



External Noise & Vibration Intrusion Assessment

11 Willoughby Road, Crow's Nest, NSW



Client:
**Buildability
Constructions Pty Ltd**

1 May 2013



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PTY LTD

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CONTENTS

Glossary.....	4
1 Introduction.....	5
1.1 Summary.....	5
1.2 Location & Description of Proposal.....	5
1.3 Scope.....	5
2 Assessment Criteria and Standards.....	6
2.1 North Sydney Council.....	6
2.2 Australian Standards.....	7
2.3 Instrumentation & Measurement Standards.....	7
3 Site Survey, Noise Monitoring & Measurements.....	8
4 Assessment.....	9
5 Recommendations and Design Advice.....	10
5.1 External Wall Systems.....	10
5.2 Roof System.....	11
5.3 Windows / Glass Doors.....	11
5.4 Provision of Mechanical Ventilation.....	11
6 Conclusion.....	12
Appendix A - Location Maps and Drawings.....	2 pages
Appendix B - Unattended Noise Logger Data.....	5 pages

GLOSSARY

NOISE

Noise is produced through rapid variations in air pressure at audible frequencies (20 Hz – 20 kHz). Most noise sources vary with time. The measurement of a variable noise source requires the ability to describe the sound over a particular duration of time. A series of industry standard statistical descriptors have been developed to describe variable noise, as outlined in Section 2.1.2 below.

NOISE DESCRIPTORS

L_{eq} – The sound pressure level averaged over the measurement period. It can be considered as the equivalent continuous steady-state sound pressure level, which would have the same total acoustic energy as the real fluctuating noise over the same time period.

$L_{Aeq(15\ min)}$ – The A-weighted equivalent continuous sound level over a 15 minute period.

L_{A90} – The A-weighted noise level that has been exceeded for 90% of the measurement duration.

dB – Decibels. The fundamental unit of sound, a Bell is defined as the logarithm of the ratio of the sound pressure squared over the reference pressure squared. A Decibel is one-tenth of a Bell. Probably the most common usage of the Decibel in reference to sound loudness is dB sound pressure level (SPL), referenced to the nominal threshold of human hearing. For sound in air and other gases, dB(SPL) is relative to 20 micropascals (μPa) = 2×10^{-5} Pa, the quietest sound a human can hear.

R_w – Weighted Sound Reduction Index. A measure of sound insulation performance of a building element. The higher the number, the better the insulation performance.

A-WEIGHTING

"A-weighting" refers to a prescribed amplitude versus frequency curve used to "weight" noise measurements in order to represent the frequency response of the human ear. Simply, the human ear is less sensitive to noise at some frequencies and more sensitive to noise at other frequencies. The A-weighting is a method to present a measurement or calculation result with a number representing how humans subjectively hear different frequencies at different levels.

NOISE CHARACTER, NOISE LEVEL AND ANNOYANCE

The perception of a given sound to be deemed annoying or acceptable is greatly influenced by the character of the sound and how it contrasts with the character of the background noise. A noise source may be measured to have only a marginal difference to the background noise level, but may be perceived as annoying due to the character of the noise. Acoustic Dynamics' analysis of noise considers both the noise level and sound character in the assessment of annoyance and impact on amenity.

1 INTRODUCTION

1.1 SUMMARY

Acoustic Dynamics has been engaged by Buildability Pty Ltd to assess external noise and vibration intrusion into the proposed mixed use development at 11 Willoughby Road, Crow's Nest.

This document provides a technical assessment, as well as recommendations for construction materials and methods to achieve compliance with the relevant acoustic design criteria and requirements. It has been prepared in accordance with the requirements of the North Sydney Council and relevant Australian Standards.

1.2 LOCATION & DESCRIPTION OF PROPOSAL

The subject site is located at 11 Willoughby Road, Crows Nest, in the North Sydney Council area of NSW. The site contains an existing commercial use development which has a ground floor bakery, with the shop of the bakery towards the front and a storage area to the rear of the bakery. Additionally, the first floor contains an office space.

The site has two road frontages with the western boundary direct to Willoughby Road and the eastern boundary direct to Willoughby Lane. The northern and southern boundaries are shared with adjacent commercial tenancies at 9 and 13 Willoughby Road respectively.

Various mechanical plant and equipment associated with the ground floor bakery and other nearby premises are located within the area. Acoustic Dynamics' assessment has considered the impact of the existing noise environment levels, including the impact from the various mechanical plant and equipment on the proposed first floor residential apartments. The proposed development is shown in the Location Map, Aerial Photo and Drawings presented within **Appendix A**.

The proposal is for alterations and additions to convert the storage area to the rear of the bakery into a separate commercial premise and to convert the existing first floor office space into two separate residential apartments. Note should be made that the commercial tenancy towards the west (Willoughby Road side), being the bakery, is proposed to remain unchanged.

1.3 SCOPE

Acoustic Dynamics has been engaged to provide an external noise and vibration intrusion assessment by the Client. The scope of the assessment is to include the following:

- Review of legislation, Council criteria and Australian Standards relevant to the external noise intrusion at the proposed development;
- Assessment of noise measurements based on data obtained from unattended and attended noise monitoring;
- Examination of architectural drawings and review of the proposed construction/materials;

- Calculation of the sound transmission reduction required to meet the criteria; and
- Recommendation of materials and construction techniques to achieve the required noise attenuation, for compliance with the relevant criteria.

2 ASSESSMENT CRITERIA AND STANDARDS

Acoustic Dynamics has conducted a review of the local Council and State Legislation that is applicable to noise intrusion into the proposed development. The relevant criteria and standards are presented in the sections below.

Note should be made that based on Acoustic Dynamics site inspection and previously conducted assessments of similar proposed developments, vibration intrusion levels into the proposed development are likely to be extremely low. We advise that an assessment of vibration intrusion into the proposed development is considered unnecessary and unwarranted.

