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Proposed Waste Transfer Station, Macs Reef

Noise and Vibration Impact Assessment

Report Number 630.10044

14 February 2011

Environmental Planning Services Pty Ltd
Suite 4, Yacaaba Street
NELSON BAY NSW 2315 Version: Revision 0

Version: Revision 0

Proposed Waste Transfer Station, Macs Reef

Noise and Vibration Impact Assessment

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DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked	Authorised
630.10044	Revision 0	14 February 2011	John Cotterill	Nathan Archer	John Cotterill

EXECUTIVE SUMMARY

SLR Consulting has been commissioned by Environmental Planning Services Pty Ltd to undertake a Noise and Vibration Impact Assessment for the proposed Waste Transfer Station (WTS) located on Lot 7008 DP 96164 on the southern side of Macs Reef Road within the Bywong district, NSW.

Existing Environment

Ambient noise surveys were conducted to characterise and quantify the existing acoustical environment in the area surrounding the Macs Reef landfill site. A background monitoring survey was undertaken at two (2) residential locations on Macs Reef Road, considered representative of the nearest potentially-affected noise-sensitive receivers to the landfill.

These measurements were used to develop noise goals for operation of the WTS in accordance with Department of Environment Climate Change and Water (DECCW) *NSW Industrial Noise Policy* (INP) and *NSW Environmental Noise Control Manual* (ENCM). Traffic generated by the operation was assessed with reference to the *Environmental Criteria for Road Traffic Noise* (ECRTN).

Weather data from an automatic weather station at Canberra Airport was used to determine prevailing weather conditions for the site. Weather data was analysed in accordance with procedures outlined in the INP. Seasonal wind records indicate that wind from 0.5 m/s to 3 m/s did not exceed the 30% threshold during the daytime period.

Potential Impacts

The noise assessment has considered the following potential environmental noise impacts:

- Noise impact of construction and operation of the WTS at surrounding residential receivers.
- Vibration impact of construction and operation of the WTS at surrounding residential receivers.
- Cumulative impact of noise from any surrounding industrial sources.
- Traffic noise impact of transportation from the WTS.

EXECUTIVE SUMMARY

Noise Assessment

A computer model was used to predict noise emissions from operation of the proposed WTS.

The construction and operational noise modelling was undertaken using ENM noise modelling software. A three-dimensional digital terrain map giving all relevant topographic information was used in the modelling process. The model used this map, together with noise source data, ground cover, shielding by barriers and/or adjacent buildings and atmospheric information to predict noise levels at the nearest potentially affected receivers.

Conclusion

Noise modelling has indicated that the noise emissions from the operation of the development are predicted to be within the project specific noise levels at all assessed receiver locations.

Construction noise levels are predicted to be within the noise affected criterion at all receiver locations. Various noise management techniques have been presented in this report to reduce the impact of construction noise on nearby residential receivers.

Traffic generated by the proposed development is predicted to be within the Environmental Criteria for Road Traffic Noise criteria.

Construction vibration levels are predicted to be considerably below the recommended damage and annoyance criteria vibration criteria at all receiver locations.

Vibration levels from operation of the development are predicted to be negligible at all receiver locations.

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1 INTRODUCTION

SLR Consulting has been commissioned by Environmental Planning Services Pty Ltd to undertake a Noise and Vibration Impact Assessment for the proposed Waste Transfer Station (WTS) located on Lot 7008 DP 96164 on the southern side of Macs Reef Road within the Bywong district, NSW (hereafter, "the Project Site").

Palerang Council, as part of its overall Waste Management Strategy is considering the construction of a small WTS on the site containing the Macs Reef Landfill to ensure that waste disposal services continue to be provided to the Wamboin/Bywong/Sutton East areas prior to the landfill reaching its capacity and closure in approximately 2-3 years time.

The noise assessment has been prepared with reference to Australian Standard AS 1055:1997 *Description and Measurement of Environmental Noise* Parts 1, 2 and 3 and in accordance with the NSW Industrial Noise Policy (INP). Where issues relating to noise are not addressed in the INP, such as construction noise and road traffic noise, reference has been made to the NSW Interim Construction Noise Guideline (ICNG) and Environmental Criteria for Road Traffic Noise (ECRTN).

1.1 Study Objective

The main objective of this report is to identify the potential noise and vibration impacts from the operation and construction of the proposed WTS.

2 PROJECT SETTING

2.1 Project Site Location

The proposed development is located on Lot 7008 DP 96164, which is situated on the western slope of Macs Reef Hill, approximately 3.5 kilometres east of the Federal Highway in the Bywong District, NSW. The Project Site location is shown in **Figure 1** and **Figure 2**.

Figure 1 Regional Setting

Source: Google Earth, 2010

Figure 2 Local Setting

Source: Google Earth, 2010

2.2 Existing Landfill

The existing landfill operation located on Macs Reef Road is expected to reach capacity within two years. The site has functioned as a landfill site and garbage depot since the 1970's and has been progressively developed over time to occupy 5.4 hectares, approximately 60% of the site. A total annual tonnage of 3,450 tonnes waste to landfill has been adopted for the Macs Reef landfill for design purposes based on investigations undertaken by Quadro 2010 in their document, "*Macs Reef Waste Transfer Station, Concept Options Report*" as prepared for Palerang Council.

The landfill is filled on a progressive lift basis extending westwards from the natural surface on the eastern side of the landfill. The landfill site also comprises material stockpile areas, a leachate/sedimentation pond, an onsite office and a Buy Back Centre.

2.3 Proposed Development

The proposed development includes the construction and establishment of a WTS at the Macs Reef Garbage Depot adjacent to the landfill area of the site; and the rehabilitation and capping of the existing landfill site.

The proposed development will include the establishment of:

- A site office;
- A Buy Back Centre demountable;
- Site amenities and water supply (e.g. water tanks);

- Waste disposal areas (4 x 30 m^3 waste bins and 1 x 30 m^3 co-mingled recyclables);
- Car parking area (approximately 6 spaces for employees and visitors);
- A security fence;
- 1 x Leachate/Stormwater Management Pond (capacity 570 m^3); and,
- Upgrade of the Macs Reef Intersection and Access Road into the WTS.

Access to the facility will be via an unnamed road located to the west of the Project Site. No stockpiling of waste materials will occur on site.

It is also intended that the Project Site will include a small Buy Back Centre which will house deposited goods for resale and an office and amenities for one (1) staff member.

Note: The existing landfill will continue to operate until the WTS becomes fully operational.

2.3.1 Accepted Waste Types and Quantities

The Project will accept and separate the following waste:

- Putrescible waste from households;
- Hazardous goods (batteries and oil only);
- Scrap metal (small cut up metal pieces);
- E- Waste;
- Small swappable items; and,
- Small valuable items.

The facility will accept only small loads (less than 2 tonnes) from private vehicles (cars, utes, trailers, small trucks) with larger loads and those from Council's contractors being taken to Council's landfills. Quantities of waste received at the Project Site are therefore expected to decrease as many of the bulkiest landfill items (e.g. mattresses, tyres, white goods etc) will no longer be accepted at the Project Site.

2.3.2 Onsite Plant and Equipment Noise Levels

A list of equipment proposed for the operation of the WTS is contained within **Table 1** .

Table 1 Plant and Equipment Items

Plant Item	Usage	Sound Power Level dBA
Hooklift trucks	Removing and delivering waste/recycle bins	105
Mini excavator	Compacting waste in bins	102
Trucks	Carting recyclables	97
Lawnmowers/slashers	Maintaining landscape	98

2.3.3 Construction

The construction of the site is predicted to take approximately 16 weeks, and will predominantly include the construction of the industrial building, installation of a weigh bridge, construction of internal access roads and office fit-out. Construction hours will be 7.00 am to 6.00 pm Monday to Friday and 7.00 am to 1.00 pm Saturday. No construction work will be conducted on Sundays or Public Holidays.

The sound power levels of the major noise generating plant and equipment expected to be used during construction are given in **Table 2**. Sound power levels of acoustically significant equipment have been obtained from a Heggies database of similar equipment.

Table 2 Acoustically Significant Construction Equipment Sound Power Levels

Equipment	L_{Aeq} Sound Power Level (dBA)
Truck & dog	97
Excavator	105
Dozer	109
Water Cart	105
Vibratory rollers	110
Grader	111

2.4 Hours of Operation

The proposed hours of operation for the project are presented in **Table 3**.

Table 3 Proposed Development Hours of Operation

Activity	Time	Day of Week
Construction	7:00 am to 6:00 pm 8:00 am to 4:00 pm	Monday to Friday Saturday
Operation	7:00 am to 11:00 am 2:00 pm to 5:00 pm 8:00 am to 4:00 pm	Monday Friday Saturday and Sunday

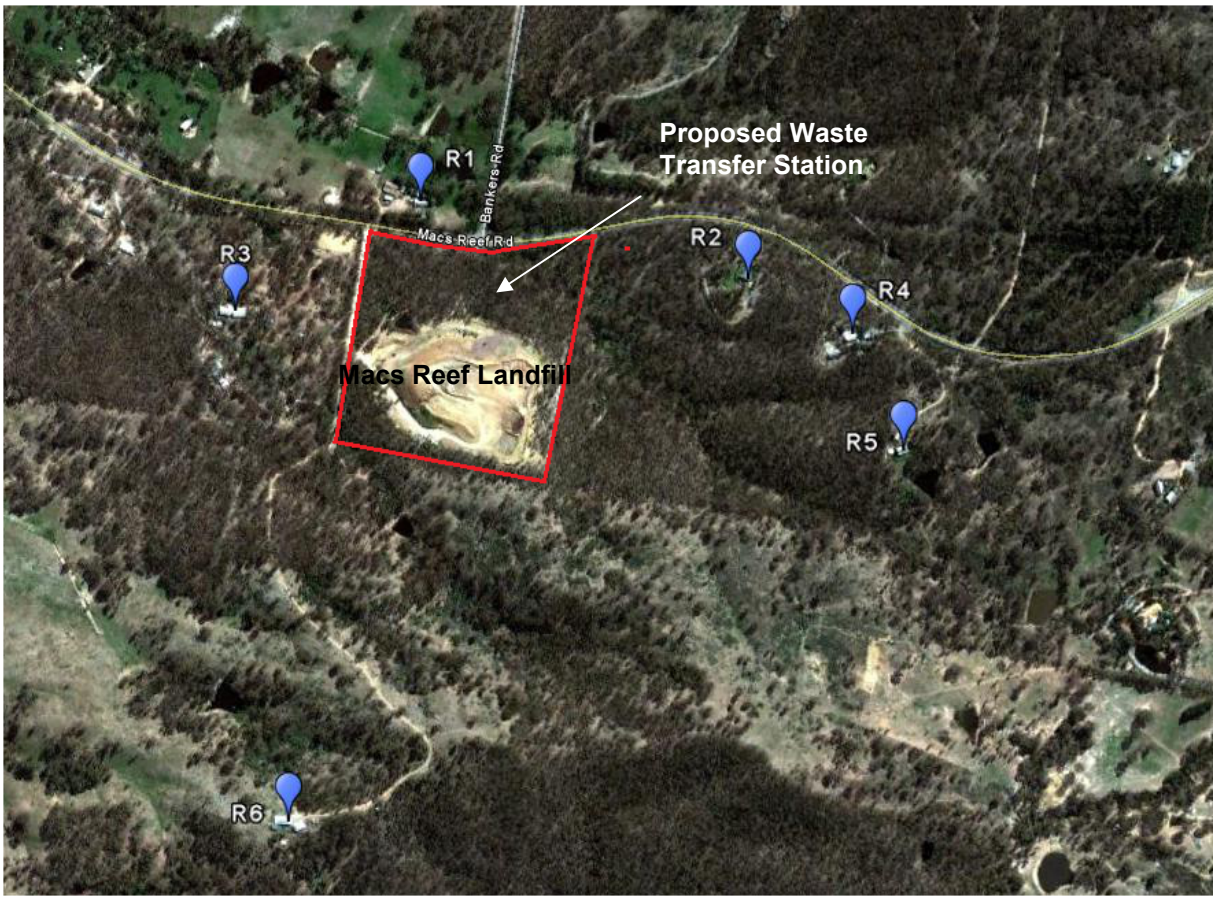
2.5 Sensitive Receptors

A number of residences are located in the area surrounding the Project Site. The nearest residences have been identified as sensitive receptor locations to be considered during the noise assessment. A list of the nearest sensitive receptors (R1 to R6) identified in the immediate vicinity of the Project Site, and their respective distances from the Project Site boundary are presented in and **Table 4** and **Figure 3**.

Table 4 Nearest Sensitive Receptors

Receptor ID	Location	Location (m, MGA56)		Distance (km) from site boundary	Elevation (m, AHD)
		Easting	Northing		
R1	704 Macs Reef Road, Bywong	709490	6104042	0.06	695
R2	649 Macs Reef Road, Bywong	709959	6103921	0.25	742
R3	733 Macs Reef Road, Bywong	709218	6103900	0.17	695
R4	625 Macs Reef Road, Bywong	710101	6103832	0.41	761
R5	625 Macs Reef Road, Bywong	710167	6103674	0.52	764
R6	707 Macs Reef Road, Bywong	709300	6103160	0.54	737

Figure 3 Sensitive Receptors Surrounding the Project Site



Source: Google Earth, 2010

3 IMPACT ASSESSMENT PROCEEDURES

3.1 General Objectives

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

The specific policy objectives are:

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

3.2 Assessing Intrusiveness

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

3.3 Assessing Amenity

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

An extract from the INP that relates to the amenity criteria is given in **Table 5**.

Table 5 Amenity Criteria – Recommended LAeq Noise levels from industrial Noise Sources

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

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

Table 6 Modification to Acceptable Noise level (ANL)* to Account for Existing Levels of industrial Noise

Total Existing L_{Aeq} noise level from Industrial Noise Sources	Maximum L_{Aeq} Noise Level for Noise from New Sources Alone, dBA
≥ Acceptable noise level plus 2 dBA	If existing noise level is *likely to decrease* in future acceptable noise level minus 10 dBA If existing noise level is *unlikely to decrease* in future existing noise level minus 10 dBA
Acceptable noise level plus 1 dBA	Acceptable noise level minus 8 dBA
Acceptable noise level	Acceptable noise level minus 8 dBA
Acceptable noise level minus 1 dBA	Acceptable noise level minus 6 dBA
Acceptable noise level minus 2 dBA	Acceptable noise level minus 4 dBA
Acceptable noise level minus 3 dBA	Acceptable noise level minus 3 dBA
Acceptable noise level minus 4 dBA	Acceptable noise level minus 2 dBA
Acceptable noise level minus 5 dBA	Acceptable noise level minus 2 dBA
Acceptable noise level minus 6 dBA	Acceptable noise level minus 1 dBA
< Acceptable noise level minus 6 dBA	Acceptable noise level

* ANL = recommended acceptable L_{Aeq} noise level for the specific receiver, area and time of day from **Table 5.**

3.4 INP Project Specific Criteria

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

Table 7 Noise Impact Assessment Methodology

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

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

Project Specific Criteria

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

Noise Management Zone

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

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

Noise Affectation Zone

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

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

3.5 Construction Noise

The DECCW has prepared an interim guideline covering construction noise. The ICNG sets out noise criteria applicable to construction site noise for the purpose of defining intrusive noise impacts.

