39.6301.L1:CFCD3

ATKINS ACOUSTICS

Postal Address
P.O. Box 432
Gladesville
N.S.W. 1675
AUSTRALIA
A.C.N. 068 727 195
A.B.N. 19 068 727 195
Telephone: 02 9879 4544
Fax: 02 9879 4810
Email: AtkinsAcoustics@bigpond.com.au

PacLib Management Pty Ltd
Level 4, 67 Epping Road
NORTH RYDE NSW 2113

Attention: Diana Banjanin

29 July 2009

Atkins Acoustics and Associates Pty Ltd.
Consulting Acoustical & Vibration Engineers

DoP COMMENTS
OPERATIONAL NOISE ASSESSMENT
PRINTING, WAREHOUSE & DISTRIBUTION FACILITY
LENORE DRIVE, ERSKINE PARK

Atkins Acoustics was engaged by PacLib to prepare an Operational Noise Assessment for a proposed printing, warehouse and distribution facility at Lenore Drive, Erskine Park. The results and findings of the assessment were presented in *'Operational Noise Assessment. Printing, Warehouse & Distribution Facilities. Lot 62 DP 1090695 Lenore Drive. Erskine Park'* Report No. 39.6301.R1:CFCD3 Rev01 dated April 2009.

The assessment was submitted to the Department of Planning (*DoP*) as part of the discussion and review associated with the Environmental Assessment process. General comments from *DoP* considered that potential risk of adverse noise impacts from the proposal were low. Albeit some additional further information was requested by the *DoP*. *DoP* internal noise assessment specialist (Jeff Parnell) raised a number of issues requiring amendment or further detail. Atkins Acoustics contacted *DoP* (Jeff Parnell) to further clarify the issues and establish a procedure to move forward. The main issues identified were:

- *Noise Criteria* – agreed with approach of intrusive criteria and measurement location. However concerns that some background measurements may have been affected by insect noise
- *Amenity Criteria* – Atkins Acoustics adopted a land use classification in accordance with the *INP* of *Urban*, *DoP* deemed that the receiver area should be classed as *Suburban*
- *Sound Power Levels* – DoP queried the sound power levels utilised for modelling particularly with respect to trucks and forklifts and referenced the *DECC Draft Construction Noise Guideline* and *DEFRA* for comparison.
- *Meteorological Effects* – acknowledged that assessment utilised adverse conditions during night time hours, however questioned lack of assessment of adverse conditions during day and evening
- *Architectural Acoustics* – ensure that the building materials and insulation can be incorporated into the design to ensure compliance with noise criteria

The above issues have been addressed and clarified in a revised noise assessment report *'Operational Noise Assessment. Printing, Warehouse & Distribution Facilities. Lot 62 DP 1090695 Lenore Drive. Erskine Park'* Report No. 39.6301.R1:CFCD3 Rev03 dated July 2009. This letter provides a brief outline addressing the *DoP* issues.

Noise Criteria
Atkins Acoustics conducted further review of the ambient noise measurements and concurred with *DoP* that measurement results at reference measurement location M1 (32 Shaula Crescent) may have been affected by insects or other localised noise source. Accordingly the revised assessment has adopted the measured levels at reference location M2 (24 Regulus Street) for determining of intrusive noise goals for all reference receiver locations (A1-A4).

Furthermore, following guidance provided in the *DECC Application Notes: NSW Industrial Noise Policy* and comments from *DoP*, the marginally higher evening background noise levels relative to day were excluded and the minimum background level of 34dB(A) and a goal of 39dB(A) adopted for assessment during evening hours.

Amenity Criteria
The *DoP* has deemed that the receiver area should be classed as *Suburban*. Although the amenity criteria are not relevant for this project, the receiver area classification has been amended.

Notwithstanding comments from *DoP* and lack of relevance to this project, under the definitions of the *INP (Section 2.2.1)* Atkins Acoustics believe that the *Indicative Noise Amenity Area* for the residential receivers would be *Urban* based on noise environment.

Sound Power Levels
DoP has made reference to the *DECC Draft Construction Noise Guideline* and *DEFRA* in terms of source sound power levels for trucks and forklifts. We note that the levels presented in these documents are typically L_{Amax} or $L_{Aeq(T)}$ noise levels.

The sound power levels adopted in the assessment were established from site attended audit measurements of trucks and forklifts as similar facilities under normal operating conditions measured over representative five to fifteen (5-15) minute measurement period in order to capture typical L_{Aeq} operating noise levels for the reference activity.

Meteorological Effects
In terms of assessment of meteorological effects, wind data was compiled into annual and seasonal wind roses *(Benbow)* for day, evening and night assessment periods. A review of source to receiver winds considering the quadrant of 45° either side of

receiver direction has shown that wind effects require assessment. Considering the findings and the requirements of the *DECC, INP* north-west (Day), south and south-west winds (Night) have been considered in the noise modelling.

The noise model adopted the following the following meteorological conditions:
- Calm: 20ºC, 60% humidity (all hours)
- North-west wind 315°: 3m/s and 20ºC, 60% humidity (Day)
- South wind 180°: 2m/s and 20ºC, 60% humidity (Night)
- South-west wind 225°: 2m/s and 20ºC, 60% humidity (Night)

Source to receiver winds during day and evening areas were not identified as a feature of the area in accordance with the requirements of the *INP*.

Architectural Acoustics
In terms of noise reduction from building materials, the required noise reductions can be readily incorporated into the building design. The selected printing machinery would typically be installed with acoustic enclosures, with the main building structure providing secondary noise control.

The assessment confirmed that during the design and specification phase of the project a detailed acoustic review of various components of the facility would be conducted to ensure that the design project noise goals are satisfied. In addition it is proposed that within three (3) months of commissioning of the facility, site inspections and noise measurements be conducted by a qualified Acoustic Consultant to demonstrate that the operation of the facility satisfies the project specific noise goals.

Discussions with *DoP* (Jeff Parnell) raised concerns with the variable location of truck/container drop off for Warehouse 2/3 during night-time hours and resulting 'grey' noise control recommendations. This issue has been addressed by providing a specified night-time drop off zone and proposed erection of a three (3) metre high acoustic wall adjacent the northern side of the drop off zone to provide shielding to the reference residential receivers to the north.

We trust the information in this letter is satisfactory. Please do not hesitate to contact our office if further information or clarification is required.

Yours sincerely,
ATKINS ACOUSTICS & ASSOCIATES PTY LTD.

Carl Fokkema

ATKINS ACOUSTICS

Postal Address
P.O. Box 432
Gladesville
N.S.W. 1675
AUSTRALIA
A.C.N. 068 727 195
A.B.N. 19 068 727 195
Telephone: 02 9879 4544
Fax: 02 9879 4810
Email: AtkinsAcoustics@bigpond.com.au

Atkins Acoustics and Associates Pty Ltd.
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OPERATIONAL NOISE ASSESSMENT
PRINTING, WAREHOUSE & DISTRIBUTION FACILITIES
LOT 62 DP 1090695 LENORE DRIVE
ERSKINE PARK

39.6301.R1:CFCD3
Rev 03

Prepared for: PacLib Group Pty Ltd
Level 4, 67 Epping Road
NORTH RYDE NSW 2113

Prepared by: Atkins Acoustics and Associates Pty Ltd.
8-10 Wharf Road
GLADESVILLE NSW 2111

July 2009

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1.0 INTRODUCTION

Atkins Acoustics was engaged by PacLib Group Pty Ltd to prepare an operational noise assessment for proposed printing, warehouse and distribution facilities to be constructed on a vacant site at Erskine Park.

The site is located within the Erskine Park Employment Area located on Lenore Drive, Erskine Park (*Figure 1*). The site is currently cleared and 'greenfield' with adjacent areas to the west and south on the opposite side of Lenore Drive currently under various stages of development for industrial use. In addition to the industrial uses, a residence is located within the industrial precinct adjacent the site to the south-west (Lot 63, DP 1090695). It is understood that the owner of the property (F. Blackwell) entered into negotiations with PacLib Group and sold the subject property to be developed for an industrial use and waived rights with respect to potential noise or other impacts associated with the subsequent development. Accordingly that residence has not been considered further in this assessment.

This report presents the results, findings and recommendations of the operational noise assessment for Major Project Application purposes. It is recommended that a qualified acoustic consultant be engaged during the detailed design development and construction phases of the project to review and ensure the acoustic requirements for the project satisfy pending noise conditions (noise).

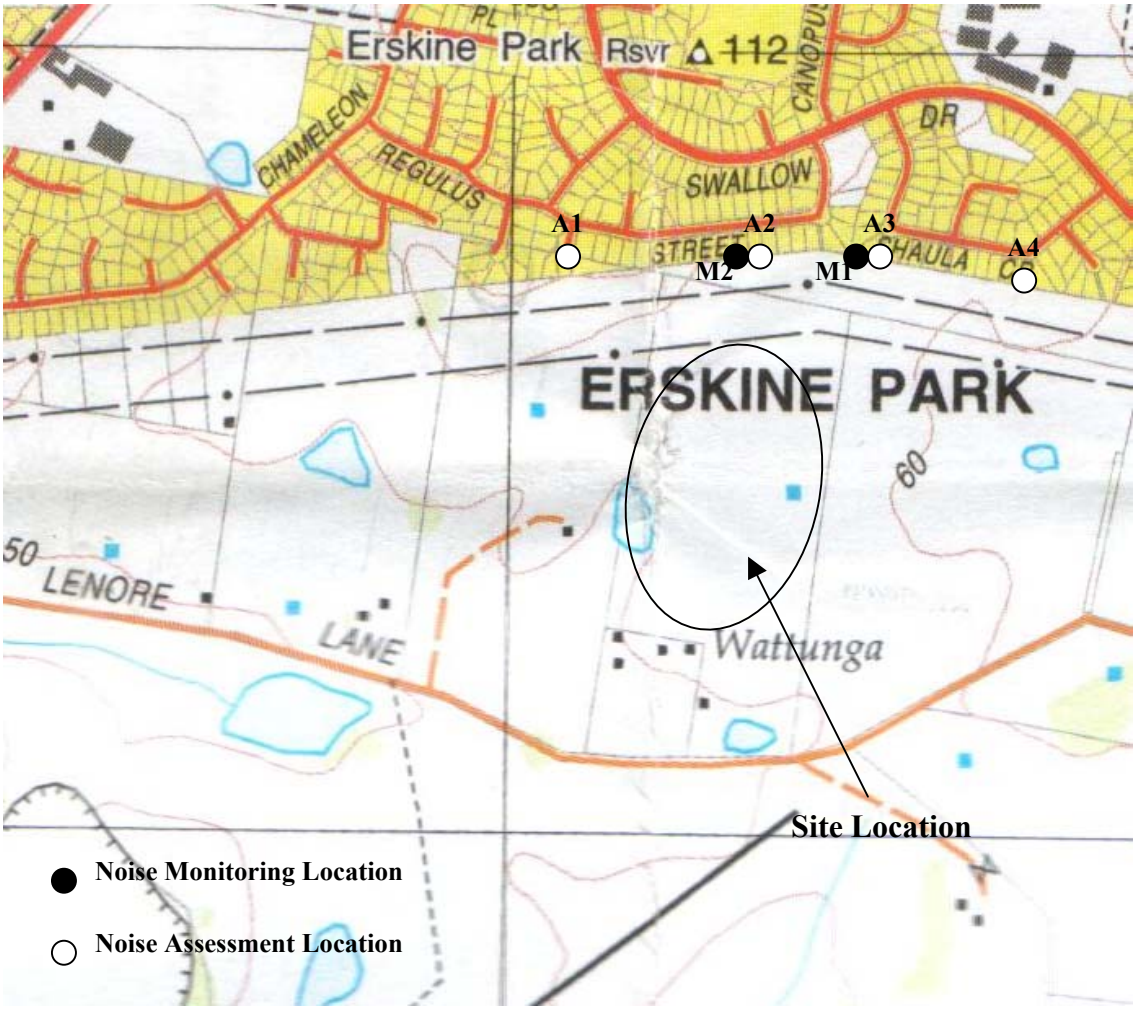
The methodology adopted for the DA noise assessment included:

- site inspections;
- measurement and assessment of existing ambient noise levels at representative noise receiver locations;
- establishment of noise assessment goals in accordance with the *DECC, Industrial Noise Policy (INP)* and *Noise Guide for Local Government (NGLG)*;

- site layout as depicted in Drawing No. 080225-DA-002 prepared by PacLib Industrial;
- prediction and assessment of operational noise emissions; and
- recommendation of conceptual noise controls, where required.

The information presented in this report has been prepared for the particular investigation described and no part should be used in any other context or for any other purpose without approval from Atkins Acoustics and PacLib Group Pty Ltd.

Figure 1: Site Location



2.0 THE PROPOSAL

2.1 The Site

The site is located on the northern side of Lenore Drive (*Figure 1*) and identified as Lot 62 DP 1090695 Lenore Drive, Erskine Park. The site and adjacent land are zoned for industrial use and form part of the Erskine Park Employment Area that will ultimately extend from Erskine Park Road (west) to Wallgrove Road (east). To the north of the site are residential properties separated from the Erskine Park Employment Area by a high voltage electricity easement.

2.2 Overview of Proposal

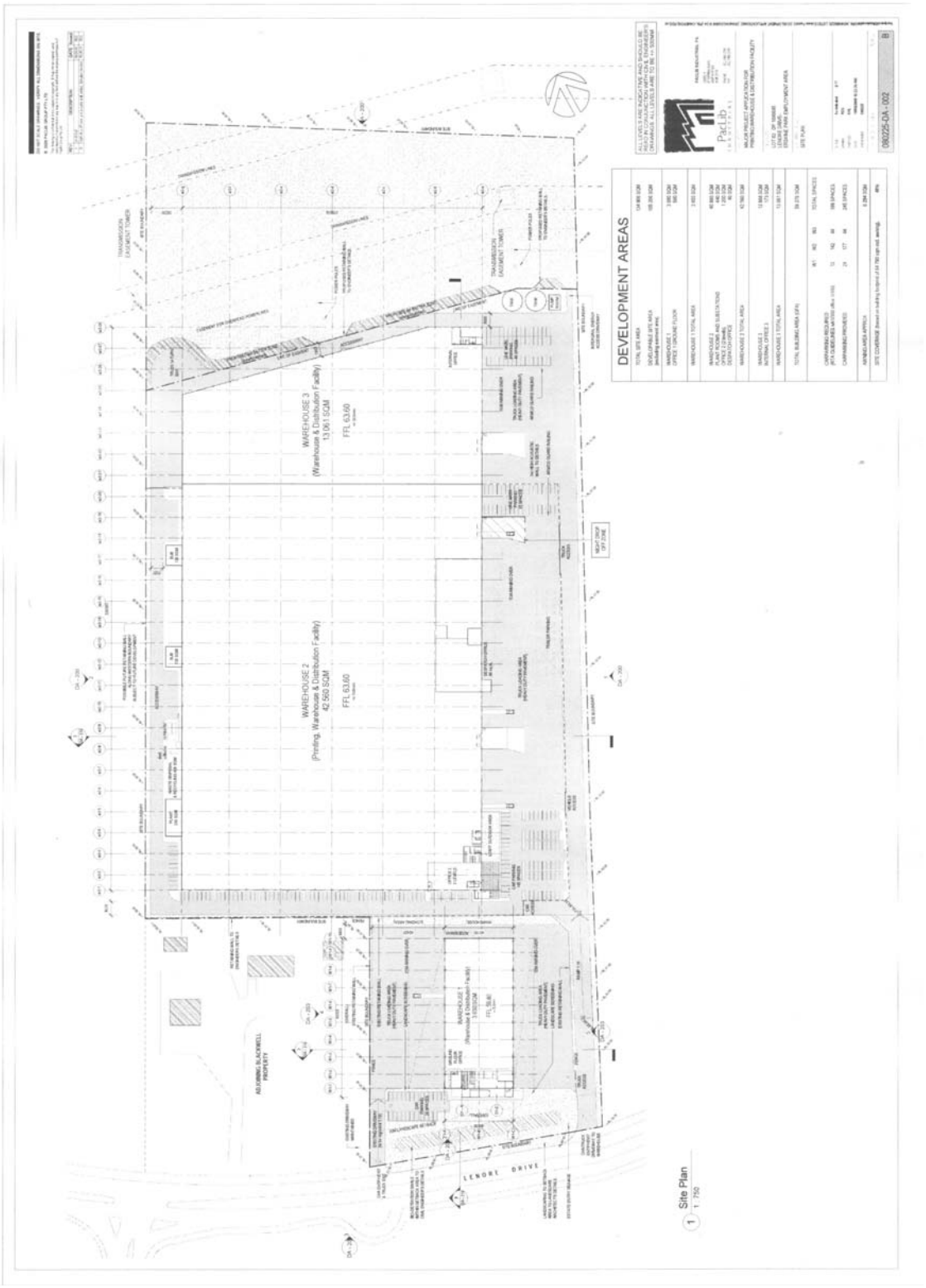
The proposal would occupy an area of approximately 56,863m^2 for warehousing, 1,973m^2 for offices and 440m^2 for substation / plant. The remainder of the site (excluding the transmission line easement to the north), being hardstand for loading docks ('at grade' and recessed), marshalling and staff parking (*Figure 2*).

