HEGGIES

REPORT 30-2615R1

Revision 0

Coca-Cola Amatil Eastern Creek
Proposed Injection Moulding Plant
Noise Impact Assessment

PREPARED FOR

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Level 10
60 Castlereagh Street
SYDNEY NSW 2000

8 NOVEMBER 2010

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Coca-Cola Amatil Eastern Creek
Proposed Injection Moulding Plant
Noise Impact Assessment

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DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked	Authorised
30-2615R1	Revision 0	8 November 2010	Tristan Robertson	John Cotterill	John Cotterill

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1 INTRODUCTION

Heggies Pty Ltd (Heggies) has been commissioned by Goodman Property Service (Aust) Pty Ltd to conduct a Noise Impact Assessment (NIA) for the construction, operation of the proposed Coca-Cola Amatil (CCA) preform injection moulding plant. The preform injection moulding plant will be located at the existing Coca-Cola Distribution Centre within the M7 Business Hub, Eastern Creek, NSW. The primary objective of the NIA is to identify potential construction, operational and road traffic noise impacts on the surrounding residential, industrial and commercial receivers and to detail procedures for minimising, managing and monitoring these impacts.

The NIA has been prepared with reference to the Conditions of Consent issue by Department of Infrastructure Planning and Natural Resources (DIPNR) for the development and Blacktown City *Council State Environmental Planning Policy N0. 59* (*SEPP 59) – Eastern Creek Precinct Plan (Stage 3) 14 December 2005*. The NIA has been prepared in general accordance with the Department of Environmental, Climate Change and Water (DECCW) NSW Industrial Noise Policy (INP), the DECCW Interim Construction Noise Guideline (July 2009) and the DECCW Environmental Criteria for Road Traffic Noise (ECRTN).

Drawings upon which this acoustic assessment was based were supplied by Goodman Property Service, and are as follows:

- CCA DA02 (A) Estate Plan
- CCA DA03 (B) Site Plan
- CCA DA04 (A) Roof Plan
- CCA DA05 (A) Site Sections
- CCA DA06 (B) Elevations 01 & 02
- CCA DA07 (B) Elevations 03 & 04
- HKCCA10 (A0) Option 6
- HKCCA15 (A1) Section A-A Option 6
- DA 01 (rev B) Approved Site Plan With Proposed PET Facility
- DA 02 (rev B) Modifications to Approved Site Plan
- DA 03 (rev C) Proposed PET Facility Site Plan
- DA 04 (rev C) Proposed PET Facility Level 1 Floor Plan
- DA 05 (rev C) Proposed PET Facility Level 2 Floor Plan
- DA 06 (rev B) Proposed PET Facility Roof Plan
- DA 07 (rev C) Proposed PET Facility Stage 1 Elevations
- DA 08 (rev C) Proposed PET Facility Stage 2 Elevations
- DA 09 (rev C) Proposed PET Facility Sections
- DA 10 (rev C) Proposed PET Facility Office and Amenities Level 1 and 2 Plans

Also, the traffic report produced by Colston Budd Hunt & Kafes Pty Ltd '*Traffic report for proposed preform injection moulding plant at Coca-Cola Amatil site, Roussell Road, Eastern Creek, Jjuly 2010'* has been referenced in this report.

1.1 Description of Proposal and Site

Coca-Cola Amatil (CCA) operates in Australia, New Zealand, Papa New Guinea, Fiji and Indonesia and currently employees more than 1,850 people in NSW. CCA propose to build a PET Preform and Closure manufacturing plant to provide preforms and closures to its in-house Blowfill Bottling Operations in Australia, New Zealand, Papa New Guinea and Fiji.

The facility will require approximately 7,500m^2 of space (expanding up to 10,000m^2) to house technical rooms, the production lines and associated storage and staging of the finished product. The building is anticipated to have multiple heights to accommodate the production line layout requirements.

The facility is proposed to be located within the site of the existing CCA Distribution Centre at Roussell Road, Eastern Creek, NSW as shown in **Figure 1** and **Figure 2**.

Current CCA distribution facility operates 24 hours per day 7 days per week and the proposed preform moulding plant will also operate 24 hours per day 7 days per week.

1.2 Acoustic Terminology

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

Figure 1 Estate Masterplan

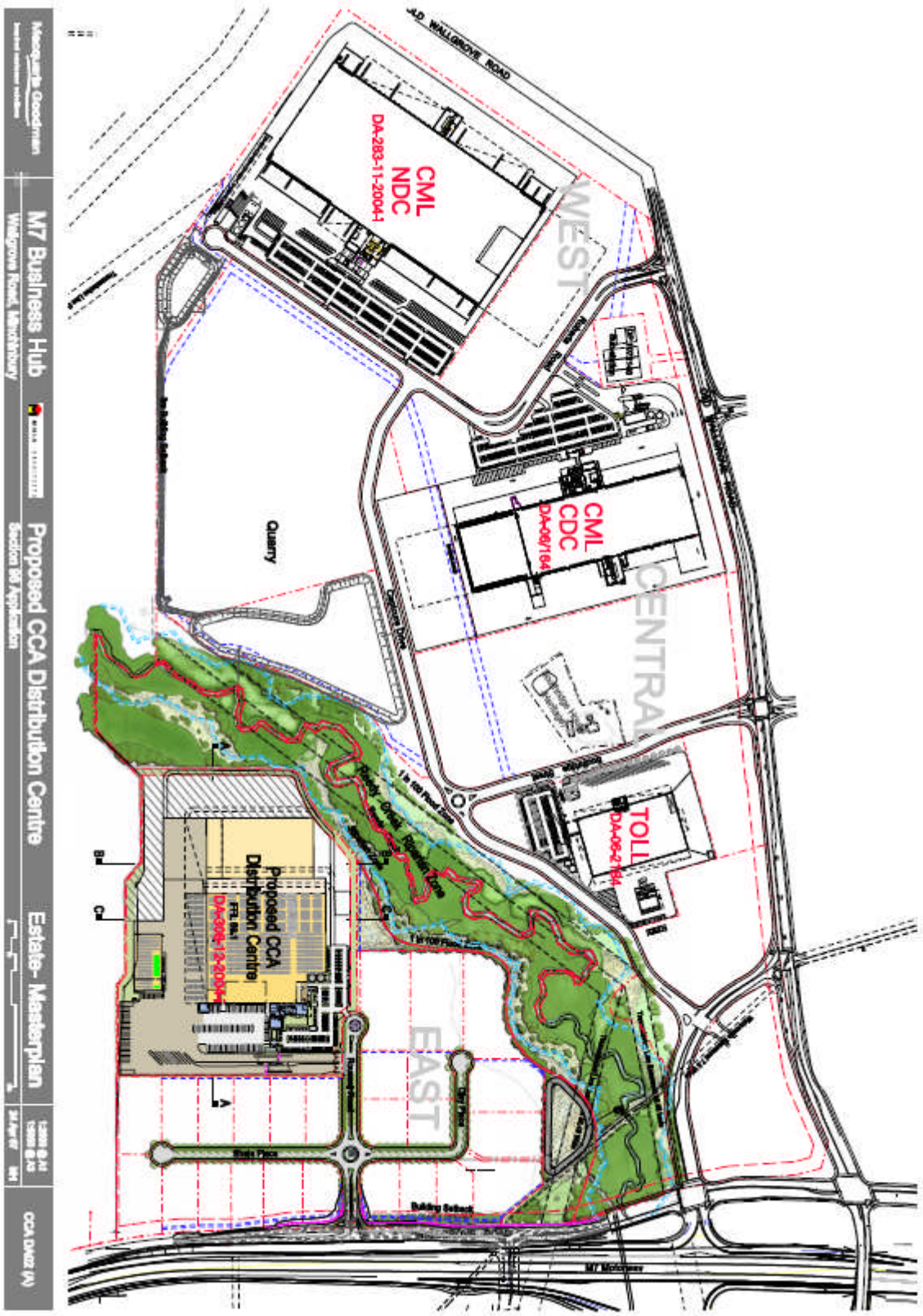
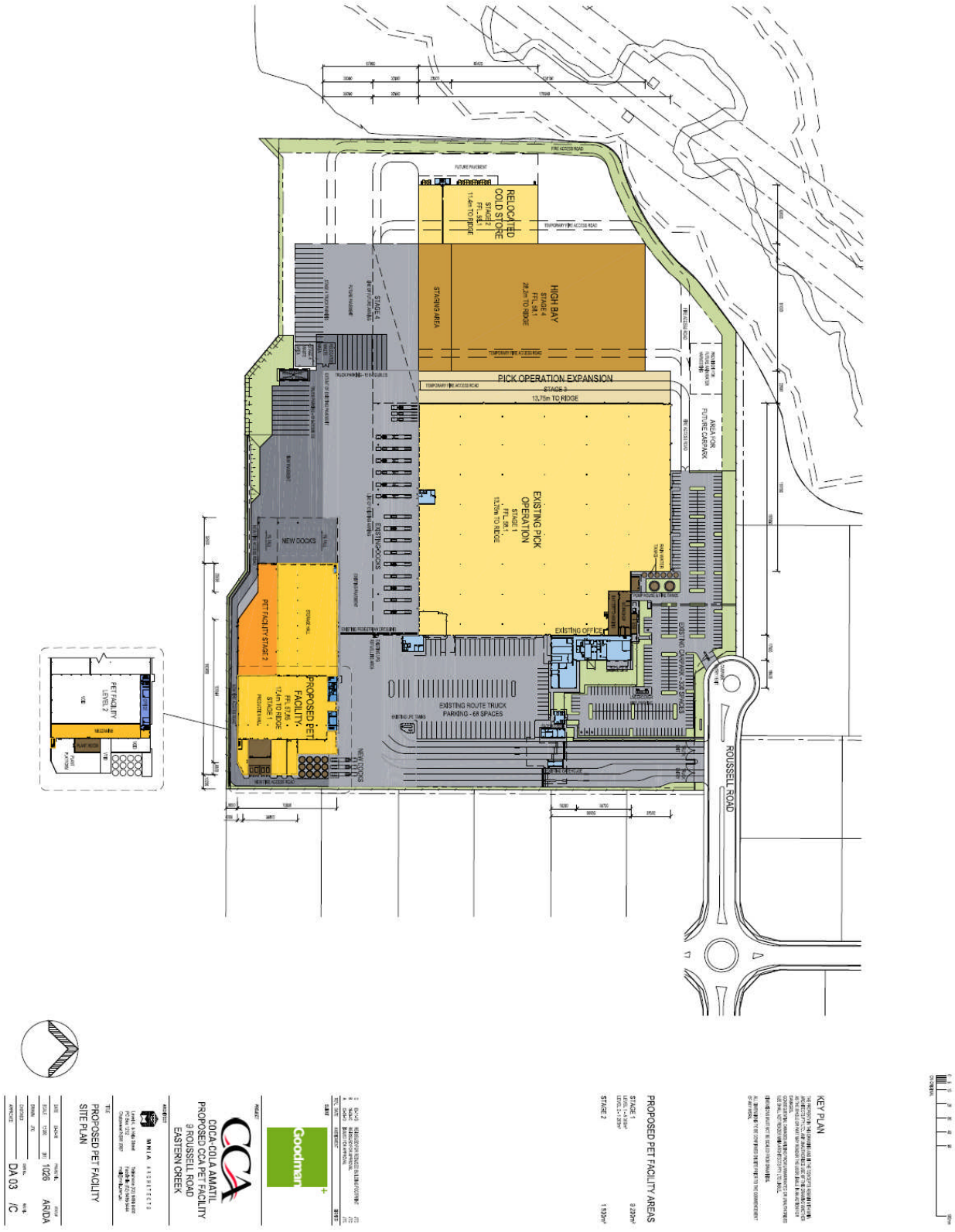


Figure 2 Site Map



1.3 Nearest Sensitive Receptors

The proposed Coca-Cola preform injection moulding plant is contained within Zone 6 of the M7 Business Hub.

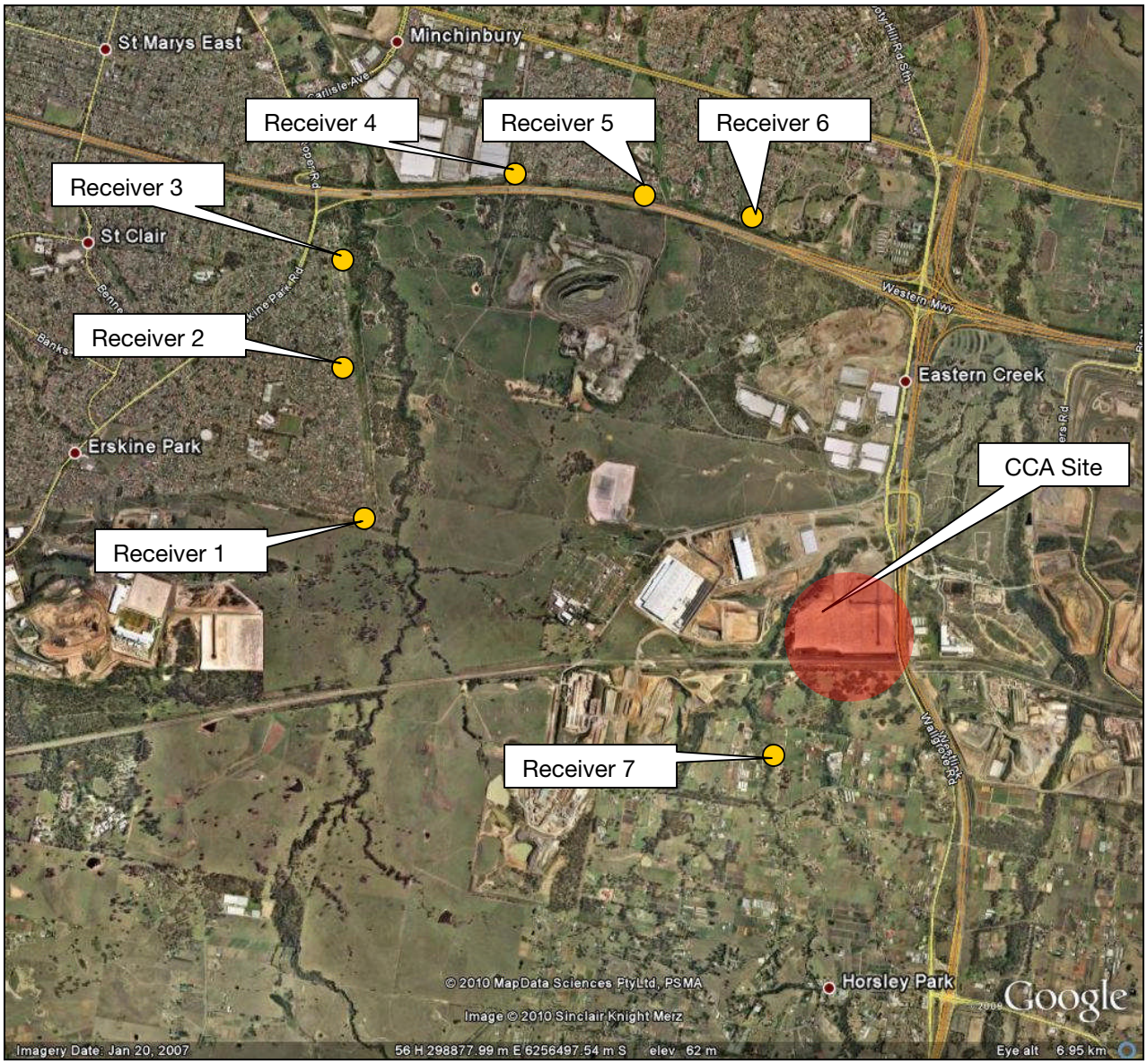
The residential suburb of Erskine Park is located west of the site. The M4 and M7 Motorway are to the north and east of the site respectively with the residential suburb of Minchinbury to the immediate north of the M4.

Sydney West Substation, further industrial areas and scattered residential properties are located to the south of the site. The nearest residence is approximately 500 metres to the south of the site.

The nearest potentially affected receivers are residents located in Erskine Park to the west, Minchinbury to the north and residences off Burley Road, Horsley Park to the south. See Location Map in **Figure 3** for details.

The acoustical environment adjacent to the M4 and M7 typifies an urban environment, with heavy and continuous traffic flows, and residences near industrial districts. Therefore, the residences in Minchinbury and the northern-most residences of Erskine Park have been assessed under the "Urban" receiver type. Other residential receivers in Erskine Park and Horsley Park have been assessed under the "Suburban" receiver type.

Figure 3 Location of Nearest Sensitive Receptors



Source: Google Earth

2 EXISTING ACOUSTICAL AND METEOROLOGICAL ENVIRONMENT

In order to determine existing ambient noise levels at the nearest residential locations to the site, a background monitoring survey were undertaken at three (3) residences, namely Receiver 1 (3 Cetus Place Erskine Park), Receiver 6 (24 Farrington Street Minchinbury) and Receiver 7 (146 Burley Road Horsley Park), as shown in **Figure 3**.

The background noise monitoring consisted of continuous, unattended noise logging and operator attended noise surveys. The operator attended noise surveys help to define noise sources and the character of noise in the area and are, therefore, used to qualify unattended noise logging results.

2.1 Unattended Continuous Noise Monitoring

The objective of the background monitoring survey was to measure $L_{A90(15minute)}$ and $L_{Aeq(15\ minute)}$ noise levels at the nearest potentially affected receivers during proposed operational periods to determine the intrusiveness and amenity criteria for the development.

The noise monitoring commenced on Thursday 22 July 2010 and concluded on Thursday 29 July 2010. The noise monitoring was conducted using ARL Type EL215 environmental noise loggers.

Any noise data during periods of rainfall and/or wind speeds in excess of 5 m/s (approximately 18 km/h) were discarded in accordance with INP weather affected data exclusion methodology. The weather data for this purpose was obtained from the nearest Bureau of Meteorology weather station at Horsley Park, approximately 4km south east of the subject site.

A summary of the results of the unattended continuous noise monitoring is given in **Table 1**. The ambient noise levels are presented in graphical format in **Appendix B, C and D**.

Table 1 Summary of Existing Ambient Noise Levels

Location	Period	RBL, Background L_{A90} Noise Level (dBA)	$L_{Aeq(15minute)}$ Noise Level
Monitoring Location 1	Daytime	34	52
Receiver 1 – 3 Cetus Place, Erskine Park	Evening	37	47
	Night	37	53
Monitoring Location 2	Daytime	52	58
Receiver 6 – 24 Farrington Street, Minchinbury	Evening	50	56
	Night	44	53
Monitoring Location 3	Daytime	39	53
Receiver 7 – 146 Burley Road, Horsley Park	Evening	38	45
	Night	35	42

Notes For Monday to Saturday, Daytime 7.00 am - 6.00 pm; Evening 6.00 pm - 10.00 pm; Night-time 10.00 pm - 7.00 am. On Sundays and Public Holidays, Daytime 8.00 am - 6.00 pm; Evening 6.00 pm - 10.00 pm; Night-time 10.00 pm - 8.00 am.

The LA90 represents the level exceeded for 90% of the interval period and is referred to as the average minimum or background noise level

The LAeq index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

All noise levels reported here are from free-field measurements, meaning that no noise reflections occurred from building/structure facades near the logging sites.

Also, background noise levels present in **Table 1** have not been affected from existing Coca-Cola activities and therefore are applicable levels to be used in the establishment of project specific noise criteria.

2.2 Operator Attended Noise Monitoring

An operator-attended noise survey was conducted at the noise monitoring location to verify the unattended logging results and to determine the character and contribution of noise sources to the total ambient noise level.

