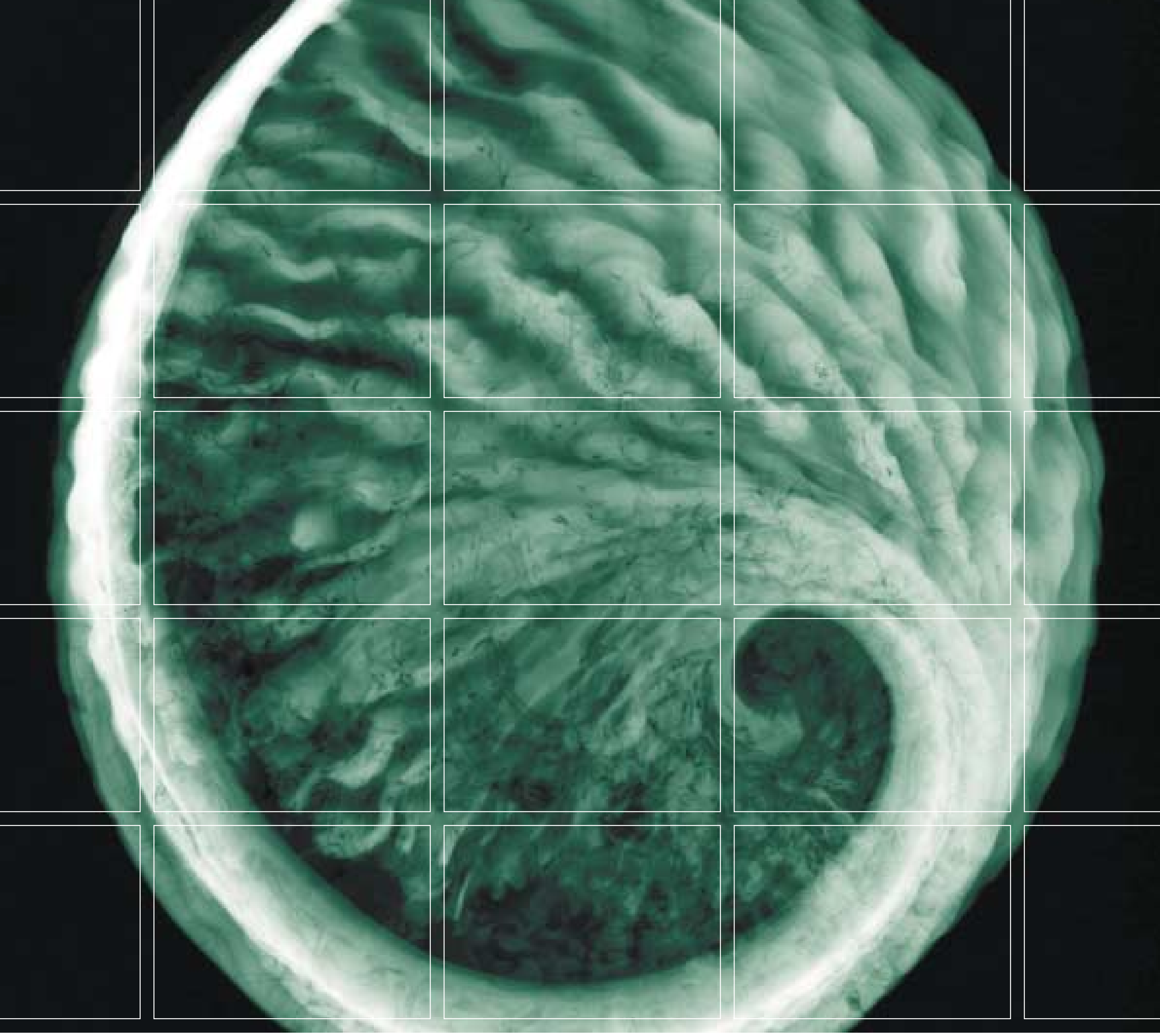

Storage & Distribution Centre Lenore Lane - Erskine Park

Acoustic Investigation

CSR

August 2006

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Position:	Project Director
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Storage & Distribution Centre Lenore Lane - Erskine Park

Acoustic Investigation

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Reference: 0053783RP1Final

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1 INTRODUCTION

This noise impact assessment has been prepared to accompany a Project Application for a Concept Plan and Stage 1 works applying to part of Lot 5 in DP1094504 at Lenore Lane, Erskine Park. Stage 1 works include earthworks and the construction and operation of a warehouse and distribution facility. The site is located south of Lenore Lane, Erskine Park, within the Penrith Local Government Area.

The site has an area of approximately 38 ha and is located in the CSR Limited's land holdings adjacent to Lenore Lane. The site is part of the Erskine Park Employment Area.

The site is south of Lenore Lane, bound by a Sydney Water pipeline to the south, by an approved industrial site to the north, proposed industrial site to the east, and land fill to the west.

Surrounding residences are located to the north within the residential area of Erskine Park, approximately 950m from the proposed warehouse and 350m from the closest earthworks area. Approximately 320m south of the site, beyond the water supply pipeline, is the Emmaus Retirement Village 'future' residences. Further south on Bakers Lane are the Emmaus Catholic College, Trinity Catholic Primary School and Mamre Christian College. Other existing residential receivers are a few isolated properties located north of and fronting Lenore Lane.

1.1 ACOUSTIC GLOSSARY

Environmental noise levels are commonly expressed in dB(A). The A-weighting scale follows the average human hearing response and enables comparison of the intensity of noise with different frequency characteristics. Noise from environmental sources such as vehicles often varies with time. For this reason, noise emission from such sources is often described in terms of statistical noise descriptors. The following descriptors are commonly used to assess noise:

- dB(A) Noise level measurement units are decibels (dB). The "A" weighting indicates that a filter has been applied to the measured results to mimic the human response to noise;
- L_{max} - The absolute maximum noise level in a noise sample;
- L_{10} - The noise level which is exceeded for 10 per cent of the time and is approximately the average of the maximum noise levels;

- L_{90} - The noise level exceeded for 90 per cent of the time and is approximately the average of the minimum noise levels. The L90 level is often referred to as the "background" noise level and is commonly used as a basis for determining noise criteria for assessment purposes;

- L_{eq} - This level represents the "equivalent" or average noise energy during a measurement period. The L_{eq} (24 hour) noise descriptor simply refers to the Leq noise level calculated over a 24 hour period. Indeed, any of the above noise descriptors may be defined in this way, with an accompanying time period (eg. L_{10} (20 minute)) as required;

- Sound Power Level Lw or SWL - This is a measure of the total power radiated by a source. The Sound Power of a source is a fundamental property of the source and is independent of the surrounding environment; and

- Lp - Sound Pressure Level - The level of sound pressure, expressed in decibels, as measured by a standard sound level meter with a microphone. This differs from Lw in that this is the received sound as opposed to the sound 'intensity'.

The following concepts offer qualitative guidance in respect of the average response to changes in noise levels:

- differences in noise level of less than approximately 2 dB are generally imperceptible in practice;

- differences in noise level of around 5 dB are considered to be significant;

- a difference in noise level of around 10 dB is generally perceived to be a doubling (or halving) of the loudness of the noise.

The NSW Environment Protection Authority (EPA) seeks to regulate noise from industrial noise sources through its Industrial Noise Policy (INP).

The INP includes a method for prescribing noise criteria for the purpose of assessing potential noise impacts from a source. This methodology is prescribed in terms of the measured "assessment background levels" and "rating background levels" of noise:

- ABL - The Assessment Background Level is the lowest tenth percentile value of the L_{90} levels measured for each day/evening/night assessment period respectively; and

- RBL - The Rating Background Level is defined as the overall single value representative background level for each of the day, evening and night periods respectively. The RBL is calculated as the median value of the corresponding ABL's (eg. for each night period of the monitoring cycle). RBL's account for temporal variation of background noise and are used in determining the intrusiveness criterion for industrial noise.

For industrial noise there are three assessment periods – Day/Evening/Night. **Day** is the time period from 7:00 am to 6:00 pm (Monday to Saturday) or 8:00 am to 6:00 pm on Sundays and public holidays. **Evening** is the time period from 6:00 pm to 10:00 pm. **Night** is the time period from 10:00 pm to 7:00 am (Monday to Saturday) or 10:00 pm to 8:00 am on Sundays and public holidays.

The Environmental Protection Authority's (EPA's) definition of an **Industrial Noise Source** is one that generally does not move from place to place, for example, a stationary source. Except where other more specific noise control guidelines apply (for example, construction activities, road or rail traffic, emergency diesel generators etc.) all industrial noise sources that are scheduled under the *Protection of the Environment Operations Act 1997* are considered to be industrial sources. In general, these include:

- rotating machinery;
- impacting mechanical sources;
- other mechanical equipment and machinery such as conveyors;
- mobile sources confined to a particular location, such as draglines and haul trucks.

Facilities, usually comprising many sources of sound including:

- industrial premises;
- extractive industries;
- commercial premises;
- -warehousing facilities; and
- -maintenance and repair facilities. (In this case, the industrial noise source is understood to encompass all the activities taking place within the property boundary of the facility).

For road traffic noise there are two assessment periods - Day and Night. **Day** is the time period from 7:00 am to 10:00 pm. Daytime noise descriptors often carry the 15hr identifier - eg. $L_{eq,15hr}$. **Night** is the time period from 10:00 pm to 7:00 am. Night time noise descriptors often carry the 9hr identifier - eg. $L_{eq,9hr}$.

1.2 *KEY NOISE ISSUES*

The main potential noise issues with respect to the proposal are broadly as follows:

- Noise from earthworks;
- Noise associated with the construction of the warehouse;
- Noise associated with the operation of the warehouse;
- Noise associated with the increased traffic to/from the site during construction and operation; and
- Cumulative noise from all existing and proposed industrial operations part of the larger development scheme (ie. Concept Plan) incorporating similar warehouse distribution operations.

The acoustic study focussed on the key issues and included noise measurement, derivation of suitable criteria in accordance with NSW Government's Industrial Noise Policy (INP) and recommendations for suitable mitigation such that residential properties are not adversely impacted. The assessment will also extend to traffic noise impact on residences in accordance with the Environmental Criteria for Road Traffic Noise (ECRTN).

2 *EXISTING NOISE ENVIRONMENT*

A key element in assessing environmental noise impact from industry is to quantify the ambient and background noise, including any existing industrial noise where relevant. From ERM's observations, the dominant noise sources at existing residential areas are related to construction activities and earthworks as well as traffic on Erskine Park Road and Mamre Road.

The existing acoustic environment was measured by means of both short-term attended and long-term unattended noise monitoring. Long term unattended noise monitoring was conducted in order to establish the level of ambient noise at residences surrounding the site. This was supplemented by attended noise monitoring to quantify the existing industrial and road traffic noise at potentially affected receivers.

Existing operating industry in the region is limited to a landfill west of the site. Limited observations during break in construction activities indicate that the landfill operations are not audible above road traffic noise at residential locations.

2.1 *LONG TERM UNATTENDED NOISE MONITORING*

During our site visit the noise from the on going construction activities in the area was audible at the Lenore Lane residences, which are expected to be potentially affected by future operations on site. Since construction noise does not represent the usual background noise levels present at these locations, long term monitoring could not be performed at these locations. In accordance with the guidance in the INP, noise logging was conducted at the nearest representative unaffected location.

The long term noise monitoring was conducted at two locations from 1 to 15 July 2005 as described in *Table 2.1* and shown in *Figure 2.1*.

It should be noted that the monitoring was conducted during school holidays. These were therefore compared to data measured during non-holiday periods in similar locations, part of studies for adjacent developments. Particularly the approved Coles Myer Distribution facility immediately east of the site.

For Lenore Lane, the resulting RBL values are consistent with that derived for neighbouring developments. The night RBL values are identical, whilst the day and evening RBLs are 1 dB lower (more conservative) in this study.

For Erskine Park residences, RBL values for the evening and night periods are at least 1 dB lower (more conservative) in this study, whilst the daytime RBL is the same or lower than that for St Clair residences used in other studies.

Table 2.1 Details of Long Term Monitoring Locations

ID	Location	Approximate Position with respect to the site	Approximate Position with respect to Lenore Lane
Location 1	1 Pisces Place, Erskine Park	950m North	900m North
Location 2	Emmaus Village, Bakers Lane, Erskine Park	400m South	1200m South

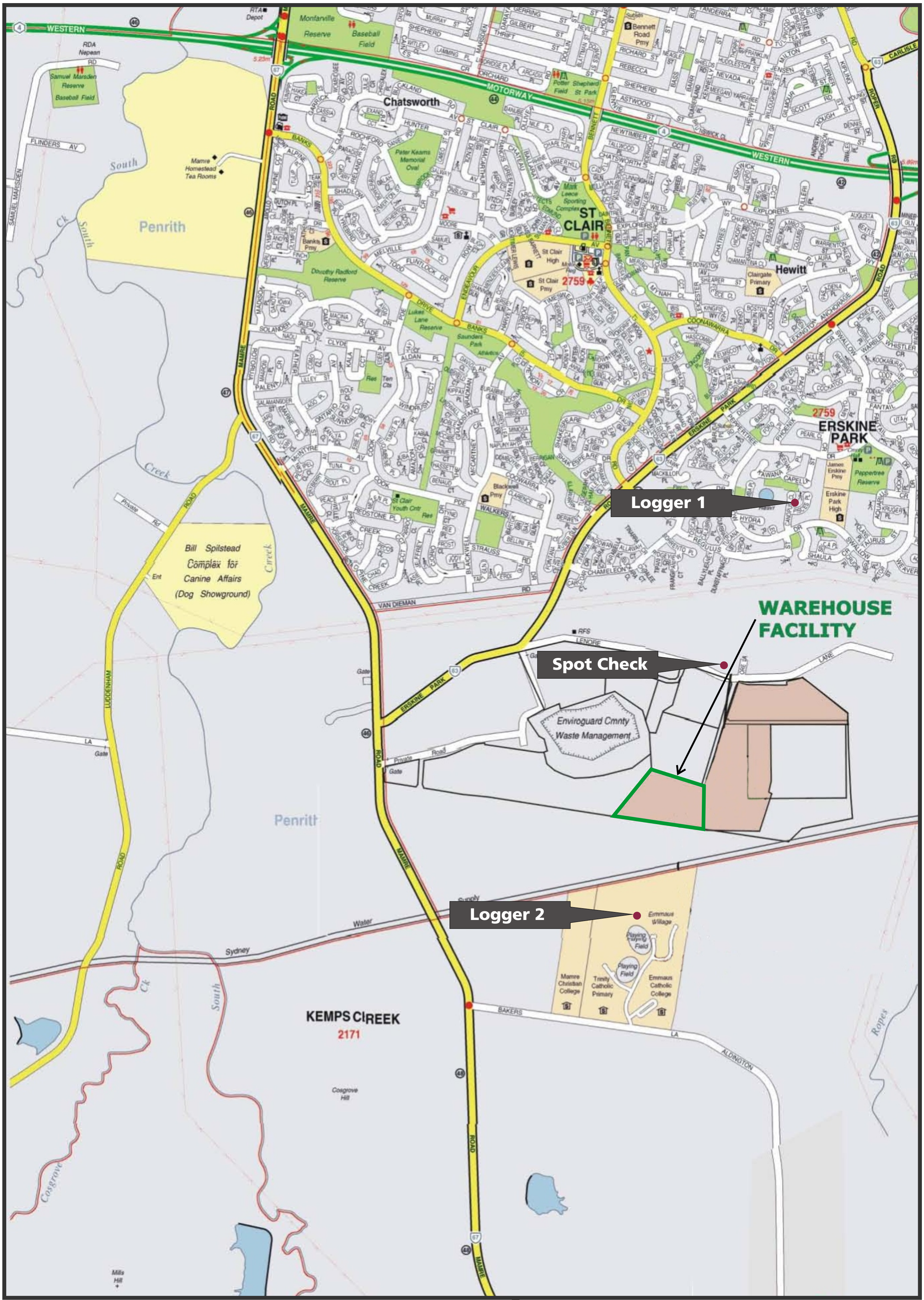

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Figure 2.1 **Site and Noise Monitoring Locations**

The Rating Background noise Levels (RBL) and ambient noise levels derived from long term noise monitoring at the two locations are summarised in *Table 2.2*. *Annex A* contains daily noise data and charts for each location. The measurement data was analysed in accordance with the INP, using weather data from the Bureau of Meteorology's Horsley Park station.

Table 2.2 Summary of Measured Background and Ambient Noise Levels

[1]Location	Rating Background Level			Ambient (L_{eq}) Noise Level		
	Day dB(A)	**Evening dB(A)**	**Night dB(A)**	**Day dB(A)**	**Evening dB(A)**	**Night dB(A)**
1. Pisces Place, Erskine Park	36	36	32	52	45	42
2. Emmaus Village, Bakers Lane, Erskine Park	38	37	33	54	42	44

1. Levels shown are weather excluded.

2.2 *SHORT TERM ATTENDED MONITORING*

In order to identify the current noise climate in the area, observations were made near the residences at Lenore Lane in the absence of any construction activity. These observations were supplemented by attended noise measurements to compare the background levels at Lenore Lane, with the long term data. The dominant noise source at Lenore Lane, in the absence of construction noise was observed to be road traffic noise from Erskine Park Road, Mamre Road and the M4 Motorway.

The attended 15 minute noise measurements at Lenore Lane are correlated with the unattended data in *Table 2.3*.

Table 2.3 Comparison of Noise Levels at different locations

Date and Time	Location ID	Location	Noise Monitoring Type	L_{90} Levels, dB(A)
01/07/2005 17:15-17:30	L1	1 Pisces Place, Erskine Park	Unattended long term logging	47
	L2	Emmaus Village, Bakers Lane, Erskine Park	Unattended long term Logging	42
	S1	Lenore Lane (Intersection of Lenore Lane and Ore Lane)	Attended 15 minute measurement	43
14/07/2005 23:30-23:45	L1	1 Pisces Place, Erskine Park	Unattended long term logging	33
	L2	Emmaus Village, Bakers Lane, Erskine Park	Unattended long term Logging	34
	S1	Lenore Lane (Intersection of Lenore Lane and Ore Lane)	Attended 15 minute measurement	32

Based on the above measurements, it is considered appropriate to adopt the data for 1 Pisces Place, Erskine Park as representative of Lenore Lane. The representative RBL values at Lenore Lane are therefore 36 dB(A), 36 dB(A) and 32 dB(A) for the day, evening and night respectively.

2.3 *PREVAILING WEATHER CONDITIONS*

The site's operational criteria are derived from the NSW Government Industrial Noise Policy (INP) which prescribes goals that are assessable under prevailing weather conditions.

The efficiency of noise propagation over long distances can be significantly affected by the weather conditions. Of most interest are source to receiver winds and the presence of temperature inversions as both these conditions can enhance received noise levels. To account for these phenomena the EPA in their INP specify weather analysis procedures to determine the prevalent weather conditions that enhance noise propagation with a view to determining whether they can be described as a feature of the project area.

In this study one year's half-hourly weather data from the Bureau of Meteorology's weather station at Horsley Park was analysed. This was done in accordance with the procedures defined in the INP, and as otherwise advised by the EPA.

2.3.1 *Prevailing Winds*

The INP recommends consideration of wind effects if they are a "feature" of the area.

The INP defines "feature" as the presence of source-to-receiver wind speed (measured at 10 m above ground level) of 3 m/s or less, occurring for 30% of the time in any assessment period and season.

This is further clarified by defining source-to-receiver wind direction as being the directional component of wind. The INP states that where wind is identified to be feature of the area then assessment of noise impacts should consider the highest wind speed below 3 m/s, which is considered to prevail for at least 30% of the time.

A thorough review of the vector components of the hal-hourly wind data described above was undertaken. The INP assessable wind directions are graphically demonstrated in *Annex B*, where the windrose arm approaches or exceeds the 30% threshold as indicated by the rose.

It is demonstrated that assessable source-to-receiver winds do not occur during day and evening assessment periods but do occur during the night time assessment period. Hence, winds are considered a feature of the area only during the night time.

2.3.2 *Temperature Inversions*

The INP states that the assessment of the impact of temperature inversions be confined to the night time noise assessment period where temperature inversions occur. Appendix F of the Industrial Noise Policy (INP) states (with respect to the percentage occurrence of stability class F during winter nights):

"It is recommended that locations that are approaching a 30 percent occurrence level as well as those locations that either equal or exceed the 30 percent level be considered when assessing the effects of temperature inversions on noise levels."

No information on the prevalence of temperature inversions for the region has been obtained. For the purposes of this assessment, it will be conservatively assumed that a temperature inversion of 3°C/100m occurs on more than 30% of winter nights, in accordance with the guidance in the INP.

3 NOISE CRITERIA

3.1 OPERATIONAL NOISE

3.1.1 *Industrial Noise Criteria*

The NSW Government's INP stipulates guidelines for assessment of noise from the operation of industrial facilities.

Assessment criteria for residences potentially affected by noise from industries should achieve the following objectives:

1. protection of the community from excessive intrusive noise; and
2. preservation of the amenity for specific land uses.

Both criteria need to be met.

