RENZO TONIN & ASSOCIATES
inspired to achieve

Acoustics
Vibration
Structural Dynamics

KINGS PARK WASTE METAL RECOVERY PROCESSING AND RECYCLING FACILITY

SUPPLEMENTARY NOISE AND VIBRATION IMPACT ASSESSMENT

3 September 2015

SELL & PARKER

TG616-03F01 EIS Supplementary Report (r12).docx

30 1982 2012 ACOUSTIC EXCELLENCE
Sydney Melbourne Brisbane Kuwait
Renzo Tonin & Associates (NSW) Pty Ltd ABN 29 117 462 861
Level 1/418A Elizabeth St SURRY HILLS NSW 2010 | PO Box 877 STRAWBERRY HILLS NSW 2012
P (02) 8218 0500 F (02) 8218 0501 sydney@renzotonin.com.au www.renzotonin.com.au

Document details

Detail	Reference
Doc reference:	TG616-03F01 EIS Supplementary Report (r12).docx
Prepared for:	SELL & PARKER
Address:	Sell & Parker Pty Ltd 24 Amelia Street Waterloo NSW 2011
Attention:	Mr Nigel Fox

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Authorised
16.06.2015	Initial draft for review	0-2		WC	RT	
18.06.2015	Issued to client		3	WC	RT	RT
23.06.2015	Revise vibration section	4		WC	RT	
25.06.2015	Issued to client for comment	5-7		WC	RT	
30.06.2015	Issued to client		8	WC	RT	RT
26.08.2015	Revise for EPA comments	9		WC	RT	
2.09.2015	Checked by RT		10-11	WC	RT	RT
3.09.2015	Final		12	WC	RT	RT

Contents

List of tables

List of figures

1 Introduction

Renzo Tonin & Associates was engaged to conduct a Noise and Vibration Impact Assessment for the proposed expansion of the existing Kings Park Waste Metal Recovery, Processing and Recycling Facility located at 45 Tattersall Road, Kings Park. The purpose of this assessment is to provide an environmental noise and vibration impact assessment of the expanded development affecting neighbouring residential and industrial premises.

This report supplements the initial noise impact report dated 6 June 2014 at the request of the NSW Department of Planning and Infrastructure so as to provide additional material in relation to potential vibration impacts from the operation of the metal shears. A new shear similar to that proposed for the proposed development has come into operation at the proponent's shredding facility in Darwin. The report has also been generally updated as a result of an internal peer review process.

For this project the following work has been undertaken:

- review of preliminary and final drawings of proposed site layout;
- review of all documentation provided for noise and vibration related items;
- site inspection and attended noise measurements;
- vibration measurements of a similar sized shear to that proposed for the development;
- identification of noise criteria and relevant guidelines;
- noise calculations to distant residential and adjacent industrial neighbours;
- assessment of likely noise and vibration impacts from proposed activities on site to neighbours; and
- provision of in-principle acoustic advice, where noise and vibration impacts exceed the recommended criteria.

Noise emissions from this proposed development is assessed to relevant noise criteria set out in the NSW 'Industrial Noise Policy' (INP - Environment Protection Authority 2000) and NSW Road Noise Policy (Environment Protection Authority 2013)

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001. Appendix A contains a glossary of acoustic terms used in this report.

2 Project description

Sell & Parker currently operates the Kings Park Waste Metal Recovery Processing and Recycling Facility at 45 Tattersall Road, Kings Park. The project proposal is to expand the facility to 23-43 Tattersall Road, the adjoining property to the east of the existing site, and increase approved capacity from 90,000 tonnes a year to 350,000 tonnes a year.

The changes to the proposed development, compared to the current and original proposal, mainly involve the reconfiguration of existing operations and expansion of the site on to the adjoining allotment to improve site safety and efficiency, improve traffic flow and reduce off-site traffic.

Operating hours sought are 6am to 9pm, Monday to Saturday.

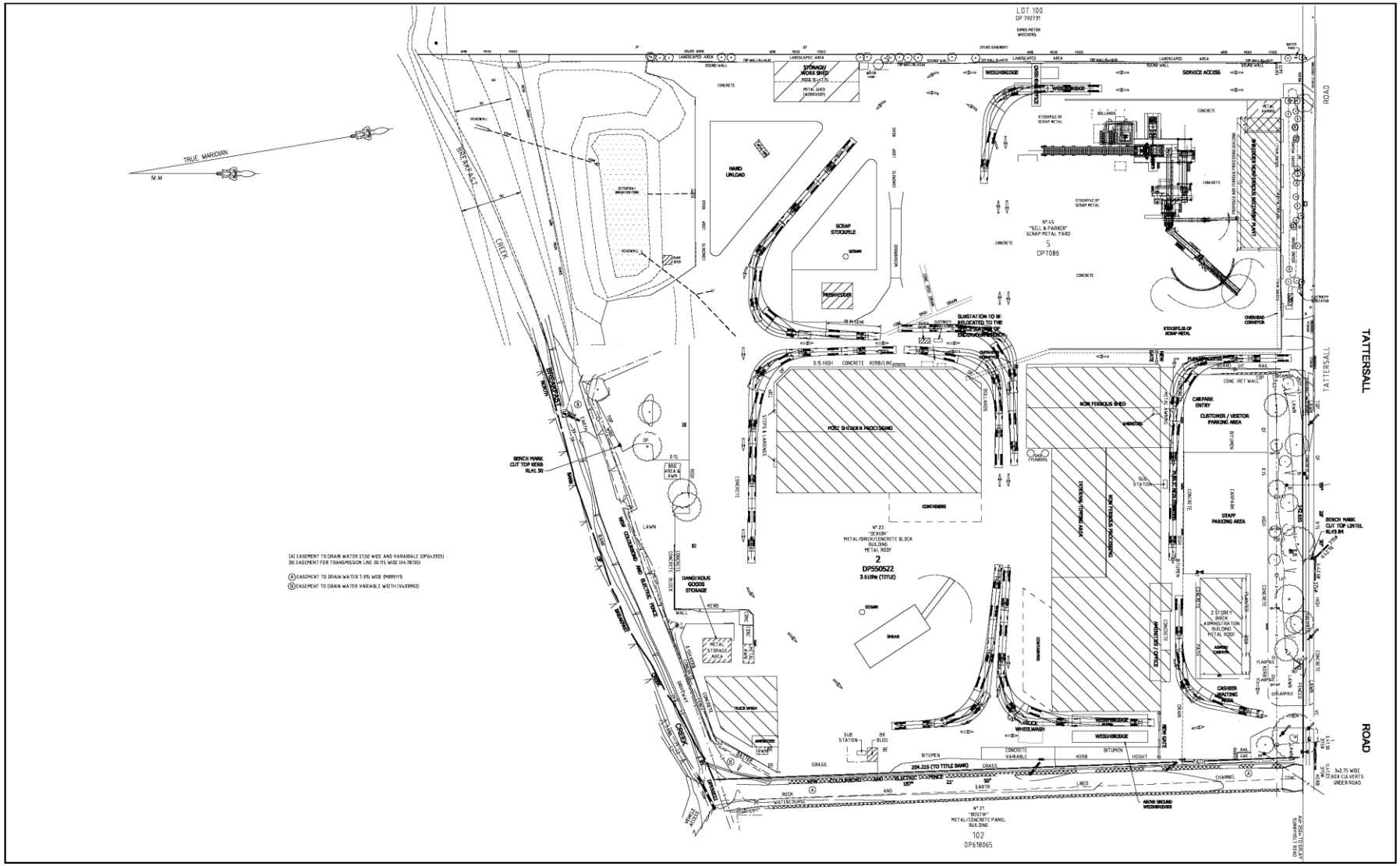
A concept plan for the modified site is presented in Figure 1 below.

In summary, the proposed development is as follows:

- The existing office will be demolished and relocated to improve safety and improve access to the shredder. The office functions will be relocated to the existing office situated at the front of the expanded site (23 Tattersall Road) to isolate pedestrians from the operational activities on the site;
- Car parking for staff and visitors will be increased and moved adjacent to the new office on the expanded site and isolated from the processing area of the facility;
- The pre-shedder will be relocated to where the shear is currently located;
- The existing shear will be replaced by an upgraded shear similar to that currently operating at the Sell & Parker Darwin site;
- The existing post shredder, non-ferrous recovery processing plant will be enclosed under a roof to improve efficiency and reduce potential for noise and dust nuisance;
- Parts of the existing building at 23 Tattersall Road will be demolished to make way for better circulation through the site;
- Additional post shredder processing will be introduced to further extract remaining recyclables (metals and plastics) from Floc material. This will involve conveying the Floc via an enclosed conveyor after shredding to inside one of the existing buildings on the expanded site (the Post Shredder Processing facility). The additional processing and storage of all Floc will be located inside and hence reduce potential for noise and dust nuisance;
- The non-ferrous shed and non-ferrous processing plant will be relocated inside the remaining buildings on the expanded site to improve efficiency and reduce potential for noise and dust nuisance;
- Maintenance shed/work shed will be relocated to old non-ferrous shed on existing site;

- The existing driveway entry at 23 Tattersall Road will be used for non-ferrous retail customers so that they are kept isolated from the processing area of the facility;
- The current Sell and Parker entry driveway will be widened so that two lanes of traffic can enter side by side at any time with two weighbridges installed so two customers can be served at the one time;
- The current exit driveway at 23 Tattersall Road will be widened and two weighbridges installed to handle traffic;
- The current exit driveway on 45 Tattersall Road will be closed and excavated to provide additional finished goods storage;
- Part of the existing sound barrier wall and some vegetation will be removed between the two lots; and
- A new truck wash facility will be installed within the existing building on the expanded site.

Figure 1: Project concept plan



RENZO TONIN & ASSOCIATES
inspired to achieve
Acoustics, Vibration & Structural Dynamics
Sydney Melbourne Brisbane Kuwait

Figure 1 - Project Concept Plan

Project:
TG616-03 Sell & Parker Blacktown

Date: 12-06-2015
Ref: TG616-03-P01 (r0)
Scale: NTS

3 Noise sensitive receivers and industrial receivers

The following residential receivers are potentially affected by noise from the site.

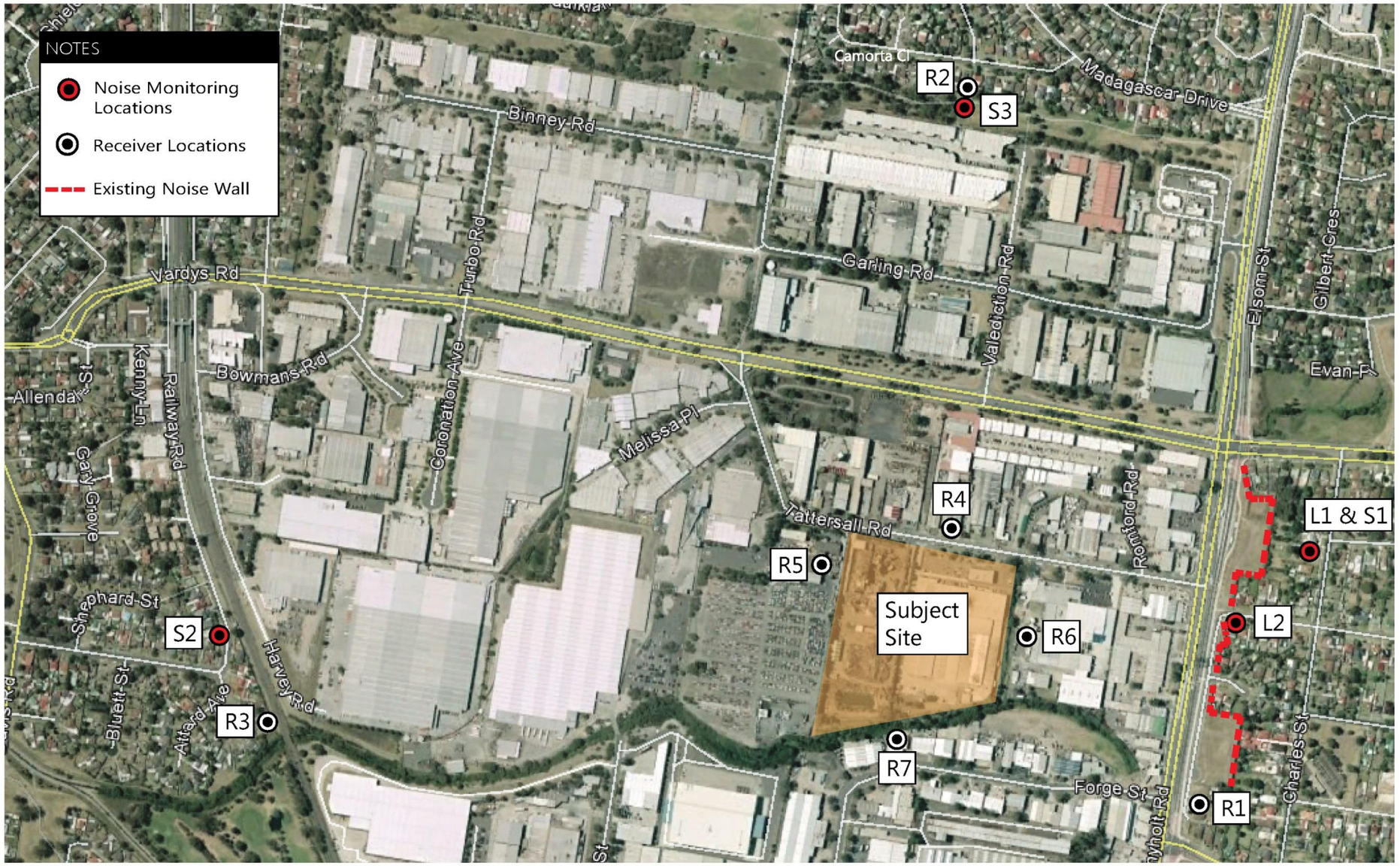
- **Receiver R1 – 189 Sunnyholt Road**
  Residential receiver located approx. 315m east of the expanded facility and considered representative of the nearest affected receivers along Sunnyholt Road.
- **Receiver R2 – 17 Camorta Close**
  Residential receiver located approx. 650m north of the expanded facility and considered representative of the nearest affected receivers along Camorta Close.
- **Receiver R3 – 3 Railway Road**
  Residential receiver located approx. 830m west of the expanded facility and considered representative of the nearest affected receivers along Railway Road.

The following lists adjacent industrial receptors:

- **Receiver R4 – 38 Tattersalls Road**
  Industrial receiver to the north of the expanded facility across from Tattersalls Road.
- **Receiver R5 – 57-69 Tattersalls Road**
  Industrial receiver to the west of the expanded facility sharing a common site boundary.
- **Receiver R6 – 21 Tattersalls Road**
  Industrial receiver to the east of the expanded facility sharing a common site boundary.
- **Receiver R7 – 38 Forge Street**
  Industrial receiver to the south of the expanded facility across Breakfast Creek.

These locations are depicted in Figure 2 below.

Figure 2: Location of subject site, residential and industrial receivers and noise monitoring locations



RENZO TONIN & ASSOCIATES
inspired to achieve
Acoustics, Vibration & Structural Dynamics
Sydney Melbourne Brisbane Kuwait

Figure 2 - Site, noise monitoring and receiver locations

Project:
TG616-03 Sell & Parker Blacktown

Date: 16-06-2015 Ref: TG616-03-P02 (r1) Scale: NTS

4 Existing acoustic environment

Criteria for the assessment of operational noise are usually derived from the existing noise environment of an area, excluding noise from the subject development.

Appendix B of the NSW EPA 'Industrial Noise Policy' (INP) outlines two methods for determining the background noise level of an area, being 'B1 – Long-term background noise method' and 'B2 – Short-term background noise method'. This assessment has used a combination of long-term unattended and short-term attended noise monitoring.