The operator attended noise survey was conducted during logger deployment on Thursday 22 July 2010. Results of this survey are shown in **Table 2**. Ambient noise levels given in **Table 2** include all noise sources such as traffic and residential activities.

Table 2 Operator Attended Noise Measurements

Location	Date/ Start Time/ Weather	Primary Noise Descriptor (dBA re 20μPa)					Description of Noise Emission and Typical Maximum Levels LAmax (dBA)
		LAmax	LA1	LA10	LA90	LAeq	
Receiver 1 3 Cetus Place, Erskine Park	22/7/10 10:35am Overcast 3m/s SW winds 14ºC	59	49	43	37	41	Birds 35-59, Nearby Industrial activities 41 Trees/wind 40-49 Existing CCA Operations 'NOT' Audible
Receiver 6 24 Farrington Street, Minchinbury	22/7/10 11:28am Overcast 3m/s SW winds 15ºC	92	85	62	53	70	Birds 45-54, Road Traffic Noise M4 (constant) 53-62 Road Cleaning Truck 92 Existing CCA Operations 'NOT' Audible
Receiver 7 146 Burley Road, Horsley Park	22/7/10 12:19pm Overcast 3m/s SW winds 15ºC	75	72	52	40	56	Birds 45, Road Traffic Noise M7 (constant)40-45 Aircraft 56- 75 Residential dog 40 Existing CCA Operations 'NOT' Audible

The ambient noise environment at Receiver 1 and 7 was typical of a suburban location. Noise sources included intermittent road traffic noise with some light industry noise.

The ambient noise environment at Receiver 6 was typical of an urban location. Noise sources included heavy and continuous traffic flow from the M4.

2.3 INP Assessment of Prevailing Weather Conditions

2.3.1 Wind

Wind has the potential to increase noise at a receiver when it is light and stable and blows from the direction of the source of the noise. As the strength of the wind increases the noise produced by the wind will obscure noise from most industrial and transport sources.

Wind effects need to be considered when wind is a feature of the area under consideration. The INP states that where wind blows from the source to the receiver at speeds up to 3 m/s for more than 30% of the time in any season, then wind is considered to be a feature of the area and noise level predictions must be made under these conditions.

In order to determine the prevailing conditions for the subject site, 12 months of weather data was obtained from a Bureau of Meteorology automatic weather station at Horsley Park, approximately 4km south east of the subject site.

This data was analysed to determine the frequency of occurrence of winds of speeds up to 3 m/s in each season during the day, evening and night time periods. The results of the wind analysis for daytime, evening, and night-time winds are presented in **Table 3**, **Table 4** and **Table 5**, respectively. In each table, the wind directions and percentage occurrence are those dominant during each season.

Table 3 Seasonal Frequency of Occurrence of Wind Speed Intervals - Daytime

Period	Calm	Wind Direction	0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/s
Summer	1.8%	N±45	4.4%	6.6%	11.0%
Autumn	4.1%	NNW±45	8.2%	7.8%	15.9%
Winter	6.7%	NNW±45	10.1%	9.5%	19.6%
Spring	0.9%	NNW±45	4.0%	5.3%	9.3%

Table 4 Seasonal Frequency of Occurrence of Wind Speed Intervals - Evening

Period	Calm	Wind Direction	0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/s
Summer	6.4%	SE±45	4.8%	9.4%	14.2%
Autumn	15.4%	SW±45	7.7%	9.8%	17.5%
Winter	12.9%	W±45	7.6%	10.4%	17.9%
Spring	8.2%	NE±45	6.3%	7.5%	13.8%

Table 5 Seasonal Frequency of Occurrence of Wind Speed Intervals – Night-time

Period	Calm	Wind Direction	0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/s
Summer	21.2%	SSW±45	10.0%	15.2%	25.3%
Autumn	22.7%	WSW±45	12.7%	15.7%	28.4%
Winter	19.4%	W±45	14.1%	8.8%	23.0%
Spring	20.8%	SSW±45	9.5%	10.0%	19.5%

From the above weather data, significant wind (ie wind speed of up to 3 m/s) was recorded but not more than the assessment threshold of 30 % during the period between August 2009 and July 2010 and therefore prevailing wind condition was not considered in this assessment.

2.3.2 Temperature Inversion

Temperature inversions, when they occur, have the ability to increase noise levels by focusing sound waves. Temperature inversions occur predominantly at night during the winter months. For a temperature inversion to be a significant characteristic of the area it needs to occur for approximately 30% of the total night-time during winter, or about two nights per week.

The NSW INP states that temperature inversions need only be considered for the night-time noise assessment period (10.00 pm to 7.00 am). Temperature inversion data was not obtainable from the Horsley Park weather station. Therefore, in accordance with the INP, operational noise levels representing a worst case scenario were modelled using the INP default temperature inversion value of 3°C/100 m for the night-time period (10 pm – 7 am).

3 IMPACT ASSESSMENT PROCEDURES

3.1 General Objectives

Responsibility for the control of noise emission in New South Wales is vested in Local Government and the DECCW. The INP was released in January 2000 and provides a framework and process for deriving noise criteria for consents and licences that will enable the DECCW to regulate premises that are scheduled under the Protection of the Environment Operations Act, 1997.

The specific policy objectives are:

- To establish noise criteria that would protect the community from excessive intrusive noise and preserve amenity for specific land uses.
- To use the criteria as the basis for deriving project specific noise levels.
- To promote uniform methods to estimate and measure noise impacts, including a procedure for evaluating meteorological effects.
- To outline a range of mitigation measures that could be used to minimise noise impacts.
- To provide a formal process to guide the determination of feasible and reasonable noise limits for consents or licences that reconcile noise impacts with the economic, social and environmental considerations of industrial development.
- To carry out functions relating to the prevention, minimisation and control of noise from the premises scheduled under the Act.

3.2 Assessing Intrusiveness

For assessing intrusiveness, the background noise level must be measured. The intrusiveness criterion essentially means that the equivalent continuous noise level (L_{Aeq}) of the source should not be more than five decibels above the measured background level (L_{A90}).

3.3 Assessing Amenity

The amenity assessment is based on noise criteria specific to land use and associated activities. The criteria relate only to industrial-type noise and do not include road, rail or community noise. The existing noise level from industry is measured. If it approaches the criterion value, then noise levels from new industries need to be designed so that the cumulative effect does not produce noise levels that would significantly exceed the criterion. For high-traffic areas there is a separate amenity criterion.

An extract from the INP that relates to the amenity criteria is given in **Table 6**.

Table 6 Amenity Criteria – Recommended LAeq Noise levels from Industrial Noise Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended $L_{Aeq(Period)}$ Noise Level (dBA)	
			Acceptable	Recommended Maximum
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45
	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
	Urban	Day	60	65
		Evening	50	55
		Night	45	50
	Urban/Industrial Interface (for existing situations only)	Day	65	70
		Evening	55	60
		Night	50	55
School classrooms - internal	All	Noisiest 1 hour period when in use	35	40
Hospital wards - internal - external	All	Noisiest 1 hour period	 35 50	 40 55
Place of worship - internal	All	When in use	40	45
Area specifically reserved for passive recreation (eg National Park)	All	When in use	50	55
Active recreation area (eg school playground, golf course)	All	When in use	55	60
Commercial premises	All	When in use	65	70
Industrial premises	All	When in use	70	75

Note: Daytime 7.00 am - 6.00 pm; Evening 6.00 pm - 10.00 pm; Night-time 10.00 pm - 7.00 am, On Sundays and Public Holidays, Daytime 8.00 am -6.00 pm; Evening 6.00 pm - 10.00 pm; Night-time 10.00 pm - 8.00 am. The L_{Aeq} index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

Table 7 Modification to Acceptable Noise level (ANL)* to Account for Existing Levels of Industrial Noise

Total Existing L_{Aeq} noise level from Industrial Noise Sources	Maximum L_{Aeq} Noise Level for Noise from New Sources Alone, dBA
≥ Acceptable noise level plus 2 dBA	If existing noise level is *likely to decrease* in future acceptable noise level minus 10 dBA If existing noise level is *unlikely to decrease* in future existing noise level minus 10 dBA
Acceptable noise level plus 1 dBA	Acceptable noise level minus 8 dBA

Total Existing L_{Aeq} noise level from Industrial Noise Sources	Maximum L_{Aeq} Noise Level for Noise from New Sources Alone, dBA
Acceptable noise level	Acceptable noise level minus 8 dBA
Acceptable noise level minus 1 dBA	Acceptable noise level minus 6 dBA
Acceptable noise level minus 2 dBA	Acceptable noise level minus 4 dBA
Acceptable noise level minus 3 dBA	Acceptable noise level minus 3 dBA
Acceptable noise level minus 4 dBA	Acceptable noise level minus 2 dBA
Acceptable noise level minus 5 dBA	Acceptable noise level minus 2 dBA
Acceptable noise level minus 6 dBA	Acceptable noise level minus 1 dBA
< Acceptable noise level minus 6 dBA	Acceptable noise level

* ANL = recommended acceptable L_{Aeq} noise level for the specific receiver, area and time of day from **Table 6**.

3.4 INP Project Specific Criteria

The INP Project Specific Noise levels are the more stringent of either the amenity or intrusive criteria. The INP states that these criteria have been selected to protect at least 90% of the population living in the vicinity of industrial noise sources from the adverse effects of noise for at least 90% of the time. Provided the criteria in the INP are achieved, it is unlikely that most people would consider the resultant noise levels excessive.

In those cases where the INP project specific assessment criteria are not achieved, it does not automatically follow that all people exposed to the noise would find the noise unacceptable. In subjective terms, exceedances of the INP project specific assessment criteria can be generally described as follows:

- Negligible noise level increase <1 dB(A) (Not noticeable by all people)
- Marginal noise level increase 1 dB(A) to 2 dB(A) (Not noticeable by most people)
- Moderate noise level increase 3 dB(A) to 5 dB(A) (Not noticeable by some people but may be noticeable by others)
- Appreciable noise level increase >5 dB(A) (Noticeable by most people)

In view of the foregoing, **Table 8** presents the methodology for assessing noise levels which may exceed the INP project specific noise assessment criteria.

Table 8 Noise Impact Assessment Methodology

Assessment Criteria	Project Specific Criteria	Noise Management Zone	Noise Affectation Zone
Intrusive	Rating background level plus 5 dBA	≤ 5 dBA above project specific criteria	> 5 dBA above project specific criteria
Amenity	INP based on existing industrial level	≤ 5 dBA above project specific criteria	> 5 dBA above project specific criteria

For the purposes of assessing the potential noise impacts the project specific, management and affectation criteria are further defined as follows:

3.4.1 Project Specific Criteria

Most people in the broader community would generally consider exposure to noise levels corresponding to this zone acceptable.

3.4.2 Noise Management Zone

Depending on the degree of exceedance of the project specific criteria (1 dBA to 5 dBA) noise impacts could range from negligible to moderate. It is recommended that management procedures be implemented including:

- Prompt response to any community issues of concern.
- Noise monitoring on site and within the community.
- Refinement of on site noise mitigation measures and plant operating procedures where practical.
- Consideration of acoustical mitigation at receivers.
- Consideration of negotiated agreements with property holders.

3.4.3 Noise Affectation Zone

Exposure to noise levels exceeding the project-specific criteria by more than 5 dB(A) may be considered unacceptable by some property holders and the INP recommends that the proponent explore the following.

- Discussions with relevant property holders to assess concerns and provide solutions.
- Implementation of acoustical mitigation at receivers.
- Negotiated agreements with property holders, where required.

3.5 Assessing Sleep Disturbance

The DECCW's current approach to assessing potential sleep disturbance is to apply an initial screening criterion of background plus 15 dBA (as described in the Application Notes to the INP), and to undertake further detailed analysis if the screening criterion cannot be achieved. The sleep disturbance screening criterion applies outside bedroom windows during the night-time period.

Where the screening criterion cannot be met, the additional analysis should consider the number of potential sleep disturbance events during the night, the level of exceedance and noise from other events. It may also be appropriate to consider other guidelines including the DECCW's ECRTN which contains additional guidance relating to the potential sleep disturbance impacts.

A review of research on sleep disturbance in the ECRTN indicates that in some circumstances, higher noise levels may occur without significant sleep disturbance. Based on studies into sleep disturbance, the ECRTN concludes that:

- "Maximum internal noise levels below 50 dBA to 55 dBA are unlikely to cause awakening reactions."
- "One or two noise events per night, with maximum internal noise levels of 65 dBA to 70 dBA, are not likely to affect health and wellbeing significantly."

It is generally accepted that internal noise levels in a dwelling, with the windows open, are 10 dBA lower than external noise levels. Based on a worst case minimum attenuation, with windows open, of 10 dBA, the first conclusion above suggests that short term external noises of 60 dBA to 65 dBA are unlikely to cause awakening reactions. The second conclusion suggests that one or two noise events per night with maximum external noise levels of 75 dBA to 80 dBA are not likely to affect health and wellbeing significantly.

3.6 Construction Noise

The DECCW released the Interim Construction Noise Guideline (July 2009). This policy sets out noise management levels for residential receivers and sensitive land uses and how they are to be applied. The policy suggests restriction to the hours of construction that applies to activities that generate noise at residences above the 'highly affected' noise management level. A summary of the noise management levels is contained in **Table 9** and **Table 10**.

Table 9 Noise at Residences using Quantitative Method

Time of day	Management level LAeq(15minute)	How to apply
Recommended standard hours Monday to Friday 7am to 6pm Saturday 8am to 1pm No work Sundays or public holidays	Noise Affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured LAeq (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences 2. if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise Affected RBL + 5 dB	A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. • For guidance on negotiating agreements see section 7.2.2.

Table 10 Noise at Sensitive Land Uses (other than Residences) using Quantitative Assessment

Land use	**Management Level, $L_{Aeq(15minute)}$ (applies when properties are being used)**
Classrooms at schools and other educational institutions	Internal noise level 45 dB(A)
Hospital wards and operating theatres	Internal noise level 45 dB(A)
Places of worship	Internal noise level 45 dB(A)
Active recreation areas (characterized by sporting activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level 65 dB(A)
Passive recreation areas (characterized by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External noise level 60 dB(A)
Community Centres	Depends on the intended use of the centre. Refer to the recommended 'maximum' internal levels in AS2107 for specific uses.

3.7 Road Traffic Noise

The DECCW released the "*Environmental Criteria for Road Traffic Noise*" (ECRTN) in May 1999. The policy sets out noise criteria applicable to different road classifications for the purpose of defining traffic noise impacts. Relevant road traffic noise criteria are identified in **Section 6.4** of this report.

4 CONSENT CONDITIONS

The existing consent conditions relevant to the noise impact assessment are provided in the DA-308-12-2004-i and are reproduced as follows:

Noise Impacts

A2.6 *Construction activities associated with the development may only be carried out between 7:00 am and 6:00 pm, Monday to Friday inclusive, and between 8:00 am and 1:00 pm on Saturdays. No works may be carried out on Sundays on Public Holidays, or otherwise outside the stated hours except where:*

a. noise from the construction activity is inaudible at the nearest affected residential receiver; or

b. it is necessary for the delivery of materials as requested by Police or other authorities for safety reasons; or

c. where it is necessary emergency work to avoid the loss of lives, property and/or to prevent environmental harm.

C2.4 *Noise generated at the development must not exceed the noise limits specified in* ***Table 11*** *below at the nearest affected residential receivers and must not exceed a night time sleep disturbance criteria also specified in* ***Table 11*** *below at the nearest affected residential receivers.*

Table 11 Noise Limits

Day ***(7am to 6pm Monday to Saturday and 8am to 6pm Sundays/ Public Holidays)***	***Evening*** ***(6pm to 10pm)***	***Night*** ***(10pm to 7am Monday to Saturday and 10pm to 8am Sundays/ Public Holidays)***	
LAeq (15 minute)	*LAeq (15 minute)*	*LAeq (15 minute)*	*LA1 (1minute)*
42	*44*	*38*	*48*

For the purpose of assessment of noise impacts specified under condition 3.18 above of this consent, noise from the development shall be:

(a) measured at the most affected point on or within the residential boundary for LAeq(15 minute) noise levels;

(b) measured at 1m from the dwelling for LA1(1 minute) noise levels;

(c) measured at wind speeds up to 3ms-1 at 10 metres above ground level;

(d) measured at temperature inversion conditions up to 3oC per 100 metres; and

(e) subject to the modification factors provided in Section 4 of the New South Wales Industrial Noise Policy (EPA, 2000).

C2.5 *The Applicant shall not permit the use of amplified telephones, external announcement or amplified pager systems, or other alarm or system (other than emergency warning signals such as fire alarms and the like) on the site at any time.*

C2.5A *Not Notwithstanding condition C2.5 of this consent, the use of reversing alarms on vehicles and equipment is permitted, subject to compliance with the noise limits specified under condition 2.4.*

Noise Compliance Monitoring

C3.1 *Unless otherwise agreed with the Director-General, within six months of the commencement of operation of the development, the Applicant shall commission a suitably qualified and experienced acoustic consultant to undertake a noise compliance assessment in accordance with the EPA's NSW Industrial Noise Policy, and submit a Noise Compliance Report to the Director-General. The noise compliance assessment shall demonstrate compliance with condition C2.3 and C2.4 of this consent. If the report demonstrates non-compliance the report shall list all mitigation options to ensure compliance with the noise limits, select the preferred option(s) giving reasoning and provide a schedule for the implementation of the preferred option(s).*

5 SEPP 59 – EASTERN CREEK PRECINCT PLAN (STAGE 3)

The *Eastern Creek Precinct Plan – Stage 3* outlines the provisions relating to development of the Stage 3 Release Area within the Eastern Creek Precinct of *State Environmental Planning Policy No. 59 – Central Western Sydney Economic and Employment Area*. The relevant noise and vibration conditions from this document are reproduced as follows:

7.8 Noise and Vibration

(e) The optimised noise level goals for the Precinct are outlined in Table 1. These goals will provide adequate protection to the noise amenity of residential areas surrounding the Precinct without unduly restricting the operation of development.

Table 1 – Optimum Noise Level Goals

Period	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6
Day	*57 dBA*	*54 dBA*	*56 dBA*	*54 dBA*	*49 dBA*	*52 dBA*
Evening	*47 dBA*	*44 dBA*	*46 dBA*	*44 dBA*	*39 dBA*	*42 dBA*
Night	*42 dBA*	*40 dBA*	*40 dBA*	*39 dBA*	*34 dBA*	*37 dBA*

6 INP PROJECT SPECIFIC NOISE EMISSION CRITERIA

6.1 Operational Noise Criteria

The noise emission design criteria for the proposed development have been established with reference to the INP outlined in **Section 3** of this report.

The amenity criteria have been established using the results of ambient noise measurements. The acoustical environment adjacent to the M4 and M7 typifies an urban environment, with heavy and continuous traffic flows, and residences near industrial districts. Therefore, the residences in Minchinbury and the northern-most residences of Erskine Park have been assessed under the "urban" receiver type. Other residential receivers in Erskine Park and Horsley Park have been assessed under the "suburban" receiver type.

The resulting operational project specific noise criteria for Residences 1, 6 and 7 will be based on L_{A90} and L_{Aeq} noise levels measured at each of these residences. The noise environment at Residence 1 is considered representative of the noise environments at Residences 1 and 2. The noise environment at Residence 6 is considered representative of the noise environments at Residences 3 to 6. The noise environment at Residence 7 is considered representative of the noise environments at Residences 7.

