

Laing O'Rourke

**Main North and North Shore  
Corridor Works Project  
(MNNSCW): Portion 7b – Northern  
Corridor Works (NCW)**

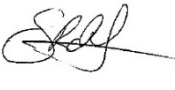


**Construction Noise and Vibration  
Impact Statement (CNVIS)**

NCW P7b - CNVIS

September 2018

**ERM Document Control Record**  
0424696 - NCW P7b - CNVIS

Version	Revision	Author	Reviewed by	ERM Approval to Issue		Comments
				Name	Date	
DRAFT	D01	SD	NL	Paul Douglass	22 June 2018	Draft report prepared by ERM
DRAFT	D02	SD	NL	Paul Douglass	6 July 2018	Revised draft report prepared by ERM
DRAFT	D03	SD	NL	Paul Douglass	14 August 2018	Addressing AA, ER and SM comments
FINAL	F01	SD	NL	Paul Douglass	27 September 2018	Finalise comments

Prepared by:	Steven De Luzuriaga
Position	Acoustics Engineer
Signed:	
Date:	27 September 2018
Reviewed by:	Nathan Lynch
Position	Principal Consultant
Signed:	
Date:	27 September 2018
Approved by:	Paul Douglass
Position:	Partner
Signed:	
Date:	27 September 2018

## Main North and North Shore Corridor Works Project (MNNSCW): Portion 7b - Northern Corridor Works (NCW)

*Construction Noise and Vibration Impact Statement (CNVIS)*

Laing O'Rourke

August 2018

ERM Reference: 0424696

[www.erm.com](http://www.erm.com)

This disclaimer, together with any limitations specified in the report, apply to use of this report. This report was prepared in accordance with the contracted scope of services for the specific purpose stated and subject to the applicable cost, time and other constraints. In preparing this report, ERM relied on: (a) client/third party information which was not verified by ERM except to the extent required by the scope of services, and ERM does not accept responsibility for omissions or inaccuracies in the client/third party information; and (b) information taken at or under the particular times and conditions specified, and ERM does not accept responsibility for any subsequent changes. This report has been prepared solely for use by, and is confidential to, the client and ERM accepts no responsibility for its use by other persons. This report is subject to copyright protection and the copyright owner reserves its rights. This report does not constitute legal advice.

# CONTENTS

## EXECUTIVE SUMMARY

1	INTRODUCTION	
1.1	PROJECT DESCRIPTION	1
1.2	PROJECT SITE SETTING	1
1.3	REVIEW AND UPDATE OF THE CNVIS	12
2	ASSESSMENT METHODOLOGY	
2.1	SCOPE OF WORK	13
2.2	POLICY SETTING	14
2.2.1	RELEVANT POLICY, GUIDELINES AND STANDARDS	15
2.3	NOISE MODELLING	19
2.3.1	PREVAILING METEOROLOGICAL CONDITIONS	20
2.4	VIBRATION ASSESSMENT	21
2.5	CUMULATIVE IMPACTS	22
2.5.1	CONSTRUCTION NOISE	22
2.5.2	CONSTRUCTION VIBRATION	23
3	EXISTING ENVIRONMENT	
3.1	NOISE CATCHMENT AREAS	24
3.2	POTENTIALLY SENSITIVE RECEPTORS	25
3.3	BACKGROUND NOISE LEVELS	26
3.4	ASSESSMENT SCENARIOS	27
4	MANAGEMENT LEVELS AND CRITERIA	
4.1	AIR-BORNE NOISE MANAGEMENT LEVELS	30
4.1.1	HIGHLY NOISE AFFECTED MANAGEMENT LEVEL	31
4.1.2	SLEEP DISTURBANCE	31
4.1.3	INTERNAL NOISE CRITERIA	32
4.2	GROUND-BORNE NOISE MANAGEMENT LEVELS	33
4.3	ROAD TRAFFIC NOISE MANAGEMENT LEVELS	33
4.4	GROUND-BORNE VIBRATION MANAGEMENT LEVELS	34
4.5	THRESHOLDS FOR ADDITIONAL MITIGATION MEASURES	36
5	IMPACT ASSESSMENT	
5.1	AIR-BORNE CONSTRUCTION NOISE	41
5.1.1	ADDITIONAL MITIGATION AND EXCEEDANCES	41
5.1.2	DISCUSSION OF RESULTS	42
5.1.3	SUMMARY OF FINDINGS	44
5.1.4	WORKING OUTSIDE STANDARD HOURS	45
5.1.5	POTENTIAL EFFECTS OF CONCURRENT WORK	45
5.1.6	CUMULATIVE IMPACTS	46
5.2	GROUND-BORNE CONSTRUCTION NOISE	47
5.3	ROAD TRAFFIC NOISE AND VIBRATION	47
5.4	GROUND-BORNE CONSTRUCTION VIBRATION	48

5.4.2	<i>DISCUSSION OF RESULTS</i>	51
5.4.3	<i>SUMMARY OF FINDINGS</i>	51
6	<i>RECOMMENDATIONS</i>	
6.1	<i>COMMUNITY CONSULTATION</i>	52
6.2	<i>MITIGATION AND MANAGEMENT MEASURES (SYDNEY METRO)</i>	57
6.3	<i>MITIGATION AND MANAGEMENT MEASURES (CNVIS)</i>	58
6.4	<i>CONSTRUCTION HOURS</i>	60
6.5	<i>ADDITIONAL MITIGATION MEASURES</i>	61
6.6	<i>MAXIMUM LEVELS FOR PLANT AND EQUIPMENT</i>	61
6.7	<i>SAFE WORKING DISTANCES FOR VIBRATION</i>	62
6.8	<i>NOISE AND VIBRATION MONITORING REQUIREMENTS</i>	62
7	<i>CONCLUSION</i>	
	<i>REFERNCES</i>	
ANNEX A	<i>ACOUSTICS GLOSSARY</i>	
ANNEX B	<i>POTENTIALLY SENSITIVE RECEPTORS</i>	
ANNEX C	<i>ASSESSMENT SCENARIOS AND NOISE MODELLING DATA</i>	
ANNEX D	<i>NOISE MODELLING RESULTS</i>	
ANNEX E	<i>STAKEHOLDERS AND COMMUNITY CONSULTATION OVERVIEW</i>	
	<i>LIST OF TABLES</i>	
TABLE 2.1	<i>MINIMUM WORKING DISTANCES FOR VIBRATION INTENSIVE ACTIVITIES (TFNSW)</i>	21
TABLE 3.1	<i>NOISE CATCHMENT AREAS (NCA)</i>	25
TABLE 3.2	<i>RATING BACKGROUND LEVELS</i>	27
TABLE 3.3	<i>ASSESSMENT SCENARIOS</i>	28
TABLE 4.1	<i>BACKGROUND NOISE AND MANAGEMENT LEVELS (RESIDENTIAL RECEPTORS)</i>	30
TABLE 4.2	<i>NOISE MANAGEMENT LEVELS (OTHER SENSITIVE RECEPTORS)</i>	31
TABLE 4.3	<i>SLEEP DISTURBANCE SCREENING LEVELS</i>	32
TABLE 4.4	<i>INTERNAL NOISE CRITERIA</i>	33
TABLE 4.5	<i>GROUND-BORNE NOISE MANAGEMENT LEVELS</i>	33
TABLE 4.6	<i>ROAD TRAFFIC NOISE MANAGEMENT LEVELS</i>	34
TABLE 4.7	<i>HUMAN COMFORT – VIBRATION DOSE VALUES (VDV)</i>	35
TABLE 4.8	<i>BUILDING DAMAGE (BS 7385)</i>	35

<i>TABLE 4.9</i>	<i>BUILDING DAMAGE (DIN4150:3)</i>	<i>36</i>
<i>TABLE 4.10</i>	<i>ADDITIONAL MITIGATION MEASURES</i>	<i>37</i>
<i>TABLE 4.11</i>	<i>ADDITIONAL MITIGATION MEASURES MATRIX (AMMM) – CONSTRUCTION (AIRBORNE) NOISE</i>	<i>38</i>
<i>TABLE 4.12</i>	<i>ADDITIONAL MITIGATION MEASURES MATRIX (AMMM) – CONSTRUCTION (GROUND-BORNE) NOISE</i>	<i>39</i>
<i>TABLE 4.13</i>	<i>ADDITIONAL MITIGATION MEASURES MATRIX (AMMM) – GROUND- BORNE VIBRATION</i>	<i>40</i>
<i>TABLE 6.1</i>	<i>COMMUNITY CONSULTATION UNDERTAKEN TO DATE</i>	<i>53</i>

#### *LIST OF FIGURES*

<i>FIGURE 1.1</i>	<i>SITE LOCALITY</i>	<i>2</i>
<i>FIGURE 1.2</i>	<i>ZONING MAP</i>	<i>3</i>
<i>FIGURE 1.3</i>	<i>NOISE CATCHMENT AREAS (NCA) AND EIS MONITORING LOCATIONS</i>	<i>4</i>
<i>FIGURE 1.4</i>	<i>POTENTIALLY SENSITIVE NOISE RECEPTORS – OVERVIEW MAP</i>	<i>5</i>
<i>FIGURE 1.5</i>	<i>POTENTIALLY SENSITIVE NOISE RECEPTORS - DETAIL 1</i>	<i>6</i>
<i>FIGURE 1.6</i>	<i>POTENTIALLY SENSITIVE NOISE RECEPTORS - DETAIL 2</i>	<i>7</i>
<i>FIGURE 1.7</i>	<i>POTENTIALLY SENSITIVE NOISE RECEPTORS - DETAIL 3</i>	<i>8</i>
<i>FIGURE 1.8</i>	<i>POTENTIALLY SENSITIVE NOISE RECEPTORS - DETAIL 4</i>	<i>9</i>
<i>FIGURE 1.9</i>	<i>POTENTIALLY SENSITIVE NOISE RECEPTORS - DETAIL 5</i>	<i>10</i>
<i>FIGURE 1.10</i>	<i>POTENTIALLY SENSITIVE NOISE RECEPTORS - DETAIL 6</i>	<i>11</i>
<i>FIGURE 5.11</i>	<i>GROUND-BORNE VIBRATION SAFE WORKING DISTANCES</i>	<i>49</i>

## **EXECUTIVE SUMMARY**

*Environmental Resources Management Australia Pty Ltd (ERM) on behalf of Laing O'Rourke Australia Construction Pty Ltd (LOR) has revised the construction noise and vibration impact statement (CNVIS) for the for construction aspects of the Main North and North Shore Corridor Works Project (MNNSCW), to incorporate activities for Portion 7b - Northern Corridor Works (NCW).*

*The NCW project and associated construction works are located in the rail corridor between Chatswood train station and St Leonards train station, and are being undertaken as part of the Sydney Metro City and Southwest project (Sydney Metro).*

*This report has been prepared to document the methodology, findings and recommendations of the assessment conducted for the NCW. The CNVIS has been conducted with due regard to and in accordance with the New South Wales (NSW) policy and guidelines relevant to noise. The CNVIS is technical in nature, a glossary of relevant acoustical concepts and terminology is provided in Annex A of this noise and vibration impact assessment report.*

*Five hundred and thirty (530) sensitive receptors have been identified in nine noise catchment areas to be representative of the closest and/or potentially most affected locations situated within the potential area of influence of the NCW project. These locations do not represent all receptors located in the vicinity of the NCW but have been selected for the purposes of this CNVIS; they are considered to be representative of locations that will experience the highest impacts associated with the NCW project.*

*The Sydney Metro - Construction Noise and Vibration Strategy (CNVS) assessment and mitigation approach has been adopted, in conjunction with the requirements of the ICNG, for construction noise and vibration aspects of the NCW project. Where the predicted construction noise levels are above the ICNG noise management levels, the Additional Mitigation Measures Matrix (AMMM) identified in Section 8 of the SM CNVS is to be implemented. The approach, guided by the AMMM, is primarily aimed at pro-active engagement with affected sensitive receivers rather than additional noise reducing mitigation.*

*The types of additional mitigation measures include alternative accommodation, monitoring, individual briefings, letter box drops, project specific respite offers, phone calls and specific notifications. These vary depending on the level by which predicted noise values exceed the existing background noise levels, and the time of day as summarised in Section 4.5 of this report.*

*Potential impacts are limited to construction noise and vibration. Brüel & Kjær's Predictor 7810 (Version 12.0) noise modelling software package was utilised to calculate noise levels using the ISO9613:2 noise propagation algorithms (international method for general purpose, 1/1 octaves) for construction aspects of the project.*

*Predicted levels were then compared to the project-specific noise criteria established for construction to identify any exceedances and qualify the magnitude and extent of potential impacts. Construction vibration emission sources were reviewed and compared to the applicable safe work distances to determine the potential for impacts to occur.*

*A summary of the results and findings are presented in Section 5.1 this CNVIS. The full set of results are presented in Annex D. Although a number of exceedances are identified, these are associated with predicted 15 minute noise values calculated via modelling for the purposes of the assessment, in accordance with the ICNG and the CNVS. These values do not represent a constant noise emission that would be experienced by the community on a daily basis throughout the NCW project.*

*The predicted noise levels will only be experienced for limited periods of time when works are occurring; they will not be experienced over a whole daytime, evening or night time periods. Any impacts associated with these works will be temporary and do not represent a permanent impact on the community and surrounding environment. Some noise from construction sites is inevitable, such that the ICNG focuses on minimising construction noise impacts, rather than only on achieving numeric noise levels.*

*These results and noted exceedances identify that good-practice construction noise management and control techniques will be required to reduce noise levels as far as practicable. To minimise impacts additional noise control, mitigation and management measures are also warranted and a Construction Noise and Vibration Management Plan (CNVMP) should be prepared. These will need to be implemented in conjunction with community and stakeholder consultation and notification processes.*

*Based on the equipment and activities identified for the NCW project, potential sources of vibration are limited to hydraulic hammering and track tamping activities. With normal construction design development and general vibration management practices in place adverse effects on building contents or adverse effects on structures are not anticipated. There is however potential for human comfort impacts. The vibration results and findings are presented in Section 5.4 this CNVIS.*

*Based on these findings of this CNVIS recommendations have been made for noise and vibration mitigation, management measures and/or monitoring options suitable to the significance of the predicted impacts and designed to minimise impacts as far as is feasible and reasonable.*

*Construction noise and vibration levels will be reduced and impacts minimised with the successful implementation of the recommendations provided in Chapter 6 of this report. Impacts may not be reduced to negligible levels for all receptors during all construction activities; however the recommendations presented here will ensure that any residual impacts are minimised as far as is practically achievable. These recommendations will need to be implemented in conjunction with community and stakeholder consultation and notification processes.*

# 1

## **INTRODUCTION**

This Construction Noise and Vibration Impact Statement (CNVIS) document has been prepared by Environmental Resources Management Australia Pty Ltd (ERM) on behalf of Laing O'Rourke Australia Construction Pty Ltd (LOR). It presents the methodology, findings and recommendations of the noise and vibration impact assessment completed for construction aspects of the Main North and North Shore Corridor Works Project (MNNSCW), Portion 7b - Northern Corridor Works (NCW).

### 1.1

#### **PROJECT DESCRIPTION**

The NCW project and associated construction works are located in the rail corridor between Chatswood train station and St Leonards train station. They are being undertaken as “enabling works” as part of the Sydney Metro City and Southwest project (Sydney Metro).

The intent of the NCW project is the realignment of the T1 North Shore Line between Chatswood Station and Brand Street, Artarmon to accommodate the new metro tracks and the future construction of the Chatswood tunnelling dive site. This CNVIS relates to Portion 7b of the MNNSCW, referred to herein as NCW. Sydney Metro is a new standalone rail network identified in Sydney's Rail Future. The Sydney Metro network consists of Sydney Metro Northwest (previously known as the North West Rail Link) and Sydney Metro City and Southwest. A core component of Sydney Metro includes the Chatswood to Sydenham project. This involves construction and operation of an underground rail line, about 15.5 kilometres long, and new stations between Chatswood and Sydenham.

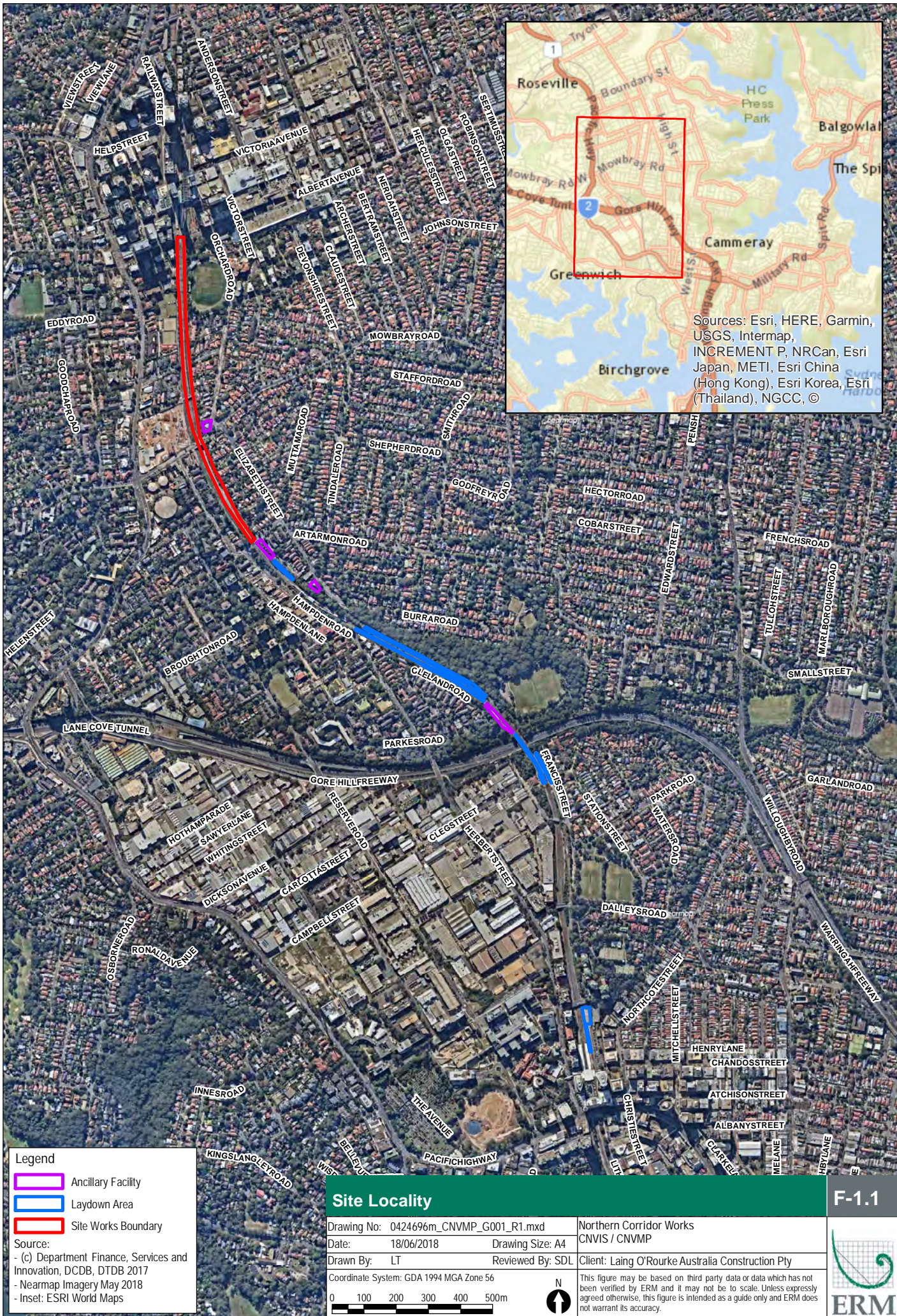
Further detail regarding the NCW scope and potential noise and vibration issues associated with the works/activities are outlined in the overall Construction Environment Management Plan (CEMP) and the Construction Noise and Vibration Management Plan (CNVMP) for the project. The latter document was prepared concurrently to this CNVIS and incorporates all recommendations (and further detail) for noise and vibration mitigation, management measures and monitoring that were established by this assessment.

### 1.2

#### **PROJECT SITE SETTING**

The area surrounding the NCW project is made up of predominantly low and medium density residential land use. High density residential and commercial land use is found to the north, surrounding Chatswood station. Artarmon station is bounded by a neighbourhood centre and more broadly by low to medium density residential land use. To the south of the project area the rail alignment is bound by light industrial, low to high density residential and recreational land uses. St Leonards station is also surrounded by commercial land use. The location of the site and other items of importance to this CNVIS are illustrated below in **Figures 1.1 to 1.10**.





**Legend**

- Ancillary Facility
- Laydown Area
- Site Works Boundary

Source:

- (c) Department Finance, Services and Innovation, DCDB, DTDB 2017
- Nearmap Imagery May 2018
- Inset: ESRI World Maps

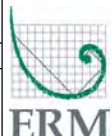
**Site Locality**

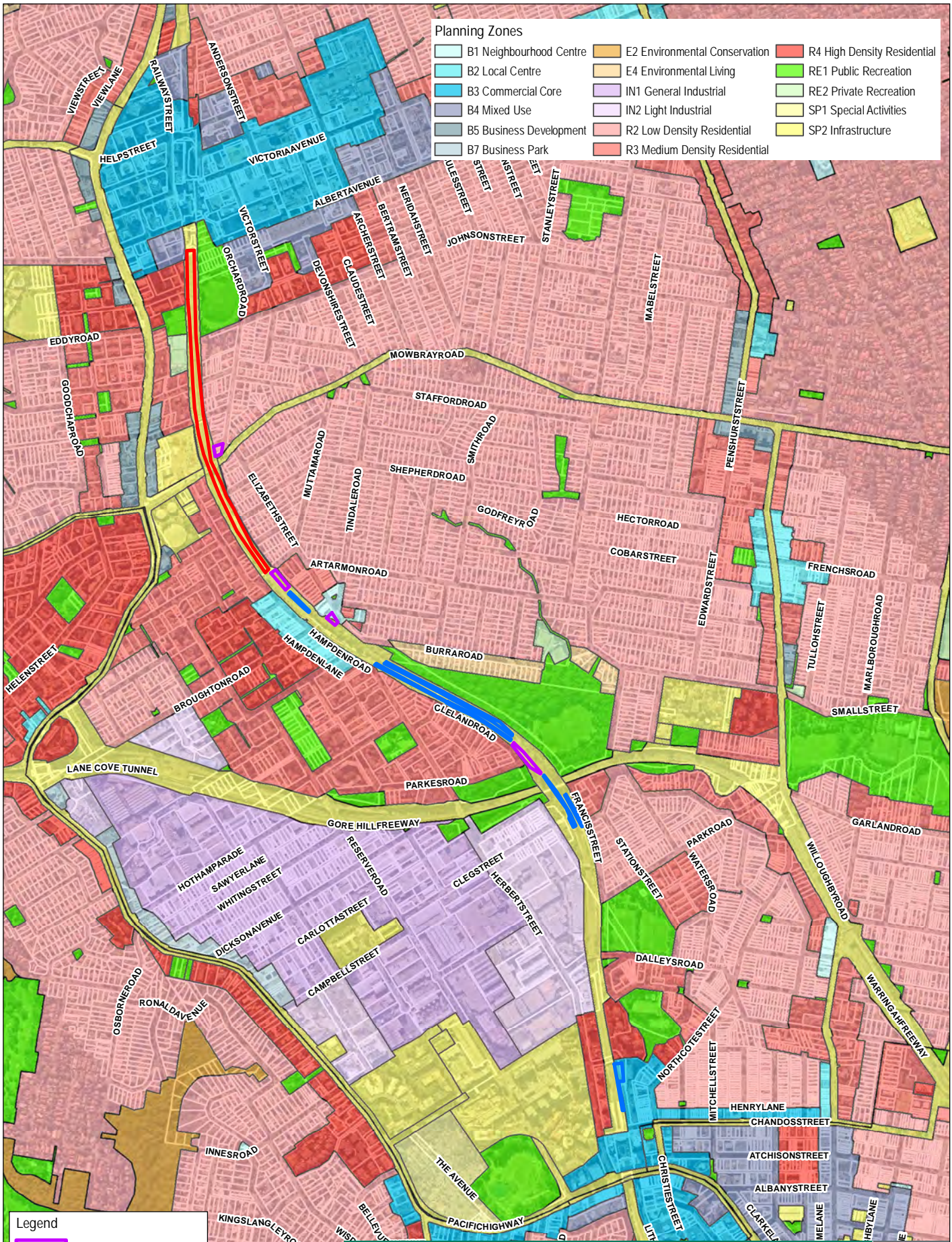
Drawing No: 0424696m_CNVP_G001_R1.mxd	Northern Corridor Works CNVIS / CNVP
Date: 18/06/2018	Drawing Size: A4
Drawn By: LT	Reviewed By: SDL
Coordinate System: GDA 1994 MGA Zone 56	
0 100 200 300 400 500m	

Client: Laing O'Rourke Australia Construction Pty

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

**F-1.1**





**Legend**

- Ancillary Facility
- Laydown Area
- Site Works Boundary

Source:  
 - (c) Department Finance, Services and Innovation, DCDB, DTDB 2017  
 - Nearmap Imagery May 2018  
 - SILEP LZN NSW DPE 2018

**Zoning Map**

Drawing No: 0424696m\_CNVP\_G002\_R1.mxd  
 Date: 18/06/2018 Drawing Size: A4  
 Drawn By: LT Reviewed By: SDL

Coordinate System: GDA 1994 MGA Zone 56

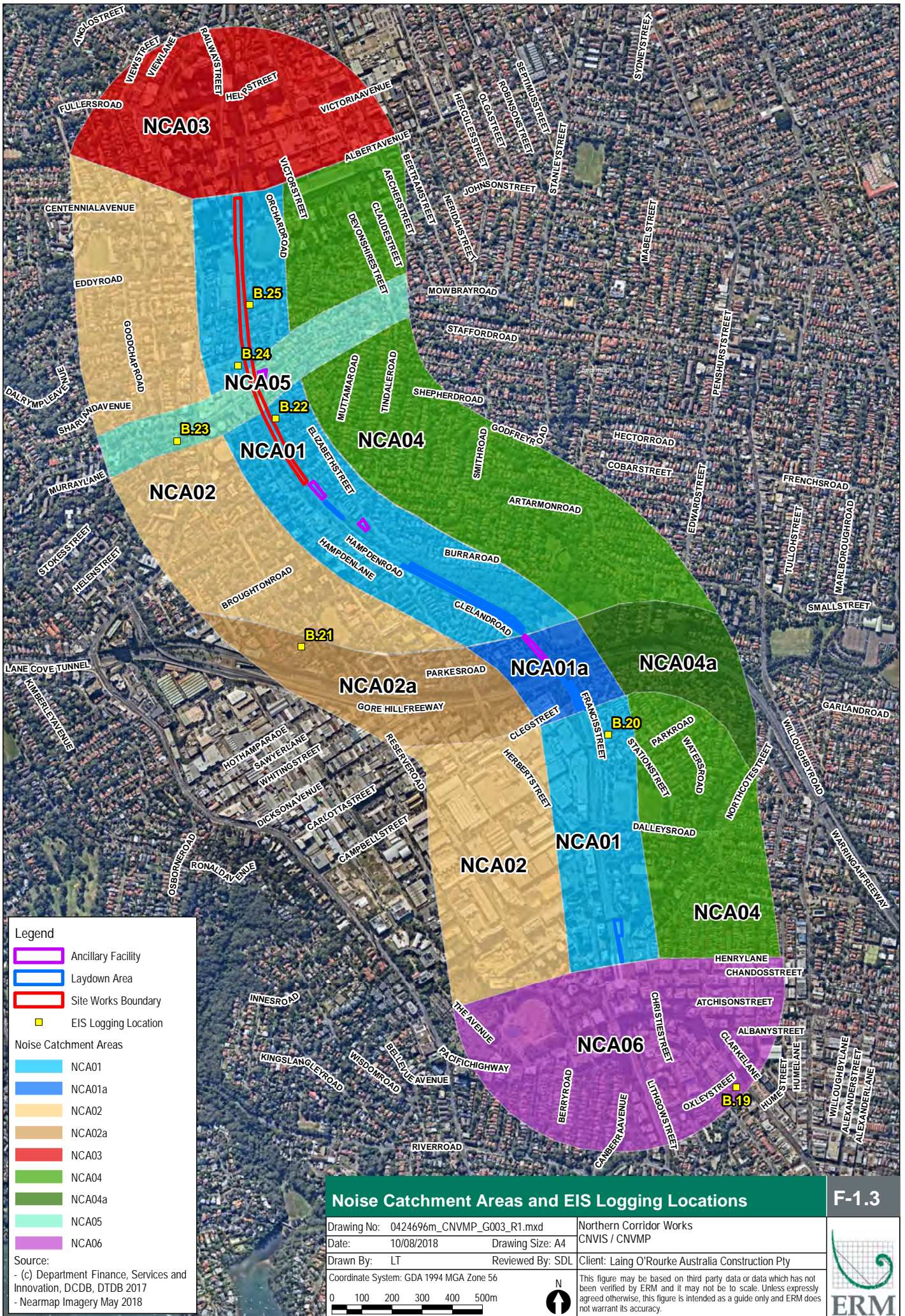
0 100 200 300 400 500m

Northern Corridor Works  
 CNVIS / CNVP

Client: Laing O'Rourke Australia Construction Pty

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

**F-1.2**



**Legend**

- Ancillary Facility
- Laydown Area
- Site Works Boundary
- EIS Logging Location

**Noise Catchment Areas**

- NCA01
- NCA01a
- NCA02
- NCA02a
- NCA03
- NCA04
- NCA04a
- NCA05
- NCA06

Source:  
 - (c) Department Finance, Services and Innovation, DCDB, DTDB 2017  
 - Nearmap Imagery May 2018

**Noise Catchment Areas and EIS Logging Locations**

F-1.3

Drawing No: 0424696m\_CNVMP\_G003\_R1.mxd  
 Date: 10/08/2018 Drawing Size: A4  
 Drawn By: LT Reviewed By: SDL

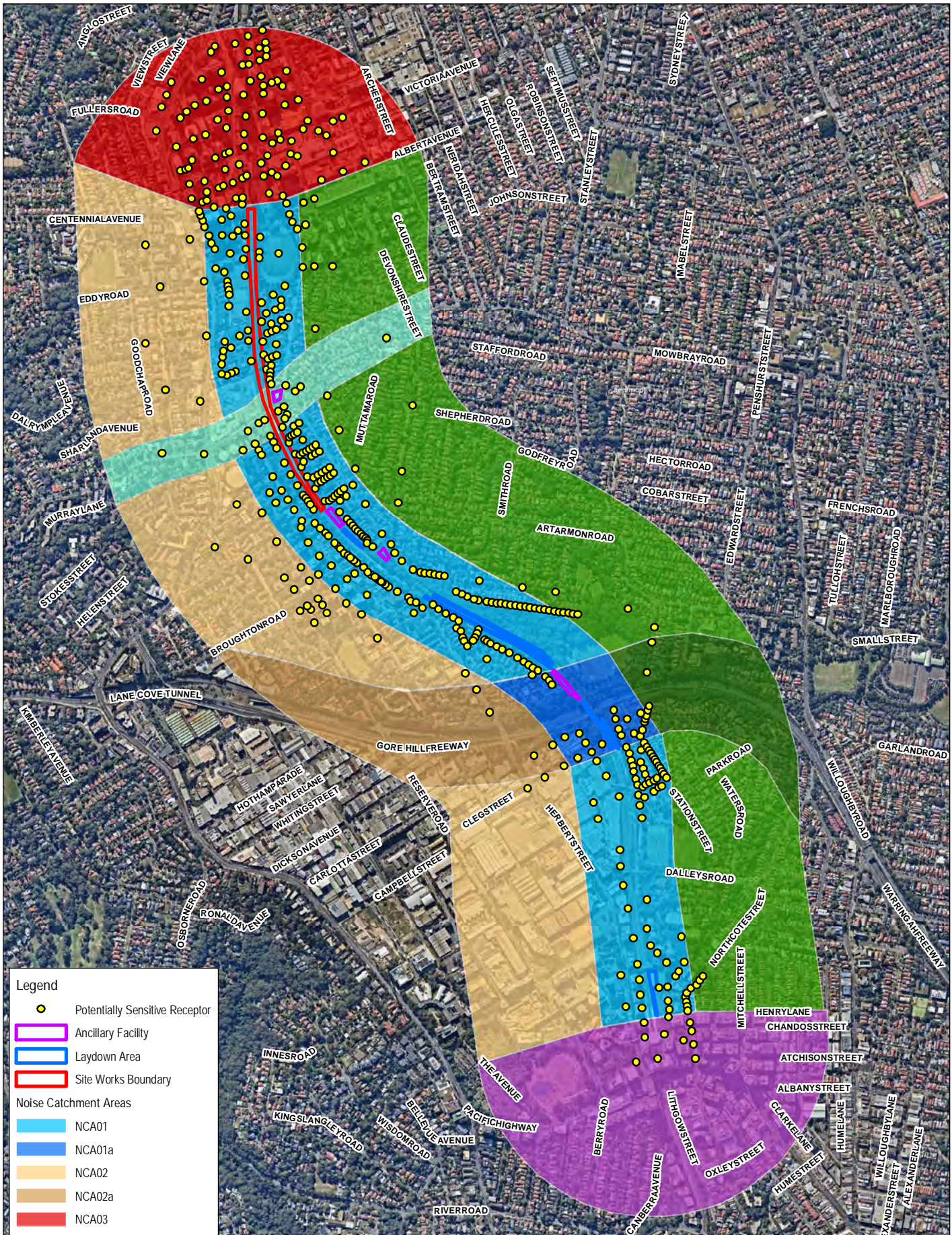
Northern Corridor Works  
 CNVIS / CNVMP  
 Client: Laing O'Rourke Australia Construction Pty

Coordinate System: GDA 1994 MGA Zone 56  
 0 100 200 300 400 500m



This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.





**Legend**

- Potentially Sensitive Receptor
- Ancillary Facility
- Laydown Area
- Site Works Boundary

**Noise Catchment Areas**

- NCA01
- NCA01a
- NCA02
- NCA02a
- NCA03
- NCA04
- NCA04a
- NCA05
- NCA06

Source:  
 - (c) Department Finance, Services and Innovation, DCDB, DTDB 2017  
 - Nearmap Imagery May 2018

### Potentially Sensitive Noise Receptors - Overview Map

F-1.4

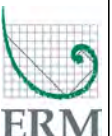
Drawing No: 0424696m\_CNVM\_P\_G004\_R0.mxd  
 Date: 18/06/2018 Drawing Size: A4  
 Drawn By: LT Reviewed By: SDL

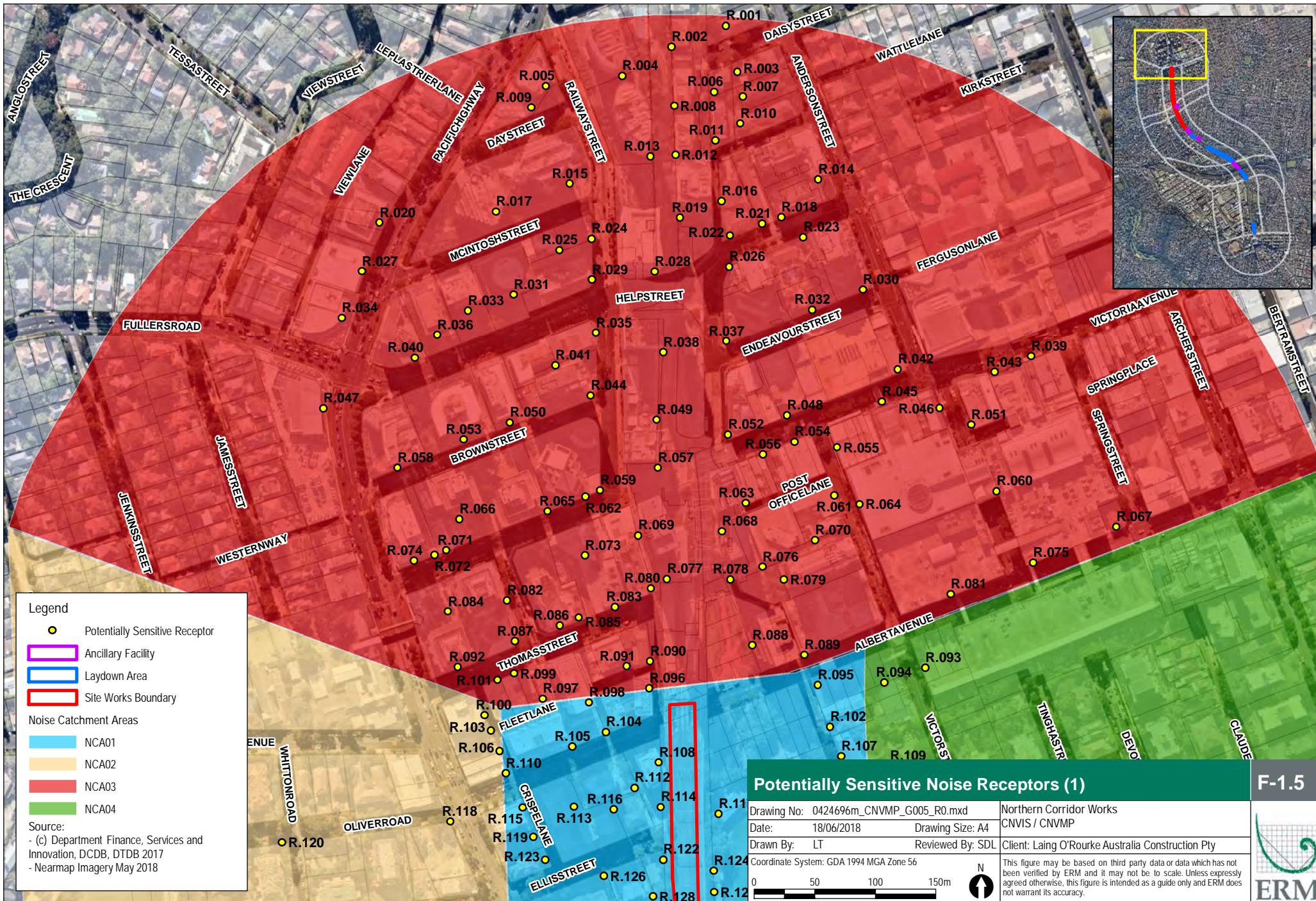
Northern Corridor Works  
 CNVIS / CNVM  
 Client: Laing O'Rourke Australia Construction Pty

Coordinate System: GDA 1994 MGA Zone 56  
 0 100 200 300 400 500m

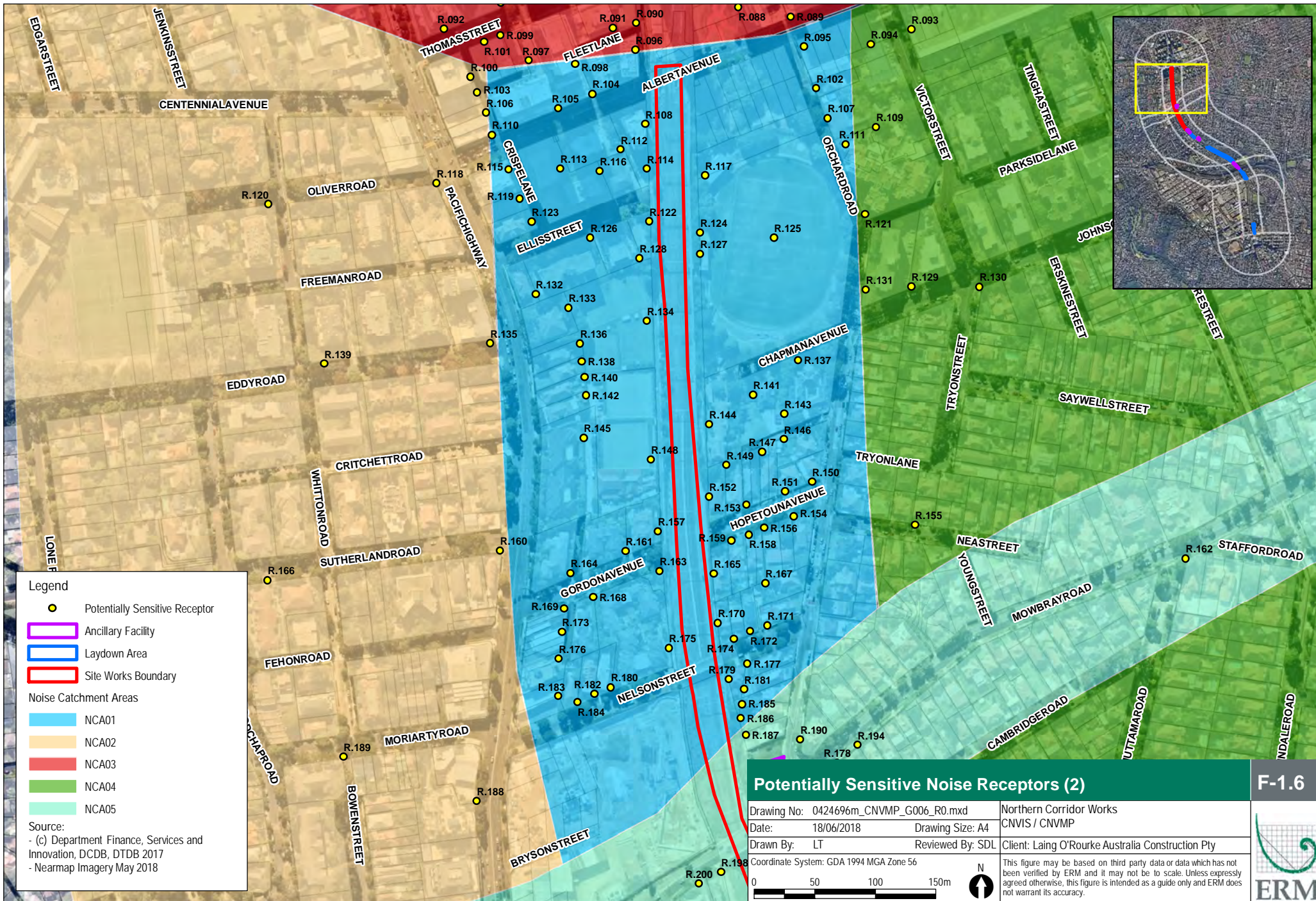


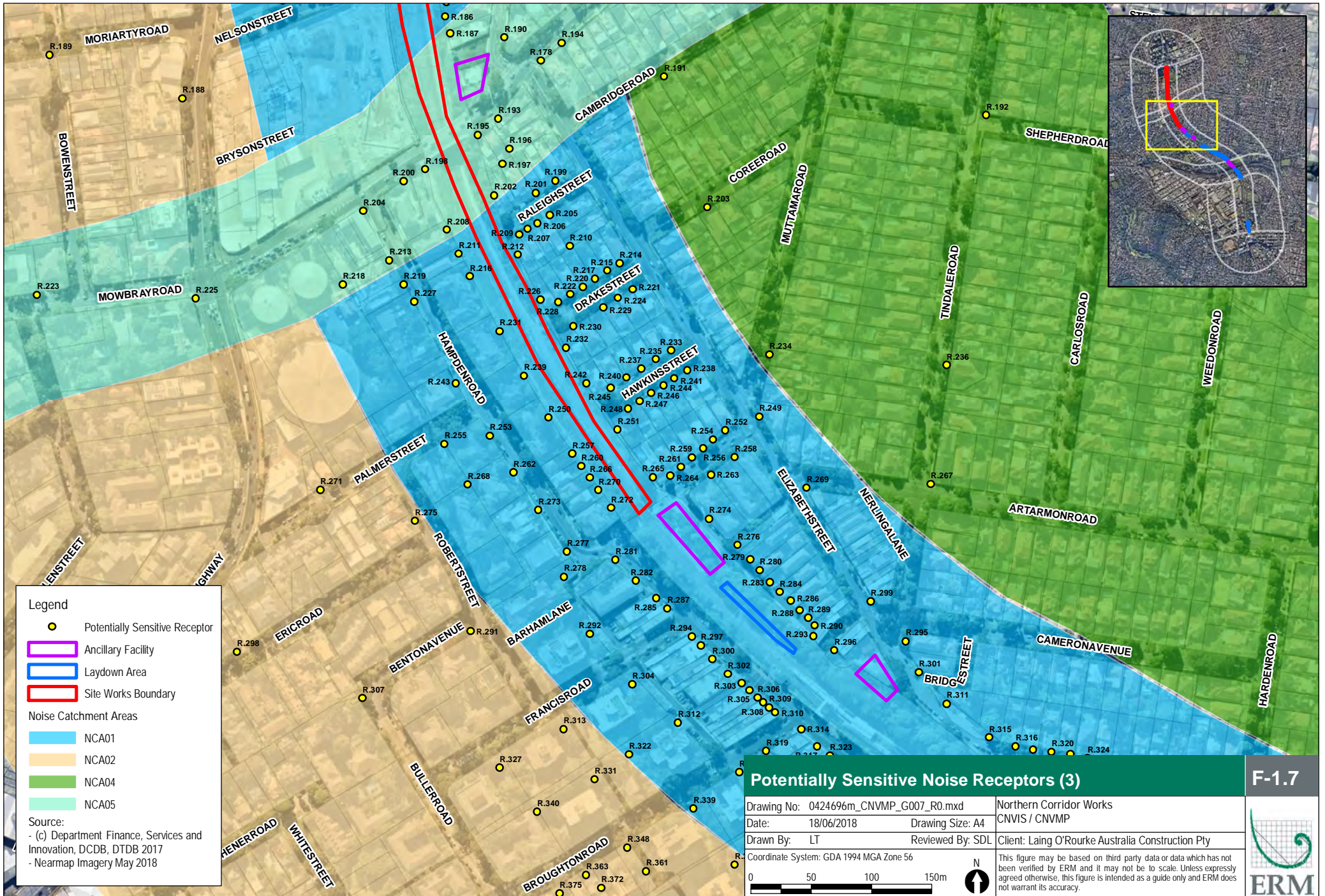
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.