As the noise environment of an area varies over time, background and ambient noise levels need to be determined for the operational times of the proposed development. For example, in a suburban or urban area the noise environment is typically at its minimum at 3am in the morning and at its maximum during the morning and afternoon traffic peak hours. The INP outlines the following standard time periods over which the background and ambient noise levels are to be determined:

- **Day:** 07:00-18:00 Monday to Saturday and 08:00-18:00 Sundays & Public Holidays
- **Evening:** 18:00-22:00 Monday to Sunday & Public Holidays
- **Night:** 22:00-07:00 Monday to Saturday and 22:00-08:00 Sundays & Public Holidays

4.1 Noise measurement locations

Noise measurements are ideally carried out at the nearest or most potentially affected locations surrounding a development. Alternatively, representative locations should be established in the case of access restrictions or a safe and secure location cannot be identified. Furthermore, representative locations may be established in the case of multiple receivers as it is usually impractical to carry out measurements at all locations surrounding a site.

The locations of the long-term unattended and short-term attended measurement are identified in Table 4.1 below and depicted in Figure 2 above.

Table 4.1 – Noise measurement locations

ID	Location	Description
Long-term unattended noise monitoring (provided by Environmental Resources Management Australia Pty Ltd)		
L1	1/50 Charles Street	The noise monitor was located in the 'free-field'. The noise monitoring location is considered representative of residential receiver locations along Sunnyholt Road.
L2	2 Anthony Street	The noise monitor was located in the 'free-field'. The noise monitoring location was supplementary for residential receiver locations along Sunnyholt Road.
Short-term attended noise monitoring (Renzo Tonin & Associates)		
S1	50 Charles Street - Kerb side	Short term attended noise measurements were conducted in the 'free field'. The noise monitoring location was selected to provide a correlation with the long term noise monitoring at Location L1.
S2	6 Railway Road - Kerb side	Short term attended noise measurements were conducted in the 'free field'. The noise monitoring location was selected to provide a correlation between the long term noise monitoring at Location L1 to the residential receivers along Railway Road.
S3	17 Camorta Close (southern side of southern site boundary)	Short term attended noise measurements were conducted in the 'free field'. The noise monitoring location was selected to provide a correlation between the long term noise monitoring at Location L1 to residential receivers along Camorta Close.

It is noted that the long term unattended noise level data reported herein was provided by Environmental Resources Management Australia Pty Ltd (ERM). The original data was re-analysed for the purpose of this report according to the guidelines contained in the INP.

The long term unattended noise monitoring was conducted with the subject site operating but site visits by Renzo Tonin & Associates on Thursday 6th February 2014 and Thursday 4th June 2015 (described in more detail below) confirm that noise from existing site operations does not contribute in any significant way to the measured background noise level at the monitoring locations. In support of this conclusion are the following observations:

i. the separation distance between the site and sensitive receivers;

ii. the acoustic shielding afforded by the intervening industrial buildings;

iii. the dominance of traffic noise from Sunnyholt Road; and,

iv. the acoustic shielding provided by the interposed 4.2m high traffic noise barriers on Sunnyholt Road the locations of which are shown in Figure 2.

4.2 Long-term unattended noise measurement results

Long-term unattended noise monitoring was carried out by ERM from Tuesday 17th December 2013 to Tuesday 24th December 2013. The results of the long term monitoring were analysed and noise level-vs-time graphs of the data were developed and are annexed in Appendix B.

Table 4.2 presents the overall single Rating Background Levels (RBL) and representative ambient L_{Aeq} noise levels for each assessment period, determined in accordance with the INP.

Table 4.2 – Long-Term Noise Monitoring Results, dB(A)

Monitoring Location	L_{A90} Rating Background Noise Level (RBL)				L_{Aeq} Ambient Noise Levels			
	Shoulder[1]	Day[2]	Evening[3]	Night[4]	Shoulder[1]	Day[2]	Evening[3]	Night[4]
L1 - 1/50 Charles Street	43	41	45	40	49	58	55	48
L2 - 2 Anthony Street	45	44	44	35	52	52	50	48

Notes:
1. Shoulder 06:00-07:00 Monday to Saturday
2. Day: 07:00-18:00 Monday to Saturday and 08:00-18:00 Sundays & Public Holidays
3. Evening: 18:00-22:00 Monday to Sunday & Public Holidays
4. Night: 22:00-07:00 Monday to Saturday and 22:00-08:00 Sundays & Public Holidays
5. As required by the INP, the external ambient noise levels presented are free-field noise levels. [ie. no façade reflection]

Given that the expanded facility will operate between 6am and 9pm from Monday to Saturday, only the shoulder, day and evening periods are assessed in this report.

4.3 Short-term attended noise measurement results

4.3.1 Noise survey Thursday 6th February 2014

Short-term attended noise measurements were undertaken during the daytime of Thursday 6th February 2014, in order to supplement the long-term noise monitoring and provide greater detail of the surrounding noise environment.

The equipment used for the short term noise measurements were two Brüel & Kjær Type 2250 precision sound level analysers which are Class 1 instruments having accuracies suitable for field and laboratory use. The instruments were calibrated prior and subsequent to measurements using a Bruel & Kjaer Type 4231 calibrator. No significant drift in calibration was observed. All instrumentation complies with AS IEC 61672.1 2004 'Electroacoustics - Sound Level Meters' and carries current NATA certification (or if less than 2 years old, manufacturers certification).

A summary of the short-term measurement results are presented in Table 4.3.

Table 4.3 – Short-term attended noise monitoring results for Thursday 6th February 2014

Location / Time	Time	Measured Noise Level, dB(A)		Comments on Measured Noise Levels
		L_{Aeq}	L_{A90}	
S1 – 50 Charles Street	2:34pm - 2:49pm	57	43	Dominant noise source at this location was traffic noise from Sunnyholt Road.
S2 – 6 Railway Road		60	46	Dominant noise source at this location was traffic noise along Railway Road, rail movements along adjacent railway line and some industrial noise audible from the Blacktown industrial area but not measureable.
S1 – 50 Charles Street	2:59pm - 3:14pm	57	42	Dominant noise source at this location was traffic noise from Sunnyholt Road.

Location / Time	Time	Measured Noise Level, dB(A)		Comments on Measured Noise Levels
		L_{Aeq}	L_{A90}	
S3 – 17 Camorta Close		47	45	Dominant noise source at this location was distant traffic noise and some industrial noise audible from the Blacktown industrial area but not measureable.

4.3.2 Noise survey Thursday 4th June 2015

Supplementary short-term attended noise measurements were undertaken during the daytime of Thursday 4th June 2015, in order to provide greater detail of the surrounding noise environment.

The equipment used for noise measurements was an NTi Audio Type XL2 precision sound level analyser which is a class 1 instrument having accuracy suitable for field and laboratory use. The instrument was calibrated prior and subsequent to measurements using a Bruel & Kjaer Type 4231 calibrator. No significant drift in calibration was observed. All instrumentation complies with IEC 61672 (parts 1-3) 'Electroacoustics - Sound Level Meters' and IEC 60942 'Electroacoustics - Sound calibrators' and carries current NATA certification (or if less than 2 years old, manufacturers certification).

A summary of the short-term measurement results are presented in Table 4.3.

Table 4.4 – Short-term attended noise monitoring results for Thursday 4th June 2015

Location / Time	Time	Measured Noise Level, dB(A)		Comments on Measured Noise Levels
		L_{Aeq}	L_{A90}	
R1 – 189 Sunnyholt Road	1:30pm - 1:45pm	62	55	The measurement location was not behind the 4.2m traffic noise barrier and had line of sight to Sunnyholt Road. Dominant noise sources at this location were traffic noise from Sunnyholt Road and noise from the BP service station workshop located directly across on Sunnyholt Road including intermittent noise from ratchet guns, saws and general impact noise (bangs). Some distant construction noise audible from a construction site on Anthony Street, to the north, but not measureable. Noise from the Sell & Parker Kings Park site was inaudible throughout the measurement period.
	1:45pm - 2:00pm	64	55	
	2:00pm - 2:15pm	64	58	
S3 – 17 Camorta Close	2:31pm - 2:46pm	47	44	Dominant noise source at this location was distant traffic noise and some industrial noise audible from the Blacktown industrial area but not measureable. Noise from the Sell & Parker Kings Park site was inaudible throughout the measurement period.

An attempt to conduct attended measurements at measurement location S1 was aborted due to the influence of extraneous noise from concreting works at a nearby construction site on Anthony Street.

4.3.3 Summary of short-term attended noise measurement results

Based on the simultaneous short-term attended noise monitoring results presented in Table 4.3, a correlation factor of 3dB was determined for the L_{A90} between the monitoring locations S1 and S2 and between location S1 and S3. The correlation factor is then applied to the long-term unattended noise monitoring results and the correlated Rating Background Noise Level results for Railway Road and Camorta Close are presented in Table 4.5.

Table 4.5 – Correlated noise monitoring results

Monitoring Location	L_{A90} Rating Background Noise Level (RBL)			
	Shoulder[1]	Day[2]	Evening[3]	Night[4]
S2 – 6 Railway Road	46	44	48	43
S3 – 17 Camorta Close	46	44	48	43

Notes:
1. Shoulder 06:00-07:00 Monday to Saturday
2. Day: 07:00-18:00 Monday to Saturday and 08:00-18:00 Sundays & Public Holidays
3. Evening: 18:00-22:00 Monday to Sunday & Public Holidays
4. Night: 22:00-07:00 Monday to Saturday and 22:00-08:00 Sundays & Public Holidays
5. As required by the INP, the external ambient noise levels presented are free-field noise levels. [ie. no façade reflection]

It is acknowledged that the RBLs determined for locations S2 and S3 are approximate only however, as confirmed below, they are separated from the subject site by such a large distance that noise impacts are well below the nominated criteria. Accordingly, it is not necessary to determine more precise background noise levels at these locations.

5 Meteorology

The NSW EPA's INP recommends that project noise criteria are to apply under weather conditions characteristic of an area. These conditions may include calm, wind and temperature inversions. In this regard, the increase in noise that results from atmospheric temperature inversions and wind effects may need to be assessed. The noise levels predicted under characteristic meteorological conditions for each receiver are then compared with the criteria, to establish whether the meteorological effect will cause a significant impact.

The NSW EPA's INP permits two approaches for assessing these effects: use of default parameters and use of site-specific parameters.

- With using default parameters, general meteorological values are used to predict noise levels, foregoing detailed analyses of site-specific meteorological data. This approach assumes that meteorological effects are conservative, in that it is likely to predict the upper range of increases in noise levels. Actual noise levels may be less than predicted.
- The use of site-specific parameters is a more detailed approach, which involves analysing site meteorological data to determine whether inversion and/or wind effects are significant features warranting assessment. Where assessment is warranted, default parameters are available for use in predicting noise or, where preferred, measured values may be used instead. The use of site-specific parameters provides a more accurate prediction of noise increases due to meteorological factors, however, is more costly especially if suitable site data is unavailable and long-term meteorological monitoring is required. Existing weather data may be used, provided the site is within a radius of 30 km of the collection point and in the same topographical basin.

For this assessment, the more detailed approach using site-specific meteorological parameters was conducted. Weather data was obtained from the Bureau of Meteorology's automatic weather station installed at the Horsley Park Equestrian Centre, located 12 km south of the subject site, over the period between 2nd June 2014 and 1st June 2015. As the subject site will operate during predominantly day and evening periods, consideration of night time temperature inversions is not required and only wind effects are considered from herein.

5.1 Wind effects

The INP specifies a procedure for assessing the significance of wind effects, and a default wind speed to be used in the assessment where these effects are found to be significant. The procedure requires that wind effects be assessed where wind is a feature of the area.

Wind is considered to be a feature where source-to-receiver wind speeds (at 10 m height) of 0.5 to 3 m/s occur for 30% of the time or more in any assessment period (day, evening and night) in any season. Winds with velocities less than 0.5 m/s (calm conditions) and greater than 3 m/s (at 10 m height), are not included in the calculations of wind occurrence.

Where there is 30% or more occurrence of wind speeds between 0.5 m/s and 3 m/s (source-to-receiver component), then the highest wind speed is used (below 3 m/s) instead of the default. Where there is less than a 30% occurrence of wind between 0.5 m/s and 3 m/s (source-to-receiver component), wind is not included in the noise-prediction calculations.

Analysis of the wind data from the Horsley Park Equestrian Centre automatic weather station was undertaken using the EPA's Noise Enhancement Wind Analysis program to determine if wind is a 'feature' of the area as defined by the INP. The program determines whether there are prevailing source-to-receiver wind conditions. The results of the analysis are presented in Table 5.1 below:

Table 5.1 – Percentage of Wind Records (up to 3 m/s) from Subject Site to Receiver, %

Receiver	Summer		Autumn		Winter		Spring	
	Day	Eve	Day	Eve	Day	Eve	Day	Eve
R1 – Sunnyholt Road	6.9	3.2	15.6	10.1	20.1	22.1	10.7	8.9
R2 – Camorta Close	10.9	21.4	16.9	25.6	14.7	28.9	7.5	21.1
R3 – Railway Road	17.6	**30.8**	10.3	7.6	5.9	2.6	12.0	22.6
R4 – 38 Tattersalls Road	8.7	17.2	17.5	**32.3**	17.4	**36.1**	7.7	18.8
R5 – 57-69 Tattersalls Road	14.6	29.7	12.6	9.0	10.7	7.0	10.1	22
R6 – 21 Tattersalls Road	6.5	5.1	16.9	21.6	23.2	**36.2**	9.1	12.5
R7 – 38 Forge Street	19.2	7.9	14.7	8.9	16.1	11.9	20.3	9.2

Notes 1. **Bold** denotes greater than 30% occurrence of wind between 0.5 m/s and 3 m/s (source-to-receiver component)

The results above indicate that there is greater than 30% occurrence of winds between 0.5 m/s and 3 m/s (source-to-receiver component) for Receivers R3, R4 and R6. Therefore, prevailing wind conditions in accordance with the INP are considered in the noise prediction calculations for Receivers R3, R4 and R6.

6 Criteria

The operation of the proposed expansion of the Kings Park Waste Metal Recovery, Processing and Recycling Facility is assessed to the NSW 'Industrial Noise Policy' (INP – Environment Protection Authority 2000). The INP is used as a guide by the EPA for setting statutory limits in licences for scheduled noise sources.

The INP has two components:

- Controlling intrusive noise impacts, and
- Maintaining noise level amenity for particular land uses for residences and other land uses.

6.1 Intrusive noise impacts

According to the INP, the intrusiveness of a noise source may generally be considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented by the L_{Aeq} descriptor) does not exceed the background noise level measured in the absence of the source by more than 5dB(A). The intrusiveness criterion is summarised as follows:

- $L_{Aeq,15minute}$ ≤ **Rating Background Level (RBL) plus 5dB(A)**

6.2 Protecting noise amenity

The Amenity Criteria are determined in accordance with Chapter 2 of the NSW INP. The INP recommends base acceptable noise levels for various receivers, including residential, commercial, industrial receivers and sensitive receivers such as schools, hospitals, churches and parks. These base noise criteria are then lowered by up to 10dB depending on the extent of existing industrial noise impact upon the receiver. Higher levels of existing industrial noise therefore result in stricter Amenity Criteria applied to any new industrial development. In this way the cumulative impacts of existing and known future industrial noise sources are minimised.

To limit continuing increases in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified in Table 2.1 of the policy, the applicable parts of which are reproduced in Table 6.1 below.

Table 6.1 – Amenity criteria – recommended L_{Aeq} noise levels from industrial sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended $L_{Aeq(Period)}$ Noise Level	
			Acceptable	Recommended Maximum
Residence	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
Industrial premises	All	When in use	70	75

Note:
1. 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
2. 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.
3. The LAeq index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

6.3 Project specific noise goals

In accordance with the INP, noise impact should be assessed in terms of both intrusiveness and amenity. Based on the background and ambient noise monitoring carried out at the nearest affected residential locations, the applicable noise criteria are as follows.

