



Project: **SICTL NOISE COMPLIANCE ASSESSMENT JANUARY 2016**

Prepared for: **Hutchinson Ports Australia  
Level 2, Operations Building  
SICTL Terminal, Gates B150-153  
Sirius Rd off Foreshore Rd  
Botany NSW 2019**

Attention: **Jennifer Stevenson**

Report No.: **Rp 003 r01 2014432SY**

#### Disclaimer

Reports produced by Marshall Day Acoustics Pty Ltd are based on a specific scope, conditions and limitations, as agreed between Marshall Day Acoustics and the Client. Information and/or report(s) prepared by Marshall Day Acoustics may not be suitable for uses other than the specific project. No parties other than the Client should use any information and/or report(s) without first conferring with Marshall Day Acoustics.

The advice given herein is for acoustic purposes only. Relevant authorities and experts should be consulted with regard to compliance with regulations or requirements governing areas other than acoustics.

#### Copyright

The concepts and information contained in this document are the property of Marshall Day Acoustics Pty Ltd. Use or copying of this document in whole or in part without the written permission of Marshall Day Acoustics constitutes an infringement of copyright. Information shall not be assigned to a third party without prior consent.

#### Document Control

Status:	Rev:	Comments	Date:	Author:	Reviewer:
Draft		Provided for information	17/02/2016	A Stoker	M Ottley
Final	01	Update noise contours	22/02/2016	A Stoker	M Ottley

## TABLE OF CONTENTS

1.0	INTRODUCTION .....	4
2.0	NOISE LIMITS .....	5
3.0	ADHERANCE TO PRESCRIBED METHODOLOGY .....	7
4.0	COMPLIANCE VERIFICATION METHODOLOGY .....	8
5.0	COMPLIANCE SURVEY .....	9
5.1	Unattended noise monitoring .....	9
5.2	Attended measurements at residential receivers .....	10
5.3	Discussion of results .....	12
6.0	ATTENDED ON-SITE NOISE SURVEY .....	12
6.1	Estimation of operational noise levels.....	12
6.2	Noise prediction model configuration .....	12
6.3	Noise model calibration .....	13
6.4	Calibration results.....	14
6.5	Noise modelling results.....	15
7.0	SUMMARY .....	17

APPENDIX A GLOSSARY OF TERMINOLOGY

APPENDIX B UNATTENDED MONITORING DATA

APPENDIX C PLANT INVENTORY AND SOUND POWER LEVELS

APPENDIX D SUMMARY OF MODELLING ASSUMPTIONS

APPENDIX E EPA RESPONSE LETTER

APPENDIX F NOISE CONTOUR PLOTS

## 1.0 INTRODUCTION

Sydney International Container Terminals Pty Ltd (SICTL) located on Sirius Road, Botany was given development consent in October 2005 by the NSW Department of Planning and Environment to construct and operate the Hayes Dock site. The current facility commenced operations in November 2013 under the development consent and also under Environment Protection Licence number 20322. The environment Protection Licence (EPL) requires that noise monitoring and a compliance assessment is to be undertaken every 6 months. Marshall Day Acoustics Pty Ltd (MDA) has been engaged to conduct the noise monitoring and verify compliance (or otherwise with the noise limits specified in the EPL).

This report provides the results of our noise monitoring undertaken in January 2016. Also detailed is the methodology and results of the noise modelling undertaken to verify compliance with the EPL noise limits (these noise limits are identical to those specified in the development consent document).

Acoustic terminology used in this report is provided in Appendix A. Supporting evidence concerning the port operations and detailed monitoring results are provided in Appendices B-F.

## 2.0 NOISE LIMITS

The noise limits applicable to the sites as required by the NSW EPA Environment Protection Licence (Licence #20322) are detailed in Section L3 of the licence and reproduced below.

*L3.1 Noise from the premises must not exceed the sound pressure level (noise) limits presented in the Table below. Note the limits represent the sound pressure level (noise) contribution, at the nominated receiver locations in the table.*

Most affected residential location	Day	Evening	Night	
	$L_{Aeq} (15 \text{ minute})$	$L_{Aeq} (15 \text{ minute})$	$L_{Aeq} (15 \text{ minute})$	$L_{Aeq, 9hrs}$
Chelmsford Avenues	40	40	40	38
Dent Street	45	45	45	43
Jennings Street	36	36	36	35
Botany Road (north of Golf Club)	47	47	47	45
Australia Avenue	35	35	35	35
Military Road	42	42	42	40

*L3.2 Noise from the premises must not exceed the noise limits presented in the Table below. Note the limits represent the noise contribution at the nominated receiver locations in the table.*

Most affected residential location	Night
	$L_{A1, (1 \text{ minute})}$
Chelmsford Avenues	53
Dent Street	59
Jennings Street	55
Botany Road (north of Golf Club)	59
Australia Avenue	57
Military Road	60

*L3.3 For the purpose of Condition L3.1 and Condition L3.2:*

- Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays,
- Evening is defined as the period from 6pm to 10pm
- Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays

*L3.4 For the purpose of Conditions L3.1 and L3.2, noise from the premises is to be measured or computed at the most affected point within the residential boundary, or at the most affected point within 30 metres of the dwelling where the dwelling is more than 30 metres from the boundary, to determine compliance with the noise level limits in Conditions L3.1 and L3.2 unless otherwise stated.*

*L3.5 Noise from the premises is to be measured at 1m from the dwelling facade to determine compliance with the  $L_{A1(1minute)}$  noise limits at Condition L3.2*

*L3.6 Where it can be demonstrated that direct measurement of noise from the premises is impractical, the EPA may accept alternative means of determining compliance (see Chapter 11 of the NSW Industrial Noise Policy (INP)).*

*L3.7 The modification factors presented in Section 4 of the NSW Industrial Noise Policy shall also be applied to the measured noise level from the premises where applicable.*

*L3.8 The noise limits specified at Conditions L3.1 and L3.2 apply under the following meteorological conditions:*

- (a) wind speeds up to 3 m/s at 10 metres above ground level; and*
- (b) temperature inversion conditions of up to 1.5 C/100m*

### 3.0 ADHERANCE TO PRESCRIBED METHODOLOGY

- In accordance with Conditions L3.1 and L3.2 (and conditions C2.7 of the development consent.), both unattended and attended measurements were conducted at the most affected point within the residential boundaries of the nominated residential receivers.
- With reference to Condition L3.5 (and Condition C2.8), LA1 noise levels were measured at the boundaries of the residences, not at 1m from the facade, as it was not possible to access the facade of the dwellings at all times of the day. At such large distances from the subject site, the noise attenuation between the property boundary and a point 1m from the facade is negligible.
- Direct measurement of noise from the operation of the premises at the receiver locations is impractical due to the complex noise environment in the vicinity of the site and receivers. Therefore, in accordance with Condition L3.6 (and Condition C2.9), the unattended and attended noise monitoring was supplemented with an alternative means of determining compliance via the use of a 3-D noise model. This is in accordance with *Chapter 11* of the NSW *Industrial Noise Policy* which allows for measurements to be taken close to the source and then calculated out to the specified receiver locations. Determination of compliance via the use of a 3-D noise model was approved by the NSW EPA on 11 July 2014 (Appendix E) and the NSW EPA requirements were provided to MDA prior to the commencement of the project.
- The assessment receiver locations considered in the noise model are in accordance with the requirements specified in conditions L3.4 and L3.5 (and Conditions C2.7 and C2.8).
- In accordance with Condition L3.7 (and Condition C2.10), the modification factors from Chapter 4 of the NSW *Industrial Noise Policy* are also applied to the measured or calculated noise level from the operation of the premises (where applicable).
- Noise limits used to verify compliance (or otherwise) have been applied under the following meteorological conditions specified in Condition L3.8 (and Condition 2.11) of the EPA Licence:
  - (a) wind speeds up to 3m/s at 10m above the ground level; or
  - (b) temperature inversion conditions of up to 1.5C/100m.

#### 4.0 COMPLIANCE VERIFICATION METHODOLOGY

The noise environment around the site is complex, comprising influences from a range of variable factors. Key complicating variables in this respect are:

- The presence of other existing noise generating industries in the area including the Patrick container terminal and DP World container terminal which also influence the noise environment in the vicinity of the SICTL
- Frequent traffic movements on Foreshore Road and Botany Road which influence both the underlying background and total ambient noise environment in the surrounding area
- Frequent air traffic movements due to the proximity of the site to the Sydney Airport.

The noise environment in the vicinity of the residential receivers is also complex, and comprises influence from a range of noise sources which include the industrial noise sources associated with the port, industrial noise sources associated with other industries in the area and road and air traffic noise.

Given the complexity of environmental noise conditions and the large distances between operational noise sources on the SICTL site and the receiver locations, isolating the contribution of different noise sources is problematic in practice. In recognition of these factors, the following methodology was used to verify compliance with the noise limits detailed in Section 2.0:

- Attended measurements of plant noise were conducted at specific points in the vicinity of the plant. Measurements were undertaken under typical operating conditions. The sound pressure levels measured in the vicinity of each plant item were then used to estimate the sound power level of each plant item.
- A 3-D noise model of site and its receivers was developed and the estimated sound power levels were input into the noise model to calculate the noise contribution from the site at the nearest receivers. Where possible long term measurements of noise from the premises were used to calibrate the noise model.
- The calculated noise levels were compared to the measured noise levels and to the noise limits detailed in Section 2.0.

## 5.0 COMPLIANCE SURVEY

### 5.1 Unattended noise monitoring

It should be noted that the original EPA planning consent denoted six off-site residential locations. The EPA subsequently accepted a proposal from SLR Consulting Australia Pty Ltd to reduce the number of residential receivers to two only as part of an accepted methodology of assessment through computer modelling. As such only two residential locations have been used for assessment.

Previous assessments conducted in November 2014 and July 2015 utilised 34 Dent Street, Botany and 59 Jennings Street, Matraville for assessment. At the time of conducting our unattended measurements, access to 59 Jennings Street was unachievable. Given this a replacement location was selected in line with EPA nominations detailed in Section 2.0. The receiver locations used for assessment in this report are:

- 34 Dent Street, Botany
- 74 Australia Ave, Matraville

In order to measure noise levels at the selected receivers, noise loggers were setup from 15 January 2016 to 30 January 2016.

In the INP, the background noise level is termed the Rating Background Level (RBL). The methodologies used to determine the long-term RBL and  $L_{Aeq}$  noise levels are from Tables 3.1 and 3.2 of the INP. The RBL and  $L_{Aeq}$  noise levels for Day, Evening and Night-time periods at each monitoring location are summarised below. The survey details and noise level results for the entire survey period are summarised in Appendix B.

In determining the noise levels at the monitoring locations, any data affected by rainfall and high wind speed has been excluded in accordance with the provisions of Appendix B of the EPA Industrial Noise Policy. Data available from the Bureau of Meteorology's Sydney Airport weather station has been used to carry out this analysis.

Severe electrical storms occurring on Thursday 21 January 2016 affected the unit placed at 74 Australia Avenue. As a consequence of this, data recorded by this logger after the evening period of 21 January was not used for analysis. As such our derivation of Day, Evening and Night levels for this position are based on the period 15 January 2016 to 21 January 2016 only.

**Table 1: Summary of unattended measurements**

Period	dB L <sub>Aeq</sub>	RBL	Comments
<i>74 Australia Avenue, Matraville</i>			
Day	57	39	Background noise levels (dB L <sub>A90</sub> ) measured at this location are in excess of the noise limit for the Day, Evening and Night-time periods. Analysis of the measured data has determined that noise impacts from the SICTL site at this location cannot be isolated due to the presence of other noise sources including traffic, aircraft and other industrial facilities in the vicinity of the receiver.
Evening	45	39	
Night	43	36	
<i>34 Dent Street, Botany</i>			
Day	55	46	Background noise levels (dB L <sub>A90</sub> ) measured at this location are in excess of the noise limit for the Day and Evening periods. Analysis of the measured data has determined that noise impacts from the SICTL site at this location cannot be isolated due to the presence of other noise sources including traffic, aircraft and other industrial facilities in the vicinity of the receiver.
Evening	52	47	
Night	49	38	

## 5.2 Attended measurements at residential receivers

In order to quantify the nature of the noise environment at the residential receivers a series of measurements were conducted during the Day, Evening and Night periods in the vicinity of the two residential receivers. Day period measurements were conducted on the 21 January 2016, with Evening and Night-time measurements conducted on 28 January 2016.

Results of the attended noise level measurements conducted at each receiver location are summarised in Table 2 below along with the subjective impression of the engineer who conducted these measurements.

**Table 2: Attended measurements at receiver locations**

Period	dB L <sub>Aeq</sub>	dB L <sub>A90</sub>	Subjective impression
<i>74 Australia Ave, Matraville</i>			
Day 0948-1003hrs 21 January 2016	51	45	Dominated by local traffic noise along Australia Ave Typical urban residential hum with some nearby industrial noise Distant road traffic noise from Beauchamp Rd, Bunnerong Rd and Botany Road Occasional construction noise from nearby industrial plant across Purcell Park Aircraft activity clearly audible No audible industrial noise from port
Evening 2113-2128hrs 28 January 2016	46	39	Dominated by intermittent local traffic noise along Australia Avenue and general urban sounds; birds, constant crickets, dog barking, people etc Constant distant road traffic noise from Beauchamp Rd, Bunnerong Rd and Botany Road Aircraft activity clearly audible No audible industrial noise from port
Night 2222-2237hrs 28 January 2016	51	40	Dominated by local traffic noise along Australia Ave Distant road traffic noise from Beauchamp Rd, Bunnerong Rd and Botany Road No audible industrial noise from port
<i>34 Dent Street, Botany</i>			
Day 0925-0940hrs 21 January 2016	55	49	Dominated by local traffic noise from Foreshore Road and Botany Road including trucks accelerating at traffic lights Aircraft activity clearly audible Minimal amount of local traffic along Dent Street No audible industrial noise from port
Evening 2138-2153hrs 28 January 2016	52	45	Dominated by local traffic noise from Foreshore Road and Botany Road including trucks accelerating at traffic lights Aircraft activity clearly audible Minimal amount of local traffic along Dent Street No audible industrial noise from port

Period	dB L <sub>Aeq</sub>	dB L <sub>A90</sub>	Subjective impression
Night 2200-2215hrs 28 January 2016	48	45	Dominated by local traffic noise from Foreshore Road and Botany Road including trucks accelerating at traffic lights  Minimal amount of local traffic along Dent Street  No audible industrial noise from port

### 5.3 Discussion of results

A review of the unattended monitoring data indicates that the ambient noise levels are significantly above the EPL and Development Consent noise limits at each of the receiver locations. The contribution from the SICTL site at these locations cannot accurately be determined due to the influence of other noise sources in the vicinity of the receivers. Furthermore, the results of the attended monitoring conducted at the two receiver locations as well as the subjective impressions of the engineer conducting the measurements indicate that noise from the SICTL site could not be perceived at these locations. We note that even if port related noise was audible that due to the presence of two other container terminals in the vicinity of the receivers, any audible port related noise at these locations could have been generated at any one of the container terminals.

