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OPERATIONAL AND CONSTRUCTION NOISE & VIBRATION ASSESSMENT SOLAR POWER FARM MOREE

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REFERENCES

Reference 1: Department of Environment and Climate Change, *Environmental Noise Control Manual* (ENCM)

Reference 2: Department of Environment and Climate Change, *Assessing Vibration: a technical guideline*

Reference 3: Australian and New Zealand Environment and Conservation Council (ANZECC), *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration*

Reference 4: German Standard DIN4150 -1986 - Part 3

Reference 5: British Standard BS7385 -1993 - Part 2

Reference 6: Department of Environment and Climate Change, *Interim Construction Noise Guideline*,

1.0 INTRODUCTION

Atkins Acoustics was commissioned by *Walsh Consulting* on behalf of *BP Solar* to conduct an operational and construction noise and vibration impact assessment for a solar power farm proposal at Moree.

The proposal would be designed to provide a one hundred and fifty (150) Megawatt (MW) photovoltaic (PV) electricity generation facility. The facility would use crystalline silicon technology optimised on trackers to maximise solar energy capture capacity. Power generated by the proposal would be fed into the national electricity grid at the *TransGrid* owned Moree 132kV substation. The proposal includes for the construction of electricity transmission lines from the site to this substation and other ancillary works.

The main aims of the noise and vibration investigations and assessment were to:

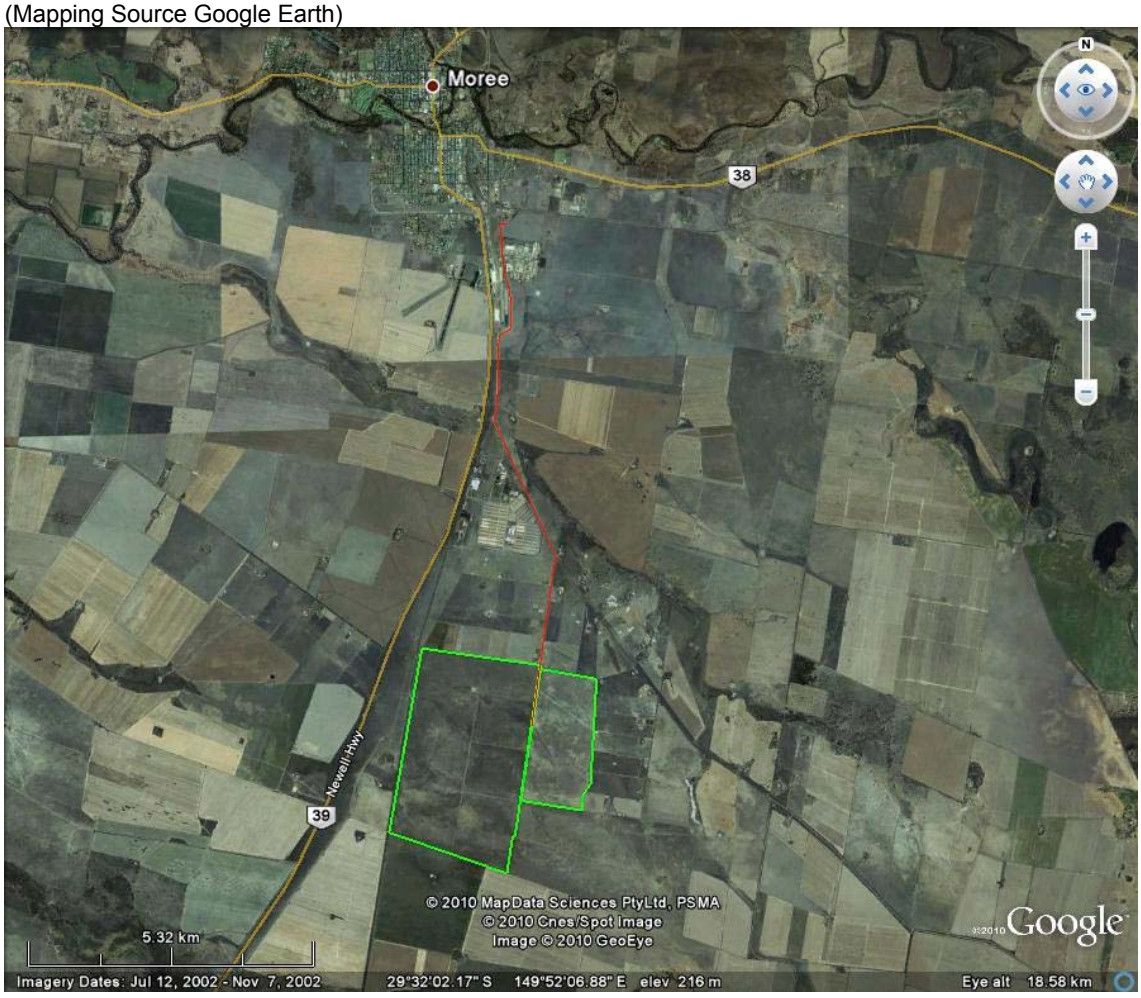
- identify potential noise and vibration impacts from the proposal;
- measure, review and comment on the existing ambient background noise levels in the vicinity of the development site;
- establish project noise goals in accordance with the following guidelines - *NSW Industrial Noise Policy* (EPA, 2000*),* the *Interim Construction Noise Guideline* (DECCW, 2009) *(ICNG)*; the *Environmental Criteria for Road Traffic Noise* (EPA, 1999); and *Assessing Vibration: a technical guideline* (DECCW, 2006)*;*
- predict and assess operational noise from the proposal;
- predict and assess construction noise and vibration impacts from the proposal;
- predict and assess traffic noise impacts from the proposal;
- where noise and vibration assessment goals are predicted to be exceeded, recommend conceptual ameliorative control options; and
- outline noise mitigation strategies, monitoring and management measures that would be applied to the project.

The information presented in the report has been prepared for the investigation described herein, and should not be used in any other context or for any other purpose without written approval from *Atkins Acoustics, Walsh Consulting* and *BP Solar.*

2.0 PROJECT DESCRIPTION

Three (3) sites were investigated for the BP Solar project, each located in the vicinity of Moree. This report provides an assessment for the preferred site.

Figure 1. Preferred Site Option
(Mapping Source Google Earth)



The site is some 1200ha in area and approximately 8km south of Moree Airport on the eastern side of the Northern Tablelands Explorer rail line and the Newell Highway.

It is intended that the electricity transmission line which is required to connect to the national power grid, would run within travelling stock routes and public roads from the site to the Moree substation *(Attachment 1)*.

2.1 Solar Power Farm Development Area

The project would provide for the construction and operation of a large scale commercial solar photovoltaic power plant, described as an array of individual photovoltaic modules, installed in sets of sub-arrays and aligned to optimise solar energy capture. *Attachment 2* provides an indicative layout for the site showing the locations of the PV modules and the sub-station.

To maximise the energy captured and efficiency, the PV modules are attached to trackers, a photo of a typical module is shown below.

Photo 1. Typical Photovoltaic Module

The strings of modules would be wired together in series and cabled to inverters, which convert the direct current (DC) generated to alternating current (AC). Small structures would house the inverters spaced regularly around the site.

A series of transformers would step up the AC current to the required voltage. The output of the transformers would be linked to an on-site substation and cabling connecting to the Moree *(TransGrid)* substation.

2.1.1 Site Works and Access

It is envisaged that the site would be developed incrementally in thirty (30) to forty-five (45) MW stages. While the site works planning has not been undertaken at this assessment and approval phase, during the detailed design and construction phases, *BP Solar*, would be responsible for the delivery of the project and environmental management.

As an overview, the site works would include the follows:

- site establishment works;
- site civil works;
- installation of screw piles for structural support of the modules;
- delivery of PV modules, trackers, electrical conduits and balance of equipment;
- fixing of modules and trackers;
- positioning of junction boxes, inverters, transformers;
- connecting of cabling;
- construction of substation;
- construction of transmission line; and
- grid connection and commissioning as required.

2.1.2 Other Services and Maintenance

Operation and maintenance of the system would involve replacement of modules, repair of inverters, and other supporting equipment, which would be expected to occur on a limited basis during the system's life cycle. Requirements for cleaning of modules would be around twice per year and depend on demand.

2.1.3 Solar Power Farm Construction Program

The staged construction program would be scheduled over a period of approximately four (4) years. It is anticipated that the construction period would be undertaken between April -November to coincide with local seasonal harvest work-force requirements. The bulk of the construction works including site establishment, access roads, pad preparation would be conducted during daytime hours (nominally 7.00am to 6.00pm). Vehicular access to the site would be provided via Halls Creek Road and Bartons Plains Road.

Traffic associated with construction during the first two (2) years could generate some three hundred (300) truck movements per month or on average fifteen (15) movements per day. During the third and fourth years truck movements could increase to six hundred (600) movements per month or on average thirty (30) movements per day. The workforce for the peak construction months during the first two years is expected to be in the order of one hundred (100) persons. During the third and forth years it is envisaged that the workforce would increase to approximately one hundred and sixty (160) persons. Shuttle buses would be used to transport workers to the main construction site. It is envisaged that approximately 80% of the workers would rely on shuttle buses (capacity 20 persons per bus) and 20% would drive by private car. For a worst case scenario (Years 3 and 4) this would equate to seven (7) bus and thirty two (32) car movements in the morning and afternoon per day.

2.1.4 Operational Noise Sources

During daylight hours sources of potential operational noise include the tracking mechanisms, inverters, kiosk transformers and the high voltage substation. It is not envisaged that there would be operational noise from the site from sunset and sunrise.

2.1.5 Potentially Noise Affected Receivers

The site is located in a rural area and generally separated from residential dwellings. *Table 1* presents a summary of residential dwellings and approximate offset distances from the *SPF* substation. Residential receptor assessment locations are shown in *Attachment 1*.

Table 1. Residential Receptor Locations

Reference Location	Receptor Identification	Distance from SPF site boundary (metres)	Distance from SPF Substation (metres)
R1	Barton Plains Road	220	1350
R2	Keams Road	750	1895
R3	Keams Road	970	2150
R4	Keams Road	650	2250
R5	Newell Highway	1800	4450
R6	Wallanoi Road	1020	3400

2.2 Power Transmission Line.

The main components of the proposal would be comprised of supporting structures and the cables that transmit electricity. It is envisaged that the transmission line would carry three conductors and an overhead ground wire. Single poles with cross arms, from which the electrical conductors would be suspended, would generally support the cables. The power transmission line would commence at the onsite substation and connect to the Moree substation *(Attachment 1)*. Preliminary investigations determined the preferred transmission line corridor and likely constraints relating to existing land use, environmentally sensitive areas and constructability.

2.2.1 Power Transmission Line Construction

The construction works and erection of the transmission lines would require a number of construction stages including:

- access track construction;
- vegetation clearing;
- site preparation;
- pole installation; and
- conductor and earth wire stringing

Vehicle movements associated with the transmission line construction is expected to comprise five-ten (5-10) trucks and in the order of fifteen - thirty (15-30) light vehicles per day.

2.2.2 Construction Hours

Proposed construction hours are 7.00am to 6.00pm Monday to Friday and 7.00am to 1.00pm Saturday. Work outside of the proposed hours would only occur when:

- activities do not cause a noise nuisance at any nearby residential building/s;
- delivery of materials which are required outside of normal hours for safety reasons as requested by Police or other authorities; and
- emergency work to avoid loss of lives and/or property.

2.2.3 Power Transmission Line Construction Program

It is anticipated that the total duration of the works would be in the order of three to four (3-4) months, however duration at any one (1) specific structure location is expected to be in the order of one to two (1-2) weeks. Construction would be undertaken in teams on a scrolling basis along the proposed route, with clearing, erection of structures, and cable stringing.

2.2.4 Potentially Noise Affected Receivers

Built up residential areas are located well away from the proposed transmission line route, however some isolated residences are in the order of 50-100m (estimated from aerial photography) of the proposed alignment. Accordingly, the noise assessment has considered anticipated construction activities and noise levels at various offset distances to represent potential receiver locations. A detailed noise and vibration management plan would be prepared to address potential impacts in more detail when the actual transmission line corridor is confirmed and approved.

2.3 Road Traffic

Likely traffic volumes generated during the operational phase of the project are summarised in *Table 2.*

Table 2: Operational Traffic Projections

Personnel	Anticipated vehicle numbers	Usage information
SPF		
3 Security Personal (one per shift)	Three light vehicle	6 movements per day.
10-12 Maintenance/Technical Staff	Ten -twelve light vehicles	24 movements per day.
Power Transmission line		
Maintenance Staff	One light vehicle.	Routine inspections of the transmission route requiring movements on the external road network and power line corridor

2.4 Intermittent Operational Noise (Sleep Disturbance)

As no nighttime operational noise sources are envisaged intermittent noise has not been assessed in terms of sleep disturbance.

2.5 Operational Ground Vibration

No operational ground vibration sources have been identified that are likely to generate ground vibration impacts at residential dwellings.

3.0 EXISTING AMBIENT NOISE ENVIRONMENT

An assessment of the existing ambient noise was undertaken to establish project noise assessment goals. The measurements included both attended audits to identify sources contributing to the ambient noise and unattended monitoring.

3.1 Monitoring Equipment and Procedures

The measurement instrumentation comprised a Svantek SVAN 949 Sound Level Analyser and RTA Environmental Noise Loggers. The reference calibration level for each instrument was checked prior to and after the measurements with a Bruel & Kjaer Sound Level Calibrator Type 4230 and remained within ± 1.

3.2 Acoustic Parameters

The ambient noise levels were measured and recorded as fifteen (15) minute percentile and energy averaged A-weighted levels *(Attachment 3)*. The percentile A-weighted sound levels are the levels exceeded for the relevant percentage of the measurement period. The parameters regarded as being the most common to describe ambient noise levels are the "L_{A90}" or the A-weight sound pressure level exceeded for 90% of the sampling period and is referred to as the background level; and, the "L_{Aeq}" or the A-weighted equivalent continuous sound pressure level for the sampling period which if maintained for the duration of the measurement period would be equal to the same energy as the actual time varying levels.

3.3 Unattended Noise Monitoring

Unattended noise monitoring was undertaken during November 2010. The reference measurement locations *(Attachment 1)* were selected to establish typical existing ambient noise levels for areas potentially exposed to operational noise impacts from the proposal. The measurements locations selected would be described as rural with limited local traffic, or rural areas subject to highway traffic and intermittent railway noise.

The measurement results were evaluated in accordance with *INP* guidelines to confirm the *RBL's* and ambient levels.

3.4 Meteorological Conditions during Monitoring

In accordance with Section 3.4 of the *INP,* noise data was excluded from the monitoring results when average wind speeds were greater than 5m/s and/or rain occurred.

3.5 Measurement Results

Attachment 3 presents a graphic presentation of the noise measurement results. *Table 3* presents a summary of the measurement data. The measurements show that the evening *RBL's* are marginally higher than the daytime levels. This finding is not uncommon for rural areas where the ambient noise can be influenced by wind direction changes and distant noise sources.

Table 3. Rating Background Levels and Ambient Noise Levels
dBA re: 20 × 10^{-6} Pa

Date	Assessment Background Noise Levels					
	RBL (dB)			Ambient $L_{Aeq, period}$		
	Day	Evening	Night	Day	Evening	Night
Reference Measurement Location R1. Barton Plains Road (1)						
RBL	29.3	32.4	29.0			
Logarithmic Average L_{Aeq}				53.9	52.3	55.0
Reference Measurement Location R6. Wallanoi Road (2)						
RBL	37.1	42.9	36.6			
Logarithmic Average L_{Aeq}				60.9	56.3	54.6

Notes: (1) Area subject to local noise activities
(2) Area subject to highway traffic noise and intermittent rail noise
(3) Daytime: 7.00am to 6.00pm Monday to Saturday, 8.00am to 6.00pm Sunday and Public Holidays.
Evening: 6.00pm to 10.00pm.
Night: 10.00pm to 7.00am Monday to Saturday, 10.00pm to 8.00am Sunday and Public Holidays.

3.6 DECCW Noise Policy Assessment Procedures

For preservation of acoustic amenity, the *DECCW Industrial Noise Policy (INP)* requires industrial noise in residential areas be within the acceptable levels for the locality and land-use. The *INP* would describe the subject residential properties as *Rural*. *Table 4* presents a summary of the *INP* acceptable and recommended maximum amenity noise goals for residential development in different noise catchments.

Table 4: DECCW Noise Policy Amenity Goals

Receiver Description	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level	
			Acceptable	Recommended Maximum
Residence	Rural (1)	Day	50	55
		Evening	45	50
		Night	40	45
	Suburban (2)	Day	55	60
		Evening	45	50
		Night	40	45
	Urban (3)	Day	60	65
		Evening	50	55
		Night	45	50

NOTES: Daytime: (7.00am to 6.00pm)
Evening: (6.00pm to 10.00pm)
Nighttime: (10.00pm to 7.00am)

(1) Rural - means an area with an acoustic environment that is dominated by natural sounds, having little or no road traffic. Such areas may include:
- an agricultural area, except those used for intense agricultural activities
- a rural recreational area such as a resort
- a wilderness area or national park
- an area generally characterised by low background noise levels (except in the immediate vicinity of industrial noise sources.

This area may be located in either a rural, rural-residential, environmental protection zone or scenic protection zone as defined on a Council LEP or other planning instrument.

(2) Suburban - an area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry. This area often has the following characteristics:
- decreasing noise levels in the evening period (1800-2200); and/or
- evening ambient noise levels defined by the natural environment and infrequent human activity.

This area may be located in either a rural, rural-residential or residential zone, as defined on an LEP or other planning instrument.

(3) Urban - an area with an acoustical environment that:
- is dominated by 'urban hum' or industrial source noise
- has through traffic with characteristically heavy and continuous traffic flows during peak periods
- is near commercial districts or industrial districts
- has any combination of the above
- where 'urban hum' means the aggregate sound of many unidentifiable, mostly traffic related sound sources.

This area may be located in either a rural, rural-residential or residential zone, as defined on a Council LEP or other planning instrument, and also includes mixed land-use zones such as mixed commercial and residential uses.

3.7 Ambient Noise Assessment for Transmission Line Construction

Given the short-term nature of the transmission line construction works, background noise measurements were not measured along the corridor. With respect to this component of the project, a 'qualitative assessment' has been undertaken *(Section 9)* to identify the cause of potential noise impacts and methods to manage noise.

4.0 PROJECT SPECIFIC TARGET NOISE ASSESSMENT GOALS

4.1 Operational Noise Goals

For the assessment of operational noise the *INP* sets out procedures for the determination of project noise goals. For substations and/or electricity networks the noise characteristics can include tonal or low frequency components. Accordingly penalties of up to 5dB may be applied to the noise assessed at a receptor location and has been considered in the noise assessment.

