ILLAWARRA INTERNATIONAL HEALTH PRECINCT

STAGE 1 - CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

ACOUSTICS AND AIR

REPORT NO. 09069-C
VERSION A

WILKINSON MURRAY

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APRIL 2009

PREPARED FOR

LA VIE DEVELOPMENTS
MARINERS COURT, MCELHONE STREET
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TABLE OF CONTENTS

1 INTRODUCTION

As requested, Wilkinson Murray Pty Ltd has conducted a “desktop” construction noise and vibration assessment of Stage 1 at the proposed Illawarra International Health Precinct at Huntley.

Wilkinson Murray Pty Limited has been engaged by La Vie Developments Pty Ltd to conduct a construction noise and vibration assessment in relation the construction activities associated with Stage 1 of the project. This report describes the assessment and management of noise and vibration associated with the site preparation and construction of stage 1 of the precinct.

2 PROJECT AND SITE DESCRIPTION

The Illawarra International Health Precinct at Huntley is to be located on a triangular parcel of land between Avondale Road, Huntley Road and Goolagong Street Huntley as shown in Figure 2-1

Figure 2-1 Site Location

.The site is to be developed over eight stages as follows

- Stage 1 – Specialist and Surgicentre
- Stage 2 – Radiology and Pathology
- Stage 3- Hospital - Casualty and Medical Centre
- Stage 4- Hospital - Obstetric Unit
- Stage 5- 352 Bed Tertiary Referral
- Stage 6 - Nurse, Medical Student, Resident Medical Officers and Registrar Accommodation
- Stage 7- Huntley Further Education Facility
- Stage 8 – Illawarra Aged and Disability Centre

This assessment relates to Stage 1 being the Specialist Surgicentre which is to be located in the Northern end of the site as shown in Figure 2-2. The centre is to consist of the following elements

- Two storey glass / brick building (2 levels at 6000 m2 each)
- Basement Parking for 240 Cars
- External Parking 70 Cars

Figure 2-2 Stage 1 Plan

The major components of the construction are detailed Table 2-1

Table 2-1 Proposed Stage 1 Construction:

Stage	Construction Equipment	Duration
Excavation	Excavator, Front End Loader with ripper, dump truck, compressor, generator	2 months
Structure	Concrete Pump, Crane, Generator, Concrete Truck, Hand Tools	8 months
Fitout	Crane, Generator, Lights, Hand Tools, Delivery Trucks	8 months

3 AMBIENT NOISE LEVELS AND SURROUNDING RECIEVERS

Indicative ambient noise levels have been established based on "typical" background noise levels in Appendix A of Australian Standard *AS1055.2 (1997) Acoustics - Description and measurement of environmental noise - Application to specific situations*.

The background noise levels for on a R2 category being "Areas with low density transportation are presented Table 3-1.

Table 3-1 Indicative Background L_{A90} noise levels for "Areas with low density transportation" – dBA.

Period	Day 07:00-18:00	Evening 18:00-22:00	Night 22:00-07:00
Background Noise Levels	45	40	35

Nearby Surrounding receivers have been determined to be;

- **Location A - East** Suburban Residences in Penrose the nearest of which are in Goolagong Street at a distance in the order of 80 m from the centre of the Stage 1 site.
- **Location B - South** A single residence to the south of the site on Huntley Road at a distance 950 m from the centre of the Stage 1 site.
- **Location C - West** A single residence to the south of the site on Huntley Road at a distance of 780 m from the centre of the Stage 1 site.

4 NOISE CRITERIA

The following sections detail the applicable site specific construction noise and vibration criteria based on the guidelines of the Department of Environment and Climate Change (DECC).

4.1 Construction Noise Criteria

The assessment of construction noise is dependent on the duration of construction in the vicinity of the potentially affected residential receiver. The DECC provides guidance for conduction noise emissions in Chapter 171 of the *Environmental Noise Control Manual (ENCM)* suggests the following noise control guidelines.

Level Restrictions

(i) *Construction period of 4 weeks and under.*
The L_{10} level measured over a period of not less than 15 minutes when the construction site is in operation must not exceed the background level by more than 20 dB(A).