Table 8 sets out the noise management levels and how they are to be applied. The approach is intended to provide respite for residents exposed to excessive construction noise outside the recommended standard hours whilst allowing construction during the recommended standard hours without undue constraints.

Table 8 Construction Noise Goals

Time of Day	Management Level	How to apply
Recommended standard hours : Monday to Friday 7:00am to 6:00pm Saturday 8:00am to 6:00pm No work on Sundays or public holidays	Noise affected RBL + 10 dBA	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq,(15mins)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to minimise noise. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dBA	The highly affected noise level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the proponent should consider very carefully if there is any other feasible and reasonable way to reduce noise below this level. If no quieter work method is feasible and reasonable, and the works proceed, the proponent should communicate with the impacted residents by clearly explaining the duration and noise levels of the works, and by describing any respite periods that will be provided.
Outside recommended standard hours	Noise affected RBL + 5 dBA	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dBA above the noise affected level, the proponent should negotiate with the community.

With respect to construction noise impacts at commercial and industrial premises, the Interim Construction Noise Guideline states the following:

Due to the broad range of sensitivities that commercial or industrial land can have to noise from construction, the process of defining management levels is separated into three categories. The external noise levels should be assessed at the most-affected occupied point of the premises:

- *Industrial premises: external $L_{Aeq(15min)}$ 75 dBA*
- *Offices, retail outlets: external $L_{Aeq(15min)}$ 70 dBA*
- *Other businesses that may be very sensitive to noise, where the noise level is project specific as discussed below.*

The proponent should undertake a special investigation to determine suitable noise levels on a project-by-project basis; the recommended 'maximum' internal noise levels in AS 2107 Acoustics – Recommended design sound levels and reverberation times for building interiors may assist in determining relevant noise levels.

3.6 Road Traffic Noise

The DECCW released the ECRTN in May 1999. The policy sets out noise criteria applicable to different road classifications for the purpose of defining traffic noise impacts. Relevant road traffic noise criteria are identified in **Section 6.3** of this report.

3.7 Vibration

German Standard DIN 4150-3 1999 "*Structural Vibration Part 3: Effects of Vibration on Structures*" provides guideline criteria for evaluating the short and long-term effects of vibration on structures. In addition, DECCW has released an interim guideline "*Assessing Vibration: A Technical Guideline"* dated February 2006, which provides guideline building vibration levels associated with a low probability of annoyance from occupants. Relevant vibration criteria are identified in **Section 8.1**of this report.

4 EXISTING ACOUSTICAL ENVIRONMENT

4.1 General Methodology

Ambient noise surveys were conducted to characterise and quantify the existing acoustical environment in the area surrounding the Macs Reef Landfill site. A background monitoring survey was undertaken at two (2) residential locations on Macs Reef Road, considered representative of the nearest potentially-affected noise-sensitive receivers to the landfill. The noise monitoring locations are shown in **Figure 4**.

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

All acoustic instrumentation employed throughout the monitoring programme has been designed to comply with the requirements of AS 1259.2-1990, "Sound Level Meters" and carries current NATA or manufacturer calibration certificates. Instrument calibration was checked before and after each measurement survey, with the variation in calibrated levels not exceeding ±0.5 dBA.

4.2 Operator-Attended Noise Monitoring

Operator attended noise measurements were conducted during the daytime at location R3. The purpose of this survey was twofold; to qualify the unattended noise logging results and to determine the contribution of existing industrial noise sources to the total ambient noise environment.

The noise survey was conducted over a 15 minute period using a B&K 2260 integrating sound level meter (S/N 2487418). The results of the operator-attended noise measurements are given in **Table 9**. Ambient noise levels given in the table include all noise sources such as road, insects, birds, as well as any industrial operations.

Figure 4 Noise Monitoring Locations

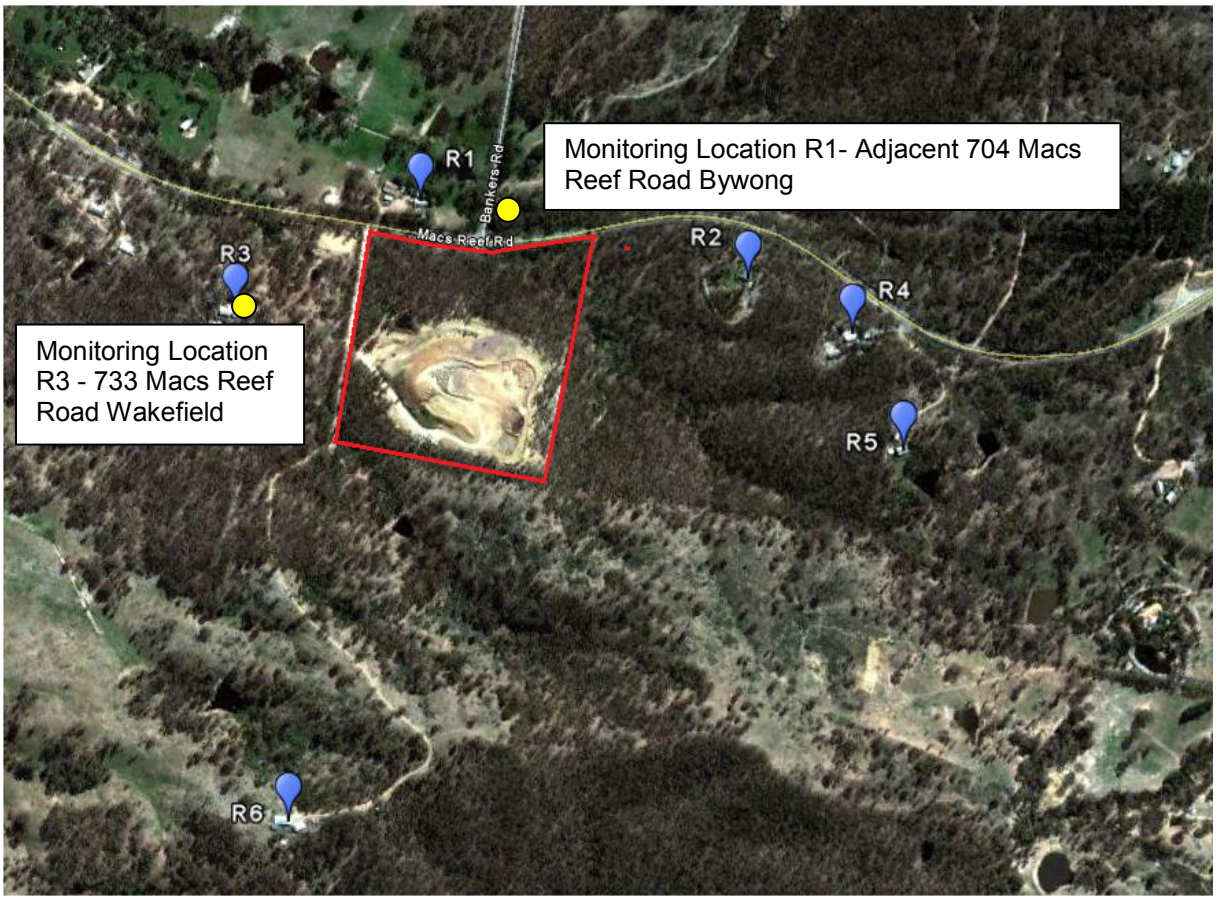


Image Source: Google Earth

Table 9 Operator Attended Noise Survey Results

Location	Date/ Start time/ Weather	Primary Noise Descriptor (dBA re 20 µPa)					Description of Noise Emission
		LAmax	LA1	LA10	LA90	LAeq	
R 3 733 Macs Reef Road	**Day** 15/12/2010 7:42 am Temp 17 °C Wind calm	71	62	49	44	50	Ambient noise is controlled by traffic on Macs Reef Road, at the time of measurement it was morning peak into Canberra. Other contributors are crickets, birds and the occasional barking dog

Results of operator-attended noise surveys indicate that local and distant road traffic and the natural environment (including some insects birds and the occasional dog) are the main contributors to the ambient noise environment during the monitoring period.

It should be noted that the existing Macs Reef Landfill site was not operating during the attended measurements.

4.3 Unattended Continuous Noise Monitoring

Background noise levels were monitored by SLR Consulting. The objective of the background noise survey was to measure $L_{A90(period)}$ and $L_{Aeq(15minute)}$ noise levels at the nearest potentially affected residential locations during the day, evening and night-time periods to enable the determination of the intrusiveness and amenity criteria for the project.

Background noise levels were monitored at two separate locations, considered to be representative of the nearest potentially affected receivers, from Monday 6 December 2010 to Wednesday 15 December 2010, inclusive. Details of monitoring locations are provided in **Table 10** and **Figure 4**.

Table 10 Ambient Noise Monitoring Locations

Location	Address Location Description	Logger Serial No.
R1	Adjacent 704 Macs Reef Road	16-306-044
R3	733 Macs Reef Road	878048

ARL noise loggers were used to monitor the ambient noise levels at each location. The noise loggers were programmed to record statistical noise level indices continuously in 15 minute intervals, including L_{Amax}, L_{A1}, L_{A50}, L_{A90}, L_{A99}, L_{Amin} and L_{Aeq}. Precautions were taken to minimise influences from extraneous noise sources and reflections from adjacent buildings.

Weather data for the survey period was obtained from the Bureau of Meteorology (BOM) weather station located at Canberra Airport (approximately 16 km south west of the project site). Noise data corresponding to periods of rainfall and/or wind speeds in excess of 5 m/s (approximately 9 knots) were discarded in accordance with INP data exclusion methodology. A summary of the results of the background surveys is given in **Table 11**. Results are displayed graphically in **Appendix A** and **Appendix B**.

Table 11 Summary of Existing Ambient Noise Levels

Location	Period	Measured Rating Background Level L_{A90}	Estimated Existing Industrial (non-landfill) Contribution L_{Aeq}
R1	Day	44 dBA	<44 dBA
	Evening	42 dBA	<39 dBA
	Night	39 dBA	<34 dBA
R3	Day	42 dBA	<44 dBA
	Evening	43 dBA	<39 dBA
	Night	39 dBA	<34 dBA

Note: Daytime 7.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 7.00 am
Morning Shoulder 6.00 am to 7.00 am
On Sundays and Public Holidays, Daytime 8.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 8.00 am

The L_{A90} represents the level exceeded for 90% of the interval period and is referred to as the average minimum or background noise level
L_{Aeq} - The equivalent continuous noise level is defined as the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

The background noise levels monitored were examined during times when the Macs Reef Landfill was open for operation and during the periods when it was closed. Overall background noise levels differed only marginally during these periods so it is considered that existing Macs Reef Landfill activities have little impact on the Rating Background Level (RBL) and therefore the background levels recorded are applicable levels to be used in the establishment of project specific noise criteria.

5 EFFECTS OF METEOROLOGY ON NOISE LEVELS

5.1.1 Wind

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

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

In order to determine the prevailing conditions for the subject site, 12 months of weather data was obtained from a Bureau of Meteorology automatic weather station at Canberra, approximately 16 km south west of the subject site.

This data was analysed to determine the frequency of occurrence of winds of speeds up to 3 m/s in each season during the day, evening and night time periods. The results of the wind analysis for daytime, evening, and night-time winds are presented in **Table 12**, **Table 13** and **Table 14** respectively. In each table, the wind directions and percentage occurrence are those dominant during each season. The percentage occurrence figures provided in bold are those that exceed the 30% threshold.

Table 12 Seasonal Frequency of Occurrence of Wind Speed Intervals - Daytime

Period	Calm	Wind Direction	0.5 - 2 m/s	2 - 3 m/s	0.5 - 3 m/s
Summer	0.5%	NNW±45	1.5%	1.5%	3.0%
Autumn	0.2%	WNW±45	1.6%	3.5%	5.1%
Winter	5.0%	NNW±45	8.2%	3.2%	11.4%
Spring	3.0%	NNW±45	8.5%	4.5%	13.0%

Table 13 Seasonal Frequency of Occurrence of Wind Speed Intervals - Evening

Period	Calm	Wind Direction	0.5 - 2 m/s	2 - 3 m/s	0.5 - 3 m/s
Summer	0.5%	SE±45	1.9%	1.3%	3.2%
Autumn	1.5%	WNW±45	1.4%	4.0%	5.4%
Winter	8.1%	NNE±45	11.1%	5.9%	17.0%
Spring	1.3%	NE±45	11.6%	6.1%	17.7%

Table 14 Seasonal Frequency of Occurrence of Wind Speed Intervals - Night

Period	Calm	Wind Direction	0.5 - 2 m/s	2 - 3 m/s	0.5 - 3 m/s
Summer	3.0%	E±45	8.1%	3.1%	11.2%
Autumn	1.5%	NNW±45	7.5%	8.5%	16.0%
Winter	15.7%	N±45	12.3%	3.2%	15.5%
Spring	17.9%	ESE±45	26.0%	4.8%	**30.8%**

From the above weather data, significant wind (ie wind speed of up to 3 m/s) was recorded more than the assessment threshold of 30% during the night-time period in Spring. As the facility will not operate during the night-time period prevailing wind was not considered in this assessment.

5.1.2 Temperature Inversion

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

As the facility will not operate during the night-time period the impact of noise during a temperature inversion has not been conducted as part of this assessment.

6 PROJECT SPECIFIC NOISE CRITERIA

6.1 Operational Noise Design Criteria

The noise emission design criteria for the project have been established with reference to the INP outlined in **Section 3.1** of this report.

The acoustical environment typifies a rural environment. Therefore, the residences in the general area have been assessed as "rural" receiver types.

The amenity criteria have been established using the results of ambient noise measurements. At both monitoring locations, the existing industrial L_{eq} noise levels in the absence of the existing waste facility are more than 6 dBA below the acceptable noise levels described in **Table 5**, therefore, the amenity criteria is equal to the acceptable noise level.