The facility (*Figure 2*) comprises two (2) main buildings with Warehouses 2 & 3 (55,621m^2) accommodated within a single building on the central northern portion of the site and Warehouse 1 (3,655m^2) in a separate building located on the southern portion of the site. Loading docks are proposed along the eastern and western facades of Warehouse 1 and eastern facade of Warehouses 2/3. The loading docks provide for a combination of rear load/unload and side loading utilising electric and manual pallet jacks and fork trucks. In terms of side loading of trucks and external use of forktrucks, information at the time of this assessment confirmed that activities outside Warehouse 2 and 3 would be typically restricted to the 7.00am to 6.00pm or located within the building. The buildings would be designed with fast action automatic roller doors.

In terms of truck movements associated with the proposal, the following hourly numbers have been projected for Monday to Saturday operations:

Day/Evening	23 x Semis & Rigid Trucks
Night	2 x Semis and/or Containers

Figure 2: Site Layout



With respect to activities on Sunday, reduced truck numbers are projected as follows:

Day/Evening	3 x Semis
Night	2 x Semis and/or Containers

The proposed hours of operation are twenty-four (24) hours, seven (7) days a week including truck access and egress. Typically outdoor use of fork trucks would be restricted to between 7.00am and 6.00pm hours, seven (7) days.

2.2.1 Plant and Equipment

It is anticipated that fixed plant and equipment required for the proposed warehouses would include:

- air-conditioning systems and ventilation for the offices and staff facilities;
- fans for the waste collection area;
- roof-top extraction fans (operating under fire mode for safety reasons); and,
- printing, finishing and sorting machinery for Warehouse 2.

The mobile plant would include gas and electric powered fork trucks and electric pallet transporters. Where practical, electric fork trucks would be specified.

The fork trucks, electric pallet transporters and majority of fixed plant and equipment would be located within Warehouse 2. Details of air-conditioning and exhaust fans were not available at the time of assessment and accordingly have not been considered further in this assessment. During the design development an acoustic consultant would be engaged to ensure that noise from air-conditioning and exhaust fans complies with the consent project noise goals. Noise from envisaged air-conditioning and exhaust fans could readily be controlled through considered selection, design and installation.

With respect to printing and finishing activities (Warehouse 2), information of similar printing systems was provided and reviewed by *Atkins Acoustics*. Based on the information provided by *PacLib* and additional investigations by *Atkins Acoustics* of documented data, space averaged internal noise levels of $L_{Aeq,15min}$ 85dB(A) was adopted for the printing area and $L_{Aeq,15min}$ 75dB(A) for the finishing area. Warehouse 1 and Warehouse 3 are for storage and distribution and it is anticipated that space averaged internal noise levels would be less than $L_{Aeq,15min}$ 60dB(A). Accordingly the internal noise from Warehouse 1 and 3 is not expected to contribute to the overall noise from the site and has not been considered further.

3.0 LOCAL ENVIRONS

Site measurements and inspections confirmed that the noise environment at potentially sensitive residential noise receivers is influenced by distant and local traffic, domestic activities including dogs and birds and existing isolated industrial premises to the south-west. It is acknowledged that the residential area to the north abuts the rezoned industrial area comprising the Erskine Park Employment Area. Referenced to the *INP* and following discussions with the Department of Planning (*DoP*), the residential areas potentially exposed to noise emissions from the site would be classified as *Suburban*. It is envisaged that with the subsequent full development of the Erskine Park Employment Area, the acoustic environment of the residential area to the north would change.

3.1 Noise Assessment Locations

The nearest potentially affected residential areas are located approximately 180m to 320m from the site at its closest point. *Table 1* and *Figure 1* identify the receiver locations selected for noise modelling and assessment.

Table 1: Assessment Locations

Assessment Location	Description	Location
A1	1 Dunnstaffnage Place	North-west
A2[1]	24 Regulus Street (M2)	North
A3[1]	32 Shaula Crescent (M1)	North-north-east
A4	12 Shaula Crescent	North-east

Note 1 Noise monitoring locations

3.2 Local Meteorology

There is no meteorological data available for the site, albeit data for 'Horsley Park' was provided by Benbow Environmental and is considered representative for Erskine Park.

3.2.1 Stability Classifications (Temperature Inversion)

Table 2 shows the frequency of occurrence of the different stability classes for the 'night' period (6pm to 7am) during winter in accordance with *Section 5.2* of the *INP*.

Table 2: Frequency of occurrence of stability classes (Horsley Park)

Stability Class	Percentage Frequency of Occurrence
A	0.50
B	1.67
C	3.60
D	60.03
E	24.16
F	10.03
Total	**100**

Weather data in *Table 2* show that F stability class conditions (temperature inversions) during winter are not a feature of the area and referenced to the *INP* assessment procedures have not been considered in the noise modelling.

3.2.2 Prevailing Wind Data

Wind data was compiled into annual and seasonal wind roses *(Benbow)* for day, evening and night assessment periods and are shown in *Appendix 2*. A review of source to receiver winds considering the quadrant of 45° either side of receiver direction has shown that wind effects require assessment. Considering the findings and the requirements of the *DECC, INP* north-west (Day), south and south-west winds (Night) have been considered in the noise modelling.

3.2.3 Review

Based on the information reviewed, the following meteorological conditions were adopted for noise modelling:

- Calm: 20ºC, 60% humidity (all hours)
- North-west wind 315°: 3m/s and 20ºC, 60% humidity (Day)
- South wind 180°: 2m/s and 20ºC, 60% humidity (Night)
- South-west wind 225°: 2m/s and 20ºC, 60% humidity (Night)

4.0 EXISTING AMBIENT NOISE LEVELS

For the purpose of assessing noise impacts from the proposal and establish project specific noise assessment goals, the existing ambient noise levels were monitored from Thursday 13 March 2008 to Thursday 20 March 2008.

The reference noise monitoring locations selected (*Table 1*) and shown on *Figure 1* were:

M1 32 Shaula Crescent, Erskine Park

M2 24 Regulus Street, Erskine Park

Site observations during installation of monitoring equipment confirmed that the ambient noise was influenced by domestic activities including dogs and birds, distant and local road traffic and distant activities associated with (operation and construction) in the Erskine Park Employment Area. During installation of noise loggers, aural observations confirmed construction and transient noise sources occasionally audible emanating from the industrial area to the south to the southern side of Lenore Lane and beyond. On retrieval of the noise loggers, no activities within the area to the south were audible.

For noise assessment, the residential receiver locations were considered as receiver 'areas' for the purpose of developing noise goals. Accordingly, monitoring location M1 represents assessment locations A3 and A4 whilst monitoring location M2 represents assessment locations A1 and A2.

The noise monitoring instrumentation consisted of RTA Technology environmental noise loggers. The loggers were set to A-weighting, fast response and programmed to calculate and record statistical noise levels at 15-minute intervals. The instruments were calibrated before and after the measurements using a Bruel & Kjaer sound level calibrator Type 4230 and no significant drift was detected.

Table 3 presents a summary of the measurement results with a graphical presentation presented in *Appendix 1*. For monitoring location M1, the assessment has considered the minimum L_{A90} during the monitoring period to discard extraneous data recorded.

Table 3: Measured RBL and L_{Aeq} Noise Levels
dB(A) re: 20×10^{-6} Pa

Date	Assessment Background Level L_{A90}			Equivalent Continuous Level L_{Aeq}		
	Day	Evening	Night	Day	Evening	Night
Reference Location M1: 32 Shaula Crescent (A3 & A4)						
Thu 13/3/08	–	43	40	–	54	49
Fri 14/3/08	38	41	40	48	52	52
Sat 15/3/08	38	42	40	*60*	*58*	53
Sun 16/3/08	37	39	36	*60*	55	49
Mon 17/3/08	39	40	37	49	*57*	*56*
Tue 18/3/08	36	42	36	49	54	52
Wed 19/3/08	39	39	38	49	56	52
RBL	**38**	**41**	**38**			
Min. L_{A90}	**36**	**39**	**36**			
Ambient L_{Aeq}				**49**	**54**	**51**
Reference Location M2: 24 Regulus Street (A1 & A2)						
Thu 13/3/08	–	35	33	–	55	44
Fri 14/3/08	35	34	34	54	58	45
Sat 15/3/08	34	35	30	52	57	44
Sun 16/3/08	33	34	28	*59*	58	43
Mon 17/3/08	35	34	33	50	53	45
Tue 18/3/08	34	*35*	33	50	*59*	44
Wed 19/3/08	38	35	31	50	54	43
RBL	**34**	**35**	**33**			
Ambient L_{Aeq}				**52**	**56**	**44**

Noise levels in *Italics* excluded
NOTE: *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)

Observations confirmed that the existing L_{Aeq} noise levels are controlled by domestic activities and animals (dogs and birds) not industrial noise or traffic noise.

5.0 ENVIRONMENTAL NOISE ASSESSMENT GOALS

Goals for the assessing industrial noise are documented in the Department of Environment and Climate Change *(DECC), Industrial Noise Policy (INP)* and *Noise Guide for Local Government (NGLG)*.

5.1 Operational Noise (*INP*)

The objectives of the *INP* are to protect the community from intrusive noise and preserve amenity. For assessment of intrusive noise, the *INP* recommends that the $L_{Aeq,15min}$ source noise should not exceed the existing L_{A90} Rating Background Level *(RBL)* by more than 5dB(A). The assessment goal for preservation of amenity requires noise levels with the introduction of new sources to be within the acceptable levels for the locality and land-use. *Table 4* present a summary of the *INP* acceptable and recommended maximum amenity assessment goals.

Table 4: INP Amenity Goals

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

NOTE: 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)

(1) In assessing noise levels at residences, the noise is assessed at the most affected point on or within the residential property boundary or, if this is more than 30m from the residence, at the most-affected point within 30m of the residence.

From the *INP* procedures, *Table 5* presents the calculated *RBL's*, the ambient L_{Aeq} noise level, intrusive and amenity noise goals and the project specific noise assessment goals. As a precautionary approach it was concluded that noise measurements at 32 Shaula Crescent were affected by extraneous noise. Accordingly existing noise levels at 24 Regulus Street were adopted for assessment purposes.

Table 5: Operational Noise Assessment Goals
dB(A) re: 20 x 10^{-6} Pa

Period (1)	Acceptable L_{Aeq} Noise Level	Existing RBL	Existing L_{Aeq} Noise Level	Intrusive Criterion L_{Aeq} Noise Level	Amenity Criterion L_{Aeq} Noise Level*	Project Assessment Goals L_{Aeq} Noise Level
All Reference Assessment Locations A1 to A4 (M2)						
Day	60	34	52	39	60	**39**
Evening	50	35	56	40	50	**39***
Night	45	33	44	38	45	**38**

NOTE: 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.
* Reference to DECC Application notes: NSW Industrial Noise Policy

The principles underpinning the establishment of noise assessment goals are that the goals are best regarded as planning tools, *"They are not mandatory, and an application for a noise-producing development is not determined purely on the basis of compliance or otherwise with the noise criteria. Numerous factors need to be taken into account in the determination. These include economic consequences, other environmental effects and the social worth of the development. The criteria help to determine consent/licence conditions because they provide information on the likely effect of any environmental noise associated with the development."*

5.2 Night-time Disturbance (*NGLG*)

The proposal would operate twenty-four (24) hours a day, accordingly intermittent night-time activities need to be addressed. To avoid disturbance during night-time hours, the *NGLG* recommends that the $L_{A1,1min}$ noise levels when assessed outside a bedroom window, should not exceed the background L_{A90} noise level by more than 15dB(A).

In accordance with the *NGLG* assessment procedures and the adopted background noise levels, intermittent $L_{A1,1min}$ noise levels from site activities during the night-time (10.00pm to 7.00am) period should not exceed:

Location A1 – A4: 48dB(A) (L_{A90} 33 + 15dB(A))

6.0 OPERATIONAL NOISE ASSESSMENT

Operational noise from the proposal has been predicted with the *ENM* environmental noise computer model. The computer model takes account of noise attenuation due to increase in distance, ground effect, atmospheric absorption, shielding from intervening structures and topography. Atmospheric conditions assumed for the noise modelling included calm conditions, 20°C air temperature and 60% relative humidity. Additional weather conditions considered in the operational noise assessment included:

- Calm: 20ºC, 60% humidity (all hours)
- North-west wind 315°: 3m/s and 20ºC, 60% humidity (Day)
- South wind 180°: 2m/s and 20ºC, 60% humidity (Night)
- South-west wind 225°: 2m/s and 20ºC, 60% humidity (Night)

Table 6 presents a summary of the building and plant/equipment sound power levels adopted for the noise modelling. The source noise levels presented have been established from site attended audit measurements of typical truck movements and gas fork truck loading activities at similar facilities. The levels presented represent a $L_{Aeq,15min}$ operating noise level for assessment purposes.

