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White Bay Berth 4 Bulk Liquids Handling  
Stolt Suisen  
Ship Noise Monitoring Report

Report Number 10-4309-R43

13 January 2012

Sydney Ports Corporation  
207 Kent Street  
SYDNEY NSW 2000

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# White Bay Berth 4 Bulk Liquids Handling

Stolt Suisen

## Ship Noise Monitoring Report

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### DOCUMENT CONTROL

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## EXECUTIVE SUMMARY

SLR Consulting Australia Pty Ltd (formerly Heggies Pty Ltd) has been commissioned by Sydney Ports Corporation (SPC) to conduct monitoring of noise emissions during the loading of the Stolt Suisen (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 Suisen vessel berthed at approximately 10.03 pm on 21 December 2011 and departed at 3.49 pm on the 22 December 2011. Noise measurements were carried out at nearby residential receivers during Stolt Suisen vessel cargo handling operations during the early morning of 22 December 2011.

The measured noise levels were found to be potentially influenced by Anzac Bridge traffic, the general urban hum and also the vessels docked at Glebe Island 7 and 8. A reference noise measurement was therefore carried out in close proximity to the Stolt Suisen 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.

Predicted ship based  $L_{Aeq(15\text{minute})}$  noise levels meet the Licence imposed noise goals at the representative location in Pyrmont. At Balmain, the measured and predicted  $L_{Aeq(15\text{minute})}$  noise levels meet the Licence imposed noise goals. At Balmain, the predicted  $L_{Aeq(\text{night})}$  noise level exceeds the noise goal by 7 dBA.

At Balmain bulk liquids terminal related maximum ( $L_{Amax}$ ) noise levels exceed the Licence imposed noise goal by 2 dBA. At Pyrmont bulk liquids terminal related maximum ( $L_{Amax}$ ) noise levels could not be measured above the ambient noise.

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.

## TABLE OF CONTENTS

1	INTRODUCTION	5
2	SITE DESCRIPTION	5
	2.1 Measurement Locations	6
3	EPA LICENCE NOISE GOALS	7
4	MEASUREMENT METHODOLOGY AND INSTRUMENTATION	8
5	RESULTS AND ANALYSIS	9
6	DISCUSSION	11
7	CONCLUSION	12
8	CLOSURE	12

## TABLES

Table 1	Representative Receiver Locations	6
Table 2	EPA License Noise Goals (Reproduced from Table U1)	7
Table 3	Noise Survey Instrumentation	8
Table 4	Measured Noise Levels - Unloading Activity	9
Table 5	Summary of Attended L <sub>Amax</sub> Noise Levels at 13 Donnelly Street, Balmain	10
Table 6	Stolt Suisen "Reference" Noise Level	10
Table 7	Comparison of Measured/Predicted Noise Levels against L <sub>Aeq</sub> (15minute) Noise Goals	10
Table 8	Comparison of Predicted Noise Levels against L <sub>Aeq</sub> (night) Noise Goals	11
Table 9	Assessment of (WB-4 Related) Measured Noise Levels against L <sub>Amax</sub> Noise Goals	11

## FIGURES

Figure 1	White Bay / Glebe Island Layout with Attended Noise Monitoring Locations	7
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## APPENDICES

Appendix A	Summary of Acoustic Terminology used in the Report
Appendix B	Description of the Balmain/Rozelle Monitoring Location - 13 Donnelly Street, Balmain
Appendix C	Description of the Pymont/Glebe Monitoring Location - 2 Point Street, Pymont

## 1 INTRODUCTION

SLR Consulting has been commissioned by Sydney Ports Corporation (SPC) to conduct monitoring of noise emissions during the loading of the "Stolt Suisen" (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 when the ship was berthed at the completion of cargo handling operations (ship auxiliary 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 11.59 pm on 22 December and 3.10 am on 22 December 2011, with the weather consisting of an overcast sky and calm conditions.

An additional "reference" noise measurement was carried out in close proximity to the Stolt Suisen 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.

The predicted noise levels correlated well with the measured levels and were assessed 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 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.