3.1.2 *Residential Intrusiveness*

The intrusiveness criterion requires that the $L_{Aeq,15min}$ noise levels from the newly-introduced source during each of the day, evening and night time periods do not exceed the existing rating background noise levels (RBL) by more than 5dB at the most affected noise sensitive location. *Table 3.1* shows the derived project specific noise criteria.

Table 3.1 Intrusiveness Noise Criteria

Receiver No	Location	Criterion, $L_{eq,15minute}$ dB(A)		
		Day	Evening	Night
1	1 Pisces Place, Erskine Park	41	41	37
2	Emmaus Village, Baker Lane	43	42	38
3	Residence on Lenore Lane	41	41	37

1. Criteria are based on the Existing Background Noise levels presented in *Table 4.2*.

3.1.3 *Amenity*

The INP stipulates acceptable and maximum noise levels from all industry consistent with maintaining amenity for specific land uses. The acceptable target noise levels are presented in *Table 3.2* for each assessment period and for appropriate surrounding land uses. In this case the 'suburban' category has been applied to determine the target noise levels at the existing residences. Also presented are goals for school classrooms that apply to the teaching facilities on Bakers Lane, Erskine Park.

Table 3.2 ***Noise Amenity Targets for Specific Land Uses***

Residential Land use	Target acceptable amenity industrial noise levels, dB(A)$L_{eq,period}$		
	Day	**Evening**	**Night**
Suburban	55	45	40
Urban	60	50	45
School classroom - internal	35 - 40 Noisiest 1-hour when in use		

1. These target levels apply to the total noise attributable to all industrial sites (as scheduled in the Protection of Environment (Operations) Act).

In this case, given that the existing industrial noise does not approach the targets, the suggested amenity levels have been applied unmodified. However, consideration to possible future developments has been given as described in the cumulative noise section later. Both the amenity and intrusiveness criteria apply to the project. *Table 3.3* summarises the applicable criteria.

Table 3.3 ***Project Specific Noise Criteria***

		RBL, dB(A)	Intrusiveness, dB(A) $L_{eq,15min}$	Amenity (Suburban), dB(A) $L_{eq,period}$	Project Specific Level, dB(A)
Location 1	Day	36	41	55	41
	Evening	36	41	45	41
	Night	32	37	40	37
Location 2	Day	38	43	55	43
	Evening	37	42	45	42
	Night	33	38	40	38
Location 3	Day	36	41	55	41
	Evening	36	41	45	41
	Night	32	37	40	37

3.1.4 Sleep Disturbance

The INP criteria are appropriate for assessing noise from continuous and intermittent sources, such as engine noise from mobile plant and general processing plant and equipment. However, transient noise sources such as reversing alarms also require assessment.

Given the transient nature of these events, the L_{eq} noise level from such sources would not be representative since the noise in question may not be present for much of the time. Hence, the above criteria are not appropriate for this type of noise.

The most important effect of these transient noises would be the possibility of disturbing the sleep of nearby residents. The EPA's Environmental Noise Control Manual (ENCM) indicates that to prevent sleep disturbance, the $L_{1,1min}$ noise level from an intrusive source should not exceed the background noise level by more than 15 dB. More recent advice from the EPA has confirmed that the Lmax descriptor is to be used in lieu of the $L_{1,1min}$. On this basis, the maximum noise level from any operational event should not exceed the levels shown in *Table 3.4*.

Table 3.4 ***Project Specific Sleep Disturbance Noise Criteria***

Receiver No	Location	Lmax Criteria, dB(A)
1	1 Pisces Place, Erskine Park	47
2	Emmaus Village, Bakers Lane, Erskine Park	48
3	Lenore Lane	47

1. Criteria are based on the Existing Background Noise levels presented in *Table 2.2*.
2. Sleep disturbance criteria apply during the night assessment period only.
3. Criteria are assessable at the façade of the most affected sleeping area.

However, this criterion does not take account of more recent research on the effects on sleep of road traffic noise. The EPA's Environmental Criteria for Road Traffic Noise (ECRTN) policy indicates that maximum noise levels below 50 - 55dB(A) inside residences from road traffic sources are unlikely to cause awakening reactions. If bedroom windows are partly open, this corresponds to an external maximum noise level of approximately **60 - 65 dB(A)** outside a residence.

In our experience, adopting the former more stringent criterion would be desirable in the first instance, and if exceedances are predicted, consideration should be given to the potential number of such events and the more recent research above.

3.2 CONSTRUCTION NOISE CRITERIA

3.2.1 Level Restriction

Construction noise is explicitly excluded from the EPA's INP, and the assessment criteria for construction noise set out in the Environmental Noise Control Manual ENCM (EPA, 1994) will be used. These are expressed in terms of the L_{10} level of noise from the construction site. The criteria depend on the existing background noise level at the assessment location and apply to residential premises only.

The EPA's criteria for noise from construction sites are assessed at residential properties:

- for construction periods of four weeks and under, the L_{10} noise level due to the construction site should not exceed the existing L_{90} background noise level by more than 20 dB;

- for construction periods of between four and 26 weeks, the L_{10} noise level due to the construction site should not exceed the existing L_{90} background noise level by more than 10 dB; and

It is generally understood that for construction periods greater than 26 weeks, the L_{10} noise level due to the construction site should not exceed the existing L_{90} background noise level by more than 5 dB, which is comparable to the operational intrusiveness noise criteria.

The assessment will focus on the earthworks, construction of the warehouse and associated concrete works. The total construction period is expected to be less than 6 months. Based on the rating background noise levels determined in *Table 2.2*, *Table 3.5* details the construction noise criteria for the proposal.

Table 3.5 Daytime Construction Noise Criteria

Receiver No	Location	Construction noise criteria, $L_{10,15minute}$ dB(A)
1	1 Pisces Place, Erskine Park	46
2	Emmaus Village, Bakers Lane, Erskine Park	48
3	Lenore Lane	46

1. Criteria are based on the Existing Background Noise levels presented in *Table 2.2*.

3.2.2 Time Restriction

ENCM also specifies time limits for construction activities where construction noise is audible at residential premises, and are outlined below:

- Monday to Friday, 7:00 am to 6:00 pm;

- Saturday, 8:00 am to 1:00 pm, otherwise 7:00 am to 1:00 pm if inaudible at residential premises; and

- no construction on Sundays or public holidays.

The proposed construction hours will be 7am to 6pm Monday to Friday and 7am to 1pm Saturdays. Where construction that will be audible at residential locations outside these hours is necessary, a separate permit will be required specific to those activities. It is often the case that if construction noise is inaudible at residences, then works can occur outside these times.

3.3 *ROAD TRAFFIC NOISE*

The potential impacts of traffic noise resulting from both the construction and operational related traffic on public roads are assessed against criteria defined in the NSW *Government's Environmental Criteria for Road Traffic Noise* (ECRTN).

Site related traffic will use routes that are currently relatively heavily trafficked and part of the broader road network. Within closer proximity to the site, residences that could be affected by site related traffic are the few isolated existing properties of Lenore Lane.

The upgrade of Lenore Lane to a four lane (dual carriageway) industrial standard collector road is near completion. This is to cater for the future expansion of industrial land uses (including this proposal) and therefore will increasingly carry a higher volume of traffic with a relatively large proportion of heavy vehicles. Further, it is understood that Development Applications for similar developments that will use Lenore Lane are being considered or approved. Site related traffic and associated noise will therefore be similar to these developments, once operational.

Section 2.2 of the NSW *Government's Environmental Criteria for Road Traffic Noise* (ECRTN) states that some industries are, by necessity, in locations that are often not served by arterial roads. Heavy vehicles must be able to get to their bases of operation, and this may mean travelling on local roads. To this end, the concept of 'principal haulage routes' has been endorsed by the then Department of Urban Affairs and Planning's North Coast Extractive Industries Standing Committee. Where local authorities identify a 'principal haulage route', the noise criteria for the route should be at least as high as those for collector roads, recognising the intent that they carry a different level and mix of traffic to say local roads. Thus, although Lenore Lane can currently be classified as a local road, it can be identified as a 'principal haulage route' for the proposed developments. Further, following the approved upgrade of Lenore Lane, which is almost complete, it will operate as a collector road in any case. The noise criteria for Lenore Lane can then be set as **60 dB(A)** $L_{eq,1hr}$ daytime and **55 dB(A)** $L_{eq,1hr}$ night time.

4 PREDICTED NOISE IMPACT

As noted earlier, the key noise issues associated with the proposed development include operational noise, construction noise and noise associated with expected increase in road traffic. These issues have been addressed based on worst case scenario predictions and past experience with similar developments.

4.1 OPERATIONAL NOISE

The proposed warehouse and distribution facility is proposed to be used 24 hours a day and 7 days per week.

General noise producing operations on site would include pallet handling and truck movements. In particular, on-site trucking activities will be the dominate noise source. To that end, noise modelling included a worst case scenario whereby all twenty (20) loading docks will be in use during the day and typically five(5) at night. This is based on expected traffic flow detailed in the traffic report. Trucks will reverse into these docks and forklifts will be used to load/unload them from beneath awning structures on the eastern and western sides of the building.

Based on data in ERM files for similar operations, the noise emission levels from on-site trucking operations were used to predict received noise at residences. As discussed above, twelve trucks were assumed operating simultaneously at the loading docks. The results of ENM predictions are summarised in *Table 6.1*.

The representative sound power level associated with a truck is 99 dB(A) $L_{eq,15min}$. The sound power level associated with a reversing alarm is 110 dB(A) L_{max} and was used for sleep disturbance predictions. Importantly for residences of Emmaus Village, the proposed warehouse building provides a significant buffer (distance and barrier) between the loading docks and these residences (proposed and existing).

Table 4.1 Operational Noise Predictions

Receptor	Predicted Noise Level, dB(A)			Criteria, $L_{eq,15minute}$, dB(A)			Sleep Criterion, $L_{1,1minute}$ dB(A)
	Day & Evening (Calm)	Night		Day	Evening	Night	
		Calm	Adverse Weather				
1. Erskine Park Residences	34$L_{eq,15min}$	28$L_{eq,15min}$ 32$L_{1,1min}$	35$L_{eq,15min}$ 39$L_{1,1min}$	41	41	37	47
2. Emmaus Retirement Village	36$L_{eq,15min}$	30$L_{eq,15min}$ 34$L_{1,1min}$	38$L_{eq,15mi}$ 42$L_{1,1min\ n}$	43	42	38	48
3. Lenore Lane Residences	38$L_{eq,15min}$	32$L_{eq,15min}$ 36$L_{1,1min}$	37$L_{eq,15min}$ 41$L_{1,1min}$	41	41	37	47

1. The resulting noise from adverse weather conditions at night is the higher of a temperature inversion of $3^{O}C/100m$ or assessable wind speed (derived as per the INP).

The results in *Table 4.1* demonstrate that noise from the site with all loading docks operational will be within noise goals at all receiver locations. It is understood that the Lenore Lane residential properties are zoned industrial use. It is therefore probable that these residential properties are developed for industrial land use.

Sleep disturbance impacts are not anticipated from the operational activities on site.

4.2 CUMULATIVE INDUSTRIAL NOISE

As mentioned earlier, there are approved adjacent industrial developments that potentially could affect the same residential receivers assessed part of this study. If we assume an equal distribution of noise criteria from say one other industrial site adjacent to and hence having similar impacts as the subject proposal, a 3dB reduction in the Amenity noise criteria would apply. This implies a modified suburban residential amenity goal for the subject site of 52dB(A)$L_{eq,11hr}$, 42dB(A) $L_{eq,4hr}$ and 37dB(A) $L_{eq,9hr}$ for the day, evening and night time periods respectively. This generally does not alter the project specific noise targets derived earlier. It should be noted that operations at sites further away from the subject site will result in different received noise levels at given receiver locations. Further, the $L_{eq,period}$ noise level from the site will be significantly reduced from the above predicted $L_{eq,15minute}$. A detailed cumulative noise impact assessment should be undertaken once details of proposed operations at neighbouring sites are clarified. .

4.3 CONSTRUCTION NOISE

4.3.1 *Earthworks Noise*

Noise from proposed earthworks activities on the 38Ha Stage 1 works site were predicted for the surrounding residential locations.

The earthworks schedule can be divided into three main stages as shown in *Table 4.2*.

Table 4.2 Construction and Earthworks Schedule

Construction Stage	Approx. Duration (weeks)	Typical Equipment Used
Stage 1: Clearing	4	D6 Dozer, 30T Excavator, 2X Dump Trucks, Tub Grinder
Stage 2: BE	12	2 X D11 Dozer, 6 X 631 Scrapers, 2 X 825 Compactors, 5000 litre Water Cart, 2 X Graders, 15 T Smooth Drum Roller
Stage 3: Trimming	10	2 X Graders, 2 X 12T Smooth Drum Roller, 10,000 litre Water Cart

Representative sound power levels associated with each item of equipment used in noise modelling are summarised in *Table 4.3.*

Table 4.3 Representative Equipment Sound Power Levels

Equipment	$L_{10,15min}$ Sound Power Level, dB(A)
D6 Dozer	108
Dump Trucks	103
Tub Grinder	110
30T Excavator	115
D11 Dozer	110
631 Scraper	116
825 Compactor	116
5000 litre Water Cart	116
Grader	114
15T Smooth Drum Roller	108
12T Smooth Drum Rollers	108
10000 litre water cart	116
Dump Trucks	103
Crane	115

Calculations were then performed taking into account the number of each type of equipment used, as well as distance of plant from the receivers. This was done for two distinct areas being the warehouse site and works in the northern most of the 38Ha site to simulate potential worst case noise for receivers to the south and north. A conservative scenario assuming the simultaneous operation of all construction equipment was used for the analysis (refer to *Table 4.2*). *Table 4.4* lists the predicted noise levels for each construction stage at the worst affected residential receivers due to earthworks.

Table 4.4 ***Predicted Construction Noise Levels at Worst Affected Residential Receivers***

Earthworks Stage	**Predicted $L_{10,15min}$ Noise Level, dB(A)**		
	1. Erskine Park	**2. Emmaus Village**	**Lenore Lane**
Warehouse Site			
Stage 1	41	57	44
Stage 2	50	66	53
Stage 3	44	60	47
Northern Areas			
Stage 1	44	41	68
Stage 2	53	50	77
Stage 3	47	44	71
$L_{10,15min}$ Criteria, dB(A)	46	48	46

Table 4.4 demonstrates that the noisiest of construction works will exceed the criteria at residential locations. It should be noted that these calculations represent the likely noisiest 15 minute period on any one day and are not necessarily representative of daily noise from the site. Furthermore, the duration of each stage is limited and will vary depending on receiver locations with respect to earthworks.

4.3.2 *Building Construction*

Noise from proposed building works on site were predicted for the surrounding residential locations. Simultaneous operation of 6 trucks and 2 cranes were used to represent typical activities.

Representative sound power levels associated with these equipment used in noise modelling are summarised in *Table 4.5.*

Table 4.5 ***Representative Equipment Sound Power Levels***

Equipment	**$L_{10,15min}$ Sound Power Level, dB(A)**
Dump Trucks	103
Crane	115

A worst case scenario assuming the simultaneous operation of all aforementioned construction equipment was used for the analysis. *Table 4.6* lists the predicted noise levels at the potentially worst affected residential receivers due to construction activities. It should be noted that the assessment location at Emmaus Village is that of the future residences at the north most part of the village and therefore most affected. However, these dwellings have not been constructed and are part of a master plan for the site. Construction at the subject site may be complete before these dwellings are occupied, hence nullifying potential impacts.

Table 4.6 ***Predicted Construction Noise Levels at Worst Affected Residential Receivers***

Receiver	Predicted $L_{10,15min}$ Noise Level, dB(A)	$L_{10,15min}$ Criteria, dB(A)
1. Erskine Park	41	46
2. Emmaus Village	53	48
3. Lenore Lane	45	46

Table 4.6 demonstrates that the noisiest of construction works will be within relevant EPA goals at most residential locations. The exception is a predicted exceedance at the closest residences, part of the proposed Emmaus Village expansion. It should be noted that these calculations represent the likely noisiest 15 minute period on any one day and are not necessarily representative of daily noise from construction.

4.4 ***ROAD TRAFFIC NOISE***

The potential for noise impacts associated with the expected increase in traffic on Lenore Lane was investigated. The number of vehicles associated with site operation on Lenore Lane is based on the Traffic Impact Assessment provided by TRAFFIX.

Table 4.4 and *Table 4.5* list the peak traffic conditions and the associated predicted traffic noise levels at the worst affected residence on Lenore Lane (assumed to be 30m from the roadway) for the Operational and Construction phases respectively.

Table 4.7 Predicted Increase in Road Traffic Noise during Operational Phase – Lenore Lane

Period	Number of Vehicles (Peak Hour)		$L_{eq,1hr}$ Noise Level, dB(A)	Criteria $L_{eq,1hr}$ dB(A)
	In	Out	(Peak Hour)	
Day Time (7am – 10pm)	70 Trucks, 160 Cars	70 Trucks	62	60
Night Time (10pm – 7am)	70 Trucks	70 Trucks, 160 Cars	62	55

Table 4.8 Predicted Increase in Road Traffic Noise during Construction Phase

Period	Vehicles (Typical Hour)		Noise Level, dB(A) (Typical Hour)	Criteria $L_{eq,1hr}$ dB(A)
	In	Out		
Day Time (7am – 10pm)	10 Trucks	10 Trucks	53	60

The results demonstrate that daytime traffic noise impacts will be marginally above relevant criterion for both operational related traffic. An exceedance is predicted for potential night time traffic operations. However, as discussed earlier, similar traffic noise levels are expected to exist in future due to traffic from other industrial land use developments at adjacent sites. It is understood that these adjacent operations have been approved. The subject proposal will result in similar traffic noise exposure. Further, Lenore Lane residences occupy industrial zoned properties.

Whilst the night time operational traffic noise predictions highlight an exceedance of the average hourly criterion, a related expected impact for Lenore Lane residences is sleep disturbance. The criterion for sleep disturbance is 60 dB(A) L_{max} outside the most exposed façade (refer to Section 5.1.4 ECRTN).

However, the subject proposal will not be dissimilar to future Lenore Lane traffic, related to approved adjacent developments. To that end, the purpose of the approved Lenore Lane upgrade is primarily to service such developments. Further, the Lenore Lane upgrade DA is likely to have highlighted such traffic noise impacts on the existing isolated Lenore Lane residences. It is also unclear whether this road upgrade will necessitate that affected residential properties are redeveloped into non-noise sensitive land use. It is understood, that an agreement (formal or otherwise) or similar measures are in place between industrial property holders or developers and owners of these few isolated residential properties.

5 RECOMMENDATIONS AND MITIGATION

5.1 CONSTRUCTION

While there is the potential for construction noise to exceed the recommended criterion (without mitigation) at the potentially closest residences, there are several mitigation measures that may be employed to reduce noise impacts. These include:

- Scheduling construction activities such that the concurrent operation of plant is limited;

- Preparation of a construction noise management plan (to be included in the project Environmental Management Plan) prior to construction to ensure that all employees understand and take responsibility for noise control at site;

- Properly maintaining plant to ensure rated noise emission levels are not exceeded;

- Undertaking construction activities guided by *AS2436-1981 "Guide to Noise Control on Construction, Maintenance and Demolition Sites";*

- Providing a contact telephone number via which the public may seek information or make a complaint. A log of complaints should be maintained and actioned by the site superintendent in a responsive manner.

It is understood that the few isolated Lenore Lane residential properties are zoned industrial use. It is therefore probable that these residential properties are developed for industrial land use, which would absolve noise impacts.

5.2 OPERATIONS

Operational noise predictions indicate that sensitive receivers will not be exposed to noise above relevant criteria. There are mitigation measures that may be employed to further reduce noise impacts. These include:

- Scheduling truck movements and loading dock operations such that concurrent operation of vehicles is minimised. This would include limiting onsite vehicle idling while loading; and

- Preparation of an operational noise management plan (to be included in the project Environmental Management Plan) prior to operation to ensure that all employees understand and take responsibility for noise control at site.

It is understood that the few isolated Lenore Lane residential properties are zoned industrial use. It is therefore probable that these residential properties are developed for industrial land use, which would absolve noise impacts.

6 *CONCLUSION*

ERM has completed a noise impact survey and assessment of the proposed construction and operation of a warehouse facility at Lenore Lane, Erskine Park. The facility is expected to comply with the relevant operational noise criteria at sensitive residential locations. The exception is at least one of the few isolated residences on Lenore Lane.

If residences along Lenore Lane are to remain, the noise assessment indicates potential impacts from future night time trucking movements associated with the proposal and similar adjacent developments. It is understood however, that an agreement (formal or otherwise) or similar measures are in place between industrial property holders or developers and owners of these few isolated residential properties. To that end, it is probable that these residences are unlikely to remain following the significant upgrade to Lenore Lane. The upgrade is needed to accommodate expected traffic, composing a relatively significant proportion of heavy vehicles. It is therefore probable that these residential properties are developed for industrial land use, which would absolve noise impacts.