Table 6: Plant/Equipment Sound Power Levels
L_{Aeq} re: 10^{-12} Watt

Plant Description	Sound Power Level								
	dB(A)	63	125	250	500	1k	2k	4k	8k
Semi/Container Truck (moving)	101	98	102	101	97	94	94	91	80
Rigid Truck (moving)	96	93	97	96	92	89	89	86	75
Fork Unloading *	95	91	92	89	91	90	90	85	-
Printing Area (Warehouse 2)[1]	85	67	72	79	79	85	79	77	72
Finishing Area (Warehouse 2) [2]	75	57	62	69	69	75	69	67	62

Notes: 1 & 2 Space averaged L_{Aeq} noise levels within the building
*Gas fork truck use, electric fork trucks –2dB(A) (Lw92)

Fixed mechanical plant including AC condensers and exhaust fans were not selected at the time of the assessment and excluded from the noise model. During the design development process an Acoustic Consultant would be engaged to review equipment selections to ensure that consent noise goals can be achieved. In terms of printing and finishing activities the space averaged levels presented in *Table 6* are based on information provided by *PacLib* and additional investigations by *Atkins Acoustics* of documented data. For noise modelling space averaged internal noise levels of $L_{Aeq,15min}$ 85dB(A) was adopted for the printing area and $L_{Aeq,15min}$ 75dB(A) for the finishing area. Details of all plant and equipment including printing and finishing processes would be reviewed and assessed by an Acoustic Consultant during the detailed design phase prior to final specification to ensure that project consent noise goals are satisfied.

Discussions with PacLib Group Pty Ltd confirmed that all transfer of stock and loading/unloading would use gas and electric powered fork trucks and pallet trolleys. For noise assessment purposes, gas powered fork trucks were considered and represent a conservative assessment albeit the Client has advised that electric fork trucks would be specified where practical and committed to use electric fork trucks in Warehouse 3.

The proposed facility would operate twenty-four (24) hours a day, seven (7) days a week comprising typically of trailer drop off and pick up during night-time hours, with limited outdoor use of fork trucks possible for Warehouse 1 and container/trailer drop off only at Warehouse 2 within the specified Night Drop Off Zone (*Figure 2*). Accordingly, night-time intermittent activities need to be considered to assess potential sleep disturbance. To provide an assessment of night-time intermittent activities, a worse case scenario has been considered and a sound power level (*Table 7*) for airbrake release adopted.

Table 7: Night-time Intermittent Noise Source
$L_{A1,1min}$ re: 10^{-12} Watts

Plant Description	Sound Power Level									
	dB(A)	63	125	250	500	1k	2k	4k	8k	16k
Airbrake Release	118	99	91	90	96	107	111	112	113	109

6.1 Noise Modelling

Sources for operational noise modelling have considered the surface areas of the building (Warehouse 2) containing the printing and finishing operations and allocated equivalent sound power levels for each surface. The assessment has considered the walls of Warehouse 2 to consist of 100-150mm precast concrete panels up to 2400mm above FFL with metal clad walls (0.6mm BMT) above 2.4m FFL and metal deck roofing (0.6mm BMT). The transmission loss (TL) adopted for 0.6mm BMT (walls and roof) and modelling purposes assuming reverberant to free field was:

Table 8: Transmission Loss

Material	Octave Band Transmission Loss (Hz)							
	31.5	63	125	250	500	1k	2k	4k
0.6mm corrugated steel	8	8	10	14	19	21	21	24

Preliminary modelling for site operations identified noise exceedances resulting from the printing / finishing equipment. Accordingly, the noise model assumptions were reconfigured to provide additional noise reductions of 10dB(A) for walls and 18dB(A) for roof of printing area, and 8dB(A) reduction for the finishing area roof. The additional noise reductions identified could be readily achieved with:

- upgraded acoustic performance of wall and roof details; OR
- installation of the printing / finishing processes within an ‘enclosure’ or ‘room’ within the building; AND/OR
- plant and equipment selection to reduce the space averaged internal noise levels (*Section 6.3*).

Except where noted, the projected truck volumes presented in *Table 9* are hourly movements to and from the site. These numbers have been utilised to develop operating scenarios for site truck movements and unloading activities during the day/evening and night operating hours.

Table 9: Forecast Hourly Truck Movements

Vehicle Type	Warehouse 1		Warehouse 2		Warehouse 3	
	Day	**Night**	**Day**	**Night**	**Day**	**Night**
Monday to Friday						
Container Truck	-	-	-	5 per night	-	-
B Double	6	-	-	-	-	-
Semi Trailer	-	3 per night	6	-	2	-
Single Trailer	4	-	-	-	-	-
12t Rigid Truck	1	-	-	-	-	-
8t Rigid Truck	2	-	-	-	-	-
6t Rigid Truck	1	-	-	-	-	-
4-5t Rigid Truck	1	-	-	-	-	-
1.5t Van	2 per day	-	-	-	-	-
Total (per hour)	**15**	**1**	**6**	**1**	**2**	**-**
Sunday						
Container Truck	Nil		-	5 per night	-	-
B Double			-	-	-	-
Semi Trailer			2	-	2 per day	-
Single Trailer			-	-	-	-
12t Rigid Truck			-	-	-	-
8t Rigid Truck			-	-	-	-
6t Rigid Truck			-	-	-	-
4-5t Rigid Truck			-	-	-	-
1.5t Van			-	-	-	-
Total (per hour)	**-**	**-**	**2**	**1**	**1**	**-**

Considering the projected hourly activities and unloading activities with fork trucks, the following envisaged operating scenarios were considered for day/evening and night $L_{Aeq,15min}$ noise modelling:

Day/Evening *WAREHOUSE 1 (2 x trucks west, 3 x trucks east)*

2 x B-Doubles (Lw101dB(A)) + 3 Rigid Trucks (Lw96dB(A))

Unloading activities – east x 2 (2 x Lw95dB(A))

WAREHOUSE 2

2 x Semis (Lw101dB(A))

Unloading activities x 2 (2 x Lw95dB(A))

WAREHOUSE 3

1 x Semi (Lw101dB(A))

Unloading activities (Lw92dB(A) - electric)

Night *WAREHOUSE 1 (1 x truck east)*

1 x Semi (Lw101dB(A))

Unloading activities – east (Lw95dB(A))

WAREHOUSE 2

2 x Semi/Containers (Lw101dB(A))

The above scenarios represent peak operations for a fifteen (15) minute assessment period and a worse case scenario for trucks in motion prior to and after being unloaded. Modelling has assumed that truck engines would be off during unloading activities with activities focused on the eastern side of the Warehouse 1. This mode of site activities represents a worse case scenario as it would provide the greatest exposure to residential properties to the north (Warehouses 2/3 provides shielding for activities on western side of Warehouse 1). The noise modelling has taken into account envisaged duration of movement of trucks on-site in order to calculate $L_{Aeq,15min}$ contributions assuming the following durations for a truck servicing Warehouse 1 of 1.5-2 minutes and Warehouse 2 & 3 of 7.5 minutes.

Truck access for Warehouses 2 & 3 is provided adjacent the eastern site boundary. For the assessment of trucks servicing these warehouses, the noise model utilised the

source noise level for semi/container trucks referenced in *Table 6* and assessed trucks as a line noise source taking into account 3 trucks (Day/Evening) and 2 trucks (Night) per 15 minute assessment period and duration for each movement of 7.5 minutes. Trucks for Warehouse 2 during night-time hours would be restricted to the specified drop off zone (*Figure 2*). No trucks are proposed for Warehouse 3 during night-time hours.

Loading / unloading activities for all warehouses were modelled simultaneously with truck movements and operation of the printing and finishing processes for day / evening hours. During night hours, loading / unloading activities were considered for Warehouse 1 (east) only as it is not proposed to externally load / unload during night hours for Warehouses 2 & 3.

Considering the recommended building materials, noise levels from internal use of electric forktrucks within the buildings would be more than 15dB(A) below the predicted levels of the outdoor trucks and forktrucks. Accordingly internal use of electric pallet trolleys and forktrucks is not considered further in this assessment.

The results of the noise modelling are presented in *Table 10 & 11* taking into account noise modelling assumptions presented in *Section 6.1*, assessment locations presented in *Section 3.1* and meteorological conditions referenced in *Section 3.2.3*.

Table 10: Predicted Operational Noise Levels (Day/Evening)
$L_{Aeq(15min)}$ dB(A) re: 20 x 10^{-6} Pa

Reference Location	Description	Predicted $L_{Aeq,15min}$ Sound Pressure Level	Assessment $L_{Aeq,15min}$ Goal (Day/Evening)	Compliance
Operational Noise - Calm				
A1	1 Dunnstaffnage Place	25.5	39	√
A2	24 Regulus Street	28.6	39	√
A3	32 Shaula Crescent	38.7	39	√
A4	12 Shaula Crescent	37.6	39	√

Table 10: Predicted Operational Noise Levels (Day/Evening) cont.
$L_{Aeq(15min)}$ dB(A) re: 20 x 10^{-6} Pa

Reference Location	Description	Predicted $L_{Aeq,15min}$ Sound Pressure Level	Assessment $L_{Aeq,15min}$ Goal (Day/Evening)	Compliance
Operational Noise – North-west wind				
A1	1 Dunnstaffnage Place	20.9	39	√
A2	24 Regulus Street	25.1	39	√
A3	32 Shaula Crescent	34.6	39	√
A4	12 Shaula Crescent	37.9	39	√

Table 11: Predicted Operational Noise Levels (Night)
$L_{Aeq(15min)}$ dB(A) re: 20 x 10^{-6} Pa

Reference Location	Description	Predicted $L_{Aeq,15min}$ Sound Pressure Level	Assessment $L_{Aeq,15min}$ Goal (Night)	Compliance
Operational Noise - Calm				
A1	1 Dunnstaffnage Place	24.4	38	√
A2	24 Regulus Street	26.3	38	√
A3	32 Shaula Crescent	29.6	38	√
A4	12 Shaula Crescent	29.5	38	√
Operational Noise – South wind				
A1	1 Dunnstaffnage Place	32.9	38	√
A2	24 Regulus Street	37.9	38	√
A3	32 Shaula Crescent	39.7	38	+1.7
A4	12 Shaula Crescent	37.5	38	√
Operational Noise – South-west wind				
A1	1 Dunnstaffnage Place	27.2	38	√
A2	24 Regulus Street	35.9	38	√
A3	32 Shaula Crescent	39.0	38	+1.0
A4	12 Shaula Crescent	39.8	38	+1.8

The modelling scenarios selected represent a range of activities, situations and noise levels likely to be emitted from the site activities. The modelling assumed all plant and equipment operating simultaneously and typical operations that are consistent for day / evening and night operations. Whilst these situations would not occur all of the time, the noise modelling represents the likely worst-case operating scenarios.

In terms of intermittent activities during night-time hours, the modelling considered the noise levels presented in *Table 7* and source locations along the eastern sides of the proposed warehouses to represent the potential most exposed locations for residential areas to the north. Preliminary modelling identified potential noise exceedances to the north and north-east in the absence of additional noise controls. Accordingly a three (3.0) metre high acoustic wall erected constructed adjacent the northern side of the night drop off zone for Warehouse 2 was recommended. Furthermore site operational management would be implemented to limit night-time container drop off for Warehouse 2 to this specified area. *Table 12* presents the predicted $L_{A1,1min}$ noise levels and assessment goals for reference receiver locations with the incorporation of the acoustic wall.

Table 12: Predicted Intermittent Noise Levels
$L_{A1,\ 1min}$ dB(A) re: 20 x 10^{-6} Pa

Reference Location	Description	Predicted $L_{A1,1min}$ Sound Pressure Level	Assessment $L_{A1,1min}$ Goal (Night)	Compliance
Intermittent Noise - Calm				
A1	1 Dunnstaffnage Place	19-25	48	√
A2	24 Regulus Street	21-32	48	√
A3	32 Shaula Crescent	21-36	48	√
A4	12 Shaula Crescent	18-34	48	√

6.2 Assessment

The noise predictions show that during calm meteorological conditions the predicted operational (L_{Aeq}) noise levels during day / evening and night scenarios (*Tables 10 & 11*) satisfy the recommended assessment goals at the reference receiver locations. During adverse meteorological conditions of south and south-west wind, marginal technical exceedances (1-1.8dB(A)) are predicted for reference locations R3 and R4. Reference to the *INP* *Chapter 11* a development is deemed non-compliant when the level is more than 2dB(A) above the statutory consent or licence conditions. In terms of night-time intermittent activities assessed in accordance with the *NGLG*, predicted (L_{A1}) noise levels (*Table 12*) satisfy the recommended assessment goals.

6.3 Operational Noise Control Recommendations and Management

The results of the noise modelling have shown that predicted levels from the proposed facility generally satisfy the recommended assessment goals with effective implementation of a range of operational management and noise amelioration measures. Marginal technical exceedances (1-1.8dB(A)) are predicted for reference locations R3 and R4. To mitigate potential noise impacts, the following control measures have been recommended and considered in the noise modelling. Prior to construction all noise control measures should be reviewed and assessed in accordance with Approval Conditions and approved by an Acoustic Consultant.

- Site layout generally in accordance with *Figure 2* Drawing No. 080225-DA-002 prepared by PacLib Industrial;
- The plant sound power levels or equivalent nominated in *Table 6* are satisfied;
- Air-conditioning systems and exhaust fans selected on acoustic performance and subject to detailed acoustic review and assessment prior to final specification to ensure that noise goals are satisfied;
- Details of mechanical plant, equipment, processes and activities shall be subject to detailed review by an Acoustic Consultant prior to final specification;
- Space averaged internal noise levels controlled to $L_{Aeq,15min}$ 60dB(A) or less within warehousing and distribution areas (Warehouse 1 & 3);
- *Building Construction – Warehouse 2*

  (Printing)

  - Roof construction acoustically upgraded to provide a minimum installed noise reduction in order of 37dB(A) or Rw43;
  - Wall (west) construction acoustically upgraded to provide a minimum installed noise reduction in order of 29dB(A) or Rw35 *(eastern side of printing area separated from external façade by workshop and computer room)*

OR

- Provide acoustic enclosure / 'room' to contain printing machines in order to reduce space averaged internal noise levels at the internal surface of the building walls to L_{Aeq} 75dB(A) and roof to L_{Aeq} 67dB(A) or less;

OR

- Selection of printing machines to reduce space averaged internal noise levels at the internal surface of the building walls to L_{Aeq} 75dB(A) and roof to L_{Aeq} 67dB(A) or less;

(Finishing)

- Roof construction acoustically upgraded to provide a minimum installed noise reduction in order of 27dB(A) or Rw33;

OR

- Provide acoustic enclosure / 'room' to contain finishing machines in order to reduce space averaged internal noise levels at the internal surface of the roof to L_{Aeq} 65dB(A) or less;

OR

- Selection of finishing machines to reduce space averaged internal noise levels at the internal surface of the building roof to L_{Aeq} 65dB(A) or less;

- *Building Construction – General*
  - Building wall cladding (Warehouse 1 and 3) precast concrete tilt-up panels (Rw40-45) up to 2400mm above FFL and steel wall cladding (0.6mm BMT) above 2400mm FFL *(Noting upgraded acoustic performance required for Warehouse 2 – Print/Finish Areas)*;
  - Building roof cladding (Warehouse 1 and 3) consisting of sheet metal (min. 0.6BMT) over fibreglass building blanket and medium duty thermofoil or similar and provide an minimum installed Rw22 or greater *(Noting upgraded acoustic performance required for Warehouse 2 – Print/Finish Areas)*;

- Any translucent panels proposed within warehouse building façades or roofs shall be specified taking into account required acoustic performance in order to control breakout noise from internal activities. Particular attention should be given to the printing and finishing areas. Any proposed translucent panel areas shall be subject to detailed review by Acoustic Consultant prior to final specification;
- Any penetrations of roof or walls shall be acoustically detailed to control breakout noise. All penetration details should be subject to acoustic review prior to final specification;
- Specification of fast acting roller doors for warehouse buildings and controlled to remain closed except for short duration opening to allow truck and/or fork truck access. Proposed fast acting roller doors selected on acoustic performance and provided a minimum installed noise reduction of 20dB(A);
- Construction of an acoustic wall (Boral Ezyshield, Fleetwood, Sentinel, masonry or equivalent) to a height not less than three (3) metres above FFL (RL66.9) extending from the eastern building façade approximately 30m east and adjacent the northern side of the night drop off zone (*Figure 2*). The acoustic wall would be subject to review by qualified Acoustic Consultant following DA Approval and during the design development phase of the project to ensure compliance with Consent Conditions;
- Where practical fixed and mobile plant be fitted with low level or broadband 'quacker' reversing alarms;

- A Site Operational Noise Management Plan developed for the site. The SONMP would include:
  - induction and certification for truck drivers to operate trucks on the site at less than 20km/h;
  - induction an certification for truck drivers to operate trucks without exhaust brakes whilst on site
  - procedures for residents to contact site management in regard to complaints or additional information;
  - follow-up procedures to inform residents of actions implemented following any noise complaints;
  - regular inspections of all site plant including trucks to ensure that the installed noise suppression units are functioning and require no maintenance; and,
  - regular audits at sensitive receiver locations to identify additional procedures to minimise noise emissions from the site.
- Within three (3) months of commissioning of the facility, site inspections and noise measurements be conducted by a qualified Acoustic Consultant to demonstrate that the operation of the facility satisfies the project specific noise goals.

