Tooheys Brewery

Acoustic Criteria

Modification of Acoustic Criteria

Report Ref

Issue | 19 July 2012

Job number 221580

Arup
Arup Pty Ltd ABN 18 000 966 165

Arup
Level 10 201 Kent Street
PO Box 76 Millers Point
Sydney 2000
Australia
www.arup.com

ARUP

Contents

Appendices

1 Introduction

1.1 Background

The Tooheys Brewery in Lidcombe has been in operation since 1955 and has undergone several upgrades during this time. In July 2007, Tooheys received single site wide planning approval from the then NSW Department of Planning (DoP) under Part 3A of the Environmental Planning and Assessment (EP&A) Act, 1979 (MP 06_0303). The approval was granted for the major upgrade of the brewery as well as a site wide approval for ongoing operations at the brewery.

In addition, Tooheys Brewery hold an Environment Protection Licence (EPL) for the site in accordance with the NSW Protection of the Environment Operations (PoEO) Act, 1997. Tooheys Brewery proposes to modify the noise limit prescribed by this EPL in consultation with the NSW Office of Environment and Heritage (OEH). The NSW Department of Planning & Infrastructure (DP&I) has confirmed that a modification of the existing planning approval is required prior to the modification of the EPL.

Routine compliance measurements were conducted by Arup in March 2011 which showed that existing noise emission criteria prescribed to the site as detailed in Section 3of EPL L1167 are not currently being met.

An acoustic audit was conducted at the Tooheys Brewery Lidcombe site in July 2011 in order to benchmark the existing acoustic environment against the compliance measurements and proposed potential noise mitigation strategies.

It is understood that Tooheys Brewery have not received noise complaints for the Tooheys Brewery Lidcombe site since 2003. It is therefore probable that current noise levels from the Tooheys Brewery are not causing adverse noise impacts on residents even though they exceed the L1167 noise criteria.

Criteria negotiations commenced between Tooheys Brewery and the OEH on 15 September 2011. During negotiations it was identified that updated noise limits would be considered, subject to a more detailed investigation into the feasibility and reasonableness of implementing noise mitigation strategies.

In December 2011 Arup undertook detailed investigations of the preferred noise mitigation strategy, including quantification of the predicted acoustic benefits. Based on the results of this investigation, this noise assessment proposes updated noise criteria that are achievable for Tooheys while avoiding adverse noise impacts on surrounding residents.

This report outlines Tooheys' proposal for criteria modification and summarises the findings of three supporting noise assessment reports conducted by Arup for Tooheys including:

- An acoustic audit of existing operations to benchmark (Appendix A);
- Recommendations for acoustic mitigation (Appendix B); and
- Conducted compliance measurements after installation of the preferred mitigation measure (Appendix C).

1.2 Site Description

The Tooheys Brewery is located at 29 Nyrang Street in Lidcombe, NSW. The site is bound on three sides by industrial premises and by Nyrang Street to the east. The nearest residential receivers are located immediately opposite the site entrance, across Nyrang Street.

Figure 1 presents an aerial view of the site in the context of its immediate surroundings along with the locations of main noise producing activities discussed further in following sections.

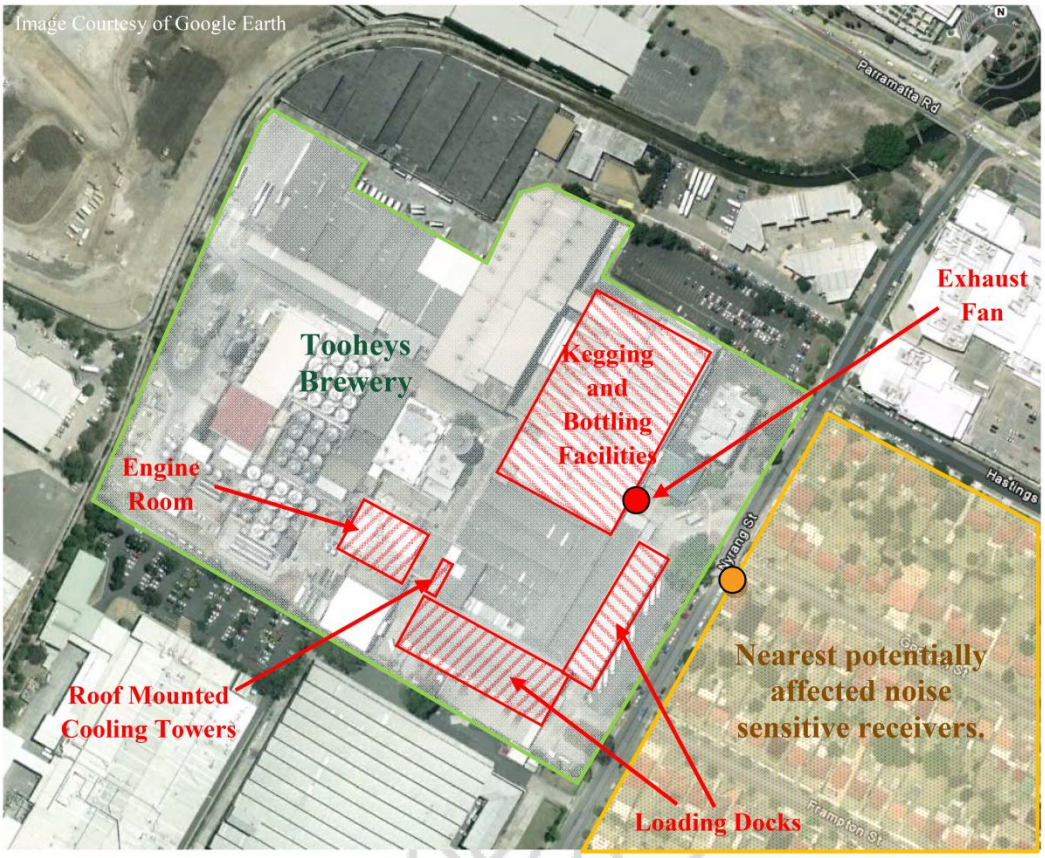


Figure 1 Aerial view of Tooheys Brewery and surroundings

2 Noise Criteria

2.1 Conditions of Approval

The operational noise limits for the Tooheys Brewery as provided in Schedule 3, Section 15 of the Tooheys' Part 3A Project Approval (MP 06_0303) are as detailed below:

Day	Evening	Night		Location
$L_{Aeq\ (period)}$			$L_{A1\ (1\ Minute)}$ OR $L_{A\ max}$	
50	50	50	65	At any residence or other noise sensitive receiver

2.2 License L1167

The operational noise limits for the Tooheys Brewery as provided in Clause L3 of Environment Protection Licence 1167 are as detailed below:

L3.1 Noise generated at the premises must not exceed the noise limits presented in the table below:

Location	At All Times $L_{Aeq(15\ minute)}$
Boundary of 24 Nyrang Street (opposite site entrance)	50 dBA

Noise from the premises is to be measured at the boundary of 24 Nyrang Street opposite site entrance to determine compliance with the $L_{Aeq(15\ minute)}$ noise limits in condition L6.1. Note: 5 dB(A) must be added to the measured level if noise is substantially tonal or impulsive in character.

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

3 Existing noise levels

3.1 Overview

Noise impacts experienced by residents along Nyrang Street are predominantly governed by loading dock activity and truck movements at the site entry. Noise sources deeper within the site are sufficiently shielded by intervening warehouse buildings and noise emissions from within the Kegging and Bottling areas are comparatively below the contribution from forecourt activities.

3.2 Environmental Noise Survey

During the acoustic audit in July 2011(Appendix A) Arup undertook attended and unattended noise surveys at the Tooheys Brewery site at Lidcombe.

Figure 2 presents the attended and unattended noise monitoring locations.

Unattended Noise Logging
Attended Noise Measurement

Figure 2 Environmental Noise Survey Measurement Locations

3.2.1 Unattended Noise Logging

Two RTA Technology Type 1 Noise Loggers fitted with microphone windshields were deployed along Nyrang Street (identified in red in Figure 2) in order to quantify the prevailing ambient noise environment of the area both in the presence and absence of Tooheys' operations. Each noise logger was left to measure for at least seven consecutive days. A summary of measured noise metrics, processed in accordance with the Department of Environment and Climate Change (DECC) Industrial Noise Policy (INP), is provided in Table 1.

The noise logger installed at the corner of Gooreen and Nyrang Streets (Location 1) is considered to be representative of current operational noise levels associated with Tooheys being experienced at the nearest residential receiver.

The noise logger installed at the corner of Calool and Nyrang Streets (Location 2) is at such a distance from the site that it is representative of the prevailing ambient noise level of the area in the absence of Tooheys' operations.

Table 1 Unattended Measured Ambient Noise Levels

Logger Location	**Time Period**	**Rating Background Level (RBL) – dBA**	**L_{Aeq} (period) - dBA**
Location 1 – Gooreen Street	Day	53	64
	Evening	50	59
	Night	49	57
Location 2 – Calool Street	Day	45	60
	Evening	47	57
	Night	45	55

3.2.2 Attended Noise Measurements

To complement unattended noise logger data and obtain a more comprehensive summary of the local noise environment, 15 minute attended noise measurements were also conducted at various locations along Nyrang Street (identified in blue in Figure 2) including at each noise logger location. Recorded L_{A90} and L_{Aeq} noise spectra at each measurement location is summarised in Table 2 and Table 3 respectively.

Table 2 Attended $L_{A90(15minute)}$ Noise Measurements

Measurement Location	**Octave Band Centre Frequency (Hz)**								**Overall (dBA)**
	63	125	250	500	1k	2k	4k	8k	
Cnr Calool and Nyrang Streets	58	60	56	50	47	44	39	32	49
Cnr Dewrang and Nyrang Streets	56	61	55	47	44	43	39	29	48
Nyrang Street north of Brewery	64	64	60	53	53	50	45	39	55
Cnr Elimatta and Nyrang Streets	55	57	50	43	41	41	37	32	45
Cnr Gooreen and Nyrang Streets	63	62	56	59	50	49	46	40	53

Table 3 Attended $L_{Aeq(15minute)}$ Noise Measurements

Measurement Location	**Octave Band Centre Frequency (Hz)**								**Overall (dBA)**
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	
Cnr Calool and Nyrang Streets	70	69	67	63	61	61	59	69	71
Cnr Dewrang and Nyrang Streets	63	68	63	58	56	59	55	46	62
Nyrang Street north of Brewery	70	72	68	60	60	59	56	51	63
Cnr Elimatta and Nyrang Streets	67	69	64	61	60	62	58	50	65
Cnr Gooreen and Nyrang Streets	66	70	62	56	56	56	54	48	61

Each measurement location was generally dominated by constant industrial noise sources from the various industry in the area as well as intermittent local traffic flows along Nyrang Street.

The northern end of Nyrang Street was influenced by road traffic noise from Parramatta Road and truck movements. The southern end of Nyrang Street was occasionally influenced by rail activity along the distant railway lines.

Measurements conducted opposite Tooheys Brewery are dominated by industrial noise emissions from the site with occasional traffic along Nyrang Street.

3.3 Modelled noise levels

As part of the acoustic audit in July 2011, an assessment of industrial noise impacts was conducted using CONCAWE1 noise propagation algorithms contained within the SoundPLAN noise modelling software suite.

A table of the calculated noise levels, based on operations in July 2011, at receiver locations is provided in Table 4 (for full methodology and report refer to Appendix A). Receiver locations are organised from north to south along Nyrang Street.

Table 4 Resultant Noise Levels at Residential Receivers in Nyrang Street

Receiver Location	Resultant Noise Level (dBA)
Nyrang Street between Gooreen and Hastings Streets	60
Corner of Nyrang and Gooreen Streets (North)	**63**
Corner of Nyrang and Gooreen Streets (South)	**63**
Nyrang Street between Gooreen and Frampton Streets	62
Corner of Nyrang and Frampton Streets (North)	62
Corner of Nyrang and Frampton Streets (South)	61
Nyrang Street between Frampton and Elimatta Streets	58
Corner of Nyrang and Elimatta Streets	56

It can be seen from the data presented in Table 4 that industrial noise levels currently experienced at the corner of Gooreen and Nyrang Streets (highlighted in bold) is in the order of 13 dBA higher than the current license condition of 50 dBA. This modelled noise level is also consistent with attended and unattended noise levels presented in Section 3.2.

[1] Manning, CJ (1981) – The Propagation of Noise from Petroleum and Petrochemical Complexes to Neighbouring Communities, Conservation of Clean Air, Water and the Environment (CONCAWE).

4 Noise mitigation

4.1 Overview

Mitigation options were assessed in December 2011 as part of the consultation process with OEH (Appendix B). The loading dock enclosure option was identified as the most effective option to reduce noise levels across Nyrang Street (i.e. forecourt loading activities). It is, however, isolated to the mitigation of such activities alone.

Mitigation measures were assessed by addressing the NSW Industrial Noise Policy (INP)[2] as it provides a framework for determining appropriate noise criteria for developments.

Figure 1.1 of the INP provides an overview of the main processes involved in its application. A copy of the flow chart is provided in Figure 3 for reference:

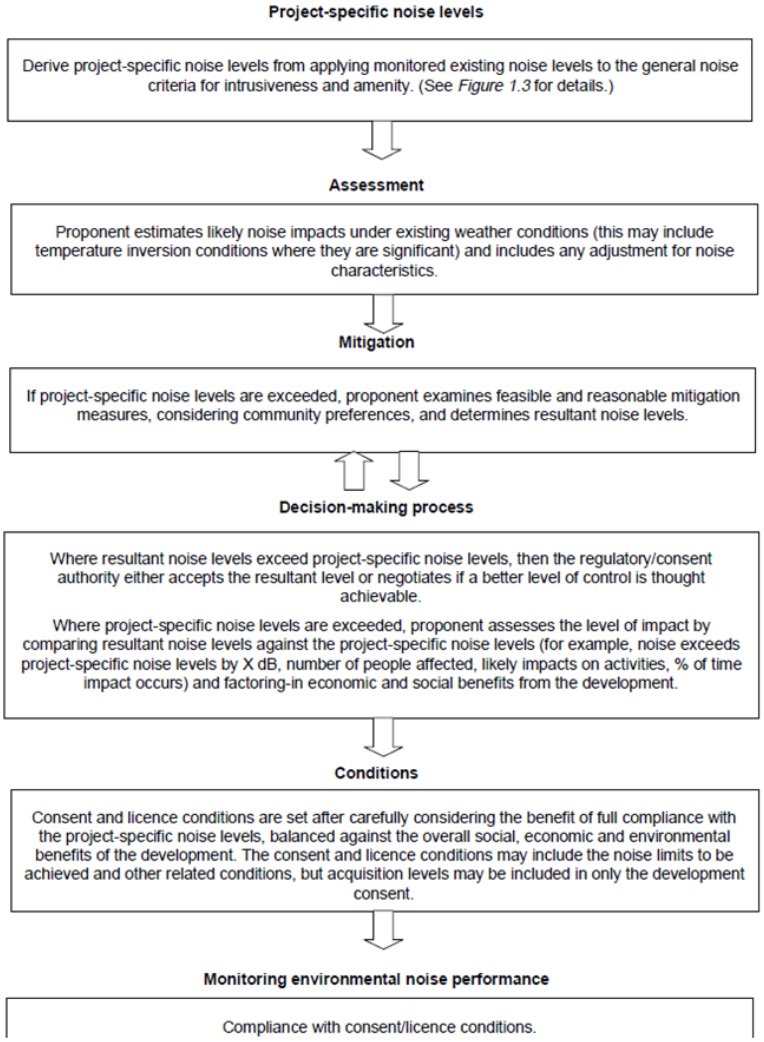


Figure 3 Excerpt from INP (Figure 1.1) describing how to apply the policy

[2] NSW Industrial Noise Policy, Environmental Protection Agency, Published January 2000.

4.2 Preferred Mitigation Measure

4.2.1 Loading dock Barrier

This noise mitigation scenario takes into account the effects of a single noise barrier on the eastern edge of the forecourt loading dock area. The acoustic benefits of a fully enclosed barrier (i.e. 5m in height to the underside of the existing canopy) were modelled. Predicted noise levels are presented in Table 5.

Table 5 Predicted noise levels – Loading dock canopy barrier

Receiver Location	Resultant Noise Level (dBA)	
	Unmitigated	Canopy Barrier
Nyrang Street between Gooreen and Hastings Streets	60	60
Corner of Nyrang and Gooreen Streets (North)	**63**	**62**
Corner of Nyrang and Gooreen Streets (South)	**63**	**61**
Nyrang Street between Gooreen and Frampton Streets	62	57
Corner of Nyrang and Frampton Streets (North)	62	56
Corner of Nyrang and Frampton Streets (South)	61	58
Nyrang Street between Frampton and Elimatta Streets	58	57
Corner of Nyrang and Elimatta Streets	56	55

Predicted noise levels presented in Table 5 show a considerable improvement at residential receiver locations directly to the east of the site. Little to no attenuation is observed at receivers opposite the site entrance.

It should be noted that car parking facilities for staff and visitors have been reinstated in the forecourt area of the brewery and truck access removed. This operational adjustment complements the implementation of a loading dock canopy barrier.