(ii) *Construction period greater than 4 weeks and not exceeding 26 weeks.*
The L_{10} level measured over a period of not less than 15 minutes when the construction site is in operation must not exceed the background level by more than 10 dB(A).

Time Restrictions

Monday to Friday	*7am–6pm*
Saturday	*7am–1pm (if inaudible at residential premises)*
	8am–1pm (if audible at residential premises)

No construction work to take place on Sundays or Public Holidays

Silencing

All possible steps should be taken to silence construction site equipment. It is particularly important that silenced equipment should be used on road or rail works where 24 hour operation is necessary.

Where the construction period is likely to be over 26 weeks, a construction noise goal based on a background + 5dBA approach is usually adopted.

Based on the above, Table 4-1 presents the applicable construction noise criteria.

Table 4-1 Site Specific Construction Noise Criteria for Normal Construction Hours – dBA

Site	Construction Duration		
	Up to 4 weeks	4 to 26 weeks	> 26 weeks
All residences	65	55	50

As the construction is to extend beyond 26 weeks the construction noise goal of 50 dBA is applicable.

4.2 Construction Vibration Criteria

Criteria for assessment of the effects of vibration on human comfort are set out in British Standard 6472-1992. Methods and criteria in that Standard are used to set “preferred” and

"maximum" vibration levels in the document "Assessing Vibration: A technical guideline" (2006) produced by the NSW DECC.

Acceptable values of human exposure to continuous vibration, such as that associated with underground drilling, are dependent on the time of day and the activity taking place in the occupied space (e.g. workshop, office, residence or a vibration-critical area). Guidance on preferred values for continuous and impulsive vibration acceleration is set out in Table 4-3.

Table 4-3 Preferred and maximum weighted rms values for continuous and impulsive vibration acceleration (m/s^2)1-80 Hz

		Preferred values		Maximum values	
Location	**Assessment period[1]**	**z-axis**	**x- and y-axes**	**z-axis**	**x- and y-axes**
Critical areas	Day- or night-time	0.0050	0.0036	0.010	0.0072
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010

In the case of intermittent vibration at Offices, schools, educational institutions and places of worship during the daytime, the "preferred" criterion is a Vibration Dose Value (VDV) of 0.2 $m/s^{1.75}$.

Calculation of VDV requires knowledge of the number of events in the relevant time period.

5 NOISE SOURCE LEVELS

Noise sources that are likely to be associated with the construction of the project are;

- Front End Loader
- Excavator with ripper
- Bogie (Dump) Truck
- Crane
- Power Tools
- Concrete Trucks
- Concrete Pumps
- Generators

Typical Sound Power Levels (SWL) of the plant likely to be used during earthworks, construction identified in Table 5-1. These SWLs have recently been measured at other similar construction sites.

Table 5-1 Typical Construction Maximum Plant Sound Power Levels (SWL)

Plant	SWL, dBA
Excavator with Ripper	107
Front End Loader	112
Bogie (Dump) Truck	112
Crane	110
Power Tools	115
Concrete Trucks	109
Concrete Pump	111
Small Generators	95

6 CONSTRUCTION NOISE ASSESSMENT

Following a review of the proposed construction, three typical construction ”worst case” scenarios have been selected for noise modelling, being;

- Excavation.
- Structure - Building Construction.
- Fitout Works.

The following sections describe these assessment scenarios, together with indicative plant numbers.

6.1 Scenario A – Excavation

This scenario consists of excavation works. Construction equipment included in this scenario is presented in Table 6-1.

Table 6-1 Construction Noise Scenario A Operations

Equipment Likely to Operate Simultaneously	Assumed Operation in any 15 minute Period
Front End Loader (1 location)	10 minutes
Excavator (1 location)	10 minutes
Dump Truck (2 locations)	5 minutes

6.2 Scenario B – Structure

This scenario consists of the construction of the building structure. Equipment included in this scenario is presented in Table 6-2.

