



**HEGGIES**

REPORT 10-4309-R33

Revision 0

**White Bay Berth 4 Bulk Liquids Handling  
Stolt Kikyo**

**Ship Noise Monitoring Report**

PREPARED FOR

**Sydney Ports Corporation  
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SYDNEY NSW 2000**

20 JULY 2010

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*Incorporating*

New Environment

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# White Bay Berth 4 Bulk Liquids Handling

## Stolt Kikyo

### Ship Noise Monitoring Report

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DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked	Authorised
10-4309-R33	Revision 0	20 July 2010	John Sleeman	Dick Godson	Dick Godson



## EXECUTIVE SUMMARY

Heggies Pty Ltd (Heggies) has been commissioned by Sydney Ports Corporation (SPC) to conduct monitoring of noise emissions during the loading of the Stolt Kikyo (a bulk liquids vessel) at White Bay Berth 4 (WB-4), as required under Clause M7.1(1a) of the EPA's Environment Protection Licence (Licence No 12095).

The Stolt Kikyo vessel berthed at approximately 7:20 am on 1 July 2010 and departed at 5:59 pm on the same day. As the ship was not berthed during the night-time period there are no Licence imposed noise goals. Not with standing daytime noise levels were measured and predicted for comparison with the night-time noise goals.

Noise measurements were carried out at nearby residential receivers during Stolt Kikyo vessel cargo handling operations on the morning of 1 July 2010.

The measured noise levels were found to be potentially influenced by local traffic, Anzac Bridge traffic, aircraft and the general urban hum. A reference noise measurement was therefore carried out in close proximity to the Stolt Kikyo vessel, where the noise environment was dominated by the WB-4 based bulk liquids cargo handling noise sources. The reference noise level was then used to predict noise levels at the representative receivers, for comparison with the attended measurements and Licence goals.

At the representative location in Pyrmont the goals would be met should the ship be berthed at night. At Balmain, the predicted noise levels would potentially exceed the  $L_{Aeq(15\text{minute})}$  noise goal by up to 2 dBA and the  $L_{Aeq(\text{night})}$  noise goal potentially exceeded by 9 dBA if the vessel were to be berthed during the night-time.

Subject to feasibility, practicality and reasonability, the potential noise control measures that may be considered in order to meet the Licence imposed noise goals (as required by Condition R4.1) and ensure noise amenity remains unchanged in the area would be the implementation of an On-site Noise Management Strategy. Noise impact mitigation measures have been evaluated in the Revised Noise Impact Mitigation and Management Strategy (Report 10-4309-R10 Revision 1), with a list of mitigation measures considered feasible and reasonable identified in the Noise Impact Mitigation Action Plan.



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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 loading of the “Stolt Kikyo” (a bulk liquids vessel) at White Bay Berth 4 (WB-4), as required under Clause M7.1(1a) of the EPA’s Environment Protection Licence (Licence No 12095).

Noise measurements were conducted during cargo handling operations (ship auxillary power unit (APU), ventilation fans, pumps and truck activity on the wharf) at two locations considered representative of the potentially most exposed residential receivers. The locations are at Balmain to the west and at Pyrmont to the east of WB-4. Measurements at both representative locations were conducted during the loading of bulk liquids from road tanker trucks to the ship via pumps on the wharf. The measurements were conducted after the ship arrived between 10.07 am and 11.28 am on 1 July 2010, with the weather consisting of a generally clear sky. There was also a light to moderate breeze from the west/north-west during the measurement period.

An additional “reference” noise measurement was carried out in close proximity to the Stolt Kikyo vessel, where the noise environment was dominated by the WB-4 based bulk liquids cargo handling noise sources. The reference noise level was then used to predict noise levels at the representative receivers for comparison with the attended measurements.

Whilst the vessel was not berthed during the night-time period during which the noise goals are applicable the measured and predicted noise levels and were compared against the noise goals set out in Table U1 of the Environment Protection Licence. Feasible and reasonable noise mitigation measures are discussed in broad terms, with the aim of minimising the noise impacts from the operations, where the noise goals are potentially exceeded.



## 2 SITE DESCRIPTION

The White Bay Port facility is located at the southern end of the Balmain peninsula. The facility occupies approximately 40 hectares of waterfront land and forms a crescent around White Bay, with a water frontage of about 2,100 m in length.