F-1.5





**Legend**

- Potentially Sensitive Receptor
- Ancillary Facility
- Laydown Area
- Site Works Boundary

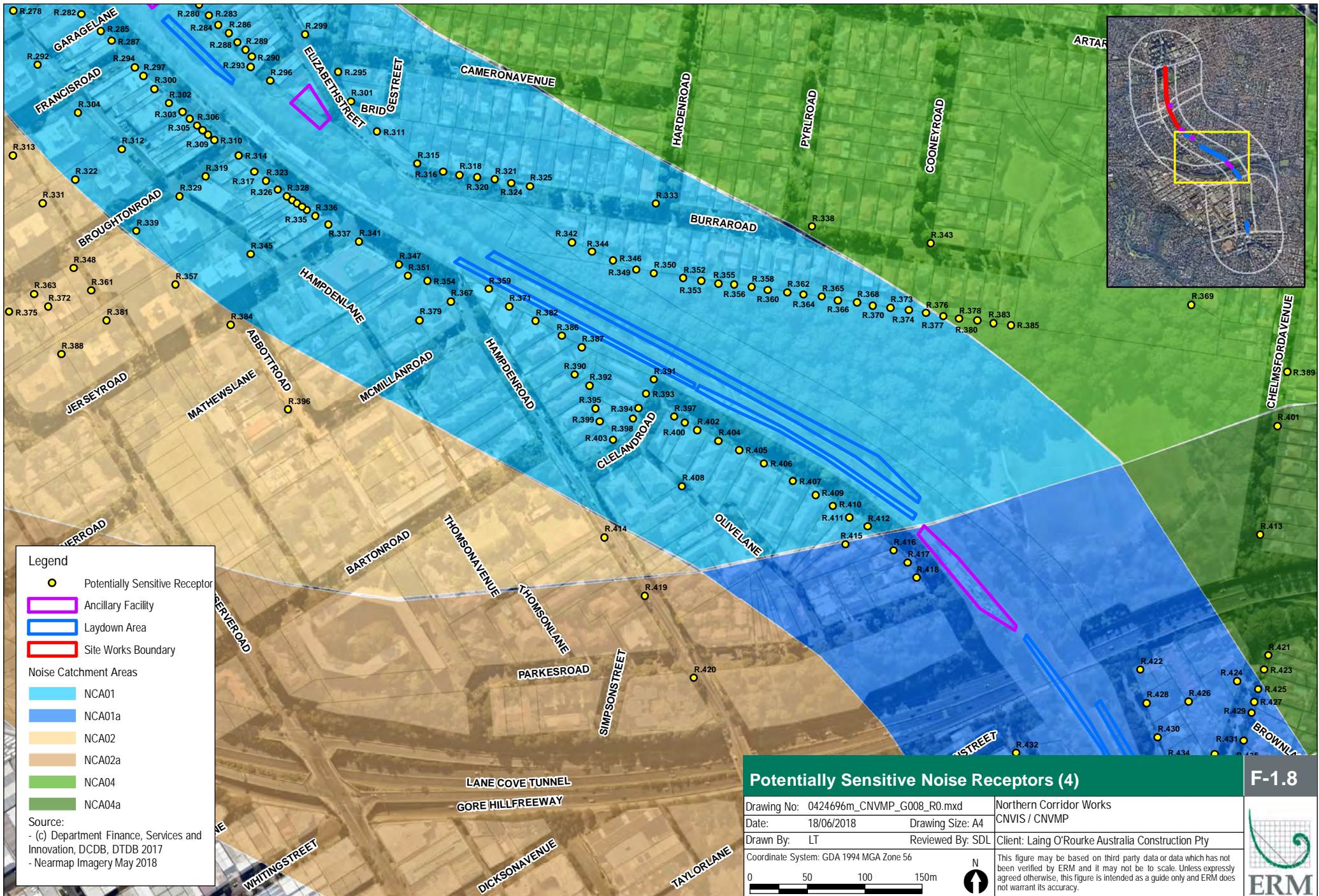
**Noise Catchment Areas**

- NCA01
- NCA02
- NCA04
- NCA05

**Source:**

- (c) Department Finance, Services and Innovation, DCDB, DTDB 2017
- Nearmap Imagery May 2018

<b>Potentially Sensitive Noise Receptors (3)</b>		<b>F-1.7</b>
Drawing No: 0424696m_CNVP_G007_R0.mxd	Northern Corridor Works CNVIS / CNVMP	
Date: 18/06/2018	Drawing Size: A4	Client: Laing O'Rourke Australia Construction Pty
Drawn By: LT	Reviewed By: SDL	
Coordinate System: GDA 1994 MGA Zone 56		
<div style="display: flex; align-items: center;"> <div style="flex: 1;"> </div> <div style="flex: 0.5; text-align: center;"> <p>N</p> </div> </div>	<p>This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.</p>	



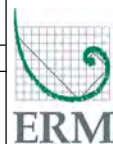
- Legend**
- Potentially Sensitive Receptor
  - Ancillary Facility
  - Laydown Area
  - Site Works Boundary

- Noise Catchment Areas**
- NCA01
  - NCA01a
  - NCA02
  - NCA02a
  - NCA04
  - NCA04a

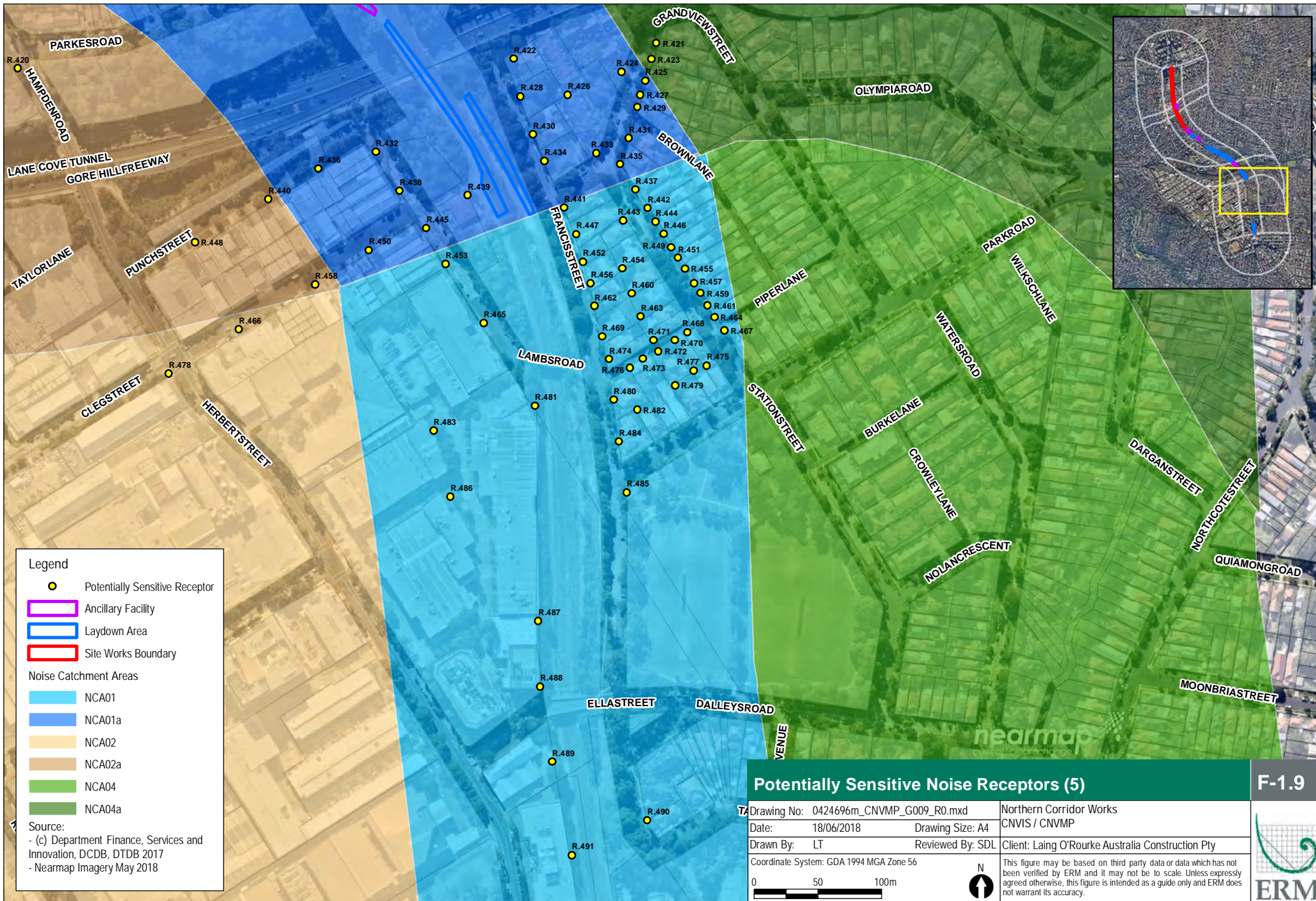
Source:  
 - (c) Department Finance, Services and Innovation, DCDB, DTDB 2017  
 - Nearmap Imagery May 2018

**Potentially Sensitive Noise Receptors (4) F-1.8**

Drawing No: 0424696m_CNVMP_G008_R0.mxd	Northern Corridor Works CNVIS / CNVMP
Date: 18/06/2018	Drawing Size: A4
Drawn By: LT	Reviewed By: SDL
Client: Laing O'Rourke Australia Construction Pty	
Coordinate System: GDA 1994 MGA Zone 56	
0 50 100 150m	N ↑
<p>This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.</p>	





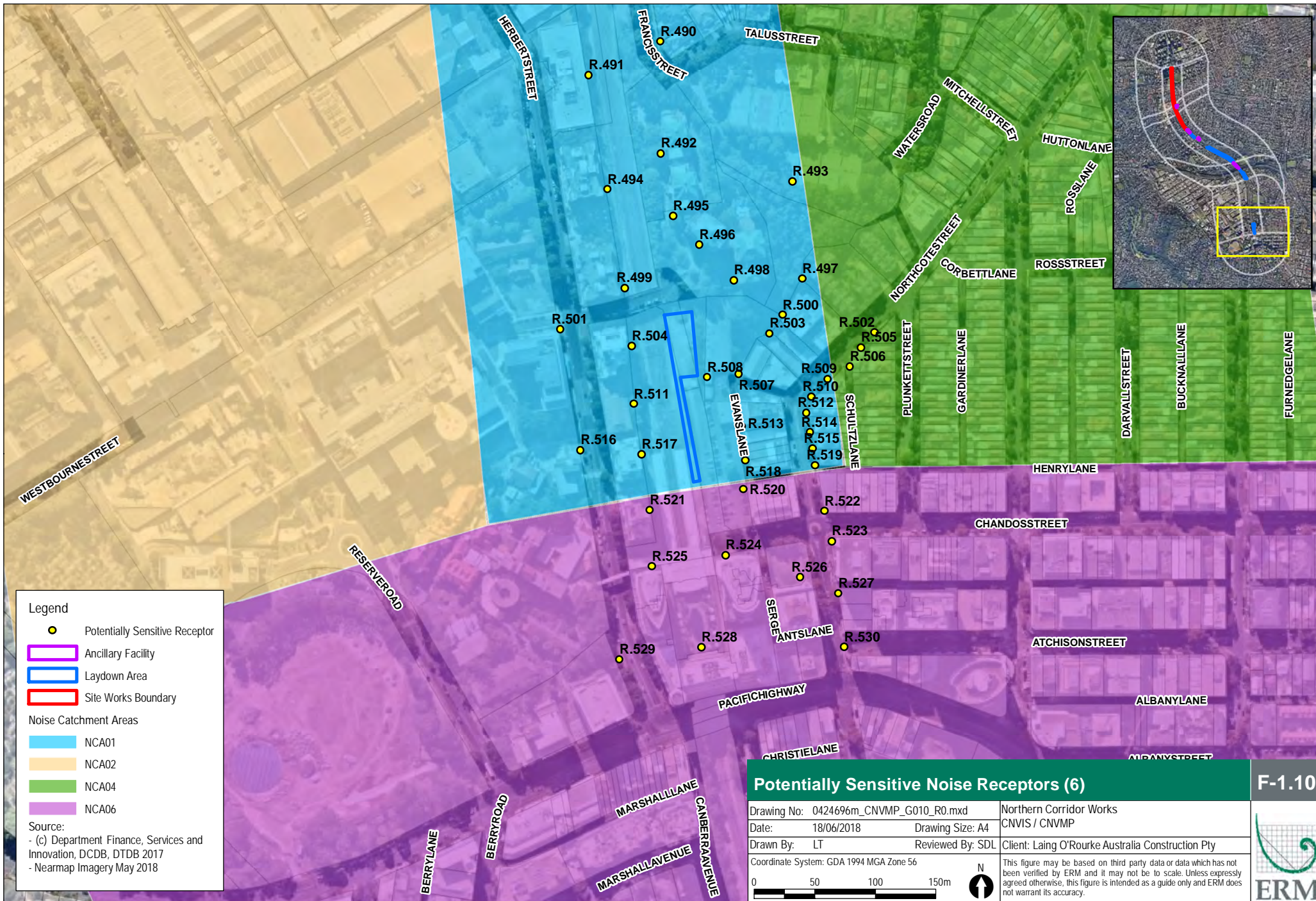


- Legend**
- Potentially Sensitive Receptor
  - Ancillary Facility
  - Laydown Area
  - Site Works Boundary
- Noise Catchment Areas**
- NCA01
  - NCA01a
  - NCA02
  - NCA02a
  - NCA04
  - NCA04a

Source:  
 - (c) Department Finance, Services and Innovation, DCDB, DTDB 2017  
 - Nearmap Imagery May 2018

**Potentially Sensitive Noise Receptors (5) F-1.9**

Drawing No: 0424696m_CNVMP_G009_R0.mxd	Northern Corridor Works CNVIS / CNVMP
Date: 18/06/2018	Drawing Size: A4
Drawn By: LT	Reviewed By: SDL
Client: Laing O'Rourke Australia Construction Pty	
Coordinate System: GDA 1994 MGA Zone 56	
0 50 100m	
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.	



**Legend**

- Potentially Sensitive Receptor
  - Ancillary Facility
  - Laydown Area
  - Site Works Boundary
- Noise Catchment Areas
- NCA01
  - NCA02
  - NCA04
  - NCA06

Source:  
 - (c) Department Finance, Services and Innovation, DCDB, DTDB 2017  
 - Nearmap Imagery May 2018

**Potentially Sensitive Noise Receptors (6)**

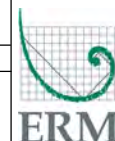
**F-1.10**

Drawing No: 0424696m_CNVMP_G010_R0.mxd	Northern Corridor Works
Date: 18/06/2018	CNVIS / CNVMP
Drawn By: LT	Reviewed By: SDL
Client: Laing O'Rourke Australia Construction Pty	

Coordinate System: GDA 1994 MGA Zone 56



This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.



### 1.3

#### *REVIEW AND UPDATE OF THE CNVIS*

The CNVIS is to was submitted to Sydney Metro for review and submitted for review and endorsement to the Acoustic Advisor and Environmental Representative, as required under CoA - A27(d) and CoA - A24(d), respectively.

Nuisance, or an unacceptable level of noise and vibration amenity, may arise from construction activities associated with new or existing developments.

These potential environmental issues are common to larger scale construction works and in this case are recognised in the broader Sydney Metro project approval documents requiring the preparation of this CNVIS, and the mitigation and management of potential impacts during the approved works and activities. This CNVIS has been conducted and documented to address these potential issues and applies directly to the NCW construction phase of Sydney Metro. It applies only to construction activities, tasks, products and services on the site over which LOR has control or influence.

On this basis, this CNVIS considers the following acoustical factors:

- Air-borne construction noise;
- Ground-borne construction noise;
- Road traffic noise during construction; and
- Ground-borne construction vibration.

Blasting activities and Tunnel Boring Machines (TBM) are not required for the NCW project and are therefore not addressed in this CNVIS. The conditions of approval (CoA) specifically relating to blasting and TBM do not apply to the NCW project.

All sound pressure levels presented in this report (e.g. noise levels predicted at a receptor) are in decibels referenced to  $2 \times 10^{-5}$  Pa. All sound power levels presented in this report (e.g. noise levels assigned to specific sources) are decibels referenced to  $10^{-12}$ W. A glossary of relevant acoustical concepts and terminology is provided in **Annex A**.

## **2.1**

### *SCOPE OF WORK*

To assess NCW construction noise and vibration (including road traffic), the following scope of work has been completed:

- Review and validate the available project and third party data and information as considered relevant to the assessment;
- Review aerial photography, zoning data, cadastre data and third party assessments conducted in the area to identify potential residential and other sensitive receptors situated within the potential area of influence of the NCW;

- Identify significant noise and vibration generating plant, equipment and machinery that may be in use or activities that will be undertaken as part of the NCW and their likely/known emissions to develop applicable assessment scenarios;
- Review third party assessments conducted in the area to establish representative baseline noise levels for the area and then develop project-specific noise and vibration criteria in accordance with recognised NSW policy and guidelines as applicable to project activities;
- Complete a quantitative assessment of key acoustical factors including potential noise and vibration impacts associated with construction aspects. The quantitative assessment was completed by predicting project noise levels (via modelling) for the scenarios developed, with vibration predicted via spreadsheet calculations. Complete a qualitative assessment of low risk acoustical factors;
- Provide a comparison of predicted levels to the project-specific noise and vibration criteria at receptors, identify any levels that exceed criteria and determine the magnitude and extent of any impacts; and
- Recommend mitigation, management measures and/or monitoring options suitable to the predicted levels and designed to minimise impacts as far as is feasible, reasonable and practicable to implement. LOR reviewed these recommendations and is committed to implementing the specified measures during the NCW project, as documented in the CNVMP.

At the time this CNVIS was prepared a CNVMP was prepared concurrently to outline the NCW project's approach to ensuring all risks associated with noise and vibration issues are considered and managed effectively, and in accordance with project's legal, planning and contractual requirements.

## 2.2

### *POLICY SETTING*

In NSW, noise pollution is regulated through the *Protection of the Environment Operations Act 1997* (POEO Act) as the key piece of environment protection legislation. Noise pollution is defined under the POEO Act as:

*'the emission of offensive noise, which means noise that by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances, is harmful (or is likely to be harmful) to or interferes unreasonably (or is likely to interfere unreasonably) with the comfort or repose of a person outside the premises from which the noise is emitted'.*

Various noise and vibration assessment guidelines endorsed by NSW regulators provide a guideline framework and methodology for deriving acceptable levels and standard methods for assessing and measuring construction impacts with due regard to the POEO Act.

The key documents, policy, guidelines and standards relevant to the NCW works are summarised below.

This CNVIS has been developed to address the requirements of the Critical State Significant Infrastructure Conditions of Approval (CoA) (SSI 15\_7400) and the requirements of the Sydney Metro Construction Environmental Management Framework (August 2016).

**CoA - E33** outlines the requirement for Construction Noise and Vibration Impact Statements to be prepared for each construction site prior to noise and vibration impacts occurring and include specific mitigation measures identified through consultation with affected sensitive receivers.

### 2.2.1 *Relevant Policy, Guidelines and Standards*

This assessment has been conducted with due regard to and in accordance with the following key policy, guidelines and standards:

- NSW Department of Environment and Climate Change - *NSW Interim Construction Noise Guideline (ICNG)*, July 2009;
- NSW Department of Environment, Climate Change and Water - *NSW Road Noise Policy (RNP)*, March 2011;
- NSW Environment Protection Authority - *NSW Environmental Noise Management - Industrial Noise Policy (INP)*, January 2000 and relevant application notes;
- NSW Government - Transport for NSW (TfNSW) - *Sydney Metro Construction Noise and Vibration Strategy (SM CNVS)*, August 2016 and CNVS Addendum June 2017;
- NSW Government - Transport for NSW (TfNSW) Infrastructure and Services Division (I&S) - *Sydney Metro Construction Noise and Vibration Strategy (I&S CNVS)*, May 2018;
- Standards Australia AS 2436-2010™ (AS2436) - Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites;
- Standards Australia AS1055-1997™ (AS1055) - Description and Measurement of Environmental Noise;
- Standards Australia AS IEC 61672.1-2004™ (AS61672) - *Electro Acoustics - Sound Level Meters Specifications Monitoring* or Standards Australia AS1259.2-1990™ (AS1259) - *Acoustics - Sound Level Meters - Integrating/Averaging* as appropriate to the device;
- Standards Australia AS/IEC 60942:2004/IEC 60942:2003 (IEC60942) - Australian Standard™ - *Electroacoustic - Sound Calibrators*;

- German Institute for Standardisation – DIN 4150 (1999-02) Part 3 (DIN4150:3) – *Structural Vibration - Effects of Vibration on Structures*;
- British Standard BS7385: Part 2-1993 (BS 7385) - *Evaluation and Measurement for Vibration in Buildings – Part 2 – Guide to Damage Levels from Ground-borne Vibration*, dated 1993; and
- NSW Department of Environment and Conservation – *NSW Environmental Noise Management – Assessing Vibration: a Technical Guideline* (the NSW Vibration Guideline), February 2006.

*NSW Interim Construction Noise Guideline (DECC 2009)*

The ICNG presents an accepted method by which construction noise and vibration impacts may be assessed for a range of receptor types for works completed in NSW. It provides a set of recommended standard hours of construction, as reproduced below:

- Monday to Friday: 7 am to 6 pm;
- Saturday: 8 am to 1pm; and
- No work on Sundays or public holidays.

The ICNG encourages works to occur within the recommended standard hours of construction unless justification is provided. It focuses on minimising construction noise impacts, rather than only on achieving numeric noise levels, and recognises that some noise from construction sites is inevitable.

The ICNG encourages organisations involved with construction, maintenance or upgrading works (e.g. large scale contractors or Government agencies) to develop their own best-practice techniques for managing construction noise and vibration, and implementing feasible and reasonable mitigation measures.

In this case the ICNG is considered the suitable document to quantifiably assess potential noise emissions and impacts associated with project construction.

The ICNG assessment methodology is outlined in more detail in **Annex A** of this report. Baseline noise values are presented in **Section 3** and construction noise criteria are presented in **Section 4** of this report.

*Sydney Metro Construction Noise and Vibration Strategy (CNVS)*

As noted above, the ICNG guideline encourages organisations involved with construction, maintenance or upgrading works (such as Sydney Metro) to develop their own best-practice techniques for managing construction noise.

In line with this recommendation the purpose of this 'Construction Noise and Vibration Strategy' is to document how Sydney Metro proposes to manage

construction noise and vibration for the Sydney Metro City and Southwest project including any potential extensions.

Generally the strategy is intended to provide a single interface for the large number of policies, guidelines, standards and regulations that apply to a large infrastructure project such as Sydney Metro. Where possible the strategy consolidates these information sources e.g. vibration criteria from numerous sources are collated into one section of this strategy for ease of reference. Further, the strategy aims to provide interpretation of the reference documents which are specific to the Metro project. Where the reference documents are found to have insufficient detail the strategy provides additional assessment criteria and methodologies.

#### *NSW Industrial Noise Policy (EPA 2000)*

Responsibility for the control of noise emissions in NSW is typically vested in Local Government and the NSW Environment Protection Authority (EPA). The INP and relevant application notes provide a framework and methodology for deriving limit conditions for consent and licence conditions.

The INP is designed for large and complex industrial sources and outlines processes designed to strike a feasible and reasonable balance between the operations of industrial activities and the protection of the community from noise levels that are intrusive or unpleasant.

The INP measurement and evaluation methodology to quantify existing ambient and background noise levels has been adopted for this CNVIS, with the baseline values utilised to derive construction noise criteria. The INP assessment terminology is outlined in more detail in **Annex A** of this report.

#### *NSW Road Noise Policy (DECCW 2011)*

The RNP was approved to replace the Environmental Criteria for Road Traffic Noise (ECRTN) with effect from 1 July 2011. The RNP outlines the range of measures needed to minimise road traffic noise and its impacts. It is intended for use by acoustics specialists as well as:

- Road project proponents;
- Determining authorities and regulators involved in the approval and construction of road projects and land use developments that generate additional traffic on existing roads; and
- City and transport planners and policymakers dealing with issues such as route corridors, heavy vehicle transport and building codes.

The RNP aims to identify the strategies that address the issue of road traffic noise from existing roads, new road projects, road redevelopment projects and new traffic-generating developments. In this case the RNP is considered the



suitable document to qualitatively assess potential noise emissions and impacts associated with construction road traffic.

The RNP vary based on road type and are dependent on the development being assessed (refer **Section 4**). The criteria values from the RNP were considered in the assessment of potential construction impacts, they are used to provide guidance on potential short-term and temporary impacts associated with heavy vehicle haulage and/or other like vehicles that may be required as part of the construction.

#### *Vibration Guidelines and Standards*

For the purposes of this CNVIS, the effects of vibration in buildings can be divided into two main categories: human comfort (annoyance) and building damage (cosmetic/structural). An overview of the applicable standards and guidelines is provided below.

**Human Comfort (annoyance):** The NSW Vibration Guideline provides guidance for assessing human exposure (comfort or annoyance issues) to vibration. The publication is based on British Standard (BS 6472-1992) – *Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)*, dated 1992.

**Cosmetic and Structural Damage:** There is currently no Australian policy or guideline for assessing the potential for building damage (cosmetic and structural) from vibration. To achieve the requirements of the SM CNVS, British Standard BS 7385 Part 2-1993 'Evaluation and measurement for vibration in buildings Part 2' has been considered for NCW works where applicable. BS 7385 provides safe limit guideline values, below which vibration is considered insufficient to cause structural or cosmetic damage to buildings. If a heritage building or structure is found to be structurally unsound a more conservative standard has been adopted i.e. German Standard DIN4150 Part 3-1999 (DIN4150-3) – *Structural Vibration - Effects of Vibration on Structures*, dated 1999. DIN4150-3 presents a set of safe limit values that below which cosmetic or structural damage is unlikely to occur.

The NSW Vibration Guideline, BS7385 and DIN 4150-3 criteria vary based on vibration type, receptor type and are dependent on the component frequency of the vibration event (refer **Section 4**). The criteria values from the NSW Vibration Guideline, BS7385 and DIN 4150-3 were considered in the assessment of potential impacts but are not reproduced here.

Some scientific and medical equipment (e.g. electron microscopes and microelectronics manufacturing equipment) can require more stringent objectives than those applicable to human comfort. There are currently no receptors identified for the NCW project that contain scientific and medical equipment. Therefore, this criteria has not been presented in this CNVIS and is not included in the assessment.

The methodology, inputs and assumptions that have informed the construction and operational noise modelling are outlined below:

- Brüel and Kjær's Predictor 7810 (Version 12.0) noise modelling software package was utilised to calculate noise levels using the International Organisation for Standardisation (ISO) 9613-2:1996 (ISO9613:2) - *Acoustics - Attenuation of Sound during Propagation Outdoors - Part 2: General Method of Calculation* noise propagation algorithms (international method for general purpose, 1/1 octaves);
- For sound calculated using ISO9613:2, the indicated accuracy is  $\pm 3$  dBA at source to receiver distances of up to 1000 metres (m) and unknown at distances above 1000m;
- The Predictor software package allowed 3D elevation data to be combined with ground regions, water, foliage, significant building structures etc. and receptor locations, to create a detailed and accurate representation of the site and surrounding area. The noise model allowed for the quantification of noise levels from multiple sources, based on sound power or pressure levels emitted from each source. The model computed the noise propagation in the assessment area of influence to specifically quantify A-weighted decibels ( $L_{eq}$ , 15minute and  $L_{max}$  in dBA) at identified receptors;
- Sound Power Level ( $L_W$ , dBA) data incorporated into the project-specific noise models was provided by the client, obtained from relevant Australian Standards or adapted from a proprietary source term database available at the time of the assessment. This assessment has considered standard good practice mitigation measures via noise modelling by adopting the midpoint values for all sound power levels:
  - $L_W$  is a measure of the total power radiated by a source; it is a fundamental property of the source and is independent of the surrounding environment;
  - $L_W$  differs from a Sound Pressure Level ( $L_P$ ) which is the level of sound pressure as measured at a distance by a standard sound level meter with a microphone.  $L_P$  is the received sound (e.g.  $L_{eq}$ , 15minute in dBA) as opposed to  $L_W$  which is the sound 'intensity' at the source;
- 3D elevation data, zoning data and cadastre (spatial data) was obtained from the NSW Government - *Land and Property Information* (LPI):
  - Buildings near the NCW were included in the noise model based on this spatial data or manually digitised from aerial photography;
  - They were modelled as building regions for the broader areas surrounding the NCW but were included as specific buildings for those in close proximity to the site;

- Noise Catchment Areas (NCA, as identified in **Section 3.1**) were utilised to establish receptor areas and locations. These locations were selected to ensure the most affected points were assessed. The NCA and receptor locations adopted for this assessment were presented in **Figures 1.3 and 1.4**;
- Noise levels were calculated at 1.5 metres (m) above ground level for all receptors, in accordance with the INP and ICNG. It is noted that ambient, background and project noise levels may be higher at receptor heights above 1.5 m;
- In all cases noise has been assessed at the most-affected point at or within the residential property boundary or, if that is more than 30 metres from the residence, at the most-affected point within 30 metres of the residence;
- The model included a temperature of 13.8°C and humidity of 57%, representative of conservative historic annual mean minimum conditions in the region. Further information is provided below regarding prevailing meteorological conditions. A ground factor of 0.6 was adopted for the modelling area (0.0 is hard, 1.0 is soft);
- Amongst other features noise modelling software offer a range of emission source types to be used to predict levels at receptors, these include but are not limited to “area sources” and “point sources”. These source types were adopted as follows:
  - To accurately represent general construction emissions, capturing the size, layout and number of noise generating plant / equipment, “area sources” were utilised to predict  $L_{eq, 15\text{minute}}$  noise levels. A separate area source was placed in the model for each phase of works to represent the distribution of noise across the broader project site during each work phase; and
- The noise assessment scenarios and modelling data are summarised in **Section 4** and presented in detail in **Annex C**. All LW, dBA values have considered and applied the relevant INP modifying factors (penalties) for offensive noise characteristics, prior to modelling.

### 2.3.1 *Prevailing Meteorological Conditions*

Prevailing meteorological conditions have the potential to increase noise levels at receptors influenced by the effects of wind and temperature inversions. Winds blowing between the source and the receptor, and temperature inversions can increase noise levels by between 1 dBA and approximately 7 dBA depending on the distance of the receptor from the source and condition. These noise level increases are normally detectable (or quantifiable via modelling) for receptor distances greater than 100 metres from the source.

For this construction noise model meteorological conditions for prevailing winds were not included in the model however a D-Class atmospheric stability condition was adopted (representing standard meteorological conditions) for all scenarios.

Although other receptors are situated at distances further from the site that could be influenced by the effects of other wind and inversion conditions, compliance at the closest receptors and further attenuation provided by intervening building structures and topography will ensure compliance at other receptors.

## 2.4 VIBRATION ASSESSMENT

To assess potential vibration impacts this CNVIS has adopted the applicable safe working distances published in the TfNSW CNS. These safe working distances have been reproduced in **Table 2.1** below.

**Table 2.1** *Minimum working distances for vibration intensive activities (TfNSW)*

Plant Item	Approx. Size/Weight/Model	Safe Working Distance - metres (m)	
		Cosmetic Damage (BS 7385)	Human Comfort (the NSW Vibration Guideline)
Vibratory Roller	1-2 tonnes	5 m	15 m to 20 m
	2-4 tonnes	6 m	20 m
	4-6 tonnes	12 m	40 m
	7-13 tonnes	15 m	100 m
	13-18 tonnes	20 m	100 m
	> 18 tonnes	25 m	100 m
Small Hydraulic Hammer	300 kg (5 to 12t excavator)	2 m	7 m
Medium Hydraulic Hammer	900 kg (12 to 18t excavator)	7 m	23 m
Large Hydraulic Hammer	1600 kg (18 to 34t excavator)	22 m	73 m
Pile Driver - Vibratory	Sheet piles	2 m to 20 m	20 m
Piling Rig - Bored	≤ 800 mm	2 m (nominal)	n/a
Piling Rig - Hammer	12t down force	15 m	50 m
Jackhammer	Hand held	1 m (nominal)	Avoid contact with structure

*Source: TfNSW I&S CNVIS, 2018*

In all cases the assessment of vibration criteria (cosmetic/structural damage and human annoyance) is focused on the closest and/or potentially most affected vibration receptors being R.170, R.174, R.175, R.177 and R179 for SCN10 (Nelson St Bridge) and R.198 and R.195 for SCN11 and SC12 (Mowbray Rd Bridge Bridge).

All safe working distances are estimates only and may vary depending on geotechnical features and intervening structures, amongst other things. In ERM's experience these safe working distances are typically conservative but offer a useful guide for the purpose of assessing impacts, evaluating mitigation and management measures and defining monitoring requirements.

Vibration safe working distances for the track tamper are unknown therefore attended vibration measurements are required at the commencement of track tamper activities (SCN04 and SCN05) to confirm that vibration levels satisfy the criteria outlined in **Section 5.3**. Where there is potential for exceedances of the criteria further vibration site law investigations will be undertaken to determine the site-specific safe working distances for the vibration generating activity. Continuous vibration monitoring with audible and visible alarms will be conducted at the nearest sensitive receivers whenever those vibration generating activities need to take place inside the calculated safe-working distances.

## 2.5 *CUMULATIVE IMPACTS*

### 2.5.1 *Construction Noise*

Noise impact assessments are generally based on predicting project-specific levels at the closest and/or most affected receptors and then comparing these to criteria or management levels that apply to the type of emission being considered. To assess potential cumulative impacts a varied approach has therefore been adopted as described below.

The construction noise criteria (ICNG) and management levels are based on both fixed (values identified in the ICNG) and existing noise levels measured at locations surrounding the site. The ICNG management levels focus on the direct impacts from the site under assessment, cumulative impacts are beyond the control of LOR, are temporary in most circumstances and are best managed by local or state consent authorities for significant projects. Therefore, a qualitative assessment of potential cumulative impacts has been conducted but limited discussion regarding cumulative impacts is required.

#### *Road Traffic Noise*

The road traffic noise criteria (RNP) are fixed values but are derived to assess the site noise level contribution (i.e. project vehicles on public roads) and the effects of cumulative road traffic noise impacts. Therefore, the RNP criteria address potential cumulative impacts without further discussion required.

## 2.5.2

### *Construction Vibration*

The vibration criteria (the NSW vibration guideline and DIN4150-3) are again fixed values derived to assess the site vibration level contribution, cumulative impacts will unlikely occur in most circumstances due to the lack of impact from existing influential sources. In addition the SM CNVS provides a conservative vibration damage screening level per receptor type is given below:

- Reinforced or framed structures: 25.0 mm/s; and
- Unreinforced or light framed structures: 7.5 mm/s.

At locations where the predicted and/or measured vibration levels are greater than shown above (peak component particle velocity), a more detailed analysis of the building structure, vibration source, dominant frequencies and dynamic characteristics of the structure would be required to determine the applicable safe vibration level. This analysis would also consider any cumulative impacts from existing vibration sources.

Therefore, a qualitative assessment of potential cumulative impacts from vibration has been conducted but limited discussion regarding cumulative impacts is required.

With the above features in mind the focus of any discussion regarding cumulative impacts is associated with construction noise, as presented in **Chapter 5** of this document.

A key element in assessing environmental noise impacts is an understanding of the existing ambient and background noise levels in the vicinity of the closest and/or potentially most affected receptors situated in proximity to a site. This chapter provides a summary of the existing noise conditions as relevant to NCW.

### 3.1

#### *NOISE CATCHMENT AREAS*

ERM has identified 'Noise Catchment Areas' (NCA) for nine discrete areas surrounding the NCW project. These NCA were established to approximate areas of land that:

- may experience similar existing noise levels;
- may experience similar noise levels to receptor locations where values are predicted via modelling; and
- to inform the extent of any notification area boundary that may be required.

These NCA are an important feature of the assessment as it is not feasible or useful to predict noise levels at every building or dwelling within the potential area of influence of the NCW. These NCAs were designed based on proximity to the rail corridor and other existing noise sources in the area such as the M2 Motorway, the Pacific Highway, Mowbray Road and the Chatswood and St Leonards Central Business District (CBD). These NCA are presented in **Figure 1.3** and are described below in **Table 2.1**.

**Table 3.1 Noise Catchment Areas (NCA)**

Noise Catchment Area (NCA)	Description	Distance (m)
		Rail/Road or Train Station
NCA01	Residential and industrial/commercial receptors within 150m of the rail corridor.	<150m
NCA01a	The southern portion of NCA01 that falls within 150m of the M2 motorway.	<150m
NCA02	Residential and commercial receptors beyond 150m and within 550m west of the rail corridor.	>150m west
NCA02a	The southern portion of NCA02 that falls within 150m of the M2 motorway.	>150m west
NCA03	Residential and commercial within a radius of 500m from the Chatswood train station encompassing the Chatswood CBD area.	<500m
NCA04	Residential and commercial receptors beyond 150m and within 550m east of the rail corridor.	>150m east
NCA04a	The southern portion of NCA04 that falls within 150m of the M2 motorway.	>150m east
NCA05	Receptors that fall within 50m of Mowbray road	<50m
NCA06	Residential and commercial within a radius of 500m from the St Leonards train station encompassing the St Leonards CBD area, in close proximity to the Pacific highway.	<500m

1. NCA presented in **Figure 1.3** of this document.

### 3.2 POTENTIALLY SENSITIVE RECEPTORS

Five hundred and thirty (530) sensitive receptors have been identified as the closest and/or potentially most affected locations situated within the potential area of influence of the NCW. The full list sensitive receptors along with the mapped locations from the noise model are provided in **Annex B**.

These locations were established based on review of aerial photography, land use zoning and cadastre data and the results of preliminary noise modelling, where receptor positions were optimised to ensure representative worst-case levels were being predicted.

The selected locations do not represent all receptors located in the vicinity of the NCW but have been selected for the purposes of this noise and vibration impact assessment; they are considered to be representative of locations that will potentially experience the highest impacts associated with the NCW, and will be the most affected during construction activities.

A rail noise barrier is located along the rail corridor between Nelson Street and Albert Avenue. Reduced impacts are therefore anticipated for the receptors where shielding is provided by the rail noise barrier.

The NCA and an overview of all sensitive receptor locations are identified in the **Figure 1.3** to **Figure 1.10**.



Existing conditions have been quantified from the data presented in the EIS. Environmental noise monitoring was conducted by SLR at seven locations between June and September 2015 to inform the EIS (TfNSW, SLR 2016). These seven monitoring locations are identified in the EIS as B.19, B.20 B.21, B.22, B.23, B.24 and B.25.