Table 6.2 – Industrial noise criteria for the proposal

Receiver Location	Intrusiveness Criteria, $L_{Aeq,15min}$, dB(A)			Amenity Criteria, $L_{Aeq,period}$, dB(A)		
	Shoulder	Day	Evening	Shoulder	Day	Evening
R1 – Sunnyholt Road	46	46	46	55	55	45
R2 – Camorta Close[1]	49	49	49	55	55	45
R3 - Railway Road[1]	49	49	49	55	55	45
R4 - 38 Tattersalls Road[2]	-	-	-	70	70	70
R5 - 57-69 Tattersalls Road[2]	-	-	-	70	70	70
R6 - 21 Tattersalls Road[2]	-	-	-	70	70	70
R7 - 38 Forge Street[2]	-	-	-	70	70	70

Notes:
1. Intrusiveness criteria determined based on correlation of short term measurements at receiver Locations R2 and R3 with short term measurements at receiver Location R1
2. The daytime amenity criteria has been adopted for the shoulder period as the subject site is located within an industrial complex where the majority of neighbouring facilities are operational during the shoulder period, and the noise environment for residential receivers during the shoulder period is similar to the day time period.
3. Receiver locations R4, R5, R6 and R7 are industrial receivers and only the amenity criteria is applicable to these receivers when in use.

In respect of the residential receivers R1-R3, as existing industrial noise is not measureable at these sites, it is concluded that the level of industrial noise is insignificant and therefore no modifications are applied to the amenity criteria shown in the table above. Comparing the intrusiveness criteria and the amenity criteria, it can be seen that for the shoulder and day period the intrusiveness criteria are more stringent and for the evening period the amenity criterion is more stringent.

In respect of the industrial receivers the amenity noise goals apply at the boundary of the site. In this instance, the subject site is the principle source of noise and there is no cumulative impact from other industries. Therefore, the amenity criteria shown in the table above for receivers R4-R7 are the project specific noise goals.

6.4 Sleep Disturbance

Noise emanating from project has been assessed for its potential to disturb sleep. The NSW EPA (formerly DEC) has made the following policy statement with respect to sleep disturbance:

Peak noise level events, such as reversing beepers, noise from heavy items being dropped or other high noise level events, have the potential to cause sleep disturbance. The potential for high noise level events at night and effects on sleep should be addressed in noise assessments for both the construction and operational phases of a development. The INP does not specifically address sleep disturbance from high noise level events.

Research on sleep disturbance is reviewed in the NSW Road Noise Policy. This review concluded that the range of results is sufficiently diverse that it was not reasonable to issue new noise criteria for sleep disturbance.

From the research, the EPA recognised that the current sleep disturbance criterion of an LA1, (1 minute) not exceeding the LA90, (15 minute) by more than 15 dB(A) is not ideal. Nevertheless, as there is insufficient evidence to determine what should replace it, the EPA will continue to use it as a guide to identify the likelihood of sleep disturbance. This means that where the criterion is met, sleep disturbance is not likely, but where it is not met, a more detailed analysis is required.

The detailed analysis should cover the maximum noise level or LA1, (1 minute), that is, the extent to which the maximum noise level exceeds the background level and the number of times this happens during the night-time period. Some guidance on possible impact is contained in the review of research results in the NSW Road Noise Policy. Other factors that may be important in assessing the extent of impacts on sleep include:

- *how often high noise events will occur*
- *time of day (normally between 10pm and 7am)*
- *whether there are times of day when there is a clear change in the noise environment (such as during early morning shoulder periods).*

The LA1, (1 minute) descriptor is meant to represent a maximum noise level measured under 'fast' time response. The EPA will accept analysis based on either LA1, (1 minute) or LA, (Max).

The NSW EPA confirm that a sleep disturbance criterion of $L_{A1(1min)} \leq L_{A90(15min)} + 15dB(A)$, should only be used as a first step guide and where the criteria is not met, more detailed analysis is required as explained in the text above.

As the subject site only operates from 6:00am to 7:00am during the night time period, the sleep disturbance criteria are only applicable from 6:00am to 7:00am. The sleep disturbance criteria for the project are presented in Table 6.3.

Table 6.3 – Sleep disturbance criteria, dB(A)

Receiver Location	Sleep disturbance criteria, 6:00am - 7:00am, $L_{A1,1minute}$
	$L_{A90(15min)}$ + 15
R1 – Sunnyholt Road	43 + 15 = 58
R2 – Camorta Close [1]	45 + 15 = 60
R3 - Railway Road [1]	45 + 15 = 60

Notes: 1. Intrusiveness criteria determined based on correlation of short term measurements at receiver Locations R2 and R3 with short term measurements at receiver Location R1

7 Predicted noise levels

7.1 Noise sources

7.1.1 Operational noise

A summary of mobile and fixed equipment included in the noise modelling for the expansion, and relevant Sound Power Levels, is provided in Table 7.1. Sound power levels for this assessment were determined based on noise levels recorded on site, previous on-site measurements and data from similar projects.

Table 7.1 – Sound Power Level of proposed plant, dB(A) re 1pW

Plant	Sound Power Level (per item])		Number of items (included in noise model)
	$L_{Aeq,\ 15min}$ dB(A)	L_{Amax} dB(A)	
Hammer Mill[2]	116	119	1
Metal Shear	112	129	1
Excavator	107	115	2
Front End Loader	107	115	2
Pre shredder	107	116	1
Seram/pedestal Crane	107	116	2
Material Handler	105	117	3
Truck	105	110	4

Notes: 1. Only the noisiest and most dominant noise sources have been presented
2. Presented Sound Power Level of the hammer mill includes noise generated by the shaker

Renzo Tonin & Associates have been advised by Sell and Parker that the air emissions control system, for the proposed hammer mill, will be designed appropriately so that noise impact to the surrounding sensitive receivers are minimised. Acoustic assessment of the air emissions control system should be undertaken during the detail design of the hammer mill to ensure that the cumulative noise of all equipment does not exceed the applicable criteria at surrounding sensitive receivers.

The mechanical services plant for the site will utilise the existing air-conditioning equipment at 23-43 Tattersalls Road. Noise emissions from the existing air-conditioning equipment will be insignificant compared to the industrial noise sources operating on site as specified in Table 7.1 and would not require further assessment.

7.1.2 Carpark vehicle movement on site

Noise generated by car park activities which may contribute to the overall L_{Aeq} noise level emission from the site includes vehicle doors closing, vehicle engines starting and vehicles moving. To assess this noise, the L_{Aeq} noise levels were determined for the relevant time period based on the number of vehicle activities expected to occur during that period at the nearest affected receiver locations. Sound power level measurements from our database and library files were used for the purpose of this assessment.

The sound power levels of the car park activities are shown in Table 7.2 below.

Table 7.2 – Sound Power Levels of car park activities, dB(A) re 1pW

Activity	Sound Power Level, dB(A) re 1pW
Vehicle door closing	86
Vehicle engine starting	92
Vehicle moving (10km/h)	79 per metre

A maximum staff capacity of 82 employees is proposed. Assuming all employees drive to work and arrive/leave within a one hour period, for modelling purposes, the worst case scenario for the car park would include 82 vehicle doors closing, 82 vehicle engine starts and 82 vehicles manoeuvring in the carpark, within a one hour period.

7.2 Predicted noise levels

Noise emissions were predicted by modelling the noise sources, receiver locations, topographical features of the intervening area, and possible noise control treatments using CadnaA (version 4.4) noise modelling computer program utilising the ISO9613 standard. The program calculates the contribution of each noise source at each specified receptor point and allows for the prediction of the total noise from a site.

- The noise prediction models takes into account:
- Location of noise sources and receiver locations;
- Height of sources and receivers;
- Separation distances between sources and receivers;
- Ground type between sources and receivers (soft); and
- Attenuation from barriers (natural and purpose built).

The noise predictions are based on the indicative layout prepared by Lean Lackenby & Hayward dated 10th October 2013, the amended site plan and reconfiguration of existing buildings on the Dexion site at 23 Tattersalls Road.

The following assumptions were made for noise prediction purposes:

- All fixed and mobile plant operating concurrently;
- 4 trucks moving on site concurrently;
- The retained 4m high acoustic screen fencing erected around the existing site's northern and western boundaries and along existing driveways as shown on site drawings and detailed in Section 8.1; and
- New 4m high acoustic screen fencing erected along the new eastern boundary of the expanded site with details of the fence presented in Section 8.1.

Predicted noise levels based on the above assumptions are summarised in Table 7.3 below. Because noise from the site is variable over the day, it is assumed the $L_{Aeq,period}$ is 3dB lower than the worst case $L_{Aeq,15min}$.

In addition meteorological effects have been considered in the predictions for Receivers R3, R4 and R6, as determined in Section 5.1. For Receivers R3, R4 and R6, a "prevailing wind condition" scenario including the default 3 m/s wind from source to receiver has been considered for all assessed time periods.

Table 7.3 – Predicted Noise Level Emission from Site Operations, dB(A)

Source	Intrusive Assessment, $L_{Aeq,15min}$			Amenity Assessment, $L_{Aeq,period}$		
	Shoulder	Day	Evening	Shoulder	Day	Evening
Receiver R1 – Residential Premises to the east - Sunnyholt Road						
Criteria	46	46	46	55	55	45
Cumulative (neutral condition)	46	46	46	43	43	43
Receiver R2 – Residential Premises to the north - Camorta Close						
Criteria	49	49	49	55	55	45
Cumulative (neutral condition)	40	40	40	37	37	37
Receiver R3 – Residential Premises to the west - Railway Road						
Criteria	49	49	49	55	55	45
Cumulative (neutral condition)	34	34	34	31	31	31
Cumulative (prevailing wind condition)	39	39	39	36	36	36
Receiver R4 – Neighbouring Industrial Premises to the north - 38 Tattersalls Road						
Criteria	-	-	-	70	70	70
Cumulative (neutral condition)	-	-	-	58	58	58
Cumulative (prevailing wind condition)	-	-	-	58	58	58
Receiver R5 – Neighbouring Industrial Premises to the west - 57-69 Tattersalls Road						
Criteria	-	-	-	70	70	70
Cumulative (neutral condition)	-	-	-	62	62	62
Receiver R6 – Neighbouring Industrial Premises to the east- 21 Tattersalls Road						
Criteria	-	-	-	70	70	70
Cumulative (neutral condition)	-	-	-	57	57	57
Cumulative (prevailing wind condition)	-	-	-	58	58	58
Receiver R7 – Neighbouring Commercial/Industrial Premises to the south - 38 Forge Street						
Criteria	-	-	-	70	70	70
Cumulative (neutral condition)	-	-	-	61	61	61

On the basis of noise measurements undertaken at Sell & Parker's Blacktown site and other similar metal recycling facilities, and after accounting for acoustic shielding provided by intervening structures between the site and both residential and industrial receptors, the character of noise as perceived at the

receiver locations is not tonal, impulsive or low frequency. Therefore, it is not necessary to apply modifying factors to correct for the character of the noise.

7.2.1 Sleep disturbance predicted levels

In addition to the above predicted noise levels, Table 7.4 below presents a summary of the predicted L_{Amax} noise levels at residential receivers during the morning shoulder period from 6:00am to 7:00am.

Table 7.4 – Predicted L_{Amax} Noise Level Emission from Site Operations, dB(A)

Receiver Location	Predicted L_{Amax} Noise Level		Sleep disturbance criteria, 6:00am - 7:00am	Complies?
	Neutral Condition	Prevailing wind condition	$L_{A90(15min)}$ + 15	
R1 – Residential Premises to the east - Sunnyholt Road	58	N/A	58	Yes
R2 – Residential Premises to the north - Camorta Close	46	N/A	60	Yes
R3 – Residential Premises to the west - Railway Road	38	44	60	Yes

7.3 Statement of noise impact

Noise impacts exist where the predicted or measured noise level is greater than the project-specific noise levels.

From the results it is shown that noise emission levels to the residential receivers (Receivers R1, R2 and R3) comply with the project-specific noise levels and sleep disturbance criteria without any additional noise mitigation measures.

Furthermore, noise emission levels to the neighbouring industrial receivers (Receivers R4, R5, R6 and R7) comply with the project-specific noise goals.

8 Noise mitigation measures

The following recommendations provide in-principle noise control solutions to reduce noise impacts to residential receivers. This information is presented for approvals and cost planning purposes and is not construction advice. Detailed assistance from an acoustic consultant shall be sought at the detailed design phase of the works. The advice provided here is in respect of acoustics only. Supplementary professional advice may need to be sought in respect of fire ratings, structural design, buildability, fitness for purpose and the like.

8.1 Acoustic screen fencing

The following acoustic screen fencing is proposed as shown on the plans of the proposed facility:

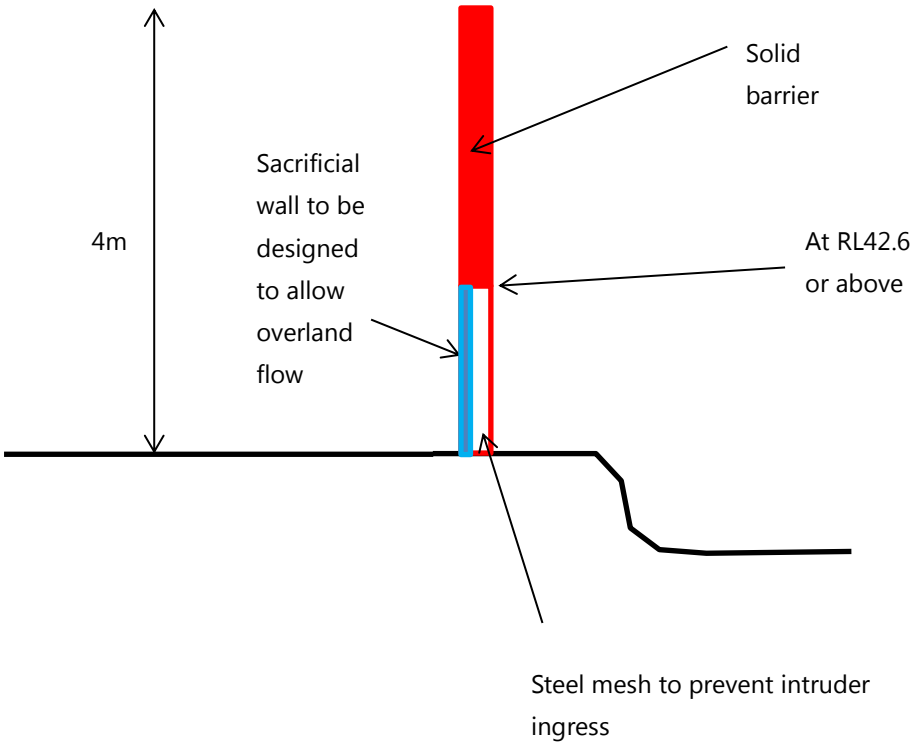
- Retain the existing acoustic screen fencing at a height of 4m, which is currently erected around the existing site northern and western boundary and along the existing driveways as shown on the site drawings; and
- An acoustic fence 4m in height shall be constructed in place of the proposed colorbond and electric fence along the new eastern boundary. Blacktown City Council requires any fencing to the eastern boundary to allow overland flow for a height of a minimum of 0.5m above the 1 in 100 year ARI flood level. As advised by Council on 20th August 2015, the Council's engineers have determined 1 in 100 year flood level of 42.1m AHD is applicable site. Sell and Parker have proposed that the base of the acoustic fence will be a sacrificial wall, constructed of material that can be sacrificed in a flood and will float away with flood waters, up to minimum 42.6m AHD and solid fencing above this height up to a total height of 4m above local ground. Refer to Figure 3.