With respect to what is considered to represent the current best practice for assessing environmental noise, the main aims are to control intrusive noise and manage increases in ambient noise *(noise creep)* from industrial sources. The intrusiveness of a noise is considered to be acceptable if the $L_{Aeq,\ 15\ min}$ level does not exceed the *RBL* by more than 5dBA. In order to preserve noise amenity, the *INP* recommends that L_{Aeq} level from industrial sources should not normally exceed the recommended acceptable noise level (*Table 4*) for the relevant assessment period, i.e. day, evening and night. Where existing L_{Aeq} levels are controlled by industrial noise, and the existing levels approach or exceed the recommended acceptable level, noise assessment goals for new sources are normally set below the existing L_{Aeq} level in order to limit any further increase or noise "creep".

For the purpose of controlling and assessing environmental noise impacts, the *INP* recommends that the acceptable levels *(INP. Tables 2.1 and 2.2)* shown in *Table 4* represent the ideal level of noise from industrial sources that should be met.

The *DECCW* recognise (*INP. Section 1.4.1)* that in setting assessment goals, the levels established in accordance with the *INP* procedures are best regarded as planning tools. The levels determined in accordance with the recommended procedures are not mandatory, and an application for a noise producing development is not determined purely on the basis of compliance or otherwise of noise goals. Other factors that need to be taken into account in the determination include economic consequences, other environmental effects and the social worth of the proposal.

For the purpose of establishing project noise goals, the existing *RBL's* and the *"Rural" INP* amenity goals form the basis of the evaluation and determining the levels summarised in *Table 5.* For assessment purposes the target noise goals are assessed at residential boundaries or thirty (30) metres from a residential dwelling on the property, if the boundary is more than thirty (30) metres from the dwelling.

Table 5: Operational Noise Goals - SPF
dBA re: 20 x 10^{-6} Pa

Period	Sound Pressure Levels				
	Existing RBL	Existing Amenity Level L_{Aeq}	Recommended Amenity Goal L_{Aeq}	Intrusive Goal L_{Aeq}	Project Noise Goals L_{Aeq}
Reference Measurement Location R6. Wallanoi Road					
Day	37	61	50	42	42
Evening	43	56	45	42	42
Night	37	55	40	42	42
Reference Measurement Location R1. Barton Plains Road					
Day	29	54	50	35	35
Evening	32	52	45	35	35
Night	29	55	40	35	35

Notes: (1) Noise levels rounded up or down
(2) Daytime: 7.00am to 6.00pm Monday to Saturday, 8.00am to 6.00pm Sunday and Public Holidays.
Evening: 6.00pm to 10.00pm.
Night: 10.00pm to 7.00am Monday to Saturday, 10.00pm to 8.00am Sunday and Public Holidays

4.2 Road Traffic Noise

Procedures for assessing road traffic noise from new land use developments are documented in the *DECCW (*EPA), *Environmental Criteria for Road Traffic Noise (ECRTN)* and summarised in *Table 6*

.

Table 6. Road Traffic Noise Goals
dBA re: 20 x 10^{-6} Pa

Land Use Development	Traffic Noise Assessment Goals		Where Goals are already Exceeded
	Daytime (7.00am to 10.00pm)	**Nighttime (10.00pm to 7.00am)**	
Land use developments with potential to create additional traffic on local roads	$L_{Aeq,\ 1\ hour}$ 55	$L_{Aeq,\ 1\ hour}$ 50	In all cases, the redevelopment should not increase existing noise levels by more than 2dBA. Where feasible and reasonable noise levels from existing roads should be reduced to meet the noise criteria. In many instances this may be achievable only through long-term strategies.
Land use developments with potential to create additional traffic on collector roads	$L_{Aeq,\ 1\ hour}$ 60	$L_{Aeq,\ 1\ hour}$ 55	
Land use developments with potential to create additional road traffic on existing freeways/arterial roads	$L_{Aeq,\ 15\ hour}$ 60	$L_{Aeq,\ 9\ hour}$ 55	

For the purpose of assessing likely future road traffic noise from the proposal the recommended daytime assessment goals of $L_{Aeq,\ 1\ hour}$ 55dBA and $L_{Aeq,\ 1\ hour}$ 60dBA have been considered.

5.0 METEOROLOGICAL CONDITIONS

A review of local meteorological data has confirmed that the Moree area is subject to seasonal prevailing winds and temperature inversions. It is recognised that the effects of meteorological conditions enhance or reduce noise propagation and noise exposure for distant receptors. In the near field wind has minor influence on measured down wind sound levels. Wind effects become more important as distances increase. Depending on wind speed and distance from a noise source, up wind noise measurement levels compared to down wind conditions can vary by over ±10dBA. Temperature gradients create similar enhancement effects to wind, however the noise impact effects are generally less than wind effects and uniform in all directions.

In accordance with *INP* procedures meteorological conditions have been assessed from data provided by *PAEHolmes*.

5.1 Moree Meteorological Conditions

The meteorological data reported for Moree Airport (site number 053115) included seasonal day, evening and night wind data and stability classes *(Attachments 3 and 4)*.

5.1.1 Wind

Table 7 presents a summary of the dominant daytime wind data and the frequency of occurrences. The results for winds up to 3m/sec show that the predominant wind is from the northern quadrant and occur for less than 30% of the period during any season. As the frequency of wind in any direction is less than 30% wind effects have not been considered for noise modelling.

Table 7: Daytime Winds and Percentage Occurrence

Season	Frequency of Occurrence's Winds ≤ 3m/s	
	Direction	<3m/sec
Summer	NE (± 45º)	15%
Autumn	ENE (± 45º)	18%
Winter	ENE (± 45º)	14%
Spring	N (± 45º)	13%

5.1.2 Atmospheric Stability

Table 8 presents summaries of the nighttime atmospheric stability class data and frequency of occurrences.

Table 8: Atmospheric Stability Frequency and ELR

Stability Class	Occurrence Percentage	Estimate ELR °C/100m	Qualitative Description
A	10.3	<-1.9	Lapse
B	4.0	-1.9 to -1.7	Lapse
C	7.2	-1.7 to -1.5	Lapse
D	47.9	-1.5 to -0.5	Neutral
E	24.2	-0.5 to 1.5	Weak Inversion
F	6.4	1.5 to 4.0	Moderate Inversion

The measurement data shows that the frequency of occurrence of weak and moderate (-0.5 °C/100m to >4.0 °C/100m) inversions is less than 30% and in accordance with the *INP* procedures do not need to be considered for the purpose of noise modelling.

6.0 OPERATIONAL NOISE AND VIBRATION

The main operational noise sources associated with the project include site traffic, kiosk transformers and the substation. The noise emitted from the site activities is expected to be continuous and free from impulsive sources when assessed at residential receptors. Noise emitted from the substation could potentially contain tonal characteristics at 100Hz.

Operational noise emitted from the site is not expected to generate $L_{A1,\ 1\ mim}$ levels greater than 5dBA above the L_{Aeq} levels during daytime hours or exceed the *DECCW* sleep disturbance assessment goal during nighttime (or daytime) hours.

During design development a detailed investigation would be undertaken to confirm likely tonal and low frequency noise is addressed in accordance with *INP* assessment procedures.

No operational vibration sources have been identified that are expected to generate ground vibration impacts at residential receptor locations.

6.1 Operational Noise Sources

Investigations have revealed that there would be no significant operational noise sources or noise emitted from the *SPF* after sunset or before sunrise. During daylight hours the main sources of potential operational noise include the kiosk transformers and a high voltage substation. *Attachment 2* provides an indicative layout for the *SPF* identifying the locations of the transformers and the sub-station. At the time of preparing the noise report, specific source items had not been nominated as the selections would be dependent of final engineering design requirement. On this understanding the source data adopted for the primary noise sources were obtained from noise measurements on similar equipment and installations. The source sound power levels are summarised in *Table 9*.

Table 9. Source Sound Power Levels
dB re 10-12 Watts

Description	1/3 Octave Band Centre Frequency Sound Power Levels LAeq 15min dB																										
	25	**31.5**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1K**	**1.25**	**1.6K**	**2K**	**2.5K**	**3.1K**	**4K**	**5K**	**6.3K**	**8K**	**10K**	**dBA**
Kiosk	55	65	65	59	58	57	59	53	51	62	49	62	54	51	50	48	45	39	40	39	35	35	35	38	35	33	30	59
Substation	77	76	70	74	58	80	102	83	79	94	88	96	95	89	82	74	71	69	64	60	54	50	47	42	35	34	32	96

NOTE: (1) The source information provided for this assessment is preliminary only.
(2) Detailed noise modelling would be undertaken during the detailed design phase to ensure that project noise goals are satisfied.

6.2 Noise Modelling Procedure

Noise from the *SPF* was modelled with the *DECCW* approved Environmental Noise Model *(ENM)* computer model. The model considers attenuation factors including distance, ground absorption, atmospheric absorption, zero topographical features as the land is flat.

Section 5.3.1 of the *INP* guidelines recommends that atmospheric stability for nighttime noise impacts only and wind effects be assessed when they occur for 30% of the time or more in any assessment period or season. Considering the site does not operate during nighttime hours atmospheric stability effects have not been considered for noise modelling. Seasonal wind data reviewed *(Section 5)* identified that there were no predominate gradient wind conditions (occurring for more than 30% of the time) hence would not be classified as a feature and have not been considered for noise modelling. The meteorological conditions adopted for the noise modelling are from the following annual average climate conditions reported for Moree relative humidity 60%, air temperature 27°C and calm wind conditions.

6.3 SPF Noise Predictions

Noise contours plots produced from the ENM modelling are presented in *Attachment 6.* The contours are presented for descriptive and visual purpose only. For assessment purposes noise levels were predicted for the referenced residential receptor locations *(Attachment 1)* selected to model and assess operational noise contributions *Table 10* presents a summary of the predicted levels.

Table 10: Predicted Sound Pressure Level Contributions
L_{Aeq} re: 20 x 10^{-6} Pa

Reference Location	Description	Predicted Sound Pressure Level Contributions dBA	Project Noise Goal dBA
R1	Barton Plains Road	26	35
R2	Keams Road	25	35
R3	Keams Road	25	35
R4	Keams Road	25	35
R5	Newell Highway	15	42
R6	Wallanoi Road	17	42

6.3 Assessment

The predicted noise levels summarised in *Table 10,* with a 5dBA allowance for a tonality correction, show that the recommended project noise goals are satisfied at the referenced residential properties.

As part of the project design, development and assessment when final details of the plant and equipment are specified and the project noise goals confirmed, a more detailed noise assessment would be undertaken to establish and confirm the extent of noise mitigation if required for the *SPF*. During the detailed project design phase, the acoustic investigations would assess for the need to adjust the source noise to account for tonality, impulsiveness, intermittency, irregularity or low-frequency content.

7.0 CONSTRUCTION NOISE AND VIBRATION ASSESSMENT GOALS

For major construction projects undertaken in New South Wales the *DECCW* recommend procedures for assessing noise and vibration impacts. Publications released and referred to by the *DECCW* with reference to the assessment of construction noise and vibration impacts include the *Interim Construction Noise Guideline (2009)* and *Assessing Vibration: a technical guideline.*

7.1 DECCW, Interim Construction Noise Guideline

The Interim Construction Noise Guideline *(ICNG)* was developed by the *DECCW* in response to concerns raised with respect to construction noise impacts. The primary objective of the *ICNG* is aimed at managing noise from construction works regulated by the *DECCW*. The guideline deals with procedures to:

- promote a clear understanding of ways to identify and minimise noise from construction works;
- focus on applying all 'feasible and reasonable' work practices to minimise construction noise impacts;
- encourage construction to be undertaken during recommended hours;
- streamline the assessment and approval stages;
- reduce time spent dealing with complaints at the project implementation stage; and
- provide flexibility in selecting site-specific feasible and reasonable work practices in order to minimise noise impacts.

The *DECCW* recognise that feasible work practices are practical to implement, while reasonable work practices take into account the balance of costs and benefits and community views. Work practices recommended by the *DECCW* can include notifying the community of expected noise impacts and when they are expected to occur.

The procedures and recommendations published in the *ICNG* for assessing construction noise impacts are best regarded as planning tools. They are not mandatory, and their

application for assessing construction noise is not determined purely on the basis of compliance or otherwise with numerical noise levels.

For the purpose of assessing and managing noise impact the *ICNG* procedures refer to the proposed construction hours and the duration of the works. For construction works extending more than three (3) weeks a 'quantitative assessment method' is recommended, for construction works that are unlikely to affect an individual or sensitive land use for more than three (3) weeks in total, the *ICNG* refers to a 'qualitative assessment method'.

7.1.1 Construction Hours

The recommended standard hours for construction activities are summarised in *Table 11*. The *DECCW* recognise that the recommended hours are not mandatory and that there would be situations, where construction works are undertaken outside of these hours.

Table 11. Recommended Standard Construction Hours

Work Type	Recommended Standard Hours of Work*
Normal Construction	Monday to Friday 7.00am to 6.00pm Saturday 8.00am to 1.00pm No works on Sundays or public holidays

* The relevant authority (consent, determination or regulatory) may impose more or less stringent construction hours

7.1.2 Quantitative Assessment Method

The *ICNG* *(Chapter 4)* refers to quantitative assessment methods involving predicted noise levels and comparing them with levels developed from Chapter 4 of the Guideline. For assessment purposes the Rating Background Level *(RBL)* is used when determining management assessment noise levels. *Table 12* sets out noise management levels at residences and how they are applied. Restrictions to construction hours may apply to activities that generate noise at residences above the 'highly noise affected ' noise management level.

Table 12. Noise at Residences (Quantitative Assessment)

Time of Day	Management Level $L_{Aeq, 15\ min}$	How to Apply
Recommended standard hours: Monday to Friday 7.00am to 6.00pm Saturday 8.00am to 1.00pm No works on Sundays or public holidays	Noise affected RBL+10dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured LAeq 15min 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	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 longer period of construction in exchange for restrictions on construction times
Outside recommended standard hours	Noise affected RBL+5	• 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 feasible and reasonable practices have been applied and noise is more than 5 above the noise affected level, the proponent should negotiate with the community

NOTE: (1) Noise levels apply at the residential property boundary that is most exposed to construction noise.
(2) If the property boundary is more than 30m from the residence the location for measuring or predicting noise levels is at the most noise-affected point within 30m of the residence.

7.1.3 Qualitative Assessment Method

The qualitative method for assessing noise is used for construction sites that are not likely to affect an individual or sensitive land use for more than three (3) weeks. Where residences may be affected by noise work practice methods be considered and a community notification program be implemented together with a Noise Management Plan.

7.1.4 Project Construction Noise Goals

Considering the *ICNG* and the measured *RBL's,* the target assessment goals recommended for evaluating construction noise are summarised in *Table 13*.

For assessment purposes construction noise is assessed at a height of 1.5m above ground level at a residential property boundary or thirty (30) metres from a residential dwelling, if the boundary is more than thirty (30) metres from the dwelling.

Table 13: Daytime Construction Noise Target Goals
dBA 20 × 10^{-6} Pa

Reference Location	Description	Existing RBL	Existing Amenity Level L_{Aeq}	Target Noise Goal L_{Aeq}
R1	Barton Plains Road	30	54	40
R2	Keams Road	30	54	40
R3	Keams Road	30	54	40
R4	Keams Road	30	54	40
R5	Newell Highway	37	61	47
R6	Wallanoi Road	37	61	47

Notes: (1) Noise levels rounded up or down
(2) Daytime: 7.00am to 6.00pm Monday to Friday, 7.00am to 1.00pm Saturday.

7.2 Ground Vibration

The effect of vibration on humans and structures is normally considered and evaluated in terms of annoyance and structural damage.

7.2.1 Annoyance

The *DECCW*, *Assessing Vibration: a technical guideline* recommends goals for assessing human response and potential disturbance to the occupants of buildings. *Table 14* presents a summary of velocity levels (rms) referenced to specific frequency bands adjusted by multiplying factors for residential receptors referenced to human response *(BS 6472-1992. Figure B1.4).*

Table 14: Vibration Levels for Assessment of Human Comfort

Frequency (Hz)	Vibration Level (mm/s)			
	Continuous Vibration		Intermittent Vibration	
	Day (2)	Night (1.4)	Day (60)	Night (90)
1	3.2	2.2	95	31
1.25	2.3	1.6	68	22
1.6	1.6	1.1	47	15
2	1.1	0.8	33	11
2.5	0.8	0.6	24	8.0
3.15	0.6	0.4	17	5.8
4	0.4	0.3	19	4.0
5	0.3	0.2	9.5	3.2
6.3	0.3	0.2	7.6	2.5
8	0.2	0.1	6.0	2.0
10	0.2	0.1	6.0	2.0
12.5	0.2	0.1	6.0	2.0
16	0.2	0.1	6.0	2.0
20	0.2	0.1	6.0	2.0
25	0.2	0.1	6.0	2.0
31.5	0.2	0.1	5.4	1.8
40	0.2	0.1	6.0	2.0
50	0.2	0.1	6.0	2.0
63	0.2	0.1	6.0	2.0
80	0.2	0.1	6.0	2.0

7.2.2 Perception

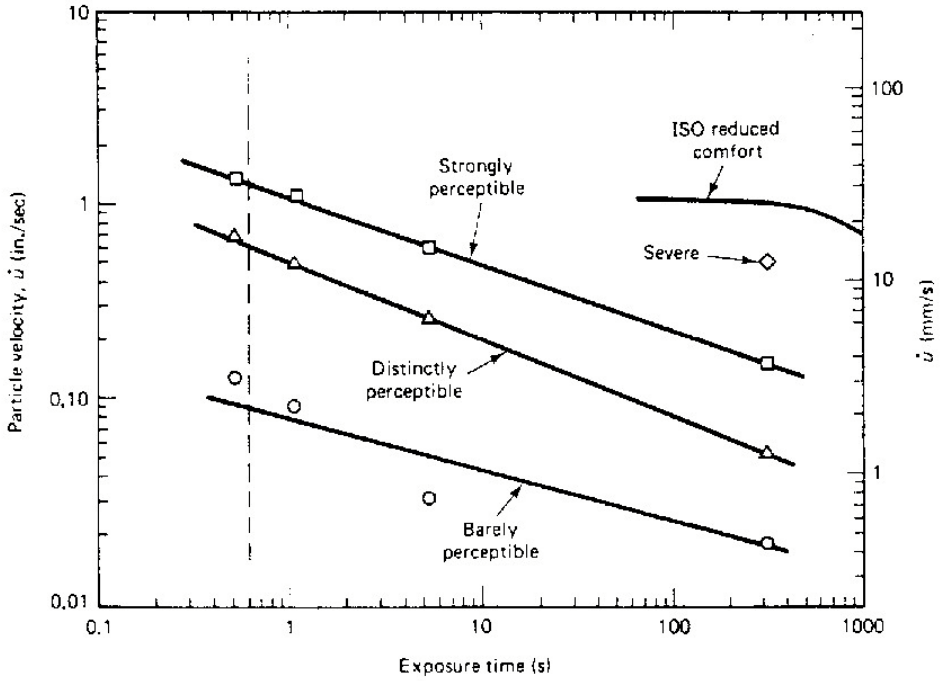
For comparison of vibration exposure levels in terms of human response, *Table 15* presents a summary of levels referenced to likely perception.