Rating Background Levels (RBL) representative of each of the nine NCAs identified for this CNVIS were adapted based on the RBLs presented in the EIS. The RBLs adopted for this CNVIS (and subsequent CNVMP) are presented in **Table 3.2** below for the day, evening and night-time periods. The following assumptions were used:

- The RBL for NCA01 was determined using the 50th percentile of the RBLs from the monitoring locations B.22, B.24 and B.25. This method was used to provide a median value of the background noise data captured across the NCA01 area. This RBL was adopted due to the close proximity to the T1 North Shore Railway and is representative of the acoustical environment under the influence of the railway;
- RBLs for NCA01a, NCA02a and NCA04a were determined using the RBL for monitoring location B.21. This RBL was adopted due to the close proximity to the M2 Motorway and is representative of the acoustical environment under the influence of the M2 Motorway;
- The RBL for NCA02 was also determined similar to NCA01 using the 50th percentile of the RBLs from the monitoring locations B.22, B.24 and B.25. This RBL was adopted due to the influence of the Pacific highway and Mowbray road traffic within this NCA which, compared to the data recorded at B.23 (see note below) provided a more conservative statistical method for establishing representative data for this acoustical environment;
- For NCA03 the RBL was determined using the 50th percentile of the RBLs from the monitoring locations B.24 and B.25. This RBL was adopted due to the potential influence of the built commercial environment near to the Chatswood CBD and provided a conservative statistical method for establishing representative data for this acoustical environment;
- Lowest RBL values from B.22 and B.25 were adopted for NCA04. This NCA is predominantly residential and situated furthest away from commercial, road and rail noise influences therefore this RBL was adopted to represent the largely residential environment of this area;
- The RBL values from B.23 were adopted for NCA05. This RBL was adopted due to the close proximity to Mowbray road and is representative of the acoustical environment under the influence of Mowbray road; and

- The RBL values from B.19 were excluded due to the high influence of traffic on the Pacific Highway. The RBL adopted for NCA06 was therefore taken from B.20 which is representative of the overall area, not directly influenced by traffic. This RBL is similar to that adopted for NCA03 (Chatswood CBD) and is considered representative of the acoustical environment near to the St Leonards CBD.

There is no formal requirement to measure existing vibration levels. In general ambient vibration levels are typically imperceptible, in the absence of any significant vibration generating source.

Due to the built environment of the area surrounding the NCW and the noise reduction expected from the shielding provided by the first row of buildings to the surrounding buildings and receptors, reduced impacts are anticipated for these additional locations and in the broader community.

**Table 3.2 Rating Background Levels**

Noise Catchment Area (NCA)	Rating Background Levels (RBL) in dBA		
	Daytime (7am to 6pm)	Evening (6pm to 10pm)	Night-time (10pm to 7am)
NCA01	42	41	35
NCA01a	49	46	41
NCA02	42	41	35
NCA02a	49	46	41
NCA03	46	44	37
NCA04	41	40	34
NCA04a	49	46	41
NCA05	63	60	45
NCA06	45	45	38

*Source: Adapted EIS Data, SLR 2016*

### 3.4 ASSESSMENT SCENARIOS

Assessment scenarios were developed to identify significant noise and vibration generating plant, equipment and machinery that may be in use or activities that will be undertaken as part of the NCW works. These scenarios were informed through information provided by LOR and the indicative construction schedule provided in the CEMP.

A summary of the 27 assessment scenarios that were considered is provided below in **Table 3.3**. The full set of data and assessment scenarios that were considered is provided in **Annex C**.

The sound power level (LW) data identified for individual plant / equipment is presented as relevant to the noise assessment, as well as the quantity of equipment and potential for out-of-hours works (OOHW) to be required.

For ground-borne vibration, the only activities and/or equipment with potential to generate vibration (i.e. excavators with hydraulic hammers (SCN10, SCN11 and SCN12) and the track tamper (SCN04 and SCN05)) are considered and assessed as is described in **Chapter 5** of this document.

A number of general modelling features are also described in **Annex C**. **Quantity** is the number of equipment operating per 15 minute assessment period. **Duty Factor** is the percentage of time the equipment operates per 15 minute assessment period, or represents a reduced emission for part of the period. **Base LW Value** is source emission or 'Sound Power Level' (LW) directly allocated to the equipment, unadjusted. **Penalty** (modifying correction factor) considers any annoying characteristics such as tonality, low frequency noise or impulsiveness. **Total LW Value** is the overall equipment source emission (LW) adjusted for the quality, duty factor and penalty.

**Table 3.3** *Assessment Scenarios*

ID	Activity	OOHW Required?	Schedule	Proposed Dates
SCN01	Clearing and Grubbing for site establishment	N	Standard Construction Hours	As required
SCN02	Overhead Wiring Footings, Structures and Wiring	Y	Weekend Possessions, Day and Night	JAN 2018 - MAR 2020
SCN03	Drainage System Installation	Y	Weekend Possessions, Day and Night	AUG 2019 - MAR 2020
SCN04	Track Slew or Switch	Y	Weekend Possessions, Day and Night	OCT 2018 - JUN 2019
SCN05	Removal of existing Tracks	Y	Weekend Possessions, Day and Night	OCT 2018 - JUN 2019
SCN06	HV Electrical Works	Y	Weekend Possessions, Day and Night	OCT 2018 - DEC 2019
SCN07	Construction of Combined Services Route (CSR)	Y	Weekend Possessions, Day and Night	OCT 2018 - DEC 2019
SCN08	Under Line Crossing (ULX) Works	Y	Weekend Possessions, Day and Night	OCT 2018 - DEC 2019
SCN09	Relocation and Termination of Utilities in Nelson St Bridge	Y	Weekend Possessions, Day and Night	NOV 2018
SCN10	Nelson St Bridge Demolition	Y	Standard Construction Hours + Weekend Possessions, Day and Night	23-24 FEB 2019 05-06 APR 2019 22-23 JUN 2019
SCN11	Mowbray Rd Bridge Demolition of break Wall-OOHW	Y	Weekend Possessions, Day and Night	6-7 OCT 2018
SCN12	Mowbray Rd Bridge Construction of base slab and deflection wall	Y	Standard Construction Hours + Weekend Possessions, Day and Night	08-26 OCT 2018

<b>ID</b>	<b>Activity</b>	<b>OOHW Required?</b>	<b>Schedule</b>	<b>Proposed Dates</b>
SCN13	Mowbray Rd Bridge Install of Precast piles - Standard Hours	N	Standard Construction Hours	05-16 NOV 2018
SCN14	Mowbray Rd Bridge Install of Crash Barrier and Footpath - OOHV	Y	Weekend Possessions, Day and Night	17-18 NOV 2018
SCN15	Mowbray Rd Bridge Footpath alterations / Road Works - Standard Hours	N	Standard Construction Hours	NOV 2018 - FEB 2019
SCN16	Rail Corridor Fence / Noise Walls Installation	Y	Standard Construction Hours + Weekend Possessions, Day and Night	VARIOUS
SCN17	Orchard Rd Ancillary Facility	Y	Standard Construction Hours + OOHV	VARIOUS
SCN18	Brand St Ancillary Facility	Y	Standard Construction Hours + OOHV	VARIOUS
SCN19	Brand St Laydown Area	Y	Standard Construction Hours + OOHV	VARIOUS
SCN20	Hampden Road Laydown Area	Y	Standard Construction Hours + OOHV	VARIOUS
SCN21	Elizabeth St Ancillary Facility	Y	Standard Construction Hours + OOHV	VARIOUS
SCN22	Elizabeth St Laydown Area	Y	Standard Construction Hours + OOHV	VARIOUS
SCN23	Cleland Rd Ancillary Facility	Y	Standard Construction Hours + OOHV	VARIOUS
SCN24	Cleland Rd Laydown Area	Y	Standard Construction Hours + OOHV	VARIOUS
SCN25	Cleland Rd Stockpiling	Y	Standard Construction Hours + OOHV	VARIOUS
SCN26	Lambs Rd Laydown Area	Y	Standard Construction Hours + OOHV	VARIOUS
SCN27	St Leonards Yard Laydown Area	Y	Standard Construction Hours + OOHV	VARIOUS

Source: LOR

A key element in assessing environmental noise impacts is an understanding of the existing ambient and background noise levels in the vicinity of the closest and/or potentially most affected receptors situated in proximity to a site. This chapter provides a summary of the existing noise conditions as relevant to NCW.

#### 4.1 AIR-BORNE NOISE MANAGEMENT LEVELS

Based on the ICNG and SM CNVS methodology the following construction Noise Management Levels (NMLs) for residential receptors in each NCA will apply to the NCW as presented in **Table 4.1**. Predicted noise levels are compared to these “criteria” values in **Section 5** to identify any activities that exceed the applicable management levels and to identify the extent of potential noise impacts.

For other sensitive receptors (i.e. not residential) the internal/external criteria value translated from the ICNG may be adopted as relevant and if other receptors are identified. External NMLs for other sensitive receptors applicable to this assessment have also been included in **Table 4.2** below. These NML values apply to other sensitive receptors when in-use.

**Table 4.1 Background Noise and Management Levels (Residential Receptors)**

Noise Catchment Area (NCA)/ Receptor type	Noise Management Level - LAeq, 15 minute			
	Standard Construction Hours RBL + 10 in dBA <sup>1</sup>	Outside Standard Construction Hours RBL + 5 in dBA		
		Daytime <sup>2</sup>	Evening <sup>3</sup>	Night <sup>4</sup>
NCA01	52	47	46	40
NCA01a	59	54	51	46
NCA02	52	47	46	40
NCA02a	59	54	51	46
NCA03	56	51	49	42
NCA04	51	46	45	39
NCA04a	59	54	51	46
NCA05	73	68	65	50
NCA06	55	50	50	43

Source: Adapted EIS Data, TfNSW/SLR 2016

1. Standard (daytime): 7:00am to 6:00pm Mondays to Fridays, inclusive and 8:00am to 1:00pm Saturdays;
2. Outside standard (daytime): 1:00pm to 6:00pm Saturdays, and 8:00am to 6:00pm on Sundays or public holidays;
3. Outside standard (evening): 6:00pm to 10pm Monday to Sunday, inclusive; and
4. Outside standard (night time): 10:00pm to 7:00am Monday to Friday and 10:00pm to 8:00am on Saturdays, Sundays and public holidays.

**Table 4.2 Noise Management Levels (Other Sensitive Receptors)**

Noise Catchment Area (NCA) / Receptor type	Noise Management Level - LAeq, 15 minute			
	Standard Construction Hours	Outside Standard Construction Hours		
		Daytime <sup>2</sup>	Evening <sup>3</sup>	Night <sup>4</sup>
Commercial	70	70	70	70
Industrial	75	75	75	75
Recreational (Active)	65	65	65	65
Place of Worship*	55	55	55	55
Educational*	55	55	55	55
Hospital wards and operating theatres*	55	55	55	55

Source: Adapted EIS Data, TfNSW/SLR 2016

1. Standard (daytime): 7:00am to 6:00pm Mondays to Fridays, inclusive and 8:00am to 1:00pm Saturdays;
2. Outside standard (daytime): 1:00pm to 6:00pm Saturdays, and 8:00am to 6:00pm on Sundays or public holidays;
3. Outside standard (evening): 6:00pm to 10pm Monday to Sunday, inclusive; and
4. Outside standard (night time): 10:00pm to 7:00am Monday to Friday and 10:00pm to 8:00am on Saturdays, Sundays and public holidays.

\* External criteria value translated from the internal ICNG management level, assuming windows operable.

#### 4.1.1 *Highly Noise Affected Management Level*

In accordance with the ICNG and SM CNVS, the Highly Noise Affected Management Level (HNML) of 75 dBA will apply to residential (dwelling) receptors.

#### 4.1.2 *Sleep Disturbance*

‘Sleep disturbance screening thresholds’ have been developed as per the guidance in the INP and SM CNVS (RBL + 15dBA). These screening levels (refer **Table 4.3**) will only apply during the night time period. These screening levels will generally apply at residential (dwelling) receptors with other sensitive receptors considered where applicable e.g. at other receptors where habitable sleeping spaces are identified.

**Table 4.3** *Sleep Disturbance Screening Levels*

Noise Catchment Area (NCA)	Sleep Disturbance Screening Level (LAmax)
NCA01	50
NCA01a	56
NCA02	50
NCA02a	56
NCA03	52
NCA04	49
NCA04a	56
NCA05	60
NCA06	53

*Source: Adapted EIS Data, TfNSW/SLR 2016*

1. These sleep disturbance screening levels only apply during the night time defined by the INP as the period from 10:00pm to 07:00am (Monday to Saturday) and 10:00pm to 08:00am (Sundays and Public Holidays).

#### **4.1.3** *Internal Noise Criteria*

In addition to the NMLs outlined above, the NCW project conditions of approval also stipulate internal noise level limits relevant to internal noise levels (air-borne and ground-borne), these conditions include CoA -E41, E42 and E43. **Table 4.4** below provides a summary of the internal noise criteria applicable under the Conditions of Approval for the NCW project.

In accordance with CoA - E41, residential receptors located in non-residential zones, likely to experience an internal noise level exceeding the criteria outlined in **Table 4.4** below (inclusive of a 5 dB penalty if rock breaking or any other annoying activity likely to result in ground-borne noise, or a perceptible level of vibration is planned (including works associated with utility adjustments)) must be offered additional mitigation in accordance with the Sydney Metro City and South West Noise and Vibration Strategy referenced in CoA - E32.

In accordance with **CoA - E42**, residential receivers in residential zones likely to experience an internal noise level of Leq(15 minute) 45 dB(A) or greater between 8pm and 7am (inclusive of a 5 dB penalty if rock breaking or any other annoying activity likely to result in ground-borne noise, or a perceptible level of vibration is planned (including works associated with utility adjustments)) must be offered additional mitigation in accordance with the Sydney Metro City and South West Noise and Vibration Strategy referenced in **CoA - E32**.

In accordance with CoA - E43, noise generated by construction must not exceed the National Standard for exposure to noise in the occupational environment of an eight-hour equivalent continuous A-weighted sound pressure level of Leq, 8 hour of 85 dBA for any employee working at a location near the CSSI.

**Table 4.4 Internal Noise Criteria**

Area	Receptor Type	Condition of Approval (CoA)	Time Period	Criteria
Non-residential zones	Residential	E41	8pm to 9pm	Leq, 15 minute 60 dBA internal
		E41	9pm to 7am	Leq, 15minute 45 dBA internal
Residential Zones	Residential	E42	8pm to 7am	Leq, 15minute 45 dBA internal
All	All	E43	all	Leq, 8 hour 85 dBA near the CSSI

Source: SM CNVS, CoA

#### 4.2 GROUND-BORNE NOISE MANAGEMENT LEVELS

Ground-borne noise is noise generated by vibration transmitted through the ground into a structure. The following ground-borne noise levels for residences are nominated in the ICNG and SM CNVS and indicate when management actions would be implemented. These levels recognise the temporary nature of construction and are only applicable when ground-borne noise levels are higher than airborne noise levels. Ground-borne noise management levels are summarised in **Table 4.5** below.

**Table 4.5 Ground-Borne Noise Management Levels**

Receptor Type	Management Level, Leq, 15 minute dBA		
	Daytime <sup>1</sup>	Evening <sup>2</sup>	Night time <sup>3</sup>
Commercial (internal)	50	-	-
Residential (internal)	45	40	35

Source: SM CNVS

1. Daytime means between 7:00am and 6:00pm, Monday to Sunday inclusive;
2. Evening means between 6:00pm and 10:00pm, Monday to Sunday inclusive; and
3. Night time means between 10:00pm to 7:00am, Monday to Sunday inclusive.

#### 4.3 ROAD TRAFFIC NOISE MANAGEMENT LEVELS

The ICNG does not include any criteria to assess off-site traffic noise associated with construction and demolition. Criteria for off-site road traffic noise applicable to 'existing residences affected by additional traffic on existing roads generated by land use developments' are specified in the RNP.

An objective of the RNP is to protect sensitive receptors against excessive decreases in amenity as the result of a project by applying apply relevant



permissible noise increase criteria. In assessing feasible and reasonable mitigation measures, an increase of up to 2 dBA represents a minor impact that is considered barely perceptible to the average person.

On this basis, as outlined in the SM CNVS, construction traffic NMLs set at 2 dBA above the existing road traffic noise levels during the daytime and night-time periods are considered appropriate to identify the onset of potential noise impacts. Where the road traffic noise levels are predicted to increase by more than 2 dBA as a result of construction traffic, consideration would be given to applying feasible and reasonable noise mitigation measures to reduce the potential noise impacts and preserve acoustic amenity.

Whilst these criteria do not specifically apply to construction/demolition traffic movements, they have been conservatively adopted here in the CNVIS and are summarised in **Table 4.6** below.

**Table 4.6** *Road Traffic Noise Management Levels*

Category	Applicable Road	Management Level, dBA	
		Daytime <sup>1</sup>	Night time <sup>2</sup>
Sub-arterial roads	e.g. Pacific Highway / Mowbray Road	L <sub>Aeq</sub> ,1 hour ≤ 60 (external)	L <sub>Aeq</sub> ,1 hour ≤ 55 (external)
Local roads	e.g. Brand St / Drake St / Hopetoun Ave	L <sub>Aeq</sub> ,1 hour ≤ 55 (external)	L <sub>Aeq</sub> ,1 hour ≤ 50 (external)

Source: SM CNVS, RNP

1. Daytime means between 7:00am and 10:00pm, Monday to Sunday inclusive; and
2. Night time means between 10:00pm to 7:00am, Monday to Sunday inclusive.

#### 4.4 GROUND-BORNE VIBRATION MANAGEMENT LEVELS

Based on the SM CNVS methodology, impacts from vibration will be considered both in terms of effects on building occupants (human comfort) and the effects on the building structure (structural/cosmetic damage). The following construction vibration management levels / criteria will apply to the NCW as presented below.

##### *Human Comfort*

The NSW Vibration Guideline and the SM CNVS provides guidance for assessing human exposure to vibration. These documents are based on *British Standard (BS 6472-1992) – Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz) dated 1992*. The Vibration Dose Values (VDV) recommended in BS 6472-1992 for which various levels of adverse comment from occupants may be expected are presented in **Table 4.7**.

**Table 4.7 Human Comfort – Vibration Dose Values (VDV)**

Place and Time	Low Probability of Adverse Comment (m/s <sup>1.75</sup> )	Adverse Comment Possible (m/s <sup>1.75</sup> )	Adverse Comment Probable (m/s <sup>1.75</sup> )
Residential buildings 16 hr day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8 hr night	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

Source: SM CNVS

1. For offices and workshops, multiplying factors of 2 and 4 respectively would be applied to the above vibration dose value ranges for a 16 hr day.
2. Human comfort VDV ranges which might result in various probabilities of adverse comment within residential buildings.

*Building Damage (Structural/Cosmetic Damage)*

To achieve the requirements of the SM CNVS, *British Standard BS7385: Part 2-1993 (BS 7385) - Evaluation and Measurement for Vibration in Buildings – Part 2 – Guide to Damage Levels from Ground-borne Vibration, dated 1993* is presented in **Table 4.8** and will be considered during works where applicable. BS 7385 provides safe limit guideline values, below which vibration is considered insufficient to cause structural or cosmetic damage to buildings.

**Table 4.8 Building Damage (BS 7385)**

Line	Type of Building	Peak Particle Velocity (PPV in mm/s) in the Frequency Range of Predominant Pulse	
		4 Hz to 15 Hz	15 Hz and Above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50mm/s at 4 Hz and above	
2	Unreinforced or light framed structures Residential or light commercial type buildings	15mm/s at 4 Hz increasing to 20mm/s at 15 Hz	20mm/s at 15 Hz increasing to 50mm/s at 40 Hz and above

Source: BS 7385, SM CNVS

For most construction activities involving intermittent vibration sources such as rock breakers, piling rigs, vibratory rollers, excavators and the like, the predominant vibration energy occurs at frequencies greater than 4 Hz (usually in the 10 Hz to 100 Hz range). On this basis, a conservative vibration damage screening level per receptor type is given below:

- Reinforced or framed structures: **25.0 mm/s**; and
- Unreinforced or light framed structures: **7.5 mm/s**.

At locations where the predicted and/or measured vibration levels are greater than shown above (peak component particle velocity), a more detailed analysis of the building structure, vibration source, dominant frequencies and dynamic characteristics of the structure would be required to determine the applicable safe vibration level.

#### *Heritage Structures*

If a heritage building or structure is found to be structurally unsound (following inspection) a more conservative cosmetic damage criteria of **2.5 mm/s** peak component particle velocity from the *German Institute for Standardisation – DIN 4150 (1999-02) Part 3 (DIN4150:3) – Structural Vibration - Effects of Vibration on Structures, dated 1999* would be considered.

The applicable German Standard DIN 4150:3 management levels are tabulated in **Table 4.9**.

**Table 4.9** *Building Damage (DIN4150:3)*

Line	Type of Structure	Guideline Values for Velocity (PPV in mm/s)		
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz <sup>1</sup>
3	Structures that, because of their particular sensitivity to vibration, cannot be classified under either of the other classifications and of great intrinsic value	3	3 to 8	8 to 10

Source: DIN4150:3, SM CNVS

1. At frequencies above 100 Hz, the values given in this column may be used as minimum values; and
2. The 50 Hz values may be applied to assess vibration at the horizontal plane of the highest building floor at all frequencies.
3. As per the CNVS, Heritage criteria are provided. It is noted that line one and line two do not apply to this project. These criteria are only to be applied if a heritage building or structure is found to be structurally unsound.

## 4.5

### **THRESHOLDS FOR ADDITIONAL MITIGATION MEASURES**

The mitigation and management measures are a feature to be outlined in the CNVMP and are defined based on the activities proposed and potential impacts. “Standard” mitigation (and practices) applicable to the NCW are

described in Section 7 of the SM CNVS and the actions set out must be implemented on all Sydney Metro construction projects.

Where the predicted “mitigated” construction noise levels are above the ICNG noise management levels, the Additional Mitigation Measures Matrix (AMMM) identified in Section 8 of the SM CNVS is to be implemented. The approach, guided by the AMMM, is primarily aimed at pro-active engagement with affected sensitive receptors rather than additional noise reducing mitigation. The AMMM applies to all receptor types where these receptors are in-use.

The types of additional mitigation measures are listed in **Table 4.10** and described in Appendix C of the SM CNVS.

**Table 4.10** *Additional Mitigation Measures*

<b>Measure</b>	<b>Abbreviation</b>
Alternative accommodation	AA
Monitoring	M
Individual briefings	IB
Letter box drops	LB
Project specific respite offer	RO
Phone calls	PC
Specific notifications	SN

1. Source: SM CNVS

The project-specific AMMM for construction (airborne) noise are identified in **Table 4.11**. Any air-borne noise level exceedances of the AMMM thresholds are highlighted in red, blue, olive green or purple (as shown in **Table 4.11**) as applicable to the findings of this assessment.

The project-specific AMMM for ground-borne noise and ground-borne vibration are identified in **Table 4.12** and **Table 4.13**.

**Table 4.11 Additional Mitigation Measures Matrix (AMMM) – Construction (Airborne) Noise**

Period	Time of Day	Mitigation Measures Predicted LAeq, 15minute Noise Level Above RBL			
		0 to 10 dBA	10 to 20 dBA	20 to 30 dBA	>30 dBA
Standard	Mon-Fri (7am - 6pm)	-	-	M, LB	M, LB
	Saturdays (8am - 1pm)				
	Sundays/Public Holidays (No Works)				
OOHW Period 1	Mon-Fri (6pm - 10pm)	-	LB	M, LB	M, IB, LB, PC, RO, SN
	Saturdays (7am-8am) and (1pm- 10pm)				
	Sundays/Public Holidays (8am-6pm)				
OOHW Period 2	Mon-Fri (10pm - 7am)	-	M, LB	M, IB, LB, PC, RO, SN	AA, M, IB, LB, PC, RO, SN
	Saturdays (10pm - 8am)				
	Sundays/Public Holidays (6pm - 7am)				

1. Source: SM CNVS

**Table 4.12 Additional Mitigation Measures Matrix (AMMM) – Construction (Ground-borne) Noise**

Period	Time of Day	Mitigation Measures Predicted LAeq, 15minute Noise Level Exceedance of NML		
		0 to 10 dBA	10 to 20 dBA	20 to 30 dBA
Standard	Mon-Fri (7am - 6pm)	LB	LB	M, LB, SN
	Saturdays (8am - 1pm)			
	Sundays/Public Holidays (No Works)			
OOHW Period 1	Mon-Fri (6pm - 10pm)	LB	M, LB, SN	M, IB, LB, PC, RO, SN
	Saturdays (7am-8am) and (1pm- 10pm)			
	Sundays/Public Holidays (8am-6pm)			
OOHW Period 2	Mon-Fri (10pm - 7am)	M, LB, SN,	AA, M, IB, LB, PC, RO, SN	AA, M, IB, LB, PC, RO, SN
	Saturdays (10pm - 8am)			
	Sundays/Public Holidays (6pm - 7am)			

1. Source: SM CNVS

**Table 4.13 Additional Mitigation Measures Matrix (AMMM) – Ground-borne Vibration**

Time Period		Mitigation Measures Predicted Vibration Levels Exceed Human Comfort Criteria (BS 6472:1992)
Standard	Mon-Fri (7am-6pm)	M, LB, RO
	Sat (8am-1pm)	
	Sun/Pub Hol (Nil)	
OOHW Period 1	Mon-Fri (6pm-10pm)	M, IB, LB, PC, RO, SN
	Sat (7am-8am and 1pm-10pm)	
	Sun/Pub Hol (8am-6pm)	
OOHW Period 2	Mon-Fri (10pm-7am)	AA, M, IB, LB, PC, RO, SN
	Sat (10pm-8am)	
	Sun/Pub Hol (6pm-7am)	

1. Source: SM CNVS

## **IMPACT ASSESSMENT**

This chapter presents the findings of the construction noise and vibration impact assessment completed with due regard to the relevant policy, guidelines and standards outlined in **Section 2.2.1**.

### **5.1**

#### ***AIR-BORNE CONSTRUCTION NOISE***

Based on the methodology, inputs and assumptions described above, LAeq, 15minute noise levels have been predicted for each of the assessment scenarios and receptors identified in this CNVIS.

Due to the large number of receptors, all resultant noise levels and comparison to the daytime and night time NML are presented in **Annex D**. Further discussion regarding their predicted values is however provided in **Section 5.1.1** to **5.1.5** below.

All noise levels have been rounded to the nearest whole integer. Values that exceed the HNML (fixed at 75 dBA for residential receptors) are highlighted in **bold and underlined** typeset.

#### **5.1.1**

##### ***Additional Mitigation and Exceedances***

Where the predicted construction noise levels are above the NML, the AMMM identified in Section 8 of the SM CNVS and **Section 4.5** of this CNVIS should be implemented. Predicted values at select receptors exceed the project-specific NML. The level by which they exceed the NML varies depending on the assessment scenario, the receptor proximity to the activity and the time of day.

A comparison of the predicted construction noise levels to the existing background noise levels (LA90, period) is therefore required (for any receptor where the NML is exceeded) to establish the necessary mitigation AMMM requirements. This comparison is provided in **Annex D**.

Any noise level exceedance of the AMMM thresholds (refer **Table 4.11**) is highlighted in red, blue, olive green or purple to illustrate the extent and level of AMMM required.

The AMMM is only applicable to commercial or other sensitive receptors (i.e. educational / places of worship) when these receptors are in use. It should be noted that these receptors may not be in use during the night time period. On this basis it has been assumed, for the purposes of this CNVIS, that commercial and educational receptors are not occupied during the evening and night time period and that places of worship are not occupied during the night time period. Where community consultation identifies that these receptor types are occupied during these periods the relevant AMMM will apply.



### *Guidance Note*

During construction works, actual noise levels will vary depending on the number of items of equipment, their exact location within the site, their usage and how many items of equipment operate concurrently at any one time. A receptor will therefore experience a range of noise levels.

Construction noise level predictions have been conducted to identify results for representative worst-case scenarios, as the predicted values consider the cumulative emission (and potential impact) of all equipment sources working concurrently.

It is not possible, or warranted to reflect potential impacts, to model every plausible activity, task or usage for each noise generating source and location, hence the conservative approach adopted here has been applied to ensure that representative worst-case noise predictions were conducted.

Furthermore, area sources were utilised to reflect the potential distribution of noise across the project area, and the potential emissions from activities undertaken at various locations within and around the site.

This assessment has considered standard good practice mitigation measures via noise modelling by adopting the midpoint values for all sound power levels. Furthermore, the 3D noise model has incorporated the shielding provided by topography and the existing rail noise barrier situated to the north of Nelson Street on both the up and down side of the rail alignment.

#### **5.1.2** *Discussion of Results*

The resultant noise levels are summarised below:

- The highest predicted noise levels range between 83 and 89 dBA associated with the Nelson St and Mowbray Rd bridge works (SCN09 to SCN12). For activities associated with all other scenarios the highest predicted noise levels range between 59 and 85 dBA. These noise levels are predicted at the nearest receptors located in generally the first row of buildings with direct line of sight to NCW works;
- The daytime NML applicable at residential (occupied dwellings) receptors for works within the recommended standard hours for construction is exceeded by up to 47 dBA at the most affected locations in SCN10, this is associated with hydraulic hammering and Nelson St Bridge demolition;
- For other key scenarios, SCN09, SCN11 and SCN12 the daytime NML applicable at residential (occupied dwellings) receptors for works within the recommended standard hours for construction is exceeded by between 20 and 46 dBA at the most affected locations;
- The magnitude and extent that predicted noise levels exceed the daytime NML applicable at commercial and other sensitive receptors for works

within the recommended standard hours for construction are much less than that identified for residential receptors and the only exceedance of the NML at non-residential receptors is predicted at R.359 (Place of Worship) by up to 16 dBA for SCN20 and SCN22;

- The extent that noise levels are predicted to exceed the NML at residential receptors, for works outside the recommended hours for construction, varies depending on the assessment scenario and period i.e. daytime, evening and night time. Predicted noise levels exceed the NML to a larger extent during the evening and night time (when compared to the daytime) as the NML are more stringent during those periods. The highest exceedances are predicted for the night time, when the most stringent NML apply;
- For commercial and other sensitive receptors the extent that noise levels are predicted to exceed the NML is the same for each period, as the NML are fixed values for all times of the day and days of the week;
- It is noted that the HNML (75 dBA) applicable at residential (dwelling) receptors is exceeded for at least one receptor in the first row of buildings in the following scenarios: SCN01, SCN03, SCN04, SCN05, SCN09, SCN10, SCN11, SCN12 and SCN16;
- It is possible to estimate internal noise levels based on the predicted values presented in **Annex D** for each scenario by deducting 10 dBA from these external values to represent windows being partially open, and by deducting 20 dBA to represent windows being closed. Comparing the estimated internal noise levels to the CoA – E41/E42 requirements (refer **Section 4.1.3**) identifies that noise levels will generally be in compliance for the broader community but levels are likely to exceed the internal noise criteria at the first row of buildings around the works. This trend is likely to occur during all scenarios where OOHW is required;
- The following scenarios are predicted to generate noise levels >30dBA above the RBL (as per the AMMM) at the closest and most affected receptors for works within the recommended standard hours of construction: SCN01, SCN03, SCN04, SCN05, SCN06, SCN08, SCN09, SCN10, and SCN16;
- The following scenarios are predicted to generate noise levels >30dBA above the RBL (as per the AMMM) at the closest and most affected receptors for works outside the recommended standard hours of construction: SCN03 to SCN12, SCN16, SCN18, SCN20, SCN21 and SCN25;
- Predicted noise levels exceed the existing background noise level to a larger extent during the evening and night time period (when compared to the daytime) as the existing background noise levels are lower during those periods;

- For works within the recommended standard hours for construction, letterbox drops and noise monitoring will be required at the most affected locations during select construction activities associated with NCW works; and
- For works outside the recommended standard hours for construction, a combination of the following mitigation will be triggered from the AMMM: alternative accommodation, monitoring, individual briefings, letter box drops, project specific respite offer, phone calls and specific notifications. These measures will be required at the most affected locations during select construction activities associated with NCW works.

### 5.1.3 *Summary of Findings*

The predicted noise levels summarised above and presented in **Annex D** are typical of construction works and activities undertaken in the vicinity of residential and commercial land use precincts. These predicted values do not represent a constant noise emission that would be experienced by the community on a daily basis throughout the project's construction schedule. The predicted noise levels will only be experienced for limited periods of time when works are occurring; they will not be experienced over whole daytime, evening or night time periods. Construction noise emissions will be temporary and do not represent a permanent impact on the community and surrounding environment.

Some noise from construction sites is inevitable, such that the ICNG focuses on minimising construction noise impacts, rather than only on achieving numeric noise levels. These results and noted exceedances identify that best-practice construction noise management and control techniques will be required to reduce noise levels as far as practicable. These will need to be implemented in conjunction with community and stakeholder consultation and notification processes outlined in the AMMM in **Section 4.5**.

#### *Technical Note*

At the time this CNVIS was finalise (September 2018) the removal of a portion of the existing rail corridor noise wall (by and third party) and subsequent installation of a temporary noise curtain was proposed/approved. To address the potential effect of this feature a review of P7b works was conducted and identified that P7b activities will not be occurring in the area near to the portion of barrier "noise wall" proposed to be removed, during the period of time when the noise wall is not there. Therefore the temporary removal of the noise wall, and/or a temporary noise curtain are not expected change the predicted construction noise levels presented in the CNVIS. Regardless, suitable safeguards and provisions are already recommended in this CNVIS and have been incorporated into the corresponding CNVMP, to be actioned in the unlikely event that P7b emissions increase as a result of this noise wall removal circumstance.

#### 5.1.4 *Working Outside Standard Hours*

Based on the noise levels predicted to exceed criteria identified in **Annex D** it is also considered that the sleep disturbance screening criteria will be exceeded at the nearest and most sensitive residential receptors during OOHW.

With due regard to the AMMM, the extent of additional mitigation required will increase for out-of-hours work (refer **Annex D**) compared to that assessed for works within the standard hours. More mitigation is necessary in accordance with the SM CNVS for works undertaken outside the recommended standard hours for construction.

This feature is a well-accepted element of good industry practice construction noise management; high noise generating activities should be avoided in the evening, at night and on the weekends as receptors are generally more sensitive during those periods.

In accordance with the requirements of the ICNG and the SM CNVS suitable recommendations, which can be practically implemented on site, should be provided in the CNVMP. Construction noise levels will be reduced and impacts minimised with the successful implementation of these recommendations. Impacts may not be reduced to negligible levels for all receptors during all construction activities; however the recommendations are designed to ensure that any residual impacts are minimised as far as is practically achievable.

#### 5.1.5 *Potential Effects of Concurrent Work*

Air-borne noise levels have been predicted via 3D noise modelling for a range of works and activities associated with the projects construction as outlined in Section 2.3. These predicted noise levels are detailed in Annex D and address each work area/activity so that any additional mitigation and management measures (to those already incorporated into the construction design and noise modelling) may be defined for each representative worst-case assessment scenario.

This method is typical of NSW construction projects especially those of the scale of NCW where there is a large spatial area (extending from Chatswood to St Leonards) and temporal boundary (three year construction program). In these cases there is limited potential for significantly increased noise levels and associated impacts to occur due to concurrent works.

This is primarily due to the dominant influence of the works conducted at or near the most affected receptor (on which the CNVIS is based), which will mask the influence of other works occurring at the time. The construction schedule / timing of works is also an influence when considering this potential as in many cases there are different activities that will be undertaken at the same location over the course of the construction schedule i.e. they will not occur concurrently.

The conservative nature of the predictive inputs that consider all plant, equipment and/or machinery operating concurrently for each scenario are also an influence when considering this feature. The predicted values do not represent a constant noise emission that would be experienced by the community on a daily basis throughout the project's construction schedule, they will only be experienced for limited periods of time when those specific activities are occurring, and they will not be experienced over the whole daytime, evening or night time period.

When evaluating potential effects of concurrent work it is also important to consider how noise levels add together. For example, if two separate activities are occurring and the noise level from each is 55 dBA at the receptor, then the resultant noise level is 58 dBA. This increase in noise level (3 dBA) will be just perceptible and a significant change in impact unlikely. If two separate activities are occurring and the noise level from one is 55 dBA and the other is 53 dBA, then the resultant noise level is 57 dBA. This increase in noise level (2 dBA) will be hardly perceptible in practice and a significant change in impact is highly unlikely.

Based on this information the CNVMP provides a set of provisions, safeguards and monitoring contingencies are provided in the unlikely event that additional issues associated with concurrent works are identified and further mitigation is required. These provisions, safeguards and contingencies are outlined in Section 10.2 of the CNVMP.

### 5.1.6 *Cumulative Impacts*

The NCW contractor in accordance with **CoA - E39** will consult with other proponents of construction activities located in and around the NCW P7B project site. Specifically this will include the Tunnels and Station Excavation Works (TSE) contractor, Sydney Trains and any other contractors that will undertake works within the NCW project area. Cumulative impacts associated with nearby construction works will be managed through the community consultation process. Sydney Trains take the lead on communications that are occurring within Sydney Train land and LOR project works will be included as a combined notification. Further detail of the community consultation process are detailed in the overarching Stakeholder and Community Involvement Plan (Sydney Metro Community Consultation Strategy).

The NCW contractor attends ongoing construction interface meetings with other contractors to understand the scope and extent of impacts and works with Sydney Metro and the AA to modify works based on noise assessment results of the NCW contractor and other contractors if known. The approach allows each contractor to provide the required respite periods identified in accordance with **CoA - E40** and minimise impacts to sensitive receivers through the application of additional mitigation in accordance with the Sydney Metro City and South West Noise and Vibration Strategy referenced in **CoA - E32**.

In accordance with EPL 12208, CoA - E40 and the SM CNVS, where the high noise impact generating construction works are planned to impact the same noise sensitive receptors in blocks of three hours, one hour respite is required between each block of work.

## 5.2 *GROUND-BORNE CONSTRUCTION NOISE*

Ground-borne construction noise impacts from NCW works are not anticipated as vibration generating source/s with the potential to generate perceptible ground-borne noise, does not form part of the overall construction design. Ground-borne construction noise is usually present on tunnelling projects when significant tunnel boring equipment is operated underground.

Hydraulic hammering is the highest vibration generating activity anticipated for the NCW works. While ground-borne noise is not expected from this activity the potential has been considered. Due to the attention given to the airborne noise for this activity it has been determined that the mitigation and management measures recommended for airborne noise from the hydraulic hammering activity will also be sufficient in managing impacts from potential ground-borne noise.

## 5.3 *ROAD TRAFFIC NOISE AND VIBRATION*

Construction road traffic (noise and vibration) impacts from NCW works are not anticipated (i.e. from additional vehicles on the public road network). Additional traffic from the project will be limited to the delivery of supplies and the arrival/departure of equipment and personnel.

In accordance with the *NSW Department of Environment, Climate Change and Water - NSW Road Noise Policy (RNP), March 2011* and the SM CNVS, construction traffic NMLs are set at 2 dBA above the existing road traffic noise levels during the daytime and night-time periods and are considered appropriate to identify the onset of potential noise impacts. Where the road traffic noise levels are predicted to increase by more than 2 dBA as a result of construction traffic, consideration would be given to applying feasible and reasonable noise mitigation measures to reduce the potential noise impacts and preserve acoustic amenity.

When considering feasible and reasonable mitigation measures where the relevant noise increase is greater than 2 dBA, consideration should also be given to the actual noise levels associated with construction traffic and whether or not these levels comply with the road traffic noise criteria in the RNP and SM CNVS (refer **Section 4.3**).

It is assumed that the noise generated from heavy vehicles due to the size of the construction works and type of works will have minimal impact to developments along their routes. For arterial and sub-arterial roads the project

will not generate a significant increase in vehicles when compared to that of the existing vehicle flows and mixes on the surrounding road network.

On local roads the noise generated from construction traffic (i.e. at site access and egress points), may result in complaints from the community due to proximity to residential (dwelling) receptors. It is therefore recommended that the construction road traffic noise mitigation measures identified in this CNVIS and the CNVMP are implemented to ensure that any residual impacts are minimised as far as is practically achievable.

#### 5.4

#### *GROUND-BORNE CONSTRUCTION VIBRATION*

With respect to the construction plant identified in the assessment scenarios presented in **Annex C**, the highest levels of vibration would be expected to occur due to the use of an excavator with hydraulic hammer during SCN10, SCN11 and SCN12 (Nelson St and Mowbray Rd bridge works). The track tamper identified in SCN04 and SCN05 has also been identified as a potential vibration generating activity.

The track tamping activity to be carried out as part of the Sydney Metro works is not anticipated to differ in any way from the track tamping carried out as part of Sydney Trains major periodic track maintenance. Therefore the vibration levels are not assumed to be higher than currently experienced during major track maintenance. Even if the tamping occurs in closer proximity to receptors than the general Sydney Trains track maintenance, the method used throughout the Sydney Trains rail network and in close proximity to buildings will not differ.

To assess potential vibration impacts the CNVIS adopted the applicable safe work distances published in the TfNSW I&S CNVS. These safe working distances do not provide guidelines on the track tamping activity, however based on the proposed equipment it is anticipated that vibration generated from track tamping will have a low to moderate risk of exceeding the human comfort criteria and a low risk of exceeding the cosmetic damage criteria.

Based on this, attended vibration measurements will be required at the commencement of track tamper (SCN04 and SCN05) and hydraulic hammering activities (SCN10, SCN 11 and SCN12) to confirm that vibration levels satisfy the criteria outlined in **Section 4.4**. Where there is potential for exceedances of the criteria further vibration site law investigations would be undertaken to determine the site-specific safe working distances for the vibration generating activity. Continuous vibration monitoring (attended or unattended with audible and visible alarms) should be conducted at the nearest sensitive receptors whenever those vibration generating activities need to take place inside the calculated safe-working distances.

The applicable safe work distance offset assessment for SCN10, SCN11 and SCN12, is provided in **Table 5.1** and presented in **Figure 5.1**.