As compliance cannot be accurately verified based on the unattended and attended monitoring results, noise modelling in accordance with the requirements of the EPA was carried out to determine the noise contribution from the SICTL site the nearest receivers. This noise modelling is discussed in the following sections of this report.

### 6.0 ATTENDED ON-SITE NOISE SURVEY

A series of attended measurements were conducted at the SICTL site on 18 January 2016 and 22 January 2016, while the site was operating under typical conditions.

This measurement data was then used to calculate the estimated noise level contribution from each individual plant item/ process at the nearest receiver.

#### 6.1 Estimation of operational noise levels

Using the sound pressure level measured in the vicinity of each plant item and the reference distance, at which the measurement was undertaken, the approximate sound power level of each plant item has been calculated and used to model noise emissions from the site.

#### 6.2 Noise prediction model configuration

An environmental noise model for the site has been developed by MDA using SoundPLAN 7.4, a commercially available computer modelling package. For this project, our noise model for prediction of sound levels has used ISO 9613-2 Acoustics - *Attenuation of sound during propagation outdoors* as the propagation algorithm methodology.

Calculations are based on commonly adopted geometric divergence of noise sources in addition to a range of factors affecting the attenuation of sound, including:

- The magnitude of the noise source in terms of sound power
- The distance between the source and receiver
- The presence of obstacles such as screens or barriers in the propagation path including any buildings on site, and terrain data

- The presence of reflecting surfaces such as building facades
- The ground absorption, defined by hardness of the ground between the source and receiver (100% hard ground assumed to be conservative)
- Attenuation due to atmospheric absorption.
- Meteorological effects such as wind gradient, temperature gradient, humidity. These generally have significant impact at distances greater than approximately 400m. The ISO-9613 method deals with the meteorological conditions favourable to propagation of sound. Over large distances (>400m), meteorological conditions can have a significant influence on noise level propagation. The environmental noise model has assumed worst case meteorological conditions for non-arid areas i.e. moderate (F-class stability category) temperature inversion or downwind conditions with wind speeds less than 3m/s. It is assumed that drainage airflow does not occur at this site, as the source level is not elevated relative to the residential receiver level.

### 6.3 Noise model calibration

For the purpose of calibrating the noise model results, two noise loggers were placed on site concurrent with the off-site monitoring. The locations of the calibration loggers are shown in Figure 1 below. The on-site calibration loggers were 01dB Duo smart monitors which have the capability to record audio. Noise levels were measured during the entire survey period in one second intervals and the loggers were also used to make audio recordings at both locations. The measurements obtained were used to determine the noise levels experienced at each calibration position for comparison to the noise level predicted via the use of calculations.

Figure 1: Location of calibration loggers (Image courtesy Six Maps)



Disclaimer: This report has been generated by various sources and is provided for information purposes only. Land and Property Information (LPI), a division of the Department of Finance and Services does not warrant or represent that the information is free from errors or omission, or that it is exhaustive. LPI gives no warranty in relation to the information, especially material supplied by third parties. LPI accepts no liability for loss, damage, or costs that you may incur relating to any use or reliance upon the information in this report.

## 6.4 Calibration results

The noise levels measured at both calibration locations were heavily impacted by extraneous noise sources, predominantly aircraft due to the proximity of the site to the Sydney Airport, but also operations from adjacent sites. Direct examination of the calibration logger results therefore does not immediately identify the noise generated by the site. The audio recordings taken at this location were analysed, with a representative sample chosen and all 1 second measurements affected by aircraft noise and some road traffic noise

eliminated as far as practicable in order to determine the  $L_{Aeq}$  noise level contribution from the site operations only.

The noise levels derived at the calibration points (with extraneous data eliminated) are compared to the predicted noise levels in Table 3 below. The period chosen for analysis, 1330-1345hrs on 28 January 2016, contained both a vessel being unloaded at the wharf and a train being unloaded to ensure that noise sources close to each of the calibration points were included in analysis.

Information provided by Hutchinson Ports Australia indicates that due to reduced workload, ship unloading operations did not occur in the night-time period during the period of our unattended on-site noise measurements. As such the model is calibrated based on day time measurements only.

We note that examination of measured noise levels on-site during the night-time period supports this information with levels in the region of 55dB  $L_{Aeq (15min)}$ , significantly lower than that predicted by modelling.

Extraneous noise events from adjacent sites could not be identified and isolated, therefore the derived noise levels at the calibration points still have the potential to be influenced by adjacent sites.

**Table 3: Noise model calibration results**

Location	Time period	Derived levels from measurements	Predicted noise level <sup>1</sup>
Calibration Point 1	Day	57dB $L_{Aeq (15min)}$	54-57dB $L_{Aeq (15min)}$
Calibration Point 2	Day	67dB $L_{Aeq (15min)}$	60-69dB $L_{Aeq (15min)}$

Note 1: Range from typical to worst case predicted noise level.

For both Calibration Point 1 and Calibration Point 2, the derived noise levels appear to be in close correlation with the predicted noise levels, with derived levels closely matching the upper range of the predicted noise levels. This is as expected given the significant activity on-site (vessel and train unloading). Given the accurate correlation of derived and predicted noise levels we consider our predictions to be representative of the site operations.

## 6.5 Noise modelling results

Noise emissions from the site have been estimated via calculation at the nearest receivers and are presented in Table 4. Details of the operating scenarios considered and assumptions regarding typical and worst case plant operation are detailed in Appendix D.

**Table 4: Calculated noise contribution from SICTL site at nearest receivers**

	Day		Evening		Night		
	Calculated noise level	Noise limit, dB $L_{Aeq}(15min)$	Calculated noise level	Noise limit, dB $L_{Aeq}(15min)$	Calculated noise level	Noise limit, dB $L_{Aeq}(15min)$	Noise limit, dB $L_{Aeq}(9\text{ hours})$
<i>74 Australia Avenue</i>							
Typical operation	28	35	28	35	22	35	35
Worst case operation	29	35	29	35	26	35	35
<i>34 Dent Street</i>							
Typical operation	41	45	41	45	40	45	43
Worst case operation	44	45	44	45	43	45	43

Calculated noise levels for both typical and worst case operation of the site comply with the noise limits at the nominated sensitive receivers.

Based on the above the current operations on site comply with the EPL and Development Consent  $L_{eq}$  noise criteria.

Summarised in Table 5 is the contribution from high noise generating sources that are impulsive in nature and generate noise levels closest to the Night time maximum/ $L_{A1(1min)}$  noise limits.

**Table 5: Calculated  $L_{A1}$ /maximum noise level contribution from SICTL site**

Source description	74 Australia Ave	Noise limit, dB $L_{A1,(1min)}$	Compliance?	34 Dent St	Noise limit, dB $L_{A1,(1min)}$	Compliance?
Spreader engaging with ship's hatch cover	50	57	✓	59	59	✓
Hatch cover being landed on vessel	48	57	✓	59	59	✓
Container landing within Quay Apron	36	57	✓	48	59	✓

During our site surveys we did observe hatch cover plates being landed and the spreader engaging with these plates landside but did not observe these activities occurring shipside. The container landing within the Quay Apron was observed, however measurements on-site were lower than those observed during our 2014 survey. In order to present a conservative assessment we have used the higher maximum levels for these activities observed during the 2014 survey.

Calculated maximum noise levels associated with impulsive noise generating activities on the site comply with the noise limits at the nominated sensitive receivers. Based on the above the current operations on site comply with the EPL and Development Consent noise criteria for sleep arousal.

## 7.0 SUMMARY

- To satisfy the requirements of the EPL for the operation of the SICTL site, Marshall Day Acoustics conducted short term attended and long-term unattended noise monitoring at 34 Dent Street and 74 Australia Ave.
- Assessment of the SICTL site noise compliance is complicated by a range of variables affecting the derivation of the noise contribution from activities conducted on the site.
- As compliance could not be accurately determined on the basis of monitoring conducted at the receiver locations, MDA developed a 3-D noise model to determine the noise contribution from the site at the nearest receivers via calculation. In order to develop the noise model, attended measurements were conducted on site in the vicinity of operational noise sources. These measurements were used to establish sound power levels for all equipment which were then incorporated into the noise model and the noise contribution of each plant item was calculated back to the receiver locations.
- The results of the noise model have been compared with the noise levels measured at two on-site calibration points. The predicted noise levels correlate closely with the measured noise levels and therefore we consider the noise model to be representative of the site operations.
- The results of the noise model indicate the noise emissions from the site comply with the noise limits at 34 Dent Street and 74 Australia Ave.

## APPENDIX A GLOSSARY OF TERMINOLOGY

<b>Ambient</b>	The ambient noise level is the noise level measured in the absence of the intrusive noise or the noise requiring control. Ambient noise levels are frequently measured to determine the situation prior to the addition of a new noise source.
<b>SPL or <math>L_p</math></b>	<u>Sound Pressure Level</u> A logarithmic ratio of a sound pressure measured at distance, relative to the threshold of hearing (20 $\mu$ Pa RMS) and expressed in decibels.
<b>SWL or <math>L_w</math></b>	<u>Sound Power Level</u> A logarithmic ratio of the acoustic power output of a source relative to $10^{-12}$ watts and expressed in decibels. Sound power level is calculated from measured sound pressure levels and represents the level of total sound power radiated by a sound source.
<b>dB</b>	<u>Decibel</u> The unit of sound level.  Expressed as a logarithmic ratio of sound pressure P relative to a reference pressure of $P_r=20 \mu\text{Pa}$ i.e. $\text{dB} = 20 \times \log(P/P_r)$
<b>dB(A)</b>	The unit of sound level which has its frequency characteristics modified by a filter (A-weighted) so as to more closely approximate the frequency bias of the human ear.
<b>A-weighting</b>	The process by which noise levels are corrected to account for the non-linear frequency response of the human ear.
<b><math>L_{Aeq}(t)</math></b>	The equivalent continuous (time-averaged) A-weighted sound level. This is commonly referred to as the average noise level.  The suffix "t" represents the time period to which the noise level relates, e.g. (8 h) would represent a period of 8 hours, (15 min) would represent a period of 15 minutes and (2200-0700) would represent a measurement time between 10 pm and 7 am.
<b><math>L_{A90}</math></b>	The A-weighted noise level equalled or exceeded for 90% of the measurement period. This is commonly referred to as the background noise level.
<b><math>L_{Amax}</math></b>	The A-weighted maximum noise level. The highest noise level which occurs during the measurement period.
<b><math>L_{A01}</math></b>	The A-weighted noise level which is equalled or exceeded for 1% of the measurement period. This is sometimes referred to as the typical maximum noise level.

## APPENDIX B UNATTENDED MONITORING DATA

### B1 74 Australia Avenue, Matraville

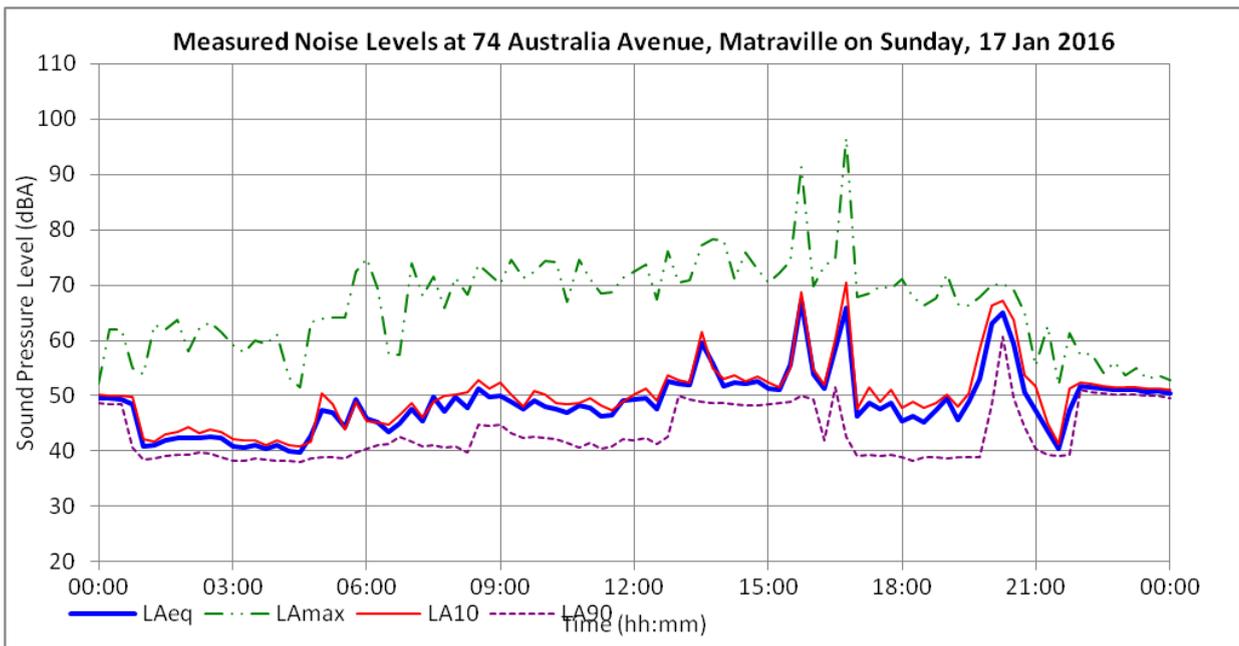
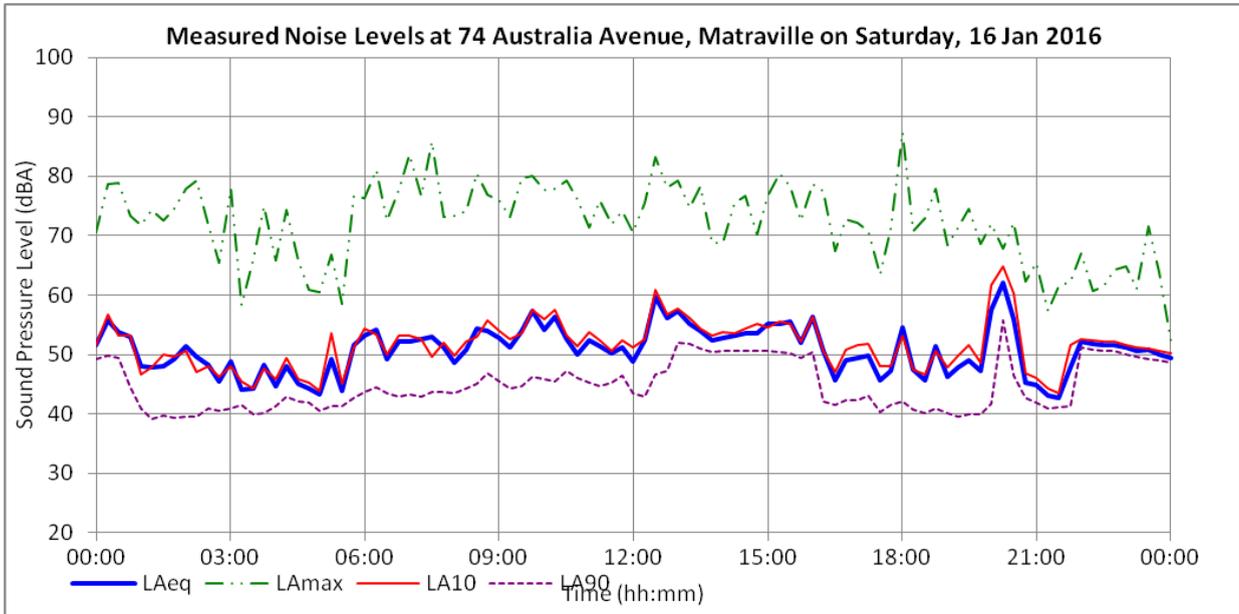
A noise logger was setup in the back yard of the residential receiver located at 74 Australia Ave, Matraville.