Table 15: Human Perception of Vibration
Ref: German Standard DIN 4150 (1986)

Vibration Levels mm/sec	Likely Perception
0.15	Perception Threshold
0.35	Barely Noticeable
1.0	Noticeable
2.2	Easily Noticeable
6.0	Strongly Noticeable
14.0	Very Strongly Noticeable

Figure 2 compares human response to vibration levels and exposure. The data in *Figure 2* demonstrates that short duration vibration exposure levels are less perceptible than longer continuous levels.

Figure 2: Human Response to Vibration



7.2.3 Structural Damage

German Standard DIN4150 Part 3 (1986) provides guidelines for evaluating the effects of vibration on structures. The values recommended in the standard are summarised in *Table 16*. The values are the maximum levels measured in any direction at the building foundation.

Table 16: Safety Limits for Structural Damage

Type of Structure	Vibration Level (mm/s)		
	< 10Hz	**10Hz to 50Hz**	**50Hz to 100Hz**
Commercial/industrial buildings or buildings with similar design	20	20 to 40	40 to 50
Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20
Structures of great intrinsic value (eg. buildings under preservation)	3	3 to 8	8 to 10

Ref: German Standard DIN4150

8.0 CONSTRUCTION PLANT NOISE and VIBRATION SOURCES

The main construction activities envisaged include: access track construction, vegetation clearing, site preparation, drilling, panel installation, wiring and transmission line erection.

8.1 Overview of Construction Activities

The construction sequence would generally be conducted as follows, however subject to the work program some activities may be conducted concurrently at multiple locations.

8.1.1 SPF Construction

The envisaged staged construction program would be scheduled over a period of approximately four (4) years. It is anticipated that the construction period would be undertaken between April -November to coincide with local seasonal harvest work-force requirements. The staged work areas are identified in *Figure 3*. The bulk of the construction works including site establishment, access roads, pad preparation would be conducted during daytime hours (nominally 7.00am to 6.00pm). Vehicular access to the *SPF* site would be provided via Halls Creek Road and Bartons Plains Road.

Following the site preparation the structural supports for each PV module would be installed by rotary drilling of the steel supports using a conventional truck mounted drilling rig. Following the placement of the supports the PV modules would be lifted into place and wired in series and cabled to inverters, transformers and the onsite substation.

Traffic associated with construction could generate some one hundred (100) truck movements per month or on average ten (10) movements per day. The workforce for the peak construction months during the first two years is expected to be in the order of one hundred (100) persons. During the third and forth years it is envisaged that the workforce would increase to approximately one hundred and sixty (160) persons.

Figure 3. Stage Construction Areas

(Mapping Source Google Earth)

8.1.2 Transmission Line Construction

Much of the transmission line route is located on cleared rural land and would not require significant clearing. If required clearing would be conducted in small teams utilising hand tools such as grass cutters and the like where appropriate. Where trees are identified, mobile plant may be utilised to remove trees including stumps.

The envisaged sequence of construction activities for the transmission line include:

- site access and clearing;
- pole hole drilling and pole installation; and
- delivery and stringing of cable.

Where required, preparation of the working areas would utilise a front-end loader. Truck mounted hydraulic drilling machines and cranes would be used to install the poles and cross arms.

8.2 Construction Equipment Noise Emission Levels

For the assessment of noise from the envisaged construction activities, the following plant noise levels (*Table 17*) have been considered.

Table 17: Plant Schedules and Sound Power Levels
dBA re: 10^{-12} Watts

Item	Plant Description	Number of Items	Sound Power Level L_{A10}
SPF Development			
Access Track Construction			
Front End Loader	Rubber Tyre	2	113
Water Cart		2	108
		Total	**114**
Vegetation Clearing			
Grass Clearing/Cutter		2	108
		Total	**108**
Site Preparation/Clean Up			
Excavators	Kato 750	4	113
Water Cart		2	108
Trucks		2	108
		Total	**115**
PV Module Support			
Drill Rigs	Truck mounted	2	107
		Total	**107**
Substation/PV Module Installation/Wiring			
Cranes	Truck mounted	2	108
Trucks		2	108
Generators		2	104
Miscellaneous Hand Tools			110
		Total	**114**
Transmission Line			
Access Track Construction			
Front End Loader		1	110
Truck		1	105
		Total	**112**
Pole Installation			
Drill Rigs	Truck Mounted	1	104
Trucks		2	108
Cranes		2	108
		Total	**111**
Cable Stringing			
Trucks		2	105
Cranes		2	108
Miscellaneous Hand Tools			110
Generator	Diesel	1	101
		Total	**110**

8.3 Construction Equipment Vibration Emission Levels

During site establishment and the construction phase, it is unlikely that plant or equipment other than trucks, would generates ground vibration. To evaluate the likely effects of vibration from truck passbys, the following vibration levels (*Table 18*) have been considered.

Table 18: Typical Plant Vibration Levels
mm/sec

Plant Description	Vibration Levels mm/sec		
	@ 5m	@ 20m	@ 40m
Truck	1	0.05	0.02

9.0 CONSTRUCTION NOISE and VIBRATION IMPACT ASSESSMENT

9.1 SPF Construction Noise Predictions

A summary of typical offset distances for staged site works and the reference assessment locations is presented in *Table 19*. The distances represent the closest point (worst case scenario) and the centre for each construction stage.

Table 19: Typical Off-set Distances

Reference Location	Description	Off Set Distance				
		Closest	Stage 1	Stage 2	Stage 3	Stage 4
		(metres)				
R1	Barton Plains Road	290	1600	1500	2400	3400
R2	Keams Road	800	1400	3200	3200	3700
R3	Keams Road	1000	1600	3400	3300	3550
R4	Keams Road	650	1750	3500	3000	2900
R5	Newell Highway	1850	5150	3800	3300	3150
R6	Wallanoi Road	1050	4100	2200	2800	3600

Predicted construction noise levels for typical site activities at reference assessment locations are presented in *Table 20*. The modelling assumed the plant schedules referenced in *Table 17* with no account of additional attenuation from topography or ground absorption.

Table 20: Predicted Construction Noise Levels (SPF)
L_{Aeq} re: 20 × 10 $^{-6}$ Pa

Description	Predicted Sound Pressure Levels LAeq 15min					
	Target Noise Goal	Closest	Stage 1	Stage 2	Stage 3	Stage 4
R1- Barton Plains Road						
Access Track Construction	40	**57**	**42**	**42**	38	35
Vegetation Clearing	40	**51**	36	36	32	29
Site Preparation	40	**58**	**43**	**43**	39	36
PV Module Support Foundations	40	**50**	35	35	31	28
Substation/PV Module Installation	40	**57**	**42**	**42**	38	35
R2- Keams Road						
Access Track Construction	40	**48**	**43**	36	36	35
Vegetation Clearing	40	**42**	37	30	30	29
Site Preparation	40	**49**	**44**	37	37	36
PV Module Support Foundations	40	**41**	36	29	29	28
Substation/PV Module Installation	40	**48**	**43**	36	36	35

Table 20: Predicted Construction Noise Levels (SPF). Cont'd.
L_{Aeq} re: 20 × 10 $^{-6}$ Pa

Description	Predicted Sound Pressure Levels LAeq 15min					
	Target Noise Goal	Closest	Stage 1	Stage 2	Stage 3	Stage 4
R3- Keams Road						
Access Track Construction	40	**46**	**42**	35	36	35
Vegetation Clearing	40	40	36	29	30	29
Site Preparation	40	**47**	**43**	36	37	36
PV Module Support Foundations	40	39	35	28	29	28
Substation/PV Module Installation	40	**46**	**42**	35	36	35
R4- Keams Road						
Access Track Construction	40	**50**	**41**	35	36	37
Vegetation Clearing	40	**44**	35	29	30	31
Site Preparation	40	**51**	**42**	36	37	38
PV Module Support Foundations	40	**43**	34	28	29	30
Substation/PV Module Installation	40	**50**	**41**	35	36	37
R5- Newell Highway						
Access Track Construction	47	41	32	34	36	36
Vegetation Clearing	47	35	26	28	30	30
Site Preparation	47	42	33	35	37	37
PV Module Support Foundations	47	34	25	27	29	29
Substation/PV Module Installation	47	41	32	34	36	36
R6 - Wallanoi Road						
Access Track Construction	47	46	34	39	37	35
Vegetation Clearing	47	40	28	33	31	29
Site Preparation	47	47	35	40	38	36
PV Module Support Foundations	47	39	27	32	30	28
Substation/PV Module Installation	47	46	34	39	37	35

The noise predictions in *Table 20* show that construction noise at the Barton Plains Road residential property exceeds the daytime target assessment goal (40dBA) during Stage 1 and Stage 2 site works. At the dwellings to the east of the *SFP* the predicted levels exceed the daytime target assessment goal (40dBA) during the Stage 1 site works. At the residential dwellings on the western side of the Newell Highway the predicted noise levels satisfy the target noise assessment noise goal of 47dBA. To assist with the reduction of noise emitted from the site during construction where practical and feasible, plant selections, temporary controls and work practices would be considered to minimise noise impacts. To further assist with the management of construction noise impacts, it is recommended that consultation be undertaken with affected landowners.

9.1.3 Transmission Line Construction

Table 21 presents the calculated noise levels during the transmission line construction works. Construction would be undertaken in teams on a scrolling basis along the transmission line route. The envisaged duration at any one (1) specific location is expected to be less than three (3) weeks.

Table 21: Predicted Construction Noise Levels (Transmission Line)
L_{Aeq} re: 20×10^{-6} Pa

Construction Area/Activity	Predicted Sound Pressure Level Referenced to Distances from Construction Activity $L_{Aeq\ 15min}$						
	25m	100m	250m	500m	1000m	2000m	3000m
Access Track Construction	76	64	56	50	44	38	32
Pole Installation	75	63	55	49	43	37	31
Cable Stringing	74	62	54	48	42	36	30

Where practical and feasible, plant selections, temporary noise controls and work practices would be considered to minimise noise impacts. This would typically involve orientation of equipment, staging of activities, shielding and minimisation of simultaneous operations. To ensure noise levels are controlled and impacts managed during construction a Construction Environmental Management Plan *(CEMP)* would be prepared and implemented by the contractors engaged.

9.3 Overview

To assist providing and understanding of potential noise impacts and the levels presented above, a summary of typical noise source levels is presented in *Table 22*.

Table 22: Range of Typical Noise Sources.
re: 20×10^{-6} Pa

Sound Pressure Level dBA	Source Description	Subjective Evaluation
105-110	Chainsaws	Very noise
90-95	Tractor without cabin	Noisy
75-90	Inside harvester cabin	Noisy
70-80	Kerbside of busy street	Loud
50-60	Department store	Moderate to quiet
25-30	Inside bedroom	Quiet

9.4 Traffic Generation

Traffic generated during construction would be associated with plant and equipment deliveries and contractors. Where possible, construction traffic would be restricted to internal roads created onsite and the transmission line right of way. Site access is from the north on Halls Creek Burrington Road and Barton Plains Road. The main residential developments along the roads are located at the rail line crossing on Halls Creek Burrington Road. Further to the east one isolated residential dwelling is located opposite the intersection with Bartons Plains Road. Four (4) residential dwellings are located on Bartons Plains Road. Daily traffic composition would be limited to construction workers and truck deliveries. *Table 23* presents the envisaged daily and hourly traffic flow projections.

Table 23: Projected Vehicle Movements (SPF)

Description	Movements	
	Daily	Hourly
Stages 1 and 2		
Trucks	15	2
Contractors Buses/Cars	8/40	4/20
Stages 2 and 3		
Trucks	30	4
Contractors Buses/Cars	14/64	7/32

Vehicle movements associated the transmission line would include the delivery of plant and materials and contractors. *Table 23* presents the envisaged daily flow projections.

Table 24: Projected Vehicle Movements (Transmission Line)

Description	Movements	
	Daily	Hourly
Trucks	5-10	2
Contractors cars	30-60	30

9.3.5 Traffic Noise Assessment

Traffic investigations have shown that additional passby vehicle trips would be generated on Halls Creek Burrington Road and Barton Plains Road.

Traffic noise at the facade of the residences has been predicted using the *Calculation of Road Traffic Noise (CoRTN)* traffic noise prediction model. The noise model considers

the following factors:

- hourly traffic counts;
- vehicle speed (50km/hr);
- percentage heavy vehicles;
- shielding if applicable; and building facade reflection (2.5dBA).

Table 25 presents a summary of the predicted hourly traffic noise levels

Table 25: Predicted Traffic Noise Levels (Construction)

Description	Sound Pressure Level LAeq. 15min		Target Noise Goal
	Stages 1-2	Stages 3-4	
Halls Creek Burrington Road	50	52	60
Intersection to Barton Plains Road	38	40	60
Barton Plains Road	43	46	55

Overall the traffic volumes generated during construction are considered as minimal and the predicted traffic noise levels satisfy the project target noise goals.

9.4 Vibration Levels from Associated Construction Activities

The main source of ground vibration that has been identified and assessed is associated with passing trucks. Ground vibration level predicted from truck passbys could range up to 0.05mm/sec at a distance of twenty (20) metres and satisfy the structural damage assessment goals *(Table 24*), and considered acceptable from a human disturbance point of view.

9.5 Management of Noise and Vibration Impacts

As part of the project management it is recommended that a "Noise Management Plan" (*NMP)* be prepared to address and manage construction noise and vibration, and methods to manage impacts. The *NMP* would be prepared in consultation with the approving authority and construction contractors. As part of the *NMP*, the following should be addressed:

- selection of plant and equipment where practical on acoustic performance;
- noise certification of site plant and equipment prior to commencing site work

and regular monitoring to ensure equipment noise emission levels do not deteriorate due to poor maintenance or damage;

- work practices to minimise potential noise and vibration impacts;
- a monitoring program to ensure that construction noise and vibration emissions are controlled and that the best possible practices are implemented;
- noise and vibration monitoring shall be conducted in response to community complaints and at the request of the *DECCW*. Reports of investigations shall be provided to the *DECCW* upon request;
- development and implementation of a public relations program to inform residents and the community of the progress of activities and potential noise and vibration impacts of each phase of the project; and
- the establishment of procedures to address noise and vibration complaints received from the public during the construction period
- The Proponent shall implement all practicable measures to undertake the development in a way that minimises the noise generated.

10.0 FINDINGS

Atkins Acoustics was commissioned by *Walsh Consulting* on behalf of *BP Solar* to conduct an operational and construction noise and vibration impact assessment for a solar power farm proposal at Moree.

The proposal would be designed to provide a one hundred and fifty (150) Megawatt (MW) photovoltaic (PV) electricity generation facility. The facility would use crystalline silicon technology optimised on trackers to maximise solar energy capture capacity. Power generated by the proposal would be fed into the national electricity grid at the *TransGrid* owned Moree 132kV substation. The proposal includes for the construction of electricity transmission lines from the site to this substation and other ancillary works.

The site is some 1200ha in area and approximately 8km south of Moree Airport on the eastern side of the Northern Tablelands Explorer rail line and the Newell Highway.

It is intended that the electricity transmission line, which is required to connect to the national power grid, would run within travelling stock routes and public roads from the site to the Moree substation.

As part of the study operational and construction noise has been assessed in accordance with the guidelines recommended in the Department of Environment and Climate Change *(DECCW),* Industrial Noise Policy *(INP),* the *DECCW* Interim Construction Noise Guideline *(ICNG),* and the *DECCW* guideline titled, Assessing Vibration: a technical guideline.

It is not envisaged that there would be operational noise emitted from the site between sunset and sunrise. During daylight hours sources of potential operational noise include the tracking mechanisms, inverters, kiosk transformers and the high voltage substation.

Resulting from the short construction period, the physical area of the power

transmission line corridor and the temporary transient nature of the works a *'Qualitative'* assessment was undertaken for the construction of the transmission line.

It is not envisaged that operational $L_{A1,\ 1\ mim}$ noise levels greater than 5dBA above the operational L_{Aeq} levels or greater than the *DECCW* nighttime sleep disturbance assessment goals.

No operational vibration sources have been identified that are likely to generate ground vibration at exposed receptors.

Traffic investigations have shown that additional passby vehicle trips would be generated on Halls Creek Burrington Road and Barton Plains Road during the construction phase and operational phase. Overall the traffic volumes generated during construction are considered to be minimal and predicted traffic noise levels satisfy the $L_{Aeq,\ 1\ hour}$ project target noise goals of 60dBA for Halls Creek Burrington Road and 55dBA on Barton Plains Road.

Predicted construction noise levels for typical site activities at reference assessment locations are presented in *Table 20*. The modelling assumed the plant schedules referenced in *Table 17* with no account of additional attenuation from topography or ground absorption. Noise predictions summarised in *Table 20* show that construction noise at the Barton Plains Road residential property exceeds the daytime target assessment goal (40dBA) during Stage 1 and Stage 2 site works. At the dwellings further to the east of the *SFP* the predicted construction noise levels exceed the daytime target assessment goal (40dBA) during the Stage 1 site works. At the assessment residential dwellings on the western side of the Newell Highway the predicted construction noise levels satisfy the target noise assessment noise goal of 47dBA.

To assist with the control of construction noise where practical and feasible, plant selections, temporary controls and work practices would be considered to minimise noise impacts. To further assist with the management of construction noise impacts, it is recommended that consultation be undertaken with affected landowners.

When assessing noise from construction activities it is recognised that the procedures and recommendations published by the *DECCW* are regarded as planning tools. The recommendations are not mandatory, and their application for assessing construction noise is not determined purely on the basis of compliance or otherwise with numerical noise levels.

The assessment has shown that ground vibration from construction activities would satisfy the recommended project goals and expected to be acceptable from both human disturbance and structural damage points of view.

To manage environmental noise impacts during construction, it is recommended that a Noise Management Plan *(NMP)* be prepared. As part of the *NMP*, it is recommended that a public relations program be developed and implemented to inform residents and the community of the progress of the activities, and potential noise and vibration impacts during each phase of the construction.

