HEGGIES

REPORT 20-1873-R2

Revision 0

Southern Regional Water Pipeline
Northern Pipeline Interconnector - Stage 2
Noise, Vibration and Air Quality Impact Assessment

PREPARED FOR

Southern Regional Water Pipeline Alliance
Level 5, 200 Creek Street
SPRING HILL QLD 4004

27 FEBRUARY 2008

HEGGIES PTY LTD
ABN 29 001 584 612

Incorporating New Environment Graeme E. Harding & Associates Eric Taylor Acoustics

Southern Regional Water Pipeline
Northern Pipeline Interconnector - Stage 2
Noise, Vibration and Air Quality Impact Assessment

PREPARED BY:

Heggies Pty Ltd
Level 1, 240 Waterworks Road Ashgrove QLD 4060 Australia
Telephone 61 7 3858 4800 Facsimile 61 7 3858 4801
Email brisbane@heggies.com Web www.heggies.com

DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked	Authorised
20-1873-R2	Revision 0	27 February 2008	Steve Henry	Joe Carroll	Mark Caslin

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

1 INTRODUCTION

The Stage 2 of Northern Pipeline Interconnector (NPI) project involves the construction of a pipeline that will link Noosa Water Treatment Plant (WTP) with the first stage of the pipeline from the Landers Shute WTP main line at Eudlo to provide a bulk fresh water supply of up to 65 ML/d between the Sunshine Coast and Brisbane. Stage 2 also includes a connection with an upgraded Image Flat WTP.

This document assesses the potential noise, vibration and air quality impacts from construction and operation of the NPI Stage 2 of the project. The principal issues in relation to noise, vibration and dust are expected during the construction phase of the works.

The environmental controls described in this document are designed to minimise the potential noise, vibration and air quality impacts of the project on nearby residences, businesses, schools, places of worship and other sensitive receptors. Mitigation measures are discussed (where necessary) to assist in minimising significant impacts to sensitive receptors.

2 TECHNICAL INFORMATION

2.1 Noise

2.1.1 Standard Noise Indices

This report makes repeated reference to certain noise level descriptors, in particular the L_{A1}, L_{A10}, L_{A90}, and L_{Amax} noise levels.

- The L_{A10} is the A-weighted sound pressure level exceeded for 10% of a given measurement period and is utilised normally to characterise typical maximum noise levels.
- The L_{A90} noise level is the A-weighted sound pressure level exceeded for 90% of a given measurement period and is representative of the average minimum background sound level (in the absence of the source under consideration), or simply the “background” level.
- The L_{A1} noise level is the A-weighted sound pressure level exceeded for 1% of a given measurement period.
- The L_{Amax} noise level is the maximum A-weighted noise level measured over a given measurement period.

2.1.2 Typical Noise Levels

Table 1 presents examples of typical noise levels.

Table 1 Typical Noise Levels

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

2.1.3 A-Weighting or dBA Noise Levels

The overall level of a sound is usually expressed in terms of dBA, as is the case in Australian Standards AS 1055 Acoustics – Description and measurement of environmental noise, AS 2702 Acoustics – Methods for the measurement of road traffic noise" and AS 3671 Acoustics – Road traffic noise intrusion – Building siting and construction", which is measured using the "A-weighting" filter incorporated in sound level meters. These filters have a frequency response corresponding approximately to that of human hearing. People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4000 Hz), and less sensitive at lower and higher frequencies. Thus, the level of a sound in dBA is a good measure of the loudness of that sound.

Different sources having the same dBA level generally sound about equally as loud, although the perceived loudness can also be affected by the character of the sound (eg the loudness of human speech and a distant motorbike may be perceived differently, although they are of the same dBA level).

2.1.4 Sensitivity of People to Noise Level Changes

A change of up to 3 dBA in the level of a sound is difficult for most people to detect, whilst a 3 dBA to 5 dBA change corresponds to a small but noticeable change in loudness. A 10 dBA change corresponds to an approximate doubling or halving in loudness.

2.2 Vibration

Humans are far more sensitive to vibration than is commonly realised. They can detect and possibly even be annoyed at vibration levels which are well below those causing any risk of damage to a building or its contents.

The actual perception of motion or vibration may not, in itself, be disturbing or annoying. An individual's response to that perception, and whether the vibration is "normal" or "abnormal", depends very strongly on previous experience and expectations, and on other connotations associated with the perceived source of the vibration. For example, the vibration that a person responds to as "normal" in a car, bus or train is considerably higher than what is perceived as "normal" in a shop, office or dwelling.

Human tactile perception of random motion, as distinct from human comfort considerations, was investigated by Diekmann and subsequently updated in German Standard DIN 4150 Part 2-1975. On this basis, the resulting degrees of perception for humans are suggested by the continuous vibration level categories given in **Table 2.**

Table 2 Vibration Levels and Human Perception of Motion

Approximate Vibration Level	Degree of Perception
0.10 mm/s	Not felt
0.15 mm/s	Threshold of perception
0.35 mm/s	Barely noticeable
1 mm/s	Noticeable
2.2 mm/s	Easily noticeable
6 mm/s	Strongly noticeable
14 mm/s	Very strongly noticeable

Note: These approximate vibration levels (in floors of building) are for vibration having frequency content in the range of 8 Hz to 80 Hz.

Table 2 suggests that people will just be able to feel continuous floor vibration at levels of about 0.15 mm/s and that the motion becomes "noticeable" at a level of approximately 1 mm/s.

2.3 Air Quality

Dust and particulate emissions associated with construction and earthworks have the potential to adversely impact on amenity and human health. Health impacts depend on particulate size. The term "particulate matter" refers to a category of airborne particles typically less than 50 microns (µm) in diameter and ranging down to 0.1 µm in size. Particles less than 10 µm and 2.5 µm are referred to as PM_{10} and $PM_{2.5}$ respectively.

Emissions of PM_{10} and $PM_{2.5}$ are considered important in terms of impact due to their ability to penetrate to varying degrees into the respiratory system. Because of their smaller particle size, particles in the $PM_{2.5}$ category tend to be less readily trapped in the upper respiratory tract and can more readily penetrate into the lungs. The respiratory system of healthy individuals generally can effectively deal with increased dust levels via a range of response mechanisms. However, recent studies suggest that the long-term exposure of sensitive individuals to high levels of PM_{10} and $PM_{2.5}$ can give rise to potential adverse health impacts including increased mortality from cardiovascular and respiratory diseases, chronic obstructive pulmonary disease and heart disease, and reduced lung capacity in asthmatic children.

Earthmoving activities and wind erosion of disturbed areas, including construction sites, give rise to dust emissions that are predominantly in the coarser fraction of the particle size range (ie larger than PM_{10}). The impacts associated with coarser dust fractions are frequently more significant in terms of nuisance and amenity rather than health. Both fine and coarse particles give rise to nuisance impacts, such as soiling of surfaces, and the creation of deposits in rainwater tanks, swimming pools, cars and other such undesirable effects.

3 PROJECT DESCRIPTION

The Northern Pipeline Interconnector (NPI) is a drought contingency project that will provide a bulk fresh water supply of up to 65 ML/d between the Sunshine Coast and Brisbane. Stage 2 of the NPI will link Noosa Water Treatment Plant (WTP) with the first stage of the pipeline from the Landers Shute WTP main line at Eudlo. The first stage of the NPI south from Landers Shute WTP feeds into the Brisbane system via the Morayfield reservoirs and North Pine Dam.

Stage 2 also includes a connection with an upgraded Image Flat WTP. Design parameters for the NPI as a whole must accommodate water from potential future sources and a reverse flow capacity to transfer water north from Brisbane under different demand management scenarios.

One balance tank and three pump stations are required to enable transfer of water from the Noosa and Image Flat WTPs to Brisbane. These are nominally located at Noosa WTP and the Image Flat connection, with one pump station and a balance tank at Nobels Road, Eudlo.

The present assessment considers two route options between Chevallum and Yandina with Option 1 travelling through Diddillibah and Option 2 travelling through Woombye. At the time of preparation of this report, Option 2 was the preferred route.

Crossings of the Bruce Highway, existing rail infrastructure and major waterways (including the South Maroochy River, Petrie Creek and Paynters Creek) will be achieved by boring beneath these features. Drilling operations are likely to be 24-hour operations. In addition, hard rock areas which may require blasting are anticipated adjacent to the Bruce Highway north of Eumundi-Kenilworth Road.

4 EXISTING ENVIRONMENT

4.1 Noise

Unattended noise measurements were conducted at 16 locations along the proposed pipeline alignment to determine the existing noise environment. The following sections detail the noise monitoring process.

4.1.1 Monitoring Locations

Noise monitoring locations Con 1 to Con 11 were chosen to represent the densest residential area or the most sensitive noise receivers adjacent to the proposed pipeline alignment which may be affected by the construction works of the NPI project. Noise monitoring was also conducted at five “operational” locations (Op 1 to 5), for the assessment of pipeline infrastructure (ie pump stations and balance tank) along the proposed pipeline alignment. The noise monitoring locations are shown in **Appendix C.**

4.1.2 Methodology

All noise measurements were conducted in general accordance with the Environmental Protection Agency’s (EPA) *Noise Measurement Manual* and *AS1055.1 1997 Acoustics - Description and measurement of environmental noises - General Procedures*.

Continuous unattended noise monitoring was conducted at locations Con 4, 5, 6, 7 and 9 between Wednesday 10 October and Monday 22 October 2007, and locations Con 1, 2, 3 and 8 and Op 1, 2, 3 and 4 between Monday 22 October and Wednesday 31 October 2007.

The inclusion of route Option 2 in the assessment subsequently resulted in additional unattended noise monitoring at locations Con 10 and 11 and Op 5. This round of monitoring was carried out between Wednesday 6 February and Thursday 14 February for locations 10 and 11 and Wednesday 20 February to Wednesday 27 February 2008 for location Op 5.

The monitoring was undertaken using Acoustic Research Laboratories Type EL-316 and EL-215 Environmental Noise Loggers programmed to record various statistical noise levels over consecutive 15 minute intervals. Each logger was checked for calibration before and after the survey with a Rion NC-73 Sound Level Calibrator and no significant drift (±0.5 dBA) in calibration was detected. The prevailing weather data was checked and no significant periods of adverse meteorological conditions occurred during the monitoring period.

4.1.3 Noise Monitoring Results

Unattended Noise Logging

The unattended ambient noise measurements were used to determine the "Rating Background Level" (RBL) for the daytime (7:00 am to 6:00 pm), evening (6:00 pm to 10:00 pm) and night-time (10:00 pm to 7:00 am) periods at each location. The RBL is the median of the 90th percentile of the background (L_{A90}) noise levels in each assessment period (day, evening and night) over the duration of the monitoring. **Table 3** contains the determined RBL for each measurement location.

Table 3 Measured Rating Background Levels

Location	Rating Background Level L_{A90} (dBA)		
	Day	Evening	Night
Con 1 – Leafy Lane, Woombye	50	43	35
Con 2 – 599 Petrie Creek Road, Rosemount	39	36	30
Con 3 – Retirement Community, Zealey Road, Nambour	37	38	34
Con 4 – 92 Sheanans Road, Yandina	49	50	39
Con 5 – Yandina Caravan Park, Old Bruce Hwy, Yandina	38	40	35
Con 6 – 2 Low Street, Yandina	38	35	28
Con 7 – 121 Holts Road, Cooroy	49	45	38
Con 8 – 39 Nandroya Road, Cooroy	39	44	33
Con 9 - Swift Drive, Cooroy	39	39	29
Con 10 – 6 Woombye - Palmwoods Road, Woombye	46	40	34
Con 11 – 102 Panorama Drive, Nambour	41	38	33
Op 1 – Nobels Road, Mooloolah Valley	37	35	27
Op 2 – 693 Diddillibah Road, Diddillibah	40	37	30
Op 3 – 5 Atkinson Road, Bli Bli	42	44	38
Op 4 – 415 Lake Macdonald Road, Lake Macdonald	34	35	32
Op 5 – 300 Image Flat Road, Image Flat	37	39	37

The typical (average) $L_{Aeq(1hour)}$ for each daytime, evening and night-time period was also noted for the locations potentially affected by operational noise from the pipeline (shown in **Table 4**).

Table 4 Measured $L_{Aeq(1hour)}$ Noise Levels

Location	Measured $L_{Aeq(1hour)}$ Noise Levels (dBA)		
	Day	Evening	Night
Op 1 – Nobels Road, Mooloolah Valley	53	50	47
Op 2 – 693 Diddillibah Road, Diddillibah	59	56	49
Op 3 – 5 Atkinson Road, Bli Bli	55	53	50
Op 4 – 415 Lake Macdonald Road, Lake Macdonald	60	54	48
Op 5 – 300 Image Flat Road, Image Flat	56	49	46

Graphs showing the statistical noise levels measured at the monitoring sites over the full monitoring period are presented in **Appendix A** for each 24-hour period.

Attended Noise Monitoring

Attended noise measurements were carried out on 10, 22 and 24 November 2007 using Rion NA-27 and SVAN 948 Sound Level Meters and 14 November 2008 using a B&K 2250 Sound Level Meter. The meters were checked for calibration before and after the measurements using a Rion NC-73 calibrator. A summary of the attended noise measurements is presented in **Table 5**.

Table 5 Attended Measurement Results Summary

Monitoring Location	Date and Time	Measured Level (dBA)			Description
		L_{A90}	L_{Aeq}	L_{A10}	
Con 1 – Leafy Lane, Woombye	22/10/07 14:07	53	57	60	Constant traffic noise from Bruce Hwy.
Con 2 – 599 Petrie Creek Road, Rosemount	22/10/07 12:04	45	54	57	Occasional traffic noise from Petrie Creek Rd and David Low Way.
Con 3 – Retirement Community, Zealey Road	22/10/07 11:21	40	54	56	Occasional traffic noise from Zealey Rd. Distant substation noise (transformer).
Con 4 – 92 Sheanans Road, Yandina	10/10/07 12:30	48	63	56	Constant traffic noise from Bruce Hwy. Farm animal noise.
Con 5 – Yandina Caravan Park, Old Bruce Hwy	10/10/07 11:44	41	45	48	Distant traffic noise from Old Bruce Highway.
Con 6 – 2 Low Street, Yandina	10/10/07 10:55	40	53	58	Occasional local road traffic noise. Distant road traffic noise from Bruce Hwy.
Con 7 – 121 Holts Road, Cooroy	10/10/07 9:55	51	55	57	Constant traffic noise from Bruce Hwy.
Con 8 – 39 Nandroya Road, Cooroy	22/10/07 9:10	41	48	51	Occasional traffic noise from Nandroya Rd. Distant traffic noise from Bruce Hwy.
Con 9 - 19 Swift Drive, Cooroy	10/10/07 9:12	43	49	51	Local road traffic noise from Swift Dr and Tewantin Rd.
Con 10 – 6 Woombye-Palmwoods Road, Woombye	14/02/08 11:58	47	50	52	Road traffic noise from Nambour Connection Road.

Monitoring Location	Date and Time	Measured Level (dBA)			Description
		LA90	LAeq	LA10	
Con 11 – 102 Panorama Drive, Nambour	14/02/08 12:29	42	46	47	Distant road traffic noise from Bruce Hwy.
Op 1 – Nobels Road, Mooloolah Valley	10/10/07 14:14	38	45	48	Occasional road traffic noise from Mooloolah Rd. Insect noise.
	24/10/07 18:12	39	51	56	Occasional road traffic noise from Nobels Rd and Mooloolah Rd. Insect noise.
	24/10/07 23:54	33	37	40	Distant traffic noise. Insect noise.
Op 2 – 693 Diddillibah Road, Diddillibah	22/10/07 13:27	42	55	59	Occasional traffic noise from Diddillibah Rd. Insect noise.
	24/10/07 19:02	38	55	58	Occasional traffic noise from Diddillibah Rd. Insect noise.
	24/10/07 23:16	32	34	36	Distant traffic noise. Insect noise.
Op 3 – 5 Atkinson Road, Bli Bli	22/10/07 12:45	46	56	59	Intermittent traffic noise from Bli Bli Road.
	24/10/07 19:27	39	51	52	Intermittent traffic noise from Bli Bli Road.
	24/10/07 22:45	35	42	45	Occasional traffic noise from Bli Bli Rd. Distant insect noise.
Op 4 – 415 Lake Macdonald Road, Lake Macdonald	22/10/07 8:30	37	52	54	Occasional traffic noise from Lake Macdonald Rd. Noise from water treatment plant.
	24/10/07 20:36	35	58	51	Occasional traffic noise from Lake Macdonald Rd. Noise from water treatment plant.
	24/10/07 22:00	42	43	45	Noise from water treatment plant. Insect noise.
Op 5 – 300 Image Flat Road, Image Flat[1]	14/02/08 13:03	40	45	47	Noise from quarry including heavy vehicles and occasional vehicle passbys on Image Flat Road

Note 1 – Evening and night-time attended measurement data unavailable due to heavy rainfall over the final stages of the monitoring program.

As noted in **Table 5**, insect noise was prevalent during the attended noise measurement period particularly during the night-time period. The one-third octave attended measurement data was adjusted (by interpolation) to remove the influence of the insects. From this both the insect adjusted and unadjusted noise levels were compared directly with the RBLs (from the noise logging). The result of this comparison indicated that the adjusted noise levels were generally consistent with the RBLs presented in **Table 3**. Therefore it was considered unnecessary to adjust the RBLs (background noise levels) to account for insect noise.

4.2 Air Quality

4.2.1 Introduction

The existing air quality environment along the pipeline route is influenced by regional air pollutant sources (mainly transport and industry related), with minor contributions from local traffic, construction, commercial/industrial sources and rural/cropping activities.

Variations in local air quality will occur due to the proximity of sources such as major roads, regional events such as bushfires and dust storms and variations of meteorological conditions such as wind speed, wind direction and atmospheric stability.

4.2.2 Air Quality Monitoring

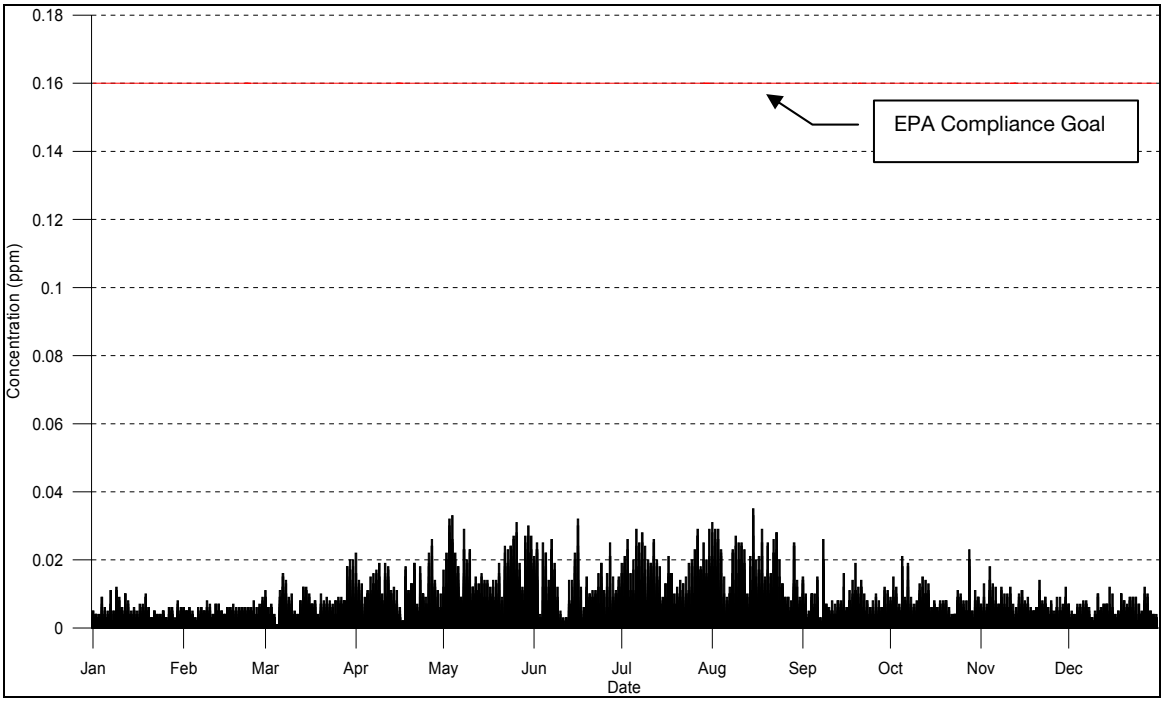
Measurements of existing meteorological parameters and air quality have been made in the general vicinity of the pipeline over a period of some years by the Queensland Environmental Protection Agency (EPA).

The EPA maintains an air quality monitoring station at Mountain Creek, approximately 13 km east-northeast of the Eudlo end of the proposed pipeline project. It is located at the Mountain Creek State Primary School, and was established in July 2001 to measure local meteorology and concentrations of ozone (O_3), oxides of nitrogen (NO_x) and PM_{10}. The latter two parameters are considered to be relevant to the current assessment of construction air quality impacts.

Oxides of Nitrogen

Figure 1 summarises the Mountain Creek 1-hour average Nitrogen Dioxide (NO_2) ambient monitoring data for one full year of validated and representative data (calendar year 2006).

Figure 1 Mountain Creek Ambient 1-hour Average NO_2 Concentrations (ppm) - 2006



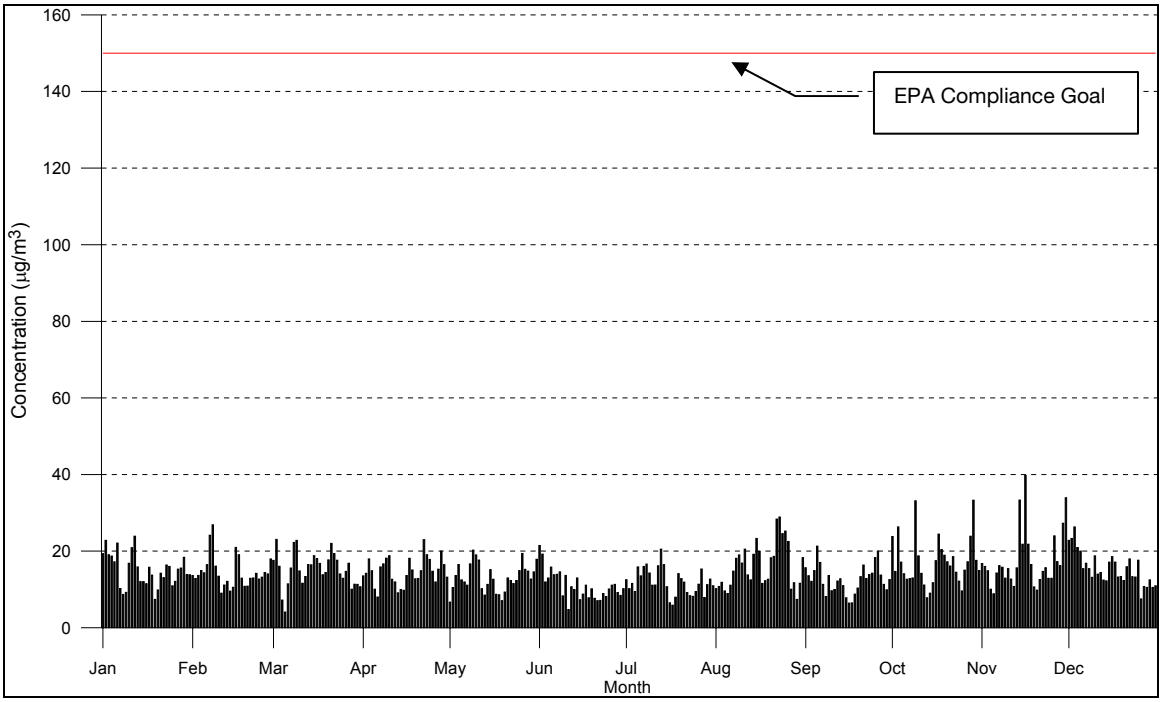
As shown in **Figure 1**, the 1-hour average NO_2 concentration did not exceed the EPA compliance goal throughout 2006. The maximum of the dataset, 0.035 ppm, was recorded on 15 August 2006. The annual average NO_2 concentration was recorded as 0.005 ppm, which also satisfies the relevant project goal of 0.01 ppm.

Particulate Matter 10 microns or less in diameter (PM_{10})

PM_{10} is measured at the Mountain Creek monitoring site using a tapered element oscillating microbalance (hereafter, "TEOM") monitor. This instrument gives real-time recordings of the ambient particulate concentration, detected by observing changes to the loading on a filter mounted within the unit.

Figure 2 summarises the Mountain Creek 24-hour average PM_{10} ambient monitoring data for one full year of validated and representative data (calendar year 2006).

Figure 2 Mountain Creek Ambient 24-hour Average PM_{10} Concentrations (µg/m³) - 2006



As shown in **Figure 2**, PM_{10} concentrations did not exceed the EPA compliance goal of 150 µg/m³ throughout 2006. The maximum of the dataset, 39.8 µg/m³, was recorded on 16 November 2006. The annual average PM_{10} concentration at Mountain Creek was 14.5 µg/m³. This also satisfies the relevant project goal of 50 µg/m³.

It is noted that in regions where road traffic is not the dominant particulate source, such as rural areas, the PM_{10} sub-set is typically approximately 50% of total suspended particulates (TSP) in the ambient air (US EPA, 2001). In the absence of monitoring data for TSP, the annual average TSP concentration for the region may therefore be derived by multiplying the annual average PM_{10} concentration by a factor of two.

To estimate a background concentration of annual TSP, this report has taken the annual average PM_{10} records at Mountain Creek for 2006 of 14.5 µg/m³ and used the above multiplier to derive the annual average TSP concentration. This corresponds to a background TSP concentration of 29 µg/m³.

In view of the forgoing, ambient air quality monitoring representative of the project site indicates that there is a capacity within the regional air shed for atmospheric emissions to be assimilated without compromising EPA air quality goals.

4.2.3 Dispersion Meteorology

To provide concurrent observations with the daily varying background PM_{10} data used in the assessment, a 2006 meteorological data set representative of the Project Region, based on weather observations recorded at the Bureau of Meteorology's (hereafter, "BoM") Automatic Weather Stations (hereafter, "AWS") at Tewantin and Nambour was created. The Tewantin AWS and Nambour AWS are located approximately 10 km east and 12 km north-northwest of the Noosa Water Treatment Plant and the Eudlo points of the pipeline respectively.

The dataset was generated synthetically through the use of The Air Pollution Model (hereafter, "TAPM"). TAPM, developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO), is a prognostic model which may be used to predict three-dimensional meteorological data, with no local data inputs required.

The model predicts wind speed and direction, temperature, pressure, water vapour, cloud, rain water and turbulence. The program allows the user to generate synthetic observations by referencing databases (covering terrain, vegetation and soil type, temperature and synoptic scale meteorological analyses) which are subsequently used in the model input to generate site-specific hourly meteorological observations.

Additionally, the TAPM model may assimilate actual local wind observations so that they can optionally be included in a model solution. The wind speed and direction observations are used to realign the predicted solution towards the observation values. This function of accounting for actual meteorological observations within the region of interest is referred to as "data assimilation".

Thus, direct measurements for 2006 of hourly average wind speed, wind direction and temperature, obtained at the BoM's Tewantin and Nambour AWSs, have been used in creating a meteorological input file for modelling purposes. Parameters not recorded by these weather stations (atmospheric stability class, mixing height and the standard deviation of wind direction – or sigma theta) but required by the meteorological input file have also been synthetically generated using TAPM.

Wind roses for the TAPM generated meteorology of the Project region can be observed in **Appendix B**. The wind rose is representative of the meteorological input file used in the assessment, and displays occurrences of winds from all quadrants.

The annual wind rose indicates that winds tend to be experienced from the southern and northeastern quadrants and are typically light to moderate, having an average wind speed of between 1.5 m/s and 8 m/s.

The seasonal variation in wind behaviour at the Project Site is also presented in **Appendix B**. The seasonal wind roses indicate the following.

- In summer, light to moderate winds occur from the southeast to south-southwest approximately 44% of the time and from the northeast approximately 10% of the time.
- In autumn, light to moderate winds are prevalent from the southeast to south-southwest approximately 47% of the time.
- In winter, light winds, being those from 1.5 m/s to 5.5 m/s, are experienced from the south to south-southwest approximately 36% of the time.

- In spring, light to moderate winds are experienced from the east-southeast to south-southwest approximately 37% of the time, and from the north to northeast approximately 27% of the time.

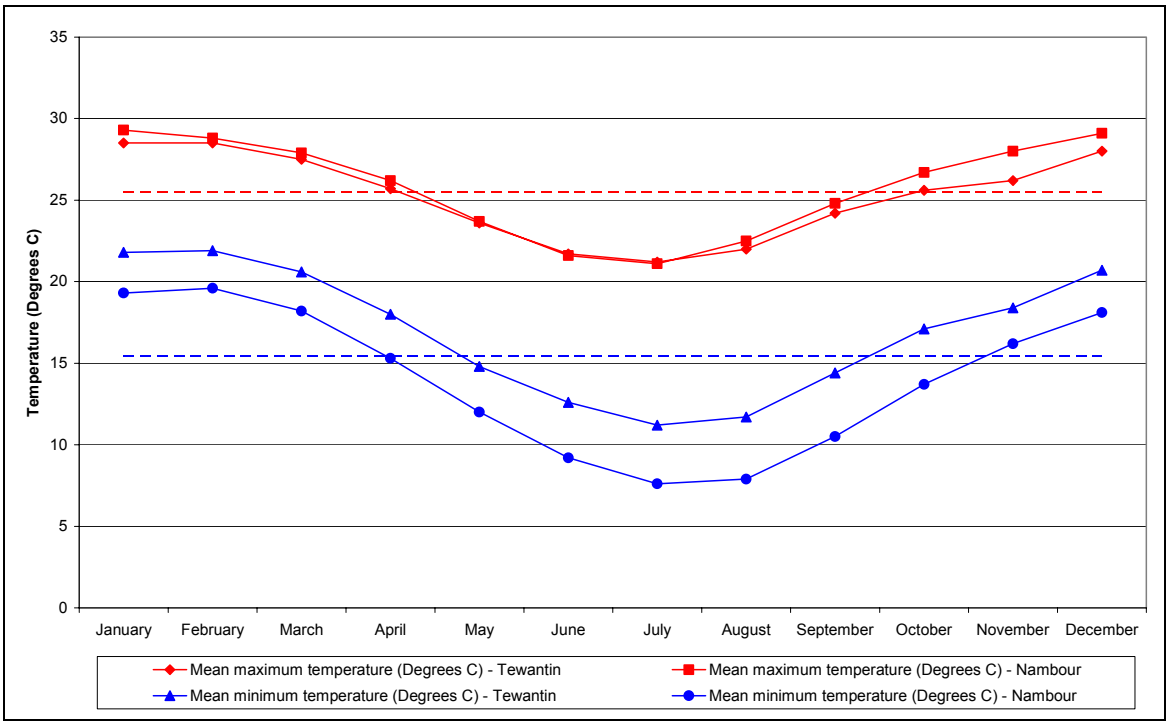
4.2.4 Regional Climate Averages

Long term climatic averages have been obtained from the Tewantin and Nambour AWSs in order to illustrate the common trends in regional climate.

Air Temperature

The monthly fluctuations in mean daily minimum and mean daily maximum temperatures at Tewantin and Nambour are shown in **Figure 3**.

Figure 3 Monthly Temperature Averages at Tewantin and Nambour

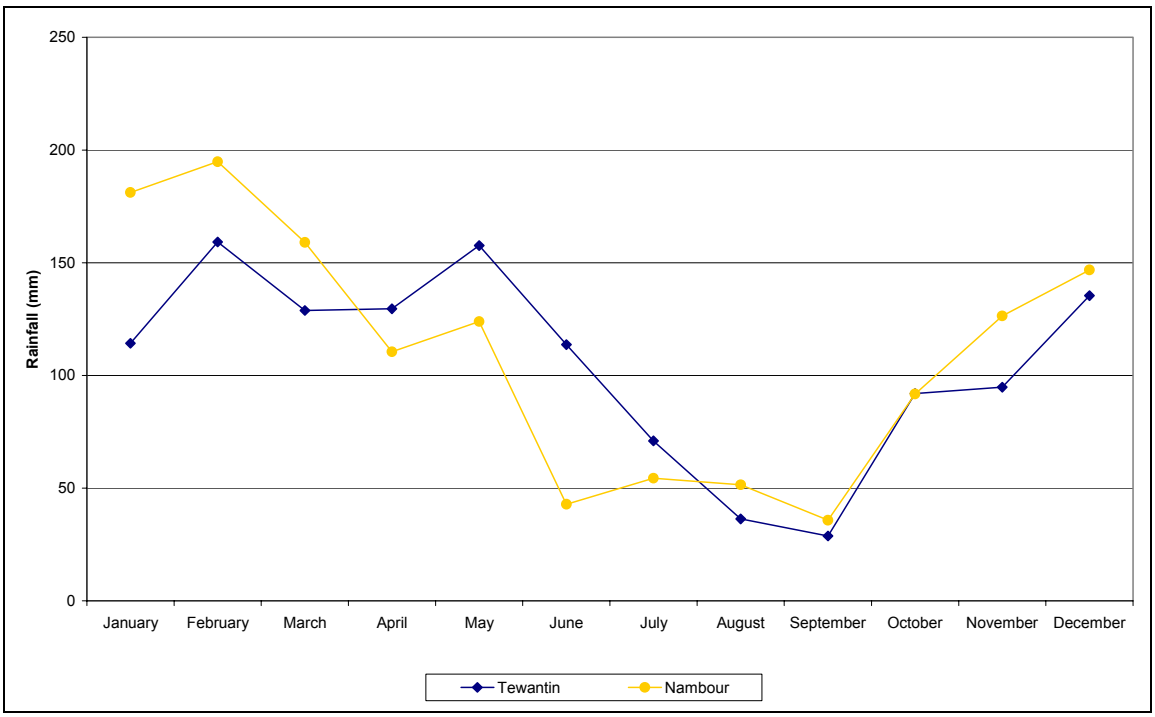


It can be seen from **Figure 3** that the temperature for the Project region may be described as mild to warm overall, based on historic data from the Tewantin and Nambour BoM stations. Average air temperatures during the day tend to vary between 21.1 C – 22.5 C in winter and 28.0 C – 29.3°C in summer. Average air temperatures during the night tend to be cool to mild, varying from 7.6°C – 12.6°C in winter to 21.1°C – 22.5°C in summer.

Rainfall

A graph displaying the median (5th decile) monthly rainfall at both the Tewantin and Nambour AWS is shown in **Figure 4**.

Figure 4 Median (5th decile) Monthly Rainfall Measurements, Tewantin and Nambour



The rainfall experienced at both Tewantin and Nambour can be described as moderate, with the area receiving, on average, between 1260 mm and 1320 mm per annum. It can be seen that rainfall is significantly lower between mid-winter to mid-spring than at any other time of the year.

Rainfall has a significant effect on the way in which particles behave in the atmosphere, and hence the way in which pollution is dispersed. When rainfall occurs, particulate matter is flushed out of the atmosphere quickly, thus reducing potential nuisance impacts, as well as those on health and visibility. Rainfall is also a determining factor in the amount of wind erosion occurring from exposed surfaces. From the data presented in **Figure 4**, it could be expected that the potential for wind erosion of dry surfaces is greater between July and September due to the lower expected rainfall.

5 APPLICABLE CRITERIA

5.1 Noise

5.1.1 Construction

For construction work occurring during normal daytime hours, provided all mechanically powered plant is fitted with appropriate mufflers, specific noise limits are generally not warranted. In this regard, it may be noted that the *Queensland Environmental Protection Policy (Noise) 1997* [EPP(Noise)] does not include construction noise limits (other than those which apply to blasting).

Noise impacts are usually minimised by limiting the hours of operation and, in particular circumstances, scheduling the noisiest activities to occur at times when they would generate least disruption. Where construction noise may affect adjacent residential premises or other residential accommodation (including hotels, motels, serviced units or backpacker accommodation), it is usually recommended to limit the hours of construction to:

- Monday to Friday - 7.00 am to 6.00 pm
- Saturday - 7.00 am to 1.00 pm

For construction works extending outside normal working hours, particular noise limits should be applied. The noise limits detailed below are recommended, based on the former EPA E1 Environmental Guideline and contemporary sleep disturbance limits.

Monday to Friday:

- 6.00 pm to 10.00 pm - background + 10 dBA $L_{Amax,adj,15min}$
- 10.00 pm to 7.00 am - sleep awakening criterion of 45 dBA L_{Amax} internal

Saturday:

- 1.00 pm to 10.00 pm - background + 10 dBA $L_{Amax,adj,15min}$
- 10.00 pm to 7.00 am - sleep awakening criterion of 45 dBA L_{Amax} internal

Sunday/Public Holidays:

- Sleep awakening criterion of 45 dBA L_{Amax} internal

The ($L_{Amax,adj,\ 15min}$) noise limits refer to the average maximum (typically L_{10} for most construction scenarios) A-weighted noise level from the construction activity measured over a 15 minute period, with adjustments for tonality or impulsiveness as applicable, as documented in full in AS 1055.

Based on a typical attenuation of 5 dBA through an open window, an L_{Amax} (external) criterion of 50 dBA is recommended for sleep disturbance, assessable at four metres from the building facade:

Applying the above noise criteria to the monitoring locations we can obtain the local construction noise criteria. These criteria are summarised in **Table 6** for construction sites and **Table 7** for operational sites. In cases where the evening (6:00 pm to 10:00 pm) construction noise criteria is lower than the 50 dBA L_{Amax} sleep awakening criterion then the evening criteria should prevail during the night-time period, Sundays and public holidays.

Table 6 Construction Noise Criteria at Monitoring Locations

	Criteria - By Monitoring Location $L_{Amax,adj,15min}$ (dBA)										
Time	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Monday to Friday											
7.00 am to 6.00 pm	No Limit										
6.00 pm to 10.00 pm	53	46*	48*	60	50	45*	55	54	49*	50	48*
10.00 pm to 7.00 am	50										
Saturday											
7.00 am to 1.00 pm	No Limit										
1.00 pm to 6.00 pm	53	46*	48*	60	50	45*	55	54	49*	50	48*
6.00 pm to 10.00 pm	53	46*	48*	60	50	45*	55	54	49*	50	48*
10.00 pm to 7.00 am	50										
Sunday and Public Holidays											
All periods	50										

* Applicable to the night-time period, Sundays and public holidays as well.

Table 7 Construction Noise Criteria at Operational Monitoring Locations

	Criteria - By Monitoring Location $L_{Amax,adj,15min}$ (dBA)				
Time	**Op 1**	**Op 2**	**Op 3**	**Op 4**	**Op 5**
Monday to Friday					
7.00 am to 6.00 pm			No Limit		
6.00 pm to 10.00 pm	45*	47*	54	45*	49*
10.00 pm to 7.00 am			50		
Saturday					
7.00 am to 1.00 pm			No Limit		
1.00 pm to 6.00 pm	45*	47*	54	45*	49*
6.00 pm to 10.00 pm	45*	47*	54	45*	49*
10.00 pm to 7.00 am			50		
Sunday and Public Holidays					
All periods			50		

* Applicable to the night-time period, Sundays and public holidays as well.

Due to the large range of land use areas the proposed NPI will be running through and as the alignment has not been finalised, a set of generic background noise levels have been obtained from Appendix A of *AS 1055.2-1997 Acoustics - Description and measurement of environmental noise*. These have been detailed in **Table 8**.

Table 8 Generic Average Background Noise Levels

Average Background Noise Levels $L_{A90,T}$ (dBA)		**Monday to Saturday**			**Sundays and Public Holidays**		
Noise Area Category	**Description of Neighbourhood**	**Day**	**Evening**	**Night**	**Day**	**Evening**	**Night**
R1	Negligible Transportation	40	35	30	40	35	30
R2	Low Density Transportation	45	40	35	45	40	35
R3	Medium Density Transportation or some commerce or industry	60	45	40	60	45	40
R4	Dense Transportation or some commerce or industry	55	50	45	55	50	45
R5	Very Dense Transportation or in commercial districts or bordering industrial districts	60	55	50	60	55	50
R6	Extremely Dense Transportation or within predominantly industrial districts	65	60	55	65	60	55

Based on the above generic background noise levels, noise criteria have been developed in order to assess noise impacts from the construction activities and are shown in **Table 9**.

Table 9 Generic Construction Noise Criteria

	Criteria - By Noise Area Category $L_{Amax,adj,15min}$					
Time	**R1**	**R2**	**R3**	**R4**	**R5**	**R6**
Monday to Friday						
7.00 am to 6.00 pm				No limit		
6.00 pm to 10.00 pm	45	50	55	60	65	70
10.00 pm to 7.00 am				50		
Saturday						
7.00 am to 1.00 pm				No limit		
1.00 pm to 6.00 pm	50	55	60	65	70	75
6.00 pm to 10.00 pm	45	50	55	60	65	70
10.00 pm to 7.00 am				50		
Sunday and Public Holidays						
All periods				50		

As the above noise criteria are based on the generic data and are not site specific, it is recommended that further analysis of construction noise impacts is conducted during detailed design for areas where construction activities are anticipated outside the daytime period.

5.1.2 Operational

Criteria for the assessment of the operational noise emissions from NPI Stage 2 of the SRWP are determined in accordance with the Environmental Protection Agency's Ecoaccess Guideline *"Planning for Noise Control".* The Ecoaccess guideline requires prior knowledge of the ambient noise environment and the assessment process takes into account three factors:

1. Control and prevention of background creep;
2. a. Determination of planning noise levels;
   b. Containment of variable and short term noise emissions by setting specific (intrusive) noise levels; and
3. Sleep disturbance.

Background Creep

Ecoaccess provides recommended Rating Background Levels (RBL) in order to prevent background noise levels from progressively increasing over time with the establishment of new developments.

The RBL is determined from noise monitoring and is the median of the 90 percentile of the background (LA9O) noise levels in each assessment period over the duration of the monitoring. The recommended RBLs are applicable to the daytime (7am to 6pm), evening (6pm to 10pm) and night-time (10pm to 7am) periods and are in **Table 10** for the areas near pumping stations.

Table 10 Recommended RBLs for each Pump Station Location

Location	Land Use	Recommended RBL (dBA)		
		Day	Evening	Night
Op 1 – Nobels Rd	Purely residential – Rural Residential	40	35	30
Op 2 – 693 Diddillibah Rd	Purely residential – Rural Residential	40	35	30
Op 3 – 5 Atkinson Rd	Purely residential – Rural Residential	40	35	30
Op 4 – 415 Lake Macdonald Rd	Purely residential – Rural Residential	40	35	30
Op 5 – 300 Image Flat Rd	Residential Area near an industrial area – Residential	45	40	35

Where existing noise levels in an area approach the recommended RBL, the criteria must be adjusted to prevent background creep. The recommended adjustments are shown in **Table 11**.

Table 11 Adjustments to Recommended RBL to Prevent Background Creep

Existing background Level at Residential Receiver	Recommended $L_{A90(1hour)}$
> Recommended RBL	Background – 10 dBA
= Recommended RBL	Recommended RBL – 10 dBA
Recommended RBL – 1	Recommended RBL – 9 dBA
Recommended RBL – 2	Recommended RBL – 5 dBA
Recommended RBL – 3	Recommended RBL – 3 dBA
Recommended RBL – 4	Recommended RBL – 2 dBA
Recommended RBL – 5	Recommended RBL – 2 dBA
< Recommended RBL – 5	Background + 5 dBA

Determination of Planning Noise Levels

Maximum Planning Noise Levels (PNL) for different noise area categories are recommended within Ecoaccess. These planning levels are applicable to the daytime (7am to 6pm), evening (6pm to 10pm) and night-time (10pm to 7am) periods (refer to **Table 12**).

Table 12 Recommended Planning Noise Levels

Location	Description of Locality	Maximum Hourly Noise Level $L_{Aeq(1hour)}$ (dBA)		
		Day	Evening	Night
Op 1	Z2, Negligible transportation. Less than 80 vehicles an hour.	50	45	40
Op 2	Z3, Low-density transportation. Less than 200 vehicles an hour.	55	50	45
Op 3	Z3, Low-density transportation. Less than 200 vehicles an hour.	55	50	45
Op 4	Z3, Low-density transportation. Less than 200 vehicles an hour.	55	50	45
Op 5	Z3, Low-density transportation. Less than 200 vehicles an hour.	55	50	45

Where existing noise levels in an area approach the maximum PNL, the noise level from any new source must be controlled to preserve the amenity of the area. To achieve this, Ecoaccess recommends modifications be made to the recommended maximum PNL depending on the existing noise levels. These modifications are summarised in **Table 13**.

Table 13 Modifications to Recommended Maximum PNL to Preserve Amenity

Existing Noise Level (dBA)	PNL for New Sources
≥ PNL + 2	Existing Noise Levels Likely to Decrease: PNL – 10
	Existing Noise Levels Unlikely to Decrease: Existing Level – 10
PNL + 1	PNL – 9
PNL	PNL – 8
PNL – 1	PNL – 6
PNL – 2	PNL – 4
PNL – 3	PNL – 3
PNL – 4	PNL – 2
PNL – 5	PNL – 2
PNL – 6	PNL – 1
< PNL – 6	PNL

Containment of Short-Term Emissions — Specific (Intrusive) Noise Level

The specific (or intrusive) noise level ($L_{Aeq(1hour)}$) is determined as follows:

- Specific Noise Level $L_{Aeq(1hour)}$ = Rating Background Level + 3 adjusted for tonality and impulsiveness.

The Specific Noise Level is determined from the existing RBL (from ambient attended and unattended noise monitoring). The lowest of the PNL and Specific Noise Levels is then chosen as the LAeq noise limit for the proposed activity.

Sleep Disturbance

Ecoaccess recommends that in order to achieve a good night sleep, internal noise levels should not exceed L_{Amax} 45 dBA more than 10-15 times per night. Based on a typical attenuation of 5 dBA through a facade with open windows, the following external criterion is recommended, assessable four metres from the façade and during the night-time period only:

- $L_{Amax\ (external)}$ 50 dBA

Limiting Criteria

The representative measured noise levels for each assessment zone are summarised in **Table 14**. These have been used to determine the applicable Ecoaccess criteria.

Table 14 Existing Noise Levels for Proposed Pump Station Locations

Pump Station Location	Measured RBL (dBA)			Measured $L_{Aeq(1hour)}$ (dBA)		
	Day	Evening	Night	Day	Evening	Night
Op 1	37	35	27	53	50	47
Op 2	40	37	30	59	56	49
Op 3	42	44	38	55	53	50
Op 4	34	35	32	60	54	48
Op 5	37	39	37	56	49	46

Based on the measured noise levels in **Table 14** and the adjustments in **Table 11** and **Table 13**, criteria for the Prevention of Background Creep, Planning Noise Level and Containment of Short-Term Emissions have been determined for each of the assessment zones. These criteria are shown in **Table 15** and **Table 16**.

Table 15 Criteria for Prevention of Background Creep

Pump Station Location	Recommended $L_{A90(1hour)}$ (dBA)		
	Day	Evening	Night
Op 1	37	25	27
Op 2	30	27	25*
Op 3	32	34	28
Op 4	39	25	25*
Op 5	42	31	25

* Threshold background level of 25 dBA as recommended in the Ecoaccess.

Table 16 Planning Noise Levels and Specific Noise Levels

Pump Station Location	Planning Noise Level – $L_{Aeq(1hour)}$ (dBA)			Specific Noise Level - $L_{Aeq(1hour)}$ (dBA)		
	Day	Evening	Night	Day	Evening	Night
Op 1	43	40	37	40	38	30
Op 2	49	46	39	43	40	33
Op 3	47	43	40	45	47	41
Op 4	50	44	38	37	38	35
Op 5	46	44	36	45	34	28

Note – The limits in Table 16 assume no tonal or impulsive characteristics in the pump station noise emissions.

Based on Heggies experience with steady state noise sources (eg pumps, air conditioners, generators etc), it is assumed that the L_{Aeq} noise levels emitted by pumps will be 1 to 2 dBA higher than L_{A9O} noise levels. This correction can be applied to the criteria contained in **Table 15** to give a corresponding L_{Aeq} criterion.

As the pumps for NPI Stage 2 are likely to be operating at any time of the day, the worst case scenario corresponding to the night-time period means the night-time noise criteria will be used to determine the limiting criteria.

Given that for steady state noise sources the L_{A9O} and L_{Aeq} descriptors are within 1 to 2 dBA of each other and that the night-time recommended $L_{A90(1hour)}$ at all locations are at least 3 dBA less than the night-time specific noise level, the night-time recommended $L_{A9O(1hour)}$ will be used as the limiting criteria.

- Op 1 – Mooloolah Valley 27 dBA
- Op 2 – Diddillibah Road 25 dBA
- Op 3 – Bli Bli 28 dBA
- Op 4 – Lake Macdonald 25 dBA
- Op 5 – Image Flat 25 dBA

5.2 Vibration

5.2.1 Human Comfort

Guidance in relation to assessing the potential human disturbance from ground-borne vibration inside buildings and structures is contained in British Standard 6472-1992 *"Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)" (BS 6472).*

Satisfactory magnitudes of peak vertical vibration velocity (ie below which the probability of "adverse comment" is low) from BS 6472 are shown in **Table 17** (for generally sinusoidal vibration).

Table 17 Satisfactory Levels of Peak Vertical Vibration Velocity (8 Hz to 80 Hz)

Type of Space Occupancy	Time of Day	Satisfactory Peak Vibration Levels in mm/s Over the Frequency Range 8 Hz to 100 Hz			
		Continuous Vibration		Impulsive Vibration with up to 3 Occurrences per Day	
		Vertical	Horizontal	Vertical	Horizontal
Critical working areas (eg some hospital operating theatres, some precision laboratories, etc)	Day Night	0.14 0.14	0.4 0.4	0.14 0.14	0.4 0.4
Residential	Day Night	0.3 to 0.6 0.2	0.8 to 1.6 0.6	8.4 to 12.6 2.8	24 to 36 8
Offices	Day Night	0.6 0.6	1.6 1.6	18 18	51 51
Workshops	Day Night	1.2 1.2	3.2 3.2	18 18	51 51

Source - BS 6472-1992

Table 17 indicates that continuous floor vibration levels above which "adverse comment" in residences and offices may arise during daytime range from approximately 0.3 mm/s to 0.6 mm/s.

5.2.2 Structural Damage

In terms of relevant vibration damage criteria, British Standard 7385: Part 2-1993 "*Evaluation and measurement for vibration in buildings Part 2*" is a definitive standard against which the likelihood of building damage from ground vibration can be assessed.

The standard sets guide values for building vibration based on the lowest vibration levels above which damage has been credibly demonstrated. These levels are judged to give a minimum risk of vibration-induced damage, where minimal risk for a named effect is usually taken as a 95% probability of no effect.

Sources of vibration which are considered in the standard include blasting, demolition, piling, ground treatments (eg compaction), construction equipment, tunnelling, road and rail traffic and industrial machinery.

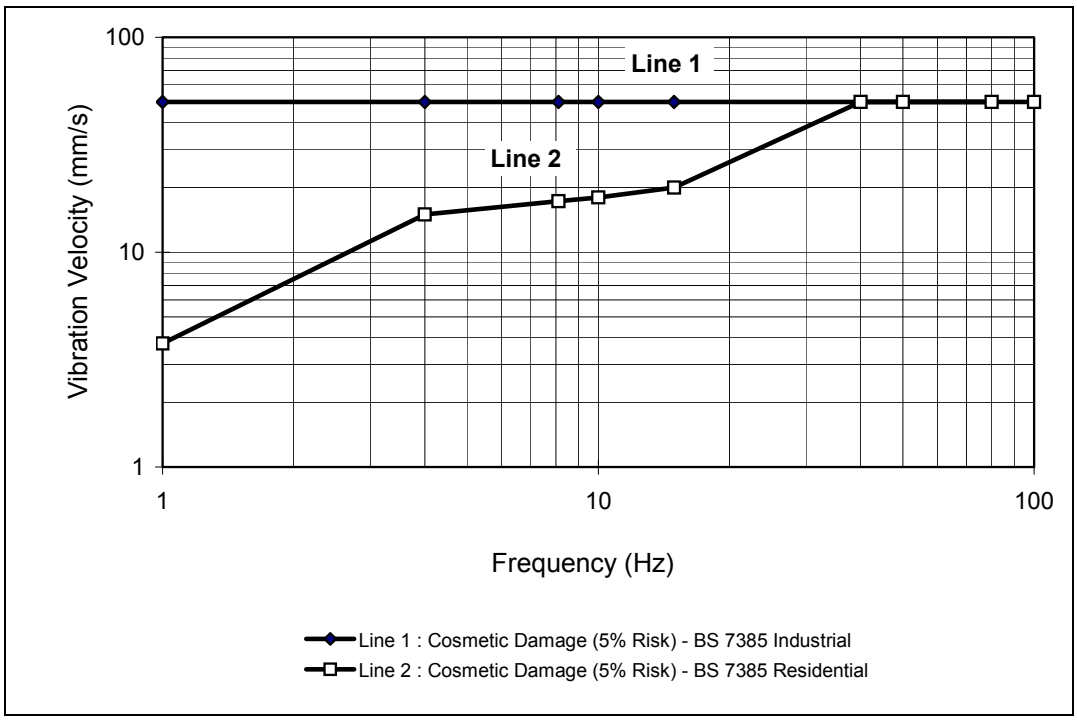
As the strain imposed on a building at foundation level is proportional to the peak particle velocity but is inversely proportional to the propagation velocity of the shear or compression waves in the ground, this quantity (ie peak particle velocity) has been found to be the best single descriptor for correlating with case history data on the occurrence of vibration-induced damage.

The guide values from this standard for transient vibration judged to result in a minimal risk of cosmetic damage to residential buildings and industrial buildings are presented numerically in **Table 18** and graphically in **Figure 5**.

Table 18 BS 7385 - Transient Vibration Guide Values for Cosmetic Damage

Line	Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
		4 Hz to 15 Hz	15 Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
2	Non-reinforced or light framed structures Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Figure 5 Graph of Transient Vibration Guide Values for Cosmetic Damage



In the lower frequency region where strains associated with a given vibration velocity magnitude are higher, the guide values for the building types corresponding to Line 2 are reduced. Below a frequency of 4 Hz where a high displacement is associated with the relatively low peak component particle velocity value, a maximum displacement of 0.6 mm (zero to peak) is recommended. This displacement is equivalent to a vibration velocity of 3.7 mm/s at 1 Hz.

BS 7385 states that the guide values in **Table 18** relate predominantly to transient vibration which does not give rise to resonant responses in structures, and to low-rise buildings. Where the dynamic loading caused by continuous vibration is such to give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values in **Table 18** may need to be reduced by up to 50%.

It is noteworthy that in addition to the guide values nominated in **Table 18**, the Standard states that:

> *"Some data suggests that the probability of damage tends towards zero at 12.5 mm/s peak component particle velocity. This is not inconsistent with an extensive review of the case history information available in the UK."*

Also that:

> *"A building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive."*

5.2.3 Safe Vibration Levels for Common Services

Vibration due to the construction process has the potential to affect services such as buried pipes, electrical and telecommunication cables.

German Standard DIN 4150-3 1999 *"Structural Vibration – Part 3: Effects of vibration on structures"* provides guidance on safe vibration levels for buried pipe work. The levels assume "current technology" as special considerations must be applied for systems associated with older structures such as might occur in the vicinity of Heritage Listed buildings. **Table 19** details the DIN 4150-3 limits for short-term vibration. The levels apply on the wall of the pipe. For long-term vibration the guideline levels presented in **Table 19** should be halved.

Table 19 DIN 4150 Part 3 – Damage to Buried Pipes – Guidelines for Short-term Vibration

Pipe Material	Peak Wall Vibration Velocity
Steel (including welded pipes)	100 mm/s
Clay, concrete, reinforced concrete, prestressed concrete, metal with or without flange (other than steel)	80 mm/s
Masonry, plastic	50 mm/s

Note: For gas and water supply pipes within 2 m of buildings, the levels given in Table 3 of DIN 4150 should be applied. Consideration must also be given to pipe junctions with the building structure as potential significant changes in mechanical loads on the pipe must be considered.

Recommended vibration criteria for electrical cables and telecommunication services such as fibre optic cables range from between 50 mm/s and 100 mm/s.

It is noted however that although the cables may sustain these vibration levels, the services they are connected to, such as transformers and switch blocks, may not. It is recommended that should such equipment be encountered during the construction process an individual vibration assessment should be carried out.

5.2.4 Blasting

The EPP (Noise) Environment Protection Amendment Regulation (No 2) 1999 contains the following blast emissions (airblast and vibration) criteria:

"61 Noise from blasting is not unlawful environmental nuisance for an affected building if:

- *the airblast overpressure is no more than 115 dB Linear Peak for 4 our of 5 consecutive blasts: and*

the ground vibration is:

- *for vibrations of more than 35 Hz – no more than 25 m/s ground vibration, peak particle velocity; or*
- *For vibrations of no more than 35 Hz – no more than 10 mm/s ground vibration, peak particle velocity."*

The subject Regulation does not nominate times of blasting. However, the Queensland EPA's Guideline document entitled "Noise and Vibration from Blasting" contains both blast emissions criteria and times of blasting.

The relevant section is as follows:

> ***"Vibration Criteria"***
>
> *"Blasting should generally only be permitted during the hours of 9 am to 3 pm, Monday to Friday, and from 9 am to 1 pm on Saturdays. Blasting should not generally take place on Sundays or public holidays.*
>
> *Blasting outside these recommended times should be approved only where:*
>
> *a. blasting during the preferred times is clearly impracticable (in such situations blasts should be limited in number and stricter airblast overpressure and ground vibration limits should apply); or*
>
> *b. There is no likelihood of persons in a noise-sensitive place being affected because of the remote location of the blast site."*

The Guideline further states (under the heading of "Weather Effects") that:

> *"When a temperature inversion or a heavy low cloud cover is present, values of airblast overpressure will be higher than normal in surrounding areas. Accordingly, blasting should be avoided if predicted values of airblast overpressure in noise-sensitive places exceed acceptable levels. If this is not practicable, blasting should be scheduled to minimise noise annoyance. An appropriate period is generally between 11 am and 1 pm. Similarly, blasting should be avoided at times when strong winds are blowing from the blasting site towards noise sensitive places."*

5.3 Air Quality

State air quality guidelines formulated by the EPA are published in the *Environmental Protection (Air) Policy 1997* (Qld Government, 1997) (hereafter, "the EPP (Air)"). Relevant air quality goals, as prescribed within Schedule 1 of the EPP (Air) are summarised in **Table 20**. Furthermore, the potential nuisance impacts from project-related emissions also need to be considered, particularly in relation to dust deposition.

While there is no specific criterion established in the EPP (Air) for dust deposition, the New South Wales Department of Environment and Climate Change sets dust deposition limits in the 2005 *Approved Methods for the Modelling and Assessment of Air Pollutants* as a maximum total dust deposition rate of 4 g/m^2/month, with a maximum incremental increase of 2 g/m^2/month.