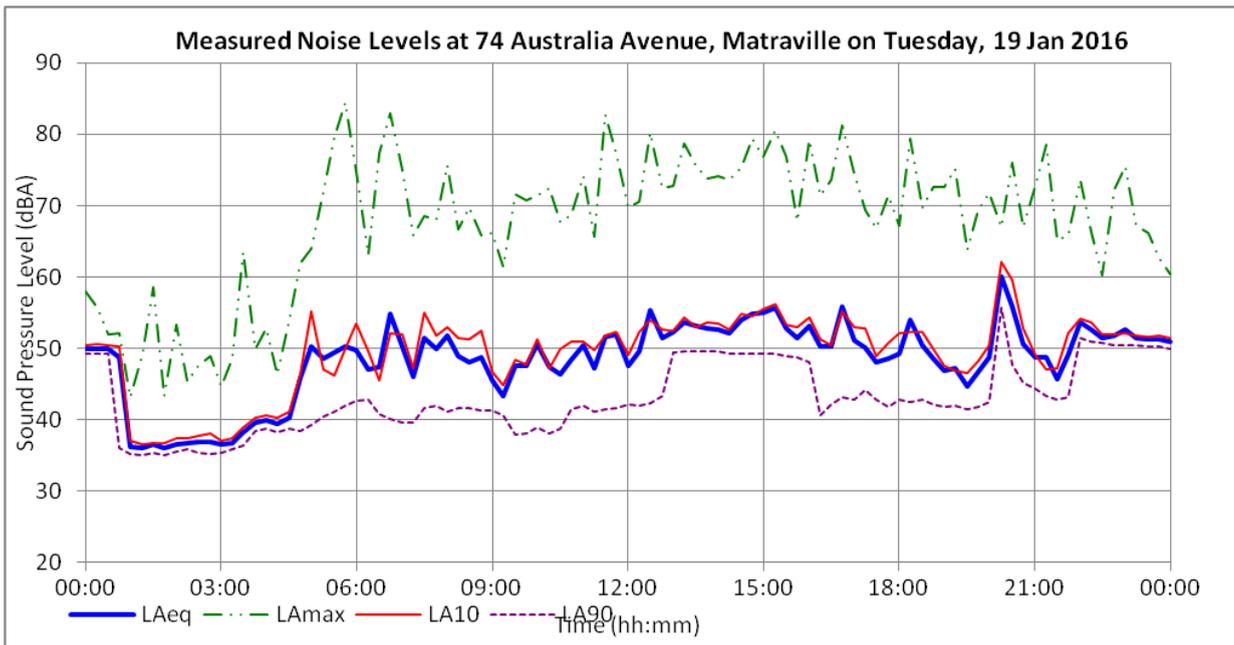
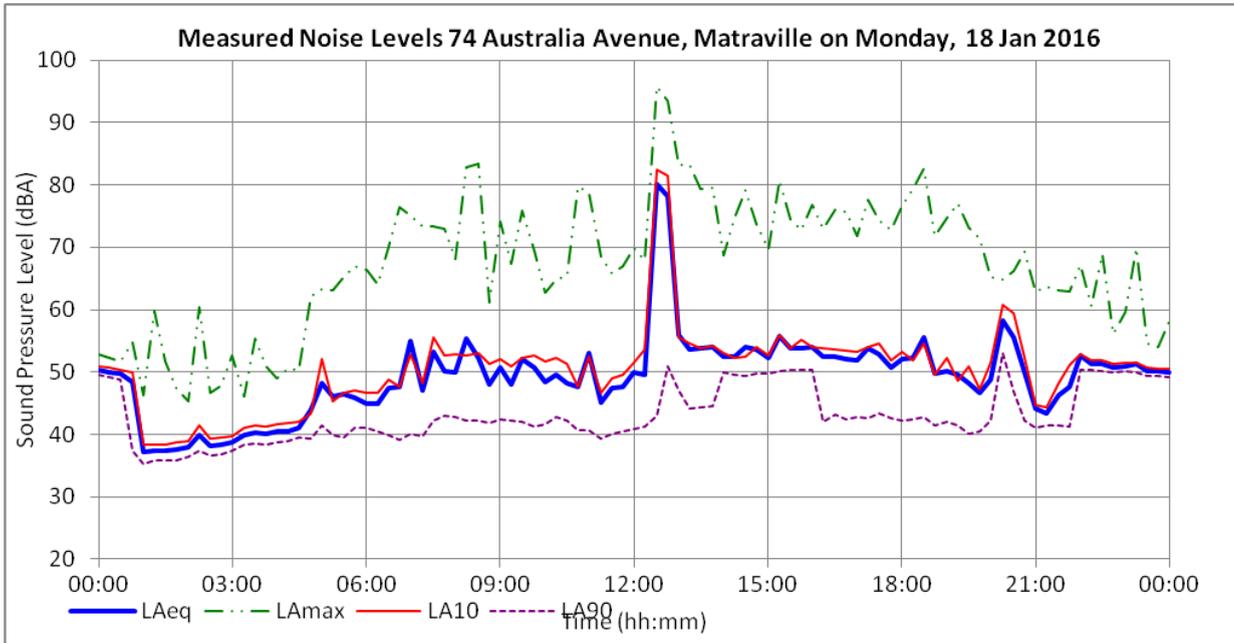


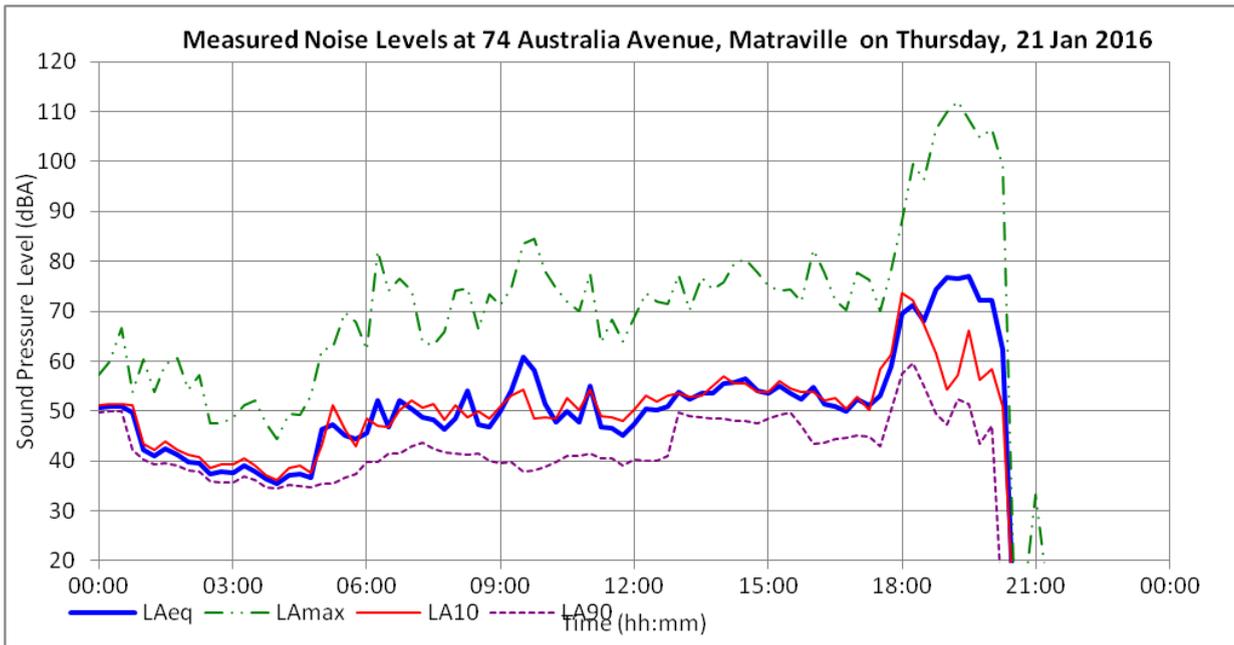
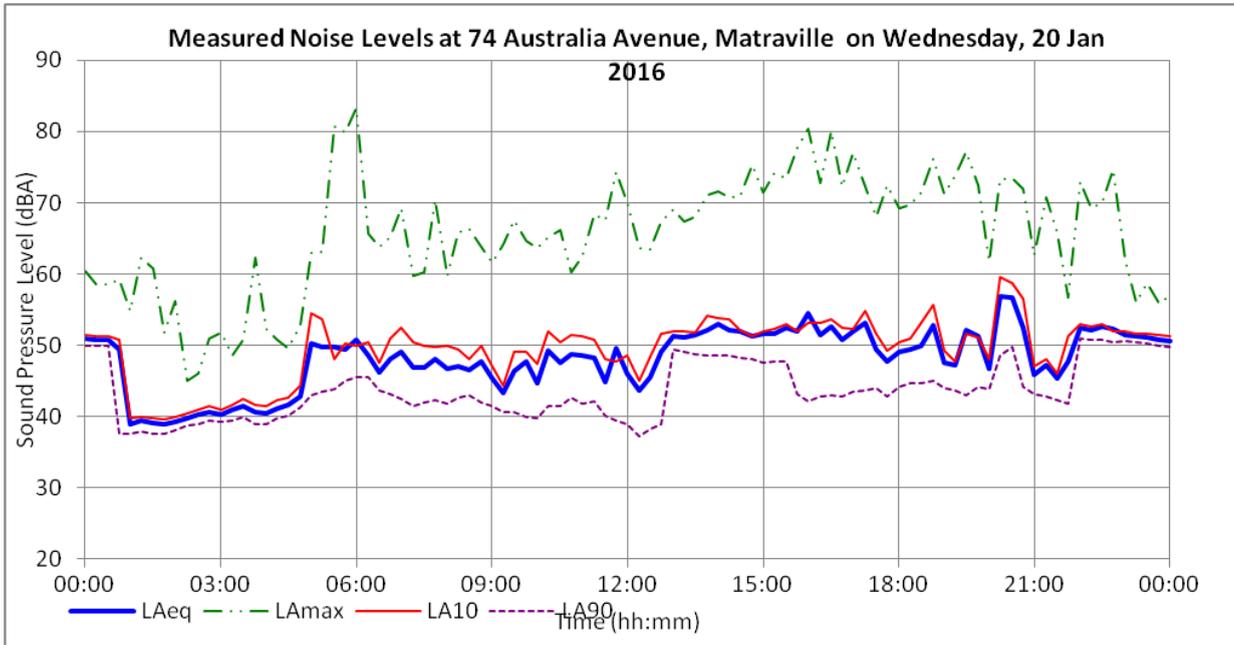
**Figure 2: Noise logger installed at 74 Australia Ave, Matraville**

Noise levels were continuously logged in 15 minute intervals at this location using a O1dB Duo noise logger (Serial number 10315) between 16 January 2016 and 29 January 2016. The noise logger was calibrated before and after conducting the measurements and no significant drift was observed. Severe electrical storms occurring on Thursday 21 January 2016 affected the unit placed at 74 Australia Avenue. As a consequence of this, all data recorded after the evening period of 21 January was not used in analysis.