4.3 Assessment after preferred mitigation measure implemented

4.3.1 Overview

The loading dock enclosure was identified as the most effective option in the assessment dated 1 December 2011 (Appendix B). The loading dock enclosure was implemented along the loading dock a portion of Nyrang Street, Lidcombe in April 2012 (refer to Figure 4).

4.3.2 Noise Survey

Attended noise measurements were conducted on Wednesday 9 May 2012 at three representative locations along the site boundaries of the nearest residential receivers located opposite the site along Nyrang Street. These residential receivers are considered representative of the nearest potentially noise affected receivers.

Corresponding measurement locations are depicted in Figure 4. For the full report of the noise assessment after the preferred mitigation measure has been implemented refer to Appendix C.

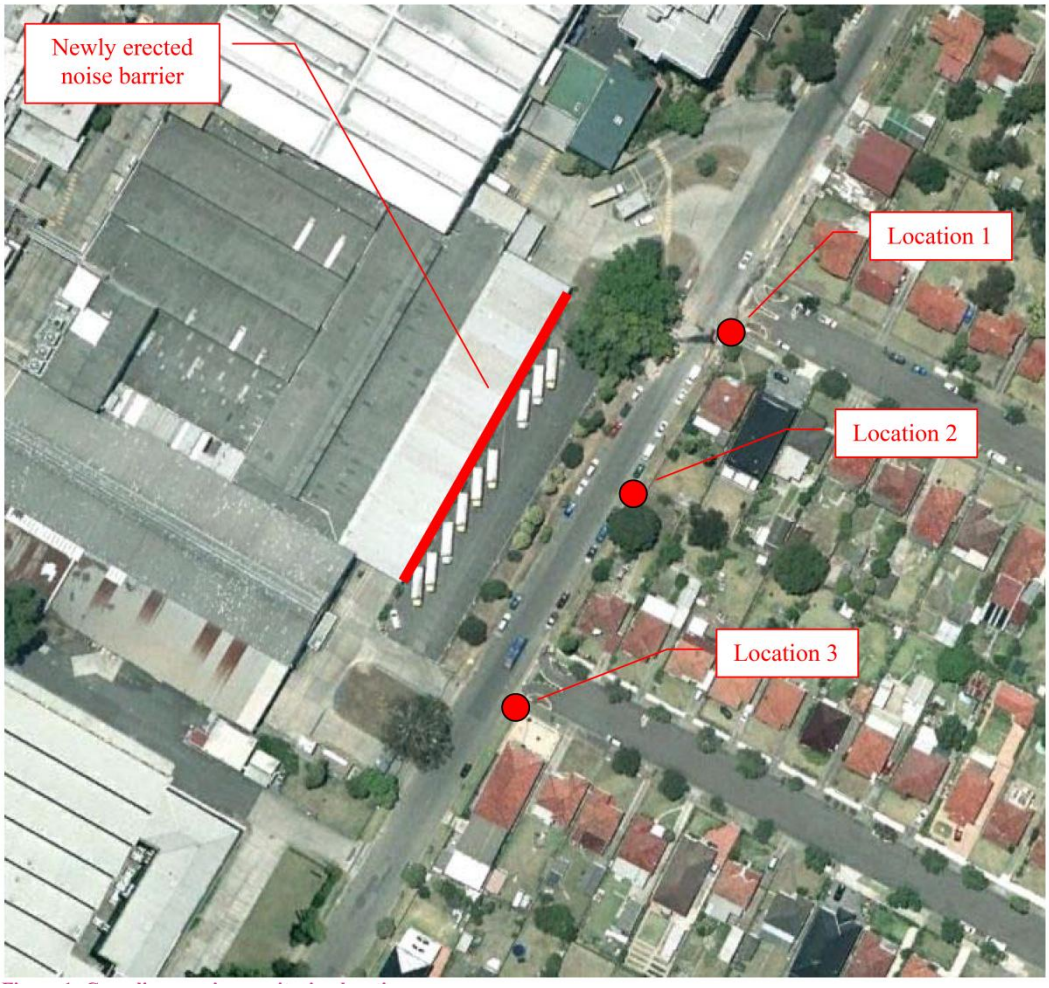


Figure 4 Compliance noise monitoring locations

Two sets of attended measurements were undertaken, one in the morning and one in the afternoon, in order to capture an accurate representation of operational activity. Expected operational activities such as loading and unloading, and truck deliveries were noted during the acoustic survey. It was confirmed with management of the brewery that operations were as per usual during the surveys conducted. It should be noted, however, that given the time of year, various operations were not at capacity due to reduced demand.

4.3.3 Results

Measured L_{Aeq} noise levels are presented in Table 6 for both the morning and afternoon measurements. These are compared against the predicted noise levels presented in Table 3. The predicted noise levels are based on modelling of the implemented mitigation measure when compared to previous baseline noise monitoring.

Table 6 Measured and predicted operational noise levels

Measurement Location	**Start**	**Duration (minutes)**	**Operational Noise Level (dBL_{Aeq})**	
			Measured	**Predicted**
1	8:09 AM	15	56	61-62
	3:23 PM	5	57	
2	8:40 AM	15	52	57
	3:14 PM	5	54	
3	9:18 AM	15	54	56-58
	2:53 PM	10	55	

4.3.4 Conclusions from implemented mitigation measures

Operational noise levels were measured to be lower than those predicted as part of the modelling undertaken for the noise mitigation assessment. The discrepancy is more likely to be due to the fact that the predicted noise levels were based on acoustic results for maximum operations (high demand / activity) compared to the compliance monitoring undertaken in Autumn (less demand / activity).

The measured noise levels are not necessarily representative of peak operations due to the time of year and corresponding demand in the market place. It is therefore recommended that predicted noise emission levels are adopted as the basis for criteria modification and a limit of 62dB L_{Aeq} is prescribed for noise levels at the boundary of 24 Nyrang Street.

5 Impact of WWTP on acoustic criteria

The recently approved (December 2011) Wastewater Treatment Plant (WWTP) on the Tooheys Brewery Site at Lidcombe was designed to the existing EPL limit (i.e. 50 dBA). The WWTP is located in the south west corner of the site and due to the location and shielding from buildings on site; the contribution to operational noise levels at residential receivers in Nyrang Street is insignificant. The most affected residence is currently predicted to experience noise levels of approximately 40 dBA from the WWTP. Current operational noise levels from other sources on site are in the order of 60 dBA. Therefore the WWTP is not likely to increase noise levels at sensitive receivers.

6 Summary

It has been demonstrated that the noise levels at the nearest sensitive receivers as a result of Tooheys Brewery operations were in the order of up to 63 dB L_{Aeq} during the daytime period. This is up to 13 dB in excess of the current EPL and Project Approval noise limits for the site. Since the implementation of the noise barrier above the loading dock there has been some reduction in the operational noise however even with the noise barrier there is still a 12 dB exceedance above the current noise limit for the site at the nearest sensitive receiver.

Tooheys Brewery has demonstrated that significant effort has been made to reduce operational noise emissions to the majority of residential receivers in Nyrang Street through the implementation of "feasible and reasonable" acoustic mitigation measures. The resultant noise levels from the Tooheys Brewery, with all "feasible and reasonable" mitigation measures, exceed the project-specific criteria from the INP.

In these circumstances, the INP states that the responsible authority may accept the resultant mitigated noise levels as the appropriate noise limits for a development, provided that the likely impact associated with the development is addressed.

Given that there have been no recent complaints about operational noise levels from Tooheys Brewery, adopting the resultant mitigated noise levels as licence conditions for Tooheys Brewery is unlikely to cause an adverse impact upon the surrounding community. The introduction of "feasible and reasonable" mitigation measures slightly reduced noise levels from the Tooheys Brewery site at the closest noise sensitive receivers compared to the existing levels.

It is therefore proposed that updated noise emission criteria be considered based on predicted mitigated noise levels (refer to section 4.2.1) shown comparatively with the approved criteria in Table 7.

Table 7 Approved and Proposed Noise Criteria

	Day	Evening	Night		Location
	$L_{Aeq\ (period)}$			$L_{A1\ (1\ Minute)}$ OR $L_{A\ max}$	
Approved	50	50	50	65	At any residence or other noise sensitive receiver
Proposed	62	62	62	65	At any residence or other noise sensitive receiver

Appendix A

Acoustic Audit Report

Tooheys Brewery

Tooheys Brewery Noise Criteria Assessment

Tooheys Brewery Noise Criteria Assessment

221616

Issue | July 2011

Arup
Arup Pty Ltd ABN 18 000 966 165

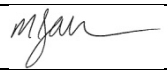
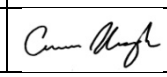
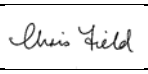
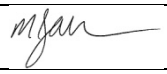
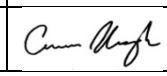
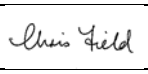
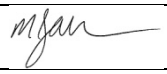
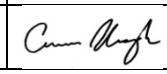
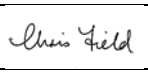
Arup
Level 10
201 Kent Street
Sydney
NSW 2000
Australia
www.arup.com

Job number 221616

ARUP

Document Verification

ARUP

Job title		Tooheys Brewery Noise Criteria Assessment		**Job number** 221616	
Document title		Tooheys Brewery Noise Criteria Assessment		**File reference**	
Document ref		221616			
Revision	**Date**	**Filename**	0001Noise Criteria Assessment Report_Draft 1.docx		
Draft 1	17/06/11	**Description**	First draft		
			Prepared by	Checked by	Approved by
		Name	Mitchell Allen	Cameron Hough	Chris Field
		Signature			
Draft 2	14/07/11	**Filename**	0002Noise Criteria Assessment Report_Draft 2.docx		
		Description	Second draft		
			Prepared by	Checked by	Approved by
		Name	Mitchell Allen	Cameron Hough	Chris Field
		Signature			
Issue	21/07/11	**Filename**	0003Noise Criteria Assessment Report.docx		
		Description	Issue		
			Prepared by	Checked by	Approved by
		Name	Mitchell Allen	Cameron Hough	Chris Field
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
			Issue Document Verification with Document		✓

Tooheys Brewery Noise Criteria Assessment

Contents

Tooheys Brewery Noise Criteria Assessment

1 Introduction

1.1 Background

The Tooheys Brewery in Lidcombe has been in operation since 1955 and has undergone several upgrades during this time. In July 2006, Tooheys received single site wide planning approval from the then NSW Department of Planning (DoP) under Part 3A of the Environmental Planning and Assessment (EP&A) Act, 1979. The approval was granted for the major upgrade of the brewery known as Project Key as well as a site wide approval for ongoing operations at the brewery.

Recent compliance measurements conducted by Arup[1] show that existing noise emission criteria prescribed to the site as detailed in Section 6 of Environmental Protection Licence (EPL) L1167 are not currently being met.

Based on site measurements and knowledge of the site from prior work with Tooheys, it is considered unlikely that Tooheys would be able to comply with the L1167 criteria except with significant operational disruption (i.e. closure of the Nyrang Street site entrance to heavy vehicles).

It is understood that Lion Nathan has not received noise complaints for the Tooheys Brewery Lidcombe site since approximately 2003. It is therefore probable that current noise levels from the Tooheys Brewery are not causing adverse noise impacts on residents even though they exceed the L1167 noise criteria.

Accordingly, negotiation of alternate noise criteria for the Tooheys Lidcombe site with the Department of Planning (DoP) and the Department of Environment, Climate Change and Water (DECCW) is recommended to result in updated noise emission objectives that are achievable for the Tooheys site while avoiding adverse noise impacts on surrounding residents.

1.2 Site Description

The Brewery is located at 29 Nyrang Street in Lidcombe. The site is bound on three sides by industrial premises and by Nyrang Street to the east. The nearest residential receivers are located immediately opposite the site entrance, across Nyrang Street.

Figure 1 presents an aerial view of the site in the context of its immediate surroundings along with the locations of main noise producing activities discussed further in following sections.

[1] Refer Arup Report *0004Compliance Noise Monitoring_FC_reissue_MJA*.

Tooheys Brewery Noise Criteria Assessment

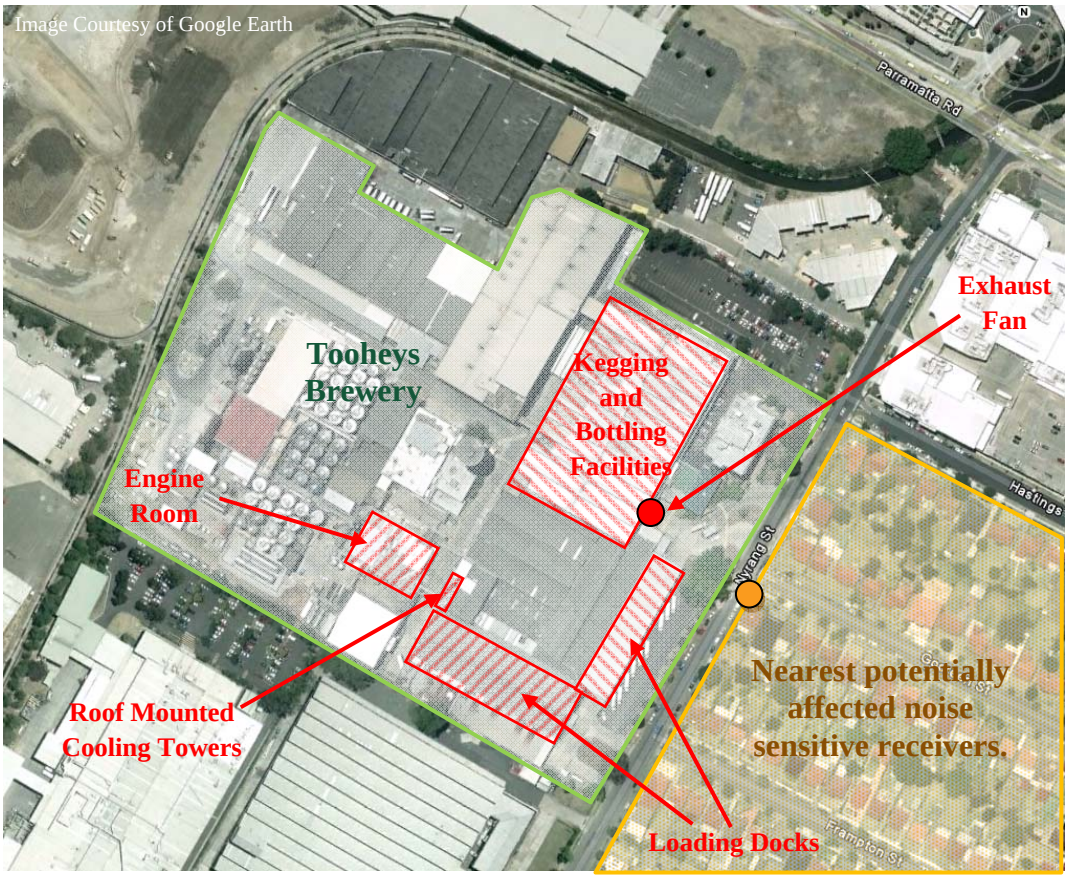


Figure 1 Aerial view of Tooheys Brewery and surroundings

Tooheys Brewery Noise Criteria Assessment

2 Noise Survey

2.1 Environmental Noise Survey

Figure 2 presents an aerial view of the site in the context of its greater surroundings. Attended and unattended noise monitoring locations are also depicted and are discussed further in the following sections.

Unattended Noise Logging
Attended Noise Measurement

Figure 2 Environmental Noise Survey Measurement Locations

2.1.1 Unattended Noise Logging

Two RTA Technology Type 1 Noise Loggers fitted with microphone windshields were deployed along Nyrang Street (identified in Figure 2) in order to quantify the prevailing ambient noise environment of the area both in the presence and absence of Tooheys operations.

Calibration of the loggers was checked prior to and following measurements using a Brüel & Kjær Electronic Calibrator Type 4231 with no significant drift in calibration being recorded. The sample time interval was set at 15 minutes and the time weighting function set to “Fast”.

Tooheys Brewery Noise Criteria Assessment

In addition to the noise loggers, a Davis Vantage Vue precision weather station was also set up at the monitoring location with no adverse weather conditions having been recorded.

Each noise logger was left to measure for at least seven consecutive days. A summary of measured noise metrics, processed in accordance with the DECCW Industrial Noise Policy (INP), is provided in Table 1. A full graphical representation of measured noise metrics is provided in Appendix B.

The noise logger installed at the corner of Gooreen and Nyrang Streets (Location 1) is considered to be representative of current operational noise levels associated with Tooheys being experienced at the nearest residential receiver.

The noise logger installed at the corner of Calool and Nyrang Streets (Location 2) is considered to be representative of the prevailing ambient noise level of the area in the absence of Tooheys operations.

Table 1 Unattended Measured Ambient Noise Levels

Logger Location	**Time Period**	**Rating Background Level (RBL) – dBA**	**L_{Aeq} (period) - dBA**
Location 1 – Gooreen Street	Day	53	64
	Evening	50	59
	Night	49	57
Location 2 – Calool Street	Day	45	60
	Evening	47	57
	Night	45	55

2.1.2 Attended Noise Measurements

To compliment unattended noise logger data and obtain a more comprehensive summary of the local noise environment, 15 minute attended noise measurements were also conducted at various locations along Nyrang Street (identified in Figure 2) including at each noise logger location. Recorded L_{A90} and L_{Aeq} noise spectra at each measurement location is summarised in Table 2 and Table 3.

