HEGGIES

REPORT 10-4309-R22

Revision 0

White Bay Berth 4 Bulk Liquids Handling
Golden Mermaid
Ship Noise Monitoring Report

PREPARED FOR

Sydney Ports Corporation
207 Kent Street
SYDNEY NSW 2000

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HEGGIES PTY LTD
ABN 29 001 584 612

Incorporating New Environment Graeme E. Harding & Associates Eric Taylor Acoustics

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PREPARED BY:

Heggies Pty Ltd
ABN 29 001 584 612
2 Lincoln Street Lane Cove NSW 2066 Australia
(PO Box 176 Lane Cove NSW 1595 Australia)
Telephone 61 2 9427 8100 Facsimile 61 2 9427 8200
Email sydney@heggies.com Web www.heggies.com

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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 Golden Mermaid (a bulk liquids vessel) at White Bay Berth 4 (WB-4), as required by Clause M7.1(1a) of the EPA's Environment Protection Licence (Licence No 12095).

Noise measurements were carried out at nearby residential receivers during Golden Mermaid vessel cargo handling operations during the evening of 14 April 2008.

The measured L_{Aeq} noise levels at both the Balmain and Pyrmont receivers were found to be dominated by noise emanating from the nearby Glebe Island 2 where car unloading operations were taking place from aboard the car carrier Rockies Highway.

Consequently at both the Balmain and Pyrmont residential locations the $L_{Aeq(15\ min)}$ and the $L_{Aeq(night)}$ contribution to the ambient by the Golden Mermaid operations could not be measured, for comparison with the Licence conditions.

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

Whilst noise levels from the Golden Mermaid could not be measured, 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 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 "Golden Mermaid" (a bulk liquids vessel) at White Bay Berth 4 (WB-4), as required by Clause M7.1(1a) of the EPA's Environment Protection Licence (Licence No 12095).

Noise measurements have been 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 Pyrmont to the east of WB-4. Measurements at both representative locations have been 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 5.45 pm and 9.00 pm on 14 April 2008, with the weather conditions a strong southerly wind. During the measurement period the sky was generally cloudy.

For the survey period from 5.45 pm and 9.00 pm the measurements of the ambient noise environment were significantly influenced by noise from the "Rockies Highway" car carrier docked at Glebe Island 2. Also, there was a contribution from noise from domestic activity and local traffic and on occasion wind at both Pyrmont and Balmain during this period.

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 two multiple-use berths and two car terminal 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 berths, two of which are currently used as car terminals and two as 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 similar acoustical environment to that of 5 Waite Street, Balmain.