The noise survey results are presented graphically overleaf:







**B2 34 Dent Street**

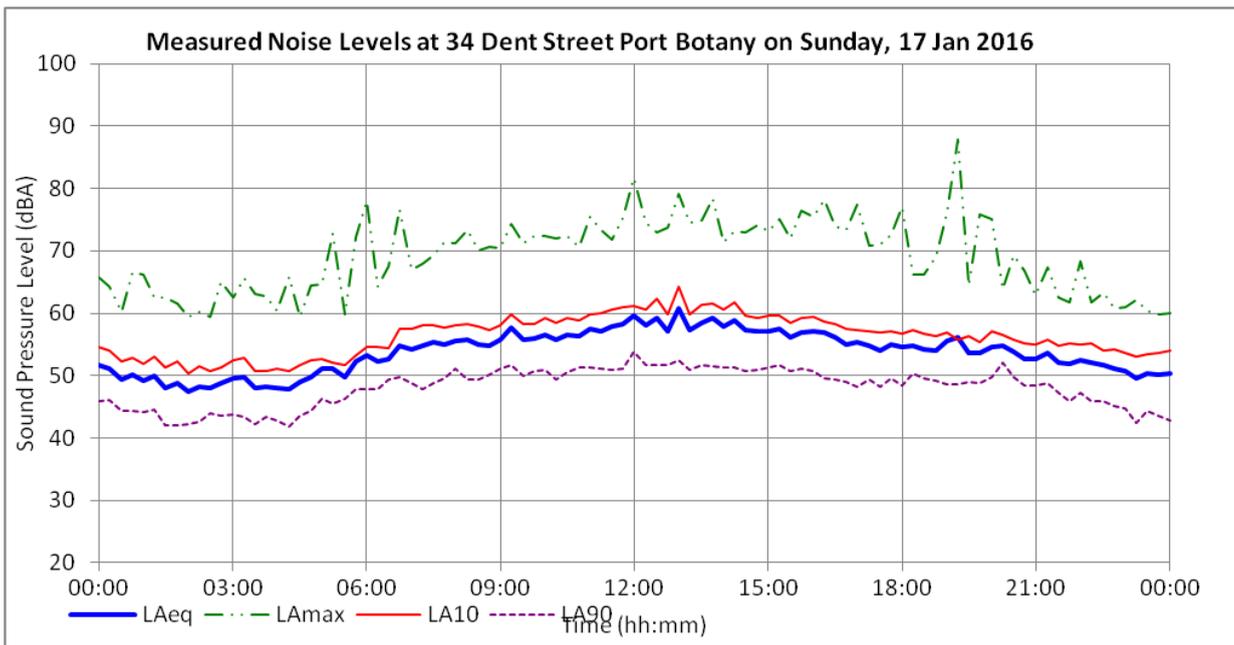
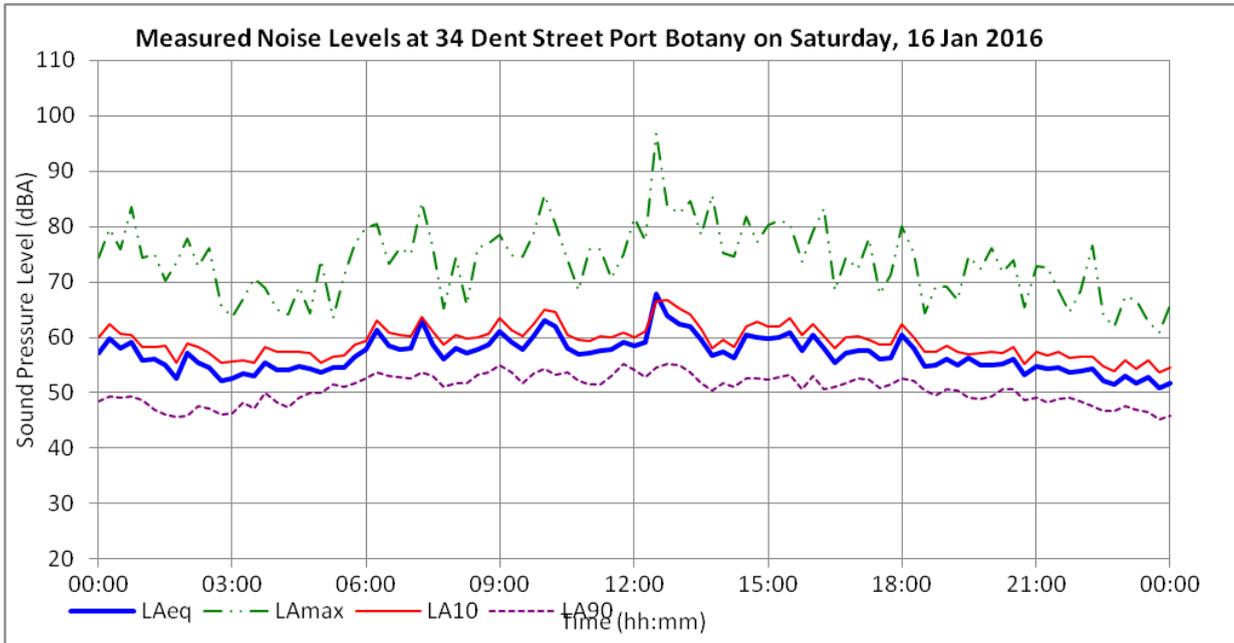
A noise logger was setup at the rear boundary of the residential receiver located at 34 Dent Street, Botany.

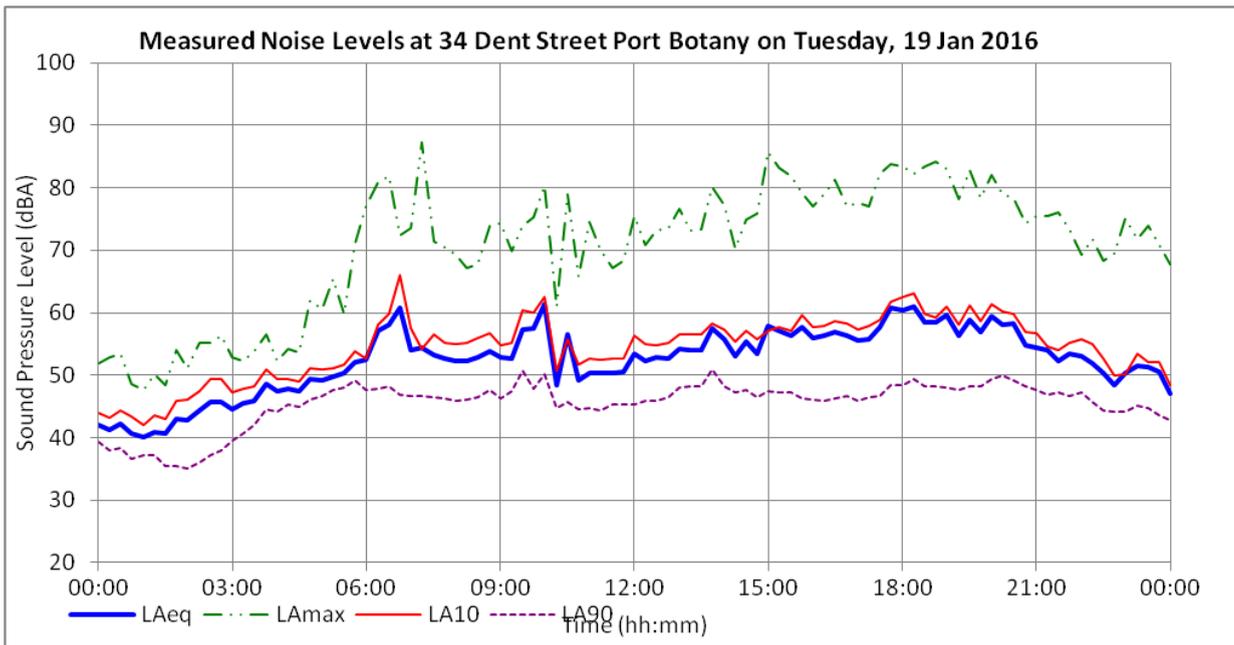
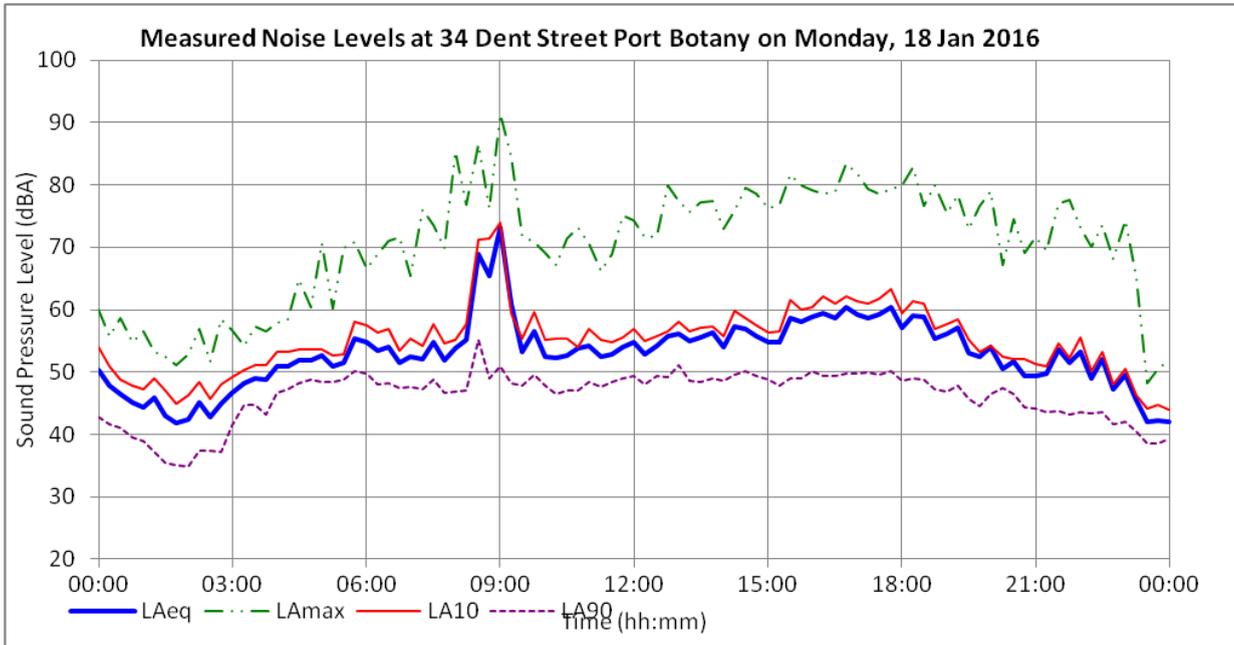


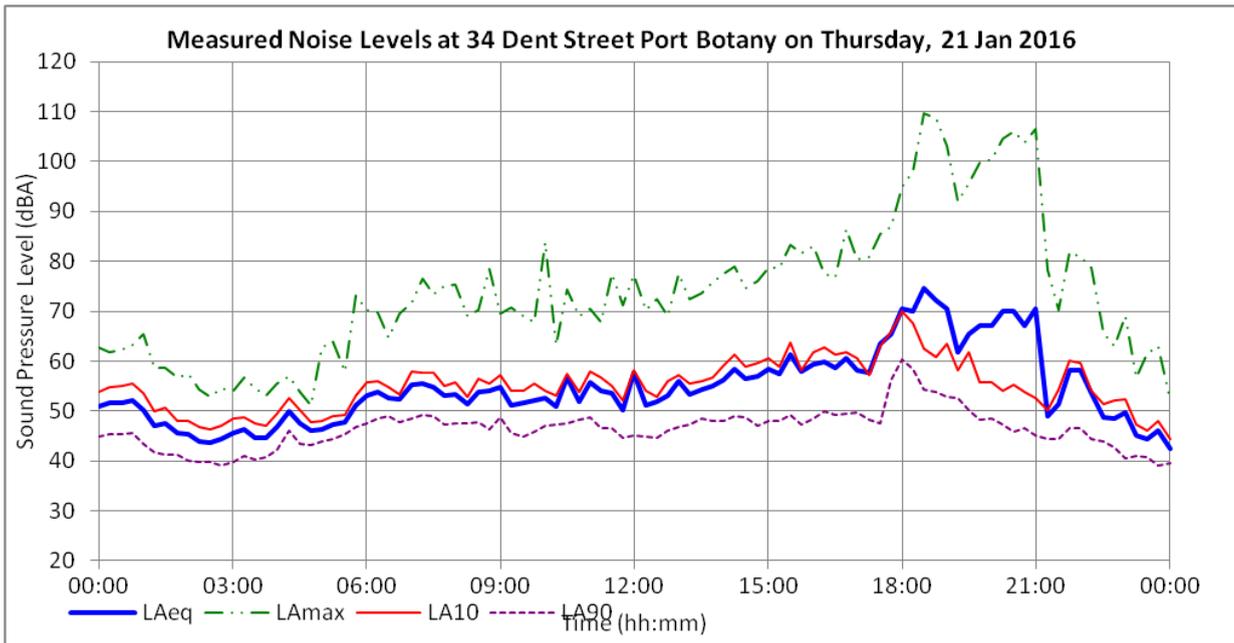
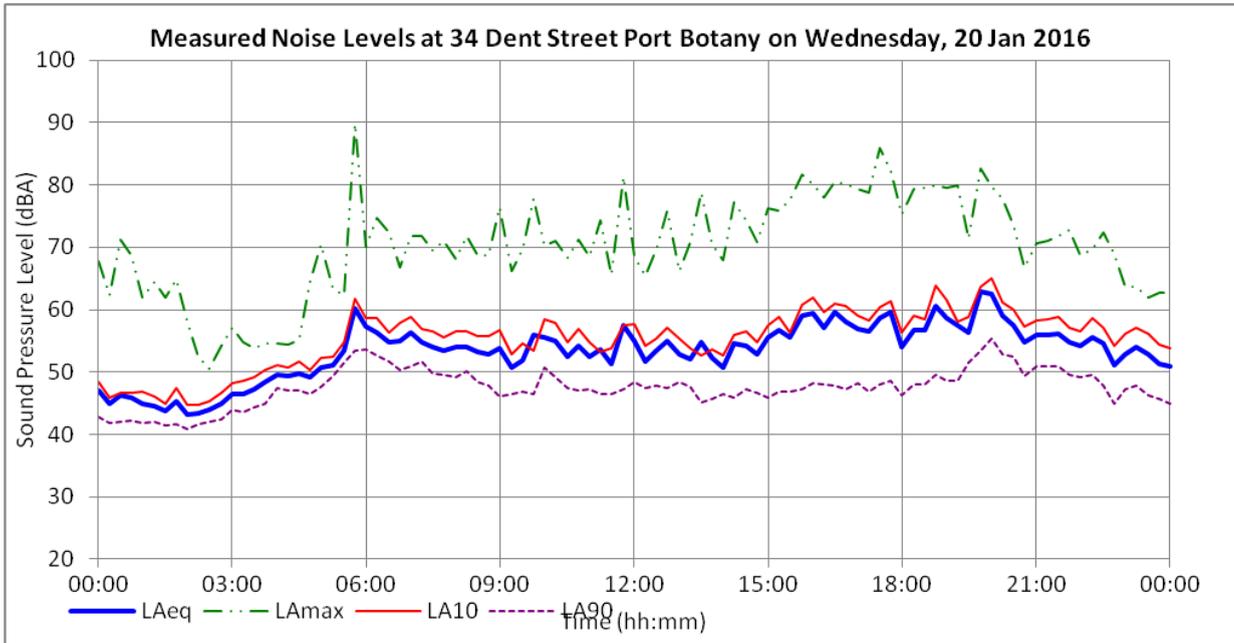
Figure B2: Noise logger installed at 34 Dent Street, Botany