Table 2 Attended $L_{A90(15minute)}$ Noise Measurements

Measurement Location	**Octave Band Centre Frequency (Hz)**								**Overall (dBA)**
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	
Cnr Calool and Nyrang Streets	58	60	56	50	47	44	39	32	49
Cnr Dewrang and Nyrang Streets	56	61	55	47	44	43	39	29	48
Nyrang Street north of Brewery	64	64	60	53	53	50	45	39	55
Cnr Elimatta and Nyrang Streets	55	57	50	43	41	41	37	32	45
Cnr Gooreen and Nyrang Streets	63	62	56	59	50	49	46	40	53

Tooheys Brewery Noise Criteria Assessment

Table 3 Attended $L_{Aeq(15minute)}$ Noise Measurements

Measurement Location	Octave Band Centre Frequency (Hz)								Overall (dBA)
	63	125	250	500	1k	2k	4k	8k	
Cnr Calool and Nyrang Streets	70	69	67	63	61	61	59	69	71
Cnr Dewrang and Nyrang Streets	63	68	63	58	56	59	55	46	62
Nyrang Street north of Brewery	70	72	68	60	60	59	56	51	63
Cnr Elimatta and Nyrang Streets	67	69	64	61	60	62	58	50	65
Cnr Gooreen and Nyrang Streets	66	70	62	56	56	56	54	48	61

Each measurement location was generally dominated by constant industrial noise sources from the various industry in the area as well as intermittent local traffic flows along Nyrang Street.

The northern end of Nyrang Street was influenced by road traffic noise from Parramatta Road and truck movements associated with *Air Road*. The southern end of Nyrang Street was occasionally influenced by rail activity along the distant railway lines.

Measurements conducted opposite Tooheys Brewery are dominated by industrial noise emissions from the site with occasional traffic along Nyrang Street.

2.2 Acoustic Site Survey

In order to quantify the contribution of specific items of plant to overall noise emissions from the site, extensive attended measurements were taken in close proximity to various noise sources (refer Figure 1). For reference, a summary of measured noise levels and spectra of significant site activities relevant to this study are presented in Appendix C.

Empirical calculations used in a previous study carried out by Arup for the Cogen facility[2] were used in order to input exhaust flue sound power data into acoustic modelling, since source measurements of the exhaust flue as-installed were not practical due to the source height. Sound power levels for all other significant items of plant were derived based on the measured spectra presented in Appendix C.

[2] Refer Arup Report *0004 EA_Final for Issue.*

Tooheys Brewery Noise Criteria Assessment

3 Noise Criteria

3.1 License L1167

Operational noise limits for Tooheys Brewery are given in Clause L6 of Environment Protection License 1167, and contain limits for noise at the site boundary of the nearest residential receiver as detailed below.

L6.1 Noise generated at the premises must not exceed the noise limits presented in the table below:

Location	At All Times $L_{Aeq(15\ minute)}$
Boundary of 24 Nyrang Street (opposite site entrance)	50 dBA

Noise from the premises is to be measured at the boundary of 24 Nyrang Street opposite site entrance to determine compliance with the $L_{Aeq(15\ minute)}$, noise limits in condition L6.1. Note: 5 dB (A) must be added to the measured level if noise is substantially tonal or impulsive in character.

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

24 Nyrang Street Lidcombe is located approximately 400 m to the south of the site – it is assumed that this is a mistake and the residence at 24 Gooreen Street, Lidcombe (which is directly opposite the Tooheys site entrance) is the intended measurement location.

3.2 Industrial Noise Policy

Noise logging measurement results presented in Table 1 have been processed in accordance with INP principles in order to set noise emission criteria based on the current prevailing ambient noise environment.

In order to more accurately determine appropriate amenity criteria, measured L_{Aeq} noise levels from the noise logger location 2 have been energetically subtracted from those measured at logger location 1. This is to better quantify industrial noise contribution alone to L_{Aeq} noise levels from Tooheys Brewery operations. Resultant adjusted L_{Aeq} noise levels are presented in Table 4.

Table 4 Calculated operational noise levels from Tooheys Brewery

Logger Location	Time Period	$L_{Aeq\ (period)}$ (dBA)
Location 1 – Gooreen Street	Day	62
	Evening	55
	Night	53

Tooheys Brewery Noise Criteria Assessment

The calculated contribution from the brewery has in turn been energetically subtracted from measured noise levels immediately opposite the site. Calculated L_{Aeq} ambient noise levels in the absence of Tooheys operations are presented in Table 5 and are used as the basis for determining amenity criteria listed in Table 6.

Table 5 Calculated ambient noise levels in the absence of Tooheys operations

Logger Location	**Time Period**	**$L_{Aeq\ (period)}$ (dBA)**
Location 1 – Gooreen Street	Day	60
	Evening	57
	Night	55

Attended $L_{Aeq(15\ minute)}$ noise measurements conducted within the site boundary aligning Nyrang Street are equal to those conducted during the same time period at the logger location in Gooreen Street (i.e. 60 dBA). Therefore, for the purpose of this assessment, the area type has been identified as falling under the "urban/industrial interface" category as defined by the INP since noise contribution from the facility has not been measured to have fallen by 5 dB.

Table 6 provides a synopsis of INP industrial noise emission criteria at the nearest noise sensitive receiver location.

Table 6 INP Noise Emission Criteria

Time Period	**Intrusive Noise Criteria $L_{Aeq\ (period)}$ - dBA**	**Amenity Noise Criteria $L_{Aeq\ (period)}$ - dBA**
Day	58	63
Evening	55	55
Night	54	50

Tooheys Brewery Noise Criteria Assessment

4 Noise Modelling

Assessment of industrial noise impacts was conducted using CONCAWE[3] noise propagation algorithms contained within the SoundPLAN noise modelling software suite.

The CONCAWE model was developed for conducting environmental noise predictions for noise from large industrial sites, and is commonly used for modelling environmental propagation of sound, including meteorological effects due to wind and/or temperature inversions, ground attenuation and atmospheric attenuation.

Wind rose information previously obtained for the site[4] was used for input into noise prediction settings. General site layout, ground topography was input into the model referencing drawings as provided by the client.

Resultant noise levels were calculated via the use of single point receiver locations aligning Nyrang Street residential boundaries.

4.1 Existing Industrial Noise Emissions

A table of current existing calculated noise levels at receiver locations is provided in Table 7. Receiver locations are organised from north to south along Nyrang Street. A colour noise contour map is also provided in Appendix D1 to illustrate paths of noise propagation.

Table 7 Resultant Noise Levels at Residential Receivers in Nyrang Street

Receiver Location	Resultant Noise Level (dBA)
Nyrang Street between Gooreen and Hastings Streets	60
Corner of Nyrang and Gooreen Streets (North)	**63**
Corner of Nyrang and Gooreen Streets (South)	**63**
Nyrang Street between Gooreen and Frampton Streets	62
Corner of Nyrang and Frampton Streets (North)	62
Corner of Nyrang and Frampton Streets (South)	61
Nyrang Street between Frampton and Elimatta Streets	58
Corner of Nyrang and Elimatta Streets	56

It can be seen from the data presented in Table 7 that industrial noise levels currently experienced at the corner of Gooreen and Nyrang Streets (highlighted in bold) is in the order of 13 dBA higher than the current license condition of 50 dBA. This modelled noise level is also consistent with attended and unattended noise levels presented in Table 3and Table 4 respectively.

[3] Manning, CJ (1981) – The Propagation of Noise from Petroleum and Petrochemical Complexes to Neighbouring Communities, Conservation of Clean Air, Water and the Environment (CONCAWE).

[4] http://www.arup.com.au/tooheys_lidcombe/files/Appendices/Appendix_F_Air_Quality.pdf

Tooheys Brewery Noise Criteria Assessment

4.2 Noise Mitigation Options

A review of the colour noise contour plot provided in Appendix D1 shows that noise levels experienced across Nyrang Street are predominantly governed by loading dock activity and truck movements at the site entry. Noise sources deeper within the site are sufficiently shielded by intervening warehouse buildings and noise emissions from within the Kegging and Bottling areas are comparatively below the contribution from forecourt activities.

Investigation was made into the acoustic benefits of installing a noise barrier along this boundary, taking into account access requirements. A summary of resultant mitigated and unmitigated noise levels at receiver locations under the scenario of a 2.5 m and a 4 m high noise barrier is provided in Table 7. A noise wall above 4 m in height is not considered feasible due to structural considerations. A colour noise contour map of each is also provided in Appendix D2 and D3 respectively.

Table 8 Resultant Noise Levels at Residential Receivers in Nyrang Street

Receiver Location	**Resultant Noise Level (dBA)**		
	Unmitigated	**2.5 m Barrier**	**4 m Barrier**
Nyrang Street between Gooreen and Hastings Streets	60	60	60
Corner of Nyrang and Gooreen Streets (North)	**63**	**62**	**59**
Corner of Nyrang and Gooreen Streets (South)	**63**	**61**	**57**
Nyrang Street between Gooreen and Frampton Streets	62	56	53
Corner of Nyrang and Frampton Streets (North)	62	56	52
Corner of Nyrang and Frampton Streets (South)	61	58	54
Nyrang Street between Frampton and Elimatta Streets	58	58	57
Corner of Nyrang and Elimatta Streets	56	56	56

Depending on the barrier height, attenuation of up to 9 dBA is afforded at some residential receiver locations. Unfortunately, due to limitations with being unable to extend the barrier along the entire length of the site boundary, noise levels at residential receivers between Gooreen and Hastings Streets and Frampton and Elimatta Streets remain largely unchanged.

Further potential mitigation options considered are as follows:

- **Extraction Fan and Loading Dock Canopies –** Calculations were made of the effects of applying an absorptive finish to the insides of loading dock roofs as well as attenuating the Kegging Hall extraction fan. In both cases, no significant reduction in overall industrial noise emission level was achieved.
- **Bottling Hall –** There was no measured difference at the site boundary when the roller shutter door to the bottling hall was open or closed. This potentially indicates that either the contribution from the bottling hall is significantly below that of other noise sources or that the existing roller shutter door is not providing any attenuation to bottling hall noise.

  Whilst on site, it was noted that the current existing roller shutter door had holes in between broken sections of Perspex covering. It is recommended that

Tooheys Brewery Noise Criteria Assessment

the roller shutter door be replaced with a more solid construction and be kept closed if possible.

- **Kegging Hall –** General operational measures are in place for the loading and unloading of kegs from to and from trucks within the Kegging Hall such as the use of sand bags and rubber mats to mitigate noise. It is difficult to police and ensure use of these noise mitigation measures.

  In the interest of preserving noise amenity of nearby residential receivers as much as possible, it is recommended that this be enforced more closely. It may be appropriate to erect operational signage in clearly visible locations, reinforcing the message.

Tooheys Brewery Noise Criteria Assessment

5 Discussion and Recommendations

It has been demonstrated that current industrial noise emissions from Tooheys Brewery operations are in the order of up to 62 dB L_{Aeq} at the nearest residential receivers in Nyrang Street during the daytime period. This is up to 12 dB in excess of the current licence for the site of 50 dBA.

During the evening and night-time periods, this noise level drops to 55 dBA and 53 dBA respectively. This is still a minimum of 3 dB in excess of the current noise criteria prescribed for the site.

Further, a comparison of ambient noise levels at residential receivers near to Tooheys Brewery and those remote from the site to the south on Nyrang Street, reveals a similar ambient noise environment in the order of up to 60 dBA during the daytime period.

Various mitigation measures have been investigated including the installation of a noise barrier along the Nyrang Street site boundary. Due to site access requirements and the influence of trucks entering and exiting the site, industrial noise levels directly opposite the site entrance remain in the order of 60 dBA.

It is recommended that a detailed investigation into feasibility and reasonableness of installation of a noise barrier be conducted in the context of the following:

- Overall cost of installation and maintenance
- Requirements for lighting and associated impacts on residences
- Potential implications with respect to vandalism
- Number of receivers that benefit
- Relative reduction to existing noise levels

As general good practice, it is recommended that the proposed repair to Bottling Hall roller shutter door and enforcement of rubber matting or sandbags within the Kegging Hall be implemented. It is difficult to quantify the noise reduction provided by these measures, however, and they will only benefit residential receiver locations directly opposite the site entrance.

The INP provides a framework for determining appropriate noise criteria for developments. *Figure 1.1* of the INP provides an overview of the main processes involved in its application. A copy of the flow chart is provided in Figure 3 for reference:

Tooheys Brewery Noise Criteria Assessment

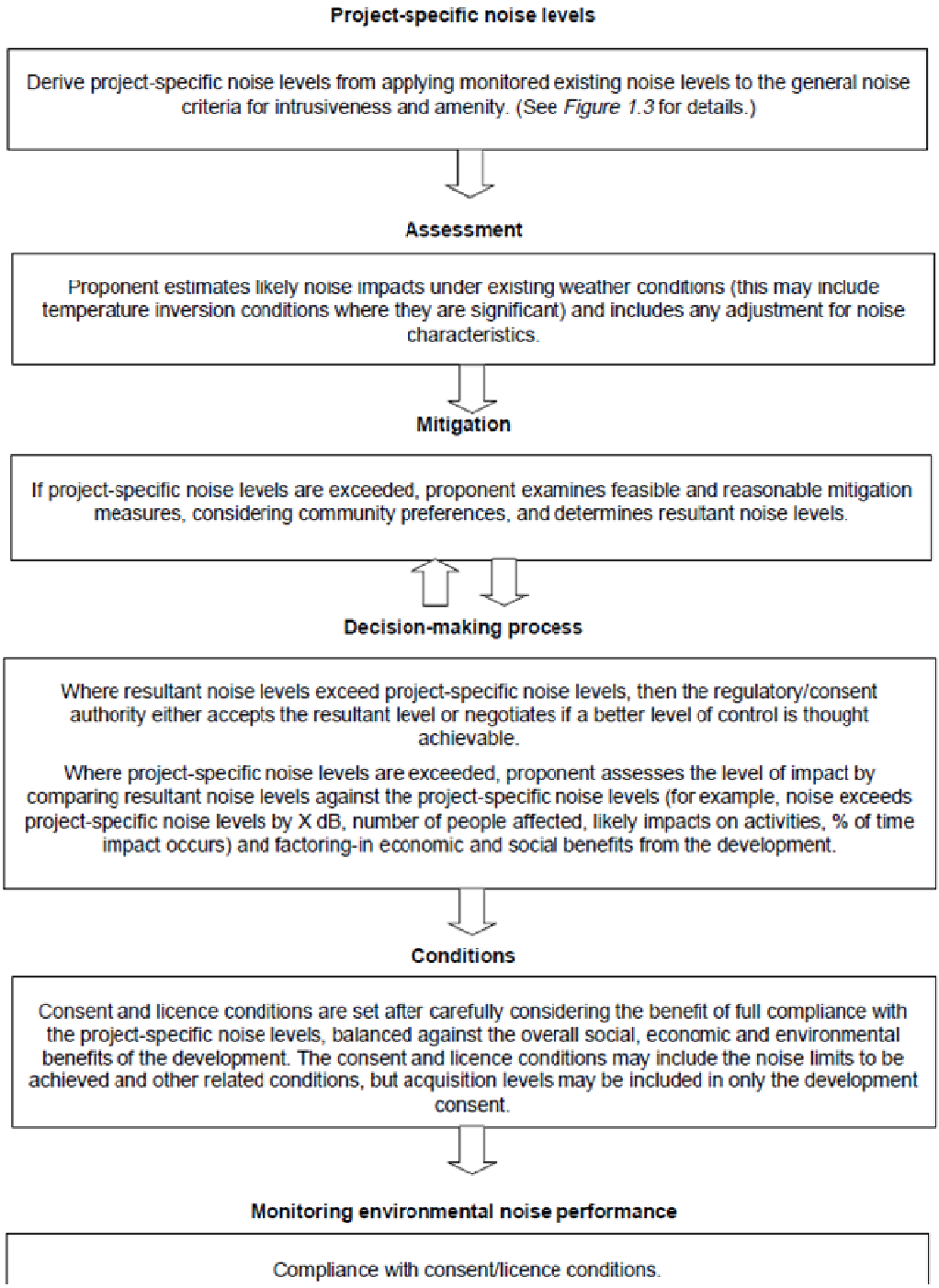


Figure 3 Excerpt from INP (Figure 1.1) describing how to apply the policy

This assessment has followed the process in order to determine possible mitigation options and their acoustic benefits. Further investigation is required in order to determine whether a noise barrier is deemed to be a “feasible or reasonable” mitigation measure in this instance.

Tooheys Brewery Noise Criteria Assessment

Resultant noise levels from the Tooheys Brewery with all “feasible and reasonable” mitigation measures exceed the project-specific criteria from the INP.

In these circumstances, the INP states that the responsible authority may accept the resultant mitigated noise levels as the appropriate noise limits for a development, provided that the likely impact associated with the development is addressed.