**Legend**

- Potentially Sensitive Receptor
- Lots
- Roads
- Rail Line
- 7m Buffer - Hydraulic Hammer
- 23m Buffer - Hydraulic Hammer
- Ancillary Facility
- Laydown Area
- Site Works Boundary
- Work Areas

Source:  
 - (c) Department Finance, Services and Innovation, DCDB, DTDB 2017  
 - Nearmap Imagery May 2018

**Ground-Borne Vibration Safe Working Distances** **F-5.1**

Drawing No: 0424696m_CNVMG011_R0.mxd	Northern Corridor Works CNVIS / CNVMP
Date: 18/06/2018	Drawing Size: A4
Drawn By: LT	Reviewed By: SDL
Client: Laing O'Rourke Australia Construction Pty	

Coordinate System: GDA 1994 MGA Zone 56

0 25 50 75m N  
↑

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.



**Table 5.1 Safe Work Distance Offset Vibration Assessment**

Scenario ID	Work Phase Description	Vibration Generating Equipment/ Plant Utilised	Applicable Safe work distance (Cosmetic)	Applicable Safe work distance (Human Comfort)	Vibration Assessment (nearest) distance (m)	Vibration Assessment (furthest) distance (m)	Works Required within applicable Safe work distances (Cosmetic)	Works Required within applicable Safe work distances (Human Comfort)	Potential OOHW Required?
SCN10	Nelson St Bridge Demolition	Excavator (with Medium Hydraulic Hammer)	7 m	23 m	10	25	N	Y	Y
SCN11	Mowbray Rd Bridge - Demolition of Break Wall-	Excavator (with Medium Hydraulic Hammer)	7 m	23 m	15	30	N	Y	Y
SCN12	Mowbray Rd Bridge - Construction of base slab and deflection wall	Excavator (with Medium Hydraulic Hammer)	7 m	23 m	15	30	N	Y	Y

1. *Partial means that the equipment will operate within some of the applicable range of safe work distances for the works*
2. *Potential OOHW may occur during Period 1 (day non-standard), however piling is not envisaged to occur during Period 2 (night time).*

### *Guidance Note*

This assessment has utilised the safe work distances for vibration generating construction activities and equipment established with due regard to the TfNSW I&S CNVS. The TfNSW I&S CNVS safe work distances were derived from BS7385 as relevant to cosmetic damage to buildings. BS7385 is a frequency (Hz) dependant criterion (less stringent at higher frequencies) and as such, works and activities may be able to occur at distances closer than those nominated in **Table 5.1** without any cosmetic or structural damage impacts occurring. This is typical of construction and demolition works in close proximity to other buildings and highlights the need to monitor and establish compliant levels during the early stages of vibration significant activities.

#### **5.4.2** *Discussion of Results*

The hydraulic hammering works identified in **Table 5.1** are not required within applicable safe work distances for cosmetic damage (7 m), therefore impacts to buildings are not anticipated. The works will however be required within the safe working distances for human comfort (23 m), and as such attended monitoring is recommended at the commencement of hydraulic hammering works.

This identifies that best-practice construction vibration management and control techniques will be required to reduce vibration levels as far as practicable. For example, vibration intensive activities may start at a position far away from a receptor and move closer as compliant levels are verified through monitoring.

It is also a requirement under CoA - E41 and E42 that LOR must identify and consult with all receptors likely to experience a perceptible level of vibration. These receptors must be offered additional mitigation in accordance with AMMM in Section 8.2.

#### **5.4.3** *Summary of Findings*

Best-practice construction vibration management and control techniques should be implemented to reduce vibration levels as far as practicable. Recommendations for mitigation and management measures in relation to ground-borne vibration are outlined in **Chapter 6**.

To minimise impacts to human comfort, additional mitigation and management measures will be warranted. These will need to be implemented in conjunction with community and stakeholder consultation and notification processes outlined in the AMMM for Ground-borne Vibration in **Section 4.5**.

For works outside the recommended standard hours for construction, letterbox drops, monitoring and a range of other additional mitigation measures from the AMMM will be required at the most affected locations during select construction activities associated with NCW.

## **RECOMMENDATIONS**

This chapter presents any recommendations for construction noise and/or vibration mitigation, community consultation, management measures or monitoring options.

The focus of this section is construction noise and vibration associated with the NCW project that have the potential to generate impacts at the closest and/or potentially most affected sensitive receptors or structures. Recommendations implemented to minimise impacts that these receptors will also assist to minimise impacts on the broader community.

The recommended mitigation and management measures (refer **Section 6.3**) have been defined based on the activities proposed and potential impacts. “Standard” mitigation (and practices) applicable to the NCW project are described in Section 7 of the SM CNVS (the actions set out must be implemented on all Sydney Metro construction projects).

### **6.1**

#### **COMMUNITY CONSULTATION**

The International Association for Public Participation (IAP2), an international leader in community engagement has developed a Public Participation Spectrum as outlined below, to help groups define the public’s role in any public participation process.

In accordance with **CoA - E33**, community consultation has commenced with the intention of identifying specific mitigation measures. Community engagement has been undertaken with select businesses in the area and residential receivers in and around Frank Channon Walk (FCW).

Consultation to date for the Northern Corridor Works (Portion 7a and 7b) has been to Inform, Consult, and Involve the public. A summary of consultation undertaken specifically for the Northern Corridor Works Portion 7a and 7b to date with the public is provided in **Table 6.1** below.

**Table 6.1 Community Consultation Undertaken to Date**

Date	Receptor	Summary
06/09/16	Various	Northern Corridor Works Information Session. Held at Chatswood Bowling Club. 40 community members attended. Community was given the opportunity to provide feedback and comment on the Northern Corridor Works, this was acknowledged and further consultation provided for specific projects. For example the closure of Frank Channon Walk.
02/09/17	Various	Information stand held at the Emerge Festival, Chatswood. Those who attended were provided with information regarding the Northern Corridor Works and the wider City and South West Metro Project.
22/12/17	Various	Notification delivered as a hard copy to 700 properties in Artarmon and Chatswood. The Notification provided a Northern Corridor Works update.
23/01/18	Various residents along the rail corridor in Brand, Hawkins, Drake and Raleigh Street and Hampden Road, Artarmon.	Notification/Fact Sheet provided information regarding upcoming Northern Corridor Works.
24/01/18	Various residents along Ellis Street, Pacific Highway, and Gordon Avenue, Chatswood.	Notification regarding Frank Channon Walk survey work as part of the Northern Corridor Works.
02/02/18	Over 700 copies distributed 100m along Rail corridor from access gate in Valetta Lane/Brand Street, Artarmon to Albert Avenue, Chatswood along Pacific Highway and Orchard Road as well as Cleland Road access Gate.	Notification/Fact sheet regarding the Northern Corridor Works was provided to businesses and residents from Artarmon to Chatswood.
02/02/18	Various residents along the rail corridor in Brand, Hawkins, Drake and Raleigh Street, Artarmon.	Door-knocked residents to inform of upcoming works relating to the Northern Corridor Works. This included specific out-of-hours work and also provided a broader overview of Northern Corridor Works.

<b>Date</b>	<b>Receptor</b>	<b>Summary</b>
17/02/18	157 notifications distributed via email to local email distribution list.	Email distributed which informed residents of upcoming work relating to the Northern Corridor Works.
23/02/18	Bicycle North Group	Briefing session provided to the Bicycle North Group. This session was to inform and consult with members about the closure of Frank Channon Walk and upcoming works associated with the Northern Corridor Works.
26/02/18	Various ( along the rail corridor between Waitara and Waverton)	12,000 copies of the Northern Corridor Works Quarterly Newsletter were distributed between Waitara and Waverton.
02/05/18	Artarmon Progress Association	Briefing session to inform and consult with residents about the Northern Corridor Works. The session was attended by representatives from NRT (Northwest and 33kV), TSE (Chatswood dive site), Laing O'Rourke (Northern Corridor Works) and Sydney Coordination Office covering Station Link i.e. temporary bus plan during the closure of the Epping to Chatswood section from 30 September 2018.
13/06/18	No. 2 and No. 10 Orchard Road.	Phone call to inform residents of work relating to the installation of a noise wall as part of the Northern Corridor Works.
15/06/18	Chatswood email distribution list.	Email distributed which informed residents of upcoming work relating to the Northern Corridor Works.
28/06/18	Various residents along the rail corridor on Hampden Road between the corner of Brand Street and 99 Hampden Road, Artarmon. Details recorded in Consultation Manager.	Door-knocked residents to inform of upcoming security fence and noise wall work in the area as part of the Northern Corridor Works.
28/06/18	Various residents along the rail corridor in Brand, Hawkins, Drake and Raleigh Street, Artarmon.	Door-knocked residents to inform of upcoming security fence and noise wall work in the area as part of the Northern Corridor Works.
27/07/18	Various residents along the rail corridor in Hawkins and Drake Street, Artarmon.	Notification/Fact sheet regarding the Northern Corridor Works (specifically the new drainage and stormwater detention basin) was provided to residents in Artarmon. Following this consultation equipment selection for the activity was modified from sheet piling to augered piling.

Additional consultation surrounding other areas of work has not yet been undertaken (e.g. Nelson St bridge works), further consultation will need to be undertaken with potentially affected receptors prior to commencement of these works. Once the relevant consultation has been undertaken, this CNVIS and associated documentation will be updated accordingly.

All consultation should be undertaken prior to the start of the relevant portion of works predicted to affect those receptors. Mitigation measures can then be tailored based on the consultation feedback. Mitigation Consultation should be undertaken at receptors to which it applies prior to the activity commencing which has triggered it. The CNVIS will be updated and reissued to the AA and ER at least four weeks prior to commencement of a particular scenario as the project progresses and consultation continues over the life of the project.

In accordance with the SM CNVS, where noise levels have been predicted above the noise management levels, the AMMM identified in **Section 4.5** is to be implemented. This will involve various methods of community consultation which are outlined in **Table 4.10**. All community consultation will be in accordance with Sydney Metro Stakeholder and Community Strategies. Consultation with businesses will be in accordance with the Sydney Metro Business Management Plan (BMP) and the small business owners support program.

Further consultation with sensitive receptors will be undertaken as the project progresses where sensitive periods can be refined based on the type of activities, expected impacts and the particular circumstances of the receptor at that time. Mitigation measures can then be tailored based on the consultation feedback.

A full suite of Sydney Metro's communication tools are outlined in the Overarching Community Communications Strategy. The stakeholder and community engagement tools to be used during the NCW project will include (refer Sydney Metro - Community Consultation Strategy - Early Works):

- **Place Managers** to be the single point of contact for affected stakeholder and the community and the project team, who will proactively doorknock properties and also respond quickly to any issues or complaints raised;
- **Doorknock** of properties adjoining the rail corridor providing information regarding fencing and noise wall works (including Orchard Road, Mowbray Road, Raleigh Street, Drake Street, Hawkins Street, Brand Street, and Hampden Road). Early engagement was completed as outlined in **Table 6.1** above;
- **Notifications, signage, newsletters** including maps to keep stakeholders and the community informed, explaining the purpose of the works, what they can expect, and any potential impacts (delivered in paper or electronic format). The two main types of Notifications are:

- **Sydney Metro Notifications** – Delivered to properties within 100m for day work, and 200m for night work. Emailed to local email distribution lists; and
- **Sydney Trains Notifications** – Delivered to properties within 250m and emailed to local email distribution lists;
- **Newsletter** to provide a three month look-ahead to properties within 500 metres of the construction site on a quarterly basis;
- **Specific Newsletter and Fact sheets** (as required) to provide detail on aspects of the work and the project. These are to be delivered to properties within 100m and emailed to local distribution lists. Copies will also be provided to Willoughby Council, identified key stakeholders, and any relevant local community groups;
- **Weekly email** update which is sent each Friday to the local email distribution lists with an overview of the work in the week ahead;
- **Newspaper advertising** to advise of work starting, the community contact facilities and road closures for example;
- **Mobile community information centre**;
- **Communications Management Control Group**, Sydney Metro will establish a new group or attend existing forums to discuss project activities with neighbouring infrastructure projects;
- **Briefings** to strata managers, council officers, SCO, government agencies, and local groups;
- **Mitigation measures** to respond to impacts; and
- **Stakeholder database** to record interactions with stakeholders and the community.

In addition to these tools, the business engagement tools to be used during the NCW project will also include (refer Sydney Metro – Business Management – Early Works):

- **Business surveys** to understand their business requirements including operating hours, main delivery times, reliance on foot traffic, any signage or advertising that may be impacted, customer origin, and other information specific to the business that will need to be considered in early works planning; and
- **Business Consultation Forum** Contractors will establish a new forum or attend existing business forums to discuss project activities. This will be augmented by stakeholder engagement activities outlined in the

Community Communications Strategy and the Overarching Community Communications Strategy.

Mitigation Consultation will be undertaken at receptors to which it applies prior to the activity commencing which has triggered it. Nearby sensitive receptors for the project are primarily residential, therefore the time of least impact of work is during day-time standard hours and no specific “sensitive periods” have been identified at this early stage.

**Annex E** of this CNVIS provides an overview of the stakeholders and community groups that will require consultation for the NCW project.

## 6.2

### *MITIGATION AND MANAGEMENT MEASURES (SYDNEY METRO)*

The overall objective of construction noise and vibration management is to limit impacts on nearby receptors. This can be achieved by implementing the requirements of the SM CNVS which reflects the intent and purpose of the ICNG. Therefore, the following hierarchical approach should be used as far as practicable:

- Where site noise levels are above goals or criteria, implement reasonable and feasible good practice environmental controls to minimise noise and vibration emissions and/or exposure duration at affected receptors;
- Where the use of best practice environmental control mitigation measures do not adequately address exceedances of goals or criteria, adopt alternative measures to minimise impacts on the community; and
- Liaise with the local community regarding scheduled works which are predicted to have increased impacts.

It is recommended that the standard noise mitigation measures presented in Section 7 of the SM CNVS be adopted for all works undertaken as part of the NCW project. The management, source control and path control measures applicable to air-borne noise should be implemented.

Prior to commencement of works, a Construction Noise and Vibration Management Plan (CNVMP) should be prepared and implemented in accordance with the requirements of the SM CNVS and this CNVIS. The CNVMP should take into consideration measures for reducing the source noise levels of construction equipment by construction planning and equipment selection where reasonable and feasible. At the time this CNVIS was prepared the CNVMP was also being developed to incorporate the recommendations of this assessment.

Sydney Metro have also developed principles for managing construction noise and vibration. These principles will apply to the NCW project and are listed below:



- All personnel and community will be informed of the effort and methods undertaken to reduce noise and vibration for the works undertaken;
- Good engagement with the community will be maintained to facilitate effective project delivery with balanced community impacts;
- Construction noise and vibration levels at sensitive receivers will be minimised where feasible and reasonable;
- Feasible and reasonable mitigation will reflect the time of day, and the degree and duration of the impact;
- The community will be informed of the dates for the intended works, sequencing and timing of noisy events. Where possible this will include an indicative schedule over a 24 hour period;
- Minimising construction noise and vibration will be viewed as a continuous improvement exercise that is inclusive of stakeholders where no idea is too small to be considered; and
- Any operational noise and vibration improvements resulting from the works will be promoted to the community.

### 6.3

#### *MITIGATION AND MANAGEMENT MEASURES (CNVIS)*

In addition to the measures set out in Section 7 of the SM CNVS, any specific mitigation measures are to be identified in the CNVMP.

The following mitigation and management measures have been incorporated into the modelling and assessment presented in this CNVIS and should be incorporated into the CNVMP and then implemented to minimise impacts as far as is feasible and reasonable. It is recommended that:

- Extended periods of high noise level generating plant, equipment or machinery (excavators, hand tools, grinders etc.) should be avoided;
- Any site buildings, equipment or other useful obstacles/objects should be positioned to act as a temporary barrier to minimise noise emissions towards the residential receptors situated in the first row of buildings surrounding the NCW project (NCA01). Other barriers such as hoardings or temporary enclosures should be used;
- Works should utilise the existing rail corridor noise barriers, particularly those near the Hopetoun Ave entrance. For example, equipment/plant should be positioned on the rail corridor level behind the barrier (at Hopetoun Ave) rather than on the ramp;
- The site will be orientated to minimise the need for reversing of equipment or vehicles, particularly during any out-of-hours work. Furthermore, non-

tonal reversing alarms should be fitted to all permanent mobile plant. Occupational health and safety requirements for use of warning systems must be followed;

- The site be proactively managed to avoid plant, equipment or machinery being unnecessarily clustered together near receptors;
- All mechanical plant and equipment is to be selected to provide quieter and less vibration emitting construction methods where feasible and reasonable;
- All mechanical plant and equipment is to be silenced by the best practical means using current technology. Mechanical plant, including noise-suppression devices, will be maintained to the manufacturer's specifications. Residential grade mufflers should be fitted to all mobile plant;
- All plant, equipment or machinery (and heavy vehicles, trucks etc.) should be turned off when not being used;
- To manage the impacts of construction road traffic noise on local roads the following best practice mitigation and management measures should be implemented: keep truck drivers informed of the designated vehicle routes, parking locations, acceptable delivery hours; instruct truck drivers to travel through local roads without stopping unless absolutely necessary. If for whatever reason, truck drivers need to stop on local roads they should position the vehicle away from residential houses and limit extended periods of engine idling; and instruct truck drivers to limit engine revving and use of exhaust brakes when travelling to and from site, especially whilst travelling on local roads;
- In accordance with CoA – E34 noise generating works in the vicinity of potentially-affected, religious, educational, community institutions and noise and vibration-sensitive businesses and critical working areas (such as theatres, laboratories and operating theatres) must not be timetabled within sensitive periods, unless other reasonable arrangements to the affected institutions are made at no cost to the affected institution or as otherwise approved by the Secretary;
- Attended noise monitoring should be conducted across all shifts during track possession work, including the night time period where sleep disturbance impacts are to be monitored;
- Attended vibration measurements will be required at the commencement of track tamper activities (SCN04 and SCN05) to confirm that vibration levels satisfy the criteria outlined in **Section 4.4**. Where there is potential for exceedances of the criteria further vibration site law investigations would be undertaken to determine the site-specific safe working distances for the vibration generating activity; and

- Continuous vibration monitoring (attended or unattended with audible and visible alarms) should be conducted at the nearest sensitive receptors whenever vibration generating activities need to take place inside the relevant safe-working distances for that activity.

## 6.4 CONSTRUCTION HOURS

### *Works within the Recommended Standard Hours*

Confining construction activities (including the delivery of plant and equipment) to the recommended standard hours for construction wherever feasible and reasonable helps reduce impacts by limiting potentially noisy construction activities to the daytime, when background noise levels are higher, and by providing respite from construction noise during the evening, overnight and on weekends.

It is recommended that construction works should be limited as far as possible to the recommended standards hours for construction, these are Monday to Friday 7am to 6pm; Saturday 8am to 1pm; and no work on Sundays or public holidays.

It is recommended that respite periods (especially for high noise and vibration generating works or activities such as hydraulic hammering) should be considered during the detailed design of the construction methodology as per the requirements of the SM CNVS.

Despite this limitation and respite works within the standard hours will require additional mitigation measures, refer **Section 6.5**.

### *Works outside the Recommended Standard Hours*

Works outside the recommended hours for construction will be required due to the NCW project's proximity to an operational rail network; to maintain a safe working environment and minimise disruption to commuters.

Any works that become necessary outside the standard hours should be justified and additional mitigation measures (refer **Section 6.5**) implemented to reduce noise impacts to acceptable levels.

In addition, an out-of-hours work application should be completed for all applicable works and activities in accordance Section 5.2 of the SM CNVS.

It is recommended that respite periods (especially for high noise and vibration generating works or activities during the night time) should be considered during the detailed design of the construction methodology as per the requirements of the SM CNVS.

## 6.5

### *ADDITIONAL MITIGATION MEASURES*

The assessment has identified that works undertaken inside the recommended standard hours for construction will generate potentially intrusive noise emissions with the potential to exceed the Noise Management Levels.

Section 8 of the SM CNVS identifies a method by which additional mitigation measures may be considered and developed depending on the extent of the exceedance and comparison to existing background LA90 noise levels, as summarised in **Section 4.5** and reproduced in **Table 4.11** of this CNVIS. This method is the basis of the construction noise assessment and the recommendations provided here.

It is recommended that additional mitigation measures be developed for works both within the recommended standard hours and outside standard hours for construction as per the requirements of the SM CNVS and informed by the results presented in **Annex D**. These measures should consider the potential for sleep disturbance impacts that could occur during the night time period due to peak or maximum noise level events.

Any additional measures deemed necessary should be considered, evaluated and addressed during the preparation of the CNVMP required for the NCW project, prior to works commencing and in any subsequent out-of-hours work applications.

#### *Extent of Additional Mitigation*

The locations at which additional mitigation measures should be implemented will vary within for each phase of work. Not all receptors will qualify for the same level of mitigation, and some receptors do not require further consideration for any additional mitigation measures.

The additional mitigation is generally limited to the closest buildings (e.g. NCA01) situated in the vicinity of the NCW project, as identified in the results presented in **Annex D**.

Therefore, it is recommended that the type and extent of any additional mitigation measures be established in accordance with the requirements of the SM CNVS but evaluated in the context of the broader community consultation program i.e. in conjunction with community and stakeholder consultation and notification processes. Furthermore, these measures should be validated during the preparation of the CNVMP (and any subsequent out-of-hours work applications) and confirmed to be suitable and effective during works.

## 6.6

### *MAXIMUM LEVELS FOR PLANT AND EQUIPMENT*

It is recommended that plant, equipment and machinery noise levels should not exceed the maximum allowable noise levels for construction equipment presented in Table 11 of the SM CNVS or those presented in this report,

whichever is the lowest value. This will insure that noise levels above those predicted here do not occur.

Where values lower than those modelled are achieved a noise level reduction to the predicted values presented in this report will occur. For example, if equipment is selected so that an overall reduction of 10 dBA is achieved, then noise levels at nearby receptors will also reduce by approximately 10 dBA.

## 6.7 *SAFE WORKING DISTANCES FOR VIBRATION*

It is recommended that the safe working distances for vibration intensive activities be applied to all works undertaken as part of the project, as far as practicable.

Importantly, where vibration intensive works are undertaken within 25m of a residential (dwelling) receptor, monitoring of off-site vibration should be conducted to determine if vibration levels are perceptible. If they are not perceptible, then no further action is required. If they are perceptible, then the management, source control and path control measures applicable to ground-borne vibration, or respite periods, should be implemented.

## 6.8 *NOISE AND VIBRATION MONITORING REQUIREMENTS*

A noise monitoring program is to be carried out for the duration of the works in accordance with the requirements specified in the CNVMP prepared for the NCW project, and any approval and licence conditions.

The methodology for any construction monitoring should be determined by a suitably qualified acoustics engineer, the findings of this CNVIS should inform the monitoring locations and frequency, amongst other key features.

Monitoring for NCW works should be implemented at the commencement of works and at regular intervals throughout the project (i.e. when new construction activities commence) to quantify the airborne noise, ground-borne noise and vibration levels associated with construction activities. Monitoring would also be required in the event of a complaint being received and should be conducted at the most affected receptor in accordance with Appendix A of the SM CNVS.

Attended measurements should be the focus of all noise monitoring however unattended noise (and vibration) monitoring may be undertaken where specific circumstances warrant.

Any noise monitoring that is undertaken should compare the measured site noise level contributions, determined in the absence of any influential source not associated with the NCW project to the predicted noise levels presented in this CNVIS. Operator attended noise measurements are preferred (due to the influence of existing ambient noise sources) and are to be undertaken to confirm that the actual measured noise levels are consistent with the predictions in this CNVIS.

Attended noise measurements are recommended at the potentially most affected receptor(s) from the commencement of construction activities to confirm that the noise levels in the adjacent community are consistent with the predictions this CNVIS. Other potentially affected receptors should also be considered as part of the monitoring regime depending on the phase of works.

Based on the scenarios assessed in this CNVIS the closest and/or potentially most affected noise sensitive receptor locations situated within the potential area of influence of the site are:

- Receptor R.152 - residential dwelling receptor situated near the rail corridor on Hopetoun Avenue;
- Receptor R.179 - residential dwelling receptor situated near the rail corridor on Nelson Street;
- Receptor R.195 - residential dwelling receptor situated near the rail corridor on Mowbray Road;
- Receptor R.209 - residential dwelling receptor situated near the rail corridor on Raleigh Street;
- Receptor R.232 - residential dwelling receptor situated near the rail corridor on Drake Street; and
- Receptor R.242 - residential dwelling receptor situated near the rail corridor on Hawkins Street.

These locations should be identified in the CNVMP prepared for P7b works and targeted for noise monitoring once works are occurring. Of course, the precise monitoring position will be selected on a case-by-case basis and adjusted where necessary to ensure that these locations remain valid, and if not, that alternate receptor locations are selected. Consideration of this feature will occur prior to works occurring as part of the normal planning and application processes, and then verified during noise monitoring.

At this stage noise monitoring should be targeted at the commencement of each new construction activity/phase of work to verify the predicted noise levels. Continued monitoring of work phases and activities would then be considered on a case by case basis.

Vibration monitoring is recommended at the commencement of vibration generating activities to confirm that vibration levels satisfy the criteria for that vibration generating activity. Where there is potential for exceedances of the criteria, further vibration site law investigations would be undertaken to determine the site-specific safe working distances for that vibration generating activity.

Continuous vibration monitoring (attended or unattended with audible and visible alarms) should be conducted at the nearest sensitive receivers whenever vibration generating activities need to take place inside the calculated safe-working distances. At this stage vibration monitoring should be targeted to SCN10, SCN11 and SCN12 with monitoring of other work phases and activities being considered on a case by case basis (i.e. if vibration generating activities are required).

## CONCLUSION

LOR engaged ERM to complete a CNVIS for construction aspects of the project as part of the Main North and North Shore Corridor Works Project (MNNSCW), Portion 7b - Northern Corridor Works (NCW). The assessment was conducted to achieve a scope of works that allowed for the successful identification of potential receptors situated in the vicinity of site emission sources and identification of significant noise and vibration generating plant, equipment and/or activities associated with the NCW and their likely/known emissions.

Existing ambient and background noise levels in the area were quantified and noise and vibration criteria developed in accordance with recognised NSW standards and guidelines as applicable to the NCW activities, and developed applicable assessment scenarios.

Potential impacts associated with construction road traffic noise and ground-borne noise qualitatively assessed, no impacts are anticipated. A quantitative construction noise and vibration impact assessment was then conducted by predicting noise levels via modelling and by assessing vibration levels via calculated safe working distances. The predictions were conducted for applicable assessment scenarios. Resultant noise and vibration levels were then compared to project-specific criteria or management levels at each receptor location and any exceedances identified. The results and findings are presented in **Chapter 5** of this CNVIS.

The full set of predicted noise levels are presented in **Annex D**. Although a number of exceedances are identified, these are associated with predicted 15 minute noise values calculated via modelling for the purposes of the assessment, in accordance with the ICNG and the SM CNVS. These values do not represent a constant noise emission that would be experienced by the community on a daily basis throughout the NCW project.

Based on these findings, recommendations have been made for noise and vibration mitigation, management measures and/or monitoring options suitable to the significance of the predicted impacts and designed to minimise impacts as far as is feasible and reasonable.

Construction noise and vibration levels will be reduced and impacts minimised with the successful implementation of the recommendations provided in **Chapter 6** of this report. Impacts may not be reduced to negligible levels for all receptors during all construction activities; however the recommendations presented here will ensure that any residual impacts are minimised as far as is practically achievable. These recommendations will need to be implemented in conjunction with community and stakeholder consultation and notification processes.

## REFERENCES

British Standard - BS5228-2:2009+A1:2014 (BS5228) - **Code of Practice for Noise and Vibration Control on Construction and Open Sites - Part 2: Vibration**;

British Standard (BS 6472-1992) - **Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)** dated 1992;

British Standard BS7385: Part 2-1993 (BS 7385) - **Evaluation and Measurement for Vibration in Buildings** – Part 2 - Guide to Damage Levels from Ground-borne Vibration, dated 1993;

German Institute for Standardisation - DIN 4150 (1999-02) Part 3 (DIN4150:3) - **Structural Vibration - Effects of Vibration on Structures**, dated 1999;

International Organisation for Standardisation (ISO) 9613-2:1996 (ISO9613:2) - **Acoustics - Attenuation of Sound during Propagation Outdoors - Part 2: General Method of Calculation**;

NSW Department of Environment and Climate Change - **NSW Interim Construction Noise Guideline (ICNG)**, July 2009;

NSW Department of Environment and Conservation - **NSW Environmental Noise Management - Assessing Vibration: a Technical Guideline** (the NSW Vibration Guideline), February 2006;

NSW Department of Environment, Climate Change and Water - **NSW Road Noise Policy (RNP)**, March 2011;

NSW Environment Protection Authority - **NSW Environmental Noise Management - Industrial Noise Policy (INP)**, January 2000 and relevant application notes;

NSW Government - Transport for NSW (TfNSW) - **Sydney Metro Construction Noise and Vibration Strategy (SM CNVS)**, August 2016 and CNVS Addendum June 2017.

NSW Government - Transport for NSW (TfNSW) Infrastructure and Services Division (I&S) - *Sydney Metro Construction Noise and Vibration Strategy (I&S CNVS)*, May 2018

Standards Australia AS1055-1997™ (AS1055) - **Description and Measurement of Environmental Noise**;

Standards Australia AS 2436-2010™ (AS2436) - **Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites**;

TfNSW - Sydney Metro - Chatswood to Sydenham **Business Management Plan** - Early Works, dated November 2017;



TfNSW - Sydney Metro - Chatswood to Sydenham **Community Communications Strategy** - Early Works, dated October 2017;

TfNSW - Sydney Metro - Chatswood to Sydenham **Construction Environmental Management Framework (CEMF)** - Appendix B of SPIR, dated August 2016;

TfNSW - Sydney Metro - Chatswood to Sydenham **Environmental Impact Statement (EIS) - Chapter 10: Construction Noise and Vibration**, dated May 2016;

TfNSW - Sydney Metro - Chatswood to Sydenham **Environmental Impact Statement (EIS) - Technical Paper 2 Noise and Vibration**, Prepared by SLR, dated April 2016;

TfNSW - Sydney Metro - Chatswood to Sydenham **Overarching Community Communications Strategy**, dated September 2017; and

TfNSW - Sydney Metro - Chatswood to Sydenham **Small Business Owners Support Program**, dated September 2017.

Annex A

## Acoustics Glossary

## **A.1** *GLOSSARY – ACOUSTICAL CONCEPTS AND TERMINOLOGY*

### **A.1.1** *What Is Noise And Vibration*

#### *Noise*

Noise is often defined as a sound, especially one that is loud or unpleasant or that causes disturbance<sup>1</sup> or simply as unwanted sound, but technically, noise is the perception of a series of compressions and rarefactions above and below normal atmospheric pressure.

#### *Vibration*

Vibration refers to the oscillating movement of any object. In a sense noise is the movement of air particles and is essentially vibration, though in regards to an environmental assessment vibration is typically taken to refer to the oscillation of a solid object(s). The impact of noise on objects can lead to vibration of the object, or vibration can be experienced by direct transmission through the ground, this is known as ground-borne vibration.

Essentially, noise can be described as what a person hears, and vibration as what they feel.

### **A.1.2** *What Factors Contribute To Environmental Noise?*

The noise from an activity, like construction works, at any location can be affected by a number of factors, the most significant being:

- how loud the activity is;
- how far away the activity is from the receiver;
- what type of ground is between the activity and the receiver location e.g. concrete, grass, water or sand;
- how the ground topography varies between the activity and the receiver (is it flat, hilly, mountainous) as blocking the line of sight to a noise source will generally reduce the level of noise; and
- any other obstacles that block the line of sight between the source to receiver e.g. buildings or purpose built noise walls.

---

<sup>1</sup> Copyright © 2011 Oxford University Press

### **A.1.3**

#### ***How to Measure and Describe Noise?***

Noise is measured using a specially designed 'sound level' meter which must meet internationally recognised performance standards. Audible sound pressure levels vary across a range of  $10^7$  Pascals (Pa), from the threshold of hearing at  $20\mu\text{Pa}$  to the threshold of pain at  $200\text{Pa}$ . Scientists have defined a statistically described logarithmic scale called Decibels (dB) to more manageably describe noise. To demonstrate how this scale works, the following points give an indication of how the noise levels and differences are perceived by an average person:

- 0 dB - represents the threshold of human hearing (for a young person with ears in good condition);
- 50 dB - represents average conversation;
- 70 dB - represents average street noise, local traffic etc;
- 90 dB - represents the noise inside an industrial premises or factory; and
- 140 dB - represents the threshold of pain - the point at which permanent hearing damage may occur.

### **A.1.4**

#### ***Human Response to Changes in Noise Levels***

The following concepts offer qualitative guidance in respect of the average response to changes in noise levels:

- Differences in noise levels of less than approximately 2 dBA are generally imperceptible in practice. An increase of 2 dB is hardly perceivable;
- Differences in noise levels of around 5 dBA are considered to be significant;
- Differences in noise levels of around 10 dBA are generally perceived to be a doubling (or halving) of the perceived loudness of the noise. An increase of 10 dB is perceived as twice as loud. Therefore an increase of 20 dB is four times as loud and an increase of 30 dB is eight times as loud etc;
- The addition of two identical noise levels will increase the dB level by about 3 dB. For example, if one car is idling at 40 dB and then another identical car starts idling next to it, the total dB level will be about 43 dB;
- The addition of a second noise level of similar character which is at least 8 dB lower than the existing noise level will not add significantly to the overall dB level; and
- A doubling of the distance between a noise source and a receiver results approximately in a 3 dB decrease for a line source (for example, vehicles travelling on a road); and a 6 dB decrease for a point source (for example, the idling car discussed above). A doubling of traffic volume for a line source results approximately in a 3 dB increase in noise, halving the traffic volume for a line source results approximately in a 3 dB decrease in noise.

### A.1.5

#### *Terms to Describe the Perception of Noise*

The following terms offer quantitative and qualitative guidance in respect of the audibility of a noise source:

- **Inaudible / Not Audible** - the noise source and/or event could not be heard by the operator, masked by extraneous noise sources not associated with the source. If a noise source is 'inaudible' its noise level may be quantified as being less than the measured  $L_{A90}$  background noise level, potentially by 10 dB or greater;
- **Barely Audible** - the noise source and/or event are difficult to define by the operator, typically masked by extraneous noise sources not associated with the source. If a source is 'barely audible' its noise level may be quantified as being 5 - 7 dB below the measured  $L_{A90}$  or  $L_{Aeq}$  noise level, depending on the nature of the source e.g. constant or intermittent;
- **Just Audible** - the noise source and/or event may be defined by the operator. However there are a number of extraneous noise sources contributing to the measurement. The noise level should be quantified based on instantaneous noise level contributions, noted by the operator;
- **Audible** - the noise source and/or event may be easily defined by the operator. There may be a number of extraneous noise sources contributing to the measurement. The noise level should be quantified based on instantaneous noise level contributions, noted by the operator; and
- **Dominant** - the noise source and/or event are noted by the operator to be significantly 'louder' than all other noise sources. The noise level should be quantified based on instantaneous noise level contributions, noted by the operator.

The following terms offer qualitative guidance in respect of acoustic terms used to describe the frequency of occurrence of a noise source during an operator attended environmental noise measurements:

- **Constant** - this indicates that the operator has noted the noise source(s) and/or event to be constantly audible for the duration of the noise measurement e.g. an air-conditioner that runs constantly during the measurement;
- **Intermittent** - this indicates that the operator has noted the noise source(s) and/or event to be audible, stopping and starting intervals for the duration of the noise measurement e.g. car pass-bys; and
- **Infrequent** - this indicates that the operator has noted the noise source(s) and/or event to be constantly audible, however; not occurring regularly or at intervals for the duration of the noise measurement e.g. a small number of aircraft are noted during the measurement.

#### **A.1.6**      *How to Calculate or Model Noise Levels?*

There are two recognised methods which are commonly adopted to determine the noise at particular location from a proposed activity. The first is to undertake noise measurements whilst the activity is in progress and measure the noise, the second is to calculate the noise based on known noise emission data for the activity in question.

The second option is preferred as the first option is largely impractical in terms of cost and time constraints, notwithstanding the meteorological factors that may also influence its quantification. Furthermore, it is also generally considered unacceptable to create an environmental impact simply to measure it. In addition, the most effective mitigation measures are determined and implemented during the design phase and often cannot be readily applied during or after the implementation phase of a project.

Because a number of factors can affect how 'loud' a noise is at a certain location, the calculations can be very complex. The influence of other ambient sources and the contribution from a particular source in question can be difficult to ascertain. To avoid these issues, and to quantify the direct noise contribution from a source/site in question, the noise level is often calculated using noise modelling software packages. The noise emission data used in may be obtained from the manufacturer or from ERM's database of measured noise emissions.

#### **A.1.7**      *Acoustic Terminology & Statistical Noise Descriptors*

Environmental noise levels such as noise generated by industry, construction and road traffic are commonly expressed in dBA. The A-weighting scale follows the average human hearing response and enables comparison of the intensity of noise with different frequency characteristics. Time varying noise sources are often described in terms of statistical noise descriptors. The following descriptors are commonly used when assessing noise and are referred to throughout this acoustic assessment:

- **Decibel (dB is the adopted abbreviation for the decibel)** - The unit used to describe sound levels and noise exposure. It is equivalent to 10 times the logarithm (to base 10) of the ratio of a given sound pressure to a reference pressure;
- **dBA** - unit used to measure 'A-weighted' sound pressure levels. A-weighting is an adjustment made to sound-level measurement to approximate the response of the human ear;
- **dBC** - unit used to measure 'C-weighted' sound pressure levels. C-weighting is an adjustment made to sound-level measurements which takes account of low-frequency components of noise within the audibility range of humans;
- **dBZ or dBL** - unit used to measure 'Z-weighted' sound pressure levels with no weighting applied, linear;

- **Hertz (Hz)** - the measure of frequency of sound wave oscillations per second. 1 oscillation per second equals 1 hertz;
- **Octave** - a division of the frequency range into bands, the upper frequency limit;
- **1/3 Octave** - single octave bands divided into three parts;
- **Leq** - this level represents the equivalent or average noise energy during a measurement period. The  $L_{eq, 15min}$  noise descriptor simply refers to the  $L_{eq}$  noise level calculated over a 15 minute period. Indeed, any of the below noise descriptors may be defined in this way, with an accompanying time period (e.g.  $L_{10, 15\text{ minute}}$ ) as required;
- **Lmax** - the absolute maximum noise level in a noise sample;
- **LN** - the percentile sound pressure level exceeded for N% of the measurement period calculated by statistical analysis;
- **L10** - the noise level exceeded for 10 per cent of the time and is approximately the average of the maximum noise levels;
- **L90** - the noise level exceeded for 90 per cent of the time and is approximately the average of the minimum noise levels. The L90 level is often referred to as the "background" noise level and is commonly used as a basis for determining noise criteria for assessment purposes;
- **Sound Power Level (Lw)** - this is a measure of the total power radiated by a source. The Sound Power of a source is a fundamental property of the source and is independent of the surrounding environment;
- **Sound Pressure Level (Lp)** - the level of sound pressure; as measured at a distance by a standard sound level meter with a microphone. This differs from Lw in that this is the received sound as opposed to the sound 'intensity' at the source;
- **Background noise** - the underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is described using the  $LA_{90}$  descriptor;
- **Ambient noise** - the all-encompassing noise associated within a given environment. It is the composite of sounds from many sources, both near and far. This is described using the  $L_{Aeq}$  descriptor;
- **Cognitive noise** - noise in which the source is recognised as being annoying; and
- **Masking** - the phenomenon of one sound interfering with the perception of another sound. For example, the interference of traffic noise with use of a public telephone on a busy street.

## *Industrial Noise Policy (INP) Terminology*

The following terminology is from the NSW Environment Protection Authority - *NSW Environmental Noise Management - Industrial Noise Policy (INP)*, January 2000 and relevant application notes:

- **Assessment Background Level (ABL)** - is defined in the INP as a single figure background level representing each assessment period (day, evening and night). Its determination is by the tenth percentile method (of the measured LA90 statistical noise levels) described in Appendix B on the INP;
- **Rating Background Level (RBL)** - is defined in the INP as the overall single figure background level representing each assessment period (day, evening and night) over the whole monitoring period (as opposed to over each 24 hour period used for the ABL). This is the level used for assessment purposes. It is defined as the median value of:
  - all the day assessment background levels over the monitoring period for the day;
  - all the evening assessment background levels over the monitoring period for the evening; or
  - all the night assessment background levels over the monitoring period for the night;
- **Extraneous noise** - noise resulting from activities that are not typical of the area. Atypical INP activities may include construction, and traffic generated by holiday periods and by special events such as concerts or sporting events. Normal daily traffic is not considered to be extraneous;
- **Most affected location(s)** - locations that experience (or will experience) the greatest noise impact from the noise source under consideration. In determining these locations, one needs to consider existing background levels, exact noise source location(s), distance from source (or proposed source) to receiver, and any shielding between source and receiver;
- **Noise criteria** - the general set of non-mandatory noise level targets for protecting against intrusive noise (for example, background noise plus 5 dB) and loss of amenity (for example, noise levels for various land uses);
- **Noise limits** - enforceable noise levels that appear in conditions on consents and licences. The noise limits are based on achievable noise levels which the proponent has predicted can be met during the environmental assessment. Exceedance of the noise limits can result in the requirement for either the development of noise management plans or legal action;
- **Project Specific Noise Levels** - target noise levels for a particular noise generating facility. They are based on the most stringent of the intrusive criteria or amenity criteria. Which of the two criteria is the most stringent is



determined by measuring the level and nature of existing noise in the area surrounding the actual or propose noise generating facility;

- **Compliance** – the process of checking that source noise levels meet with the noise limits in a statutory context;
- **Non-compliance** – development is deemed to be in non-compliance with its noise consent/ licence conditions if the monitored noise levels exceed its statutory noise limit by more than 2 dB;
- **Feasible and Reasonable measures** – feasibility relates to engineering considerations and what is practical to build; reasonableness relates to the application of judgement in arriving at a decision, taking into account the following factors:
  - noise mitigation benefits (amount of noise reduction provided, number of people protected);
  - cost of mitigation (cost of mitigation versus benefit provided);
  - community views (aesthetic impacts and community wishes); and
  - noise levels for affected land uses (existing and future levels, and changes in noise levels);
- **Meteorological Conditions** – wind and temperature inversion conditions;
- **Temperature Inversion** – an atmospheric condition in which temperature increases with height above the ground; and
- **Adverse Weather** – weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).