The facility layout comprises the following main elements:

- Five multiple-use berths spread along the northern side of White Bay;
- Storage warehouse situated to the northeast of White Bay, Berth 4 (WB-4); and
- Internal road continuing from Robert Street providing truck access to storage areas of Docks 1 to 6.

The Glebe Island facility which includes four multiple-use berths is located adjacent to the White Bay Port on a neighbouring peninsula south of White Bay.

Berth 4 is located approximately in the middle of the northern side of White Bay, as shown in **Figure 1**. To the north and northwest of the site is a mixture of residential dwellings consisting of 1 and 2 storey detached houses and terraces. A number of recently constructed 4 and 5 storey residential developments are situated directly west of Berth 4 and incorporate acoustic façade treatments to achieve satisfactory internal noise levels. In addition, buildings in direct view were designed to provide significant acoustical shielding to the rest of the development. The storage warehouse (on port land) to the northeast of WB-4 is about 20 m at the highest point and provides significant acoustic shielding to the residential properties directly behind. To the southeast of the site is Glebe Island, another working port area with four multiple-use berths. To the southeast of WB-4, about 550 m across the water, is the Pyrmont Peninsula, with a number of high-rise residential apartments near the waterfront.

### 2.1 Measurement Locations

The Noise Impact Assessment (NIA) Study (Report Number 10-4309-R1 prepared by Heggies) for the proposed bulk liquid terminal operation has previously identified 5 Waite Street and 36 Refinery Drive as the most affected receiver locations within the Balmain / Rozelle and Pyrmont / Glebe areas respectively.

For the current study, in the Balmain / Rozelle area, monitoring was carried out only at 13 Donnelly Street (also assessed in the noise impact assessment) due to the availability of day/night access to the property boundary. Note that noise measurements at 13 Donnelly Street can be carried out off-street, whereas at 5 Waite Street noise measurements require backyard access. Furthermore, the location at 13 Donnelly Street is in close proximity of 5 Waite Street. It is approximately the same distance away and is also directly exposed to loading operations at WB-4. It is therefore considered to be of a similar acoustical environment to that of 5 Waite Street, Balmain.

The monitoring location at 36 Refinery Drive, identified by the NIA as the most affected receiver in the Pyrmont / Glebe area, was found to be exposed to high levels of traffic related noise from the Anzac Bridge. Giba Park (a publicly accessible park situated at the front of the 4 level apartment complex at 2 Point Street) was therefore selected as the representative measurement location for the Pyrmont / Glebe area, as it allowed ship noise measurements to be taken in the relative absence of traffic noise. Giba Park is considered to be equivalent to 2 Point Street, Pyrmont

