HEGGIES

REPORT 10-4309-R30

Revision 0

CSL Pacific

Glebe Island Berth 1

Compliance Noise Monitoring

PREPARED FOR

Sydney Ports Corporation
Level 4, 20 Windmill Street
Walsh Bay NSW 2000 Australia

8 APRIL 2010

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1 INTRODUCTION

Heggies Pty Ltd (Heggies) has been commissioned by Sydney Ports Corporation (SPC) to conduct monitoring of noise emissions during the unloading of the "CSL Pacific" (a bulk cargo vessel) at Glebe Island Berth 1 (GI-1), as required by Clause M7.1 of the EPA's Environment Protection Licence (Licence No 13008). This report provides the results of the monitoring as required by Clause R4.1(2) of the Licence.

Noise measurements have been conducted during cargo handling operations (ship auxillary power unit (APU), ventilation fans, on board salt conveyors and unloading gantry) at three locations considered representative of the potentially most exposed residential receivers. The locations are at Balmain to the west, Glebe to the south and Pyrmont to the east of GI-1. Measurements at the three representative locations have been conducted during the loading of bulk salt from the ship to the wharf. The measurements were conducted after the ship arrived between 8.28 pm on the 31 March and 1.50 am on 1 April 2010. During the measurement period, the sky was partially clear, with a slight south to southwesterly wind.

2 SITE DESCRIPTION

The Glebe Island Port facility is located north of Anzac Bridge between Johnsons Bay and White Bay on Glebe Island. The facility occupies approximately 40 hectares of waterfront land and forms a crescent around Glebe Island, with a water frontage of about 1,400 m in length.

The facility layout comprises the following main elements:

- Two berths on the eastern side of Glebe Island designated GI-1 and GI-2, and two berths on the western side designated GI-7 and GI-8;
- Concrete/asphalt area previously used for vehicle storage; and
- Internal road continuing from Sommerville Road providing truck access to the storage areas of Docks 1 to 2.

The adjacent White Bay Island facility to the west of Glebe Island consists of 5 berths on the northern side of White Bay.

Berth 1 is located approximately at the southern end of the eastern port side of Glebe Island, as shown in Figure 1 . To the east of the site are a number of recently constructed multilevel apartments which are part of the Jackson's Landing development. West of White Bay is located the Balmain peninsula, and to the south and on the opposite side of Blackwattle Bay is located Glebe Point.

2.1 EPA Environment Protection Licence

The licence specifies noise limits in the table of Section L6.1, these are reproduced in **Table 1**.

Table 1 Licence Noise Limits Measured in dBA

The residence most affected by noise at	Day		Evening		Night		
	LAeq (15minute)	LAeq (day)	LAeq (15minute)	LAeq (evening)	LAeq (15minute)	LAeq (night)	LA1 (1minute)
Balmain	Not applicable	Not applicable	53	50	48	45	56
Glebe	Not applicable	Not applicable	53	50	48	45	60
Pyrmont	Not applicable	Not applicable	53	50	48	45	61