In June 1998, the National Environment Protection Council of Environment Ministers agreed to set uniform standards for ambient air quality to apply to all States and Territories. These standards are contained in the National Environment Protection Measure (NEPM) for ambient air quality.

The NEPM standards for pollutants relevant to this assessment are summarised in **Table 21**.

Table 20 Relevant Queensland Air Quality Indicators and Compliance Goals

Pollutant	Averaging Period	Goal
Carbon monoxide	8 hours	8 ppm (10 mg/m^3)
Nitrogen dioxide	1 hour	0.16 ppm (320 µg/m^3)
	4 hours	0.046 ppm (95 µg/m^3)
	Annual	0.01 ppm (30 µg/m^3)
PM_{10}	24 hours	150 µg/m^3
	Annual	50 µg/m^3
Total Suspended Particulate (TSP)	Annual	90 µg/m^3

Note 1 Source: Queensland Environmental Protection Agency, EPP (Air) 1997.
Note 2 Gravimetric concentrations expressed at 1 atmosphere pressure, 0°C

Table 21 National Environment Protection Measure (NEPM) Ambient Air Quality Goals

Pollutant	Averaging Time	Maximum Concentration	Maximum Allowable exceedances
Carbon Monoxide (CO)	8 Hour	9.0 ppm (11 mg/m^3)	1 day a year
Nitrogen dioxide (NO_2)	1 Hour	0.12 ppm (246 µg/m^3)	1 day a year
	Annual	0.03 ppm (62 µg/m^3)	none
Particulate matter <10 µm (PM_{10})	24 Hours	50 µg/m^3	5 days a year

Note 1 Source: National Environment Protection Council 1998.
Note 2 Gravimetric concentrations expressed at 1 atmosphere pressure, 0°C

The NEPM also provides advisory reporting standards of 25 µg/m^3 (24 hour average) and 8 µg/m^3 (annual average) for particulate matter less than 2.5 microns in aerodynamic diameter ($PM_{2.5}$).

The NEPM standards are intended to apply only to performance monitoring stations that satisfy the criteria for siting incorporated into the NEPM. The siting criteria stipulates that performance monitoring stations should be located in a manner such that they contribute to obtaining a representative measure of air quality likely to be experienced by the general population in a region.

Therefore, the NEPM are not intended to be used in areas impacted by local pollutant sources, such as in the vicinity of major roads or industry sources. They are also intended as a long-term reporting goal, and to guide the formulation of strategies for managing human activities that may affect the environment to achieve the standards within 10 years of their inception in 1998. For this reason, current State goals are recommended for comparison purposes.

6 POTENTIAL IMPACTS

Noise and vibration levels during construction are highly dependent on the construction activities undertaken, duration of construction and location of construction. The most significant noise source during construction will be heavy plant and equipment operation.

Construction air quality impacts will, in the most part, arise during clearing and earthmoving operations. The main impact is expected to be dust raised by direct mechanical action (eg digging, dozing, grading), by moving vehicles (eg spoil trucks) or wind. Very small quantities of gaseous air pollutants will be emitted from internal combustion engines of construction equipment.

Operational noise impacts will be limited to the operation and maintenance of the three pump stations.

During operation, potential air quality impacts from pipeline-related activities will be almost completely restricted to the immediate vicinity of the pumping stations and storage tanks. Pumping will be undertaken by high capacity electrically operated pumps.

6.1 Noise

6.1.1 Construction Noise

The project team have provided Heggies with a basic understanding of the construction equipment to be used during the construction phase of this project. This list of equipment, along with generic construction equipment sound power levels, has been used to determine the likely acoustic footprint of construction activities along the NPI Stage 2 alignment.

Table 22 provides the sound power levels and the anticipated noise levels at given offset distances from the pipeline alignment and assumes no acoustic shielding (ie from topography, buildings or noise barriers etc) between the construction activity and receiver.

Table 22 Acoustic Footprint of Construction Activities

Construction Equipment	Maximum Sound Power Level (dBA)	Construction Noise Levels (dBA)					
		SPL[1] @ 5m	SPL[1] @ 10m	SPL[1] @ 20m	SPL[1] @ 50m	SPL[1] @ 100m	SPL[1] @ 200m
Excavator	110	83	77	71	63	57	51
Cranes	105	78	72	66	58	52	46
Tip truck	111	84	78	72	64	58	52
Generator	107	80	74	68	60	54	48
Backhoe	107	80	74	68	60	54	48
Bored Piling Rig	116	89	83	77	69	63	57
Rock Breaker	137	110	104	98	90	84	78
Directional Drilling Rig	115	88	82	76	68	62	56

1 - LA10 Sound Pressure Level (derived by subtracting 5 dBA from the maximum sound Pressure Level)

Table 23 indicates the approximate number of homes within 50 m, 100 m and 200 m offsets of the NPI Stage 2 project broken down into the two route options. This can be used as a guide to determine the number of homes that will experience the predicted construction noise levels provided in **Table 22**.

Table 23 Approximate Number of Residences along Alignment within Given Offset Distances

Offset Distance	Approximate Number of Homes within Offset Distance	
	Route Option 1	Route Option 2
50 m	176	201
100 m	271	322
200 m	560	557

As discussed in **Section 5.1.1**, there are typically no limits to construction noise during standard construction hours. No exceedance of the construction noise criteria is expected for all general construction works that will be restricted to standard construction hours.

However, if construction outside of these hours is required then a Construction Noise and Vibration Management Plan is recommended to determine whether any noise sensitive locations will be adversely affected and what mitigation and monitoring measures would be appropriate if required.

Directional Drilling / Micro-Tunnelling

The potential impacts associated with Directional Drilling / Micro-Tunnelling is generally associated with air-borne noise from the tunnel pits as well as regenerated noise inside nearby buildings.

Regenerated noise levels are highly dependent on the tunnel/hole size as well as strata type and slant distance (distance between TBM cutting face and building foundation). Heggies' previous experience suggests that there will be no adverse effects on sensitive locations provided micro-tunnelling activities are to be conducted at least 50 m from any sensitive location. Notwithstanding this, monitoring of potential regenerated noise is recommended for micro-tunnelling works taking place within 100 m from any noise sensitive receiver particularly during night-time tunnelling operations.

In addition, strategies to notify the community about progressive tunnelling activities and how to make a complaint or enquiry regarding the works will be important to manage.

6.1.2 Operational Noise

To date, all proposed SRWP pump stations have undergone a separate detailed acoustic assessment. The following provides a general guide, based on our experience with other SRWP pumping stations, of the major sources of continuous noise and likely impacts associated with the pump stations.

The general construction of the pump station includes the following:

- 2 x Large Pumps – 87 dBA SPL at 1 m.
  - Located in pump hall.
- 2 x Pump motors typically 80 dBA SPL at 1 m for the large pumps.
  - Located in pump hall.
- 6 x Pump Hall Supply Fans Fantech Fantech SQ0634AP10/21 – 90 dB SWL (67 dBA at 3 m).
  - Mounted inside the pump hall at acoustic louvre locations.
- 6 x HV Switchroom Roof Exhaust Fans Fantech MMD506/3 – 82 dB SWL (54 dBA at 3 m).
  - Mounted above mezzanine floor in duct.
- 6 x HV Switchroom Supply Fans Fantech MMD506/4 – 83 dB SWL (54 dBA at 3 m).
  - Mounted inside HV switchroom at acoustic louvre location.
- 1 x LV Switchroom Roof Exhaust Fan Fantech CD314V – 83 dB SWL (47 dBA at 3 m).
  - Mounted in ceiling of LV switchroom.
- 1 x Office ventilation fan – 71 dB SWL (39 dBA at 3 m).
  - Mounted in ceiling of office.
- 1 x Transformer kiosk - 67 dBA SPL at 0.3 m.
  - Located in weatherproof enclosure outside building.
- 2 x High Voltage drive units – 75 dBA SPL at 1 m.

- Located in HV switchroom.

Pump Station Construction

The pump house construction proposed is assumed to be as follows:

- Floor – concrete slab.
- Walls - 150 mm precast concrete tilt-up panels.
- Roof – Colorbond Spandek roof sheeting.

The following building treatments have also been assumed to be incorporated into the design.

- Ceiling – 2 layers 13 mm Fyrcheck with 50 mm foil-faced insulation blanket in ceiling cavity.
- Exhaust hoods in the ceiling of the pump hall.
- Acoustic louvres similar to Fantech SBL2 600 mm thick.
- Rw 45 doors on outside of building.
- One (1) large roller door in wall of pump hall.

Pump House Noise Emissions

Calculations were conducted to determine the level of noise emitted from the pump hall. Noise sources included were as follows:

- One (1) pump operating at any one time (with the second pump on standby).
- One (1) motor operating with respective pump.
- Three (3) supply air fans on duty at any one time.

Noise emissions from the pump station impacting on nearby residences are influenced by the orientation of the pump hall due to the locations of acoustically "weak" areas such as air grills and the roller door.

Calculations were conducted to determine the levels of noise emitted due to the operation of the pump hall, all roof-mounted fans and the a/c unit and the transformer. The predicted noise levels are presented in **Table 24**.

Table 24 Pump Station Noise Emission

Pump Station Location	Distance to Nearest Receiver	LA9O(1hour) Limiting Criteria (dBA)	Predicted Noise Level (dBA)		
			Pump Hall	Roof-mounted Fans & A/C	Transformer
Op 1 – Mooloolah Valley	200 m	27	29	24	9
Op 2 – Diddillibah	100 m	25*	35	30	15
Op 3 – Bli Bli	100 m	28	35	30	15
Op 4 – Lake Macdonald	350 m	25*	24	19	4
Op 5 – Image Flat	200 m	25	29	24	9

* Threshold background level of 25 dBA as recommended in the Ecoaccess.

The predicted noise level due to breakout from the pump hall exceeds the Ecoaccess criterion at all proposed locations with the exception of Op 4. The noise levels received due to the combined operation of all fans and air-conditioning units is predicted to exceed the recommended assessment criterion at Diddillibah and Bli Bli.

Noise emissions from the transformer kiosk, inclusive of a 3 dBA penalty for tonality, achieve the recommended assessment criterion at the nearest residence for all proposed locations. However, for the pump station as a whole to achieve the assessment criterion, the noise level from each individual source must be less than the assessment criterion.

6.2 Vibration

6.2.1 Construction Vibration

The highest vibration impacts are expected to occur during the construction phase of the project. The major potential sources of ground vibration are blasting (if required), bulldozers (ripping) and hydraulic rock breakers. Comments regarding the expected vibration levels and their possible effects are presented below.

Blasting

Blasting is not thought to be required on this phase of the project, and will only be considered where the geology is too hard for the use of the excavator. If it proves to be necessary, it is only thought to be required in the region adjacent to the Bruce Highway north of Eumundi-Kenilworth Road.

Should blasting prove necessary, the blast design should be reviewed if there is any risk whatsoever that sensitive receiver locations will be impacted by the blasting operations. The need for blasting mitigations measures would be considered on a case-by-case basis.

Bored Piling

It is proposed to use bored piles rather than driven piles on this project to reduce potential noise and vibration impacts.

There should be no building damage or human comfort impacts associated with vibration from bored piling on this project.

Bulldozers

Typical ground vibration levels from bulldozers ripping terrain range from 1 mm/s to 2 mm/s at distances of approximately 5 m. At distances greater than 20 m, vibration levels are usually below 0.2 mm/s.

There should be no building damage or human comfort impacts associated with vibration from bulldozer movements or ripping on this project.

Hydraulic Rock Breakers

Rock breakers and rock drills can generate relatively high vibration levels at close distances. However, the vibration usually contains higher frequencies, to which buildings and building occupants are less susceptible. Nevertheless, these sources may be associated with significant regenerated noise in adjacent buildings. **Table 25** sets out the typical ground vibration levels at various distances from a large rock breaker operating in hard sandstone.

Table 25 Typical Rock Breaker Vibration Levels (mm/s) versus Distance

	Vibration Level (mm/s) at Given Distance					
	5 m	**10 m**	**20 m**	**30 m**	**40 m**	**50 m**
Heavy Rock Hammering	4.50	1.30	0.40	0.20	0.14	0.10

Based on the levels contained in **Table 25** and the likely offset distance to the nearest homes along the pipeline alignment, there should be no building damage or human comfort impacts associated with vibration from rock breaker operations on this project.

Heavy Vehicle Movements

Heavy vehicles passing over normal (smooth) road surfaces generate relatively low vibration levels, typically ranging from 0.01 mm/s to 0.2 mm/s at the footings of buildings located 10 m to 20 m from a roadway. Very large surface irregularities can cause levels up to 5 to 10 times higher.

Provided all truck routes are maintained to avoid large surface irregularities (eg potholes), there should be no building damage or human comfort impacts associated with vibration from truck movements on this project.

6.2.2 Operational

It is anticipated that during the operational phase of the NPI Stage 2 there will be no associated activities that have potential to generate vibration levels capable of exceeding the building damage and human comfort guideline levels.

6.3 Air Quality

Air pollutants associated with the project are mostly emitted during construction in the form of particulates, with minor contributions of carbon monoxide (CO) and nitrogen oxides (NOx) associated with fuel combustion from vehicles and plant.

During dry conditions, on-site construction activities have the potential to generate dust. The following activities are those identified as a specific potential source of dust generation as a result of construction works:

- Vegetation clearing.
- Earthmoving activities and excavation including construction of batters and stabilisation of earthworks.
- Movement of vehicles and construction machinery, both within and outside the construction site.
- Transport of construction materials, fill, rubble and waste.
- Stockpiling of materials.
- Build-up of material around erosion and sedimentation controls.
- Blasting in hard rock areas – see below.

Most of these activities will occur for a limited period at any location along the pipeline route. Construction hours will be from 7 am to 6 pm. Construction activities will generally be of a low intensity. Earthworks over most of the pipeline length will be restricted primarily to trenching and filling activities. Equipment to be used on site will include excavators, cranes, tip trucks, backhoes, generators and compressors. Access to the pipeline will be by sealed and unsealed roads.

Micro Tunnelling

It is noted that longer term worksites may be required for micro tunnelling works depending on the selected alignment of the pipeline. From the proposed route options provided for the Project, micro tunnelling may be required at the following locations:

- under Under numerous crossings of the Bruce Highway;,
- Regions of significant topography, in particular to the between Panorama Drive and Petrie Creek Road (east of Nambour) and east of Image Flat Road (northwest of Nambour);
- Existing rail infrastructure, including at Duhs Road (north of Nambour) and between the Bruce Highway and Nambour North Connection Road (south of Yandina); and
- and aA number of waterways, including the South Maroochy River, Petrie Creek and Paynters Creek.

It should be noted that However, as the micro tunnelling process is a completely underground activity, no significant air quality impacts are anticipated associated with such works. Extracted materials from the tunnelling process will be stockpiled at the tunnel portals, creating a potential source of emissions through wind erosion of particulate matter. Consequently, the modelling conducted for standard operations (**Section 6.3.2**) can also be applied to sections of micro tunnelling.

Blasting Works

Blasting of areas of hard-rock may be required adjacent to the Bruce Highway north of Eumundi-Kenilworth Road. In order to assess the potential impact on the area surrounding these blasting operations, a separate modelling scenario incorporating standard and blasting-related activities has been developed for this assessment.

Construction activities will generally be of a low intensity. Earthworks over most of the pipeline length will be restricted primarily to trenching and filling activities. Equipment to be used on site will include excavators, cranes, tip trucks, backhoes, generators and compressors. Access to the pipeline will be by sealed and unsealed roads.

6.3.1 Atmospheric Dispersion Modelling

The impact of emissions from the Project was assessed using the Ausplume computer dispersion model developed by the Victorian EPA. This assessment involved earthwork activities being undertaken during construction of the pipeline.

Modelling Assumptions

The following assumptions have been made in the course of this modelling assessment:

- Hours of construction are assumed to be 7am to 6pm, or 11 operational hours, for all plant and equipment.
- Work is anticipated to be conducted within a corridor 30 m wide and 150 m long. Total area of disturbance at any one time is assumed to be 4500 m^2.
- It is assumed that there will be 30 haulage trucks servicing the site per day, removing excavated materials. Each truck is assumed to have a load capacity of 10 t. The daily throughput of excavated material is therefore assumed to be 300 t per day.
- A grader is to be employed and is assumed to operate at an average speed of 5 km/hour, accounting for stopping and starting associated with this process. Movement of the grader has been represented as a series of three volume sources with a spacing of 12.5 m.

- An unsealed haul route has been simulated, with a nominal length of 100 m extending out from the centre of the work site. Movement of haul trucks along this route represented by 4 volume sources with a spacing of 25 m.
- The movement of small private vehicles about the site has not been included in the modelling, as the associated particulate emissions are not anticipated to be significant.
- The emission rate for excavator operation accounts for the excavation of materials and loading of haul trucks. These two processes are assumed to occur in succession.
- An emission reduction factor of 50% associated with water spraying along the unsealed haul route has been applied.
- A representative surface roughness of 0.4 m was selected within the modelling, being representative of rolling rural conditions and areas with low vegetation. Irwin rural wind profile exponents were used.
- Background particulate environment has been established with reference to the data presented in Section 4.2.
- For the blasting scenario, the first four hours of an operational day are assumed to be drilling. Drilling is followed by one hour of blasting. Standard construction activities from the original scenario are maintained throughout the operational day.
- One blast is assumed per day. A blast area of 125 m is assumed.

Emission Rates

The emission rates used in the modelling assessment have been listed in **Table 26.** These emission rates have been calculated using assumptions detailed above and the relevant emission factor formulae listed in the National Pollutant Inventory document, *Emission Estimation Technique Manual for Mining, Version 2.3*, (Environment Australia, 2001) and USEPA AP-42 documents *13.2.2 Unpaved Roads* (USEPA, 2003) and *13.2.5 Industrial Wind Erosion* (USEPA, 2006).

Table 26 Estimated Particulate Emission Rates for "Worst Case" Construction Scenario

Source	Pollutant Emission Rate (mg/s)	
	PM_{10}	**Total Suspended Particulate (TSP)**
Wind erosion	0.023[1] (wind speeds 5.1-8.2 m/s) 0.46[1] (wind speeds 8.2-10.8 m/s)	0.059[1] (wind speeds 5.1-8.2 m/s) 1.16[1] (wind speeds 8.2-10.8 m/s)
Grading	2.95	6.60
Excavation/ loading	0.87	1.84
Truck movements	11.81	43.7
Drilling	344.44	655.56
Blasting	720.97	1386.48

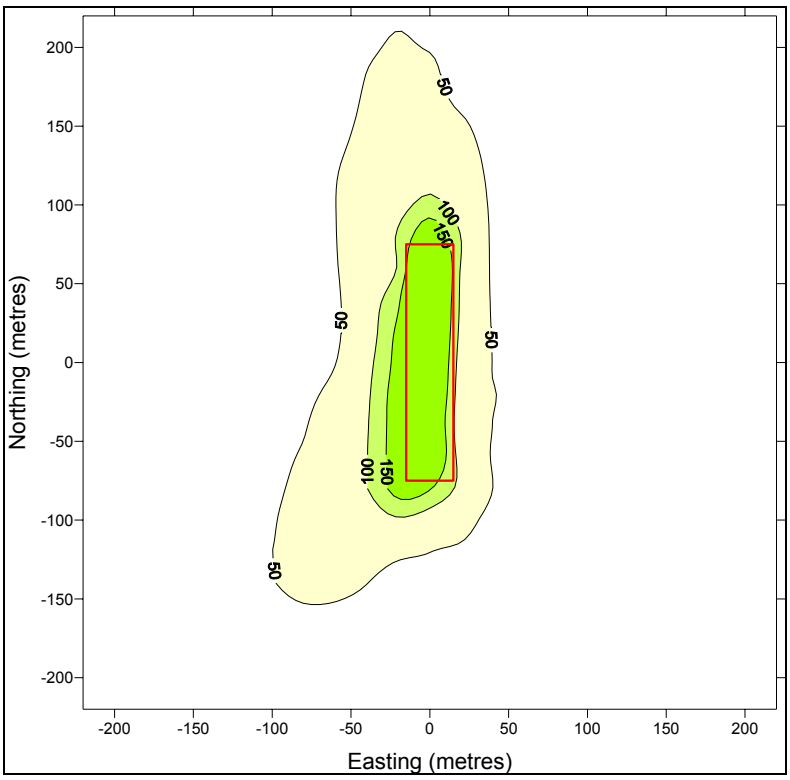
Note 1 Emission rate is expressed as a flux in units of mg/s/m^2 as Wind Erosion has been modelled as area source.

6.3.2 Modelling Assessment

Emission Assessment – Standard Operations

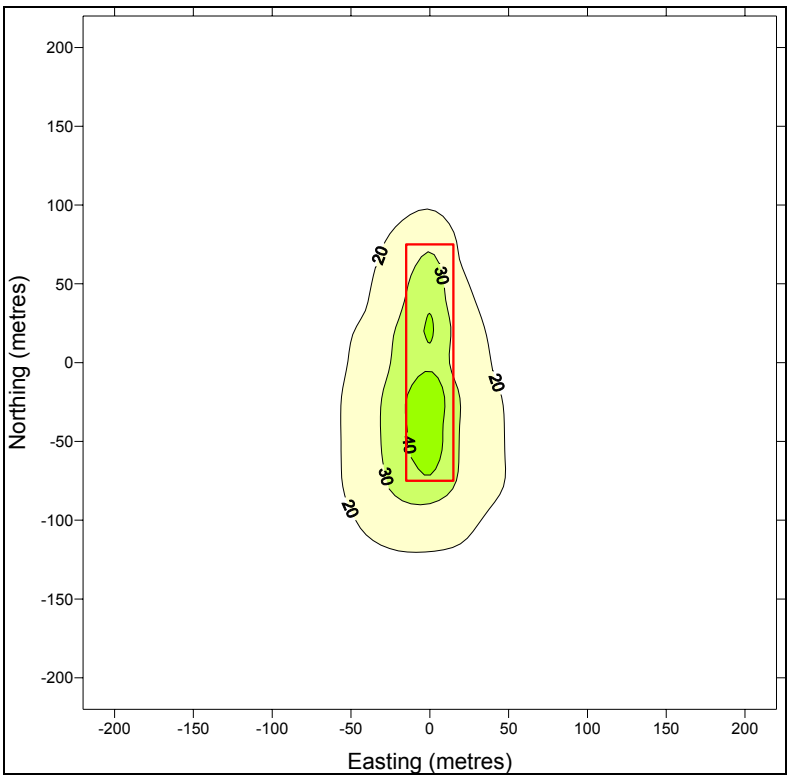
The results of the modelling for PM_{10} (24-hour and annual average), TSP (annual average) and Dust Deposition for standard construction operations are illustrated in **Figure 6**, **Figure 7**, **Figure 8** and **Figure 9** below. These contour plots present the maximum predicted impact from construction activities and provide an indicative "footprint" that could be applied to any given work site, excluding where blasting is to occur, along the route of the pipeline.

Figure 6 Predicted Worst-Case 24-hour Average PM_{10} (µg/m³) – Standard Operations



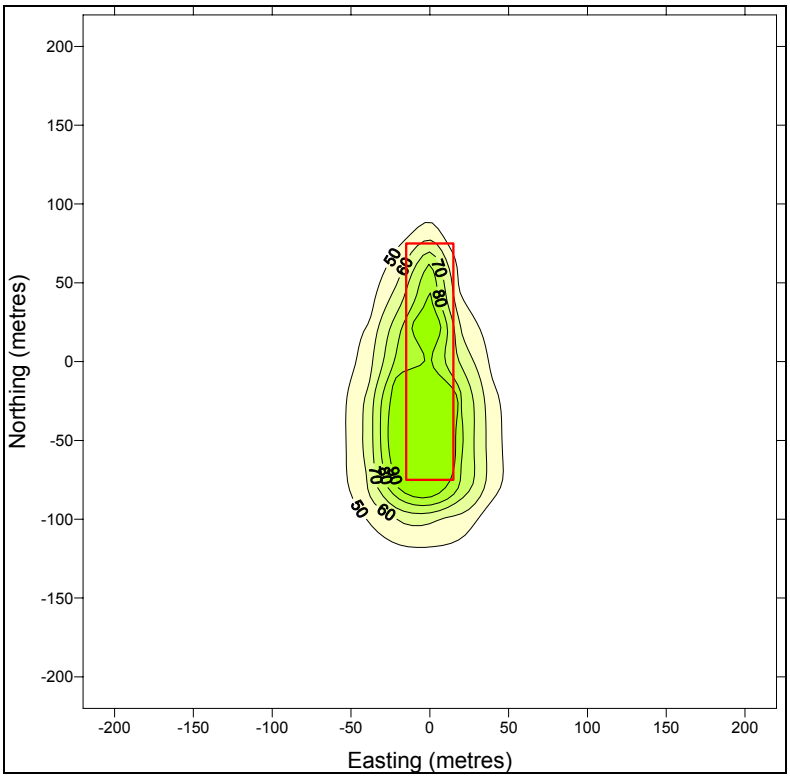
Note 1 EPA Compliance Goal is 150 µg/m³ at a Sensitive Receptor

Figure 7 Predicted Annual Average PM_{10} (µg/m³) – Standard Operations



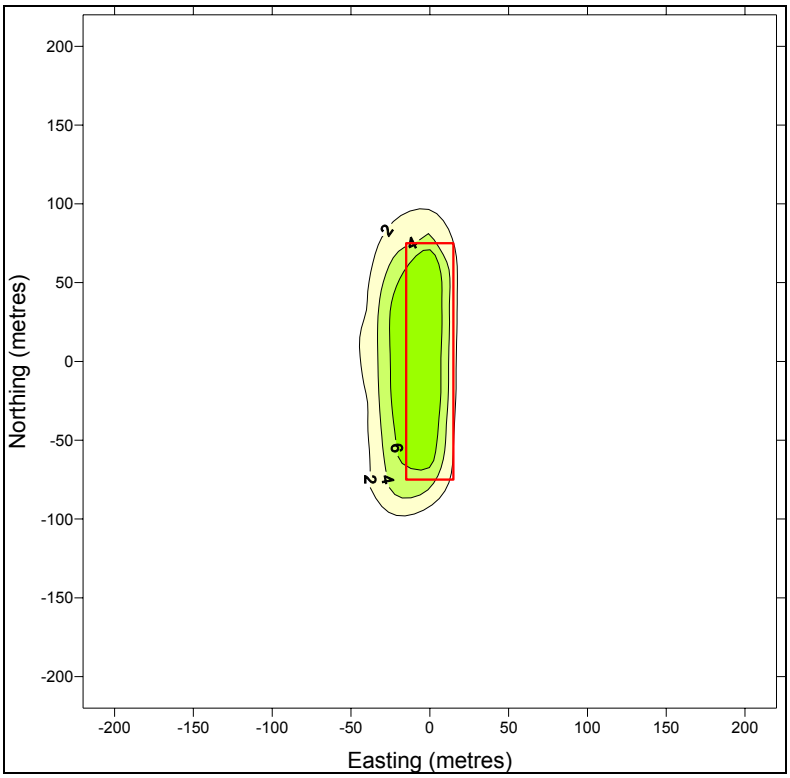
Note 1 EPA Compliance Goal is 50 µg/m³ at a Sensitive Receptor

Figure 8 Predicted Annual Average TSP (µg/m³) – Standard Operations



Note 1 EPA Compliance Goal is 90 µg/m³ at a Sensitive Receptor

Figure 9 Predicted Monthly Average Dust Deposition (g/m²/month) – Standard Operations

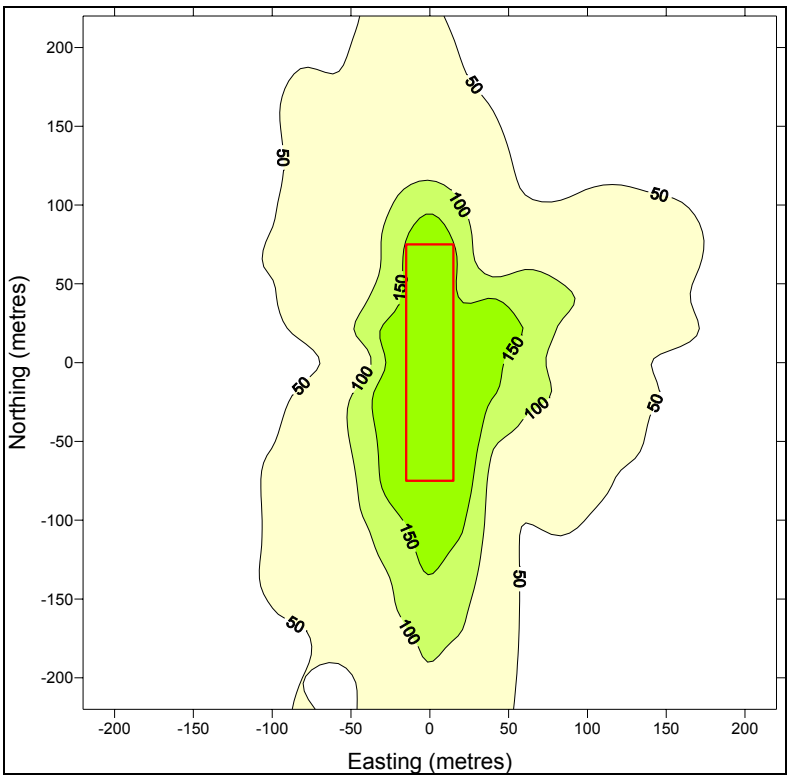


Note 1 EPA Compliance Goal is an incremental increase of 2 g/m²/month at a Sensitive Receptor

Emission Assessment – Blasting Operations

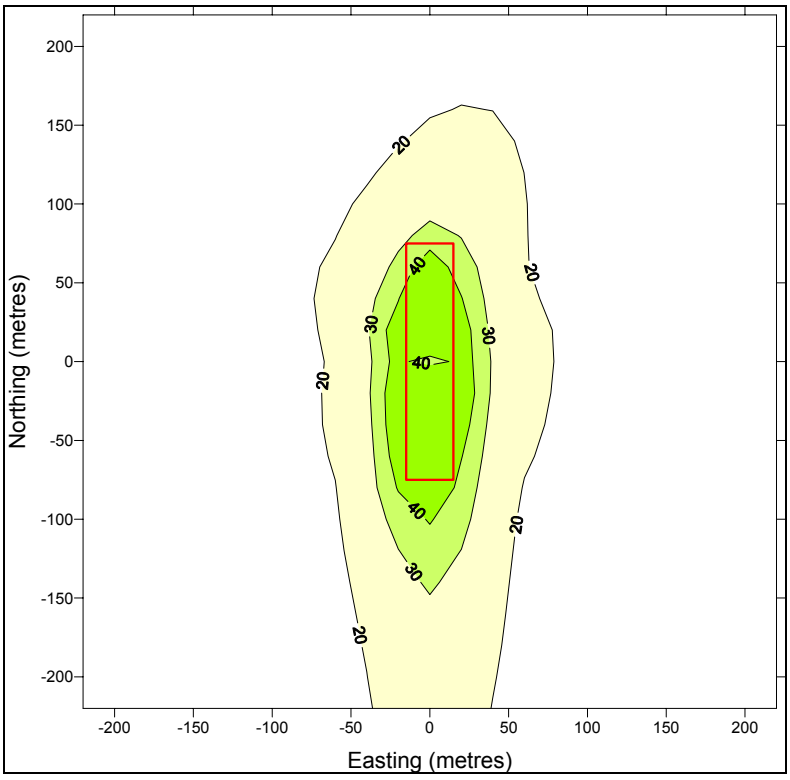
The results of the modelling for PM_{10} (24-hour and annual average), TSP (annual average) and Dust Deposition for blasting construction operations are illustrated in **Figure 10**, **Figure 11**, **Figure 12** and **Figure 13** below. These contour plots present the maximum predicted impact from construction activities and provide an indicative "footprint" that could be applied to worksites where blasting of hard-rock is required (i.e. Adjacent to the Bruce Highway north of Eumundi-Kenilworth Road).

Figure 10 Predicted Worst-Case 24-hour Average PM_{10} (µg/m³) – Blasting Operations



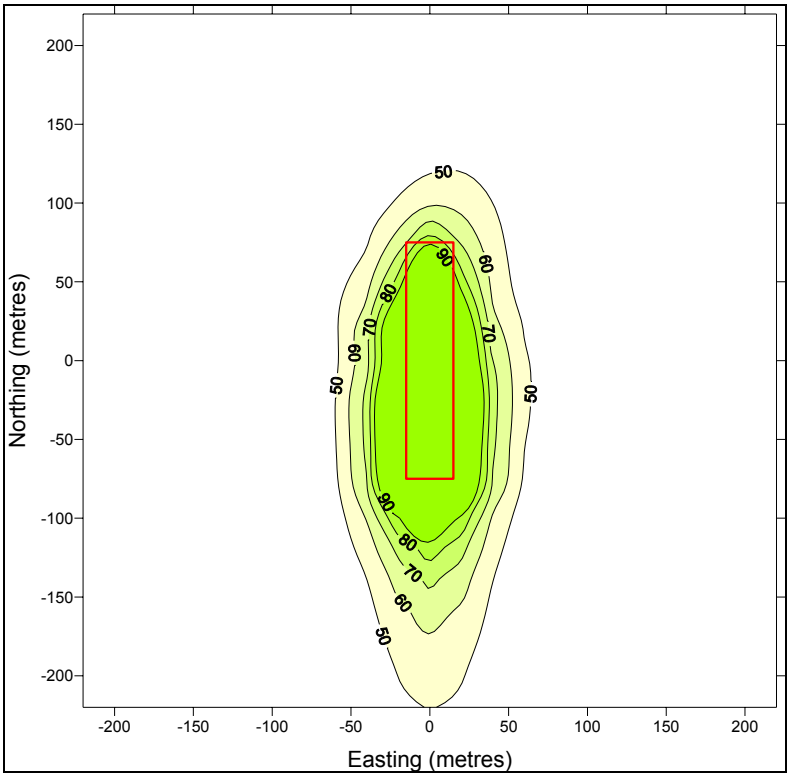
Note 1 EPA Compliance Goal is 150 µg/m³ at a Sensitive Receptor

Figure 11 Predicted Annual Average PM_{10} (µg/m³) – Blasting Operations



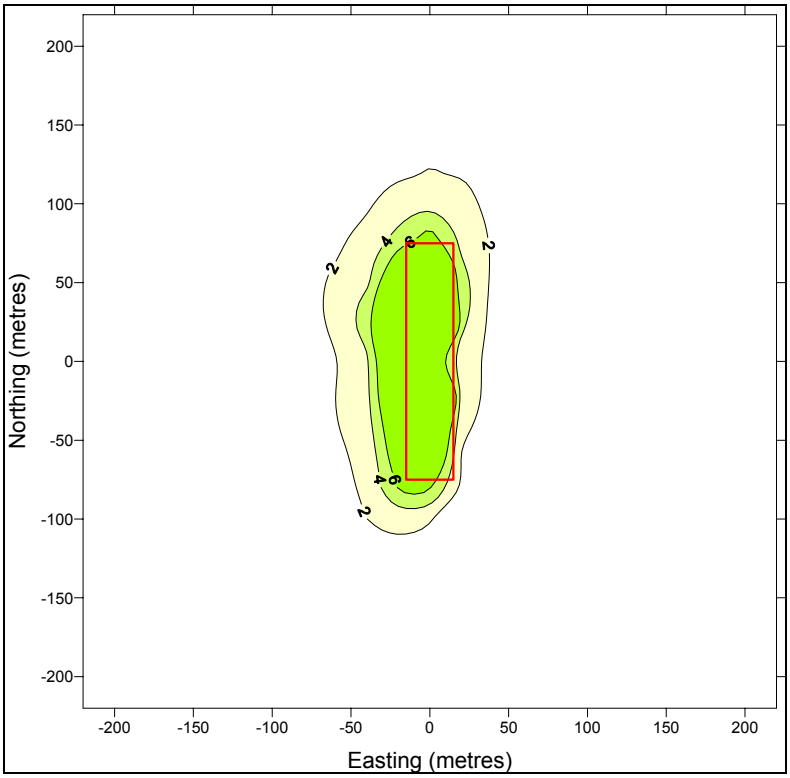
Note 1 EPA Compliance Goal is 50 µg/m³ at a Sensitive Receptor

Figure 12 Predicted Annual Average TSP (µg/m³) – Blasting Operations



Note 1 EPA Compliance Goal is 90 µg/m³ at a Sensitive Receptor

Figure 13 Predicted Monthly Average Dust Deposition (g/m²/month) – Blasting Operations



Note 1 EPA Compliance Goal is an incremental increase of 2 g/m^2/month at a Sensitive Receptor

6.3.3 Emission Assessment Conclusions

It can be seen from examination of the figures presented in **Section 6.3.2**, and comparison with the relevant project air quality goals, that minimal impact from particulate matter emissions are expected to be associated with works conducted along the pipeline.

The greatest distance that an exceedance of relevant air quality goal occurs is approximately 15 m to 20 m and 50 m to 60 m from the extent of standard construction and blasting operations respectively, both of which are attributable to the contour associated with 24-hour average PM_{10}.

Based on this modelling outcome, work conducted within 20 m of a residential property should be carried out with regard to appropriate additional dust mitigation measures to ensure that air quality impacts are appropriately managed.

It should be noted that the above analysis assumes that activities are undertaken at a constant rate and long-term emission factors are used for estimation of sources such as wind-blown dust. The onus will be on operators to ensure that such controls are applied appropriately and that attention is paid to the prevailing meteorology if activities are undertaken upwind of and in close proximity to sensitive receptors (residences and businesses).

Impacts of air pollutants associated with fuel combustion (principally PM_{10}, NO_2, CO and unburnt hydrocarbons) should also be acknowledged. It is noted that the anticipated rate of truck movements is of the order of 30 haulage trucks servicing the site per day.

Previous atmospheric dispersion modelling projects conducted by Heggies indicate that adverse air quality impacts associated with emissions from truck movements of this magnitude would be easily contained within the worksite boundaries. As such, no adverse air quality impacts from this source are anticipated at the nearest sensitive receptors. This is supported by ambient air quality monitoring (refer **Section 4.2.2**) which suggests that there is a capacity within the regional air shed for atmospheric emissions to be dispersed without compromising air quality goals.

6.3.4 Greenhouse Gas Emissions

It is noted that operations relating to the construction and operation of the project have the potential to generate greenhouse gas emissions. Sources of greenhouse gases would be the combustion of diesel and other automotive fuel types for the construction phase and consumption of externally sourced electricity for the operational phase.

As the project is currently in planning phase, specific details relating to the amount of diesel fuel and electricity required for the construction and operational phases of the project respectively are yet to be finalised. It is recommended that once these figures are known, the greenhouse gas emissions for each phase are calculated in accordance with the relevant Australian Greenhouse Office methodologies.

It should be noted that the most significant project-related source of greenhouse gas emissions would likely be related to consumption of electricity during the operational phase. To that end, it is noted that a number of alternative energy sources are being considered for implementation with the project.

7 MITIGATION MEASURES AND SAFEGUARDS

7.1 Noise

7.1.1 Construction Noise

Comprehensive noise mitigation strategies would need to be considered and implemented wherever possible, especially during any evening and night work periods.

AS2436-1981 "*Guide to Noise Control on Construction, Maintenance and Demolition Sites"* sets out numerous practical recommendations to assist in mitigating construction noise emissions. Examples of strategies that should be considered for the NPl Stage 2 project are listed below.

Source Noise Control Strategies

- Quietest plant and equipment that can economically undertake the work should be selected wherever possible.
- Regular maintenance of equipment to keep it in good working order.

Work Practice Control Strategies

- Construction work to occur wherever possible within the day (7:00 am to 6:00 pm) period.
- Where possible, avoid the coincidence of plant and equipment working simultaneously close together and near sensitive sites.
- Maintenance work and access points to the alignment to be located as far as possible from sensitive areas wherever feasible.
- Operators of construction equipment to be made aware of potential noise problems and of techniques to minimise noise emission through a continuous process of operator education.

Noise Barrier Control Strategies

- Where possible, use hoarding stockpiles and site sheds/buildings as noise barriers between equipment and sensitive areas.
- Construct acoustic shed/enclosures over tunnel portals if

Community Liaison Strategies

- Active community consultation and the maintenance of positive relations with residents.
- Where construction noise levels exceed the recommended criteria or in the event of complaints, a detailed investigation of construction noise could be required.
- The following details elaborate further on the strategies outlined above and should be examined and implemented in critical areas wherever practical.

Work Practice Controls

- Engines not started before 7:00 am where possible and queuing of trucks in front of residential areas prior to the normal 7:00 am start time to be avoided wherever possible.
- Loading and unloading of goods and material away from sensitive areas.
- The batch plants for the project are currently located away from residential areas. This approach should be kept in mind if/when other batching plants are proposed.

- Reversing alarms within construction areas cannot be avoided for safety reasons. Consideration should therefore be given to sourcing so-called "quiet" white-noise alarms whose annoying character diminishes quickly with distance, and self-adjusting alarms which adjust emission levels to the local background noise level.
- "Real time" feedback on noise emissions to plant operators. This greatly assists operators to minimise emissions for certain types of plant and equipment.
- Large rocks to be placed in dump trucks not dropped.
- Horn signals should be kept at a low volume where feasible

Source Noise Controls

- Noise measurements of plant and equipment to maintain/check noise emissions.
- Mobile plant such as excavators, front end loaders and other diesel powered equipment to be fitted with residential class mufflers.
- Minimise the usage of truck exhaust brakes on site.
- Use of compactors rather than vibrating rollers where possible.
- It is particularly important that residents are pre-warned of any night time work and the reason for its necessity is explained. This public notification will be in a manner satisfactory to the EPA, in accordance with relevant conditions.
- Bored piling instead of impact pile driving wherever possible. If driven piling is required the only effective noise control is the use of shrouds although the noise attenuation is moderate (possibly up to 10 dBA). Bored piles are typically at least 20 dBA quieter.
- Where possible, use silenced air compressors on site.
- It is important that detailed examination of the precision drilling operations be conducted, once the layout and location of the plant items have been established. Noise from fixed plant such as generators and compressors can be treated with enclosures and barriers; selection of quiet plant and in some cases through additional distance from the receiver and the use of longer leads/hoses. In this case however, the additional attenuation required would not be practicably achievable through the use of distance alone, therefore containment within the abovementioned enclosure will be the most effective treatment of these sources. Alternatively, specifically designed separate enclosures could be used, such as sea containers with forced air circulation and silencers at openings.

Barrier Noise Controls

- Use material stock pile at batching plants to shield residences.

Community Liaison Controls

- Construction site personnel to be made aware of all community attitudes and complaints.
- Residents be made aware of times and duration they will be affected. Making residents aware of likely future occurrence of noise significantly reduces annoyance and allows people to arrange themselves accordingly.
- It has been well established that resident sensitivity thresholds are strongly influenced by "fear of the unknown or unexpected" and by concern regarding potential for damage to dwellings. While these typical reactions are clearly understandable, the underlying concerns are often technically unjustified.

- It is therefore proposed to implement, as part of the broader community involvement plan, a well-planned, focussed community awareness program where this is considered appropriate, to improve the understanding of the noise and vibration issues and to assist in allaying fears and concerns, particularly where vibration is the perceived concern. This program would include, for example, inviting representative groups of the community to a short, concentrated Noise and Vibration Briefing prior to the works approaching their community.
- 24 hour/day complaints phone number.
- Monitoring of noise and vibration during critical stages, especially at night-time (if required).
- Nominated person to receive, log, track and respond to complaints with an appropriate timeframe and to record what actions were taken.

7.1.2 Operational Noise

Potential exceedances of the assessment criterion have been identified for all proposed pump station locations within NPI Stage 2. The following noise control measures may be required to achieve compliance:

- Increasing separation distance between the pump station and noise sensitive receivers.
- Absorption in the pump hall in the form of an acoustic tile ceiling or custom absorptive treatments on the walls to reduce reverberant noise.
- Additional exhaust air hood noise breakout control through silencers or additional lined ducting.
- Increased ceiling/roof construction.
- Treatment of the roller door and jamb or substitution with hinged doors with higher noise attenuation properties.
- Detailed design of the transformer enclosure.

Further detailed mitigation of operational noise from the pump stations will be addressed separately in site specific impact assessments.

7.2 Vibration

Blasting during the construction phase of the NPI Stage 2 has been discussed in **Section 6.2.1** as a vibration intensive activity that may adversely affect sensitive locations. The following sections discuss possible mitigation strategies to minimise the noise and vibration impacts and also outlines a recommended blast monitoring program.

7.2.1 Blast Mitigation

If required, blasting noise and vibration levels may be reduced by application of the following:

- Reducing the maximum instantaneous charge (MIC by using delays, reduced hole diameter and/or deck loading.
- Changing the burden and spacing by altering the drilling pattern and/or delay layout, or altering the hole inclination.
- Exercise strict control over spacing and orienting all blast drill holes.
- Use minimum practicable sub-drilling which gives satisfactory toe conditions.
- Investigate alternative rockbreaking techniques.
- Establish times of blasting to suit local conditions.
- Direction of detonator initiation away from near residences.

- Use of optimum type and deep of stemming.
- Explosive column initiated from bottom.

The use of some (or all) of these techniques would be assessed and recommended accordingly via the Blast Monitoring Program contained in the following section. It is anticipated that compliance with the nominated criteria for blasting can be achieved by these techniques when correctly implemented via the below recommended Blast Monitoring Program.

7.2.2 Blast Monitoring Program

General Procedure

The Programme of Monitoring will be developed with reference to the procedures described in AS 2187.2-1993, *"Explosives – Storage, Transport and Use"* and with reference to the ANZECC's *"Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration", September 1990.*

The blast emissions will be quantified for all blast events conducted at the pipeline excavation works.

Predicted Blast Emission Levels

Blast emission (ground vibration and airblast) data from every blast will be used to refine subsequent blast designs in order to control blast emission levels, particularly when blasting close to residences and other vibration sensitive structures.

It is anticipated that following the first 10 blasts sufficient blast emission data will be available to determine the allowable range of Maximum Instantaneous Charge (MIC) for a given offset distance. All subsequent blast emission levels will be predicted using the continually refined site laws.

Instrumentation

The vibration and airblast monitoring for all blasts will be conducted at the closest residence(s) and other structures to the pipeline excavation works, using Instantel vibration monitors or equivalent.

These blast monitors are dedicated battery-powered units capable of measuring vibration in the frequency range 2 Hz to 250 Hz down to 0.2 mm/s in the absence of an amplifier or 0.02 mm/s using a 10 times amplifier. The units can be set up to operate unattended, triggered by vibrations above a preset vibration threshold. In terms of vibration, the output from the unit gives the respective vibration levels in the three orthogonal directions in velocity, amplitude and acceleration.

Time history waveform data from the vibration and airblast source can also be printed out on site. Further detailed analysis can be conducted via the Instantel software which resides on a PC. Via this software, the Blast Reports for each blast can be generated, including the FFT (Fast Fourier Transform) frequency analysis data for vibration (in the three orthogonal directions), calibration and sensor-check data and the time history waveforms.

The Instantel units that will be utilised for the blast monitoring include the MiniMate Plus units, the description of capability and technical information for which is available upon request. Each unit carries a traceable calibration to a NATA laboratory and also conducts a self calibration of the unit and its transducers following each recorded vibration and airblast event.

Monitoring Locations

At each nominated location/structure, the triaxial vibration velocity transducers will be attached to a "stiff" part of the structure, in accordance with the procedures nominated in various international Standards in relation to the assessment of structural damage from vibration. Airblast will be measured at a location adjacent to the structure.

Unless specific locations are nominated at the respective structures or equipment items, an aluminium plate will be adhered to a stiff part of the structure or equipment either in the horizontal or vertical plane, to which the triaxial transducer can be bolted.

Site Law Development

The measured levels of vibration and airblast from the blasts will then be used to progressively compile prediction "Site Laws" for blasting on the proposed site to aid the design of subsequent blasting.

In the site law plots, a line will be generated for the mean (50% exceedance) and the 20% exceedance (or 1 blast in 5) for the measured vibration and airblast data.

As the initial blasting progresses, the vibration site laws will be used to verify, or determine, the allowable maximum weight of explosive to be used in the subsequent blasting based on the 20% exceedance prediction equations.

Reporting

Upon completion of the blasting exercise, a report on the results of the blasting will be compiled which will include the background information to the blasting, description of the monitoring locations, instrumentation, monitoring results and the final site laws for vibration.

Meteorological Considerations

Blasting will be avoided, where possible, under the following meteorological conditions:

- When winds are blowing from the blast site to the nearest receiver at a magnitude likely to enhance blasting impacts.
- Where there is heavy low level cloud.
- Where a temperature inversion is present.

Notifying Landowners or Occupiers of Blast Events

The closest residence(s) to the site will be contacted by telephone on the morning of blasting indicating an expected time of firing.

Wherever possible, the blasts will be conducted at the same (nominated) time of day.

Non Compliance and Corrective Action

Where the vibration and/or airblast monitoring identifies non-compliance with the relevant criteria, the Contractor will plan and carry out corrective action.

The corrective action may involve supplementary monitoring in order to identify the source of the non-conformance and/or may involve modification of the blasting techniques or programme in order to avoid any recurrence or minimise its adverse effects.

Complaint Handling

The Alliance will adopt the following protocol for handling complaints. This protocol is intended to ensure that the issues are addressed and that appropriate corrective action is identified and implemented as necessary:

- All complaints will be forwarded to the Project Manager.
- Records will be kept regarding the source and nature of the complaint.
- The complaint will be investigated in order to determine whether a criterion exceedance has occurred.
- If excessive vibration and/or airblast have been caused, corrective action will be planned and implemented.
- Details of complaints and corrective action will be reported to the Contractor.
- Complainants will be informed that their complaints are being addressed, and (if appropriate) that corrective action is being taken.
- Follow-up monitoring or other investigations will be carried out to confirm the effectiveness of the corrective action.
- Complainants will be informed of the successful implementation of the corrective action that has been taken to mitigate the adverse effects.

7.3 Air Quality

7.3.1 Construction

Air quality management controls are recommended during construction to:

- Assist in ensuring that standards of air quality during the construction works comply with legislative guidelines, conditions of approval and other relevant Authority conditions; and
- Ensure that construction activities that have the potential to generate dust emissions, odours and gaseous emissions are controlled to avoid degradation of air quality, nuisance to adjoining properties, impacts on neighbouring amenity and health, and community complaints.

Recommended construction control measures include:

- The size of areas that require clearing should be kept a minimum, as much as practicable.
- Cleared areas should be revegetated as soon as practicable.
- Cleared vegetation should be chipped/mulched and used on cleared areas to minimise wind-generated dust.
- Temporary access roads and open areas should be watered when necessary to reduce dust generation.
- Wind breaks of earth banks and other screens should be considered to reduce the capacity of the wind to raise dust from open areas.
- Ensure that the entire vehicle fleet (Trucks, Excavators, etc) is regularly serviced and maintained to minimise emissions.
- Truck wheel washes or other dust removal devices should be installed where necessary to minimise transport of dirt/dust offsite.
- All truck loads should be covered.
- Vehicle speeds on unsealed roads should be reduced when visible dust generation is noted.

- Construction activities upwind of and close to residences should cease or appropriate control measures be applied during periods of high wind.
- Stockpiles and exposed areas should be regularly watered.
- Construction equipment powered by internal combustion engines should be sited as far as practicable downwind from residences (see wind roses – **Appendix B**).
- Use of odorous chemicals and dusty or odour-generating construction or maintenance activities should be situated downwind of residences where possible.

7.3.2 Operational

Regular inspection of the project area should be undertaken to ensure that air pollutant emissions are minimised. This should include:

- Periodic inspection of cleared/rehabilitated areas to ensure that vehicle and wind-generated dust emissions are minimal.
- Maintenance any on-site equipment and pipeline maintenance equipment so that air pollutant emissions are minimised.

8 CONCLUSION

Heggies has been commissioned by the Southern Regional Water Pipeline Project Alliance to assess the potential noise, vibration and air quality impacts associated with the construction and operation of Stage 2 of the proposed Northern Pipeline Inter-connector.

Measurements of the existing ambient noise environment have been made and construction noise levels have been predicted based upon proposed construction equipment and expected activities. Mitigation and management strategies have been recommended in situations where construction needs to occur outside the standard daytime period (ie 7 am to 6 pm Monday to Friday and 8 am to 1 pm Saturday). Provided construction activities are constrained to the day period, minimal impacts are anticipated.

The results of the operational noise assessment predicted areas where pump station noise levels are expected to exceed the defined criterion. Generic noise mitigation strategies in the form of suitable building construction (applied to other SRWP pump stations) have been recommended.

Based on the data provided and the investigations undertaken for this report, it is anticipated that all noise issues associated with both the construction and operational phases of the NPI Stage 2 project can be adequately controlled, in relation to the various sensitive locations adjacent to the alignment, through appropriate mitigation (physical or management) measures.

Vibration intensive activities during the construction (and operational phases) of the NPI Stage 2 have been identified and it has been determined that blasting is the only activity where sensitive locations may be adversely affected.

Though blasting is not anticipated, it remains a possibility and as a consequence blasting mitigation techniques have been provided to reduce the magnitude of the noise and vibration levels as well as the perception of vibration at sensitive locations. A recommended blast monitoring program has also been detailed which provides guidelines to minimise any impacts due to blasting. Compliance with the Environmental Protection Regulation 1998 criteria is therefore likely to be achieved for the project.

Air pollutants relating to the proposed pipeline project that will potentially affect air quality are related primarily to construction activities. Emissions will mainly be in the form of dust raised by mechanical operations, transport activities and wind. Small quantities of gaseous pollutants will be emitted from internal combustion engines in construction equipment, but ambient concentrations of these substances should be low compared to relevant guidelines. Standard maintenance procedures, normal operational inspections and appropriate siting should be adequate to ensure that combustion products are not an issue for residents during construction.

The generation and impact of construction dust emissions will be minimised by use of appropriate management techniques, in particular the minimisation of cleared areas and the use of watering to bind the surface layer.

Air pollutant emissions during pipeline operation will be very low, mainly relating to maintenance activities. Inspections should be carried out on a regular basis to ensure that dust and odour emissions from sources along the pipeline corridor are minimal. Equipment used on the site will be appropriately operated and maintained to ensure that air pollutant emissions are minimised.

9 REFERENCES

The following documents and resources have been used in the production of this report:

- Australian Standard AS1055.1 (1997), Acoustics - Description and measurement of environmental noise - General procedures
- Australian Standard AS1055.2 (1997), Acoustics - Description and measurement of environmental noise - Application to specific situations
- Queensland Government (2004), Ecoaccess-Guideline Planning for Noise Control. Internet http://www.epa.qld.gov.au/publications/p01369aa.pdf/Planning_for_noise_control.pdf
- British Standard BS7385 Part 2 (1993), Evaluation and measurement for vibration in buildings - Guide to damage levels from groundborne vibration
- Australian Government (1998), Best Practice Environmental Management in Mining - Noise, Vibration and Airblast Control. Internet. http://www.industry.gov.au/assets/documents/itrinternet/Noise_Vibration_and_Airblast_Control00123105228.pdf
- Queensland Government (1998), Environmental Protection Regulation. Internet http://www.legislation.qld.gov.au/Search/isysquery/697340e4-3a8e-4730-9b84-8e675d61a73e/3/doc/EnvProtR98.pdfBureau of Meteorology, Historic Climate Data for Nambour and Tewantin AWS.
- Bureau of Meteorology, Hourly Weather Observations for 2006 from Nambour and Tewantin AWS.
- National Environment Protection Council (1998), National Environment Protection (Ambient Air Quality) Measure.
- NSW Department of Environment and Climate Change (2005), Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales.
- Queensland Environmental Protection Agency, Hourly monitoring data for NO_2 and PM_{10} from Mountain Creek Monitoring Station.
- Queensland Government (1997), Environmental Protection (Air) Policy 1997. Office of the Queensland Parliamentary Council.
- US Environmental Protection Agency (1998), Miscellaneous Sources, Unpaved Roads – Background Documentation, AP-42: Compilation of Air Pollutant Emission Factors, Fifth Edition. Chapter 13.2.2.

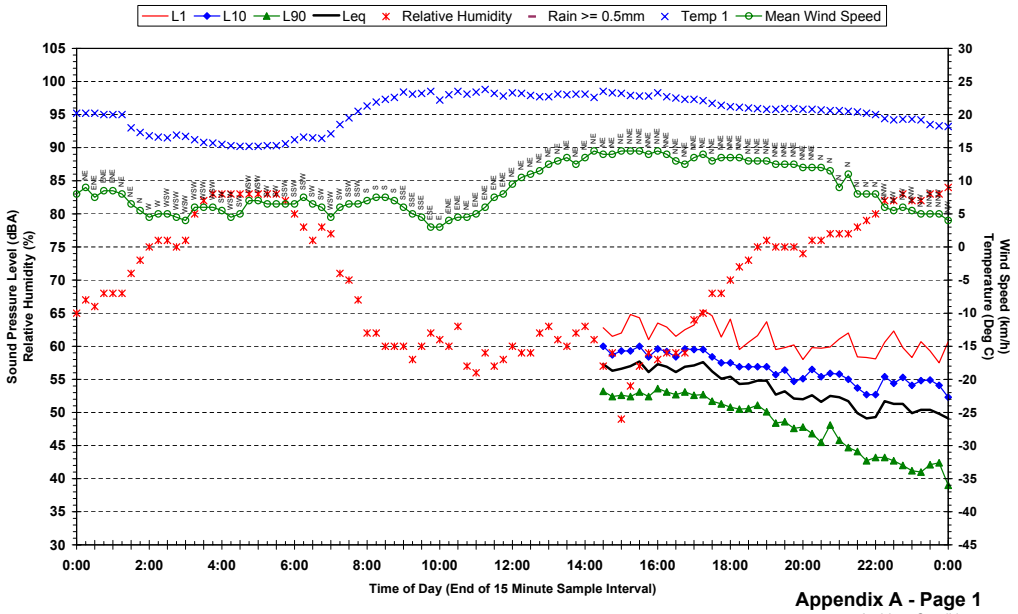
- US EPA (2003) Compilation of Air Pollutant Emission Factors AP-42 - Chapter 13.2.2 Unpaved Roads.
- US EPA (2006) Compilation of Air Pollutant Emission Factors AP-42 (Chapter 13, Section 13.2.5 Industrial Wind Erosion).