2.1 NORTH SYDNEY COUNCIL

2.1.1 REQUEST FOR FURTHER INFORMATION

Acoustic Dynamics has been provided with a copy of a letter (Ref DA49/13, dated 28 March 2013) sent to the proponent from North Sydney Council requesting further information relating to the proposed development. A review of the letter revealed the following information relating to external noise and vibration intrusion into the proposed development:

5. **Noise impacts to proposed first floor residential tenancies** – due to the proposed location of residencies directly above the existing bakery, there is concern that early morning operations associated with the bakery may impact upon this residential receiver in terms of noise and vibration. A report from an Acoustic Engineer (who is a member or eligible to be a member of the Association of Australian Acoustical Consultants) is required that outlines any acoustic impacts associated with the bakery, and any proposed measures to mitigate these impacts so that noise and vibration does not adversely impact on this residential receiver.

2.1.2 LOCAL ENVIRONMENT PLAN

Acoustic Dynamics review of the North Sydney Local Environment Plan 2001 did not yield relevant information or criteria relating to external noise and vibration intrusion into the proposed development.

2.1.3 DEVELOPMENT CONTROL PLAN

Acoustic Dynamics review of the North Sydney Development Control Plan 2002 relevant the following information and criteria relating to external noise and vibration intrusion into the proposed development:

Section 7 Residential Development

7.2 Environmental Criteria

Acoustic Privacy

h. Acoustic privacy for residents. Noise levels within dwellings, with windows closed, do not exceed the following:

- **recreation/work areas 40dBA**
- **sleeping areas 35dBA**

Readings are to be $L_{Aeq(1hour)}$ when measured during the noisiest 1 hour period between Day 7am-6pm; Evening – 6pm to 10pm; and Night – 10pm to 7am.

2.2 AUSTRALIAN STANDARDS

Australian Standard 2107 recommends satisfactory and maximum design sound levels for various types of occupancy within buildings. AS 2107 recommends the following design sound levels for areas within a residential development:

Table 2.1 - Recommended design sound levels for different areas of occupancy in buildings (Extract from Australian Standard 2107 Table 1)

Type of Occupancy / Activity	Recommended Design Sound Level, L_{Aeq}	
	Satisfactory	Maximum
7 RESIDENTIAL BUILDINGS		
Houses and apartments near minor roads - Living Areas	30 dB(A)	40 dB(A)
Sleeping Areas	30 dB(A)	35 dB(A)

Acoustic Dynamics advises that external noise intrusion into the residential areas of the proposed development should not exceed the recommended design sound levels in **Table 2.1** above. Furthermore, Acoustic Dynamics advises that achieving compliance with the requirements of Australian Standard 2107 will also ensure compliance with requirements of North Sydney Council.

2.3 INSTRUMENTATION & MEASUREMENT STANDARDS

All measurements are conducted in accordance with Australian Standard 1055.1-1997, "Acoustics - Description and Measurement of Environmental Noise Part 1: General Procedures". Acoustic Dynamics' sound measurements are conducted using precision sound level meters conforming to the requirements of IEC 61672-2002 "Electroacoustics: Sound Level Meters – Part 1: Specifications". The survey instrumentation used during the previous background noise survey is set out below.

Table 2.2 - Noise Survey Instrumentation

Type	Serial Number	Instrument Description
2260	2413547	Brüel & Kjaer Modular Precision Sound Level Meter
4189	2607949	Brüel & Kjaer 12.5 mm Prepolarised Condenser Microphone
4231	1730737	Brüel & Kjaer Acoustic Calibrator
ARL-EL-316	16-306-020	Acoustic Research Laboratories Noise Logger

The reference sound pressure level was checked prior to and after the measurements using the acoustic calibrator and remained within acceptable limits.

3 SITE SURVEY, NOISE MONITORING & MEASUREMENTS

Acoustic Dynamics advises that the existing noise environment levels at the subject development site have been determined based on the results of unattended noise logging conducted at the subject site between Monday 22 April 2013 and Monday 29 April 2013. The unattended noise logger was deployed above an awning along the western facade of 11 Willoughby Road Crow's Nest. The logger location is indicated in **Appendix A**. The results from the unattended noise logger are presented graphically in **Appendix B**.

Acoustic Dynamics advises that the existing noise environment levels experienced along the western facade of 11 Willoughby Road Crow's Nest are dominated by patron activities from nearby commercial premises, vehicle and pedestrian traffic, including vehicles and pedestrians and staff associated with the ground floor bakery, as well as an air conditioning unit associated with the bakery.

The external L_{Aeq} noise levels have been determined for daytime, evening and night-time periods, in accordance with the requirements of North Sydney Council. **Table 3.1** below presents the processed noise data obtained from the unattended noise logger.

Table 3.1 - Measured $L_{Aeq}(1hr)$ Noise Levels – Noise Logger

Location	Time of Day	Average Maximum $L_{Aeq}(1hr)$ Noise Level [dB]
Along Western Facade of 11 Willoughby Road, Crow's Nest	Daytime (7am – 6pm)	65
	Evening (6pm – 10pm)	67
	Night-time (10pm – 7am)	67

Additionally, Acoustic Dynamics advises that the existing noise environment levels within the light well area and to the rear of the existing first floor office space are different to the existing noise environment levels experienced along the western facade of the subject site. Acoustic Dynamics advises that the existing noise environment levels experienced within these areas are dominated by various mechanical plant and equipment associated with the ground floor bakery and other nearby premises.

Acoustic Dynamics advises that the exhaust fan associated with the bakery was the loudest of the various mechanical plant and equipment within the light well area and to the rear of the first floor office space. An operator attended measurement of noise emission from the exhaust fan associated with the bakery was measured and a noise level of L_{Aeq} 64dB was measured at 1m from the exhaust.

Additionally, Acoustic Dynamics has conducted operator attended noise measurements during the operation of various mechanical plant and equipment in the vicinity, including the bakery exhaust fan, within the existing first floor office space, with windows closed and open. The results of Acoustic Dynamics operator attended measurements are presented in **Table 3.2** below.