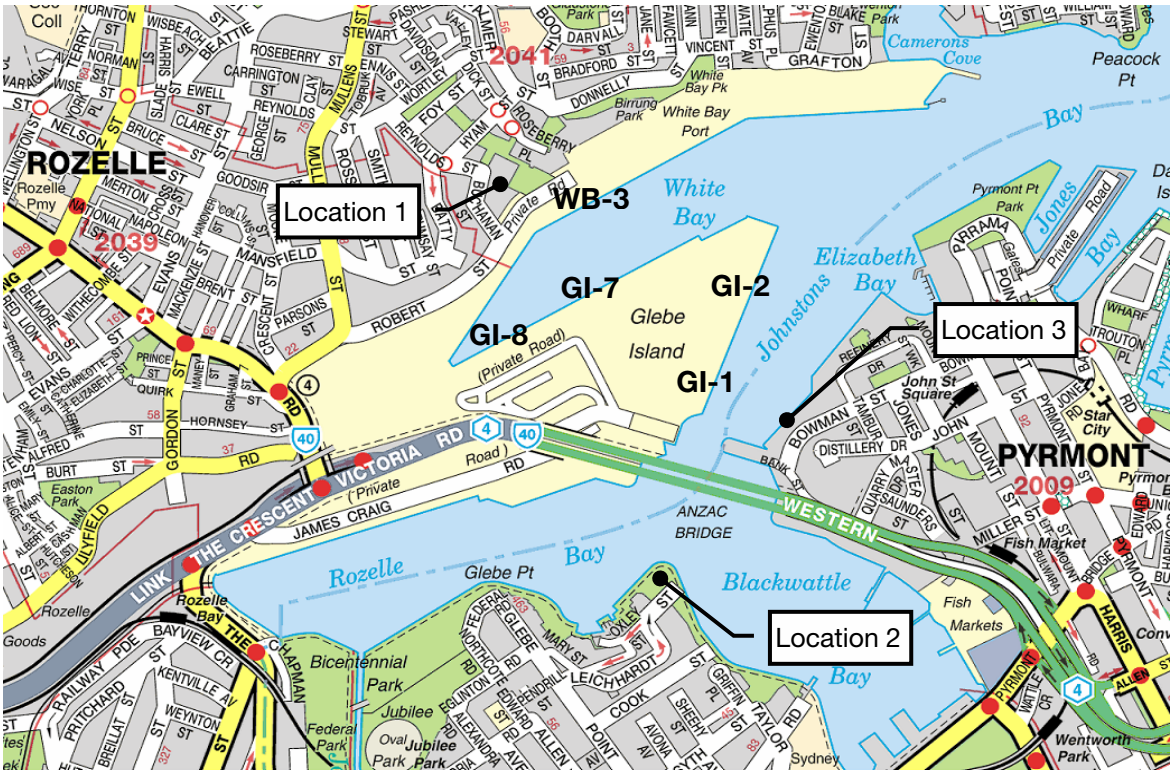
Section M7.1 of the licence requires that the licensee must arrange for an accredited acoustic consultant to monitor noise from the premises '*at the most affected noise sensitive receiver in Balmain , Glebe and Pyrmont, to determine whether the activities at the premises comply with the noise limits specified in condition L6.1'*.

2.2 Measurement Locations

The table from Section L6.1 specifies noise limits at '*the residence most affected by noise*' at Balmain, Glebe and Pyrmont. Accordingly, we have measured ambient noise levels at the closest residences at these areas which are shown in as follows:

- Location 1 - Balmain - at ground level adjacent to and east of the apartment building located at 1 Reynolds Street. This location is 645 m north-west of GI-1.
- Location 2 - Glebe - at ground level adjacent to and east of 53 Leichhardt St, Glebe. This location is 545 m south of GI-1.
- Location 3 - Pyrmont - at ground level adjacent to and west of the Jackson's Landing apartment building located at 4 Bowman Street, Pyrmont. This location is 200 m east of GI-1.

Figure 1 White Bay / Glebe Island Layout with Attended Noise Monitoring Locations



3 MEASUREMENT METHODOLOGY AND INSTRUMENTATION

The licence calls for L_{Aeq} (A-weighted equivalent continuous) sound pressure level measurements to be carried out at '*the residence most affected by noise*' at Balmain, Glebe and Pyrmont. Furthermore, the noise monitoring is required to be undertaken over a period of sufficient duration to ensure representative results from all activities and combinations of activities that would be expected to occur. The activities during this visit of the unloading of the bulk salt carrier were ship unloading to the wharf during the day, evening and night-time, with the loading of salt into trucks using front end loaders on the wharf occurring during the day. Accordingly, noise monitoring is required during the evening and night-time on order to determine compliance with the noise limits.

Attended noise level measurements were carried out at 1.5 m above ground level at Reynolds Street, Balmain, 1.5 m above ground at Leichhardt St, Glebe, and 1.5 m above ground at Bowman Street, Pyrmont.

A "reference" measurement was conducted in close proximity to the CSL Pacific, where the noise environment was dominated by bulk cargo unloading related noise. The "reference" measurement was then used as a basis for the estimation of GI-1 activity related noise at the receivers of interest.