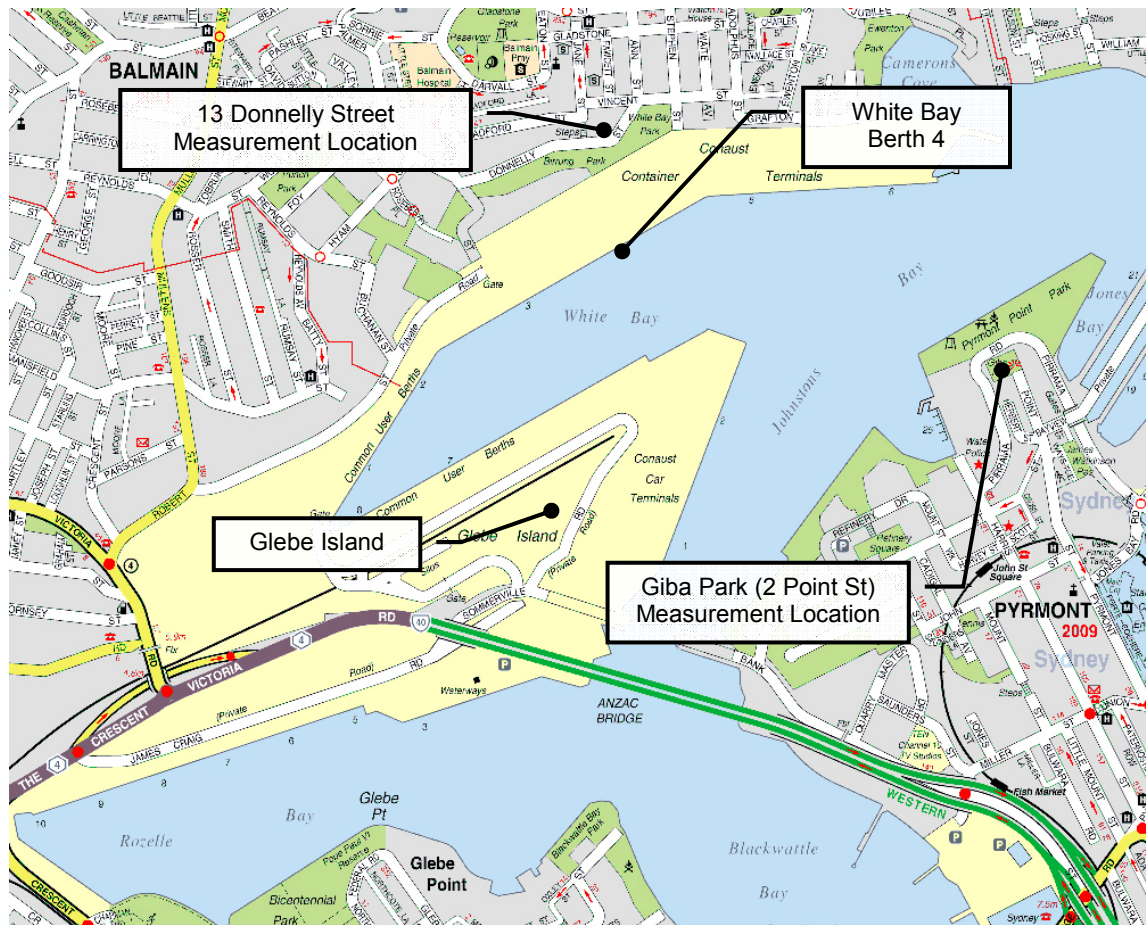
The monitoring location at 36 Refinery Drive, identified by the NIA as the most affected receiver in the Pyrmont / Glebe area, was found to be exposed to high levels of traffic related noise from the Anzac Bridge. Giba Park (a publicly accessible park situated at the front of the 4 level apartment complex 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
Pyrmont and Glebe	2 Point Street, Pyrmont	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 60 m from the hull of the Stolt Suisen vessel, 120 m from the rear engine room/exhaust stack area

**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
Pyrmont 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 requires  $L_{Aeq}$  (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, ship pumps and truck activity on the wharf in addition to APUs), in accordance with Clause M7.1(2).

Ship noise levels during periods of unloading inactivity exist immediately after the ship berths, while the unloading 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 Suisen berthed at approximately 10:03 pm on 21 December 2011 and departed at 3:49 pm on the following day. Pumping had commenced by midnight after the vessel berthed and was completed the following day. Measurements were conducted between 12.20 am and 3.10 am on 22 December 2011, 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 Suisen, 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	2677334	Brüel & Kjær 12.5 mm Pressure-field Microphone
4231	2482669	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 adequate information to enable an estimate of the LAeq(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 of periods of unloading activities were carried out during the early morning of 22 December 2011, commencing at approximately 12.20 am.

Two separate 15 minute measurements were carried out at the representative Balmain location during cargo handling operations at WB-4, at 12.20 am and 2.10 am. At this location the noise from bulk handling at WB4 was clearly audible and considered the main contributor to the measurement, with the measurements also potentially influenced by traffic on Anzac Bridge and general urban noise.