In accordance with the INP, the project specific noise levels reflect the most stringent noise level requirements from the noise levels derived from both the intrusive and amenity criteria. Applying the most stringent requirement as the project specific noise levels ensures that both intrusive noise is limited and amenity is protected.

The resulting operational project specific noise criteria for residences and sensitive receiver locations R1 to R6 will be based on L_{A90} and L_{Aeq} noise levels measured at Location R1- Adjacent 704 Macs Reef Road and Location R3-733 Macs Reef Road (see **Figure 4**). The noise environment at Location R1 is assumed to be representative of the noise environments at Residences R1, R2 and R4 due to the residences proximity to Macs Reef Road. Similarly the noise environment at Location R3 is assumed to be representative of the noise environments at Residences R3, R5 and R6.

The resulting operational project specific noise criteria for the project are shown in **Table 15**.

Table 15 Project Specific Noise Criteria

Location	Period	Measured Background Noise Level (L_{A90})	Adopted RBL L_{A90}	Intrusiveness Criteria $L_{Aeq(15minute)}$	Amenity Criteria $L_{Aeq(Period)}$	Project Specific Noise Criteria $L_{Aeq(15min)}$
R1,R2, R4	Day	44 dBA	44 dBA	49 dBA	55 dBA	**49 dBA**
	Evening	42 dBA	42 dBA	47 dBA	45 dBA	**45 dBA**
	Night	39 dBA	39 dBA	44 dBA	40 dBA	**40 dBA**
R3, R5,R6	Day	42 dBA	42 dBA	47 dBA	55 dBA	**47 dBA**
	Evening	43 dBA	42* dBA	47 dBA	45 dBA	**45 dBA**
	Night	39 dBA	39 dBA	44 dBA	40 dBA	**40 dBA**

* Adjusted as per INP Application Notes

6.2 Construction Noise Goals

The construction noise goals for surrounding residential receivers, which have been determined from the measured background noise levels, are presented in **Table 16**.

Table 16 Construction Noise Goals

Location	Recommended Hours Construction Noise Goal $L_{Aeq(15minute)}$	
	Noise Affected (dBA)	Highly Noise Affected (dBA)
R1,R2,R4	54	75
R3, R5,R6	52	75

Note Recommended hours between the hours of 7.00 am and 6.00 pm Monday to Friday, and 8.00 am to 6.00 pm Saturdays.

6.3 Road Traffic Noise Goals

The proposed development will use Macs Reef Road as access to the site for deliveries and despatching. Macs Reef Road falls into the category of a "collector road" and for this reason the noise criteria outlined in **Table 17** have been adopted.

Table 17 Environmental Criteria for Road Traffic Noise

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

* In all cases (where criteria are already exceeded), traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dBA.

The proposed WTS will only operate during the daytime period and therefore night-time road traffic noise levels have not been considered as part of this assessment.

7 ASSESSMENT OF NOISE IMPACTS

7.1 Noise Modelling

A computer model was used to predict noise emissions from the subject development. The Environmental Noise Model (ENM) noise modelling software used has been produced in conjunction with the DECCW. A three-dimensional digital terrain map giving all relevant topographic information was used in the modelling process. The model used this map, together with noise source data, ground cover, shielding by barriers and/or adjacent buildings and atmospheric information to predict noise levels at the nearest potentially affected receivers.

Noise levels were predicted at the residences which represent the nearest, most potentially affected locations.

7.2 Noise Modelling Parameters

The predicted noise emission levels for operation of proposed development at potentially affected receivers have been calculated under the meteorological parameters shown in **Table 18.**

Table 18 Modelling Parameters

Assessment Condition	Temperature	Wind Speed and Direction	Relative Humidity	Temperature Gradient
Day - Calm	20^{o}C	0 m/s to 0.5 m/s	65%	n/a

7.3 Operational Scenario

The operational scenario considered for the purpose of noise predictions included the following assumptions

- Two (2) customer light vehicles (cars etc) on site. One (1) entering the site and one (1) leaving the site.
- A hook truck loading a waste bin.
- An excavator compacting waste in the bins.
- Lawnmower.

Due to the number of active noise sources on site this is considered to be a worst case operating scenario for the site.

7.4 Predicted Noise Levels

Predicted noise emission levels from the subject site at the nearest receivers are provided in **Table 19**.

Table 19 Predicted Daytime Noise Emission Levels

Receptor ID	Location	Predicted Noise Level $L_{Aeq(15minute)}$ dBA	Project Specific Noise Level $L_{Aeq(15minute)}$ dBA
R1	704 Macs Reef Road, Bywong	41	49
R2	649 Macs Reef Road, Bywong	38	49
R3	733 Macs Reef Road, Bywong	42	47
R4	625 Macs Reef Road, Bywong	36	49
R5	625 Macs Reef Road, Bywong	34	47
R6	707 Macs Reef Road, Bywong	33	47

Noise emission levels during the daytime period are predicted to be within the project specific noise levels at all assessed receiver locations.

7.5 Cumulative Impact

The INP prescribes detailed calculation routines for establishing "project specific" $L_{Aeq(15minute)}$ intrusive criteria and $L_{Aeq(Period)}$ amenity criteria at potentially affected receivers for a development (in isolation).

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

7.6 Predicted Construction Noise Levels

Noise modelling was carried out for a worst case construction scenario assuming that all equipment operated simultaneously.

Table 20 details the potential predicted noise levels from construction activities surrounding the subject site. Predicted noise levels in **bold** indicate an exceedance of the ICNG noise affected criterion.

Table 20 Predicted Construction Noise Levels

Receptor ID	Location	Predicted Noise Level $L_{Aeq(15minute)}$ dBA	Construction Noise Goals $L_{Aeq(15minute)}$ dBA	
			Noise Affected	Highly Noise Affected
R1	704 Macs Reef Road, Bywong	49	54	75
R2	649 Macs Reef Road, Bywong	46	54	75
R3	733 Macs Reef Road, Bywong	50	52	75
R4	625 Macs Reef Road, Bywong	44	54	75
R5	625 Macs Reef Road, Bywong	42	52	75
R6	707 Macs Reef Road, Bywong	41	52	75

A review of **Table 20** indicates that $L_{Aeq(15minute)}$ noise levels from construction operations are predicted to be below the noise affected goals at all locations.

Notwithstanding the preceding, the following recommendations are made with the aim of minimising construction noise impacts at nearby noise sensitive receivers:

- An important aspect of the mitigation of noise impacts during all construction phases will be adherence to the standard daytime construction hours.
- Noisy plant operating simultaneously to be avoided wherever possible.
- Maintenance work on all construction plant will be carried out away from noise sensitive areas and confined to standard daytime construction hours, where practicable.
- Site noisy equipment behind structures that act as barriers or at the greatest distance from the noise-sensitive area or orient the equipment so that noise emissions are directed away from any sensitive areas.
- Keep equipment well maintained.
- Employ “quiet” practices when operating equipment (eg positioning and unloading of trucks in appropriate areas).
- Implementation of an effective complaints handling system.

With regard to potentially offensive noise events associated with construction activities AS 2436-1981 “*Guide to noise control on construction, maintenance and demolition sites”* provides the following:

If noisy operations must be carried out, then a responsible person should maintain liaison between the neighbouring community and the contractor. This person should inform the public at what time to expect noisy operations and also inform the contractor of any special needs of the public.

Consultation and cooperation between the contractor and his neighbours and the removal of uncertainty and rumour can help to reduce the adverse reaction to noise.

7.7 Road Traffic Noise

Access to the site is via Macs Reef Road. Council supplied average daily traffic (ADT) figures for Macs Reef Road for the period 20/07/2008 to 27/12/2009 inclusive for a position near the Federal Highway (to the west of the WTS site).

The ADT figures, which were based on seven (7) and five (5) day counts, range from 2,700 for the week ending 03/08/2008 (7 day count) to 3,839 for the week ending 01/02/2009 (5 day count).

As no peak hour volume was available a design peak hour volume of 15% of ADT was adopted.

This provides for

- ADT of 1,920 vehicles per day (vpd) each way.
- Peak hour volume of 288 vehicles per hour (vph) each way ie 576 vph.

Vehicles using the site will be limited to less than 2 tonnes essentially cars, wagons, utilities and trailers only. The expected peak future traffic generation for the site is 71 vehicles per hour. Trucks would only access the site to pick up waste/recycle bins (weekly) or carting recyclables (quarterly). These truck trips would be at times to avoid peak traffic flows and hence have little impact on traffic noise generation.

It has been assumed as a worst case that the vehicles generated by the WTS would be additional to the existing traffic on Macs Reef Road.

Road traffic noise contributions from the proposed WTS have been predicted at 48 metres from Macs Reef Road (the approximate distance of the nearest dwelling to the roadway) and are presented in **Table 21**.

Table 21 Predicted Road Traffic Noise Levels – Macs Reef Road

	Predicted Traffic Noise Level Day 7:00 am to 10:00 pm		**Criteria Day 7:00 am to 10:00 pm**
	Existing	**Existing with WTS**	
Macs Reef Road	57.4 dBA $L_{Aeq(1hour)}$	57.9 dBA $L_{Aeq(1hour)}$	60 dBA $L_{Aeq(1hour)}$

The road traffic noise level contribution from the WTS is predicted to be below the relevant noise goal specified in the ECRTN for Macs Reef Road.

8 VIBRATION ASSESSMENT

8.1 Vibration Criteria

Table 22 provides a summary of the relevant operational and construction vibration goals.

Table 22 Vibration Velocity Damage and Annoyance Risk Criteria (mm/s)

Receiver Area	Damage Risk (mm/s) (DIN4150-3)		Annoyance Risk (mm/s) (DECCW)	
	Horizontal	Vertical	Horizontal	Vertical
Residential/Dwellings	15	5	1.2	0.45
Commercial/Offices	40	20	1.6	0.6
Industrial/Workshops	40	20	3.2	1.2
Mechanical (On/Off)	20/5	20/5	-	-
Electronic/Computers	5	5	-	-
Subsurface/Pipework	50-100	50-100	-	-
Heritage Listed Structure	8	3	-	-

8.2 Typical Equipment Vibration Levels

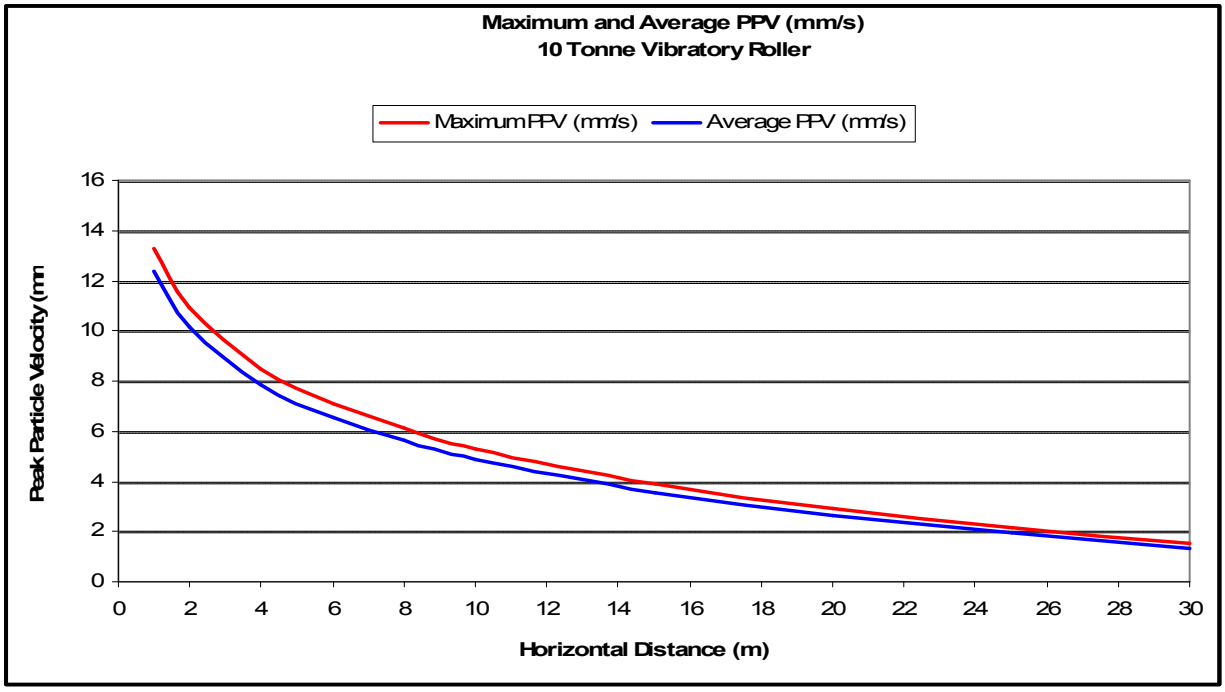
The major vibration generating activities will occur during the earth works phase of the construction of the facility, and from heavy vehicles accessing the site during operation. Typical vibration levels for the major vibration generating equipment proposed for use at the site are contained in **Table 23**.

Table 23 Typical Equipment Vibration Levels

Equipment	Peak Particle Velocity (PPV) at 10 m
Compactor (Vibratory Roller)	5 mm/s
Dozer	3 mm/s
Grader	1 mm/s
Trucks (various)	<0.1 mm/s
Excavator digging	0.2 mm/s

A typical attenuation curve for compaction using a vibratory roller is contained in **Figure 5**.

Figure 5 10 Tonne Vibratory Roller



8.3 Prediction of Vibration Levels from Construction

Due to the distance of the site from the nearest residential receivers the vibration levels from construction are predicted to be significantly below the relevant vibration criteria.

8.4 Predicted Operational Vibration Levels

The major cause of operational vibration will be heavy vehicle movements on the site. Vibration levels from heavy vehicle movements have been predicted to be negligible at all receiver locations.

9 CONCLUSION

SLR Consulting has prepared a Noise and Vibration Impact Assessment for the proposed WTS at Macs Reef, NSW. The objectives of the assessment were to identify the potential impacts of noise and vibration due to the construction and operation of the development on surrounding receivers.

Noise modelling has indicated that the noise emissions from the operation of the development are predicted to be within the project specific noise levels at all assessed receiver locations.

Construction noise levels are predicted to be within the noise affected criterion at all receiver locations. Various noise management techniques have been presented in this report to reduce the impact of construction noise on nearby residential receivers.

Traffic generated by the proposed development is predicted to be within the ECRTN criteria.