7.0 CONCLUSION

PacLib Group Pty Ltd propose to develop a vacant site at Erskine Park to accommodate proposed printing, warehouse and distribution facilities. The site is located within the Erskine Park Employment Area located on Lenore Drive, Erskine Park (*Figure 1*).

Site inspections and noise measurements confirmed that the noise environments at potentially exposed noise receiver locations is influenced by domestic activities including dogs and birds, distant and local road traffic noise and distant activities associated with isolated industrial sites (operation and construction) within the Erskine Park Employment Area to the south. Referenced to the *INP* and additional discussions with *DoP* the residential areas potentially exposed to noise from the subject development would be described as *Suburban*.

The nearest potentially affected residential areas are located to the north-west, north and north-east of the proposed development and approximately 180m to 320m from the proposal at its closest point. *Figure 1* identifies the receiver locations selected for noise assessment.

Goals for the assessing environmental noise impacts from the proposal have been developed from procedures documented in the *DECC, Industrial Noise Policy (INP),* and *Noise Guide for Local Government (NGLG)*.

Noise modelling considered twenty-four (24) hour operation with operating scenarios representing day / evening and night activities. The noise modelling represents a range of activities, situations and noise levels likely to be emitted from the site with all plant

and equipment operating simultaneously. The predictions conducted in accordance with *INP* procedures show that during calm meteorological conditions the operational noise levels satisfy the recommended project assessment goals. During adverse meteorological conditions of south and south-west wind, marginal technical exceedances (1-1.8dB(A)) are predicted for reference locations R3 and R4. Reference to the *INP* *Chapter 11* a development is deemed non-compliant when the source noise level is more than 2dB(A) above the statutory consent or licence conditions.

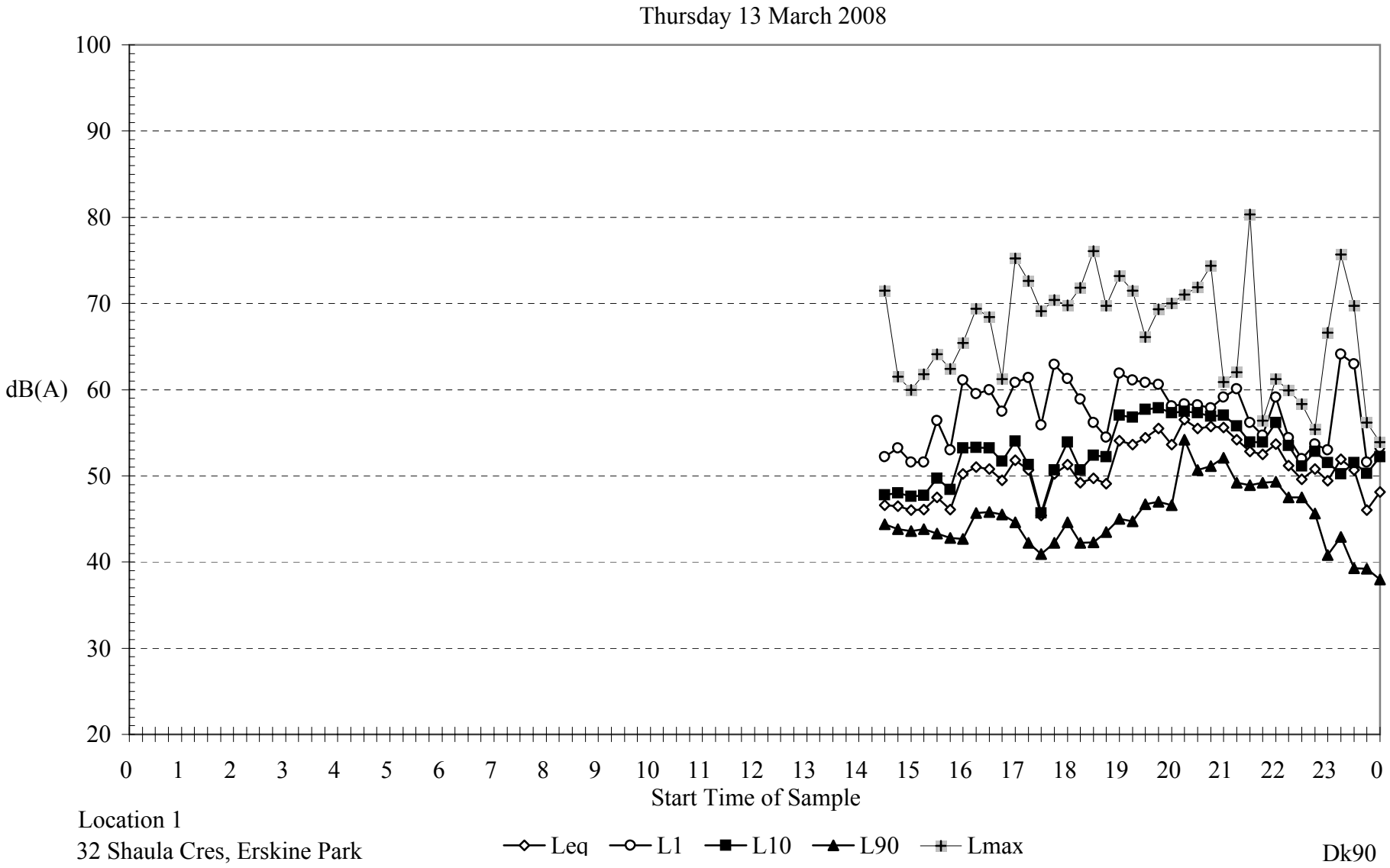
Noise modelling for envisaged night-time activities has shown that intermittent noise sources satisfy the *NGLG* disturbance goals.

The results and findings presented in this report are based on site operations and management procedures in accordance with the assumptions presented in *Section 6.1*, and the understanding that effective site management and noise mitigation controls (*Section 6.3*) are incorporated into the design and operation of the facility.

It is acknowledged that the noise assessment has been conducted for typical plant and equipment established from data from similar facilities in respect of fixed mechanical and print/finishing activities. Therefore the noise modelling adopted a number of assumptions that are documented in the report. Accordingly the assessment has recommended that a qualified acoustic consultant be engaged during the design development phase to review specifications and activities to ensure the acoustic requirements for the project can be achieved and Consent Conditions satisfied.

APPENDIX 1: AMBIENT NOISE MEASUREMENT RESULTS

Ambient Sound Pressure Levels



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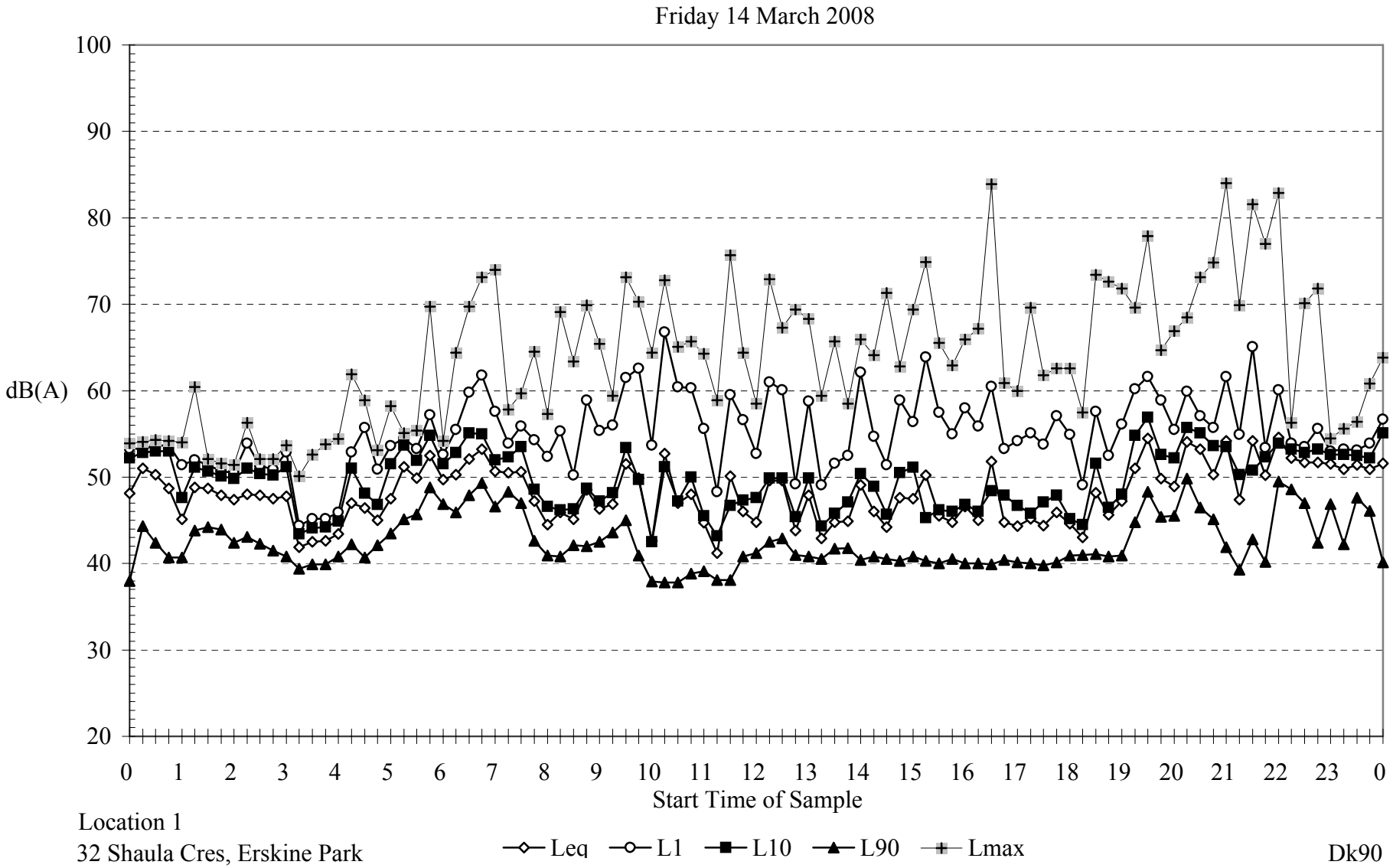
Ambient Sound Pressure Levels



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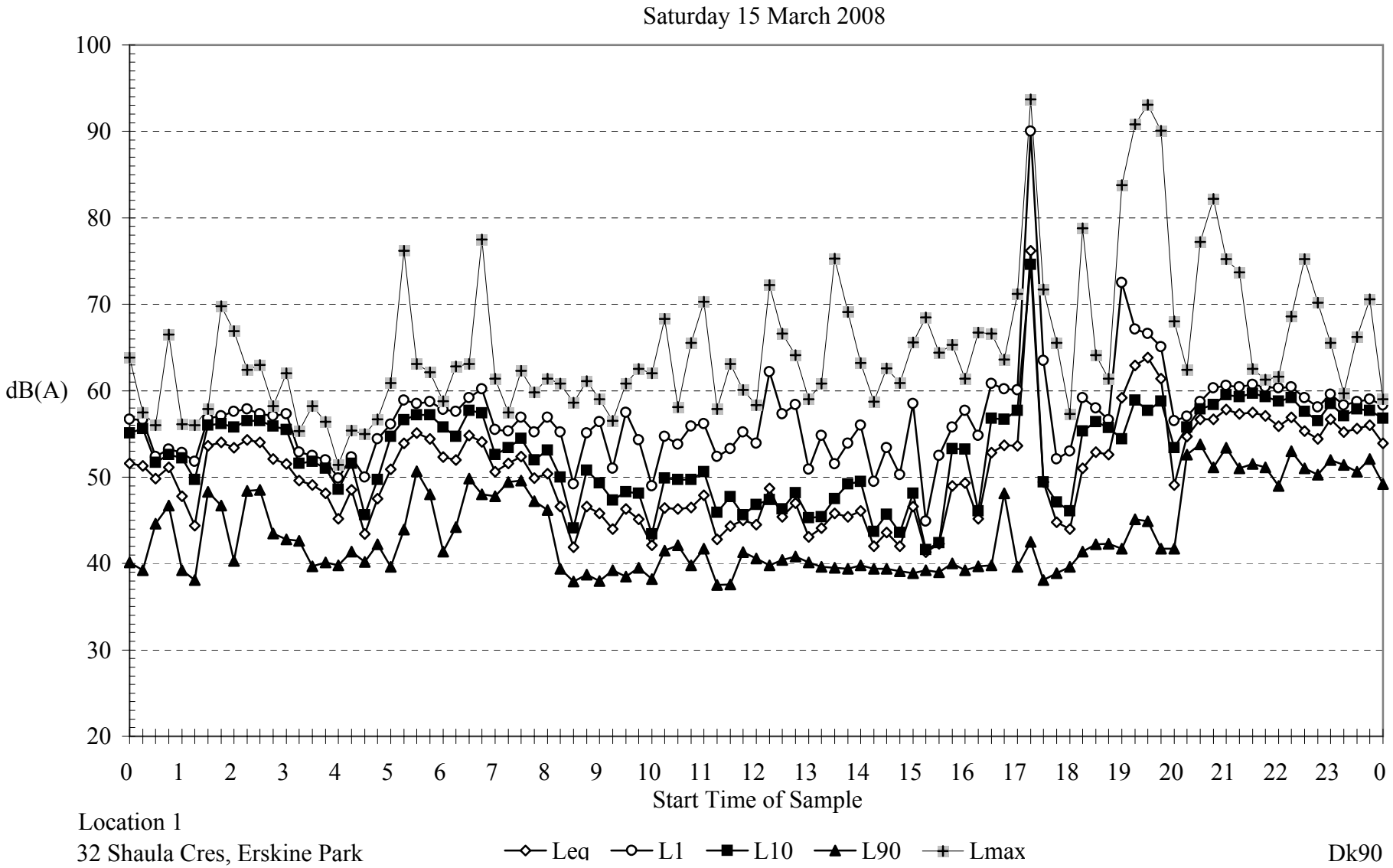