One 15 minute noise measurement was also carried out at the representative receiver at the Pymont site, commencing at 2.50 am. At this location, the vessel was not audible with the measurement generally influenced by Anzac Bridge traffic as well as 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 - Unloading Activity**

Address	Start Time	LAeq (15min)	LA90 (15min)	WB-4 Related LAmax Range	Comments
13 Donnelly Street (Balmain/Rozelle)	12.20 am	49 dBA	45 dBA	50 dBA to 61 dBA	LAeq influenced by WB-4 noise as well as noise from the vessels at Glebe Island berth 7 and 8
	2.10 am	50 dBA	47 dBA	50 dBA to 60 dBA	
Level 5, 2 Point Street (Pymont/Glebe)	2.50 am	43 dBA	38 dBA	non observed	Stolt Suisen vessel "not audible"

Note 1: During the measurements at Donnelly Street the sound level meter was paused during local vehicle passbys.

During the measurements at 13 Donnelly Street (at approximately 12.20 am and 2.10 am) noise from WB-4 operations such as the ship APU were clearly audible, as well as noise from the vessels Pioneer and UBC Canada at berths Glebe Island 7 and 8 respectively. Noise from the ship APU was considered the dominant source influencing the LAeq noise level and was found to be constant in nature. The LAeq was also potentially influenced by the vessels at Glebe Island berth 7 and 8 and by Anzac Bridge traffic and associated noise during measurements at Donnelly Street.

During the measurement at Point Street, the ambient noise resulted from Anzac Bridge traffic as well as the general urban hum or city noise. There was also noise from distant boat passbys. An LAeq noise level of 43 dBA was recorded for the 2.50 am survey.

Noise from trucks and truck loading was audible at Balmain and Pymont, 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 Pymont monitoring location.

**Table 5 Summary of Attended LA<sub>max</sub> Noise Levels at 13 Donnelly Street, Balmain**

LA <sub>max</sub> Source	LA <sub>max</sub> Range	Notes
Trucks arriving and leaving the site	50 dBA to 61 dBA	Truck engine noise.
Truck air brakes	55 dBA to 58 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 Suisen, where the noise environment was dominated by bulk liquids loading related noise.

**Table 6** presents the “reference” noise measurements carried out 58 m away from the hull of the vessel, Stolt Suisen, where the noise environment was dominated by bulk liquids cargo handling related noise.

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

Reference	Location	Distance from Source	Height of Source	LA <sub>eq</sub>
1	WB-4	58 m	15 m	60 dBA

Calculations were performed with the reference measurements taken in close proximity of the Stolt Suisen vessel. Up to two silenced pumps have been assumed to be continuously 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 LA<sub>eq(15minute)</sub>, and the LA<sub>eq(9hour)</sub> noise levels.

Predictions that indicate bulk liquids loading related LA<sub>eq(15minute)</sub> noise levels at the representative receivers at 13 Donnelly Street and 2 Point Street were 48 dBA and 37 dBA respectively.

The measured LA<sub>eq(15minute)</sub> noise level of 49 dBA is the marginally higher than the predicted noise level at 13 Donnelly Street, and consistent with minimal influence from local traffic, the vessels at Glebe Island 7 and 8 and other localised noise sources. The predicted LA<sub>eq(15minute)</sub> noise level at 2 Point Street is below the ambient noise level at this location and is consistent with WB-4 related noise not being 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 LA<sub>eq(15minute)</sub> Noise Goals**

Prediction Location	Measured/Predicted LA <sub>eq</sub> Noise Levels <sup>1</sup>	LA <sub>eq(15 minute)</sub> Noise Goals	LA <sub>eq(15 minute)</sub> Exceedance of Licence Goals <sup>2</sup>
13 Donnelly Street (Balmain/Rozelle)	49/48 dBA	49 dBA	No exceedance
Level 5, 2 Point Street (Pymont/Glebe)	43/37 dBA	41 dBA	No exceedance

Note 1: 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.

**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)	48 dBA	41 dBA	7 dBA exceedance
Level 5, 2 Point Street (Pymont/Glebe)	38 dBA	N/A	N/A

**Table 9 Assessment of (WB-4 Related) Measured Noise Levels against LAmax Noise Goals**

Measurement Location	Range of Maximum Measured Levels (LAmax Range)	LAmax Noise Goals	Range of Recorded LAmax Exceedances of the Licence Noise Goals <sup>1</sup>
13 Donnelly Street (Balmain/Rozelle)	50 dBA to 61 dBA	59 dBA	2 dBA exceedance
Level 5, 2 Point Street (Pymont/Glebe)	N/A	51 dBA	No exceedance

Note 1: No LAmax events associated with the bulk liquids unloading activity at WB-4 were recorded during the monitoring periods at 2 Point Street, Pymont.