Construction vibration levels are predicted to be considerably below the recommended damage and annoyance criteria vibration criteria at all receiver locations.

Vibration levels from operation of the development are predicted to be negligible at all receiver locations.

10 CLOSURE

This report has been prepared by SLR Consulting with all reasonable skill, care and diligence, and taking account of the manpower and resources devoted to it by agreement with the client. Information reported herein is based on the interpretation of data collected and has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of Environmental Planning Services Pty Ltd. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR Consulting.

SLR Consulting disclaims any responsibility to the client and others in respect of any matters outside the agreed scope of the work.

Statistical Ambient Noise Levels
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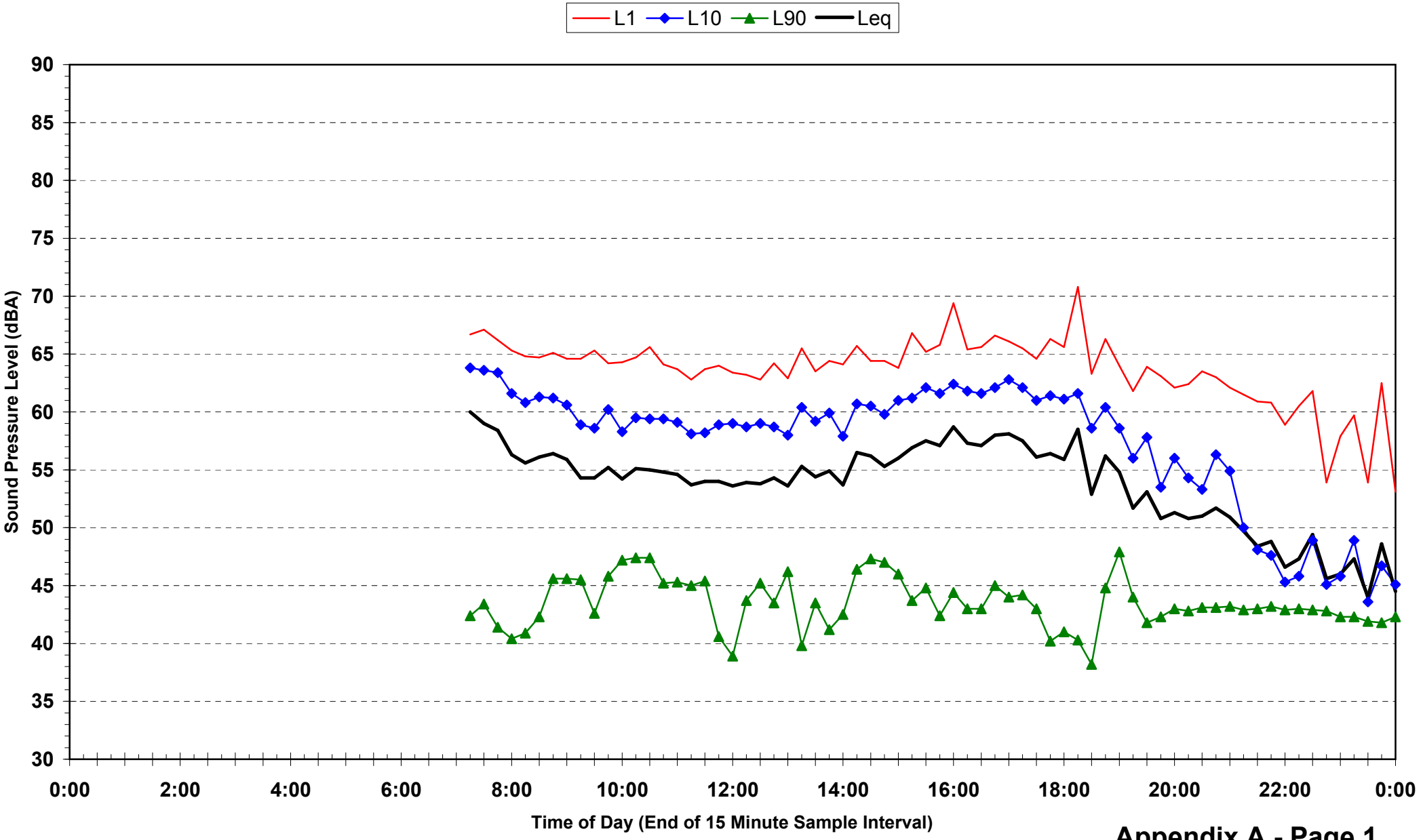

Appendix A - Page 1
Statistical Noise Levels
Heggies Report 630.10044

Statistical Ambient Noise Levels
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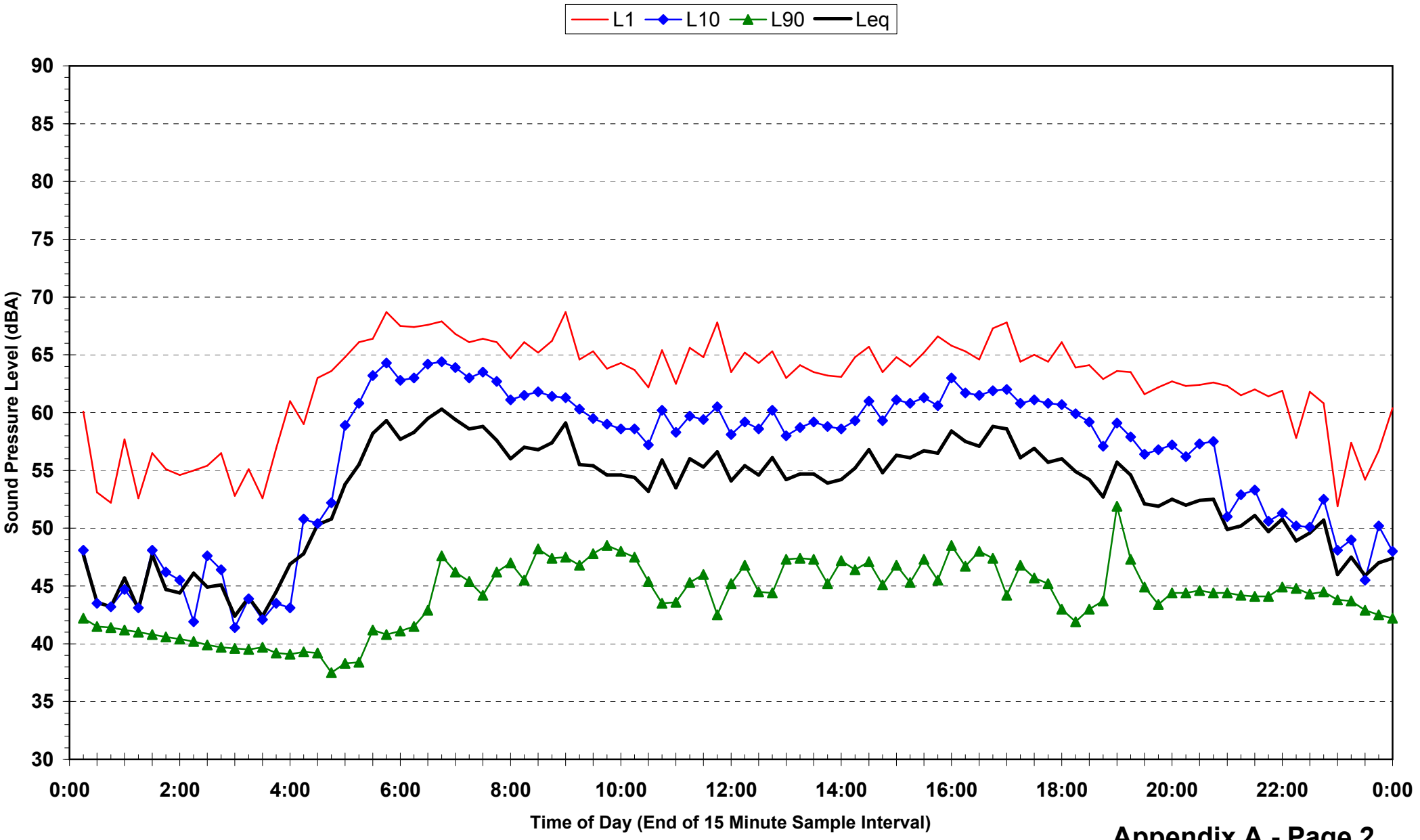

Appendix A - Page 2
Statistical Noise Levels
Heggies Report 630.10044

Statistical Ambient Noise Levels
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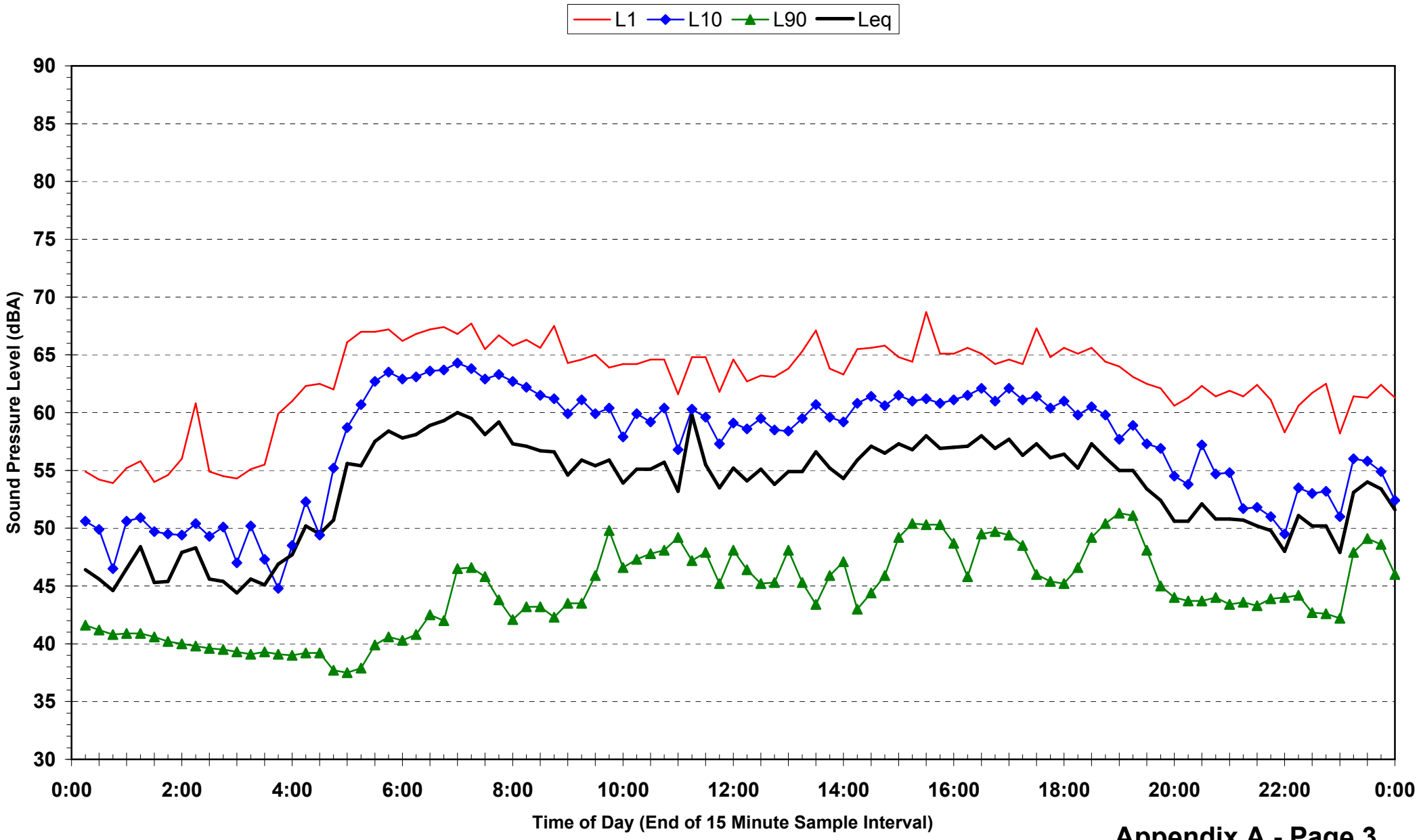

Statistical Ambient Noise Levels
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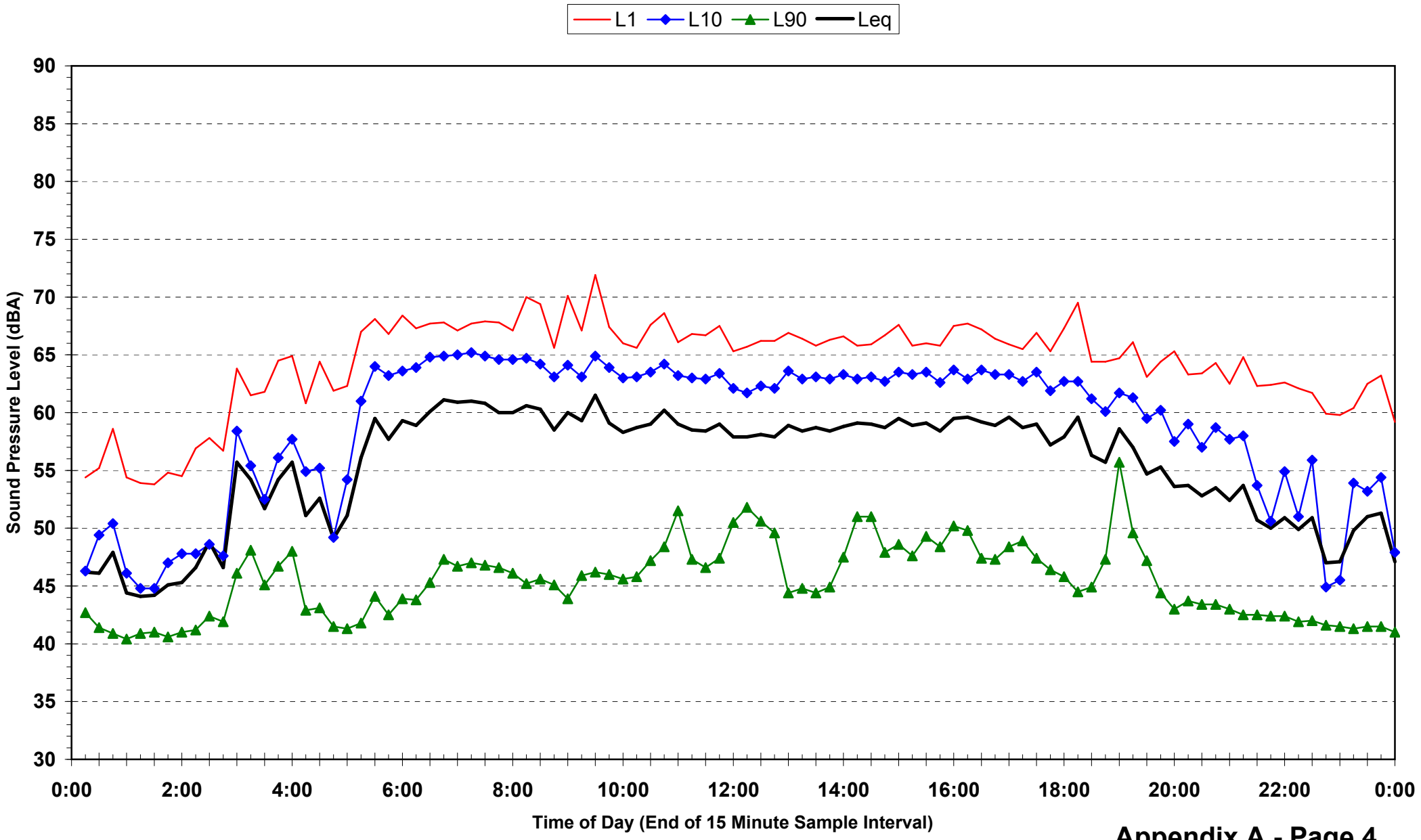