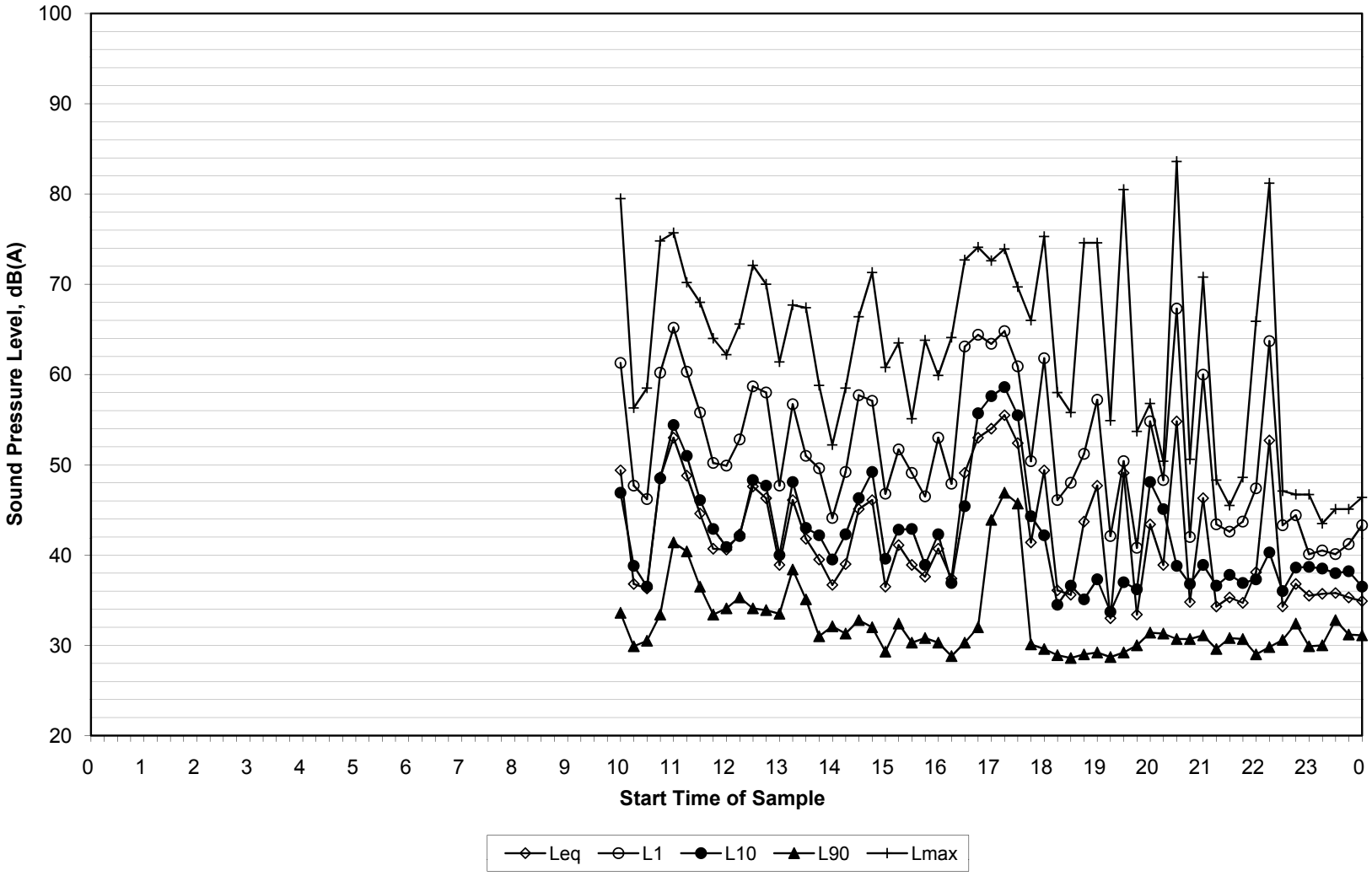
ATTACHMENT 1: REFERENCE MONITORING-ASSESSMENT LOCATIONS

(Mapping Source Google Earth)