Table 3.2 - Measured L_{Aeq} Noise Levels – Operator Attended

Location	Window Closed/Open	L_{Aeq} Noise Level [dB]
Within Existing Living Room	Closed	42
	Open	52
Within Existing Bed Room	Closed	45
	Open	53

4 ASSESSMENT

Based on the external noise levels measured along the western facade and within the light well area and to the rear of the first floor, and based on the internal design sound level for a particular area of the proposed development, Acoustic Dynamics has calculated the minimum required external noise attenuation and R_w for each building component.

The internal design sound level for a particular area of the subject development is the maximum permissible $L_{Aeq}(1 \text{ hour})$ noise level within that area, with external windows and doors closed. The internal design sound levels applicable to the critical areas of the proposed development have been determined in accordance with the criteria and guidelines of Council, and are presented in **Table 4.1** below.

Table 4.1 –Measured Maximum External Noise Levels & Component Noise Attenuation & R_w for Facades

Apartment No.	Room	Maximum Indoor Design Sound Level (windows closed) [dB] ¹	Measured Maximum External Noise Level [dB] ²	Required Component External Noise Attenuation		
				Walls R_w	Windows R_w	Roof R_w
1	Bed 1	35	64	38	31	40
	Bed 2/Study	35	63 ³	43	36	40
	Living/Kitchen	40	62 ³	35	31	34
	Bathroom	50	64	26	21	28
2	Bed 1	35	64	38	33	40
	Bed 2/Study	35	64	39	33	40
	Living/Kitchen	40	64	38	29	37
	Bathroom	50	64	27	22	28

- Note: 1) Maximum indoor design sound level based on North Sydney Council criteria.
 2) The Measured Maximum External L_{Aeq} Noise Levels are based on the measured noise levels, as presented in **Table 3.1 & Table 3.2**.
 3) The Measured Maximum External Noise Levels are $L_{Aeq(1 \text{ hr})}$ noise levels, based on the measured daytime/night-time noise levels, and include adjustments to take account of distance losses and shielding provided by the structure of the development.

Acoustic Dynamics advises that based on the measured external noise levels, we advise that calculated noise levels within some of the rooms will exceed the relevant internal noise level criteria by more than 10 dB, with the windows open. Acoustic Dynamics advises that mechanical ventilation should be installed to service the subject development, to provide adequate ventilation to the dwelling and enable building occupants to leave external doors and windows closed, during peak periods of external noise levels. Accordingly, the proposed development is assessed as achieving compliance with the relevant acoustic requirements.

5 RECOMMENDATIONS AND DESIGN ADVICE

Acoustic Dynamics' analysis and prediction calculations indicate the following recommendations should be incorporated into the proposed development as a minimum, to ensure that the internal design sound levels are achieved.

5.1 EXTERNAL WALL SYSTEMS

Acoustic Dynamics understands that the masonry external wall systems of the subject site are proposed to be remain unchanged. We advise that the external wall systems currently constructed, will achieve the minimum required R_w 43, as presented in **Table 4.1** above.

5.2 ROOF SYSTEM

Acoustic Dynamics understands that the sheet metal roof system of the subject site is proposed to remain unchanged. We advise that the sheet metal roof system currently constructed, will achieve the minimum required R_w 40, as presented in **Table 4.1** above.

5.3 WINDOWS / GLASS DOORS

The following table sets out the minimum required glazing for the windows throughout the proposed development to ensure that the internal design sound levels are achieved.

Table 5.1 – Window & Glass Door Glazing Thickness Schedule

Apartment No.	Area / Room	Minimum R_w of Window System	Minimum Glazing Recommended ¹	
			Option 1 (Preferred)	Option 2
1	Bed 1	31	6.38mm laminated	15mm monolithic
	Bed 2/Study	36	8.5mm VLam Hush	14.38mm laminated
	Living/Kitchen	31	6.38mm laminated	15mm monolithic
	Bathroom	21	5mm monolithic	NA
2	Bed 1	33	6.5mm VLam Hush	10.38mm laminated
	Bed 2/Study	33	6.5mm VLam Hush	10.38mm laminated
	Living/Kitchen	29	6.38mm laminated	15mm monolithic
	Bathroom	22	5mm monolithic	NA

Note: 1) Minimum glazing has been specified to meet acoustic requirements. Acoustic Dynamics advises that some windows/glass doors may also need to meet applicable safety standards. Additional advice should be sought to verify such requirements.

Acoustic Dynamics advises that the installation of all windows must ensure an adequate acoustic (air tight) seal when closed. Any sound flanking paths around the windows must be sealed to provide adequate acoustic insulation. All gaps between the window frame and the wall structure should be sealed using polystyrene rods and silicone mastic sealant, prior to the fitting of architraves.

It is advised that the acoustic performance of the selected windows frames should be confirmed with the suppliers to ensure that the glazing and frame systems will achieve the minimum acoustic performance levels (R_w) recommended in **Table 5.1** above.

5.4 PROVISION OF MECHANICAL VENTILATION

Due to the calculated maximum internal noise levels within the residential apartments when windows and external doors are open, Acoustic Dynamics recommends that appropriate mechanical ventilation be installed to service the subject development, to ensure compliance with the relevant ventilation (including fresh air) requirements.

The installation of mechanical ventilation will provide occupants with the option to leave external doors and windows closed, during peak periods of external noise levels.

6 CONCLUSION

Acoustic Dynamics has conducted an assessment of external noise and vibration intrusion into the proposed mixed use development at 11 Willoughby Road, Crow's Nest, NSW. A review of applicable criteria was conducted and noise levels were assessed in accordance with the requirements of:

- (a) North Sydney Council; and
- (b) Australian Standards.

The performance of the building components proposed for use in the development have been assessed against the R_w values presented in **Table 4.1** to determine their suitability for achieving compliance with the noise criteria.