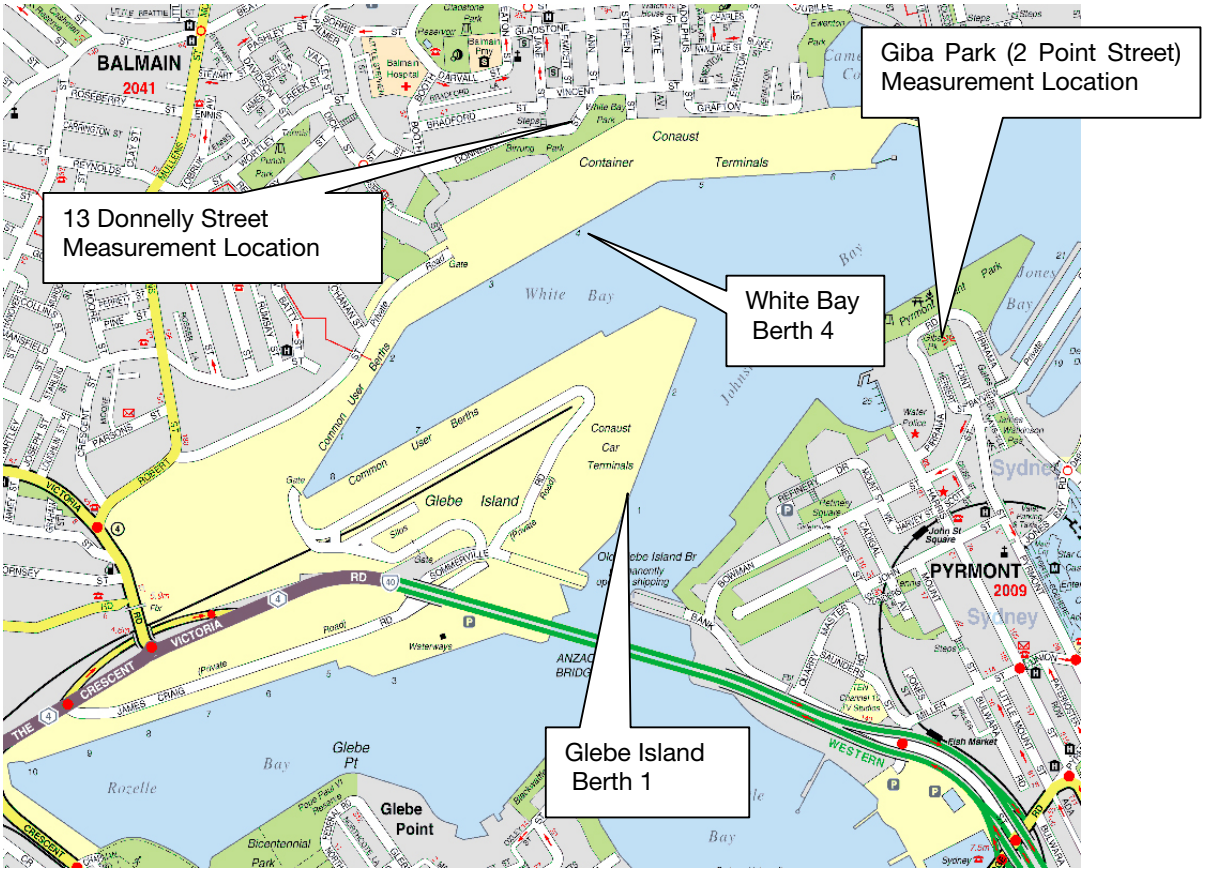
The monitoring location at 36 Refinery Drive, identified by the NIA as the most affected receiver in the Pyrmont / Glebe area, was found to be exposed to high levels of traffic related noise from the Anzac Bridge. Giba Park (a publicly accessible park situated at the top of the 4 level apartment complex 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 level 5, 2 Point Street.

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, on top of a 4 storey building at 2 Point Street (ie height equivalent of a 5 storey building)

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))**	**LAmax**
Balmain and Rozelle	49 dBA	41 dBA	59 dBA
Pyrmont and Glebe	41 dBA	Not Applicable	51 dBA

Explanatory notes:

1. L_{Amax} 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 $L_{Aeq(Night)}$ has been determined to be a higher number than the intrusive criteria $L_{Aeq(15minute)}$ 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, ship pumps and truck activity on the wharf in addition to APUs), in accordance with Clause M7.1 (2).

A window of opportunity to measure ship noise levels during periods of loading inactivity exists 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 at least 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. For the noise monitoring of the Golden Mermaid monitoring was timed to co-incide with the ship arriving (at approximately 5.45 pm) which enabled residential noise measurements to be conducted during the setup phase and also during the ship loading phase.

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 on top of the residential apartment complex at 2 Point Street, Pyrmont.

A car carrier ship, "Rockies Highway" was berthed at the nearby Glebe Island 2, approximately 400 m from WB-4 during the evening period. Prior to arrival of the Golden Mermaid noise measurement of the car carrier Rockies Highway was conducted at 13 Donnelly Street, with the contribution to the ambient estimated to be an L_{Aeq} of 60 dBA.

As a result of noise from the car carrier Rockies Highway, local traffic and domestic activity direct measurements of the bulk liquids unloading related noise at the representative receivers was influenced by noise from external sources.