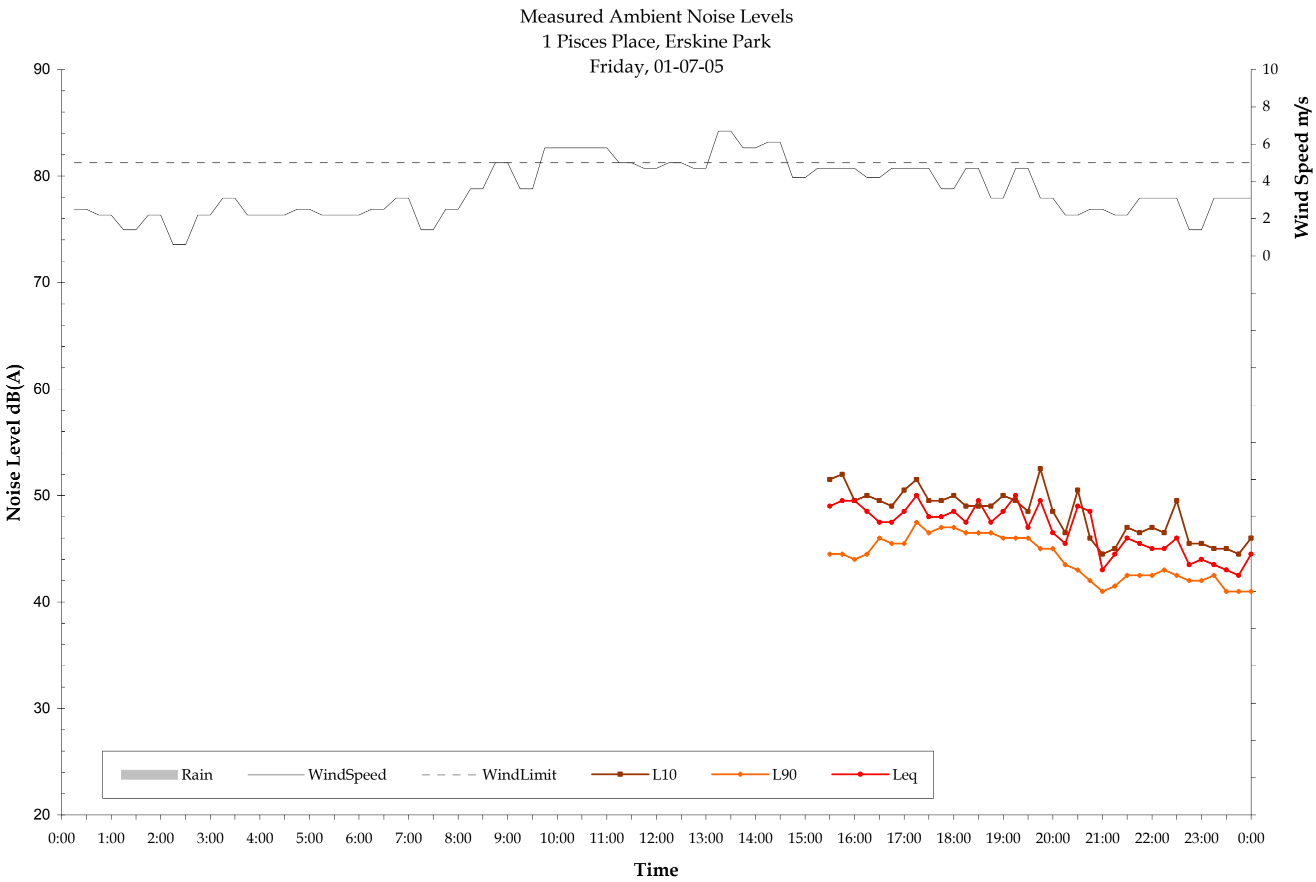
Annex A

Long Term Monitoring Data

Table A.1 Location 1 – 1 Pisces Place, Erskine Park

Date	ABL Day	ABL Evening	ABL Night	Leq 11hr Day	Leq 4hr Evening	Leq 9hr Night
Friday, 01-07-05	0	41.5	32.5	0	47.5	41.8
Saturday, 02-07-05	33.5	30.5	28	49	44	38.3
Sunday, 03-07-05	33.5	31.5	28.5	50	41.6	40
Monday, 04-07-05	34.5	40.5	31.5	52.3	45.2	41.6
Tuesday, 05-07-05	36	42	31.5	49.1	46.5	43.2
Wednesday, 06-07-05	36.5	35.5	34	48.3	43.7	44.9
Thursday, 07-07-05	41	32	27.5	57.9	43.5	42.6
Friday, 08-07-05	36	36	33	52.5	44.3	41.9
Saturday, 09-07-05	0	35	0	0	42	0
Sunday, 10-07-05	0	0	0	0	0	0
Monday, 11-07-05	0	32.5	32.5	0	41.6	40.7
Tuesday, 12-07-05	37	43.5	0	50.9	47.4	0
Wednesday, 13-07-05	0	39	32	0	44.5	43
Thursday, 14-07-05	35.5	34	32	50.4	43.9	43.2
Friday, 15-07-05	0	0	0	0	0	0
Summary Values	36	35.5	32	52.3	44.7	42.2

1. ‘0’ indicates periods with too few valid samples due to weather or logger operation.
2. Leq24hr encompasses the period 7am to 7am


Measured Ambient Noise Levels
1 Pisces Place, Erskine Park
Friday, 01-07-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
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Leq
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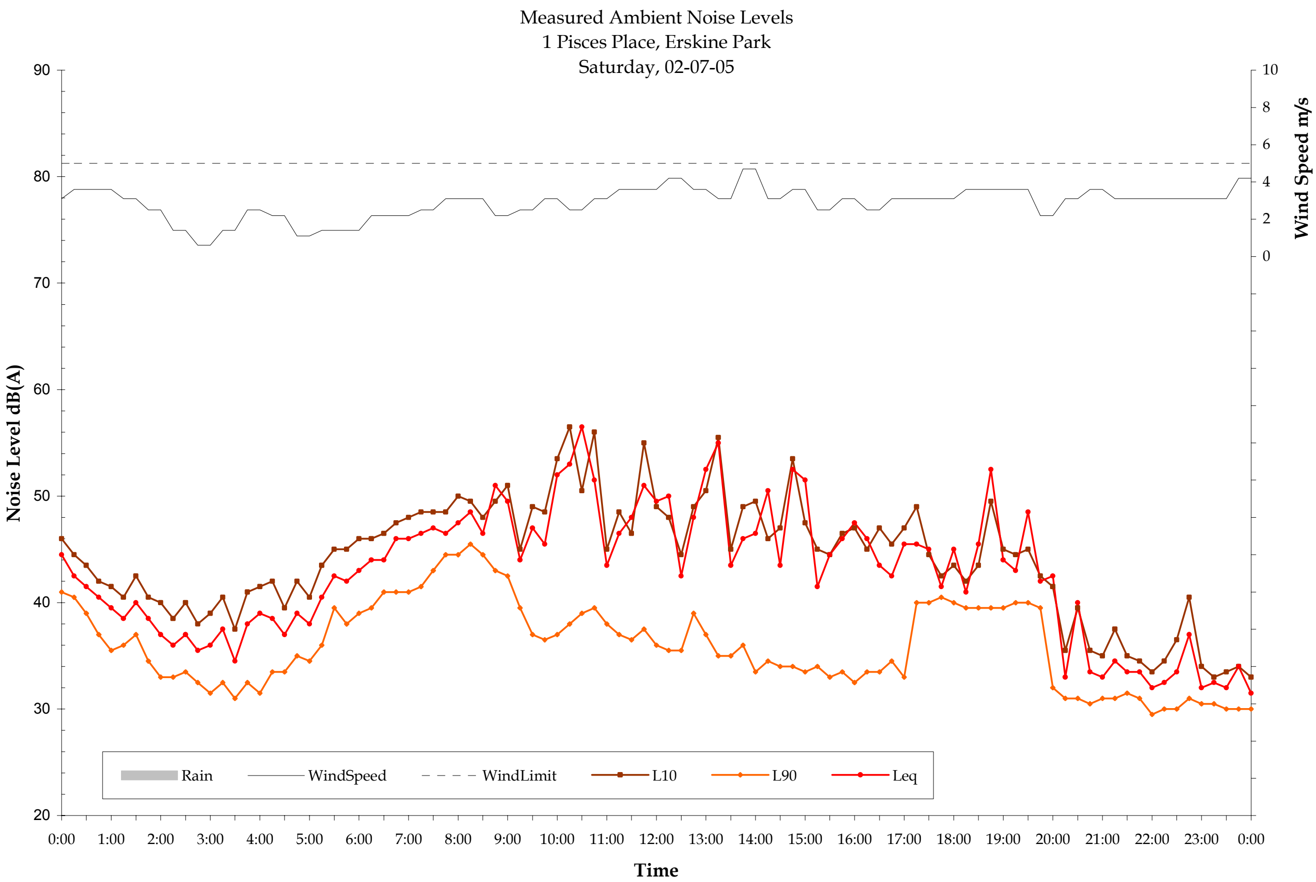
Measured Ambient Noise Levels
1 Pisces Place, Erskine Park
Saturday, 02-07-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
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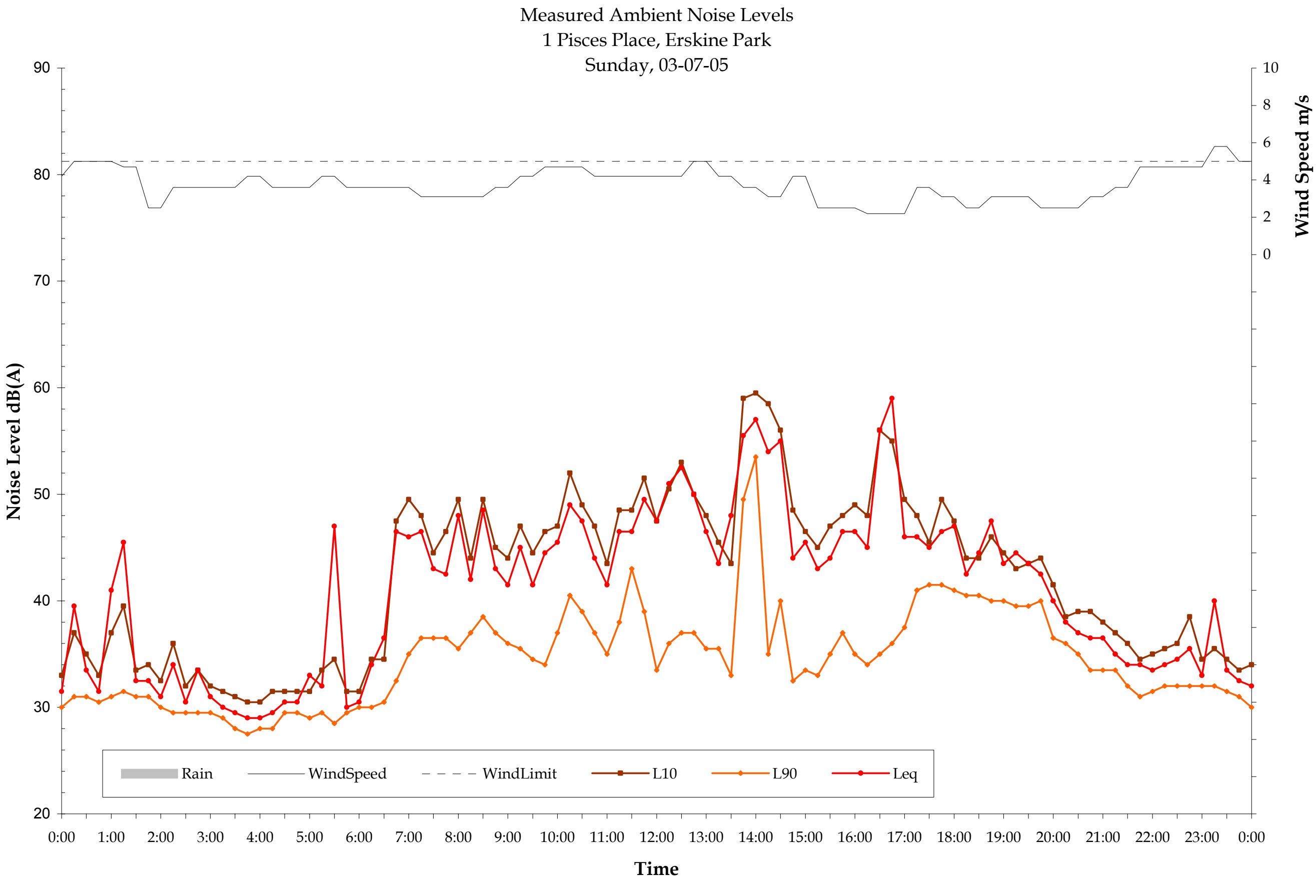
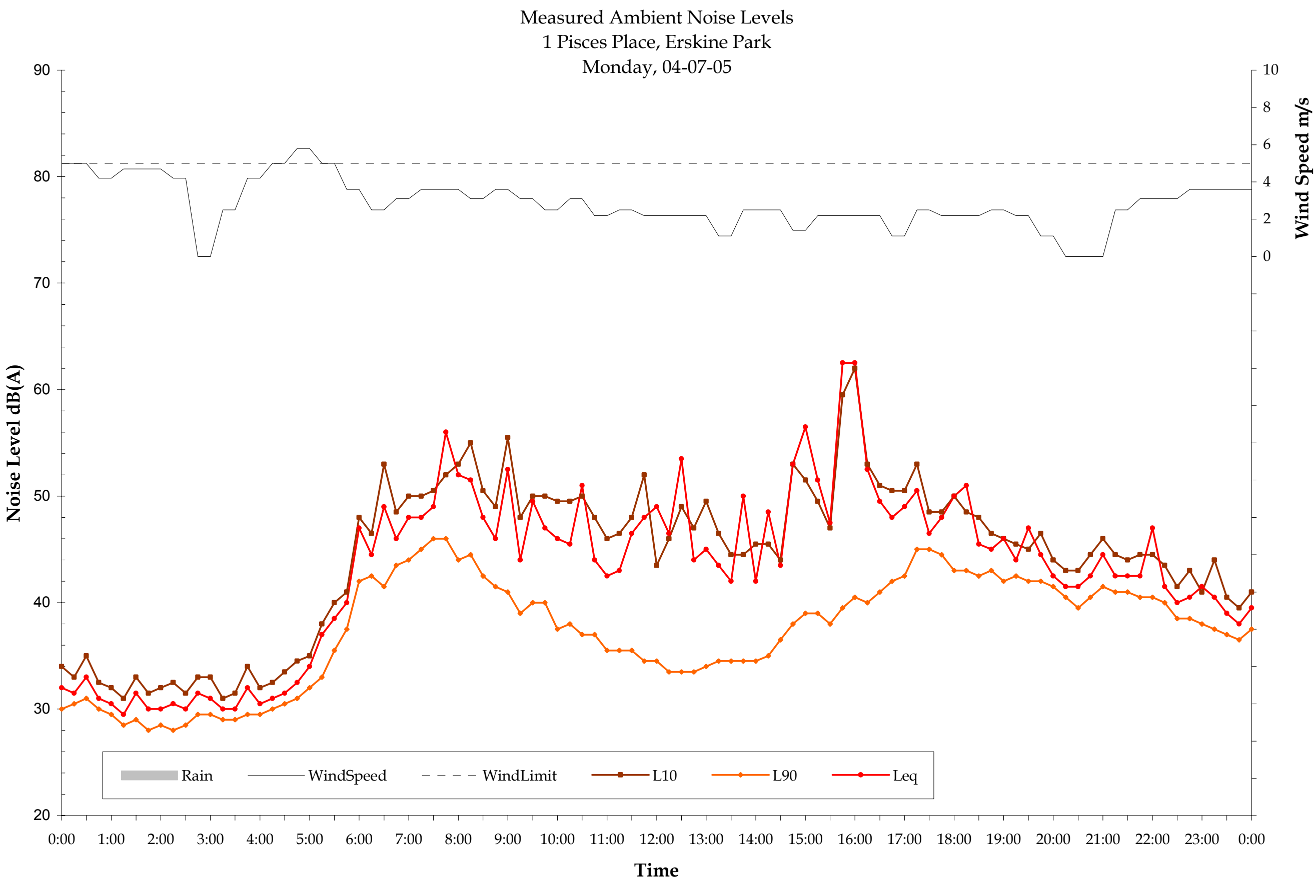
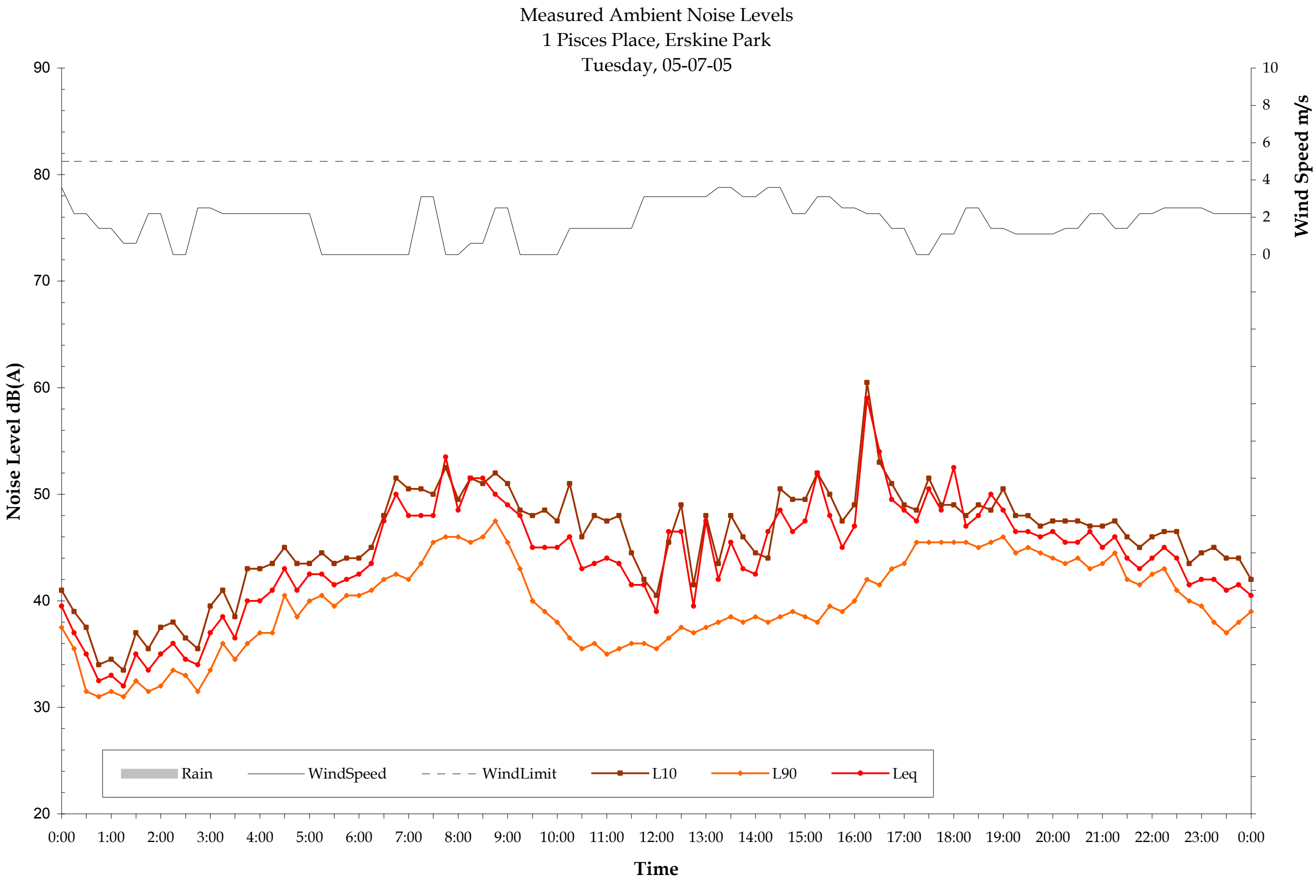
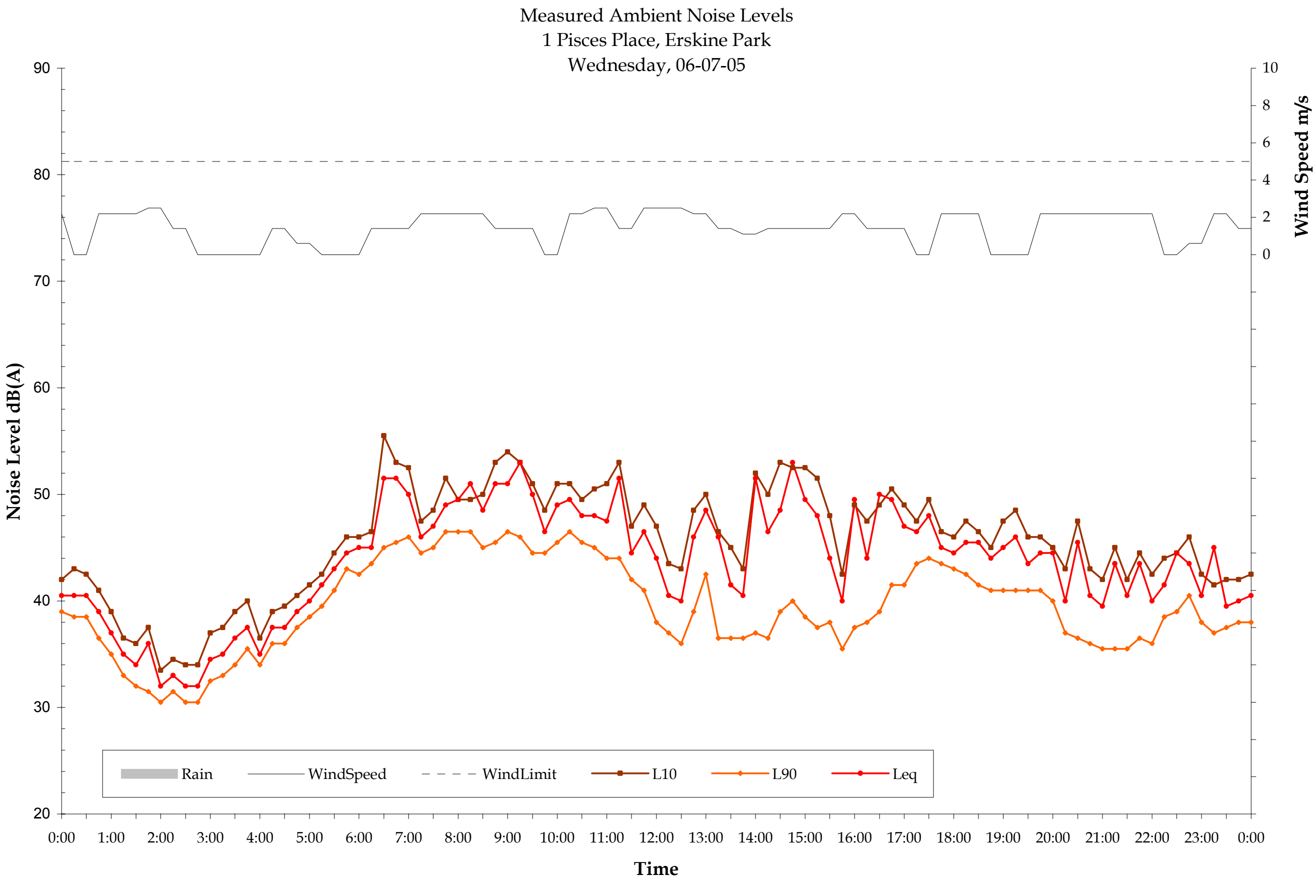
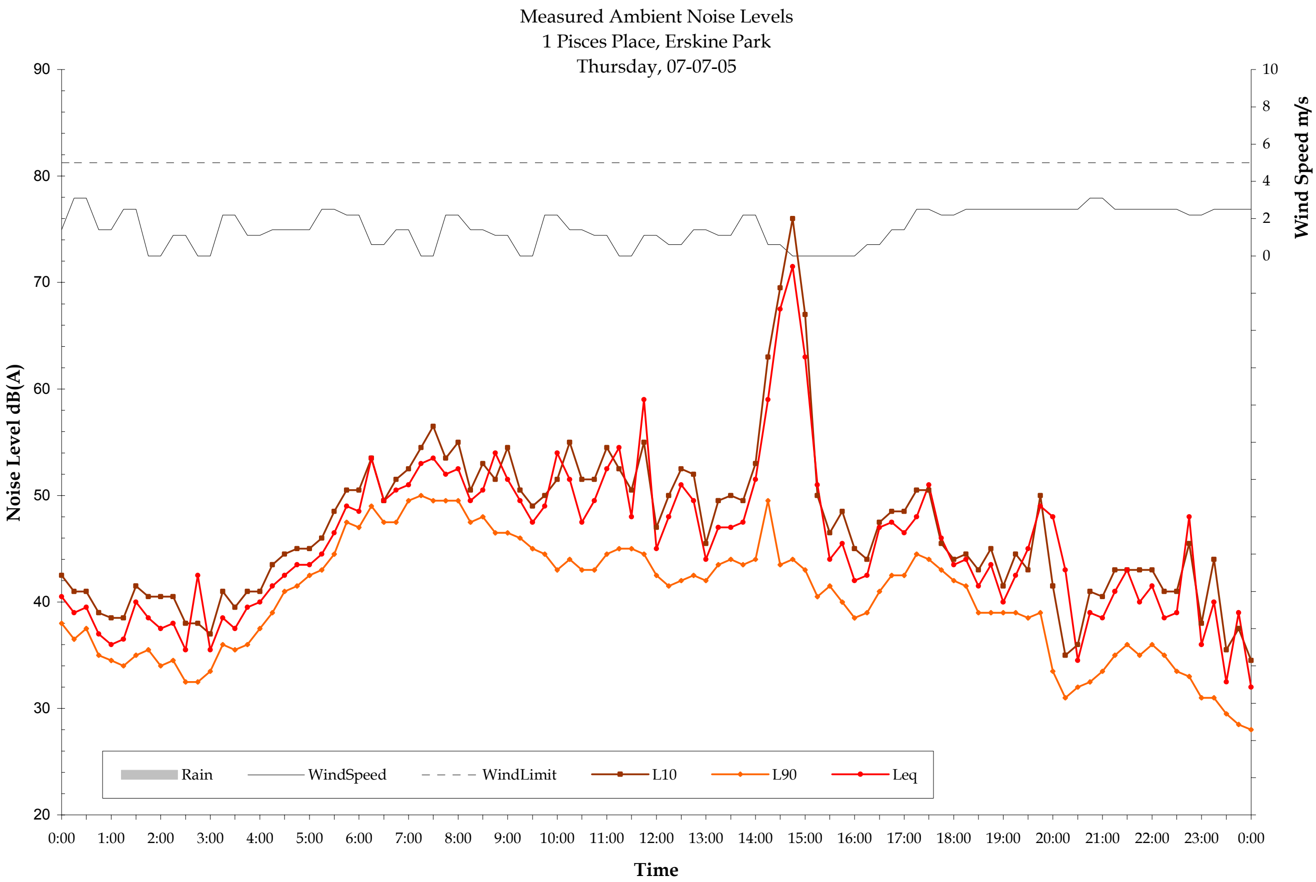
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 0:00