The assessment examined the facades most exposed to external noise intrusion as well as facades less exposed to external noise intrusion, providing a minimum requirement and allowing for the optimised selection of components for the respective areas within the development.

Recommendations and advice have been provided in **Section 5** for material selection to be used in construction for:

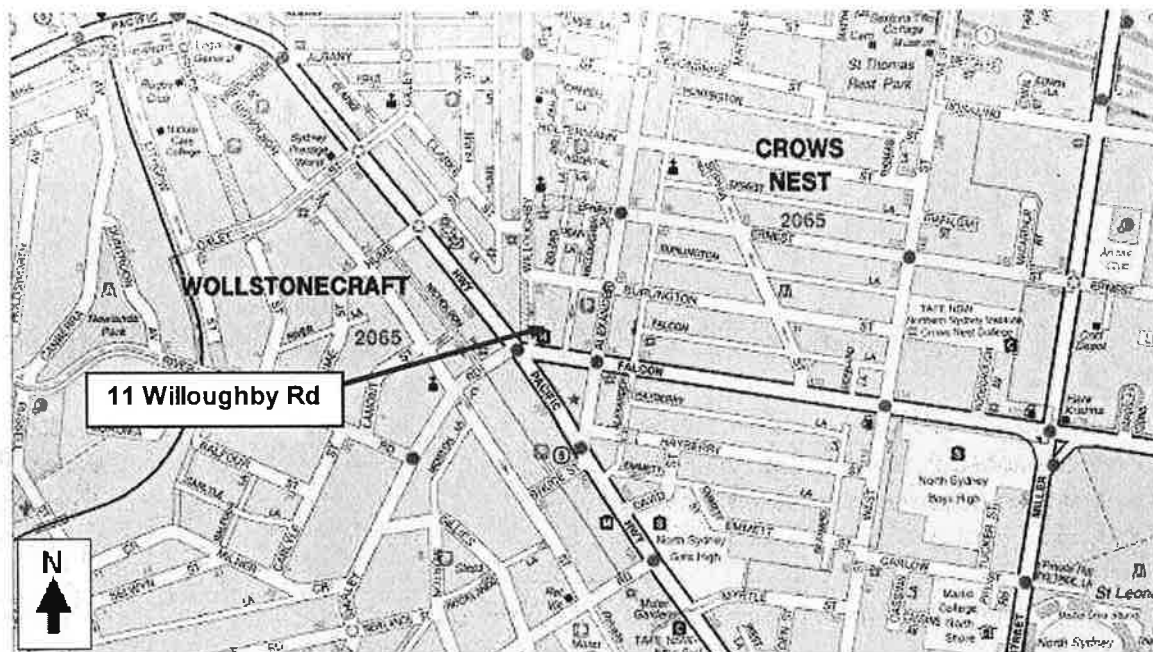
- (a) Walls;
- (b) Ceiling and roof;
- (c) Windows; and
- (d) Mechanical ventilation.

Should alternative construction systems and materials be selected, they must meet the required objective design noise reduction shown in **Table 4.1** for the respective areas within the development.

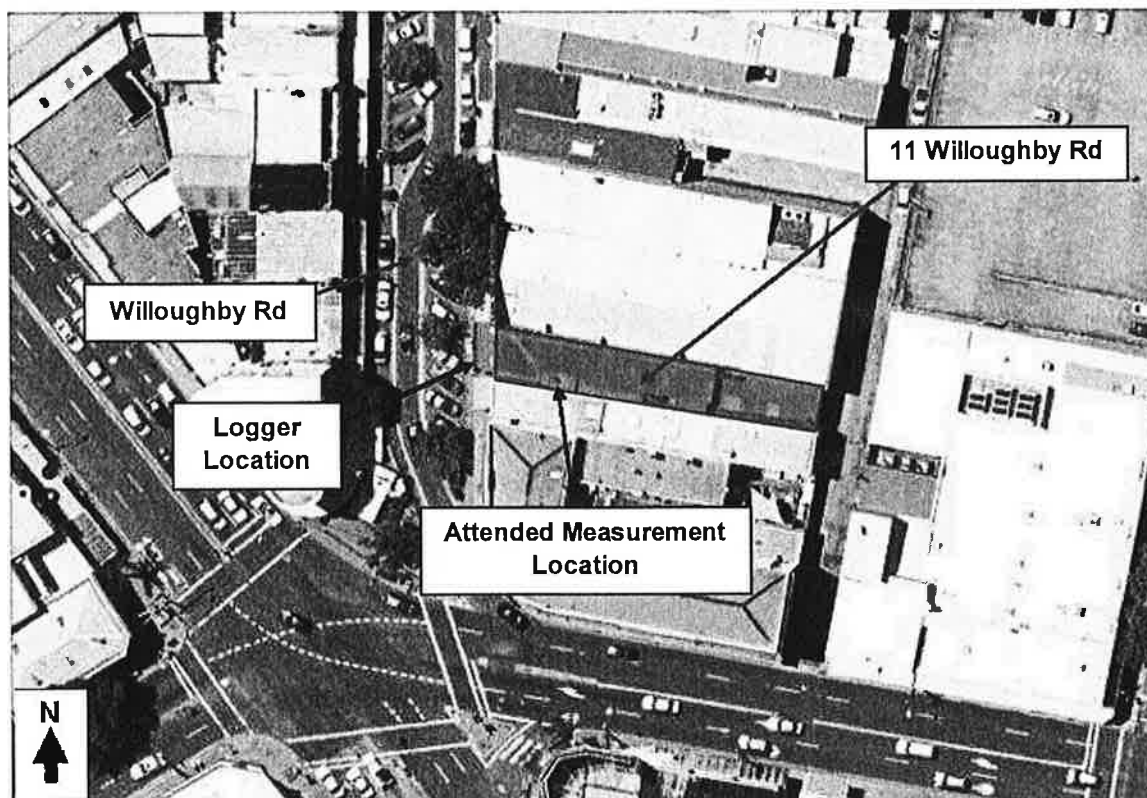
Acoustic Dynamics advises that incorporation of the recommendations in section 5 of this report into the design and construction of the proposed development will achieve compliance with the relevant acoustic design requirements of North Sydney Council and Australian Standards.