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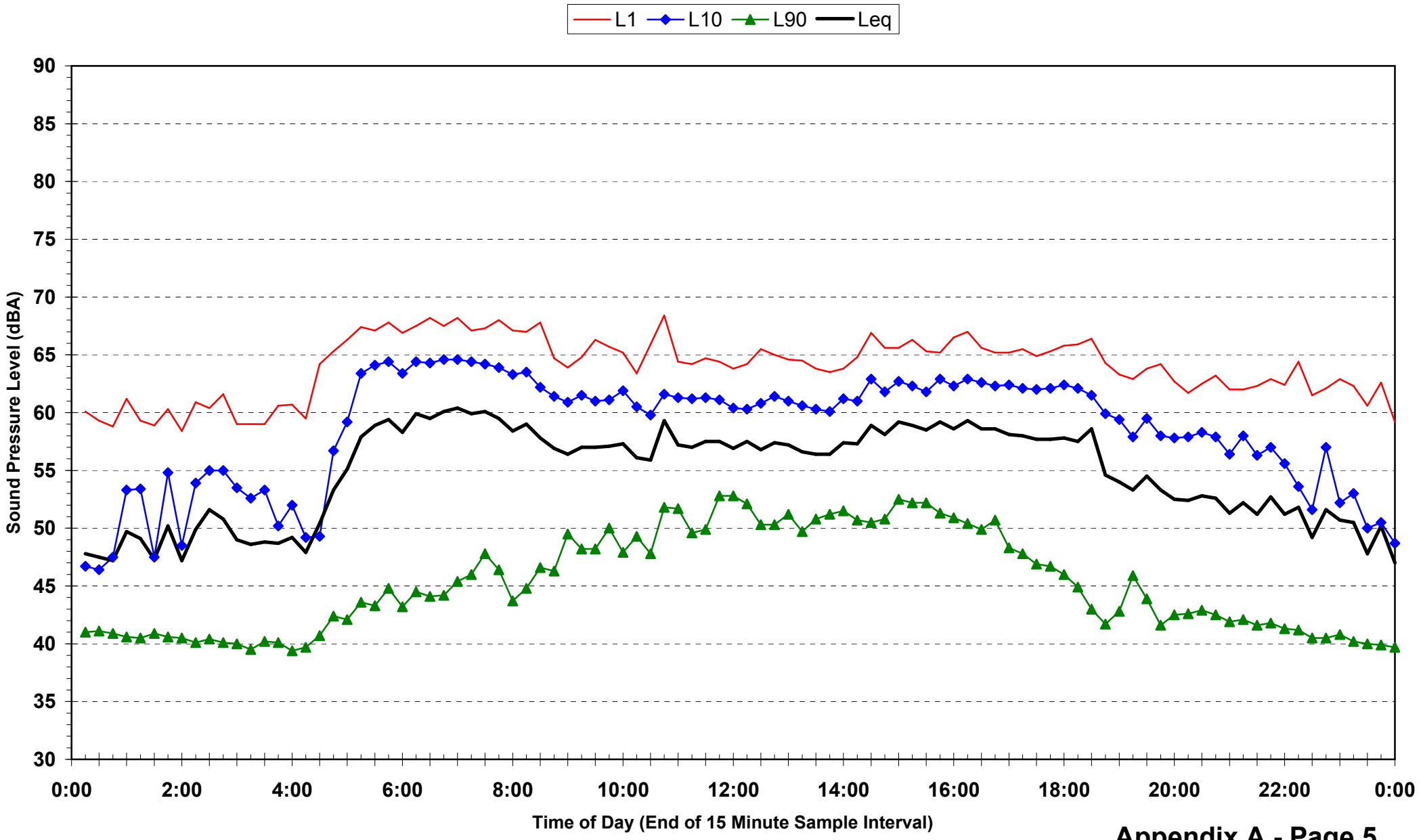

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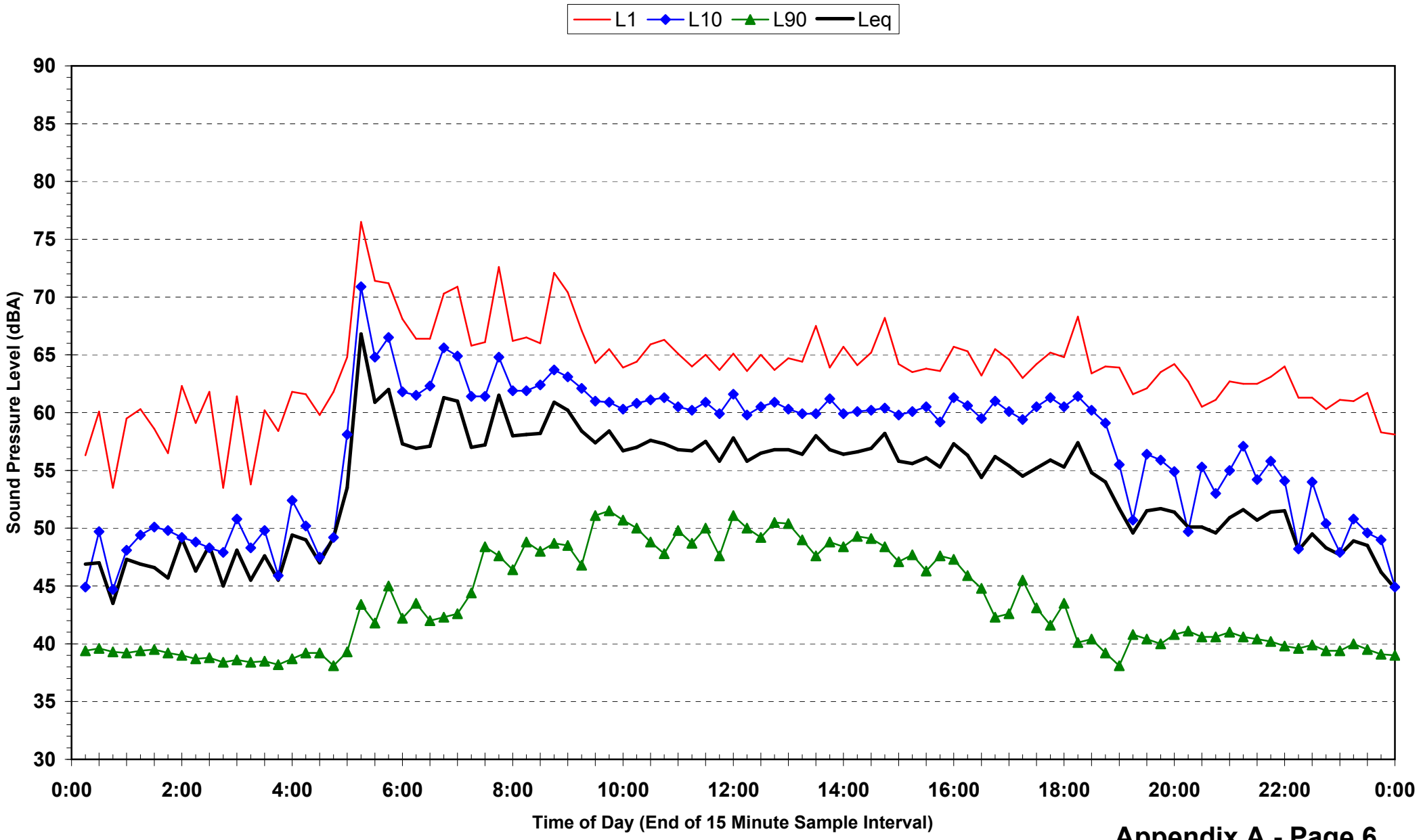

Statistical Ambient Noise Levels
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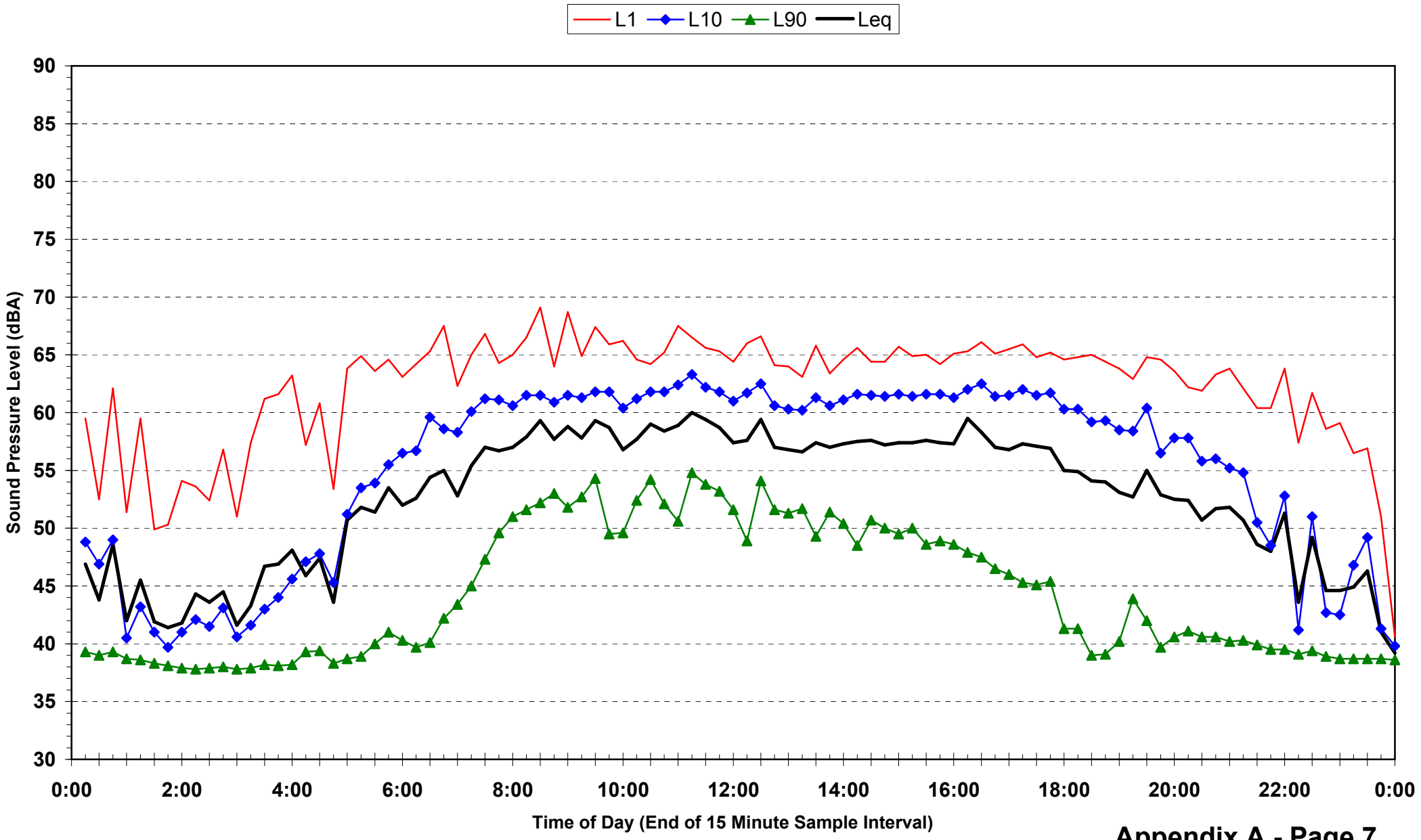