Appendix A

Report 20-1873-R2

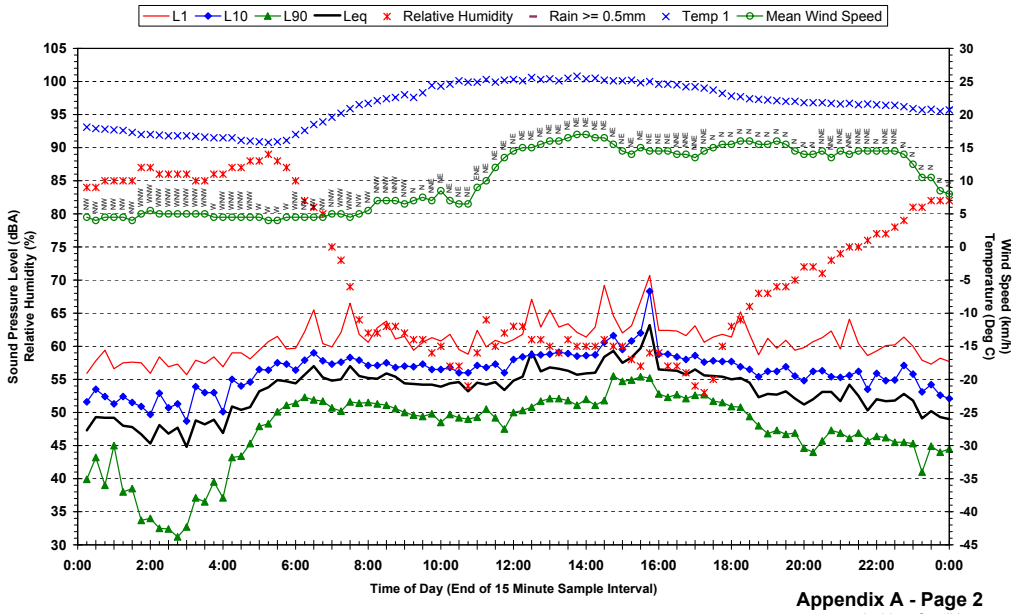
Existing Noise Environment Charts

Statistical Ambient Noise Levels
20-1873 Con 1 - Leafy Lane - Monday 22 October 2007



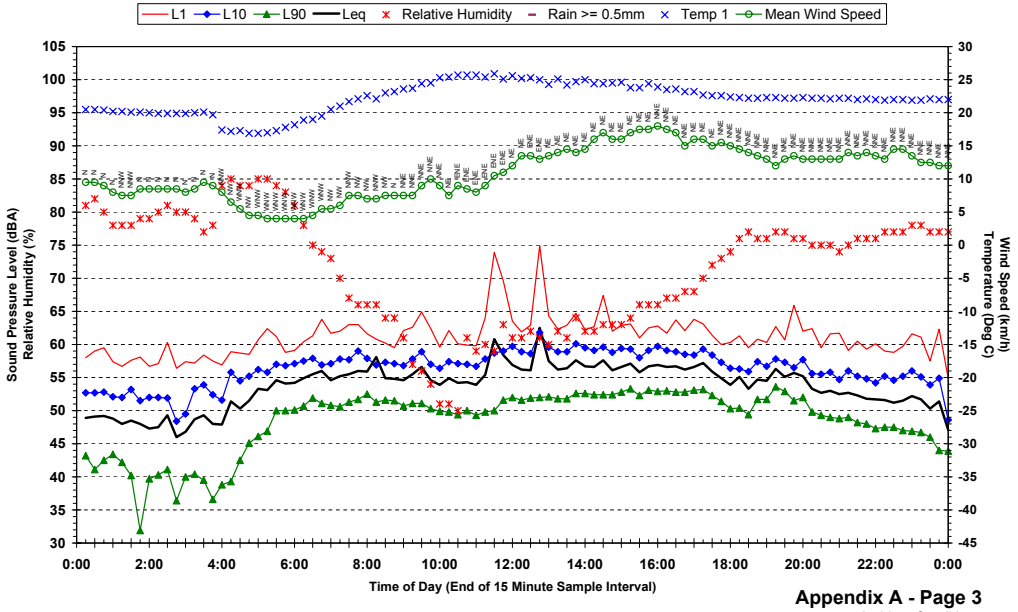
Appendix A - Page 1
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 1 - Leafy Lane - Tuesday 23 October 2007



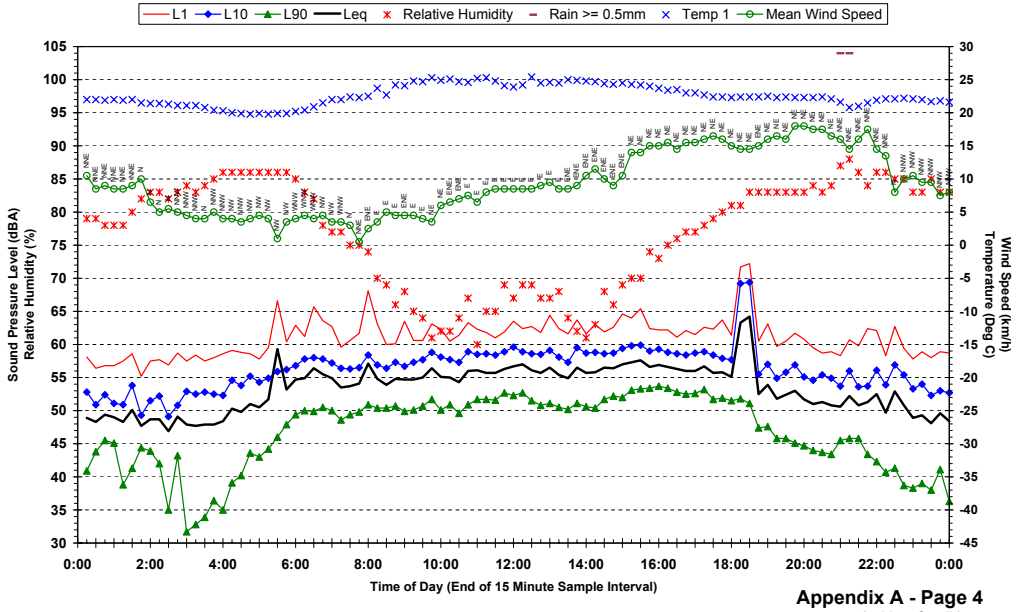
Appendix A - Page 2
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 1 - Leafy Lane - Wednesday 24 October 2007



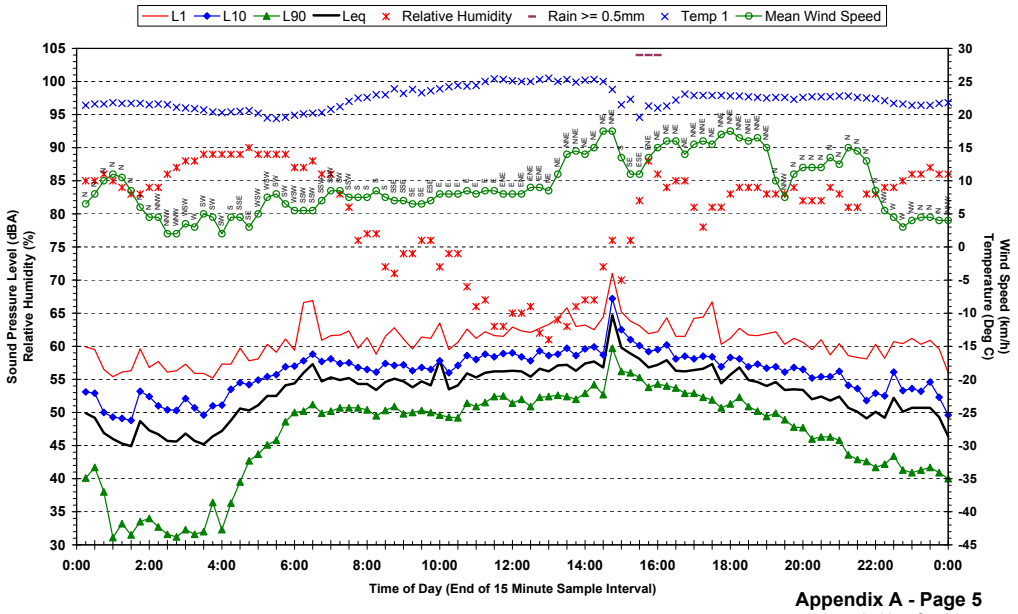
Appendix A - Page 3
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 1 - Leafy Lane - Thursday 25 October 2007



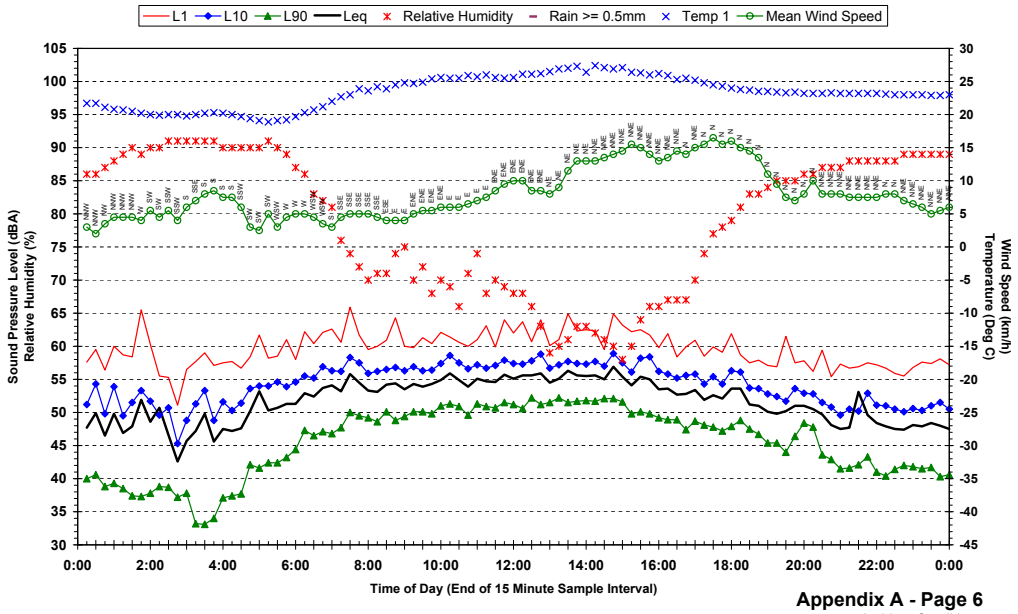
Appendix A - Page 4
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 1 - Leafy Lane - Friday 26 October 2007



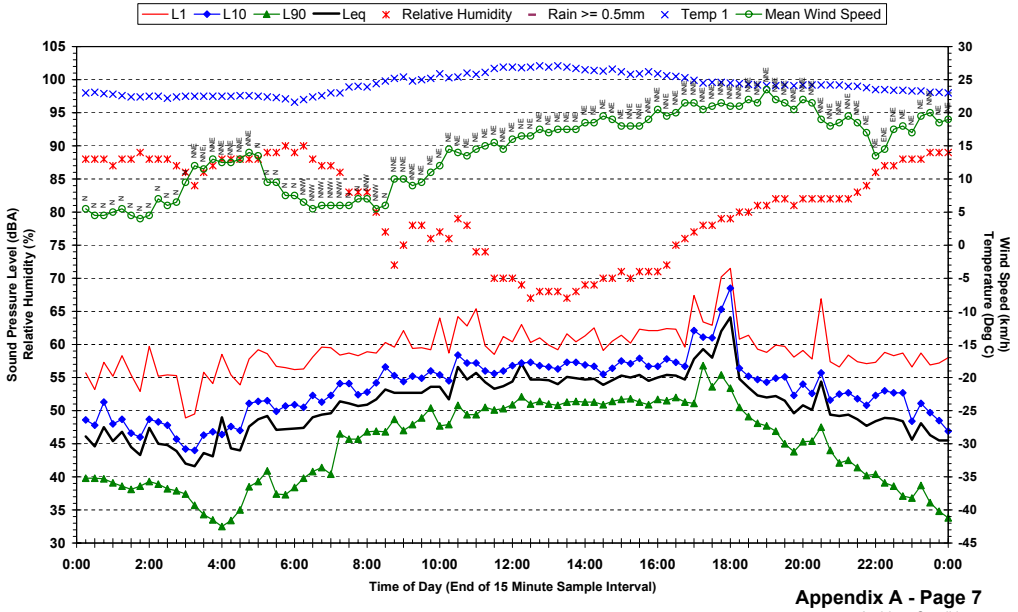
Appendix A - Page 5
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 1 - Leafy Lane - Saturday 27 October 2007



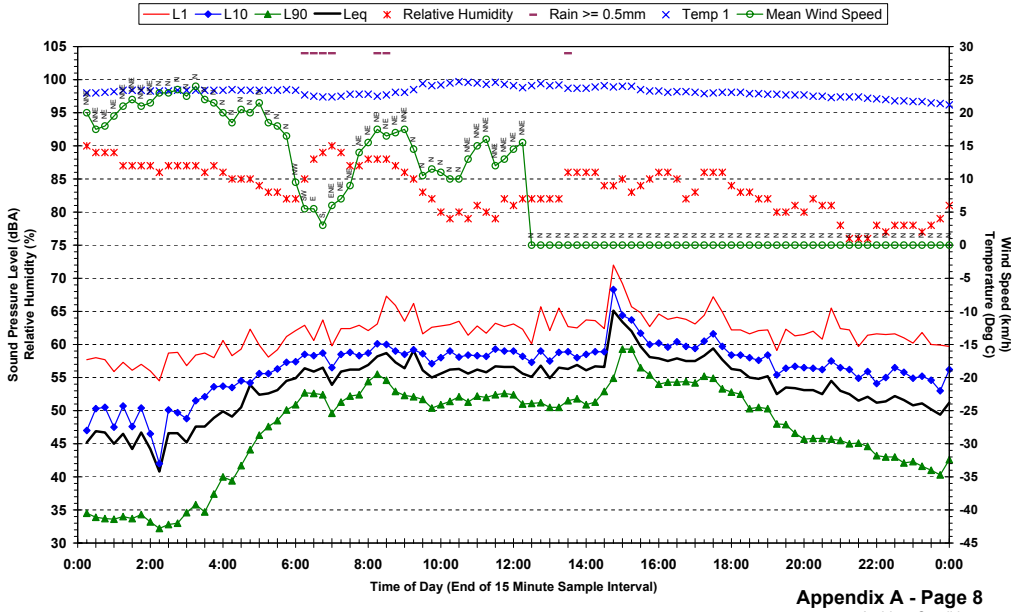
Appendix A - Page 6
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 1 - Leafy Lane - Sunday 28 October 2007



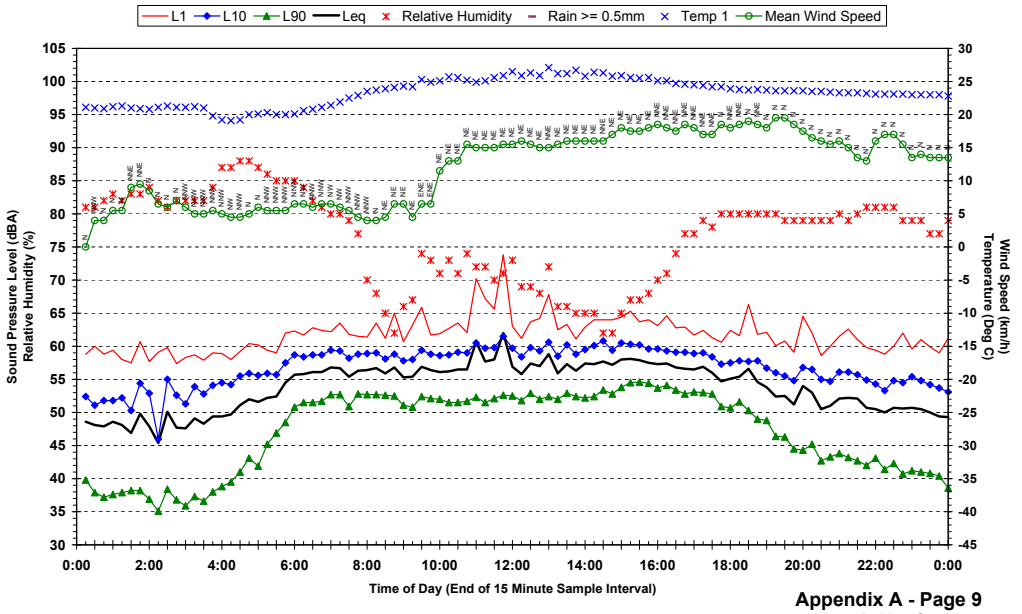
Appendix A - Page 7
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 1 - Leafy Lane - Monday 29 October 2007

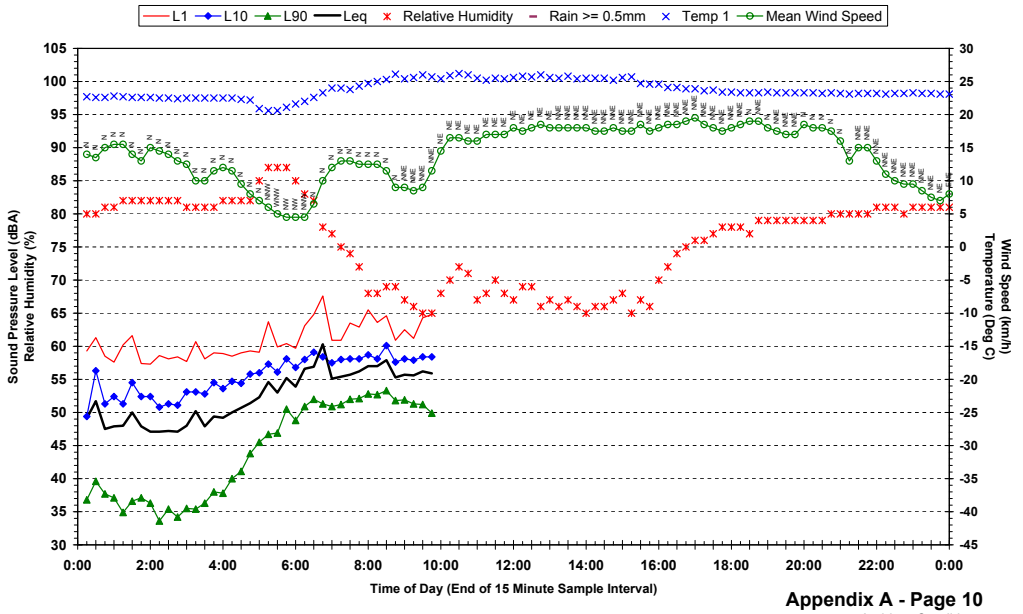


Appendix A - Page 8
Ambient Conditions
Heggies Report 20-1873

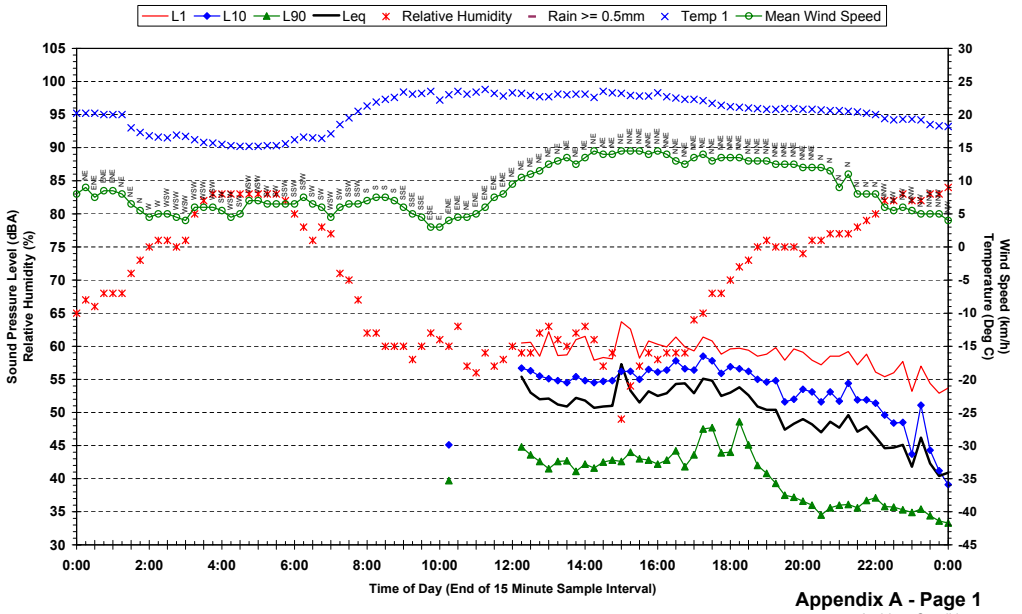
Statistical Ambient Noise Levels
20-1873 Con 1 - Leafy Lane - Tuesday 30 October 2007



Statistical Ambient Noise Levels
20-1873 Con 1 - Leafy Lane - Wednesday 31 October 2007

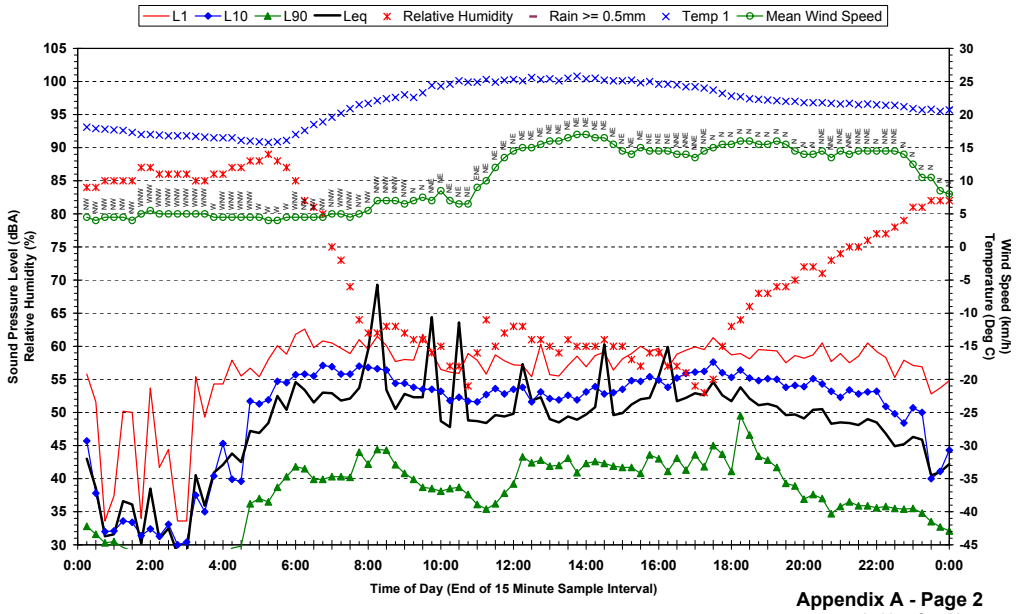


Statistical Ambient Noise Levels
20-1873 Con 2 - 599 Petrie Creek Road - Monday 22 October 2007



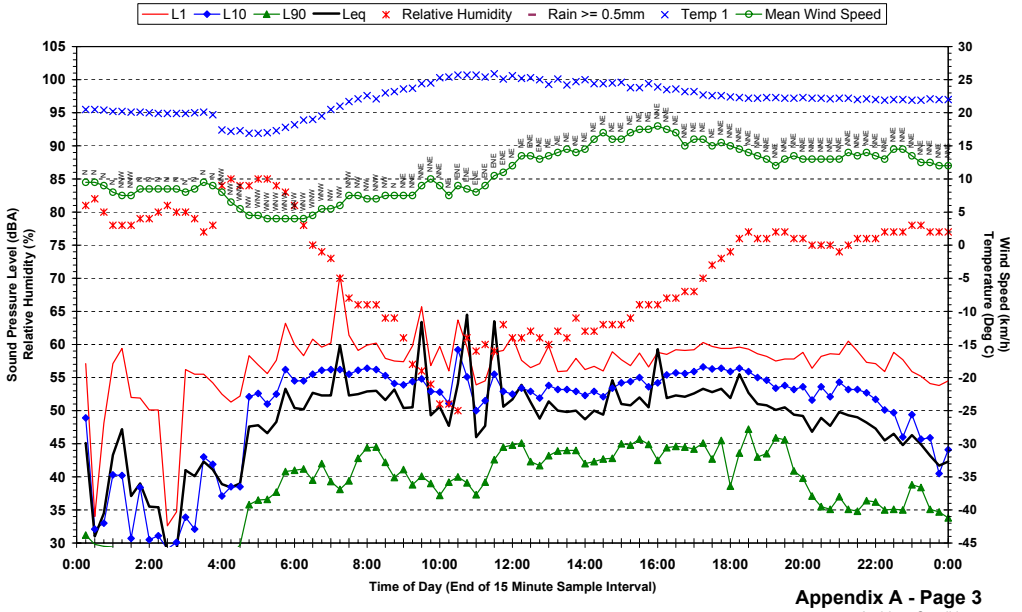
Appendix A - Page 1
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 2 - 599 Petrie Creek Road - Tuesday 23 October 2007



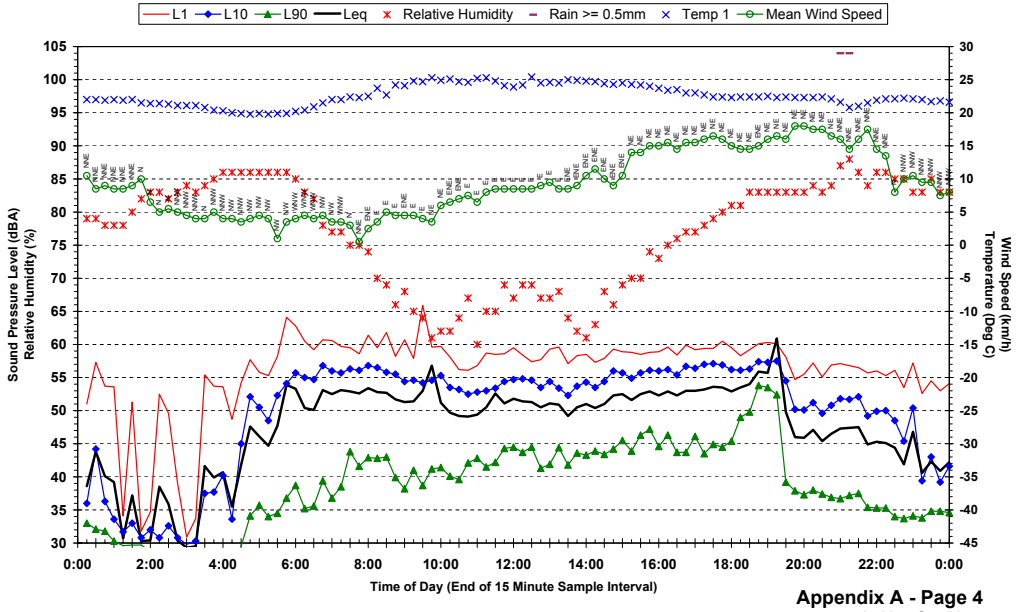
Appendix A - Page 2
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 2 - 599 Petrie Creek Road - Wednesday 24 October 2007



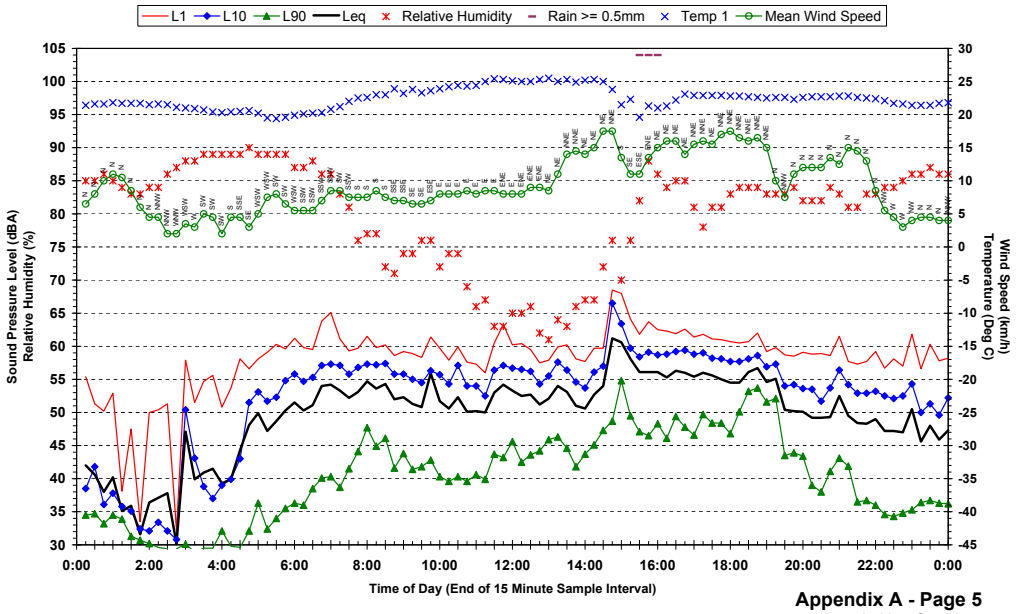
Appendix A - Page 3
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 2 - 599 Petrie Creek Road - Thursday 25 October 2007

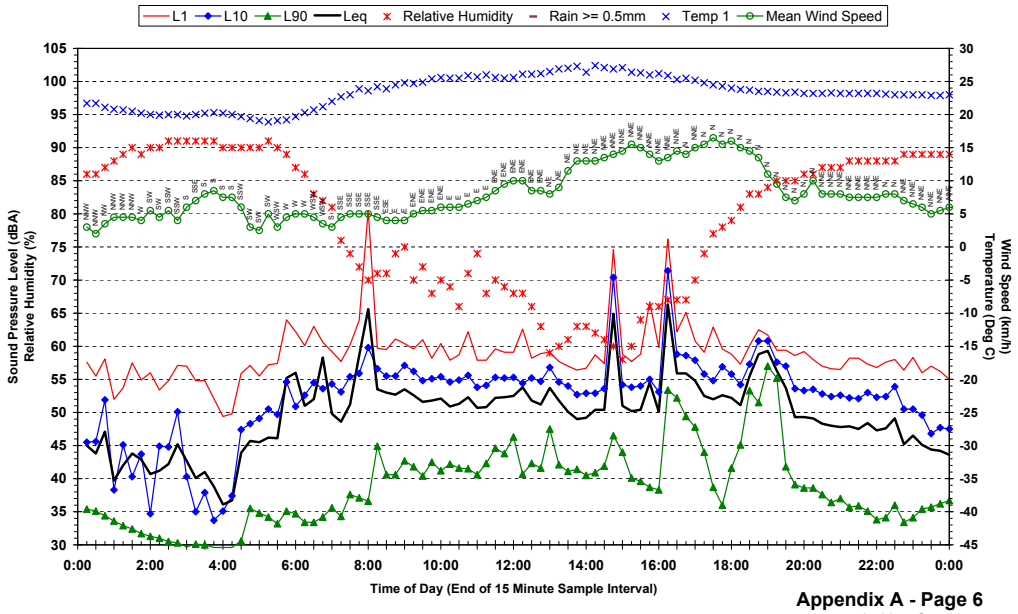


Appendix A - Page 4
Ambient Conditions
Heggies Report 20-1873

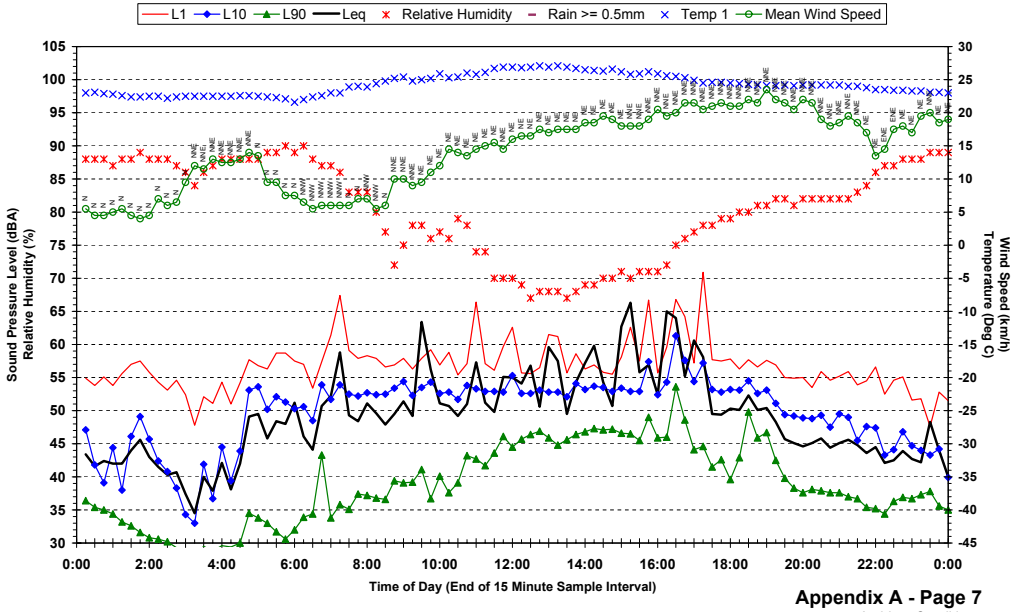
Statistical Ambient Noise Levels
20-1873 Con 2 - 599 Petrie Creek Road - Friday 26 October 2007



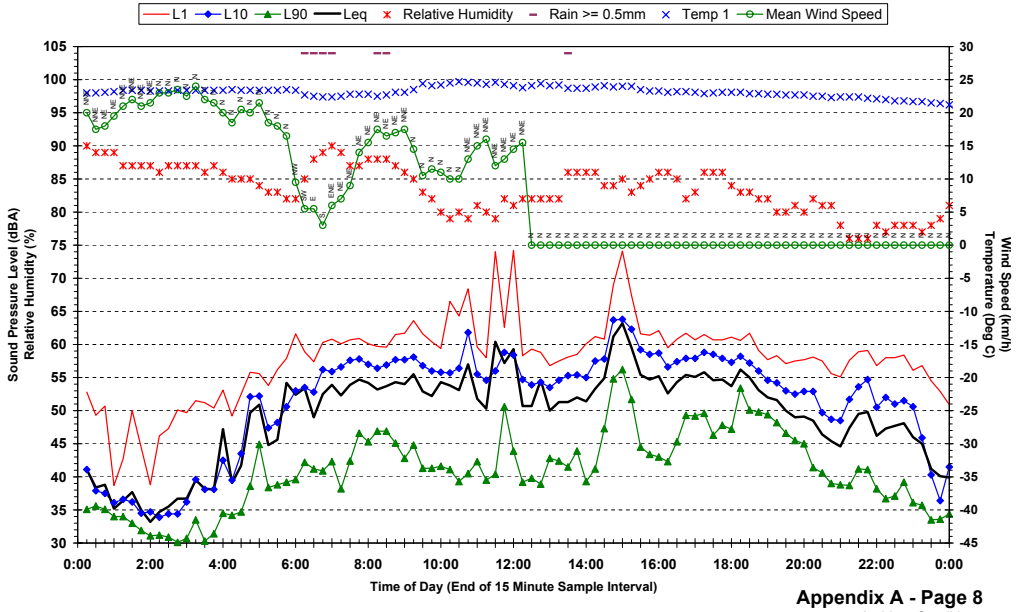
Statistical Ambient Noise Levels
20-1873 Con 2 - 599 Petrie Creek Road - Saturday 27 October 2007



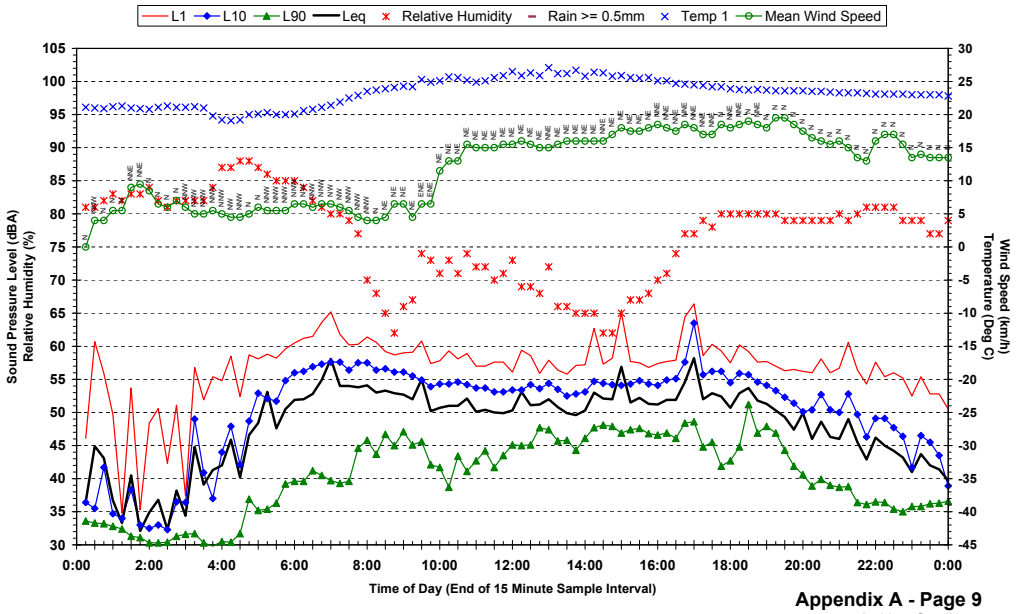
Statistical Ambient Noise Levels
20-1873 Con 2 - 599 Petrie Creek Road - Sunday 28 October 2007



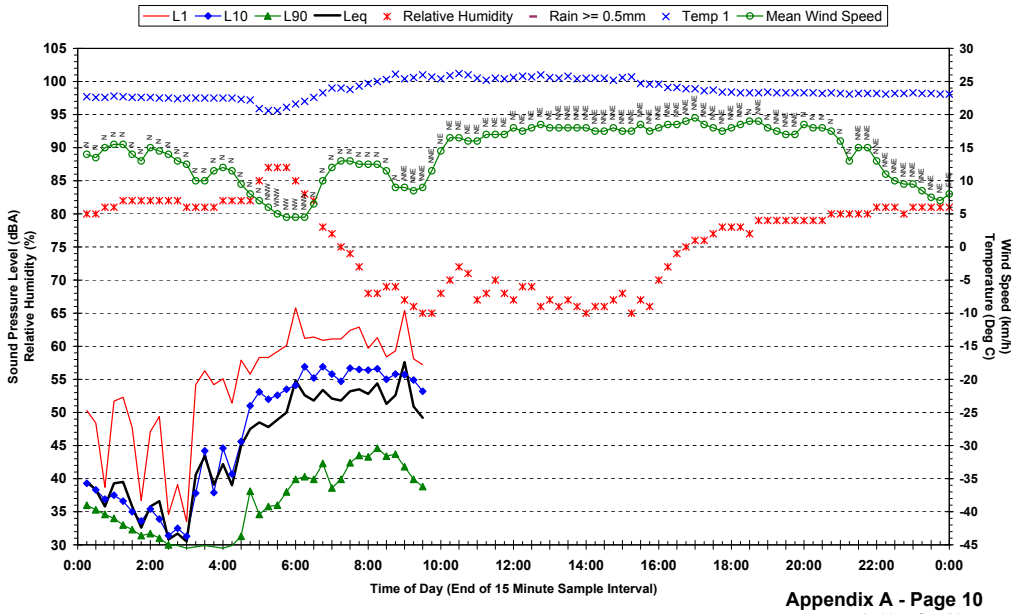
Statistical Ambient Noise Levels
20-1873 Con 2 - 599 Petrie Creek Road - Monday 29 October 2007



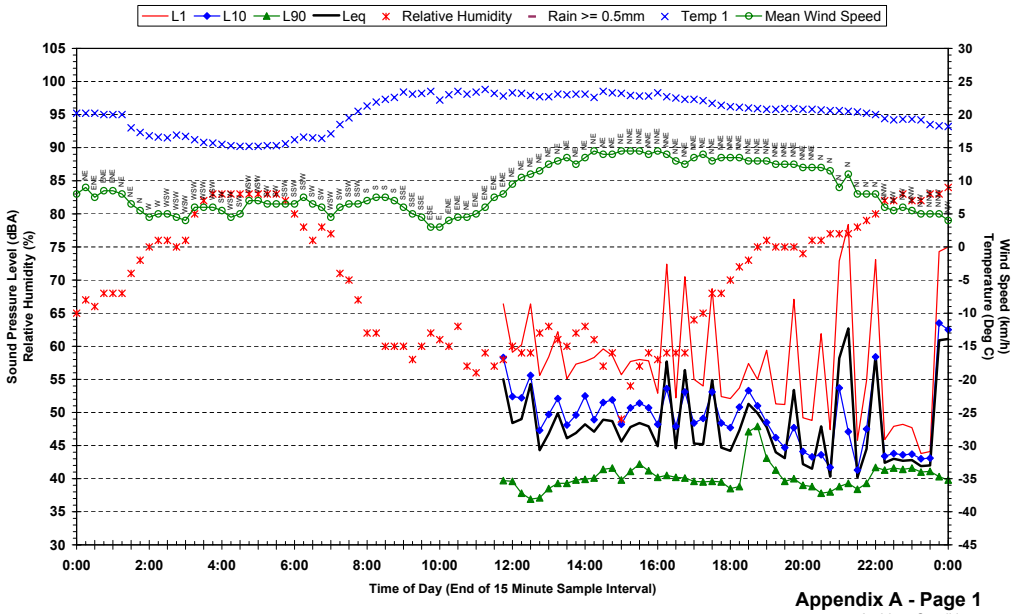
Statistical Ambient Noise Levels
20-1873 Con 2 - 599 Petrie Creek Road - Tuesday 30 October 2007



Statistical Ambient Noise Levels
20-1873 Con 2 - 599 Petrie Creek Road - Wednesday 31 October 2007

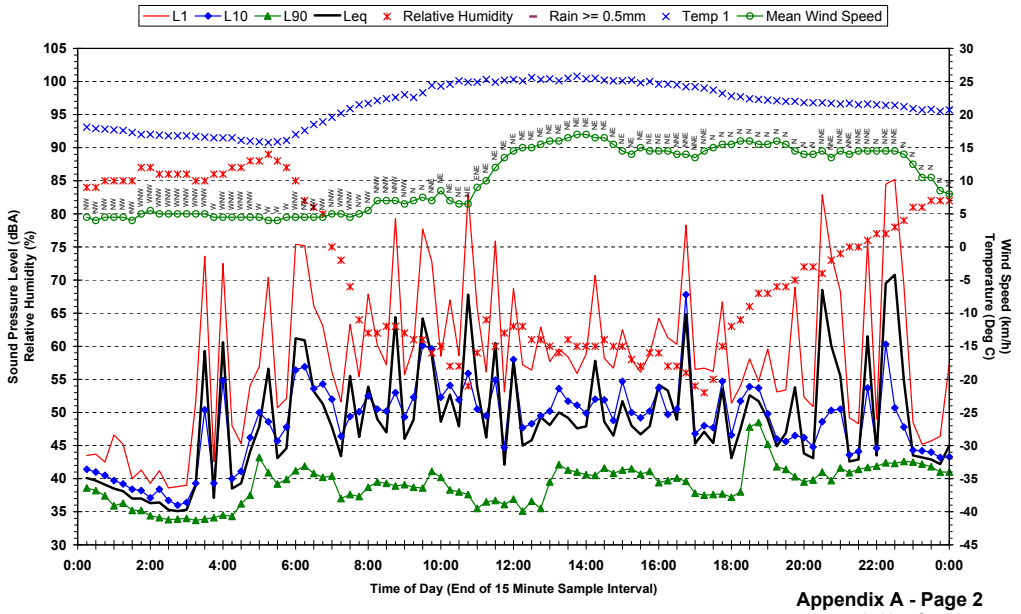


Statistical Ambient Noise Levels
20-1873 Con 3 - Zealey Road - Monday 22 October 2007



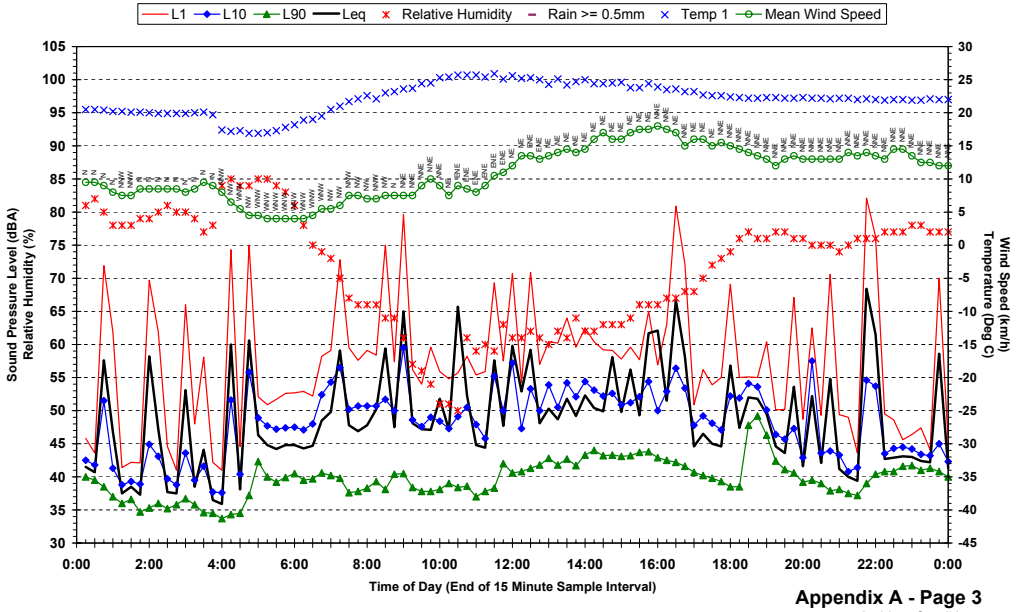
Appendix A - Page 1
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 3 - Zealey Road - Tuesday 23 October 2007



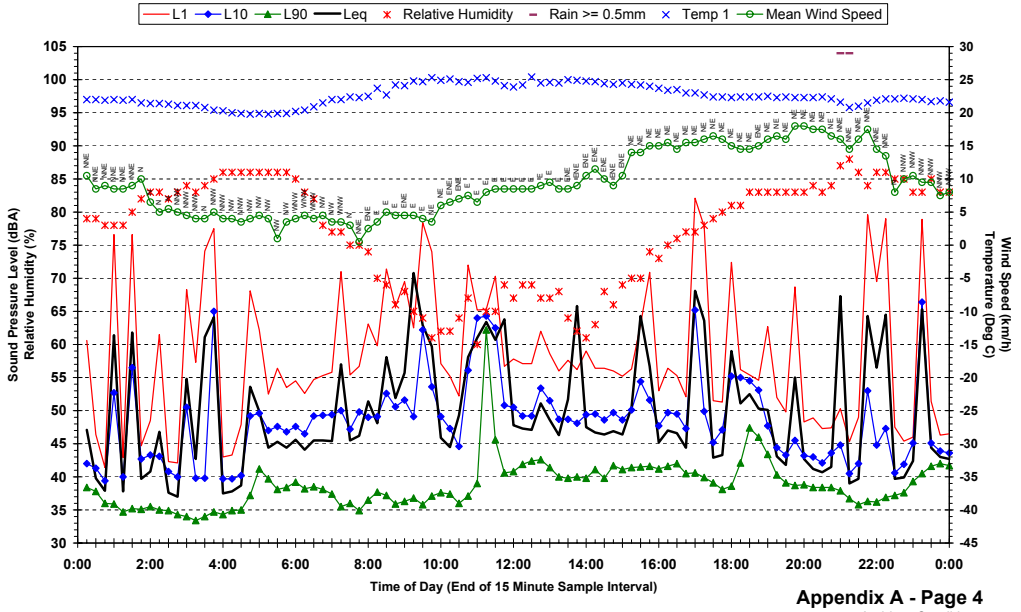
Appendix A - Page 2
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 3 - Zealey Road - Wednesday 24 October 2007



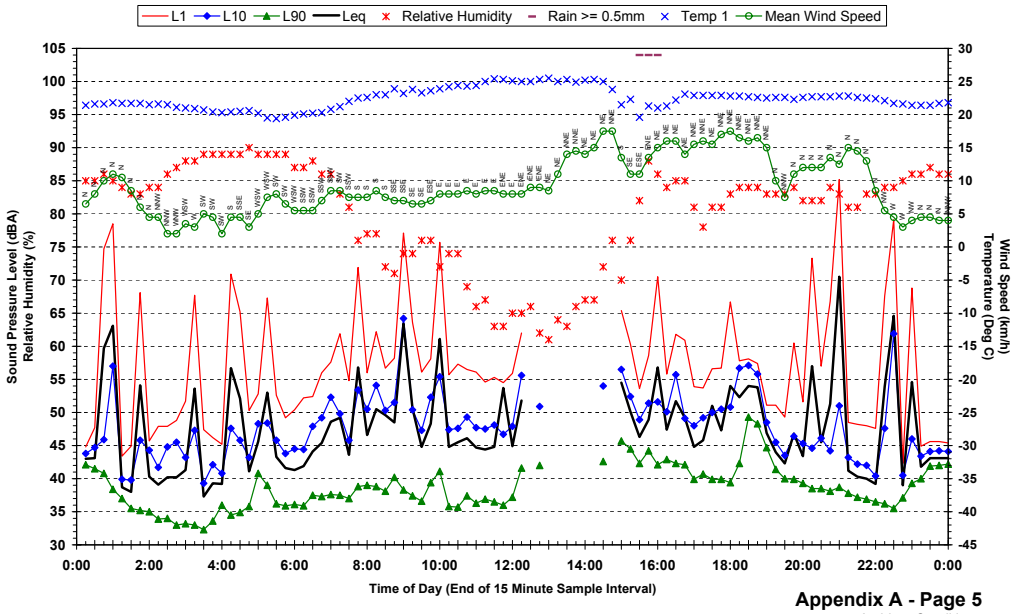
Appendix A - Page 3
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 3 - Zealey Road - Thursday 25 October 2007

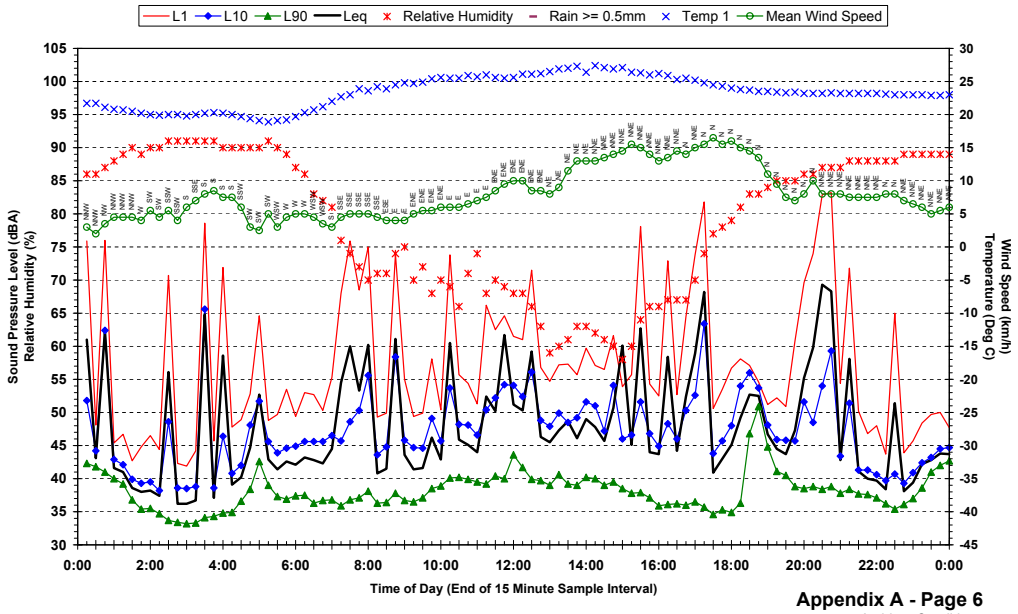


Appendix A - Page 4
Ambient Conditions
Heggies Report 20-1873

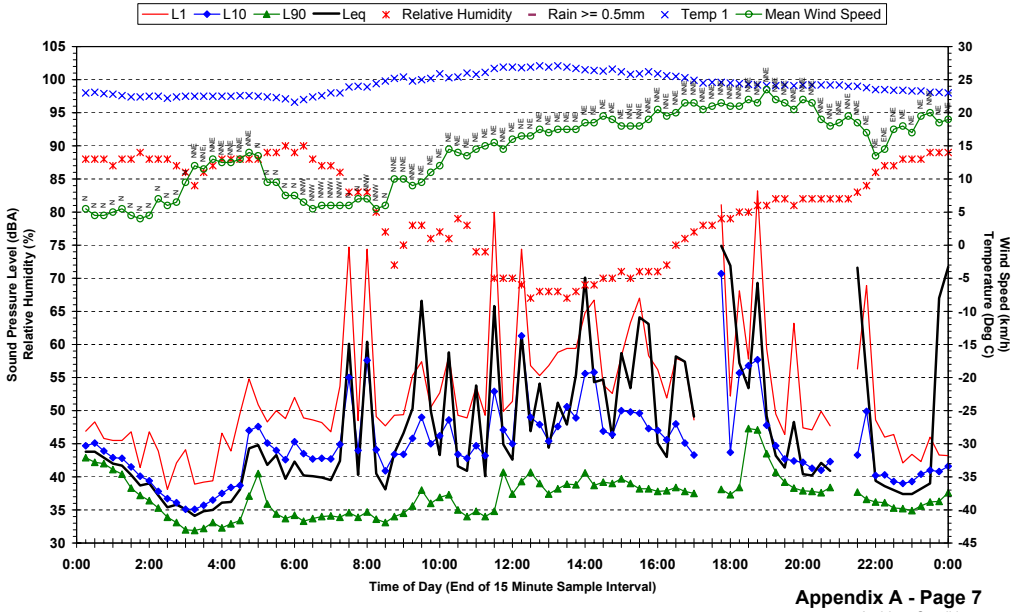
Statistical Ambient Noise Levels
20-1873 Con 3 - Zealey Road - Friday 26 October 2007



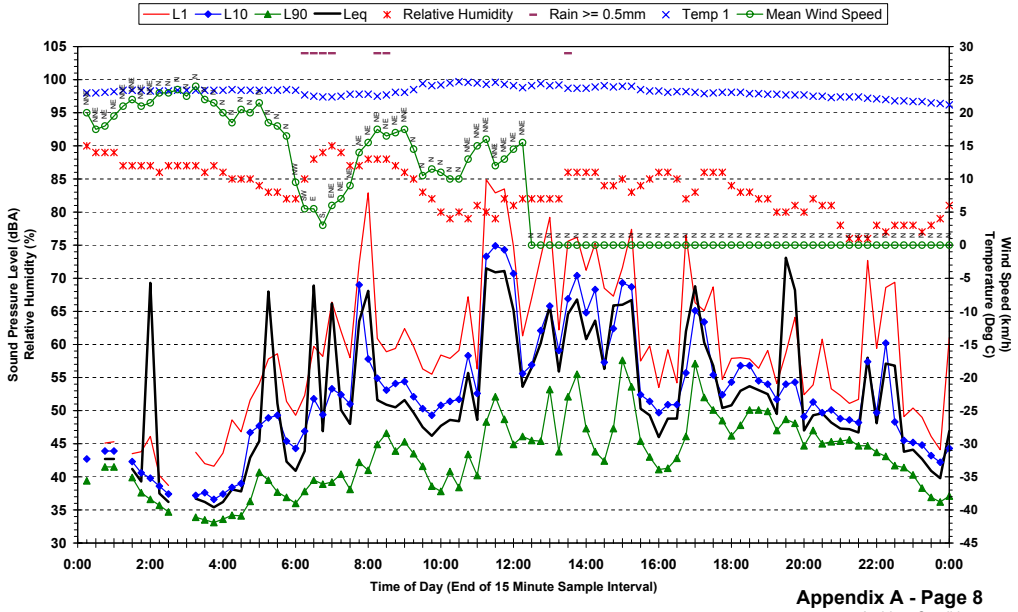
Statistical Ambient Noise Levels
20-1873 Con 3 - Zealey Road - Saturday 27 October 2007



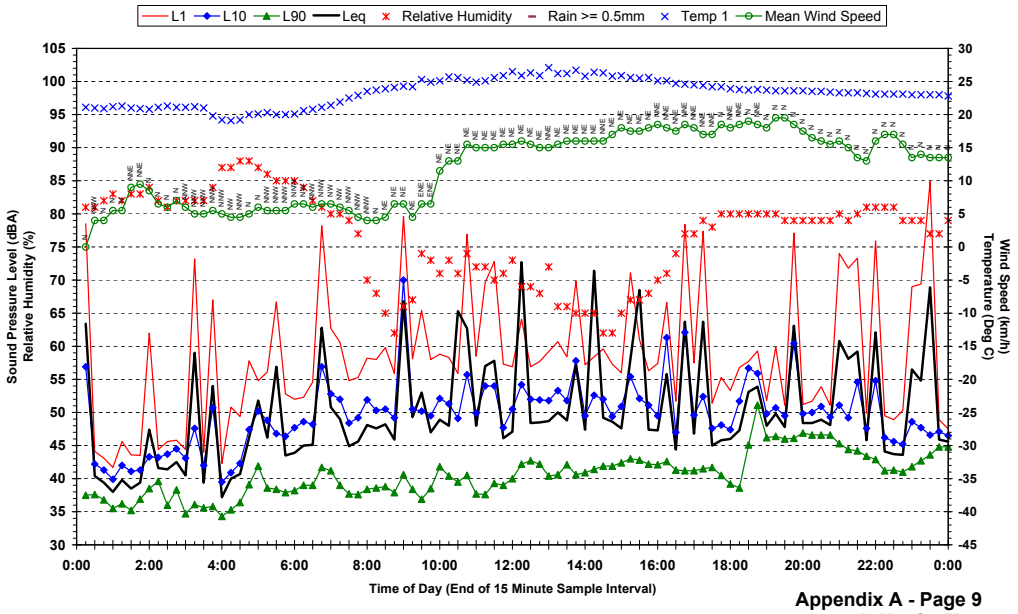
Statistical Ambient Noise Levels
20-1873 Con 3 - Zealey Road - Sunday 28 October 2007



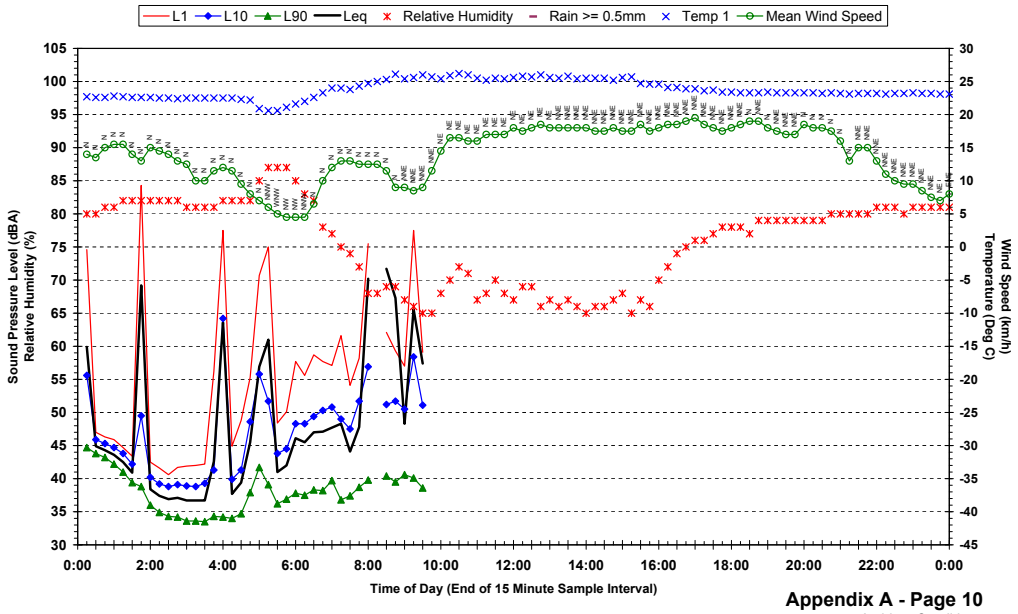
Statistical Ambient Noise Levels
20-1873 Con 3 - Zealey Road - Monday 29 October 2007



