted to be minor. It is also noted that there is significant wooded area between this location and the site which may provide slight noise reduction. This has not been included in the noise predictions modelling.

Given that the exceedance predicted is negligible and would only occur under adverse meteorological conditions, further noise mitigation measures are not considered necessary.

Noise from the proposed operation is constant in nature and therefore, during the night-time period the levels are expected to be significantly below 55 dB(A) L_{Amax} at all receptor locations. Therefore, the operation is not predicted to give rise to sleep disturbance.

A predicted noise contour map for the adverse night-time meteorological conditions is presented in Appendix C. It should be noted that these noise contours are indicative only due to interpolation within the calculation grid, the results of the point-to-point calculations presented in Table 5-4 are more accurate than the noise contours.

5.4 Construction Noise

Based on similar size projects, the total construction period is expected to be approximately 24 months with a peak period of up to 6 months.

The main construction activities would involve the following stages:

- Stage 1: Removing the layer of vegetation and levelling,
- Stage 2: Bulk earthworks including site grading and excavation work,
- Stage 3: Establishing concrete foundations for plant and buildings,
- Stage 4: Construction of buildings and installation of equipment and machinery, and
- Stage 5: Pipe line construction.

5 Assessment of Potential Noise Impacts

5.4.1 Construction Equipment and Associated Noise Levels

Typical construction equipment expected on this site and noise levels are summarised in Table 5-5. The sound power levels of these items have been taken from Appendix D of Australian Standard AS 2436-1981: “Guide to noise control on construction, maintenance and demolition sites” and library data.

The sound power levels presented in the table are indicative and should be used only as a guide.

Table 5-5 Sound Power Levels – Construction Equipment

Scenario	Proposed Activities	Equipment / Plant Item	Sound Power Level L_{Aeq} dB(A)
1	Site preparation & Earthworks	Excavator Bulldozer Grader Roller Loader Dump truck	108 – 112 102 – 114 114 – 118 103 – 112 103 – 111 102 – 107
2	Concrete Foundation Works	Concrete truck Concrete mixer Compactor Crane	103 – 113 107 – 111 113 – 115 104 – 108
3	Building Construction	Crane Delivery trucks Pneumatic tools Electric tools Power generators Hammers	104 – 108 102 – 110 110 – 115 100 – 108 100 – 106 101 – 112
4	Pre-pipeline Construction	Excavator Track trencher Crushing machine Truck Crane	108 – 112 114 – 120 114 – 124 102 – 108 104 – 108
5	Pipeline Construction	Welding / Bending machine Pipe layer Bulldozer Padding machine	92 – 100 100 – 106 100 – 110 96 – 106

5.4.2 Predicted Construction Noise Levels

The noise levels generated by the construction activities listed above have been predicted at each receptor location. Noise generated by construction activities would vary as construction progresses. The noise modelling has been carried out considering the adverse meteorological conditions. The results are presented in Table 5-6.

5 Assessment of Potential Noise Impacts

Table 5-6 Predicted Construction Noise Levels

Location	Predicted Noise Level under Adverse Meteorological Conditions L_{Aeq} dB(A)		Daytime Noise Criterion L_{Aeq} dB(A)	Exceedance
	Power Station Construction	Pipeline Construction		
A	28 – 35	31 – 38	55	No
B	32 – 39	37 – 44	55	No
C	34 – 40	42 – 48	55	No
D	32 – 39	49 – **56**	55	~ 1 dB (during Pre-pipeline Construction)
E	29 – 36	42 – 48	55	No
F	< 30	38 – 45	55	No
G	30 – 37	42 – 48	55	No
H	-	50 – **57**	55	~ 2 dB (during Pre-pipeline Construction)
I	-	52 – **59**	55	~ 4 dB (during Pre-pipeline Construction)
J	-	52 – **59**	55	~ 4 dB (during Pre-pipeline Construction)

The predicted construction noise levels presented in Table 5-6 show that no exceedances of the noise limit is expected at Locations A, B, C, E, F and G. A slight exceedance is predicted at Location D which is considered negligible whilst a marginal exceedance is predicted at Location H during the proposed pipeline construction. Greater exceedances are predicted at Locations I and J due to their proximity to the proposed pipeline. This exceedance would only occur for a limited duration while the pipeline works are in the immediate vicinity of these locations.

It should be noted that the predicted noise levels presented above result from a conservative noise modelling approach where it has been assumed that all equipment would operate continuously and simultaneously during the assessment period. With more realistic operational patterns, it is predicted that the only marginal exceedances of the noise limits would occur at Locations I and J.

Physical construction noise mitigation measures are not considered necessary. However, adoption of noise management strategies implementing good industry practice is recommended to minimise noise emissions from the proposed construction works. Recommendations on noise management strategies are provided in Section 6.1.

5.5 Off-Site Traffic Noise

The potential off-site traffic noise impact associated with the proposed operation has been assessed based on the URS Traffic Study undertaken for the development.

5 Assessment of Potential Noise Impacts

5.5.1 Operation

The ongoing operation of the power station will generate significantly less traffic than the construction phase of the project. During the operational phase, staff levels are expected to average up to five full time persons on site generating approximately ten car trips per day. The increase in traffic from the daily operation of the power station is accounted for in the general growth in traffic for the region. An increase in traffic volumes is expected during maintenance which would take place every 2 to 3 years.

Compared to the existing traffic volumes, the proposed traffic volumes generated by the development would be insignificant. Therefore a further detailed assessment is not deemed necessary.

5.5.2 Construction

As the specific duration and start/finish times of construction shifts have not been determined, it is assumed that that all movements would take place during the peak periods for the region. This would produce a conservative worst-case scenario in the event that shifts commence 7.00 am - 8:00 am and conclude 4.00 pm - 5.00 pm and that all personnel, material and equipment deliveries would occur in those periods.

It is expected that the number of construction personnel during the peak construction period would reach 250 personnel per day. The vehicle movements associated with construction personnel assumes a vehicle occupancy rate of 1.2 persons per vehicle. All construction personnel are assumed to arrive to the site in the morning peak hour and leave in the afternoon peak hour.

The legislation and guidelines listed in Section 4.1 do not include any criteria to assess off-site traffic noise associated with construction. It is assumed that off-site traffic noise with the proposed construction is minimised as much as is practically possible by limitations on construction hours to 7.00 am – 6.00 pm, and Australian Design Rules which apply to road-registered vehicles.

Noise management strategies to minimise the noise from the off-site road traffic associated with the proposed construction have been provided in Section 6.1 of this report.

6

Noise Mitigation Measures

6.1 Construction Noise

While the proposed construction activities have limited potential for impact on the local ambient noise environment, the following noise management strategies can be applied which would further reduce the potential for noise issues during the proposed construction period:

- Carrying out all construction works during the standard daytime construction hours;
- Scheduling construction to minimise multiple use of the noisiest equipment or plant items near noise sensitive receptors;
- Strategic positioning of plant items to reduce the noise emission to noise sensitive receptors, where possible;
- Carrying out maintenance work away from noise sensitive receptors, where practicable;
- Ensuring engine covers are closed, maintenance of silencers and mechanical condition. Regular maintenance and noise testing for major items of construction equipment that are significant contributors to construction noise levels;
- Awareness training for staff and contractors in environmental noise issues including;
  - Minimising the use of horn signals and maintaining to a low volume. Alternative methods of communication should be considered;
  - Avoiding any unnecessary noise when carrying out manual operations and when operating plant; and
  - Switching off any equipment not in use for extended periods during construction work;
- Restricting heavy vehicles' entry to site and departure from site to the nominated construction hours;
- Where noise level exceedances cannot be avoided, consideration should be given to applying time restrictions and/or providing quiet periods for nearby residents;
- Community consultation with local residents and building owners to assist in the alleviation of community concerns. Previous experience on similar projects has demonstrated that affected noise sensitive receptors may be willing to endure higher construction noise levels for a shorter duration if they have been provided with sufficient warning in the place of intermittent but extended periods of construction noise at lower levels; and
- Maintaining a suitable complaint register. Should noise complaints be received, undertake noise monitoring at the locations concerned. Reasonable and feasible measures would need to be implemented to reduce noise impacts.

With the implementation of the mitigation measures above, construction noise at all receptor locations is expected to comply with the noise limit.

6.2 Operational Noise

The exhaust stack is required to be designed to comply with the noise emission levels specified in Table 5.2. To ensure compliance with the noise limit, noise mitigation measures such as silencers should be implemented, where required.

7

Conclusion

URS has completed a noise impact assessment for the proposed gas-fired power station at Tarrone, Victoria. This assessment has been prepared in support of the Works Approval and EES Referral application for the proposed operation.

The assessment of potential noise impacts of the proposed construction and operation of the facility, on surrounding noise sensitive receptor locations, has been carried out in accordance with relevant Victoria EPA noise guidelines. Throughout the assessment, typical and 'worst-case' factors have been taken into consideration.

The assessment found that the adopted noise limits can generally be achieved with no further noise mitigation measures beyond those already proposed by AGL (including mitigation measures for the proposed stack). Minimal exceedances are expected only under adverse meteorological conditions where the occurrence would be relatively infrequent. Slight exceedances would only occur for specific short duration construction activities. The proposed operation of the facility is not expected to significantly degrade the existing acoustic environment nor generate community annoyance.

The predicted noise levels should be verified during commissioning, and in the unlikely event of any significant discrepancies from this assessment, there is scope to provide additional attenuation through measures such as acoustic enclosures and silencers.

On the basis of these conclusions, it is the finding of this assessment that the development should be acceptable with respect to noise generation.

8

References

Victoria Environment Protection Act 1970;

State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) No.N-1, Victoria EPA 1989;

Interim guidelines for control of noise from industry in country Victoria N3/89, Victoria EPA, 1989

Noise Control Guidelines TG 302/92, Victoria EPA, 1992

Environment Protection (Residential Noise) Regulations 2008: Regulatory Impact Statement (Publication No 1230, June 2008), Victorian EPA; and

Guidelines for Community Noise, World Health Organisation (WHO), 1999

9

Limitations

URS Australia Pty Ltd (URS) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of AGL Energy Limited (AGL) and only those third parties who have been authorised in writing by URS to rely on the report. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the Proposal dated 12 September 2008.

The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works and URS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URS was false.

This report was prepared between March and October 2009 and is based on the conditions encountered and information reviewed at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

A

Appendix A Glossary of Acoustic Terminology

Appendix A

A wide range of acoustic parameters and technical terms are used in this report. To assist in understanding the technical contents, a brief description of the acoustic terms is provided in this section.