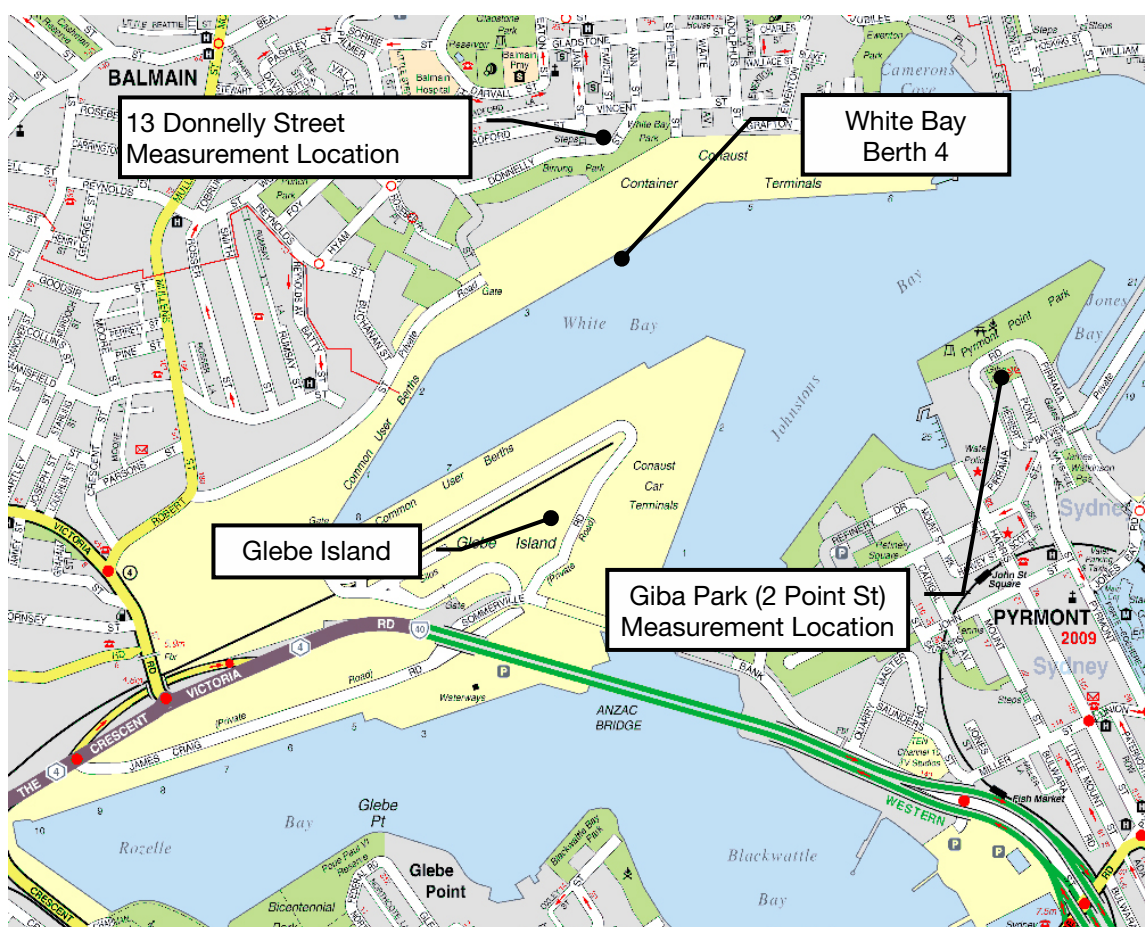
**Table 1** summarises the receiver locations where measurements were conducted in each area and gives a brief description of each location. A more detailed description and photos of the selected monitoring locations are presented in **Appendix B** and **Appendix C**.



**Table 1 Representative Receiver Locations**

Location	Representative Receiver Location	Description
Balmain and Rozelle	13 Donnelly Street, Balmain	Ground level at the front of residence, about 7 m away from the facade
Pymont and Glebe	2 Point Street, Pymont	At Giba Park, in front of 4 storey building at 2 Point Street.
Reference Measurement	White Bay Berth 4 Deck	On deck of White Bay Berth 4, and approximately 76 m from the ship rear engine room/exhaust stack area, the main source of noise from the Stolt Kikyo vessel..

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





### 3 EPA LICENCE NOISE GOALS

For the purpose of the bulk liquid cargo handling operations at White Bay Berth 4 (WB-4), the Environment Protection Licence granted by the EPA sets out the project noise goals at the neighbouring residential communities. The noise goals are set out in Table U1 of the Licence conditions and reproduced in **Table 2**.

**Table 2 EPA License Noise Goals (Reproduced from Table U1)**

Location	Night		
	LAeq(15minute)	LAeq(Night)	LAmx
Balmain and Rozelle	49 dBA	41 dBA	59 dBA
Pymont and Glebe	41 dBA	Not Applicable	51 dBA

Explanatory notes:

1. LAmx means maximum A-weighted sound pressure level measured on fast time weighting during the time over which sound is measured.
2. All other acoustic terms including “night” have the same meaning as in the INP.
3. Not Applicable: In instances where the amenity criteria LAeq(Night) has been determined to be a higher number than the intrusive criteria LAeq(15minute) that the amenity criteria is less stringent than the intrusive criteria, then the amenity criteria becomes ‘not applicable’. This is because compliance with the criteria will ensure compliance with the intrusive criteria will ensure compliance with the amenity criteria.





## 4 MEASUREMENT METHODOLOGY AND INSTRUMENTATION

The licence calls for  $L_{Aeq}$  (A-weighted equivalent continuous) sound pressure level measurements to be carried out at locations representative of those potentially most affected (ie, waterfront) locations during periods of inactivity (eg, ship Auxiliary Power Units (APUs) operating) and during loading operations (eg, wharf pumps and truck activity on the wharf in addition to APUs), in accordance with Clause M7.1 (2).