The construction of acoustic screens can be from any durable material with sufficient mass (min. 15kg/m^2) to prevent direct noise transmission such as aluminium, product, fibrous-cement, timber, polypropylene material, or other appropriate acoustic material or any combination of such materials, provided they withstand the weather elements and for the sacrificial wall, materials can be sacrificed by water flows experienced in a 1 in 100 year flood.

In addition to the above, the noise screen shall be designed with regard to the following:

- The extent of noise reduction required of the noise screen as a whole as perceived from any potentially affected receiver sites.
- Any gaps and penetrations of the noise screen shall be sealed.
- All joints between noise screen panels will be sealed air tight.
- Noise screens will have no clearance gaps underneath them.
- Noise screen will allow overland flow

Figure 3: New eastern boundary wall sketch - elevation view (Not to scale)



9 Road traffic noise assessment

9.1 Road traffic noise criteria

The EPA's 'Road Noise Policy' (RNP) is used to assess the potential traffic noise impact generated from the site's operations. Table 3 – 'Road traffic noise assessment criteria for residential land uses' divides land use developments into different categories and lists the respective criteria for each case.

Based on functionality, Sunnyholt Road is categorised as an 'arterial' road. The potentially affected residential premises are located in the vicinity of Sunnyholt Road, and all have an acoustic environment which is dominated by traffic noise from Sunnyholt Road. Therefore, the appropriate traffic noise criterion for these residences is the 'arterial' road noise criteria presented in Table 9.1.

Table 9.1 – EPA Road Traffic Noise Criteria, dB(A)

Road Category	Type of project/land use	Assessment Criteria, dB(A)	
		Day 7am – 10pm	Night 10pm – 7am
Freeway/arterial/sub-arterial roads	3. Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq(15hr)}$ 60 (external)	$L_{Aeq(9hr)}$ 55 (external)

According to the guidelines, for existing residences affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'no build option'. In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dB(A).

9.2 Road traffic noise predictions & assessment

Existing annual average daily traffic (AADT) volumes along Sunnyholt Road have been obtained from traffic counting undertaken by the Roads and Maritime Services' (RMS) at a permanent traffic counting station (station no. 69.046) located on Sunnyholt Road at Kings Park, north of Forge Street. The AADT volume is reported to be 40,257 vehicles at the traffic counting station. It is noted that vehicle movements from the subject site would be insignificant (less than 170 vehicles movements per day) in comparison to the AADT along Sunnyholt Road and therefore, the increase in road traffic noise due to traffic generated by the subject site would be insignificant for residential properties currently experiencing noise from Sunnyholt Road.

Furthermore, the additional traffic on Sunnyholt Road as a result of the subject site would not contribute to the existing traffic noise levels from Sunnyholt Road to the affected residences and would be significantly less than the allowable 2 dB(A) increase to existing traffic noise levels.

10 Vibration impact assessment

10.1 Vibration criteria

Vibration levels during the operation of the site will be insignificant at each residential receiver due to the large separation distances between plant and receivers. As such, this report only assesses vibration levels to adjacent industrial premises.

The effects of ground vibration on buildings resulting from construction may be segregated into the following three categories:

1. Disturbance to building occupants - vibration in which the occupants or users of the building are inconvenienced or possibly disturbed,
2. Effects on building contents - vibration where the building contents may be affected; and
3. Effects on building structures - vibration in which the integrity of the building or structure itself may be prejudiced.

In general, vibration criteria for human disturbance (1.) are more stringent than vibration criteria for effects on building contents (2.) and building structural damage (3.). Hence, compliance with the more stringent limits dictated by (1.), would ensure that compliance is also achieved for the other two categories.

10.1.1 Disturbance to buildings occupants

Assessment of potential disturbance from vibration on human occupants of buildings is in accordance with the EPA's '*Assessing Vibration; a technical guideline*' (EPA, 2006). The guideline provides criteria which are based on the British Standard BS 6472-1992 '*Evaluation of human exposure to vibration in buildings (1-80Hz)*'. Sources of vibration are defined as either 'Continuous', 'Impulsive' or 'Intermittent'.

Table 10.1 provides definitions and examples of each type of vibration. Vibration sources are defined as Continuous, Impulsive or Intermittent.

Table 10.1 – Types of Vibration

Type of Vibration	Definition	Examples
Continuous vibration	Continues uninterrupted for a defined period (usually throughout the day-time and/or night-time)	Machinery, steady road traffic, continuous construction activity (such as tunnel boring machinery).
Impulsive vibration	A rapid build-up to a peak followed by a damped decay that may or may not involve several cycles of vibration (depending on frequency and damping). It can also consist of a sudden application of several cycles at approximately the same amplitude, providing that the duration is short, typically less than 2 seconds	Infrequent: Activities that create up to 3 distinct vibration events in an assessment period, e.g. occasional dropping of heavy equipment, occasional loading and unloading.
Intermittent vibration	Can be defined as interrupted periods of continuous or repeated periods of impulsive vibration that varies significantly in magnitude	Trains, nearby intermittent construction activity, passing heavy vehicles, forging machines, impact pile driving, jack hammers. Where the number of vibration events in an assessment period is three or fewer, this would be assessed against impulsive vibration criteria.

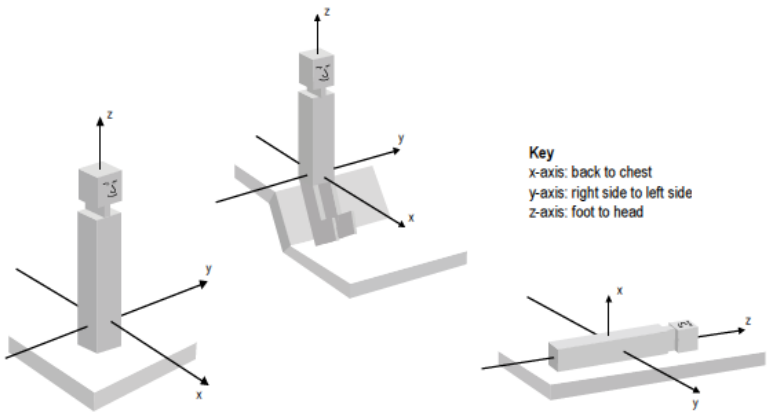
Source: Assessing Vibration; a technical guideline, Department of Environment & Climate Change, 2006

The vibration criteria are defined as a single weighted root mean square (rms) acceleration source level in each orthogonal axis. Section 2.3 of the guideline states:

> *'Evidence from research suggests that there are summation effects for vibrations at different frequencies. Therefore, for evaluation of vibration in relation to annoyance and comfort, overall weighted rms acceleration values of the vibration in each orthogonal axis are preferred (BS 6472).'*

When applying the criteria, it is important to note that the three directional axes are referenced to the human body, i.e. x-axis (back to chest), y-axis (right side to left side) or z-axis (foot to head). Vibration may enter the body along different orthogonal axes and affect it in different ways. Therefore, application of the criteria requires consideration of the position of the people being assessed, as illustrated in Figure 4. For example, vibration measured in the horizontal plane is compared with x- and y-axis criteria if the concern is for people in an upright position, or with the y- and z- axis criteria if the concern is for people in the lateral position.

Figure 4: Orthogonal Axes for Human Exposure to Vibration



The preferred and maximum values for continuous and impulsive vibration impacting on the adjacent industrial premises are defined in Table 2.2 of the guideline and are reproduced in Table 10.2.

Table 10.2 – Preferred and Maximum Levels for Human Comfort

Location	Assessment period[1]	Preferred values		Maximum values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Continuous vibration (Weighted RMS Acceleration, m/s^2, 1-80Hz)					
Workshops	Day- or night-time	0.04	0.029	0.080	0.058
Impulsive vibration (Weighted RMS Acceleration, m/s^2, 1-80Hz)					
Workshops	Day- or night-time	0.64	0.46	1.28	0.92

Notes: 1. Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am

The acceptable vibration dose values (VDV) for intermittent vibration impacting on the adjacent industrial premises are defined in Table 2.4 of the guideline and are reproduced in Table 10.3.

Table 10.3 – Acceptable vibration dose values for intermittent vibration

Location	Daytime[1]		Night-time[1]	
	Preferred value	Maximum value	Preferred value	Maximum value
Workshops	0.80	1.60	0.80	1.60

Notes: 1. Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am

10.2 Vibration measurements and assessment

In order to quantify the vibration levels from the highest vibration producing plant, attended vibration measurements were undertaken for the hammer mills at the Kings Park site. Vibration measurements were conducted on Friday 9th May 2014, between 10.30am and 11.30am. The measurement location was approximately 10 m from the plant item which corresponds to the distance from the hammer mill to the boundary. Vibration measurements were conducted over 1 minute periods with the plant item operating normally with continuous feed over the time of measurement.

Vibration measurements were also taken for a large metal shear located at the Sell & Parker Darwin plant with a capacity of 350,000 tonnes a year which is similar to that proposed for the Kings Park development. Vibration measurements were conducted on Monday 25th May 2015, between 3.30pm and 6.30pm, and on Tuesday 26th May 2015, between 8:30am and 11:30am. The measurements were conducted at different distances from the plant item over 5 minute periods with the plant item operating continuously with continuous feed over the time of measurement. A distance of 50m corresponds to the distance from the plant item to the boundary.

Vibration levels were measured in three orthogonal axes (x, y and z) using a Sinus Soundbook precision sound and vibration analyser and three PCB Type 393B12 accelerometers or three Endevco Type 61C13 accelerometers. The PCB Type 393B12 accelerometers were calibrated using factory settings. The Endevco Type 61C13 accelerometers were calibrated before and after the measurements using a Bruel & Kjaer Type 4294 calibration exciter. No significant drift in calibration was observed.

Based on the vibration measurements conducted, the vibration sources are classified as continuous and/or intermittent as per the definitions presented in Table 10.1. The vibration sources do not exhibit the characteristics of impulsive vibration and therefore the assessment for impulsive vibration is not considered further from herein.

10.2.1 Hammer mill

The following results were obtained for the hammer mill:

Table 10.4 – Measured vibration levels for the hammer mill

Plant Item	Measurement No.	Approximate distance to plant, m	Measured weighted rms acceleration, m/s^2		
			x-axis	y-axis	z-axis
Hammer Mill [1] (9th May 2014)	1	10	0.001	0.001	0.007
	2		0.001	0.001	0.007
	3		0.001	0.001	0.006
	4		0.001	0.001	0.006
	5		0.001	0.001	0.006
	6		0.001	0.001	0.006

Notes: Measured vibration levels for the hammer mill include the operation of the shaker

For the table above it can be seen that vibration levels from the existing Kings Park hammer mill in the x and y axes are up to 0.001 m/s^2 and in the z axis up to 0.007 m/s^2 when at 10 m from the plant. When assessed against the established vibration criteria presented in Table 10.2, the measured vibration levels comply with the preferred limits for continuous vibration of 0.029 m/s^2 in the x and y axes and the preferred limit of 0.04 m/s^2 in the z axis.

The operation of the hammer mill is also assessed against the intermittent vibration criteria and the results are presented in the table below:

Table 10.5 – Measured intermittent vibration levels for hammer mill

Plant Item	Measurement No.	Approximate distance to plant, m	Measured vibration dose value, $m/s^{1.75}$
Hammer Mill (9th May 2014)	1	10	0.025
	2		0.025
	3		0.023
	4		0.023
	5		0.021
	6		0.023

Based on the measured vibration dose value in in Table 10.5 the estimated vibration dose value over the daytime (7:00am to 10:00pm) is 0.13 $m/s^{1.75}$ and the estimated vibration dose value over the night-time (10:00pm to 7:00am) 0.06 $m/s^{1.75}$. It is noted that the plant operates only from 6:00am to 9:00pm. When assessed against the established vibration criteria presented in Table 10.3, the estimated vibration dose

values comply with the preferred limits for intermittent vibration of 0.80 $m/s^{1.75}$ for both day and night periods.

Given that the measured vibration levels were measured at approximately 10 m from the hammer mill and the nearest industrial receiver is in excess of 30 m from the hammer mill, it is not expected that vibration levels in the z axis will exceed the preferred limits for continuous vibration at the nearest receivers. Therefore, vibration levels from the operation of the hammer mill will comply with the applicable vibration criteria at nearby receivers.

10.2.2 Metal shear

The following results were obtained for the metal shear located at the Darwin site:

Table 10.6 – Measured continuous vibration levels for metal shear

Plant Item	Measurement No.	Approximate distance to plant, m	Measured weighted rms acceleration, m/s^2		
			x-axis	y-axis	z-axis
Metal Shear (25th & 26th May 2015)	1	5.5	0.006	0.001	0.003
	2		0.002	0.001	0.006
	3		0.002	0.001	0.006
	4		0.048	0.002	0.004
	5		0.015	0.002	0.004
	6		0.018	0.002	0.003
	7	9 (rear of metal shear)	0.012	0.003	0.003
	8		0.008	0.002	0.005
	9		0.008	0.002	0.002
	10	50	0.006	0.001	0.001
	11		0.017	0.006	0.001
	12		0.018	0.006	0.001
	13		0.015	0.006	0.001

It can be seen from the above table that vibration levels in the x and y axes are up to 0.018 m/s^2 and in the z axis up to 0.001 m/s^2 when at 50 m from the plant. When assessed against the established vibration criteria presented in Table 10.2, the measured vibration levels comply with the preferred limits for continuous vibration of 0.029 m/s^2 in the x and y axes and the preferred limit of 0.04 m/s^2 in the z axis.

The operation of the metal shear is also assessed against the intermittent vibration criteria and the results are presented in the table below at a distance of 50m:

Table 10.7 – Measured intermittent vibration levels for metal shear

Plant Item	Measurement No.	Approximate distance to plant, m	Measured vibration dose value, $m/s^{1.75}$
Metal Shear (25th & 26th May 2015)	10	50	0.017
	11		0.194
	12		0.270
	13		0.166

Based on the measured vibration dose value in in Table 10.6 the estimated vibration dose value over the daytime (7:00am to 10:00pm) is 0.75 $m/s^{1.75}$ and the estimated vibration dose value over the night-time (10:00am to 7:00am) 0.39 $m/s^{1.75}$. It is noted that the plant operates only from 6:00am to 9:00pm. When assessed against the established vibration criteria presented in Table 10.3, the estimated vibration dose values comply with the preferred limits for intermittent vibration of 0.80 $m/s^{1.75}$ for both day and night periods.

The metal shear at the subject site will be located in excess of 50 m from the boundary of the nearest adjoining industrial premises. The measured vibration levels from the Darwin site shows compliance with the vibration criteria for both continuous vibration and intermittent vibration at 50 m. It is noted that the foundations of the metal shear at the Darwin site are embedded in rock and the surrounding soil is hard, unlike the geology of the Kings Park site which consists of soft clayey soil. The vibration levels from the new metal shear at the subject site are expected to be lower than the measured levels accounting for the ground impedance of softer ground at the subject site. Therefore, vibration levels from the operation of the metal shear will comply with the applicable vibration criteria at nearby receivers.

11 Conclusion

An assessment of environmental noise impact from the proposed expansion of the Kings Park Waste Metal Recovery, Processing and Recycling Facility has been made.

Noise impact from the proposed expansion upon the potentially most affected noise sensitive residential locations and existing and future neighbouring industrial premises, has been quantified and compared to the noise guidelines set by the EPA.

Noise emissions to residential premises are predicted to comply with the project-specific noise levels without noise mitigation measures.

Noise and vibration emissions from site operations to neighbouring industrial premises also comply with the project-specific noise levels and sleep disturbance criteria, once the noise mitigation measures proposed in Section 8, as part of the expansion, are implemented.

Potential traffic noise associated with the operation of the facility and impacting nearby residential receivers is assessed as being insignificant and would comply with the relevant EPA noise policy.

In summary, noise and vibration emissions from the construction and operation of the proposed expansion will comply with the relevant requirements of the NSW EPA.