An equivalent ship sound power level was calculated based on the "reference" measurement and noise contributions related to the bulk cargo handling were estimated at each noise sensitive location.

In accordance with the licence the noise monitoring was undertaken in accordance with Australian Standard AS 2659.1-1988 '*Guide to the use of Sound-Measuring Equipment Part 1 - Portable Sound Level Meters'*, and monitoring guidance was provided by the Industrial Noise Policy (INP).

All items of acoustic instrumentation employed during the noise monitoring surveys were designed to comply with the requirements of AS IEC 61672.1 2004: "*Electroacoustics-Sound level meters-Specifications*" and carried appropriate and current NATA (or manufacturer) calibration certificates. Calibration was checked prior to and subsequent to the noise survey. Any drift in calibration was within 0.5 dBA and therefore considered acceptable.

The survey instrumentation used during the studies is set out in **Table 2**.

Table 2 Noise Survey Instrumentation

Type	Serial Number	Instrument Description
2260	2414605	Brüel & Kjær Modular Precision Sound Level Meter
4193	2368563	Brüel & Kjær 12.5 mm Prepolarised Condenser Microphone
ND9	N433655	Acoustic Research Laboratories Calibrator

Given the relatively constant nature of noise related to the bulk cargo handling operations, short-term measurements (of 15 minute duration) are usually considered to be sufficient to provide adequate information to enable an estimate of the $L_{Aeq(night)}$ noise levels at the selected residential receivers. On this occasion however, the ambient noise environment was dominated by other sources at Locations 1 and at location 2 during the evening and night-time and the $L_{Aeq(15minute)}$ and $L_{Aeq(night)}$ source noise levels were not able to be estimated accurately based on the measurements.

A brief description of acoustic terminology used in this report is presented in **Appendix A**.

4 RESULTS AND ANALYSIS

The results of the attended noise measurements are summarised in **Table 3**. It should be noted that the measured noise levels presented below include noise from the bulk cargo handling facility at GI -1 as well as ambient noise unrelated to the facility.

Table 3 Measured Noise Levels - CSL Pacific Unloading Salt

Address	Start Time	L_{Aeq} (15min)	L_{A90} (15min)	GI-1 Related L_{Amax} Range	Comments
Reynolds Street (Balmain / Rozelle)	9.36 pm	50 dBA	47 dBA	Non observed	CSL Pacific not audible. L_{Aeq} from local traffic, Anzac Bridge
	0.41 am	45 dBA	43 dBA	Non observed	CSL Pacific not audible. L_{Aeq} from local traffic, Anzac Bridge
Leichhardt Street (Glebe)	8.28 pm	57 dBA	54 dBA	Non observed	L_{Aeq} dominated noise from Anzac Bridge, crickets. CSL Pacific not audible.
	1.35 am	48 dBA	46 dBA	Non observed	L_{Aeq} dominated noise from Anzac Bridge, CSL Pacific 'barely' audible.
Bowman Street (Pyrmont)	9.04 pm	57 dBA	55 dBA	Non observed	L_{Aeq} influenced by CSL Pacific plus Anzac Bridge traffic, crickets, seagulls, aircraft
	1.08 am	54 dBA	53 dBA	Non observed	L_{Aeq} dominated by CSL Pacific plus influence from Anzac Bridge traffic and seagulls.

Two separate measurements were carried out at the representative receiver at the Balmain site at 9.36 pm and 0.41 am. At this location, the measurement was influenced by urban hum, local and Anzac Bridge traffic.

Two separate measurements were carried out at the representative Glebe location during cargo handling operations at GI-1, at 8.28 pm and 1.35 am. At this location, during both surveys, noise from traffic on Anzac Bridge was dominating the ambient noise environment. The CSL Pacific was 'barely' audible above the Anzac Bridge traffic noise.

Two separate measurements were carried out at the representative Pyrmont location during cargo handling operations at GI-1, at 9.04 pm and 1.08 am. At this location, during both surveys, noise from the CSL Pacific was a significant contributor to the ambient noise environment, with contributions also from Anzac Bridge traffic, crickets and seagulls. The noise from the CSL Pacific was constant in nature and not considered tonal. Furthermore, no short-term 'impact' noise events from GI-1 were recorded during either survey.