Ship noise levels during periods of loading inactivity exist immediately after the ship berths, while the loading equipment is being set up (hoses unrolled and connected to the ship's manifold etc). The equipment setup phase usually lasts less than 2 hours, after which the loading is continuous, with up to two road tankers filling the ship at any one time. Ship noise measurements during periods of activity can be measured at any time after loading commences.

The previous ship noise monitoring report prepared by Heggies (Report Number 10-4309-R2 Revision 1) concluded that measurements are best carried out at night (preferably after 1.00 am). Extraneous noise (not related to the subject activity) is generally at a minimum at this time and measurement results are consequently likely to be much more meaningful.

The bulk liquids ship Stolt Kikyo berthed at approximately 7.20 am on Thursday 1 July 2010, with the ship scheduled to complete the loading of bulk liquids prior to departing later the same day. Measurements were conducted between 10.07 am and 11.27 am on 1 July 2010, following the arrival of the vessel.

Attended noise level measurements were carried out at 1.5 m above ground level at 13 Donnelly Street and 1.5 m above ground level at Giba Park, located adjacent to the residential apartment complex at 2 Point Street, Pyrmont.

A "reference" measurement was conducted in close proximity to the Stolt Kikyo, where the noise environment was dominated by bulk liquids loading related noise. The "reference" measurement was then used as a basis for the estimation of WB-4 activity related noise at the receivers of interest.

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

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 survey. Any drift in calibration was within 0.5 dBA and considered acceptable.

The survey instrumentation used during the studies is set out in **Table 3**.

**Table 3 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
4231	1730711	Brüel & Kjær Calibrator



Environmental noise measurements were carried out with reference to the guidelines contained within the NSW Industrial Noise Policy, 2000 (INP). In circumstances where it was not practical to carry out measurements at the potentially most affected receiver locations as predicted by the Noise Impact Assessment, locations of similar noise characteristics were chosen, as described in **Section 2.1**.

Given the relatively constant nature of noise related to the bulk liquids cargo handling operations, short-term measurements (of 15 minute duration) are usually considered to be sufficient to provide sufficient information to enable an estimate of the  $L_{Aeq(night)}$  noise levels at the selected residential receivers. A brief description of acoustic terminology used in this report is presented in **Appendix A**.

Attended measurements during periods of unloading activities were carried out during the morning of 1 July 2010, commencing at approximately 10.07 am.

One 15 minute measurement was carried out at the representative Balmain location during cargo handling operations at WB-4, commencing at 10.38 am. At this location, the noise from bulk handling at WB4 was the audible, with the measurements also influenced by local traffic, aircraft noise, birds and the general urban hum.

One 15 minute noise measurement was also carried out at the representative receiver at the Pyrmont site, commencing at 10.07 am. At this location, the vessel was not audible with the measurement generally influenced by Anzac Bridge traffic, local traffic and the general urban hum.



## 5 RESULTS AND ANALYSIS

The results of the 15 minute duration attended noise measurements are summarised in **Table 4**. Discussion of the results is presented in **Section 6** of this report. It should be noted that the measured noise levels presented below include noise from the bulk liquids cargo handling facility at WB-4 as well as ambient noise unrelated to the facility.

**Table 4 Measured Noise Levels - Loading Activity**

Address	Start Time	LAeq (15min)	LA90 (15min)	WB-4 Related LAmax Range	Comments
13 Donnelly Street (Balmain / Rozelle)	10.38 am	57 dBA	52 dBA	56 dBA to 57 dBA	LAeq influenced by WB-4 noise as well as from local sources
Level 5, 2 Point Street (Pyrmont / Glebe)	10.07 am	54 dBA	49 dBA	non observed	Stolt Kikyo not audible"

During the measurements at 13 Donnelly Street (at approximately 10.38 am) noise from WB-4 operations such as the ship APU were clearly audible. Noise from the ship APU was the dominant source, and to a lesser extent noise from the wharf pumps. Both were contributors to the LAeq noise level and were found to be constant in nature. The LAeq was also significantly influenced by local traffic, Anzac Bridge traffic, aircraft and the general urban hum.

During the measurement at Point Street, the ambient noise resulted from local traffic, aircraft and the general the urban hum or city noise. An LAeq noise level of 54 dBA was recorded for the 10.07 am survey.