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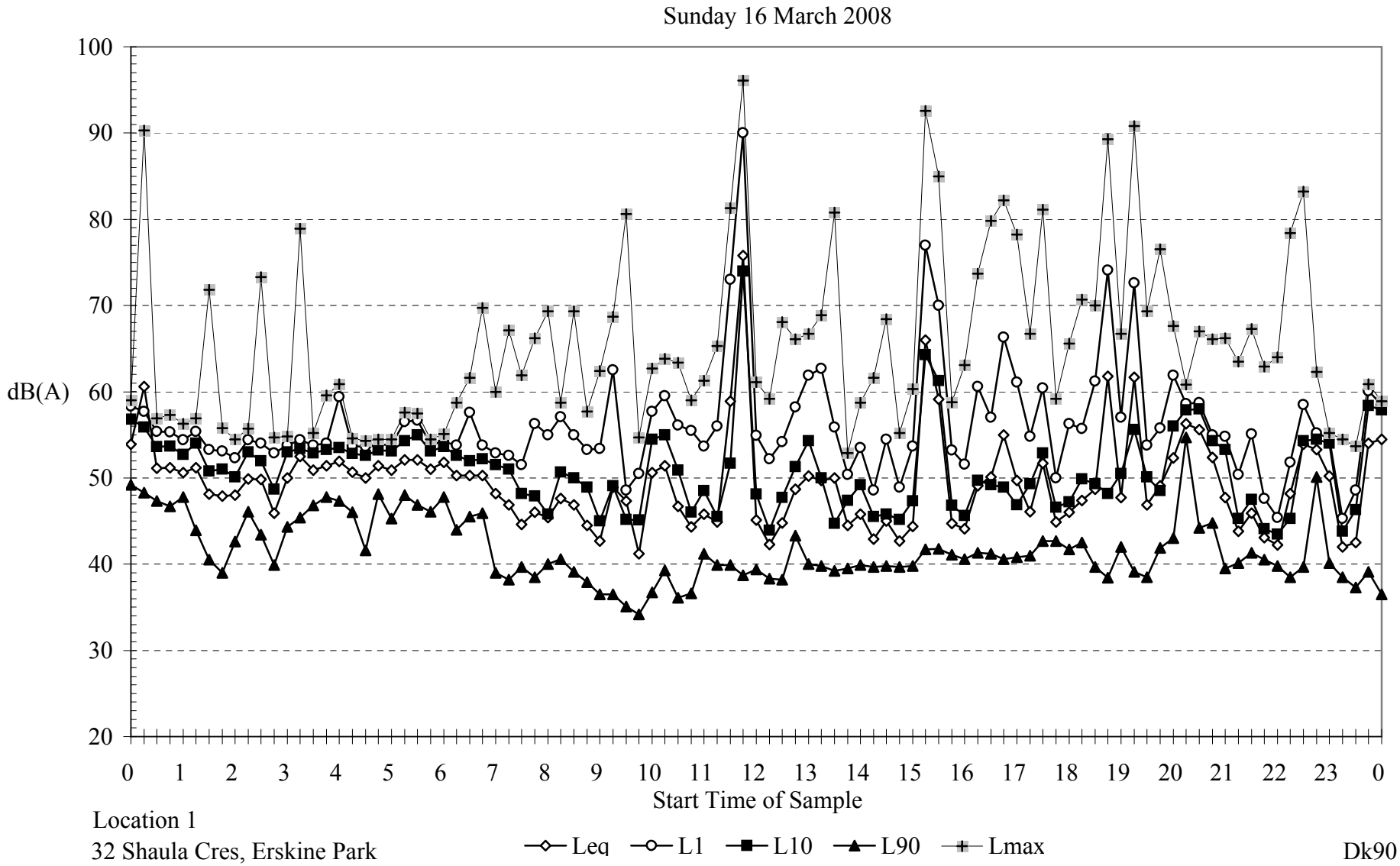

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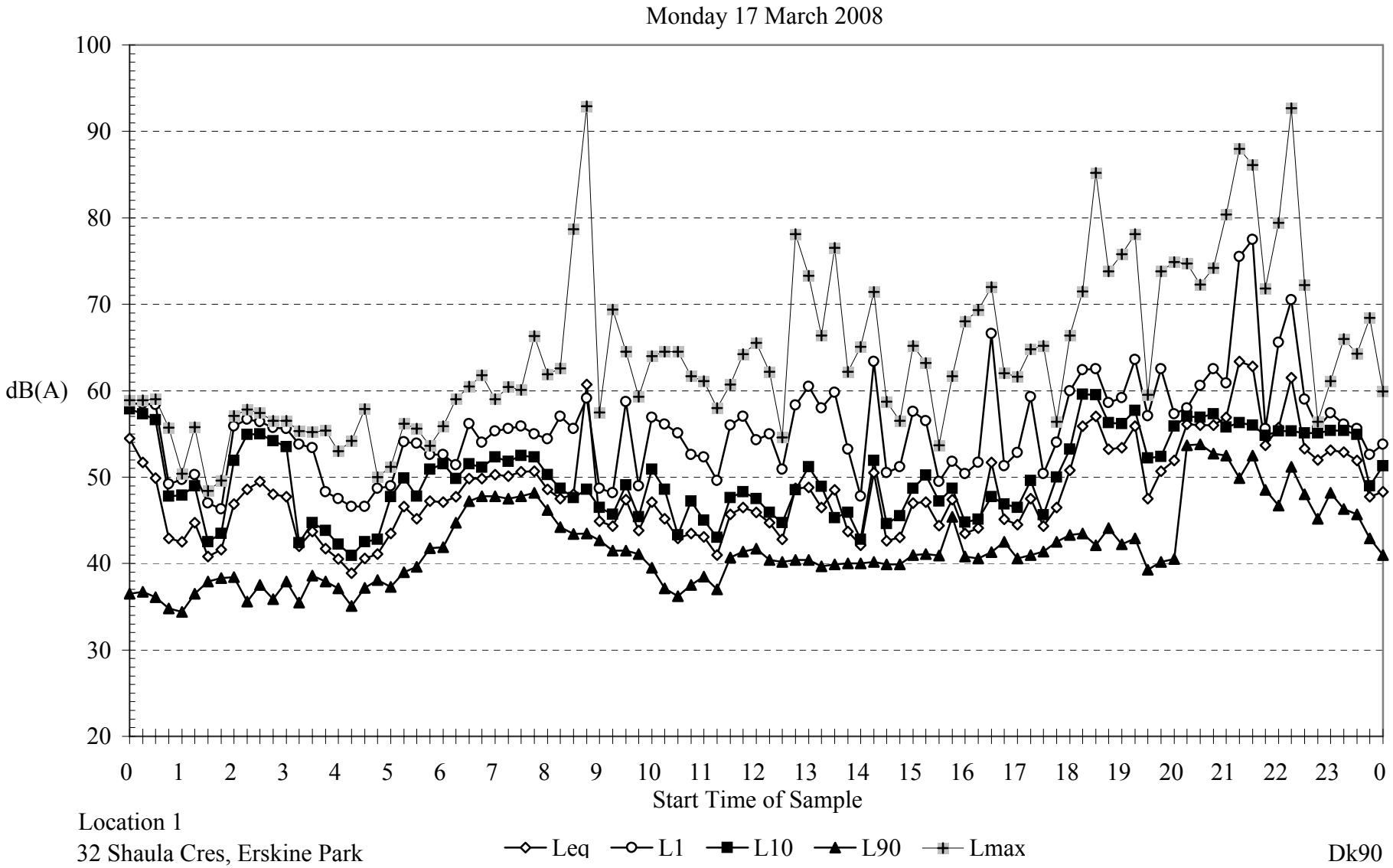

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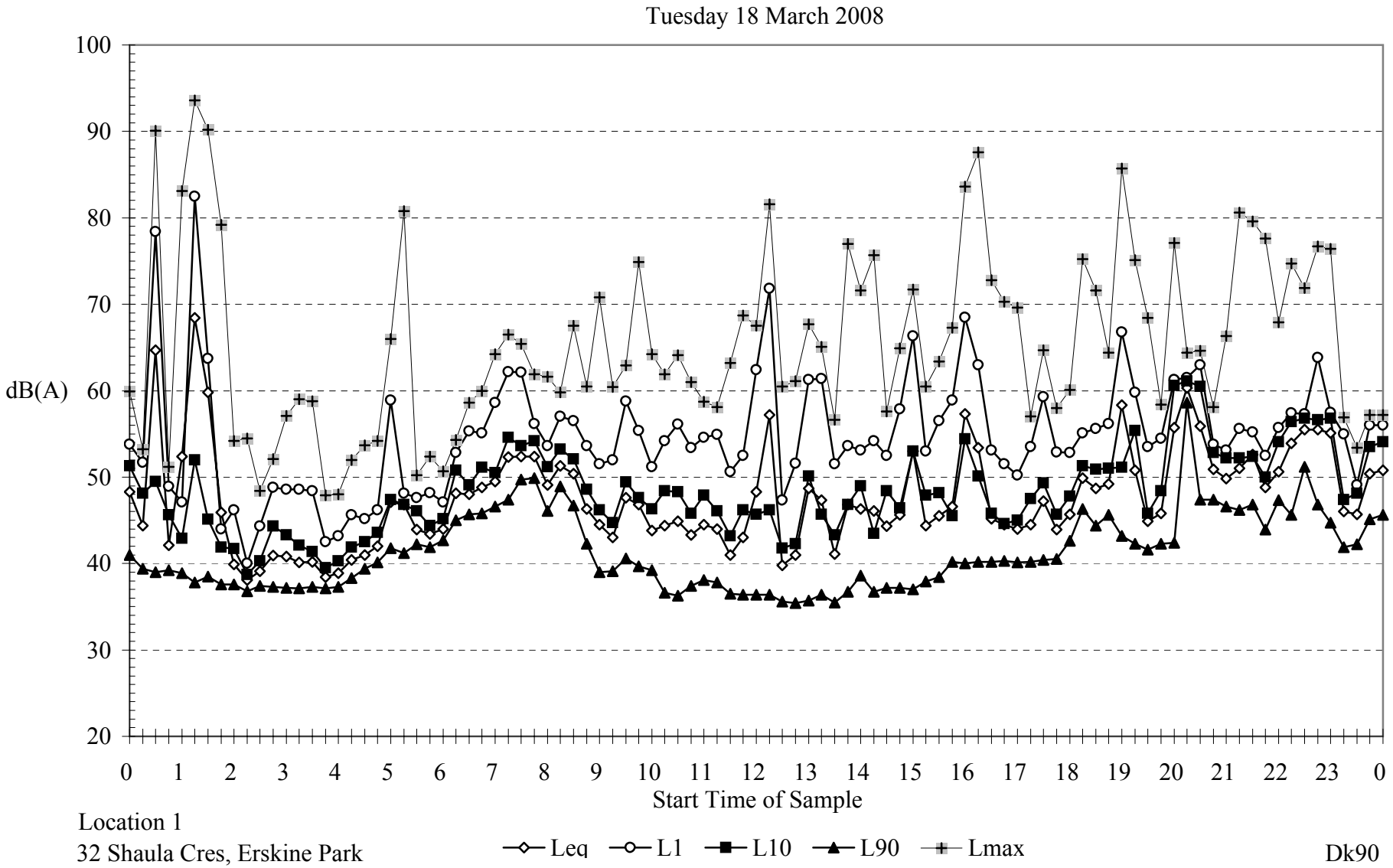

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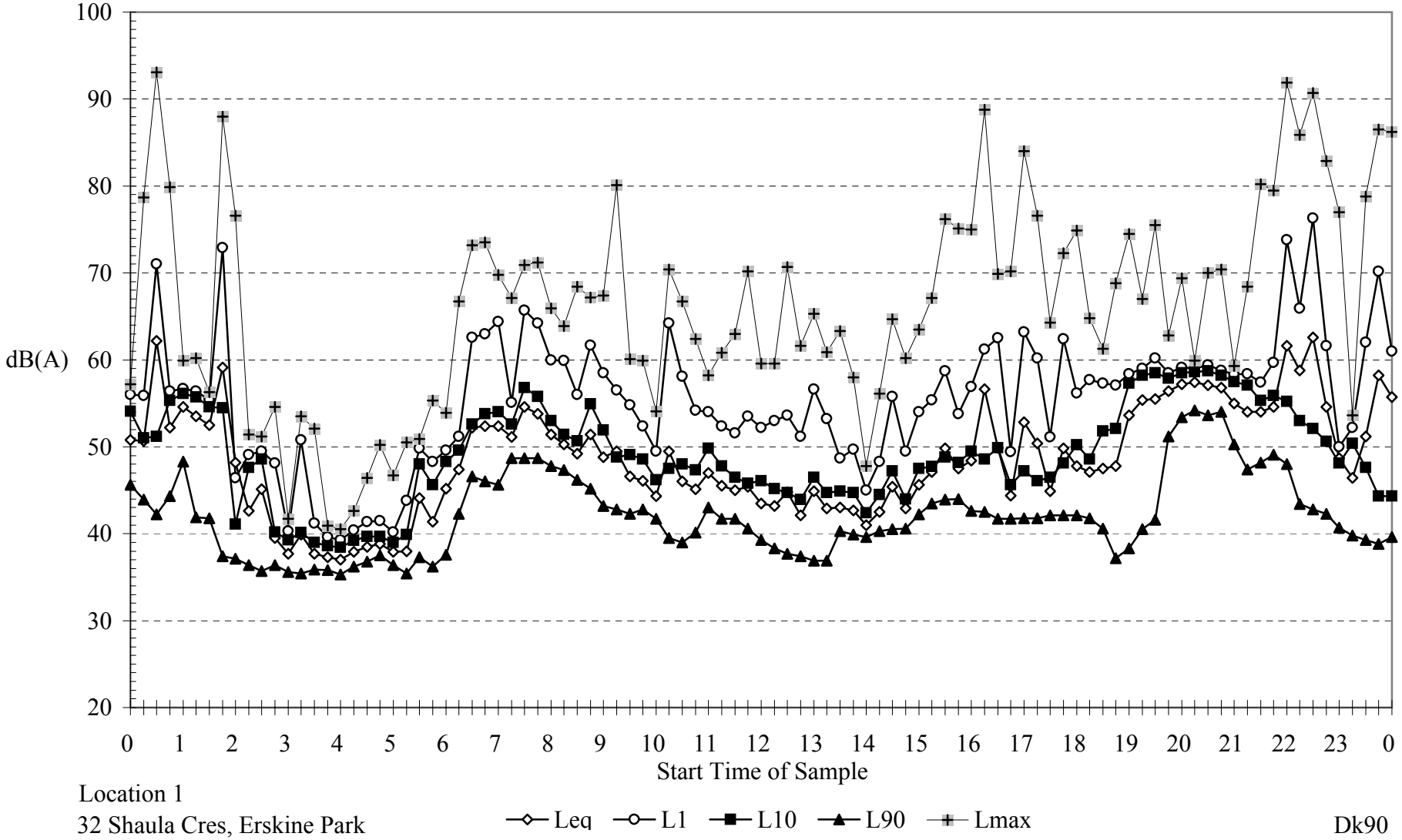
Ambient Sound Pressure Levels