ATTACHMENT 2: AMBIENT SOUND PRESSURE LEVEL MEASUREMENTS

Ambient Sound Pressure Levels

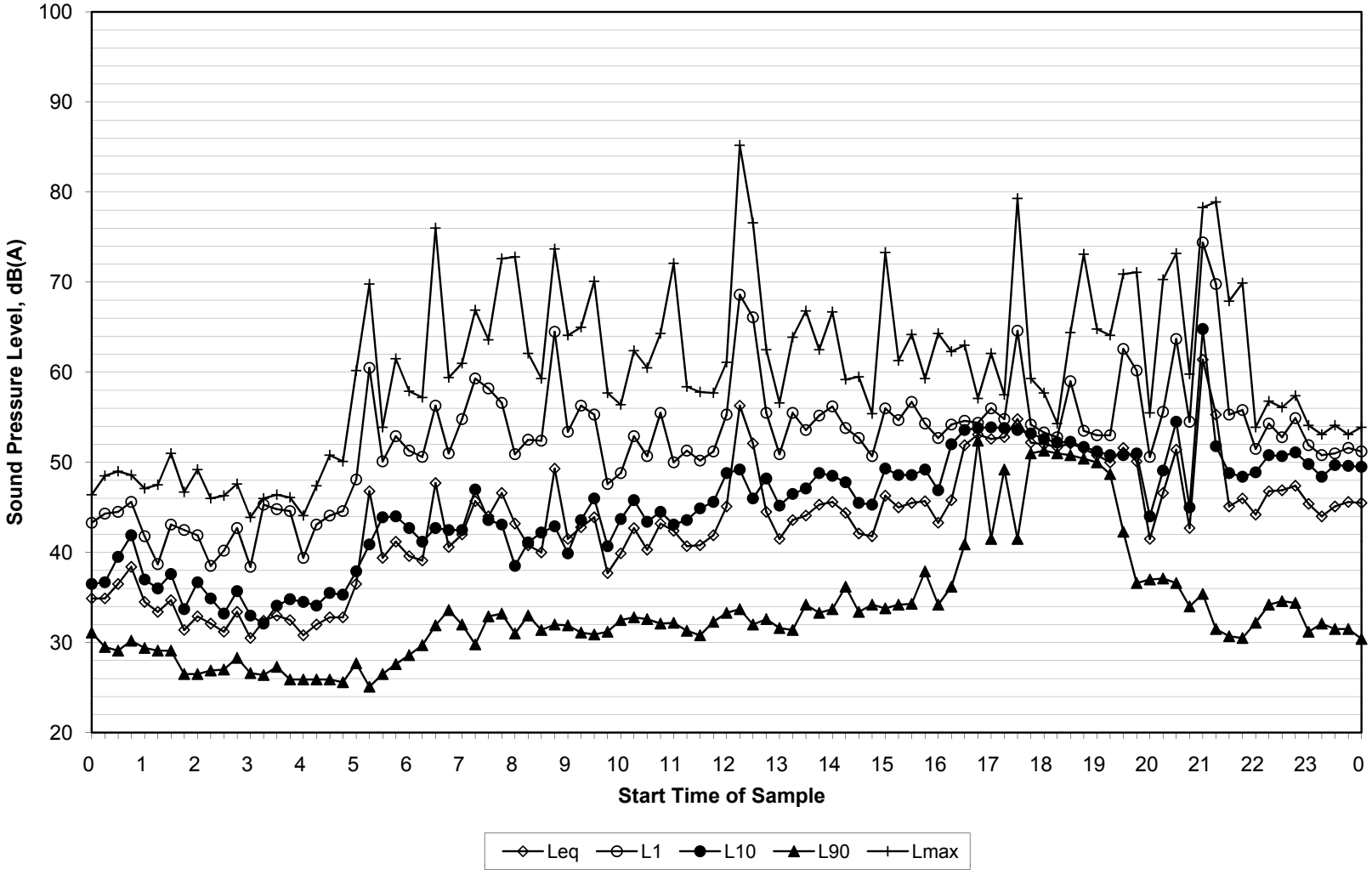
Monday, 1 November 2010



Measurement Location R1
Barton Plains Road

Ambient Sound Pressure Levels

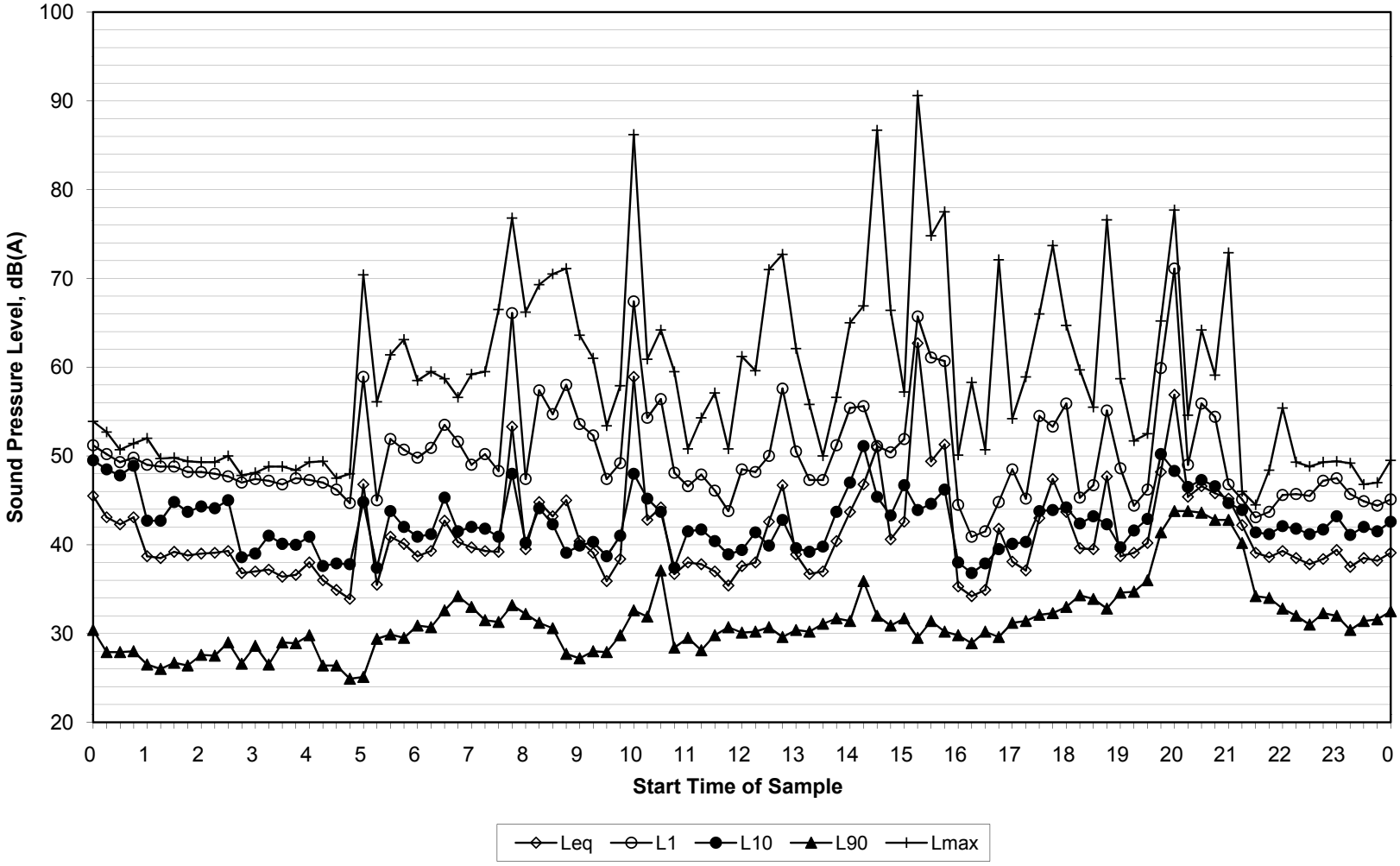
Tuesday, 2 November 2010



Measurement Location R1
Barton Plains Road

Ambient Sound Pressure Levels

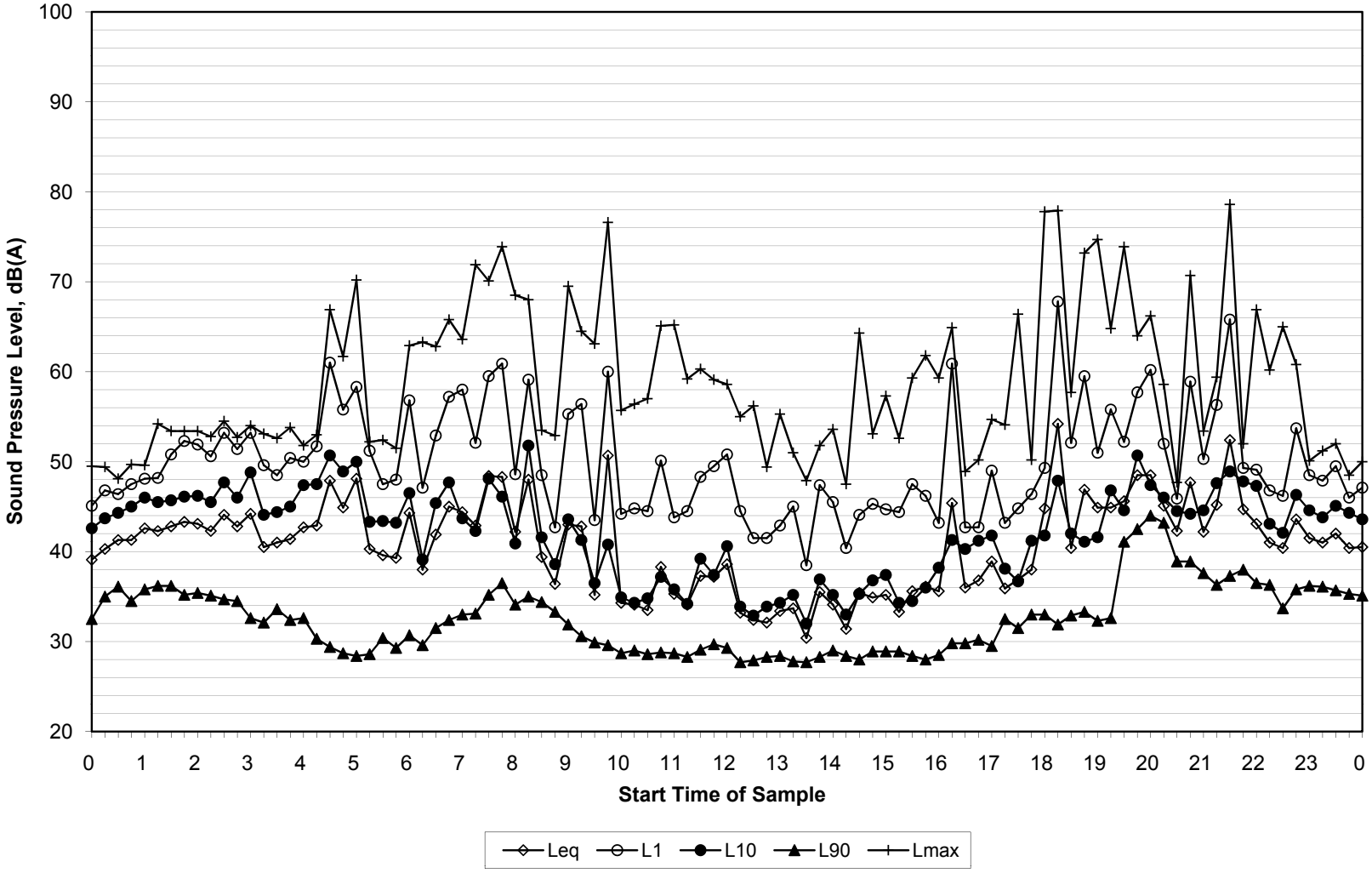
Wednesday, 3 November 2010



Measurement Location R1
Barton Plains Road

Ambient Sound Pressure Levels

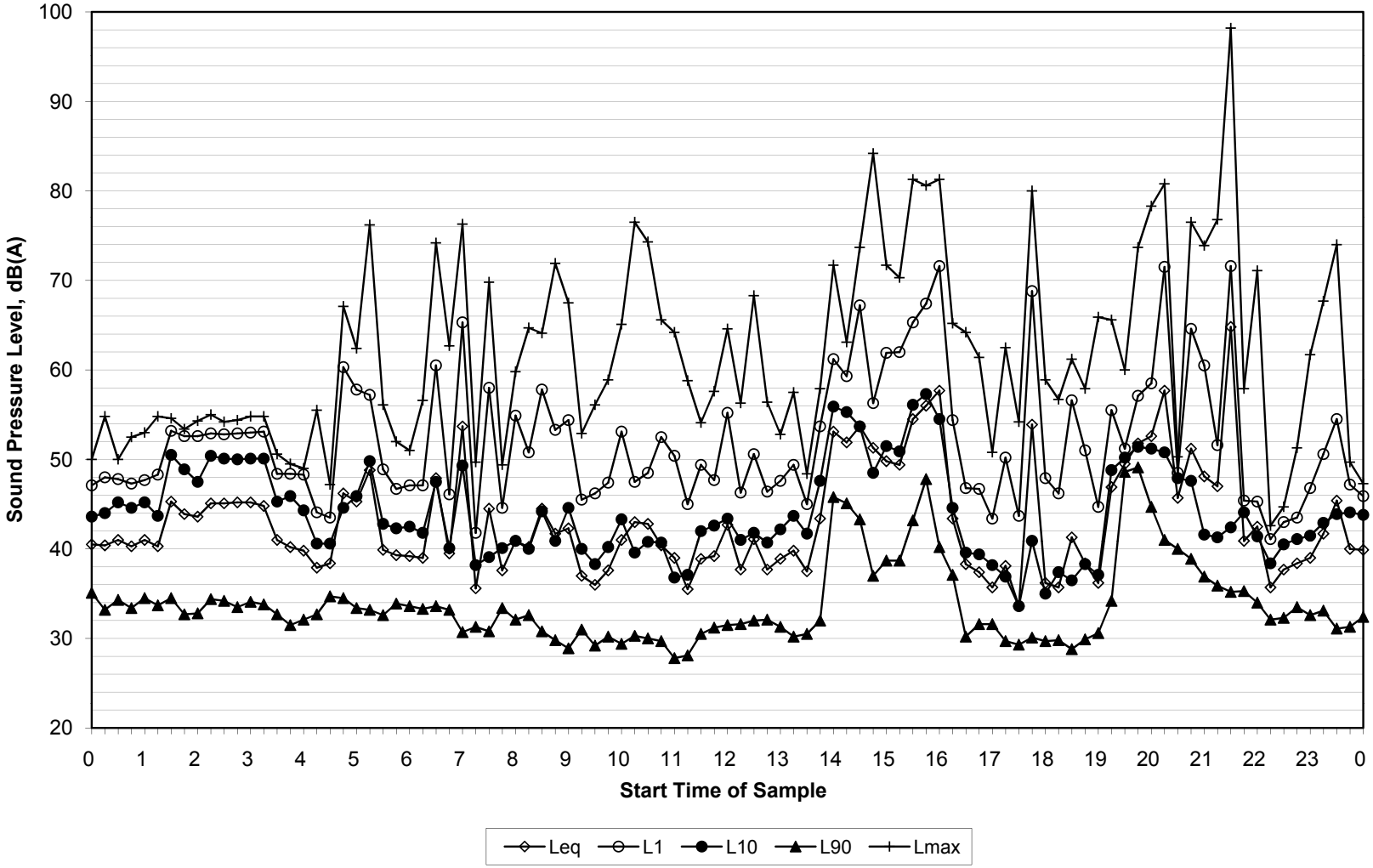
Thursday, 4 November 2010



Measurement Location R1
Barton Plains Road

Ambient Sound Pressure Levels

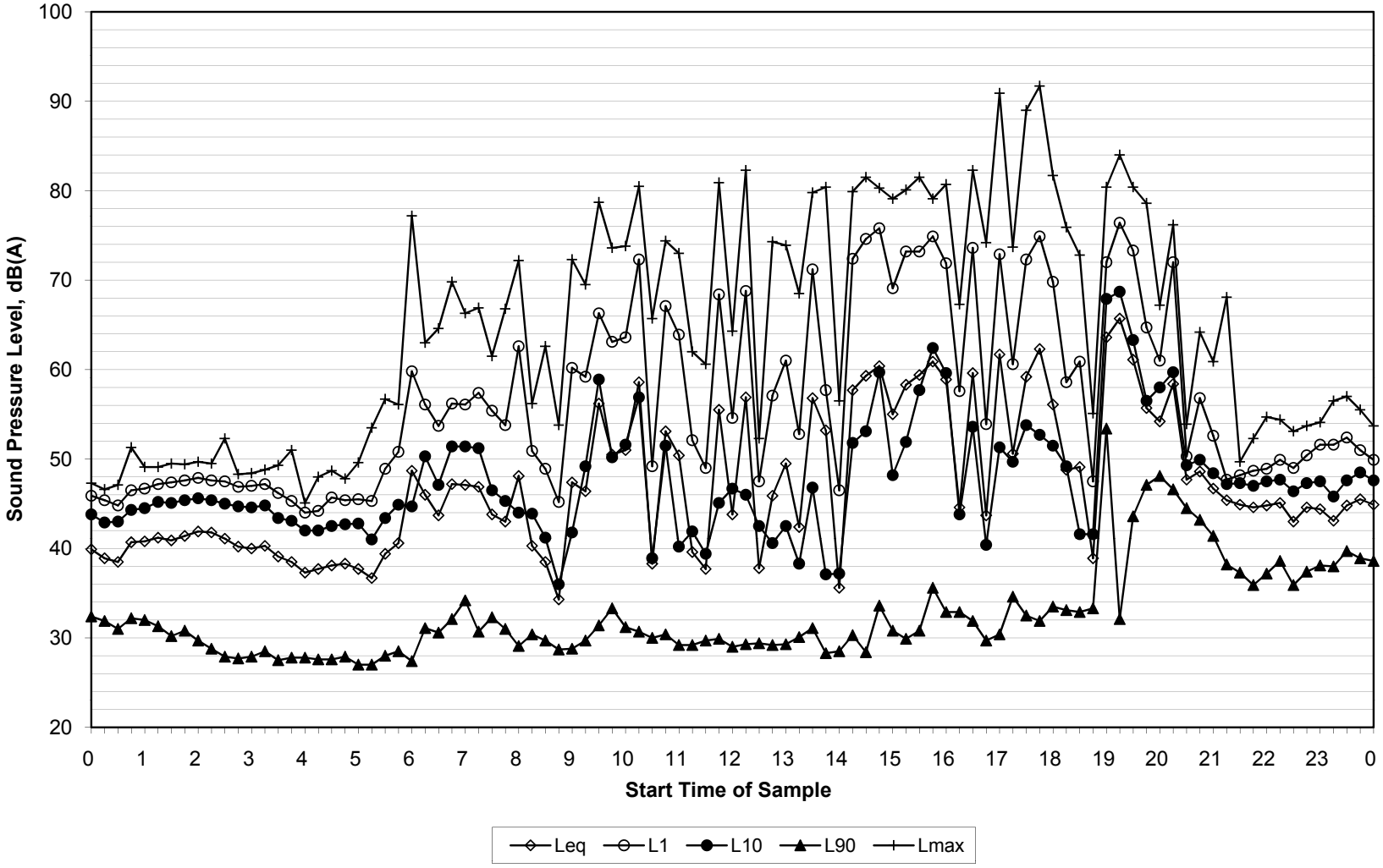
Friday, 5 November 2010



Measurement Location R1
Barton Plains Road

Ambient Sound Pressure Levels

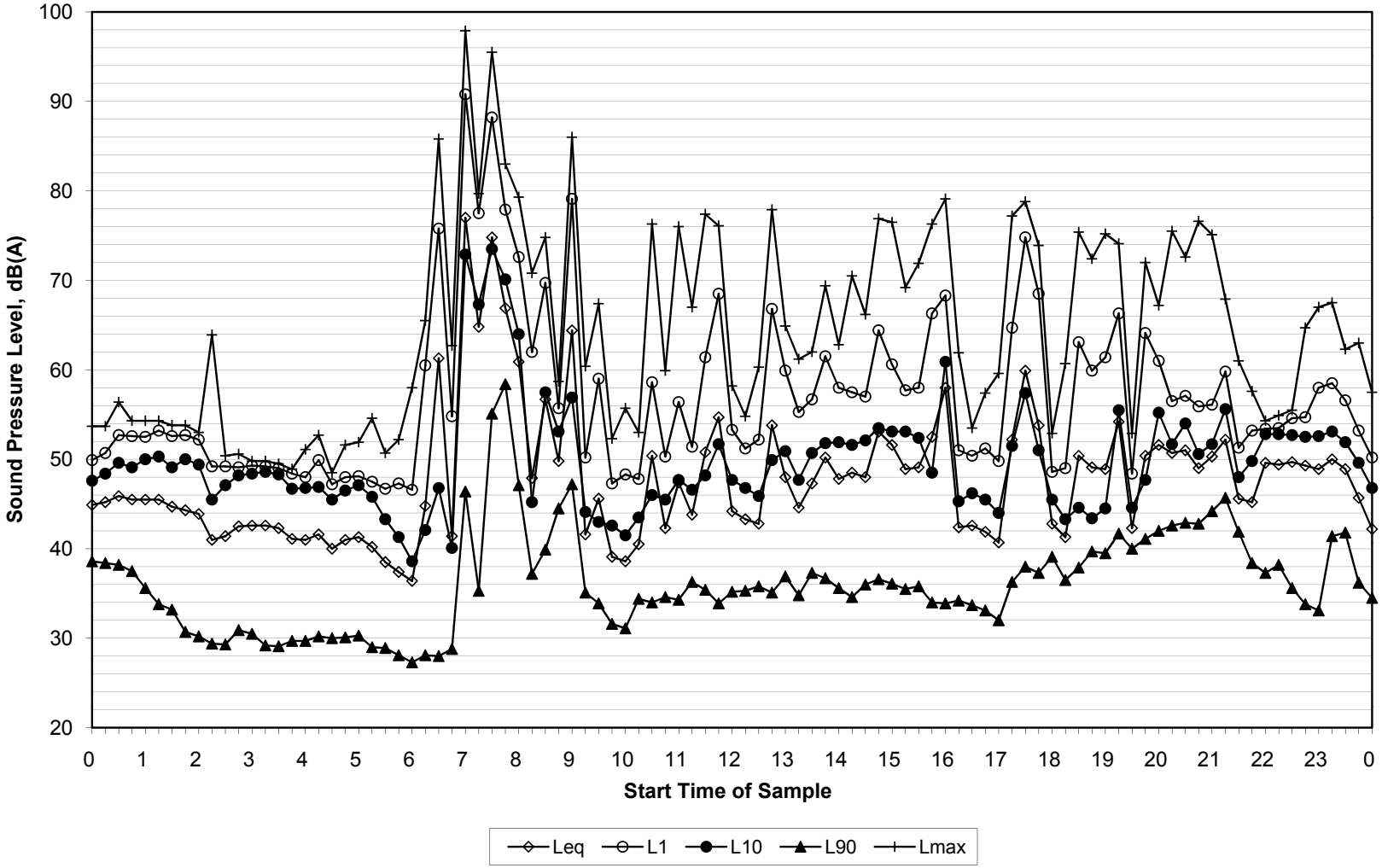
Saturday, 6 November 2010



Measurement Location R1
Barton Plains Road

Ambient Sound Pressure Levels

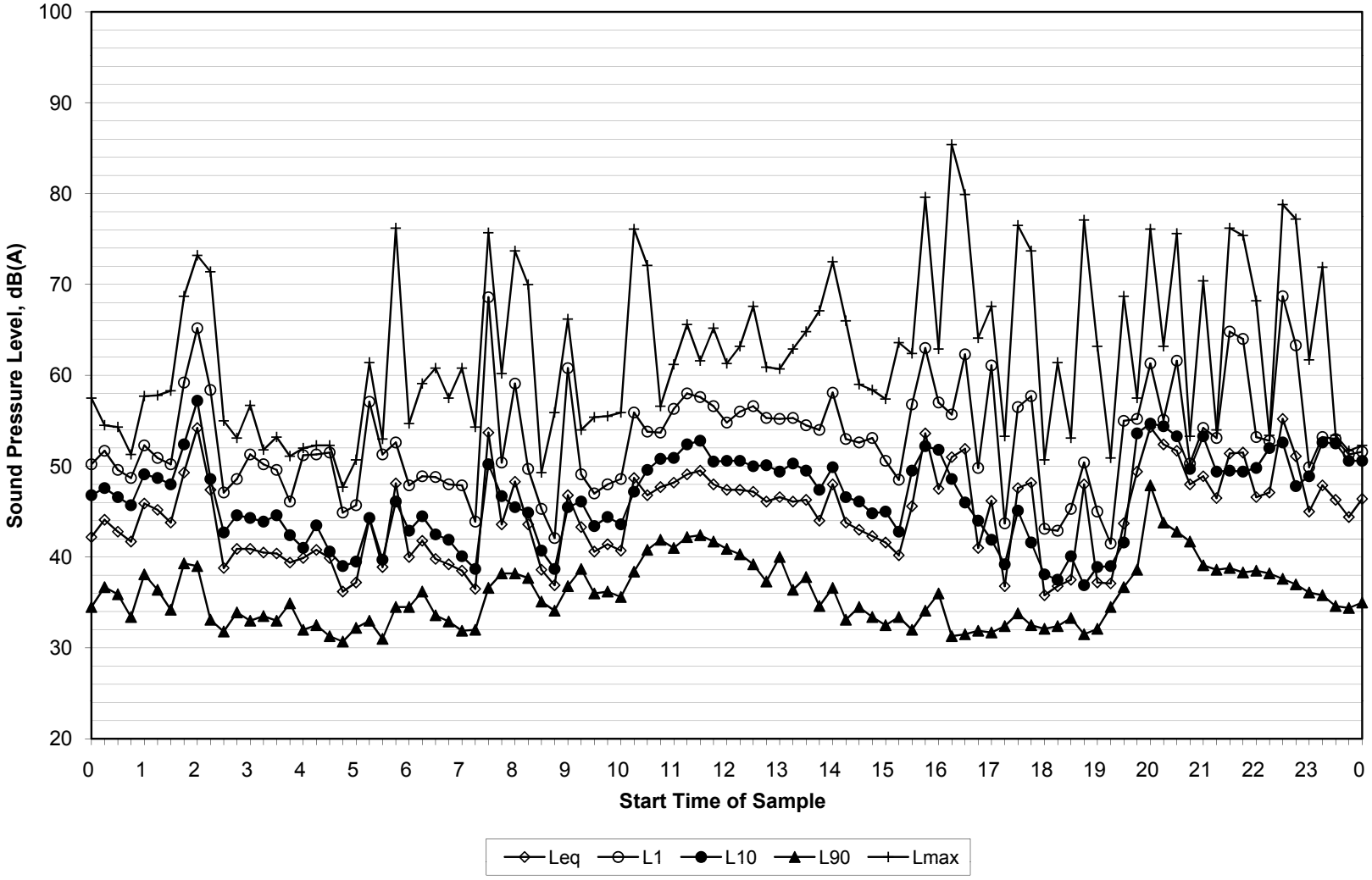
Sunday, 7 November 2010



Measurement Location R1
Barton Plains Road

Ambient Sound Pressure Levels