## *A.1 VIBRATION - GLOSSARY OF TERMS, DEFINITIONS AND METHODOLOGY*

### *A.1.1 How to Measure and Control Vibration*

Vibration refers to the oscillating movement of any object. In relation to construction projects, ground-borne vibration is the most likely outcome of works and potentially has three (3) effects on vibration sensitive receivers, these are:

- Ground-borne vibration that may cause annoyance;
- Ground-borne vibration that may have adverse effect on a structure e.g. a building; and
- Regenerated noise due to ground-borne vibration.

Each of these potential effects can be assessed in accordance with the relevant standard. Perceptible levels of vibration often create concern for the surrounding community at levels well below structural damage guideline values; this issue needs to be managed as part of the vibration monitoring program.

Vibration is typically measured using specific devices that record the velocity or acceleration at a designated receiver location – usually being the closest premises to works. Modern vibration monitoring devices will typically capture amplitude data for the three (3) orthogonal axes being, the transverse, longitudinal and vertical and also the frequency at which the measured vibration event occurs.

Monitoring of this level of detail enables analysis of significant vibration events to determine compliance with relevant guidelines such as the NSW Department of Environment and Conservation – NSW Environmental Noise Management – *Assessing Vibration: a Technical Guideline* (the NSW vibration guideline), February 2006 and the German Institute for Standardisation – DIN 4150 (1999-02) Part 3 (DIN4150-3) – *Structural Vibration - Effects of Vibration on Structures*.

Vibration propagates in a different manner to noise and can be difficult to control depending on the frequency of the source in question, although identifying the strategy best suited to controlling vibration follows a similar approach to that of noise. This includes elimination, control at the source, control along the propagation path and control at the receiver and/or a combination of these, such as no work/respite periods.

### **A.1.2**      *Vibration Descriptors*

The following terms are often used to describe measured vibration levels.

- **Parameter** – an attribute with a value - for example, weighting;
- **Particle Velocity** – the instantaneous value of the distance travelled by a particle per unit time in a medium that is displaced from its equilibrium state by the passage of a sound or vibration wave;
- **Peak Component Particle Velocity (PCPV)** – is the highest (maximum or peak) particle velocity which is recorded during a particular vibration event over the three (3) axes. PCPV is measured in the unit, mm/s;
- **Phase** – the relative position of a sound wave to some reference point, the phase of a wave is given in radians, degrees, or fractions of a wavelength;
- **Acceleration** – the change in velocity over time. Acceleration is dependent on the velocity and the frequency of the vibration event (velocity is a vector), as such acceleration changes in two ways - magnitude and/or direction. Acceleration is measured in the unit; m/s<sup>2</sup>;

- **Perceptible** – vibration levels that a receiver of building occupant may ‘feel’. 0.2mm/s is typically considered to be the human threshold for perception of vibration;
- **Geophone or accelerometer** – the transducer/device typically used to measure vibration;
- **Damage** – is defined in DIN 4150-3 to include minor non-structural effects such as cosmetic damage or superficial cracking in paint or cement render, the enlargement of cracks already present, and the separation of partitions or intermediate walls from load bearing walls;
- **Vibration Dose Value (VDV)** – a concept outlined in the NSW vibration guideline, which is a calculative approach to assessing the impact of intermittent vibration or extended periods of impulsive vibration. VDV require the measurement of the overall weighted RMS (Root Mean Square) acceleration levels over the frequency range 1Hz to 80Hz. To calculate VDV the following formula (refer Section 2.4.1 of the guideline) is used:

$$VDV = \left[ \int_0^T a^4(t) dt \right]^{0.25}$$

Where VDV is the vibration dose value in  $m/s^{1.75}$ ,  $a(t)$  is the frequency-weighted RMS of acceleration in  $m/s^2$  and  $T$  is the total period of the day (in seconds) during which vibration may occur;

- **MIC** - Maximum Instantaneous Charge or explosive charge mass (kg) detonated per delay (any 8ms interval); and
- **SD** (m) - The scaled distance for air-blast and ground vibration from the charge to the receiver.

Annex B

## Potentially Sensitive Receptors

<b>Table B.1</b>		<b>GPS Co-ordinates (Zone 56H)</b>		<b>Ground Height (AHD) m</b>
<b>Location ID</b>	<b>Description (NCA_Receptor Type)</b>	<b>Easting</b>	<b>Northing</b>	
R.001	NCA03_Residential	331644.72	6259245.97	102
R.002	NCA03_Residential	331599.74	6259228.51	101
R.003	NCA03_Residential	331654.12	6259207.94	100
R.004	NCA03_Residential	331559.12	6259204.51	101
R.005	NCA03_Commercial	331495.91	6259196.20	104
R.006	NCA03_Residential	331634.95	6259191.33	98
R.007	NCA03_Residential	331658.52	6259187.50	98
R.008	NCA03_Residential	331601.91	6259179.71	99
R.009	NCA03_Commercial	331483.78	6259178.30	104
R.010	NCA03_Residential	331656.70	6259165.07	97
R.011	NCA03_Residential	331636.00	6259151.18	96
R.012	NCA03_Residential	331602.99	6259139.60	99
R.013	NCA03_Residential	331582.34	6259138.14	100
R.014	NCA03_Residential	331720.83	6259119.06	94
R.015	NCA03_Commercial	331515.71	6259115.61	98
R.016	NCA03_Residential	331640.94	6259101.11	94
R.017	NCA03_Commercial	331454.73	6259092.41	100
R.018	NCA03_Residential	331690.32	6259088.03	92
R.019	NCA03_Commercial	331606.85	6259087.61	97
R.020	NCA03_Commercial	331358.49	6259083.51	104
R.021	NCA03_Residential	331674.51	6259082.69	92
R.022	NCA03_Residential	331647.99	6259072.91	92
R.023	NCA03_Residential	331708.52	6259071.40	92
R.024	NCA03_Commercial	331533.54	6259070.19	96
R.025	NCA03_Commercial	331507.14	6259060.67	97
R.026	NCA03_Residential	331647.38	6259047.11	93
R.027	NCA03_Commercial	331343.96	6259043.22	104
R.028	NCA03_Residential	331585.63	6259042.83	100
R.029	NCA03_Commercial	331533.78	6259036.41	97
R.030	NCA03_Commercial	331757.71	6259028.11	90
R.031	NCA03_Commercial	331469.22	6259023.95	99
R.032	NCA03_Commercial	331715.90	6259011.59	92
R.033	NCA03_Commercial	331431.76	6259010.89	101
R.034	NCA03_Commercial	331327.36	6259004.70	106
R.035	NCA03_Commercial	331537.34	6258992.47	98
R.036	NCA03_Commercial	331406.21	6258990.76	103
R.037	NCA03_Commercial	331645.14	6258985.60	96
R.038	NCA03_Commercial	331592.73	6258976.43	100
R.039	NCA03_Commercial	331896.52	6258973.09	88
R.040	NCA03_Commercial	331387.53	6258971.90	104
R.041	NCA03_Commercial	331503.89	6258965.85	101
R.042	NCA03_Commercial	331786.57	6258962.50	90
R.043	NCA03_Commercial	331866.66	6258960.29	88
R.044	NCA03_Commercial	331533.01	6258940.84	101
R.045	NCA03_Commercial	331773.23	6258935.76	92
R.046	NCA03_Commercial	331821.30	6258930.38	90
R.047	NCA03_Commercial	331312.16	6258930.23	108

<b>Table B.1</b>		<b>GPS Co-ordinates (Zone 56H)</b>		<b>Ground Height (AHD) m</b>
<b>Location ID</b>	<b>Description (NCA_Receptor Type)</b>	<b>Easting</b>	<b>Northing</b>	
R.048	NCA03_Commercial	331695.13	6258924.53	95
R.049	NCA03_Commercial	331587.35	6258920.72	100
R.050	NCA03_Commercial	331466.04	6258918.36	104
R.051	NCA03_Commercial	331847.09	6258916.54	89
R.052	NCA03_Commercial	331646.40	6258908.67	98
R.053	NCA03_Commercial	331427.99	6258904.46	106
R.054	NCA03_Commercial	331701.28	6258902.45	95
R.055	NCA03_Commercial	331736.56	6258898.00	94
R.056	NCA03_Commercial	331675.29	6258892.18	97
R.057	NCA03_Commercial	331588.30	6258881.16	101
R.058	NCA03_Commercial	331373.52	6258881.01	108
R.059	NCA03_Commercial	331540.75	6258862.45	104
R.060	NCA03_Commercial	331868.10	6258861.83	88
R.061	NCA03_Commercial	331734.25	6258858.25	94
R.062	NCA03_Commercial	331528.50	6258857.31	104
R.063	NCA03_Commercial	331660.80	6258851.98	99
R.064	NCA03_Commercial	331754.98	6258851.07	93
R.065	NCA03_Commercial	331497.52	6258845.22	104
R.066	NCA03_Commercial	331424.53	6258838.85	107
R.067	NCA03_Commercial	331967.16	6258832.36	88
R.068	NCA03_Commercial	331641.32	6258828.65	100
R.069	NCA03_Commercial	331572.06	6258825.33	102
R.070	NCA03_Commercial	331718.19	6258821.53	95
R.071	NCA03_Commercial	331413.76	6258812.87	107
R.072	NCA03_Commercial	331403.75	6258809.18	108
R.073	NCA03_Commercial	331528.33	6258808.82	103
R.074	NCA03_Commercial	331386.85	6258804.38	108
R.075	NCA03_Commercial	331898.30	6258802.73	88
R.076	NCA03_Commercial	331674.98	6258799.42	97
R.077	NCA03_Commercial	331596.01	6258789.40	100
R.078	NCA03_Commercial	331648.51	6258789.04	98
R.079	NCA03_Commercial	331692.47	6258788.90	96
R.080	NCA03_Commercial	331582.63	6258781.57	100
R.081	NCA03_Commercial	331830.23	6258776.77	90
R.082	NCA03_Commercial	331463.81	6258771.73	104
R.083	NCA03_Commercial	331552.91	6258766.25	100
R.084	NCA03_Commercial	331415.20	6258762.38	106
R.085	NCA03_Commercial	331523.10	6258757.30	100
R.086	NCA03_Commercial	331507.60	6258751.00	100
R.087	NCA03_Commercial	331470.12	6258738.04	103
R.088	NCA03_Commercial	331666.32	6258734.68	95
R.089	NCA03_Commercial	331709.50	6258726.57	94
R.090	NCA03_Commercial	331582.06	6258721.42	98
R.091	NCA03_Commercial	331562.57	6258717.42	98
R.092	NCA03_Commercial	331423.17	6258716.70	106
R.093	NCA04_Commercial	331809.33	6258716.20	90
R.094	NCA04_Commercial	331775.54	6258703.98	91

Table B.1		GPS Co-ordinates (Zone 56H)		Ground Height (AHD) m
Location ID	Description (NCA_Receptor Type)	Easting	Northing	
R.095	NCA01_Commercial	331720.48	6258702.01	93
R.096	NCA03_Commercial	331581.25	6258699.32	98
R.097	NCA03_Commercial	331493.27	6258690.44	102
R.098	NCA01_Commercial	331531.60	6258687.45	100
R.099	NCA03_Commercial	331469.67	6258711.33	103
R.100	NCA02_Commercial	331445.17	6258676.95	105
R.101	NCA03_Commercial	331456.13	6258705.92	104
R.102	NCA01_Residential	331730.63	6258667.45	92
R.103	NCA02_Commercial	331450.64	6258664.22	104
R.104	NCA01_Commercial	331545.59	6258662.97	99
R.105	NCA01_Commercial	331517.61	6258650.98	101
R.106	NCA02_Commercial	331457.80	6258647.48	104
R.107	NCA01_Educational	331739.97	6258642.97	92
R.108	NCA01_Residential	331589.30	6258638.02	97
R.109	NCA04_Residential	331780.12	6258635.48	91
R.110	NCA01_Commercial	331462.66	6258629.00	103
R.111	NCA01_Residential	331755.07	6258621.35	92
R.112	NCA01_Residential	331569.19	6258616.97	98
R.113	NCA01_Residential	331519.17	6258601.32	100
R.114	NCA01_Residential	331590.80	6258601.10	96
R.115	NCA01_Residential	331476.71	6258600.56	102
R.116	NCA01_Residential	331551.86	6258599.28	98
R.117	NCA01_Recreational	331638.65	6258595.71	94
R.118	NCA02_Commercial	331417.04	6258589.24	103
R.119	NCA01_Residential	331485.57	6258576.55	101
R.120	NCA02_Residential	331278.01	6258572.03	95
R.121	NCA04_Residential	331770.88	6258563.76	93
R.122	NCA01_Residential	331592.85	6258557.68	96
R.123	NCA01_Residential	331495.48	6258557.64	100
R.124	NCA01_Recreational	331634.66	6258548.49	94
R.125	NCA01_Recreational	331695.82	6258544.37	93
R.126	NCA01_Residential	331543.83	6258544.34	98
R.127	NCA01_Recreational	331634.84	6258530.73	94
R.128	NCA01_Residential	331584.56	6258527.40	96
R.129	NCA04_Residential	331809.21	6258504.14	95
R.130	NCA04_Residential	331865.42	6258503.80	94
R.131	NCA04_Residential	331771.53	6258501.29	94
R.132	NCA01_Residential	331499.02	6258497.55	98
R.133	NCA01_Residential	331525.93	6258486.46	96
R.134	NCA01_Recreational	331590.78	6258475.52	96
R.135	NCA02_Residential	331461.22	6258457.11	96
R.136	NCA01_Residential	331535.48	6258457.02	96
R.137	NCA01_Residential	331715.56	6258443.03	96
R.138	NCA01_Residential	331537.04	6258442.07	96
R.139	NCA02_Residential	331324.35	6258440.28	88
R.140	NCA01_Residential	331539.22	6258429.29	96
R.141	NCA01_Residential	331678.46	6258414.74	97

Table B.1		GPS Co-ordinates (Zone 56H)		Ground Height (AHD) m
Location ID	Description (NCA_Receptor Type)	Easting	Northing	
R.142	NCA01_Residential	331540.46	6258414.33	96
R.143	NCA01_Residential	331704.15	6258398.93	98
R.144	NCA01_Residential	331642.28	6258390.32	97
R.145	NCA01_Residential	331538.59	6258379.12	97
R.146	NCA01_Residential	331703.90	6258377.92	99
R.147	NCA01_Residential	331685.79	6258367.65	99
R.148	NCA01_Commercial	331594.26	6258361.09	97
R.149	NCA01_Residential	331656.33	6258356.57	99
R.150	NCA01_Residential	331727.15	6258342.78	101
R.151	NCA01_Residential	331704.99	6258334.94	101
R.152	NCA01_Residential	331642.28	6258330.50	99
R.153	NCA01_Residential	331673.09	6258323.86	101
R.154	NCA01_Residential	331712.01	6258314.40	102
R.155	NCA04_Residential	331812.10	6258307.23	105
R.156	NCA01_Residential	331687.69	6258304.94	102
R.157	NCA01_Residential	331599.87	6258301.85	99
R.158	NCA01_Residential	331674.98	6258299.26	101
R.159	NCA01_Residential	331660.66	6258294.40	101
R.160	NCA02_Residential	331469.34	6258286.02	100
R.161	NCA01_Residential	331573.16	6258285.57	99
R.162	NCA05_Residential	332035.65	6258279.61	104
R.163	NCA01_Residential	331601.36	6258269.11	100
R.164	NCA01_Residential	331527.58	6258267.33	100
R.165	NCA01_Residential	331645.82	6258267.03	100
R.166	NCA02_Residential	331277.34	6258261.52	104
R.167	NCA01_Residential	331688.66	6258259.21	103
R.168	NCA01_Residential	331546.35	6258247.75	100
R.169	NCA01_Commercial	331522.35	6258238.02	100
R.170	NCA01_Residential	331649.22	6258226.31	101
R.171	NCA01_Residential	331690.13	6258224.30	104
R.172	NCA01_Residential	331676.07	6258219.60	103
R.173	NCA01_Commercial	331520.62	6258218.83	100
R.174	NCA01_Residential	331662.47	6258213.22	103
R.175	NCA01_Residential	331608.98	6258205.77	102
R.176	NCA01_Residential	331517.87	6258196.66	101
R.177	NCA01_Residential	331673.74	6258192.79	104
R.178	NCA05_Mixed Use	331747.75	6258110.89	106
R.179	NCA01_Residential	331658.41	6258179.98	102
R.180	NCA01_Residential	331560.87	6258173.24	101
R.181	NCA01_Residential	331670.89	6258171.66	104
R.182	NCA01_Residential	331547.37	6258167.70	101
R.183	NCA01_Commercial	331517.60	6258165.97	102
R.184	NCA01_Residential	331533.53	6258160.78	102
R.185	NCA01_Residential	331669.46	6258159.38	104
R.186	NCA01_Residential	331668.32	6258147.67	104
R.187	NCA05_Residential	331672.60	6258133.67	104
R.188	NCA02_Mixed Use	331450.25	6258079.47	104



<b>Table B.1</b>		<b>GPS Co-ordinates (Zone 56H)</b>		<b>Ground Height (AHD) m</b>
<b>Location ID</b>	<b>Description (NCA_Receptor Type)</b>	<b>Easting</b>	<b>Northing</b>	
R.189	NCA02_Residential	331340.24	6258115.87	106
R.190	NCA05_Residential	331717.51	6258130.24	106
R.191	NCA04_Residential	331850.00	6258097.81	97
R.192	NCA04_Residential	332117.22	6258065.80	84
R.193	NCA05_Residential	331712.47	6258062.88	106
R.194	NCA05_Residential	331764.81	6258125.64	106
R.195	NCA05_Residential	331695.60	6258049.39	104
R.196	NCA05_Residential	331721.55	6258037.97	106
R.197	NCA05_Residential	331715.84	6258025.26	105
R.198	NCA05_Residential	331652.01	6258020.79	104
R.199	NCA01_Residential	331759.95	6258011.51	104
R.200	NCA05_Residential	331633.73	6258011.15	104
R.201	NCA01_Residential	331743.61	6258001.39	103
R.202	NCA05_Residential	331709.10	6257999.31	101
R.203	NCA04_Residential	331885.98	6257989.24	100
R.204	NCA05_Industrial	331600.49	6257986.22	104
R.205	NCA01_Residential	331755.10	6257983.08	101
R.206	NCA01_Residential	331744.84	6257976.33	100
R.207	NCA01_Residential	331736.92	6257971.52	100
R.208	NCA05_Residential	331669.95	6257970.60	102
R.209	NCA01_Residential	331729.65	6257966.72	99
R.210	NCA01_Residential	331771.85	6257957.37	98
R.211	NCA01_Residential	331679.59	6257950.66	100
R.212	NCA01_Residential	331728.87	6257949.97	96
R.213	NCA05_Industrial	331622.09	6257945.34	102
R.214	NCA01_Residential	331813.16	6257942.85	96
R.215	NCA01_Residential	331802.80	6257936.81	96
R.216	NCA01_Residential	331688.90	6257932.05	97
R.217	NCA01_Residential	331792.60	6257930.07	95
R.218	NCA05_Industrial	331583.54	6257925.40	104
R.219	NCA01_Industrial	331633.73	6257925.40	100
R.220	NCA01_Residential	331782.58	6257923.33	93
R.221	NCA01_Residential	331823.72	6257921.36	94
R.222	NCA01_Residential	331772.21	6257917.11	93
R.223	NCA05_Residential	331329.65	6257916.59	104
R.224	NCA01_Residential	331811.83	6257914.08	93
R.225	NCA05_Place of Worship	331461.40	6257913.94	104
R.226	NCA01_Residential	331747.50	6257912.79	92
R.227	NCA01_Residential	331642.70	6257911.11	98
R.228	NCA01_Residential	331762.36	6257910.71	92
R.229	NCA01_Residential	331799.64	6257906.35	92
R.230	NCA01_Residential	331774.67	6257890.75	90
R.231	NCA01_Residential	331713.49	6257886.51	92
R.232	NCA01_Residential	331768.71	6257872.94	88
R.233	NCA01_Residential	331855.55	6257870.82	90
R.234	NCA04_Residential	331937.37	6257867.19	98
R.235	NCA01_Residential	331843.34	6257863.26	88

Table B.1		GPS Co-ordinates (Zone 56H)		Ground Height (AHD) m
Location ID	Description (NCA_Receptor Type)	Easting	Northing	
R.236	NCA04_Residential	332084.42	6257858.56	93
R.237	NCA01_Residential	331831.13	6257855.70	87
R.238	NCA01_Residential	331869.21	6257854.17	90
R.239	NCA01_Residential	331733.77	6257849.62	88
R.240	NCA01_Residential	331818.91	6257848.14	86
R.241	NCA01_Residential	331858.60	6257847.47	89
R.242	NCA01_Residential	331785.57	6257843.48	86
R.243	NCA01_Residential	331677.26	6257843.31	92
R.244	NCA01_Residential	331849.66	6257841.88	87
R.245	NCA01_Residential	331805.53	6257839.80	85
R.246	NCA01_Residential	331839.23	6257835.18	86
R.247	NCA01_Residential	331829.54	6257828.47	85
R.248	NCA01_Residential	331820.23	6257822.33	84
R.249	NCA01_Residential	331929.02	6257815.80	92
R.250	NCA01_Residential	331754.04	6257815.06	87
R.251	NCA01_Residential	331811.29	6257805.01	84
R.252	NCA01_Residential	331900.82	6257804.42	89
R.253	NCA01_Residential	331705.18	6257799.77	90
R.254	NCA01_Residential	331890.67	6257796.84	88
R.255	NCA01_Residential	331667.63	6257793.12	93
R.256	NCA01_Residential	331882.33	6257789.57	86
R.257	NCA01_Residential	331773.60	6257785.12	86
R.258	NCA01_Residential	331908.40	6257782.19	88
R.259	NCA01_Residential	331873.08	6257781.84	85
R.260	NCA01_Residential	331781.08	6257774.75	85
R.261	NCA01_Residential	331863.68	6257773.95	83
R.262	NCA01_Residential	331725.12	6257769.52	90
R.263	NCA01_Residential	331888.80	6257767.65	84
R.264	NCA01_Residential	331855.20	6257766.98	82
R.265	NCA01_Residential	331840.76	6257765.61	82
R.266	NCA01_Residential	331788.31	6257765.10	85
R.267	NCA04_Residential	332070.98	6257759.91	85
R.268	NCA01_Residential	331686.90	6257759.55	93
R.269	NCA01_Residential	331968.20	6257756.70	88
R.270	NCA01_Residential	331795.55	6257754.97	84
R.271	NCA02_Residential	331564.72	6257755.15	102
R.272	NCA01_Residential	331805.92	6257740.02	83
R.273	NCA01_Residential	331745.73	6257738.28	89
R.274	NCA01_Residential	331887.32	6257731.14	80
R.275	NCA02_Residential	331643.46	6257729.23	95
R.276	NCA01_Residential	331911.07	6257709.17	80
R.277	NCA01_Residential	331769.33	6257703.82	86
R.278	NCA01_Residential	331767.14	6257682.99	85
R.279	NCA01_Residential	331921.46	6257697.60	79
R.280	NCA01_Residential	331929.17	6257688.40	78
R.281	NCA01_Residential	331809.70	6257697.04	82
R.282	NCA01_Residential	331826.49	6257679.79	81

Table B.1		GPS Co-ordinates (Zone 56H)		Ground Height (AHD) m
Location ID	Description (NCA_Receptor Type)	Easting	Northing	
R.283	NCA01_Residential	331937.78	6257678.60	78
R.284	NCA01_Residential	331945.80	6257670.29	77
R.285	NCA01_Mixed Use	331843.44	6257665.16	80
R.286	NCA01_Residential	331955.00	6257663.16	76
R.287	NCA01_Mixed Use	331852.75	6257656.52	80
R.288	NCA01_Residential	331962.42	6257655.15	76
R.289	NCA01_Residential	331969.54	6257648.92	76
R.290	NCA01_Residential	331974.88	6257642.68	76
R.291	NCA02_Residential	331689.33	6257637.73	87
R.292	NCA01_Residential	331788.27	6257635.58	83
R.293	NCA01_Residential	331973.99	6257633.78	76
R.294	NCA01_Mixed Use	331872.97	6257633.59	80
R.295	NCA01_Residential	332050.43	6257629.51	74
R.296	NCA01_Commercial	331991.11	6257621.80	76
R.297	NCA01_Mixed Use	331880.56	6257626.12	80
R.298	NCA02_Residential	331495.82	6257620.65	101
R.299	NCA01_Commercial	332021.48	6257662.43	76
R.300	NCA01_Mixed Use	331889.94	6257614.72	81
R.301	NCA01_Residential	332061.32	6257603.73	74
R.302	NCA01_Mixed Use	331902.86	6257602.22	82
R.303	NCA01_Mixed Use	331914.39	6257594.69	82
R.304	NCA01_Residential	331823.39	6257593.85	87
R.305	NCA01_Mixed Use	331920.83	6257588.71	82
R.306	NCA01_Mixed Use	331927.49	6257582.72	82
R.307	NCA02_Residential	331599.77	6257582.25	96
R.308	NCA01_Mixed Use	331932.10	6257578.85	82
R.309	NCA01_Mixed Use	331937.04	6257574.68	82
R.310	NCA01_Mixed Use	331942.24	6257570.30	82
R.311	NCA01_Residential	332084.32	6257577.55	73
R.312	NCA01_Residential	331861.60	6257562.08	90
R.313	NCA02_Residential	331766.52	6257556.62	94
R.314	NCA01_Commercial	331963.61	6257556.66	82
R.315	NCA01_Residential	332119.38	6257549.65	72
R.316	NCA01_Residential	332141.65	6257542.49	70
R.317	NCA01_Mixed Use	331977.10	6257542.40	83
R.318	NCA01_Residential	332156.02	6257539.63	69
R.319	NCA01_Commercial	331934.69	6257538.47	85
R.320	NCA01_Residential	332171.51	6257537.75	69
R.321	NCA01_Residential	332187.01	6257535.87	68
R.322	NCA01_Residential	331820.98	6257535.53	94
R.323	NCA01_Mixed Use	331987.46	6257534.44	84
R.324	NCA01_Residential	332201.10	6257532.58	68
R.325	NCA01_Residential	332217.54	6257529.77	68
R.326	NCA01_Mixed Use	331997.86	6257526.70	83
R.327	NCA02_Residential	331713.60	6257524.67	95
R.328	NCA01_Mixed Use	332005.72	6257521.11	83
R.329	NCA01_Residential	331912.15	6257520.91	90

Table B.1		GPS Co-ordinates (Zone 56H)		Ground Height (AHD) m
Location ID	Description (NCA_Receptor Type)	Easting	Northing	
R.330	NCA01_Mixed Use	332010.22	6257517.91	82
R.331	NCA02_Residential	331792.43	6257515.02	98
R.332	NCA01_Mixed Use	332014.46	6257514.89	82
R.333	NCA01_Residential	332327.30	6257514.52	72
R.334	NCA01_Mixed Use	332018.68	6257511.91	82
R.335	NCA01_Mixed Use	332022.86	6257508.95	82
R.336	NCA01_Mixed Use	332030.62	6257503.87	82
R.337	NCA01_Mixed Use	332041.98	6257496.69	81
R.338	NCA04_Residential	332463.49	6257494.60	76
R.339	NCA01_Residential	331874.49	6257490.79	94
R.340	NCA02_Residential	331744.57	6257488.08	98
R.341	NCA01_Mixed Use	332068.64	6257481.77	80
R.342	NCA01_Residential	332254.17	6257480.92	68
R.343	NCA04_Residential	332567.19	6257480.15	73
R.344	NCA01_Residential	332271.50	6257472.69	66
R.345	NCA01_Residential	331973.90	6257470.46	90
R.346	NCA01_Residential	332290.19	6257465.21	66
R.347	NCA01_Residential	332103.42	6257461.87	81
R.348	NCA02_Residential	331819.52	6257458.41	98
R.349	NCA01_Residential	332310.37	6257456.98	66
R.350	NCA01_Residential	332325.55	6257453.72	66
R.351	NCA01_Residential	332111.33	6257451.73	81
R.352	NCA01_Residential	332351.35	6257449.81	64
R.353	NCA01_Residential	332366.98	6257447.47	67
R.354	NCA01_Residential	332128.12	6257447.43	80
R.355	NCA01_Residential	332381.83	6257445.12	68
R.356	NCA01_Residential	332395.61	6257444.27	68
R.357	NCA02_Residential	331908.38	6257444.10	93
R.358	NCA01_Residential	332410.94	6257442.03	68
R.359	NCA01_Place of Worship	332181.59	6257440.19	78
R.360	NCA01_Residential	332424.77	6257439.41	68
R.361	NCA02_Residential	331834.96	6257438.83	97
R.362	NCA01_Residential	332441.97	6257437.17	68
R.363	NCA02_Residential	331785.26	6257435.82	100
R.364	NCA01_Residential	332456.17	6257435.30	68
R.365	NCA01_Residential	332472.25	6257433.43	68
R.366	NCA01_Residential	332486.08	6257430.44	68
R.367	NCA01_Residential	332148.66	6257429.46	80
R.368	NCA01_Residential	332502.90	6257428.57	68
R.369	NCA04_Residential	332794.43	6257426.48	69
R.370	NCA01_Residential	332516.73	6257425.96	68
R.371	NCA01_Residential	332199.23	6257425.17	78
R.372	NCA02_Residential	331797.68	6257424.90	99
R.373	NCA01_Residential	332532.06	6257424.09	69
R.374	NCA01_Residential	332547.76	6257421.84	69
R.375	NCA02_Residential	331763.42	6257420.38	100
R.376	NCA01_Residential	332562.72	6257419.23	69

<b>Table B.1</b>		<b>GPS Co-ordinates (Zone 56H)</b>		<b>Ground Height (AHD) m</b>
<b>Location ID</b>	<b>Description (NCA_Receptor Type)</b>	<b>Easting</b>	<b>Northing</b>	
R.377	NCA04_Residential	332578.04	6257416.61	69
R.378	NCA04_Residential	332591.50	6257414.37	69
R.379	NCA01_Residential	332121.07	6257413.10	84
R.380	NCA04_Residential	332607.58	6257412.87	69
R.381	NCA02_Residential	331848.51	6257412.85	95
R.382	NCA01_Residential	332222.53	6257412.53	76
R.383	NCA04_Residential	332621.78	6257410.63	68
R.384	NCA02_Residential	331956.56	6257409.21	91
R.385	NCA04_Residential	332637.11	6257408.76	68
R.386	NCA01_Residential	332245.22	6257399.35	74
R.387	NCA01_Residential	332262.63	6257389.35	74
R.388	NCA02_Residential	331808.98	6257383.48	94
R.389	NCA04_Residential	332877.83	6257368.05	78
R.390	NCA01_Residential	332256.50	6257365.82	76
R.391	NCA01_Residential	332325.49	6257361.31	76
R.392	NCA01_Residential	332269.40	6257356.15	77
R.393	NCA01_Residential	332319.05	6257349.06	77
R.394	NCA01_Residential	332312.28	6257336.48	77
R.395	NCA01_Residential	332274.88	6257336.16	78
R.396	NCA02_Educational	332006.82	6257335.40	90
R.397	NCA01_Residential	332343.40	6257329.13	77
R.398	NCA01_Residential	332307.44	6257327.13	78
R.399	NCA01_Residential	332278.43	6257324.88	80
R.400	NCA01_Residential	332352.50	6257323.63	78
R.401	NCA04a_Residential	332869.44	6257321.05	71
R.402	NCA01_Residential	332363.50	6257317.49	78
R.403	NCA01_Residential	332290.03	6257308.76	81
R.404	NCA01_Residential	332381.69	6257307.76	78
R.405	NCA01_Residential	332400.09	6257299.94	78
R.406	NCA01_Residential	332421.74	6257288.32	78
R.407	NCA01_Residential	332447.03	6257272.97	78
R.408	NCA01_Residential	332350.02	6257268.42	82
R.409	NCA01_Residential	332466.70	6257260.72	78
R.410	NCA01_Residential	332481.85	6257251.05	78
R.411	NCA01_Residential	332496.03	6257241.38	76
R.412	NCA01_Residential	332512.15	6257233.32	74
R.413	NCA04a_Residential	332854.50	6257226.19	56
R.414	NCA02_Residential	332282.48	6257223.95	86
R.415	NCA01a_Residential	332492.81	6257217.85	74
R.416	NCA01a_Residential	332534.72	6257212.37	72
R.417	NCA01a_Residential	332546.97	6257201.73	70
R.418	NCA01a_Residential	332554.71	6257188.83	69
R.419	NCA02a_Residential	332317.97	6257172.83	79
R.420	NCA02a_Residential	332360.64	6257101.41	71
R.421	NCA04a_Residential	332861.55	6257120.95	54
R.422	NCA01a_Residential	332749.73	6257108.72	57
R.423	NCA04a_Residential	332857.74	6257108.41	55

<b>Table B.1</b>		<b>GPS Co-ordinates (Zone 56H)</b>		<b>Ground Height (AHD) m</b>
<b>Location ID</b>	<b>Description (NCA_Receptor Type)</b>	<b>Easting</b>	<b>Northing</b>	
R.424	NCA01a_Residential	332834.29	6257098.59	57
R.425	NCA01a_Residential	332852.83	6257091.50	57
R.426	NCA01a_Residential	332791.94	6257080.69	60
R.427	NCA01a_Residential	332849.01	6257080.60	58
R.428	NCA01a_Residential	332755.11	6257079.43	60
R.429	NCA01a_Residential	332846.83	6257070.78	59
R.430	NCA01a_Residential	332764.67	6257049.55	63
R.431	NCA01a_Residential	332839.97	6257046.67	62
R.432	NCA01a_Commercial	332641.39	6257035.93	61
R.433	NCA01a_Residential	332814.55	6257034.88	64
R.434	NCA01a_Residential	332773.64	6257028.62	64
R.435	NCA01a_Residential	332833.35	6257026.07	65
R.436	NCA01a_Commercial	332596.30	6257022.67	61
R.437	NCA01_Residential	332845.31	6257006.22	66
R.438	NCA01a_Commercial	332660.31	6257005.41	67
R.439	NCA01a_Industrial	332713.51	6257001.99	70
R.440	NCA02a_Commercial	332557.32	6256998.79	63
R.441	NCA01_Residential	332789.18	6256992.16	68
R.442	NCA01_Residential	332854.72	6256991.72	67
R.443	NCA01_Residential	332835.43	6256982.12	69
R.444	NCA01_Residential	332860.83	6256981.29	68
R.445	NCA01a_Commercial	332681.05	6256975.86	70
R.446	NCA01_Residential	332867.44	6256971.63	69
R.447	NCA01_Residential	332798.75	6256971.24	70
R.448	NCA02a_Commercial	332499.53	6256965.11	68
R.449	NCA01_Residential	332873.04	6256960.94	70
R.450	NCA01a_Commercial	332636.00	6256958.62	67
R.451	NCA01_Residential	332878.64	6256952.80	70
R.452	NCA01_Residential	332804.13	6256949.72	71
R.453	NCA01_Commercial	332696.26	6256948.10	73
R.454	NCA01_Residential	332834.85	6256944.43	72
R.455	NCA01_Residential	332883.98	6256944.15	71
R.456	NCA01_Residential	332810.10	6256932.98	73
R.457	NCA01_Residential	332891.10	6256932.96	72
R.458	NCA02a_Commercial	332593.73	6256931.89	69
R.459	NCA01_Residential	332896.44	6256925.07	73
R.460	NCA01_Residential	332842.39	6256924.72	74
R.461	NCA01_Residential	332901.78	6256915.41	74
R.462	NCA01_Residential	332813.09	6256915.05	75
R.463	NCA01_Residential	332849.34	6256906.74	75
R.464	NCA01_Residential	332907.13	6256906.25	75
R.465	NCA01_Commercial	332726.00	6256901.83	77
R.466	NCA02_Commercial	332533.98	6256896.72	74
R.467	NCA01_Residential	332914.99	6256895.73	75
R.468	NCA01_Residential	332886.09	6256894.37	76
R.469	NCA01_Residential	332819.07	6256891.14	77
R.470	NCA01_Residential	332875.97	6256888.22	77

Table B.1		GPS Co-ordinates (Zone 56H)		Ground Height (AHD) m
Location ID	Description (NCA_Receptor Type)	Easting	Northing	
R.471	NCA01_Residential	332859.20	6256888.19	77
R.472	NCA01_Residential	332863.31	6256879.55	77
R.473	NCA01_Residential	332850.83	6256873.53	78
R.474	NCA01_Residential	332824.45	6256873.21	78
R.475	NCA01_Residential	332901.27	6256868.34	77
R.476	NCA01_Residential	332840.97	6256866.59	78
R.477	NCA01_Residential	332890.79	6256864.36	78
R.478	NCA02_Commercial	332479.05	6256862.13	74
R.479	NCA01_Residential	332876.33	6256852.80	79
R.480	NCA01_Residential	332828.04	6256841.52	80
R.481	NCA01_Commercial	332766.27	6256836.79	79
R.482	NCA01_Residential	332846.68	6256833.64	80
R.483	NCA01_Commercial	332686.81	6256817.30	78
R.484	NCA01_Residential	332832.22	6256808.65	81
R.485	NCA01_Recreational	332838.37	6256768.92	83
R.486	NCA01_Commercial	332700.05	6256765.43	78
R.487	NCA01_Commercial	332768.86	6256668.04	76
R.488	NCA01_Commercial	332770.44	6256616.69	77
R.489	NCA01_Commercial	332779.86	6256557.67	77
R.490	NCA01_Residential	332854.36	6256511.84	76
R.491	NCA01_Commercial	332795.39	6256484.37	76
R.492	NCA01_Residential	332854.72	6256419.66	74
R.493	NCA01_Recreational	332963.49	6256396.54	68
R.494	NCA01_Residential	332810.92	6256389.94	78
R.495	NCA01_Residential	332864.92	6256367.99	76
R.496	NCA01_Residential	332886.67	6256344.20	75
R.497	NCA01_Residential	332971.65	6256316.33	66
R.498	NCA01_Residential	332915.23	6256314.97	74
R.499	NCA01_Residential	332825.21	6256308.57	78
R.500	NCA01_Residential	332955.33	6256286.41	66
R.501	NCA01_Hospital	332771.97	6256274.48	83
R.502	NCA04_Residential	333031.43	6256271.73	74
R.503	NCA01_Commercial	332944.56	6256270.95	67
R.504	NCA01_Residential	332830.80	6256260.73	78
R.505	NCA04_Residential	333020.10	6256259.33	74
R.506	NCA04_Residential	333010.89	6256243.76	76
R.507	NCA01_Commercial	332919.25	6256237.74	68
R.508	NCA01_Commercial	332893.07	6256234.91	74
R.509	NCA01_Residential	332992.79	6256233.42	74
R.510	NCA01_Residential	332979.08	6256218.72	74
R.511	NCA01_Residential	332832.67	6256212.90	78
R.512	NCA01_Residential	332975.04	6256205.67	75
R.513	NCA01_Commercial	332921.68	6256194.36	71
R.514	NCA01_Residential	332978.21	6256189.47	76
R.515	NCA01_Residential	332980.07	6256176.05	77
R.516	NCA01_Hospital	332788.60	6256174.71	81
R.517	NCA01_Residential	332838.88	6256171.28	77

<b>Table B.1</b>		<b>GPS Co-ordinates (Zone 56H)</b>		<b>Ground Height (AHD) m</b>
<b>Location ID</b>	<b>Description (NCA_Receptor Type)</b>	<b>Easting</b>	<b>Northing</b>	
R.518	NCA01_Commercial	332924.58	6256166.33	73
R.519	NCA01_Residential	332982.31	6256162.26	78
R.520	NCA06_Commercial	332923.01	6256142.60	75
R.521	NCA06_Residential	332845.71	6256125.31	74
R.522	NCA06_Commercial	332990.11	6256124.44	79
R.523	NCA06_Commercial	332996.04	6256099.56	80
R.524	NCA06_Residential	332908.45	6256088.03	76
R.525	NCA06_Residential	332847.57	6256078.71	74
R.526	NCA06_Commercial	332969.99	6256069.92	80
R.527	NCA06_Commercial	333001.38	6256056.61	82
R.528	NCA06_Commercial	332888.38	6256012.19	76
R.529	NCA06_Commercial	332820.53	6256002.03	76
R.530	NCA06_Commercial	333006.16	6256012.39	84