APPENDIX A – LOCATION MAP, AERIAL PHOTO & DRAWINGS

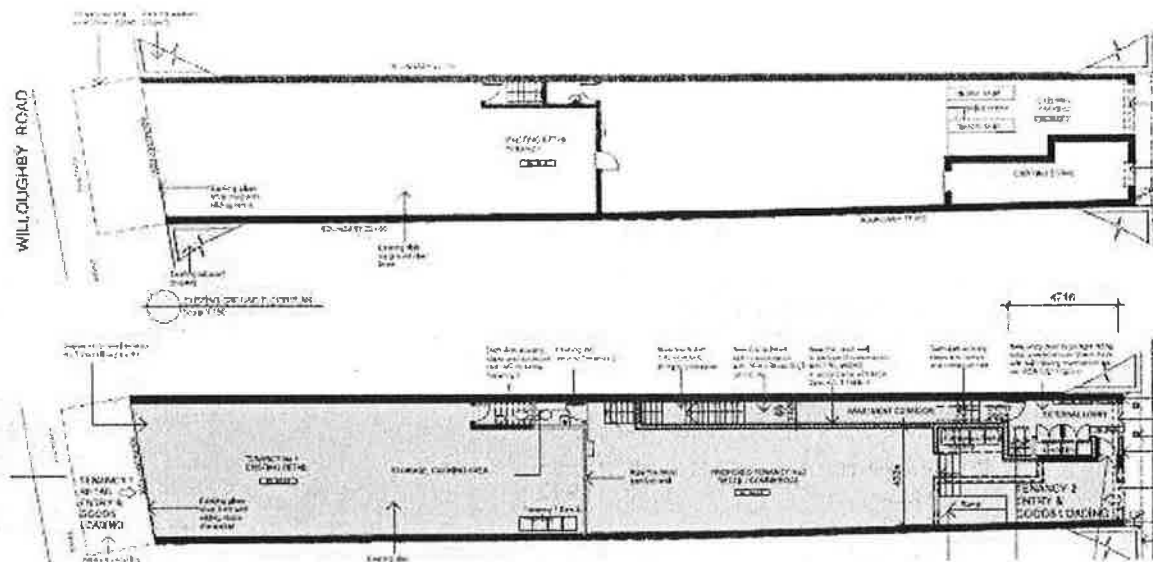
A.1 LOCATION MAP



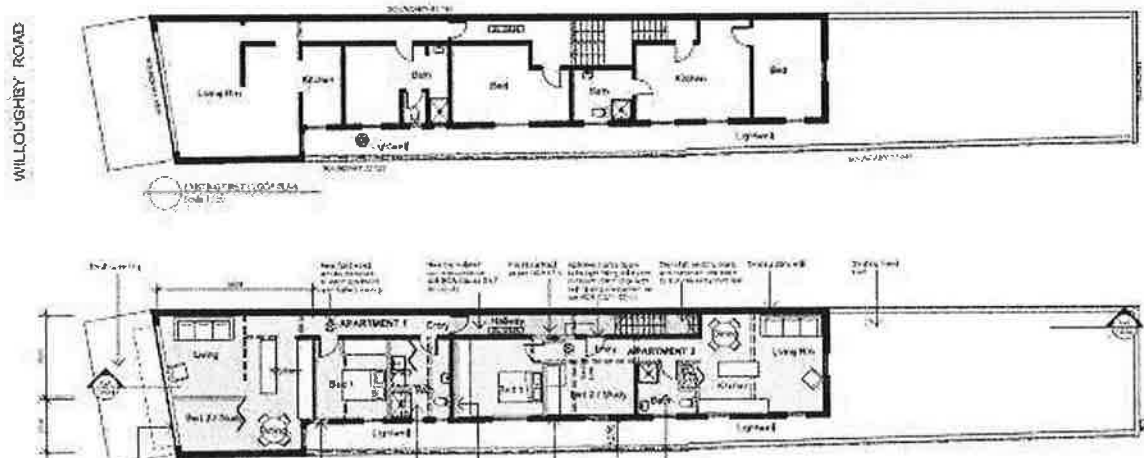