## 6 DISCUSSION

Predicted ship based LAeq(15minute) noise levels meet the Licence imposed noise goals at the representative location in Pymont. At Balmain, the measured LAeq(15minute) noise levels meet the Licence imposed noise goal, and the predicted LAeq(night) noise level exceeds the noise goal by 7 dBA.

Bulk liquids terminal related maximum (LAmax) noise levels at the representative monitoring locations in Pymont complied with the Licence goal. At Balmain bulk liquids terminal related maximum (LAmax) noise levels exceed the noise goal by 2 dBA. The exceedance is mainly from the tanker truck engine noise.

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 Revision 1) 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

Noise measurements were carried out during the Stolt Suisen bulk liquids cargo handling operations during the early morning of 22 December 2011. The measured noise levels were found to be potentially influenced on occasion by the vessels at Glebe Island 7 and 8 as well as Anzac Bridge traffic and the general urban hum. A reference noise measurement was carried out in close proximity of the Stolt Suisen 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.

Predicted ship based  $L_{Aeq(15\text{minute})}$  noise levels meet the Licence imposed noise goals at the representative location in Pyrmont. At Balmain, the measured and predicted  $L_{Aeq(15\text{minute})}$  noise levels meet the Licence imposed noise goals. At Balmain, the predicted  $L_{Aeq(\text{night})}$  noise level exceeds the noise goal by 7 dBA.

At Balmain bulk liquids terminal related maximum ( $L_{Amax}$ ) noise levels exceed the Licence imposed noise goal by 2 dBA. At Pyrmont bulk liquids terminal related maximum ( $L_{Amax}$ ) noise levels meet the Licence imposed noise goal.

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.

## 8 CLOSURE

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

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

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

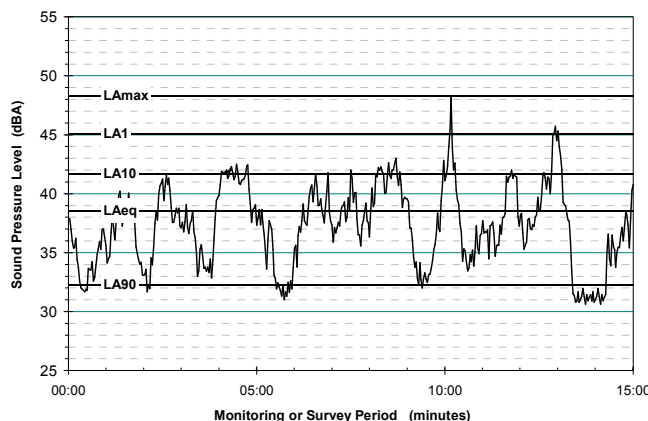
ACOUSTIC TERMINOLOGY USED IN THE REPORT

**Typical Noise Indices**

This Report makes repeated reference to certain noise level descriptors, in particular the LA10, LA90 and LAeq and LAm<sub>ax</sub> 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.

**Graphical Display of Typical Noise Indices**



The LAm<sub>ax</sub> noise level is the maximum A-weighted noise level associated with road traffic movements.

**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

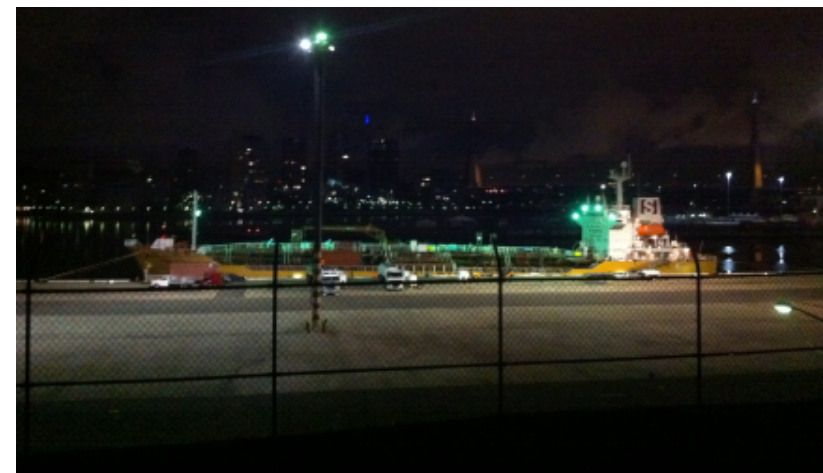
The location is situated approximately 170 m away from and directly overlooking White Bay Berth 4 (across the park). It is elevated some 15 m above dock level. The measurement was conducted from street level (from a footpath) with Donnelly Street traffic less than 2 m away.



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



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