Measured Ambient Noise Levels
1 Pisces Place, Erskine Park
Sunday, 03-07-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq


Measured Ambient Noise Levels
1 Pisces Place, Erskine Park
Monday, 04-07-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq


Measured Ambient Noise Levels
1 Pisces Place, Erskine Park
Tuesday, 05-07-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq


Measured Ambient Noise Levels
1 Pisces Place, Erskine Park
Wednesday, 06-07-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq


Measured Ambient Noise Levels
1 Pisces Place, Erskine Park
Thursday, 07-07-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
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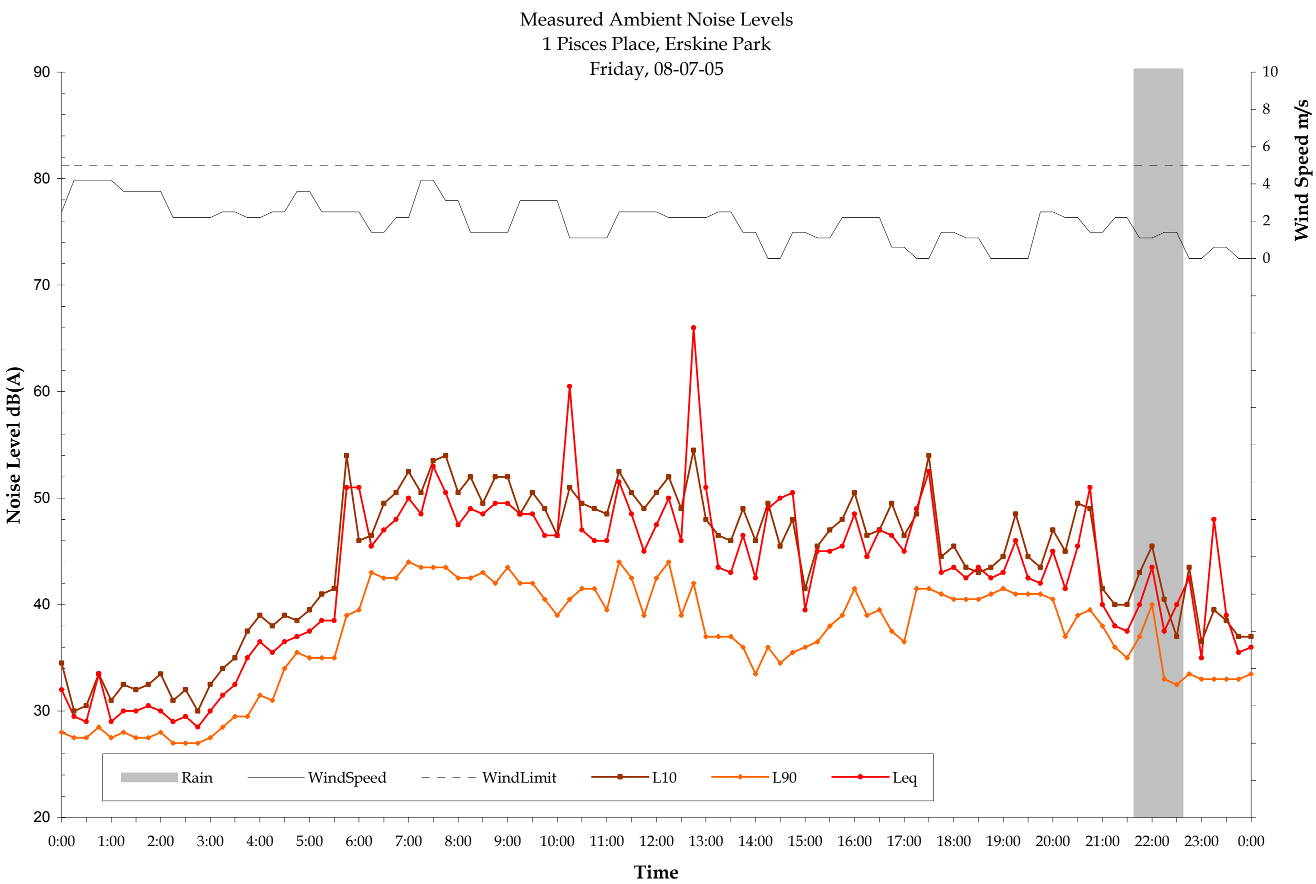
Measured Ambient Noise Levels
1 Pisces Place, Erskine Park
Friday, 08-07-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
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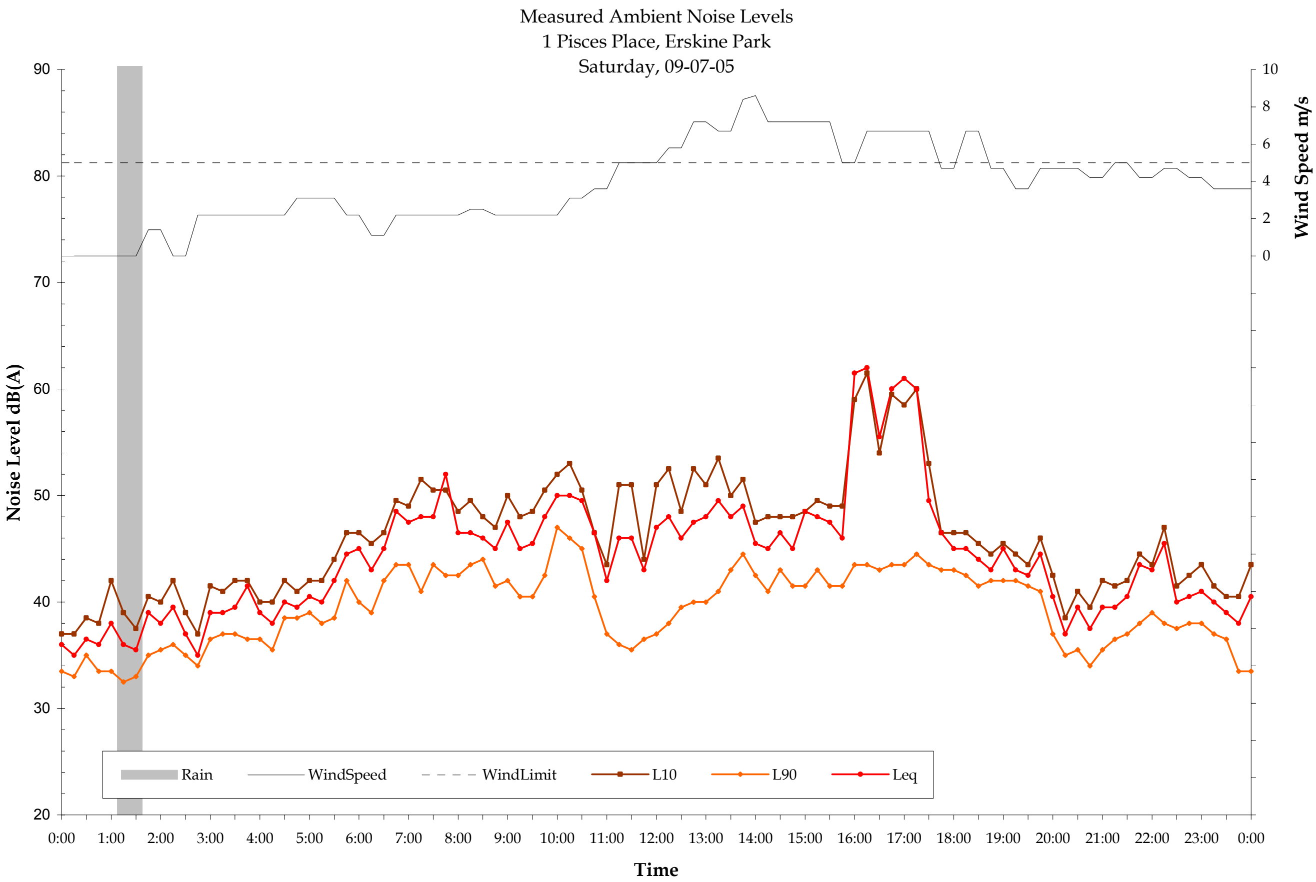
Measured Ambient Noise Levels
1 Pisces Place, Erskine Park
Saturday, 09-07-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq
90
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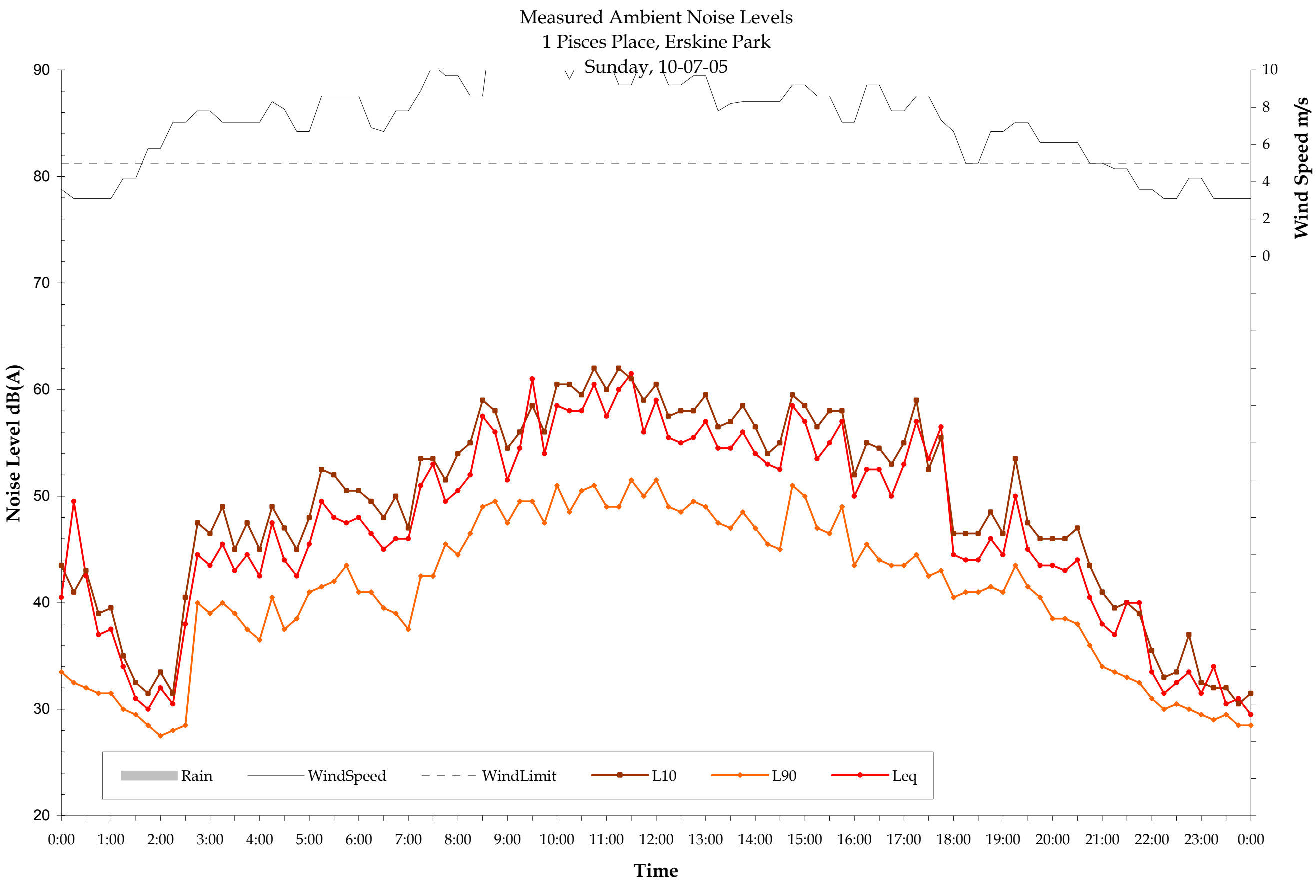
Measured Ambient Noise Levels
1 Pisces Place, Erskine Park
Sunday, 10-07-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
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Leq
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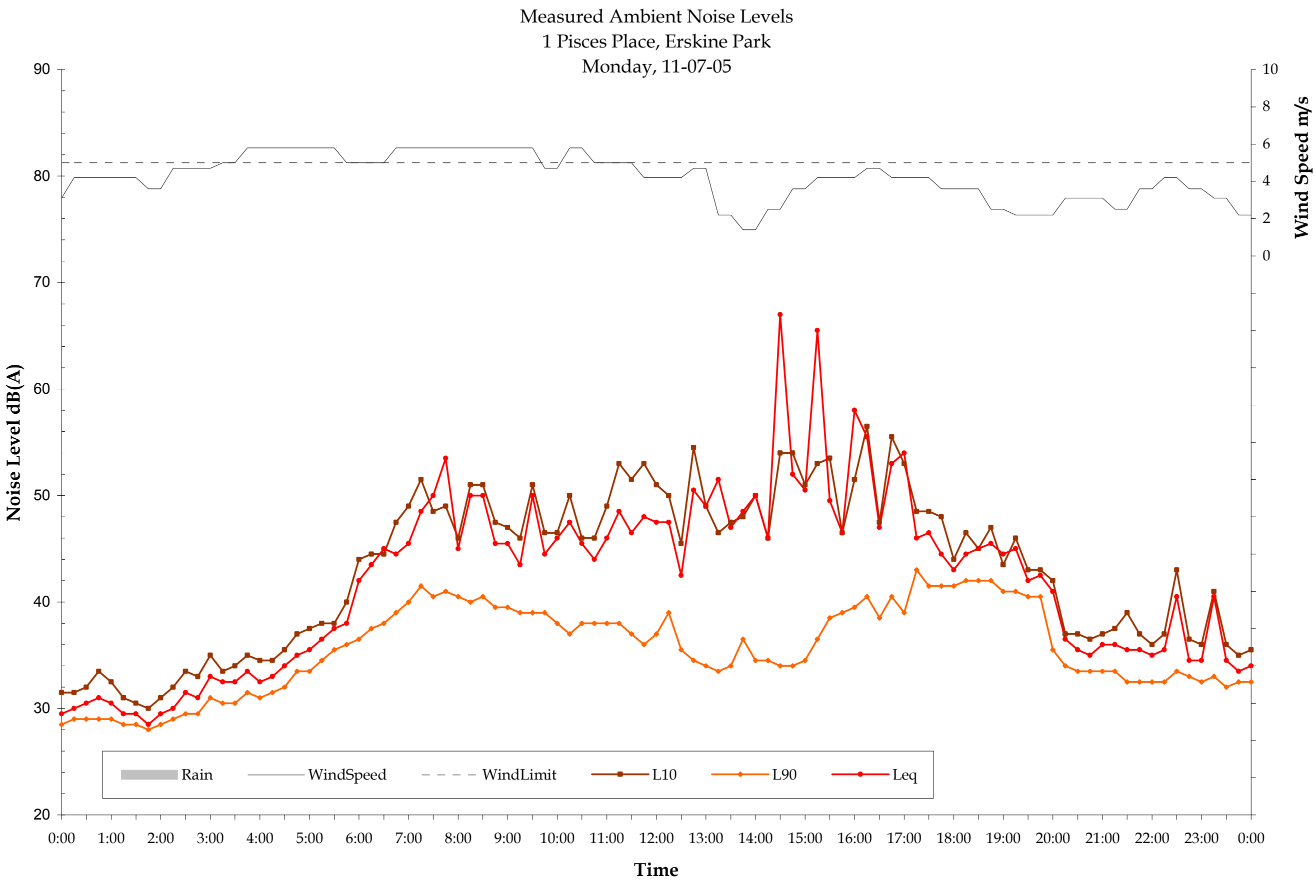
Measured Ambient Noise Levels
1 Pisces Place, Erskine Park
Monday, 11-07-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
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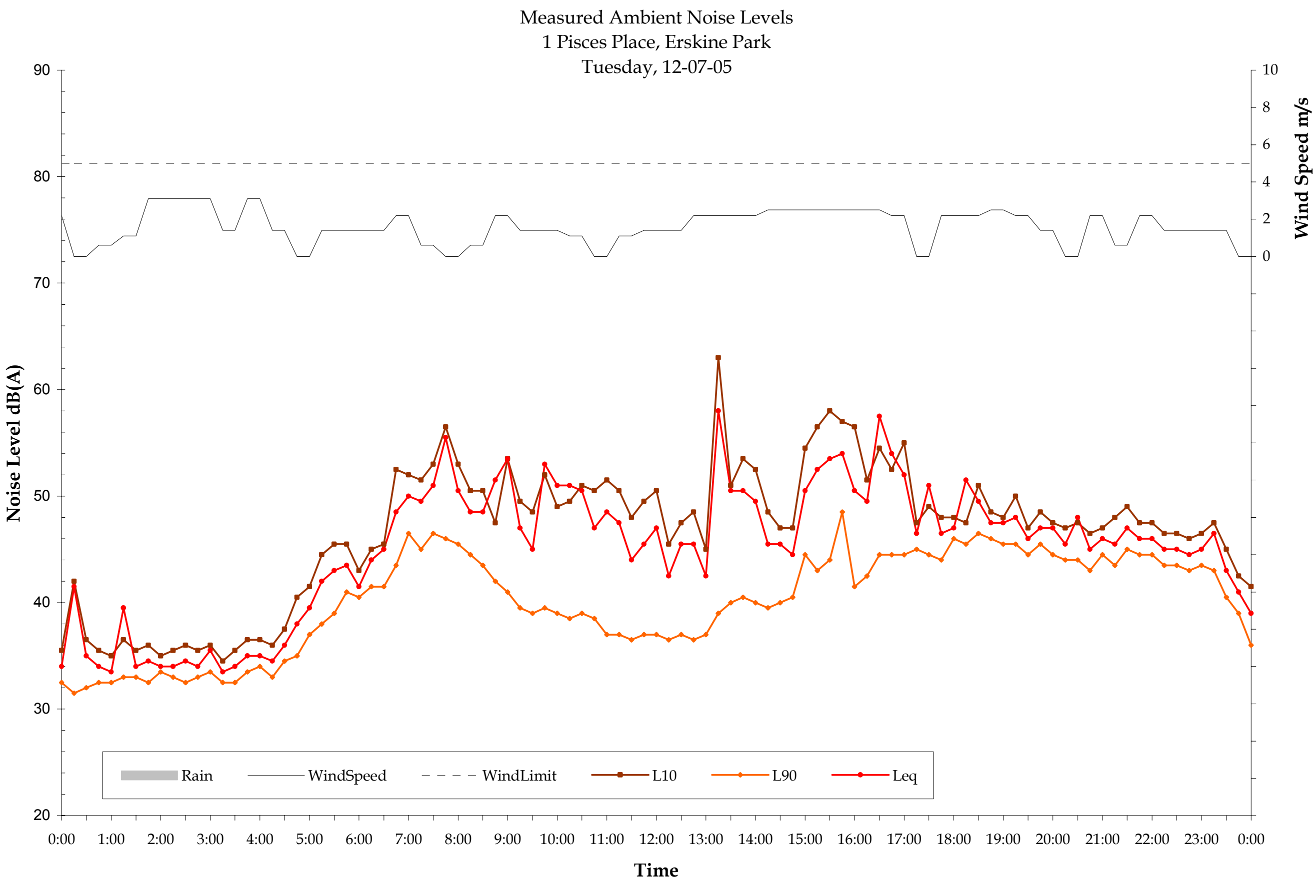