In order to confirm the contribution to the ambient by bulk cargo related noise, noise levels were predicted based on the reference measurements taken in close proximity of the CSL Pacific, where the noise environment was dominated by bulk cargo unloading related noise.

Table 4 presents the "reference" noise measurements carried out between 70 m and 133 m away from significant sources on the bulk cargo vessel CSL Pacific. The measurements were conducted on the GI-1 wharf. It was noted the main noise source from the ship was the enclosed conveyor, above the deck for typically 50 percent of the ship length and this a line source.

Table 4 CSL Pacific "Reference" Noise Level

Reference	Location	Distance from Source	L_{Aeq}
1	GI-1	133 m	56 dBA
2	GI-1	82 m	57 dBA
3	GI-1	70 m	56 to 59 dBA

Calculations for night-time were performed using the reference measurements presented in **Table 4**. Predictions indicate bulk cargo unloading related L_{Aeq} noise levels of 38 dBA at Balmain, 40 dBA at Glebe, and 50 dBA at Pyrmont. The predicted noise levels, at Balmain, and Glebe are well below the ambient, and consistent with the CSL Pacific being not audible, or 'barely audible'. At Pyrmont, the predicted noise level is slightly below the measured overall $L_{Aeq(15minute)}$ level of 53 dBA. This is consistent with the expected ambient being of the order of 48 dBA at Pyrmont, in the absence of CSL Pacific unloading activity.

Additionally, calculations where performed for the evening period (before 10 pm) when front end loaders were loading trucks on the western side of the ship. Predictions indicate bulk cargo unloading related L_{Aeq} noise levels of 45 dBA at Balmain, 46 dBA at Glebe, and 52 dBA at Pyrmont.

A comparison of the predicted noise levels with the noise limits listed in the Licence Conditions are presented in **Table 5** and **Table 6** for the evening and **Table 7** and **Table 8** for the night-time.

Table 5 Assessment of Measured/Predicted Noise Levels Against $L_{Aeq(15minute)}$ Evening Noise Limits

Prediction Location	Measured/Predicted L_{Aeq} Noise Levels	$L_{Aeq(15\ minute)}$ Noise Limits	$L_{Aeq\ (15\ minute)}$ Exceedance of Licence Limits
Reynolds Street (Balmain / Rozelle)	50/45 dBA	53 dBA	No exceedance
Leichhardt Street (Glebe)	57/46 dBA	53 dBA	No exceedance
Bowman Street (Pyrmont)	57/52 dBA	53 dBA	No exceedance

Table 6 Assessment of Predicted Noise Levels Against $L_{Aeq(evening)}$ Noise Limits

Prediction Location	Measured / Predicted L_{Aeq} Noise Levels	$L_{Aeq(evening)}$ Noise Limits	L_{Aeq} Exceedance of Licence Limits
Reynolds Street (Balmain / Rozelle)	50/45 dBA	50 dBA	No exceedance
Leichhardt Street (Glebe)	57/46 dBA	50 dBA	No exceedance
Bowman Street (Pyrmont)	57/52 dBA	50 dBA	2 dBA exceedance

Table 7 Assessment of Measured/Predicted Noise Levels Against $L_{Aeq(15minute)}$ Night-time Noise Limits

Prediction Location	Measured/Predicted L_{Aeq} Noise Levels	$L_{Aeq(15\ minute)}$ Noise Limits	$L_{Aeq\ (15\ minute)}$ Exceedance of Licence Limits
Reynolds Street (Balmain / Rozelle)	45/38dBA	48 dBA	No exceedance
Leichhardt Street (Glebe)	48/40 dBA	48 dBA	No exceedance
Bowman Street (Pyrmont)	54/50 dBA	48 dBA	2 dBA exceedance

Table 8 Assessment of Predicted Noise Levels Against $L_{Aeq(night)}$ Noise Limits

Prediction Location	Measured / Predicted L_{Aeq} Noise Levels	$L_{Aeq(night)}$ Noise Limits	L_{Aeq} Exceedance of Licence Limits
Reynolds Street (Balmain / Rozelle)	45/38 dBA	45 dBA	No exceedance
Leichhardt Street (Glebe)	48/40 dBA	45 dBA	No exceedance
Bowman Street (Pyrmont)	54/50 dBA	45 dBA	5 dBA exceedance

The results in the tables are also presented graphically in **Figure 2** and **Figure 3**. with Locations 1, 2 and 3 referring to Balmain, Glebe and Pyrmont respectively.