APPENDIX A Glossary of terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) 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 than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of every day sounds: 0dB The faintest sound we can hear 30dB A quiet library or in a quiet location in the country 45dB Typical office space. Ambience in the city at night 60dB CBD mall at lunch time 70dB The sound of a car passing on the street 80dB Loud music played at home 90dB The sound of a truck passing on the street 100dB The sound of a rock band 115dB Limit of sound permitted in industry 120dB Deafening
dB(A)	A-weighted decibels. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.

L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

APPENDIX B Long term unattended noise monitoring results

RENZO TONIN & ASSOCIATES
inspired to achieve

Acoustics
Vibration
Structural Dynamics

sydney@renzotonin.com.au
ww.renzotonin.com.au

2 Anthony St, Blacktown

Background & Ambient Noise Monitoring Results - NSW 'Industrial Noise Policy', 2000						
	L_{A90} Background Noise Levels[5]			L_{Aeq} Ambient Noise Levels		
Date	**Day**	**Evening**	**Night**	**Day**	**Evening**	**Night**
Tuesday-17-December-2013	44.2	43.4	35.4	53.4	49.5	48.7
Wednesday-18-December-2013	44.1	43.4	34.9	52.2	51.4	48.0
Thursday-19-December-2013	44.2	43.6	36.6	52.8	50.7	47.9
Friday-20-December-2013	43.9	44.2	38.5	52.1	50.1	47.8
Saturday-21-December-2013	42.4	41.7	34.0	51.0	49.0	46.0
Sunday-22-December-2013	42.6	43.5	35.2	51.2	49.5	47.2
Monday-23-December-2013	45.0	44.2	33.6	52.8	50.2	47.1
Tuesday-24-December-2013	44.3	-	-	50.5	-	-
Representative Weekday	**44.2**	**43.6**	**35.4**	**52.4**	**50.4**	**47.9**
Representative Weekend	**42.5**	**42.6**	**34.6**	**51.1**	**49.2**	**46.7**
Representative Week	**44.2**	**43.5**	**35.2**	**52.1**	**50.1**	**47.6**

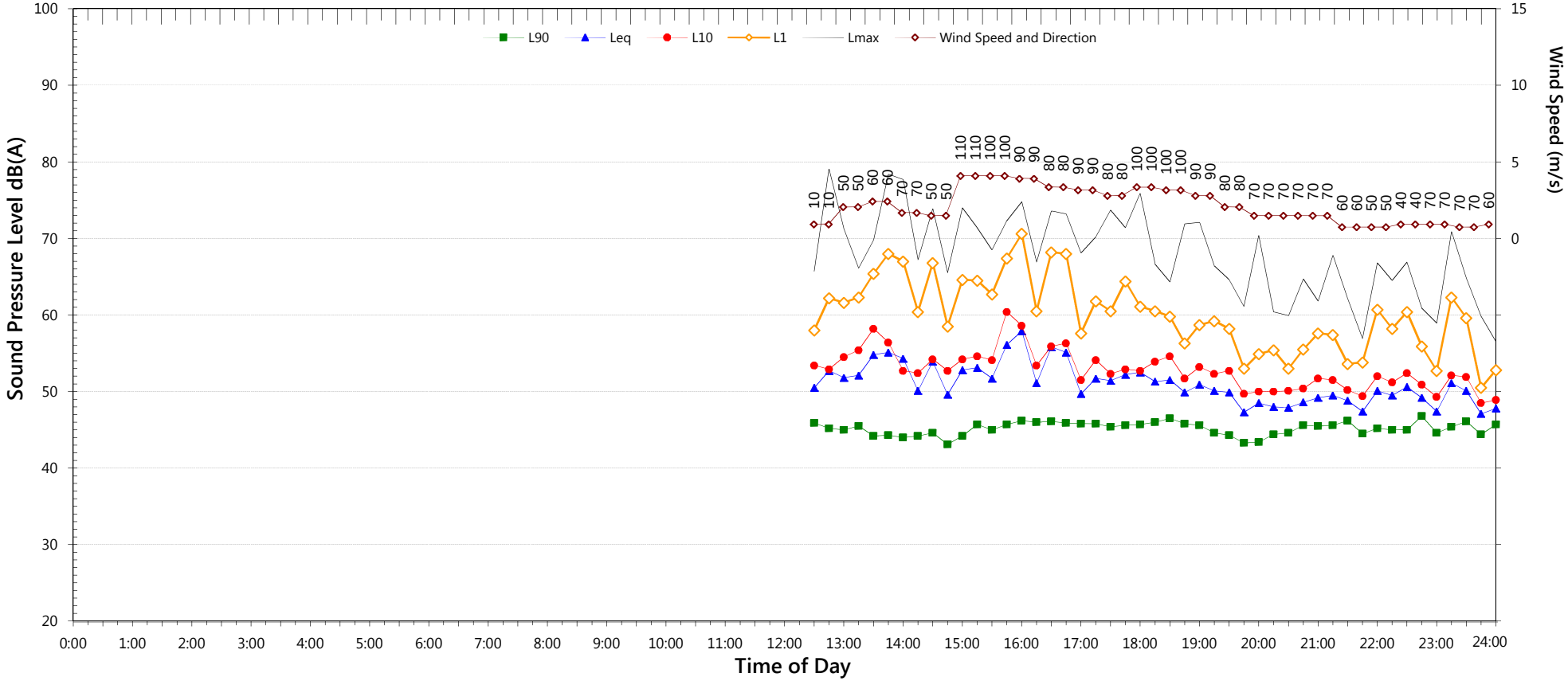
Notes:

1. Day is taken to be 7:00am to 6:00pm
2. Evening is taken to be 6:00pm to 10:00pm.
3. Night is taken to be the remaining periods.
4. Rating Background Level (RBL) for L90 and logarithmic average for Leq
5. Assessment Background Level (ABL)
6. Rating Background Level (RBL) for L90 and logarithmic average for Leq

Unattended Noise Monitoring Results

2 Anthony St, Blacktown

Tuesday, 17 December 2013



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	44.2	43.4	35.4
Leq	53.4	49.5	48.7

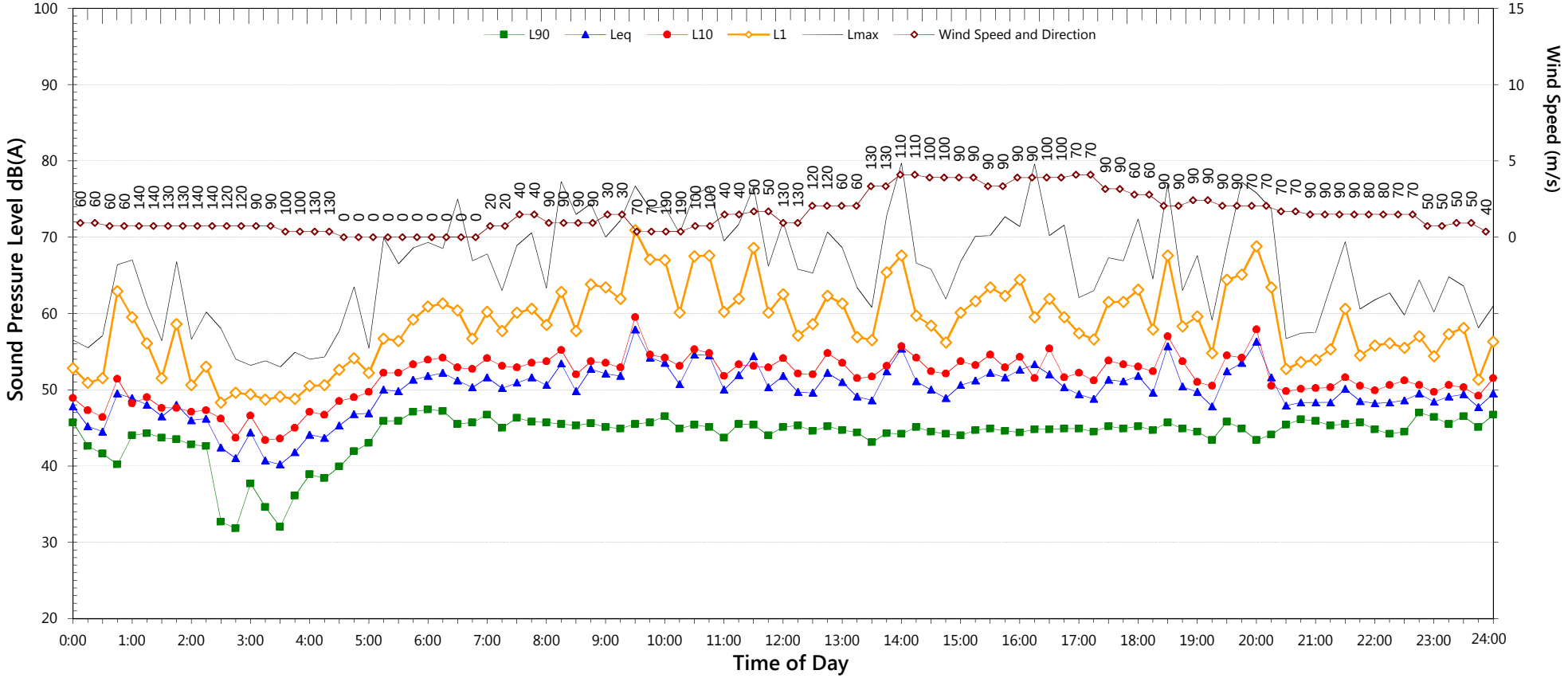
NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax >65dB(A) and where Lmax- Leq ≥15dB(A)

Unattended Noise Monitoring Results

2 Anthony St, Blacktown

Wednesday, 18 December 2013



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	44.1	43.4	34.9
Leq	52.2	51.4	48.0

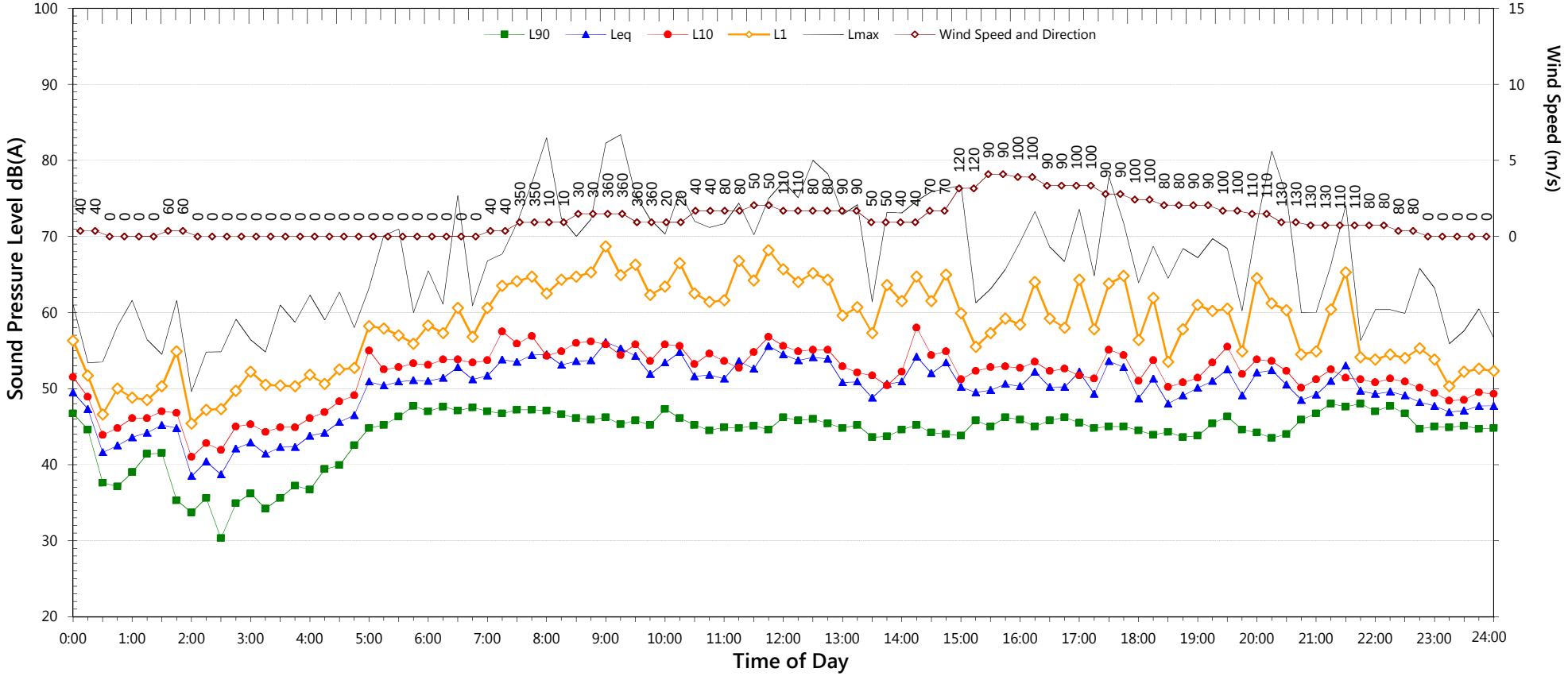
NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax >65dB(A) and where Lmax- Leq ≥15dB(A)

Unattended Noise Monitoring Results

2 Anthony St, Blacktown

Thursday, 19 December 2013



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	44.2	43.6	36.6
Leq	52.8	50.7	47.9

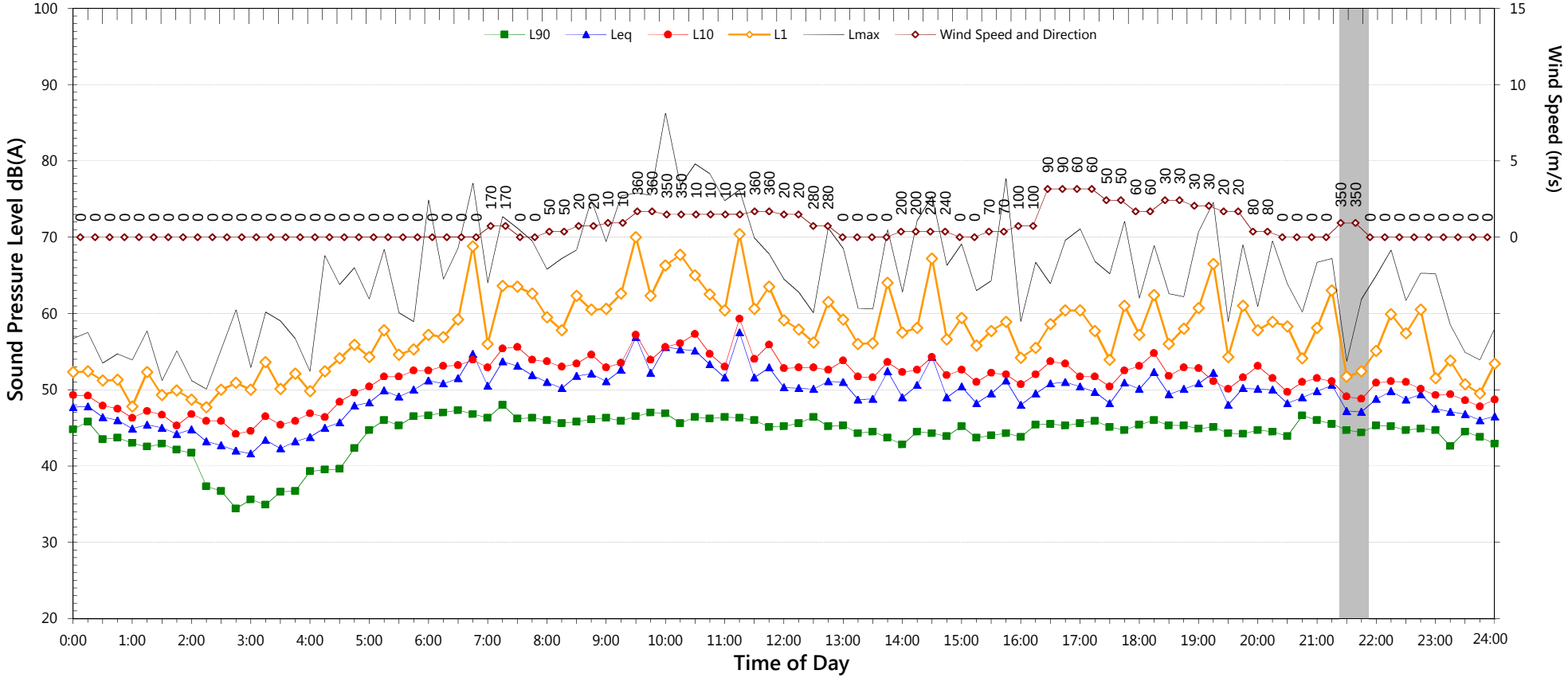
NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax >65dB(A) and where Lmax- Leq ≥15dB(A)