A.2 AERIAL PHOTO



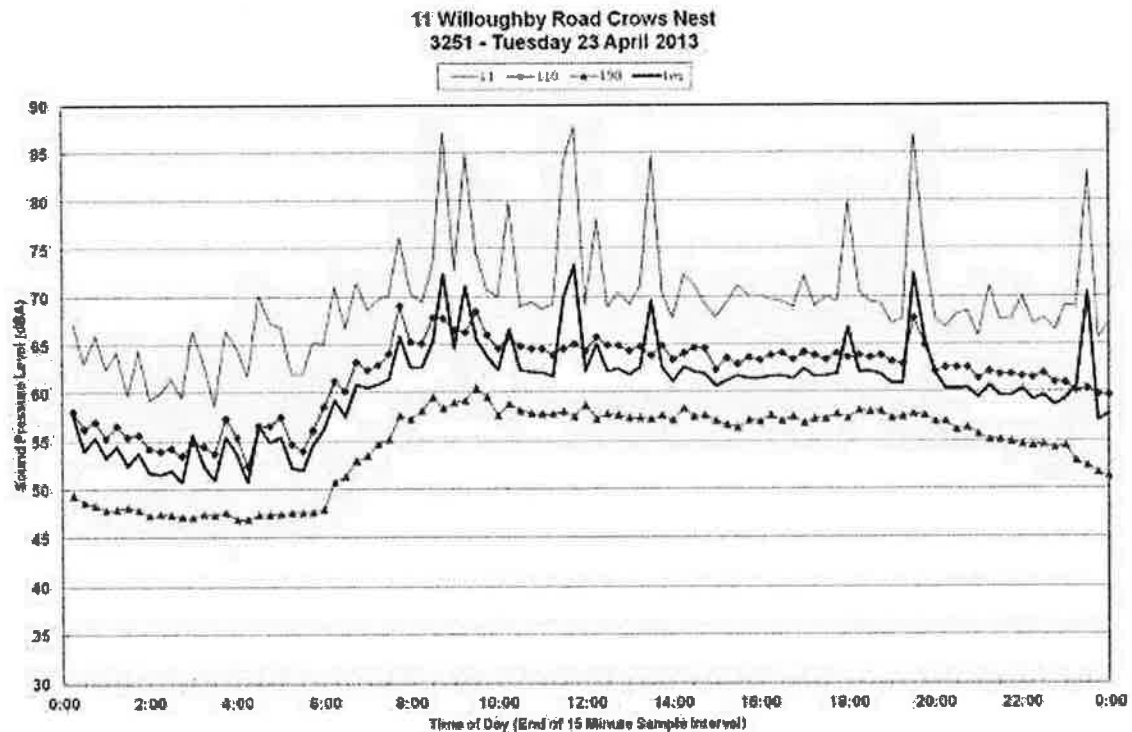
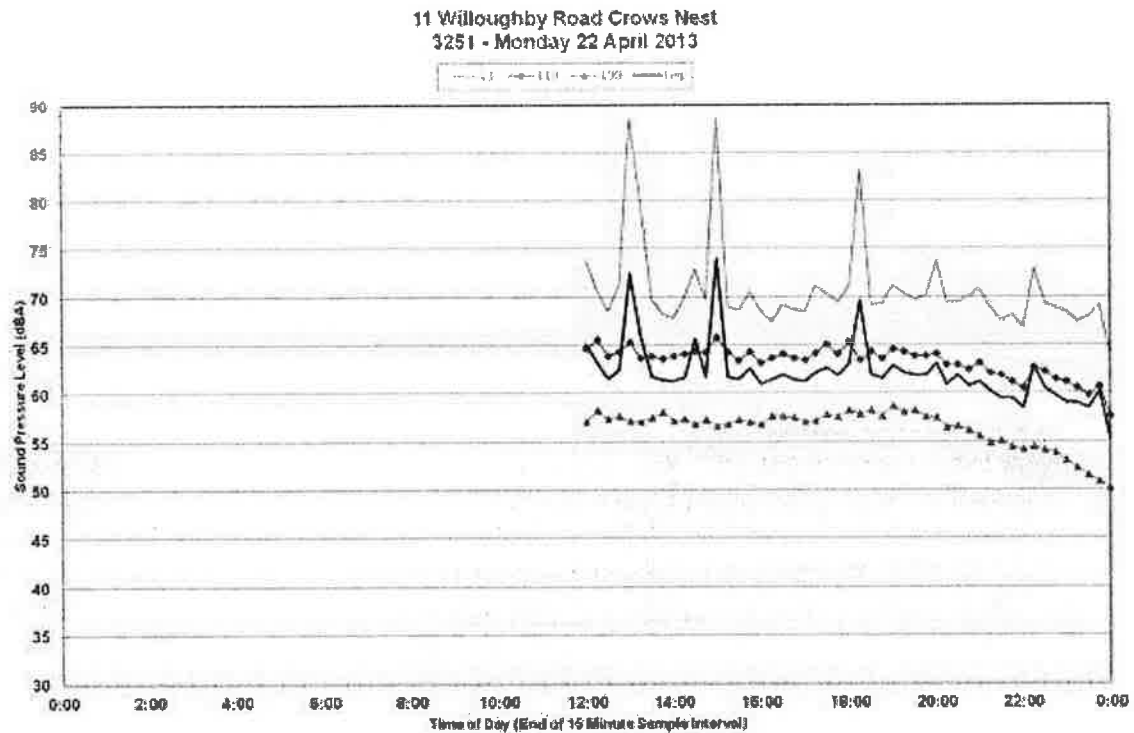
A.3 GROUND FLOOR PLAN DRAWING