Noise from trucks and truck unloading was audible at Balmain, with a summary of the LAmax truck noise events at the site presented in **Table 5**. WB 4 related LAmax noise events were not observed at the Pyrmont monitoring location.

**Table 5 Summary of Attended LAmax Noise Levels at 13 Donnelly Street, Balmain**

LAmax Source	LAmax Range	Notes
Truck air brakes	56 dBA to 57 dBA	Truck parking brake air was heard from a truck on arrival to the site. The event lasted for approximately 1 second.

In order to confirm the contribution to the ambient noise by bulk liquids related noise, noise levels were predicted based on the reference measurements taken in close proximity of the Stolt Kikyo, where the noise environment was dominated by bulk liquids loading related noise.

**Table 6** presents the "reference" noise measurements carried out 60 m away from the bulk liquids vessel Stolt Kikyo, and also 40 m from the pumping units located on the wharf, where the noise environment was dominated by bulk liquids cargo handling related noise. The first measurement was taken 60 m from the rear of the ship in the direction towards 13 Donnelly Street, Balmain, where ship noise dominated the ambient.

The second measurement was taken from the silenced pump(s) in use. In typical bulk liquids handling for the Stolt Kikyo two silenced pumps are used, however in the ultimate configuration up to three silenced pumps may be in operation.

**Table 6 Stolt Kikyo “Reference” Noise Level**

Reference	Location	Distance from Source	Height of Source	LAeq
1	WB-4	60 m	15 m	60 dBA
2	WB-4	40 m	1 m	62 dBA

Notes 1. Safety constraints limited the minimum distance to the vessel, and hence the pumps to 40 m

Calculations were performed with the reference measurements taken in close proximity of the Stolt Kikyo vessel. Up to two pumps have been assumed to be operational in any 15 minute period and pumping would occur for typically 30 percent of the night-time period. Therefore for comparison with the licence conditions, which are applicable during the night-time period only, calculations were in order performed to determine the LAeq(15minute), and the LAeq(9hour) noise levels.

Predictions that indicate bulk liquids loading related LAeq(15minute) noise levels at the representative receivers at 13 Donnelly Street and 2 Point Street were 51 dBA and 36 dBA respectively.

The calculated LAeq(15minute) noise level of 51 dBA is lower than the measured noise levels of 57 dBA at 13 Donnelly Street, and consistent with the influence of local traffic, aircraft and other localised noise sources. The calculated LAeq(15minute) noise level at 2 Point Street is significantly below the ambient noise level at this location and is consistent with WB-4 related noise being not audible.

A comparison of the measured and predicted noise levels with the noise goals listed in the Licence Conditions is presented in **Table 7**, **Table 8** and **Table 9**.

**Table 7 Comparison of Measured/Predicted Noise Levels Against LAeq(15minute) Noise Goals**

Prediction Location	Measured/Predicted LAeq Noise Levels <sup>1</sup>	LAeq(15 minute) Noise Goals	LAeq (15 minute) Exceedance of Licence Goals <sup>2</sup>
13 Donnelly Street (Balmain / Rozelle)	57/51 dBA	49 dBA	N/A
Level 5, 2 Point Street (Pyrmont / Glebe)	47/35 dBA	41 dBA	N/A

Notes : 1. At 13 Donnelly Street the predicted noise levels are considered a more accurate representation of the ship noise given the potential influence of local traffic, aircraft and other localised noise sources at this location. At 2 Point Street, the predicted level is considered more representative of WB-4 noise, given the significant contribution to the ambient by other sources at this location, and that WB-4 noise was not audible. This level meets the 41 dBA licence condition.  
2. Not applicable as the vessel was not berthed during the night-time period.

**Table 8 Comparison of Predicted Noise Levels Against LAeq(night) Noise Goals**

Prediction Location	Predicted LAeq Noise Levels	LAeq(night) Noise Goals	LAeq Exceedance of Licence Goals <sup>2</sup>
13 Donnelly Street Balmain / Rozelle)	50 dBA <sup>1</sup>	41 dBA	N/A
Level 5, 2 Point Street (Pyrmont / Glebe)	35 dBA	N/A	N/A

Notes: 1. The predicted LAeq(9hour) night-time level is marginally lower than the predicted LAeq(15minute) noise level presented in **Table 7** as a result of the pumps assumed not to be operating continuously over the full 9 hour night-time period.  
2. Not applicable as the vessel was not berthed during the night-time period.