Unattended Noise Monitoring Results

2 Anthony St, Blacktown

Friday, 20 December 2013



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	43.9	44.2	38.5
Leq	52.1	50.1	47.8

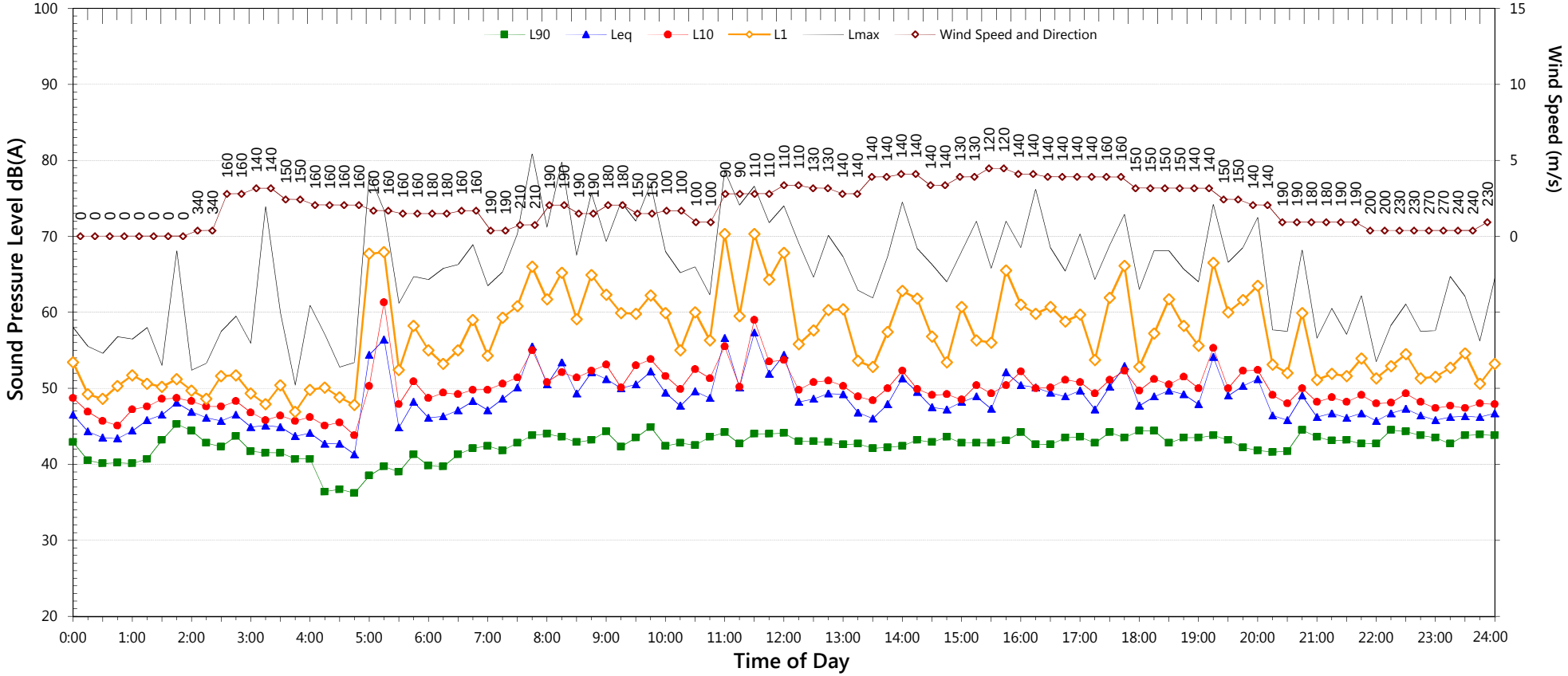
NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax >65dB(A) and where Lmax- Leq ≥15dB(A)

Unattended Noise Monitoring Results

2 Anthony St, Blacktown

Saturday, 21 December 2013



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	42.4	41.7	34.0
Leq	51.0	49.0	46.0

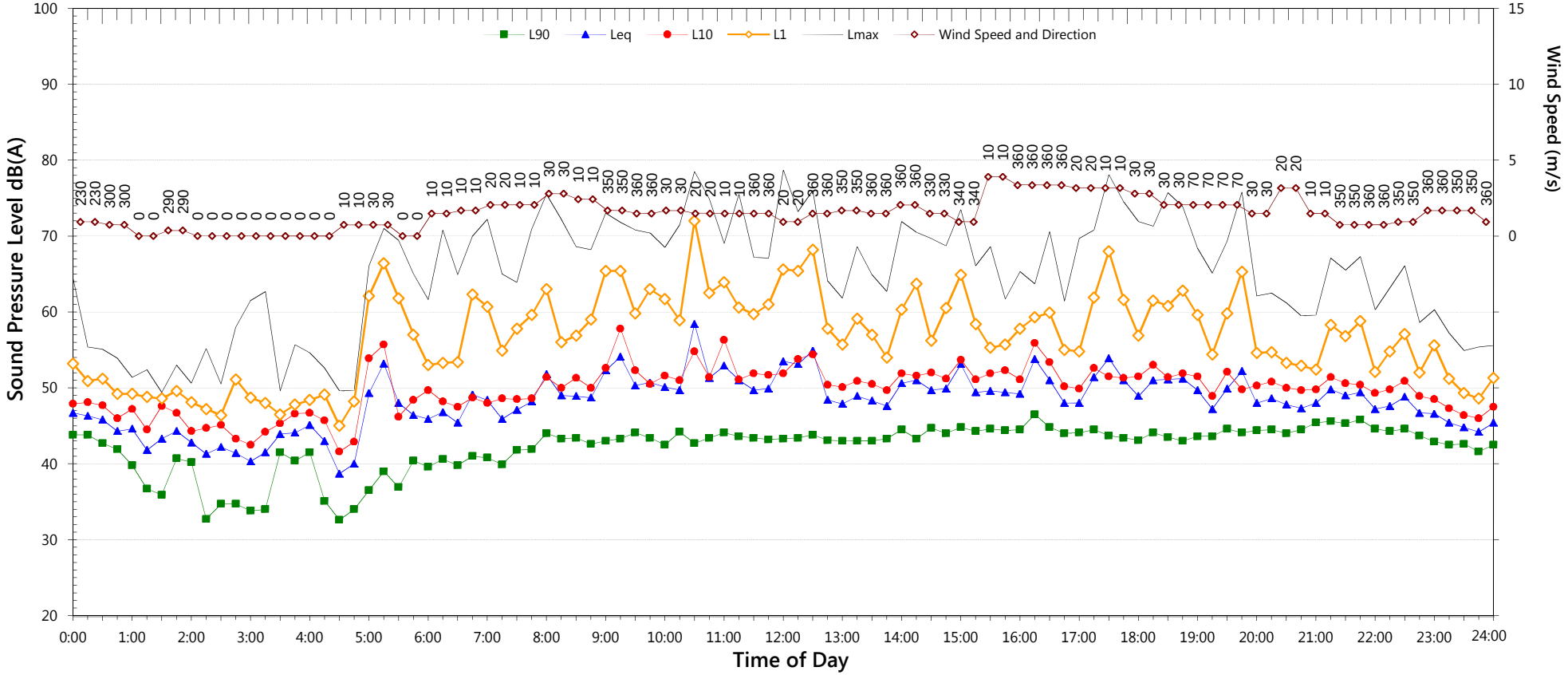
NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax >65dB(A) and where Lmax- Leq ≥15dB(A)

Unattended Noise Monitoring Results

2 Anthony St, Blacktown

Sunday, 22 December 2013



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	42.6	43.5	35.2
Leq	51.2	49.5	47.2

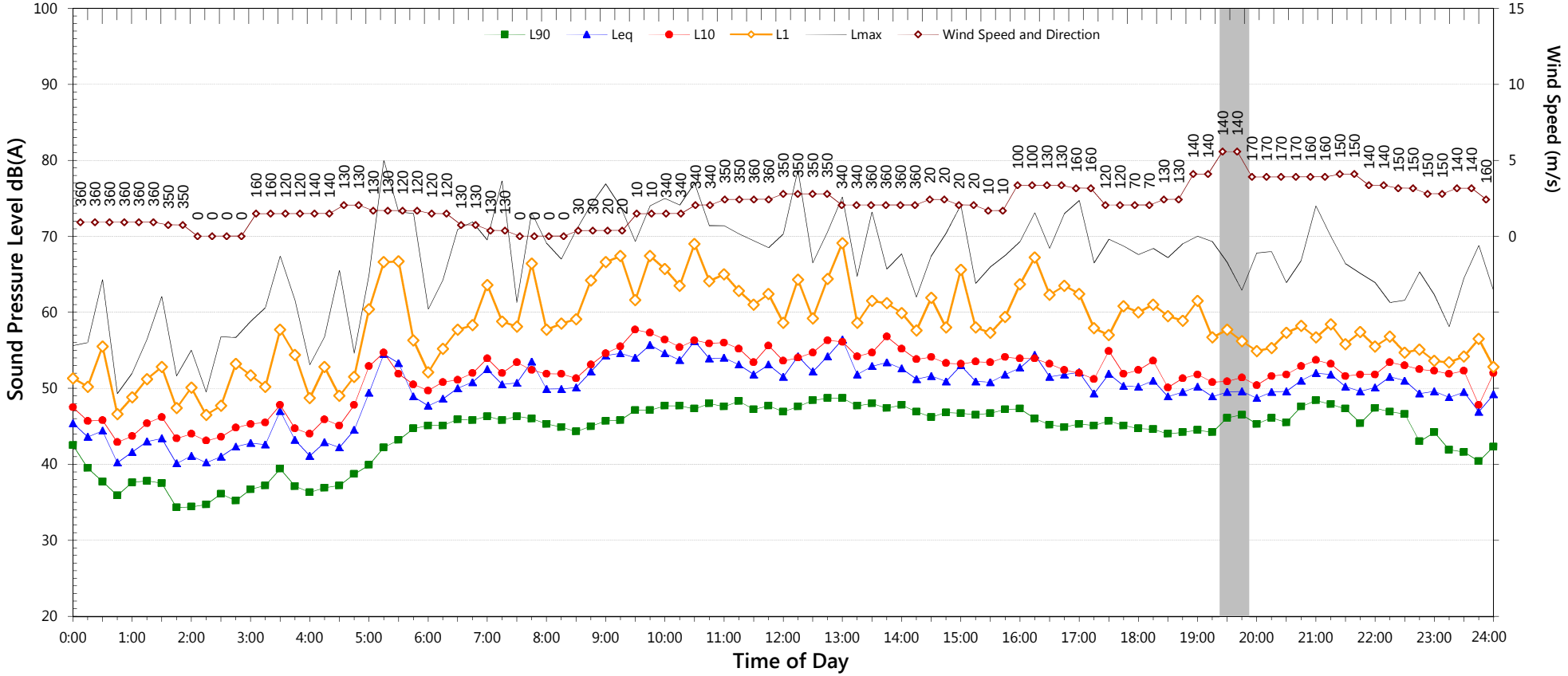
NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax >65dB(A) and where Lmax- Leq ≥15dB(A)

Unattended Noise Monitoring Results

2 Anthony St, Blacktown

Monday, 23 December 2013



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	45.0	44.2	33.6
Leq	52.8	50.2	47.1

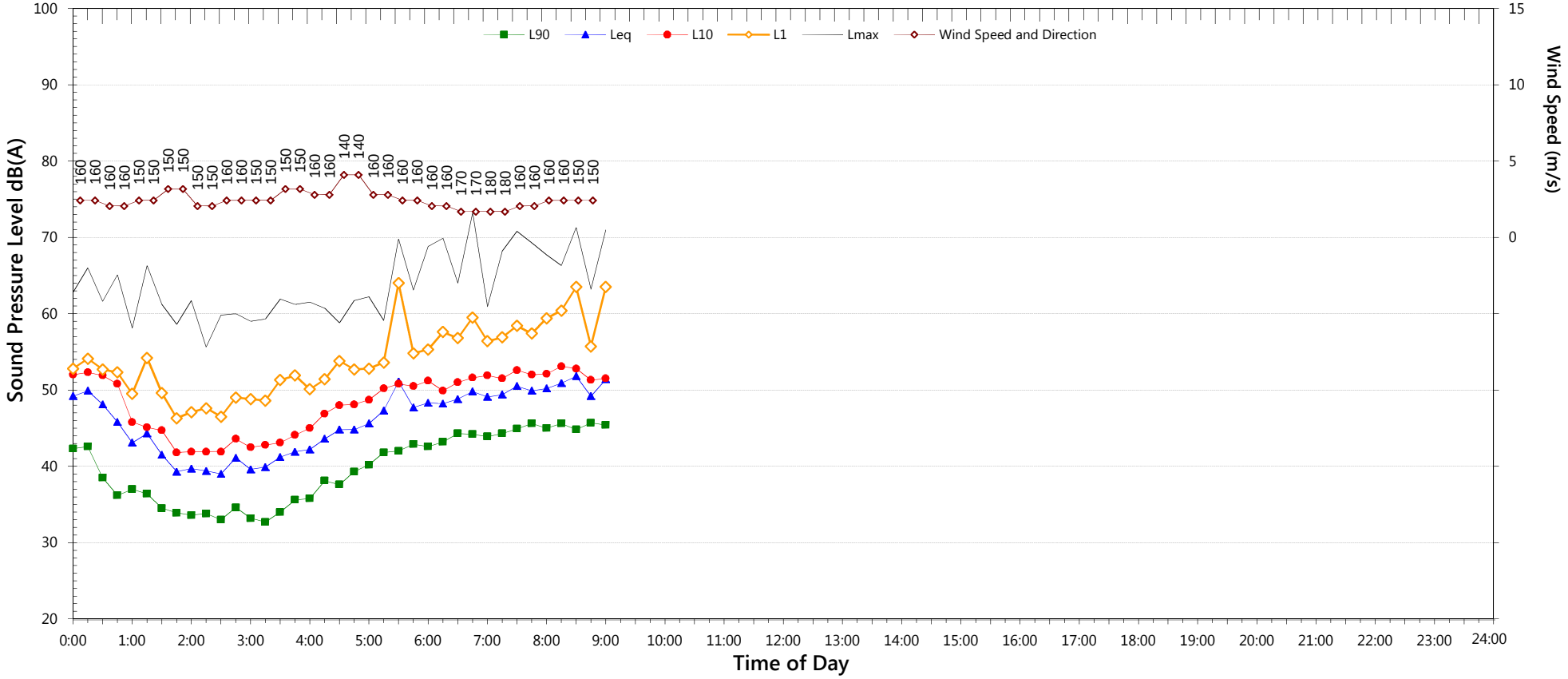
NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax >65dB(A) and where Lmax- Leq ≥15dB(A)