Measured Ambient Noise Levels
1 Pisces Place, Erskine Park
Tuesday, 12-07-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
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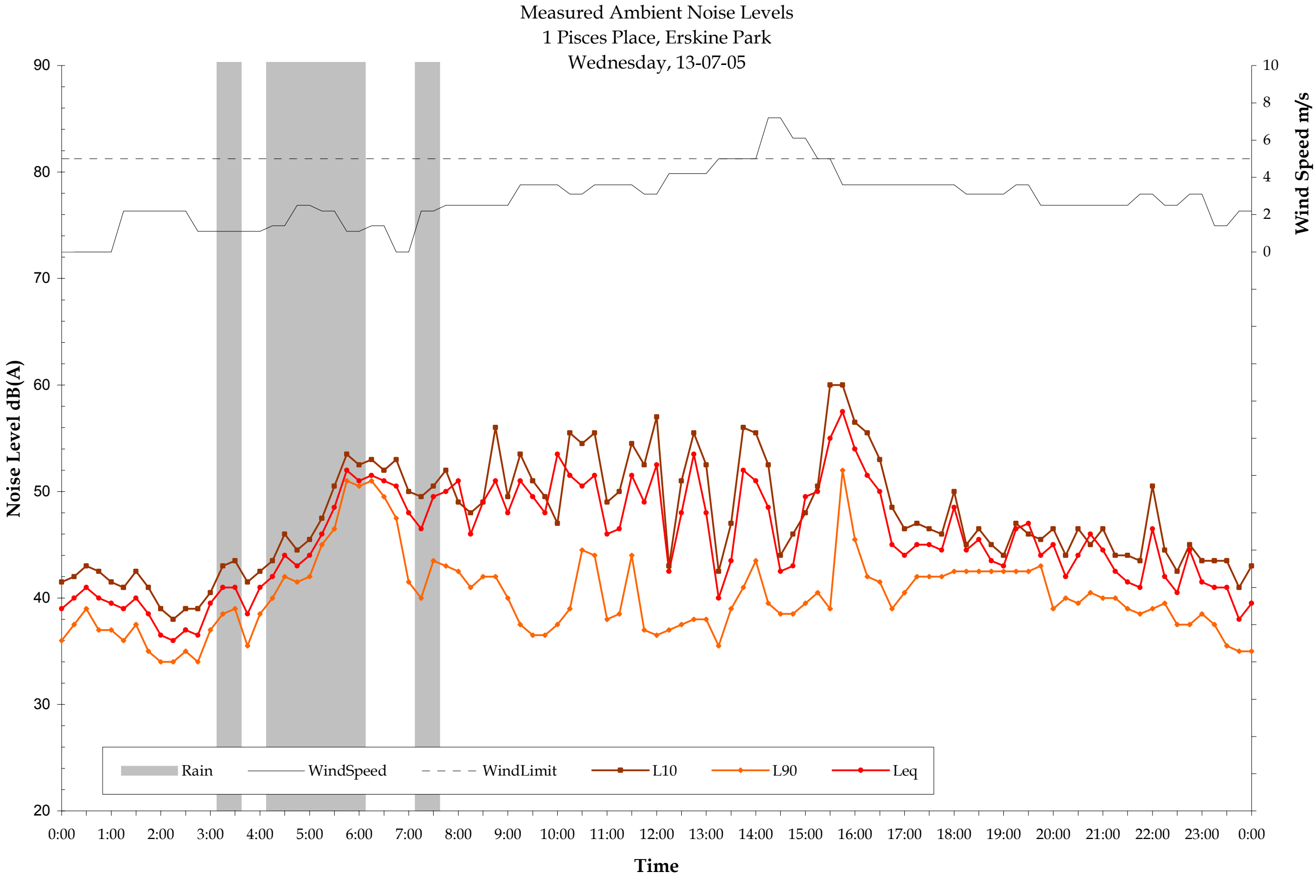
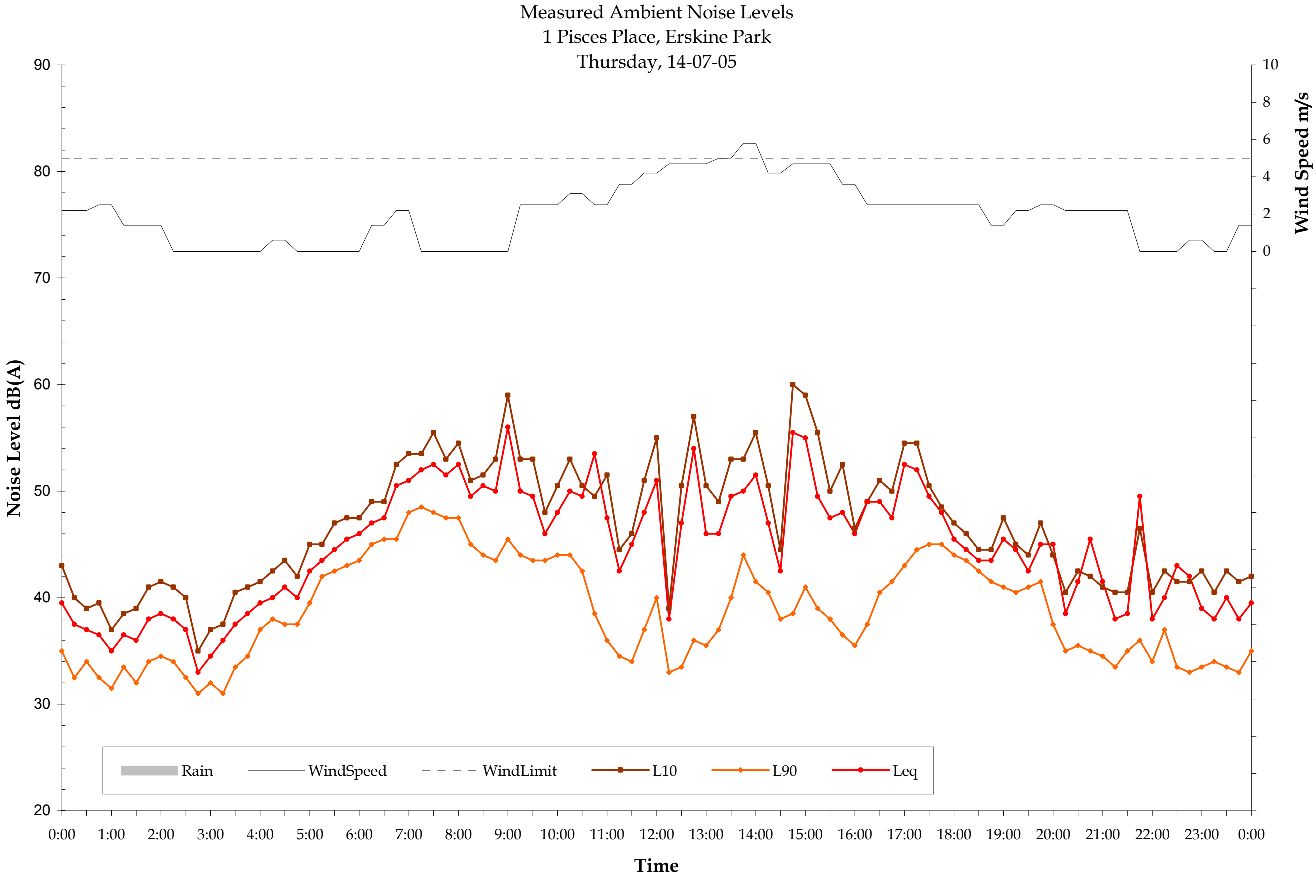
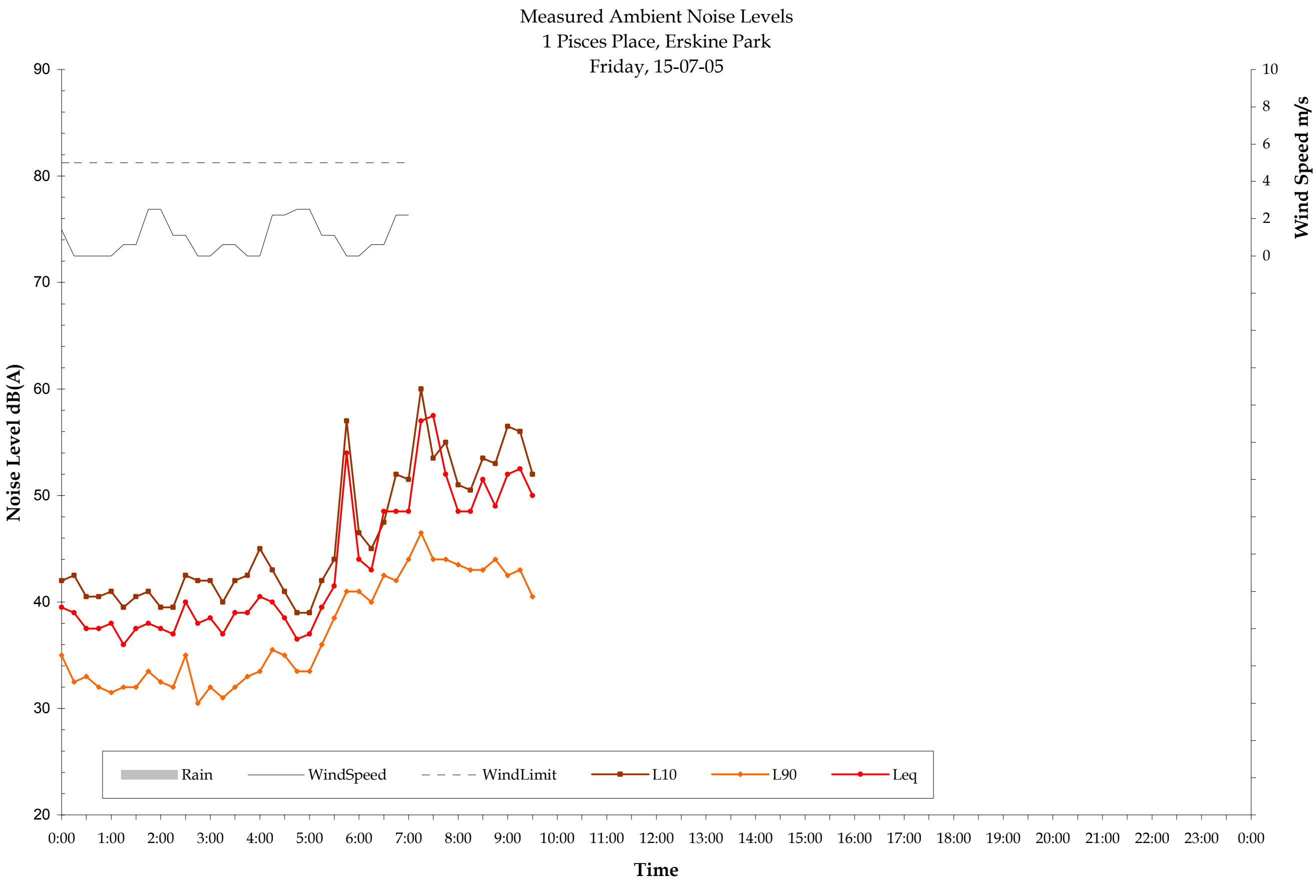


Measured Ambient Noise Levels
1 Pisces Place, Erskine Park
Wednesday, 13-07-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq



Measured Ambient Noise Levels
1 Pisces Place, Erskine Park
Thursday, 14-07-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq



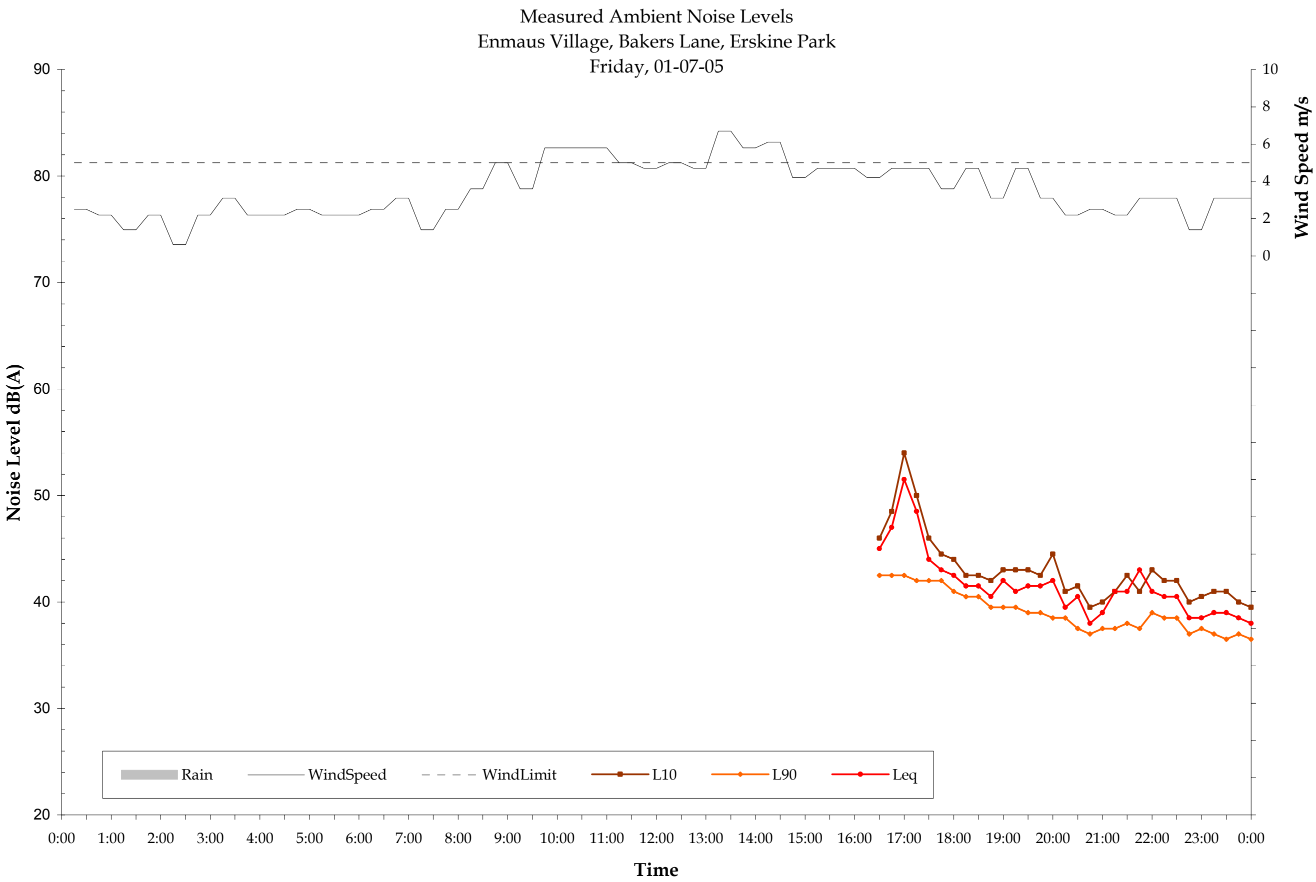
Measured Ambient Noise Levels
1 Pisces Place, Erskine Park
Friday, 15-07-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq

Table A.2 Location 2- Emmaus Village, Bakers Lane, Erskine Park

Date	ABL Day	ABL Evening	ABL Night	Leq 11hr Day	Leq 4hr Evening	Leq 9hr Night
Friday, 01-07-05	0	37.5	33.5	0	41.1	41.6
Saturday, 02-07-05	37.5	36.5	33	52.3	41.5	41.1
Sunday, 03-07-05	36.5	35.5	33	52	40.9	43.3
Monday, 04-07-05	37	33.5	32.5	50.5	40.3	44.2
Tuesday, 05-07-05	39.5	37	34	60.2	40.3	44.5
Wednesday, 06-07-05	37.5	35	34.5	49.6	42.2	44.6
Thursday, 07-07-05	41	39	32	50.8	45.4	44.6
Friday, 08-07-05	37	35.5	34	50.1	41.2	40.7
Saturday, 09-07-05	0	36.5	0	0	41.6	0
Sunday, 10-07-05	0	0	0	0	0	0
Monday, 11-07-05	0	35	32.5	0	41.1	45.6
Tuesday, 12-07-05	39	38.5	0	51	43	0
Wednesday, 13-07-05	0	35	32.5	0	42.4	43.9
Thursday, 14-07-05	40.5	36.5	32.5	50.5	43.1	43.1
Friday, 15-07-05	0	0	0	0	0	0
Summary Values	37.5	36.5	33	53.5	42.1	43.6

1. '0' indicates periods with too few valid samples due to weather or logger operation.