The resulting operational project specific noise criteria for the proposed development are shown in **bold** within **Table 12.** Since the noise emissions associated with the operation of CCA are considered to be continuous, the $L_{Aeq(15minute)}$ and the $L_{Aeq(period)}$ noise criteria are directly comparable parameters and the more stringent of the intrusiveness or the amenity criteria sets the project specific noise criteria.

Table 12 Project Specific Noise Criteria

Location	Period	Intrusiveness Criteria $L_{Aeq(15minute)}$	DECCW Acceptable Amenity Criteria $L_{Aeq(Period)}$	Project Specific Noise Criteria $L_{Aeq(15minute)}$
1 (Cetus Pl)	Day	**39**	55	**39**
2 (Fantail Cres)	Evening	**42**	45	**42**
	Night	42	**40**	**40**
3 (Swamphen St)	Day	**57**	60	**57**
4 (Grazier Pl)	Evening	55	**50**	**50**
5 (Rutherglen Pl)	Night	49	**43**[1]	**43**[1]
6 (Farrington St				
7 (Burley Rd)	Day	**44**	55	**44**
	Evening	**43**	45	**43**
	Night	**40**	40	**40**

Note 1: As described in **Table 7**, a modification factor has been applied to acceptable noise level to account for existing level of industrial noise.

6.2 Sleep Disturbance Noise Goals

Night-time sleep disturbance noise goals have been set with reference to the INP Application Notes as outlined in **Section 3.5** of this report and are presented in **Table 13.** These noise goals have been determined based on the minimum $L_{A90(15minute)}$ noise level recorded at Residences 1, 6 and 7 during the night-time over the noise monitoring period.

Table 13 Sleep Disturbance Noise Goals

Location	Period	Sleep Disturbance $L_{A1(1minute)}$ Noise Goal
1 (Cetus Pl)	Night-time (10 pm – 7 am)	48
2 (Fantail Cres)		
3 (Swamphen St)		50
4 (Grazier Pl)		
5 (Rutherglen Pl)		
6 (Farrington St)		
7 (Burley Rd)		48

6.3 Construction Noise Goals

The daytime background noise level (L_{A90}) has been determined at the most potentially affected residential locations. The project specific construction noise goals are presented in **Table 14** and would be applicable for the proposed development.

Table 14 Construction Noise Goals – Potentially Affected Residential Areas

Location	Construction $L_{Aeq(15minute)}$ Nose Goal (dBA)	
	Noise Affected	Highly Noise Affected
1 (Cetus Pl)	44	75
2 (Fantail Cres)		
3 (Swamphen St)	62	
4 (Grazier Pl)		
5 (Rutherglen Pl)		
6 (Farrington St)		
7 (Burley Rd)	49	

Note: Recommended standard hours: Monday to Friday 7am to 6pm, Saturday 8am to 1pm and no work Sundays or public holidays

6.4 Road Traffic Noise Goals

The site is located within the M7 industrial precinct at Eastern Creek, which is bounded by Wallgrove Road to the east and Old Wallgrove Road to the north and west. The site is located on the southern side of Roussell Road, west of Wallgrove Road, as shown on **Figure 1**.

The proposed development involves the construction of a new preform injection moulding plant within the south-eastern corner of the existing distribution centre. The proposed development will be integrated with the existing Coca-Cola Amatil distribution facility with access from Roussell Road via Wallgrove Road.

We note that no residentially zone land is located near Roussell Road and only industrial/commercial zoned land surrounds Roussell road. Therefore in accordance with the ECRTN, only Wallgrove Road has been assessed with relation to road traffic noise from the proposed development.

Wallgrove Road falls into the category of "collector road" and it is for this reason the noise criteria outlined in **Table 15** have been adopted.

Table 15 DECCW Environmental Criteria for Road Traffic Noise

Type of Development	Descriptor	Traffic Noise Goal
8. Land use developments with potential to create additional traffic on Collector roads	LAeq(1hour) Daytime	60 dBA*
	LAeq(1hour) Night-time	55 dBA*

7 NOISE IMPACT ASSESSMENT

7.1 Noise Modelling Parameters

A computer model will be used to predict noise emissions from the proposed development. SoundPLAN V6.4 with CONCAWE algorithm has been used to calculate the noise emissions from the subject development. A three-dimensional digital terrain map giving all relevant topographic information was used in the modelling process. The model used the following parameters to predict noise levels at the nearest potentially affected receivers:

- The topographic map,
- The noise source data, which was complied from a Heggies database,
- Ground cover,
- Shielding by barriers and/or adjacent buildings, and
- Atmospheric information. Prediction of operational noise under calm and prevailing meteorological condition (temperature inversion) was conducted. Atmospheric parameters under which noise predictions were made are given in **Table 16**.

Table 16 Meteorological Parameters for Noise Predictions

	Temperature	Humidity	Wind Speed	Wind Direction	Temperature Gradient
Calm (all Periods)	20^0C	70%	N/A	N/A	N/A
Temperature inversion	10^0C	90%	Worst Case	Worst Case	3°C/100 m

The following assumptions were made in predicting $L_{Aeq(15minute)}$ noise emission levels from the existing and proposed developments:

Existing Operations

- 18 forklifts operate continuously outside the factory building at any one time.
- 22 delivery trucks are on site and operating continuously.

Proposed Operations

- 3 forklifts operate continuously outside the factory building at any one time.
- 12 delivery trucks are on site and operating continuously.
- 12 rooftop air-conditioning are operating.
- The preform injection moulding facility in full operation.

7.2 Operational Noise Emission

7.2.1 Equipment Sound Power Levels

Sound power levels for acoustically significant items of plant and equipment have been obtained from supplied manufacturer data from Husky Injection Molding Systems Ltd. Where sound power data was not available from the manufacturer, sound power levels have been sourced from Heggies noise source database. The L_{Aeq} sound power levels of plant and equipment from existing and proposed operations are given below in **Table 17**. **Appendix E** provides the octave band plant and equipment sound power levels used in the noise modelling.

Table 17 Equipment Sound Power Levels

Plant and Equipment	L_{Aeq} Sound Power Level (dBA re 10^{-12} W)
Truck departure/arrival	92
Air-conditioning Unit (single unit)	95
Gas powered forklift	95
Roof top exhaust fan	97
Silos	
Silo Loading Blower	80
Blender Room	
Blender	70
Vacuum pump	75
Dryer Room	
Resin Dryers	85
Injection Moulding Hall	
Preform Injection Machine	85
Preform Injection Machine Enhanced Blower	80
Closure Injection Machine	85
Closure Printers	85
Closer Printing Dryers	85
Mould Dehumidifier	80
Services Room	
Water Pump	72
Screw Chiller Remote Condenser	86
Air Compressor	68
Service Mezzanine	
Remote Condenser	91
Regrind Room	
Granulator	85

It is relevant to note that since details of the rooftop air-conditioning units have not been provided at this stage of the development, we have assumed that a maximum L_{Aeq} sound power level of 95 dBA is required to meet the project specific noise criteria. We note that the required sound power noise level of 95dBA can also be achieved with higher sound power level air-conditioning units with implementation of adequate shielding or enclosures around the equipment.

7.2.2 Operational Noise Modelling Scenario

Noise levels were predicted at all nearest affect residential location (as indicated in **Figure 3** from the existing and proposed CCA operations. The following scenarios were modelled:

Scenario 1

- Existing CCA operations
- Proposed CA preform injection moulding facility operations
- Calm weather conditions

Scenario 2

- Existing CCA operations

- Proposed CA preform injection moulding facility operations
- Prevailing weather condition (Temperature Inversion)

7.2.3 Operational Noise Modelling Results

The operational noise levels were predicted at three representative residential locations in both Minchinbury and Erskine Park (ie three residential locations in Minchinbury and three residential locations in Erskine Park) and at a representative residential location in Horsley Park, off Burley Road (see **Figure 3**). A summary of the results of these predictions for scenario 1 and 2 are contained within **Table 18** and **Table 19** respectively.

Table 18 Scenario 1 - Predicted Operational Noise Levels at Residential Receivers Under Calm Weather Condition

Residential Receiver Location	Predicted $L_{Aeq(15minute)}$ Noise Level (dBA)			INP Project Specific Noise Criteria			$L_{Aeq(15minute)}$ Noise Consent Criteria (dBA)			$L_{Aeq(15minute)}$ SEPP 59 Criteria (dBA)		
	Existing	Future	Total	Day	Eve	Night	Day	Eve	Night	Day	Eve	Night
1 (Cetus Pl)	<30	<30	<30	39	42	40						
2 (Fantail Cres)	<30	<30	<30	39	42	40						
3 (Swamphen St)	<30	<30	<30	57	50	45						
4 (Grazier Pl)	<30	<30	<30	57	50	45	42	44	38	52	42	37
5 (Rutherglen Pl)	<30	<30	<30	57	50	45						
6 (Farrington St)	<30	<30	<30	57	50	45						
7 (Burley Rd)	32	<30	33	44	43	40						

The $L_{Aeq(15minute)}$ noise levels for existing and proposed CCA operations under calm weather conditions are predicted to meet the INP $L_{Aeq(15minute)}$ project specific noise criteria, the $L_{Aeq(15minute)}$ noise goals specified in the consent conditions and the SEPP 59 Criteria at all residences.

Table 19 Scenario 2 - Predicted Operational Noise Levels at Residential Receivers Under Temperature Inversion Condition

Residential Receiver Location	Predicted Existing + Future $L_{Aeq(15min)}$ Noise Level (dBA)	INP Project Specific Noise Criteria			$L_{Aeq(15minute)}$ Noise Consent Criteria (dBA)			$L_{Aeq(15minute)}$ SEPP 59 Criteria (dBA)		
	Temperature Inversion	Day	Eve	Night	Day	Eve	Night	Day	Eve	Night
1 (Cetus Pl)	<30	39	42	40						
2 (Fantail Cres)	<30	39	42	40						
3 (Swamphen St)	<30	57	50	45						
4 (Grazier Pl)	<30	57	50	45	42	44	38	52	42	37
5 (Rutherglen Pl)	<30	57	50	45						
6 (Farrington St)	<30	57	50	45						
7 (Burley Rd)	37	44	43	40						

The $L_{Aeq(15minute)}$ noise levels for existing and proposed CCA operations under temperature inversion condition are predicted to meet the INP $L_{Aeq(15minute)}$ project specific noise criteria, the $L_{Aeq(15minute)}$ noise goals specified in the consent conditions and the SEPP 59 Criteria at all residences.

The potential for sleep disturbance at nearby residence locations has been assessed as the facility is proposed to operate 24 hours a day 7 days per week. Typical L_{Amax} noise levels for these activities are provided in **Table 20**.

The predicted sleep disturbance worst case scenario noise levels associated with the proposed preform injection moulding plant facility operations are present in **Table 21**. **Appendix E** provides the octave band plant and equipment sound power levels used in the noise modelling.

Table 20 Equipment Maximum Sound Power Levels

Plant and Equipment	**Typical Maximum Sound Power Level (dBA re 10^{-12} W)**
Truck departure/arrival	97
Air-conditioning Unit (single unit)	103
Gas powered forklift	100
Roof top exhaust fan	102
Silos	
Silo Loading Blower	85
Blender Room	
Blender	75
Vacuum pump	80
Dryer Room	
Resin Dryers	90
Injection Moulding Hall	
Preform Injection Machine	90
Preform Injection Machine Enhanced Blower	85
Closure Injection Machine	90
Closure Printers	90
Closer Printing Dryers	90
Mould Dehumidifier	85
Services Room	
Water Pump	77
Screw Chiller Remote Condenser	91
Air Compressor	73
Service Mezzanine	
Remote Condenser	96
Regrind Room	
Granulator	90

Table 21 Predicted Sleep Disturbance Noise Levels at Residential Receivers

Location	Assessment Point	Predicted $L_{A1(1minute)}$ Noise Level (dBA)			Night-time $L_{A1(1minute)}$ Noise Consent Criterion (dBA)
		Existing Operations	Proposed Operations	Total	
Erskine Park Residential Receivers	1 (Cetus Pl)	<30	<30	<30	48
	2 (Fantail Cres)	<30	<30	<30	
	3 (Swamphen St)	<30	<30	<30	
Minchinbury Residential Receivers	4 (Grazier Pl)	<30	<30	<30	
	5 (Rutherglen Pl)	<30	<30	<30	
	6 (Farrington St)	<30	<30	<30	
Horsley Park Residential Receivers	7 (Burley Rd)	42	38	43	

The $L_{A1(1minute)}$ noise levels are predicted to be below the sleep disturbance noise goals specified in **Table 11** and **Table 13** for night-time operation of the CCA preform injection moulding facility. This being the case, sleep disturbance is unlikely to occur at residential locations surrounding the proposed CCA preform injection moulding facility.

7.2.4 Cumulative Noise Assessment

The proposed development site is situated within a developed industrial area in Eastern Creek, NSW. Existing industrial properties are located to the north, south and west of the subject site.

Potential cumulative noise impacts from existing and successive developments are embraced by the INP procedures by ensuring that the appropriate noise emission criteria (and consent limits) are established with a view to maintaining acceptable noise *amenity* levels for residences. Therefore, the cumulative impact of the proposed development with existing industrial noise sources has been assessed in the determination of the amenity levels at surrounding potentially noise sensitive areas.

7.3 Construction Noise Emission

Acoustically significant plant and equipment proposed during the construction period will consist of the following:

- Concrete agitators
- Concrete boom pump
- Cranes
- Hand tools (various)
- Delivery trucks
- Genset

7.3.1 Equipment Sound Power Levels

The sound power levels of the major noise generating plant and equipment to be used in the construction of the CCA preform injection moulding facility are given in **Table 1**. Sound power levels for equipment used in the assessment have been obtained from a Heggies database of similar equipment. Details of these levels are given in **Appendix E**.

Table 22 Acoustically Significant Equipment Sound Power Levels

Building Construction Equipment	Sound Power Level (dBA re 10^{-12} W)
Concrete transit mixers	111
Concrete boom pump	107
Mobile Cranes	104
Hand tools	up to 104
Delivery trucks	92
Genset	107

7.3.2 Construction Noise Modelling Results

The noise levels from the proposed construction were predicted at three representative residential locations in both Minchinbury and Erskine Park (ie three residential locations in Minchinbury and three residential locations in Erskine Park) and at a representative residential location in Horsley Park, off Burley Road (see **Figure 3**). A summary of the results of these predictions are contained within **Table 23**.

Table 23 Predicted Construction Noise Levels at Residential Receivers

Location	Assessment Point	Predicted $L_{Aeq(15minute)}$ Noise Level (dBA)	Construction $L_{Aeq(15minute)}$ Design Goal (dBA)	
			Noise Affected	Highly Noise Affected
Erskine Park Residential	1 (Cetus Pl)	<30	44	75
	2 (Fantail Cres)	<30		
	3 (Swamphen St)	<30		
Minchinbury Residential	4 (Grazier Pl)	<30	62	
	5 (Rutherglen Pl)	<30		
	6 (Farrington St)	<30		
Horsley Park Residential	7 (Burley Rd)	31	49	

The modelling results in **Table 23** indicate that the predicted $L_{Aeq(15minute)}$ noise levels for construction meet all construction noise goals at all residences.

7.4 Road Traffic Noise Assessment

The traffic report by Colston Budd Hunt & Kafes Pty Ltd '*Traffic report for proposed preform injection moulding plant at Coca-Cola Amatil site, Roussell Road, Eastern Creek, July 2010,* provided the existing and predicted traffic flows from the development on the surrounding road network and has been reproduced in **Table 24** along with the calculated noise level increase on the surrounding road network from the proposed development.

Table 24 Existing Two-Way (Sum of Both Directions) Peak Hour Traffic Flows Plus Development Traffic

Road/location	Morning (vehicles/hour)			Afternoon (vehicles/hour)		
	Existing	Proposed development		Existing	Proposed development	
		Traffic Count	Road Traffic noise level increase (dBA)		Traffic Count	Road Traffic noise level increase (dBA)
Wallgrove Road (north of Roussell Road)	1875	+15	0.03	2080	+15	0.03
Wallgrove Road (south of Roussell Road)	1835	+5	0.01	2000	+5	0.01

The ECRTN states that in all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dBA. **Table 24** predicts that all roads surrounding the proposed development will likely meet the project specific noise criteria presented in **Section 6.4**.

8 DISCUSSION AND CONCLUSIONS

Heggies has undertaken a noise impact assessment for the construction and the operation of the proposed CCA preform injection moulding plant at the existing Coca-Cola Distribution Centre.

Computer noise modelling has been carried out to predict the noise level, from the CCA facility, at the nearest residential receiver locations.

Operational Assessment

The noise emissions from the existing operation of CCA and the proposed operation of preform injection moulding facility have been assessed against noise criteria described in Consent Conditions in **Section 4**, *SEPP 59 – Eastern Creek Precinct Plan (Stage 3)* in **Section 5** and also with INP noise criteria in **Section 6.1**.

The noise modelling has been carried out under two meteorological conditions (ie Scenario 1: Calm weather and Scenario 2: Prevailing weather including wind and temperature inversion). From the noise modelling results in **Table 18** and **Table 19**, the $L_{Aeq(15minute)}$ noise levels are predicted to be less than 30 dBA at all residential locations in Erskine Park and Minchinbury for calm and prevailing weather conditions. The $L_{Aeq(15minute)}$ noise levels are predicted to be 37 dBA at residential locations in Horsley Park under prevailing weather conditions and 33 dBA under the calm weather conditions. Therefore the noise emissions from the existing and the proposed operations of CCA are predicted to comply with the INP noise criteria, the noise goals specified in the CCA Consent Conditions and *SEPP 59 – Eastern Creek Precinct Plan (Stage 3)* conditions the under both meteorological conditions.

Also, the cumulative noise impacts have been assessed and comply with the relevant project specific noise goal criteria outline in **Section 6.1**.

Sleep Disturbance Assessment

The potential for sleep disturbance at nearby residence locations due to the noise emissions from the night-time operations of the existing and the proposed CCA has been assessed. From the noise modelling results in **Table 21**, the $L_{A1(1minute)}$ noise levels are predicted to be less than 30 dBA at all residential locations in Erskine Park and Minchinbury and 38 dBA at residential locations in Horsley Park. These noise levels are below the sleep disturbance noise goals described in Consent Conditions and INP Application Notes. Therefore it is unlikely that the noise emissions from the operations of CCA at night-time will cause sleep disturbance at the residence locations.

Construction Assessment

The potential noise emissions from the proposed construction of CCA have been assessed in accordance with the DECCW's Interim Construction Noise Guideline. From the noise modelling results in **Table 23**, the $L_{Aeq(15minute)}$ noise level at the nearest residences are predicted to be less than 30 dBA at all residence locations in Erskine Park and Minchinbury and it is predicted to be 31 dBA at Horsley Park residence location. These noise levels indicate compliance with noise goals in **Table 14**.

On the basis of above, the noise emissions from the proposed construction and operation of CCA preform injection moulding facility are predicted to comply with the relevant noise criteria and the potential noise impact is likely to be negligible.

Road Traffic Noise Assessment

The predicted road traffic noise levels increases presented in **Table 24** shows that all roads surrounding the proposed development are likely to meet the project specific noise criteria presented in **Section 6.4**.

1 Sound Level or Noise Level

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

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

The symbols SPL, L or L_P are commonly used to represent Sound Pressure Level. The symbol L_A represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2×10^{-5} Pa.