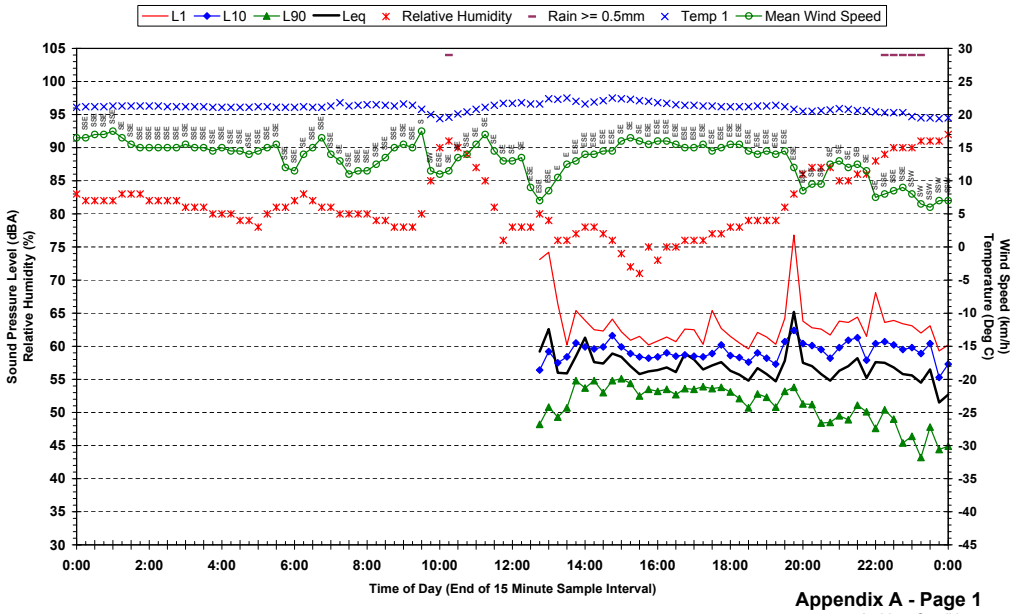
Statistical Ambient Noise Levels
20-1873 Con 3 - Zealey Road - Tuesday 30 October 2007



Statistical Ambient Noise Levels
20-1873 Con 3 - Zealey Road - Wednesday 31 October 2007

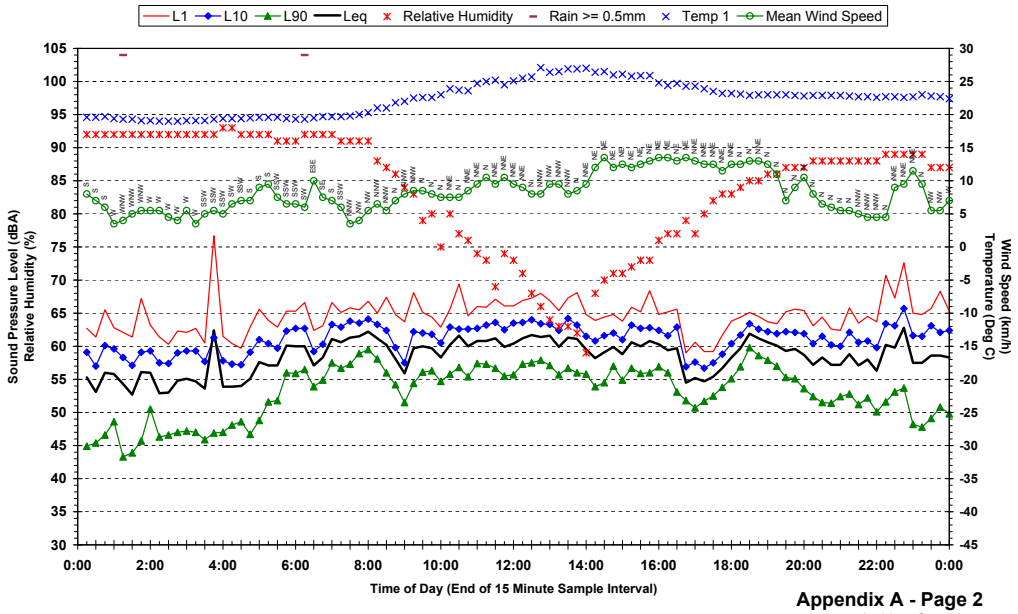


Statistical Ambient Noise Levels
20-1873 Con 4 - 92 Sheanans Road - Wednesday 10 October 2007



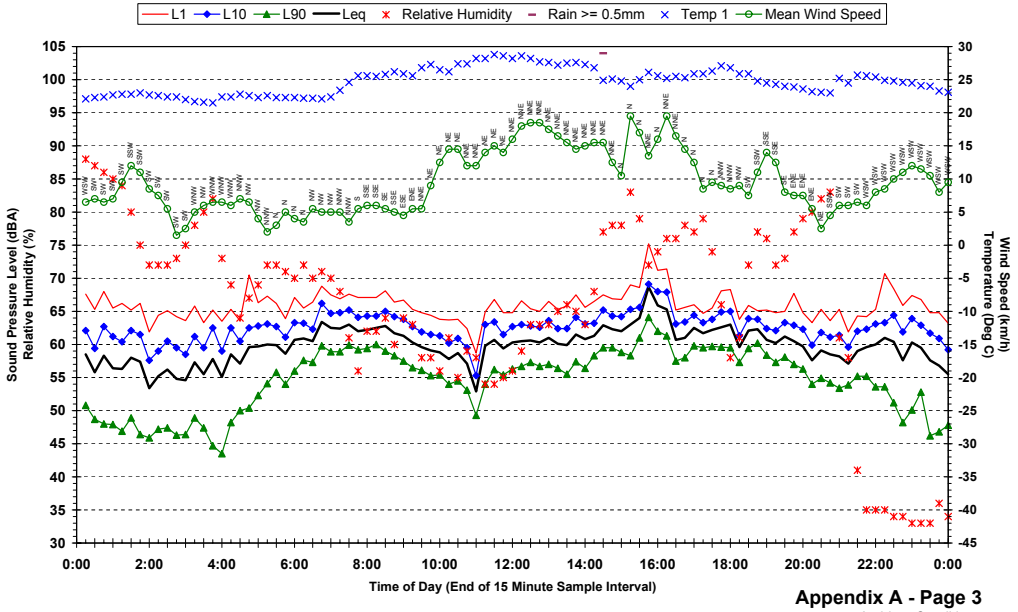
Appendix A - Page 1
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 4 - 92 Sheanans Road - Thursday 11 October 2007



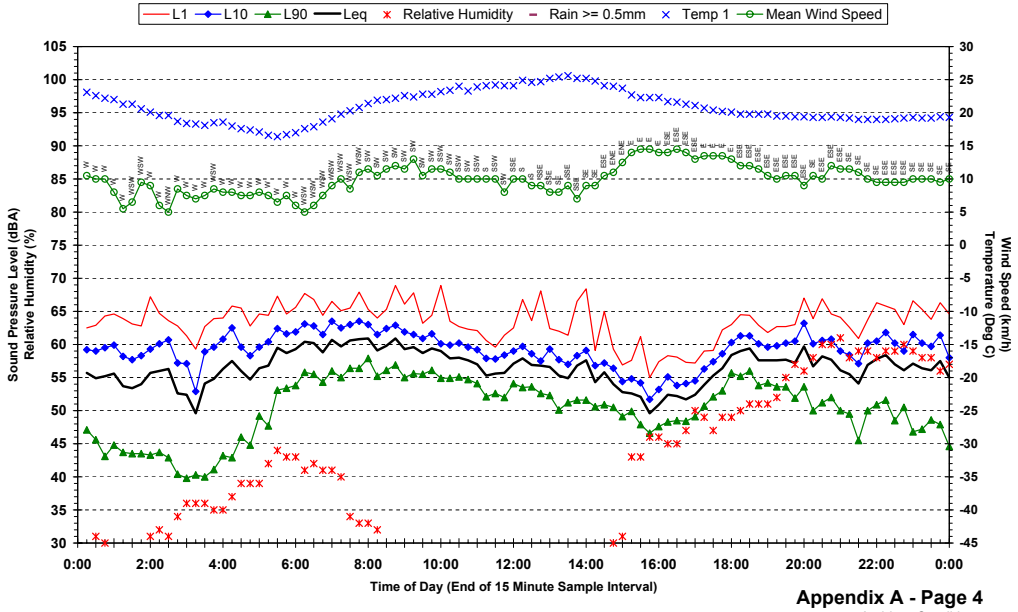
Appendix A - Page 2
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 4 - 92 Sheanans Road - Friday 12 October 2007



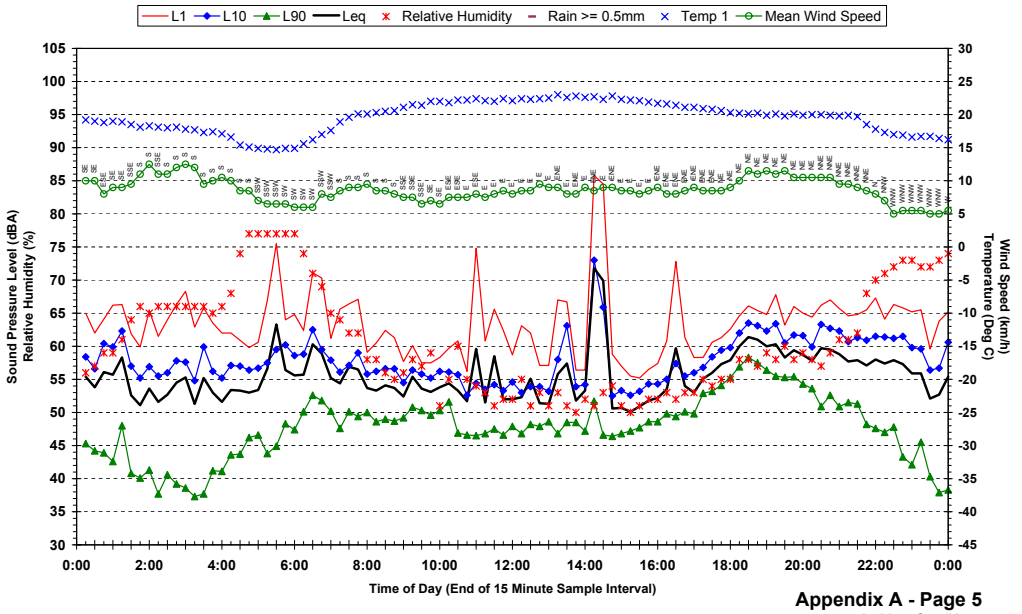
Appendix A - Page 3
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 4 - 92 Sheanans Road - Saturday 13 October 2007



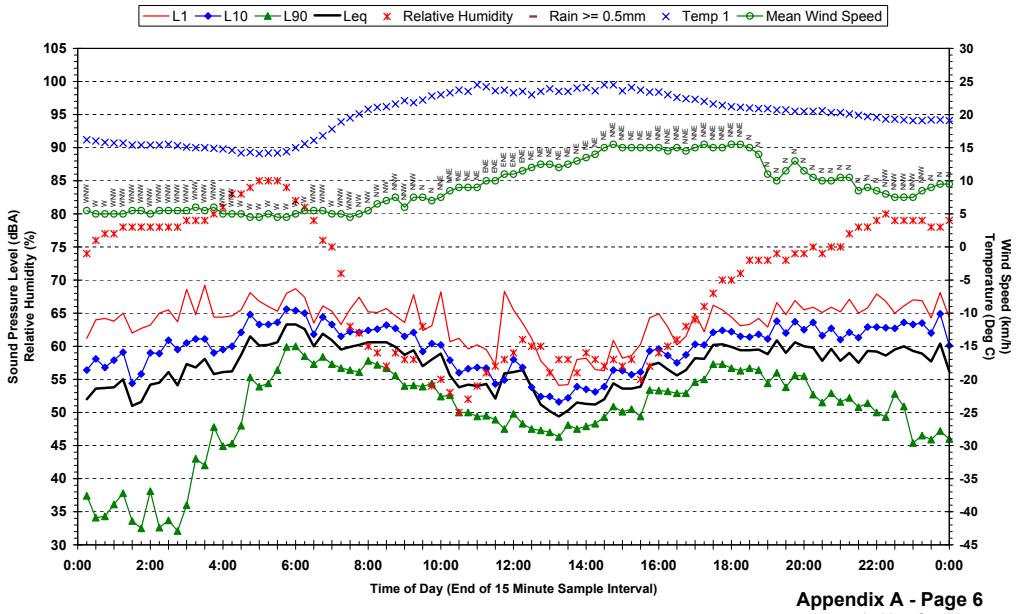
Appendix A - Page 4
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 4 - 92 Sheanans Road - Sunday 14 October 2007



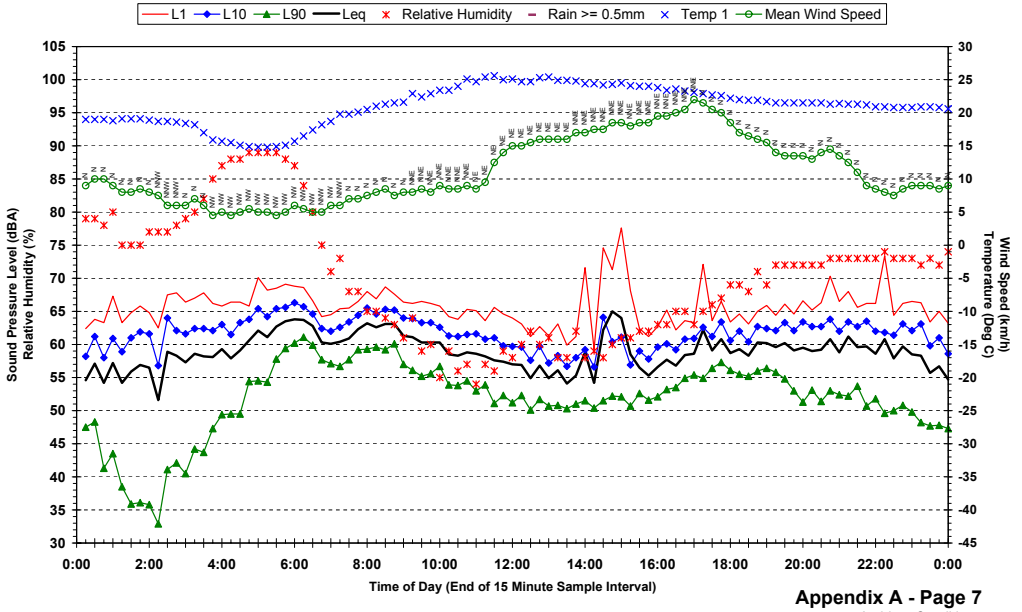
Appendix A - Page 5
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 4 - 92 Sheanans Road - Monday 15 October 2007



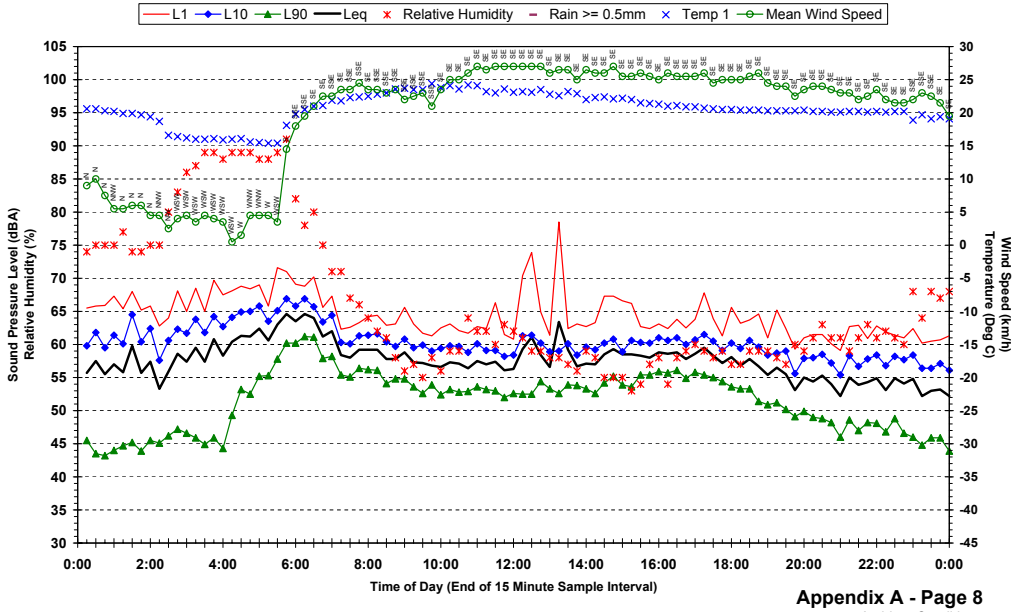
Appendix A - Page 6
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 4 - 92 Sheanans Road - Tuesday 16 October 2007



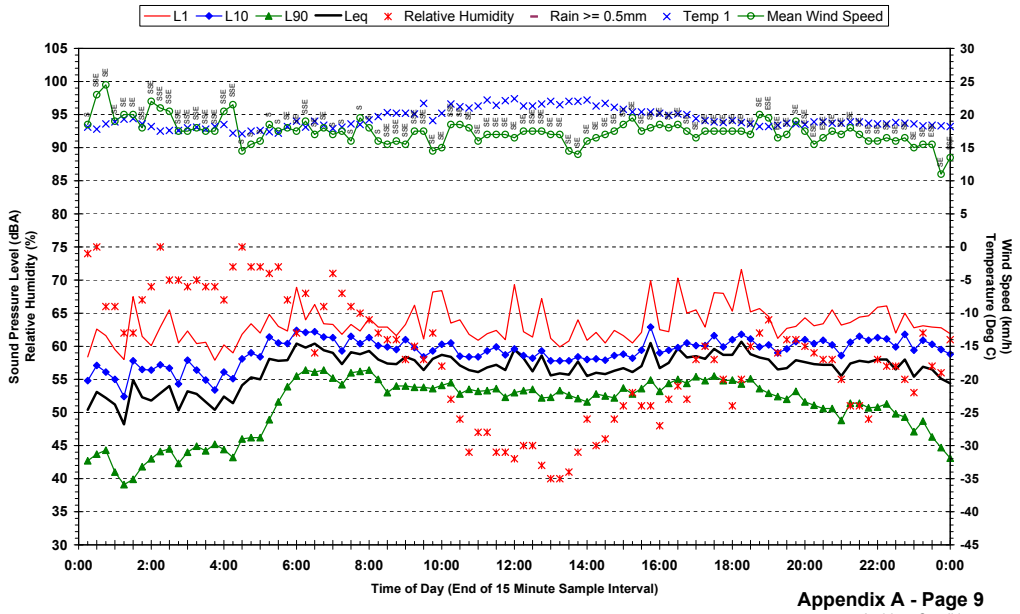
Appendix A - Page 7
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 4 - 92 Sheanans Road - Wednesday 17 October 2007



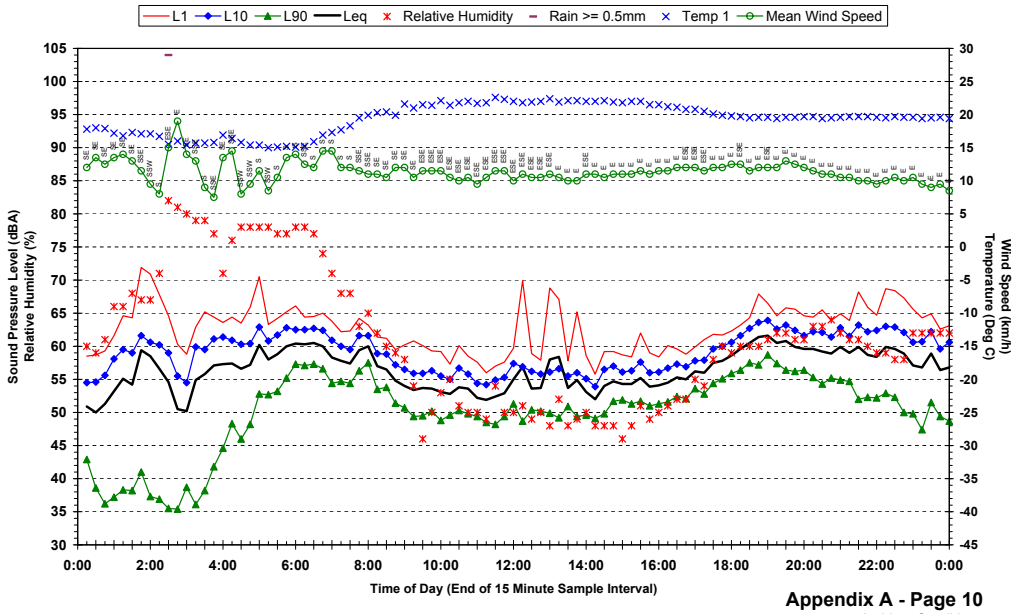
Appendix A - Page 8
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 4 - 92 Sheanans Road - Thursday 18 October 2007



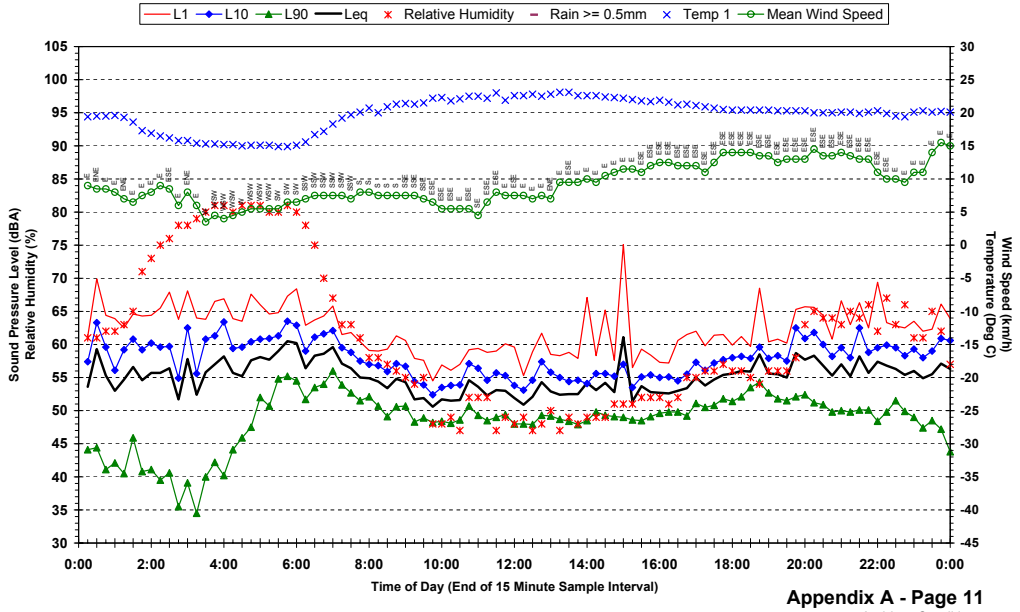
Appendix A - Page 9
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 4 - 92 Sheanans Road - Friday 19 October 2007



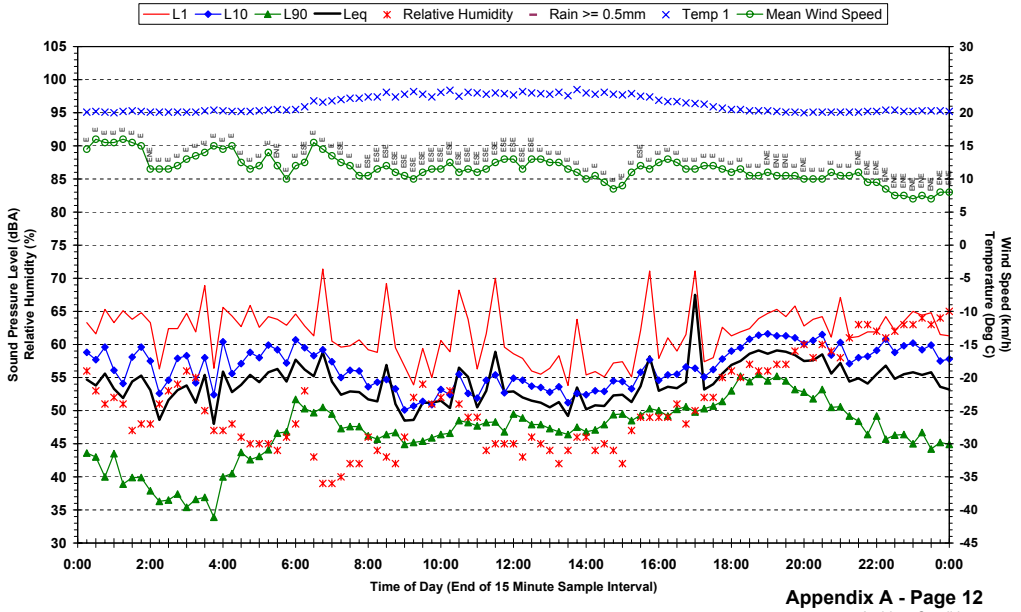
Appendix A - Page 10
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 4 - 92 Sheanans Road - Saturday 20 October 2007



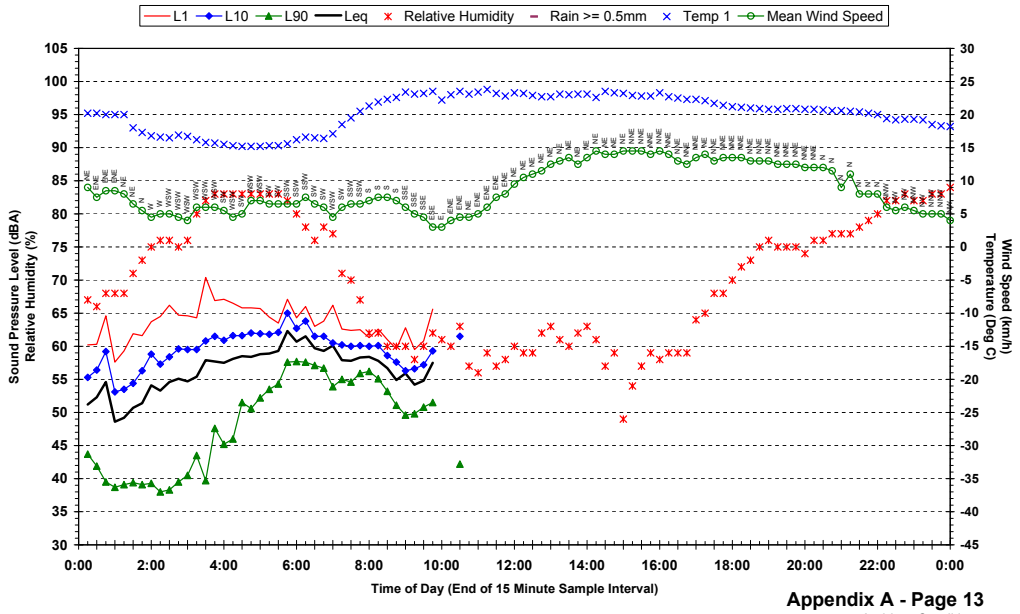
Appendix A - Page 11
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 4 - 92 Sheanans Road - Sunday 21 October 2007

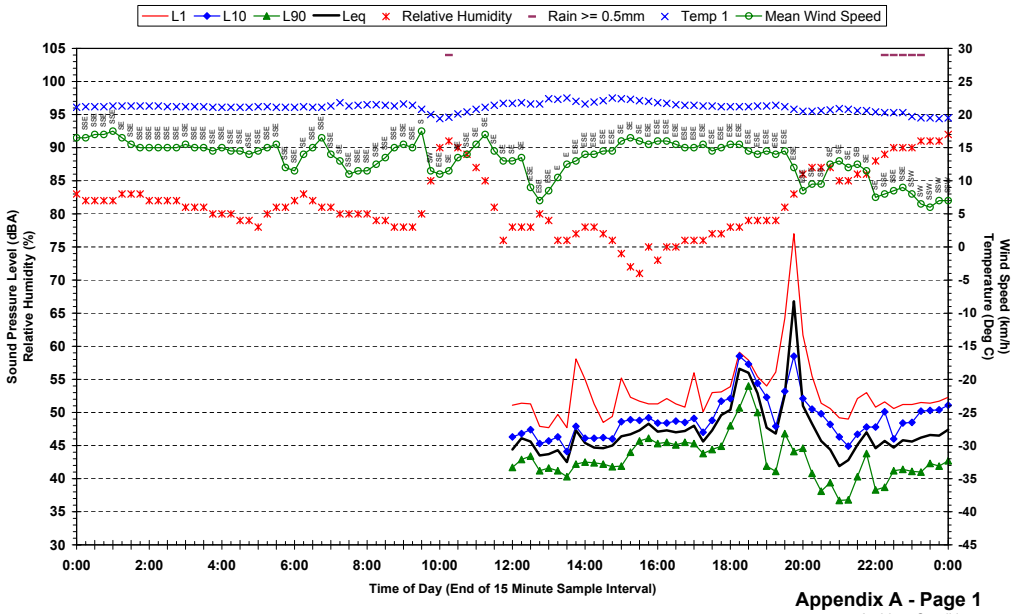


Appendix A - Page 12
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 4 - 92 Sheanans Road - Monday 22 October 2007

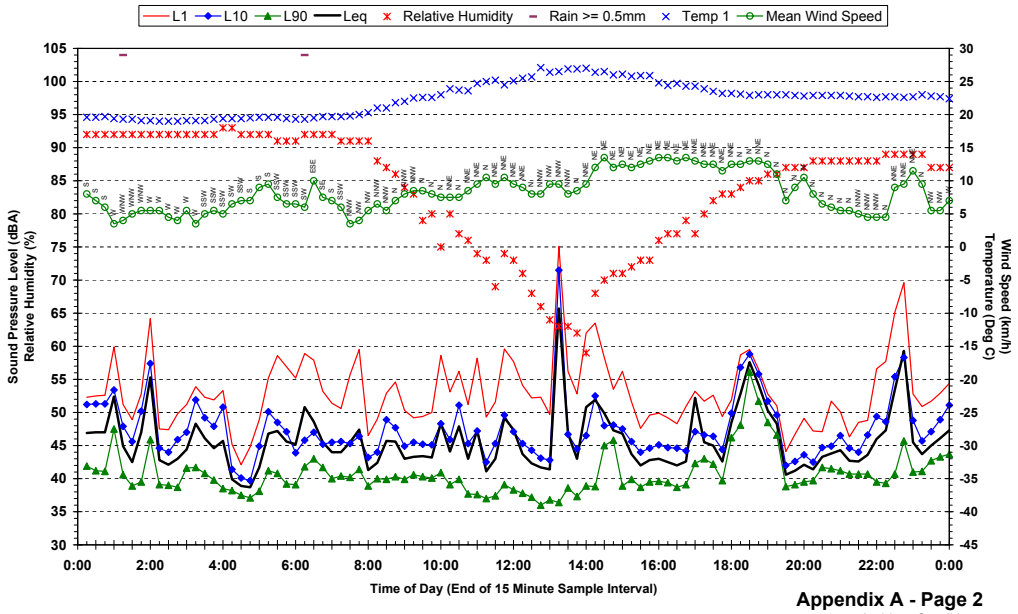


Statistical Ambient Noise Levels
20-1873 Con 5 - Yandina Caravan Park - Wednesday 10 October 2007



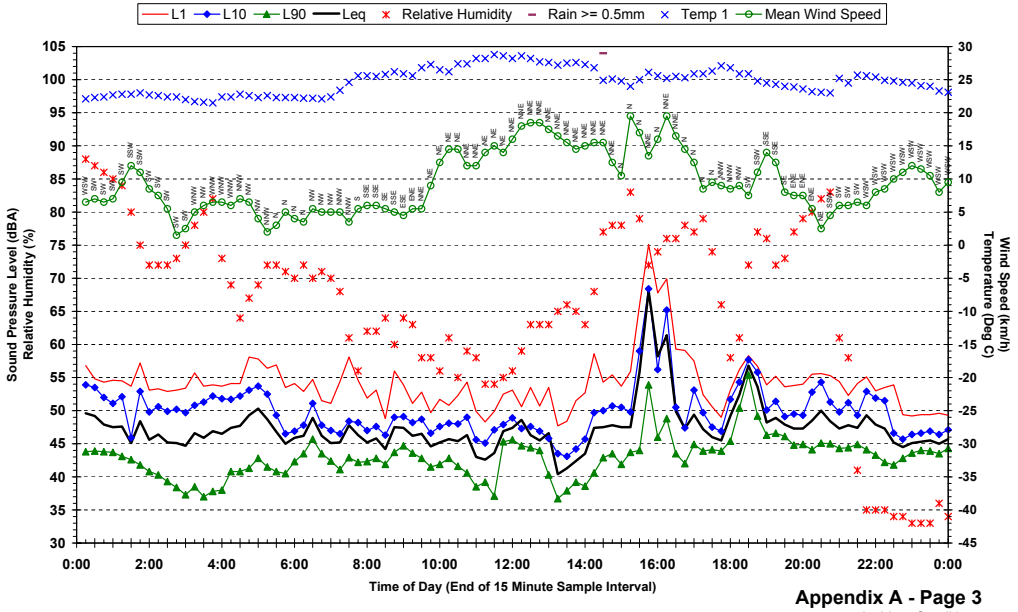
Appendix A - Page 1
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 5 - Yandina Caravan Park - Thursday 11 October 2007



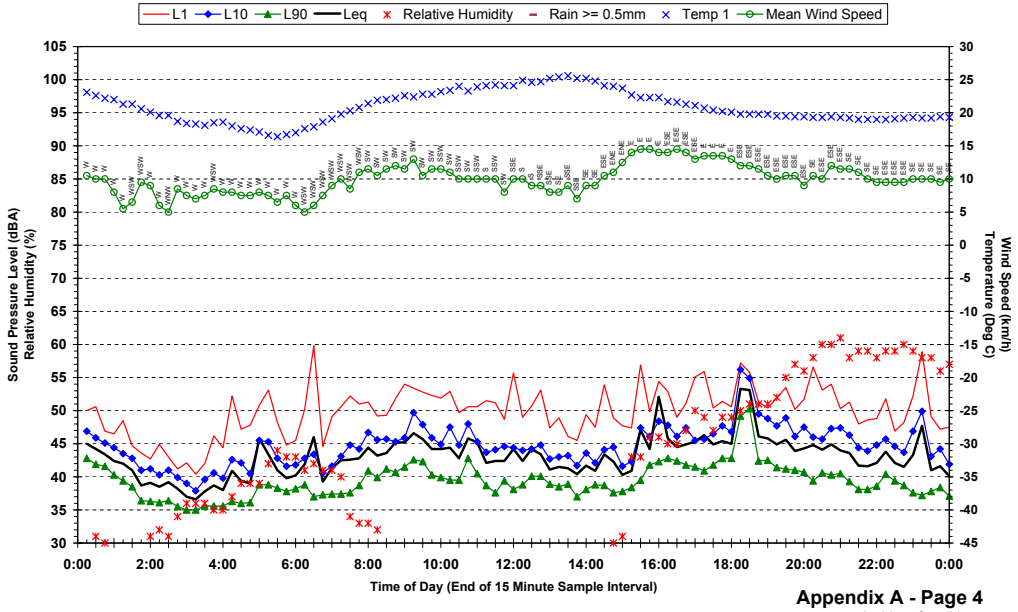
Appendix A - Page 2
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 5 - Yandina Caravan Park - Friday 12 October 2007



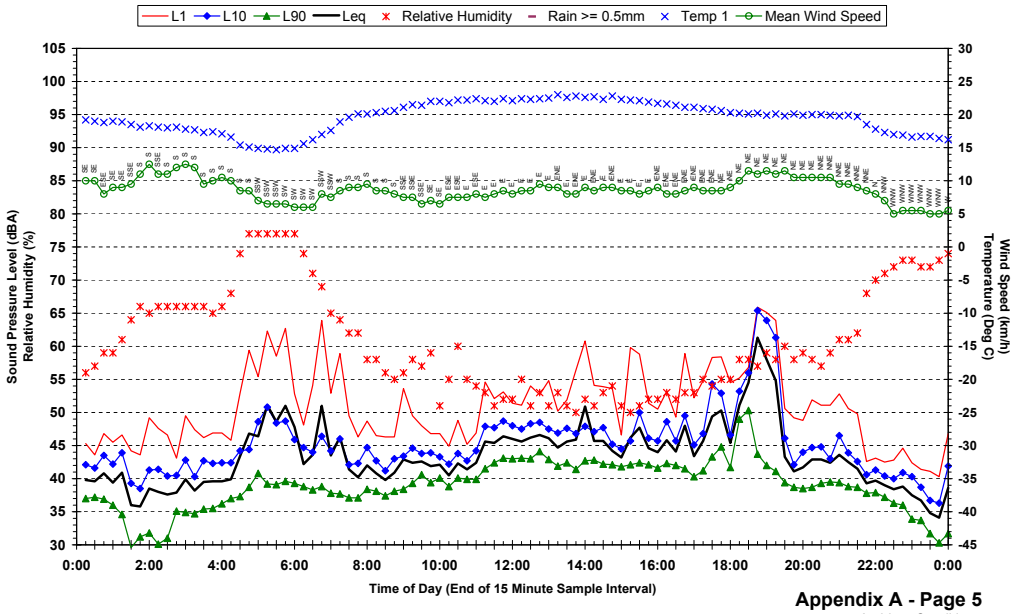
Appendix A - Page 3
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 5 - Yandina Caravan Park - Saturday 13 October 2007



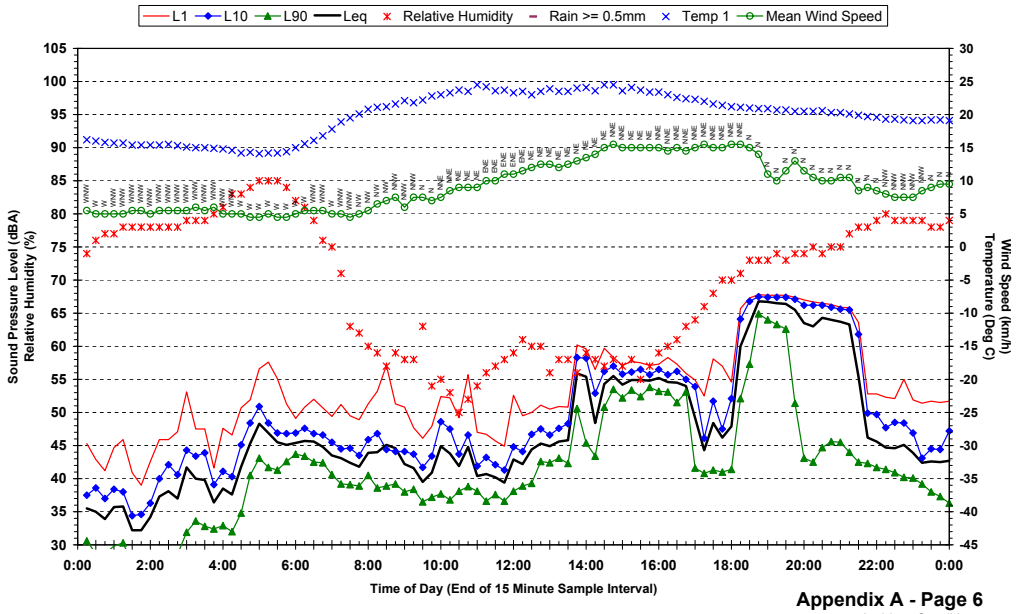
Appendix A - Page 4
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 5 - Yandina Caravan Park - Sunday 14 October 2007



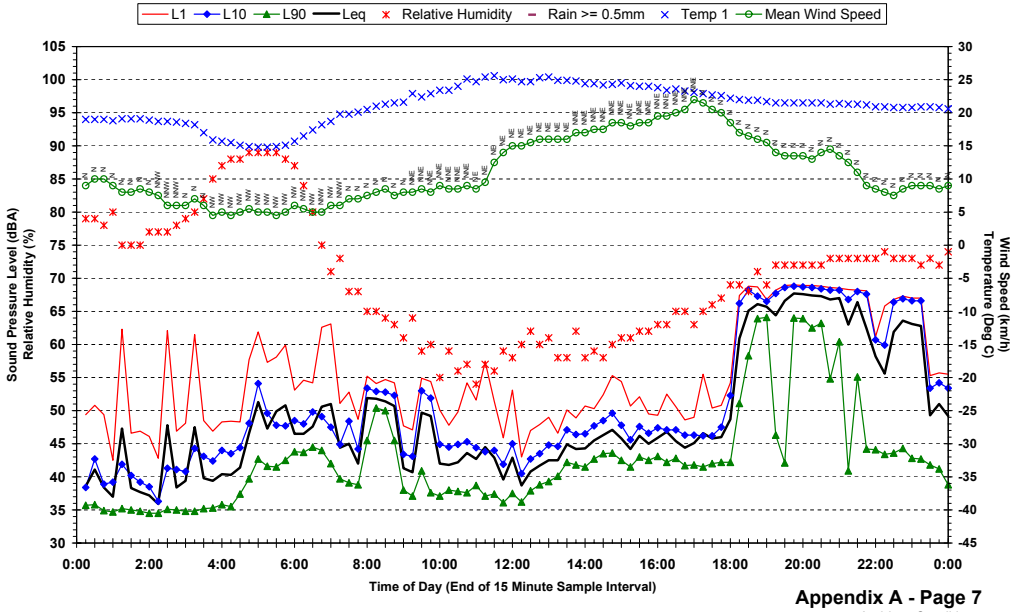
Appendix A - Page 5
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 5 - Yandina Caravan Park - Monday 15 October 2007



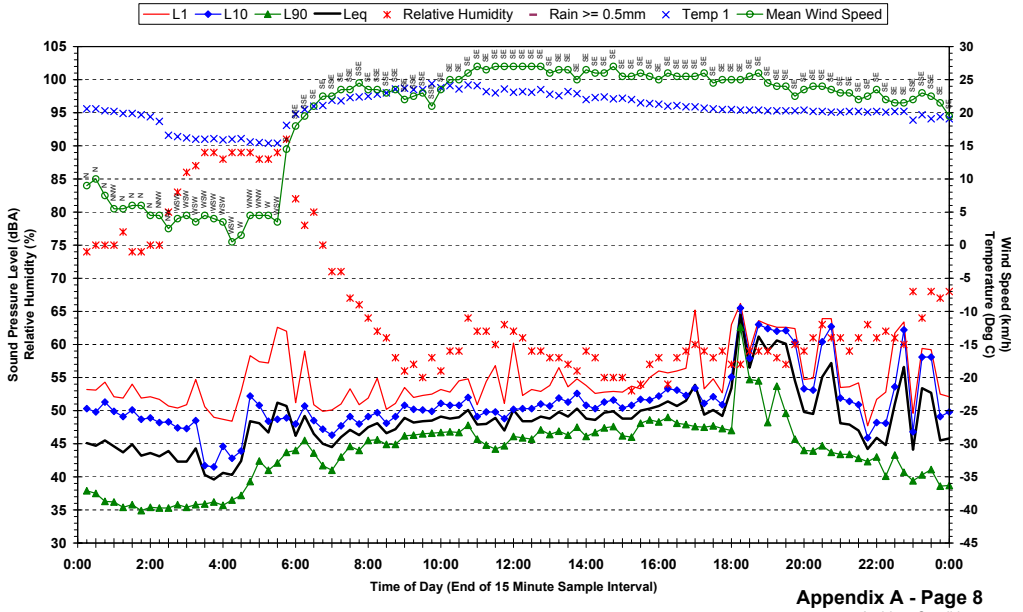
Appendix A - Page 6
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 5 - Yandina Caravan Park - Tuesday 16 October 2007



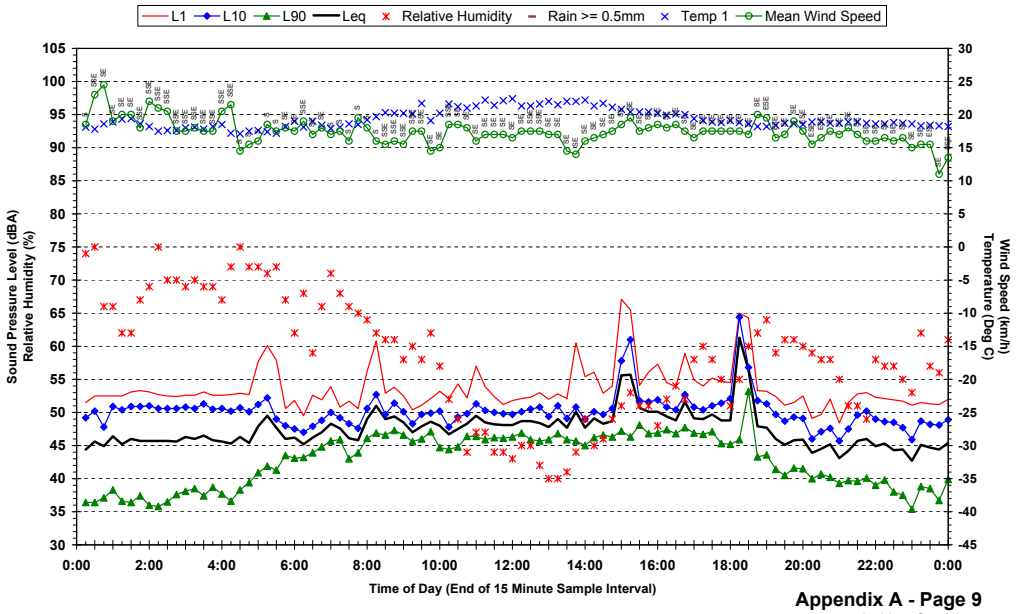
Appendix A - Page 7
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 5 - Yandina Caravan Park - Wednesday 17 October 2007

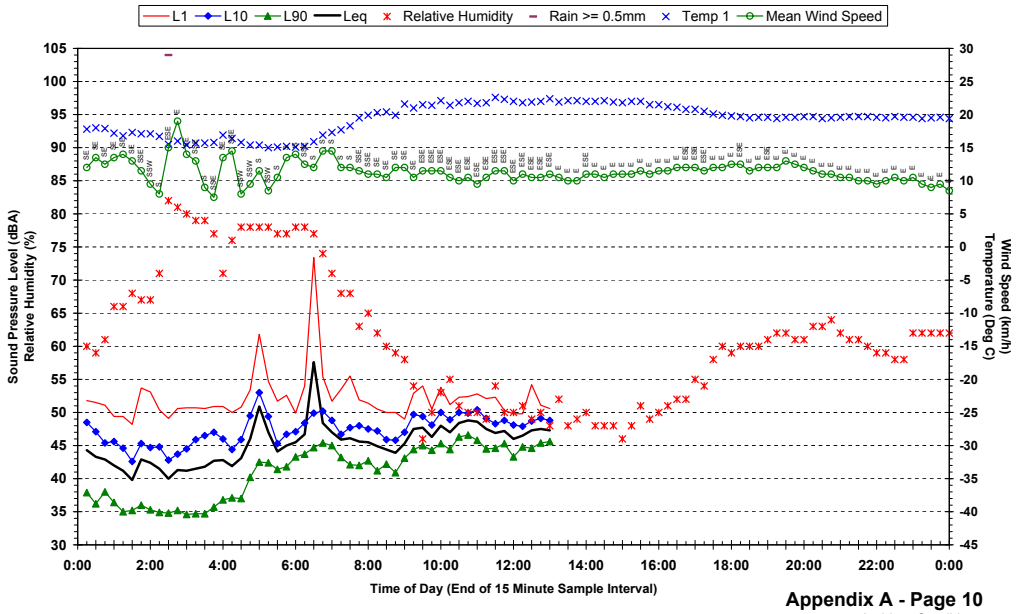


Appendix A - Page 8
Ambient Conditions
Heggies Report 20-1873

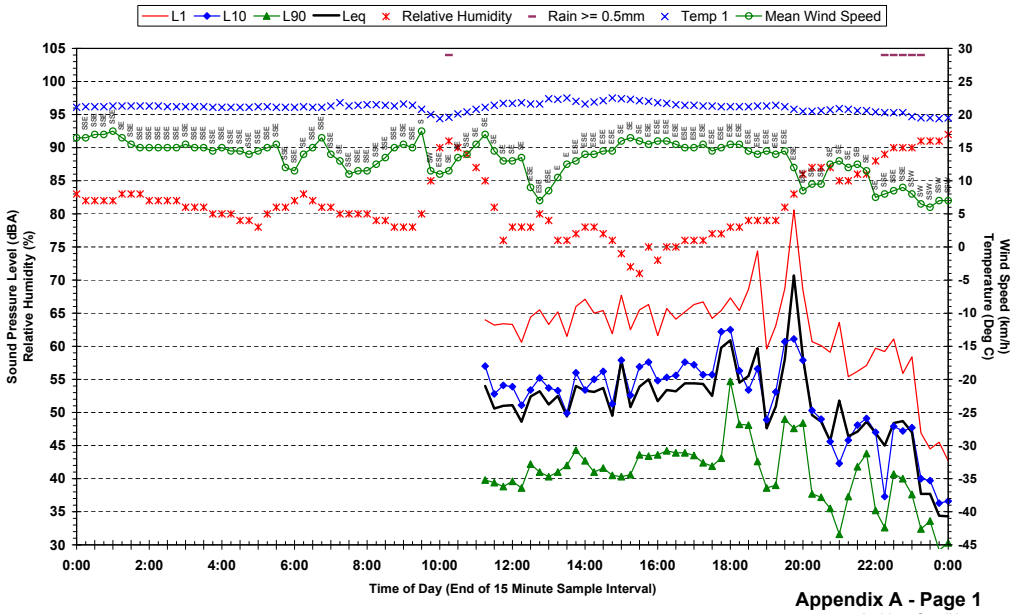
Statistical Ambient Noise Levels
20-1873 Con 5 - Yandina Caravan Park - Thursday 18 October 2007



Statistical Ambient Noise Levels
20-1873 Con 5 - Yandina Caravan Park - Friday 19 October 2007

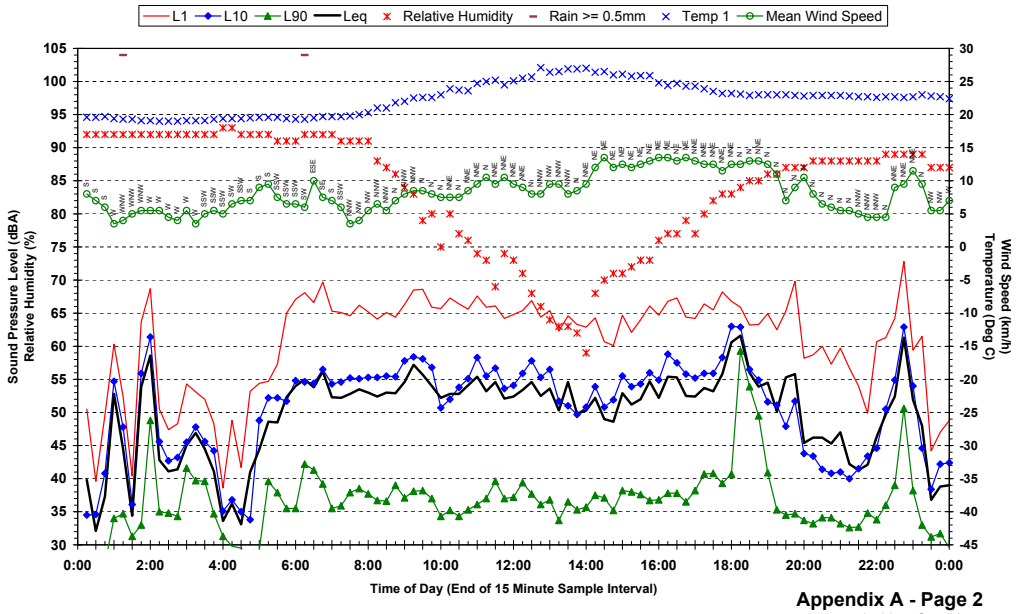


Statistical Ambient Noise Levels
20-1873 Con 6 - 2 Low Street - Wednesday 10 October 2007



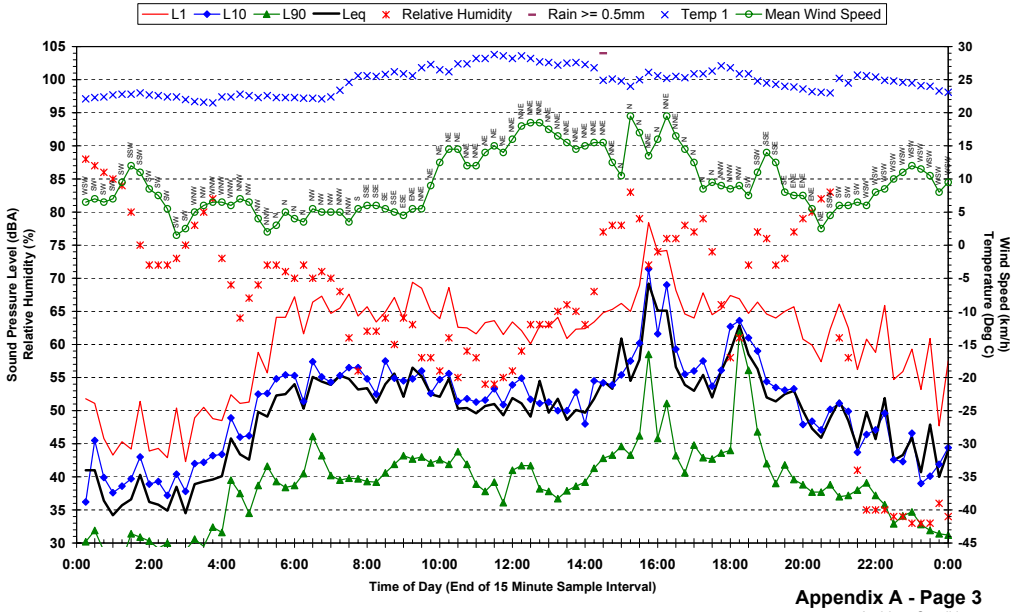
Appendix A - Page 1
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 6 - 2 Low Street - Thursday 11 October 2007



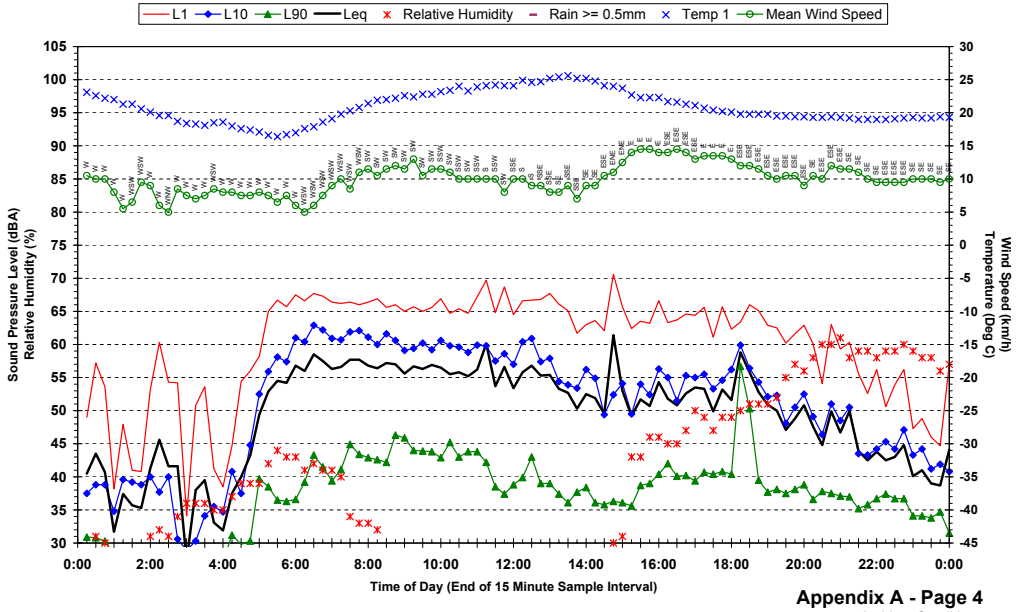
Appendix A - Page 2
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 6 - 2 Low Street - Friday 12 October 2007



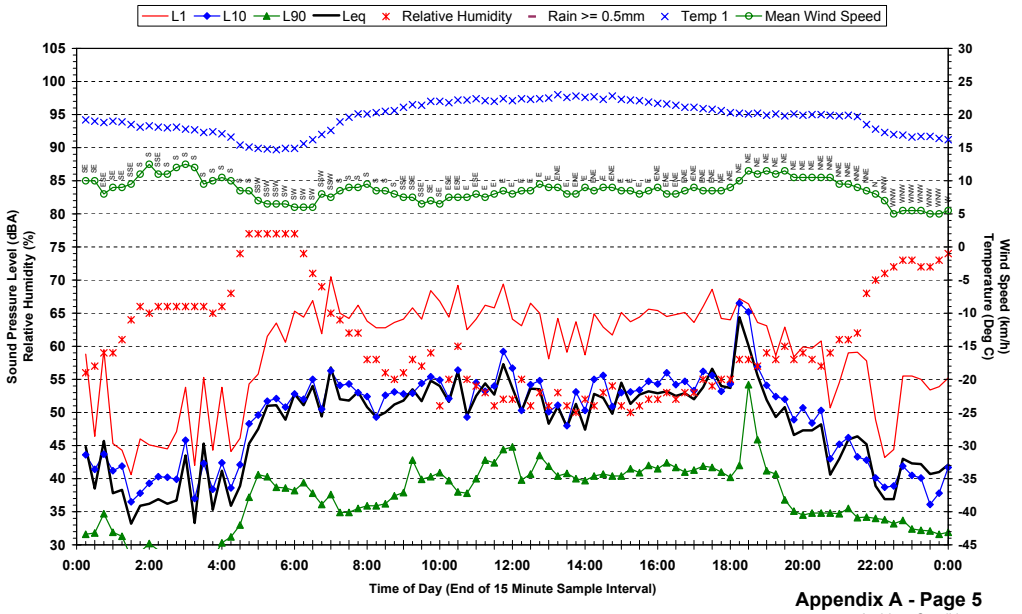
Appendix A - Page 3
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 6 - 2 Low Street - Saturday 13 October 2007