2. Leq24hr encompasses the period 7am to 7am


Measured Ambient Noise Levels
Enmaus Village, Bakers Lane, Erskine Park
Friday, 01-07-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq
90
80
70
60
50
40
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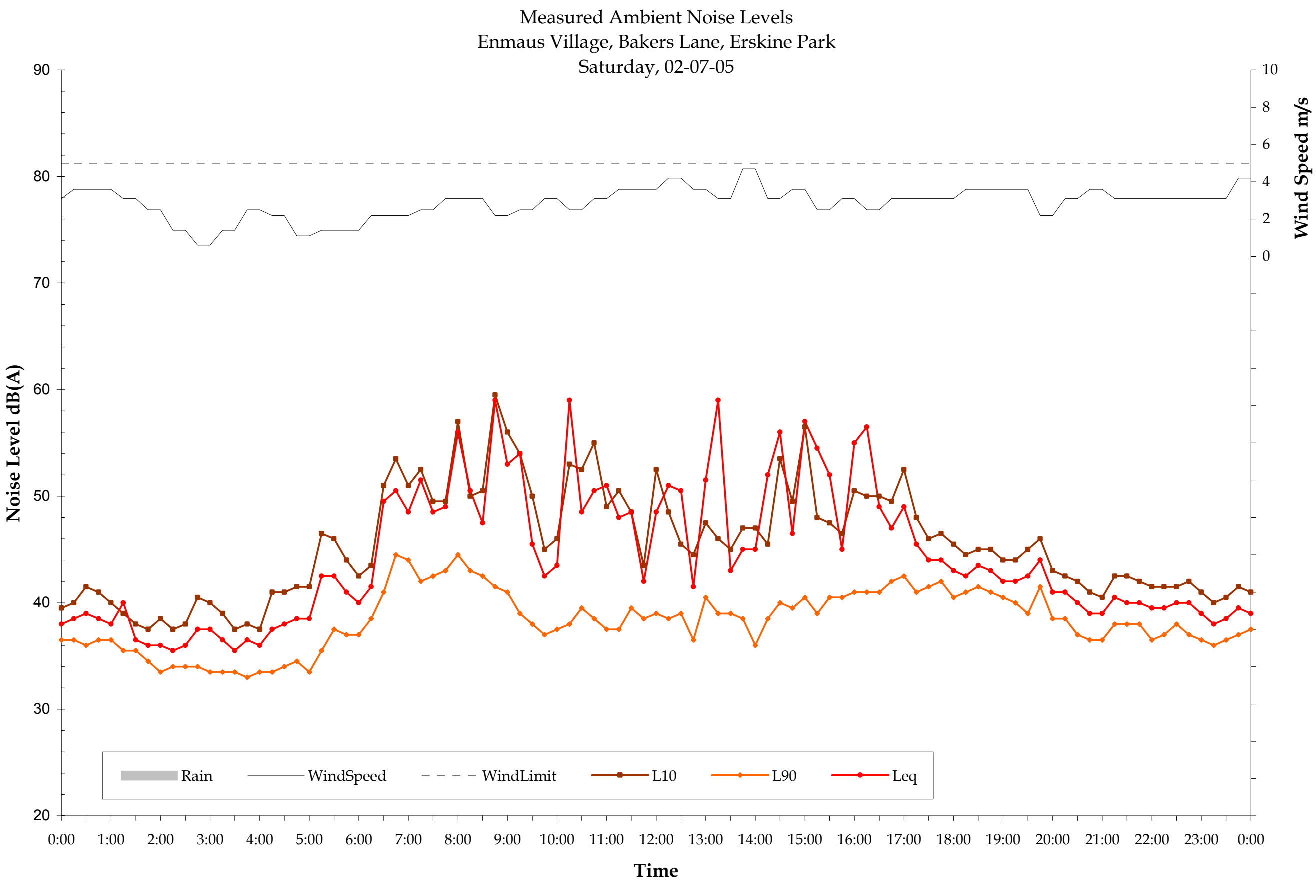
Measured Ambient Noise Levels
Enmaus Village, Bakers Lane, Erskine Park
Saturday, 02-07-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq
90
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70
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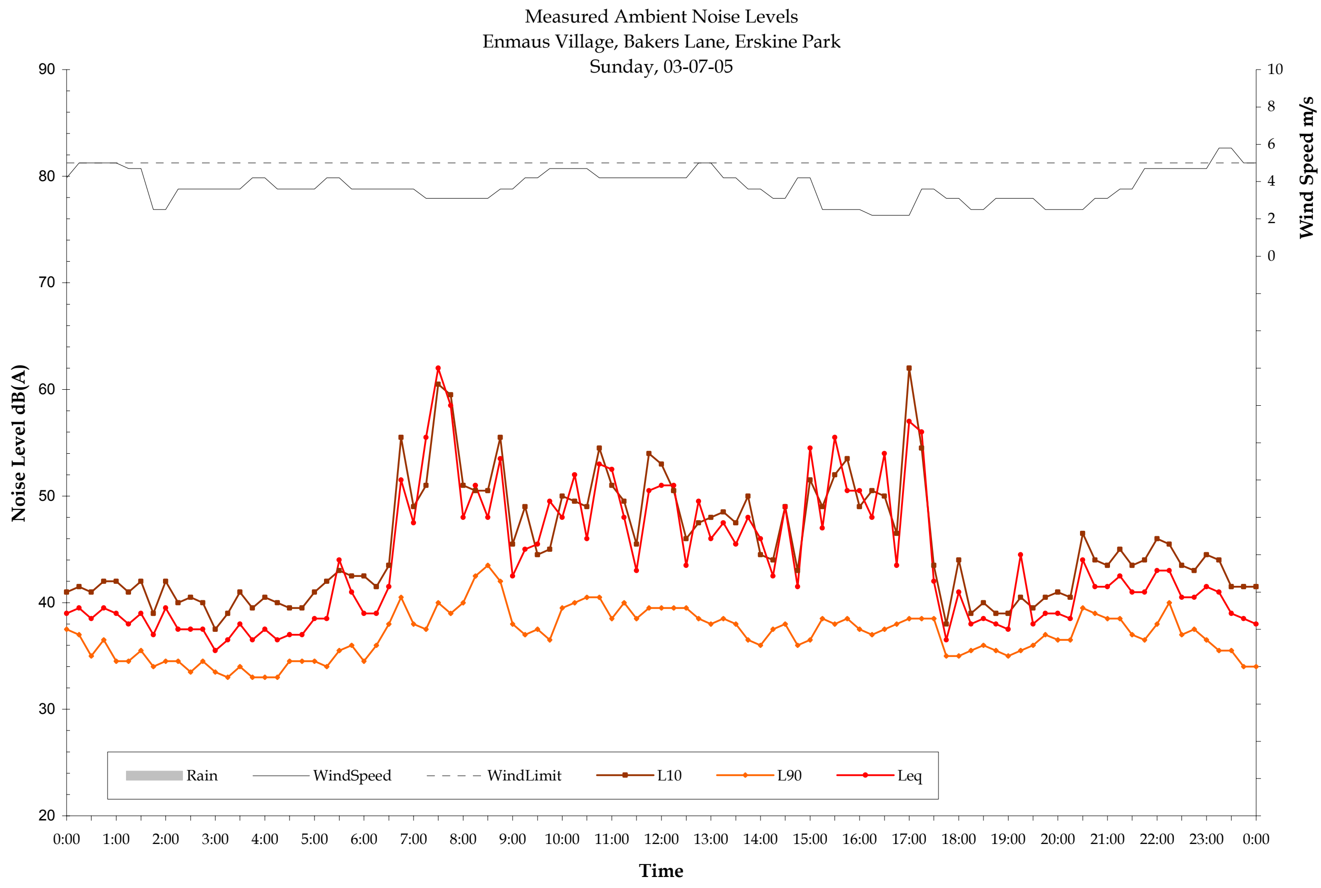
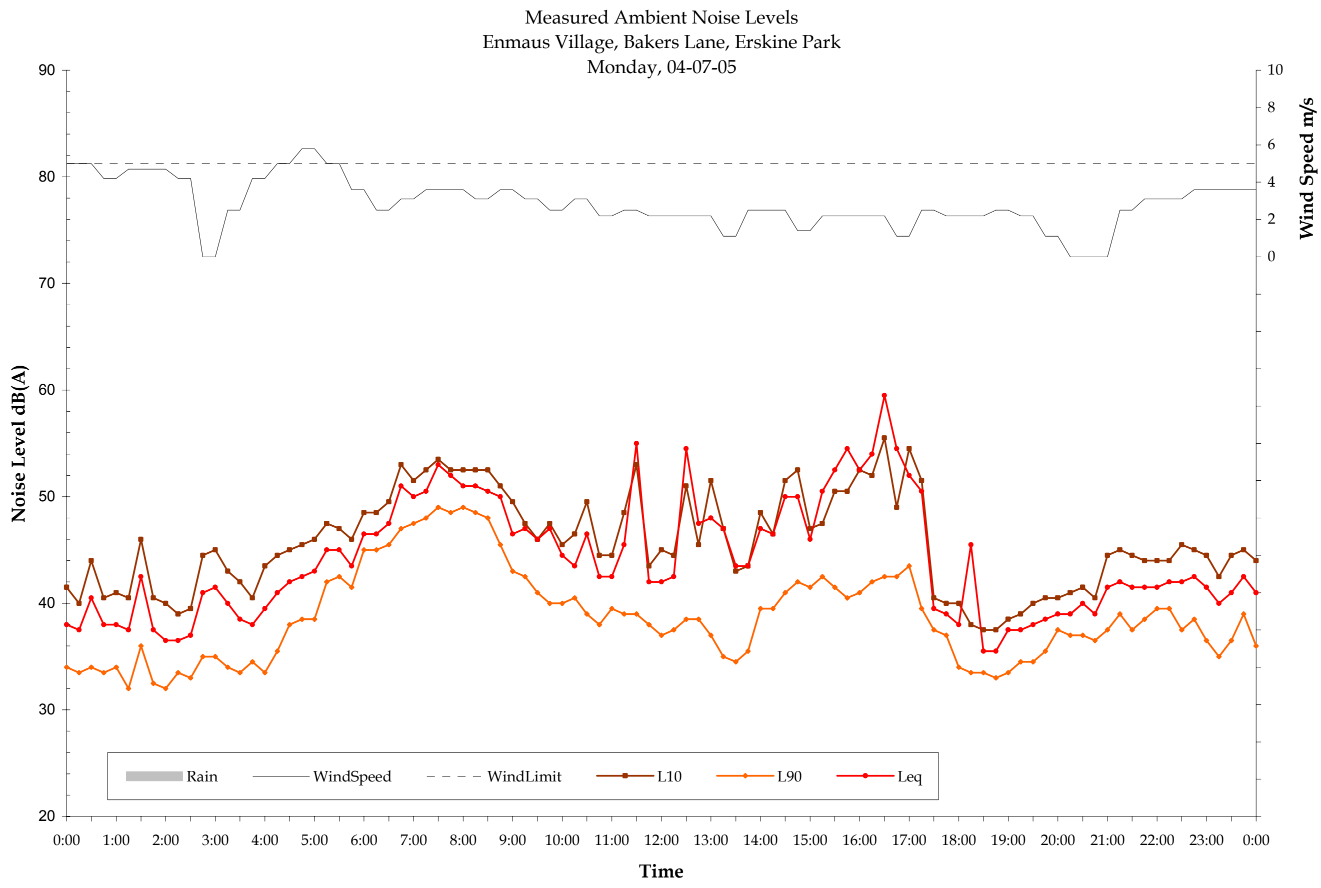

Measured Ambient Noise Levels
Enmaus Village, Bakers Lane, Erskine Park
Sunday, 03-07-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq


Measured Ambient Noise Levels
Enmaus Village, Bakers Lane, Erskine Park
Monday, 04-07-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
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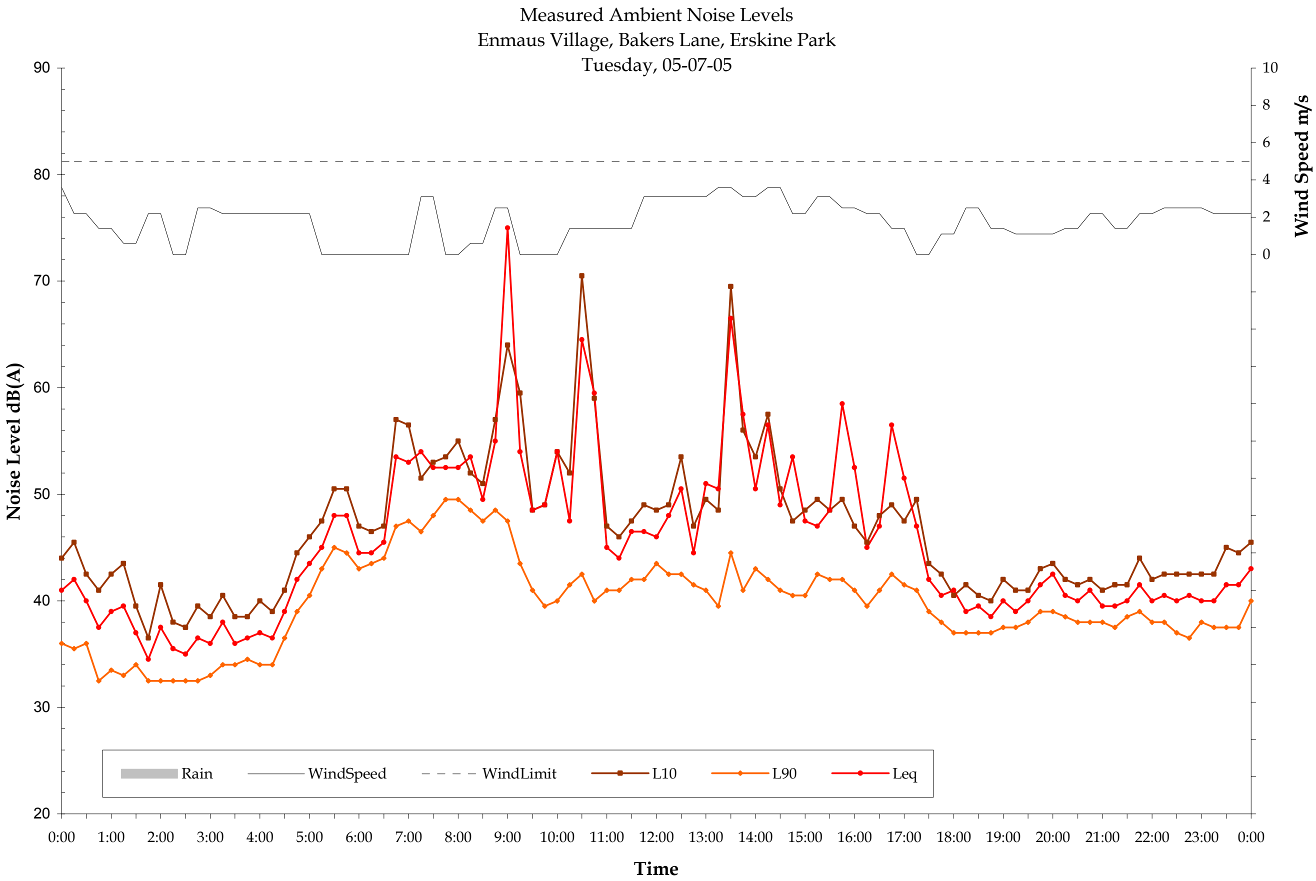
WindLimit
L10
L90
Leq