2 "A" Weighted Sound Pressure Level

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

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

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

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

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

3 Sound Power Level

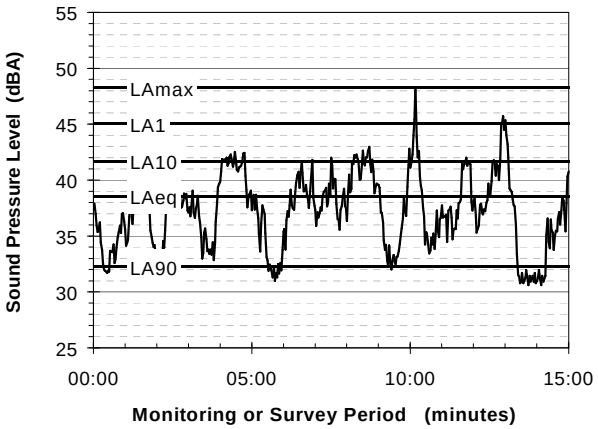
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or L_W, or by the reference unit 10^{-12} W.

The relationship between Sound Power and Sound Pressure may be likened to an electric radiator, which is characterised by a power rating, but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

4 Statistical Noise Levels

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

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



Of particular relevance, are:

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

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

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

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

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

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

5 Tonality

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

6 Impulsiveness

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

7 Frequency Analysis

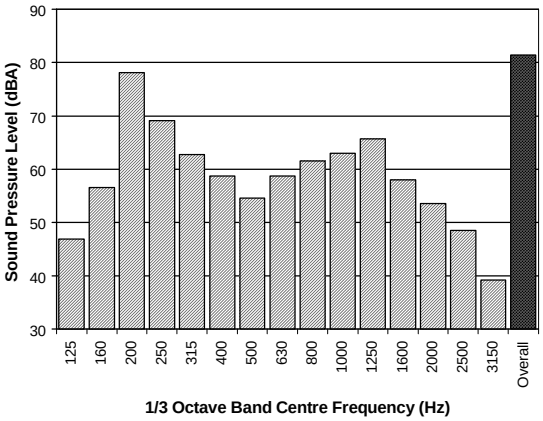
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal. This analysis was traditionally carried out using analogue electronic filters, but is now normally carried out using Fast Fourier Transform (FFT) analysers.

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

Frequency analysis can be in:

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

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



8 Vibration

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

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

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

The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated. A vibration level V, expressed in mm/s can be converted to decibels by the formula 20 log (V/V_o), where V_o is the reference level (10^{-9} m/s). Care is required in this regard, as other reference levels may be used by some organizations.

9 Human Perception of Vibration

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

10 Over-Pressure

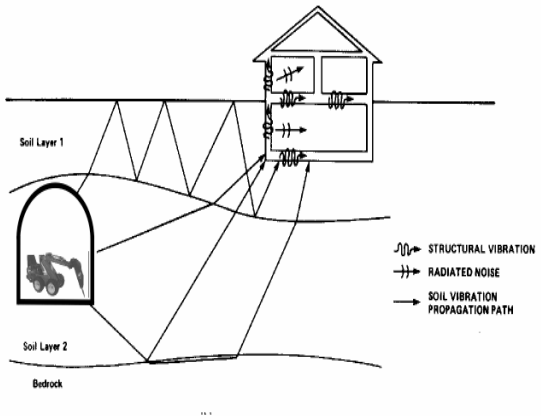
The term "over-pressure" is used to describe the air pressure pulse emitted during blasting or similar events. The peak level of an event is normally measured using a microphone in the same manner as linear noise (ie unweighted), at frequencies both in and below the audible range.

11 Ground-borne Noise, Structure-borne Noise and Regenerated Noise

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

Typical sources of ground-borne or structure-borne noise include tunnelling works, underground railways, excavation plant (eg rockbreakers), and building services plant (eg fans, compressors and generators).

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



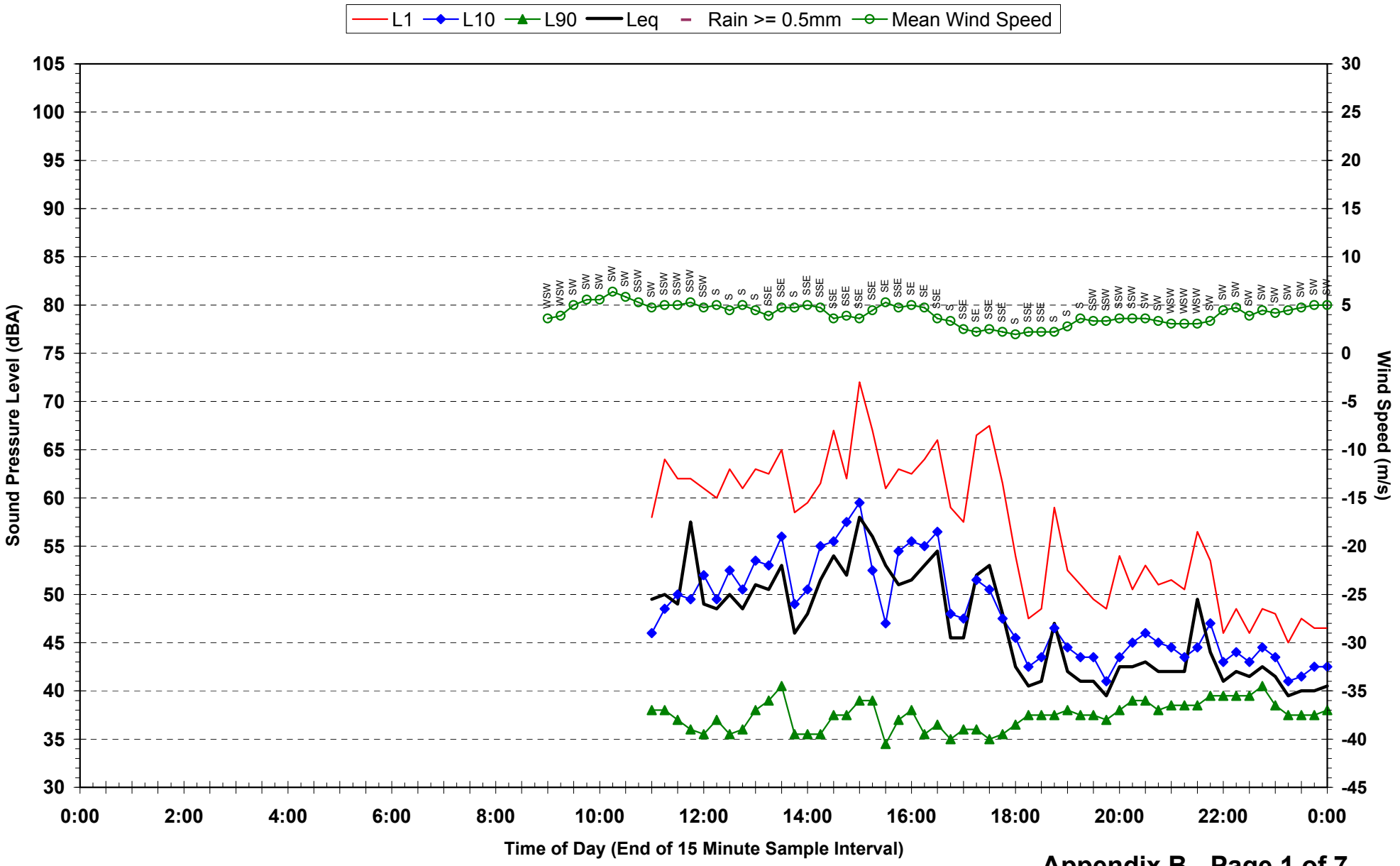
The term "regenerated noise" is also used in other instances where energy is converted to noise away from the primary source. One example would be a fan blowing air through a discharge grill. The fan is the energy source and primary noise source. Additional noise may be created by the aerodynamic effect of the discharge grill in the airstream. This secondary noise is referred to as regenerated noise.

Appendix B

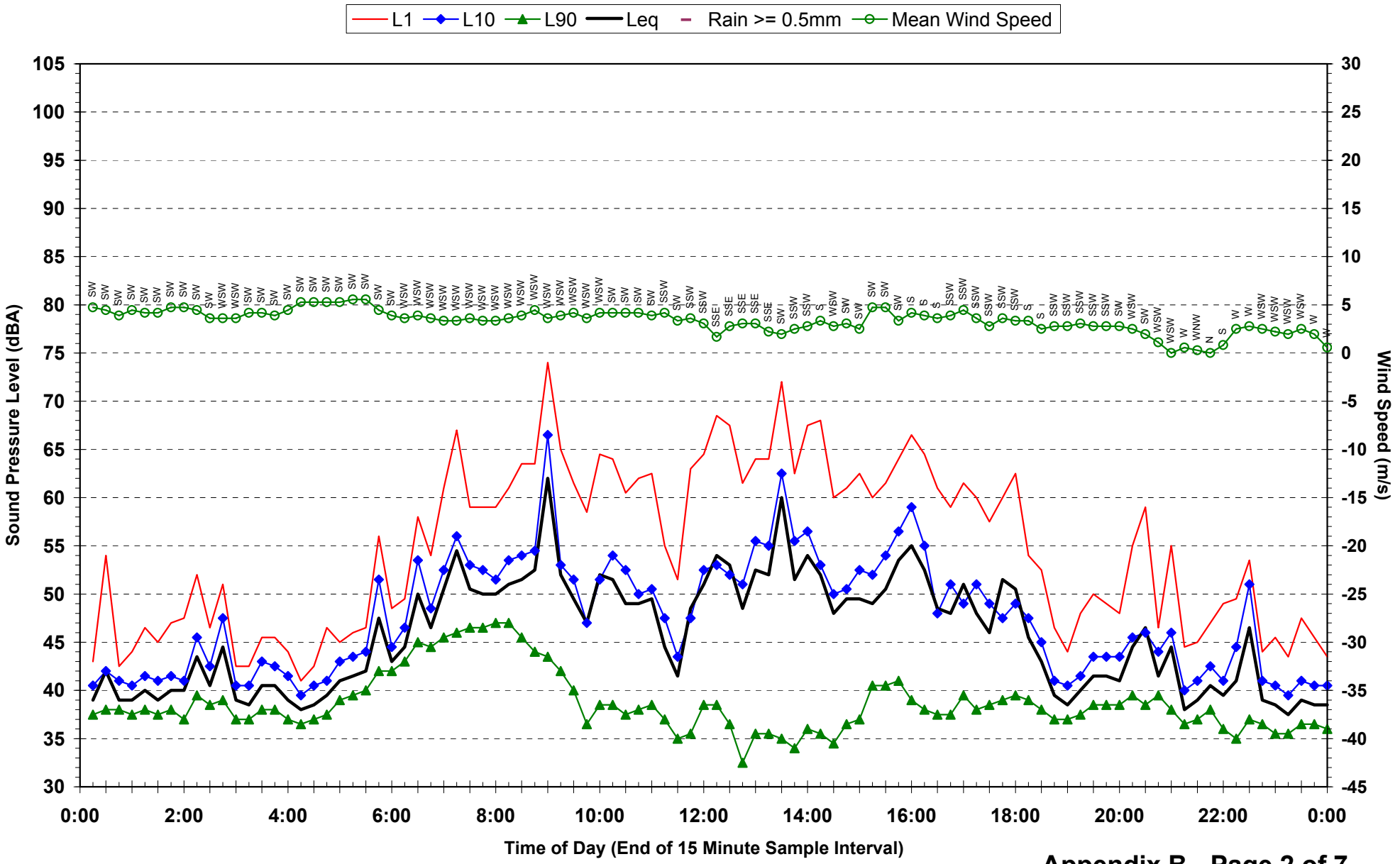
Report 30-2615

Statistical Ambient Noise Levels - 3 Cetus Place, Erskine Park

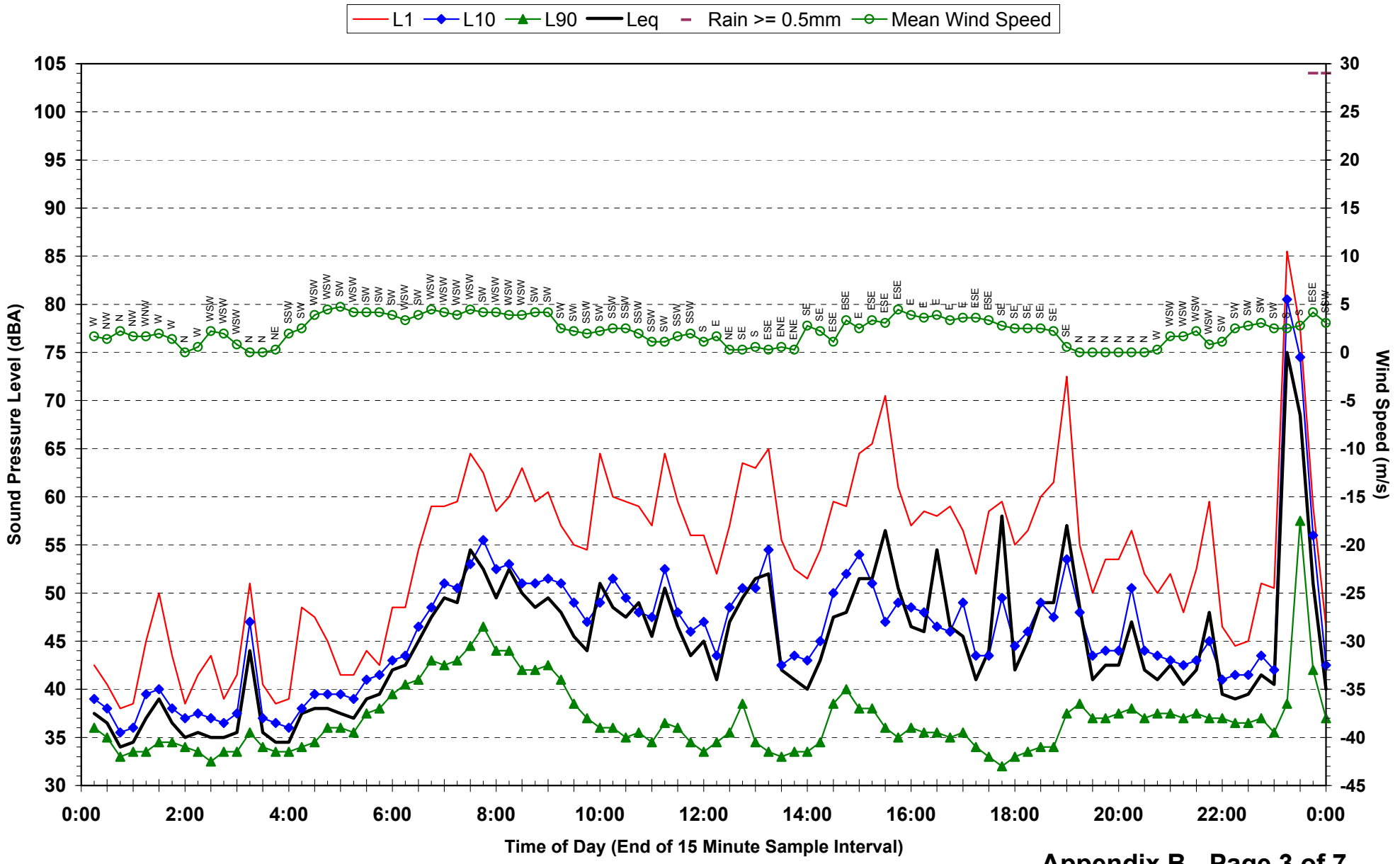
Statistical Ambient Noise Levels
3 Cetus Place Erskine Park - Thursday 22 July 2010



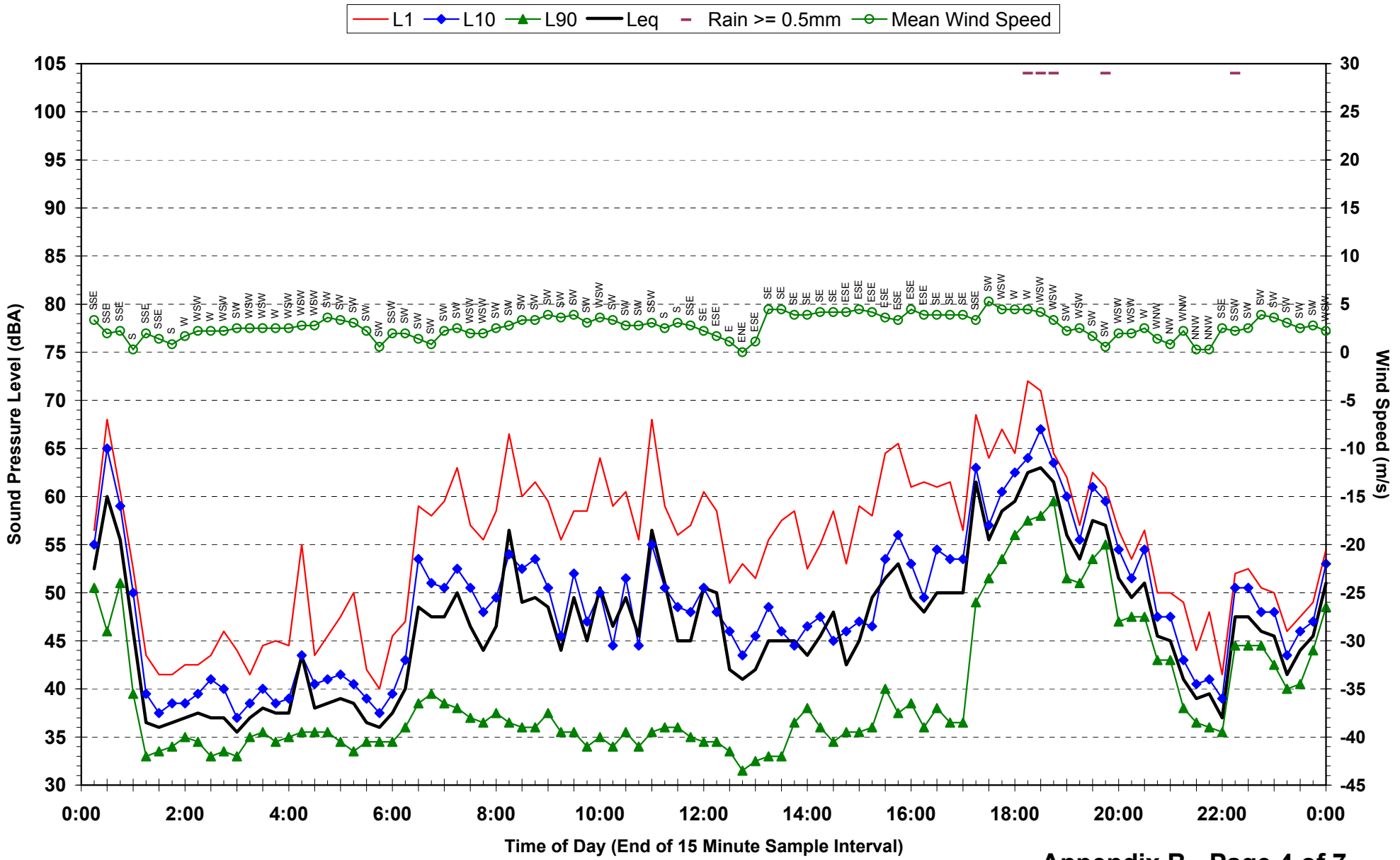
Statistical Ambient Noise Levels
3 Cetus Place Erskine Park - Friday 23 July 2010