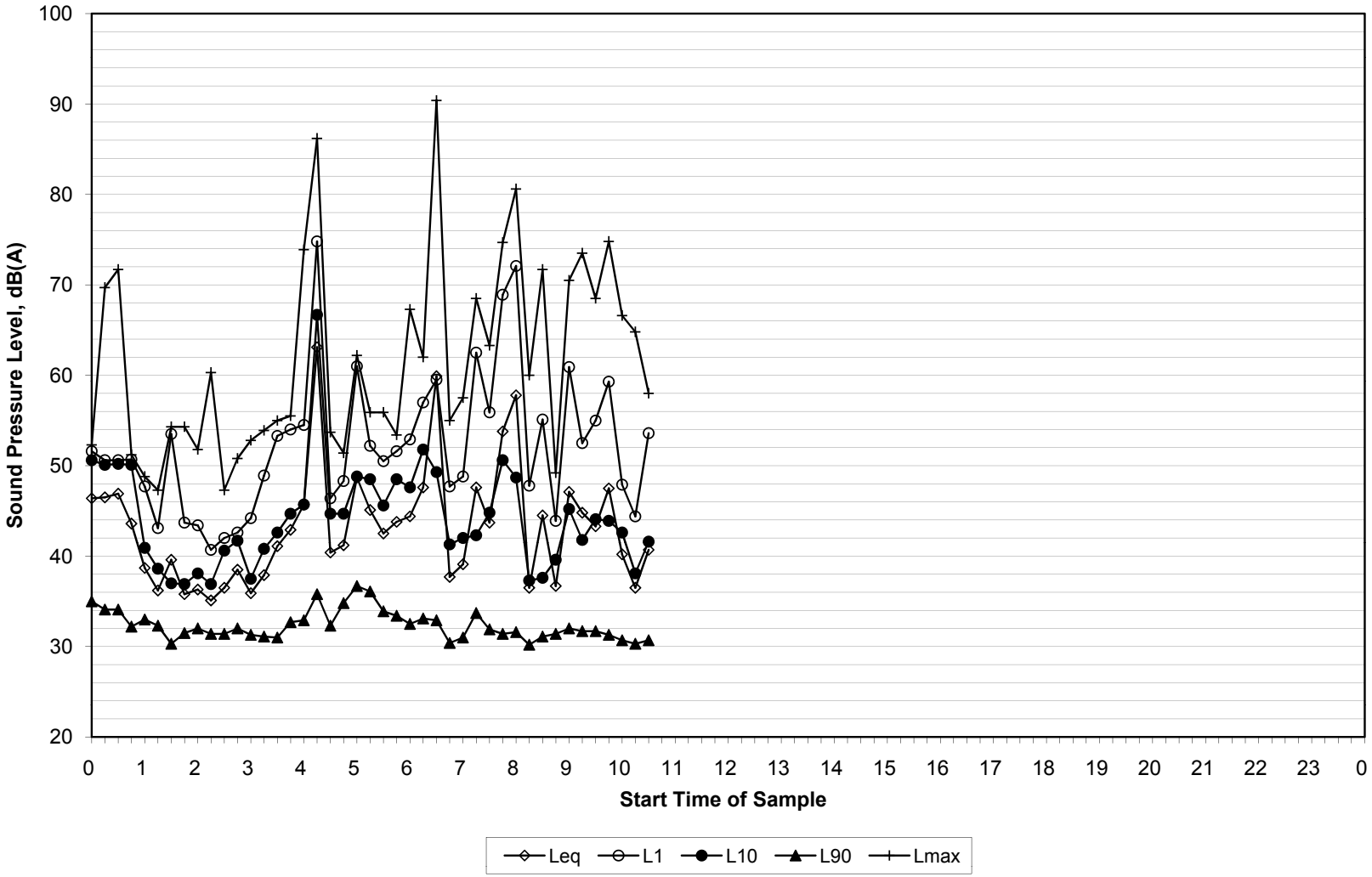
Monday, 8 November 2010



Measurement Location R1
Barton Plains Road

Ambient Sound Pressure Levels

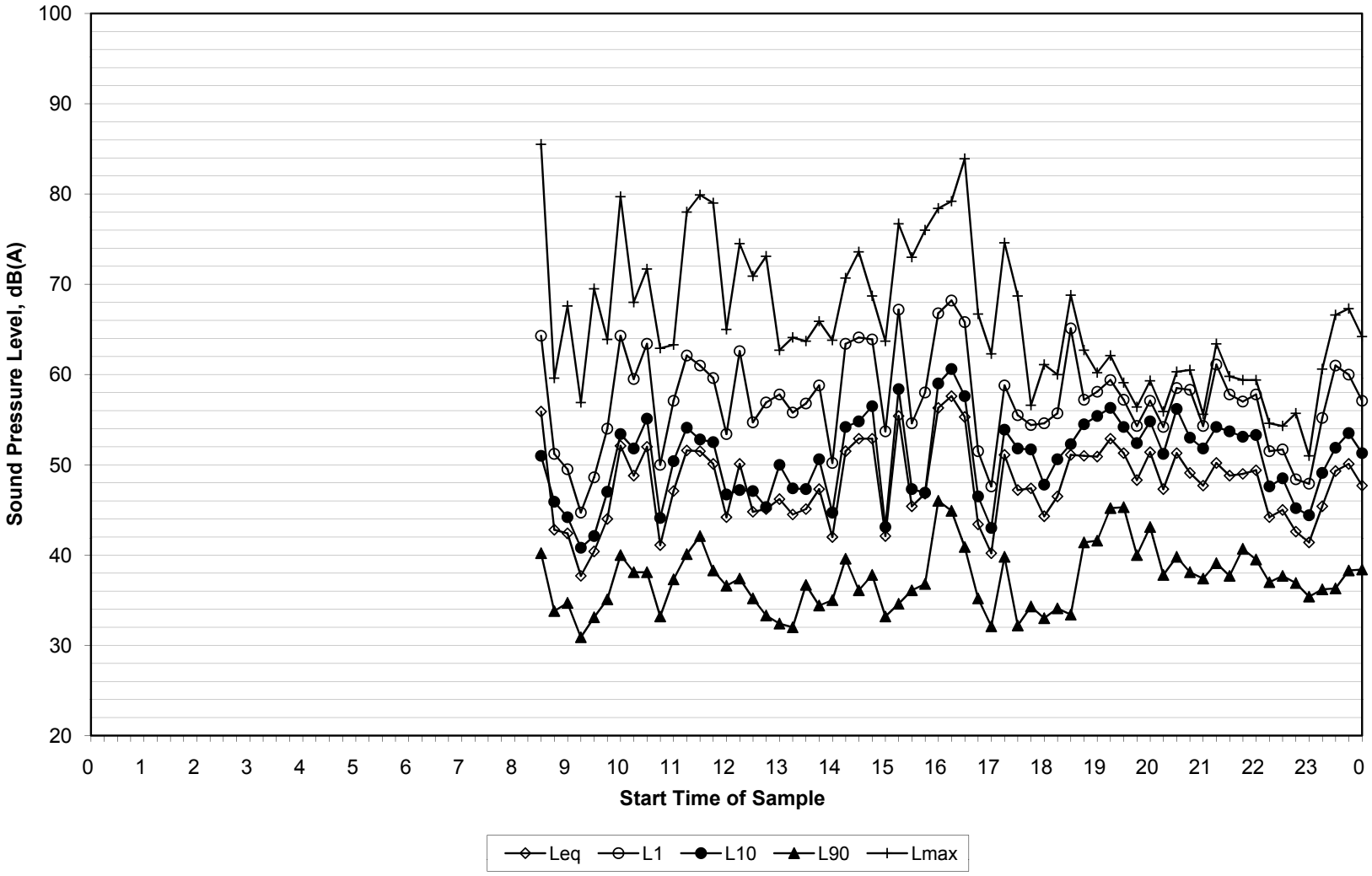
Tuesday, 9 November 2010



Measurement Location R1
Barton Plains Road

Ambient Sound Pressure Levels

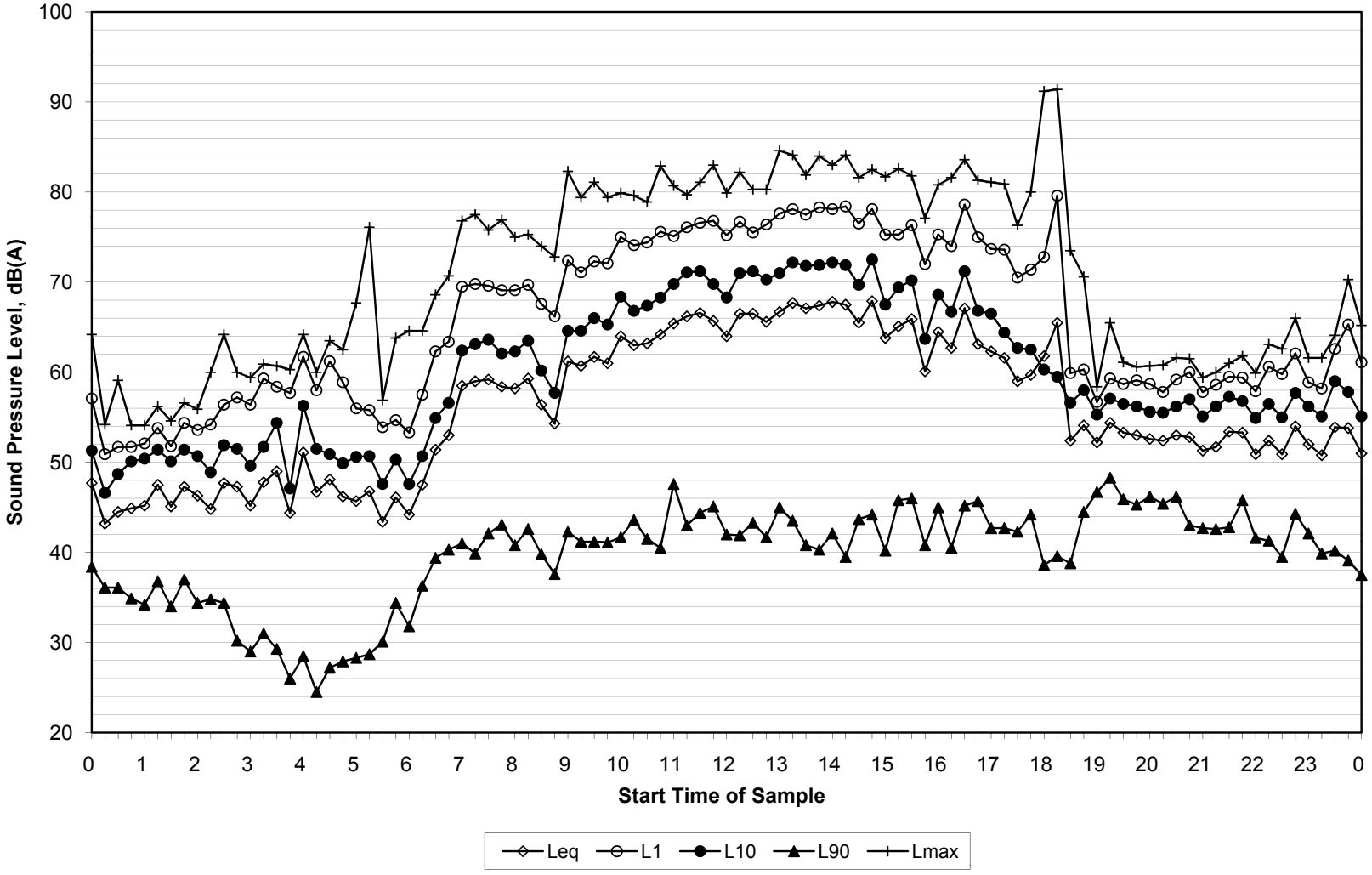
Monday, 1 November 2010



Measurement Location R5
Wallanoi Road

Ambient Sound Pressure Levels

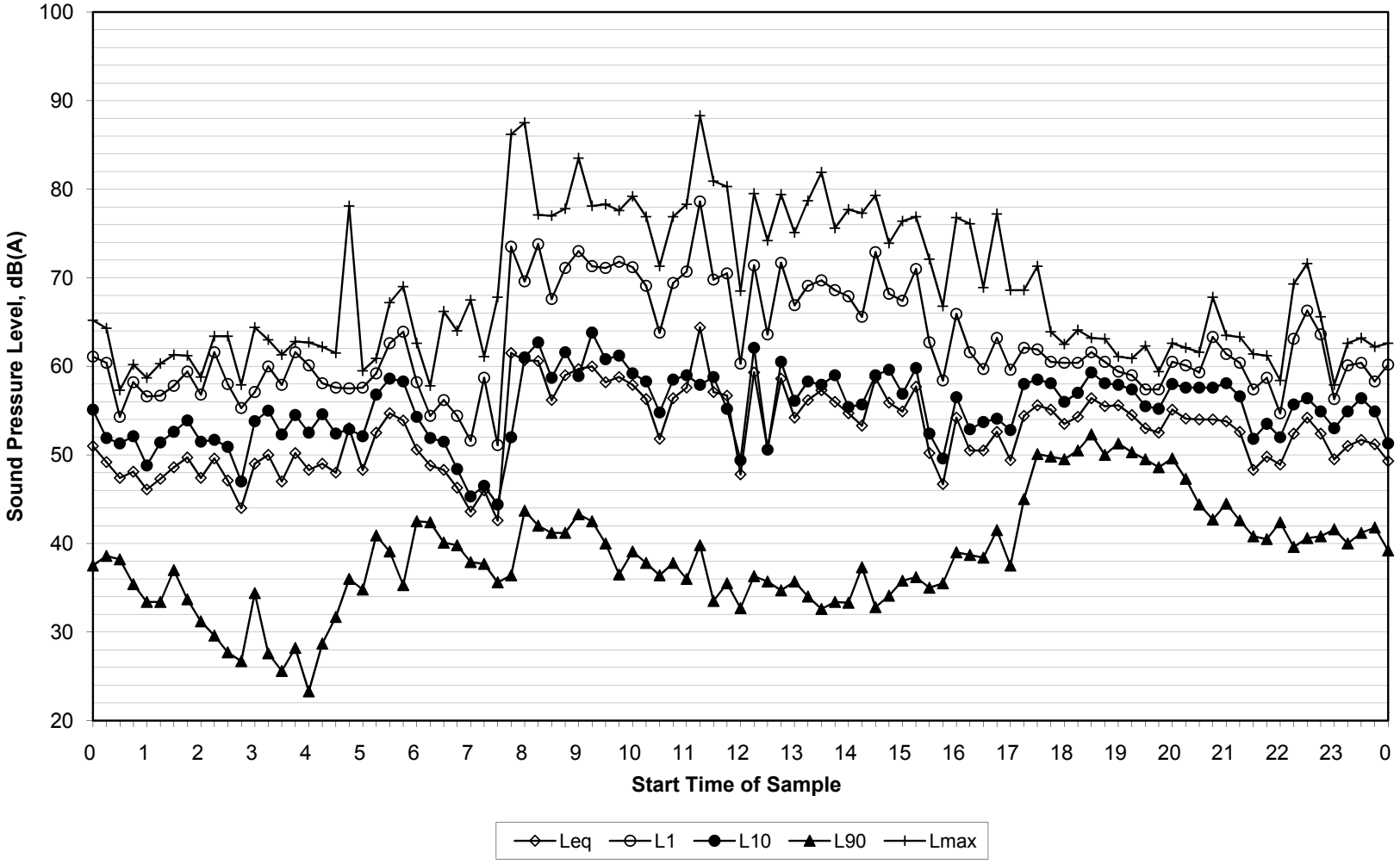
Tuesday, 2 November 2010



Measurement Location R5
Wallanoi Road

Ambient Sound Pressure Levels

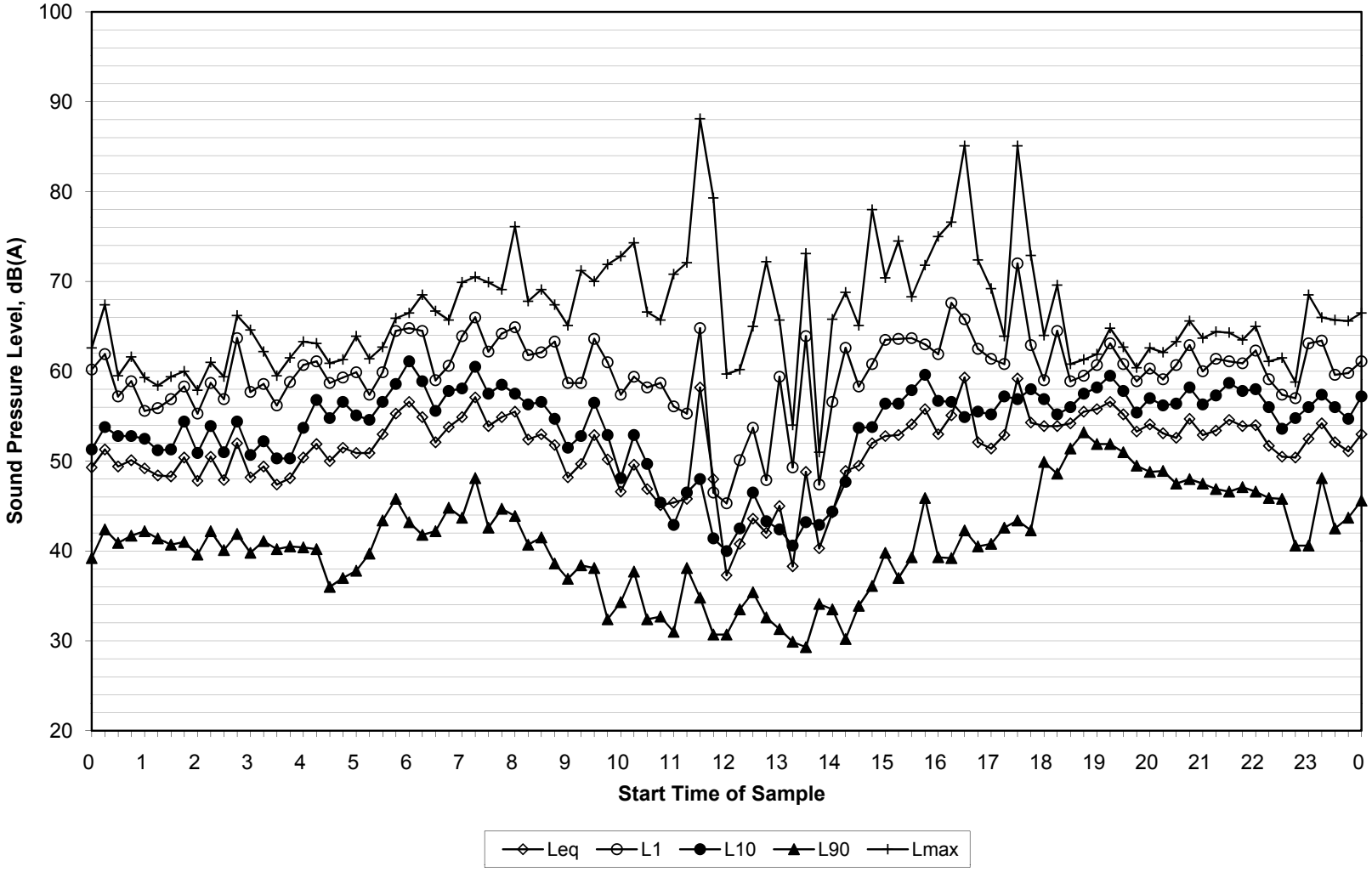
Wednesday, 3 November 2010



Measurement Location R5
Wallanoi Road

Ambient Sound Pressure Levels

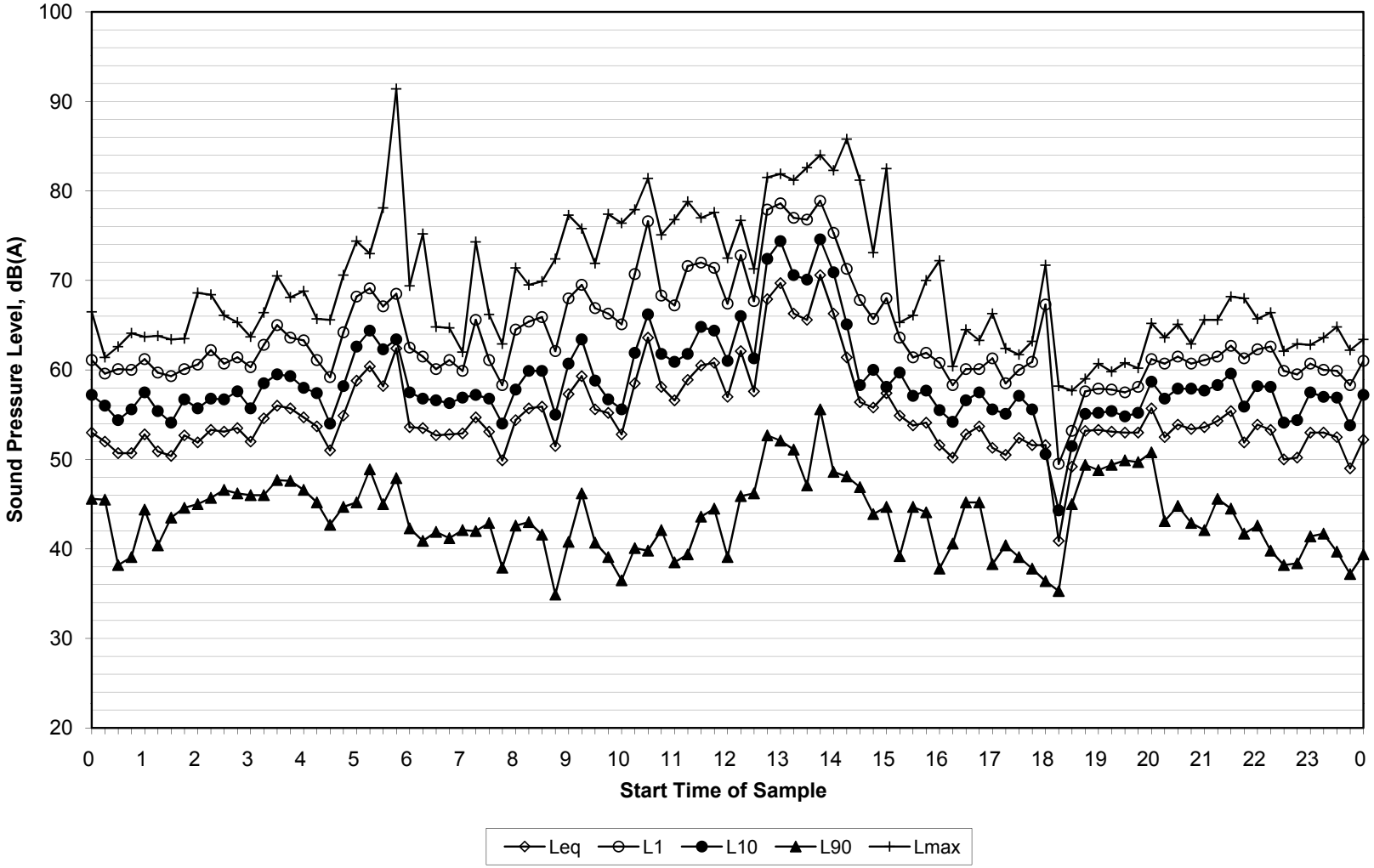
Thursday, 4 November 2010



Measurement Location R5
Wallanoi Road

Ambient Sound Pressure Levels

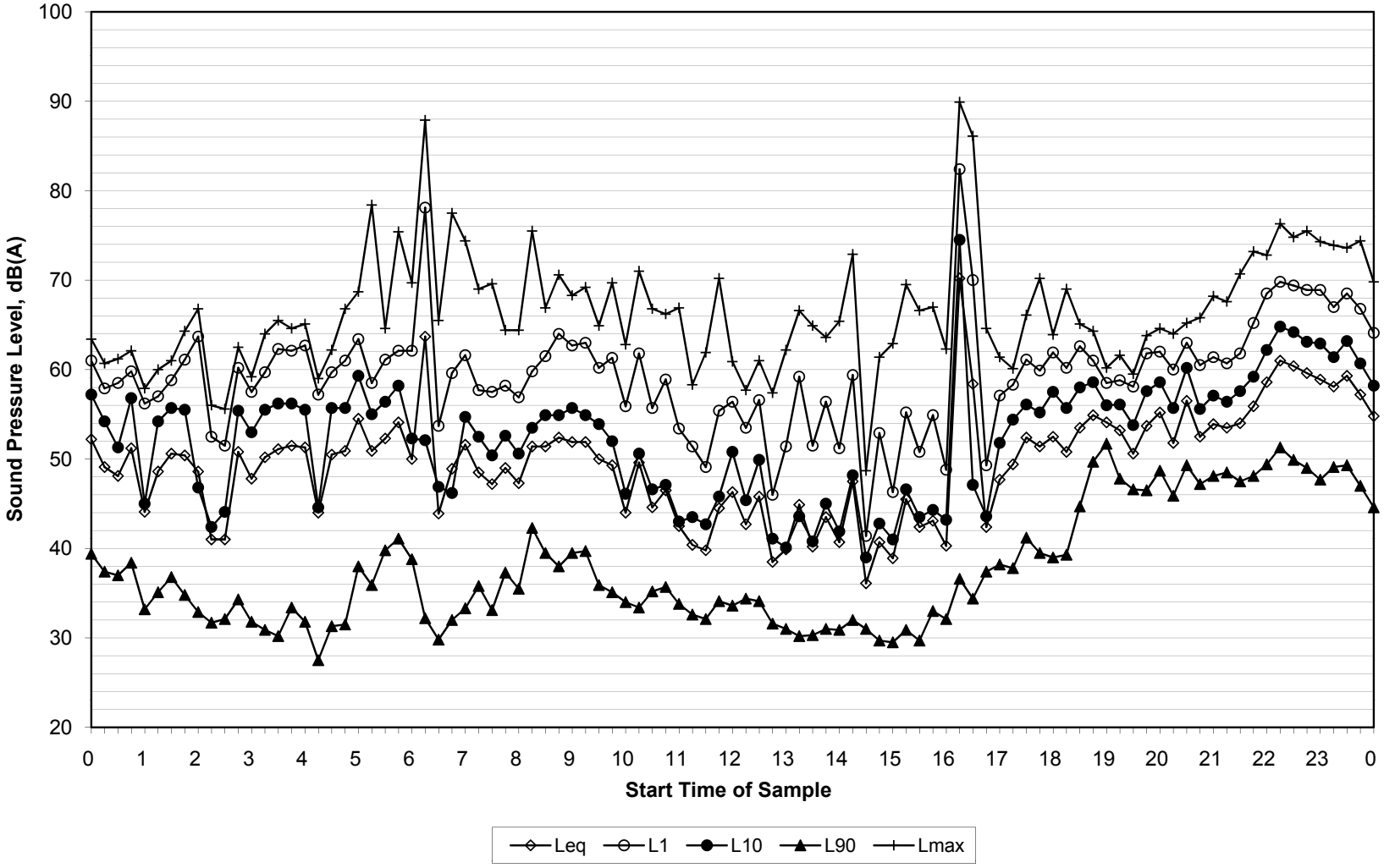
Friday, 5 November 2010



Measurement Location R5
Wallanoi Road

Ambient Sound Pressure Levels

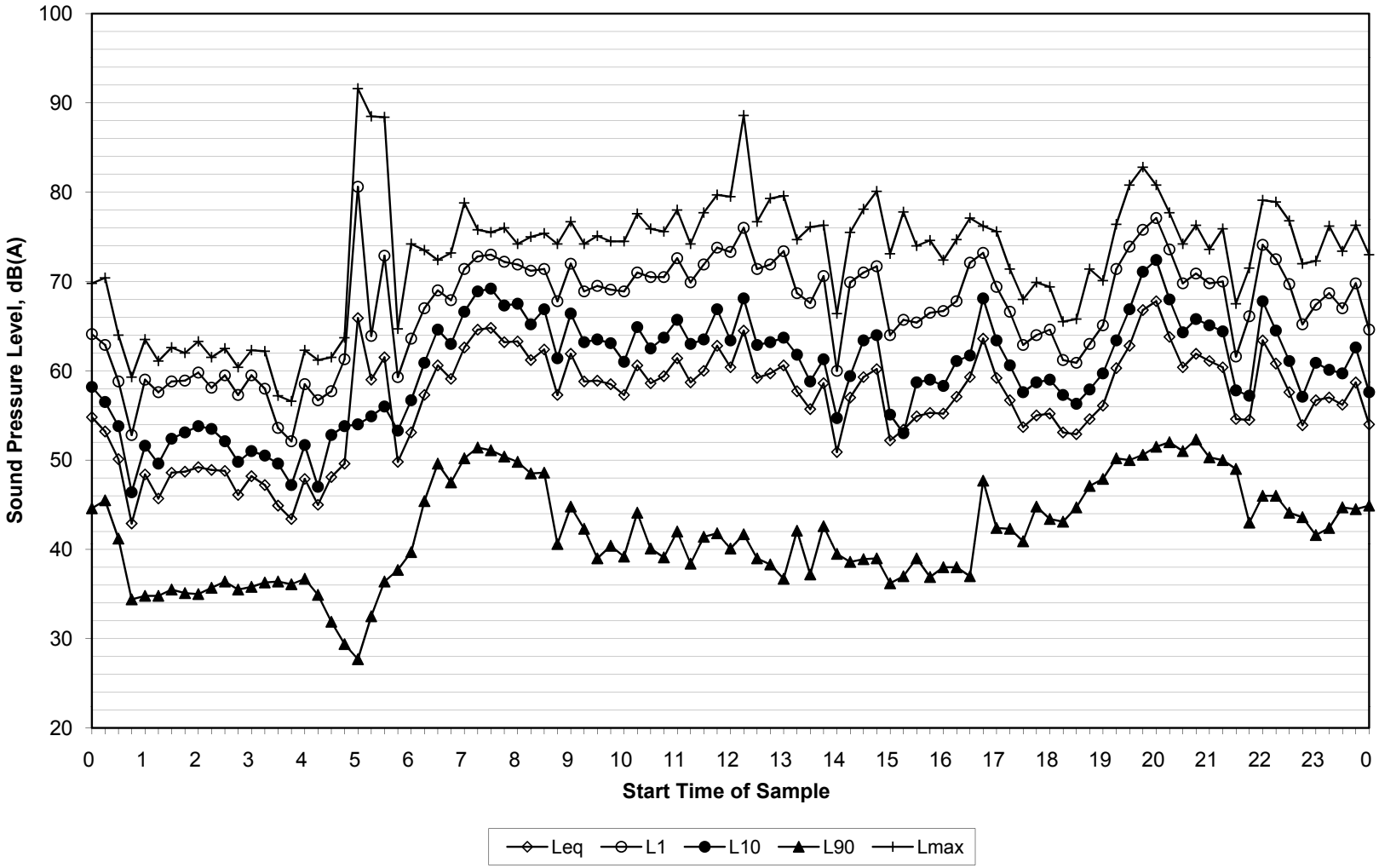
Saturday, 6 November 2010



Measurement Location R5
Wallanoi Road