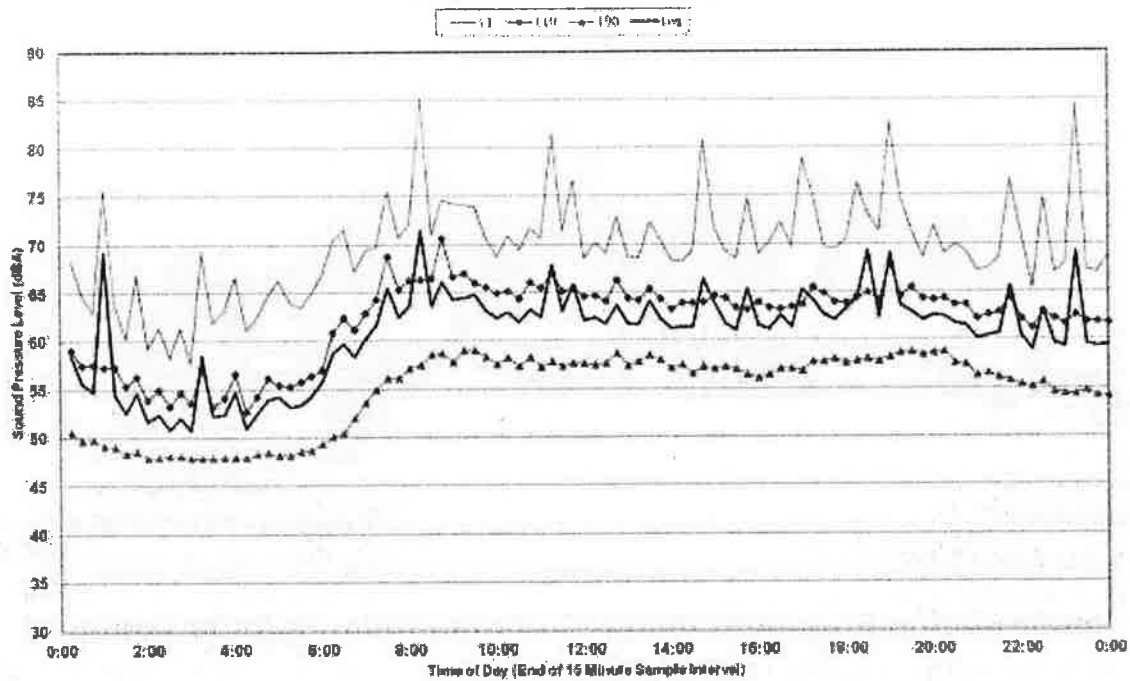
A.4 FIRST FLOOR PLAN DRAWING



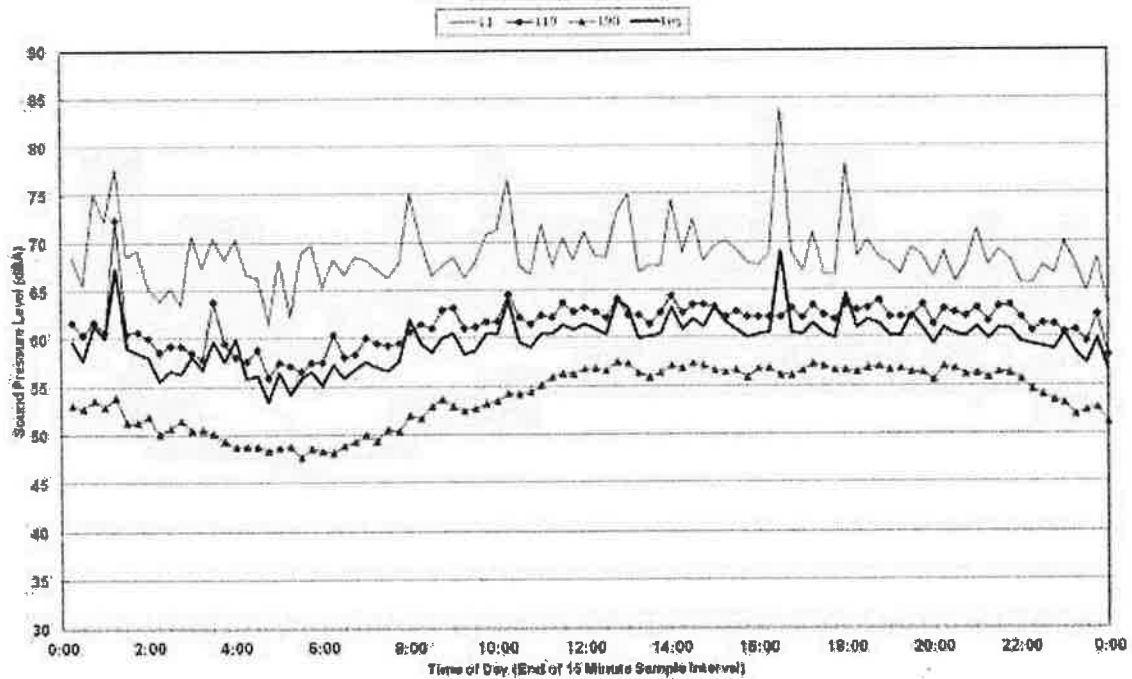
APPENDIX B – UNATTENDED NOISE LOGGER DATA



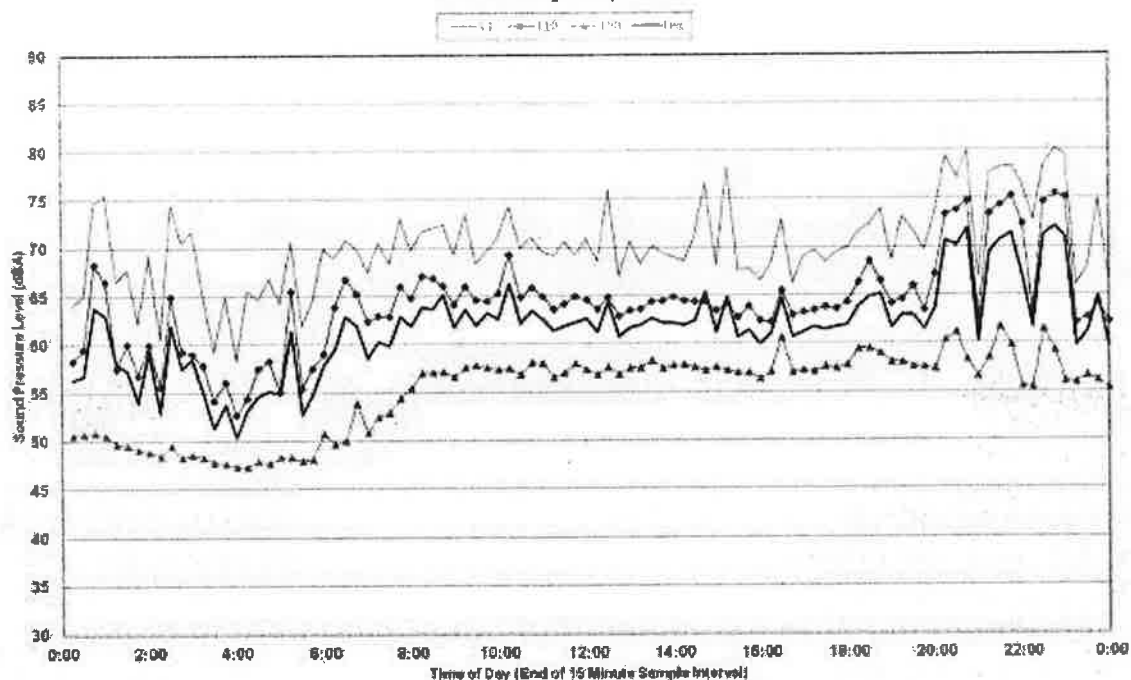
11 Willoughby Road Crows Nest
3251 - Wednesday 24 April 2013