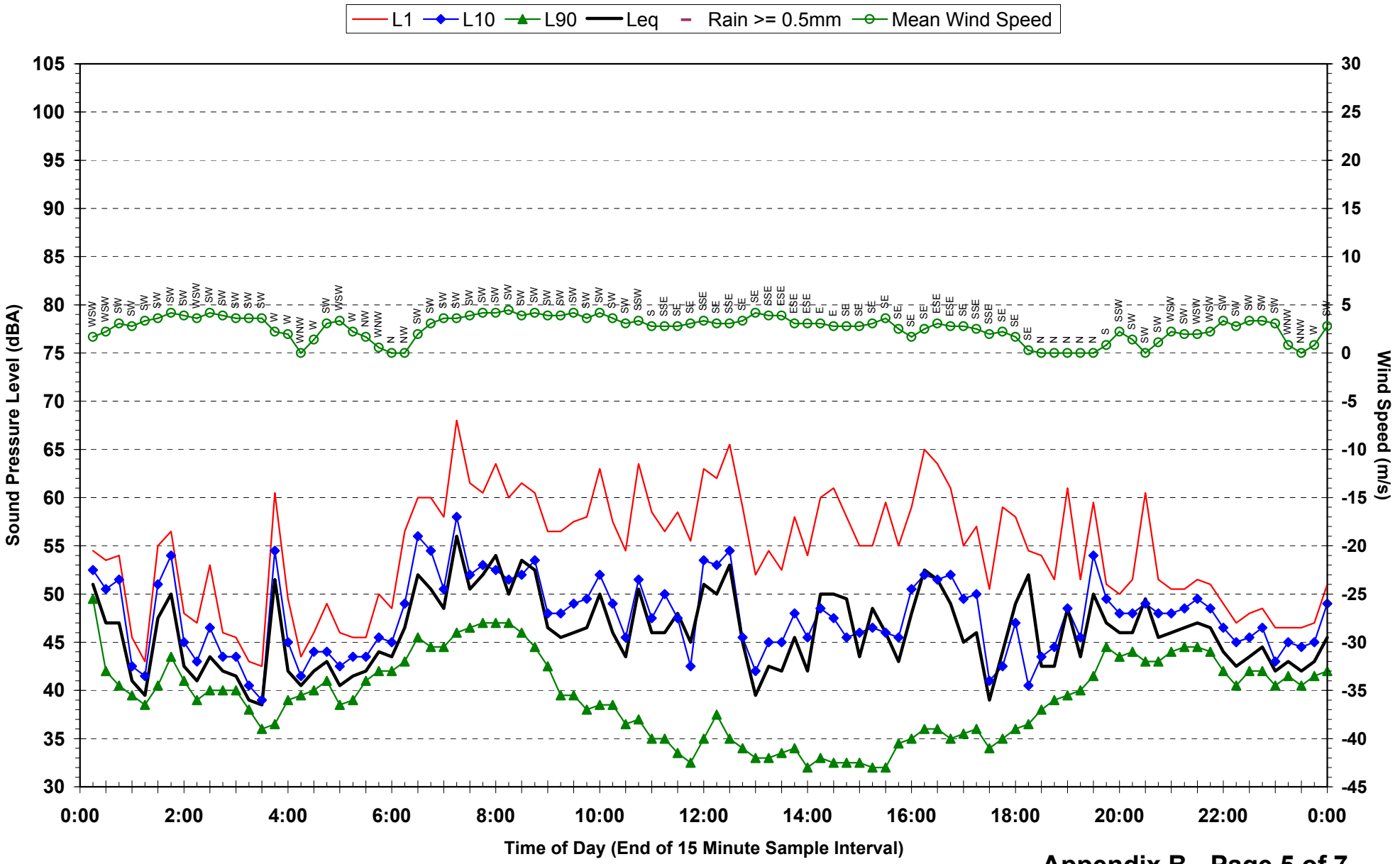
Statistical Ambient Noise Levels
3 Cetus Place Erskine Park - Saturday 24 July 2010



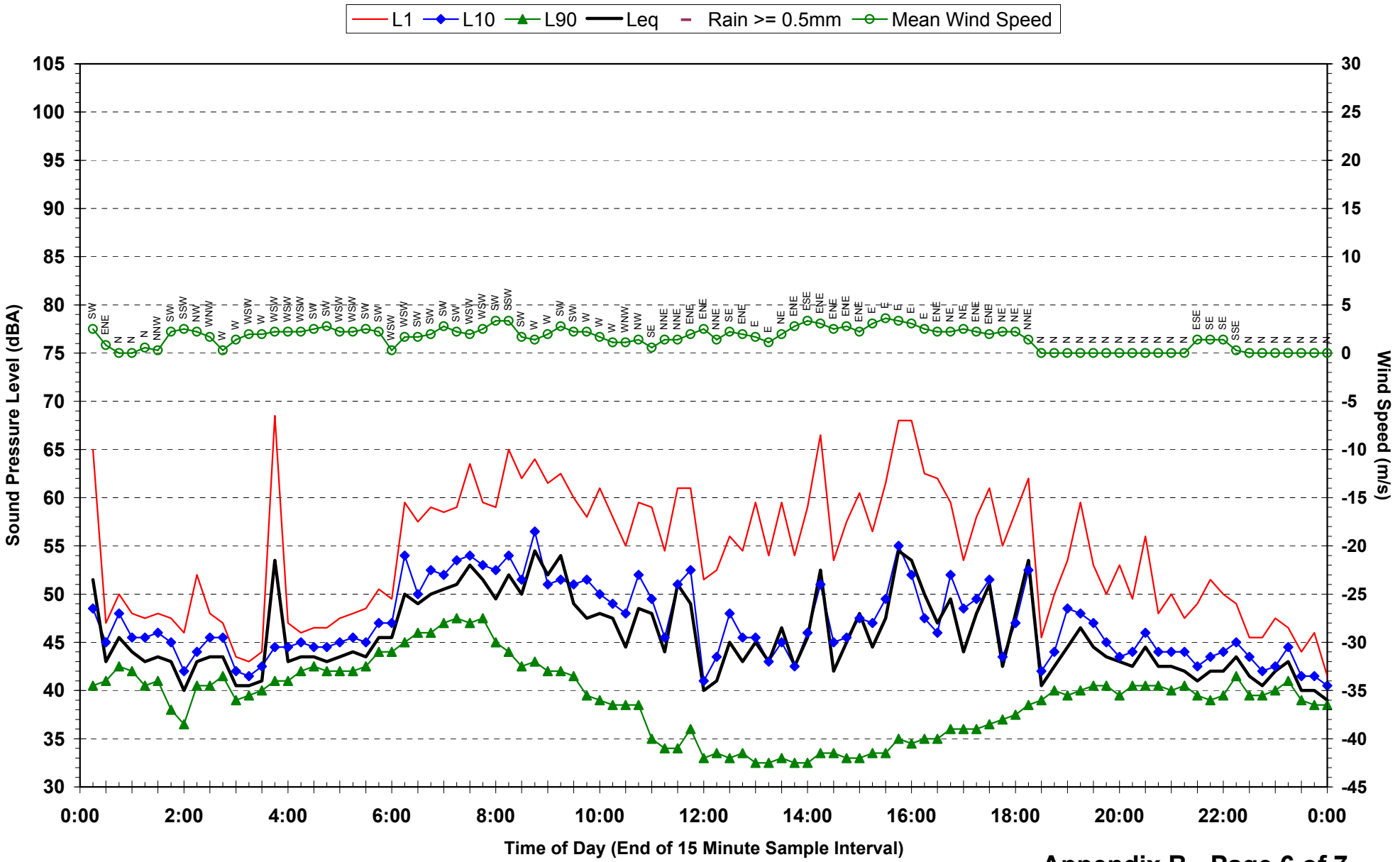
Statistical Ambient Noise Levels
3 Cetus Place Erskine Park - Sunday 25 July 2010



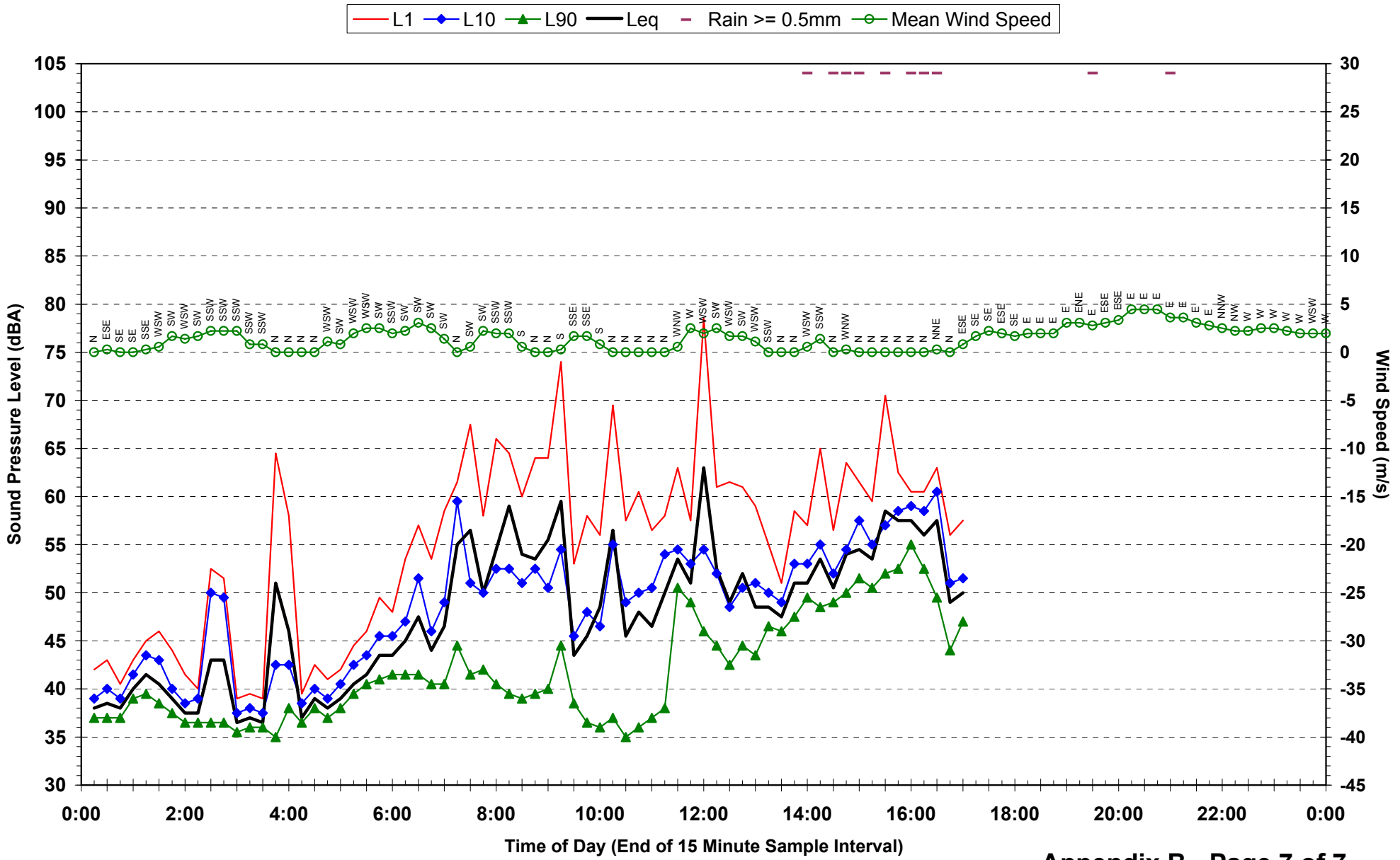
Statistical Ambient Noise Levels
3 Cetus Place Erskine Park - Monday 26 July 2010



Statistical Ambient Noise Levels
3 Cetus Place Erskine Park - Tuesday 27 July 2010



Statistical Ambient Noise Levels
3 Cetus Place Erskine Park - Wednesday 28 July 2010