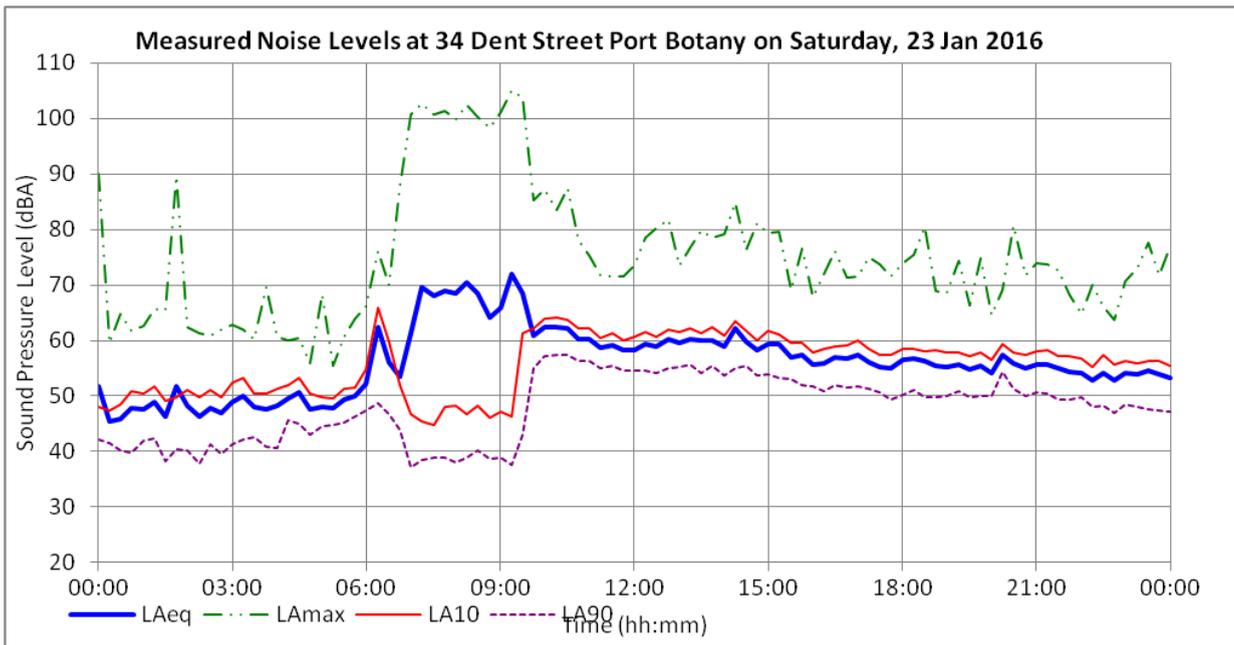
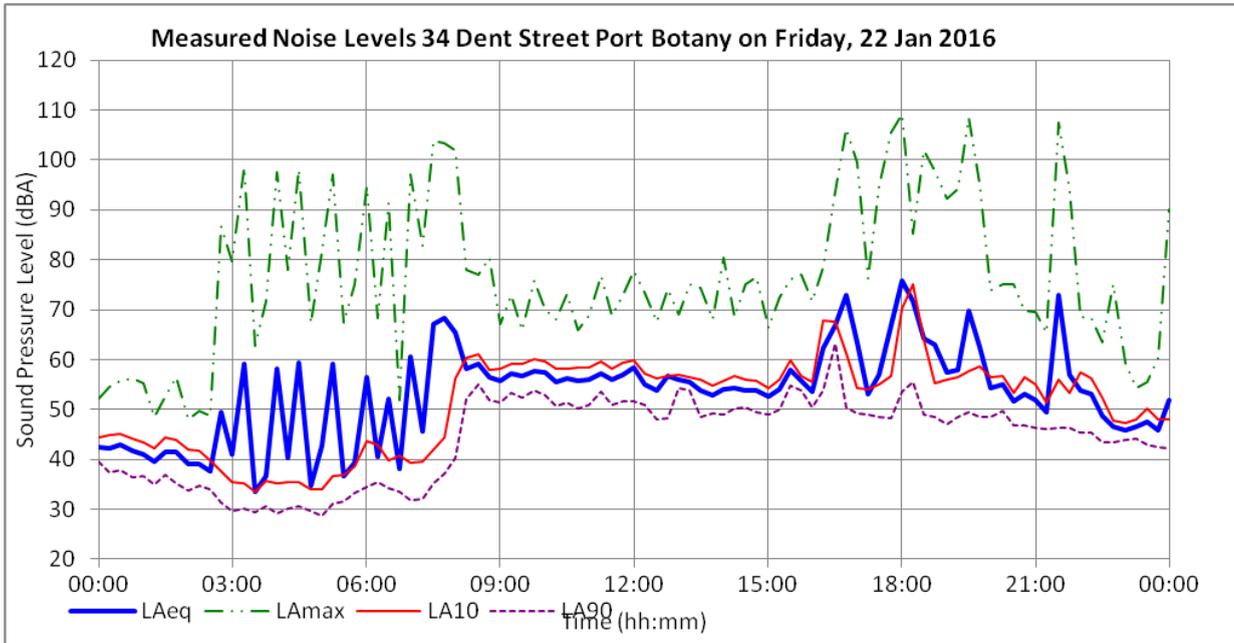
Noise levels were continuously logged in 15 minute intervals at this location using a 01dB Cube noise logger (Serial number 10419) between 16 January 2015 and 29 January 2016. The noise logger was calibrated before and after conducting the measurements and no significant drift was observed.

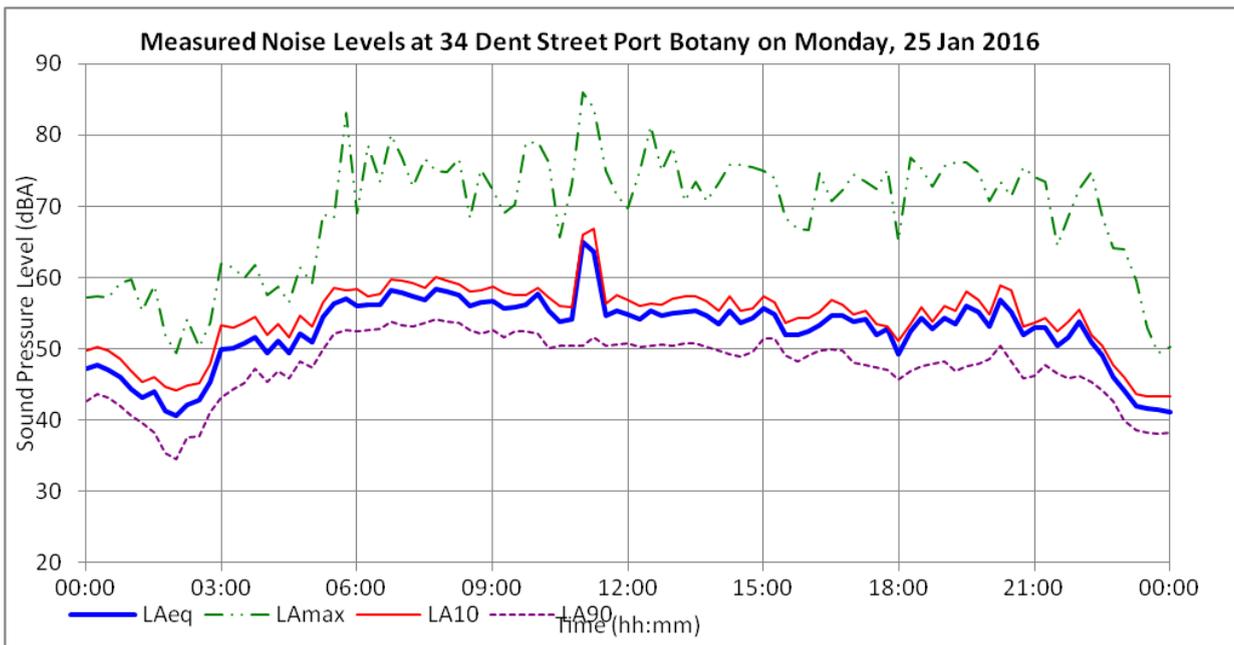
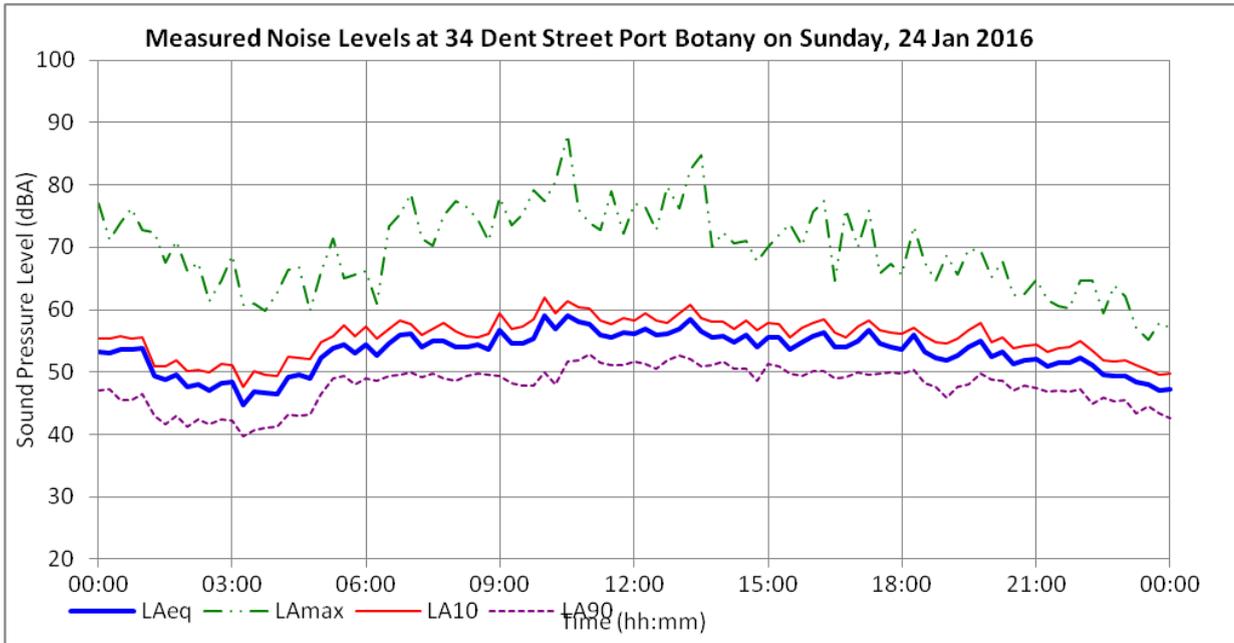
The noise survey results are presented graphically overleaf.

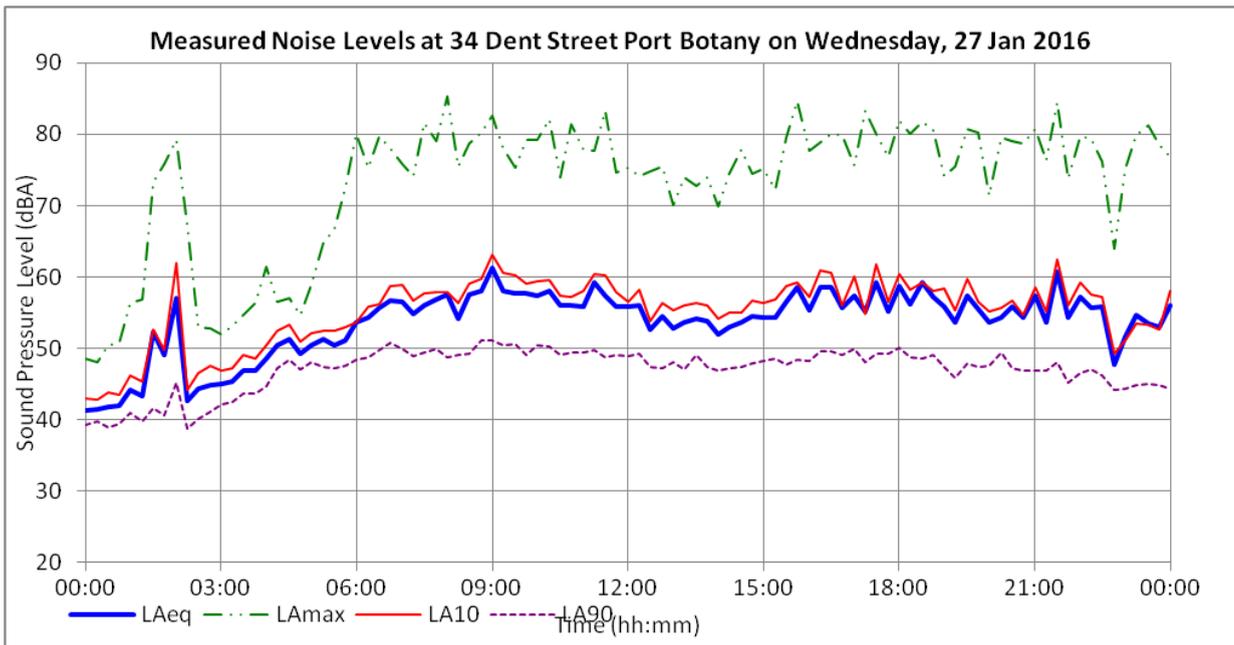
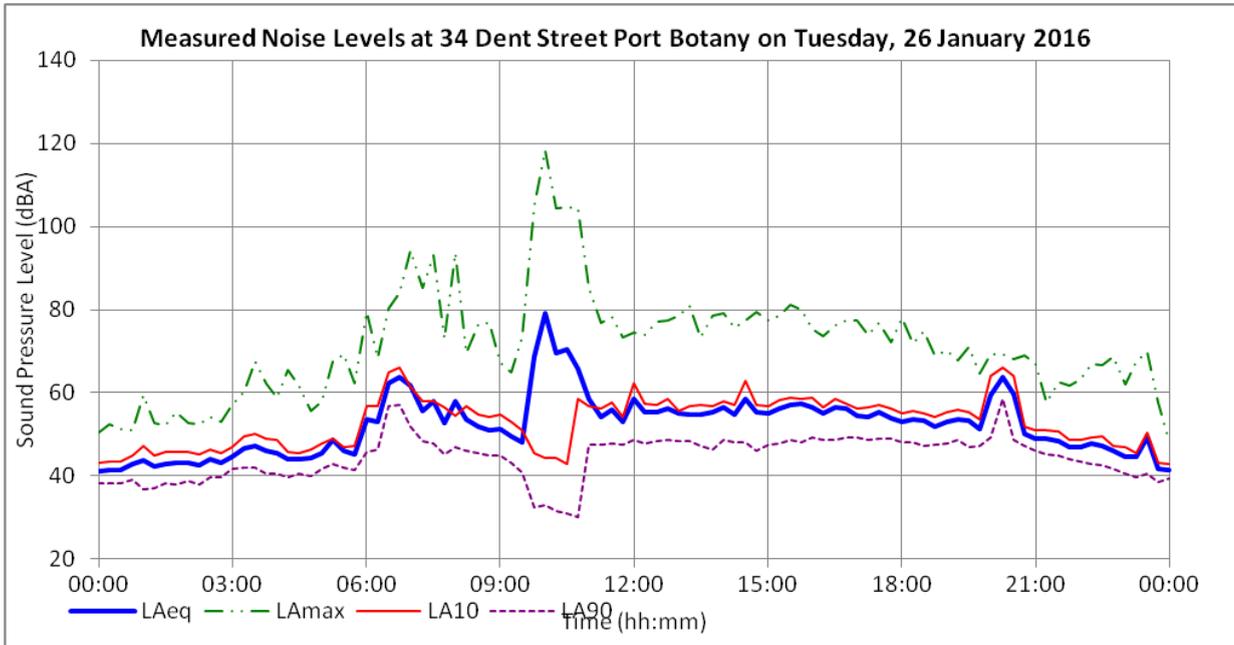