Typical Noise Levels: Compared to the static air pressure (10^5 Pa), the audible sound pressure variations are very small ranging from about 20 µPa ($20x10^{-6}$ Pa), which is called "threshold of hearing" to 100 Pa. A sound pressure of approximately 100 Pa is so loud that it causes pain and is therefore called "threshold of pain".

dB (Decibel): A unit of sound level measurement. The human ear responds to sound logarithmically rather than linearly, so it is convenient to deal in logarithmic units in expressing sound levels. To avoid a scale which is too compressed, a factor of 10 is introduced, giving rise to the decibel. It is equivalent to 10 times the logarithm (to base 10) of the ratio of a given sound pressure to a reference pressure.

Perception of Sound: The number of sound pressure variation per second is called the frequency of sound, and is measured in Hertz (Hz). The normal hearing for a healthy young person ranges from approximately 20 Hz to 20 kHz. In terms of sound pressure levels, audible sound ranges from the threshold of hearing at 0 dB to the threshold of pain at 130 dB and over. A change of 1 dB or 2 dB in the level of a sound is difficult for most people to detect, whilst a 3 dB to 5 dB change corresponds to small but noticeable change in loudness. An increase of about 8 – 10 dB is required before the sound subjectively appears to be significantly louder.

Sound Pressure (SPL): Sound pressure is the measure of the level or loudness of sound. Like sound power level, it is measured in logarithmic units. The symbol used for sound pressure level is SPL, and it is generally specified in dB. 0 dB is taken as the threshold of human hearing.

Table A-1 Sound Pressure Levels of Some Common Sources

Sound Pressure Level (dB)	Sound Source	Typical Subjective Description
140	Propeller aircraft; artillery fire, gunner's position	Intolerable
120	Riveter; rock concert, close to speakers; ship's engine room	
110	Grinding; sawing	
100	Punch press and wood planers, at operator's position; pneumatic hammer or drilling (at 2 m)	Very noisy
80	Kerbside of busy highway; shouting; Loud radio or TV	Noisy
70	Kerbside of busy traffic	
60	Department store, restaurant, conversational speech	
50	General office	Moderate
40	Private office; Quiet residential area	Quiet
30	Unoccupied theatre; quiet bedroom at night	
20	Unoccupied recording studio; Leaves rustling	Very quiet
10	Hearing threshold, good ears at frequency of maximum sensitivity	
0	Hearing threshold, excellent ears at frequency maximum response	

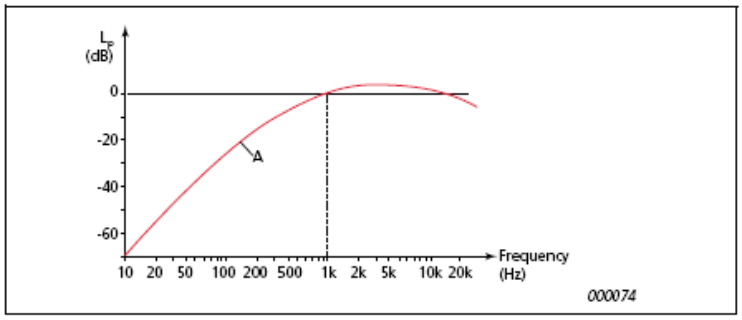
Appendix A

Sound Power (SWL): Sound power is the energy radiated from a sound source. This power is essentially independent of the surroundings, while the sound pressure depends on the surroundings (e.g. reflecting surfaces) and distance to the receptor. If the sound power is known, the sound pressure at a point can be calculated. Sound power is also measured in logarithmic units, 0 dB sound power level corresponding to 1 pW (10^{-12} W). The symbol used for sound power level is SWL or Lw, and it is specified in dB.

Frequency: Frequency is synonymous to pitch and is measured in units of Hz.

Frequency Spectrum: In environmental noise investigations, it is often found that the single-number indices, such as L_{Aeq}, do not fully represent the characteristics of the noise. If the source generates noise with distinct frequency components, then it is useful to measure the frequency content in octave or one-third octave frequency bands. For calculating noise levels, octave spectra are often used to account for the frequency characteristics of propagation.

"A" Frequency Weighting: The method of frequency weighting the electrical signal with a noise measuring instrument to simulate the way the human ear responds to a range of acoustic frequencies. It is based on the 40 dB equal loudness contour. The symbols for the noise parameters often include the letter "A" (e.g. L_{Aeq}) to indicate that frequency weighting has been included in the measurement.



Adverse Weather: Weather effects (wind and temperature inversions) that enhance noise. The prescribed conditions are for wind occurring more than 30 % of the time in any assessment period in any season and/or for temperature inversions occurring more than 30 % of the nights in winter.

Assessment Period: The period in a day over which assessments are made: day (7.00 am – 6.00 pm, Monday to Saturday; or 8.00 am – 6.00 pm on Sundays and public holidays), evening (6.00 pm – 10.00 pm, all days) or night (10.00 pm – 7.00 am, Monday to Saturday; or 10.00 pm – 8.00 am on Sundays and public holidays).

Ambient Noise: The all-encompassing sound at a site comprising all sources such as industry, traffic, domestic, and natural noises. This is represented as the L_{Aeq} noise level in environmental noise assessment. (See also L_{Aeq})

Background Noise: Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is measured statistically as the A-weighted noise level exceed for ninety per cent of a sample period. This is represented as the L_{A90} noise level (See also L_{A90}).

Free Field: An environment in which a sound wave may propagate in all directions without obstructions or reflections. Free field noise measurements are carried out outdoors at least 3.5 m from any acoustic reflecting structures other than the ground.

Appendix A

Extraneous Noise: Noise resulting from activities that are not typical of the area. Untypical activities may include construction, and traffic generated by holiday periods and by special events such as concerts or sporting events. Normal daily traffic is not considered to be extraneous.

Impulsive Noise: Noise having a high peak of short duration or a sequence of such peaks. Noise from impacts or explosions, e.g., from a pile driver, punch press or gunshot, is called impulsive noise. It is brief and abrupt, and its startling effect causes greater annoyance than would be expected from a simple measurement of the sound pressure level.

Intermittent Noise: Noise with a level that abruptly drops to the level of or below the background noise several times during the period of observation. The time during which the level remains at a constant value different from that of the ambient being of the order of 1 s or more.

Meteorological Conditions/Effects: Wind and temperature inversion conditions.

Noise Barrier: Solid walls or partitions, solid fences, earth mounds, earth berms, buildings. Etc used to reduce noise without eliminating it.

Temperature Inversion: An atmospheric condition in which temperature increases with height above the ground.

Tonality: Noise containing a prominent frequency and characterised by a definite pitch.

L_{Aeq}: A-weighted equivalent continuous noise level. This parameter is widely used and is the constant level of noise that would have the same energy content as the varying noise signal being measured. The letter “A” denotes that the A-weighting has been included and “eq” indicates that an equivalent level has been calculated. This is referred to as the ambient noise level. (See Ambient Noise)

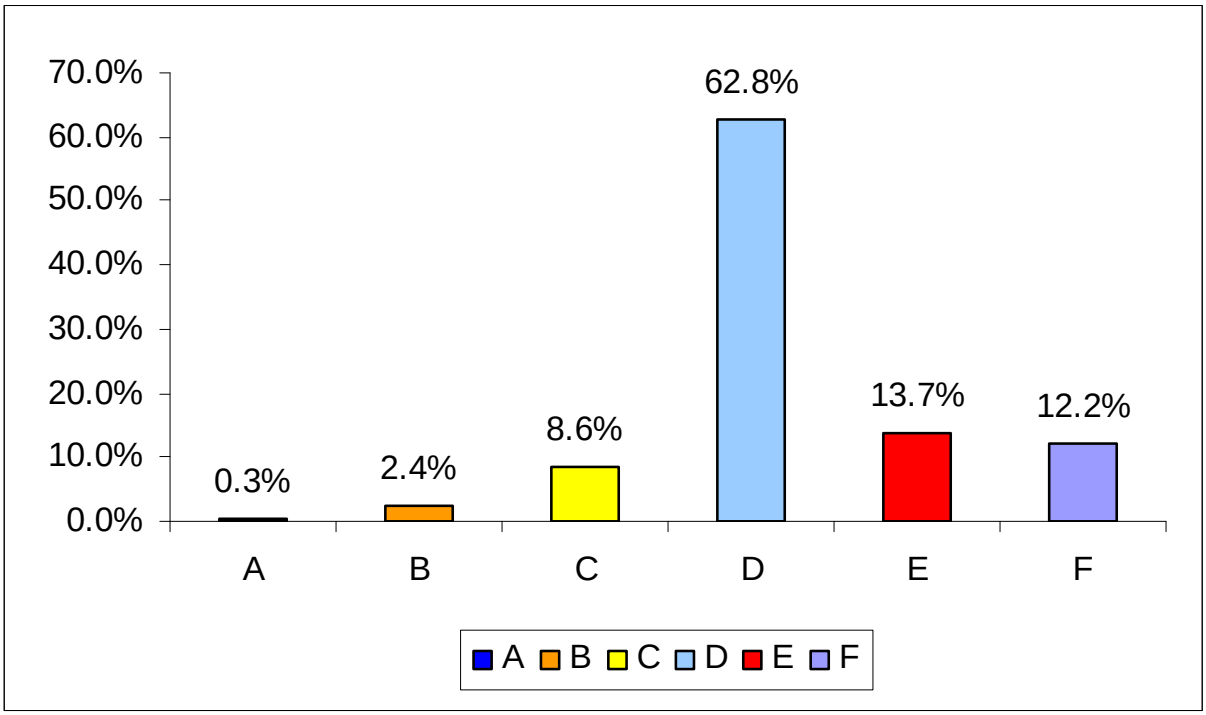
L_{A90}: The A-weighted sound pressure level which is exceeded for 90 % of the measurement period. It is determined by calculating the 90^{th} percentile (lowest 10 %) noise level of the period. This is referred to as the background noise level. (See Background Noise)