Given the history of there being no recent complaints about operational noise levels from Tooheys Brewery, adopting the resultant mitigated noise levels as licence conditions for Tooheys Brewery is unlikely to cause an adverse impact upon the surrounding community. Indeed, the introduction of “feasible and reasonable” mitigation measures will reduce noise levels from the Tooheys Brewery site at the closest noise-sensitive receivers compared to the existing levels.

It is recommended that, subsequent to all mitigation measures identified as reasonable and feasible being implemented, OEH adopts the “resultant levels” as the licence criteria for Tooheys Brewery.

Tooheys Brewery Noise Criteria Assessment

Appendix A

Glossary

Tooheys Brewery Noise Criteria Assessment

Decibel (dB)

The ratio of sound pressures which we can hear is a ratio of 10^6:1 (one million : one). For convenience, therefore, a logarithmic measurement scale is used. The resulting parameter is called the 'sound level' (L) and the associated measurement unit is the decibel (dB). As the decibel is a logarithmic ratio, the laws of logarithmic addition and subtraction apply. Some typical noise levels are given below:

Noise Level dB(A)	Example
130	Threshold of pain
120	Jet aircraft take-off at 100 m
110	Chain saw at 1 m
100	Inside disco
90	Heavy trucks at 5 m
80	Kerbside of busy street
70	Loud radio (in typical domestic room)
60	Office or restaurant
50	Domestic fan heater at 1m
40	Living room
30	Theatre
20	Remote countryside on still night
10	Sound insulated test chamber
0	Threshold of hearing

'A'-Weighted Sound Level dB(A)

The unit generally used for measuring environmental, traffic or industrial noise is the A-weighted sound pressure level in decibels, denoted dB(A). An A-weighting network can be built into a sound level measuring instrument such that sound levels in dB(A) can be read directly from a meter. The weighting is based on the frequency response of the human ear and has been found to correlate well with human subjective reactions to various sounds. An increase or decrease of approximately 10 dB corresponds to a subjective doubling or halving of the loudness of a noise. A change of 2 to 3 dB is subjectively barely perceptible.

Sound Power and Sound Pressure

The sound power level (L_w) of a source is a measure of the total acoustic power radiated by a source. The sound pressure level (L_p) varies as a function of distance from a source. However, the sound power level is an intrinsic characteristic of a source (analogous to its mass), which is not affected by the environment within which the source is located.

Tooheys Brewery Noise Criteria Assessment

Frequency

The rate of repetition of a sound wave. The subjective equivalent in music is pitch. The unit of frequency is the Hertz (Hz), which is identical to cycles per second. A thousand hertz is often denoted kilohertz (kHz), eg 2 kHz = 2000 Hz. Human hearing ranges from approximately 20 Hz to 20 kHz. The most commonly used frequency bands are octave bands, in which the mid frequency of each band is twice that of the band below it. For design purposes, the octave bands between 63 Hz to 8 kHz are generally used. For more detailed analysis, each octave band may be split into three one-third octave bands or, in some cases, narrow frequency bands.

Equivalent Continuous Sound Level (L_{Aeq})

Another index for assessment for overall noise exposure is the equivalent continuous sound level, L_{eq}. This is a notional steady level, which would, over a given period of time, deliver the same sound energy as the actual time-varying sound over the same period. Hence fluctuating levels can be described in terms of a single figure level.

Statistical Noise Levels

For levels of noise that vary widely with time, for example road traffic noise, it is necessary to employ an index that allows for this variation. 'A'-weighted statistical noise levels are denoted L_{A10}, dBL_{A90} etc. The reference time period (T) is normally included, eg. dBL_{A10}, 5min or dBL_{A90}, 8hr.

$L_{A90, T}$

Refers to the sound pressure level measured in dB(A), exceeded for 90% of the time interval (T) –i.e. measured noise levels were greater than this value for 90% of the time interval. This is also often referred to the background noise level.

$L_{A10, T}$

Refers to the sound pressure level measured in dB(A), exceeded for 10% of the time interval (T). This is often referred to as the average maximum noise level and is frequently used to describe traffic noise.

$L_{A10, 1 hr}$

For traffic noise, L_{A10} (1hr) is the highest hourly LA10 noise level measured over each day of a measurement period. L_{A10} (1hr) is the average maximum noise level resulting from the "worst hour" of the traffic flow.

$L_{A10, 18 hr}$

L_{A10} (18hr) refers to the arithmetic average of the eighteen 1-hour LA10 traffic noise levels over the time period from 6:00 am to midnight. L_{A10} (18hr) is representative of the average maximum traffic noise level from each day of measurements.

Tooheys Brewery Noise Criteria Assessment

$L_{A1, T}$

Refers to the sound pressure level measured in dB(A), exceeded for 1% of the time interval (T). This is often used to represent the maximum noise level from a period of measurement.

Assessment Background Level (ABL)

A single-number figure used to characterise the background noise levels from a single day of a noise survey. ABL is derived from the measured noise levels for the day, evening or night time period of a single day of background measurements. The ABL is calculated to be the tenth percentile of the background LA90 noise levels – i.e. the measured background noise is above the ABL 90% of the time.

Rating Background Level (RBL)

A single-number figure used to characterise the background noise levels from a complete noise survey. The RBL for a day, evening or night time period for the overall survey is calculated from the individual Assessment Background Levels (ABL) for each day of the measurement period, and is numerically equal to the median (middle value) of the ABL values for the days in the noise survey.

Tooheys Brewery Noise Criteria Assessment

Appendix B

Unattended Noise Survey Data

Tooheys Brewery Noise Criteria Assessment

B1 Noise Logger Location 1 – 31 Nyrang Street, Lidcombe (cnr Gooreen Street)

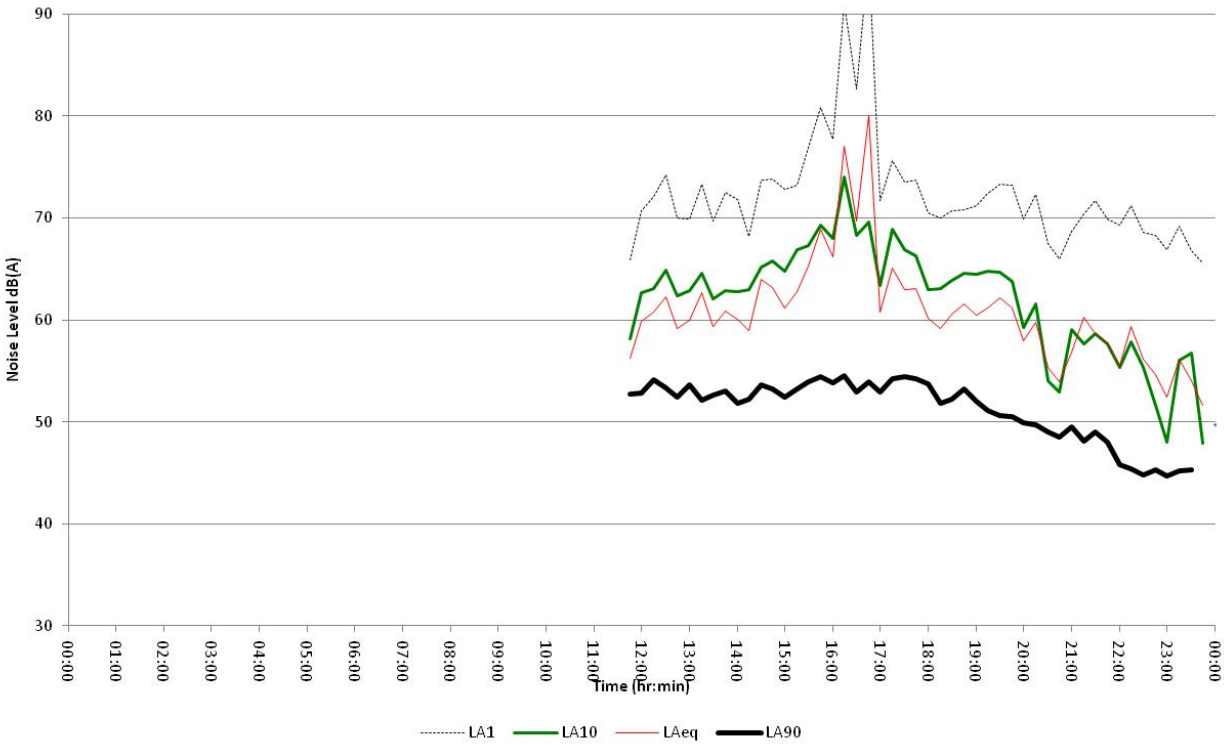


Figure 4 Measured Noise Levels – Logger Location 1 – Friday 15 April 2011, dB re 20 µPa.

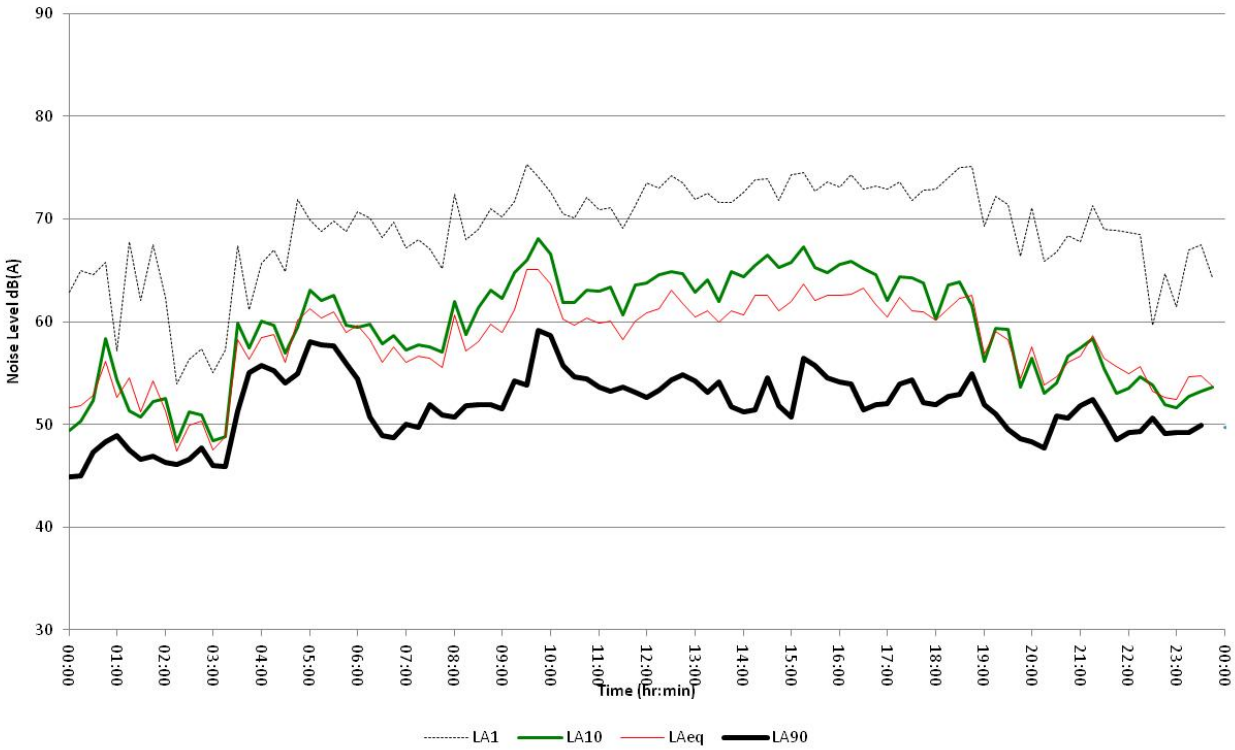


Figure 5 Measured Noise Levels – Logger Location 1 – Saturday 16 April 2011, dB re 20 µPa.

Tooheys Brewery Noise Criteria Assessment

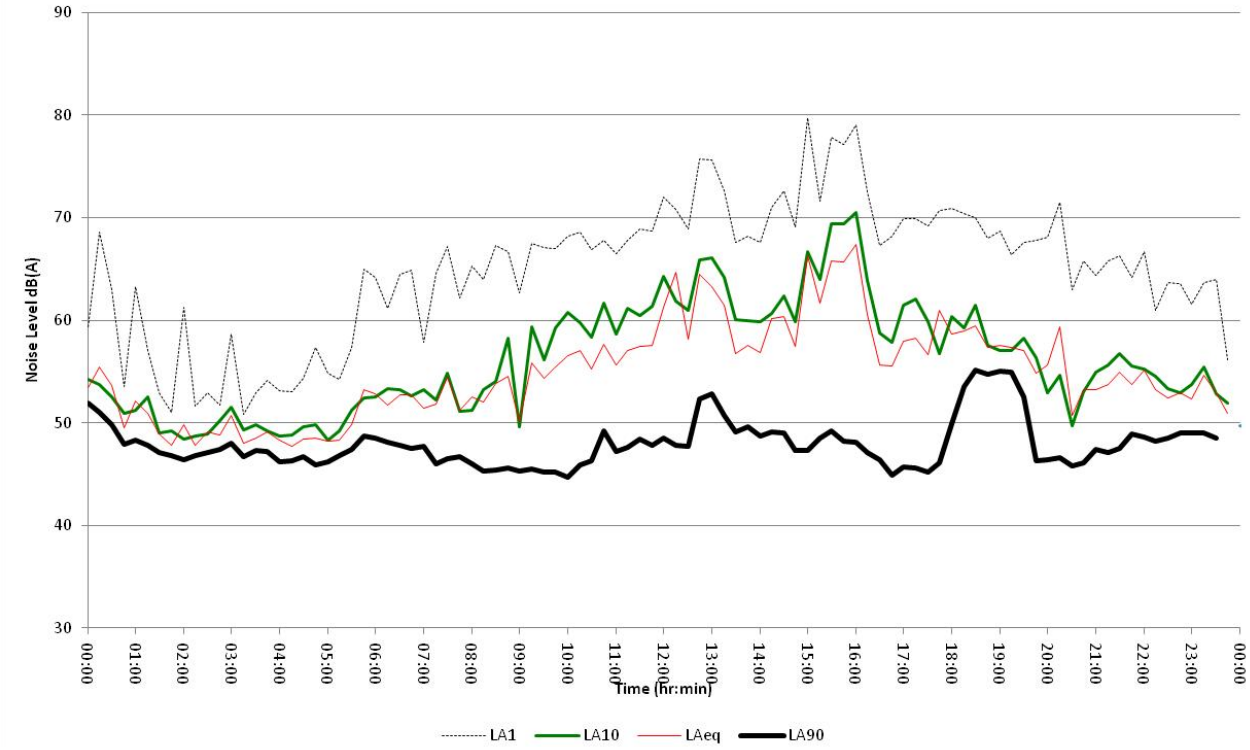


Figure 6 Measured Noise Levels – Logger Location 1 – Sunday 17 April 2011, dB re 20 µPa.

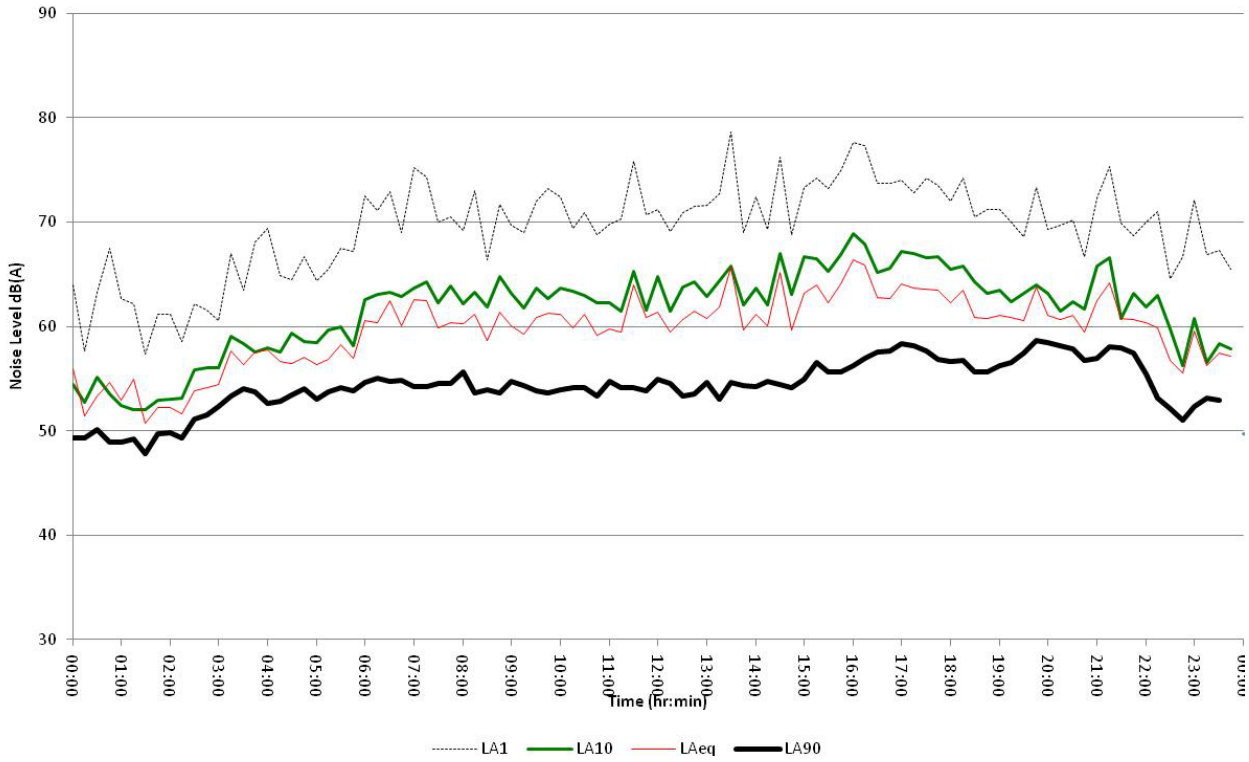


Figure 7 Measured Noise Levels – Logger Location 1 – Monday 18 April 2011, dB re 20 µPa.