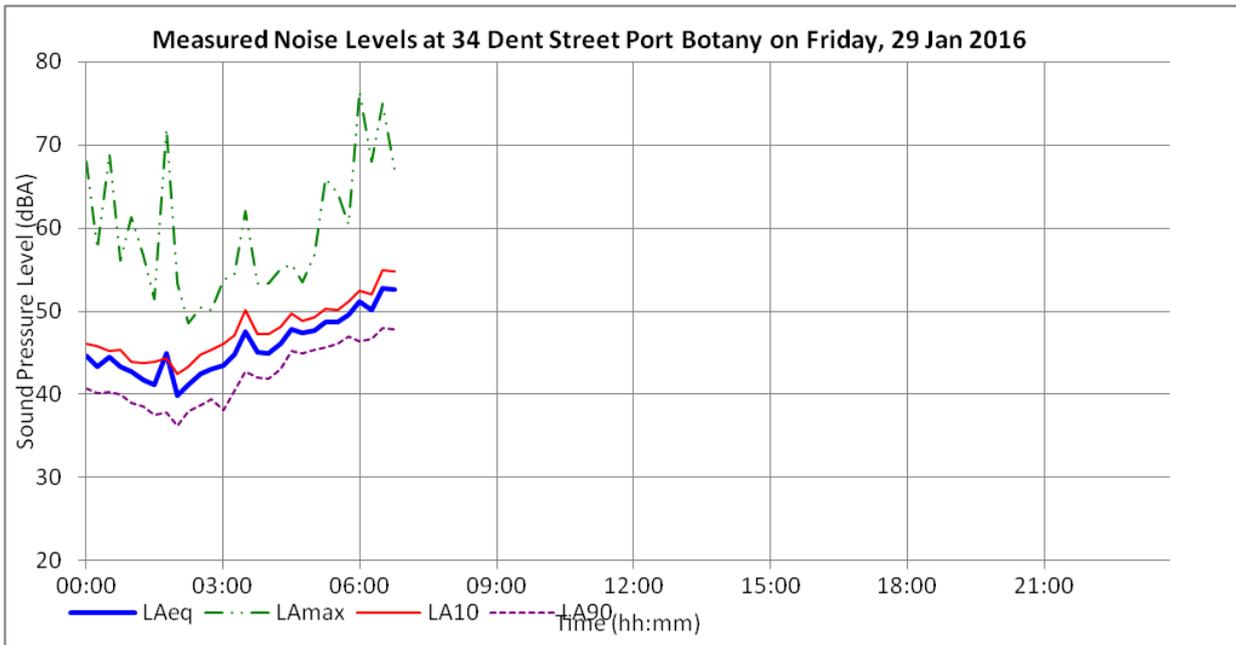
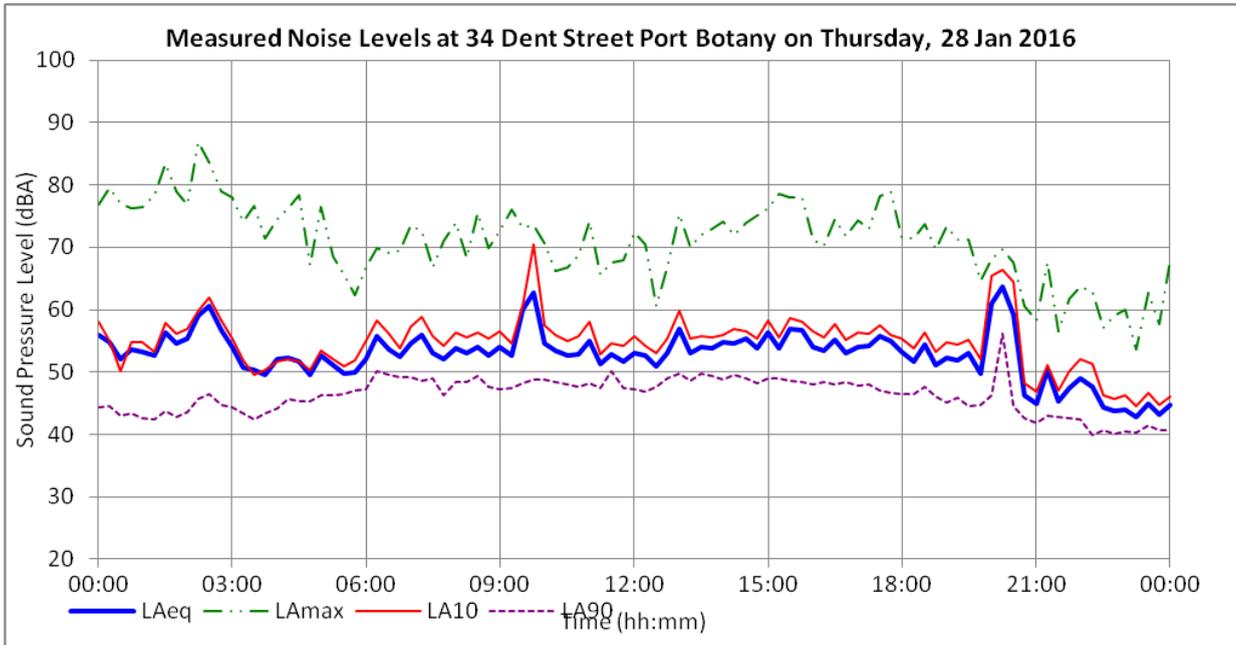












## APPENDIX C PLANT INVENTORY AND SOUND POWER LEVELS

The following inventory of large plant was provided by SICTL.

Table C1: SICTL Inventory of Large Plant

Active / Inactive	Master Asset ID	Description	Serial No	Build Year	Type	Manufacturer / OEM	Comments
A	QC01	Quay Crane	1661-1	2012	Shuttle Boom Crane	ZPMC	Height = 55m total, ~37m to ropes
A	QC02	Quay Crane	1661-2	2012	Shuttle Boom Crane	ZPMC	Height = 55m total, ~37m to ropes
A	QC03	Quay Crane	1715-1	2012	Shuttle Boom Crane	ZPMC	Height = 55m total, ~37m to ropes
A	QC04	Quay Crane	1715-2	2012	Shuttle Boom Crane	ZPMC	Height = 55m total, ~37m to ropes
A	ASC01L	Automated Stacking Crane	ASC-G1334	2013	-	Kone Cranes	Height = 24m total, ~22m to hoisting motor
A	ASC01W	Automated Stacking Crane	ASC-G1335	2013	-	Kone Cranes	Height = 24m total, ~22m to hoisting motor
A	ASC02L	Automated Stacking Crane	ASC-G1336	2013	-	Kone Cranes	Height = 24m total, ~22m to hoisting motor
A	ASC02W	Automated Stacking Crane	ASC-G1337	2013	-	Kone Cranes	Height = 24m total, ~22m to hoisting motor
A	ASC03L	Automated Stacking Crane	ASC-G1338	2013	-	Kone Cranes	Height = 24m total, ~22m to hoisting motor
A	ASC03W	Automated Stacking Crane	ASC-G1339	2013	-	Kone Cranes	Height = 24m total, ~22m to hoisting motor

A	ASC04L	Automated Stacking Crane	ASC-G1550	2015	-	Kone Cranes	Height = 24m total, ~22m to hoisting motor
A	ASC04W	Automated Stacking Crane	ASC-G1551	2015	-	Kone Cranes	Height = 24m total, ~22m to hoisting motor
A	ASC05L	Automated Stacking Crane	ASC-G1552	2015	-	Kone Cranes	Height = 24m total, ~22m to hoisting motor
A	ASC05W	Automated Stacking Crane	ASC-G1553	2015	-	Kone Cranes	Height = 24m total, ~22m to hoisting motor
A	ASC06L	Automated Stacking Crane	ASC-G1554	2015	-	Kone Cranes	Height = 24m total, ~22m to hoisting motor
A	ASC06W	Automated Stacking Crane	ASC-G1555	2015	-	Kone Cranes	Height = 24m total, ~22m to hoisting motor
A	SC01	Shuttle Carrier	4927	2013	SHC250H	Cargotec	Height ~9m to engine
A	SC02	Shuttle Carrier	4928	2013	SHC250H	Cargotec	Height ~9m to engine
A	SC03	Shuttle Carrier	4929	2013	SHC250H	Cargotec	Height ~9m to engine
A	SC04	Shuttle Carrier	4930	2013	SHC250H	Cargotec	Height ~9m to engine
A	SC05	Shuttle Carrier	4931	2013	SHC250H	Cargotec	Height ~9m to engine
A	SC06	Shuttle Carrier	4932	2013	SHC250H	Cargotec	Height ~9m to engine
A	SC07	Shuttle Carrier	4933	2013	SHC250H	Cargotec	Height ~9m to engine
A	SC08	Shuttle Carrier	4934	2013	SHC250H	Cargotec	Height ~9m to engine
A	RS01	Reach Stacker	13RS45020090	2013	SRSC45C2	Sany	Height of engine ~ 1.5m
A	RS02	Reach Stacker	13RS45020091	2013	SRSC45C2	Sany	Height of engine ~ 1.5m

	RS03	Reach Stacker	14RS45450058	2014	SRSC4545	Sany	Height of engine ~ 1.5m
	RS04	Reach Stacker	14RS45450059	2014	SRSC4545	Sany	Height of engine ~ 1.5m
A	EH01	Empty Handler	13DG1080030	2013	SDCY100K8-T	Sany	Not In Use
A	FL01	Fork Lift 16 T	13CP16010015	2013	SCP160C	Sany	Not measured
A	FL02	Fork Lift 5T	P455D 006 9888CNF	2013	C50SD / V3800T	Clark	Not measured
A	FL03	Fork Lift 2.5T	P232D 1419 9843CNF	2013	C25D	Clark	Not measured
A	FL04	Fork Lift 2.5T	P232D 1352 9843CNF	2013	C25D	Clark	Not measured
I	FL05	Fork Lift 2.5T	NA	NA	GEX25	Clark	Not measured
A	EWP01	Elevated workplatform	300171339	2013	JLG 800AJ	JLG	Not In Use
A	EWP02	Elevated workplatform	B200013419	2013	JLG324ES	JLG	Not In Use
A	TT01	Terminal Tractor	NA	2013	Terberg	Terberg	Not In Use
A	NSG 02	Reefer Generator 02 (25 Plug)	NA	NA	Rental Waterfront	NA	Not In Use
A	NSG 03	Reefer Generator 03 (25 Plug)	NA	NA	Rental Waterfront	NA	Not In Use
A	NSG 04	Reefer Generator 04( 30 Plug)	NA	NA	Rental Waterfront	NA	Not In Use

Photos of each plant type referenced above are provided overleaf



Figure 3: Reach Stacker



Figure 4: Shuttle Carrier



Figure 5: Quay Crane



Figure 6: ASC unloading container

The octave band sound power level derived for each plant item is detailed in Table C2 below.

**Table C2: Octave Band Sound Power Level**

Source	Octave Band Centre Frequency (Hz)							dBA
	63	125	250	500	1000	2000	4000	
ASC Roller and Quacker	104	106	101	101	101	101	95	106
Quay Crane Quacker	90	89	96	94	95	93	86	99
Quay Crane Rollers	105	101	102	104	102	101	93	107
Truck reversing in ASC area	99	94	89	92	94	93	84	98
Truck idling in ASC area	101	96	89	94	94	92	84	98
Truck accelerating from idling and driving out of ASC lane	100	94	90	92	96	94	87	100
Truck movement	97	96	88	88	89	87	83	93
Train locomotive (C509)	107	106	102	100	97	98	92	104
Train locomotive idling	108	104	101	101	95	88	81	101
Train shunting LA1 Lw	104	105	112	109	111	108	106	115
Shuttle in Quay Crane area	105	104	102	102	99	95	93	104
Hatch Cover plate landing $L_{A1}$ Lw	136	132	124	125	116	111	100	125
Spreader attempting to engage with hatch cover plate $L_{A1}$ Lw	139	135	132	130	126	122	113	132
Container landing $L_{A1}$ Lw	118	121	116	114	110	104	99	116
Shuttle carrier movement in ASC Area	101	99	98	102	101	99	90	105

Source	Octave Band Centre Frequency (Hz)							dBA
	63	125	250	500	1000	2000	4000	
Reach stacker in Train Area	104	106	105	100	98	96	92	104
Reach stacker movement in Exchange pad area	101	99	98	102	101	99	90	105

**APPENDIX D SUMMARY OF MODELLING ASSUMPTIONS**

SICTL has provided the following typical and worst case operational scenarios. SICTL have reported that not all worst cast scenarios are underway at once as there is not enough plant to do this. Yard, quay and rail operations are managed for efficient usage of plant – this system is colour-coded below. Additionally, the differences between the INP noise periods and the SICTL shift times are explained in the table below.