Wednesday 19 March 2008



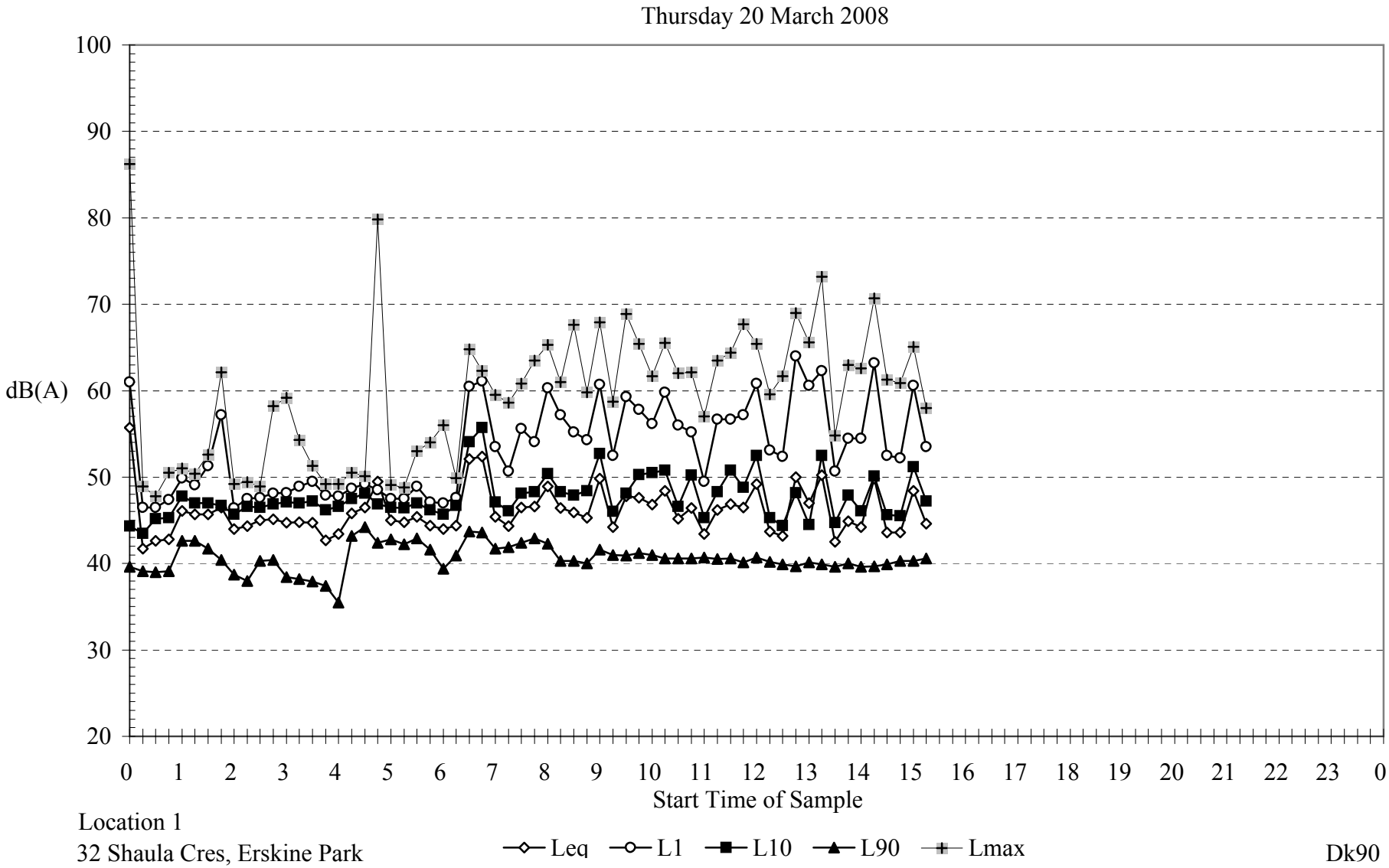
Location 1

32 Shaula Cres, Erskine Park

Dk90

6301r1.xls

Ambient Sound Pressure Levels



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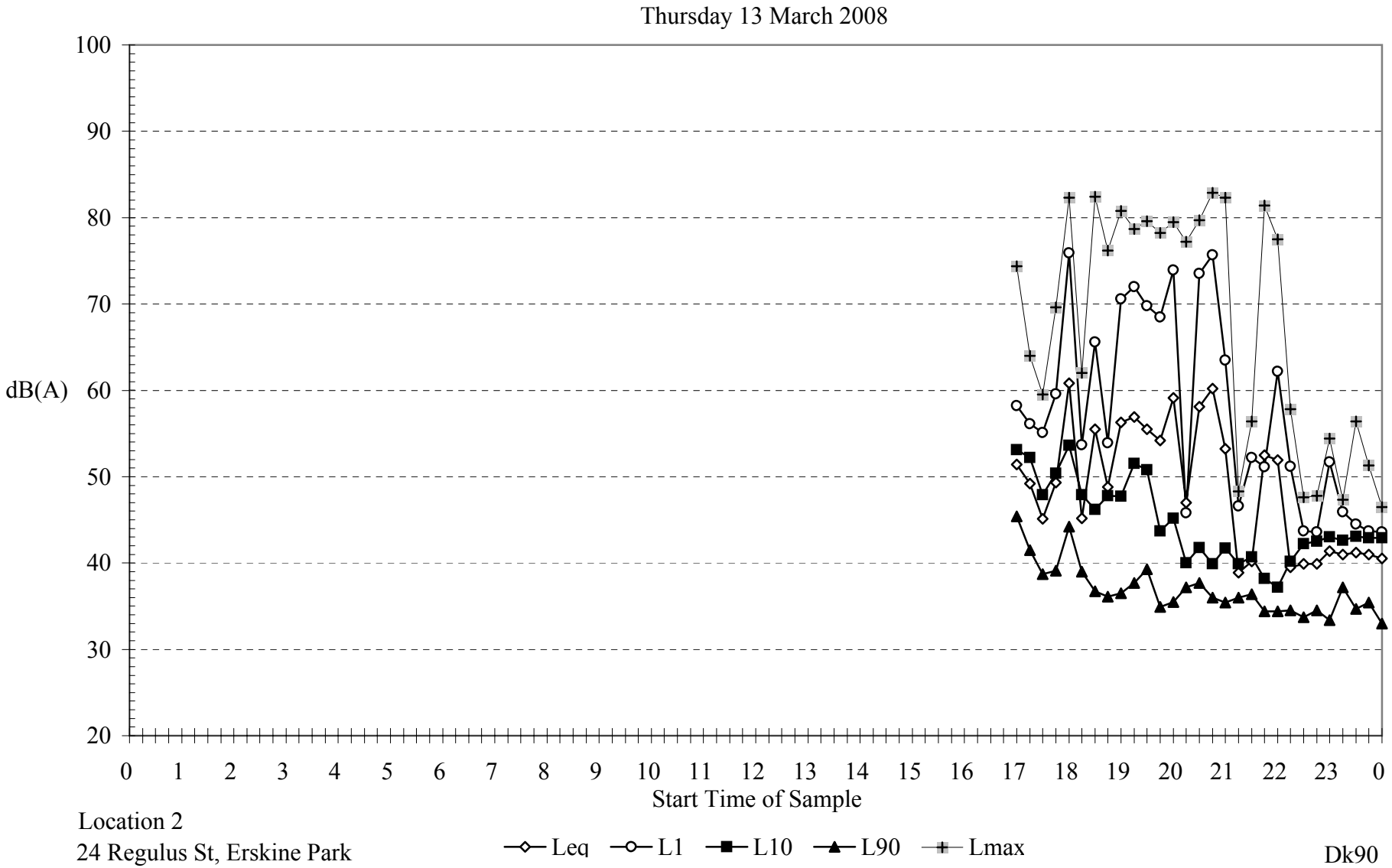

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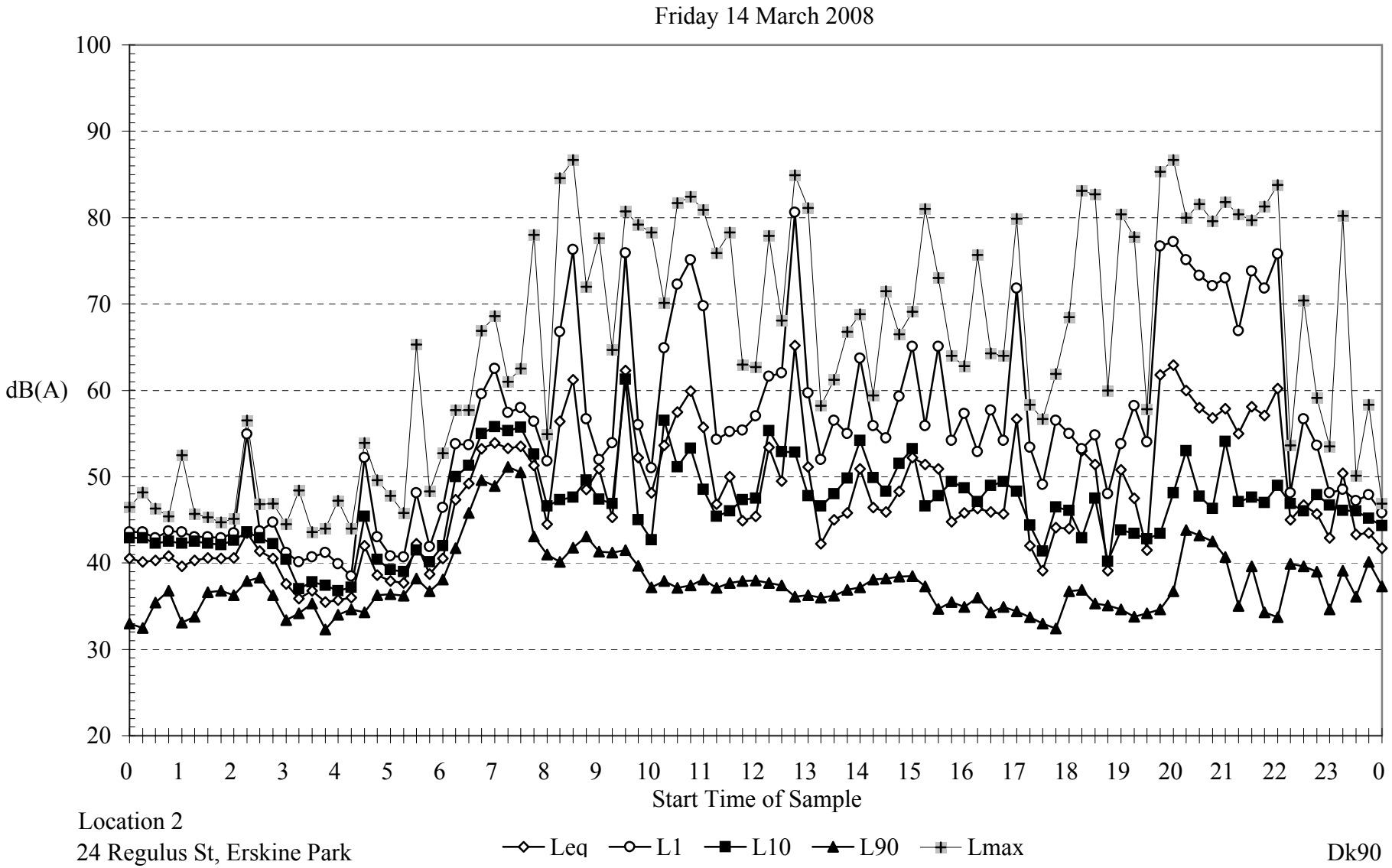

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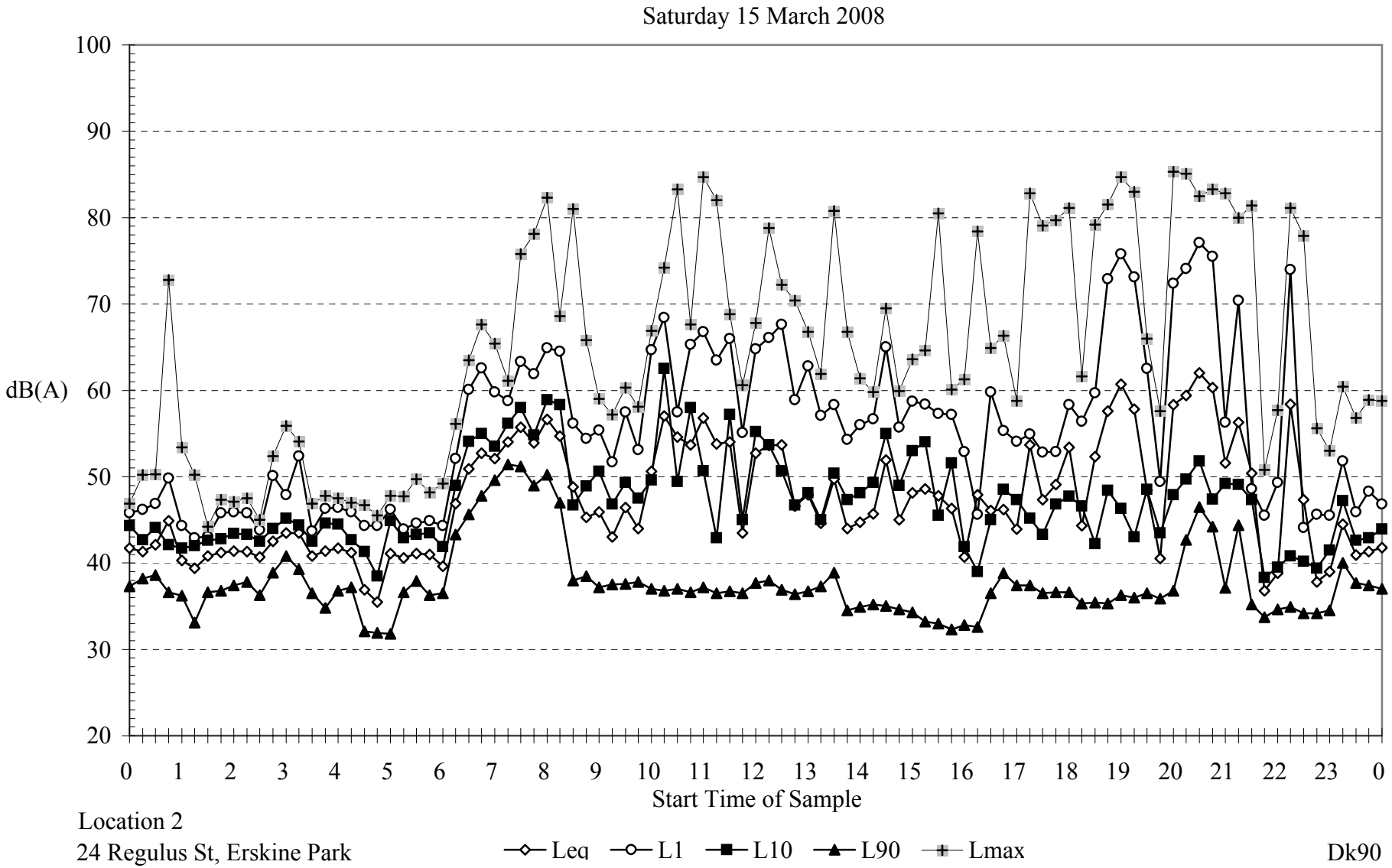