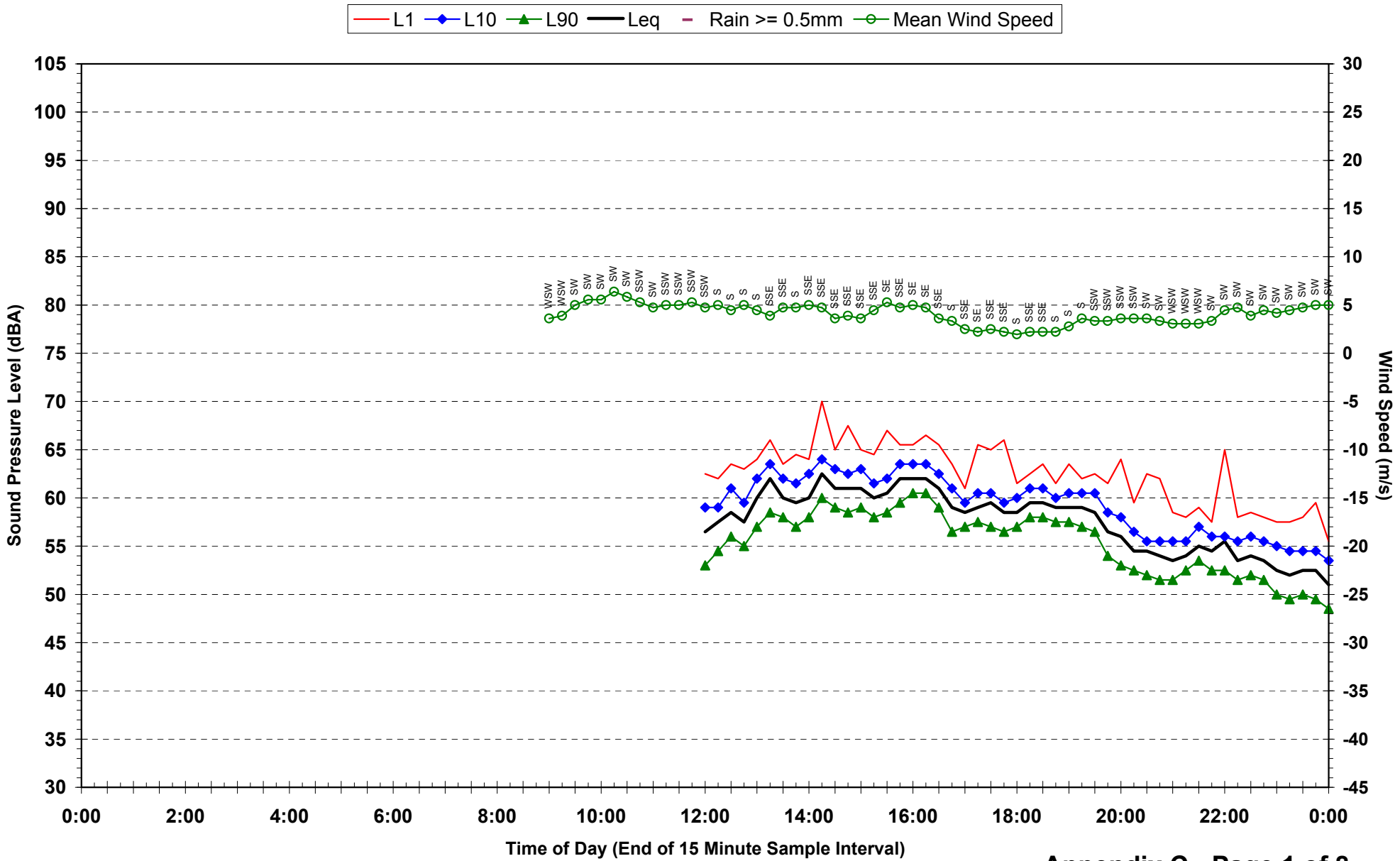


Appendix C

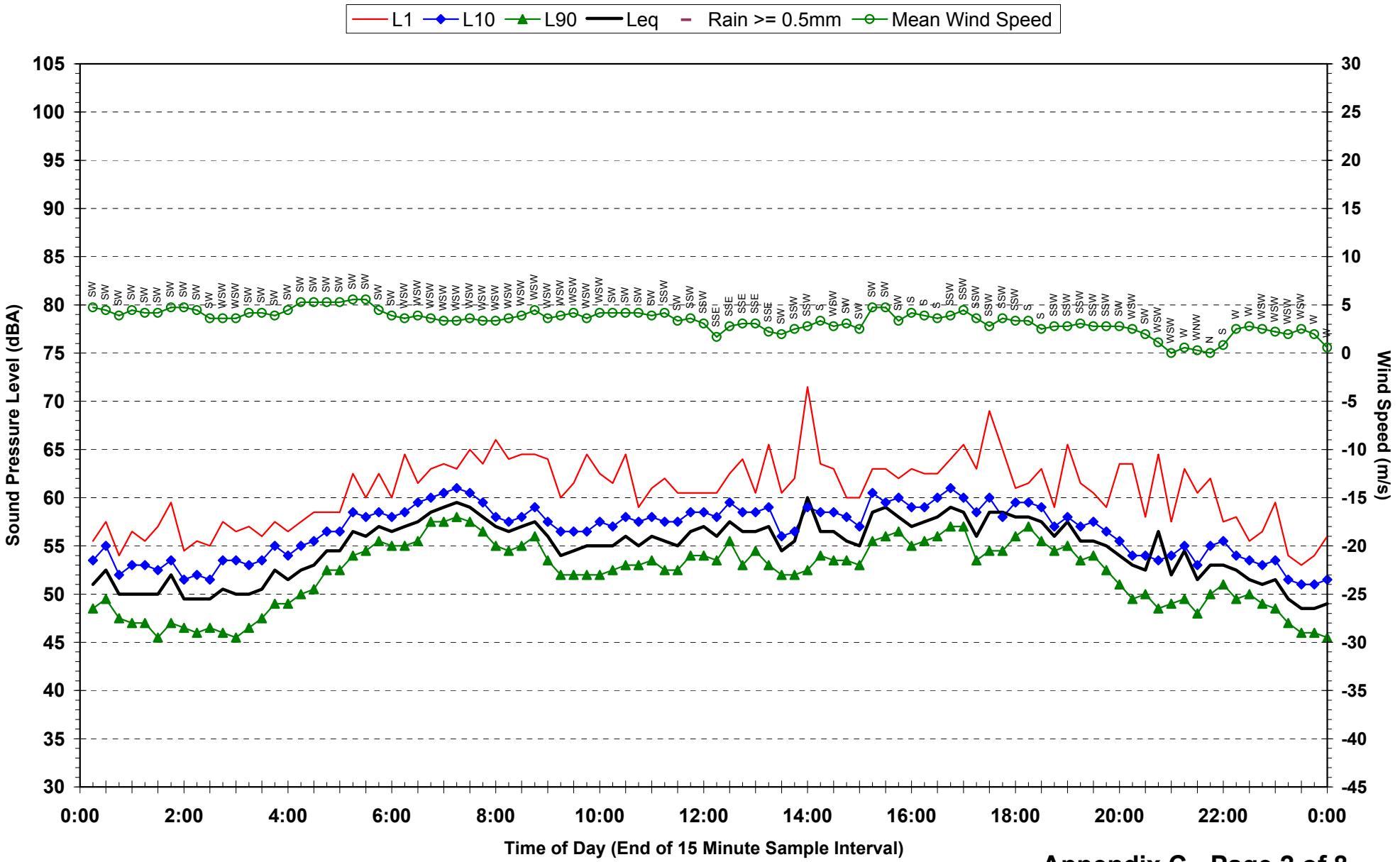
Report 30-2492

Statistical Ambient Noise Levels - 24 Farrington Street, Minchinbury

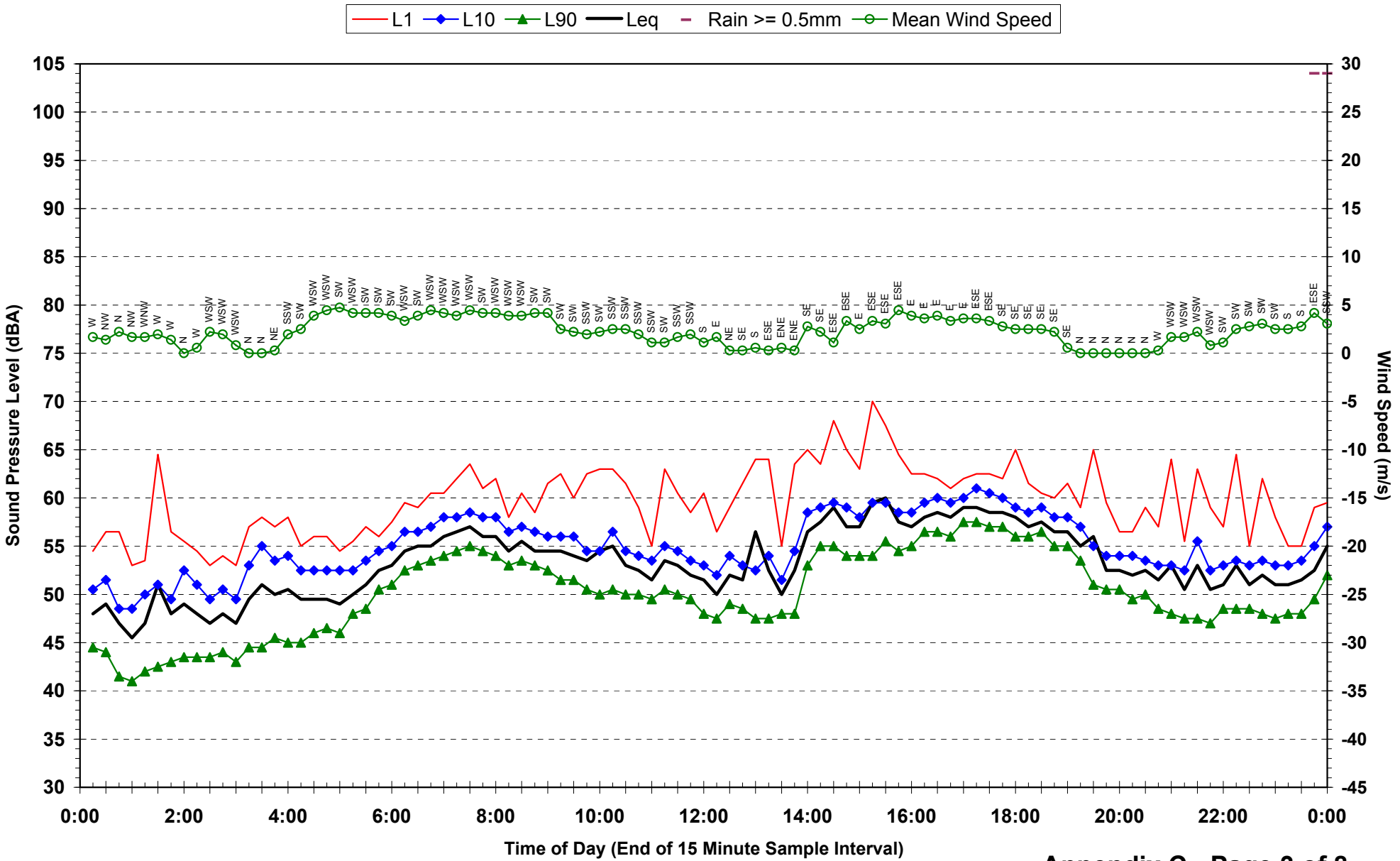
Statistical Ambient Noise Levels
24 Farrington Street Minchinbury - Thursday 22 July 2010



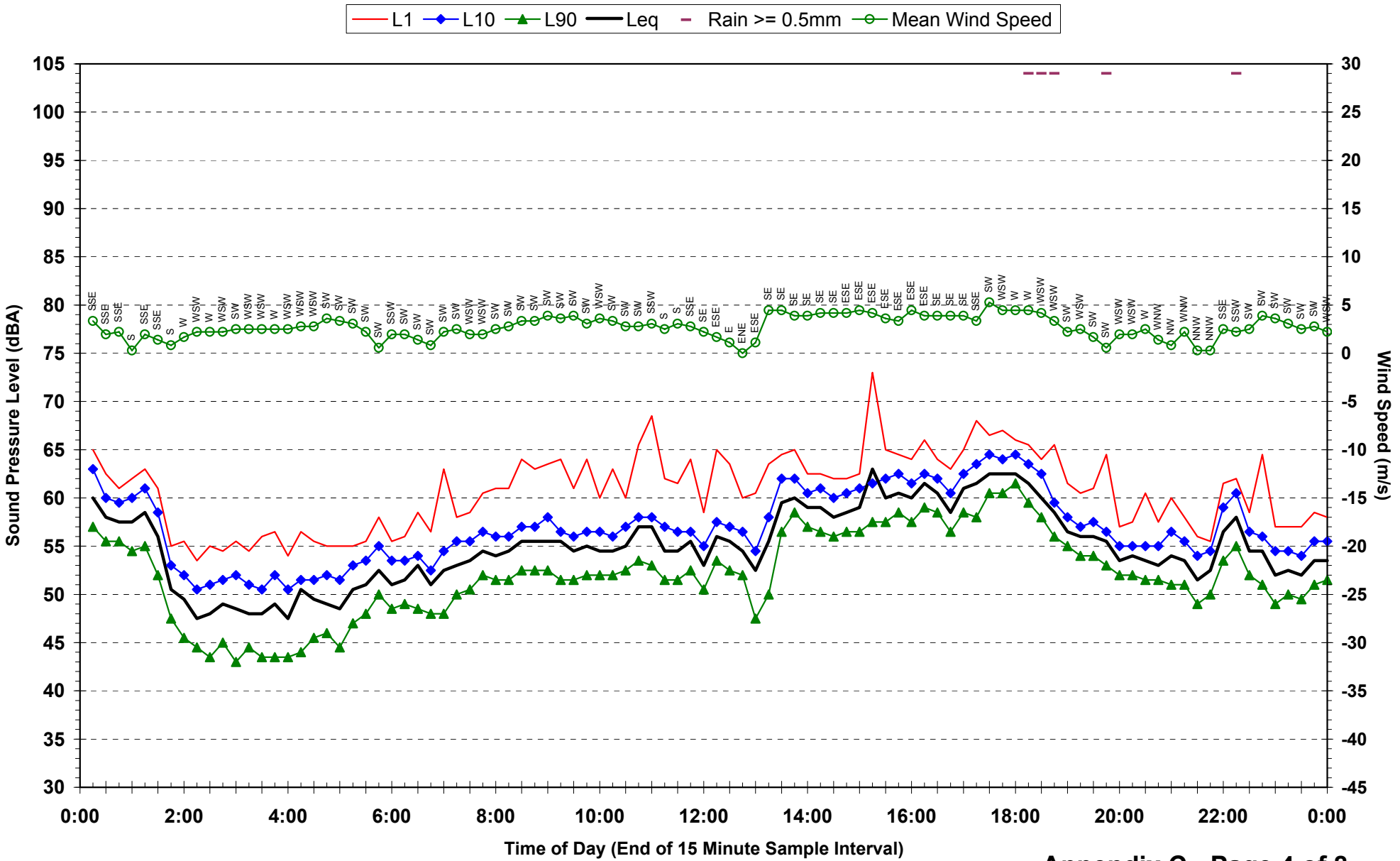
Statistical Ambient Noise Levels
24 Farrington Street Minchinbury - Friday 23 July 2010



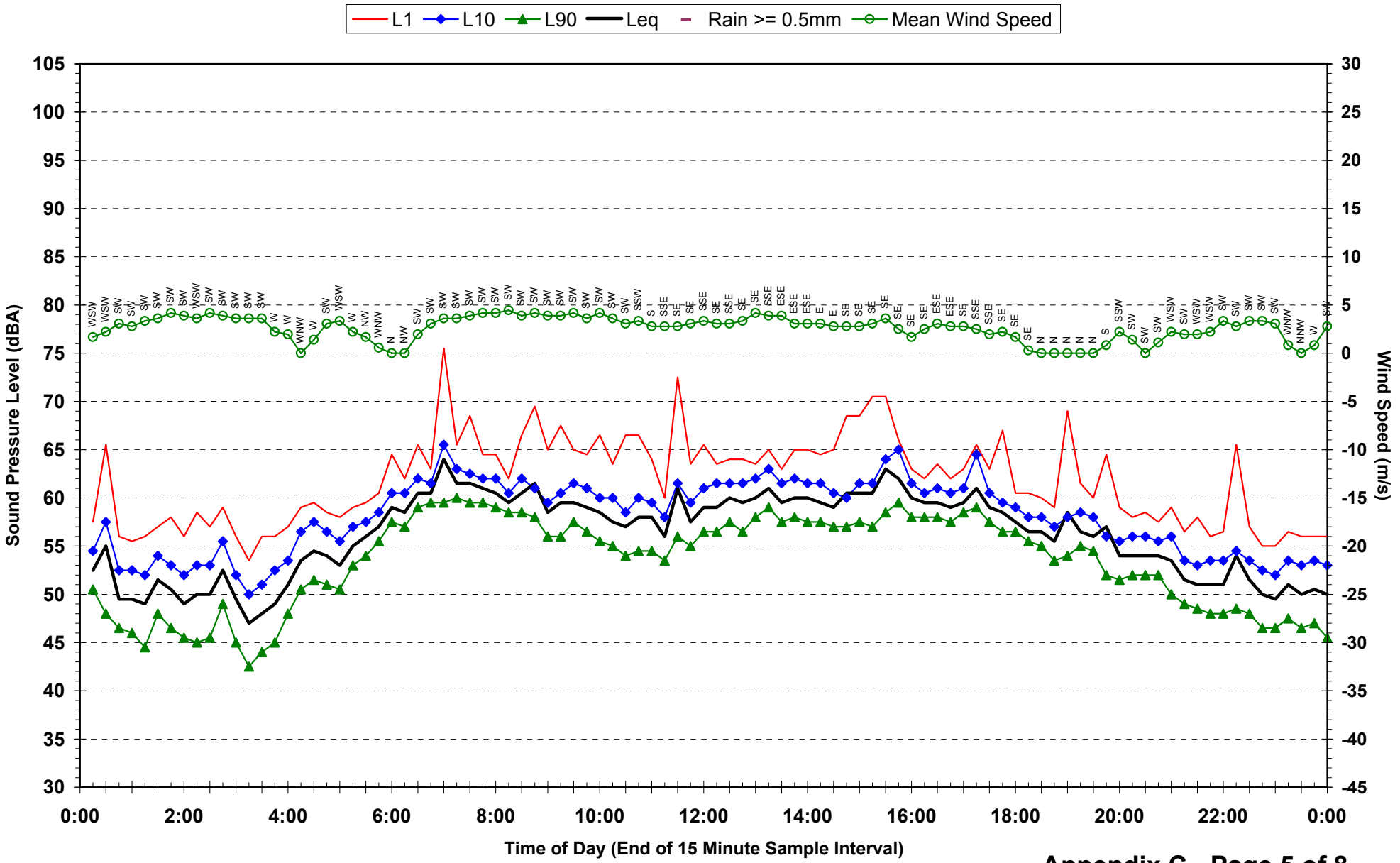
Statistical Ambient Noise Levels
24 Farrington Street Minchinbury - Saturday 24 July 2010



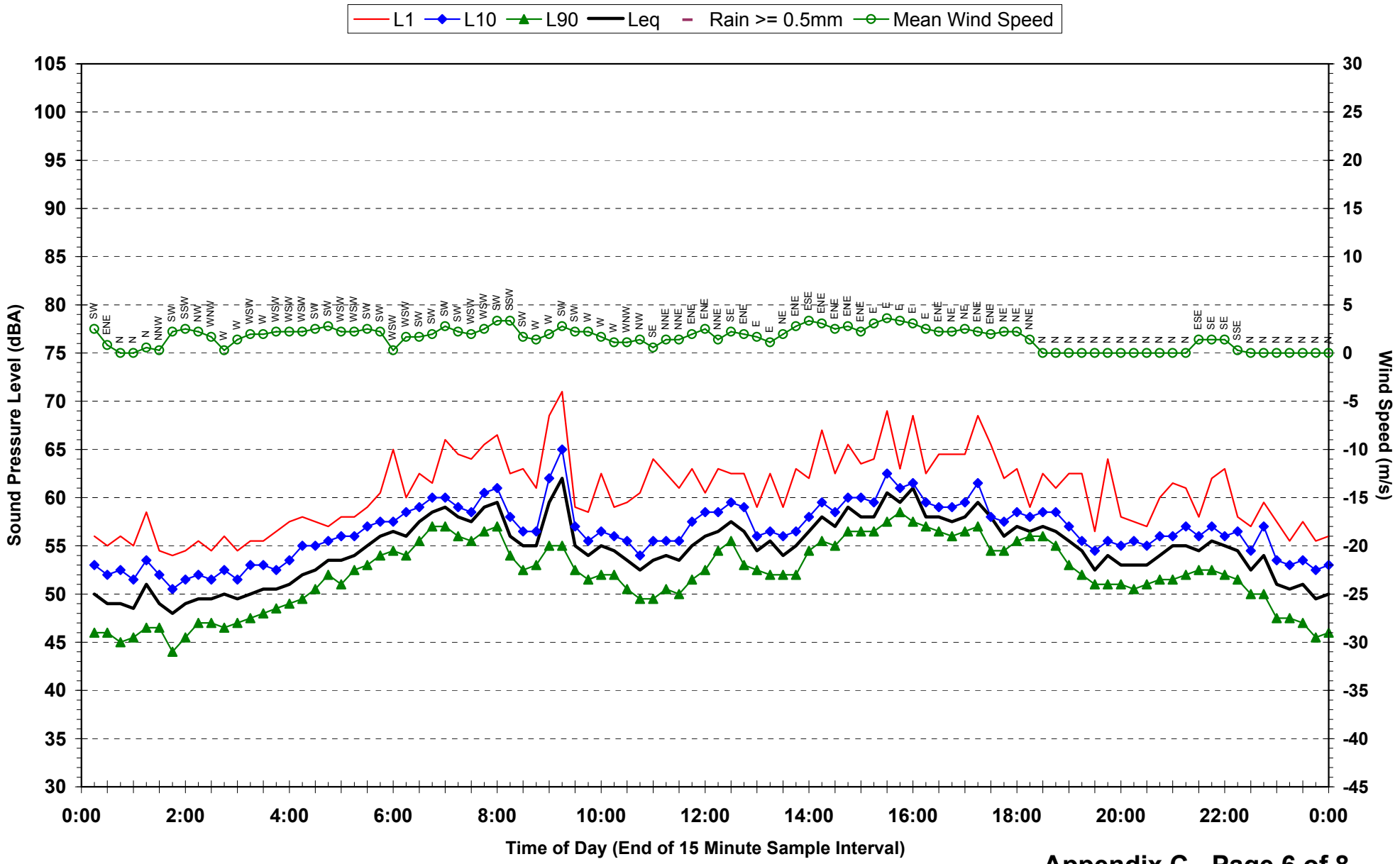
Statistical Ambient Noise Levels
24 Farrington Street Minchinbury - Sunday 25 July 2010



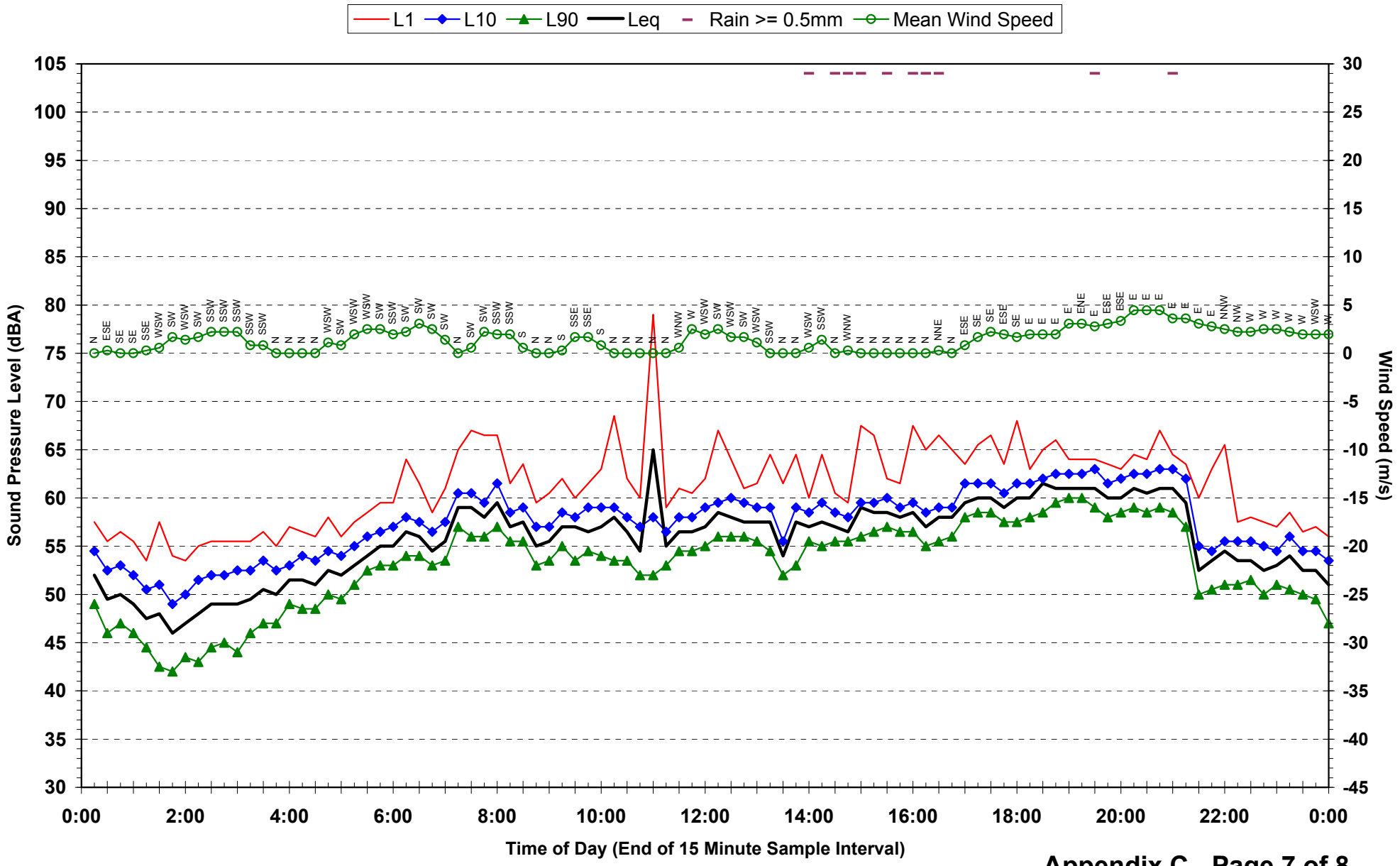
Statistical Ambient Noise Levels
24 Farrington Street Minchinbury - Monday 26 July 2010