Measured Ambient Noise Levels
Enmaus Village, Bakers Lane, Erskine Park
Tuesday, 05-07-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq
90
80
70
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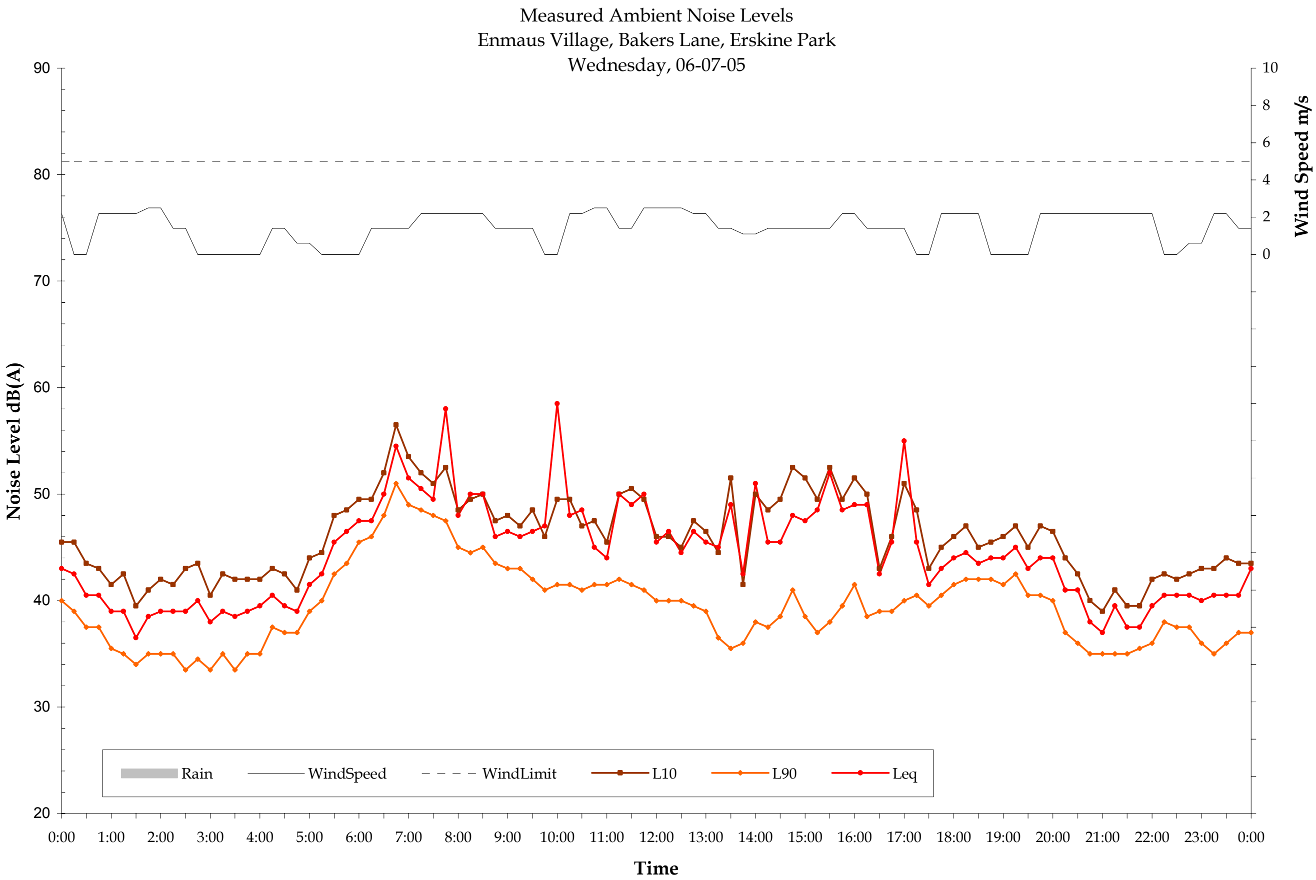
Measured Ambient Noise Levels
Enmaus Village, Bakers Lane, Erskine Park
Wednesday, 06-07-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq
90
80
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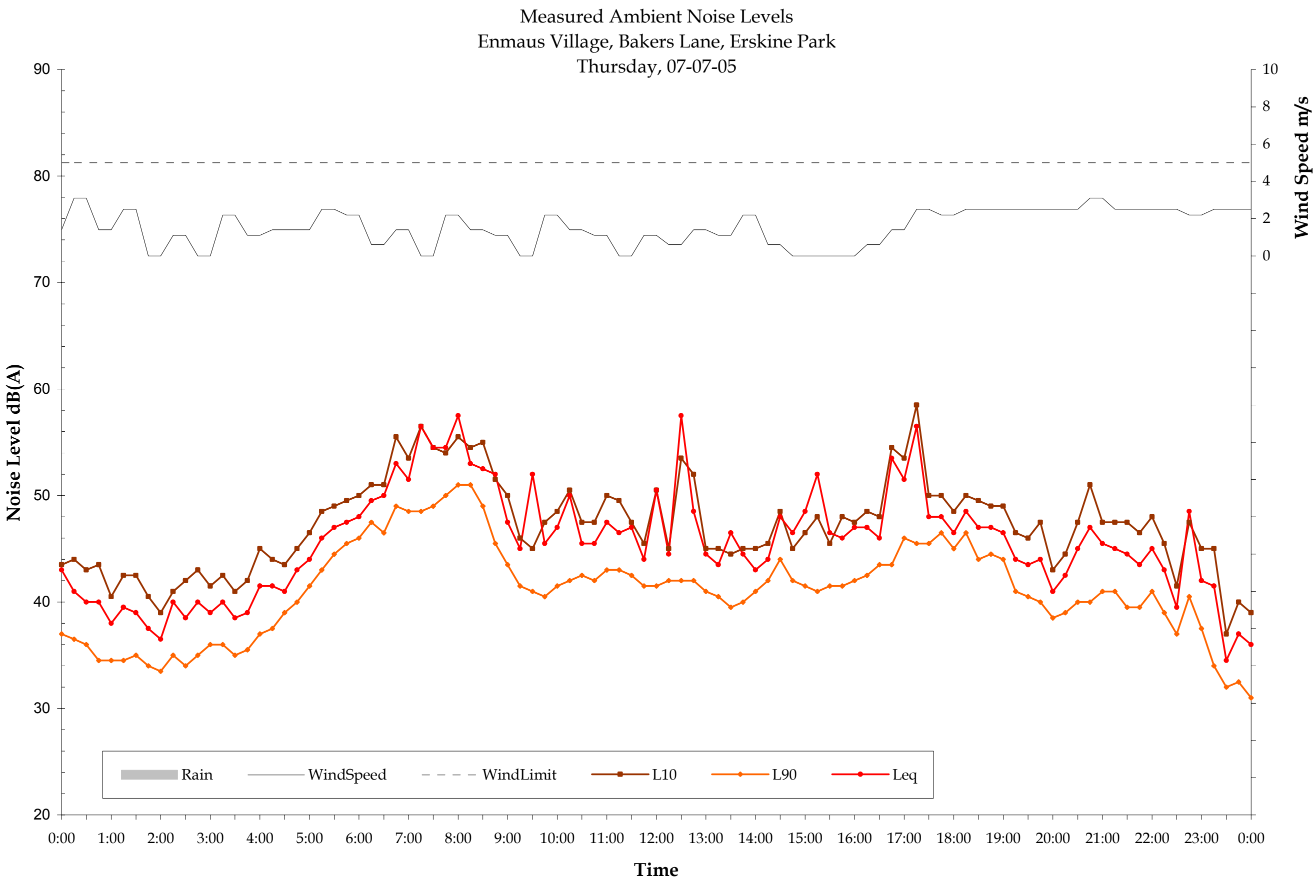
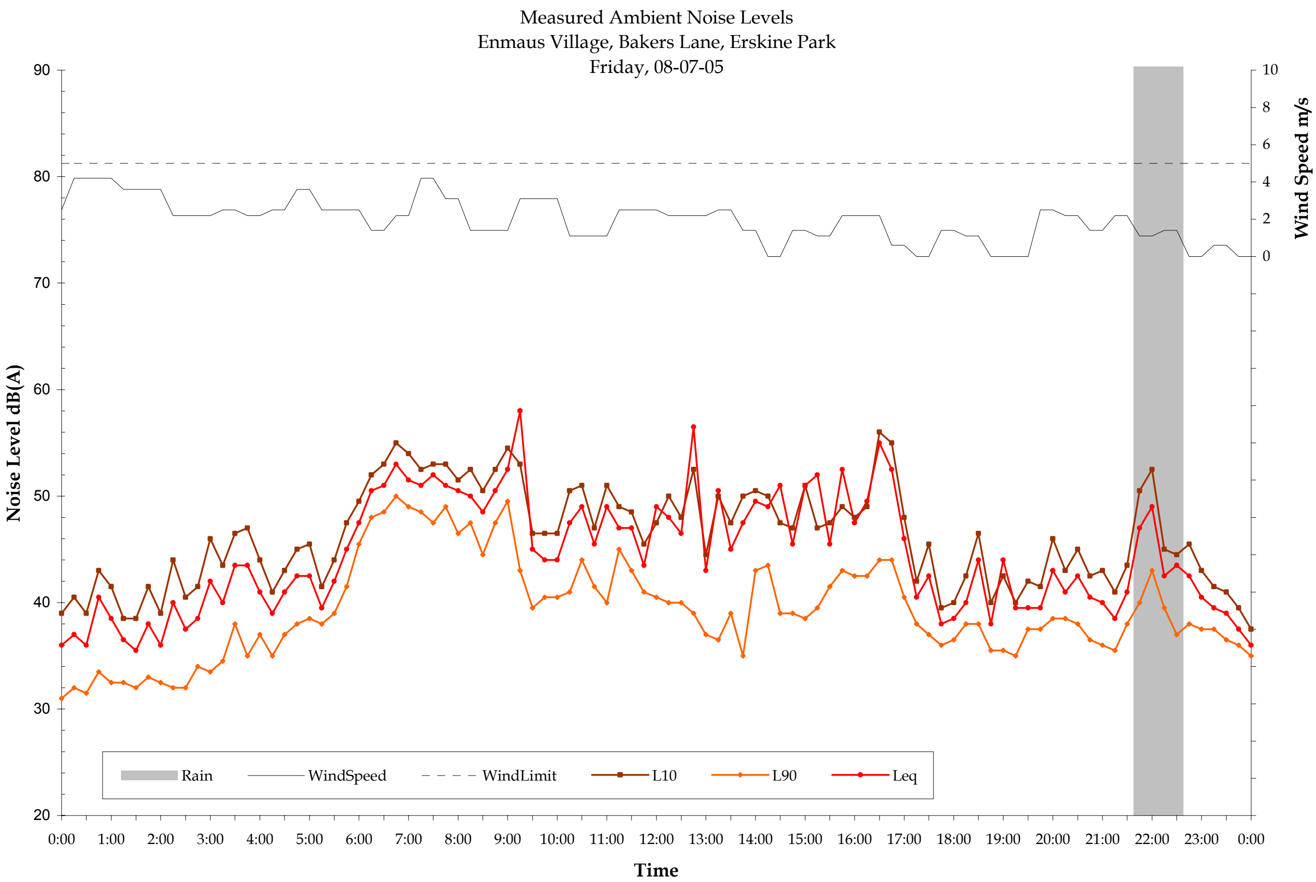
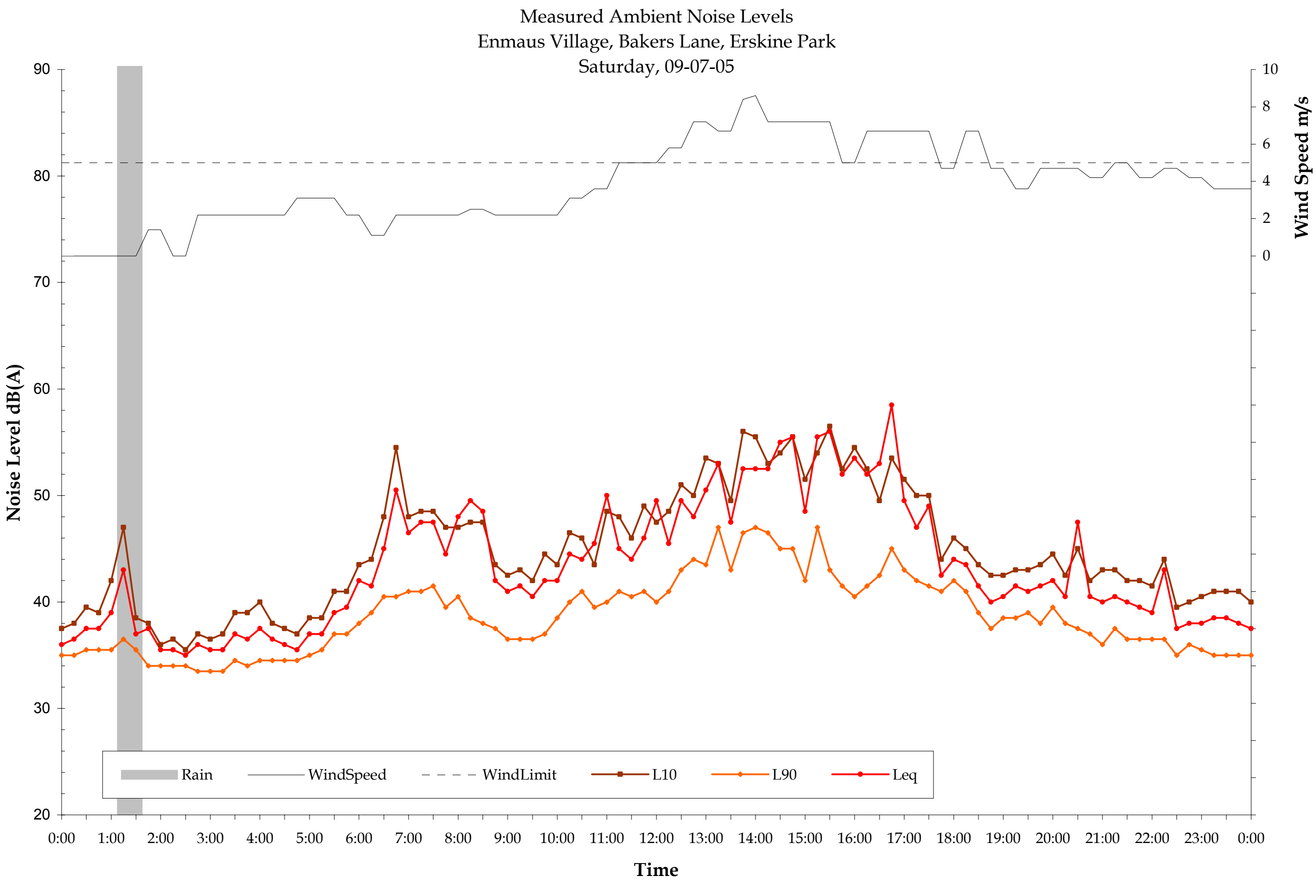
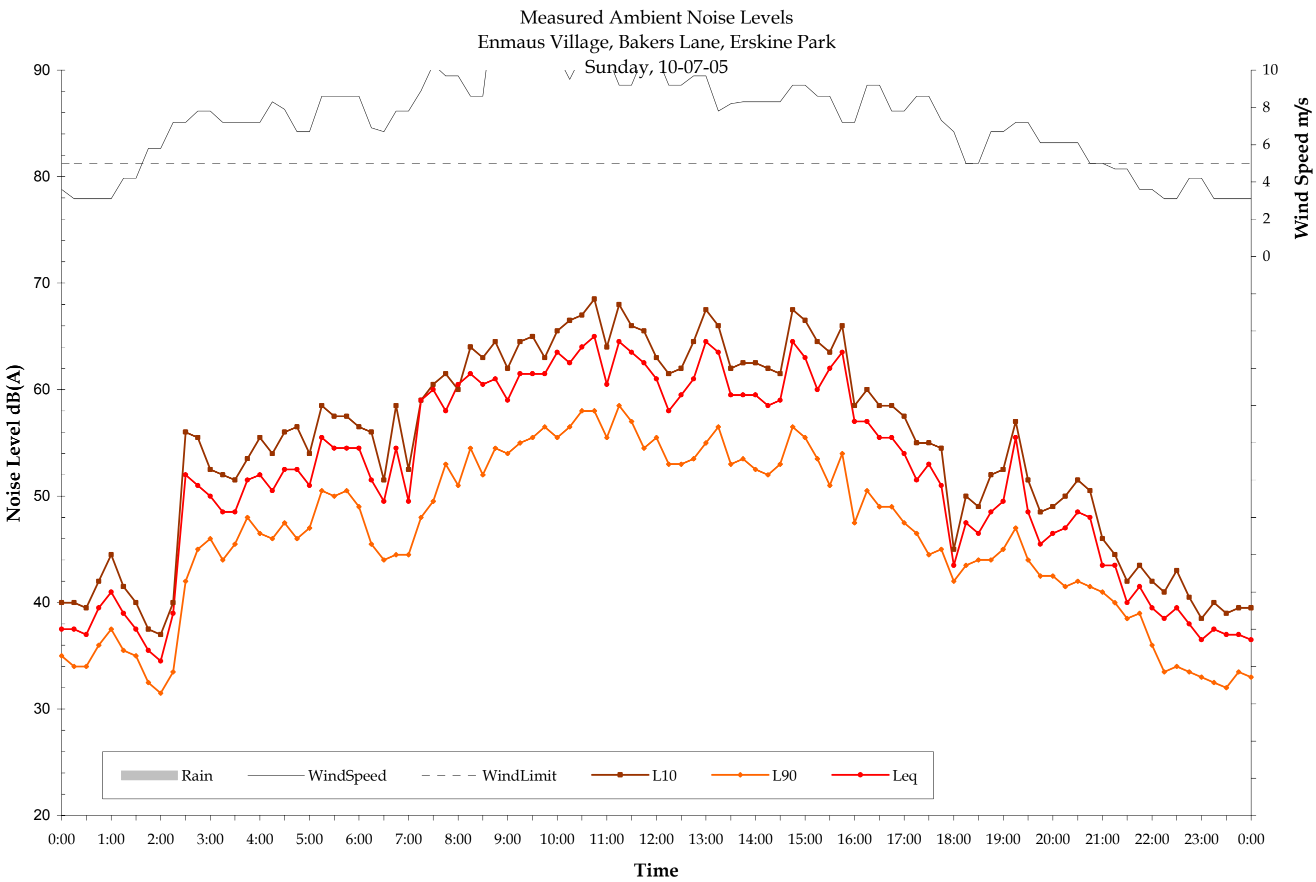
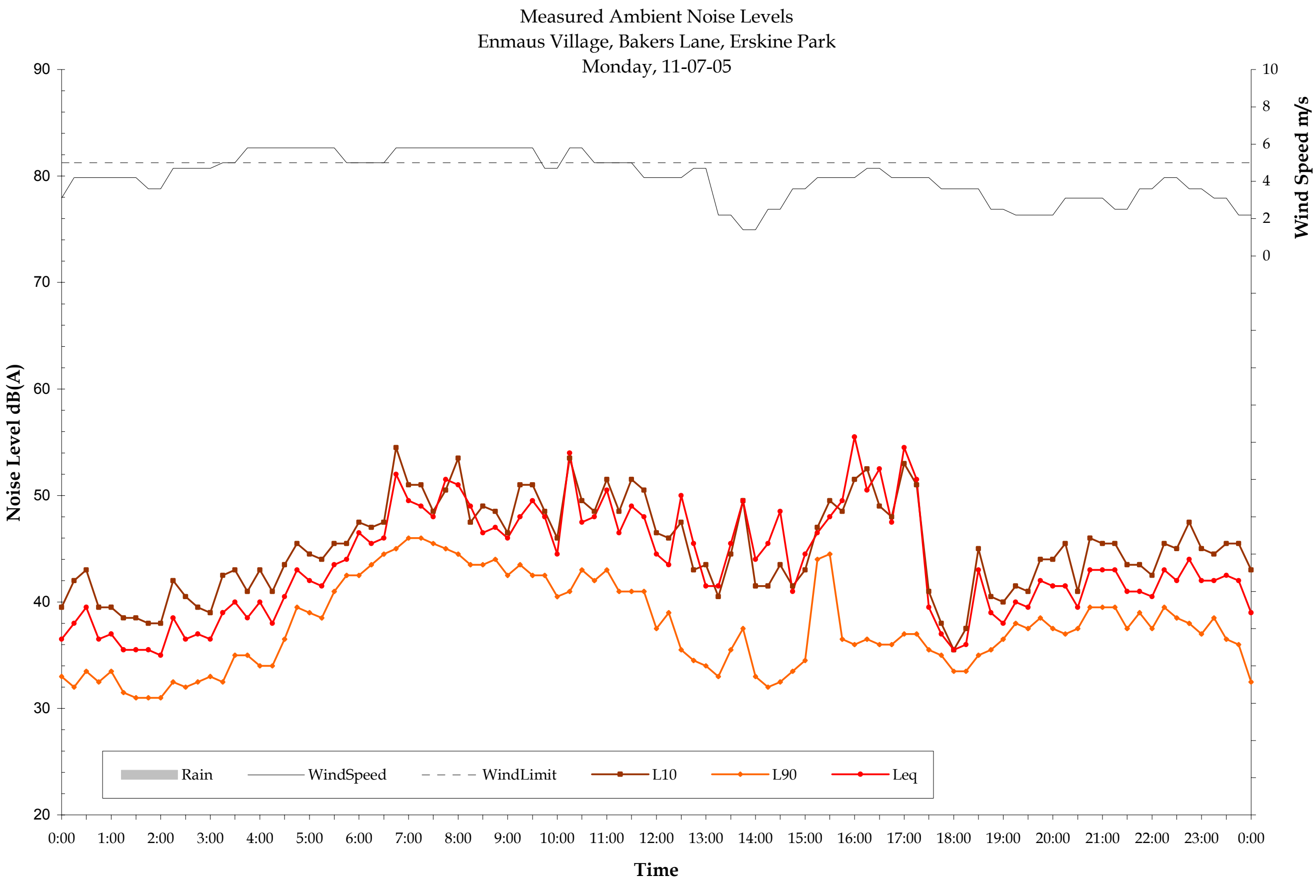
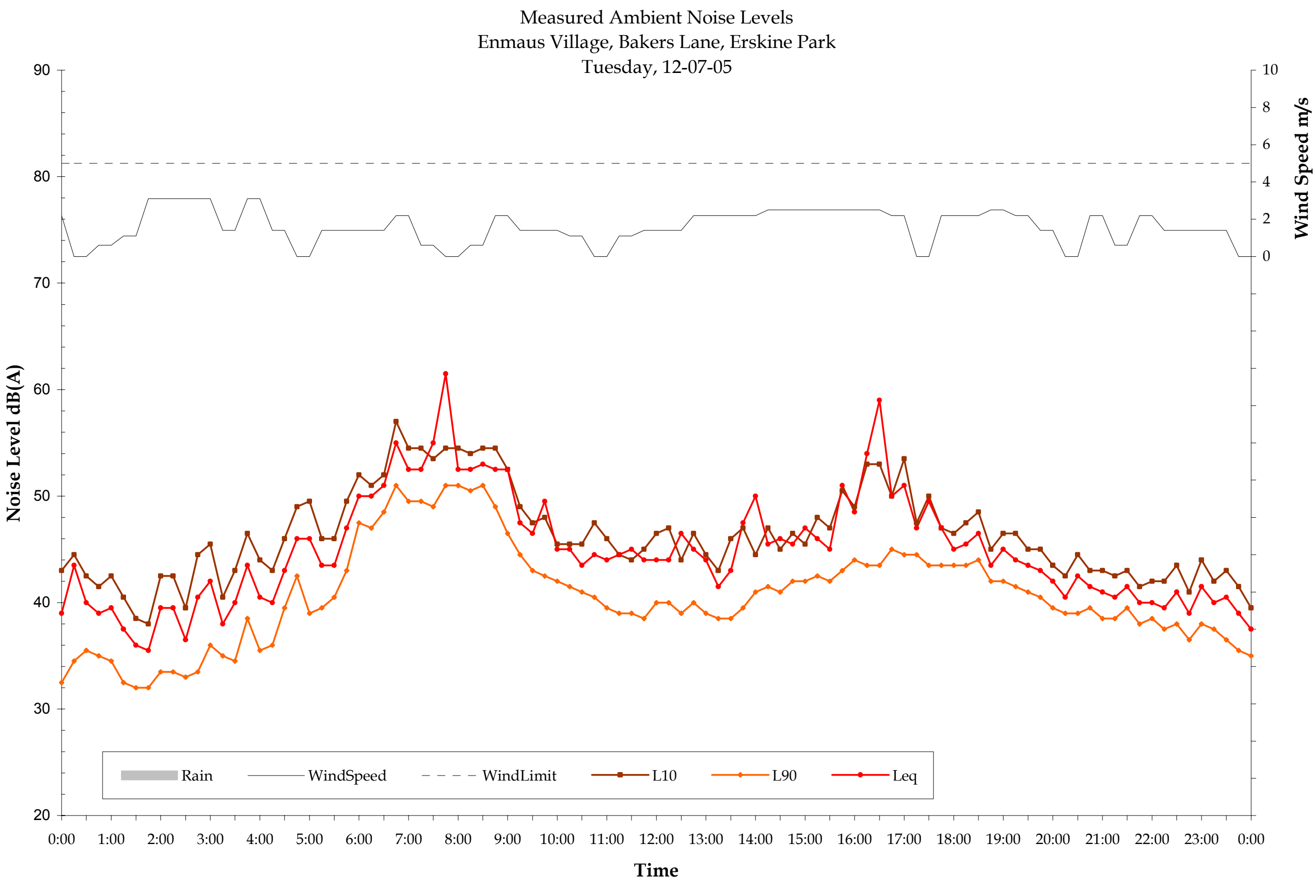

Measured Ambient Noise Levels
Enmaus Village, Bakers Lane, Erskine Park
Thursday, 07-07-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq