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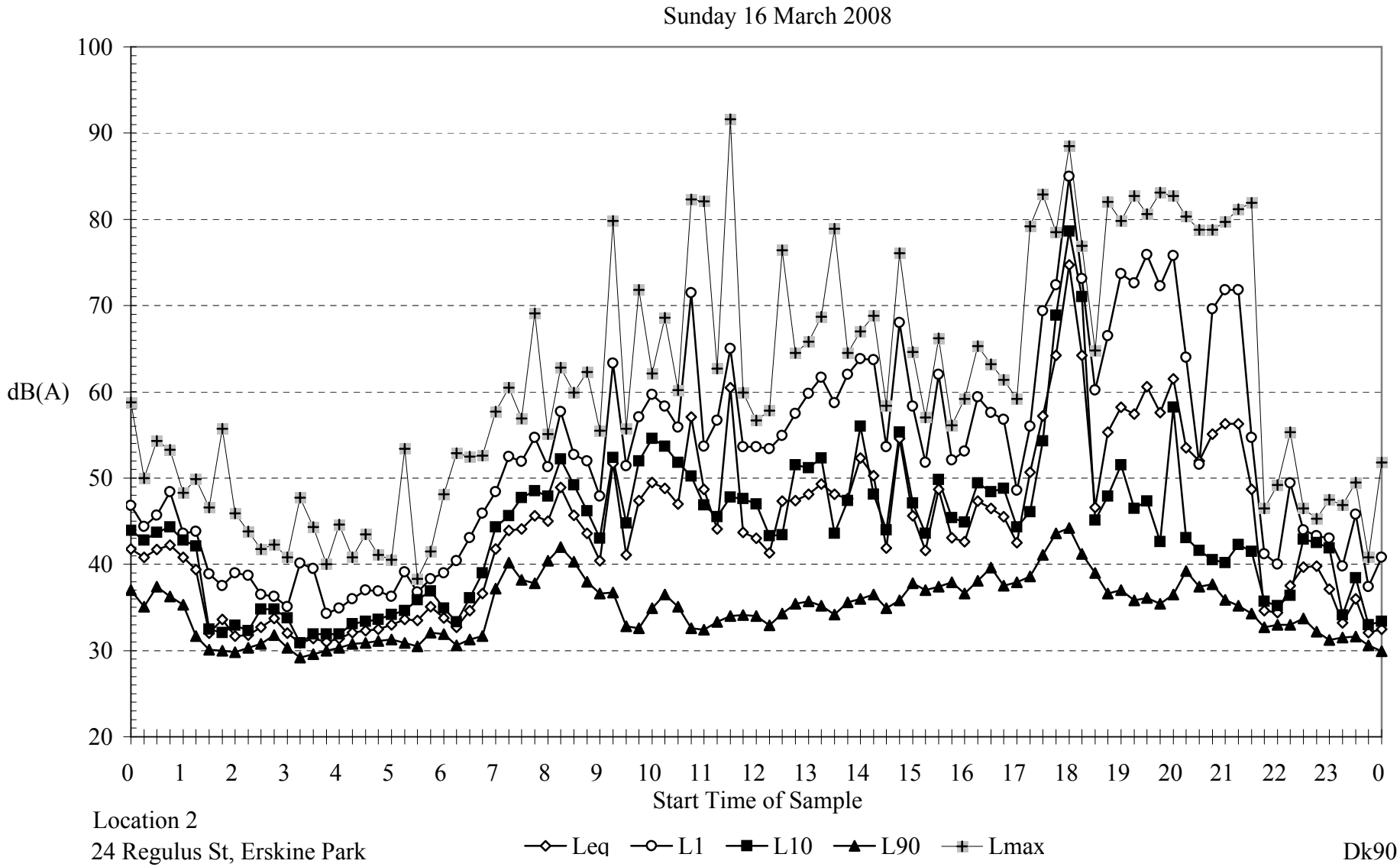

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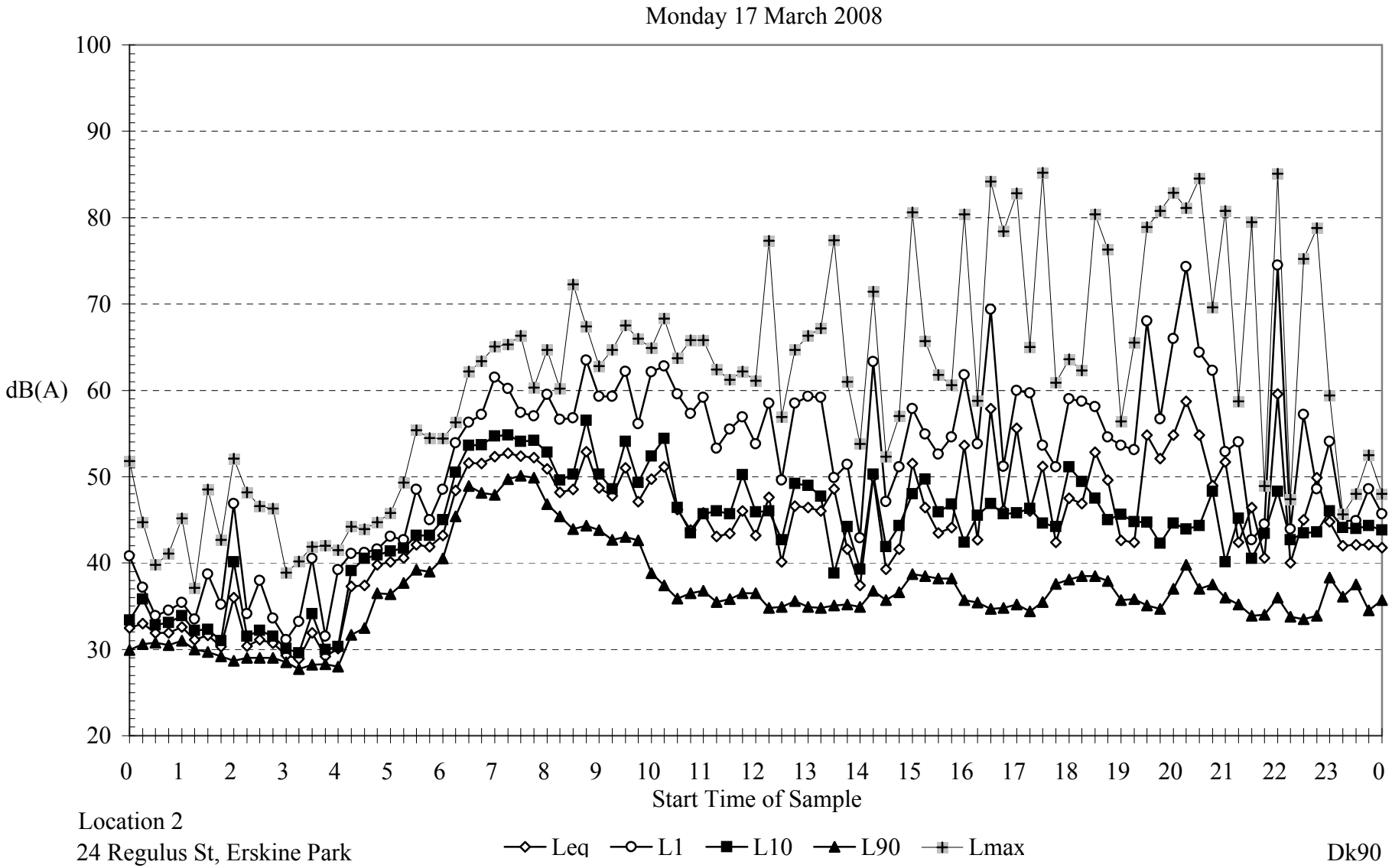

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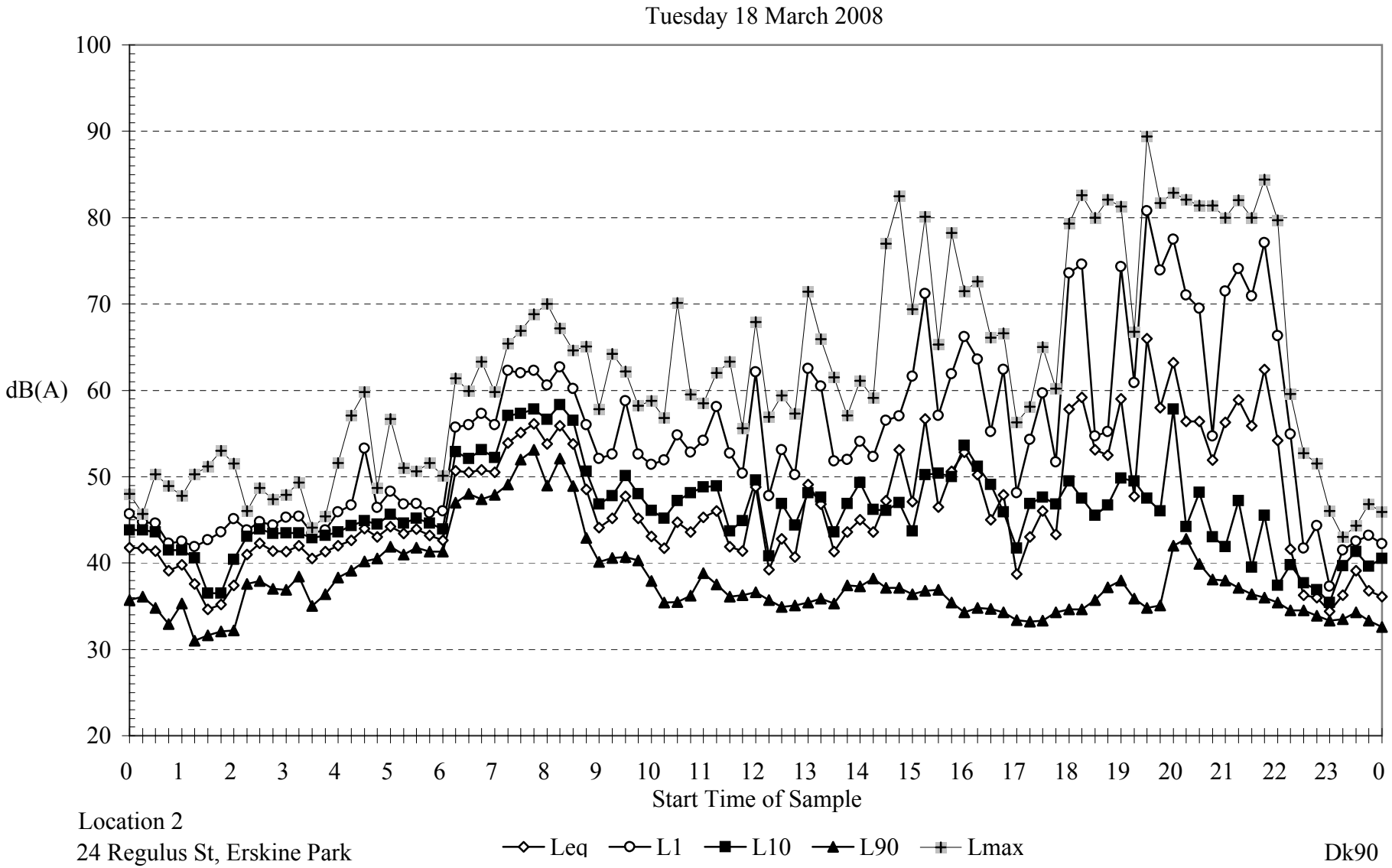

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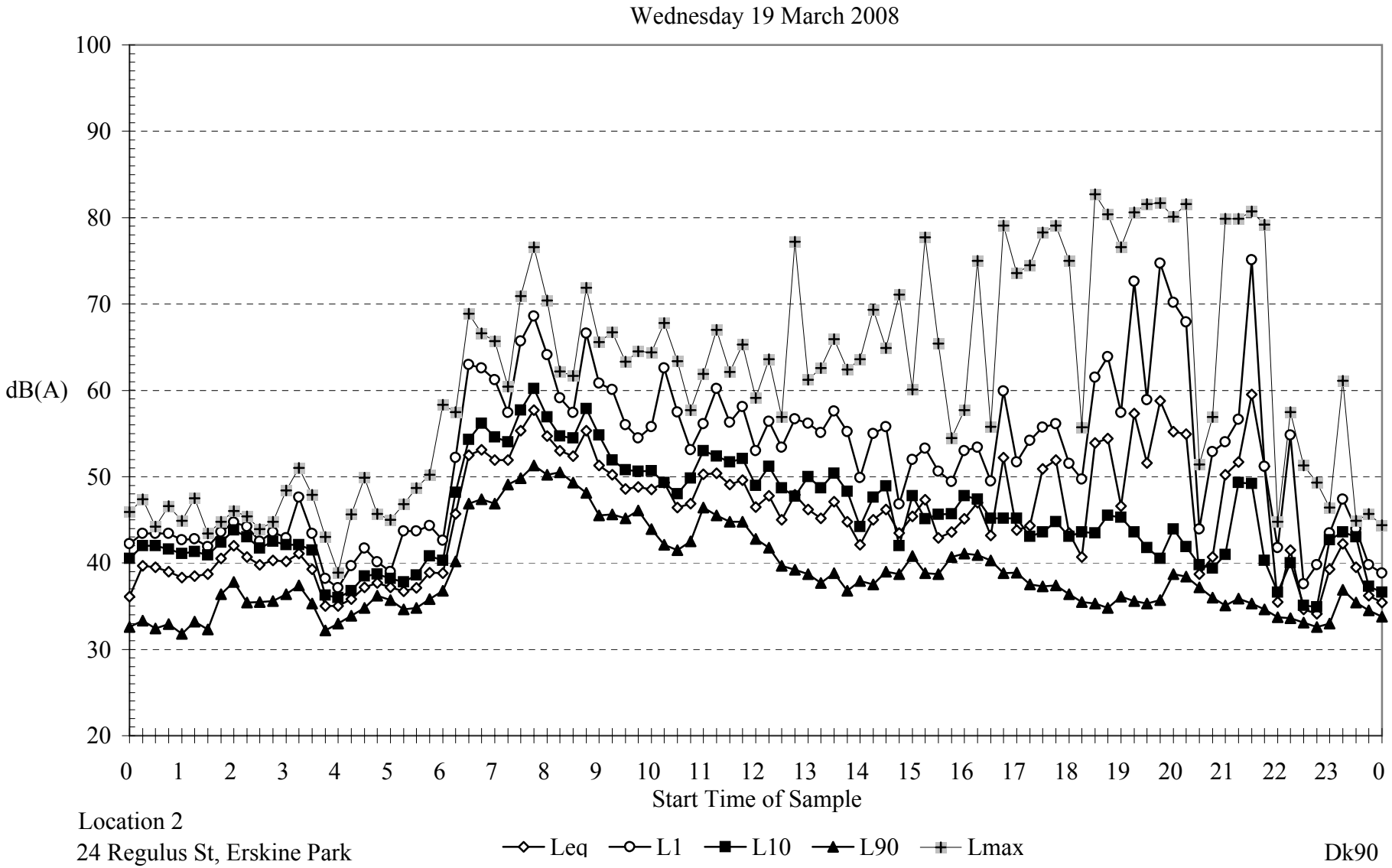