B

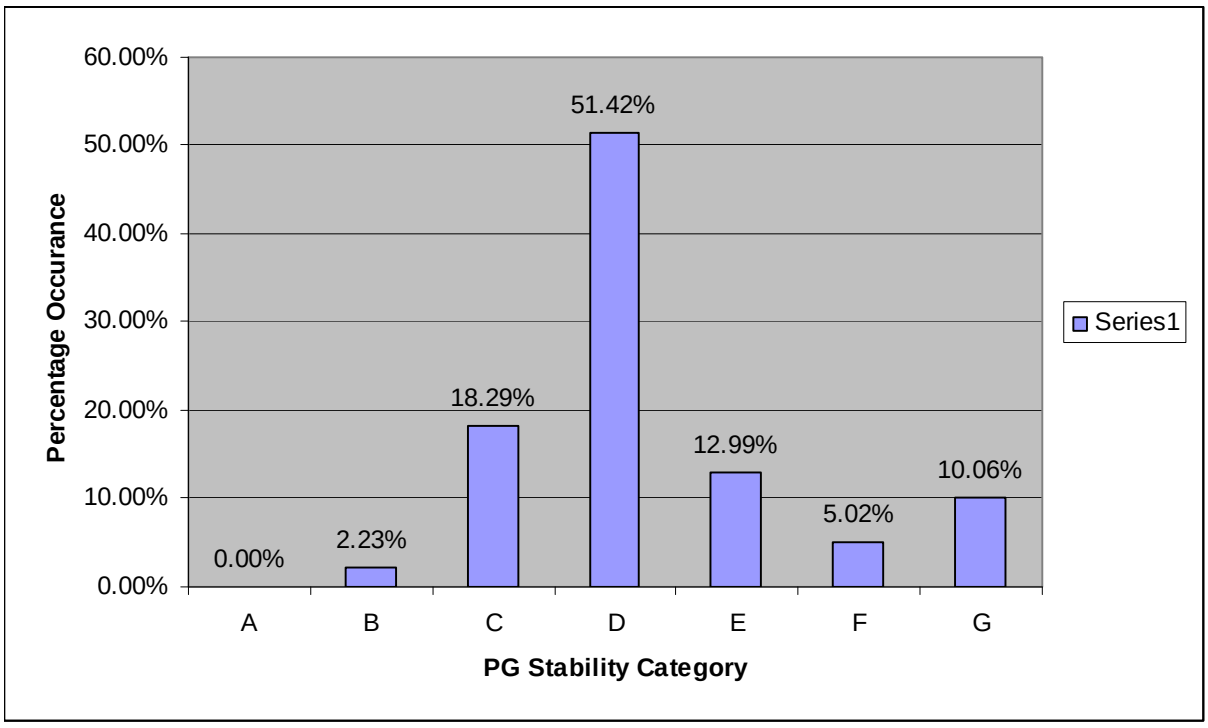
Appendix B Analysis of Meteorological Data

Appendix B

CALMET Stability Categories

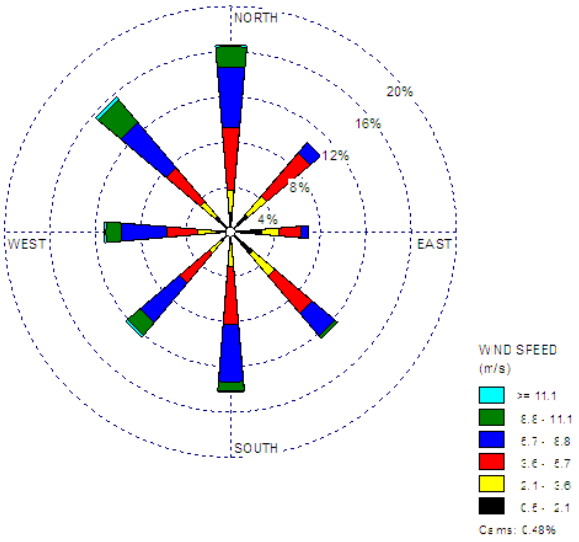


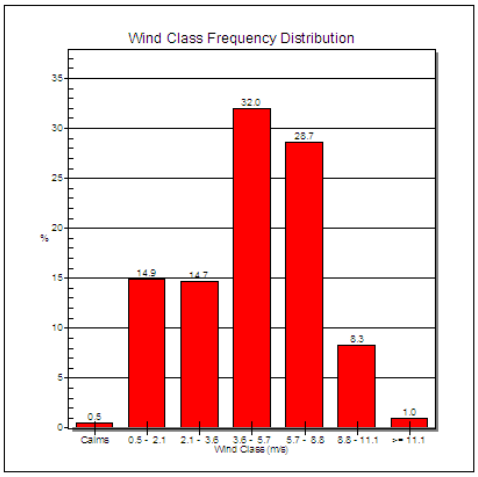
Calculated Stability Categories from Met Data using Cloud Cover



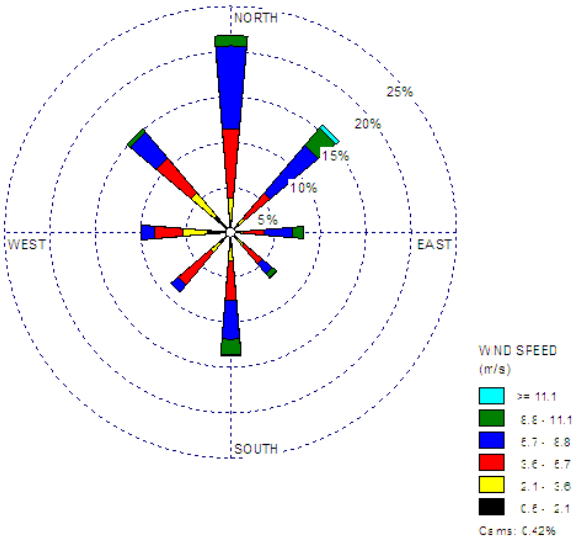
Appendix B

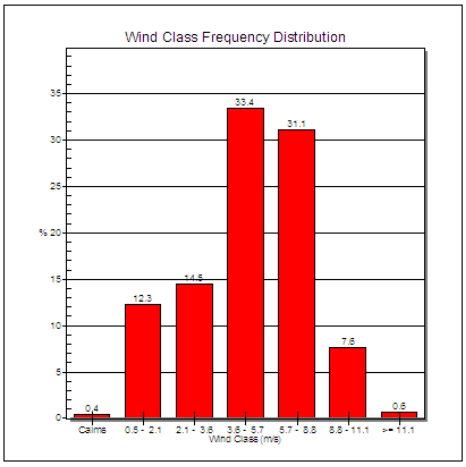
All Seasons





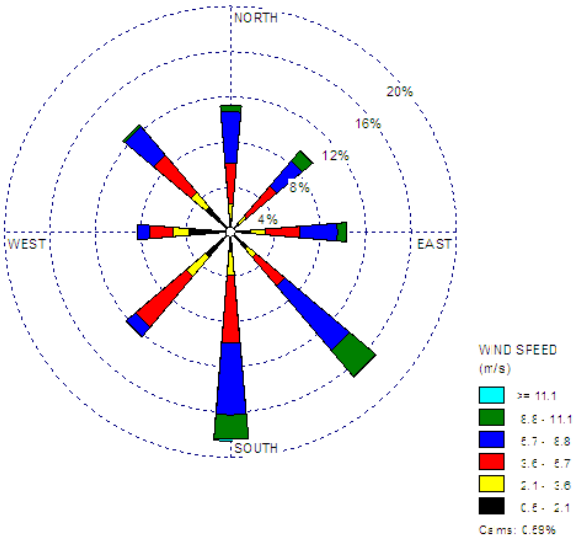
Summer (December – February)

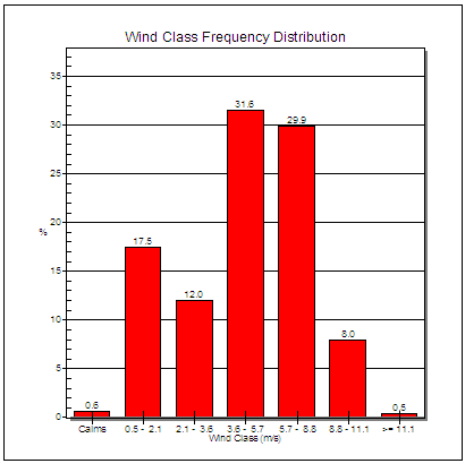




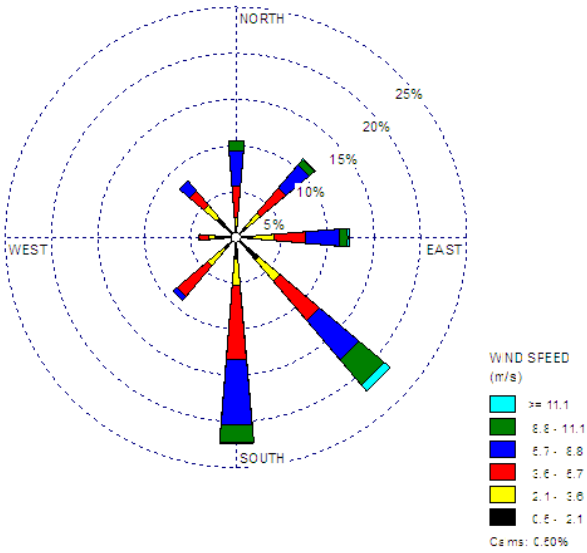
Appendix B

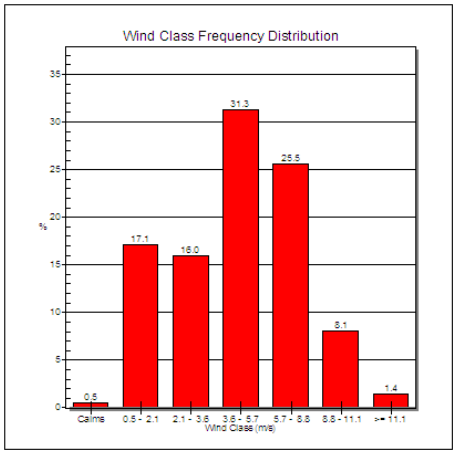
Autumn (March – May)





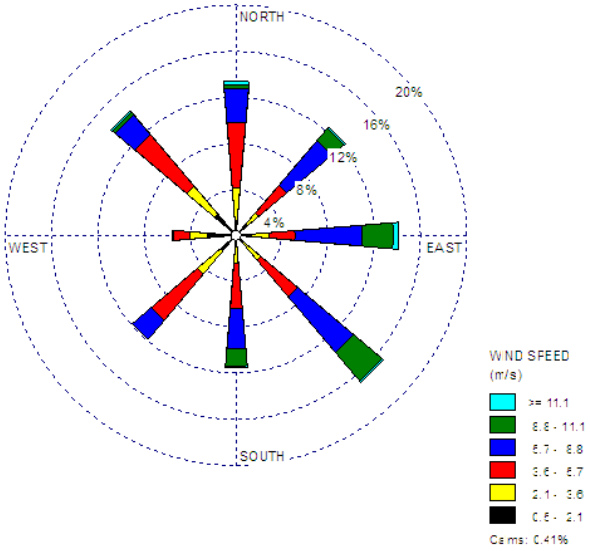
Winter (June – August)