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	2414702	Brüel & Kjær Modular Precision Sound Level Meter
4189	2378026	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. On this occasion however, the ambient noise environment was dominated by another source and the $L_{Aeq(15minute)}$ and $L_{Aeq(night)}$ noise levels were not able to be estimated.

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

Two separate measurements were carried out at the representative Balmain location during cargo handling operations at WB-4, at 7.09 pm and 8.45 pm. At this location, during both surveys, noise from the Rockies Highway car carrier at Glebe Island 2 was dominating the ambient noise environment.

One noise measurement was also carried out at the representative receiver at the Pyrmont site, at 7.30 pm. At this location, the measurement was also dominated by the Rockies Highway car carrier at Glebe Island 2, and also influenced by local traffic noise, domestic activity and on occasion wind.

5 RESULTS AND ANALYSIS

The results of the attended noise measurements are summarised in **Table 4** and **Table 5**. 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 - Setup Activity with Pumps not Operating

Address	Start Time	LAeq (15min)	LA90 (15min)	WB-4 Related LAmax Range	Comments
13 Donnelly Street (Balmain / Rozelle)	7.09 pm	60 dBA	59 dBA	Not measurable (ambient dominated by car carrier)	LAeq dominated noise from the car carrier, Golden Mermaid « just » audible.
Level 5, 2 Point Street (Pyrmont / Glebe)	7.30 pm	58 dBA	56 dBA	Non observed	Ambient dominated by car carrier, general urban noise, wind. Golden Mermaid not audible.

Table 5 Measured Noise Levels - Loading Activity with Pumps Operating

Address	Start Time	LAeq (15min)	LA90 (15min)	WB-4 Related LAmax Range	Comments
13 Donnelly Street (Balmain / Rozelle)	8.45 pm	59 dBA	57 dBA	Not measurable	LAeq dominated noise from the car carrier, Golden Mermaid « just » audible

During the first and second measurements at 13 Donnelly Street (at approximately 7.09 pm and 8.45 pm) noise from the ship APU was “just” audible with the ambient dominated by noise from the car carrier Rockies Highway, with the car carrier noise constant in nature. Pumps that were operational during the second (loading) survey were not generally audible above the car carrier Rockies Highway noise. L_{Aeq} noise levels of 60 dBA and 59 dBA were recorded for the 7.09 pm and 8.45 pm surveys respectively. It is noted the Golden Mermaid was “just” audible, and the LAeq noise level did not change after arrival (60 dBA being recorded before arrival and 60 dBA after arrival), hence the Golden Mermaid LAeq level will be significantly lower than 60 dBA.

During the measurement at Point Street, the ambient noise was generally dominated from the car carrier Rockies Highway, with also contributions from general city noise and on occasion wind. During the measurements associated WB-4 ship noise was not audible. An L_{Aeq} noise level of 58 dBA was recorded for the 7.30 pm survey.

In summary at both the Balmain and Pyrmont residential locations the $L_{Aeq(15\ min)}$ and the $L_{Aeq(night)}$ contribution to the ambient by the unloading of the Golden Mermaid could not be measured due to domination of the ambient by noise from the car carrier Rockies Highway at Glebe Island 2.

At Balmain whilst trucks were observed leaving WB-4, associated noise could not be measured above the ambient background, which was dominated by the car carrier Rockies Highway.

6 CONCLUSION

Noise measurements were carried out during the Golden Mermaid cargo handling operations during the evening of 14 April 2008. The measured L_{Aeq} noise levels at both the Balmain and Pyrmont were found to be dominated by noise emanating from the nearby Glebe Island 2 where car unloading operations were taking place from aboard the car carrier Rockies Highway.

Consequently at both the Balmain and Pyrmont residential locations the $L_{Aeq(15\ min)}$ and the $L_{Aeq(night)}$ contribution to the ambient by the Golden Mermaid operations could not be measured, for comparison with the Licence conditions.

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

Whilst noise levels from the Golden Mermaid could not be measured, 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.