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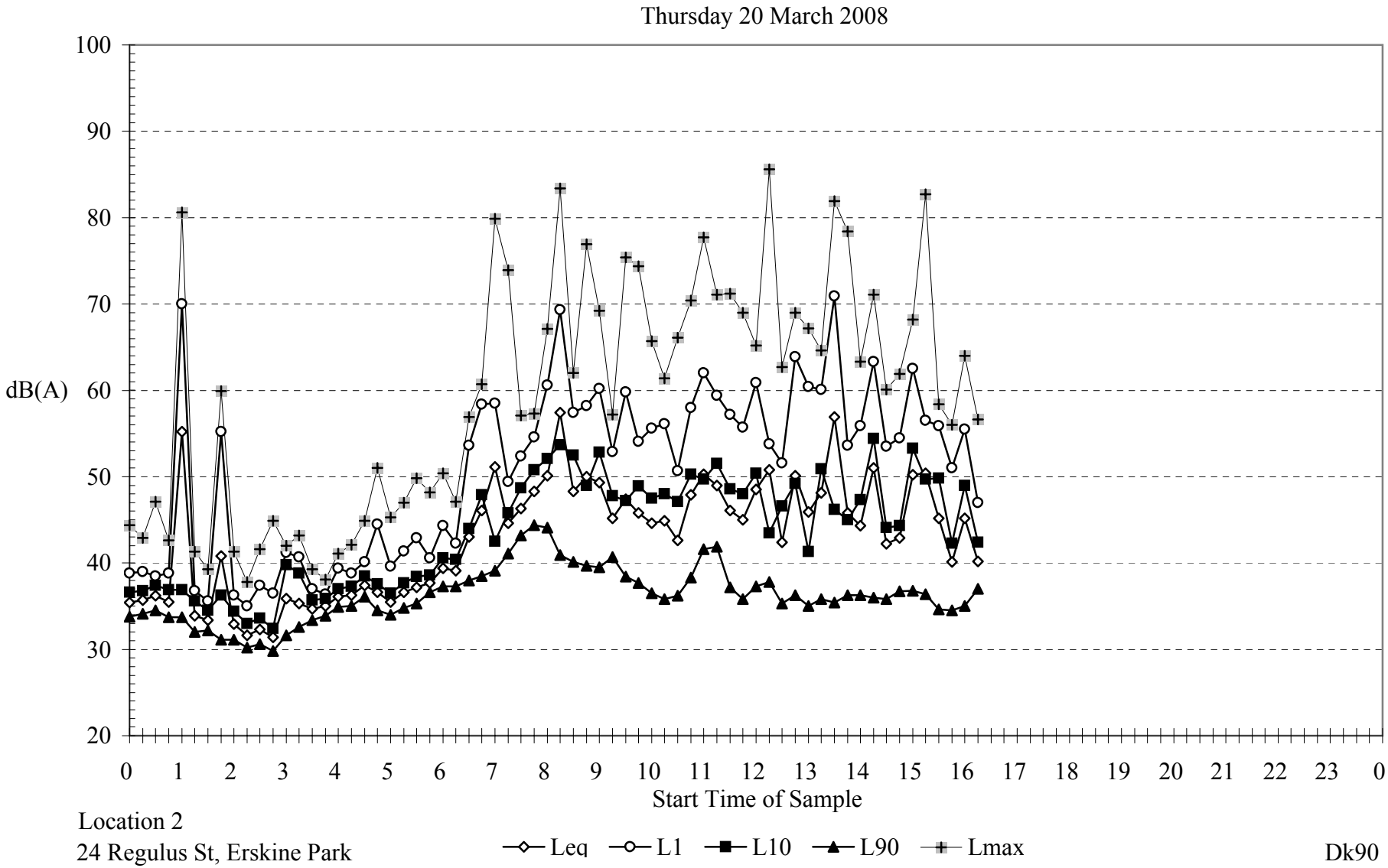

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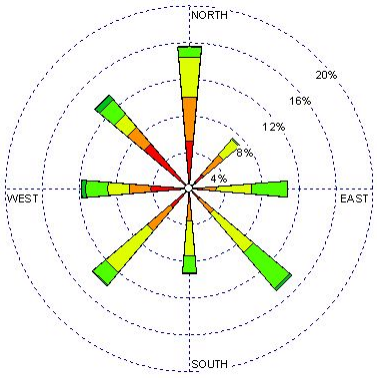
APPENDIX 2: WIND ROSES – HORSLEY PARK

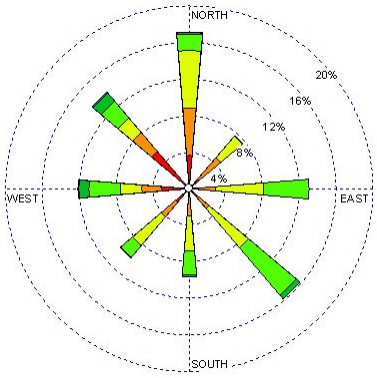
Wind Rose Plots for the Referenced Meteorological Station - Bureau of Meteorology
Horsley Park Equestrian Centre AWS (2002-2007) – DAY TIME

All Seasons



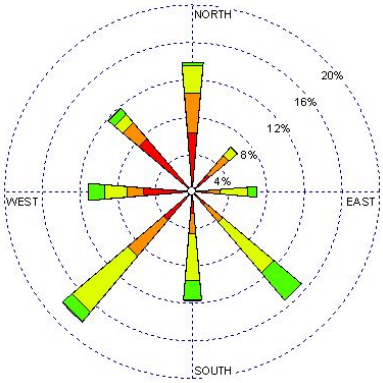
Average Wind Speed: 3.78 m/s
Calms Frequency: 3.41 %
Axis Frequencies: 4%, 8%, 12%, 16%, 20%

Summer (December – February)



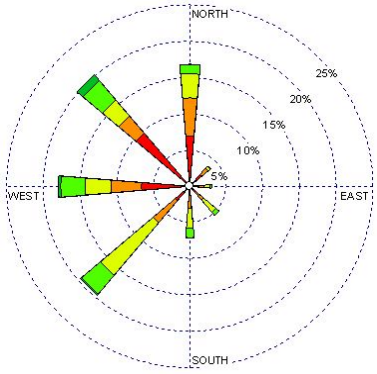
Average Wind Speed: 4.22 m/s
Calms Frequency: 1.49 %
Axis Frequencies: 4%, 8%, 12%, 16%, 20%

Autumn (March – May)



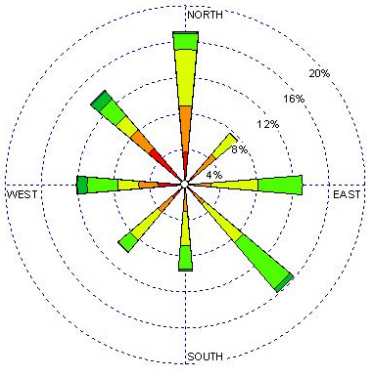
Average Wind Speed: 3.28 m/s
Calms Frequency: 4.78 %
Axis Frequencies: 4%, 8%, 12%, 16%, 20%

Winter (June – August)



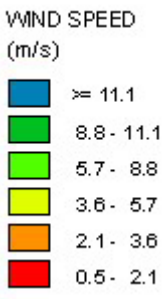
Average Wind Speed: 3.35 m/s
Calms Frequency: 6.24 %
Axis Frequencies: 5%, 10%, 15%, 20%, 25%

Spring (September – November)



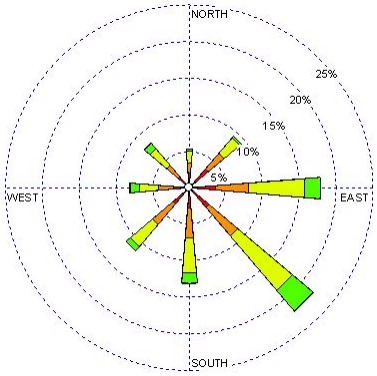
Average Wind Speed: 4.31 m/s
Calms Frequency: 0.92 %
Axis Frequencies: 4%, 8%, 12%, 16%, 20%

Legend



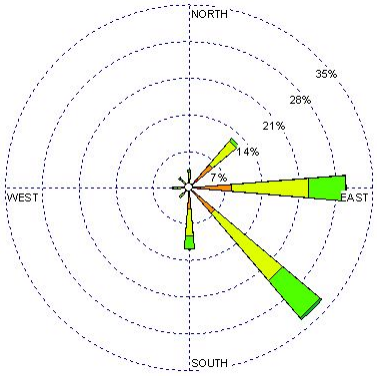
Wind Rose Plots for the Referenced Meteorological Station - Bureau of Meteorology
Horsley Park Equestrian Centre AWS (2002-2007) – EVENING TIME

All Seasons



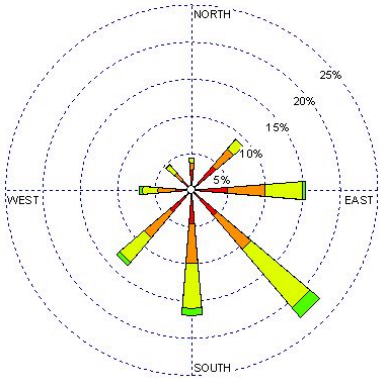
Average Wind Speed: 3.44 m/s
Calms Frequency: 4.75 %
Axis Frequencies: 5%, 10%, 15%, 20%, 25%

Summer (December – February)



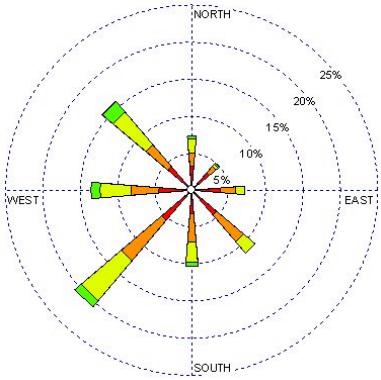
Average Wind Speed: 4.34 m/s
Calms Frequency: 0.63 %
Axis Frequencies: 7%, 14%, 21%, 28%, 35%

Autumn (March – May)



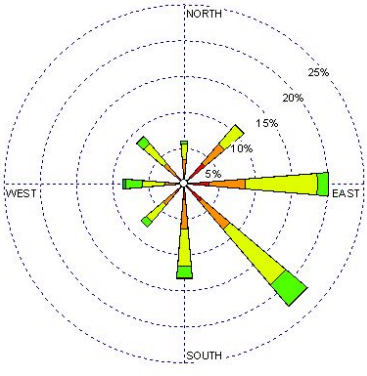
Average Wind Speed: 2.97 m/s
Calms Frequency: 6.66 %
Axis Frequencies: 5%, 10%, 15%, 20%, 25%

Winter (June – August)



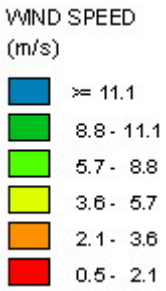
Average Wind Speed: 2.81 m/s
Calms Frequency: 9.21 %
Axis Frequencies: 5%, 10%, 15%, 20%, 25%

Spring (September – November)



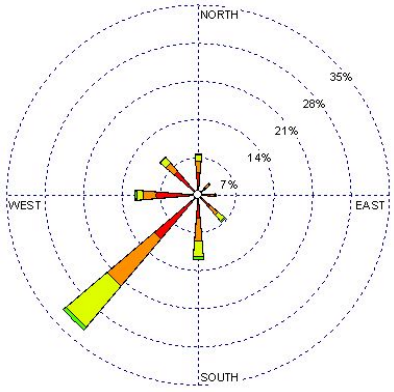
Average Wind Speed: 3.72 m/s
Calms Frequency: 2.11 %
Axis Frequencies: 5%, 10%, 15%, 20%, 25%

Legend



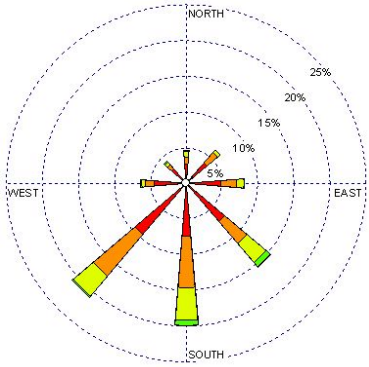
Wind Rose Plots for the Referenced Meteorological Station - Bureau of Meteorology
Horsley Park Equestrian Centre AWS (2002-2007) – NIGHT TIME

All Seasons



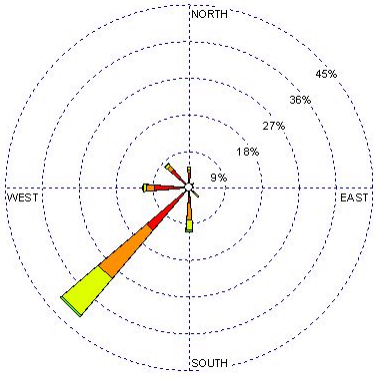
Average Wind Speed: 2.33 m/s
Calms Frequency: 14.09 %
Axis Frequencies: 7%, 14%, 21%, 28%, 35%

Summer (December – February)



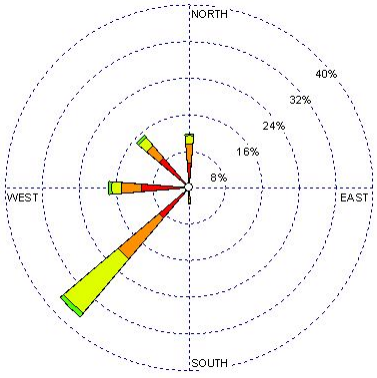
Average Wind Speed: 2.27 m/s
Calms Frequency: 14.25 %
Axis Frequencies: 5%, 10%, 15%, 20%, 25%

Autumn (March – May)



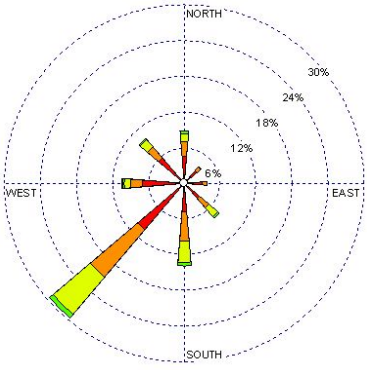
Average Wind Speed: 2.18 m/s
Calms Frequency: 16.91 %
Axis Frequencies: 9%, 18%, 27%, 36%, 45%

Winter (June – August)



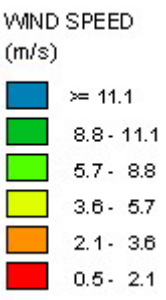
Average Wind Speed: 2.49 m/s
Calms Frequency: 13.39 %
Axis Frequencies: 8%, 16%, 24%, 32%, 40%

Spring (September – November)



Average Wind Speed: 2.40 m/s
Calms Frequency: 11.76 %
Axis Frequencies: 6%, 12%, 18%, 24%, 30%

Legend



APPENDIX 3: DEFINITION OF TERMS

A-Weighted: See dB(A)

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.

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

The table below lists examples of typical noise levels.

Sound Pressure Level (dB(A))	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	Curbside 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.

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_{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 will 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.

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 EPA 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.

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

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).

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 will 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.

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 monitoring period for the night.

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

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

Individual stationary 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 stationary 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.