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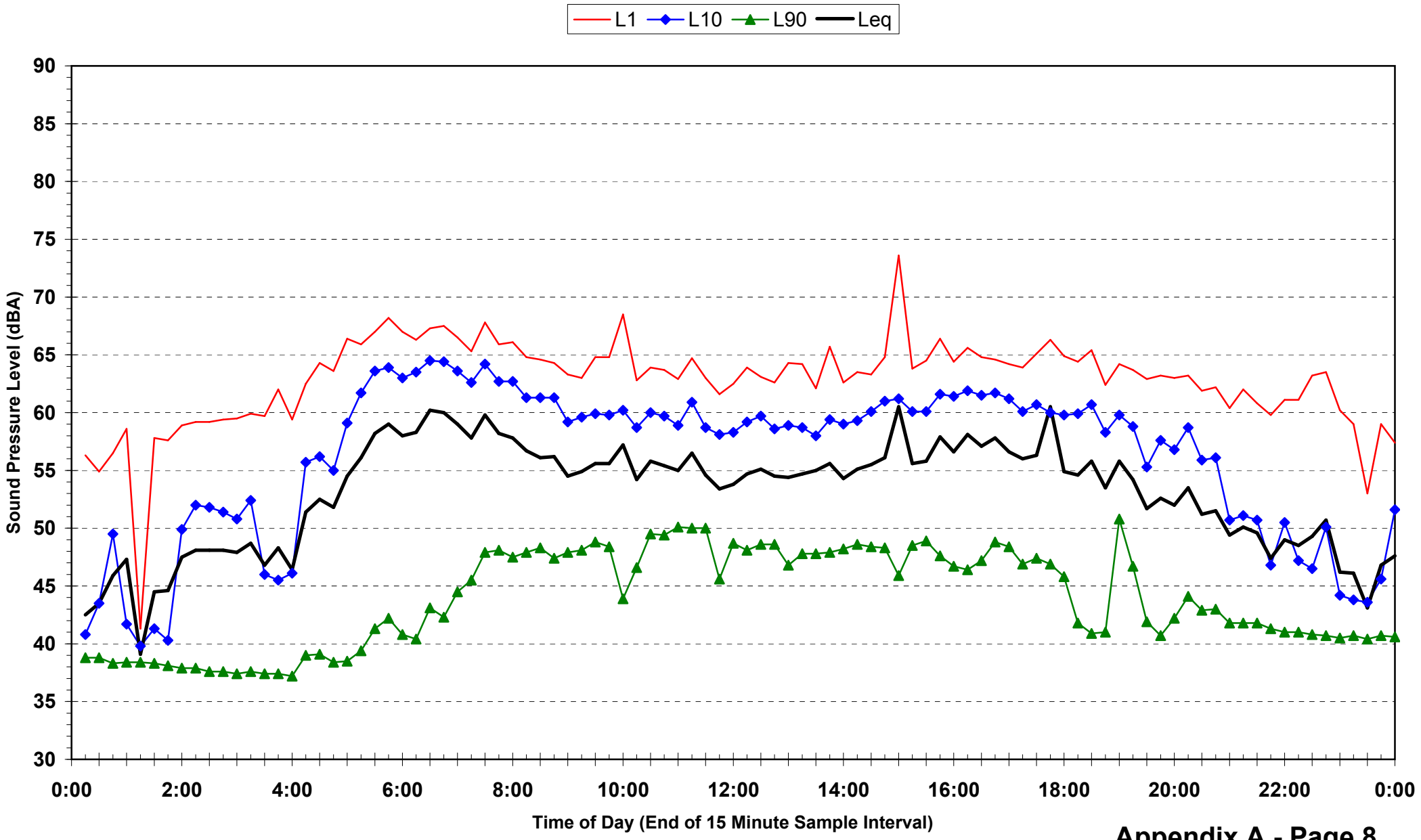

Statistical Ambient Noise Levels
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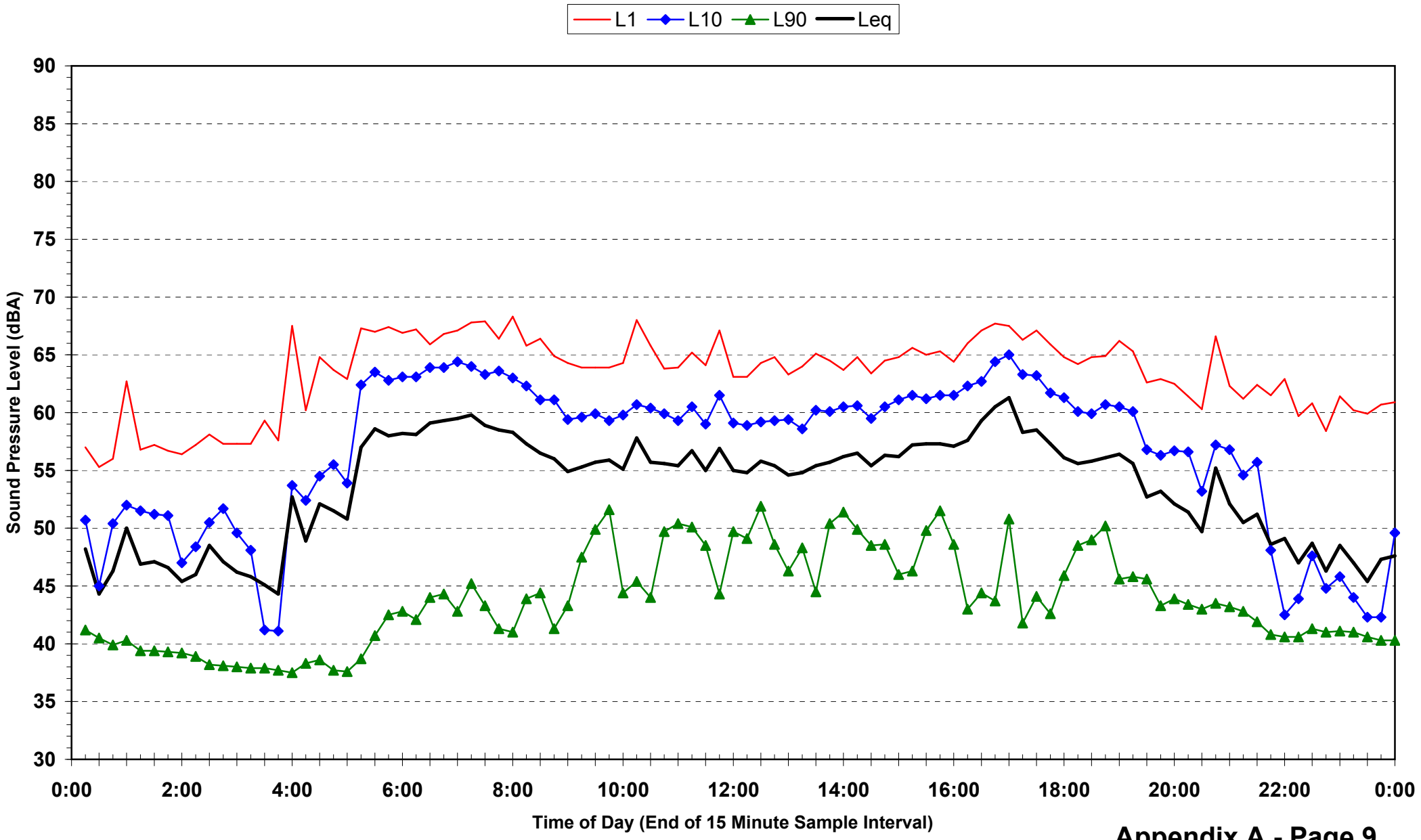

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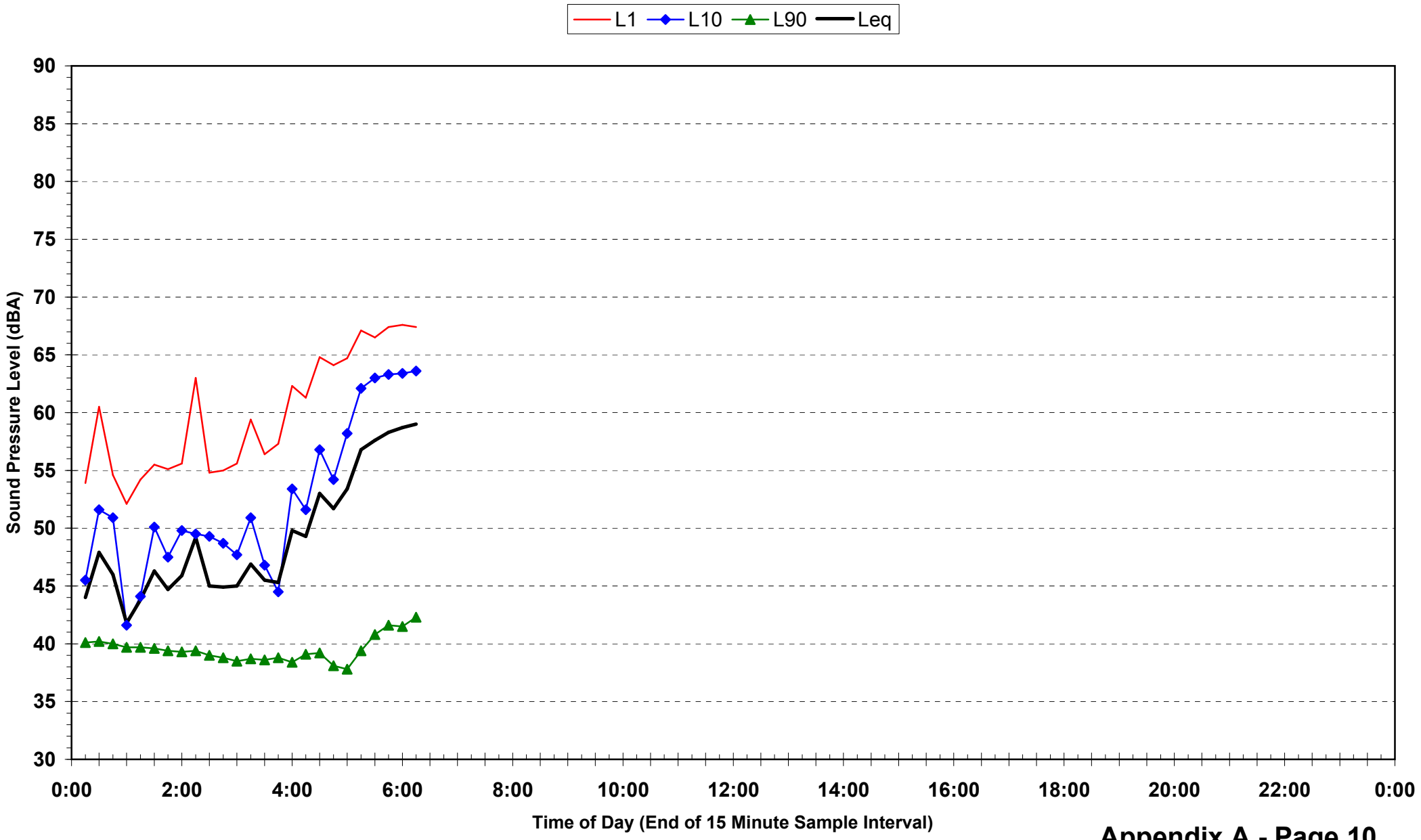

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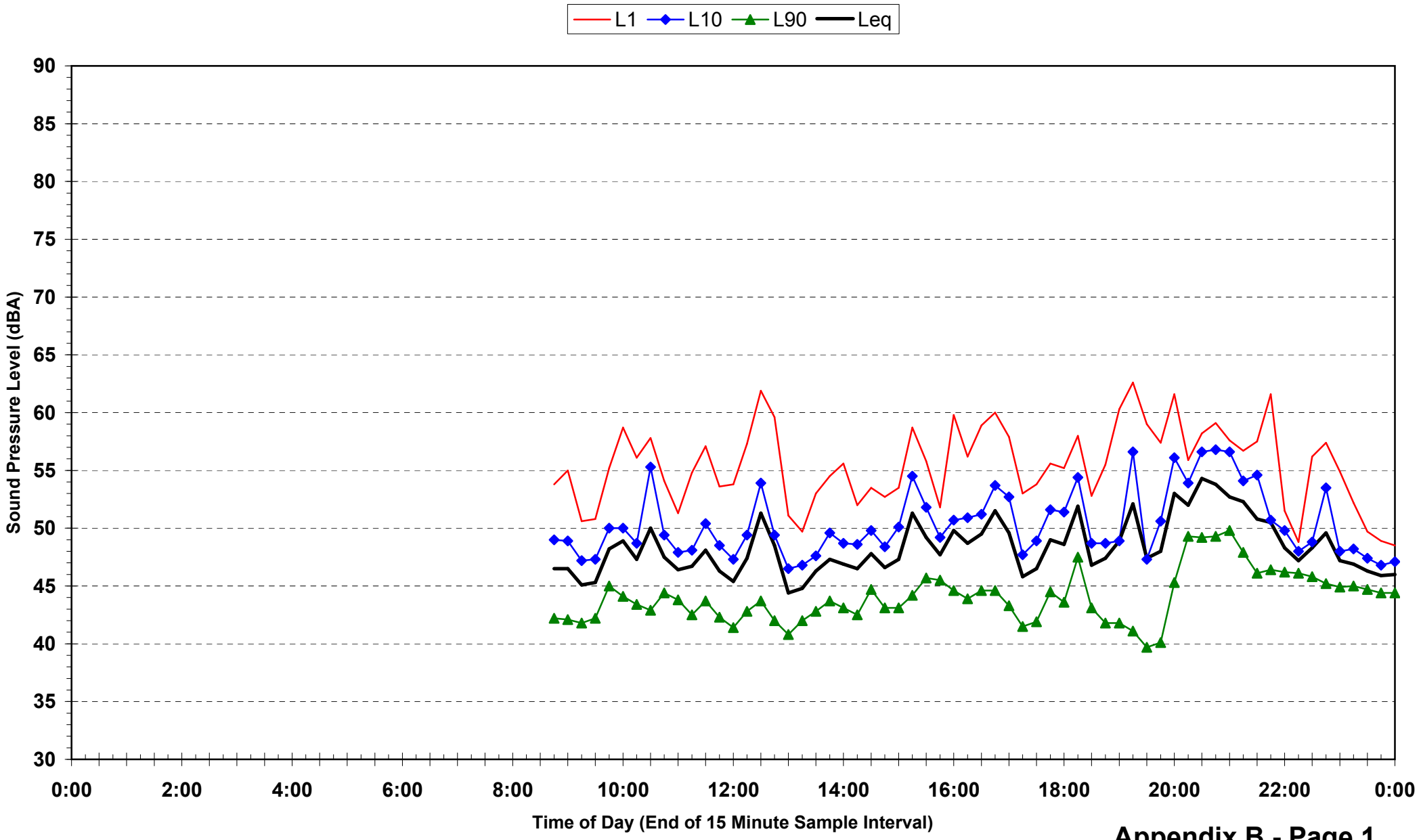