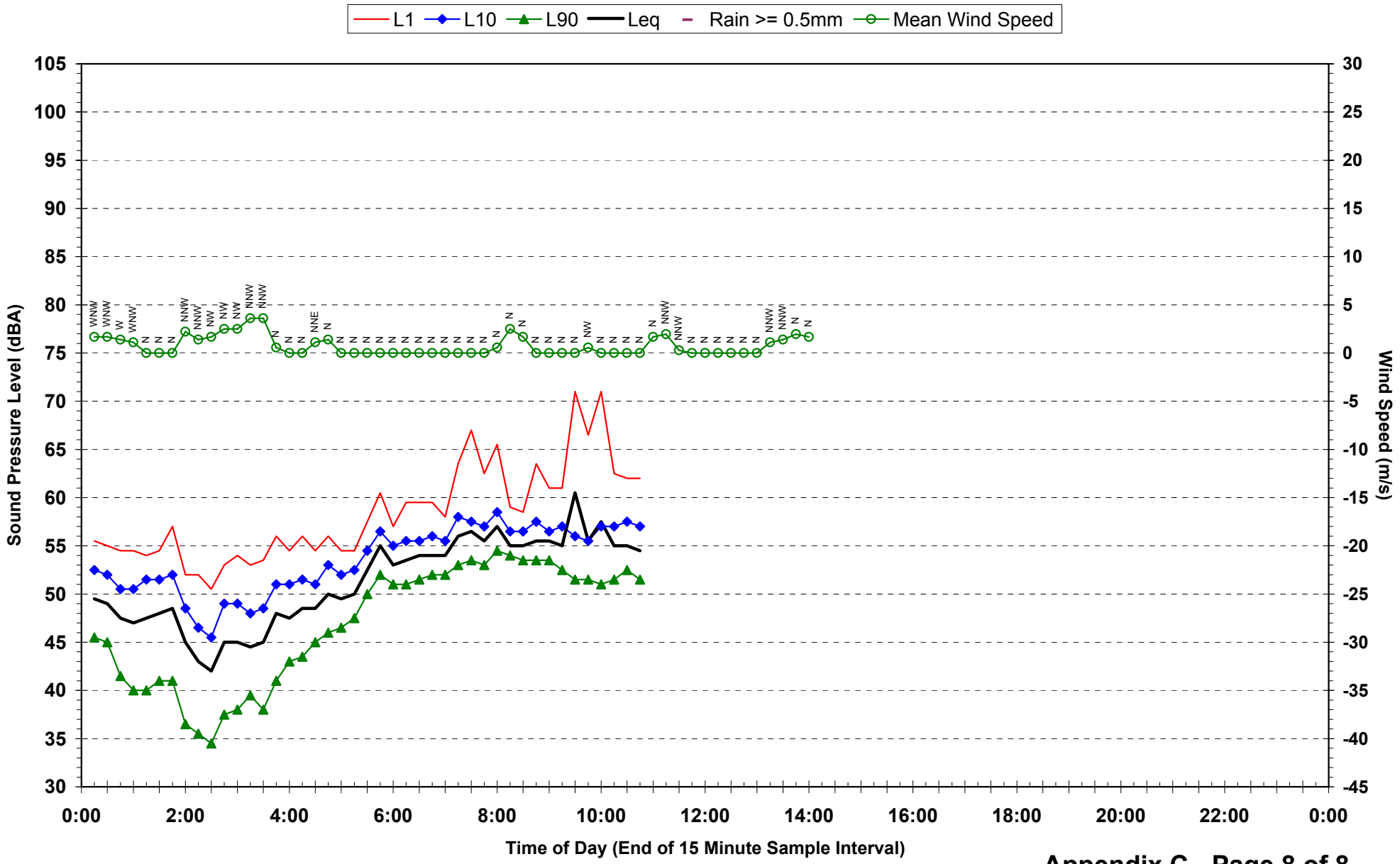
Statistical Ambient Noise Levels
24 Farrington Street Minchinbury - Tuesday 27 July 2010



Statistical Ambient Noise Levels
24 Farrington Street Minchinbury - Wednesday 28 July 2010



Statistical Ambient Noise Levels
24 Farrington Street Minchinbury - Thursday 29 July 2010

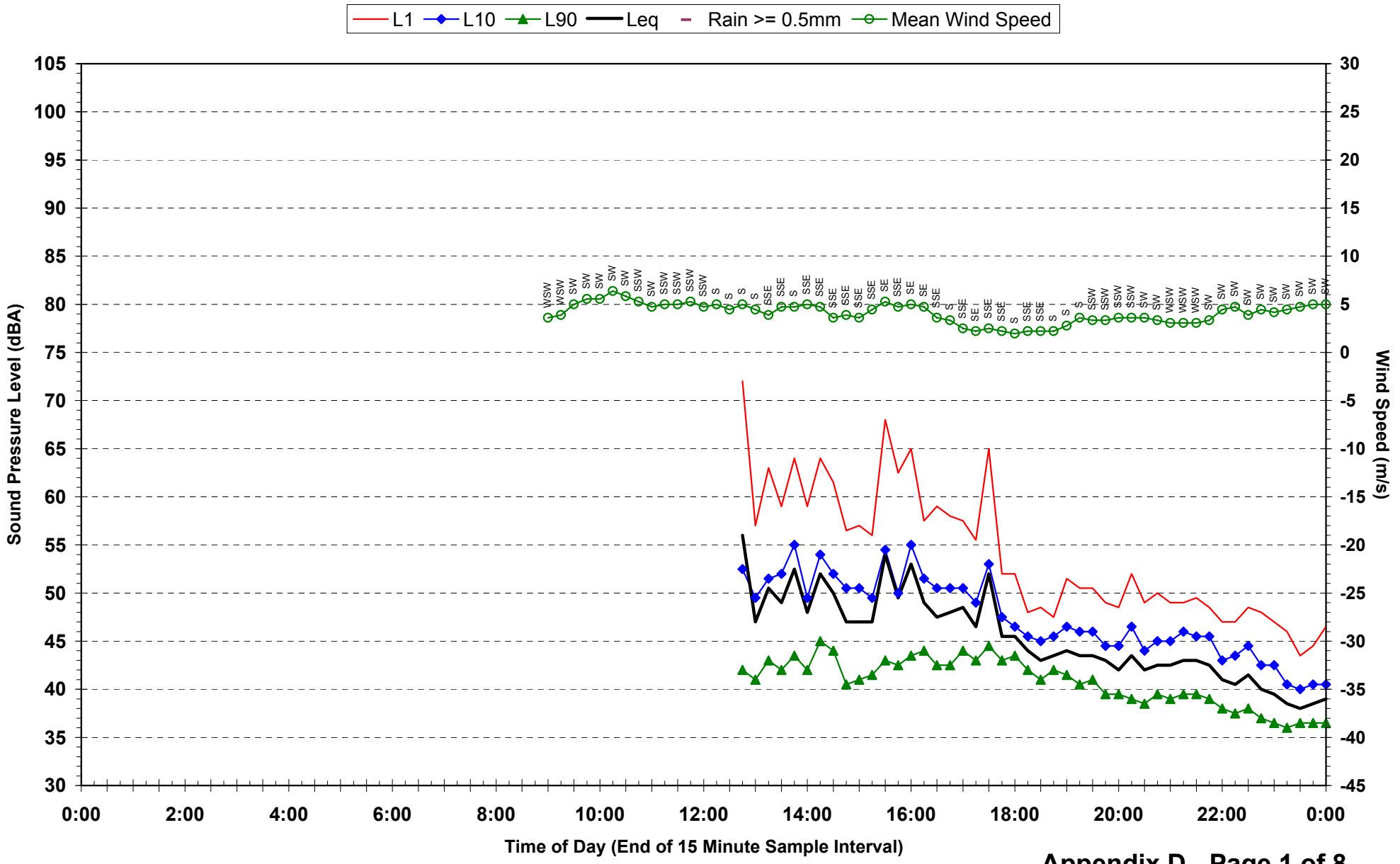


Appendix D

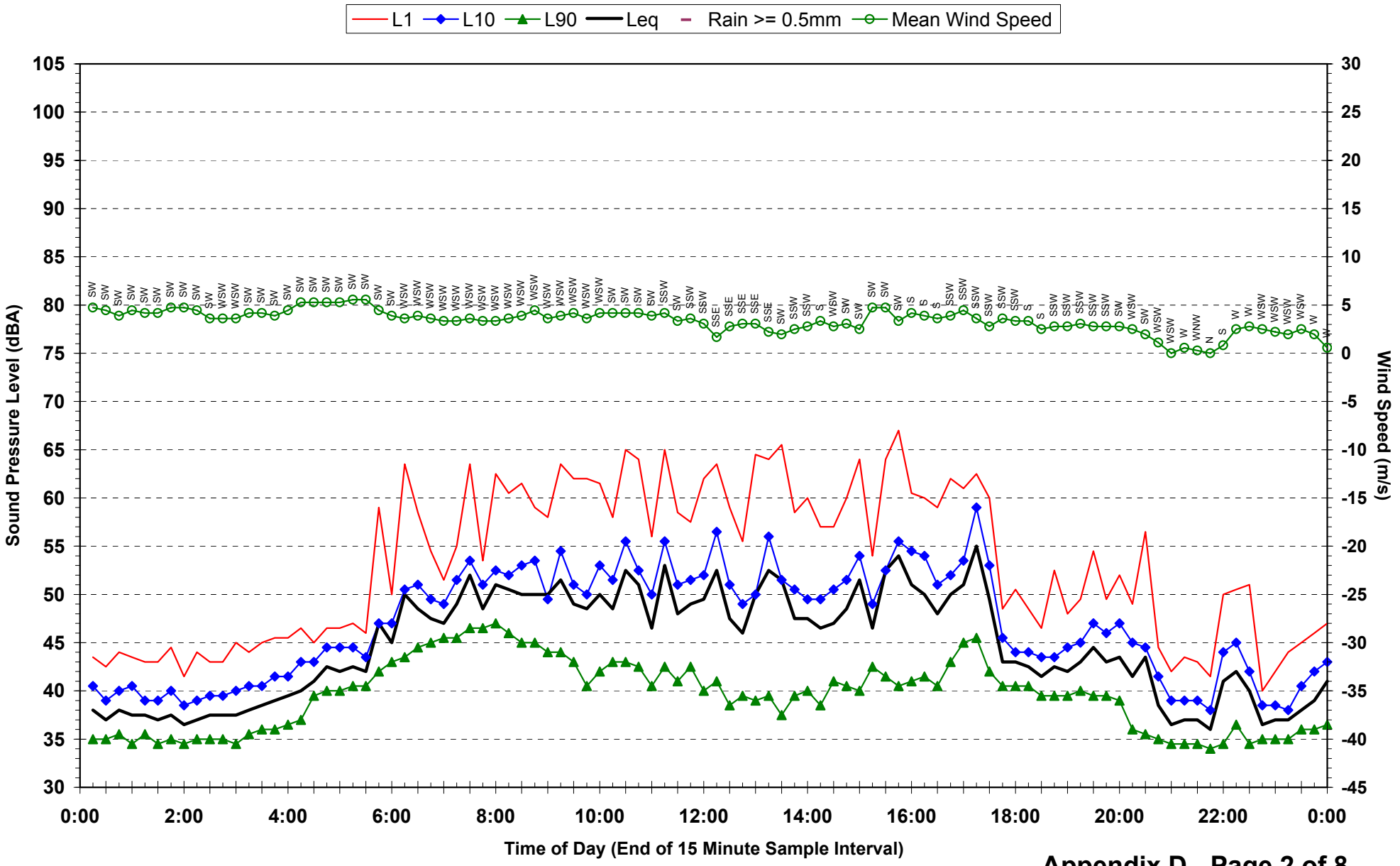
Report 30-2615

Statistical Ambient Noise Levels - 146 Burley Road, Horsley Park

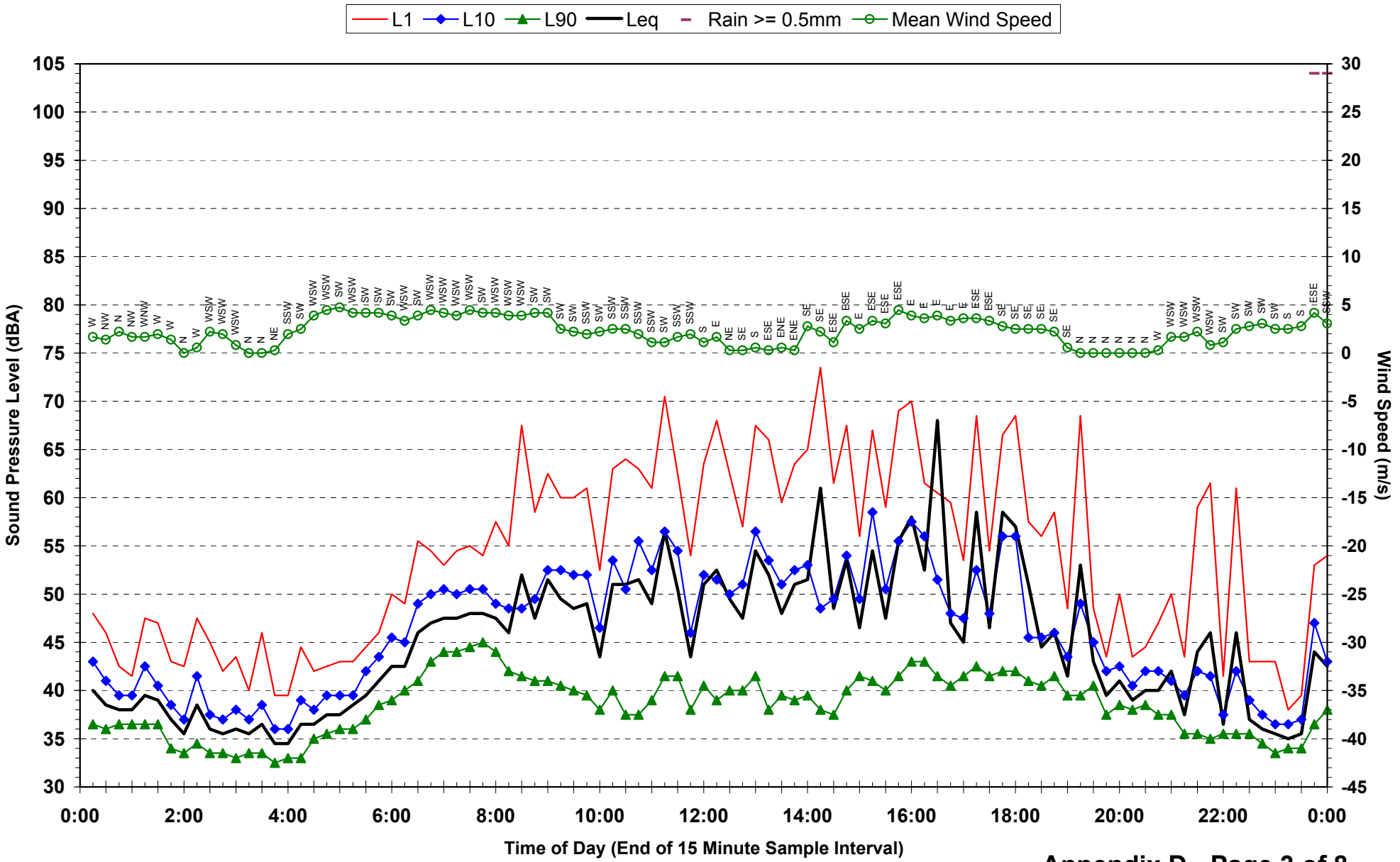
Statistical Ambient Noise Levels
146 Burley Road Horsley Park - Thursday 22 July 2010



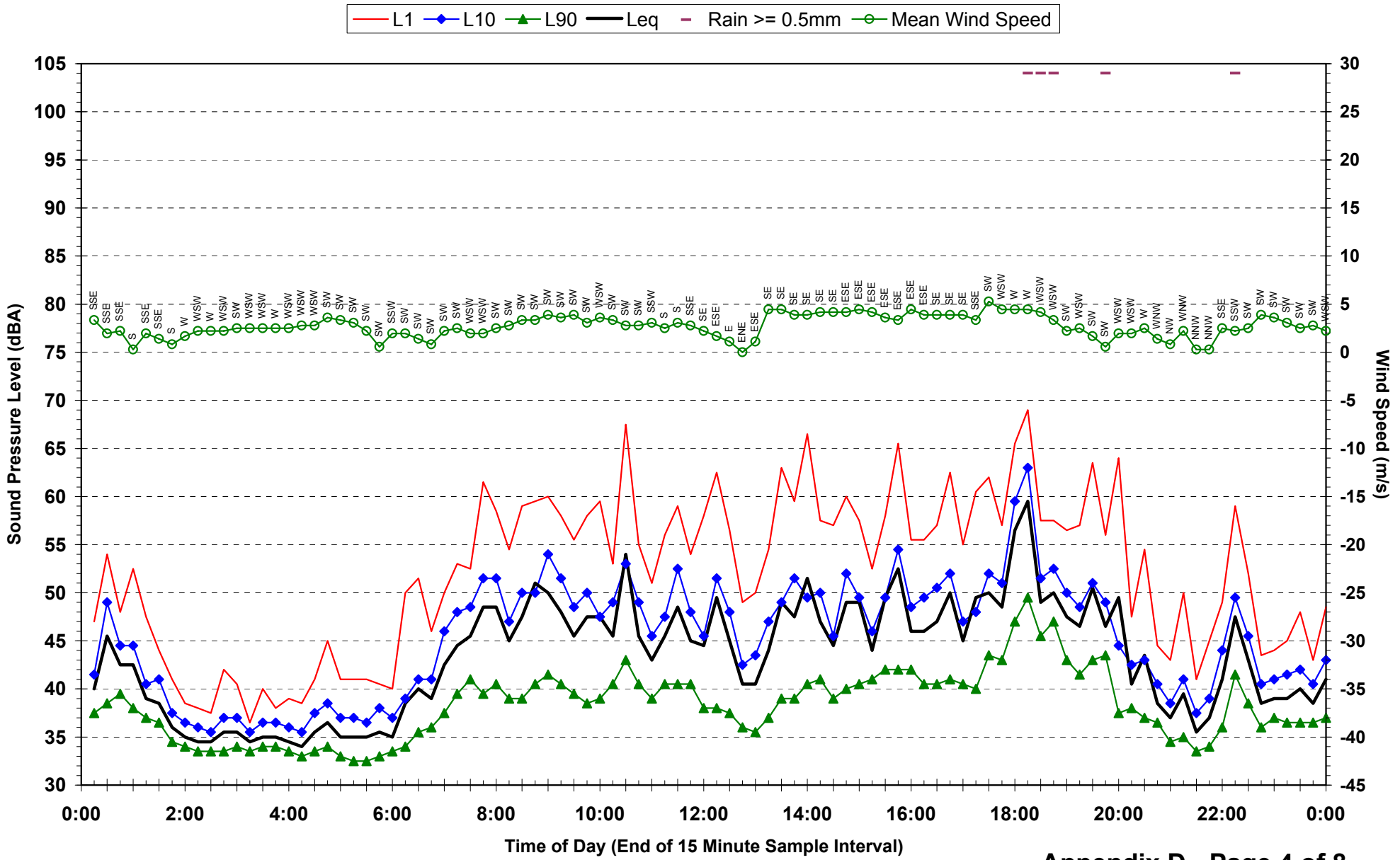
Statistical Ambient Noise Levels
146 Burley Road Horsley Park - Friday 23 July 2010