Unattended Noise Monitoring Results

2 Anthony St, Blacktown

Tuesday, 24 December 2013



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	44.3	-	-
Leq	50.5	-	-

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax >65dB(A) and where Lmax- Leq ≥15dB(A)

RENZO TONIN & ASSOCIATES
inspired to achieve

Acoustics
Vibration
Structural Dynamics

sydney@renzotonin.com.au
ww.renzotonin.com.au

1/50 Charles St, Blacktown

Background & Ambient Noise Monitoring Results - NSW 'Industrial Noise Policy', 2000						
	L_{A90} Background Noise Levels[5]			L_{Aeq} Ambient Noise Levels		
Date	**Day**	**Evening**	**Night**	**Day**	**Evening**	**Night**
Tuesday-17-December-2013	41.3	44.6	35.8	51.0	51.6	48.5
Wednesday-18-December-2013	39.2	41.5	41.4	50.3	48.9	47.3
Thursday-19-December-2013	40.4	45.1	41.4	48.1	50.7	48.6
Friday-20-December-2013	44.4	49.7	37.5	65.5	61.0	48.4
Saturday-21-December-2013	40.2	40.7	39.8	50.7	50.6	46.5
Sunday-22-December-2013	44.4	49.8	41.6	60.1	53.8	48.9
Monday-23-December-2013	45.8	40.6	33.0	54.6	50.3	47.7
Tuesday-24-December-2013	40.3	-	-	46.9	-	-
Representative Weekday	**40.9**	**44.6**	**37.5**	**58.5**	**55.3**	**48.1**
Representative Weekend	**42.3**	**45.3**	**40.7**	**57.6**	**52.5**	**47.9**
Representative Week	**40.9**	**44.6**	**39.8**	**58.3**	**54.7**	**48.1**

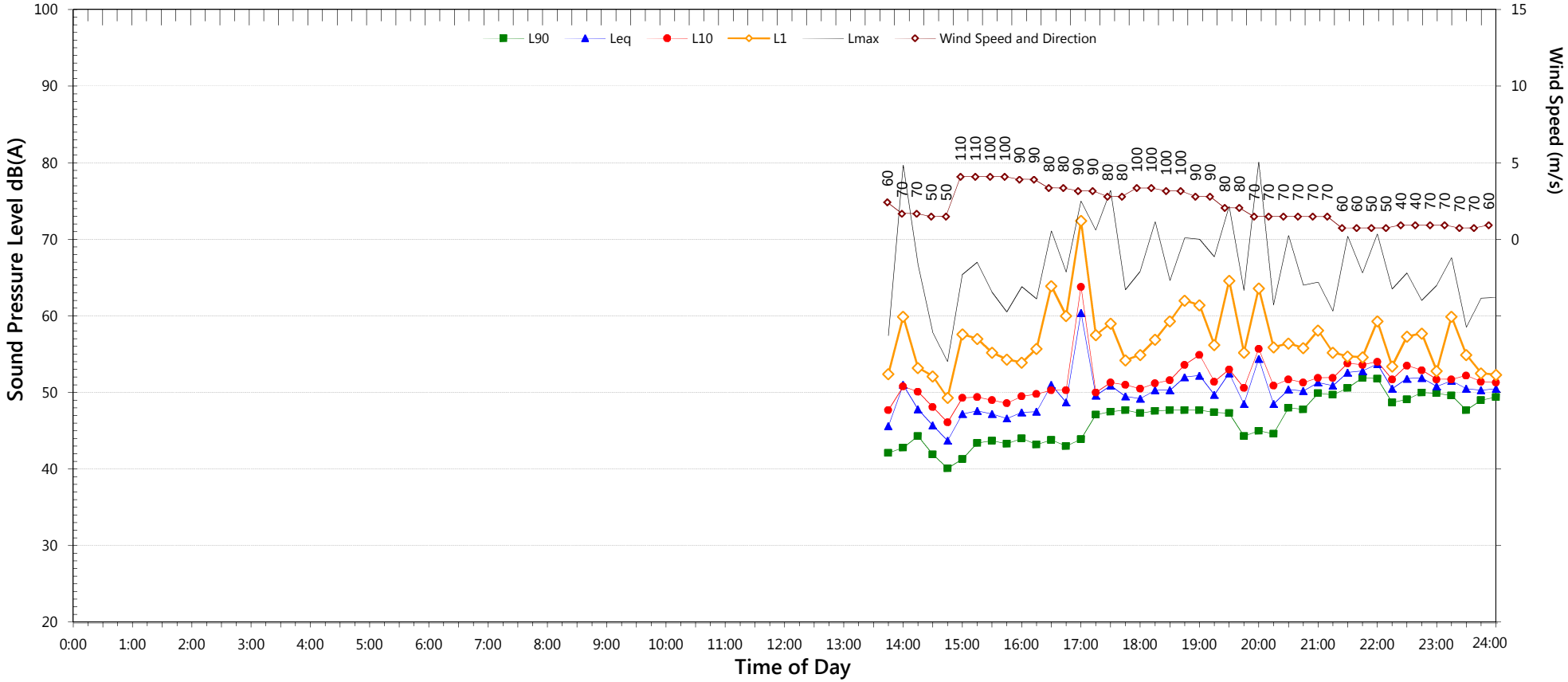
Notes:

1. Day is taken to be 7:00am to 6:00pm
2. Evening is taken to be 6:00pm to 10:00pm.
3. Night is taken to be the remaining periods.
4. Rating Background Level (RBL) for L90 and logarithmic average for Leq
5. Assessment Background Level (ABL)
6. Rating Background Level (RBL) for L90 and logarithmic average for Leq

Unattended Noise Monitoring Results

1/50 Charles St, Blacktown

Tuesday, 17 December 2013



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	41.3	44.6	35.8
Leq	51.0	51.6	48.5

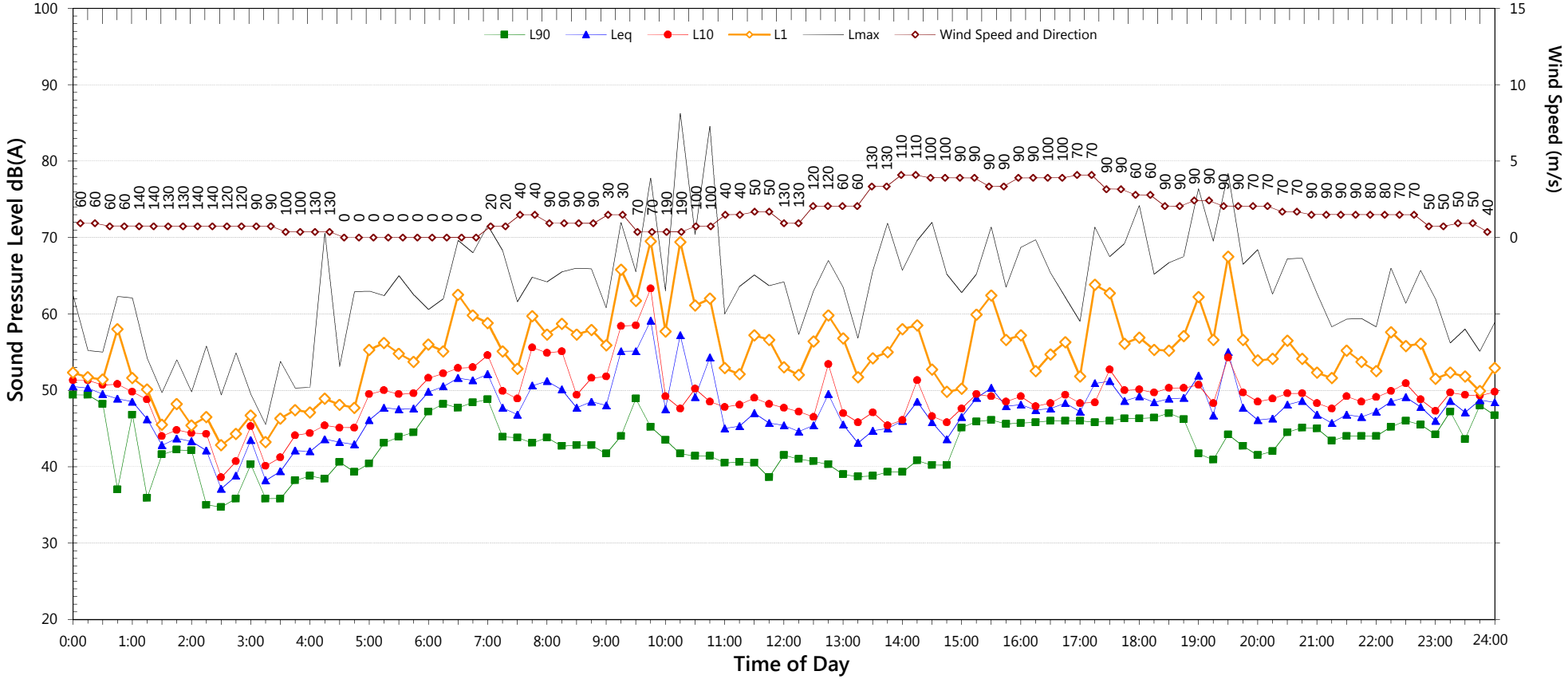
NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax >65dB(A) and where Lmax- Leq ≥15dB(A)

Unattended Noise Monitoring Results

1/50 Charles St, Blacktown

Wednesday, 18 December 2013



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	39.2	41.5	41.4
Leq	50.3	48.9	47.3

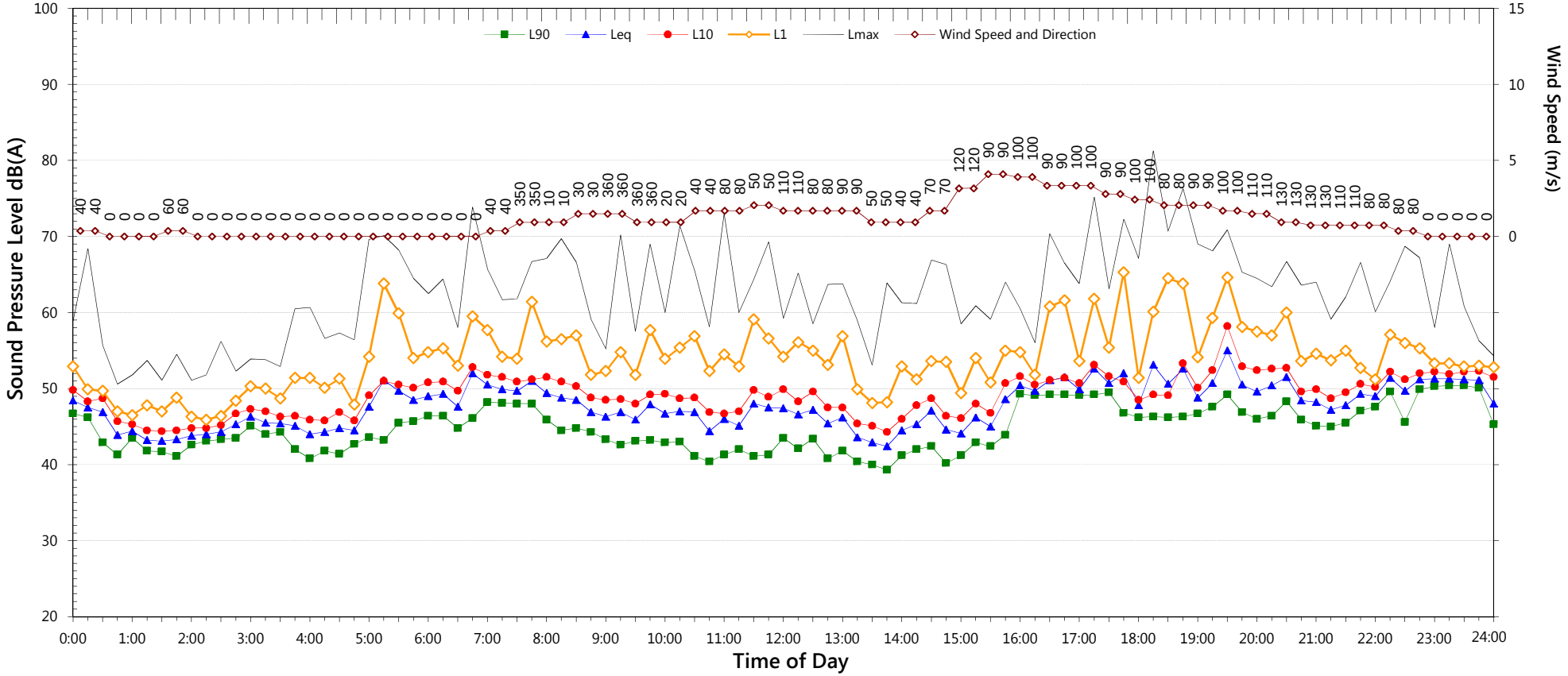
NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax >65dB(A) and where Lmax- Leq ≥15dB(A)

Unattended Noise Monitoring Results

1/50 Charles St, Blacktown

Thursday, 19 December 2013



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	40.4	45.1	41.4
Leq	48.1	50.7	48.6

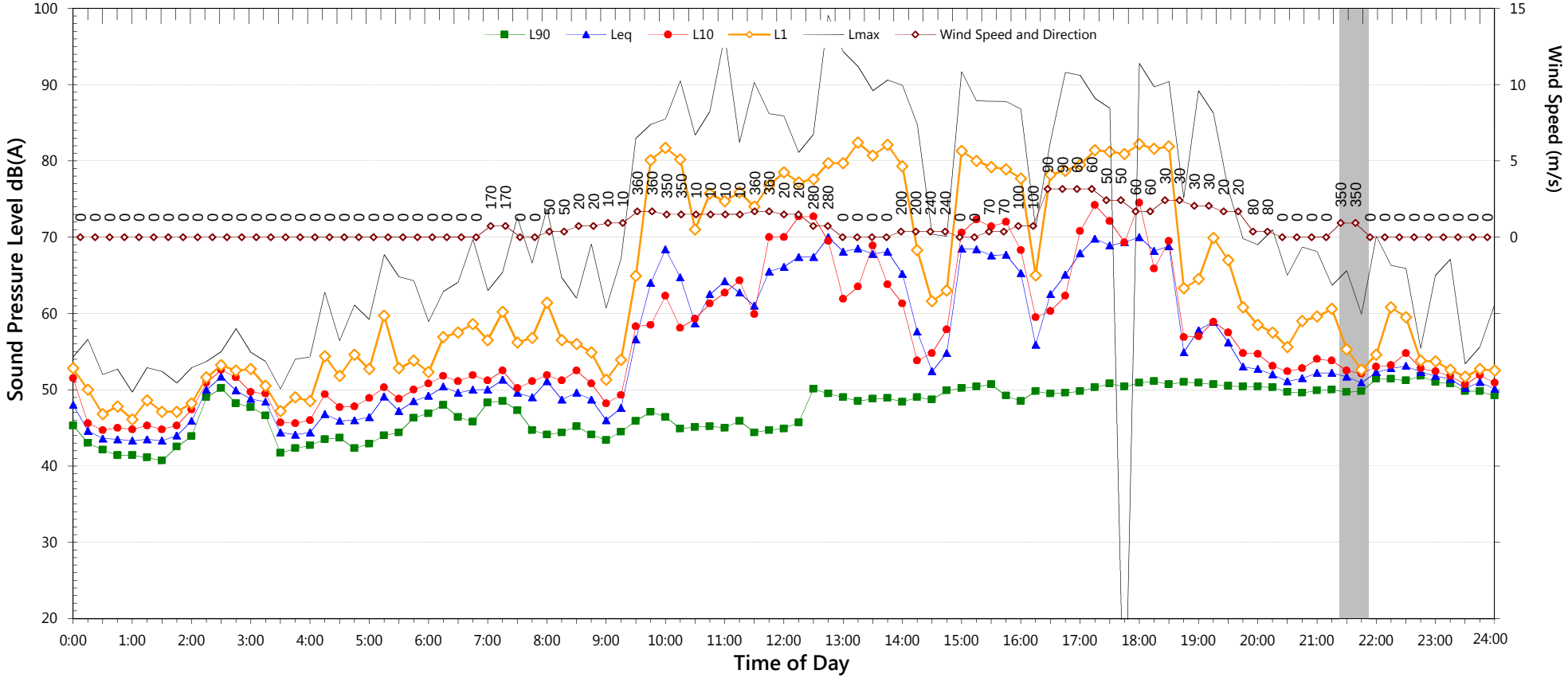
NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax >65dB(A) and where Lmax- Leq ≥15dB(A)