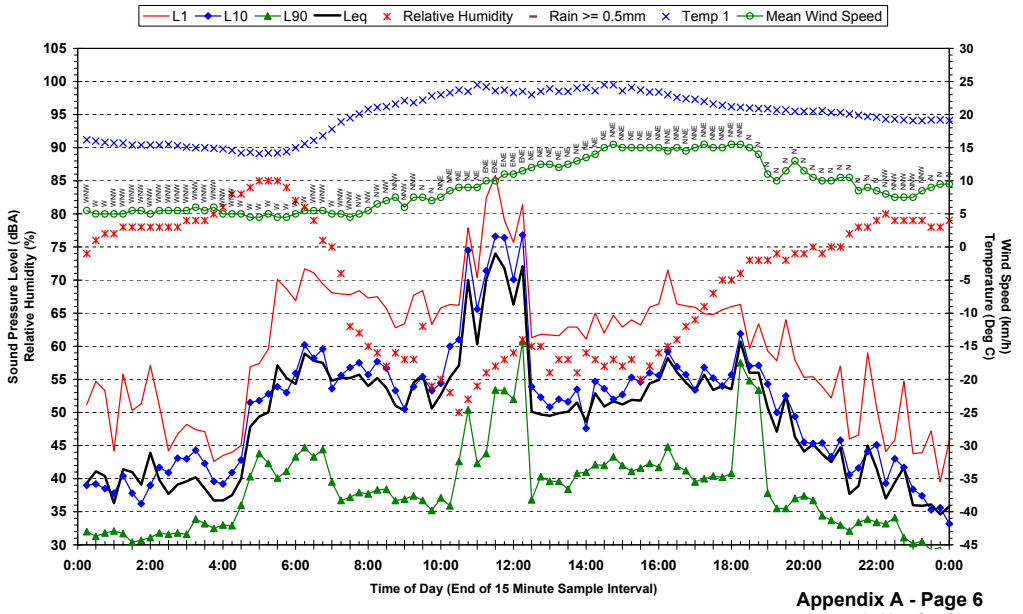
Appendix A - Page 4
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 6 - 2 Low Street - Sunday 14 October 2007



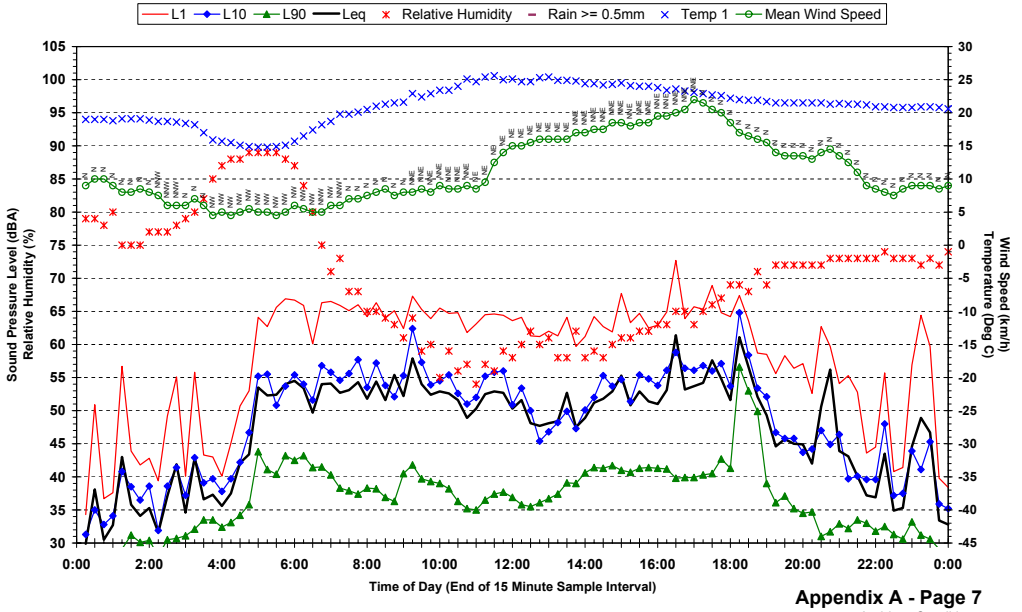
Appendix A - Page 5
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 6 - 2 Low Street - Monday 15 October 2007



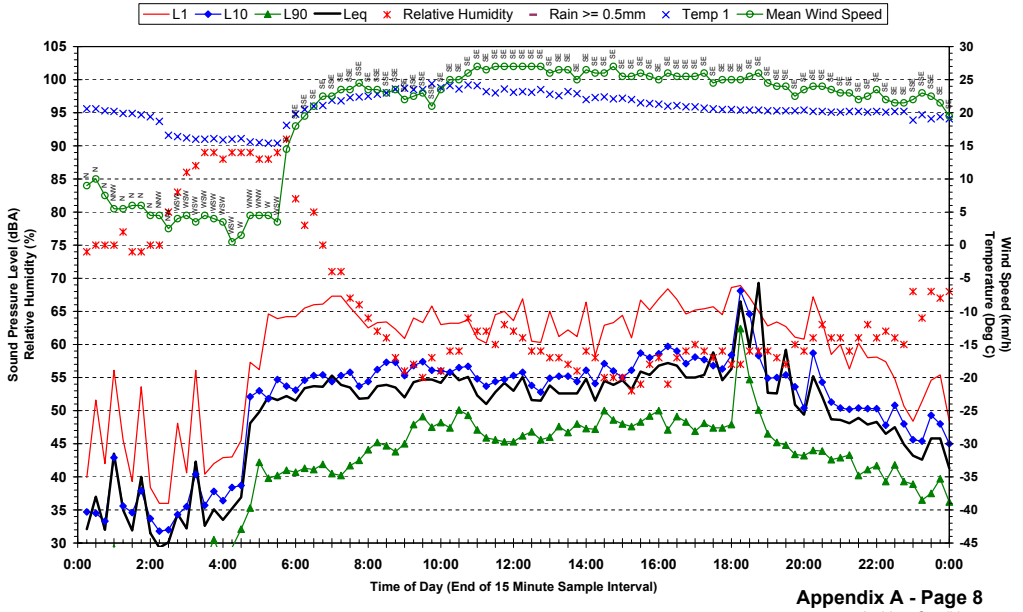
Appendix A - Page 6
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 6 - 2 Low Street - Tuesday 16 October 2007



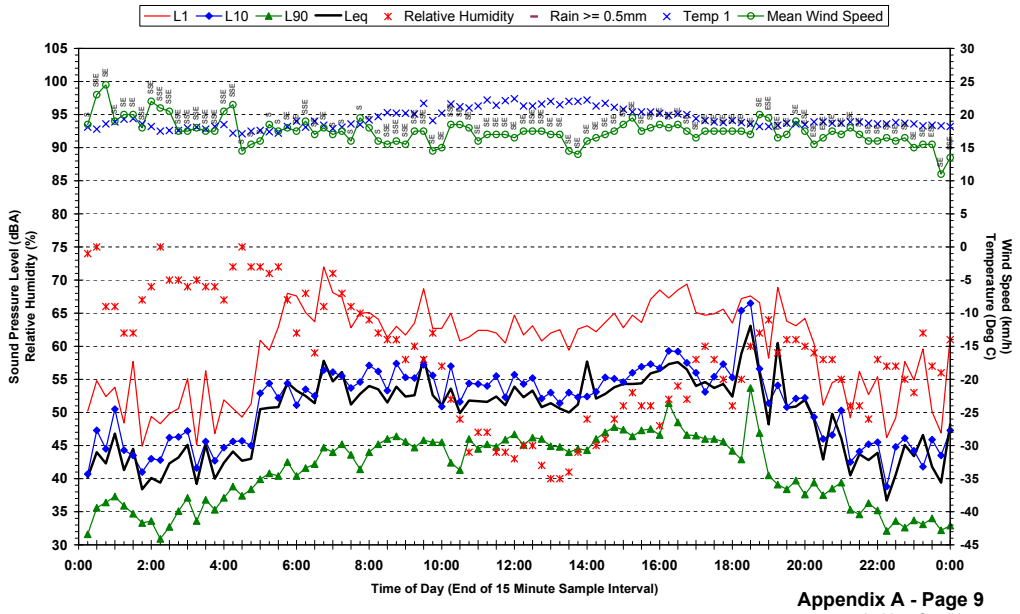
Appendix A - Page 7
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 6 - 2 Low Street - Wednesday 17 October 2007

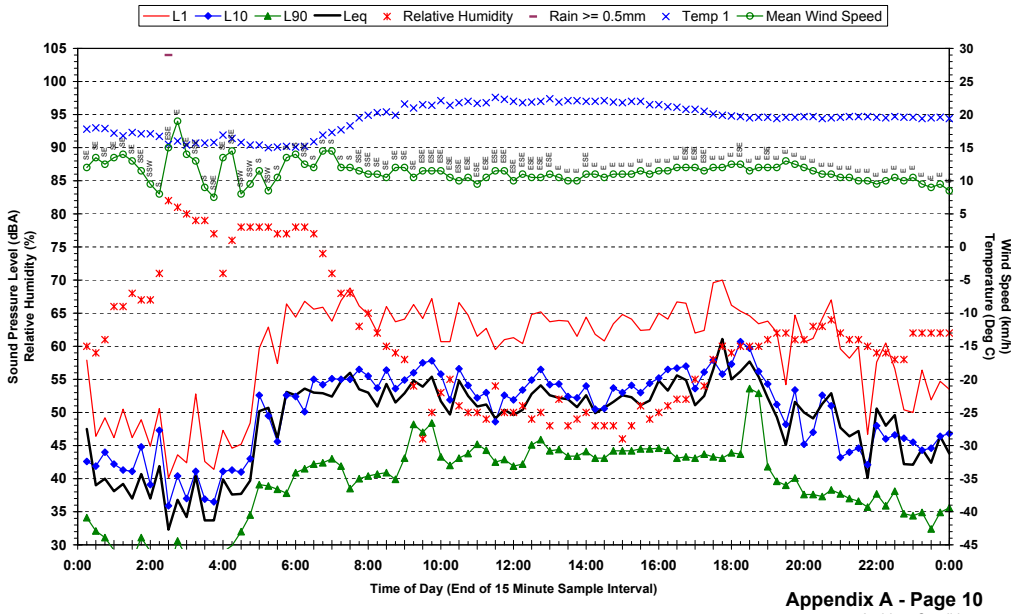


Appendix A - Page 8
Ambient Conditions
Heggies Report 20-1873

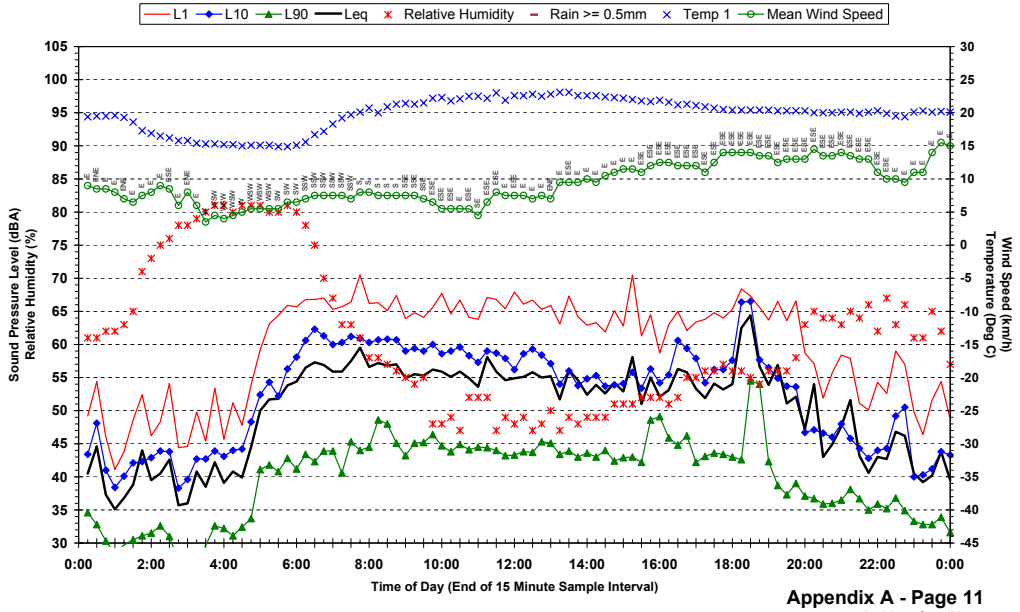
Statistical Ambient Noise Levels
20-1873 Con 6 - 2 Low Street - Thursday 18 October 2007



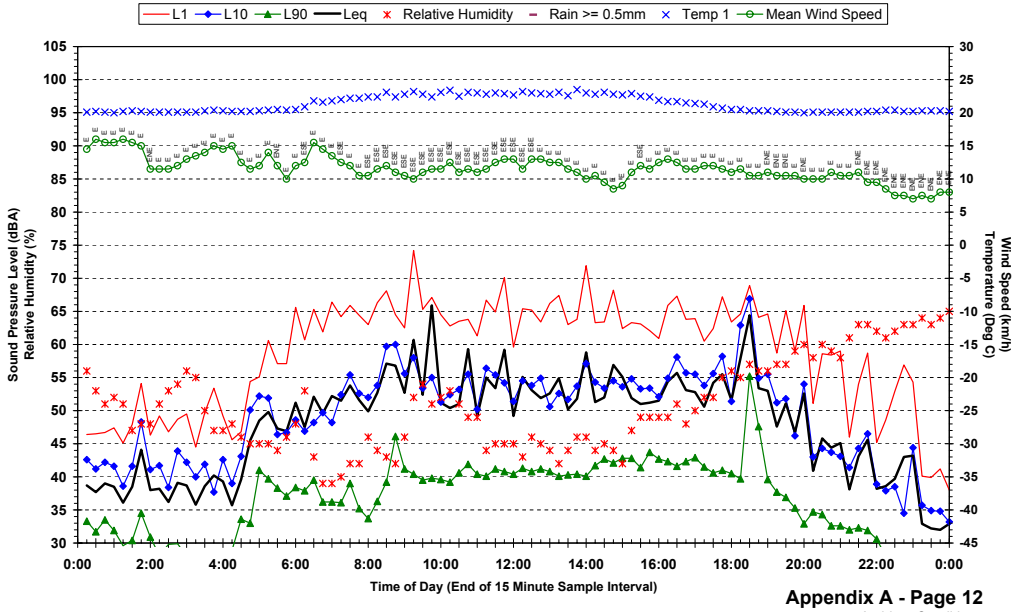
Statistical Ambient Noise Levels
20-1873 Con 6 - 2 Low Street - Friday 19 October 2007



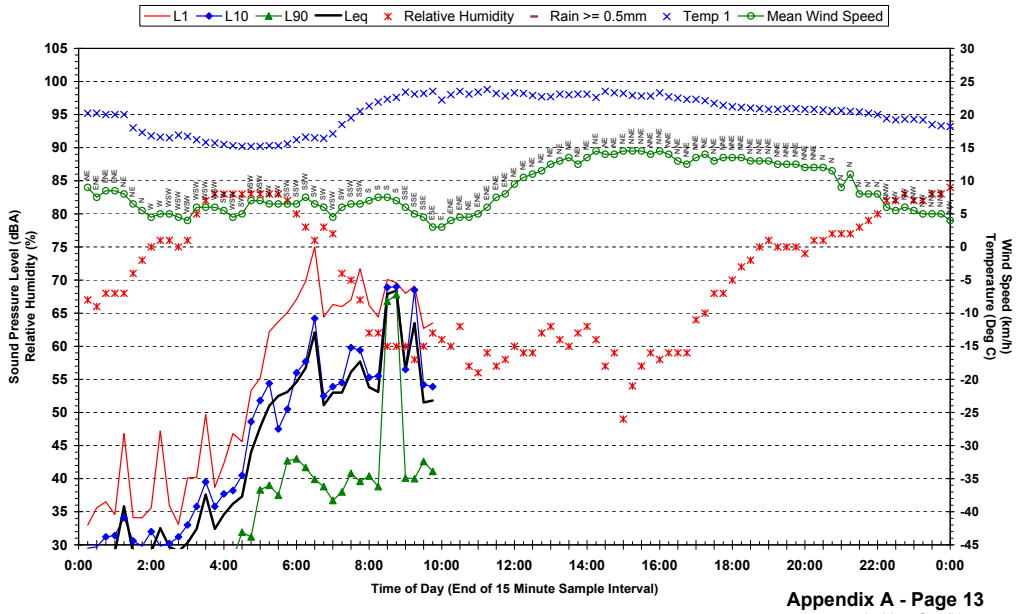
Statistical Ambient Noise Levels
20-1873 Con 6 - 2 Low Street - Saturday 20 October 2007



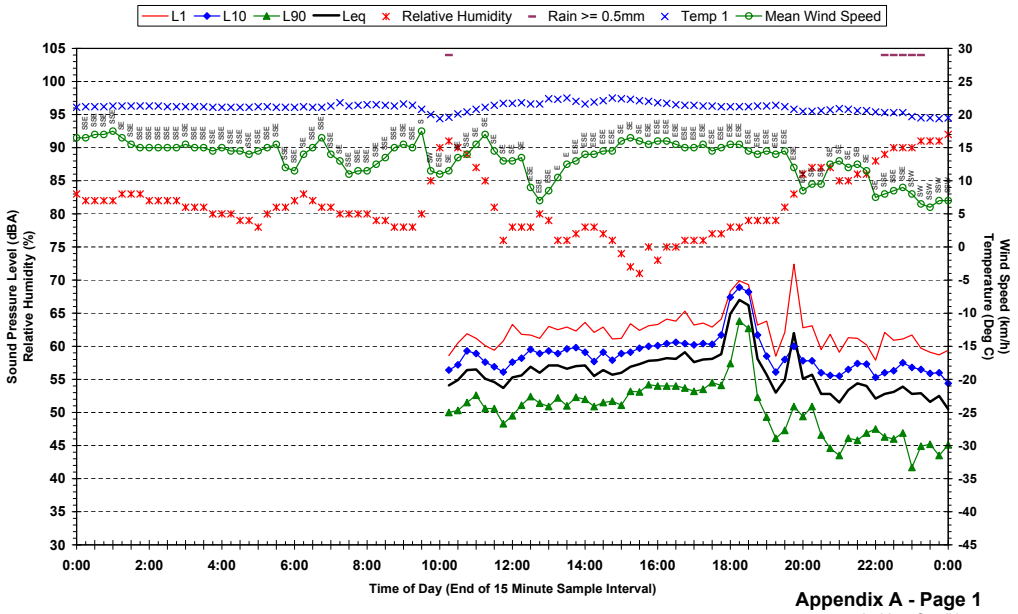
Statistical Ambient Noise Levels
20-1873 Con 6 - 2 Low Street - Sunday 21 October 2007



Statistical Ambient Noise Levels
20-1873 Con 6 - 2 Low Street - Monday 22 October 2007

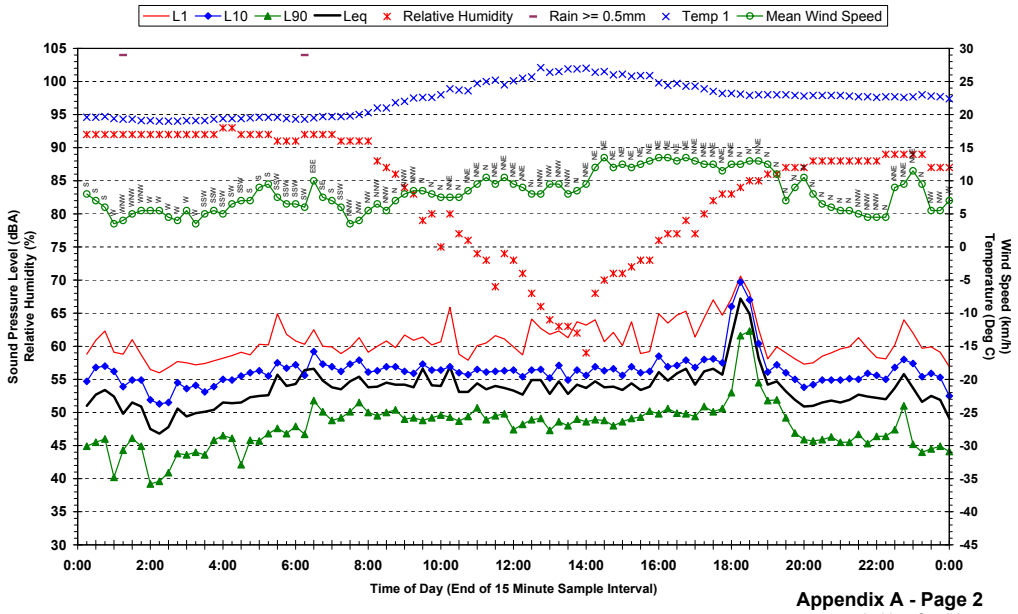


Statistical Ambient Noise Levels
20-1873 Con 7 - 121 Holts Road - Wednesday 10 October 2007



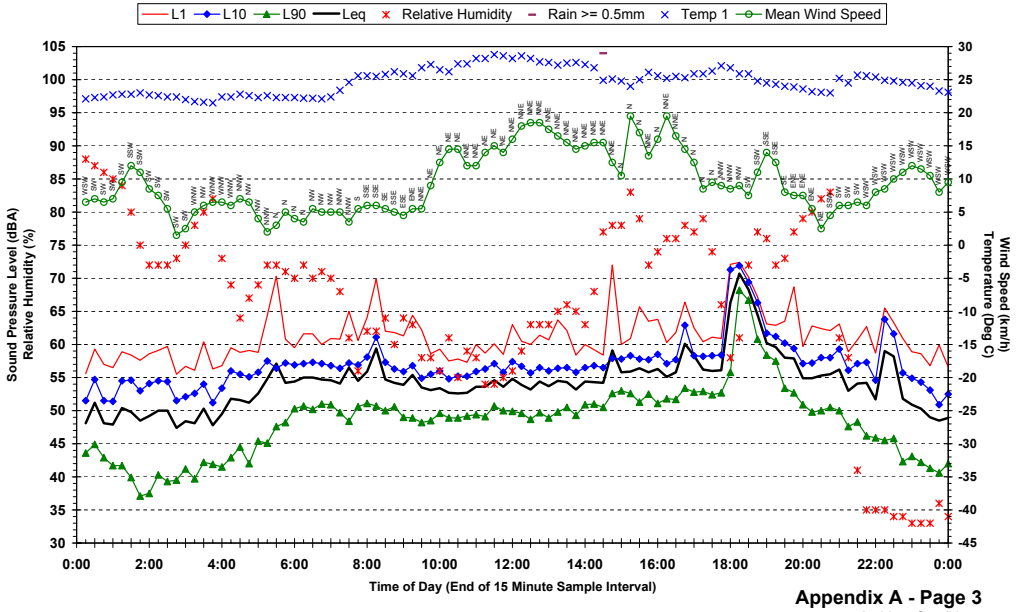
Appendix A - Page 1
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 7 - 121 Holts Road - Thursday 11 October 2007



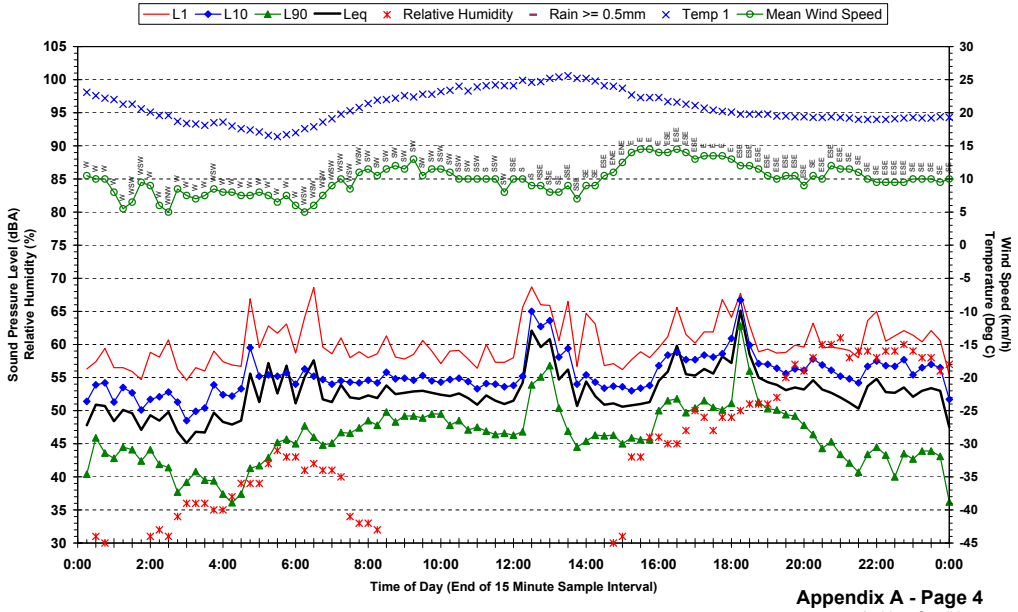
Appendix A - Page 2
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 7 - 121 Holts Road - Friday 12 October 2007



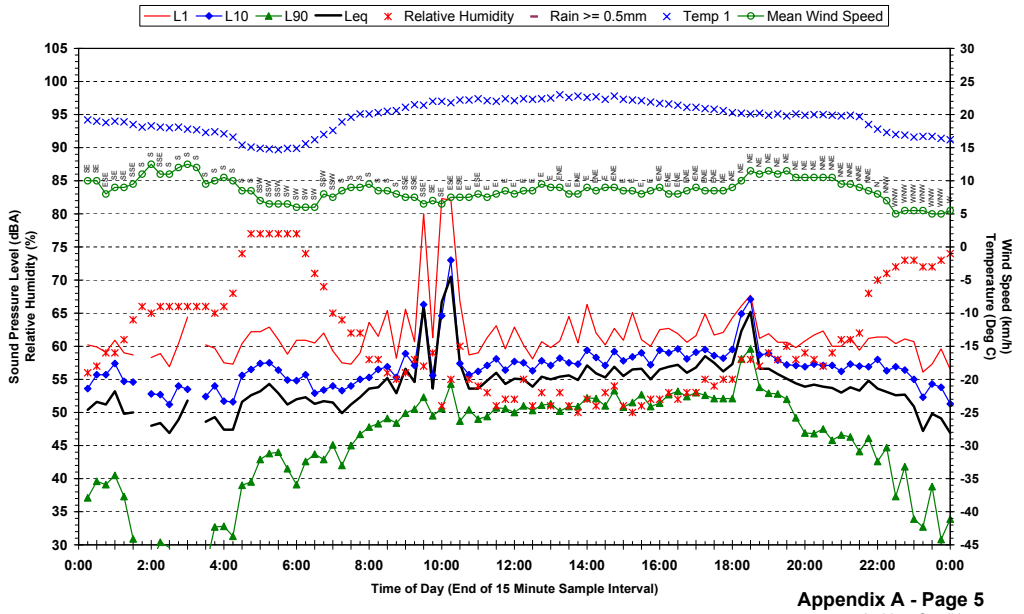
Appendix A - Page 3
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 7 - 121 Holts Road - Saturday 13 October 2007

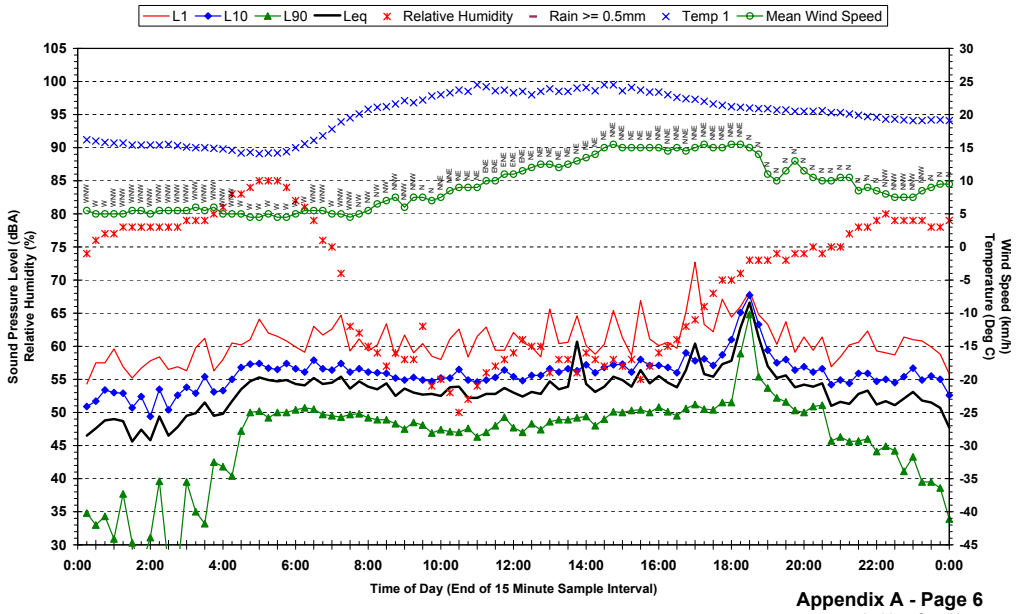


Appendix A - Page 4
Ambient Conditions
Heggies Report 20-1873

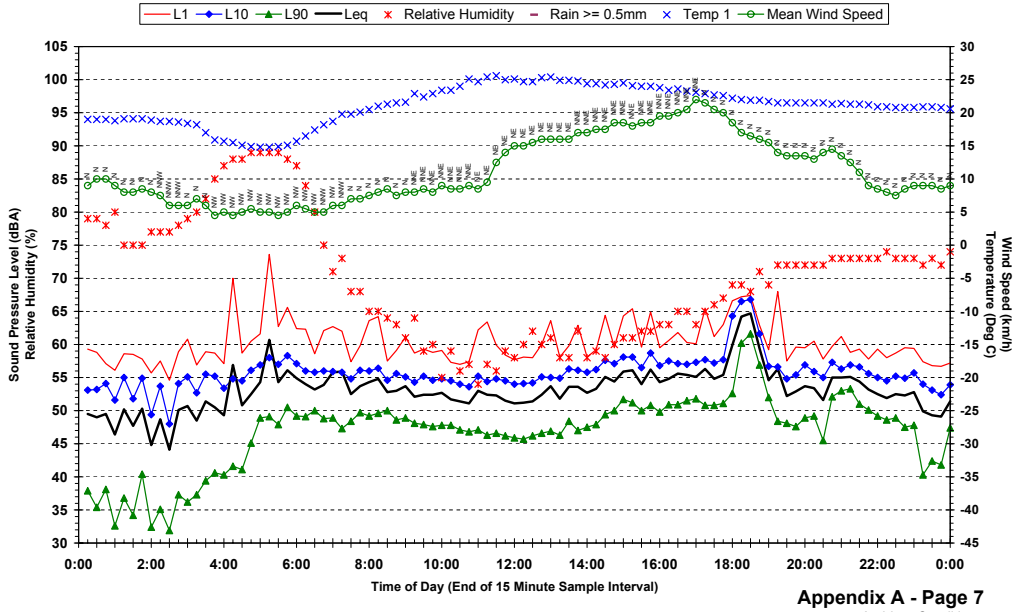
Statistical Ambient Noise Levels
20-1873 Con 7 - 121 Holts Road - Sunday 14 October 2007



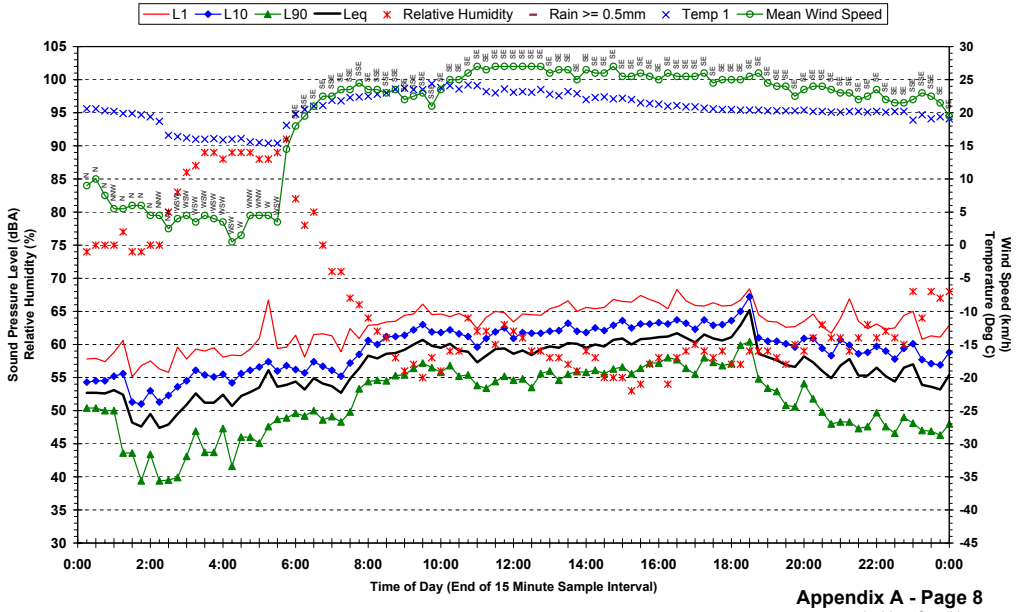
Statistical Ambient Noise Levels
20-1873 Con 7 - 121 Holts Road - Monday 15 October 2007



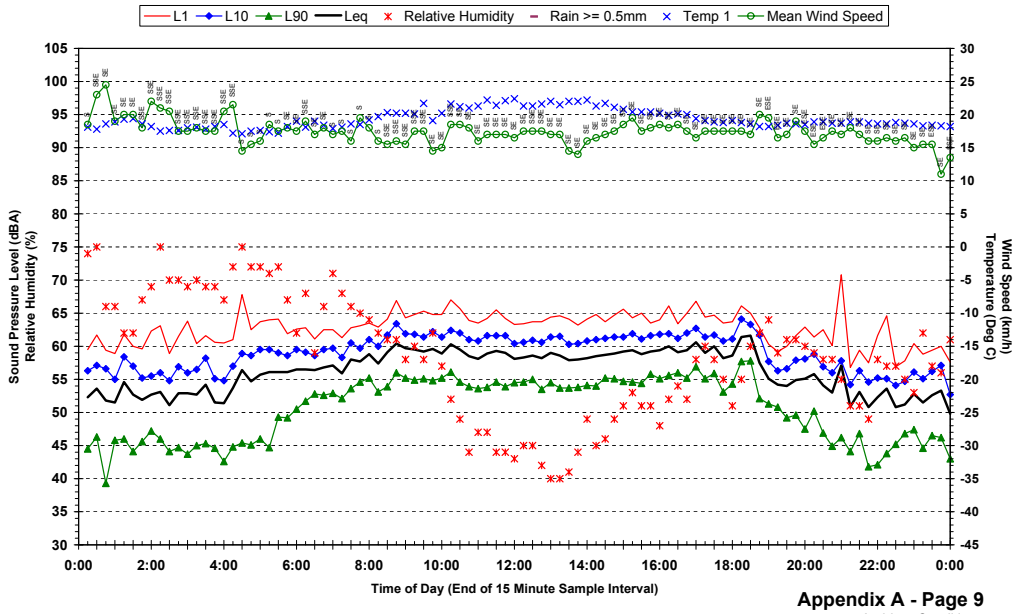
Statistical Ambient Noise Levels
20-1873 Con 7 - 121 Holts Road - Tuesday 16 October 2007



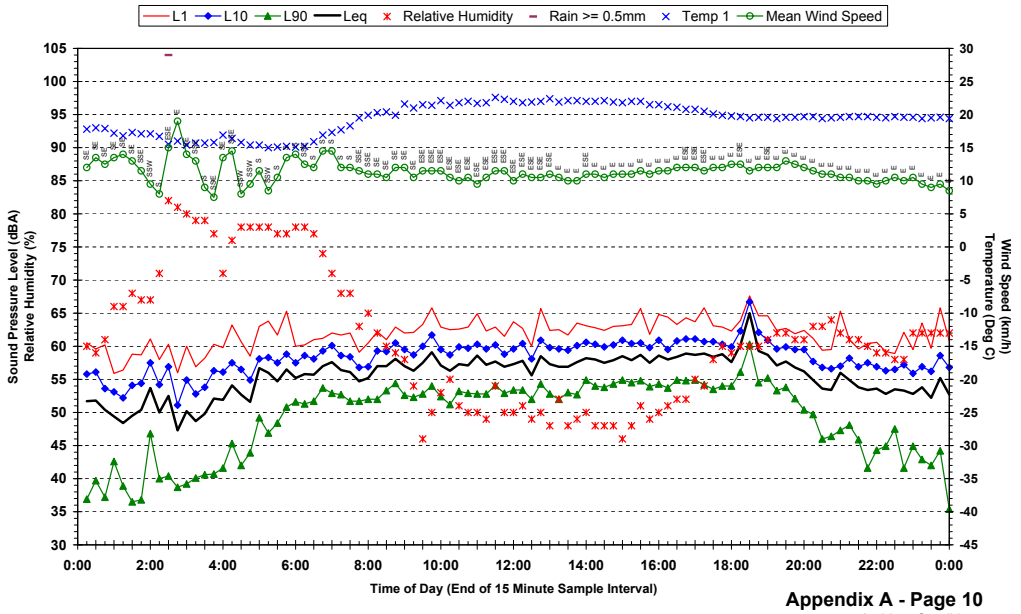
Statistical Ambient Noise Levels
20-1873 Con 7 - 121 Holts Road - Wednesday 17 October 2007



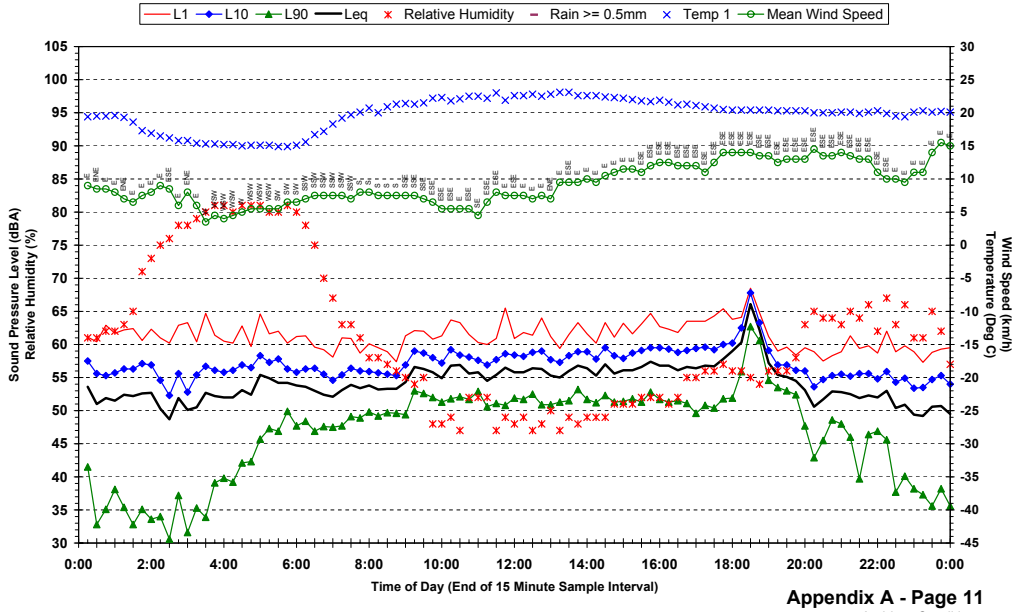
Statistical Ambient Noise Levels
20-1873 Con 7 - 121 Holts Road - Thursday 18 October 2007



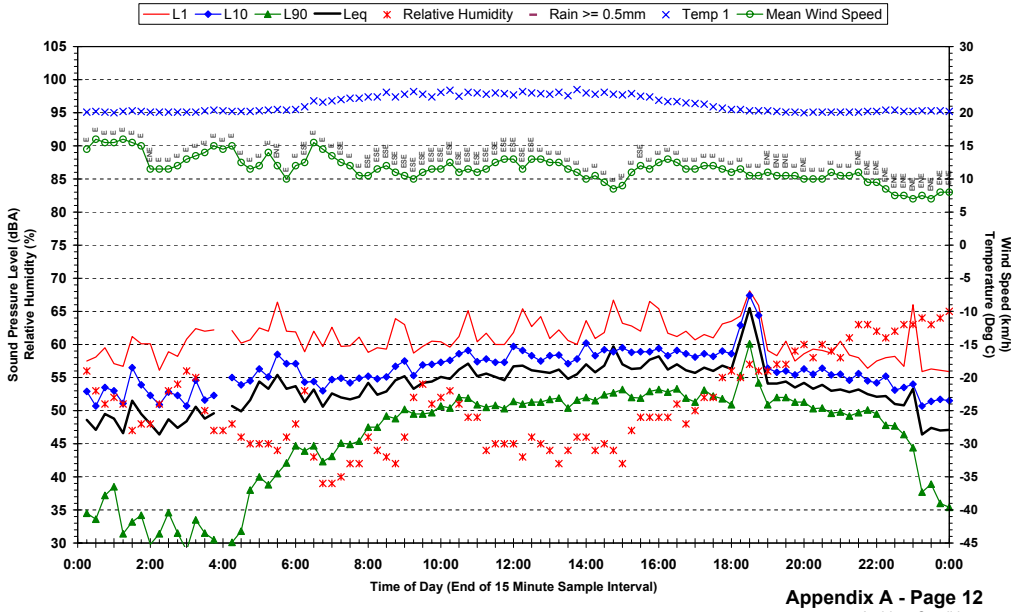
Statistical Ambient Noise Levels
20-1873 Con 7 - 121 Holts Road - Friday 19 October 2007



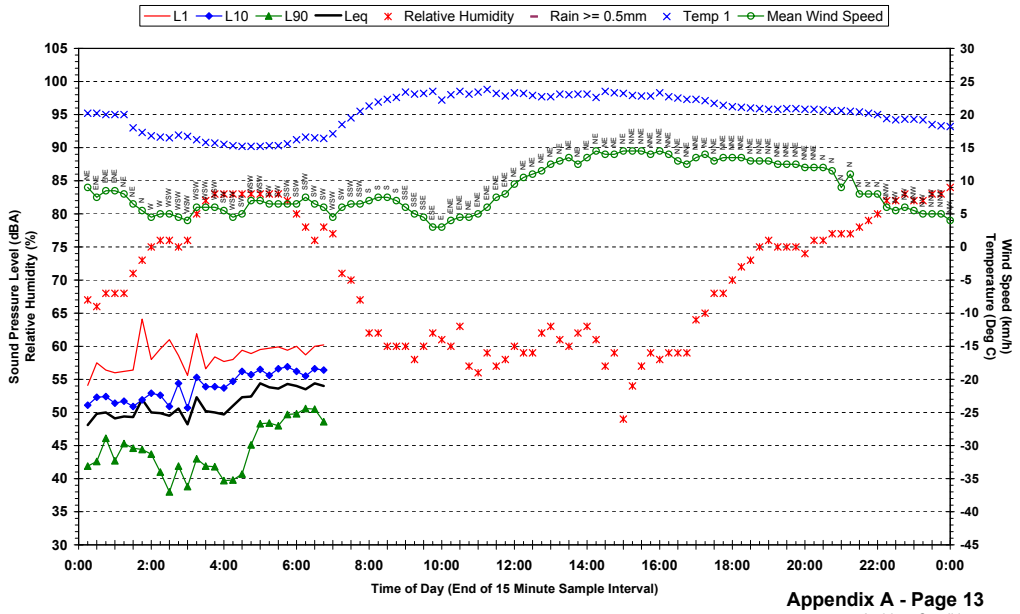
Statistical Ambient Noise Levels
20-1873 Con 7 - 121 Holts Road - Saturday 20 October 2007



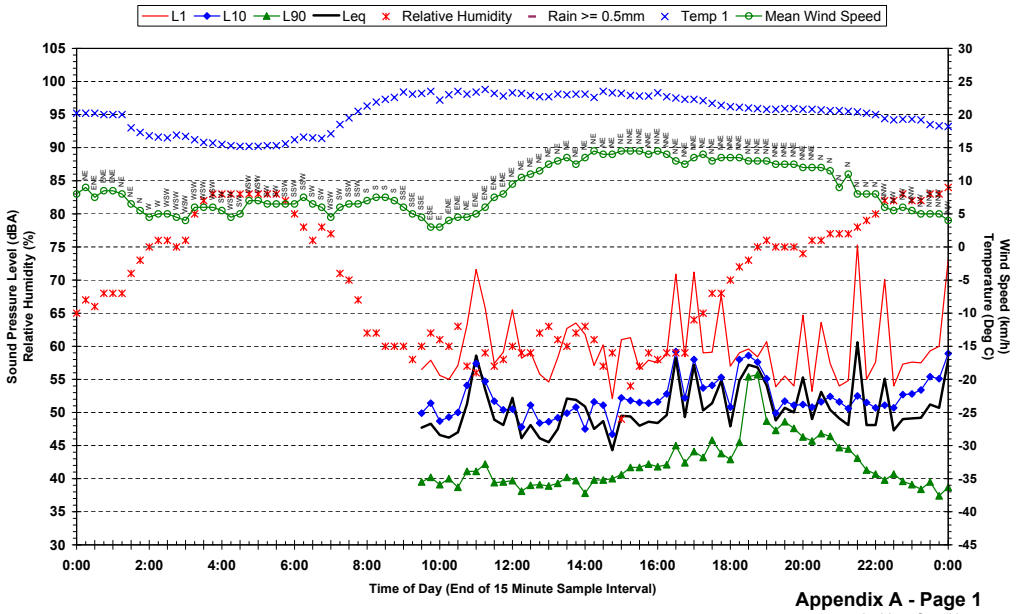
Statistical Ambient Noise Levels
20-1873 Con 7 - 121 Holts Road - Sunday 21 October 2007



Statistical Ambient Noise Levels
20-1873 Con 7 - 121 Holts Road - Monday 22 October 2007

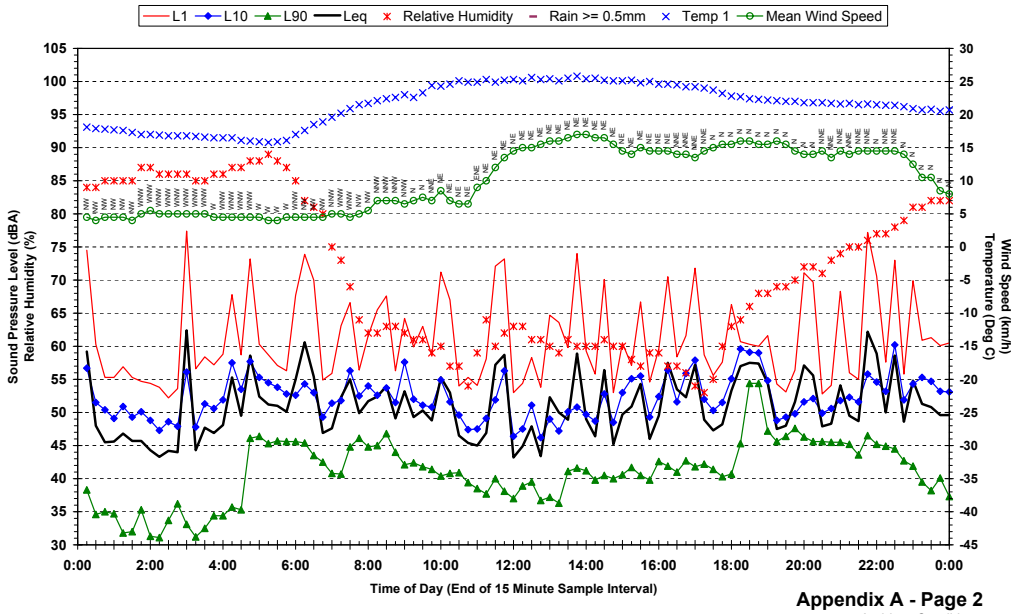


Statistical Ambient Noise Levels
20-1873 Con 8 - 39 Nandroya Rd - Monday 22 October 2007



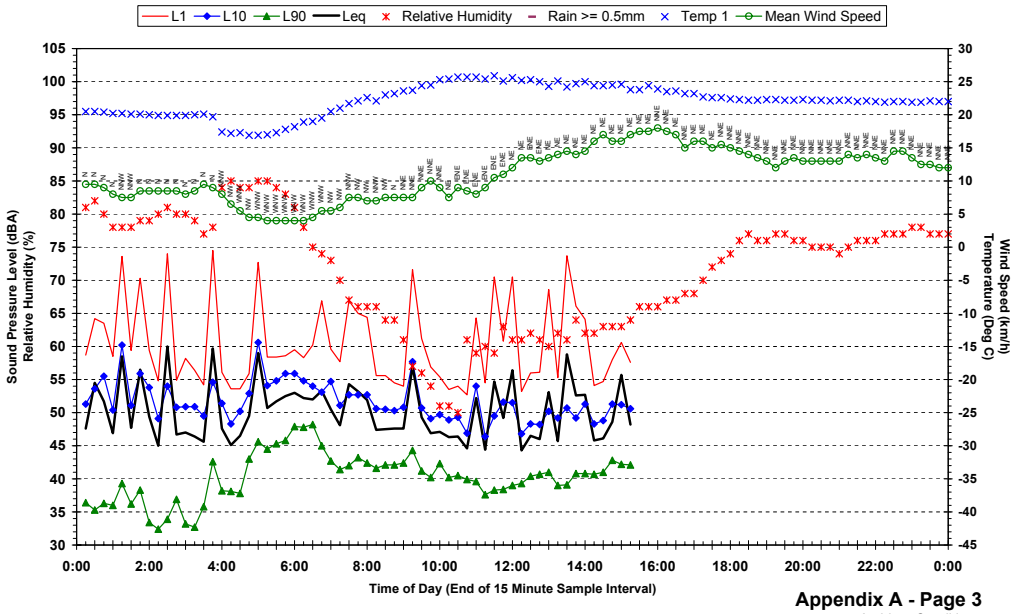
Appendix A - Page 1
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 8 - 39 Nandroya Rd - Tuesday 23 October 2007



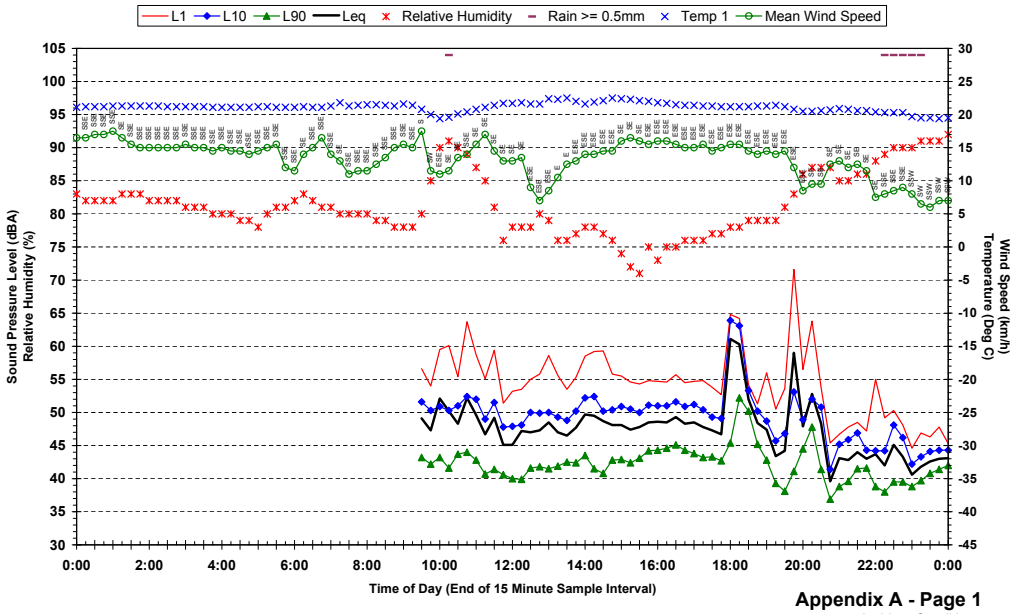
Appendix A - Page 2
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 8 - 39 Nandroya Rd - Wednesday 24 October 2007



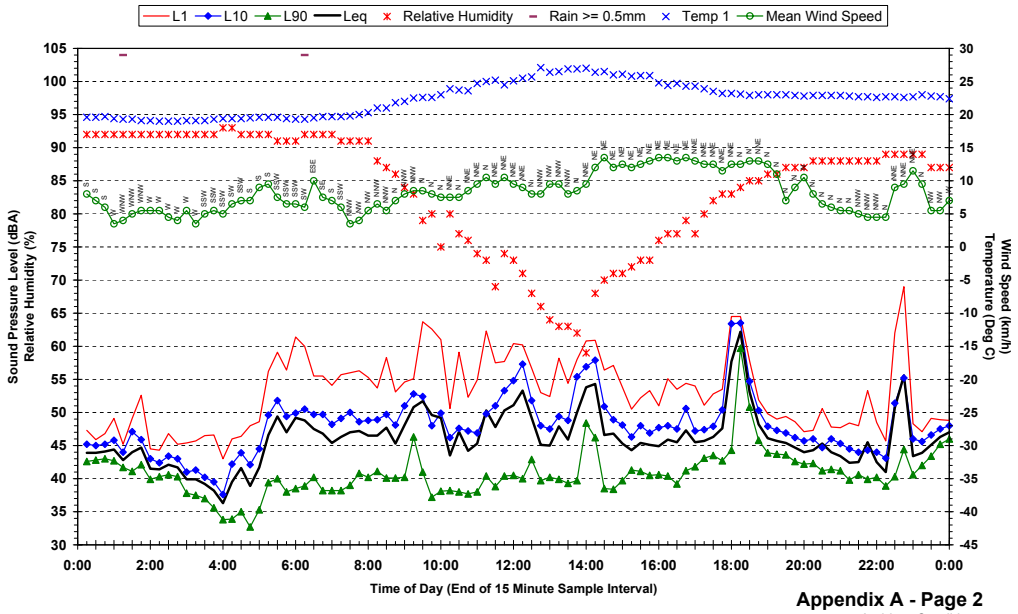
Appendix A - Page 3
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 9 - 19 Swift Drive - Wednesday 10 October 2007



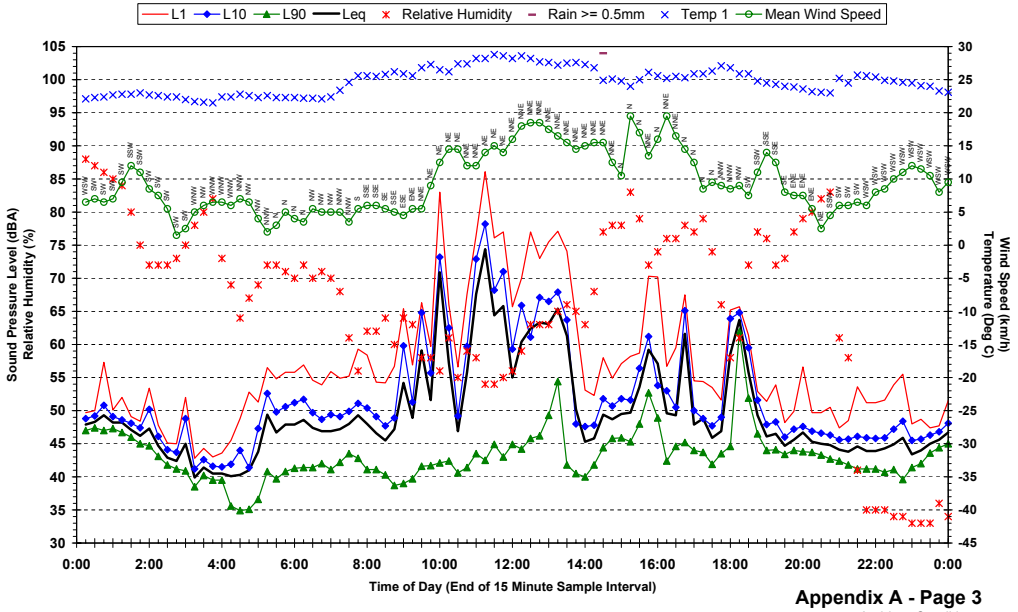
Appendix A - Page 1
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 9 - 19 Swift Drive - Thursday 11 October 2007



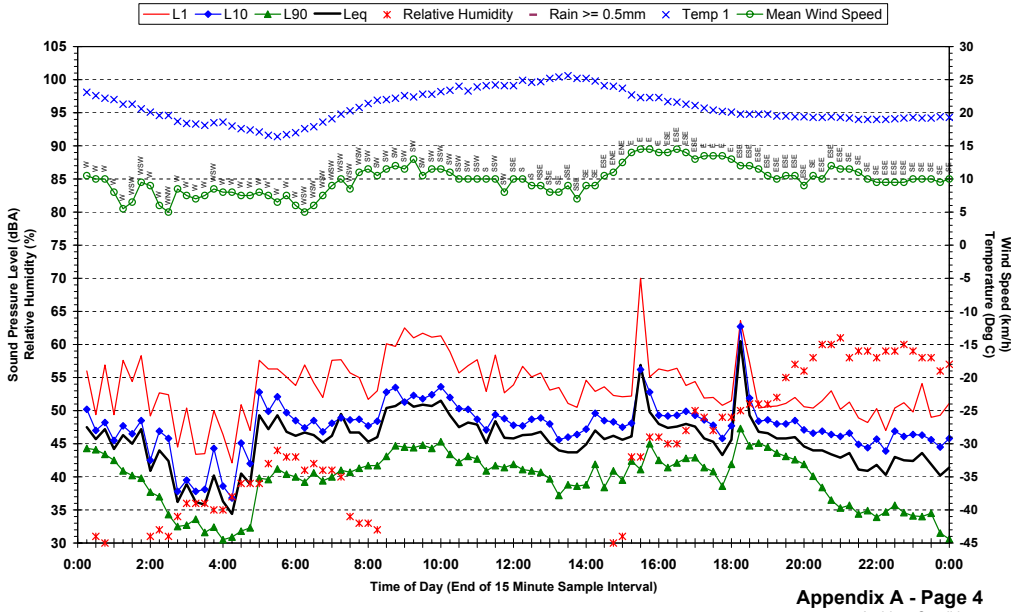
Appendix A - Page 2
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 9 - 19 Swift Drive - Friday 12 October 2007