**Table 9 Assessment of (WB-4 Related) Measured Noise Levels Against LA<sub>max</sub> Noise Goals**

<b>Measurement Location</b>	<b>Range of Maximum Measured Levels (LA<sub>max</sub> Range)</b>	<b>LA<sub>max</sub> Noise Goals</b>	<b>Range of Recorded LA<sub>max</sub> Exceedances of the Licence Noise Goals</b>
13 Donnelly Street (Balmain / Rozelle)	56 dBA to 57 dBA	59 dBA	N/A
Level 5, 2 Point Street (Pymont / Glebe)	N/A	51 dBA	N/A

- Notes:
1. No LA<sub>max</sub> events associated with the bulk liquids unloading activity at WB-4 were recorded during the monitoring periods at 2 Point Street, Pymont.
  2. Not applicable as the vessel was not berthed during the night-time period.



## 6 DISCUSSION

The Stolt Kikyō vessel was not berthed at WB-4 during the night-time, being the time period over which the Licence imposed noise goals are applicable. Never the less based on the day time measurements, measured and predicted noise levels have been compared with the goals.

At the representative location in Pyrmont the goals would be met should the ship be berthed at night. At Balmain, the predicted noise levels would potentially exceed the  $L_{Aeq(15minute)}$  noise goal by up to 2 dBA and the  $L_{Aeq(night)}$  noise goal potentially exceeded by 9 dBA if the vessel where to be berthed during the night-time.

In order to fulfil the requirement of Licence Condition R4.1, and in relation to compliance with Licence Conditions O4.1 and O4.2, the potential in-concept noise control measures are discussed below for the sources identified.

A Revised Noise Impact Mitigation and Management Strategy (Report No 10-4309-R10 Revision1) has been prepared for the operation. Taking into consideration the infrequency and limited duration of the operation, expected costs, development times, uncertainty of effective outcome, and the impact on flexibility in relation to ships that may be used in the operation, the implementation of ship specific engineering noise control measures is not considered practical nor reasonable within the Revised Noise Impact Mitigation and Management Strategy. Instead, the document recommends an on-site mitigation management strategy be implemented based on operator awareness and procedures to identify and repair abnormally noisy equipment, as outlined within the Noise Impact Mitigation Action Plan.



## 7 CONCLUSION

The Stolt Kikyō vessel berthed at approximately 7:20 am on 1 July 2010 and departed at 5:59 pm on the same day. As the ship was not berthed during the night-time period there are no Licence imposed noise goals. Not with standing daytime noise levels were measured and predicted for comparison with the night-time noise goals.

Noise measurements were carried out at nearby residential receivers during Stolt Kikyō vessel cargo handling operations on the morning of 1 July 2010.

The measured noise levels were found to be potentially influenced by local traffic, Anzac Bridge traffic, aircraft and the general urban hum. A reference noise measurement was therefore carried out in close proximity to the Stolt Kikyō vessel, where the noise environment was dominated by the WB 4 based bulk liquids cargo handling noise sources. The reference noise level was then used to predict noise levels at the representative receivers, for comparison with the attended measurements.

At the representative location in Pyrmont the goals would be met should the ship be berthed at night. At Balmain, the predicted noise levels would potentially exceed the  $L_{Aeq(15\text{minute})}$  noise goal by up to 2 dBA and the  $L_{Aeq(\text{night})}$  noise goal potentially exceeded by 9 dBA if the vessel were to be berthed during the night-time.

Potential noise control measures that may be considered to meet the Licence imposed noise goals (as required by Condition R4.1) subject to feasibility, practicality and reasonability, include a combination of applying engineering noise control measures to trucks and an on-site noise management strategy. Noise impact mitigation measures have been evaluated in the Revised Noise Impact Mitigation and Management Strategy (Report 10-4309-R10 Revision 1), with a list of mitigation measures considered feasible and reasonable identified in the Noise Impact Mitigation Action Plan.