**Table D1: SICTL Typical and Worst Case Operating Scenarios**

Area	Governing INP Period	SICTL work times within each INP period	TYPICAL Operating Scenario	WORST-CASE Operating Scenario
QUAY	Day	Part of Day shift 0700 - 1400 & Part of Evening shift 1400 - 1800	2 Quay Cranes working one ship	4 Quay Cranes working two ships
			6 Shuttle Carriers (3 per Quay Crane)	8 Shuttle Carriers
	2 Small forklifts & 4 light vehicles	2 Small forklifts & 6 light vehicles		
Evening	Part of Evening shift 1800 - 2200	2 Quay Cranes working one ship	4 Quay Cranes working two ships	
		6 Shuttle Carriers (3 per Quay Crane)	8 Shuttle Carriers	
2 Small forklifts & 4 light vehicles	2 Small forklifts & 6 light vehicles			
Night	All of Night shift 2200 - 0600 & Part of Day shift 0600 - 0700	2 Quay Cranes working one ship	4 Quay Cranes working two ships	
6 Shuttle Carriers (3 per Quay Crane)	8 Shuttle Carriers			
2 Small forklifts & 4 light vehicles	2 Small forklifts & 6 light vehicles			
YARD	Day	Part of Day shift 0700 - 1400 & Part of Evening shift 1400 - 1800	6 Automated Stacking Cranes (always working)	12 Automated Stacking Cranes (always working)
			1 Reach Stacker	1 Reach Stackers
	1 Shuttle Carriers	2 Shuttle Carriers		
Evening	Part of Evening shift 1800 - 2200	6 Automated Stacking Cranes (always working)	12 Automated Stacking Cranes (always working)	
		1 Reach Stacker	1 Reach Stackers	
1 Shuttle Carriers	1 Shuttle Carriers			

Area	Governing INP Period	SICTL work times within each INP period	TYPICAL Operating Scenario	WORST-CASE Operating Scenario
RAIL	Night	All of Night shift 2200 - 0600 & Part of Day shift 0600 - 0700	6 Automated Stacking Cranes (always working) 1 Reach Stacker 1 Shuttle Carriers	12 Automated Stacking Cranes (always working) 1 Reach Stackers 2 Shuttle Carriers
	Day	Part of Day shift 0700 - 1400 & Part of Evening shift 1400 - 1800	2 Reach Stackers 2 trains per shift	3 Reach Stackers 3 trains per shift
	Evening	Part of Evening shift 1800 - 2200	2 Reach Stackers 2 trains per shift	3 Reach Stackers 3 trains per shift
	Night	All of Night shift 2200 - 0600 & Part of Day shift 0600 - 0700	No trains scheduled	No trains scheduled

Based on the above schedule Marshall Day has incorporated the following assumptions to model the typical and worst case noise operations of the site. As a worst case scenario we have assumed that the Quay, Yard and Rail operations will all occur concurrently. However, in reality it is understood that typically only 2 of the three areas will be operating at full capacity simultaneously.

**Table D2: Noise model assumptions**

DAY TIME TYPICAL	DAY TIME WORST CASE	EVENING TIME TYPICAL	EVENING TIME WORST CASE	NIGHT TIME TYPICAL	NIGHT TIME WORST CASE
<i>Quay Area</i>					
Quay Crane x 2 Operating for 50% of the time. Speed is 5km/h. Assumed that quay crane rollers operate for 25% of the time.	Quay Crane x 4 Operating for 50% of the time. Speed is 5km/h. Assumed that quay crane rollers operate for 25% of the time.	Quay Crane x 2 Operating for 50% of the time. Speed is 5km/h. Assumed that quay crane rollers operate for 25% of the time.	Quay Crane x 4 Operating for 50% of the time. Speed is 5km/h. Assumed that quay crane rollers operate for 25% of the time.	Quay Crane x 2 Operating for 50% of the time. Speed is 5km/h. Assumed that quay crane rollers operate for 25% of the time.	Quay Crane x 4 Operating for 50% of the time. Speed is 5km/h. Assumed that quay crane rollers operate for 25% of the time.
Shuttle Carrier x 6 4 x picking up containers at crane Unloading/loading for 25% of the time.	Shuttle Carrier x 8 6 x picking up containers at crane Unloading/loading for 25% of the time.	Shuttle Carrier x 6 4 x picking up containers at crane Unloading/loading for 25% of the time.	Shuttle Carrier x 8 6 x picking up containers at crane Unloading/loading for 25% of the time.	Shuttle Carrier x 6 4 x picking up containers at crane Unloading/loading for 25% of the time.	Shuttle Carrier x 8 6 x picking up containers at crane Unloading/loading for 25% of the time.
<i>ASC Area and Exchange Pad/Yard</i>					
6 x ASC Crane. 7 movements in a 15 minute period.	12 x ASC Crane. 12 movements in a 15 min period.	6 x ASC Crane. 7 movements in a 15 minute period.	12 x ASC Crane. 12 movements in a 15 min period.	6 x ASC Crane. 7 movements in a 15 minute period.	12 x ASC Crane. 12 movements in a 15 min period.
1 x Reach Stacker. Moves for 20% of time.	1 x Reach Stacker. Each moves for 20% of the time.	1 x Reach Stacker. Moves for 20% of time.	1 x Reach Stacker. Each moves for 20% of the time.	1 x Reach Stacker. Moves for 20% of time.	1 x Reach Stacker. Each moves for 20% of the time.

DAY TIME TYPICAL	DAY TIME WORST CASE	EVENING TIME TYPICAL	EVENING TIME WORST CASE	NIGHT TIME TYPICAL	NIGHT TIME WORST CASE
1 x Shuttle Carrier Moves for 33.33% of the time.	2 x Shuttle Carriers. Each moves for 33.33% of the time.	1 x Shuttle Carrier Moves for 33.33% of the time.	2 x Shuttle Carriers Each moves for 33.33% of the time.	1 x Shuttle Carrier Moves for 33.33% of time.	2 x Shuttle Carriers. Each moves for 33.33% of the time.
7 truck movements in 15 minute period at 5km/h	12 truck movements in 15 min period at 5km/h	7 truck movements in 15 minute period at 5km/h	12 Truck movements in 15 min period at 5km/h	7 truck movements in 15 minute period at 5km/h	12 Truck movements in 15 min period at 5km/h
7 container landings in 15 min period	12 container landings in 15 min period	7 container landings in 15 min period	12 container landings in 15 min period	7 container landings in 15 min period	12 container landings in 15 min period
<i>Rail Area</i>					
2 x Reach Stackers. Each moves for 50% of the time.	3 x Reach Stackers. Each moves for 50% of the time.	2 x Reach Stackers. Each moves for 50% of the time.	3 x Reach Stackers. Each moves for 50% of the time.	No trains or unloading/loading activity	No trains or unloading/loading activity
1 x Train movement i.e. 3 locomotives in 4 hours.	1 x Train movement i.e. 3 locomotives in 2.5 hours.	1 x Train movement i.e. 3 locomotives in 4 hours.	1 x Train movement i.e. 3 locomotives in 2.5 hours.	No trains or unloading/loading activity	No trains or unloading/loading activity
1 x Shunting	1 x Shunting	1 x Shunting	1 x Shunting		

APPENDIX E EPA RESPONSE LETTER



Our reference: DOC14/127781  
Contact: Jacqueline Roberts

Mr John Ieroklis  
Environmental & Safety Compliance Engineer  
Hutchison Ports Australia  
PO Box 734  
Botany NSW 1455

Dear John

**Re: Sydney International Container Terminals  
Port Botany Terminal 3 – Operational Compliance Measurements  
SLR Proposed Scope of Works**

The Environment Protection Authority (EPA) has reviewed correspondence from SLR Consulting Australia Pty Ltd ("SLR") dated 5 June 2014 submitted on behalf of Hutchison Ports Australia ("HPA") detailing a proposed methodology for conducting noise measurements and modelling at the Sydney International Container Terminal ("SICTL") as an alternative to conducting environmental noise monitoring at all six noise monitoring locations outlined in the SICTL environment protection licence (EPL No. 20322).

The EPA does not object to the use of a calibrated noise model in this case to demonstrate compliance with the noise limits specified on EPL No. 20322. However, it is noted that the EPA's position may change in the future due to technological, physical or operational changes in and around the licensed premises.

The following aspects of the proposed modelling approach should be addressed:

- Input Sound Power Levels (SWL) will need to be updated from time to time to reflect any deterioration in the noise performance of the plant and equipment used on site, and any additions or replacements;
- A detailed inventory must be maintained, and provided with model results, to enable tracking of plant and equipment introduction and replacement, as well as any deterioration in noise performance. This inventory should include:
  - Source noise levels (for example SWL or Sound Pressure Levels measured at a specified distance) for each individual item of plant and equipment;
  - Details, including source noise levels, of each item during each activity undertaken by that item (for example, for the ASC this includes during winching, rolling noise, movement alarms and when unloading containers to trucks); and
  - Service and replacement date and description for each item.
- Representative source heights and locations will need to be chosen carefully as they will significantly affect any barrier attenuation and the resulting predicted noise contribution of the site at both the calibration point and receiver locations. This will be especially important in the case of

PO Box 668 Parramatta NSW 2124  
Level 13, 10 Valentine Avenue, Parramatta NSW 2150  
Tel: (02) 9995 5000 Fax: (02) 9995 6900  
ABN 43 692 285 758  
[www.epa.nsw.gov.au](http://www.epa.nsw.gov.au)

unshielded sources such as locomotive exhausts, likely to be above the 3m high barrier which is adjacent to the rail siding; and

- The methodology used, scenarios modelled and uncertainties will need to be described in detail in any noise compliance reports, so that the EPA can have confidence that the predicted noise levels at receiver locations are representative of the likely actual received noise levels.

Particular care will be needed in calibrating the model against measurements made at the proposed calibration point, which will be affected by road traffic noise from Foreshore Road as well as other sources in the area including ships in port, the existing Patrick container terminal, an adjoining construction site and Sydney Airport. The EPA requires at least two on-site calibration points which is likely to provide a more reliable result, by allowing measurements to be shielded from road traffic and airport noise and to allow the effect of local sources to be accounted for.

If you have any questions or queries in regards the above, please do not hesitate to contact Jacqueline Roberts on (02) 9995 5259.

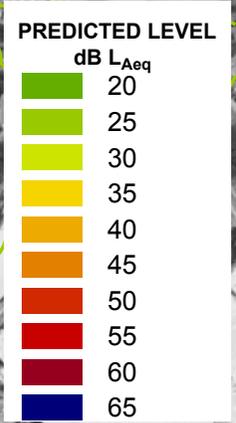
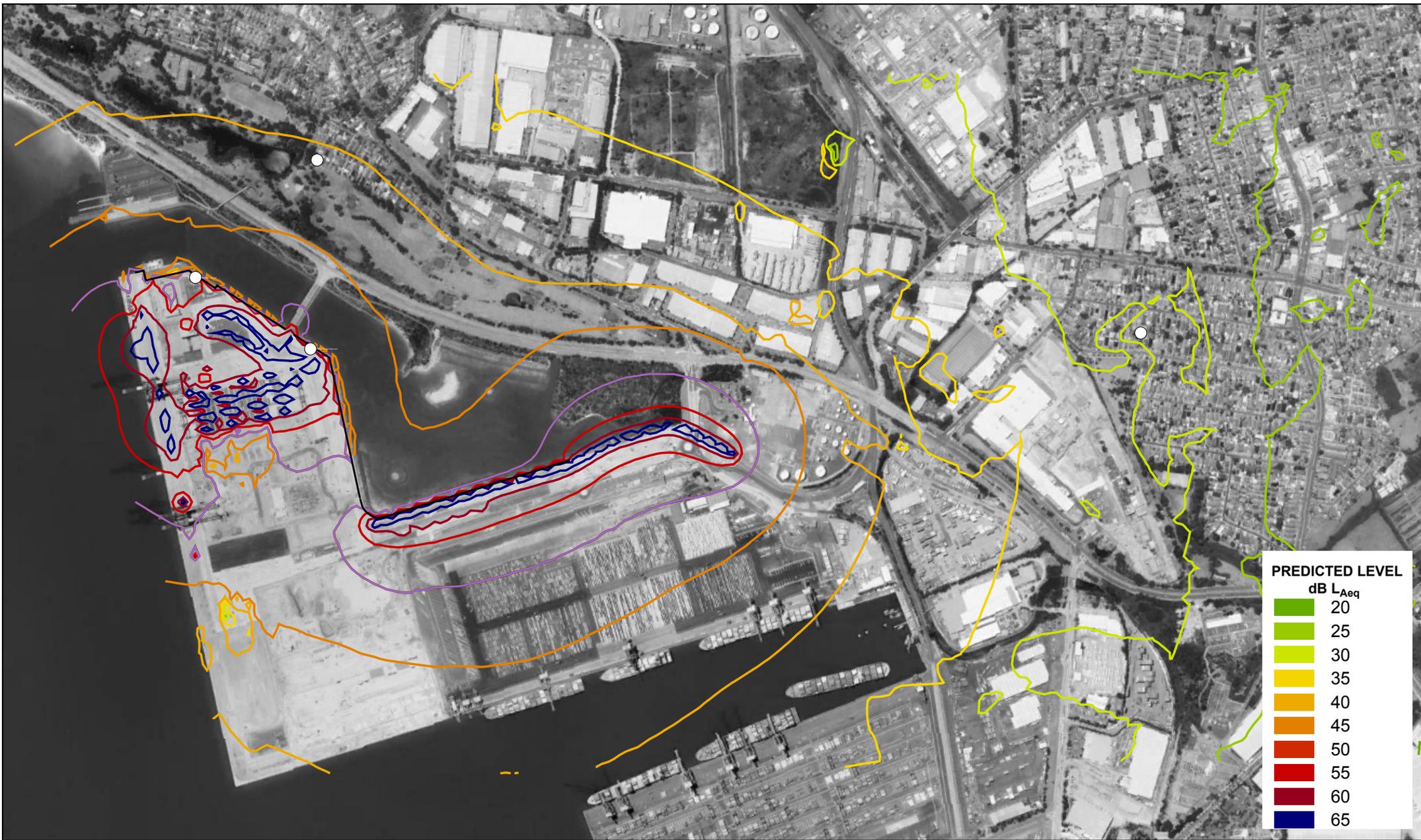
Yours sincerely