Appendix B - Page 1
Statistical Noise Levels
Heggies Report 630.10044

Statistical Ambient Noise Levels
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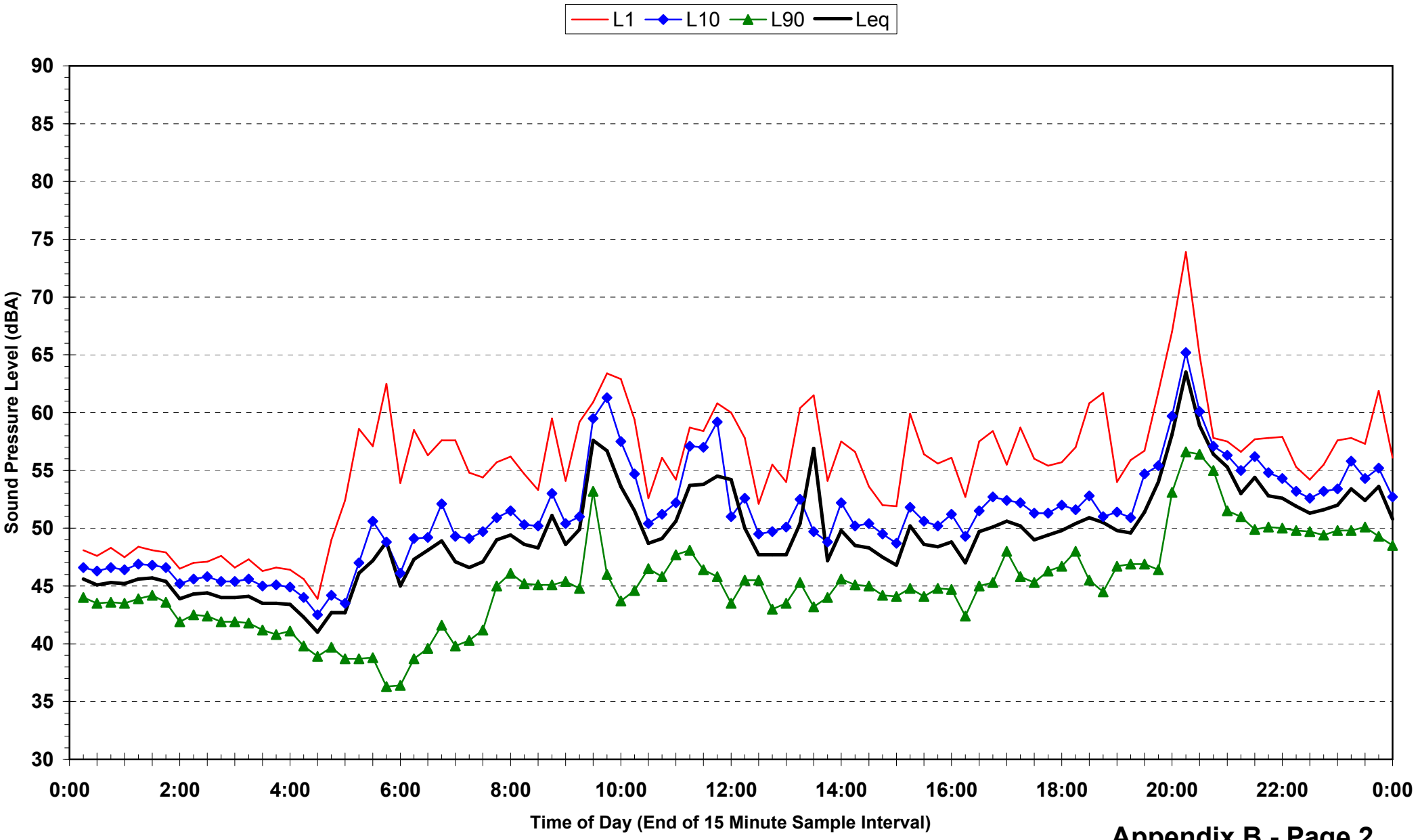

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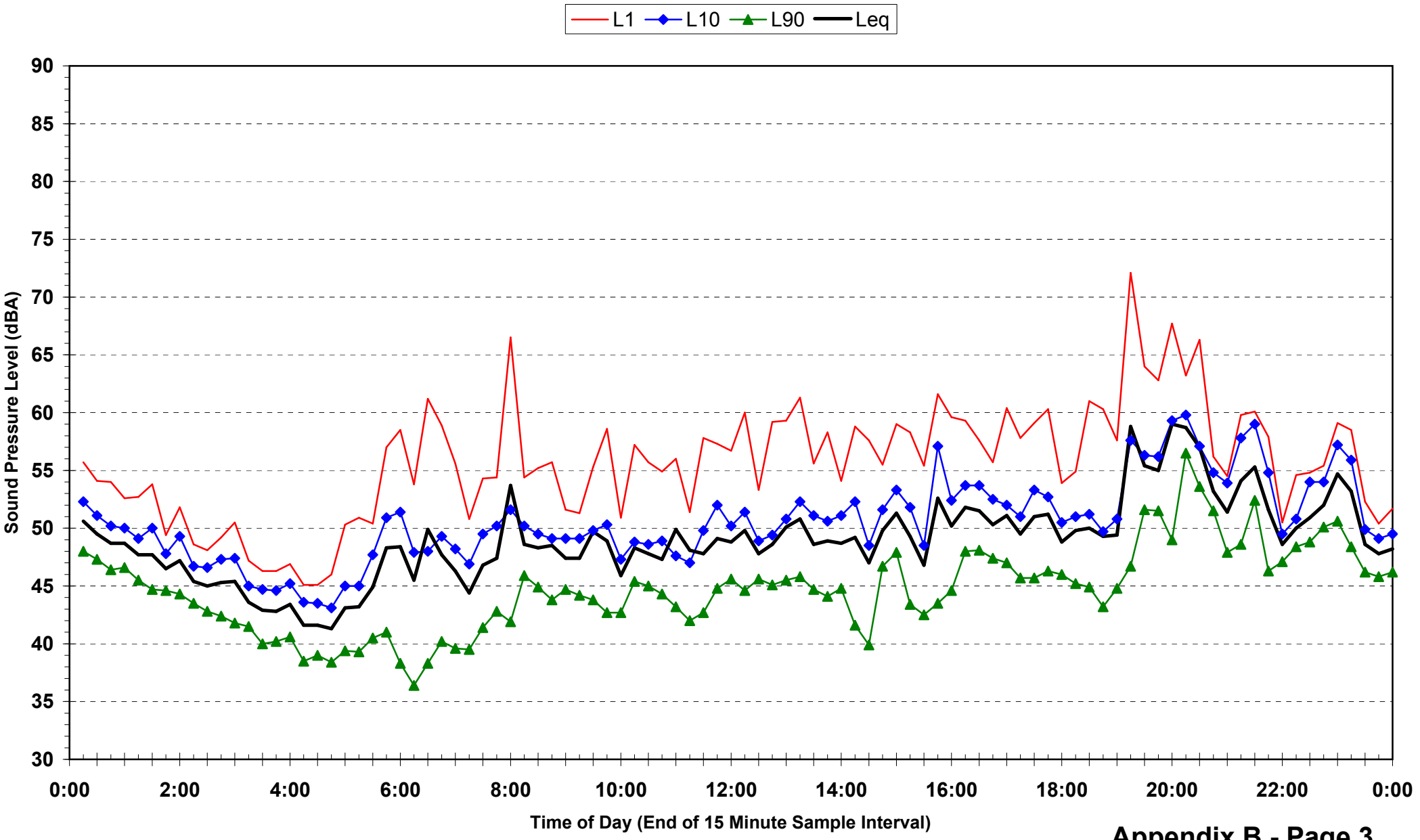

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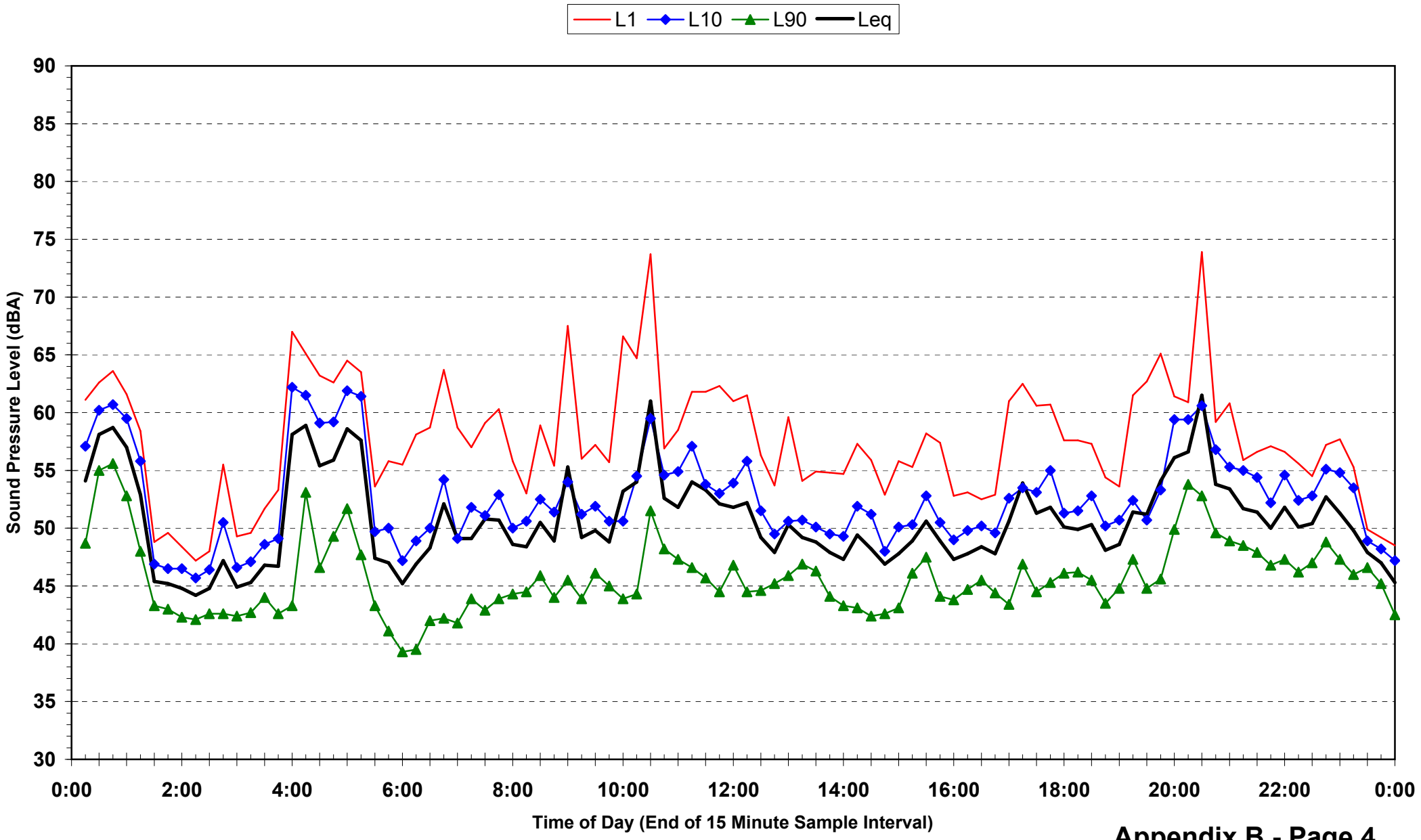

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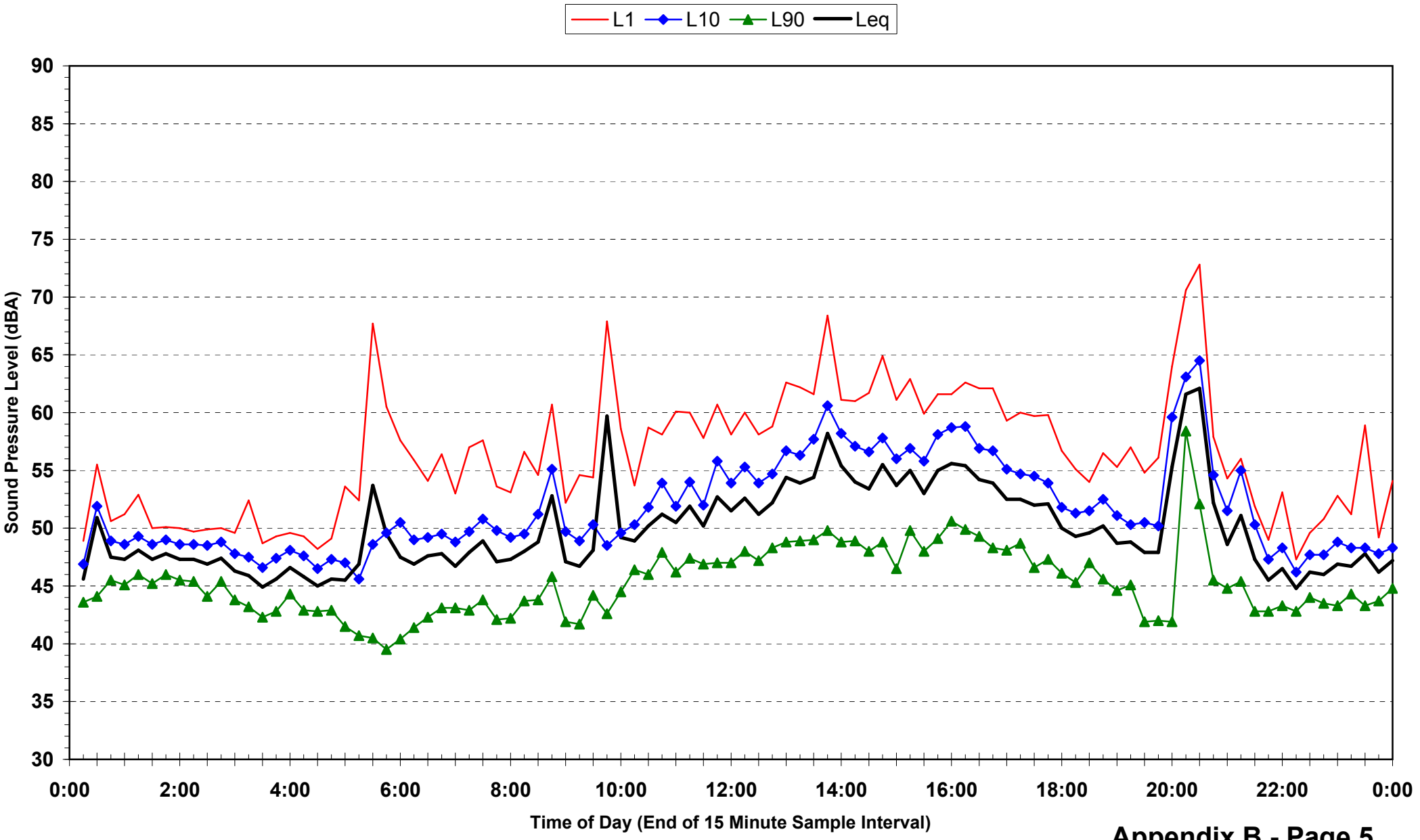