1. All GPS coordinates are in UTM, Zone 56H
2. Australian Height Datum in metres (m).



Annex C

## Assessment Scenarios and Noise Modelling Data







Schedule	Timing Details - OOHW?	Area of Works	Activity	Assessment Scenario ID	Potential (AB / GB / W) Impacts	Equipment	LW Item	Quantity (Q)	Penalty (P)	Duty Factor (DF)	LW Modified (C / P / DF)	Spectral Data - dBA per 1/1 Octave - Frequency in Hertz (Hz)									
												31.5	63	125	250	500	1000	2000	4000	8000	
VARIOUS	Standard Construction Hours + OOHW	In rail corridor, off Cleland Road	Cleland Rd Ancillary Facility	SCN 23-A	AB Noise	Generator	99.0	1.0	0.0	100%	99.0	64.9	87.1	91.4	87.4	92.7	91.2	92.2	87.8	78.6	
				SCN 23-B	AB Noise	Hand Tool	102.0	1.0	0.0	50%	99.0	60.1	74.9	87.6	90.3	91.8	93.7	92.8	85.9	78.2	
				SCN 23-C	AB Noise	Light Vehicle	106.0	2.0	0.0	75%	107.8	76.9	84.9	93.0	95.4	100.7	103.4	101.8	96.1	90.8	
				SCN 23-D	AB Noise	Lighting Tower	80.0	2.0	0.0	100%	83.0	56.7	65.9	72.0	74.5	76.9	76.1	77.3	68.1	62.0	
VARIOUS	Standard Construction Hours + OOHW	In rail corridor, off Cleland Road	Cleland Rd Ancillary Facility	↑ SCN 23	AB Noise	↑ TOTAL EMISSION (LW, 15minute in dBA)	108.0	-	-	-	108.8	77.3	89.3	96.0	97.1	101.8	104.0	102.8	97.0	91.3	
VARIOUS	Standard Construction Hours + OOHW	In rail corridor, off Cleland Road	Cleland Rd Laydown Area	SCN 24-A	AB Noise	Heavy Vehicle	107.0	1.0	0.0	50%	104.0	59.7	85.1	89.4	95.8	99.1	96.4	98.4	87.4	80.6	
				SCN 24-B	AB Noise	Hand Tool	102.0	1.0	0.0	50%	99.0	60.1	74.9	87.6	90.3	91.8	93.7	92.8	85.9	78.2	
				SCN 24-C	AB Noise	Bobcat	104.0	1.0	0.0	50%	101.0	48.7	70.9	80.0	86.5	96.9	97.1	92.3	84.1	82.0	
				SCN 24-D	AB Noise	Lighting Tower	80.0	2.0	0.0	100%	83.0	56.7	65.9	72.0	74.5	76.9	76.1	77.3	68.1	62.0	
VARIOUS	Standard Construction Hours + OOHW	In rail corridor, off Cleland Road	Cleland Rd Laydown Area	↑ SCN 24	AB Noise	↑ TOTAL EMISSION (LW, 15minute in dBA)	109.6	-	-	-	106.6	64.0	85.7	91.9	97.3	101.6	100.7	100.2	90.8	85.3	
VARIOUS	Standard Construction Hours + OOHW	In rail corridor, off Cleland Road	Cleland Rd Stockpiling	SCN 25-A	AB Noise	16t Excavator	105.0	1.0	0.0	100%	105.0	62.5	83.2	91.9	94.5	99.8	100.8	96.1	90.8	83.6	
				SCN 25-B	AB Noise	Heavy Vehicle	107.0	1.0	0.0	50%	104.0	59.7	85.1	89.4	95.8	99.1	96.4	98.4	87.4	80.6	
				SCN 25-C	AB Noise	Hand Tool	102.0	1.0	0.0	50%	99.0	60.1	74.9	87.6	90.3	91.8	93.7	92.8	85.9	78.2	
				SCN 25-D	AB Noise	Bobcat	104.0	1.0	0.0	50%	101.0	48.7	70.9	80.0	86.5	96.9	97.1	92.3	84.1	82.0	
				SCN 25-E	AB Noise	Lighting Tower	80.0	2.0	0.0	100%	83.0	56.7	65.9	72.0	74.5	76.9	76.1	77.3	68.1	62.0	
VARIOUS	Standard Construction Hours + OOHW	In rail corridor, off Cleland Road	Cleland Rd Stockpiling	↑ SCN 25	AB Noise	↑ TOTAL EMISSION (LW, 15minute in dBA)	110.9	-	-	-	108.9	66.3	87.6	94.9	99.1	103.8	103.8	101.7	93.8	87.5	
VARIOUS	Standard Construction Hours + OOHW	In rail corridor, off Lambs Rd + Francis Street	Lambs Rd Laydown Area	SCN 26-A	AB Noise	Heavy Vehicle	107.0	1.0	0.0	50%	104.0	59.7	85.1	89.4	95.8	99.1	96.4	98.4	87.4	80.6	
				SCN 26-B	AB Noise	Hand Tool	102.0	1.0	0.0	50%	99.0	60.1	74.9	87.6	90.3	91.8	93.7	92.8	85.9	78.2	
				SCN 26-C	AB Noise	Bobcat	104.0	1.0	0.0	50%	101.0	48.7	70.9	80.0	86.5	96.9	97.1	92.3	84.1	82.0	
				SCN 26-D	AB Noise	Lighting Tower	80.0	2.0	0.0	100%	83.0	56.7	65.9	72.0	74.5	76.9	76.1	77.3	68.1	62.0	
VARIOUS	Standard Construction Hours + OOHW	In rail corridor, off Lambs Rd + Francis Street	Lambs Rd Laydown Area	↑ SCN 26	AB Noise	↑ TOTAL EMISSION (LW, 15minute in dBA)	109.6	-	-	-	106.6	64.0	85.7	91.9	97.3	101.6	100.7	100.2	90.8	85.3	
VARIOUS	Standard Construction Hours + OOHW	In rail corridor, off St Leonards Station	St Leonards Yard Laydown Area	SCN 27-A	AB Noise	Heavy Vehicle	107.0	1.0	0.0	50%	104.0	59.7	85.1	89.4	95.8	99.1	96.4	98.4	87.4	80.6	
				SCN 27-B	AB Noise	Hand Tool	102.0	1.0	0.0	50%	99.0	60.1	74.9	87.6	90.3	91.8	93.7	92.8	85.9	78.2	
				SCN 27-C	AB Noise	Bobcat	104.0	1.0	0.0	50%	101.0	48.7	70.9	80.0	86.5	96.9	97.1	92.3	84.1	82.0	
				SCN 27-D	AB Noise	Lighting Tower	80.0	2.0	0.0	100%	83.0	56.7	65.9	72.0	74.5	76.9	76.1	77.3	68.1	62.0	
VARIOUS	Standard Construction Hours + OOHW	In rail corridor, off St Leonards Station	St Leonards Yard Laydown Area	↑ SCN 27	AB Noise	↑ TOTAL EMISSION (LW, 15minute in dBA)	109.6	-	-	-	106.6	64.0	85.7	91.9	97.3	101.6	100.7	100.2	90.8	85.3	

Annex D

## Noise Modelling Results









Clearing and Grubbing for site establishment		SCND1	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)				
Table D.1	Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night
	R-527_A	NCA06_Commercial	19	-51	-	-	-	-	-	-	-	-	-	-	-
	R-528_A	NCA06_Commercial	20	-50	-	-	-	-	-	-	-	-	-	-	-
	R-529_A	NCA06_Commercial	34	-36	-	-	-	-	-	-	-	-	-	-	-
	R-530_A	NCA06_Commercial	15	-55	-	-	-	-	-	-	-	-	-	-	-







Overhead Wiring Footings, Structures and Wiring		SCN02	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)				
Table D.2	Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night
	R.529_A	NCA06_Commercial	25	-45	-45	-45	-45	-	-	-	-	-	-	-	-
	R.530_A	NCA06_Commercial	7	-63	-63	-63	-63	-	-	-	-	-	-	-	-









Table D.3		Drainage System Installation	SCN03	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	28	-42	-42	-42	-42	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	8	-62	-62	-62	-62	-	-	-	-	-	-	-	-	







Table D.4		Track Slew or Switch	SCND4	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	31	-39	-39	-39	-39	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	13	-57	-57	-57	-57	-	-	-	-	-	-	-	-	









Table D.5		Removal of existing Tracks	SCND5	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	32	-38	-38	-38	-38	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	13	-57	-57	-57	-57	-	-	-	-	-	-	-	-	







Table D.6		HV Electrical Works	SCND6	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	29	-41	-41	-41	-41	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	10	-60	-60	-60	-60	-	-	-	-	-	-	-	-	









Construction of Combined Services Route		SCN07	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Table D.7	(CSR)	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night
Name	Description	27	-43	-43	-43	-43	-	-	-	-	-	-	-	-
R.529_A	NCA06_Commercial	8	-62	-62	-62	-62	-	-	-	-	-	-	-	-
R.530_A	NCA06_Commercial													







Table D.8		Under Line Crossing (ULX) Works	SCN08	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	28	-42	-42	-42	-42	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	9	-61	-61	-61	-61	-	-	-	-	-	-	-	-	







Table D.9		Relocation and Termination of Utilities in Nelson St Bridge			SCN09							Mitigation / Management (AMMM)						
Name	Description	Predicted Noise Level	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)							
			Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night				
R.933.A	NCAD1_Residential	40	-12	-7	-6	0												
R.934.A	NCAD1_Residential	46	-6	-1	0	0												
R.935.A	NCAD1_Residential	40	-12	-7	-6	0												
R.936.A	NCAD1_Residential	40	-12	-7	-6	0												
R.937.A	NCAD1_Residential	48	-4	1	2	8												
R.938.A	NCAD1_Residential	40	-12	-7	-6	0												
R.939.A	NCAD1_Plane of Worship	46	-6	-1	0	0												
R.940.A	NCAD1_Residential	40	-12	-7	-6	0												
R.941.A	NCAD1_Residential	37	-15	-10	-9	-3												
R.942.A	NCAD1_Residential	35	-17	-12	-11	-5												
R.943.A	NCAD1_Residential	36	-16	-11	-10	-4												
R.944.A	NCAD1_Residential	36	-16	-11	-10	-4												
R.945.A	NCAD1_Residential	36	-16	-11	-10	-4												
R.946.A	NCAD1_Residential	36	-16	-11	-10	-4												
R.947.A	NCAD1_Residential	44	-8	-3	-2	4												
R.948.A	NCAD1_Residential	36	-16	-11	-10	-4												
R.949.A	NCAD1_Residential	37	-14	-9	-8	-2												
R.950.A	NCAD1_Residential	36	-16	-11	-10	-4												
R.951.A	NCAD1_Residential	46	-6	-1	0	0												
R.952.A	NCAD1_Residential	35	-17	-12	-11	-5												
R.953.A	NCAD1_Residential	37	-15	-10	-9	-3												
R.954.A	NCAD1_Residential	37	-15	-10	-9	-3												
R.955.A	NCAD1_Residential	37	-15	-10	-9	-3												
R.956.A	NCAD1_Residential	37	-15	-10	-9	-3												
R.957.A	NCAD1_Residential	38	-14	-9	-8	-2												
R.958.A	NCAD1_Residential	37	-14	-9	-8	-2												
R.959.A	NCAD1_Residential	37	-14	-9	-8	-2												
R.960.A	NCAD1_Residential	29	-23	-18	-17	-11												
R.961.A	NCAD1_Residential	37	-14	-9	-8	-2												
R.962.A	NCAD1_Residential	37	-14	-9	-8	-2												
R.963.A	NCAD1_Residential	37	-14	-9	-8	-2												
R.964.A	NCAD1_Residential	37	-14	-9	-8	-2												
R.965.A	NCAD1_Residential	37	-14	-9	-8	-2												
R.966.A	NCAD1_Residential	37	-14	-9	-8	-2												
R.967.A	NCAD1_Residential	37	-14	-9	-8	-2												
R.968.A	NCAD1_Residential	37	-14	-9	-8	-2												
R.969.A	NCAD1_Residential	37	-14	-9	-8	-2												
R.970.A	NCAD1_Residential	36	-16	-11	-10	-4												
R.971.A	NCAD1_Residential	46	-6	-1	0	0												
R.972.A	NCAD1_Residential	35	-17	-12	-11	-5												
R.973.A	NCAD1_Residential	37	-15	-10	-9	-3												
R.974.A	NCAD1_Residential	37	-15	-10	-9	-3												
R.975.A	NCAD1_Residential	35	-17	-12	-11	-5												
R.976.A	NCAD1_Residential	38	-14	-9	-8	-2												
R.977.A	NCAD1_Residential	37	-14	-9	-8	-2												
R.978.A	NCAD1_Residential	37	-14	-9	-8	-2												
R.979.A	NCAD1_Residential	29	-23	-18	-17	-11												
R.980.A	NCAD1_Residential	37	-14	-9	-8	-2												
R.981.A	NCAD1_Residential	37	-15	-10	-9	-3												
R.982.A	NCAD1_Residential	46	-6	-1	0	0												
R.983.A	NCAD1_Residential	37	-14	-9	-8	-2												
R.984.A	NCAD1_Residential	30	-22	-17	-16	-10												
R.985.A	NCAD1_Residential	37	-14	-9	-8	-2												
R.986.A	NCAD1_Residential	42	-10	-5	-4	2												
R.987.A	NCAD1_Residential	43	-9	-4	-3	3												
R.988.A	NCAD1_Residential	30	-22	-17	-16	-10												
R.989.A	NCAD1_Residential	39	-12	-7	-6	0												
R.990.A	NCAD1_Residential	36	-16	-11	-10	-4												
R.991.A	NCAD1_Residential	42	-10	-5	-4	2												
R.992.A	NCAD1_Residential	40	-12	-7	-6	0												
R.993.A	NCAD1_Residential	33	-19	-14	-13	-7												
R.994.A	NCAD1_Residential	33	-19	-14	-13	-7												
R.995.A	NCAD1_Residential	33	-19	-14	-13	-7												
R.996.A	NCAD1_Residential	33	-19	-14	-13	-7												
R.997.A	NCAD1_Residential	35	-17	-12	-11	-5												
R.998.A	NCAD1_Residential	35	-17	-12	-11	-5												
R.999.A	NCAD1_Residential	37	-15	-10	-9	-3												
R.1000.A	NCAD1_Residential	42	-10	-5	-4	2												
R.1001.A	NCAD1_Residential	35	-17	-12	-11	-5												
R.1002.A	NCAD1_Residential	44	-8	-3	-2	4												
R.1003.A	NCAD1_Residential	37	-14	-9	-8	-2												
R.1004.A	NCAD1_Residential	42	-10	-5	-4	2												
R.1005.A	NCAD1_Residential	44	-8	-3	-2	4												
R.1006.A	NCAD1_Residential	42	-10	-5	-4	2												
R.1007.A	NCAD1_Residential	41	-11	-6	-5	1												
R.1008.A	NCAD1_Residential	43	-9	-4	-3	3												
R.1009.A	NCAD1_Residential	42	-10	-5	-4	2												
R.1010.A	NCAD1_Residential	41	-11	-6	-5	1												
R.1011.A	NCAD1_Residential	43	-9	-4	-3	3												
R.1012.A	NCAD1_Residential	41	-11	-6	-5	1												
R.1013.A	NCAD1_Residential	32	-27	-22	-19	-14												
R.1014.A	NCAD1_Residential	43	-9	-4	-3	3												
R.1015.A	NCAD1_Residential	30	-29	-24	-21	-16												
R.1016.A	NCAD1_Residential	34	-25	-20	-17	-12												
R.1017.A	NCAD1_Residential	34	-25	-20	-17	-12												
R.1018.A	NCAD1_Residential	34	-25	-20	-17	-12												
R.1019.A	NCAD1_Residential	37	-22	-17	-14	-9												
R.1020.A	NCAD1_Residential	36	-23	-18	-15	-10												
R.1021.A	NCAD1_Residential	35	-24	-19	-16	-11												
R.1022.A	NCAD1_Residential	32	-27	-22	-19	-14												
R.1023.A	NCAD1_Residential	28	-31	-26	-23	-18												
R.1024.A	NCAD1_Residential	33	-26	-21	-18	-13												
R.1025.A	NCAD1_Residential	28	-31	-26	-23	-18												
R.1026.A	NCAD1_Residential	30	-29	-24	-21	-16												
R.1027.A	NCAD1_Residential	29	-30	-25	-22	-17												
R.1028.A	NCAD1_Residential	34	-25	-20	-17	-12												
R.1029.A	NCAD1_Residential	28	-31	-26	-23	-18												
R.1030.A	NCAD1_Residential	36	-23	-18	-15	-10												
R.1031.A	NCAD1_Residential	28	-31	-26	-23	-18												
R.1032.A	NCAD1_Residential	32	-27	-22	-19	-14												
R.1033.A	NCAD1_Residential	38	-21	-16	-13	-8												
R.1034.A	NCAD1_Residential	32	-27	-22	-19	-14												
R.1035.A	NCAD1_Residential	35	-24	-19	-16	-11												
R.1036.A	NCAD1_Residential	38	-21	-16	-13	-8												
R.1037.A	NCAD1_Residential	38	-21	-16	-13	-8												
R.1038.A	NCAD1_Residential	30	-29	-24	-21	-16												
R.1039.A	NCAD1_Residential	38	-21	-16	-13	-8												
R.1040.A	NCAD1_Residential	38	-21	-16	-13	-8												
R.1041.A	NCAD1_Residential	39	-20	-15	-12	-7												
R.1042.A	NCAD1_Residential	38	-21	-16	-13	-8												
R.1043.A	NCAD1_Residential	30	-29	-24	-21	-16												
R.1044.A	NCAD1_Residential	38	-21	-16	-13	-8												
R.1045.A	NCAD1_Residential	37	-22	-17	-14	-9												
R.1046.A	NCAD1_Residential	38	-21	-16	-13	-8												
R.1047.A	NCAD1_Residential	40	-12	-7	-6	0												
R.1048.A	NCAD1_Residential	38	-21	-16	-13	-8												
R.1049.A	NCAD1_Residential	38	-21	-16	-13	-8												
R.1050.A	NCAD1_Residential	36	-16	-11	-10	-4												
R.1051.A	NCAD1_Residential	38	-21	-16	-13	-8												
R.1052.A	NCAD1_Residential	38	-21	-16	-13	-8												
R.1053.A	NCAD1_Residential	31	-39	-34	-31	-26												
R.1054.A	NCAD1_Residential	33	-31	-26	-23	-18												
R.1055.A	NCAD1_Residential	38	-21	-16	-13	-8												
R.1056.A	NCAD1_Residential	40	-12	-7	-6	0												
R.1057.A	NCAD1_Residential	38	-21	-16	-13	-8												
R.1058.A	NCAD1_Residential	38	-21	-16	-13	-8												
R.1059.A	NCAD1_Residential	31	-39	-34	-31	-26												
R.1060.A	NCAD1_Residential	33	-31	-26	-23	-18												
R.1061.A	NCAD1_Residential	38	-21	-16	-13	-8												
R.1062.A	NCAD1_Residential	38	-21	-16	-13	-8												
R.1063.A	NCAD1_Residential	38	-21	-16	-13	-8												
R.1064.A	NCAD1_Residential	38	-21	-16	-13	-8												
R.1065.A	NCAD1_Residential	38	-21	-16	-13	-8												
R.1066.A	NCAD1_Residential	38	-21	-16	-13	-8												
R.1067.A	NCAD1_Residential	38	-21	-16	-13	-8												

Relocation and Termination of Utilities in Nelson St Bridge		SCND9	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)				
Table D.9	Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night
	R.529_A	NCA06_Commercial	35	-35	-35	-35	-35	-	-	-	-	-	-	-	-
	R.530_A	NCA06_Commercial	16	-54	-54	-54	-54	-	-	-	-	-	-	-	-





Table D.10	Name	Description	Nelson St Bridge Demolition		SCN10				Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)				
			Day	Standard	Day Standard	Night	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
																					Day Standard
R.933_A	NCAD01	Residential	40	-12																	
R.934_A	NCAD01	Residential	47	-5	0	1	7														
R.935_A	NCAD01	Residential	41	-11																	
R.936_A	NCAD01	Residential	41	-6																	
R.937_A	NCAD02	Residential	49	-3	2	3	9														
R.938_A	NCAD01	Residential	41	-11	-6	-5	1														
R.939_A	NCAD01	Place of Worship	47	-8	47	8															
R.960_A	NCAD01	Residential	41	-11	-6	-5	1														
R.961_A	NCAD02	Residential	37	-15	-10	-9															
R.962_A	NCAD01	Residential	35	-17	-12	-11															
R.963_A	NCAD02	Residential	37	-15	-10	-9															
R.964_A	NCAD01	Residential	36	-16	-11	-10															
R.965_A	NCAD01	Residential	36	-16	-11	-10															
R.966_A	NCAD01	Residential	36	-16	-11	-10															
R.967_A	NCAD01	Residential	45	-7	-2	-1	5														
R.968_A	NCAD01	Residential	36	-16	-11	-10															
R.969_A	NCAD04	Residential	38	-13	-8	-7															
R.970_A	NCAD01	Residential	36	-16	-11	-10															
R.971_A	NCAD01	Residential	47	-5	0	1	7														
R.972_A	NCAD02	Residential	35	-17	-12	-11															
R.973_A	NCAD01	Residential	38	-14	-9	-8															
R.974_A	NCAD01	Residential	38	-14	-9	-8															
R.975_A	NCAD02	Residential	34	-18	-13	-12															
R.976_A	NCAD01	Residential	38	-14	-9	-8															
R.977_A	NCAD04	Residential	38	-13	-8	-7															
R.978_A	NCAD04	Residential	38	-13	-8	-7															
R.979_A	NCAD01	Residential	29	-23	-18	-17															
R.980_A	NCAD04	Residential	38	-13	-8	-7															
R.981_A	NCAD02	Residential	37	-15	-10	-9															
R.982_A	NCAD01	Residential	47	-5	0	1	7														
R.983_A	NCAD04	Residential	37	-14	-9	-8															
R.984_A	NCAD02	Residential	31	-21	-16	-15															
R.985_A	NCAD04	Residential	37	-14	-9	-8															
R.986_A	NCAD01	Residential	43	-9	-4	-3															
R.987_A	NCAD01	Residential	44	-8	-3	-2															
R.988_A	NCAD02	Residential	30	-22	-17	-16															
R.989_A	NCAD04	Residential	40	-11	-6	-5															
R.990_A	NCAD01	Residential	35	-17	-12	-11															
R.991_A	NCAD01	Residential	43	-9	-4	-3															
R.992_A	NCAD01	Residential	42	-10	-5	-4															
R.993_A	NCAD01	Residential	33	-19	-14	-13															
R.994_A	NCAD01	Residential	33	-19	-14	-13															
R.995_A	NCAD01	Residential	33	-19	-14	-13															
R.996_A	NCAD01	Residential	33	-19	-14	-13															
R.997_A	NCAD01	Residential	35	-17	-12	-11															
R.998_A	NCAD01	Residential	36	-16	-11	-10															
R.999_A	NCAD01	Residential	36	-16	-11	-10															
R.400_A	NCAD01	Residential	43	-9	-4	-3															
R.401_A	NCAD04	Residential	36	-23	-18	-15															
R.402_A	NCAD01	Residential	45	-7	-2	-1															
R.403_A	NCAD01	Residential	37	-15	-10	-9															
R.404_A	NCAD01	Residential	43	-9	-4	-3															
R.405_A	NCAD01	Residential	47	-5	0	1	7														
R.406_A	NCAD01	Residential	42	-10	-5	-4															
R.407_A	NCAD01	Residential	42	-10	-5	-4															
R.408_A	NCAD01	Residential	44	-8	-3	-2															
R.409_A	NCAD01	Residential	43	-9	-4	-3															
R.410_A	NCAD01	Residential	46	-6	-1	0	6														
R.411_A	NCAD01	Residential	44	-8	-3	-2															
R.412_A	NCAD01	Residential	42	-10	-5	-4															
R.413_A	NCAD04	Residential	32	-27	-22	-19															
R.414_A	NCAD01	Residential	44	-8	-3	-2															
R.415_A	NCAD01	Residential	30	-29	-24	-21															
R.416_A	NCAD01	Residential	35	-24	-19	-16															
R.417_A	NCAD01	Residential	35	-24	-19	-16															
R.418_A	NCAD01	Residential	34	-26	-21	-17															
R.419_A	NCAD02	Residential	37	-22	-17	-14															
R.420_A	NCAD02	Residential	36	-23	-18	-15															
R.421_A	NCAD04	Residential	36	-23	-18	-15															
R.422_A	NCAD01	Residential	32	-27	-22	-19															
R.423_A	NCAD04	Residential	27	-32	-27	-24															
R.424_A	NCAD01	Residential	25	-34	-29	-26															
R.425_A	NCAD01	Residential	27	-32	-27	-24															
R.426_A	NCAD01	Residential	29	-30	-25	-22															
R.427_A	NCAD01	Residential	29	-30	-25	-22															
R.428_A	NCAD01	Residential	34	-25	-20	-17															
R.429_A	NCAD01	Residential	28	-31	-26	-23															
R.430_A	NCAD01	Residential	37	-22	-17	-14															
R.431_A	NCAD01	Residential	28	-31	-26	-23															
R.432_A	NCAD01	Residential	32	-27	-22	-19															
R.433_A	NCAD01	Residential	28	-31	-26	-23															
R.434_A	NCAD01	Residential	39	-20	-15	-12															
R.435_A	NCAD01	Residential	31	-28	-23	-20															
R.436_A	NCAD01	Residential	35	-24	-19	-16															
R.437_A	NCAD01	Residential	39	-13	-8	-7															
R.438_A	NCAD01	Commercial	30	-40	-40	-40															
R.439_A	NCAD01	Commercial	39	-39	-39	-39															
R.440_A	NCAD02	Commercial	35	-35	-35	-35															
R.441_A	NCAD01	Residential	40	-12	-7	-6															
R.442_A	NCAD01	Residential	39	-13	-8	-7															
R.443_A	NCAD01	Residential	30	-22	-17	-16															
R.444_A	NCAD01	Residential	39	-13	-8	-7															
R.445_A	NCAD01	Commercial	37	-33	-33	-33															
R.446_A	NCAD01	Residential	39	-13	-8	-7															
R.447_A	NCAD01	Residential	42	-10	-5	-4															
R.448_A	NCAD02	Commercial	39	-31	-31	-31															
R.449_A	NCAD01	Residential	39	-13	-8	-7															
R.450_A	NCAD01	Commercial	37	-33	-33	-33															
R.451_A	NCAD01	Residential	39	-13	-8	-7															
R.452_A	NCAD01	Residential	42	-10	-5	-4															
R.453_A	NCAD01	Commercial	30	-40	-40	-40															
R.454_A	NCAD01	Residential	32	-20																	

Table D.10		Nelson St Bridge Demolition	SCN10	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	35	-35	-35	-35	-35	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	16	-54	-54	-54	-54	-	-	-	-	-	-	-	-	



Mowbray Rd Bridge Demolition of break																		
Table D.11																		
Name	Description	Wall: DOHW	SCN11	Comparison to NML						If NML Exceeded - Comparison to RBL			Mitigation / Management (AMMM)					
			Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night			
R.177.A	NCAD01_Residential		65	13	18	18	19	25	23	20	24	M, LB	M, LB	M, LB	AA, M, IB, IB, PC, RO, SN			
R.178.A	NCAD01_Mixed Use		65	-8	-3	0	15	19	16	21	20	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.179.A	NCAD01_Residential		67	20	25	23	26	32	29	27	29	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.180.A	NCAD01_Residential		63	11	16	11	12	21	21	21	22	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.181.A	NCAD01_Residential		70	18	23	24	24	30	28	28	29	M, LB	M, LB	M, LB	AA, M, IB, IB, PC, RO, SN			
R.182.A	NCAD01_Residential		62	10	10	10	16	22	20	20	21	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.183.A	NCAD01_Commercial		54	-14	-14	14	14	20	20	20	21	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.184.A	NCAD01_Residential		60	8	13	14	14	20	18	18	19	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.185.A	NCAD01_Residential		71	19	24	25	25	31	29	29	30	M, LB	M, LB	M, LB	AA, M, IB, IB, PC, RO, SN			
R.186.A	NCAD01_Residential		73	23	27	26	26	33	31	31	31	M, LB	M, LB	M, LB	AA, M, IB, IB, PC, RO, SN			
R.187.A	NCAD01_Residential		73	0	5	8	8	23	10	10	13	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.188.A	NCAD01_Mixed Use		55	3	3	3	8	9	15	13	14	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.189.A	NCAD01_Residential		62	5	5	12	6	12	6	10	11	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.190.A	NCAD05_Residential		62	-11	-6	-3	12	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.191.A	NCAD04_Residential		48	-9	-2	4	3	9	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.192.A	NCAD05_Residential		62	10	15	18	18	23	20	20	21	M, LB	M, LB	M, LB	AA, M, IB, IB, PC, RO, SN			
R.193.A	NCAD05_Residential		74	1	6	9	24	11	11	11	14	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.194.A	NCAD05_Residential		61	-12	-7	-4	11	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.195.A	NCAD05_Residential		88	10	15	18	18	23	20	20	21	M, LB	M, LB	M, LB	AA, M, IB, IB, PC, RO, SN			
R.196.A	NCAD05_Residential		68	-5	0	3	18	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.197.A	NCAD05_Residential		74	1	6	9	24	11	11	11	14	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.198.A	NCAD05_Residential		81	8	13	14	14	20	18	18	19	M, LB	M, LB	M, LB	AA, M, IB, IB, PC, RO, SN			
R.199.A	NCAD01_Residential		55	3	8	9	15	13	13	14	14	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.200.A	NCAD05_Residential		71	-2	3	6	21	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.201.A	NCAD01_Residential		56	4	9	10	16	14	15	15	15	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.202.A	NCAD01_Residential		49	4	9	12	27	14	14	14	17	M, LB	M, LB	M, LB	AA, M, IB, IB, PC, RO, SN			
R.203.A	NCAD04_Residential		22	-2	3	4	10	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.204.A	NCAD05_Residential		85	10	15	18	18	23	20	20	21	M, LB	M, LB	M, LB	AA, M, IB, IB, PC, RO, SN			
R.205.A	NCAD01_Residential		57	5	10	11	15	17	15	15	16	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.206.A	NCAD01_Residential		61	9	14	15	17	15	18	19	20	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.207.A	NCAD01_Residential		69	17	22	23	29	27	27	27	29	M, LB	M, LB	M, LB	AA, M, IB, IB, PC, RO, SN			
R.208.A	NCAD05_Residential		70	-3	2	5	20	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.209.A	NCAD01_Residential		72	20	25	26	26	32	30	30	31	M, LB	M, LB	M, LB	AA, M, IB, IB, PC, RO, SN			
R.210.A	NCAD01_Residential		51	-1	4	5	11	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.211.A	NCAD01_Residential		66	14	19	24	26	26	24	24	25	M, LB	M, LB	M, LB	AA, M, IB, IB, PC, RO, SN			
R.212.A	NCAD01_Residential		70	18	23	24	24	30	28	28	29	M, LB	M, LB	M, LB	AA, M, IB, IB, PC, RO, SN			
R.213.A	NCAD05_Residential		52	-28	-23	-23	-23	-23	-23	-23	-23	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.214.A	NCAD01_Residential		49	-2	3	4	10	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.215.A	NCAD01_Residential		50	-2	3	4	10	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.216.A	NCAD01_Residential		66	14	19	20	26	24	24	24	25	M, LB	M, LB	M, LB	AA, M, IB, IB, PC, RO, SN			
R.217.A	NCAD01_Residential		51	-4	5	4	11	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.218.A	NCAD05_Residential		50	-25	-25	-25	-25	-25	-25	-25	-25	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.219.A	NCAD01_Residential		51	-24	-24	-24	-24	-24	-24	-24	-24	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.220.A	NCAD01_Residential		49	-3	2	3	9	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.221.A	NCAD01_Residential		50	-2	3	4	10	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.222.A	NCAD01_Residential		51	-1	4	5	11	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.223.A	NCAD05_Residential		85	-28	-23	-23	-23	-23	-23	-23	-23	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.224.A	NCAD01_Residential		53	1	6	7	13	11	11	11	12	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.225.A	NCAD05_Place of Worship		55	0	0	0	0	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.226.A	NCAD01_Residential		64	12	17	18	24	18	22	22	22	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.227.A	NCAD01_Residential		52	0	5	6	12	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.228.A	NCAD01_Residential		51	-1	4	5	11	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.229.A	NCAD01_Residential		51	-1	4	5	11	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.230.A	NCAD01_Residential		54	2	7	8	12	14	12	12	13	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.231.A	NCAD01_Residential		65	13	18	19	19	25	23	23	24	M, LB	M, LB	M, LB	AA, M, IB, IB, PC, RO, SN			
R.232.A	NCAD01_Residential		52	0	5	6	12	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.233.A	NCAD01_Residential		47	-5	0	1	7	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.234.A	NCAD04_Residential		50	-1	4	5	11	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.235.A	NCAD04_Residential		47	-5	0	1	7	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.236.A	NCAD04_Residential		42	-9	-4	-3	8	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.237.A	NCAD01_Residential		46	-6	-1	0	6	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.238.A	NCAD01_Residential		46	-6	-1	0	6	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.239.A	NCAD01_Residential		65	13	18	19	19	25	23	23	24	M, LB	M, LB	M, LB	AA, M, IB, IB, PC, RO, SN			
R.240.A	NCAD01_Residential		48	-4	1	2	8	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.241.A	NCAD01_Residential		50	-2	3	4	10	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.242.A	NCAD01_Residential		61	14	19	20	26	19	23	23	24	M, LB	M, LB	M, LB	AA, M, IB, IB, PC, RO, SN			
R.243.A	NCAD01_Residential		47	-5	0	1	7	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.244.A	NCAD01_Residential		49	-3	2	3	9	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.245.A	NCAD01_Residential		51	-1	4	5	11	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.246.A	NCAD01_Residential		49	-3	2	3	9	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.247.A	NCAD01_Residential		50	-2	3	4	10	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.248.A	NCAD01_Residential		51	-1	4	5	11	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.249.A	NCAD01_Residential		51	-1	4	5	11	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.250.A	NCAD01_Residential		64	12	17	18	24	22	22	22	23	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.251.A	NCAD01_Residential		65	13	18	19	19	25	23	23	24	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.252.A	NCAD01_Residential		51	-1	4	5	11	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.253.A	NCAD01_Residential		47	-5	0	1	7	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.254.A	NCAD01_Residential		52	0	5	6	12	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.255.A	NCAD01_Residential		46	-6	-1	0	6	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.256.A	NCAD01_Residential		52	0	5	6	12	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.257.A	NCAD01_Residential		63	11	16	17	17	23	21	21	21	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.258.A	NCAD01_Residential		51	-1	4	5	11	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.259.A	NCAD01_Residential		50	-2	3	4	10	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.260.A	NCAD01_Residential		63	11	16	17	17	23	21	21	21	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.261.A	NCAD01_Residential		53	1	6	7	13	11	11	11	12	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.262.A	NCAD01_Residential		50	-2	3	4	10	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.263.A	NCAD01_Residential		48	-4	1	2	8	-	-	-	-	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.264.A	NCAD01_Residential		53	1	6	7	13	11	11	11	12	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			
R.265.A	NCAD01_Residential		55	3	8	9	15	13	13	13	14	M, LB	M, LB	M, LB	M, IB, IB, PC, RO, SN			



Table D.11		Mowbray Rd Bridge Demolition of break	Wall: DOWH	SCN11	Comparison to NML												Mitigation / Management (AMMM)			
Name	Description				Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night			
R.353.A	NCAD1_Residential	43	-9	-1	4	-3	3	-	-	-	-	-	-	-	-	-				
R.354.A	NCAD1_Residential	51	-1	4	5	11	-	-	-	-	-	-	-	-	-	-				
R.355.A	NCAD1_Residential	43	-9	-7	-3	-3	-	-	-	-	-	-	-	-	-	-				
R.356.A	NCAD1_Residential	43	-9	-4	-4	-3	-	-	-	-	-	-	-	-	-	-				
R.357.A	NCAD2_Residential	47	-5	0	1	7	-	-	-	-	-	-	-	-	-	-				
R.358.A	NCAD1_Residential	43	-9	-4	-3	3	-	-	-	-	-	-	-	-	-	-				
R.359.A	NCAD1_Plane of Worship	43	-9	0	-1	0	-	-	-	-	-	-	-	-	-	-				
R.360.A	NCAD1_Residential	42	-10	-5	-4	2	-	-	-	-	-	-	-	-	-	-				
R.361.A	NCAD2_Residential	37	-15	-10	-9	-3	-	-	-	-	-	-	-	-	-	-				
R.362.A	NCAD1_Residential	42	-10	-5	-4	2	-	-	-	-	-	-	-	-	-	-				
R.363.A	NCAD2_Residential	38	-14	-9	-8	-2	-	-	-	-	-	-	-	-	-	-				
R.364.A	NCAD1_Residential	39	-13	-8	-7	-1	-	-	-	-	-	-	-	-	-	-				
R.365.A	NCAD1_Residential	39	-13	-8	-7	-1	-	-	-	-	-	-	-	-	-	-				
R.366.A	NCAD1_Residential	39	-13	-8	-7	-1	-	-	-	-	-	-	-	-	-	-				
R.367.A	NCAD1_Residential	49	-3	2	3	9	-	-	-	-	-	-	-	-	-	-				
R.368.A	NCAD1_Residential	39	-13	-8	-7	-1	-	-	-	-	-	-	-	-	-	-				
R.369.A	NCAD4_Residential	38	-13	-8	-7	-1	-	-	-	-	-	-	-	-	-	-				
R.370.A	NCAD1_Residential	38	-14	-9	-8	-2	-	-	-	-	-	-	-	-	-	-				
R.371.A	NCAD1_Residential	49	-3	2	3	9	-	-	-	-	-	-	-	-	-	-				
R.372.A	NCAD2_Residential	37	-15	-10	-9	-3	-	-	-	-	-	-	-	-	-	-				
R.373.A	NCAD1_Residential	39	-13	-8	-7	-1	-	-	-	-	-	-	-	-	-	-				
R.374.A	NCAD1_Residential	38	-14	-9	-8	-2	-	-	-	-	-	-	-	-	-	-				
R.375.A	NCAD2_Residential	34	-18	-13	-12	-6	-	-	-	-	-	-	-	-	-	-				
R.376.A	NCAD1_Residential	39	-13	-8	-7	-1	-	-	-	-	-	-	-	-	-	-				
R.377.A	NCAD4_Residential	39	-12	-7	-6	0	-	-	-	-	-	-	-	-	-	-				
R.378.A	NCAD4_Residential	39	-12	-7	-6	0	-	-	-	-	-	-	-	-	-	-				
R.379.A	NCAD1_Residential	31	-21	-16	-15	-9	-	-	-	-	-	-	-	-	-	-				
R.380.A	NCAD4_Residential	39	-12	-7	-6	0	-	-	-	-	-	-	-	-	-	-				
R.381.A	NCAD2_Residential	37	-15	-10	-9	-3	-	-	-	-	-	-	-	-	-	-				
R.382.A	NCAD1_Residential	48	-4	1	2	8	-	-	-	-	-	-	-	-	-	-				
R.383.A	NCAD4_Residential	39	-12	-7	-6	0	-	-	-	-	-	-	-	-	-	-				
R.384.A	NCAD2_Residential	34	-18	-13	-12	-6	-	-	-	-	-	-	-	-	-	-				
R.385.A	NCAD4_Residential	38	-13	-8	-7	-1	-	-	-	-	-	-	-	-	-	-				
R.386.A	NCAD1_Residential	45	-7	-2	-1	5	-	-	-	-	-	-	-	-	-	-				
R.387.A	NCAD1_Residential	45	-7	-2	-1	5	-	-	-	-	-	-	-	-	-	-				
R.388.A	NCAD2_Residential	32	-20	-15	-14	-8	-	-	-	-	-	-	-	-	-	-				
R.389.A	NCAD4_Residential	39	-12	-7	-6	0	-	-	-	-	-	-	-	-	-	-				
R.390.A	NCAD1_Residential	38	-14	-9	-8	-2	-	-	-	-	-	-	-	-	-	-				
R.391.A	NCAD1_Residential	44	-8	-3	-2	4	-	-	-	-	-	-	-	-	-	-				
R.392.A	NCAD1_Residential	44	-8	-3	-2	4	-	-	-	-	-	-	-	-	-	-				
R.393.A	NCAD1_Residential	39	-13	-8	-7	-1	-	-	-	-	-	-	-	-	-	-				
R.394.A	NCAD1_Residential	36	-16	-11	-10	-4	-	-	-	-	-	-	-	-	-	-				
R.395.A	NCAD1_Residential	38	-14	-9	-8	-2	-	-	-	-	-	-	-	-	-	-				
R.396.A	NCAD2_Residential	35	-20	-15	-14	-8	-	-	-	-	-	-	-	-	-	-				
R.397.A	NCAD1_Residential	42	-10	-5	-4	2	-	-	-	-	-	-	-	-	-	-				
R.398.A	NCAD1_Residential	44	-8	-3	-2	4	-	-	-	-	-	-	-	-	-	-				
R.399.A	NCAD1_Residential	42	-10	-5	-4	2	-	-	-	-	-	-	-	-	-	-				
R.400.A	NCAD1_Residential	42	-10	-5	-4	2	-	-	-	-	-	-	-	-	-	-				
R.401.A	NCAD4a_Residential	35	-24	-19	-16	-11	-	-	-	-	-	-	-	-	-	-				
R.402.A	NCAD1_Residential	47	-5	0	1	7	-	-	-	-	-	-	-	-	-	-				
R.403.A	NCAD1_Residential	44	-8	-3	-2	4	-	-	-	-	-	-	-	-	-	-				
R.404.A	NCAD1_Residential	44	-8	-3	-2	4	-	-	-	-	-	-	-	-	-	-				
R.405.A	NCAD1_Residential	44	-8	-3	-2	4	-	-	-	-	-	-	-	-	-	-				
R.406.A	NCAD1_Residential	44	-8	-3	-2	4	-	-	-	-	-	-	-	-	-	-				
R.407.A	NCAD1_Residential	43	-9	-4	-3	3	-	-	-	-	-	-	-	-	-	-				
R.408.A	NCAD1_Residential	44	-8	-3	-2	4	-	-	-	-	-	-	-	-	-	-				
R.409.A	NCAD1_Residential	43	-9	-4	-3	3	-	-	-	-	-	-	-	-	-	-				
R.410.A	NCAD1_Residential	47	-5	0	1	7	-	-	-	-	-	-	-	-	-	-				
R.411.A	NCAD1_Residential	49	-3	2	3	9	-	-	-	-	-	-	-	-	-	-				
R.412.A	NCAD1_Residential	43	-9	-4	-3	3	-	-	-	-	-	-	-	-	-	-				
R.413.A	NCAD4a_Residential	30	-29	-24	-21	-16	-	-	-	-	-	-	-	-	-	-				
R.414.A	NCAD1_Residential	46	-7	-2	-1	5	-	-	-	-	-	-	-	-	-	-				
R.415.A	NCAD1a_Residential	31	-28	-23	-20	-15	-	-	-	-	-	-	-	-	-	-				
R.416.A	NCAD1a_Residential	39	-20	-15	-12	-7	-	-	-	-	-	-	-	-	-	-				
R.417.A	NCAD1a_Residential	39	-20	-15	-12	-7	-	-	-	-	-	-	-	-	-	-				
R.418.A	NCAD1a_Residential	40	-19	-14	-11	-6	-	-	-	-	-	-	-	-	-	-				
R.419.A	NCAD2a_Residential	42	-17	-12	-9	-4	-	-	-	-	-	-	-	-	-	-				
R.420.A	NCAD2a_Residential	41	-18	-13	-10	-5	-	-	-	-	-	-	-	-	-	-				
R.421.A	NCAD4a_Residential	33	-26	-21	-18	-13	-	-	-	-	-	-	-	-	-	-				
R.422.A	NCAD1a_Residential	22	-37	-32	-29	-24	-	-	-	-	-	-	-	-	-	-				
R.423.A	NCAD4a_Residential	29	-30	-25	-22	-17	-	-	-	-	-	-	-	-	-	-				
R.424.A	NCAD1a_Residential	29	-30	-25	-22	-17	-	-	-	-	-	-	-	-	-	-				
R.425.A	NCAD1a_Residential	29	-30	-25	-22	-17	-	-	-	-	-	-	-	-	-	-				
R.426.A	NCAD1a_Residential	31	-28	-23	-20	-15	-	-	-	-	-	-	-	-	-	-				
R.427.A	NCAD1a_Residential	32	-27	-22	-19	-14	-	-	-	-	-	-	-	-	-	-				
R.428.A	NCAD1a_Residential	32	-27	-22	-19	-14	-	-	-	-	-	-	-	-	-	-				
R.429.A	NCAD1a_Residential	27	-32	-27	-24	-19	-	-	-	-	-	-	-	-	-	-				
R.430.A	NCAD1a_Residential	28	-31	-26	-23	-18	-	-	-	-	-	-	-	-	-	-				
R.431.A	NCAD1a_Residential	27	-32	-27	-24	-19	-	-	-	-	-	-	-	-	-	-				
R.432.A	NCAD1a_Commercial	34	-36	-31	-28	-23	-	-	-	-	-	-	-	-	-	-				
R.433.A	NCAD1a_Commercial	39	-31	-26	-23	-18	-	-	-	-	-	-	-	-	-	-				
R.434.A	NCAD1a_Residential	40	-19	-14	-11	-6	-	-	-	-	-	-	-	-	-	-				
R.435.A	NCAD1a_Residential	35	-24	-19	-16	-11	-	-	-	-	-	-	-	-	-	-				
R.436.A	NCAD1a_Commercial	31	-31	-26	-23	-18	-	-	-	-	-	-	-	-	-	-				
R.437.A	NCAD1a_Residential	40	-19	-14	-11	-6	-	-	-	-	-	-	-	-	-	-				
R.438.A	NCAD1a_Commercial	32	-38	-33	-30	-25	-	-	-	-	-	-	-	-	-	-				
R.439.A	NCAD1a_Commercial	36	-34	-29	-26	-21	-	-	-	-	-	-	-	-	-	-				
R.440.A	NCAD2a_Commercial	38	-32	-27	-24	-19	-	-	-	-	-	-	-	-	-	-				
R.441.A	NCAD1a_Residential	40	-19	-14	-11	-6	-	-	-	-	-	-	-	-	-	-				
R.442.A	NCAD1a_Residential	36	-18	-13	-10	-5	-	-	-	-	-	-	-	-	-	-				
R.443.A	NCAD1a_Residential	34	-18	-13	-10	-5	-	-	-	-	-	-	-	-	-	-				
R.444.A	NCAD1a_Residential	40	-19	-14	-11	-6	-	-	-	-	-	-	-	-	-	-				
R.445.A	NCAD1a_Commercial	39	-31	-26	-23	-18	-	-	-	-	-	-	-	-	-	-				
R.446.A	NCAD1a_Residential	40	-19	-14	-11	-6	-	-	-	-	-	-	-	-	-	-				
R.447.A	NCAD1a_Residential	42	-10	-5	-4	2	-	-	-	-	-	-	-	-	-	-				
R.448.A	NCAD2a_Commercial																			