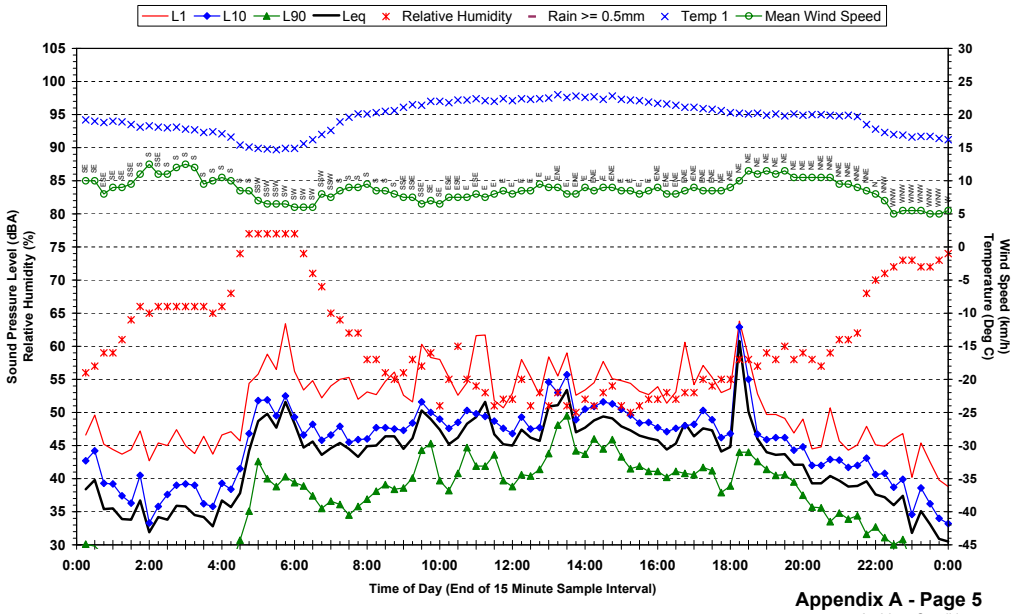
Appendix A - Page 3
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 9 - 19 Swift Drive - Saturday 13 October 2007



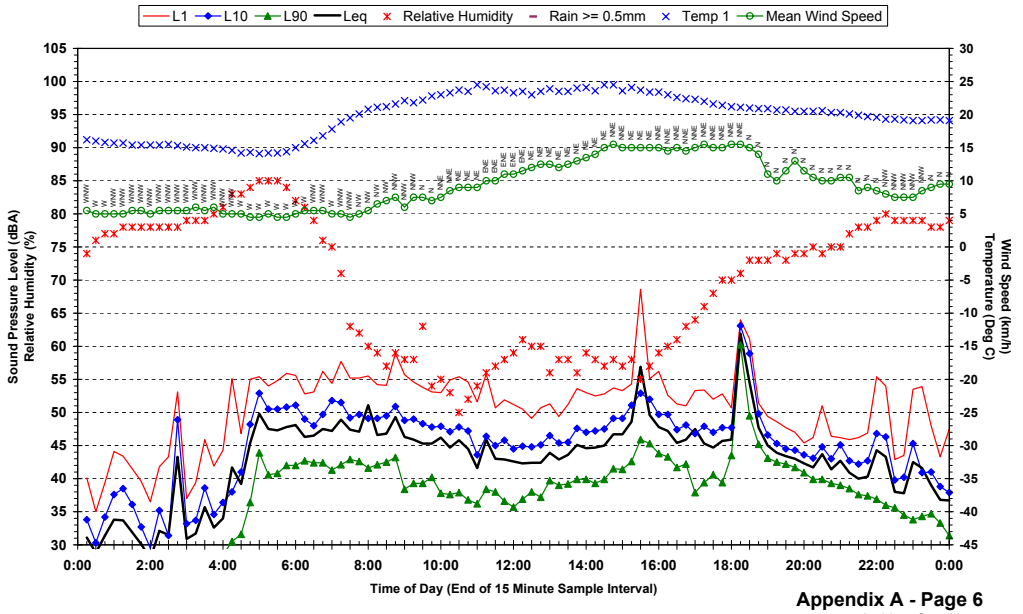
Appendix A - Page 4
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 9 - 19 Swift Drive - Sunday 14 October 2007



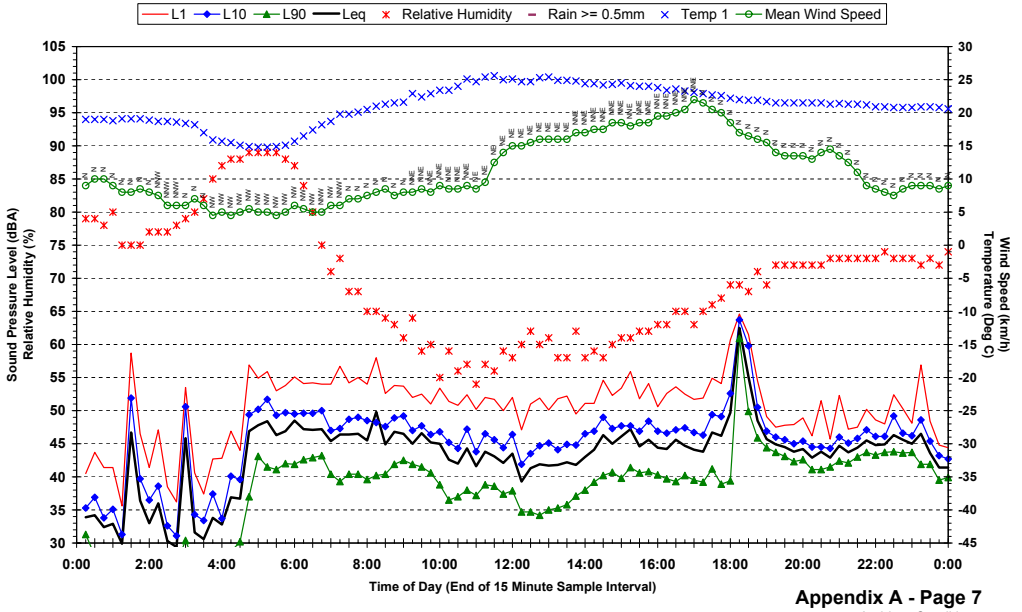
Appendix A - Page 5
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 9 - 19 Swift Drive - Monday 15 October 2007



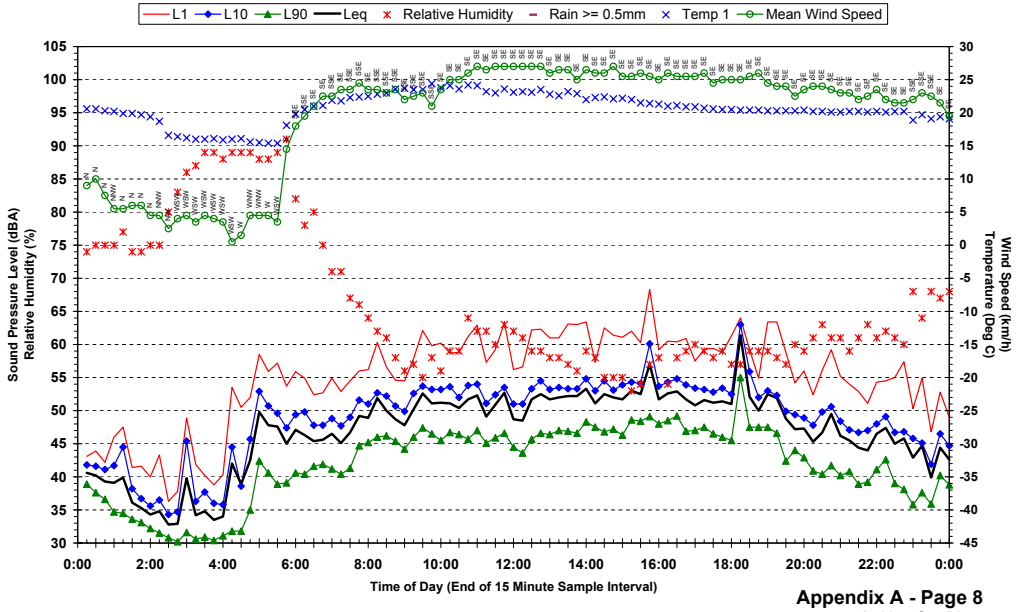
Appendix A - Page 6
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 9 - 19 Swift Drive - Tuesday 16 October 2007



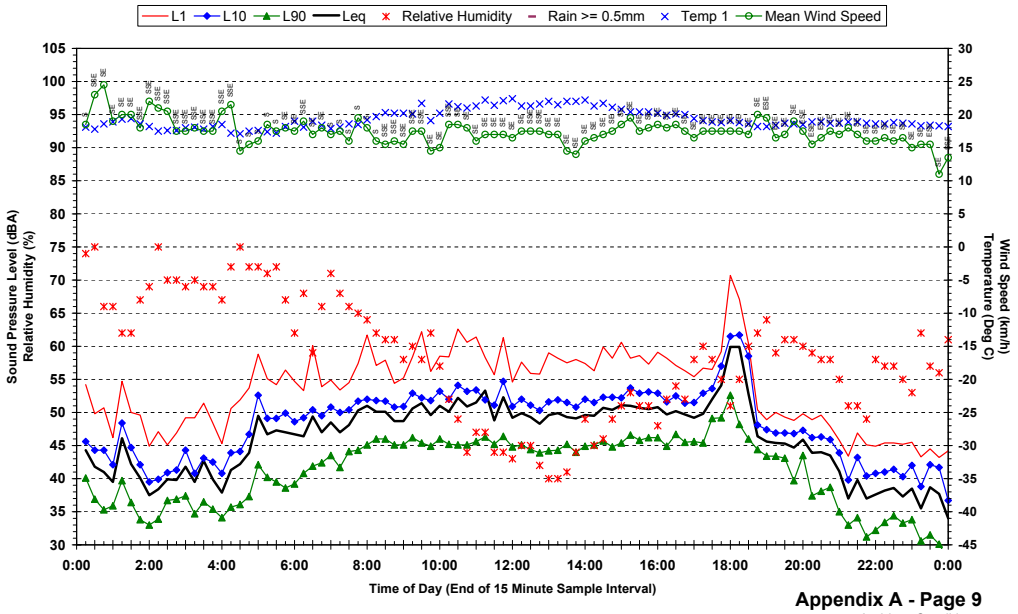
Appendix A - Page 7
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 9 - 19 Swift Drive - Wednesday 17 October 2007



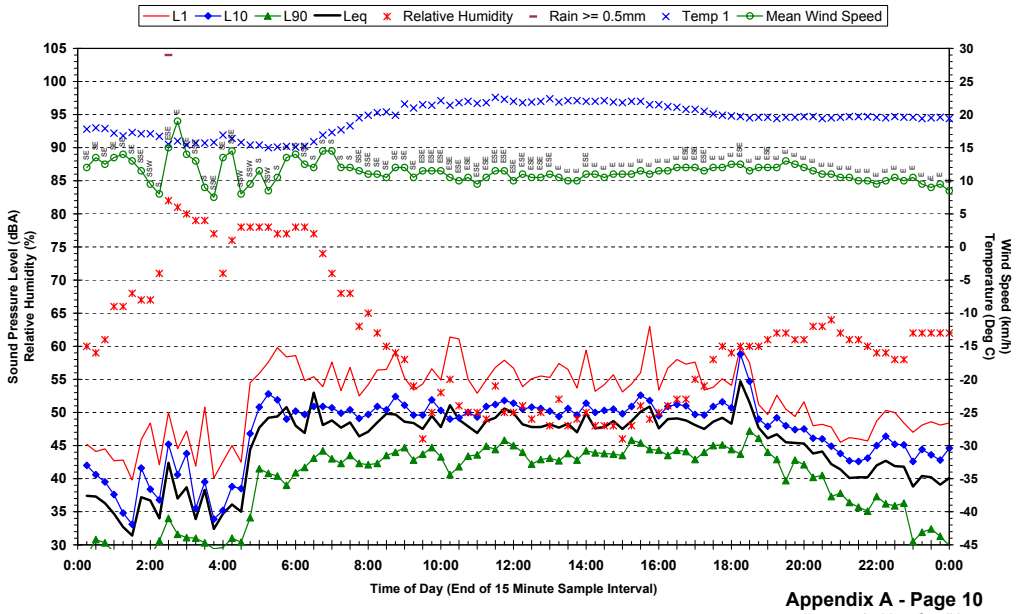
Appendix A - Page 8
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 9 - 19 Swift Drive - Thursday 18 October 2007



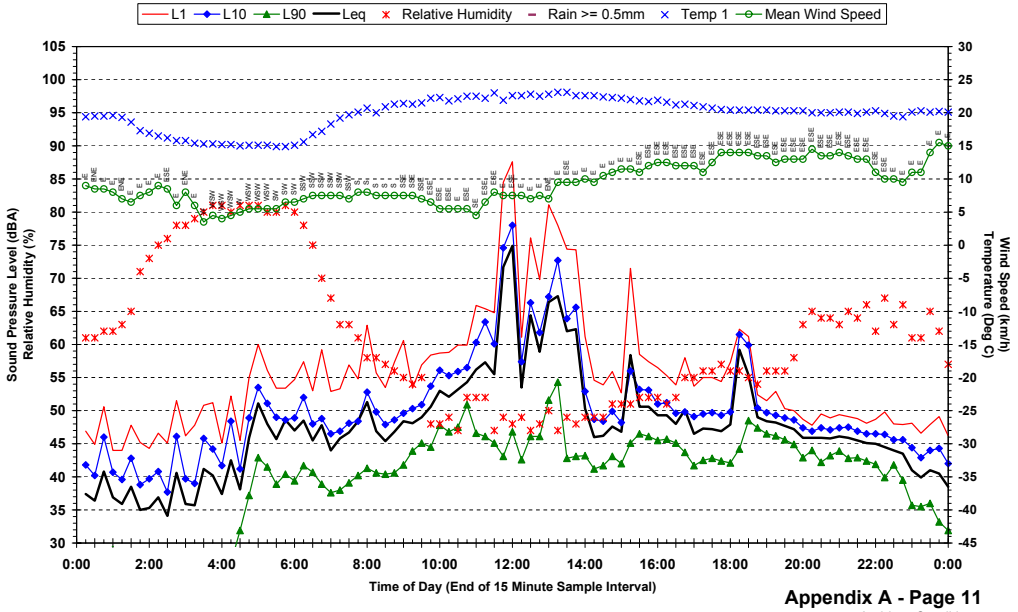
Appendix A - Page 9
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 9 - 19 Swift Drive - Friday 19 October 2007



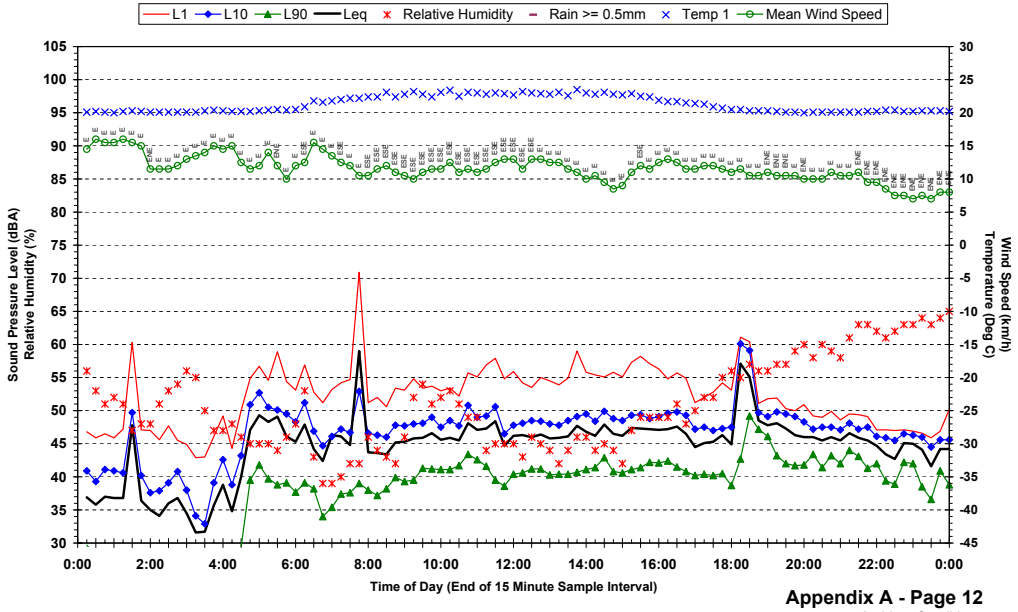
Appendix A - Page 10
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 9 - 19 Swift Drive - Saturday 20 October 2007



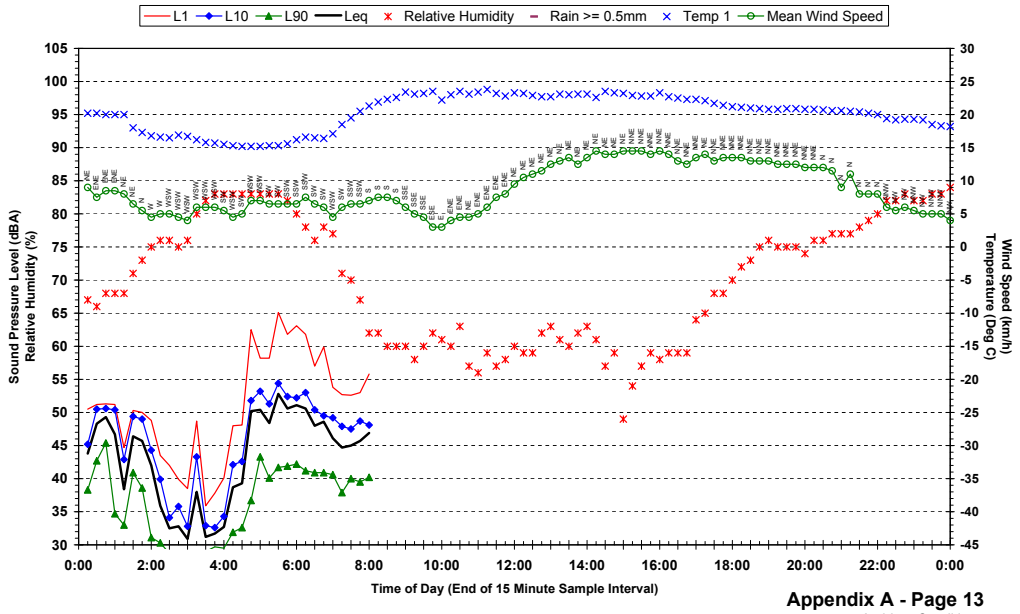
Appendix A - Page 11
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 9 - 19 Swift Drive - Sunday 21 October 2007

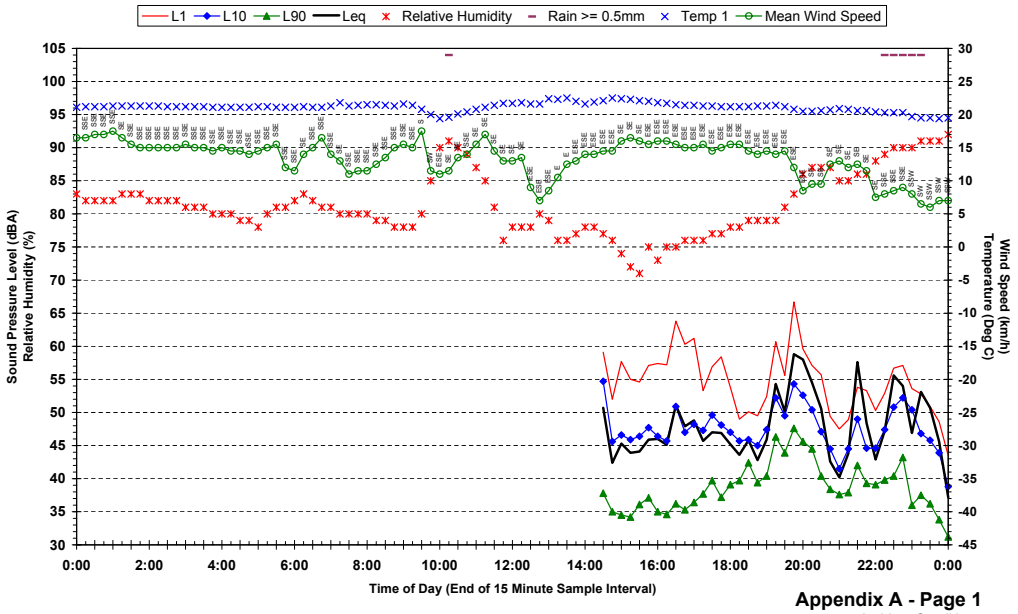


Appendix A - Page 12
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 9 - 19 Swift Drive - Monday 22 October 2007

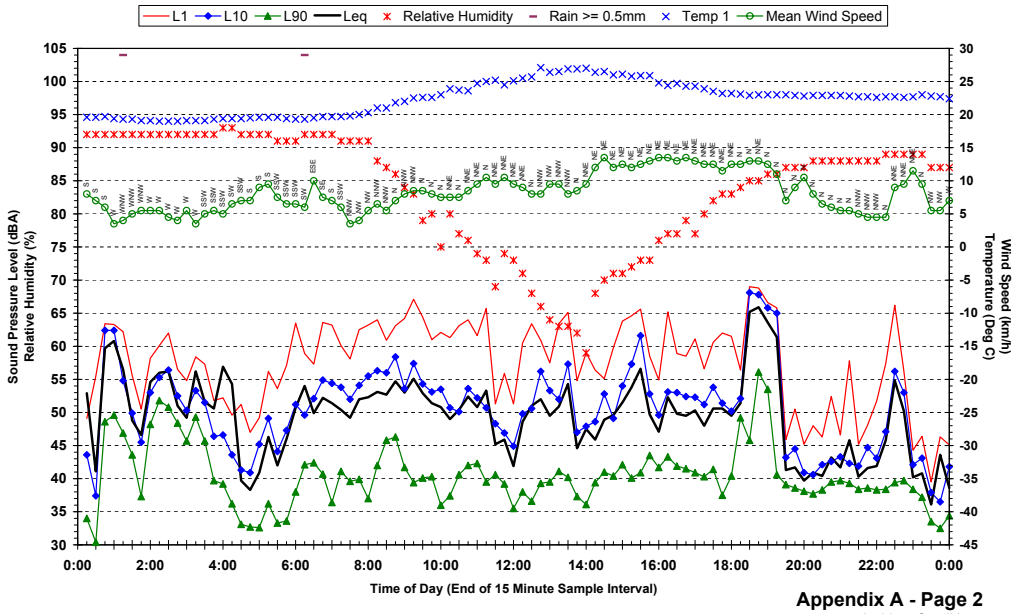


Statistical Ambient Noise Levels
20-1873 Op 1 - Nobels Road - Wednesday 10 October 2007



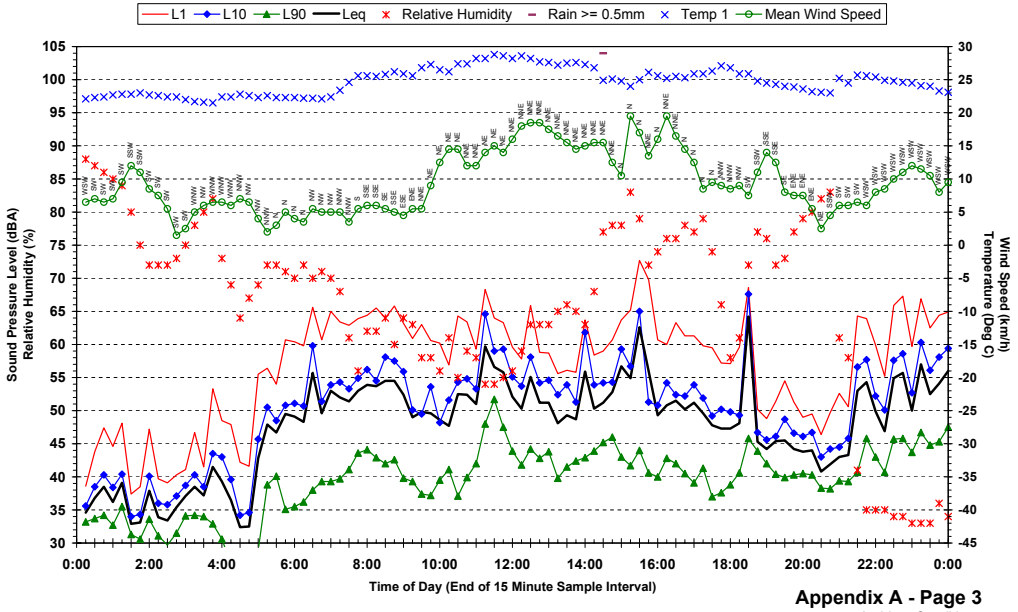
Appendix A - Page 1
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Op 1 - Nobels Road - Thursday 11 October 2007



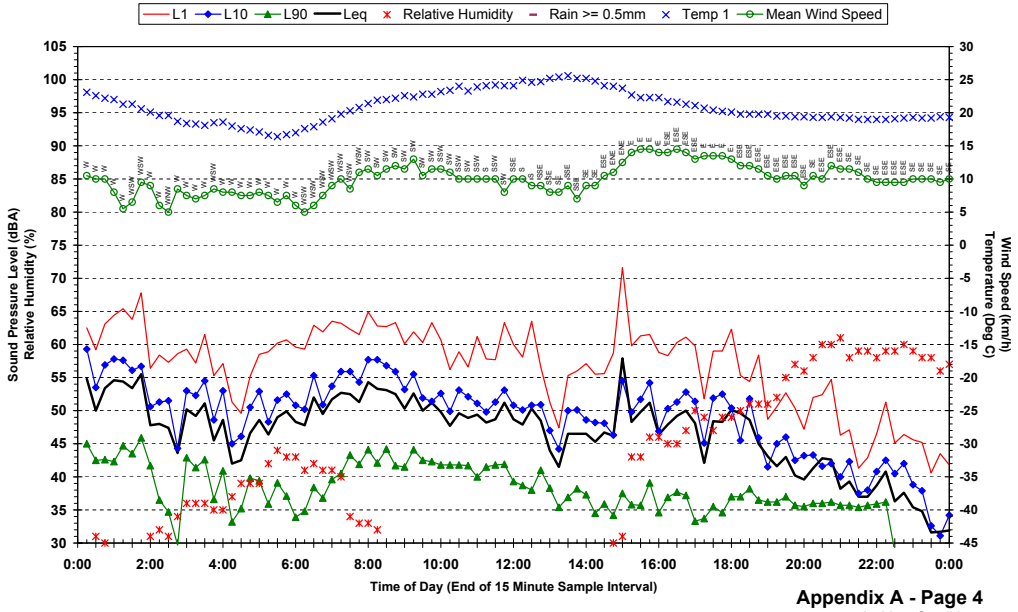
Appendix A - Page 2
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Op 1 - Nobels Road - Friday 12 October 2007



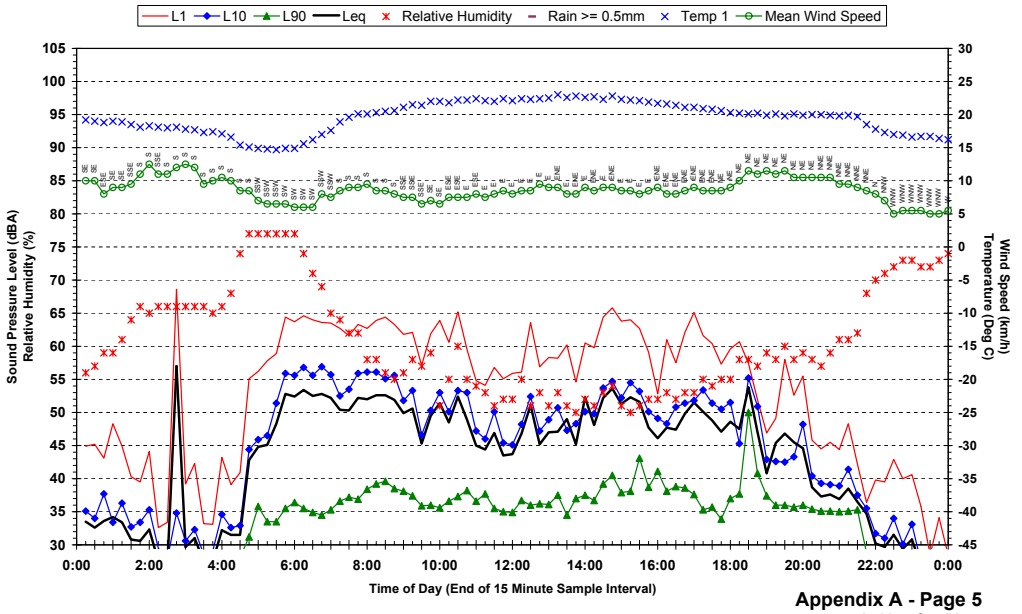
Appendix A - Page 3
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Op 1 - Nobels Road - Saturday 13 October 2007



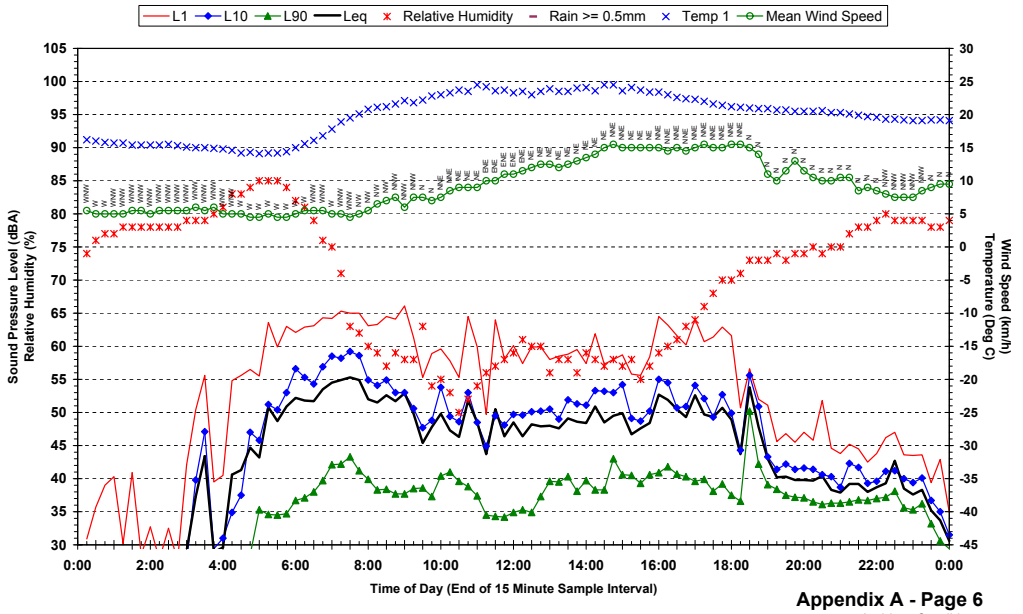
Appendix A - Page 4
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Op 1 - Nobels Road - Sunday 14 October 2007



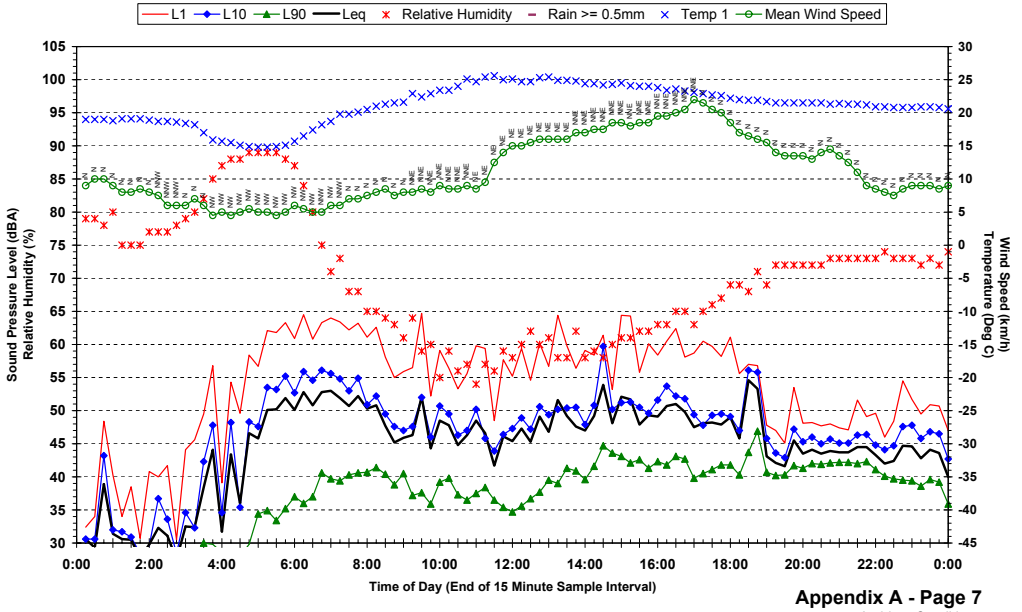
Appendix A - Page 5
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Op 1 - Nobels Road - Monday 15 October 2007



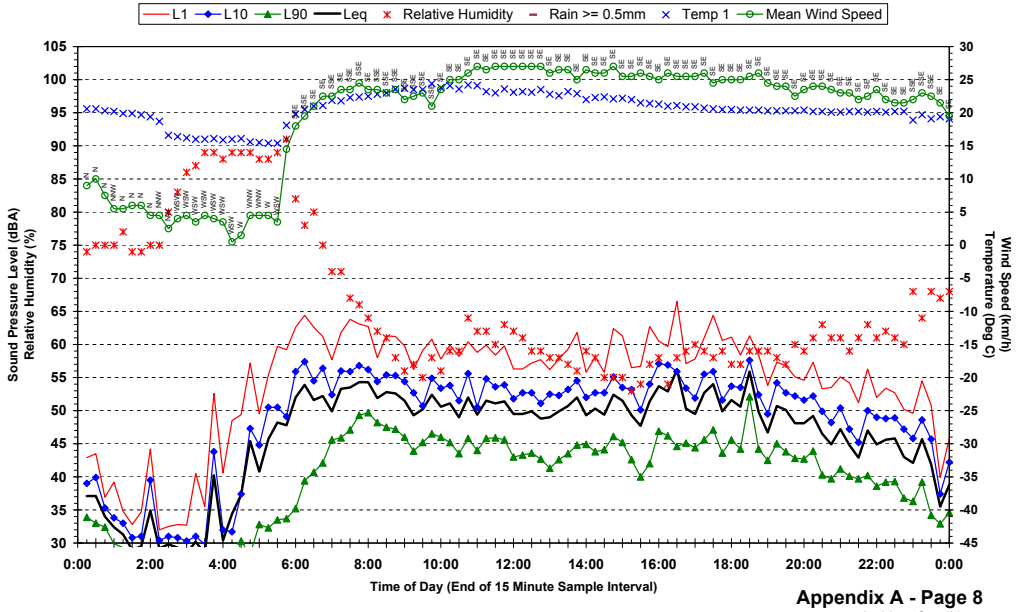
Appendix A - Page 6
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Op 1 - Nobels Road - Tuesday 16 October 2007



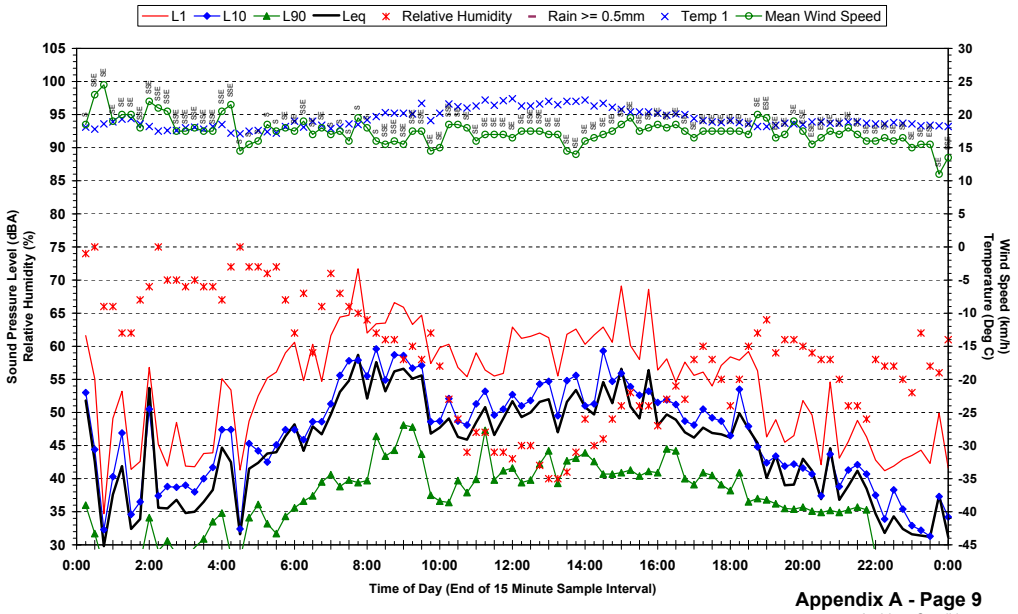
Appendix A - Page 7
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Op 1 - Nobels Road - Wednesday 17 October 2007

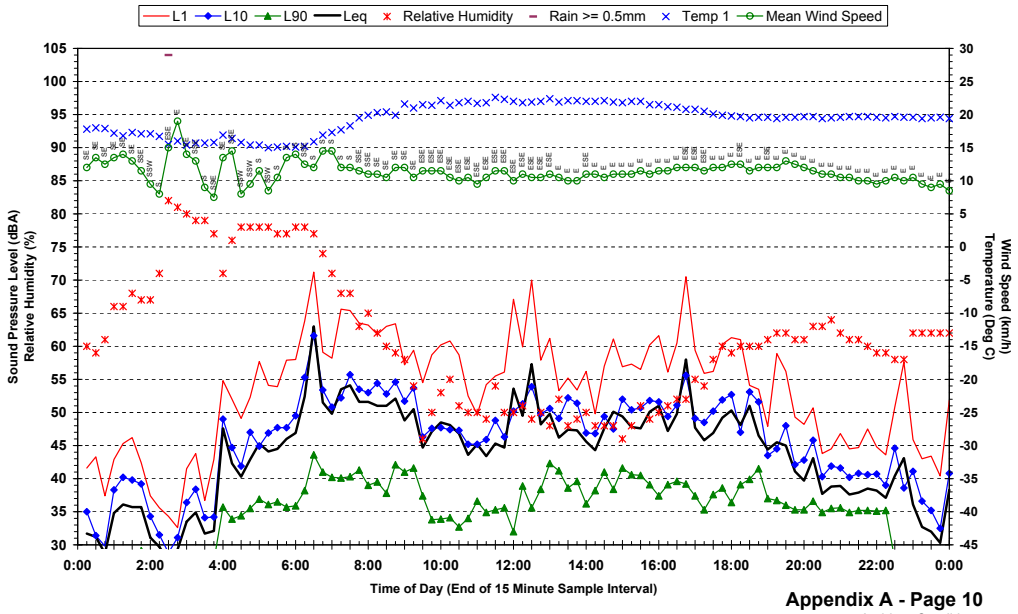


Appendix A - Page 8
Ambient Conditions
Heggies Report 20-1873

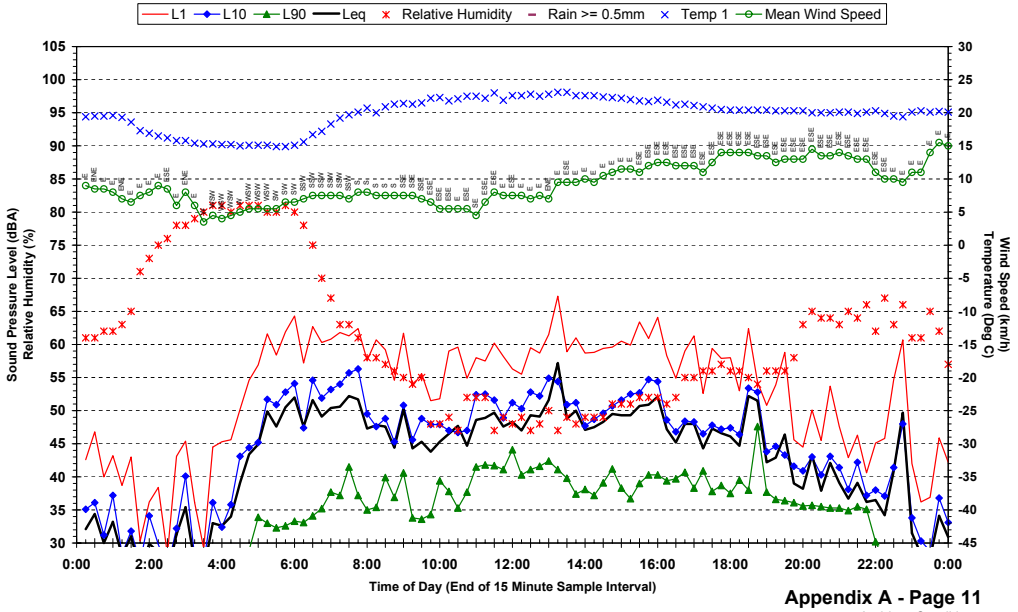
Statistical Ambient Noise Levels
20-1873 Op 1 - Nobels Road - Thursday 18 October 2007



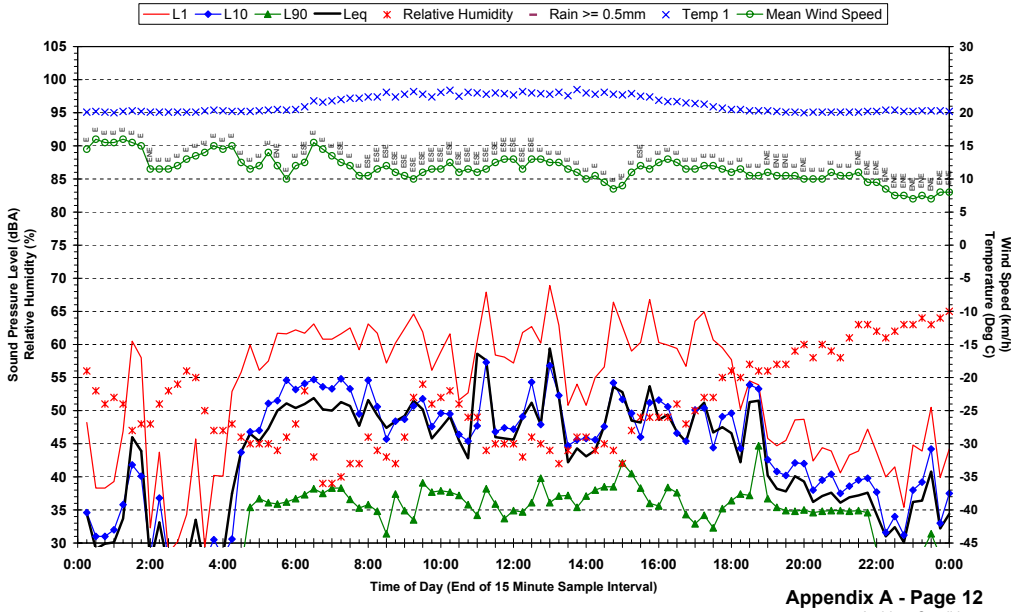
Statistical Ambient Noise Levels
20-1873 Op 1 - Nobels Road - Friday 19 October 2007



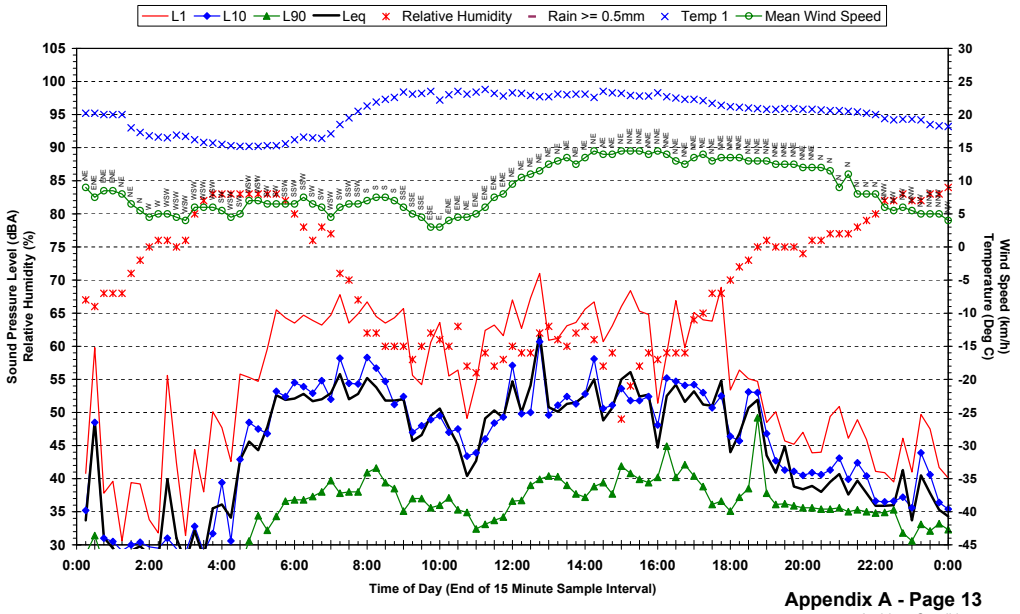
Statistical Ambient Noise Levels
20-1873 Op 1 - Nobels Road - Saturday 20 October 2007



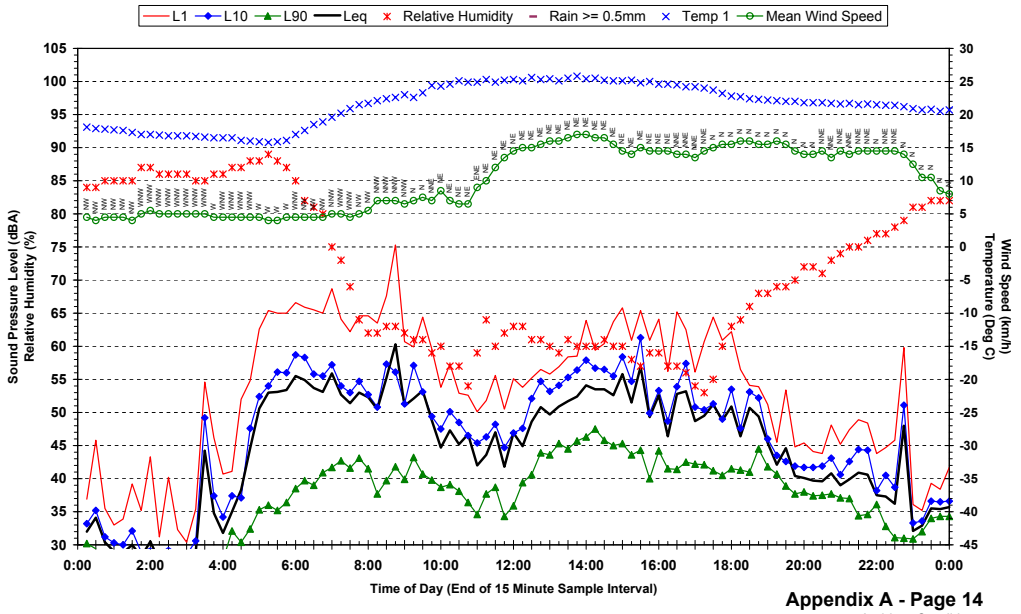
Statistical Ambient Noise Levels
20-1873 Op 1 - Nobels Road - Sunday 21 October 2007



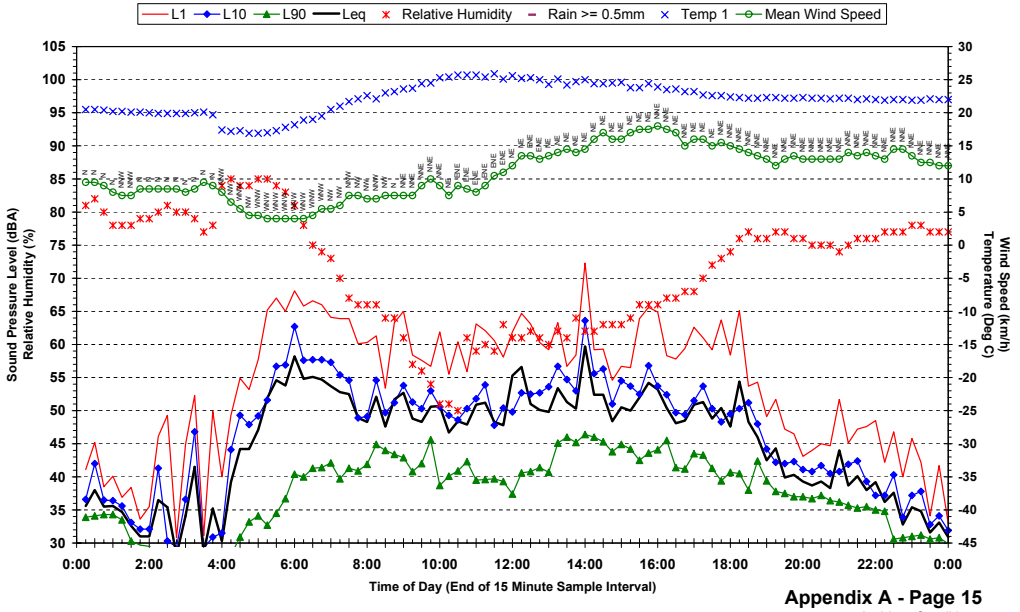
Statistical Ambient Noise Levels
20-1873 Op 1 - Nobels Road - Monday 22 October 2007



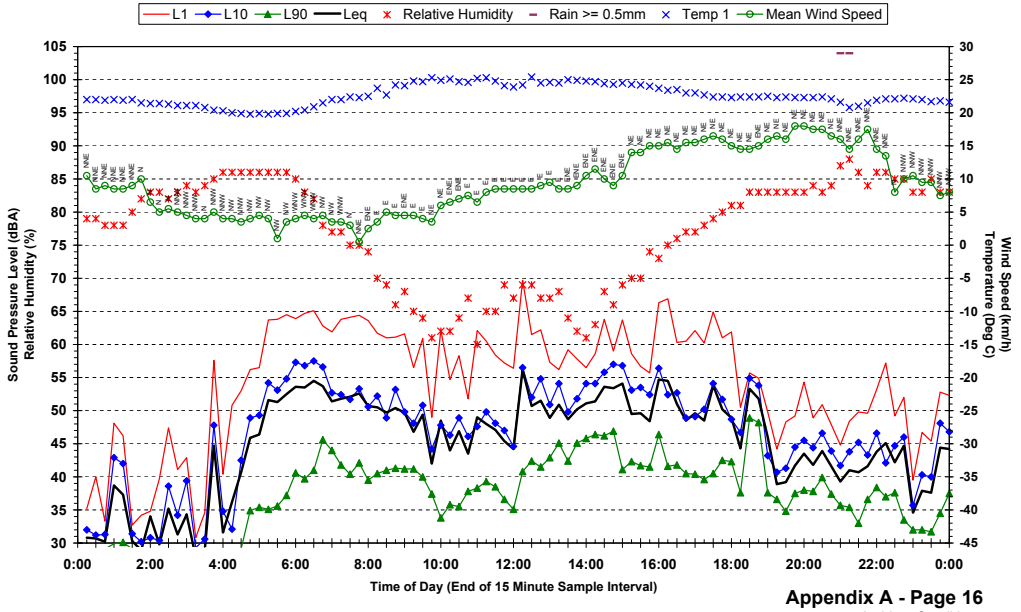
Statistical Ambient Noise Levels
20-1873 Op 1 - Nobels Road - Tuesday 23 October 2007



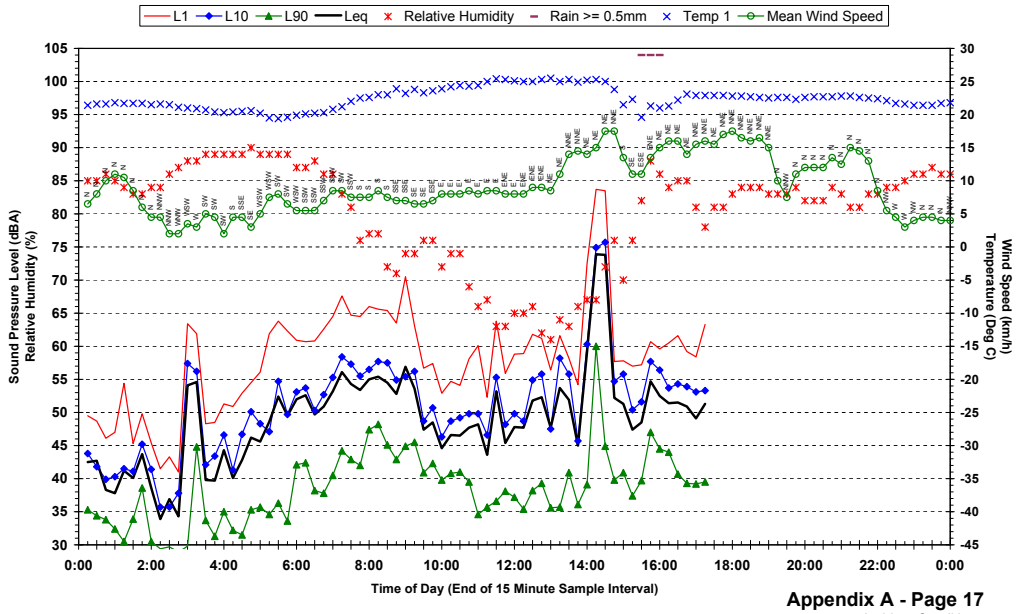
Statistical Ambient Noise Levels
20-1873 Op 1 - Nobels Road - Wednesday 24 October 2007



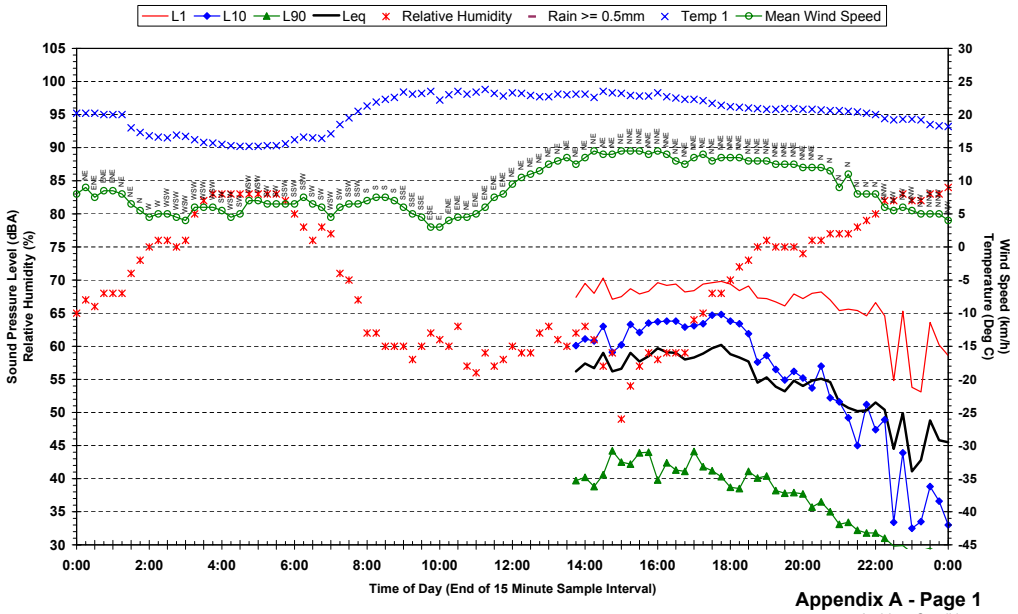
Statistical Ambient Noise Levels
20-1873 Op 1 - Nobels Road - Thursday 25 October 2007



Statistical Ambient Noise Levels
20-1873 Op 1 - Nobels Road - Friday 26 October 2007

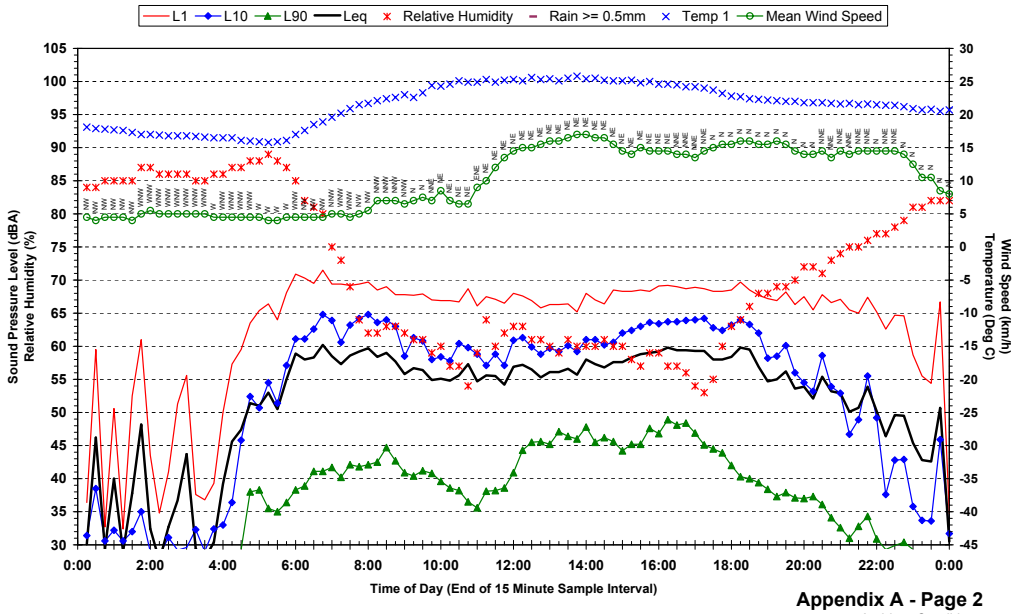


Statistical Ambient Noise Levels
20-1873 Op 2 - 693 Diddillibah Road - Monday 22 October 2007



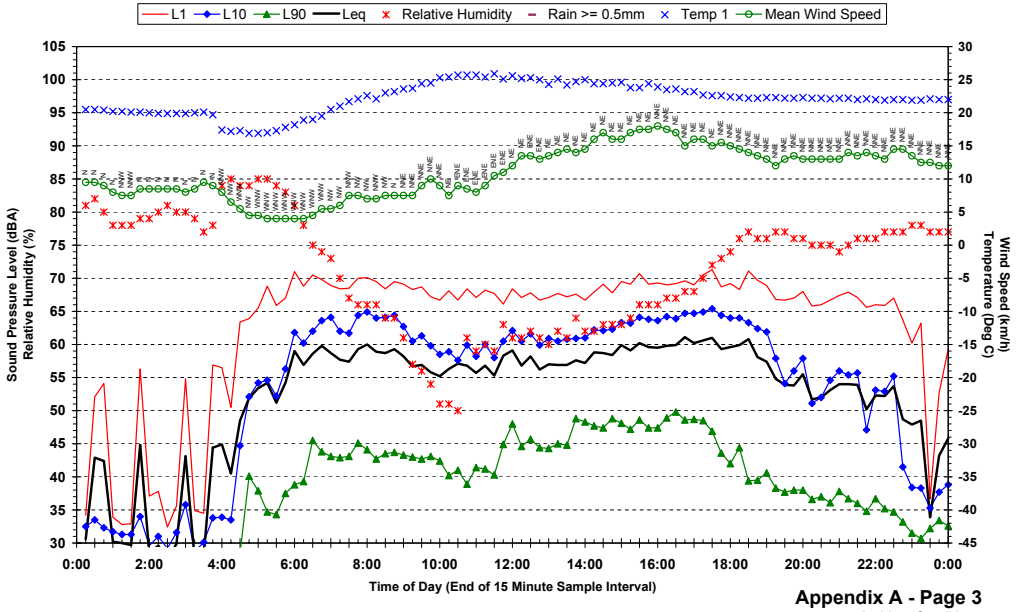
Appendix A - Page 1
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Op 2 - 693 Diddillibah Road - Tuesday 23 October 2007