Table 6-2 Construction Noise Scenario B Operations

Equipment Likely to Operate Simultaneously	Assumed Operation in any 15 minute Period
Concrete Truck (1 location)	10 minutes
Concrete Pump (1 location)	10 minutes
Crane (1 location)	10 minutes
Compressor (1 location)	15 minutes
Dump Truck (2 locations)	5 minutes

6.3 Scenario C - Fitout

This scenario consists of Fitout works. Equipment included in this scenario is presented in Table 6-3.

Table 6-3 Construction Noise Scenario C Operations

Equipment Likely to Operate Simultaneously	Assumed Operation in any 15 minute Period
Gantry Crane, (1 location)	5 minutes
Generator, (1 location)	15 minutes
Hand Tools (2 locations)	5 minutes
Delivery Truck (1 location)	5 minutes

6.4 Construction Noise Modelling

For noise modelling purposes, identified construction equipment was located across the relevant areas of the proposed construction sites, representing typical locations during the relevant construction period.

Site related noise emissions were modeled using the ISO algorithms implemented in the "Cadna A" acoustic noise prediction software. Factors that are addressed in the noise modeling are:

- Equipment sound level emissions and location;
- Screening effects from buildings;
- Receiver locations;
- Ground topography;
- Noise attenuation due to geometric spreading;
- Ground Absorption; and
- Atmospheric absorption.

6.5 Noise Modeling Results

The following sections present the predicted $L_{A10(15\ minute)}$ construction noise levels associated with each scenario detailed in Sections 6.1, 6.2 and 6.3. Noise levels have been predicted at surrounding residences.

6.6 Noise Modeling Results

The following sections present the predicted noise levels associated with each scenario detailed in the previous sections. $L_{A10(15\ minute)}$ construction noise levels have been predicted at surrounding residences.

Table 6-6 presents the results of the noise modelling.

Table 6-6 Predicted $L_{A10(15\ min)}$ Construction Noise Levels due to Construction Works.

	Receiver Location	Predicted Noise Level - dBA			DECC Noise Objective
		Excavation	Structure	Fitout	
A	Penrose Residences	56	53	57	50
B	South East Single Residence	33	34	38	50
C	West Single Residence	33	33	36	50

A review of the noise predictions indicates compliance with the established construction noise objective at receivers that are remote from the site that is the single residences to the West and South.

In the case of residences to the east which are in relatively close proximity to residences an exceedance of the established construction noise goal of up to 7 dBA is predicted.

It is noted that there is less shielding provided by surrounding industrial buildings in the direction of these residences. This is illustrated in Figures 6-1 and 6-3.

Figure 6-1 Construction Noise Contours – Scenario A Site Excavation.