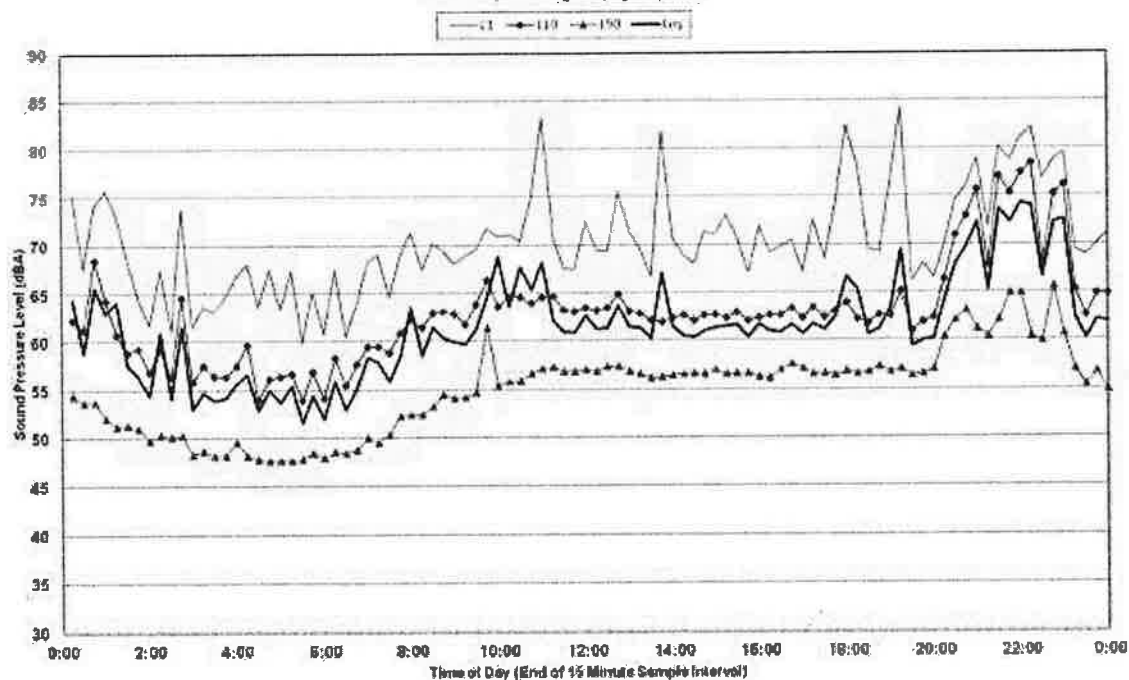
11 Willoughby Road Crows Nest
3251 - Thursday 25 April 2013



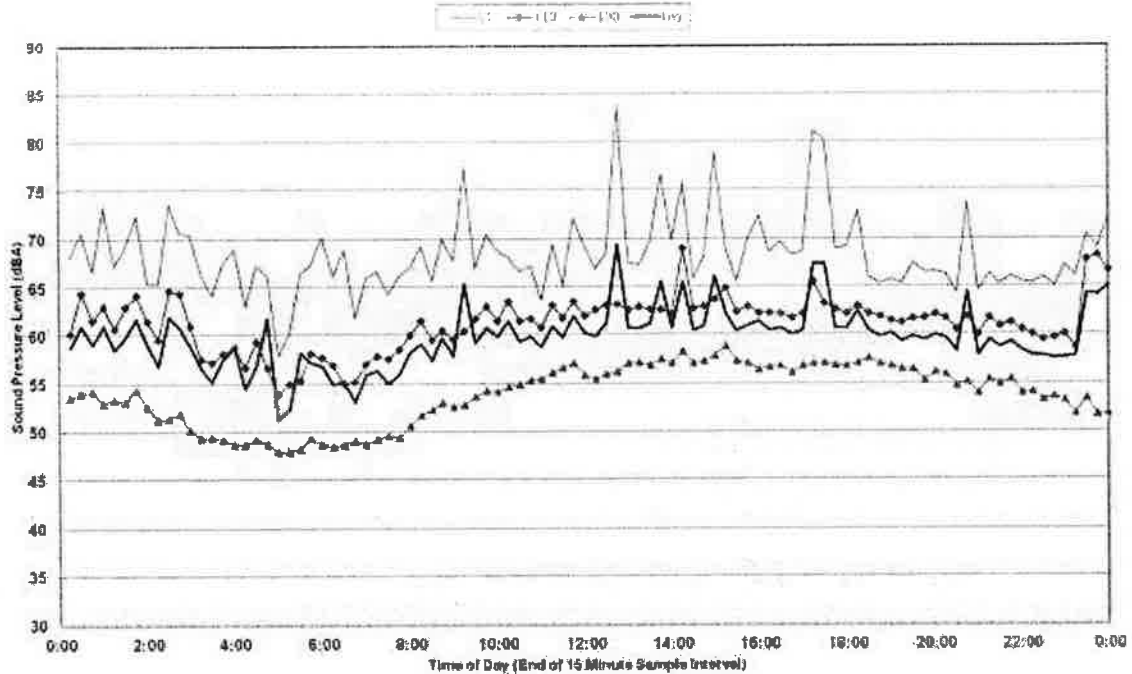
11 Willoughby Road Crows Nest
3251 - Friday 26 April 2013



11 Willoughby Road Crows Nest
3251 - Saturday 27 April 2013



11 Willoughby Road Crows Nest
3251 - Sunday 28 April 2013



11 Willoughby Road Crows Nest
3251 - Monday 29 April 2013