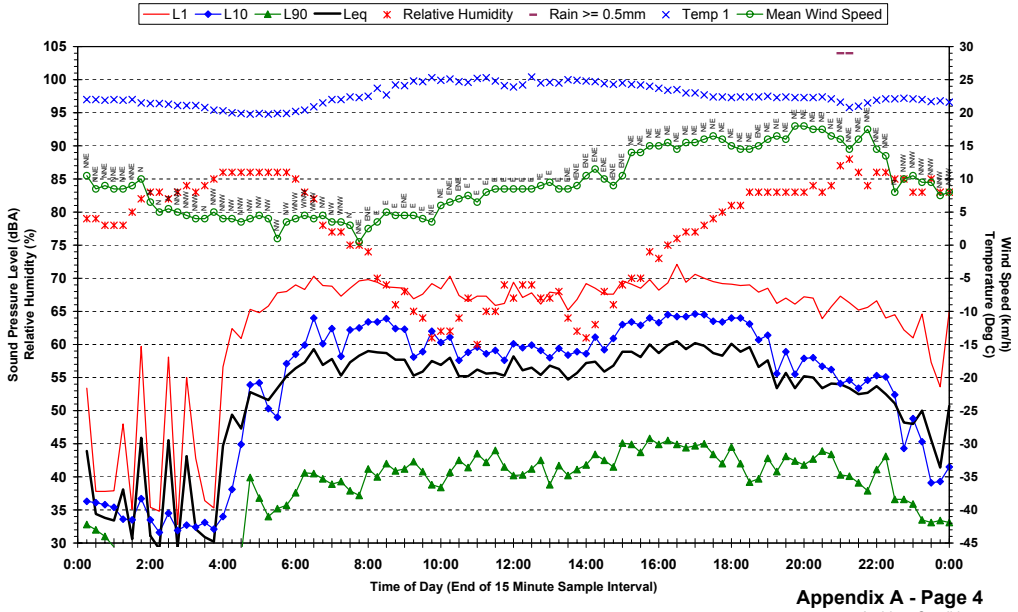
Appendix A - Page 2
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Op 2 - 693 Diddillibah Road - Wednesday 24 October 2007



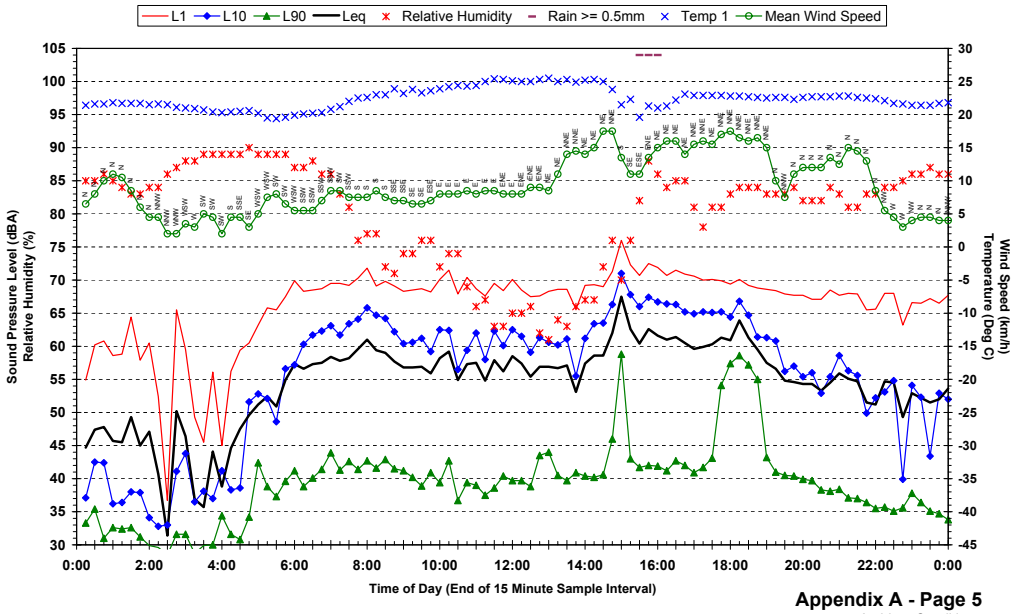
Appendix A - Page 3
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Op 2 - 693 Diddillibah Road - Thursday 25 October 2007



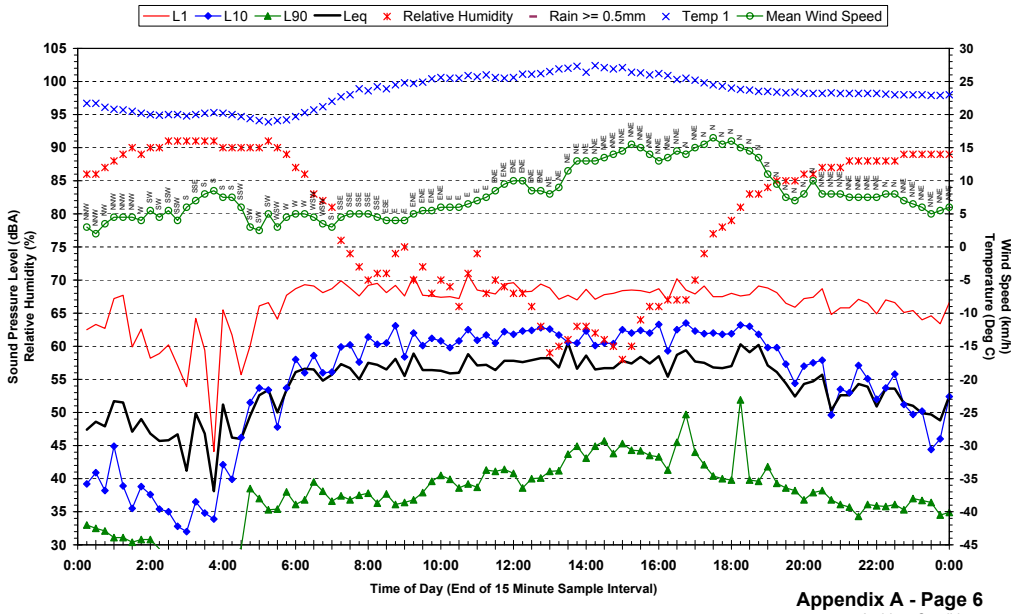
Appendix A - Page 4
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Op 2 - 693 Diddillibah Road - Friday 26 October 2007



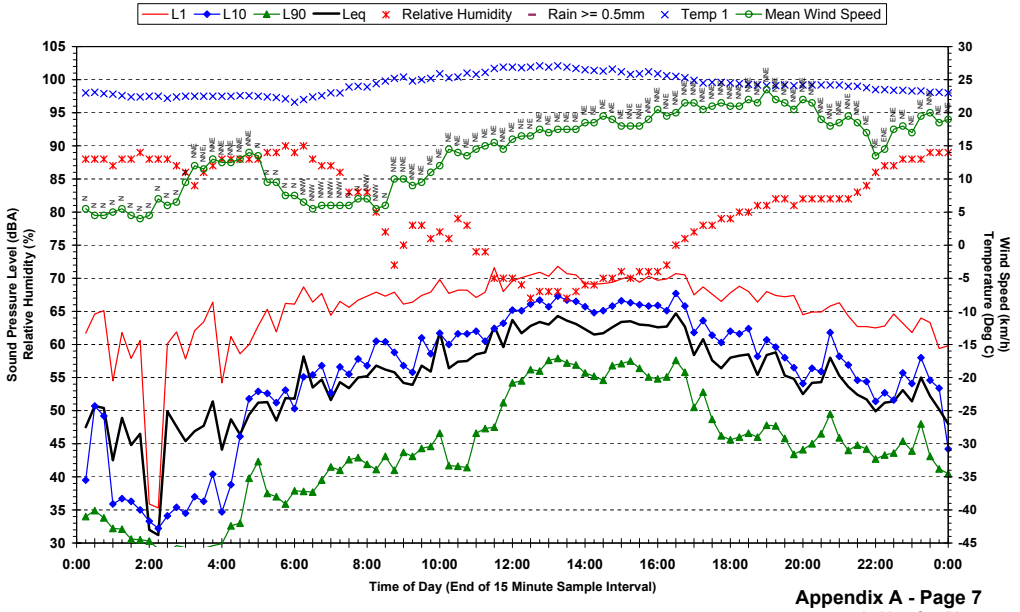
Appendix A - Page 5
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Op 2 - 693 Diddillibah Road - Saturday 27 October 2007



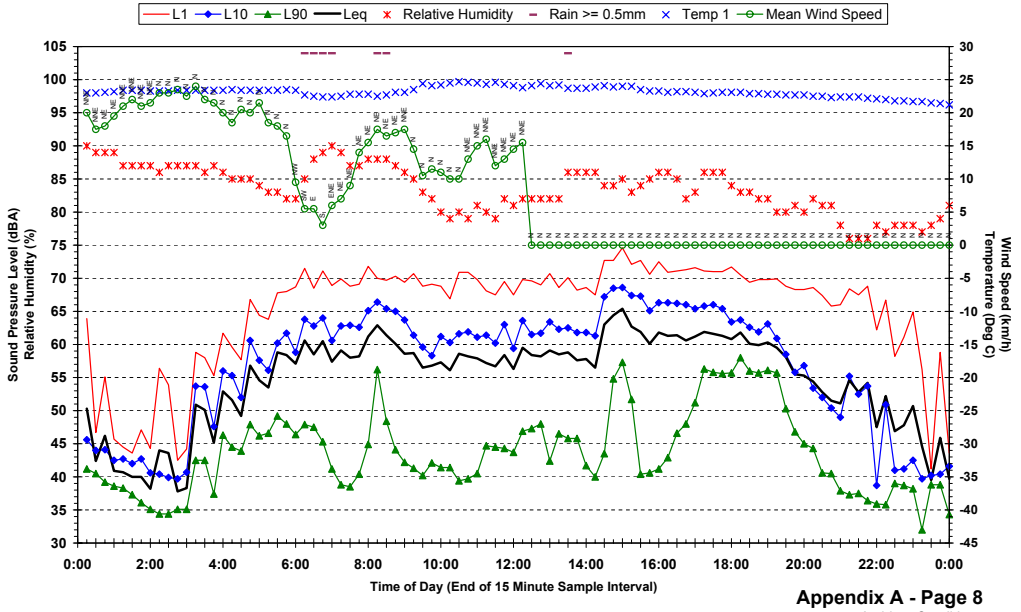
Appendix A - Page 6
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Op 2 - 693 Diddillibah Road - Sunday 28 October 2007



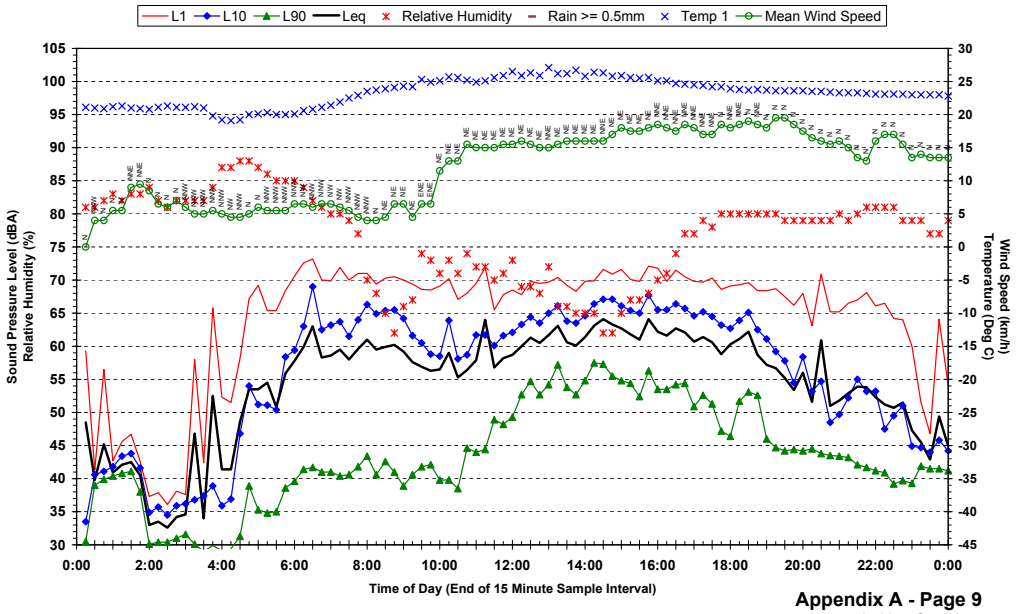
Appendix A - Page 7
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Op 2 - 693 Diddillibah Road - Monday 29 October 2007

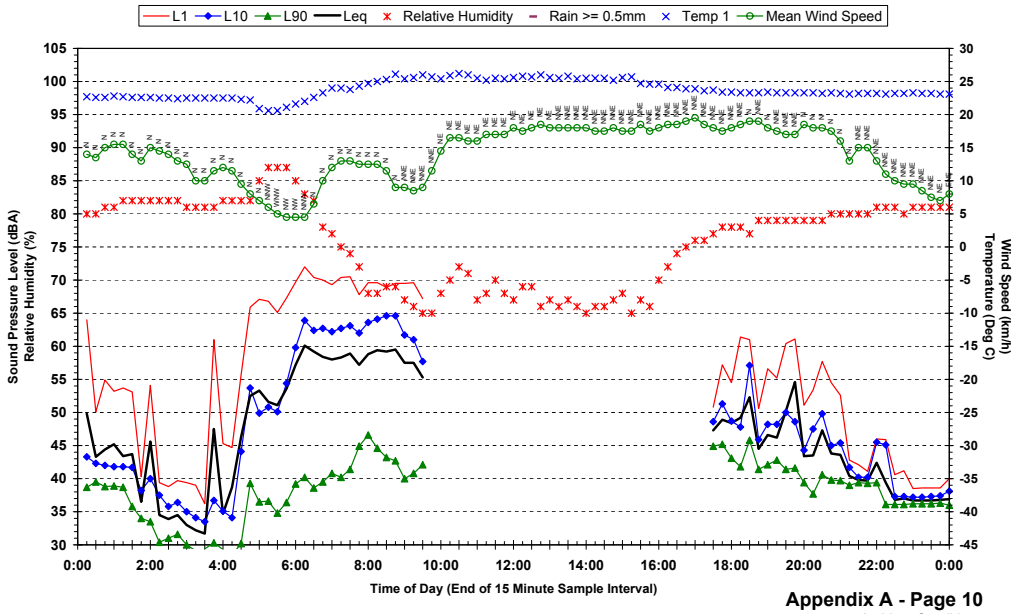


Appendix A - Page 8
Ambient Conditions
Heggies Report 20-1873

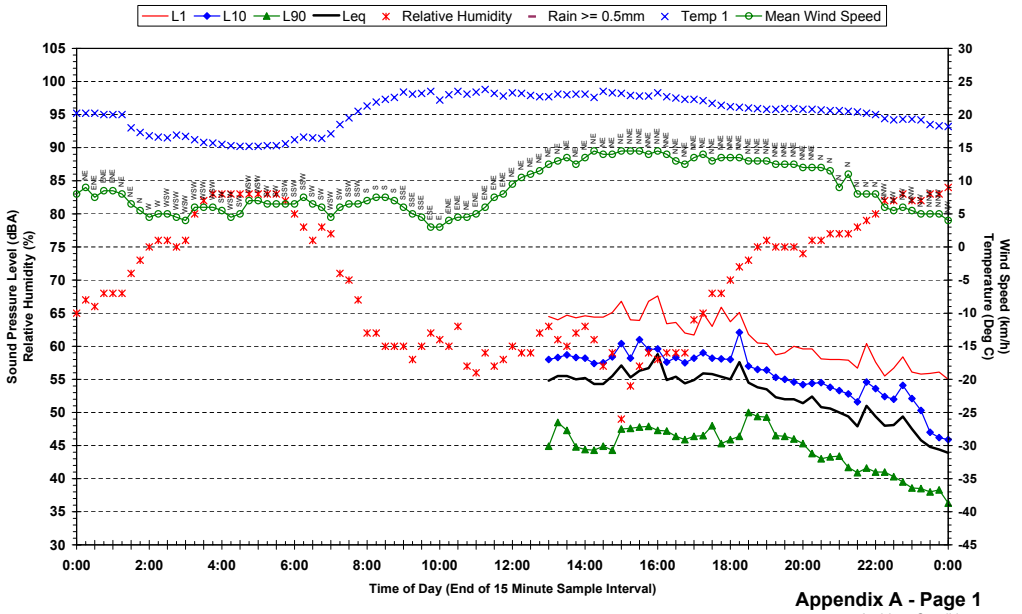
Statistical Ambient Noise Levels
20-1873 Op 2 - 693 Diddillibah Road - Tuesday 30 October 2007



Statistical Ambient Noise Levels
20-1873 Op 2 - 693 Diddillibah Road - Wednesday 31 October 2007

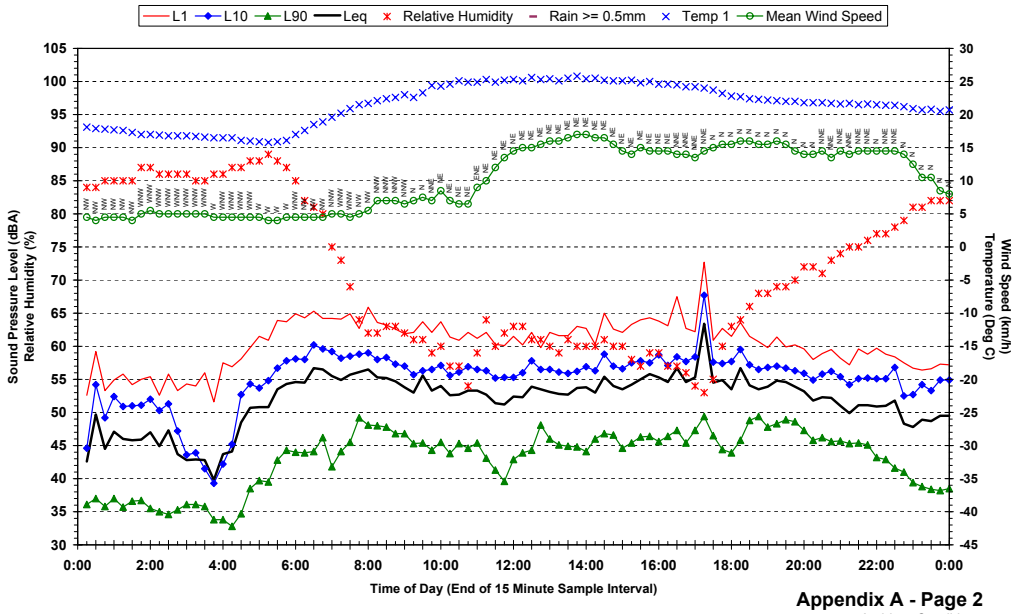


Statistical Ambient Noise Levels
20-1873 Op 3 - 5 Atkinson Road - Monday 22 October 2007



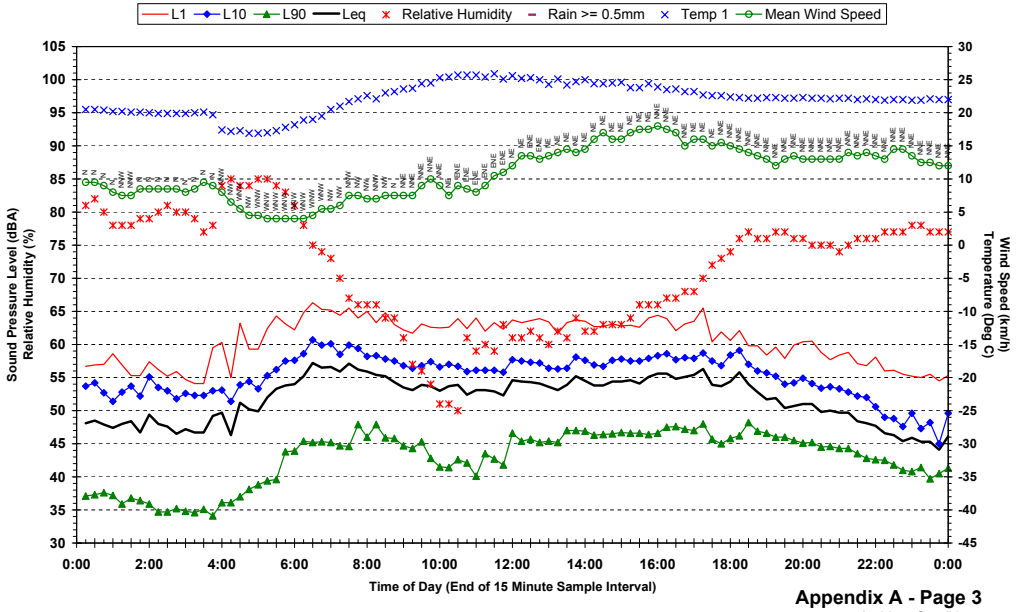
Appendix A - Page 1
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Op 3 - 5 Atkinson Road - Tuesday 23 October 2007



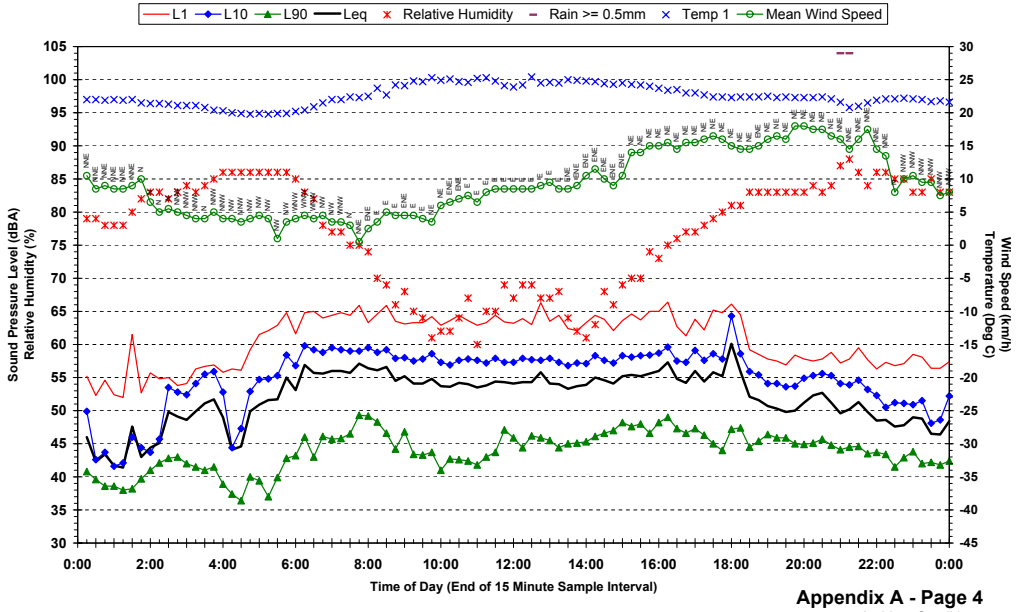
Appendix A - Page 2
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Op 3 - 5 Atkinson Road - Wednesday 24 October 2007



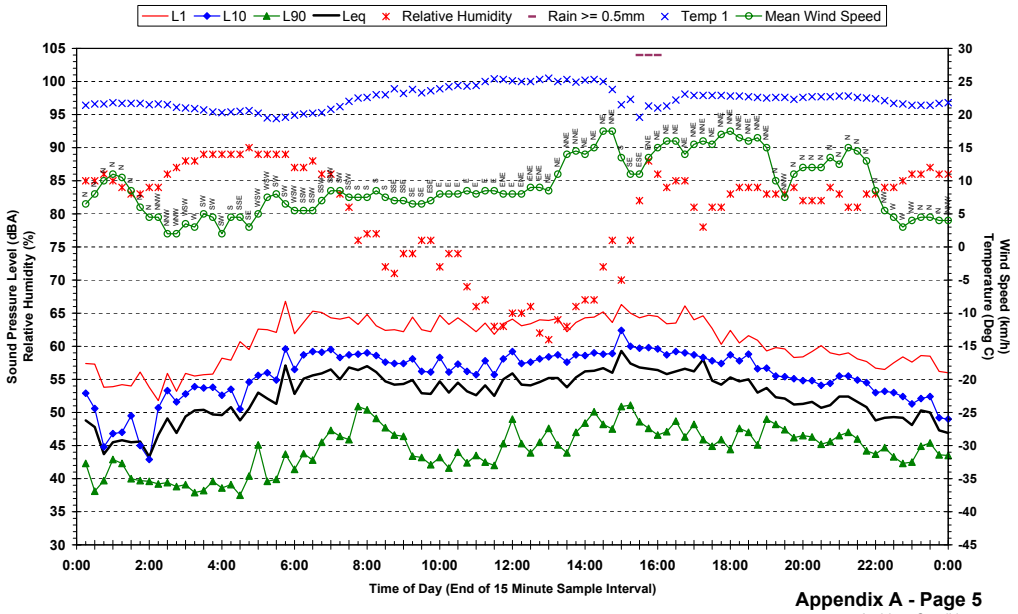
Appendix A - Page 3
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Op 3 - 5 Atkinson Road - Thursday 25 October 2007



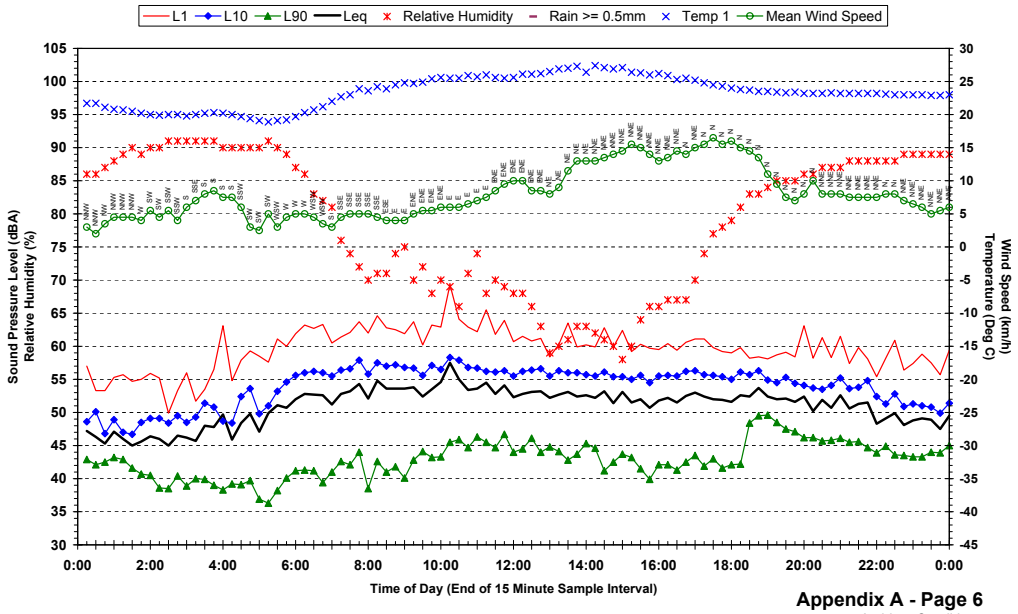
Appendix A - Page 4
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Op 3 - 5 Atkinson Road - Friday 26 October 2007



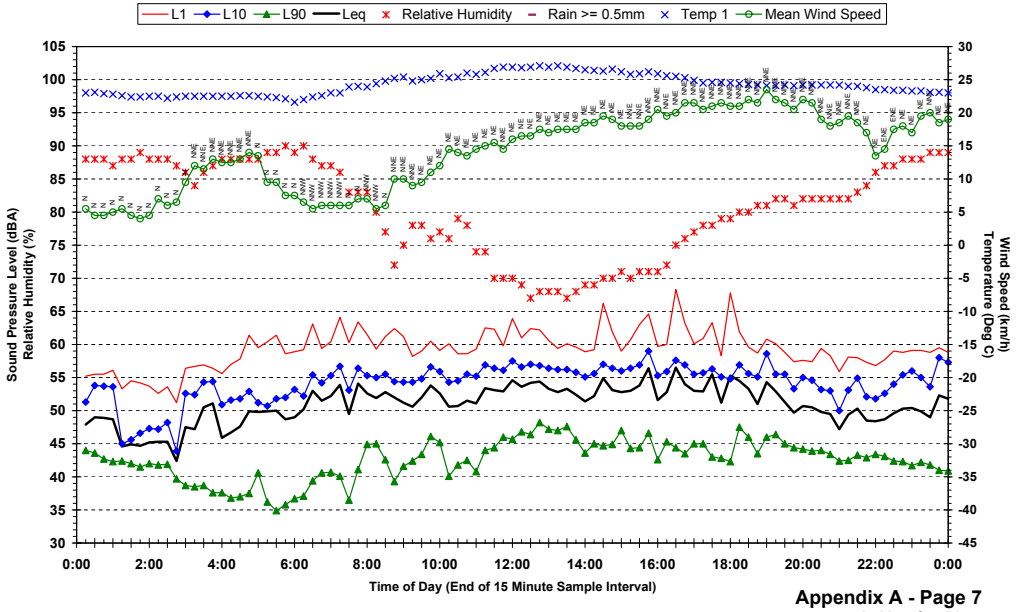
Appendix A - Page 5
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Op 3 - 5 Atkinson Road - Saturday 27 October 2007



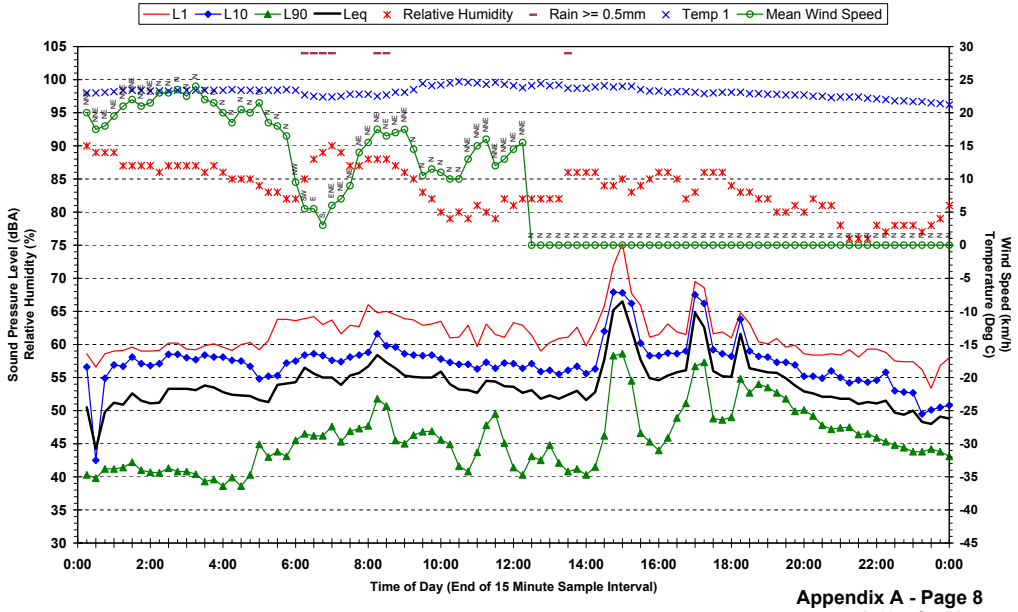
Appendix A - Page 6
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Op 3 - 5 Atkinson Road - Sunday 28 October 2007



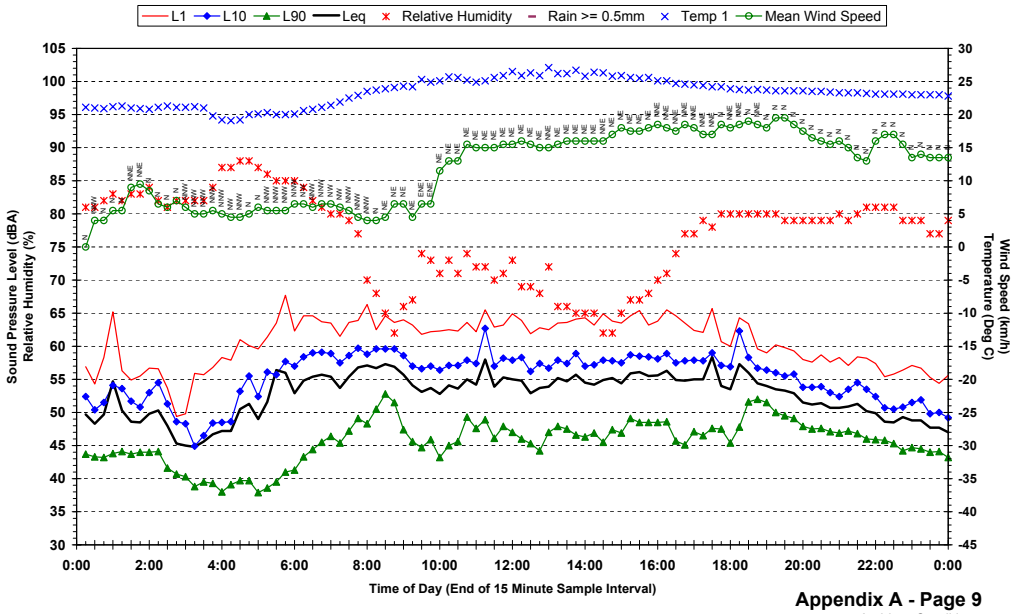
Appendix A - Page 7
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Op 3 - 5 Atkinson Road - Monday 29 October 2007

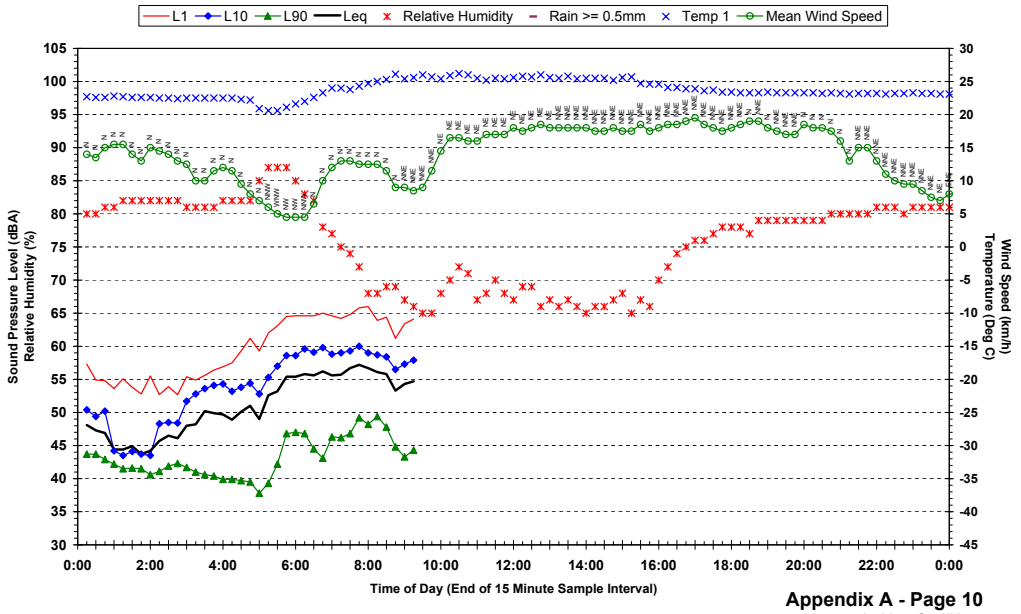


Appendix A - Page 8
Ambient Conditions
Heggies Report 20-1873

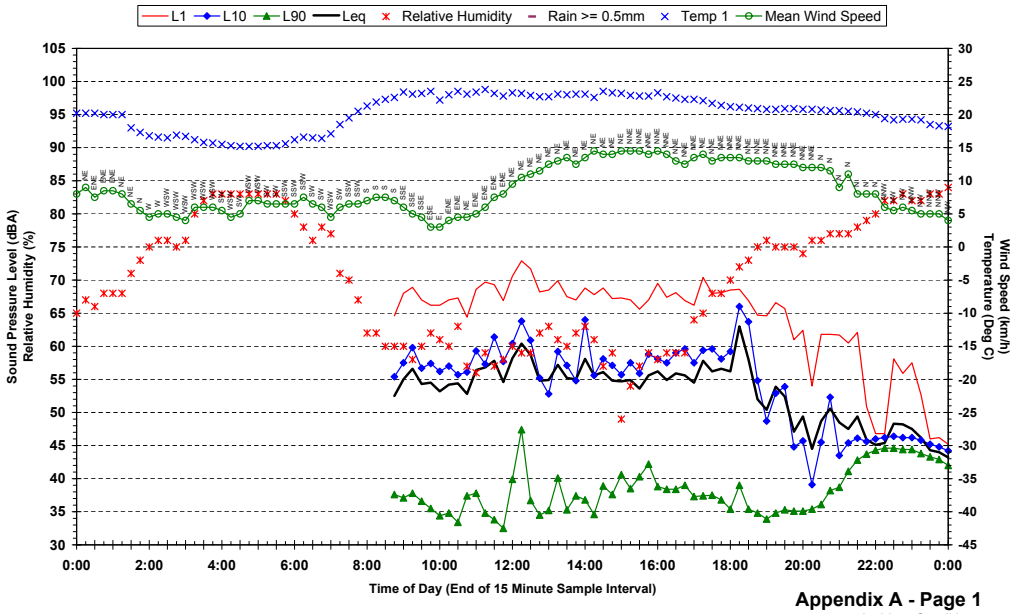
Statistical Ambient Noise Levels
20-1873 Op 3 - 5 Atkinson Road - Tuesday 30 October 2007



Statistical Ambient Noise Levels
20-1873 Op 3 - 5 Atkinson Road - Wednesday 31 October 2007

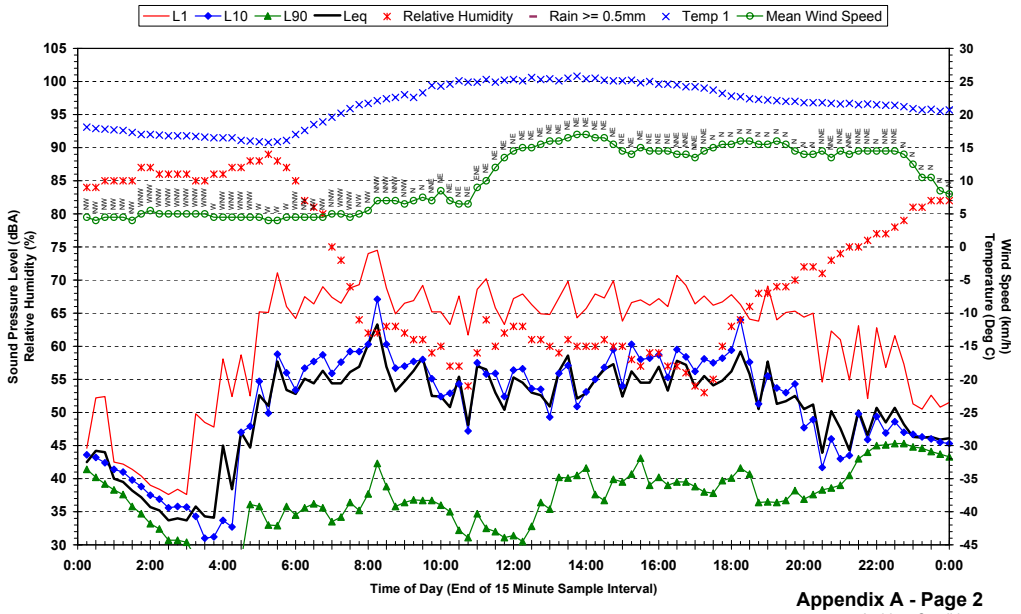


Statistical Ambient Noise Levels
20-1873 Op 4 - 415 Lake Macdonald Drive - Monday 22 October 2007



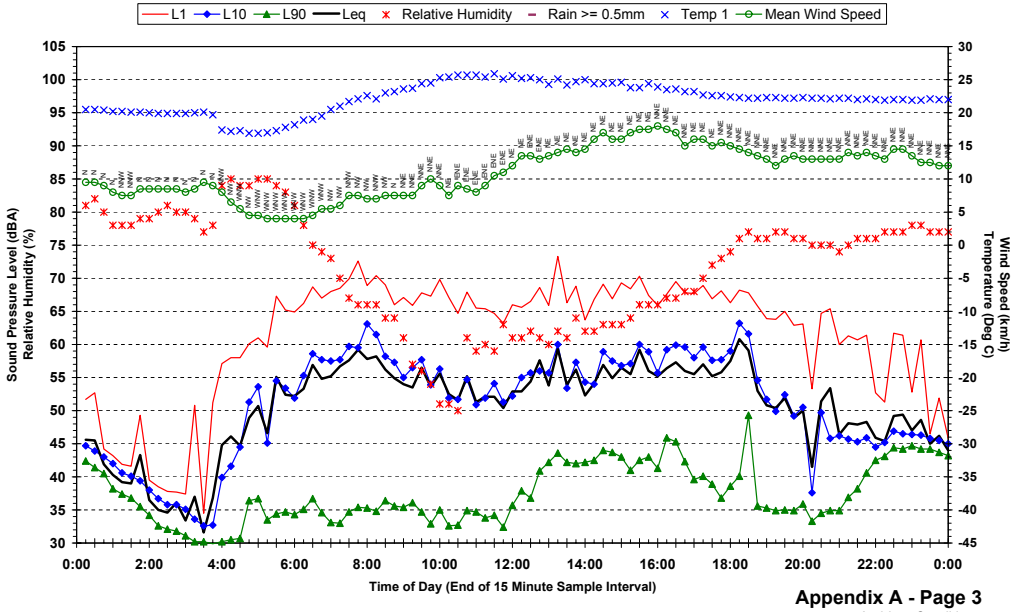
Appendix A - Page 1
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Op 4 - 415 Lake Macdonald Drive - Tuesday 23 October 2007



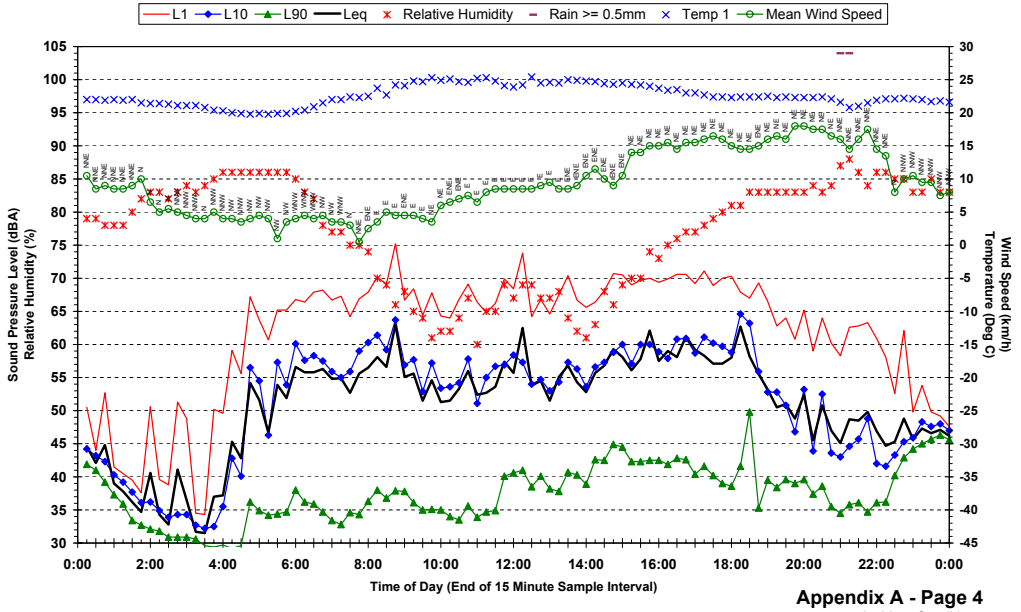
Appendix A - Page 2
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Op 4 - 415 Lake Macdonald Drive - Wednesday 24 October 2007



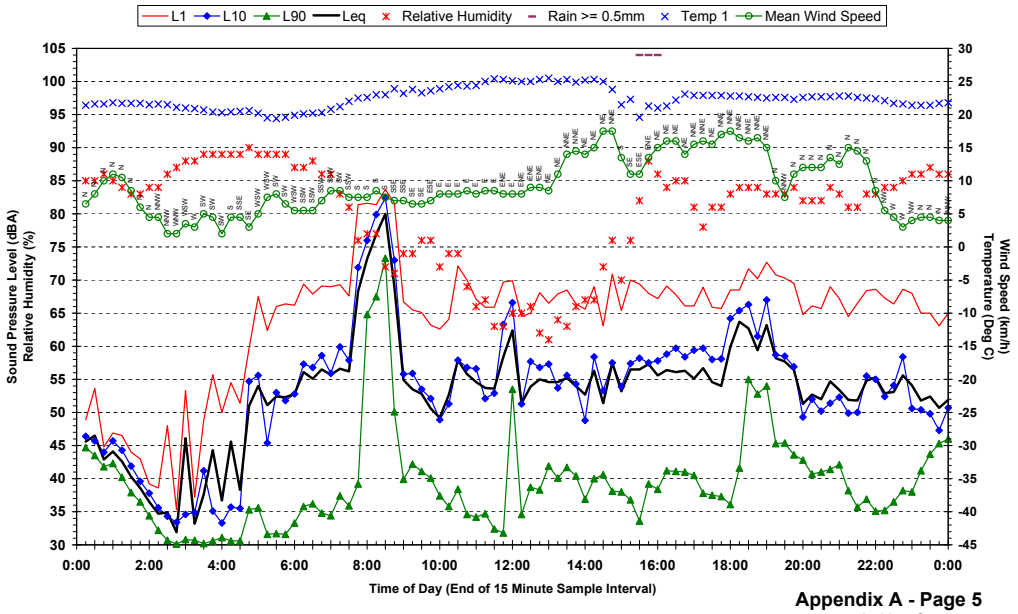
Appendix A - Page 3
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Op 4 - 415 Lake Macdonald Drive - Thursday 25 October 2007

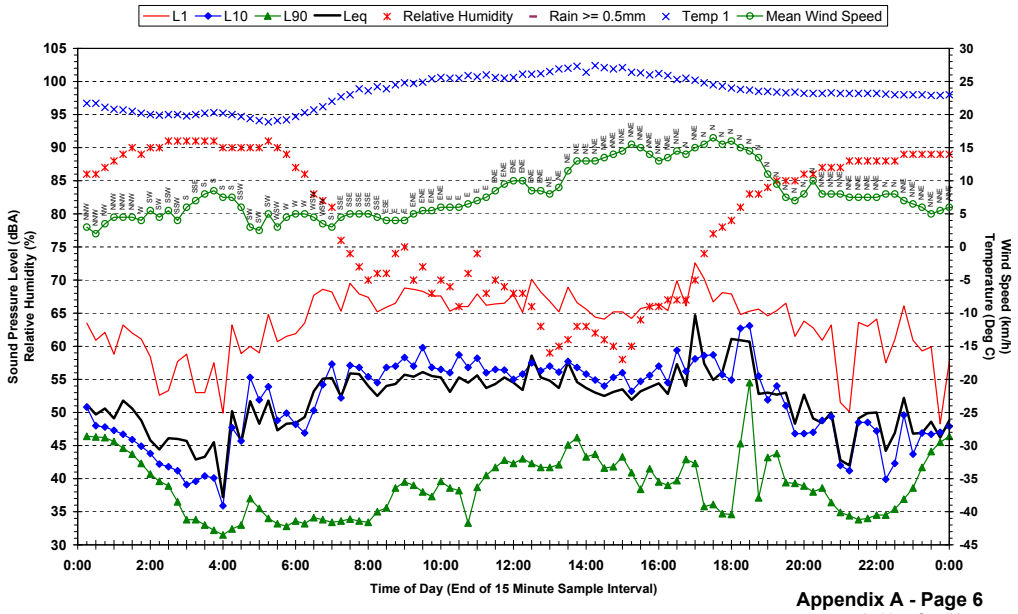


Appendix A - Page 4
Ambient Conditions
Heggies Report 20-1873

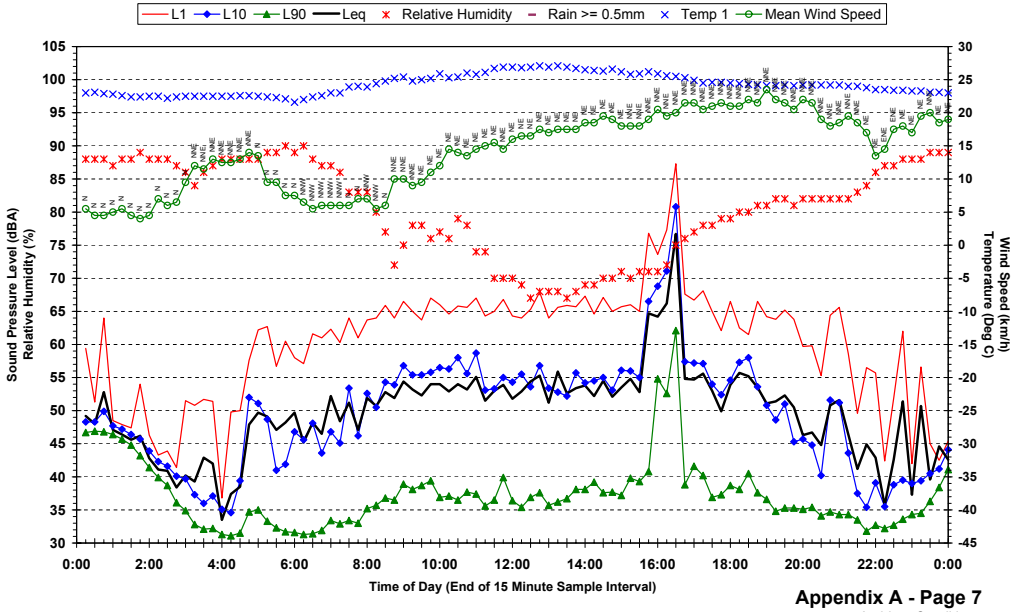
Statistical Ambient Noise Levels
20-1873 Op 4 - 415 Lake Macdonald Drive - Friday 26 October 2007



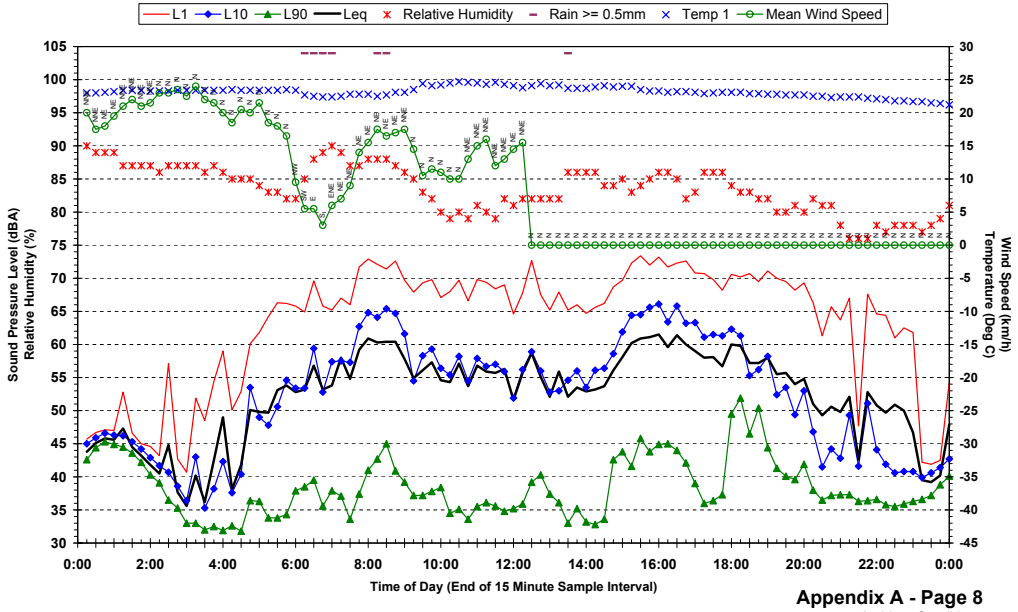
Statistical Ambient Noise Levels
20-1873 Op 4 - 415 Lake Macdonald Drive - Saturday 27 October 2007



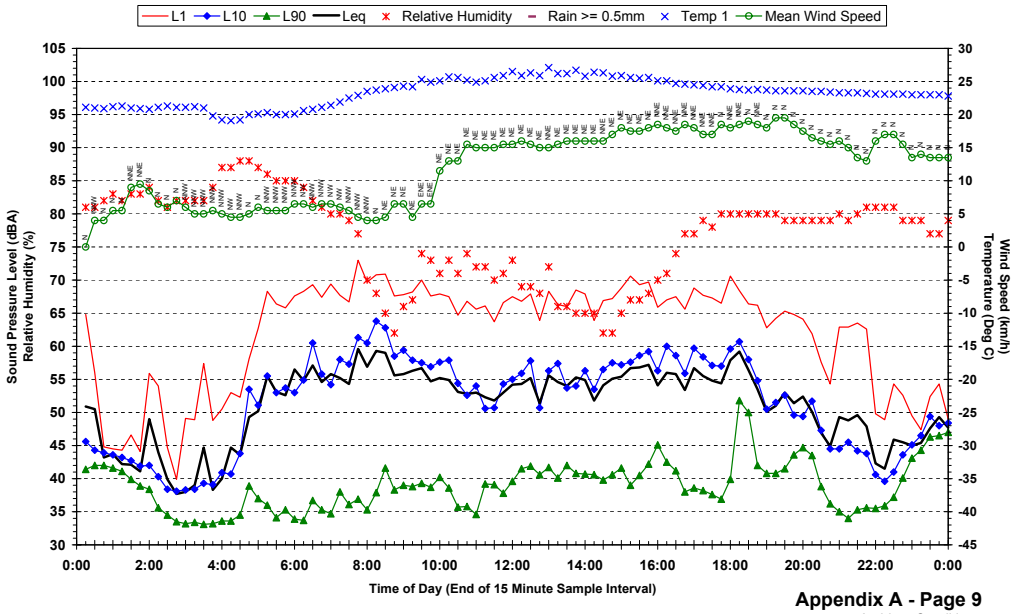
Statistical Ambient Noise Levels
20-1873 Op 4 - 415 Lake Macdonald Drive - Sunday 28 October 2007



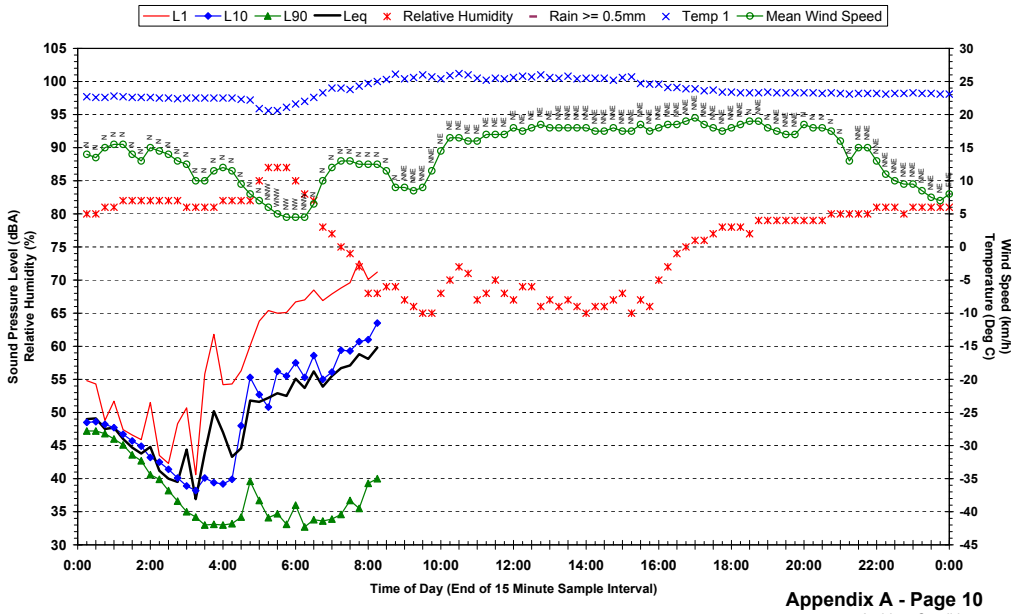
Statistical Ambient Noise Levels
20-1873 Op 4 - 415 Lake Macdonald Drive - Monday 29 October 2007



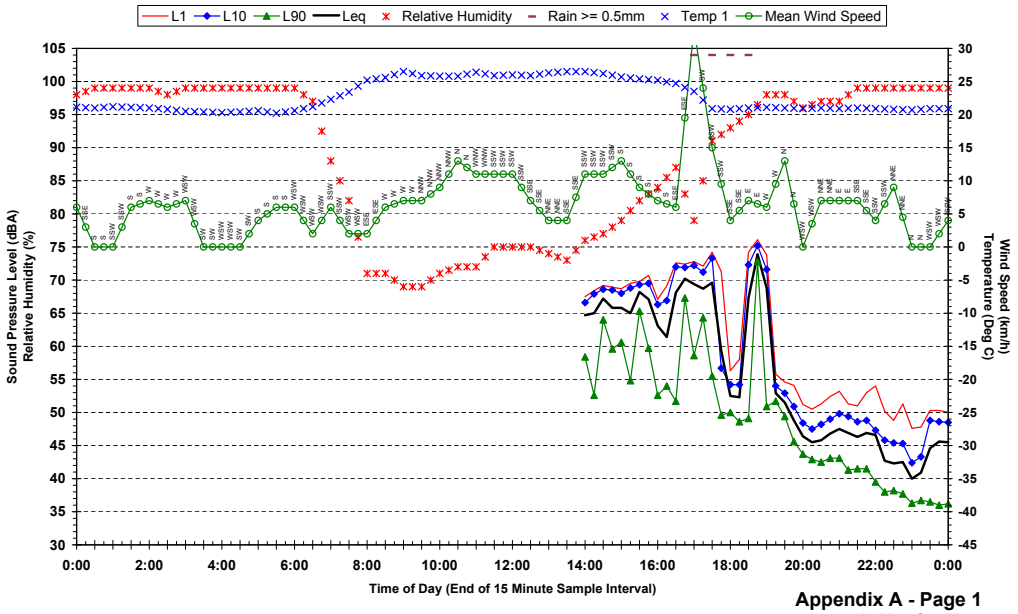
Statistical Ambient Noise Levels
20-1873 Op 4 - 415 Lake Macdonald Drive - Tuesday 30 October 2007



Statistical Ambient Noise Levels
20-1873 Op 4 - 415 Lake Macdonald Drive - Wednesday 31 October 2007