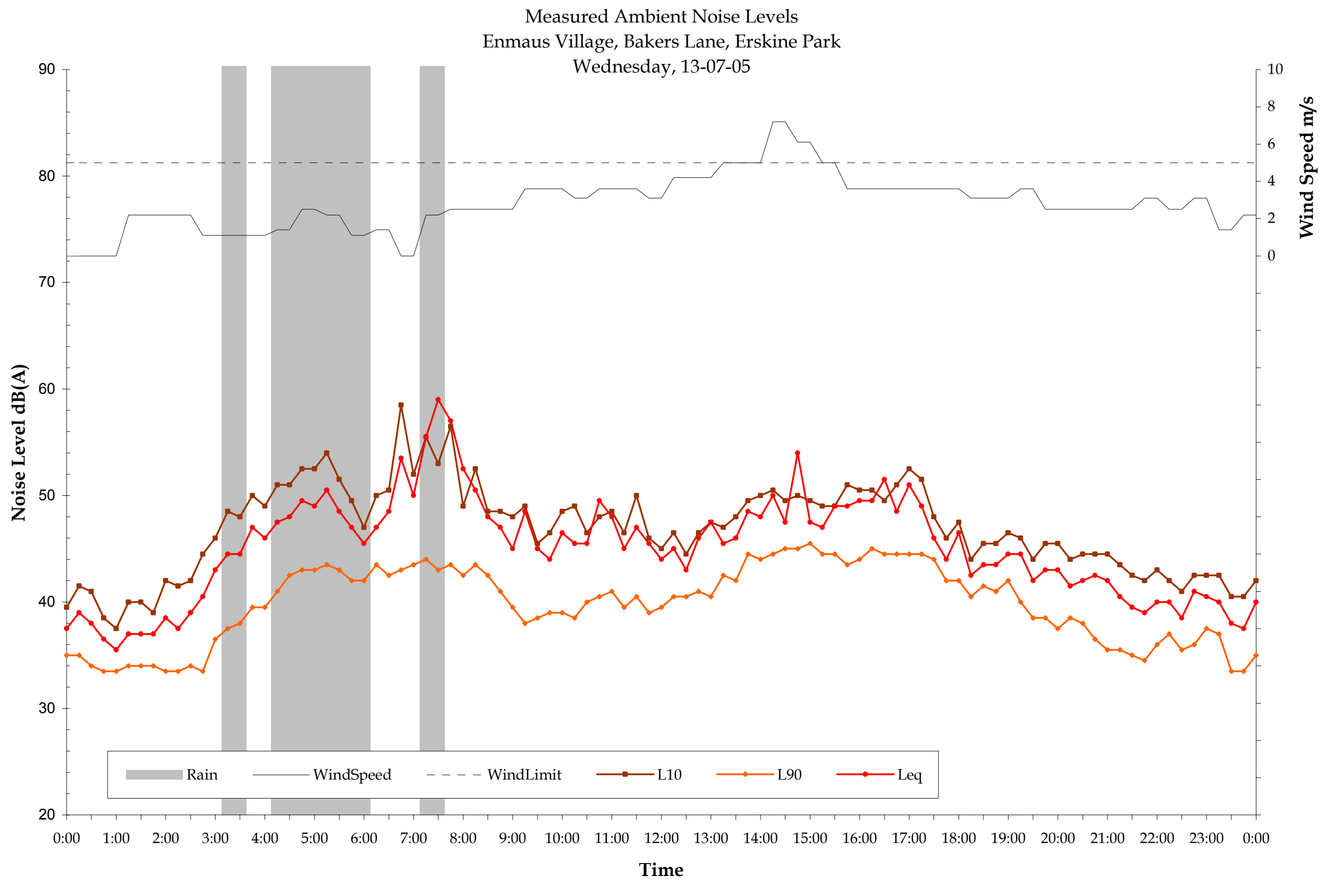

Measured Ambient Noise Levels
Enmaus Village, Bakers Lane, Erskine Park
Friday, 08-07-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq

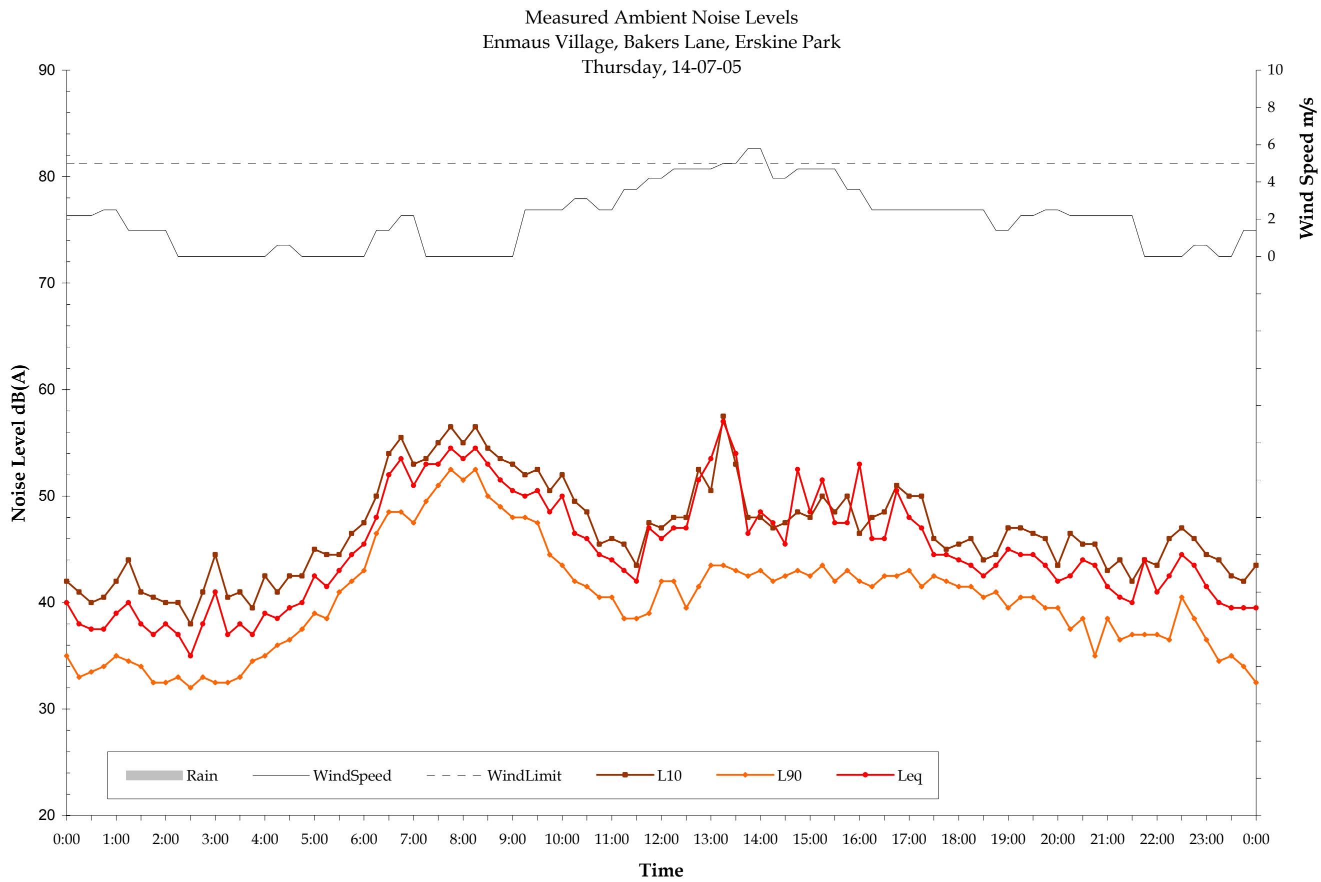

Measured Ambient Noise Levels
Enmaus Village, Bakers Lane, Erskine Park
Saturday, 09-07-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 0:00

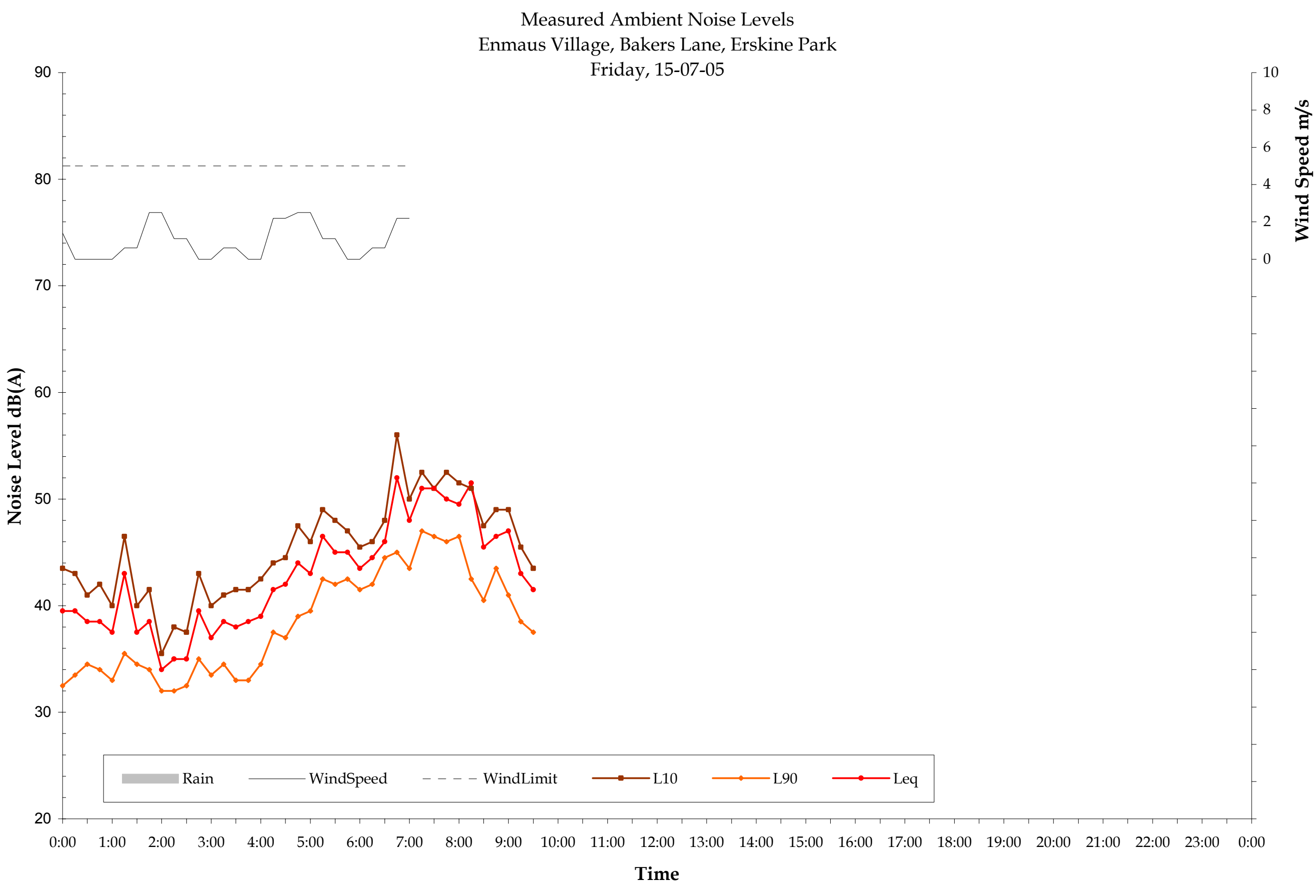

Measured Ambient Noise Levels
Enmaus Village, Bakers Lane, Erskine Park
Sunday, 10-07-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 0:00


Measured Ambient Noise Levels
Enmaus Village, Bakers Lane, Erskine Park
Monday, 11-07-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq


Measured Ambient Noise Levels
Enmaus Village, Bakers Lane, Erskine Park
Tuesday, 12-07-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq


Measured Ambient Noise Levels
Enmaus Village, Bakers Lane, Erskine Park
Wednesday, 13-07-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq


Measured Ambient Noise Levels
Enmaus Village, Bakers Lane, Erskine Park
Thursday, 14-07-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq

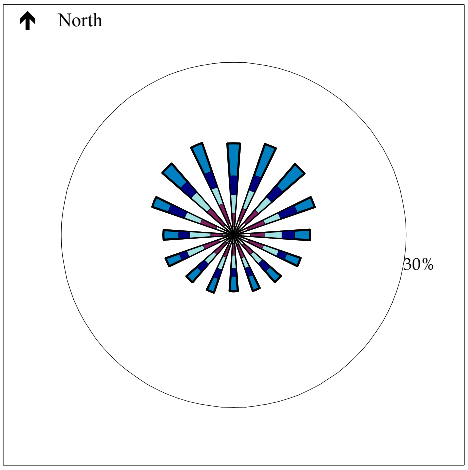

Measured Ambient Noise Levels
Enmaus Village, Bakers Lane, Erskine Park
Friday, 15-07-05
Noise Level dB(A)
Wind Speed m/s
Time
Rain
WindSpeed
WindLimit
L10
L90
Leq

Annex B

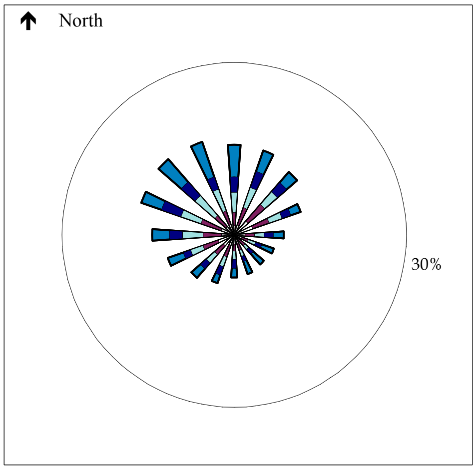
Horsley Park Vector Wind Roses

Day

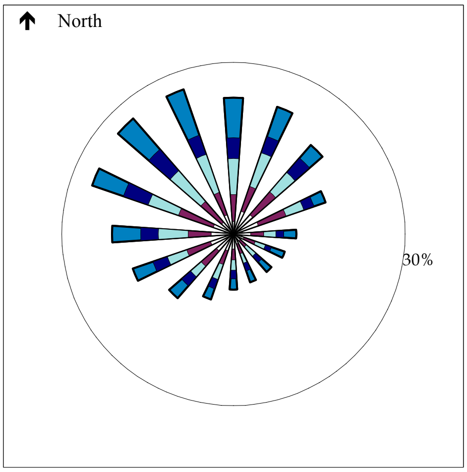
Summer



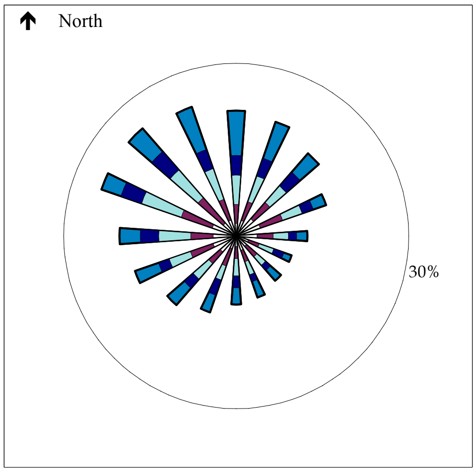
Spring



Winter



Autumn

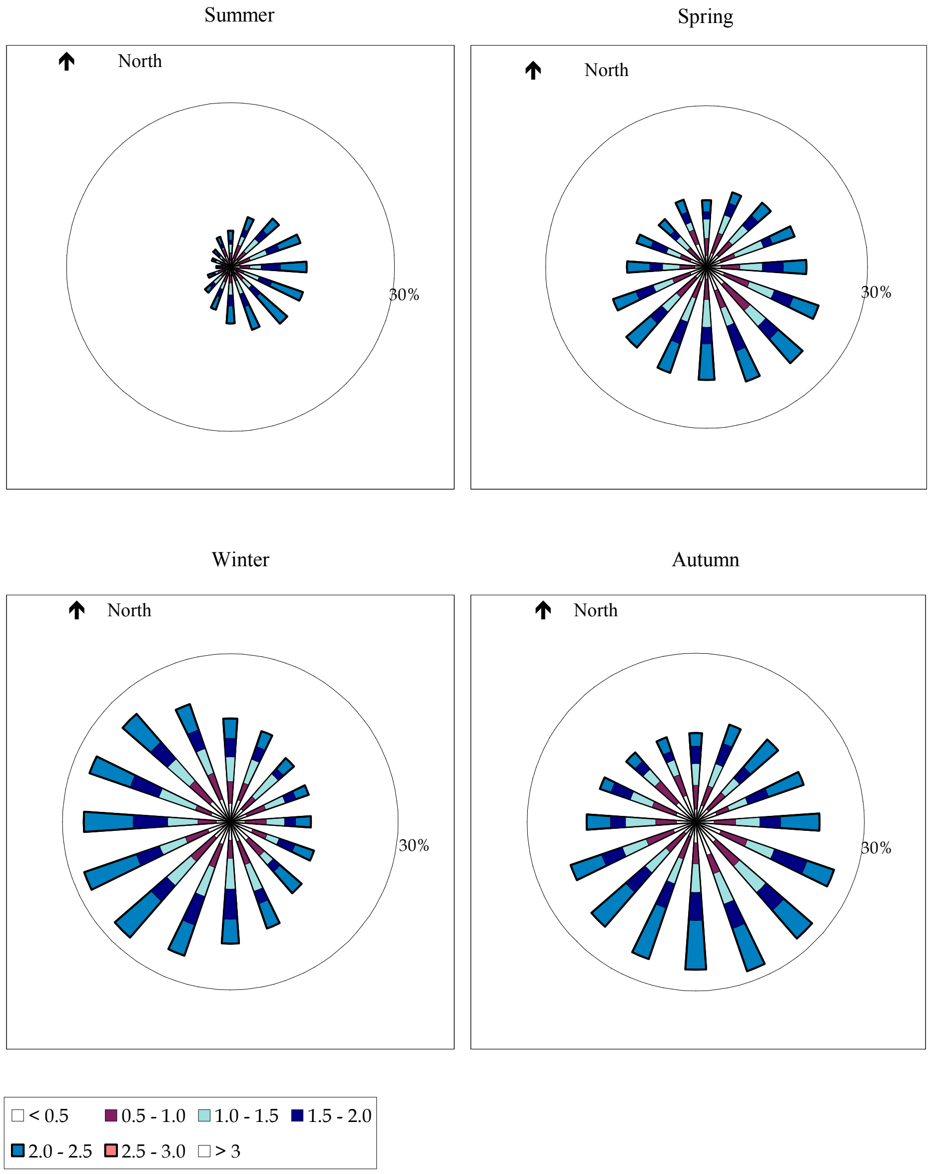


□ < 0.5 ■ 0.5 - 1.0 ■ 1.0 - 1.5 ■ 1.5 - 2.0
■ 2.0 - 2.5 ■ 2.5 - 3.0 □ > 3

Data Source: Horsley Park AWS (BoM)
Data Range: 30 min, 01-07-04 to 14-07-05

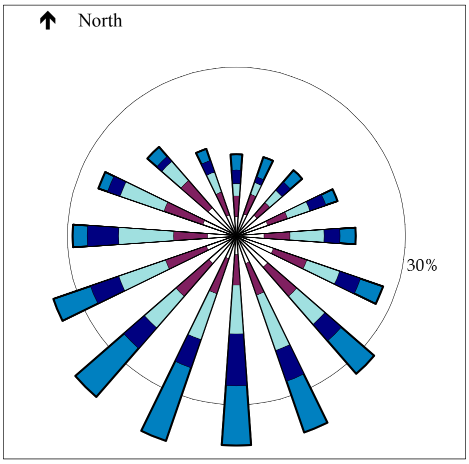
The segments of each arm represent the six valid wind speed classes, with increasing windspeed from the centre outwards.
The length of each arm represents the vector components (for each direction) of wind speeds 3m/s or below as a proportion of the total time for the period .
The circle represents the 30% occurrence threshold.

Evening

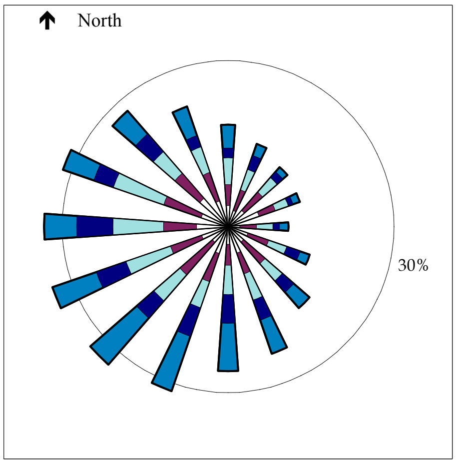

Summer
North
30%
Spring
North
30%
Winter
North
30%
Autumn
North
30%
< 0.5
0.5 - 1.0
1.0 - 1.5
1.5 - 2.0
2.0 - 2.5
2.5 - 3.0
> 3

Night

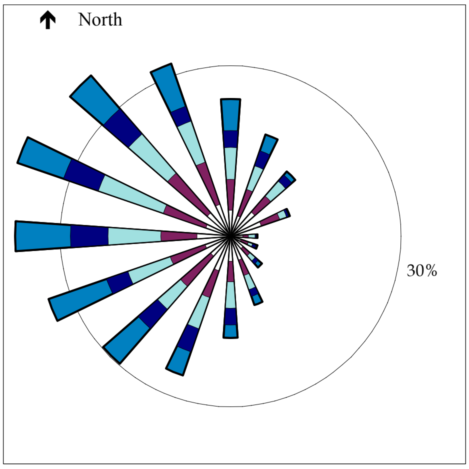
Summer



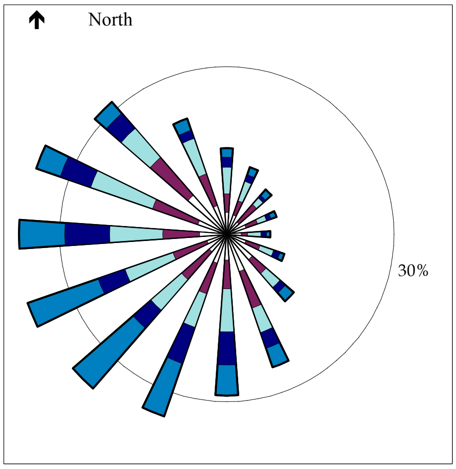
Spring



Winter



Autumn



< 0.5   0.5 - 1.0   1.0 - 1.5   1.5 - 2.0
2.0 - 2.5   2.5 - 3.0   > 3

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