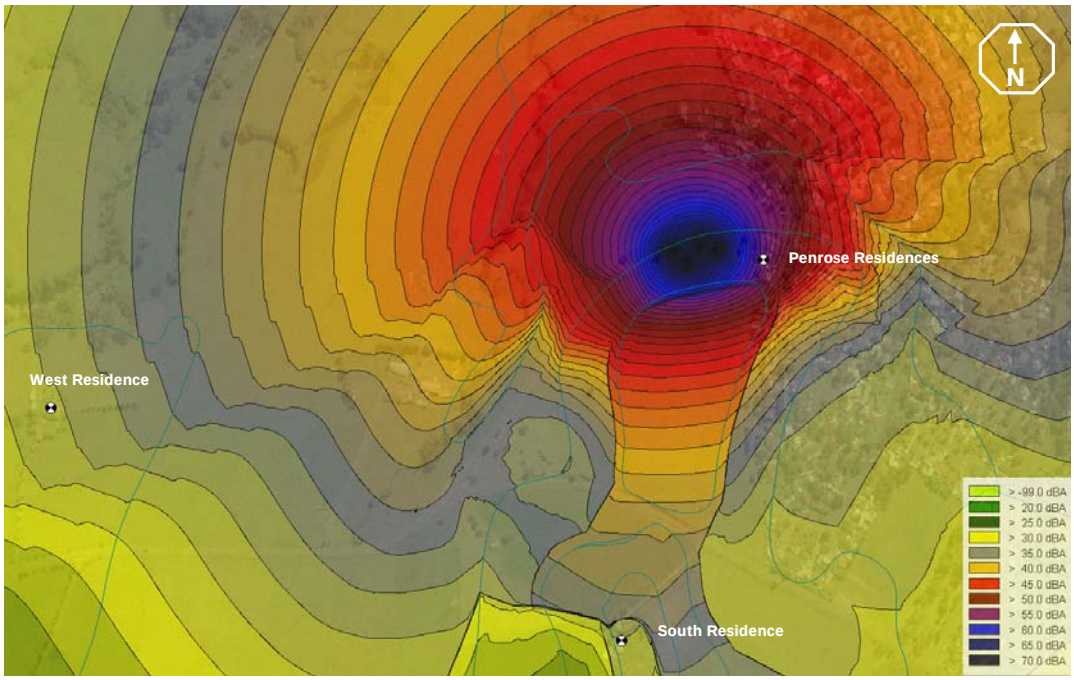


Figure 6-2 Construction Noise Contours – Scenario B Structure.

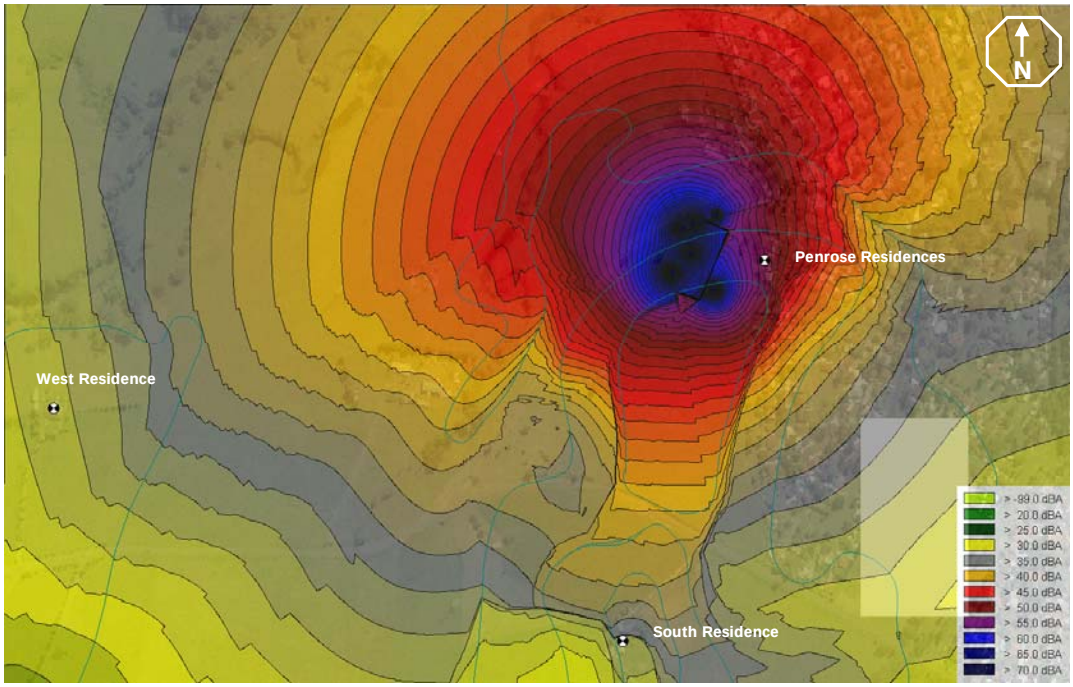
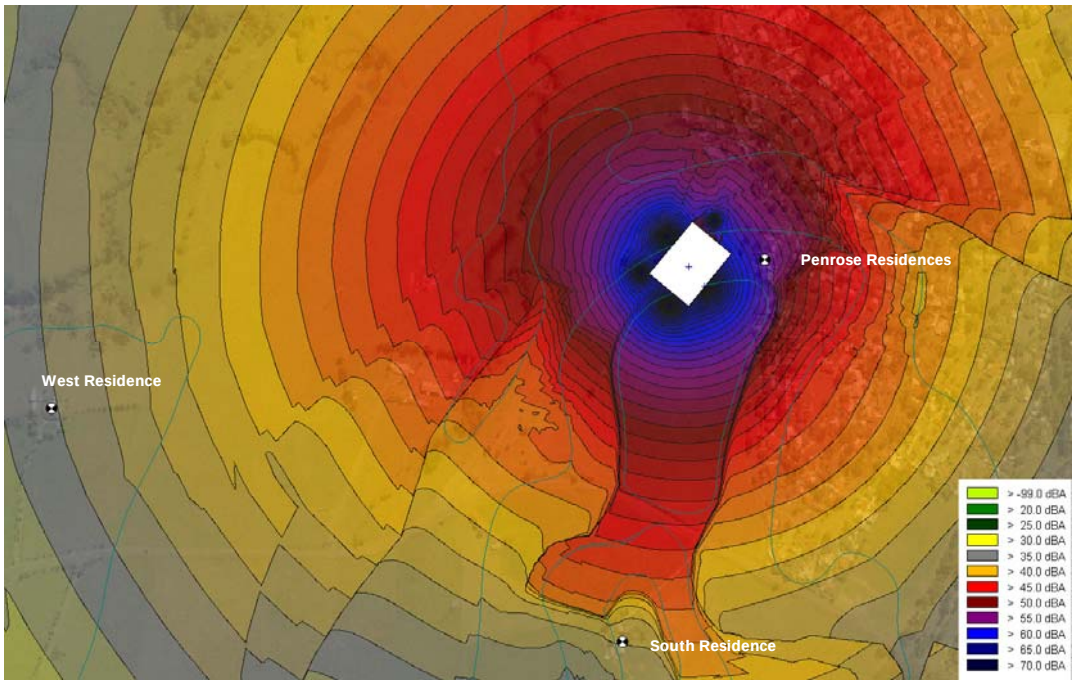