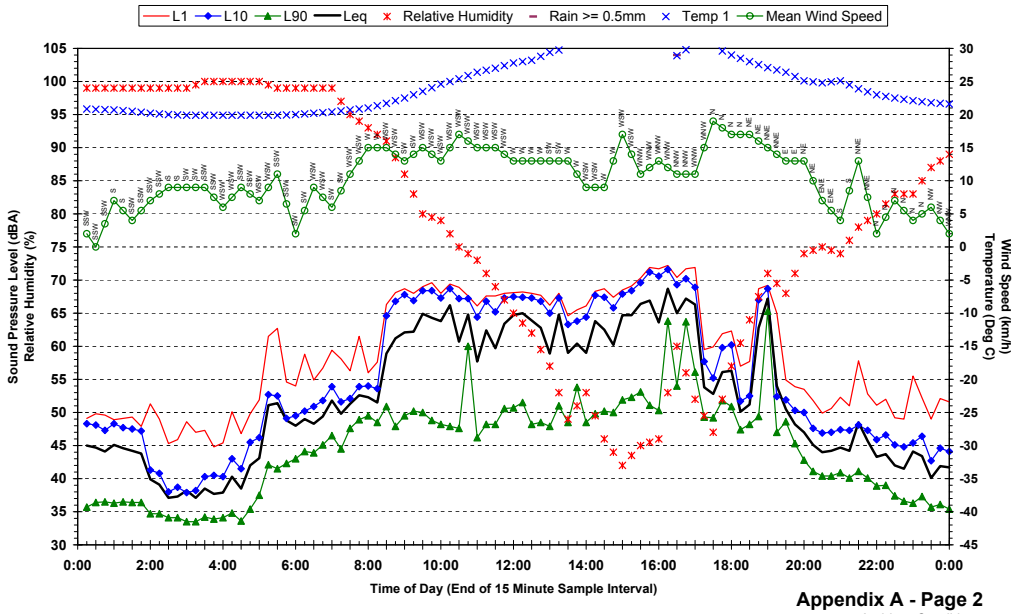


Statistical Ambient Noise Levels
20-1873 Con 10 - 6 Woombye-Palmwoods Road - Wednesday 6 February 2008



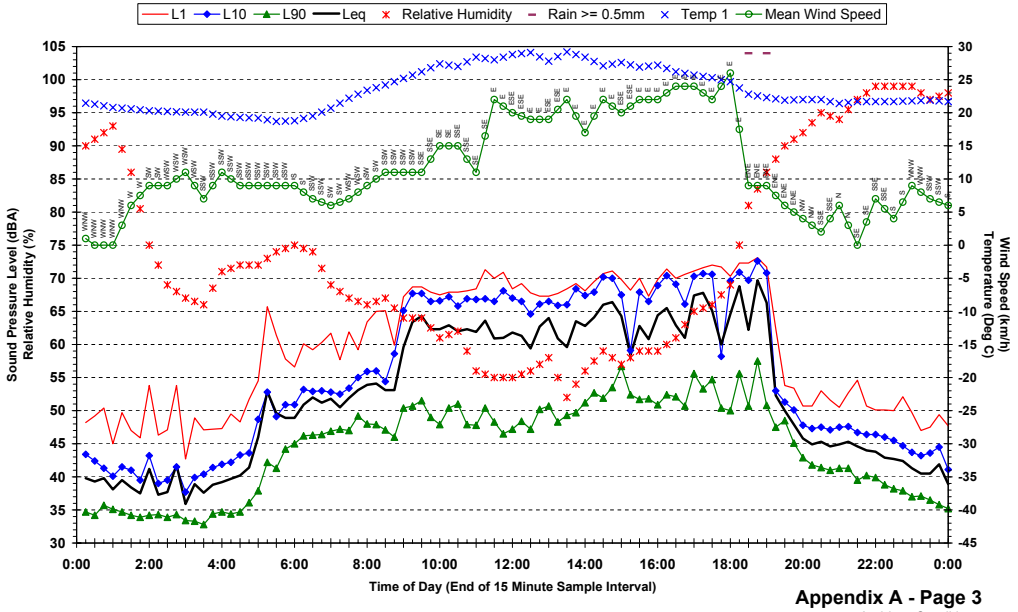
Appendix A - Page 1
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 10 - 6 Woombye-Palmwoods Road - Thursday 7 February 2008



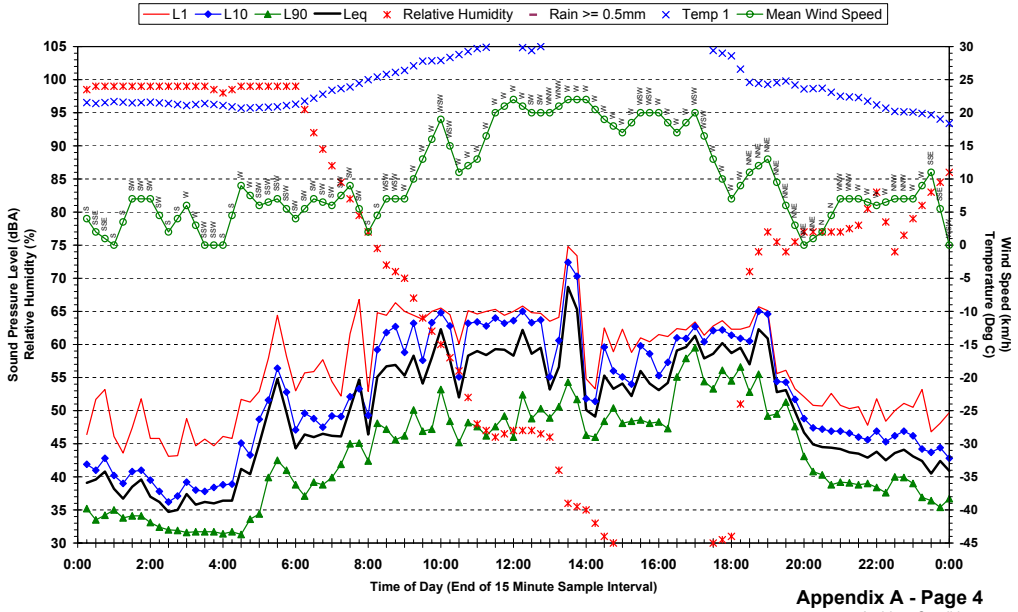
Appendix A - Page 2
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 10 - 6 Woombye-Palmwoods Road - Friday 8 February 2008



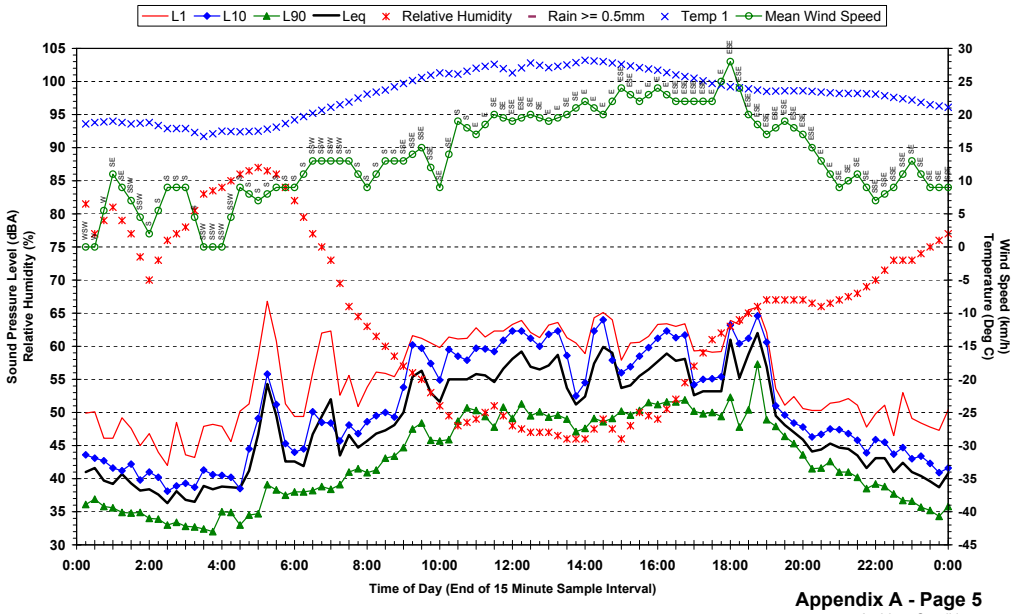
Appendix A - Page 3
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 10 - 6 Woombye-Palmwoods Road - Saturday 9 February 2008



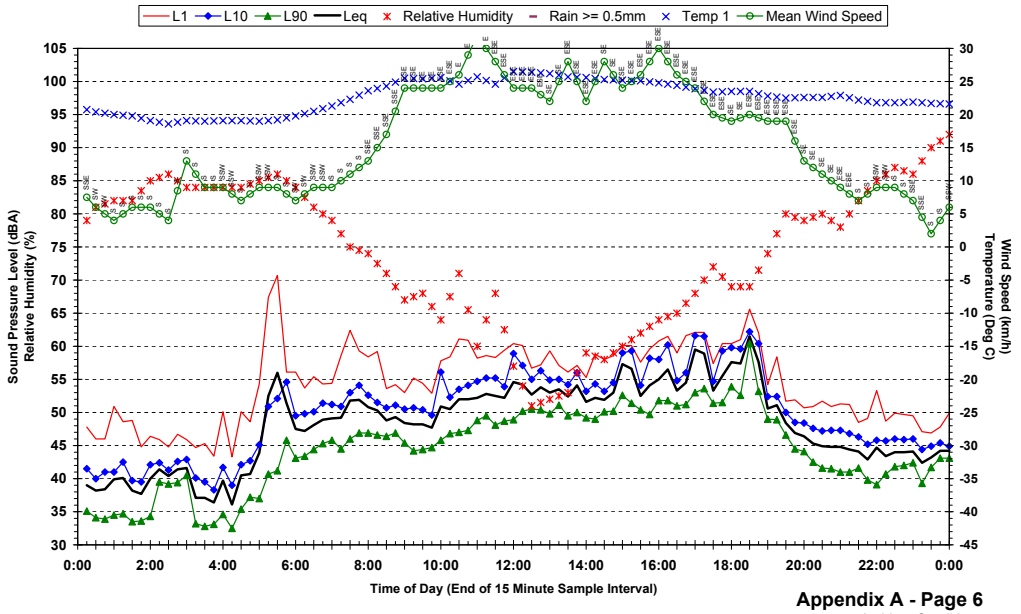
Appendix A - Page 4
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 10 - 6 Woombye-Palmwoods Road - Sunday 10 February 2008



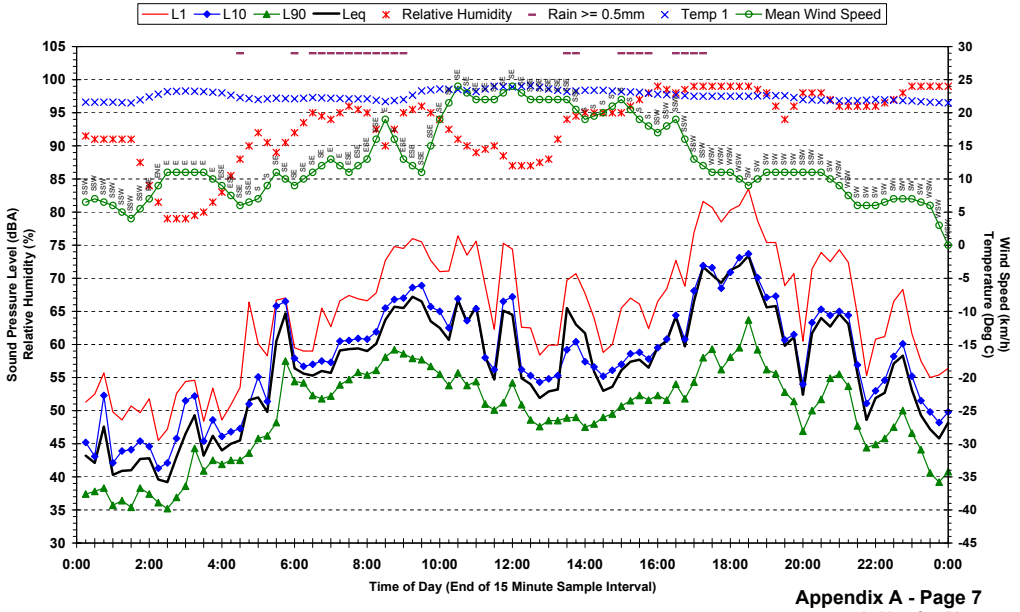
Appendix A - Page 5
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 10 - 6 Woombye-Palmwoods Road - Monday 11 February 2008



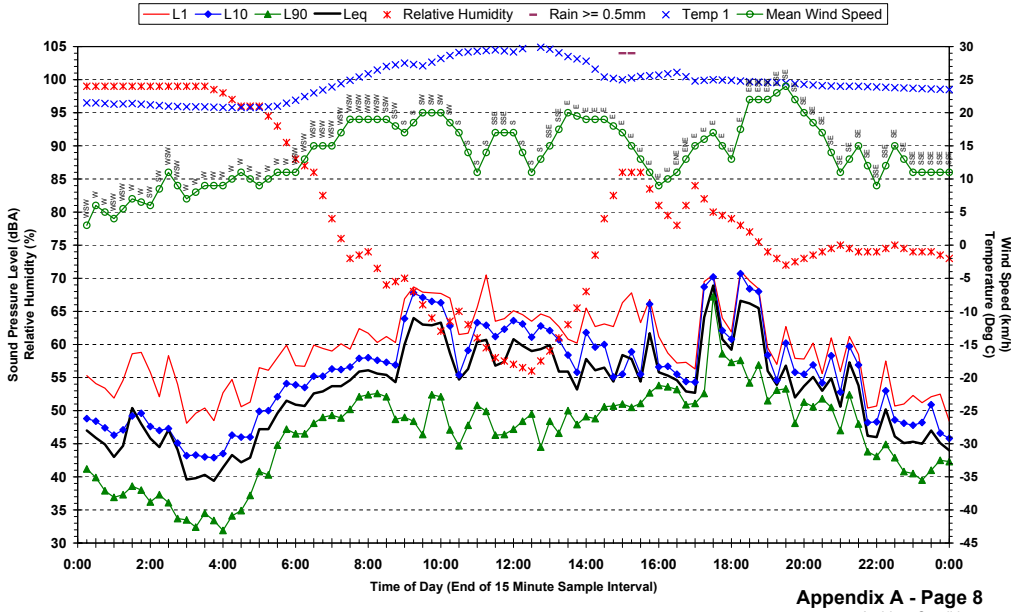
Appendix A - Page 6
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 10 - 6 Woombye-Palmwoods Road - Tuesday 12 February 2008



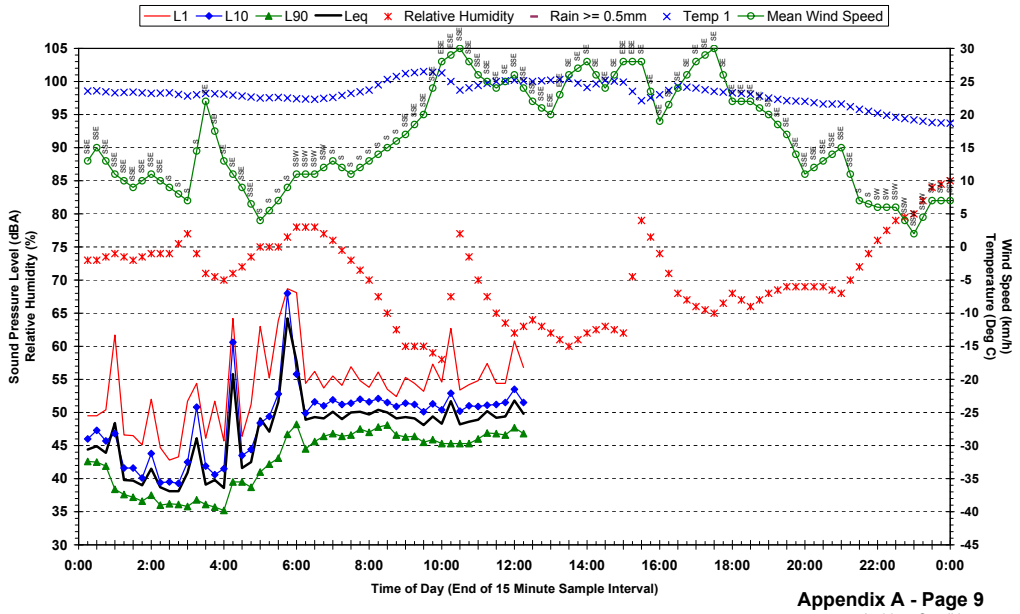
Appendix A - Page 7
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 10 - 6 Woombye-Palmwoods Road - Wednesday 13 February 2008

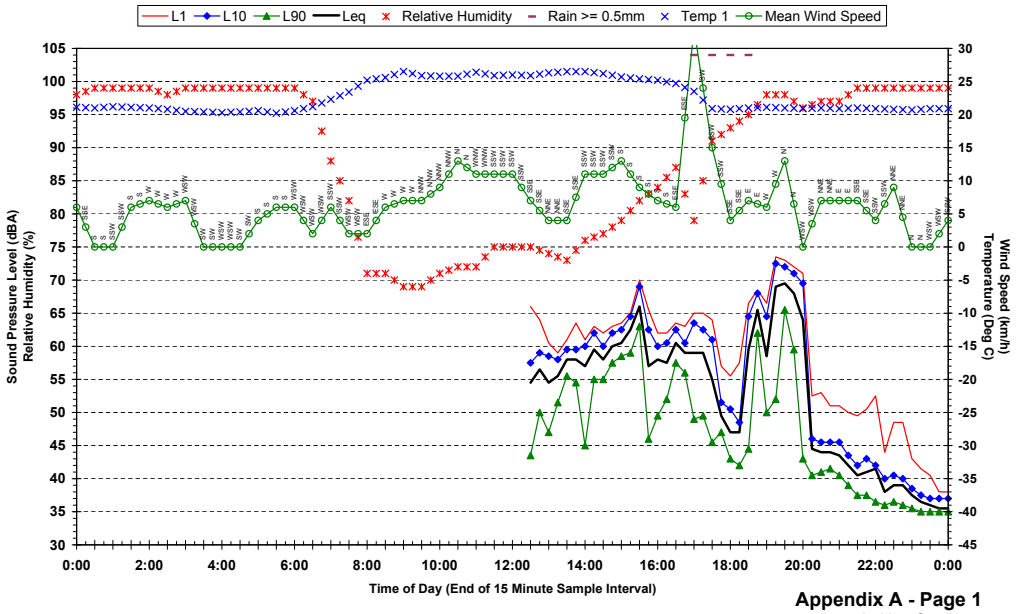


Appendix A - Page 8
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 10 - 6 Woombye-Palmwoods Road - Thursday 14 February 2008

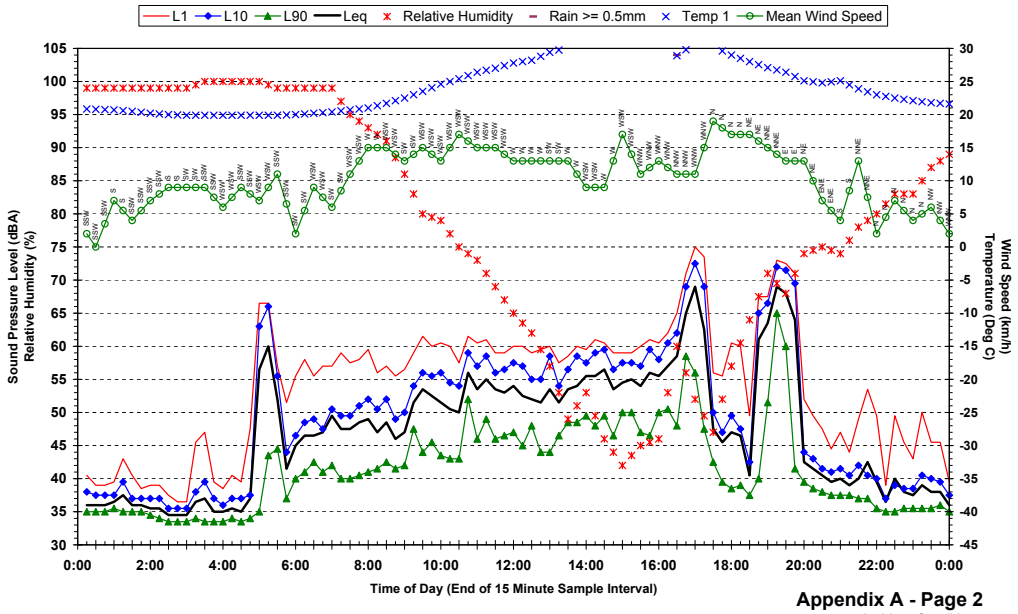


Statistical Ambient Noise Levels
20-1873 Con 11 - 102 Panorama Drive - Wednesday 6 February 2008



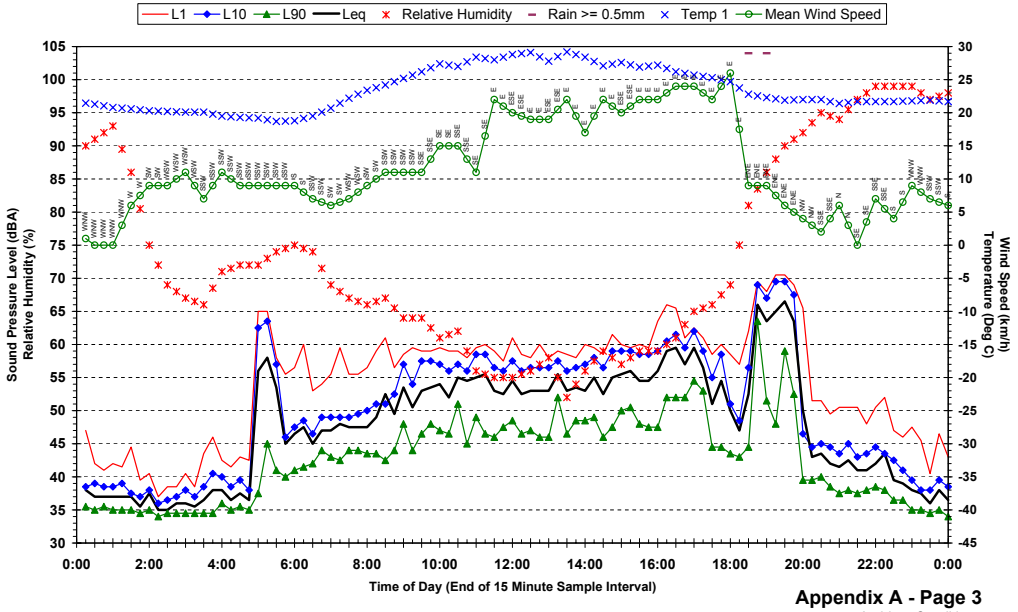
Appendix A - Page 1
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 11 - 102 Panorama Drive - Thursday 7 February 2008



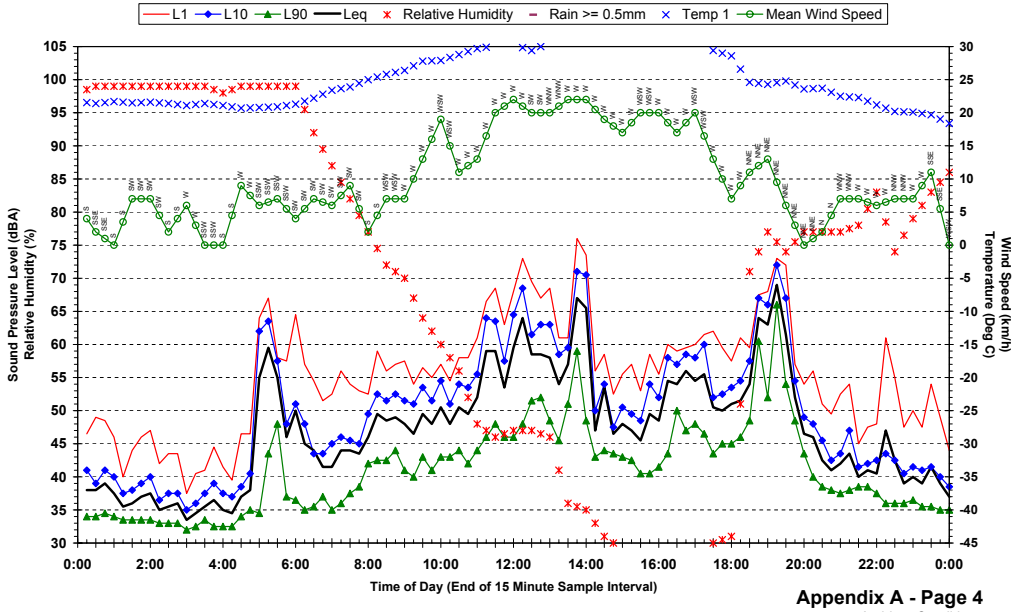
Appendix A - Page 2
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 11 - 102 Panorama Drive - Friday 8 February 2008



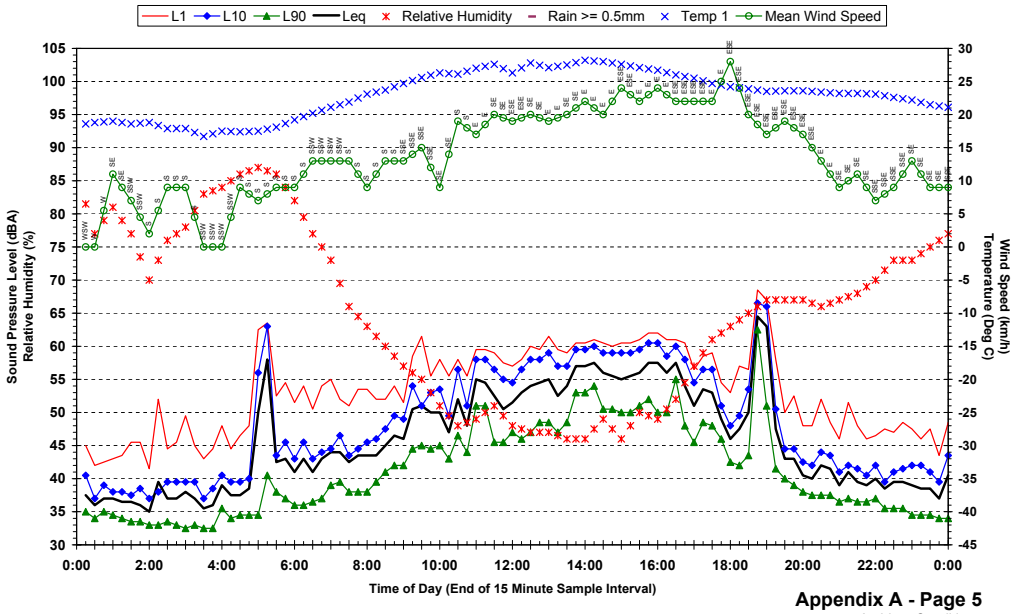
Appendix A - Page 3
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 11 - 102 Panorama Drive - Saturday 9 February 2008



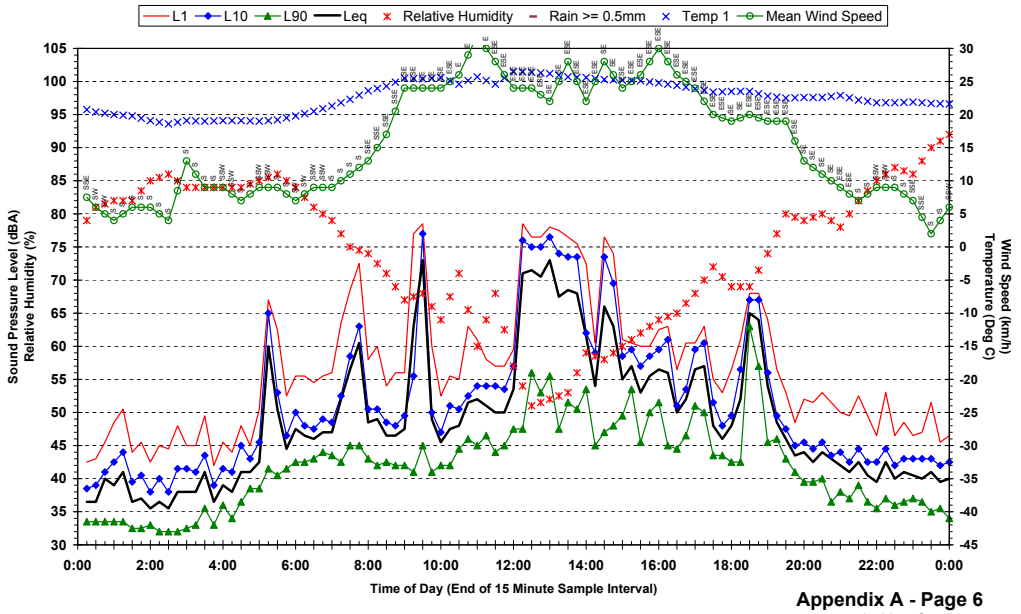
Appendix A - Page 4
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 11 - 102 Panorama Drive - Sunday 10 February 2008



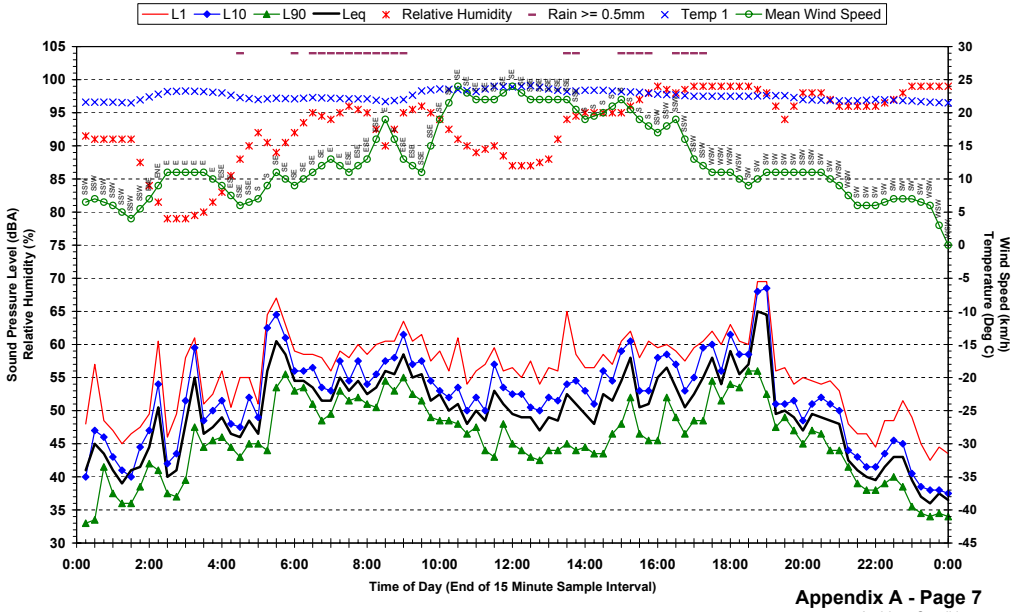
Appendix A - Page 5
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 11 - 102 Panorama Drive - Monday 11 February 2008



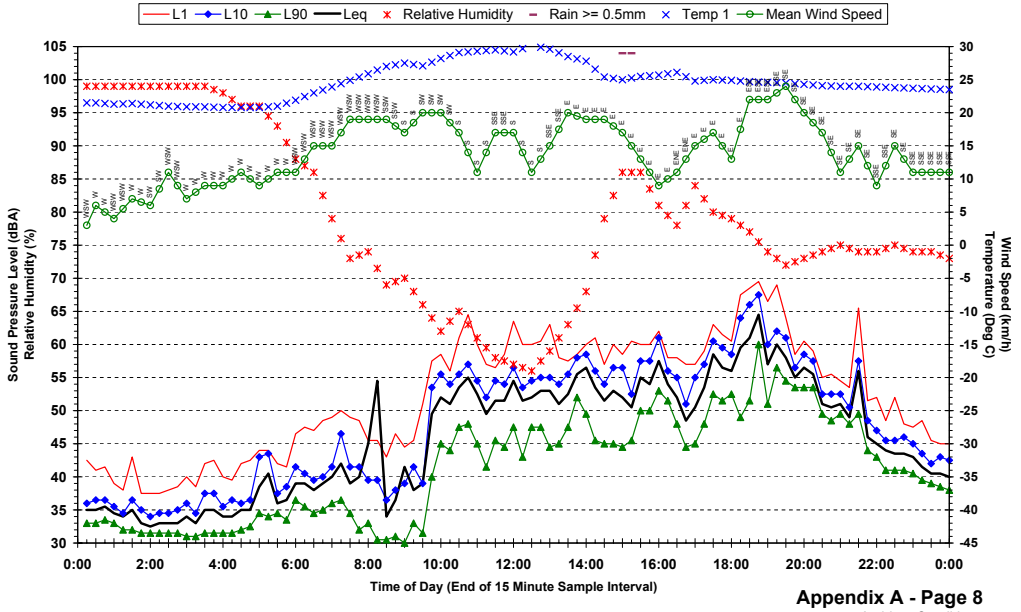
Appendix A - Page 6
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 11 - 102 Panorama Drive - Tuesday 12 February 2008



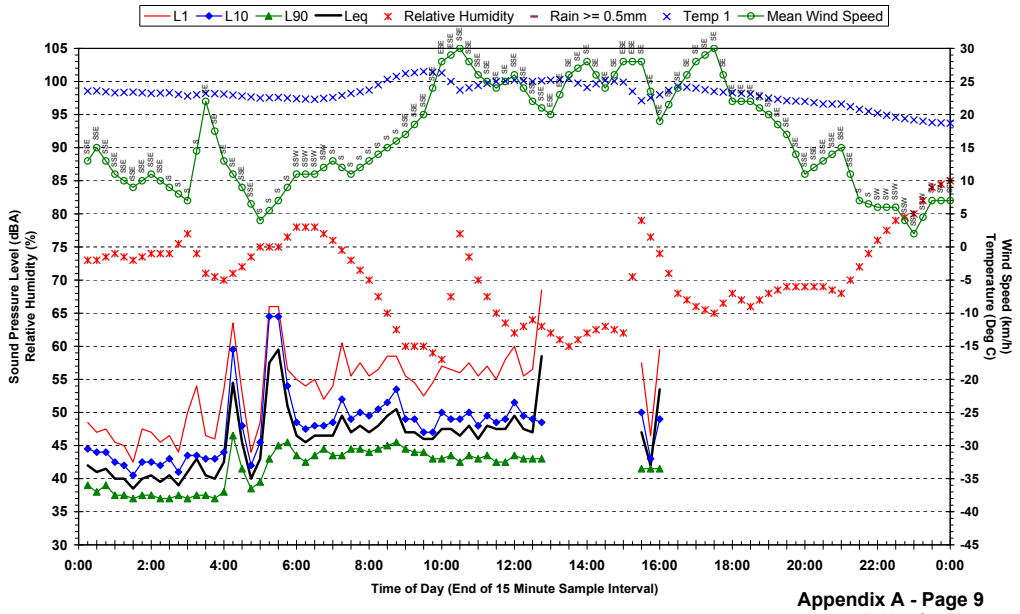
Appendix A - Page 7
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 11 - 102 Panorama Drive - Wednesday 13 February 2008

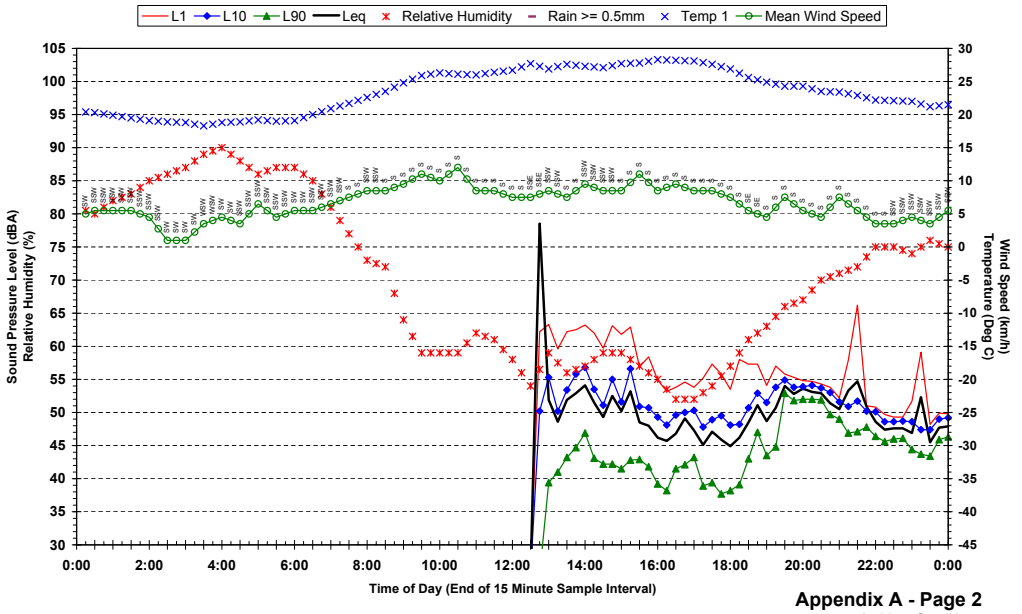


Appendix A - Page 8
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Con 11 - 102 Panorama Drive - Thursday 14 February 2008

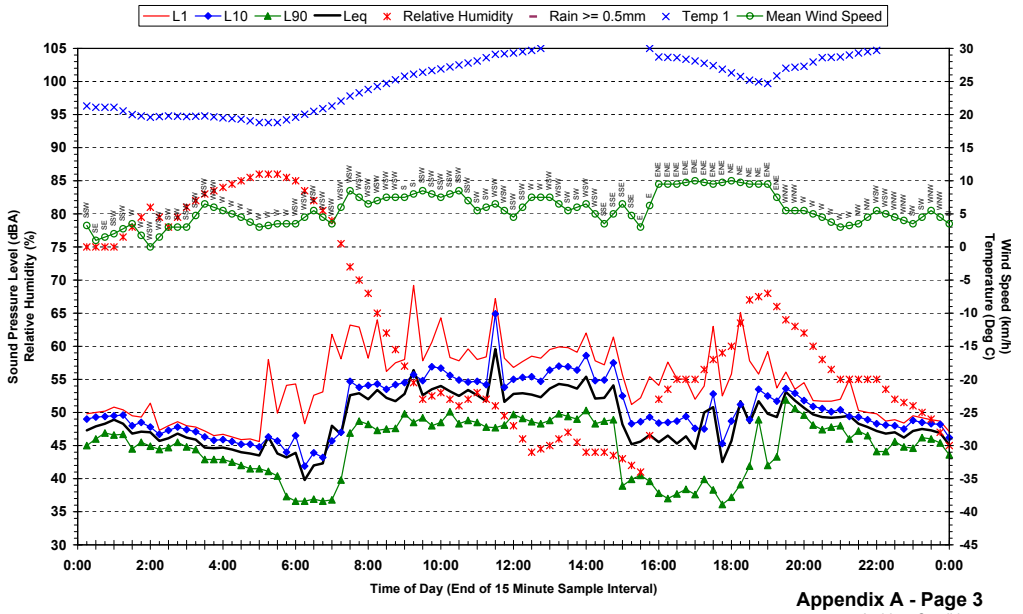


Statistical Ambient Noise Levels
20-1873 Op 5 - 300 Image Flat Road - Wednesday 20 February 2008



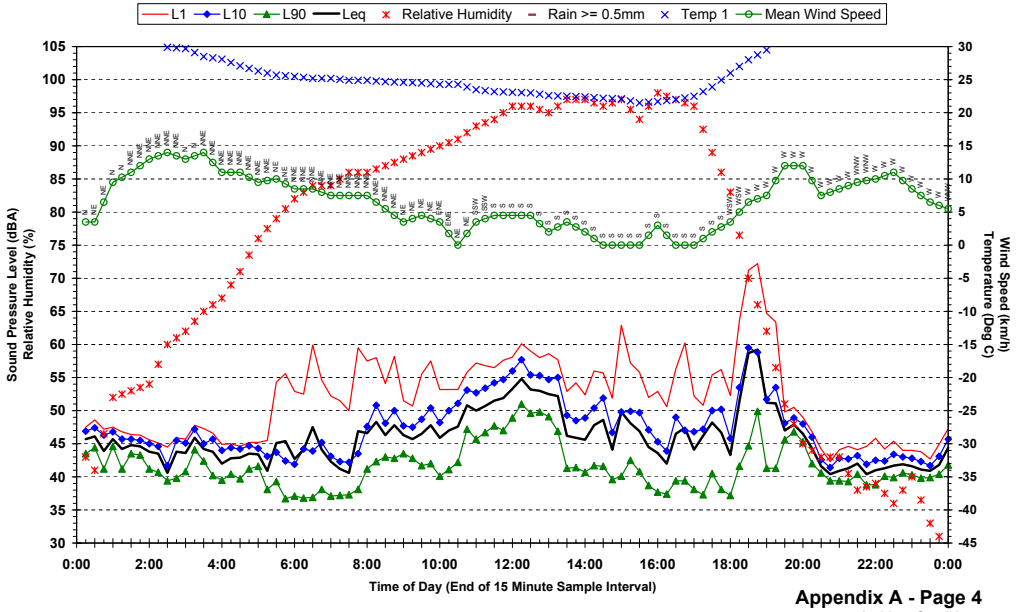
Appendix A - Page 2
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Op 5 - 300 Image Flat Road - Thursday 21 February 2008



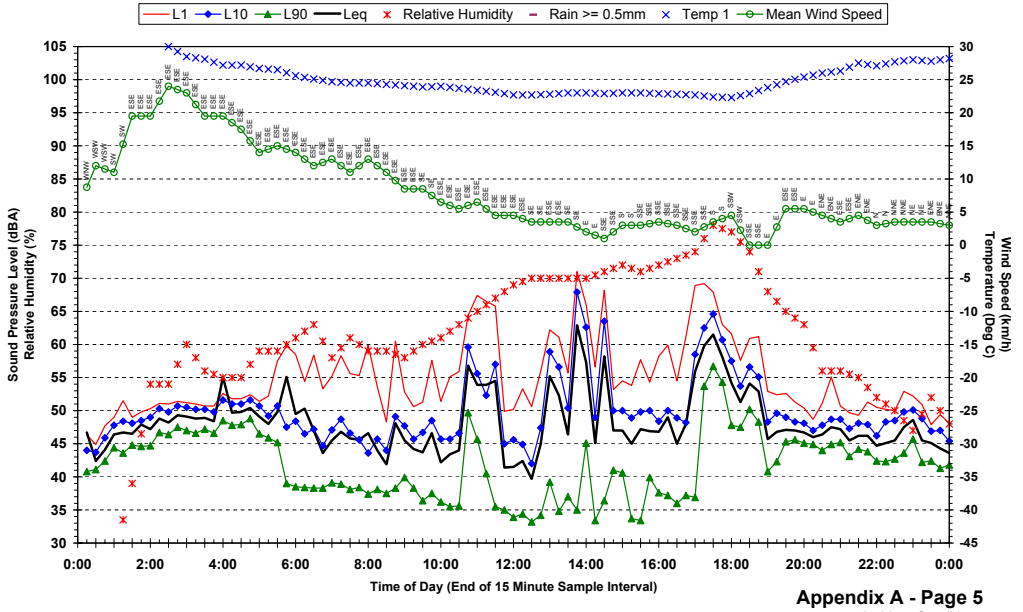
Appendix A - Page 3
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Op 5 - 300 Image Flat Road - Friday 22 February 2008



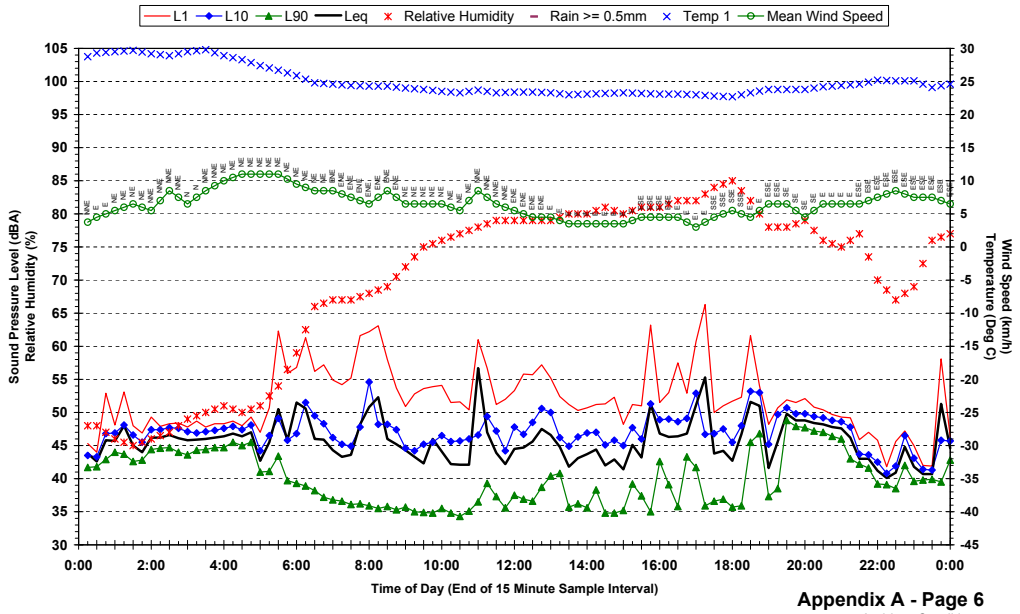
Appendix A - Page 4
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Op 5 - 300 Image Flat Road - Saturday 23 February 2008



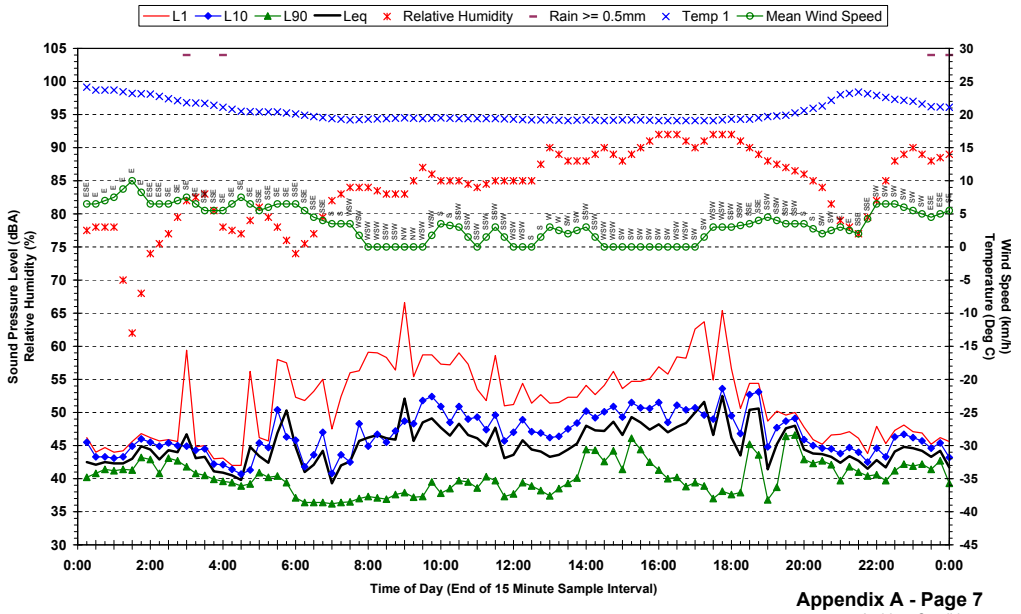
Appendix A - Page 5
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Op 5 - 300 Image Flat Road - Sunday 24 February 2008



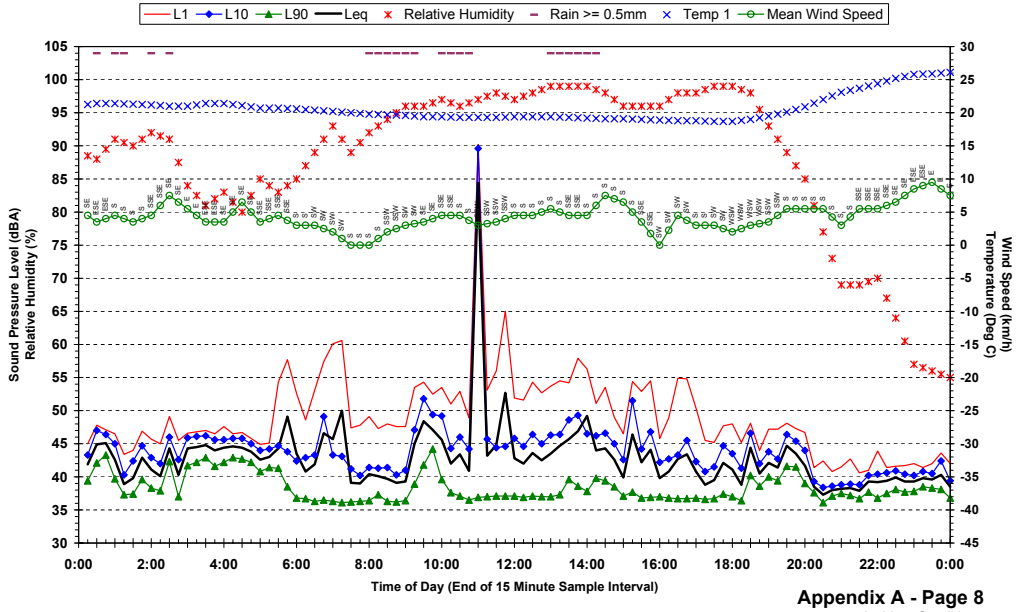
Appendix A - Page 6
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Op 5 - 300 Image Flat Road - Monday 25 February 2008

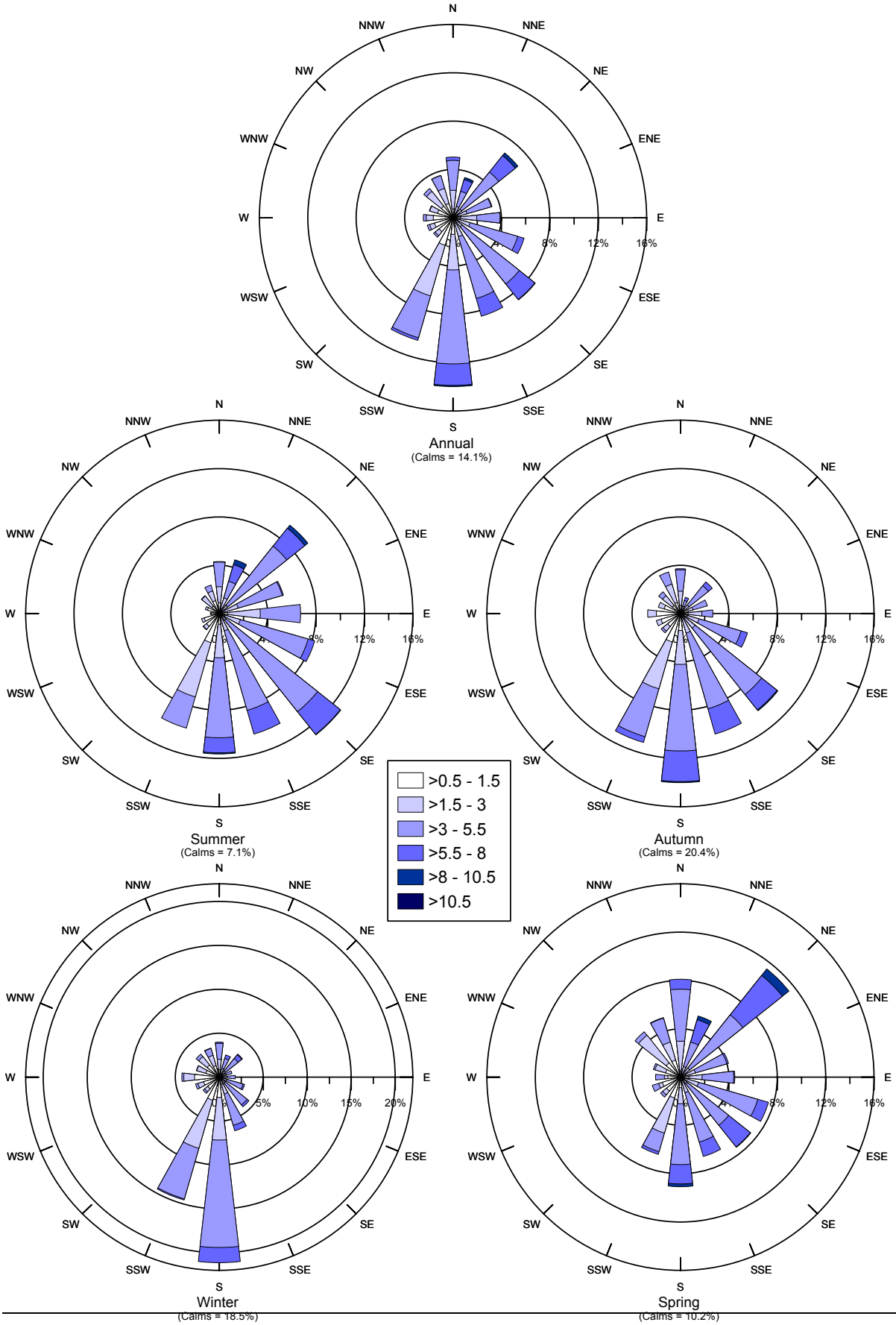


Appendix A - Page 7
Ambient Conditions
Heggies Report 20-1873

Statistical Ambient Noise Levels
20-1873 Op 5 - 300 Image Flat Road - Tuesday 26 February 2008



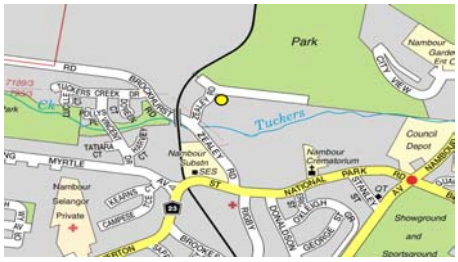
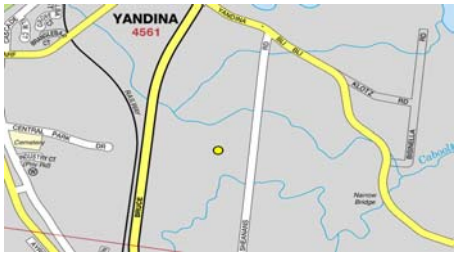
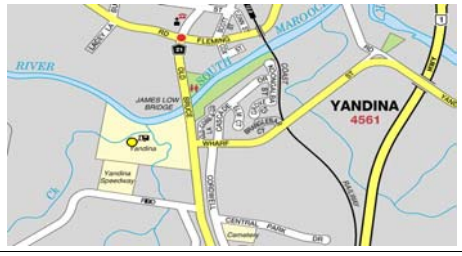
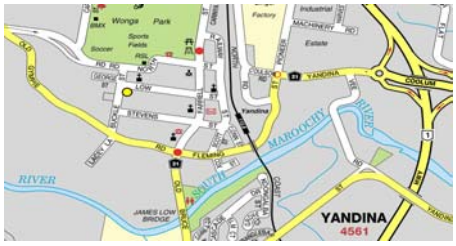
Appendix A - Page 8
Ambient Conditions
Heggies Report 20-1873

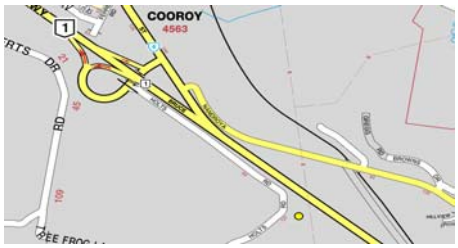
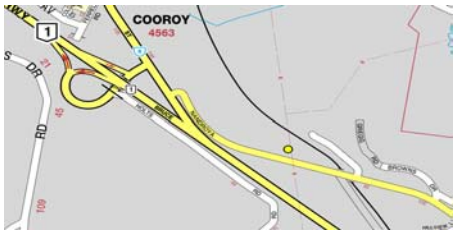
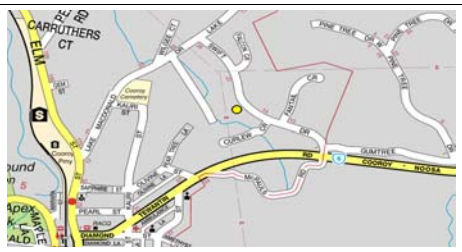
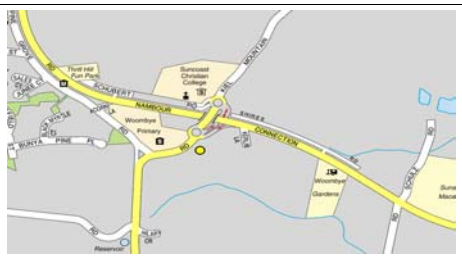
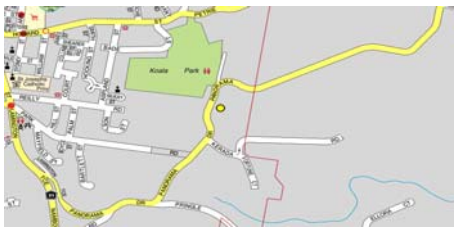
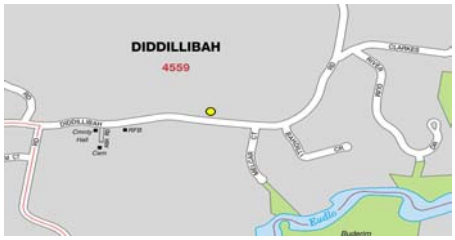

N
NNE
NE
ENE
E
ESE
SE
SSE
S
SSW
SW
WSW
W
WNW
NW
NNW
0%
4%
8%
12%
16%
Annual
(Calms = 14.1%)
Summer
(Calms = 7.1%)
Autumn
(Calms = 20.4%)
Winter
(Calms = 18.5%)
Spring
(Calms = 10.2%)
0%
5%
10%
15%
20%
>0.5 - 1.5
>1.5 - 3
>3 - 5.5
>5.5 - 8
>8 - 10.5
>10.5

Appendix C

Report 20-1873-R2

Summary of Ambient Noise Monitoring Locations

Location	Map	Photo
For Construction Phase		
Con 1 – Leafy Lane, Woombye		
Con 2 – 599 Petrie Creek Road, Rosemount		
Con 3 – Retirement Community, Zealey Road, Nambour		
Con 4 – 92 Sheanans Road, Yandina		
Con 5 – Yandina Caravan Park, Old Bruce Hwy, Yandina		
Con 6 – 2 Low Street, Yandina		

Con 7 – 121 Holts Road, Cooroy		
Con 8 – 39 Nandroya Road, Cooroy		
Con 9 - 19 Swift Drive, Cooroy		
Con 10 – 6 Woombye-Palmwoods Rd, Woombye		
Con 11 – 102 Panorama Drive, Nambour		
For Operational Phase		
Op 1 – Nobels Road, Mooloolah Valley		
Op 2 – 693 Diddillibah Road, Diddillibah		

Op 3 – 5 Atkinson Road, Bli Bli		
Op 4 – 415 Lake Macdonald Road, Lake Macdonald		
Op 5 – 300 Image Flat Road, Image Flat