Mowbray Rd Bridge Demolition of break		SCN11	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Wall: OOHW		Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night
Name	Description													
R.529_A	NCA06_Commercial	37	-33	-33	-33	-33	-	-	-	-	-	-	-	-
R.530_A	NCA06_Commercial	17	-53	-53	-53	-53	-	-	-	-	-	-	-	-

Table D.12		Mowbray Rd Bridge Construction of base slab and deflection wall	SCN12												Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Comparison to NML				If NML Exceeded - Comparison to RBL											
			Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night
R.001.A	NCA03_Residential	29	-27	-22	-22	-20	-13											
R.002.A	NCA03_Residential	36	20	15	15	13	6											
R.003.A	NCA03_Residential	26	20	15	15	13	6											
R.004.A	NCA03_Residential	27	29	24	24	22	15											
R.005.A	NCA03_Commercial	28	42	42	42	42	42											
R.006.A	NCA03_Residential	30	26	21	21	19	12											
R.007.A	NCA03_Residential	29	27	22	22	20	13											
R.008.A	NCA03_Residential	35	21	16	16	14	7											
R.009.A	NCA03_Commercial	28	42	42	42	42	42											
R.010.A	NCA03_Residential	29	27	22	22	20	13											
R.011.A	NCA03_Residential	28	28	23	23	21	14											
R.012.A	NCA03_Residential	43	-13	-6	-6	4	1											
R.013.A	NCA03_Residential	45	-11	-4	-4	1	1											
R.014.A	NCA03_Residential	31	-25	-20	-20	-18	-11											
R.015.A	NCA03_Commercial	33	-37	-37	-37	-37	-37											
R.016.A	NCA03_Residential	28	28	23	23	21	14											
R.017.A	NCA03_Commercial	30	40	40	40	40	40											
R.018.A	NCA03_Residential	30	26	21	21	19	12											
R.019.A	NCA03_Commercial	48	-22	-22	-22	-22	-22											
R.020.A	NCA03_Commercial	29	41	41	41	41	41											
R.021.A	NCA03_Residential	27	29	24	24	22	15											
R.022.A	NCA03_Residential	27	29	24	24	22	15											
R.023.A	NCA03_Residential	27	29	24	24	22	15											
R.024.A	NCA03_Commercial	41	29	29	29	29	29											
R.025.A	NCA03_Commercial	30	40	40	40	40	40											
R.026.A	NCA03_Residential	27	29	24	24	22	15											
R.027.A	NCA03_Commercial	31	39	39	39	39	39											
R.028.A	NCA03_Residential	31	39	39	39	39	39											
R.029.A	NCA03_Commercial	41	29	29	29	29	29											
R.030.A	NCA03_Commercial	30	40	40	40	40	40											
R.031.A	NCA03_Commercial	30	40	40	40	40	40											
R.032.A	NCA03_Commercial	32	38	38	38	38	38											
R.033.A	NCA03_Commercial	30	40	40	40	40	40											
R.034.A	NCA03_Commercial	32	38	38	38	38	38											
R.035.A	NCA03_Commercial	38	32	32	32	32	32											
R.036.A	NCA03_Commercial	30	40	40	40	40	40											
R.037.A	NCA03_Commercial	32	38	38	38	38	38											
R.038.A	NCA03_Commercial	45	25	25	25	25	25											
R.039.A	NCA03_Commercial	28	42	42	42	42	42											
R.040.A	NCA03_Commercial	30	40	40	40	40	40											
R.041.A	NCA03_Commercial	32	38	38	38	38	38											
R.042.A	NCA03_Commercial	32	38	38	38	38	38											
R.043.A	NCA03_Commercial	28	42	42	42	42	42											
R.044.A	NCA03_Commercial	39	31	31	31	31	31											
R.045.A	NCA03_Commercial	29	41	41	41	41	41											
R.046.A	NCA03_Commercial	29	41	41	41	41	41											
R.047.A	NCA03_Commercial	41	23	23	23	23	23											
R.048.A	NCA03_Commercial	32	38	38	38	38	38											
R.049.A	NCA03_Commercial	40	30	30	30	30	30											
R.050.A	NCA03_Commercial	32	38	38	38	38	38											
R.051.A	NCA03_Commercial	29	41	41	41	41	41											
R.052.A	NCA03_Commercial	29	41	41	41	41	41											
R.053.A	NCA03_Commercial	31	39	39	39	39	39											
R.054.A	NCA03_Commercial	32	38	38	38	38	38											
R.055.A	NCA03_Commercial	33	37	37	37	37	37											
R.056.A	NCA03_Commercial	31	39	39	39	39	39											
R.057.A	NCA03_Commercial	35	35	35	35	35	35											
R.058.A	NCA03_Commercial	34	36	36	36	36	36											
R.059.A	NCA03_Commercial	36	34	34	34	34	34											
R.060.A	NCA03_Commercial	40	40	40	40	40	40											
R.061.A	NCA03_Commercial	34	36	36	36	36	36											
R.062.A	NCA03_Commercial	37	33	33	33	33	33											
R.063.A	NCA03_Commercial	33	37	37	37	37	37											
R.064.A	NCA03_Commercial	32	38	38	38	38	38											
R.065.A	NCA03_Commercial	34	36	36	36	36	36											
R.066.A	NCA03_Commercial	33	37	37	37	37	37											
R.067.A	NCA03_Commercial	34	36	36	36	36	36											
R.068.A	NCA03_Commercial	48	-22	-22	-22	-22	-22											
R.069.A	NCA03_Commercial	44	-26	-26	-26	-26	-26											
R.070.A	NCA03_Commercial	33	-37	-37	-37	-37	-37											
R.071.A	NCA03_Commercial	34	36	36	36	36	36											
R.072.A	NCA03_Commercial	34	36	36	36	36	36											
R.073.A	NCA03_Commercial	34	36	36	36	36	36											
R.074.A	NCA03_Commercial	34	36	36	36	36	36											
R.075.A	NCA03_Commercial	33	37	37	37	37	37											
R.076.A	NCA03_Commercial	34	36	36	36	36	36											
R.077.A	NCA03_Commercial	51	19	19	19	19	19											
R.078.A	NCA03_Commercial	48	22	22	22	22	22											
R.079.A	NCA03_Commercial	34	36	36	36	36	36											
R.080.A	NCA03_Commercial	51	19	19	19	19	19											
R.081.A	NCA03_Commercial	31	39	39	39	39	39											
R.082.A	NCA03_Commercial	31	39	39	39	39	39											
R.083.A	NCA03_Commercial	35	35	35	35	35	35											
R.084.A	NCA03_Commercial	33	37	37	37	37	37											
R.085.A	NCA03_Commercial	32	38	38	38	38	38											
R.086.A	NCA03_Commercial	34	36	36	36	36	36											
R.087.A	NCA03_Commercial	31	39	39	39	39	39											
R.088.A	NCA03_Commercial	51	19	19	19	19	19											
R.089.A	NCA03_Commercial	47	23	23	23	23	23											
R.090.A	NCA03_Commercial	52	18	18	18	18	18											
R.091.A	NCA03_Commercial	33	37	37	37	37	37											
R.092.A	NCA03_Commercial	34	36	36	36	36	36											
R.093.A	NCA04_Commercial	36	34	34	34	34	34											
R.094.A	NCA04_Commercial	32	38	38	38	38	38											
R.095.A	NCA01_Residential	47	23	23	23	23	23											
R.096.A	NCA03_Commercial	43	27	27	27	27	27											
R.097.A	NCA03_Commercial	52	18	18	18	18	18											
R.098.A	NCA01_Residential	36	34	34	34	34	34											
R.099.A	NCA03_Commercial	31	39	39	39	39	39											
R.100.A	NCA03_Commercial	33	37	37	37	37	37											
R.101.A	NCA03_Commercial	32	38	38	38	38	38											
R.102.A	NCA01_Residential	47	0	1	1	7	7											
R.103.A	NCA02_Commercial	32	38	38	38	38	38											
R.104.A	NCA01_Residential	37	33	33	33	33	33											
R.105.A	NCA01_Commercial	35	35	35	35	35	35											
R.106.A	NCA02_Commercial	32	38	38	38	38	38											
R.107.A	NCA01_Educational	46	-9	-9	-9	-9	-9											
R.108.A	NCA01_Residential	54	2	7	8	14	12											

Table D.12 Mowbray Rd Bridge Construction of base slab and deflection wall. The table lists various noise prediction scenarios with columns for Name, Description, Predicted Noise Level, Comparison to NML (Day Standard, Day Non-Standard, Evening, Night), and Mitigation / Management (AMMM) (Day Standard, Evening, Night). It includes mitigation measures like M, LB, AA, M, IB, LB, PC, RO, SN.

Table D.12 Mowbray Rd Bridge Construction of base slab and deflection wall																
		SCN12 Predicted Noise Level	Comparison to NML						If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description		Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night		
R.353.A	NCAD1_Residential	43	-9													
R.354.A	NCAD1_Residential	51	-1	4	5	11										
R.355.A	NCAD1_Residential	43	-9													
R.356.A	NCAD1_Residential	43	-9													
R.357.A	NCAD2_Residential	47	-5	0	1	7										
R.358.A	NCAD1_Residential	43	-9													
R.359.A	NCAD1_Plane of Worship	49	-6													
R.360.A	NCAD1_Residential	42	-10													
R.361.A	NCAD2_Residential	37	-15	-10	-9	-3										
R.362.A	NCAD1_Residential	42	-10													
R.363.A	NCAD2_Residential	38	-14	-9	-8	-2										
R.364.A	NCAD1_Residential	39	-13	-8	-7	-1										
R.365.A	NCAD1_Residential	39	-13	-8	-7	-1										
R.366.A	NCAD1_Residential	39	-13	-8	-7	-1										
R.367.A	NCAD1_Residential	49	-3	2	3	9										
R.368.A	NCAD1_Residential	39	-13	-8	-7	-1										
R.369.A	NCAD4_Residential	38	-13	-8	-7	-1										
R.370.A	NCAD1_Residential	38	-14	-9	-8	-2										
R.371.A	NCAD1_Residential	49	-3	2	3	9										
R.372.A	NCAD2_Residential	37	-15	-10	-9	-3										
R.373.A	NCAD1_Residential	39	-13	-8	-7	-1										
R.374.A	NCAD1_Residential	38	-14	-9	-8	-2										
R.375.A	NCAD2_Residential	34	-18	-13	-12	-6										
R.376.A	NCAD1_Residential	39	-13	-8	-7	-1										
R.377.A	NCAD4_Residential	39	-12	-7	-6	0										
R.378.A	NCAD4_Residential	39	-12	-7	-6	0										
R.379.A	NCAD1_Residential	31	-21	-16	-15	-9										
R.380.A	NCAD4_Residential	31	-21	-16	-15	-9										
R.381.A	NCAD2_Residential	37	-15	-10	-9	-3										
R.382.A	NCAD1_Residential	48	-4	1	2	8										
R.383.A	NCAD4_Residential	39	-12	-7	-6	0										
R.384.A	NCAD2_Residential	34	-18	-13	-12	-6										
R.385.A	NCAD4_Residential	38	-13	-8	-7	-1										
R.386.A	NCAD1_Residential	45	-7	-2	-1	5										
R.387.A	NCAD1_Residential	45	-7	-2	-1	5										
R.388.A	NCAD2_Residential	32	-20	-15	-14	-8										
R.389.A	NCAD4_Residential	39	-12	-7	-6	0										
R.390.A	NCAD1_Residential	38	-14	-9	-8	-2										
R.391.A	NCAD1_Residential	44	-8	-3	-2	4										
R.392.A	NCAD1_Residential	44	-8	-3	-2	4										
R.393.A	NCAD1_Residential	39	-13	-8	-7	-1										
R.394.A	NCAD1_Residential	36	-16	-11	-10	-4										
R.395.A	NCAD1_Residential	38	-14	-9	-8	-2										
R.396.A	NCAD2_Residential	35	-20	-15	-14	-8										
R.397.A	NCAD1_Residential	42	-10	-5	-4	2										
R.398.A	NCAD1_Residential	44	-8	-3	-2	4										
R.399.A	NCAD1_Residential	42	-10	-5	-4	2										
R.400.A	NCAD1_Residential	42	-10	-5	-4	2										
R.401.A	NCAD4_Residential	35	-24	-19	-16	-11										
R.402.A	NCAD1_Residential	5	17	0	1	7										
R.403.A	NCAD1_Residential	44	-8	-3	-2	4										
R.404.A	NCAD1_Residential	44	-8	-3	-2	4										
R.405.A	NCAD1_Residential	44	-8	-3	-2	4										
R.406.A	NCAD1_Residential	44	-8	-3	-2	4										
R.407.A	NCAD1_Residential	43	-9	-4	-3	3										
R.408.A	NCAD1_Residential	41	-11	-6	-5	1										
R.409.A	NCAD1_Residential	43	-9	-4	-3	3										
R.410.A	NCAD1_Residential	47	-5	0	1	7										
R.411.A	NCAD1_Residential	47	-5	0	1	7										
R.412.A	NCAD1_Residential	43	-9	-4	-3	3										
R.413.A	NCAD4_Residential	30	-29	-24	-21	-16										
R.414.A	NCAD1_Residential	46	-7	-2	-1	5										
R.415.A	NCAD1a_Residential	31	-28	-23	-20	-15										
R.416.A	NCAD1a_Residential	39	-20	-15	-12	-7										
R.417.A	NCAD1a_Residential	39	-20	-15	-12	-7										
R.418.A	NCAD1a_Residential	38	-21	-16	-13	-8										
R.419.A	NCAD2a_Residential	42	-17	-12	-9	-4										
R.420.A	NCAD2a_Residential	41	-18	-13	-10	-5										
R.421.A	NCAD4a_Residential	33	-26	-21	-18	-13										
R.422.A	NCAD1a_Residential	22	-37	-32	-29	-24										
R.423.A	NCAD4a_Residential	29	-30	-25	-22	-17										
R.424.A	NCAD1a_Residential	29	-30	-25	-22	-17										
R.425.A	NCAD1a_Residential	29	-30	-25	-22	-17										
R.426.A	NCAD1a_Residential	31	-28	-23	-20	-15										
R.427.A	NCAD1a_Residential	32	-27	-22	-19	-14										
R.428.A	NCAD1a_Residential	32	-27	-22	-19	-14										
R.429.A	NCAD1a_Residential	27	-32	-27	-24	-19										
R.430.A	NCAD1a_Residential	21	-38	-33	-30	-25										
R.431.A	NCAD1a_Residential	27	-32	-27	-24	-19										
R.432.A	NCAD1a_Residential	34	-26	-21	-18	-13										
R.433.A	NCAD1a_Residential	39	-20	-15	-12	-7										
R.434.A	NCAD1a_Residential	40	-19	-14	-11	-6										
R.435.A	NCAD1a_Residential	35	-24	-19	-16	-11										
R.436.A	NCAD1a_Residential	31	-28	-23	-20	-15										
R.437.A	NCAD1a_Residential	40	-19	-14	-11	-6										
R.438.A	NCAD1a_Residential	32	-27	-22	-19	-14										
R.439.A	NCAD1a_Residential	36	-23	-18	-15	-10										
R.440.A	NCAD1a_Residential	38	-21	-16	-13	-8										
R.441.A	NCAD1a_Residential	40	-19	-14	-11	-6										
R.442.A	NCAD1a_Residential	36	-23	-18	-15	-10										
R.443.A	NCAD1a_Residential	34	-25	-20	-17	-12										
R.444.A	NCAD1a_Residential	40	-19	-14	-11	-6										
R.445.A	NCAD1a_Residential	39	-20	-15	-12	-7										
R.446.A	NCAD1a_Residential	40	-19	-14	-11	-6										
R.447.A	NCAD1a_Residential	42	-10	-5	-4	2										
R.448.A	NCAD1a_Residential	41	-9	-4	-3	3										
R.449.A	NCAD1a_Residential	40	-19	-14	-11	-6										
R.450.A	NCAD1a_Residential	37	-15	-10	-9	-3										
R.451.A	NCAD1a_Residential	40	-19	-14	-11	-6										
R.452.A	NCAD1a_Residential	45	-7	-2	-1	5										
R.453.A	NCAD1a_Residential	36	-23	-18	-15	-10										
R.454.A	NCAD1a_Residential	35	-17	-12	-9	-4										
R.455.A	NCAD1a_Residential	40	-19	-14	-11	-6										
R.456.A	NCAD1a_Residential	40	-19	-14	-11	-6										
R.457.A	NCAD1a_Residential	40	-19	-14	-11	-6										
R.458.A	NCAD1a_Residential	40	-19	-14	-11	-6										
R.459.A	NCAD1a_Residential	40	-19	-14	-11	-6										
R.460.A	NCAD1a_Residential	34	-25	-20	-17	-12										
R.461.A	NCAD1a_Residential	39	-20	-15	-12	-7										
R.462.A	NCAD1a_Residential	42	-10	-5	-4	2										
R.463.A	NCAD1a_Residential	34	-25	-20	-17	-12										
R.464.A	NCAD1a_Residential	40	-19	-14	-11	-6										
R.465.A	NCAD1a_Residential	28	-42	-37	-34	-29										
R.466.A	NCAD1a_Residential	37	-15	-10	-9	-3										
R.467.A	NCAD1a_Residential	31	-28	-23	-20	-15										
R.468.A	NCAD1a_Residential	31	-28	-23	-20	-15										
R.469.A	NCAD1a_Residential	40	-19	-14	-11	-6										
R.470.A	NCAD1a_Residential	30	-22	-17	-14	-9										
R.471.A	NCAD1a_Residential	38	-14	-9	-8	-2										
R.472.A	NCAD1a_Residential	36	-16	-11	-10	-4										
R.473.A	NCAD1a_Residential	31	-21	-16	-13	-8										
R.474.A	NCAD1a_Residential	40	-19	-14	-11	-6										
R.475.A	NCAD1a_Residential	32	-20	-15	-12	-7										
R.476.A	NCAD1a_Residential	33	-19	-14	-11	-6										
R.477.A	NCAD1a_Residential	40	-19	-14	-11	-6										
R.478.A	NCAD1a_Residential	42	-10	-5	-4	2										
R.479.A	NCAD1a_Residential	35	-17	-12	-9	-4										
R.480.A	NCAD1a_Residential	42	-10	-5	-4	2										
R.481.A	NCAD1a_Residential	24	-46	-41	-38	-33										
R.482.A	NCAD1a_Residential	30	-22	-17	-14	-9										
R.483.A	NCAD1a_Residential	34	-26	-21	-18	-13										
R.484.A	NCAD1a_Residential	43	-9	-4	-3	3										
R.485.A	NCAD1a_Residential	40	-19	-14	-11	-6										
R.486.A	NCAD1a_Residential	21	-51	-46	-43	-38										
R.487.A	NCAD1a_Residential	25	-45	-40	-37	-32										
R.488.A	NCAD1a_Residential	25	-45	-40	-37	-32										
R.489.A	NCAD1a_Residential	36	-23	-18	-15	-10										
R.490.A	NCAD1a_Residential	37	-15	-10	-9	-3										
R.491.A	NCAD1a_Residential	23	-47	-42	-39	-34										
R.492.A	NCAD1a_Residential	27	-39	-34	-31	-26										
R.																

Table D.12		Mowbray Rd Bridge Construction of base slab and deflection wall	SCN12	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	37	-33		-33	-33		-	-	-		-	-	-	
R.530_A	NCA06_Commercial	17	-53		-53	-53		-	-	-		-	-	-	



Table D.13 Mowbray Rd Bridge Install of Precast piles			SCN13	Comparison to NML								If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Standard Hours	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night
R.177.A	NCAD01 Residential		51	-1															
R.178.A	NCAD05 Mixed Use		51	-22															
R.179.A	NCAD01 Residential		58																
R.180.A	NCAD01 Residential		49	-3															
R.181.A	NCAD01 Residential		56	4															
R.182.A	NCAD01 Residential		47	-5															
R.183.A	NCAD01 Commercial		41	-29															
R.184.A	NCAD01 Residential		45	-7															
R.185.A	NCAD01 Residential		57	5															
R.186.A	NCAD01 Residential		59	7															
R.187.A	NCAD05 Residential		59	14															
R.188.A	NCAD02 Mixed Use		41	-11															
R.189.A	NCAD02 Residential		37	-15															
R.190.A	NCAD05 Residential		48	-25															
R.191.A	NCAD04 Residential		33	-18															
R.192.A	NCAD05 Residential		38	-23															
R.193.A	NCAD05 Residential		60	-13															
R.194.A	NCAD05 Residential		47	-26															
R.195.A	NCAD05 Residential		70	-3															
R.196.A	NCAD05 Residential		54	-19															
R.197.A	NCAD05 Residential		60	-13															
R.198.A	NCAD05 Residential		67	-6															
R.199.A	NCAD01 Residential		40	-12															
R.200.A	NCAD05 Residential		56	-17															
R.201.A	NCAD01 Residential		41	-11															
R.202.A	NCAD05 Residential		64	-9															
R.203.A	NCAD04 Residential		34	-17															
R.204.A	NCAD05 Industrial		40	-25															
R.205.A	NCAD01 Residential		42	-10															
R.206.A	NCAD01 Residential		47	-5															
R.207.A	NCAD01 Residential		55	3															
R.208.A	NCAD05 Residential		56	17															
R.209.A	NCAD01 Residential		58	6															
R.210.A	NCAD01 Residential		37	-15															
R.211.A	NCAD01 Residential		52	0															
R.212.A	NCAD01 Residential		56	4															
R.213.A	NCAD05 Industrial		38	-37															
R.214.A	NCAD01 Residential		34	-18															
R.215.A	NCAD01 Residential		35	-17															
R.216.A	NCAD01 Residential		52	0															
R.217.A	NCAD01 Residential		37	-15															
R.218.A	NCAD05 Industrial		36	-39															
R.219.A	NCAD01 Industrial		37	-38															
R.220.A	NCAD01 Residential		35	-17															
R.221.A	NCAD01 Residential		35	-17															
R.222.A	NCAD01 Residential		36	-16															
R.223.A	NCAD05 Industrial		41	-43															
R.224.A	NCAD01 Residential		38	-14															
R.225.A	NCAD05 Place of Worship		40	-15															
R.226.A	NCAD01 Residential		51	-3															
R.227.A	NCAD01 Residential		37	-15															
R.228.A	NCAD01 Residential		36	-16															
R.229.A	NCAD01 Residential		36	-16															
R.230.A	NCAD01 Residential		39	-13															
R.231.A	NCAD01 Residential		50	-2															
R.232.A	NCAD01 Residential		48	4															
R.233.A	NCAD01 Residential		33	-19															
R.234.A	NCAD04 Residential		35	-16															
R.235.A	NCAD01 Residential		33	-19															
R.236.A	NCAD04 Residential		27	-24															
R.237.A	NCAD01 Residential		32	-20															
R.238.A	NCAD01 Residential		36	-16															
R.239.A	NCAD01 Residential		51	-1															
R.240.A	NCAD01 Residential		33	-19															
R.241.A	NCAD01 Residential		36	-16															
R.242.A	NCAD01 Residential		47	-5															
R.243.A	NCAD01 Residential		32	-20															
R.244.A	NCAD01 Residential		34	-18															
R.245.A	NCAD01 Residential		37	-15															
R.246.A	NCAD01 Residential		34	-18															
R.247.A	NCAD01 Residential		35	-17															
R.248.A	NCAD01 Residential		36	-16															
R.249.A	NCAD01 Residential		37	-15															
R.250.A	NCAD01 Residential		51	-1															
R.251.A	NCAD01 Residential		44	-8															
R.252.A	NCAD01 Residential		35	-17															
R.253.A	NCAD01 Residential		33	-19															
R.254.A	NCAD01 Residential		37	-15															
R.255.A	NCAD01 Residential		31	-21															
R.256.A	NCAD01 Residential		37	-15															
R.257.A	NCAD01 Residential		50	-3															
R.258.A	NCAD01 Residential		37	-15															
R.259.A	NCAD01 Residential		35	-17															
R.260.A	NCAD01 Residential		39	-3															
R.261.A	NCAD01 Residential		38	-14															
R.262.A	NCAD01 Residential		37	-15															
R.263.A	NCAD01 Residential		34	-18															
R.264.A	NCAD01 Residential		38	-14															
R.265.A	NCAD01 Residential		40	-12															
R.266.A	NCAD01 Residential		49	-3															
R.267.A	NCAD01 Residential		27	-24															
R.268.A	NCAD01 Residential		31	-21															
R.269.A	NCAD01 Residential		34	-18															
R.270.A	NCAD01 Residential		48	-4															
R.271.A	NCAD02 Residential		33	-19															
R.272.A	NCAD01 Residential		46	-6															
R.273.A	NCAD01 Residential		37	-15															
R.274.A	NCAD01 Residential		36	-16															
R.275.A	NCAD02 Residential		35	-17															
R.276.A	NCAD01 Residential		29	-23															
R.277.A	NCAD01 Residential		40	-12															
R.278.A	NCAD01 Residential		25	-27															
R.279.A	NCAD01 Residential		30	-22															
R.280.A	NCAD01 Residential		31	-21															
R.281.A	NCAD01 Residential		44	-8															
R.282.A	NCAD01 Residential		46	-6															
R.283.A	NCAD01 Residential		32	-20															
R.284.A	NCAD01 Residential		32	-20															
R.285.A	NCAD01 Mixed Use		37	-15															
R.286.A	NCAD01 Residential		32	-20															
R.287.A	NCAD01 Mixed Use		45	-7															
R.288.A	NCAD01 Residential		32	-20															
R.289.A	NCAD01 Residential		32	-20															
R.290.A	NCAD01 Residential		32	-20															
R.291.A	NCAD02 Residential		35	-17															
R.292.A	NCAD01 Residential		35	-17															
R.293.A	NCAD01 Residential		34	-18															
R.294.A	NCAD01 Mixed Use		45	-7															





Table D.13		Mowbray Rd Bridge Install of Precast piles - Standard Hours	SCN13	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	72	-48	-	-	-	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	72	-68	-	-	-	-	-	-	-	-	-	-	-	

Table D.14 Mowbray Rd Bridge Install of Crash Barrier and Footpath - OOHV																		
Name			SCN14				Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night
R.001.A	NCA03 Residential	14	-42	-37	-35	-28	-42	-37	-35	-28								
R.002.A	NCA03 Residential	22	-34	-29	-27	-20	-34	-29	-27	-20								
R.003.A	NCA03 Residential	15	-48	-40	-36	-27	-48	-40	-36	-27								
R.004.A	NCA03 Residential	13	-43	-38	-36	-29	-43	-38	-36	-29								
R.005.A	NCA03 Commercial	14	-56	-56	-56	-56	-56	-56	-56	-56								
R.006.A	NCA03 Residential	15	-41	-36	-34	-27	-41	-36	-34	-27								
R.007.A	NCA03 Residential	14	-42	-37	-35	-28	-42	-37	-35	-28								
R.008.A	NCA03 Residential	20	-36	-31	-29	-22	-36	-31	-29	-22								
R.009.A	NCA03 Commercial	14	-56	-56	-56	-56	-56	-56	-56	-56								
R.010.A	NCA03 Residential	14	-42	-37	-35	-28	-42	-37	-35	-28								
R.011.A	NCA03 Residential	13	-43	-38	-36	-29	-43	-38	-36	-29								
R.012.A	NCA03 Residential	28	-28	-23	-21	-14	-28	-23	-21	-14								
R.013.A	NCA03 Residential	29	-27	-22	-20	-13	-27	-22	-20	-13								
R.014.A	NCA03 Residential	16	-40	-35	-33	-26	-40	-35	-33	-26								
R.015.A	NCA03 Commercial	18	-52	-52	-52	-52	-52	-52	-52	-52								
R.016.A	NCA03 Residential	13	-43	-38	-36	-29	-43	-38	-36	-29								
R.017.A	NCA03 Commercial	15	-55	-55	-55	-55	-55	-55	-55	-55								
R.018.A	NCA03 Residential	15	-41	-36	-34	-27	-41	-36	-34	-27								
R.019.A	NCA03 Commercial	13	-37	-37	-37	-37	-37	-37	-37	-37								
R.020.A	NCA03 Commercial	15	-55	-55	-55	-55	-55	-55	-55	-55								
R.021.A	NCA03 Residential	12	-44	-39	-37	-30	-44	-39	-37	-30								
R.022.A	NCA03 Residential	12	-44	-39	-37	-30	-44	-39	-37	-30								
R.023.A	NCA03 Residential	12	-44	-39	-37	-30	-44	-39	-37	-30								
R.024.A	NCA03 Commercial	26	-44	-44	-44	-44	-44	-44	-44	-44								
R.025.A	NCA03 Commercial	15	-55	-55	-55	-55	-55	-55	-55	-55								
R.026.A	NCA03 Residential	13	-43	-38	-36	-29	-43	-38	-36	-29								
R.027.A	NCA03 Commercial	16	-54	-54	-54	-54	-54	-54	-54	-54								
R.028.A	NCA03 Residential	18	-38	-33	-31	-24	-38	-33	-31	-24								
R.029.A	NCA03 Commercial	26	-44	-44	-44	-44	-44	-44	-44	-44								
R.030.A	NCA03 Commercial	16	-54	-54	-54	-54	-54	-54	-54	-54								
R.031.A	NCA03 Commercial	15	-55	-55	-55	-55	-55	-55	-55	-55								
R.032.A	NCA03 Commercial	17	-53	-53	-53	-53	-53	-53	-53	-53								
R.033.A	NCA03 Commercial	15	-55	-55	-55	-55	-55	-55	-55	-55								
R.034.A	NCA03 Commercial	18	-52	-52	-52	-52	-52	-52	-52	-52								
R.035.A	NCA03 Commercial	23	-47	-47	-47	-47	-47	-47	-47	-47								
R.036.A	NCA03 Commercial	16	-54	-54	-54	-54	-54	-54	-54	-54								
R.037.A	NCA03 Commercial	18	-52	-52	-52	-52	-52	-52	-52	-52								
R.038.A	NCA03 Commercial	30	-40	-40	-40	-40	-40	-40	-40	-40								
R.039.A	NCA03 Commercial	14	-56	-56	-56	-56	-56	-56	-56	-56								
R.040.A	NCA03 Commercial	16	-54	-54	-54	-54	-54	-54	-54	-54								
R.041.A	NCA03 Commercial	17	-53	-53	-53	-53	-53	-53	-53	-53								
R.042.A	NCA03 Commercial	17	-53	-53	-53	-53	-53	-53	-53	-53								
R.043.A	NCA03 Commercial	14	-56	-56	-56	-56	-56	-56	-56	-56								
R.044.A	NCA03 Commercial	24	-46	-46	-46	-46	-46	-46	-46	-46								
R.045.A	NCA03 Commercial	15	-55	-55	-55	-55	-55	-55	-55	-55								
R.046.A	NCA03 Commercial	15	-55	-55	-55	-55	-55	-55	-55	-55								
R.047.A	NCA03 Commercial	21	-39	-39	-39	-39	-39	-39	-39	-39								
R.048.A	NCA03 Commercial	18	-52	-52	-52	-52	-52	-52	-52	-52								
R.049.A	NCA03 Commercial	25	-45	-45	-45	-45	-45	-45	-45	-45								
R.050.A	NCA03 Commercial	18	-52	-52	-52	-52	-52	-52	-52	-52								
R.051.A	NCA03 Commercial	15	-55	-55	-55	-55	-55	-55	-55	-55								
R.052.A	NCA03 Commercial	15	-55	-55	-55	-55	-55	-55	-55	-55								
R.053.A	NCA03 Commercial	17	-53	-53	-53	-53	-53	-53	-53	-53								
R.054.A	NCA03 Commercial	17	-53	-53	-53	-53	-53	-53	-53	-53								
R.055.A	NCA03 Commercial	18	-52	-52	-52	-52	-52	-52	-52	-52								
R.056.A	NCA03 Commercial	17	-53	-53	-53	-53	-53	-53	-53	-53								
R.057.A	NCA03 Commercial	21	-49	-49	-49	-49	-49	-49	-49	-49								
R.058.A	NCA03 Commercial	19	-51	-51	-51	-51	-51	-51	-51	-51								
R.059.A	NCA03 Commercial	22	-48	-48	-48	-48	-48	-48	-48	-48								
R.060.A	NCA03 Commercial	16	-54	-54	-54	-54	-54	-54	-54	-54								
R.061.A	NCA03 Commercial	18	-52	-52	-52	-52	-52	-52	-52	-52								
R.062.A	NCA03 Commercial	22	-48	-48	-48	-48	-48	-48	-48	-48								
R.063.A	NCA03 Commercial	18	-52	-52	-52	-52	-52	-52	-52	-52								
R.064.A	NCA03 Commercial	18	-52	-52	-52	-52	-52	-52	-52	-52								
R.065.A	NCA03 Commercial	19	-51	-51	-51	-51	-51	-51	-51	-51								
R.066.A	NCA03 Commercial	18	-52	-52	-52	-52	-52	-52	-52	-52								
R.067.A	NCA03 Commercial	19	-51	-51	-51	-51	-51	-51	-51	-51								
R.068.A	NCA03 Commercial	33	-37	-37	-37	-37	-37	-37	-37	-37								
R.069.A	NCA03 Commercial	29	-41	-41	-41	-41	-41	-41	-41	-41								
R.070.A	NCA03 Commercial	18	-52	-52	-52	-52	-52	-52	-52	-52								
R.071.A	NCA03 Commercial	19	-51	-51	-51	-51	-51	-51	-51	-51								
R.072.A	NCA03 Commercial	19	-51	-51	-51	-51	-51	-51	-51	-51								
R.073.A	NCA03 Commercial	20	-50	-50	-50	-50	-50	-50	-50	-50								
R.074.A	NCA03 Commercial	19	-51	-51	-51	-51	-51	-51	-51	-51								
R.075.A	NCA03 Commercial	19	-51	-51	-51	-51	-51	-51	-51	-51								
R.076.A	NCA03 Commercial	19	-51	-51	-51	-51	-51	-51	-51	-51								
R.077.A	NCA03 Commercial	36	-34	-34	-34	-34	-34	-34	-34	-34								
R.078.A	NCA03 Commercial	13	-37	-37	-37	-37	-37	-37	-37	-37								
R.079.A	NCA03 Commercial	19	-51	-51	-51	-51	-51	-51	-51	-51								
R.080.A	NCA03 Commercial	37	-33	-33	-33	-33	-33	-33	-33	-33								
R.081.A	NCA03 Commercial	17	-53	-53	-53	-53	-53	-53	-53	-53								
R.082.A	NCA03 Commercial	17	-53	-53	-53	-53	-53	-53	-53	-53								
R.083.A	NCA03 Commercial	21	-49	-49	-49	-49	-49	-49	-49	-49								
R.084.A	NCA03 Commercial	19	-51	-51	-51	-51	-51	-51	-51	-51								
R.085.A	NCA03 Commercial	17	-53	-53	-53	-53	-53	-53	-53	-53								
R.086.A	NCA03 Commercial	19	-51	-51	-51	-51	-51	-51	-51	-51								
R.087.A	NCA03 Commercial	17	-53	-53	-53	-53	-53	-53	-53	-53								
R.088.A	NCA03 Commercial	36	-34	-34	-34	-34	-34	-34	-34	-34								
R.089.A	NCA03 Commercial	31	-39	-39	-39	-39	-39	-39	-39	-39								
R.090.A	NCA03 Commercial	38	-34	-34	-34	-34	-34	-34	-34	-34								
R.091.A	NCA03 Commercial	18	-52	-52	-52	-52	-52	-52	-52	-52								
R.092.A	NCA03 Commercial	19	-51	-51	-51	-51	-51	-51	-51	-51								
R.093.A	NCA04 Commercial	21	-49	-49	-49	-49	-49	-49	-49	-49								
R.094.A	NCA04 Commercial	18	-52	-52	-52	-52	-52	-52	-52	-52								
R.095.A	NCA01 Commercial	32	-38	-38	-38	-38	-38	-38	-38	-38								
R.096.A	NCA03 Commercial	29	-41	-41	-41	-41	-41	-41	-41	-41								
R.097.A	NCA03 Commercial	17	-53	-53	-53	-53	-53	-53	-53	-53								
R.098.A	NCA01 Commercial	21	-49	-49	-49	-49	-49	-49	-49	-49								
R.099.A	NCA03 Commercial	17	-53	-53	-53	-53	-53	-53	-53	-53								
R.100.A	NCA03 Commercial	18	-52	-52	-52	-52	-52	-52	-52	-52								
R.101.A	NCA03 Commercial	17	-53	-53	-53	-53	-53											