Tooheys Brewery Noise Criteria Assessment

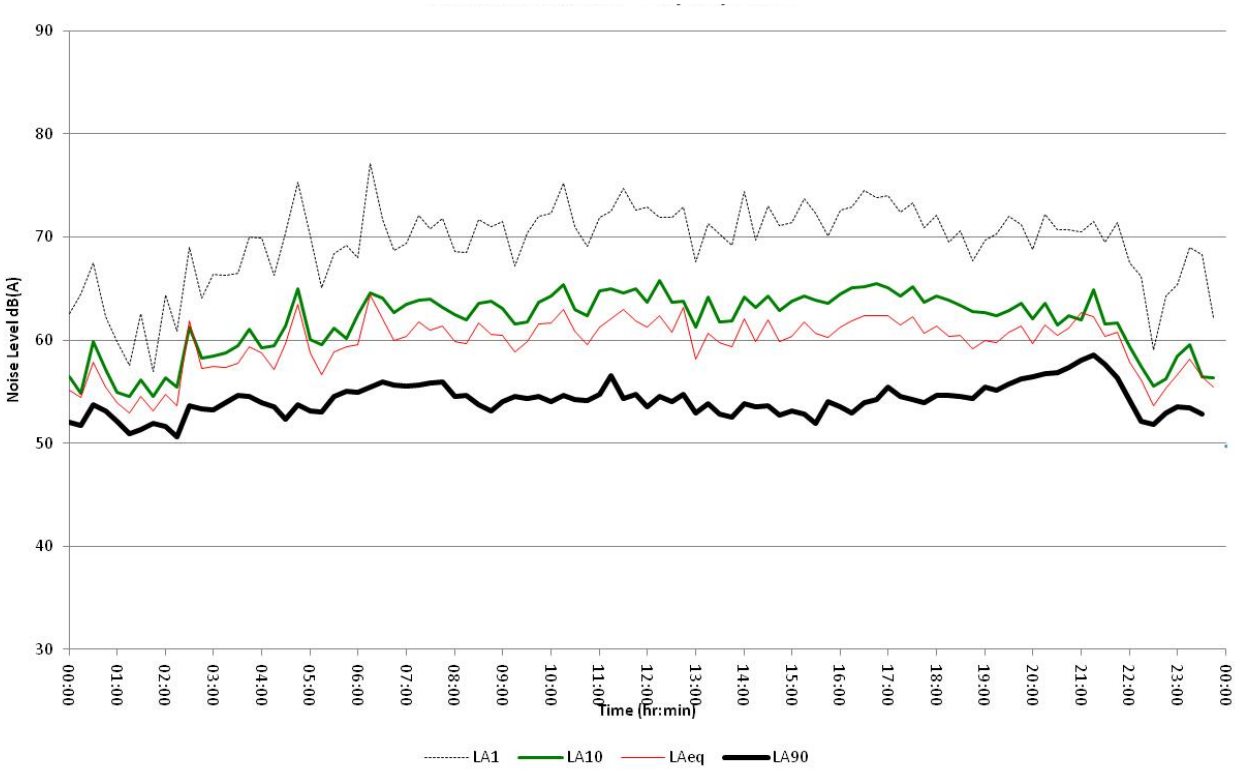


Figure 8 Measured Noise Levels – Logger Location 1 – Tuesday 19 April 2011, dB re 20 µPa.

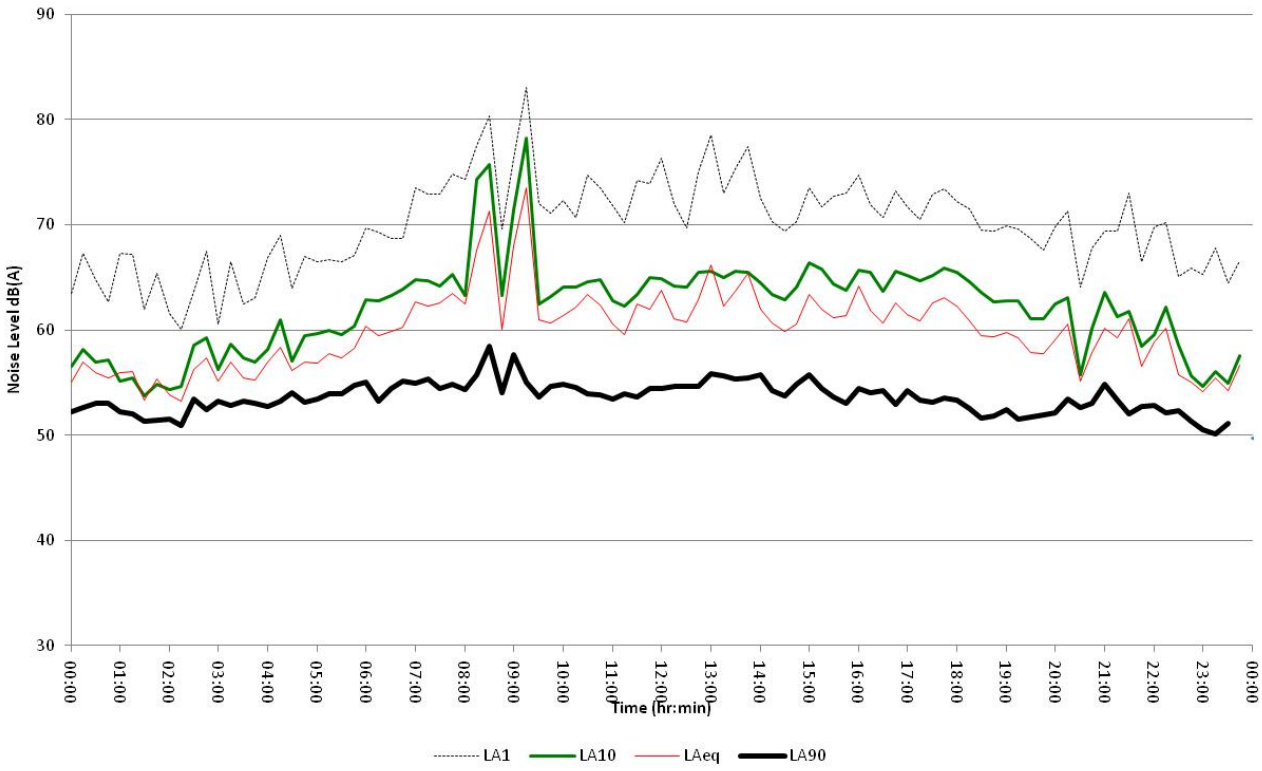


Figure 9 Measured Noise Levels – Logger Location 1 – Wednesday 20 April 2011, dB re 20 µPa.

Tooheys Brewery Noise Criteria Assessment

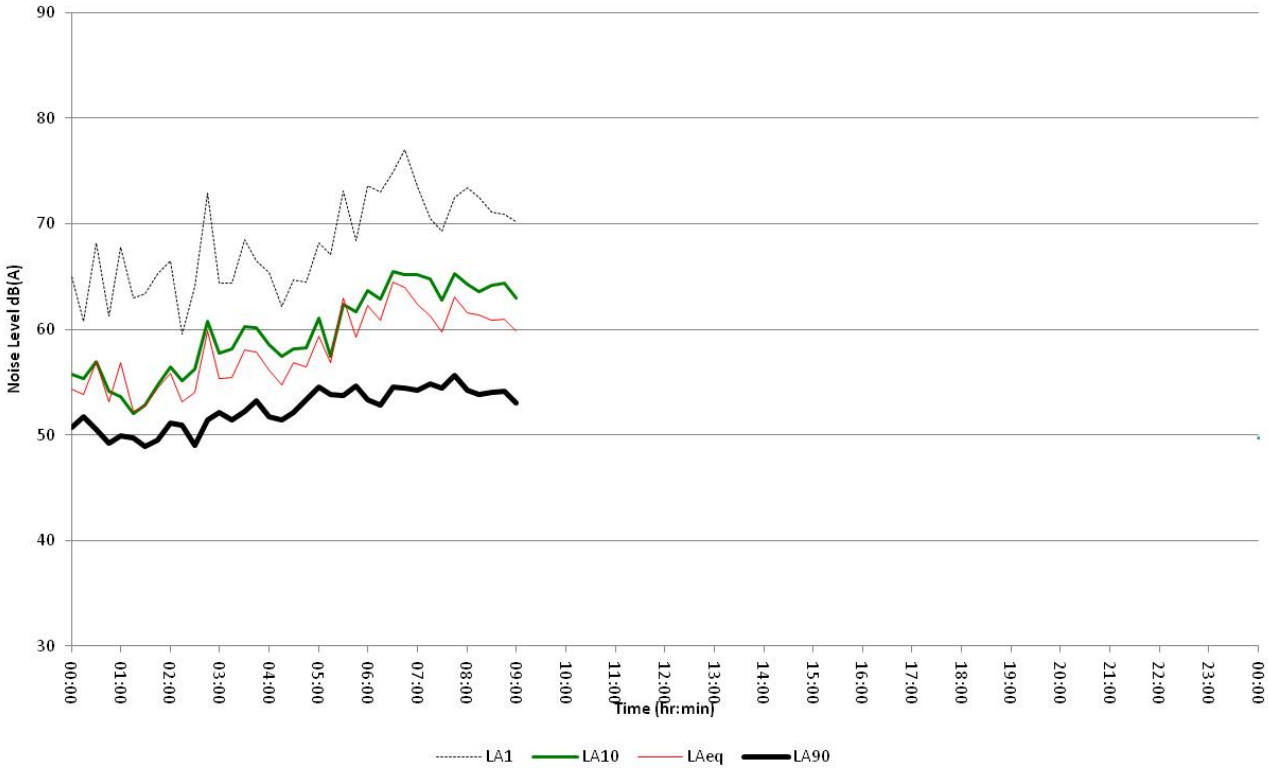


Figure 10 Measured Noise Levels – Logger Location 1 – Thursday 21 April 2011, dB re 20 µPa.

Tooheys Brewery Noise Criteria Assessment

B2 Noise Logger Location 2 – 34 Calool Street, Lidcombe (cnr Nyrang Street)

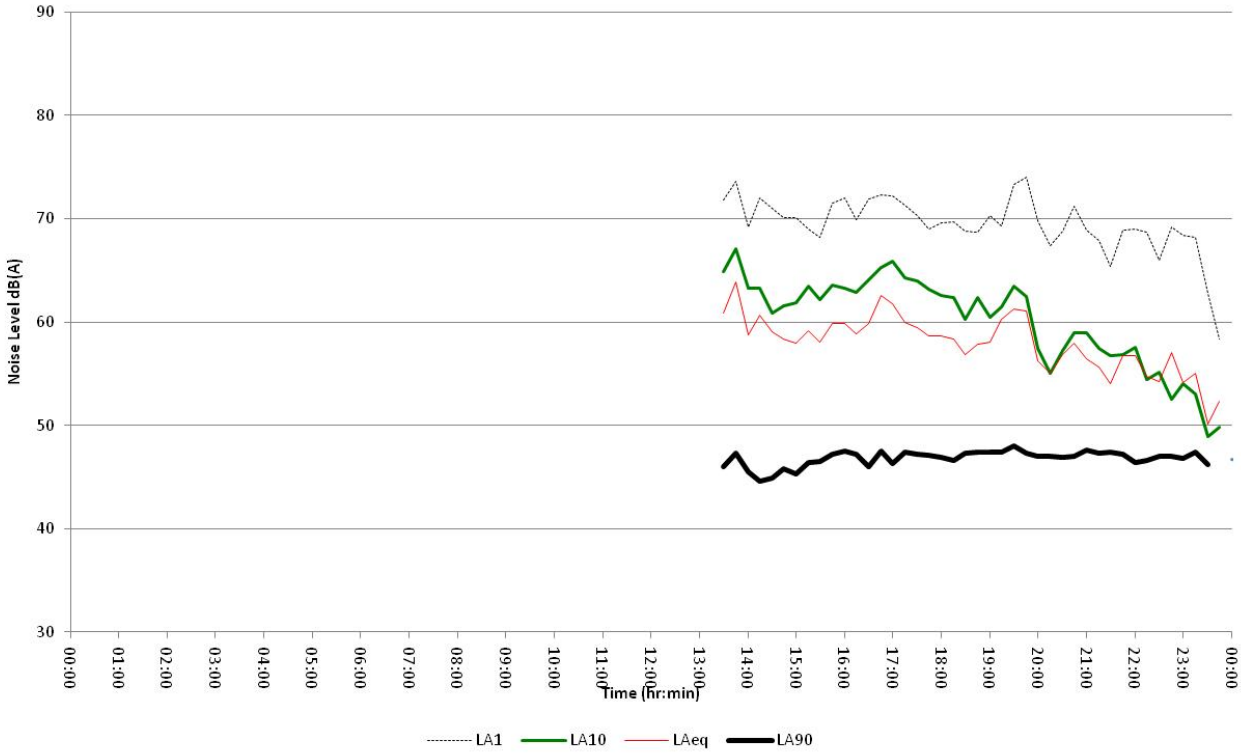


Figure 11 Measured Noise Levels – Logger Location 2 – Tuesday 3 May 2011, dB re 20 µPa.

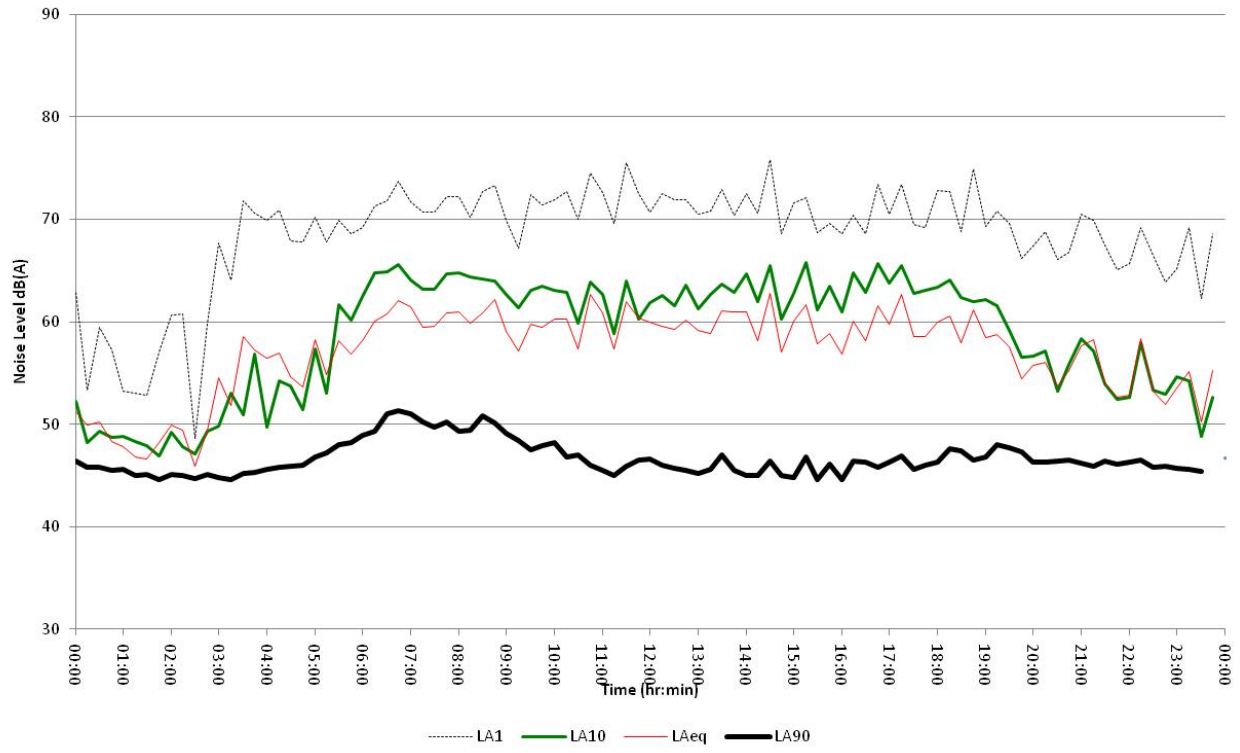


Figure 12 Measured Noise Levels – Logger Location 2 – Wednesday 4 May 2011, dB re 20 µPa.