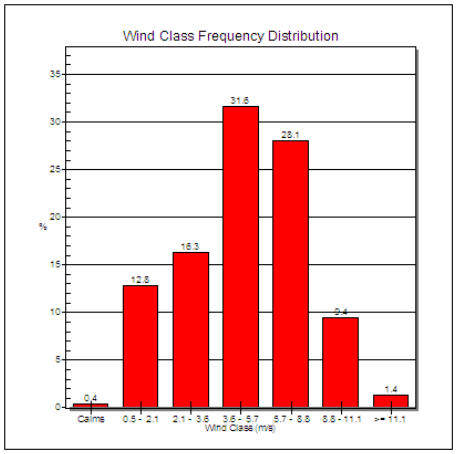




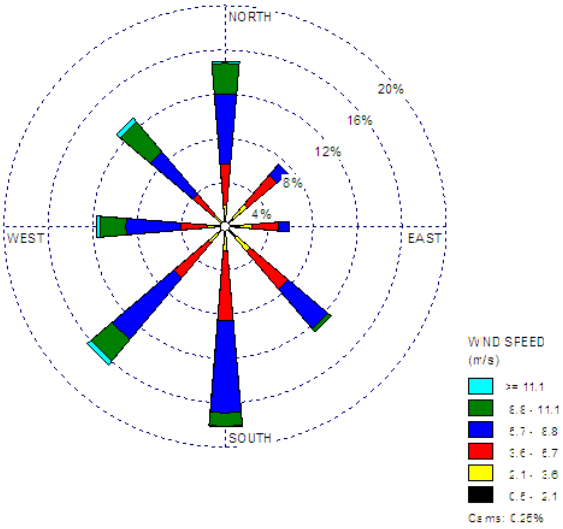
Appendix B

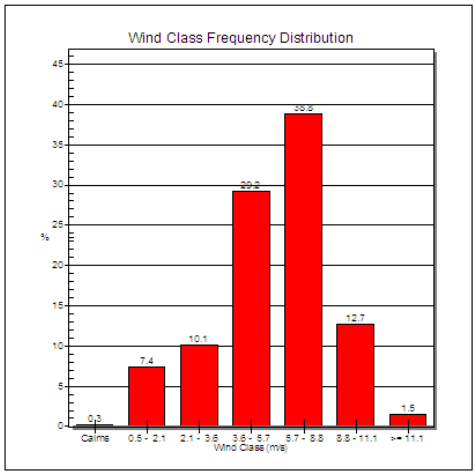
Spring (September – November)





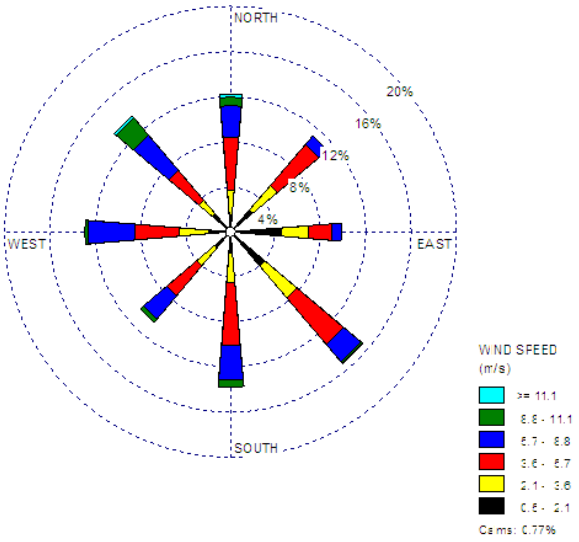
Daytime (7.00 am – 6.00 pm)

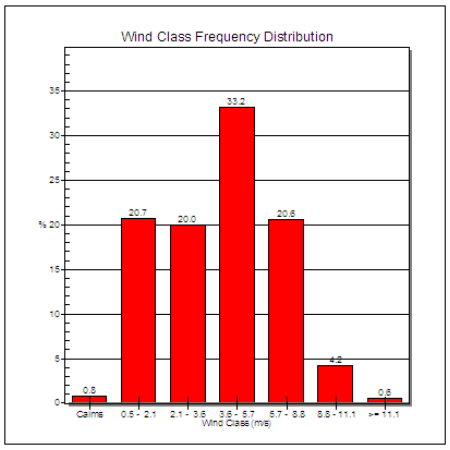




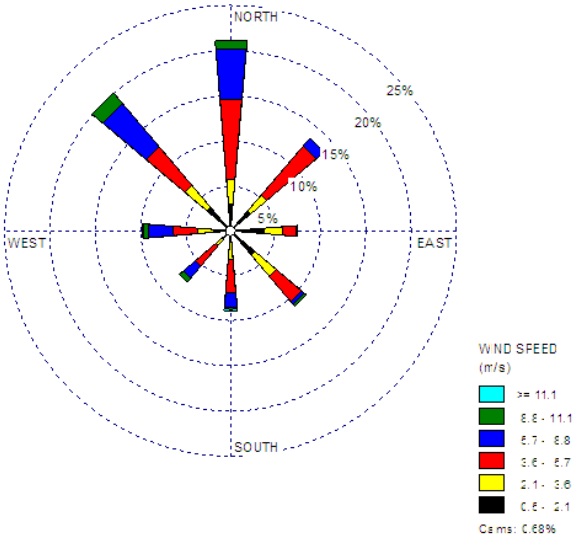
Appendix B

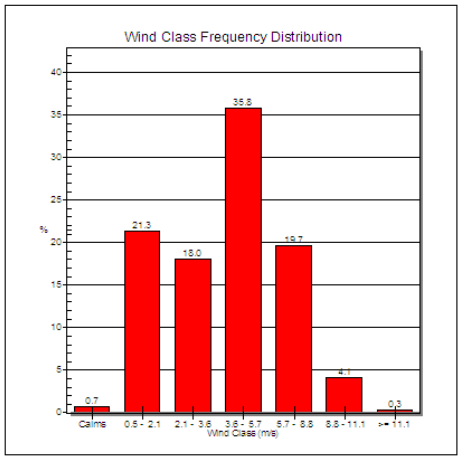
Evening (6.00 pm – 10.00 pm)





Night-time (10.00 pm – 7.00 am)

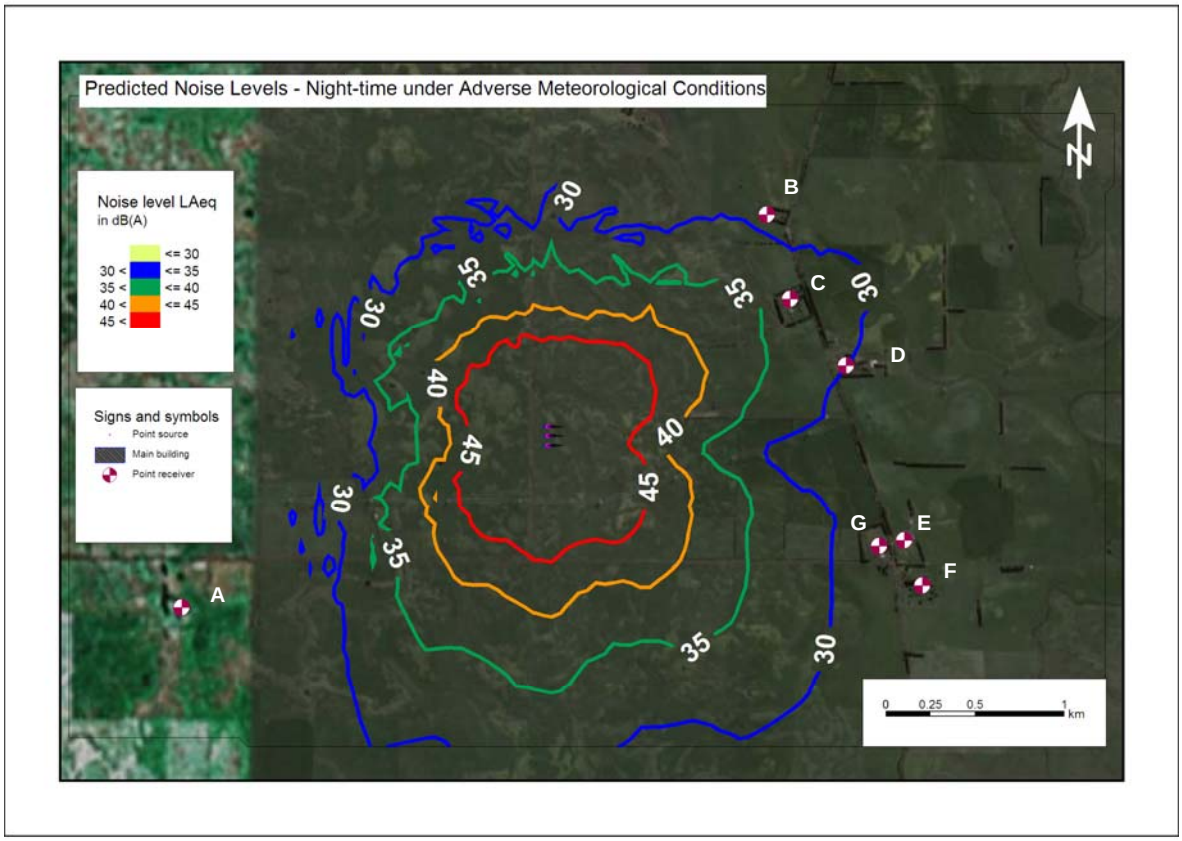




C

Appendix C Noise Contours

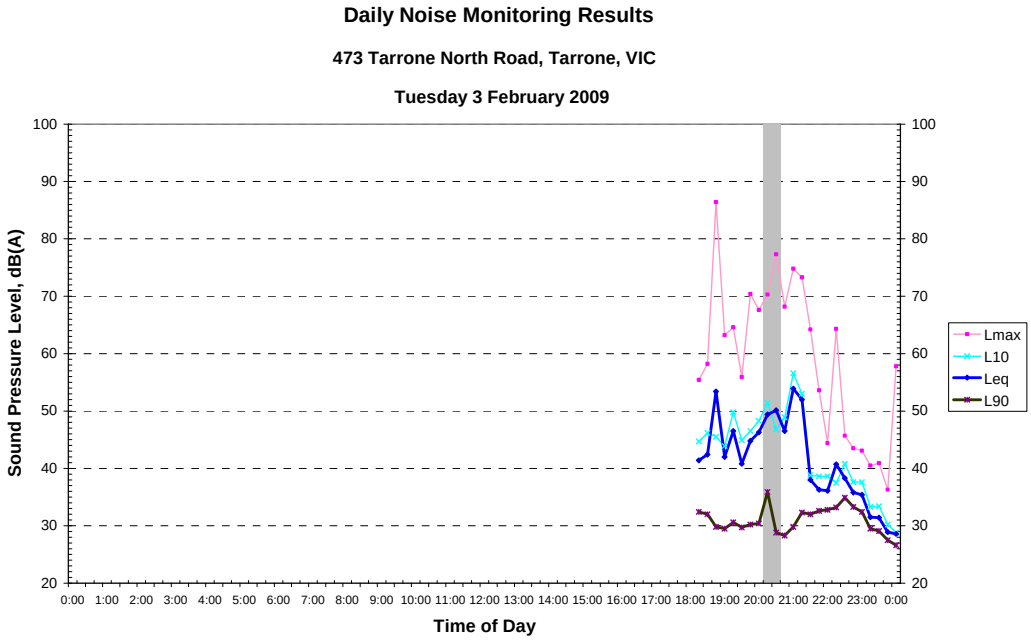
Appendix C


Predicted Noise Levels - Night-time under Adverse Meteorological Conditions
N
Noise level LAeq
in dB(A)
<= 30
30 < <= 35
35 < <= 40
40 < <= 45
45 <
Signs and symbols
Point source
Main building
Point receiver
A
B
C
D
E
F
G
30
35
40
45
0 0.25 0.5 1 km