Ambient Sound Pressure Levels

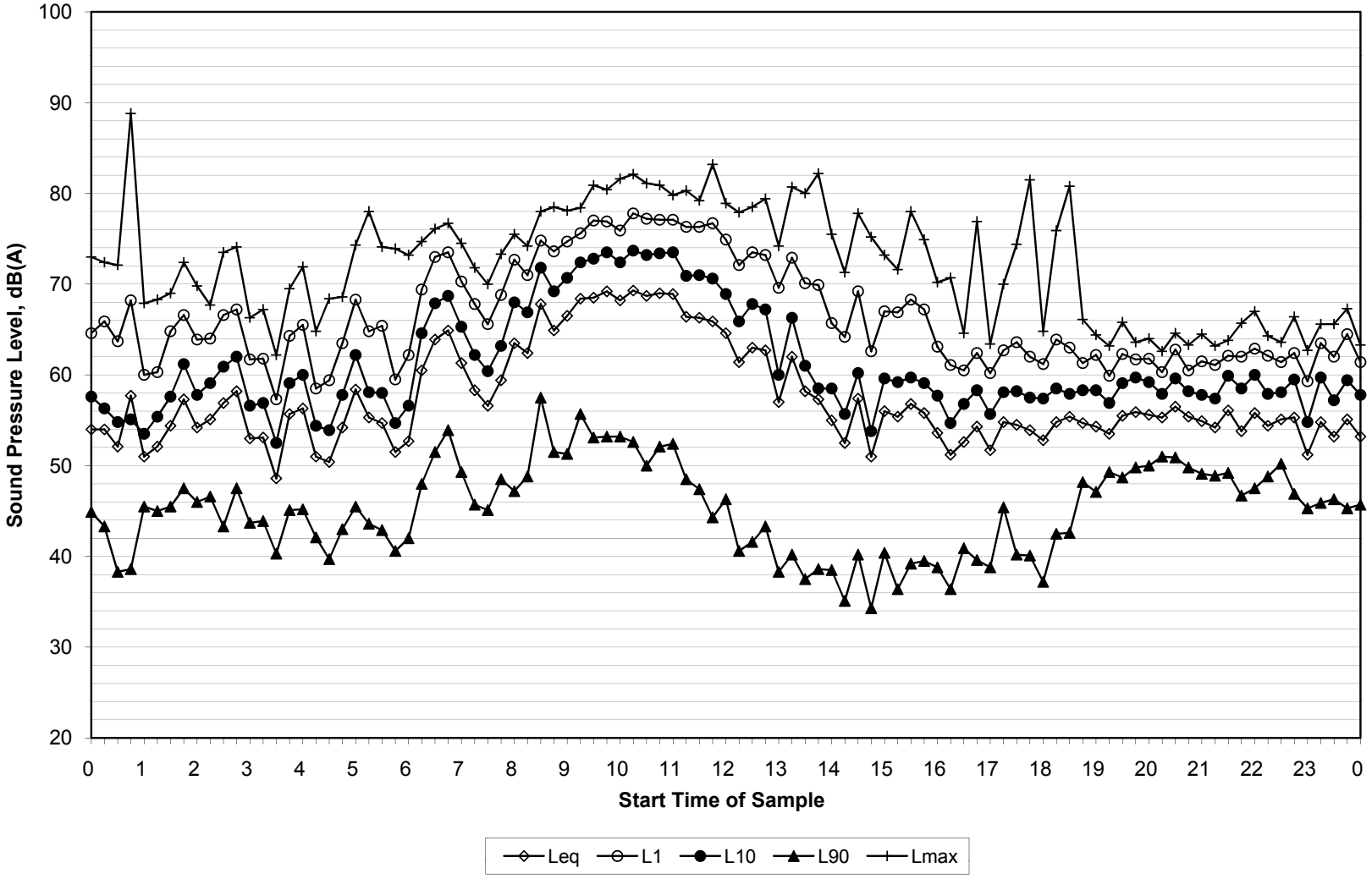
Sunday, 7 November 2010



Measurement Location R5
Wallanoi Road

Ambient Sound Pressure Levels

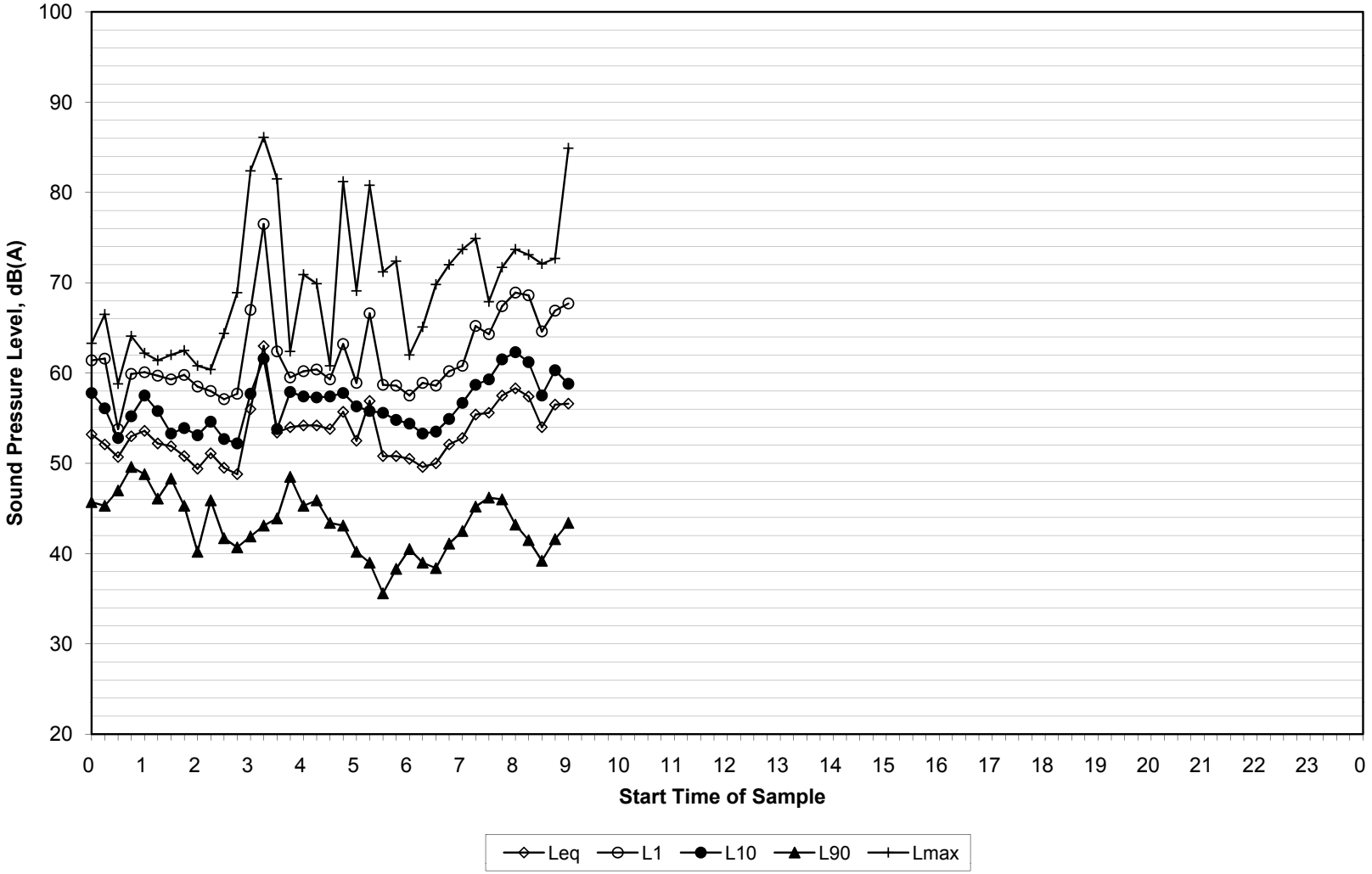
Monday, 8 November 2010



Measurement Location R5
Wallanoi Road

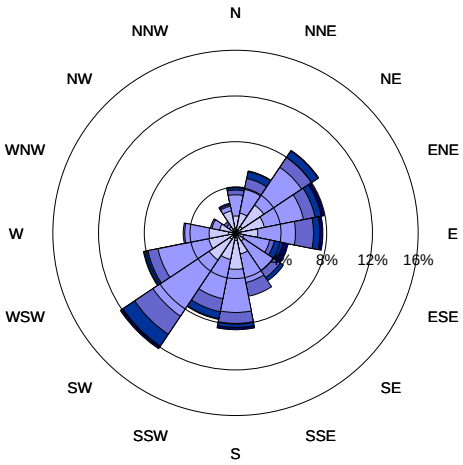
Ambient Sound Pressure Levels

Tuesday, 9 November 2010



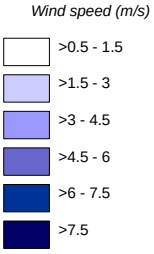
Measurement Location R5
Wallanoi Road

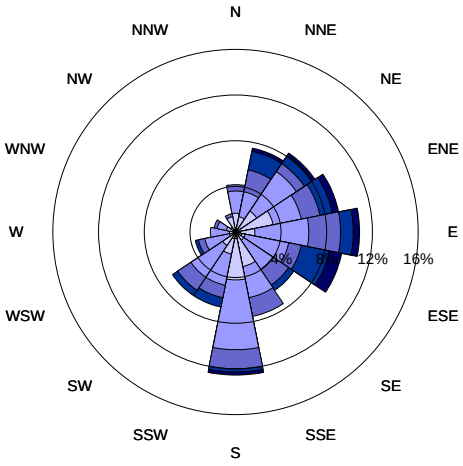
ATTACHMENT 3: SEASONAL WIND ROSES



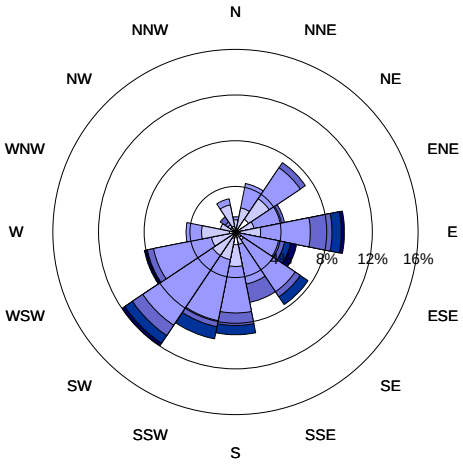
Annual
Calms = 3.5%

Annual and seasonal windroses for Moree - 2008 Evening (6pm to 10pm)

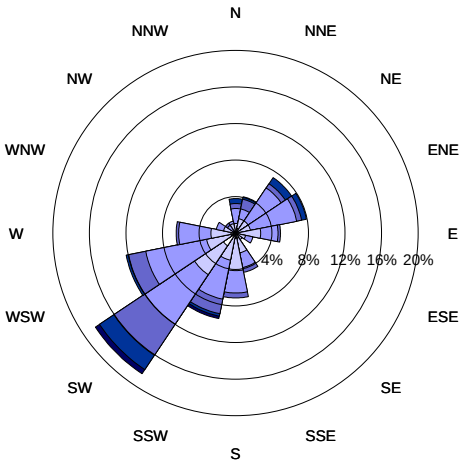




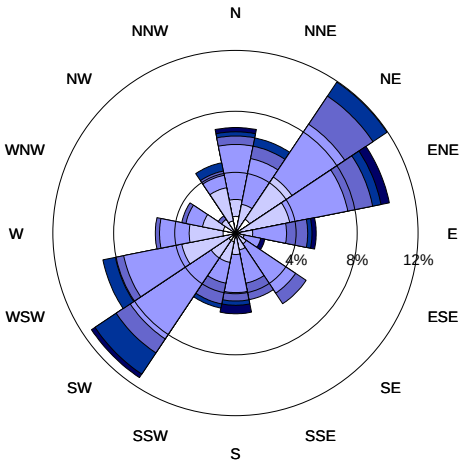
Summer
Calms = 1.1%



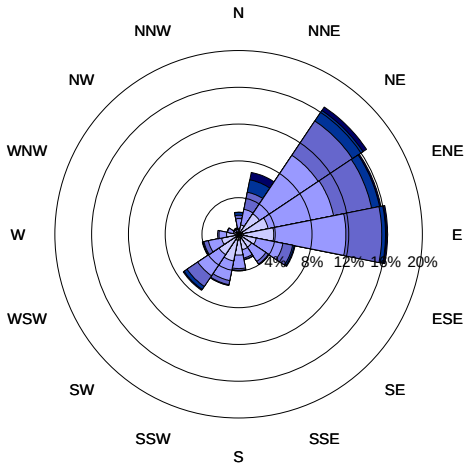
Autumn
Calms = 4.9%



Winter
Calms = 6.3%

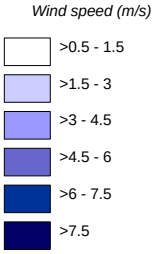


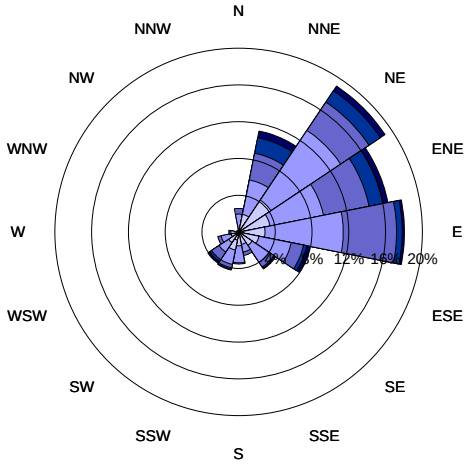
Spring
Calms = 1.7%



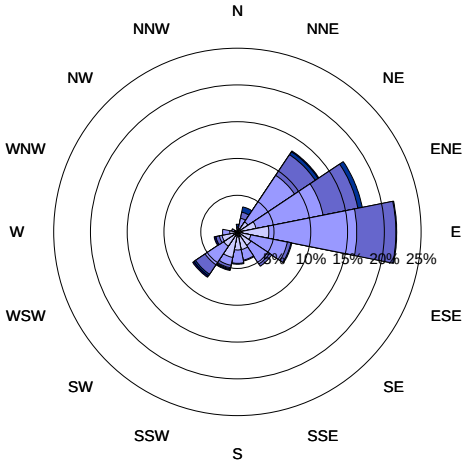
Annual
Calms = 3.0%

Annual and seasonal windroses for Moree - 2008 Night time (10pm to 7am)