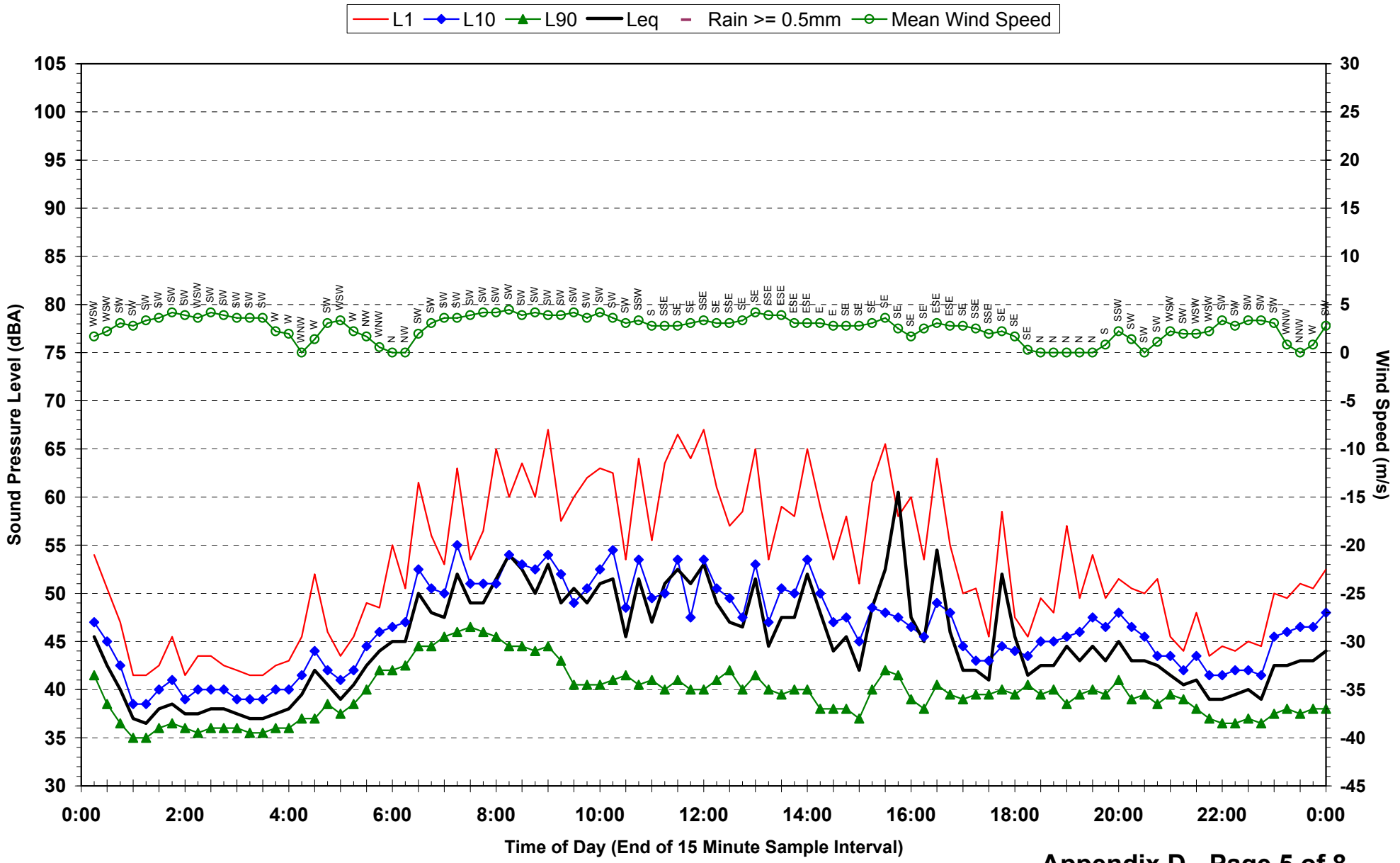
Statistical Ambient Noise Levels
146 Burley Road Horsley Park - Saturday 24 July 2010



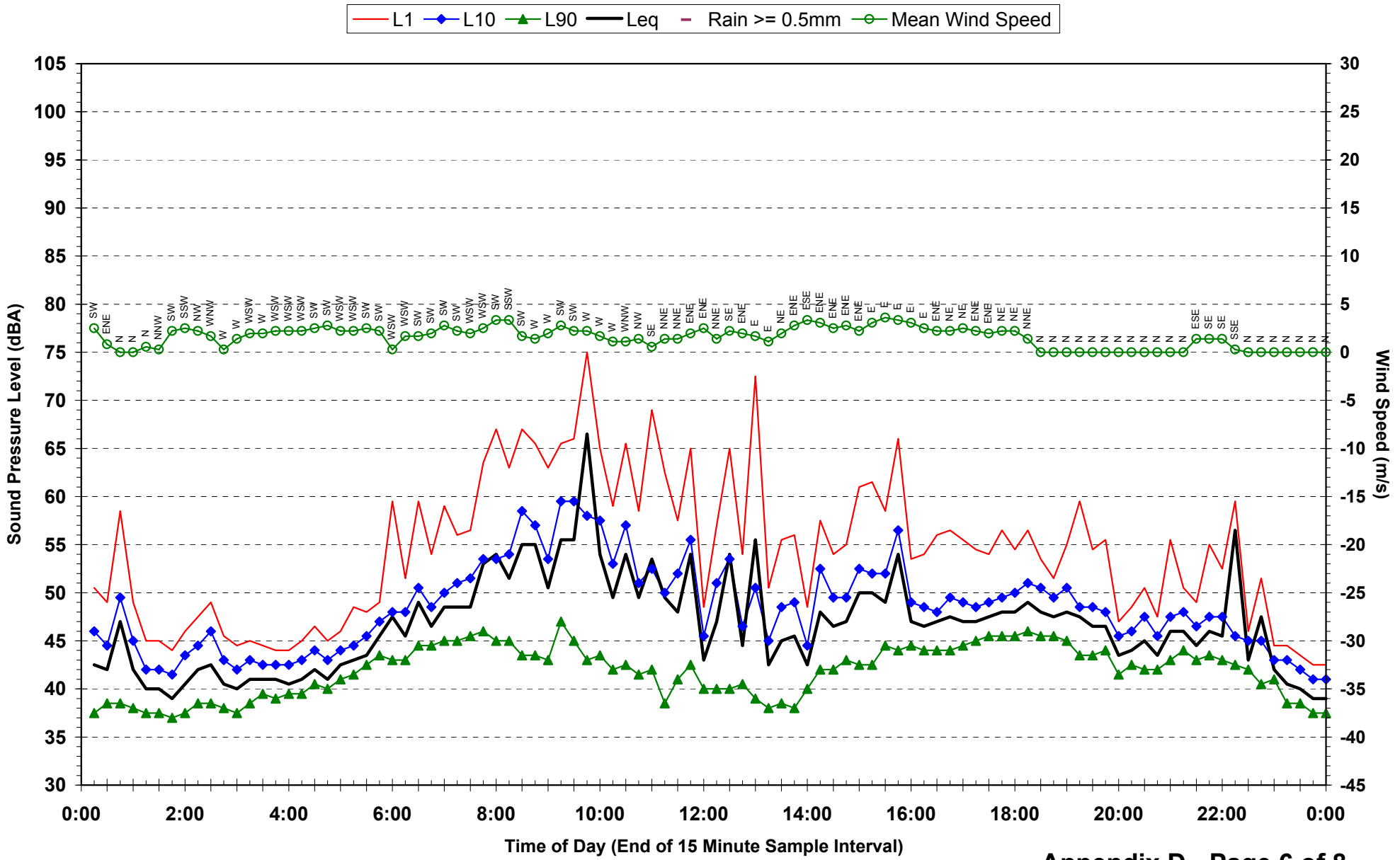
Statistical Ambient Noise Levels
146 Burley Road Horsley Park - Sunday 25 July 2010



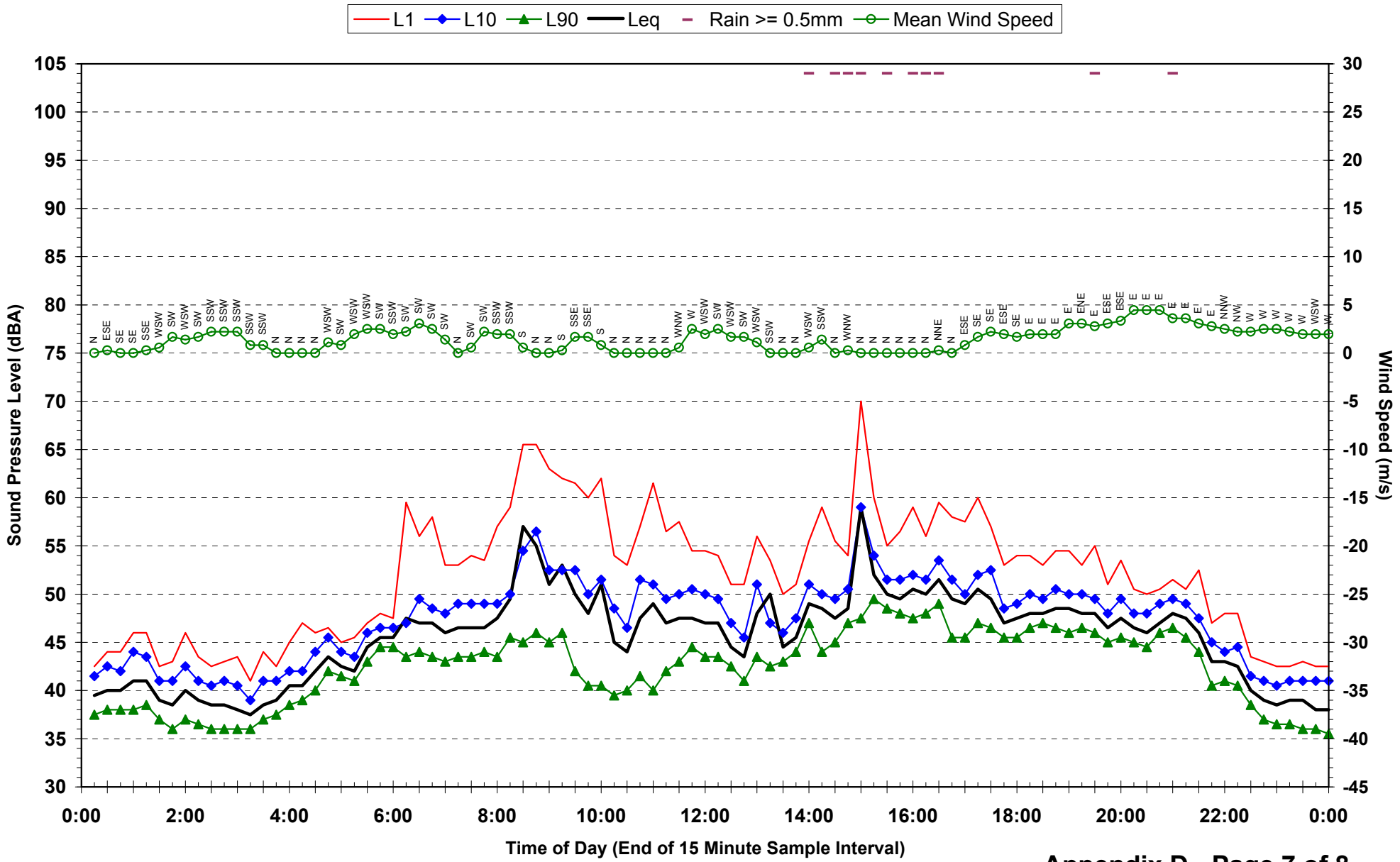
Statistical Ambient Noise Levels
146 Burley Road Horsley Park - Monday 26 July 2010



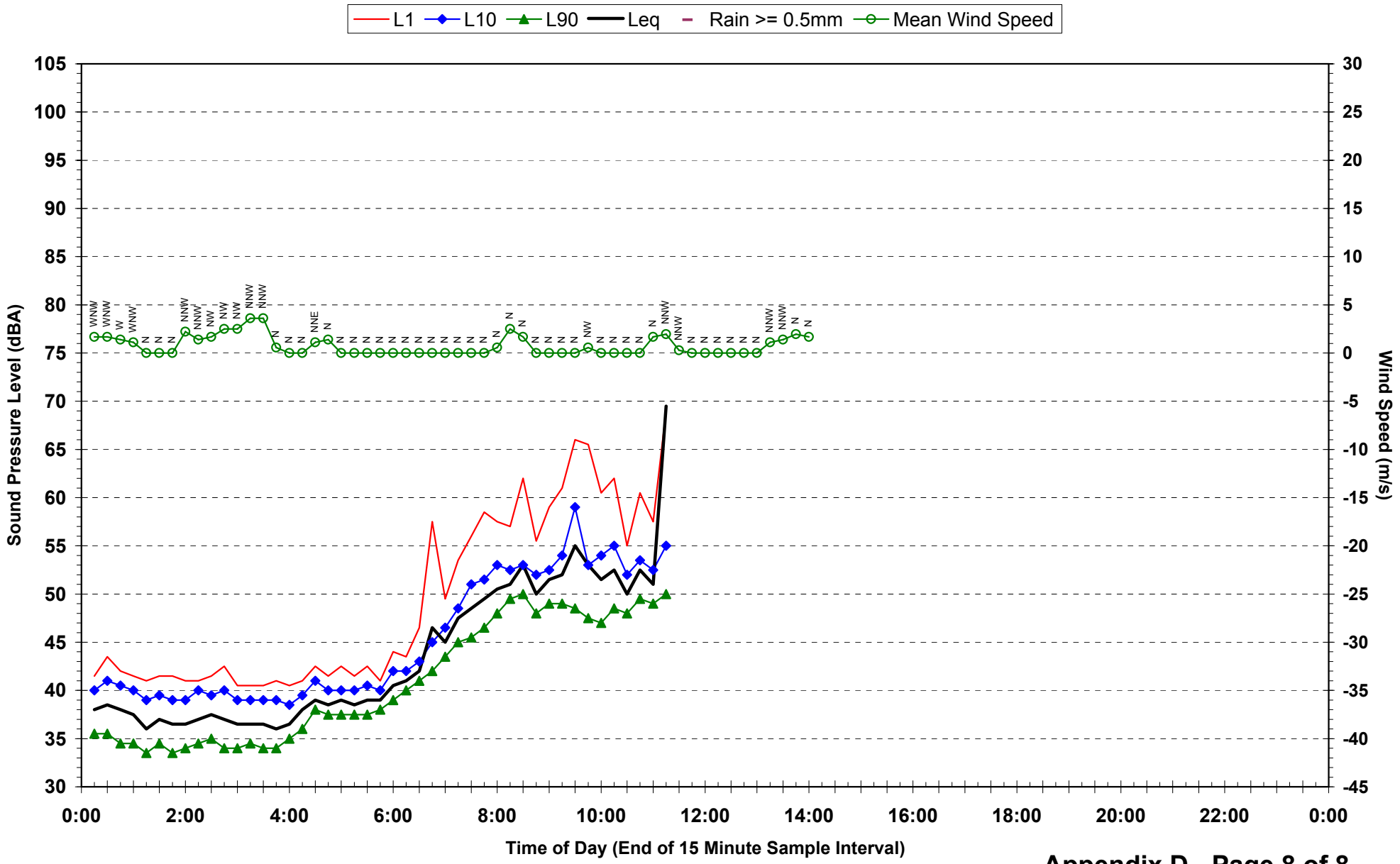
Statistical Ambient Noise Levels
146 Burley Road Horsley Park - Tuesday 27 July 2010



Statistical Ambient Noise Levels
146 Burley Road Horsley Park - Wednesday 28 July 2010



Statistical Ambient Noise Levels
146 Burley Road Horsley Park - Thursday 29 July 2010



Equipment Sound Power Levels

Equipment Description	1/1 Octave Band LAeq Sound Power Levels (dB)										Overall (dBA)
	31.5	63	125	250	500	1k	2k	4k	8k	16k	
Truck departure/arrival	100	95	93	88	88	88	85	81	76	72	92
Gas powered forklift	-	102	93	93	91	89	88	80	72	-	95
Genset	109	112	113	110	101	102	99	93	84	76	107
Transit mixer	103	108	108	105	106	107	105	99	94	86	111
Concrete boom pump	100	106	113	110	104	98	97	92	88	88	107
Delivery truck	96	104	106	99	100	98	92	85	77	77	102
Crane	103	109	99	99	102	100	96	92	90	90	104
Hand tools (grinder)	63	67	65	67	75	84	95	100	100	95	104
Air-conditioning Unit	84	85	98	93	90	90	88	84	75	66	95
Silo loading blower	109	96	86	79	73	70	69	69	71	77	80
Blender	99	86	76	69	63	60	59	59	61	67	70
Vacuum pump	104	91	81	74	68	65	64	64	66	72	75
Resin Dryer	114	101	91	84	78	75	74	74	76	82	85
Preform injection machine	114	101	91	84	78	75	74	74	76	82	85
Preform injection machine enhanced blower	109	96	86	79	73	70	69	69	71	77	80
Closure injection machine	114	101	91	84	78	75	74	74	76	82	85
Closure printer	114	101	91	84	78	75	74	74	76	82	85
Closer printing dryer	114	101	91	84	78	75	74	74	76	82	85
Mould Dehumidifier	109	96	86	79	73	70	69	69	71	77	80
Water pump	101	88	78	71	65	62	61	61	63	69	72
Screw chiller remote condenser	115	102	92	85	79	76	75	75	77	83	86
Air compressor	97	84	74	67	61	58	57	57	59	65	68
Remote condenser	120	107	97	90	84	81	80	80	82	88	91
Granulator	114	101	91	84	78	75	74	74	76	82	85
Roof top exhaust fan	101	98	98	97	92	93	86	81	70	55	97

Equipment Sound Power Levels

Equipment Description	1/1 Octave Band Typical Maximum Sound Power Levels (dB)										Overall (dBA)
	31.5	63	125	250	500	1k	2k	4k	8k	16k	
Truck departure/arrival	105	100	98	93	93	93	90	86	81	77	97
Gas powered forklift	-	107	98	98	96	94	93	85	77	-	100
Air-conditioning Unit	89	90	103	98	95	95	93	89	80	71	100
Silo loading blower	114	101	91	84	78	75	74	74	76	82	85
Blender	104	91	81	74	68	65	64	64	66	72	75
Vacuum pump	109	96	86	79	73	70	69	69	71	77	80
Resin Dryer	119	106	96	89	83	80	79	79	81	87	90
Preform injection machine	119	106	96	89	83	80	79	79	81	87	90
Preform injection machine enhanced blower	114	101	91	84	78	75	74	74	76	82	85
Closure injection machine	119	106	96	89	83	80	79	79	81	87	90
Closure printer	119	106	96	89	83	80	79	79	81	87	90
Closer printing dryer	119	106	96	89	83	80	79	79	81	87	90
Mould Dehumidifier	114	101	91	84	78	75	74	74	76	82	85
Water pump	106	93	83	76	70	67	66	66	68	74	77
Screw chiller remote condenser	120	107	97	90	84	81	80	80	82	88	91
Air compressor	102	89	79	72	66	63	62	62	64	70	73
Remote condenser	125	112	102	95	89	86	85	85	87	93	96
Granulator	119	106	96	89	83	80	79	79	81	87	90
Roof top exhaust fan	102	106	103	103	102	97	98	91	86	75	60