D

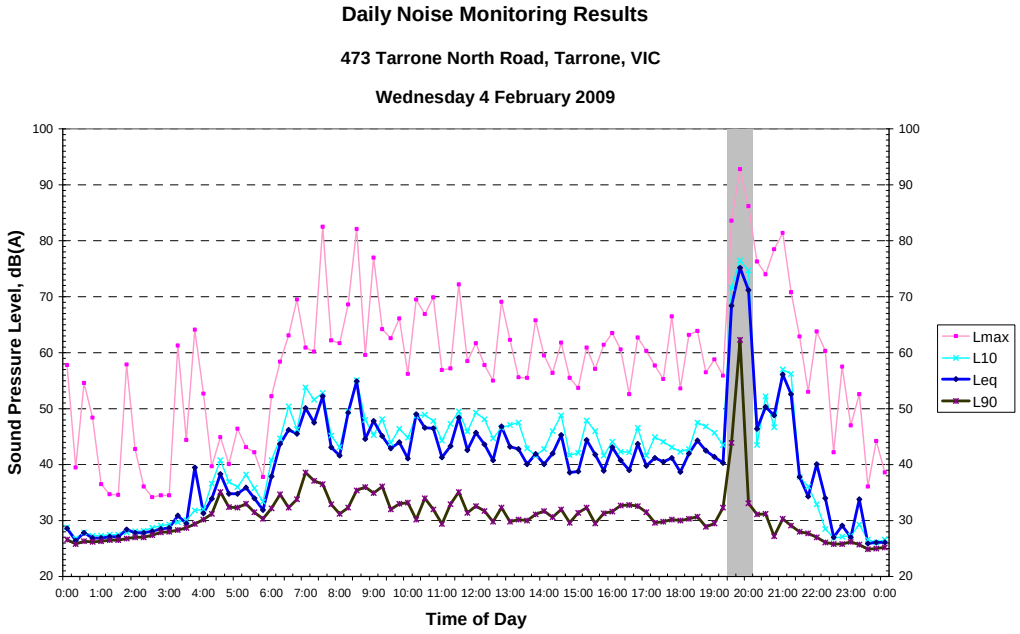
Appendix D Daily Noise Monitoring Plots

Appendix D



Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous
Measured data during these periods were excluded from calculation of noise levels averaged for the period.



Note:

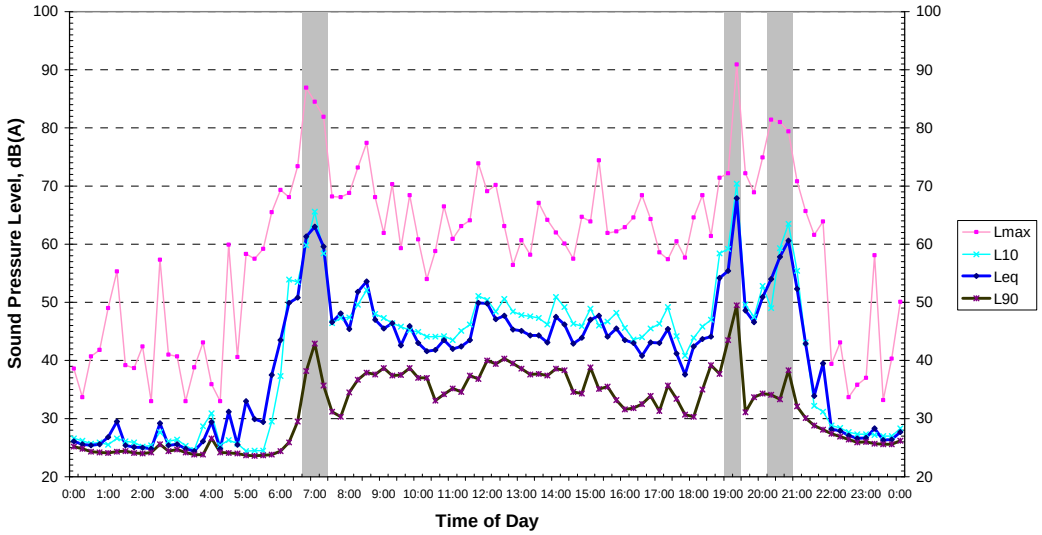
Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Appendix D

Daily Noise Monitoring Results

473 Tarrone North Road, Tarrone, VIC

Thursday 5 February 2009



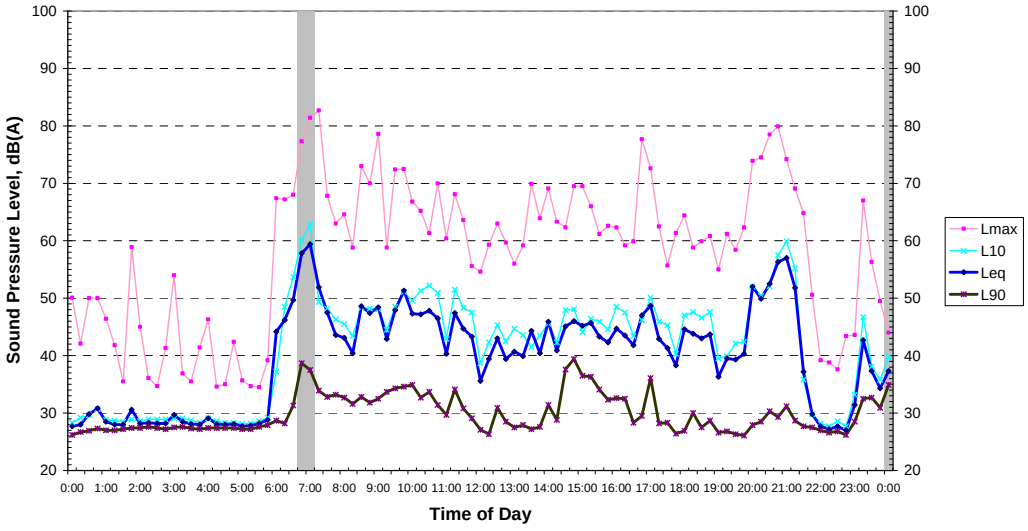
Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Daily Noise Monitoring Results

473 Tarrone North Road, Tarrone, VIC

Friday 6 February 2009



Note:

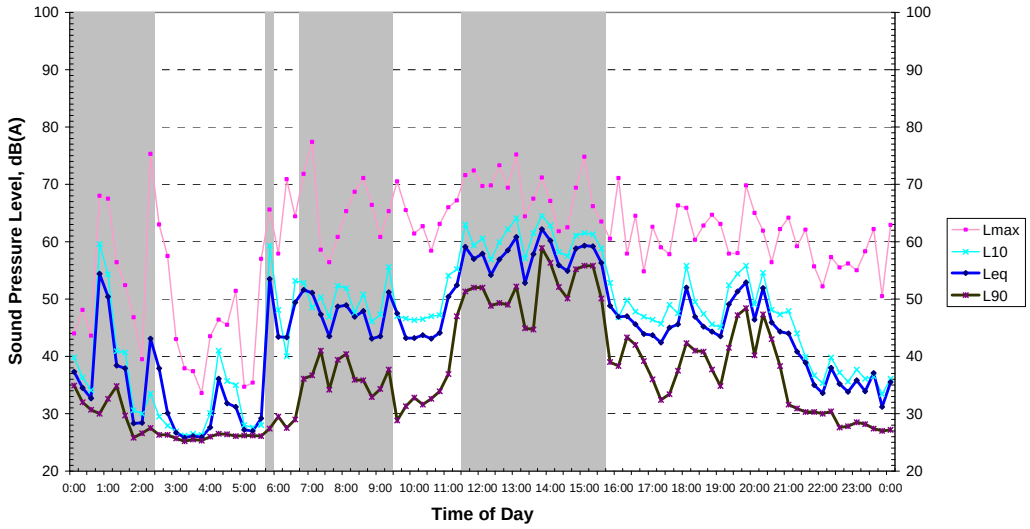
Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Appendix D

Daily Noise Monitoring Results

473 Tarrone North Road, Tarrone, VIC

Saturday 7 February 2009



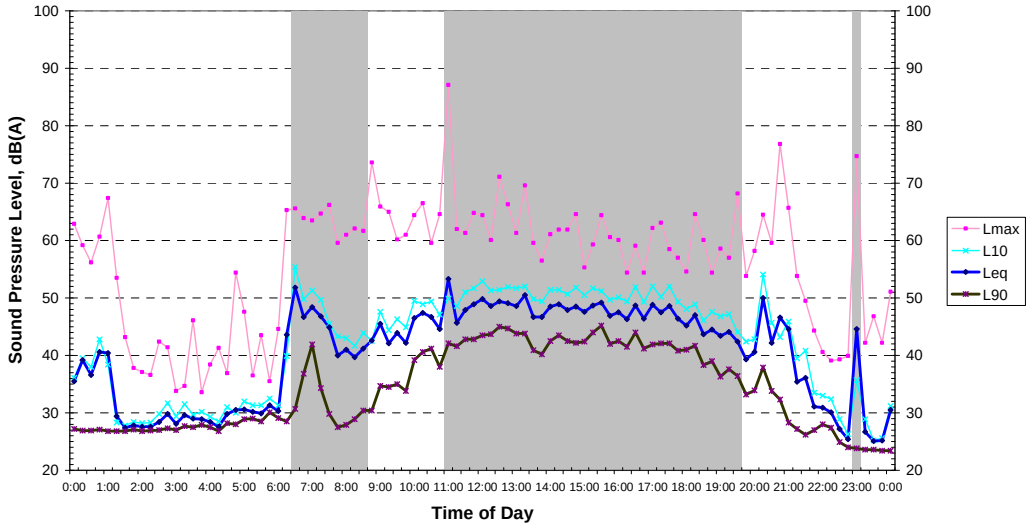
Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Daily Noise Monitoring Results