Figure 2 Evening Noise Limits, Predicted and Measured Noise Levels

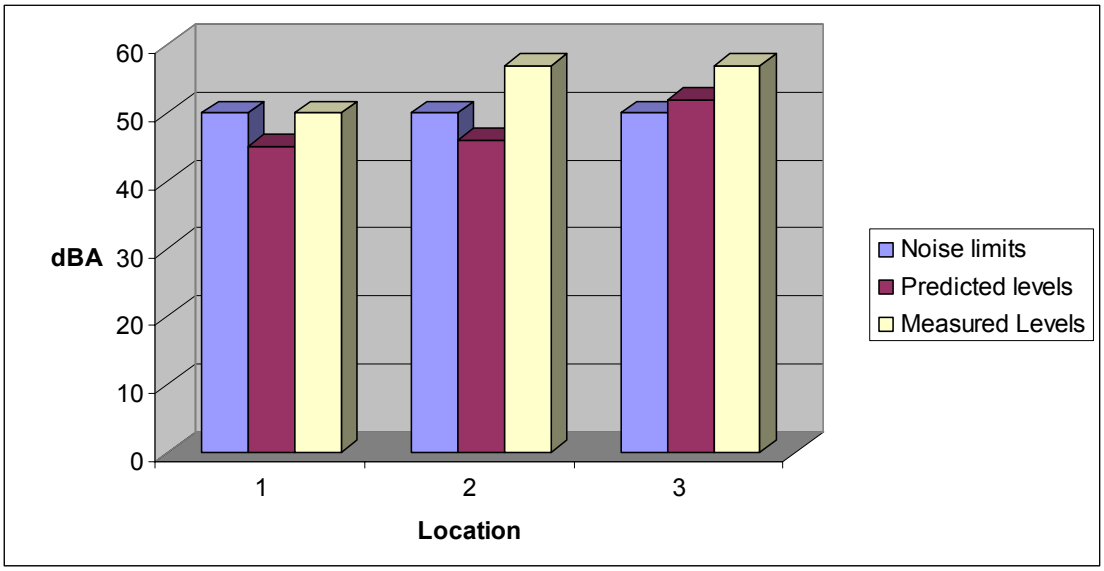
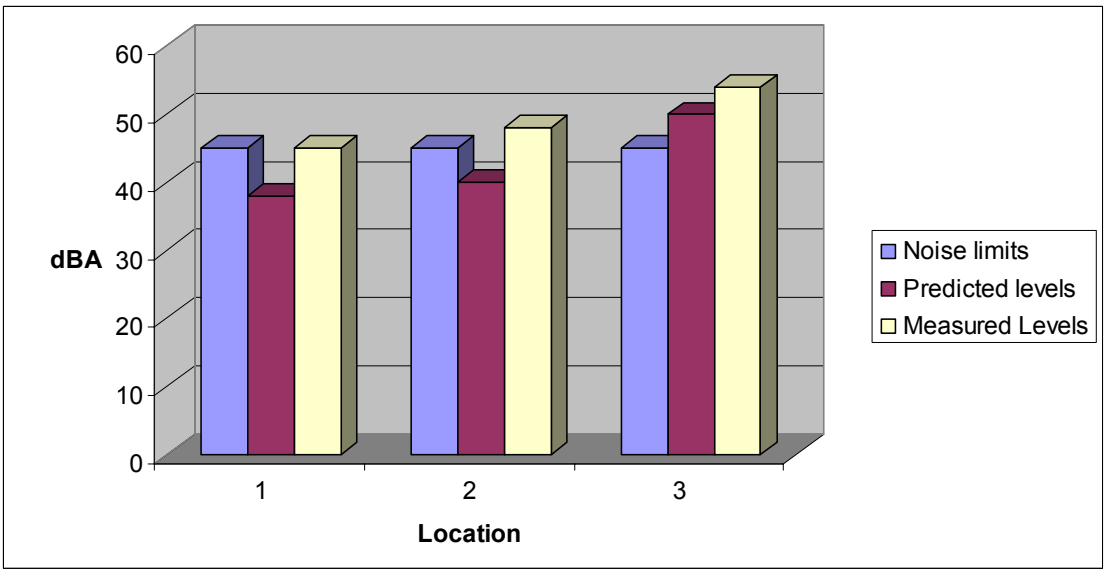