Tooheys Brewery Noise Criteria Assessment

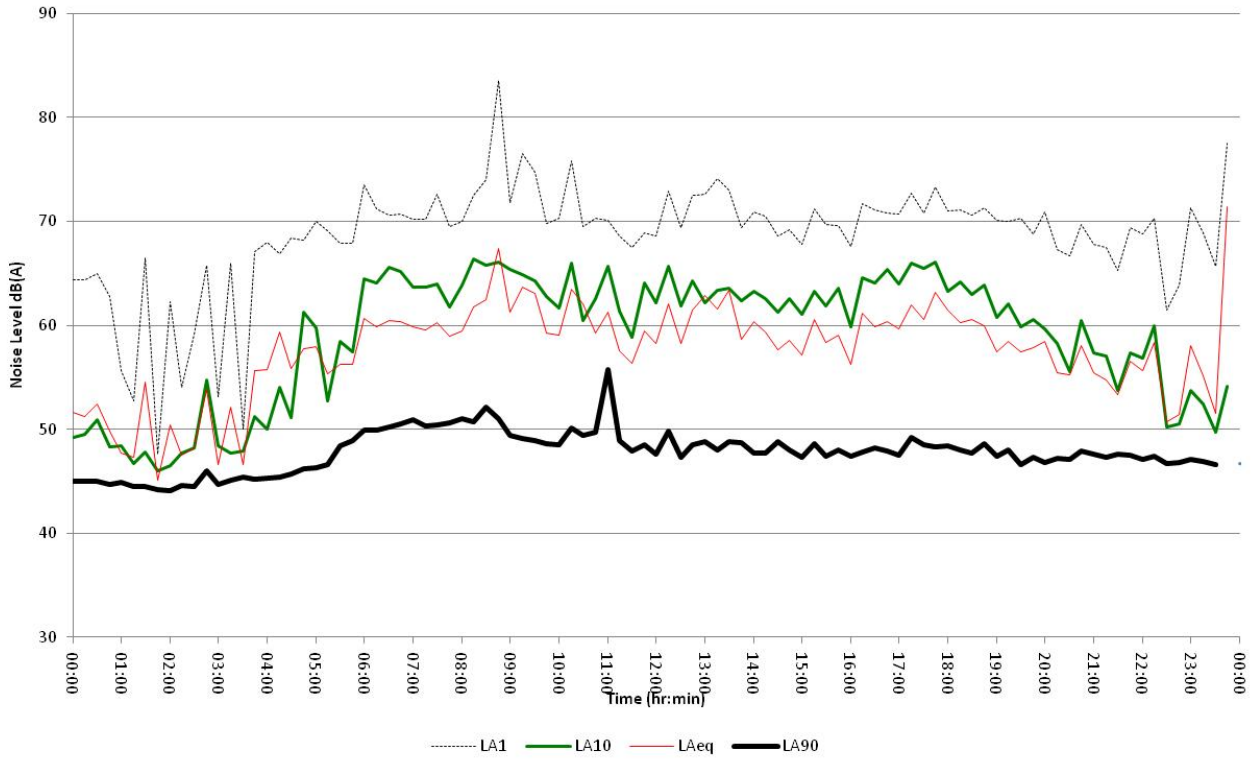


Figure 13 Measured Noise Levels – Logger Location 2 – Thursday 5 May 2011, dB re 20 µPa.

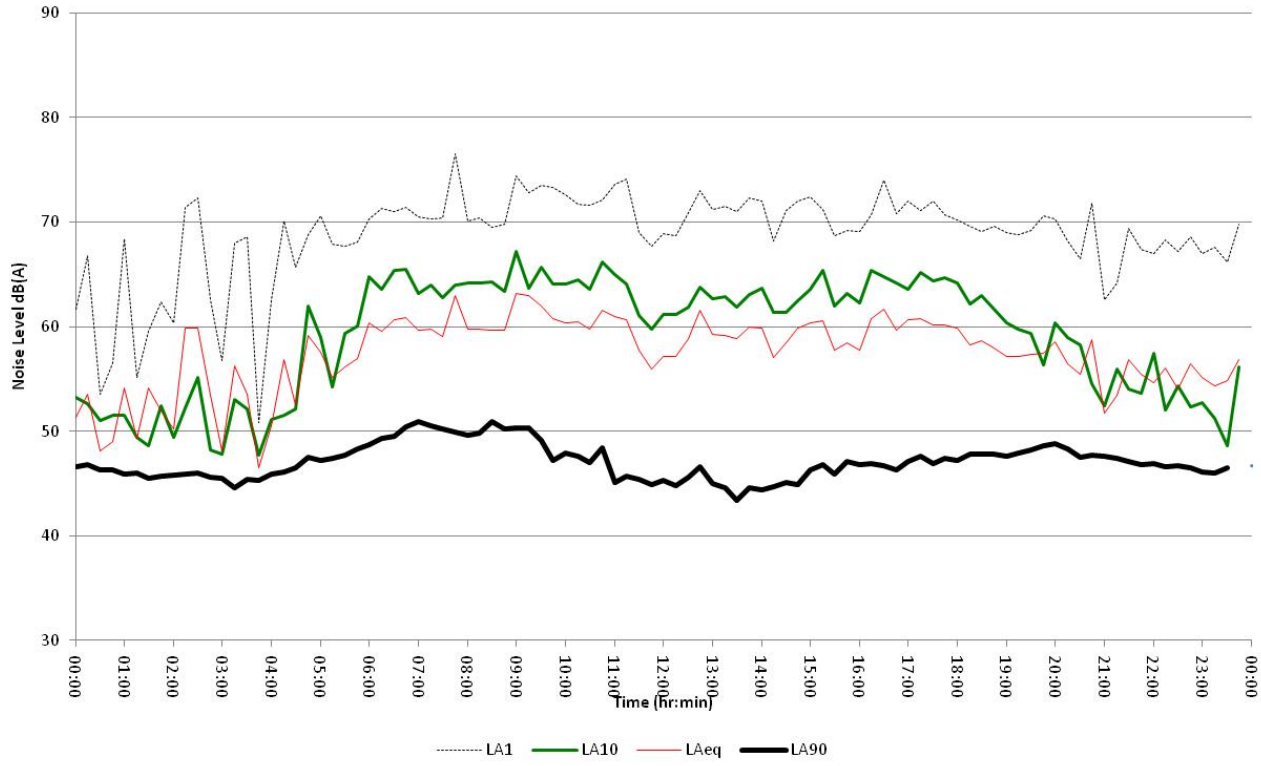


Figure 14 Measured Noise Levels – Logger Location 2 – Friday 6 May 2011, dB re 20 µPa.

Tooheys Brewery Noise Criteria Assessment

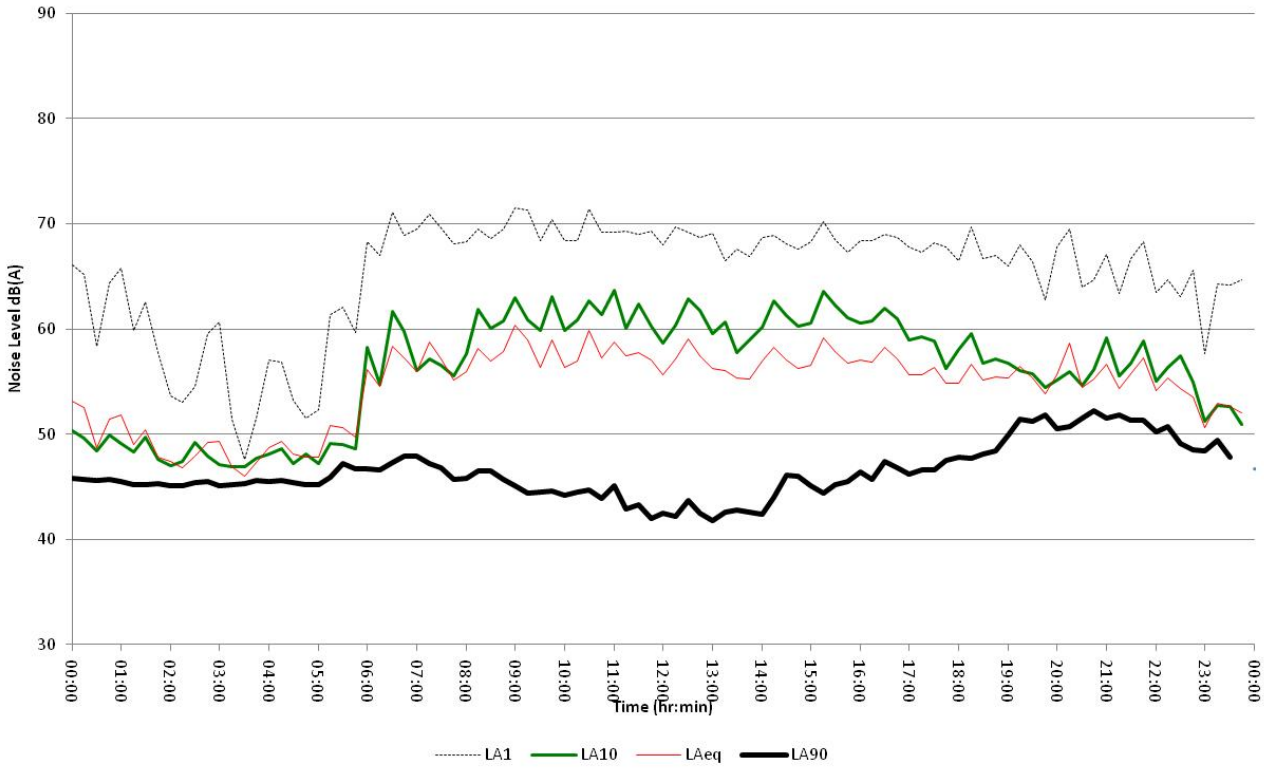


Figure 15 Measured Noise Levels – Logger Location 2 – Saturday 7 May 2011, dB re 20 µPa.

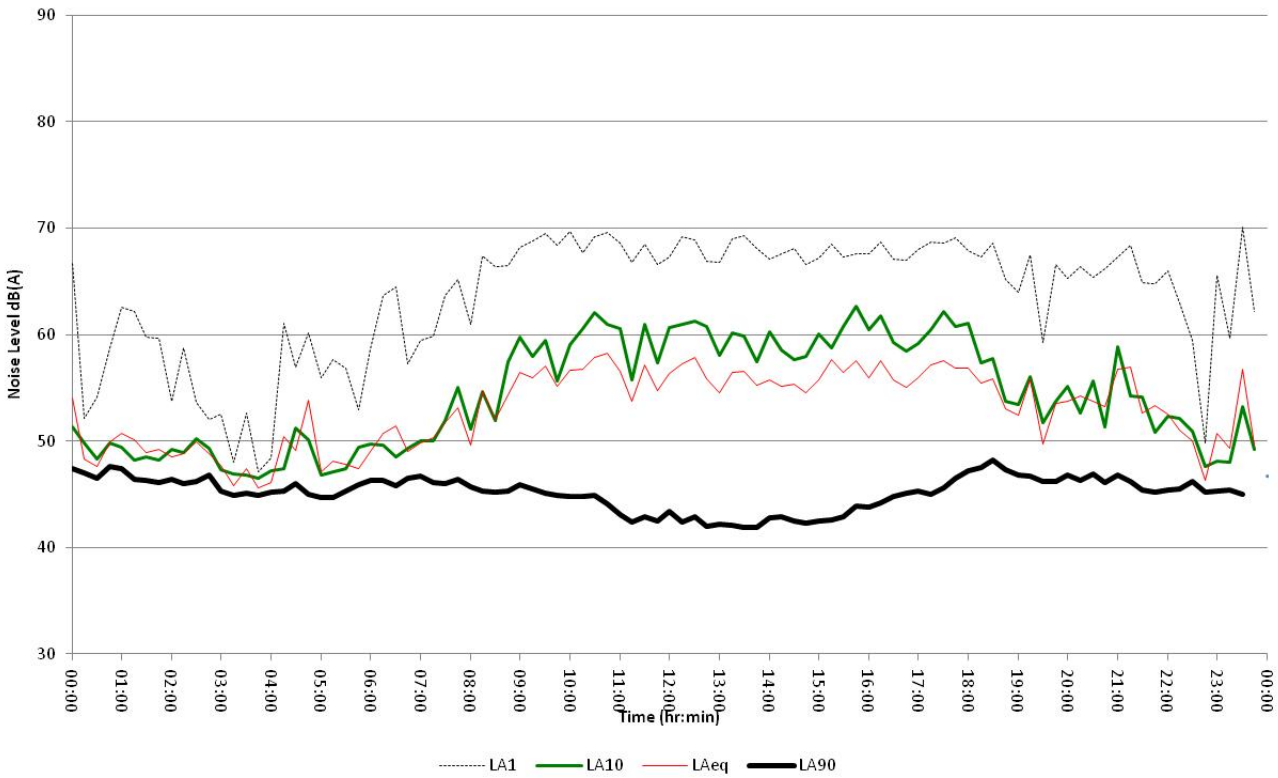


Figure 16 Measured Noise Levels – Logger Location 2 – Sunday 8 May 2011, dB re 20 µPa.

Tooheys Brewery Noise Criteria Assessment

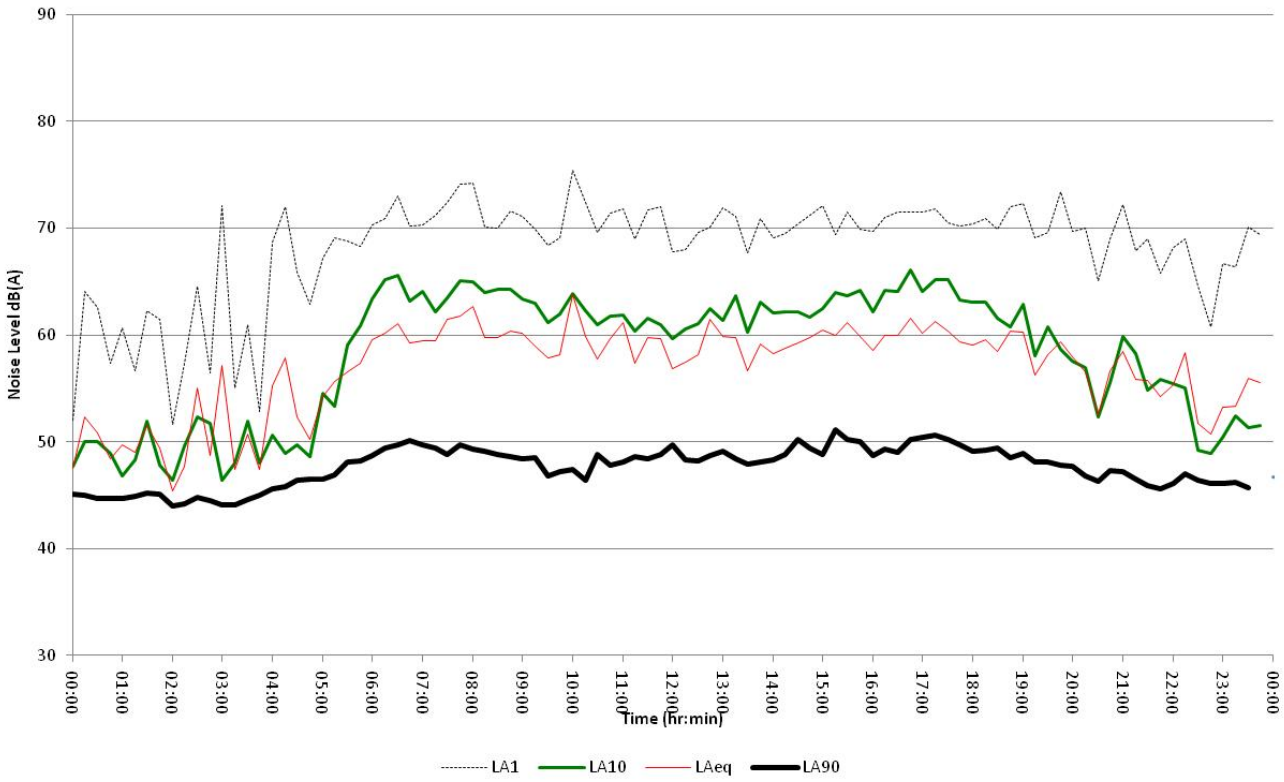


Figure 17 Measured Noise Levels – Logger Location 2 – Monday 9 May 2011, dB re 20 µPa.