Unattended Noise Monitoring Results

1/50 Charles St, Blacktown

Friday, 20 December 2013



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	44.4	49.7	37.5
Leq	65.5	61.0	48.4

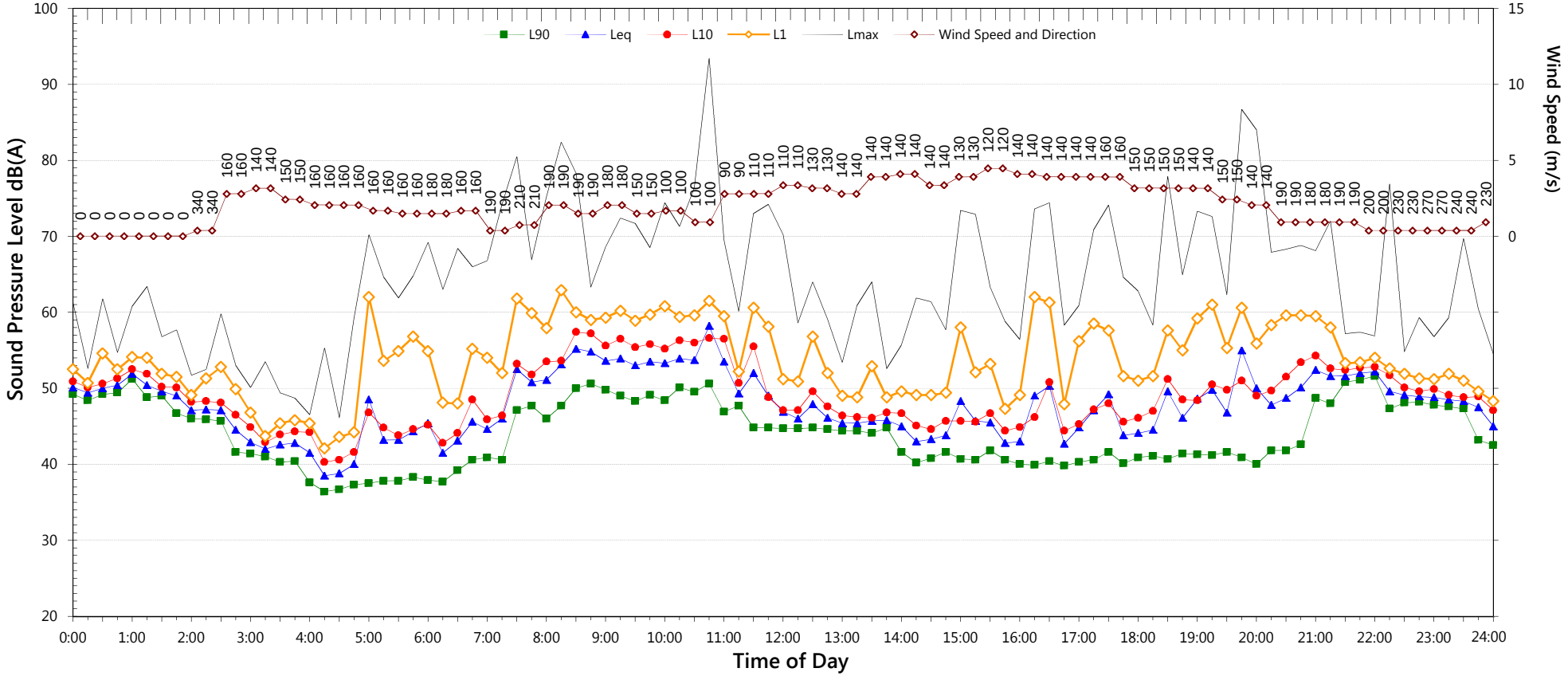
NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax >65dB(A) and where Lmax- Leq ≥15dB(A)

Unattended Noise Monitoring Results

1/50 Charles St, Blacktown

Saturday, 21 December 2013



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	40.2	40.7	39.8
Leq	50.7	50.6	46.5

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

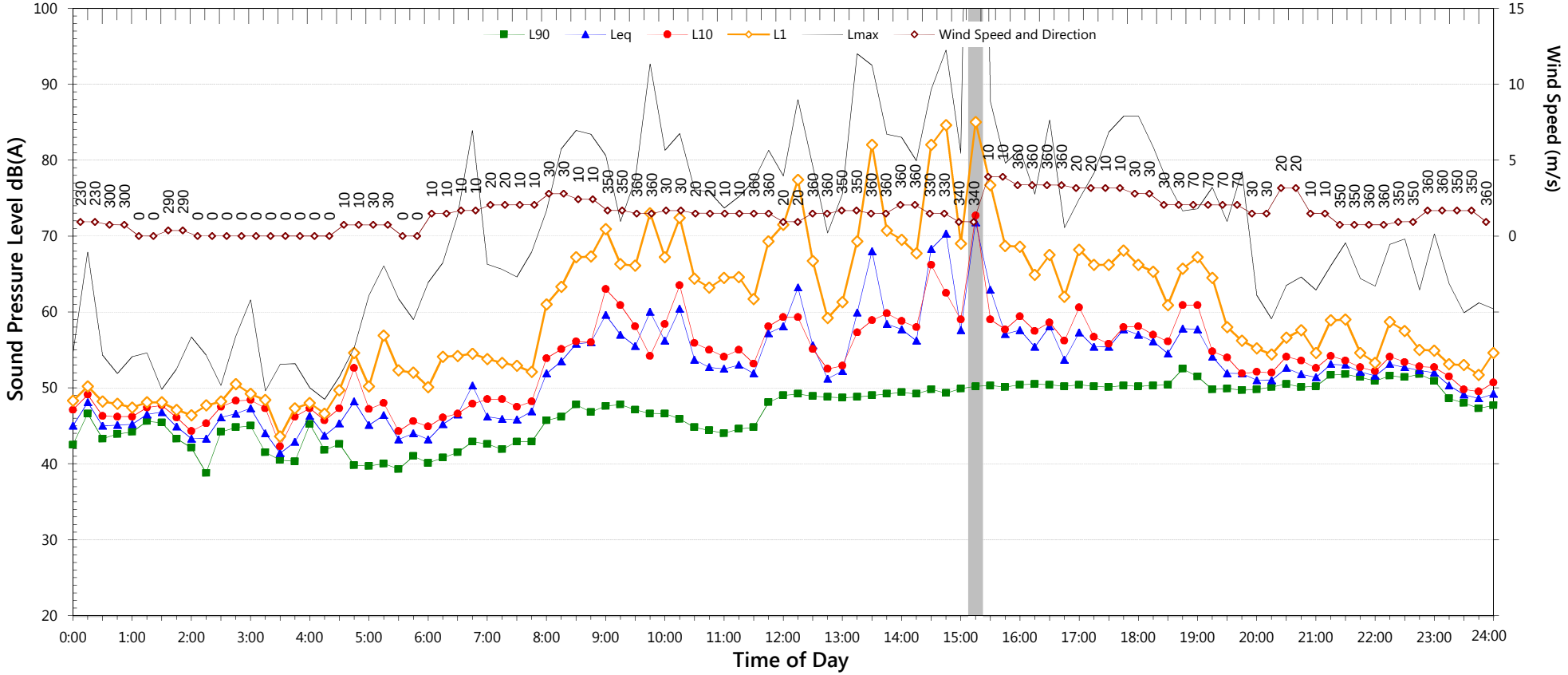
3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax >65dB(A) and where Lmax- Leq ≥15dB(A)

Unattended Noise Monitoring Results

1/50 Charles St, Blacktown

Sunday, 22 December 2013



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	44.4	49.8	41.6
Leq	60.1	53.8	48.9

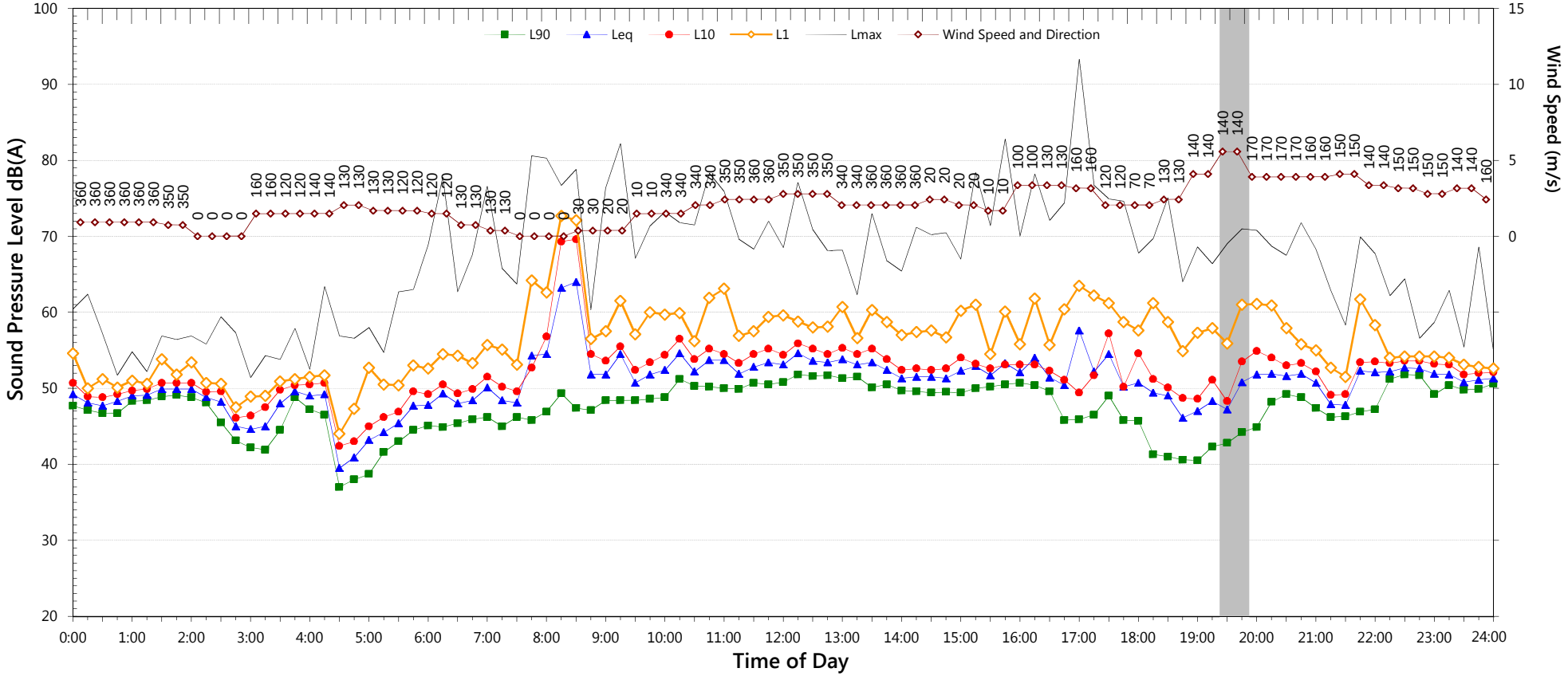
NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax >65dB(A) and where Lmax- Leq ≥15dB(A)

Unattended Noise Monitoring Results

1/50 Charles St, Blacktown

Monday, 23 December 2013



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	45.8	40.6	33.0
Leq	54.6	50.3	47.7

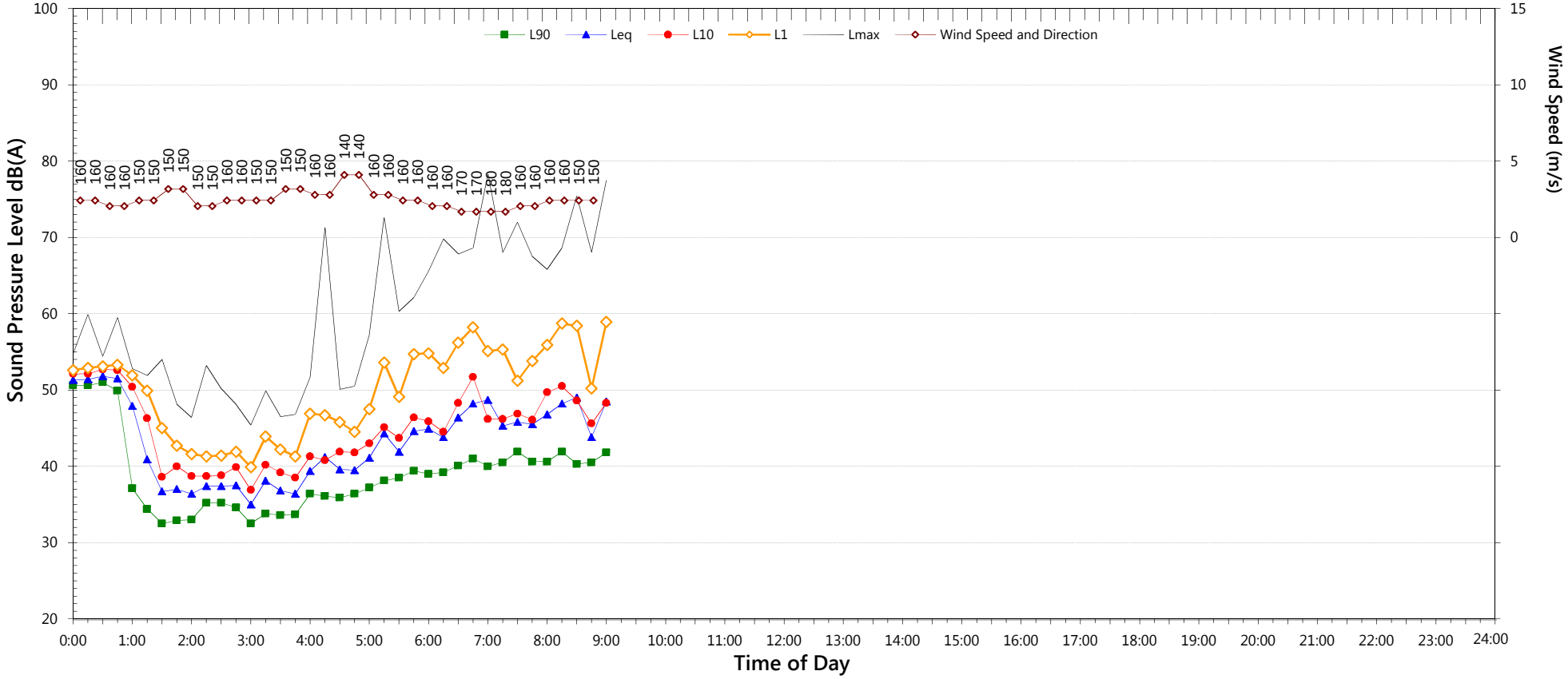
NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured in free-field; tabulated results facade corrected
4. Night time Lmax values are shown only where Lmax >65dB(A) and where Lmax- Leq ≥15dB(A)

Unattended Noise Monitoring Results

1/50 Charles St, Blacktown

Tuesday, 24 December 2013



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	40.3	-	-
Leq	46.9	-	-

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax >65dB(A) and where Lmax- Leq ≥15dB(A)