Figure 6-3 Construction Noise Contours – Scenario C Fitout.



Measures that can be adopted to mitigate identified potential exceedances are:

- Install a solid perimeter barrier on the eastern side of the site as soon a practicable. A 2 m barrier will provide reductions of up to 10 dBA at residences to the east.
- Access to the site should be from the western side of the site.
- Focus the stationary plant on the western side of the site which will increase the distance to eastern residences and also utilise any shielding to these residences provided by the new structure.
- Site Access should not utilise Goolgong Street. This will ensure that adjunct residences are not subjected to direct noise from passing truck movements.

6.7 Construction Vibration

Advice from the geotechnical engineer indicated that excavation will be in soil with a small amount of rock. Accordingly, at this stage rockbreaking is not envisaged. Any rock will be removed by a ripper attached to the rear of an excavator or bulldozer.

Taking into account the ground conditions and a minimum distance from the excavation area of 30 metres there will be no perceptible vibration at residences.

7 CONSTRUCTION NOISE MANAGEMENT MEASURES

Without mitigation, noise levels from some construction activities have been predicted to exceed the nominated design goals at some residential receivers. Therefore, noise control measures have been recommended to ensure that noise levels are mitigated at affected residences.

A range of possible approaches to reducing the impact of construction noise is described below. It is proposed that these strategies be applied to areas of exceedance identified in the preceding section.

- *Operator Instruction* – Operators should be trained in order to raise their awareness of potential noise problems and to increase their use of techniques to minimise noise emission.
- *Equipment Selection* - All fixed plant at the work sites should be appropriately selected, and be in good working order. Any plant that is faulty and exhibiting excessive noise should be fixed or replaced with an item of plant that is in good working condition.
- *Site Noise Planning* - Where practical, the layout and positioning of noise-producing plant and activities on each work site should be optimised to minimise noise emission levels.
- *Community Liaison* - liaison should be maintained between the communities overlooking the work site and the parties associated with the construction works to provide effective feedback in regard to perceived emissions.

8 CONCLUSION

This assessment of Stage 1 of Illawarra International Health Precinct has established noise and vibration criteria appropriate for the construction activities. An assessment of potential noise and vibration indicates the following:

- Compliance with established construction noise criteria is indicated at the isolated residences to the west and south.
- An exceedance of up to 7 dBA is predicted at residences to the East in Penrose. Therefore the construction of a perimeter noise barrier / fence is recommended to mitigate any noise impact at these residences.
- Other measures and procedures have been recommended to reduce noise levels at the eastern residences for all stages of the construction.