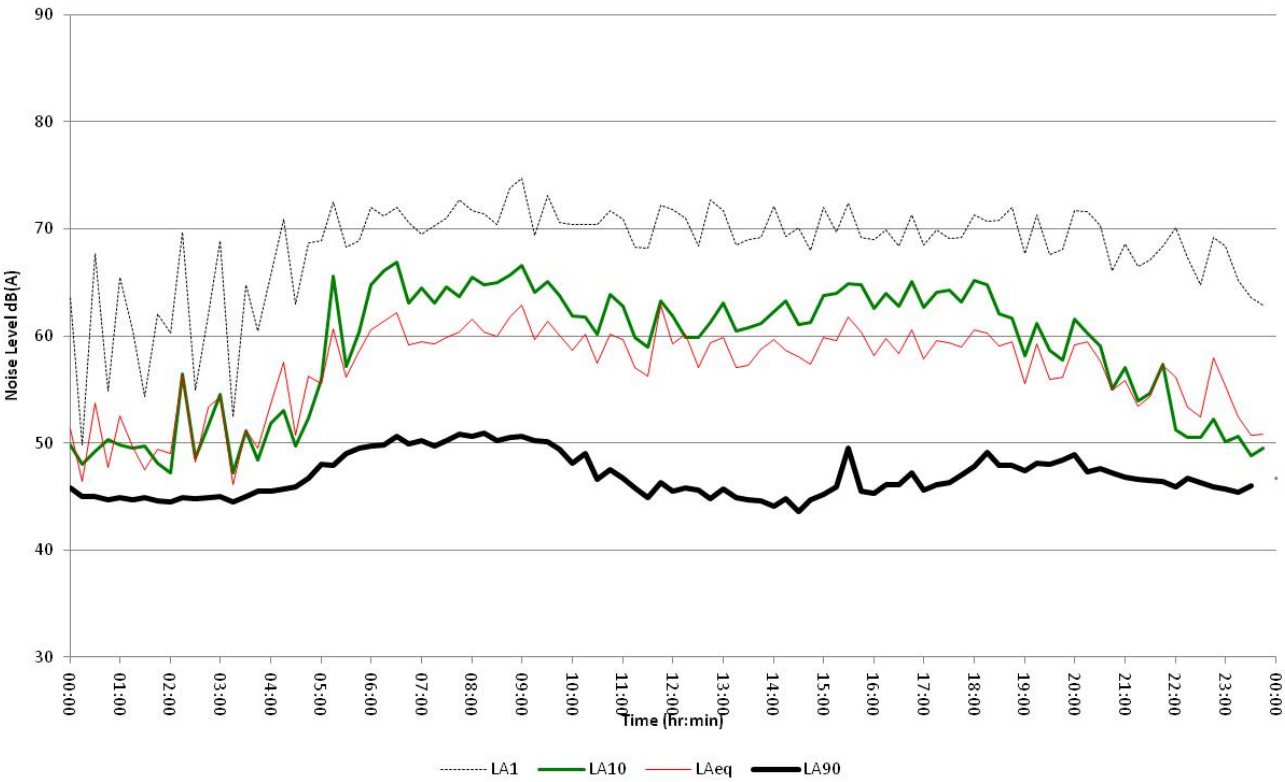


Figure 18 Measured Noise Levels – Logger Location 2 – Tuesday 10 May 2011, dB re 20 µPa.

Tooheys Brewery Noise Criteria Assessment

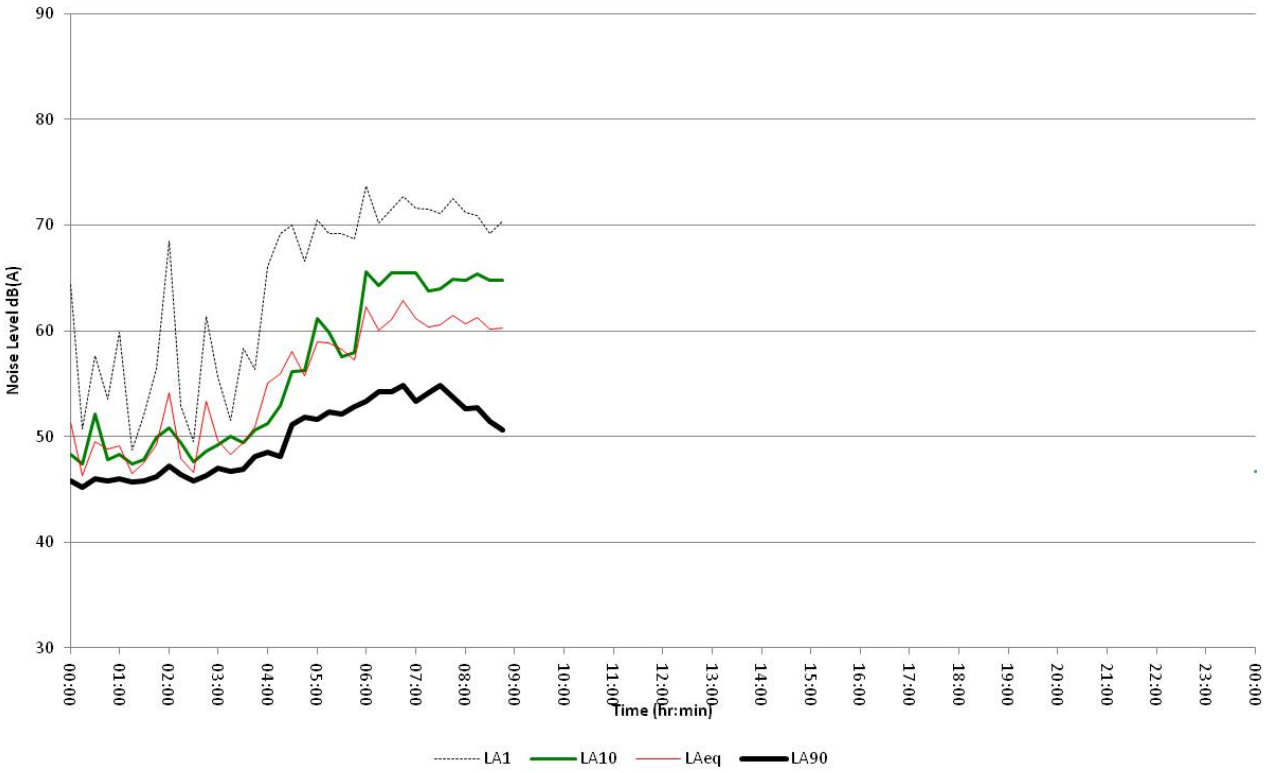


Figure 19 Measured Noise Levels – Logger Location 2 – Wednesday 11 May 2011, dB re 20 µPa.

Tooheys Brewery Noise Criteria Assessment

Appendix C

Attended Noise Survey Data

Tooheys Brewery Noise Criteria Assessment

Table 9 On-Site Attended L_{Aeq} Noise Measurements

Measurement Description	Approximate Measurement Distance	Octave Band Centre Frequency (Hz)								Overall (dBA)
		63	125	250	500	1k	2k	4k	8k	
Loading/Unloading Activity	4m	75	68	69	93	69	68	64	58	75
B-Double Truck	Idling @ 1m	77	78	77	80	80	77	68	57	84
	Slow passby @ 1m (closest point)	75	78	69	74	73	70	63	54	77
	Truck Entering Site @ 1m (closest point)	76	75	68	70	70	70	65	57	75
	Truck Exiting Site @ 1m (closest point)	86	87	88	85	80	75	81	68	86
Forklift	Horn @ 1m	70	64	77	74	62	69	70	60	76
	Reversing alarm @ 1m	73	70	71	67	77	65	56	50	78
	Idling @ 1m	71	66	67	70	62	65	59	53	71
Engine Room	1m from facade	82	79	79	79	78	76	76	70	83
Kegging Hall	Internal spatial average (reverberant)	83	79	77	75	73	72	66	60	78
Bottling Hall	Internal spatial average (reverberant)	72	75	71	73	75	77	76	71	82
	Half way to site boundary (Roller shutter door open)	67	62	54	57	55	53	49	44	60
	Half way to site boundary (Roller shutter door open)	67	62	56	56	55	53	49	43	60
Kegging Hall Extraction Fan in Tunnel	1m from fan casing	76	80	78	76	72	66	58	49	77
Roof mounted Cooling Towers	1m from intake	81	75	70	70	73	72	73	71	79
Cogen Cooling Tower	1m from intake	89	84	82	77	82	69	69	68	80
Cogen Exhaust Silencer	1m from opening	89	87	79	72	69	67	69	80	81

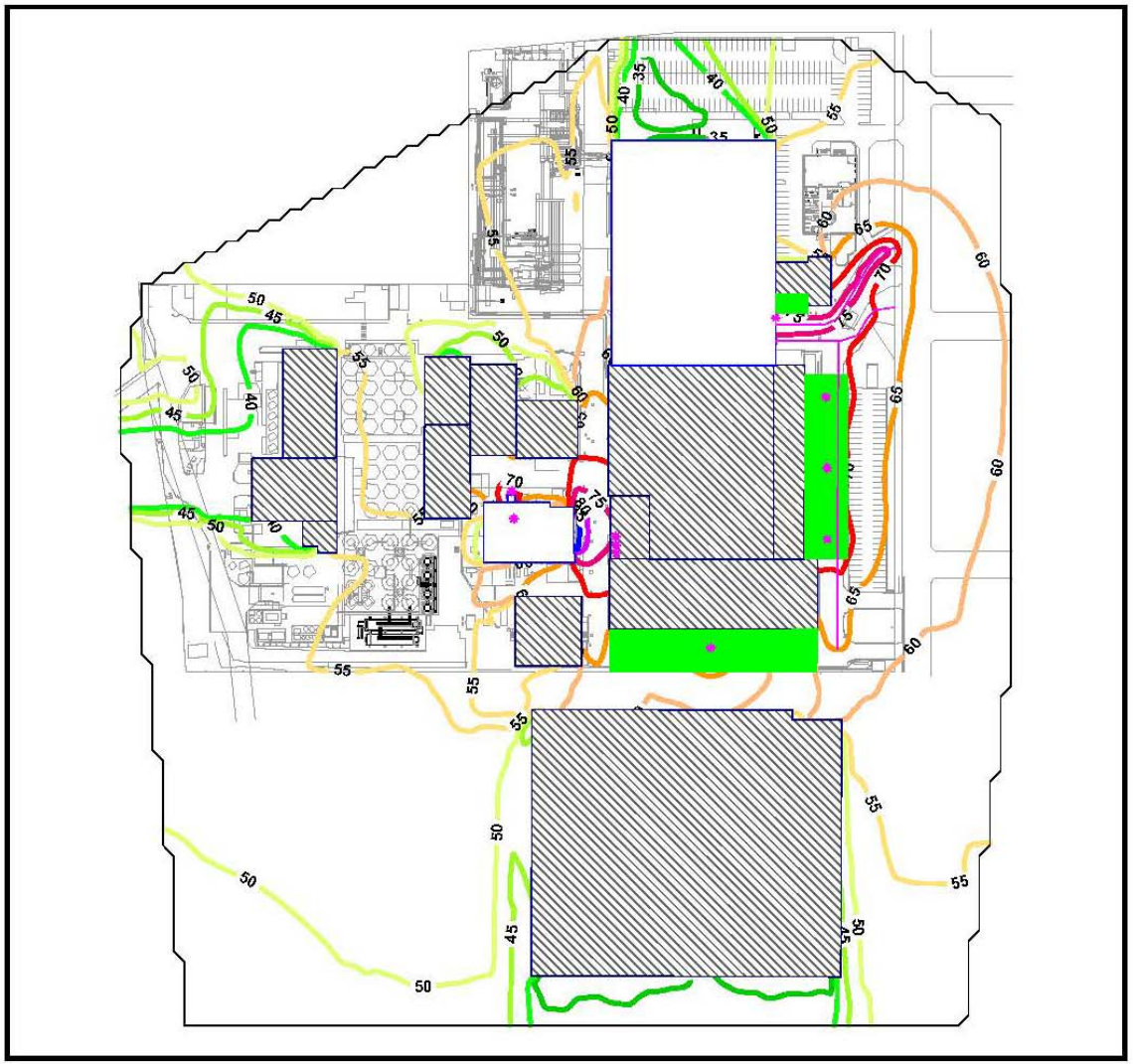
Tooheys Brewery Noise Criteria Assessment

Appendix D

Colour Noise Contour Plots

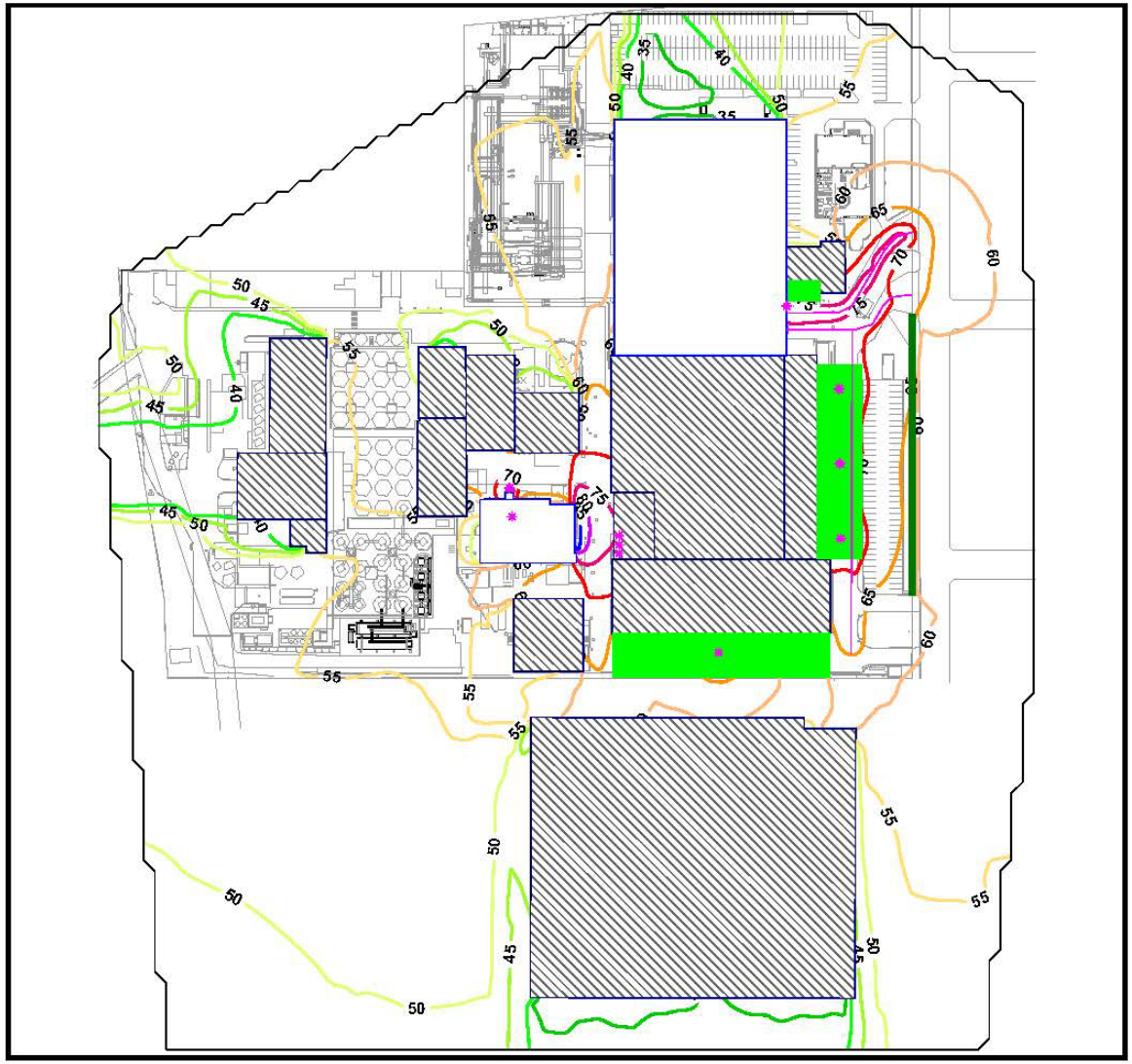
Tooheys Brewery Noise Criteria Assessment