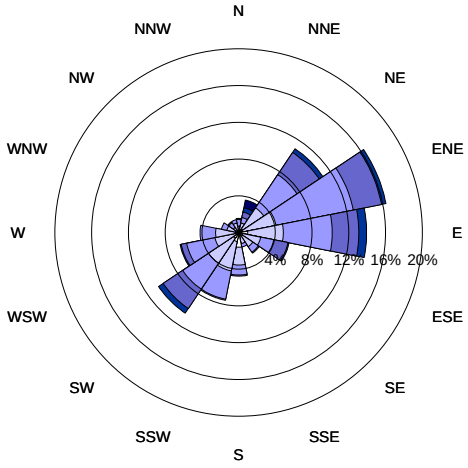




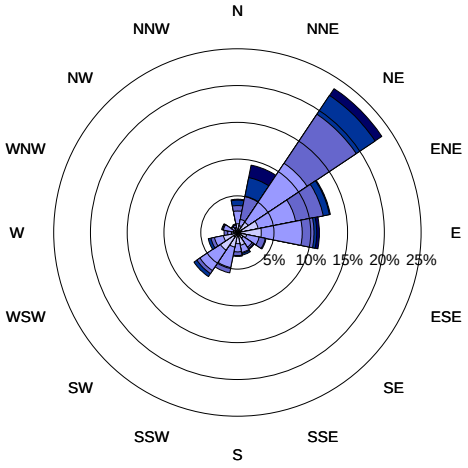
Summer
Calms = 1.5%



Autumn
Calms = 2.7%



Winter
Calms = 5.6%



Spring
Calms = 2.3%

ATTACHMENT 4: STABILITY CLASS DATA (NIGHTTIME)

STATISTICS FOR FILE: Z:\Ajobs 5300-5399\5389 Atkins Acoustics Met\Metdata\moree_08.aus
MONTHS: All
HOURS : All
OPTION: Frequency

PASQUILL STABILITY CLASS 'A'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.000229	0.004235	0.002632	0.000114	0.000000	0.000000	0.000000	0.000000	0.007211
NE	0.000572	0.003090	0.003434	0.000114	0.000000	0.000000	0.000000	0.000000	0.007211
ENE	0.000229	0.002976	0.002976	0.000229	0.000000	0.000000	0.000000	0.000000	0.006410
E	0.000114	0.002861	0.003777	0.000687	0.000000	0.000000	0.000000	0.000000	0.007440
ESE	0.000458	0.002518	0.003090	0.000000	0.000000	0.000000	0.000000	0.000000	0.006066
SE	0.000114	0.004235	0.002404	0.000343	0.000000	0.000000	0.000000	0.000000	0.007096
SSE	0.000114	0.002747	0.003663	0.000343	0.000000	0.000000	0.000000	0.000000	0.006867
S	0.000229	0.003090	0.003777	0.000572	0.000000	0.000000	0.000000	0.000000	0.007669
SSW	0.000114	0.001488	0.002976	0.000572	0.000000	0.000000	0.000000	0.000000	0.005151
SW	0.000000	0.002747	0.002060	0.000801	0.000000	0.000000	0.000000	0.000000	0.005608
WSW	0.000114	0.002404	0.002289	0.000343	0.000000	0.000000	0.000000	0.000000	0.005151
W	0.000114	0.003319	0.002060	0.000458	0.000000	0.000000	0.000000	0.000000	0.005952
WNW	0.000343	0.002632	0.001030	0.000572	0.000000	0.000000	0.000000	0.000000	0.004578
NW	0.000000	0.002976	0.001831	0.000114	0.000000	0.000000	0.000000	0.000000	0.004922
NNW	0.000000	0.001831	0.002861	0.000000	0.000000	0.000000	0.000000	0.000000	0.004693
N	0.000343	0.005379	0.004464	0.000229	0.000000	0.000000	0.000000	0.000000	0.010415
CALM									0.000687
TOTAL	0.003090	0.048529	0.045324	0.005494	0.000000	0.000000	0.000000	0.000000	0.103125

MEAN WIND SPEED (m/s) = 3.07
NUMBER OF OBSERVATIONS = 901

PASQUILL STABILITY CLASS 'B'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.000000	0.000343	0.002060	0.000801	0.000000	0.000000	0.000000	0.000000	0.003205
NE	0.000000	0.000687	0.001030	0.000572	0.000000	0.000000	0.000000	0.000000	0.002289
ENE	0.000000	0.000458	0.001946	0.000801	0.000000	0.000000	0.000000	0.000000	0.003205
E	0.000000	0.000687	0.001831	0.001145	0.000000	0.000000	0.000000	0.000000	0.003663
ESE	0.000000	0.000343	0.001602	0.000801	0.000000	0.000000	0.000000	0.000000	0.002747
SE	0.000000	0.000114	0.000343	0.000687	0.000000	0.000000	0.000000	0.000000	0.001145
SSE	0.000229	0.000000	0.000916	0.000458	0.000000	0.000000	0.000000	0.000000	0.001602
S	0.000000	0.000114	0.000687	0.000687	0.000000	0.000000	0.000000	0.000000	0.001488
SSW	0.000000	0.000114	0.000801	0.001030	0.000000	0.000000	0.000000	0.000000	0.001946
SW	0.000000	0.000229	0.001030	0.001946	0.000000	0.000000	0.000000	0.000000	0.003205
WSW	0.000114	0.000687	0.001717	0.001145	0.000000	0.000000	0.000000	0.000000	0.003663
W	0.000000	0.000114	0.001145	0.001030	0.000000	0.000000	0.000000	0.000000	0.002289
WNW	0.000000	0.000000	0.000343	0.000114	0.000000	0.000000	0.000000	0.000000	0.000458
NW	0.000000	0.000114	0.000229	0.000114	0.000000	0.000000	0.000000	0.000000	0.000458
NNW	0.000000	0.000572	0.002175	0.000916	0.000000	0.000000	0.000000	0.000000	0.003663
N	0.000000	0.000229	0.002518	0.002060	0.000000	0.000000	0.000000	0.000000	0.004807
CALM									0.000000
TOTAL	0.000343	0.004807	0.020373	0.014307	0.000000	0.000000	0.000000	0.000000	0.039831

MEAN WIND SPEED (m/s) = 4.15
NUMBER OF OBSERVATIONS = 348

PASQUILL STABILITY CLASS 'C'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.000000	0.000916	0.002518	0.004922	0.000000	0.000000	0.000000	0.000000	0.008355
NE	0.000000	0.001030	0.003090	0.001717	0.000000	0.000000	0.000000	0.000000	0.005837
ENE	0.000114	0.000801	0.002747	0.001946	0.000000	0.000000	0.000000	0.000000	0.005608
E	0.000114	0.000229	0.001831	0.003891	0.000000	0.000000	0.000000	0.000000	0.006066
ESE	0.000114	0.000687	0.001145	0.001259	0.000000	0.000000	0.000000	0.000000	0.003205
SE	0.000000	0.000114	0.000916	0.000229	0.000000	0.000000	0.000000	0.000000	0.001259
SSE	0.000000	0.000000	0.000343	0.000229	0.000000	0.000000	0.000000	0.000000	0.000572
S	0.000000	0.000458	0.001145	0.000801	0.000000	0.000000	0.000000	0.000000	0.002404
SSW	0.000000	0.000343	0.001488	0.002404	0.000000	0.000000	0.000000	0.000000	0.004235
SW	0.000000	0.001259	0.001831	0.004235	0.000000	0.000000	0.000000	0.000000	0.007325
WSW	0.000000	0.000572	0.002289	0.002861	0.000000	0.000000	0.000000	0.000000	0.005723
W	0.000000	0.000229	0.000458	0.000343	0.000000	0.000000	0.000000	0.000000	0.001030
WNW	0.000000	0.000229	0.000572	0.000343	0.000000	0.000000	0.000000	0.000000	0.001145
NW	0.000000	0.000343	0.000229	0.000458	0.000000	0.000000	0.000000	0.000000	0.001030
NNW	0.000000	0.000916	0.002518	0.002060	0.000000	0.000000	0.000000	0.000000	0.005494
N	0.000114	0.000916	0.005608	0.005952	0.000000	0.000000	0.000000	0.000000	0.012590
CALM									0.000000
TOTAL	0.000458	0.009042	0.028728	0.033650	0.000000	0.000000	0.000000	0.000000	0.071878

MEAN WIND SPEED (m/s) = 4.36
NUMBER OF OBSERVATIONS = 628

PASQUILL STABILITY CLASS 'D'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.000000	0.003090	0.006181	0.014078	0.016253	0.009614	0.000916	0.000000	0.050132
NE	0.000229	0.006181	0.013620	0.016138	0.012361	0.003777	0.000229	0.000000	0.052535
ENE	0.000343	0.008012	0.022204	0.018313	0.006410	0.001831	0.000229	0.000000	0.057342
E	0.000572	0.007096	0.016596	0.018427	0.007211	0.002060	0.000229	0.000114	0.052306
ESE	0.000229	0.003891	0.011217	0.007096	0.003434	0.001717	0.000572	0.000000	0.028156
SE	0.000000	0.003319	0.006753	0.003090	0.001373	0.000572	0.000000	0.000000	0.015108
SSE	0.000229	0.002976	0.004807	0.003891	0.000572	0.000000	0.000000	0.000000	0.012476
S	0.000114	0.003891	0.007211	0.003777	0.003434	0.000572	0.000343	0.000343	0.019686
SSW	0.000687	0.005151	0.006638	0.007096	0.010072	0.002976	0.001145	0.000229	0.033993
SW	0.000916	0.005265	0.008126	0.012934	0.017512	0.008355	0.003319	0.000572	0.056999
WSW	0.000229	0.004922	0.007440	0.004578	0.007669	0.005036	0.002632	0.001030	0.033536
W	0.000114	0.003205	0.003663	0.002175	0.002518	0.001373	0.000801	0.000343	0.014193
WNW	0.000114	0.002289	0.001488	0.000572	0.001030	0.000916	0.000229	0.000000	0.006638
NW	0.000343	0.001145	0.001373	0.001602	0.001259	0.000687	0.000229	0.000343	0.006982
NNW	0.000229	0.003090	0.002175	0.001145	0.002175	0.000916	0.000114	0.000000	0.009843
N	0.000000	0.001946	0.007554	0.004693	0.009614	0.003205	0.000343	0.000000	0.027355
CALM									0.001373
TOTAL	0.004349	0.065469	0.127046	0.119606	0.102896	0.043608	0.011331	0.002976	0.478654

MEAN WIND SPEED (m/s) = 5.18
NUMBER OF OBSERVATIONS = 4182

ALL PASQUILL STABILITY CLASSES

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.001145	0.012934	0.020373	0.021174	0.016253	0.009614	0.000916	0.000000	0.082408
NE	0.002747	0.019801	0.047728	0.025066	0.012361	0.003777	0.000229	0.000000	0.111709
ENE	0.002289	0.020831	0.047385	0.024951	0.006410	0.001831	0.000229	0.000000	0.103926
E	0.002976	0.021518	0.046240	0.029415	0.007211	0.002060	0.000229	0.000114	0.109763
ESE	0.001831	0.011560	0.023463	0.010187	0.003434	0.001717	0.000572	0.000000	0.052764
SE	0.001259	0.011102	0.017855	0.004922	0.001373	0.000572	0.000000	0.000000	0.037084
SSE	0.002289	0.010644	0.014421	0.005837	0.000572	0.000000	0.000000	0.000000	0.033764
S	0.003548	0.014879	0.020716	0.006982	0.003434	0.000572	0.000343	0.000343	0.050818
SSW	0.003319	0.015108	0.022777	0.012361	0.010072	0.002976	0.001145	0.000229	0.067987
SW	0.002976	0.016711	0.029186	0.022662	0.017512	0.008355	0.003319	0.000572	0.101293
WSW	0.001831	0.014879	0.023349	0.010415	0.007669	0.005036	0.002632	0.001030	0.066842
W	0.001946	0.011560	0.011560	0.004120	0.002518	0.001373	0.000801	0.000343	0.034222
WNW	0.001717	0.007096	0.006181	0.001717	0.001030	0.000916	0.000229	0.000000	0.018885
NW	0.001259	0.006410	0.004693	0.002289	0.001259	0.000687	0.000229	0.000343	0.017168
NNW	0.001488	0.008813	0.010415	0.004235	0.002175	0.000916	0.000114	0.000000	0.028156
N	0.001717	0.011789	0.023807	0.013162	0.009614	0.003205	0.000343	0.000000	0.063637
CALM									0.019572
TOTAL	0.034337	0.215635	0.370150	0.199496	0.102896	0.043608	0.011331	0.002976	1.000000

MEAN WIND SPEED (m/s) = 4.21
NUMBER OF OBSERVATIONS = 8737

FREQUENCY OF OCCURENCE OF STABILITY CLASSES

A : 10.3%
B : 4.0%
C : 7.2%
D : 47.9%
E : 24.2%
F : 6.4%

STABILITY CLASS BY HOUR OF DAY

Hour	A	B	C	D	E	F
01	0000	0000	0000	0176	0145	0043
02	0000	0000	0000	0168	0159	0037
03	0000	0000	0000	0159	0166	0039
04	0000	0000	0000	0150	0178	0036
05	0000	0000	0000	0160	0169	0035
06	0000	0000	0000	0170	0158	0036
07	0013	0002	0015	0230	0080	0024
08	0019	0008	0040	0297	0000	0000
09	0024	0011	0082	0247	0000	0000
10	0056	0031	0092	0185	0000	0000
11	0081	0048	0079	0156	0000	0000
12	0120	0051	0069	0124	0000	0000
13	0145	0043	0062	0114	0000	0000
14	0154	0038	0055	0117	0000	0000
15	0131	0049	0050	0134	0000	0000
16	0106	0044	0055	0159	0000	0000
17	0052	0023	0029	0223	0023	0014
18	0000	0000	0000	0223	0098	0043
19	0000	0000	0000	0170	0148	0046
20	0000	0000	0000	0144	0170	0050
21	0000	0000	0000	0168	0161	0035
22	0000	0000	0000	0174	0150	0040
23	0000	0000	0000	0169	0151	0044
24	0000	0000	0000	0165	0161	0039

ATTACHMENT 5: SPF - NOISE CONTOUR PLOT (CALM)

(Mapping Source Google Earth)

ATTACHMENT 6: TERMS AND DEFINITIONS

A-Weighted: See

Adverse weather: Weather effects that enhance noise (that is, wind and temperature inversion) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more that 30% of the nights in winter).

Ambient noise: The all-encompassing noise associated within a given environment. It is the composite of sounds from many sources, both near and far.

Assessment background level (ABL): The single figure background level representing each assessment period day, evening and night (that is, three assessment background levels are determined for each 24-h period of the monitoring period). Its determination is by the tenth percentile method.

Assessment period: The period in a day over which assessments are made: day (0700-0800h), evening (1800 to 2200h) or night (2200 to 0700h).

Background Noise: The underlying level of noise present in the ambient noise, excluding the noise source under extraneous noise is removed. This is described using the L_{A90} descriptor.

Cumulative noise level: Refers to the total level of noise from all sources.

Day: The period between 0700 and 1800hrs (Monday-Saturday) and 0800-1800 (Sunday and Public Holidays).

dB: Abbreviation for decibel-a unit of sound measurement. Given sound pressure to a reference pressure.

dBA: Unit used to measure "A-weighted" sound pressure levels. A-weighting is an adjustment made to sound level measurement to approximate the response of the human ear.

A change of 1 or in the level of a sound is difficult to detect, whilst a 3 to 5 change corresponds to a small but noticeable change in loudness. A 10 change corresponds to an approximate doubling or halving in loudness.

The table below lists examples of typical noise levels.

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

Default parameters: In assessing meteorological enhancement of noise, refers to set values for weather parameters, such as wind speeds and temperature gradients, to be used in predicting source noise levels.

Equivalent Continuous Noise Levels: The level of noise equivalent to the energy average of noise levels occurring over a measurement period.

Evening: Refers to the period between 1800-2200hrs.

ATTACHMENT 6: TERMS AND DEFINITIONS

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

Feasible and reasonable measures: Feasibility relates to engineering considerations and what is practical to build; reasonableness relates to the application of judgement in arriving at a decision, taking into account the following factors:

- noise mitigation benefits (amount of noise reduction provided, number of people protected)
- cost of mitigation (cost of mitigation versus benefits provided)
- community views (aesthetic impacts and community wishes)
- noise levels for affected land uses (existing and future levels, and changes in noise levels).

Fluctuating Noise: Noise that varies continuously and to an appreciable extent over the period of observation.

Greenfield site: Undeveloped land.

Impulsive Noise: Noise having a high peak of short duration, or a sequence of such peaks. A sequence of such peaks. A sequence of such impulses in rapid succession is termed 'repetitive impulsive noise'.

Intrusive Noise: refers to noise that intrudes above the background level by more than 5 decibels.

L_{A10}: The A-weighted sound pressure level that is exceeded for 10% of the time over which a given sound is measured. This is considered to represent the average maximum noise level.

L_{A90}: The A-weighted sound pressure level that is exceeded for 90% of the time over which a given sound is measured. This is considered to represent the background noise.

L_{Aeq}: The equivalent continuous noise level – the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

Long-term annoyance: Prolonged annoyance over months and years.

Median: The middle value in a number of values sorted in ascending or descending order. Hence, for an odd number of values, the value of the median is simply the middle value. If there is an even number of values the median is the arithmetic average of the two middle values.

Meteorological conditions: wind and temperature inversion conditions.

Most-affected locations(s): Locations that experience (or would experience) offensive noise from the noise source under consideration. In determining these locations, one needs to consider existing background levels, exact noise source locations(s), distance from source (or proposed source) to receiver, and any shielding between source and receiver.

Night: The period between 2200 and 0700 (Monday-Saturday) and 2200-0800 (Sunday and Public Holidays)

ATTACHMENT 6: TERMS AND DEFINITIONS

Negotiated agreement: An agreement involving the negotiation of an achievable noise limit in cases where the project specific noise levels cannot be met. The agreement is negotiated between the proponent and the DEC or the proponent and the community. Such an agreement is reached through balancing the merits of a development, the feasibility and reasonableness of available mitigation measures and the noise impacts produced.

Noise criteria: The general set of non-mandatory noise level targets for protecting against intrusive noise (for example, background noise plus 5dB) and loss of amenity (for example, noise levels for various land uses).

Rating Background Level (RBL): the overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period (as opposed to over each 24-h period used for the assessment background level). This is the level used for assessment purposed. It is defined as the median value of:

- all the day assessment background levels over the monitoring period for the day
- all the evening assessment background levels over the monitoring period for the evening; or
- all the night assessment background levels over the

Non-mandatory: With reference to the proposed policy, means not required by legislation. The proposed policy specifies criteria to be strived for, but the legislation does not make these criteria compulsory. However, the policy would be used as a guide to setting statutory (legally enforceable) limits for licences and consents.

Performed-based goals: Goals specified in terms of the outcomes/performance to be achieved, but not in terms of the means of achieving them.

Receiver: The noise-sensitive land at which noise from a development can be heard.

Industrial noise sources: Sources that do not generally move from place to place, eg. industrial or commercial sources. In general, these include:

- Individual sources such as:
  - heating, ventilating and air conditioning (HVAC) equipment,
  - rotating machinery,
  - impacting mechanical sources,
  - other mechanical equipment and machinery such as conveyors.
  - mobile sources confined to particular location such as draglines and haul trucks.

- facilities, usually comprising many sources of sound, including:
  - industrial premises,
  - extractive industries,
  - commercial premises,
  - warehousing facilities,
  - maintenance and repair facilities.

  (In this case, the industrial source is understood to encompass all the activities taking place within the property boundary of the facility).

Temperature inversion: An atmospheric condition where temperature increases with height above the ground.