11 July 2014

**JAMES GOODWIN**  
Unit Head – Sydney Industry  
Environment Protection Authority

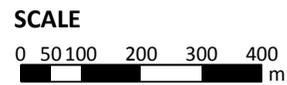
APPENDIX F NOISE CONTOUR PLOTS



**LEGEND**  
 ○ Point receiver  
 — Existing Noise Wall

Version: SoundPLAN 7.4  
 Prediction method: ISO 9613-2:1996  
 Model number: 3  
 Version: SoundPLAN 7.4  
 File: Day Typical  
 Prediction Height: 1.5 m

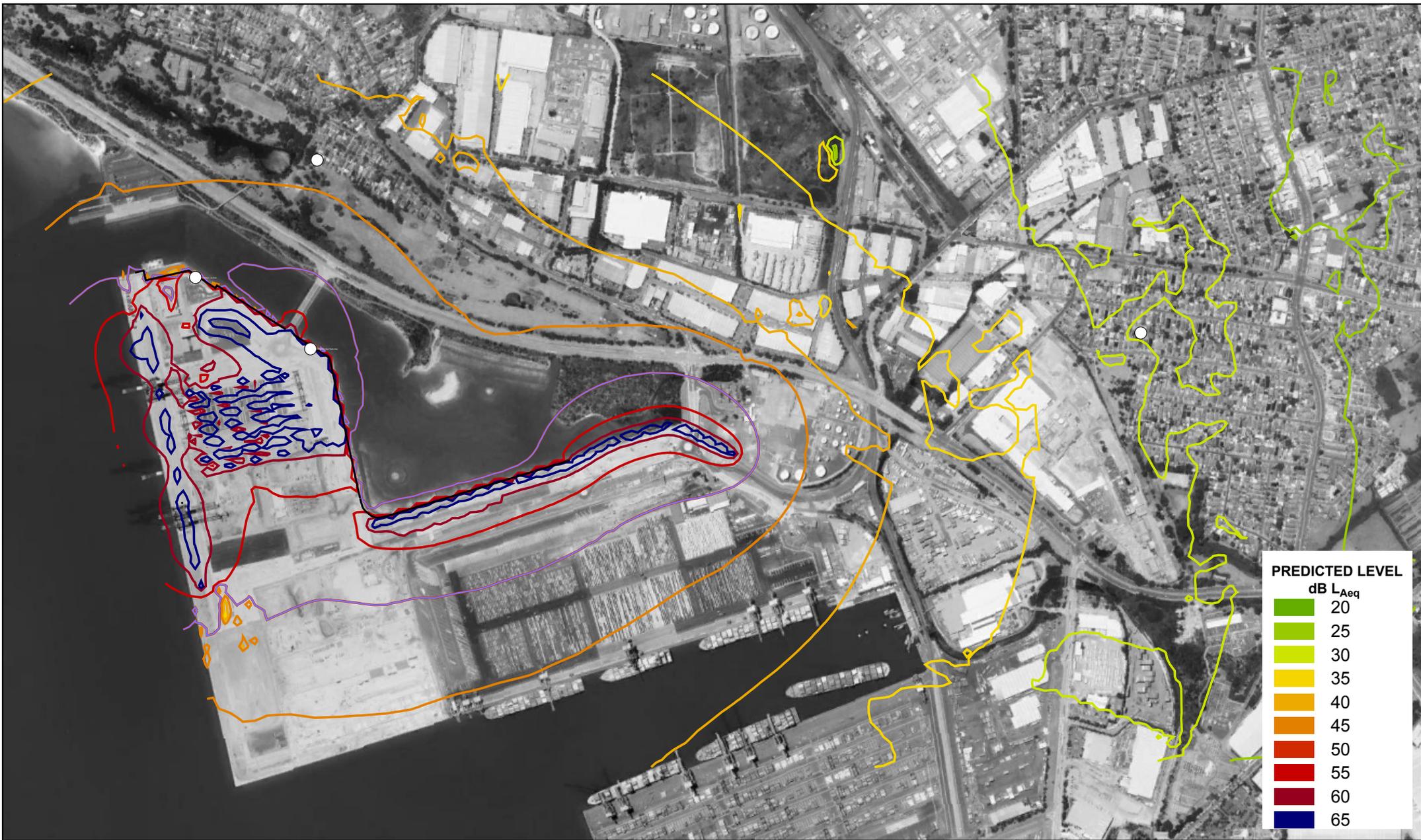
Project number: 2014432SY  
 Client name: SICTL



**Survey 3 - January 2015**

Day/Evening - Typical Operation





**LEGEND**  
 ○ Point receiver  
 — Existing Noise Wall

Version: SoundPLAN 7.4  
 Prediction method: ISO 9613-2:1996  
 Model number: 3  
 Version: SoundPLAN 7.4  
 File: Day/Evening Worst Case  
 Prediction Height: 1.5 m

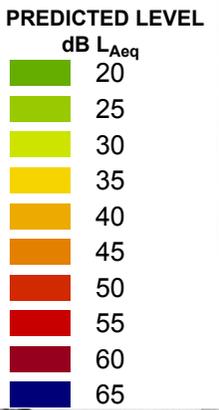
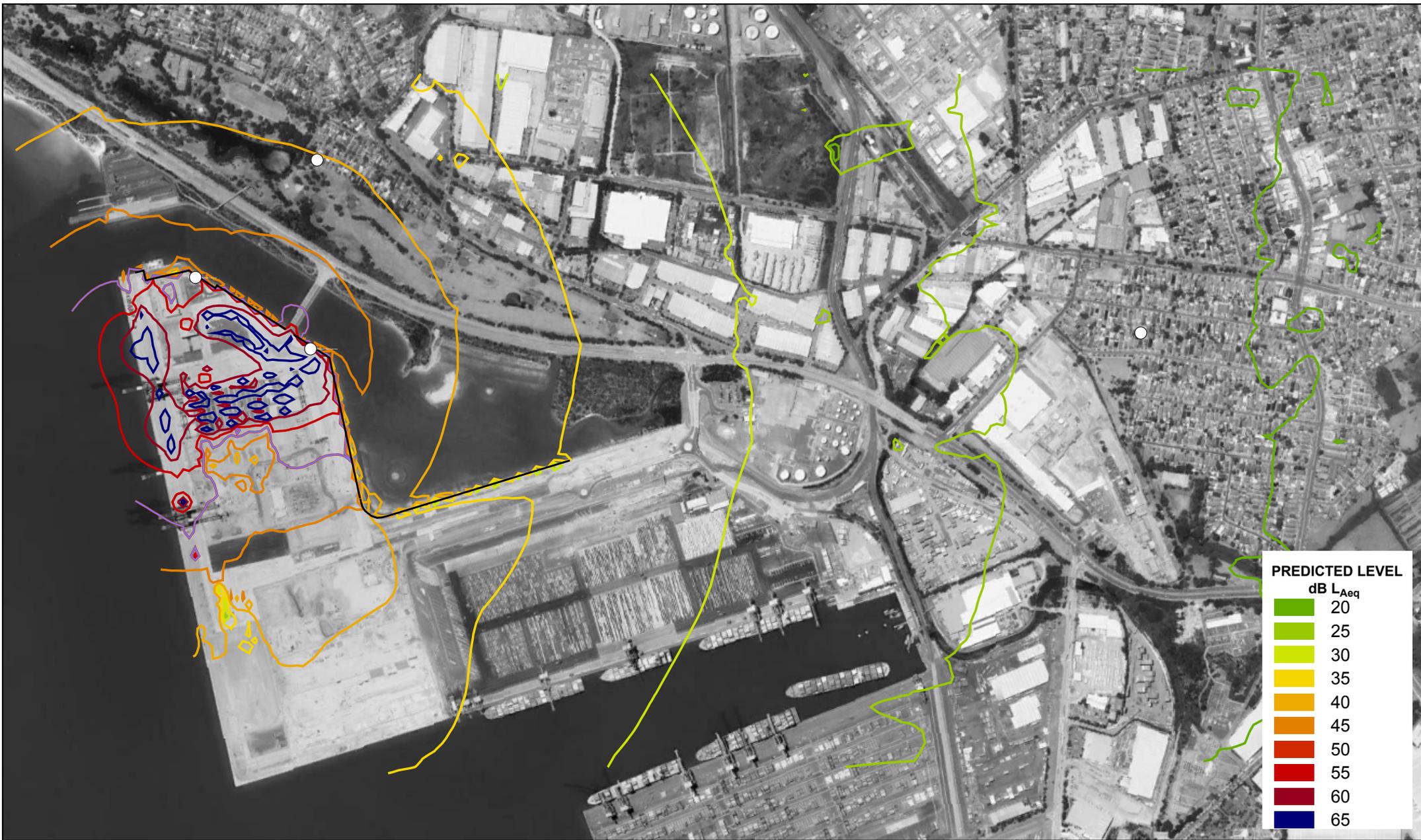
Project number: 2014432SY  
 Client name: SICTL

**SCALE**  
 0 50 100 200 300 400 m



**Survey 3 - January 2016**  
 Day/Evening - Worst Case Operation

**MARSHALL DAY**   
 Acoustics



**LEGEND**  
 ○ Point receiver  
 — Existing Noise Wall

Version: SoundPLAN 7.4  
 Prediction method: ISO 9613-2:1996  
 Model number: 3  
 Version: SoundPLAN 7.4  
 File: Night Typical  
 Prediction Height: 1.5 m

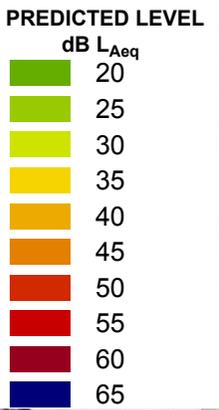
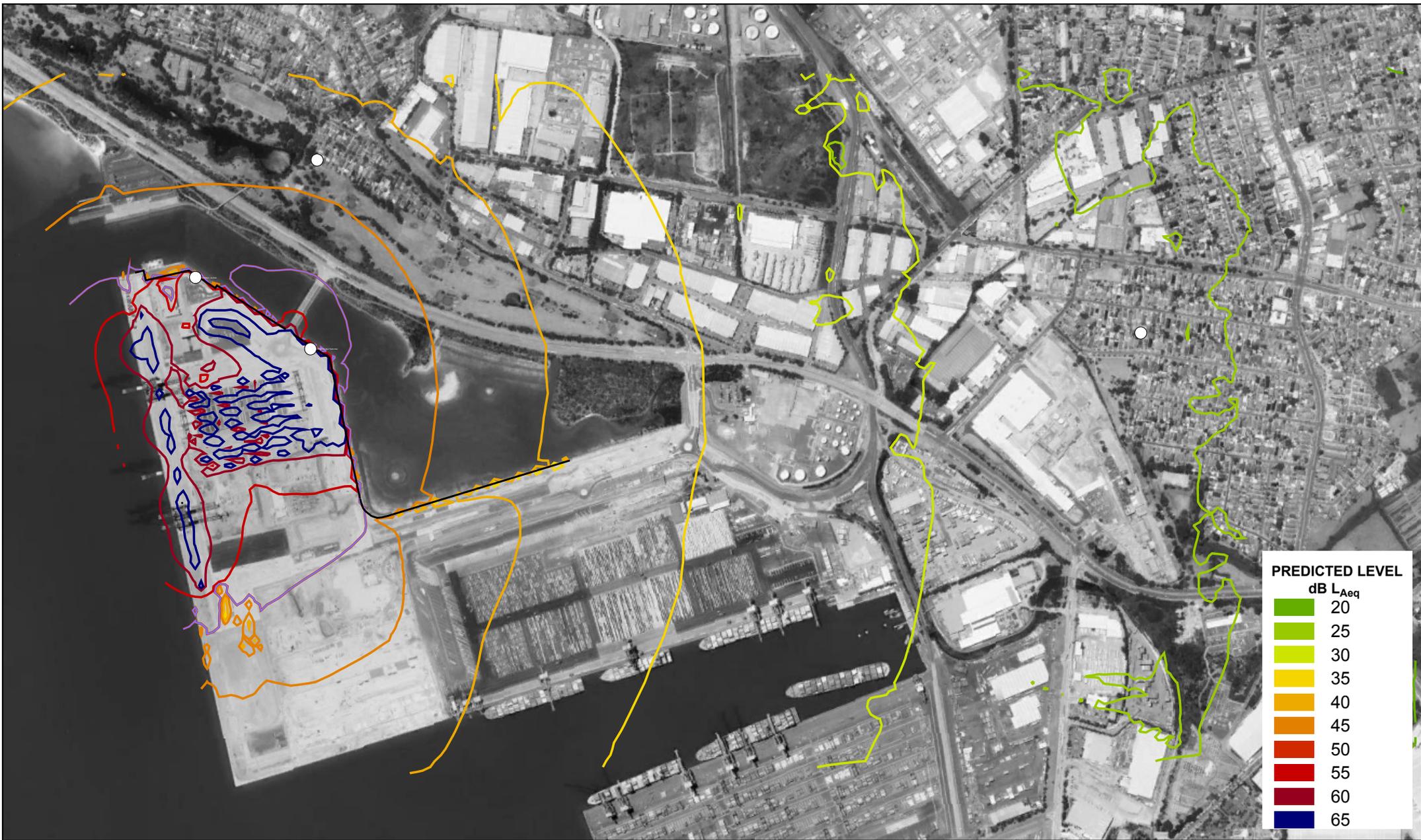
Project number: 2014432SY  
 Client name: SICTL



**Survey 3 - January 2016**

Night - Typical Operation

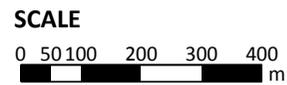




**LEGEND**  
 ○ Point receiver  
 — Existing Noise Wall

Version: SoundPLAN 7.4  
 Prediction method: ISO 9613-2:1996  
 Model number: 3  
 Version: SoundPLAN 7.4  
 File: Night Worst Case  
 Prediction Height: 1.5 m

Project number: 2014432SY  
 Client name: SICTL



**Survey 3 - January 2016**

Night - Worst Case Operation