D1 Existing Industrial Noise Emissions



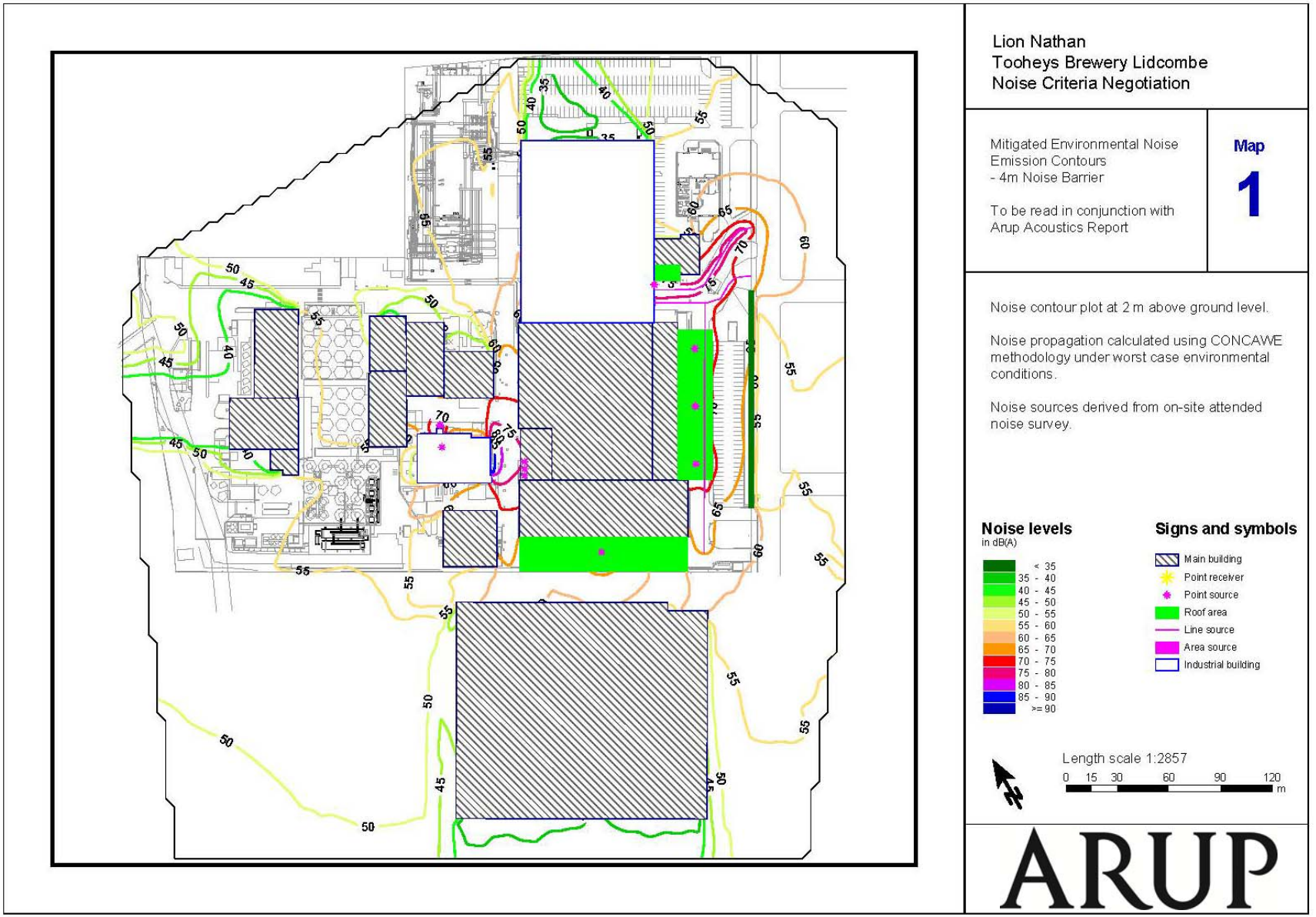
Tooheys Brewery Noise Criteria Assessment

D2 Mitigated Industrial Noise Emissions – 2.5 m Noise Barrier



Tooheys Brewery Noise Criteria Assessment

D3 Mitigated Industrial Noise Emissions – 4 m Noise Barrier



Appendix B

Recommended Acoustic Mitigation Measures Report

Tooheys Brewery

Tooheys Brewery Lidcombe

Tooheys Brewery Noise Mitigation Assessment

221616-01

Issue | 1 December 2011

Arup
Arup Pty Ltd ABN 18 000 966 165

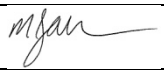
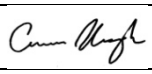
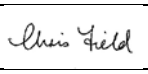
Arup
Level 10
201 Kent Street
Sydney
NSW 2000
Australia
arup.com.au

Job number 221616-01

ARUP

Document Verification

ARUP

Job title		Tooheys Brewery Lidcombe		**Job number**	221616-01
Document title		Tooheys Brewery Noise Mitigation Assessment		**File reference**	
Document ref		221616-01			
Revision	**Date**	**Filename**	0004Noise Mitigation Assessment.docx		
Issue	1 Dec 2011	**Description**	Issue		
			Prepared by	Checked by	Approved by
		Name	Mitchell Allen	Cameron Hough	Chris Field
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
				Issue Document Verification with Document	✓

Contents

Tables

1 Introduction

The Tooheys Brewery in Lidcombe is currently operating under Environmental Protection Licence (EPL) L1167. It has been identified that existing operational noise limits are not currently being met[1].

An acoustic audit was conducted at the Tooheys Brewery Lidcombe site in order to benchmark the existing acoustic environment and propose potential noise mitigation strategies. It was identified that current licence targets were unlikely to be achievable[2].

Criteria negotiations were undertaken between Tooheys and the Office of Environment and Heritage (OEH) on 15 September 2011. During negotiation discussions, it was identified that updated noise limits would be considered subject to a more-detailed investigation into the feasibility and reasonableness of implementing noise mitigation strategies.

This report summarises recommendations of this investigation as the result of input from OEH and collaboration with Tooheys. A preferred mitigation strategy along with quantification of predicted acoustic benefits is provided.

[1] Arup Report *0004Compliance Noise Monitoring_issue*

[2] Arup Report *0003Noise Criteria Assessment Report*

2 Acoustic Assessment

During the acoustic audit conducted on site, operational activities within the loading dock forecourt were identified as being the most significant contributor to noise levels at residential receivers in Nyrang Street. Trucks entering and exiting the site also govern noise levels immediately opposite the site entrance.

2.1 Noise Mitigation Strategies

Two possible mitigation strategies were identified in collaboration with the design team:

- Installing a noise barrier aligning the Nyrang Street frontage of the site
- Installing a noise barrier enclosing the loading dock facing Nyrang Street

The following sections discuss the relative benefits and constraints of each option.

2.1.1 Nyrang Street Noise Barrier

Benefits

- Noise mitigation provided to multiple operational noise sources including partial mitigation of truck movements entering and exiting the site.

Constraints

- A substantial height barrier would be required in order to be acoustically effective due to physical distance from operational noise sources.
- The extents of the barrier are governed by access requirements to the site (i.e. main truck entrance and proposed car parking entrance on south eastern boundary).
- Safety issues associated with interrupted line of sight for vehicles entering and exiting the facility.
- Maintenance and security issues associated with upkeep of the barrier.

It should be noted that, as per discussions with OEH, the effects of road traffic noise along Nyrang Street being reflected back towards residential receivers should also be considered under implementation of a noise barrier in this location.

One potential way of addressing this issue is through installation of absorptive barriers such as those made from planter boxes[3]. This has the benefit of deterring graffiti but carries with it the onus of maintenance and upkeep. Further, lighting would likely be required to preserve pedestrian safety.

Care must be taken to integrate noise barriers aligning site boundaries with the aesthetic of the area. Such guidance can be adapted from legislative documentation on the subject as discussed with OEH[4][5].

[3] http://www.phiireland.ie/products/florawall.htm
[4] *Noise Wall Design Guideline* - NSW Roads and Traffic Authority (Nov, 2006)
[5] *Guidelines on the Design of Noise Barriers* - Environmental Protection/Highways Department, Government of Hong Kong (Jan 2003)

2.1.2 Loading Dock Enclosure

Benefits

- Most-effective noise mitigation for the most acoustically significant operational activity.
- Proximity to noise source affords most efficient noise mitigation.
- Little impact on operational requirements of the site.

Constraints

- Not effective for other forecourt activities such as trucks entering and exiting the site.

This approach to mitigation is most effective for the greatest contributor to noise levels across Nyrang Street (i.e. forecourt loading activities). It is, however, isolated to the mitigation of such activities alone.

It should be noted that car parking facilities for staff and visitors have been reinstated in the forecourt area of the brewery and truck access removed. This operational adjustment complements the implementation of a loading dock canopy barrier.

Further, separate to this study, a 3 m high Colorbond barrier has been erected at the south-eastern corner of the site to visually conceal palette storage. This has the acoustic benefit of shielding loading dock activities within the south-western loading dock and the transition of vehicles between the two areas.

It is also possible to complement this mitigation measure with the planting of flora aligning the Nyrang Street boundary of the site. Whilst this will have little acoustic benefit, the psychological benefit of visually concealing operational activities within the Tooheys site is not inconsiderable. It will also assist with potential issues raised with regard to headlight beams shining into residential receivers across Nyrang Street.

2.1.3 Acoustic Modelling

In light of the above analysis, the loading dock canopy option has been identified as a more suitable approach to noise mitigation.

This noise mitigation scenario takes into account the effects of a single noise barrier on the eastern edge of the forecourt loading dock area. The acoustic benefits of a fully enclosed barrier (i.e. 5m in height to the underside of the existing canopy) were modelled. Predicted noise levels are presented in Table 1.

Table 1 Predicted noise levels – Loading dock canopy barrier

Receiver Location	**Resultant Noise Level (dBA)**	
	Unmitigated	**Canopy Barrier**
Nyrang Street between Gooreen and Hastings Streets	60	60
Corner of Nyrang and Gooreen Streets (North)	**63**	**62**
Corner of Nyrang and Gooreen Streets (South)	**63**	**61**
Nyrang Street between Gooreen and Frampton Streets	62	57
Corner of Nyrang and Frampton Streets (North)	62	56
Corner of Nyrang and Frampton Streets (South)	61	58
Nyrang Street between Frampton and Elimatta Streets	58	57
Corner of Nyrang and Elimatta Streets	56	55

Predicted noise levels presented in Table 1 show a considerable improvement at residential receiver locations directly to the east of the site. Little to no attenuation is observed at receivers opposite the site entrance.

3 Discussion

Receivers directly across from entrance governed by trucks entering and exiting the site – this is, however, characteristic of the area. In view of a history of little to no noise complaints, it would appear that current operations are not against current community expectations.

Tooheys has demonstrated that significant effort has been made to reduce operational noise emissions to the majority of residential receivers in Nyrang Street through the implementation of “feasible and reasonable” acoustic mitigation measures.

It is therefore recommended that updated noise emission criteria be considered based on predicted mitigated noise levels summarised in Table 1.

Appendix C

Compliance Noise Monitoring Report

Memorandum

ARUP

To	Ian Newsom	Date	2 May 2012
Copies	Mitchell Allen Cameron Hough	Reference number	221616-02/CDH
From	Cameron Heggie x0222	File reference	
Subject	Tooheys Brewery, Lidcombe. Compliance Noise Monitoring Report		

1 Introduction

Arup Acoustics has been engaged by Lion Nathan to monitor environmental noise levels from operations at the Tooheys Brewery, Lidcombe. This compliance noise monitoring is subsequent to acoustic design work already conducted in consultation with The NSW Office of Environment and Heritage (OEH).

Measurements have been undertaken in order to quantify the performance of noise mitigation measures implemented on site. Results of this assessment are to inform negotiations with the OEH for input into updated noise emission limits for the site.

2 Measurement Procedure

Attended noise measurements were conducted on Wednesday 9 May 2012 at three representative locations along the site boundaries of the nearest residential receivers located opposite the site along Nyrang Street. These residential receivers are considered representative of the nearest potentially noise affected receivers. Corresponding measurement locations are depicted in Figure 1 for reference.

Noise measurements were taken using a Brüel and Kjær Type 2250 sound level meter (serial number 2449851),checked for calibration before and after each monitoring session using a Brüel & Kjær Type 4231 Sound Level Calibrator, with no significant drift in calibration occurring. The meter was mounted on a tripod at approximately 1.5 m above ground level, and set to fast time response.

In order to measure operational noise emissions from the brewery alone, measurements were paused for extraneous noise events such as vehicular passbys and aeroplane flyovers. Whilst every effort was made to exclude contribution from noise sources external to the site, various artefacts were unavoidable (e.g. distant construction noise, road traffic from Great Western Motorway).

All vehicular movements on the brewery site were included in the analysis and incorporated into measured noise levels presented here-in. This is in keeping with the principles of the OEH which

considers noise from traffic movements on an industrial site to be part of its industrial noise level, as detailed in the Industrial Noise Policy (2000).

Two sets of attended measurements were undertaken, one in the morning and one in the afternoon, in order to capture an accurate representation of operational activity. Expected operational activities such as loading and unloading, truck deliveries, etc were noted during the acoustic survey. It was confirmed with management of the brewery that operations were as per usual during the surveys conducted. It should be noted, however, that given the time of year, various operations were not at capacity due to reduced demand.

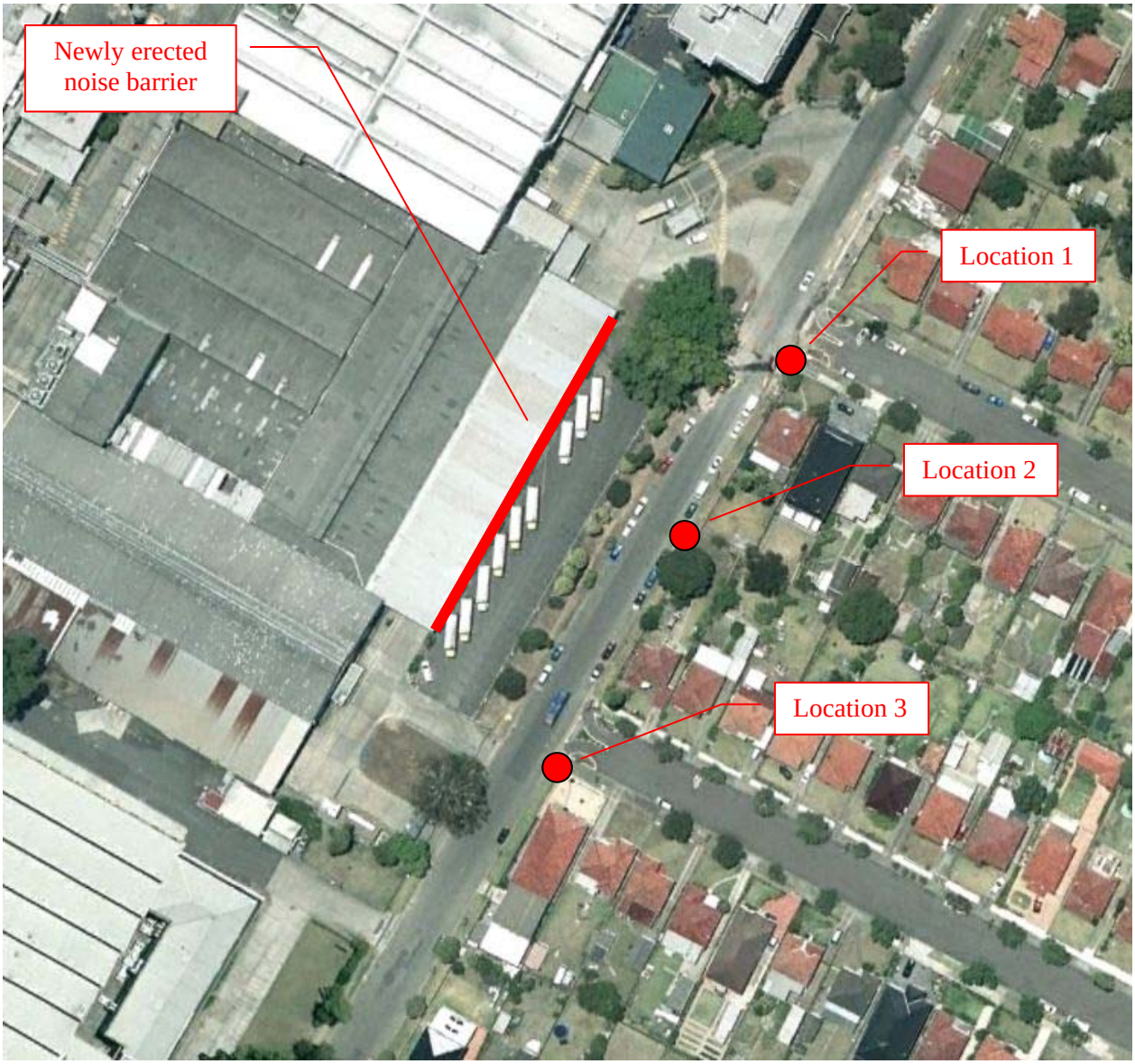


Figure 1- Compliance noise monitoring locations

3 Measured Noise Levels

Measured L_{Aeq} noise levels are presented below in Table 1 for both the morning and afternoon measurements. Predicted noise levels detailed as part of the previous assessment on site are also provided for reference. These predicted noise levels are taken from Arup Report *0004Noise Mitigation Assessment* dated 1 December 2011.

Measurement Location	Start	Duration (minutes)	Operational Noise Level (dBL_{Aeq})	
			Measured	Predicted
1	8:09 AM	15	56	61-62
	3:23 PM	5	57	
2	8:40 AM	15	52	57
	3:14 PM	5	54	
3	9:18 AM	15	54	56-58
	2:53 PM	10	55	

Table 1 Measured and predicted operational noise levels

The data presented in Table 1 shows the general trend of measurements to follow those predicted ie. the highest noise levels are observed at measurement locations that benefit most from the new noise barrier.

Operational noise levels in general, however, are measured to be lower than those modelled as part of the previous noise mitigation assessment. This is likely due to the discrepancy between the time of year of the acoustic audit which formed the basis of acoustic modelling (i.e. Summer – high demand / activity) and the time of year in which compliance monitoring was undertaken (i.e. Autumn – less demand / activity).

4 Conclusion

Measured operational noise levels presented in Table 1 are below those predicted for the site subsequent to the implementation of noise mitigation measures. This shows an improvement to previous operational noise emissions and is in keeping with Lion Nathan's commitment to preserve the acoustic amenity of nearby noise sensitive receivers.

As discussed, measured noise levels are not necessarily representative of peak operations due to the time of year and corresponding demand in the market place. As such, it is recommended that noise emission levels predicted in the previous study be maintained as the basis for criteria negotiations. Alternatively, additional monitoring may be conducted to supplement measurements during the peak season.