473 Tarrone North Road, Tarrone, VIC

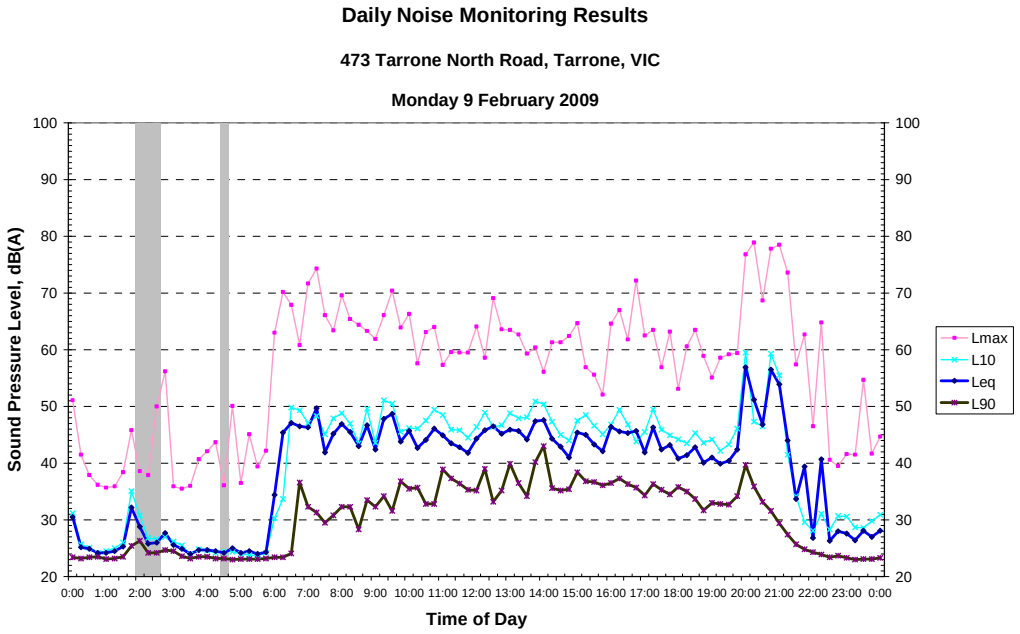
Sunday 8 February 2009



Note:

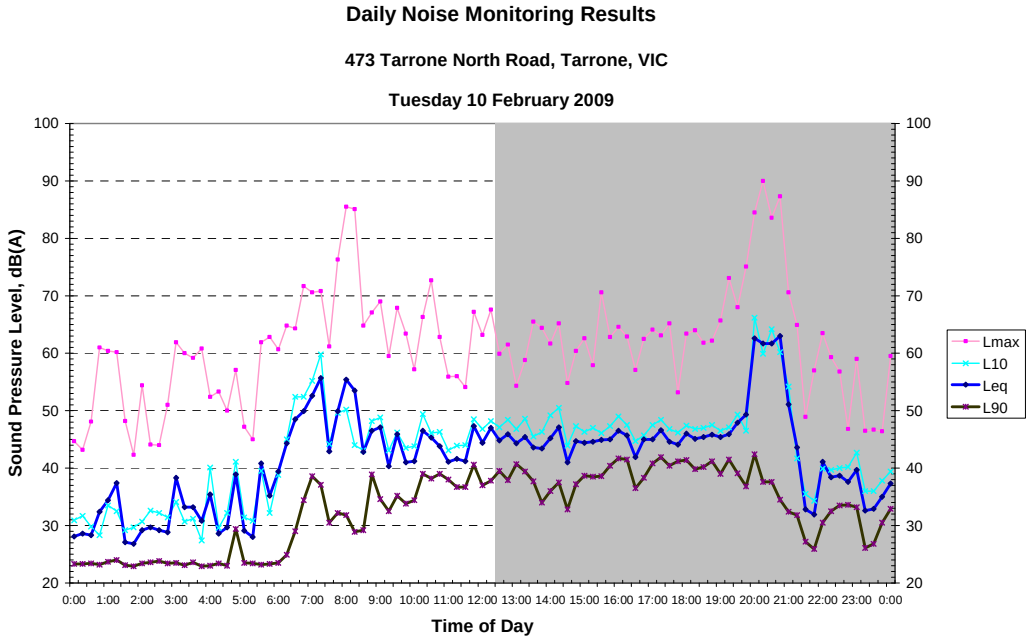
Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Appendix D



Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.



Note:

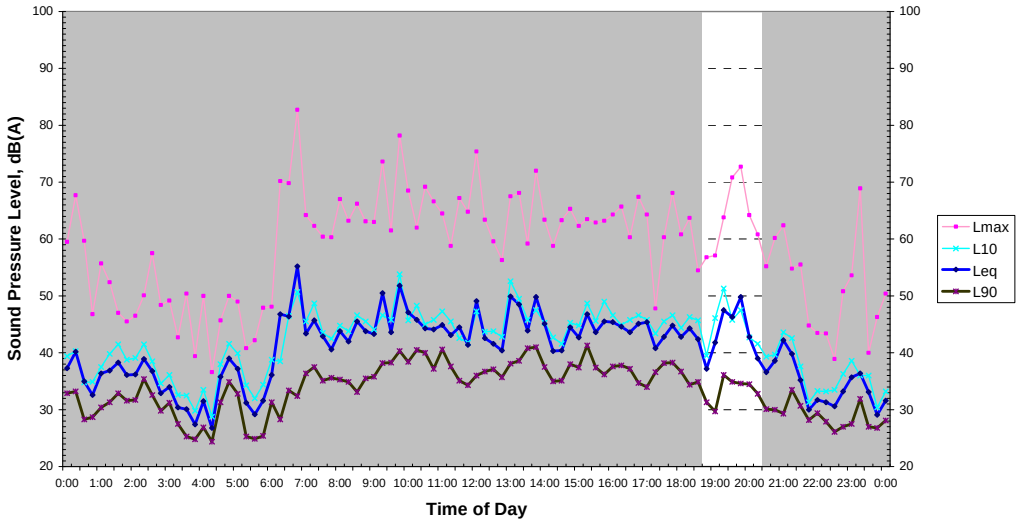
Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Appendix D

Daily Noise Monitoring Results

473 Tarrone North Road, Tarrone, VIC

Wednesday 11 February 2009



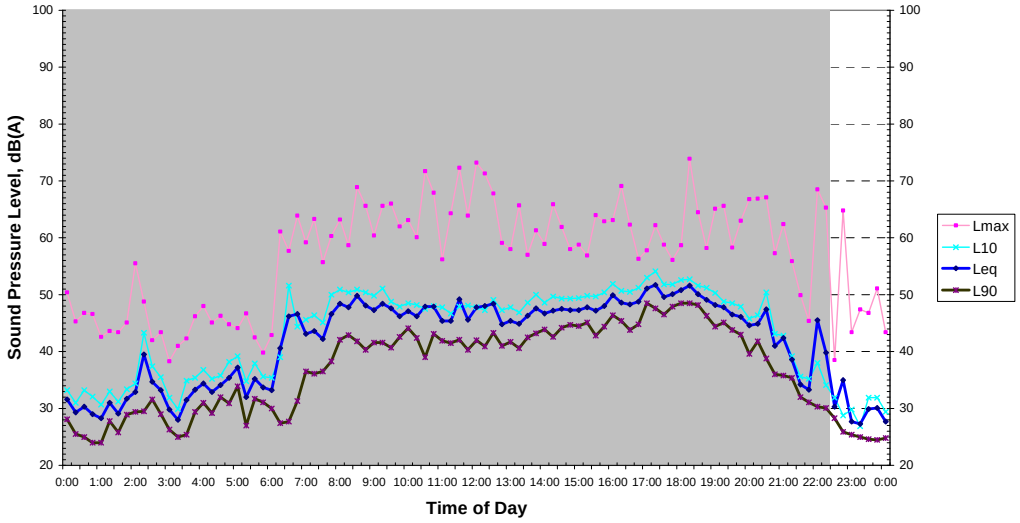
Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Daily Noise Monitoring Results

473 Tarrone North Road, Tarrone, VIC

Thursday 12 February 2009



Note:

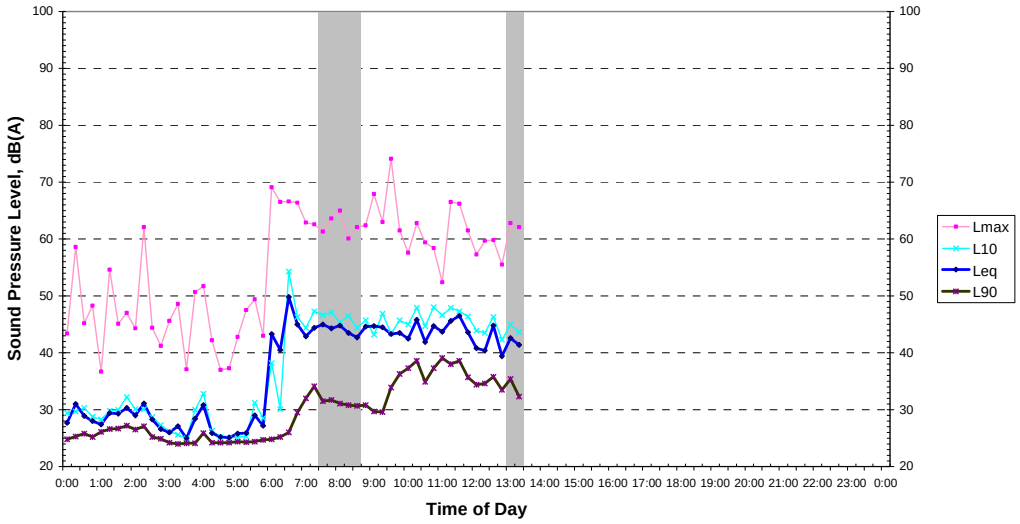
Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Appendix D