Figure 3 Night-time Noise Limits, Predicted and Measured Noise Levels.



Clause R4.1(2)(v) of the Licence requires details of any remedial action. In this instance, no remedial action was taken, as the SPC received no complaints from the community regarding noise from the CSL Pacific activity at GI-1.

5 CONCLUSION

Noise measurements were carried out during the CSL Pacific bulk cargo handling operations between 8.28 pm on the 31 March and 1.50 am on 1 April 2010. A reference noise measurement was also carried out in close proximity of the CSL Pacific vessel, where the noise environment was dominated by the GI-1 based bulk cargo handling noise sources. The reference level was then used to predict noise levels at the representative receivers in the absence of other surrounding activity related noise.

During the night-time, it was found that $L_{Aeq(15minute)}$ predicted noise level exceeds the Licence imposed noise limit at the representative location in Pyrmont by 5 dBA. Measured noise levels were 4 dBA higher than predicted, as a result of contributions from other sources such as Anzac Bridge traffic and seagulls. The measured night-time $L_{Aeq(15minute)}$ noise levels at Balmain were 45 dBA, hence the CSL Pacific bulk cargo handling operations comply with the noise limit at this location. This was confirmed by the predicted noise levels. At Glebe, the night-time ambient noise environment was dominated by traffic from the Anzac Bridge and the $L_{Aeq(15\ min)}$ and the $L_{Aeq(night)}$ contribution to the ambient by the CSL Pacific could not be measured, for comparison with the Licence conditions. Predicted noise levels at Glebe from the CSL Pacific bulk cargo unloading activities comply with the licence noise limits at this location.

During the evening, in addition to noise from the CSL Pacific unloading bulk salt onto the wharf, front end loaders were loading trucks. At Pyrmont it was found that the $L_{Aeq(15minute)}$ predicted noise level exceeds the Licence imposed noise limit at the representative assessment location by 2 dBA. The measured evening $L_{Aeq(15minute)}$ noise levels at Balmain were 50 dBA, hence the CSL Pacific bulk cargo handling operations comply with the noise limit at this location. This was confirmed by the predicted noise levels. At Glebe the evening ambient noise environment was dominated by traffic from the Anzac Bridge and the $L_{Aeq(15\ min)}$ and the $L_{Aeq(evening)}$ contribution to the ambient from the CSL Pacific could not be measured, for comparison with the Licence conditions. Predicted evening noise levels at Glebe from the CSL Pacific bulk cargo unloading activities comply with the licence noise limits at this location.

Bulk cargo terminal related maximum (L_{Amax}) noise levels were not observed to cause exceedances at any of the representative monitoring locations for the duration of attended measurements.