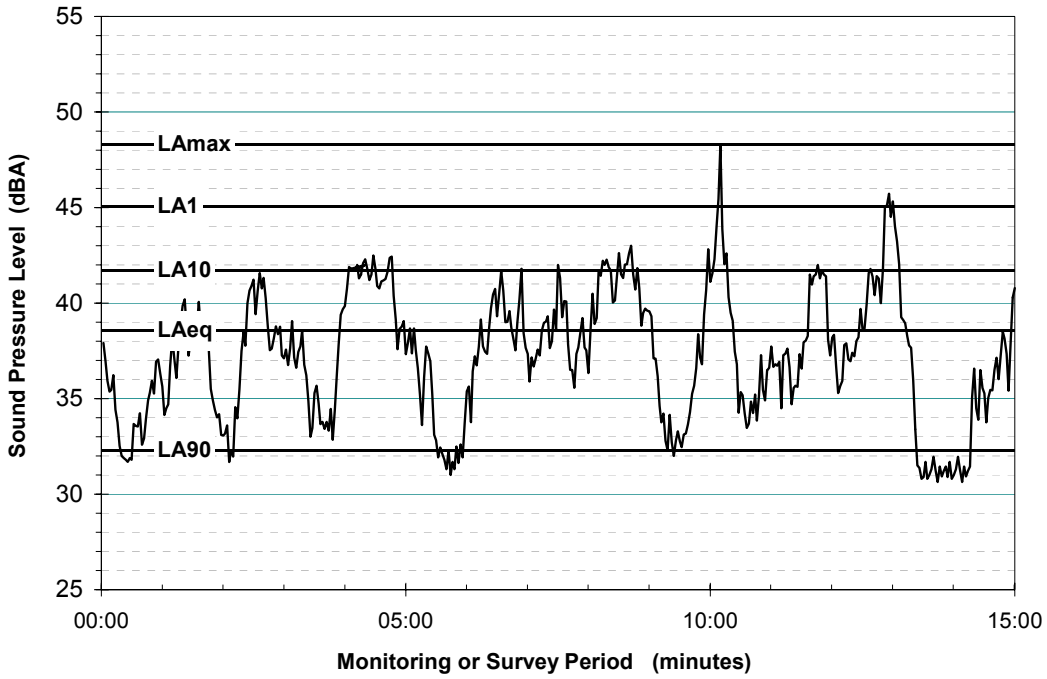
ACOUSTIC TERMINOLOGY USED IN THE REPORT

Typical Noise Indices

This Report makes repeated reference to certain noise level descriptors, in particular the 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

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).

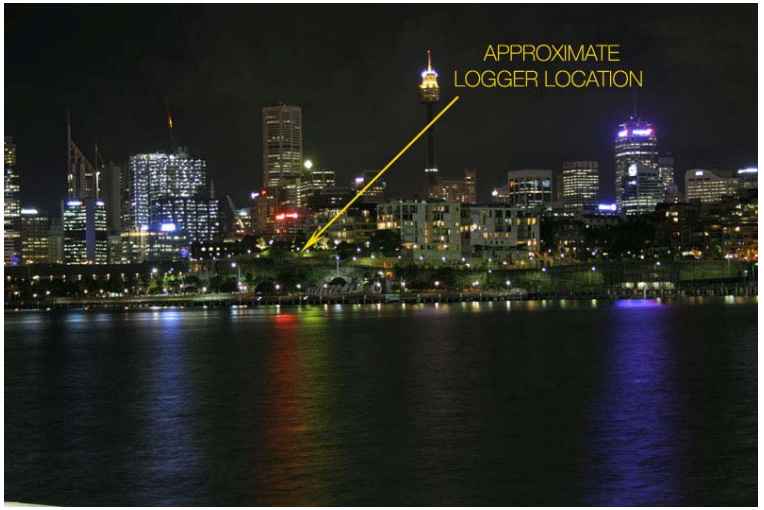
View from WB-4 deck towards 13 Donnelly Street

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 from west, north and east 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