Daily Noise Monitoring Results

473 Tarrone North Road, Tarrone, VIC

Friday 13 February 2009



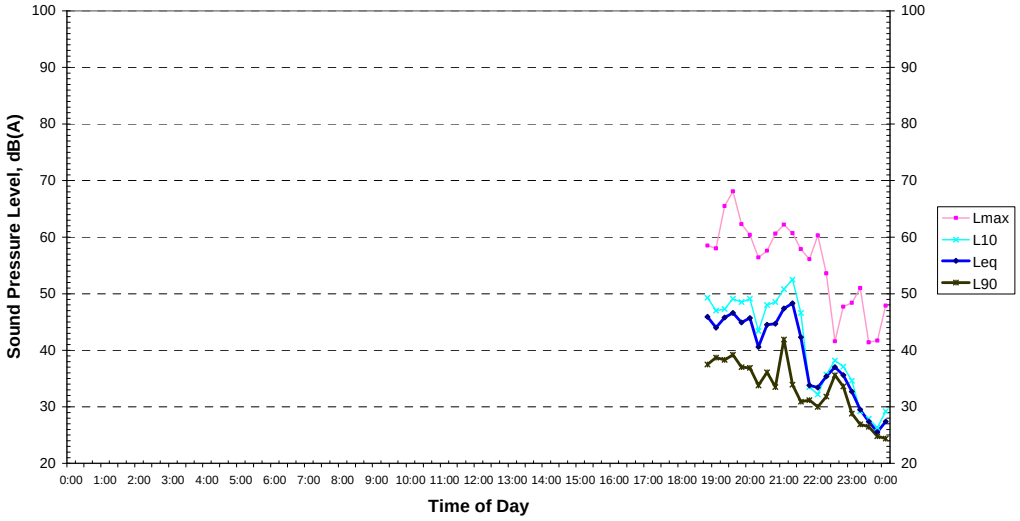
Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Daily Noise Monitoring Results

574 Tarrone North Road, Tarrone, VIC

Tuesday 3 February 2009



Note:

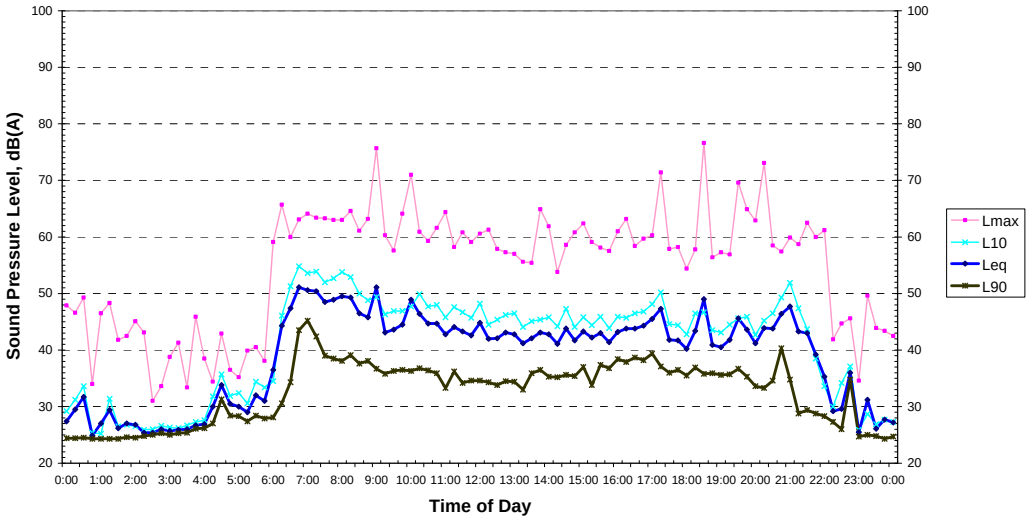
Shaded periods indicate periods affected by adverse weather conditions or extraneous
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Appendix D

Daily Noise Monitoring Results

574 Tarrone North Road, Tarrone, VIC

Wednesday 4 February 2009



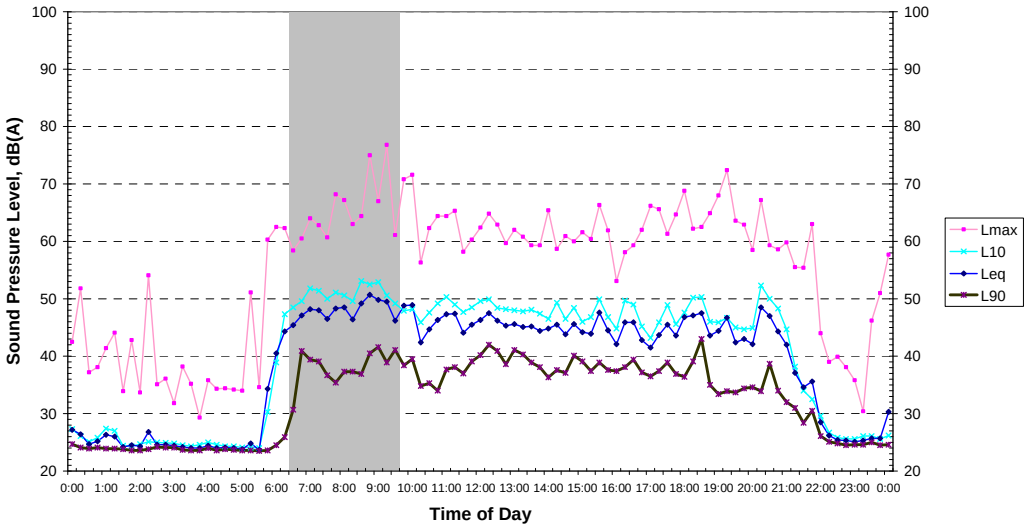
Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Daily Noise Monitoring Results

574 Tarrone North Road, Tarrone, VIC

Thursday 5 February 2009



Note:

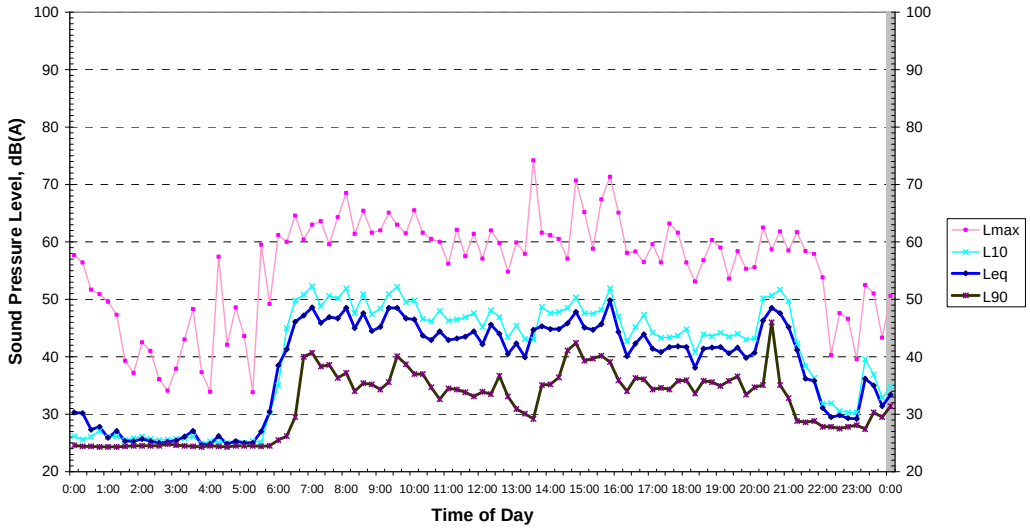
Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Appendix D

Daily Noise Monitoring Results

574 Tarrone North Road, Tarrone, VIC

Friday 6 February 2009



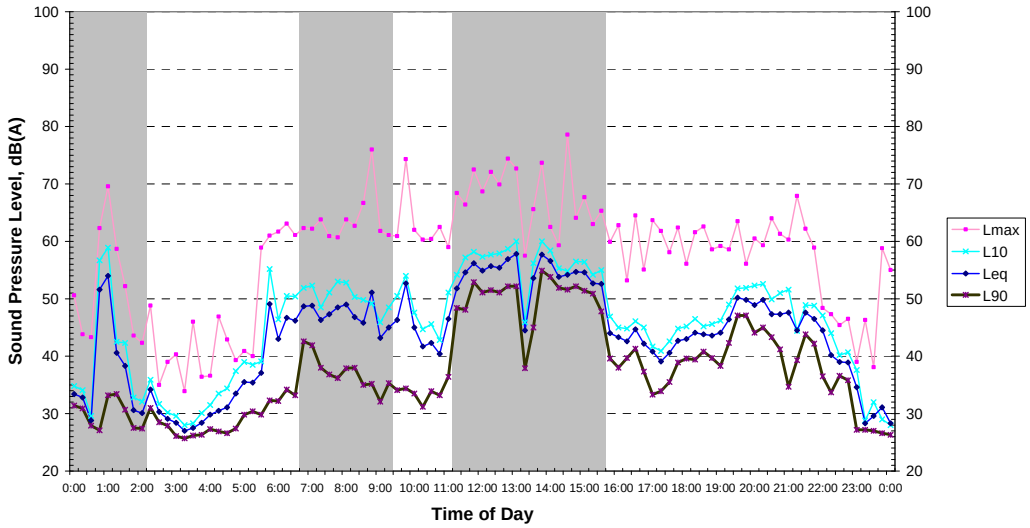
Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Daily Noise Monitoring Results

574 Tarrone North Road, Tarrone, VIC

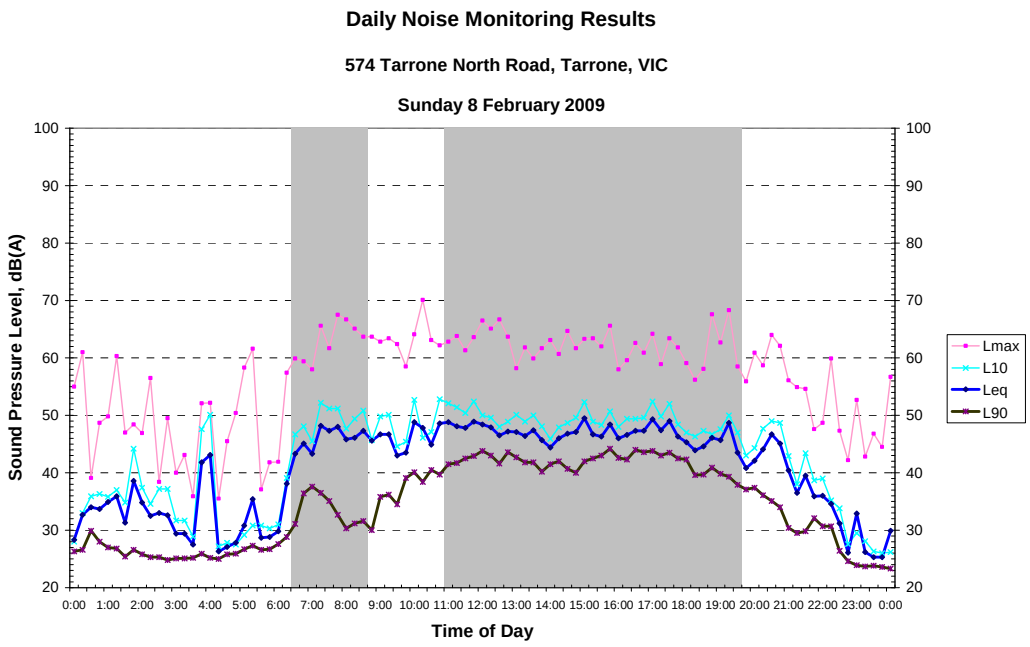
Saturday 7 February 2009



Note:

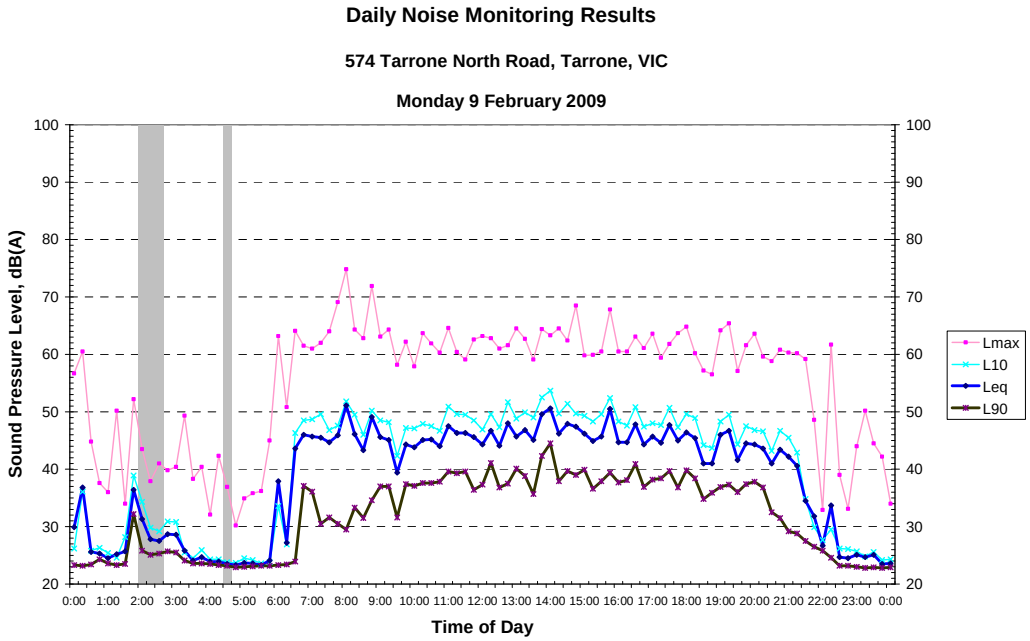
Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Appendix D



Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.



Note:

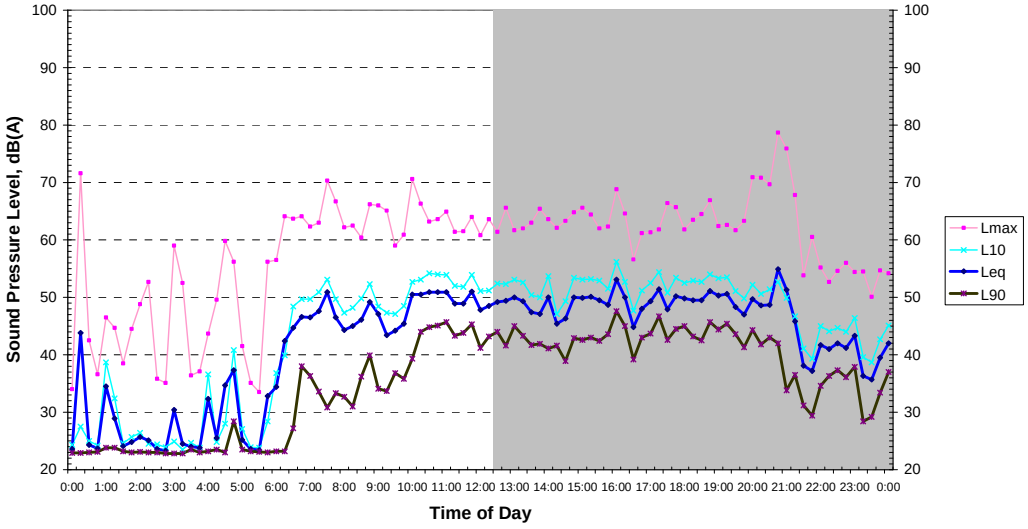
Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Appendix D

Daily Noise Monitoring Results

574 Tarrone North Road, Tarrone, VIC

Tuesday 10 February 2009



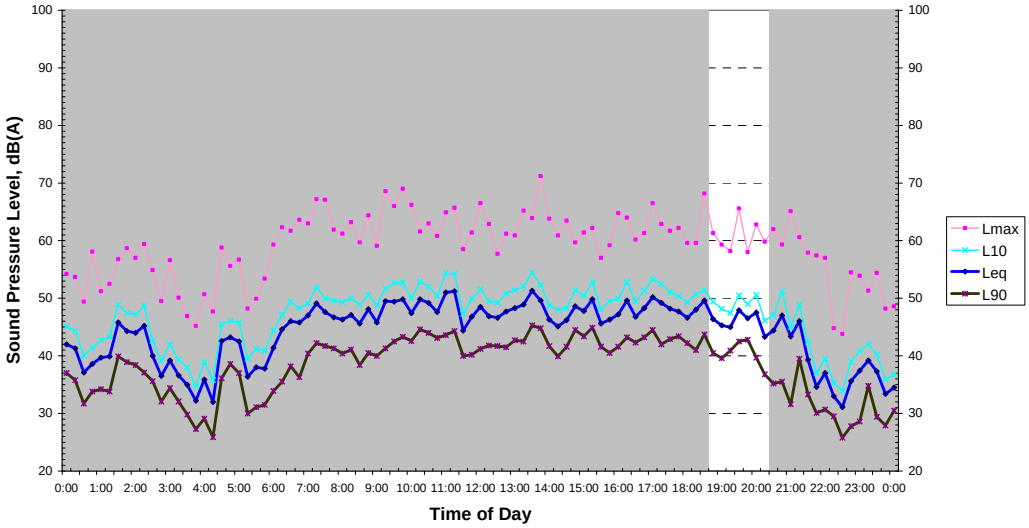
Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Daily Noise Monitoring Results

574 Tarrone North Road, Tarrone, VIC

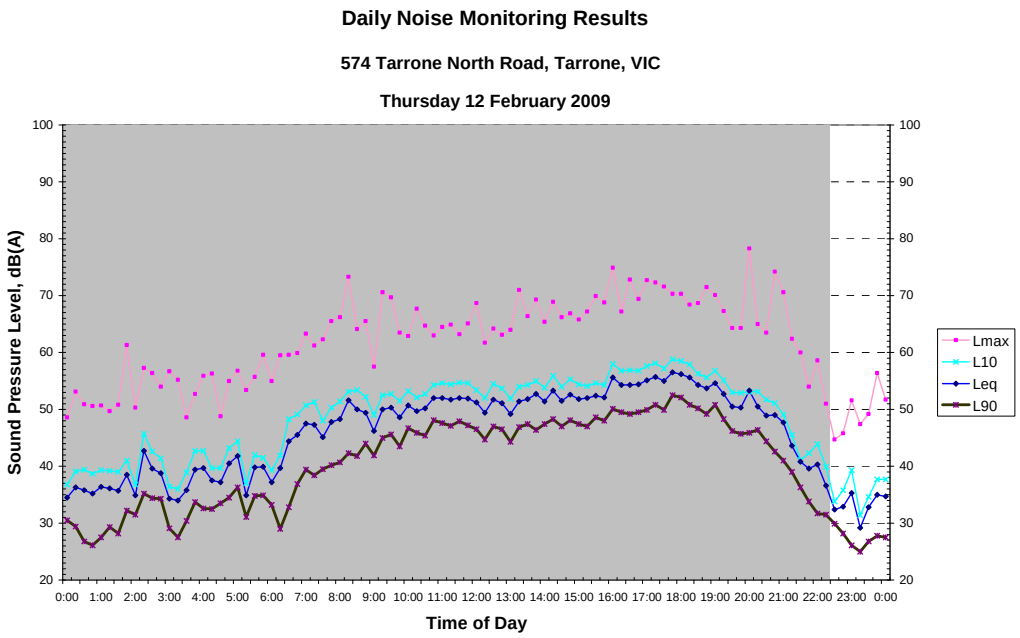
Wednesday 11 February 2009



Note:

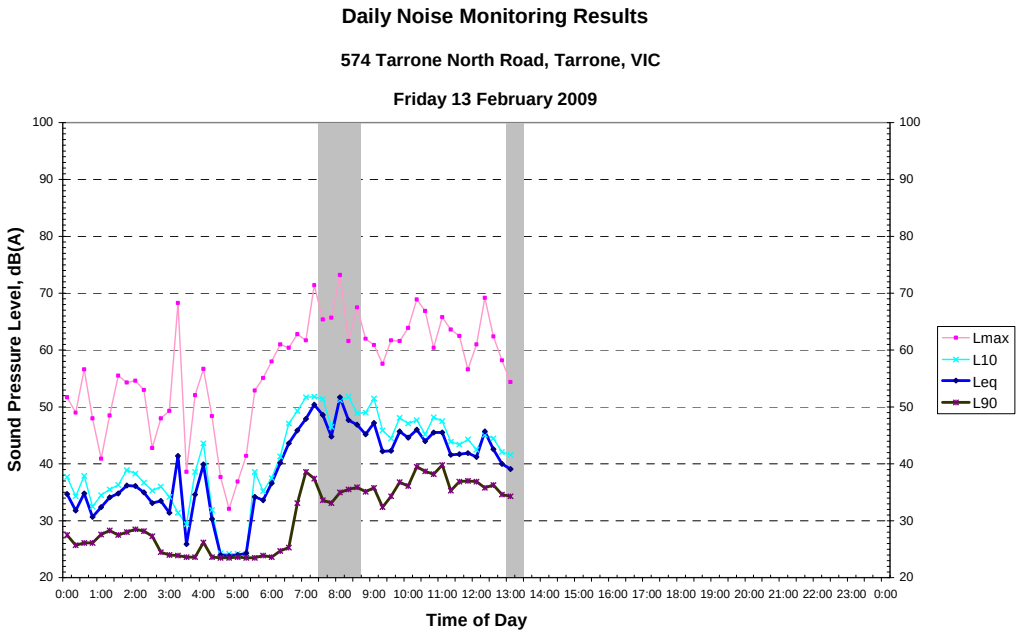
Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Appendix D



Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.



Note:

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Measured data during these periods were excluded from calculation of noise levels averaged for the period.

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