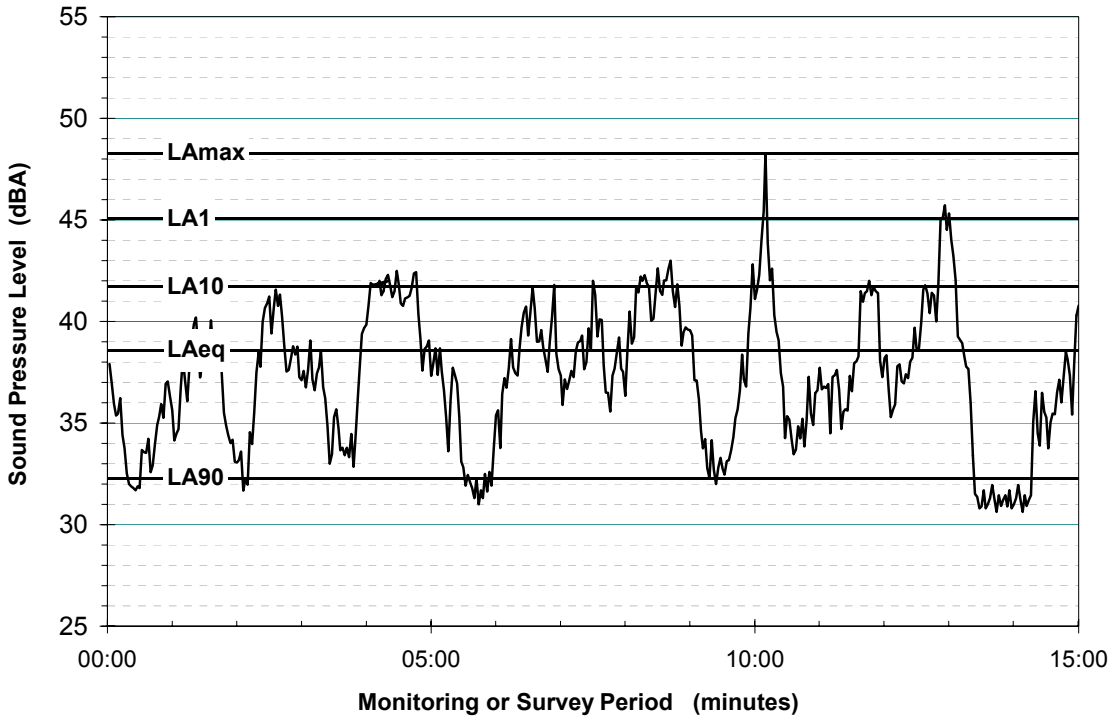
ACOUSTIC TERMINOLOGY USED IN THE REPORT

Typical Noise Indices

This Report makes repeated reference to certain noise level descriptors, in particular the L_{A10}, L_{A90} and L_{Aeq} and L_{Amax} noise levels.

- The L_{A10} is the A-weighted sound pressure level exceeded 10% of a given measurement period and is utilised normally to characterise typical maximum noise levels.
- The L_{Aeq} is essentially the average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound over the same measurement period. The $L_{Aeq(15hour)}$ is the measurement parameter used to describe the road traffic noise level over the entire daytime (7.00 am to 10.00 pm) period. The $L_{Aeq(9hour)}$ is the measurement parameter used to describe the road traffic noise level over the entire night-time (10.00 pm to 7.00 am) period. Similarly, the $L_{Aeq(1hour)}$ is the measurement parameter used to describe the road traffic noise level during the loudest 1-hour period during the daytime or night-time periods.
- The L_{A90} noise level is the A-weighted sound pressure level exceeded 90% of a given measurement period and is representative of the average minimum background sound level (in the absence of the source under consideration), or simply the "background" level.
- The L_{Amax} noise level is the maximum A-weighted noise level associated with road traffic movements.

Graphical Display of Typical Noise Indices



Typical Noise Levels

The following table presents examples of typical noise levels.