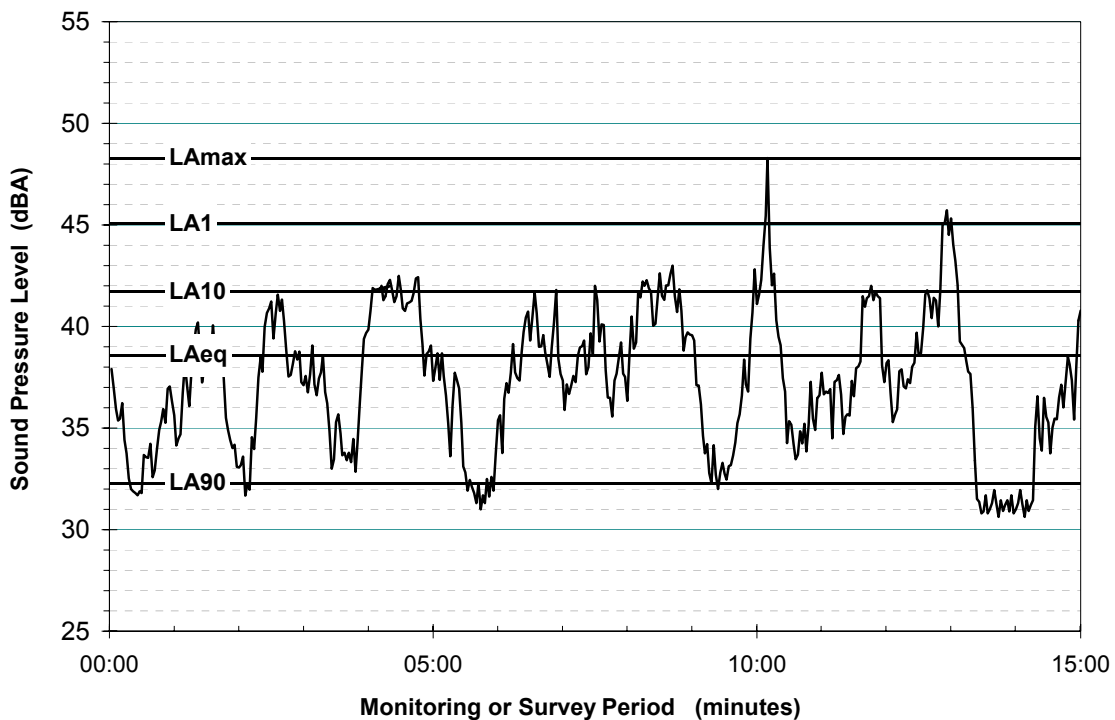
## ACOUSTIC TERMINOLOGY USED IN THE REPORT

### Typical Noise Indices

This Report makes repeated reference to certain noise level descriptors, in particular the LA10, LA90 and LAeq and LAmax noise levels.

- The LA10 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 LAeq 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 LAeq(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 LAeq(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 LAeq(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 LA90 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 LAmax 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	Threshold of pain	Intolerable
120	Heavy rock concert	Extremely noisy
110	Grinding on steel	
100	Loud car horn at 3 m	Very noisy
90	Construction site with pneumatic hammering	
80	Kerb side of busy street	Loud
70	Loud radio or television	
60	Department store	Moderate to
50	General Office	Quiet
40	Inside private office	Quiet to
30	Inside bedroom	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

## 13 DONNELLY STREET, BALMAIN

The location is situated approximately 170 m away from and directly overlooking White Bay Berth 4 (across the park). It is elevated some 15 m above dock level. The measurement was conducted from street level (from a footpath) with Donnelly Street traffic less than 2 m away.



Aerial Photo showing the monitoring location at 13 Donnelly Street, relative to White Bay Berth 4 (WB-4).



View from WB-4 deck towards 13 Donnelly Street



View from 13 Donnelly St towards the bulk liquids ship, berthed at WB-4

### 2 POINT STREET, PYRMONT

This monitoring location is situated approximately 660 m away from White Bay Berth 4 (across the bay). Monitoring was conducted at a height equivalent of a 5 storey building, on the cliffs edge. Pirrama Road encircles the park on the western, northern and eastern sides, approximately 15 m below.



Aerial Photo showing the monitoring location at 2 Point Street, relative to White Bay Berth 4 (WB-4).



View from WB-4 deck towards 2 Point Street



View from 2 Point Street towards the bulk liquids ship berthed at WB-4