Mowbray Rd Bridge Install of Crash Barrier and Footpath - DOWH																		
Table D.14 SCN14																		
Name	Description	Predicted Noise Level	Comparison to NML						Comparison to RBL									
			Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night				
R.177.A	NCAD1_Residential	31	-1			5	11				10	19						
R.178.A	NCAD5_Mixed Use	51	-22		17	-14	-1											
R.179.A	NCAD1_Residential	38			11	17	18			10	19	27	10			LB		
R.180.A	NCAD1_Residential	9	-3		2	3	9				4	4	4					LB
R.181.A	NCAD1_Residential	56	4		9	10	16			14	14	15	23			LB		LB
R.182.A	NCAD1_Residential	47	0		0	7	7					9	17					LB
R.183.A	NCAD1_Commercial	41	-29		-29	-29	-29											LB
R.184.A	NCAD1_Residential	45	-7		-2	-1	5											LB
R.185.A	NCAD1_Residential	57	5		10	11	17			15	15	16	27			LB		LB
R.186.A	NCAD1_Residential	59	7		12	19	19			17	17	18	28			LB		LB
R.187.A	NCAD5_Residential	59	14		-9	-6	9											LB
R.188.A	NCAD2_Mixed Use	41	-11		-6	-5	1											
R.189.A	NCAD2_Residential	37	-15		-10	-9	1											
R.190.A	NCAD5_Residential	48	-25		-20	-17	-2											
R.191.A	NCAD4_Residential	33	-18		-13	-12	-6											
R.192.A	NCAD5_Residential	28	-23		-18	-17	-11											
R.193.A	NCAD5_Residential	60	-13		-8	-5	10											LB
R.194.A	NCAD5_Residential	47	-26		-21	-18	-3											LB
R.195.A	NCAD5_Residential	70	-3		2	5	20											
R.196.A	NCAD5_Residential	54	-19		-14	-11	4											
R.197.A	NCAD5_Residential	60	-13		-8	-5	10											LB
R.198.A	NCAD5_Residential	67	-6		-1	2	17											
R.199.A	NCAD1_Residential	40	-12		-7	-6	0											
R.200.A	NCAD5_Residential	56	-17		-12	-9	6											LB
R.201.A	NCAD1_Residential	41	-11		-6	-5	1											
R.202.A	NCAD5_Residential	64	-9		-4	-1	14											LB
R.203.A	NCAD4_Residential	34	-17		-12	-11	-5											
R.204.A	NCAD5_Industrial	40	-25		-20	-18	-2											
R.205.A	NCAD1_Residential	42	-10		-5	-4	2											
R.206.A	NCAD1_Residential	47	-5		0	1	7											LB
R.207.A	NCAD1_Residential	55	3		9	15	13			13	13	14	25			LB		LB
R.208.A	NCAD5_Residential	56	-17		-12	-9	6											LB
R.209.A	NCAD1_Residential	58	6		11	12	18			16	16	17	27			LB		LB
R.210.A	NCAD1_Residential	37	-15		-10	-9	-3											
R.211.A	NCAD1_Residential	52	0		5	6	12											LB
R.212.A	NCAD1_Residential	56	4		9	10	16			14	14	15	23			LB		LB
R.213.A	NCAD5_Industrial	38	-37		-37	-37	-37											
R.214.A	NCAD1_Residential	38	-38		-38	-38	-38											
R.215.A	NCAD1_Residential	35	-17		-12	-11	-5											
R.216.A	NCAD1_Residential	52	0		5	6	12											LB
R.217.A	NCAD5_Industrial	37	-35		-35	-35	-35											
R.218.A	NCAD5_Industrial	36	-39		-39	-39	-39											
R.219.A	NCAD5_Industrial	37	-38		-38	-38	-38											
R.220.A	NCAD1_Residential	35	-17		-12	-11	-5											
R.221.A	NCAD1_Residential	35	-17		-12	-11	-5											
R.222.A	NCAD1_Residential	36	-16		-11	-10	-4											
R.223.A	NCAD5_Industrial	41	-43		-43	-43	-43											
R.224.A	NCAD1_Residential	38	-14		-9	-8	-2											
R.225.A	NCAD5_Phase of Worship	40	-15		-10	-9	-3											
R.226.A	NCAD1_Residential	41	-11		-6	-5	1											
R.227.A	NCAD1_Residential	37	-15		-10	-9	-3											LB
R.228.A	NCAD1_Residential	36	-16		-11	-10	-4											
R.229.A	NCAD1_Residential	36	-16		-11	-10	-4											
R.230.A	NCAD1_Residential	39	-13		-8	-7	-1											
R.231.A	NCAD1_Residential	50	-2		3	4	10											LB
R.232.A	NCAD1_Residential	48	1		8	9	15											LB
R.233.A	NCAD1_Residential	33	-19		-14	-13	-7											
R.234.A	NCAD4_Residential	35	-16		-11	-10	-4											
R.235.A	NCAD1_Residential	33	-19		-14	-13	-7											
R.236.A	NCAD4_Residential	27	-24		-19	-18	-12											
R.237.A	NCAD1_Residential	32	-20		-15	-14	-8											
R.238.A	NCAD1_Residential	36	-16		-11	-10	-4											
R.239.A	NCAD1_Residential	51	-1		4	5	11											LB
R.240.A	NCAD1_Residential	33	-19		-14	-13	-7											
R.241.A	NCAD1_Residential	36	-16		-11	-10	-4											
R.242.A	NCAD1_Residential	47	0		5	6	12											LB
R.243.A	NCAD1_Residential	32	-20		-15	-14	-8											
R.244.A	NCAD1_Residential	34	-18		-13	-12	-6											
R.245.A	NCAD1_Residential	37	-15		-10	-9	-3											
R.246.A	NCAD1_Residential	34	-18		-13	-12	-6											
R.247.A	NCAD1_Residential	35	-17		-12	-11	-5											
R.248.A	NCAD1_Residential	36	-16		-11	-10	-4											
R.249.A	NCAD1_Residential	37	-15		-10	-9	-3											
R.250.A	NCAD1_Residential	51	-1		4	5	11											LB
R.251.A	NCAD1_Residential	44	-8		-3	-2	4											
R.252.A	NCAD1_Residential	35	-17		-12	-11	-5											
R.253.A	NCAD1_Residential	33	-19		-14	-13	-7											
R.254.A	NCAD1_Residential	37	-15		-10	-9	-3											
R.255.A	NCAD1_Residential	31	-21		-16	-15	-9											
R.256.A	NCAD1_Residential	37	-15		-10	-9	-3											
R.257.A	NCAD1_Residential	30	-23		-18	-17	-11											LB
R.258.A	NCAD1_Residential	37	-15		-10	-9	-3											
R.259.A	NCAD1_Residential	35	-17		-12	-11	-5											
R.260.A	NCAD1_Residential	48	2		9	9	13											LB
R.261.A	NCAD1_Residential	38	-14		-9	-8	-2											
R.262.A	NCAD1_Residential	37	-15		-10	-9	-3											
R.263.A	NCAD1_Residential	34	-18		-13	-12	-6											
R.264.A	NCAD1_Residential	38	-14		-9	-8	-2											
R.265.A	NCAD1_Residential	40	-12		-7	-6	0											
R.266.A	NCAD1_Residential	49	3		9	9	13											LB
R.267.A	NCAD4_Residential	27	-24		-19	-18	-12											
R.268.A	NCAD1_Residential	31	-21		-16	-15	-9											
R.269.A	NCAD1_Residential	34	-18		-13	-12	-6											
R.270.A	NCAD1_Residential	48	2		9	9	13											LB
R.271.A	NCAD2_Residential	33	-19		-14	-13	-7											
R.272.A	NCAD1_Residential	46	-6		-1	0	6											LB
R.273.A	NCAD1_Residential	37	-15		-10	-9	-3											
R.274.A	NCAD1_Residential	36	-16		-11	-10	-4											
R.275.A	NCAD2_Residential	35	-17		-12	-11	-5											
R.276.A	NCAD1_Residential	29	-29		-29	-29	-29											
R.277.A	NCAD1_Residential	40	-12		-7	-6	0											
R.278.A	NCAD1_Residential	25	-27		-22	-21	-15											
R.279.A	NCAD1_Residential	30	-23		-18	-17	-11											
R.280.A	NCAD1_Residential	31	-21		-16	-15	-9											
R.281.A	NCAD1_Residential	44	-8		-3	-2	4											
R.282.A	NCAD1_Residential	46	-6		-1	0	6											LB
R.283.A	NCAD1_Residential	32	-20		-15	-14	-8											
R.284.A	NCAD1_Residential	32	-20		-15	-14	-8											
R.285.A	NCAD1_Mixed Use	32	-20		-15	-14	-8											LB
R.286.A	NCAD1_Residential	32	-20		-15	-14	-8											
R.287.A	NCAD1_Mixed Use	45	-7		-2	-1	5											LB
R.288.A	NCAD1_Residential	32	-20		-15	-14	-8											
R.289.A	NCAD1_Residential																	



Table O.14		Mowbray Rd Bridge Install of Crash Barrier and Footpath - OOHW	SCN14	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	72	-48	-48	-48	-48	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	72	-68	-68	-68	-68	-	-	-	-	-	-	-	-	









Table D.15		Mowbray Rd Bridge Footpath alterations / Road Works - Standard Hours	SCN15	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	23	-47	-	-	-	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	41	-66	-	-	-	-	-	-	-	-	-	-	-	





Table D.16		Rail Corridor Fence / Noise Walls Installation	SCN16 Predicted Noise Level	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description			Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night
R.353.A	NCAD1_Residential	38	-14	-9	-8	-2	-	-	-	-	-	-	-	-	
R.354.A	NCAD1_Residential	47	-5	0	1	7	-	-	-	-	-	-	-	-	
R.355.A	NCAD1_Residential	38	-14	-9	-8	-2	-	-	-	-	-	-	-	-	
R.356.A	NCAD1_Residential	38	-14	-9	-8	-2	-	-	-	-	-	-	-	-	
R.357.A	NCAD2_Residential	45	-7	-2	-1	5	-	-	-	-	-	-	-	-	
R.358.A	NCAD1_Residential	38	-14	-9	-8	-2	-	-	-	-	-	-	-	-	
R.359.A	NCAD1_Residential	38	-14	-9	-8	-2	-	-	-	-	-	-	-	-	
R.360.A	NCAD1_Residential	38	-14	-9	-8	-2	-	-	-	-	-	-	-	-	
R.361.A	NCAD2_Residential	37	-15	-10	-9	-3	-	-	-	-	-	-	-	-	
R.362.A	NCAD1_Residential	37	-15	-10	-9	-3	-	-	-	-	-	-	-	-	
R.363.A	NCAD2_Residential	33	-19	-14	-13	-7	-	-	-	-	-	-	-	-	
R.364.A	NCAD1_Residential	37	-15	-10	-9	-3	-	-	-	-	-	-	-	-	
R.365.A	NCAD1_Residential	37	-15	-10	-9	-3	-	-	-	-	-	-	-	-	
R.366.A	NCAD1_Residential	36	-16	-11	-10	-4	-	-	-	-	-	-	-	-	
R.367.A	NCAD1_Residential	46	-6	-1	-0	6	-	-	-	-	-	-	-	-	
R.368.A	NCAD1_Residential	36	-16	-11	-10	-4	-	-	-	-	-	-	-	-	
R.369.A	NCAD4_Residential	34	-17	-12	-11	-5	-	-	-	-	-	-	-	-	
R.370.A	NCAD1_Residential	36	-16	-11	-10	-4	-	-	-	-	-	-	-	-	
R.371.A	NCAD1_Residential	43	-9	-4	-3	8	-	-	-	-	-	-	-	-	
R.372.A	NCAD2_Residential	31	-21	-16	-15	-9	-	-	-	-	-	-	-	-	
R.373.A	NCAD1_Residential	36	-16	-11	-10	-4	-	-	-	-	-	-	-	-	
R.374.A	NCAD1_Residential	36	-16	-11	-10	-4	-	-	-	-	-	-	-	-	
R.375.A	NCAD2_Residential	29	-23	-18	-17	-11	-	-	-	-	-	-	-	-	
R.376.A	NCAD1_Residential	36	-16	-11	-10	-4	-	-	-	-	-	-	-	-	
R.377.A	NCAD4_Residential	36	-16	-11	-10	-4	-	-	-	-	-	-	-	-	
R.378.A	NCAD4_Residential	36	-16	-11	-10	-4	-	-	-	-	-	-	-	-	
R.379.A	NCAD1_Residential	25	-27	-22	-21	-15	-	-	-	-	-	-	-	-	
R.380.A	NCAD4_Residential	36	-16	-11	-10	-4	-	-	-	-	-	-	-	-	
R.381.A	NCAD2_Residential	29	-23	-18	-17	-11	-	-	-	-	-	-	-	-	
R.382.A	NCAD1_Residential	45	-7	-2	-1	5	-	-	-	-	-	-	-	-	
R.383.A	NCAD4_Residential	36	-16	-11	-10	-4	-	-	-	-	-	-	-	-	
R.384.A	NCAD2_Residential	26	-26	-21	-20	-14	-	-	-	-	-	-	-	-	
R.385.A	NCAD4_Residential	35	-16	-11	-10	-4	-	-	-	-	-	-	-	-	
R.386.A	NCAD1_Residential	40	-12	-7	-6	0	-	-	-	-	-	-	-	-	
R.387.A	NCAD1_Residential	40	-12	-7	-6	0	-	-	-	-	-	-	-	-	
R.388.A	NCAD2_Residential	26	-26	-21	-20	-14	-	-	-	-	-	-	-	-	
R.389.A	NCAD4_Residential	35	-16	-11	-10	-4	-	-	-	-	-	-	-	-	
R.390.A	NCAD1_Residential	39	-13	-8	-7	1	-	-	-	-	-	-	-	-	
R.391.A	NCAD1_Residential	41	-11	-6	-5	1	-	-	-	-	-	-	-	-	
R.392.A	NCAD1_Residential	37	-15	-10	-9	-3	-	-	-	-	-	-	-	-	
R.393.A	NCAD1_Residential	35	-17	-12	-11	-5	-	-	-	-	-	-	-	-	
R.394.A	NCAD1_Residential	34	-18	-13	-12	-6	-	-	-	-	-	-	-	-	
R.395.A	NCAD1_Residential	35	-17	-12	-11	-5	-	-	-	-	-	-	-	-	
R.396.A	NCAD2_Residential	28	-27	-22	-21	-15	-	-	-	-	-	-	-	-	
R.397.A	NCAD1_Residential	38	-14	-9	-8	-2	-	-	-	-	-	-	-	-	
R.398.A	NCAD1_Residential	41	-11	-6	-5	1	-	-	-	-	-	-	-	-	
R.399.A	NCAD1_Residential	38	-14	-9	-8	-2	-	-	-	-	-	-	-	-	
R.400.A	NCAD1_Residential	39	-13	-8	-7	1	-	-	-	-	-	-	-	-	
R.401.A	NCAD4_Residential	31	-28	-23	-20	-15	-	-	-	-	-	-	-	-	
R.402.A	NCAD1_Residential	40	-12	-7	-6	0	-	-	-	-	-	-	-	-	
R.403.A	NCAD1_Residential	40	-12	-7	-6	0	-	-	-	-	-	-	-	-	
R.404.A	NCAD1_Residential	39	-13	-8	-7	1	-	-	-	-	-	-	-	-	
R.405.A	NCAD1_Residential	40	-12	-7	-6	0	-	-	-	-	-	-	-	-	
R.406.A	NCAD1_Residential	40	-12	-7	-6	0	-	-	-	-	-	-	-	-	
R.407.A	NCAD1_Residential	39	-13	-8	-7	1	-	-	-	-	-	-	-	-	
R.408.A	NCAD1_Residential	39	-13	-8	-7	1	-	-	-	-	-	-	-	-	
R.409.A	NCAD1_Residential	39	-13	-8	-7	1	-	-	-	-	-	-	-	-	
R.410.A	NCAD1_Residential	40	-12	-7	-6	0	-	-	-	-	-	-	-	-	
R.411.A	NCAD1_Residential	39	-13	-8	-7	1	-	-	-	-	-	-	-	-	
R.412.A	NCAD1_Residential	37	-15	-10	-9	-3	-	-	-	-	-	-	-	-	
R.413.A	NCAD4_Residential	27	-32	-27	-24	-19	-	-	-	-	-	-	-	-	
R.414.A	NCAD2_Residential	38	-14	-9	-8	-2	-	-	-	-	-	-	-	-	
R.415.A	NCAD1a_Residential	25	-34	-29	-26	-21	-	-	-	-	-	-	-	-	
R.416.A	NCAD1a_Residential	35	-24	-19	-16	-11	-	-	-	-	-	-	-	-	
R.417.A	NCAD1a_Residential	34	-25	-20	-17	-12	-	-	-	-	-	-	-	-	
R.418.A	NCAD1a_Residential	36	-23	-18	-15	-10	-	-	-	-	-	-	-	-	
R.419.A	NCAD2a_Residential	35	-24	-19	-16	-11	-	-	-	-	-	-	-	-	
R.420.A	NCAD2a_Residential	33	-26	-21	-18	-13	-	-	-	-	-	-	-	-	
R.421.A	NCAD4a_Residential	26	-31	-26	-23	-18	-	-	-	-	-	-	-	-	
R.422.A	NCAD1a_Residential	28	-31	-26	-23	-18	-	-	-	-	-	-	-	-	
R.423.A	NCAD4a_Residential	24	-35	-30	-27	-22	-	-	-	-	-	-	-	-	
R.424.A	NCAD1a_Residential	39	-13	-8	-7	1	-	-	-	-	-	-	-	-	
R.425.A	NCAD1a_Residential	24	-35	-30	-27	-22	-	-	-	-	-	-	-	-	
R.426.A	NCAD1a_Residential	25	-34	-29	-26	-21	-	-	-	-	-	-	-	-	
R.427.A	NCAD1a_Residential	25	-34	-29	-26	-21	-	-	-	-	-	-	-	-	
R.428.A	NCAD1a_Residential	30	-29	-24	-21	-16	-	-	-	-	-	-	-	-	
R.429.A	NCAD1a_Residential	25	-34	-29	-26	-21	-	-	-	-	-	-	-	-	
R.430.A	NCAD1a_Residential	23	-36	-31	-28	-23	-	-	-	-	-	-	-	-	
R.431.A	NCAD1a_Residential	24	-35	-30	-27	-22	-	-	-	-	-	-	-	-	
R.432.A	NCAD1a_Residential	31	-28	-23	-20	-15	-	-	-	-	-	-	-	-	
R.433.A	NCAD1a_Residential	31	-28	-23	-20	-15	-	-	-	-	-	-	-	-	
R.434.A	NCAD1a_Residential	34	-25	-20	-17	-12	-	-	-	-	-	-	-	-	
R.435.A	NCAD1a_Residential	30	-29	-24	-21	-16	-	-	-	-	-	-	-	-	
R.436.A	NCAD1a_Residential	37	-15	-10	-9	-3	-	-	-	-	-	-	-	-	
R.437.A	NCAD1a_Residential	33	-19	-14	-13	-7	-	-	-	-	-	-	-	-	
R.438.A	NCAD1a_Residential	28	-27	-22	-21	-15	-	-	-	-	-	-	-	-	
R.439.A	NCAD1a_Residential	34	-25	-20	-17	-12	-	-	-	-	-	-	-	-	
R.440.A	NCAD2a_Residential	33	-26	-21	-18	-13	-	-	-	-	-	-	-	-	
R.441.A	NCAD1a_Residential	35	-24	-19	-16	-11	-	-	-	-	-	-	-	-	
R.442.A	NCAD1a_Residential	33	-19	-14	-13	-7	-	-	-	-	-	-	-	-	
R.443.A	NCAD1a_Residential	27	-32	-27	-24	-19	-	-	-	-	-	-	-	-	
R.444.A	NCAD1a_Residential	33	-19	-14	-13	-7	-	-	-	-	-	-	-	-	
R.445.A	NCAD1a_Residential	33	-19	-14	-13	-7	-	-	-	-	-	-	-	-	
R.446.A	NCAD1a_Residential	34	-18	-13	-12	-6	-	-	-	-	-	-	-	-	
R.447.A	NCAD1a_Residential	35	-17	-12	-11	-5	-	-	-	-	-	-	-	-	
R.448.A	NCAD2a_Residential	34	-18	-13	-12	-6	-	-	-	-	-	-	-	-	
R.449.A	NCAD1a_Residential	33	-19	-14	-13	-7	-	-	-	-	-	-	-	-	
R.450.A	NCAD1a_Residential	32	-20	-15	-14	-8	-	-	-	-	-	-	-	-	
R.451.A	NCAD1a_Residential	33	-19	-14	-13	-7	-	-	-	-	-	-	-	-	
R.452.A	NCAD1a_Residential	33	-19	-14	-13	-7	-	-	-	-	-	-	-	-	
R.453.A	NCAD1a_Residential	33	-19	-14	-13	-7	-	-	-	-	-	-	-	-	
R.454.A	NCAD1a_Residential	30	-22	-17	-16	-10	-	-	-	-	-	-	-	-	
R.455.A	NCAD1a_Residential	34	-18	-13	-12	-6	-	-	-	-	-	-	-	-	
R.456.A	NCAD1a_Residential	35	-17	-12	-11	-5	-	-	-	-	-	-	-	-	
R.457.A	NCAD1a_Residential	33	-19	-14	-13	-7	-	-	-	-	-	-	-	-	
R.458.A	NCAD2a_Residential	28	-27	-22	-21	-15	-	-	-	-	-	-	-	-	
R.459.A	NCAD1a_Residential	33	-19	-14	-13	-7	-	-	-	-	-	-	-	-	
R.460.A	NCAD1a_Residential	27	-32	-27	-24	-19	-	-	-	-	-	-	-	-	
R.461.A	NCAD1a_Residential	33	-19	-14	-13	-7	-	-	-	-	-	-	-	-	
R.462.A	NCAD1a_Residential	36	-16	-11	-10	-4	-	-	-	-	-	-	-	-	
R.463.A	NCAD1a_Residential	30	-22	-17	-16	-10	-	-	-	-	-	-	-	-	
R.464.A	NCAD1a_Residential	33	-19	-14	-13	-7	-	-	-	-	-	-	-	-	
R.465.A	NCAD1a_Residential	26	-44	-44	-44	-44	-	-	-	-	-	-	-	-	
R.466.A	NCAD2a_Residential	28	-27	-22	-21	-15	-	-	-	-	-	-	-	-	
R.467.A	NCAD1a_Residential	23	-36	-31	-28	-23	-	-	-	-	-	-	-	-	
R.468.A	NCAD1a_Residential	25	-34	-29	-26	-21	-	-	-	-	-	-	-	-	
R.469.A	NCAD1a_Residential	34	-18	-13	-12	-6	-	-	-	-	-	-	-	-	
R.470.A	NCAD1a_Residential	23	-36	-31	-28	-23	-	-	-	-	-	-	-	-	
R.471.A	NCAD1a_Residential	31	-21	-16	-15	-9	-	-	-	-	-	-	-	-	
R.472.A	NCAD1a_Residential	31	-21	-16	-15	-9	-	-	-	-	-	-	-	-	
R.473.A	NCAD1a_Residential	25	-34	-29	-26	-21	-	-	-	-	-	-	-	-	
R.474.A	NCAD1a_Residential	34	-18	-13	-12	-6	-	-	-	-	-	-	-	-	
R.475.A															

Table D.16		Rail Corridor Fence / Noise Walls Installation	SCN16	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	29	-41	-41	-41	-41	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	10	-60	-60	-60	-60	-	-	-	-	-	-	-	-	







Table D.1.7		Orchard Rd Ancillary Facility		SCN17		Comparison to NML								If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night			
R.353.A	NCAD1 Residential	22	-30	-25	-24	-18	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.354.A	NCAD1 Residential	28	-24	-19	-18	-12	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.355.A	NCAD1 Residential	22	-30	-25	-24	-18	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.356.A	NCAD1 Residential	22	-30	-25	-24	-18	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.357.A	NCAD2 Residential	29	-23	-18	-17	-11	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.358.A	NCAD1 Residential	22	-30	-25	-24	-18	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.359.A	NCAD1 Place of Worship	28	-27	-21	-21	-27	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.360.A	NCAD1 Residential	22	-30	-25	-24	-18	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.361.A	NCAD2 Residential	18	-34	-29	-28	-22	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.362.A	NCAD1 Residential	17	-35	-30	-29	-23	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.363.A	NCAD2 Residential	18	-34	-29	-28	-22	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.364.A	NCAD1 Residential	18	-34	-29	-28	-22	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.365.A	NCAD1 Residential	17	-35	-30	-29	-23	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.366.A	NCAD1 Residential	17	-35	-30	-29	-23	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.367.A	NCAD1 Residential	26	-26	-21	-20	-14	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.368.A	NCAD1 Residential	17	-35	-30	-29	-23	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.369.A	NCAD4 Residential	18	-33	-28	-27	-21	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.370.A	NCAD1 Residential	18	-34	-29	-28	-22	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.371.A	NCAD1 Residential	28	-24	-19	-18	-12	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.372.A	NCAD2 Residential	18	-34	-29	-28	-22	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.373.A	NCAD1 Residential	18	-34	-29	-28	-22	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.374.A	NCAD1 Residential	19	-33	-28	-27	-21	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.375.A	NCAD2 Residential	16	-36	-31	-30	-24	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.376.A	NCAD1 Residential	19	-33	-28	-27	-21	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.377.A	NCAD4 Residential	19	-33	-27	-26	-20	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.378.A	NCAD4 Residential	18	-33	-28	-27	-21	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.379.A	NCAD1 Residential	11	-41	-36	-35	-29	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.380.A	NCAD4 Residential	18	-33	-28	-27	-21	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.381.A	NCAD2 Residential	16	-36	-31	-30	-24	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.382.A	NCAD1 Residential	28	-24	-19	-18	-12	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.383.A	NCAD4 Residential	18	-33	-28	-27	-21	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.384.A	NCAD2 Residential	14	-38	-33	-32	-26	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.385.A	NCAD4 Residential	18	-33	-28	-27	-21	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.386.A	NCAD1 Residential	24	-28	-23	-22	-16	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.387.A	NCAD1 Residential	24	-28	-23	-22	-16	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.388.A	NCAD2 Residential	13	-39	-34	-33	-27	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.389.A	NCAD4 Residential	20	-31	-26	-25	-19	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.390.A	NCAD1 Residential	18	-34	-29	-28	-22	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.391.A	NCAD1 Residential	24	-28	-23	-22	-16	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.392.A	NCAD1 Residential	23	-29	-24	-23	-17	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.393.A	NCAD1 Residential	17	-35	-30	-29	-23	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.394.A	NCAD1 Residential	16	-36	-31	-30	-24	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.395.A	NCAD1 Residential	16	-36	-31	-30	-24	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.396.A	NCAD2 Educational	17	-35	-30	-29	-23	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.397.A	NCAD1 Residential	20	-32	-27	-26	-20	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.398.A	NCAD1 Residential	21	-31	-26	-25	-19	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.399.A	NCAD1 Residential	19	-33	-28	-27	-21	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.400.A	NCAD1 Residential	22	-30	-25	-24	-18	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.401.A	NCAD4 Residential	17	-37	-32	-31	-25	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.402.A	NCAD1 Residential	25	-27	-22	-21	-15	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.403.A	NCAD1 Residential	20	-32	-27	-26	-20	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.404.A	NCAD1 Residential	23	-29	-24	-23	-17	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.405.A	NCAD1 Residential	23	-29	-24	-23	-17	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.406.A	NCAD1 Residential	23	-29	-24	-23	-17	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.407.A	NCAD1 Residential	23	-29	-24	-23	-17	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.408.A	NCAD1 Residential	23	-29	-24	-23	-17	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.409.A	NCAD1 Residential	23	-29	-24	-23	-17	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.410.A	NCAD1 Residential	25	-27	-22	-21	-15	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.411.A	NCAD1 Residential	24	-28	-23	-22	-16	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.412.A	NCAD1 Residential	22	-30	-25	-24	-18	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.413.A	NCAD4 Residential	12	-47	-42	-39	-34	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.414.A	NCAD2 Residential	24	-28	-23	-22	-16	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.415.A	NCAD1 Residential	12	-47	-42	-39	-34	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.416.A	NCAD1 Residential	18	-34	-29	-28	-22	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.417.A	NCAD1 Residential	18	-34	-29	-28	-22	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.418.A	NCAD1 Residential	18	-34	-29	-28	-22	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.419.A	NCAD2 Residential	19	-33	-28	-27	-21	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.420.A	NCAD2 Residential	17	-37	-32	-31	-25	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.421.A	NCAD4 Residential	16	-43	-38	-37	-31	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.422.A	NCAD1 Residential	11	-48	-43	-40	-35	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.423.A	NCAD4 Residential	9	-50	-45	-42	-37	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.424.A	NCAD1 Residential	7	-52	-47	-44	-39	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.425.A	NCAD1 Residential	9	-50	-45	-42	-37	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.426.A	NCAD1 Residential	12	-47	-42	-39	-34	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.427.A	NCAD1 Residential	11	-48	-43	-40	-35	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.428.A	NCAD1 Residential	12	-47	-42	-39	-34	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.429.A	NCAD1 Residential	7	-52	-47	-44	-39	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.430.A	NCAD1 Residential	17	-42	-37	-36	-30	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.431.A	NCAD1 Residential	10	-49	-44	-41	-36	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.432.A	NCAD1 Commercial	14	-56	-51	-48	-43	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.433.A	NCAD1 Residential	10	-49	-44	-41	-36	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.434.A	NCAD1 Residential	19	-40	-35	-32	-27	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.435.A	NCAD1 Residential	14	-45	-40	-37	-32	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.436.A	NCAD1 Commercial	17	-53	-48	-45	-40	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.437.A	NCAD1 Residential	19	-33	-28	-27	-21	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.438.A	NCAD1 Commercial	13	-57	-52	-49	-44	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.439.A	NCAD1 Residential	18	-34	-29	-28	-22	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.440.A	NCAD2 Commercial	17	-53	-48	-45	-40	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.441.A	NCAD1 Residential	19	-33	-28	-27	-21	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.442.A	NCAD1 Residential	19	-33	-28	-27	-21	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.443.A	NCAD1 Residential	13	-39	-34	-33	-27	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.444.A	NCAD1 Residential	19	-33	-28	-27	-21	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.445.A	NCAD1 Commercial	18	-52	-47	-44	-39	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.446.A	NCAD1 Residential	19	-33	-28	-27	-21	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.447.A	NCAD1 Residential	21	-31	-26	-25	-19	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.448.A	NCAD2 Commercial	19	-51	-46	-43	-38	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.449.A	NCAD1 Residential	19	-33	-28	-27	-21	-	-	-	-	-	-	-	-	-	-	-	-	-		
R.450.A	NCAD1 Commercial	15	-55	-50	-47	-42															

Table D.17		Orchard Rd Ancillary Facility	SCN17	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	75	-55	-55	-55	-55	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	71	-71	-71	-71	-71	-	-	-	-	-	-	-	-	







Table D.18		Brand St Ancillary Facility	SCN18	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	17	-53		-53	-53	-53	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	0	-70		-70	-70	-70	-	-	-	-	-	-	-	









Table D.19		Brand St Laydown Area	SCN19	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	7	-63	-63	-63	-63	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	0	-70	-70	-70	-70	-	-	-	-	-	-	-	-	







Table D.20		Hampden Road Laydown Area	SCN20	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	17	-53		-53	-53	-53	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	51	-65		-65	-65	-65	-	-	-	-	-	-	-	









Table D.21		Elizabeth St Ancillary Facility	SCN21	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	18	-52	-52	-52	-52	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	21	-68	-68	-68	-68	-	-	-	-	-	-	-	-	







Table D.22		Elizabeth St Laydown Area	SCN22	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	19	-51	-51	-51	-51	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	14	-56	-56	-56	-56	-	-	-	-	-	-	-	-	









Table O.23		Cleland Rd Ancillary Facility	SCN23	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	19	-51	-51	-51	-51	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	15	-55	-55	-55	-55	-	-	-	-	-	-	-	-	







Table D.24		Citland Rd Laydown Area	SCN24	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	19	-51	-51	-51	-51	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	16	-54	-54	-54	-54	-	-	-	-	-	-	-	-	

Table D-25: Comparison of Noise Levels. Columns include Name, Description, Predicted Noise Level, and Comparison to NML (Day Standard, Day Non-Standard, Evening, Night) and Mitigation/Management (AMMM) (Day Standard, Day Non-Standard, Evening, Night).







Table D.25		Cleland Rd Stockpiling	SCN25	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	20	-50	-50	-50	-50	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	18	-52	-52	-52	-52	-	-	-	-	-	-	-	-	







Table D.26		Lambos Rd Laydown Area	SCN26	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	13	-57	-57	-57	-57	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	23	-47	-47	-47	-47	-	-	-	-	-	-	-	-	









Table D.27		St Leonards Yard Laydown Area	SCN27	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	25	-45	-45	-45	-45	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	30	-40	-40	-40	-40	-	-	-	-	-	-	-	-	

Annex E

## Stakeholders and Community Consultation Overview

**Table E.1** Stakeholders and community overview

Stakeholders	Detail	
Local council	City of Willoughby	
Local member	The Hon. Gladys Berejiklian MP, Premier of NSW and Member for Willoughby	
Local groups	<ul style="list-style-type: none"> <li>• Chatswood East Progress Association</li> <li>• Chatswood West Progress Association</li> <li>• Chatswood Chamber of Commerce</li> <li>• Artarmon Progress Association</li> </ul>	<ul style="list-style-type: none"> <li>• Artarmon Village Chamber of Commerce</li> <li>• Artarmon Bush Care</li> <li>• Bike North</li> </ul>
Government agencies	<ul style="list-style-type: none"> <li>• Sydney Coordination Office</li> <li>• Roads and Maritime Services</li> <li>• Department of Planning and Environment</li> <li>• Office of Environment and Heritage</li> <li>• Transport for NSW</li> <li>• NSW Trains</li> </ul>	<ul style="list-style-type: none"> <li>• NSW TrainLink</li> <li>• Sydney Trains</li> <li>• Sydney Water</li> <li>• Ausgrid</li> <li>• Heritage Council</li> </ul>

Stakeholders	Detail	
Senior Stakeholders	<ul style="list-style-type: none"> <li>• Federation of Willoughby Progress Associations</li> <li>• District Commissioner - North, Greater Sydney Commission</li> </ul>	<ul style="list-style-type: none"> <li>• Mayor, Willoughby City Council</li> <li>• Willoughby District Historical Society Inc.</li> </ul>
Road users	<ul style="list-style-type: none"> <li>• Road users on Mowbray Road, Pacific Highway, Hampden Road, Orchard Road, Nelson Street and Gordon Avenue</li> </ul>	
Religious	<ul style="list-style-type: none"> <li>• 35 Hampden Road – Artarmon Mosque</li> </ul>	
Residents and businesses		
Thomas Street	<ul style="list-style-type: none"> <li>• 18 – 543 residential apartments + strata manager</li> <li>• 12 – 18 Commercial office suites + Strata Title Management</li> </ul>	<ul style="list-style-type: none"> <li>• 8 – 7 storey commercial office building + strata manager</li> <li>• 2 – Guide Dogs Association</li> </ul>
Albert Avenue	<ul style="list-style-type: none"> <li>• 65 – Mandarin Centre (rooftop sports club, cinema, food court and 26 retail shops) + Centre Management</li> <li>• 73-77 – 329 Student apartments + Building Manager</li> <li>• 100 – 42 Residential apartments + strata manager</li> </ul>	<ul style="list-style-type: none"> <li>• 67 – 15 Storey commercial tower + Managing Agent (CBRE). Mix of finance and Government tenancies</li> <li>• 84-86 – 32 Residential apartments + strata manager</li> <li>• 88 – 36 Residential apartments + strata manager</li> </ul>
Victor Street	<ul style="list-style-type: none"> <li>• 31-37 – Sebel Apartments, 112 residential apartments and 52 serviced apartments + strata management</li> </ul>	
Victoria Avenue	<ul style="list-style-type: none"> <li>• 436 – Chatswood Interchange Management</li> </ul>	
Ellis Street	<ul style="list-style-type: none"> <li>• 2 – Digital Evolution Design</li> <li>• 3 – 12 Residential apartments + strata manager</li> <li>• 4-6 – 18 Residential Apartments + strata manager</li> </ul>	<ul style="list-style-type: none"> <li>• 7-13 – 48 Residential apartments + strata manager</li> <li>• 8 – 40 Residential apartments + strata manager</li> </ul>
Chapman Avenue	<ul style="list-style-type: none"> <li>• 2 – Keenagers Day Centre</li> <li>• 6 – Uniting Chapman Close, 12 unit retirement village and Uniting Northern Sydney Regional Office</li> </ul>	
Hopetoun Avenue	<ul style="list-style-type: none"> <li>• 1A-13 – 7 residential homes</li> </ul>	<ul style="list-style-type: none"> <li>• 2-12 – 6 residential homes</li> </ul>
Mowbray Road	<ul style="list-style-type: none"> <li>• 340 – 2 double storey residences (duplex)</li> <li>• 342 - 6 residential units + NSW Strata Management</li> </ul>	<ul style="list-style-type: none"> <li>• 344-346 - 9 residential units + strata manager</li> <li>• 348 – Ausgrid, heritage substation</li> </ul>
Pacific Highway	<ul style="list-style-type: none"> <li>• 655 – Chatswood Bowling Club</li> </ul>	

Stakeholders	Detail	
Orchard Road	<ul style="list-style-type: none"> <li>• 2-22 - 9 residential homes</li> </ul>	
Gordon Avenue	<ul style="list-style-type: none"> <li>• 5-9 - Louder Minds (home based business) and 15 residential units + strata manager</li> <li>• 1-3 - 12 residential units (Frank Knight Property Management)</li> <li>• 10 - 10 residential apartments + strata manager</li> </ul>	
Nelson Street	<ul style="list-style-type: none"> <li>• 2 - 2 Home based businesses and residential home</li> <li>• 1-5 – 3 residential homes</li> <li>• 9-11 - 45 residential units (Dunns Strata Management, Property Manager – Oasis Property Management)</li> </ul>	<ul style="list-style-type: none"> <li>• 15 - 7 residential units + strata manager</li> <li>• 17 - 6 residential units + strata manager</li> <li>• 19 - 1 residential home</li> </ul>
Elizabeth Street	<ul style="list-style-type: none"> <li>• 1-3 – 2 residential homes</li> </ul>	<ul style="list-style-type: none"> <li>• 40-52 – 9 residential homes</li> </ul>
Raleigh Street	<ul style="list-style-type: none"> <li>• 1-7 – 4 residential homes</li> </ul>	<ul style="list-style-type: none"> <li>• 8-14 – 4 residential homes</li> </ul>
Drake Street	<ul style="list-style-type: none"> <li>• 1-13 – 13 residential homes</li> </ul>	<ul style="list-style-type: none"> <li>• 12 – Family Day Care</li> <li>• 7 – Family Day Care</li> </ul>
Hawkins Street	<ul style="list-style-type: none"> <li>• 1-11 – 6 residential homes</li> </ul>	<ul style="list-style-type: none"> <li>• 2-14 – 7 residential homes</li> </ul>
Brand Street	<ul style="list-style-type: none"> <li>• 1-13 – 7 residential homes</li> <li>• 2 – 8 residential apartments + strata manager</li> </ul>	<ul style="list-style-type: none"> <li>• 4 - 10 residential apartments + strata manager</li> <li>• 8-10 – 16 residential apartments + strata manager</li> </ul>
Hampden Road	<ul style="list-style-type: none"> <li>• 9 – 12 residential apartments + strata manager</li> <li>• 11 – 16 residential apartments + strata manager</li> <li>• 13 – 24 residential apartments + strata manager</li> <li>• 15 – 8 residential apartments + strata manager</li> <li>• 17 – 16 residential apartments + strata manager</li> <li>• 19 - 4 residential apartments + strata manager</li> <li>• 21- 4 residential apartments + strata manager</li> <li>• 24 - 10 residential apartments + strata manager</li> <li>• 25 – 13 residential apartments + strata manager</li> </ul>	<ul style="list-style-type: none"> <li>• 67 – 9 residential apartments + strata manager</li> <li>• 77-83 – 4 residential homes</li> <li>• 85-91 – 10 residential apartments + strata manager</li> <li>• 97 – 12 residential apartments + strata manager</li> <li>• 99 – 16 residential apartments + strata manager</li> <li>• 107 – 18 residential apartments + strata manager</li> <li>• 115 – 10 residential apartments + strata manager</li> <li>• 117-119 – 12 residential apartments + strata manager</li> <li>• 130 – The Thai Artarmon, restaurant</li> </ul>

Stakeholders	Detail	
	<ul style="list-style-type: none"> <li>• 26 - 5 residential apartments + strata manager</li> <li>• 27 – 4 residential apartments + strata manager</li> <li>• 28-32 - 8 residential apartments + strata manager</li> <li>• 29 – 4 residential apartments + strata manager</li> <li>• 31 – 4 residential apartments + strata manager</li> <li>• 33 – 8 residential apartments + strata manager</li> <li>• 36 – 6 residential apartments + strata manager</li> <li>• 38 -- 10 residential apartments + strata manager</li> <li>• 40 – 6 residential apartments + strata manager</li> <li>• 42 - 4 residential apartments + strata manager</li> <li>• 44 - 12 residential apartments + strata manager and ground floor retail (Pizza Luna, Laing &amp; Simmons)</li> </ul>	<ul style="list-style-type: none"> <li>• 2/130 – Inter Deserts</li> <li>• 132 – Artarmon Mowers, retail</li> <li>• 134-136 – Bella Babes Day Care Centre</li> <li>• 136 – Artarmon Medical Centre</li> <li>• 142 - 16 residential apartments + strata manager</li> <li>• 148 – 10 residential apartments + strata manager</li> <li>• 152-156 – 20 residential apartments + strata manager</li> <li>• 158-162 – 20 residential apartments + strata manager</li> <li>• 164 – 18 residential apartments + strata manager</li> <li>• 170-174 – 12 residential apartments + strata manager</li> <li>• 176 – 8 residential apartments + strata manager</li> <li>• 182-190 – 32 residential apartments + strata manager</li> </ul>
McMillan Road	<ul style="list-style-type: none"> <li>• 1 – 9 residential apartments + strata manager</li> </ul>	<ul style="list-style-type: none"> <li>• 2 – 32 residential apartments +strata manager</li> </ul>
Cleland Road	<ul style="list-style-type: none"> <li>• 1 – 4 residential apartments + strata manager</li> <li>• 2 – 4 residential units + strata manager</li> <li>• 4-6 – 2 residential homes</li> <li>• 3 – 4 residential apartments + strata manager</li> <li>• 5-7A – 2 residential homes</li> <li>• 8-12 – 4 residential units + strata manager</li> <li>• 14-16 – 2 residential homes</li> <li>• 18 – 4 residential apartments + strata manager</li> </ul>	<ul style="list-style-type: none"> <li>• 20 – 4 residential units + strata manager</li> <li>• 24-28 – 6 residential units + strata manager</li> <li>• 30 – 10 residential apartments + strata manager</li> <li>• 32 – 6 residential apartments + strata manager</li> <li>• 34 – 8 residential apartments + strata manager</li> <li>• 36 – residential home</li> <li>• 38 - 10 residential apartments + strata manager</li> </ul>
Parkes Road	<ul style="list-style-type: none"> <li>• 1-3 – 8 residential apartments + strata manager</li> <li>• 5 – 12 residential apartments + strata manager</li> </ul>	<ul style="list-style-type: none"> <li>• 9-15 – 4 residential homes</li> </ul>
Burra Road	<ul style="list-style-type: none"> <li>• 17-53 – 19 residential homes</li> </ul>	<ul style="list-style-type: none"> <li>• 28-52 – 12 residential homes</li> </ul>

**ERM** has over 100 offices  
across the following  
countries worldwide

Australia	Netherlands
Argentina	New Zealand
Belgium	Peru
Brazil	Poland
China	Portugal
France	Puerto Rico
Germany	Singapore
Hong Kong	Spain
Hungary	Sri Lanka
India	Sweden
Indonesia	Taiwan
Ireland	Thailand
Italy	UK
Japan	USA
Korea	Venezuela
Malaysia	Vietnam
Mexico	

### **Environmental Resources Management**

Level 15 309 Kent Street  
Sydney NSW 2000  
Locked Bag 3012,  
Australia Square NSW 1215

T: 61 2 8584 8888  
F: 61 2 8584 8800  
[www.erm.com](http://www.erm.com)