Typical Noise Levels

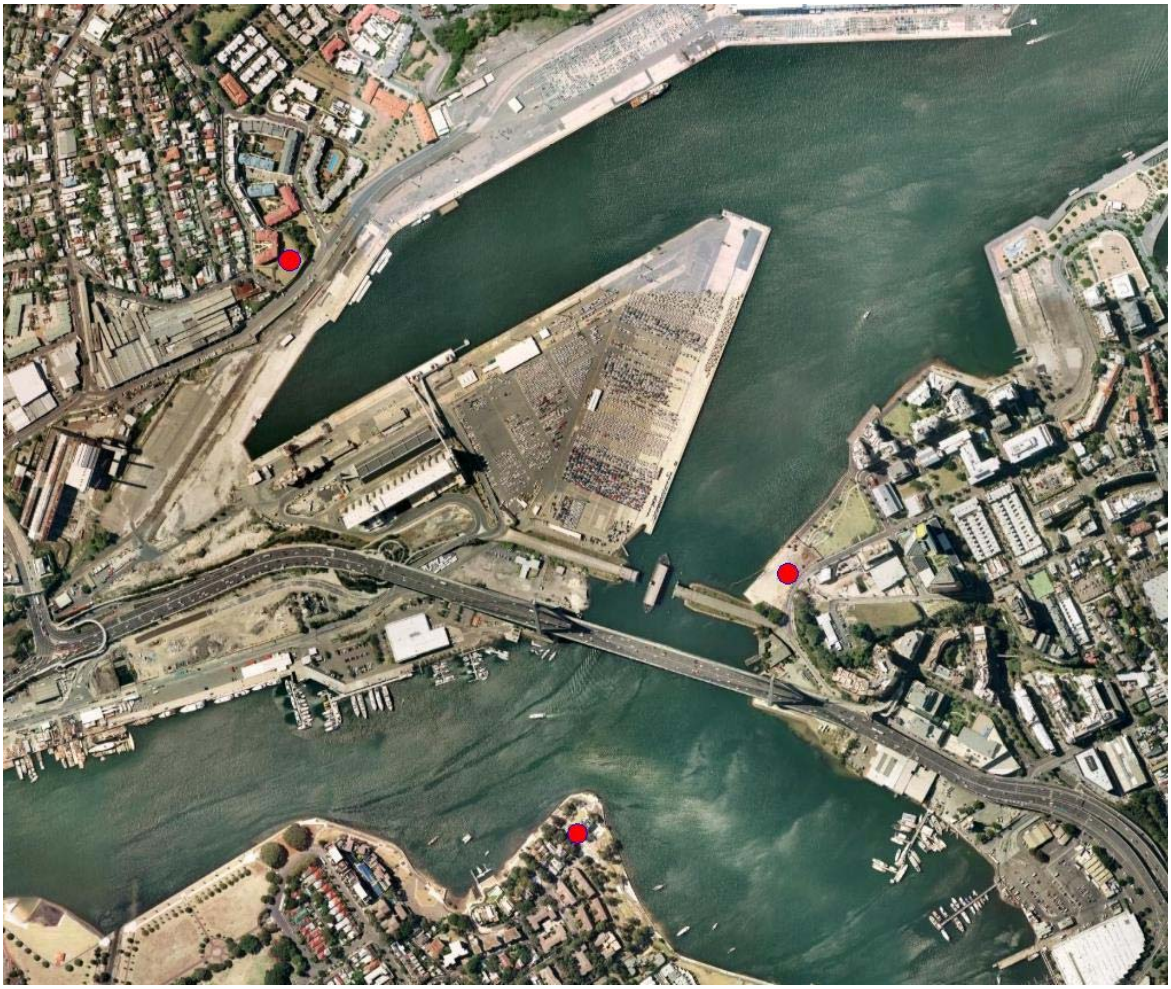
Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130 120 110	Threshold of pain Heavy rock concert Grinding on steel	Intolerable Extremely noisy
100 90	Loud car horn at 3 m Construction site with pneumatic hammering	Very noisy
80 70	Kerb side of busy street Loud radio or television	Loud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

A-Weighting or dBA Noise Levels

The overall level of a sound is usually expressed in terms of dBA, which is measured using the "A-weighting" filter incorporated in sound level meters. These filters have a frequency response corresponding approximately to that of human hearing. People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4000 Hz), and less sensitive at lower and higher frequencies. Thus, the level of a sound in dBA is a good measure of the "loudness" of that sound. Different sources having the same dBA level generally sound about equally as loud, although the perceived loudness can also be affected by the character of the sound (eg the loudness of human speech and a distant motorbike may be perceived differently, although they are of the same dBA level).

Sensitivity of People to Noise Level Changes

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



Aerial View of the Area Showing Measurement Locations

View of the CSL Pacific from Pyrmont.