Statistical Ambient Noise Levels
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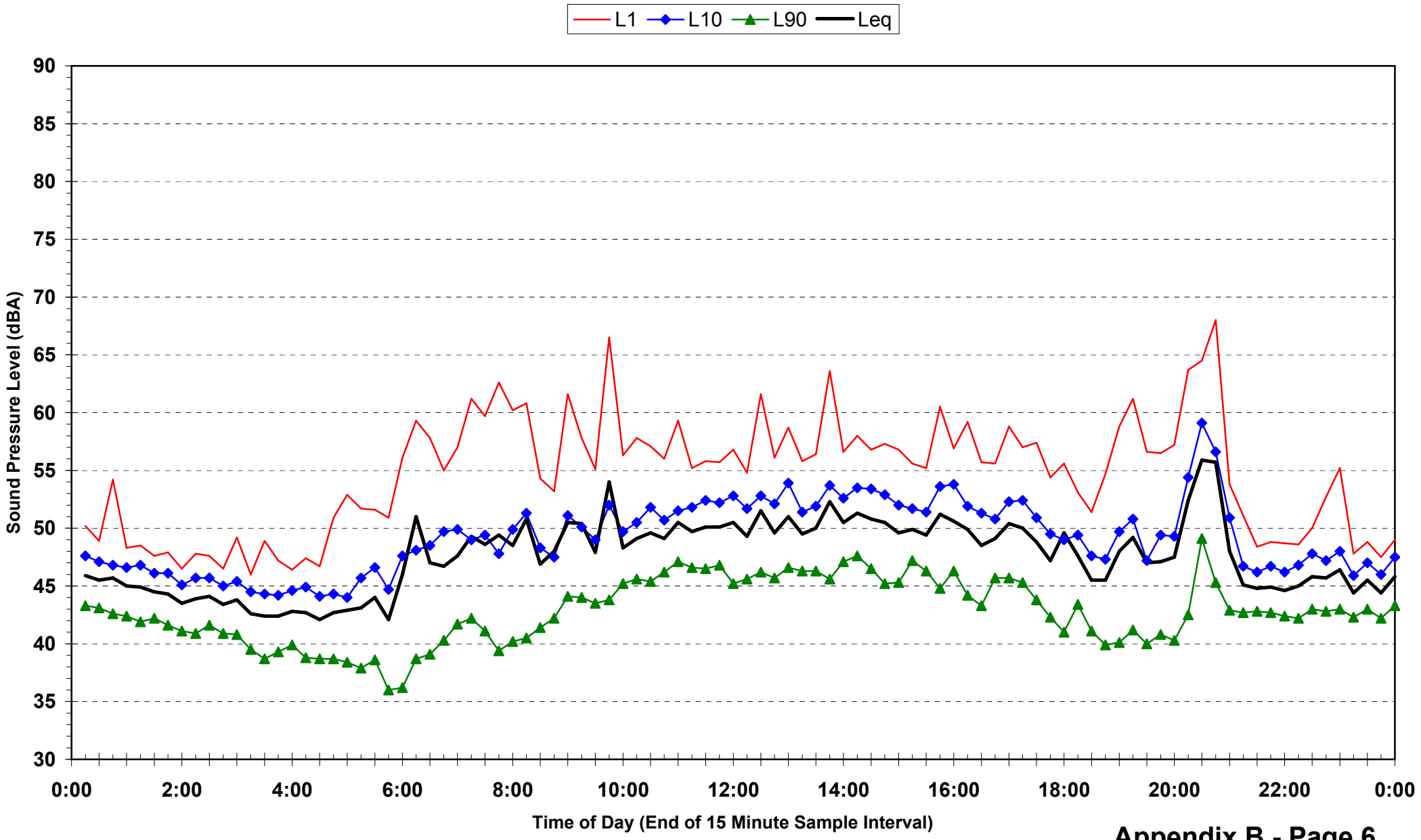

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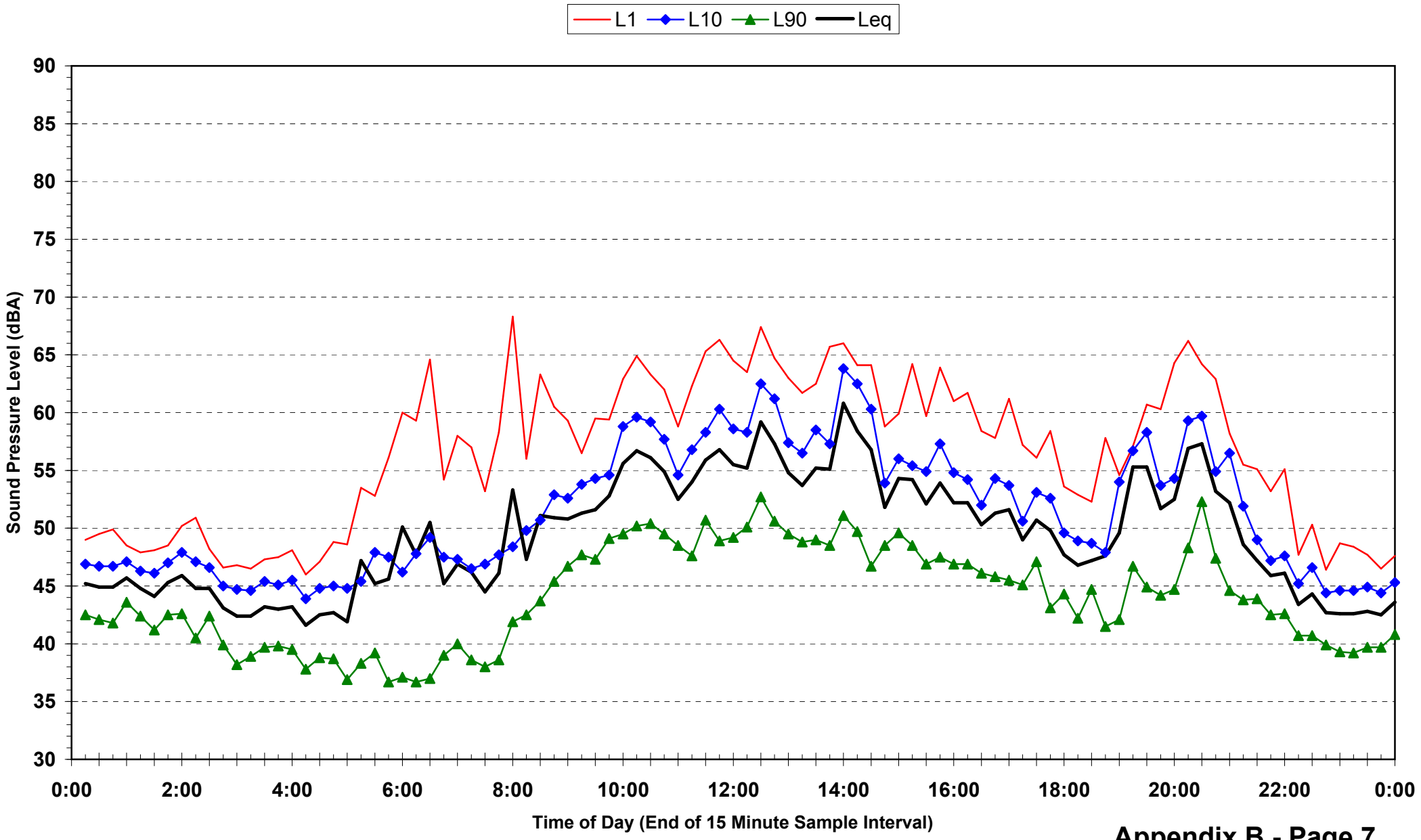

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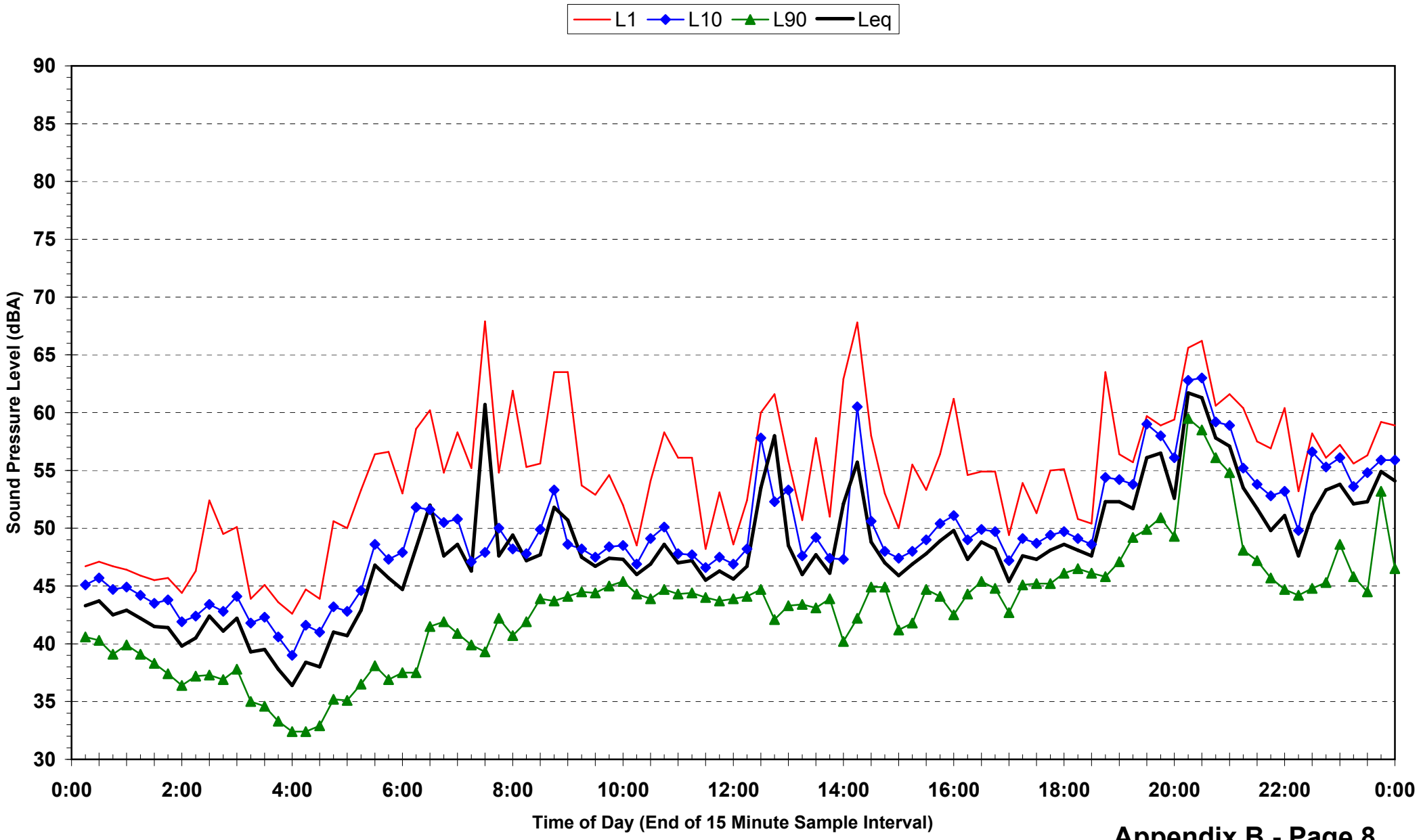

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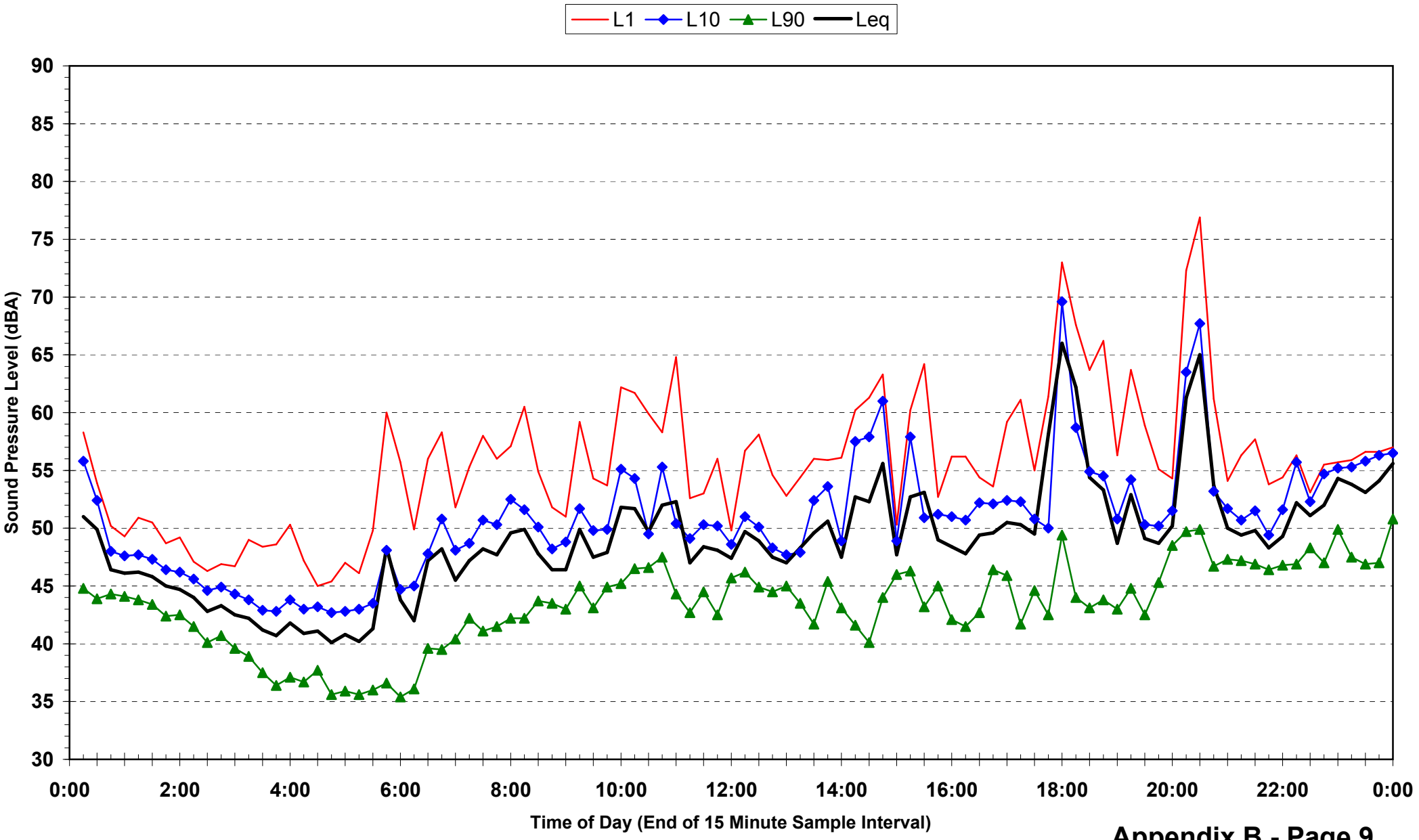

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