Vibration associated with excavation is predicted to comply with established human comfort and structural damage criteria.

Note
All materials specified by Wilkinson Murray Pty Limited have been selected solely on the basis of acoustic performance. Any other properties of these materials, such as fire rating, chemical properties etc. should be checked with the suppliers or other specialised bodies for fitness for a given purpose.

Quality Assurance
We are committed to and have implemented AS/NZS ISO 9001:2000 "Quality Management Systems – Requirements". This management system has been externally certified and Licence No. QEC 13457 has been issued.

AAAC
This firm is a member firm of the Association of Australian Acoustical Consultants and the work here reported has been carried out in accordance with the terms of that membership.

Version	Status	Date	Prepared by	Checked by
A	Final	28 April 2009	Brian Clarke	John Wasserman

APPENDIX A

GLOSSARY OF TERMS

GLOSSARY

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph overleaf, are here defined.

Maximum Noise Level (L_{Amax}) – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

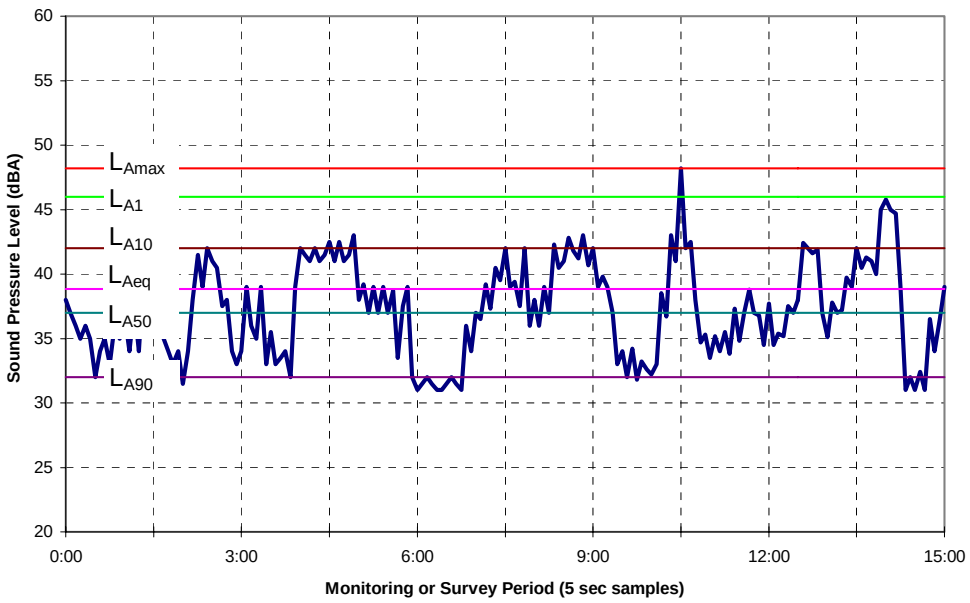
L_{A50} – The L_{A50} level is the noise level which is exceeded for 50% of the sample period. During the sample period, the noise level is below the L_{A50} level for 50% of the time.

L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

ABL – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day. It is determined by calculating the 10^{th} percentile (lowest 10^{th} percent) background level (L_{A90}) for each period.

RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period **–** daytime, evening and night time.

SEL – Sound exposure level abbreviated as SEL and L_{AE}, is the total noise energy produced from a single noise event. The Sound Exposure Level is a metric used to describe the amount of noise from an event such as an individual aircraft flyover. It is computed from measured dBA sound levels. The Sound Exposure Level is the integration of all the acoustic energy contained within the event.


60
55
50
45
40
35
30
25
20
Sound Pressure Level (dBA)
LAmax
LA1
LA10
LAeq
LA50
LA90
0:00
3:00
6:00
9:00
12:00
15:00
Monitoring or Survey Period (5 sec samples)